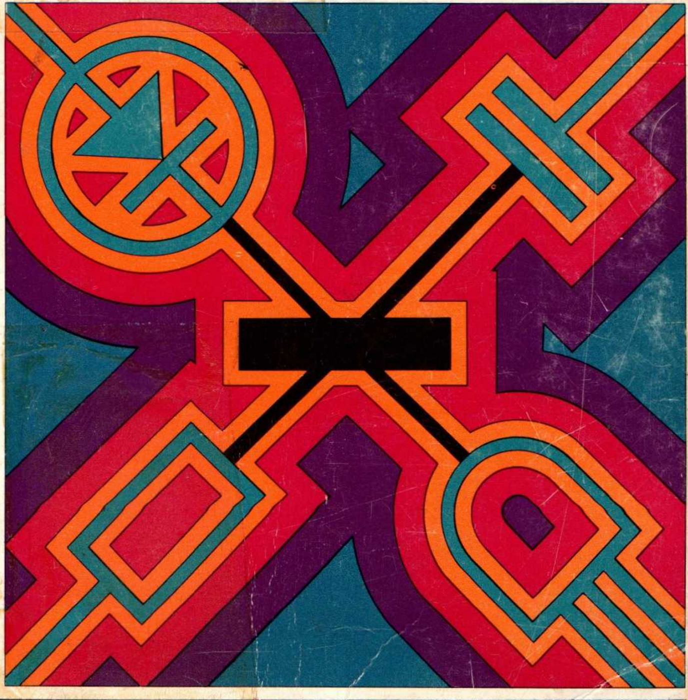
PHILIPS

POCKETBOOK

electron tubes
semiconductors
integrated circuits
components
materials

1971



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EINDHOVEN - The Netherlands

January 1971

PREFACE

The 1971 edition of the Pocketbook is a completely revised version of the preceding one, containing brief data on the majority of the products of the Electronic Components and Materials Division of NV Philips' Gloeilampenfabrieken.

Unless otherwise specified all dimensions are given in mm. The European projection method is employed in the dimensional drawings.

The Pocketbook does not give information on availability or terms of delivery, and is subject to change without notice. Please regard it as a guide only and, for a comprehensive source of information on electronic components and materials, refer to our Data Handbook system, made up of three series of handbooks, which will be issued annually.

The three series, identified by the colours noted, each comprise the following parts:

ELECTRON TUBES (blue)

		latest issue
Part 1	Transmitting tubes for communication (pentodes, tetrodes) Associated accessories	Jan. 1971
Part 2	Tubes for microwave equipment	Feb. 1970
Part 3	Special quality tubes Miscellaneous devices	Mar. 1970
Part 4	Receiving tubes	Apr. 1970
Part 5	Cathode ray tubes Camera tubes Photo tubes Photoconductive devices Associated accessories	May 1970

		latest issue
Part 6	Photomultiplier tubes Devices for nuclear equipment	June 1970
Part 7	Voltage stabilizing and reference tubes Counter, selector and indicator tubes Trigger tubes and switching diodes Thyratrons Industrial rectifying tubes Ignitrons High voltage rectifying tubes Miscellaneous Associated accessories	July 1970
Part 8	T.V. picture tubes	Aug. 1970
Part 9	Transmitting tubes for communication Tubes for r.f. heating (triodes) Associated accessories	Jan. 1971

SEMICONDUCTORS AND INTEGRATED CIRCUITS (red)

Part 1	Signal diodes Tunnel diodes Variable capacitance diodes Voltage regulator diodes Rectifier diodes Thyristors, diacs, triacs Rectifier stacks Accessories Heatsinks	Sep. 1970
Part 2	Low frequency transistors Low frequency power transistors Deflection transistors Accessories	Oct. 1970

Part 3	High frequency transistors Switching transistors Accessories	Nov. 1970
Part 4	Transmitting transistors Microwave devices Field effect transistors Dual transistors Microminiature devices for thick- and thin film circuits Beam lead devices for thick and thin-film circuits Photo devices Accessories	Dec. 1970
Part 5	Digital integrated circuits FC family: standard temperature range FC family: extended temperature range FD family FD family: standard temperature range Linear integrated circuits	Feb. 1970

COMPONENTS AND MATERIALS (green)

Part 1	Circuit blocks 100 kHz Series Circuit blocks 1-Series Circuit blocks 10-Series Circuit blocks 20-Series Circuit blocks 40-Series Counter modules 50-Series Norbits 60-Series. 61-Series Circuit blocks 90-Series Circuit blocks for ferrite core memory drive Input/output devices	Sep. 1970

		latest issue
Part 2	Fixed resistors Variable resistors Non-linear resistors Ceramic capacitors Polyester, polycarbonate, polystyrene, paper capacitors Electrolytic capacitors Variable capacitors	Dec. 1970
Part 3	FM tuners Coils Piezoelectric ceramic resonators and filters Loudspeakers Television tuners Components for black and white television Components for colour television Deflection assemblies for camera tubes Audio and mains transformers	Mar. 1970
Part 4	Ferrites for radio, audio and television Ferroxcube potcores and square cores Microchokes Ferroxcube transformer cores Piezoxide Permanent magnet materials	Mar. 1970
Part 5	Memory products Magnetic heads Quartz crystal units Microwave devices Variable mains transformers Electro-mechanical components	June 1970

The above subdivision of our Data Handbook system is valid at the date of issue of this Pocketbook; minor changes may be introduced before next issue,

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TYPE DESIGNATION CODES AND SYMBOLS FOR ELECTRON TUBES

TYPE DESIGNATION CODE FOR RADIO AND TELEVISION RECEIVING TUBES

This type designation code relates to tubes designed for use primarily in reproducing and recording equipment for domestic applications such as: radio and television receivers, record players, tape recorders and audio amplifiers, home cinema projectors, hearing aids, and similar equipment.

The type designation consists of: TWO OR MORE LETTERS FOLLOWED BY A SERIAL NUMBER

Example and explanation:

PL504

First letter indicates the heater voltage or current	Second and subsequent letters indicate the construction and/or application of the tube. (If there is more than one electrode system these letters are placed in alphabetical order.)	Serial number
D ≤1.4 V; series or parallel supply **E** 6.3 V; series or parallel supply **G** miscellaneous; parallel supply **L** 450 mA; series supply **P** 300 mA; series supply **U** 100 mA; series supply The use of letters A (4 V), B (180 mA), C (200 mA), F (12.6 V), K (2 V), V (50 mA), and Y (450 mA) has been discontinued.	**A** diode (excluding rectifiers) **B** double diode with common cathode (excluding rectifiers) **C** triode (excluding power output triodes) **D** power output triode **E** tetrode (excluding power output tetrodes) **F** pentode (excluding power output pentodes) **H** hexode or heptode (of the hexode type) **K** octode or heptode (of the octode type) **L** power output tetrode or power output pentode **M** tuning indicator **Y** half-wave rectifier **Z** full-wave rectifier	The serial number consists of three figures the first figure indicating the type of base: 1) **1** miscellaneous base types **2** miniature 10-pin base **3** octal base **5** magnoval base **8** noval base **9** miniature 7-pin base The last figure of tetrodes and pentodes (excluding power output tubes) indicates the type of characteristic, as follows: even figure: sharp cutoff characteristic odd figure: variable-mu characteristic

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1) The use of remaining figures for other base types and the use of serial numbers of one and two figures has been discontinued.

TYPE DESIGNATION CODE FOR PROFESSIONAL RECEIVING-TYPE TUBES

This type designation code relates to professional receiving-type vacuum tubes designed for use primarily in communication equipment, data processing equipment or in other industrial applications.

The type designation consists of: TWO OR MORE LETTERS FOLLOWED BY A SERIAL NUMBER

Example and explanation:

ECC2000

First letter indicates the heater voltage	Second and subsequent letters indicate the construction and/or application of the tube. (If there is more than one electrode system these letters are placed in alphabetical order.)	Serial number
E 6.3 V; parallel or series supply	**A** diode **C** triode (excluding power output triodes) **D** power output triode **E** tetrode (excluding power output tetrodes) **F** pentode (excluding power output pentodes) **H** heptode **L** power output tetrode or power output pentode **M** tuning indicator	The serial number consists of four figures, the first figure indicating the type of base: [1] **1** miscellaneous base types **2** miniature 10-pin base **3** octal base **5** magnoval base **8** noval base **9** miniature 7-pin base

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Serial numbers for prototypes always end in zero, those for variants in one of the figures 1 to 9. The other first figures will be used for new base types as required.

TYPE DESIGNATION CODE FOR CATHODE-RAY TUBES

This type designation code relates to cathode-ray tubes for all applications such as: television and radar display tubes, oscilloscope tubes, monitor tubes and view finders.

The type designation consists of: ONE LETTER FOLLOWED BY TWO GROUPS OF FIGURES JOINED BY A HYPHEN, AND ONE OR TWO LETTERS

Example and explanation:

D10-11GH

A59-11W

First letter indicates the application and/or construction of tube	First figure or group of figures indicates the screen dimensions	Second figure or group of figures	Final letters indicate the screen properties
A TV display tube for domestic applications **D** Oscilloscope tube, single trace **E** Oscilloscope tube, multiple trace **F** Radar display tube, direct view **L** Display storage tube **M** TV display tube for professional applications, direct view **P** Display tube for professional applications, projection **Q** Flying spot scanner	For rectangular screens the screen diagonal in cm For circular screens the screen diameter in cm	Serial number	The first letter denotes the colour of the fluorescence (or phosphorescence in the case of long or very long persistence screens) according to the regions of the Kelly Chart of colour designations for lights, where applicable: **A** Reddish-purple, purple, bluish-purple **B** Purplish-blue, blue, greenish-blue **D** Blue-green **G** Bluish-green, green, yellowish-green **K** Yellow-green **L** Orange, orange-pink **R** Reddish-orange, red, pink, purplish-pink, purplish-red, red-purple **Y** Greenish-yellow, yellow, yellowish-orange **W** indicates the "standard white" television display tube phosphor **X** indicates tri-colour screens The second letter is a serial letter to denote other specific differences in screen properties. Word description of persistence (Time to decay to 10% of initial light output)

less than 1 μs	very short	1 ms to 100 ms	medium
1 μs to 10 μs	short	100 ms to 1 s	long
10 μs to 1000 μs	medium short	more than 1 s	very long

TYPE DESIGNATION CODE FOR PROFESSIONAL TUBES

This type designation code relates to tubes designated for use primarily in radio or television transmitting equipment, in navigation or communication equipment or in other industrial applications.

The type designation consists of: TWO LETTERS FOLLOWED BY A SERIAL NUMBER

Example and explanation:

YK1005

First letter indicates the category	Second letter indicates the construction and/or application	Serial number
X Tubes employing photosensitive materials	**A** diode	The serial number consists of four figures. Serial numbers for prototypes always end in zero, those for variants in one of the figures 1 to 9.
	C trigger tube	
Y Vacuum tubes for transmitting, microwave or industrial applications	**D** triode (including double triodes)	
	G miscellaneous	
Z Gasfilled tubes (except tubes employing photosensitive material)	**H** travelling wave tube	
	J magnetron	
	K klystron	
	L tetrode or pentode (including double tetrodes or double pentodes)	
	M cold cathode indicator or counter tube	
	P photomultiplier tube, radiation counter tube	
	Q camera tube	
	T thyratron	
	X ignitron, image intensifier or image converter	
	Y rectifier	
	Z voltage stabiliser	

GROUPS OF LETTERS ALLOCATED TO EXISTING PHOSPHORS

Designation		*E.I.A. number*	*Colour*		*Persistence (10%)*
New	*Old*		*Fluorescence*	*Phosphorescence*	
BA	C		purplish blue		very short
BC	V		purplish blue		killed
BD	A		blue		very short
BE	B	P11	blue	blue	medium short
BF	U		purplish blue		medium short
GB	M	P32	purplish blue	yellowish green	long
GE	K	P24	green	green	short
GH	H	P31	green	green	medium short
GJ	G	P1	yellowish green	yellowish green	medium
GK	G[1]		yellowish green	yellowish green	medium
GL	N	P2	yellowish green	yellowish green	medium short
GM	P	P7	purplish blue	yellowish green	long
GN	J		blue	green (infrared excited)	medium short (fluorescence)
GP		P2	bluish green	green	medium short
GR		P39	green	green	long
GU			white	white	very short
LA	D		orange	orange	medium
LB	E		orange	orange	long
LC	F		orange	orange	very long
LD	L	P33	orange	orange	very long
W	W	P4	white for TV display tubes		
X	X	P22	three-colour for TV display tubes		
YA	Y		yellowish orange	yellowish orange	medium

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[1] Used in projection tubes

CATHODE-RAY TUBES (Old system)

The type number consists of two capital letters followed by two sets of figures (e.g. DG13-2, MW31-16).

First letter: indicates the method of focusing and deflection.
Second letter: indicates properties of the screen.
First group of figures: indicates dimensions of the screen.
Second group of figures: indicates a serial number.

The key to this system is given in the following tables.

First letter

A — Electrostatic focusing and electromagnetic deflection.
D — Electrostatic focusing and electrostatic deflection in two directions.
M — Electromagnetic focusing and electromagnetic deflection.

Second letter

Indicates the phosphor screen properties.

First group of figures

For round tubes	: screen diameter in cm
For rectangular tubes	: screen diagonal in cm

Second group in figures

Serial number

TRANSMITTING TUBES (Old system)

The type number consists of two or three capital letters followed by two sets of figures. For some types a group of letters is added (e.g. TAL12/10, DCG4/1000G).

First letter: indicates the tube classification.
Second letter: indicates type of filament or cathode.

First group of figures: indicates operating voltage.
Second group of figures: indicates power.
Added letters: indicate the tube base.

The key to this system is given in the following tables.

First letter

- D —Rectifying tube (included grid-controlled tubes)
- M —Triode (A.F. amplifying tube or modulator)
- P —Pentode
- Q —Tetrode
- T —Triode (R.F., A.F. or oscillator tube)

For tubes having dual systems two of the above mentioned letters are used (e.g. QQC04/15).

Second letter

(third letter for tubes having dual systems)

- A —Directly-heated tungsten filament
- B —Directly-heated thoriated tungsten filament
- C —Directly-heated oxide-coated filament
- E —Indirectly-heated oxide-coated cathode

Third letter

(fourth letter for tubes having dual systems)

- G —Mercury-vapour filling
- H —Helix or other integral cooler
- L —Forced air cooling
- W —Water cooling
- X —Xenon filling

When the type number does not contain a letter indicating the cooling, the tube is radiation-cooled.

First group of figures

Rectifying tubes:	Approx. d.c. output voltage in kilovolts in a threephase half-wave rectifying circuit.
Transmitting tubes:	Approx. max. anode voltage in kilovolts.

Second group of figures

Rectifying tubes: Approx. d.c. output power in watts or kilowatts per tube in a three-phase half-wave rectifying circuit.
R.F. tubes: Approx. output power in watts or kilowatts in class C telegraphy.
Modulators: Approx. anode dissipation in watts or kilowatts.

Added letters

B —Cables
E —Medium 7p.-base
ED—Edison base
EG—Goliath base
G —Medium 4p.-base
GB—Jumbo 4p.-base
GS—Super jumbo 4p.-base
N —Medium 5p.-base
P —P-base

PHOTOTUBES AND PHOTOMULTIPLIERS (old system)

The type number consists of two figures followed by two letters (e.g. 90AV).
First figure : indicates the tube base.
Second figure: indicates a serial number.
First letter : indicates the type of cathode.
Second letter : indicates the class of phototube.
Third letter : letter P only for photomultipliers
The key for this system is given in the following tables.

First figure

2—Loctal 8p.-base
3—Octal 8p.-base
5—Special base
8—Noval 9p.-base
9—Miniature 7p.-base

Second figure—Serial number

First letter

A —Caesium-antimony cathode (blue sensitive)
C —Caesium-on-oxidized-silver cathode (red sensitive)
T —Tialkali cathode
U—Caesium-antimony cathode with quartz window

Second letter

G—Gasfilled V—High vacuum

VOLTAGE STABILIZERS (Old system)

The type number consists of a number followed by a capital letter, a figure and in some cases by a second capital letter (e.g. 85A2, 150C1K).

Number: indicates burning voltage.
First letter: indicates the current range.
Figure: indicates a serial number.
Second letter: indicates the tube base.

The key for this system is given in the following tables.

Number

Average burning voltage in volts

First letter

A —max. 10 mA
B —max. 22 mA
C —max. 40 mA
D—max. 100 mA
E —max. 200 mA

Second letter

E —Edison
K—Octal 8p.-base
P —P-base

Figure

Serial number

SYMBOLS

Electrodes

a	Anode
ah	Auxiliary anode
a_{ign}	Ignition anode
d	Anode of detection diode
D	Deflection plate or rod
f	Filament or resistance wire
fc	Filament tap or star point of three star connected filaments
g	Grid
i.c.	Internal connection (not to be connected externally)
k	Cathode
$k_{(i)}$	Input cathode lead of U.H.F. tube
$k_{(o)}$	Output cathode lead of U.H.F. tube
l	Fluorescent screen
m	External conducting coating
n.c.	Tube pin which may be connected externally
pr	Primer (auxiliary electrode of cold cathode tubes to ensure safe triggering)
s	Internal shield
S	Switch
st	Starter or trigger electrode of cold cathode tubes

Electrode systems

D	Diode	P	Pentode
H	Hexode or Heptode	Q	Tetrode
		T	Triode

Voltages

V_a	Anode voltage Burning voltage of voltage stabilizer
ΔV_a	Burning voltage variation of voltage stabilizer in stabilizing range
V_{arms}	A.C. anode voltage (rms value)

$V_{a\mathrm{invp}}$	Peak value of inverse anode voltage
$V_{a\mathrm{p}}$	Peak value of anode voltage
V_{arc}	Arc voltage
V_b	Supply voltage
V_{ba}	Anode supply voltage
V_{bg2}	Supply voltage of second grid
V_{contr}	Voltage range of current regulator
V_d	Anode voltage of detection diode
$V_{d\mathrm{inv}}$	Inverse anode voltage of detection diode
$V_{d\mathrm{invp}}$	Peak value of inverse anode voltage of detection diode
V_{eff}	RMS value of a voltage
V_{ext}	Extinguishing voltage
V_f	Filament or heater voltage
V_{fwd}	Forward voltage
V_g	Grid voltage
$V_{g(\mathrm{arc})}$	Grid voltage of conducting tube
$V_{g\mathrm{invp}}$	Peak value of inverse grid voltage
$V_{g\mathrm{p}}$	Peak value of grid voltage
V_i	A.C. input voltage per tube
V_{ign}	Voltage necessary for breakdown to the concerning electrode
V_{invp}	Peak value of inverse voltage
V_k	Voltage between cathode and chassis
V_{kf}	Voltage between cathode and filament
$V_{kf\mathrm{p}}$	Peak value of voltage between cathode and filament
V_l	Voltage of fluorescent screen
V_m	Maintaining voltage
V_o	A.C. output voltage: d.c. output voltage
V_{osc}	Oscillator voltage
V_{pr}	Primer voltage of a cold cathode tube
V_{r}	Regulation voltage
V_{res}	Resonator voltage
V_{st}	Starter voltage of a cold cathode tube
V_{tr}	Secondary transformer voltage (without load)

Currents

I_a	Anode current
I_{a0}	Dark current

$I_{a\max}$	Anode current at full drive
$I_{a\min}$	Anode current without drive
I_{ah}	Auxiliary anode current
I_{ap}	Peak value of anode current
I_b	Supply current
I_{contr}	Current range of voltage stabilizer
I_d	Anode current of detection diode
I_{dp}	Peak value of anode current of detection diode
I_f	Filament current
I_g	Grid current
$I_{g\max}$	Grid current at full drive
$I_{g\min}$	Grid current without drive
I_{gp}	Peak value of grid current
I_k	Cathode current
I_l	Current of fluorescent screen
I_o	D.C. output current per tube
I_{pr}	Primer current of a cold cathode tube
I_{rec}	Recommended current
I_{reg}	Stabilized current of current regulator
I_{st}	Starter current
$I_{st\,\mathrm{transf}}$	Starter current required to initiate the main discharge
I_{surge}	Surge current

Powers

W_a	Anode dissipation
W_g	Grid dissipation
W_{ig}	Driving power
W_o	Max. output power

Resistances

R_a	External anode resistor; Matching resistance Total anode resistance of rectifying tube
$R_{a\sim}$	External a.c. resistance or load resistance in an anode lead
R_{aa}	Load resistance of push-pull amplifier (anode to anode)
R_{damping}	Damping resistance
R_{eq}	Equivalent noise resistance

R_E	Resistance of thermo-element	
R_f	Resistance of filament	
R_g	External resistance between grid and cathode	
$R_{g'}$	External resistance between grid and cathode of next tube	
R_i	Internal resistance	
R_{id}	Internal resistance of detection diode	
R_k	Resistance between cathode and chassis	
R_{kf}	External resistance between cathode and filament	
R_{st}	External resistor in the starter lead of a cold cathode tube	
R_t	Total anode resistance of rectifying tube	
R_1	External resistance between $+V_b$ and g_2	potentiometer
R_2	External resistance between g_2 and chassis	
R_3	External resistance between g_2 and k	
R_4	External resistance between k and chassis	

Capacitances

C_a	Anode to all other elements except control grid	
C_{ag}	Anode to grid, all other elements earthed	
C_{ak}	Anode to cathode, all other elements earthed	
C_{dk}	Anode to cathode of detection diode	all other elements earthed
C_{x1x2}	Deflection plate x_1 to deflection plate x_2	
C_{y1y2}	Deflection plate y_1 to deflection plate y_2	
C_{filt}	Input capacitor of smoothing filter	
C_g	Grid to all other elements except anode	

Miscellaneous

d_{tot}	Total distortion
f	Frequency
F	Noise level
g	Voltage gain per stage
G	Current amplification (Gain)
m	Number of anodes of rectifying tubes
M	Deflection factor
N	Sensitivity
N_a	Luminous anode sensitivity
N_k	Luminous cathode sensitivity

S	Mutual conductance
S_c	Conversion conductance
S_{eff}	Effective slope of oscillator tube
S_o	Mutual conductance of oscillator triode at $V_g = 0$ V and $V_{\mathrm{osc}} = 0$ V
t_{amb}	Ambient temperature
t_{bulb}	Bulb or envelope temperature
t_{Hg}	Temperature of condensed mercury (at the cathode)
t_{rec}	Recommended temperature
T_{av}	Averaging time
T_{dion}	Deionization time
T_{imp}	Pulse duration
T_h	Heating time of tube
T_{ion}	Ionization time
T_{imp}	Pulse time
T_w	Waiting time of a tube = time which has to pass between switching on of the filament (or heater) voltage and switching on of the voltages on the other electrodes
α	Shadow section on fluorescent screen
β	Light sector on a fluorescent screen
η	Efficiency
μ	Gain factor
μ_{g2g1}	Gain factor of grid No. 2 with respect to grid No. 1

GENERAL OPERATIONAL RECOMMENDATIONS RECEIVING TUBES

1. GENERAL

Where deviations from these directives are permissible or necessary, statements to that effect will be made on the relevant data sheets. If applications are considered not referred to in the data sheet of the relevant tube type extra care should be taken with circuit design to avoid that the tube is overloaded due to unfavourable operating conditions.

Users are warned for applying a tube in circuits where use is made of tube characteristics not controlled by the manufacturer. When at a later date batches of tubes are delivered which show different values for these characteristics this may result in unsatisfactory performance of the equipment.

2. LIMITING VALUES

2.1 Limiting values are in accordance with the applicable rating system as defined by I.E.C. publication 134.

Reference may be made to one of the following 3 rating systems.

2.1.1 *Absolute maximum rating system.* Absolute maximum ratings are limiting values of operating and environmental conditions applicable to any electronic device of a specified type as defined by its published data, and should not be exceeded under the worst probable conditions.

These values are chosen by the device manufacturer to provide acceptable serviceability of the device, taking no responsibility for equipment variations, environmental variations, and the effects of changes in operating conditions due to variations in the characteristics of the device under consideration and of all other electronic devices in the equipment.

The equipment manufacturer should design so that, initially and throughout life, no absolute maximum value for the intended service is exceeded with any device under the worst probable operating conditions with respect to supply voltage variation, equipment components spread and variation, equipment control adjustment, load variations, signal variation, environmental conditions, and spread or variations in characteristics of the device under consideration and of all other electronic devices in the equipment.

2.1.2 *Design-maximum rating system.* Design-maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electronic device* of a specified type as defined by its published data, and should not be exceeded under the worst probable conditions. These values are chosen by the device manufacturer to provide acceptable serviceability of the device, taking responsibility for the effects of changes in operating conditions due to variations in the characteristics of the electronic device under consideration.

The equipment manufacturer should design so that, initially and throughout life, no design-maximum value for the intended service is exceeded with a bogey device under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, variation in characteristics of all other devices in the equipment, equipment control adjustment, load variation, signal variation and environmental conditions.

2.1.3 *Design-centre rating system.* Design-centre ratings are limiting values of operating and environmental conditions applicable to a bogey electronic device* of a specified type as defined by its published data, and should not be exceeded under average conditions.

These values are chosen by the device manufacturer to provide acceptable serviceability of the device in average applications, taking responsibility for normal changes in operating conditions due to rated supply-voltage variation, equipment component spread and variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations or spread in the characteristics of all electronic devices.

The equipment manufacturer should design so that, initially, no design-centre value for the intended service is exceeded with a bogey electronic device* in equipment operating at the stated normal supply-voltage.

2.2 If the tube data specify limiting values according to more than one rating system the circuit has to be designed so that none of these limiting values is exceeded under the relevant conditions.

*Note**. A bogey tube is a tube whose characteristics have the published nominal values for the type. A bogey tube for any particular application can be obtained by considering only those characteristics which are directly related to the application.

2.3 In addition to the limiting values given in the individual data sheets the directives in the following paragraphs should be observed.

3. FLOATING ELECTRODES

All tube electrodes should have a d.c. connection to the cathode (no floating electrodes).

4. ELECTRODE CURRENT

The limiting values I_a, I_{g2}, I_k etc. are the d.c. components of the electrode currents averaged over any 50 ms period.

5. ELECTRODE DISSIPATION

The limiting values W_a, W_{g2} etc. are the average values, obtained by averaging over any 1 s period.

6. HEATER CIRCUIT

Any deviation from the nominal heater voltage (tubes for parallel connection) or from the nominal heater current (tubes for series connection) has a detrimental effect on tube performance and life, and should therefore be kept at a minimum. Such deviations may be caused by:

a) Spread in the characteristics of components such as transformers, resistors, capacitors etc.

b) Mains voltage fluctuations.

The maximum deviation of the heater voltage should not exceed ±15% (design maximum value) in the case of parallel connection, and the maximum deviation of the heater current should not exceed ±8% (design maximum value) in the case of series connection.

7. NO CONNECTIONS SHOULD BE MADE TO A PIN MARKED I.C.

REPLACEMENT GUIDE FOR ELECTRON TUBES

INTRODUCTION

The guide presents a survey of all types of electron tubes for which our tubes can be used as replacements.

Types for which a suitable replacement is sought are listed alphabetically and numerically in the first column; where applicable, alternative CV numbers of our corresponding tubes are listed in the second column; and the type numbers of our equivalent or replacement tubes in the third column.

Type numbers printed between brackets in the third column are near equivalents of the types to be replaced; however, in almost all cases the circuits in which they are to be fitted can be adapted to make use of them as replacements.

Replacements for obsolete types are also listed. In many cases the recommended replacement can be used without modifying the circuit or equipment in which it is to be fitted. In some cases, however, it may be necessary to change or rewire the socket, fit an adapter, or alter the circuit slightly. Where an obsolete triode is to be replaced by a pentode, the latter can be used in triode connection.

The fact that a tube is listed does not imply that it can always be supplied.

TYPE DESIGNATION CODES, RATING SYSTEMS AND LETTER SYMBOLS FOR SEMICONDUCTORS AND INTEGRATED CIRCUITS

TYPE DESIGNATION CODE FOR SEMICONDUCTOR DEVICES

GENERAL

This type designation code applies to discrete devices either with or without junctions, and to multiple devices[1])
The type designation consists of:

TWO LETTERS FOLLOWED BY A SERIAL NUMBER

The first letter distinguishes between junction and non-junction devices and gives an indication of the material

A. Devices with one or more junctions, using material with a band gap of 0.6 to 1.0 eV, such as germanium
B. Devices with one or more junctions, using material with a band gap of 1.0 to 1.3 eV, such as silicon
C. Devices with one or more junctions, using material with a band gap of 1.3 eV and more, such as gallium arsenide
D. Devices with one or more junctions, using material with a band gap of less than 0.6 eV, such as indium antimonide
R. Devices without junction, using materials such as those employed in Hall generators and photoconductive cells

---

[1]) A multiple device is defined as a combination of similar or dissimilar active devices, contained in a common encapsulation that cannot be dismantled, and of which all electrodes of the individual devices are accessible from the outside.
Multiples of similar devices as well as multiples consisting of a main device and an auxiliary device are designated according to the code for discrete devices described above.
Multiples of dissimilar devices of other nature are designated by the second letter G.

The second letter indicates primarily the main application respectively main application and construction if a further differentiation is essential

A. Detection diode, high speed diode, mixer diode
B. Variable capacitance diode
C. Transistor for a.f. applications ($R_{th\ j\text{-}mb} > 15\,^{\circ}\mathrm{C/W}$)
D. Power transistor for a.f. applications ($R_{th\ j\text{-}mb} \leqslant 15\,^{\circ}\mathrm{C/W}$)
E. Tunnel diode
F. Transistor for r.f. applications ($R_{th\ j\text{-}mb} > 15\,^{\circ}\mathrm{C/W}$)
G. Multiple of dissimilar devices
H. Field probe
K. Hall generator in an open magnetic circuit, e.g. magnetogram or signal probe
L. Power transistor for r.f. applications ($R_{th\ j\text{-}mb} \leqslant 15\,^{\circ}\mathrm{C/W}$)
M. Hall generator in a closed electrically energised magnetic circuit, e.g. Hall modulator or multiplier
P. Radiation sensitive device
Q. Radiation generating device
R. Electrically triggered controlling and switching device having a breakdown characteristic ($R_{th\ j\text{-}mb} > 15\,^{\circ}\mathrm{C/W}$)
S. Transistor for switching applications ($R_{th\ j\text{-}mb} > 15\,^{\circ}\mathrm{C/W}$)
T. Electrically, or by means of light, triggered controlling and switching power device having a breakdown characteristic ($R_{th\ j\text{-}mb} \leqslant 15\,^{\circ}\mathrm{C/W}$)
U. Power transistor for switching applications ($R_{th\ j\text{-}mb} \leqslant 15\,^{\circ}\mathrm{C/W}$)
X. Multiplier diode, e.g. varactor, step recovery diode
Y. Rectifying diode, booster diode, efficiency diode
Z. Voltage reference or voltage regulator diode

The serial number consists of:

Three figures for semiconductor devices designed for use primarily in consumer goods
One letter and two figures for semiconductor devices designed for use primarily in professional equipment

EXAMPLES

AF139 Germanium r.f. transistor intended primarily for "entertainment" applications

BYX27 Silicon rectifying diode intended primarily for "industrial" applications

TYPE DESIGNATION FOR SEMICONDUCTOR DEVICES FORMING A RANGE OF VARIANTS

The type designation of a range of variants of:

1. voltage reference or voltage regulator diodes
2. rectifying diodes
3. thyristors

distinctly belonging to one basic type may be qualified by a suffix part which is clearly separated from the basic part by a dash (–).

The basic part being the same for the whole range, is in accordance with the designation code for discrete devices.

The suffix part consists of:

1. *for voltage reference or voltage regulator diodes*

   one letter followed by the typical zener voltage and where appropriate the letter R[1])

   The first letter indicates the nominal tolerance of the zener voltage in %.
   A = 1 %; B = 2 %; C = 5 %; D = 10 %; E = 15 %

   The typical zener voltage is related to the nominal current rating for the whole range. The letter V is used to denote the decimal point when this occurs.

2. *for rectifying diodes*

   a number and where appropriate the letter R[1])

   The number generally indicates the maximum repetitive peak reverse voltage.

   For controlled avalanche types it indicates the maximum crest working reverse voltage

---

[1]) The letter R indicates reverse polarity (stud anode). The normal polarity (stud cathode) and symmetrical executions are not specially indicated.

3. *for thyristors*

a number and where appropriate the letter R [1]) (see foregoing page).

The number generally indicates either the maximum repetitive peak reverse voltage or the maximum repetitive peak off-state voltage, whichever is lower.

For controlled avalanche types it indicates the maximum crest working reverse voltage.

EXAMPLES

BZY88series	Range of silicon voltage regulator diodes for industrial applications
BZY88-C9V1	The particular type out of the range with a typical zener voltage of 9.1 V ± 5 %
BYX13-1200	The particular normal polarity type out of the BYX13series with a maximum repetitive peak reverse voltage of 1200 V
BTX13-200R	The particular reverse polarity type out of the BTX13 thyristor range of which the lower maximum repetitive peak voltage is 200 V

OLD SYSTEM

The first letter is always "O", indicating a semiconductor device. *The second* (*and third*) *letter*(*s*) indicate the general class of device.

A - diode or rectifier	C - transistor
AP - photodiode	CP - phototransistor
AZ - zener diode	RP - photoconductive cell

The group of figures is a serial number indicating a particular design or development.

EXAMPLES

OA81	Semiconductor diode
OAZ200	Zener diode
OC72	Transistor

TYPE DESIGNATION FOR SEMICONDUCTOR RECTIFIER STACKS

The type designation consists of:

THREE LETTERS FOLLOWED BY A SERIAL NUMBER

The first 2 *letters* indicate the type of stack:

OS. Denotes a semiconductor rectifier diode stack
OT. Denotes a semiconductor stack in which also thyristors are used

The third letter indicates the type of circuit:

A. Single phase half wave
B. Two phase half wave
C. Three phase half wave (three phase star)
D. Four phase half wave (four phase star)
E. Six phase half wave (six phase star)
F. Three phase double Y with interphase transformer
H. Single phase full wave (single phase bridge)
J. Single phase magnetic amplifier bridge
K. Three phase full wave (three phase bridge)
L. Four phase full wave (four phase bridge)
M. Voltage doubler (half a single phase full wave)
S. Miscellaneous (such as combinations of single diodes and passive components)

The serial number is sometimes followed by a suffix letter for the indication of variants.

TYPE DESIGNATION CODE FOR INTEGRATED CIRCUITS

This code applies to networks in non-accessible envelopes, such as integrated circuit devices.

For the purpose of type designation the integrated circuits are divided into four groups:

- digital family circuits i.e. circuits belonging to a family of circuits which are related in their specifications, and primarily designed to be mutually connected;
- digital solitary circuits;
- analogue (linear) type of circuits;
- mixed digital-analogue type of circuits.

The type designations consist of:

THREE LETTERS FOLLOWED BY THREE FIGURES[1])

DIGITAL FAMILY CIRCUITS

The first two letters indicate the family for the digital family circuits.

DIGITAL SOLITARY CIRCUITS

The first letter is "S"

The second letter is used to extend the serial number.

DIGITAL FAMILY AND SOLITARY CIRCUITS

The third letter indicates the circuit function in categories

H Combinatorial circuit
J Bistable or multistable sequential circuit
K Monostable sequential circuit
L Level converter
N Bimetastable or multimetastable sequential circuit
Q Read/write memory circuit
R Read-only memory circuit

---

[1]) Sometimes the type designation is followed by a version letter to denote a variant with respect to electrical performance and/or encapsulation.

S Sense amplifier
Y Miscellaneous

ANALOGUE (LINEAR) TYPE CIRCUITS
The first letter is "T"

MIXED DIGITAL/ANALOGUE TYPE CIRCUITS
The first letter is "U"

ANALOGUE AND DIGITAL/ANALOGUE CIRCUITS
The second and third letters are used to extend the serial number.

ALL TYPES
The first two figures represent the serial number.
The third figure indicates the operating ambient temperature range

1	0 to + 70° C or wider
2	− 55 to + 125° C or wider
3	− 10 to + 85° C or wider
4	+ 15 to + 55° C or wider
5	− 25 to + 70° C or wider
6	− 40 to + 85° C or wider
0	open

RATING SYSTEMS

ACCORDING TO I.E.C. PUBLICATION 134

1. DEFINITIONS OF TERMS USED

1.1 *Electronic device.* An electronic tube or valve, transistor or other semiconductor device.

Note: This definition excludes inductors, capacitors, resistors and similar components.

1.2 *Characteristic.* A characteristic is an inherent and measurable property of a device. Such a property may be electrical, mechanical, thermal, hydraulic, electro-magnetic, or nuclear, and can be expressed as a value for stated or recognized conditions. A characteristic may also be a set of related values, usually shown in graphical form.

1.3 *Bogey electronic device.* An electronic device whose characteristics have the published nominal values for the type. A bogey electronic device for any particular application can be obtained by considering only those characteristics which are directly related to the application.

1.4 *Rating.* A value which establishes either a limiting capability or a limiting condition for an electronic device. It is determined for specified values of environment and operation, and may be stated in any suitable terms.

Note: Limiting conditions may be either maxima or minima.

1.5 *Rating system.* The set of principles upon which ratings are established and which determine their interpretation.

NOTE. The rating system indicates the division of responsibility between the device manufacturer and the circuit designer, with the object of ensuring that the working conditions do not exceed the ratings.

2. ABSOLUTE MAXIMUM RATING SYSTEM

Absolute maximum ratings are limiting values of operating and environmental conditions applicable to any electronic device of a specified type as defined by its published data, which should not be exceeded under the worst probable conditions.

These values are chosen by the device manufacturer to provide acceptable serviceability of the device, taking no responsibility for equipment variations, environmental variations, and the effects of changes in operating conditions due to variations in the characteristics of the device under consideration and of all other electronic devices in the equipment.

The equipment manufacturer should design so that, initially and throughout life, no absolute maximum value for the intended service is exceeded with any device under the worst probable operating conditions with respect to supply voltage variation, equipment component variation, equipment control adjustment, load variations, signal variation, environmental conditions, and variations in characteristics of the device under consideration and of all other electronic devices in the equipment.

3. DESIGN MAXIMUM RATING SYSTEM

Design maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electronic device of a specified type as defined by its published data, and should not be exceeded under the worst probable conditions.

These values are chosen by the device manufacturer to provide acceptable serviceability of the device, taking responsibility for the effects of changes in operating conditions due to variations in the characteristics of the electronic device under consideration.

The equipment manufacturer should design so that, initially and throughout life, no design maximum value for the intended service is exceeded with a bogey device under the worst probable operating conditions with respect to supply voltage variation, equipment component variation, variation in characteristics of all other devices in the equipment, equipment control adjustment, load variation, signal variation and environmental conditions.

4. DESIGN CENTRE RATING SYSTEM

Design centre ratings are limiting values of operating and environmental conditions applicable to a bogey electronic device of a specified type as defined by its published data, and should not be exceeded under normal conditions.

These values are chosen by the device manufacturer to provide acceptable serviceability of the device in average applications, taking responsibility for normal changes in operating conditions due to rated supply voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all electronic devices.

The equipment manufacturer should design so that, initially, no design centre value for the intended service is exceeded with a bogey electronic device in equipment operating at the stated normal supply voltage.

NOTE. It is common use to apply the Absolute Maximum System in semiconductor published data.

LETTER SYMBOLS FOR SEMICONDUCTOR DEVICES

excluding rectifier diodes and thyristors

This system is based on the Recommendations of the INTERNATIONAL ELECTROTECHNICAL COMMISSION as published in I.E.C. Publication 148.

QUANTITY SYMBOLS

1. Instantaneous values of current, voltage and power, which vary with time are represented by the appropriate lower case letter.

   Examples: i, v, p

2. Maximum (peak), average, d.c. and root-mean-square values are represented by the appropriate upper case letter.

   Examples: I, V, P

SUBSCRIPTS FOR QUANTITY SYMBOLS

1. Total values are indicated by upper case subscripts.

   Examples: I_C, I_{CM}, I_{CAV}, i_C, V_{EB}

2. Values of varying components are indicated by lower case subscripts.

   Examples: i_c, I_c, v_{eb}, V_{eb}

3. To distinguish between maximum (peak), average, d.c. and root-mean-square values, the following subscripts are added:
   For maximum (peak) values: M or m
   For average values : AV or av (only if it is necessary to distinguish between d.c. and average)
   For d.c. values : no additional subscript
   For root-mean-square values: (rms)

   Examples: I_C, I_{cm}, I_{CAV}, $I_{c(\mathrm{rms})}$, $I_{C(\mathrm{RMS})}$

4. List of subscripts (examples, see figure 1)

A, *a* = Anode terminal
K, *k* = Cathode terminal
E, *e* = Emitter terminal
B, *b* = Base terminal
C, *c* = Collector terminal
(BR) = Break-down
X, *x* = Specified circuit
M, m = Maximum (peak) value
AV, av = Average value
(RMS), (rms) = R.M.S. value
F, *f* = Forward
R, *r* = As first subscript: Reverse. As second subscript: Repetitive
O = As third subscript: The terminal not mentioned is open circuited
S = As second subscript: Non repetitive
As third subscript: Short circuit between the terminal not mentioned and the reference terminal
Z = Zener. (Replaces *R* to indicate the actual zener voltage, current or power of voltage reference or voltage regulator diodes)

5. Examples of the application of the rules:
Figure 1 represents a transistor collector current, consisting of a direct current and a signal, as a function of time.

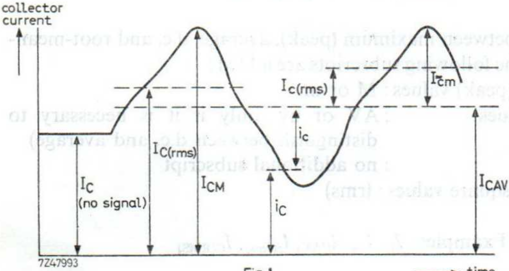

Fig.1

CONVENTIONS FOR SUBSCRIPT SEQUENCE

1. *Currents*

For transistors the first subscript indicates the terminal carrying the current (conventional current flow from the external circuit into the terminal is positive).

For diodes a forward current (conventional current flow into the anode terminal) is represented by the subscript F or f; a reverse current (conventional current flow out of the anode terminal) is represented by the subscript R or r.

2. *Voltages*

For transistors normally, two subscripts are used to indicate the points between which the voltage is measured. The first subscript indicates one terminal point and the second the reference terminal.

Where there is no possibility of confusion, the second subscript may be omitted.

For diodes a forward voltage (anode positive with respect to cathode) is represented by the subscript F or f and a reverse voltage (anode negative with respect to cathode) by the subscript R or r.

3. *Supply voltages*

Supply voltages may be indicated by repeating the terminal subscript.

Examples: V_{EE}, V_{CC}, V_{BB}

The reference terminal may then be indicated by a third subscript.

Examples: V_{EEB}, V_{CCB}, V_{BBC}

4. In devices having more than one terminal of the same type, the terminal subscripts are modified by adding a number following the subscript and on the same line.

   Example: $V_{B2\text{-}E}$ voltage between second base and emitter

   In multiple unit devices, the terminal subscripts are modified by a number preceding the terminal subscripts:

   Example: $V_{1B\text{-}2B}$ voltage between the base of the first unit and that of the second one.

ELECTRICAL PARAMETER SYMBOLS

1. The values of four pole matrix parameters or other resistances, impedances, admittances, etc... inherent in the device, are represented by the lower case symbol with the appropriate subscripts.

   Examples: h_{ib}, z_{fb}, y_{oc}, h_{FE}

2. The four pole matrix parameters of external circuits and of circuits in which the device forms only a part are represented by the upper case symbols with the appropriate subscripts.

   Examples: H_i, Z_o, H_F, Y_R

SUBSCRIPTS FOR PARAMETER SYMBOLS

1. The static values of parameters are indicated by upper case subscripts.

   Examples: h_{IB}, h_{FE}

   Note: The static value is the slope of the line from the origin to the operating point on the appropriate characteristic curve, i.e. the quotient of the appropriate electrical quantities at the operating point.

2. The small signal values of parameters are indicated by lower case subscripts.

Examples: h_{ib}, z_{ob}

3. The first subscript, in matrix notation identifies the element of the four pole matrix.

i (for 11) = input f (for 21) = forward transfer
o (for 22) = output r (for 12) = reverse transfer

Examples:
$$V_1 = h_i I_1 + h_r V_2$$
$$I_2 = h_f I_1 + h_o V_2$$

Notes [1]) The voltage and current symbols in matrix notation are indicated by a single digit subscript.
The subscript 1 = input; the subscript 2 = output

[2]) The voltages and currents in these equations may be complex quantities.

4. The second subscript identifies the circuit configuration.

e = common emitter c = common collector
b = common base j = common terminal, general

Examples: (common base)
$$I_1 = y_{ib} V_{1b} + y_{rb} V_{2b}$$
$$I_2 = y_{fb} V_{1b} + y_{ob} V_{2b}$$

When the common terminal is understood, the second subscript may be omitted.

5. If it is necessary to distinguish between real and imaginary parts of the four pole parameters, the following notations may be used.

$\mathrm{Re}(h_{ib})$ etc... for the real part
$\mathrm{Im}(h_{ib})$ etc... for the imaginary part

LIST OF LETTER SYMBOLS

excluding rectifier diodes and thyristors

Letter symbol	*Definition*
$b_{ib}, b_{ie}, b_{ob}, b_{oe}$	See y parameters
C_c ¹)	Collector capacitance (emitter open-circuited to a.c. and d.c.)
C_d ¹)	Diode capacitance
C_e ¹)	Emitter capacitance (collector open-circuited to a.c. and d.c.)
$C_{ib}, C_{ie}, C_{ob}, C_{oe}$ ¹)	See y parameters
d	Distortion
F	Noise figure
f	Frequency
F_c	Conversion noise figure
$f_{hfb}, f_{hfe}, f_{yfe}$	Cut-off frequency (frequency at which the parameter indicated by the subscript is 0.7 of its low frequency value)
f_T	Transition frequency (gain-bandwidth product)
$g_{ie}, g_{ib}, g_{oe}, g_{ob}$	See y parameters
G_p	Power gain
G_S	Source conductance
G_{tr}	Transducer gain
G_{UM}	Maximum unilateralised power gain
h_{FB}, h_{FC}, h_{FE}	Static value of the forward current transfer ratio or d.c. current gain (output voltage held constant)
h_{fb}, h_{fc}, h_{fe}	Small signal value of the forward current transfer ratio or small signal current gain (output short-circuited to a.c.)

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¹) As an exception to the general rule for electrical parameters capacitances are represented by the upper-case letter.

Letter symbol	*Definition*
h_{IB}, h_{IC}, h_{IE}	Static value of the input resistance (output voltage held constant)
h_{ib}, h_{ic}, h_{ie}	Small signal value of the input impedance (output short-circuited to a.c.)
h_{OB}, h_{OC}, h_{OE}	Static value of the output conductance (input current held constant)
h_{ob}, h_{oc}, h_{oe}	Small signal value of the output admittance (input open-circuited to a.c.)
h_{RB}, h_{RC}, h_{RE}	Static value of the reverse voltage transfer ratio (input current held constant)
h_{rb}, h_{rc}, h_{re}	Small signal value of the reverse voltage transfer ratio (input open-circuited to a.c.)
I_B, I_C, I_E	Total d.c. (or average) current
I_b, I_c, I_e	Varying component of the current
i_B, i_C, i_E	Instantaneous total value of the current
i_b, i_c, i_e	Instantaneous value of the varying component of the current
I_{BAV}, I_{CAV}, I_{EAV}	Total average current (to distinguish between average and d.c. if necessary)
I_{BEX}, I_{CEX}	Total base, respectively collector current under specified conditions. These symbols are commonly used in case of a reverse biased emitter junction
I_{BM}, I_{CM}, I_{EM}	Maximum (peak) value of the total current
I_{bm}, I_{cm}, I_{em}	Maximum (peak) value of the varying component of the current
I_{CBO}	Collector cut-off current (open emitter)
I_{CEO}	Collector cut-off current (open base)
I_{CBS} or I_{CES}	Collector cut-off current (emitter short-circuited to base)
I_{EBO}	Emitter cut-off current (open collector)
I_F	Total forward current of a diode (d.c. or average)
i_F	Instantaneous total value of the forward current of a diode

Letter symbol	*Definition*
I_{FAV}	Total average forward current of a diode (to distinguish between average and d.c. if necessary)
I_{FM}	Peak forward current of a diode
I_i, I_o	Input, respectively output current of a specified circuit
I_R	Total reverse (cut-off) current of a diode
i_R	Instantaneous total value of the reverse current of a diode
I_{RRM}	Repetitive peak reverse current of a diode
I_{RSM}	Non repetitive peak reverse current of a diode
I_Z	Zener current (d.c. or average)
I_{ZM}	Peak zener current
I_{ZS}	Non repetitive zener current
P_i, P_o	Input, respectively output power of a specified circuit
P_{tot}	Total power dissipation in the device
P_Z	Zener power dissipation
P_{ZM}	Peak zener power dissipation
P_{ZSM}	Non repetitive peak zener power dissipation
Q_s	Recovered charge
r_D	Diode (internal) series resistance
R_S	Source resistance
R_{th}	Thermal resistance
$R_{th\ j\text{-}a}$	Thermal resistance from junction to ambient
$R_{th\ j\text{-}mb}$	Thermal resistance from junction to mounting base
$R_{th\ j\text{-}c}$	Thermal resistance from junction to case
$R_{th\ mb\text{-}h}$	Thermal resistance from mounting base to heatsink
r_z	Dynamic-slope resistance of a zener diode
S_z	Temperature coefficient of the operating voltage of a zener diode

Letter symbol	*Definition*
T_{amb}	Ambient temperature
T_{case}	Case temperature
t_d	Delay time
t_f	Fall time
t_{fr}	Forward recovery time of a diode
T_j	Junction temperature
t_{off}	Turn off time ($t_{\mathrm{off}}=t_s+t_f$)
t_{on}	Turn on time ($t_{\mathrm{on}}=t_d+t_r$)
t_r	Rise time
t_{rr}	Reverse recovery time of a diode
t_s	Storage time
T_{stg}	Storage temperature
V_{BB}, V_{CC}, V_{EE}	Supply voltage
V_{BE}, V_{CB}, V_{CE}, V_{EB}	Total value of the voltage (d.c. or average)
V_{be}, V_{cb}, V_{ce}, V_{eb}	Varying component of the voltage
v_{BE}, v_{CB}, v_{CE}, v_{EB}	Instantaneous value of the total voltage
v_{be}, v_{cb}, v_{ce}, v_{eb}	Instantaneous value of the varying component of the voltage
$V_{BE\mathrm{fl}}$	Base-emitter floating voltage (open base)
$V_{BE\mathrm{sat}}$, $V_{CE\mathrm{sat}}$	Saturation voltage at specified bottoming conditions
$V_{(\mathrm{BR})}$	Breakdown voltage
$V_{(\mathrm{BR})CBO}$, $V_{(\mathrm{BR})CEO}$, $V_{(\mathrm{BR})EBO}$	Breakdown voltage between the terminal indicated by the first subscript and the reference terminal (second subscript) when the third terminal is open circuited
$V_{(\mathrm{BR})CER}$	Collector-emitter breakdown voltage with a specified resistance between emitter and base
$V_{(\mathrm{BR})CES}$	Collector-emitter breakdown voltage with the emitter short circuited to the base
V_{CBO}, V_{CEO}, V_{EBO}	Voltage of the terminal indicated by the first subscript w.r.t. the reference terminal (second subscript) with the third terminal open circuited
V_{CEK}	Knee voltage at specified conditions

Letter symbol	*Definition*	
V_{CER}	Collector-emitter voltage with a specified resistance between emitter and base	
V_{CES}	Collector-emitter voltage with the emitter short circuited to the base	
$V_{CE\,.\,\mathrm{sust}}$	Collector-emitter sustaining voltage under the condition, indicated by the third subscript	
V_{CEX}	Collector-emitter voltage in a specified circuit. This symbol is commonly used to indicate a reverse biased emitter junction	
$V_{EB\mathrm{fl}}$	Emitter-base floating voltage (open emitter)	
V_F	Continuous forward voltage of a diode	
V_{FM}	Peak forward voltage of a diode	
V_i, V_o	Input, respectively output voltage of a specified circuit	
V_{pt}	Punch through voltage	
V_R	Continuous reverse voltage of a diode	
V_{RM}	Peak reverse voltage of a diode	
V_{RSM}	Non repetitive peak reverse voltage of a diode	
V_Z	Operating voltage (zener voltage) of a zener diode	
y_{ib}, y_{ie}	Input admittance	Output short circuited to a.c.
g_{ib}, g_{ie}	Input conductance	
C_{ib}, C_{ie}	Input capacitance	
b_{ib}, b_{ie}	Input susceptance	
φ_{ib}, φ_{ie}	Phase angle of input admittance	
y_{fb}, y_{fe}	Transfer admittance	Output short circuited to a.c.
g_{fb}, g_{fe}	Transfer conductance	
C_{fb}, C_{fe}	Transfer capacitance	
φ_{fb}, φ_{fe}	Phase angle of transfer admittance	

Letter symbol	*Definition*	
y_{ob}, y_{oe}	Output admittance	Input short circuited to a.c.
g_{ob}, g_{oe}	Output conductance	
C_{ob}, C_{oe}	Output capacitance	
b_{ob}, b_{oe}	Output susceptance	
$\varphi_{ob}, \varphi_{oe}$	Phase angle of output admittance	
y_{rb}, y_{re}	Feedback admittance	Input short circuited to a.c.
g_{rb}, g_{re}	Feedback conductance	
C_{rb}, C_{re}	Feedback capacitance	
$\varphi_{rb}, \varphi_{re}$	Phase angle of feedback admittance	

LETTER SYMBOLS FOR RECTIFIER DIODES AND THYRISTORS

This system is based on the Recommendations of the INTERNATIONAL ELECTROTECHNICAL COMMISSION.

QUANTITY SYMBOLS

1. Instantaneous values of current, voltage and power, which vary with time are represented by the appropriate lower case letter.

   Examples: i, v, p

2. Maximum (peak), average, d.c. and root-mean-square values are represented by the appropriate upper case letter.

   Examples: I, V, P

SUBSCRIPTS FOR QUANTITY SYMBOLS

1. Total values are indicated by upper case subscripts.
2. Values of varying components are indicated by lower case subscripts.
3. For power rectifier diodes and thyristors the terminal(s) are *not* indicated in the subscripts, except for the gate-terminal of thyristors.
4. List of subscripts:

   G, g = Gate terminal
   F, f = Forward[1]
   D, d = Forward off-state[1]; non trigger (gate voltage or current)
   T, t = Forward on-state[1]; trigger (gate voltage or current)
   R, r = As first subscript; Reverse
   As second subscript: Repetitive

---

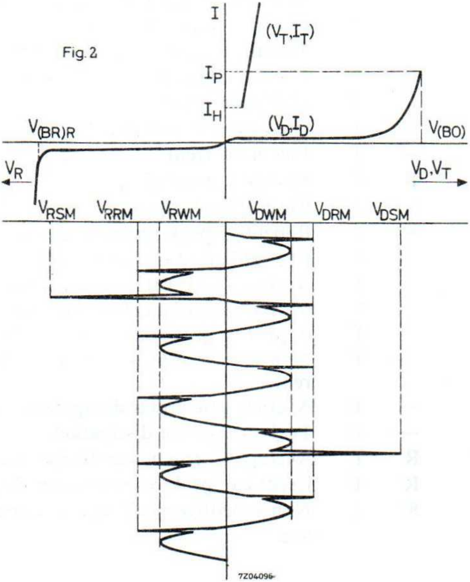
[1] For the anode-cathode voltage of thyristors F is replaced either by D or by T, to distinguish between "off-state" (non triggered) and "on-state" (triggered).

AV, av = Average value
M, m = Maximum (peak or crest) value
(RMS), (rms) = R.M.S. value
(BR) = Breakdown
(BO) = Breakover
H = Holding
P = Pick-up
Q = Turn off
S = As a second subscript: Non repetitive
W = Working

5. Examples of the application of the rules.

The figure represents a simplified thyristor characteristic together with an anode-cathode voltage as a function of time (no gate signal).

Fig. 2



LIST OF LETTER SYMBOLS FOR RECTIFIER DIODES (R) AND THYRISTORS (T)

Instantaneous values (i, p, v) and a.c. components (lower case subscripts) have been omitted:

Letter symbol	*R*	*T*	*Description*
I_D	—	T	Off-state current (d.c.)
I_F	R	—	Forward current (d.c. or average)
I_{FAV}	R	—	Total average forward current (to distinguish between average and d.c. if necessary)
I_{FGM}	—	T	Forward peak gate current
I_{FRM}	R	—	Repetitive peak forward current
I_{FSM}	R	—	Non repetitive peak forward current
I_H	—	T	Holding current
I_{GT}	—	T	Gate current to trigger the device
I_P	—	T	Pick up current
I_R	R	T	Reverse current (d.c.)
I_{RG}	—	T	Reverse gate current
I_{RRM}	R	T	Repetitive peak reverse current
I_T	—	T	Forward on-state current (d.c.)
I_{TAV}	—	T	Average (forward) on-state current
$I_{T(RMS)}$	—	T	R.M.S. value of the (forward) on-state current
I_{TRM}	—	T	Repetitive peak (forward) on-state current
I_{TSM}	—	T	Non repetitive peak (forward) on-state current
P_{GAV}	—	T	Average gate power dissipation
P_{GM}	—	T	Peak gate power dissipation
P_{RAV}	R	T	Average reverse power dissipation
P_{RRM}	R	T	Repetitive peak reverse power dissipation
P_{RSM}	R	T	Non repetitive peak reverse power dissipation

Letter symbol	*R*	*T*	*Description*
$V_{(BO)}$	—	T	Breakover voltage
$V_{(BR)R}$	R	T	Reverse breakdown voltage
V_D	—	T	Continuous off-state voltage
V_{DRM}	—	T	Repetitive peak off-state voltage
V_{DSM}	—	T	Non repetitive peak off-state voltage
V_{DWM}	—	T	Crest working off-state voltage
V_F	R	—	Continuous forward voltage
V_{FGM}	—	T	Forward peak voltage, gate-cathode
V_{GD}	—	T	Gate-cathode voltage not to trigger the device
V_{GT}	—	T	Gate-cathode voltage to trigger the device
V_R	R	T	Continuous reverse voltage
V_{RGM}	—	T	Reverse peak voltage, gate-cathode
V_{RRM}	R	T	Repetitive peak reverse voltage
V_{RSM}	R	T	Non repetitive peak reverse voltage
V_{RWM}	R	T	Crest working reverse voltage
V_T	—	T	Continuous (forward) on-state voltage

LIST OF LETTER SYMBOLS FOR DIGITAL INTEGRATED CIRCUITS

Letter symbol	*Definition*
f	Maximum operating frequency
f_c	Clock rate
I_P	Supply current
M	D.C. noise margin
M_H	D.C. noise margin, signal level HIGH (defined as: $M_H = V_{QH\,\mathrm{min}} - V_{\mathrm{GH\,min}}$)
M_L	D.C. noise margin, signal level LOW (defined as: $M_L = V_{\mathrm{GLmax}} - V_{\mathrm{QLmax}}$)
N_a	Available d.c. fan-out (defined as: $N_a = I_{\mathrm{QLmax}}/-I_{\mathrm{GLmax}}$)
P_{av}	Average power consumption at 50% duty cycle (defined as: $P_{av} = \frac{1}{2} V_P(I_{PH} + I_{PL})$)
P_H	Power consumption, signal level HIGH
P_L	Power consumption, signal level LOW
P_{tot}	Power dissipation, i.e. the total power dissipated by the device
T_{amb}	Operating ambient temperature
t_{pd}	Average propagation delay time (defined as: $t_{pd} = \frac{1}{2}(t_{pdr} + t_{pdf})$)
t_{pdf}	Fall propagation delay time
t_{pdr}	Rise propagation delay time
V_P	Supply voltage

LIST OF LETTER SYMBOLS FOR LINEAR INTEGRATED CIRCUITS

Letter symbol	*Definition*
CMMR	Common-mode rejection ratio
F	Noise figure
$f_{c-\mathrm{o}}$	Cut-off frequency
G_{tr}	Transducer gain
G_v	Voltage gain
I_{io}	Input offset current
$I_{O\mathrm{M}}$	Peak output current
P_o	Output power of a specified circuit
P_{tot}	Total power dissipation in the device
R_L	Load resistance
T_{amb}	Ambient temperature
V_B	Voltage of supply battery
V_i	Input voltage of a specified circuit
V_{io}	Input offset voltage
V_o	Output voltage of a specified circuit
$V_{O\mathrm{M}}$	Peak output voltage swing at $R_L = 10\ \mathrm{k}\Omega$
V_N	Negative supply voltage
V_P	Positive supply voltage
Z_i	Input impedance

REPLACEMENT GUIDE FOR SEMICONDUCTORS AND INTEGRATED CIRCUITS

INTRODUCTION

Semiconductors and integrated circuits listed alphabetically and numerically in the left-hand column of this guide can be replaced by our own types listed opposite them in the right-hand column. If the type numbers in both columns are the same, the recommended replacement completely satisfies the specification of the semiconductor or integrated circuit listed in the left-hand column and is its equivalent.

If the type numbers in both columns differ, the specifications or characteristic data of the recommended replacement may differ in some respect from those of the type listed on the left. Compare their respective data sheets or consult the abridged data in this book.

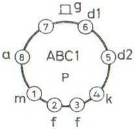
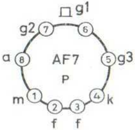
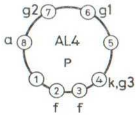
Type numbers given in parentheses are near equivalents of their counterparts in the left-hand column, one or more of the electrical or mechanical data of the two types differing by at least 20 per cent.

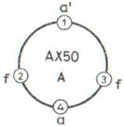
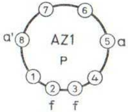
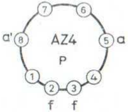
Replacement guides for transistors, for small signal diodes, for voltage regulator (zener) diodes, and for integrated circuits are given.
Field effect transistors, thyristors, and rectifier diodes are not listed.

The fact that a semiconductor or integrated circuit is listed does not imply that it can always be supplied.

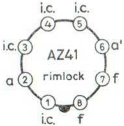
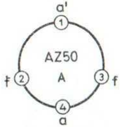
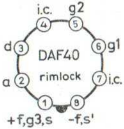
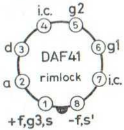
ELECTRON TUBES

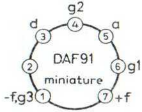
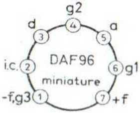
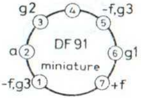
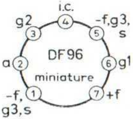
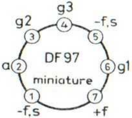
RECEIVING AND AMPLIFYING TUBES

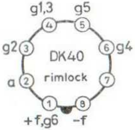
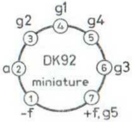
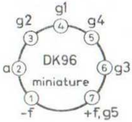
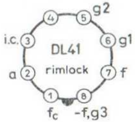
Type and application	V_f (*V*) I_f (*A*)	*Characteristic data*			*Limiting values*	*Base connections*
		Typical (triode)				
ABC1 Double diode triode	4 0.65	$V_a = 250$ V $V_g = -7$ V	$I_a = 4$ mA $S = 2$ mA/V	$R_i = 13.5$ kΩ $\mu = 27$	$W_a = 1.5$ W $I_k = 10$ mA $V_{kf} = 50$ V	
		Typical				
AF7 R.F. pentode	4 0.65	$V_a = 250$ V $V_{g2} = 90$ V $V_{g3} = 0$ V	$V_{g1} = -2$ V $I_a = 3$ mA $I_{g2} = 1.1$ mA	$S = 2.1$ mA/V $R_i = 2$ MΩ $C_{ag1} = <0.003$ pF	$W_a = 1$ W $I_k = 6$ mA $V_{kf} = 50$ V	
		Operating class A				
AL4 Output pentode	4 1.75	$V_a = 250$ V $V_{g2} = 250$ V $R_k = 150$ Ω	$I_a = 36$ mA $I_{g2} = 4$ mA $S = 9$ mAV	$R_i = 50$ kΩ $R_a = 7$ kΩ $W_o = 4.5$ W	$W_a = 9$ W $I_k = 55$ mA $V_{kf} = 100$ V	

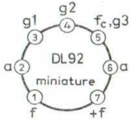
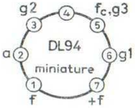
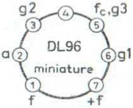
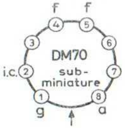
		Operating and Limiting				
AX50 Gasfilled Double anode rectifier	4 3.75	$V_{tr} = 2 \times 500\ \mathrm{V_{rms}}$ $\bar{I}_o\ = \leqslant 275$ mA	$I_{ap}\ = \leqslant\ 1$ A $V_{arc} =\ \ 15$ V	$R_t = > 2 \times 100\ \Omega$ at $C_{filt} = 16\ \mu\mathrm{F}$	$R_t = > 2 \times 200\ \Omega$ at $C_{filt} = < 64\ \mu\mathrm{F}$	
		Operating and Limiting				
AZ1 Double anode rectifier	4 1.1	$V_{tr} = 2 \times 300\ \mathrm{V_{rms}}$ $V_{tr} = 2 \times 500\ \mathrm{V_{rms}}$	$I_o = \leqslant 100$ mA $I_o = \leqslant 60$ mA	$R_t = \geqslant 2 \times 60\ \Omega$ $R_t = \geqslant 2 \times 100\ \Omega$	$C_{filt} = 60\ \mu\mathrm{F}$	
		Operating and Limiting				
AZ4 Double anode rectifier	4 2.3	$V_{tr} = 2 \times 300\ \mathrm{V_{rms}}$ $V_{tr} = 2 \times 500\ \mathrm{V_{rms}}$	$I_o = \leqslant 200$ mA $I_o = \leqslant 120$ mA	$R_t = \geqslant 2 \times 60\ \Omega$ $R_t = \geqslant 2 \times 100\ \Omega$	$C_{filt} = 60\ \mu\mathrm{F}$	

RECEIVING AND AMPLIFYING TUBES

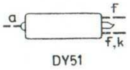
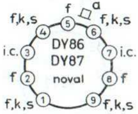
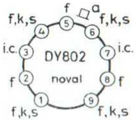
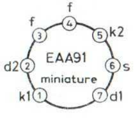
Type and application	V_f *(V)* I_f *(A)*	*Characteristic data*			*Limiting values*	*Base connections*
AZ41 Double anode rectifier	4 0.72	*Operating and Limiting* $V_{tr} = 2 \times 300\ V_{rms}$ $V_{tr} = 2 \times 500\ V_{rms}$	$I_o = \leqslant 70$ mA $I_o = \leqslant 60$ mA	$R_t = \geqslant 2 \times 100\ \Omega$ $R_t = \geqslant 2 \times 200\ \Omega$	$C_{filt} = 50\ \mu F$	
AZ50 Double anode rectifier	4 3	*Operating and Limiting* $V_{tr} = 2 \times 300\ V_{rms}$ $V_{tr} = 2 \times 500\ V_{rms}$	$I_o = \leqslant 300$ mA $I_o = \leqslant 250$ mA	$R_t = \geqslant 2 \times 100\ \Omega$ $R_t = \geqslant 2 \times 200\ \Omega$	$C_{filt} = 16\ \mu F$ $C_{filt} = 64\ \mu F$	
DAF40 Diode-pentode	1.4 0.025	*Typical (pentode)* $V_a = 67.5$ V $V_{g2} = 67.5$ V $V_{g1} = 0$ V	$I_a = 0.85$ mA $I_{g2} = 0.2$ mA $S = 0.7$ mA/V	$R_i = 1.6$ MΩ $\mu_{g2g1} = 32$ $R_{eq.} = 8.7$ kΩ	$W_a = 0.2$ W $I_k = 1.2$ mA $I_d = 0.2$ mA	
DAF41 Diode- A.F. pentode	1.4 0.025	*Operating (pentode)* $V_b = 67.5$ V $V_{g1} = 0$ V	$R_a = 0.22$ MΩ $R_{g2} = 0.82$ MΩ	$I_a = 0.17$ mA $I_{g2} = 0.04$ mA $V_o/V_i = 60$	$W_a = 0.1$ W $I_k = 0.5$ mA $I_d = 0.2$ mA	

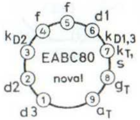
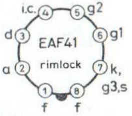
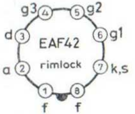
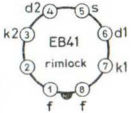
DAF91 Diode- A.F. pentode	1.4 0.05	*Typical (pentode)* $V_a = 67.5$ V $V_{g2} = 67.5$ V $V_{g1} = 0$ V	$I_a = 1.6$ mA $I_{g2} = 0.4$ mA $S = 0.62$ mA/V	$R_i = 0.6$ MΩ $\mu_{g2g1} = 13.5$	$W_a = 0.25$ W $I_k = 4.5$ mA $I_d = 0.2$ mA	
		Operating (pentode) $V_b = 67.5$ V $V_{g1} = 0$ V $R_a = 1$ MΩ	$R_{g1} = 10$ MΩ $R_{g2} = 3.9$ MΩ $I_b = 60$ μA	$V_o/V_i = 55$ $d_{tot} = 3\%$		
DAF96 Diode- A.F. pentode	1.4 0.025	*Operating (pentode)* $V_b = 85$ V $R_a = 1$ MΩ $R_{g2} = 2.7$ MΩ	$R_{g1} = 10$ MΩ $R_{g1} = 2.2$ MΩ $I_a = 64$ μA	$I_{g2} = 21$ μA $V_o/V_i = 70$ $d_{tot} = 2.4\%$	$W_a = 30$ mW $I_k = 1$ mA $I_d = 0.2$ mA	
DF91 Remote cut-off pentode	1.4 0.05	*Typical* $V_a = 90$ V $V_{g2} = 45$ V $V_{g1} = 0$ V	$I_a = 1.8$ mA $I_{g2} = 0.65$ mA $S = 0.75$ mA/V	$R_i = 0.8$ MΩ $\mu_{g2g1} = 11$ $R_{eq.} = 16$ kΩ	$W_a = 0.5$ W $I_k = 5.5$ mA $C_{ag1} = 0.01$ pF	
DF96 Remote cut-off pentode	1.4 0.025	*Typical* $V_b = 85$ V $V_{g1} = 0$ V $R_{g2} = 39$ kΩ	$I_a = 1.65$ mA $I_{g2} = 0.55$ mA $S = 0.85$ mA/V	$R_i = 1$ MΩ $\mu_{g2g1} = 14$ $R_{eq.} = 14$ kΩ	$W_a = 0.25$ W $I_k = 2.2$ mA $C_{ag1} = 0.01$ pF	
DF97 Remote cut-off pentode	1.4 0.025	*Typical* $V_b = 85$ V $V_{g1} = 0$ V $V_{g3} = 0$ V	$R_{g2} = 33$ kΩ $I_a = 1.7$ mA $I_{g2} = 0.7$ mA	$S = 0.94$ mA/V $R_i = 0.45$ MΩ $\mu_{g2g1} = 20$	$W_a = 0.25$ W $I_k = 2.5$ mA	

Type and application	V_f *(V)* I_f *(A)*	*Characteristic data*			*Limiting values*	*Base connections*
		Operating				
DK40 Octode	1.4 0.05	$V_a = V_b = 67.5$ V $V_{g2} = 67.5$ V $V_{g4} = 0$ V $V_{g5} = 67.5$ V	$R_{g1+g3} = 35$ kΩ $V_{osc} = 8$ V_{rms} $I_a = 1$ mA $I_{g2} = 2.6$ mA	$I_{g5} = 0.25$ mA $S_c = 0.43$ mA/V $R_i = 0.9$ MΩ $R_{eq.} = 67$ kΩ	$W_a = 0.2$ W $W_{g2} = 0.2$ W $W_{g5} = 0.02$ W $I_k = 5$ mA	
		Operating				
DK92 Heptode	1.4 0.05	$V_b = 85$ V $V_{g4} = 60$ V $V_{g3} = 0$ V $V_{g2} = 30$ V $V_{osc} = 4$ V_{rms}	$R_{g1} = 27$ kΩ $I_a = 0.65$ mA $I_{g1} = 0.13$ mA $I_{g2} = 1.65$ mA	$I_{g4} = 0.14$ mA $S_c = 0.32$ mA/V $R_i = 1$ MΩ $R_{eq.} = 0.1$ MΩ	$W_a = 0.2$ W $W_{g2} = 0.2$ W $W_{g4} = 0.1$ W $I_k = 4$ mA	
		Operating				
DK96 Heptode	1.4 0.025	$V_a = V_b = 85$ V $V_{g3} = 0$ V $V_{osc} = 4$ V_{rms} $R_{g1} = 27$ kΩ $R_{g2} = 33$ kΩ	$R_{g4} = 0.12$ MΩ $I_a = 0.6$ mA $I_{g1} = 85$ μA $I_{g2} = 1.5$ mA	$I_{g4} = 0.14$ mA $S_c = 0.3$ mA/V $R_i = 0.8$ MΩ $R_{eq.} = 0.1$ MΩ	$W_a = 0.15$ W $W_{g2} = 0.1$ W $W_{g4} = 0.03$ W $I_k = 2.6$ mA	
		Operating class A				
DL41 Output pentode	1.4 0.1 pins: 1-(7+8)	$V_a = 90$ V $V_{g2} = 90$ V $V_{g1} = -3.6$ V $V_i = 3.1$ V_{rms}	$R_a = 11.3$ kΩ $I_a = 8$ mA $I_{g2} = 1.3$ mA $S = 2.45$ mA/V	$R_i = 90$ kΩ $\mu_{g2g1} = 10$ $W_o = 0.33$ W $d_{tot} = 10\%$	$W_a = 1.2$ W $W_{g2} = 0.6$ W $I_k = 12$ mA	

DL92 Output pentode	1.4 0.1 Pins: 5-(1+7)	*Operating class A* $V_a = V_b = 84$ V $V_{g1} = -6.5$ V $V_i = 5.1$ V_{rms} $R_{g2} = 10$ kΩ	$R_a = 7$ kΩ $I_a = 8$ mA $I_{g2} = 1.7$ mA $S = 1.55$ mA/V	$R_i = 0.1$ MΩ $\mu_{g2g1} = 4.5$ $W_o = 0.19$ W $d_{tot} = 13\,\%$	$W_a = 0.7$ W $W_{g2} = 0.15$ W $I_k = 11$ mA	
DL94 Output pentode	1.4 0.1 Pins: 5-(1+7)	*Operating class A* $V_a = 86$ V $V_{g2} = 86$ V $V_{g1} = -4.5$ V $V_i = 4$ V_{rms}	$I_a = 8$ mA $I_{g2} = 1.8$ mA $S = 2$ mA/V $R_i = 110$ kΩ	$\mu_{g2g1} = 7.3$ $R_a = 8$ kΩ $W_o = 0.28$ W $d_{tot} = 10\,\%$	$W_a = 1.2$ W $W_{g2} = 0.45$ W $I_k = 12$ mA	
DL96 Output pentode	1.4 0.05 Pins: 5-(1+7)	*Operating class A* $V_a = 85$ V $V_{g2} = 85$ V $V_{g1} = -5.2$ V $V_i = 3.5$ V_{rms}	$I_a = 5$ mA $I_{g2} = 0.9$ mA $S = 1.4$ mA/V $R_i = 150$ kΩ	$\mu_{g2g1} = 7$ $R_a = 13$ kΩ $W_o = 0.2$ W $d_{tot} = 10\,\%$	$W_a = 0.6$ W $W_{g2} = 0.2$ W $I_k = 6$ mA	
DM70 Tuning indicator	1.4 0.025 (Pin 5 pos.)	*Operating* $V_a = 85$ V $V_g = 0$ V	$I_a = 0.17$ mA	$V_g = -10$ V (for complete extinction)	$W_a = 75$ mW $I_k = 0.6$ mA $V_a =$ min. 45 V	

RECEIVING AND AMPLIFYING TUBES

Type and application	V_f *(V)* I_f *(A)*	*Characteristic data*			*Limiting values*	*Base connections*
DM71 = DM70 with short leads						
		Typical and Limiting				
DY51 E.H.T. Single anode rectifier	1.4 0.55	$V_a = 100$ V $I_a = 13$ mA $C_a = 0.8$ pF	$-V_{ap} = \leqslant 15$ kV $I_a = \leqslant 0.35$ mA	$I_{ap} = \leqslant 40$ mA [1]) $C_{\text{filt}} = \leqslant 2000$ pF	$V_f = < 1.6$ V $V_f = > 1.3$ V	
		Operating and Limiting				
DY86-DY87 E.H.T. Single anode rectifier	1.4 0.55	$V_o = 18$ kV $I_o = 0.15$ mA	R_i (at $I_a = 1$ mA) 20 kΩ	$V_{a\,\text{inv.}\,p} = \leqslant 22$ kV [3]) $I_o = < 0.5$ mA [2])	$I_{ap} = < 40$ mA [1]) $C_{\text{filt}} = < 2000$ pF	
		Operating and Limiting				
DY802 E.H.T. Single anode rectifier	1.4 0.6	$V_o = 20$ kV $I_o = 0.2$ mA	$V_{a\,\text{inv.}\,p} = \leqslant 25$ kV [3])	$I_o = \leqslant 0.5$ mA [2])	$I_{op} = < 50$ mA $C_{\text{filt}} = < 3000$ pF	
		Operating and Limiting				
EAA91 Double diode	6.3 0.3	$V_{tr} = 150$ V$_{\text{rms}}$ $I_o = 9$ mA	$R_t = \geqslant 300\ \Omega$ $C_{\text{filt}} = \leqslant 8\ \mu$F	$V_{+k/-f} = 330$ V $V_{-k/+f} = 150$ V	$-V_{dp} = 420$ V $I_{dp} = 54$ mA	

		Operating (triode)				
EABC80 Triple diode triode	6.3 0.48	$V_b = 170$ V $R_a = 0.1$ MΩ **$R_{g'} = 0.33$ MΩ** **$I_a = 0.82$ mA** $V_o/V_i = 42$	$V_b = 200$ V $R_a = 0.1$ MΩ $R_{g'} = 0.33$ MΩ $I_a = 1$ mA $V_o/V_i = 44$	$V_b = 250$ V $R_a = 0.1$ MΩ $R_{g'} = 0.33$ MΩ $I_a = 1.4$ mA $V_o/V_i = 47$	$W_a = 1$ W $I_k = 5$ mA $V_{kf} = 150$ V	
		Typical (diodes)				
		R_{iD1} (at $V_{d1} = +10$ V) $= 5$ kΩ	R_{iD2} (at $V_{d2} = +5$ V) $= 200$ Ω	R_{iD3} (at $V_{d3} = +5$ V) $= 200$ Ω	$V_{d\,\text{inv. p}} = 350$ V $I_{d1} = 1$ mA $I_{d2}, I_{d3} = 10$ mA	
		Typical (pentode)				
EAF41 Diode- Remote cut-off pentode	6.3 0.2	$V_a = V_b = 250$ V $V_{g1} = -2$ V $R_{g2} = 95$ kΩ	$I_a = 5$ mA $I_{g2} = 1.6$ mA $S = 1.8$ mA/V	$R_i = 1.2$ MΩ $\mu_{g2g1} = 19$ $R_{eq.} = 9$ kΩ	$W_a = 2$ W $I_k = 10$ mA $V_{kf} = 50$ V	
		Typical (pentode)				
EAF42 Diode- Remote cut-off pentode	6.3 0.2	$V_a = V_b = 250$ V $V_{g1} = -2$ V $V_{g3} = 0$ V $R_{g2} = 110$ kΩ	$I_a = 5$ mA $I_{g2} = 1.5$ mA $S = 2$ mA/V	$R_i = 1.4$ MΩ $\mu_{g2g1} = 16$ $R_{eq.} = 7.5$ kΩ	$W_a = 2$ W $I_k = 10$ mA $V_{kf} = 100$ V	
		Operating and Limiting				
EB41 Double diode	6.3 0.3	$V_{tr} = 150\ V_{rms}$ $I_o = 9$ mA	$R_t = \geqslant 300$ Ω $C_{filt} = 8\ \mu$F	$V_{kf} = 150$ V	$-V_{dp} = 420$ V $I_{dp} = 54$ mA	

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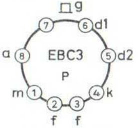
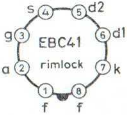
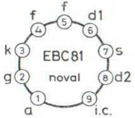
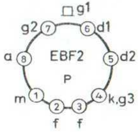
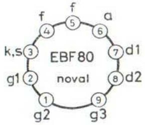
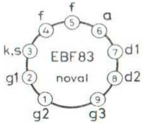
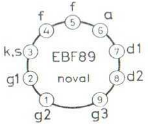
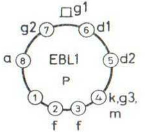
1) Max. duration is 10% of a line scanning cycle, but max. 10 μs. 2) During short periods as in T.V. operation $I_o = < 0.8$ mA. 3) Max. duration 22% of a line scanning cycle and max. 18 μs.

RECEIVING AND AMPLIFYING TUBES

Type and application	$V_f\ (V)$ $I_f\ (A)$	*Characteristic data*			*Limiting values*	*Base connections*
		Typical (*triode*)				
EBC3 Double diode triode	6.3 0.2	$V_a = 200$ V $V_g = -4.3$ V	$I_a = 4$ mA $S = 2$ mA/V	$R_i = 15$ kΩ $\mu = 30$	$W_a = 1.5$ W $I_k = 10$ mA $V_{kf} = 75$ V	
		Typical (*triode*)				
EBC41 Double diode triode	6.3 0.23	$V_a = 250$ V $V_g = -3$ V	$I_a = 1$ mA $S = 1.2$ mA/V	$R_i = 58$ kΩ $\mu = 70$ $R_{eq.} = < 150$ kΩ	$W_a = 0.5$ W $I_k = 5$ mA $V_{kf} = 100$ V	
		Typical (*triode*)				
EBC81 Double diode triode	6.3 0.23	$V_a = 250$ V $V_g = -3$ V	$I_a = 1$ mA $S = 1.2$ mA/V	$R_i = 58$ kΩ $\mu = 70$ $R_{eq.} = \leqslant 150$ kΩ	$W_a = 0.5$ W $I_k = 5$ mA $V_{kf} = 100$ V	
		Operating (*triode*)				
		$V_b = 250$ V $R_a = 22$ kΩ $R_k = 1.8$ kΩ	$R_g = 1$ MΩ $R_{g'} = 0.68$ MΩ	$I_a = 0.7$ mA $V_o/V_i = 51$		
		Typical (*pentode*)				
EBF2 Double diode Remote cut-off pentode	6.3 0.2	$V_a = V_b = 250$ V $V_{g1} = -2$ V $R_{g2} = 95$ kΩ	$I_a = 5$ mA $I_{g2} = 1.6$ mA	$S = 1.8$ mA/V $R_i = 1.3$ MΩ	$W_a = 1.5$ W $I_k = 10$ mA $V_{kf} = 100$ V	

		Typical (pentode)				
EBF80	6.3	$V_a = V_b = 250$ V	$I_a = 5$ mA	$R_i = 1.4$ MΩ	$W_a = 1.5$ W	
Double diode	0.3	$V_{g1} = -2$ V	$I_{g2} = 1.75$ mA	$\mu_{g2g1} = 18$	$I_k = 10$ mA	
Remote cut-off		$V_{g3} = 0$ V	$S = 2.2$ mA/V	$R_{eq.} = 6.8$ kΩ	$V_{kf} = 100$ V	
pentode		$R_{g2} = 95$ kΩ				
		Operating (pentode)				
		$V_b = 250$ V	$R_{g1} = 1$ MΩ	$I_a = 0.75$ mA		
		$R_a = 0.22$ MΩ	$R_{g1'} = 0.68$ MΩ	$I_{g2} = 0.3$ mA		
		$R_{g2} = 0.82$ MΩ	$R_k = 1.8$ kΩ	$V_o/V_i = 110$		
		Typical (pentode)				
EBF83	6.3	$V_a = 12.6$ V	$V_{g1} =$ [1]) V	$S = 1$ mA/V	$I_k = 5$ mA	
Double diode	0.3	$V_{g2} = 12.6$ V	$I_a = 0.45$ mA	$R_i = 1$ MΩ	$V_{kf} = 50$ V	
Remote cut-off		$V_{g3} = 0$ V	$I_{g2} = 0.14$ mA	$C_{ag1} = <2.5$ mpF		
pentode						
		Typical (pentode)				
EBF89	6.3	$V_a = 250$ V	$V_{g1} = -2$ V	$S = 3.8$ mA/V	$W_a = 2.25$ W	
Double diode	0.3	$V_{g2} = 100$ V	$I_a = 9$ mA	$R_i = 1$ MΩ	$I_k = 16.5$ mA	
Remote cut-off		$V_{g3} = 0$ V	$I_{g2} = 2.7$ mA	$\mu_{g2g1} = 20$	$V_{kf} = 100$ V	
pentode						
		Operating class A (pentode)				
EBL1	6.3	$V_a = 250$ V	$I_a = 36$ mA	$\mu_{g2g1} = 23$	$W_a = 9$ W	
Double diode	1.18	$V_{g2} = 250$ V	$I_{g2} = 4$ mA	$R_a = 7$ kΩ	$I_k = 55$ mA	
Output pentode		$V_{g1} = -6$ V	$S = 9$ mA/V	$W_o = 4.5$ W	$V_{kf} = 50$ V	
		$V_i = 4.2\ V_{rms}$	$R_i = 50$ kΩ	$d_{tot} = 10\%$		

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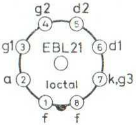
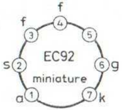
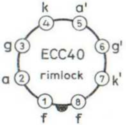
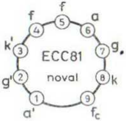
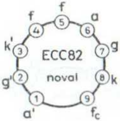
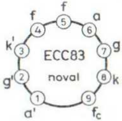
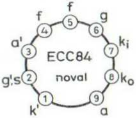
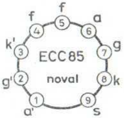
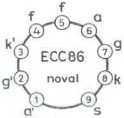
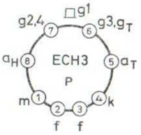
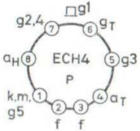
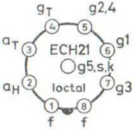
[1]) Obtained by grid current biasing, $R_{g1} = 2.2$ MΩ.

RECEIVING AND AMPLIFYING TUBES

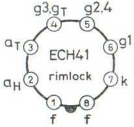
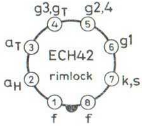
Type and application	V_f *(V)* I_f *(A)*	*Characteristic data*			*Limiting values*	*Base connections*
		Operating class A (pentode)				
EBL21 Double diode Output pentode	6.3 0.8	$V_a=250$ V $V_{g2}=250$ V $V_{g1}=-6$ V $V_i=4.2\ V_{rms}$	$I_a=36$ mA $I_{g2}=4.5$ mA $S=9$ mA/V $R_i=50$ kΩ	$\mu_{g2g1}=23$ $R_a=7$ kΩ $W_o=4.5$ W $d_{tot}=10\%$	$W_a=11$ W $I_k=60$ mA $V_{kf}=50$ V	
EC86	6.3 0.2	For further data see PC86			$V_{+k/-f}=100$ V $V_{-k/+f}=50$ V	
EC88	6.3 0.165	For further data see PC88				
		Typical				
EC92 R.F. triode	6.3 0.15	$V_a=250$ V $V_g=-2$ V	$I_a=10$ mA $S=5.5$ mA/V	$R_i=11$ kΩ $\mu=60$	$W_a=2.5$ W $I_k=15$ mA $V_{kf}=100$ V	
		$V_a=100$ V $V_g=-1$ V	$I_a=3$ mA $S=3.8$ mA/V	$R_i=16.5$ kΩ $\mu=62$		
EC97	6.3 0.215	For further data see PC97				
EC900	6.3 0.18	For further data see PC900				

ECC40 A.F. double-triode	6.3 0.6	*Operating* $V_b=250$ V $R_a=0.1$ MΩ $R_g=1$ MΩ	$R_{g'}=0.33$ MΩ $R_k=2.2$ kΩ $I_a=1.4$ mA	$V_o=<44\ \mathrm{V_{rms}}$ $V_o/V_i=24$ $d_{tot}=3.7\,\%$	$W_a=1.5$ W $I_k=10$ mA $V_{kf}=100$ V	
ECC81 R.F. double-triode	6.3 0.3 or	*Typical* $V_a=250$ V $V_g=-2$ V	$I_a=10$ mA $S=5.5$ mA/V	$R_i=11$ kΩ $\mu=60$	$W_a=2.5$ W $I_k=15$ mA $V_{kf}=90$ V	
	12.6 0.15	$V_a=100$ V $V_g=-1$ V	$I_a=3$ mA $S=3.8$ mA/V	$R_i=16.5$ kΩ $\mu=6.2$		
ECC82 A.F. double triode	6.3 0.3 or	*Typical* $V_a=250$ V $V_g=-8.5$ V	$I_a=10.5$ mA $S=2.2$ mA/V	$R_i=7.7$ kΩ $\mu=17$	$W_a=2.75$ W $I_k=20$ mA $V_{kf}=180$ V	
	12.6 0.15	*Operating* $V_b=250$ V $R_a=0.1$ MΩ $R_g=1$ MΩ	$R_{g'}=0.33$ MΩ $R_k=2.2$ kΩ $I_a=1.63$ mA	$V_o=32\ \mathrm{V_{rms}}$ $V_o/V_i=14$ $d_{tot}=5.9\,\%$		
ECC83 A.F. double-triode	6.3 0.3 or	*Typical* $V_a=250$ V $V_g=-2$ V	$I_a=1.2$ mA $S=1.6$ mA/V	$R_i=62.5$ kΩ $\mu=100$	$W_a=1$ W $I_k=8$ mA $V_{kf}=180$ V	
	12.6 0.15	*Operating* $V_b=250$ V $R_a=0.1$ MΩ $R_g=1$ MΩ	$R_{g'}=0.33$ MΩ $R_k=1.5$ kΩ $I_a=0.86$ mA	$V_o=26\ \mathrm{V_{rms}}$ $V_o/V_i=54.5$ $d_{tot}=3.9\,\%$		
ECC84 Double-triode	6.3 0.33	*Typical* $V_a=90$ V $V_g=-1.5$ V	$I_a=12$ mA $S=6$ mA/V	$R_i=4$ kΩ $\mu=24$	$W_a=2$ W $I_k=22$ mA $V_{kf}=100$ V	

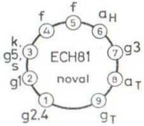
Type and application	V_f *(V)* I_f *(A)*	*Characteristic data*			*Limiting values*	*Base connections*
ECC85 R.F. double-triode	6.3 0.435	*Typical* $V_a = 250$ V $V_g = -2.7$ V	$I_a = 10$ mA $S = 6.1$ mA/V	$R_i = 9$ kΩ $\mu = 55$	$W_a = 2.5$ W $I_k = 15$ mA $V_{kf} = 90$ V	
ECC86 Double-triode	6.3 0.33	*Typical* $V_a = 6.3$ V $V_g = -0.4$ V	$I_a = 0.9$ mA $S = 2.6$ mA/V	$R_i = 5.4$ kΩ $\mu = 14$	$W_a = 0.6$ W $I_k = 20$ mA $V_{kf} = 30$ V	
ECC88	6.3 0.365	For further data see PCC88				
ECC189	6.3 0.365	For further data see PCC189			$V_{kf} = 50$ V	
ECF80	6.3 0.43	For further data see PCF80			$V_{kf} = 100$ V	
ECF86	6.3 0.39	For further data see PCF86			$V_{kf} = 100$ V	
ECF200	6.3 0.41	For further data see PCF200				
ECF201	6.3 0.41	For further data see PCF201				
ECF801	6.3 0.41	For further data see PCF801				

ECF802	6.3 0.43	For further data see PCF802			$V_{kf}=100$ V	
ECH3 Triode- hexode	6.3 0.2	*Frequency changer (hexode)*				
		$V_a=V_b=250$ V	$V_{g1}=-2$ V	$I_{gT+g3}=0.2$ mA	$W_a=1.2$ W	
		$R_1=25$ kΩ	$I_a=3$ mA	$S_c=0.65$ mA/V	$I_k=15$ mA	
		$R_2=33$ kΩ	$I_{g2+g4}=3$ mA	$R_i=1.3$ MΩ	$V_{kf}=100$ V	
		$R_{gT+g3}=50$ kΩ				
		Oscillator (triode)				
		$V_b=250$ V	$R_a=45$ kΩ	$I_{gT+g3}=0.2$ mA	$W_a=1.5$ W	
		$V_{osc}=8$ V_{rms}	$R_{gT+g3}=50$ kΩ	$I_a=3.3$ mA		
ECH4 Triode- heptode	6.3 0.35	*Frequency changer (heptode)*				
		$V_a=V_b=250$ V	$I_a=3$ mA	$S_c=0.75$ mA/V	$W_a=1.5$ W	
		$R_{g2+g4}=24$ kΩ	$I_{g2+g4}=6.2$ mA	$R_i=1.4$ MΩ	$I_k=15$ mA	
		$R_{g3+gT}=50$ kΩ	$I_{g3+gT}=0.19$ mA	$R_{eq.}=55$ kΩ	$V_{kf}=50$ V	
		$V_{g1}=-2$ V				
		Oscillator (triode)				
		$V_b=250$ V	$R_{gT+g3}=50$ kΩ	$I_a=4.5$ mA	$W_a=0.8$ W	
		$R_a=20$ kΩ	$I_{gT+g3}=0.19$ mA	$S_{eff}=0.55$ mA/V		
ECH21 Triode- heptode	6.3 0.33	*Frequency changer (heptode)*				
		$V_a=V_b=250$ V	$I_a=3$ mA	$S_c=0.75$ mA/V	$W_a=1.5$ W	
		$R_{g2+g4}=24$ kΩ	$I_{g2+g4}=6.2$ mA	$R_i=1.4$ MΩ	$I_k=15$ mA	
		$R_{gT+g3}=50$ kΩ	$I_{gT+g3}=0.19$ mA	$R_{eq.}=55$ kΩ	$V_{kf}=50$ V	
		$V_{g1}=-2$ V				
		Oscillator (triode)				
		$V_b=250$ V	$R_{gT+g3}=50$ kΩ	$I_a=4.5$ mA	$W_a=0.8$ W	
		$R_a=20$ kΩ	$I_{gT+g3}=0.19$ mA	$S_{eff}=0.55$ mA/V		

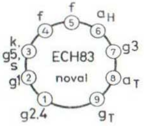
RECEIVING AND AMPLIFYING TUBES

Type and application	V_f *(V)* I_f *(A)*	*Characteristic data*			*Limiting values*	*Base connections*
		Frequency changer (*hexode*)				
ECH41	6.3	$V_a=V_b=250$ V	$V_{g1}=-2$ V	$S_c=0.5$ mA/V	$W_a=0.8$ W	
Triode	0.225	$R_1=33$ kΩ	$I_a=3$ mA	$R_i=2$ MΩ	$I_k=7$ mA	
hexode		$R_2=47$ kΩ	$I_{g2+g4}=2.2$ mA	$R_{eq.}=170$ kΩ	$V_{kf}=100$ V	
		$R_{gT+g3}=20$ kΩ	$I_{gT+g3}=0.35$ mA			
		Oscillator (*triode*)				
		$V_b=250$ V	$R_{gT+g3}=20$ kΩ	$V_{osc}=8\ V_{rms}$	$W_a=0.9$ W	
		$R_a=30$ kΩ	$I_{gT+g3}=0.35$ mA	$S_{eff}=0.55$ mA/V	$I_k=5.5$ mA	
		$I_a=4.9$ mA				
		Frequency changer (*hexode*)				
ECH42	6.3	$V_a=V_b=250$ V	$V_{g1}=-2$ V	$S_c=0.75$ mA/V	$W_a=1.5$ W	
Triode-	0.23	$R_1=27$ kΩ	$I_a=3$ mA	$R_i=\geqslant 1$ MΩ	$I_k=10$ mA	
hexode		$R_2=27$ kΩ	$I_{g2+g4}=3$ mA	$R_{eq.}=0.1$ MΩ	$V_{kf}=100$ V	
		$R_{gT+g3}=22$ kΩ	$I_{gT+g3}=0.35$ mA			
		Oscillator (*triode*)				
		$V_b=250$ V	$I_{gT+g3}=0.35$ mA	$V_{osc}=8\ V_{rms}$	$W_a=0.8$ W	
		$R_a=33$ kΩ	$I_a=5.1$ mA	$S_{eff}=0.6$ mA/V	$I_k=6$ mA	
		$R_{gT+g3}=22$ kΩ				

		Frequency changer (heptode)			
ECH81	6.3	$V_b = 250$ V	$I_a = 3.3$ mA	$S_c = 1.1$ mA/V	$W_a = 2$ W
Triode-heptode	0.3	$R_a = 8.2$ kΩ	$I_{g2+g4} = 7.8$ mA	$R_i = 0.8$ MΩ	$I_k = 18$ mA
		$R_{g2+g4} = 22$ kΩ	$I_{gT+g3} = 0.2$ mA	$R_{eq.} = 30$ kΩ	$V_{kf} = 100$ V
		$R_{gT+g3} = 47$ kΩ	$I_{g1} = 0.5$ µA 1)		
		Operating (heptode)			
		$V_b = 250$ V	$I_a = 11$ mA	$R_i = 0.24$ MΩ	
		$R_a = 8.2$ kΩ	$I_{g2+g4} = 7$ mA	$\mu_{g2g1} = 25$	
		$R_{g2+g4} = 22$ kΩ	$I_{g1} = 0.5$ µA 1)	$R_{eq.} = 4.5$ kΩ	
		$V_{g3} = 0$ V	$S = 4.5$ mA/V		
		Oscillator (triode)			
		$V_b = 250$ V	$R_{gT+g3} = 47$ kΩ	$I_a = 4.5$ mA	$W_a = 0.8$ W
		$R_a = 33$ kΩ	$I_{gT+g3} = 0.2$ mA	$S_{eff} = 0.65$ mA/V	$I_k = 6.5$ mA



		Frequency changer (heptode)			
ECH83	6.3	$V_a = 12.6$ V	$R_{g3} = 47$ kΩ	$I_{g3} = 18$ µA	$I_k = 5$ mA
Triode-heptode	0.3	$V_{g2+g4} = 12.6$	$I_a = 0.17$ mA	$S_c = 0.22$ mA/V	$V_{kf} = 150$ V
		$V_{g1} =$ 2) V	$I_{g2+g4} = 0.3$ mA	$R_i = 1.5$ MΩ	
		$V_{osc} = 1.7\ V_{rms}$			
		Operating (heptode)			
		$V_a = 12.6$ V	$I_a = 0.4$ mA	$R_i = 0.85$ MΩ	
		$V_{g2+g3+g4} = 12.6$ V	$I_{g2+g3+g4} = 0.25$ mA	$R_{eq.} = 6.5$ kΩ	
		$V_{g1} =$ 2) V	$S = 0.75$ mA/V		
		Typical (triode)			
		$V_a = 12.6$ V	$I_a = 0.75$ mA	$R_i = 13$ kΩ	$W_a = 0.8$ W
		$V_{g1} =$ 3) V	$S = 1.4$ mA/V	$\mu = 18.3$	$I_k = 6.5$ mA



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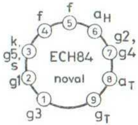
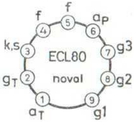
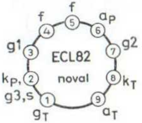
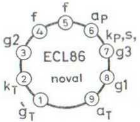
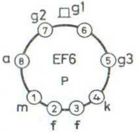
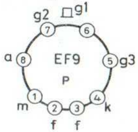
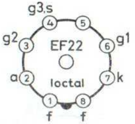
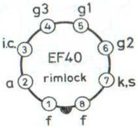
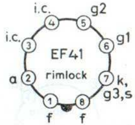
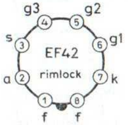
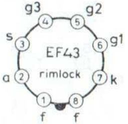
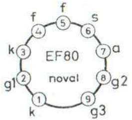
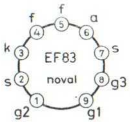
1) Grid current bias obtained with $R_{g1} = 1$ MΩ and with zero Volts a.g.c. voltage; resulting grid one voltage: -0.5 V
2) Obtained by grid current biasing; $R_{g1} = 1$ MΩ. 3) Obtained by grid current biasing: $R_{g1} = 47$ kΩ.

Type and application	V_f *(V)* I_f *(A)*	*Characteristic data*			*Limiting values*	*Base connections*
		Typical (heptode)				
ECH84 Triode- heptode	6.3 0.3	$V_a = 135$ V $V_{g3} = 0$ V $V_{g2+g4} = 14$ V	$V_{g1} = 0$ V $I_a = 1.7$ mA	$I_{g2+g4} = 0.9$ mA $S = 2.2$ mA/V	$W_a = 1.7$ W $I_k = 12.5$ mA $V_{kf} = 100$ V	
		Typical (triode)				
		$V_a = 50$ V $V_g = 0$ V	$I_a = 3$ mA $S = 3.7$ mA/V	$R_i = 13.5$ kΩ $\mu = 50$	$W_a = 1.3$ W $I_k = 10$ mA	
ECH200	6.3 0.435	For further data see PCH200			$V_{kf} = 100$ V	
		Operating class A (pentode)				
ECL80 Triode- output pentode	6.3 0.3	$V_a = 200$ V $V_{g2} = 200$ V $V_{g3} = 0$ V $V_{g1} = -8$ V	$I_a = 17.5$ mA $I_{g2} = 3.3$ mA $S = 3.3$ mA/V $R_i = 0.15$ MΩ	$\mu_{g2g1} = 14$ $R_{a\sim} = 11$ kΩ $W_o = 1.75$ W $V_i = 5.1$ V_{rms}	$W_a = 3.5$ W $I_k = 25$ mA $V_{kf} = 150$ V	
		Operating (triode)				
		$V_b = 200$ V $R_a = 0.1$ MΩ $R_g = 0.33$ MΩ	$I_a = 1.2$ mA $V_o = 29$ V_{rms}	$V_o/V_i = 10$ $d_{tot} = 8\%$	$W_a = 1$ W $I_k = 8$ mA	

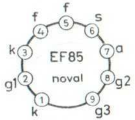
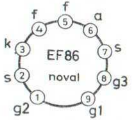
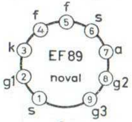
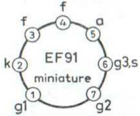
ECL82 Triode- output pentode	6.3 0.78	*Operating class A (pentode)* $V_{ba}=V_{bg2}=272$ V $R_{g2}=$ 2.2 kΩ R_k =650 Ω $R_{a\sim}=$ 8 kΩ	 I_a =28 mA $I_{g2}=6.5$ mA at $V_i=0$ V I_a =27 mA	 $I_{g2}=10.8$ mA at $V_i=9.5$ V_{rms} $W_o=3.5$ W $d_{tot}=10\%$	 $W_a=$ 5 W I_k = 50 mA $V_{kf}=150$ V	
		Operating (triode) V_b =200 V R_a =0.22 MΩ R_g = 3 MΩ $R_{g'}$=0.68 MΩ	 $R_k=$ 2.2 kΩ R_s=0.22 MΩ I_a =0.52 mA	 $V_o=26$ V_{rms} $V_o/V_i=51$ d_{tot} = 1.6%	 $W_a=$ 1 W I_k = 15 mA $V_{kf}=100$ V	
ECL84	6.3 0.72	For further data see PCL84			$V_{kf}=200$ V	
ECL85 **ECL805**	6.3 0.875	For further data see PCL85			$V_{kf}=100$ V	
ECL86 Triode- output pentode	6.3 0.66	*Operating class A (pentode)* V_a =250 V V_{g2} =250 V R_k =170 V $R_{a\sim}=7$ kΩ	 I_a =36 mA $I_{g2}=$ 6 mA at $V_i=0$ V I_a =37 mA	 $I_{g2}=10.2$ mA at $V_i=3.2$ V_{rms} $W_o=4$ W $d_{tot}=10\%$	 $W_a=$ 9 W I_k = 55 mA $V_{kf}=100$ V	
		Operating (triode) V_b =250 V R_g =0.22 MΩ $R_{g'}$=0.68 MΩ	 $R_k=1.75$ kΩ $I_a=$ 0.6 mA	 V_o =3.2 V_{rms} $V_o/V_i=70$ d_{tot} =0.4%	 $W_a=$ 0.5 W I_k = 4 mA $V_{kf}=100$ V	

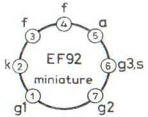
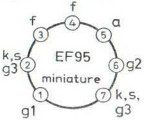
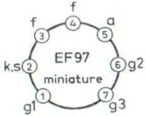
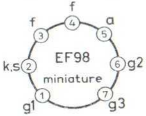
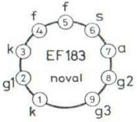
RECEIVING AND AMPLIFYING TUBES

Type and application	V_f *(V)* I_f *(A)*	*Characteristic data*			*Limiting values*	*Base connections*
ED500	6.3 0.35	For further data see PD500				
EF6 Sharp cut-off pentode	6.3 0.2	*Typical* $V_a = 250$ V $V_{g2} = 100$ V $V_{g1} = -2$ V	 $V_{g3} = 0$ V $I_a = 3$ mA $I_{g2} = 0.8$ mA	 $S = 1.8$ mA/V $R_i = 1.2$ MΩ $C_{ag1} = <3$ mpF	 $W_a = 1$ W $I_k = 6$ mA	
EF9 Remote cut-off pentode	6.3 0.2	*Typical* $V_a = V_b = 250$ V $R_{g2} = 90$ kΩ $V_{g3} = 0$ V	 $V_{g1} = -2.5$ V $I_a = 6$ mA $I_{g2} = 1.7$ mA	 $S = 2.2$ mA/V $R_i = 1.2$ MΩ $C_{ag1} = <2$ mpF	 $W_a = 2$ W $I_k = 10$ mA $V_{kf} = 100$ V	
EF22 Remote cut-off pentode	6.3 0.2	*Typical* $V_a = V_b = 250$ V $R_{g2} = 90$ kΩ $V_{g3} = 0$ V	 $V_{g1} = -2.5$ V $I_a = 6$ mA $I_{g2} = 1.7$ mA	 $S = 2.2$ mA/V $R_i = 1.2$ MΩ $C_{ag1} = <2$ mpF	 $W_a = 2$ W $I_k = 10$ mA $V_{kf} = 50$ V	
EF40 A.F. pentode	6.3 0.2	*Operating* $V_b = 250$ V $R_a = 0.1$ MΩ $R_{g2} = 0.39$ MΩ	 $R_{g1} = 1$ MΩ $R_{g1'} = 0.33$ MΩ $R_k = 1$ kΩ	 $I_k = 2$ mA $V_o/V_i = 112$	 $W_a = 1$ W $I_k = 6$ mA $V_{kf} = 100$ V	

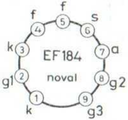
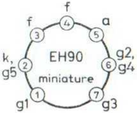
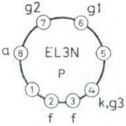
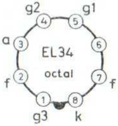
EF41 Remote cut-off pentode	6.3 0.2	*Typical* $V_a = V_b = 250$ V $R_{g2} = 90$ kΩ $V_{g1} = -2.5$ V	$I_a = 6$ mA $I_{g2} = 1.7$ mA $S = 2.2$ mA/V	$R_i = 1.1$ MΩ $\mu_{g2g1} = 18$ $R_{eq.} = 6.5$ kΩ	$W_a = 2$ W $I_k = 10$ mA $V_{kf} = 100$ V	
EF42 Wide band sharp cut-off pentode	6.3 0.33	*Typical* $V_a = 250$ V $V_{g2} = 250$ V $V_{g3} = 0$ V $V_{g1} = -2$ V	$I_a = 10$ mA $I_{g2} = 2.4$ mA $S = 9$ mA/V	$R_i = 0.5$ MΩ $\mu_{g2g1} = 83$ $R_{eq.} = 840$ Ω	$W_a = 3.5$ W $I_k = 25$ mA $V_{kf} = 100$ V	
EF43 Wide band remote cut-off pentode	6.3 0.33	*Typical* $V_a = V_b = 250$ V $V_{g3} = 0$ V $V_{g1} = -2$ V	$R_{g2} = 33$ kΩ $I_a = 15$ mA $I_{g2} = 3.5$ mA	$S = 6.4$ mA/V $R_i = 0.5$ MΩ $R_{eq.} = 1.7$ kΩ	$W_a = 3.75$ W $I_k = 20$ mA $V_{kf} = 100$ V	
EF80 Sharp cut-off pentode	6.3 0.3	*Typical* $V_a = 170$ V $V_{g2} = 170$ V $V_{g3} = 0$ V $V_{g1} = -2$ V	$I_a = 10$ mA $I_{g2} = 2.5$ mA $S = 7.4$ mA/V	$R_i = 0.5$ MΩ $\mu_{g2g1} = 50$ $R_{eq.} = 1$ kΩ	$W_a = 2.5$ W $I_k = 15$ mA $V_{kf} = 150$ V	
EF83 Remote cut-off pentode	6.3 0.2	*Typical* $V_a = 250$ V $V_{g2} = 50$ V $V_{g3} = 0$ V	$V_{g1} = -1.6$ V $I_a = 4$ mA $I_{a2} = 1.15$ mA	$S = 1.6$ mA/V $R_i = 1.6$ MΩ $\mu_{g2g1} = 10$	$W_a = 1$ W $I_k = 6$ mA $V_{kf} = 100$ V	

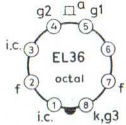
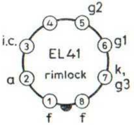
RECEIVING AND AMPLIFYING TUBES

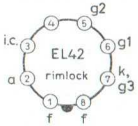
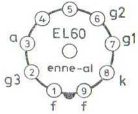
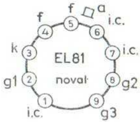
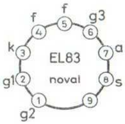
Type and application	V_f *(V)* I_f *(A)*	*Characteristic data*			*Limiting values*	*Base connections*
		Typical				
EF85 Remote cut-off wide band pentode	6.3 0.3	$V_a = V_b = 250$ V $R_{g2} = 60$ kΩ $V_{g3} = 0$ V $V_{g1} = -2$ V	$I_a = 10$ mA $I_{g2} = 2.5$ mA $S = 6$ mA/V	$R_i = 0.6$ MΩ $\mu_{g2g1} = 26$ $R_{eq.} = 1.4$ kΩ	$W_a = 2.5$ W $I_k = \cdot 15$ mA $V_{kf} = 150$ V	
		Operating				
EF86 A.F. pentode	6.3 0.2	$V_b = 250$ V $R_a = 0.1$ MΩ $R_{g2} = 0.39$ MΩ	$R_k = 1$ kΩ $R_{g1'} = 0.33$ MΩ $I_k = 2$ mA	$V_o = 50$ V_{rms} $V_o/V_i = 123$ $d_{tot} = 5\%$	$W_a = 1$ W $I_k = 6$ mA $V_{kf} = 100$ V	
		Typical				
EF89 Remote cut-off pentode	6.3 0.2	$V_a = V_b = 250$ V $R_{g2} = 50$ kΩ $V_{g3} = 0$ V	$V_{g1} = -2$ V $I_a = 9$ mA $I_{g2} = 3$ mA	$S = 3.5$ mA/V $R_i = 0.9$ MΩ $R_{eq.} = 4.2$ kΩ	$W_a = 2.25$ W $I_k = 16.5$ mA $V_{kf} = 100$ V	
		Typical				
EF91 Sharp cut-off pentode	6.3 0.3	$V_a = 250$ V $V_{g2} = 250$ V $V_{g3} = 0$ V $V_{g1} = -2$ V	$I_a = 10$ mA $I_{g2} = 2.55$ mA $S = 7.6$ mA/V	$R_i = 1$ MΩ $\mu_{g2g1} = 70$ $R_{eq.} = 1.2$ kΩ	$W_a = 2.5$ W $I_k = 15$ mA $V_{kf} = 150$ V	

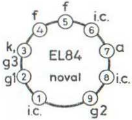
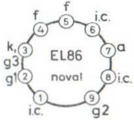
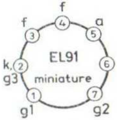
EF92 Remote cut-off	6.3 0.2	*Typical* $V_a = 250$ V $V_{g2} = 150$ V $V_{g3} = 0$ V	$V_{g1} = -0.65$ V $I_a = 8$ mA $I_{g2} = 2$ mA	$S = 2.5$ mA/V $\mu_{g2g1} = 30$	$W_a = 2.5$ W $I_k = 12$ mA $V_{kf} = 100$ V	
EF95 Sharp cut-off pentode	6.3 0.175	*Typical* $V_a = 180$ V $V_{g2} = 120$ V $R_k = 200\ \Omega$	$I_a = 7.7$ mA $I_{g2} = 2.4$ mA $S = 5.1$ mA/V	$R_i = 0.69$ MΩ $R_{eq.} = 2$ kΩ	$W_a = 1.7$ W $I_k = 18$ mA $V_{kf} = 90$ V	
EF97 Remote cut-off pentode	6.3 0.3	*Typical* $V_a = 12.6$ V $V_{g2} = 6.3$ V $V_{g3} = 0$ V	$V_{g1} = -0.7$ V $I_a = 3.3$ mA $I_{g2} = 0.95$ mA	$S = 2.1$ mA/V $R_i = 50$ kΩ $R_{eq.} = 5$ kΩ	$W_a = 0.5$ W $I_k = 15$ mA $V_{kf} = 50$ V	
EF98 Sharp cut-off pentode	6.3 0.3	*Typical* $V_a = 12.6$ V $V_{g2} = 6.3$ V $V_{g3} = 0$ V	$V_{g1} = -0.75$ V $I_a = 2$ mA $I_{g2} = 0.7$ mA	$S = 2$ mA/V $R_i = 0.2$ MΩ $\mu_{g2g1} = 4.1$	$W_a = 0.5$ W $I_k = 15$ mA $V_{kf} = 50$ V	
EF183 Remote cut-off pentode	6.3 0.3	*Typical* $V_a = 200$ V $V_{g2} = 90$ V $V_{g3} = 0$ V	$V_{g1} = -2$ V $I_a = 12$ mA $I_{g2} = 4.5$ mA	$S = 12.5$ mA/V $R_i = 0.5$ MΩ $R_{eq.} = 490\ \Omega$	$W_a = 2.5$ W $I_k = 20$ mA $V_{kf} = 150$ V	

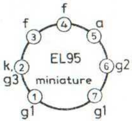
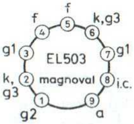
RECEIVING AND AMPLIFYING TUBES

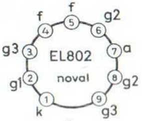
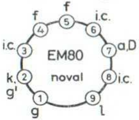
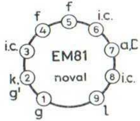
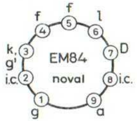
Type and application	V_f *(V)* I_f *(A)*	*Characteristic data*			*Limiting values*	*Base connections*
EF184 Sharp cut-off pentode	6.3 0.3	*Typical* $V_a = 200$ V $V_{g2} = 200$ V $V_{g3} = 0$ V $V_{g1} = -2.5$ V	$I_a = 10$ mA $I_{g2} = 4.1$ mA $S = 15$ mA/V	$R_i = 380$ kΩ $\mu_{g2g1} = 60$ $R_{eq.} = 330$ Ω	$W_a = 2.5$ W $I_k = 25$ mA $V_{kf} = 150$ V	
EFL200	6.3 0.81	For further data see PFL200				
EH90 Dual controle heptode	6.3 0.3	*Operating* $V_a = 100$ V $V_{g2+g4} = 30$ V $V_{g1} = -1$ V	$V_{g3} = 0$ V $I_a = 0.75$ mA $I_{g2+g4} = 1.1$ mA	$S_{g1} = 1.1$ mA/V $R_i = 0.9$ MΩ	$W_a = 1$ W $I_k = 14$ mA $V_{+k/-f} = 200$ V $V_{-k/+f} = 100$ V	
EL3N Output pentode	6.3 0.9	*Operating class A* $V_a = 250$ V $V_{g2} = 250$ V $R_k = 150$ Ω $I_a = 36$ mA	$I_{g2} = 4$ mA $S = 9$ mA/V $R_i = 50$ kΩ $\mu_{g2g1} = 23$	$R_a = 7$ kΩ $W_o = 4.5$ W $V_i = 4.2$ V_{rms} $d_{tot} = 10\%$	$W_a = 9$ W $I_k = 55$ mA $V_{kf} = 100$ V	
EL34 A.F. output pentode	6.3 1.5	*Operating class A* $V_a = 250$ V $V_{g2} = 265$ V $V_{g1} = -13.5$ V $V_{g3} = 0$ V	$I_a = 100$ mA $I_{g2} = 15$ mA $S = 12.5$ mA/V $R_i = 17$ kΩ	$R_{a\sim} = 2$ kΩ $W_o = 11$ W $V_i = 8.7$ V_{rms} $d_{tot} = 10\%$	$W_a = 25$ W $I_k = 150$ mA $V_{kf} = 100$ V	

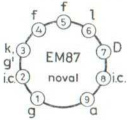
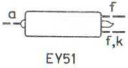
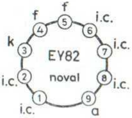
		Class AB				
		V_b $=375$ V	I_a $=2\times75$ mA	I_{g2} $=2\times22$ mA		
		$R_{aa\sim}$ $=$ 3.4 kΩ	$I_{g2}=2\times11$ mA	at $V_i=21$ V_{rms}		
		R_k $=130$ Ω	at $V_i=0$ V	$W_o=35$ W		
		R_{g2} $=470$ Ω	I_a $=2\times95$ mA	$d_{tot}=5\%$		
		V_{g3} $=$ 0 V				
		Typical				
EL36	6.3	V_a $=100$ V	I_a $=100$ mA	R_i $=5$ kΩ	W_a $=$ 12 W	
Line and A.F.	1.25	$V_{g2}=100$ V	$I_{g2}=$ 7 mA	$\mu_{g2g1}=5.6$	$W_{g2}=$ 5 W	
output pentode		$V_{g1}=-8.2$ V	S $=$ 14 mA/V		I_k $=200$ mA	
					V_{kf} $=100$ V	
		Operating class A				
		V_a $=300$ V	I_a $=2\times18$ mA	I_{g2} $=2\times19$ mA		
		V_{g2} $=150$ V	$I_{g2}=2\times0.5$ mA	at $V_i=20$ V_{rms}		
		V_{g1} $=-29$ V	at $V_i=0$ V	$W_o=44.5$ W		
		$R_{aa\sim}=$ 3.5 kΩ	I_a $=2\times100$ mA	$d_{tot}=7.2\%$		
		Operating class A				
EL41	6.3	V_a $=250$ V	I_{g2} $=5.2$ mA	$R_{a\sim}=7$ kΩ	$W_a=$ 9 W	
A.F. output	0.71	$V_{g2}=250$ V	S $=10$ mA/V	W_o $=3.9$ W	I_k $=$ 55 mA	
pentode		$R_k=170$ Ω	R_i $=40$ kΩ	V_i $=3.8$ V_{rms}	$V_{kf}=100$ V	
		I_a $=$ 36 mA	$\mu_{g2g1}=22$	d_{tot} $=10\%$		

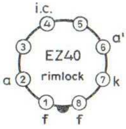
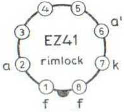
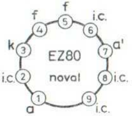
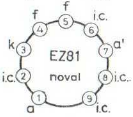
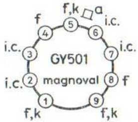
Type and application	V_f *(V)* I_f *(A)*	*Characteristic data*			*Limiting values*	*Base connections*
EL42 A.F. output pentode	6.3 0.2	*Operating class A* $V_a = 225$ V $V_{g2} = 225$ V $R_k = 360\ \Omega$ $I_a = 26$ mA	 $I_{g2} = 4.1$ mA $S = 3.2$ mA/V $R_i = 90$ kΩ $\mu_{g2g1} = 11$	 $R_{a\sim} = 9$ kΩ $W_o = 2.8$ W $V_i = 8\ V_{rms}$ $d_{tot} = 12\,\%$	 $W_a = 6$ W $I_k = 35$ mA $V_{kf} = 100$ V	
EL60 = EL34 with different base						
EL81 Line time base and A.F. output pentode	6.3 1.05	*Typical* $V_a = 250$ V $V_{g2} = 250$ V $V_{g3} = 0$ V	 $V_{g1} = -38.5$ V $I_a = 32$ mA $I_{g2} = 2.4$ mA	 $S = 4.6$ mA/V $R_i = 15$ kΩ $\mu_{g2g1} = 5.1$	 $W_a = 8$ W $I_k = 180$ mA $V_{kf} = 100$ V	
		Operating class B $V_a = 200$ V $V_{bg2} = 200$ V $R_{g2} = 1$ kΩ $R_{aa\sim} = 2.5$ kΩ	 $V_{g1} = -31.5$ V $I_a = 2 \times 25$ mA $I_{g2} = 2 \times 2$ at $V_i = 0$ V	 $I_a = 2 \times 87$ mA $I_{g2} = 2 \times 12.5$ mA at $V_i = 22.5\ V_{rms}$ $W_o = 20$ W $d_{tot} = 5.2\,\%$		
EL82	6.3 0.8	For further data see PL82			$V_{kf} = 100$ V	
EL83 Video output pentode	6.3 0.71	*Typical* $V_a = 250$ V $V_{g2} = 250$ V $V_{g3} = 0$ V	 $V_{g1} = -5.5$ V $I_a = 36$ mA $I_{g2} = 5$ mA	 $S = 10$ mA/V $R_i = 0.13$ MΩ $\mu_{g2g1} = 24$	 $W_a = 9$ W $I_k = 70$ mA $V_{kf} = 100$ V	

EL84 A.F. output pentode	6.3 0.76	*Operating class A* $V_a = 250$ V $V_{g2} = 250$ V $R_k = 135\ \Omega$ $I_a = 48$ mA	$I_{g2} = 5.5$ mA $S = 11.3$ mA/V $R_i = 38$ kΩ $\mu_{g2g1} = 19$	$R_{a\sim} = 5.2$ kΩ $W_o = 5.7$ W $V_i = 4.3\ V_{rms}$ $d_{tot} = 10\%$	$W_a = 12$ W $I_k = 65$ mA $V_{kf} = 100$ V	
		Class B $V_a = 300$ V $V_{g2} = 300$ V $V_{g1} = -14.7$ V $R_{aa\sim} = 8$ kΩ	$I_a = 2 \times 7.5$ mA $I_{g2} = 2 \times 0.8$ mA at $V_i = 0$ V $I_a = 2 \times 46$ mA	$I_{g2} = 2 \times 11$ mA at $V_i = 10\ V_{rms}$ $W_o = 17$ W $d_{tot} = 4\%$		
EL86 Frame and A.F. output pentode	6.3 0.76	*Operating class A* $V_b = 200$ V $R_{g2} = 470\ \Omega$ $R_k = 215\ \Omega$	$R_{a\sim} = 2.5$ kΩ $I_a = 64$ mA $I_{g2} = 11.4$ mA	$V_i = 7\ V_{rms}$ $W_o = 5.3$ W $d_{tot} = 10\%$	$W_a = 12$ W $I_k = 100$ mA $V_{kf} = 200$ V	
		Class AB $V_{ba} = 250$ V $V_{bg2} = 200$ V $R_k = 150\ \Omega$ $R_{aa\sim} = 5.5$ kΩ	$I_a = 2 \times 50$ mA $I_{g2} = 2 \times 2$ mA at $V_i = 0$ V $I_a = 2 \times 55$ mA	$I_{g2} = 2 \times 13$ mA at $V_i = 13\ V_{rms}$ $W_o = 18.5$ W $d_{tot} = 4.5\%$		
EL91 A.F. output pentode	6.3 0.2	*Operating class A* $V_a = 250$ V $V_{g2} = 250$ V $R_k = 740\ \Omega$	$I_a = 16$ mA $I_{g2} = 2.4$ mA $R_a = 16$ kΩ	$W_o = 1.4$ W $V_i = 5.3\ V_{rms}$ $d_{tot} = 10\%$	$W_a = 4$ W $I_k = 25$ mA $V_{+k/-f} = 150$ V	

Type and application	V_f *(V)* I_f *(A)*	*Characteristic data*			*Limiting values*	*Base connections*
		Typical				
EL95	6.3	$V_a = 250$ V	$I_a = 24$ mA	$\mu_{g2g1} = 17$	$W_a = 6$ W	
A.F. output	0.2	$V_{g2} = 250$ V	$I_{g2} = 4.5$ mA	$R_i = 80$ kΩ	$I_k = 35$ mA	
pentode		$V_{g1} = -9$ V	$S = 5$ mA/V		$V_{kf} = 100$ V	
		Operating class A				
		$V_a = 250$ V	$I_a = 24$ mA	$V_i = 5\ V_{rms}$		
		$V_{g2} = 250$ V	$I_{g2} = 4.5$ mA	$W_o = 3$ W		
		$R_k = 320\ \Omega$	$R_{a\sim} = 10$ kΩ	$d_{tot} = 12\%$		
EL500	6.3 1.38	For further data see PL500			$W_a = 12$ W $V_{kf} = 200$ V	
		Typical				
EL503	6.3	$V_a = 250$ V	$I_a = 110$ mA	$\mu_{g2g1} = 13$	$W_a = 29$ W	
A.F. output	1.05	$V_{g2} = 250$ V	$I_{g2} = 7$ mA	$R_i = 5.4$ kΩ	$I_k = 200$ mA	
pentode		$V_{g1} = -14$ V	$S = 23$ mA/V		$V_{kf} = 100$ V	
		Operating class AB				
		$V_{ba} = 265$ V	$I_a = 2 \times 115$ mA	$I_{g2} = 2 \times 36$ mA		
		$V_{bg2} = 265$ V	$I_{g2} = 2 \times 7.5$ mA	at $V_i = 12.2\ V_{rms}$		
		$R_k = 56\ \Omega$	at $V_i = 0$ V	$W_o = 40$ W		
		$R_{aa\sim} = 2.4$ kΩ	$I_a = 2 \times 125$ mA	$d_{tot} = 5\%$		
EL504	6.3 1.38	For further data see PL504			$V_{kf} = 200$ V	

EL505	6.3 2.0	For further data see PL505			$V_{kf} = 200$ V	
EL508	6.3 0.825	For further data see PL508			$V_{kf} = 100$ V	
EL509	6.3 2.0	For further data see PL509			$V_{kf} = 200$ V	
EL802 Video Output pentode	6.3 0.8	*Typical* $V_a = 170$ V $V_{g2} = 170$ V $V_{g3} = 0$ V	$R_k = 36\ \Omega$ $I_a = 30$ mA $I_{g2} = 6.5$ mA	$S = 40$ mA/V $\mu_{g2g1} = 70$	$W_a = 6$ W $I_k = 100$ mA $V_{kf} = 100$ V	
EM80 Tuning indicator	6.3 0.3	*Operating* $V_b = V_l = 250$ V $R_a = 0.5$ MΩ $R_g = 3$ MΩ	$V_{bg} = -1$ V $I_a = 0.37$ mA $I_l = 2$ mA $\beta = 5°$	$V_{bg} = -14$ V $I_a = 0.01$ mA $I_l = 2.3$ mA $\beta = 50°$	$W_a = 0.2$ W $I_k = 3$ mA $V_{kf} = 100$ V	
EM81 Tuning indicator	6.3 0.3	*Operating* $V_b = V_l = 250$ V $R_a = 0.5$ MΩ $R_g = 3$ MΩ	$V_{bg} = -1$ V $I_a = 0.37$ mA $I_l = 2$ mA $\alpha = 65°$	$V_{bg} = -10.5$ V $I_a = 0.02$ mA $I_l = 2.3$ mA $\alpha = 5°$	$W_a = 0.2$ W $I_k = 3$ mA $V_{kf} = 100$ V	
EM84 Tuning indicator	6.3 0.21	*Operating* $V_b = V_l = 250$ V $R_{a,D} = 470$ kΩ $R_g = 3$ MΩ	$V_{bg} = 0$ V $I_{a+D} = 0.45$ mA $I_l = 1$ mA $\alpha = 21$ mm	$V_{bg} = -22$ V $I_{a+D} = 0.06$ mA $I_l = 1.8$ mA $\alpha = 0$ mm	$W_a = 0.5$ W $I_k = 3$ mA $V_{kf} = 100$ V	

Type and application	V_f *(V)* I_f *(A)*	*Characteristic data*			*Limiting values*	*Base connections*
EM87 Tuning indicator	6.3 0.3	*Operating* $V_b = V_l = 250$ V $R_{a,D} = 100$ kΩ $R_g = 3$ MΩ	$V_{bg} = 0$ V $I_{a+D} = 2$ mA $I_l = 1$ mA $\alpha = 21$ mm	$V_{bg} = -15$ V $I_{a+D} = 0.2$ mA $I_l = 2$ mA $\alpha = -1.5$ mm	$W_a = 0.6$ W $I_k = 5$ mA $V_{kf} = 250$ V	
EY51 E.H.T. rectifier diode	6.3 0.09	*Operating and Limiting* $V_{tr} = \leqslant 5$ kV$_{rms}$ $I_o = \leqslant 3$ mA $R_t = \geqslant 0.1$ MΩ $C_{filt} = \leqslant 0.1$ μF $f = 50$ Hz	$V_{ainv.p} = <17$ kV $I_o = \leqslant 3$ mA $R_t = \geqslant 0.1$ MΩ $C_{filt} = \leqslant 0.01$ μF $f = 10$–500 KHz	$V_{ainv.p} = <17$ kV $I_o = \leqslant 0.35$ mA $I_{op} = \leqslant 80$ mA $C_{filt} = \leqslant 5000$ pF		
EY81	6.3 0.81	For further data see PY81				
EY82 High-vacuum single anode	6.3 0.9	*Operating (two tubes)* $V_{tr} = 2 \times 250$ V$_{rms}$ $V_o = 225$ V $I_o = 360$ mA $R_t = 2 \times 75$ Ω	$V_{tr} = 280$ V$_{rms}$ $V_o = 250$ V $I_o = 360$ mA $R_t = 2 \times 95$ Ω	$V_{tr} = 2 \times 300$ V$_{rms}$ $V_o = 268$ V $I_o = 360$ mA $R_t = 2 \times 110$ Ω	$V_{a\,inv.p} = 850$ V $I_o = 360$ mA $I_{ap} = 1.1$ A $V_{kf\,p} = 450$ V $C_{filt} = 60$ μF	
EY86-EY87	6.3 0.09	For further data see DY86–DY87				
EY88	6.3 1.55	For further data see PY88				

EY500 A	6.3 2.1	For further data see PY500 A				
EZ40 Double anode rectifier	6.3 0.6	*Operating* $V_{tr}=2\times 250\ V_{rms}$ $I_o=90$ mA $R_t=2\times 125\ \Omega$	$V_{tr}=2\times 300\ V_{rms}$ $I_o=90$ mA $R_t=2\times 215\ \Omega$	$V_{tr}=2\times 350\ V_{rms}$ $I_o=90$ mA $R_t=2\times 300\ \Omega$	$V_{tr}=2\times 350\ V_{rms}$ $I_o=90$ mA $C_{filt}=50\ \mu F$ $V_{kf\,p}=500$ V	
EZ41 Double anode rectifier	6.3 0.4	*Operating* $V_{tr}=2\times 250\ V_{rms}$ $V_o=253$ V	$I_o=60$ mA $R_t=2\times 150\ \Omega$	$C_{filt}=8\ \mu F$	$V_{tr}=250\ V_{rms}$ $I_o=60$ mA $V_{kf}=350$ V	
EZ80 Double anode rectifier	6.3 0.6	*Operating* $V_{tr}=2\times 250\ V_{rms}$ $V_o=260$ V $I_o=90$ mA $R_t=2\times 125\ \Omega$	$V_{tr}=2\times 300\ V_{rms}$ $V_o=310$ V $I_o=90$ mA $R_t=2\times 215\ \Omega$	$V_{tr}=2\times 350\ V_{rms}$ $V_o=360$ V $I_o=90$ mA $R_t=2\times 300\ \Omega$	$V_{tr}=2\times 350\ V_{rms}$ $I_o=90$ mA $V_{kf}=500$ V $C_{filt}=50\ \mu F$	
EZ81 Double anode rectifier	6.3 1.0	*Operating* $V_{tr}=2\times 250\ V_{rms}$ $V_o=245$ V $I_o=160$ mA $R_t=2\times 150\ \Omega$	$V_{tr}=2\times 350\ V_{rms}$ $V_o=352$ V $I_o=150$ mA $R_t=2\times 230\ \Omega$	$V_{tr}=2\times 450\ V_{rms}$ $V_o=497$ V $I_o=100$ mA $R_t=2\times 310\ \Omega$	$V_{a\,invp}=1300$ V $I_{ap}=500$ mA $V_{kf}=500$ V $C_{filt}=50\ \mu F$	
GY501 Single-anode E.H.T. rectifier	3.15 0.4	*Operating* $V_o=25$ kV	$I_a=1.5$ mA		$-V_{ap}=35$ kV [1] $V_o=27.5$ kV [1] $I_a=1.7$ mA	

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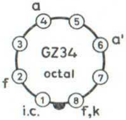
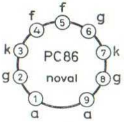
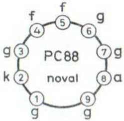
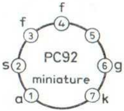
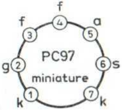
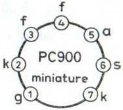
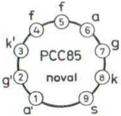
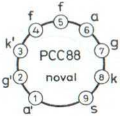
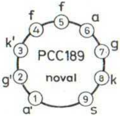
[1] Absolute max.

Type and application	V_f (*V*) I_f (*A*)	*Characteristic data*			*Limiting values*	*Base connections*
GZ34 Double anode rectifier	5.0 1.9	*Operating* $V_{tr} = 2 \times 300\ V_{rms}$ $V_o = 330$ V $I_o = 250$ mA $R_t = 2 \times 75\ \Omega$	$V_{tr} = 2 \times 400\ V_{rms}$ $V_o = 430$ V $I_o = 250$ mA $R_t = 2 \times 125\ \Omega$	$V_{tr} = 2 \times 550\ V_{rms}$ $V_o = 640$ V $I_o = 160$ mA $R_t = 2 \times 200\ \Omega$	$V_{a\,invp} = 1500$ V $I_{ap} = 750$ mA $C_{filt} = 60\ \mu F$	
PABC80	9.5 0.3	For further data see UABC80				
PC86 U.H.F. triode	3.8 0.3	*Typical* $V_a = 175$ V $V_g = -1.5$ V	$I_a = 12$ mA $S = 14$ mA/V	$\mu = 68$ $R_{eq.} = 230\ \Omega$	$W_a = 2.2$ W $I_k = 20$ mA $V_{+k/-f} = 100$ V[1])	
PC88 U.H.F. triode	3.8 0.3	*Typical* $V_a = 160$ V $R_k = 100\ \Omega$	$I_a = 12.5$ mA $S = 13.5$ mA/V	$\mu = 65$ $R_{eq.} = 240\ \Omega$	$W_a = 2$ W $I_k = 13$ mA $V_{kf} = 100$ V[1])	
PC92 H.F. triode	3.1 0.3	*Typical* $V_a = 200$ V $V_g = -0.9$ V	$I_a = 12$ mA $S = 7.2$ mA/V	$\mu = 67$ $R_{eq.} = 400\ \Omega$	$W_a = 2.5$ W $I_k = 15$ mA $V_{kf} = 250$ V[2])	
		$V_a = 100$ V $V_g = -0.9$ V	$I_a = 3$ mA $S = 3.8$ mA/V	$\mu = 58$		

PC97 V.H.F. triode	4.5 0.3	*Typical* $V_a=135$ V $V_g=-1$ V	$I_a=11$ mA $S=13$ mA/V	$R_i=5$ kΩ $\mu=65$	$W_a=2.2$ W $I_k=20$ mA $V_{kf}=100$ V	
PC900 V.H.F. triode	3.9 0.3	*Typical* $V_a=135$ V $V_s=0$ V	$V_{g1}=-1$ V $I_a=11.5$ mA	$S=14.5$ mA/V $\mu=76$	$W_a=2.2$ W $I_k=20$ mA $V_{kf}=100$ V	
		Operating $V_{ba}=135$ V $V_s=0$ V $R_a=1.5$ kΩ	$R_k=0$ Ω $I_a=16.5$ mA $I_g=20$ μA	$S=20$ mA/V $\mu=84$		
PCC85 R.F. double triode	9.0 0.3	*Typical* $V_a=170$ V $V_g=-1.75$ V	$I_a=10$ mA $S=6.7$ mA/V	$\mu=48$	$W_a=2.5$ W $I_k=15$ mA $V_{kf}=90$ V	
PCC88 R.F. double triode (cascode)	7.6 0.3	*Typical* $V_a=90$ V $V_g=-1.3$ V	$I_a=15$ mA $S=12.5$ mA/V	$\mu=33$ $R_{eq.}=300$ Ω	$W_a=1.8$ W $I_k=25$ mA $V_{kf}=50$ V	
PCC189 R.F. double triode (cascode)	7.6 0.3	*Typical* $V_a=90$ V $V_g=-1.4$ V	$I_a=15$ mA $S=12.5$ mA/V	$R_i=2.5$ kΩ $\mu=32$	$W_a=1.8$ W $I_k=22$ mA $V_{kf}=80$ V	

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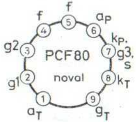
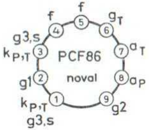
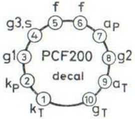
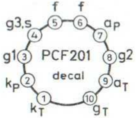
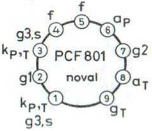
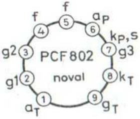
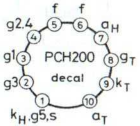
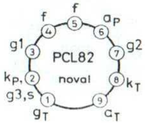
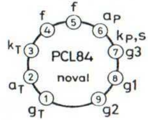
[1]) A.C. component max. 50 V_{rms}. [2]) D.C. component max. 100 V_{rms}.

Type and application	V_f (*V*) I_f (*A*)	*Characteristic data*			*Limiting values*	*Base connections*
		Typical (*pentode*)				
PCF80	9.0	$V_a = 170$ V	$I_a = 10$ mA	$R_i = 0.4$ MΩ	$W_a = 1.7$ W	
Triode-	0.3	$V_{g2} = 170$ V	$I_{g2} = 2.8$ mA	$\mu_{g2g1} = 47$	$I_k = 14$ mA	
Pentode		$V_{g1} = -2$ V	$S = 6.2$ mA/V	$R_{eq.} = 1.5$ kΩ	$V_{+k/-f} = 200$ V	
		Freq. changer (*pentode*)				
		$V_a = 170$ V	$R_k = 330$ Ω	$I_{g2} = 2$ mA		
		$V_{g2} = 170$ V	$R_{g1} = 0.1$ MΩ	$I_{g1} = 20$ μA		
		$V_{osc} = 3.5$ V$_{rms}$	$I_a = 6.5$ mA	$S_c = 2.2$ mA/V		
		Typical (*triode*)				
		$V_a = 100$ V	$I_a = 14$ mA	$R_i = 4$ kΩ	$W_a = 1.5$ W	
		$V_g = -2$ V	$S = 5$ mA/V	$\mu = 20$	$I_k = 14$ mA	
		Typical (*pentode*)				
PCF86	8.0	$V_a = 170$ V	$I_a = 10$ mA	$R_i = >350$ kΩ	$W_a = 2$ W	
Triode-	0.3	$V_{g2} = 150$ V	$I_{g2} = 3.8$ mA	$\mu_{g2g1} = 70$	$I_k = 18$ mA	
pentode		$V_{g1} = -1.2$ V	$S = 12$ mA/V	$R_{eq.} = 1$ kΩ	$V_{kf} = 100$ V	
		Freq. changer (*pentode*)				
		$V_{ba} = 190$ V	$R_{g2} = 18$ kΩ	$I_{g2} = 3$ mA		
		$V_{bg2} = 190$ V	$R_{g1} = 0.1$ MΩ	$I_{g1} = 30$ μA		
		$V_{osc} = 2.3$ V$_{rms}$	$I_a = 8.5$ mA	$S_c = 4.5$ mA/V		
		Typical (*triode*)				
		$V_a = 100$ V	$I_a = 14$ mA	$R_i = 3$ kΩ	$W_a = 1.5$ W	
		$V_g = -3$ V	$S = 5.7$ mA/V	$\mu = 17$	$I_k = 15$ mA	

		Typical (pentode)				
PCF200	8.5	$V_a = 160$ V	$V_{g1} = -1.7$ V	$S = 14$ mA/V	$W_a = 2.1$ W	
Triode	0.3	$V_{g2} = 135$ V	$I_a = 13$ mA	$\mu_{g2g1} = 53$	$I_k = 20$ mA	
pentode		$V_{g3} = 0$ V	$I_{g2} = 5.3$ mA		$V_{kf} = 150$ V	
		Operating (pentode)				
		$V_b = 230$ V	$R_k = 83\ \Omega$	$S = 14$ mA/V		
		$R_a = 5.6$ kΩ	$I_a = 12.5$ mA	$r_{g1} = 6.6$ kΩ		
		$R_{g2} = 22$ kΩ	$I_{g2} = 5.1$ mA	(at $f = 40$ MHz)		
		Typical (triode)				
		$V_a = 170$ V	$I_a = 8.5$ mA	$R_i = 11$ kΩ	$W_a = 1.5$ W	
		$V_g = -1$ V	$S = 5.2$ mA/V	$\mu = 57$	$I_k = 18$ mA	
		Typical (pentode)				
PCF201	8.5	$V_a = 160$ V	$V_{g1} = -1.4$ V	$S = 12.6$ mA/V	$W_a = 2.1$ W	
Triode-pentode	0.3	$V_{g2} = 110$ V	$I_a = 13$ mA	$\mu_{g2g1} = 45$	$I_k = 20$ mA	
		$V_{g3} = 0$ V	$I_{g2} = 5.3$ mA		$V_{kf} = 150$ V	
		Operating (g3 to earth)				
		$V_b = 250$ V	$R_k = 76\ \Omega$	$S = 12.6$ mA/V		
		$R_a = 6.8$ kΩ	$I_a = 12.8$ mA	$r_{g1} = 7.4$ kΩ		
		$R_{g2} = 27$ kΩ	$I_{g2} = 5.2$ mA	(at $f = 40$ MHz)		
		Typical (triode)				
		$V_a = 100$ V	$I_a = 14$ mA	$R_i = 3.6$ kΩ	$W_a = 1.5$ W	
		$V_g = -2$ V	$S = 4.8$ mA/V	$\mu = 17.5$	$I_k = 18$ mA	

RECEIVING AND AMPLIFYING TUBES

Type and application	V_f *(V)* I_f *(A)*	*Characteristic data*			*Limiting values*	*Base connections*
		Typical (pentode)				
PCF801 Triode- pentode	8.5 0.3	$V_a = 170$ V $V_{g2} = 120$ V $V_{g1} = -1.4$ V	$I_a = 10$ mA $I_{g2} = 3$ mA $S = 11$ mA/V	$R_i = >350$ kΩ $\mu_{g2g1} = 55$ $R_{eq.} = 1.5$ kΩ	$W_a = 2$ W $I_k = 18$ mA $V_{kf} = 100$ V	
		Freq. changer (pentode)				
		$V_{ba} = 200$ V $V_{bg2} = 200$ V $V_{osc} = 1.6\ V_{rms}$ $V_{bg1} = -1.4$ V	$R_a = 2.7$ kΩ $R_{g2} = 27$ kΩ $R_{g1} = 0.1$ MΩ $I_a = 10$ mA	$I_{g2} = 3$ mA $I_{g1} = 8$ μA $S_c = 5$ mA/V		
		Typical (triode)				
		$V_a = 100$ V $V_g = -3$ V	$I_a = 15$ mA $S = 9$ mA/V	$R_i = 2.2$ kΩ $\mu = 20$	$W_a = 1.5$ W $I_k = 20$ mA	
		Typical (pentode)				
PCF802 Triode- pentode	9.0 0.3	$V_a = 100$ V $V_{g2} = 100$ V $V_{g1} = -1$ V	$I_a = 6$ mA $I_{g2} = 1.7$ mA $S = 5.5$ mA/V	$R_i = 0.4$ MΩ $\mu_{g2g1} = 47$	$W_a = 1.2$ W $I_k = 15$ mA $V_{kf} = 100$ V ¹)	
		Typical (triode)				
		$V_a = 200$ V $V_g = -2$ V	$I_a = 3.5$ mA $S = 3.5$ mA/V	$R_i = 20$ kΩ $\mu_{g2g1} = 70$	$W_a = 1.4$ W $I_k = 10$ mA	

		Typical (heptode)				
PCH200 Triode- heptode	8.5 0.3	$V_a = 14$ V $V_{g2,g4} = 14$ V $V_{g3} = 0$ V $V_{g1} = 0$ V $I_a = 1.5$ mA $I_{g2} = 1.3$ mA	$V_a = 14$ V $V_{g2,g4} = 14$ V $V_{g3} = 0$ V $V_{g1} = -1.8$ V $I_a = 20$ μA	$V_a = 14$ V $V_{g2,g4} = 14$ V $V_{g3} = -1.8$ V(<2.2) $V_{g1} = 0$ V $I_a = 20$ μA	$W_a = 0.5$ W $I_k = 8$ mA $V_{kf} = 100$ V	
		Typical (triode)				
		$V_a = 100$ V $V_g = -1$ V $I_a = 9$ mA	$S = 8.8$ mA/V $\mu = 50$	$V_a = 200$ V $V_g = -7$ V (<11) $I_a = 0.1$ A	$W_a = 1.5$ W $I_k = 20$ mA	
		Operating class A (pentode)				
PCL82 Triode output pentode	16 0.3	$V_{ba} = V_{bg2} = 230$ V $R_{g2} = 1.2$ kΩ $R_k = 490$ Ω $R_{a\sim} = 6$ kΩ	$I_a = 30$ mA $I_{g2} = 6.6$ mA at $V_i = 0$ V $I_a = 31$ mA	$I_{g2} = 11$ mA at $V_i = 7.8$ V_{rms} $W_a = 3.25$ W $d_{tot} = 10\%$	$W_a = 7$ W $I_k = 50$ mA $V_{kf} = 200$ V	
		Operating (triode)				
		$V_b = 200$ V $R_a = 220$ kΩ $R_k = 2.2$ kΩ $R_s = 0.22$ MΩ	$R_g = 3$ MΩ $R_{g'} = 0.68$ MΩ $I_a = 0.52$ mA	$V_o/V_i = 52$ $V_o = <26$ V_{rms} $d_{tot} = 1.6\%$	$W_a = 1$ W $I_k = 15$ mA	
		Operating (pentode)				
PCL84 Triode Video output pentode	15 0.3	$V_b = 220$ V $V_{g2} = 220$ V $R_a = 3$ kΩ	$V_{g1} = -3.3$ V $I_a = 18$ mA	$I_{g2} = 3.1$ mA $S = 9.7$ mA/V	$W_a = 4$ W $I_k = 40$ mA $V_{kf} = 200$ V	
		Typical (triode)				
		$V_a = 200$ V $V_g = 1.7$ V	$I_a = 3$ mA $S = 4$ mA/V	$\mu = 65$	$W_a = 1$ W $I_k = 12$ mA	

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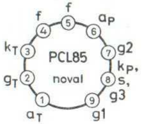
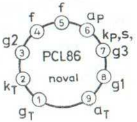
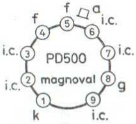
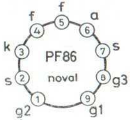
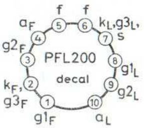
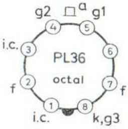
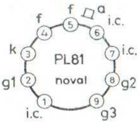
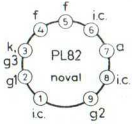
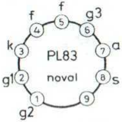
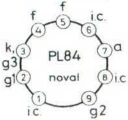
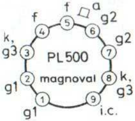
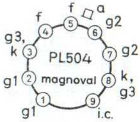
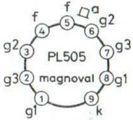
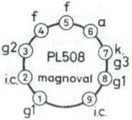
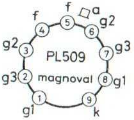
[1] A.C. component max. 65 V_{rms}.

Type and application	V_f (*V*) I_f (*A*)	*Characteristic data*			*Limiting values*	*Base connections*
		Operating (pentode)				
PCL85	17.5	V_a = 50 V	$V_{g1} = -1$ V	$I_{g2p} = 35$ mA	W_a = 8 W	
PCL805	0.3	$V_{g2} = 170$ V	$I_{ap} = 200$ mA		I_k = 75 mA	
Triode-frame					$V_{kf} = 200$ V	
output pentode		*Typical (triode)*				
		$V_a = 100$ V	I_a = 10.5 mA	R_i = 9 kΩ	$W_a = 0.5$ W	
		V_g = 0 V	S = 7 mA/V	$\mu = 63$	$I_k = 15$ mA	
		Operating class A (pentode)				
PCL86	13.3	V_a = 230 V	I_a = 39 mA	$I_{g2} = 10.5$ mA	W_a = 9 W	
Triode-	0.3	V_{g2} = 230 V	I_{g2} = 6.5 mA	at $V_i = 3.6\ V_{rms}$	I_k = 55 mA	
output pentode		R_k = 125 Ω	at V_i = 0 V	$W_o = 4.1$ W	$V_{kf} = 100$ V	
		$R_{a\sim} = 5.1$ kΩ	I_a = 40.7 mA	$d_{tot} = 10\%$		
		Operating (triode)				
		$V_b = 200$ V	$R_{g'} = 680$ kΩ	$V_o/V_i = 66$	$W_a = 0.5$ W	
		$R_a = 220$ kΩ	$I_a = 0.42$ mA	d_{tot} = 0.6 %	$I_k = 4$ mA	
		R_k = 2.6 kΩ	$V_o = 3.2\ V_{rms}$			
		Typical				
PD500	7.3	$V_a = 25$ kV	$-V_g$(at $I_a = 1.5$ mA)	$-V_g$(at $I_a = 0.1$ mA)	W_a = 30 W	
Shunt	0.3	V_s = 0 V	$= 7 - 30$ V	$= < 40$ V	I_a = 1.6 mA	
stabilizer triode					$V_{kf} = 250$ V	
		Typical				
PF86	4.5	V_a = 250 V	$V_{g1} = -2.2$ V	S = 2.2 mA/V	W_a = 1 W	
Pentode	0.3	$V_{g2} = 140$ V	I_a = 3 mA	R_i = 2.5 MΩ	I_k = 4 mA	
		V_{g3} = 0 V	I_{g2} = 0.6 mA	$\mu_{g2g1} = 38$	$V_{kf} = 100$ V	

PFL200 Double pentode	17 0.3	*Typical (L section)* $V_a = 170$ V $V_{g2} = 170$ V $V_{g1} = -2.7$ V	 $I_a = 30$ mA $I_{g2} = 7$ mA $S = 22$ mA/V	 $R_i = 33$ kΩ $\mu_{g2g1} = 38$	 $W_a = 5.1$ W $I_k = 60$ mA $V_{kf} = 200$ V	
		Typical (F section) $V_a = 150$ V $V_{g2} = 150$ V $V_{g1} = -2.1$ V	 $I_a = 10$ mA $I_{g2} = 3$ mA $S = 8.5$ mA/V	 $R_i = 150$ kΩ $\mu_{g2g1} = 38$	 $W_a = 1.5$ W $I_k = 15$ mA $V_{kf} = 200$ V	
PL36 Line output pentode	25 0.3	*Typical* $V_a = 100$ V $V_{g2} = 100$ V $V_{g1} = -8.2$ V	 $I_a = 100$ mA $I_{g2} = 7$ mA $S = 14$ mA/V	 $R_i = 5$ kΩ $\mu_{g2g1} = 5.6$	 $W_a = 12$ W $I_k = 200$ mA $V_{kf} = 250$ V $V_{ap} = 7$ kV	
PL81 Line time base and A.F. Output pentode	21.5 0.3	*Typical* $V_a = 170$ V $V_{g2} = 170$ V $V_{g3} = 0$ V	 $V_{g1} = -22$ V $I_a = 45$ mA $I_{g2} = 2.9$ mA	 $S = 6.2$ mA/V $R_i = 10$ kΩ $\mu_{g2g1} = 5.3$	 $W_a = 7.5$ W $I_k = 180$ mA $V_{kf} = 200$ V $V_{ap} = 7$ kV	
		Operating class B $V_a = 170$ V $V_{bg2} = 170$ V $V_{g3} = 0$ V $R_{g2} = 1$ kΩ $R_{aa\sim} = 2.5$ kΩ	 $V_{g1} = -27$ V $I_a = 2 \times 20$ mA $I_{g2} = 2 \times 1.5$ mA at $V_i = 0$ V	 $I_a = 2 \times 73$ mA $I_{g2} = 2 \times 10$ mA at $V_i = 19\ V_{rms}$ $W_o = 13.5$ W $d_{tot} = 5.2\%$		

Type and application	V_f (*V*) I_f (*A*)	*Characteristic data*			*Limiting values*	*Base connections*
		Operating class A				
PL82 Frame and A.F. output pentode	16.5 0.3	$V_a = V_b = 200$ V $R_{g2} = 680\ \Omega$ $V_{g1} = -13.9$ V $I_a = 45$ mA	$I_{g2} = 8.5$ mA $S = 8.6$ mA/V $R_i = 24\ \mathrm{k}\Omega$ $\mu_{g2g1} = 10$	$R_{a\sim} = 4\ \mathrm{k}\Omega$ $W_o = 4.2$ W $V_i = 7\ \mathrm{V_{rms}}$ $d_{tot} = 10\%$	$W_a = 9$ W $I_k = 75$ mA $V_{kf} = 200$ V $V_{ap} = 2.5$ kV	
		Typical				
PL83 Video output pentode	15 0.3	$V_a = 170$ V $V_{g2} = 170$ V $V_{g3} = 0$ V	$V_{g1} = 2.3$ V $I_a = 36$ mA $I_{g2} = 5$ mA	$S = 10.5$ mA/V $R_i = 0.1\ \mathrm{M}\Omega$ $\mu_{g2g1} = 24$	$W_a = 9$ W $I_k = 70$ mA $V_{kf} = 200$ V ¹)	
		Operating class AB				
PL84 Frame and A.F. output pentode	15 0.3	$V_{ba} = 230$ V $V_{bg2} = 200$ V $R_k = 130\ \Omega$ $R_{aa\sim} = 4\ \mathrm{k}\Omega$	$I_a = 2 \times 56$ mA $I_{g2} = 2 \times 2.3$ mA at $V_i = 0$ V $I_a = 2 \times 61$ mA	$I_{g2} = 2 \times 17.5$ mA at $V_i = 14.6\ \mathrm{V_{rms}}$ $W_o = 17.5$ W $d_{tot} = 5.4\%$	$W_a = 12$ W $I_k = 100$ mA $V_{kf} = 200$ V	
PL95	4.5 0.3	For further data see EL95			$V_{kf} = 200$ V	
		Typical (dynamic)				
PL500 Line output pentode	27 0.3	$V_a = 50$ V $V_{g2} = 200$ V	$V_{g1} = -10$ V $I_a = 420$ mA	$I_{g2} = 37$ mA	$W_a = 12$ W $V_{ap} = 7$ kV $I_k = 250$ mA $V_{kf} = 250$ V	

PL504 Line output pentode	27 0.3	*Typical (dynamic)* $V_a = 50$ V $V_{g2} = 200$ V	$V_{g1} = -10$ V $I_a = 420$ mA	$I_{g2} = 37$ mA	$W_a = 16$ W $V_{ap} = 7$ kV $I_k = 250$ mA $V_{kf} = 250$ V	
PL505 Line output pentode	40 0.3	*Typical (dynamic)* (1) $V_a = 160$ V $V_{g2} = 160$ V $V_{g1} = V_{g3} = 0$ V	$I_a = 1.4$ A $I_{g2} = 45$ mA	(2) $V_a = 50$ V $V_{g2} = 175$ V $V_{g1} = -10$ V $I_a = 0.8$ A	$W_a = 25$ W $V_{ap} = 7$ kV $I_k = 500$ mA $V_{kf} = 250$ V	
PL508 Frame output pentode	17 0.3	*Typical (dynamic)* (1) $V_a = V_{g2} = 190$ V $V_{g1} = -17$ V $I_a = 60$ mA	$I_{g2} = 5$ mA $S = 9$ mA/V $\mu_{g2g1} = 8$	(2) $V_a = 50$ V $V_{g2} = 190$ V $V_{g1} = -1$ V $I_{ap} = 320$ mA $I_{g2} = 60$ mA	$W_a = 25$ W $I_k = 500$ mA $V_{kf} = 250$ V	
PL509 Line output pentode	40 0.3	*Typical (dynamic)* (1) $V_a = 160$ V $V_{g2} = 160$ V $V_{g1} = V_{g3} = 0$ V	$I_a = 1.4$ A $I_{g2} = 45$ mA	(2) $V_a = 50$ V $V_{g2} = 175$ V $V_{g1} = -10$ V $I_a = 0.8$ A $I_{g2} = 70$ mA	$W_a = 30$ W $V_{ap} = 7$ kV $I_k = 500$ mA $V_{kf} = 250$ V	

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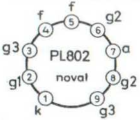
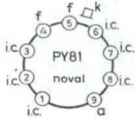
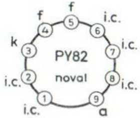
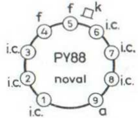
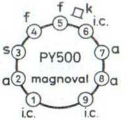
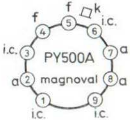
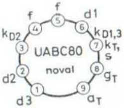
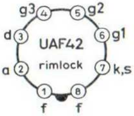
[1] D.C. component max. 150 V

Type and application	V_f *(V)* I_f *(A)*	*Characteristic data*			*Limiting values*	*Base connections*
		Typical				
PL802 Video output pentode	16 0.3	$V_a = 170$ V $V_{g2} = 170$ V $V_{g3} = 0$ V	$V_{bg1} = 0$ V $R_k = 36\ \Omega$ $I_a = 30$ mA	$I_{g2} = 6.5$ mA $S = 40$ mA/V $\mu_{g2g1} = 70$	$W_a = 6$ W $I_k = 100$ mA $V_{kf} = 200$ V	
PM84	4.2 0.3	For further data see UM84				
		Limiting				
PY81 Booster diode	17 0.3	$V_{bo} = \leqslant 550$ V $V_b = \leqslant 250$ V $W_a = \leqslant 3.5$ W	$I_a = \leqslant 150$ mA $I_{ap} = \leqslant 450$ mA $V_{ap} = \leqslant 5$ kV [1]) [2])	$V_{kfp} = < 5$ kV [1]) $R_s = \geqslant 80\ \Omega$ V_f/earth $\leqslant 220$ V_{rms}		
		Operating				
PY82 Single anode rectifier	19 0.3	$V_{tr} = 127$ V_{rms} $V_o = 127$ V $I_o = 180$ mA $R_t = 0\ \Omega$	$V_{tr} = 220$ V_{rms} $V_o = 195$ V $I_o = 180$ mA $R_t = 65\ \Omega$	$V_{tr} = 250$ V_{rms} $V_o = 195$ V $I_o = 180$ mA $R_t = 125\ \Omega$	$V_{a\,\mathrm{invp}} = 700$ V $I_o = 180$ mA $V_{+k/-f\mathrm{p}} = 550$ V [3]) $C_{\mathrm{filt}} = 60\ \mu$F	
		Limiting				
PY88 Booster diode	30 0.3	$V_{bo} = \leqslant 550$ V $V_b = \leqslant 250$ V $W_a = \leqslant 5$ W	$I_a = \leqslant 220$ mA $I_{ap} = \leqslant 550$ mA $-V_{ap} = \leqslant 6$ kV [1])	$V_{kfp} = 6.6$ kV $R_s = \geqslant 80\ \Omega$ V_f/earth < 220 V_{rms}		

		Typical and Limiting				
PY500 Booster diode	42 0.3	$R_i = 45.5\ \Omega$ $C_{kf} = 3.7$ pF $C_{ak} = 13$ pF	$W_a = \leqslant 11$ W $I_a = \leqslant 440$ mA $I_{ap} = \leqslant 800$ mA	$-V_{ap} = 5.6$ kV 1) $V_{kfp} = 6.3$ kV 1) $R_s = \geqslant 100\ \Omega$		
PY500A Booster diode		For further data see PY500	$I_{ap} = \leqslant 1000$ mA			
		Operating (triode)				
UABC80 Triple diode triode	28 0.1	$V_b = 100$ V $R_a = 0.1$ MΩ $R_{g'} = 0.33$ MΩ $I_a = 0.35$ mA $V_o/V_i = 35$	$V_b = 170$ V $R_a = 0.1$ MΩ $R_{g'} = 0.33$ MΩ $I_a = 0.82$ mA $V_o/V_i = 42$	$V_b = 200$ V $R_a = 0.1$ MΩ $R_{g'} = 0.33$ MΩ $I_a = 1$ mA $V_o/V_i = 44$	$W_a = 1$ W $I_k = 5$ mA $V_{kf} = 150$ V	
		Typical (diodes)				
		R_{iD1} (at $V_{d1} =$ +10 V) = 5 kΩ	R_{iD2} (at $V_{d2} =$ +5 V) = 200 Ω	R_{iD3} (at $V_{d3} =$ +5 V) = 200 Ω	$V_{dinvp} = 350$ V $I_{d1} = 1$ mA $I_{d2}, I_{d3} = 10$ mA	
		Typical (pentode)				
UAF42 Diode-pentode	12.6 0.1	$V_a = V_b = 170$ V $R_{g2} = 56$ kΩ $V_{g3} = 0$ V $V_{g1} = -2$ V	$I_a = 5$ mA $I_{g2} = 1.5$ mA $S = 2$ mA/V	$R_i = >0.9$ MΩ $\mu_{g2g1} = 16$ $R_{eq.} = 7.5$ kΩ	$W_a = 2$ W $I_k = 10$ mA $V_{kf} = 150$ V	
UB41	19 0.1	For further data see EB41				

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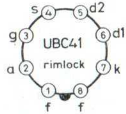
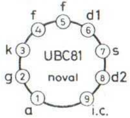
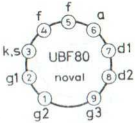
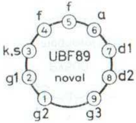
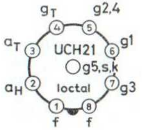
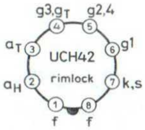
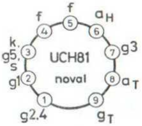
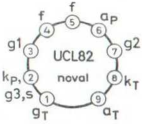
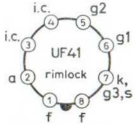
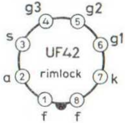
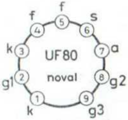
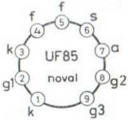
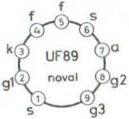
1) Max. pulse duration 22% of a cycle with a max. of 18 μs. 2) Cathode pos. with respect to the anode. 3) Max. 220 V_{rms} A.C. voltage + max. 250 V D.C. voltage.

RECEIVING AND AMPLIFYING TUBES

Type and application	V_f *(V)* I_f *(A)*	*Characteristic data*			*Limiting values*	*Base connections*
UBC41 Double diode-triode	14 0.1	*Typical (triode)* $V_a = 170$ V $V_g = -1.55$ V	$I_a = 1.5$ mA $S = 1.65$ mA/V	$R_i = 42$ kΩ $\mu = 70$	$W_a = 0.5$ W $I_k = 5$ mA $V_{kf} = 150$ V	
UBC81 Double diode-triode	14 0.1	*Typical (triode)* $V_a = 170$ V $V_g = -1.55$ V	$I_a = 1.5$ mA $S = 1.65$ mA/V	$R_i = 42$ kΩ $\mu = 70$	$W_a = 0.5$ W $I_k = 5$ mA $V_{kf} = 100$ V	
		Operating (triode) $V_b = 170$ V $R_a = 0.1$ MΩ $R_k = 3.9$ kΩ	$R_g = 1$ MΩ $R_{g'} = 0.33$ MΩ	$I_a = 0.45$ mA $V_o/V_i = 37$		
UBF80 Double diode-pentode	17 0.1	*Typical (pentode)* $V_a = V_b = 170$ V $R_{g2} = 47$ kΩ $V_{g3} = 0$ V $V_{g1} = -2$ V	$I_a = 5$ mA $I_{g2} = 1.75$ mA $S = 2.2$ mA/V	$R_i = 0.9$ MΩ $\mu_{g2g1} = 18$ $R_{eq.} = 6.2$ kΩ	$W_a = 1.5$ W $I_k = 10$ mA $V_{kf} = 150$ V	
UBF89 Double diode-pentode	19 0.1	*Typical (pentode)* $V_a = 170$ V $V_{g2} = 100$ V, $V_{g3} = 0$ V	$V_{g1} = -1$ V $I_a = 12$ mA $I_{g2} = 4$ mA	$S = 5$ mA/V $\mu_{g2g1} = 20$ $R_i = 0.4$ MΩ	$W_a = 2.25$ W $I_k = 16.5$ mA $V_{kf} = 100$ V	

UCC85	26 0.1	For further data see PCC85				
		Freq. changer (heptode)				
UCH21 Triode- heptode	14 0.1	$V_a = V_b = 200$ V $R_{g2+g4} = 15.5$ kΩ $R_{gT+g3} = 50$ kΩ $V_{g1} = -2$ V	$I_a = 5.2$ mA $I_{g2+g4} = 3.5$ mA $I_{gT+g3} = 0.19$ mA	$S_c = 0.75$ mA/V $R_i = 1$ MΩ $R_{eq.} = 55$	$W_a = 1.5$ W $I_k = 15$ mA $V_{kf} = 150$ V	
		Oscillator (triode)				
		$V_b = 200$ V $R_a = 20$ kΩ	$R_{gT+g3} = 50$ kΩ $I_{gT+g3} = 0.19$ mA	$I_a = 4.1$ mA $S_{eff} = 0.45$ mA/V		
		Freq. changer (hexode)				
UCH42 Triode- hexode	14 0.1	$V_b = 170$ V $R_1 = 18$ kΩ $R_2 = 27$ kΩ $R_{gT+g3} = 22$ kΩ	$V_{g1} = -1.85$ V $I_a = 2.1$ mA $I_{g2+g4} = 2.6$ mA $I_{gT+g3} = 0.35$ mA	$S_c = 0.67$ mA/V $R_i = >1$ MΩ $R_{eq.} = 65$ kΩ	$W_a = 1.5$ W $i_k = 10$ mA $V_{kf} = 150$ V	
		Oscillator (triode)				
		$V_b = 170$ V $R_a = 10$ kΩ	$R_{gT+g3} = 22$ kΩ $I_{gT+g3} = 0.35$ mA	$I_a = 6.5$ mA $S_{eff} = 0.75$ mA/V	$W_a = 0.8$ W $I_k = 7$ mA	

Type and application	V_f *(V)* I_f *(A)*	*Characteristic data*			*Limiting values*	*Base connections*
		Freq. changer (heptode)				
UCH81	19	$V_b = 170$ V	$I_a = 3.3$ mA	$S_c = 1.1$ mA/V	$W_a = 1.8$ W	
Triode	0.1	$R_{g2+g4} = 10$ kΩ	$I_{g2+g4} = 8.2$ mA	$R_i = 0.8$ MΩ	$I_k = 18$ mA	
heptode		$R_{gT+g3} = 47$ kΩ	$I_{gT+g3} = 0.2$ mA	$R_{eq.} = 30$ kΩ	$V_{kf} = 100$ V	
		$I_{g1} = 0.5\ \mu$A 1)				
		Operating (heptode)				
		$V_b = 170$ V	$I_a = 8$ mA	$R_i = 0.4$ MΩ		
		$R_{g2+g4} = 18$ kΩ	$I_{g2+g4} = 5$ mA	$\mu_{g2g1} = 25$		
		$V_{g3} = 0$ V	$S = 3.9$ mA/V	$R_{eq.} = 4$ kΩ		
		$I_{g1} = 0.5\ \mu$A 1)				
		Oscillator (triode)				
		$V_b = 170$ V	$R_{gT+g3} = 47$ kΩ	$I_a = 4.5$ mA	$W_a = 0.8$ W	
		$R_a = 15$ kΩ	$I_{gT+g3} = 0.2$ mA	$S_{eff} = 0.65$ mA/V	$I_k = 6.5$ mA	
					$V_{kf} = 100$ V	
		Operating class A (pentode)				
UCL82	50	$V_{ba} = V_{bg2} = 200$ V	$I_a = 35$ mA	$I_{g2} = 13.3$ mA	$W_a = 7$ W	
Triode	0.1	$R_{g2} = 470$ Ω	$I_{g2} = 7.8$ mA	at $V_i = 6.7\ V_{rms}$	$I_k = 50$ mA	
output pentode		$R_k = 330$ Ω	at $V_i = 0$ V	$W_o = 3.3$ W	$V_{kf} = 200$ V	
		$R_{a\sim} = 4.5$ kΩ	$I_a = 37$ mA	$d_{tot} = 10\%$		
		Operating (triode)				
		$V_b = 170$ V	$R_g = 3$ MΩ	$V_o/V_i = 51$	$W_a = 1$ W	
		$R_a = 220$ kΩ	$R_{g'} = 0.68$ MΩ	$V_o = <25\ V_{rms}$	$I_k = 15$ mA	
		$R_k = 2.7$ kΩ	$I_a = 0.43$ mA	$d_{tot} = 2.3\%$	$V_{kf} = 200$ V	
		$R_s = 0.22$ MΩ				

UF41 R.F. pentode	12.6 0.1	*Typical* $V_b = 170$ V $R_{g2} = 40$ kΩ $V_{g1} = -2.5$ V	$I_a = 6$ mA $I_{g2} = 1.75$ mA $S = 2.2$ mA/V	$R_i = 1$ MΩ $\mu_{g2g1} = 18$ $R_{eq.} = 6.5$ kΩ	$W_a = 2$ W $I_k = 10$ mA $V_{kf} = 150$ V	
UF42 R.F. pentode	21 0.1	*Typical* $V_a = 170$ V $V_{g2} = 170$ V $V_{g3} = 0$ V $V_{g1} = -2$ V	$I_a = 10$ mA $I_{g2} = 2.8$ mA $S = 8$ mA/V	$R_i = 300$ kΩ $\mu_{g2g1} = 52$ $R_{eq.} = 1.06$ kΩ	$W_a = 2$ W $I_k = 15$ mA $V_{kf} = 150$ V	
UF80 R.F. pentode	19 0.1	*Typical* $V_a = 170$ V $V_{g2} = 170$ V $V_{g3} = 0$ V $V_{g1} = -2$ V	$I_a = 10$ mA $I_{g2} = 2.5$ mA $S = 7.4$ mA/V	$R_i = 0.4$ MΩ $\mu_{g2g1} = 50$ $R_{eq.} = 1.0$ kΩ	$W_a = 2.5$ W $I_k = 15$ mA $V_{kf} = 150$ V	
UF85 R.F. pentode	19 0.1	*Typical* $V_a = V_b = 170$ V $R_{g2} = 27$ kΩ $V_{g3} = 0$ V $V_{g1} = -2$ V	$I_a = 9.7$ mA $I_{g2} = 2.6$ mA $S = 5.9$ mA/V	$R_i = 0.3$ MΩ $R_{eq.} = 1.4$ kΩ	$W_a = 2.5$ W $I_k = 15$ mA $V_{kf} = 150$ V	
UF89 R.F. pentode	12.6 0.1	*Typical* $V_a = V_b = 170$ V $R_{g2} = 15$ kΩ $V_{g3} = 0$ V $V_{g1} = -1.95$ V	$I_a = 11$ mA $I_{g2} = 3.9$ mA $S = 3.8$ mA/V	$R_i = 0.45$ MΩ $R_{eq.} = 4.5$ kΩ	$W_a = 2.25$ W $I_k = 16.5$ mA $V_{kf} = 150$ V	

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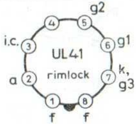
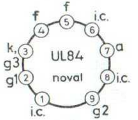
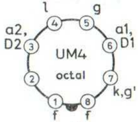
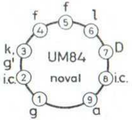
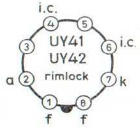
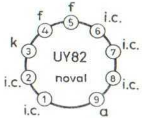
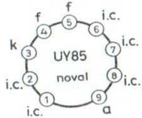
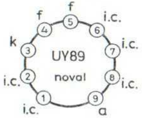
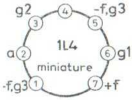
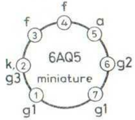
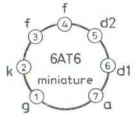
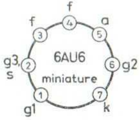
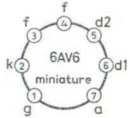
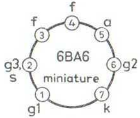
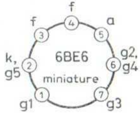
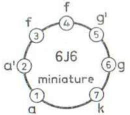
[1]) Grid current bias obtained with $R_{g1} = 1$ MΩ and with zero volts a.g.c. voltage; resulting grid No 1 voltage: −0.5 V.

RECEIVING AND AMPLIFYING TUBES

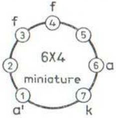
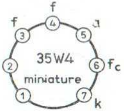
Type and application	V_f (V) I_f (A)	Characteristic data			Limiting values	Base connections
UL41 A.F. output pentode	45 0.1	*Operating class A* $V_a = 170$ V $V_{g2} = 170$ V $V_{g1} = -10.4$ V $I_a = 53$ mA	$I_{g2} = 10$ mA $S = 9.5$ mA/V $R_i = 20$ kΩ $\mu_{g2g1} = 10$	$R_{a\sim} = 3$ kΩ $V_i = 6\ V_{rms}$ $W_o = 4$ W $d_{tot} = 10\%$	$W_a = 9$ W $I_k = 75$ mA $V_{kf} = 150$ V	
UL84 A.F. output pentode	45 0.1	*Operating class A* $V_a = 170$ V $V_{g2} = 170$ V $V_{g1} = -12.5$ V $I_a = 70$ mA	$I_{g2} = 3.5$ mA $S = 11$ mA/V $R_i = 26$ kΩ $\mu_{g2g1} = 8$	$R_{a\sim} = 2$ kΩ $V_i = 6.1\ V_{rms}$ $W_o = 5.1$ W $d_{tot} = 10\%$	$W_a = 12$ W $I_k = 100$ mA $V_{kf} = 200$ V	
UM4 Tuning indicators	12.6 0.1	*Operating* $V_b = V_l = 200$ V $R_{a1,a2} = 1$ MΩ	$V_g = 0$ V $I_l = 1.4$ mA $\alpha = 90°$	$V_g = -4.2$ V $I_l = 1.8$ mA $\alpha = 5°$	$R_g = 3$ MΩ $V_{kf} = 150$ V	
UM84 Tuning indicator	12 0.1	*Operating* $V_b = V_l = 170$ V $R_{gD} = 470$ kΩ $R_g = 3$ MΩ	$V_{bg} = 0$ V $I_{a+D} = 0.3$ mA $I_l = 0.6$ mA $\alpha = 20$ mm	$V_{bg} = -15$ V $I_{a+D} = 0.04$ mA $I_l = 1.05$ mA $\alpha = 0$ mm	$W_a = 0.5$ W $I_k = 3$ mA $V_{+k/-f} = 250$ V	

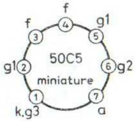
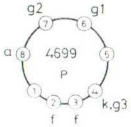
UY41-UY42 Single anode rectifiers	31 0.1	*Operating* $V_{tr} = 127\ \mathrm{V_{rms}}$ $V_o = 135$ V $I_o = 100$ mA $R_t = 0\ \Omega$	$V_{tr} = 220\ \mathrm{V_{rms}}$ $V_o = 188$ V $I_o = 100$ mA $R_t = 160\ \Omega$	$V_{tr} = 250\ \mathrm{V_{rms}}$ $V_o = 205$ V $I_o = 100$ mA $R_t = 210\ \Omega$	$V_{a\,\mathrm{invp}} = 700$ V $I_{ap} = 660$ mA $V_{kfp} = 550$ V $C_{\mathrm{filt}} = 50\ \mu\mathrm{F}$	
UY82 Single anode rectifier	55 0.1	*Operating* $V_{tr} = 127\ \mathrm{V_{rms}}$ $V_o = 127$ V $I_o = 180$ mA $R_t = 0\ \Omega$	$V_{tr} = 220\ \mathrm{V_{rms}}$ $V_o = 195$ V $I_o = 180$ mA $R_t = 65\ \Omega$	$V_{tr} = 250\ \mathrm{V_{rms}}$ $V_o = 195$ V $I_o = 180$ mA $R_t = 125\ \Omega$	$V_{a\,\mathrm{invp}} = 700$ V $I_{ap} = 1.1$ A $V_{kfp} = 550$ V $C_{\mathrm{filt}} = 60\ \mu\mathrm{F}$	
UY85 Single anode rectifier	38 0.1	*Operating* $V_{tr} = 127\ \mathrm{V_{rms}}$ $V_o = 135$ V $I_o = 110$ mA $R_t = 0\ \Omega$	$V_{tr} = 220\ \mathrm{V_{rms}}$ $V_o = 215$ V $I_o = 110$ mA $R_t = 90\ \Omega$	$V_{tr} = 250\ \mathrm{V_{rms}}$ $V_o = 245$ V $I_o = 110$ mA $R_t = 100\ \Omega$	$V_{a\,\mathrm{invp}} = 700$ V $I_{ap} = 660$ mA $V_{kfp} = 550$ V $C_{\mathrm{filt}} = 100$ pF	
UY89 Single anode rectifier	31 0.1	*Operating* $V_{tr} = 127\ \mathrm{V_{rms}}$ $V_o = 135$ V $I_o = 100$ mA $R_t = 0\ \Omega$	$V_{tr} = 220\ \mathrm{V_{rms}}$ $V_o = 188$ V $I_o = 100$ mA $R_t = 160\ \Omega$	$V_{tr} = 250\ \mathrm{V_{rms}}$ $V_o = 205$ V $I_o = 100$ mA $R_t = 210\ \Omega$	$V_{a\,\mathrm{invp}} = 700$ V $I_{ap} = 600$ mA $V_{kfp} = 550$ V $C_{\mathrm{filt}} = 50\ \mu\mathrm{F}$	

Type and application	V_f *(V)* I_f *(A)*	*Characteristic data*			*Limiting values*	*Base connections*
		Typical				
1L4 Sharp cut-off pentode	1.4 0.05	$V_a = 90$ V $V_{g2} = 90$ V $V_{g1} = 0$ V	$I_a = 4.5$ mA $I_{g2} = 2$ mA	$S = 1$ mA/V $R_i = 0.35$ MΩ	$V_a = 110$ V $V_{g2} = 90$ V $I_k = 6.5$ mA	
		Operating class A				
6AQ5 Output pentode	6.3 0.45	$V_a = 250$ V $V_{g2} = 250$ V $V_{g1} = -12.5$ V $I_a = 45$ mA	$I_{g2} = 4.5$ mA $S = 4.1$ mA/V $R_i = 52$ kΩ $R_{a\sim} = 5$ kΩ	$I_a = 47$ mA $I_{g2} = 7$ mA $W_o = 4.5$ W $V_i = 8.8$ V_{rms} $d_{tot} = 8\%$	$W_a = 12$ W $V_{kf} = 100$ V	
		Typical (triode)				
6AT6 Double diode Triode	6.3 0.3	$V_a = 250$ V $V_g = -3$ V $V_a = 100$ V $V_g = -1$ V	$I_a = 1$ mA $S = 1.2$ mA/V $I_a = 0.8$ mA $S = 1.3$ mA/V	$R_i = 58$ kΩ $\mu = 70$ $R_i = 54$ kΩ $\mu = 70$	$W_a = 0.5$ W $V_{kf\,p} = 90$ V	
		Typical				
6AU6 Sharp cut-off pentode	6.3 0.3	$V_a = 250$ V $V_{g2} = 150$ V $V_{g1} = -1$ V	$V_{g3} = 0$ V $I_a = 10.6$ mA $I_{g2} = 4.3$ mA	$S = 5.2$ mA/V $R_i = 1$ MΩ	$W_a = 3.5$ W $V_{kf} = 100$ V	

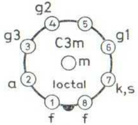
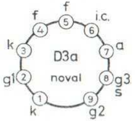
6AV6 Double diode Triode	6.3 0.3	*Typical (triode)* $V_a=250$ V $V_g=-2$ V	$I_a=1.2$ mA $S=1.6$ mA/V	$R_i=62.5$ kΩ $\mu=100$	$W_a=0.55$ W $V_{kf}=100$ V	
6BA6 Remote cut-off pentode	6.3 0.3	*Typical* $V_a=250$ V $V_{g2}=100$ V $V_{g3}=0$ V	$R_k=68$ Ω $I_a=11$ mA $I_{g2}=4.2$ mA	$S=4.4$ mA/V $R_i=1$ MΩ $R_{eq.}=4$ kΩ	$W_a=3.4$ W $V_{kf}=100$ V	
6BE6 Heptode	6.3 0.3	*Operating* $V_a=250$ V $V_{g2+g4}=100$ V $V_{g3}=-1.5$ V	$R_{g1}=20$ kΩ $I_a=2.9$ mA $I_{g2+g4}=6.8$ mA	$I_{g1}=0.5$ μA $S_c=475$ μA/V $R_i=1$ MΩ	$W_a=1.1$ W $I_k=20$ mA $V_{kf}=100$ V	
6J6 Double triode	6.3 0.45	*Typical* $V_a=100$ V $I_a=8.5$ mA	$R_k=100$ Ω $S=5.3$ mA/V	$R_i=7.1$ kΩ $\mu=38$	$W_a=1.5$ W $I_k=25$ mA $V_{kf\,p}=100$ V	
		Operating $V_a=150$ V $V_g=-10$ V $R_g=625$ Ω	$I_a=2\times15$ mA $I_g=2\times8$ mA	$W_{ig}=0.35$ W $W_o=3.5$ W		

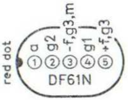
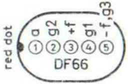
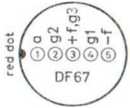
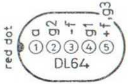
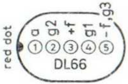
RECEIVING AND AMPLIFYING TUBES

Type and application	V_f *(V)* I_f *(A)*	*Characteristic data*			*Limiting values*	*Base connections*
6X4 Double anode rectifier	6.3 0.6	*Operating* $V_{tr} = 2 \times 325\ V_{rms}$ $I_o = 70$ mA	$R_t = 2 \times 520\ \Omega$	$C_{filt} = 10\ \mu F$	$V_{a\,invp} = 1.25$ kV $I_{ap} = 210$ mA	
12AT6	12.6 0.15	For further data see 6AT6				
12AU6	12.6 0.15	For further data see 6AU6				
12AV6	12.6 0.15	For further data see 6AV6				
12BA6	12.6 0.15	For further data see 6BA6				
12BE6	12.6 0.15	For further data see 6BE6				
35W4 Single anode rectifier	35 0.15 pins: 3+4	*Operating* $V_{tr} = 117\ V_{rms}$ $I_o = 90$ mA	$R_t = \geqslant 15\ \Omega$	$C = 40\ \mu F$	$V_{a\,invp} = 330$ V $I_{ap} = 0.6$ A	

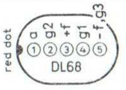
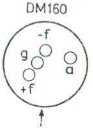
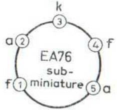
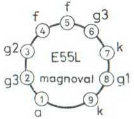
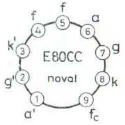
		Operating class A				
50C5 Output pentode	50 0.15	V_a = 110 V V_{g2} = 110 V V_{g1} = −7.5 V	I_a = 49 mA I_{g2} = 4 mA S = 7.5 mA/V	R_i = 14 kΩ $R_{a\sim}$ = 2.5 kΩ W_o = 1.9 W	W_a = 5.5 W	
		Operating class AB				
4699 Output pentode	6.3 1.5	V_{ba} = 425 V V_{bg2} = 425 V R_{g2} = 22 kΩ R_k = 170 Ω $R_{aa\sim}$ = 8 kΩ	I_a = 2 × 46 mA I_{g2} = 2 × 5 mA at V_i = 0 V I_a = 2 × 58 mA	I_{g2} = 2 × 14.5 mA at V_i = 17 V_{rms} W_o = 29 W d_{tot} = 5 %	W_a = 18 W I_k = 90 mA V_{kf} = 50 V	

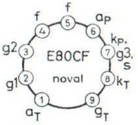
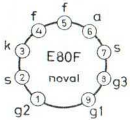
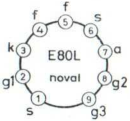
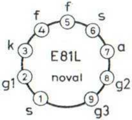
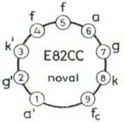
SPECIAL QUALITY TUBES

Type and application	V_f *(V)* I_f *(A)*	*Characteristic data*			*Limiting values*	*Base connections*
C3m A.F.–R.F. output pentode	20 0.125	*Operating* $V_{ba} = 225$ V $V_{bg2} = 155$ V $V_{g3} = 0$ V $R_k = 250\ \Omega$	$I_a = 16$ mA $I_{g2} = 3$ mA $S = 6.5$ mA/V $R_i = 250$ kΩ	$\mu_{g2g1} = 19$ $R_{a\sim} = 10$ kΩ $W_o = 1.5$ W $d_{tot} = 10\%$	$W_a = 4$ W $I_k = 30$ mA $V_{kf} = 120$ V	
D3a Wide band pentode	6.3 0.315	*Typical* $V_{ba} = 190$ V $V_{bg2} = 160$ V $V_{g3} = 0$ V $V_{bg1} = +10$ V	$R_k = 400\ \Omega$ $I_a = 22$ mA $I_{g2} = 6$ mA $S = 35$ mA/V	$R_i = 120$ kΩ $\mu_{g2g1} = 80$ $R_{eq.} = 150\ \Omega$	$W_a = 4.2$ W $I_k = 30$ mA $V_{kf} = 60$ V	
DC70 U.H.F. Osc. triode	1.25 0.2	*Typical* $V_a = 150$ V $V_g = -4.5$ V *Oscillator* $V_a = 150$ V $I_k = 20$ mA	$I_a = 12$ mA $S = 3.4$ mA/V $W_o = 0.45$ W	$R_i = 4$ kΩ $\mu = 14$ $f = 500$ MHz	$W_a = 2.4$ W $I_k = 20$ mA $I_g = 5$ mA	

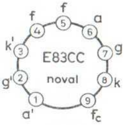
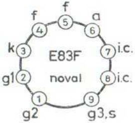
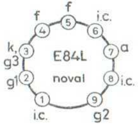
		Typical				
DF61N R.F. pentode	1.25 0.025	$V_a = 67.5$ V $V_{g2} = 67.5$ V $V_{g1} = 0$ V	$I_a = 1.7$ mA $I_{g2} = 0.45$ mA $S = 0.95$ mA/V	$R_i = 1$ MΩ $\mu_{g2g1} = 21$	$I_k = 2.5$ mA $C_{ag1} = 0.01$ pF	
		Operating				
DF66 A.F. pentode	0.625 0.015	$V_b = 22.5$ V $R_a = 1$ MΩ $R_{g2} = 2$ MΩ	$V_{g1} = -0.62$ V $R_{g1} = 5$ MΩ $R_{g1'} = 5$ MΩ	$I_k = 16$ μA $V_o/V_i = 33$	$V_a = 45$ V $V_{g2} = 45$ V $I_k = 100$ μA	
		Operating				
DF67 A.F. pentode	0.625 0.133	$V_b = 22.5$ V $R_a = 1$ MΩ $R_{g2} = 3.3$ MΩ	$V_{g1} = 0$ V $R_{g1} = 10$ MΩ $R_{g1'} = 5$ MΩ	$I_a = 11.7$ μA $I_{g2} = 2.5$ μA $V_o/V_i = 31$	$W_a^{\cdot} = 1.5$ mW $I_k = 75$ μA $R_{g1} = 10$ MΩ	
		Operating				
DL64 Output pentode	1.25 0.01	$V_b = 15$ V $V_{g2} = 15$ V $V_{g1} = -1.5$ V	$I_a = 160$ μA $I_{g2} = 40$ μA $S = 180$ μA/V	$R_i = 0.4$ MΩ $R_{a\sim} = 0.1$ MΩ $W_o = 0.95$ mW	$V_a = 45$ V $V_{g2} = 45$ V $I_k = 0.6$ mA	
		Operating				
DL66 Output pentode	1.25 0.015	$V_b = 22.5$ V $V_{g2} = 22.5$ V $V_{g1} = -1.4$ V	$I_a = 300$ μA $I_{g2} = 75$ μA $S = 350$ μA/V	$R_i = 0.3$ MΩ $R_{a\sim} = 75$ kΩ $W_o = 2.7$ mW	$V_a = 45$ V $V_{g2} = 45$ V $I_k = 1$ mA	

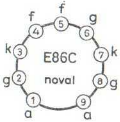
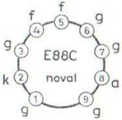
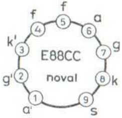
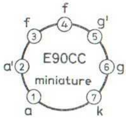
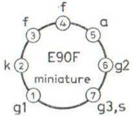
SPECIAL QUALITY TUBES

Type and application	V_f *(V)* I_f *(A)*	*Characteristic data*			*Limiting values*	*Base connections*
DL68 Output pentode	1.25 0.025	*Operating* $V_a = 22.5$ V $V_{g2} = 22.5$ V $V_{g1} = -2.2$ V	$R_{a\sim} = 37.5$ kΩ $I_a = 600$ μA $I_{g2} = 150$ μA	$V_i = 1.3\ V_{rms}$ $W_o = 5$ mW $d_{tot} = 10\%$	$W_a = 0.1$ W $W_{g2} = 0.025$ W $I_k = 2.3$ mA	
DM160 Computer indicator	1.0 0.03	*Operating* $V_a = 50$ V $R_g = 0.1$ MΩ	$V_{bg} = 0$ V $I_a = 585$ μA	$V_{bg} = -3$ V $I_a = < 5$ μA	$V_a = 100$ V $I_a = 850$ μA $R_g = \leqslant 1.1$ MΩ $R_g = \geqslant 0.09$ MΩ	
EA76 Diode	6.3 0.15	*Operating and limiting* $V_{d\,invp} = \leqslant 420$ V	$I_d = \leqslant 9$ mA	$I_{dp} = \leqslant 54$ mA		
E55L Wide band Output pentode	6.3 0.6	*Typical* $V_a = 125$ V $V_{g2} = 125$ V $V_{g1} = -3$ V	$V_{g3} = 0$ V $I_a = 50$ mA $I_{g2} = 5.5$ mA	$S = 45$ mA/V $R_i = 20$ kΩ $\mu_{g2g1} = 30$	$W_a = 10$ W $I_k = 75$ mA $V_{kf} = 200$ V	
E80CC Double triode	6.3 0.6 or 12.6 0.3	*Typical* $V_a = 250$ V $R_k = 920$ Ω	$I_a = 6$ mA $S = 2.7$ mA/V	$R_i = 10$ kΩ $\mu = 2.7$	$W_a = 2$ W $I_k = 12$ mA $V_{kf} = 120$ V	

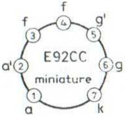
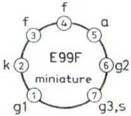
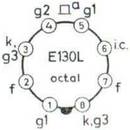
E80CF Triode pentode	6.3 0.33	*Typical (pentode)* $V_{ba}=170$ V $V_{bg2}=170$ V $R_k=155\ \Omega$ *Typical (triode)* $V_{ba}=100$ V $R_k=120\ \Omega$	$I_a=10$ mA $I_{g2}=2.8$ mA $S=6.2$ mA/V $I_a=14$ mA $S=5$ mA/V	$R_i=0.4$ MΩ $\mu_{g2g1}=40$ $R_i=3.6$ kΩ $\mu=18$	$W_a=2.15$ W $I_k=18$ mA $V_{kf}=100$ V $W_a=1.75$ W $I_k=18$ mA	
E80F A.F. pentode	6.3 0.3	*Operating* $V_{ba}=250$ V $V_{bg2}=250$ V $R_a=0.22$ MΩ $R_{g2}=1.2$ MΩ	$R_k=1.5$ kΩ $R_{g1}=1$ MΩ $R_{g1'}=0.68$ MΩ	$I_a=0.8$ mA $I_{g2}=0.17$ mA $V_o/V_i=175$	$W_a=1.3$ W $I_k=9$ mA $V_{+k/-f}=120$ V $V_{-k/+f}=60$ V	
E80L Output pentode	6.3 0.7	*Operating class A* $V_a=200$ V $V_{g2}=200$ V $V_{g3}=0$ V $R_k=130\ \Omega$	$I_a=30$ mA $I_{g2}=4.1$ mA $S=9$ mA/V $R_i=52$ kΩ	$R_{a\sim}=7$ kΩ $W_o=2.7$ W $d_{tot}=10\%$	$W_a=8$ W $I_k=50$ mA $V_{kf}=120$ V	
E81L Output pentode	6.3 0.375	*Operating class A* $V_a=210$ V $V_{g2}=210$ V $V_{g3}=0$ V	$R_k=120\ \Omega$ $R_{a\sim}=15$ kΩ $I_a=20$ mA	$I_{g2}=5.3$ mA $W_o=1$ W $d_{tot}=5\%$	$W_a=4.5$ W $I_k=30$ mA $V_{kf}=120$ V	
E82CC Double triode	6.3 0.3 or 12.6 0.15	*Typical* $V_a=250$ V $R_k=800\ \Omega$	$I_a=10.5$ mA $S=2.2$ mA/V	$R_i=7.7$ kΩ $\mu=17$	$W_a=3$ W $I_k=22$ mA $V_{kf}=100$ V	

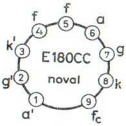
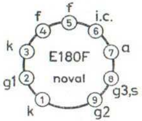
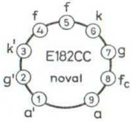
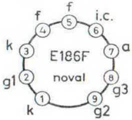
SPECIAL QUALITY TUBES

Type and application	V_f *(V)* I_f *(A)*	*Characteristic data*			*Limiting values*	*Base connections*
E83CC Double triode	6.3 0.3 or 12.6 0.15	*Typical* $V_a = 250$ V $R_k = 1.6$ kΩ	$I_a = 1.25$ mA $S = 1.6$ mA/V	$R_i = 62.5$ kΩ $\mu = 100$	$W_a = 1.2$ W $I_k = 9$ mA $V_{kf} = 200$ V	
E83F Pentode	6.3 0.3	*Typical* $V_a = 210$ V $V_{g2} = 120$ V $V_{g3} = 0$ V $R_k = 165$ Ω	$I_a = 10$ mA $I_{g2} = 2.1$ mA $S = 9$ mA/V	$R_i = 0.5$ MΩ $\mu_{g2g1} = 38$ $R_{eq.} = 750$ Ω	$W_a = 2.1$ W $I_k = 16$ mA $V_{kf} = 100$ V	
E84L Output pentode	6.3 0.76	*Operating class A* $V_a = 250$ V $V_{g2} = 250$ V $R_k = 135$ Ω $I_a = 48$ mA	$I_{g2} = 5.5$ mA $S = 11.3$ mA/V $R_i = 40$ kΩ $\mu_{g2g1} = 19$	$R_{a\sim} = 4.5$ kΩ $W_o = 5.7$ W $d_{tot} = 10\%$ $V_i = 4.4\ V_{rms}$	$W_a = 13.5$ W $I_k = 75$ mA $V_{kf} = 100$ V	
		Class B $V_a = 300$ V $V_{g2} = 300$ V $V_{g1} = -14.7$ V $R_{aa\sim} = 8$ kΩ	$I_a = 2 \times 7.5$ mA $I_{g2} = 2 \times 0.8$ mA at $V_i = 0$ V $I_a = 2 \times 46$ mA	$I_{g2} = 2 \times 11$ mA at $V_i = 10\ V_{rms}$ $W_o = 17$ W $d_{tot} = 4\%$		

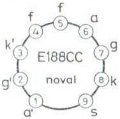
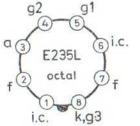
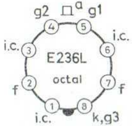
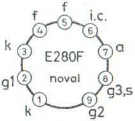
E86C U.H.F. triode	6.3 0.165	*Typical* $V_{ba}=185$ V $V_{bg}=+8$ V $R_k=800\ \Omega$	$I_a=12$ mA $S=14$ mA/V $R_i=4.8$ kΩ	$\mu=68$ $R_{eq.}=250\ \Omega$	$W_a=2.4$ W $I_k=20$ mA $V_{kf}=100$ V $f=800$ MHz	
E88C U.H.F. triode	6.3 0.155	*Typical* $V_a=160$ V $V_g=-1.25$ V $I_a=12.5$ mA	$S=13.5$ mA/V $R_i=5.2$ kΩ $\mu=70$	$R_{eq.}=240\ \Omega$ $F=9.6$ dB at $f=850$ MHz	$W_a=2.6$ W $I_k=16.5$ mA $V_{+k/-f}=125$ V $V_{-k/+f}=60$ V	
E88CC Double triode	6.3 0.3	*Typical* $V_{ba}=100$ V $V_{bg}=+9$ V $R_k=680\ \Omega$	$I_a=15$ mA $S=12.5$ mA/V $\mu=33$	$R_{eq.}=300\ \Omega$ $F=4.6$ dB at $f=200$ MHz	$W_a=1.8$ W $I_k=20$ mA $V_{+k/-f}=150$ V $V_{-k/+f}=100$ V	
E90CC Double triode computer application	6.3 0.4	*Typical* $V_a=100$ V $V_g=-2.1$ V	$I_a=8.5$ mA $S=6$ mA/V	$R_i=4.5$ kΩ $\mu=27$	$W_a=2$ W $I_k=15$ mA $V_{kf}=100$ V	
E90F Sharp cut-off pentode	6.3 0.15	*Typical* $V_{ba}=250$ V $V_{g2}=150$ V $V_{g3}=0$ V $R_k=100\ \Omega$	$I_a=7.4$ mA $I_{g2}=2.9$ mA $S=4.6$ mA/V	$R_i=1.3$ MΩ $\mu_{g2g1}=48$ $R_{eq.}=2.5$ kΩ	$W_a=2.6$ W $I_k=15$ mA $V_{kf}=100$ V	

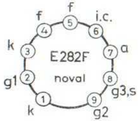
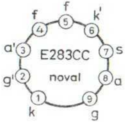
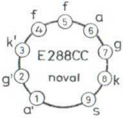
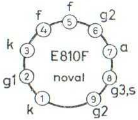
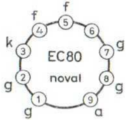
SPECIAL QUALITY TUBES

Type and application	V_f (*V*) I_f (*A*)	*Characteristic data*			*Limiting values*	*Base connections*
E92CC Double triode computer application	6.3 0.4	*Typical* $V_a = 150$ V $V_g = -1.7$ V	$I_a = 8.5$ mA $S = 6$ mA/V	$R_i = 7.5$ kΩ $\mu = 45$	$W_a = 2$ W $I_k = 5$ mA $V_{kf} = 100$ V	
E99F Remote cut-off pentode	6.3 0.15	*Typical* $V_{ba} = 250$ V $V_{bg2} = 100$ V $V_{g3} = 0$ V $R_k = 80\ \Omega$	$I_a = 9.2$ mA $I_{g2} = 3.3$ mA $S = 3.8$ mA/V	$R_i = 1$ MΩ $\mu_{g2g1} = 25$ $R_{eq.} = 3.5$ kΩ	$W_a = 3.3$ W $I_k = 17$ mA $V_{kf} = 100$ V	
E130L Output pentode	6.3 1.7	*Operating class A* $V_a = 250$ V $V_{g2} = 150$ V $V_{g1} = -15.5$ V	$R_{a\sim} = 2.7$ kΩ $V_i = 3.8\ V_{rms}$ $I_a = 100$ mA	$I_{g2} = 18$ mA $W_o = 11.5$ W $d_{tot} = 10\%$	$W_a = 27.5$ W $I_k = 300$ mA $V_{+k/f-} = 200$ V $V_{-k/f+} = 100$ V	
		Class AB $V_a = 300$ V $V_{g2} = 150$ V $V_{g1} = -17$ V $R_{aa\sim} = 1.6$ kΩ	$I_a = 2 \times 80$ mA $I_{g2} = 2 \times 2.5$ mA at $V_i = 0$ V $I_a = 2 \times 182$ mA	$I_{g2} = 2 \times 22$ mA at $V_i = 9V_{rms}$ $W_o = 60$ W $d_{tot} = 5\%$		

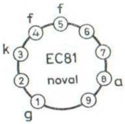
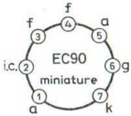
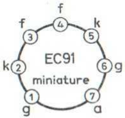
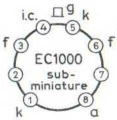
E180CC Double triode computer application	6.3 0.4 or 12.6 0.2	*Typical* $V_a = 150$ V $V_g = -1.85$ V	$I_a = 8.5$ mA $S = 6.4$ mA/V	$R_i = 7.2$ kΩ $\mu = 46$	$W_a = 2$ W $I_k = 20$ mA $V_{+k/f-} = 200$ V $V_{-k/f+} = 100$ V	
E180F Wide band pentode	6.3 0.3	*Typical* $V_{ba} = 190$ V $V_{bg2} = 160$ V $V_{g3} = 0$ V $V_{bg1} = +9$ V	$R_k = 630$ Ω $I_a = 13$ mA $I_{g2} = 3.3$ mA $S = 16.5$ mA/V	$R_i = 90$ kΩ $\mu_{g2g1} = 50$ $R_{eq.} = 330$ Ω	$W_a = 3$ W $I_k = 25$ mA $V_{kf} = 60$ V	
E182CC Double triode computer application	6.3 0.64 or 12.6 0.32	*Typical* $V_a = 120$ V $V_g = -2$ V	$I_a = 36$ mA $S = 15$ mA/V	$R_i = 1.6$ kΩ $\mu = 24$	$W_a = 4.5$ W $I_k = 60$ mA $V_{kf} = 200$ V	
E186F Wide band pentode	6.3 0.32	*Typical* $V_{ba} = 190$ V $V_{bg2} = 160$ V $V_{g3} = 0$ V $V_{bg1} = +9$ V	$R_k = 630$ Ω $I_a = 13$ mA $I_{g2} = 3.3$ mA $S = 16.5$ mA/V	$R_i = 100$ kΩ $\mu_{g2g1} = 53$ $R_{eq.} = 330$ Ω	$W_a = 3$ W $I_k = 25$ mA $V_{kf} = 60$ V	

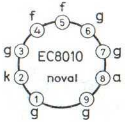
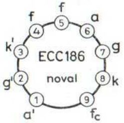
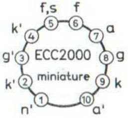
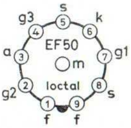
SPECIAL QUALITY TUBES

Type and application	V_f *(V)* I_f *(A)*	*Characteristic data*			*Limiting values*	*Base connections*
E188CC Double triode	6.3 0.335	*Typical* $V_{ba}=100$ V $V_{bg}=+9$ V $R_k=680\ \Omega$	$I_a=15$ mA $S=12.5$ mA/V $\mu=33$	$R_{eq.}=250\ \Omega$ $F=4.6$ dB at $f=200$ MHz	$W_a=1.65$ W $I_k=22$ mA $V_{+k/-f}=150$ V $V_{-k/+f}=100$ V	
E235L Output pentode	6.3 1.2	*Typical* $V_a=100$ V $V_{g2}=100$ V $R_k=75\ \Omega$	$I_a=100$ mA $I_{g2}=5.2$ mA $S=14$ mA/V	$R_i=5\ \text{k}\Omega$ $\mu_{g2g1}=5.6$	$W_a=15$ W $I_k=220$ mA $V_{+k/-f}=250$ V $V_{-k/+f}=200$ V	
E236L Output pentode	6.3 1.2	*Typical* $V_a=100$ V $V_{g2}=100$ V $R_k=75\ \Omega$	$I_a=100$ mA $I_{g2}=5.2$ mA $S=14$ mA/V	$R_i=5\ \text{k}\Omega$ $\mu_{g2g1}=5.6$	$W_a=15$ W $I_k=220$ mA $V_{ap}=7$ kV $V_{+k/-f}=250$ V	
E280F Wide band pentode	6.3 0.315	*Typical* $V_{ba}=190$ V $V_{bg2}=160$ V $V_{g3}=0$ V $V_{bg1}=+8$ V	$R_k=370\ \Omega$ $I_a=20$ mA $I_{g2}=6$ mA $S=26$ mA/V	$R_i=100\ \text{k}\Omega$ $\mu_{g2g1}=60$ $R_{eq.}=220\ \Omega$	$W_a=4$ W $I_k=30$ mA $V_{+k/-f}=120$ V $V_{-k/+f}=60$ V	

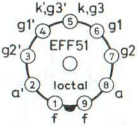
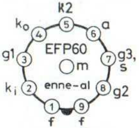
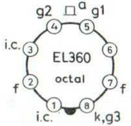
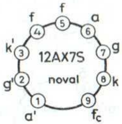
E282F Wide band pentode	6.3 0.35	*Typical* $V_{ba} = 125$ V $V_{bg2} = 125$ V $V_{g3} = 0$ V $V_{bg1} = +12$ V	$R_k = 300\ \Omega$ $I_a = 35$ mA $I_{g2} = 11$ mA $S = 26$ mA/V	$\mu_{g2g1} = 27$ $R_{eq.} = 200\ \Omega$ $F = 7$ dB at $f = 100$ MHz	$W_a = 4.2$ W $I_k = 50$ mA $V_{kf} = 100$ V	
E283CC A.F. double triode	6.3 0.33	*Typical* $V_a = 250$ V $R_k = 1.6\ \text{k}\Omega$	$I_a = 1.25$ mA $S = 1.6$ mA/V	$R_i = 62.5\ \text{k}\Omega$ $\mu = 100$	$W_a = 1.2$ W $I_k = 9$ mA $V_{kf} = 200$ V	
		Operating $V_{ba} = 250$ V $R_a = 47\ \text{k}\Omega$ $R_k = 1.2\ \text{k}\Omega$	$R_o = 150\ \text{k}\Omega$ $I_a = 1.18$ mA $V_o = 23\ V_{rms}$	$V_o/V_i = 37.5$ $d_{tot} = 7\%$		
E288CC R.F. double triode	6.3 0.475	*Typical* $V_{ba} = 100$ V $V_{bg} = +9$ V $R_k = 350\ \Omega$	$I_a = 30$ mA $S = 20$ mA/V $R_i = 1.25\ \text{k}\Omega$	$\mu = 25$ $R_{eq.} = 200\ \Omega$ $F = 5.7$ dB	$W_a = 3$ W $I_k = 40$ mA $V_{kf} = 150$ V	
E810F Wide band pentode	6.3 0.34	*Typical* $V_{ba} = 135$ V $V_{bg2} = 165$ V $V_{g3} = 0$ V $V_{bg1} = +12.5$ V	$R_k = 360\ \Omega$ $I_a = 35$ mA $I_{g2} = 5$ mA $S = 50$ mA/V	$R_i = 42\ \text{k}\Omega$ $\mu_{g2g1} = 57$ $R_{eq.} = 110\ \Omega$	$W_a = 5$ W $I_k = 50$ mA $V_{kf} = 100$ V	
EC80 U.H.F. triode	6.3 0.34	*Typical* $V_a = 250$ V $V_g = -1.5$ V	$I_a = 15$ mA $S = 12$ mA/V	$\mu = 80$ $f = < 500$ MHz	$W_a = 4$ W $I_k = 15$ mA $V_{kf} = 100$ V	

SPECIAL QUALITY TUBES

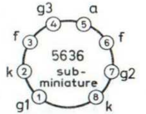
Type and application	V_f (*V*) I_f (*A*)	*Characteristic data*			*Limiting values*	*Base connections*
EC81 U.H.F. oscillator triode	6.3 0.175	*Typical* $V_a = 150$ V $V_g = -2$ V	$I_a = 30$ mA $S = 5.5$ mA/V	$\mu = 16$ $f = <750$ MHz	$W_a = 5$ W $I_k = 30$ mA $V_{kf} = 100$ V	
EC90 R.F. triode	6.3 0.15	*Typical* $V_a = 250$ V $V_g = -8.5$ V	$I_a = 10.5$ mA $S = 2.2$ mA/V	$R_i = 7.7$ kΩ $\mu = 17$	$W_a = 3.5$ W $I_k = 30$ mA $V_{kf} = 150$ V	
		Operating $f = 100$ MHz $V_a = 300$ V $V_g = -27$ V	$I_a = 17$ mA $+I_g = 2.9$ mA	$W_o = 3.3$ W $\eta = 55\%$		
EC91 U.H.F. triode	6.3 0.3	*Typical* $V_a = 250$ V $V_g = -1.5$ V $I_a = 10$ mA	$S = 8.5$ mA/V $R_i = 12$ kΩ	$\mu = 100$ $R_{eq.} = 400$ Ω	$W_a = 2.5$ W $I_k = 15$ mA $V_{kf} = 150$ V	
EC1000 Triode measuring application	6.3 0.185	*Typical* $V_a = 80$ V $V_g = -2$ V $I_a = 14$ mA	$S = 14.5$ mA/V $\mu = 27.5$	$-I_g = \leqslant 0.01$ μA $f = 400$ MHz	$W_a = 1.5$ W $I_k = 22$ mA $V_{kf} = 55$ V	

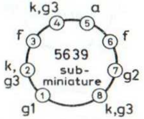
EC8010 U.H.F. triode	6.3 0.28	*Typical* $V_{ba}=200$ V $R_a=$ 2.4 kΩ	$R_k=47$ Ω $I_a=25$ mA	$S=28$ mA/V $\mu=60$	$W_a=$ 4.5 W $I_k=$ 35 mA $V_{kf}=100$ V	
ECC186 Double triode computer application	6.3 0.3 or 12.6 0.15	*Typical* $V_a=$ 250 V $V_g=-8.5$ V $R_g=$ 0.1 MΩ	$I_a=10.5$ mA $S=2.2$ mA/V	$R_i=7.7$ kΩ $\mu=17$	$W_a=2.75$ W $I_k=$ 20 mA $V_{kf}=$ 90 V	
ECC2000 V.H.F. double triode	6.3 0.335	*Typical* $V_a=$ 90 V $V_g=-1.4$ V	$I_a=27$ mA $S=22$ mA/V	$\mu=28$ $R_{eq.}=150$ Ω	$W_a=$ 2.7 W $I_k=$ 40 mA $V_{+k/-f}=150$ V	
		$V_{a'}=$ 90 V $V_{sn}=$ 0 V $V_{g'}=-1.4$ V	$I_a=$ 27 mA $S=17.5$ mA/V	$\mu=27$ $R_{eq.}=200$ Ω		
EF50 Wide band pentode	6.3 0.3	*Operating* $V_a=250$ V $V_{g2}=250$ V $V_{g3}=$ 0 V $R_k=$ 32 Ω	$C_k=50$ pF $V_R=-1.55$ V $I_a=10$ mA	$I_{g2}=$ 3 mA $S=6.5$ mA/V $R_i=$ 1 MΩ	$W_a=$ 3 W $I_k=$ 15 mA $V_{kf}=100$ V	

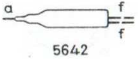
SPECIAL QUALITY TUBES

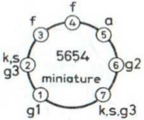
Type and application	V_f *(V)* I_f *(A)*	*Characteristic data*			*Limiting values*	*Base connections*
EFF51 H.F. double pentode	6.3 0.75	*Operating* $V_a = 300$ V $V_{g2} = 225$ V $R_{g2} = 42$ kΩ	 $V_{g1} = -2$ V $I_a = 10$ mA $I_{g2} = 1.8$ mA	 $S = 9$ mA/V $R_i = 0.25$ MΩ $R_{eq.} = 750$ Ω	$W_a = 3$ W $I_k = 15$ mA $V_{kf} = 50$ V	
EFP60 Secondary emission pentode	6.3 0.37	*Typical* $V_a = 250$ V $V_{g2} = 250$ V $V_{g3} = 0$ V $V_{k3} = 150$ V	 $V_{g1} = -2$ V $I_a = 20$ mA $I_{g2} = 1.5$ mA $I_{k3} = -15.6$ mA	 $S = 25$ mA/V $R_i = 70$ $\mu_{g2g1} = 110$	$W_a = 2$ W $W_{k3} = 1$ W $I_{k1} = 8$ mA $V_{k1f} = 50$ V	
EL360 Output pentode	6.3 1.27	$V_a = 250$ V $V_{g2} = 250$ V	$V_{g1} = -46$ V $I_a = 48$ mA	$I_{g2} = 5.5$ mA $S = 6.9$ mA/V	$W_a = 15$ W $I_k = 200$ mA $V_{kf} = 200$ V	
12AX7S A.F. double triode	6.3 0.3 or 12.6 0.15	*Typical* $V_a = 250$ V $V_g = -2$ V	 $I_a = 1.2$ mA $S = 1.6$ mA/V	 $R_i = 62.5$ kΩ $\mu = 100$	$W_a = 1.1$ W $I_k = 20$ mA $V_{kf} = 100$ V	
5636 Dual control pentode	6.3 0.15	*Typical* $V_a = 100$ V $V_{g2} = 100$ V $V_{g3} = 0$ V	 $R_k = 150$ Ω $I_a = 5.3$ mA $I_{g2} = 4$ mA	 $S_{ag1} = 3.2$ mA/V $S_{ag3} = 0.5$ mA/V $R_i = 110$ kΩ	$W_a = 1.1$ W $I_k = 16$ mA $V_{kf} = 200$ V	

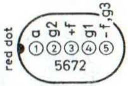
		Operating class A			
5639 Output pentode	6.3 0.45	$V_a = 150$ V $V_{g2} = 100$ V $R_k = 100\ \Omega$	$I_a = 21$ mA $I_{g2} = 4$ mA $S = 9$ mA/V	$R_i = 50\ \text{k}\Omega$ $R_{a\sim} = 9\ \text{k}\Omega$ $W_o = 1$ W	$W_a = 4$ W $I_k = 40$ mA $V_{kf} = 200$ V
5642 E.H.T. rectifier	1.25 0.2				$V_{a\,\text{invp}} = 10$ kV $I_a = 250\ \mu$A $I_{ap} = 1.5$ mA
		Typical			
5654 Wide band pentode	6.3 0.175	$V_a = 120$ V $V_{g2} = 120$ V $V_{g1} = -2$ V	$I_a = 7.5$ mA $I_{g2} = 2.5$ mA	$S = 5$ mA/V $R_i = 0.34\ \text{M}\Omega$	$W_a = 1.65$ W $I_k = 20$ mA $V_{kf} = 135$ V
		Operating class A			
5672 A.F. power pentode	1.25 0.05	$V_a = 67.5$ V $V_{g2} = 67.5$ V $V_{g1} = -6.5$ V	$I_a = 3.1$ mA $I_{g2} = 0.95$ mA $S = 0.65$ mA/V	$R_a = 20\ \text{k}\Omega$ $W_o = 65$ mW $d_{\text{tot}} = 10\,\%$	$V_a = 90$ V $V_{g2} = 90$ V $I_k = 5$ mA
		Typical			
5678 pentode	1.25 0.05	$V_a = 67.5$ V $V_{g2} = 67.5$ V $V_{g1} = 0$ V	$I_a = 1.8$ mA $I_{g2} = 0.48$ mA	$S = 1.1$ mA/V $R_i = 1\ \text{M}\Omega$	$V_a = 90$ V $V_{g2} = 67.5$ V

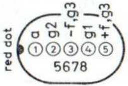




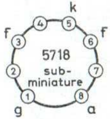
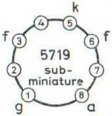
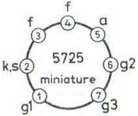
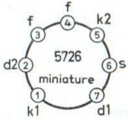


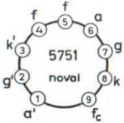
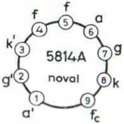
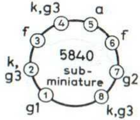
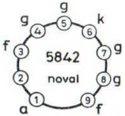
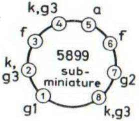




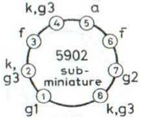
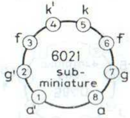
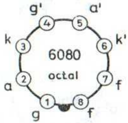
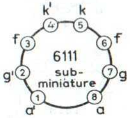


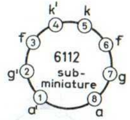
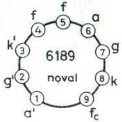
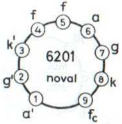
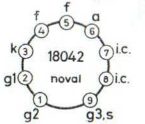
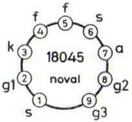
SPECIAL QUALITY TUBES

Type and application	V_f *(V)* I_f *(A)*	*Characteristic data*			*Limiting values*	*Base connections*
5718 U.H.F. oscillator triode	6.3 0.15	*Typical* $V_a = 100$ V $R_k = 150\ \Omega$ $I_a = 8.5$ mA	$S = 5.8$ mA/V $R_i = 4.7$ kΩ	$\mu = 27$ $f = < 1000$ MHz	$W_a = 3.3$ W $I_k = 22$ mA $V_{kf} = 200$ V	
5719 A.F. triode	6.3 0.15	*Typical* $V_{ba} = 100$ V $R_k = 1.5$ kΩ	$I_a = 0.73$ mA $S = 1.7$ mA/V	$R_i = 41$ kΩ $\mu = 70$	$W_a = 0.55$ W $I_k = 3.3$ mA $V_{kf\,p} = 200$ V	
5725 Sharp cut-off pentode	6.3 0.175	*Typical* $V_a = 120$ V $V_{g2} = 120$ V $V_{g3} = 0$ V	$V_{g1} = -2$ V $I_a = 5.2$ mA $I_{g2} = 3.5$ mA	$S_{g1} = 3.2$ mA/V $S_{g3} = 0.47$ mA/V $R_i = 150$ kΩ	$W_a = 1.85$ W $I_k = 20$ mA $V_{kf} = 100$ V	
5726 Double diode	6.3 0.3	*Operating* $V_{tr} = 2 \times 165\ V_{rms}$ $C = 8\ \mu F$	$R_s = 300\ \Omega$	$I_o = \geqslant 16$ mA	$V_{inv\,p} = 360$ V $I_{d\,p} = 60$ mA $V_{kf\,p} = 360$ V	

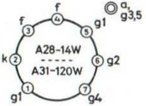
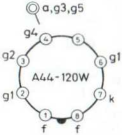
5751 A.F. double triode	6.3 0.35 or 12.6 0.175	*Typical* $V_{ba} = 250$ V $R_k = 3$ kΩ $V_{bg} = 0$ V	$I_a = 1$ mA $S = 1.2$ mA/V	$R_i = 58$ kΩ $\mu = 70$	$W_a = 0.8$ W $V_{kf} = 100$ V	
5814A Double triode	6.3 0.35 or 12.6 0.175	*Typical* $V_{ba} = 250$ V $R_k = 800$ Ω $V_{bg} = 0$ V	$I_a = 10.5$ mA $S \doteq 2.2$ mA/V	$R_i = 7.7$ kΩ $\mu = 17$	$W_a = 3$ W $I_k = 22$ mA $V_{kf} = 100$ V	
5840 R.F. pentode	6.3 0.15	*Typical* $V_{ba} = 100$ V $V_{bg2} = 100$ V $R_k = 150$ Ω	$I_a = 7.5$ mA $I_{g2} = 2.4$ mA	$S = 5$ mA/V $R_i = 260$ kΩ	$W_a = 1.1$ W $I_k = 16.5$ mA $V_{kf} = 200$ V	
5842 Wide band triode	6.3 0.3	*Typical* $V_a = 150$ V $R_k = 60$ Ω	$I_a = 26$ mA $S = 24$ mA/V	$R_i = 2.1$ kΩ $\mu = 50$	$W_a = 4.5$ W $I_k = 38$ mA $V_{kf} = 60$ V	
5899 Remote cut-off pentode	6.3 0.15	*Typical* $V_a = 100$ V $V_{g2} = 100$ V $R_k = 120$ Ω	$I_a = 7.2$ mA $I_{g2} = 2$ mA	$S = 4.5$ mA/V $R_i = 260$ kΩ	$W_a = 1.1$ W $I_k = 16.5$ mA $V_{kf} = 200$ V	

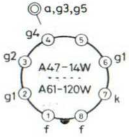
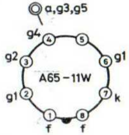
SPECIAL QUALITY TUBES

Type and application	V_f *(V)* I_f *(A)*	*Characteristic data*			*Limiting values*	*Base connections*
5902 Output pentode	6.3 0.45	*Operating class A* $V_{ba}=109$ V $V_{bg2}=109$ V $R_k=270\ \Omega$	$I_a=30$ mA $I_{g2}=2.2$ mA $S=4.2$ mA/V	$R_i=15$ kΩ $R_{a\sim}=3$ kΩ $W_o=1$ W	$W_a=4$ W $I_k=50$ mA $V_{kf}=200$ V	
6021 Double triode	6.3 0.3	*Typical* $V_a=100$ V $R_k=150\ \Omega$	$I_a=6.5$ mA $S=5.4$ mA/V	$R_i=6.5$ kΩ $\mu=35$	$W_a=0.7$ W $I_k=22$ mA $V_{kf}=200$ V	
6080 Double triode Series regulator	6.3 2.5	*Typical* $V_a=100$ V $R_k=300\ \Omega$	$I_a=100$ mA $S=6.5$ mA/V	$R_i=300\ \Omega$ $\mu=2$	$W_a=13$ W $I_k=125$ mA $V_{kf\,p}=300$ V	
6111 Double triode	6.3 0.3	*Typical* $V_a=100$ V $V_g=-1.9$ V	$I_a=8.5$ mA $S=5$ mA/V	$R_i=4$ kΩ $\mu=20$	$W_a=1.1$ W $I_k=22$ mA $V_{kf\,p}=200$ V	

6112 Double triode	6.3 0.3	*Typical* $V_a = 100$ V $V_g = -1.2$ V	$I_a = 0.8$ mA $S = 1.8$ mA/V	$R_i = 38.8$ kΩ $\mu = 70$	$W_a = 0.55$ W $I_k = 3.3$ mA $V_{kf\,p} = 200$ V	
6189 Double triode	6.3 0.3 or 12.6 0.15	*Typical* $V_a = 250$ V $V_g = -8.5$ V $I_a = 10.5$ mA	$S = 2.2$ mA/V $R_i = 7.7$ kΩ	$\mu = 17$ $-I_g = <0.5$ μA	$W_a = 3$ W $I_k = 22$ mA $V_{kf} = 110$ V	
6201 Double triode	6.3 0.3 or 12.6 0.15	*Typical* $V_a = 250$ V $R_k = 200$ Ω $I_a = 10$ mA	$S = 5.5$ mA/V $R_i = 10.9$ kΩ	$\mu = 60$ $-I_{g1} = <0.7$ μA	$W_a = 2.8$ W $I_k = 18$ mA $V_{kf} = 100$ V	
18042 pentode	18 0.1	*Typical* $V_a = 210$ V $V_{g2} = 120$ V $V_{g3} = 0$ V $R_k = 165$ Ω	$I_a = 10$ mA $I_{g2} = 2.1$ mA $S = 9$ mA/V	$R_i = 0.5$ MΩ $\mu_{g2g1} = 38$ $R_{eq.} = 750$ Ω	$W_a = 2.1$ W $I_k = 16$ mA $V_{kf} = 100$ V	
18045 Output pentode	18 0.13	*Operating class A* $V_a = 210$ V $V_{g2} = 210$ V $V_{g3} = 0$ V $R_k = 120$ Ω $I_a = 20$ mA	$I_{g2} = 5.3$ mA $S = 11$ mA/V $R_i = 0.3$ MΩ $\mu_{g2g1} = 36$	$R_{eq.} = 1.2$ kΩ $R_{a\sim} = 15$ kΩ $W_o = 1$ W $d_{tot} = 5\%$	$W_a = 4.5$ W $I_k = 30$ mA $V_{kf} = 120$ V	

CATHODE-RAY TUBES — T.V. Picture tubes

Type Deflection angle Transmission	V_f (V) I_f (A)	Typical operating characteristics	Min. useful screen diag.	width	height	Max. overall length	Base connections
A28-14W 1) 90° 50 %	11 0.075	$V_{a,g3,g5} = 11$ kV $V_{g4} = 0$–350 V 2) $V_{g2} = 250$ V $-V_{g1}' = 35$–69 V 3) $V_k = 32$–58 V 4)	263	228	171	250	
A31-20W 1) 90° 54 %			295	257	195	277	
A31-120W 1) 110° 50%			295	257	195	233	
A44-120W 1) 110° 48 %	6.3 0.3	$V_{a,g3,g5} = 18$ kV $V_{g4} = 0$–400 V 2) $V_{g2} = 400$ V $-V_{g1} = 40$–77 V 3) $V_k' = 36$–66 V 4)	413	346	270	291	

A47-14W 110° 48 %			446	384	305	309	
A47-26W[1] 110° 48 %			446	384	305	309	
A50-120W[1] 110° 45 %			473	394	308	319	
A59-11W[1] 110° 45 %	6.3 0.3	$V_{a,g3,g5} = 20$ kV $V_{g4} = 0$–400 V[2] $V_{g2} = 400$ V $-V_{g1} = 40$–77 V[3] $V_k = 36$–66 V[4]	566	489	385	367	
A59-15W 110° 45 %			566	489	385	367	
A59-16W[1] 110° 45 %			567	491	388	375	
A59-23W[1] 110° 45 %			566	489	385	367	
A61-120W[1] 110° 42 %			578	481	375	370	
A65-11W[1] 110° 43 %	6.3 0.3	$V_{a,g3,g5} = 20$ kV $V_{g4} = 0$–400 V[2] $V_{g2} = 500$ V $-V_{g1} = 50$–93 V[3] $V_k = 45$–80 V[4]	617	530	416	391	

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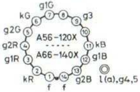
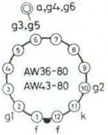
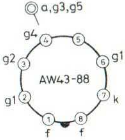
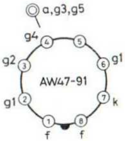
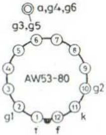
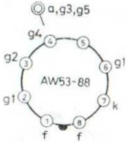
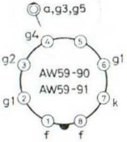
[1]) Tube can be used without safety panel. [2]) Voltage range to obtain optimum overall focus at 100 μA beam current.
[3]) Grid voltage for visual cut-off. [4]) Cathode voltage for visual cut-off.

CATHODE-RAY TUBES - T.V. Picture tubes

Type *Deflection angle* *Transmission*	V_f *(V)* I_f *(A)*	*Typical operating characteristics*	*Min. useful screen*			*Max. overall length*	*Base connections*
			diag.	*width*	*height*		
A56-120X [1] 90° 53 %	**Colour tubes**		533	447	337	482	
A63-120X [1] 90° 52.5%	6.3 0.9	$V_{a,g4,g5}$ = 25 kV V_{g3} = 4.2–5.0 kV V_{g2} = 210–495 V $-V_{g1}$ = 70–140 V [3]	584	504	396	531	
A66-120X [1] 90° 52.5 %			617.8	518	390	528	
A66-140X [1] 110° 52%			617.8	518	390	438	
AW36-80 **AW36-80Z** 90° 75 %	6.3 0.3	$V_{a,g4,g6}$ = 12 kV $V_{g3,g5}$ = –70 to 230 V [2] V_{g2} = 300 V $-V_{g1}$ = 40–80 V [3]	330	306.5	241	369	
AW43-80 **AW43-80Z** 90° 75 %	6.3 0.3	$V_{a,g4,g6}$ = 16 kV $V_{g3,g5}$ = –75 to 235 V [2] V_{g2} = 300 V $-V_{g1}$ = 40–80 V [3]	390	362	273	402	
AW43-88 110° 75 %	6.3 0.3	$V_{a,g3,g5}$ = 16 kV V_{g2} = 300 V V_{g4} = 0–400 V [2] $-V_{g1}$ = 30–72 V [3] V_k = 28–60 V [4]	400	374.5	295	326	

AW47-91 110° 75%	6.3 0.3	$V_{a,g3,g5} = 20$ kV $V_{g4} = 0\text{–}400$ V ²) $V_{g2} = 400$ V $-V_{g1} = 40\text{–}77$ V ³) $V_k = 36\text{–}66$ V ⁴)	446	384	305	309	
AW53-80 **AW53-80Z** 90° 70%	6.3 0.3	$V_{a,g4,g6} = 16$ kV $V_{g3,g5} = -75$ to 235 V ²) $V_{g2} = 300$ V $-V_{g1} = 40\text{–}80$ V ³)	511	482	378	492	
AW53-88 110° 75%	6.3 0.3	$V_{a,g3,g5} = 16$ kV $V_{g4} = 0\text{–}400$ V ²) $V_{g2} = 300$ V $-V_{g1} = 30\text{–}72$ V ³) $V_k = 28\text{–}60$ V ⁴)	514.5	484	382.5	381	
AW59-90 110° 75%	6.3 0.3	$V_{a,g3,g5} = 18$ kV $V_{g4} = 0\text{–}400$ V ²) $V_{g2} = 300$ V $-V_{g1} = 30\text{–}72$ V ³) $V_k = 28\text{–}60$ V ⁴)	566	489	385	386	
AW59-91 110° 75%	6.3 0.3	$V_{a,g3,g5} = 18$ kV $V_{g4} = 0\text{–}400$ V ²) $V_{g2} = 400$ V $-V_{g1} = 40\text{–}77$ V ³) $V_k = 36\text{–}66$ V ⁴)	566	489	385	366	

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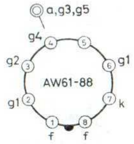
¹) Tube can be used without safety panel. ²) Voltage range to obtain optimum overall focus at 100 μA beam current. ³) Grid voltage for visual cut-off. ⁴) Cathode voltage for visual cut-off.

CATHODE-RAY TUBES — T.V. Picture tubes

Type *Deflection angle* *Transmission*	V_f *(V)* I_f *(A)*	*Typical operating characteristics*	*Min. useful screen*			*Max. overall length*	*Base connections*
			diag.	*width*	*height*		
AW61-88 110° 75%	6.3 0.3	$V_{a,g3,g5} = 16$ kV $V_{g2} = 300$ V $V_{g4} = 0$–400 V 1) $-V_{g1} = 30$–72 V 2) $V_k = 28$–60 V 3)	579.5	544.5	428.5	411	

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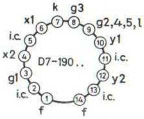
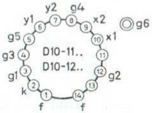
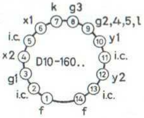
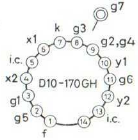
1) Volt. range to obtain optimum overall focus at 100 μA beam current. 2) Grid volt. for visual cut-off.

3) Cathode voltage for visual cut-off.

CATHODE-RAY TUBES - Instrument tubes

Type	V_f *(V)* I_f *(A)*	*Typical operating conditions*		*Display area Deflection factor* *hor. vert.*	*Max. overall length*	*Base connections*
D7-190GH **D7-190GM** **D7-190GP**	6.3 0.3	$V_{g2,g4,g5(l)}=1$ kV $V_{g3}=100$–180 V	$-V_{g1}=<35$ V[1]	6 cm × 5 cm $M_x=$ 29 V/cm $M_y=$ 11.5 V/cm	225	
D10-11BE **D10-11GH** **D10-11GM** **D10-11GP**	6.3 0.095	$V_{g6(l)}=4$ kV $V_{g5}=1$ kV $V_{g4}=1$ kV	$V_{g3}=50$–200 V $V_{g2}=1$ kV $-V_{g1}=25$–67 V[1]	full scan × 6 cm $M_x=$ 27.5 V/cm $M_y=$ 9.8 V/cm	320	
D10-12BE **D10-12GH** **D10-12GM** **D10-12GP**	6.3 0.3					
D10-160GH **D10-160GM** **D10-160GP**	6.3 0.3	$V_{g2,g4,g5(l)}=1.5$ kV $V_{g3}=140$–275 V	$-V_{g1}=<50$ V[1]	8 cm × 6 cm $M_x=$ 32 V/cm $M_y=$ 13.7 V/cm	260	
D10-161..	6.3 0.095	For further data see D10-160..				
D10-170GH	6.3 0.3	$V_{g7(l)}=6$ kV $V_{g6}=1$ kV $V_{g5}=1$ kV	$V_{g3}=170$–230 V $V_{g2,g4}=1$ kV $-V_{g1}=16$–40 V[1]	8 cm × 6 cm $M_x=$ 13 V/cm $M_y=$ 3.5 V/cm	335	

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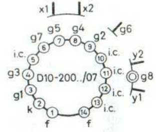
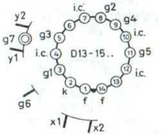
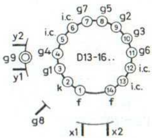
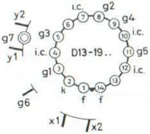
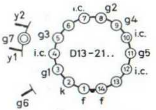
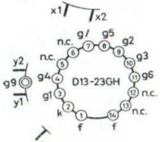
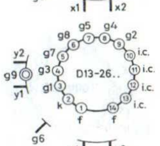
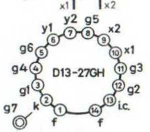
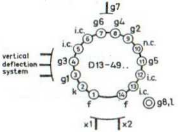
[1]) Grid voltage for visual cut-off.

CATHODE-RAY TUBES - Instrument tubes

Type	*V_f (V)* *I_f (A)*	*Typical operating conditions*		*Display area Deflection factor* *hor.*	*vert.*	*Max. overall length*	*Base connections*
D10-200GH/07	6.3 0.3	$V_{g8(l)} = 15$ kV $V_{g7} = 1.5$ kV $V_{g6} = 1.5$ kV $V_{g5} = 1.5$ kV	$V_{g4} = 1.5$ kV $V_{g3} = 380–520$ V $V_{g2} = 1.5$ kV $-V_{g1} = 40–100$ V	8 cm × $M_x =$ 12 V/cm	5 cm $M_y =$ 3.5 V/cm	383	
D13-15BE **D13-15GH** **D13-15GM** **D13-15GP**	6.3 0.3	$V_{g7(l)} = 4$ kV $V_{g6} = 2$ kV $V_{g5} = 2$ kV $V_{g4} = 2$ kV	$V_{g3} = 220–710$ V $V_{g2} = 2$ kV $-V_{g1} = 60–96$ V [1])	10 cm × $M_x =$ 23 V/cm	6 cm $M_y =$ 5.9 V/cm	468	
D13-16BE **D13-16GH** **D13-16GP**	6.3 0.3	$V_{g9(l)} = 10$ kV $V_{g8} = 1.67$ kV $V_{g7} = 1.67$ kV $V_{g6} = 1.67$ kV $V_{g5} = 1.67$ kV	$V_{g4} = 230–500$ V $V_{g3} = 1.67$ kV $V_{g2} = 1.67$ kV $-V_{g1} = 50–120$ V [1])	10 cm × $M_x =$ < 18 V/cm	6 cm $M_y =$ 6 V/cm	600	
D13-16../01	Equivalent to D13-16 . . but for internal graticule						
D13-19BE **D13-19GH** **D13-19GM** **D13-19GP**	6.3 0.3	$V_{g7(l)} = 10$ kV $V_{g6} = 1.67$ kV $V_{g5} = 1.67$ kV $V_{g4} = 1.67$ kV	$V_{g3} = 320–500$ V $V_{g2} = 1.67$ kV $-V_{g1} = 53–82$ V [1])	10 cm × $M_x =$ 30 V/cm	6 cm $M_y =$ 10.9 V/cm	452	

D13-21BE **D13-21GH** **D13-21GM** **D13-21GP**	6.3 0.3	$V_{g7(l)} = 10$ kV $V_{g6} = 1.67$ kV $V_{g5} = 1.67$ kV $V_{g4} = 1.67$ kV	$V_{g3} = 320–500$ V $V_{g2} = 1.67$ kV $-V_{g1} = 50–80$ V 1)	10 cm × $M_x =$ 30 V/cm	4 cm $M_y =$ 6.4 V/cm	468	
D13-23GH	6.3 0.3	$V_{g9(l)} = 6$ kV $V_{g8} = 1.3$ kV $V_{g7} = 1.3$ kV $V_{g6} = 1.3$ kV $V_{g5} = 1.3$ kV	$V_{g4} = 180–390$ V $V_{g3} = 1.3$ kV $V_{g2} = 1.3$ kV $-V_{g1} = 31–93$ V 1)	10 cm × $M_x =$ < 14 V/cm	5 cm	600	
D13-26GH **D13-26GP**	6.3 0.3	$V_{g9(l)} = 15$ kV $-V_{g8} = 12–18$ V $V_{g7} = 1.5$ kV $V_{g6} = 1.5$ kV $V_{g5} = 1.5$ kV	$V_{g4} = 1.5$ kV $V_{g3} = 375–625$ V $V_{g2} = 1.5$ kV $-V_{g1} = 40–90$ V 1)	10 cm × $M_x =$ 9.5 V/cm	6 cm $M_y =$ 2.9 V/cm	450	
D13-26 . . /01		Equivalent to D13-26 . . but for internal graticule					
D13-27GH	6.3 0.3	$V_{g7(l)} = 3$ kV $V_{g6} = 1.5$ kV $V_{g5} = 1.5$ kV $V_{g4} = 300–550$ V	$V_{g3} = 1.5$ kV $V_{g2} = 1.5$ kV $-V_{g1} = 38–135$ V 1)	full scan × $M_x =$ 24 V/cm	8 cm $M_y =$ 11.5 V/cm	350	
D13-49BE	6.3 0.3	$V_{g8(l)} = 24$ kV $V_{g7} = 4.0$ kV $V_{g6} = 4.0$ kV $V_{g5} = 4.0$ kV	$V_{g4} = 4.0$ kV $V_{g3} = 500–1200$ V $V_{g2} = 4.0$ kV $-V_{g1} = 90–300$ V 1)	6.3 cm × $M_x =$ 32 V/cm	2 cm $M_y =$ 10 V/cm	625	

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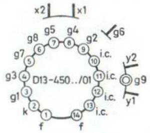
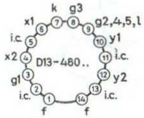
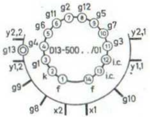
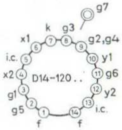
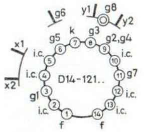
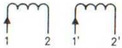
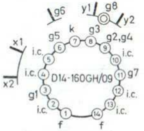
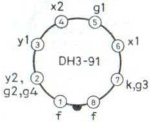
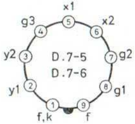
1) Grid voltage for visual cut-off.

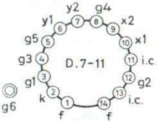
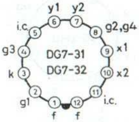
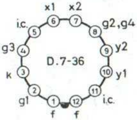
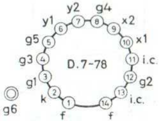
CATHODE-RAY TUBES - Instrument tubes

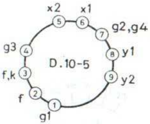
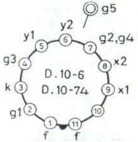
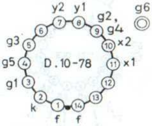
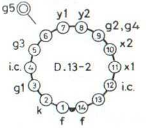
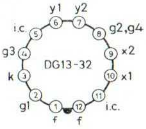
Type	*V_f (V)* *I_f (A)*	*Typical operating conditions*		*Display area Deflection factor* *hor.*	*vert.*	*Max. overall length*	*Base connections*
D13-450GH/01	6.3 0.3	$V_{g9(l)}=15$ kV $-V_{g8/g7}=12$–18 V $V_{g7}=1.5$ kV $V_{g6}=1.5$ kV $V_{g5}=1.5$ kV	$V_{g4}=1.5$ kV $V_{g3}=400$–550 V $V_{g2}=1.5$ kV $-V_{g1}=40$–100 V 1)	10 cm × $M_x=$ 9.9 V/cm	6 cm $M_y=$ 3 V/cm	459	
D13-480GH **D13-480GM** **D13-480GP**	6.3 0.3	$V_{g2,g4,g5(l)}=2$ kV $V_{g3}=220$–370 V	$-V_{g1}=65$ V 1)	10 cm × $M_x=$ 31.3 V/cm	8 cm $M_y=$ 14.4 V/cm	310	
D13-481..	6.3 0.095	For further data see D13-480..					
D13-500GH/01	6.3 0.3	$V_{g13(l)}=15$ kV $-V_{g12-g11}=9$–15 V $V_{g11}=2.5$ kV $V_{g10}=2.5$ kV $-V_{g9-g2}=250$–375 V $V_{g8-g2}=200$ V $V_{g7}=2.5$ kV	$-V_{g6-g2}=400$–600 V $V_{g5}=2.5$ kV $-V_{g4-g2}=600$–800 V $V_{g3}=2.5$ kV $V_{g2}=2.5$ kV $-V_{g1}=50$–150 V 1)	10 cm × $M_x=$ 15 V/cm	6 cm $M_y=$ 2 V/cm	493	
D14-120GH **D14-120GM** **D14-120GP**	6.3 0.3	$V_{g7(l)}=10$ kV $V_{g6}=1.5$ kV $V_{g5}=1.5$ kV	$V_{g3}=250$–350 V $V_{g2,g4}=1.5$ kV $-V'_{g1}=20$–60 V 1)	10 cm × $M_x=$ 15.5 V/cm	8 cm $M_y=$ 4.2 V/cm	385	

D14-121GH **D14-121GM** **D14-121GP**	6.3 0.3	$V_{g8(l)} = 10$ kV $V_{g7} = 1.5$ kV $V_{g6} = 1.5$ kV $V_{g5} = 1.5$ kV	$V_{g3} = 250\text{–}350$ V $V_{g2,g4} = 1.5$ kV $-V_{g1} = 20\text{–}60$ V 1)	10 cm × 8 cm $M_x =$ 15.5 V/cm $M_y =$ 4.2 V/cm	385	
D14-122..		This type is equivalent with type D14-120 . . , but provided with a rotation coil.				
D14-123..		This type is equivalent with type D14-121 . . , but provided with a rotation coil.				
D14-160GH/09	6.3 0.3	$V_{g8(l)} = 10$ kV $V_{g7} = 1.5$ kV $V_{g6} = 1.5$ kV $V_{g5} = 1.5$ kV	$V_{g3} = 500$ V $V_{g2+4} = 1.5$ kV $-V_{g1} = 60$ V 1)	10 cm × 8 cm $M_x =$ 15.5 V/cm $M_y =$ 4.2 V/cm	418	
DH3-91	6.3 0.3	$V_{g4,g2,y2(l)} = 500$ V	$-V_{g1} = 8\text{–}27$ V 1)	full scan × full scan $M_x =$ 56.5 V/cm $M_y =$ 49 V/cm	105	
DB7-5 **DG7-5** **DP7-5** **DB7-6** **DG7-6** 2) **DP7-6**	6.3 0.3	$V_{g3(l)} = 800$ V $V_{g2} = 200\text{–}300$ V	$-V_{g1} = <50$ V 1)	full scan × full scan $M_x =$ 62.5 V/cm $M_y =$ 40 V/cm	160	

1) Grid voltage for visual cut-off. 2) X plates asymmetrical.

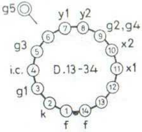
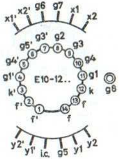
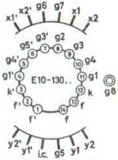
CATHODE-RAY TUBES - Instrument tubes

Type	*V_f (V)* *I_f (A)*	*Typical operating conditions*		*Display area* *Deflection factor* *hor.*	*vert.*	*Max. overall length*	*Base connections*
DB7-11 **DH7-11** **DN7-11** **DP7-11**	6.3 0.095	$V_{g6(l)} = 1.2$ kV $V_{g5} = 300$ V $V_{g4} = 300$ V	$V_{g3} = 20$–150 V $V_{g2} = 1.2$ kV $-V_{g1} = 30$–80 V [1]	6 cm × $M_x =$ 10.7 V/cm	4.5 cm $M_y =$ 3.7 V/cm	296	
DG7-31 [2] **DG7-32**	6.3 0.3	$V_{g4,g2(l)} = 500$ V $V_{g3} = 0$–120 V	$-V_{g1} = 50$–100 V [1]	full scan × $M_x =$ 37 V/cm	full scan $M_y =$ 21 V/cm	172	
DB7-36 **DG7-36** **DN7-36**	6.3 0.3	$V_{g4,g2(l)} = 1.5$ kV $V_{g3} = 247$–397 V	$-V_{g1} = 40$–80 V [1]	6.8 cm × $M_x =$ 27.3 V/cm	5.7 cm $M_y =$ 18.8 V/cm	296	
DB7-78 **DH7-78** **DN7-78** **DP7-78**	6.3 0.3	$V_{g6(l)} = 1.2$ $V_{g5} = 300$ $V_{g4} = 300$ $V_{g3} = 20$–150 $V_{g2} = 1.2$ $-V_{g1} = 36$–72	4.0 kV 1000 V 1000 V 35–165 V 1.0 kV 30–60 V [1]	6 cm × $M_x =$ 10.7 V/cm at $V_{g6(l)} = 1.2$ kV 35.6 V/cm at $V_{g6(l)} = 4$ kV	4.5 cm $M_y =$ 3.7 V/cm 12.2 V/cm	296	

DB10-5 **DG10-5**	4.0 0.56	$V_{g5(l)} = 2.5$ kV $V_{g4,g2} = 1.0$ kV	$V_{g3} = 200$–340 V $-V_{g1} = 18$–46 V [1])	full scan × $M_x =$ 27 V/cm	full scan $M_y =$ 21 V/cm	344	
DB10-6 **DG10-6** **DP10-6**	6.3 0.3	$V_{g5(l)} = 4$ kV $V_{g4,g2} = 2$ kV	$V_{g3} = 400$–720 V $-V_{g1} = 45$–100 V [1])	full scan × $M_x =$ 46 V/cm	full scan $M_y =$ 36 V/cm	341	
DB10-74 **DG10-74** **DP10-74**	6.3 0.3	$V_{g5(l)} = 4$ kV $V_{g4,g2} = 2$ kV	$V_{g3} = 400$–720 V $-V_{g1} = 45$–100 V [1])	full scan × $M_x =$ 46 V/cm	full scan $M_y =$ 36 V/cm	341	
DB10-78 **DH10-78** **DN10-78** **DP10-78**	6.3 0.3	$V_{g6(l)} = 4$ kV $V_{g5} = 1$ kV $V_{g4,g2} = 1$ kV	$V_{g3} = 150$–350 V $-V_{g1} = 22$–38 V [1])	7.5 cm × $M_x =$ 34 V/cm	5.5 cm $M_y =$ 11 V/cm	305	
DB13-2 **DG13-2** **DP13-2**	6.3 0.3	$V_{g5(l)} = 4$ kV $V_{g4,g2} = 2$ kV	$V_{g3} = 400$–720 V $-V_{g1} = 45$–100 V [1])	full scan × $M_x =$ 31 V/cm	full scan $M_y =$ 27 V/cm	435	
DG13-32	6.3 0.6	$V_{g4,g2(l)} = 2$ kV $V_{g3} = 340$–640 V	$-V_{g1} = \leqslant 90$ V [1])	full scan × $M_x =$ 26 V/cm	full scan $M_y =$ 21 V/cm	385	

[1]) Grid voltage for visual cut-off. [2]) X plates asymmetrical

CATHODE-RAY TUBES - Instrument tubes

Type	V_f (*V*) I_f (*A*)	*Typical operating conditions*		*Display area Deflection factor*		*Max. overall length*	*Base connections*
				hor.	*vert.*		
DB13-34 **DG13-34** **DP13-34**	6.3 0.6	$V_{g5(l)} = 4$ kV $V_{g4,g2} = 2$ kV	$V_{g3} = 400$–690 V $-V_{g1} = 45$–75 V[1])	10.2 cm × $M_x =$ 23.7 V/cm	10.2 cm 17.7 V/cm	430	
E10-12BE **E10-12GH** **E10-12GM** **E10-12GP**	6.3 0.3	$V_{g8(l)} = 3$ kV $V_{g7} = 1$ kV $V_{g6} = 1$ kV $V_{g5} = 1$ kV	$V_{g4} = 180$–380 V $V_{g3} = 1$ kV $V_{g2} = 1$ kV $-V_{g1} = 25$–90 V[1])	full scan × $M_x =$ 15 V/cm	7 cm $M_y =$ 7 V/cm	410	
E10-130BE **E10-130GH** **E10-130GM** **E10-130GP**	6.3 0.3	$V_{g8(l)} = 4$ kV $V_{g7} = 1$ kV $V_{g6} = 1$ kV $V_{g5} = 1$ kV	$V_{g4} = 200$–320 V $V_{g3} = 1$ kV $V_{g2} = 1$ kV $-V_{g1} = 25$–90 V[1])	full scan × $M_x =$ 17 V/cm	7 cm $M_y =$ 7.4 V/cm	410	

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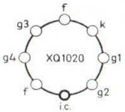
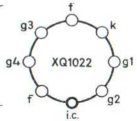
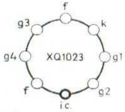
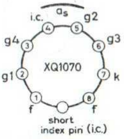
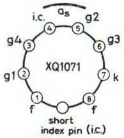
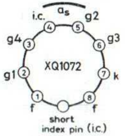
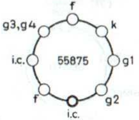
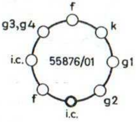
[1]) Grid voltage for visual cut-off.

CATHODE-RAY TUBES — Camera tubes "Plumbicons"

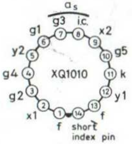
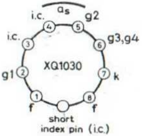
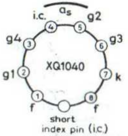
Type	V_f *(V)*	*Applications*		*Dimensions*		*Base*
Resolution	I_f *(mA)*			*diam.*	*length*	*connections*
XQ1020 ≥600 lines	6.3 300	For use in black and white broadcast cameras	Focusing: magn. Deflection: magn. >275 μA/lm	30.6	220	
XQ1020L **XQ1020R** **XQ1020G** **XQ1020B**		For use in colour broadcast cameras	>275 μA/lm > 60 μA/lm >125 μA/lm > 32 μA/lm			
XQ1021		For industrial black and white cameras		For all further informations see data of the XQ1020 series		
XQ1021R **XQ1021G** **XQ1021B**		For use in industrial colour cameras				
XQ1022	6.3 300	For use with X-ray image intensifiers in medical equipment (P20 light distribution)	Focusing: magn. Deflection: magn. >200 μA/lm	30.6	214	
XQ1023 ≥700 lines	6.3 300	For use in black and white cameras	Focusing: magn. Deflection: magn. 450 μA/lmF	30.6	220	
XQ1023L		For use in the luminance channel of four tube colour cameras	450 μA/lmF			
XQ1023R		For use in the red channel of both three and four tube colour cameras	160 μA/lmF			

CATHODE-RAY TUBES - Camera tubes "Plumbicons"

Type *resolution*	*V_f (V)* *I_f (mA)*	*Applications*		*Dimensions*		*Base*
				diam.	*length*	*connections*
XQ1024		For industrial black and white cameras		For all further information see data of the XQ1023 series		
XQ1024R		For use in the red channel of industrial colour cameras				
XQ1025 **XQ1025L** **XQ1025R**		The tubes of the XQ1025 series are identical to the tubes of the XQ1023 series but incorporate an infra-red reflecting filter on the anti-halation glass disc. For all further information see data of the XQ1023 series				
XQ1026		For industrial black and white cameras		For all further information see data of the XQ1025 series		
XQ1026R		For use in the red channel of industrial colour cameras				
XQ1070 **XQ1070/01** ≥600 lines	6.3 95	For use in black and white cameras	Focusing: magn. Deflection: magn. >275 μA/lm	26.6	167	
XQ1070L-XQ1070/01L **XQ1070R-XQ1070/01R** **XQ1070G-XQ1070/01G** **XQ1070B-XQ1070/01B**		For use in colour cameras in broadcast, educational and high quality industrial applications	>275 μA/lm >60 μA/lm >125 μA/lm >32 μA/lm			

XQ1071 **XQ1071/01** ⩾600 lines	6.3 95	For use in industrial black and white cameras	Focusing: magn. Deflection: magn. >275 μA/lm	26.6	167	
XQ1071R-XQ1071/01R **XQ1071G-XQ1071/01G** **XQ1071B-XQ1071/01B**		For use in colour cameras in industrial, educational and medical applications	> 60 μA/lm >125 μA/lm > 32 μA/lm			
XQ1072 ⩾600 lines	6.3 95	For use with X-ray intensifier in medical equipment (P20 light distribution)	Focusing: magn. Deflection: magn. >200 μA/lm	26.6	162	
55875 ⩾600 lines	6.3 90	For use in black and white broadcast cameras	Focusing: magn. Deflection: magn. >275 μA/lm	30.6	220	
55875L **55875R** **55875G** **55875B**		For use in colour broadcast cameras	>275 μA/lm > 60 μA/lm >125 μA/lm > 32 μA/lm			
55875-IG		For black and white industrial cameras		For all further informations see data of the 55875 series		
55875R-IG **55875G-IG** **55875B-IG**		For use in the chrominance channels of industrial colour cameras				
55876/01 ⩾600 lines	6.3 90	For use with X-ray image intensifier in medical equipment (P20 light distribution)	Focusing: magn. Deflection: magn. >200 μA/lm	30.6	214	

CATHODE-RAY TUBES - Camera tubes "Vidicons"

Type *resolution*	V_f *(V)* I_f *(mA)*	*Applications*		*Dimensions* *diam.*	 *length*	*Base* *connections*
XQ1010 ≥600 lines	6.3 300	For use in compact T.V. systems in industrial and other applications	Focusing: electrostatic Deflection: electrostatic	25.5	159	
XQ1030 ≥600 lines	6.3 95	For use in low-cost industrial cameras, home cameras, and for amateur use	Focusing: magn. Deflection: magn.	25.5	144	
XQ1040 series ≥1000 lines	6.3 95	For use in colour and black and white telecine equipment	Focusing: magn. Deflection: magn.	25.5	158	

The XQ1040 has 4 grades namely:

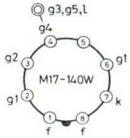
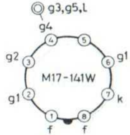
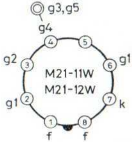
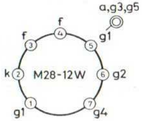
XQ1041:	For use in medical and industrial X-ray equipment in combination with an X-ray image intensifier tube
XQ1042:	For use in industrial and broadcast application in which a high picture quality is required
XQ1043:	For use in normal industrial applications.
XQ1044:	Low-cost tube for non-critical applications, experiments, amateur use etc.

XQ1050 series	6.3 300	For all other data refer to the data of the tubes of the XQ1040 series

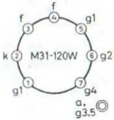
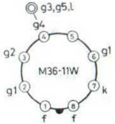
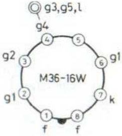
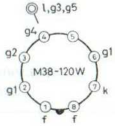
The XQ1050 has 4 grades namely:

XQ1051
XQ1052
XQ1053
XQ1054

CATHODE-RAY TUBES — Monitor tubes

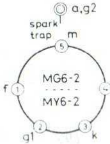
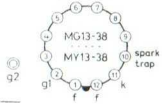
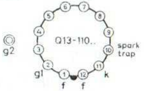
Type *Deflection angle* *Resolution (min)*	V_f *(V)* I_f *(A)*	*Typical operating characteristics*	*Min. useful screen (mm)*			*Max. overall length*	*Base connections*
			diag.	*width*	*height*		
M17-140W 70° 1000 lines	6.3 0.3	$V_{g3,g5(l)} = 14$ kV $V_{g4} = 0\text{–}400$ V $V_{g2} = 400$ V $-V_{g1}^{1)} = 30\text{–}62$ V	155	124	93	234	
M17-141W 70° 1100 lines	6.3 0.3	$V_{g3,g5(l)} = 16$ kV $V_{g4} = 0\text{–}400$ V $V_{g2} = 600$ V $-V_{g1}^{1)} = 40\text{–}90$ V	155	124	93	240	
M21-11W 90° 650 lines	11 0.075	$V_{g3,g5(l)} = 12$ kV $V_{g4} = 0\text{–}400$ V $V_{g2} = 400$ V $-V_{g1}^{1)} = 32\text{–}69$ V $V_k^{2)} = 29\text{–}62$ V	195	180	135	222	
M21-12W 110° 625 lines	6.3 0.3	$V_{g3,g5(l)} = 16$ kV $V_{g4} = 0\text{–}400$ V $V_{g2} = 300$ V $-V_{g1}^{1)} = 35\text{–}72$ V	200	190.5	149.2	205	
M28-12W 90° 850 lines	11 0.075	$V_{a,g3,g5} = 13$ kV $V_{g4} = 50\text{–}400$ V $V_{g2} = 350$ V $-V_{g1}^{1)} = 46\text{–}91$ V $V_k^{2)} = 44\text{–}80$ V	262.5	228	171	250	

CATHODE-RAY TUBES — Monitor tubes

Type Deflection angle Resolution (min)	V_f (V) I_f (A)	Typical operating characteristics	Min. useful screen (mm) diag.	width	height	Max. overall length	Base connections
M31-120W 110° 850 lines	11 0.075	$V_{a,g3,g5} = 11$ kV $V_{g4} = 0$–350 V $V_{g2} = 250$ V $-V_{g1}$ ¹) $= 35$–69 V V_k ²) $= 32$–58 V	295	257	195	233	
M36-11W 90° 650 lines	11 0.075	$V_{g3,g5(l)} = 16$ kV $V_{g4} = 0$–500 V $V_{g2} = 600$ V $-V_{g1}$ ¹) $= 43$–98 V V_k ²) $= 40$–90 V	329	304.5	241	317	
M36-16W 90° 650 lines	11 0.075	$V_{g3,g5(l)} = 16$ kV $V_{g4} = 0$–500 V $V_{g2} = 600$ V $-V_{g1}$ ¹) $= 43$–98 V V_k ²) $= 40$–90 V	329	305	241	317	
M38-120W 110° 650 lines	6.3 0.3	$V_{a,g3,g5} = 16$ kV $V_{g4} = 0$–400 V $V_{g2} = 400$ V V_{g1} ¹) $= 40$–85 V	350	291	226	280	

¹) Grid voltage for visual cut-off. ²) Cathode voltage for visual cut-off.

CATHODE-RAY TUBES — Flying spot scanners and Projection tubes

Type *Deflection angle* *Resolution (min)*	V_f *(V)* I_f *(A)*	*Typical operating characteristics*	*Min. useful screen (mm)*			*Max. overall length*	*Base connections*
			diag.	*width*	*height*		
MC13-16 **MK13-16**		Apart for the phosphor the Q13-110 . . is equivalent to the M. 13-16					
MG6-2 **MU6-2** **MW6-2** **MY6-2** 67.5°	6.3 0.3	$V_{g2(l)} = 25$ kV $-V_{g1}$ 1) $= 40$–90 V	Useful screen diam. min. 55 mm			268	
MG13-38 **MU13-38** **MW13-38** **MY13-38** 47°	6.3 0.3	$V_{g2(l)} = 50$ kV $-V_{g1}$ 1) $= 100$–170 V $I_{g2\,p}$ = max. 2.5 mA	Useful diam. min. 69 × 92 mm²			374	
Q13-110BA **Q13-110GU** 40° 1000 lines	6.3 0.3	$V_{g2(l)} = 25$ kV $I_l = 50$–$150\ \mu$A $-V_{g1}(I_l = 0) = 50$–100 V	Useful screen diam. min. 108 mm			347	

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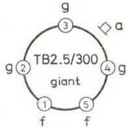
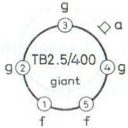
1) Grid voltage for visual cut-off.

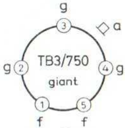
TRANSMITTING TUBES – TRIODES

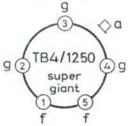
Type and application	V_f (V) I_f (A)	Operating conditions					Limiting values		Accessories	Base connections Max. dimensions	
			f (MHz)	V_a (kV)	I_a (A)	W_o (kW)	V_a (kV)	W_a (kW)		diam.	length
TAL12/10 R.F. power triode	22 38 1)	C telegr. C telegr.	5 20	12 10	1.21 1.45	10.5 10.5	12 12	4 4	Fil. conn.: 40604 Ins. pedestal: K501 Supp. ring: 40603 Protect. cap. for grid seals: 40632	194	471
TAL12/20 R.F. power triode	21.5 78	C telegr. C an. mod.	28 28	12 10	2.7 1.4	22 9.5	12 12	18 18	Fil. conn.: 40662 Grid. conn.: 40664 Cooling house: K503/01	125	567
TAL12/35 Air cooled R.F. power triode	28.3 48.5 1)	C telegr. C telegr.	20 37.5	15 10	4.2 4.2	48.5 26	15 15	18 18	Fil. conn.: 40606 Protect. cap for seals: 40632 Cooling house: K505	226	630
TAW12/10 R.F. power triode	22 38 1)	C telegr. C telegr.	5 75	12 4	1.7 1.7	15 3.5	12 12	7.5 7.5	Fil. conn.: 40604 Water jacket: K700 Prot. cap for seals: 40632	194	440

TAW12/20	For further data see TAL12/20								Water jacket: K707	108	578
TAW12/35G	For further data see TAL12/35							30	Water jacket: K715	226	650
TB2/500 R.F. power triode	12 7.3	C telegr. C telegr.	20 100	2.0 1.7	0.46 0.46	0.64 0.40	2.0 2.0	0.3 0.3	An. conn.: 40626 Socket: 40204	86	243
TB2.5/300 R.F. power triode	6.3 5.4	C telegr. C an. mod. B mod.	75 75 —	2.5 2.0 2.5	0.205 0.255$^{2)}$ 0.356$^{2)}$	0.39 0.41$^{2)}$ 0.70$^{2)}$	2.5 2.5 2.5	0.14 0.14 0.14	An. conn.: 40624 Socket: 2422 512 01001		
TB2.5/400 R.F. power triode	6.3 5.8	C telegr. C an. mod. B mod.	150 150 —	2.5 2.0 2.5	0.205 0.128 0.356$^{2)}$	0.39 0.20 0.70$^{2)}$	3.0 2.4 3.0	0.15 0.10 0.15	An. conn.: 40624 Socket: 2422 512 01001		
TB3/750 R.F. power triode	5 14.1	C telegr. C osc. B mod.	100 100 —	4.0 4.0 4.0	0.38 0.76$^{2)}$ 0.54$^{2)}$	1.20 2.32$^{2)}$ 1.55$^{2)}$	4.0 4.0 4.0	0.35 0.35 0.35	An. conn.: 40624 Chimney: 40666 Socket: 2422 512 01001		
TB4/1250 R.F. power triode	10 9.9	C telegr. C an. mod. B mod.	100 100 —	4.0 3.0 4.0	0.535 0.450 0.736$^{2)}$	1.70 1.05 2.30$^{2)}$	4.0 3.0 4.0	0.45 0.30 0.45	An. conn.: 40626 Socket: 2422 512 00001		



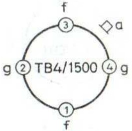
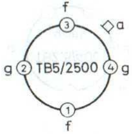






$^{1)}$ Per phase. $^{2)}$ Two tubes.

TRANSMITTING TUBES - Triodes

Type and application	V_f *(V)* I_f *(A)*	*Operating conditions*					*Limiting values*		*Accessories*	*Base connections* *Max. dimensions*	
			f *(MHz)*	V_a *(kV)*	I_a *(A)*	W_o *(kW)*	V_a *(kV)*	W_a *(kW)*		*diam.*	*length*
TB4/1500 Industrial R.F. power triode	5 32.5	Ind. osc. Ind. osc.	50 50	5.4 4.5	0.320 0.380	1.64 1.60	6.3 6.3	0.5 0.5	An. conn.: 40665 Socket: 2422 511 05001		
TB5/2500 Industrial R.F. power triode	6.3 32.5	Ind. osc. Ind. osc.	50 50	5.4 4.5	0.53 0.60	2.75 2.55	6.3 6.3	0.8 0.8	An. conn.: 40665 Socket: 2422 511 05001		
TBH6/14	as	**TBL6/14**	However with integral helical water cooler and different dimensions							185	351
TBH6/6000	as	**TBL6/6000**								130	219
TBH7/8000	as	**TBL7/8000**								130	219
TBH7/9000	as	**TBL7/9000**								130	211
TBH12/25	as	**TBL12/25**								185	410
TBH12/38	as	**TBL12/38**								185	422
TBL2/300 Air cooled coaxial R.F. power triode	3.4 19	C telegr. C telegr. Ind. osc.	175 900 470	2.50 1.30 1.75	0.26 0.35 0.17	0.48 0.16 0.38	2.5 1.3 1.8	0.3 0.3 0.3		41.5	72

TBL2/400	3.4	C telegr.	470	2.0	0.40	0.6	2.2	0.4		41.5	83
Air cooled	19	C telegr.	810	1.8	0.40	0.41	2.0	0.4			
coaxial R.F.		Ind. osc.	470	2.0	0.38	0.48	2.2	0.4			
power triode		Ind. osc.	810	1.8	0.38	0.28	2.0	0.4			
TBL2/500	3.4	C telegr.	400	2.5	0.38	0.67	2.7	0.5		41.5	83
Air cooled	19	C telegr.	625	2.2	0.38	0.58	2.0	0.5			
coaxial R.F. power triode											
TBL6/14	6.3	Ind. osc.	30	7.0	3.5	17.7	8.0	10	Fil. conn.: 40662	115	315
Air cooled	130	Ind. osc.	30	6.0	3.3	14.3	8.0	10	Grid conn.: 40664		
industrial R.F. power triode									Ins. pedestal: K508		
TBL6/20	6.3	C telegr.	110	5.0	4.8	17	5.5	10	Fil. conn.: 40652	170	277
Air cooled coaxial R.F.	154	B teleph. 2)	170 –220	4.0	4.8	12	4.5	10	Fil. conn.: 40653 Grid and anode conn.: 40651		
power triode		B teleph. 3)	170 –220	4.0	4.8	12	4.5	10	Insp. pedest.: 40654		
TBL6/4000	6.3	Ind. osc.	50	7.0	0.9	4.9	8.0	1.7	Socket:	86	178
Air cooled	65	Ind. osc.	50	6.0	0.9	4.1	8.0	1.7	2422 511 05001		
industrial R.F. power triode											
TBL6/6000	12.6	C telegr.	75	6.0	1.5	6.9	6.0	5.0	Fil. conn.: 40634	123	195
Air cooled R.F.	33	C an. mod.	75	5.0	1.2	4.7	5.0	3.4	Grid conn.: 40622		
power triode		B mod.	—	6.0	3.0 1)	13.3 1)	6.0	5.0	Grid conn. 4): 40650 Insp. pedest.: 40630		

1) Two tubes. 2) Neg. mod.; pos. sync. 3) Pos. mod.; neg. sync. 4) $f = < 30$ MHz.

TRANSMITTING TUBES - Triodes

Type and application	V_f (V) I_f (A)	Operating conditions					Limiting values		Accessories	Base connections Max. dimensions	
			f (MHz)	V_a (kV)	I_a (A)	W_o (kW)	V_a (kV)	W_a (kW)		diam.	length
TBL7/8000	12.6	C telegr.	30	6.5	2.0	9.5	7.2	6.0	Fil. conn.: 40634	123	195
Air cooled R.F.	33	Ind. osc.	50	6.0	1.5	6.0	7.0	6.0	Grid conn.: 40622		
power triode									Grid conn.[2]): 40650		
									Ins. pedest.: 40630		
TBL7/9000	12.6	Ind. osc.	50	7.2	1.5	6.1[3])	8.0	6.0	Grid and fil.	123	186
Air cooled	32	Ind. osc.	50	6.2	1.4	5.0[3])	8.0	6.0	conn.: 40634		
industrial R.F.									Ins. pedestal:		
power triode									40630		
TBL12/25	8	Ind. osc.	30	12	3.2	29	13	15	Fil. conn.: 40662	198	378
Air cooled	98	Ind. osc.	30	8	3.2	18	13	15	Grid conn.: 40663		
industrial R.F.									Ins. pedestal:		
power triode									40648		
TBL12/38	8	Ind. osc.	30	12	4.5	39	13	15	Fil. conn.: 40662	198	404
Air cooled	130	Ind. osc.	30	8	4.5	23	13	15	Grid conn.: 40663		
industrial R.F.									Ins. pedestal: 40648		
power triode											
TBL12/40	8	C telegr.	30	12	4.5	41	13	15	Fil. conn.: 40662	225	392
Air cooled R.F.	130	C an mod.	30	10	3.5	27	10	10	Grid conn.: 40663		
power triode		B mod.	—	10	3.2[1])	19[1])	13	15	Ins. pedestal: 40648		
TBL12/100	17.5	C telegr.	15	12	12	108	13.5	45	Fil. conn.: 40628	286	660
Air cooled R.F.	196	C an. mod.	15	10	10.5	80	10.0	30	Air jacket: K506		
power triode		B mod.	—	12	24[1])	202[1])	15.0	45			

TBL15/125	$V_f=17.5$ V[4], $I_f=196$A; $V_f=15.5$ V[5], $I_f=131$ A For further data see TBL12/100				
TBW6/14 Water cooled	For further data see TBL6/14	15	Water jacket: K720	115	330
TBW6/20 Water cooled	For further data see TBL6/20	12	Water jacket: K718	128	238
TBW6/6000 Water cooled	For further data see TBL6/6000	6	Water jacket: K713	71	190
TBW7/8000 Water cooled	For further data see TBL7/8000		Water jacket: K713	71	190
TBW7/9000 Water cooled	For further data see TBL7/9000		Water jacket: K721	86	224
TBW12/25 Water cooled	For further data see TBL12/25	20	Water jacket: K717	145	376
TBW12/38 Water cooled	For further data see TBL12/38	20	Water jacket: K722	145	422
TBW12/100 Water cooled	For further data see TBL12/100	50	Water jacket: K714	240	620

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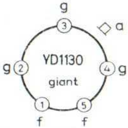
[1] Two tubes. [2] $f = < 30$ MHz. [3] Power in the load. [4] Single phase filament energizing. [5] Three phase filament energizing.

TRANSMITTING TUBES - Triodes

Type and application	V_f *(V)* I_f *(A)*	*Operating conditions*	f *(MHz)*	V_a *(kV)*	I_a *(A)*	W_o *(kW)*	*Limiting values* V_a *(kV)*	*Limiting values* W_a *(kW)*	*Accessories*	*Base connections Max. dimensions diam.*	*length*
TBW15/125		$V_f = 17.5$ V$^{1)}$, $I_f = 196$ A; $V_f = 15.5$ V$^{2)}$, $I_f = 131$ A						50	Water jacket:		
Water cooled		For further data see TBL12/100							K714		
YD1000	12.6	C telegr.	10	15	9.75	120	16	45	Fil. conn.: 40670	140	380
Water cooled R.F.	160	C telegr.	30	8	8.75	55	12.5	45	Grid conn.: 40671		
power triode		C an. mod.	30	11	7.60	66	11.5	30	Water jacket:		
		B mod.	—	12	$9.40^{3)}$	$78^{3)}$	12	45	K724		
YD1001		For further data see YD1000						35	Ins. pedestal:	300	380
Air cooled									40672		
YD1002		For further data see YD1000						60	Vap. cooling	218	380
Vapour cooled									system: K728		
YD1010	18	C telegr.	10	15	29.3	360	15	120	Fil. conn.: 40667	218	656
Water cooled R.F.	280	C telegr.	30	12	24.7	245	12	120	Water jacket: K723		
power triode		C an. mod.	30	11	19.0	165	11	80			
		B mod.	—	12	$52.0^{3)}$	$450^{3)}$	12	120			
YD1012		For further data see YD1010						180	Vap. cooling	315	650
Vapour cooled									system: K729		

YD1120	12.6	C telegr.	30	6.0	1.50	6.9	6.2	5.0		119	200
Air cooled R.F.	33	C telegr.	220	3.0	1.25	2.7	4.0	5.0			
power triode		C an. mod.	75	5.0	1.20	4.7	5.0	3.4			
		B mod.	—	6.0	3.0[3])	13.3[3])	6.0	5.0			
YD1130	5	SSB [4])	30	2.5	0.07	0	3.0	0.4	An. conn.: 40624	 g a g YD1130 giant g f f	
R.F. power	14.1	SSB [5])	30	2.5	0.40	0.64	3.0	0.4	Chimney: 40666		
triode		SSB [6])	30	2.5	0.27	0.64	3.0	0.4	Socket:		
		B mod.	—	3.0	0.67[3])	1.30[3])	3.0	0.4	2422 512 01001		
YD1140	17.5	C telegr.	30	12	12.0	108	12.5	100	Fil. conn.: 40628	240	620
Water cooled R.F.	196	C an. mod.	30	10	10.5	83	10.5	66	Water jacket: K714		
power triode		Ind. osc.	30	12	14.0	124	13.0	100			
		B mod.	—	10	16.0[3])	106[3])	15.0	100			
YD1141		For further data see YD1140						45	Air jacket: K506	286	660
Air cooled											
YD1150	6.3	Ind. osc.	27.12	6.0	1.0	5	7.2	2.5	Fil. conn.: 40688	123	172
Air cooled R.F.	33	Ind. osc.	160	5.0	1.0	4	6.0	2.5	Fil. conn.[7]): 40689		
industrial									Grid conn.[8]): 40686		
power triode									Grid conn.[9]): 40687		
									Ins. pedest.: 40630		
YD1151		For further data see YD1150							Water jacket: K713	62	172
Water cooled											
YD1152		As YD1150 however with integral								131	207
Water cooled		helical water cooler									

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[1]) Single phase filament energizing. [2]) Three phase filament energizing. [3]) Two tubes. [4]) Zero signal.
[5]) Single tone. [6]) Double tone. [7]) Filament/cathode connector. [8]) $f = < 30$ MHz. [9]) $f = > 30$ MHz.

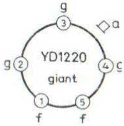
TRANSMITTING TUBES - Triodes

Type and application	V_f (V) I_f (A)	Operating conditions					Limiting values		Accessories	Base connections Max. dimensions	
			f (MHz)	V_a (kV)	I_a (A)	W_o (kW)	V_a (kV)	W_a (kW)		diam.	length
YD1160 Air cooled R.F. industrial power triode	6.3 66	Ind. osc. Ind. osc.	27.12 150	6.5 5.0	1.8 2.0	9.2 7.5	7.2 6.0	5.0 5.0	Fil. conn.: 40688 Fil. conn.1): 40689 Grid conn.2) : 40686 Grid conn.3) : 40687 Ins. pedest.: 40630	123	192
YD1161 Water cooled		For further data see YD1160							Water jacket: K726	62	192
YD1162 Water cooled		As YD1160 however with integral helical water cooler								131	227
YD1170 Air cooled R.F. industrial power triode	5.8 130	Ind. osc.	120	6.0	3.4	16.2	7.2	10	Fil. conn.: 40692 Fil. conn.: 40693 Grid conn.4) : 40690 Grid conn.5) : 40691 Ins. pedest.: 40654	159	217
YD1171 Water cooled		For further data see YD1170							Water jacket: K727	84	217
YD1172 Water cooled		As YD1170 however with integral helical water cooler								114	217

YD1173 Air cooled R.F. industrial power triode	5.4 65	Ind. osc.	50	10	1.75	13.7	12	10	Fil. conn.: 40692 Fil. conn.: 40693 Grid conn.4) : 40690 Grid conn.5) : 40691 Ins. pedest.: 40654	159	217
YD1180 Air cooled R.F. industrial power triode	7.0 175	Ind. osc.	90	7.5	5.4	33	9.0	15	Fil. conn. 40708 Fil. conn. 40709 Grid conn. 40710 4) Grid conn. 40711 5)	192	243
YD1182 Water cooled R.F. industrial power triode	7 175	Ind. osc.	90	7.5	5.4	33	9	20	Fil. conn.: 40708 Fil. conn.: 40709 Grid conn.4) : 40710 Grid conn.5) : 40711	130	270
YD1190 Air cooled		For further data see YD1192						20	Ins. pedestal: 40729	216	290
YD1192 Water cooled R.F. industrial power triode	8.4 235	Ind. osc.	30	8.0	10	65	9.6	40	Fil. conn.: 40705 Fil. conn.: 40706 Grid conn.4) : 40707 Grid conn.5) : 40736	160	322
YD1193 Vapour cooled		For further data see YD1192							Boiler: K735	290	283

1) Filament/cathode connector. 2) $f = < 30$ MHz. 3) $f = > 30$ MHz. 4) $f = < 4$ MHZ. 5) $f = > 4$ MHz.

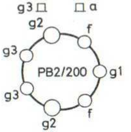
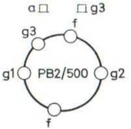
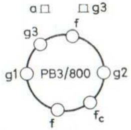
TRANSMITTING TUBES - Triodes

Type and application	V_f *(V)* I_f *(A)*	*Operating conditions*					*Limiting values*		*Accessories*	*Base connections Max. dimensions*	
			f *(MHz)*	V_a *(kV)*	I_a *(A)*	W_o *(kW)*	V_a *(kV)*	W_a *(kW)*		*diam.*	*length*
YD1202 Water cooled industrial power triode	12.2 250	Ind. osc. Ind. osc.	30 30	10 12	16 13	124 124	14.4 14.4	80 80	Fil. conn.: 40695 Fil. conn.: 40696 Grid conn.1): 40694 Grid conn.2): 40737	190	446
YD1203 Vapour cooled		For further data see YD1202							Grid conn.: 40737 Boiler: K735	290	381
YD1212 Water cooled R.F. industrial power triode	12.6 380	Ind. osc.	30	14	23.5	247	16.8	120	Fil. conn.: 40695 Fil. conn.: 40696 Grid conn.1): 40694 Grid conn.2): 40737	190	446
YD1213 Vapour cooled		For further data see YD1212							Boiler: K733	290	381
YD1220 Industrial triode	5 14	Ind. osc.	85	4.0	0.38	1.18	4.2	0.35	Chimney: 40666 Socket: 2422 512 01001		

YD1240 Air cooled R.F. industrial power triode	6.3 33	Ind. osc.	27.12 60	5.0 4.5	0.75 0.70	2.9 2.4	5.5 5.5	1.5 1.5	Fil. conn.: 40688 Fil. conn.3): 40689 Grid conn.4): 40686 Grid conn.5): 40687	67	172
YD1342 Water cooled F.R. industrial power triode	14 555	Ind. osc.	30	16	42	489	19.2	240	Fil. conn.: 40695 Fil. conn.: 40696 Grid conn.1): 40694 Grid conn.2): 40737	230	580
YD1352S Water cooled magnetically beamed triode	5 6.1	Ind. osc.	5	4.5	0.72	3.1	4.5	2	Magnet assembly: 40765 Grid conn.: 40766	44	164

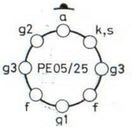
1) $f = < 4$ MHz. 2) $f = > 4$ MHz. 3) Filament/cathode connector. 4) $f = < 30$ MHz. 5) $f = > 30$ MHz.

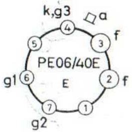
TRANSMITTING TUBES - Tetrodes, Pentodes

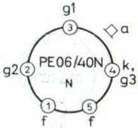
Type and application	V_f *(V)* I_f *(A)*	*Operating conditions*						*Limiting values*		*Accessories*	*Base connections Max. dimensions*
			f *(MHz)*	V_a *(kV)*	V_{g2} *(V)*	I_a *(mA)*	W_o *(W)*	V_a *(kV)*	W_a *(W)*		*diam.* *length*
PB 2/200	12	C telegr.	20	2.0	300	190	270	2.0	110	An. conn.:	
R.F. power	3.35	C telegr.	60	1.5	200	350$^{1)}$	305$^{1)}$	2.0	110	40600	
pentode		C ag$_2$ mod.	20	1.8	300	114	147	2.0	110	Socket:	
		B mod.	—	2.0	400	284$^{1)}$	400$^{1)}$	2.0	110	40207	
PB2/500	12	C telegr.	10	2.5	400	340	600	2.5	250	An. conn.:	
R.F. power	7.3	C telegr.	60	1.5	450	750$^{1)}$	625$^{1)}$	2.5	250	40600	
pentode		C ag$_2$ mod.	10	2.0	300	235	325	2.5	250	Socket:	
		B mod.	—	2.5	500	566$^{1)}$	1000$^{1)}$	2.5	250	40200	
PB3/800	12	C telegr.	10	3.0	300	550	1200	3.0	450	An. conn.:	
R.F. power	8.5	C telegr.	60	1.8	300	985$^{1)}$	975$^{1)}$	3.0	450	40626	
pentode		C ag$_2$ mod.	20	2.0	500	315	425	3.0	450	Socket:	
		B mod.	—	3.0	600	770$^{1)}$	1600$^{1)}$	3.0	450	40201	

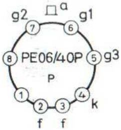
PE05/25 R.F. power pentode	12.6 0.7	C telegr. C ag_2 mod.	100 100	0.5 0.4	250 200	90 70	33 20	0.5 0.5	12 12	Socket: 40210/02
PE06/40E R.F. power pentode	12.6 0.65	C telegr. C ag_2 mod. B mod.	60 60 —	0.6 0.5 0.6	300 160[2]) 300	195 146 230[1])	72 40 100[1])	0.6 0.6 0.6	25 25 25	An. conn.: 28906022 Socket: 40220
PE06/40N	6.3 1.3	For further data see PE06/40E								Socket: 2422 512 03001
PE06/40P	6.3 1.3	For further data see PE06/40E								Socket: 2422 514 00001
PE1/100 R.F. power pentode	12.6 1.3	C telegr. C ag_2 mod. B mod.	60 60 —	1.0 0.8 1.0	250 250 250	177 120 268[1])	132 75 194[1])	1.0 1.0 1.0	45 45 45	Socket: 2422 513 00001

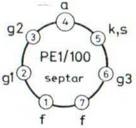
[1]) Two tubes. [2]) $R_{g2} = 34$ kΩ



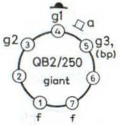
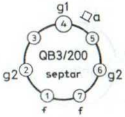
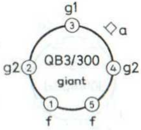
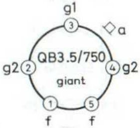


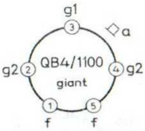
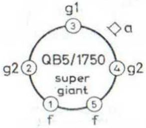
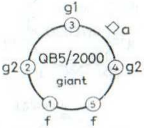






TRANSMITTING TUBES - Tetrodes, Pentodes

Type and application	V_f (V) I_f (A)	Operating conditions	f (MHz)	V_a (kV)	V_{g2} (V)	I_a (mA)	W_o (W)	Limiting values V_a (kV)	W_a (W)	Accessories	Base connections Max. dimensions diam. length
QB2/250	10	C telegr.	30	2.0	400	180	275	2.0	100	An. conn.:	
R.F. beam	5	C ag$_2$ mod.	30	1.6	300	150	180	1.6	67	40619	
power pentode		AB mod.	—	2.5	750	290$^{1)}$	490$^{1)}$	2.5	125		
QB3/200	6	C telegr.	50	3.0	250	115	280	3.0	65	An. conn.:	
R.F. power	3.5	C telegr.	220	1.5	250	117	110	1.5	65	40624	
tetrode		C ag$_2$ mod.	50	2.5	250	110	230	2.5	45	Socket:	
		C ag$_2$ mod.	220	1.5	250	80	75	1.5	45	2422 513 00001	
		B mod.	—	1.75	500	170$^{1)}$	175$^{1)}$	3.0	65		
QB3/300	5	C telegr.	120	3.0	350	167	375	3.0	125	An. conn.:	
R.F. power	6.5	C ag$_2$ mod.	120	2.5	350	152	300	2.5	83	40624	
tetrode		B mod.	—	2.5	600	216$^{1)}$	345$^{1)}$	3.0	125	Socket:	
										2422 512 01001	
QB3/300GA		Metal-shell giant base									
		For further data see QB3/300									
QB3.5/750	5	C telegr.	75	4.0	500	312	1000	4.0	250	An. conn.:	
R.F. power	14.1	C ag$_2$ mod.	75	3.0	400	225	510	3.2	165	40624	
tetrode		B mod.	—	3.0	300	550$^{1)}$	1240$^{1)}$	4.0	250	Socket:	
										2422 512 01001	
QB3.5/750GA		Metal-shell Giant base									
		For further data see QB3.5/750									

QB4/1100	5	C telegr.	75	4.0	500	350	1100	4.0	400	An. conn.: 40624		
R.F. power	14.1	C telegr.	100	3.5	500	250	650	4.0	400	Chimney: 40666		
tetrode		C ag_2 mod.	75	3.0	500	275	630	3.2	270	Socket:		
		B mod.	—	4.0	750	586[1]	1540[1]	4.0	400	2422 512 01001		
QB4/1100GA		Metal-shell Giant base For further data see QB4/1100										
QB5/1750	10	C telegr.	60	5.0	600	440	1760	5.0	500	An. conn.:		
R.F. power	9.9	C ag_2 mod.	60	4.0	600	380	1200	4.0	330	40626		
tetrode		SSB[2]	30	5.0	700	56	0	5.0	500	Socket:		
		SSB[3]	30	5.0	700	280	900	5.0	500	2422 512 00001		
		B mod.	—	5.0	600	580[1]	2220[1]	5.0	500			
QB5/2000	7.5	C telegr.	30	5.0	600	600	2400	5.5	800	An. conn.:		
R.F. power	22.6	SSB[2]	30	4.0	600	150	0	5.5	800	40665		
tetrode		SSB[4]	30	4.0	600	465	1300	5.5	800	Socket:		
		SSB[3]	30	4.0	600	330	650	5.5	800	2422 512 00001		
QBL3.5/2000	3.6	C telegr.	800	4.3[5]	600[6]	850	2100[7]	4.5	1500		89	215
Coaxial U.H.F.	58											
power tetrode												
QBL4/800	5	C telegr.	110	4.0	500	315	930	4.0	500		67	120
R.F. power	13.5	C telegr.	110	2.5	500	310	530	4.0	500			
tetrode												
QBL5/3500	6.3	C telegr.	75	5.0	800	1100	4100	5.0	3000	Fil. conn.: 40634	97	169
Air cooled R.F.	32.5	C telegr.	220	4.0	800	1100	2900	4.0	3000	g2 conn.: 40622		
power tetrode		C ag_2 mod.	110	4.0	800	900	2700	4.0	2000	Ins. pedestal: 40635		

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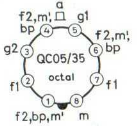
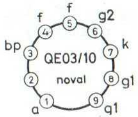
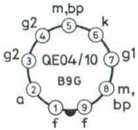
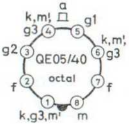
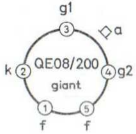
[1] Two tubes. [2] Zero signal. [3] Double tone. [4] Single tone. [5] V_{a-g1}. [6] V_{g2-g1}. [7] Power in the load

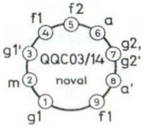
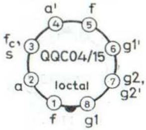
TRANSMITTING TUBES - Tetrodes, Pentodes

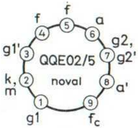
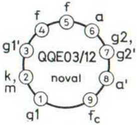
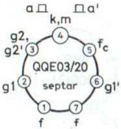
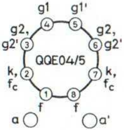
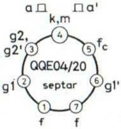
Type and application	V_f *(V)* I_f *(A)*	*Operating conditions*						*Limiting values*		*Accessories*	*Base connections Max. dimensions*	
			f *(MHz)*	V_a *(kV)*	V_{g2} *(V)*	I_a *(mA)*	W_o *(W)*	V_a *(kV)*	W_a *(W)*		*diam.*	*length*
QBW5/3500 Water cooled		For further data see QBL5/3500								Water jacket: K713	70.5	160
QC05/35 R.F. beam power tetrode for mobile equipment	1.6 3.2	C telegr.	60	0.60	180	150	65	0.65	25	An. conn.: 28 906 022 Socket: 2422 501 03001		
		C telegr.	175	0.40	190	150	35	0.65	25			
		C ag$_2$ mod.	60	0.48	135	94	34	0.48	14			
QE03/10 R.F. tetrode	6 0.75	C telegr.	30	0.3	250	50	10	0.3	12	Socket: 2422 502 01003		
		C telegr.	50	0.3	250	50	8	0.3	12			
QE04/10 R.F. tetrode	6.3 0.6	C telegr.	60	0.30	250	43	8.0	0.4	7.5	Socket: 2422 502 04001		
		C telegr.	150	0.30	250	46	6.3	0.4	7.5			
		C ag$_2$ mod.	60	0.25	200	38	5.8	0.4	7.5			
QE05/40 R.F. beam power tetrode	6.3 1.25	C telegr.	60	0.60	150	112	52	0.60	20.0	An. conn.: 28 906 022 Socket: 2422 501 03001		
		C telegr.	175	0.32	180	140	25	0.32	20.0			
		C ag$_2$ mod.	60	0.48	135	94	34	0.48	13.3			
		AB mod.	—	0.60	180	200[1])	82[1])	0.60	20.0			

QE05/40F	12.6 0.62	For further data see QE05/40										
QE05/40H	26.5 0.3	For further data see QE05/40										
QE05/40K	13.5 0.58	For further data see QE05/40										
QE08/200	6.3	C telegr.	30	0.75	250	385	200	1.10	100	An. conn.:		
R.F. beam	3.9	C ag$_2$ mod.	30	0.60	250	300	130	0.65	67	40680		
power tetrode		SSB ²)	30	0.75	310	130	0	0.83	100	Socket:		
		SSB ³)	30	0.75	310	270	220	0.83	100	2422 512 01001		
		B mod.	—	0.75	250	560¹)	300¹)	0.83	100			
QE08/200H	26.5 0.85	For further data see QE08/200										
QEL1/150	6	C telegr.	150	2.0	250	250	370	2.0	250	Chimney:	42	63
Air cooled R.F.	2.6	C ag$_2$ mod.	150	1.6	250	200	230	1.6	165	4322 026 11701		
power tetrode		SSB ²)	175	2.0	300	75	0	2.0	250	Socket:		
		SSB ⁴)	175	2.0	300	250	300	2.0	250	2422 513 01001		
		SSB ³)	175	2.0	300	160	150	2.0	250			
QEL1/150H	26.5 0.58	For further data see QEL1/150										

¹) Two tubes. ²) Zero signal. ³) Double tone. ⁴) Single tone.

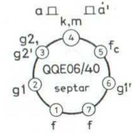
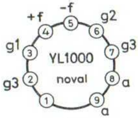
TRANSMITTING TUBES - Tetrodes, Pentodes

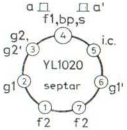
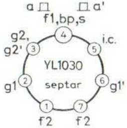
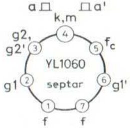
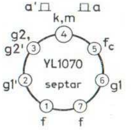
Type and application	V_f (V) I_f (A)	Operating conditions	f (MHz)	V_a (kV)	V_{g2} (V)	I_a (mA)	W_o (W)	Limiting values V_a (kV)	W_a (W)	Accessories	Base connections	Max. dimensions diam.	length
QEL2/200	6	SSB[1])	30	2.0	400	70	0	2.0	250	Chimney:		42	63
V.H.F./U.H.F.	2.6	SSB[2])	30	2.0	400	350	400[3])	2.0	250	4322 026 11701			
tetrode		SSB[4])	30	2.0	400	225	400[3])	2.0	250	Socket:			
		A.M. teleph.	30	2.0	400	175	105	2.0	250	2422 513 01001			
QEL2/275	6	C telegr.	175	2.0	250	250	390	2.0	250	Chimney:		42	63
V.H.F./U.H.F.	2.6	C telegr.	500	2.0	300	250	250	2.0	250	4322 026 11701			
tetrode		C ag_2 mod.	175	1.5	250	200	235	1.5	165	Socket:			
		SSB[1])	175	2.0	350	100	0	2.0	250	2422 513 01001			
		SSB[2])	175	2.0	350	250	300	2.0	250				
QEL2/275H	26.5 0.58	For further data see QEL2/275											
QQC03/14 Quick heating double tetrode	3.15 1.65	C telegr. [5])[6])	200	0.25	250[7])	90	11[3])	0.3	14	Tube retainer: 40647 Socket: 2422 502 01003			
QQC04/15	3.15	C telegr.[5])	60	0.60	200	60	26.6	0.6	12	Socket:			
Quick heating	1.36 or	C telegr.[5])	60	0.25	175	60	10.6	0.6	12	2422 501 05001			
double tetrode	6.3												
	0.68												

QQE02/5	6.3	C telegr.5)	500	0.18	180	56	5.8	0.25	6	Socket:	
R.F. double	0.6 or	C ag_2 mod.5)	500	0.18	180	40	4.2	0.20	4	2422 502 01003	
tetrode	12.6	C freq. mult.5)	167	0.18	180 8)	40	2.35	0.25	6		
	0.3		−500								
QQE03/12	6.3	C telegr.5)	200	0.3	175	76	14.5	0.30	10.0	Tube retainer:	
R.F. double	0.82	C ag_2 mod.5)	200	0.2	175	86	9.8	0.24	9.2	40647	
tetrode	or 12.6	C freq. mult.5)	67	0.3	150	48	6.5	0.30	10.0	Socket:	
	0.41		−200							2422 502 01003	
QQE03/20	6.3	C telegr.5)	200	0.6	250	100	48	0.6	20	An. conn.	
R.F. double	1.3 or	C ag_2 mod.5)	200	0.5	250	80	31	0.5	20	40623	
tetrode	12.6	C freq. mult.5)	67	0.3	250	90	10	0.6	20	Socket:	
	0.65		−200							2422 513 00001	
QQE03/32	See QQE03/20 except for neutralizing cap.										
QQE04/5	6.3	C telegr.5)	960	0.25	160	70	7.0	0.4	16	Socket:	
R.F. double	0.6 or	C freq. mult.5)	320	0.25	150	76	2.8	0.4	16	B8 700 71	
tetrode	12.6		−960								
	0.3										
QQE04/20	6.3	C telegr.5)	200	0.75	200	48	26	0.75	15	An. conn.:	
R.F. double	1.6 or	C telegr.5)	250	0.40	200	80	17	0.67	15	40615	
power tetrode	12.6	C ag_2 mod.5)	200	0.60	200	36	17	0.60	10	Socket:	
	0.8									2422 513 00001	

1) Zero signal. 2) Single tone. 3) Power in the load. 4) Double tone. 5) Two systems in push-pull
6) Intermittent service. 7) $R_{g2} = 22\ \text{k}\Omega$. 8) $R_{g2} = 1.2\ \text{k}\Omega$.

TRANSMITTING TUBES - Tetrodes, Pentodes

Type and application	$V_f(V)$ $I_f(A)$	Operating conditions						Limiting values		Accessories	Base connections Max. dimensions	
			f (MHz)	V_a (kV)	V_{g2} (V)	I_a (mA)	W_o (W)	V_a (kV)	W_a (W)		diam.	length
QQE06/40	6.3	C telegr.⁶)	200	0.6	250	200	90	0.75	40	An. conn.	 	
R.F. double	1.8 or	C telegr.⁶)	500	0.5	250	200	60	0.60	40	40623		
power tetrode	12.6	C ag_2 mod.⁶)	250	0.6	250	150	64	0.60	28	Socket:		
	0.9	B mod.⁶)	—	0.6	250	200	86	0.60	40	2422 513 00001		
YL 1000	1.1	C telegr.	50	0.3	150	40	8.0¹)	0.3	5.0	Socket:	 	
Quick	0.88	C telegr.	175	0.3	150	30	3.3¹)			2422 502 01003		
heating												
R.F. pentode												
YL1010	10	SSB²)	30	8.0	1200	2000	0	12	30 kW	Connectors:	140	315
Water	200	SSB³)	30	8.0	1200	5900	30 kW⁵)	12	30 kW	Inner fil.: 40725		
cooled		SSB⁴)	30	8.0	1200	3800	30 kW⁵)	12	30 kW	Outer fil.: 40726		
coaxial R.F.										Grid No. 1: 40727		
power tetrode										Grid No. 2: 40728		
										Water jacket:		
										K732		
YL1011		For further data see YL1010								Ins. pedestal:	215	315
Air cooled										40729		
YL1012		For further data see YL1010							45 kW	Boiler: K728		
Vapour cooled												

YL1020	1.6	C telegr.[6])	200	0.30	250	100	19		0.60	20	An. conn.: 40623	
Quick	4.0	C telegr.[6])	460	0.40	250	100	21		0.45	20	Socket:	
heating		C ag$_2$ mod.[6])	200	0.30	250	80	16		0.50	14	2422 513 00001	
R.F. double		C fr. tripler[6])	66.7	0.30	250	90	9		0.60	20		
tetrode			−200									
YL1030	2.1	C telegr.[6])	180	0.40	250	200	53		0.75	40	An. conn.: 40623	
Quick	4.5	C telegr.[6])	475	0.35	250	200	38		0.50	40	Socket:	
heating		C ag$_2$ mod.[6])	180	0.40	250	150	39		0.60	28	2422 513 00001	
R.F. double		C fr. tripler[6])	50	0.50	250	120	20		0.75	40		
tetrode			−150									
YL1060	6.3	C telegr.[6])	175	1.0	230	200	146		1.0	60	An. conn.: 40681	
R.F. double	1.8 or	C ag$_2$ mod.[6])	175	0.75	250	180	97		0.8	42	Socket:	
tetrode	12.6										2422 513 00001	
	0.9											
YL1070	6.3	SSB[2])[7])	7	1.0	250	50	0		1.0	60	An. conn.: 40681	
Double	1.8 or	SSB[3])[7])	7	1.0	250	195	141		1.0	60	Socket:	
tetrode	12.6	SSB[4])[7])	7	1.0	250	131	141[5])		1.0	60	2422 513 00001	
	0.9											
YL1071		$V_f = 13.25$ V; $I_f = 0.86$ A or $V_f = 26.5$ V; $I_f = 0.43$ A For further data see YL1070										

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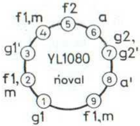
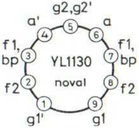
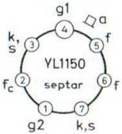
[1]) Power in the load. [2]) Zero signal. [3]) Single tone. [4]) Double tone. [5]) Peak envelope power.
[6]) Two systems in push-pull. [7]) Two sections in parallel.

TRANSMITTING TUBES - Tetrodes, Pentodes

Type and application	V_f *(V)* I_f *(A)*	*Operating conditions*	*f (MHz)*	V_a *(kV)*	V_{g2} *(V)*	I_a *(mA)*	W_o *(W)*	*Limiting values* V_a *(kV)*	W_a *(W)*	*Accessories*	*Base connections Max. dimensions diam*	*length*
YL1080	1.6	C telegr.[1]	200	0.3	175	75	12[2]	0.30	5.0	Retainer: 40647		
Quick	2.5	C ag_2 mod.[1]	200	0.2	200	68	7.0[2]	0.24	3.3	Socket:		
heating		C fr. tripler[1]	67	0.3	150	48	3.5[2]	0.30	5.0	2422 502 01003		
R.F. double			–200									
tetrode												
YL1090	21	SSB[3]	30	9	1500	5 A	0	15	120 kW	Connectors:	260	507
Water cooled	350	SSB[4]	30	9	1500	21 A	120 kW[6]	15	120 kW	Fil.: 40732		
coaxial R.F.		SSB[5]	30	9	1500	13.2 A	120 kW[6]	15	120 kW	Grid No. 1: 40733		
power tetrode		C ag_2 mod.	30	11	800	25 A	220 kW	11.5	80 kW	Grid No. 2: 40734		
YL1091		For further data see YL1090							150 kW	Boiler: K729	315	507
Vapour cooled												
YL1100	26.5	C telegr.	400	0.90	300	170	80[2]	1.0	115		32.2	50
Air cooled	0.52	C telegr.	1200	0.90	300	170	40[2]	1.0	115			
coaxial beam		C ag_2 mod.	400	0.70	250	130	45[2]	0.8	75			
power tetrode		SSB[3]	60	0.85	300	40	0	1.0	115			
		SSB[5]	60	0.85	300	100	40[6]	1.0	115			
YL1101	6.3	For further data see YL1100										
	2.1											

YL1102 Heatsink cooling	26.5 0.52	For further data see YL1100								28	50
YL1103 Heatsink cooling	6.3 2.1	For further data see YL1100								28	50
YL1110 Air cooled coaxial beam power tetrode	6.3 7.85	C telegr.	470	2.5	400	500	730 [2]	2.5	700		53	61
		C ag$_2$ mod.	400	2.0	400	500	600 [2]	2.0	400			
		SSB [3]	30	2.5	450	160	0	2.5	600			
		SSB [5]	30	2.5	450	350	680 [6]	2.5	600			
YL1120 Air cooled coaxial R.F. power tetrode	12.6 14.5	SSB [3]	13	5.0	700	700	0	5.5	4000	Socket: 40682 Air duct: 40683 or Ins. pedestal: 40654	159	202
		SSB [4]	13	5.0	700	1800	5100 [2][6]	5.5	4000			
		SSB [5]	13	5.0	700	1260	5100 [2][6]	5.5	4000			
YL1121 Air cooled R.F. power tetrode	12.6 14.5	SSB [3]	30	5.0	650	700	0	5.5	4000	Socket: 40699 Air duct: 40683 or Ins. pedestal: 40654	159	229
		SSB [4]	30	5.0	650	1850	5000 [2]	5.5	4000			
		SSE [5]	30	5.0	650	1300	5000 [6]	5.5	4000			
YL1130 Quick heating R.F. double tetrode	1.1 2.9	C telegr. [1]	200	0.28	175	84	16	0.3	8.0	Socket: 2422 502 01004		
		C telegr. [1]	500	0.18	175	80	8.0	0.2	8.0			
		Freq. tripler [1]	167 −500	0.18	175	60	3.5	0.2	8.0			
YL1150 R.F. beam power tetrode	6.3 1.9 or 12.6 0.95	SSB [3]	30	0.6	250	100	0	0.75	75	An. conn.: 40634 Socket: 2422 513 00001		
		SSB [4]	30	0.6	250	325	110 [2]	0.75	75			
		SSB [5]	30	0.6	250	220	110 [2][6]	0.75	75			
		AB mod.	—	0.6	250	520 [7]	200 [7]	0.75	75			

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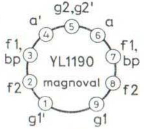
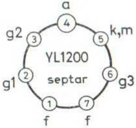
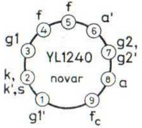
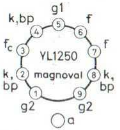
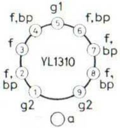
[1] Two systems in push-pull. [2] Power in the load. [3] Zero signal. [4] Single tone. [5] Double tone.
[6] Peak envelope power. [7] Two tubes in push-pull.

TRANSMITTING TUBES - Tetrodes, Pentodes

Type and application	V_f (V) I_f (A)	Operating conditions	f (MHz)	V_a (kV)	V_{g2} (V)	I_a (mA)	W_o (W)	Limiting values V_a (kV)	W_a (W)	Accessories	Base connections Max. dimensions diam.	length
YL1170		Ruggedized version of QEL2/200										
YL1181 Air cooled coaxial R.F. power tetrode	5 64	SSB 2) SSB 3) SSB 5)	30 30 30	4.5 4.5 4.5	800 800 800	500 1330 930	0 3000 1) 4) 3000 1) 4)	6.0 6.0 6.0	4000 4000 4000	Connectors: Fil.: 40721 Grid No. 1: 40722 Grid No. 2: 40723 Ins. pedestal: 40724	100	180
YL1182 Vapour cooled		For further data see YL1181							6000	Boiler: K731	122	180
YL1190 Quick heating R.F. double tetrode	1.1 4.2	C telegr. 6) C telegr. 6) C ag_2 mod. 6)	200 500 175	0.35 0.26 0.28	170 170 150	140 140 100	33 19 19	0.4 0.3 0.33	16 16 11	Socket: 2422 502 05001		
YL1200 R.F. power pentode	12.6 1.3	SQ tube for special pulse or static application								Socket: 2422 513 00001		
YL1210		$V_f = 6.75$ V; $I_f = 0.72$ A or $V_f = 13.5$ V; $I_f = 0.36$ A For further data see QQE03/12										

YL1220	$V_f = 6.75$ V; $I_f = 0.56$ A or $V_f = 13.5$ V; $I_f = 0.28$ A For further data see QQE02/5												
YL1230	5	SSB[2])	1–30	3.0	560	380	0	3.5	1500	Socket: 40704	95.3	85	
Air cooled	18	SSB[3])	1–30	3.0	560	750	1050[1])	3.5	1500				
R.F. power		SSB[5])	1–30	3.0	560	570	1050[1])[4])	3.5	1500				
tetrode													
YL1240	6.75	C telegr.[6])	175	0.40	180	90	21 [1])	0.40	15	Socket:			
R.F. double	0.8 or	C ag$_2$ mod.[6])	175	0.32	140	76	13.5[1])	0.32	10	B8 702 16			
tetrode	13.5	C fr. tripler [6])	58	0.35	165	86	10 [1])	0.45	15				
	0.4		−174										
YL1250	6.75	C telegr.	75	0.55	235	136	52[1])	0.55	25	Socket:			
R.F. beam	1.2 or	C telegr.	175	0.40	230	150	38 [1])	0.45	25	40685			
power	13.5												
tetrode	0.6												
YL1280	5.5	C telegr.	600	2.5	500	1000	1600	2.5	1500	Socket: 40704			
Air cooled	17.3	C ag$_2$ mod.	600	2.0	500	830	940	2.0	1000		95.3	85	
R.F. beam													
power tetrode													
YL1290	19	For further data see QE08/200											
	2.3												
YL1310	1.2	SSB [2])	30	0.6	240	41	0	0.7	25	Socket: 40685			
Quick heating	4.2	SSB [3])	30	0.6	240	92	36	0.7	25				
beam power		SSB [5])	30	0.6	240	68	36	0.7	25				
tetrode													

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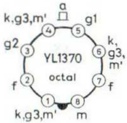
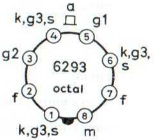
[1]) Power in the load. [2]) Zero-signal. [3]) Single tone. [4]) Peak envelope power output. [5]) Double tone.
[6]) Two systems in push-pull.

TRANSMITTING TUBES - Tetrodes, Pentodes

Type and application	V_f (V) I_f (A)	Operating conditions	f (MHz)	V_a (kV)	V_{g2} (V)	I_a (mA)	W_o (W)	Limiting values V_a (kV)	Limiting values W_a (W)	Accessories	Base connections Max. dimensions diam.	length
YL1320	6	C telegr.	175	2.0	200	250	270	2.0		Socket: 40739	41.6	62.6
Heatsink	2.6	C telegr.	470	0.8	6)	250	100	2.0				
cooled												
R.F. power												
tetrode												
YL1330	7	C telegr.	220	7.0	1060	3800	17.6 kW	8.6	10 kW	Chimney: 40683	159	263
Air cooled	127	SSB 1)	10	6.0	1350	1300	0	7.2	10 kW	Socket: 40699		
coaxial tetrode		SSB 2)	10	6.0	1350	3500	10.8 kW 4) 5)	7.2	10 kW	Ins. pedestal:		
		SSB 3)	10	6.0	1350	2400	10.8 kW 4) 5	7.2	10 kW	40654		
YL1340	6	SSB 1)	30	2.2	300	100	0	2.5	350	Chimney:	42	63
Air cooled	3.2	SSB 2)	30	2.2	300	215	318 4) 5)	2.5	350	4322 026 11701		
R.F. beam		SSB 3)	30	2.2	300	167	318 4) 5)	2.5	350	Socket:		
power tetrode		AB mod.	—	2.2	400	580 7)	770 7)	2.5	350	2422 513 01001		
YL1341	26.5 0.73	For further data see YL1340										
YL1360	13.5 0.28	For further data see QQE04/5										
YL1370	6.3	C telegr.	60	0.60	200	150	63	0.60	27	Socket:		
R.F. beam	1.125	C ag$_2$ mod.	60	0.48	165	125	42	0.48	18	2422 501 03001		
power		SSB 1)	30	0.60	200	24	0	0.60	27			
tetrode		SSB 2)	30	0.60	200	125	49 5)	0.60	27			
		SSB 3)	30	0.60	200	86	49 5)	0.60	27			

YL1371	12.6	For further data see YL1370										
	0.562											
YL1372	26.5	For further data see YL1370										
	0.3											
YL1420	6.3	Class AB	175	4.0	600	1900	6250$^{4)}$$^{8)}$	6.5	6000	Socket:	125	174
Air cooled	120	Class B	230	5.5	600	1700	6300$^{4)}$	6.5	6000	40742		
V.H.F. power										Tube extractor:		
tetrode										40754		
YL1430	8.0	Class AB	175	6	650	2500	12.5 kW$^{4)}$$^{5)}$	9.0	12 kW	Socket:	164	208
Air cooled	120	Class B	230	7.5	650	2500	13 kW$^{4)}$	9.0	12 kW	40742		
V.H.F. power										Tube extractor:		
tetrode										40754		
YL1440	4.2	Class AB	175	3.0	500	700	1550$^{4)}$$^{8)}$	4.0	1500	Socket:	64	125
Air cooled	53	Class AB	175	2.5	500	600	700$^{4)}$$^{8)}$	4.0	1500	40742		
V.H.F. power		Class B	230	3.5	500	900	2200$^{4)}$	4.0	1500	Tube extractor:		
tetrode										40754		
YL1470	6.8	Class B	110	6.0	500	1500	6.6$^{4)}$	8.4	6000	Socket:	125	174
Air cooled	120		110	7.0	550	2200	10.5$^{4)}$			40742		
V.H.F. power										Tube extractor:		
tetrode										40754		
6293	6.3	For use as a pulse modulator tube in both										
Beam power	1.25	fixed and mobile equipment										
tetrode		$V_{ba}=3$ kV; $V_{bg2}=300$ V; $V_{g1p}=65$ V; $R_l=1.5$ kΩ; $I_{ap}=1.5$ A.										



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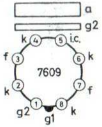
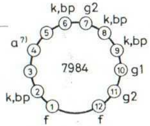
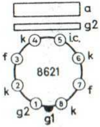
1) Zero signal. 2) Single tone. 3) Double tone. 4) Power in the load. 5) Peak envelope power output.
6) Adjust for operating conditions. 7) Two tubes in push-pull. 8) $W_{i\,sync.}$

TRANSMITTING TUBES - Tetrodes, Pentodes

Type and application	*V_f (V)* *I_f (A)*	*Operating conditions*	*f (MHz)*	*V_a (kV)*	*V_{g2} (V)*	*I_a (mA)*	*W_o (W)*	*Limiting values* *V_a (kV)*	*W_a (W)*	*Accessories*	*Base connections* *Max. dimensions* *diam. length*
7609	26.5	C telegr.	150	2.0	250	250	370	2.0	250	Chimney:	
Air cooled	0.57	C ag$_2$ mod.	150	1.6	250	200	230	1.6	165	4322 026 11701	
R.F. power		AB mod.	—	2.0	300	470 6)	580 6)	2.0	250	Socket:	
tetrode										2422 513 01001	
7984	13.5	C telegr.	175	0.32	165	150	26.5	0.6	20		
R.F. power	0.58		175	0.45	200	180	46	0.75	35		
tetrode											
8621	25.6	SSB 1)	7	2.0	350	100	0	2.0	250	Chimney:	
Air cooled	0.56	SSB 2)	7	2.0	350	250	270 4)5)	2.0	250	4322 026 11701	
R.F. power		SSB 3)	7	2.0	350	174	270 4)5)	2.0	250	Socket:	
tetrode										2422 513 01001	

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1) Zero signal. 2) Single tone. 3) Double tone. 4) Power in the load. 5) Peak envelope power. 6) Two tubes.

7) Pins 3,4 and 5 should be interconnected on the socket.

MICROWAVE TUBES - Pulsed magnetrons

Type	V_f *(V)* I_f *(A)*	*Frequency* *Pulse duration* (T_{imp}) *Duty factor* (δ)	*Characteristics*	*Limiting values*
JP9-2.5D **JP9-2.5E**	6.3 0.5	9.415–9.475 GHz 0.1 μs 0.0002	$V_{ap} = 3.6$ kV $I_{ap} = 3$ A $W_{op} = 4$ kW	$I_{ap} = 3.5$ A $T_{imp} = 1.0$ μs $\delta = 0.001$
JP9-7A air cooled	6.3 0.6	9.21 –9.27 GHz 1 μs 0.001	$V_{ap} = 5.5$ kV $I_{ap} = 4.5$ A $W_{op} = 7.5$ kW	$I_{ap} = 5.5$ A $T_{imp} = 2.5$ μs $\delta = 0.0025$
JP9-7D air cooled	6.3 0.6	9.345 –9.405 GHz 0.1 μs 0.0001	$V_{ap} = 5.7$ kV $I_{ap} = 6.0$ A $W_{op} = 9.5$ kW	$I_{ap} = 7.0$ A $T_{imp} = 1.0$ μs $\delta = 0.002$
JP9-15 **JP9-15B**	6.3 0.55	9.345 –9.405 GHz 9.415 –9.475 GHz 0.1 μs 0.0002	$V_{ap} = 7.6$ kV $I_{ap} = 7.5$ A $W_{op} = 21$ kW	$I_{ap} = 9.0$ A $T_{imp} = 2.5$ μs $\delta = 0.0015$
JP9-18	6.3 0.55	9.38–9.44 GHz 0.1 μs 0.0002	$V_{ap} = 7.2$ kV $I_{ap} = 8.6$ A $W_{op} = 21$ kW	$I_{ap} = 10$ A $T_{imp} = 2.5$ μs $\delta = 0.0015$

JP9-75	10 2.85	9.345–9.405 GHz 0.1 μs 0.0002	$V_{ap} = 15$ kV $I_{ap} = 15$ A $W_{op} = 80$ kW	$I_{ap} = 17$ A $T_{imp} = 5.5$ μs $\delta = 0.002$
YJ1000	6.3 0.5	9.19 –9.32 GHz 0.1 μs 0.0002	$V_{ap} = 3.4$ kV $I_{ap} = 3.0$ A $W_{op} = 3$ kW	$I_{ap} = 3.5$ A $T_{imp} = 1.0$ μs $\delta = 0.001$
YJ1010 **YJ1011** tunable air cooled	13.75 3.1	8.5 –9.6 GHz 0.6 μs 0.001	$V_{ap} = 21.5$ kV $I_{ap} = 27.5$ A $W_{op} = 225$ kW	$I_{ap} = 30$ A $T_{imp} = 2.75$ μs $\delta = 0.0011$
YJ1020	4.0 3.4	32.7 –33.4 GHz 0.04 μs 0.0001	$V_{ap} = 12.5$ kV $I_{ap} = 10.5$ A $W_{op} = 25$ kW	$I_{ap} = 16$ A $T_{imp} = 0.05$ μs $\delta = 0.0003$
YJ1021	4.0 3.4	32.7 –33.4 GHz 0.1 μs 0.0002	$V_{ap} = 12.5$ kV $I_{ap} = 12.5$ A $W_{op} = 30$ kW	$I_{ap} = 16$ A $T_{imp} = 0.5$ μs $\delta = 0.0003$
YJ1030	5.0 0.5	5.4–5.9 GHz 1.0 μs 0.002	$V_{ap} = 1.2$ kV $I_{ap} = 0.8$ A $W_{op} = 160$ W	$I_{ap} = 1.0$ A $T_{imp} = 3.0$ μs $\delta = 0.002$
YJ1060	6.3 0.55	9.345 –9.405 GHz 2.5 μs 0.001	$V_{ap} = 7.2$ kV $I_{ap} = 7.5$ A $W_{op} = 20$ kW	$I_{ap} = 8.0$ A $T_{imp} = 2.5$ μs $\delta = 0.002$
YJ1071	6.3 0.55	9.380 –9.440 GHz 0.1 μs 0.0001	$V_{ap} = 5.7$ kV $I_{ap} = 6$ A $W_{op} = 10.5$ kW	$I_{ap} = 7.0$ A $T_{imp} = 0.1$ μs $\delta = 1.0$

MICROWAVE TUBES - Pulsed magnetrons

Type	V_f *(V)* I_f *(A)*	*Frequency* *Pulse duration* (T_{imp}) *Duty factor* (δ)	*Characteristics*	*Limiting values*
YJ1110	6.3 0.55	9.345–9.405 GHz 0.1 μs 0.0001	$V_{ap}=7.8$ kV $I_{ap}=7.5$ A $W_{op}=20$ kW	$I_{ap}=9.0$ A $T_{\text{imp}}=2.5$ μs $\delta=0.0015$
YJ1111	6.3 0.55	9.415–9.475 GHz 0.1 μs 0.0001	$V_{ap}=7.8$ kV $I_{ap}=7.5$ A $W_{op}=20$ kW	$I_{ap}=9.0$ A $T_{\text{imp}}=2.5$ μs $\delta=0.0015$
YJ1120	6.3 0.55	9.38 – 9.44 GHz 0.15 μs 0.00015	$V_{ap}=8.2$ kV $I_{ap}=8.0$ A $W_{op}=25$ kW	$I_{ap}=9.5$ A $T_{\text{imp}}=1.5$ μs $\delta=0.0015$
YJ1121	6.3 0.6	9.415–9.475 GHz 0.15 μs 0.00015	$V_{ap}=8.3$ kV $I_{ap}=9.0$ A $W_{op}=26$ kW	$I_{ap}=10$ A $T_{\text{imp}}=1.5$ μs $\delta=0.0015$
YJ1140 air cooled	12.6 3.2	16.35–16.65 GHz 0.5 μs 0.0004	$V_{ap}=12$ kV $I_{ap}=15$ A $W_{op}=45$ kW	$I_{ap}=15$ A $T_{\text{imp}}=1$ μs $\delta=0.001$
YJ1200	12.4 2.2	9.345–9.405 GHz 4 μs 0.0016	$V_{ap}=12$ kV $I_{ap}=12$ A $W_{op}=50$ kW	$I_{ap}=14$ A $T_{\text{imp}}=5$ μs $\delta=0.0025$
YJ1290	6.3 1.0	9.415–9.475 GHz 0.5 μs 0.00062	$V_{ap}=14$ kV $I_{ap}=14$ A $W_{op}=65$ kW	$I_{ap}=16$ A $T_{\text{imp}}=1$ μs $\delta=0.001$

YJ1300	6.3 0.5	9.38–9.44 GHz 1 μs 0.0005	$V_{ap} = 7.5$ kV $I_{ap} = 7$ A $W_{op} = 20$ kW	$I_{ap} = 7.5$ A $T_{imp} = 2.5\ \mu s$ $\delta = 0.0015$
2J42	6.3 <0.6	9.345–9.405 GHz 1 μs 0.001	$V_{ap} = 5.5$ kV $I_{ap} = 4.5$ A $W_{op} = 7.5$ kW	$I_{ap} = 5.5$ A $T_{imp} = 2.5\ \mu s$ $\delta = 0.0025$
2J51A tunable air cooled	6.3 1.0	8.5 –9.6 GHz 0.1 μs 0.00033	$V_{ap} = 14$ kV $I_{ap} = 14$ A $W_{op} = 60$ kW	$I_{ap} = 15.5$ A $T_{imp} = 3.6\ \mu s$ $\delta = 0.0012$
2J55	6.3 1.0	9.345–9.405 GHz 0.1 μs 0.00033	$V_{ap} = 12$ kV $I_{ap} = 12$ A $W_{op} = 50$ kW	$I_{a} = 15$ A $T_{imp} = 2.5\ \mu s$ $\delta = 0.001$
4J50	13.75 3.5	9.345–9.405 GHz 1 μs 0.001	$V_{ap} = 21.5$ kV $I_{ap} = 27.5$ A $W_{op} = 225$ kW	$I_{ap} = 27.5$ A $T_{imp} = 1.2\ \mu s$ $\delta = 0.001$
4J52A air cooled	12.6 2.2	9.345–9.405 GHz 4–5 μs 0.001	$V_{ap} = 15$ kV $I_{ap} = 15$ A $W_{op} = 80$ kW	$I_{ap} = 16$ A $T_{imp} = 5\ \mu s$ $\delta = 0.003$
5J26 tunable air cooled	23.5 2.2	1.22 –1.35 GHz 1 μs 0.001	$V_{ap} = 28$ kV $I_{ap} = 46$ A $W_{op} = 450$ kW	$I_{a} = 55$ A $T_{imp} = 1\text{–}6\ \mu s$ $\delta = 0.0025$
725A air cooled	6.3 1.0	9.345–9.405 GHz 1 μs 0.0012	$V_{ap} = 12$ kV $I_{ap} = 12$ A $W_{op} = 50$ kW	$I_{ap} = 16$ A $T_{imp} = 2.5\ \mu s$ $\delta = 0.0012$

MICROWAVE TUBES - Pulsed magnetrons

Type	V_f *(V)* I_f *(A)*	*Frequency* *Pulse duration* (T_{imp}) *Duty factor* (δ)	*Characteristics*	*Limiting values*
5586 tunable air cooled	16 3.2	2.7 –2.9 GHz 1 μs 0.0005	$V_{ap}=28.5$ kV $I_{ap}=70$ A $W_{op}=800$ kW	$I_{ap}=70$ A $T_{\text{imp}}=2.5$ μs $\delta=0.001$
6972 air cooled	10 3.25	9.345 –9.405 GHz 0.1 μs 0.0002	$V_{ap}=15$ kV $I_{ap}=15$ A $W_{op}=80$ kW	$I_{ap}=18$ A $T_{\text{imp}}=5.5$ μs $\delta=0.002$
7028	6.3 0.5	9.345 –9.475 GHz 0.1 μs 0.0002	$V_{ap}=3.4$ kV $I_{ap}=3.0$ A $W_{op}=3.0$ kW	$I_{ap}=3.5$ A $T_{\text{imp}}=0.02$–1.0 μs $\delta=0.001$
7093 air cooled	5.0 3.9	34.512 –35.208 GHz 0.1 μs 0.0002	$V_{ap}=12.5$ kV $I_{ap}=12.5$ A $W_{op}=40$ kW	$I_{ap}=16$ A $T_{\text{imp}}=0.4$ μs $\delta=0.0003$
55029 **55030** **55031/02** **55031/01** **55032/02** **55032/01** air-cooled	13.75 3.0–3.75	9.405–9.505 GHz 9.345–9.405 GHz 9.260–9.345 GHz 9.168–9.260 GHz 9.085–9.168 GHz 9.003–9.085 GHz 0.25 μs-0.0005	$V_{ap}=21.5$ kV $I_{ap}=24$ A $W_{op}=220$ kW	$I_{ap}=27.5$ A $T_{\text{imp}}=1$ μs $\delta=0.001$

MICROWAVE TUBES - Continuous-wave magnetrons

Type	V_f *(V)* I_f *(A)*	*Frequency*	*Characteristics*	*Limiting values*
DX206 air cooled	4.0 30	2.425–2.475 GHz	$V_a = 5.4$–5.8 kV $I_a = 380$ mA $W_o = 1.2$ kW	$I_{ap} = 1.3$ A
JPT9-01 tunable air cooled	6.3 1.2	9.15–9.60 GHz	$V_a = 0.9$– –1.1 kV $I_a = 50$ mA $W_o = 10$ W	$I_{ap} = 0.1$ A
YJ1160 water cooled	4.8 35	2.425–2.475 GHz	$V_a = 4.45$–4.85 kV $I_a = 750$ mA $W_o = 2.0$ kW	$I_{ap} = 2.1$ A
YJ1162 air cooled	4.8 35	2.425–2.475 GHz	$V_a = 4.45$–4.85 kV $I_a = 750$ mA $W_o = 2.0$ kW	$I_{ap} = 2.1$ A
YJ1191 Water and air cooled	5.5 46	2.425–2.475 GHz	$V_a = 6.8$–7.2 kV $I_a = 1.25$ A $W_o = 5.0$ kW	$I_{ap} = 2.6$ A
YJ1280 air cooled	5.0 28	2.425–2.475 GHz	$V_a = 5.4$–5.8 kV $I_a = 380$ mA $W_o = 1.2$ kW	$I_{ap} = 0.8$ A
7090	5.3 3.5	2.425–2.475 GHz	$V_a = 1.65$ kV $I_a = 200$ mA $W_o = 0.2$ kW	$I_{ap} = 1.4$ A

MICROWAVE TUBES - Klystrons

Type	V_f *(V)* I_f *(A)*	*Frequency*	*Characteristics*	*Limiting values*
KS9-40 tunable	6.3 <0.7	9.3–9.5 GHz	$W_o = 40$ mW $V_{res} = 300$ V	$V_{kf} = 50$ V $t_{shell} = 150°C$
KS9-40D tunable	6.3 <0.7	9.38–9.51 GHz	$W_o = 35$ mW $V_{res} = 300$ V	$V_{kf} = 50$ V $t_{shell} = 150°C$
YK1000 3) **YK1004** 3)	7.5 32	0.4–0.62 GHz 0.61–0.79 GHz	$W_o = 11$ kW Gain = 30 dB	Coll. dissip. = 50 kW
YK1001 1) **YK1002** 2)	7.5 32	0.47–0.86 GHz	$W_o = 11$ kW Gain = 30 dB	Coll. dissip. = 36 kW Coll. dissip = 40 kW
YK1005	7.5 32	0.47–0.86 GHz	$W_o = 11$ kW Gain = 40 dB	Coll. dissip. = 40 kW
YK1010 tunable	3.5 1.75	67–74 GHz	$W_o = 130$ mW $V_{res} = 2.5$ kV	$t_{res} = 80°C$
YK1070	6.3	7.750–8.100 GHz	$W_o = 1.2$ W	$V_{kf} = 45$ V
YK1071	0.8	7.425–7.750 GHz	$V_{res.} = 750$ V	$t = 150°C$
YK1072		7.125–7.425 GHz		
YK1073	Contact	6.875–7.125 GHz		
YK1074	cooled	6.575–6.875 GHz		
YK1075		6.425–6.575 GHz		
YK1076		6.125–6.425 GHz		
YK1077		5.925–6.225 GHz		
tunable				

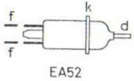
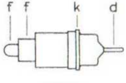
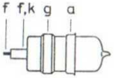
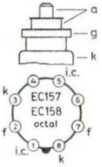
YK1090 [4])	6.3	10.5–12.2 GHz	W_o = 400 mW	$t = 200°C$
tunable	1.2		V_{res} = 400 V	
YK1091	6.3	10.5–12.2 GHz	W_o = 400 mW	$t = 200°C$
tunable	1.2		V_{res} = 400 V	
YK1110	3.8	2.993–3.003 GHz	W_{op} = 6 MW	W_{op} = 8 MW
	76		Gain = 30 dB	
YK1140	6.3	7.750–8.100 GHz	W_o = 1.2 W	V_{kfp} = 45 V
YK1141	0.8	7.425–7.750 GHz	$V_{res.}$ = 750 V	t = 150°C
YK1142		7.125–7.425 GHz		
YK1143	Forced air	6.875–7.125 GHz		
YK1144	cooled	6.575–6.875 GHz		
YK1145		6.425–6.575 GHz		
YK1146		6.125–6.425 GHz		
YK1147		5.925–6.225 GHz		
tunable				
YK1150	7.5	0.47–0.86 GHz	W_o = 23 kW	Coll. dissip. = 60 kW
air cooled	32		Gain = 44 dB	
2K25	6.3	8.50–9.66 GHz	W_o = 50 mW	V_{kf} = 50 V
tunable	0.45		V_{res} = 300 V	t_{shell} = 110°C
723A/B	6.3	8.702–9.548 GHz	W_o = 25 mW	V_{kf} = 50 V
tunable	0.6		V_{res} = 300 V	t_{shell} = 110°C
55335	6.3	31–36 GHz	W_o = > 150 mW	$t = 80°C$
tunable	0.8		V_{res} = 2.25 kV	

[1]) Air cooled drift tubes and cooled collector. [2]) Air cooled drift tubes and water cooled collector.
[3]) Water cooled collector, drift tubes and output resonator. [4]) Ruggedized.

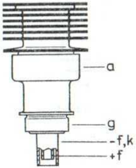
MICROWAVE TUBES - Travelling-wave tubes

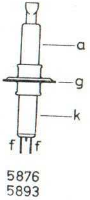
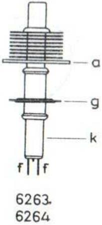
Type	$V_f\,(V)$ $I_f\,(A)$	*Frequency*	*Characteristics*	*Limiting values*
LB6-25	6.3 0.95	5.925–6.425 GHz	$W_{o\,\text{sat.}} = 25$ W Gain $= 38$ dB	$t_{\text{amb}} = -10$ to $+65°$C
YH1090	6.3 1.0	3.4–4.2 GHz	$W_{o\,\text{sat.}} = 25$ W Gain $= 42$ dB	$t_{\text{coll.}} = 140°$C $I_k = 65$ mA
YH1170	6.3 1.0	5.8–8.5 GHz	$W_{o\,\text{sat.}} = 22$ W Gain $= 42$ dB	$t_{\text{coll.}} = 150°$C $I_k = 60$ mA
7537	6.3 0.8	4.4–5.0 GHz	$W_{o\,\text{sat.}} = >6$ W Gain $= >36$ dB	$t_{\text{coll.}} = 175°$C $I_k = 55$ mA
55340	6.3 0.8	3.8–4.2 GHz	$W_{o\,\text{sat.}} = >8$ W Gain $= >39$ dB	$t_{\text{coll.}} = 175°$C $I_k = 55$ mA

MICROWAVE TUBES - Diodes and Triodes

Type and application	V_f *(V)* I_f *(A)*	*Characteristics data*			*Limiting values*	*Base connections*
EA52 **EA53** Measuring diodes	6.3 0.3	*Typical* $I_d = 0.5$ mA	$V_d = <3$ V		$V_{dinvp} = 1$ kV $I_k = 0.3$ mA $I_{kp} = 5$ mA $f = 1$ GHz	 EA52  EA53
EC55 U.H.F. disc seal triode	6.3 0.4	*Typical* $V_a = 250$ V $V_g = -3.5$ V	$I_a = 20$ mA $S = 6$ mA/V	$\mu = 30$	$V_a = 350$ V $I_k = 40$ mA $W_a = 10$ W $W_g = 0.1$ W	 EC55
EC157 Disc seal triode (metal-glass)	6.3 0.75	*Typical* $V_a = 180$ V $I_a = 60$ mA $V_g = -1.25$ V $S = 21$ mA/V $\mu = 43$	*Operating* $f = 4$ GHz $V_{ba} = 200$ V $I_a = 30$ mA $B = 50$ MHz $W_o = 0.5$ W $G = 6$ dB	$f = 4$ GHz $V_{ba} = 200$ V $I_a = 60$ mA $B = 50$ MHz $W_o = 1.8$ W $G = 8$ dB	$V_a = 300$ V $I_k = 70$ mA $W_a = 12.5$ W $W_g = 0.2$ W	

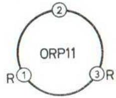
MICROWAVE TUBES - Diodes and Triodes

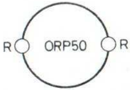
Type and application	V_f *(V)* I_f *(A)*	*Characteristics data*			*Limiting values*	*Base connections*
EC158 Disc seal triode (metal glass)	6.3 0.9	*Typical* $V_a = 180$ V $I_a = 140$ mA $S = 28$ mA/V $\mu = 30$	*Operating* $f = 4$ GHz $V_{ba} = 200$ V $I_a = 140$ mA	$B = 50$ MHz $W_o = 5.3$ W $G = 6$ dB	$V_a = 300$ V $I_k = 170$ mA $W_a = 30$ W	
YD1050 Disc seal triode	6.0 0.98	*Typical* $V_a = 500$ V $I_a = 100$ mA $\delta = 27$ mA/V $\mu = 60$	*C.W. oscillator* $f = 0.5$ $V_a = 600$ $I_a = 80$ $W_o = 26$	2.5 GHz 600 V 100 mA 16 W	$V_a = 1$ kV $I_k = 125$ mA $W_a = 100$ W $f = 2.5$ GHz	 YD1050 2C39A
2C39A Disc seal power triode (air cooled)	6.3 1.03	*Typical* $V_a = 600$ V $I_a = 75$ mA $S = 25$ mA/V $\mu = 100$	*C.W. oscillator* $f = 2.5$ GHz $V_a = 800$ V $I_a = 100$ mA $W_o = 18$ W	*Freq. doubler* $f = 1–2$ GHz $V_a = 400$ V $I_a = 55$ mA $W_o = 4.1$ W	$V_a = 1$ kV $I_k = 125$ mA $W_a = 100$ W $f = 3.0$ GHz	
2C39BA	6.0 0.98	for further data see 2C39A	$W_o = 24$ W	$W_o = 5.2$ W	$f = 3.5$ GHz	

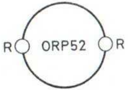
5876 Pencil type UHF high-mu triode	6.3 0.135	*Typical* $V_a = 250$ V $R_k = 75\ \Omega$	$I_a = 18$ mA $S = 6.5$ mA/V	$R_i = 8.6\ \text{k}\Omega$ $\mu = 56$	$V_a = 360$ V $I_a = 25$ mA $W_a = 6.25$ W $f = 1.7$ GHz	
5876A	ruggedized version of the 5876					
5893 Pencil type UHF medium-mu triode	6.0 0.28	*Typical* $V_a = 200$ V $R_k = 100\ \Omega$	$I_a = 25$ mA $S = 6$ mA/V	$R_i = 4.5\ \text{k}\Omega$ $\mu = 27$	$V_a = 330$ V $I_a = 35$ mA $W_a = 7$ W $f = 3.3$ GHz	
6263 Pencil type UHF medium-mu triode	6.0 0.28	*Typical* $V_a = 200$ V $R_k = 100\ \Omega$	$I_a = 27$ mA $S = 7$ mA/V	$R_i = 3.8\ \text{k}\Omega$ $\mu = 27$	$V_a = 330$ V $I_a = 40$ mA $W_a = 8$ W $f = 1.7$ GHz	
6263A	ruggedized version of the 6263					
6264 Pencil type UHF medium-mu triode	6.0 0.28	*Typical* $V_a = 200$ V $R_k = 100\ \Omega$	$I_a = 18.5$ mA $S = 6.8$ mA/V	$R_i = 5.9\ \text{k}\Omega$ $\mu = 40$	$V_a = 330$ V $I_a = 40$ mA $W_a = 8$ W $f = 1.7$ GHz	
6264A	ruggedized version of the 6264					
7289	ruggedized version of the 2C39BA					
8108	ruggedized version of the EC157					

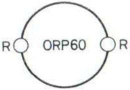
PHOTOSENSITIVE DEVICES - Cadmium sulphide photoconductive cells

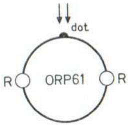
Type	$P_{\text{max.}}$ *at* $T_{\text{amb}}=25°C$	*Cell voltage d.c. and repetitive peak (max.)*	*Cell resistance at 50 lux; 2700° K colour temp.*	*Sensitive area*	*Max. dimensions*		*Base connections*
					diam.	*length*	
ORP11 [1]	400 mW	300 V	1.7 kΩ	1.25 cm^2	17	58	
ORP30N [1]	1.5 W	350 V	330 Ω	4.5 cm^2	34.5	70	
ORP50 [1] [2]	400 mW	300 V	2.7 kΩ	50 mm^2	16	44	
ORP52 [1]	400 mW	200 V	1.2 kΩ	50 mm^2	16	44	
ORP60 [1] **ORP61** [2]	70 mW	350 V	60 kΩ	0.25 mm^2	6	16.5	



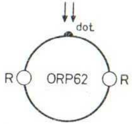


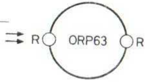


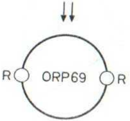


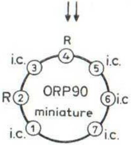


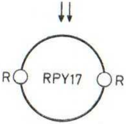
ORP62[2]	100 mW	350 V	46 kΩ	1.5 mm^2	6	16.5
ORP63[2]	75 mW	100 V	1.6 kΩ	15 mm^2	6	26
ORP69[1][2]	100 mW	350 V	30 kΩ		6	16.5
ORP90[2]	1 W	350 V	1 kΩ	3.2 cm^2 (total area)	19	60.3
RPY13 CdS cells-lamp combination	150 mW (each cell)	200 V	15 Ω	lamp filam. $V_f = 24$ V $I_f = 54$–66 mA	22	55.6
RPY17[2]	225 mW	400 V	7 kΩ	64 mm^2 (total area)	10.3 × 4.3	22
RPY18[2]	500 mW 2 W[3]	100 V	25 Ω	1.5 cm^2 (total area)	16.3 × 6	27
RPY19[2]	500 mW 2 W[3]	400 V	3 kΩ	1.5 cm^2 total area	16.3 × 6	27

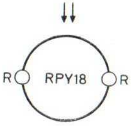


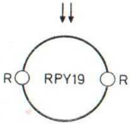


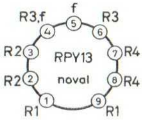












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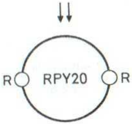
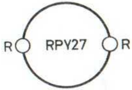
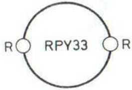
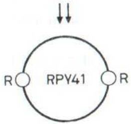
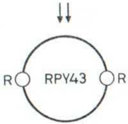
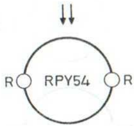
[1] Top sensitivity. [2] Side sensitivity. [3] With a heatsink with $K = 5\,^\circ\mathrm{C/W}$.

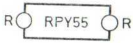
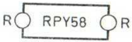
PHOTOSENSITIVE DEVICES - Cadmium sulphide photoconductive cells

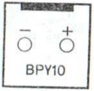
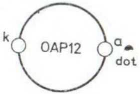
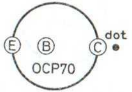
Type	$P_{\max.}$ *at* $T_{\mathrm{amb}}=25°C$	*Cell voltage d.c. and repetitive peak (max.)*	*Cell resistance at 50 lux; 2700° K colour temp.*	*Sensitive area*	*Max. dimensions*		*Base connections*
					diam.	*length*	
RPY20 ^{2})	1 W 3 W ^{3})	400 V	1.5 kΩ	3 cm^2 (total area)	16.3 × 6	43	
RPY27 ^{1})	1 W	400 V	650 Ω	3.2 cm^2 (total area)	32	23	
RPY33 ^{1})	75 mW	50 V	1.33–4.4 kΩ ^{5})	15 mm^2	9.4	3.4	
RPY41 ^{2})	225 mW	100 V	1.6 kΩ	64 mm^2 (total area)	10.3 × 4.3	22	
RPY43 ^{2})	750 mW	400 V	1.5 kΩ		13.5 × 2	30.5	
RPY54 ^{2})	500 mW	200 V	1.5 kΩ	1.5 cm^2	16.3 × 6	27	







RPY55 [1]	1 W	200 V	420 Ω	3.2 cm^2 (tot. area)	32	7.6	
RPY58 [2]	200 mW[4]	50 V	600 Ω		6 × 2	6	

Type and application	*Sensitive area (mm^2)*	*Light sensitivity µA/lux.*	*Peak spectral response (µm)*	*Dark current (µA)*	*Cut-off frequency (kHz)*	*Outlines (mm)*	*Base connections*
BPY10 photo voltaic cell; tape and card readers	2.8	0.016 (2700°K)	$\lambda_m = 0.8$	at $V_R = 1$ V $I_R = < 10$	$C_d < 1$ nF	length < 7.6 width < 2.2 height < 2.5 leads > 37	
	Ratings:	$V_R = 1$ V	$I_F = 10$ mA	$T_j = 100$°C			
OAP12 Photo-diode General purpose	1	0.05 (2500°K)	$\lambda_m = 1.55$	at $V_R = 10$ V $I_R = < 15$	at $V_R = 10$ V $f_C = 50$	length < 9.4 width < 2.8 leads > 28	
	Ratings:	$V_R = 30$ V	$I_R = 3$ mA	$P_{tot} = 30$ mW			
OCP70 Photo transistor General purpose	7	0.9 (2700°K)	$\lambda_m = 1.43$	at $I_B = 0$ $-V_{CE} = 4.5$ V $-I_{CEO} < 325$	for modulated light $f_C > 3$	length < 15 width < 6 leads > 37	
	Ratings:	$-V_{CEO} = 7.5$ V	$-I_{CM} = 20$ mA	$P_{tot} = 100$ mW	$T_j = 65$°C		

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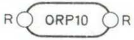
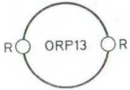
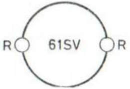
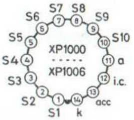
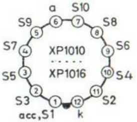
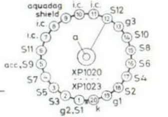
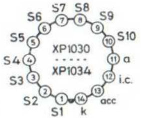
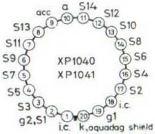
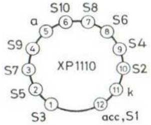
[1] Top sensitivity. [2] Side sensitivity. [3] With a heatsink with $K = 5$°C/W. [4] $T_{amb.} = 40$°C. [5] At 25.6 lux.

PHOTOSENSITIVE DEVICES - Photoconductive cells

Type	*Spectral response range*	*Sensitive area*	*Max. current*	*Cell resistance*	*Max. temperature*	*Base connections*
ORP10	visible to 7.5 μm	3 mm^2	100 mA at $t_{amb} = 20°C$	30–120 Ω	70°C	
ORP13	visible to 5.6 μm	3 mm^2	5 mA at $t_{amb} = 77°K$	20–60 kΩ	77°K	
61SV	0.3 to 3.5 μm	36 mm^2	0.5 mA	1–4 MΩ	60°C	

PHOTOSENSITIVE DEVICES - Photomultipliers

Type	*Spectral response*	*Useful diam.*	*N_a A/lumen or G(ain)*	*at V_b (V)*	*Dark curr. (μA)*	*at N_a A/lm or G(ain)*	*Max. length*	*Base connections*
10 stages								
XP1000	A(S11)	44	700	1800	0.015	100	148	
XP1001[4])	A(S11)	44	700	1800	0.015	100	148	
XP1002	T(S20)	44	400	1800	0.015	60	148	
XP1003	TU	44	400	1800	0.015	60	148	
XP1004	U(S13)	44	700	1800	0.015	100	148	
XP1005	C(S1)	44	100	1800	< 10	20	148	
XP1006	D	44	250	1800	0.02	60	148	

10 stages								
XP1010[5]	A(S11)	32	700	1800	0.01	60	127	
XP1011[6]	A(S11)	32	700	1800	0.01	60	127	
XP1015[6]	A(S11)	32	700	1800	0.01	60	219	
XP1016[6]	T(S20)	32	400	1800	10 nA	60	127	
12 stages								
XP1020	A(S11)	42	$G=10^8$	2500	<5	$G=10^8$	197	
XP1021	A(S11)	42	$G=10^8$	2500	<5	$G=10^8$	207	
XP1023	U(S13)	42	$G=10^8$	2500	<5	$G=10^8$	207	
10 stages								
XP1030	A(S11)	63.5	250	1800	<0.2	100	159	
XP1031[4]	A(S11)	63.5	250	1800	<0.2	100	159	
XP1032	U(S13)	63.5	250	1800	<0.2	100	198	
XP1033	U(S13)	63.5	250	1800	<0.2	100	205	
XP1034	D	63.5	250	1800	20 nA	60	159	
14 stages								
XP1040	A(S11)	110	$G=10^8$	2400	2	$G=10^8$	281	
XP1041	D	110	$G=10^8$	2250	2	$G=10^8$	281	
10 stages								
XP1110[6]	A(S11)	14	250	1800	0.02	30	105	

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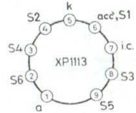
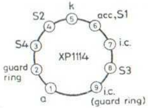
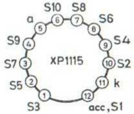
[4] Energy resolution for ^{137}Cs(0.661 MeV) = 8.5%. [5] Low noise. [6] Ruggedized.

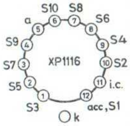
PHOTOSENSITIVE DEVICES - **Photomultipliers**

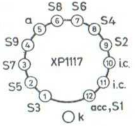
Type	*Spectral response*	*Useful diam.*	*N_a A/lumen or G(ain)*	*at V_b (V)*	*Dark curr. (μA)*	*at N_a A/lm or G(ain)*	*Max. length*	*Base connections*
6 stages **XP1113**	A(S11)	14	0.9	1200	0.01	0.3	70	
4 stages **XP1114**	A(S11)	14	20 mA/lm	900	<0.1 nA	4 mA/lm	70	
10 stages **XP1115**³)²)	A(S11)	14	250	1800	0.02	30	105	
10 stages **XP1116**³)	C(S1)	14	20	1800	<10	20	105	
9 stages **XP1117**³)	T(S20)	14	100	1800	0.01	30	105	
10 stages **XP1118**	U(S13)	14	250	1800	0.02	30	105	

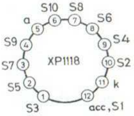




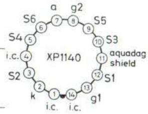


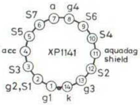


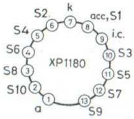


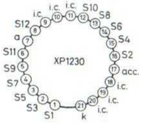


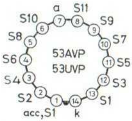
6 stages **XP1140**	S4	150 mm²	$G=10^4$	3750	0.03	$G=10^4$	123
7 stages **XP1141**	A(S11)	42	$G=10^4$	3500	0.1	$G=10^4$	167
6 stages **XP1143**	S4	280 mm²	$G=10^4$	3500	1	$G=10^4$	160
10 stages **XP1180**[4])	A(S11)	20	200	1800	5 nA	30	98
10 stages **XP1210**	A(S11)	42	$G=10^7$	4000	<1	$G=10^7$	177
10 stages **XP1220**	A(S11)	14	$G=10^7$	2100	<1	$G=10^7$	95
12 stages **XP1230**	D	42	$G=10^8$	2100	02	$G=10^8$	141
11 stages **53AVP** **53UVP**	A(S11) U(S13)	44 44	400 400	1800 1800	0.015 0.015	60 60	153 153











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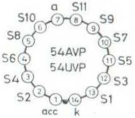
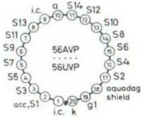
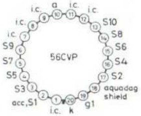
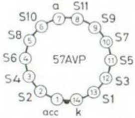
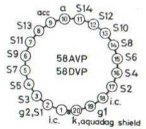
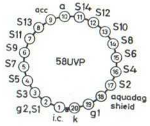
[2]) With flying leads. [3]) Ruggedized. [4]) Energy resolution for ^{137}Cs(0.661 MeV) = 11%.

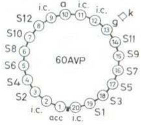
PHOTOSENSITIVE DEVICES - Photomultipliers

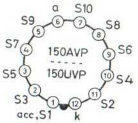
Type	*Spectral response*	*Useful diam.*	*N_a A/lumen or G(ain)*	*at V_b (V)*	*Dark curr. (μA)*	*at N_a A/lm or G(ain)*	*Max. length*	*Base connections*
11 stages								
54AVP	A(S11)	111	500	1800	0.2	250	235	
54UVP	U(S13)	111	500	1800	0.2	250	235	
14 stages								
56AVP	A(S11)	42	$G=10^8$	2200	0.5	$G=10^8$	192	
56AVP/03	A(S11)	42	$G=10^8$	2150	0.1	$G=10^8$	192	
56AVP/05	A/05	42	$G=10^8$	2200	0.5	$G=10^8$	192	
56UVP	U(S13)	42	$G=10^8$	2200	0.5	$G=10^8$	192	
10 stages								
56CVP	C(S1)	42	100	2750	< 10	20	174	
14 stages								
56DUVP	DU	42	$G=10^8$	2100	0.2	$G=10^8$	192	
56DUVP/03	DU	42	$G=10^8$	2100	0.2	$G=10^8$	192	
56DVP	D	42	$G=10^8$	2100	0.2	$G=10^8$	192	
56DVP/03	D	42	$G=10^8$	2100	0.2	$G=10^8$	192	
14 stages								
56TUVP	TU	42	$G=10^8$	2500	< 5	$G=10^8$	192	
56TVP	T(S20)	42	$G=10^8$	2500	< 5	$G=10^8$	192	
11 stages								
57AVP	A(S11)	200	250	1800	< 1	60	328	

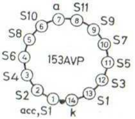
14 stages							
58AVP	A(S11)	110	$G=10^8$	2400	2	$G=10^8$	281
58DVP	D	110	$G=10^8$	2250	2	$G=10^8$	281
14 stages							
58UVP	U(S13)	110	$G=10^8$	2400	2	$G=10^8$	340
12 stages							
60AVP	A(S11)	200	$G=10^8$	3000	<20	$G=10^8$	318
10 stages							
150AVP	A(S11)	32	700	1800	0.01	60	127
150CVP	C(S1)	32	100	1800	<10	20	127
150UVP	U(S13)	32	700	1800	0.01	60	127
11 stages							
153AVP[1]	A(S11)	44	400	1800	0.015	60	153











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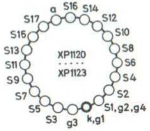
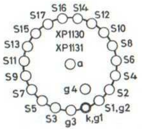
[1] Energy resolution for ^{137}Cs(0.661 MeV) = 8.5%.

PHOTOSENSITIVE DEVICES - Windowless photomultipliers

Type[1]	*Cathode*[2] *Dynode*	*Pressure (mm Hg)* *Quant. eff. UV*	*Gain at* $V_b = 4\ kV$	*Dark curr. at Gain* $= 10^6$	*Max. dimensions* *diam.*	*length*	*Base connections*
XP1120	Ni Cu-Be-O	10^{-5}–10^{-6} 10% at 80 nm	$5 \cdot 10^7$	10^{-10} A	60.5	325	
XP1121	Cu-Be-O Cu-Be-O	10^{-5}–10^{-6} 20% at 68 nm	$5 \cdot 10^7$	10^{-10} A	60.5	325	
XP1122	Ni Cu-Be-O	10^{-5}–10^{-6} 10% at 80 nm	$5 \cdot 10^7$	10^{-10} A	60.5	325	
XP1123	Cu-Be-O Cu-Be-O	10^{-5}–10^{-6} 20% at 68 nm	$5 \cdot 10^7$	10^{-10} A	60.5	325	
XP1130	Ni Cu-Be-O	10^{-5}–10^{-10} 10% at 80 nm	$5 \cdot 10^7$	10^{-10} A	90.5	321	
XP1131	Cu-Be-O Cu-Be-O	10^{-5}–10^{-10} 20% at 68 nm	$5 \cdot 10^7$	10^{-10} A	90.5	321	

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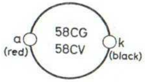
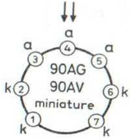
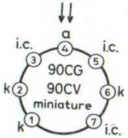
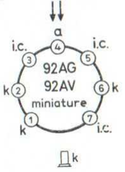
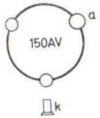
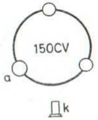
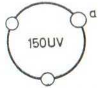
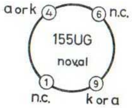
[1]) Potted voltage dividers; [2]) Minimum useful area 22 × 22 mm^2.

PHOTOSENSITIVE DEVICES - Photo tubes

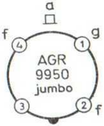
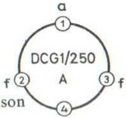
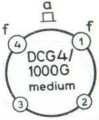
Type	*Sensitivity* *sensitivity area*	*Operating characteristics*	*Limiting values*	*Max. dimensions*		*Base connections*
				diam.	*height*	
58CG Gasfilled	red 1.1 cm²	V_b = 85 V R_a = 1 MΩ N = 100 μA/lm I_{dark} = max. 0.1 μA	V_b = 90 V I_k = 1.5 μA t_{amb} = 100 °C	17	33	
58CV Vacuum	red 1.1 cm²	V_b = 50 V R_a = 1 MΩ N = 20 μA/lm I_{dark} = max. 0.05 μA	V_b = 250 V I_k = 3 μA t_{amb} = 100 °C	17	33	
90AG Gasfilled	blue 4.0 cm²	V_b = 85 V R_a = 1 MΩ N = 130 μA/lm I_{dark} = max. 0.1 μA	V_b = 90 V I_k = 2.5 μA t_{amb} = 70 °C	19	54	
90AV Vacuum	blue 4.0 cm²	V_b = 100 V R_a = 1 MΩ N = 45 μA/lm I_{dark} = max. 0.05 μA	V_b = 100 V I_k = 5 μA t_{amb} = 70 °C	19	54	
90CG Gasfilled	red 3.0 cm²	V_b = 90 V R_a = 1 MΩ N = 125 μA/lm I_{dark} = max. 0.1 μA	V_b = 90 V I_k = 2 μA t_{amb} = 100 °C	19	54	

PHOTOSENSITIVE DEVICES - Photo tubes

Type	*Sensitivity* *sensitivity area*	*Operating* *characteristics*	*Limiting* *values*	*Max. dimensions* diam.	height	*Base connections*
90CV Vacuum	red 3.0 cm^2	V_b = 50 V R_a = 1 MΩ N = 20 μA/lm I_{dark} = max. 0.05 μA	V_b = 250 V I_k = 10 μA t_{amb} = 100°C	19	54	
92AG Gasfilled	blue 2.1 cm^2	V_b = 85 V R_a = 1 MΩ N = 130 μA/lm I_{dark} = max. 0.1 μA	V_b = 90 V I_k = 0.0125 μA/mm^2 t_{amb} = 70°C	19	54	
92AV Vacuum	blue 2.1 cm^2	V_b = 85 V R_a = 1 MΩ N = 45 μA/lm I_{dark} = 0.05 μA	V_b = 100 V I_k = 0.025 μA/mm^2 t_{amb} = 70°C	19	54	
150AV Vacuum	blue 7.1 cm^2	V_a = 6–90 $V_{d.c.}$ I_a = max. 50×10^{-9} A I_{ap} = max. 35×10^{-6} A N = 60×10^{-6} A/lm	V_a = 100 $V_{d.c.}$ I_{kp} = 50×10^{-9} A/mm^2 $t_{bulb} > -90$°C $< +60$°C	52	82	
150CV Vacuum	red 5.3 cm^2	V_a = 6–90 $V_{d.c.}$ I_a = max. 35×10^{-9} A I_{ap} = max. 25×10^{-6} A N = 20×10^{-6} A/lm	V_a = 100 $V_{d.c.}$ I_{kp} = 50×10^{-9} A/mm^2 t_{bulb} = > -90°C $< +60$°C	52	82	
150UV Vacuum	blue 7.1 cm^2	V_a = 6–90 $V_{d.c.}$ I_a = max. 50×10^{-9} A I_{ap} = max. 35×10^{-6} A N = 35×10^{-6} A/lm	V_a = 100 $V_{d.c.}$ I_{kp} = 50×10^{-9} A/mm^2 t_{bulb} = > -90°C $< +60$°C	52	110	

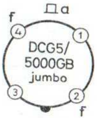
155UG Gasfilled	Ultra-violet	$V_m = 180–220\,V$ Spectral response = 200–290 nm	$t_{amb} = > -25\,°C$ $< +70\,°C$	30	35	

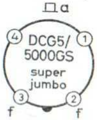
GAS-FILLED TUBES -High voltage rectifiers

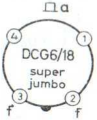
Type and application	V_f *(V)* I_f *(A)*	*Circuit*	$V_{tr\ rms}$ *(kV)*	V_o *(kV)*	I_o *(A)*	W_o *(kW)*	*Limiting* values	*Accessories*	*Base*
AGR9950 Grid-controlled mercury-vapour rectifier	5.0 6.5	[1]) [2]) [3])	4.6 5.3 9.2	4.1 6.2 12.4	2 3 3	8.3 18.6 37.2	f = 150 Hz V_{ainvp} = 13 kV I_o = 1 A I_{ap} = 4 A	Anode cap heat container: 40616 Socket: 2422 511 02001	
DCG1/250 Mercury-vapour rectifier	4.0 2.5	[1]) [2]) [3])	1.06 1.22 2.12	0.95 1.43 2.86	0.5 0.75 0.75	0.48 1.07 2.15	f = 500 Hz V_{ainvp} = 3 kV I_o = 0.25 A I_{ap} = 1.25 A	Socket: 2422 512 02001	 Edison
DCG4/1000ED Mercury-vapour rectifier	2.5 4.8	[1]) [2]) [3])	3.5 4.1 7.1	3.3 4.8 9.6	0.5 0.75 0.75	1.59 3.6 7.2	f = 150 Hz V_{ainvp} = 10 kV I_o = 0.25 A I_{ap} = 1 A	An. conn.: 40619 Socket: E300022	
DCG4/1000G		For further data see DCG4/1000ED						Socket: 2422 511 04001	

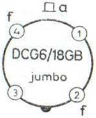
DCG4/5000 Mercury-vapour rectifier	4.0 7.0	[1] [2] [3]	4.6 5.3 9.2	4.1 6.2 12.4	2.5 3.75 3.75	10.3 23.3 46.6	f = 150 Hz V_{ainvp} = 13 kV I_o = 1.25 A I_{ap} = 5 A	An. conn.: 40619 Socket: 65909 BG/01 Goliath
DCG5/5000EG Mercury-vapour rectifier	5.0 7.0	[1] [2] [3]	4.75 5.5 9.5	4.3 6.5 12.9	3 4.5 4.5	12.9 29 58	f = 150 Hz V_{ainvp} = 13 kV I_o = 1.5 A I_{ap} = 6 A	An. conn.: 40619 Goliath Socket: 65909BG/01
DCG5/5000GB	For further data see DCG5/5000EG							Socket: 2422 511 02001
DCG5/5000GS	For further data see DCG5/5000EG							Socket: 2422 511 01001
DCG6/18 Mercury-vapour rectifier	5.0 11.5	[1] [2] [3]	5.3 6.1 10.6	4.8 7.2 14.4	6 9 9	28.8 65 130	f = 150 Hz V_{ainvp} = 15 kV I_o = 3 A I_{ap} = 12 A	An. conn.: 40619 Socket: 2422 511 01001
DCG6/18GB	For further data see DCG6/18							Socket: 2422 511 02001

[1] Two phase-half wave (2 tubes) [2] Three phase-half wave (3 tubes) [3] Three phase-full wave (6 tubes)

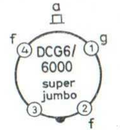
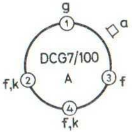
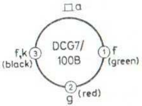
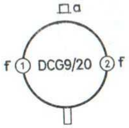


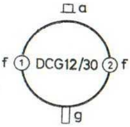
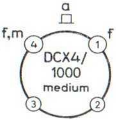
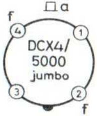
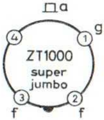
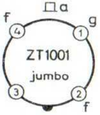






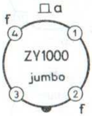
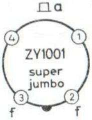
GAS-FILLED TUBES - High voltage rectifiers

Type and application	V_f *(V)* I_f *(A)*	*Circuit*	$V_{tr.rms}$ *(kV)*	V_o *(kV)*	I_o *(A)*	W_o *(kW)*	*Limiting values*	*Accessories*	*Base*
DCG6/6000 Grid controlled mercury-vapour rectifier	5.0 6.5	1) 2) 3)	4.6 5.3 9.2	4.1 6.2 12.4	2 3 3	8.3 18.6 37.2	$f = 150$ Hz $V_{ainvp} = 13$ kV $I_o = 1$ A $I_{ap} = 4$ A	Anode cap heat container: 40616 Socket: 2422 511 01001	
DCG7/100 Grid controlled mercury-vapour rectifier	5.0 14	1) 2) 3)	5.3 6.1 10.6	4.8 7.2 14.4	20 30 30	96 216 432	$f = 150$ Hz $V_{ainvp} = 15$ kV $I_o = 10$ A $I_{ap} = 45$ A	An. conn.: 40620 Socket: 40409	
DCG7/100B		See DCG7/100 except for socket							
DCG9/20 Mercury-vapour rectifier	5.0 13.5	1) 2) 3)	7.4 8.6 14.8	6.7 10 20	5 7.5 7.5	33.5 75 150	$f = 150$ Hz $V_{ainvp} = 21$ kV $I_o = 2.5$ A $I_{ap} = 10$ A	An. conn.: 40620 An. cap heat container: 40616 Socket: 40209	

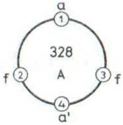
DCG12/30 Grid controlled mercury-vapour rectifier	5.0 13.5	[1] [2] [3]	9.5 11 19.1	8.6 12.9 25.8	5 7.5 7.5	43 97 194	f = 150 Hz V_{ainvp} = 27 kV I_o = 2.5 A I_{ap} = 10 A	An. conn.: 40620 An. cap heat container: 40616 Socket: 40209	
DCX4/1000 Xenon-filled rectifier	2.5 5.0	[1] [2] [3]	3.5 4.1 7.1	3.2 4.8 9.6	0.5 0.75 0.75	1.6 3.6 7.2	f = 150 Hz V_{ainvp} = 10 kV I_o = 0.25 A I_{ap} = 1 A	An. conn.: 40619 Socket: 2422 511 04001	
DCX4/5000 Xenon-filled rectifier	5.0 7.1	[1] [2] [3]	3.5 4.1 7.1	3.2 4.8 9.6	2.5 3.75 3.75	8 18 36	f = 150 Hz V_{ainvp} = 10 kV I_o = 1.25 A I_{ap} = 5 A	An. conn.: 40619 Socket: 2422 511 02001	
ZT1000 Grid controlled mercury-vapour rectifier	5.0 13	[1] [2] [3]	7.4 8.5 14.8	6.7 10 20	5 7.5 7.5	33.5 75 150	f = 150 Hz V_{ainvp} = 21 kV I_o = 2.5 A I_{ap} = 10 A	An. conn. 40620 An. cap heat container: 40616 Socket: 2422 511 01001	
ZT1001			For further data see ZT1000					Socket: 2422 511 02001	

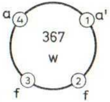
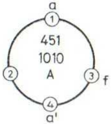
[1] Two phase-half wave (2 tubes). [2] Three phase-half wave (3 tubes). [3] Three phase-full wave (6 tubes).

GAS-FILLED TUBES - High voltage rectifiers

Type and application	V_f *(V)* I_f *(A)*	*Circuit*	$V_{tr.rms}$ *(kV)*	V_o *(kV)*	I_o *(A)*	W_o *(kW)*	*Limiting values*	*Accessories*	*Base*
ZY1000 Mercury-vapour rectifier	5.0 7.0	¹) ²) ³)	4.75 5.5 9.5	4.3 6.45 12.9	3 4.5 4.5	12.9 29 58	$f = 150$ Hz $V_{ainvp} = 13.5$ kV $I_o = 1.5$ A $I_{ap} = 6$ A	An. conn.: 40619 Socket: 2422 511 02001	
ZY1001		For further data see ZY1000						Socket: 2422 511 01001	
ZY1002		For further data see ZY1000						Socket: 65909BG/01	Goliath

GAS-FILLED TUBES - Low voltage rectifiers

Type	V_f *(V)* I_f *(A)*	T_w *(s)*	*Typical characteristics*	*Limiting values*	*Max. dimensions diam.*	*Max. dimensions length*	*Base*
328 Double anode rectifier	1.9 3.0	15	$V_{arc} = 7$ V $V_{ign} = 16$ V	$V_{ainvp} = 90$ V $I_a = 0.65$ A $I_{ap} = 4.0$ A $R_t = \text{min } 3\ \Omega$ $t_{amb} = -55°C$ $+75°C$	33	112	

354 Single anode rectifier	1.9 5.5	30	$V_{\text{arc}} = 8$ V $V_{\text{ign}} = 16$ V	$V_{a\text{invp}} = 400$ V $I_a = 0.25$ A $I_{ap} = 1.25$ A	R_t = min. 50 Ω $t_{\text{amb}} = \begin{matrix}-55\,°\text{C}\\+75\,°\text{C}\end{matrix}$	62	120	Edison
367 Double anode rectifier	1.9 8.0	30	$V_{\text{arc}} = 9$ V $V_{\text{ign}} = 16$ V	$V_{a\text{invp}} = 140$ V $I_a = 3$ A $I_{ap} = 18$ A	R_t = min. 1 Ω $t_{\text{amb}} = \begin{matrix}-55\,°\text{C}\\+75\,°\text{C}\end{matrix}$	81	170	
451 Double anode rectifier	1.9 2.8	15	$V_{\text{arc}} = 7$ V $V_{\text{ign}} = 11$ V	$V_{a\text{invp}} = 50$ V $I_a = 0.65$ A $I_{ap} = 4.0$ A	R_t = min. 3 Ω $t_{\text{Hg}} = 30$–$75\,°$C	33	112	
1010 Double anode rectifier	1.9 3.5	15	$V_{\text{arc}} = 9$ V $V_{\text{ign}} = 16$ V	$V_{a\text{invp}} = 185$ V $I_a = 0.65$ A $I_{ap} = 4.0$ A	R_t = min. 10 Ω $t_{\text{amb}} = \begin{matrix}-55\,°\text{C}\\+75\,°\text{C}\end{matrix}$	37	120	
1037 Double anode rectifier	1.9 11	120	$V_{\text{arc}} = 9$ V $V_{\text{ign}} = 16$ V	$V_{a\text{invp}} = 185$ V $I_a = 3.0$ A $I_{ap} = 18$ A	R_t = min. 1.75 Ω $t_{\text{Hg}} = 30$–$80\,°$C	85	240	Goliath
1039 Double anode rectifier	1.9 20	120	$V_{\text{arc}} = 9$ V $V_{\text{ign}} = 16$ V	$V_{a\text{invp}} = 185$ V $I_a = 7.5$ A $I_{ap} = 45$ A	R_t = min. 075 Ω $t_{\text{Hg}} = 30$–$80\,°$C	94	264	Goliath
1049 Double anode rectifier	1.9 28.5	120	$V_{\text{arc}} = 9$ V $V_{\text{ign}} = 16$ V	$V_{a\text{invp}} = 185$ V $I_a = 12.5$ A $I_{ap} = 75$ A	R_t = min. 0.3 Ω $t_{\text{Hg}} = 30$–$80\,°$C	101	280	Straps
1054 Double anode rectifier	1.9 68	120	$V_{\text{arc}} = 9$ V $V_{\text{ign}} = 16$ V	$V_{a\text{invp}} = 150$ V $I_a = 20$ A $I_{ap} = 120$ A	R_t = min. 0.18 Ω $t_{\text{Hg}} = 30$–$80\,°$C	111	350	Straps

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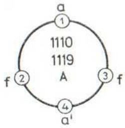
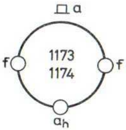
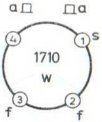
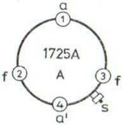
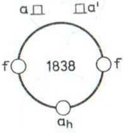
[1] Two phase-half wave (2 tubes). [2] Three phase-half wave (3 tubes). [3] Three phase-full wave (6 tubes).

GAS-FILLED TUBES - Low voltage rectifiers

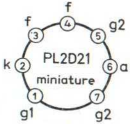
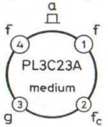
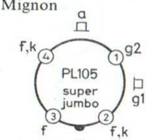
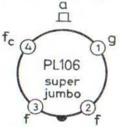
Type	V_f *(V)* I_f *(A)*	T_w *(s)*	*Typical characteristics*	*Limiting values*		*Max. dimensions*		*Base*
						diam.	*length*	
1069K Double anode rectifier	3.25 70	120	$V_{arc} = 10$ V $V_{ign} = 16$ V	$V_{ainvp} = 170$ V $I_a = 30$ A $I_{ap} = 200$ A	R_t = min. 0.12 Ω $t_{Hg} = 30$–75 °C	114	365	Straps
1110 Double anode rectifier	1.9 3.5	15	$V_{arc} = 9$ V $V_{ign} = 16$ V	$V_{ainvp} = 185$ V $I_a = 0.85$ A $I_{ap} = 5.0$ A	R_t = min. 4 Ω $t_{amb} = {-55}$ °C +75 °C	39	131	
1119 Double anode rectifier	1.9 5.8	30	$V_{arc} = 9$ V $V_{ign} = 16$ V	$V_{ainvp} = 140$ V $I_a = 1.5$ A $I_{ap} = 9.0$ A	R_t = min. 1.8 Ω $t_{amb} = {-55}$ °C +75 °C	71	142	
1138 Single anode rectifier	2.5 27	120	$V_{arc} = 10$ V $V_{ign} = 16$ V	$V_{ainvp} = 275$ V $I_a = 15$ A $I_{ap} = 85$ A	R_t = min. 0.3 Ω $t_{Hg} = 30$–80 °C	115	269	Goliath
1163 Single anode rectifier	2.25 17	3	$V_{arc} = 9$ V $V_{ign} = 16$ V	$V_{ainvp} = 375$ V $I_a = 6$ A $I_{ap} = 36$ A	R_t = min. 0.5 Ω $t_{amb} = {-55}$ °C +75 °C	83	178	Goliath
1164 Single anode rectifier	2.5 25	15	$V_{arc} = 9$ V $V_{ign} = 16$ V	$V_{ainvp} = 225$ V $I_a = 15$ A $I_{ap} = 90$ A	R_t = min. 0.3 Ω $t_{amb} = {-55}$ °C +75 °C	98	220	Goliath

1173 Single anode rectifier	1.9 13	60	$V_{\text{arc}} = 12$ V $V_{\text{ign}} = 22$ V	$V_{a\text{invp}} = 850$ V $I_a = 4$ A $I_{ap} = 20$ A	$R_t = \text{min. } 0.75\ \Omega$ $t_{\text{Hg}} = 30–75\,^\circ\text{C}$	62	189	
1174 Single anode rectifier	1.9 12	60	$V_{\text{arc}} = 12$ V $V_{\text{ign}} = 22$ V	$V_{a\text{invp}} = 850$ V $I_a = 6$ A $I_{ap} = 30$ A	$R_t = \text{min. } 0.5\ \Omega$ $t_{\text{Hg}} = 30–75\,^\circ\text{C}$	77	218	
1176 Single anode rectifier	1.9 28	120	$V_{\text{arc}} = 12$ V $V_{\text{ign}} = 22$ V	$V_{a\text{invp}} = 850$ V $I_a = 15$ A $I_{ap} = 75$ A	$R_t = \text{min. } 0.2\ \Omega$ $t_{\text{Hg}} = 30–75\,^\circ\text{C}$	92	301	Straps
1177 Single anode rectifier	1.9 60	120	$V_{\text{arc}} = 12$ V $V_{\text{ign}} = 28$ V	$V_{a\text{invp}} = 850$ V $I_a = 25$ A $I_{ap} = 135$ A	$R_t = \text{min. } 0.1\ \Omega$ $t_{\text{Hg}} = 30–75\,^\circ\text{C}$	128	362	Straps
1710 Double anode rectifier	1.9 8.0	30	$V_{\text{arc}} = 10$ V $V_{\text{ign}} = 22$ V	$V_{a\text{invp}} = 470$ V $I_a = 1.5$ A $I_{ap} = 9.0$ A	$R_t = \text{min. } 2.5\ \Omega$ $t_{\text{Hg}} = 30–80\,^\circ\text{C}$	69.5	205	
1725A Double anode rectifier	1.9 3.5	15	$V_{\text{arc}} = 10$ V $V_{\text{ign}} = 22$ V	$V_{a\text{invp}} = 470$ V $I_a = 0.65$ A $I_{ap} = 4.0$ A	$R_t = \text{min. } 5\ \Omega$ $t_{\text{amb}} = \begin{matrix} -55\,^\circ\text{C} \\ +75\,^\circ\text{C} \end{matrix}$	71	135	
1738 Double anode rectifier	1.9 18	120	$V_{\text{arc}} = 9$ V $V_{\text{ign}} = 20$ V	$V_{a\text{invp}} = 300$ V $I_a = 7.5$ A $I_{ap} = 45$ A	$R_t = \text{min. } 0.2\ \Omega$ $t_{\text{Hg}} = 30–80\,^\circ\text{C}$	94	284	Goliath

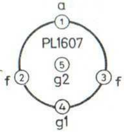
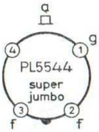
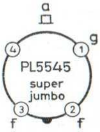
GAS-FILLED TUBES - Low voltage rectifiers

Type	V_f *(V)* I_f *(A)*	T_w *(s)*	*Typical characteristics*	*Limiting values*		*Max. dimensions*		*Base connections*
						diam.	*length*	
1749A Double anode rectifier	1.9 25	120	$V_{arc} = 10$ V $V_{ign} = 22$ V	$V_{ainvp} = 300$ V $I_a = 12.5$ A $I_{ap} = 75$ A	$R_t =$ min. 0.1 Ω $t_{Hg} = 30–80$°C	101	290	Straps
1788 Double anode rectifier	1.9 11	120	$V_{arc} = 9$ V $V_{ign} = 22$ V	$V_{ainvp} = 300$ V $I_a = 5$ A $I_{ap} = 30$ A	$R_t =$ min. 0.3 Ω $t_{Hg} = 30–80$°C	94	284	Goliath
1838 Double anode rectifier	1.9 21.5	120	$V_{arc} = 10$ V $V_{ign} = 22$ V	$V_{ainvp} = 360$ V $I_a = 7.5$ A $I_{ap} = 45$ A	$R_t =$ min. 0.25 Ω $t_{Hg} = 30–80$°C	97	262	
1849 Double anode rectifier	1.9 29	120	$V_{arc} = 10$ V $V_{ign} = 22$ V	$V_{ainvp} = 360$ V $I_a = 12.5$ A $I_{ap} = 75$ A	$R_t =$ min. 0.2 Ω $t_{Hg} = 30–80$°C	105	294	Straps
1859 Double anode rectifier	1.9 60	120	$V_{arc} = 12$ V $V_{ign} = 28$ V	$V_{ainvp} = 360$ V $I_a = 25$ A $I_{ap} = 150$ A	$R_t =$ min. 0.1 Ω $t_{Hg} = 30–80$°C	143	436	Straps

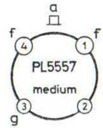
GAS-FILLED TUBES - Thyratrons

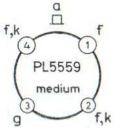
PL2D21 Tetrode	6.3 0.6	20	$V_{arc} = 8$ V $T_{ion} = 0.5\ \mu s$ $T_{dion} = 35\ \mu s$	$V_{ap} = 650$ V $V_{ainp} = 1.3$ kV $I_k = 0.1$ A	$I_{kp} = 0.5$ A $t_{amb} = -75°C$ $+90°C$	19	54	
PL3C23A Triode	2.5 7.0	>15	$V_{arc} = 10$ V $T_{ion} = 10\ \mu s$ $T_{dion} = 1000\ \mu s$	$V_{ap} = 1.5$ kV $V_{ainvp} = 1.5$ kV $I_k = 1.6$ A $I_{kp} = 6.4$ A	$I_g = 10$ mA $I_{gp} = 50$ mA $t_{Hg} = -40°C$ $+80°C$	52	155	
PL10 Triode	1.85 3.4	0	$V_{arc} = 20–35$ V at $I_a = 0.1–0.4$ A	$V_{ap} = 400$ V $V_{ainvp} = 400$ V $I_a = 100$ mA	$I_{ap} = 4$ A $t_{amb} = -75°C$ $+90°C$	21.5	105	Mignon
PL105 Tetrode	5.0 10	>300	$V_{arc} = 12$ V $T_{ion} = 10\ \mu s$ $T_{dion} = 1000\ \mu s$	$V_{ap} = 2.5$ kV $V_{ainvp} = 2.5$ kV $I_a = 6.4$ A	$I_{ap} = 40$ A $t_{Hg} = 40–80°C$	123	288	
PL106 Triode	2.5 22	60	$V_{arc} = 12$ V $T_{ion} = 10\ \mu s$ $T_{dion} = 500\ \mu s$	$V_{ap} = 2$ kV $V_{ainvp} = 2$ kV $I_k = 6.4$ A	$I_{kp} = 80$ A $t_{Hg} = 25–80°C$	73	290	
PL150 Triode	1.9 26	>60	$V_{arc} = 12$ V $T_{ion} = 10\ \mu s$ $T_{dion} = 1000\ \mu s$	$V_{ap} = 120$ V $V_{ainvp} = 250$ V $I_a = 17$ A	$I_{ap} = 65$ A $t_{Hg} = 40–80°C$	92	293	Straps
PL255 Triode	5.0 11	>600	$V_{arc} = 10$ V $T_{ion} = 10\ \mu s$ $T_{dion} = 1000\ \mu s$	$V_{ap} = 1.5$ kV $V_{ainvp} = 2.5$ kV $I_k = 10$ A	$I_{kp} = 100$ A $t_{Hg} = 35–75°C$	102	334	Straps

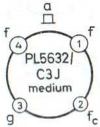
GAS-FILLED TUBES - Thyratrons

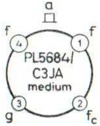
Type	V_f *(V)* I_f *(A)*	T_w *(s)*	*Typical characteristics*	*Limiting values*		*Max. dimensions*		*Base connections*
						diam.	*length*	
PL260 Triode	5.0 19	>600	V_{arc} = 10 V T_{ion} = 10 μs T_{dion} = 1000 μs	V_{ap} = 2.0 kV V_{ainvp} = 2.5 kV I_k = 60 A	I_{kp} = 200 A t_{Hg} = 40–80°C	127	405	Straps
PL1607 Tetrode	2.0 2.6	>30	V_{arc} = 15 V T_{dion} = 500 μs	V_{ap} = 650 V V_{ainvp} = 650 V I_a = 0.5 A	I_{ap} = 2 A t_{amb} = −75°C +90°C	48	142	
PL5544 Triode	2.5 12	>60	V_{arc} = 12 V T_{ion} = 10 μs T_{dion} = 400 μs	V_{ap} = 1.5 kV V_{ainvp} = 1.5 kV I_k = 3.2 A	I_{kp} = 40 A t_{amb} = −55°C +70°C	67	190	
PL5545 Triode	2.5 21	>60	V_{arc} = 12 V T_{ion} = 10 μs T_{dion} = 500 μs	V_{ap} = 1.5 kV V_{ainvp} = 1.5 kV I_k = 6.4 A	I_{kp} = 80 A t_{amb} = −55°C +70°C	67	229	

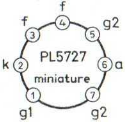
PL5557 Triode	2.5 5.0	10	$V_{\text{arc}} = 12$ V $T_{\text{ion}} = 10\ \mu s$ $T_{\text{dion}} = 1000\ \mu s$	$V_{ap} = 2.5$ kV $V_{ainvp} = 5.0$ kV $I_a = 0.5$ A	$I_{ap} = 2$ A $t_{\text{Hg}} = 35\text{–}80\,°\text{C}$	52	155
PL5559 Triode	5.0 4.5	>300	$V_{\text{arc}} = 12$ V $T_{\text{ion}} = 10\ \mu s$ $T_{\text{dion}} = 1000\ \mu s$	$V_{ap} = 1$ kV $V_{ainvp} = 1$ kV $I_k = 2.5$ A	$I_{kp} = 15$ A $t_{\text{Hg}} = 40\text{–}80\,°\text{C}$	76	185
PL5632/ **C3J** Triode	2.5 9.0	60	$V_{\text{arc}} = 10$ V $T_{\text{ion}} = 10\ \mu s$ $T_{\text{dion}} = 1000\ \mu s$	$V_{ap} = 900$ V $V_{ainvp} = 1.25$ kV $I_k = 2.5$ A	$I_{kp} = 30$ A $t_{\text{amb}} = \begin{matrix} -55\,°\text{C} \\ +75\,°\text{C} \end{matrix}$	40	150
PL5684/ **C3JA** Triode	2.5 9.0	60	$V_{\text{arc}} = 10$ V $T_{\text{ion}} = 10\ \mu s$ $T_{\text{dion}} = 1000\ \mu s$	$V_{ap} = 1$ kV $V_{ainvp} = 1.25$ kV $I_k = 2.5$ A	$I_{kp} = 30$ A $t_{\text{amb}} = \begin{matrix} -55\,°\text{C} \\ +75\,°\text{C} \end{matrix}$	40	150
PL5727 Tetrode	6.3 0.6	20	$V_{\text{arc}} = 8$ V $T_{\text{ion}} = 0.5\ \mu s$ $T_{\text{dion}} = 75\ \mu s$	$V_{ap} = 650$ V $V_{ainvp} = 1.3$ kV $I_k = 0.1$ A	$I_{kp} = 0.5$ A $t_{\text{amb}} = -75\,°\text{C}$ $t_{\text{bulb}} = +150\,°\text{C}$	19	54



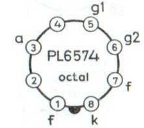
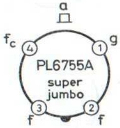
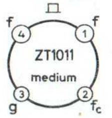
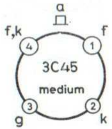


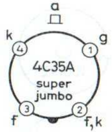
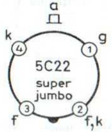
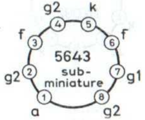
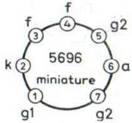
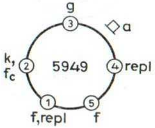




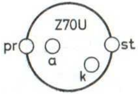
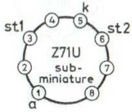
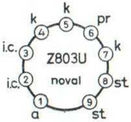
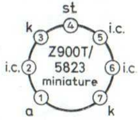
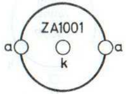


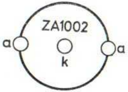
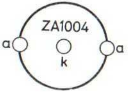
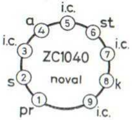
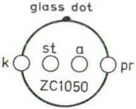
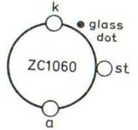
GAS-FILLED TUBES - Thyratrons

Type	V_f (V) I_f (A)	T_w (s)	Typical characteristics	Limiting values		Max. dimensions diam.	Max. dimensions length	Base connections
PL6574 Tetrode	6.3 0.95	> 15	$V_{arc} = 10$ V $V_a/V_{g1} = 275$ $V_a/V_{g2} = 370$	$V_{ap} = 650$ V $V_{ainvp} = 1.3$ kV $I_k = 0.3$ A	$I_{kp} = 2$ A $t_{amb} = -75\,°C$ $+90\,°C$	33	70	
PL6755A Triode	2.5 11	> 30	$V_{arc} = 12$ V $T_{ion} = 10\ \mu s$ $T_{dion} = 500\ \mu s$	$V_{ap} = 2$ kV $V_{ainvp} = 2$ kV $I_k = 3.6$ A	$I_{kp} = 40$ A $t_{amb} = 0–55\,°C$	59	228	
ZT1011 Triode	2.5 8.5	> 10	$V_{arc} = 10$ V $T_{dion} = 200–300\ \mu s$ $I_g = < 20\ \mu A$	$V_{ap} = 1.5$ kV $V_{ainvp} = 1.5$ kV $I_k = 2.5$ A	$I_{kp} = 30$ A $t_{amb} = -55\,°C$ $+75\,°C$	40	120	
3C45 Hydrogen triode	6.3 2.25	> 120	Oper. factor $V_{ap} \cdot I_{ap} \cdot f_{imp} =$ max. 0.3×10^9 VAHz	$V_{ap} = 3$ kV $V_{ainvp} = 3$ kV $I_a = 45$ mA	$I_{ap} = 35$ A $t_{amb} = -50\,°C$ $+90\,°C$	40	132	

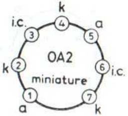
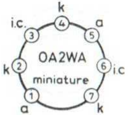
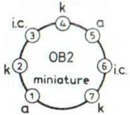
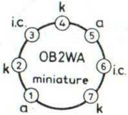
4C35A Hydrogen triode	6.3 6.1	>180	Oper. factor $V_{ap} \cdot I_{ap} \cdot f_{\mathrm{imp}} =$ max. 2×10^9 VAHz	$V_{ap} = 8$ kV $V_{ainvp} = 8$ kV $I_a = 100$ mA	$I_{ap} = 90$ A $t_{\mathrm{amb}} = -50\,^\circ\mathrm{C}$, $+90\,^\circ\mathrm{C}$	65	174	
5C22 Hydrogen triode	6.3 10.6	>300	Oper. factor = $V_{ap} \cdot I_{ap} \cdot f_{\mathrm{imp}} =$ max. 3.2×10^9 VAHz	$V_{ap} = 16$ kV $V_{ainvp} = 16$ kV $I_a = 200$ mA	$I_{ap} = 325$ A $t_{\mathrm{amb}} = -50\,^\circ\mathrm{C}$, $+90\,^\circ\mathrm{C}$	65	222	
5643 Tetrode	6.3 0.15	10	$V_{\mathrm{arc}} = 10$ V $I_a = 20$ mA	$V_{ap} = 500$ V $V_{ainvp} = 500$ V $I_k = 22$ mA	$I_{kp} = 100$ mA $t_{\mathrm{amb}} = -55\,^\circ\mathrm{C}$, $+100\,^\circ\mathrm{C}$	10.16	34.9	
5696 Tetrode	6.3 0.15	10	$V_{\mathrm{arc}} = 10$ V $T_{\mathrm{dion}} = 40$ μs	$V_{ap} = 500$ V $V_{ainvp} = 500$ V $I_k = 25$ mA	$I_{kp} = 100$ mA $t_{\mathrm{amb}} = -55\,^\circ\mathrm{C}$, $+90\,^\circ\mathrm{C}$	19	44.5	
5949 Hydrogen triode	6.3 18.5	>900	Oper. factor $V_{ap} \cdot I_{ap} \cdot f_{\mathrm{imp}} =$ max. 6.25×10^9 VAHz	$V_{ap} = 25$ kV $V_{ainvp} = 25$ kV $I_a = 0.5$ A	$I_{ap} = 500$ A $t_{\mathrm{amb}} = -55\,^\circ\mathrm{C}$, $+75\,^\circ\mathrm{C}$	84	317	

GAS-FILLED TUBES - Trigger tubes and switching diodes

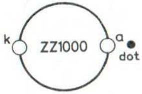
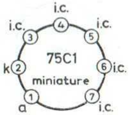
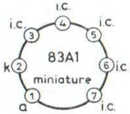
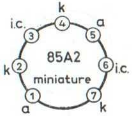
Type	*Characteristics*		*Limiting values*	*Max. dimensions*		*Base connections*
				diam.	*length*	
Z70U Trigger tube	$V_{ba} = 250$ V $V_m = 116$ V $I_k = 5$ mA	$V_{st\,ign} = 145$ V $C_{st} =$ min. 100 pF	$V_{ba} = 310$ V $I_{kp} = 200$ mA $t_{bulb} = \begin{matrix}-55\,°\mathrm{C}\\ +100\,°\mathrm{C}\end{matrix}$	10.16	23.5	
Z71U Trigger tube	$V_{ba} = 150$ V $V_m = 60$ V $I_k = 7$ mA	$V_{st\,ign} = 80$ V $I_{st} = 40\ \mu$A	$V_{ba} = 170$ V $I_{kp} = 12$ mA $t_{bulb} = \begin{matrix}-50\,°\mathrm{C}\\ +70\,°\mathrm{C}\end{matrix}$	10.16	45	
Z803U Trigger tube	$V_{ba} = 240$ V $V_m = 105$ V $I_k = 40$ mA	$V_{st\,ign} = 132$ V $C_{st} = 500$ pF $I_{st} = 45\ \mu$A	$V_{ba} = 290$ V $I_{kp} = 200$ mA $V_{a\,st} = 290$ V $-V_{a\,st} = 140$ V	22	45	
Z900T/ **5823** Trigger tube	$V_{ba} = 117\ \mathrm{V_{a.c.}}$ $175\ \mathrm{V_{d.c.}}$ $V_m = 62$ V $I_k = 15$ mA	$V_{st\,ign} \neq 80$ V $C_{st} =$ min. 400 pF	$V_{ba} = 200$ V $I_{kp} = 150$ mA	19	54	
ZA1001 Switching diode	$V_{ign} = 128$ V $V_m = 93$ V	$I_k = 1.5$ mA $r_{ins} =$ min. 300 MΩ	$-V_{ap} = 100$ V $t_{bulb} = \begin{matrix}-55\,°\mathrm{C}\\ +70\,°\mathrm{C}\end{matrix}$	6.5	25	

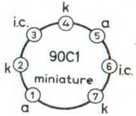
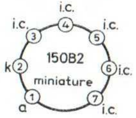
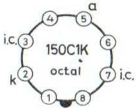
ZA1002 Switching and light diode	$V_{\text{ign}} = 170$ V $V_{\text{m}} = 109$ V	$I_k = 3.5$ mA $r_{\text{ins}} =$ min. 300 MΩ	$-V_{ap} = 200$ V $I_{kp} = 50$ mA $t_{\text{bulb}} = \frac{-55\,^\circ\text{C}}{+70\,^\circ\text{C}}$	6.5	25	
ZA1004 Indicator diode	$V_{\text{ign}} = 90$ V $V_{\text{ext}} =$ min. 83.5 V $I_k = 1$ mA	$E = 60$ lux $r_{\text{ins}} =$ min. 300 MΩ	$-V_{ap} = 70$ V $I_{kp} = 3$ mA $t_{\text{bulb}} = \frac{-55\,^\circ\text{C}}{+70\,^\circ\text{C}}$	6.5	25	
ZC1040 Trigger tube	$V_{ba} = 220$ V$_{\text{a.c.}}$ 300 V$_{\text{d.c.}}$ $V_{\text{m}} = 112$ V	$V_{st\,\text{ign}} = 130$ V $C_{st} =$ min. 200 pF $I_{st} = 200$ μA	$V_a = 250$ V$_{\text{a.c.}}$ $I_k = 40$ mA $I_{kp} = 200$ mA $t_{\text{bulb}} = \frac{-55\,^\circ\text{C}}{+75\,^\circ\text{C}}$	22	55.6	
ZC1050 Trigger tube	$V_{ba} = 300$ V $V_m = 136$ V $I_k = 2$ mA	$V_{st\text{ign}} = 180$ V $C_{st} =$ min. 1 nF	$-V_a = 100$ V $-V_{st} = 100$ V $I_{kp} = 10$ mA t_{bulb} -55°C $+70^\circ$C	6 5	31	
ZC1060 Trigger tube	$V_a = <800$ V >100 V	$I_k = <20$ mA $r_{\text{ins}} = >300$ MΩ	$I_{kp} = 5000$ A $t_{\text{bulb}} = \frac{-55^\circ\text{C}}{+125^\circ\text{C}}$	13	31	

GAS-FILLED TUBES - Stabilizing and reference tubes

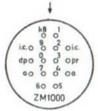
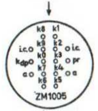
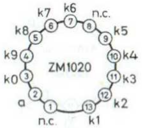
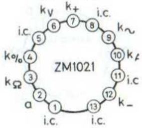
Type	*Characteristics and range values*	*Limiting values*	*Max. dimensions*		*Base connections*
			diam.	*length*	
OA2 Voltage stabilizing tube	$V_{\text{ign}} = \text{max. } 180\text{ V}$ $V_{\text{m}}\ (I_k = 5\text{–}30\text{ mA}) = 144\text{–}160\text{ V}$ $V_r = \text{max. } 6\text{ V}$ $r_a\ (I_k = 20\text{ mA}) = 80\ \Omega$ $t_{\text{amb}} = 25\,^\circ\text{C}$	$I_{kp} = 75\text{ mA}$ $-V_{ap} = 125\text{ V}$ $t_{\text{amb}} = \begin{matrix} -55\,^\circ\text{C} \\ +90\,^\circ\text{C} \end{matrix}$	19	66.7	
OA2WA Voltage Stabilizing tube	$V_{\text{ign}} = \text{max. } 165\text{ V}$ $V_{\text{m}}\ (I_k = 5\text{–}30\text{ mA}) = 144\text{–}153\text{ V}$ $V_r\ (I_k = 5\text{–}30\text{ mA}) = \text{max. } 5\text{ V}$ $r_a\ (I_k = 20\text{ mA}) = 80\ \Omega$ $t_{\text{amb}} = 25\,^\circ\text{C}$	$I_{kp} = 75\text{ mA}$ $-V_{ap} = 125\text{ V}$ $t_{\text{amb}} = -\ 55\,^\circ\text{C}$ $t_{\text{bulb}} = +150\,^\circ\text{C}$	19	66.7	
OB2 Voltage stabilizing tube	$V_{\text{ign}} = \text{max. } 127\text{ V}$ $V_{\text{m}}\ (I_k = 17.5\text{ mA}) = 106\text{–}111\text{ V}$ $V_r\ (I_k = 5\text{–}30\text{ mA}) = \text{max. } 3.5\text{ V}$ $r_a\ (I_k = 20\text{ mA}) = 80\ \Omega$ $t_{\text{amb}} = 25\,^\circ\text{C}$	$I_{kp} = 75\text{ mA}$ $-V_{ap} = 75\text{ V}$ $t_{\text{amb}} = \begin{matrix} -55\,^\circ\text{C} \\ +90\,^\circ\text{C} \end{matrix}$	19	66.7	
OB2WA Voltage stabilizing tube	$V_{\text{ign}} = \text{max. } 130\text{ V}$ $V_{\text{m}}\ (I_k = 5\text{–}30\text{ mA}) = 105\text{–}111\text{ V}$ $V_r\ (I_k = 5\text{–}30\text{ mA}) = \text{max. } 2.5\text{ V}$ $r_a\ (I_k = 20\text{ mA}) = 80\ \Omega$ $t_{\text{amb}} = 25\,^\circ\text{C}$	$I_{kp} = 75\text{ mA}$ $-V_{ap} = 75\text{ V}$ $t_{\text{amb}} = \text{min. } 55\,^\circ\text{C}$ $t_{\text{bulb}} = \text{max. } 150\,^\circ\text{C}$	19	66.7	

GAS-FILLED TUBES - Stabilizing and reference tubes

Type	*Characteristics and range values*	*Limiting values*	*Max. dimensions*		*Base connections*
			diam.	*length*	
ZZ1000 Voltage reference tube	$V_{\text{ign}} = \text{max. } 115\text{ V}$ $V_{\text{m}}\ (I_k = 3.2\text{ mA}) = 80.1\text{–}82.5\text{ V}$ $r_a = 200\ \Omega$	$I_{kp} = 20\text{ mA}$ $-V_{ap} = 100\text{ V}$ $t_{\text{bulb}} = \begin{matrix}-55\,^\circ\text{C}\\ +125\,^\circ\text{C}\end{matrix}$	6.5	30	
75C1 Voltage stabilizing tube	$V_{\text{ign}} = \text{max. } 115\text{ V}$ $V_{\text{m}}\ (I_k = 30\text{ mA}) = 75\text{–}81\text{ V}$ $V_r\ (I_k = 2\text{–}60\text{ mA}) = \text{max. } 8\text{ V}$ $r_a = 130\ \Omega$	$I_{kp} = 100\text{ mA}$ $-V_{ap} = 50\text{ V}$ $t_{\text{bulb}} = \begin{matrix}-55\,^\circ\text{C}\\ +140\,^\circ\text{C}\end{matrix}$	19	54.5	
83A1 Voltage reference tube	$V_{\text{ign}} = \text{max. } 120\text{ V}$ $V_{\text{m}}\ (I_k = 4.5\text{ mA}) = 83\text{–}84.5\text{ V}$ $r_a = 250\ \Omega$	$I_{kp} = 10\text{ mA}$ $-V_{ap} = 50\text{ V}$ $t_{\text{bulb}} = \begin{matrix}-55\,^\circ\text{C}\\ +150\,^\circ\text{C}\end{matrix}$	19	54	
85A2 Voltage reference tube	$V_{\text{ign}} = \text{max. } 115\text{ V}$ $V_{\text{m}}\ (I_k = 5.5\text{ mA}) = 83\text{–}87\text{ V}$ $r_a = 300\ \Omega$	$I_{kp} = 40\text{ mA}$ $-V_{ap} = 75\text{ V}$ $t_{\text{bulb}} = \begin{matrix}-55\,^\circ\text{C}\\ +90\,^\circ\text{C}\end{matrix}$	19	54	

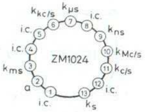
90C1 Voltage stabilizing tube	V_{ign} = max. 115 V V_m (I_k = 20 mA) = 86–94 V V_r (I_k = 1–40 mA) max. 14 V r_a (I_k = 20 mA) = 300 Ω	I_{kp} = 100 mA $-V_{ap}$ = 75 V $t_{bulb} = \begin{matrix} -55°C \\ +110°C \end{matrix}$	19	54	
150B2 Voltage stabilizing tube	V_{ign} = max. 180 V V_m (I_k = 10 mA) = 146–154 V V_r (I_k = 5–15 mA) = max. 5 V r_a (I_k = 10 mA) = 350 Ω	I_{kp} = 40 mA $-V_{ap}$ = 130 V $t_{bulb} = \begin{matrix} -55°C \\ +110°C \end{matrix}$	19	54	
150C1K Voltage stabilizing tube	V_{ign} = max. 205 V V_m (I_k = 20 mA) = 144–164 V V_r (I_k = 5–40 mA) = max. 8 V	I_{kp} = 75 mA	43	114	

GAS-FILLED TUBES - Indicating tubes

Type		*Characteristics*	*Limiting values*	*Base connections*
ZM1000 **ZM1000R** 1)	Numerals 0–9 Numeral height 14 mm Side viewing	V_{ign} = max. 170 V V_m = 140 V I_a = min. 1.5 mA I_a ≈ max. 4.5 mA V_{ext} = min. 118 V	I_{ap} = 12 mA t_{amb} = −50°C +70°C	
ZM1001 **ZM1001R** 1)	Characters +, −, ~, x, y, z Character height 10–14 mm	For further data see ZM1000		
ZM1005 **ZM1005R** 1)	Numerals 0–9 Numeral height 14 mm Side viewing	V_{ign} = max. 170 V V_m = 140 V I_a = max. 2.5 mA $V_{ext.}$ = min. 118 V	I_{ap} = 20 mA t_{amb} = −50°C +70°C	
ZM10201)	Numerals 0–9 Numeral height 15.5 mm Top viewing	V_{ign} = max. 170 V V_m = 140 V I_a min. = 1 mA I_a max. = 3 mA $V_{ext.}$ = min. 118 V	I_{ap} = 10 mA t_{amb} = −50°C +70°C	
ZM1021	Characters A, V, Ω, %, ~, +, −.	For further data see ZM1020		
ZM1022	The ZM1022 is electrically identical with type ZM1020 but has no filter coating			
ZM1023	The ZM1023 is electrically identical with type ZM1021 but has no filter coating			

ZM1024

Characters c/s, Kc/s, Mc/s, μs, ms, ns, s
For further data see ZM1020



ZM1025

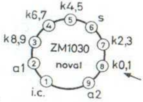
The ZM1025 is electrically identical with type
ZM1024 but has no filter coating

ZM1030[1]

Numerals 0–9
Numeral height 15.5 mm
Side viewing

V_{ign} = max. 170 V
V_m = 140 V
I_a min. 3 mA
I_a max. 5 mA
$V_{ext.}$ = min. 110 V

I_{ap} = 12 mA
$t_{bulb} = \begin{matrix} -55^\circ\text{C} \\ +70^\circ\text{C} \end{matrix}$

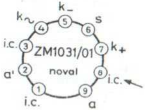


ZM1031/01[1]

Signs +, −, ∼.
Sign height 15 mm
Side viewing

V_{ign} = max. 170 V
V_m = 140 V
I_a = min. 2 mA
I_a = max. 4 mA
r_a = 4.5 kΩ

I_{ap} = 10 mA
$t_{bulb} = \begin{matrix} -55^\circ\text{C} \\ +70^\circ\text{C} \end{matrix}$



ZM1032

Signs 0–9
The ZM1032 is electrically identical with type
ZM1030 but has no filter coating

ZM1033/01

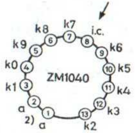
The ZM1033/01 is electrically identical with type
ZM1031/01 but has no filter coating

ZM1040[1]

Numerals 0–9
Numeral height 30 mm
Side viewing

V_{ign} = max. 170 V
V_m = 140 V
I_k = min. 3 mA
I_k = max. 6 mA
$V_{ext.}$ = min. 120 V

I_{kp} = 20 mA
$t_{bulb} = \begin{matrix} 0^\circ\text{C} \\ +70^\circ\text{C} \end{matrix}$



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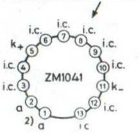
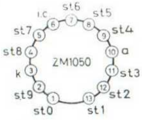
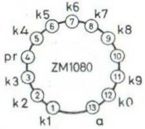
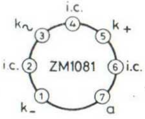
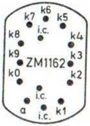
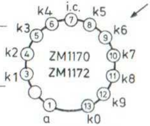
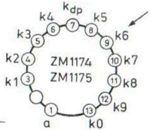
[1] Provided with a red contrast filter. [2] Pins 1 and 2 to be interconnected externally.

Type		*Characteristics*	*Limiting values*	*Base connections*
ZM1041[1])	Signs +, −. Sign height 20 mm Side viewing	V_{ign} = max. 170 V V_{m} = 140 V I_k = min. 3 mA I_k = max. 6 mA $V_{\text{ext.}}$ = min. 120 V	I_{kp} = 20 mA t_{bulb} = −50°C +70°C	
ZM1042	The ZM1042 is electrically identical with type ZM1040 but has no filter coating			
ZM1043	The ZM1043 is electrically identical with type ZM1041 but has no filter coating			
ZM1050	Numerals 0–9 Numeral height 3 mm Top viewing	V_{tr} = 110 V_{rms} R_k = 10 kΩ R_{st} = 330 kΩ C_k = 33 nF I_{st} = 50 μA V_{m} = 84 V I_k = 3 mA	V_{tr} = 150 V_{rms} I_k = 4 mA R_{st} = min. 0.1 MΩ max. 0.47 MΩ t_{bulb} = −55°C +70°C	
ZM1080[1])	Numerals 0–9 Numeral height 13 mm Side viewing	V_b = min. 170 V V_{m} = 140 V I_k = min. 1.5 mA I_k = max. 3.5 mA	I_{kp} = 12 mA t_{bulb} = −50°C +70°C	
ZM1081[1])	Characters −, +, ~. Character height 10.5 mm Side viewing	V_b = min. 170 V V_{m} = 140 V I_k = min. 1.5 mA I_k = max. 3.5 mA	I_{kp} = 12 mA t_{bulb} = −50°C +70°C	

ZM1082	The ZM1082 is electrically identical with type ZM1080 but has no filter coating			
ZM1083	The ZM1083 is electrically identical with type ZM1081 but has no filter coating			
ZM1162	Numerals 0–9 Numeral height 15.5 mm Topviewing	$V_{ign} = $ min. 170 V $V_m = 150–170$ V $I_k = 2.5$ mA	$I_{kp} = 3.5$ mA $t_{bulb} = \begin{matrix} -10°C \\ +70°C \end{matrix}$	
ZM1170	Numerals 0–9 Numeral height 15.5 mm Side viewing	$V_{ign} = $ min. 170 V $V_m = 135–160$ V $I_k = 2.5$ mA	$I_{kp} = 12$ mA $t_{bulb} = \begin{matrix} -50°C \\ +70°C \end{matrix}$	
ZM1172	The ZM1172 is electrically identical with type ZM1170 but has no filter coating			
ZM1174 to **ZM1177**	Numerals 0–9 Numeral height 15,5 mm Side viewing	$V_{ign} = $ max. 170 V $V_m = 135–160$ V $I_k = 2.5$ mA	$I_{kp} = 12$ mA $t_{bulb} = \begin{matrix} -50°C \\ +70°C \end{matrix}$	
ZM1174 **ZM1175** **ZM1176** **ZM1177**	Decimal point on the left hand side. Red contrast filter Decimal point on the left hand side. No filter Decimal point on the right hand side. Red contrast filter Decimal point on the right hand side. No filter			

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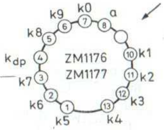
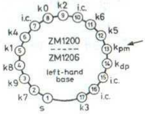
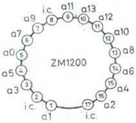
[1] Provided with a red contrast filter. [2] Pins 1 and 2 to be interconnected externally.

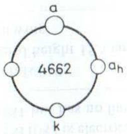
GAS-FILLED TUBES - Indicating tubes

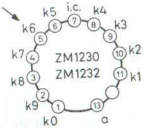
Type		*Characteristics*	*Limiting values*	*Base connections*
ZM1200 pandicon	Numerals 0–9 Numeral height 10 mm Side viewing	$V_{\mathrm{ign}} = \text{max. } 170\ \mathrm{V}$ $V_{\mathrm{m}} = 160\ \mathrm{V}$	$I_{ap} = 12\ \mathrm{mA}$ $t_{\mathrm{amb}} = \begin{matrix} -50^\circ\mathrm{C} \\ +70^\circ\mathrm{C} \end{matrix}$	
ZM1202 **ZM1204** **ZM1206** pandicon	Numerals 0–9 Numeral height 10 mm Side viewing	$V_{\mathrm{ign}} = \text{max. } 170\ \mathrm{V}$ $V_{\mathrm{m}} = 160\ \mathrm{V}$	$I_{a\_} = 12\ \mathrm{mA}$ $t_{\mathrm{amb}} = \begin{matrix} -50^\circ\mathrm{C} \\ +70^\circ\mathrm{C} \end{matrix}$	
ZM1230 **ZM1232**	Numerals 0–9 Numeral height 15,5 mm Side viewing	$V_{\mathrm{ign}} = \text{min. } 170\ \mathrm{V}$ $V_{\mathrm{m}} = 135\text{–}160\ \mathrm{V}$ $I_k = 2.5\ \mathrm{mA}$	$I_{kp} = 12\ \mathrm{mA}$ $t_{\mathrm{bulb}} = \begin{matrix} -50^\circ\mathrm{C} \\ +70^\circ\mathrm{C} \end{matrix}$	
4662	Neon light bar Side viewing	$V_{\mathrm{ign}} = 165\text{–}190\ \mathrm{V}$ $I_{ah} = 40\text{–}50\ \mu\mathrm{A}$ $V_{\mathrm{m}} = 150\text{–}170\ \mathrm{V}$	$I_a = 2\ \mathrm{mA}$	

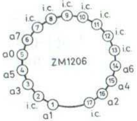


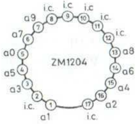


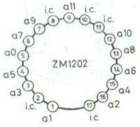




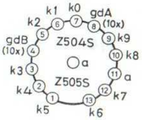








GAS-FILLED TUBES - Counter and selector tubes

Type	*Characteristics and operating conditions*		*Base connections*
Z504S Counter and selector tube	Max. counting speed = 5 kHz Supply voltage = 475 V Output current = 340 μA Output voltage = 35 V	Anode supply voltage = 375–1000 V Time constant rise of anode supply voltage when switching on $V_{ba} < 550$ V = 1.0 ms $V_{ba} > 550$ V = 6.0 ms	
Z505S Selector tube	Max. counting speed = 50 kHz Supply voltage = 500 V Output current = 800 μA Output voltage = 24 V	Anode supply voltage = 400–1000 V Time constant rise of anode supply voltage min. 2 ms	

GAS-FILLED TUBES - Ignitrons

Type	*Ignitor characteristics*		*Single phase A.C. control (2 tubes in inverse parallel connection)*					*Water flow*	*Max. dimensions*	
	$V_{\text{ign.}}$ *(V)*	$I_{\text{ign.}}$ *(A)*	V_{main} *($V_{\text{a.c.}}$)*	T_{av} *(max.) (s)*	*P(max.) (kVA)*	I_{av} *(max.) (A)*	δ *(%)*	*q (l/min)*	*diam.*	*length*
PL5555	< 200	15	2400	1.66	2400	135		min. 9	146	570
f=25–60 Hz										
ZX1051	150	6–8	250	18.0	600	30.2	2.8	min. 2	70	600
f=25–60 Hz		< 12	380	11.8	600	30.2	4.2			
			600	7.5	600	30.2	6.7			
ZX1052	150	6–8	250	14.0	1200	75.6	3.5	min. 5	104	600
f=25–60 Hz		< 12	380	9.4	1200	75.6	5.3			
			600	5.8	1200	75.6	8.4			
ZX1053	180 V	6–8	250	11.0	2400	192	4.4	min. 9	146	695
f=25–60 Hz		< 12	380	7.3	2400	192	6.8			min.
			600	4.6	2400	192	10.6			
ZX1060	150	6–8	250	18.0	630	21	1.9	min. 3	70	196
f=25–60 Hz		< 12	380	11.8	850	21	2.1			
			600	8.0	1200	21	2.3			
ZX1061	150	6–8	250	24.0	630	38	3.3	min. 3	70	634
f=25–60 Hz		< 12	380	15.8	850	38	3.8			
			600	10.0	1200	38	4.2			

ZX1062	150	6–8	250	21.0	1250	110	4.9	min. 6	104	600
f=25–60 Hz		< 12	380	13.8	1650	110	5.6			
			600	8.7	2300	110	6.4			
ZX1063	180	6–8	250	12.5	2500	210	4.7	min. 9	146	695
f=25–60 Hz		< 12	380	8.4	2750	210	6.5			(min.)
			600	5.3	3225	210	8.7			

NUCLEAR DEVICES - Radiation counter tubes

Type	*Description*	*Radiation sensitivity*	*Wall thickness* (*mg/cm^2*)	*Anode resistor* (*MΩ*)	*Plateau Operating voltage* (*V*)	*Max. plateau slope* (*%/V*)	*Max. dead time* (*μs*)	*Max. backgr. (shielded)* (*counts/min.*)	*Eff. length Window diam.* (*mm*)	*Max. dimensions*	
										diam. (*mm*)	*length* (*mm*)
ZP1080	Dip counter	β,γ	30	3.9	450–600	0.15	60	50	70	20	175
ZP1081	Pour-in counter								66	56	147
ZP1082	Pour-in counter								66	28	147
ZP1083	Dip counter								70	35	145
ZP1100	Cylinder counter with a filter	γ	80–100	2.2	500–650	0.15	15	2	16	10	37
18503	Cylinder counter	γ	250	10	400–600	0.03	90	10	40	17	55
18504	Mica window counters	β,γ	2.0–3.0^{1})	10	400–600	0.03	90	10	9∅	17	55
18505		α,β,γ	1.5–2.0^{1})	10	450–700	0.02	175	15	19.8∅	26	57
18506		β,γ	2.5–3.5^{1})	10	450–700	0.035	190	25	27.8∅	34	57
18507	End window counter	X-ray	2.5–3.5^{1})	4.7	1600–2000	0.04	110	25	107	26	127

18509	High flux counter	β,γ	80–100	2.2	500–650	0.15	15	2	16	6.2	37
18511	Side window counter	X-ray	2.0–2.5 [1]		1500–1850				67	27	128
18515 **18516**	Low level mica window counters	α,β β	1.5–2.0 [1] 10 [1]	4.7 10	500–700 500–750	0.09 0.03	65 70	5 9	19.8⌀ 27.8⌀	26 34	30 34
18517	Guard counter for 18515		1 mm	10	800–1200	0.03	1000	75		80	90
18518	Guard counter for 18515 or 18536							70			
18520 **18522**	Cylinder counters	γ	0.7 mm 0.5 mm	2.7 10	375–475 600–1000	0.15 0.03	220 550	40 160	140 400	23.6 42	170 480
18526	End window counter	α,β,γ	1.5–2.0 [1]	10	450–700	0.035	190	25	27.8⌀	34	57
18527	End window counter	α,β,γ	1.5–2.0 [1]	10	450–700	0.035	190	25	37	35	86
18529	High flux counter	β,γ	80–100	2.2	500–600	0.3	11	1	8	6.2	25
18536	Low level mica window counter	α,β	1.5–2.0 [1]	10	500–750	0.07	60	9	27.8⌀	34	34
18545	Cylinder counter	γ	525	2.7	380–480	0.1	200	75	240	23.6	270

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[1] Window thickness.

NUCLEAR DEVICES - Radiation counter tubes

Type	*Description*	*Radiation sensitivity*	*Wall thickness* *(mg/cm²)*	*Anode resistor* *(MΩ)*	*Plateau Operating voltage* *(V)*	*Max. plateau slope* *(%/V)*	*Max. dead time* *(μs)*	*Max. backgr. (shielded)* *(counts/min)*	*Eff. length Window diam.* *(mm)*	*Max. dimensions*	
										diam. *(mm)*	*length* *(mm)*
18546	End window counter	β	3.5–4.0 1)	4.7	700–1100	0.04	45	30	51∅	58	45
18550	Thin wall cylinder counters	β,γ	32–40	4.7	500–650	0.08	45	12	28	10	52
18552			40–60	2.2	450–800	0.02	70	30	75	19	142
18553			40–60	2.2	450–800	0.02	100	60	185	19	290
18555			40–60	2.2	450–800	0.02	70	30	75	19	142

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1) Window thickness.

NUCLEAR DEVICES - Scintillators

Type	*Applications*	*Charactersitics*				
SAM series	Zn S-scintillator for α and $\alpha+\beta$ radiation detection	Time constant of fluorescence	0.1–1 μs			
		Wave length of a max. emission	450 nm			
		Max. amb. temperature	40°C			
		Detection efficiency min.	47.5%			
		av.	55.0%			
SIS series	NaI (TI) crystal scintillator for γ and X-rays detection and spectrometry	Time constant of fluorescence	$0.25 \cdot 10^{-6}$ s			
		Time constant of phosphorescence	$2.5 \cdot 10^{-3}$ s			
		Wavelength of max. emission	425 nm			
		Density	3.67			
		Refractive index	1.77			
		Max. temperature gradient	10°C min^{-1}			
SPF **SPP** **SPT**	Fluorescent plastic scintillator for α, β, γ, protrons, fast neutrons and cosmic rays detection		SPF	SPP	SPT	
		Decay constant with ^{60}Co source	3.6±0.06	2.14±0.06	2.10±0.06	ns
		Relative light output (compared with SPF32/25 and a ^{239}Pu source)	1	1.30	1.22	
		Wavelength of maximum emission	440	425	425	nm
		Density	1.05	1.02	1.04	
		Refractive index	1.594	1.585	1.592	
		Ratio no. of H-atoms to no. of C-atoms	0.998	1.103	1.036	
		Softening point	85	75	80	°C
		Spectrum width at half max.	80	50	50	nm
SPH series	Plastic hornyak scintillator for fast neutrons measurement in nuclear reactors	Time constant of fluorescence	0.1–1 μs			
		Wavelength of max. emission	450 nm			
		Softening point	80–85°C			
		Response to fast neutrons	1.5%			
		Ratio no. of H-atoms to no. of C-taoms	≈1.0			

Photoscintillators for X-ray spectrometry and medical applications

These types comprise a photomultiplier and a thin NaI (Tl) scintillator (with the exception of type PS 1014 SF) as well as a mu-metal screen.
The voltage divider is incorporated (with the exception of types PS1010 and PS5302)
The envelope of the photoscintillator is made of stainless steel.
The scintillators have a Be window or an Al window (thickness 0.2 mm).

Type	*Photomultiplier tube type:*	*Scintillator*	*Max. dimensions*	
			diam.	*overall length*
PS1010	XP1010	SIS 32 × 2	48	131
PS1011	XP1010	SIS 32 × 2	46	181
PS1012	XP1010	SIS 32 × 2	46	192
PS1013	XP1010	SIS 32 × 6	48	167
PS1014	As type PS1013 but with a construction, which makes it possible to mount a collimator.			
PS1014SF	As type PS1013 but with accommodation for an interchangeable NaI (Tl) scintillator. These scintillators (to be ordered separately) are delivered in an adapted mount, which can be screwed into the probe. The max. diameter of the scintillator is 25 mm, the thickness depends on the application.			
PS5302	53AVP/02	SIS 44 × 2	63.2	157

Basic miniature probes for nuclear and photometric applications

These types comprise a photomultiplier, a voltage divider and a mu-metal screen.
They have accommodation to mount easily an alpha-, beta-, gamma- or fast neutron scintillator (to be ordered separately).
The envelope of the probe is made of stainless steel.

Type	*Photomultiplier Type:*	*Max. dimensions*	
		diam.	*overal length*
PS1520	XP1110/01	24.3	165
PS1521	XP1110	24.3	165

Photoscintillator for gamma-ray detection and -counting in liquids

This watertight type comprises a photomultiplier, a NaI (Tl) scintillator and a pre-amplifier as well as a mu-metal screen. The voltage divider is incorporated.

The envelope of the photoscintillator is made of stainless steel and provided with a flange for easy mounting. The stainless steel window of the scintillator has a thickness of 0.5 mm.

Type	*Photomultiplier tube Type:*	*Scintillator*	*Max. dimensions*	
			diam.	*overall length*
PS1531	53AVP	SIS 44 × 50	130	303

Basic miniature probes for nuclear applications

These types comprise a photomultiplier, a voltage divider and a mu-metal screen.

They have accommodation to mount easily a plastic scintillator coupled with a light guide (both to be ordered separately).

The envelope of the probe is made of soft iron and aluminium.

Type	*Photomultiplier tube Type:*	*Max. dimenstions*	
		diam.	*overall length*
PS2010/50	12 stage version of type XP1115	34	230
PS2010/100	As type P2010/50 but with a 100 Ω output connection instead of 50 Ω	34	230

Rectangular photoscintillators for nuclear applications

These types comprise a photomultiplier and a SPABM or SPF scintillator as well as a mu-metal screen.
The voltage divider is incorporated.
The envelope of the photoscintillator is made of aluminium.
These types are insensitive to light.

Type	*Photomultiplier tube Type:*	*Scintillator*	*Max. dimensions*		
			height	*width*	*overall length*
PS5400	54AVP	SPABM 139 × 209	237.2	165.5	382
PS5410	54AVP	SPF 139 × 209	237.2	165.5	382

Photoscintillators for gamma-ray spectrometry

These types comprise a photomultiplier and a NaI (Tl) scintillator (with or without well) as well as a mu-metal screen.
The voltage divider is not incorporated.
The envelope of the photoscintillator is made of aluminium.
The aluminium window of the scintillator has a thickness of 0.5 mm.

Type	*Photomultiplier tube type:*	*Scintillator*	*Resolution for* 137_{Cs}*: 661 keV*	*Max. dimensions*	
				diam.	*overal length*
XP1050	153AVP	SIS 44 × 50	$\leqslant 9\%$	63	207
XP1051	153AVP	SIS 44 × 50	$\leqslant 10\%$	63	207
XP1052	XP1001	SIS 44 × 50	$\leqslant 8\%$	63	205
XP1053	XP1001	SIS 44 × 50	$\leqslant 10\%$	63	205
XP1190	XP1031	SIS 75 × 63	$\leqslant 9\%$	82.5	230
XP1191	XP1031	SIS 75 × 75	$\leqslant 8.5\%$	82.5	242
XP1192	XP1031	SIS 75 × 75	$\leqslant 11\%$	82.5	242
XP1193	XP1031	SIS 75 × 50	$\leqslant 9.5\%$	82.5	216
XP1200	150AVP (selected)	SIS 38 × 25	$\leqslant 9\%$	46.2	156

Universal photoscintillator base assembly

This type is essentially a probe-like mechanical system with provisions for mounting a photomultiplier tube, a voltage divider, a limiter and a scintillator or lightguide.

The necessary wiring is already present as well as printed wiring boards carrying the limiter and voltage divider.

The photomultiplier, scintillator lightguide or fastening clip must be ordered separately.

S5600:	HT supply of the photomultiplier	max. 2500 V
	HT supply current	max. 1.20 mA/kV
	Limiter supply voltage	24 V
	Limiter supply current	35 mA

The following versions are available:

S5600/01: Complete assembly with:

- mu-metal and soft-iron shields
- fastening rings for lightguide or scintillator
- socket for the photomultiplier
- decoupling capacitors for the photomultiplier
- 2 printed circuit boards carrying the voltage divider
- 1 printed circuit board carrying the limiter.

This assembly is intended for use with a photomultiplier type 56 AVP, 56 DVP, 56 DUVP, 56 TVP, 56 TUVP or 56 UVP.

S5600/02: As type S5600/01 but for use with a photomultiplier type 56 CVP.

S5600/03: As type S5600/01 but for use with a photomultiplier type 58 AVP, 58 DVP, 58 UVP, XP1040 or XP1041.

Pulsed-light source

Intended for use in applications where a very short light pulse is needed e.g., time response measurements of photoelectric devices. It comprises a pulsed-light unit with monitor diode, and a power and pulse supply unit.

SL109:	Light pulse rise time	max. 0.5 ns
	Light pulse width at half height	max. 0.9 ns
	Pulse repetition frequency	0–150 p.p.s.
	Coaxial outlets, synchronization and monitor signals	50 Ω

NUCLEAR DEVICES - Neutron generator tubes

Type	*Typical operating*				*Max. dimensions*	
					diam.	*length*
18600R	$V_{\text{ion-source}} = 2$ kV d.c.		$V_{\text{target}} = -125$ kV d.c.		70	726
	$I_{\text{ion-source}} = 0.3$ mA d.c.		$I_{\text{target}} = 100$ μA d.c.			
	$V_{\text{replenisher}} = 1.5$ V		Neutron yield min. 10^8 n/s			
	$I_{\text{replenisher}} = 3.5$ A					
			(continuous)	(pulsed)		
18601	Neutron yield		$2\cdot10^8$	$2\cdot10^{11}$ n/s	70	762
	Pulse duration		—	5–1000 μs		
	Target voltage		-125	-125 kV		
	Target current		100	mean 100 μA		
	Ion source supply voltage		2	1.6 kV		
	Ion source current		10^{-4}	peak 1 A		
	Pressure regulator		3	4.2 A		
	Gas pressure		$3\cdot10^{-5}$	$8\cdot10^{-3}$ torr		
	Ambient temperature		25	25 °C		
18602	Neutron yield	$3\cdot10^{10}$ n/s	$V_{\text{suppressor}}$	-500 V	150	650
	$V_{\text{accelerating}}$	150 kV	$I_{\text{suppressor}}$	160 μA		
	I_{target}	1.5 mA	Gas pressure	1.6×10^{-3} torr		
	$V_{\text{ion source}}$	5.5 kV	$T_{\text{amb.}}$	25°C		
	$I_{\text{ion source}}$	4 mA	Cooling			
	$I_{\text{pressure regulator}}$	approx. 4 A	water flow	6 to 8 l/min.		

NUCLEAR DEVICES - Semiconductor radiation detectors

Lithium drifted germanium detectors

Planar detectors intended for measurement of gamma-radiation and X-rays, used at cryogenic temperatures.

Basic type number	*Active area (cm^2)*	*Depletion depth (mm)*	*Gamma energy resolution (R) (1.33 MeV) (keV-FWHM) at 77° K*		
			SQ	*A*	*B*
APY16	3	5 8 10 12	$R < 2.5$ keV	$2.5 \leqslant R < 3$ keV	$3 \leqslant R < 3.5$ keV
APY17	5	5 8 10 12			
APY18	8	5 8 10 12			
APY19	10	5 8 10 12			

True coaxial double open ended detectors intended for measurement of gamma-radiation and X-rays, used at cryogenic temperatures.

Basic type	*Effective active volume (cm^3)*	*Gamma energy resolution (R) (1.33 MeV) at 77° K (keV-FWHM)*		
		SQ	*A*	*B*
APY21	20	$R \leqslant 2.5$ keV	$2.5 \leqslant R < 3$ keV	$3 \leqslant R < 4$ keV
APY22	25			
APY23	30			
APY24	35			
APY25	40			
APY26	45			
APY27	50			
APY28	55			
APY29	60			

True coaxial single open ended detectors intended for measurement of gamma-radiation and X-rays, used at cryogenic temperatures.

APY41	20	$R \leqslant 2.5$ keV	$2.5 \leqslant R < 3$ keV	$3 \leqslant R < 4$ keV
APY42	25			
APY43	30			
APY44	35			
APY45	40			
APY46	45			
APY47	50			
APY48	55			
APY49	60			

NUCLEAR DEVICES - Semiconductor radiation detectors

Lithium drifted silicon detectors

Detectors intended for measurement of beta and heavy high-energy particles. The detectors can be used from 25°C to −196°C.

CHARACTERISTICS

Basic type number	*Active area (mm^2)*	*Depletion depth (mm)*	*Resolution (keV-FWHM)*					
			alpha 20°C		*beta 20°C*		*beta −30°C*	
			SQ	*A*	*SQ*	*A*	*SQ*	*A*
			max.	*max.*	*max.*	*max.*	*max.*	*typ.*
BPX10	25	2	25	30	10	12	5	5
		3	30	35	12	15	6	6
		5	35	50	15	17	8	8
BPX12	100	2	30	40	12	15	6	6
		3	35	50	14	17	7	7
		5	40	60	18	20	9	9
BPX13	200	2	35	50	13	17	7	7
		3	40	60	16	19	9	9
		5	45	70	19	22	11	11
BPX14	300	2	40	60	16	19	8	8
		3	45	70	17	21	10	10
		5	50	90	20	25	12	12

Diffused silicon detectors

Detectors intended for measurement of particles and for health physics applications.

Basic type number	*Active area (mm^2)*	*Shape*
BPY20	12	circular
BPY22	100	circular
BPY23	200	circular
BPY24	200	square

Partially depleted silicon surface barrier detectors

Detectors intended for measurement of alpha- and low energy beta-radiation particles and fission products.

In conjunction with totally depleted detectors they can be used for particle identification purposes.

+ Available types.

Basic type number	*Active area (mm^2)*	*Quality class*	*Max. resolution at 20°C (keV-FWHM)*		*Depletion depth (μm)*								
			alpha	*beta*	100	200	350	500	700	1000	1500	2000	2500
Circular detectors													
BPY51	25	SQ	15	12	+	+	+	+	+	+			
		A	18	13	+	+	+	+	+	+	+	+	+
		B	25	20	+	+	+	+	+	+	+	+	+
BPY52	50	SQ	18	13	+	+	+	+	+	+			
		A	20	15	+	+	+	+	+	+	+	+	+
		B	25	20	+	+	+	+	+	+	+	+	+
BPY53	100	SQ	18	13	+	+	+	+	+	+			
		A	20	15	+	+	+	+	+	+	+	+	+
		B	25	20	+	+	+	+	+	+	+	+	+
BPY54	200	SQ	20	15	+	+	+	+	+	+			
		A	25	20	+	+	+	+	+	+	+	+	+
		B	30	25	+	+	+	+	+	+	+	+	+
BPY55	300	SQ	20	15			+	+	+	+			
		A	25	20	+	+	+	+	+	+			
		B	30	25	+	+	+	+	+	+			
BPY56	450	SQ	30	25			+	+	+	+			
		A	35	30		+	+	+	+	+			
		B	40	35		+	+	+	+	+			
BPY57	600	SQ	30	25			+	+	+	+			
		A	35	30		+	+	+	+	+			
		B	40	35		+	+	+	+	+			
Annular detectors													
BPY58	100		30	25	+	+	+	+	+	+	+	+	
BPY59	200		40	35	+	+	+	+	+	+	+	+	

NUCLEAR DEVICES - Semiconductor radiation detectors

Totally depleted silicon surface barrier detectors

Detectors for measurement of alpha-radiation and particles. They can be stacked with a partially depleted silicon surface barrier detecto
or with a lithium drifted silicon detector.

Basic type number	*Active area (mm^2)*	*Quality class*	*Max. resolution at 20° C (keV-FWHM)*		*Depletion depth (µm)*													
			alpha	*beta*	*3 to 7*	*7 to 12*	*12 to 17*	*17 to 22*	*22 to 30*	50	100	200	350	500	700	1000	1500	2000
Circular detectors																		
					±0.25	±0.5 µm				±1 µm					±2 µm			
BPY81	25	A	20	15	•	•	•	•	•	+	+	+	+	+	+	+	+	+
		B	25	20														
						±1 µm									±2 µm			
BPY82	50	A	20	15		•	•	•	•	+	+	+	+	+	+	+	+	+
		B	25	20														
							±1 µm								±2 µm			
BPY83	100	A	20	15			•	•	•	•	+	+	+	+	+	+	+	+
		B	25	20														
									±2 µm									
BPY84	200	A	25	20					•	•	+	+	+	+	+	+	+	+
		B	30	25														
										±2 µm								
BPY85	300	A	25	20						•	•	+	+	+	+	+		
		B	30	25														
												±2 µm						
BPY86	450	A	35	30								+	+	+	+	+		
		B	40	35														
												±2 µm						
BPY87	600	A	35	30								+	+	+	+	+		
		B	40	35														
Annular detectors																		
BPY88	100	—	30	25							+	+	+	+	+	+	+	+
BPY89	200	—	40	35							+	+	+	+	+	+	+	+

Silicon checker-board counter

Type: **BPY75-300**

Resolution: Alpha resolution is 90 keV, or better (FWHM at 20°C) for ^{241}Am (5.48 MeV) Noise of the electronics excluded.

Depletion depth: With a bias voltage of approximately 120 volts the depletion layer is 300 ± 30 μm thick.

Cryostats

	Consumption of cryostat and dewar per 24 hours:	Holding time for one charge:
CRY1: vertical cryostat supplied without dewar.		
CRY2: cryostat CRY1 supplied with a 25 litre dewar.	**CRY2**: 0.9 litres	**CRY2**: 24 days
CRY3: right-angle crystat mounted on top of the dewar	**CRY3**: 1.5 litres	**CRY3**: 14 days
CRY4: right-angle cryostat mounted below a 17 litre dewar	**CRY4**: 1.7 litres	**CRY4**: 10 days
CRY101: vertical dipstick cryostat mounted on top of a 34 litre dewar	**CRY101**: 0.9 litres	**CRY101**: 30 days
CRY103: right-angle cryostat mounted on top of a 34 litre dewar	**CRY103**: 1.5 litres	**CRY103**: 20 days
CRY104: right-angle cryostat mounted below a 17 litre dewar	**CRY104**: 1.7 litres	**CRY104**: 10 days

Charge sensitive pre-amplifier with a field-effect transistor in the first stage

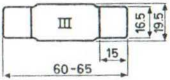
56050-01: intended for use with silicon diffused junction and surface barrier radiation detectors.

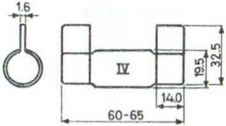
56054: intended for low temperature operated germanium and silicon radiation detectors

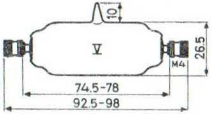
56055: intended for Si(Li) and Ge(Li) X-ray detectors operated at liquid nitrogen temperature. The pre-amplifier is mounted directly to the cryostat, without intermediate plugs. The first stage is built into the cryostat and operates at a temperature of approximately 130° K.

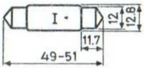
MISCELLANEOUS - Rare gas cartridges

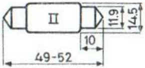
Type	*Starting voltage (V)*	*Min. extinguishing voltage (V)*	*Max. surge current (A)*	*during (sec)*	*Max. fuse in series (A)*	*Capacitive discharge (Ws)*	*Max. line voltage ($V_=$)*	*($V_\sim$)*	*Dimensions see fig.:*
4349	130–180	110	5	3	6	10	70	75	I
4369	150–200	110	10	3	10	10	70	75	IV
4370	80–120	60	10	3	10	10	36	50	IV
4371	150–250	110	5	3	6	10	70	75	II
4372	280–350	250	2.5	1	6	10	200	180	IV
4378	80–120	60	10	3	10	10	36	50	III
4379	280–350	130	10	3	10	10	50	180	IV
4383	280–350	130	5	3	6	10	50	180	II
4390	700–910	200	25	3	25	500	175	300	V
4397	400–500	200	5	1	6	10	150	230	IV







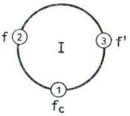


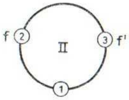


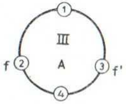
MISCELLANEOUS - Current regulators

Type	*V* (*V*)	$I_{tol.}$ (*A*)	*at V* (*V*)	*Max. dimensions* *diam.*	*length*	*Base*
329	10–30	1.08–1.22	20	34	119	I
340	3–10	5.5–6.3	7	53	156	Edison
1904	30–80	0.096–0.104	60	39	110	II
1905	2–6	0.96–1.04	4	35	100	Edison
1908	5–15	0.76–0.86	7	35	107	II
1909	5–45	0.60–0.67	30	56	123	II
1910	5–15	1.35–1.50	8.5	35	110	II
1927	40–120	0.172–0.188	80	40.5	138	III
1928	80–240	0.172–0.188	160	40.5	147	III
1941A	80–200	0.29–0.31	140	53	162	Edison + III

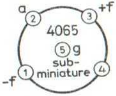
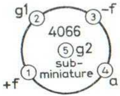
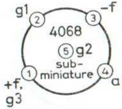
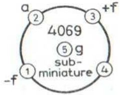
Base connections







MISCELLANEOUS - Electrometer tubes

Type and application	V_f (V) I_f (mA)	Characteristics data (Typical)			Limiting values	Base connections
4065 Triode	1.25 13	$V_a = 9$ V $V_g = -2.5$ V	$I_a = 100$ µA $S = 80$ µA/V	$\mu = 2$ $-I_g = 8.5 \times 10^{-14}$ A 1)	$V_a = 25$ V $I_a = 250$ µA $V_f = < 1.5$ V > 1.1 V	
4066 Tetrode	1.25 13	$V_a = 4.5$ V $V_{g2} = -3.2$ V $V_{g1} = 3$ V	$I_a = 20$ µA $-I_{g2} = 2.5 \times 10^{-15}$ A	$S_{ag2} = 17$ µA/V $I_{g1} = 250$ µA 1)	$V_a = 10$ V $I_k = 300$ µA $V_f = < 1.5$ V > 1.1 V	
4068 Pentode	1.25 8.2	$V_a = 10$ V $V_{g2} = 6.5$ V $V_{g1} = -2.5$ V	$I_a = 5$ µA $I_{g2} = 2.2$ µA $I_{g1} = 3 \times 10^{-15}$ A 1)	$S = 10.5$ µA/V $R_1 = 10.5$ MΩ $\mu_{a-g1} = 110$	$V_a = 45$ V $V_{g2} = 45$ V $I_k = 180$ µA $V_f = < 1.5$ V > 1.1 V	
4069 Triode	1.25 14	$V_a = 9$ V $V_g = -2.7$ V	$I_a = 100$ µA $S = 80$ µA/V	$-I_g = 1.6 \times 10^{-13}$ A 1) $\mu = 2$	$V_a = 25$ V $I_a = 250$ µA $V_f = < 1.5$ V > 1.1 V	

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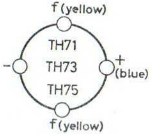
1) Valid only in darkness

MISCELLANEOUS - Thermocouples

Type	*Characteristics and limiting values*								*Base connections*
	I_f (mA)	I_f [1] (mA)	$I_f\,(E=12\,mV)$ (mA)	*Max.* I_f (mA) *t max. 1 min.*	R_f (Ω)	R_{th} (Ω)	*Max. dimensions* *diam.*	*Max. dimensions* *length*	
TH71	0–15	0–5	10	20	68	6.0	7.9	25	
TH73	0–75	0–20	40	100	7.0	3.5			
TH75	0–300	0–100	200	350	1.2	3.5			

MISCELLANEOUS - Dry reed switches

		$P_{max.}$	$V_{max.}$	$I_{max.}$	*Max. dimensions* *diam.*	*Max. dimensions* *length (except leads)*
RI-12	Single-pole, single-throw, normally open	5 W	50 V	100 mA	3.97	28.3

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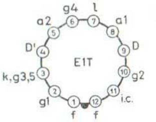
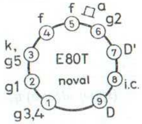
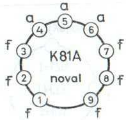
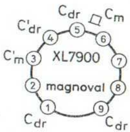
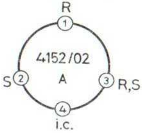
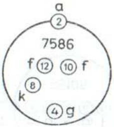
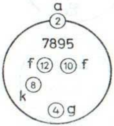
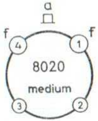
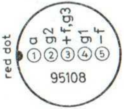
[1] In this range V_o is proportional to the square of I_f

MISCELLANEOUS

Type	V_f *(V)* I_f *(A)*	*Characteristics data*			*Limiting values*	*Base connections*
E1T Decade- counter tube	6.3 0.3	*Operating* $V_b = 300$ V $V_{bg1} = 11.9$ V $V_{bg2} = 300$ V $V_D = 156$ V	$V_l = 300$ V $I_k = 0.95$ mA $I_{g2} = 0.1$ mA $R_k = 15$ kΩ	$R_{g4} = 47$ kΩ $R_{a1} = 39$ kΩ $R_{a2} = 1$ MΩ	$V_b = 400$ V	
E80T Beam- deflection tube	6.3 0.15	*Typical* $V_a = 100$ V $V_{g3+4} = 250$ V $V_{g2} = 70$ V	$V_{g1} = 0$ V $V_D = 120$ V $V_D = 120$ V	$I_a = 1.35$ mA $I_k = 2.0$ mA	$V_a = 330$ V $I_k = 55$ mA $V_{kf} = 50$ V	
K81A Noise diode	1.85 2.5	*Typical* $V_a = 100$ V	$I_a = 15$ mA	$F = 13$ dB	$V_f = 2.0$ V $V_a = 150$ V $I_a = 20$ mA $W_a = 3$ W	

XL7900 Vibrating capacitor		Contact potential over C_m -50 to $+50$ mV Short term drift of contact potentional $<100\ \mu V$	Insulation $>10^{15}\ \Omega$ Temp. dependence $20\ \mu V/^\circ C$		$V_{Cm} = 25$ V	
4152/02 Bimetal relay	I_r 85–115 mA $R = 370\ \Omega$	$V_m = 220\ V_{d.c.}$ $V_m = 220\ V_{a.c.}$ $V_m = 380\ V_{a.c.}$	$I_{max.} = 1.5$ A $I_{max.} = 1.5$ A $I_{max.} = 0.7$ A When switching on	$I_{max.} = 250$ mA $I_{max.} = 250$ mA $I_{max.} = 75$ mA When switching off	$I_r = 125$ mA $t_{amb} = -10^\circ C$ $+60^\circ C$	
7586 Nuvistor triode	6.3 0.135	*Typical* $V_{ba} = 75$ V $V_{bg} = 0$ V $R_k = 100\ \Omega$	$C_k = 1300\ \mu F$ $I_a = 10.5$ mA $S = 11.5$ mA/V	$R_i = 3\ k\Omega$ $\mu = 35$	$V_a = 110$ V $I_k = 15$ mA $W_a = 1$ W	
7895 Nuvistor triode	6.3 0.135	*Typical* $V_{ba} = 110$ V $V_{bg} = 0$ V $R_k = 150\ \Omega$	$C_k = 1000\ \mu F$ $I_a = 7$ mA $S = 9.4$ mA/V	$R_i = 6.8\ k\Omega$ $\mu = 64$	$V_a = 110$ V $I_k = 15$ mA $W_a = 1$ W	

MISCELLANEOUS

Type	V_f *(V)* I_f *(A)*	*Characteristics data*			*Limiting values*	*Base connections*
8020 High-vacuum high-voltage diode	5.0 6.0	*Typical* $V_a = 200$ V $I_a = 100$ mA	*Surge limiter* $V_f = 5.5$ V $V_{ap} = 10$ kV $I_{ap} = >2$ A	*Rectifier* $V_{ainvp} = <40$ kV $I_{ap} = <100$ mA $I_a = <750$ mA	*Surge limiter* $V_f = 5.8$ V $V_{ap} = 12.5$ kV $W_a = 75$ W $V_{ainvp} = 40$ kV	
95108 Transmitting pentode for use in radio sondes	1.25 0.045	*Typical* $V_a = 45$ V $V_{g2} = 45$ V $V_{g1} = -2.75$ V	$I_a = 875$ μA $I_{g2} = 200$ μA $S = 650$ μA/V	$R_i = 0.75$ MΩ $\mu_{g2g1} = 9.3$	$V_a = 120$ V $I_k = 16$ mA $W_a = 1.0$ W $W_{g2} = 0.2$ W	

REPLACEMENT GUIDE
ELECTRON TUBES

REPLACEMENT GUIDE FOR ELECTRON TUBES

Type to be replaced	CV number	Replacement type
0.1NE3/1		(ZP1010)
1A3	753	1A3;DA90
1AB6		1AB6;DK96
1AC6		1AC6;DK92
1AH5		1AH5 DAF96
1AJ4		1AJ4;DF96
1BG2		1BG2;DY51
1BQ2		1BQ2;DY802
1C1		1R5;DK91
1C2		DK92;1AC6
1C3		DK96;1AB6
1CP31	2302	1CP31;DH3-91
1F1		1AJ4;DF96
1F2		1L4;DF92
1F3		1T4;DF91
1FD1		1AH5;DAF96
1FD9		1S5;DAF91
1G35P		4C35A;6268
1G45P		3C45
1H2		1S2;DY86
1L4		1L4;DF92
1M3	2980	1M3;DM70
1N3		1N3;DM71
1N16		(RG1-240A)
1P1		3C4;DL96
1P10		3S4;DL92
1P11		3V4;DL94
1P23		(3554)
1P32		(3546PW)
1P37		(90AG)
1P41		(53CG)

Type to be replaced	CV number	Replacement type
1R5	782	1R5;DK91
1S2		1BQ2;DY802
1S2A		1BQ2;DY802
1S5	784	1S5;DAF91
1T4	785;1971	1T4;DF91
1U4	2507	1U4
1.5NG12		(ZP1010)
2B29		(5894);(QQE06/40)
2B32		832A;QQE04/20
2B46		6146;QE05/40
2B52		6252;QQE03/20
2B94		5894;QQE06/40
2C39A	2516	2C39A
2C39BA		2C39BA;7289
2D21	797	PL2D21;EN91; PL5727;M8204
2D21W	2876	PL5727;M8204
2D21WA	4018	PL5727;M8204
2E24		(2E26);(QV05-10)
2E26	3990	2E26;QV05-10
2G57		PL5557
2G402A		DCX4/1000;3B28
2G/472B		DCX4/5000;4B32
2H28		3B28;DCX4/1000
2H66		866A;DCG4/1000G
2HA5		2HA5;XC900
2HR8		2HR8;XF86
2J42	3676	2J42
2J42A		(JP9-15)
2J51	3560	2J51
2J51A	5134	2J51A
2J55		2J55

Type to be replaced	CV number	Replacement type
2K25	2792	2K25
2V/400A	32	DCG4/1000G;866A
2V/400B		(DCG4/1000G);(866A)
2V/470C		(DCG4/5000)
2V/471A		(DCG4/5000)
2V/490C		(DCG4/5000)
2V/500C		(DCG4/5000)
2V/530A		(DCG9/20);(6508)
2V/530E		(DCG9/20);(6508)
2V/531E		(DCG9/20);(6508)
3A4		3A4;DL93
3A5		3A5;DCC90
3AJ8		3AJ8;XCH81
3AL5		3AL5;XAA91
3ALP1	2175	3ALP1;DG7-5
3ALP7	5171	3ALP7;DP7-5
3ALP11		3ALP11;DB7-5
3AMP1	2431	3AMP1
3AMP1A		3AMP1A;DG7-32
3B28	1835	3B28;DCX4/1000
3BH2		3BH2;GY501
3BKP2		3BKP2;DN7-78
3BKP7		3BKP7;DP7-78
3BKP11		3BKP11;DB7-78
3BKP31		3BKP31;DH7-78
3BX6		3BX6;XF80
3BY7		3BY7;XF85
3BYP2		3BYP2;DN7-11
3BYP7		3BYP7;DP7-11
3BYP11		3BYP11;DB7-11
3BYP31		3BYP31;DH7-11
3BZ6		3BZ6
3C4		3C4;DL96
3C23A		PL3C23A
3C45	6007	3C45;PL345
3C800E		TB5/2500
3CB6		3CB6
3CJA		3CJA/5684
3CX100A5		7289
3E29	2295;3599	3E29;QQV5-P10
3EH7		3EH7;XF183
3EJ7		3EJ7;XF184
3F65		QB3/200
3G49P		5949
3G/501A		PL5545A
3G/502A		PL6807
3GK5		3GK5
3HA5		3HA5;LC900
3Q4		3Q4;DL95
3S4	484;2370; 820	3S4;DL92
3V4	2983	3V4;DL94
3V/340B		(PL5557)
3V/390A	5027	PL5559
3V490A		(PL105)
3V/531E		(DCG12/30;(5870)
3WP1	3946	3WP1;DG7-36
3WP2		3WP2;DN7-36
3WP7		3WP7;DP7-36
3WP11		3WP11;DB7-36

REPLACEMENT GUIDE FOR ELECTRON TUBES

Type to be replaced	CV number	Replacement type
4-65A	1905	4-65A;QB3/200
4/100BU		AZ50
4-125A	2963	4-125A;QB3/300GA
4-250A	2964	4-250A;QB3.5/750GA
4-400A	3879	4-400A;QB4/1100GA; YL1461
4B13		QB2/250
4B26	1836	1163
4B32	2518	4B32;DCX4/5000
4BL8		4BL8;XCF80
4C35	1787	4C35A;6268
4C35A	5247	4C35A;6268
4CM4		4CM4;PC86
4CX250B		4CX250B;QEL2/275
4CX250F		4CX250F;QEL2/275H
4CX250FG		4CX250FG;8621
4CX250R		4CX250R;7580W
4CX350A		8321;YL1340
4CX350F		8322;YL1341
4D21	2963	4-125A;QB3/300GA
4DL4		4DL4;PC88
4EH7		4EH7;LF183
4EJ7		4EJ7;LF184
4ER5		4ER5;PC95
4ES8		4ES8;XCC189
4F15R		4X150A;QEL1/150
4F20R		4X150D
4F21		QB3/300;6155
4FY5		4FY5;PC97
4G/280K		PL2D21;EN91; PL5727;M8204
4GJ7		4GJ7;XCF801
4GTP		(3546PW)
4H/135M		QEL1/50;4X150A
4H/136M		QEL1/150H;4X150D
4H/160M		QEL2/250;4X250B

Type to be replaced	CV number	Replacement type
4HA5		4HA5;PC900
4J	2797	QQE06/40;5894
4J50		4J50
4J50A		4J50A
4J52A	5018	4J52A
4JW8		4JW8;XCF802
4KM50000LA		(YK1000)
4KM50000LA3		(YK1000)
4KM50000LF		(YK1004)
4Q025		RG3-250
4X150A	2519	4X150A;QEL1/150
4X150D	3991	4X150D;QEL1/150H
4X150B	2487	4X250B;QEL2/250
4X500A		4X500A;QBL4/800
5/62CM		DH13-78;5BHP31
5A/160H		EF91;6AM6
5A/170K		E180F;6688
5ADP1	5035	5ADP1;DG13-34
5ADP2		5ADP2;DN13-34
5ADP7	5125	5ADP7;DP13-34
5ADP11		5ADP11;DB13-34
5AR4	1377	5AR4;GZ34
5B21		1164
5B/250A	124	QE06/50;807
5BHP31	5168	5BHP31;DH13-78
5C21		PL5545A
5C22	2520	5C22;6279
5C/100A		QB2/250;813
5CBP2		5CBP2;(D13-15GP)

Type to be replaced	CV number	Replacement type
5CBP11		5CBP11;(D13-15BE)
5CBP31		5CBP31;(D13-15GH)
5CLP2		5CLP2;DN13-10
5CP1A		(DG13-2)
5CP7A	3954	(DP13-2)
5CP11A		(DB13-2)
5D22	2964	4-250A;QB3.5/750GA
5F20RA		QEL2/275
5F22		QB3.5/750GA
5F23		QB4/1100GA
5GJ7		5GJ7;LCF801
5HG8		5HG8;LCF86
5J		(2 × YL1230)
5J26	3602	5J26
5T33		(TB4/1250);(5868)
5U4		5U4GB
5U4GB		
5U8		5U8
5U9		5U9;LCF201
5UP1		DG13-32
5Y3GT	1856	5Y3GT
6AB8		6AB8;ECL80
6AF9		6AF9
6AJ8	2128	6AJ8;ECH81
6AJ9		6AJ9;ECF202
6AK5	850	6AK5;EF95
6AK5W	4010;5216	6AK5W;E95F 5654;M8100
6AK8		6AK8;EABC80
6AL3		6AL3;EY88
6AL5	283	6AL5;EAA91
6AL5W	4007;5189	6AL5W;5726; E91AA;M8212
6AM5	136	6AM5;EL91
6AM6	138	6AM6;EF91
6AM6S		6AM6S;M8083
6AQ4	417	6AQ4;EC91
6AQ5	1862	6AQ5;EL90
6AQ8		6AQ8;ECC85
6AS6W	4011	6AS6W;5725
6AT6	452	6AT6;EBC90
6AU4GTA		6AU4GTA
6AU6	2524	6AU6;EF94
6AU8		(6BL8);(ECF80)
6AU8A		(6BL8);(ECF80)
6AV6	2526	6AV6;EBC91
6AX4GT		6AX4GTB
6AX4GTA		6AX4GTB
6AX4GTB		6AX4GTB
6BA6	454	6BA6;EF93
6BA6W	5037;4009	6BA6W;5749
6BD7		6BD7;EBC80
6BD7A		6BD7A;EBC81
6BE6	453	6BE6;EK90
6BK6		6AV6;EBC91
6BL8	5215	6BL8;ECF80
6BH6		(7693);(E90F)
6BM8		6BM8;ECL82
6BN5	3526	6BN5;EL85
6BQ5	2975	6BQ5;EL84
6BR5	1352	6BR5;EM80
6BT4	3891	6BT4;EZ40
6BX6	1376	6BX6;EF80
6BY7	1375	6BY7;EF85
6C4	133	6C4;EC90
6C10		6CU7;ECH42

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Type to be replaced	CV number	Replacement type
6C12		6AJ8;ECH81
6C16		6BL8;ECF80
6CA4	5072	6CA4;EZ81
6CA7	1741	6CA7;EL34
6CH6	2127	6CH6;EL821
6CJ3		(6EC4A);(EY500A)
6CJ5	3886	6CJ5;EF41
6CJ6	2721	6CJ6;EL81
6CK5	3889	6CK5;EL41
6CK6	2726	6CK6;EL83
6CM4		6CM4;EC86
6CM5	2940	6CM5;EL36
6CQ6	131	6CQ6;EF92
6CS6		6CS6;EH90
6CT7	3883	6CT7;EAF42
6CU7	3888	6CU7;ECH42
6CV7	3882	6CV7;EBC41
6CW5	5094	6CW5;EL86
6CW7	5281	6CW7;ECC84
6D2		EB91
6D4		6D4;EN93
6D5	1949	6D4;EN93
6DA5	5055	6DA5;EM81
6DA6	5156	6DA6;EF89
6DC8		6DC8;EBF89
6DJ8	5358	6DJ8;ECC88
6DL4		6DL4;EC88
6DL5		6DL5;EY500A
6DR8		6DR8;EBF83
6DS8		6DS8;ECH83
6DX8		6DX8;ECL84
6DY5		6DY5;EL82
6EA8		6EA8
6EC4		6EC4A;EY500A
6EC4A		
6ED4		6ED4;ED500
6EH7		6EH7;EF183
6EJ7		6EJ7;EF184
6EL7		6BX6;EF80
6ES6		6ES6;EF97
6ES8		6ES8;ECC189
6ET6		6ET6;EF98
6F12		6AM6;EF91
6F16		6CJ5;EF41
6F19		6BY7;EF85
6F21		6CQ6;EF92
6F23		6BX6;EF80
6F26		6F26;EF85
6F29		EF183;6EH7
6F30		EF184;6EJ7
6F50R		QBL4/800;4X500A
6FC7		6FC7;ECC89
6FD12		6DC8;EBF89
6FG6		6FG6;EM84
6FV5		6FV5;EL136
6FW8		(6ES8);(ECC189)
6FY5		6FY5;EC97
6G45		PL5545A
6GB5		6GB5;EL500
6GB5A		6GB5A;EL504
6GH8A		6GH8A
6GJ7		6GJ7;ECF801
6GK6		6GK6
6GM8		6HM8;ECC86
6GV8		6GV8;ECL85
6GW8		6GW8;ECL86
6H51		(DCG6/18);(6693)
6HA5		6HA5;EC900
6HG8		6HG8;ECF86
6HU6		6HU6;EM87

Type to be replaced	CV number	Replacement type
6J4WA	5311	(M8248)
6J6	858	6J6;ECC91
6JE6		(6KG6A);(EL509)
6JS6		6JS6;(6LF6)
6JW8		6JW8;ECF802
6JX8		6JX8;ECH84
6K4	468	EC70;6778
6KD6		6KD6;(6LF6)
6KG6		6KG6A;EL509
6KG6A		
6KM6		6KM6;(6KG6A/EL509)
6KN6		6KN6;(6LF6)
6KW6		6KW6;EL508
6L12		6AQ8;ECC85
6L13		12AX7;ECC83
6L16		6CW7;ECC84
6LD3		6CV7;EBC41
6LD6		6LD6;EL802
6LD12		6AK8;EABC80
6LF6		6LF6
6LN8		6LN8;LCF80
6LV6		6LV6;(6LF6)
6LX8		6LX8;LCF802
6M5		6M5;EL80
6N3		6N3;EY82
6N8		6N8;EBF80
6P15		6BQ5;EL84
6Q4	1886	6Q4;EC80
6R3		6R3;EY81
6R4	1865;1888	6R4;EC81
6S2	2966	6S2A;EY87
6S2A		
6SN7GT		6SN7GTB
6SN7GTB		6SN7GTB

Type to be replaced	CV number	Replacement type
6T40		TB4/1500
6T50		TB5/2500
6T51		(TB5/2500)
6U3		6U3;EY80
6U8	5065	6U8;ECF82
6U8A		6U8A
6U9		6U9;ECF201
6V4	1535	6V4;EZ80
6V9		6V9;ECH200
6X2	426	6X2;EY51
6X4	493	6X4;EZ90
6X5GT		6X5GT;EZ35
6X9		6X9;ECF200
6Y9		6Y9;EFL200
7AN7	5192	7AN7;PCC84
7C24		(YD1120)
7D9		6AM5;EL91;M8082
7D10		EL821;6CH6
7DJ8		7DJ8;PCC88
7EF7		7EF7;PCC89
7ES8		7ES8;PCC189
7F16		6CJ5;EF41
7HG8		8HG8;PCF86
8A1	1282	DG7-36;3WP1
8A8		9A8;PCF80
8B8		8B8;XCL82
8CW5		8CW5;XL86

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Type to be replaced	CV number	Replacement type
8D3		6AM6;EF91; 6AM6S;M8083
8DX8		8DX8;XCL84
8GJ7		8GJ7;PCF801
8GW8		8GW8;XCL86
8HG8		8HG8;PCF86
8NE31		(ZP1000)
8U9		8U9;PCF201
8X9		8X9;PCF200
9A8		9A8;PCF80
9AK8		9AK8;PABC80
9AQ8		9AQ8;PCC85
9ED4		9ED4;PD500
9GV8		9GV8;XCL85
9JW8		9JW8;PCF802
9Q205		(DCG6/18);6693)
9U8		9U8:PCF82
9V9		9V9;PCH200
10C14		19D8;UCH81
10CW5		10CW5;LL86
10DX8		10DX8;LCL84
10FC12		19FL8;UBF89
10KG6		10KG6
10L14		UCC85
10LD3		14L7;UBC41
10LD12		UABC80
10LD13		UBC81
10NE40		(ZP1000)
10P18		45B5;UL84
11E13		QQE03/12;6360
11Y9		11Y9;LFL200
12AC5		12AC5;UF41
12AJ7		12AJ7;HCH81
12AQ5		12AQ5
12AT6		12AT6;HBC90
12AT7	455	12AT7;ECC81
12AT7WA	4024;5212	12AT7WA;E81CC; 6201;M8162
12AU6	1961	12AU6;HF94
12AU7	491	12AU7;ECC82
12AU7WA	4003	12AU7WA;(M8136)
12AV6		12AV6;HBC91
12AX7	492	12AX7;ECC83
12AX7S		12AX7S;(M8137)
12AX7WA	4004	(M8137)
12BA6	1928	12BA6;HF93
12BE6		12BE6;HK90
12BY7A		12BY7A
12CU5		12CU5
12EB20		(ZP1010)
12S7		12S7;UAF42

Type to be replaced	CV number	Replacement type
13CM5		13CM5;XL36
13GB5 13GB5A		13GB5A;XL504
14ABP4		14ABP4;AW36-21
14ABP4A		14ABP4A;AW36-20
14AHP4		14AHP4;AW36-81
14AHP4A		14AHP4A;AW36-80
14GW8		14GW8;PCL86
14K7		14K7;UCH42
14L7		14L7;UBC41
14Y7		14Y7;UCH80
15A6		15A6;PL83
15CW5		15CW5;PL84
15DQ8		15DQ8;PCL84
16A5		16A5;PL82
16A8		16A8;PCL82
16AQ3		16AQ3;XY88
16LD6		16LD6;PL802
16Y9		17Y9;PFL200
17		PL5557
17BTP4		17BTP4;AW43-80
17C8		17C8;UBF80
17CUP4		(17BTP4);(AW43-80)
17CVP4		17BTP4;AW43-80
17DCP4		(AW43-88)
17DJP4		17BTP4;AW43-80
17DYP4		(AW43-89)
17KW6		17KW6;PL508
17Y9		17Y9;PFL200
17Z3		17Z3;PY81
18GB5		18GB5;LL500
18GB5A		18GB5A;LL504
18GV8		18GV8;PCL85
19ALP4		(AW47-91)
19AMP4		(19CWP4)
19AQ5		19AQ5;HL90
19AQP4		(AW47-91)
19ASP4		(19CWP4)
19BAP4		(19CWP4)
19BCP4		(19CWP4)
19BEP4		AW47-91
19CEP4		(19CWP4)
19CTP4		AW47-91
19CWP4		19CWP4
19CXP4		(AW47-91)
19D8		19D8;UCH81
19DJP4		AW47-91
19FL8		19FL8;UBF89
19KF6		19KF6
19SU		19Y3;PY82
19X3		19X3;PY80
19Y3		19Y3;PY82

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Type to be replaced	CV number	Replacement type
20A2		PL6574
20A3	797	PL2D21;PL5727;M8204
20AQ3		20AQ3;LY88
20CG		20CG
20CV	5120	20CV
20LF6		20LF6
21A1		PL6574
21A6	5077	21A6;PL81
21B12A		PL5684
21CPL4		21CLP4;AW53-80
21DKP4		AW53-88
21DVP4		AW53-80
21DWP4		(AW53-88)
21ELP4		21CLP4;AW53-80
21ENP4		21CLP4;AW53-80
21EP4		(AW53-20)
21EXP4		(AW53-89)
21EZP4		(AW53-89)
21FCP4		(AW53-88)
22AL3		20AQ3;LY88
23ABP4		(AW59-90)
23ADP4		A59-16W
23AMP4		(AW59-90)
23AQP4		AW59-90
23AXP4		AW59-91
23AYP4		A59-16W
23BCP4		AW59-90
23BEP4		A59-16W
23BNP4		A59-16W
23BRP4		(A59-16W)
23BSP4		A59-16W
23BYP4		(A59-16W)
23CJP4		A59-16W
23CKP4		A59-16W
23CLP4		A59-16W
23CMP4		AW59-90;23CMP4
23CNP4		A59-16W
23CRP4		A59-16W
23CSP4		(A59-16W)
23CVP4		(A59-91)
23CPX4		(AW59-91)
23DEP4		A59-11W
23DFP4		AW59-91
23DGP4		A59-16W
23DHP4		A59-16W
23DJP4		(A59-16W)
23DRP4		(A59-11W)
23EBP4		AW59-90
23EJP4		AW59-91
23FGP4		A59-11W
23KP4/03		AW59-90
23RP4		(A59-16W)
23SP4		A59-16W
23VP4		(AW59-91)
24AXP4		AW61-88
25E5		25E5;PL36
25MP4		A65-11W
27GB5		27GB5;PL500
27GB5A		27GB5A;PL504

Type to be replaced	CV number	Replacement type
27KG6		27KG6A;LL509
27KG6A		
27LF6		27LF6
27RP4		27RP4
28EB40/1B		(ZP1010)
28EC4		28EC4A;LY500A
28EC4A		
30A5		30A5;HL94
30AE3		30AE3;PY88
30C1		9A8;PCF80
30L1		7AN7;PCC84
30P16		16A5;PL82
30P18		15CW5;PL84
31A3		31A3;UY41
31AV3		31AV3;UY89
31EB40		(ZP1000)
31EB70G		(ZP1000)
35W4		35W4;HY90
38A3		38A3;UY85
40KG6		40KG6A;PL509
40KG6A		
42EC4		42EC4A;PY500A
42EC4A		
45A5	1977	45A5;UL41
45B5		45B5;UL84
45BA6		367
*50AVP		150AVP
*50AVP/02		XP1010
50B5		50B5
50MB8		50BM8;UCL82
50C5	1959	50C5;HL92
50L6GT	571	50L6GT
*51AVP		150AVP

Type to be replaced	CV number	Replacement type
*51UVP		150UVP
52AVP		52AVP;(XP1180)
52CG	2896	52CG
53AVP		53AVP;(XP1000)
53CG		53CG
53UVP		53UVP;(XP1004)
54AVP		54AVP
54UVP		54UVP
*55AVP		56AVP
55N3		55N3;UY82
56AVP		56AVP
56AVP/03		56AVP/03
56AVP/05		56AVP/05
56CVP		56CVP
56DUVP		56DUVP
56DUVP/03		56DUVP/03
56DVP		56DVP
56DVP/03		56DVP/03
56TUVP		56TUVP
56TVP		56TVP
56UVP		56UVP
57		PL5559
57AVP		57AVP
58AVP		58AVP
58CG		58CG
58CV		58CV
58DVP		58DVP
58UVP		58UVP
60AVP		60AVP
61SV		61SV;7634
62DDT		6CV7;EBC41
62TH		6CU7;ECH42
62VP		6CJ5;EF41
63TP		6AB8;ECL80
64SPT		6BX6;EF80
65ME		6BR5;EM80

* Obsolete type with replacement type

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Type to be replaced	CV number	Replacement type
66KU		6BT4;EZ40
67BT		6CK5;EL41
75B1	284	75B1
75C1	2454	75C1;M8225
76NB3		76NB3
83A1		83A1;7980
85A1	431	85A1;OE3
85A2	449	85A2;OG3; M8098
90AG	2270	90AG
90AV	2132	90AV
90C1	5173	90C1;M8206
90CG		90CG
90CV		90CV
90NB3		90NB3
90NS		90NS
92AG		92AG
92AV		92AV
95A1	286	95A1
100C		100C
100CB		100CB
100E1		100E1
100NB		100NB
100R		8020
105A		PL105
108C1	1833	OB2;OB2;OB2WA; M8224
120C		120C
120NB		120NB
121VP		UF41;12AC5
141DDT		UBC41;14L7
141TH		UCH42;14K7
150A1		150A1
150AV		150AV
150AVP		150AVP
*150AVP/02		XP1010
150B2	2225	150B2;6354;M8163
150C1		150C1
150C2	1832	OA2; OA2WA;M8223
150C3		150C3;OD3
150C4	1832	M8223
150CV		150CV
150CVP		150CVP
150UV		150UV
150UVP		150UVP
*152AVP		XP1110;(XP1115)
*152UVP		XP1118
153AVP		153AVP;(XP1001)
153C		153C
155N		155N
155UG		155UG
163Pen		PL82;16A5
171DDP		UBF80;17C8
172		(PL105)
172K		(MW43-69);(17BQP4)
173K		(MW43-69);(17BQP4)
200CB		200CB
200HB		200HB
200LB		200LB
200NB		200NB
210-0159		ZX1061
212K		MW53-80
213P		R142
213Pen		PL81;21A6
272		PL5557
287A		PL5557
309		PL5557
311SU		UY41;31A3
323A,323B		(PL3C23)

* Obsolete type with replacement type

Type to be replaced	CV number	Replacement type
328		328
329		329
340		340
367	2634	367
393A		(PL3C23)
417A	2642	417A;5842
451		451
451PT		UL41;45A5
460BU	2644	1561
502A		(PL2D21);(PL5727); (M8204)
575A		(7136);(DCG6/18GB)
631		PL5559
651		ZX1052
652		ZX1051
653B		ZX1055
655		ZX1053;(ZX1063)
656		ZX1052
657		ZX1051
673		(6693);(DCG6/18)
676		(PL105)
682		ZX1060
686		ZX1060
710		PL5684/C3JA
715		PL5557
732A/B	1795	732A/B
725A	722	725A
813	26	813;QB2/250
816	724	(866A);(DCG4/1000G)
829B		(5894);(QQE06/40)
832		832A;QQE04/20
832A	788	832A;QQE04/20
833A		833A:(TB4/1250)
857B		(6786);(DCG7/100B)
866		866A;DCG4/1000G
866A	32	866A;DCG4/1000G
866B		(866A);(DCG4/1000G)
868	2680	(3554)
869;869A		(6508);(DCG9/20)
869B	2723	(6508);(DCG9/20)
872		872A;DCG5/5000GB
872A	642	872A;DCG5/5000GB
872B		ZY1000
873		(DCG6/6000)
884		(PL2D21);(PL5727); (M8204)
885		(PL2D21);(PL5727); (M8204)
912NB4		912NB4
918		(3554)
927		(3546PW)
966		866A;DCG4/1000G
967		PL5557
1010		1010
1018		1018
1037		1037
1038		1038
1039		1039
1049		1049
1054		1054
1069K		1069K
1081		ZX1061
1110		1110
1119		1119
1129		1129
1138		1138
1163	1836	1163
1164		1164
1173		1173

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Type to be replaced	CV number	Replacement type
1174		1174
1176		1176
1177		1177
1257		PL5559
1267		PL1267/Z300T
1319		(XQ1030)
1320		(XQ1030)
1331		1331
1561		1561
1607		PL1607
1625		(PE06/40E)
1701		PL5557
1710		1710
1725A		1725A
1738		1738
1749A		1749A
*1759		1859+1289
1788		1788
1838		1838
1849		1849
1859		1859
1875		1875
1876	2718	1876
1877	1134	1877
1878		1878
1884		1884
1904H		1904H
1905		1905
1908		1908
*1909		1909H

Type to be replaced	CV number	Replacement type
1909H		1909H
1910		1910
1923		1923
1927		1927
1928		1928
1941A		1941A
2000		1163
2100A		8020
2183		1164
2255AMR		XQ1054
2255IND		XQ1053
2255NOR		XQ1052
2255ROE		XQ1051
2255FIM		XQ1050
3069		866A;DCG4/1000G
3070		872A;DCG5/5000GB
3078A		(6508);(DCG9/20)
3530		3530
3533A		3533A
*3534		3534
3538		3538
*3541		3533A
3545		3545
3545PW		3545PW
3546		3546
3546PW		3546PW
3554		3554
3572		866A;DCG4/1000G
3861B		QEL1/150;4X150A
3874A		QB2/250;813
3885A		3B28;DCX4/1000
4049D		(DCG4/5000)
4065	495	4065
4066	2730	4066
4067		4067

* Obsolete type with replacement type

Type to be replaced	CV number	Replacement type
4068	2348	4068
4069		4069
4070		4070
4078A		(DCG9/20);(6508)
4078GA		(DCG9/20);(6508)
4078Z		(DCG9/20);(6508)
4152/02		4152/02
4260		PL5557
4261		PL5557
4349		4349
4369		4369
4370		4370
4371		4371
4372		4372
*4373		4369
4378		4378
4379		4379
4390		4390
4397		4397
4438		(XP1011)
4439		(XP1011)
4440		XP1011
4441		(XP1011)
4459		(56TVP)
4460		(XP1115); (XP1111)
4461		(XP1011)
4463		(XP1002)
4478		(XQ1030)
4488		(XQ1030)
4503		(XQ1053)
4591		55875
4592		(XQ1020)
4613		4613

Type to be replaced	CV number	Replacement type
4641		4641
4646		4646
*4648		DCG1/250; DCG4/1000G;866A
*4649		DCG4/1000ED
4657		4657
4659		4659
4662		4662
4682		4682
4683		4683
4699		4699
5021B		DCG4/1000G;866A
5031		DCG5/5000GB;872A
5121		DCX4/1000;3B28
5544	2210	PL5544
5545	2215	PL5545
5550		(ZX1060)
5551		ZX1051
5551A		ZX1051
5552		ZX1052
5552A		ZX1052
5553		ZX1053;(ZX1063)
5553A		ZX1053;(ZX1063)
5553B		ZX1053
5555		ZX1055
5555A		ZX1055
5557	2957	PL5557
5559		PL5559
5586	3611	5586
5632		PL5632;C3J
5636	3928	5636;EF730
5639	2662	5639
5641		5641
5642	2241	5642;DY70
5643	5079	5643

* Obsolete type with replacement type

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Type to be replaced	CV number	Replacement type
5644	3987	5644
5651	2573;5186	5651;M8098
5654	4010;5216	5654;E95F; 6AK5W;M8100
5672	2238	5672
5678	2254	5678;DF60
5684		PL5684/C3J/A
5696	3512	5696;EN92
5718	3930	5718;EC71
5719	4008	5719
5725	4011	5725;6AS6W
5726	4007;5189	5726(E91AA); (6AL5W);(M8212)
5727	4018	PL5727;M8204
5749	4009	5749;6BA6W
5751	4017	5751
5762		(YD1120)
5763	2129	5763;QE03/10;M8096
5771		5771
5783		5783WA;M8190
5783W	3960;3933 4066	5783WA;(M8190)
5819		(XP1000)
5822		ZX1061
5822A		ZX1061
5823		5823;Z900T
5840	3929	5840;EF732
5842	3789	5842;417A
5847	3905	5847;E182F
5855		5855;XR1-12
5861		5861;EC55
5866	1924	5866;TB2.5/300
5867	1350	5867;TB3/750
5868	1351	5868;TB4/1250
5869		5869;(DCG6/6000)
5870		5870;DCG12/30
5876		5876
5876A		5876A
5893		5893
5894	2797	5894;QQE06/40
5895	1838	5895;QQC04/15
5899	475;477	5899;(EF731)
5902	4029	5902
5920	5214	5920;E90CC
5923		5923;TBW6/6000
5924	3926	5924;TBL6/6000
5949	3521	5949
5949A		5949A
6007		6007;DL67
6008		6008;DF67
6011		(PL5684/C3JA)
6021	3986	6021;(ECC70)
6027		(JP9-15)
6027H		(YJ1060)
6057		(M8137)
6058	4025	(M8079)
6060		M8162
6062	4039	6062
6064	4014	M8083
6065	4015	M8161
6067		M8136
6073	2903	M8223
6074		M8224
6075		6075;QBW5/3500
6076	5219	6076;QBL5/3500
6077		6077;TBW12/100
6078		6078;TBL12/100
6079	3522	6079;QB5/1750
6080	2984	6080
6083		6083;PE1/100

Type to be replaced	CV number	Replacement type
6084	2729	6084;E80F
6085		6085;E80CC
6086		6086;18042
6096	4010;5216	5654;E95F; 6AK5W;M8100
6097	4007	5726;E91AA; 6AL5W;M8212
6097B		XP1000
6097F		(XP1001)
6097G		(XP1000)
6099		M8081
6100	4058	M8080
6101	4031	M8081
6111		6111
6112		6112
6135	4022	M8080
6146	3523	6146;QE05/40
6146A		6146A;QE05/40
6146B		6146B;YL1370
6155	2130	6155;QB3/300
6156	2131	6156;QB3.5/750
6159		6159;QE05/40H
6159A		6159A;QE05/40H
6159B		6159B;YL1372
6187		M8196
6189	4003	6189;12AU7WA; M8136;E82CC
6198/A		(XQ1053)
6199		150AVP
6201	4024;3508; 5212	6201;E81CC; 12AT7WA;M8162
6205	2432	6205;EF734
6206		6206
6211		6211
6218		6218;E80T
6227		6227;E80L
6252	2799	6252;QQE03/20
6255B		(56AVP/05)
6255G		(56UVP)
6255S		(56AVP/03)
6263		6263
6263A		6263A
6264		6264
6264A		6264A
6267	2901	6267;EF86;M8195
6268	1787	6268;4C35A
6279	2520	6279;5C22
6286		6286
6291		150AVP
6292		6292
6293		6293
6308		(ZZ1000)
6334		56032
6342A		XP1001
6346		(ZX1051)
6347		(ZX1052)
6348		(ZX1053)
6354	2225	6354;150B2; M8163
6360;6360A	2798	6360;QQE03/12
6362		XP1111;(XP1110)
6363		XP1030
6364		(54AVP)
6365		(XP1113)
6370	5106	6370;E1T
6373	2105	6373;DL70
6374	2235	6374;M8091
6375	2275	6375;DC70
6443	4044	M8091

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Type to be replaced	CV number	Replacement type
6463	5304	6463
6467		150AVP;(XP1180)
6476		Z502S
6489	469	6489;EA76
6508		6508;DCG9/20
6511		(ZX1061)
6524		(6252);(QQE03/20)
6538		6538;Z800U
6539		6539;Z801U
6574	2253	PL6574
6587		(5C22);(6279)
6617		6617;TBW12/25
6618		6618;TBL12/25
6626		M8223
6627		M8224
6655A		XP1000
6681		6681;E83CC
6686		6686;E81L
6688	3998	6688;E180F; (E186F);(7737)
6689		6689;E83F
6693		6693;DCG6/18
6700	5277	6700;ET51
6755		PL6755
6778		6778;EC70
6779	2434	6779;Z803U
6786		6786;DCG7/100B
6807		PL6807
6810A		(56AVP);(56AVP/05)
6810B		(56AVP);(56AVP/05)
6816		6816;YL1101
6844A		ZM1020
6850		(6252);(QQE03/20)
6883		6883;QE05/40F
6883A		6883A;QE05/40F
6883B		6883B;YL1371

Type to be replaced	CV number	Replacement type
6884		6884;YL1100
6894		(7136);(DCG6/18GB)
6895		(6693);(DCG6/18)
6903		XP1004
6907		6907
6911		XP1005
6922	2492	6922;E88CC; (E188CC);(7308)
6923	5140	6923;EA52
6935		XP1111;(XP1110)
6939		6939;QQE02/5
6960		6960;TBW7/8000
6961		6961;TBL7/8000
6972		6972
6977		6977;DM160
7004		7004;TBL2/300
7008		7008;YJ1010
7011		YJ1011
7025		7025;12AX7S;M8137
7028		7028
7034		4X150A;QEL1/150
7035		4X150D;QEL1/150H
7038		(XQ1050)
7038A		(XQ1040);(XQ1050)
7046		(58AVP);(XP1040)
7062		7062;E180CC
7064		XP1000
7065		150AVP
7090		7090
*7091		YJ1162
7092		7092;TB5/2500
7093		7093
7102		150CVP
7111		YJ1011
7119	5188	7119;E182CC

* Obsolete type with replacement type

Type to be replaced	CV number	Replacement type
7136		7136;DCG6/18GB
7189		7189
7203		4CX250B;QEL2/275
7204		4CX250F; QEL2/275H
7213		7213;YL1280
7237		(TBL7/8000);(6961)
7247		7247
7262		(XQ1042);(XQ1043)
7262A		(XQ1030);(XQ1042); (XQ1043)
7264		(56AVP);(56AVP/05); (56AVP/SP)
7265		(56TVP)
7289		7289
7291/A		(XQ1040);(XQ1050)
*7292		YJ1160
7308	5231;4108	7308;E188CC
7316		7316;ECC186
7320		7320;E84L
7326		XP1002
7336		(XQ1040)
7351		(XQ1050)
7377		7377;QQE04/5
7378		7378;QE08/200
7386		PL5545A
7459		(YD1120)
7475	1070	7475
7522		(XQ1010)
7527		7527;QB4/1100; YL1460
7534		7534;E130L
7537		7537
7580		7580;QEL2/200
7580W		YL1170;4CX250R
7609		7609
7632		7632;ORP10
7633		7633;ORP11
7634		7634;61SV
7643		7643;E80CF
7645		(6939);(QQE02/5)
7650		7650;YL1110
7664		XP1004
7681		(ZX1062)
7693		7693;E90F
7694		7694;E99F
7696		XP1001
7697		(XQ1052);(XQ1053)
7704		7704;QBL5/4000
7709		7709
7710		7710;Z70U
7711		7711
7714		7714;Z805U
7721		D3a
7722		7722;E280F
7735A,B		(XQ1052);(XQ1053)
7737		7737;E186F
7746		(XP1001)
7751		7751;E235F
7753		7753;TBL6/4000
7764		(XP1113)
7767		XP1111;(XP1110)
7788		7788;E810F
7800		(TBL12/40)
7804		7804;TBL6/14
7805		7805;TBW6/14
7806		7806;TBL12/38
7807		7807;TBW12/38
7817		XP1000;(XP1001)
7818		XP1030;(XP1031)

* Obsolete type with replacement type

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Type to be replaced	CV number	Replacement type
7819		(54AVP)
7836		7836;QE08/200H
7843		YL1102;7843
7844		YL1103;7844
7850		(56AVP);(56AVP/05)
7854		7854;YL1060
7860		(XP1115)
7899		7899
7908		(XP1115)
7909		(XP1110);(XP1111)
7980		7980;83A1
7981		PL7981
7983		7983;QQC03/14
7984		7984
7986		7986;TB2.5/400
8008		8008;DCG5/5000GS
8008A		ZY1001
8020	2967	8020
8032		8032;QE05/40K
8032A		8032A;YL1371
8042		8042;QC05/35
8053		XP1001;(XP1000)
8054		XP1031;(XP1030)
8055		54AVP
8062		150CVP
8063	5234	PL5684/C3JA
8078		TB4/1500
8108	5397	8108;EC157
8116		8116;YL1071
8117		8117;YL1070
8118		8118;YL1020
8119		8119;TBL2/400
8120		8120;TBL2/500
8163		8163;YD1130
8165		8165;QB3/200
8177		8177;QBL3.5/2000
8179		8179;QB5/2000
8223		8223;E288CC
8228		8228;ZZ1000
8233		8233;E55L
8253/6587A		(5C22);(6279)
8254		8254;EC1000
8255		8255;E88C
8268		8268;TBW7/9000
8269		8269;TBL7/9000
8270		ZT1000
8278		8278;EL503
8298A		8298A;YL1370;6146B
8321		8321;YL1340
8322		8322;YL1341
8348		8348;YL1080
8356		(YJ1040)
8408		8408;YL1130
8421		(ZM1020)
8429		8429;YL1120
8436		8436;EC158
8438		8438;QB4/1100GA; YL1461
8438A		8438A;YL1461
8453		8453;ZM1050
8457		8457;YL1210
8458		8458;YL1240
8463		8463;YL1000
8482		ZT1001
8483		(XQ1030);(XQ1040)
8484		(XQ1052);(XQ1053)

Type to be replaced	CV number	Replacement type
8505		8505;YL1250
8507		(XQ1050);(XQ1052)
8511		(XQ1030)
8541		XQ1040;XQ1042
8544		8544;LCF80
8552		8552;YL1371
8560		8560;YL1320
8566		(XQ1040);(XQ1050)
8572		(XQ1040);(XQ1050)
8573		XQ1040
8577		8577;YL1220
8579		8579;YL1150
8580		8580;YL1190
8591		8591;TBH6/14
8592		8592;TBH7/8000
8593		8593;TBH7/9000
8594		8594;TBH12/38
8603		8603;YL1310
8604		55851S
8610		8610;TBH6/6000
8621		8621;4CX250FG
8625		(XQ1050);(XQ1052)
8626		(XQ1040);XQ1042
8628		(55851)
8637		8637;YL1300
8654		8654;YL1230
8666		8666;YD1170
8667		8667;YD1171
8668		8668;YD1172
8679		8679;YL1121
8680		8680;YD1212
8683		8683;YL1360
8728		8728;YD1150
8729		8729;YD1151
8730		8730;YD1152
8731		8731;YD1160
8732		8732;YD1161
8733		8733;YD1162
8734		8734;YD1173
8735		8735;YD1182
8736		8736;YD1192
8744		8744;YL1330
8752		8752;YD1202
8801		8801;YD1180
8867		8867;YD1352S
9514B		(56AVP);(56AVP/05)
9514S		(56AVP/03)
9524B		(XP1180)
9530B		(54AVP)
9530Q		(54UVP)
9531A		(XP1031)
9531B		(XP1030)
9536B		XP1001
9545B		(57AVP)
9552B		XP1004
9553		XP1005
9558B		(XP1002)
9578B		XP1030
9578U		(XP1030)
9578X		XP1030
9579B		(54AVP)
9579U		(54AVP)
9583B		54AVP
9584B		53AVP;(XP1000)
9584X		53AVP;(XP1000)
9593B		(56AVP);(56AVP/05)
9594B		(56AVP);(56AVP/05)
9601B		(XP1180)
9607B		(XP1002)
9609		(XP1110);(XP1111)

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Type to be replaced	CV number	Replacement type
9618B		(54AVP)
9623B		(57AVP)
9677		XQ1042;XQ1043
9728		XQ1052;XQ1053
9745		(XQ1010)
10667F		(XQ1050)
10667G		(XQ1053)
10667M		(XQ1054)
10667S		(XQ1052)
10667SC		(XQ1050)
10667T		(XQ1052)
13201A		13201A
13201E		13201E
16907		16907
18014		18014
18042		18042;6086
18045		18045
18503		18503
18504		18504
18505		18505
18506		18506
18507		18507
18509		18509
18511		18511
18515		18515
18516		18516
18517		18517
18518		18518
18520		18520
18524		18524;(ZP1082)
18525		18525;(ZP1072)
18526		18526
18529		18529
18533		18533;(ZP1083)
18536		18536
18537		18537
18538		18538
18545		18545
18546		18546
18550		18550
18552		18552
18553		18553
18600		18600
18600R		18600R
18601		18601
18602		18602
18700		18700
38116		1163
38166		866A;DCG4/1000G
38172		872A;DCG5/5000GB
55029		55029
55030		55030
55031/01		55031/01
55031/02		55031/02
55032/01		55032/01
55032/02		55032/02
*55035		2J42
*55040		725A
*55125		YJ1191
*55230		5J26
55305		55305
55306		55306
55335		55335
55340		55340
*55370		YK1010
*55390		2K25
*55391		723A/B
*55850AM		(XQ1044)
*55850F		(XQ1040)
*55850N		(XQ1043)

* Obsolete type with replacement type

Type to be replaced	CV number	Replacement type
*55850S		(XQ1042)
*55850SR		(XQ1041)
*55851AM		XQ1044
*55851F		XQ1040
*55851N		XQ1043
*55851S		XQ1042
*55851SR		XQ1041
*55852AM		XQ1054
*55852F		XQ1050
*55852N		XQ1053
*55852S		XQ1052
*55852SR		XQ1051
55875		55875
55875B		55875B
55875G		55875G
55875L		55875L
55875R		55875R
55875-IG		55875-IG
55875B-IG		55875B-IG
55875G-IG		55875G-IG
55875R-IG		55875R-IG
55876/01		55876/01
*56000		8020
56001		56001
56006		56006
56032		56032
56050-01		56050-01
56054		56054
56055		56055
62019		62019
62022		62022
62028		62028
62031		62031
68506	2775	1163
68508		1164
95108		95108
95322		95322
*95398		—
178148		1163
178149		1163
180238		1164
189048		1163
189049		1163
217283		1164
289414		1163
289416		1163
766776		1164
A28-13W		A28-13W
A28-14W		A28-14W
A31-20W		A31-20W
A31-120W		A31-120W
A44-120W		A44-120W
*A47-11W		A47-26W
A47-13W		19CWP4
A47-14W		A47-14W
A47-15W		19CWP4
A47-17W		A47-26W
A47-18W		A47-26W
A47-26W		A47-26W
A50-120W		A50-120W
A56-120X		A56-120X
A59-11W		A59-11W
A59-12W		A59-11W
A59-13W		A59-16W
A59-14W		A59-16W
A59-15W		A59-15W
A59-16W		A59-16W

* Obsolete type with replacement type

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Type to be replaced	CV number	Replacement type
A59-23W		A59-23W
A61-120W		A61-120W
*A63-11X		A63-120X
A63-120X		A63-120X
A65-11W		A65-11W
A66-120X		A66-120X
A66-140X		A66-140X
A4051		QE06/50;807
AA91E		5726;E91AA; 6AL5W;M8212
AB2		AB2
ABC1		ABC1
ABL1		ABL1
ACS4		QBL5/3500;6076
ACT70		YD1120
ACT100		(TB6/14);(7804)
AF7		AF7
AG3B28	1835	DCX4/1000;3B28
AG575A		(DCG6/18GB);(7136)
AG866A	32	DCG4/1000G;866A
AG869B		(DCG9/20);(6508)
AG872A	642	DCG5/5000GB;872A
AG5004		(DCG4/1000G);(866A)
AG5005		(DCG7/100)
AG5006		(DCG6/18);(6693)
AG5209		85A2;OG3;M8098
AG5210		OB2;OB2WA;M8224
AG5211		OA2;150C2; OA2WA;M8223
AG8008		DCG5/5000GS;8008
AGR9950		5869;(DCG6/6000)
AGR9951		5870;DCG12/30
AH201		(866A);(DCG4/1000G)
AH205		(DCG7/100)
AH213		(DCG9/20);(6508)
AH217		DCG5/5000GB;872A

Type to be replaced	CV number	Replacement type
AH221	5	(DCG4/5000)
AH238		DCG4/5000
AJ5551		ZX1051
AJ5551A		ZX1051
AJ5552		ZX1052
AJ5552A		ZX1062
AJ5553A		ZX1053
AJ5553B		ZX1053;(ZX1063)
AJ6346		(ZX1051)
AJ6347		(ZX1052)
AL4		AL4
APY16		APY16
APY17		APY17
APY18		APY18
APY19		APY19
APY20		APY20
APY21		APY21
APY22		APY22
APY23		APY23
APY24		APY24
APY25		APY25
APY26		APY26
APY27		APY27
APY28		APY28
APY29		APY29
APY41		APY41
APY42		APY42
APY43		APY43
APY44		APY44
APY45		APY45
APY46		APY46
APY47		APY47
APY48		APY48
APY49		APY49
AR10		(ZX1052)

* Obsolete type with replacement type

Type to be replaced	CV number	Replacement type
AR10T		(ZX1052)
AR14		ZX1051
AR14T		(ZX1051)
AR14TP		(ZX1051)
AR14TWS		(ZX1051)
AR21		EBC33
ARP34		EF39
ART10TP		(ZX1052)
ART10TWS		(ZX1052)
ASG5007		(DCG12/30);(5870)
ASG5017		PL5557
ASG5023		PL3C23
ASG5044B		PL6755
ASG5045B		PL106
ASG5121		PL2D21;EN91; PL5727;M8204
ASG5155A		(PL255)
ASG5544		PL5544
ASG5545		PL5545
ASG5696		5696
ASG5727		PL5727;M8204
ASG5823		5823;Z900T
ASG5830		(DCG7/100)
ASG6011		PL5684/C3JA
ASG6574		PL6574
ASG6807		PL6807
ATS25		807;QE06/50
AU1		AZ50
*AW21-10		M21-11W
AW36-20		AW36-20;14ABP4A
AW36-21		AW36-21;14ABP4
AW36-80		AW36-80;14AHP4A
AW36-80Z		AW36-80Z
AW36-81		AW36-81;14AHP4
AW43-80		AW43-80;17BTP4
AW43-80Z		AW43-80Z
AW43-88		AW43-88
AW43-89		AW43-89
AW47-12		(AW47-91)
AW47-30		(AW47-91)
AW47-90		AW47-91
AW47-91		AW47-91
AW47-94		AW47-91
AW47-97		(AW47-91)
AW53-80		AW53-80;21CPL4
AW53-80Z		AW53-80Z
AW53-88		AW53-88
AW53-89		AW53-89
AW59-90		AW59-90;23CMP4
AW59-91		AW59-91
AW61-88		AW61-88
AX3C23		PL3C23
AX4-125A	2130	6155;QB3/300
AX4-250A	2131	6156;QB3.5/750
AX50		AX50
AX105		PL105
AX195		AX195
AX224	1835	DCX4/1000;3B28
AX228		(DCX4/5000);(4B32)
AX230	2518	DCX4/5000;4B32
AX5551		ZX1051
AX5551A		ZX1051
AX5552		ZX1052
AX5552A		ZX1052
AX5553		ZX1053
AX5553B		ZX1053
AX5555		ZX1055
AX5822		ZX1061
AX5822A		ZX1061

* Obsolete type with replacement type

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Type to be replaced	CV number	Replacement type
AX7585		ZX1052
AX9900		5866;TB2.5/300
AX9901		5867;TB3/750
AX9902		5868;TB4/1250
AX9903	2797	5894;QQE06/40
AX9904		5923;TBW6/6000
AX9904R		5924;TBL6/6000
AX9905		5895;QQC04/15
AX9906		6077;TBW12/100
AX9906R		6078;TBL12/100
AX9907		6075;QBW5/3500
AX9907R		6076;QBL5/3500
AX9908		6079;QB5/1750
AX9909		6083;PE1/100
AX9910		6252;QQE03/20
AX9911		4C35A;6268
AX9912		5C22
AZ1	2860	AZ1
AZ4		AZ4
AZ11		AZ11
AZ12		AZ12
AZ31	2862	AZ31
AZ41	3892	AZ41
AZ50	1264	AZ50
B6H		(18533);(ZP1083)
B65	1988	6SN7GT
B109		UCC85
B142	1927	(TB4/1250);(5868)
B152		ECC81;12AT7
B309		ECC81;12AT7
B329		ECC82;12AU7
B339		ECC83;12AX7
B719		ECC85;6AQ8
B1135		TB3/750;5867

Type to be replaced	CV number	Replacement type
B5030		ZM1030
B5031		Z520M
B5032		Z521M
B5092		(ZM1020)
B5441		(ZM1000)
BF61		EL41;6CK5
BF62		EL42
BF451		UL41;45A5
BK24		ZX1052
BK24A		(ZX1052)
BK24B		(ZX1052)
BK24C		ZX1052
BK34		ZX1063
BK34A		(ZX1063)
BK34B		(ZX1063)
BK42		ZX1051
BK42A		ZX1051
BK42B		(ZX1051)
BK42C		ZX1051
BK46		ZX1055
BK66		(ZX1060)
BK146		ZX1053;ZX1063
BK168		(ZX1061)
BK168B		(ZX1061)
BK542		ZX1061
BM1002		JP9-15B
BM1048		JP9-15
BM1049		2J42
BMQ10/14		(XP1118)
BMS10/14		(XP1110)
BMS11/23		(XP1180)
BPX10		BPX10
BPX12		BPX12
BPX13		BPX13
BPX14		BPX14

Type to be replaced	CV number	Replacement type
BPX52		BPX52
BPX56		BPX56
BPY20		BPY20
BPY22		BPY22
BPY23		BPY23
BPY24		BPY24
BPY51		BPY51
BPY52		BPY52
BPY53		BPY53
BPY54		BPY54
BPY55		BPY55
BPY56		BPY56
BPY57		BPY57
BPY58		BPY58
BPY59		BPY59
BPY75-300		BPY75-300
BPY81		BPY81
BPY82		BPY82
BPY83		BPY83
BPY84		BPY84
BPY85		BPY85
BPY86		BPY86
BPY87		BPY87
BPY88		BPY88
BPY89		BPY89
BR191B		YD1120
BR1126		YD1230
BT5		PL5559
BT17		(PL105)
BT19		(PL5557)
BT29		PL255
BT69		(DCG7/1000B);(6786)
BT77		PL5545A
BT79		(3C45)
BT91		PL5544
BTW6-3		(TBW6/14)
C3J		PL5632/C3J
C3JA		PL5684/C3JA
C3m	5232	C3m
C6A		(PL5545A)
C6J		PL5545A
C6JA		(PL5545A)
C6L		(PL5545A)
C6M		(PL5545A)
C6P		(PL5545A)
C8		C8
C10		C10
C21AA		(AW53-88)
C21KM		(AW53-80);(21CPL4)
C102A		XQ1053;XQ1054
C102B		XQ1043;XQ1044
C103A		XQ1052
C103B		XQ1042
C104A		XQ1050
C104B		XQ1040
C143	26	QB2/250;813
C144	2666	(QQE06/40);(5894)
C178A		QQE06/40;5894
C180	788	QQE04/20;832A
C350		(QE06/50);(807)
C866A		DCG4/1000G;866A
C872		DCG5/5000GB;872A
C1108		QB3/300;6155
C1112		QB3.5/750;6156
C1134		QQE03/20;6252
C1136		QB4/1100;7527

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Type to be replaced	CV number	Replacement type
C9132		(XQ1053)
C9132A		XQ1053
C9133		(XQ1050);(XQ1052)
C9133A		XQ1050;XQ1052
C9138		(XQ1054);XQ1030
C9138A		XQ1054
CBL1		CBL1
CBL6		CBL6
CBL31		CBL31
CC81E		12AT7WA;E81CC; 6201;M8162
CC86E		6463
CCa		E88CC;6922
CCH35		CCH35
CD18		ZM1020
CD26		ZM1020
CD64		ZM1080
CE225		1163
CE226		1163
CE235		1164
CE305		(PL5557)
CE306		(PL5545A)
CE308		(PL105)
CE309		PL5557
CE311		PL3C23A
CE866A		DCG4/1000G;866A
CE872A		DCG5/5000GB;872A
CE5685/C6J		PL5545A
CF50		CF50
CK1084		(ZM1080)
CK5651	3573;5186	5651;M8098
CK5654	4010;5216	5654;E95F; 6AK5W;M8100
CK5672	2238	5672

Type to be replaced	CV number	Replacement type
CK5678	2254	5678;DF60
CK5725	4011	5725;6AS6W; M8196
CK5726	4007;5189	5726;E91AA; 6AL5W;M8212
CK5783		5783WA;M8190
CK6021	3986	6021;ECC70
CK8650		(ZM1000)
CL4		CL4
CL1002		(XP1000)
CL1003		XP1030
CL1005		150CVP
CL1006		XP1005
CL1008		(XP1004)
CL1009		XP1032
CL1012		150AVP
CL1015		(56AVP)
CL1090		(56AVP);(56AVP/05)
CME1901		(AW47-91)
CME1902		AW47-91
CME1903		AW47-91
CME1906		19CWP4
CME2301		AW59-90;23CMP4
CME2302		AW59-90;23CMP4
CME2303		AW59-91
CQL/03-1		QEL2/275
CR1100	5219	QBL5/3500;6076
CRY1		CRY1
CRY2		CRY2
CRY3		CRY3
CRY4		CRY4
CRY101		CRY101
CRY103		CRY103
CRY104		CRY104
CST2/12		(PL255)

Type to be replaced	CV number	Replacement type
CT1/2500		PL5559
CW1100		QBW5/3500;6075
CY2		CY2
D2M9		EAA91;6AL5; 6AL5W;(E91AA); 5726
D3a		7721
D7-190..		D7-190..
D10-11..		D10-11..
D10-12..		D10-12..
D10-160..		D10-160..
D10-161..		D10-161..
D10-170..		D10-170..
D10-200..		D10-200..
D13-15..		D13-15..
D13-16..		D13-16..
D13-16../01		D13-16../01
D13-19..		D13-19..
D13-21..		D13-21..
D13-23..		D13-23..
*D13-24..		(D13-49..)
D13-26..		D13-26..
D13-26../01		D13-26../01
D13-27..		D13-27..
D13-49..		D13-49..
D13-450../01		D13-450../01
D13-480..		D13-480..

Type to be replaced	CV number	Replacement type
D13-481..		D13-481..
D13-500../01		D13-500../01
D14-120..		D14-120..
D14-121..		D14-121..
D14-122..		D14-122..
D14-123..		D14-123..
D14-160../09		D14-160../09
D18-120..		D18-120..
D77		EAA91;6AL5
D152		EAA91;6AL5
DA90	753	DA90;1A3
DAC21		DAC21
DAF40		DAF40
DAF41		DAF41
DAF91	784	DAF91;1S5
DAF96		DAF96;1AH5
*DB7-1		DB7-5;3ALP11
*DB7-2		DB7-6
*DB7-3		DB7-5;3ALP11
*DB7-4		DB7-6
DB7-5		DB7-5;3ALP11
DB7-6		DB7-6
DB7-11		DB7-11
DB7-36		DB7-36;3WP11
DB7-78		DB7-78
*DB7-91		DB7-11
DB10-6		DB10-6
DB10-78		DB10-78
*DB10-94		DB10-78
DB13-2		DB13-2
DB13-34		DB13-34;5ADP11
*DB13-76		D13-15BE
*DB13-78		D13-21BE
*DB13-79		D13-21BE
DC70	2275	DC70;6375

* Obsolete type with replacement type

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Type to be replaced	CV number	Replacement type
*DC80		DC70;6375
DC90		DC90
DC96		DC96
DCC90	808	DCC90;3A5
DCG1/250		DCG1/250
DCG1.5/250		DCG1.5/250
DCG2/500		DCG2/500
DCG4/1000A		DCG4/1000A;866A
DCG4/1000ED	1625	DCG4/1000ED
DCG4/1000G	32	DCG4/1000G;866A
DCG4/5000	1629	DCG4/5000
DCG5/5000EG		DCG5/5000EG; ZY1002
DCG5/5000GB	642	DCG5/5000GB;872A; ZY1000
DCG5/5000GS		DCG5/5000GS;8008; ZY1001
DCG6/18		DCG6/18;6693
DCG6/18GB		DCG6/18GB;7136
DCG6/6000		DCG6/6000;(5869)
DCG7/100		DCG7/100
DCG7/100B		DCG7/100B;6786
DCG9/20		DCG9/20;6508
DCG12/30		DCG12/30;5870
DCX4/1000	1835	DCX4/1000;3B28
DCX4/5000	2518	DCX4/5000;4B32
DD6		EAA91;6AL5
DDB47		Z806W
DDB52		Z302C
DDB70		Z504S
DDPP39S		CBL1
*DE2/200		DCG1/250; DCG4/1000G;866A
DET22	273	EC55;5861
DF21		DF21

Type to be replaced	CV number	Replacement type
DF22		DF22
DF60	2254	DF60;5678
DF61N	2371	DF61N
DF63	2433	DF63
DF67		DF67;6008
DF72	2101	DF72
DF73	2103	DF73
DF91	785;1971	DF91;1T4
DF92	1758 2742;2795	DF92;1L4
DF96		DF96;1AJ4
*DG7-1		DG7-5;3ALP1
*DG7-2		DG7-6
*DG7-3		DG7-5;3ALP1
*DG7-4		DG7-6
DG7-5	2175	DG7-5;3ALP1
DG7-6	5269	DG7-6
DG7-31		DG7-31
DG7-32		DG7-32;3AMP1A
DG7-36	3946	DG7-36;3WP1
DG10-2		DG10-2
DG10-3		DG10-3
DG10-5		DG10-5
DG10-6		DG10-6
DG10-74		DG10-74
DG13-2	2191	DG13-2
DG13-32		DG13-32
DG13-34	5035	DG13-34;5ADP1
*DG13-78		D13-21GH
DH3-91	2302	DH3-91;1CP31
DH7-11		DH7-11;3BYP31
DH7-78		DH7-78;3BKP31
*DH7-91		DH7-11
DH10-78		DH10-78
*DH10-94		DH10-78

* Obsolete type with replacement type

Type to be replaced	CV number	Replacement type
*DH13-76		D13-15GH;5CBP31
DH13-78		DH13-78;5BHP31
*DH13-79		D13-21GH
DH63	587	6Q7G
DH63(Met)		6Q7GT
DH77	452	EBC90;6AT6
DH109		UABC80
DH118		UBC41;14L7
DH119		UBC81
DH142		UBC41;14L7
DH147		EBC33
DH150		EBC41;6CV7
DH718		EBC41;6CV7
DH719		EABC80;6AK8
*DHM10-93		E10-12GH
DK21		DK21
DK40		DK40
DK91		DK91;1R5
DK92		DK92;1AC6
DK96		DK96;1AB6
DL21		DL21
DL41		DL41
DL64	2331	DL64
DL67		DL67;6007
DL68		DL68
DL69	2361	DL69
DL70	2105	DL70;6373
DL92	2370;484 820	DL92;3S4
DL93	807;2390	DL93;3A4
DL94	2983	DL94;3V4
DL95	818	DL95;3Q4
DL96		DL96;3C4
DL620	2238	5672
DL652		DL69
DM70	2980	DM70;1M3
DM71		DM71;1N3
DM160		DM160;6977
*DN7-1		DG7-5;3ALP1
*DN7-2		DG7-6
*DN7-3		DG7-5;3ALP1
*DN7-4		DG7-6
*DN7-5		DG7-5;3ALP1
DN7-11		DN7-11;3BYP2
DN7-36		DN7-36;3BWP2
DN7-78		DN7-78;3BKP2
*DN9-4		DN10-78;DH10-78
*DN9-5		DG10-5
*DN10-5		DG10-5
*DN10-6		DG10-6
DN10-78		DN10-78
*DN10-94		DN10-78
DN13-34		DN13-34;5ADP2
*DN13-76		D13-15GP
*DN13-78		D13-21GP
*DN13-79		D13-21GP
DN143		EBL21
*DNM10-93		E10-12GP
DP7-5	5171	DP7-5;3ALP7
DP7-6		DP7-6
DP7-11		DP7-11
DP7-36		DP7-36;3WP7
DP7-78		DP7-78
*DP7-91		DP7-11
DP10-106		DP10-6
*DP10-78		DN10-78
*DP10-94		DN10-78
DP13-2		DP13-2
DP13-34		DP13-34;5ADP7
*DP13-76		D13-15GM

* Obsolete type with replacement type

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Type to be replaced	CV number	Replacement type
*DP13-78		D13-21GM
*DP13-79		D13-21GM
DP61		EF95;6AK5
*DPM10-93		E10-12GM
DQ2		DCG4/1000G;866A
DQ2a		DCG4/1000ED
DQ4		DCG5/5000GB;872A
DQ4a		DCG5/5000EG
DQ5		(DCG6/18);(6693)
DQ5B		(DCG6/18GB)
DQ5C		(DCG6/18)
DQ6		(DCG9/20);(ZT1000)
DQ7		(DCG7/100B);(6786)
DQ45		(ZY1000)
*DR7-3		DG7-5
*DR7-4		DG7-6
DR7-5		DG7-5
DR7-6		DG7-6
DR10-6		DG10-6
DR13-2		DG13-2
DR869B		(6508);(DCG9/20)
DW4-500		1561
DX2		DXC4/1000;3B28
DX144		EC157;8108
DX145		EC157;8108
DX145A		EC157;8108
DX151		YK1010
DX155		7093
DX184		55335
DX206		DX206
DX267		DX267
DX274		8603;YL1310
DX276		DX276
DX285		YJ1180
DY51		DY51;1BG2

Type to be replaced	CV number	Replacement type
DY70	2241	DY70;5642
DY86 DY87		DY87;DY802
DY802		DY802;1BQ2
E1T	5106	E1T;6370
E10-12BE		E10-12BE
E10-12GH		E10-12GH
E10-12GM		E10-12GM
E10-12GP		E10-12GP
E10-130BE		E10-130BE
E10-130GH		E10-130GH
E10-130GM		E10-130GM
E10-130GP		E10-130GP
E55L		E55L;8233
E80CC		E80CC;6085
E80CF		E80CF;7643
E80F	2729	E80F;6084
E80L		E80L;6227
E80T	5724	E80T;6218
E81CC	4024;5212; 3508	E81CC;6201; (12AT7WA);(M8162)
E81L		E81L;6686
E82CC		E82CC
E83CC		E83CC;6681
E83F		E83F;6689
E84L		E84L;7320
E86C		E86C
E88C		E88C;8255
E88CC	2492	E88CC;6922

* Obsolete type with replacement type

Type to be replaced	CV number	Replacement type
E90CC	5214	E90CC;5920
E90F		E90F;7693
E91AA	4007;5189	E91AA;5726; (6AL5W);(M8212)
E91N	4018	PL5727;M8204
E92CC		E92CC
E95F	4010;5216	E95F;5654; (6AK5W);(M8100)
E99F		E99F;7694
E125A		QB3/300;6155
E130L		E130L;7534
E180CC		E180CC;7062
E180F	3998	E180F;6688
E182CC	5188	E182CC;7119
E182F		E182F;5847
E186F		E186F;7737
E188CC	5231;4108	E188CC;7308
E235F		E235F;7751
E235L		E235L
E236L		E236L
E250A		QB3.5/750;6156
E280F		E280F;7722
E282F		E282F
E283CC		E283CC
E288CC		E288CC;8223
E810F		E810F;7788
E1485	807	DL93;3A4
E1955	797	PL2D21;EN91; PL5727;E91N;M8204
E2016		EF92;6CQ6;M8161
E2157	455	ECC81;12AT7
E2163	491	ECC82;12AU7
E2164	492	ECC83;12AX7
EA50		EA50
EA52	5140	EA52;6923

Type to be replaced	CV number	Replacement type
EA53		EA53
EA76	469	EA76;6489
EAA91	283	EAA91;6AL5
EAA901		E91AA;5726; (6AL5W);(M8212)
EAA901S		E91AA;5726;6AL5W
EABC80		EABC80;6AK8
EAC91	137	EAC91;M8097
EAF42	3883	EAF42;6CT7
EAF801		EAF801
EB4		EB4
EB34	1054	EB34
EB41	3881	EB41
EB91	140	EAA91;6AL5
EBC3	1428	EBC3
EBC33	1055	EBC33
EBC41	3882	EBC41;6CV7
EBC80		EBC80;6BD7
EBC81		EBC81;6BD7A
EBC90	452	EBC90;6AT6
EBC91	2526	EBC91;6AV6
EBF2	2925	EBF2
EBF32	501	EBF32
EBF35		EBF35
EBF80		EBF80;6N8
EBF83		EBF83;6DR8
EBF89		EBF89;6DC8
EBL1		EBL1
EBL21		EBL21
EBL31	2926	EBL31
EC50	2927	EC50
EC52		EC52
EC54		EC54
EC55		EC55;5861
*EC56		EC157;8108

* Obsolete type with replacement type

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Type to be replaced	CV number	Replacement type
*EC57		EC157;8108
EC70	468	EC70;6778
EC71	3930	EC71;5718
EC80	1886	EC80;6Q4
EC81	1865;1888	EC81;6R4
EC86		EC86;6CM4
EC88		EC88;6DL4
EC90	133	EC90;6C4;M8080
EC91	417	EC91;6AQ4; M8099
EC92		EC92
EC93		EC93
EC97		EC97;6FY5
EC157	5397	EC157;8108
EC158		EC158;8436
EC900		EC900;6HA5
EC1000		EC1000;8254
EC8010		EC8010
ECC33	2821	ECC33
ECC34		ECC34
ECC40	3884	ECC40
ECC70	3986	ECC70;6021
ECC81	455	ECC81;12AT7
ECC82	491	ECC82;12AU7
ECC83	492	ECC83;12AX7
ECC84	5281	ECC84;6CW7
ECC85		ECC85;6AQ8
ECC86		ECC86;6GM8
ECC88	5358	ECC88;6DJ8
ECC89		ECC89;6FC7
ECC91	858	ECC91;6J6;M8081
ECC186		ECC186;7316
ECC189	5331	ECC189;6ES8
ECC801		E81CC;6201; 12AT7WA;(M8162)

Type to be replaced	CV number	Replacement type
ECC801S		E81CC;6201; 12AT7WA;(M8162)
ECC802		12AU7WA;6189; (M8136)
ECC802S		12AU7WA;6189; (M8136)
ECC803		12AX7S;7025;M8137
ECC803S		12AX7S;7025; (M8137)
ECC808		ECC808
ECC960		E90CC;5920
ECC962		E92CC
ECC2000		ECC2000
ECF1		ECF1
ECF80	5215	ECF80;6BL8; E80CF;7643
ECF82	5065	ECF82;6U8
ECF86		ECF86;6HG8
ECF200		ECF200;6X9
ECF201		ECF201;6U9
ECF202		ECF202;6AJ9
ECF801		ECF801;6GJ7
ECF802		ECF802;6JW8
ECH3	2929	ECH3
ECH4		ECH4
ECH21		ECH21
ECH33	2930	ECH33
ECH42	3888	ECH42;6CU7
ECH81	2128	ECH81;6AJ8
ECH83		ECH83;6DS8
ECH84		ECH84;6JX8
ECH113		ECH42;6CU7
ECH200		ECH300;6V9
ECL80		ECL80;6AB8

* Obsolete type with replacement type

Type to be replaced	CV number	Replacement type
ECL82		ECL82;6BM8
ECL83		ECL83
ECL84		ECL84;6DX8
ECL85		ECL805;6GV8
ECL86		ECL86;6GW8
ECL805		ECL805;6GV8
ED500		ED500;6ED4
EE17		PL5557
EE575A		DCG6/18GB;7136
EE866		866A;DCG4/1000G
EE869B		(6508);(DCG6/20)
EF9		EF9
EF22	303	EF22
EF37A	5080;358	EF37A
EF39	1053	EF39
EF40	3885	EF40
EF41	3886	EF41;6CJ5
EF42	3887	EF42
EF43		EF43
EF50		EF50
EF54	380;1136	EF54
EF55	173	EF55
EF80	1376	EF80;6BX6
EF83		EF83
EF85	1375	EF85;6BY7
EF86	2901	EF86;6267;M8195
EF89	5156	EF89;6DA6
EF91	138	EF91;6AM6; 6AM6S;M8083
EF92		EF92;6CQ6;M8161
EF93	454	EF93;6BA6
EF94	2524	EF94;6AU6
EF95	850	EF95;6AK5;6AK5W; 5654;E95F;M8100
EF97		EF97;6ES6

Type to be replaced	CV number	Replacement type
EF98		EF98;6ET6
EF183		EF183;6EH7
EF184		EF184;6EJ7
EF730	3928	EF730;5636
EF731	477;475	EF731;5899
EF732	3929	EF732;5840
EF734		EF734;6205
EF861		E180F;6688
EF905		E95F;5664; 6AK5W;M8100
EFL200		EFL200;6Y9
EFM1		EFM1
EFM11		EFM11
EH90		EH90;6CS6
EH900		(E91H);(6687)
EK2	1426	EK2
EK90	453	EK90;6BE6
EL12		EL12
EL32	1052;5233	EL32
EL34	1741	EL34;6CA7
EL36	2940	EL36;6CM5
EL37	586	EL37
EL41	3889	EL41;6CK5
EL42	3890	EL42
EL50	2941	EL50
EL51		EL51
EL60		EL60
EL71		EL71;5902
EL80		EL80;6M5
EL81	2721	EL81;6CJ6
EL82		EL82;6DY5
EL83	2726	EL83;6CK6
EL84	2975	EL84;6BQ5
EL85	3526	EL85;6BN5
EL86	5094	EL86;6CW5

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Type to be replaced	CV number	Replacement type
EL90	1862	EL90;6AQ5
EL91	136	EL91;6AM5;M8082
EL95		EL95;6DL5
EL136		EL136;6FV5
EL183		EL183
EL360		EL360
EL500		EL500
EL503		EL503;8278
EL504		EL504;6GB5A
EL505		EL505;6KG6
EL508		EL508;6KW6
EL509		EL509;6KG6A
EL802		EL802;6LD6
EL821	2127	EL821;6CH6
EL822	2382	EL822
EL861		E81L;6686
EL-C3J		PL5632/C3J
EL-C3JA		PL5684/C3JA
EL-C6A		(PL5545A)
EL-C6H-1		(PL5545A)
EL-C6J		(PL5545A)
EL-C6JA		(PL5545A)
EL-C6JK		(PL5545A)
EL-C6L		(PL5545A)
EL-C6M		(PL5545A)
ELL80		ELL80
EM1		EM1
EM80	1352	EM80;6BR5
EM81	5055	EM81;6DA5
EM84		EM84;6FG6
EM87		EM87;6HU6
EN32	2253	PL6574
EN33		EN33
EN70	474	EN70

Type to be replaced	CV number	Replacement type
EN91	797	EN91;PL2D21; PL5727;M8204
EN92	3512	5696
EN93	1949	EN93;6D4
ER21A		Z805U;7714
ES85		(TB2.5/300);(5866)
ES204A		TB3/750;5867
ES833		(TB4/1250);(5868)
ES833A		(TB4/1250);(5868)
ESU103		DCX4/1000;3B28
ESU150		(DCG4/5000)
ESU200	5	(DCG4/5000)
ESU575		(DCG6/18GB);(7136)
ESU673		(DCG6/18);(6693)
ESU866	32	DCG4/1000G;866A
ESU866ES		DCG4/1000ED
ESU872	642	DCG5/5000GB;872A
ESU8008		DCG5/5000GS;8008
ET51	5277	ET51;6700
EW3H		(18505);(18506)
EY51	426	EY51;6X2
EY80		EY80;6U3
EY81		EY81;6R3
EY82		EY82;6N3
EY86 EY87	2966	EY87;6S2A
EY88		EY88;6AL3
EY500 EY500A		EY500A;6EC4A
EZ35	574	EZ35
EZ40	3891	EZ40;6BT4
EZ41		EZ41
EZ80	1535	EZ80;6V4
EZ81	5072	EZ81;6CA4

Type to be replaced	CV number	Replacement type
EZ90	493	EZ90;6X4
F2.5M3		XQ1052;XQ1053
F16-10LD		F16-10LD
F21-10LD		F21-10LD
F31-10LC		F31-10LC
F41-10LC		F41-10LC
F41-11C		F41-11LC
F353		872A;DCG5/5000GB
F353A		872A;DCG5/5000GB
F366A		866A;DCG4/1000G
F369A		(6508);(DCG9/20)
F369B		(6508);(DCG9/20)
F672B		872A;DCG5/5000GB
F869B		(6508);(DCG9/20)
FG17	2957	PL5557
FG27A		(PL5559)
FG57		PL5559
FG97		(PL5557)
FG98A		(PL5557)
FG105		PL105
FG172		(PL105)
FG235A		ZX1052
FG258A		ZX1053
FG271		ZX1051
FS9A		150AVP
FS10A/70		XP1030
FS12-A47		(XP1000)
FS12-A70		(XP1030)
FTL3-2		(TBL7/8000);(6961)
FW4-500	1264	AZ50
FX219	2520	5C22;6279
FX225	1787	6268;4C35A
FX227	372	3C45
FX229	3521	5949
FX231		5C22;6279
G1		3554
G4		(3554);(3546PW)
G5H		(18503)
G9		(3554)
G10/1d		DCG4/1000G;866A
G10/1dv		DCX4/1000;3B28
G10/4d		(DCG5/5000GB)
G20/5d		(DCG9/20);(6508)
G24H		(18545)
G48		1163
G49		1163
G108/1K		OB2;OB2WA; M8224
G150/4K		OA2;OA2WA; M8223
G4120		1561
GA50		90AG
GA90		ZM1020
GC10B	2271	Z303C
GD83M		83A1;7980
GD85M/S		85A2;OG3;M8098
GD85WR		(ZZ1000)
GD90M		90C1;M8206
GD100A/S		7475
GD100B		7475

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Type to be replaced	CV number	Replacement type
GD100B/S		7475
GD150A/S		150C3;OD3
GD150M		OA2;OA2WA;M8223
GD150M/S		150C2
GL2D21		PL2D21;EN91; PL5727;M8204
GL3C23		PL3C23A
GL57		PL5559
GL238A		ZX1055
GL238B		ZX1055
GL414		PL5559
GL415		(ZX1060)
GL575A		(7136);(DCG6/18GB)
GL673		(6693);(DCG6/18)
GL681		ZX1060
GL807		807;QE6/50
GL813		813;QB2/250
GL829B		(5894);(QQE06/40)
GL832A		832A;QQE04/20
GL866A		866A;DCG4/1000G
GL872A		872A;DCG5/5000GB
GL5544		PL5544
GL5545		PL5545A
GL5550		(ZX1060)
GL5551		ZX1051
GL5551A		ZX1051
GL5552		ZX1052
GL5552A		ZX1052
GL5553A		ZX1053;(ZX1063)
GL5553B		(ZX1053)
GL5555		ZX1055
GL5557		PL5557
GL5559		PL5559
GL5632		PL5632/3CJ

Type to be replaced	CV number	Replacement type
GL5720		(PL5559)
GL5727		PL5727;M8204
GL5788		(ZX1055)
GL5822		ZX1061
GL5822A		ZX1061
GL5855		(PL255)
GL6011		(PL5684/C3JA)
GL6159		6159;QE05/40H
GL6346		(ZX1051)
GL6347		(ZX1052)
GL6348		(ZX1053)
GL6513		(ZX1055)
GL6514		(ZX1055)
GL6807		PL6807
GL7151		(ZX1063)
GL7681		(ZX1053);(ZX1062)
GLE10000/025/1		DCG4/1000ED
GLE13000/1.5/6		DCG5/5000GB;872A
GLE15000/3/12		DCG6/18;6693
GLE20000/2.5/10		DCG9/20;6508
GN3		ZM1020
GN4		ZM1020
GN6		ZM1080
GR10A		Z503M
GR10M		ZM1022
GR16		ZC1040
GR41		(Z70W)
GR43		(Z70U)
GRG250/3000		PL5557
GS10C	2325	Z502S
GS10C/S		Z502S
GTR83X		(ZZ1000)
GU1		(DCG1/250)
GU12		(DCG4/1000G);(866A)
GU18		(DCG4/5000)

Type to be replaced	CV number	Replacement type
GU20/21		(DCG4/5000)
GU21SP		(DCG4/5000)
GXU1		DCX4/1000;3B28
GXU2		DCX4/5000;4B32
GY86		GY87
GY87		
GY501		GY501;3BH2
GZ34	1377	GZ34;5AR4
HBC90		HBC90;12AT6
HBC91		HBC91;12AV6
HC4		(18509)
HCH81		HCH81;12AJ7
HF61		EF41
HF62		EF42
HF93	1928	HF93;12BA6
HF94	1961	HF94;12AU6
HF121		UF41
HF255		(6508);(DCG9/20)
HF258		(DCG4/1000G); (866A)
HK90		HK90;12BE6
HL90		HL90;19AQ5
HL92	1959	HL92;50C5
HL94		HL94;30A5
HMO4		EK90;6BE6
HP6	138	EF91;6AM6
HT17		PL5557
HT415		5C22;6279

Type to be replaced	CV number	Replacement type
HY90		HY90;35W4
J213AAA		1163
JNT1-500	3602	5J26
JP2-0.2		7090
JP2-1A		DX206
JP2-2.5A		YJ1162
JP2-2.5W		YJ1160
*JP2-5W		YJ1191
JP8-02B	6072	JP8-02B
JP9-2.5		7028
JP9-2.5B		YJ1000
JP9-2.5C		JP9-2.5C
JP9-2.5D		JP9-2.5D
JP9-2.5E	10758	JP9-2.5E
JP9-2.5F		JP9-2.5F
JP9-7	3676	2J42
JP9-7A	370	JP9-7A
JP9-7D		JD9-7D
JP9-15	3997	JP9-15;YJ1110
JP9-15B		JP9-15B;YJ1111
JP9-15D	5123	JP9-15D
JP9-18		JP9-18
JP9-50A		2J55
JP9-75		JP9-75
JP9-80	5018	4J52A
JP9-250		4J50
JP35-30		7093
JPS9-200		YJ1180
JPT9-01	2420	JPT9-01
JPT9-60	3560;5134	2J51A

* Obsolete type with replacement type

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Type to be replaced	CV number	Replacement type
K81A		K81A
K211		(YK1110)
K345 series		YK1140 to YK1147
K365		(YK1000)
K366 series		YK1140 to YK1147
K367 series		YK1070 to YK1077
K1209		(54AVP)
K1213		(XP1030)
K1295		(XP1000)
K1299		(XP1001)
K1306		(XP1004)
K1361		150AVP;(XP1180)
K1384		(57AVP)
K1390		XP1030
K1391		(54AVP)
K1430		(150CVP)
K1566		(XP1118)
K1927		XP1002
K1961		XP1001
K2199		XP1001
K2244		(56TVP)
K2253		XP1030
K2276		150CVP
K3003		KS9-40G
K3020		(KS9-40B)
KM2290		XP1005
KM2334		(56AVP/05)
KM2368		(58AVP);(XP1040)
KR11000		YK1091
KS7-85		KS7-85

Type to be replaced	CV number	Replacement type
KS9-20	1975	723A/B
KS9-20A	2792	2K25
KS9-20B	9334	KS9-20B
KS9-20D		KS9-20D
KS9-40		KS9-40
KS9-40B		KS9-40B
KS9-40D		KS9-40D
KS35-50		55335
KS70-40		YK1010
KT66		EL37
KU676		(PL5632);(C3J)
KXR04-200		YK1090
L77	133	EC90;6C4;M8080
LA9-3B	6087	LA9-3B
LB3-250B	6223	LB3-250B
LB4-8		55340
LB6-10		LB6-10
LB6-20		LB6-20
LB6-25		LB6-25
LB6-25A		LB6-25A
LB8-20		YH1080
LC900		LC900;3HA5
LCF80		LCF80;6LN8
LCF86		LCF86;5HG8
LCF201		LCF201;5U9
LCF801		LCF801;5GJ7
LCF802		LCF802;6LX8

Type to be replaced	CV number	Replacement type
LCL84		LCL84;10DX8
LDR03		LDR03;ORP12
LF183		LF183;4EH7
LF184		LF184;4EJ7
LFL200		LFL200;11Y9
LL86		LL86;10CW5
LL500		LL500;18GB5
LL504		LL504;18GB5A
LL509		LL509;27KG6A
LN119		UCL82
LN152		ECL80;6AB8
LN309		PCL82;16A8
LN329		PCL83
LY88		LY88;20AQ3
LY500		LY500A;28EC4A
LY500A		
LZ329		PCF80;9A8
M6H		(18524)
M17-140W		M17-140W
M17-141W		M17-141W
M21-11W		M21-11W
M21-12W		M21-12W
M28-12W		M28-12W
M31-120W		M31-120W
M36-11W		M36-11W
*M36-13W		M38-120W
M36-16W		M36-16W
M38-120W		M38-120W
M502	2284	4J50
M503A	1866	JP9-7D
M508	370	JP9-7A
M513		(JP9-15)
M515		YJ1120
M513B		JP9-15
M526	3676	2J42
M541		5J26
M542	3611	5586
M551	5018	4J52A
M559		(YJ040)
M575		JP9-75
M581		YJ1290
M597		YJ1071
M598B		JP9-18
M599A		JP9-2.5D
M599B		JP9-2.5E
M5005		YJ1200
M5022		YJ1121
M5023		YJ1110
M5024		YJ1111
M5031		JP9-7L
M5042		YJ1250
M5043		YJ1300
M7075		(XQ1042);(XQ1043)
M8079	4025	M8079;5726;E91AA
M8080	4058	M8080
M8081	4031	M8081
M8082	4063	M8082
M8083	4014	M8083
M8091	4044	M8091
M8097	4059	M8097
M8098	4048	M8098
M8099	4070	M8099

* Obsolete type with replacement type

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Type to be replaced	CV number	Replacement type
M8100	4010	M8100;5654; 6AK5W;E95F
M8136	4003	M8136;(6189); 12AU7WA
M8137	4004	M8137;(7025); (12AX7S)
M8157	483	M8157
M8161	4015	M8161
M8162	4024	M8162;(12AT7WA); (6201);(E81CC)
M8163	4104;5132	M8163
M8190	4066;3960	M8190;(5783WA)
M8195	4085	M8195
M8196	4011	M8196;(6AS6W); (5725)
M8204	4018	M8204
M8206		M8206
M8212	4007	M8212;(E91AA); (6AL5W);(5726)
M8214	4035	M8214
M8223	4020;4100	M8223;OA2WA
M8224	4028;4101	M8224;OB2WA
M8225	4080	M8225
M8248	5311	M8248
MAG3		2J42
MAG4		JP9-15
MAG16		YJ1121
*MC13-16		Q13-110BA
ME1001	273	EC55;5861
ME1100		723A/B
ME1101		2J42
ME1101A		JP9-15
ME1101D		JP9-7D
ME1401	495;2269	4065
ME1402	2730	4066
ME1403	2348	4068
ME1404		4069
ME1503		(4C35A)
ME1504		PL5559
MG6-2		MG6-2
MG10H		(18520)
MG13-38		MG13-38
MI1050		ZX1051
MI1053		ZX1051
MI1100		ZX1052
MI1103		ZX1052
MI1104		ZX1061
MI1200		ZX1053;ZX1063
MI1203		ZX1053;ZX1063
MI1300		(ZX1063)
MI2053A		ZX1051
MI2100A		ZX1052
MI2103A		ZX1052
MI2104A		ZX1061
MI2200A		ZX1053
MI2203A		ZX1053
*MK13-16		(Q13-110GU)
ML4-125A		4-124A;QB3/300GA
ML4-250A		4-250A;QB3.5/750GA
ML4-400A		4-400A;QB4/1100GA
ML813		813;QB2/250
ML833A		(5868);(TB4/1250)
ML866A		866A;DCG4/1000G
ML869B		(6508);(DCG9/20)
ML872A		872A;DCG5/5000GB
ML7351A		(XQ1052);(XQ1053)
ML8008		8008;DCG5/5000GS

* Obsolete type with replacement type

Type to be replaced	CV number	Replacement type
MO10		ET51;6700
MT17		PL5557
MT57	612	PL5559
MT105		PL105
MT5544	2210	PL5544
MT5545	2215	PL5545A
MT5557		PL5557
MT5559		PL5559
MU6-2		MU6-2
MU13-38		MU13-38
MW6-2	1737	MW6-2
*MW13-32		MW13-38
MW13-38		MW13-38
MX113		MX113
MX114		18506
MX118		18537
MX120		18520
MX120/01		18520/01
MX122		18538
MX124		18524;(ZP1082)
MX124/01		18525
MX133		18533;(ZP1083)
MX135		ZP1000
MX136		ZP1010
MX145		18545
MX146		18503
MX147		18504
MX148		18505
MX149		18506
MX151		18509
MX152		18515
MX153		18516
MX157		18515/17
MX158		18516/18
MX163		18529

Type to be replaced	CV number	Replacement type
MX164		18550
MX166		18536
MX167		18546
MX170		18510
MX175		18508
MX177		18552
MX178		18553
MX966B		DCG4/1000G;866A
MY6-2		MY6-2
MY13-38		MY13-38
N1-140/08		ZX1052
N17	820	DL92;3S4
N18	818	DL95;3Q4
N19		DL94;3V4
N25		DL96;3C4
N66		EL37
N77	136	EL91;6AM5;M8082
N119		UL84
N142		UL41;45A5
N144		EL91;6AM5;M8082
N150		EL41;6CK5
N151		EL42
N152		PL81;21A6
N153		PL83;15A6
N154		PL82;16A5
N155		EL85;6BN5
N329		PL82:16A5
N359		PL81;21A6
N379		PL84;15CW5
N709		EL84;6BQ5

* Obsolete type with replacement type

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Type to be replaced	CV number	Replacement type
N727		EL90;6AQ5;M8245
NL575A		DCG6/18GB
NL673		(6693);(DCG6/10)
NL710		(PL5684);PL5559
NL714		(PL3C23)
NL715		PL5557
NL720		PL5684
NL730		(PL6755)
NL778		(PL106)
NL803		(ZM1080)
NL869B		(6508);(DCG9/20)
NL1005		ZX1051
NL1005A		ZX1051
NL1009A		(ZX1062)
NL1009A/P		(ZX1062)
NL1022		ZX1061
NL1022A/P		(ZX1061)
NL1031		ZX1051
NL1032		ZX1053
NL1051A		ZX1051
NL1051A/P		ZX1051
NL1052		ZX1052
NL1052A		ZX1052
NL1052A/P		ZX1052
NL1053		ZX1053
NL1053A		ZX1053
NL0181		ZX1061
NL1081P		ZX1061
NL1082		ZX1062
NL1082P		ZX1062
NL5030		ZM1030
NL5550		(ZX1060)
NL5551		ZX1051
NL5552		ZX1052
NL5553B		ZX1053
NL5553B/P		ZX1053
NL5555		ZX1055
NL5555A		(ZX1055)
NL5684/Ne		(PL5684)
NL6989/C6J/KL		PL5545
NL8421/5092		ZM1020
NL-C6JK/Ne		PL5545
NU807		807;QE06/50
NU813		813;QB2/250
NU832		832A;QQE04/20
NU866A		866A;DCG4/1000G
NU872A		872A;DCG5/5000GB
OA2	1832	OA2;OA2WA;M8223
OA2WA	4020;4100	OA2WA;M8223
OA3		(75C1)
OA4		PL1267/Z300T
OA4G	752	PL1267/Z300T
OB2	1833	OB2;OB2WA;M8224
OB2WA	4028;4101	OB2WA;M8224
OB120-1		OB120-1
OB120-2		OB120-2
OB120-3		OB120-3
OB120-4		OB120-4
OC3		(4687K)
OD3		OD3;150C3
OE3	431	85A1;OE3
OG3	449	85A2;OG3;M8098

Type to be replaced	CV number	Replacement type
*OH3		90C1
ORP10		ORP10;7632
ORP11		ORP11;7633
ORP12		ORP12;LDR03
ORP13		ORP13
*ORP14		RPY14
ORP30 N		ORP30 N
ORP50		ORP50
ORP52		ORP52
ORP60		ORP60
ORP61		ORP61
ORP62		ORP62
ORP63		ORP63
ORP69		ORP69
*ORP80		RPY13
ORP90		ORP90
ORP93		ORP93
ORP94		ORP94
OT400		(TB4/1250);(5868)
P2-12		QQE04/20;832A
P2-40B		(QQE06/40);(5894)
P6		1163
P15		1164
P810		(XQ1030)
P831		(XQ1040);(XQ1042)
P841		XQ1050;XQ1052
P841X		XQ1051
P842		XQ1040;XQ1042
P842X		XQ1041
P843		XQ1052
P844		XQ1042
P846		(XQ1050);(XQ1052)
P847		(XQ1040);(XQ1042)
P848		XQ1053;XQ1054
P849		XQ1043;XQ1044
P854		55875
P860		XQ1052;XQ1053
P862		XQ1030
P864		(XQ1040 series)
P865		XQ1041;XQ1051
P868		XQ1041
P8000		55875
P8001		55875IG
PA5021		DCG4/1000G;866A
PABC80		PABC80;9AK8
PB2/200		PB2/200
PB2/500		PB2/500
PB3/800		PB3/800
PC86		PC86;4CM4
PC88		PC88;4DL4
PC92		PC92
PC95		PC95;4ER5
PC97		PC97;4FY5
PC900		PC900;4HA5
PCC84	5192	PCC84;7AN7
PCC85		PCC85;9AQ8
PCC88		PCC88;7DJ8
PCC89		PCC89;7EF7
PCC189		PCC189;7ES8
PCF80		PCF80;9A8
PCF82		PCF82
PCF86		PCF86;8HG8
PCF200		PCF200;8X9
PCF201		PCF201;8U9

* Obsolete type with replacement type

REPLACEMENT GUIDE FOR ELECTRON TUBES

Type to be replaced	CV number	Replacement type
PCF801		PCF801;8GJ7
PCF802		PCF802;9JW8
PCH200		PCH200:9V9
PCL82		PCL82;16A8
PCL83	5144	PCL83
PCL84		PCL84;15DQ8
PCL85		PCL85;18GV8
PCL86		PCL86;14GW8
PCL805		PCL805
PD500		PD500;9ED4
PE05/25		PE05/25
PE06/40E		PE06/40E;PE06/40N
PE06/40P		PE06/40P
PE1/100		PE1/100;6083
PF83		PF83
PF86		PF86
PFL200		PFL200;17Y9
PJ23		(3554)
PL2D21		PL2D21;EN91; PL5727;M8204
*PL3C23		PL3C23A
PL3C23A		PL3C23A
PL10		PL10
PL17		PL5557
PL21		PL2D21;PL5727
PL33		PL33
PL36		PL36;25E5
*PL57		PL5559
PL81	5077	PL81;21A6
PL82		PL82;16A5
PL83		PL83;15A6
PL84		PL84;15CW5
PL95		PL95
PL105		PL105
PL106		PL106
PL150		PL150
PL255		PL255
PL260		PL260
PL323		PL3C23
PL345	372	3C45
PL435	1787	4C35A;6268
PL435A	5247	4C35A;6268
PL500		PL500;27GB5
PL504		PL504
PL505		PL509;40KG6A
PL508		PL508;17KW6
PL509		PL509;40KG6A
PL522	2520	5C22;6279
PL802		PL802;16LD6
PL820		PL820
PL1267	1992	Z300T
PL1607		PL1607
PL5544	2210	PL5544
*PL5545	2215	PL5545A
PL5545A		PL5545A
*PL5551		ZX1051
*PL5551A		ZX1051
*PL5552		ZX1052
*PL5552A		ZX1052
*PL5553B		ZX1053
PL5555		ZX1055
PL5557	2957	PL5557
PL5559		PL5559
PL5632		PL5632/C3J
PL5684		PL5684/C3JA
PL5727	4018	PL5727;M8204
*PL5822		ZX1061
PL5822A		ZX1061
PL6011		PL5684/C3JA
PL6549		(QB3/200)

* Obsolete type with replacement type

Type to be replaced	CV number	Replacement type
PL6574	2253	PL6574
*PL6755		PL6755A
PL6755A		PL6755A
PL6807		PL6807
PL7981		PL7981
PM04		EF93;6BA6
PM05		EF95;6AK5
PM07		EF91;6AM6
PM61		(XP1113)
PM84		PM84
PM101		(XP1110);(XP1111)
PS1010		PS1010
PS1011		PS1011
PS1012		PS1012
PS1013		PS1013
PS1014		PS1014
PS1014SF		PS1014SF
PS1520		PS1520
PS1521		PS1521
PS1531		PS1531
PS2010/50		PS2010/50
PS2010/100		PS2010/100
PS5302		PS5302
PS5400		PS5400
PS5410		PS5410
PTW255		(XQ1030);(XQ1040)
PTW2255		XQ1050
PV30S		CY2
PY80		PY80;19X3
PY81		PY81;17Z3
PY82		PY82;19Y3
PY83		PY83
PY88		PY88;30AE3
PY500		PY500A;42EC4A
PY500A		
PY800		PY800
Q13-110BA		Q13-110BA
Q13-110GU		Q13-110GU
Q160-1		(QB3/300);(6155)
Q400-1		(QB4/1100);(7527)
Q450-1		QB4/1100;7527
QA2400		M8161
QA2401		M8080
QA2402		M8082
QA2403		M8083
QB2/250	26	QB2/250;813
QB3/200	1905	QB3/200;4-65A
QB3/300	2130	QB3/300;6155
QB3/300GA	2963	QB3/300GA;4-125A
QB3.5/750	2131	QB3.5/750;6156
QB3.5/750GA	2964	QB3.5/750GA;4-250A
QB4/1100		QB4/1100;7527
QB4/1100GA		QB4/1100GA;4-400A
QB5/1750	3522	QB5/1750;6079
QB5/2000		QB5/2000;8179
QBL3.5/2000		QBL3.5/2000;8177
QBL4/800		QBL4/800;4X500A
QBL5/3500		QBL5/3500;6076
QBL5/4000		QBL5/4000;7704
QBW5/3500		QBW5/3500;6075
QC05/35		QC05/35;8042
QE03/10		QE03/10;5763;M8096
QE04/10	309;483;1510	QE04/10;M8157
QE05/40	3523	QE05/40;6146
QE05/40F		QE05/40F;6883
QE05/40H		QE05/40H;6159

* Obsolete type with replacement type

REPLACEMENT GUIDE FOR ELECTRON TUBES

Type to be replaced	CV number	Replacement type
QE05/40K		QE05/40K;8032
QE08/200		QE08/200;7378
QE08/200H		QE08/200H;7836
QEL1/150	2519	QEL1/150;4X150A
QEL1/150H		QEL1/150H;4X150D
QEL2/200		QEL2/200;7580
QEL2/275		QEL2/275;4CX250B
QEL2/275H		QEL2/275H; 4CX250F
QQC03/14		QQC03/14;7983
QQC04/15	1838	QQC04/15;5895
QQE02/5	2466	QQE02/5;6939
QQE03/12	2798	QQE03/12;6360
QQE03/20	2799	QQE03/20;6252
QQE04/5		QQE04/5;7377
QQE04/20	788	QQE04/20;832A
QQE06/40	2797	QQE06/40;5894
QQV02-6		QQE02/5;6939
QQV03-10	2798	QQE03/12;6360
QQV03/20A	2799	QQE03/20;6252
QQV04-15	788	QQE04/20;832A
QQV04-16		QQE04/5;7377
QQV06-40A	2797	(QQE06/40);(5894)
QQV07-40	2666	QQV07/40;829B
QQV5-P10	2295;3599	QQV5-P10;3E29
QQZ03-10		QQC03/14;7983
QQZ03-20		YL1020;8118
QQZ04-15	1838	QQC04/15;5895
QQZ06-40		YL1030
QS75-20		75B1
QS83-3		(85A2);(OG3);M8098
QS92-10		7475
QS95-10		95A1
QS150-40		150C3;OD3
QS1200	2225	150B2;6354;M8163
QS1207	1832	OA2;OA2WA;M8223
QS1208	1833	OB2;OB2WA;M8224
QS1209		85A2
QS1210		OA2WA;M8223
QS1211		OB2WA;M8224
QS1212		M8098
QS1213		M8142
QS1215		90C1
QS1250		(5823);(Z900T)
QS2404		M8079
QS2406		M8162;6201; E81CC;12AT7WA
QV03-12	2129	QE03/10;5763
QV04-7	309;1510	QE04/10
QV05-10	3990	QV05-10;2E26
QV06-20	3523	QE05/40;6146
QV06-20B		QE05/40F;6883
QV06-20C		QE05/40H;6159
QV08-100		QE08/200
QV08-100B		YL1290
QV1-150A	2519	QEL1/150
QV1-150D		QEL1/150H;4X150D
QV2-250C		QEL2/275;4CX250B
QY2-100	26	QB2/250;813
QY3-65	1905	QB3/200;4-65A
QY3-125	2130	QB3/300;6155
QY3-125B	2963	QB3/300GA;4-125A
QY3-1000A		QBL3.5/2000;8177
QY4-250	2131	QB3.5/750;6156
QY4-250B	2964	QB3.5/750GA;4-250A
QY4-400		QB4/1100;7527
QY4-400B		QB4/1100GA;4-400A
QY4-500A		QBL4/800;4X500A
QY5-500	3522	QB5/1750;6079
QY5-800		QB5/2000;8179

Type to be replaced	CV number	Replacement type
QY5-3000A		QBL5/3500;6076
QY5-3000W		QBW5/3500;6075
QZ06-20		QC05/35;8042
R6A		1163
R12	426	EY51;6X2
R12A		EY51;6X2
R15A		1164
R18	2235	EY84;6374;M8091
R120		(1725A)
R142		R142
R243	273	EC55;5861
R290		K81A
RG1-125		(DCG4/1000G);(866A)
RG1-240A		RG1-240A
RG1-250	3667	DCG1/250
RG3-250	1625	DCG4/1000ED
RG3-250A	32	DCG4/1000G;866A
RG3-1250		DCG4/5000
RG4-1250	5	RG4-1250
RG4-3000		DCG6/18;6693
RG250/1000		DCG1/250
RG250-3000		DCG4/1000G;866A
RG1000/3000		DCG5/5000GB;872A
RHK6332		723A/B
RI12		RI12
RK807		QE6/50;807
RK866		DCG4/1000G;866A
RL17		PL5557
RL21		PL2D21;EN91; PL5727
RL57		PL5559
RL105		PL105
RL1267		PL1267/Z300T
RL16989/Ne		(PL5545)
RPY13		RPY13
RPY14		RPY14
RPY17		RPY17
RPY18		RPY18
RPY19		RPY19
RPY20		RPY20
RPY27		RPY27
RPY33		RPY33
RPY37		RPY37
RPY40		RPY40
RPY41		RPY41
RPY43		RPY43
RPY54		RPY54
RPY55		RPY55
RPY58		RPY58
RR3-250	1835	DCX4/1000;3B28
RR3-1250		DCX4/5000;4B32
RR3-1250A	2399	RR3-1250A
RR3-1250B		DCX4/5000;4B32
RS612		(TB2.5/400)
RS613		TBL2.5/300;5866
RS614		TB2.5/400
RS630		TB3/750;5867
RS631		TB4/1250;5868
RS685		QB3/300;6155
RS686		QB3.5/750;6156
RS687		QB5/1750;6079
RS1002A		QB4/1100;7527
RS1003		(YL1200)

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Type to be replaced	CV number	Replacement type
RS1006B		TB2.5/400
RS1007		QB3/300;6155
RS1009		QQE06/40;5894
RS1011L		(TBL6/20)
RS1011W		(TBW6/20)
RS1012L		YL1181
RS1012V		YL1182
RS1016		TB4/1250;5868
RS1019		QQE03/20;6252
RS1026		TB3/750;5867
RS1029		QQE03/12;6360
RS1036		TB4/1500
RS1041V		YD1012
RS1041W		YD1010
RS1046		TB5/2500;7092
RS1082CL		YL1011
RS1082CV		YL1012
RS1082CW		YL1010
RS2002V		YL1091
RS2002W		YL1090
RS2021L		YD1001
RS2021V		YD1002
RS2021W		YD1000
RT47H4		A47-11W
RT47T1		(19CWP4)
RT59-H4		A59-11W
RT59T1		A59-16W
RV120/350		1561
RV120/350S		AZ1
RV120/500		1561
RV120/500S		AZ4
RX120A		1164
RY12-100	2967	8020

Type to be replaced	CV number	Replacement type
S1.5/80dv		PL5545
S15/5d		(DCG12/30);(5870)
S15/40		(DCG7/100)
S15/40i		(DCG7/100)
S856		OA2;OA2WA;M8223
S860		OB2;OB2WA;M8224
S5600		S5600
S5600/01		S5600/01
S5600/02		S5600/02
S5600/03		S5600/03
SAS		(ZX1060)
SBS		ZX1051
SCS		ZX1052
SCS3		ZX1061
SD61		EA50
SDR		ZX1055
SDS		ZX1053;(ZX1063)
SK220 series		YK1140 to YK1147
SK222 series		YK1070 to YK1077
SL109		SL109
SP4		SP4
SP6		EF91;7AM6
SR6		ZZ1000
SR44		ZZ1000
SR55		OB2
SR56		OA2
SRS360		TB3/750;5867
SRS361		TB2.5/300;5866
SRS362		TB4/1250;5868
SRS455		QB3/300;6155

Type to be replaced	CV number	Replacement type
SRS456		QB3.5/750;6156
SRS457		QB5/1750;6079
SRS4451		QQE06/40;5894
SRS4452		QQE3/20;6252
ST11		7475
Ste1000/2.5/15		PL5559
Ste1300/01/05		PL2D21;PL5727; EN91
Ste1500/15/45		(DCG7/100)
Ste2500/6/40		PL105
STV85/10		85A2;OG3
STV108/30		OB2;OB2WA;M8224
STV150/30		OA2;OA2WA;M8223
SU61		EY51;6X2
T2M05		ECC91;6J6;M8081
T130-1		(TB2.5/400)
T300-1		(TB4/1250);(5868)
T350-1		(TB3/750);(5867)
T380-1		TB3/750;5867
T500-1		TB4/1250;5868
T813		813;QB2/250
T866A		866A;DCG4/1000G
T872A		872A;DCG5/5000GB
*TA12/20000K		TAW12/20
TAL12/10		TAL12/10
TAL12/20		TAL12/20
TAL12/35		TAL12/35
TAW12/10		TAW12/10
TAW12/20		TAW12/20
TAW12-35G		TAW12-35G
TB2/500		TB2/500
TB2.5/300	1924	TB2.5/300;5866
TB2.5/400		TB2.5/400;7986
TB3/750	1350	TB3/750;5867
TB4/1250	1351	TB4/1250;5868
TB4/1500		TB4/1500;8078
TB5/2500		TB5/2500;7092
TBH6/14		TBH6/14;8591
TBH6/6000		TBH6/6000;8610
TBH7/8000		TBH7/8000;8592
TBH7/9000		TBH7/9000:8593
TBH12/25		TBH12/25
TBH12/38		TBH12/38;8594
TBL2/300		TBL2/300;7004
TBL2/400		TBL2/400;8119
TBL2/500		TBL2/500;8120
TBL6/14		TBL6/14;7804
TBL6/20		TBL6/20
TBL6/4000		TBL6/4000;7753
TBL6/6000;3926		TBL6/6000;5924
TBL7/8000		TBL7/8000;6961
TBL7/9000		TBL7/9000;8269
TBL12/25		TBL12/25;6618
TBL12/38		TBL12/38;7806
TBL12/40		TBL12/40;7800
TBL12/100		TBL12/100;6078
TBL15/125		TBL15/125
TBW6/14		TBW6/14;7805
TBW6/20		TBW6/20
TBW6/6000		TBW6/6000;5923
TBW7/8000		TBW7/8000;6960
TBW7/9000		TBW7/9000;8268
TBW12/25		TBW12/25;6617
TBW12/38		TBW12/38;7807

* Obsolete type with replacement type

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Type to be replaced	CV number	Replacement type
TBW12/100		TBW12/100;6077
TBW15/125		TBW15/125
*TC2/250		TB3/750;5867
*TC2/3000		TB3/750;5867
TD03-10	273	TD03-10
TD03-10G		EC55;5861
TD2-300A		TBL2/300;7004
TD2-400A		TBL2/400;8119
TD2-500A		TBL2/500;8120
TFZ103B		(PL5544)
TFZ106B		(PL5545)
TG30		3C45
TG57		PL5559
TG200B		4C35A
TG1000		5C22
TG3000		5949
TH71		TH71
TH73		TH73
TH75		TH75
TH302		(YD1300)
TH308		(YD1330)
TH328		(YD1330)
TH813	26	813;QB2/250
TH1450		4J50
TH1526		5J26
TH1586		5586
TH1725A		725A
TH2203		6975
TH2220 series		YK1140 to YK1147
TH2225		2K25
TH5021B		866A;DCG4/1000G
TH5021V		DCG4/1000ED
TH5031B		872A;DCG5/5000GB
TH5031V		DCG5/5000EG
TH5040		(6508);(DCG9/20)
TH5090		(7136);(DCG6/18GB)
TH5130		(6693);(DCG6/18)
TH5521V/B		3B28;DCX4/1000
TH6011		PL5557
TH6031		PL5559
TH6050		(PL5559)
TH6120		PL105
TH6220		PL5545A
TH6220A		PL5545A
TH6230		PL3C23
TH6345		3C45
TH6435		4C35A
TH6522		5C22
TH6907		5949
TH7010		(ZX1060)
TH7020		ZX1051
TH7021		(ZX1051)
TH7023		ZX1051
TH7030		ZX1052;(ZX1063)
TH7031		(ZX1052);(ZX1063)
TH7033		ZX1052;(ZX1063)
TH7034		ZX1061
TH7035		(ZX1062)
TH7036		ZX1062
TH7040		ZX1053
TH7041		(ZX1053)
TH7043		ZX1053
TH9800		XQ1040
TH9801		(XQ1040)
TH9804		(XQ1040)
TH9805		(XQ1043)
TH9806		XQ1053
TH9807		XQ1050;XQ1052
TH9808		(XQ1043)
TH9809		(XQ1042)

* Obsolete type with replacement type

Type to be replaced	CV number	Replacement type
TH9810		(XQ1040)
TH9811		(XQ1040)
TH9812		(XQ1051)
TH9815		XQ1051
TH9821		XQ1010
TH9824		XQ1010
THX806		(XQ1010)
TQ1/2		PL3C23A
TQ2		(PL5557)
TQ2/3		(PL6755A)
TQ2/6		(PL106)
TQ2/12		(PL255)
TQ6		(5870);(DCG12/30)
TQ7		(DCG7/100)
TS49		C3m
TS51/EF95		EF95;6AK5
TS52/ECC91		ECC91;6J6;M8081
TS53/18042		18042;6086
TS54/E83F		E83F;6689
TS56/18014		18014
TT10		QB2/250
TT15		(QQE04/20);(832A)
TT16		QB3/300GA;4-125A
TT16D		QB3/300;6155
TT17		PL5557
TT20		QQE03/20;6252
TX2/3		PL5544
TX2/6		PL5544A
TX2/61		PL6807
TX12-20A		(TAL12/20)
TX12-20W		(TAW12/20)
TX920		PL5559
TXM100		PL2D21;EN91; PL5727
TY2-125	1924	TB2.5/300;5866
TY2-150		TB2.5/400
TY3-250	1350	TB3/750;5867
TY4-350		(TB4/1250);(5868)
TY4-400		TB3/750;5867
TY4-400C		YD1220;TY4-400C
TY4-500	1351	TB4/1250;5868
TY5-500		TB4/1500
TY6-12A		TBL6/20
TY6-12W		TBW6/20
TY6-800		TB5/2500;7092
TY6-1250A		TBL6/4000;7753
TY6-3000A		YD1230
TY6-5000A		TBL6/6000;5924
TY6-5000B		YD1120
TY6-5000H		TBH6/6000
TY6-5000W		TBW6/6000;5923
TY7-6000A		TBL7/8000;6961
TY7-6000H		TBH7/8000
TY7-6000W		TBW7/8000;6960
TY8-15A		TBL6/14;7804
TY8-15H		TBH6/14;8591
TY8-15W		TBW6/14;7805
TY8-6000A		TBL7/9000;8269
TY8-6000W		TBW7/9000;8268
TY8-6000H		TBH7/9000;8593
TY12-15A		TBL12/40
TY12-20A		TBL12/38;7806
TY12-20H		TBH12/38;8594
TY12-20W		TBW12/38;7807
TY12-25A		TBL12/25;6618
TY12-25W		TBW12/25;6617
TY12-50A		TBL12/100;6078
TY12-50W		TBW12/100;6077
TY12-120W		YD1010
TY74		(PL5557)

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Type to be replaced	CV number	Replacement type
TY76		(PL5559)
TY77		(PL5559)
TY78		(PL5559)
TY84		(PL5559)
TY85		(PL105)
TY6030		(PL5559)
TY6050		(PL5559)
TY6100		(PL5559)
TY6120		(PL105)
TY6220		(PL5545)
U18		AZ50
U18/20	1264	AZ50
U-25/08		(ZX1060)
U-25/08P		(ZX1060)
U30		U30
U43		EY51;6X2
U49		EY86;6S2;EY87;6S2A
U-70/08		ZX1051
U-70/08P		ZX1051
U78	493	EZ90;6X4
U119		UY85;38A3
U-140/08		ZX1052
U-140/08P		ZX1052
U142		UY41;31A3
U143		AZ31
U147		EZ35
U150		EZ40;6BT4
U151		EY51;6X2
U152		PY80;19X3
U153		PY81;17Z3
U154		PY82;19Y3
U192		PY82;19Y3
U-350/08		ZX1053
U-350/08P		ZX1053
U381		UY85;38A3
U709		EZ81;6CA4
UABC80		UABC80
UAF42		UAF42;12S7
UB41		UB41
UBC41		UBC41;14L7
UBC81		UBC81
UBF80		UBF80;17C8
UBF89		UBF89;19FL8
UBL1		UBL1
UBL21		UBL21
UCC85		UCC85
UCH4		UCH4
UCH21		UCH21
UCH42		UCH42;14K7
UCH80		UCH80-14Y7
UCH81		UCH81;19D8
UCL11		UCL11
UCL82		UCL82;50BM8
UE966A		866A;DCG4/1000G
UE967		PL5557
UE972A		872A;DCG5/5000GB
UF21		UF21
UF41		UF41;12AC5
UF42		UF42
UF80		UF80
UF85		UF85
UF89		UF89
UL41	1977	UL41;45A5
UL44		UL44
UL84		UL84;45B5

Type to be replaced	CV number	Replacement type
UM4		UM4
UM84		UM84
UU12		EZ81;6CA4
UX866		866A;DCG4/1000G
UY1N		UY1N
UY3		UY3
UY11		UY11
UY41		UY41;31A3
UY42		UY42
UY82		UY82;55N3
UY85		UY85;38A3
UY89		UY89;31AV3
UY807		807;QE06/50
V2M70		EZ90;6X4
V40		8020
V41		AZ41
V54		YK1090
V61		EZ40;6BT4
V154		YK1091
V1103		6360;QQE03/12
VA220 series		YK1140 to YK1147
VA222 series		YK1070 to YK1077
VH550		DCG4/1000ED
VH550H		DCG4/1000G;866A
VH7400		DCG5/5000GB;872A
VH7400A		DCG5/5000EG
VJ5551		ZX1051
VJ5551A		ZX1051

Type to be replaced	CV number	Replacement type
VJ5552A		ZX1052
VJ5553		ZX1053
VJ5553B		ZX1053
VMP11/30		(150AVP)
VMP11/44		(56AVP)
VMP11/44A		(XP1001)
VMP11/44B		(XP1000)
VMP11/44C		(XP1000)
VMP11/111		(54AVP)
VMP11/170		(57AVP)
VMP13/44		(56AVP/05)
VMQ11/44		(XP1004)
VMQ13/44		(56UVP)
VR105-30		OB2;OB2WA;M8224
VR150-30	216	150C3;OD3
VS70		7475
[1])VT39		(6508);(DCG9/20)
VT39A		(6508);(DCG9/20)
VT42A		(872A); (DCG5/5000GB)
VT46		(866A); (DCG4/1000G)
VT46A		866A;DCG4/1000G
VT88		(832A);(QQE04/20)
VT88A		832A;QQE04/20
VT100		807;QE06/50
VT118		832A;QQE04/20
VT144		QB2/250
VT259		(5894);(QQE06/40)
VT267	2967	8020
VT286		832A;QQE04/20
VT510		QE04/10
VTP7386		(PL5545)
VU134		1877
VX32B		(4065)

[1]) American VT-numbers unless otherwise stated.

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Type to be replaced	CV number	Replacement type
VX41		(4066)
1)VX550A		DCX4/1000;3B28
1)VX7400		DCX4/5000;4B32
W17	785	DF91;1T4
W25		DF96;1AJ4
W77	131	EF92;6CQ6;M8161
W81		EF22
W142		UF41;12AC5
W143		EF22
W147		EF39
W150		EF41;6CJ5
W719		EF85;6BY7
W727		6BA6;EF93
WD119		UBF89;19FL8
WD142		UAF42;12S7
WD150		EAF42;6CT7
WD709		EBF80;6N8
WE12		EM4
WE17		PL5557
WE289A		1163
WL2D21		PL2D21;EN91; PL5727;M8204
WL17		PL5557
WL57		PL5559
WL105		PL105
WL172		(PL105)
WL414		(PL255)
WL502A		(PL5727);(M8204)

Type to be replaced	CV number	Replacement type
WL575A		DCG6/18GB);(7136)
WL624		(PL105)
WL631		PL5559
WL632A		(PL5559)
WL676		(PL105)
WL813		813;QB2/250
WL866A		866A;DCG4/1000G
WL869B		(6508);(DCG9/20)
WL872A		872A;DCG5/5000GB
WL885		PL2D21);(EN91); (PL5727);(M8204)
WL5550		(ZX1060)
WL5551		ZX1051
WL5551A		ZX1051
WL5552		ZX1052
WL5552A		(ZX1052)
WL5553		ZX1053;(ZX1063)
WL5553A		ZX1053
WL5553B		ZX1053;(ZX1063)
WL5555		ZX1055
WL5555A		(ZX1055)
WL5557		PL5557
WL5559		PL5559
WL5685		(PL5545A)
WL5720		(PL5559)
WL5822		ZX1061
WL5822A		(ZX1061)
WL6376		(ZP1010)
WL6998		(ZP1000)
WL7306		PL5684
WL289-416D		1163
WT210-0001		PL2D21;EN91; PL5727;M8204
WT210-0015		PL5557

1)SFR

Type to be replaced	CV number	Replacement type
WT210-0018		(150C1K)
WT210-0056		PL5559
WT210-0062		PL5557
WT210-0069		PL5557
WT210-0071		ZX1051
WT210-0072		(ZX1052)
WT210-0073		(ZX1053)
WT210-0074		PL105
WT210-0079		PL105
WT210-0091		(PL1267/Z300T)
WT272		PL5557
WTT108		PL3C23
WTT11		PL5559
WTT117		PL5557
WTT118		PL105
X17	782	DK91;1R5
X20		DK92;1AC6
X25		DK96;1AB6
X77	453	6BE6;EK90
X119		UCH81;19D8
X142		UCH42;14K7
X143		ECH21
X150		ECH42;6CU7
X719		ECH81;6CJ8
X727		6BE6;EK90
XAA91		XAA91;3AL5
XB767A		(PL2D21);(EN91); (PL5727);(M8204)
XC31		(Z70U)
XC900		XC900;2HA5
XCC189		XCC189;4ES8

Type to be replaced	CV number	Replacement type
XCF80		XCF80;4BL8
XCF801		XCF801;4GJ7
XCF802		XCF802;4JW8
XCH81		XCH81;3AJ8
XCL82		XCL82;8B8
XCL84		XCL84;8DX8
XCL85		XCL85;9GV8
XCL86		XCL86;8GW8
XF80		XF80;3BX6
XF85		XF85;3BY7
XF86		XF86;2HR8
XF183		XF183;3EH7
XF184		XF184;3EJ7
XG1-2500		PL5559
XG2		EN70
XG2-12		PL255
XG2-25		PL260
XG2-500	1144	(PL5557)
XG2-6400		(PL105)
XG5-500	2957	PL5557
XG15-10		6786;DCG7/100B
XG15-12		(DCG7/100B)
XGQ2-6400		PL105
XH3-045	372	3C45
XH8-100	1787	4C35A
XH16-200	2520	5C22
XH25-500	3521	5949
XL36		XL36;13CM5
XL86		XL86;8CW5
XL500		XL500;13GB5
XL504		XL504;13GB5A
XL7900/00		XL7900/00
XN3		ZM1080
XP1000		XP1000
XP1001		XP1001

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Type to be replaced	CV number	Replacement type
XP1002		XP1002
XP1003		XP1003
XP1004		XP1004
XP1005		XP1005
XP1006		XP1006
XP1010		XP1010
XP1011		XP1011
XP1015		XP1015
XP1016		XP1016
XP1020		XP1020
XP1021		XP1021
XP1023		XP1023
XP1030		XP1030
XP1031		XP1031
XP1032		XP1032
XP1033		XP1033
XP1034		XP1034
XP1040		XP1040
XP1041		XP1041
XP1050		XP1050
XP1051		XP1051
XP1052		XP1052
XP1053		XP1053
XP1060		150AVP
XP1070		XP1030
XP1090		XP1000
XP1110		XP1110
XP1113		XP1113
XP1114		XP1114
XP1115		XP1115
XP1116		XP1116
XP1117		XP1117
XP1118		XP1118
XP1120		XP1120
XP1121		XP1121
XP1122		XP1122
XP1123		XP1123
XP1130		XP1130
XP1131		XP1131
XP1140		XP1140
XP1141		XP1141
XP1143		XP1143
XP1180		XP1180
XP1190		XP1190
XP1191		XP1191
XP1193		XP1193
XP1200		XP1200
XP1210		XP1210
XP1220		XP1220
XP1230		XP1230
XQ1001		XQ1051
XQ1002		XQ1050
XQ1003		XQ1052;XQ1053
XQ1004		XQ1054
XQ1010		XQ1010
XQ1020		XQ1020
XQ1020B		XQ1020B
XQ1020G		XQ1020G
XQ1020L		XQ1020L
XQ1020R		XQ1020R
XQ1021		XQ1021
XQ1021B		XQ1021B
XQ1021G		XQ1021G
XQ1021R		XQ1021R
XQ1022		XQ1022
XQ1023		XQ1023
XQ1023L		XQ1023L
XQ1023R		XQ1023R
XQ1024		XQ1024
XQ1024R		XQ1024R

Type to be replaced	CV number	Replacement type
XQ1025		XQ1025
XQ1025L		XQ1025L
XQ1025R		XQ1025R
XQ1026		XQ1026
XQ1026R		XQ1026R
XQ1030		XQ1030
XQ1040		XQ1040
XQ1041		XQ1041
XQ1042		XQ1042
XQ1043		XQ1043
XQ1044		XQ1044
XQ1050		XQ1050
XQ1051		XQ1051
XQ1052		XQ1052
XQ1053		XQ1053
XQ1054		XQ1054
XQ1060		XQ1051
XQ1061		(XQ1052)
XQ1062		(XQ1053)
XQ1063		(XQ1054)
XQ1064		(XQ1054)
XQ1065		(XQ1050)
XQ1070		XQ1070
XQ1070/01		XQ1070/01
XQ1070B		XQ1070B
XQ1070/01B		XQ1070/01B
XQ1070G		XQ1070G
XQ1070/01G		XQ1070/01G
XQ1070L		XQ1070L
XQ1070/01L		XQ1070/01L
XQ1070R		XQ1070R
XQ1070/01R		XQ1070/01R
XQ1071		XQ1071
XQ1071/01		XQ1071/01
XQ1071B		XQ1071B
XQ1071/01B		XQ1071/01B
XQ1071G		XQ1071G
XQ1071/01G		XQ1071/01G
XQ1071R		XQ1071R
XQ1071/01R		XQ1071/01R
XQ1072		XQ1072
XR1-12		XR1-12;5855
*XR1-1600		PL5684/C3JA
XR1-1600A	5234	PL5684/C3JA
XR1-3200	2210	PL5544
XR1-3200A		PL7981
XR1-6400	2215	PL5545A
XR1-6400A		PL6807;(PL5545A)
XR81		55335
XY88		XY88;16AQ3
Y25		DM71;1N3
Y119		UM80;19BR5
YD1000		YD1000
YD1001		YD1001
YD1002		YD1002
YD1010		YD1010
YD1012		YD1012
YD1050		YD1050
YD1051		YD1051
YD1120		YD1120
YD1130		YD1130;8163
YD1140		YD1140
YD1141		YD1141
YD1150		YD1150;8728
YD1151		YD1151;8729

* Obsolete type with replacement type

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Type to be replaced	CV number	Replacement type
YD1152		YD1152;8730
YD1160		YD1160;8731
YD1161		YD1161;8732
YD1162		YD1162;8733
YD1170		YD1170;8666
YD1171		YD1171;8667
YD1172		YD1172;8668
YD1173		YD1173;8734
YD1180		YD1180;8801
YD1182		YD1182;8735
YD1190		YD1190
YD1192		YD1192;8736
YD1193		YD1193
YD1202		YD1202;8752
YD1203		YD1203
YD1212		YD1212;8680
YD1213		YD1213
YD1220		YD1220
YD1230		YD1230
YD1240		YD1240
YD1300		YD1300
YD1330		YD1330
YD1342		YD1342
YD1352S		YD1352S;8867
YH1080		YH1080
YH1090		YH1090
YH1170		YH1170
YJ1000		YJ1000
YJ1010		YJ1010
YJ1011		YJ1011
YJ1020		YJ1020
YJ1021		YJ1021
YJ1030		YJ1030
YJ1040		YJ1040
YJ1060		YJ1060
YJ1071		YJ1071
*YJ1080		YJ1160
*YJ1082		YJ1162
YJ1100		YJ1100
YJ1101		YJ1101
YJ1110		YJ1110
YJ1111		YJ1111
YJ1112		YJ1112
YJ1120		YJ1120
YJ1121		YJ1121
YJ1140		YJ1140
YJ1150		YJ1150
YJ1160		YJ1160
YJ1162		YJ1162
YJ1170		YJ1170
YJ1180		YJ1180
*YJ1190		YJ1191
YJ1191		YJ1191
YJ1200		YJ1200
YJ1250		YJ1250
YJ1280		YJ1280
YJ1290		YJ1290
YJ1300		YJ1300
YK1000		YK1000
YK1001		YK1001
YK1002		YK1002
YK1004		YK1004
YK1005		YK1005
YK1010		YK1010
YK1061		YK1061
YK1070		YK1070
YK1071		YK1071
YK1072		YK1072
YK1073		YK1073
YK1074		YK1074

* Obsolete type with replacement type

Type to be replaced	CV number	Replacement type
YK1075		YK1075
YK1076		YK1076
YK1077		YK1077
YK1090		YK1090
YK1091		YK1091
YK1110		YK1110
YK1140		YK1140
YK1141		YK1141
YK1142		YK1142
YK1143		YK1143
YK1144		YK1144
YK1145		YK1145
YK1146		YK1146
YK1147		YK1147
YK1150		YK1150
YL1000		YL1000;8463
YL1010		YL1010
YL1011		YL1011
YL1012		YL1012
YL1020		YL1020;8118
YL1030		YL1030
YL1060		YL1060;7854
YL1070		YL1070;8117
YL1071		YL1071;8116
YL1080		YL1080;8348
YL1090		YL1090
YL1091		YL1091
YL1100		YL1100;6884
YL1101		YL1101;6816
YL1102		YL1102;7843
YL1103		YL1103;7844
YL1110		YL1110;7650
YL1120		YL1120;8429
YL1121		YL1121
YL1130		YL1130;8408
YL1150		YL1150;8579
YL1170		YL1170;7580W
YL1181		YL1181
YL1182		YL1182
YL1190		YL1190;8580
YL1200		YL1200
YL1210		YL1210;8457
YL1220		YL1220;8577
YL1230		YL1230;8654
YL1240		YL1240;8458
YL1250		YL1250;8505
YL1280		YL1280;7213
YL1290		YL1290
YL1300		YL1300;8637
YL1310		YL1310;8603
YL1320		YL1320;8560
YL1321		YL1321
YL1322		YL1322
YL1330		YL1330;8744
YL1340		YL1340;8321
YL1341		YL1341;8322
YL1360		YL1360;8683
YL1370		YL1370;6146B;8298A
YL1371		YL1371;6883B
YL1372		YL1372;6159B
YL1420		YL1420
YL1430		YL1430
YL1440		YL1440
YL1460		YL1460
YL1461		YL1461
YL1470		YL1470
YX1172		YX1172
YX1220		YX1220

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Type to be replaced	CV number	Replacement type
*Z50T		Z71U;7711
Z70U		Z70U;7710
*Z70W		7709
*Z71U		7711
Z77	138	EF91;6AM6;M8083
Z90		EF50
Z142		UF42
Z150		EF42
Z152		EF80;6BX6
Z225		(DCG4/1000G)
Z300T	1992	PL1267/Z300T
Z302C		Z302C
Z303C	2271	Z303C
Z500T		Z500T
Z502S	2325	Z502S
Z504S		Z504S;ZM1070
Z505S		Z505S;ZM1060
*Z510M		ZM1020
*Z520M		ZM1020
*Z521M		ZM1021
*Z522M		ZM1040
*Z550M		ZM1050
Z700U		Z70U;7710
Z700W		7709
Z701U		7711
Z719		EF80;6BX6
Z729	2901	EF86;6267;M8195
Z800U		Z800U;6538
Z801U		Z801U;6539
Z803U	2434	Z803U;6779
*Z804U		—
*Z805U		7714
Z806W		Z806W
Z860X		(Z803U)
Z861X		(Z805U);(7714)
Z900T	5122	Z900T;5823
Z901T		Z801T
Z5823		Z900T;5823
Z7869		(XQ1070);(XQ1071)
Z7870		XQ1070;XQ1071
Z7999		55875
*ZA1000		ZA1002
ZA1001		ZA1001
ZA1002		ZA1002
*ZA1003		ZA1004
ZA1004		ZA1004
ZC1010		(Z70W)
ZC1040		ZC1040
ZC1050		ZC1050
ZC1060		ZC1060
ZD17	784	DAF91;1S5
ZD25		DAF96;1AH5
ZD152		EBF80;6N8
ZM1000		ZM1000
ZM1000R		ZM1000R
ZM1001		ZM1001
ZM1001R		ZM1001R
ZM1005		ZM1005
ZM1005R		ZM1005R
ZM1020		ZM1020
ZM1021		ZM1021
ZM1022		ZM1022
ZM1023		ZM1023
ZM1024		ZM1024
ZM1025		ZM1025

* Obsolete type with replacement type

Type to be replaced	CV number	Replacement type
ZM1030		ZM1030
ZM1031/01		ZM1031/01
ZM1032		ZM1032
ZM1033/01		ZM1033/01
ZM1040		ZM1040
ZM1041		ZM1041
ZM1042		ZM1042
ZM1043		ZM1043
ZM1050		ZM1050;8453;Z550M
ZM1060		ZM1060;Z505S
ZM1070		ZM1070;Z504S
ZM1080		ZM1080
ZM1081		ZM1081
ZM1082		ZM1082
ZM1083		ZM1083
ZM1160		ZM1160
ZM1162		ZM1162
ZM1170		ZM1170
ZM1172		ZM1172
ZM1174		ZM1174
ZM1175		ZM1175
ZM1176		ZM1176
ZM1177		ZM1177
ZM1200		ZM1200
ZM1202		ZM1202
ZM1204		ZM1204
ZM1206		ZM1206
ZM1230		ZM1230
ZM1232		ZM1232
*ZP1000		—
*ZP1001		—
*ZP1010		—
*ZP1020		—
ZP1080		ZP1080
ZP1081		ZP1081
ZP1082		ZP1082
ZP1083		ZP1083
ZP1100		ZP1100
ZT1000		ZT1000;8270
ZT1001		ZT1001;8482
ZT1011		PL5684/C3JA
*ZX1000		ZX1060
ZX1040		(ZX1062)
ZX1051		ZX1051
ZX1052		ZX1052
ZX1053		ZX1053
ZX1055		ZX1055
ZX1060		ZX1060
ZX1061		ZX1061
ZX1062		ZX1062
ZX1063		ZX1063
ZY1000		ZY1000;872A
ZY1001		ZY1001;8008A
ZY1002		ZY1002
ZZ1000		ZZ1000;8228
ZZ1010		(90C1)
ZZ1020		(ZZ1000)

* Obsolete type with replacement type

REPLACEMENT GUIDE FOR ELECTRON TUBES

CV number	Comparable type
CV5	RG4-1250
CV26	QB2/250;813
CV32	DCG4/1000G;866A
CV131	6CQ6;EF92
CV133	6C4;EC90
CV136	EL91;6AM5
CV137	EAC91
CV138	6AM6;EF91
CV152	DCG4/5000
CV173	EF55
CV273	CV273
CV283	6AL5;EAA91
CV284	75B1
CV286	95A1
CV303	EF22
CV309	QE04/10
CV358	EF37A
CV370	JP9-7A
CV372	3C45
CV380	EF54
CV417	6AQ4;EC91
CV424	QQE06/40;5894
CV426	EY51;6X2
CV431	85A1;OE3
CV449	85A2;OG3
CV452	6AT6;EBC90
CV453	EK90;6BE6
CV454	EF93;6BA6
CV455	ECC81;12AT7
CV468	EC70;6778
CV469	6489;EA76
CV474	EN70
CV475	EF731;5899
CV477	EF731;5899
CV483	QE04/10
CV484	3S4;DL92
CV491	ECC82;12AU7
CV492	ECC83;12AX7
CV493	EZ90;6X4
CV495	4065
CV501	EBF32
CV571	50L6GT
CV586	EL37
CV635	(TB4/1250P);(5868)
CV642	DCG5/5000GB;872A
CV722	725A
CV753	1A3DA90
CV782	1R5;DK91
CV784	1S5;DAF91
CV785	1T4;DF91
CV788	QQE04/20;832A
CV797	PL2D21;EN91; PL5727;M8204
CV807	3A4;DL93
CV808	3A5;DCC90
CV818	3Q4;DL95
CV820	3S4;DL92
CV850	EF95;6AK5
VC858	6J6;ECC91
CV1052	EL32
CV1053	EF39
CV1054	EB34
CV1055	EBC33
CV1070	7475
CV1136	EF54
CV1264	AZ50
CV1350	TB3/750;5867
CV1351	TB4/1250;5868
CV1352	6BR5;EM80
CV1355	RG4-1250

CV number	Comparable type
CV1375	6BY7;EF85
CV1376	6BX6;EF80
CV1377	5AR4;GZ34
CV1426	EK2
CV1428	EBC3
CV1449	DCG5/5000GB;872A
CV1453	4378
CV1510	QE04/10
CV1535	6V4;EZ80
CV1625	DCG4/1000ED; RG3-250
CV1629	DCG4/5000
CV1737	MW6-2
CV1741	6CA7;EL34
CV1758	1L4;DF92
CV1787	4C35A
CV1795	723A/B
CV1832	OA2;150C2;150C4
CV1833	OB2
CV1835	DCX4/1000;3B28
CV1836	1163
CV1838	QQC04/15;5895
CV1856	5Y3GT
CV1862	6AQ5;EL90
CV1865	EC81;6R4
CV1886	EC80;6Q4
CV1888	EC81;6R4
CV1905	QB3/200;4-65A
CV1924	TB2.5/300;5866
CV1928	HF93;12BA6
CV1949	EN93;6D4
CV1959	HL92;50C5
CV1961	HF94;12AU6
CV1971	1T4;DF91
CV1977	45A4;UL41
CV1992	PL1267/Z300T
CV2101	DF72
CV2103	DF73
CV2105	6373;DL70
CV2127	EL821;6CH6
CV2128	6AJ8;ECH81
CV2129	QE03/10;5763;M8096
CV2130	QB3/300;6155
CV2131	QB3.5/750;6156
CV2132	90AV
CV2133	90CG
CV2134	90CV
CV2175	DCG7-3ALP1
CV2191	DG13-2
CV2210	PL5544
CV2215	PL5545A
CV2225	150B2;6354
CV2235	6374
CV2238	5672
CV2241	5642;DY70
CV2253	PL6574
CV2254	DF60;5678
CV2270	90AG
CV2271	Z303C
CV2275	DC70;6375
CV2284	(4J50)
CV2295	QQV5-P10;3E29
CV2302	DH3-91;1CP31
CV2325	Z502S
CV2331	DL64
CV2348	4068
CV2361	DL69
CV2370	3S4;DL92
CV2371	DF61N

REPLACEMENT GUIDE FOR ELECTRON TUBES

CV number	Comparable type
CV2382	EL822
CV2390	3A4;DL93
CV2399	RR3-1250A
CV2420	JPT9-01
CV2431	3AMP1
CV2432	6205
CV2433	DF63
CV2434	Z803U;6779
CV2454	75C1
CV2466	QQE02/5;6939
CV2487	QEL2/250;4X250B
CV2492	6922;E88CC
CV2507	1U4
CV2516	2C39A
CV2518	DCX4/5000;4B32
CV2519	QEL1/150;4X150A
CV2520	6279;5C22
CV2524	6AU6;EF94
CV2526	EBC91;6AV6
CV2573	5651
CV2634	367
CV2642	417A;5842
CV2662	5639
CV2718	1876
CV2721	EL81;6CJ6
CV2726	6CK6;EL83
CV2729	6084;E80F
CV2730	4066
CV2742	1L4;DF92
CV2753	PL5684/C3JA
CV2792	2K25
CV2795	1L4;DF92
CV2797	QQE06/40;5894
CV2798	QQE03/12;6360
CV2799	QQE03/20;6252
CV2821	ECC33
CV2860	AZ1
CV2862	AZ31
CV2876	PL5727;M8204
CV2896	52CG
CV2901	6267;EF86
CV2925	EBF2
CV2926	EBL31
CV2927	EC50
CV2929	ECH3
CV2930	ECH33
CV2940	6CM5;EL36
CV2941	EL50
CV2957	PL5557
CV2963	QB3/300GA;4-125A
CV2964	QB3.5/750GA;4-250A
CV2966	EY87;652A
CV2967	8020
CV2975	EL84;6BQ5
CV2980	1M3;DM70
CV2983	3V4;DL94
CV3508	M8162;E81CC; 6201;12AT7WA
CV3512	5696;EN92
CV3521	5949
CV3522	6079;QB5/1750
CV3523	QE05/40;6146
CV3526	EL85;6BN5
CV3560	2J51
CV3599	QQV5-P10;3E29
CV3602	5J26
CV3611	5586
CV3676	2J42
CV3789	5842;417A
CV3879	QB4/1100GA;4-400A

CV number	Comparable type
CV3881	EB41
CV3882	EBC41;6CV7
CV3883	EAF42;6CT7
CV3884	ECC40
CV3885	EF40
CV3886	EF41;6CJ5
CV3887	EF42
CV3888	ECH42;6CU7
CV3889	6CK5;EL41
CV3890	EL42
CV3891	EZ40;6BT4
CV3892	AZ41
CV3893	4X150G;QV1-150G
CV3905	5847
CV3926	TBL6/6000;5924
CV3928	5636;EF730
CV3929	EF732;5840
CV3930	EC71;5718
CV3933	5783WA
CV3946	3WP1;DG7-36
CV3960	5783WA;M8190
CV3986	6021;ECC70
CV3987	5644
CV3990	2E26;QV05-10
CV3991	4X150D
CV3997	JP9-15
CV3998	E180F;6688
CV4003	M8136;6189 12AU7WA
CV4004	M8137
CV4007	5726;E91AA; 6AL5W;M8212
CV4008	5719
CV4009	5749;6BA6W

CV number	Comparable type
CV4010	6AK5W;E95F; 5654;M8100
CV4011	6AS6W;5725;M8196
CV4014	M8083
CV4015	M8161
CV4017	5751
CV4018	PL5727;M8204
CV4019	M8245
CV4020	M8223;OA2WA
CV4024	6201;E81CC; 12AT7WA;M8162
CV4025	5726;E91AA;M8079
CV4028	OB2WA;M8224
CV4031	M8081
CV4039	M8214
CV4044	M8091
CV4048	M8098
CV4058	M8080
CV4049	M8097
CV4063	M8082
CV4066	M8190;5783WA
CV4070	M8099
CV4080	M8225
CV4085	M8195
CV4100	M8223;OA2WA
CV4101	M8224;OB2WA
CV4104	M8163
CV4108	E188CC 7308
CV5018	4J52A
CV5017	PL5559
CV5035	DG13-34;5ADP1
CV5037	6BA6W;5749
CV5055	6DA5;EM81
CV5065	6U8;ECF82

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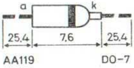
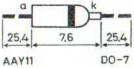
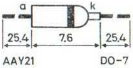
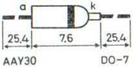
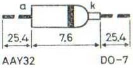
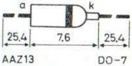
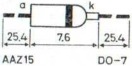
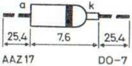
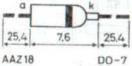
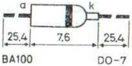
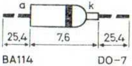
CV number	Comparable type
CV5072	6CA4;EZ81
CV5077	PL81;21A6
CV5079	5643
CV5080	EF37A
CV5094	6CW5;EL86
CV5106	6370;E1T
CV5120	20CV
CV5122	Z900T;5823
CV5123	JP9-15D
CV5125	DP13-34
CV5132	M8163
CV5134	2J51A
CV5135	JP9-15
CV5140	6923;EA52
CV5144	PCL83
CV5156	6DA6;EF89
CV5157	DP13-2
CV5171	DP7-5;3ALP7
CV5173	90C1
CV5186	5651
CV5188	7119;E182CC
CV5189	5726;6AL5W; E91AA;M8212
CV5190	M8245
CV5192	PCC84;7AN7
CV5212	12AT7WA;E81CC; 6201;M8162
CV5214	5920;E90CC
CV5215	6BL8;ECF80
CV5216	6AK5W;E95F; 5654;M8100
CV5231	7308;E188CC
CV5232	C3m
CV5233	EL32
CV5234	XR1-1600A;8063
CV5247	4C35A
CV5269	DG7-6
CV5277	6700;ET51
CV5278	Z510M
CV5281	6CW7;ECC84
CV5311	M8248
CV5331	ECC189;6ES8
CV5358	6DJ8;ECC88
CV5397	EC157;8108
CV5724	E80T;6218
CV5900	KS7-85
CV5915	ECH21
CV6007	3C45
CV6072	JP8-02B
CV6087	LA9-3B
CV6223	LB3-250B
CV6225	YJ1030
CV8505	YJ1040
CV8652	YJ1010
CV9334	KS9-20B
CV10758	JP9-2.5E

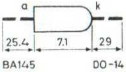
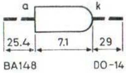
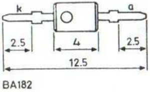
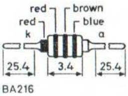
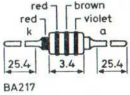
SEMICONDUCTORS
AND
INTEGRATED CIRCUITS

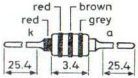
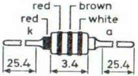
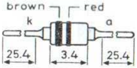
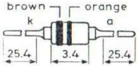
LOW POWER DIODES

Type and applications	*Ratings* (*mA*) (*V*)	(°*C*)	$R_{th\,j-a}$ (°*C/mW*)	V_F *at* (*V*)	I_F (*mA*)	I_R *at* (*µA*)	V_R (*V*)	*Char.*	*Outlines* (*mm*)
AA119 AM/FM detector germanium point contacted	I_F = 35 I_{FRM} = 100 V_R = 30 V_{RRM} = 45	T_{amb} = 60 T_{stg} = +75	0.45	$T_{amb} = 60°C$ 0.16 0.50 2.6	 0.1 1.0 30	$T_{amb} = 60°C$ 4.5 16 170	 0.1 10 45	matched pair 2-AA119	
AAY11 switch germanium point contacted	I_F = 35 I_{FRM} = 150 V_R = 60 V_{RRM} = 90	T_j = 75 T_{stg} = +75	0.4	$T_j = 25°C$ 0.72 2.1	 5 30	$T_j = 25°C$ 25 130	 50 90		
AAY21 switch . germanium point contacted	I_F = 20 I_{FM} = 50 V_R = 15	T_{amb} = 60 T_j = 75 T_{stg} = +75	0.75	$T_j = 60°C$ 0.27 0.53 0.95	 2 10 50	$T_j = 60°C$ 18 40	 5 15	$C_d < 1.2$ pF	
AAY30 switch germanium gold bonded	I_F = 110 I_{FRM} = 400 V_R = 30 V_{RRM} = 50	T_j = 75 T_{stg} = +75	0.45	$T_j = 60°C$ <0.14 <0.41 <0.99	 0.1 10 150	$T = 60°C$ <40 <60 <500	 1.5 10 50	$C_d < 1.0$ pF $Q_s < 500$ pC	
AAY32 switch germanium gold bonded	I_F = 110 I_{FRM} = 150 V_R = 30 V_{RRM} = 30	T_j = 85 T_{stg} = +85	0.45	$T_j = 60°C$ <0.14 <0.41 <0.99	 0.1 10 150	$T_j = 60°C$ <15 <30 <200	 1.5 10 30	$C_d < 1.5$ pF $Q_s < 150$ pC	

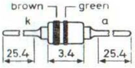
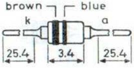
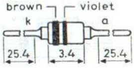
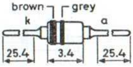
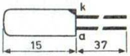
AAZ13 fast switch germanium gold bonded	$I_F = 30$ $I_{FRM} = 100$ $V_R = 8$	$T_j = 75$ $T_{stg} = +75$	0.5	$T_{amb} = 25°C$ 0.27 1 0.50 10 0.60 30	$T_{amb} = 60°C$ 30 3 190 8	$C_d = 3.3$ pF $Q_s = 20$ pC	
AAZ15 switch germanium gold bonded	$I_F = 140$ $I_{FRM} = 250$ $V_R = 75$ $V_{RRM} = 100$	$T_j = 85$ $T_{stg} = +85$	0.45	$T_j = 60°C$ <0.15 0.1 <0.40 10 <1.07 250	$T_j = 60°C$ <30 1.5 <80 50 <300 100	$C_d < 2$ pF $Q_s < 1800$ pC	
AAZ17 switch germanium gold bonded	$I_F = 140$ $I_{FRM} = 250$ $V_R = 50$ $V_{RRM} = 75$	$T_j = 85$ $T_{stg} = +85$	0.45	$T_j = 60°C$ <0.15 0.1 <0.40 10 <1.07 250	$T_j = 60°C$ <30 1.5 <300 50 <500 75	$C_d < 2$ pF $Q_s < 900$ pC	
AAZ18 switch germanium gold bonded	$I_F = 180$ $I_{FRM} = 300$ $V_R = 20$ $V_{RRM} = 20$	$T_j = 75$ $T_{stg} = +75$	0.45	$T_j = 60°C$ <0.14 0.1 <0.36 10 <0.76 300	$T_j = 60°C$ <30 1.5 <45 10 <100 20	$C_d < 1.5$ pF $Q_s < 200$ pC	
BA100 general purposes silicon junction	$I_F = 90$ $I_{FRM} = 100$ $I_{FSM} = 200$ $V_R = 60$	$T_j = 90$ $T_{stg} = +90$	0.4	$T_{amb} = 60°C$ 0.5 0.1 0.6 1.0 0.85 30	$T_{amb} = 75°C$ $\lesssim 10$ 10 <20 60	—	
BA114 stabilizer silicon alloyed	$I_F = 20$ $T_{amb} = 90$ $T_{stg} = +90$		0.4	$T_{amb} = 25°C$ <0.56 0.1 <0.7 1 <1.05 20	—	—	

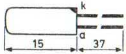
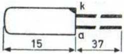
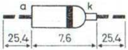
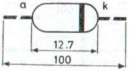
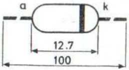
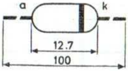
LOW POWER DIODES

Type and application	*Ratings* (*mA*) (*V*)	*Ratings* (*°C*)	$R_{th\,j-a}$ (*°C/mW*)	V_F at (*V*)	I_F (*mA*)	I_R at (*μA*)	V_R (*V*)	*Char.*	*Outlines* (*mm*)
BA145	$I_F = 300$	$T_j = 125$	0.2	$T_j = 125°C$		$T_j = 125°C$		$C_d = 4$ pF	
clamping diode	$I_{FRM} = 2000$			0.3	1	10	10	$Q_s < 0.4$ nC	
silicon	$V_{RWM} = 300$	$T_{stg} = +125$		0.4	10	25	100		
double diffused	$V_{RRM} = 350$			0.56	100	52	300		
				1.0	2000				
BA148	$I_{FAV} = 400$	$T_j = 150$	0.2	$T_j = 150°C$		$T_j = 125°C$		$C_d = 4$ pF	
clamping diode	$I_{FRM} = 3000$			< 0.6	25	10	10	$Q_s < 0.8$ nC	
silicon	$V_{RWM} = 300$	$T_{stg} = +125$		< 1	200	25	100		
double diffused	$V_{RRM} = 350$			< 1.5	2000	52	300		
BA182	$I_F = 100$	$T_j = 100$	0.4	$T_j = 25°C$		$T_j = 60°C$		$C_d < 1$ pF	
switch	$V_R = 35$	$T_{stg} = +100$		0.68	2	50 pA	1		
silicon				0.75	10	30 pA	10		
planar				0.85	100	1.1 nA	35		
BA216	$I_F = 75$	$T_j = 200$	0.60	$T_j = 25°C$		$T_j = 25°C$			
stabiliser	$I_{FRM} = 150$			0.5	0.2	1.5	10		
silicon	$I_{FSM} = 1000$	$T_{stg} = +200$		0.62	0.2				
oxide passivated	$V_{RRM} = 10$			0.7	15				
				1	15				
BA217	$I_F = 75$	$T_j = 200$	0.60	$T_j = 25°C$		$T_j = 25°C$		$C_d < 5$ pF	
general purpose	$I_{FRM} = 150$			0.7	1	0.05	10		
silicon	$I_{FSM} = 2000$	$T_{stg} = +200$		1.0	10	0.2	30		
oxide passivated	$V_{RRM} = 30$			1.5	50				

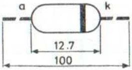
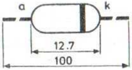
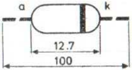
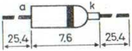
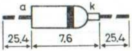
BA218	$I_F = 75$	$T_j = 200$	0.60	$T_j = 25^\circ C$		$T_j = 25^\circ C$		$C_d < 5$ pF	 BA218
general purpose	$I_{FRM} = 150$			0.7	1	0.05	25		
silicon	$I_{FSM} = 2000$	$T_{stg} = +200$		1.0	10	0.2	50		
oxide passivated	$V_{RRM} = 50$			1.5	50				
BA219	$I_F = 100$	$T_j = 200$	0.60	$T_j = 25^\circ C$		$T_j = 25^\circ C$		$C_d < 5$ pF	 BA219
general purpose	$I_{FRM} = 300$			0.65	1	0.2	50		
silicon	$I_{FSM} = 2000$	$T_{stg} = +200$		0.85	10	0.5	100		
oxide passivated	$V_{RRM} = 100$			1.5	100				
BAV10	$I_F = 300$	$T_j = 200$	0.5	$T_j = 25^\circ C$		$T_j = 25^\circ C$		$C_d < 2.5$ pF	 BAV10
high speed switch	$I_{FRM} = 600$			0.75	10	0.1	60		
silicon	$I_{FSM} = 4000$	$T_{stg} = +200$		1.0	200	$T_{amb} = 150^\circ C$			
planar epitaxial	$V_{RRM} = 60$			1.25	500	100	60		
BAW62	$I_F = 100$	$T_j = 200$	0.6	$T_j = 25^\circ C$		$T_j = 150^\circ C$		$C_d < 4$ pF	 BAW62 DO-35
fast switch	$I_{FRM} = 225$			< 0.75	5	< 50	20	$Q_s < 50$ pC	
silicon	$V_R = 75$	$T_{stg} = +200$		< 1.0	100	< 100	75		
planar epitaxial	$V_{RRM} = 75$								
BAX12	$I_F = 400$	$T_j = 200$	0.3	$T_j = 25^\circ C$		$T_j = 150^\circ C$		$C_d < 35$ pF	 BAX12
switch	$I_{FRM} = 800$			< 0.75	10	50	90	$Q_s < 0.5$ nC	
silicon	$I_{FSM} = 6000$	$T_{stg} = +200$		< 0.90	100	< 100	90		
whiskerless	$V_R = 90$			< 1.25	400				
BAX13	$I_F = 75$	$T_j = 200$	0.6	$T_j = 25^\circ C$		$T_j = 150^\circ C$		$C_d < 3$ pF	 BAX13
fast switch	$I_{FRM} = 150$			< 0.7	2	< 10	10	$Q_s < 45$ pC	
silicon	$V_R = 50$	$T_{stg} = +200$		< 1.0	20	< 25	50		
whiskerless	$V_{RRM} = 50$			< 1.53	75				

LOW POWER DIODES

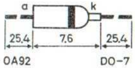
Type and application	Ratings (mA) (V)	Ratings (°C)	$R_{th\,j-a}$ (°C/mW)	V_F (V)	at I_F (mA)	I_R (µA)	at V_R (V)	Char.	Outlines (mm)
BAX15 general purpose silicon whiskerless	$I_F = 250$ $I_{FRM} = 500$ $V_R = 150$ $V_{RRM} = 180$	$T_j = 200$ $T_{stg} = +200$	0.4	$T_j = 25^\circ C$ < 1.0 < 1.35	 100 250	$T_j = 100^\circ C$ < 10	 150	$C_d < 20$ pF $Q_s = 1$ nC	 BAX15
BAX16 general purpose silicon whiskerless	$I_F = 200$ $I_{FRM} = 300$ $V_R = 150$ $V_{RRM} = 150$	$T_j = 200$ $T_{stg} = +200$	0.4	$T_j = 25^\circ C$ < 0.65 < 1.3 < 1.5	 1 100 200	$T_j = 150^\circ C$ < 25 < 100	 50 150	$C_d < 10$ pF $Q_s < 0.7$ nC	 BAX16
BAX17 general purpose silicon whiskerless	$I_F = 200$ $I_{FRM} = 300$ $V_R = 200$ $V_{RRM} = 200$	$T_j = 200$ $T_{stg} = +200$	0.4	$T_j = 25^\circ C$ < 0.65 < 1.1 < 1.2	 1 100 200	$T_j = 150^\circ C$ < 25 < 100	 50 200	$C_d < 10$ pF $Q_s < 0.7$ nC	 BAX17
BAX18 general purpose silicon wiskerless	$I_F = 500$ $I_{FRM} = 2000$ $I_{FSM} = 6000$ $V_{RRM} = 175$	$T_j = 200$ $T_{stg} = +200$	0.3	$T_j = 150^\circ C$ 2.0	 2000	$T_j = 150^\circ C$ 100	 75		 BAX18
BRY39	See section MISCELLANEOUS TRANSISTORS								
OA5 general purposes germanium gold bonded	$I_{FAV} = 125$ $I_{FRM} = 350$ $V_R = 100$ $V_{RRM} = 100$	$T_{amb} = 75$ $T_{stg} = +90$	—	$T_{amb} = 60^\circ C$ < 0.20 < 0.50 < 1.25	 0.1 10 300	$T_{amb} = 60^\circ C$ < 26 < 30 < 120	 1.5 10 100	—	 OA5

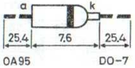
OA7 switch germanium gold bonded	I_F = 140 I_{FRM} = 250 V_R = 25 V_{RRM} = 25	T_{amb} = 75 T_{stg} = +75	0.4	$T_{amb}=60°C$ <0.19 0.1 <0.28 10 <0.75 50	$T_{amb}=60°C$ <20 1.5 <30 10 <150 25	—	 OA7
OA9 switch germanium gold bonded	I_F = 270 I_{FRM} = 500 V_R = 25 V_{RRM} = 25	T_{amb} = 75 T_{stg} = +90	0.35	$T_{amb}=60°C$ <0.15 0.1 <0.35 10	$T_{amb}=60°C$ <20 1.5 <45 10 <100 25	$C_d<7$ pF	 OA9
OA47 switch germanium gold bonded	I_F = 110 I_{FRM} = 150 V_R = 25 V_{RRM} = 25	T_j = 75 T_{stg} = +75	0.45	$T_j=60°C$ <0.14 0.1 <0.43 10 <1.1 150	$T_j=60°C$ <20 1.5 <90 20 <160 25	$C_d<3.5$ pF $Q_s<600$ pC	 OA47 DO-7
OA70 video detector germanium point contacted	I_F = 50 I_{FRM} = 150 V_R = 15 V_{RRM} = 22.5	T_{amb} = 75	—	$T_{amb}=25°C$ 0.15 0.1 0.43 1.0 1.7 30	$T_{amb}=25°C$ 5 1.5 30 10 180 25	$C_d=1$ pF	 OA70
OA72 AM/FM detector germanium	I_F = 10 I_{FM} = 100 V_R = 30 V_{RRM} = 45	—	—	$T_{amb}=25°C$ 0.2 0.1 1.4 10 2.4 30	$T_{amb}=25°C$ 0.8 1.5 4.5 10 130 45	matched pair 2-OA72	 OA72
OA73 video detector germanium	I_F = 50 I_{FM} = 150 V_R = 20 V_{RRM} = 30	T_{amb} = 75	—	$T_{amb}=25°C$ <0.2 0.1 <1.0 8	$T_{amb}=25°C$ <18 1.5 <400 20 <1200 30	$C_d=1$ pF	 OA73

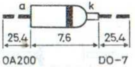
LOW POWER DIODES

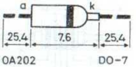
Type and	*Ratings*		$R_{th\,j-a}$	V_F *at*	I_F	I_R *at*	V_R	*Char.*	*Outlines*
applications	*(mA)* *(V)*	*(°C)*	*(°C/mW)*	*(V)*	*(mA)*	*(µA)*	*(V)*		*(mm)*
OA79	I_F = 35	T_{amb} = 60	—	T_{amb}=60°C		T_{amb}=60°C		matched	
AM/FM detector	I_{FRM} = 100			0.16	0.1	4.5	0.1	pair	12.7 100
germanium	V_R = 30			1.4	10	16	10	2-OA79	
point contacted	V_{RRM} = 45			2.6	30	170	45		OA79
OA81	I_F = 50	T_{amb} = 75	—	T_{amb}=60°C		T_{amb}=60°C		—	
general purposes	I_{FRM} = 150			0.13	0.1	15	1.5		12.7 100
germanium	V_R = 90			1.3	10	20	10		
point contacted	V_{RRM} = 115			2.3	30	190	100		OA81
OA85	I_F = 50	T_{amb} = 75	—	T_{amb}=60°C		T_{amb}=60°C		—	
general purposes	I_{FRM} = 150			0.13	0.1	12	1.5		12.7 100
germanium	V_R = 90			1.05	10	17	10		
point contacted	V_{RRM} = 115			1.95	30	190	100		OA85
OA90	I_F = 8	T_{amb} = 75	—	T_{amb}=60°C		T_{amb}=60°C		—	
video detector	I_{FRM} = 45			0.12	0.1	11	1.5		25.4 7.6 25.4
germanium	V_R = 20	T_{stg} = +90		0.95	10	45	10		
point contacted	V_{RRM} = 30			1.95	30	400	30		OA90 DO-7
OA91	I_F = 50	T_{amb} = 75	0.4	T_{amb}=60°C		T_{amb}=60°C		—	
general purposes	I_{FRM} = 150			0.1	0.1	15	1.5		25.4 7.6 25.4
germanium	V_R = 90	T_{stg} = +75		1.05	10	20	10		
point contacted	V_{RRM} = 115			1.9	30	190	100		OA91 DO-7

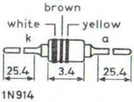
OA92 switch germanium point contacted	I_F = 10 I_{FRM} = 50 V_R = 15 V_{RRM} = 15	T_{amb} = 75 T_{stg} = +90	0.55	T_{amb} = 25°C < 0.23 < 0.6 < 2.0	 0.1 1 10	T_{amb} = 25°C < 6 < 40 < 85	 1.5 10 15	C_d < 0.5 pF
OA95 general purposes germanium point contacted	I_F = 50 I_{FRM} = 150 V_R = 90 V_{RRM} = 115	T_{amb} = 75 T_{stg} = +75	0.4	T_{amb} = 60°C 0.1 0.95 1.75	 0.1 10 30	T_{amb} = 60°C 12 17 200	 1.5 10 100	—
OA200 general purposes silicon junction	I_F = 160 I_{FRM} = 250 V_R = 50	T_{amb} = 125 T_{stg} = +125	0.4	T_{amb} = 125°C < 0.30 < 0.65 < 0.80	 0.1 10 30	T_{amb} = 125°C 1 T_{amb} = 25°C 0.02	 50 50	C_d = 10 pF
OA202 general purposes silicon junction	I_F = 160 I_{FRM} = 250 V_R = 150	T_{amb} = 125 T_{stg} = +125	0.4	T_{amb} = 125°C < 0.30 < 0.65 < 0.80	 0.1 10 30	T_{amb} = 125°C 0.5 T_{amb} = 25°C 0.01	 150 150	C_d = 10 pF
1N914 high speed silicon whiskerless	I_F = 75 I_{FRM} = 225 V_R = 75 V_{RRM} = 100	T_{amb} = 175 T_{stg} = +200	—	T_j = 25°C < 1	 10	T_j = 25°C < 5 T_j = 150°C < 50	 75 20	C_d < 4 pF
1N914A **1N914B**	Equivalent to 1N914 except for: Equivalent to 1N914 except for:			< 1 < 1	20 100	band 4 added: brown < 100 band 4 added: red	 100	



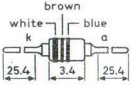
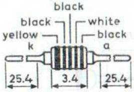
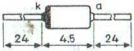






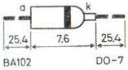
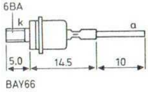
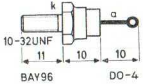
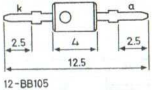


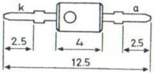
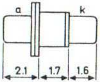
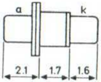
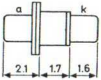
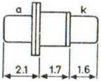
LOW POWER DIODES

Type and applications	*Ratings* *(mA) (V)*	*(°C)*	$R_{th\,j-a}$ *(°C/mW)*	V_F *(V)*	*at* I_F *(mA)*	I_R *(µA)*	*at* V_R *(V)*	*Char.*	*Outlines (mm)*
1N916 high speed silicon whiskerless	$I_F = 75$ $I_{FRM} = 225$ $V_R = 75$ $V_{RRM} = 100$	$T_{amb} = 175$ $T_{stg} = +200$	—	$T_j = 25°C$ <1	 10	$T_j = 25°C$ <5 $T_j = 150°C$ <50	 75 20	$C_d < 2$ pF	 1N916
1N916A **1N916B**	Equivalent to 1N916 except for: Equivalent to 1N916 except for:			<1 <1	20 30	band 4 added: band 4 added:		brown red	
1N4009 general purpose ultra high speed silicon	$V_R = 25$ $P_{tot} = 250$	$T_{stg} = +200$	0.6	$T_{amb} = 25°C$ <1	 30	$T_{amb} = 25°C$ <0.1 $T_{amb} = 150°C$ <100	 25 25	$C_d < 4$ pF	 1N4009
1N4148 ultra high speed silicon whiskerless	$I_F = 75$ $I_{FRM} = 225$ $V_R = 75$ $V_{RRM} = 75$	$T_j = 200$ $T_{stg} = +200$		$T_j = 25°C$ <1.0	 10	$T_j = 150°C$ <50	 20	$C_d < 4$ pF	 1N4148 DO-35
1N4150 general purpose silicon wiskerless	$I_F = 300$ $I_{FRM} = 600$ $I_{FSM} = 4000$ $V_R = 50$	$T_j = 200$ $T_{stg} = +200$		$T_j = 25°C$ <0.62 <0.74 <0.92 <1	 1 10 100 200	$T_j = 25°C$ <0.1 $T_{amb} = 150°C$ <100	 50 50	$C_d < 2.5$ pF	 1N4150

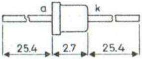
1N4151	I_F = 200	T_j = 200	$T_j = 25°C$	$T_j = 25°C$	$C_d < 2$ pF	 1N4151
military; industrial	I_{FRM} = 450		< 1 50	< 0.05 50		
silicon	V_R = 50	T_{stg} = +200		$T_{amb} = 150°C$		
wiskerless	V_{RRM} = 75			< 50 50		
1N4154	I_F = 200	T_j = 200	$T_j = 25°C$	$T_j = 25°C$	$C_d < 4$ pF	 1N4154
military; industrial	I_{FRM} = 450		< 1 30	< 0.1 25		
silicon	V_R = 25	T_{stg} = +200		$T_{amb} = 150°C$		
wiskerless				< 100 25		
1N4446	Equivalent to 1N4148 except for:		$T_j = 25°C$			
	I_F = 200	I_{FRM} = 450	< 1.0 20			
1N4448	Equivalent to 1N4446 except for:		$T_j = 25°C$	$T_j = 100°C$		
			< 1.0 100	< 3 20		

VARIABLE CAPACITANCE DIODES

Type and applications	Ratings (mA) (V)	(W) (°C)	R_{th} (°C/W)	I_R at V_R (μA) (V)	Characteristics	Outlines (mm)
BA102 variable capacitance silicon	$I_R=0.1$ $V_R=20$	$T_j=$ 90 $T_{stg}=+90$	$R_{th\,j-a}=$ 400	$T_j=80°C$ <5 20	$\frac{C_d(V_R=10\ V)}{C_d(V_R=4\ V)}<0.7$ at $f\leqslant 300$MHz $r_D<3\ \Omega$ at $V_R=4$ V	
BAY66 varactor silicon double diffused	$I_{FRM}=400$ $V_R=100$ $P_{tot}=12$	$T_j=150$ $T_{stg}=+150$	$R_{th\,j-a}=$ 120 $R_{th\,j-mb}=$ 10	$T_j=25°C$ <10 100 $T_j=150°C$ <200 100	$C_d=65$ pF at $V_F=0.5$ V $C_d=25$ pF at $V_R=0$ $C_d<6$ pF at $V_R=100$ V $r_D<2.0\ \Omega$ at $V_R=48$ V; $f=200$ MHz	
BAY96 varactor silicon planar epitaxial	$V_R=120$ $P_{tot}=20$ $T_j=175$ $T_{stg}=+175$		$R_{th\,j-mb}=$ 7.5	—	$C_d=28$ to 39 pF at $V_R=6$ V; $f=1$ MHz $r_D<1.2\ \Omega$ at $V_R=6$ V; $f=400$ MHz	
12-BB105A variable capacitance silicon planar u.h.f. tuner	$I_F=20$ $V_R=28$ $V_{RM}=30$	$T_j=60$ $T_{stg}=+60$	$R_{th\,j-a}=$ 400	$T_j=25°C$ <0.1 28 $T_j=60°C$ <1 28	$C_d=11.5$ pF at $V_R=3$ V; $f=1$ MHz $C_d=2.3$ to 2.8 pF at $V_R=25$ V; $f=1$ MHz $r_D=0.4\ \Omega$ at $I_F=5$ mA; $f=200$ MHz	
12-BB105B	Equivalent to 12-BB105A except for:				$C_d=2.0$ to 2.3 pF at $V_R=25$ V; $f=1$ MHz	

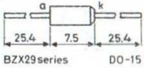
12-BB105G	Equivalent to 12-BB105A except for:				$C_d = 1.8$ to 2.8 pF at $V_R = 25$ V; $f = 1$ MHz	
12-BB106 variable capacitance silicon planar v.h.f. tuner	$I_F = 20$ $V_R = 28$ $V_{RRM} = 30$	$T_j = 60$ $T_{stg} = +100$	$R_{th\,j-a} =$ 400	$T_j = 25°C$ <0.05 28 $T_j = 60°C$ <0.2 28	$C_d > 20$ pF at $V_R = 3$ V; $f = 0.5$ MHz $C_d = 4.0$ to 5.6 pF at $V_R = 25$ V; $f = 0.5$ MHz $r_D = 0.4\ \Omega$ at $C_d = 25$ pF; $f = 200$ MHz	 12-BB106
BXY27 varactor silicon planar epitaxial	$V_R = 55$ $P_{tot} = 4$ $T_j = 175$ $T_{stg} = +175$		$R_{th\,j-pin} =$ 20	$T_{amb} = 25°C$ <1 6	$C_d = 3.0$ to 6.5 pF at $V_R = 6$ V; $f = 1$ MHz $r_D = 0.4\ \Omega$ at $V_R = 6$ V; $f = 2$ GHz	 BXY27
BXY28 varactor silicon planar epitaxial	$V_R = 45$ $P_{tot} = 3.5$ $T_j = 175$ $T_{stg} = +175$		$R_{th\,j-pin} =$ 30	$T_{amb} = 25°C$ <1 6	$C_d = 1.0$ to 2.5 pF at $V_R = 6$ V; $f = 1$ MHz $r_D = 0.9\ \Omega$ at $V_R = 6$ V; $f = 2$ GHz	 BXY28
BXY29 varactor silicon planar epitaxial X-band	$V_R = 25$ $P_{tot} = 1$ $T_j = 150$ $T_{stg} = +150$		$R_{th\,j-pin} =$ 50	$T_{amb} = 25°C$ <1.0 6	$C_d = 1.0$ pF at $V_R = 6$ V; $f = 1$ MHz $L_d = 650$ pH	 BXY29
BXY32 varactor silicon planar epitaxial X-band	$V_R = 20$ $P_{tot} = 1$ $T_j = 150$ $T_{stg} = +150$		$R_{th\,j-pin} =$ 50	$T_{amb} = 25°C$ <1.0 6	$C_d = 0.75$ pF at $V_R = 6$ V; $f = 1$ MHz $L_d = 650$ pH	 BXY32

TUNNEL DIODES

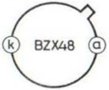
Type and application	*Ratings*	*Characteristics at $T_{amb} = 25°C$*			*Outlines (mm)*
AEY23 high speed switch germanium tunnel	$I_{FM} = 10$ mA $I_{RM} = 10$ mA $T_{stg} = +90°C$	$I_P = 1$ mA $V_P = 65$ V $V_V = 300$ V $I_P/I_V < 6$	$C_{tot} < 6$ pF $C_p = 0.6$ pF $L_s = 3$ nH $r_s = 5\ \Omega$	$g_j = 6.5\ m\Omega^{-1}$ $f_r = 2.4$ GHz $f_0 = 1.8$ GHz $t_r < 4.0$ ns	
AEY24 high speed switch germanium tunnel	$I_{FM} = 25$ mA $I_{RM} = 25$ mA $T_{stg} = +90°C$	$I_P = 2.5$ mA $V_P = 70$ V $V_V = 320$ V $I_P/I_V < 6$	$C_{tot} < 10$ pF $C_p = 0.6$ pF $L_s = 3$ nH $r_s = 3.5$ nH	$g_j = 14\ m\Omega^{-1}$ $f_r = 1.8$ GHz $f_0 = 1.2$ GHz $t_r < 2.5$ ns	
AEY25 high speed switch germanium tunnel	$I_{FM} = 50$ mA $I_{RM} = 50$ mA $T_{stg} = +90°C$	$I_P = 4.7$ mA $V_P = 75$ V $V_V = 330$ V $I_P/I_V < 6$	$C_{tot} < 15$ pF $C_p = 0.6$ pF $L_s = 3$ nH $r_s = 2.5\ \Omega$	$g_j = 33\ m\Omega^{-1}$ $f_r = 2.4$ GHz $f_0 = 0.8$ GHz $t_r < 2.0$ ns	 AEY23 to 28
AEY26 high speed switch germanium tunnel	$I_{FM} = 50$ mA $I_{RM} = 50$ mA $T_{stg} = +90°C$	$I_P = 5$ mA $V_P = 75$ V $V_V = 330$ V $I_P/I_V < 6$	$C_{tot} < 15$ pF $C_p = 0.6$ pF $L_s = 3$ nH $r_s = 2.5\ \Omega$	$g_j = 33\ m\Omega^{-1}$ $f_r = 2.4$ GHz $f_0 = 0.8$ GHz $t_r < 2.0$ ns	
AEY27 high speed switch germanium tunnel	$I_{FM} = 100$ mA $I_{RM} = 100$ mA $T_{stg} = +90°C$	$I_P = 10$ mA $V_P = 80$ V $V_V = 340$ V $I_P/I_V < 6$	$C_{tot} < 50$ pF $C_p = 0.6$ pF $L_s = 3$ nH $r_s = 1.8\ \Omega$	$g_j = 65\ m\Omega^{-1}$ $f_r = 2.0$ GHz $f_0 = 0.3$ GHz $t_r < 1.5$ ns	
AEY28 high speed switch germanium tunnel	$I_{FM} = 100$ mA $I_{RM} = 100$ mA $T_{stg} = +90°C$	$I_P = 20$ mA $V_P = 80$ V $V_V = 360$ V $I_P/I_V < 6$	$C_{tot} < 50$ pF $C_p = 0.6$ pF $L_s = 3$ nH $r_s = 1.0\ \Omega$	$g_j = 100\ m\Omega^{-1}$ $f_r = 1.4$ GHz $t_r < 1.2$ ns	

ZENER DIODES

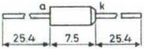
Type and applications														*Outlines (mm)*
BZX29-	**C5V6**	**C6V2**	**C6V8**	**C7V5**	**C8V2**	**C9V1**	**C10**	**C11**	**C12**	**C13**	**C15**	**C16**	**C18**	
at I_Z (mA)	50	50	20	20	20	20	20	20	20	20	20	10	10	
$V_Z(V)$	5.6	6.2	6.8	7.5	8.2	9.1	10	11	12	13	15	16	18	
$S_Z(mV/°C)$	+1.1	+2.2	+2.7	+3.4	+3.9	+4.65	+5.5	+6.6	+7.8	+8.45	+10.5	+11.2	+13.5	
r_Z (Ω)	<5	<2	<3.5	<4.4	>4.5	<5	<7	<8	<9	<10	<14	<16	<20	
BZX29-	**C20**	**C22**	**C24**	**C27**	**C30**	**C33**	**C36**	**C39**	**C43**	**C47**	**C51**	**C56**		
at I_Z (mA)	10	10	10	10	10	5	5	5	5	5	5	5		
$V_Z(V)$	20	22	24	27	30	33	36	39	43	47	51	56		
$S_Z(mV/°C)$	+15.0	+17.6	+19.2	+23.0	+25.5	+28.0	+30.5	+35.0	+38.5	+42.5	+46.0	+50.5		
r_Z	<22	<23	<25	<35	<40	<45	<50	<60	<70	<80	<95	<110		
Ratings	$I_{FRM}=400$ mA; $P_{tot}=1.5$ W; $T_j=175°C$; $T_{stg}=+175°C$													
Characteristics	$R_{th\,j-a}=100°C/W$; $V_F<1.5$ V at $I_F=200$ mA; tolerance of V_Z: 5%													



ZENER DIODES

Type and applications	Ratings (mA)	(W)	(°C)	R_{th} (°C/W)	V_F (V)	at I_F (mA)	V_Z, (V)	S_Z, (mV/°C)	r_Z (Ω)	at I_Z (mA)	Outlines (mm)
BZX48 5%	$I_Z = 10$ $I_{ZM} = 10$		$T_{amb} \doteq +100$ $T_{stg} = +150$	—	—	—	6.42 6.45 6.47	< +0.13 < +0.13 < +0.13	70 20 14	1 2 3	
BZX49 5%	Equivalent to BZX48 except for							< +0.325		1 to 3	
BZX50 5%	Equivalent to BZX48 except for							< +0.65		1 to 3	

Type and applications													Outlines (mm)
BZX61-	**C7V5**	**C8V2**	**C9V1**	**C10**	**C11**	**C12**	**C13**	**C15**	**C16**	**C18**	**C20**	**C22**	**C24**
at I_Z (mA)	20	20	20	20	20	20	20	20	10	10	10	10	10
V_Z(V)	7.5	8.2	9.1	10	11	12	13	15	16	18	20	22	24
S_Z(mV/°C)	+3.0	+3.3	+4.6	+5.0	+5.5	+6.0	+6.5	+9.0	+10	+11	+12	+13	+14
r_Z (Ω)	<6.0	<7.5	<8.0	<8.5	<9.0	<9.0	<10	<14	<16	<20	<22	<23	<25
BZX61-	**C27**	**C30**	**C33**	**C36**	**C39**	**C43**	**C47**	**C51**	**C56**	**C62**	**C68**	**C75**	
at I_Z (mA)	10	10	10	10	5	5	5	5	5	5	5	5	
V_Z(V)	27	30	33	36	39	43	47	51	56	62	68	75	
S_Z(mV/°C)	+16	+21	+23	+25	+27	+30	+38	+41	+45	+50	+54	+60	
r_Z (Ω)	<35	<40	<45	<50	<60	<70	<80	<95	<105	<110	<120	<135	
Ratings	$I_{FAV}=1$ A; $I_{ZM}=3$ A; $P_{tot}=1$ W; $T_j=175$°C; $T_{stg}=+175$°C												
Characteristics	$R_{th\,j-a}=0.15$°C/mW; $V_F<1.1$ V at $I_F=100$ mA; tolerance: 5%												



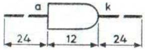
BZX61 series DO-15

BZX70-	**C10**	**C11**	**C12**	**C13**	**C15**	**C16**	**C18**	**C20**	**C22**	**C24**	**C27**
at I_Z (mA)	50	50	50	50	50	20	20	20	20	20	20
$V_Z(V)$	10	11	12	13	15	16	18	20	22	24	27
$S_Z(mV/°C)$	+7.0	+7.5	+8.0	+8.5	+10	+11	+12	+14	+16	+18	+20
r_Z (Ω)	<4.0	<4.5	<5.0	<6.0	<8.0	<9	<11	<12	<13	<14	<18

BZX70-	**C30**	**C33**	**C36**	**C39**	**C43**	**C47**	**C51**	**C56**	**C62**	**C68**	**C75**
at I_Z (mA)	20	20	20	10	10	10	10	10	10	10	10
$V_Z(V)$	30	33	36	39	43	47	51	56	62	68	75
$S_Z(mV/°C)$	+25	+30	+32	+35	+40	+45	+50	+55	+60	+65	+70
r_Z (Ω)	<22	<25	<30	<35	<40	<50	<55	<63	<75	<90	<100

Ratings $I_{FAV}=1$ A; $I_{FRM}=3$ A; $I_{ZRM}=5$ A; $P_{tot}=2.5$ W; $T_j=150°$C; $T_{stg}=+150°$C

Characteristics $R_{th\,j-a}=50°$C/W; $V_F<1.5$ V at $I_F=1$ A; tolerance of V_Z: 5%

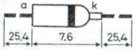


BZX70 series

BZX75-	**C1V4**	**C2V1**	**C2V8**	**C3V6**	**C1V4**	**C2V1**	**C2V8**	**C3V6**
at I_F (mA)	1	1	1	1	10	10	10	10
V_F(V)	<1.34	<2.05	<2.70	<3.45	1.4	2.1	2.8	3.6
S_F(mV/°C)	4	6	8	10	3.3	5.0	6.6	8.2
r_d (Ω)	60	90	120	150	6	9	12	15

Ratings $I_{FRM}=250$ mA; $V_R=10$ V; $P_{tot}=400$ mW; $T_j=175°$C; $T_{stg}=+175°$C

Characteristics $R_{th\,j-a}=0.35°$C/mW; $I_R<500$ nA (C1V4, C2V1) <200 nA (C2V8, C3V6) at $V_R=5$ V
$Q_s>600$ pC at $I_F=10$ mA to $V_R=5$ V; $C_d<250$ pF at $V_R=0$; $f=1$ MHz; tolerance of V_F: 5%



BZX75 series DO-7

ZENER DIODES

Type and applications															
BZX79-	**C4V7**	**C5V1**	**C5V6**	**C6V2**	**C6V8**	**C7V5**	**C8V2**	**C9V1**	**C10**	**C11**	**C12**	**C13**	**C15**	**C16**	**C18**
at I_Z (mA)	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
V_Z(V)	4.7	5.1	5.6	6.2	6.8	7.5	8.2	9.1	10	11	12	13	15	16	18
S_Z(mV/°C)	−1.4	−0.8	+1.2	+2.3	+3.0	+4.0	+5.0	+6.0	+7.0	+8.0	+9.0	+10.5	+12.5	+13.0	+15.0
r_Z (Ω)	80	60	25	10	15	15	15	15	20	20	25	30	30	40	45
C_d(pF)*)	130	110	95	90	85	80	75	70	70	65	65	60	55	52	47
BZX79-	**C20**	**C22**	**C24**	**C27**	**C30**	**C33**	**C36**	**C39**	**C43**	**C47**	**C51**	**C56**	**C62**	**C68**	**C75**
at I_Z (mA)	5	5	5	5	5	5	2	2	2	2	2	2	2	2	2
V_Z(V)	20	22	24	27	30	33	36	39	43	47	51	56	62	68	75
S_Z(mV/°C)	+17.0	+19.0	+21.0	+23.5	+26	+29	+31	+34	+37	+40	+44	+47	+51	+56	+60
r_Z (Ω)	55	55	70	80	80	80	90	130	150	170	180	200	215	240	255
C_d(pF)*)	36	34	33	30	27	25	23	21	21	19	19	18	17	17	16.5

Outlines (mm)

BZX79

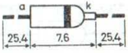
*) at $V_R=0$

Ratings $I_{F(AV)}=250$ mA; $I_{FRM}=250$ mA; $P_{tot}=15$ W; $T_j=200$°C; $T_{stg}=+200$°C

Characteristics $R_{th\,j-a}=0.44$°C/mW; $V_F<0.9$ at $I_F=10$ mA; tolerance of V_Z: 5%

Type and applications		*Ratings* (mA) (W) (°C)	R_{th} (°C/W)	V_F (V)	*at* I_F (mA)	V_Z, (V)	S_Z, (mV/°C)	r_Z (Ω)	*at* I_Z (mA)
BZY56	5%	I_F = 50 I_Z = 25 P_{tot} = 0.28 T_j = 150 T_{stg} = +150	$R_{th\,j-a}$ = 450	0.61 0.76	0.1 10	4.7	−2.0	370	1
BZY57	5%					5.1	−1.8	360	1
BZY58	5%					5.6	−1.0	280	1
BZY59	5%					6.2	+0.5	200	1
BZY60	5%					6.8	+2.7	5.0	1
BZY61	5%					7.5	+4.0	8.0	1
BZY62	5%					8.2	+5.0	6.2	1
BZY63	5%					9.1	+6.2	8.0	1

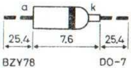
Outlines (mm)



BZY56 to 63 DO-7

BZY78 1%	$I_{FAV}=50$ $I_{FRM}=50$ $I_Z\ =25$ $I_{ZRM}=25$	$P_{tot}=\ 0.28$ $T_j\ =\ 150$ $T_{stg}=+150$	$R_{th\,j-a}=$ 450	<0.75	1	5.3	18	11.5

$T_j=-40$ to $+25°C$: $S_Z=+0.32$
$T_j=+25$ to $+100°C$: $S_Z=-0.21$



Type and applications

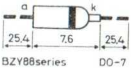
Outlines (mm)

BZY88-	**C3V3**	**C3V6**	**C3V9**	**C4V3**	**C4V7**	**C5V1**	**C5V6**	**C6V2**	**C6V8**	**C7V5**	**C8V2**	**C9V1**
at I_Z *(mA)*	5	5	5	5	5	5	5	5	5	5	5	5
V_Z *(V)*	3.3	3.6	3.9	4.3	4.7	5.1	5.6	6.2	6.8	7.5	8.2	9.1
S_Z *(mV/°C)*	−2.3	−2.0	−2.05	−1.8	−1.55	−1.2	−0.2	+2.0	+3.2	+4.2	+5.0	+6.0
r_Z (Ω)	83.5	76	76	70	62	46	22	7.0	3.0	3.0	3.5	4.75

BZY88-	**C10**	**C11**	**C12**	**C13**	**C15**	**C16**	**C18**	**C20**	**C22**	**C24**	**C27**	**C30**
at I_Z *(mA)*	5	5	5	5	5	5	5	5	5	5	5	5
V_Z *(V)*	10	11	12	13	15	16	18	20	22	24	27	30
S_Z *(mV/°C)*	+7.0	+8.7	+9.0	+10.5	+12.5	+13	+15	+17	+19	+21	+23.5	+26
r_Z (Ω)	<25	<35	<35	<35	<40	<45	<50	<60	<65	<75	<85	<95

Ratings $I_{FRM}=250$ mA/ $I_{ZRM}=250$ mA; $P_{tot}=0.4$ W; $P_{ZSM}=15$ W; $T_j=175°C$; $T_{stg}=+175°C$

Characteristics $R_{th\,j-a}=310°C/W$; $V_F<0.9$ V at $I_F=10$ mA; tolerance of V_Z: 5%



Type and applications

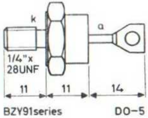
Outlines (mm)

BZY91-	**C10**	**C11**	**C12**	**C13**	**C15**	**C16**	**C18**	**C20**	**C22**	**C24**	**C27**	**C30**	**C33**	**C36**
at I_Z (A)	2	2	2	2	2	2	2	1	1	1	1	1	1	1
V_Z (V)	10	11	12	13	15	16	18	20	22	24	27	30	33	36
S_Z (mV/°C)	9	10	11	12	13	15	16	15	17	19	22	25	28	32
r_Z (Ω)	<0.4	<0.4	<0.5	<0.5	<0.6	<0.6	<0.7	<0.8	<0.8	<0.9	<1.0	<1.1	<1.2	<1.3

BZY91-	**C39**	**C43**	**C47**	**C51**	**C56**	**C62**	**C68**	**C75**
at I_Z (A)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
V_Z (V)	39	43	47	51	56	62	68	75
S_Z (mV/°C)	35	39	44	48	53	59	64	71
r_Z (Ω)	<1.4	<1.5	<1.7	<1.8	<2.0	<2.2	<2.4	<2.6

Ratings $I_{FAV}=10$ A; $I_{FRM}=30$ A; $I_{ZRM}=100$ A; $P_{tot}=75$ W; $T_j=175$°C; $T_{stg}=+175$°C
$P_{ZSM}=4400$ W (0.1 ms); 1480 W (1 ms); 500 W (10 ms); 170 W (100 ms)

Characteristics $R_{th\,j-mb}=1.47$°C/W; $V_F<1.5$ V at $I_F=10$ A; tolerance of V_Z: 5%
Reverse polarity types available

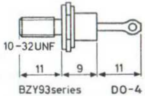


BZY93-	**C7V5**	**C8V2**	**C9V1**	**C10**	**C11**	**C12**	**C13**	**C15**	**C16**	**C18**	**C20**	**C22**
at I_Z (mA)	2	2	1	1	1	1	1	1	0.5	0.5	0.5	0.5
V_Z (V)	7.5	8.2	9.1	10	11	12	13	15	16	18	20	22
S_Z (mV/°C)	3	4	5	7	7.5	8	8.5	10	11	12	14	16
r_Z (Ω)	0.04	0.05	0.07	0.07	0.08	0.08	0.08	0.1	0.18	0.2	0.2	0.21

BZY93-	**C24**	**C27**	**C30**	**C33**	**C36**	**C39**	**C43**	**C47**	**C51**	**C56**	**C62**	**C68**	**C75**
at I_Z (mA)	0.5	0.5	0.5	0.5	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
V_Z (V)	24	27	30	33	36	39	43	47	51	56	62	68	75
S_Z (mV/°C)	18	21	25	30	32	35	40	45	50	55	60	65	70
r_Z	0.22	0.25	0.3	0.32	0.75	0.85	0.9	1.0	1.2	1.3	1.5	1.8	2.0

Ratings $I_{FAV}=5$ A; $I_{FRM}=15$ A; $I_{ZRM}=20$ A; $P_{tot}=20$ W; $T_j=175$°C; $T_{stg}=+175$°C

Characteristics $R_{th\,j-mb}=5$°C/W; $V_F<1.5$ V at $I_F=5$ A; tolerance of V_Z: 5%

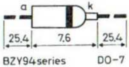


BZY94-	C10	C11	C12	C13	C15	C16	C18	C20	C22	C24	C27	C30	C33	C36
at I_Z *(mA)*	5	5	5	5	5	5	5	5	5	5	5	5	5	5
V_Z *(V)*	10	11	12	13	15	16	18	20	22	24	27	30	33	36
S_Z *(mV/°C)*	7	8.7	9	10.5	12.5	13	15	17	19	21	23.5	26	29	31
r_Z (Ω)	<25	<35	<35	<35	<40	<45	<50	<60	<65	<75	<85	<95	<110	<120

BZY94-	C39	C43	C47	C51	C56	C62	C68	C75
at I_Z *(mA)*	2	2	2	2	2	2	2	2
V_Z *(V)*	39	43	47	51	56	62	68	75
S_Z *(mV/°C)*	34	37	40	44	47	51	56	60
r_Z (Ω)	<130	<150	<170	<180	<200	<215	<240	<255

Ratings $I_{FAV}=250$ mA; $I_{ZRM}=250$ mA; $P_{tot}=400$ mW; $P_{ZSM}=15$ W; $T_j=175°C$; $T_{stg}=+175°C$

Characteristics $R_{th\,j-a}=310°C/W$; $V_F<0.9$ V at $I_F=10$ mA; tolerance of V_Z: 5%

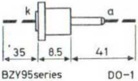


BZY95-	C10	C11	C12	C13	C15	C16	C18	C20	C22	C24	C27	C30	C33	C36
at I_Z *(mA)*	50	50	50	50	50	20	20	20	20	20	20	20	20	20
V_Z *(V)*	10	11	12	13	15	16	18	20	22	24	27	30	33	36
S_Z *(mV/°C)*	7	7.5	8	8.5	10	11	12	14	16	18	20	25	30	32
r_Z (Ω)	0.75	0.80	0.85	0.90	1.0	2.4	2.5	2.8	3.0	3.4	3.8	4.5	5.0	5.5

BZY95-	C39	C43	C47	C51	C56	C62	C68	C75
at I_Z *(mA)*	10	10	10	10	10	10	10	10
V_Z *(V)*	39	43	47	51	56	62	68	75
S_Z *(mV/°C)*	35	40	45	50	55	60	65	70
r_Z (Ω)	12	13	14	15	17	18	18	20

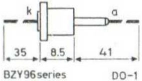
Ratings $I_{FAV}=1$ A; $I_{FRM}=3$ A; $I_{ZRM}=5$ A; $P_{tot}=1.5$ W; $P_{ZSM}=100$ W; $T_j=175°C$; $T_{stg}=+175°C$

Characteristics $R_{th\,j-a}=100°C/W$; $V_F<1.5$ V at $I_F=1$ A; tolerance of V_Z: 5%



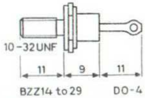
Type and applications								
BZY96-	**C4V7**	**C5V1**	**C5V6**	**C6V2**	**C6V8**	**C7V5**	**C8V2**	**C9V1**
at I_Z (*mA*)	100	100	100	100	100	50	50	50
V_Z (*V*)	4.7	5.1	5.6	6.2	6.8	7.5	8.2	9.1
S_Z (*mV/°C*)	−0.6	+0.1	+1	+2	+3	+4	+5	+6.4
r_Z (Ω)	2.5	1.0	0.7	0.6	0.6	1.0	1.2	1.8
Ratings	$I_{FAV}=1$ A; $I_{FRM}=3$ A; $I_{ZRM}=3.5$ A; $P_{tot}=1.5$ W; $P_{ZSM}=20$ W; $T_j=175$°C; $T_{stg}=+175$°C							
Characteristics	$R_{th\,j-a}=100$°C/W; $V_F<1.5$ V at $I_F=1$ A; tolerance of V_Z: 5%							

Outlines (mm)

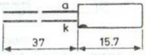


Type and applications		*Ratings* (*mA*) (*W*) (°*C*)	R_{th} (°*C/W*)	V_F at (*V*)	I_F (*mA*)	V_Z, (*V*)	S_Z, (*mV/°C*)	r_Z at (Ω)	I_Z (*mA*)
BZZ14	5%					5.6	+0.7	4.5	20
BZZ15	5%					6.2	+2.1	2.2	20
BZZ16	5%					6.8	+2.9	2.07	20
BZZ17	5%					7.5	+3.75	2.3	20
BZZ18	5%					8.2	+4.7	2.6	20
BZZ19	5%	$I_{FAV}=500$				9.1	+5.8	3.18	20
BZZ20	5%	$I_{FRM}=7000$	$R_{th\,j-a}=70$			10	+7.0	3.8	20
BZZ21	5%	$I_{ZRM}=7000$		<1.0	200	11	+7.5	4.4	20
BZZ22	5%	$P_{tot}=10$				12	+8.8	5.25	20
BZZ23	5%	$P_{ZSM}=45$	$R_{th\,j-mb}=10$			13	+10.0	6.3	20
BZZ24	5%	$T_j=150$				15	+12.6	8.9	20
BZZ25	5%	$T_{stg}=+150$				16	+13.8	10.5	20
BZZ26	5%					18	+16.4	14.5	20
BZZ27	5%					20	+19.0	19.5	20
BZZ28	5%					22	+21.6	26	20
BZZ29	5%					24	+24.2	33.5	20

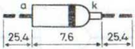
Outlines (mm)



OAZ200	5%	$I_{FAV} = 100$					4.7	−2.0	350	1
OAZ201	5%	$I_{FRM} = 250$					5.1	−1.8	330	1
OAZ202	5%	$I_{ZRM} = 250$					5.6	−1.0	275	1
OAZ203	5%	$I_{ZSM} = 10\,000$	(100 µs)	$R_{th\,j-a} = 400$	0.73	10	6.2	+0.5	215	1
OAZ204	5%	$P_{tot} = 0.5$		$R_{th\,j-c} = 150$	0.80	100	6.8	+2.5	40	1
OAZ205	5%	$T_j = 150$					7.5	+4.0	8.6	1
OAZ206	5%	$T_{stg} = +150$					8.2	+5.0	7.6	1
OAZ207	5%						9.1	+6.2	9.6	1
1N748A	5%						3.9	−1.90	<23	20
1N749A	5%						4.3	−1.55	<22	20
1N750A	5%						4.7	−0.845	<19	20
1N751A	5%	$I_{FAV} = 250$					5.1	−0.405	<17	20
1N752A	5%	$I_{ZRM} = 250$					5.6	+0.336	<11	20
1N753A	5%	$P_{tot} = 0.4$		$R_{th\,j-a} = 310$	<0.9	10	6.2	+1.36	<7	20
1N754A	5%	$T_j = 175$					6.8	+2.38	<5	20
1N755A	5%	$T_{stg} = +175$					7.5	+3.37	<6	20
1N756A	5%						8.2	+4.26	<8	20
1N757A	5%						9.1	+5.1	<10	20
1N758A	5%						10	+6.0	<17	20
1N759A	5%						12	+7.2	<30	20



OAZ200 to OAZ207



1N746A to
1N759A

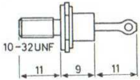
DO−7

RECTIFIER DIODES

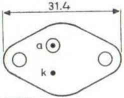
MAx stroom 1,2

Reverse spann.

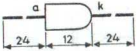
Type and applications	Ratings I_{FAV} (A)	I_{FRM} (A)	I_{FSM} (A)	V_{RWM} (V)	V_{RRM} (V)	V_{RSM} (V)	$^*R_{th\,j-a}$ $R_{th\,j-mb}$ (°C/W)	Outlines (mm)
AYY10-120 rectifier	3.8	12	90	95	120	120	*65 5	AYY10-120 DO-4
BY118 booster diode	5	14	—	—	300	—	5	BY118
BY122	See section Rectifier stacks							
BY123	See section Rectifier stacks							
BY126 mains rectifier	1.2	10	40	450	650	650	*60	BY126
BY127 mains rectifier	1.2	10	40	800	1250	1250	*60	BY127
BY140 fast defl. diode	2.5 (mA)	0.25 $I_{RRM}=$ 0.15	1	15 (kV)	15 (kV)	15 (kV)	—	BY140
BY164	See section Rectifier Stacks							
BY176 e.h.t. rectifier	2.5 (mA)	0.25 $I_{RRM}=$ 0.15	—	15 (kV)	15 (kV)	15 (kV)	—	BY176



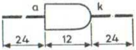
AYY10-120 DO-4



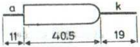
BY118



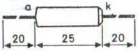
BY126



BY127

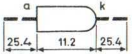


BY140

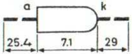


BY176

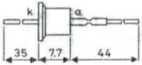
BY179	See section Rectifier stacks							
BY184 V_{g2} supply colour t.v. silicon		2.0 (mA)	100 (mA)	1	1500	1800	1800	*175
BYX10 low current rect.		0.5	3	15	800	1600	1600	*150
BYX13 mains rectifier	**-800(R)** **-1000(R)** **-1200(R)**	20	100	400	400 500 600	800 1000 1200	800 1000 1200	1.1
BYX22 power rectifier	**-600** **-1200**	1.4	15	40	400 800	600 1200	600 1200	*60 solder tags 10 mm
BYX23 mains rectifier	**-400** **-600** **-800** **-1000**	150	750	1600	400 600 800 1000	$P_{RAV} = 30$ W $P_{RRM} = 8$ kW $P_{RSM} = 30$ kW		0.4
BYX25 mains rectifier	**-600(R)** **-800(R)** **-1000(R)**	20	440	360	600 800 1000	$P_{RAV} = 38$ W $P_{RRM} = 3$ kW $P_{RSM} = 18$ kW		*50 1.3



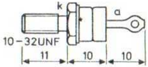
BY184



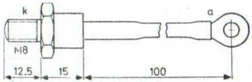
BYX10 DO-14



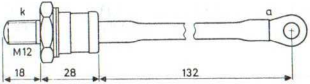
BYX22 series DO-1



BYX25series DO-4

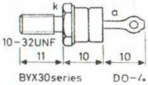


BYX13series

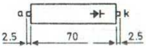


BYX23series

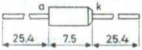
RECTIFIER DIODES

Type and		*Ratings*						$^*R_{th\,j-a}$	*Outlines*
applications		I_{FAV} (A)	I_{FRM} (A)	I_{FSM} (A)	V_{RWM} (V)	V_{RRM} (V)	V_{RSM} (V)	$R_{th\,j-mb}$ $(^\circ C/W)$	*(mm)*
BYX27	**-400**	250	1250	4000	400	$P_{RAV} = 80$ W		0.2	
mains	**-600**				600	$P_{RRM} = 20$ kW			
rectifier	**-800**				800	$P_{RSM} = 80$ kW			
	-1000				1000				
								$R_{th\,j-oil} =$	
BYX29	**-75000**	50 (mA)	0.25	5	75 kV	—	—	3.2	
high volt.	**-100000**				100 kV			2.7	
in X-ray	**-125000**				125 kV			1.6	
	-150000				150 kV			1.6	
BYX30	**-200(R)**	14	310	250	200	$P_{RAV} = 30$ W		*50	
fast	**-300(R)**		$I_{RRM} = 20$		300	$P_{RRM} = 5.5$ kW		1.3	
switch	**-400(R)**				400	$P_{RSM} = 18$ kW			
	-500(R)				500				
	-600(R)				600				
BYX32	**-400(R)**	150	750	1600	400	400	450	0.4	
mains	**-600(R)**				600	600	650		
rectifier	**-800(R)**				800	800	900		
	-1000(R)				1000	1000	1100		
	-1200(R)				1200	1200	1300		
	-1600(R)				1200	1600	1600		

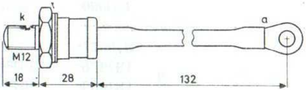
BYX33 mains rectifier	**-400(R)** **-600(R)** **-800(R)** **-1000(R)** **-1200 (R)** **-1600 (R)**	400	2000	4000	400 600 800 1000 1200 1200	400 600 800 1000 1200 1600	450 650 900 1100 1300 1600	0.2
BYX34 fast switch	**-200** **-300** **-400** **-500**	70	1000	1200	200 300 400 500	$P_{RAV} = 30$ W $P_{RRM} = 8$ kW $P_{RSM} = 30$ kW		0.4
BYX35 high voltage in X-ray, LASER		50 (mA)	0.16	15	25 (kV)	37.5 (kV)	40 (kV)	$R_{th\,j-oil} =$ 8
BYX36 general purpose	**-150** **-300** **-600**	0.8	5	30	100 200 400	150 300 600	150 300 600	



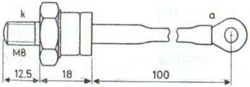
BYX35



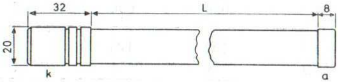
BYX36series DO-15



BYX32series

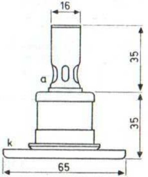


BYX34series



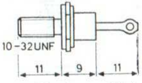
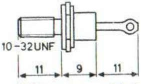
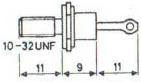
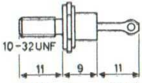
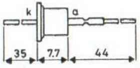
BYX29series

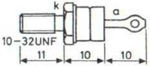
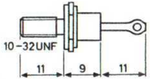
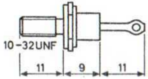
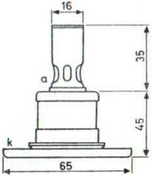
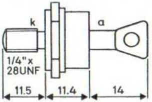
BYX29- 75000;L=102
BYX29-100000;L=130
BYX29-125000;L=190
BYX29-150000;L=190



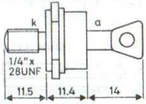
BYX27series
BYX33series

RECTIFIER DIODES

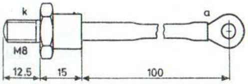
Type and applications		*Ratings*						$*R_{th\,j-a}$	*Outlines*
		I_{FAV} (*A*)	I_{FRM} (*A*)	I_{FSM} (*A*)	V_{RWM} (*V*)	V_{RRM} (*V*)	V_{RSM} (*V*)	$R_{th\,j-mb}$ (°*C*/*W*)	(*mm*)
BYX38 mains rectifier	**-300(R)** **-600(R)** **-900(R)** **-1200(R)**	6	20	38	200 400 600 800	300 600 900 1200	300 600 900 1200		 BYX38series DO-4
BYX39 power rectifier	**-600(R)** **-800(R)** **-1000(R)**	6	120	100	600 800 1000	$P_{RAV} = 10$ W $P_{RRM} =$ 2 kW $P_{RSM} =$ 4 kW		*50 4.5	 BYX39series DO-4
BYX40 power rectifier	**-600(R)** **-800(R)** **-1000(R)**	12	250	180	600 800 1000	$P_{RRM} = 1.2$ kW $P_{RSM} = 8$ kW		*50 2.2	 BYX40 series DO-4
BYX42 mains rectifier	**-300(R)** **-600(R)** **-900(R)** **-1200(R)**	10	60	125	200 400 600 800	300 600 900 1200	300 600 900 1200	*50 3	 BYX42series DO-4
BYX45 series rectifi- cation	**-600R** **-800R** **-1000R**	1.5	15	40	600 800 1000	$P_{RRM} = 800$ W $P_{RSM} = 2.5$ kW		*60 solder tags 10 mm	 BYX45series DO-1

BYX46	**-200(R)**				200				 BYX46 series DO-4
fast recovery	**-300(R)**				300	$P_{RRM}=9.5$ kW		*50	
rectifier	**-400(R)**	22	400	300	400	$P_{RSM}=18$ kW		1.3	
	-500(R)				500				
	-600(R)				600				
BYX48	**-300(R)**				200	300	300		 BYX48series DO-4
mains	**-600(R)**	6	36	90	400	600	600	*50	
rectifier	**-900(R)**				600	900	900	4.5	
	-1200(R)				800	1200	1200		
BYX50	**-200(R)**				200	200	250	*50	 BYX50 series DO-4
power	**-300(R)**				300	300	350	3.5	
rectifier	**-400(R)**	6	40	80	400	400	450		
	-500(R)				500	500	550		
	-600(R)				600	600	650		
BYX51	**-1200(R)**				800	1200	1200	0.13	 BYX51 series
power	**-1600(R)**	400	2000	6000	1200	1600	1600		
rectifier	**-2000(R)**				1200	2000	2000		
BYX52	**-300(R)**				200	300	300		 BYX52 series
power	**-600(R)**	40	450	800	400	600	600	0.8	
rectifier	**-900(R)**				600	900	900		
	-1200(R)				800	1200	1200		

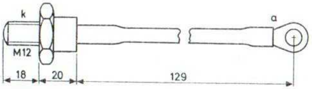
RECTIFIER DIODES

Type and applications		*Ratings*						$^*R_{th\,j-a}$	*Outlines*
		I_{FAV} (A)	I_{FRM} (A)	I_{FSM} (A)	V_{RWM} (V)	V_{RRM} (V)	V_{RSM} (V)	$R_{th\,j-mb}$ $(^\circ C/W)$	*(mm)*
BYX56 power rectifier	**-600(R)** **-800(R)** **-1000(R)**	47	450	800	600 800 1000	$P_{RRM} = 6.5$ kW $P_{RSM} = 4.0$ kW		0.8	 BYX56 series
BYX59 high freq. power rectifier	**-200** **-300** **-400** **-500**	70	1000	1200	200 300 400 500	200 300 400 500	220 330 440 550	0.4	
BYY73 mains rectifier		40	200	800	300	600	600	1.0	
BYY74		reverse polarity version of BYY73							
BYY75 mains rectifier		40	200	800	500	1000	1000	1.0	
BYY76		reverse polarity version of BYY75							
BYY77 mains rectifier		40	200	800	600	1200	1200	1.0	

BYY78	reverse polarity version of BYY77						
BYZ14 mains rectifier	40	200	800	200	400	400	1.0
BYZ15	reverse polarity version of BYZ14						

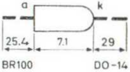


BYX59 series



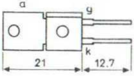
BYY73
BYY75
BYY77
BYZ14

THYRISTORS

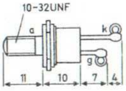
Type and application	Ratings (mA) (V)	(°C)	$R_{th\,j-a}$ (°C/mW)	V_F at I_F (V) (mA)	I_R at V_R (μA) (V)	Char.	Outlines (mm)
BR100 trigger device silicon	$I_{FRM}=2A$ $P_{tot}=150$ mW	$T_j=100$ $T_{stg}=+100$	0.2	$T_j=25°C$ $V_{(BO)}<36$ $I_{(BO)}<0.1$	$T_j=25°C$ $\Delta V>6$		

Type and applications	Ratings: I (A)	V_{RWM} V_{DWM} (V)	V_{DRM} (V)	V_{DSM} (V)	$*V_{FGM}$ V_{RGM} (V)	$*P_{GAV}$ P_{GM} (W)	T_j (°C)	$R_{th\,j-mb}$ (°C/W)	I_H (mA)	t_{on} (μs)	t_q (μs)
BT100A -300R **-500R**	$I_{TAV}=2$ $I_{T(RMS)}=4.5$ $I_{TRM}=20$ $I_{TSM}=40$ $I_{FGM}=0.25$	200 400	300 500	300 500	5	*0.1 1	100	8	4	1.3	10
BT101-300R **-500R**	$I_{TAV}=6.5$ $I_{T(RMS)}=15$ $I_{TRM}=50$ $I_{TSM}=55$ $I_{FGM}=2$	200 400	300 500	300 500	*10 5	*0.5 5	125	3	—	—	—
BT102	Equivalent to BT101										
BTX18 -100 **-200** **-300** **-400** **-500**	$I_{TAV}=1$ $I_{T(RMS)}=1.6$ $I_{TRM}=10$ $I_{TSM}=10$ $I_{FGM}=0.2$	100 200 300 400 500	120 240 350 500 600	120 240 350 500 600	*10 5	*0.05 0.5	125	10	<5	—	20

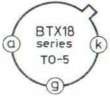
BTX35	**-500R** **-600R** **-700R** **-800R**	$I_{TAV} = 12$ $I_{T(RMS)} = 19$ $I_{TRM} = 140$ $I_{TSM} = 140$ $I_{FGM} = 2$	500 600 700 800	$P_{RSM} = 18$ kW	*10 5	*0.5 5	125	1.6	10	2	< 100
BTX36	**-500R** **-600R** **-700R** **-800R**	$I_{TAV} = 16$ $I_{T(RMS)} = 25$ $I_{TRM} = 200$ $I_{TSM} = 200$ $I_{FGM} = 2$	500 600 700 800	$P_{RSM} = 18$ kW	*10 5	*0.5 5	125	1.6	10	2	< 100
BTX37	**-500R** **-600R** **-700R** **-800R**	$I_{TAV} = 50$ $I_{T(RMS)} = 78$ $I_{TRM} = 700$ $I_{TSM} = 680$ $I_{FGM} = 2$	500 600 700 800	$P_{RSM} = 40$ kW	*10 5	*0.5 5	125	0.6	10	3	< 250

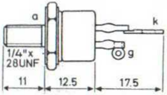


BT100A series

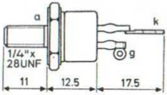


BT101

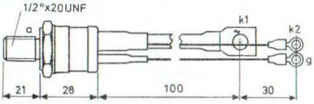




BTX35series



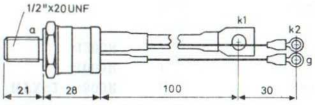
BTX36series



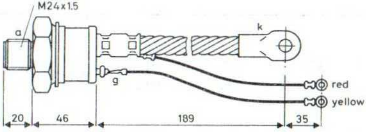
BTX37series

Type and applications		Ratings: I (A)	V_{RWM} V_{DWM} (V)	V_{DRM} (V)	V_{DSM} (V)	$^*V_{FGM}$ V_{RGM} (V)	$^*P_{GAV}$ P_{GM} (W)	T_j ($^\circ C$)	$R_{th\,j-mb}$ ($^\circ C/W$)	I_H (mA)	t_{on} (μs)	t_q (μs)
BTX38	**-500R**	I_{TAV} = 70	500	P_{RSM} = 40 kW		*10 5	*0.5 5	125	0.4	10	3	< 250
	-600R	$I_{T(RMS)}$ = 110	600									
	-700R	I_{TRM} = 1000	700									
	-800R	I_{FGM} = 900	800									
		I_{FGM} = 2										
BTX41	**-800R**	$I_{T(AV)}$ = 250	800	800	900	*6 5	*2 10	110	0.12	< 150	< 20	200
	-1000R	$I_{T(RMS)}$ = 110	1000	1000	1200							
	-1200R	I_{TRM} = 2500	1200	1200	1400							
	-1400R	I_{TSM} = 155	1400	1400	1600							
	-1600R	I_{FGM} = 3	1600	1600	1800							
BTX47	**-1000R**	I_{TAV} = 16	800	P_{RSM} = 18 kW		*10 5	*0.5 5	125	1.0	10	5	< 100
	-1200R	$I_{T(RMS)}$ = 25	800									
	-1400R	I_{TRM} = 160	800									
		I_{TSM} = 155										
		I_{FGM} = 2										
BTX48		Equivalent to BTX47 except for:		I_{TRM} = 200 A			I_{TSM} = 200 A					
BTX49	**-600R**	I_{TAV} = 70	600	P_{RSM} = 40 kW		*10 10	*1.0 5	125	0.3	< 150	5	< 100
	-700R	$I_{T(RMS)}$ = 110	700									
	-800R	I_{TRM} = 1000	800									
	-1000R	I_{TSM} = 1050	1000									
	-1200R	I_{FGM} = 2	1200									

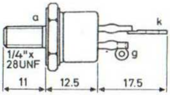
BTX50	**-600R**	$I_{TAV} = 70$	600	$P_{RSM} = 40$ kW		*10 10	*1.0 5	125	0.3	<150	5	<100
	-700R	$I_{T(RMS)} = 110$	700									
	-800R	$I_{TRM} = 1000$	800									
	-1000R	$I_{TSM} = 1500$	1000									
	-1200R	$I_{FGM} = 2$	1200									
BTX68	**-500R**	$I_{TAV} = 6.4$	500	$P_{RSM} = 12$ kW		*10 5	*0.5 5	125	3.0	10	3	<50
	-600R	$I_{TRM} = 60$	600									
	-700R	$I_{TSM} = 80$	700									
	-800R	$I_{FGM} = 2$	800									
	-1000R		1000									
BTX81	**-400R**	$I_{TAV} = 20$	400	400	500	*10 5	*1 5	125	1.0	<100	5	<100
	-500R	$I_{T(RMS)} = 31$	500	500	850							
	-600R	$I_{TRM} = 200$	600	600	850							
	-700R	$I_{TSM} = 450$	700	700	850							
	-800R	$I_{FGM} = 2$	800	800	850							



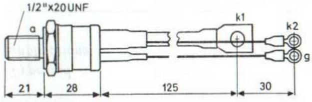
BTX38series



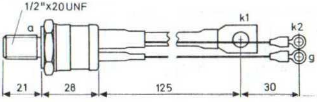
BTX41 series



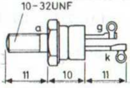
BTX47series



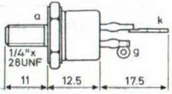
BTX49series TO-94



BTX50 series TO-94



BTX68series

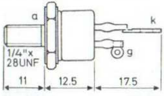


BTX81series TO-48

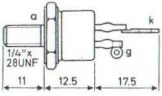
THYRISTORS

Type and applications	*Ratings:* I (A)	V_{RWM} V_{DWM} (V)	V_{DRM} (V)	V_{DSM} (V)	$^*V_{FGM}$ V_{RGM} (V)	$^*P_{GAV}$ P_{GM} (W)	T_j $(°C)$	$R_{th\,j-mb}$ $(°C/W)$	I_H (mA)	t_{on} (μs)	t_q (μs)
BTX82	Equivalent to BTX81 except for: $I_{TAV}=26$ A; $I_{T(RMS)}=40$ A; $I_{TRM}=350$ A; $I_{TSM}=600$ A										
BTX92 -800R **-1000R** **-1200R**	$I_{TAV}\ =\ 16$ $I_{T(RMS)}=\ 25$ $I_{TRM}\ =150$ $I_{TSM}\ =280$ $I_{FGM}\ =\ \ 2$	800 1000 1200	$P_{RSM}=10$ kW		*10 10	*1 5	125	1.0	<200	2	<100
BTX94 -400 Triac **-500** **-600** **-700** **-800** **-1000** **-1200**	$I_{T(RMS)}=\ 25$ $\pm I_{TRM}\ =100$ $\pm I_{TSM}\ =250$ $\pm I_{GM}\ =\ \ 2$	±400 ±500 ±600 ±700 ±800 ±1000 ±1200	±400 ±500 ±600 ±700 ±800 ±1000 ±1200		$V_{GM}=$ ±10	*1 5	125	1.0		1.5	—
BTY79 -400R **-500R** **-600R** **-700R** **-800R** **-1000R**	$I_{TAV}\ =6.4$ $I_{T(RMS)}=10$ $I_{TRM}\ =60$ $I_{TSM}\ =80$ $I_{FGM}\ =\ 2$	400 500 600 700 800 1000	400 500 600 700 800 1000	500 1100 1100 1100 1100 1100	*10 5	*0.5 5	125	3.0	10	3	<50

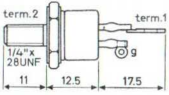
BTY87	**-400R**	$I_{TAV} = 12$	400	400	500	*10 5	*0.5 5	125	1.6	10	2	<50
	-500R	$I_{T(RMS)} = 19$	500	500	850							
	-600R	$I_{TRM} = 140$	600	600	850							
	-700R	$I_{TSM} = 140$	700	700	850							
	-800R	$I_{FGM} = 2$	800	800	850							
BTY91	**-400R**	$I_{TAV} = 16$	400	400	500	*10 5	*0.5 5	125	1.6	10	2	<50
	-500R	$I_{T(RMS)} = 25$	500	500	850							
	-600R	$I_{TRM} = 200$	600	600	850							
	-700R	$I_{TSM} = 200$	700	700	850							
	-800R	$I_{FGM} = 2$	800	800	850							
BTY95	**-500R**	$I_{TAV} = 50$	500	500	850	*10 5	*0.5 5	125	0.6	10	3	<100
	-600R	$I_{T(RMS)} = 78$	600	600	850							
	-700R	$I_{TRM} = 700$	700	700	850							
	-800R	$I_{TSM} = 680$	800	800	850							
		$I_{FGM} = 2$										
BTY99	**-500R**	$I_{TAV} = 70$	500	500	850	*10 5	*0.5 5	125	0.4	10	3	<100
	-600R	$I_{T(RMS)} = 110$	600	600	850							
	-700R	$I_{TRM} = 1000$	700	700	850							
	-800R	$I_{TSM} = 900$	800	800	850							
		$I_{FGM} = 2$										



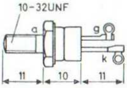
BTX82 series TO-48



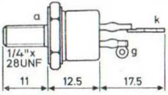
BTX92 series TO-48



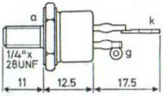
BTX94 series TO-48



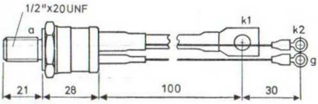
BTY79 series



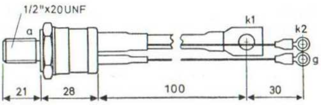
BTY87 series



BTY91 series



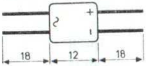
BTY95 series



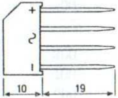
BTY99 series

RECTIFIER STACKS

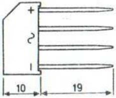
Type and applications	Ratings								
	I_O (A)	I_{ORM} (A)	I_{ISM} (A)	$V_{I(RMS)}$ (V)	V_{IWM} (V)	V_{IRM} (V)	V_{ISM} (V)	P_{IRM} (kW)	P_{ISM} (kW)
BY122	0.8	3	15	42	60	120	120	—	—
BY123	0.7	3	15	280	400	800	800	—	—
BY164	1.4	5	25	60	85	120	120	—	—
BY179	1	5	25	280	400	800	800	—	—



BY122
BY123



BY164



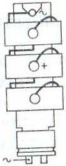
BY179

Type and application	Ratings						Characteristics					
	$I_{F(AV)}$ (A)	I_{FRM} (A)	I_{FSM} (A)	V_{RWM} (V)	P_{RRM} (kW)	P_{RSM} (kW)	V_F at (V)	I_F (A)	$V_{(BR)R}$ at (kV)	I_R (A)	I_{RM} at (A)	V_{RM} (V)
OSB9110 -4	6	120	85	2	1.2	6	<4	20	<3.76	5	<0.6	$V_{RWM\max}$
-6				3	1.8	9	<6	20	<5.64	5		
. . .				. . .	. . .	. . .	. . .	. . .	. . .	. . .		
-28				14	8.4	42	<28	20	<26.32	5		
-30				15	9	45	<30	20	<28.2	5		
OSM9110 series Equivalent to OSB9110 series												
OSS9110 -3	6	120	85	3	1.8	9	<6	20	<5.64	5	<0.6	$V_{RWM\max}$
-4				4	2.4	12	<8	20	<7.52	5		
. . .				. . .	. . .	. . .	. . .	. . .	. . .	. . .		
-29				29	17.4	87	<58	20	<54.52	5		
-30				30	18	90	<60	20	<56.4	5		
OSB9210 -4	20	440	360	2	4	26	<3.6	50	<3.76	5	<0.6	$V_{RWM\max}$
-6				3	6	39	<5.4	50	<5.64	5		
. . .				. . .	. . .	. . .	. . .	. . .	. . .	. . .		
-28				14	28	182	<25.2	50	<26.32	5		
-30				15	30	195	<27	50	<28.2	5		
OSM9210 series Equivalent to OSB9210 series												
OSS9210 -3	20	440	360	3	6	39	<5.4	50	<5.64	5	<0.6	$V_{RWM\max}$
-4				4	8	52	<7.2	50	<7.52	5		
. . .				. . .	. . .	. . .	. . .	. . .	. . .	. . .		
-29				29	58	377	<52.2	50	54.52	5		
-30				30	60	390	<54	50	56.4	5		

RECTIFIER STACKS

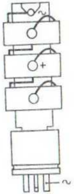
Type and application	Ratings						Characteristics					
	$I_{F(AV)}$ (*A*)	I_{FRM} (*A*)	I_{FSM} (*A*)	V_{RWM} (*V*)	P_{RRM} (*kW*)	P_{RSM} (*kW*)	V_F at (*V*)	I_F (*A*)	$V_{(BR)R}$ at (*kV*)	I_R (*A*)	I_{RM} at (*A*)	V_{RM} (*V*)
OSB9310 -4	12	250	180	2	2	12	<5	50	<4	5	<0.3	$V_{RWM\max}$
-6				3	3	18	<7.5	50	<6	5		
. . .				. . .	. . .	. . .	. . .	. . .	. . .	. . .		
-28				14	14	84	<35	50	<28	5		
-30				15	15	90	<37.5	50	<30	5		
OSM9310 series Equivalent to OSB9310 series												
OSS9310 -3	12	250	180	3	3	18	<7.5	50	<6	5	<0.3	$V_{RWM\max}$
-4				4	4	24	<10	50	<8	5		
. . .				. . .	. . .	. . .	. . .	. . .	. . .	. . .		
-29				29	29	174	<72.5	50	<58	5		
-30				30	30	180	<75	50	<60	5		
OSB9410 -4	10	450	800	2	9	55	<3.6	150	<4	5	<1.6	$V_{RWM\max}$
-6				3	13.5	80	<5.4	150	<6	5		
. . .				. . .	. . .	. . .	. . .	. . .	. . .	. . .		
-28				14	63	37.5	25.2	150	<20	5		
-30				15	67.5	100	27	150	<30	5		
OSM9410 series Equivalent to OSB9410 series												
OSS9410 -3	10	450	800	3	13.5	80	<5.4	150	<6	5	<1.6	$V_{RWM\max}$
-4				4	18	105	<7.2	150	<8	5		
. . .				. . .	. . .	. . .	. . .	. . .	. . .	. . .		
-29				29	130.5	775	<52.2	150	<58	5		
-30				30	135	800	<54	150	<60	5		

OSB9110-nE
OSB9210-nE
OSB9310-nE



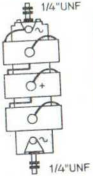
base: jumbo
with bayonet

OSB9110-nF
OSB9210-nF
OSB9310-nF

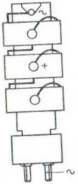


base:
A3-20

OSB9110-nA
OSB9210-nA
OSB9310-nA

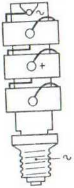


OSB9110-nB
OSB9210-nB
OSB9310-nB

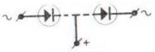


base:
super jumbo
with bayonet

OSB9110-nC
OSB9210-nC
OSB9310-nC

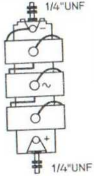


base:
goliath

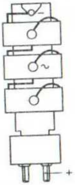


centre tap

OSM9110-nA
OSM9210-nA
OSM9310-nA

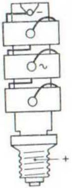


OSM9110-nB
OSM9210-nB
OSM9310-nB



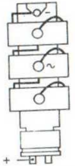
base:
super jumbo
with bayonet

OSM9110-nC
OSM9210-nC
OSM9310-nC



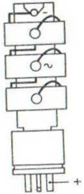
base:
goliath

OSM9110-nE
OSM9210-nE
OSM9310-nF

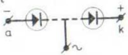


base: jumbo
with bayonet

OSM9110-nF
OSM9210-nF
OSM9310-nF

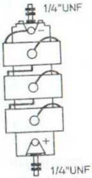


base:
A3-20

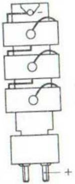


centre tap

OSS9110-nA
OSS9210-nA
OSS9310-nA

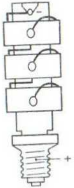


OSS9110-nB
OSS9210-nB
OSS9310-nB



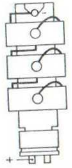
base:
super jumbo
with bayonet

OSS9110-nC
OSS9210-nC
OSS9310-nC



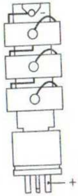
base:
goliath

OSS9110-nE
OSS9210-nE
OSS9310-nE

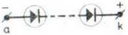


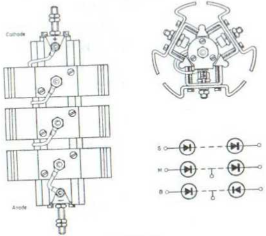
base: jumbo
with bayonet

OSS9110-nF
OSS9210-nF
OSS9310-nF



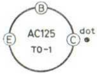
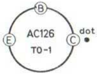
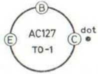
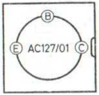
base:
A3-20

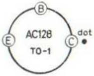
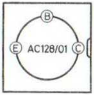
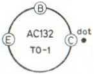
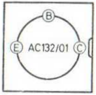
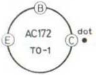




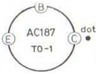
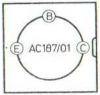
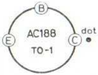
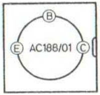
The drawing shows the OSS9410.
The OSB9410 and OSM9410 differ in the following respects:
OSB9410 - has a centre top marked +;
anode and cathode are marked ~.
OSM9410 - has a centre top marked ~.

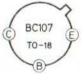
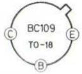
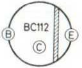
LOW FREQUENCY TRANSISTORS

Type and applications	*Characteristics at:*	I_C *(mA)*	V_{CE} *(V)*	*Characteristics at:*	I_E *(mA)*	V_{CB} *(V)*	*Ratings*	*Outlines (mm)*
AC125 p-n-p driver	$h_{FE}=100$ $f_T=1.7$ MHz $F<10$ dB $h_{fe}<170$	−2 −10 −0.5 −2	−5 −2 −5 −5	$-I_{CBO}<10\ \mu A$ $C_c<50$ pF	0 0	−10 −5	$-I_C=100$ mA $-V_{CEO}=12$ V $P_{tot}=500$ mW $T_j=90°C$ $R_{th\,j-a}=0.3°C/mW$	length <9.4 width <6.1 leads >38 
AC126 p-n-p driver	$h_{FE}=140$ $f_T=2.3$ MHz $F<10$ dB $h_{fe}<300$	−2 −10 −0.5 −2	−5 −2 −5 −5	$-I_{CBO}<10\ \mu A$ $C_c<50$ pF	0 0	−10 −5	$-I_C=100$ mA $-V_{CEO}=12$ V $P_{tot}=500$ mW $T_j=90°C$ $R_{th\,j-a}=0.3°C/mW$	length <9.4 width <6.1 leads >38 
AC127 n-p-n driver output	$h_{FE}=100$ $f_T=2.5$ MHz $F<10$ dB	20 10 0.5	0.6 2 5	$I_{CBO}<10\ \mu A$ $C_c=70$ pF	0 0	0.5 5	$I_C=0.5$ A $V_{CEO}=12$ V $P_{tot}=340$ mW $T_j=90°C$ $R_{th\,j-a}=0.37°C/mW$	length <9.4 width <6.4 leads >38 
AC127/AC128 matched pair	$h_{FE1}/h_{FE2}=1.1$	|300|	0.6					
AC127/AC132 matched pair	$h_{FE1}/h_{FE2}=1.1$	|50|	0.6					
AC127/01	Equivalent to AC127 except for:						$R_{th\,j-a}=0.25°C/mW$	length <15.7 width <7.2 leads >38 

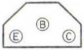
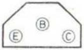
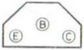
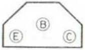
AC128 p-n-p output	$h_{FE} < 175$ $f_T = 1.5$ MHz $h_{fe} = 1.25$	-50 -10 -60	0.6 -2 -9	$-I_{CBO} < 10\ \mu A$ $-I_{CBO} < 0.2$ mA $C_c = 100$ pF	0 0 0	-10 -32 -5	$-I_{CM} = 2$ A $-V_{CEO} = 16$ V $P_{tot} = 1$ W $T_j = 90°C$ $R_{th\,j-a} = 0.29°C/mW$	length < 9.4 width < 6.4 leads > 38	
2-AC128 matched pair	$h_{FE1}/h_{FE2} = 1.1$	-300	0.6						
AC128/01	Equivalent to AC128 except for:						$R_{th\,j-a} = 0.18°C/mW$	length < 15.7 width < 7.2 leads > 38	
AC132 p-n-p output	$h_{FE} = 135$ $f_T = 2$ MHz $F < 10$ dB	-20 -10 -0.5	0 -2 -5	$-I_{CBO} < 10\ \mu A$ $V_{EB} < 0.55$ V $C_c = 40$ pF	0 200 0	-0.5 0 -5	$-I_C = 200$ mA $-V_{CEO} = 12$ V $P_{tot} = 500$ mW T_j 90°C $R_{th\,j-a} = 0.30°C/mW$	length < 9.4 width < 6.1 leads > 38	
2-AC132 matched pair	$h_{FE1}/h_{FE2} = 1.1$	-200	0.6						
AC132/01	Equivalent to AC132 except for:						$R_{th\,j-a} = 0.19°C/mW$	length < 1.57 width < 7.2 leads > 38	
AC172 n-p-n pre-amplifier	$h_{FE} = 110$ $f_T = 2.5$ MHz $F < 4$ dB $h_{fe} < 110$	1 10 0.5 0.5	5 2 5 5	$I_{CBO} < 10\ \mu A$ $C_c = 70$ pF	0 0	10 5	$I_C = 10$ mA $V_{CEO} = 12$ V $P_{tot} = 200$ mW $T_j = 90°C$ $R_{th\,j-a} = 0.37°C/mW$	length < 9.4 width < 6.1 leads > 38	

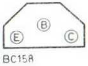
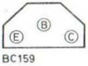
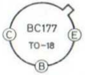
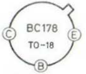
LOW FREQUENCY TRANSISTORS

Type and applications	*Characteristics at:*	I_C *(mA)*	V_{CE} *(V)*	*Characteristics at:*	I_E *(mA)*	V_{CB} *(V)*	*Ratings*	*Outlines (mm)*	
AC187	$V_{BE} < 135$ mV	5	10	$I_{CBO} < 0.1$ mA	0	25	$I_{CM} = 2$ A	length < 9.4	
n-p-n	$h_{FE} > 70$	5	10	$C_c < 180$ pF	0	5	$V_{CEO} = 15$ V	width < 6.1	
medium	$h_{FE} < 500$	300	1				$P_{tot} = 800$ mW	leads > 38	
power	$f_T = 5$ MHz	10	2				$T_j = 90°C$		
							$R_{th\,j-a} = 0.29°C/mW$		
AC187/AC188 matched pair	$h_{FE1}/h_{FE2} < 1.25$	|500|	|1|						
AC187/01	Equivalent to AC187 except for:						$R_{th\,j-a} = 0.18°C/mW$	length < 15.7 width < 7.2 leads > 38	
AC188	$-V_{BE} < 145$ mV	−5	−10	$-I_{CBO} < 0.2$ mA	0	−25	$-I_{CM} = 2$ A	length < 9.4	
p-n-p	$h_{FE} > 70$	−5	−10	$C_c < 110$ pF	0	−5	$-V_{CEO} = 15$ V	width < 6.1	
medium	$h_{FE} < 500$	−300	−1				$P_{tot} = 800$ mW	leads > 38	
power	$f_T = 1.5$ MHz	−10	−2				$T_j = 90°C$		
							$R_{th\,j-a} = 0.29°C/mW$		
AC188/01	Equivalent to AC188 except for:						$R_{th\,j-a} = 0.18°C/mW$	length < 15.1 width < 7.2 leads > 38	

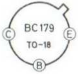
BC107(-A)(-B)	$A: h_{FE} < 220$	2	5	$I_{CBO} < 15\ \mu A$	0	20	$I_{CM} = 200$ mA	length < 5.3	
n-p-n	$B: h_{FE} < 450$	2	5	$C_c < 4.5$ pF	0	10	$V_{CEO} = 45$ V	width < 4.8	
driver	$h_{fe} < 500$	2	5				$P_{tot} = 300$ mW	leads > 12.7	
	$f_T = 300$ MHz	10	5				$T_j = 175$°C		
	$F = 2$ dB	0.2	5				$R_{th\,j-a} = 0.5$°C/mW		
BC108(-A)(-B)(-C)									
Equivalent to	$A, B: h_{fe} < 900$	2	5				$V_{CEO} = 20$ V		
BC107(-A)(-B)	$C: h_{FE} < 800$	2	5						
except for:									
BC109(-B)(-C)	$B: h_{FE} < 450$	2	5	$I_{CBO} < 15\ \mu A$	0	20	$I_{CM} = 200$ mA	length < 5.3	
n-p-n	$C: h_{FE} < 800$	2	5	$C_c < 4.5$ pF	0	10	$V_{CEO} = 20$ V	width < 4.8	
input	$h_{FE} < 900$	2	5				$P_{tot} = 300$ mW	leads > 12.7	
	$f_T = 300$ MHz	10	5				$T_j = 175$°C		
	$F < 4$ dB	0.2	5				$R_{th\,j-a} = 0.5$°C/mW		
BC112	$V_{BE} = 0.65$ V	2	1	$C_c = 4$ pF	0	5	$I_{CM} = 50$ mA	length < 2	
n-p-n	$f_T = 150$ MHz	2	5				$V_{CEO} = 20$ V	width < 1.8	
red dot	$h_{FE} > 100$	2	1				$P_{tot} = 50$ mW	leads > 18	
	$F = 2$ dB	0.2	5				$T_j = 125$°C		
	$h_{fe} = 130$	0.2	5				$R_{th\,j-a} = 1.6$°C/mW		
BC112	$V_{BE} = 0.65$ V	2	1	$C_c = 4$ pF	0	5	$I_{CM} = 50$ mA	length < 2	
n-p-n	$f_T = 150$ MHz	2	5				$V_{CEO} = 20$ V	width < 1.8	
yellow dot	$h_{FE} > 140$	2	1				$P_{tot} = 50$ mW	leads > 18	
	$F < 4$ dB	0.2	5				$T_j = 125$°C		
	$h_{fe} = 220$	0.2	5				$R_{th\,j-a} = 1.6$°C/mW		
BC112	$V_{BE} = 0.65$ V	2	1	$C_c = 4$ pF	0	5	$I_{CM} = 50$ mA	length < 2	
n-p-n	$f_T = 150$ MHz	2	5				$V_{CEO} = 20$ mV	width < 1.8	
green dot	$h_{FE} > 280$	2	1				$P_{tot} = 50$ mW	leads > 18	
	$F = 2$ dB	0.2	5				$T_j = 125$°C		
	$h_{fe} = 380$	0.2	5				$R_{th\,j-a} = 1.6$°C/mW		

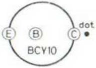
LOW FREQUENCY TRANSISTORS

Type and applications	Characteristics at:	I_C (mA)	V_{CE} (V)	Characteristics at:	I_E (mA)	V_{CB} (V)	Ratings	Outlines (mm)
BC146	Equivalent to BC112 except for: $V_{BE} = 0.63$ V	 2	 1					
BC147 n-p-n driver	$h_{fe} < 500$ $f_T = 300$ MHz $F = 2$ dB	2 10 0.2	5 5 5				$I_{CM} = 200$ mA $V_{CEO} = 45$ V $P_{tot} = 220$ mW $T_j = 125$°C $R_{th\,j-a} = 0.45$°C/mW	height < 5.1 width < 7.6 depth < 4.6 leads < 5.5  BC147
BC148 n-p-n driver jungle	$h_{fe} < 900$ $f_T = 300$ MHz $F = 2$ dB	2 10 0.2	5 5 5				$I_{CM} = 200$ mA $V_{CEO} = 20$ V $P_{tot} = 220$ mW $T_j = 125$°C $R_{th\,j-a} = 0.45$°C/mW	height < 5.1 width < 7.6 depth < 4.6 leads < 5.5  BC148
BC149 n-p-n input hi-fi	$h_{fe} < 900$ $f_T = 300$ MHz $F < 4$	2 10 0.2	5 5 5				$I_{CM} = 200$ mA $V_{CEO} = 20$ V $P_{tot} = 220$ mW $T_j = 125$°C $R_{th\,j-a} = 0.45$°C/mW	height < 5.1 width < 7.6 depth < 4.6 leads < 5.5  BC149
BC157 p-n-p driver	$h_{FE} = 140$ $h_{fe} < 260$ $f_T = 150$ MHz $F = 2$ dB	−2 −2 −10 −0.2	−5 −5 −5 −5	$-I_{CBO} = 1$ nA $C_c = 4.5$ pF	0 0	−20 −10	$-I_C = 100$ mA $-V_{CEO} = 45$ V $P_{tot} = 250$ mW $T_j = 125$°C $R_{th\,j-a} = 0.4$°C/mW	height < 5.1 width < 7.6 depth < 4.6 leads < 5.5  BC157

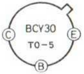
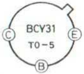
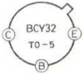
BC158(-A)(-B)	$A: h_{FE}=180$	-2	-5	$I_{CBO}=1$ nA	0	-20	$-I_C=100$ mA	height <5.1	
p-n-p	$B: h_{FE}=290$	-2	-5	$C_c=4.5$ pF	0	-10	$-V_{CEO}=25$ V	width <7.6	
driver	$A: h_{fe}<260$	-2	-5				$P_{tot}=250$ mW	depth <4.6	
	$B: h_{fe}<500$	-2	-5				$T_j=125°C$	leads <5.5	
	$f_T=150$ MHz	-10	-5				$R_{th\,j-a}=0.4°C/mW$		
	$F=2$ dB	-0.2	-5						
BC159(-A)(-B)	$A: h_{FE}=180$	-2	-5	$-I_{CBO}=1$nA	0	-20	$-I_C=100$ mA	height <5.1	
p-n-p	$B: h_{FE}=290$	-2	-5	$C_c=4.5$ pF	0	-10	$-V_{CEO}=20$ V	width <7.6	
input	$A: h_{fe}<260$	-2	-5				$P_{tot}=250$ mW	depth <4.6	
hi-fi	$B: h_{fe}<500$	-2	-5				$T_j=125°C$	leads <5.5	
	$f_T=150$ MHz	-10	-5				$R_{th\,j-a}=0.4°C/mW$		
	$F=1$ dB	-0.2	-5						
BC177	$-V_{BE}<0.75$ V	-2	-5	$-I_{CBO}<100$ nA	0	-20	$-I_{CM}=200$ mA	length <5.3	
p-n-p	$h_{FE}=140$	-2	-5	$C_c=4.5$ pF	0	-10	$-V_{CEO}=45$ V	width <4.8	
driver	$F<10$ dB	0.2	-5				$P_{tot}=300$ mW	leads >12.7	
audio ampl.	$f_T=130$ MHz	-10	-5				$T_j=175°C$		
	$h_{fe}<260$	-2	-5				$R_{th\,j-a}=0.5°C/mW$		
BC178(-A)	Equivalent to BC177 except for:						$-V_{CEO}=25$ V		
	$h_{FE}=180$	-2	-5						
BC178(-B)	Equivalent to BC177 except for:						$-V_{CEO}=25$ V		
	$h_{FE}=290$	-2	-5						
	$h_{fe}<500$	-2	-5						

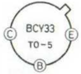
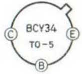
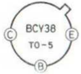
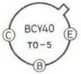
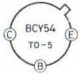
LOW FREQUENCY TRANSISTORS

Type and applications	*Characteristics at:*	I_C *(mA)*	V_{CE} *(V)*	*Characteristics at:*	I_E *(mA)*	V_{CB} *(V)*	*Ratings*	*Outlines (mm)*
BC179(-A)	Equivalent to BC178(-A) except for:						$-V_{CEO}=20$ V	
	$F<4$ dB	-0.2	-5					
BC179(-B)	Equivalent to BC178(-B) except for:						$-V_{CEO}=20$ V	
	$F<4$ dB	-0.2	-5					
BC200	$-V_{BE}=650$ mV	-2	-1	$-I_{CBO}<100$ nA	0	-20	$-I_C=50$ mA	
p-n-p	$h_{FE}>60$	-2	-1	$C_c=5$ pF	0	-5	$-V_{CEO}=20$ V	
red dot	$h_{fe}=75$	-0.2	-0.5				$P_{tot}=50$ mW	
hearing aids	$f_T=90$ MHz	-2	-5				$T_j=125°C$	
	$F=2$ dB	-0.2	-5				$R_{th\,j-a}=1.6$ °C/mW	
BC200	$-V_{BE}=650$ mV	-2	-1	$-I_{CBO}<100$ nA	0	-20	$-I_C=50$ mA	length <1.8
p-n-p	$h_{FE}>100$	-2	-1	$C_c=5$ pF	0	-5	$-V_{CEO}=20$ V	width <1.8
yellow dot	$h_{fe}=140$	-0.2	-0.5				$P_{tot}=50$ mW	leads >12 
hearing aids	$f_T=90$ MHz	-2	-5				$T_j=125°C$	
	$F=1.5$ dB	-0.2	-5				$R_{th\,j-a}=1.6°C/mW$	
BC200	$-V_{BE}=650$ mV	-2	-1	$-I_{CBO}<100$ nA	0	-20	$-I_C=50$ mA	
p-n-p	$h_{FE}>175$	-2	-1	$C_c=5$ pF	0	-5	$-V_{CEO}=20$ V	
green dot	$h_{fe}=250$	-0.2	-0.5				$P_{tot}=50$ mW	
hearing aids	$f_T=90$ MHz	-2	-5				$T_j=125°C$	
	$F=2$ dB	-0.2	-5				$R_{th\,j-a}=1.6°C/mW$	

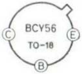
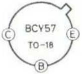
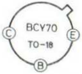
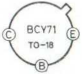
BC237(-A)(-B)	$V_{BE} < 770$ mV	10	5	$I_{CBO} < 15\ \mu A$	0	20	$I_C = 100$ mA	length < 5.2	
n-p-n	A; $h_{FE} = 180$	2	5	$C_c < 4.5$ pF	0	10	$V_{CEO} = 45$ V	width < 5.2	
driver	B; $h_{FE} = 290$	2	5				$P_{tot} = 300$ mW	leads > 12.7	
audio ampl.	A; $h_{fe} = 220$	2	5				$T_j = 125°C$		
	B; $h_{fe} = 330$	2	5				$R_{th\,j-a} = 0.33°C/mW$		
	$F = 2$ dB	0.2	5						
	$f_T = 300$ MHz	10	5						
BC238	$V_{BE} < 770$ mV	10	5	$I_{CBO} < 15\ \mu A$	0	20	$I_C = 100$ mA	length < 5.2	
(-A)(-B)(-C)	A; $h_{FE} = 180$	2	5	$C_c < 4.5$ pF	0	10	$V_{CEO} = 20$ V	width < 5.2	
n-p-n	B; $h_{FE} = 290$	2	5				$P_{tot} = 300$ mW	leads > 12.7	
driver	C; $h_{FE} = 520$	2	5				$T_j = 125°C$		
audio ampl.	A; $h_{fe} = 220$	2	5				$R_{th\,j-a} = 0.33°C/mW$		
television	B; $h_{fe} = 330$	2	5						
	C; $h_{fe} = 600$	2	5						
	$F = 2$ dB	0.2	5						
	$f_T = 300$ MHz	10	5						
BC239(-B)(-C)	$V_{BE} < 770$ mV	10	5	$I_{CBO} < 15\ \mu A$	0	20	$I_C = 100$ mA	length < 5.2	
n-p-n	B; $h_{FE} = 290$	2	5	$C_c < 4.5$ pF	0	10	$V_{CEO} = 20$ V	width < 5.2	
input	C; $h_{FE} = 520$	2	5				$P_{tot} = 300$ mW	leads > 12.7	
hi-fi	B; $h_{FE} = 330$	2	5				$T_j = 125°C$		
	C; $h_{fe} = 600$	2	5				$R_{th\,j-a} = 0.33°C/mW$		
	$F = 1.2$ dB	0.2	5						
	$f_T = 300$ MHz	10	5						
BCY10	$h_{FE} = 24$	−30	−2	$-I_{CBO} < 100$ nA	0	−6	$-I_{CM} = 500$ mA	length < 15.7	
p-n-p	$h_{FE} = 15$	−150	−1				$-V_{CES} = 32$ V	width < 6.0	
medium	$f_T = 1.5$ MHz	−1	−6				$P_{tot} = 415$ mW	leads > 37	
power	$F < 20$ dB	0.5	−2				$T_j = 150°C$		
	$h_{fe} = 40$	−10	−6				$R_{th\,j-a} = 0.4°C/mW$		

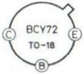
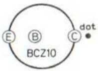
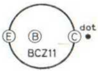
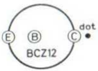
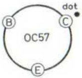
LOW FREQUENCY TRANSISTORS

Type and applications	*Characteristics at:*	I_C (*mA*)	V_{CE} (*V*)	*Characteristics at:*	I_E (*mA*)	V_{CB} (*V*)	*Ratings*	*Outlines (mm)*	
BCY11	Equivalent to BCY10 except for:						$-V_{CES}=60$ V		
BCY12	Equivalent to BCY10 except for:								
	$h_{FE}=40$	-30	-2						
	$h_{FE}=25$	-150	-1						
	$f_T=2$	-1	-6						
BCY30	$h_{FE}<35$	-20	-4.5	$-I_{CBO}<50$ nA	0	-6	$-I_{CM}=100$ mA	length <6.6	
p-n-p	$f_T=1.2$ MHz	-1	-6	$C_c<60$ pF	0	-6	$-V_{CEO}=50$ V	width <9.4	
switch	$h_{fe}<35$	-1	-6				$P_{tot}=250$ mW	leads >38	
general	$F<20$ dB	-0.5	-2				$T_j=150°C$		
							$R_{th\,j-a}=0.5°C/mW$		
BCY31	$h_{FE}<60$	-20	-4.5	$-I_{CBO}<50$ nA	0	-6	$-I_{CM}=100$ mA	length <6.6	
p-n-p	$f_T=1.7$ MHz	-1	-6	$C_c<60$ pF	0	-6	$-V_{CEO}=50$ V	width <9.4	
switch	$h_{fe}<60$	-1	-6				$P_{tot}=250$ mW	leads >38	
general	$F<20$ dB	-0.5	-2				$T_j=150°C$		
							$R_{th\,j-a}=0.5°C/mW$		
BCY32	$h_{FE}<70$	-20	-4.5	$-I_{CBO}<50$ nA	0	-6	$-I_{CM}=100$ mA	length <6.6	
p-n-p	$f_T=2.5$ MHz	-1	-6	$C_c<60$ pF	0	-6	$-V_{CEO}=50$ V	width <9.4	
switch	$h_{fe}<80$	-1	-6				$P_{tot}=250$ mW	leads >38	
general	$F<20$ dB	-0.5	-2				$T_j=150°C$		
							$R_{th\,j-a}=0.5°C/mW$		

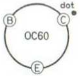
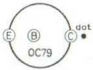
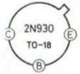
BCY33	$h_{FE} < 35$	-20	-4.5	$-I_{CBO} < 50$ nA	0	-6	$-I_{CM} = 100$ mA	length < 6.6	
p-n-p	$f_T = 1.5$ MHz	-1	-6	$C_c < 60$ pF	0	-6	$-V_{CEO} = 25$ V	width < 9.4	
switch	$h_{fe} < 35$	-1	-6				$P_{tot} = 250$ mW	leads > 38	
general	$F < 20$ dB	-0.5	-2				$T_j = 150°C$		
							$R_{th\,j-a} = 0.5°C/mW$		
BCY34	$h_{FE} < 60$	-20	-4.5	$-I_{CBO} < 50$ nA	0	-6	$-I_{CM} = 100$ mA	length < 6.6	
p-n-p	$f_T = 2.4$ MHz	-1	-6	$C_c < 60$ pF	0	-6	$-V_{CEO} = 25$ V	width < 9.4	
switch	$h_{fe} < 60$	-1	-6	$F < 20$ dB	0.5	-2	$P_{tot} = 250$ mW	leads > 38	
general							$T_j = 150°C$		
							$R_{th\,j-a} = 0.5°C/mW$		
BCY38	$h_{FE} < 30$	-150	-1	$-I_{CBO} < 100$ nA	0	-6	$-I_{CM} = 500$ mA	length < 6.6	
p-n-p	$f_T = 1.5$ MHz	-1	-6	$C_c < 150$ pF	0	-6	$-V_{CEO} = 24$ V	width < 9.4	
switch	$h_{fe} < 100$	-10	-6				$P_{tot} = 410$ mW	leads > 38	
general	$F < 20$ dB	-0.5	-2				$T_j = 150°C$		
							$R_{th\,j-a} = 0.3°C/mW$		
BCY39	Equivalent to BCY38 except for:						$-V_{CEO} = 60$ V		
	$h_{FE} < 50$	-150	-1						
BCY40	$h_{FE} < 120$	-150	-1	$-I_{CBO} < 100$ nA	0	-6	$-I_{CM} = 500$ mA	length < 6.6	
p-n-p	$f_T = 2.5$ MHz	-1	-6	$C_c < 150$ pF	0	-6	$-V_{CEO} = 24$ V	width < 9.4	
switch	$F < 20$ dB	-0.5	-2				$P_{tot} = 410$ mW	leads > 38	
general	$h_{fe} < 160$	-10	-6				$T_j = 150°C$		
							$R_{th\,j-a} = 0.3°C/mW$		
BCY54	$h_{FE} < 70$	-150	-1	$-I_{CBO} < 100$ nA	0	-6	$-I_{CM} = 500$ mA	length < 6.6	
p-n-p	$f_T = 2.0$ MHz	-1	-6	$C_c < 150$ pF	0	-6	$-V_{CEO} = 50$ V	width < 9.4	
switch	$F < 20$ dB	-0.5	-2				$P_{tot} = 410$ mW	leads > 38	
general	$h_{FE} < 120$	-10	-6				$T_j = 150°C$		
							$R_{th\,j-a} = 0.3°C/mW$		

LOW FREQUENCY TRANSISTORS

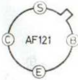
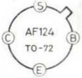
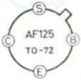
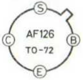
Type and applications	Characteristics at:	I_C (mA)	V_{CE} (V)	Characteristics at:	I_E (mA)	V_{CB} (V)	Ratings	Outlines (mm)
BCY56	$h_{FE} > 40$	0.01	5	$I_{CBO} < 100$ nA	0	20	$I_{CM} = 100$ mA	length < 5.3
n-p-n	$h_{FE} < 800$	2	5	$C_c = 4.5$ pF	0	5	$V_{CEO} = 45$ V	width < 4.8
general	$f_T = 350$ MHz	10	5				$P_{tot} = 300$ mW	leads > 12.7
	$F < 5$ dB	0.2	5				$T_j = 175°$C	
	$h_{ie} = 3500$ kΩ	2	5				$R_{th\,j-a} = 0.5°$C/mW	
	$h_{fe} < 500$	2	5					
	$h_{oe} = 17.5\ \mu\Omega^{-1}$	2	5					
BCY57	$h_{FE} > 100$	0.01	5	$I_{CBO} < 100$ nA	0	20	$I_{CM} = 100$ mA	length < 5.3
n-p-n	$h_{FE} < 800$	2	5	$C_c = 4.5$ pF	0	20	$V_{CEO} = 20$ V	width < 4.8
general	$f_T = 350$ MHz	10	5				$P_{tot} = 300$ mW	leads > 12.7
	$F < 5$ dB	0.2	5				$T_j = 175°$C	
	$h_{ie} = 7500$ kΩ	2	5				$R_{th\,j-a} = 0.5°$C/mW	
	$h_{fe} < 900$	2	5					
	$h_{oe} = 35\ \mu\Omega^{-1}$	2	5					
BCY70	$h_{FE} > 45$	−1	−1	$-I_{CBO} < 10$ nA	0	−40	$-I_{CM} = 200$ mA	length < 5.3
p-n-p	$h_{FE} > 15$	−50	−1	$-I_{CBO} < 500$ nA	0	−50	$-V_{CEO} = 40$ V	width < 4.8
general	$f_T > 250$ MHz	−10	−20	$C_c < 6$ pF	0	−10	$P_{tot} = 350$ mW	leads > 12.7
	$F < 6$ dB	−0.1	−5				$T_j = 200°$C	
							$R_{th\,j-a} = 0.5°$C/mW	
BCY71	$h_{FE} > 90$	−1	−1	$-I_{CBO} < 50$ nA	0	−40	$-I_{CM} = 200$ mA	length < 5.3
p-n-p	$h_{FE} > 100$	−10	−1	$-I_{CBO} < 500$ nA	0	−45	$-V_{CEO} = 45$ V	width < 4.8
general	$f_T > 200$ MHz	−10	−20	$C_c < 6$ pF	0	−10	$P_{tot} = 350$ mW	leads > 12.7
	$F < 2$ dB	−0.1	−5				$T_j = 200°$C	
							$R_{th\,j-a} = 0.5°$C/mW	

BCY72	$h_{FE}>40$	−1	−1	$-I_{CBO}<50$ nA	0	−20	$-I_{CM}=200$ mA	length <5.3	
p-n-p	$h_{FE}>50$	−10	−1	$-I_{CBO}<500$ nA	0	−25	$-V_{CEO}=25$ V	width <4.8	
general	$f_T=200$ MHz	−10	−20	$C_c<6$ pF	0	−10	$P_{tot}=350$ mW	leads >12.7	
	$F<6$ dB	−0.1	−5				$T_j=200°C$		
							$R_{th\,j-a}=0.5°C/mW$		
BCZ10	$h_{FE}=17.5$	−20	−4.5	$-I_{CBO}<100$ nA	0	−10	$-I_{CM}=50$ mA	length <15.7	
p-n-p	$C_c<80$ pF	−1	−6				$-V_{CEO}=25$ V	width <6.0	
general	$f_{hfb}=1$ MHz	−1	−6				$P_{tot}=250$ mW	leads >37	
	$F=8.0$ dB	−0.5	−2				$T_j=150°C$		
	$h_{fe}<60$	−1	−6				$R_{th\,j-a}=0.5°C/mW$		
BCZ11	$h_{FE}=29$	−20	−4.5	$-I_{CBO}<100$ nA	0	−10	$-I_{CM}=50$ mA	length <15.7	
p-n-p	$C_c<80$ pF	−1	−6				$-V_{CEO}=25$ V	width <6.0	
general	$f_{hfb}=1.5$ MHz	−1	−6				$P_{tot}=250$ mW	leads >37	
	$F=6.0$ dB	0.5	−2				$T_j=150°C$		
	$h_{fe}<60$	−1	−6				$R_{th\,j-a}=0.5°C/mW$		
BCZ12	$C_c<80$ pF	−1	−6	$-I_{CBO}<100$ nA	0	−10	$-I_{CM}=50$ mA	length <15.7	
p-n-p	$f_{hfb}=1$ MHz	−1	−6				$-V_{CEO}=60$ V	width <6.0	
general	$F=8$ dB	0.5	−2				$P_{tot}=250$ mW	leads >37	
	$h_{fe}=15$	−1	−6				$T_j=150°C$		
							$R_{th\,j-a}=0.5°C/mW$		
OC57	$-V_{BE}=0.12$ V	−0.25	−0.5	$-I_{CBO}=1.5\ \mu A$	0	−2	$-I_{CM}=10$ mA	length <4	
p-n-p	$h_{FE}=30$	−0.25	−0.5	$F<10$ dB	0.5	−2	$-V_{CEO}=3$ V	width <3	
hearing	$f_{hfe}>0.01$ MHz	−0.25	−0.5				$P_{tot}=20$ mW	leads >37	
aids	$h_{fe}=35$	−0.25	−0.5				$T_j=75°C$		
							$R_{th\,j-a}=1.5°C/mW$		
OC58	Equivalent to OC57 except for:								
	$h_{FE}=55$	−0.25	−0.5						
	$h_{fe}=55$	−0.25	−0.5						

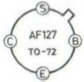
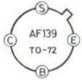
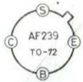
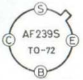
LOW FREQUENCY TRANSISTORS

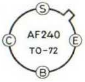
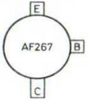
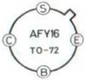
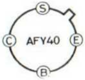
Type and applications	Characteristics at:	I_C (mA)	V_{CE} (V)	Characteristics at:	I_E (mA)	V_{CB} (V)	Ratings	Outlines (mm)	
OC59	Equivalent to OC57 except for:								
	$h_{FE}=70$	-0.25	-0.5						
	$h_{fe}=80$	-0.25	-0.5						
OC60	$h_{FE}>60$	-3	-2	$-I_{CBO}=1.5\ \mu A$	0	-2	$-I_{CM}=10$ mA	length < 4	
p-n-p	$h_{fe}=60$	-0.5	-2	$F<15$ dB	0.5	-2	$-V_{CEO}=3$ V	width < 3	
hearing							$P_{tot}=20$ mW	leads > 37	
aids							$T_j=75°C$		
							$R_{th\,j-a}=1.5°C/mW$		
OC79	$h_{FE}<100$	-50	-6				$-I_{CM}=300$ mA	length < 15.7	
p-n-p	$h_{FE}<75$	-300	-1				$-V_{CEO}=13$ V	width < 6.0	
driver	$f_{hfe}>8$ kHz	-50	-6				$P_{tot}=550$ mW	leads > 37	
							$T_j=75°C$		
							$R_{th\,j-a}=0.22°C/mW$		
2N929	$h_{FE}>60$	0.5	5	$I_{CBO}<10$ nA	0	45	$I_{CM}=60$ mA	length < 5.3	
n-p-n	$h_{FE}>100$	10	5	$-V_{EB}<0.8$ V	-0.5	5	$V_{CEO}=45$ V	width < 4.8	
general	$f_T>50$ MHz	0.5	5	$C_c<8$ pF	0	5	$P_{tot}=300$ mW	leads > 12.7	
	$f_{hfe}>0.2$ MHz	0.5	5				$T_j=175°C$		
	$F<4$ dB	0.01	5				$R_{th\,j-a}=0.5°C/mW$		
	$h_{fe}=200$	1	5						
2N930	$h_{FE}>150$	0.5	5	$I_{CBO}<10$ nA	0	45	$I_{CM}=60$ mA	length < 5.3	
n-p-n	$h_{FE}>200$	10	5	$-V_{EB}<0.8$ V	-0.5	5	$V_{CEO}=45$ V	width < 4.8	
general	$f_T>50$ MHz	0.5	5	$C_c<8$ pF	0	5	$P_{tot}=300$ mW	leads > 12.7	
	$f_{hfe}>0.1$ MHz	0.5	5				$T_j=175°C$		
	$F<3$ dB	0.01	5				$R_{th\,j-a}=0.5°C/mW$		
	$h_{fe}=350$	1	5						

HIGH FREQUENCY TRANSISTORS

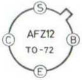
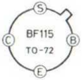
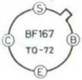
Type and applications	*Characteristics at:*	I_C (mA)	V_{CE} (V)	*Characteristics at:*	I_E (mA)	V_{CB} (V)	*Ratings*	*Outlines (mm)*	
AF121	$h_{FE} = 75$	-3	-10	$-I_{CBO} < 8\ \mu A$	0	-10	$-I_{CM} = 15$ mA	length < 9	
p-n-p	$-C_{re} < 0.65$ pF	-1	-10	$F < 6$ dB	2	-5	$-V_{CER} = 25$ V	width < 4.8	
tuners	$f_T = 270$ MHz	-3	-10				$P_{tot} = 140$ mW	leads > 12.7	
	$\|y_{fe}\| = 80\ m\Omega^{-1}$	-3	-10				$T_j = 75°C$		
							$R_{th\,j-a} = 0.45°C/mW$		
AF124	$-V_{BE} < 330$ mV	-1	-6	$-I_{CBO} < 8\ \mu A$	0	-6	$-I_C = 10$ mA	length < 5.3	
p-n-p	$-C_{re} = 1.5$ pF	-1	-6	$h_{FE} = 140$	1	-6	$-V_{CEO} = 15$ V	width < 4.8	
f.m.	$h_{fe} = 150$	-1	-6	$f_T = 75$ MHz	1	-6	$P_{tot} = 60$ mW	leads > 12.7	
				$F < 9.5$ dB	1	-6	$T_j = 75°C$		
				$\|y_{fb}\| = 16\ m\Omega^{-1}$	1	-6	$R_{th\,j-a} = 0.75°C/mW$		
				$G_p = 14$ dB	1	-6			
AF125	$-V_{BE} < 330$ mV	-1	-6	$-I_{CBO} < 8\ \mu A$	0	-6	$-I_C$ 10 mA	length < 5.3	
p-n-p	$-C_{re} = 1.5$ pF	-1	-6	$h_{FE} = 140$	1	-6	$-V_{CEO} = 15$ V	width < 4.8	
r.f.	$h_{fe} = 150$	-1	-6	$f_T = 75$ MHz	1	-6	$P_{tot} = 60$ mW	leads > 12.7	
	$\|y_{fe}\| = 34$	-1	-6	$F = 3$ dB	1	-6	$T_j = 75°C$		
	$\|y_{re}\| = 0.08$	-1	-6	$F_c < 5$ dB	1	-6	$R_{th\,j-a} = 0.75°C/mW$		
				$\|y_{fb}\| = 15\ m\Omega^{-1}$	1	-6			
				$G_p = 13$ dB	1	-6			
AF126	$-C_{re} = 1.5$ pF	-1	-6	$-I_{CBO} < 8\ \mu A$	0	-6	$-I_C = 10$ mA	length < 5.3	
p-n-p	$h_{fe} = 150$	-1	-6	$h_{FE} = 140$	1	-6	$-V_{CEO} = 15$ V	width < 4.8	
i.f.	$\|y_{fe}\| = 32\ m\Omega^{-1}$	-1	-6	$f_T = 75$ MHz	1	-6	$P_{tot} = 60$ mW	leads > 12.7	
				F 4.5 dB	1	-6	$T_j = 75°C$		
				$F_c < 5$ dB	1	-6	$R_{th\,j-a} = 0.75°C/mW$		
				$G_p = 25$ dB	1	-6			

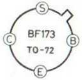
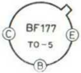
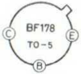
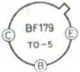
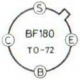
HIGH FREQUENCY TRANSISTORS

Type and applications	*Characteristics at:*	I_C *(mA)*	V_{CE} *(V)*	*Characteristics at:*	I_E *(mA)*	V_{CB} *(V)*	*Ratings*	*Outlines (mm)*	
AF127	$-V_{BE}<330$ mV	−1	−6	$-I_{CBO}<8\ \mu$A	0	−6	$-I_C=10$ mA	length < 5.3	
p-n-p	$-C_{re}=1.5$ pF	−1	−6	$h_{FE}=140$	1	−6	$-V_{CEO}=15$ V	width < 4.8	
i.f.	$\lvert y_{fe}\rvert=37\ \text{m}\Omega^{-1}$	−1	−6	$f_T=75$ MHz	1	−6	$P_{tot}=60$ mW	leads > 12.7	
r.f.				$F<3$ dB	1	−6	$T_j=75$°C		
				$F_c<5$ dB	1	−6	$R_{th\,j-a}=0.75$°C/mW		
				$G_p=42$ dB	1	−6			
AF139	$-C_{re}=0.25$ pF	−1.5	−12	$-I_{CBO}<8\ \mu$A	0	−20	$-I_{CM}=10$ mA	length < 5.3	
p-n-p	$f_T=550$ MHz	−1.5	−12	$h_{FE}=55$	2	−6	$-V_{CEO}=15$ V	width < 4.8	
pre-ampl.				$F<8.2$ dB	1.5	−12	$P_{tot}=60$ mW	leads > 12.7	
mixer-				$\lvert y_{fb}\rvert=37\ \text{m}\Omega^{-1}$	1.5	−12	$T_j=90$°C		
oscill.				$G_{UM}=11.5$ dB	1.5	−12	$R_{th\,j-a}=0.75$°C/mW		
				$G_{tr}=11$ dB	1.5	−12			
				$G_{tr\,rev}=-23$ dB	1.5	−12			
AF239	$-C_{re}=0.23$ pF	−2	−10	$-I_{CBO}<8\ \mu$A	0	−20	$-I_{CM}=10$ mA	length < 5.3	
p-n-p	$f_T=650$ MHz	−2	−10	$V_{EB}=35$ mV	2	−10	$-V_{CEO}=15$ V	width < 4.8	
tuner				$h_{FE}=33$	2	−10	$P_{tot}=60$ mW	leads > 12.7	
				$F<6$ dB	2	−10	$T_j=90$°C		
				$\lvert y_{fb}\rvert=20\ \text{m}\Omega^{-1}$	2	−10	$R_{th\,j-a}=0.75$°C/mW		
				$G_{UM}=17$ dB	2	−10			
				$G_{tr}=14$ dB	2	−10			
AF239S	$-C_{re}=200$ fF	−2	−10	$-I_{CBO}<60\ \mu$A	0	−20	$-I_{CM}=15$ mA	length < 5.3	
p-n-p	$f_T=780$ MHz	−2	−10	$V_{EB}=400$ mV	5	−5	$-V_{CEO}=15$ V	width < 4.8	
pre-ampl.				$F<6$ dB	−2	−10	$P_{tot}=60$ mW	leads > 12.7	
mixer				$G_{tr}=15$ dB	−2	−10	$T_j=90$°C		
							$R_{th\,j-a}=0.40$°C/mW		

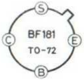
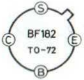
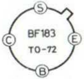
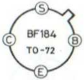
AF240	$-V_{BE} = 370$ mV	−2	−10	$-I_{CBO} < 8$ μA	0	−10	$-I_{CM} = 10$ mA	length < 5.3	
p-n-p	$h_{FE} = 25$	−2	−10	$F = 5.5$ dB	2	−10	$-V_{CEO} = 15$ V	width < 4.8	
tuner	$-C_{re} = 0.26$ pF	−1	−10	$G_{tr} = 14$ dB	2	−10	$P_{tot} = 60$ mW	leads > 12.7	
	$f_T = 650$ MHz	−2	−10				$T_j = 90$°C		
							$R_{th\,j-a} = 0.75$°C/mW		
AF267	$-V_{BE} = 350$ mV	−2	−10				$-I_C = 10$ mA	diameter < 4.8	
p-n-p	$h_{FE} > 10$	−2	−10				$-V_{CEO} = 15$ V	height < 2.7	
pre-ampl	$h_{FE} > 10$	−10	−2				$P_{tot} = 60$ mW	leads > 7	
mixer	$-C_{re} = 400$ fF	−2	−10				$T_j = 90$°C		
	$f_T = 780$ MHz	−2	−10				$R_{th\,j-a} = 0.6$°C/mW		
	$F < 6$ dB	−2	−10						
	$G_{tr} = 12$ dB	−2	−10						
AFY16	$-C_{re} = 0.25$ pF	−1.5	−12	$-I_{CBO} < 3$ μA	0	−20	$-I_{CM} = 8$ mA	length < 5.3	
p-n-p	$f_T = 550$ MHz	−1.5	−12	$h_{FE} = 60$	1.5	−12	$-V_{CEO} = 25$ V	width < 4.8	
pre-ampl.				$F < 8$ dB	1.5	−12	$P_{tot} = 60$ mW	leads > 12.7	
				$\|y_{fb}\| = 14$ mΩ^{-1}	1.5	−12	$T_j = 90$°C		
				$G_{UM} = 11.5$ dB	1.5	−12	$R_{th\,j-a} = 0.75$°C/mW		
				$G_{tr} = 11$ dB	1.5	−12			
				$G_{tr\,rev} = -23$ dB	1.5	−12			
AFY40	$-C_{re} = 0.25$ pF	−1	−12	$-I_{CBO} < 8$ μA	0	−20	$-I_{CM} = 20$ mA	length < 9	
p-n-p	$f_T = 700$ MHz	−6	−12	$V_{EB} < 0.45$ V	4	−20	$-V_{CEO} = 20$ V	width < 4.8	
output				$h_{FE} = 50$	1.5	−12	$P_{tot} = 140$ mW	leads > 12.7	
aerial				$h_{FE} > 10$	4	−20	$T_j = 90$°C		
				$F = 7$ dB	1.5	−12	$R_{th\,j-a} = 0.55$°C/mW		
				$P_o = 2.7$ mW	4	−20			
				$G_{tr} = 12$ dB	4	−20			

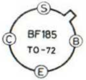
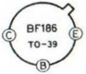
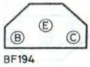
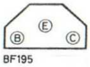
HIGH FREQUENCY TRANSISTORS

Type and applications	*Characteristics at:*	I_C *(mA)*	V_{CE} *(V)*	*Characteristics at:*	I_E *(mA)*	V_{CB} *(V)*	*Ratings*	*Outlines (mm)*	
AFZ12	$-V_{BE} < 0.38$ V	−1	−6	$-I_{CBO} < 6\ \mu$A	0	−6	$-I_C = 10$ mA	length < 5.3	
p-n-p	$h_{FE} = 60$	−1	−6	$\lvert y_{fb}\rvert = 30$ mΩ^{-1}	1	−10	$-V_{CEO} = 10$ V	width < 4.8	
v.h.f.	$-C_{re} < 1.5$ pF	−1	−6				$P_{tot} = 85$ mW	leads > 12.7	
	$f_T = 180$ MHz	−1	−6				$T_j = 75$°C		
	$F < 7.5$ dB	−1	−12				$R_{th\,j-a} = 0.6$°C/mW		
	$h_{fe} = 70$	−1	−6						
	$\lvert y_{fe}\rvert = 34$	−1	−12						
BF115	$h_{FE} < 165$	1	10	$-V_{EB} < 740$ mV	−1	10	$I_{CM} = 30$ mA	length < 5.3	
n-p-n	$h_{FE} > 40$	20	2	$\lvert y_{fb}\rvert = 30$ mΩ^{-1}	−1	10	$V_{CEO} = 30$ V	width < 4.8	
general	$-C_{re} = 0.65$ pF	1	10				$P_{tot} = 145$ mW	leads > 12.7	
	$f_T = 230$ MHz	1	10				$T_j = 175$°C		
	$F = 3.5$ dB	1	10				$R_{th\,j-a} = 0.9$°C/mW		
	$F_c = 2.5$ dB	1	10						
	$\lvert y_{fe}\rvert = 30$ mΩ^{-1}	1	10						
BF167	$V_{BE} = 0.7$ V	4	10				$I_{CM} = 25$ mA	length < 5.3	
n-p-n	$h_{FE} = 57$	4	10				$V_{CEO} = 30$ V	width < 4.8	
gain-control	$-C_{re} = 0.15$ pF	1	10				$P_{tot} = 130$ mW	leads > 12.7	
video	$f_T = 350$ MHz	4	10				$T_j = 175$°C		
	$F = 3$ dB	4	10				$R_{th\,j-a} = 1.0$°C/mW		
	$\lvert y_{fe}\rvert = 95$ mΩ^{-1}	4	10						
	$G_{UM} = 42$ dB	4	10						
	$G_{tr} = 26$ dB	4	10						
	$\Delta G_{tr} = 60$ dB	4	10						

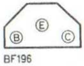
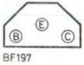
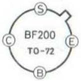
BF173	h_{FE}	$=85$	7	10					I_{CM}	$=25$ mA	length <5.3	
n-p-n	$-C_{re}$	$=0.23$ pF	1	10					V_{CEO}	$=25$ V	width <4.8	
video	f_T	$=550$ MHz	5	10					P_{tot}	$=260$ mW	leads >12.7	
output	$\|y_{fe}\|$	$=145$ mΩ^{-1}	7	10					T_j	$=175$°C		
	G_{UM}	$=42.5$	7	10					$R_{th\,j-a}$	$=0.65$°C/mW		
	G_{tr}	$=26$	7.2	16.6								
BF177	V_{BE}	<1.2 V	15	10					I_{CM}	$=50$ mA	length <6.6	
n-p-n	h_{FE}	>20	15	10					V_{CEO}	$=60$ V	width <8.5	
t.v.	$-C_{re}$	<3.5 pF	10	20					P_{tot}	$=600$ mW	leads >38.1	
	f_T	$=120$ MHz	10	20					T_j	$=200$°C		
									$R_{th\,j-a}$	$=220$°C/mW		
BF178	V_{BE}	<1.2 V	20	15					I_{CM}	$=50$ mA	length <6.6	
	h_{FE}	>20	20	15					V_{CEO}	$=115$ V	width <8.5	
	$-C_{re}$	<3.5 pF	10	20					P_{tot}	$=600$ mW	leads >38.1	
	f_T	$=120$ MHz	10	10					T_j	$=200$°C		
									$R_{th\,j-a}$	$=220$°C/mW		
BF179	V_{BE}	<1.2 V	20	15					I_{CM}	$=50$ mA	length <6.6	
	h_{FE}	>20	20	15					V_{CEO}	$=115$ V	width <8.5	
	$-C_{re}$	<3.5 pF	10	20					P_{tot}	$=600$ mW	leads >38.1	
	f_T	$=120$ MHz	10	10					T_j	$=200$°C		
BF180	$-C_{re}$	$=0.28$ pF	1	10	h_{FE}	$=45$	-2	10	I_{CM}	$=20$ mA	length <5.3	
n-p-n	f_T	$=675$ MHz	2	10	F	$=4.5$ dB	-2	10	V_{CEO}	$=20$ V	width <4.8	
television					G_{UM}	$=24$ dB	-2	10	P_{tot}	$=150$ mW	leads >12.7	
tuner					G_{tr}	$=16.5$ dB	-2	10	T_j	$=175$°C		
									$R_{th\,j-a}$	$=1$°C/mW		

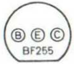
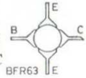
HIGH FREQUENCY TRANSISTORS

Type and applications	Characteristics at:	I_C (mA)	V_{CE} (V)	Characteristics at:	I_E (mA)	V_{CB} (V)	Ratings	Outlines (mm)	
BF181	$-C_{re} = 0.28$	1	10	$h_{FE} = 28.5$	−2	10	$I_{CM} = 20$ mA	length < 5.3	
n-p-n	$f_T = 600$ MHz	2	10	$\lvert y_{fb} \rvert = 25\ \text{m}\Omega^{-1}$	−2	10	$V_{CEO} = 20$ V	width < 4.8	
u.h.f.				$G_{UM} = 11$ dB	−2	10	$P_{tot} = 150$ mW	leads > 12.7	
				$G_{tr} = 8$ dB	−2	10	$T_j = 175$°C		
							$R_{th\,j-a} = 1$°C/mW		
BF182	$-C_{re} = 0.33$ pF	1	10	$-V_{EB} = 770$ mV	−2	10	$I_{CM} = 15$ mA	length < 5.3	
n-p-n	$f_T = 650$ MHz	2	10	$h_{FE} = 20$	−2	10	$V_{CEO} = 20$ V	width < 4.8	
integrated				$F = 7.4$ dB	−2	10	$P_{tot} = 150$ mW	leads > 12.7	
tuner				$\lvert y_{fb} \rvert = 18\ \text{m}\Omega^{-1}$	−2	10	$T_j = 175$°C		
				$\lvert y_{rb} \rvert = 1.3\ \text{m}\Omega^{-1}$	−2	10	$R_{th\,j-a} = 1$°C/mW		
				$G_{UM} = 11$ dB	−2	10			
				$G_{tr} = 10$ dB	−2	10			
BF183	$-C_{re} = 0.33$ pF	1	10	$h_{FE} = 25$	−3	10	$I_{CM} = 15$ mA	length < 5.3	
n-p-n	$f_T = 800$ MHz	3	10	$\lvert y_{fb} \rvert = 18\ \text{m}\Omega^{-1}$	−3	10	$V_{CEO} = 20$ V	width < 4.8	
integrated				$G_{UM} = 13$ dB	−3	10	$P_{tot} = 150$ mW	leads > 12.7	
tuner				$G_{tr} = 12$ dB	−3	10	$T_j = 175$°C		
							$R_{th\,j-a} = 1$°C/mW		
BF184	$V_{BE} < 740$ mV	1	10				$I_{CM} = 30$ mA	length < 5.3	
n-p-n	$h_{FE} = 115$	1	10				$V_{CEO} = 20$ V	width < 4.8	
i.f.	$-C_{re} = 0.65$ pF	1	10				$P_{tot} = 145$ mW	leads > 12.7	
	$f_T = 300$ MHz	1	10				$T_j = 175$°C		
	$F_c = 3$ dB	1	10				$R_{th\,j-a} = 0.9$°C/mW		
	$\lvert y_{fe} \rvert = 35\ \text{m}\Omega^{-1}$	1	10						

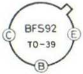
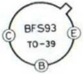
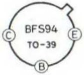
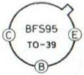
BF185	V_{BE}	< 740 mV	1	10	$\lvert y_{fb} \rvert$	$= 33$ mΩ^{-1}	-1	10	I_{CM}	$= 30$ mA	length < 5.3	
n-p-n	h_{FE}	$= 67$	1	10					V_{CEO}	$= 20$ V	width < 4.8	
pre-ampl.	$-C_{re}$	$= 0.65$ pF	1	10					P_{tot}	$= 145$ mW	leads > 12.7	
	f_T	$= 220$ MHz	1	10					T_j	$= 175$°C		
	F	$= 4$ dB	1	10					$R_{th\,j-a}$	$= 0.9$°C/mW		
BF186	V_{BE}	< 1.2 V	40	20					I_{CM}	$= 60$ mA	length < 6.6	
n-p-n	h_{FE}	> 20	40	20					V_{CBO}	$= 190$ mV	width < 8.5	
t.v. output	$-C_{re}$	< 3.5	10	20					P_{tot}	$= 2.75$ mW	leads > 12.7	
luminance	f_T	$= 120$ MHz	10	10					T_j	$= 200$°C		
ampl.									$R_{th\,j-a}$	$= 200$°C/mW		
BF194	h_{FE}	$= 115$	1	10					I_{CM}	$= 30$ mA	length < 7.6	
n-p-n	$-C_{re}$	$= 0.95$ pF	1	10					V_{CEO}	$= 20$ V	width < 4.6	
radio	f_T	$= 260$ MHz	1	10					P_{tot}	$= 250$ mW	height < 5.1	
television	F	$= 1.2$ dB	1	10					T_j	$= 125$°C	lock-fit	
	F_c	$= 2$ dB	1	10					$R_{th\,j-a}$	$= 0.40$°C/mW		
	$\lvert y_{fe} \rvert$	$= 33$	1	10								
BF195	h_{FE}	$= 67$	1	10					I_{CM}	$= 30$ mA	length < 7.6	
n-p-n	$-C_{re}$	$= 0.95$ pF	1	10					V_{CEO}	$= 20$ V	width < 4.6	
radio	f_T	$= 200$ MHz	1	10					P_{tot}	$= 250$ mW	height < 5.1	
television	F	$= 200$ MHz	1	10					T_j	$= 125$°C	lock-fit	
	F_c	$= 2.5$ dB	1	10					$R_{th\,j-a}$	$= 0.40$°C/mW		
	$\lvert y_{fe} \rvert$	$= 34$	1	10								

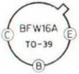
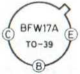
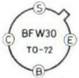
HIGH FREQUENCY TRANSISTORS

Type and applications	*Characteristics at:*	I_C *(mA)*	V_{CE} *(V)*	*Characteristics at:*	I_E *(mA)*	V_{CB} *(V)*	*Ratings*	*Outlines (mm)*	
BF196	$V_{BE} < 840$ mV	4	10				$I_{CM} = 25$ mA	length < 7.6	
n-p-n	$h_{FE} > 20$	6	2				$V_{CEO} = 30$ V	width < 4.6	
gain-control	$h_{FE} > 10$	15	5				$P_{tot} = 250$ mW	height < 5.1	
video	$-C_{re} = 0.2$ pF	1	10				$T_j = 250°C$	lock-fit	
	$f_T = 400$ MHz	4	10				$R_{th\,j-a} = 0.4°C/mW$		
	$F = 3$ dB	4	10						
	$\lvert y_{fe} \rvert = 100\ m\Omega^{-1}$	4	10						
	$G_{UM} = 40$ dB	4	10						
	$G_{tr} = 25.5$ dB	4	a.g.c.						
	$\Delta G_{tr} = 60$ dB	4	a.g.c.						
BF197	$V_{BE} < 0.9$ V	7	10				$I_{CM} = 25$ mA	length < 7.6	
n-p-n	$h_{FE} > 38$	7	10				$V_{CEO} = 25$ V	width < 4.6	
video	$-C_{re} = 0.3$ pF	1	10				$P_{tot} = 250$ mW	leads > 5.1	
output	$f_T = 550$ MHz	5	10				$T_j = 125°C$	lock-fit	
	$\lvert y_{fe} \rvert = 170\ m\Omega^{-1}$	7	10				$R_{th\,j-a} = 0.4°C/mW$		
	$G_{UM} = 43$ dB	7	10						
BF200	$-C_{re} = 0.28$ pF	1	10	$h_{FE} = 30$	−3	10	$I_{CM} = 20$ mA	length < 5.3	
n-p-n	$\lvert y_{fe} \rvert = 56\ m\Omega^{-1}$	2	10	$f_T = 650$ MHz	−3	10	$V_{CEO} = 20$ V	width < 4.8	
gain-control				$F = 2.7$ dB	−3	10	$P_{tot} = 150$ mW	leads > 12.7	
tuner				$\lvert y_{fb} \rvert = 70\ m\Omega^{-1}$	−3	10	$T_j = 175°C$		
				$G_{UM} = 22$ dB	−3	10	$R_{th\,j-a} = 1°C/mW$		
				$G_{UM} = 28$ dB	−2	10			
				$G_{tr} = 3$ dB	−3	a.g.c.			

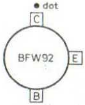
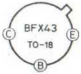
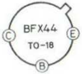
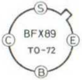
BF254	V_{BE} <0.74 V	1	10				I_{CM} $=30$ mA	length <5.2	
n-p-n	h_{FE} <140	10	10				V_{CEO} $=20$ V	width <5.2	
f.m. tuners	$-C_{re}=0.85$ pF	1	10				P_{tot} $=300$ mW	leads >12.7	
mixer	f_T $=260$ MHz	1	10				T_j $=125$°C		
	F $=1.5$ dB	1	10				$R_{th\,j-a}=0.33$°C/mW		
	F_c $=3$ dB	1	10						
	$\|y_{fb}\|$ $=33$ mΩ^{-1}	1	10						
BF255	V_{BE} <0.74 V	1	10				I_{CM} $=30$ mA	length <5.2	
n-p-n	h_{FE} $=87$	10	10				V_{CEO} $=20$ V	width <5.2	
f.m. tuners	$-C_{re}=0.85$ pF	1	10				P_{tot} $=300$ mW	leads >12.7	
i.f. ampl.	f_T $=200$ MHz	1	10				T_j $=125$°C		
input	F $=3.5$ dB	1	10				$R_{th\,j-a}=0.33$°C/mW		
	F_c $=4$ dB	1	10						
	$\|y_{fb}\|$ $=34$ mΩ^{-1}	1	10						
BFR63	h_{FE} >25	50	5	$I_{CBO}<10$ μA	0	20	I_{CM} $=500$ mA	diameter <9.7	
n-p-n	h_{FE} >25	150	5	C_e <4.5 pF	0	20	V_{CEO} $=25$ V	height <5.75	
band I, II	$-C_{re}=1.7$ pF	10	20				P_{tot} $=3.5$ W	leads $>\square 25$	
III and IV	f_T >1000 MHz	75	20				T_j $=150$°C	stud. length <12	
vert. defl.	f_T $=1100$ MHz	150	20				$R_{th\,j-mb}=25$°C/W	stud: 8–32 UNC	
oscilloscope	P_o $=150$ mW	70	20						
oscillator	G_p $=16$ dB	70	20						
BFR64	Equivalent to BFR63 except for:								
	$f_T=1000$ MHz	15	20						
	$f_T=1200$ MHz	150	20						

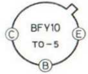
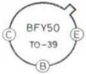
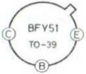
HIGH FREQUENCY TRANSISTORS

Type and applications	*Characteristics at:*	I_C *(mA)*	V_{CE} *(V)*	*Characteristics at:*	I_E *(mA)*	V_{CB} *(V)*	*Ratings*	*Outlines (mm)*	
BFS92	$h_{FE} > 20$	−10	−10	$-I_{CBO} < 50$ nA	0	80	$-I_{CM} = 1$ A	length < 6.6	
p-n-p	$h_{FE} > 30$	−150	−10	$C_c < 20$ pF	0	10	$-V_{CEO} = 60$ V	width < 8.5	
general	$h_{FE} > 20$	−500	−10	$t_d = 20$ ns			$P_{tot} = 5$ W	leads > 12.7	
industrial	$h_{FE} > 15$	−1000	−10	$t_r = 35$ ns			$T_j = 200$°C		
	$f_T = 70$ MHz	−50	−10	$t_s = 500$ ns			$R_{th\,j-a} = 220$°C/W		
	$h_{fe} = 100$	−10	−5	$t_f = 65$ ns					
BFS93	$h_{FE} > 50$	−10	−10	$-I_{CBO} < 50$ nA	0	80	$-I_{CM} = 1$ A	length < 6.6	
p-n-p	$h_{FE} > 70$	−150	−10	$C_c < 20$ pF	0	80	$-V_{CEO} = 60$ V	width < 8.5	
general	$h_{FE} > 30$	−500	−10	$t_d = 20$ ns			$P_{tot} = 5$ W	leads > 12.7	
industrial	$h_{FE} > 15$	−1000	−10	$t_r = 35$ ns			$T_j = 200$°C		
	$f_T = 70$ MHz	−50	−10	$t_s = 500$ ns			$R_{th\,j-a} = 220$°C/W		
	$h_{fe} = 100$	−10	−5	$t_f = 65$ ns					
BFS94	$h_{FE} > 30$	−10	−10	$-I_{CBO} < 50$ nA	0	60	$-I_{CM} = 1$ A	length < 6.6	
p-n-p	$h_{FE} > 40$	−150	−10	$C_c < 20$ pF	0	80	$-V_{CEO} = 40$ V	width < 8.5	
general	$h_{FE} > 25$	−500	−10	$t_d = 20$ ns			$P_{tot} = 5$ W	leads > 12.7	
industrial	$h_{FE} > 15$	−1000	−10	$t_r = 35$ ns			$T_j = 200$°C		
	$f_T = 70$ MHz	−50	−10	$t_s = 500$ ns			$R_{th\,j-a} = 220$°C/W		
	$h_{fe} = 100$	−10	−5	$t_f = 65$ ns					
BFS95	$h_{FE} > 50$	−10	−10	$-I_{CBO} < 50$ nA	0	30	$-I_{CM} = 1$ A	length < 6.6	
p-n-p	$h_{FE} > 70$	−150	−10	$C_c < 20$ pF	0	80	$-V_{CEO} = 35$ V	width < 8.5	
general	$h_{FE} > 30$	−500	−10	$t_d = 20$ ns			$P_{tot} = 5$ W	leads > 12.7	
industrial	$h_{FE} > 15$	−1000	−10	$t_r = 35$ ns			$T_j = 200$°C		
	$f_T = 70$ MHz	−50	−10	$t_s = 500$ ns			$R_{th\,j-a} = 220$°C/W		
	$h_{fe} = 100$	−10	−5	$t_f = 65$ ns					

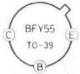
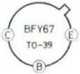
BFW10	See section: FIELD EFFECT TRANSISTORS									
BFW11	See section: FIELD EFFECT TRANSISTORS									
BFW16A	h_{FE}	>25	50	5	$I_{CBO} < 20\ \mu A$	0	20	$I_{CM} = 300$ mA	length < 6.6	
n-p-n	h_{FE}	>25	150	5	$C_c < 4$ pF	0	15	$V_{CEO} = 25$ V	width < 8.5	
band I to V	f_T	$=1200$ MHz	150	15				$P_{tot} = 1500$ mW	leads > 12.7	
vert. ampl.	$-C_{re}$	$=1.7$ pF	10	15				$T_j = 200°C$		
oscilloscope	F	<6 dB	30	15				$R_{th\,j-a} = 250°C/W$		
	G_p	$=16$ dB	70	18						
	P_o	$=150$ mW	70	18						
BFW17A	h_{FE}	>25	50	5	$I_{CBO} < 20\ \mu A$	0	20	$I_{CM} = 300$ mA	length < 6.6	
n-p-n	h_{FE}	>25	150	5	$C_c < 4$ pF	0	15	$V_{CEO} = 25$ V	width < 8.5	
band I to III	f_T	$=1.1$ GHz	150	15				$P_{tot} = 1.5$ W	leads > 12.7	
	$-C_{re}$	$=1.7$ pF	10	15				$T_j = 200°C$		
	G_p	$=16$ dB	70	18				$R_{th\,j-a} = 250°C/W$		
	P_o	$=150$ mW	70	18						
BFW30	h_{FE}	>25	25	5	$I_{CBO} < 50$ nA	0	10	$I_{CM} = 100$ mA	length < 5.3	
n-p-n	h_{FE}	>25	50	5	$C_c < 105$ pF	0	5	$V_{CEO} = 10$ V	width < 4.8	
wide band	f_T	$=1600$ MHz	50	5				$P_{tot} = 250$ mW	leads > 12.7	
amplifier	$-C_{re}$	$=0.8$ pF	2	5				$T_j = 200°C$		
	F	<5 dB	2	5				$R_{th\,j-a} = 0.7°C/mW$		
	G_p	$=21$ dB	30	5						
	d_{im}	$=-60$ dB	30	6						
BFW61	See section: FIELD EFFECT TRANSISTORS									

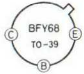
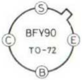
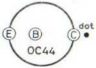
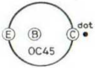
HIGH FREQUENCY TRANSISTORS

Type and applications	Characteristics at:	I_C (mA)	V_{CE} (V)	Characteristics at:	I_E (mA)	V_{CB} (V)	Ratings	Outlines (mm)	
BFW92	h_{FE} < 150	2	1	$I_{CBO} < 50$ nA	0	10	I_{CM} = 50 mA	diameter < 4.8	
n-p-n	h_{FE} > 20	25	1	C_c = 0.7 pF	0	10	V_{CEO} = 15 V	height < 2.7	
wide-band	f_T = 1 GHz	2	5				P_{tot} = 130 mW	leads > 7	
I to V	f_T = 1.6 GHz	25	5				T_j = 125°C		
	$-C_{re}$ = 0.6 pF	2	5				$R_{th\,j-a}$ = 0.4°C/mW		
	F = 4 dB	2	5						
	G_p = 23 dB	10	10						
	P_o = 8 mW	10	10						
	d_{im} = −45 dB	10	6						
BFX43	h_{FE} < 60	10	1	$I_{CBO} < 100$ nA	0	20	I_{CM} = 250 mA	length < 5.3	
n-p-n	f_T > 500 MHz	10	10	C_c < 4 pF	0	5	V_{CEO} = 15 V	width < 4.8	
aerial	$\|y_{fe}\|$ = 108 mΩ^{-1}	40	10				P_{tot} = 360 mW	leads > 12.7	
band I to III	G_{tr} = 10 dB	40	10				T_j = 200°C		
							$R_{th\,j-a}$ = 0.48°C/mW		
BFX44	$h_{FE} < 120$	10	1	$I_{CBO} < 100$ nA	0	20	I_{CM} = 250 mA	length < 5.3	
n-p-n	$h_{FE} > 20$	100	1	C_c < 4 pF	0	5	V_{CEO} = 15 V	width < 4.8	
wide-band	f_T > 500 MHz	10	10				P_{tot} = 360 mW	leads > 12.7	
oscilloscope	f_T > 300 MHz	100	3				T_j = 200°C		
							$R_{th\,j-a}$ = 0.48°C/mW		
BFX89	$h_{FE} > 20$	25	1	$C_c < 1.7$ pF	0	10	I_{CM} = 50 mA	length < 5.3	
n-p-n	f_T = 1200 MHz	25	5				V_{CEO} = 15 V	width < 4.8	
v.h.f.	F < 6.5 dB	2	5				P_{tot} = 200 mW	leads > 12.7	
u.h.f.	P_o = 6 mW	8	10				T_j = 200°C		
	G_p = 22 dB	8	10				$R_{th\,j-a}$ = 0.88°C/mW		

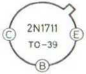
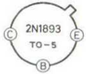
BFY10	$h_{fe} > 20$	5	5	$I_{CBO} < 2\ \mu A$	0	20	$I_{CM} = 75$ mA	length < 6.6	
n-p-n	$\lvert y_{fe}\rvert = 22\ m\Omega^{-1}$	5	10	$V_{BE} < 1.5$ V	−10	5	$V_{CEX} = 45$ V	width < 8.5	
ampl. appl.				$h_{FE} < 50$	−10	5	$P_{tot} = 300$ mW	leads > 38	
				$C_c < 3$ pF	0	10	$T_j = 175$°C		
				$f_T = 120$ MHz	−5	10	$R_{th\,j-a} = 0.5$°C/mW		
				$F < 40$ dB	−5	10			
				$\lvert y_{fb}\rvert = 22$	−5	10			
BFY11	Equivalent to BFY10 except for:								
	$h_{FE} < 125$	−10	5	$h_{fe} > 35$	5	5			
BFY50	$h_{FE} = 112$	150	10	$I_{CBO} < 50$ nA	0	60	$I_{CM} = 1$ A	length < 6.6	
n-p-n	$f_T = 140$ MHz	50	10	$C_c < 12$ pF	0	10	$V_{CEO} = 35$ V	width < 8.5	
general	$h_{fe} = 90$	10	5				$P_{tot} = 5$ W	leads > 12.7	
	$h_{fe} = 60$	1	5				$T_j = 200$°C		
							$R_{th\,j-a} = 0.22$°C/mW		
BFY51	$h_{FE} = 123$	150	10	$I_{CBO} < 50$ nA	0	40	$I_{CM} = 1$ A	length < 6.6	
n-p-n	$f_T = 160$ MHz	50	10	$C_c < 12$ pF	0	10	$V_{CEO} = 20$ V	width < 8.5	
general	$h_{fe} = 100$	10	5				$P_{tot} = 5$ W	leads > 12.7	
	$h_{fe} = 65$	1	6				$T_j = 200$°C		
							$R_{th\,j-a} = 0.22$°C/mW		

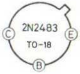
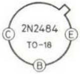
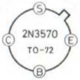
HIGH FREQUENCY TRANSISTORS

Type and applications	Characteristics at:	I_C (mA)	V_{CE} (V)	Characteristics at:	I_E (mA)	V_{CB} (V)	Ratings	Outlines (mm)	
BFY52	$h_{FE} = 142$	150	10	$I_{CBO} < 50$ nA	0	30	$I_{CM} = 1$ A	length < 6.6	
n-p-n	$f_T = 185$ MHz	50	10	$C_c < 12$ pF	0	10	$V_{CEO} = 20$ V	width < 8.5	
general	$h_{fe} = 110$	10	5				$P_{tot} = 5$ W	leads > 12.7	
	$h_{fe} = 70$	1	5				$T_j = 200°C$		
							$R_{th\,j-a} = 0.22°C/mW$		
BFY55	$h_{FE} < 120$	150	10	$I_{CBO} < 10$ nA	0	60	$I_{CM} = 1$ A	length < 6.6	
n-p-n	$f_T > 60$ MHz	50	10	$C_c < 12$	0	10	$V_{CEO} = 35$ V	width < 8.5	
oscillator	$h_{fe} = 52$	10	6				$P_{tot} = 4$ W	leads > 12.7	
	$h_{fe} = 36$	1	6				$T_j = 200°C$		
							$R_{th\,j-a} = 0.22°C/mW$		
BFY67	$V_{BE} < 0.9$ V	1	5	$I_{CBO} < 10$ nA	0	60	$I_{CM} = 1$ A	length < 6.6	
n-p-n	$h_{FE} = 32$	0.1	10	$C_c < 25$ pF	0	10	$V_{CEO} = 30$ V	width < 8.5	
general	$h_{FE} = 73$	10	10	$h_{ib} < 34\ \Omega$	-1	5	$P_{tot} = 800$ mW	leads > 12.7	
	$h_{FE} = 62$	150	10	$h_{ib} < 8\ \Omega$	-5	10	$T_j = 200°C$		
	$h_{FE} = 43$	500	10	$h_{ob} < 0.5\ \mu\Omega^{-1}$	-1	5	$R_{th\,j-a} = 0.22°C/mW$		
	$f_T = 127$ MHz	50	10	$h_{ob} < 0.1\ \mu\Omega^{-1}$	-5	10			
	$F < 12$ dB	0.3	10						
	$h_{fe} < 100$	1	5						
	$h_{fe} < 130$	5	10						

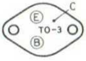
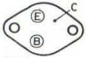
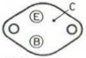
BFY68	$V_{BE} < 0.9$	1	5	$I_{CBO} < 10$ nA	0	60	$I_{CM} = 1$ A	length < 6.6	
n-p-n	$h_{FE} = 76$	0.1	10	$C_c < 25$ pF	0	10	$V_{CEO} = 30$ V	width < 8.5	
general	$h_{FE} = 148$	10	10	$h_{ib} < 34\ \Omega$	−1	5	$P_{tot} = 800$ mW	leads > 12.7	
switch	$h_{FE} = 135$	150	10	$h_{ib} < 8\ \Omega$	−5	−10	$T_j = 200°$C		
	$h_{FE} = 80$	500	10	$h_{ob} < 0.5\ \mu\Omega^{-1}$	−1	5	$R_{th\,j-a} = 0.22°$C/mW		
	$f_T = 135$ MHz	50	10	$h_{ob} < 0.1\ \mu\Omega^{-1}$	−5	10			
	$F < 8$ dB	0.3	10						
	$h_{fe} < 200$	1	5						
	$h_{fe} < 300$	5	10						
BFY90	$h_{FE} < 150$	2	1	$I_{CBO} < 10$ nA	0	15	$I_{CM} = 50$ mA	length < 5.3	
n-p-n	$-C_{re} < 0.8$ pF	2	5	$C_c < 1.5$ pF	0	10	$V_{CEO} = 15$ V	width < 4.8	
general	$f_T > 1000$ MHz	2	5				$P_{tot} = 200$ mW	leads > 12.7	
band I to IV	$F < 5$ dB	2	5				$T_j = 200°$C		
	$\lvert y_{fe}\rvert = 45\ \text{m}\Omega^{-1}$	2	5				$R_{th\,j-a} = 0.88°$C/mW		
	$G_{UM} = 22$ dB	2	5						
	$P_o = 12$ mW	14	10						
OC44	$-V_{BE} < 185$ mV	−1	−6	$-I_{CBO} < 0.01$ mA	0	−15	$-I_{CM} = 10$ mA	length < 15	
p-n-p	$\lvert y_{fe}\rvert = 30\ \text{m}\Omega^{-1}$	−1	−6	$f_{hfb} = 15$ MHz	1	−6	$-V_{CEO} = 5$ V	width < 5.2	
mixer							$P_{tot} = 85$ mW	leads > 37	
oscillator							$T_j = 75°$C		
							$R_{th\,j-a} = 0.6°$C/mW		
OC45	$-V_{BE} < 195$ mV	−1	−6	$-I_{CBO} < 0.01$ mA	0	−15	$-I_{CM} = 10$ mA	length < 15	
p-n-p	$\lvert y_{fe}\rvert = 28\ \text{m}\Omega^{-1}$	−1	−6	$f_{hfb} = 12$ MHz	1	−6	$-V_{CEO} = 5$ V	width < 5.2	
mixer							$P_{tot} = 85$ mW	leads > 37	
oscillator							$T_j = 75°$C		
							$R_{th\,j-a} = 0.6°$C/mW		

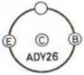
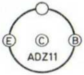
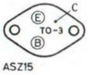
HIGH FREQUENCY TRANSISTORS

Type and applications	Characteristics at:	I_C (mA)	V_{CE} (V)	Characteristics at:	I_E (mA)	V_{CB} (V)	Ratings	Outlines (mm)	
2N1613	$h_{FE} > 20$	0.1	10	$I_{CBO} < 10$ nA	0	60	$I_{CM} = 1$ A	length < 6.6	
n-p-n	$h_{FE} > 40$	150	10	$C_c < 25$ pF	0	10	$V_{CER} = 50$ V	width < 8.5	
general	$h_{FE} > 20$	500	10				$P_{tot} = 3$ W	leads > 12.7	
	$f_T > 60$ MHz	50	10				$T_j = 200°C$		
	$F < 12$ dB	0.3	10				$R_{th\,j-a} = 220°C/W$		
	$h_{fe} < 100$	1	5						
	$h_{fe} < 150$	5	10						
2N1711	$h_{FE} > 35$	0.1	10	$I_{CBO} < 10$ nA	0	60	$I_{CM} = 1$ A	length < 6.6	
n-p-n	$h_{FE} > 100$	150	10	$C_c < 25$ pF	0	10	$V_{CER} = 50$ V	width < 8.5	
general	$h_{FE} > 40$	500	10				$P_{tot} = 3$ W	leads > 12.7	
	$f_T < 70$ MHz	50	10				$T_j = 200°C$		
	$F < 8$ dB	0.3	10				$R_{th\,j-a} = 220°C/W$		
	$h_{fe} < 200$	1	5						
	$h_{fe} < 300$	5	10						
2N1893	$h_{FE} > 35$	10	10	$I_{CBO} < 10$ nA	0	90	$I_C = 500$ mA	length < 6.6	
n-p-n	$h_{FE} > 40$	150	10	$C_c < 15$ pF	0	10	$V_{CEO} = 80$ V	width < 8.5	
general	$h_{fe} > 45$	5	10				$P_{tot} = 3$ W	leads > 38	
	$h_{fe} > 2.5$	50	10				$T_j = 200°C$		
							$R_{th\,j-a} = 219°C/W$		
2N2297	$h_{FE} > 30$	10	10	$I_{CBO} < 10$ nA	0	60	$I_C = 1$ A	length < 6.6	
n-p-n	$h_{FE} > 40$	150	10	$C_c < 12$ pF	0	10	$V_{CEO} = 35$ V	width < 8.5	
v.h.f.	$h_{FE} > 15$	1000	10				$P_{tot} = 5$ W	leads > 12.7	
	$f_T > 60$ MHz	50	10				$T_j = 200°C$		
							$R_{th\,j-a} = 220°C/W$		

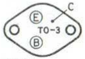
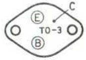
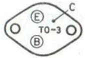
2N2483	$h_{FE} > 40$	0.01	5	$I_{CBO} < 10$ nA	0	45	$I_{CM} = 50$ mA	length < 5.3	
n-p-n	$h_{FE} > 75$	0.1	5	$C_c < 6$ pF	0	5	$V_{CEO} = 60$ V	width < 4.8	
general	$h_{FE} > 175$	1	5				$P_{tot} = 360$ mW	leads > 12.7	
	$h_{FE} < 500$	10	5				$T_j = 200$°C		
	$f_T = 80$ MHz	0.5	5				$R_{th\,j-a} = 0.48$°C/mW		
	$F < 4$ dB	0.01	5						
	$h_{fe} > 80$	1	5						
2N2484	$h_{FE} > 100$	0.01	5	$I_{CBO} < 10$ nA	0	45	$I_{CM} = 50$ mA	length < 5.3	
n-p-n	$h_{FE} > 175$	0.1	5	$C_c < 6$ pF	0	5	$V_{CEO} = 60$ V	width < 4.8	
general	$h_{FE} > 250$	1	5				$P_{tot} = 360$ mW	leads > 12.7	
	$h_{FE} < 800$	10	5				$T_j = 200$°C		
	$f_T = 80$ MHz	0.5	5				$R_{th\,j-a} = 0.48$°C/mW		
	$F < 3$ dB	0.01	5						
	$h_{fe} > 150$	1	5						
2N3570	$h_{FE} > 20$	5	6	$I_{CBO} < 10$ nA	0	6	$I_C = 50$ mA	length < 5.3	
n-p-n	$f_T > 1500$ MHz	5	6	$-C_{re} < 0.75$ pF	0	6	$V_{CEO} = 15$ V	width < 4.8	
v.h.f.	$h_{fe} > 20$	5	6	$F < 7$ dB	−2	6	$P_{tot} = 200$ mW	leads > 12.7	
u.h.f.							$T_j = 200$°C		
							$R_{th\,j-a} = 0.88$°C/mW		
2N3571	Equivalent to 2N3570 except for:								
	$f_T > 1200$ MHz	5	6	$-C_{re} < 0.85$ pF	0	6			
				$F < 4$ dB	−2	6			
2N3572	Equivalent to 2N3570 except for:								
	$f_T > 1000$ MHz	5	6	$-C_{re} < 0.85$ pF	0	6	$V_{CEO} = 13$ V		
				$F < 6$ dB	−2	6			

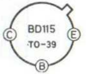
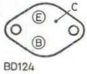
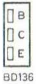
POWER TRANSISTORS

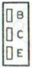
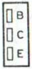
Type and applications	Characteristics at:	I_C (A)	V_{CE} (V)	Characteristics at:	I_E (A)	V_{CB} (V)	Ratings	Outlines (mm)	
AD149 p-n-p class B push-pull l.f.	$-V_{BE} < 1.2$ V $f_T = 0.5$ MHz	-3.5 -0.5	-1 -2	$-I_{CBO} < 3$ mA $h_{FE} < 100$ $h_{FE} < 85$ $C_c = 220$ pF	0 -1 -3 0	-50 0 0 -5	$-I_C = 3.5$ A $-V_{CEO} = 30$ V $P_{tot} = 32.5$ W $T_j = 100$°C $R_{th\,j-mb} = 2.0$°C/W	length < 39.5 width < 26.6 height < 7.0 leads < 13.0	 AD149
2-AD149 matched pair	$h_{FE1}/h_{FE2} < 1.25$ $h_{FE1}/h_{FE2} < 1.25$	-0.3 -3							
AD161 n-p-n class B l.f.	$V_{BE} < 1.1$ V $h_{FE} < 300$ $h_{FE} < 320$ $f_T = 3$ MHz	2 0.05 0.5 0.01	1 1 1 2	$I_{CBO} < 500$ μA $C_c = 150$ pF	0 0	32 5	$I_{CM} = 3$ mA $V_{CEO} = 20$ V $P_{tot} = 4$ W $T_j = 90$°C $R_{th\,j-mb} = 4.5$°C/W	length < 31.4 width < 19 height < 8.9 leads < 10.5	 AD161
AD161/AD162 matched pair	$h_{FE1}/h_{FE2} < 1.25$	|0.5|	|1|						
AD162 p-n-p class B l.f.	$-V_{BE} < 0.85$ V $h_{FE} < 300$ $h_{FE} < 320$ $f_T = 1.5$	-2 -0.05 -0.5 -0.01	-1 -1 -1 -2	$-I_{CBO} < 200$ μA $C_c = 115$ pF	0 0	-32 -5	$-I_{CM} = 3$ A $-V_{CEO} = 20$ V $P_{tot} = 6$ W $T_j = 90$°C $R_{th\,j-mb} = 4.5$°C/W	length < 31.4 width < 19 height < 8.9 leads < 10.5	 AD162
2-AD162 matched pair	$h_{FE1}/h_{FE2} < 1.25$ $h_{FE1}/h_{FE2} < 1.25$	-0.05 -0.5	-1 -1						

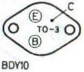
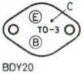
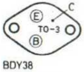
ADY26	$h_{fe} = 1.7$	−1	−12	$-I_{CBO} < 200\ \mu A$	0	−2	$-I_{CM} = 30$ A	length < 10.5	
p-n-p	$t_{on} = 25\ \mu s$	−25	−18	$-V_{BE} < 1$ V	5	0	$-V_{CEO} = 60$ V	width < 25	
l.f.	$t_{off} = 75\ \mu s$	−25	−18	$-V_{BE} < 2$ V	25	0	$P_{tot} = 100$ W	leads > 16	
				$h_{FE} < 120$	5	0	T_j 90°C		
				$h_{FE} = 25$	25	0	$R_{th\ j-mb} = 0.6$°C/W		
				$C_c = 350$ pF	0	−12			
ADZ11				$-I_{CBO} < 200\ \mu A$	0	−2	$-I_{CM} = 20$ A	length < 10.5	
p-n-p				$-V_{BE} < 2$ V	−15	0	$-V_{CEO} = 40$ V	width < 25	
l.f.				$h_{FE} < 120$	−1.2	0	$P_{tot} = 45$ W	leads > 16	
				$h_{FE} > 25$	−5	0	$T_j = 90$°C		
				$h_{FE} > 15$	−15	0	$R_{th\ j-mb} = 0.8$°C/W		
				$f_{hfe} > 0.08$	1	−12			
ADZ12	Equivalent to ADZ11 except for:			$f_{hfe} > 100$ kHz	1	−12	$-V_{CEO} = 60$ V		
ASZ15	$h_{FE} < 55$	−1 A	−1	$-V_{CE\,sat} < 0.4$ V	−10 A	−1 A	$-I_{CM} = 10$ A	length < 39.5	
p-n-p	$h_{FE} < 30$	−6 A	−1	$-V_{BE\,sat} < 1.4$ V	−10 A	−1 A	$-V_{CEO} = 60$ V	width < 26.2	
power	$f_T = 0.2$ MHz	−1 A	−5	$t_d < 2\ \mu s$			$P_{tot} = 30$ W	height < 7.0	
	$-I_{CBO} < 0.1$ mA	0	−5	$t_r < 25\ \mu s$			$T_j = 90$°C	leads < 13	
	$-V_{BE} < 1.6$ V	6 A	0	$t_s < 10\ \mu s$			$R_{th\ j-mb} = 1.5$°C/mW		
	$C_c = 190$ pF	0	−5	$t_f < 20\ \mu s$					
2-ASZ15	$h_{FE1}/h_{FE2} < 1.25$	0.3 A	—						
matched pair	$h_{FE1}/h_{FE2} < 1.25$	6.0 A	—						

POWER TRANSISTORS

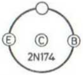
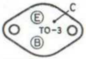
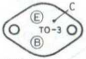
Type and applications	Characteristics at:	I_C (mA)	V_{CE} (V)	I_E (mA)	V_{CB} (V)	Characteristics at:	I_C (mA)	I_B (mA)	Ratings	Outlines (mm)
ASZ16	$h_{FE} < 130$	−1 A	−1			$-V_{CE\,\text{sat}} < 0.4$ V	−10 A	−1 A	$-I_{CM} = 10$ A	length < 39.5
p-n-p	$h_{FE} < 80$	−6 A	−1			$-V_{BE\,\text{sat}} < 1.4$ V	−10 A	−1 A	$-V_{CEO} = 32$ V	width < 26.2
power	$f_T = 0.25$ MHz	−1 A	−5			$t_d < 2$ µs			$P_{\text{tot}} = 30$ W	height < 7.0
	$-I_{CBO} < 0.1$ mA			0	−5	$t_r < 25$ µs			$T_j = 90$°C	leads < 13
	$-V_{BE} < 1.4$ V			6 A	0	$t_s < 10$ µs			$R_{th\,j-mb} = 90$°C	
	$C_c = 190$ pF			0	−5	$t_f < 20$ µs				
2-ASZ16	$h_{FE1}/h_{FE2} < 1.25$	−0.3 A	—							
matched pair	$h_{FE1}/h_{FE2} < 1.25$	−6.0 A	—							ASZ16
ASZ17	Equivalent to ASZ16 except for:									
	$h_{FE} < 75$	−1 A	−1							
	$h_{FE} < 45$	−6 A	−1							
	$f_T = 0.22$ MHz	−1 A	−5							
ASZ18	Equivalent to ASZ16 except for:									ASZ17 ASZ18
	$h_{FE} < 110$	−1 A	−1							
	$h_{FE} < 65$	−6 A	−1							
	$f_T = 0.22$ MHz	−1 A	−5							
AUY10	$f_T = 120$ MHz	−300	−10			$t_d < 0.2$ µs			$-I_C = 0.7$ A	length < 39.5
p-n-p	$-I_{CBO} < 4.5$ mA			0	−60	$t_r < 0.2$ µs			$-V_{CEX} = 60$ V	width < 26.2
power	$h_{FE} > 40$			600	−10	$t_f < 0.2$ µs			$P_{\text{tot}} = 6$ W	height < 7.0
	$C_c < 85$ pF			0	−10				$T_j = 75$°C	leads < 13
									$R_{th\,j-mb} = 4$°C/W	 AUY10

Type and applications	Characteristics at:	I_C (A)	V_{CE} (V)	Characteristics at:	I_E (A)	V_{CB} (V)	Ratings	Outlines (mm)	
BD115 n-p-n class A a.f.	V_{BE} <1 V h_{FE} >22 h_{FE} $=60$ f_T $=145$ MHz $-C_{re}=3.5$ pF	50 50 50 30 10	100 100 100 100 20	$I_{CBO}=550$ mA	0	200	I_{CM} $=200$ mA V_{CEO} $=180$ V P_{tot} $=6$ W T_j $=200°$C $R_{th\,j-mb}=12.5°$C/W	length <6.6 width <8.5 leads >12.7	
BD124 n-p-n hi-fi output stages	$V_{BE}=1$ V $h_{FE}>25$ $h_{FE}>35$ $h_{FE}>25$ f_T $=120$ MHz	2 0.05 0.5 2 0.25	5 5 5 5 5	$I_{CBO}=0.5$ μA	0	45	I_{CM} $=4$ A V_{CEO} $=45$ V P_{tot} $=15$ W T_j $=175°$C $R_{th\,j-mb}=7.5°$C/W	length <31.4 width <19 height <8.9 leads >9	
BD135 hi-fi ampl. driver	$V_{BE}<1$ V $h_{FE}>25$ $h_{FE}<250$ f_T $=250$ MHz	0.5 0.005 0.15 0.05	2 2 2 5	$I_{CBO}<100$ nA	0	30	I_{CM} $=1.5$ A V_{CEO} $=45$ V P_{tot} $=6.5$ W T_j $=125°$C $R_{th\,j-mb}=10°$C/W	length <11.1 width <7.8 height <2.8 leads >15.3	
BD136 p-n-p hi-fi ampl. deriver	$-V_{BE}<1$ V h_{FE} >25 h_{FE} <250 f_T $=75$ MHz	-0.5 -0.005 -0.15 -0.05	-2 -2 -2 -5	$-I_{CBO}<100$ nA	0	-30	$-I_{CM}$ $=1.5$ A $-V_{CEO}=45$ W P_{tot} $=6.5$ W T_j $=125°$C $R_{th\,j-mb}=10°$C/W	length <11.1 width <7.8 height <2.8 leads >15.3	
BD135/BD136 matched pair	$h_{FE1}/h_{FE2}<1.6$	$\|0.15\|$	$\|2\|$						

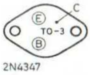
Type and applications	*Characteristics at:*	I_C (A)	V_{CE} (V)	*Characteristics at:*	I_E (A)	V_{CB} (V)	*Ratings*	*Outlines (mm)*	
BD137 n-p-n hi-fi ampl. driver	$V_{BE} < 1$ V $h_{FE} > 25$ $h_{FE} < 160$ $f_T = 250$ MHz	0.5 0.005 0.15 0.05	2 2 2 2	$I_{CBO} < 100$ nA	0	30	$I_{CM} = 1.5$ A $V_{CEO} = 60$ V $P_{tot} = 6.5$ W $T_j = 125°$C $R_{th\,j-mb} = 10°$C/W	length < 11.1 width < 7.8 height < 2.8 leads > 15.3	 BD137
BD138 p-n-p hi-fi ampl. driver	$-V_{BE} < 1$ V $h_{FE} > 25$ $h_{FE} < 160$ $f_T = 250$ MHz	−0.5 −0.005 −0.15 −0.05	−2 −2 −2 −2	$-I_{CBO} < 100$ nA	0	−30	$-I_{CM} = 1.5$ A $-V_{CEO} = 60$ V $P_{tot} = 6.5$ W $T_j = 125°$C $R_{th\,j-mb} = 10°$C/W	length < 11.1 width < 7.8 height < 2.8 leads > 15.3	 BD138
BD137/BD138 matched pair	$h_{FE1}/h_{FE2} < 1.6$	|0.15|	|2|						
BD139 n-p-n hi-fi ampl. driver	$V_{BE} < 1$ V $h_{FE} > 25$ $h_{FE} < 160$ $f_T = 250$ MHz	0.5 0.005 0.15 0.05	2 2 2 2	$I_{CBO} < 100$ nA	0	30	$I_{CM} = 1.5$ A $V_{CEO} = 80$ V $P_{tot} = 6.5$ W $T_j = 125°$C $R_{th\,j-mb} = 10°$C/W	length < 11.1 width < 7.8 height < 2.8 leads > 15.3	 BD139
BD140 p-n-p hi-fi ampl. driver	$-V_{BE} < 1$ V $h_{FE} > 25$ $h_{FE} > 160$ $f_T = 250$ MHz	−0.5 −0.005 −0.15 −0.05	−2 −2 −2 −2	$-I_{CBO} < 100$ nA	0	−30	$-I_{CM} = 1.5$ A $-V_{CEO} = 80$ V $P_{tot} = 6.5$ W $T_j = 125°$C $R_{th\,j-mb} = 10°$C/W	length < 11.1 width < 7.8 height < 2.8 leads > 15.3	 BD140

BD139/BD140	$h_{FE1}/h_{FE2} < 1.6$	|0.15|	|2|						
matched pair									
BDY10	$V_{BE} < 3$ V	2	2	$I_{CBO} < 300\ \mu$A	0	50	$I_{CM} = 4$ A	length < 39.5	
n-p-n	$h_{FE} = 25$	2	2	$C_c < 500$ pF	0	20	$V_{CEO} = 40$ V	width < 26.2	
general	$h_{FE} = 10$	4	2				$P_{tot} = 125$ W	height < 9.5	
l.f.	$f_T > 1$ MHz	0.2	5				$T_j = 175$°C	leads < 13.0	
							$R_{th\,j-mb} = 1$°C/W		
BDY11	Equivalent to BDY10 except for:			$I_{CBO} < 300\ \mu$A	0	100	$V_{CEO} = 70$ V		
BDY20	$V_{BE} < 1.8$ V	4	4	$I_{CBO} < 5$ mA	0	100	$I_{CM} = 15$ A	length < 39.5	
n-p-n	$h_{FE} > 20$	4	4	$C_c = 250$ pF	0	20	$V_{CEO} = 60$ V	width < 26.6	
hi-fi	$f_T = 1$ MHz	1	4				$P_{tot} = 115$ W	height < 9.5	
signal	$f_{hfe} = 9$ kHz	1	4				$T_j = 200$°C	leads > 11	
processing							$R_{th\,j-mb} = 1.5$°C/W		
2-BDY20	$h_{FE1}/h_{FE2} < 1.6$	0.4	4						
matched pair	$h_{FE1}/h_{FE2} < 1.3$	4	4						
BDY38	$V_{BE} < 2$ V	2	4	$I_{CBO} < 1$ mA	0	50	$I_{CM} = 6$ A	length < 39.5	
n-p-n	$h_{FE} > 30$	0.2	4	$C_c = 250$ pF	0	20	$V_{CEO} = 40$ V	width < 26.6	
hi-fi	$f_T = 1$ MHz	1	4				$P_{tot} = 115$ W	height < 9.5	
signal	$f_{hfe} = 12$ kHz	1	4				$T_j = 200$°C	leads > 11	
processing							$R_{th\,j-mb} = 1.5$°C/W		
2-BDY38	$h_{FE1}/h_{FE2} < 1.5$	0.2	4						
matched pair	$h_{FE1}/h_{FE2} < 1.2$	2	4						

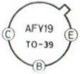
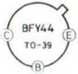
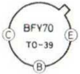
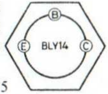
POWER TRANSISTORS

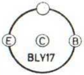
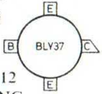
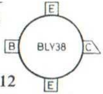
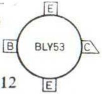
Type and applications	Characteristics at:	I_C (A)	V_{CE} (V)	Characteristics at:	I_r (A)	V_{CB} (V)	Ratings	Outlines (mm)	
2N174	$h_{FE} < 50$	-5	-2	$-I_{CBO} = 100\ \mu A$	0	-2	$I_E = 15$	length < 10.5	
p-n-p	$h_{FE} = 20$	-12	-2				$-V_{CBX} = 80$ V	width < 25	
l.f.	$f_{hfe} = 0.01$ MHz	-5	-6				$P_{tot} = 150$ W	leads > 16	
	$t_r = 15\ \mu s$	-12	-12				$T_j = 100°C$		
	$t_f = 15\ \mu s$	-12	-12				$R_{th\, j-mb} = 0.5°C/W$		
2N277	Equivalent to 2N174 except for:						$-V_{CBX} = 40$ V		
	$h_{FE} < 70$	-5	-2						
	$h_{FE} = 25$	-12	-2						
2N441	Equivalent to 2N174 except for:						$-V_{CBX} = 40$ V		
	$h_{FE} < 40$	-5	-2						
2N1100	Equivalent to 2N174 except for:						$V_{CBX} = 100$ V		
2N3055	$V_{BE} < 1.8$ V	4	4				$I_C = 15$ A	length < 39.5	
n-p-n	$h_{FE} > 20$	4	4				$V_{CER} = 70$ V	width < 26.6	2N3055
hi-fi	$f_T > 0.8$ MHz	1	4				$P_{tot} = 115$ W	height < 9.5	
signal	$f_{hfe} > 15$ kHz	1	4				$T_j = 200°C$	leads > 11	
processing							$R_{th\, j-mb} = 1.5°C/W$		
2N3442	$V_{BE} < 1.7$ V	3	4	$I_{CBO} = 50\ \mu A$	0	140	$I_{CM} = 15$ A	length < 39.5	
n-p-n	$V_{BE} < 5.7$ V	10	4	$C_c = 100$ pF	0	50	$V_{CEO} = 140$ V	width < 26.6	2N3442
audio ampl.	$h_{FE} > 20$	3	4				$P_{tot} = 117$ W	height < 9.5	
power suppl.	$h_{FE} > 7.5$	10	4				$T_j = 200°C$	leads > 11	
converters	$h_{fe} > 2$	2	4				$R_{th\, j-mb} = 1.5°C/W$		

2N4347	$V_{BE} < 2.0$ V	2	4	$I_{CBO} = 50\ \mu$A	0	140	$I_{CM} = 10$ A	length < 39.5
n-p-n	$V_{BE} < 4.0$ V	5	4	$C_c = 100$ pF	0	50	$V_{CEO} = 120$ V	width < 26.6
audio ampl.	$h_{FE} > 20$	2	4				$P_{tot} = 100$ W	height < 9.5
power suppl.	$h_{FE} > 7.5$	5	4				$T_j = 200$°C	leads > 11
converters							$R_{th\,j-mb} = 1.5$°C/W	

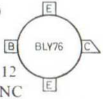
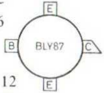
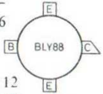
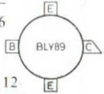


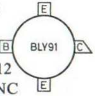
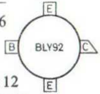
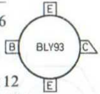
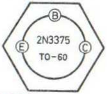
TRANSMITTER TRANSISTORS

Type and applications	*Characteristics at:*	I_C *(mA)*	V_{CE} *(V)*	*Characteristics at:*	I_E *(mA)*	V_{CB} *(V)*	*Ratings*	*Outlines (mm)*	
AFY19				$-I_{CBO} < 10\ \mu A$	0	−10	$-I_{CM} = 300$ mA	length < 6.6	
p-n-p				$h_{FE} = 80$	80	−12	$-V_{CES} = 32$ V	width < 8.5	
transmitter				$C_c = 12$ pF	0	−10	$P_{tot} = 800$ mW	leads > 12.7	
				$f_T = 350$ MHz	100	−5	$T_j = 90°C$		
				$P_o > 500$ mW	80	−12	$R_{th\,j-a} = 0.25°C/mW$		
				$G_p > 10$ dB	80	−12			
BFY44	$h_{FE} = 20$	150	10	$I_{CBO} < 500$ nA	0	40	$I_{CM} = 1$ A	length < 6.6	
n-p-n	$h_{FE} = 20$	500	5	$C_c < 12$ pF	0	40	$V_{CEO} = 60$ V	width < 8.5	
v.h.f.	$f_T = 210$ MHz	100	10	$\lvert y_{fb} \rvert = 98\ m\Omega^{-1}$	−150	24	$P_{tot} = 5$ W	leads > 13	
transmitter	$P_o = 2.1$ W	—	40				$T_j = 200°C$		
	$G_p = 7$ dB	—	40				$R_{th\,j-a} = 0.035°C/mW$		
	$\eta = 50\%$	—	40						
BFY70	$h_{FE} = 20$	150	10	$I_{CBO} < 500$ nA	0	28	$I_{CM} = 1$ W	length < 6.6	
n-p-n	$h_{FE} = 20$	500	5	$C_c < 14$ pF	0	28	$V_{CEO} = 40$ V	width < 8.5	
v.h.f.	$f_T = 210$ MHz	100	10	$\lvert y_{fb} \rvert = 98\ m\Omega^{-1}$	−150	24	$P_{tot} = 5$ W	leads > 38	
transmitter	$P_o = 1.5$ W	—	28				$T_j = 200°C$		
	$G_p = 7$ dB	—	28				$R_{th\,j-c} = 0.035°C/mW$		
	$\eta = 50\%$	—	28						
BLY14	$f_T = 190$ MHz	0.1	10	$I_{CBO} < 500$ nA	0	40	$I_{CM} = 1$ A	length < 28.2	
n-p-n	$P_o = 3.6$ W	0.19	40	$h_{FE} = 11$	−0.15	10	$V_{CEO} = 55$ V	width < 28.2	
transmitter	$G_p = 7.6$	0.19	40	$h_{FE} = 11$	−0.5	10	$P_{tot} = 100$ W	height < 10.5	
h.f.	$\eta = 48\%$	0.19	40	$C_c < 10$ pF	0	40	$T_j = 175°C$	leads = 17	
				$\lvert y_{fb} \rvert = 98\ m\Omega^{-1}$	−0.15	24	$R_{th\,j-mb} = 1.5°C/mW$	collector: M5	

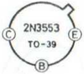
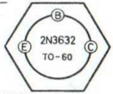
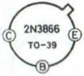
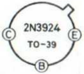
BLY17	f_T = 70 MHz	1.5	10	$I_{CBO} < 10$ mA	0	40	I_{CM} = 10 A	length < 28.2	
n-p-n	P_o = 40 W	1.8	40	$I_{CBO} < 20$ mA	0	100	V_{CER} = 100 V	width < 28.2	
transmitter	G_p = 7.5 dB	1.8	40	h_{FE} = 13	− 5	0	P_{tot} = 100 W	height < 10.5	
h.f.	η = 55%	1.8	40	h_{FE} = 9	− 10	0	T_j = 175°C	leads = 17	
				C_c < 150 pF	0	40	$R_{th\,j-mb}$ = 1.5°C/mW	collector: M5	
BLY37	$V_{BE} < 1.5$ V	0.5	5	C_c = 8 pF	0	28	I_{CM} = 2.5 A	diameter < 10	
n-p-n	h_{FE} = 35	0.5	5				V_{CEO} = 36 V	height < 5.8	
transmitter	f_T = 800 MHz	0.5	5				P_{tot} = 10 W	leads > 21.7	
f.m.	P_i < 1.5 W	—	28				T_j = 200°C	stud length < 12	
	P_o = 6 W	—	28				$R_{th\,j-h}$ = 12.5°C/W	stud: 8–32 UNC	
	G_p > 6 dB	—	28						
	η > 60%	—	28						
BLY38	$V_{BE} < 1.5$	0.25	5	C_c = 5.5 pF	0	13.8	I_{CM} = 1.5 A	diameter < 10	
n-p-n	h_{FE} = 70	0.25	5				V_{CEO} = 18 V	height < 5.8	
transmitter	f_T = 1 GHz	0.25	5				P_{tot} = 5.5 W	leads > 21.7	
f.m.	P_i < 0.5 W	—	13.8				T_j = 200°C	stud length < 12	
	P_o = 2 W	—	13.8				$R_{th\,j-h}$ = 31°C/W	stud: 8–32 UNC	
	G_p > 6 dB	—	13.8						
	η > 60%	—	13.8						
BLY53	$V_{BE} < 1.5$ V	0.5	5	C_c = 10 pF	0	13.8	I_{CM} = 4 A	diameter < 10	
n-p-n	h_{FE} = 50	0.5	5				V_{CEO} = 18 V	height < 5.8	
transmitter	f_T = 800 MHz	0.5	5				P_{tot} = 15 W	leads > 21.7	
f.m.	P_i < 2 W	—	13.8				T_j = 200°C	stud length < 12	
	P_o = 6 W	—	13.8				$R_{th\,j-h}$ = 12.5°C/W	stud: 8–32 UNC	
	G_p > 4.7 dB	—	13.8						
	η > 60%	—	13.8						

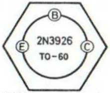
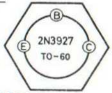
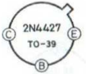
TRANSMITTING TRANSISTORS

Type and applications	*Characteristics at:*	I_C (A)	V_{CE} (V)	*Characteristics at:*	I_E (A)	V_{CB} (V)	*Ratings*	*Outlines (mm)*
BLY76	$V_{BE} < 1.5$ V	0.25	5	$C_c = 3.5$ pF	0	28	I_{CM} = 1 A	diameter < 10 
n-p-n	$h_{FE} = 30$	0.25	5				V_{CEO} = 36 V	height < 5.8
transmitter	f_T = 900 MHz	0.25	5				P_{tot} = 4 W	leads > 21.7
f.m.	P_i < 0.4 W	—	28				T_j = 200°C	stud length < 12
	P_o < 2 W	—	28				$R_{th\,j-h}$ = 31°C/W	stud : 8–32 UNC
	G_p > 7 dB	—	28					
	η > 60%	—	28					
BLY87	$h_{FE} > 5$	0.5	5	$C_c < 15$ pF	0	15	I_{CM} = 3.75 A	diameter < 9.6 
n-p-n	f_T = 700 MHz	0.35	10				V_{CEO} = 18 V	height < 5.75
transmitter	P_i < 1.0 W	—	13.5				P_{tot} = 16 W	leads > 25
v.h.f.	P_o = 8 W	—	13.5				T_j = 200°C	stud length < 12
	G_p > 9 dB	—	13.5				$R_{th\,j-h}$ = 11°C/W	stud : 8–32 UNC
	η > 70%	—	13.5					
BLY88	$h_{FE} > 5$	0.5	5	$C_c < 30$ pF	0	15	I_{CM} = 7.5 A	diameter < 9.6 
n-p-n	f_T = 700 MHz	0.7	10				V_{CEO} = 18	height < 5.75
transmitter	P_i < 2.65 W	—	13.5				P_{tot} = 29 W	leads > 25
v.h.f.	P_o < 15 W	—	13.5				T_j = 200°C	stud length < 12
	G_p > 7.5 dB	—	13.5				$R_{th\,j-h}$ = 6°C/W	stud : 8–32 UNC
	η > 65%	—	13.5					
BLY89	$h_{FE} > 5$	0.5	5	$C_c < 45$ pF	0	15	I_{CM} = 10 A	diameter < 9.6 
n-p-n	f_T = 700 MHz	1	10				V_{CEO} = 18 V	height < 5.75
transmitter	P_i < 5.75 W	—	13.5				P_{tot} = 44 W	leads > 25
v.h.f.	P_o = 23 W	—	13.5				T_j = 200°C	stud length < 12
	G_p > 6 dB	—	13.5				$R_{th\,j-h}$ = 4°C/W	stud : 8–32 UNC
	η > 70%	—	13.5					

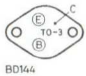
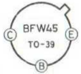
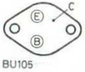
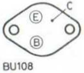
BLY91	$h_{FE} > 5$	0.5	5	$C_c < 10$ pF	0	30	$I_{CM} = 2.25$ A	diameter < 9.6	
n-p-n	$f_T = 500$ MHz	0.2	20				$V_{CEO} = 36$ V	height < 5.75	
transmitter	$P_i < 0.5$ W	—	28				$P_{tot} = 16$ W	leads > 25	
v.h.f.	$P_o = 8$ W	—	28				$T_j = 200$°C	stud length < 12	
	$G_p > 12$ dB	—	28				$R_{th\,j-h} = 11$°C/W	stud : 8–32 UNC	
	$\eta > 50\%$	—	28						
BLY92	$h_{FE} > 5$	0.5	5	$C_c < 20$ pF	0	30	$I_{CM} = 4.5$ A	diameter < 9.6	
n-p-n	$f_T = 500$ MHz	0.4	20				$V_{CEO} = 36$ V	height < 5.75	
transmitter	$P_i < 1.5$	—	28				$P_{tot} = 29$ W	leads > 25	
v.h.f.	$P_o = 15$	—	28				$T_j = 200$°C	stud length < 12	
	$G_p > 10$	—	28				$R_{th\,j-h} = 6$°C/W	stud : 8–32 UNC	
	$\eta > 50\%$	—	28						
BLY93	$h_{FE} > 5$	0.5	5	$C_c = 30$ pF	0	30	$I_{CM} = 6$ A	diameter < 9.6	
n-p-n	$f_T = 500$ MHz	0.6	20				$V_{CEO} = 30$ V	height < 5.75	
transmitter	$P_i < 2.9$ W	—	28				$P_{tot} = 44$ W	leads > 25	
v.h.f.	$P_o = 23$ W	—	28				$T_j = 200$°C	stud length < 12	
	$G_p > 9$ dB	—	28				$R_{th\,j-h} = 4$°C/W	stud : 8–32 UNC	
	$\eta > 60\%$	—	28						
2N3375	$V_{BE} < 1.5$ V	0.5	5	$C_c < 10$ pF	0	28	$I_{CM} = 1.5$ A	length < 7.6	
n-p-n	$h_{FE} > 15$	0.125	5				$V_{CEO} = 40$ V	width < 8.6	
transmitter	$h_{FE} > 10$	0.25	5				$P_{tot} = 11.6$ W	stud < 11.5	
v.h.f.	$f_T = 500$ MHz	0.125	28				$T_j = 200$°C	leads 3.9	
u.h.f.	$P_o = 7.5$ W	< 0.41	28				$R_{th\,j-mb} = 15$°C/W	stud : 10–32 UNF	
	$G_p > 8.7$ dB	< 0.41	28						
	$\eta > 65\%$	< 0.41	28						

TRANSMITTING TRANSISTORS

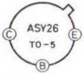
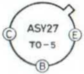
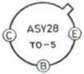
Type and applications	Characteristics at:	I_C (A)	V_{CE} (V)	Characteristics at:	I_E (A)	V_{CB} (V)	Ratings	Outlines (mm)
2N3553	$V_{BE} < 1.5$ V	0.25	5	$C_c < 10$ pF	0	28	$I_{CM} = 1$ A	length < 6.6
n-p-n	$h_{FE} > 15$	0.125	5				$V_{CEO} = 40$ V	width < 8.5
transmitter	$h_{FE} > 10$	0.25	5				$P_{tot} = 7$ W	leads > 12.7
v.h.f.	$f_T = 500$ MHz	0.125	28				$T_j = 200$°C	
u.h.f.	$P_o = 2.5$ W	< 0.18	28				$R_{th\,j-mb} = 25$°C/W	
	$G_p > 10$ dB	< 0.18	28					
	$\eta > 50\%$	< 0.18	28					
2N3632	$V_{BE} < 1.5$ V	1	5	$C_c < 20$ pF	0	28	$I_{CM} = 3$ A	length < 7.6
n-p-n	$h_{FE} > 10$	0.25	5				$V_{CEO} = 40$ V	width < 8.6
transmitter	$h_{FE} > 5$	1	5				$P_{tot} = 23$ W	stud < 11.5
v.h.f.	$f_T = 400$ MHz	0.25	28				$T_j = 200$°C	leads 3.9
u.h.f.	$P_o > 13.5$ W	0.69	28				$R_{th\,j-mb} = 7.5$°C/W	stud: 10–32 UNF
	$G_p > 5.9$ dB	0.69	28					
	η 70%	0.69	28					
2N3866	$h_{FE} > 10$	0.05	5	$C_c < 3$ pF	0	28	$I_{CM} = 0.4$ A	length < 6.6
n-p-n	$h_{FE} > 5$	0.36	5				$V_{CEO} = 30$ V	width < 8.5
class A, B, C	$f_T = 700$ MHz	0.025	15				$P_{tot} = 5$ W	leads > 12.7
multiplier	$P_o = 1.8$ W	< 0.107	28				$T_j = 200$°C	
oscillator	$\eta > 60\%$	< 0.107	28				$R_{th\,j-mb} = 35$°C/W	
2N3924	$V_{BE} < 1.5$ V	0.25	5	$C_c < 20$ pF	0	13.5	$I_{CM} = 1.5$ A	length < 6.6
n-p-n	$h_{FE} > 10$	0.25	5				$V_{CEO} = 18$ V	width < 8.5
transmitter	$f_T > 250$ MHz	0.1	13.5				$P_{tot} = 7$ W	leads > 12.7
v.h.f.	$P_o = 4$ W	< 0.42	14				$T_j = 200$°C	
	$G_p > 6$ dB	< 0.42	14				$R_{th\,j-mb} = 25$°C/W	
	$\eta > 70\%$	< 0.42	14					

2N3926	$V_{BE} < 1.5$ V	0.5	5	$C_c < 20$ pF	0	13.5	$I_{CM} = 3$ A	length < 7.6	
n-p-n	$h_{FE} > 5$	0.5	5				$V_{CEO} = 18$ V	width < 8.6	
transmitter	$f_T > 250$	0.1	13.5				$P_{tot} = 11.6$ W	stud < 11.5	
v.h.f.	$P_o = 7$ W	< 0.74	14				$T_j = 200°$C	leads = 3.9	
	$G_p > 5.4$ dB	< 0.74	14				$R_{th\,j-mb} = 15°$C/W	stud: 10–32 UNF	
	$\eta > 70\%$	< 0.74	14						
2N3927	$V_{BE} < 1.5$ V	1	5	$C_c < 45$ pF	0	13.5	$I_{CM} = 4.5$ A	length < 7.6	
n-p-n	$h_{FE} > 5$	1	5				$V_{CEO} = 18$ V	width < 8.6	
transmitter	$f_T > 200$ MHz	0.2	13.5				$P_{tot} = 23$ W	stud < 11.5	
v.h.f.	$P_o = 12$ W	< 1.1	14				$T_j = 200°$C	leads = 3.9	
	$G_p > 4.8$ dB	< 1.1	14				$R_{th\,j-mb} = 7.5°$C/W	stud: 10–32 UNF	
	$\eta > 80\%$	< 1.1	14						
2N4427	$h_{FE} > 10$	0.1	5	$C_c < 4$ pF	0	12	$I_{CM} = 0.4$ A	length < 6.6	
n-p-n	$h_{FE} > 5$	0.36	5				$V_{CEO} = 20$ V	width < 8.5	
class A, B, C	$f_T = 700$ MHz	0.025	10				$P_{tot} = 3.5$ W	leads > 12.7	
multiplier	$P_o = 1$ W	< 0.167	12				$T_j = 200°$C		
oscillator	$\eta > 50\%$	< 0.167	12				$R_{th\,j-mb} = 35°$C/W		

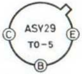
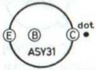
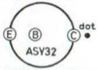
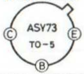
DEFLECTION TRANSISTORS

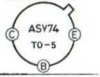
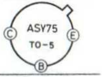
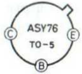
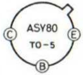
Type and applications	*Characteristics at:*	I_C *(A)*	V_{CE} *(V)*	*Characteristics at:*	I_E *(A)*	V_{CB} *(V)*	*Ratings*	*Outlines (mm)*
BD144 n-p-n vert. defl.	$V_{BE} < 0.9$ V $h_{FE} > 5$ $h_{FE} > 20$ $f_T = 12$ MHz	0.2 0.005 0.2 0.05	20 20 20 5	$I_{CBO} < 3$ mA	0	800	$I_{CM} = 250$ mA $-I_{EM} = 250$ mA $V_{CERM} = 800$ V $P_{tot} = 8$ W $T_j = 135°$C $R_{th\,j-mb} = 5°$C/W	length < 39.5 width < 26.6 height < 9.5 leads > 11 
BFW45 n-p-n horizontal defl. oscilloscopes	$V_{BE} < 1.3$ V $h_{FE} > 20$ $-C_{re} < 3.5$ pF $f_T = 120$ MHz	50 50 10 10	20 20 20 10	$I_{CBO} < 100$ nA $C_c < 6$ pF	0 0	100 20	$I_{CM} = 100$ mA $V_{CEO} = 130$ V $P_{tot} = 2.5$ W $T_j = 200°$C $R_{th\,j-a} = 200°$C/W	length < 6.6 width < 8.5 leads > 12.7 
BU105 n-p-n horizontal deflection	$V_{BE} = 1$ V $h_{FE} = 8$ $f_T = 7.5$ MHz	2 0.8 0.1	5 5 5	$C_c = 65$ pF $t_f = 0.75$ μs at: $I_{CMnom} = 2$ A $I_{B(end)nom} = 1.5$ A $L_B = 10$ μH	0	10	$I_{CM} = 2.5$ A $-I_{EM} = 4.0$ A $-I_{BM} = 1.5$ A $V_{CERM} = 1500$ V $P_{tot} = 10$ W $T_j = 115°$C $R_{th\,j-mb} = 2.5°$C/W	length < 39.5 width < 26.6 height < 9.5 leads > 11 
BU108 n-p-n horizontal deflection colour t.v.	$h_{FE} = 4$ $f_T = 7$ MHz	4 0.1	5 5	$C_c = 125$ pF $t_f = 0.7$ μs at: $I_{CMnom} = 4.5$ A $I_{B(end)nom} = 1.8$ A $L_B = 10$ μH	0	10	$I_{CM} = 5$ A $-I_{EM} = 7$ A $-I_{BM} = 2.5$ A $V_{CERM} = 1500$ V $P_{tot} = 12.5$ W $T_j = 115°$C $R_{th\,j-mb} = 1.6°$C/W	length < 39.5 width < 26.6 height < 9.5 leads > 11 

SWITCHING TRANSISTORS

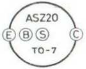
Type and applications	*Characteristics at:*	I_C *(mA)*	V_{CE} *(V)*	I_E *(mA)*	V_{CB} *(V)*	*Characteristics at:*	I_C *(mA)*	I_B *(mA)*	*Ratings*	*Outlines (mm)*
ASY26	$-V_{BE} < 1.5$ V	−300	−1			$-V_{CE\,\mathrm{sat}} < 0.25$ V	−50	−2	$-I_{CM} = 300$ mA	length < 6.6
p-n-p	$h_{FE} < 80$	−20	−1			$-V_{BE\,\mathrm{sat}} < 0.55$ V	−50	−2.4	$-V_{CEO} = 15$ V	width < 8.5
general	$h_{FE} = 27$	−200	−1			$t_d < 75$ ns			$P_{\mathrm{tot}} = 150$ mW	leads > 38
	$f_T = 8$ MHz	−3	−5			$t_r < 350$ ns			$T_j = 85°$C	
	$h_{fe} = 50$	−2	−5			$t_s < 1500$ ns			$R_{th\,j-a} = 0.4°$C/mW	
	$-I_{CBO} < 7\ \mu$A			0	−30	$t_f < 620$ ns				
	$C_c < 16$ pF			0	−5					
ASY27	$-V_{BE} < 1.4$ V	−300	−1			$-V_{CE\,\mathrm{sat}} < 0.25$ V	−50	−1.25	$-I_{CM} = 300$ mA	length < 6.6
p-n-p	$h_{FE} = < 150$	−20	−1			$-V_{BE\,\mathrm{sat}} < 0.45$ V	−50	−1.55	$-V_{CEO} = 15$ V	width < 8.5
general	$h_{FE} = 40$	−200	−1			$t_d < 75$ ns			$P_{\mathrm{tot}} = 150$ W	leads > 38
	$f_T = 14$ MHz	−3	−5			$t_r < 350$ ns			$T_j = 85°$C	
	$h_{fe} = 90$	−2	−5			$t_s < 1500$ ns			$R_{th\,j-a} = 0.4°$C/mW	
	$-I_{BCO} < 7\ \mu$A			0	−25	$t_f < 620$ ns				
	$C_c < 16$ pF			0	−5					
ASY28	$V_{BE} < 1.5$ V	300	1			$V_{CE\,\mathrm{sat}} < 0.25$ V	50	2	$I_{CM} = 300$ mA	length < 6.6
n-p-n	$h_{FE} < 80$	20	1			$V_{BE\,\mathrm{sat}} < 0.55$ V	50	2.4	$V_{CEO} = 15$ V	width < 8.5
general	$h_{FE} = 32$	200	1			$t_d < 90$ ns			$P_{\mathrm{tot}} = 150$ mW	leads > 38
	$f_T = 14$ MHz	3	5			$t_r < 400$ ns			$T_j = 85°$C	
	$h_{fe} = 50$	2	5			$t_s < 700$ ns			$R_{th\,j-a} = 0.4°$C/mW	
	$I_{CBO} < 7\ \mu$A			0	30	$t_f < 620$ ns				
	$C_c < 16$ pF			0	5					

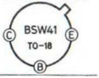
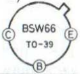
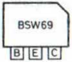
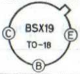
SWITCHING TRANSISTORS

Type and applications	Characteristics at:	I_C (mA)	V_{CE} (V)	I_E (mA)	V_{CB} (V)	Characteristics at:	I_C (mA)	I_B (mA)	Ratings	Outlines (mm)
ASY29	$V_{BE} < 1.4$ V	300	1			$V_{CE\,sat} < 0.25$ V	50	1.25	$I_{CM} = 300$ mA	length < 6.6
n-p-n	$h_{FE} < 150$	20	1			$V_{BE\,sat} < 0.45$ V	50	1.55	$V_{CEO} = 15$ V	width < 8.5
general	$h_{FE} = 84$	200	1			$t_d < 75$ ns			$P_{tot} = 150$ mW	leads > 38
	$f_T = 20$ MHz	3	5			$t_r < 300$ ns			$T_j = 85°$C	
	$h_{fe} = 90$	2	5			$t_s < 800$ ns			$R_{th\,j-a} = 0.4°$C/mW	
	$I_{CBO} < 7$ μA			0	25	$t_f < 520$ ns				
	$C_c < 16$ pF			0	5					
ASY31	$f_T > 4$ MHz	−3	−5			$-V_{CE\,sat} < 0.25$ V	−50	−2	$-I_{CM} = 200$ mA	length < 15
p-n-p	$-I_{CBO} < 3$ μA			0	−5	$-V_{BE\,sat} < 0.55$ V	−50	−2.4	$-V_{CEO} = 15$ V	width < 5.2
computer	$-V_{BE} < 0.65$ V			100	0				$P_{tot} = 175$ mW	leads > 37
	$h_{FE} > 30$			10	0				$T_j = 75°$C	
	$h_{FE} > 20$			100	0				$R_{th\,j-a} = 0.4°$C/mW	
	$C_c < 16$ pF			0	−5					
ASY32	$f_T > 6$ MHz	−3	−5			$-V_{CE\,sat} < 0.25$ V	−50	−1.25	$-I_{CM} = 200$ mA	length < 15
p-n-p	$-I_{CBO} < 3$ μA			0	−5	$-V_{BE\,sat} < 0.45$ V	−50	−1.55	$-V_{CEO} = 15$ V	width < 5.2
computer	$-V_{BE} < 0.55$ V			100	0				$P_{tot} = 125$ mW	leads > 37
	$h_{FE} > 50$			10	0				$T_j = 75°$C	
	$h_{FE} > 30$			100	0				$R_{th\,j-a} = 0.4°$C/mW	
	$C_c < 16$ pF			0	−5					
ASY73	$I_{CBO} < 3$ μA			0	5	$V_{CE\,sat} < 0.30$ V	200	10	$I_C = 400$ mA	length < 6.6
n-p-n	$h_{FE} > 20$			−200	0	$V_{BE\,sat} < 0.90$ V	200	12	$V_{CEO} = 15$ V	width < 8.5
symmetrical	$C_c < 30$ pF			0	5				$P_{tot} = 140$ mW	leads > 38
	$f_T > 4$ MHz			−3	5				$T_j = 75°$C	
									$R_{th\,j-a} = 0.35°$C/mW	

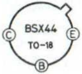
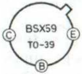
ASY74	$I_{CBO} < 3\ \mu A$			0	5	$V_{CE\,sat} < 0.37$ V	400	20	$I_C = 400$ mA	length < 6.6
n-p-n	$h_{FE} > 20$			−400	0	$V_{BE\,sat} < 0.70$ V	200	7	$V_{CEO} = 15$ V	width < 8.5
symmetrical	$C_c < 30$ pF			0	5				$P_{tot} = 140$ mW	leads > 38
	$f_T > 6$ MHz			−3	5				$T_j = 75$°C	
									$R_{th\,j-a} = 0.35$°C/mW	
ASY75	$I_{CBO} < 3\ \mu A$			0	5	$V_{CE\,sat} < 0.37$ V	400	13.5	$I_C = 400$ mA	length < 6.6
n-p-n	$h_{FE} > 30$			−400	0	$V_{CE\,sat} < 0.6$ V	200	5	$V_{CEO} = 15$ V	width < 8.5
symmetrical	$C_c < 30$ pF			0	5				$P_{tot} = 140$ mW	leads > 38
	$f_T > 10$ MHz			−3	5				$T_j = 75$°C	
									$R_{th\,j-a} = 0.35$°C/mW	
ASY76	$h_{FE} > 75$	−10	−6			$-V_{CE\,sat} < 0.3$ V	−300	−12	$-I_{CM} = 1$ A	length < 6.6
p-n-p	$h_{FE} < 130$	−300	0						$-V_{CEX} = 32$ V	width < 8.5
pulse-	$f_T > 0.5$ MHz	−10	−5						$P_{tot} = 500$ mW	leads > 38
oscillator	$h_{fe} = 81$	−25	−5						$T_j = 85$°C	
	$-I_{CBO} < 10\ \mu A$			0	−10				$R_{th\,j-a} = 0.25$°C/mW	
	$-V_{BE} < 0.75$ V			300	0					
	$C_c < 60$ pF			0	−5					
	$F < 15$ dB			0.5	−2					
ASY77	Equivalent to ASY76 except for								$-V_{CEX} = 60$ V	
ASY80	$f_T > 0.7$ MHz	−10	−5			$-V_{CE\,sat} < 0.4$ V	−300	−6	$-I_{CM} = 1$ A	length < 6.6
p-n-p	$h_{fe} = 96$	−25	−5						$-V_{CEX} = 10$ V	width < 8.5
pulse-	$-I_{CBO} < 10\ \mu A$			0	−10				$P_{tot} = 500$ mW	leads > 38
oscillatoı	$-V_{BE} < 0.75$ V			300	0				$T_j = 85$°C	
	$h_{FE} > 60$			−50	0				$R_{th\,j-a} = 0.25$°C/mW	
	$h_{FE} > 50$			−300	0					
	$C_c < 60$ pF			0	−5					
	$F < 15$ dB			0.5	−2					

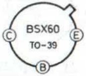
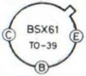
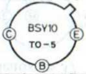
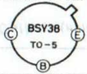
SWITCHING TRANSISTORS

Type and applications	*Characteristics at:*	I_C *(mA)*	V_{CE} *(V)*	I_E *(mA)*	V_{CB} *(V(*	*Characteristics at:*	I_C *(mA)*	I_B *(mA)*	*Ratings*	*Outlines (mm)*
ASZ20	$F < 6$ dB	−1	−6						$-I_C = 25$ mA	length <9.5
p-n-p	$h_{fe} > 45$	−1	−6						$-V_{CER} = 40$ V	width <8.6
wide-band	$\|y_{fe}\| = 310$ mΩ^{-1}	−10	−6						$P_{tot} = 110$ mW	leads >38
	$-I_{CBO} < 4.5$ μA			0	−6				$T_j = 75$°C	
	$h_{FE} > 40$			−1	−6				$R_{th\,j-a} = 0.6$°C/mW	
	$h_{FE} < 500$			−10	−2					
	$C_c < 2.5$ pF			0	−6					
	$f_1 > 100$ MHz			10	−2					
ASZ21	$h_{FE} > 30$	−10	−0.5			$-V_{CE\,sat} < 1.1$ V	−50	−3	$-I_{CM} = 50$ mA	length <5.3
p-n-p	$h_{FE} > 50$	−30	−1.0			$-V_{BE\,sat} < 0.75$ V	−30	−0.9	$-V_{CEO} = 15$ V	width <4.8
fast	$-I_{CBO} < 3.5$ μA			0	−0.5	$t_d = 30$ ns			$P_{tot} = 120$ mW	leads >12.7
	$C_c < 5$ pF			0	−6	$t_r = 20$ ns			$T_j = 85$°C	
	$f_T > 300$ MHz			10	−2	$t_r = 40$ ns			$R_{th\,j-a} = 0.5$°C/mW	
						$t_f = 40$ ns				
BCY30 to **34**	See section: LOW FREQUENCY TRANSISTORS									
BCY38 to **40**	See section: LOW FREQUENCY TRANSISTORS									
BCY54	See section: LOW FREQUENCY TRANSISTORS									
BCY56	See section: LOW FREQUENCY TRANSISTORS									
BCY57	See section: LOW FREQUENCY TRANSISTORS									
BRY39	See section: MISCELLANEOUS TRANSISTORS									

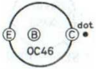
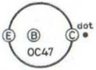
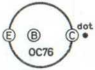
BSW41	$h_{FE} > 30$	10	10			$V_{CE\,sat} < 0.7$ V	500	35	$I_{CM} = 500$ mA	length < 5.3
n-p-n	$h_{FE} > 20$	500	10			$V_{BE\,sat} < 1.8$ V	500	50	$V_{CEO} = 25$ V	width < 4.8
driver	$f_T > 250$ MHz	50	10			$t_{on} < 50$ ns			$P_{tot} = 1$ W	leads > 12.7
	$I_{CBO} < 0.5$ μA			0	30	$t_{off} < 100$ ns			$T_j = 200$°C	
	$C_c < 8$ pF			0	10				$R_{th\,j-a} = 0.175$°C/mW	
BSW66	$h_{FE} < 30$	10	5			$V_{CE\,sat} < 0.4$ V	500	50	$I_{CM} = 2$ A	length < 6.6
n-p-n	$h_{FE} > 15$	1 A	5			$V_{BE\,sat} < 1.1$ V	500	50	$V_{CEO} = 100$ V	width < 8.5
general	$f_T = 80$ MHz	100	20			$t_{on} = 0.5$ μs			$P_{tot} = 0.8$ W	leads > 12.7
inductive load	$I_{CBO} < 100$ μA			0	100	$t_{off} = 1$ μs			$P_{tot} = 5$ W($T_{case} = 25$°C)	
switching	$C_c < 35$ pF			0	10				$T_j = 200$°C	
									$R_{th\,j-a} = 220$°C/W	
BSW67	Equivalent to BSW66 except for:								$V_{CEO} = 120$ V	
BSW68	Equivalent to BSW66 except for:					$V_{CE\,sat} < 0.5$ V	500	50	$V_{CEO} = 150$ V	
BSW69	$V_{BE} < 0.75$ V	4	2			$V_{CE\,sat} < 4$ V	20	1	$I_C = 50$ mA	length < 7.62
n-p-n	$h_{FE} > 30$	4	2						$V_{CER} = 150$ V	width < 2.5
driver	$f_T = 130$ MHz	10	5						$P_{tot} = 125$ mW	height < 6.5
	$I_{CBO} < 100$ nA			0	100				$T_j = 125$°C	leads > 2.3
	$I_{CBO} < 10$ μA			0	150				$R_{th\,j-a} = 0.6$°C/mW	
	$C_c = 2$ pF			0	10					
BSX19	$V_{BE} = 0.8$ V	10	1			$V_{CE\,sat} < 0.25$	10	1	$I_{CM} = 500$ mA	length < 5.3
n-p-n	$h_{FE} < 60$	10	1			$V_{BE\,sat} < 0.85$	10	1	$V_{CEO} = 15$ V	width < 4.8
fast	$h_{FE} > 10$	100	2			$t_s < 10$ ns			$P_{tot} = 360$ mW	leads > 12.7
	$f_T = 500$ MHz	10	10						$T_j = 200$°C	
	$I_{CBO} < 400$ nA			0	20				$R_{th\,j-a} = 0.48$°C/mW	
	$C_c < 4$ pF			0	5					

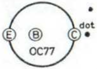
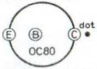
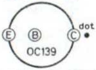
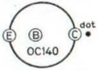
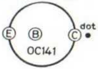
SWITCHING TRANSISTORS

Type and applications	Characteristics at:	I_C (mA)	V_{CE} (V)	I_E (mA)	V_{CB} (V)	Characteristics at:	I_C (mA)	I_B (mA)	Ratings	Outlines (mm)
BSX20	Equivalent to BSX19 except for:					$t_s < 13$ ns				
	$h_{FE} > 120$	10	1							
	$h_{FE} > 20$	100	2							
	$f_T = 600$ MHz	10	10							
BSX21	$h_{FE} = 82$	10	1			$V_{CE\,sat} = 0.7$ V	4	0.4	$I_{CM} = 250$ mA	length < 5.3
n-p-n	$h_{FE} = 55$	20	1			$V_{BE\,sat} = 1.2$ V	4	0.4	$V_{CEO} = 80$ V	width < 4.8
driver	$f_T = 160$ MHz	4	10						$P_{tot} = 300$ mW	leads > 12.7
	$I_{CBO} < 50$ μA			0	90				$T_j = 175$°C	
	$C_c = 3.4$ pF			0	10				$R_{th\,j-a} = 0.5$°C/mW	
BSX44	$h_{FE} = 80$	1	0.3			$V_{CE\,sat} < 0.45$ V	50	5	$I_{CM} = 200$ mA	length < 5.3
n-p-n	$h_{FE} = 45$	50	0.5			$V_{BE\,sat} < 1.30$ V	50	5	$V_{CEO} = 60$ V	width < 4.8
ultra	$h_{FE} = 25$	100	1			$t_{on} = 6$ ns			$P_{tot} = 300$ mW	leads > 12.7
high-speed	$f_T = 740$ MHz	20	2			$t_{off} = 8$ ns			$T_j = 200$°C	
	$I_{CBO} < 50$ nA			0	5				$R_{th\,j-a} = 0.58$°C/mW	
	$C_c < 3$ pF			0	5					
BSX59	$h_{FE} > 30$	500	1						$I_{CM} = 1$ A	length < 6.6
n-p-n	$h_{FE} < 90$	500	1						$V_{CEO} = 45$ V	width < 8.5
high-speed	$f_T = 450$ MHz	50	10						$P_{tot} = 0.8$ V	leads > 38.0
core driver	$I_{CBO} < 500$ nA			0	40				$T_j = 200$°C	
	$C_c < 10$ pF			0	10				$R_{th\,j-a} = 220$°C/W	

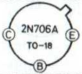
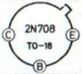
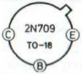
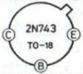
BSX60	$h_{FE} > 30$	500	1						$I_{CM} = 1$ A	length < 6.6
n-p-n	$h_{FE} < 90$	500	1						$V_{CEO} = 30$ V	width < 8.5
high-speed	$f_T = 475$	50	10						$P_{tot} = 0.8$ W	leads > 38.0
core driver	$I_{CBO} < 500$ nA			0	40				$T_j = 200$°C	
	$C_c < 10$ pF			0	10				$R_{th\,j-a} = 200$°C/W	
BSX61	$h_{FE} > 30$	500	1						$I_{CM} = 1$ A	length < 6.6
n-p-n	$h_{FE} < 90$	500	1						$V_{CEO} = 45$ V	width < 8.5
high-speed	$f_T = 475$ MHz	50	10						$P_{tot} = 0.8$ W	leads > 38.0
core driver	$I_{CBO} < 500$ nA			0	40				$T_j = 200$°C	
	$C_c < 10$ pF			0	10				$R_{th\,j-a} = 220$°C/W	
BSX82	See section: FIELD EFFECT TRANSISTORS									
BSY10	$h_{FE} < 45$	10	5			$V_{CE\,sat} < 1$ V	10	1	$I_{CM} = 75$ mA	length < 8.5
n-p-n	$f_T = 180$ MHz	5	10			$t_d = 4.7$ ns			$V_{CEX} = 60$ V	width < 6.6
high-speed	$F < 40$ dB	5	10			$t_r = 13$ ns			$P_{tot} = 300$ mW	leads > 38
	$h_{fe} > 40$	5	5			$t_s = 35$ ns			$T_j = 175$°C	
	$I_{CBO} < 2\ \mu$A			0	20	$t_f = 75$ ns			$R_{th\,j-a} = 0.5$°C/mW	
	$C_c = 5$ pF			0	5					
BSY11	Equivalent to BSY10 except for:								$V_{CEX} = 45$ V	
	$h_{FE} < 60$	10	5							
	$h_{fe} > 55$	5	5							
BSY38	$h_{FE} < 60$	10	0.35			$V_{CE\,sat} < 0.6$ V	100	10	$I_{CM} = 200$ mA	length < 5.3
n-p-n	$h_{FE} < 45$	100	1			$V_{BE\,sat} < 1.5$ V	100	10	$V_{CEX} = 15$ V	width < 4.8
very	$f_T = 350$ MHz	10	2			$t_{on} < 14$ ns			$P_{tot} = 300$ mW	leads > 12.7
high-speed	$I_{CBO} < 100$ nA			0	20	$t_{off} < 45$ ns			$T_j = 175$°C	
	$-V_{EB} = 0.95$ V			-100	0				$R_{th\,j-a} = 0.5$°C/mW	
	$C_c < 5$ pF			0	5					

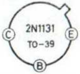
SWITCHING TRANSISTORS

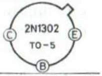
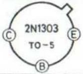
Type and applications	*Characteristics at:*	I_C *(mA)*	V_{CE} *(V)*	I_E *(mA)*	V_{CB} *(V)*	*Characteristics at:*	I_C *(mA)*	I_B *(mA)*	*Ratings*	*Outlines (mm)*
BSY39	Equivalent to BSY38 except for:									
	$h_{FE} < 120$	10	0.35							
	$h_{FE} < 70$	100	1							
OC46 p-n-p high-speed	$h_{FE} < 80$			15	0				$-I_{CM} = 125$ mA $-V_{CEX} = 20$ V $P_{tot} = 80$ mW $T_j = 90°C$ $R_{th\,j-a} = 0.6°C/mW$	length < 15 width < 5.2 leads > 37 
	$f_{hfb} > 3$ MHz			3	−5					
OC47 p-n-p high-speed	$h_{FE} < 200$			15	0				$-I_{CM} = 125$ mA $-V_{CEX} = 20$ V $P_{tot} = 8$ mW $T_j = 90°C$ $R_{th\,j-a} = 0.6°C/mW$	length < 15 width < 5.2 leads > 37 
	$f_{hfb} > 4.5$ MHz			3	−5					
OC76 p-n-p pulse- oscillator	$-V_{BE} < 0.7$ V	−125	−0.7						$-I_{CM} = 250$ mA $-V_{CEO} = 16$ V $P_{tot} = 125$ mW $T_j = 75°C$ $R_{th\,j-a} = 0.4°C/mW$	length < 15.7 width < 6.0 leads > 37 
	$h_{FE} < 170$	−125	−0.7							
	$h_{FE} < 125$	−250	−1							
	$-I_{CBO} < 10\ \mu A$			0	−10					
	$f_{hfb} = 0.9$ MHz			10	−6					
	$F < 15$ dB			−0.5	−2					

OC77	$-V_{BE} < 0.7$ V	−125	−0.7						$-I_{CM} = 250$ mA	length < 15.7
p-n-p	$h_{FE} > 25$	−125	−0.7						$-V_{CEO} = 15$ V	width < 6.0
pulse-	$h_{FE} > 15$	−250	−1						$P_{tot} = 125$ mW	leads > 37
oscillator	$-I_{CBO} < 10$ μA			0	−10				$T_j = 75$°C	
	$f_{hfb} > 0.35$ MHz			10	−6				$R_{th\,j-a} = 0.4$°C/mW	
	$F < 15$ dB			−0.5	−2					
OC80	$h_{FE} = 180$	−50	−6						$-I_{CM} = 600$ mA	length < 15.7
p-n-p	$-I_{CBO} < 20$ μA			0	−12				$-V_{CES} = 32$ V	width < 6.0
pulse-	$h_{FE} = 85$			600	0				$P_{tot} = 550$ mW	leads > 37
oscillator	$f_{hfb} = 2$ MHz			50	−6				$T_j = 75$°C	
									$R_{th\,j-a} = 0.22$°C/mW	
OC139	$f_T = 6$ MHz	3	5			$V_{CE\,sat} < 0.22$ V	50	3.1	$I_C = 250$ mA	length < 15
n-p-n	$I_{CBO} < 3$ μA			0	5	$V_{BE\,sat} < 0.5$ V	50	3.1	$V_{CEX} = 20$ V	width < 5.2
symmetrical	$h_{FE} < 84$			−15	0				$P_{tot} = 145$ mW	leads > 37
high-speed	$h_{FE} > 15$			−200	0				$T_j = 75$°C	
									$R_{th\,j-a} = 0.35$°C/mW	
OC140	$f_T = 12$ MHz	3	5			$V_{CE\,sat} < 0.37$ V	400	20	$I_C = 400$ mA	length < 15
n-p-n	$I_{CBO} < 3$ μA			0	5	$V_{BE\,sat} < 0.90$ V	400	20	$V_{CEX} = 20$ V	width < 5.2
symmetrical	$h_{FE} < 150$			−15	0				$P_{tot} = 145$ mW	leads > 37
high-speed	$h_{FE} < 67$			−200	0				$T_j = 75$°C	
									$R_{th\,j-a} = 0.35$°C/mW	
OC141	$f_T = 20$ MHz	3	5			$V_{CE\,sat} < 0.37$ V	400	13.3	$I_C = 400$ mA	length < 15
n-p-n	$I_{CBO} < 3$ μA			0	5	$V_{BE\,sat} < 0.70$ V	400	20	$V_{CEX} = 20$ V	width < 5.2
symmetrical	$h_{FE} < 200$			−15	0				$P_{tot} = 145$ mW	leads > 37
high-speed	$h_{FE} < 134$			−200	0				$T_j = 75$°C	
									$R_{th\,j-a} = 0.35$°C/mW	

SWITCHING TRANSISTORS

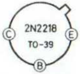
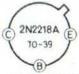
Type and applications	*Characteristics at:*	I_C *(mA)*	V_{CE} *(V)*	I_E *(mA)*	V_{CB} *(V)*	*Characteristics at:*	I_C *(mA)*	I_B *(mA)*	*Ratings*	*Outlines (mm)*
2N706A	$h_{FE} < 60$	10	1			$V_{CE\,sat} < 0.6$ V	10	1	$I_C = 50$ mA	length < 5.3
n-p-n	$f_T > 200$ MHz	10	10			$V_{BE\,sat} < 0.9$ V	10	1	$V_{CEO} = 15$ V	width < 4.8
high-speed	$I_{CBO} < 10\ \mu$A			0	25	$t_{on} < 40$ ns			$P_{tot} = 300$ mW	leads > 12.7
	$C_c < 5$ pF			0	5	$t_{off} < 75$ ns			$T_j = 175$°C	
									$R_{th\,j-a} = 0.5$°C/mW	
2N708	$h_{FE} > 15$	0.5	1			$V_{CE\,sat} < 0.4$ V	10	1	$I_{CM} = 500$ mA	length < 5.3
n-p-n	$h_{FE} < 120$	10	1			$V_{BE\,sat} < 0.8$ V	10	1	$V_{CEO} = 15$ V	width < 4.8
very	$f_T > 300$	10	10			$t_s < 25$ ns			$P_{tot} = 360$ mW	leads > 12.7
high-speed	$I_{CBO} < 25$ nA			0	20				$T_j = 200$°C	
	$C_c < 6$ pF			0	10				$R_{th\,j-a} = 0.48$°C/mW	
2N709	$h_{FE} < 120$	10	0.5			$V_{CE\,sat} < 0.3$ V	3	0.15	$I_{CM} = 200$ mA	length < 5.3
n-p-n	$h_{FE} > 15$	30	1			$V_{BE\,sat} < 0.85$ V	3	0.15	$V_{CEO} = 6$ V	width < 4.8
ultra	$f_T > 600$ MHz	5	4			$t_{on} < 15$ ns			$P_{tot} = 300$ mW	leads > 12.7
high-speed	$I_{CBO} < 50$ nA			0	5	$t_{off} < 15$ ns			$T_j = 200$°C	
	$C_c < 3$ pF			0	5				$R_{th\,j-a} = 0.58$°C/mW	
2N743	$h_{FE} > 10$	1	0.25			$V_{CE\,sat} < 1$ V	100	10	$I_C = 200$ mA	length < 5.3
n-p-n	$h_{FE} > 20$	10	0.35			$V_{BE\,sat} < 1.5$ V	100	10	$V_{CEO} = 12$ V	width < 4.8
very	$h_{FE} > 10$	100	1			$t_s < 14$ ns			$P_{tot} = 300$ mW	leads > 12.7
high-speed	$f_T > 300$ MHz	10	10						$T_j = 175$°C	
	$I_{CBO} < 1\ \mu$A			0	20				$R_{th\,j-a} = 0.5$°C/mW	
	$C_c < 5$ pF			0	5					

2N744	Equivalent to 2N743 except for:									
	$h_{FE} > 20$	1	0.25			$t_s < 18$ ns				
	$h_{FE} > 40$	10	0.35							
	$h_{FE} > 20$	100	1							
2N753	Equivalent to 2N706A except for:									
	$h_{FE} < 120$	10	1							
2N914	$h_{FE} > 30$	10	1			$V_{CE\,sat} < 0.7$ V	200	20	$I_{CM} = 500$ mA	length < 5.3
n-p-n	$h_{FE} > 10$	500	5			$V_{BE\,sat} < 0.8$ V	10	1	$V_{CEO} = 15$ V	width < 4.8
very	$f_T > 300$ MHz	20	10			$t_{on} < 40$ ns			$P_{tot} = 360$ mW	leads > 12.7
high-speed	$I_{CBO} < 25$ nA			0	20	$t_{off} < 40$ ns			$T_j = 200°C$	
	$C_c < 6$ pF			0	10				$R_{th\,j-a} = 0.48°C/mW$	
2N1131	$h_{FE} > 45$	−150	−10			$-V_{CE\,sat} < 1.5$ V	−150	−15	$-I_C = 0.6$ A	length < 6.6
p-n-p	$f_T > 50$ MHz	−50	−10			$-V_{BE\,sat} < 1.3$ V	−150	−15	$-V_{CEO} = 35$ V	width < 8.5
high-speed	$h_{fe} < 50$	−1	−5						$P_{tot} = 2$ W	leads > 38
	$h_{fe} > 20$	−5	−10						$T_j = 175°C$	
	$-I_{CBO} < 1$ μA			0	−3				$R_{th\,j-a} = 250°C/W$	
	$C_c < 45$ pF			0	−10					
2N1132	$h_{FE} < 90$	−150	−10			$-V_{CE\,sat} < 1.5$ V	−150	−15	$-I_C = 0.6$ A	length < 6.6
p-n-p	$f_T > 60$ MHz	−50	−10			$-V_{BE\,sat} < 1.3$ V	−150	−15	$-V_{CEO} = 35$ V	width < 8.5
high-speed	$h_{fe} < 100$	−1	−5						$P_{tot} = 2$ W	leads > 38
	$h_{fe} > 30$	−5	−10						$T_j = 175°C$	
	$-I_{CBO} < 1$ mA			0	−3				$R_{th\,j-a} = 250°C/W$	
	$C_c < 45$ pF			0	−10					

Type and applications	*Characteristics at:*	I_C *(mA)*	V_{CE} *(V)*	I_E *(mA)*	V_{CB} *(V)*	*Characteristics at:*	I_C *(mA)*	I_B *(mA)*	*Ratings*	*Outlines (mm)*
2N1302	$h_{FE} = 48$	200	0.35			$V_{CE\,sat} < 2.2$ V	10	0.5	$I_{CM} = 300$ mA	length < 6.6
n-p-n	$f_T = 10$ MHz	1	5			$V_{BE\,sat} < 0.4$ V	10	0.5	$V_{CEO} = 25$ V	width < 8.5
medium	$I_{CBO} < 6\ \mu$A			0	25	$t_d = 65$ ns			$P_{tot} = 150$ mW	leads > 38
speed	$C_c < 20$ pF			0	5	$t_r = 220$ ns			$T_j = 85$°C	
						$t_s = 500$ ns			$R_{th\,j-a} = 0.4$°C/mW	
						$t_f = 365$ ns				
2N1303	$h_{FE} = 35$	−200	−0.35			$-V_{CE\,sat} < 0.2$ V	−10	−0.5	$-I_{CM} = 300$ mA	length < 6.6
p-n-p	$f_T = 5$ MHz	−1	−5			$-V_{CE\,sat} < 0.4$ V	−10	−0.5	$-V_{CEO} = 25$ V	width < 8.5
medium	$-I_{CBO} < 6\ \mu$A			0	−25	$t_d = 60$ ns			$P_{tot} = 150$ mW	leads > 38
speed	$C_c < 20$ pF			0	−5	$t_r = 300$ ns			$T_j = 85$°C	
						$t_s = 700$ ns			$R_{th\,j-a} = 0.4$°C/mW	
						$t_f = 600$ ns				
2N1304	Equivalent to 2N1302 except for:									
	$h_{FE} = 65$	200	0.35			$V_{CE\,sat} < 0.2$ V	10	0.25		
	$f_T = 15$ MHz	1	5			$V_{BE\,sat} < 0.35$ V	10	0.5		
						$t_d = 60$ ns				
						$t_r = 210$ ns				
						$t_f = 350$ ns				
2N1305	Equivalent to 2N1303 except for:									
	$h_{FE} = 55$	−200	−0.35			$-V_{CE\,sat} < 0.2$ V	−10	−0.25		
	$f_T = 10$ MHz	−1	−5			$-V_{BE\,sat} < 0.35$ V	−10	−0.5		
						$t_d = 55$ ns				
						$t_r = 200$ ns				
						$t_f = 450$ ns				

2N1306	Equivalent to 2N1302 except for:					
	$h_{FE}=95$	200	0.35			
	$f_T=20$ MHz	1	5	$V_{CE\,sat}<0.2$ V	10	0.17
				$V_{BE\,sat}<0.35$ V	10	0.5
				$t_d=55$ ns		
				$t_r=170$ ns		
				$t_f=315$ ns		
2N1307	Equivalent to 2N1303 except for:					
	$h_{FE}=90$	−200	−0.35			
	$f_T=15$ MHz	−1	−5	$-V_{CE\,sat}<0.2$ V	−10	−0.17
				$-V_{BE\,sat}<0.35$ V	−10	−0.5
				$t_d=50$ ns		
				$t_r=180$ ns		
				$t_f=350$ ns		
2N1308	Equivalent to 2N1302 except for:					
	$h_{FE}=145$	200	0.35			
	$f_T=30$ MHz	1	5	$V_{CE\,sat}<0.2$ V	10	0.13
				$V_{BE\,sat}<0.35$ V	10	0.5
				$t_d=55$ ns		
				$t_r=165$ ns		
				$t_f=290$ ns		
2N1309	Equivalent to 2N1303 except for:					
	$h_{FE}=130$	−200	−0.35			
	$f_T=20$ MHz	−1	−5	$-V_{CE\,sat}<0.2$ V	−10	−0.13
				$-V_{BE\,sat}<0.35$ V	−10	−0.5
				$t_d=45$ ns		
				$t_r=155$ ns		
				$t_f=350$ ns		

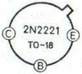
SWITCHING TRANSISTORS

Type and applications	*Characteristics at:*	I_C *(mA)*	V_{CE} *(V)*	I_E *(mA)*	V_{CB} *(V)*	*Characteristics at:*	I_C *(mA)*	I_B *(mA)*	*Ratings*	*Outlines (mm)*
2N2218	$h_{FE} > 25$	1	10			$V_{CE\,sat} < 1.6$ V	500	50	$I_C = 0.8$ A	length < 6.6
n-p-n	$h_{FE} > 40$	150	10			$V_{BE\,sat} < 2.6$ V	500	50	$V_{CEO} = 30$ V	width < 8.5
high-speed	$h_{FE} > 20$	500	10						$P_{tot} = 0.8$ W	leads > 38
	$f_T > 250$ MHz	20	20						$T_j = 75$°C	
	$I_{CBO} < 10$ nA			0	50				$R_{th\,j-a} = 190$°C/W	
	$C_c < 8$ pF			0	10					
2N2218A	$h_{FE} > 25$	1	10			$V_{CE\,sat} < 1.0$ V	500	50	$I_C = 0.8$ A	length < 6.6
n-p-n	$h_{FE} > 40$	150	10			$V_{BE\,sat} < 2.0$ V	500	50	$V_{CEO} = 40$ V	width < 8.5
high-speed	$h_{FE} > 25$	500	10						$P_{tot} = 0.8$ W	leads > 38
	$f_T > 250$ MHz	20	20						$T_j = 175$°C	
	$I_{CBO} < 10$ nA			0	60				$R_{th\,j-a} = 190$°C/W	
	$C_c < 8$ pF			0	10					
2N2219	Equivalent to 2N2218 except for:									
	$h_{FE} > 50$	1	10							
	$h_{FE} > 100$	150	10							
	$h_{FE} > 30$	500	10							
2N2219A	Equivalent to 2N2218A except for:									
	$h_{FE} > 50$	1	10							
	$h_{FE} > 100$	150	10							
	$h_{FE} > 30$	500	10							
	$f_T = 300$ MHz	20	20							

2N2221 Equivalent to 2N2218 except for:

$P_{\text{tot}} = 0.5$ W
$R_{th\,j-a} = 300°\text{C/W}$

length < 5.3
width < 4.8
leads > 12.7



2N2221A Equivalent to 2N2218A except for:

$P_{\text{tot}} = 0.5$ W
$R_{th\,j-a} = 300°\text{C/W}$

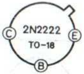
length < 5.3
width < 4.8
leads > 12.7

2N2222 Equivalent to 2N3318 except for:

$h_{FE} > 50$	1	10
$h_{FE} > 100$	150	10
$h_{FE} > 30$	500	10

$P_{\text{tot}} = 0.5$ W
$R_{th\,j-a} = 300°\text{C/W}$

length < 5.3
width < 4.8
leads > 12.7

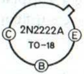


2N2222A Equivalent to 2N2218A except for:

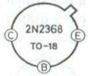
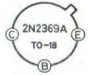
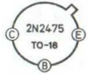
$h_{FE} > 50$	1	10
$h_{FE} > 100$	150	10
$h_{FE} > 40$	500	10
$f_T > 300$ MHz	20	20

$P_{\text{tot}} = 0.5$ W
$R_{th\,j-a} = 300°\text{C/W}$

length < 5.3
width < 4.8
leads > 12.7

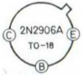
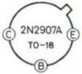


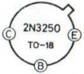
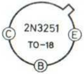
SWITCHING TRANSISTORS

Type and applications	Characteristics at:	I_C (mA)	V_{CE} (V)	I_E (mA)	V_{CB} (V)	Characteristics at:	I_C (mA)	I_B (mA)	Ratings	Outlines (mm)
2N2368	$h_{FE} > 10$	100	2			$V_{CE\,sat} < 0.25$ V	10	1	$I_{CM} = 500$ mA	length < 5.3
n-p-n	$f_T > 400$ MHz	10	10			$V_{BE\,sat} < 0.85$ V	10	1	$V_{CEO} = 15$ V	width < 4.8
very	$I_{CBO} < 0.4\ \mu$A			0	20	$t_s < 10$ ns			$P_{tot} = 360$ mW	leads > 12.7
high-speed	$C_c < 4$ pF			0	5	$t_{off} < 15$ ns			$T_j = 200°$C	
									$R_{th\,j-a} = 0.48°$C/mW	
2N2369	Equivalent to 2N2368 except for:					$t_s < 13$ ns				
	$h_{FE} > 20$	100	2			$t_{off} < 18$ ns				
	$f_T > 500$ MHz	10	10							
2N2369A	$h_{FE} > 30$	30	0.4			$V_{CE\,sat} < 0.5$ V	100	10	$I_{CM} = 500$ mA	length < 5.3
n-p-n	$h_{FE} > 20$	100	1			$V_{BE\,sat} < 1.6$ V	100	10	$V_{CEO} = 15$ V	width < 4.8
very	$f_T > 500$ MHz	10	10			$t_s = 13$ ns			$P_{tot} = 360$ mW	leads > 12.7
high-speed	$C_c < 4$ pF			0	5	$t_{off} = 18$ ns			$T_j = 200°$C	
									$R_{th\,j-a} = 0.48°$C/mW	
2N2475	$h_{FE} > 20$	1	0.3			$V_{CE\,sat} < 0.4$ V	20	0.66	$V_{CEO} = 6$ V	length < 5.3
n-p-n	$h_{FE} > 30$	20	0.4			$V_{BE\,sat} < 1.0$ V	20	0.66	$P_{tot} = 500$ mW	width < 4.8
high-speed	$h_{FE} > 20$	50	0.5			$t_{on} < 20$ ns			$T_j = 200°$C	leads > 12.7
	$f_T > 600$ MHz	20	2			$t_{off} < 15$ ns			$R_{th\,j-a} = 0.58°$C/mW	
	$I_{CBO} < 50$ nA			0	5					
	$C_c < 3$ pF			0	5					

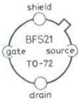
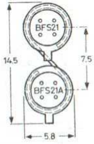
2N2904	$h_{FE} > 35$	-10	-10			$-V_{CE\,sat} < 1.6$ V	-500	-50	$-I_C = 0.6$ A	length < 6.6
p-n-p	$h_{FE} > 40$	-150	-10			$-V_{BE\,sat} < 2.6$ V	-500	-50	$-V_{CEO} = 40$ V	width < 8.5
driver	$h_{FE} > 20$	-500	-10			$t_d < 10$ ns			$P_{tot} = 3$ W	leads > 38
	$f_T > 200$ MHz	-50	-20			$t_r < 40$ ns			$T_j = 200$°C	
	$-I_{CBO} < 20$ nA			0	-50	$t_s < 80$ ns			$R_{th\,j-a} = 290$°C/W	
	$C_c < 8$ pF			0	-10	$t_f < 30$ ns				
2N2904A	Equivalent to 2N2904 except for:									
	$h_{FE} > 40$	-10	-10						$-V_{CEO} = 60$ V	
	$h_{FE} > 40$	-500	-10							
	$-I_{CBO} < 10$ nA			0	-50					
2N2905	Equivalent to 2N2904 except for:									
	$h_{FE} > 75$	-10	-10							
	$h_{FE} > 100$	-150	-10							
	$h_{FE} > 30$	-500	-10							
2N2905A	Equivalent to 2N2904 except for:									
	$h_{FE} > 100$	-10	-10						$-V_{CEO} = 60$ V	
	$h_{FE} > 100$	-150	-10							
	$h_{FE} > 50$	-500	-10							
	$-I_{CBO} < 10$ nA			0	-50					
2N2906	$h_{FE} > 20$	-0.1	-10			$-V_{CE\,sat} < 1.6$ V	-500	-50	$-I_C = 0.6$ A	length < 5.3
p-n-p	$h_{FE} > 35$	-10	-10			$-V_{BE\,sat} < 2.6$ V	-500	-50	$-V_{CEO} = 40$ V	width < 4.8
driver	$h_{FE} > 20$	-500	-10			$t_d < 10$ ns			$P_{tot} = 1.8$ W	leads > 12.7
	$f_T > 200$ MHz	-50	-20			$t_r < 40$ ns			$T_j = 200$°C	
	$-I_{CBO} < 20$			0	-50	$t_s < 80$ ns			$R_{th\,j-a} = 97$°C/W	
	$C_c < 8$ pF			0	-10	$t_f < 30$ ns				

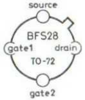
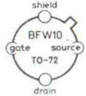
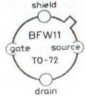
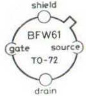
SWITCHING TRANSISTORS

Type and applications	*Characteristics at:*	I_C (*mA*)	V_{CE} (*V*)	I_E (*mA*)	V_{CB} (*V*)	*Characteristics at:*	I_C (*mA*)	I_B (*mA*)	*Ratings*	*Outlines (mm)*
2N2906A	Equivalent to 2N2906 except for:								$-V_{CEO} = 60$ V	
	$h_{FE} > 40$	-0.1	-10							
	$h_{FE} > 40$	-10	-10							
	$h_{FE} > 40$	-500	-10							
	$-I_{CBO} < 10$ nA			0	-50					
2N2907	$h_{FE} > 35$	-0.1	-10			$-V_{CE\,sat} < 1.6$	-500	-50	$-I_C = 0.6$ A	length < 5.3
p-n-p	$h_{FE} > 75$	-10	-10			$-V_{BE\,sat} < 2.6$	-500	-50	$-V_{CEO} = 40$ V	width < 4.8
driver	$h_{FE} > 30$	-500	-10						$P_{tot} = 0.4$ W	leads > 12.7
	$f_T > 200$ MHz	-50	-20						$T_j = 200$°C	
	$-I_{CBO} < 20$ nA			0	-50				$R_{th\,j-a} = 438$°C/W	
	$C_c < 8$ pF			0	-10					
2N2907A	Equivalent to 2N2907 except for:									
	$h_{FE} > 75$	-0.1	-10						$-V_{CEO} = 60$ V	
	$h_{FE} > 100$	-10	-10							
	$h_{FE} > 50$	-500	-10							
	$-I_{CBO} < 10$ nA			0	-50					
2N3133	$h_{FE} > 25$	-1	-10			$-V_{CE\,sat} < 0.6$ V	-150	-15	$-I_C = 0.6$ A	length < 6.6
p-n-p	$h_{FE} > 10$	-150	-1			$-V_{BE\,sat} < 1.5$ V	-150	-15	$-V_{CEO} = 35$ V	width < 8.5
high-speed	$h_{FE} > 40$	-150	-10			$t_{on} < 75$ ns			$P_{tot} = 3$ W	leads > 38
	$f_T > 200$ MHz	-50	-20			$t_{off} < 150$ ns			$T_j = 200$°C	
	$-I_{CBO} < 50$ nA			0	-30				$R_{th\,j-a} = 290$°C/mW	
	$C_c < 10$ pF			0	-10					

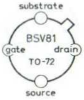
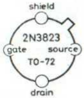
2N3134	Equivalent to 2N3133 except for:									
	$h_{FE} > 50$	-1	-10							
	$h_{FE} > 25$	-150	-1							
	$h_{FE} > 100$	-150	-10							
2N3250	$h_{FE} > 45$	-1	-1			$-V_{CE\,\mathrm{sat}} < 0.5$ V	-50	-5	$-I_C = 200$ mA	length < 5.3
p-n-p	$h_{FE} > 15$	-15	-1			$-V_{BE\,\mathrm{sat}} < 1.2$ V	-50	-5	$-V_{CEO} = 40$ V	width < 4.8
high-speed	$f_T > 250$ MHz	-10	-20			$t_d < 35$ ns			$P_{\mathrm{tot}} = 1.2$ W	leads > 12.7
	$F < 6$ dB	-0.1	-5			$t_r < 35$ ns			$T_j = 200°\mathrm{C}$	
	$h_{fe} > 50$	-1	-10			$t_s < 175$ ns			$R_{th\,j-a} = 0.485°\mathrm{C/mW}$	
	$C_c < 6$ pF			0	-10	$t_f < 50$ ns				
2N3250A	Equivalent to 2N3250 except for:								$-V_{CE} = 60$ V	
2N3251	$h_{FE} > 90$	-1	-1			$-V_{CE\,\mathrm{sat}} < 0.5$ V	-50	-5	$-I_C = 200$ mA	length < 5.3
p-n-p	$h_{FE} > 30$	-15	-1			$-V_{BE\,\mathrm{sat}} < 1.2$ V	-50	-5	$-V_{CEO} = 40$ V	width < 4.8
high-speed	$f_T > 300$ MHz	-10	-20			$t_d < 35$ ns			$P_{\mathrm{tot}} = 1.2$ W	leads > 12.7
	$F < 6$ dB	0.1	-0.1			$t_r < 35$ ns			$T_j = 200°\mathrm{C}$	
	$h_{fe} > 100$	-1	-10			$t_s < 200$ ns			$R_{th\,j-a} = 0.485°\mathrm{C/mW}$	
	$C_c < 6$ pF			0	-10	$t_f < 50$ ns				
2N3251A	Equivalent to 2N3251 except for:								$-V_{CEO} = 60$ V	

FIELD EFFECT TRANSISTORS

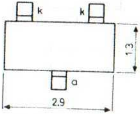
Type and applications	*Characteristics at:*	V_{DS} *(V)*	V_{GS} *(V)*	*Characteristics at:*	I_D *(mA)*	V_{DS} *(V)*	*Ratings*	*Outlines (mm)*
BFS21; **BFS21A** individual transistor n-channel differential ampl.	$I_{DSS} > 1$ mA	15	0	$I_G < 0.5\ \mu A$	0.5	15	$I_D = 20$ mA $I_G = 10$ mA $\pm V_{DS} = 30$ V $V_{DGO} = 30$ V $-V_{GSO} = 30$ V $P_{tot} = 300$ mW $T_j = 200°$C $R_{th\,j-a} = 0.59°$C/mW	length < 5.3 width < 4.8 leads > 12.7 
				$-V_{(P)GS} < 6$ V	0.5	15		
				$g_{fs} > 1.0\ m\Omega^{-1}$	0.5	15		
				$C_{rs} < 0.75$ pF	0.5	15		
BFS21; **BFS21A** matched pain in metal S-clip	$\frac{I_{D1-S1S}}{I_{D2-S2S}} < 1.05$	15	0	*Characteristics at:*	I_D (mA)	V_{DG} (V)	$I_D = 4$ mA $I_G = 0.5$ mA voltage between any two terminals $V = 30$ V $P_{tot} = 30$ mW $T_{amb} = -20$ to $+100°$C	
				BFS21:				
				$\Delta V_{GS} < 20$ mV	0.1	15		
				$\frac{d\,\Delta V_{GS}}{dT} < 75\ \mu V/°C$	0.1	15		
				$\Delta \frac{1}{g_{fs}} < 75\ \Omega$	0.1	15		
				$CMRR > 60$ dB	0.1	15		
				BFS21A:				
				$\Delta V_{G_S} < 10$ mV	0.1	15		
				$\frac{d\,\Delta V_{GS}}{dT} < 40\ \mu V/°C$	0.1	15		
				$\Delta \frac{1}{g_{fs}} < 37.5\ \Omega$	0.1	15		
				$CMRR > 66$ dB	0.1	15		

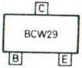
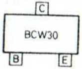
Type and applications	Characteristics at:	V_{DS} (V)	V_{GS} (V)	Characteristics at:	I_D (mA)	V_{DS} (V)	Ratings	Outlines (mm)	
BFS28	$\pm I_{G1\text{-}SS} < 1$ nA	0	8	$\lvert y_{fs}\rvert > 8$ mΩ^{-1}	10	13	$I_D = 20$ mA	length < 5.3	
depletion type	$\pm I_{G2\text{-}SS} < 1$ nA	0	8	$-C_{rs} = 25$ fF	10	13	$\pm V_{G1\text{-}S} = 8$ V	width < 4.8	
communication				$F_{\min} = 3$ dB	10	13	$\pm V_{G2\text{-}S} = 8$ V	leads > 12.7	
instrumentation				$G_{tr} = 18$ dB	10	13	$P_{tot} = 200$ mW		
control				$G_{UM} = 21$ dB	10	13	$T_j = 135$°C		
							$R_{th\,j-a} = 0.55$°C/mW		
BFW10	$I_{DSS} < 20$ mA	15	0	$-V_{GS} < 7.5$ V	0.4	15	$I_D = 20$ mA	length < 5.3	
n-channel	$F < 2.5$ dB	15	0	$-V_{(P)GS} < 8$ V	0.5 ns	15	$\pm V_{DS} = 30$ V	width < 4.8	
broad-band	$\lvert y_{fs}\rvert > 3.2$ mΩ^{-1}	15	0				$P_{tot} = 300$ mW	leads > 12.7	
ampl.							$T_j = 200$°C		
							$R_{th\,j-a} = 0.59$°C/mW		
BFW11	$I_{DSS} < 10$ mA	15	0	$-V_{GS} < 4$ V	0.05	15	$I_D = 20$ mA	length < 5.3	
n-channel	$F < 2.5$ dB	15	0	$-V_{(P)GS} < 6$ V	0.5 nA	15	$\pm V_{DS} = 30$ V	width < 4.8	
broad-band	$\lvert y_{fs}\rvert > 3.2$ mΩ^{-1}	15	0				$P_{tot} = 300$ mW	leads > 12.7	
ampl.							$T_j = 200$°C		
							$R_{th\,j-a} = 0.59$°C/mW		
BFW61	$I_{DSS} < 20$	15	0	$-V_{GS} < 7.5$ V	0.2	15	$I_D = 20$ mA	length < 5.3	
n-channel	$\lvert y_{fs}\rvert > 2$	15	0	$-V_{(P)GS} < 8$ V	1 nA	15	$\pm V_{DSS} = 25$ V	width < 4.8	
							$P_{tot} = 300$ mW	leads > 12.7	
							$T_j = 200$°C		
							$R_{th\,j-a} = 0.59$°C/mW		

FIELD EFFECT TRANSISTORS

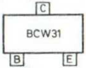
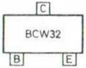
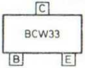
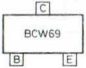
Type and applications	*Characteristics at:*	V_{DS} *(V)*	V_{GS} *(V)*	*Characteristics at:*	I_D *(mA)*	V_{DS} *(V)*	*Ratings*	*Outlines (mm)*	
BSV 81	I_{DSX} < 1 nA	10	−5				I_{DM} = 50 mA	length < 5.3	
n-channel	$-I_{GSS} < 10$ pA	0	−10				I_{SM} = 50 mA	width < 4.8	
switch	I_{GSS} < 10 pA	0	10				V_{DB} = 30 V	leads > 12.7	
chopper	$r_{ds\,on}$ $< 100\ \Omega$	0	0				V_{SB} = 30 V		
	$r_{DS\,off} > 10$ GΩ	10	−5				$\pm V_{GB}$ = 10 V		
	C_{rs} < 0.5 pF	0	−5				$\pm V_{G-N}$ = 15 V		
	C_{rd} < 1.2 pF	0	−5				P_{tot} = 200 mW		
							T_j = 125°C		
							$R_{th\,j-a}$ = 0.5°C/mW		
2N3823	I_{DSS} < 20 mA	15	0	$-V_{GS}$ < 7.5 V	0.4	15	I_G = 10 mA	length < 5.3	
n-channel	$-I_{GSS} < 0.5$ nA	−20	0	$-V_{(P)GS} < 8$ V	0.5 nA	15	V_{DS} = 30 V	width < 4.8	
i.f.; r.f.	$\lvert y_{fs} \rvert < 6.5\ \text{m}\Omega^{-1}$	15	0				P_{tot} = 300 mW	leads > 12.7	
ampl.	$-C_{rs}$ < 2 pF	15	0				T_j = 200°C		

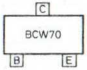
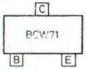
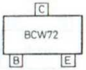
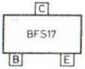
MICROMINIATURE DEVICES FOR THICK- AND THIN-FILM CIRCUITS

Type and	Ratings		$R_{th\,j-a}$	V_F at	I_F	I_R at	V_R	Char.	Outlines
applications	(mA) (V)	(°C)	(°C/mW)	(V)	(mA)	(µA)	(V)		(mm)
BAW56	$I_{FAV} = 50$	$T_j = 125$	1.4	$T_j = 25$°C		$T_j = 125$°C		$C_d < 2$ pF	 BAW56
thick- and thin-film	$I_{FRM} = 100$			<0.715	1	<8	10	$Q_s < 45$ pC	
high speed switch	$V_R = 25$	$T_{stg} = +125$		<0.855	10	<10	25		
planar epitaxial	$V_{RRM} = 50$			<1.1	50				
				<1.3	100				

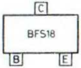
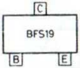
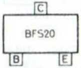
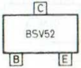
Type and applications	Characteristics at:	I_C (mA)	V_{CE} (V)	I_E (mA)	V_{CB} (V)	Characteristics at:	I_C (mA)	I_B (mA)	Ratings	Outlines (mm)
BCW29	$-V_{BE} > 600$ mV	−2	−5			$-V_{CE\,sat} = 180$ mV	−50	−2.5	$-I_{CM} = 200$ mA	length < 2.9
p-n-p	$-V_{BE} < 750$ mV	−2	−5			$-V_{BE\,sat} = 810$ mV	−50	−2.5	$-V_{CEO} = 20$ V	width < 1.3
general	$h_{FE} > 120$	−2	−5						$P_{tot} = 150$ mW	height < 0.85
	$h_{FE} < 260$	−2	−5						$T_j = 125$°C	leads = 0.5
	$f_T = 150$ MHz	−10	−5						$R_{th\,j-a} = 0.9$°C/mW	
	$F < 10$ dB	−0.2	−5							
	$-I_{CBO} < 1000$ nA			0	−20					
	$C_c = 7$ pF			0	−10					
BCW30	Equivalent to BCW29 except for:									
	$h_{FE} > 215$	−2	−5							
	$h_{FE} < 500$	−2	−5							

MICROMINIATURE DEVICES FOR THICK- AND THIN-FILM CIRCUITS

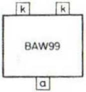
Type and applications	*Characteristics at:*	I_C *(mA)*	V_{CE} *(mA)*	I_E *(mA)*	V_{CB} *(V)*	*Characteristics at:*	I_C *(mA)*	I_B *(mA)*	*Ratings*	*Outlines (mm)*
BCW31	$V_{BE} > 550$ mV	2	5			$V_{CE\,sat} = 230$ mV	50	2.5	$I_{CM} = 200$ mA	length < 2.9
n-p-n	$V_{BE} < 700$ mV	2	5			$V_{BE\,sat} = 870$ mV	50	2.5	$V_{CEO} = 20$ V	width < 1.3
general	$h_{FE} > 110$	2	5						$P_{tot} = 150$ mW	height < 0.85
	$h_{FE} < 220$	2	5						$T_j = 125$°C	leads = 0.5
	$f_T = 300$ MHz	10	5						$R_{th\,j-a} = 0.9$°C/mW	
	$F < 10$ dB	0.2	5							
	$I_{CBO} < 100$ nA			0	20					
	$C_c = 4$ pF			0	10					
BCW32	Equivalent to BCW31 except for:									
	$h_{FE} > 200$	2	5							
	$h_{FE} < 450$	2	5							
BCW33	Equivalent to BCW31 except for:									
	$h_{FE} > 420$	2	5							
	$h_{FE} < 800$	2	5							
BCW 69	$-V_{BE} > 600$ mV	−2	−5			$V_{CE\,sat} < 300$ mV	−10	−0.5	$-I_{CM} = 200$ mA	length < 2.9
p-n-p	$-V_{BE} < 750$ mV	−2	−5			$V_{CE\,sat} = 180$ mV	−50	−2.5	$-V_{CEO} = 45$ V	width < 1.3
general	$h_{FE} = 90$	−0.01	−5			$V_{BE\,sat} = 720$ mV	−10	−0.5	$P_{tot} = 150$ mW	height < 0.85
	$h_{FE} > 120$	−2	−5			$V_{BE\,sat} = 810$ mV	−50	−2.5	$T_j = 125$°C	leads = 0.5
	$h_{FE} < 260$	−2	−5						$R_{th\,j-a} = 0.9$°C/mW	
	$f_T = 150$ MHz	−10	−5							
	$F < 10$ dB	−0.2	−5							
	$-I_{CBO} < 100$ nA			0	−20					
	$C_c < 7$ pF			0	−10					

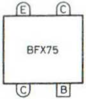
BCW70	Equivalent to BCW69 except for:									
	$h_{FE} > 150$	−0.01	−5							
	$h_{FE} > 215$	−2	−5							
	$h_{FE} < 500$	−2	−5							
BCW71	$V_{BE} > 550$	2	5			$V_{CE\,sat} < 250$ mV	10	0.5	$I_{CM} = 200$ mA	length < 2.9
n-p-n	$V_{BE} < 700$	2	5			$V_{CE\,sat} = 230$ mV	50	2.5	$V_{CEO} = 45$ V	width < 1.3
general	$h_{FE} = 90$	0.01	5			$V_{BE\,sat} = 750$ mV	10	0.5	$P_{tot} = 150$ mW	height < 0.85
	$h_{FE} > 110$	2	5			$V_{BE\,sat} = 870$ mV	50	2.5	$T_j = 125°$C	leads = 0.5
	$h_{FE} < 220$	2	5						$R_{th\,j-a} = 0.9°$C/mW	
	$f_T = 300$ MHz	10	5							
	$F < 10$ dB	0.2	5							
	$I_{CBO} < 100$ nA			0	20					
	$C_c < 4$ pF			0	10					
BCW72	Equivalent to BCW71 except for:									
	$h_{FE} = 150$	0.01	5							
	$h_{FE} > 200$	2	5							
	$h_{FE} < 450$	2	5							
BFS17	$h_{FE} > 20$	25	1						$I_{CM} = 50$ mA	length < 2.9
n-p-n	$f_T = 1$ GHz	2	5						$V_{CEO} = 15$	width < 1.3
v.h.f.	$-C_{re} = 0.65$ pF	2	5						$P_{tot} = 150$ mW	height < 0.85
u.h.f.	$F = 4.5$ dB	2	5						$T_j = 125°$C	leads = 0.5
	$d_{im} = -45$ dB	10	6						$R_{th\,j-a} = 0.9°$C/mW	
	$I_{CBO} < 10$ nA			0	10					
	$C_c < 1.5$ pF			0	10					

MICROMINIATURE DEVICES FOR THICK- AND THIN-FILM CIRCUITS

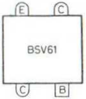
Type and applications	Characteristics at:	I_C (mA)	V_{CE} (V)	I_E (mA)	V_{CB} (V)	Characteristics at:	I_C (mA)	I_B (mA)	Ratings	Outlines (mm)
BFS18	$V_{BE} > 0.65$ V	1	10						$I_{CM} = 30$ mA	length < 2.9
n-p-n	$V_{BE} < 0.74$ V	1	10						$V_{CEO} = 20$ V	width < 1.3
h.f.	$h_{FE} > 35$	1	10						$P_{tot} = 150$ mW	height < 0.85
	$h_{FE} < 125$	1	10						$T_j = 125$°C	leads = 0.5
	$f_T = 200$ MHz	1	10						$R_{th\,j-a} = 0.9$°C/mW	
	$F = 4$ dB	1	10							
	$I_{CBO} < 100$ nA			0	20					
	$C_c = 1$ pF			0	10					
BFS19	Equivalent to BFS18 except for:									
	$h_{FE} > 65$	1	10							
	$h_{FE} < 225$	1	10							
	$f_T = 260$ MHz	1	10							
BFS20	$V_{BE} = 740$ mV	7	10						$I_{CM} = 25$ mA	length < 2.9
n-p-n	$h_{FE} = 85$	7	10						$V_{CEO} = 20$ V	width < 1.3
i.f.	$f_T = 450$ MHz	5	10						$P_{tot} = 150$ mW	height < 0.85
v.h.f.	$I_{CBO} < 100$ nA			0	20				$T_j = 125$°C	leads = 0.5
	$C_c = 0.8$ pF			0	10				$R_{th\,j-a} = 0.9$°C/mW	
BSV52	$h_{FE} > 25$	1	1			$V_{CE\,sat} < 400$ mV	50	5	$I_{CM} = 200$ mA	length < 2.9
n-p-n	$h_{FE} > 25$	50	1			$V_{BE\,sat} < 1200$ mV	50	5	$V_{CEO} = 12$ V	width < 1.3
very high	$f_T = 500$ MHz	10	10			$t_s < 13$ ns			$P_{tot} = 150$ mV	height < 0.85
switching	$I_{CBO} < 100$ nA			0	10	$t_{on} < 12$ ns			$T_j = 125$°C	leads = 0.5
						$t_{off} < 18$ ns			$R_{th\,j-a} = 0.9$°C/mW	

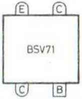
BEAM LEAD DEVICES FOR THICK- AND THIN-FILM CIRCUITS

Type and applications	Ratings (mA) (V) (°C)	$R_{th\,j-a}$ (°C/mW)	V_F at (V)	I_F (mA)	I_R at (nA)	V_R (V)	Char.	Outlines (mm)
BAW 99	$I_F = 50$	1.25	$T_j = 25°C$		$T_j = 25°C$		$C_d < 2$ pF	length < 0.4
for hybrid i.c.	$I_{FRM} = 100$		< 1.1	50	< 100	25	$Q_s < 25$ pC	width < 0.32
bare crystal	$V_R = 25$				$T_j = 125°C$			leads > 0.08
wit al. leads	$V_{RRM} = 38$				< 20	25		
high speed switch	$T_j = 125$							
silicon planar								

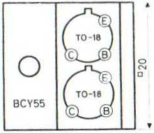
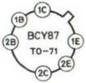
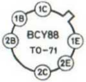
Type and applications	Characteristics at:		I_C (mA)	V_{CE} (V)	I_E (mA)	V_{CB} (V)	Characteristics at:	I_C (mA)	I_B (mA)	Ratings	Outlines (mm)
BFX75	V_{BE}	> 0.6 V	1	10						$I_{CM} = 30$ mA	length < 0.32
for hybrid i.c.	V_{BE}	< 0.7 V	1	10						$V_{CEO} = 20$ V	width < 0.26
bare crystal	h_{FE}	> 70	1	10						$P_{tot} = 80$ mW	leads > 0.08
with al. leads	h_{FE}	< 280	1	10						$T_j = 125°C$	
h.f.	f_T	= 330 MHz	1	10						$R_{th\,j-a} = 1.25°C/mW$	
general	F	= 3 dB	1	10							
	$-C_{re}$	= 0.65 pF	1	10							
	I_{CBO}	< 100 nA			0	10					
	C_c	= 1.5 pF			0	10					
BFX76	Equivalent to BFX75 except for:										
	$h_{FE} > 33$		1	10							
	$h_{FE} < 110$		1	10							
	f_T	= 260 MH	1	10							

BEAM LEAD DEVICES FOR THICK- AND THIN-FILM CIRCUITS

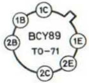
Type and applications	Characteristics at:	I_C (mA)	V_{CE} (V)	I_E (mA)	V_{CB} (V)	Characteristics at:	I_C (mA)	I_B (mA)	Ratings	Outlines (mm)
BSV 61	$h_{FE} > 80$	1	1			$V_{CEO\,sust} > 9$ V	10	0	$I_{CM} = 50$ mA	length < 0.3
n-p-n	$h_{FE} < 300$	1	1			$V_{CE\,sat} < 0.25$ V	10	1	$V_{CEO} = 9$ V	width < 0.26
bare crystal	$h_{FE} = 160$	10	1			$V_{BE\,sat} > 0.70$ V	10	1	$P_{tot} = 80$ mW	leads > 0.08
with al. leads	$f_T = 640$ MHz	5	2			$B_{BE\,sat} < 0.85$ V	10	1	$T_j = 125$°C	
for hybrid i.c.	$I_{CBO} < 10\ \mu$A	$T_j = 125$°C		0	20				$R_{th\,j-a} = 1.25$°C/mW	
high-speed	$I_{CBO} < 100$ nA	$T_j = 25$°C		0	20					
switching	$C_c < 4$ pF			0	5					
{for bread-boarding gold wire leads}										
BSV 62	Equivalent to BSV61 except for:									
	$h_{FE} > 17$	1	1			$V_{CEO\,sust} > 12$ V	10	0		
	$h_{FE} < 50$	1	1							
	$h_{FE} = 70$	10	1							
	$f_T = 510$ MHz	5	2							
BSV 63	Equivalent to BSV61 except for:									
	$h_{FE} > 30$	1	1			$V_{CEO\,sust} > 12$ V	10	0		
	$h_{FE} < 120$	1	1							
	$h_{FE} = 95$	10	1							
	$f_T = 560$ MHz	5	2							

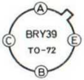
BSV 71	$h_{FE} > 20$	1	1			$V_{CEO\,\mathrm{sust}} > 6$ V	10	0	$I_{CM} = 50$ mA	length < 0.32
n-p-n	$h_{FE} = 40$	1	1			$V_{CE\,\mathrm{sat}} < 300$ mV	3	0.15	$V_{CEO} = 6$ V	width < 0.26
for hybrid i.c.	$h_{FE} > 20$	10	0.5			$V_{CE\,\mathrm{sat}} < 450$ mV	30	3	$P_{\mathrm{tot}} = 80$ mW	leads > 0.08
bare crystal	$h_{FE} < 120$	10	0.5						$T_j = 125$°C	
wit al. leads	$f_T = 675$ MHz	5	5.5						$R_{th\,j-a} = 1.25$°C/mW	
very high	$I_{CBO} < 5\ \mu$A			0	5					
speed	$I_{CBO} < 10\ \mu$A			0	15					
switching	$C_c < 3$ pF			0	5					

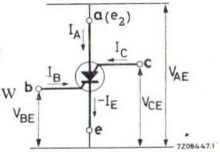
MISCELLANEOUS TRANSISTORS

Type and applications	*Characteristics at:*	I_C *(mA)*	V_{CE} *(V)*	*Characteristics at:*	I_E *(mA)*	V_{CB} *(V)*	*Ratings*	*Outlines (mm)*
BCY55	$h_{FE} > 100$	0.01	5	$I_{CBO} < 10$ nA	0	45	$I_{CM} = 60$ mA	
n-p-n	$h_{FE} > 200$	10	5	$C_c < 8$ pF	0	5	$V_{CEO} = 450$ V	
dual-tr.	$f_T = 80$ MHz	0.5	5				$P_{tot} = 300$ mW	
	$f_{hfe} > 0.1$ MHz	0.5	5				$T_j = 125$°C	
	$F > 0.1$ dB	0.01	5				$R_{th\,j-a} = 0.33$°C/mW	
	$h_{fe} > 150$	1	5					
Characteristics of	$\Delta V_{BE} < 3$ mV			$\Delta V/\Delta T < 6\ \mu$V/°C				
the matched tr.	$I_{1C}/I_{2C} > 0.8$			$\Delta T/\Delta T < 2$ nA/°C				
BCY87	$F < 3$ dB	0.05	5	$I_{CBO} < 5$ nA	0	20	$I_C = 30$ mA	length > 5.3
n-p-n				$h_{FE} > 100$	−0.05	10	$V_{CEO} = 40$ V	width > 4.8
dual-tr.				$h_{FE} < 450$	−0.05	10	$P_{tot} = 150$ mW	leads < 12.7
				$C_c < 3.5$ pF	0	10	$T_j = 175$°C	
				$f_T > 50$ MHz	−0.5	10	$R_{th\,j-a} = 1$°C/mW	
Characteristics of	$\Delta V_{BE} < 3$ mV			$\Delta V/\Delta T < 3\ \mu$V/°C				
the matched tr.	$I_{1C}/I_{2C} > 0.9$			$\Delta T/\Delta T < 0.5$ nA/°C				
BCY88	$F < 4$ dB	0.05	5	$I_{CBO} < 20$ nA	0	20	$I_C = 30$ mA	length > 5.3
n-p-n				$h_{FE} > 120$	−0.5	10	$V_{CEO} = 40$ V	width > 4.8
dual-tr.				$h_{FE} < 600$	−0.5	10	$P_{tot} = 150$ mW	leads < 12.7
				$C_c < 3.5$ pF	0	10	$T_j = 175$°C	
				$f_T > 50$ MHz	−0.5	10	$R_{th\,j-a} = 1$°C/mW	
Characteristics of	$\Delta V_{BE} < 6$ mV			$\Delta V/\Delta T < 6\ \mu$V/°C				
the matched tr.	$I_{1C}/I_{2C} > 0.8$			$\Delta I/\Delta T < 2$ nA/°C				

BCY89	$F<4$ dB	0.05	5	$I_{CBO}<10$ nA	0	20	$I_C=30$ mA	length > 5.3
n-p-n				$h_{FE}>100$	−10	10	$V_{CEO}=40$ V	width > 4.8
dual-tr.				$h_{FE}<600$	−10	10	$P_{tot}=150$ mW	leads < 12.7
				$C_c<3.5$ pF	0	10	$T_j=175$°C	
				$f_T>50$ MHz	−0.5	10	$R_{th\,j-a}$ /1°C/mW	
Characteristics of	$\Delta V_{BE}<10$ mV			$\Delta V/\Delta T<10$ μV/°C				
the matched tr.	$I_{1C}/I_{2C}>0.7$			$\Delta I/\Delta T<10$ nA/°C				
BRY39	n-p-n transistor:							
p-n-p-n	$h_{FE}>50$	10	2	$C_c<5$ pF	0	20	$I_{CM}=100$ mA	length < 5.3
driver	$f_T=300$ MHz	10	2				$V_{CER}=70$ V	width < 4.8
numerical	p-n-p transistor:							leads > 12.8
indicator				$h_{FE}>0.25$	1	0	$I_{EM}=500$ mA	
tubes				$h_{FE}<2.5$	1	0	$-V_{CEO}=70$ V	
	combined device:							
	$V_{AE}<1.4$ V	$I_A=50$ mA		$I_C=0$			$P_{tot}=250$ mW	
	$V_{AE}<1.2$ V	$I_A=1$ mA		$I_C=10$ mA			$T_j=150$°C	
							$R_{th\,j-a}=0.5$°C/mW	







a = anode (emitter of p-n-p transistor)

40809	The package consists of: AC127; AC128; AC127/AC128
package	For data of mentioned types see section: LOW FREQUENCY TRANSISTORS
l.f.	Performance of a class-B complementary output stage:
	$P_o\leqslant 1.2$ W $I_{CM}=470$ mA
	$d_{tot}=10\%$ $V_S=9$ V
	$V_{i(rms)}=5.6$ mV

MISCELLANEOUS TRANSISTORS

Type and applications					
40819	The package consists of: AC187; AC188; AC187/01; AC188/01				
package	For data of mentioned types see section: LOW FREQUENCY TRANSISTORS				
l.f.	AC187 (pre-amplifier)	500	1	h_{FE} 100 to 200	
	AC188 (driver)	500	1	h_{FE} 100 to 200	
	AC187/01 (output stage)	500	1	h_{FE} 200 to 500	
	AC188/01 (output stage)	500	1	h_{FE} 200 to 500	
	Performance of an audio amplifier				
	$P_o \leqslant 3$ W	$I_{CM} = 750$ mA		$P_o \leqslant 1$ W	$I_{CM} = 710$ mA
	$d_{tot} = 10\%$	$V_S = 15$ V		$d_{tot} = 10\%$	$V_S = 6$ V
	$V_{i(rms)} = 5.5$ mV			$V_{i(rms)} = 41$ mV	
40820	The package consists of: BF194B (mixer oscillator transistor)				
package	BF195C (controlled first i.f. transistor)				
h.f.	BF195D (second i.f. transistor)				
	For data of mentioned types see section: HIGH FREQUENCY TRANSISTORS				
	except for: BF194B	1	10	I_B 5–9 μA	
	BF195C	1	10	I_B 9–14 μA	
	BF195D	1	10	I_B 14–26 μA	
	Performance of a h.f. section of 6 V m.w. radio receiver:				
	Signal to obtain:				
	$V_o = 10$ mV	$E = 25\ \mu$V/m		$I_{tot} = 3$ mA	
	signal/noise = 26 dB	$E = 500\ \mu$V/m			

40822
package
h.f.

The package consists of: BF179A (G-Y amplifier)
BF179B (R-Y amplifier)
BF179C (B-Y amplifier)

Performance of a colour difference amplifier:
G-Y: $V_{op-p} = 100$ V Bandwidth = 1 MHz
R-Y: Gain = 30 $V_{op-p} = 170$ V Bandwidth = 1 MHz
B-Y: Gain = 50 $V_{op-p} = 200$ V Bandwidth = 1 MHz
Transient response: $t_r = t_f = 300$ ns; overshoot < 5%

40829
package
h.f.

The package consists of: BF254B (mixer oscillator)
BF255C (controlled first i.f. transistor)
BF255D (second i.f. transistor)

For data of mentioned types see section: HIGH FREQUENCY TRANSISTORS
except for: BF254B $I_C = 1$ mA; $V_{CE} = 10$ V $I_B = 5$–9 μA
BF255C $I_C = 1$ mA; $V_{CE} = 10$ V $I_B = 9$–14 μA
BF225D $I_C = 1$ mA: $V_{CE} = 10$ V $I_B = 14$–26 μA

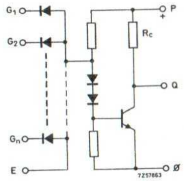
Performance of a h.f. section of 6 V m.w. radio receiver:
Signal to obtain:
$V_o = 10$ mV $E = 25$ μV/m $I_{tot} = 3$ mA
Signal/noise = 26 dB $E = 500$ μV/m

DIGITAL MONOLITHIC INTEGRATED CIRCUITS

FC family (Diode-Transistor Logic)
Standard temperature range

Supply voltage	V_P	6.0 V ± 5%
Operating ambient temperature	T_{amb}	0 to 75°C

* collector resistor R_c omitted



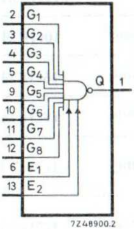
Basic gate circuit

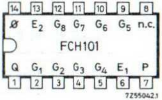
CHARACTERISTICS at $T_{amb} = 25°C$ (each gate)

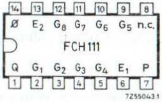
Type number	*Description (positive logic)*	t_{pd} *typ. (ns)*	N_a *min.*	M_L *typ. (V)*	P_{av} *typ. (mW)*	*Package*
FCH101*	Single 8-input NAND gate	30	8	1.2	7.0	DIL 14p
FCH111		30	8	1.2	11.0	DIL 14p
FCH121*	Dual 4-input NAND gate	30	8	1.2	7.0	DIL 14p
FCH131		30	8	1.2	11.0	DIL 14p
FCH141*	Triple 3-3-2 input NAND gate	30	8	1.2	7.0	DIL 14p
FCH161		30	8	1.2	11.0	DIL 14p
FCH151*	Triple 3-input NAND gate	30	8	1.2	7.0	DIL 14p
FCH171		30	8	1.2	11.0	DIL 14p
FCH181*	Quadruple 2-input NAND gate	30	8	1.2	7.0	DIL 14p
FCH191		30	8	1.2	11.0	DIL 14p
FCH201*	Sextuple inverter	30	8	1.2	7.0	DIL 14p
FCH211		30	8	1.2	11.0	DIL 14p

Logic diagrams and terminal connections

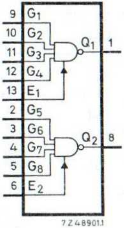
FCH101
FCH111

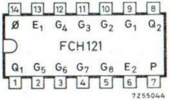


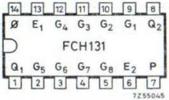




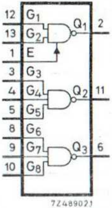
FCH121
FCH131

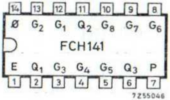


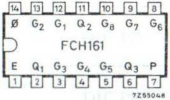




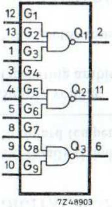
FCH141
FCH161

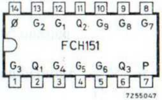


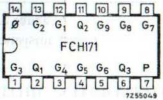




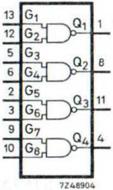
FCH151
FCH171

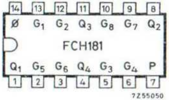


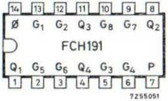




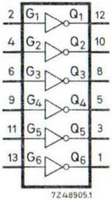
FCH181
FCH191

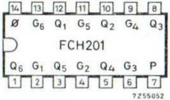


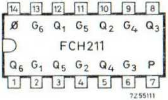




FCH201
FCH211







DIGITAL MONOLITHIC INTEGRATED CIRCUITS

FC family (Diode-Transistor Logic)
Standard temperature range

Supply voltage	V_P	6.0 V ±5%
Operating ambient temperature	T_{amb}	0 to 75°C

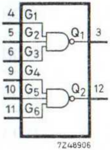
* Collector resistor R_c omitted

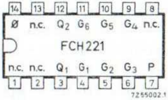
CHARACTERISTICS at $T_{amb} = 25°C$

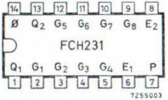
Type number	*Description (positive logic)*	t_{pd} *typ. (ns)*	N_a *min.*	M_L *typ. (V)*	P_{av} *typ. (mW)*	*Package*
FCH221	Dual 3-input line driver NAND gate	35	14	1.2	11 each gate	DIL 14p
FCH231	Dual 4-input line driver NAND gate	35	20	1.2	11 (each gate)	DIL 14p
FCH281	Single 5-bit comparator	150	7	1.2	50	DIL 14p
FCH291	Single 5-bit parity checker	150	7	1.2	110	DIL 14p
FCH301	Single 4-bit decoder	100	9	0.6	250	DIL 16p
FCH311*	Sextuple inverter	30	8	—	7	DIL 14p
FCH321		30	8	—	11	DIL 14p

Logic diagrams and terminal connections

FCH221







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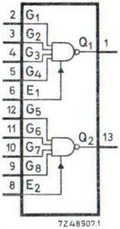
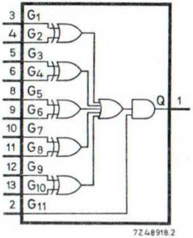
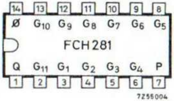
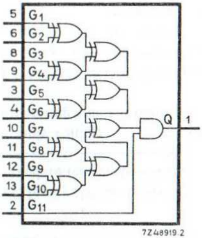


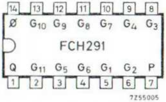
FCH281

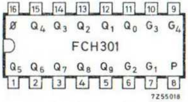




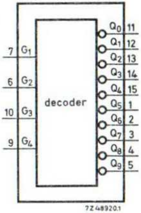
FCH291



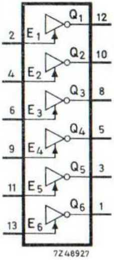


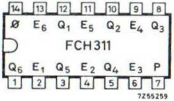


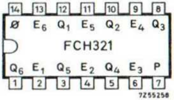
FCH301



FCH311
FCH321







DIGITAL MONOLITHIC INTEGRATED CIRCUITS

FC family (Diode-Transistor Logic)
Standard temperature range

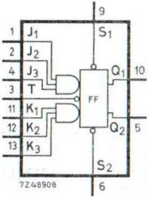
Supply voltage	V_P	6.0 V ±5%
Operating ambient temperature	T_{amb}	0 to 75°C

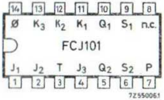
CHARACTERISTICS at $T_{amb} = 25°C$

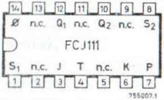
Type number	*Description (positive logic)*	f_c *min. (MHz)*	N_a *min.*	M_L *typ. (V)*	P_{av} *typ. (mW)*	*Package*
FCJ101	Single JK flip-flop	10	8	1.2	36	DIL 14p
FCJ111	Single JK master-slave flip-flop	5	8	1.2	67	DIL 14p
FCJ121	Dual JK master-slave flip-flop	7	8	1.2	50	DIL 14p
FCJ131	Dual JK master-slave flip-flop	7	8	1.2	100	DIL 14p
FCJ141	Decade counter	7	7	1.2	180	DIL 14p
FCJ191	Dual JK master slave flip-flop	7	8	1.2	100	DIL 16p
FCJ201	Single JK master-slave flip-flop	5	8	1.2	67	DIL 14p
FCJ211	Dual JK master-slave flip-flop	7	8	1.2	100	DIL 14p

Logic diagrams and terminal connections

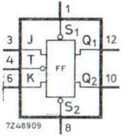
FCJ101



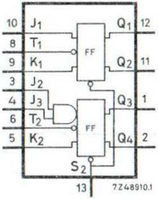


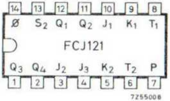


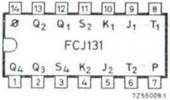
FCJ111



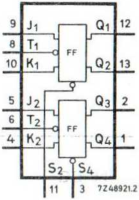
FCJ121



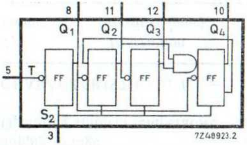


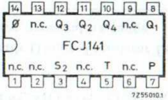


FCJ131

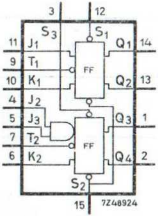


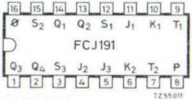
FCJ141



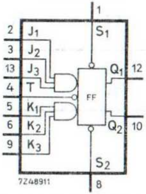


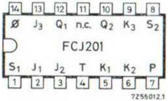
FCJ191



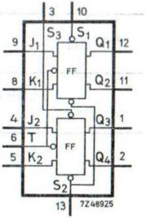


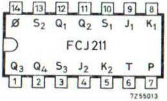
FCJ201





FCJ211





DIGITAL MONOLITHIC INTEGRATED CIRCUITS

FC family (Diode-Transistor Logic)

Standard temperature range

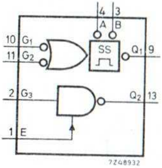
Supply voltage	V_P	6.0 V ±5%
Operating ambient temperature	T_{amb}	0 to 75°C

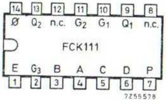
CHARACTERISTICS at $T_{amb} = 25°C$

Type number	*Description (positive logic)*	t_{pd} $(G_1 \rightarrow Q_1)$ *typ. (ns)*	t_{pd} $(G_3 \rightarrow Q_3)$ *typ. (ns)*	f_c *min. (MHz)*	N_a *min.*	M_L *typ. (V)*	P_{av} *typ. (mW)*	*Package*
FCK111	Monostable multivibrator	70	40	—	14	1.2	58	DIL 14p
FCL101	Level detector (Schmitt trigger)	—	—	1	3	—	19	DIL 14p
FCY101	Triple gate input expander (10 diode array)	—	—	—	—	—	—	DIL 14p

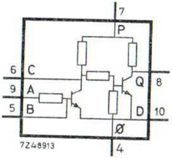
Logic diagrams and terminal connections

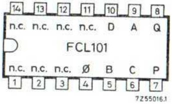
FCK111



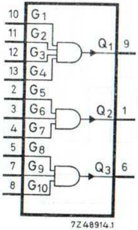


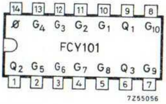
FCL101



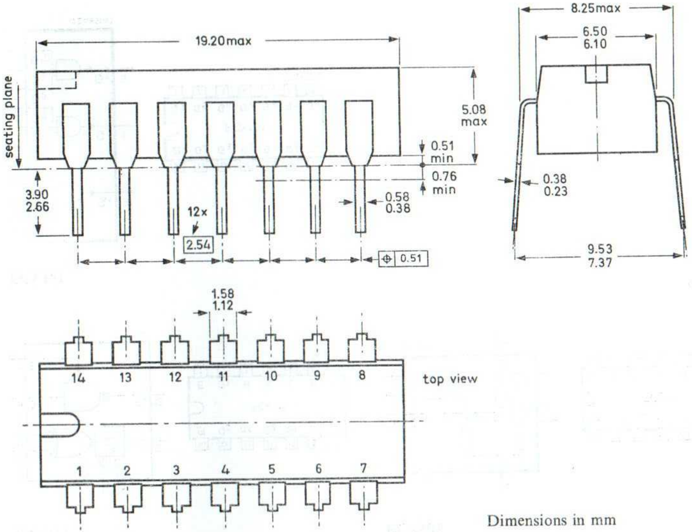


FCY101



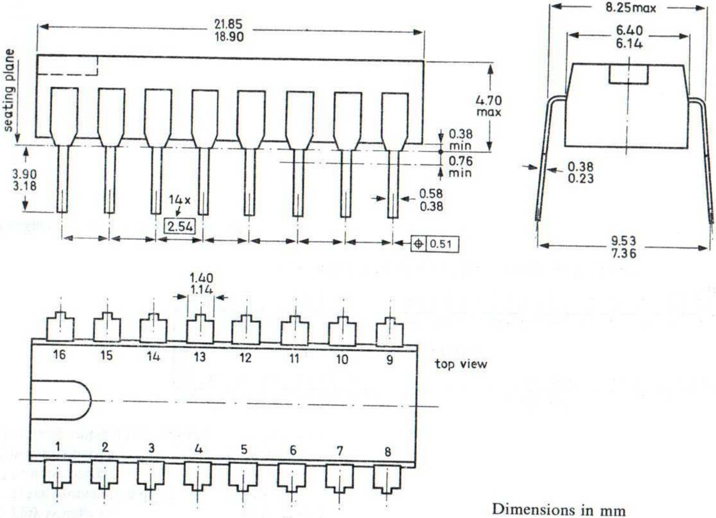


14 pin plastic dual in-line (DIL 14p)



Dimensions in mm

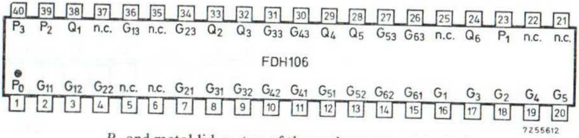
16 pin plastic dual in-line (DIL 16p)



Dimensions in mm

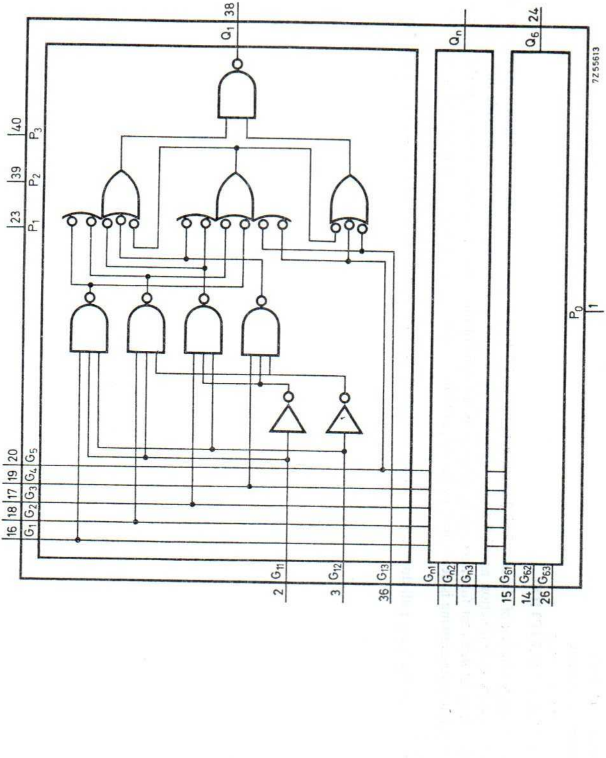
FD family (MOS)
FDH106 Arithmetic/logic array

Supply voltage V_{P1}	−24 to −28 V
Average propagation delay	250 ns
D.C. noise margin	>1 V
Power dissipation	35 mW
Operating ambient temperature	−55 to +85°C



P_0 and metal lid on top of the package are connected

Package: 40 lead ceramic dual in-line


23
P$_1$
39
P$_2$
40
P$_3$
Q$_1$
38
Q$_n$
Q$_6$
24
7Z55613
P$_0$
1
16
G$_1$
18
G$_2$
17
G$_3$
19
G$_4$
20
G$_5$
G$_{11}$
2
G$_{12}$
3
G$_{13}$
36
G$_{n1}$
G$_{n2}$
G$_{n3}$
G$_{61}$
15
G$_{62}$
14
G$_{63}$
26

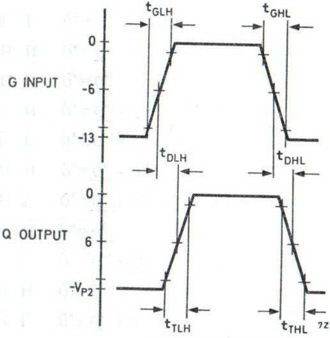
FD family (MOS)
FDH106 (continued)

GENERAL DESCRIPTION

The FDH106 consists of six, identical, 3-input gate networks. Five coded control lines determine the function of the six gate networks. Each network may function as a full adder/subtractor, or, if used as a 2-input gate, it can provide all logic functions of 2 variables. Thus one of 32 different functions can be selected by the control lines; the selected function is available six times.
The output voltage swing is determined by the output buffer supply voltage. All inputs are protected against over-voltage caused by static charges.
Inputs G_1 to G_5 have pull-down resistors connected to P_3, so that they assume the LOW state when left floating.

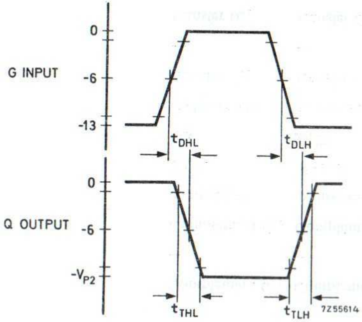
Timing diagrams also for types: **FDH116; FDH126; FDH136; FDH146; FDH156**

FDH106



non-inverting function

FDH106



inverting function

Measurements performed under the following conditions: $V_{P1} = -24$ to -28 V; $V_{P2} = V_{P3} = -12$ to -14 V; $t_{GLH} = t_{GHL} = 150$ ns.

FD family (MOS)
FDH106 (continued)

FUNCTION TABLE

G_5	G_4	G_3	G_2	G_1	*logic equation* (*positive logic*)	*logic function*	
						positive logic	*negative logic*
L	L	L	L	L	$Q_n=1$	—	—
L	L	L	L	H	$Q_n=\overline{G_{n1}}+\overline{G_{n2}}$	NAND	NOR
L	L	L	H	L	$Q_n=\overline{G_{n1}}+G_{n2}$	—	—
L	L	L	H	H	$Q_n=\overline{G_{n1}}$	Complement G_{n1}	Complement G_{n1}
L	L	H	L	L	$Q_n=G_{n1}+\overline{G_{n2}}$	—	—
L	L	H	L	H	$Q_n=\overline{G_{n2}}$	Complement G_{n2}	Complement G_{n2}
L	L	H	H	L	$Q_n=\overline{G_{n1}}\cdot\overline{G_{n2}}+G_{n1}\cdot G_{n2}$	comparator	exclusive-OR
L	L	H	H	H	$Q_n=\overline{G_{n1}}\cdot\overline{G_{n2}}$	NOR	NAND
L	H	L	L	L	$Q_n=G_{n1}+G_{n2}$	OR	AND
L	H	L	L	H	$Q_n=\overline{G_{n1}}\cdot G_{n2}+G_{n1}\cdot\overline{G_{n2}}$	exclusive-OR	comparator
L	H	L	H	L	$Q_n=G_{n2}$	transfer G_{n2}	transfer G_{n2}
L	H	L	H	H	$Q_n=\overline{G_{n1}}\cdot G_{n2}$	—	—
L	H	H	L	L	$Q_n=G_{n1}$	transfer G_{n1}	transfer G_{n1}
L	H	H	L	H	$Q_n=G_{n1}\cdot\overline{G_{n2}}$	—	—
L	H	H	H	L	$Q_n=G_{n1}\cdot G_{n2}$	AND	OR
L	H	H	H	H	$Q_n=0$	—	—

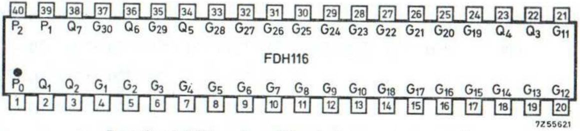
FUNCTION TABLE (*continued*)

G_5 G_4 G_3 G_2 G_1	*logic equation (positive logic)*	*logic function*	
		positive logic	*negative logic*
H L L L L	$Q_n=\overline{G_{n3}}$	Complement G_{n3}	Complement G_{n3}
H L L L H	$Q_n=\overline{G_{n1}}\cdot\overline{G_{n3}}+\overline{G_{n2}}\cdot\overline{G_{n3}}+G_{n1}\cdot G_{n2}\cdot G_{n3}$	—	—
H L L H L	$Q_n=\overline{G_{n1}}\cdot\overline{G_{n3}}+G_{n2}\cdot\overline{G_{n3}}+G_{n1}\cdot\overline{G_{n2}}\cdot G_{n3}$	—	—
H L L H H	$Q_n=G_{n1}\cdot G_{n3}+\overline{G_{n1}}\cdot\overline{G_{n3}}$	comparator	exclusive-OR
H L H L L	$Q_n=G_{n1}\cdot\overline{G_{n3}}+\overline{G_{n2}}\cdot\overline{G_{n3}}+\overline{G_{n1}}\cdot G_{n2}\cdot G_{n3}$	—	—
H L H L H	$Q_n=G_{n2}\cdot G_{n3}+\overline{G_{n2}}\cdot\overline{G_{n3}}$	comparator	exclusive-OR
H L H H L	$Q_n=G_{n1}\cdot G_{n2}\cdot\overline{G_{n3}}+G_{n1}\cdot\overline{G_{n2}}\cdot G_{n3}+\overline{G_{n1}}\cdot G_{n2}\cdot G_{n3}+\overline{G_{n1}}\cdot\overline{G_{n2}}\cdot\overline{G_{n3}}$	subtract	subtract
H L H H H	$Q_n=G_{n1}\cdot G_{n3}+G_{n2}\cdot G_{n3}+\overline{G_{n1}}\cdot\overline{G_{n2}}\cdot\overline{G_{n3}}$	—	—
H H L L L	$Q_n=G_{n1}\cdot\overline{G_{n3}}+G_{n2}\cdot\overline{G_{n3}}+\overline{G_{n1}}\cdot\overline{G_{n2}}\cdot G_{n3}$	—	—
H H L L H	$Q_n=G_{n1}\cdot G_{n2}\cdot G_{n3}+G_{n1}\cdot\overline{G_{n2}}\cdot\overline{G_{n3}}+\overline{G_{n1}}\cdot G_{n2}\cdot\overline{G_{n3}}+\overline{G_{n1}}\cdot\overline{G_{n2}}\cdot G_{n3}$	add	add
H H L H L	$Q_n=G_{n2}\cdot\overline{G_{n3}}+\overline{G_{n2}}\cdot G_{n3}$	exclusive-OR	comparator
H H L H H	$Q_n=G_{n1}\cdot G_{n3}+\overline{G_{n2}}\cdot G_{n3}+\overline{G_{n1}}\cdot G_{n2}\cdot\overline{G_{n3}}$	—	—
H H H L L	$Q_n=G_{n1}\cdot\overline{G_{n3}}+\overline{G_{n1}}\cdot G_{n3}$	exclusive-OR	comparator
H H H L H	$Q_n=\overline{G_{n1}}\cdot G_{n3}+G_{n2}\cdot G_{n3}+G_{n1}\cdot\overline{G_{n2}}\cdot\overline{G_{n3}}$	—	—
H H H H L	$Q_n=\overline{G_{n1}}\cdot G_{n3}+\overline{G_{n2}}\cdot G_{n3}+G_{n1}\cdot G_{n2}\cdot\overline{G_{n3}}$	—	—
H H H H H	$Q_n=G_{n3}$	transfer G_{n3}	transfer G_{n3}

DIGITAL MONOLITHIC INTEGRATED CIRCUITS

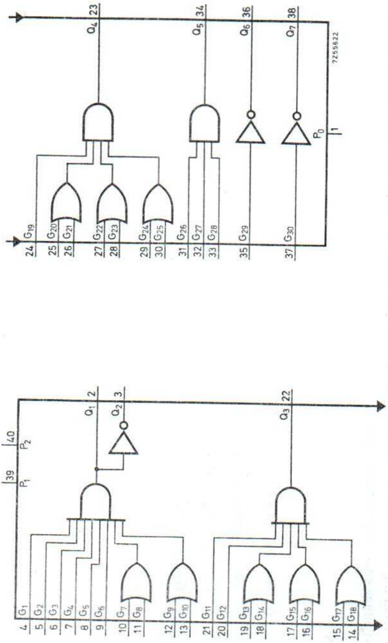
FD family (MOS)
FDH116 Control logic array

Supply voltage V_{P1}	−24 to −28 V
Average propagation delay	250 ns
D.C. noise margin	>1 V
Power dissipation	150 mV
Operating ambient temperature	−55 to +85°C



P_0 and metal lid on top of the package are connected

Package: 40 lead ceramic dual in-line


4 G1
5 G2
6 G3
7 G4
8 G5
9 G6
10 G7
11 G8
12 G9
13 G10
21 G11
20 G12
19 G13
18 G14
17 G15
16 G16
15 G17
14 G18
39 P1
40 P2
Q1 2
Q2 3
Q3 22
24 G19
25 G20
26 G21
27 G22
28 G23
29 G24
30 G25
31 G26
32 G27
33 G28
35 G29
37 G30
Q4 23
Q5 34
Q6 36
Q7 38
P0 1
7Z55622

FD family (MOS)
FDH116 (continued)

GENERAL DESCRIPTION

The FDH116 contains all the logic functions shown in the diagram and described in the logic function below. It is intended to perform the control logic in all MOS digital systems. The output voltage swing is determined by the output buffer supply voltage. All inputs are protected against over-voltage caused by static charges.

LOGIC FUNCTIONS

Positive logic

$Q_1 = G_1 \cdot G_2 \cdot G_3 \cdot G_4 \cdot G_5 \cdot G_6 \cdot (G_7 + G_8) \cdot (G_9 + G_{10})$

$Q_2 = \overline{G_1 \cdot G_2 \cdot G_3 \cdot G_4 \cdot G_5 \cdot G_6 \cdot (G_7 + G_8) \cdot (G_9 + G_{10})}$

$Q_3 = G_{11} \cdot G_{12} \cdot (G_{13} + G_{14}) \cdot (G_{15} + G_{16}) \cdot (G_{17} + G_{18})$

$Q_4 = G_{19} \cdot (G_{20} + G_{21}) \cdot (G_{22} + G_{23}) \cdot (G_{24} + G_{25})$

$Q_5 = G_{26} \cdot G_{27} \cdot G_{28}$

$Q_6 = \overline{G_{29}}$

$Q_7 = \overline{G_{30}}$

Negative logic

$$Q_1 = G_1 + G_2 + G_4 + G_4 + G_5 + G_6 + G_7 \cdot G_8 + G_9 \cdot G_{10}$$

$$Q_2 = \overline{G_1 + G_2 + G_3 + G_4 + G_5 + G_6 + G_7 \cdot G_8 + G_9 \cdot G_{10}}$$

$$Q_3 = G_{11} + G_{12} + G_{13} \cdot G_{14} + G_{15} \cdot G_{16} + G_{17} \cdot G_{18}$$

$$Q_4 = G_{19} + G_{20} \cdot G_{21} + G_{22} \cdot G_{23} + G_{24} \cdot G_{25}$$

$$Q_5 = G_{26} + G_{27} + G_{28}$$

$$Q_6 = \overline{G_{29}}$$

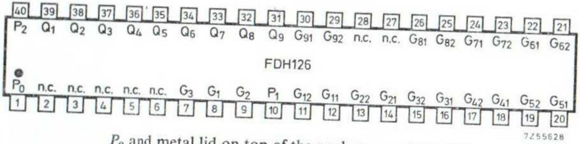
$$Q_7 = \overline{G_{30}}$$

For timing diagrams see **FDH106**

DIGITAL MONOLITHIC INTEGRATED CIRCUITS

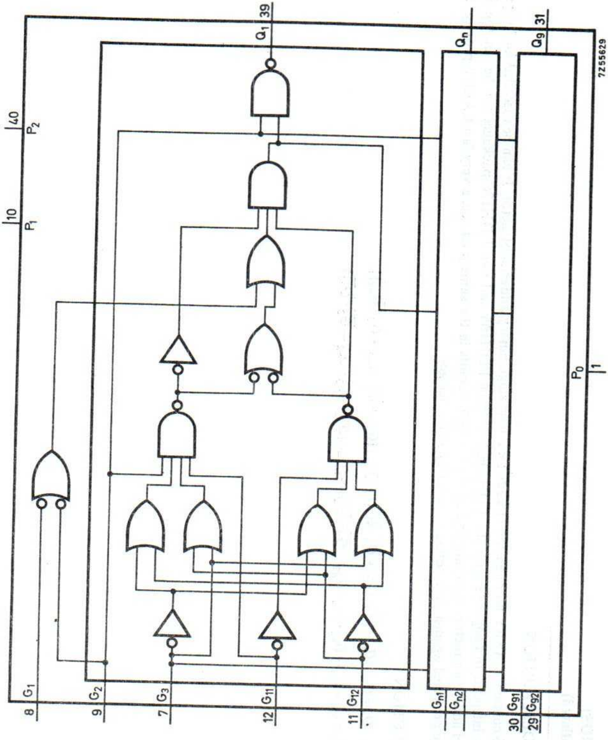
FD family (MOS)
FDH126 Carry array

Supply voltage V_{P1}	-24 to -28 V
Average propagation delay	250 ns
D.C. noise margin	>1 V
Power dissipation	200 mW
Operating ambient temperature	-55 to -85°C



P_0 and metal lid on top of the package are connected

Package: 40 lead ceramic dual in line


8 G1
9 G2
7 G3
12 G11
11 G12
Gn1
Gn2
30 Gg1
29 Gg2
Q1 39
Qn
Qg 31
P0 1
P1 10
P2 40
7Z55629

FD family (MOS)
FDH126 (continued)

GENERAL DESCRIPTION

The FDH126 contains CARRY propagation circuits for a nine stage binary adder/subtractor. It can be cascaded for longer word lengths. The device is intended to cooperate with the FDH106; e.g. three FDH106 and two FDH126 packages can be put together to make an 18-bit parallel adder/subtractor. By combining all the CARRY circuits in the same package, a very fast CARRY propagation is obtained. All inputs are protected against over-voltage caused by static charges.

LOGIC FUNCTION

Positive logic: $Q_n = G_2 \cdot \{G_{n1} \cdot (\overline{G_3} \cdot G_{n2} + G_3 \cdot \overline{G_{n2}}) + Q_{n-1}(G_{n1} + \overline{G_3} \cdot G_{n2} + G_3 \cdot \overline{G_{n2}})\}$

Negative logic: $Q_n = G_2 + G_{n1} \cdot (G_3 \cdot G_{n2} + \overline{G_3} \cdot \overline{G_{n2}}) + Q_{n-1}(G_{n1} + G_3 \cdot G_{n2} + \overline{G_3} \cdot \overline{G_{n2}})$

FUNCTION TABLE

G_2	G_3	Q_{n-1}	G_{n1}	G_{n2}	Q_n
H	X	H	H	X	H
H	H	H	L	H	L
H	H	H	L	L	H
H	H	L	H	H	L
H	H	L	H	L	H
H	X	L	L	X	L
H	L	H	L	H	H
H	L	H	L	L	L
H	L	L	H	H	H
H	L	L	H	L	L
L	X	X	X	X	L

For $n=1$: $Q_{n-1}=G_1$

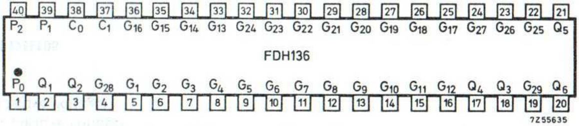
H = HIGH state (the more positive voltage)
L = LOW state (the less positive voltage)
X = state is immaterial

For timing diagrams see **FDH106**

DIGITAL MONOLITHIC INTEGRATED CIRCUITS

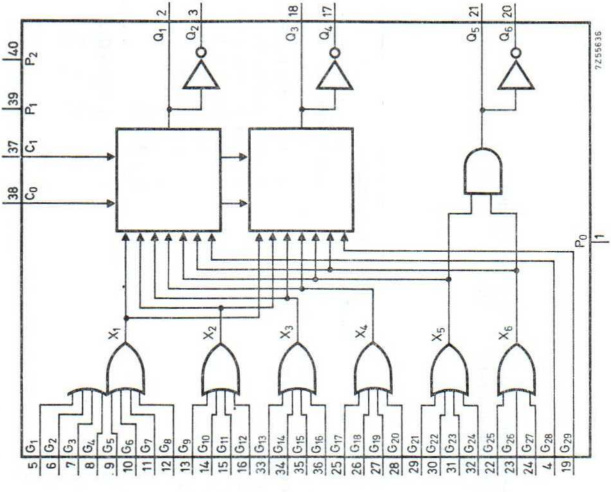
FD family (MOS)
FDH136 AND-OR gating array

Supply voltage V_{P1}	−24 to −28 V
Average propagation delay	180 ns
D.C. noise margin	>1 V
Power dissipation	230 mW
Operating ambient temperature	−55 to +85°C



P_0 and metal lid on top of the package are connected.

Package: 40 lead caramic dual in-time


38 C0
37 C1
39 P1
40 P2
Q1 2
Q2 3
Q3 18
Q4 17
Q5 21
Q6 20
P0 1
X1
X2
X3
X4
X5
X6
5 G1
6 G2
7 G3
8 G4
9 G5
10 G6
11 G7
12 G8
13 G9
14 G10
15 G11
16 G12
33 G13
34 G14
35 G15
36 G16
25 G17
26 G18
27 G19
28 G20
29 G21
30 G22
31 G23
32 G24
22 G25
23 G26
24 G27
4 G28
19 G29
7Z55636

DIGITAL MONOLITHIC INTEGRATED CIRCUITS

FD family (MOS)
FDH136

GENERAL DESCRIPTION

The FDH136 contains general purpose, expandable OR/AND/NAND gates.
Two control lines C_0 and C_1 provide four different logic configurations, as shown in the function table.
Complementary outputs are available.
All inputs are protected against over-voltages caused by static charges.

FUNCTION TABLE

C_0	C_1	logic equation	
		positive logic	*negative logic*
X	X	$X_1=G_1+G_2+G_3+G_4+G_5+G_6+G_7+G_8$ $X_2=G_9+G_{10}+G_{11}+G_{12}$ $X_3=G_{13}+G_{14}+G_{15}+G_{16}$ $X_4=G_{17}+G_{18}+G_{19}+G_{20}$ $X_5=G_{21}+G_{22}+G_{23}+G_{24}$ $X_6=G_{25}+G_{26}+G_{27}$ $Q_5=X_5\cdot X_6$ $Q_6=\overline{X_5}+\overline{X_6}$	$X_1=G_1\cdot G_2\cdot G_3\cdot G_4\cdot G_5\cdot G_6\cdot G_7\cdot G_8$ $X_2=G_9\cdot G_{10}\cdot G_{11}\cdot G_{12}$ $X_3=G_{13}\cdot G_{14}\cdot G_{15}\cdot G_{16}$ $X_4=G_{17}\cdot G_{18}\cdot G_{19}\cdot G_{20}$ $X_5=G_{21}\cdot G_{22}\cdot G_{23}\cdot G_{24}$ $X_6=G_{25}\cdot G_{26}\cdot G_{27}$ $Q_5=X_5+X_6$ $Q_6=\overline{X_5}\cdot\overline{X_6}$
L	L	$Q_1=X_1\cdot X_2\cdot X_3\cdot G_{28}$ $Q_2=\overline{X_1}+\overline{X_2}+\overline{X_3}+\overline{G_{28}}$ $Q_3=X_4\cdot X_5\cdot X_6\cdot G_{29}$ $Q_4=\overline{X_4}+\overline{X_5}+\overline{X_6}+\overline{G_{29}}$	$Q_1=X_1+X_2+X_3+G_{28}$ $Q_2=\overline{X_1}\cdot\overline{X_2}\cdot\overline{X_3}\cdot\overline{G_{28}}$ $Q_3=X_4+X_5\times X_6+G_{29}$ $Q_4=\overline{X_4}\cdot\overline{X_5}\cdot\overline{X_6}\cdot\overline{G_{29}}$

FUNCTION TABLE (*continued*)

C_0	C_1	logic equation	
		positive logic	*negative logic*
L	H	$Q_1 = X_1 \cdot X_2 \cdot X_3 \cdot X_4 \cdot X_5 \cdot X_6 \cdot G_{28}$	$Q_1 = X_1 + X_2 + X_3 + X_4 + X_5 + X_6 + G_{28}$
		$Q_2 = \overline{X_1} + \overline{X_2} + \overline{X_3} + \overline{X_4} + \overline{X_5} + \overline{X_6} + \overline{G_{28}}$	$Q_2 = \overline{X_1} \cdot \overline{X_2} \cdot \overline{X_3} \cdot \overline{X_4} \cdot \overline{X_5} \cdot \overline{X_6} \cdot \overline{G_{28}}$
		$Q_3 = X_1 \cdot X_2 \cdot G_{29}$	$Q_3 = X_1 + X_2 + G_{29}$
		$Q_4 = \overline{X_1} + \overline{X_2} + \overline{G_{29}}$	$Q_4 = \overline{X_1} \cdot \overline{X_2} \cdot \overline{G_{29}}$
H	L	$Q_1 = X_1 \cdot X_2 \cdot G_{28}$	$Q_1 = X_1 + X_2 + G_{28}$
		$Q_2 = \overline{X_1} + \overline{X_2} + \overline{G_{28}}$	$Q_2 = \overline{X_1} \cdot \overline{X_2} \cdot \overline{G_{28}}$
		$Q_3 = X_3 \cdot X_4 \cdot G_{29}$	$Q_3 = X_3 + X_4 + G_{29}$
		$Q_4 = \overline{X_3} + \overline{X_4} + \overline{G_{29}}$	$Q_4 = \overline{X_3} \cdot \overline{X_4} \cdot \overline{G_{29}}$
H	H	$Q_1 = X_1 \cdot X_2 \cdot X_3 \cdot X_4 \cdot G_{28}$	$Q_1 = X_1 + X_2 + X_3 + X_4 + G_{28}$
		$Q_2 = \overline{X_1} + \overline{X_2} + \overline{X_3} + \overline{X_4} + \overline{G_{28}}$	$Q_2 = \overline{X_1} \cdot \overline{X_2} \cdot \overline{X_3} \cdot \overline{X_4} \cdot \overline{G_{28}}$
		$Q_3 = X_5 \cdot X_6 \cdot G_{29}$	$Q_3 = X_5 + X_6 + G_{29}$
		$Q_4 = \overline{X_5} + \overline{X_6} + \overline{G_{29}}$	$Q_4 = \overline{X_5} \cdot \overline{X_6} \cdot \overline{G_{29}}$

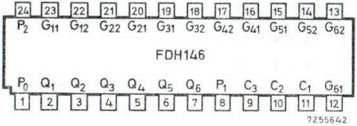
H = HIGH state (the more positive voltage)
L = LOW state (the less positive voltage)
X = state is immaterial

For timing diagrams see **FDH106**

DIGITAL MONOLITHIC INTEGRATED CIRCUITS

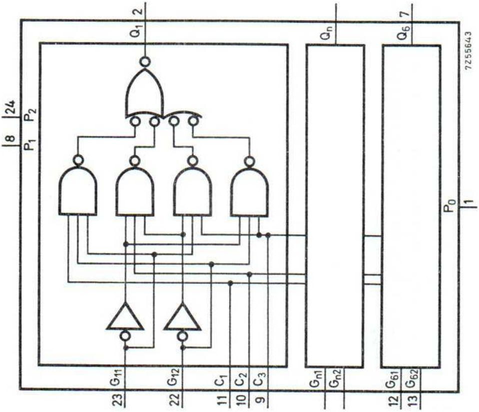
FD family (MOS)
FDH146 Variable gate array

Supply voltage V_{P1}	-24 to -28 V
Average propagation delay	250 ns
D.C. noise margin	>1 V
Power dissipation	35 mW
Operating ambient temperature	-55 to $+85$°C



P_0 and metal lid on bottom of the package are connected

Package: 24 lead ceramic dual in-line


8
P1
24
P2
Q1
2
Qn
Q6
7
P0
1
7Z55643
23
G11
22
G12
11
C1
10
C2
9
C3
Gn1
Gn2
12
G61
13
G62

FD family (MOS)
FDH146 (continued)

GENERAL DESCRIPTION

The FDH146 consists of six, identical, 2-input gate networks. Three coded control lines determine the function of the six gate networks, so that eight different functions can be selected; the selected function is available six times.
The control inputs have pull-down resistors connected to P_2, so that they assume the LOW state, when left floating.
All inputs are protected against over-voltage caused by static charges.

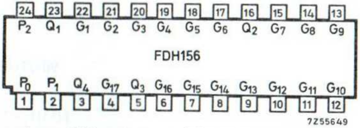
FUNCTION TABLE

C_3	C_2	C_1	*logic equation (positive logic)*	*logic function*	
				positive logic	*negative logic*
L	L	L	$Q_n = \mathrm{LOW}$	—	—
L	L	H	$Q_n = \overline{G_{n1} \cdot G_{n2}}$	NAND	NOR
L	H	L	$Q_n = G_{n1} + G_{n2}$	OR	AND
L	H	H	$Q_n = G_{n1} \cdot \overline{G_{n2}} + \overline{G_{n1}} \cdot G_{n2}$	exclusive-OR	comparator
H	L	L	$Q_n = G_{n1} \cdot G_{n2} + \overline{G_{n1}} \cdot \overline{G_{n2}}$	comparator	exclusive-OR
H	L	H	$Q_n = \overline{G_{n1} + G_{n2}}$	NOR	NAND
H	H	L	$Q_n = G_{n1} \cdot G_{n2}$	AND	OR
H	H	H	$Q_n = \mathrm{HIGH}$	—	—

For timing diagrams see **FDH106**

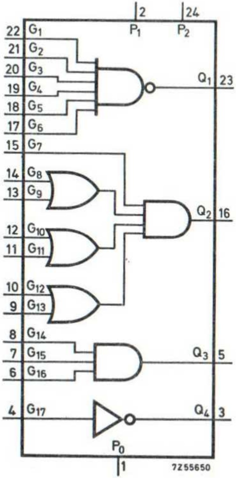
FD family (MOS)
FDH156 Fixed logic array

Supply voltage V_{P1}	-24 to -28 V
Average propagation delay	150 ns
D.C. noise margin	>1 V
Power dissipation	160 mW
Operating ambient temperature	-55 to $+85$°C



P_0 and metal lid on bottom of the package are connected

Package: 24 lead ceramic dual in-line



GENERAL DESCRIPTION

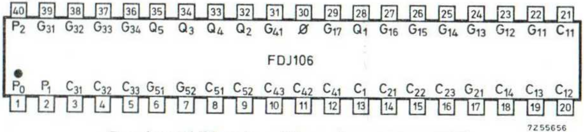
The FDH156 contains all the logic functions shown in the diagram and described in the logic functions below. It is intended to perform logic functions in all MOS digital systems. The output voltage swing is determined by the output buffer supply voltage (V_{P2}).
All inputs are protected against over-voltage caused by static charges.

LOGIC FUNCTIONS

Positive logic	*Negative logic*
$Q_1 = \overline{G_1 \cdot G_2 \cdot G_3 \cdot G_4 \cdot G_5 \cdot G_6}$	$Q_1 = \overline{G_1 + G_2 + G_3 + G_4 + G_5 + G_6}$
$Q_2 = G_7 \cdot (G_8 + G_9) \cdot (G_{10} + G_{11}) \cdot (G_{12} + G_{13})$	$Q_2 = G_7 + G_8 \cdot G_9 + G_{10} \cdot G_{11} + G_{12} \cdot G_{13}$
$Q_3 = G_{14} \cdot G_{15} \cdot G_{16}$	$Q_3 = G_{14} + G_{15} + G_{16}$
$Q_4 = \overline{G_{17}}$	$Q_4 = \overline{G_{17}}$

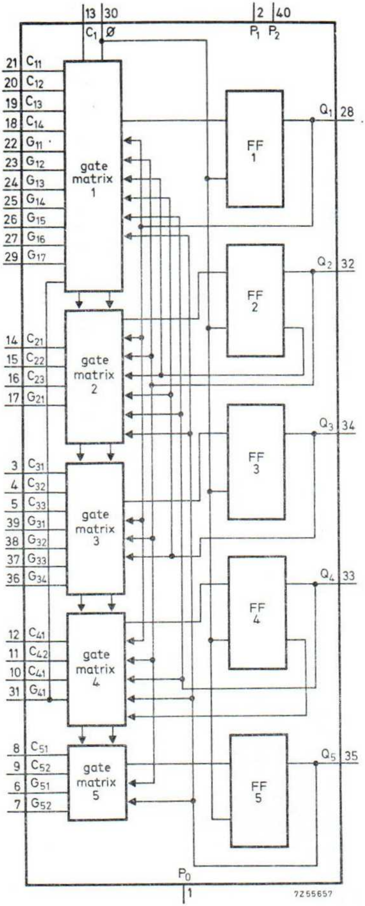
FD family (MOS)
FDJ106 Register array

Supply voltage V_{P1}	-24 to -28 V
Propagation delay	150 ns
D.C. noise margin	>1 V
Power dissipation	180 mW
Operating ambient temperature	-55 to $+85$°C



P_0 and metal lid on top of the package are connected

Package: 40 lead ceramic dual in-line


13
30
C_1
Ø
2
40
P_1
P_2
21 C_{11}
20 C_{12}
19 C_{13}
18 C_{14}
22 G_{11}
23 G_{12}
24 G_{13}
25 G_{14}
26 G_{15}
27 G_{16}
29 G_{17}
gate matrix 1
FF 1
Q_1 28
FF 2
Q_2 32
14 C_{21}
15 C_{22}
16 C_{23}
17 G_{21}
gate matrix 2
FF 3
Q_3 34
3 C_{31}
4 C_{32}
5 C_{33}
39 G_{31}
38 G_{32}
37 G_{33}
36 G_{34}
gate matrix 3
FF 4
Q_4 33
12 C_{41}
11 C_{42}
10 C_{41}
31 G_{41}
gate matrix 4
8 C_{51}
9 C_{52}
6 G_{51}
7 G_{52}
gate matrix 5
FF 5
Q_5 35
P_0
1
7Z55657

FD family (MOS)
FDJ106 (continued)

GENERAL DESCRIPTION

The FDJ106 is an array of 5 flip-flops, designed to act as a synchronous bit slice of a CPU.
Each of the 5 D-type flip-flops has at least one external input and output, as well as individually controlled transfer and input SELECT logic.
The input gating matrix can therefore enable transfers from external inputs or from other registers in the same array.
The register array contains one bit of each of the five main registers in most computers:

FF1 – accumulator
FF2 – memory data register
FF3 – multiplier/quotient register
FF4 – program counter
FF5 – instruction register

All inputs are protected against over-voltage caused by static charge.

LOGIC FUNCTION

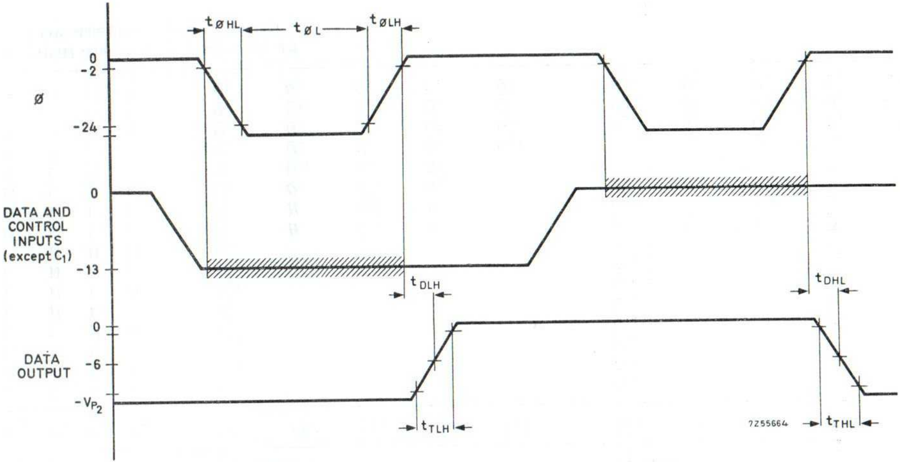
Register input selection table

The FDJ106 outputs will conform to the following input transfer function table. With the given set of control inputs, including C_1, which is common to all gate matrices, each flip-flop will have at its D-input the signal shown in the table below.
With the control inputs established, the output of each register will assume the state of its input after the positive going edge of ϕ.

control input (for any gate matrix)				*Flip-flop inputs*									
				C_1 : *HIGH*					C_1 : *LOW*				
C_{n4}	C_{n3}	C_{n2}	C_{n1}	*FF1*	*FF2*	*FF3*	*FF4*	*FF5*	*FF1*	*FF2*	*FF3*	*FF4*	*FF5*
L	L	L	L	H					G_{41}				
L	L	L	H	G_{17}					G_{17}				
L	L	H	L	G_{16}					G_{16}				
L	L	H	H	G_{15}					G_{15}				
L	H	L	L	G_{14}					G_{14}				
L	H	L	H	G_{13}					G_{13}				
L	H	H	L	G_{12}					G_{12}				
L	H	H	H	G_{11}					G_{11}				
H	L	L	L	H	H	G_{34}	H		Q_1	$\overline{Q_2}$	G_{34}	$\overline{Q_4}$	
H	L	L	H	H	H	G_{33}	H		Q_1	H	G_{33}	H	
H	L	H	L	Q_5	Q_5	G_{32}	G_{41}		Q_1	G_{21}	G_{32}	L	
H	L	H	H	Q_4	Q_{21}	G_{31}	H		Q_1	Q_2	G_{31}	Q_4	
H	H	L	L	$\overline{Q_2}$	Q_4	H	Q_1	G_{52}	Q_1	Q_2	Q_3	Q_4	G_{52}
H	H	L	H	Q_2	Q_1	Q_2	Q_2	G_{51}	Q_1	Q_2	Q_3	Q_4	G_{51}
H	H	H	L	Q_3	Q_3	Q_1	Q_5	Q_2	Q_1	Q_2	Q_3	Q_4	Q_5
H	H	H	H	Q_1	Q_2	Q_3	Q_4	Q_5	Q_1	Q_2	Q_3	Q_4	Q_5

H = HIGH state (the more positive voltage)
L = LOW state (the less positive voltage)

FDJ106 (continued)



Timing diagram notes:

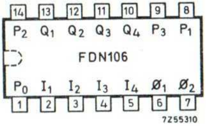
1. Data and control inputs must remain valid for the shaded interval to ensure proper entry.
2. C_1 may be switched in the same manner as all other inputs, providing it completes its switching transition before input G_{41} becomes LOW, for any given clock pulse.

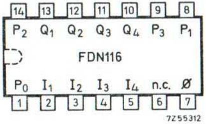
DIGITAL MONOLITHIC INTEGRATED CIRCUITS

FD family (MOS)

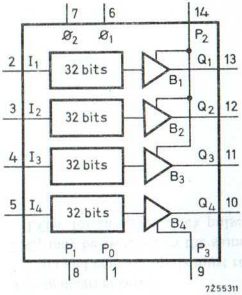
SHIFT REGISTERS (metal ceramic DIL 14p)

Supply voltage	−24 to −28 V
D.C. noise margin	>1 V
Clock rate (2 Phase)	0.01 MHz to 3 MHz
Clock rate (1 Phase)	0.01 MHz to 1 MHz
Power dissipation	300 mW
Operating ambient temperature	−55 to +85°C

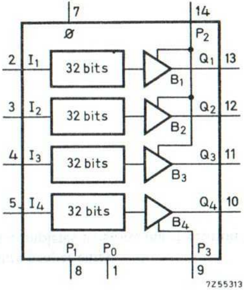




FDN106 Quadruple 32-bit dynamic shift register (2-Phase)



FDN116 Quadruple 32-bit dynamic shift register (1-Phase)



GENERAL DESCRIPTION

The FDN106 and FDN116 packages comprise 4 separate 32-bit shift registers that can be used independently or can be externally connected to make registers up to 128-bits long. Clock and power lines are common to all four registers. The output buffers are bi-directional, low impedance NRZ[1]), that by suitable biasing will directly drive MOS, DTL or TTL loads or, because they have separate supply voltages (V_{P2}; V_{P3}), a combination of MOS and bipolar. V_{P2} and V_{P3} are output buffer voltages only, so the output LOW signal is independent of the width and amplitude of the clock pulse.

The FDN106 uses a two-phase external clock, has low power dissipation and will operate at high speed.

The FDN116 uses a single phase external clock, and is for applications not calling for the low power economy and high speed of the FDN106.

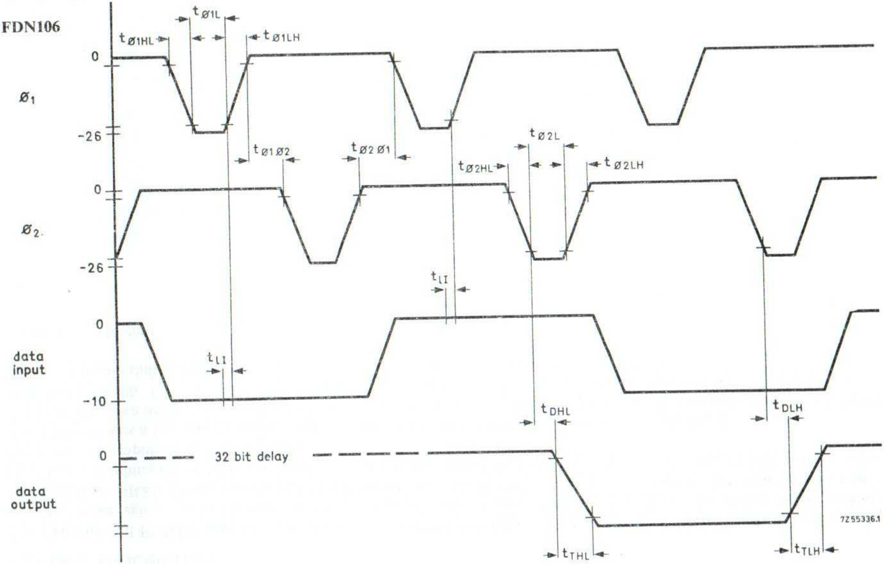
With the FDN106; FDN116; the FDN126; FDN136 (variable length 1 to 64-bit dynamic shift registers) and the FDN146; FDN156 (256-bit dynamic shift registers) shift registers of any length can be built from off-the-shelf parts.

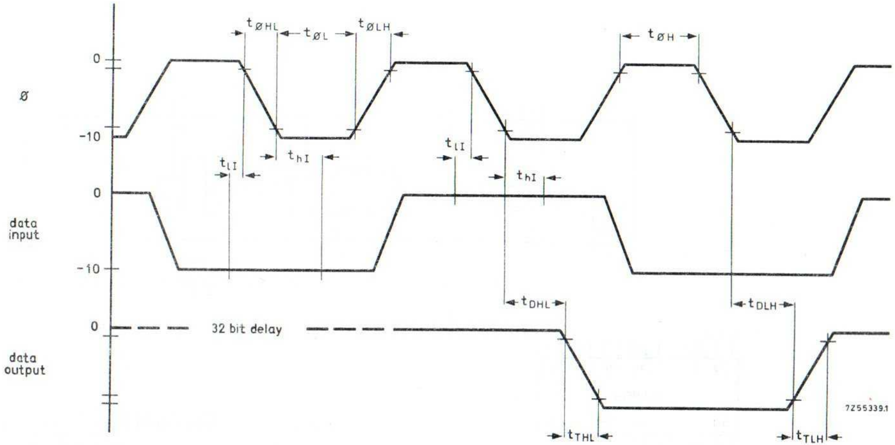
---

[1]) Non return to zero

Timing diagrams

FDN106





Note

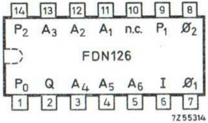
1. With the FDN106 the data inputs must also remain for the $t_{\phi LH}$ period of ϕ_1 as well.

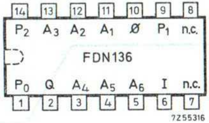
DIGITAL MONOLITHIC INTEGRATED CIRCUITS

FD family (MOS)

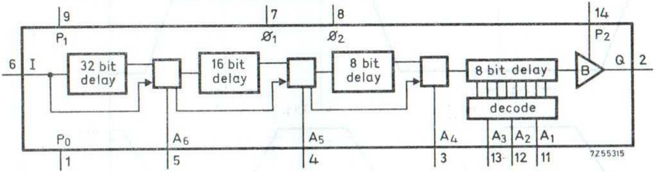
SHIFT REGISTERS (metal ceramic DIL 14p)

Supply voltage	−24 to −28 V
D.C. noise margin	>1 V
Clock rate (2 Phase)	0.01 MHz to 3 MHz
Clock rate (1 Phase)	0.01 MHz to 1 MHz
Power dissipation	300 mW
Operating ambient temperature	−55 to +85°C

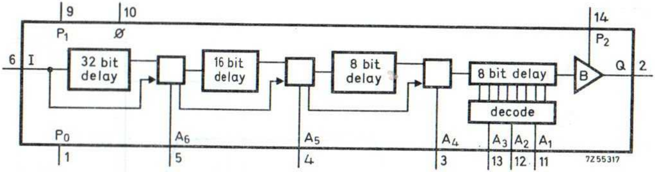




FDN126 Variable length 1 to 64 bit dynamic shift register (2-Phase).



FDN136 Variable length 1 to 64 bit dynamic shift register (1-Phase).



GENERAL DESCRIPTION

The FDN126 and FDN136 are unique in that the bit length of both registers can be set from 1 to 64 bits by appropriate choice of the logic state of 6 control inputs. The same input and output leads are used, the control inputs determine the number of register stages connected between them.

The FDN126 is essentially for high speed operation and needs a 2 phase external clock.

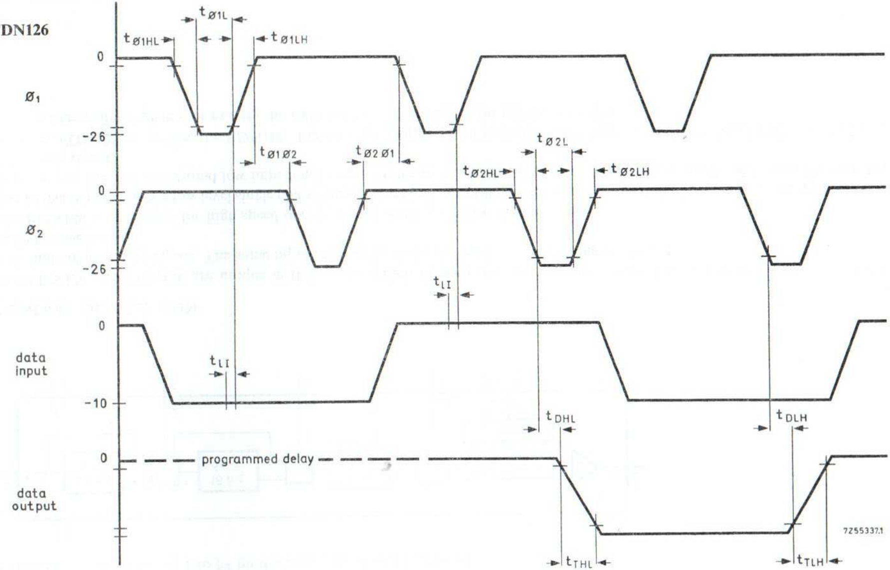
The FDN136 needs only a low level single phase external clock; it is suitable for applications that do not demand speeds in excess of 1 MHz.

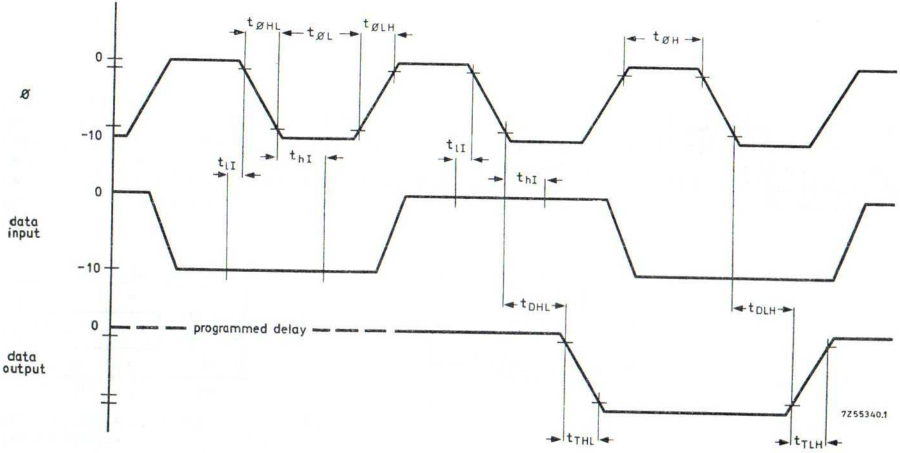
Both circuits use a bi-directional low impedance output buffer which, when appropriately biased, is capable of driving MOS or DTL and TTL loads direct.

With the FDN126; FDN136, the FDN106; FDN116 (quadruple 32-bit dynamic shift registers) and FDN146; FDN156 (256 bit dynamic shift registers) shift registers of exactly the right length can be built from off-the-shelf parts.

Timing diagrams

FDN126



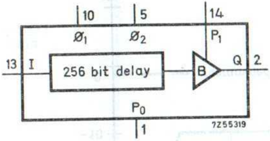


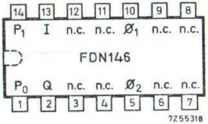
Note

1. During a continuous series of LOW signals the data output may return momentarily to zero once every clock cycle, i.e. when the register output normally changes signal. The data output should not be sampled during this period.

FDN146 256-bit dynamic shift register (2-Phase) (metal ceramic DIL 14p)

Supply voltage	−24 to −28 V
D.C. noise margin	>1 V
Clock rate (2-Phase)	0.01 to 3 MHz
Power dissipation	300 mW
Operating ambient temperature	−55 to +85°C

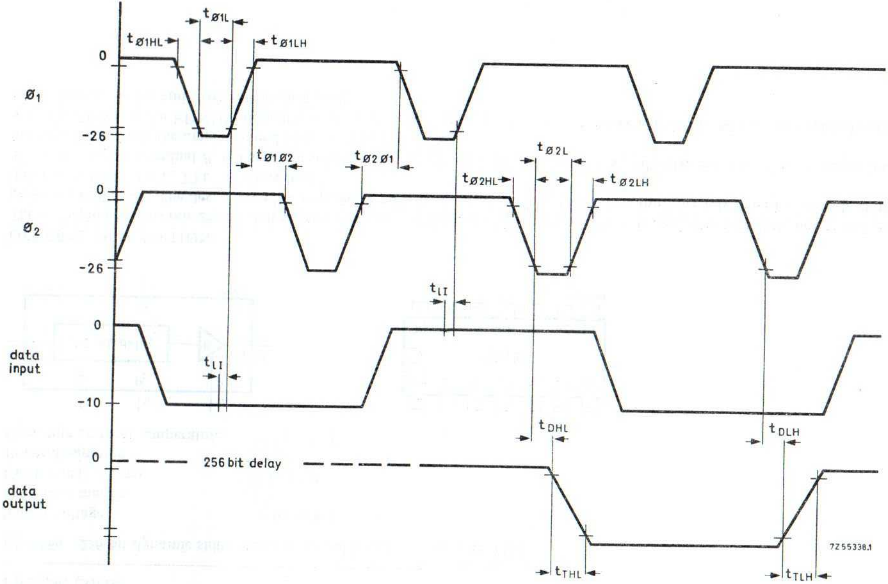




GENERAL DESCRIPTION

The FDN146 contains one continuous 256-bit shift register with one serial input and one serial output. It dissipates very little power and uses a two-phase external clock. The device has a low impedance push-pull output buffer which, when appropriately biased is capable of interfacing direct with MOS, DTL, TTL and other loads. The buffer supply terminal P_1 is a separate supply which determines the output LOW signal only. This provides an output level that is independent of both the amplitude and width of the clock pulse. With the FDN146, the FDN106 (a quadruple 32-bit shift register) and FDN126 (a variable length 1 to 64 bit shift register) shift registers of exactly the right length can be built from off-the-shelf parts.

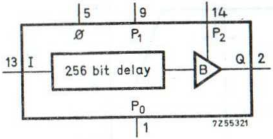
Timing diagram

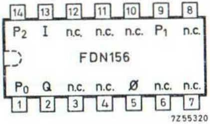


FD family (MOS)

FDN156 256-bit dynamic shift register (1-Phase) (metal ceramic DIL 14p)

Supply voltage	−26 to −28 V
D.C. noise margin	>1 V
Clock rate (1-Phase)	0.01 to 1 MHz
Power dissipation	800 mW
Operating ambient temperature	−55 to −85°C





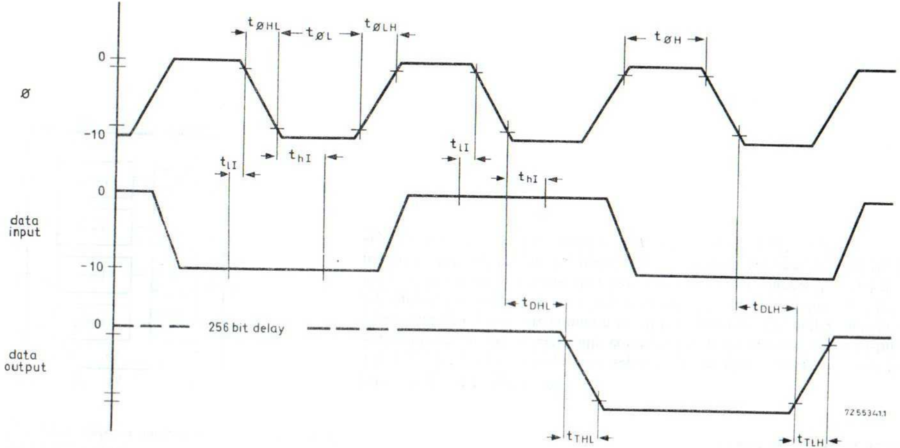
GENERAL DESCRIPTION

The FDN156 contains one 256-bit shift register with one serial input and one serial output. It dissipates very little power and uses a one-phase external clock. The device has a low impedance push-pull output buffer which, when appropriately biased is capable of interfacing direct with MOS, DTL, TTL and other loads.

The buffer supply terminal P_2 is a separate supply which determines the output LOW signal only. This provides an output level that is independent of both the amplitude and width of the clock pulse.

With the FDN156, the FDN116 (a quadruple 32-bit shift register) and FDN136 (a variable length 1 to 64-bit shift register) shift registers of any length can be built from off-the-shelf parts.

Timing diagram

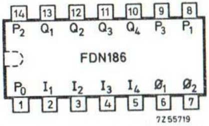


DIGITAL MONOLITHIC INTEGRATED CIRCUITS

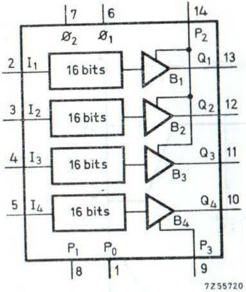
FD family (MOS)

FDN186 Quadruple 16-bit dynamic shift register

Supply voltage V_{P1}	-24 to -28 V
D.C. noise margin	>1 V
Clock rate	0.01 to 3 MHz
Power dissipation	800 mW
Operating ambient temperature	-55 to $+85$°C



14 lead metal-ceramic dual in-line

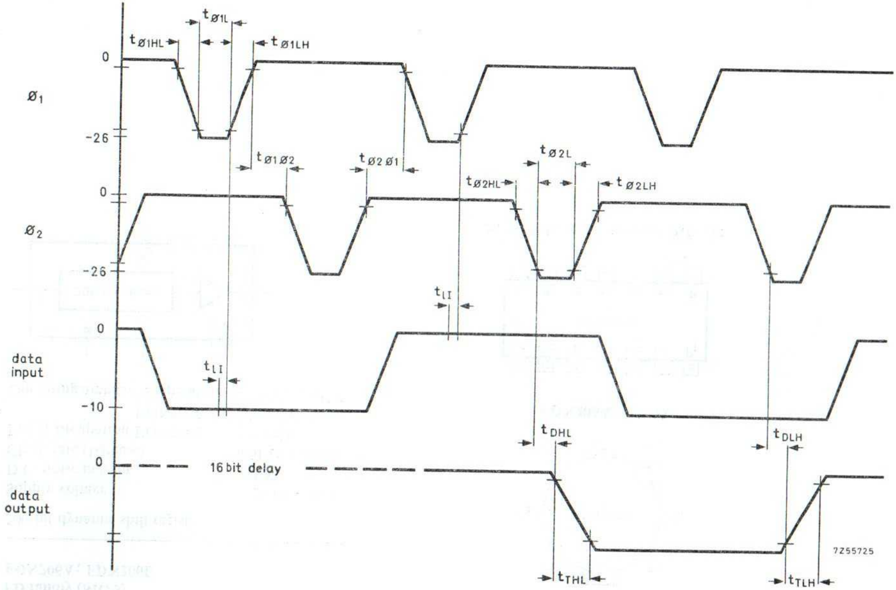


GENERAL DESCRIPTION

The FDN186 package comprises 4 separate 16-bit shift registers that can be used independently or can be externally connected to make registers up to 64-bits long. Clock and power lines are common to all four registers. The output buffers are bi-directional, low impedance NRZ[1]), that by suitable biasing will directly drive MOS, DTL or TTL loads or, because they have separate output voltages (V_{P2}, V_{P3}), a combination of MOS and bipolar. V_{P2} and V_{P3} are output buffer voltages only, and the output signal is independent of the width and amplitude of the clock pulse.

[1]) Non-return to zero

Timing diagram

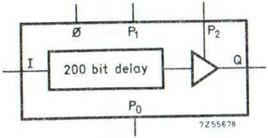


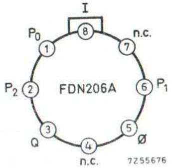
DIGITAL MONOLITHIC INTEGRATED CIRCUITS

FD family (MOS)
FDN206A; FDN206B

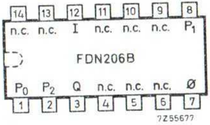
200-bit dynamic shift register

Supply voltage	− 26 to − 28 V
D.C. noise margin	> 1 V
Clock rate (1-Phase)	0.01 to 1 MHz
Power dissipation FDN206A:	625 mW
FDN206B:	800 mW
Operating ambient temperature	− 55 to + 85°C





FDN206A: TO-99



FDN206B: metal ceramic DIL 14p

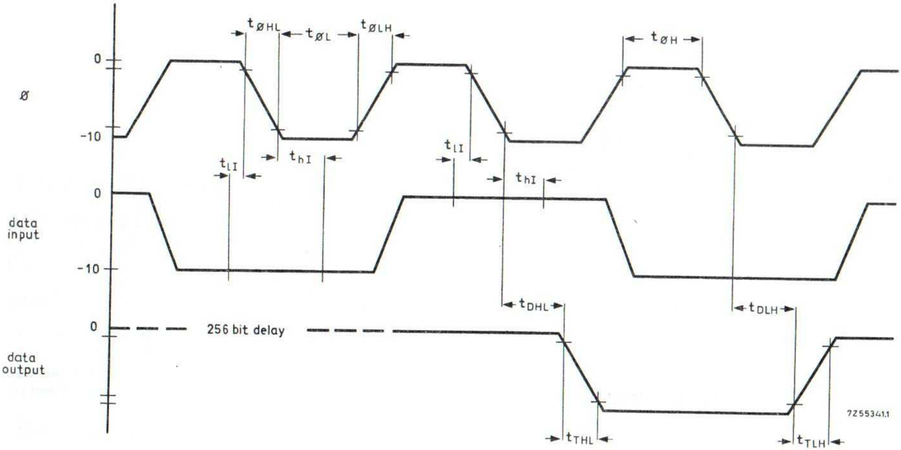
GENERAL DESCRIPTION

The FDN206 contains one 200-bit shift register with one serial input and one serial output. It dissipates very little power and uses a one-phase external clock. The device has a low impedance push-pull output buffer which, when appropriately biased is capable of interfacing direct with MOS, TTL and other loads.

The buffer supply terminal P_2 is a separate supply which determines the output LOW signal only. This provides an output level that is independent of both the amplitude and width of the clock pulse.

With the FDN206, the FDN116 (a quadruple 32-bit shift register) and FDN136 (a variable length 1 to 64-bit shift register) shift registers of any required length can be built from off-the-shelf parts.

Timing diagram

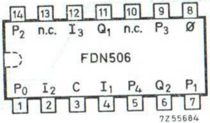


DIGITAL MONOLITHIC INTEGRATED CIRCUITS

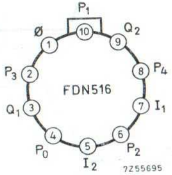
FD family (MOS)
FDN506; FDN516

Dual 32-bit static registers

Supply voltages V_{P1}:	-24 to -28 V
V_{P2}:	-12 to -14 V
D.C. noise margin	>1 V
Clock rate (1-Phase)	0 to 1.5 MHz
Power dissipation FDN506:	800 mW
FDN516:	625 mW
Operating ambient temperature	-55 to $+85$°C

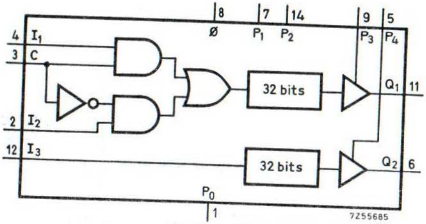


FDN506: metal ceramic DIL 14p

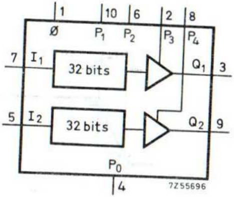


FDN516: TO-100

FDN506



FDN516



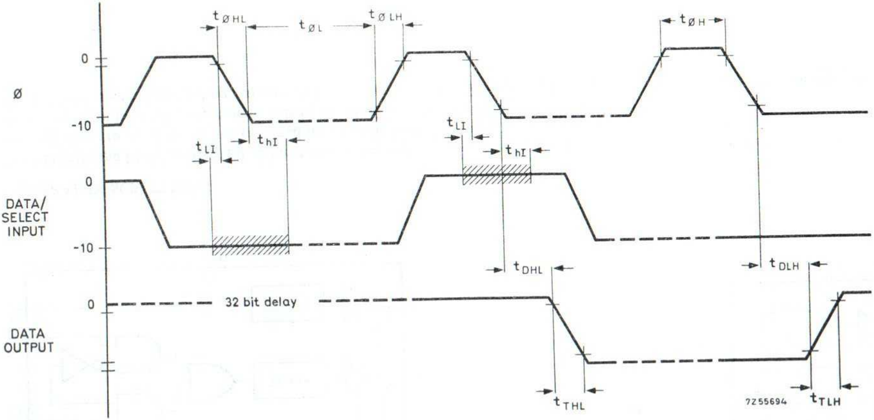
GENERAL DESCRIPTION

The FDN506 and FDN516 are dual 32-bit static shift registers. They require a single phase, low voltage, external clock signal, and may be operated down to d.c. without loss of stored information. Both devices utilize common power and clock lines; the output buffer supplies are separated to facilitate independent biasing for MOS or TTL load drive. The FDN506 contains the gating, external SELECT command and data inputs for selection of two independent data streams.

FD family (MOS)

Timing diagram

FDN506; FDN516



Notes:

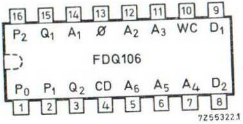
1. Clock pulse ϕ is normally kept LOW.
2. The data and select inputs must remain valid for the shaded interval to ensure proper selection and entry of input data.
3. Data is kept in the register for arbitrarily long periods by keeping the clock LOW.

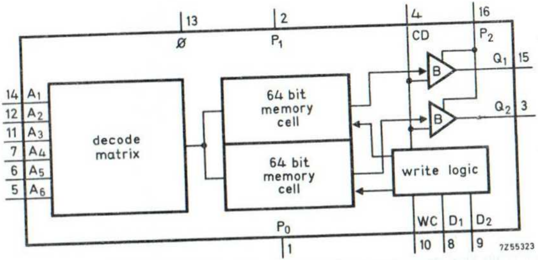
DIGITAL MONOLITHIC INTEGRATED CIRCUITS

FD family (MOS)

FDQ106 (metal ceramic DIL 16p)
Read/write random access memory,
128-bit, 64 word, 2-bits per word

Supply voltage	−24 V to −28 V
Standby power per bit	3 μW
Power consumption per bit	135 mW
Read access time	max. 1 μs
D.C. noise margin	min. 1 V
Max. data read rate	1 MHz
Max. data write rate	1 MHz
Operating ambient temperature	−55 to +85°C



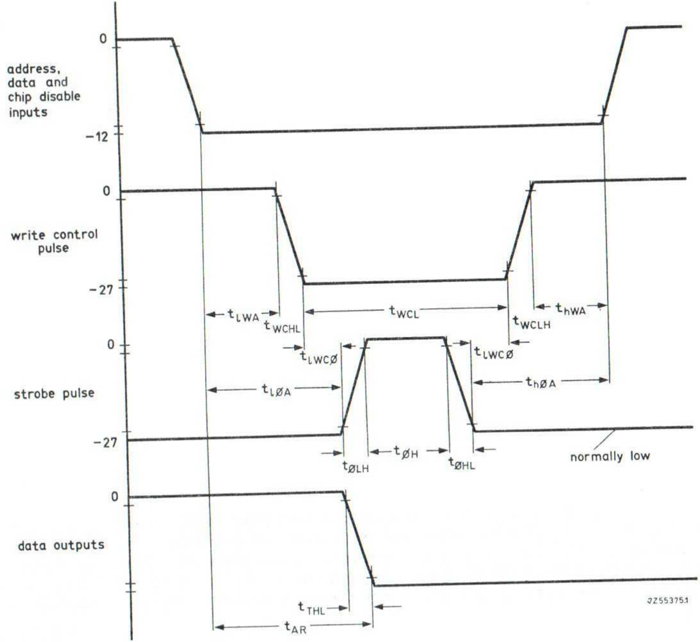


GENERAL DESCRIPTION

The FDQ106 is a monolithic, 128-bit random access/write memory. It is organized as two 64-bit memories with 6 common single-rail address inputs and two separate outputs; it is used as a 64 word, 2-bits per word memory. It requires a single-phase clock strobe pulse to refresh the data stored in all the memory cells simultaneously and to change the data stored in a cell in the write mode. It also incorporates a chip disable that inhibits both data inputs and output buffers for expanded memory applications. The memory is activated in the write mode by applying a write control pulse; at all other times it is in the read mode.

Timing diagram

FDQ106



Timing diagram notes

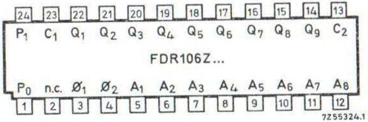
1. During address change or chip disable inputs, the strobe (ϕ) must be LOW and the write control (WC) must be HIGH.
2. For every write cycle a strobe pulse is required. The strobe pulse may be the inverse of the write control pulse, provided $t_{lWC\phi} \geqslant 0$.
3. A strobe pulse is not required for a read cycle. However, a minimum strobe pulse repetition of 10 kHz is required, and strobe pulses may occur during read cycles if the $t_{l\phi A}$ leadtime is observed.
4. Data is written into a memory cell only when the write control pulse is LOW. At all other times, the memory is in the read mode.
5. Whether they are in read or write cycles, all memory cells are simultaneously refreshed during a strobe pulse. No cycling through addresses is required.
6. During a write cycle, the memory's outputs are active, so the new data in will also be read out of the memory after t_{AR}.
7. The chip disable control also inhibits the write control. Therefore a disabled chip can be strobed, or its addresses can be changed, but its contents cannot be changed.
8. If the address inputs remain unchanged, the data outputs appear as d.c. levels, no return to zero.

DIGITAL MONOLITHIC INTEGRATED CIRCUITS

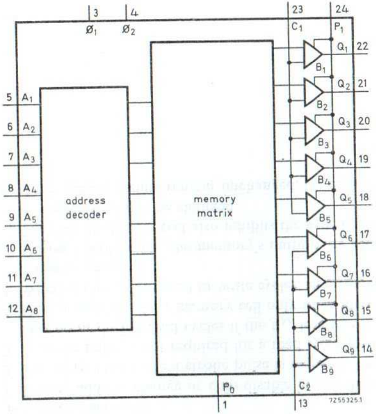
FD family (MOS)

FDR106Z } Read only memory, 256 word,
FDR106Z1 } 9-bits per word

Read access time	max. 1 μs
Clock rate	max. 1 MHz
Power dissipation	36 mW
D.C. noise margin	1 V
Operating ambient temperature	−55 to +85°C



metal ceramic DIL 24p



FDR106Z . . .	256 words 9 bits/word (no discrete content).
FDR106Z1	256 words 9 bits/word (fixed bit pattern).

GENERAL DESCRIPTION

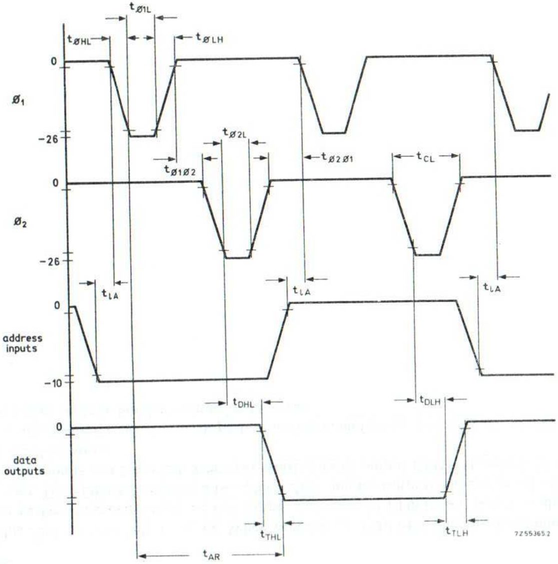
The FDR106Z is a monolithic 2304-bit read only memory. When ordering an FDR106Z the customer must send a bit pattern matrix with the desired content. For performance evaluation, we can supply specimens of FDR106Z1, which is identical to the FDR106Z but contains a bit pattern of our own. The FDR106Z requires a two phase clock, but the outputs remain steady as long as the address remains unchanged. The normal configuration is as a 256 word, 9-bits per word, parallel output ROM. However, by means of two output inhibit controls it can be set up for 512 4-bit words.

The memory matrix is programmed with the aid of a mask pattern during manufacture. The only d.c. supply is the output buffer supply, which is variable and can be biased to drive bipolar output loads direct.

FD family (MOS)

Timing diagram

FDR106Z(Z1)



Address and output inhibit timing requirements:

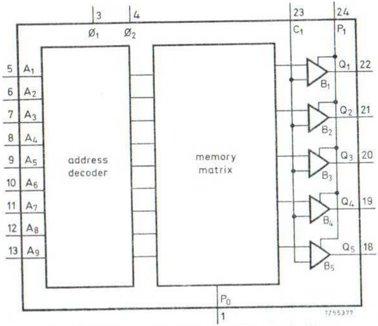
1. Address input signals are clocked into the memory during ϕ_1, and must remain present throughout ϕ_1. Address lead time ($t_{l\mathrm{A}}$) must be $\geqslant 0$.
2. Output inhibit signals act without delay. If output signals are to be read during phase 1, output inhibit signals must be delayed with respect to their associated address until phase 2 (t_{CL}).
3. The output signals remain steady for as many clock cycles as the address and output inhibit signals remain unchanged.

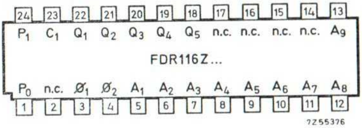
DIGITAL MONOLITHIC INTEGRATED CIRCUITS

FD family (MOS)

FDR116Z }
FDR116Z1 } Read only memory, 512 word, 5-bits per word

Read acces time	max. 850 ns
Clock rate	max. 1.2 MHz
Power dissipation	36 mW
D.C. noise margin	>1 V
Operating ambient temperature	− 55 to + 85°C





Metal ceramic DIL 24p

FDR116Z. . .	512 words 5 bits/word (no discrete content).
FDR116Z1	512 words 5 bits/word (fixed bit pattern).

GENERAL DESCRIPTION

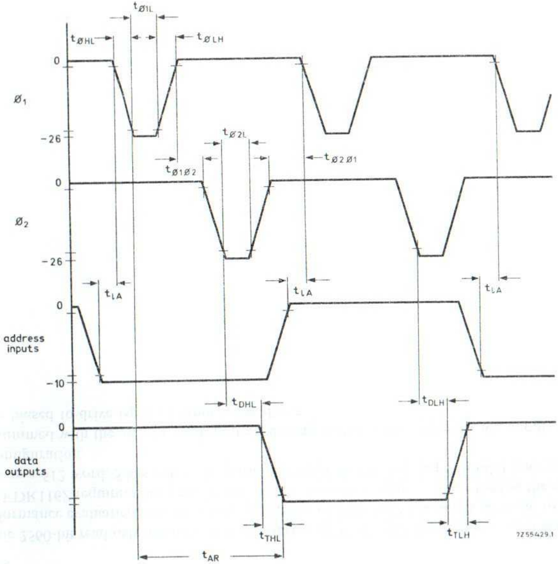
The FDR116Z is a monolithic 2560-bit read only memory. When ordering an FDR116Z the customer must send a bit pattern matrix with the desired content. For performance evaluation, we can supply specimens of FDR116Z1, which is identical to the FDR116Z but contains a bit pattern of our own. The FDR116Z requires a two phase clock, but the outputs remain steady as long as the address remains unchanged. The normal configuration is as a 512 word, 5-bits per word, parallel output ROM. An output inhibit control allows the use of multiple FDR116Z in a wired-OR configuration.

The memory matrix is programmed with the aid of a mask pattern during manufacture. The only d.c. supply is the output buffer supply, which is variable and can be biased to drive bipolar output loads direct.

FD family (MOS)

Timing diagram

FDR116Z(Z1)



Address and output inhibit timing requirements:

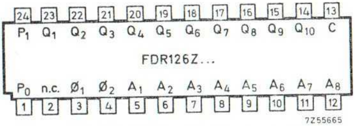
1. Address input (and output inhibit input) signals are clocked into the memory during ϕ_1, and must remain present throughout ϕ_1. Address lead time (t_{IA}) must be $\geqslant 0$.
2. The output signals remain steady for as many clock cycles as the address and output inhibit signals remain unchanged.

DIGITAL MONOLITHIC INTEGRATED CIRCUITS

FD family (MOS)

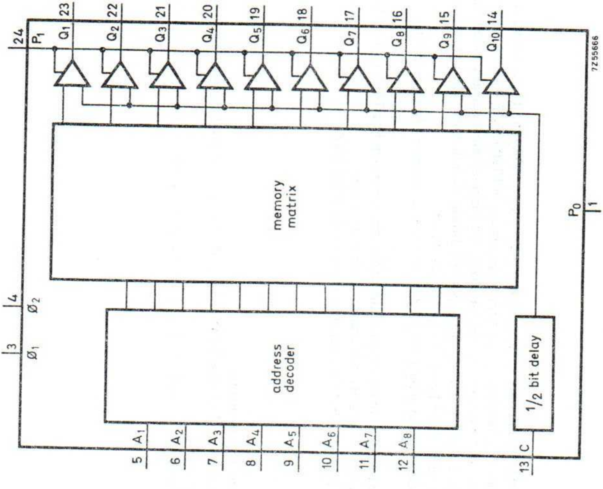
FDR126Z } Read only memory, 256 word,
FDR126Z1 } 10 bits per word

Read access time	max. 1 μs
Clock rate	max. 1 MHz
Power dissipation	100 mW
D.C. noise margin	>1 V
Operating ambient temperature	−55 to +85°C



P_0 and metal package bottom are connected

24 lead metal-ceramic dual in-line



24
P_1
Q_1 23
Q_2 22
Q_3 21
Q_4 20
Q_5 19
Q_6 18
Q_7 17
Q_8 16
Q_9 15
Q_{10} 14
7Z55666
3
$Ø_1$
4
$Ø_2$
memory matrix
address decoder
1/2 bit delay
P_0
1
5 A_1
6 A_2
7 A_3
8 A_4
9 A_5
10 A_6
11 A_7
12 A_8
13 C

FD family (MOS)

GENERAL DESCRIPTION

The FDR126Z is a monolithic 2560-bit read only memory. When ordering an FDR126Z the customer must send a bit pattern matrix with the desired content. For performance evaluation, we can supply specimens of FDR126Z1, which is identical to the FDR126Z but contains a bit pattern of our own. The FDR126Z requires a two phase clock; the outputs remain steady as long as the address remains unchanged. The memory matrix is programmed with the aid of a mask pattern during manufacture. The only d.c. supply is the output buffer supply, which is variable and can be biased to drive bipolar output loads direct.

The FDR126Z1 is a pre-programmed version of the FDR126Z READ-ONLY memory. It is intended to convert from ASCII to SELECTRIC line code and vice versa.

When 7-bit address of either code is applied to the inputs of the ROM, the corresponding 7-bits of the other code will appear at the outputs.

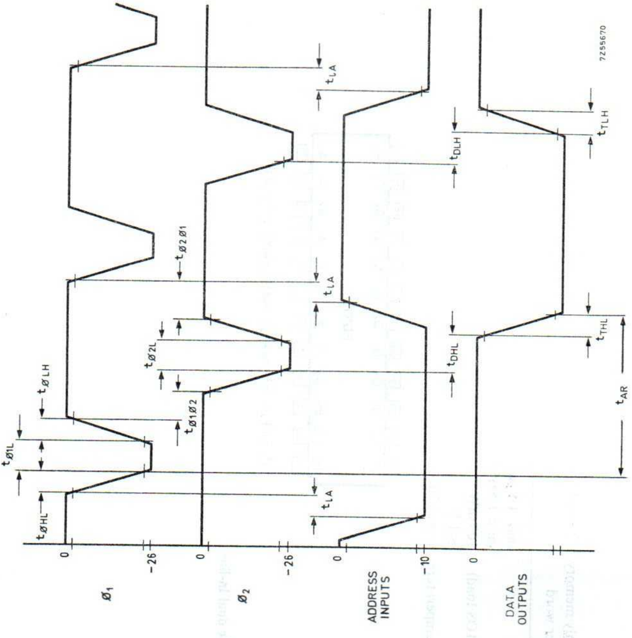
The three remaining outputs are used for parity and control code indications.

The electrical characteristics of the FDR126Z1 are equal to those of the FDR126Z.

Timing diagram

Address and output inhibit timing requirements:

1. Address and output inhibit signals are clocked into the memory during ϕ_1, and must remain present throughout ϕ_1. Address and output inhibit lead time (t_{IA}) must be $\geqslant 0$.
2. The output signals remain steady for as many clock cycles as the address and output inhibit signals remain unchanged.


Ø1
0
−26
Ø2
0
−26
ADDRESS INPUTS
0
−10
DATA OUTPUTS
0
$t_{ØHL}$
$t_{Ø1L}$
$t_{ØLH}$
$t_{Ø1Ø2}$
$t_{Ø2L}$
$t_{Ø2Ø1}$
t_{LA}
t_{LA}
t_{LA}
t_{DHL}
t_{THL}
t_{DLH}
t_{TLH}
t_{AR}
7Z55670

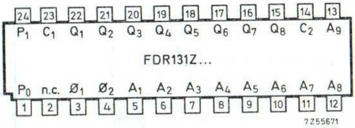
DIGITAL MONOLITHIC INTEGRATED CIRCUITS

FD family (MOS)

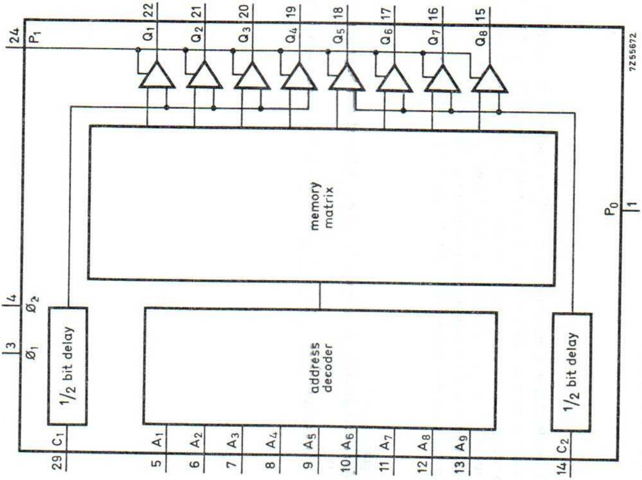
FDR131Z
FDR131Z1 } Read only memory, 512 word, 8 bits per word

Read access time	max. 1.5 μs
Clock rate	max. 1 MHz
Power dissipation (MOS load)	100 mW
D.C. noise margin	>1 V
Operating ambient temperature	0 to +70° C

24 lead metal-ceramic dual in-line



P_0 and metal package bottom are connected


24
P1
3
Ø1
4
Ø2
22
Q1
21
Q2
20
Q3
19
Q4
18
Q5
17
Q6
16
Q7
15
Q8
7Z55672
1/2 bit delay
address decoder
memory matrix
1/2 bit delay
P0
1
29
C1
5
A1
6
A2
7
A3
8
A4
9
A5
10
A6
11
A7
12
A8
13
A9
14
C2

FD family (MOS)

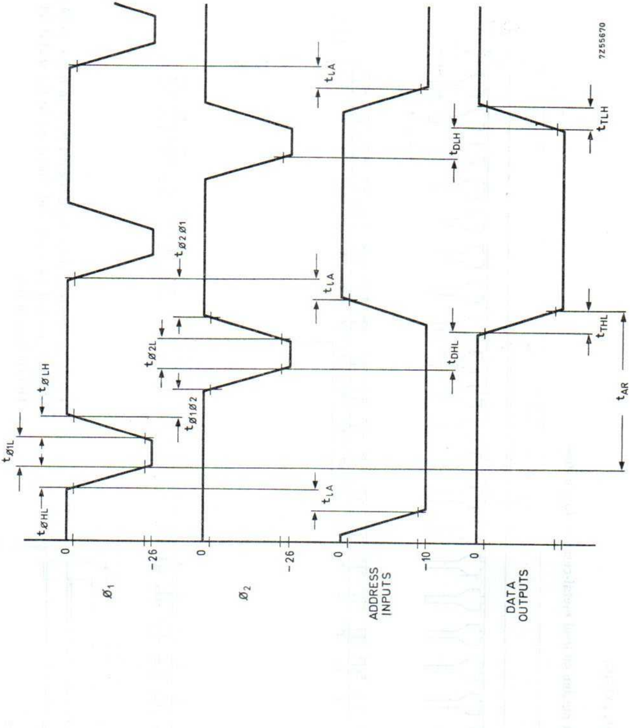
GENERAL DESCRIPTION

The FDR131Z is a monolithic 4096-bit READ-only memory (ROM) with a capacity of 512 words, 8-bits per word. With two output-inhibit control lines C_1 and C_2 it can also operate as a 1024-word, 4-bits per word memory. The memory matrix is given the desired content by means of a special mask. When ordering, customers have to complete a set of forms specifying the bit pattern to be associated with each address. An output-inhibit control makes it possible to use several FDR131Z memories in wired-OR configuration.
The only d.c. supply is the output buffer supply (P_1), which may be adapted to interface direct with either MOS or bipolar DTL/TTL. The inputs of the FD circuits are effectively protected against over voltage caused by static charge.

Timing diagram

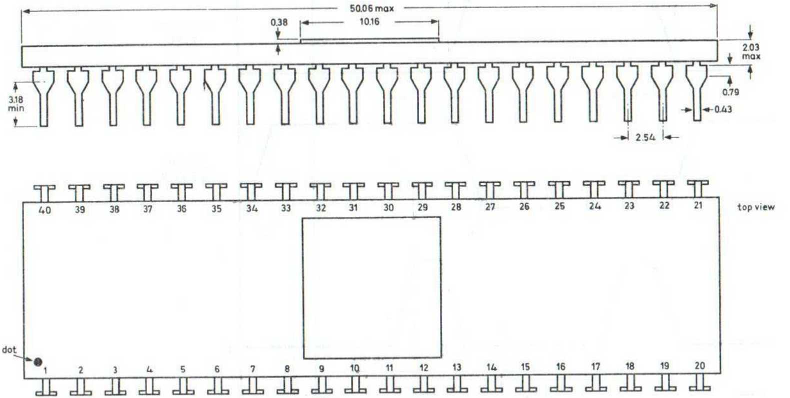
Address and output inhibit timing requirements:

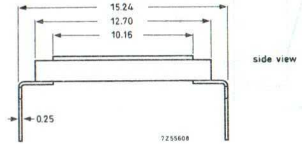
1. Address and output inhibit signals are clocked into the memory during ϕ_1, and must remain present throughout ϕ_1. Address and output inhibit lead time (t_{IA}) must be $\geqslant 0$.
2. The output signals remain steady for as many clock cycles as the address and output inhibit signals remain unchanged.


Ø1
Ø2
ADDRESS INPUTS
DATA OUTPUTS
0
-26
0
-26
0
-10
0
t_ØHL
t_Ø1L
t_ØLH
t_Ø1Ø2
t_Ø2L
t_Ø2Ø1
t_LA
t_LA
t_LA
t_DHL
t_DLH
t_THL
t_TLH
t_AR
7Z55670

FD family (MOS)

Package outline 40 lead metal-ceramic dual in-line

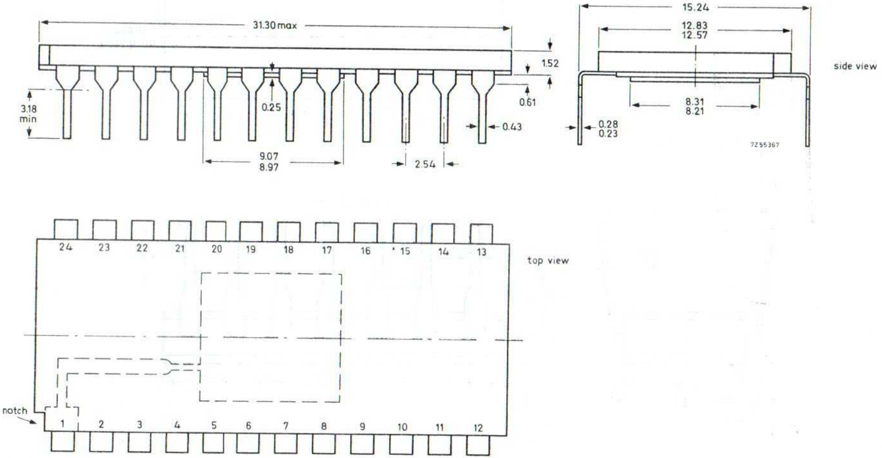




Notes

1. Leads on opposite sides are designed to fit in holes 15.24 mm apart.
2. Pin 1 is marked by a dot and connected to the metal lid on top of the package.
3. Dimensions in mm.

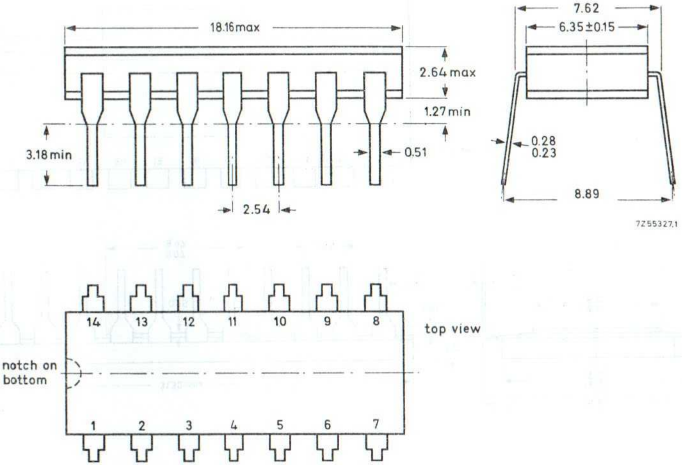
Metal ceramic 24 pin dual in-line



Dimensions in mm

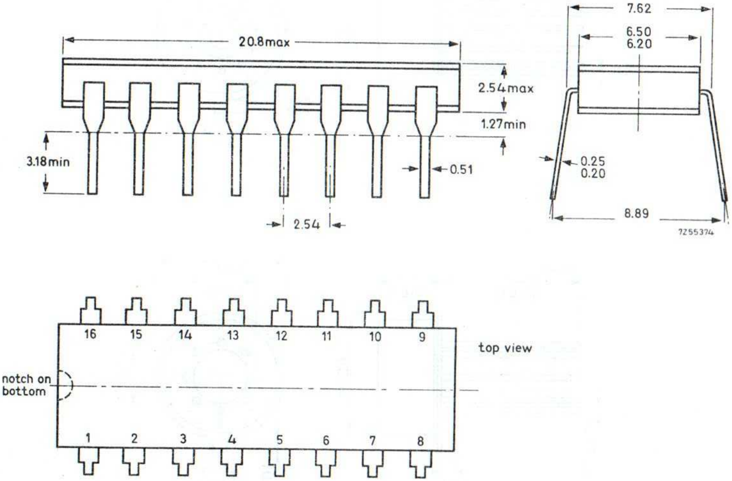
FD family (MOS)

Metal ceramic 14 pin dual in-line



Dimensions in mm

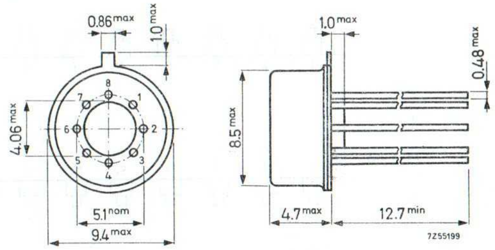
Metal ceramic 16 pin dual in-line



Dimensions in mm

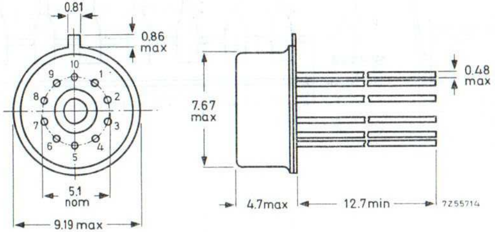
FDN206A

TO-99 metal envelope



FDN516

TO-100 metal envelope

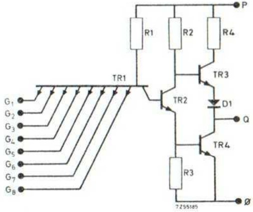


DIGITAL MONOLITHIC INTEGRATED CIRCUITS

FJ family (Transistor-Transistor Logic)

Standard temperature range

Supply voltage	V_P	5.0 V ± 5%
Operating ambient temperature	T_{amb}	0 to 70°C



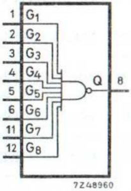
Basic gate circuit

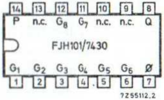
CHARACTERISTICS at $T_{amb} = 25°C$ (each gate)

Type number	*Description (positive logic)*	t_{pd} *typ. (ns)*	N_a *min.*	M_L *typ. (V)*	P_{av} *typ. (mW)*	*Package*
FJH101/7430	Single 8-input NAND gate	13	10	1.0	10	DIL 14p
FJH111/7420	Dual 4-input NAND gate	13	10	1.0	10	DIL 14p
FJH121/7410	Triple 3-input NAND gate	13	10	1.0	10	DIL 14p
FJH131/7400	Quadruple 2-input NAND gate	13	10	1.0	10	DIL 14p
FJH141/7440	Dual 4-input NAND power gate	13	30	1.0	26.5	DIL 14p
FJH151/7450	Dual expandable 2 + 2-input AND-OR-NOT gate	13	10	1.0	14.25	DIL 14p
FJH161/7451	Dual 2 + 2-input AND-OR-NOT gate	13	10	1.0	14.25	DIL 14p

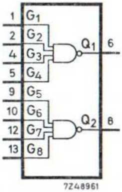
Logic diagrams and terminal connections

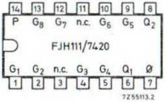
FJH101/7430

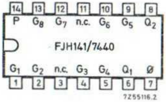




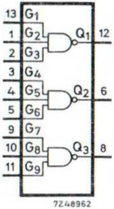
FJH111/7420
FJH141/7440

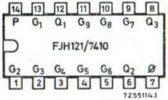




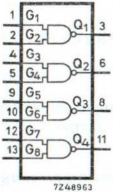


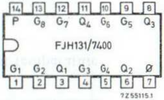
FJH121/7410



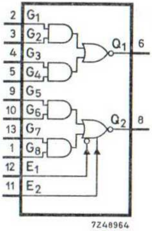


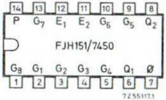
FJH131/7400



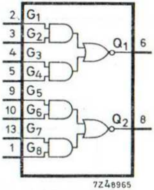


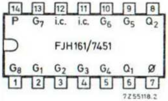
FJH151/7450





FJH161/7451

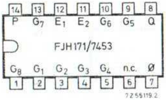


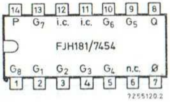


Pin 14 = P = positive supply voltage; pin 7 = Ø = earth

DIGITAL MONOLITHIC INTEGRATED CIRCUITS

FJ family (Transistor-Transistor Logic)
Standard temperature range





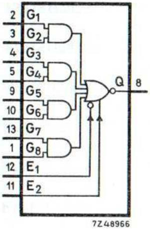
Supply voltage	V_P	5.0 V ±5%
Operating ambient temperature	T_{amb}	0 to 70°C

CHARACTERISTICS at $T_{amb} = 25°C$ (each gate)

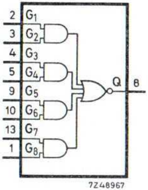
Type number	*Description (positive logic)*	t_{pd} *typ. (ns)*	N_a *min.*	M_L *typ. (V)*	P_{av} *typ. (mW)*	*Package*
FJH171/7453	Expandable 2+2+2+2 input AND-OR-NOT gate	13	10	1.0	14.25	DIL 14p
FJH181/7454	2+2+2+2 input AND-OR-NOT gate	13	10	1.0	14.25	DIL 14p
FJH191/7480	Full adder	—	5	1.0	105	DIL 14p
FJH221/7402	Quadruple 2-input NOR gate	13	10	1.0	14.25	DIL 14p
FJH231/7401	Quadruple 2-input NAND gate	22	10	1.0	7.5	DIL 14p
FJH241/7404	Sextuple 1-input inverter	13	10	1.0	10	DIL 14p
FJH251/7405	Sextuple 1-input inverter	13	10	1.0	10	DIL 14p
FJH261/7442	BCD-to-decimal decoder	20	10	—	140	DIL 16p
FJH291/7403	Quadruple 2-input NAND gate	22	10	1.0	7.5	DIL 14p

Logic diagrams and terminal connections

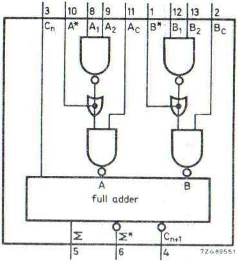
FJH171/7453

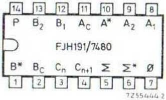


FJH181/7454

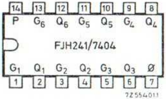


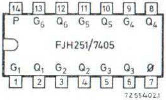
FJH191/7480

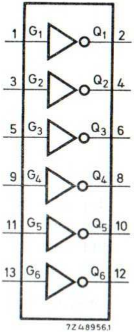




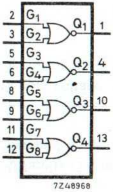
FJH241/7404
FJH251/7405

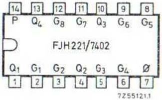


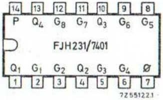




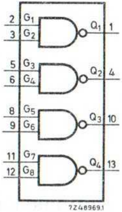
FJH221/7402



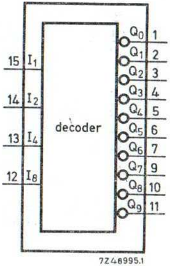


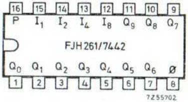


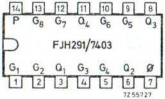
FJH231/7401



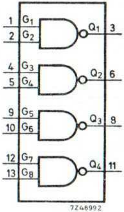
FJH261/7442





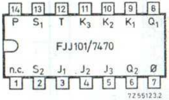


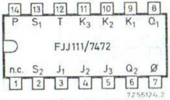
FJH291/7403

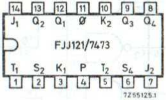


DIGITAL MONOLITHIC INTEGRATED CIRCUITS

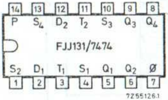
FJ family (Transistor-Transistor Logic)
Standard temperature range

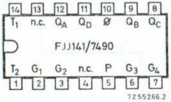


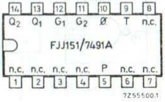




Supply voltage V_P 5.0 V ± 5%
Operating ambient temperature T_{amb} 0 to 70°C





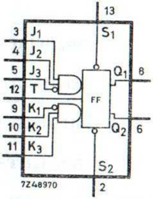


CHARACTERISTICS at $T_{amb} = 25°C$

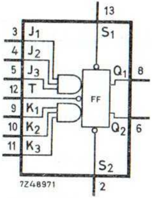
Type number	*Description (positive logic)*	f_c *min. (MHz)*	N_a *min.*	M_L *typ. (V)*	P_{av} *typ. (mW)*	*Package*
FJJ101/7470	Single JK flip-flop	20	10	–	70	DIL 14p
FJJ111/7472	Single JK master-slave flip-flop	10	10	–	40	DIL 14p
FJJ121/7473	Dual JK master-slave flip-flop	10	10	–	40	DIL 14p
FJJ131/7474	Dual D-type edge-triggered flip-flop	15	10	–	42.5	DIL 14p
FJJ141/7490	BCD decade counter	10	10	–	160	DIL 14p
FJJ151/7491A	8-bit shift register	10	10	1.0	175	DIL 14p
FJJ181/7475	Quadruple gated D flip-flop	–	10	1.0	160	DIL 16p

Logic diagrams and terminal connections

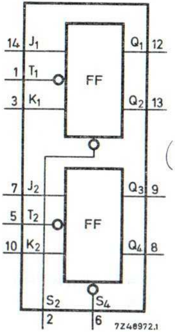
FJJ101/7470



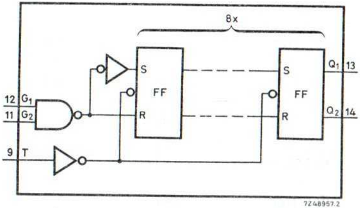
FJJ111/7472



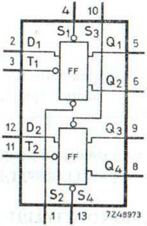
FJJ121/7473



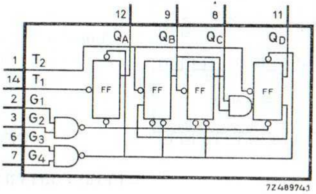
FJJ151/7491A



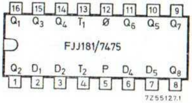
FJJ131/7474

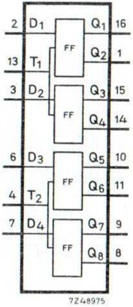


FJJ141/7490



FJJ181/7475

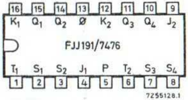


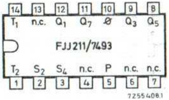


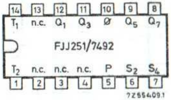
DIGITAL MONOLITHIC INTEGRATED CIRCUITS

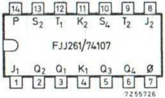
FJ family (Transistor-Transistor Logic)
Standard temperature range

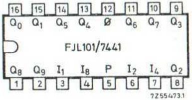
Supply voltage	V_P	5.0 V ± 5%
Operating ambient temperature	T_{amb}	0 to 70°C

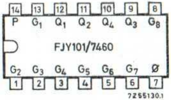










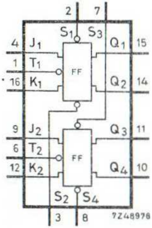


CHARACTERISTICS at $T_{amb} = 25°C$

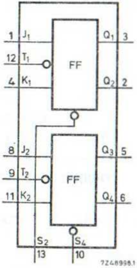
Type number	*Description (positive logic)*	f_c *min. (MHz)*	N_a *min.*	M_L *typ. (V)*	P_{av} *typ. (mW)*	*Package*
FJJ191/7476	Dual JK master-slave flip-flop	10	10	1.0	80	DIL 16p
FJJ211/7493	Single decoded NIT driver	–	–	–	100	DIL 14p
FJJ251/7492	Single asynchronous 4-bit binary counter	10	10	1.0	155	DIL 14p
FJJ261/74107	Dual JK master-slave flip-flop	10	10	—	40	DIL 14p
FJL101/7441	Single asynchronous 4-bit binary counter	10	10	1.0	128	DIL 16p
FJY101/7460*	Dual 4-input AND-OR-NOT expander			1.0	4.0	DIL 14p

Logic diagrams and terminal connections

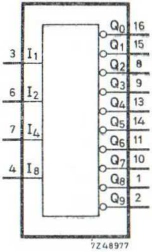
FJJ191/7476



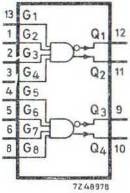
FJJ261/74107



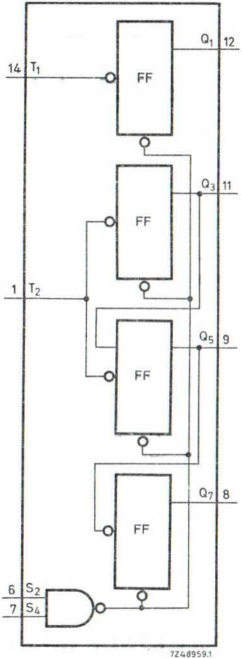
FJL101/7451



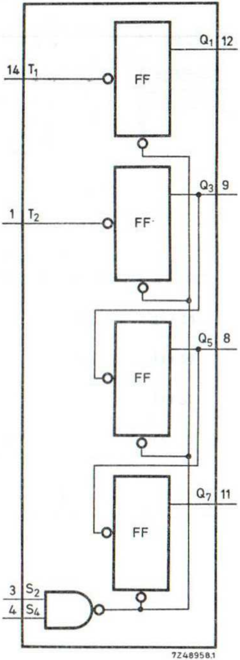
FJY101/7460



FJJ211/7493



FJJ251/7492



* Propagation delay time typ. 15ns.

LINEAR MONOLITHIC INTEGRATED CIRCUITS

CHARACTERISTICS at $T_{amb} = 25°C$.

Audio amplifiers

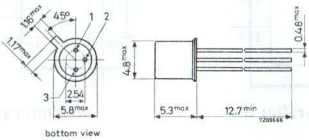
Type number	G_{tr}	Z_i	R_L	f_{c-o}	P_o	V_o	P_{tot}	V_P	*Package*
TAA263	77 dB				>10 mW	<7 V	<70 mW	8 V	TO-72
TAA300*		15 kΩ	8 Ω	20 kHz	1 W		0.8 W	9 V	TO-74
TAA310	100 dB	20 kΩ		15 kHz		2 V	160 mW	7 V	TO-74
TAA435**	80 dB	70 kΩ		10 kHz	>4 W			14 V	TO-74

* Input signal for 1 W output = typ. 8.5 mV.

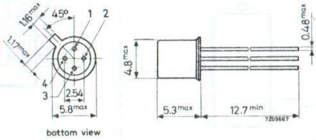
** Audio pre-amplifier and driver.

TAA320 MOST pre-amplifier in TO-18 package

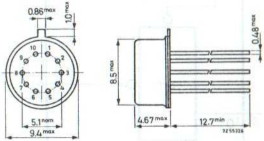
Drain-source voltage	max. 20 V
Drain current	max. 25 mA
Gate-source voltage	typ. 11 V
Gate-source resistance	min. 100 GΩ
Transfer admittance	typ. 75 Ω^{-1}



TO-18

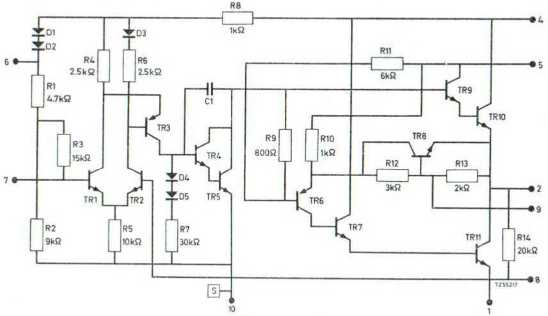


TO-72

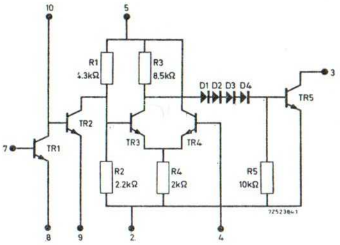


TO-74 (reduced height)

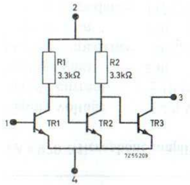
TAA300



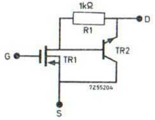
TAA310



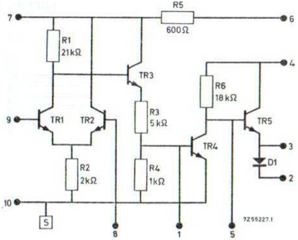
TAA263



TAA320



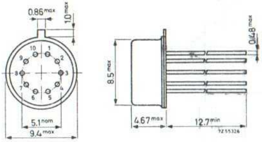
TAA435



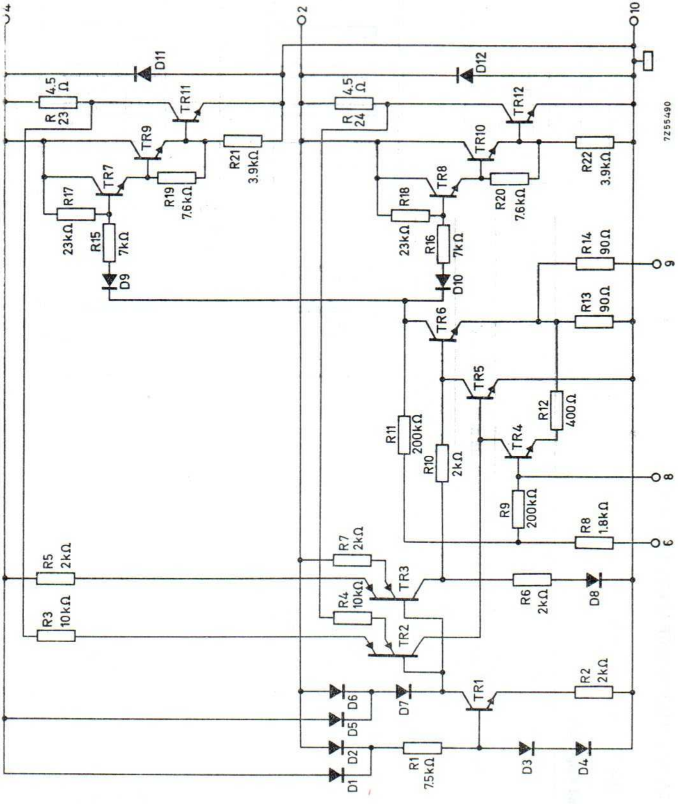
Audio amplifiers

TAA970 Microphone amplifier (TO-74)

Supply voltage	±4.8 V	
Supply current	±10 to ±100 mA	
Voltage gain	130	pin 9 not connected
Output impedance	80 Ω	
Voltage gain	180	pin 9 connected to pin 10
Output impedance	115 Ω	

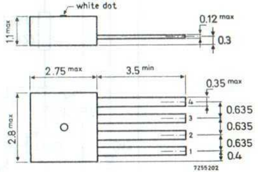


TO-74 (reduced height)


4
2
10
D11
D12
R 23
4.5 Ω
R 24
4.5 Ω
TR11
TR12
TR9
TR10
TR7
TR8
R21 3.9kΩ
R22 3.9kΩ
R17 23kΩ
R18 23kΩ
R19 7.6kΩ
R20 7.6kΩ
R15 7kΩ
R16 7kΩ
D9
D10
R14 90Ω
9
R13 90Ω
TR6
TR5
R11 200kΩ
R12 400Ω
TR4
R10 2kΩ
8
R9 200kΩ
R8 1.8kΩ
6
R5 2kΩ
R7 2kΩ
TR3
R6 2kΩ
D8
R3 10kΩ
R4 10kΩ
TR2
R2 2kΩ
TR1
D6
D7
D5
D2
D1
R1 7.5kΩ
D3
D4
7Z55490

LINEAR MONOLITHIC INTEGRATED CIRCUITS

CHARACTERISTICS at $T_{amb} = 25°C$



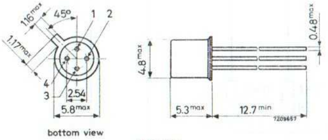
Hearing aid amplifiers

Type number	G_{tr}	P_o	f_{c-o}	P_{tot}	V_P	*Package*
OM200	80 dB	>0.2 mW	20 kHz	max. 25 mW	max. 5 V	
TAA370	90 dB	1.5 mW	30 kHz	max. 120 mW	1.3 V	TO-89

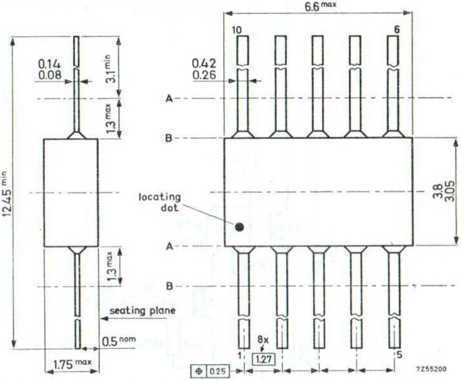
Instrumentation and control

TAA560 Level control amplifier and timer (TO-72)

Supply voltage	2.0 to 2.5 V
Input threshold voltage	1.4 to 1.6 V.
Output current (off-state)	max. 0.1 μA
Output current (on-state)	max. 50 mA.

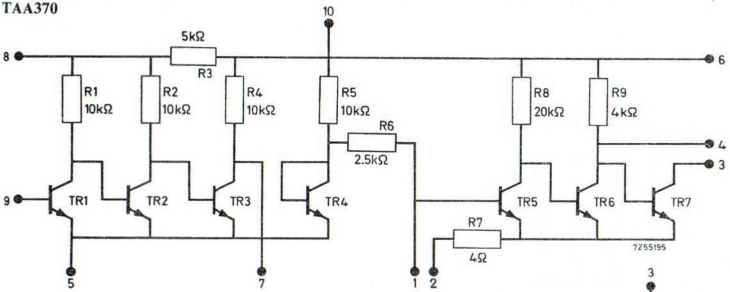


TO-72

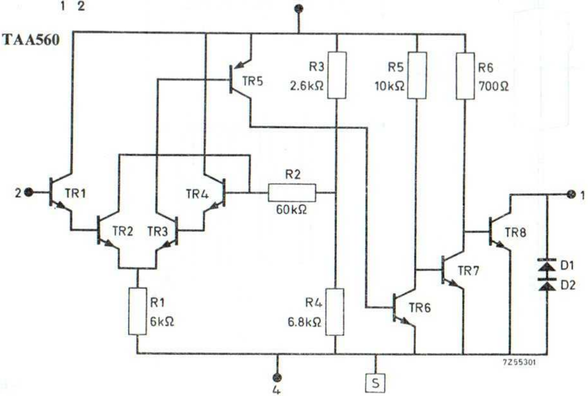


TO-89

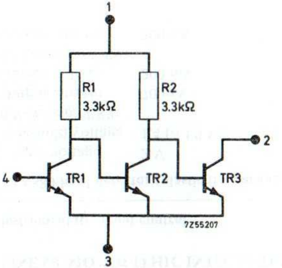
TAA370



TAA560



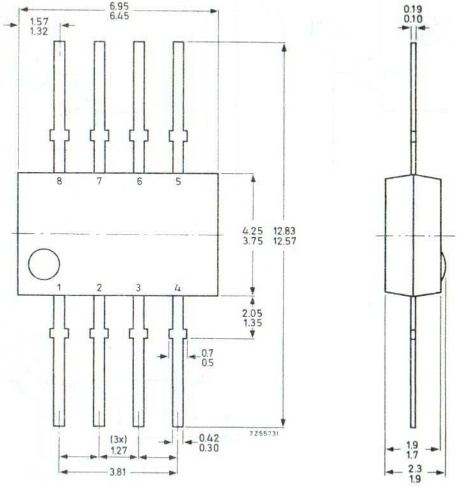
OM200

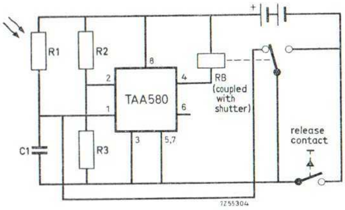


Instrumentation and control

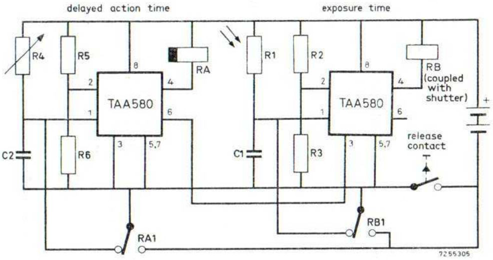
TAA580 level detector (plastic flat package)

Supply voltage	2 V
Threshold voltage	1.4 to 1.9 V
ON-state of TR9:	
Output current	70 mA
Output voltage	200 mV
OFF-state of TR9:	
Output current	200 μA





Camera shutter time control



Delayed action shutter

Notes:

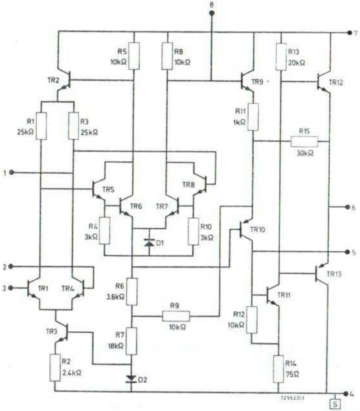
1. For shutter time range of 1 ms to 20 s; C_1 ≈ 270 nF; R_1 $\leqslant 70$ MΩ.
2. Solenoid inductance $L_S \leqslant 180$ mH $\Big\}$ DATA for RB and RA
   R_S values: 64 Ω to 114 Ω

CHARACTERISTICS at $T_{amb} = 25°C$

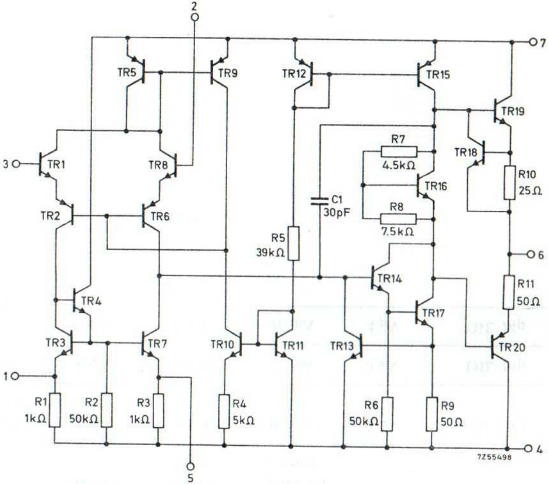
Operational amplifiers

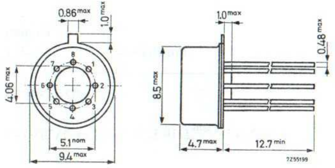
Type number	G_v	*CMRR*	V_i	V_{io}	I_{io}	V_{oM} (*typ.*)	V_P	V_N	*Package*
TAA521	45000	90 dB	8 to 10 V	<7.5 mV	<0.75 μA	13 V	15 V	15 V	TO-99
TAA522	45000	90 dB	8 to 10 V	<5.0 mV	<15 mV	14 V	15 V	15 V	TO-99
TBA221	100000	90 dB	$> \pm 12$ V	< 6 mV	< 0.2 μA	± 10 V	15 V	15 V	TO-99
TBA222	200000	90 dB	± 12 V	< 5 mV	< 0.2 μA	± 10 V	15 V	15 V	TO-99

TAA521/TAA522



TBA221/TBA222





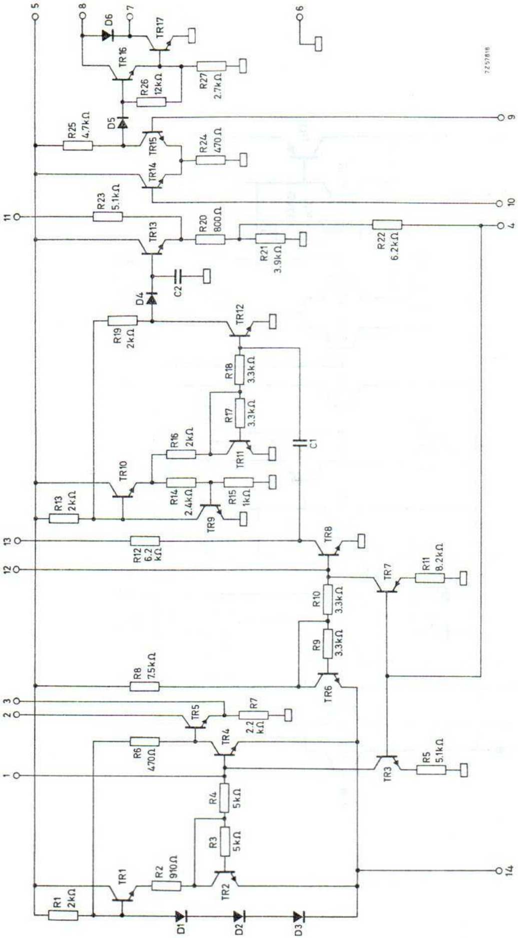
TO-99

LINEAR MONOLITHIC INTEGRATED CIRCUITS

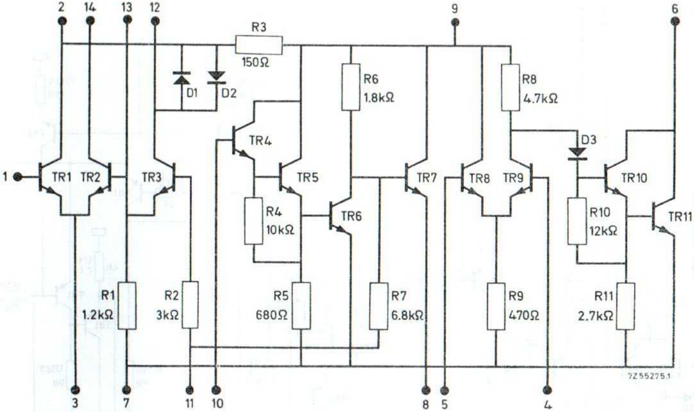
CHARACTERISTICS at $T_{amb} = 25°C$.

Radio circuits

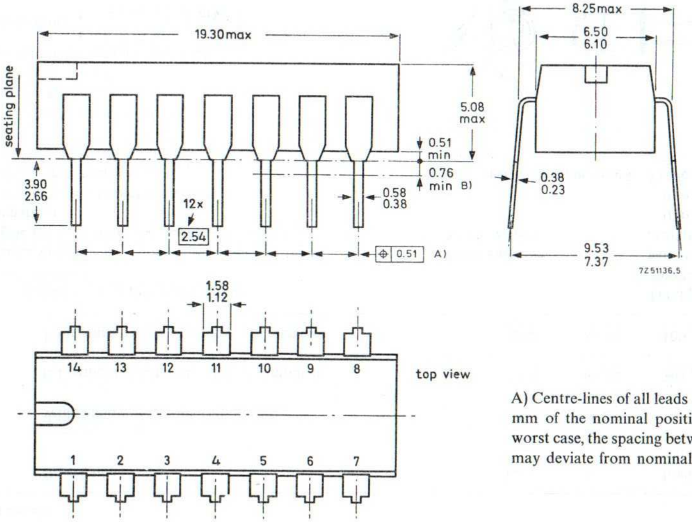
Type number	*Description*	*Supply voltage*	*Obtainable output power*	*Total quiescent current*	*Sensitivity*	*Package*
TAA840	R.F. amplifier, local oscillator, mixer, i.f. amplifier, detector a.g.c., for AM-radio, audio pre-amplifier	6 V	0.5 W	16.5 mA	2 μV	DIL 14p
TAD100	mixer, oscillator i.f. amplifier, a.g.c.-detector, audio pre-amplifier for AM-radio	6.0 V	0.7 W	15 mA	4 μV	DIL 14p
		9.0 V	1.5 W	21 mA	4 μV	DIL 14p


5
8
7
6
D6
TR17
TR16
R26
12kΩ
R27
2.7kΩ
7Z57818
D5
R25
4.7kΩ
TR15
R24
470Ω
TR14
9
10
11
R23
5.1kΩ
TR13
R20
800Ω
R21
3.9kΩ
R22
6.2kΩ
4
C2
D4
TR12
R19
2kΩ
R18
3.3kΩ
R17
3.3kΩ
R16
2kΩ
TR11
C1
TR10
R14
2.4kΩ
R15
1kΩ
R13
2kΩ
TR9
13
R12
6.2
kΩ
TR8
12
TR7
R11
8.2kΩ
R10
3.3kΩ
R9
3.3kΩ
R8
7.5kΩ
TR6
3
2
TR5
R7
2.2
kΩ
R6
470Ω
TR4
1
TR3
R5
5.1kΩ
R4
5kΩ
R3
5kΩ
R2
910Ω
TR1
TR2
14
R1
2kΩ
D1
D2
D3

TAD100


2
14
13
12
9
6
R3
150Ω
D1
D2
R6
1.8kΩ
R8
4.7kΩ
D3
1
TR1
TR2
TR3
TR4
TR5
TR6
TR7
TR8
TR9
TR10
TR11
R4
10kΩ
R10
12kΩ
R1
1.2kΩ
R2
3kΩ
R5
680Ω
R7
6.8kΩ
R9
470Ω
R11
2.7kΩ
7Z55275.1
3
7
11
10
8
5
4

14 pin dual in-line (DIL 14p)



A) Centre-lines of all leads are within ±0.254 mm of the nominal position shown; in the worst case, the spacing between any two leads may deviate from nominal by ±0.51 mm.

LINEAR MONOLITHIC INTEGRATED CIRCUITS

CHARACTERISTICS at $T_{\text{amb}} = 25°\text{C}$

Television circuits

Type number	*Description*	V_P	G_v	*Input limiting voltage*	*Package*
TAA350	Wide band differential amplifier	6 V	80 dB	100 μV	TO-74
TAA450	R.F. amplifier ratio detector a.f. amplifier	7.5 V	69 dB	300 μV	TO-74
TAA570	Four stage limiter amplifier, f.m. detector	12 V	80 dB	100 μV	TO-74

TAA700 Television signal processing circuit

- Video pre-amplifier
- Gated a.g.c. detector for vision i.f. amplifier and tuner
- Noise gate for a.g.c. and sync. separator circuits
- Sync. separator
- Automatic horizontal synchronisation
- Vertical sync. pulse separator
- Blanking facility for video amplifier.

	Total power dissipation 400 mW
	Supply voltage 12 V
Video amplifier	gain 9.5 dB
A.G.C. *circuit*	available a.g.c. voltage 0 to 7 V (for tuner) 0 to 8 V (for i.f.)
Vert. synchronisation circuit	Vertical output pulses: min 10 V
Package	QUIL 16p

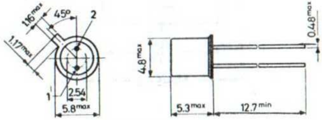
TAA550 Voltage stabilizer (TO-18)

Supply current typ. 5 mA

Stabilized voltage 30 to 35 V

Differential internal resistance: typ. 12Ω.

Temp. stabilisation: $\begin{cases} \text{typ. } 0.13 \text{ mV/°C} \\ -3.1 \text{ to } +1.55 \text{ mV/°C} \end{cases}$



TO-18 (2-pins)

TAA630 Synchronous demodulator for colour difference drive

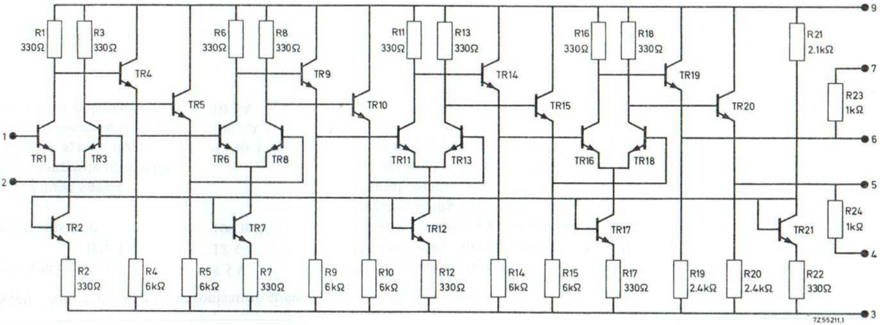
Supply voltage	12 V	Package: 16 lead dual in-line
Gain of R–Y demodulation	7	
Gain of B–Y demodulator	12.5	
Input impedance of R–Y and B–Y channel	1 kΩ	
Output impedance of R–Y, B–Y and G–Y channel	100 Ω	
Operating ambient temperature	−20 to +80°C	

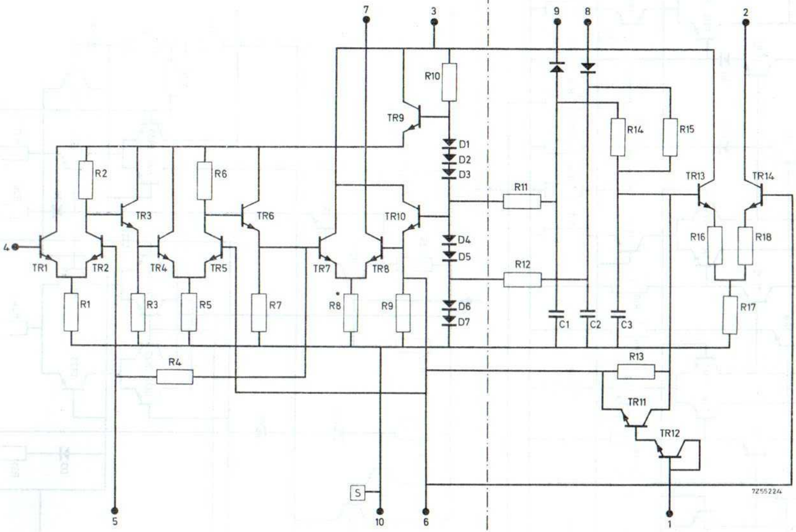
TBA240 Automatic line synchronisation circuit (16 lead quadruple in-line)

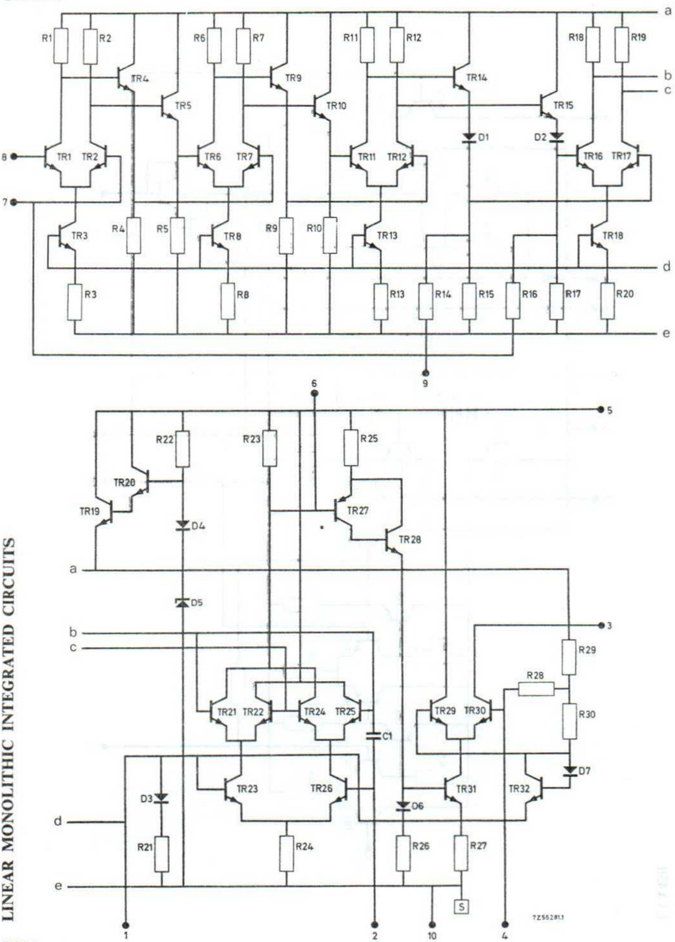
Supply voltages (pin 7)	5.5 V
(pin 1)	12 V
Power dissipation	100 mW
Required input signals	
Typical composite peak white to peak sync voltage	0.5 to 3 V
Negative noise pulse current	100 μA
Positive noise pulse current	10 μA

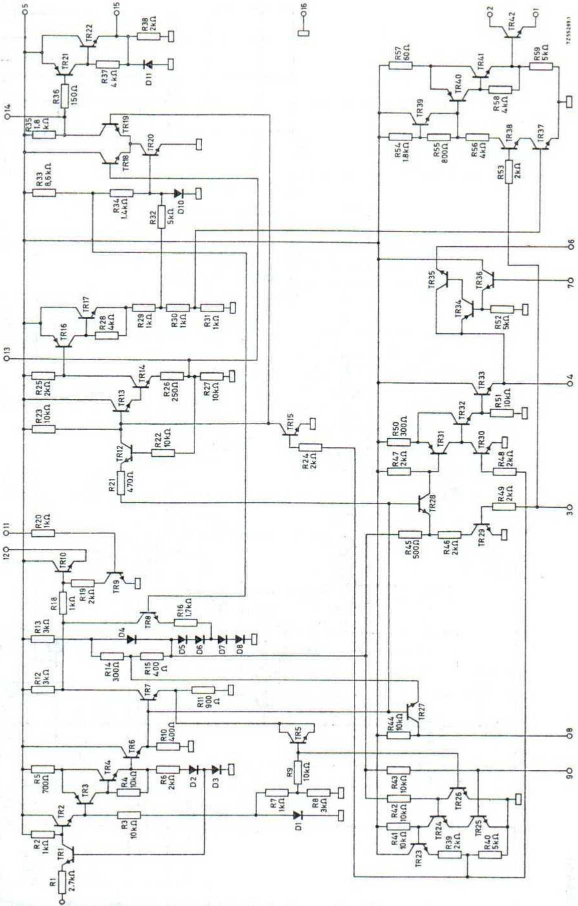
Delivered output signals	
Discriminator output voltage	4 V
Positive going sync pulse voltage	7.5 V
Negative going noise pulse voltage	2 V
Typical composite video with inverted noise pulses, peak to white to peak sync voltage	0.5 to 3 V

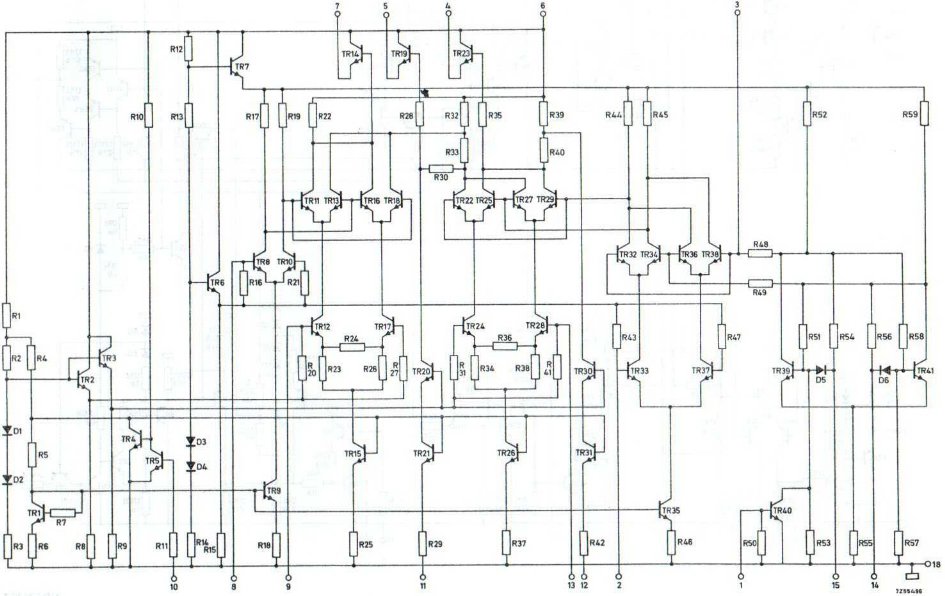
TAA350

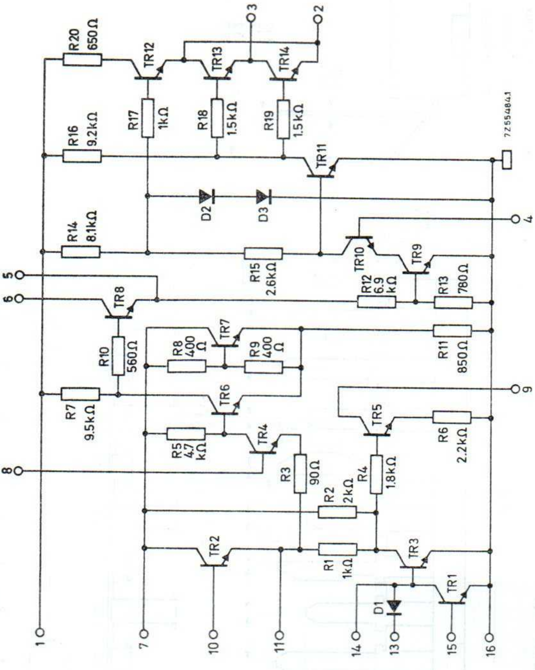

9
7
6
5
4
3
1
2
R1 330Ω
R3 330Ω
TR4
TR5
R6 330Ω
R8 330Ω
TR9
TR10
R11 330Ω
R13 330Ω
TR14
TR15
R16 330Ω
R18 330Ω
TR19
TR20
R21 2.1kΩ
R23 1kΩ
TR1
TR3
TR6
TR8
TR11
TR13
TR16
TR18
TR2
TR7
TR12
TR17
TR21
R24 1kΩ
R2 330Ω
R4 6kΩ
R5 6kΩ
R7 330Ω
R9 6kΩ
R10 6kΩ
R12 330Ω
R14 6kΩ
R15 6kΩ
R17 330Ω
R19 2.4kΩ
R20 2.4kΩ
R22 330Ω
7Z55211.1


7
3
9
8
2
R10
TR9
D1
D2
D3
R14
R15
TR13
TR14
R2
R6
R11
TR3
TR6
TR10
4
TR1
TR2
TR4
TR5
TR7
TR8
D4
D5
R12
R16
R18
R1
R3
R5
R7
R8
R9
D6
D7
C1
C2
C3
R17
R4
R13
TR11
TR12
S
7Z55224
5
10
6
1

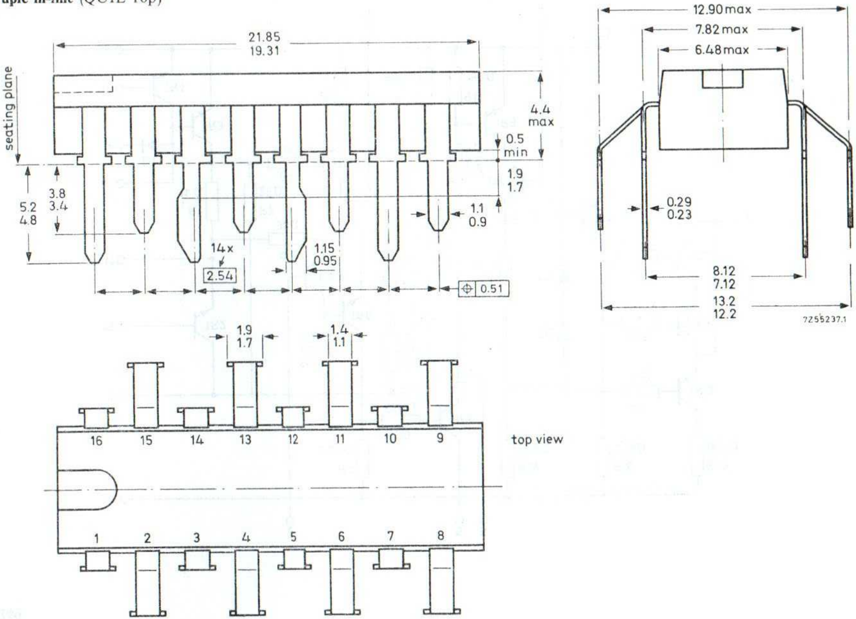

R1
R2
TR4
TR5
R6
R7
TR9
TR10
R11
R12
TR14
TR15
R18
R19
a
b
c
D1
D2
8
TR1
TR2
TR6
TR7
TR11
TR12
TR16
TR17
7
TR3
R4
R5
TR8
R9
R10
TR13
TR18
d
R3
R8
R13
R14
R15
R16
R17
R20
e
9
6
5
R22
R23
R25
TR20
TR19
TR27
D4
TR28
a
D5
b
c
3
R29
R28
TR21
TR22
TR24
TR25
TR29
TR30
R30
C1
D7
TR23
TR26
TR31
TR32
D3
D6
d
R21
R24
R26
R27
e
S
7Z55281.1
1
2
10
4


1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
TR1
TR2
TR3
TR4
TR5
TR6
TR7
TR8
TR9
TR10
TR12
TR13
TR14
TR15
TR16
TR17
TR18
TR19
TR20
TR21
TR22
TR23
TR24
TR25
TR26
TR27
TR28
TR29
TR30
TR31
TR32
TR33
TR34
TR35
TR36
TR37
TR38
TR39
TR40
TR41
TR42
R1 2.7kΩ
R2 1kΩ
R3 10kΩ
R4 10kΩ
R5 700Ω
R6 2kΩ
R7 1kΩ
R8 3kΩ
R9 10kΩ
R10 400Ω
R11 900 Ω
R12 3kΩ
R13 3kΩ
R14 300Ω
R15 400 Ω
R16 1.7kΩ
R18 1kΩ
R19 2kΩ
R20 1kΩ
R21 470Ω
R22 10kΩ
R23 10kΩ
R24 2kΩ
R25 2kΩ
R26 250Ω
R27 10kΩ
R28 4kΩ
R29 1kΩ
R30 1kΩ
R31 1kΩ
R32 5kΩ
R33 8.6kΩ
R34 1.4kΩ
R35 1.8 kΩ
R36 150Ω
R37 4kΩ
R38 2kΩ
R39 2kΩ
R40 5kΩ
R41 10kΩ
R42 10kΩ
R43 10kΩ
R44 10kΩ
R45 500Ω
R46 2kΩ
R47 2kΩ
R48 2kΩ
R49 2kΩ
R50 300Ω
R51 10kΩ
R52 5kΩ
R53 2kΩ
R54 1.8kΩ
R55 800Ω
R56 4kΩ
R57 60Ω
R58 4kΩ
R59 5kΩ
D1
D2
D3
D4
D5
D6
D7
D8
D10
D11
7Z55289.1


7
5
4
6
3
TR14
TR19
TR23
TR7
TR6
TR8 TR10
TR11 TR13
TR16 TR18
TR22 TR25
TR27 TR29
TR32 TR34
TR36 TR38
TR12
TR17
TR24
TR28
TR20
TR30
TR33
TR37
TR39
TR41
TR2
TR3
TR4
TR5
TR1
TR9
TR15
TR21
TR26
TR31
TR35
TR40
R1
R2
R3
R4
R5
R6
R7
R8
R9
R10
R11
R12
R13
R14
R15
R16
R17
R18
R19
R 20
R21
R22
R23
R24
R25
R26
R 27
R28
R29
R30
R 31
R32
R33
R34
R35
R36
R37
R38
R39
R40
R 41
R42
R43
R44
R45
R46
R47
R48
R49
R50
R51
R52
R53
R54
R55
R56
R57
R58
R59
D1
D2
D3
D4
D5
D6
10
8
9
11
13
12
2
1
15
14
18
7Z55496


R20 650Ω
TR12
TR13
TR14
3
2
R16 9.2kΩ
R17 1kΩ
R18 1.5kΩ
R19 1.5kΩ
TR11
7Z55484.1
D2
D3
R14 8.1kΩ
R15 2.6kΩ
TR10
TR9
4
5
6
TR8
R12 6.9 kΩ
R13 780Ω
R10 560Ω
R8 400 Ω
R9 400 Ω
TR7
R11 850Ω
R7 9.5kΩ
TR6
9
TR5
R6 2.2kΩ
R5 4.7 kΩ
TR4
8
R3 90Ω
R4 1.8kΩ
R2 2kΩ
TR2
R1 1kΩ
TR3
TR1
D1
1
7
10
11
14
13
15
16

Quadruple in-line (QUIL 16p)



CHARACTERISTICS at $T_{amb} = 25°C$.

Various applications

TAA293 General purpose amplifier (TO-74)

Supply voltage	6.0 V
Transducer gain	80 dB
Noise figure	6 dB
Frequency reponse	600 kHz

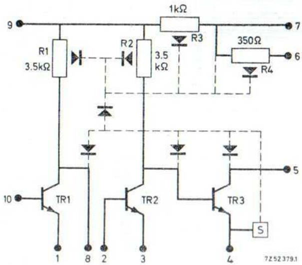
TAB101 Ring (de)modulator (TO-74)

Collector cut-off current max. 100 nA

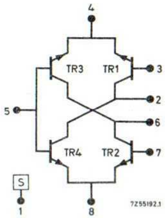
Base-emitter voltage differences max. 5 mV

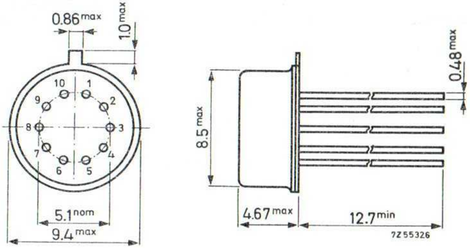
Common-base current gain differences max. 0.008

TAA293



TAB101





TO-74 (reduced height)

Various applications (continued)

TAA640 Limiter amplifier (with f.m. detector and a.f. pre-amplifier)

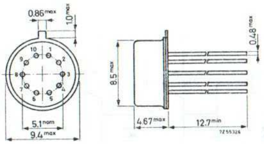
Package: TO-116 (14 lead quadruple in-line)

Supply voltage	22 V
Total current drain	26.7 mA
Input limiting voltage	100 μV
A.M. rejection	44 dB
A.F. output voltage	1.6 V
Total distortion ($\Delta f = \pm 50$ kHz)	5 %
Total distortion ($\Delta f = \pm 15$ kHz)	1.6 %

TAA960 Triple amplifier for active filters

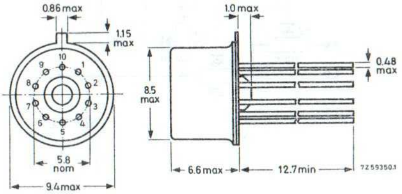
Package: TO-74 (reduced height)

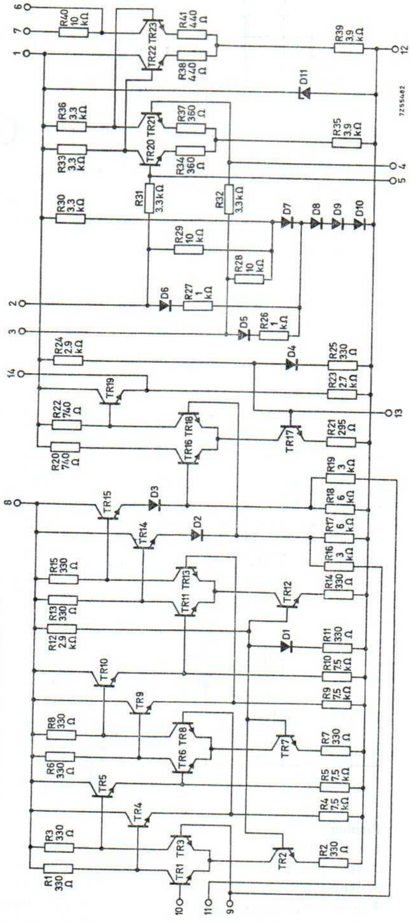
Supply voltage	6 V
Supply current	1.9 mA
Transfer admittance	9 mΩ^{-1}
Voltage gain (each ampl.)	39 dB
Input resistance (pin 1, 7, 8)	25 kΩ
Output resistance (pin 2, 5, 6)	9 kΩ
(pin 4)	500 Ω
Q factor (in *RC* filter)	45



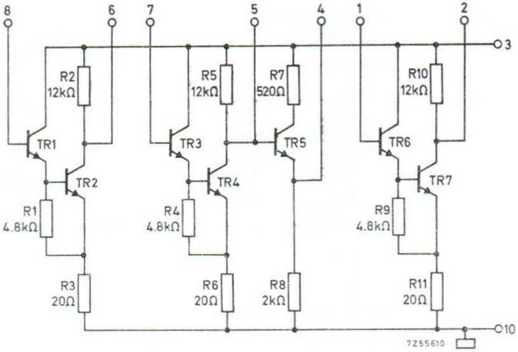
TBA281 Voltage regulator

Line regulation	0.1 % V_0
Load regulation	0.03 % V_0
Stand-by current drain	23 mA
Input voltage range	9.5 to 40 V
Output voltage range	2.0 to 37 V
Input-output voltage difference	3.0 to 38 V

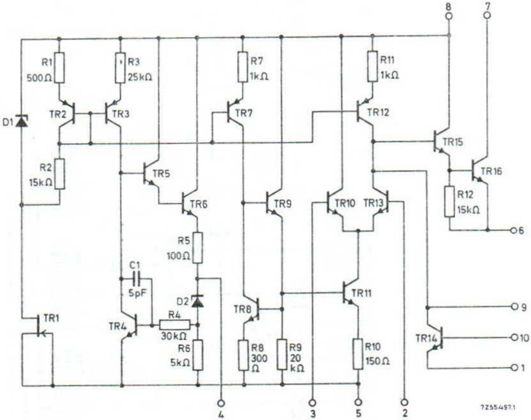



6
7
1
2
3
14
8
10
11
9
12
13
4
5
R1 330 Ω
R2 330 Ω
R3 330 Ω
R4 7.5 kΩ
R5 7.5 kΩ
R6 330 Ω
R7 330 Ω
R8 330 Ω
R9 7.5 kΩ
R10 7.5 kΩ
R11 330 Ω
R12 2.9 kΩ
R13 330 Ω
R14 330 Ω
R15 330 Ω
R16 3 kΩ
R17 6 kΩ
R18 6 kΩ
R19 3 kΩ
R20 740 Ω
R21 295 Ω
R22 740 Ω
R23 2.7 kΩ
R24 2.9 kΩ
R25 330 Ω
R26 1 kΩ
R27 1 kΩ
R28 10 kΩ
R29 10 kΩ
R30 3.3 kΩ
R31 3.3 kΩ
R32 3.3 kΩ
R33 3.3 kΩ
R34 360 Ω
R35 3.9 kΩ
R36 3.3 kΩ
R37 360 Ω
R38 440 Ω
R39 3.9 kΩ
R40 10 kΩ
R41 440 Ω
TR1
TR2
TR3
TR4
TR5
TR6
TR7
TR8
TR9
TR10
TR11
TR12
TR13
TR14
TR15
TR16
TR17
TR18
TR19
TR20
TR21
TR22
TR23
D1
D2
D3
D4
D5
D6
D7
D8
D9
D10
D11
7Z55482

TAA960



TBA281



Pinning

1. Current sense
2. Inverting input
3. Non-inverting input
4. Reference voltage (V_{ref})
5. Negative supply voltage ($-V_N$)
6. Output voltage (V_o)
7. Collector voltage (V_C)
8. Positive supply voltage (V_P)
9. Frequency compensation
10. Current limit

REPLACEMENT GUIDE
SEMICONDUCTORS

REPLACEMENT GUIDE TRANSISTORS

Type to be replaced	Replacement type
2N174	2N174
2N256	2N526;ASY80
2N441	2N441
2N442	2N442
2N526	2N526
2N527	2N527
2N696	2N696;(2N1613)
2N697	2N697;(2N1613)
2N698	2N1893
2N699	2N1893
2N706	2N706
2N706A	2N706A
2N708	2N708;BC107A;BCY56 BSX20
2N709	2N709;BSX20
2N743	BC108A;BCY57;BSX19
2N744	BC108A;BCY57 BSX20;(BSY19)
2N753	2N753
2N760	BCY56;BC107A
2N760A	2N2483
2N849	(BSX19)
2N850	(BSX20)
2N851	(BSX19)
2N914	BSX20
2N916	(BF200)
2N918	2N918;BF180
2N929	2N929;(BC107A);BCY56
2N930	2N930;(BC107A);BCY56
2N956	2N956
2N1100	2N1100
2N1131	2N1131
2N1132	2N2904
2N1302	2N1302;ASY73

Type to be replaced	Replacement type
2N1303	2N1303
2N1304	2N1304;ASY74
2N1306	2N1306;ASY75
2N1308	2N1308
2N1487	BDY20;BD182
2N1488	BDY20
2N1489	BDY20;BD182
2N1490	BDY20
2N1566A	(2N2219A)
2N1573	2N1613
2N1574	2N1711
2N1613	2N1613
2N1711	2N1711
2N1893	2N1893
2N1924	ASY77
2N1925	(ASY77)
2N1926	(ASY77)
2N1990N	BSX21
2N1990R	BSX21
2N2192	2N2219A
2N2192A	2N2219A
2N2193	BFY55
2N2193A	2N2218A
2N2194	2N2218A
2N2194A	2N2218A
2N2217	2N2218
2N2218	2N2218;(BSX60)
2N2218A	2N2218A
2N2219	2N2219
2N2219A	2N2219A
2N2220	2N2221
2N2221	2N2221
2N2221A	2N2221A
2N2222	2N2222
2N2222A	2N2222A

Type to be replaced	Replacement type
2N2368	2N2368;BSX19
2N2369	2N2369;BSX20
2N2369A	2N2369;BSX20
2N2387	(2N929);(BCY56)
2N2388	(2N930)
2N2389	(2N1613);(2N2218A)
2N2390	(2N1711);(2N2219A)
2N2393	(2N1131)
2N2394	(2N2904)
2N2395	(2N1613)
2N2396	(2N1613)
2N2410	2N2410(2N2218A)
2N2432	(2N2570)
2N2483	2N2483
2N2484	2N2484
2N2537	2N2219
2N2538	2N2219
2N2586	2N2484
2N2604	(BCY70)
2N2605	(BCY71)
2N2692	2N930
2N2693	2N929;BCY56
2N2694	2N929;BCY56
2N2695	(BCY72)
2N2696	BCY72
2N2857	2N2857
2N2865	(BF180);(BF183)
2N2883	BFW16A
2N2884	BFW16A
2N2894	2N2894
2N2904	2N2904
2N2904A	2N2904A
2N2905	2N2905
2N2905A	2N2905A
2N2906	2N2906
2N2906A	2N2906A
2N2907	2N2907
2N2907A	2N2907A
2N3009	(BSX20)
2N3010	BSX19
2N3011	BSX20
2N3013	(BSX20)
2N3014	(BSX20)
2N3015	2N2410
2N3037	(2N1893)
2N3055	BDY20
2N3252	2N3252
2N3253	(BSX59)
2N3292	2N2218
2N3375	2N3375
2N3485	(BCY70)
2N3485A	(BCY70)
2N3486	(BCY71)
2N3486A	(BCY71)
2N3502	2N3134
2N3503	2N2904A;2N2905
2N3504	BCY71
2N3505	(BCY71)
2N3553	2N3553
2N3554	BSX60
2N3570	2N3570
2N3571	2N3571
2N3572	2N3572
2N3632	2N3632
2N3702	(BC157);(BC177)
2N3703	(BC157);(BC177)
2N3704	(BC107A);(BC147A)
2N3705	(BC107A);(BC147A)
2N3706	(BC108A);(BC148A)

REPLACEMENT GUIDE TRANSISTORS

Type to be replaced	Replacement type
2N3707	(BC109C);(BC149C)
2N3708	(BC108A);(BC148A)
2N3709	(BC108A);(BC148A)
2N3710	(BC108A);(BC148A)
2N3711	(BC108B);(BC148B)
2N3712	(BF178)
2N3724	BSX60
2N3725	BSX59
2N3819	(BFW61)
2N3823	2N3823;BFW10;BFW11
2N3829	(BCY71)
2N3866	2N3866
2N3924	2N3924
2N3926	2N3926
2N3927	2N3927
2N4030	(2N2904A)
2N4031	(2N2909A)
2N4032	(2N2909A)
2N4033	(2N2219A)
2N4046	(BSX60)
2N4047	(BSX59)
2N4058	(BC158)
2N4059	(BC158B)
2N4060	(BC158)
2N4061	(BC158A)
2N4062	(BC158B)
2N4091	BSV78
2N4092	BSV79
2N4093	BSV80
2N4391	BSV78
2N4392	BSV79
2N4393	BSV80
2N4427	2N4427
2N4856	BSV78
2N4857	BSV79
2N4858	BSV80
2N4859	BSV78
2N4860	BSV79
2N4861	BSV80
AC107	AC107
AC116	(AC125)
AC117	AC128/01;(AC188/01)
AC121	AC128
AC122	(AC125);(AC126)
AC124	(AC128/01)
AC127	AC127
AC130	(AC127)
AC131	AC128
AC131/30	(AC128)
AC139	AC128
AC141	AC127;(AC187)
AC142	(AC128);(AC188)
AC150	(AC125)
AC151	(AC125)
AC152	AC128
AC153	AC128
AC153K	AC128/01;(AC188/01)
AC160	AC125;AC126
AC161	AC125
AC162	(AC125)
AC163	(AC126)
AC170	AC125
AC171	AC126
AC173	AC132
AC175	(AC187/01)
AC176K	(AC187/01)
AC178	AC128/01;(AC188/01)
AC179	(AC187/01)
AC180	AC128

Type to be replaced	Replacement type
AC180K	AC128/01
AC181	(AC127)
AC181K	(AC187/01)
AC184	AC128
AC185	AC127
AC186	(AC187/01)
AC187K	AC187/01
AC188K	AC188/01
AC193	AC188
AC194	AC187
ACY16	(AC128/01)
ACY23	AC125;AC132
ACY32	AC125;AC132
ACY33	AC128;(AC128/01)
ACY38	(AC125)
AD130	AD149
AD131	(AD149)
AD132	(ASZ15)
AD133	(ADZ11)
AD138	ASZ16;(AD149)
AD138/50	(ASZ15)
AD139	AD139
AD142	AD149
AD148	(AD139)
AD149	AD149
AD150	AD149
AD152	(AD162)
AD153	AD149
AD155	AD162;AD139
AD161	AD161
AD162	AD162
AD163	(ASZ15)
AD164	AD162
AD165	AD161
AD169	(AD162)

Type to be replaced	Replacement type
ADY27	AD149
ADY28	ASZ15
AF106	AF106
AF114	AF114
AF115	AF115
AF116	AF116
AF117	AF117
AF121	AF121
AF124	AF124
AF125	AF125
AF126	AF126
AF127	AF127
AF134	AF124
AF135	AF125
AF136	AF125
AF137	AF126
AF138	AF126
AF139	AF139
AF166	AF126
AF170	AF127
AF178	AF178
AF181	(AF121)
AF193	AF121
AF200	AF121
AF201	AF121
AF202	AF121
AF202S	AF121
AF239	AF239
AF239S	AF239S
AF240	AF240
AF251	(AF239S);(AF239)
AF256	AF106
AF257	AF106
AF264	AF106
AF267	AF267

REPLACEMENT GUIDE TRANSISTORS

Type to be replaced	Replacement type
AF269	AF269
AF279	AF267
AF280	AF267
AFY11	AFZ12
AFY13	(AF124)
AFY15	(AF126)
AFY16	AFY16
AFY29	(AF126)
AFZ12	AFZ12
ASY24B	(ASY26)
ASY26	ASY26
ASY27	ASY27
ASY28	ASY28;ASY74
ASY29	ASY29;ASY75
ASY70	ASY80
ASY81	ASY77
ASZ15	ASZ15
ASZ16	ASZ16
ASZ17	ASZ17
ASZ18	ASZ18
AUY19	ASZ15
AUY20	ASZ15
AUY21	ASZ15
AUY22	ASZ15
AUY28	ASZ15
AUY30	ASZ15
AUY31	ASZ16
AUY32	ASZ15
AUY33	ASZ16;(AD149)
BC26J	BC179
BC107A	BC107A
BC107B	BC107B
BC108A	BC108A
BC108B	BC108B
BC108C	BC108C

Type to be replaced	Replacement type
BC109B	BC109B
BC109C	BC109C
BC113	BC238B
BC114	BC239B
BC115	(BC147A);BC107A
BC116	(BC157);(BC117)
BC117	BF178
BC118	BC237A
BC119	2N2218
BC120	2N2218
BC121wsz	(BC146rd)
BC121gb	(BC146yw)
BC121gr	(BC146yw)
BC121bl	(BC146gn)
BC122wsz	(BC146rd)
BC122gb	(BC146yw)
BC122gr	(BC146yw)
BC122bl	(BC146gn)
BC125	(BC107A);(BC147A)
BC126	2N2218
BC127	BC146rd
BC128	BC146gn
BC129	(BC107)
BC130	(BC108)
BC131	(BC109)
BC132	BC238A
BC134	BC237B
BC135	(BC107A);(BC147A)
BC136	(BC107A);(BC147A)
BC137	(BC177);(BC157)
BC138	2N2906
BC139	2N2904
BC140	2N2219
BC141	BD139
BC142	2N2218A

Type to be replaced	Replacement type
BC143	2N2904A
BC144	2N2218A
BC147	BC147
BC148	BC148
BC149	BC149
BC153	(BC157);BC177
BC154	(BC157);BC177
BC155	(BC146)
BC156	BC146
BC157	BC157
BC158	BC158
BC159	BC159
BC167	BC237
BC168	BC238
BC169	BC239
BC170A	BC238A
BC170B	BC238B
BC170C	BC238C
BC171A	BC237A
BC171B	BC237B
BC172A	BC238A
BC172B	BC238B
BC172C	BC238C
BC173B	BC239B
BC173C	BC239C
BC177	BC177
BC178	BC178
BC179	BC179
BC181	(BC157);(BC177)
BC182	BC237A
BC183	(BC237A)
BC184	BCY56
BC194	2N2221
BC198	BC146yw
BC199	BC146gn
BC201	(BC200)
BC202	(BC200yw)
BC203	(BC200yw)
BC204	(BC157)
BC205	(BC158)
BC206	(BC159)
BC207	BC237
BC208	BC238
BC209	BC239
BC212	(BC157);(BC177)
BC213	(BC157);(BC177)
BC214	(BC157);(BC177)
BC237	BC237
BC238	BC238
BC239	BC239
BC250	(BC179)
BC251	(BC177)
BC252	(BC178)
BC253	(BC179)
BC257	(BC177)
BC258	(BC178)
BC259	(BC179)
BC261	BC177
BC262	BC179
BC267	BC107
BC268	BC108
BC269	BC109
BC297	BC177
BC317	BC237
BC318	BC238
BC319	BC239
BC341	(BD137)
BC382	BC237
BC383	BC237
BC384	BC237B

REPLACEMENT GUIDE TRANSISTORS

Type to be replaced	Replacement type
BC385	BC237
BC386	BC238
BCY58	BCY58
BCY59	BCY59
BCY65	(2N2484)
BCY66	(BC107B);(2N930)
BCY78	BC177;BCY70
BCY79	BC177;BCY71
BD106A	BD124
BD107A	(BD124)
BD109	BD124
BD130	BDY20
BD135	BD135
BD136	BD136
BD137	BD137
BD138	BD138
BD139	BD139
BD140	BD140
BDY12	(BD124)
BDY15A	BD124
BDY16A	(BD124)
BDY34	BD124
BF110	(BF178)
BF111	(BD115)
BF114	(BF178)
BF117	BD115
BF118	(BD115)
BF121	(BF196)
BF123	BF197
BF125	(BF197)
BF127	BF196
BF140	BF178
BF140D	BF178
BF152	BF183
BF153	BF185;(BF195)

Type to be replaced	Replacement type
BF154	BF196
BF155	(BF180);(BF181); (BF182);(BF183)
BF156	BF178
BF157	BF179
BF158	BF173;(BF197)
BF159	BF173;(BF197)
BF160	BF185;(BF195)
BF161	(BF180);(BF181);(BF182)
BF162	(BF200)
BF163	BF167;(BF196)
BF164	BF173;(BF197)
BF165	BF185;(BF195)
BF166	BF200
BF167	BF167
BF169	(BF115)
BF169R	(BF115)
BF173	BF173
BF174	BF178
BF175	BF167;(BF196)
BF176	BF173;(BF197)
BF177	BF177
BF178	BF178
BF179	BF179
BF180	BF180
BF181	BF181
BF182	BF182
BF183	BF183
BF184	BF184
BF185	BF185
BF186	BF186
BF189	BF115;(BF184)
BF194	BF194
BF195	BF195

Type to be replaced	Replacement type
BF196	BF196
BF197	BF197
BF198	(BF196);(BF167)
BF199	(BF197);(BF173)
BF200	BF200
BF222	(BF115)
BF223	(BF197)
BF224	BF173;(BF197)
BF225	BF167;(BF196)
BF232	BF173
BF234	(BF254)
BF235	(BF255)
BF237	(BF115)
BF238	(BF115)
BF240	BF196
BF241	BF196
BF251	BF167
BF254	BF254
BF255	BF255
BF257	BF336
BF258	BF337
BF259	BF338
BF261	BF167
BF268	BFY90
BF270	(BF167)
BF271	(BF173)
BF287	(BF167)
BF288	(BF167)
BF294	(BD115)
BF297	(BD115)
BF298	(BD115)
BF306	BF173
BF310	(BF197)
BF311	(BF197)
BF334	BF334

Type to be replaced	Replacement type
BF335	BF335
BF336	BF336
BF337	BF337
BF338	BF338
BF384	(BF180)
BF385	(BF180)
BFX37	(BC179B);BCY71
BFX38	2N2905A
BFX39	2N2904
BFX40	2N2905A
BFX41	2N2904A
BFX48	(BC177)
BFX60	BF173
BFX62	BF180
BFX89	BFX89
BFY19	BC108A;BCY57
BFY22	BC146
BFY23	BC146
BFY23a	BC146
BFY24	BC146
BFY29	(BC146)
BFY30	(BC146)
BFY33	BFY51;(2N1613)
BFY34	2N1613;BFY55
BFY37	BC108A;BCY57
BFY39-1	BC107A;BCY56
BFY39-2	BC107A;BCY56
BFY39-3	BC107B;(BCY56)
BFY40	(BFY50);BFY51; (2N1613)
BFY41	2N1889
BFY46	2N1711
BFY50	BFY50 BSX60;(2N1613)
BFY51	BFY51;(2N1613)

REPLACEMENT GUIDE TRANSISTORS

Type to be replaced	Replacement type
BFY52	BFY52
BFY56	BSX61
BFY64	2N2905
BFY65	2N1893;BF178
BFY66	2N918;BF180
BFY69	(BC146)
BFY69A	(BC146)
BFY72	2N2219
BFY75	BC107A;(BCY56)
BFY77	BCY56;(BC109C)
BFY80	(BSX21)
BFY85	BCY87;BCY88;BCY89
BFY86	BCY87;BCY88;BCY89
BFY87	BC146
BFY87A	BC146
BFY88	(BFY90)
BFY91	BCY87;BCY88;BCY89
BFY92	BCY87;BCY88;BCY89
BLY14	(BLY21);(2N3553)
BSW10	2N2218A
BSW19	BCY71
BSW43	BC238B
BSW43A	BC237B
BSW44	(BC177);(BC178)
BSW45	(BC178B)
BSW72	(BC177)
BSW73	(BC177)
BSW74	(BC177)
BSW75	(BC177)
BSW82	(2N2221)
BSW83	(2N2222)
BSW84	(2N2221A)
BSW85	(2N2222A)
BSX24	BCY56;BC107A
BSX27	BSX20

Type to be replaced	Replacement type
BSX28	BSX20
BSX38	(2N2222)
BSX39	BSX19;BSX20
BSX40	2N2904
BSX41	2N2905
BSX45	BFY55
BSX46	BSW66
BSX48	(2N2221)
BSX49	(2N2222)
BSX51	2N2222
BSX51A	2N2222A
BSX53	2N2222
BSX54	2N2222
BSX72	2N2410
BSX75	2N2221A
BSX79	(2N2222)
BSX80	BC148;BC147
BSY17	2N706A
BSY18	2N706A
BSY19	2N708;BC107A;BCY56; BSX20;BSY19
BSY21	2N914;BSX20
BSY34	(BSX61)
BSY44	2N1613;BFY55;2N2218A
BSY45	2N1893
BSY46	BFY55
BSY51	2N697;BFY51;(2N1613)
BSY52	2N1420;(2N1711);(2N2219)
BSY53	(BFY51);(BFY50) (BSX60);2N1613
BSY54	BFY68;2N1711
BSY55	2N1893
BSY58	(BSX60)

Type to be replaced	Replacement type
BSY61	BC108A;BC148A
BSY62	2N706A
BSY63	2N708
BSY70	2N706
BSY71	2N1711
BSY72	BC108A;BCY57
BSY73	BC108A;BCY57
BSY74	BC108A;BCY57
BSY80	BC108A;BCY57
BSY81	BFY52
BSY83	2N2297;BFY55 (2N1613)
BSY84	(2N1711)
BSY85	(2N1893)
BSY91	BFY51;BFY52;2N1613
BSY92	2N1711
BSY95A	BC108A;BCY57;(BSX20)
BUY12	(BDY19)
BUY13	BDY18
OC16	(AD162)
OC22	(AD149)
OC23	(AD149)
OC24	(AD149)
OC26	(AD149)
OC27	(AD149)
OC30	AD162
OC42	(AC125)
OC44	(AF126)
OC45	(AF126)
OC70	(AC125)
OC71	(AC125)
OC72	(AC125)
OC74	(AC125)
OC75	(AC125)
OC79	(AC125)

Type to be replaced	Replacement type
OC80	(AC126)
OC83	(AC128)
OC169	(AF126)
OC171	(AF124)
OC303	(AC125)
OC304-1	(AC125)
OC304-2	(AC125)
OC304-3	(AC125)
OC305-1	(AC126)
OC306-1	(AC125)
OC306-2	(AC125)
OC306-3	(AC125)
OC307-1	(ASY76)
OC307-2	(ASY76)
OC307-3	(ASY80)
OC308	(ASY76)
OC309-1	(ASY77)
OC309-2	(ASY77)
OC309-3	(ASY80)
OC430	(BCY33)
OC440	(BCY30);(BCY31)
OC443	(BCY34);(BCY33)
OC445	(BCY30);(BCY31)
OC449	(BCY30)
OC450	(BCY30)
OC460	(BCY34)
OC463	(BCY34)
OC465	(BCY34)
OC466	(BCY34)
OC467	(BCY34)
OC468	(BCY32)
OC469	(BCY30)
OC470	(BCY31)
SFT223	2N1305
SFT229	ASY27

REPLACEMENT GUIDE TRANSISTORS

Type to be replaced	Replacement type
SFT321	AC125
SFT322	AC125
SFT323	AC125;AC126
SFT351	AC125
SFT352	AC125
SFT353	AC125;AC126
TF78/30	(AD162)
TIS37	(BC158)
TIS38	(BC158)
TIXS39	BFW17

REPLACEMENT GUIDE SMALL SIGNAL DIODES

Type to be replaced	Replacement type
1N34A	OA91;OA95
1N48	OA91;OA95
1N54A	OA91;OA95
1N60	AA119;(OA79)
1N64	AA119;(OA79)
1N87A	AA119;(OA79)
1N198	OA91;OA95
1N456	BAY38
1N541	AA119
1N643	(BAX16)
1N658	BAX16
1N659	BAX16
1N660	BAX16
1N661	(BAX16)
1N662	BAX16
1N663	BAX16
1N914	1N914
1N914A	1N914A
1N914B	1N914B
1N915	BAY38
1N916A	1N914A
1N917	BAY38
1N2069	BY127
1N2070	BY127
1N2071	BY127
1N3062	BAY38
1N3063	BAY38
1N3064	BAY38
1N3070	BAX16
1N3592	OA47
1N3595	BYX10
1N3600	BAY38
1N3604	1N3604
1N4001	(BY127)
1N4002	(BY127)
1N4003	(BY127)
1N4004	(BY127)
1N4005	(BY127)
1N4006	(BY127)
1N4007	(BY127)
1N4009	1N4009
1N4148	(1N914)
1N4149	1N914B
1N4150	(1N914B)
1N4151	(1N3604)
1N4152	1N914B
1N4153	1N914B
1N4154	(1N4009)
1N4446	(1N914A)
1N4447	1N914B
1N4448	(1N914B)
1N4454	(1N914)
1N5220	1N3604
1S920	(BA148)
1S921	(BA148)
1S922	(BA148)
1S923	(BA148)
AA111	OA90
AA112	OA90
AA113	(AA119)
AA114	OA90
AA116	OA90
AA117	OA91;OA95
AA118	OA95
AA119	AA119
AA130	OA90
AA131	AA119
AA132	OA91;OA95
AA133	(OA91);(OA95)
AA134	OA91;OA95

REPLACEMENT GUIDE SMALL SIGNAL DIODES

Type to be replaced	Replacement type
AA135	(AAZ18)
AA136	AAZ17
AA137	AA119
AA138	OA90
AA140	(AA119);(OA79)
AA142	(AA119);(OA79)
AA143	AAY32
AA144	AAZ15
AAY13	AAY32
AAY27	AAY32
AAY28	AAZ15
AAY30	AAZ17
AAY32	AAZ17
AAY33	AAZ17
AAY41	(AAZ18)
AAY47	AAY30
AAY49	AAY30
AAZ10	(AAZ18)
AAZ15	AAZ15
AAZ18	AAZ18
BA101	(BA102)
BA102	BA102
BA103	(BAX16)
BA104	(BAX16)
BA105	(BYX10)
BA108	(BAX16)
BA125	BA102
BA127	(BA100);BAX16
BA128	BAX16
BA129	BA148
BA130	BAX13
BA133	(BYX10)
BA137	BAX16;(BA100)
BA139	(BB105A)
BA140	(BB105G)

Type to be replaced	Replacement type
BA141	(BB105A)
BA142	(BB105G
BA143	BA182
BA147	BAX16;(BA100)
BA148	BA148
BA149	BB105G
BA152	(BA182)
BA161	BB105A;BB105B
BA162	BB105G
BA164	BAX13
BA170	BAX16;(BA100)
BA173	BA145
BA174	(BAX13)
BA176	BAX16
BA177	BAX78
BA182	BA182
BAW21	BAX16
BAX20	BAX16
BAX21	BAX16
BAX22	BAX16
BAX25	BAX13
BAX26	BAX13
BAX27	BAX78
BAY17	BAX16
BAY18	BAX16
BAY19	BAX16
BAY20	(BAX16)
BAY32	BAX16
BAY33	BAX16
BAY39	(BAX78)
BAY41	BAX78
BAY42	BAX78
BAY43	(BAX78)
BAY44	BAX16
BAY45	BAX16

Type to be replaced	Replacement type
BAY60	1N4009
BAY63	BAX78
BAY68	BAX78
BAY69	BAX78
BAY71	BAY38
BAY74	BAY38
BAY92	BYX10
BAY93	(BAY38)
BAY94	(1N4009)
BAY95	(1N3604)
BAY98	BAX16
BAY99	BAX16
BB100	(BB105G)
BB103	BB110
BB104	BB104
BB105A	BB105A
BB105B	BB105B
BB105G	BB105G
BB106	BB106
BB110	BB110
BB141	BB105A
BB142	BB105G
BY100	(BY127)
BY103	(BY127)
BY133	(BY127)
BY134	BY127
BY135	BY127
BY144	BY176
BY151N	BY127
BY152N	BY127
BYY31	BY127
BYY32	BY127
BYY33	BY127
BYY34	BY127
BYY35	BY127

Type to be replaced	Replacement type
BYY36	BY127
BYY37	BY127
BYY88	(BY127)
BYY89	(BY127)
BYY90	(BY127)
BYY91	(BY127)
E11	BY127
E21	BY127
E41	BY127
E61	BY127
E81	BY127
E101	(BY127)
G498	AAZ17
G498.1	AAZ17
G580	AAZ18
ITT600DPD	(1N914B)
ITT601DPD	(1N914B)
ITT700	1N3604
ITT777	1N4009
ME120	(BY140)
MR21	BA145
MR31	BA145
MR41	BYX10
OA127	BAX16
OA128	BAX16
OA129	BAX16
OA130	BAX16
OA150	OA91;OA95
OA159	AA119
OA160	OA90
OA161	(OA91);(OA95)
OA172	AA119
OA174	OA91;OA95
OA180	AAY30
OA182	AAZ15

REPLACEMENT GUIDE SMALL SIGNAL DIODES

Type to be replaced	Replacement type
SFD021	OA47
SDF037	OA47
SFD43	(BAY38)
SFD83	BAY38
SFD84	BAX13
SFD86	(BAX16)
SFD89	BYX10
SFD108	OA91;OA95
SFD122	AAY32
SFD135	AAZ15
SFD143	(1N914)
SFD180	BAX16
SFD181	BAX16
SFD183	1N914
SFD184	BAV10

REPLACEMENT GUIDE VOLTAGE REGULATOR (ZENER) DIODES

Type to be replaced	Replacement type
1N708	BZY88-C5V6
1N709	-C6V2
1N710	-C6V8
1N711	-C7V5
1N712	-C8V2
1N713	BZY88-C9V1
1N714	-C10
1N715	-C11
1N716	-C12
1N717	-C13
1N718	BZY88-C15
1N719	-C16
1N720	-C18
1N721	-C20
1N722	-C22
1N723	BZY88-C24
1N724	-C27
1N725	-C30
1N726	BZX61-C33
1N727	-C36
1N728	BZX61-C39
1N729	-C43
1N730	-C47
1N731	-C51
1N732	-C56
1N733	BZX61-C62
1N734	-C68
1N735	-C75
1N746A	BZY88-C3V3
1N747A	-C3V6
1N748A	BZY88-C3V9
1N749A	-C4V3
1N750A	-C4V7
1N751A	-C5V1
1N752A	-C5V6
1N753A	BZY88-C6V2
1N754A	-C6V8
1N755A	-C7V5
1N756A	-C8V2
1N757A	-C9V1
1N758A	BZY88-C10
1N759A	-C12
1N957	-C6V8
1N958	-C7V5
1N959	-C8V2
1N960	BZY88-C9V1
1N961	-C10
1N962	-C11
1N963	-C12
1N964	-C13
1N965	BZY88-C15
1N966	-C16
1N967	-C18
1N968	-C20
1N969	-C22
1N970	BZY88-C24
1N971	-C27
1N972	-C30
1N973	BZY94-C33
1N974	-C36
1N975	BZY94-C39
1N976	-C43
1N977	-C47
1N978	-C51
1N979	-C56
1N980	BZY94-C62
1N981	-C68
1N982	-C75
1N1816	BZY93-C13
1N1817	-C15

REPLACEMENT GUIDE VOLTAGE REGULATOR (ZENER) DIODES

Type to be replaced	Replacement type
1N1818	BZY93-C16
1N1819	-C18
1N1820	-C20
1N1821	-C22
1N1822	-C24
1N1823	BZY93-C27
1N1824	-C30
1N1825	-C33
1N1826	-C36
1N1827	-C39
1N1828	BZY93-C43
1N1829	-C47
1N1830	-C51
1N1831	-C56
1N1832	-C62
1N1833	BZY93-C68
1N1834	-C75
1N2970	-C6V8
1N2971	-C7V5
1N2872	-C8V2
1N2973	BZY93-C9V1
1N2974	-C10
1N2975	-C11
1N2976	-C12
1N2977	-C13
1N2979	BZY93-C15
1N2980	-C16
1N2982	-C18
1N2984	-C20
1N2985	-C22
1N2986	BZY93-C24
1N2988	-C27
1N2989	-C30
1N2990	-C33
1N2991	-C36

Type to be replaced	Replacement type
1N2992	BZY93-C39
1N2993	-C43
1N2995	-C47
1N2997	-C51
1N2999	-C56
1N3000	BZY93-C62
1N3001	-C68
1N3002	-C75
1N3016	BZX29-C6V8
1N3017	-C7V5
1N3018	BZX29-C8V2
1N3019	-C9V1
1N3020	-C10
1N3021	-C11
1N3022	-C12
1N3023	BZX29-C13
1N3024	-C15
1N3025	-C16
1N3026	-C18
1N3027	-C20
1N3028	BZX29-C22
1N3029	-C24
1N3030	-C27
1N3031	-C30
1N3032	-C33
1N3033	BZX29-C36
1N3034	-C39
1N3035	-C43
1N3036	-C47
1N3037	-C51
1N3038	BZX29-C56
1N3039	-C62
1N3040	-C68
1N3041	-C75
1N3042	-C82

Type to be replaced	Replacement type
1N3043	BZX29-C91
1N3044	-C100
1N3309	BZY91-C10
1N3310	-C11
1N3311	-C12
1N3312	BZY91-C13
1N3314	-C15
1N3315	-C16
1N3317	-C18
1N3319	-C20
1N3320	BZY91-C22
1N3321	-C24
1N3323	-C27
1N3324	-C30
1N3325	-C33
1N3326	BZY91-C36
1N3327	-C39
1N3328	-C43
1N3330	-C47
1N3332	-C51
1N3334	BZY91-C56
1N3335	-C62
1N3336	-C68
1N3337	-C75
1N4158	BZX29-C6V8
1N4159	BZX29-C7V5
1N4160	-C8V2
1N4161	-C9V1
1N4162	-C10
1N4163	-C11
1N4164	BZX29-C12
1N4165	-C13
1N4166	-C15
1N4167	-C16
1N4168	-C18

Type to be replaced	Replacement type
1N4169	BZX29-C20
1N4170	-C22
1N4171	-C24
1N4172	-C27
1N4173	-C30
1N4174	BZX29-C33
1N4175	-C36
1N4176	-C39
1N4177	-C43
1N4178	-C47
1N4179	BZX29-C51
1N4180	-C56
1N4181	-C62
1N4182	-C68
1N4183	-C75
1N4184	BZX29-C82
1N4185	-C91
1N4186	-C100
1N4831	-C9V1
1N4832	-C10
1N4833	BZX29-C11
1N4834	-C12
1N4835	-C13
1N4836	-C15
1N4837	-C16
1N4838	BZX29-C18
1N4839	-C20
1N4840	-C22
1N4841	-C24
1N4842	-C27
1N4843	BZX29-C30
1N4844	-C33
1N4845	-C36
1N4846	-C39
1N4847	-C43

REPLACEMENT GUIDE VOLTAGE REGULATOR (ZENER) DIODES

Type to be replaced	Replacement type
1N4848	BZX29-C47
1N4849	-C51
1N4850	-C56
1N4851	-C62
1N4852	-C68
1N4853	BZX29-C75
1N4854	-C82
1N4855	-C91
1N4856	-C100
11Z6	-C3V3
12Z6	BZX29-C3V6
13Z6	-C3V9
14Z6	-C4V3
15Z6	-C4V7
16Z6	-C5V1
17Z6	BZX29-C5V6
18Z6	-C6V2
19Z6	-C6V8
20Z6	-C7V5
21Z6	-C8V2
22Z6	BZX29-C9V1
23Z6	-C10
24Z6	-C11
25Z6	-C12
26Z6	-C13
28Z6	BZX29-C15
31Z6	BZY88-C3V3
32Z6	-C3V6
33Z6	-C3V9
34Z6	-C4V3
35Z6	BZY88-C4V7
36Z6	-C5V1
37Z6	-C5V6
38Z6	-C6V2
39Z6	-C6V8
40Z6	BZY88-C7V5
41Z6	-C8V2
42Z6	-C9V1
43Z6	-C10
79Z6	BZY93-C6V8
80Z6	BZY93-C7V5
81Z6	-C8V2
82Z6	-C9V1
83Z6	-C10
84Z6	-C11
85Z6	BZY93-C12
86Z6	-C13
88Z6	-C15
1102	BZY88-C3V3
1103	-C3V9
1104	BZY88-C4V7
1105	-C5V6
1106	-C6V8
1107	-C7V5
1108	-C8V2
1109	BZY88-C9V1
1110	-C10
1111	-C11
1112	-C12
1113	-C13
1115	BZY88-C15
1116	-C16
1118	-C18
1120	-C20
1122	-C22
1124	BZY88-C24
1127	-C27
1130	-C30
1133	BZY94-C33
1206	BZY93-C6V8

Type to be replaced	Replacement type
1207	BZY93-C7V5
1208	-C8V2
1209	-C9V1
1210	-C10
1211	-C11
1212	BZY93-C12
1213	-C13
1215	-C15
1216	-C16
1218	-C18
1220	BZY93-C20
1222	-C22
1224	-C24
1227	-C27
1230	-C30
1233	BZY93-C33
1236	-C36
1239	-C39
1243	-C43
1247	-C47
1302	BZX29-C3V3
1303	-C3V9
1304	-C4V7
1305	-C5V6
1306	-C6V8
1307	BZX29-C7V5
1308	-C8V2
1309	-C9V1
1310	-C10
1311	-C11
1312	BZX29-C12
1313	-C13
1315	-C15
1316	-C16
1318	-C18

Type to be replaced	Replacement type
1320	BZX29-C20
1322	-C22
1324	-C24
1327	-C27
1330	-C30
1333	BZX29-C33
1336	-C36
1339	-C39
1343	-C43
1347	-C47
4120;4220	BZY93-C10(R)*
4121;4221	-C11(R)
4122;4222	-C12(R)
4123;4223	-C13(R)
4124;4224	-C15(R)
4125;4225	BZY93-C16(R)
4126;4226	-C18(R)
4127;4227	-C20(R)
4128;4228	-C22(R)
4129;4229	-C24(R)
4130;4230	BZY93-C27(R)
4131;4231	-C30(R)
4132;4232	-C33(R)
4133;4233	-C36(R)
4134;4234	-C39(R)
4135;4235	BZY93-C43(R)
4136;4236	-C47(R)
4137;4237	-C51(R)
4138;4238	-C56(R)
4139;4239	-C62(R)
4140;4240	BZY93-C68(R)
4141;4241	-C75(R)
4320;4420	BZY91-C10(R)
4321;4421	-C11(R)
4322;4422	-C12(R)

*) R denotes reversed polarity

REPLACEMENT GUIDE VOLTAGE REGULATOR (ZENER) DIODES

Type to be replaced	Replacement type	Type to be replaced	Replacement type
4323;4423	BZY91-C13(R)*	4536;4636	BZY91-C47(R)*
4324;4424	-C15(R)	4537;4637	-C51(R)
4325;4425	-C16(R)	4538;4638	-C56(R)
4326;4426	-C18(R)	4539;4639	-C62(R)
4327;4427	-C20(R)	4540;4640	-C68(R)
4328;4428	BZY91-C22(R)	4541;4641	BZY91-C75(R)
4329;4429	-C24(R)	5320	BZX29-C10
4330;4430	-C27(R)	5321	-C11
4331;4431	-C30(R)	5322	-C12
4332;4432	-C33(R)	5323	-C13
4333;4433	BZY91-C36(R)	5324	BZX29-C15
4334;4434	-C-39(R)	5325	-C16
4335;4435	-C43(R)	5326	-C18
4336;4436	-C47(R)	5327	-C20
4337;4437	-C51(R)	5328	-C22
4338;4438	BZY91-C56(R)	5329	BZX29-C24
4339;4439	-C62(R)	5330	-C27
4340;4440	-C68(R)	5331	-C30
4341;4441	-C75(R)	5332	-C33
4520;4620	-C10(R)	5333	-C36
4521;4621	BZY91-C11(R)	5334	BZX29-C39
4522;4622	-C12(R)	5335	-C43
4523;4623	-C13(R)	5336	-C47
4524;4624	-C15(R)	5337	-C51
4525;4625	-C16(R)	5338	-C56
4526;4626	BZY91-C18(R)	5339	BZX29-C62
4527;4627	-C20(R)	5340	-C68
4528;4628	-C22(R)	5341	-C75
4529;4629	-C24(R)	5342	-C82
4530;4630	-C27(R)	5343	-C91
4531;4631	BZY91-C30(R)	5344	BZX29-C100
4532;4632	-C33(R)	5508	BZY88-C3V3
4533;4633	-C36(R)	5509	-C3V6
4534;4634	-C39(R)	5510	-C3V9
4535;4635	-C43(R)	5511	-C4V3

*) R denotes reversed polarity

Type to be replaced	Replacement type	Type to be replaced	Replacement type
5512	BZY88-C4V7	7713	BZX29-C5V1
5513	-C5V1	7714	-C5V6
5514	-C5V6	7715	-C6V2
5515	-C6V2	7716	-C6V8
5516	-C6V8	7717	-C7V5
5517	BZY88-C7V5	7718	BZX29-C8V2
5518	-C8V2	7719	-C9V1
5519	-C9V1	7720	-C10
5520	-C10	7721	-C11
5521	-C11	7722	-C12
5522	BZY88-C12	7723	BZX29-C13
5523	-C13	7724	-C15
5524	-C15	7725	-C16
5525	-C16	7726	-C18
5526	-C18	7727	-C20
5527	BZY88-C20	7728	BZX29-C22
5528	-C22	7729	-C24
5529	-C24	7730	-C27
5530	-C27	7731	-C30
5531	-C30	7732	-C33
5532	BZX61-C33	7733	BZX29-C36
5533	-C36	7734	-C39
5534	-C39	7735	-C43
5535	-C43	7736	-C47
5536	-C47	7737	-C51
5537	BZX61-C51	7738	BZX29-C56
5538	-C56	7739	-C62
5539	-C62	7740	-C68
5540	-C68	7741	-C75
5541	-C75	9971	BZY88-C3V6
7708	BZX29-C3V3	9972	BZY88-C4V3
7709	-C3V6	9973	-C5V1
7710	-C3V9	9974	-C6V2
7711	-C4V3	9981	BZX29-C3V6
7712	-C4V7	9982	-C4V3

REPLACEMENT GUIDE VOLTAGE REGULATOR (ZENER) DIODES

Type to be replaced	Replacement type
9983	BZX29-C5V1
9984	-C6V2
BZ102-2V8	BZY88-C2V7
BZ102-3V4	-C3V3
BZX10	-C6V2
BZX11	BZY88-C6V8
BZX12	-C7V5
BZX13	-C8V2
BZX14	-C9V1
BZX15	-C10
BZX16	BZY88-C11
BZX17	-C12
BZX18	-C13
BZX19	-C15
BZX20	-C16
BZX21	BZY88-C18
BZX22	-C20
BZX23	-C22
BZX24	-C24
BZX25	-C27
BZX26	BZY88-C30
BZX27	BZY94-C33
BZX55-C5V6	BZX29-C5V6
-C6V2	-C6V2
-C6V8	-C6V8
BZX55-C7V5	BZX29-C7V5
-C8V2	-C8V2
-C9V1	-C9V1
BZY14	BZY88-C5V6
BZY15	-C6V8
BZY16	BZY88-C8V2
BZY17	-C10
BZY18	-C12
BZY19	-C15
BZY20	-C18
BZY21	BZY88-C22
BZY83-C4V7	-C4V7
BZY83-C4V7	-C4V7
-C5V1	-C5V1
-C5V6	-C5V6
BZY83-C6V2	BZY88-C6V2
-C6V8	-C6V8
-C7V5	-C7V5
-C8V2	-C8V2
-C8V1	-C9V1
BZY83-C10	BZY88-C10
-C11	-C11
-C12	-C12
-C13V5	-C13
-C15	-C15
BZY83-C16V5	BZY88-C16
-C18	-C18
-C20	-C20
-C22	-C22
-C24V5	-C24
BZY85-C3V3	BZY88-C3V3
-C3V6	-C3V6
-C3V9	-C3V9
-C4V3	-C4V3
-C4V7	-C4V7
BZY85-C5V1	BZY88-C5V1
-C5V6	-C5V6
-C6V2	-C6V2
-C6V8	-C6V8
-C7V5	-C7V5
BZY85-C8V2	BZY88-C8V2
-C9V1	-C9V1
-C10	-C10
-C11	-C11
-C12	-C12

Type to be replaced	Replacement type
BZY85-C13	BZY88-C13
-C13V5	-C13
-C15	-C15
-C16	-C16
-C16V5	-C16
BZY85-C18	BZY88-C18
-C20	-C20
-C22	-C22
-C24	-C24
-C24V5	-C24
BZY85-C27	BZY88-C27
-C30	-C30
-C33	BZY94-C33
BZY92-C3V9	BZX29-C3V9
-C4V3	-C4V3
BZY92-C4V7	BZX29-C4V7
-C5V1	-C5V1
-C5V6	-C5V6
-C6V2	-C6V2
-C6V8	-C6V8
BZY92-C7V5	BZX29-C7V5
-C8V2	-C8V2
-C9V1	-C9V1
-C10	-C10
-C11	-C11
BZY92-C12	BZX29-C12
-C13	-C13
-C15	-C15
-C16	-C16
-C18	-C18
BZY92-C20	BZX29-C20
-C22	-C22
-C24	-C24
-C27	-C27
-C30	-C30

Type to be replaced	Replacement type
BZY92-C33	BZY29-C33
-C36	-C36
BZZ10	BZY88-C6V2
BZZ11	-C6V8
BZZ12	-C7V5
BZZ13	BZY88-C8V2
OA126-5	-C5V1
OA126-6	-C6V2
OA126-7	-C6V8
OA126-8	-C8V2
OA126-9	BZY88-C9V1
OA126-10	-C10
OA126-11	-C11
OA126-12	-C12
OA126-14	-C15
OA126-18	BZY88-C18
OAZ200	-C5V1
OAZ201	-C5V6
OAZ202	-C6V2
OAZ203	-C6V2
OAZ204	BZY88-C6V8
OAZ205	-C7V5
OAZ206	-C8V2
OAZ207	-C9V1
OAZ208	-C4V7
OAZ209	BZY88-C5V6
OAZ210	-C6V2
OAZ211	-C7V5
OAZ212	-C9V1
OAZ213	-C10
RZ10A	BZY93-C10
RZ12A	-C12
RZ15A	-C15
RZ18A	-C18
RZ22A	-C22

REPLACEMENT GUIDE VOLTAGE REGULATOR (ZENER) DIODES

Type to be replaced	Replacement type
RZ27A	BZY93-C27
RZ33A	-C33
RZ39A	-C39
RZ47A	-C47
RZ56A	-C56
Z3	BZY88-C3V6
Z4	-C4V3
Z5	-C5V6
Z6	-C6V2
Z7	-C7V5
Z8	BZY88-C8V2
Z10	-C10
Z12	-C12
Z15	-C15
Z18	-C18
Z22	BZY88-C22
ZD3,9	BZX29-C3V9
ZD4,3	-C4V3
ZD4,7	-C4V7
ZD5,1	-C5V1
ZD5,6	BZX29-C5V6
ZD6,2	-C6V2
ZD6,8	-C6V8
ZD7,5	-C7V5
ZD8,2	-C8V2
ZD9,1	BZX29-C9V1
ZD10	-C10
ZD11	-C11
ZD12	-C12
ZD13	-C13
ZD15	BZX29-C15
ZD16	-C16
ZD18	-C18
ZD20	-C20
ZD22	-C22
ZD24	BZX29-C24
ZD27	-C27
ZD30	-C30
ZD33	-C33
ZD36	-C36
ZD39	BZX29-C39
ZD43	-C43
ZD47	-C47
ZD51	-C51
ZD56	-C56
ZD62	BZX29-C62
ZD68	-C68
ZD75	-C75
ZD82	-C82
ZD91	-C91
ZD100	BZX29-C100
Z-E6V9	BZY88-C6V8
Z-E9V4	-C9V1
Z-E12V7	-C13
Z-E17V2	-C18
Z-E23V2	BZY88-C24
Z-E31V	-C30
ZF3,3	-C3V3
ZF3,6	-C3V6
ZF3,9	-C3V9
ZF4,3	BZY88-C4V3
ZF4,7	-C4V7
ZF5,1	-C5V1
ZF5,6	-C5V6
ZF6,2	-C6V2
ZF6,8	BZY88-C6V8
ZF7,5	-C7V5
ZF8,2	-C8V2
ZF9,1	-C9V1
ZF10	-C10

Type to be replaced	Replacement type
ZF11	BZY88-C11
ZF12	-C12
ZF13	-C13
ZF15	-C15
ZF16	-C16
ZF18	BZY88-C18
ZF20	-C20
ZF22	-C22
ZF24	-C24
ZF27	-C27
ZF30	BZY88-C30
ZF33	BZY94-C33
ZG3,3	BZY88-C3V3
ZG3,9	-C3V9
ZG4,7	-C4V7
ZG5,6	BZY88-C5V6
ZG6,8	-C6V8
ZG8,2	-C8V2
ZG10	-C10
ZG12	-C12
ZG15	BZY88-C15
ZG18	-C18
ZG22	-C22
ZG27	-C27
ZG33	BZY94-C33
ZL6	BZY93-C6V8
ZL7	-C7V5
ZL8	-C8V2
ZL6,8	-C6V8
ZL8,2	-C8V2
ZL10	BZY93-C10
ZL12	-C12
ZL15	-C15
ZL18	-C18
ZL22	-C22
ZL27	BZY93-C27
ZL33	-C33
ZL39	-C39
ZL47	-C47
ZL56	-C56
ZL68	BZY93-C68
ZM3,9	BZX29-C3V9
ZM4,7	-C4V7
ZM5,6	-C5V6
ZM6,8	-C6V8
ZM8,2	BZX29-C8V2
ZM10	-C10
ZM12	-C12
ZM15	-C15
ZM18	-C18
ZM22	BZX29-C22
ZM27	-C27
ZM33	-C33
ZM39	-C39
ZM47	-C47
ZM56	BZX29-C56
ZM68	-C68
ZM82	-C82
ZM100	-C100
ZP2,7	BZY88-C2V7
ZP3	BZY88-C3V0
ZP3,3	-C3V3
ZP3,6	-C3V6
ZP3,9	-C3V9
ZP4,3	-C4V3
ZP4,7	BZX79-C4V7 BZY88-C4V7
ZP5,1	BZX79-C5V1 BZY88-C5V1
ZP6,2	BZX79-C6V2

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Type to be replaced	Replacement type
ZP6,2	BZY88-C6V2
ZP6,8	BZX79-C6V8
	BZY88-C6V8
ZP7,5	BZX79-C7V5
	BZY88-C7V5
ZP8,2	BZX79-C8V2
	BZY88-C8V2
ZP9,1	BZX79-C9V1
	BZY88-C9V1
ZP10	BZX79-C10
ZP10	BZY88-C10
ZP11	BZX79-C11
	BZY88-C11
ZP12	BZX79-C12
	BZY88-C12
ZP13	BZX79-C13
	BZY88-C13
ZP15	BZX79-C15
	BZY88-C15
ZP16	BZX79-C16
ZP16	BZY88-C16
ZP18	BZX79-C18
	BZY88-C18
ZP20	BZX79-C20
	BZY88-C20
ZP22	BZX79-C22
	BZY88-C22
ZP24	BZX79-C24
	BZY88-C24
ZP27	BZX79-C27
ZP27	BZY88-C27
ZP30	BZX79-C30
	BZY88-C30
ZX6,8	BZY93-C6V8
ZX7,5	-C7V5

Type to be replaced	Replacement type
ZX8,2	BZY93-C8V2
ZX9,1	-C9V1
ZX10	-C10
ZX11	-C11
ZX12	-C12
ZX13	BZY93-C13
ZX15	-C15
ZX16	-C16
ZX18	-C18
ZX20	-C20
ZX22	BZY93-C22
ZX24	-C24
ZX27	-C27
ZX30	-C30
ZX33	-C33
ZX36	BZY93-C36
ZX39	-C39
ZX43	-C43
ZX47	-C47
ZX51	-C51
ZX56	BZY93-C56
ZX62	-C62
ZX68	-C68
ZX75	-C75

REPLACEMENT GUIDE INTEGRATED CIRCUITS

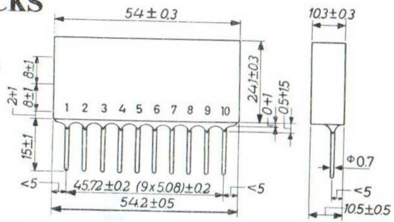
Type to be replaced	Replacement type
CA3011	TAA380A
CA3013	TAA380
LM101	TAA812
LM201	TAA811
SAA700	(TAA700)
SF252	FHJ101A
SF253	FHJ101B
SF262	FHJ121A
SF263	FHJ121B
SG212	FHH181A
SG213	FHH181B
SG222	FHH141A
SG223	FHH141B
SG232	FHY101
SG242	FHH121A
SG243	FHH121B
SG252	FHH161A
SG253	FHH161B
SG262	FHH101A
SG263	FHH101B
SG322	FHH201A
SG323	FHH201B
SM62	FHJ141A
SM63	FHJ141B
SN7400N	FJH131
SN7401N	FJH231
SN7402N	FJH221
SN7404N	FJH241
SN7405N	FJH251
SN7410N	FJH121
SN7420N	FJH111
SN7430N	FJH101
SN7440N	FJH141
SN7441AN	FCL111
SN7450N	FJH151
SN7451N	FJH161
SN7453N	FJH171
SN7454N	FJH181
SN7470N	FJJ101
SN7472N	FJJ111
SN7473N	FJJ121
SN7474N	FJJ131
SN7475N	FJJ181
SN7476N	FJJ191
SN7480N	FJH191
SN7490N	FJJ141
SN7492N	FJJ251
SN7493N	FJJ211
SN14224N	FCH101
SN14306N	FCH141
SN14310N	FCH221
SN14316N	FCH151
SN14326N	FCH161
SN14327N	FCY101
SN14331N	FCH121
SN14336N	FCH171
SN14346N	FCH181
SN14361N	FCH131
SN14366N	FCH191
SN14386N	FCH201
SN14396N	FCH211
TAA131	(OM200)
TAA141	(TAA263)
TAA151	(TAA293)
TAA750	(TAA320)
TAA940	(TAA550)
TBA271	(TAA550)
TBA311	(TAA700)
μA702A	TAA242
μA702C	TAA241

REPLACEMENT GUIDE INTEGRATED CIRCUITS

Type to be replaced	Replacement type
μA709	TAA522
μA709C	TAA521
μA723C	TBA281
μA741	TBA222
μA741C	TBA221
ZTK33	(TAA550)

COMPONENTS AND MATERIALS

CIRCUIT BLOCKS



Circuit blocks 1-Series

Maximum pulse repetition frequency = 100 kHz, for triggered logic applications
Supply: $V_P = +6\ \mathrm{V} \pm 5\,\%$, $V_N = -6\ \mathrm{V} \pm 5\,\%$
Ambient temperature range: -20 to $+60\,^\circ\mathrm{C}$
Logic levels:
binary "1": $0.7\ V_N$ to V_N
binary "0": 0 to -0.2 V

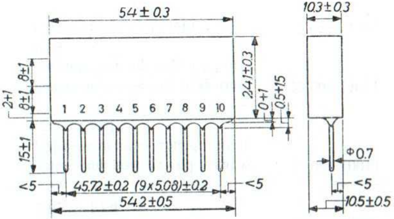
The 1-Series is composed of the following circuit blocks and assembled panels.

description	*abbreviation*	*colour*	*basic circuit*	*function*	*catalog number*
Circuit blocks					
Dual gate inverter	2.GI1	yellow	two gate inverting amplifiers	dual NAND or dual NOR, set/reset flip-flop, non-inverting amplifier, relay driver; furthermore it can be preceded by one or two level logic	2722 001 08001
Flip-flop	FF3 FF4	red	bi-stable multivibrator	memory, binary scaler-of-two memory, shift register	2722 001 00021 2722 001 00031
Dual negative gate	2.3N1	orange	two identical three-input diode gates	in conjunction with 2.GI1 two- or three-stage logic levels can be formed	2722 001 01001
	2.2N1		two identical two-input diode gates		2722 001 01011
Dual pulse logic	2.PL2	orange	two identical pulse gates	in conjunction with FF3 or FF4 a bi-directional shift register or a bi-directional counter can be formed	2722 001 03011

Pulse shaper	PS2	green	Schmitt trigger followed by an inverting amplifier	converting non-standard signals into standard signals	2722 001 11011
Positive reset unit	PR1	blue	non-inverting amplifier	resetting of max 40 flip-flops FF3 or FF4	2722 001 22001
One-shot multivibrator	OS2	green	monostable multivibrator	generating positive and negative pulses with adjustable duration (max. 1 ms)	2722 001 10011
Pulse driver	PD1	green	monostable multivibrator with built-in trigger gate	generating pulses for triggering and resetting flip-flops FF3 or FF4	2722 001 13011
Printed-wiring board	PDA1			for mounting up to four units PD1	4322 026 34710
Power amplifier	PA1		non-inverting high-power amplifier	max. output: 60 V, 600 mA	2722 032 00011
Printed-wiring board	PAA1			for mounting up to four units PA1	4322 026 33630
Assembled panels					
Dual decade counter	2.DCA2		2 × four flip-flops FF3, mounted on a printed-wiring board	decade counter (1-2-4-8 code)	2722 009 00011
Reversible counter	BCA1		five flip-flops FF4 and five dual pulse logics 2.PL2, mounted on a printed-wiring board	bi-directional shift register, bi-directional decade counter	2722 009 00021

description	*abbreviation*	*colour*	*basic circuit*	*function*	*catalog number*
Dual numerical indicator tube driver assembly	2.ID1		two decoding and driving circuits for numerical indicator tubes (ZM1000, ZM1020, ZM1040 or ZM1080) mounted on a printed-wiring board	operating in conjunction with decade counters (1-2-4-8 or 1-2-4-2 code) for numerical display	2722 009 05001
Decade counter and numerical indicator tube driver assembly	DCA3		four flip-flops FF3 with a decoding and driving circuit ID1, mounted on a printed-wiring board	decade counter (1-2-4-8 code) with ID1 for numerical display	2722 009 00031

Circuit blocks for ferrite core memory drive

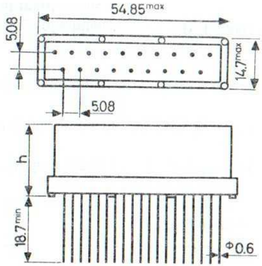


Maximum pulse repetition frequency = 100 kHz. These blocks have been designed for properly performing the specific functions in magnetic core memories. They should be used in conjunction with 1-Series circuit blocks.

Supply: $V_P = +6\ \text{V} \pm 5\,\%$, $V_N = -6\ \text{V} \pm 5\,\%$
Ambient temperature range: 0 to +60°C
Logic levels:
binary "1": 0.7 V_N to V_N
binary "0": 0 to −0.2 V

The series is composed of the following circuit blocks.

description	*abbreviation*	*colour*	*basic circuit*	*function*	*catalog number*
Dual selection switch	2.SS1	blue	two identical selection switch circuits	current switches in series with drive wires of a ferrite core memory	2722 001 14001
Selection gate	SG1	orange	AND-gate followed by a two-input AND-gate	two-level AND operation between address register and selection switches in ferrite core memories, read/write control	2722 001 04001
Pulse generator	PG1	green	pulse generating circuit	drive current switch for the drive wires and inhibit wires of a ferrite core memory	2722 001 12001
Read amplifier	RA2A	yellow	pre-amplifier followed by a full-wave rectifier	amplification of signals originating from the sense wire of ferrite core memories	2722 001 09011
	RA2B		strobing circuit followed by a pulse stretching circuit		2722 001 09021



Circuit blocks 10-Series

Maximum pulse repetition frequency = 30 kHz, for triggered logic applications.
Supply: $V_P = +12\ \text{V} \pm 5\%$, $V_N = -12\ \text{V} \pm 5\%$
Ambient temperature range: −25 to +55°C
Logic levels:
binary "1": $\frac{2}{3} V_P$ to V_P
binary "0": 0 to 0.3 V

The 10-Series is composed of the following circuit blocks and assembled panels.

h = max. 27.0 mm for high case
= max. 19.5 mm for low case

description	*abbreviation*	*case*	*basic circuit*	*function*	*catalog number*
Circuit blocks Dual positive gate inverter amplifier	2.GI10	low	two gate inverting amplifiers	dual NAND with four inputs in total	2722 004 08001
	2.GI11	high		dual NAND with six inputs in total	2722 004 08011
	2.GI12	high		dual NAND with eight inputs in total	2722 004 08021
Flip-flop	FF10	low	bi-stable multivibrator	memory, one stage of a binary counter or shift register, one stage of a bi-directional counter or bi-directional shift register	2722 004 00001
	FF11	high	bi-stable multivibrator with built-in trigger gates	memory, binary divider, two stages of a bi-directional counter or bi-directional shift register	2722 004 00011
	FF12	high	bi-stable multivibrator with built-in trigger gates and set/reset inputs	as FF11	2722 004 00021
Dual trigger gate	2.TG13	low	two pulse gate circuits	one stage of a bi-directional counter or bi-directional shift register in conjunction with FF11 or FF12, one stage of a binary counter or shift register in conjunction with FF10	2722 004 15001
	2.TG14	low	as 2.TG13 but with two separate built-in diodes for extension of the number of gate inputs	as 2.TG13	2722 004 15011

Quadruple trigger gate	4.TG15	high	four pulse gate circuits	two stages of a bi-directional counter or bi-directional shift register in conjunction with FF11 or FF12, one stage of a bi-directional counter or bi-directional shift register in conjunction with FF10	2722 004 15021
Timer unit	TU10	high	Schmitt trigger followed by an inverting amplifier, with built-in trigger gate	delay function; max. delay is 60 s	2722 004 18001
Gate amplifier	GA11	low	gate circuit followed by a non-inverting amplifier	AND-, AND-AND-, AND-OR, preceded by one-level or two-level logic circuits	2722 004 17001
One-shot multivibrator	OS11	high	monostable multivibrator with built-in trigger gate	generating positive and negative pulses with adjustable duration	2722 004 10011
Pulse driver	PD11	high	monostable multivibrator with built-in trigger gate	generating pulses for triggering and resetting flip-flops FF10, FF11 or FF12	2722 004 13011
Pulse shaper	PS10	low	Schmitt trigger followed by an inverting amplifier	converting non-standard signals into standard signals	2722 004 11001
Relay driver	RD10	low	non-inverting medium power amplifier	driving relays; output: 55 V, 200 mA (resistive loads) 30 V, 200 mA (inductive loads)	2722 004 16001
	RD11	low		driving relays; output: 55 V, 200 mA	2722 004 16011

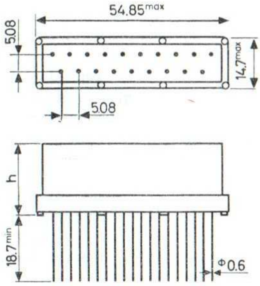
description	abbreviation	case	basic circuit	function	catalog number
Power amplifier	PA10		high-power amplifier	output: 55 V/2 A	2722 032 00021
Printed-wiring board	PAA10			for mounting up to four units PA10	4322 026 38680
Numerical indicator tube driver	ID10	high	decoding and driving circuit for numerical indicator tubes (ZM1000, ZM1020, ZM1040 or ZM1080)	operating in conjunction with decade counters (1-2-4-8 or 1-2-4-2 code) for numerical display	2722 004 20001
Assembled panels Decade counter and numerical indicator tube driver assembly	DCA10		four flip-flops FF12 with or without ID10, mounted on a printed-wiring board	DCA 10A: single decade counter with ID10	2722 009 02001
				DCA 10B: as DCA 10A, but without ID10	2722 009 02011
				DCA 10C: buffer memory with ID10	2722 009 02021
				DCA 10D: as DCA 10C, but without ID10	2722 009 02031
				DCA 10E: binary counter, scaler of 16	2722 009 02041
Dual decade counter and numerical indicator tube driver assembly	2.DCA11		2 × four flip-flops FF12, with or without ID10, mounted on a printed-wiring board	2.DCA 11A: dual decade counter with ID10	2722 009 02051
				2.DCA 11B: as 2.DCA 11A, but without ID10	2722 009 02061

Dual decade counter assembly	2.DCA12	2 × four flip-flops FF12, mounted on a printed-wiring board	2.DCA 12A : dual decade counter	2722 009 02071
			2.DCA 12B : decade counter and buffer memory	2722 009 02081
			2.DCA 12C : binary counter, scaler of 16, binary scaler of 256	2722 009 02091
Reversible decade counter and numerical indicator tube driver assembly	BCA10	four flip-flops FF12, two quadruple trigger gates 4.TG15, with or without 2.GI10 and/or ID10, mounted on a printed-wiring board	BCA 10A : reversible decade counter (1-2-4-8 code) with ID10	2722 009 02101
			BCA 10B : as BCA 10A, but without ID10	2722 009 02111
			BCA 10C : reversible decade counter (forward 1-2-4-8 code, reverse 1-2-4-2 code) without 2.GI10 and with ID10	2722 009 02121
			BCA 10D : as BCA 10C, but without ID10	2722 009 02131
Dual shift register assembly	2.SRA10	2 × five flip-flops FF12, mounted on a printed-wiring board	dual 5-stages one-directional shift register, dual one-directional decade ring counter, single 10-stages one-directional shift register	2722 009 03001
Reversible shift register assembly	RSR10	five flip-flops FF12, one dual trigger gate 2.TG13 and two quadruple trigger gates 4.TG15	5-stages reversible shift register, reversible decade ring counter, one-directional shift register with additional inputs for parallel information shift	2722 009 03011

Circuit blocks 20-Series

Maximum pulse repetition frequency = 1 MHz*), for triggered logic applications.
Supply: $V_{P1} = +12\text{ V} \pm 5\%$, $V_{P2} = +6\text{ V} \pm 10\%$, $V_N = -12\text{ V} \pm 5\%$
Ambient temperature range: −25 to +85°C
Logic levels:
binary "1": V_{P2}
binary "0": 0 to 0.5 V

The 20-Series is composed of the following circuit blocks.



h = max. 27.0 mm for high case
= max. 19.5 mm for low case

description	*abbreviation*	*case*	*basic circuit*	*function*	*catalog number*
Dual gate inverter	2.GI20	low	two gate inverting amplifiers	dual NAND (pos. logic) or dual NOR (neg. logic) with four inputs in total	2722 005 08001
	2.GI21			as 2.GI20 but with 6 inputs in total	2722 005 08011
	2.GI22			as 2.GI20 but with increased loadibility	2722 005 08021
Flip-flop	FF20	low	bi-stable multivibrator	memory	2722 005 00001
	FF22	high	bi-stable multivibrator	binary counter; shift register	2722 005 00011
	FF23	high	bi-stable multivibrator with built-in trigger gates		2722 005 00021

Dual trigger gate	2.TG23	low	two pulse gate circuits	in conjunction with FF23 a second pair of pulse inputs is formed to make one stage of a bi-directional counter or shift register	2722 005 15001
One-shot multivibrator	OS20	high	monostable multivibrator with built-in trigger gate	generating positive and negative pulses with adjustable duration (max. 50 ms)	2722 005 10001
Pulse shaper	PS20	low	Schmitt trigger followed by an inverting amplifier	converting non-standard signals into standard signals	2722 005 11001
Dual line driver	2.LD21	low	two driver circuits for terminated lines	driving 75 Ω cables with logic gating capability	2722 005 21001
Dual line receiver	2.LR22	low	two receiver circuits for terminated lines	converting 3 V-signal levels to standard system levels	2722 005 19011
Pulse driver	PD21	high	monostable multivibrator with built-in trigger gate	generating pulses for triggering and resetting flip-flops	2722 005 13001

*) 3.5 MHz for circuit blocks FF22, 2.GI20, 2.GI21 and 2.GI22.

CIRCUIT BLOCKS

Circuit blocks 40-series

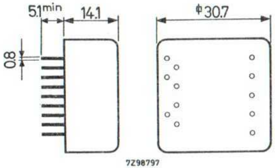


Fig. 1

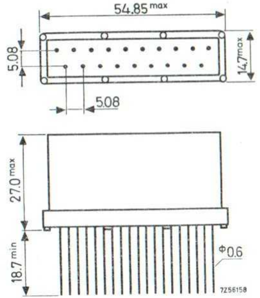


Fig. 2

The 40-Series is composed of the following circuit blocks:

DOA40 (Fig. 2), supply: $V_P = +15\text{V} \pm 3\%$, $V_N = -15\text{V} \pm 3\%$
DOA42 (Fig. 1), supply: $V_P = +15\text{ V} \pm 3\%$ $V_N = -15\text{ V} \pm 3\%$
DZD40 (Fig. 2), supply: $V_P = +12\text{ V} \pm 5\%$, $V_N = -12\text{ V} \pm 5\%$
PSM40 (Fig. 2), supply: $V_P = +12\text{ V} \pm 5\%$, $V_N = -12\text{ V} \pm 5\%$

description	*abbreviation*	*basic circuit*	*application*	*catalog number*
Operational amplifier Temperature range 0 to 85°C	DOA40	high gain, wide band, low drift d.c. differential amplifier	instrumentation and control circuits	2722 010 01011
Differential amplifier Temperature range −25 to +85°C	DOA42	high gain d.c. differential amplifier with low input bias current	instrumentation and control circuits	9331 019 30112
Differential zero detector Temperature range 0 to 70°C	DZD40	2-stage d.c. coupled differential amplifier followed by an OR-gate and an inverting amplifier	for use as zero detector, voltage comparator, polarity detector, adjustable discriminator, differential amplifier	2722 010 00001

Phase shift module Temperature range −25 to +85°C	PSM40		units produces line zero synchronized output pulses of which leading edge can be shifted by a control voltage	for use in conjunction with a trigger source for the control of the conduction angle of thyristors	2722 010 02001

Counter modules 50-Series

Maximum counting rate
uni-directional : 50 kHz
bi-directional : 12 kHz
Supply
indicator tubes : +250 V ± 18%
logic circuits : + 24 V ± 10%
Ambient temperature range : −25 to +70 °C

see "Power supplies", section "ACCESSORIES FOR CIRCUIT BLOCKS".

The 50-series is composed of the following modules.

description	*abbreviation*	*case*	*basic circuit*	*function*	*catalog number*
Numerical indicator counter	NIC50	Fig. 1	uni-directional decade counter coupled to a numerical indicator tube ZM1000	preset programmed control systems	2722 007 03001
Reversible indicator counter	RIC50	Fig. 1	bi-directional decade counter coupled to a numerical indicator tube ZM1000	preset programmed control systems	2722 007 04001
Memory indicator driver	MID50	Fig. 1	buffer memory coupled to a numerical indicator tube ZM1000	storage of information from NIC50 or RIC50	2722 007 05001

CIRCUIT BLOCKS

description	*abbreviation*	*case*	*basic circuit*	*function*	*catalog number*
Sign indicator driver	SID50	Fig. 1	indicator tube ZM1001 with driving circuit for plus and minus characters	plus and minus character indicator; characters ~, X, Y and Z are accessible	2722 007 06001
Triple NOR gate	3.NOR50	Fig. 2	6 input buffer NOR and dual 4 input NOR	buffer NOR for adapting the output levels of NIC50 and RIC50 to standard logic levels; 4 input NOR for logic purposes (e.g. memory function)	2722 007 00001
Quadruple NOR gate	4.NOR51	Fig. 2	quadruple 4 input NOR	logic purposes (e.g. memory function)	2722 007 00011
Pulse shaper and reset unit	PSR50	Fig. 2	pulse shaper: Schmitt trigger followed by an inverting amplifier; reset unit: monostable multivibrator	pulse shaper: converting input signals into counting pulses for NIC50 and RIC50; reset unit: generating pulses for resetting NIC50 and RIC50, generating pulses for resetting memories formed by cross-connected 4 input NOR's, generating transfer pulses for MID50	2722 007 01001

Lamp/relay driver	LRD50	Fig. 2	inverting low-power amplifier preceded by a 3 input OR-gate	driving lamps and relays	2722 007 02001
Printer drive units	PDU50A	Fig. 2	ten separate inverting stages	driving decimal input printers	2722 007 08001
	PDU50B	Fig. 2	scanning circuit		2722 007 08011
Decade counter and divider	DCD50	Fig. 2	four flip-flops	divider of 2, 3, 4, 5, 6, 8, 9, 10, 12 and 16	2722 007 07001
10 position thumbwheel switch	SU50	see "Thumbwheel switches", section "INPUT/OUTPUT DEVICES"			

For non-standard circuit configurations the empty case assembly ECA50 (catalog number 2722 007 89001) comprising a plastic case, a general purpose printed-wiring board and a rear bar is available.

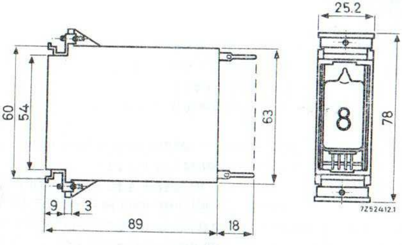


Fig. 1

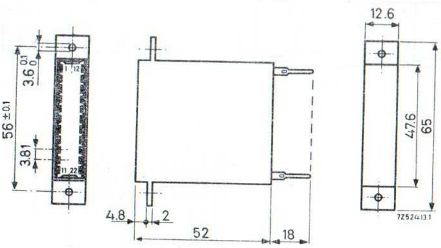


Fig. 2

60-Series NORBITS

These circuit blocks represent an important advance in static switching devices for industrial control systems. They use NOR logic as a basis of operation (positive logic).

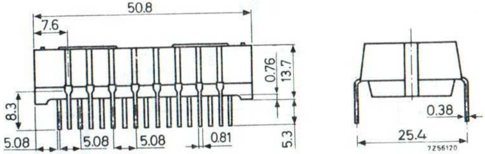
Supply: $V_S = +24\ \text{V} \pm 25\,\%$ or
$+12\ \text{V} \pm 5\,\%$ at reduced ratings

Ambient temperature range: -10 to $+70\,^\circ\text{C}$

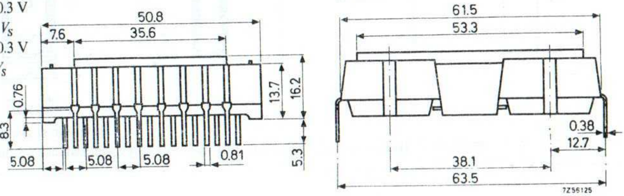
Logic levels:

at $V_S = 24\ \text{V} \pm 25\%$: $0\ \text{V} < \text{binary ``0''} < +0.3\ \text{V}$
$11.4\ \text{V} < \text{binary ``1''} < V_S$

at $V_S = 12\ \text{V} \pm 5\%$: $0\ \text{V} < \text{binary ``0''} < +0.3\ \text{V}$
$8.3\ \text{V} < \text{binary ``1''} < V_S$



Size A



Size B

The 60-Series NORBITS is composed of the following circuit blocks.

description	*type*	*case*	*colour*	*basic circuit and function*	*catalog number*
Dual four input NOR gate	2.NOR60	size A	black	two identical NOR-circuits, each with four inputs	2722 008 00001
Quadruple $2 \times 2 + 2 \times 3$ input NOR gate	4.NOR60	size A	black	two identical 2-input and two identical 3-input NOR circuits	2722 008 00011
Dual inverter amplifier	2.IA60	size A	blue	two identical inverting amplifiers or single inverting low power amplifier by connecting two units in tandem	2722 008 01001

Dual low power amplifier	2.LPA60	size A	blue	two identical inverting low power amplifiers	2722 032 00041
Timer unit	TU60	size A	red	time delay circuit: following a "0" going input the output is a delayed "1"; no delay occurs when input returns to "1" (output goes "0" immediately)	2722 008 03001
Dual input switch filter	2.SF60	size A	green	two identical filters for eliminating the effects of contact bounce of mechanical switches and interference on input lines of same	2722 008 02001
Power amplifier	PA60	size B	blue	Schmitt trigger, buffer and driver stage and power amplifier for load switching	2722 032 00031
Components and accessories for 60-series Norbits: (See also ACCESSORIES FOR CIRCUITS BLOCKS AND ELECTR-MECH. COMPONENTS)					
Thyristor trigger transformer	TT60	34 × 34 moulded	brown	It can produce, in conjunction with PA60, two pulse currents of up to 400 mA	2722 032 00051
Plastic mounting chassis	UMC60	245 × 95		Mounting facility for 6 size A or 3 size B blocks or combination	4322 026 38330
Printed-wiring board for use in UMC60	PWB63	183 × 89		Tracks are such that only short jumpers need be used to obtain all kinds of logic functions	4322 026 73750
Breadboard block	BB60	38 × 56 × 14		For easy realization of instructive circuits with one BB60 for each size A block	9390 192 00002

61-Series NORBITS

Extension to the NORBIT range in order to facilitate using NORBITS in thyristorized power control circuits.
Encapsulation: size A block like 60-series units; colour: black.
The 61-series comprises the following types:

description	*type*	*basic circuit and function*	*catalog number*
Dual 2-input NOR-gate with diode resistor networks	2NOR61	two two-input transistor-resistor NOR gates and diode gating facilities specifically applicable as a d.c. counting/shifting stage	2722 008 00021
Rectifier and synchronization assembly	RSA61	rectifier circuits to provide (a) an unregulated voltage of +24 V, (b) synchronization signals, (C) +12 V and −12 V (zener stabilized) for servo amplifiers	2722 008 05001
Universal power amplifier	UPA61	three independent circuits to provide (a) d.c. switching amplifier, (b) power oscillator for driving thyristor trigger transformers, (c) phase shift module and (d) current source for linear capacitor discharging	2722 032 00071
Dual trigger transformers	TT61	two identical trigger transformers to match the pulse output from a power amplifier (e.g. UPA61) to thyrister gates	2722 032 00081
Differential amplifier	DOA61	amplification 10x/100x, loop shaping and comparison with reference signals in analogue closed-loop systems	2722 008 04001

Circuit blocks 90-series

Circuit blocks in size A encapsulation, operating with trigger logic but partly compatible with 60-series, intended for use in counters and shift registers of industrial control systems.

description	*type*	*basic circuit and function*	*catalog number*
Flip-flop	FF90	set-reset bistable multivibrator with trigger gates; input 1–0 edge of 3 μs max.	2713 001 00001
Twin trigger tube	2.TG90	two extra independent trigger gates for the EF90	2713 001 00002
Pulse shaper	PS90	Schmitt trigger circuit followed by an inverting amplifier for (a) driving the trigger inputs of one or more EF90 or 2. TG90 units or (b) shaping signals to produce NORBIT60 drive levels	2713 001 00003

ACCESSORIES FOR CIRCUIT BLOCKS

Power supplies

The following power supply units and sub-assemblies for power supplies are available: Power supply units for digital circuit blocks

application	*fits 19″ chassis*	*dimensions (mm)*	*input*	*d.c. output*	*stability ratio*	*catalog number*
1 Series circuit blocks	4322 026 38240	215 × 125 × 70	220 V 235 V 50–60 Hz	−6 V, 600 mA +6 V, 150 mA	450 : 1 360 : 1	2722 151 00011
10-Series circuit blocks	4322 026 38240	214 × 123 × 91	105–120 V 200–240 V 45–65 Hz	−12 V, 400 mA +12 V, 1000 mA	350 : 1 1000 : 1	2722 151 00021
Counter modules 50-Series		170 × 140 × 87	110, 120, 130, 220, 230, 240 V 45–65 Hz	+24 V ± 5%, 0–250 mA for logic supply; +250 V ± 18%, max. 40 mA for numerical indicator tube supply		2722 151 00061
60-Series NORBITS		146 × 76 × 77	240, 230, 220, 120 or 100 V 47–440 Hz	+30 to +18 V for 0 to 500 mA		2722 151 00041 type PSU60
60-Series NORBITS		146 × 76 × 77	240, 230, 220, 120 or 100 V 47–440 Hz	+30 to +18 V for 0 to 500 mA, and +100 V, 25 mA		2722 151 00051 type PSU61
60-Series NORBITS	fits in UMC60	90 × 83	220 V (110 V)	+30 to +18 V for 0–150 mA		4322 000 01000 (4322 000 01010) type LSU60

Sub-assemblies for power supplies

Type MF0.5A : Mains filter for use between <250 V mains and mains input of control systems consuming less than 0.5 $A_{a.c.}$
Attenuation 0.1–10 MHz : 50 dB.
Dimensions : 88 × 47 × 39 mm.

Type MF2A : Mains filter for use between <250 V mains and mains input of control systems consuming less than $2A_{a.c.}$
Attenuation 0.3–15 MHz : >50 dB
Dimensions : 153 × 47 × 39 mm.

Locking aids

(to secure circuit blocks to the p.w. board)

Locking tag for the 1-series	4322 026 33690
Locking cap for the 10-series and the 20-series	4322 026 32150
Soldering tag for locking cap	4322 026 32140

Stickers

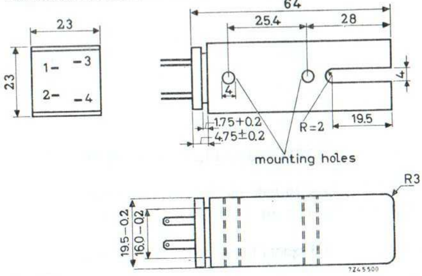
These are drawing symbols of circuit blocks printed on self-adhesive, transparent material. They can be used for fast preparation of system drawings.

Stickers for circuit blocks of the 1-, 10- and 20-Series are available in rolls of 1000 pieces; stickers for circuit blocks of the 40-Series of counter modules 50-Series, and 60- and 61-Series Norbits are available in sheets.

Printed-wiring boards: (see ELECTRO-MECHANICAL COMPONENTS)

INPUT/OUTPUT DEVICES

Vane switched oscillator VSO



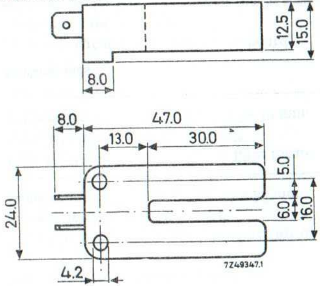
Catalog number 2722 031 00001

Application: This unit can be applied as a static switching device, the switching action being determined by the position of a vane. For the vane any metal can be used.

Technical performance

Vane material	any metal
Supply, terminals 2–1	12 $V_{d.c.}$, 12 mA
Output voltage, terminals 3–4	5.75 V ± 15 % open circuit, isolated
Maximum permissible voltage between 1–2 and 3–4	100 V_p
Output impedance (without vane)	4.1 kΩ ± 10 %
Maximum detection frequency	1 kHz
Operating temperature range	−25 to +85 °C

Iron vane switched reed IVSR



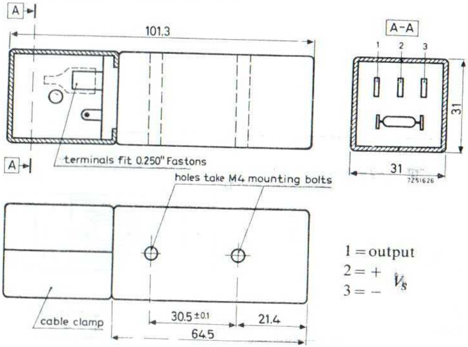
Catalog number 2722 031 00011

Application: It can be applied as a limit switch, position indicator or as a signal source for low counting speeds. In conjunction with a d.c. amplifier or with the TTM it can be used for power switching. It can succesfully replace micro switches.

Technical performance

Vane material	mild steel
Load switching capacity (non inductive)	≤1.2 VA
Voltage switching capacity	≤32 $V_{d.c.}$ ≤50 $V_{a.c.}$
Current switching capacity (non inductive)	≤0.1 $A_{d.c.}$
Switching frequency	≤100 Hz
Operating temperature range	−25 to +70 °C

Electronic proximity detector EPD



1 = output
2 = + V_S
3 = −

Catalog number 2722 031 00021

Application: The electronic proximity detector is a static switching device, the switching action being determined by the presence of a metallic object. The metal can be any electrically conducting material of rather arbitrary shape.

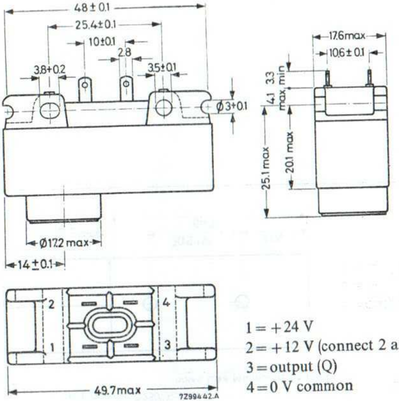
It can be applied as a detector for the presence, passage or position of metal parts and is a versatile tool in various industrial automation set-ups.

Technical performance

Supply voltage (V_S)	12 $V_{d.c.}$
Consumed current	16 mA
Output voltage, no object being detected	approximately $V_S - 0.5$ V
Output resistance	
no object being detected	680 Ω ± 10 %
object being detected	3.3 kΩ
Minimum load	1 kΩ
Maximum detection frequency	1 kHz
Operating temperature range	−25 to +85 °C

INPUT/OUTPUT DEVICES

Miniature electronic proximity detector EPD60



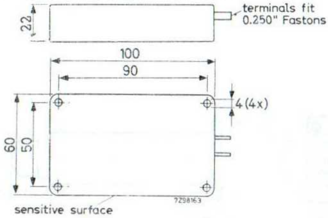
1 = +24 V
2 = +12 V (connect 2 and 1)
3 = output (Q)
4 = 0 V common

Catalog number 2722 031 00091

Application: It can be applied as a static switching device, the switching action being determined by the position of a metal object. In this way a static equivalent for the well-known mechanical miniature switch is obtained.

Technical performance	
Supply voltage (V_s)	+24 V ±25%, or +12 V ±5%
Consumed current (nominal)	15 mA
Output voltage	
no object being detected	max. 0.3 V
object being detected	min. +11.4 V at $V_s = +24$ V min. +8.3 V at $V_s = +12$ V
Output resistance	
no object being detected	3 kΩ
object being detected	15 kΩ
Maximum detection frequency	1 kHz
Operating temperature range	−25 to +70°C

Magnetic proximity detector MPD



Catalog number 2722 031 00031

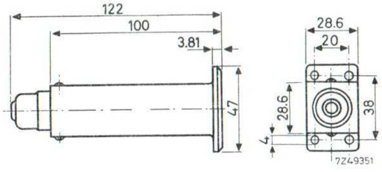
Application: This unit can be applied as a detector for the presence, passage or position of ferreous parts. It is a versatile tool in industrial automation set-ups.

Technical performance

Load switching capacity	$\leqslant 25$ W
Voltage switching capacity	$\leqslant 200\ V_{d.c.}$
Current switching capacity	$\leqslant 1\ A_{d.c.}$
Switching frequency	$\leqslant 100$ Hz
Contact resistance, initially	$\leqslant 100$ mΩ
Operating temperature, range	-25 to $+70$°C

INPUT/OUTPUT DEVICES

Photo-electric detector CSPD



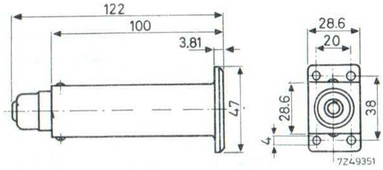
Catalog number 2722 031 00041

Application: Input device in digital systems. To be used in conjunction with lamp unit 1MLU.

Technical performance

Type of detector	cadmiumsulfide
Max. voltage	150 V_p
Max. dissipation at 40°C	0.2 W
Max. switching frequency	6 Hz
Max. operating distance (with 1 MLU)	1 m
Operating temperature range	−10 to +40°C

Lamp unit 1 MLU



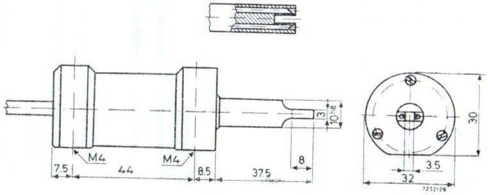
Catalog number 2722 031 00051

Application: To be used in conjunction with photo-electric detector CSPD

Technical performance

Supply voltage	≤6 $V_{a.c.}$ or 6 $V_{d.c.}$
Max. operating distance (with CSPD)	1 m
Operating temperature range	−10 to +40°C

Light interruption probe L1P1



Catalog number 2722 031 00041

Application: The light interruption probe can be used for the detection of the presence or passage of small objects. Major applications are envisaged in the field of accurate positioning and revolution counting.

Connections: The unit is provided with a 4-core colour coded shielded cable with a length of 2 m:

White lead to +12 V
Yellow lead to +12 V via a resistor (supplied with the unit)
Brown lead common 0 V
Green lead to load

Technical performance

Output, unloaded	
no object	0 to +1.25 V
with object	+4.8 to +12 V
Output impedance	
no object	max. 2.1 kΩ
complete interception	max. 1.1 kΩ
Max. detection frequency	>10 kHz
Operating temperature range	0 to +50°C

Thyristor trigger module TTM

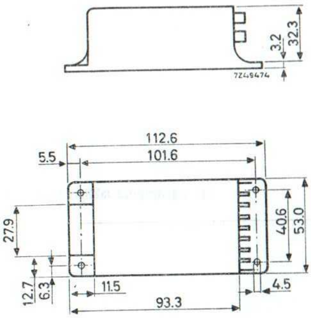
Catalog number 2722 032 00061

Application: The thyristor trigger module is intended for use as a supply of repetitive gate trigger pulses for one or two thyristors.

It can be applied in a variety of circuits.

The possibility of logic control (e.g. in conjunction with 60-series Norbits or with circuit blocks of the 10-series or 20-series) makes it well adapted for automation and control systems. In conjunction with a phase shift module (PSM, catalog number 2722 010 02001), linear conduction angle control over 10 to 170° is possible.

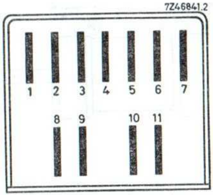
With three TTM's 3-phase operation of thyristors can be achieved.



Technical performance

Supply	12 $V_{d.c.}$, 35 mA
Operating temperature range	−25 to +85°C
Number of outputs	2, isolated. Output voltages are in phase.
Isolation of outputs	rated at 500 V_{rms} operation
Voltage	⩽10 $V_{d.c.}$
Current (one output loaded with 16 Ω the other output short-circuited)	250 mA.
Impedance (both outputs or one output loaded with 16 Ω)	25 Ω
Nominal pulse frequency (both outputs loaded with 16 Ω)	2.3 kHz
Pulse width at 3 V (both outputs loaded with 16 Ω)	>20 μs
Pulse rise time	<0.5 μs

Terminal location



1 = supply + 12 V
2 = } interconnected, except for on-off control and conduction angle control with a po-
3 = } tentiometer or a control voltage
4 = } interconnected, except for control
5 = } with a switch which is normally open
6 = supply 0 V
7 = safety-catch input
8 = gate thyristor 1
9 = cathode thyristor 1
10 = gate thyristor 2
11 = cathode thyristor 2

Thumbwheel switches

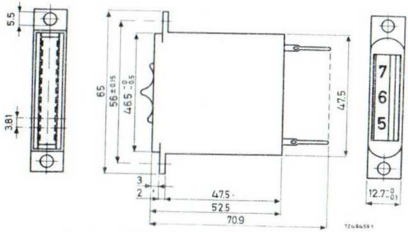


Fig. 1: Switch for façade mounting

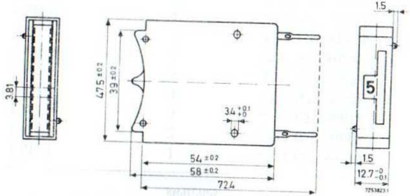


Fig. 2: Switch for block mounting

Catalog number 4311 027 82 . . . .

Application: These switches have been developed to be used as pre-set devices in digital control systems, in which numerical information is handled. Two versions are available, one for façade mounting and one for block mounting.

Technical performance

Working voltage	50 $V_{d.c.}$
Insulation resistance	$\geqslant 10^8\ \Omega$
Current switching capacity in purely resistive circuits	0.1 $A_{d.c.}$
Maximum current carrying capacity	0.5 $A_{d.c.}$
Contact resistance	$\leqslant 50$ mΩ
Losses (tan δ), measured at 1 MHz	$\leqslant 25.10^{-4}$
Capacitance, measured at 1 MHz	$\leqslant 15$ pF
Life	in excess of 100000 complete rotations, at a rate of 1 step/s
Operating torque	250 to 750 gcm
after 20000 rotations	150 to 650 gcm
Printed-wiring boards	glass-epoxy; goldplated tracks
Operating temperature range	-25 to $+25$°C

INPUT/OUTPUT DEVICES

Façade mounting

The switches can be mounted in panels with a thickness up to 4 mm by means of mounting façades. The following mounting façades are available

mounting façade	*number of switches*	*catalog number*
FMF1	1	4311 027 80598
FMF2	2	4311 027 80608
FMF3	3	4311 027 80618
FMF4	4	4311 027 80628
FMF5	5	4311 027 80638
FMF6	6	4311 027 80648
FMF7	7	4311 027 81163
FMF8	8	4311 027 81173
FMF9	9	4311 027 81183
FMF10	10	4311 027 81193

Block mounting

These switches which do not require a front façade can be "block mounted" by means of mounting brackets and 3 mm tie rods. Accessories include:

End piece	(cat. no. 4311 027 82151)
Spacer	(cat. no. 4311 027 82161)
Blank housing	(cat. no. 4311 027 82141)

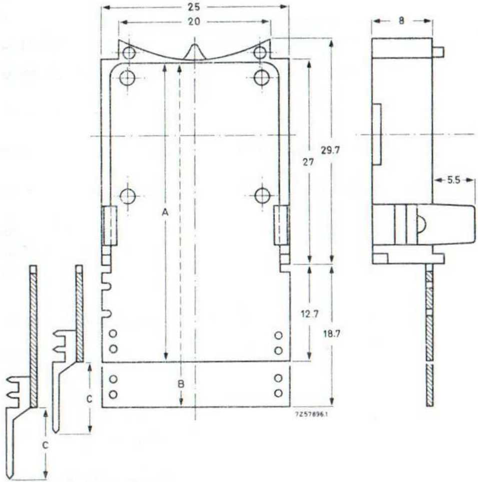
	description	*abbreviation*	*index*	*catalog number* 4311 027	
				façade mounting	*block mounting*
decimal and 2 position switches	10 position 2 pole switch	10P2C	0–9	82201	82521
	10 position 1 pole switch	10P1C	0–9	82321	82401
	2 position 4 pole sign switch	2P4+ −	+, −	82231	82641
	2 position 2 pole sign switch	2P2+ −	+, −	82341	82601
	2 position 4 pole sign switch	2P4× ÷	×, ÷	82311	82651
	2 position 2 pole sign switch	2P2× ÷	×, ÷	82351	82611
	2 position 4 pole sign switch	2P401	0, 1	82281	82661
	2 position 2 pole sign switch	2P201	0, 1	82361	82501
	2 position 4 pole sign switch	2P4MA	M, A*)	82291	82671
	2 position 2 pole sign switch	2P2MA	M, A*)	82371	82621
	2 position 4 pole sign switch	2P4AvAr	Av, Ar**)	82301	82681
	2 position 2 pole sign switch	2P2AvAr	Av, Ar**)	82381	82631
binary decoding switches (including 4 diodes BAX13 and a resistor of 12 kΩ)	decoding switch 1248 negative logic	1248N	0–9	82221	82391
	decoding switch 1248 positive logic	1248P	0–9	82251	82411
	decoding switch 1242 (jump at 8) negative logic (Berkeley code)	1242N	0–9	82211	82711
	decoding switch 1242 (jump at 8) positive logic (Berkeley code)	1242P	0–9	82241	82721
	decoding switch 1248 negative logic***)	1248N/C	0–9	82451	82541
	decoding switch 1248 positive logic***)	1248P/C	0–9	82431	82551
	decoding switch 1242 (jump at 8) negative logic***)	1242N/C	0–9	82441	82571
	decoding switch 1242 (jump at 8) positive logic***)	1242P/C	0–9	82421	82581
	decoding switch 2 out of 5 plus 2 out of 2	2522 plus blank	0–9		82771

for notes see next page.

	description	*abbreviation*	*index*	*catalog number* 4311 027	
				façade mounting	*block mounting*
binary coding switches	coding switch 1248	1248C	0–9	82271	82531
	coding switch 1242 (jump at 8)	1242C	0–9	82261	82701
	coding switch 1248****)	1248C/C	0–9	82471	82561
	coding switch 1242 (jump at 8)****)	1242C/C	0–9	82461	82591
	coding switch 1248	1248S	0–9		82511

Note: The contacts of all switches break before make.
*) "Start" and "Stop" for latin-based languages.
**) "Forward" and "Reverse" for latin-based languages.
***) Switch decodes 9-complement of decimal digit on thumbwheel.
****) Switch encodes 9-complement of decimal digit on thumbwheel.

Miniature thumbwheel switches



Catalog number 4311 027 84 . . .

Application: These switches have been developed for use as preset devices in digital systems which have to handle numerical data.

Technical performance

Working voltage	60 $V_{d.c.}$
Insulation resistance	$> 10^9\ \Omega$
Current switching capacity in purely resistive circuits	0.1 $A_{d.c.}$
Maximum current carrying capacity	2 $A_{d.c.}$
Contact resistance	$< 100\ m\Omega$
Capacitance measured at 1 MHz	< 10 pF
Standard gate resistor	3900 Ω
Life	in excess of 100000 complete rotations at a rate of 1 step/s
Operating torque	100 to 200 gcm
Printed-wiring board	glass epoxy; goldplated tracks on nickel
Operating temperature range	−25°C to +70°C

Mounting accessories

Male end piece	4311 027 84321
Female end piece	84331
Spacer	84591

Survey of types

description	*type* *)	*catalog number*
Decimal switches		
10 position 1 pole switch	M 10P1C	4311 027 84001
	MW 10P1C	84011
10 position 2 pole switch	M 10P2C	84041
Binary switches		
Decoding types:		
decoding switch 1.2.4.8, negative logic, with complement	M 1248/NC	4311 027 84201
	MW 1248/NC	84211
decoding switch 1.2.4.8, positive logic, with complement	M 1248/PC	84241
	MW 1248/PC	84251
Encoding types:		
encoding switch 1.2.4.8	MW 1248	84171
encoding switch 1.2.4.8, with complement	M 1248/C	84161
	MW 1248/C	84291
encoding switch 1.2.4.8, with isolating diodes for negative logic	M 1248/N	84081
	MW 1248/N	84091
encoding switch 1.2.4.8, with isolating diodes for positive logic	M 1248/P	84121
	MW 1248/P	84131

Note: The contacts of all switches break before make.

*) Terminal style: M = without pins (solder direct to track plate)
MW = with pins (for wire wrapping)

MEMORY PRODUCTS

Ferroxcube memory cores

minimum cycle times	*core size*	*core type*	*nominal operating conditions*					*relevant typical output characteristics*				
			T °C	I mA	DR	t_r μs	t_d μs	uV_1 mV	rV_1 mV	wV_z mV	t_p μs	t_s μs
5 μs	50 mil	6C2	70	755	0.50	0.25	1.2	105	103	7	0.45	0.88
1.5 μs	30 mil	6F8	40	655	0.50	0.1	0.5	55	53	6	0.20	0.39
1.5 μs	30 mil	6F3	70	740	0.50	0.15	0.6	60	58	5	0.25	0.50
1.0 μs	20 mil	6H3	40	835	0.50	0.05	0.45	55	53	5	0.095	0.19
1.0 μs	20 mil	6H2	70	900	0.50	0.05	0.28	48	45	4	0.110	0.22
0.65 μs	20 mil	6H5	60	800	0.50	0.05	0.25	72	69	7.5	0.105	0.195
0.5 μs	20 mil	6H4	45	665	0.50	0.05	0.30	54	52	5	0.108	0.220
0.5 μs	18 mil	6H6	60	770	0.50	0.05	0.20	59	57	5	0.095	0.175
0.3 μs	14 mil	6V1	40	1100	0.50	0.025	0.15	34	33	5	0.06	0.11

NOTE: Offers for cores differing from those of our range may be made on request.

Matrix planes and stacks

SYSTEMS We can supply matrix planes and stacks for the three following memory systems:

(A) 2D-systems (word organised memories)
(B) 3D-systems (bit organised memories)
(C) $2\frac{1}{2}$D-systems

Matrix planes are available in frame construction, on a printed-wiring board and in a construction suitable for mounting on a printed- wiring board (Platrices).

MEMORY PRODUCTS

A number of types have been standardised on core pattern, wiring, types of core and construction.

Matrix planes with 50 mil cores
Catalog number, for ordering: 2722 043 ..... (for suffix see Table)

core pattern preferred	*wiring* X Y Z S	*core type*	*unlacquered*		*lacquered*	
			left	*right*	*left*	*right*
			suffix	*suffix*	*suffix*	*suffix*
64 × 64	1 1 1 1	6C1	06001	06081	06011	06091
		6D5	06021	06101	06031	06111
		6C2	06041	06121	06051	06131
		6D9	06061	06141	06071	06151
4 × 16 × 16	1 1 4 4	6C1	25001		25011	
		6D5	25021		25031	
		6C2	25041		25051	
		6D9	25061		25071	
4 × 32 × 32	1 1 4 4	6C1	26001		26011	
		6D5	26021		26031	
		6C2	26041		26051	
		6D9	26061		26071	
4 × 64 × 64	1 1 4 4	6C1	27001		27011	
		6D5	27021		27031	
		6C2	27041		27051	
		6D9	27061		27071	

Dimensions in mm

The dimensions A to D refer to Figs. 1 and 2.

core pattern	*A*	*B*	*C*	*D*
64 × 64	120	120	100.2	100.2
4 × 16 × 16	85	85	64.5	64.5
4 × 32 × 32	125	125	105.2	105.2
4 × 64 × 64	208	208	186.7	186.7

$d = 3.2$
$H = 4.8$

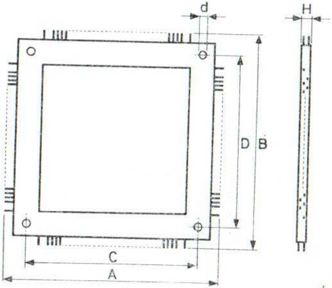


Fig. 1

$d = 4.2$
$H = 3.2$

Matrix planes with 30 mil cores

Catalog number, for ordering, 2722 044 . . . . . (for suffix see Table)

core pattern preferred	*wiring X Y Z S*	*core type*	*lacquered left suffix*	*lacquered right suffix*	*dimensions in mm Figs. 1 and 2 A × B*	*dimensions in mm Figs. 1 and 2 C × D*
64 × 64	1 1 1 1	6F8 6F3	06061 06081	06071 06091	85.5 × 85.5	65.5 × 65.5
4 × 64 × 64	1 1 4 4	6F8 6F3	27061 27081	27071 27091	138.3 × 138.3	118.1 × 118.1
2 × 64 × 128 1)	1 1 4 4	6F8 6F3	35061 35081	35071 35091	138.3 × 139	118.1 × 118.8
128 × 128 1)	1 1 4 4	6F8 6F3	08061 08081	08071 08091	139 × 139	118.8 × 118.8

Matrix planes with 20 mil cores
Catalog number, for ordering 2722 045 . . . . . (for suffix see Table)

d = 4.2
H = 4.8

core pattern preferred	*wiring* X	Y	Z	S	*core type*	*lacquered* *left* *suffix*	*lacquered* *right* *suffix*	*dimensions in mm Figs 1 and 2* *A* × *B*	*dimensions in mm Figs 1 and 2* *C* × *D*
128 × 128	1	1	4	4	6H3	08021	08031	120 × 120	100.1 × 100.1
	1	1	4	4	6H2	08041	08051		
	1	1	8	4	6H3	08061	08071		
	1	1	8	4	6H2	08081	08091		
2 × 64 × 128	1	1	4	4	6H3	35021	35031	119.3 × 120	99.5 × 100.1
	1	1	4	4	6H2	35041	35051		
	1	1	8	4	6H3	35061	35071		
	1	1	8	4	6H2	35081	35091		
4 × 64 × 64	1	1	4	4[2]	6H3	27021	27041	119.3 × 119.3	99.5 × 99.5
	1	1	4	4[2]	6H2	27031	27051	119.3 × 119.3	99.5 × 99.5
	1	1	8	8	6H3	27061	27071	122 × 122	102.1 × 102.1
	1	1	8	8	6H2	27081	27091	122 × 122	102.1 × 102.1

[1] Matrices with interlaced sense wiring. [2] Matrices without interlaced sense wiring.

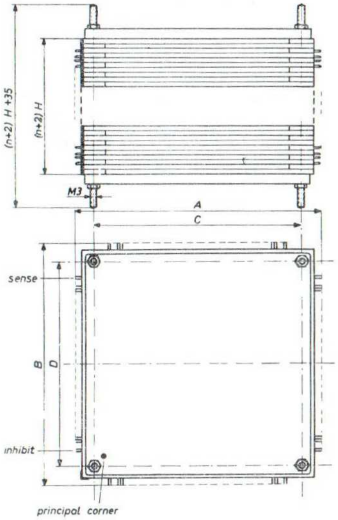


Fig. 2. Dimensions in mm
n = number of planes
Dimensions A to D: see Tables

Platrices with 50 mil cores, for direct mounting on printed wiring boards

Standard range
Preferred types (paper-base laminate frame, 6 C2 cores)

core pattern	*catalog number*		*outer dimensions over the tags (mm)*
	for 2.54 mm grid	*for 2.50 mm grid*	
16 × 16	2722 051 02051	2722 051 02041	82 × 82
16 × 32	2722 051 10051	2722 051 10041	82 × 122
32 × 32	2722 051 05051	2722 051 05041	122 × 122
4 × (4 × 16)	2722 051 28051	2722 051 28041	82 × 82
4 × 8 × 8	2722 051 22051	2722 051 22041	82 × 82
4 × 8 × 16	2722 051 29051	2722 051 29041	82 × 122
4 × 12 × 12	2722 051 24051	2722 051 24041	102 × 102
4 × 16 × 16	2722 051 25051	2722 051 25041	122 × 122
2 × 16 × 32	2722 051 20051	2722 051 20041	122 × 122

MEMORY PRODUCTS

3D core matrices on printed wiring boards

Core matrices for the 3D system mounted and lacquered on the copper-clad surface at both sides of a glass-epoxy board. Special attention has been paid to heat transfer.

Versions with 30 mil cores
Cycle time 2 μs. Core pitch 30 mil Dimensions 89 × 89 or 140 × 140 mm, thickness 1.6 mm

Spacing in stacks 3.2 mm

Standard range:

core pattern	*wiring*				*core type*	*main dimensions*	*catalog number* 2722 061 .....
	X	*Y*	*Z*	*S*			
2 × (4 × 32 × 32)	1	1	4	4	6F8	89 × 89	26011
					6F3		26001
2 × (2 × 32 × 64)	1	1	2	2	6F8	89 × 89	21011
					6F3		21001
2 × (64 × 64)	1	1	1	1	6F8	89 × 89	06011
					6F3		06001
2 × (4 × 64 × 64)	1	1	4	4	6F8	140 × 140	27011
	1	1	4	4	6F3		27001
	1	1	8	4	6F8		27031
	1	1	8	4	6F3		27021
2 × (2 × 64 × 128) 1)	1	1	4	4	6F8	140 × 140	35011
	1	1	4	4	6F3		35001
	1	1	8	4	6F8		35031
	1	1	8	4	6F3		35021

2×(128×128) 1)	1	1	4	4	6F8	140×140	08011
	1	1	4	4	6F3		08001
	1	1	8	4	6F8		08031
	1	1	8	4	6F3		08021

Versions with 20 mil cores

Cycle time 1 μs. Core pitch 20 mil Dimensions 115 × 115 × 1.6 mm

Spacing in stacks 3.2 mm

Standard range:

core pattern	*wiring*				*core type*	*catalog number*
	X	*Y*	*Z*	*S*		2722 062 .....
2×(4×64×64)	1	1	4	4 2)	6H2	27001
	1	1	4	4 2)	6H3	27011
	1	1	4	8	6H2	27021
	1	1	4	8	6H3	27031
2×(2×64×128)	1	1	4	4	6H2	35001
	1	1	4	4	6H3	35011
	1	1	4	8	6H2	35021
	1	1	4	8	6H3	35031
2×(128×128)	1	1	4	4	6H2	08001
	1	1	4	4	6H3	08011
	1	1	4	8	6H2	08021
	1	1	4	8	6H3	08031

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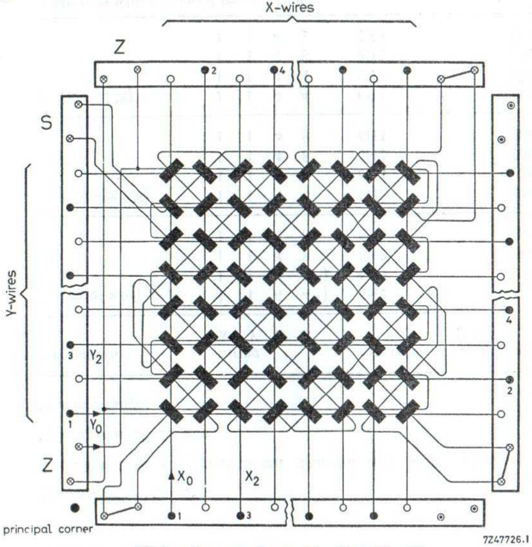
1) Matrices with interlaced sense wiring

2) Matrices without interlaced sense wiring.



Wiring diagram of a matrix plane (50 mil)

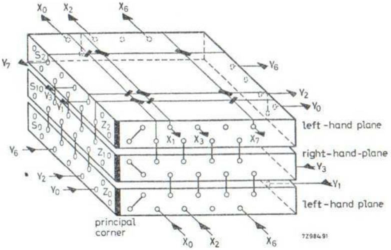
● lower lugs

○ upper lugs

⊗ S and Z lugs

Left-hand plane

arrows show current flow in write direction



Principle of the connections to a stack having an odd number of single-matrix planes (50 mil)

Complete magnetic core memories

memory	*standard*		*standard*	*standard timing*		*standard*	*power-supplies*
type	*capacity range*		*operating*	*access*	*full*	*operating*	*required*
	words	*bits*	*modes*	*max.*	*cycle*	*environment*	
F1-2	1 024	8	Random access	0.7 μs	4 μs	0–55°C	+12 V, 3 A
	and multiples		Read-restore				
			Read-write				
			Clear-write				
			Split-cycle				
F1-3	1 024	max. 18	Random access	1 μs	3 μs	0–50°C	115/220 V
	2 048	max. 18	Read-restore				40–60 Hz
	4 096	max. 18	Clear-write		(half		
	8 192	max. 18	Read-only		cycle		
	and multiples		Write only		2 μs)		
			Split-cycle				
500G2	524 288	9	Random access	1.2 μs	2.5 μs	10–40°C	3-phase a.c. mains
	262 144	1.8	Read-restore				220 V or 380 V,
	131 072	36	Read-write		(half		48 to 62 Hz
	and multiples		Clear-write		cycle		
			Split-cycle		1.3		
			Read only		1.2)		
			Write only				
Two cores-per-bit memory	16 384	36	Random access	150 ns	300 ns	0–40°C	+ and −5 V
	8 192	72	Read/restore				+ and −10 V
	4 096	144	Read/write				−15 V
			Clear/write				+ and −30 V
			Split-cycle				

memory type	*approximate size*	*signal characteristics*		*features*
		input	*output*	
F1-2	Height 120 mm Depth 200 mm Width 75 mm	“0” = 0 V (2 mA) “1” = 2.8–6 V (25 μA)	“0” = 0 V (30 mA) “1” = 4 V (0 mA)	Information retention Multiplication of capacity by parallel connection.
F1-3	Height 133 mm Depth 328 mm Width 483 mm (including power supply)	“0” = 0 V (3 mA) “1” = 2.8–5.5 V (100 μA)	“0” = 0 V (10 mA) “1” = 5 V (1 mA)	Address register, memory retention and power supply optional. Output signals of address register are accessible.
500G2	Height 1470 mm Depth 500 mm Width 445 mm	“0” ≥ 2.3 V “1” ≤ 1.2 V	“0” ≥ 2.5 V “1” ≤ 0.5 V	2½D system Information retention Multiplication of capacity by parallel connection.
Two cores-per-bit memory	Height 940 mm Depth 403 mm Width 486 mm	75 Ω coaxial cables, terminated with 75 Ω returned to −1.6 V		Information retention Address register

Glass delay line modules

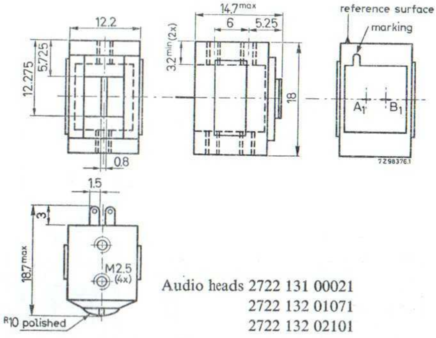
type	*capacity*	*data rate*	*delay*	*operating temperature*	*power supplies required*
GDM11 (master)	256 bits	0.5 MHz	512 μs	0–55°C	5 V at 150 mA
GDM11 (master)	256 bits	4 MHz	64 μs	0–55°C	5 V at 150 mA
GDM12 (slave)	256 bits	as set by master	as set by master	0–55°C	5 V at 100 mA

type	*approx. size*	*signal characteristics*		*features* (GDM11 and GDM21 only)
		input	*output*	
GDM11	Length 150 mm	"0" = 0–0.8 V (1.6 mA)	"0" = 0–0.4 V (16 mA)	Modules can be paralleled if larger capacities are needed
GDM21	Height 30 mm	"1" = 2.0–5.5 V (1 mA)	"1" = 2.4–5.0 V (0.4 mA)	Built-in crystal-controlled clock will drive up to seven slaves
GDM12	Width 52 mm			

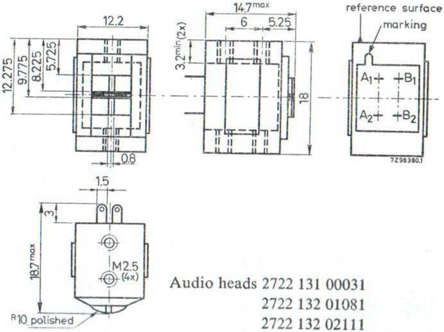
MAGNETIC HEADS

Audio heads (studio)

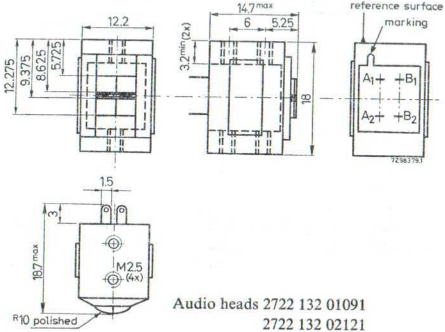
type	*tape width (inch)*	*number of tracks*	*track width (mm)*	*gap length (μm)*	*inductance (mH)*	*catalog number*
erase	$\frac{1}{4}$	1	6.55	2 × 100	1.7	2722 131 00021
erase	$\frac{1}{4}$	2	2.5	2 × 100	1.7	2722 131 00031
record	$\frac{1}{4}$	1	6.55	7	7	2722 132 01071
reproduce	$\frac{1}{4}$	1	6.55	4	75	2722 132 02101
record	$\frac{1}{4}$	2	2.35	7	7	2722 132 01081
reproduce	$\frac{1}{4}$	2	2.35	4	75	2722 132 02111
record (stereo)	$\frac{1}{4}$	2	2.90	7	7	2722 132 01091
reproduce (stereo)	$\frac{1}{4}$	2	2.90	4	75	2722 132 02121



Audio heads 2722 131 00021
2722 132 01071
2722 132 02101



Audio heads 2722 131 00031
2722 132 01081
2722 132 02111

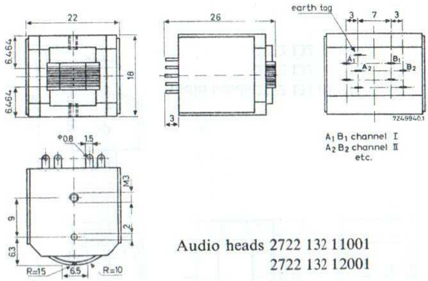


Audio heads 2722 132 01091
2722 132 02121

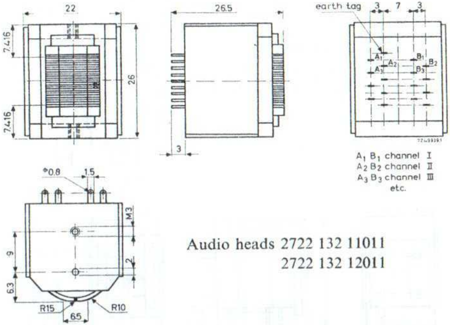
MAGNETIC HEADS

Audio heads (voice filing)

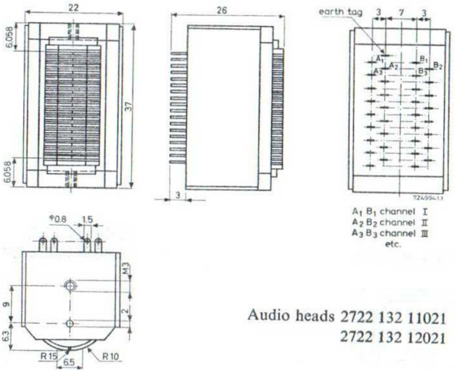
type	*tape width (inch)*	*number of tracks*	*track width (mm)*	*number of tracks on tape, interlaced use*	*gap length (μm)*	*inductance (mH)*	*catalog number*
record	$\frac{1}{4}$	4	0.5	7	6–7	6	2722 132 11001
reproduce	$\frac{1}{4}$	4	0.5	7	3–4	53	2722 132 12001
record	$\frac{1}{2}$	8	0.5	15	6–7	6	2722 132 11011
reproduce	$\frac{1}{2}$	8	0.5	15	3–4	53	2722 132 12011
record	1	17	0.5	31	6–7	6	2722 132 11021
reproduce	1	17	0.5	31	3–4	53	2722 132 12021



Audio heads 2722 132 11001
2722 132 12001



Audio heads 2722 132 11011
2722 132 12011



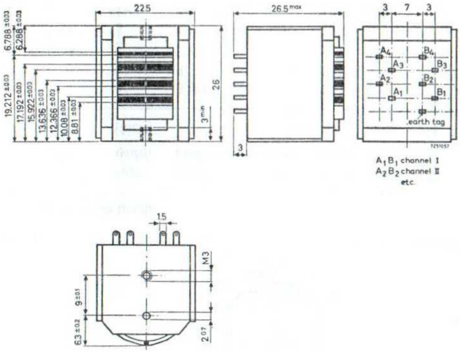
A₁ B₁ channel I
A₂ B₂ channel II
A₃ B₃ channel III
etc.

Audio heads 2722 132 11021
2722 132 12021

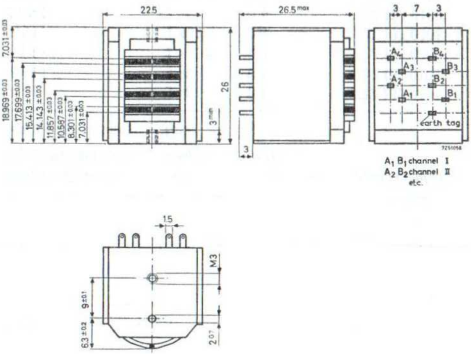
Instrumentation heads

type	tape width	number of tracks (data + annotation)	track width (mm)		number of tracks on tape, interlaced use	gap length	inductance (mH)	catalog number
	(inch)		data	annotation	(data + annotation)	(μm)		
record	½	3 + 1	1.27	0.5	7 + 1	3–4	0.1	2722 133 01001
record	½	4	1.27		7 + 1	3–4	0.1	2722 133 01011
reproduce	½	3 + 1	1.27	0.5	7 + 1	1.5–2.5	2.0	2722 133 02001
reproduce	½	4	1.27		7 + 1	1.5–2.5	2.0	2722 133 02011
record	1	7 + 1	1.27	0.5	14 + 2	3–4	0.1	2722 133 01021
reproduce	1	7 + 1	1.27	0.5	14 + 2	1.5–2.5	2.0	2722 133 02021

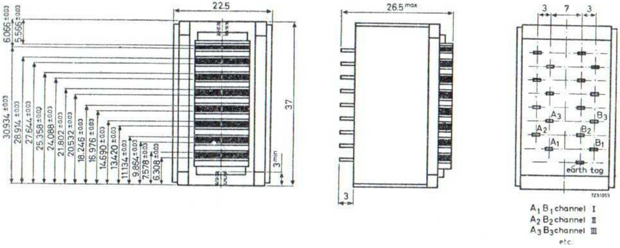
MAGNETIC HEADS

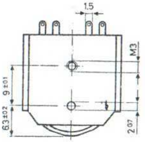


Instrumentation heads 2722 133 01001
2722 133 02001



Instrumentation heads 2722 133 01011
2722 133 02011



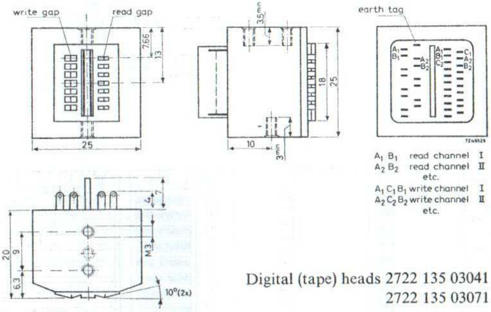


Instrumentation heads 2722 133 01021
2722 133 02021

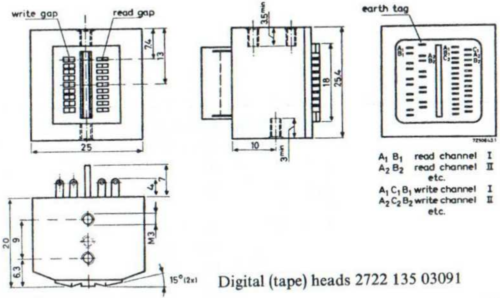
MAGNETIC HEADS

Digital (tape) heads

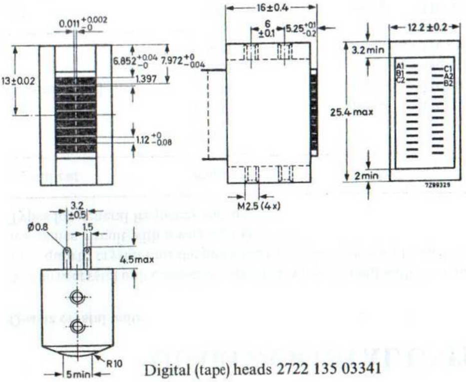
type	*tape width (inch)*	*number of tracks*	*track width (mm)*		*gap length (μm)*		*inductance (μH)*		*catalog number*
			write	*read*	*write*	*read*	*write*	*read*	
write/read	½	7 } dual gap	1.20	0.74	11–13	5–6	30	330	2722 135 03041
write/read	½	7	1.20	0.74	11–13	5–6	125	1000	2722 135 03071
write/read	½	9	1.08	0.98	11–13	5–6	20	1250	2722 135 03091
write/read	½	9 } single gap	1.08		12		1450		2722 135 03341
write/read	½	7	1.18		12		450		2722 135 03351



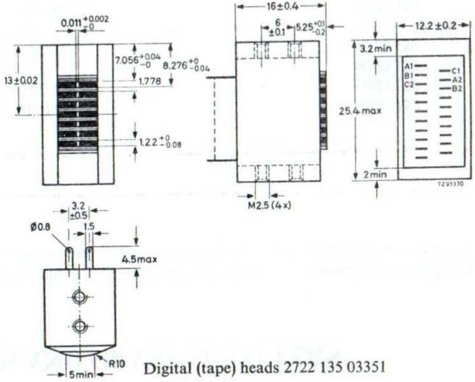
Digital (tape) heads 2722 135 03041
2722 135 03071



Digital (tape) heads 2722 135 03091



Digital (tape) heads 2722 135 03341



Digital (tape) heads 2722 135 03351

QUARTZ CRYSTAL UNITS AND CRYSTAL FILTERS

Quartz crystal units

A quartz crystal unit consists of a quartz crystal element with electrodes, mounted in a glass or metal holder having connecting pins or leads. In a quartz crystal unit the piezoelectric characteristics of quartz have been used to obtain a component that is equivalent to a stable resonance circuit with a very high Q-factor.

Types for general frequency stabilisation

crystal cut	*frequency range*	*holder*	*type ref.*
	(MHz)		
AT	1.8–20	metal - HC-6/U, HC-17/U	4322 152
(fundamental)	7–20	metal - HC-18/U, HC-25/U	4322 153
	2.3–20	all-glass - HC-27/U	4322 154
	4.5–20	all-glass - HC-26/U, HC-29/U	4322 155
AT	10–61	metal - HC-6/U, HC-17/U	4322 157
(third overtone)	17–61	metal - HC-18/U, HC-25/U	4322 158
	10–61	all-glass - HC-27/U	4322 159
	10	all-glass - HC-27/U	4322 159 00001
	20–61	all-glass - HC-26/U, HC-29/U	4322 160
AT	50–87	metal - HC-6/U, HC-17/U	4322 163
(fifth overtone)	50–87	metal - HC-18/U, HC-25/U	4322 164
	50–87	all-glass - HC-27/U	4322 165
	50–87	all-glass - HC-26/U, HC-29/U	4322 166

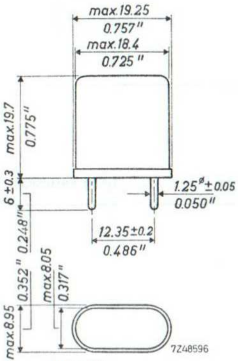
Types for special applications

application	*holder*	*data*	*crystal cut*	*for further data see type*
steering of models	HC-6/U	27.125 MHz, 0/+60°C total tolerance $\pm 1000 \times 10^{-6}$ series resonance	AT	4322 157 00010
		40.68 MHz, 0/+60°C total tolerance $\pm 500 \times 10^{-6}$ series resonance	AT	4322 157 00020
		13.56 MHz, 0/+60°C total tolerance $\pm 500 \times 10^{-6}$ $C_L = 30$ pF in parallel	AT	4322 152 01300
measuring equipment	HC-6/U	1 MHz −20/+70°C	AT	4322 152 01240
		4.5 Total tol.		01280
		5.5 $\pm 100 \times 10^{-6}$		01250
		6.75 $C_L = 30$ pF in		01290
		10.7 parallel		01260

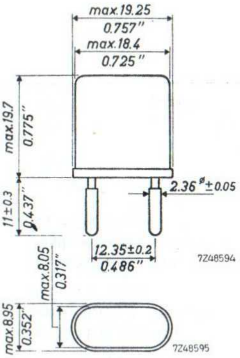
QUARTZ CRYSTAL UNITS AND CRYSTAL FILTERS

Metal and all-glass holders

The following holders state the nominal frequency in MHz on the top.
The figures on one of the faces constitute registration numbers that relate to the data and series of manufacture.

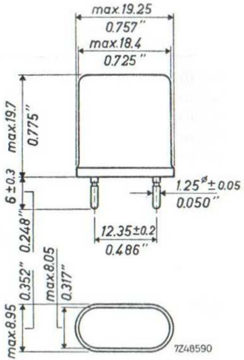


HC-6/U

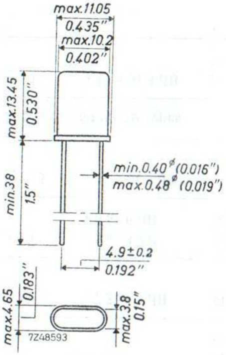


HC-17/U

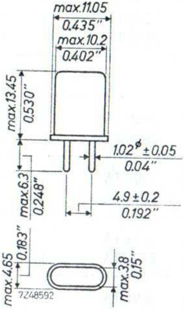
HC-27/U



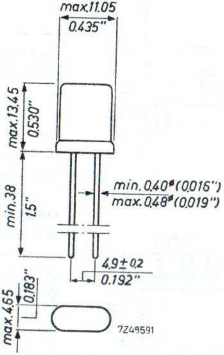
The four holders below state the nominal frequency in MHz on one of the faces.
The figures on the other faces constitute registration numbers that relate to the date and series of manufacture.



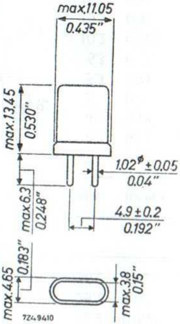
HC-18/U



HC-25/U



HC-26/U



HC-29/U

QUARTZ CRYSTAL UNITS AND CRYSTAL FILTERS / MICROWAVE DEVICES

Crystal filters

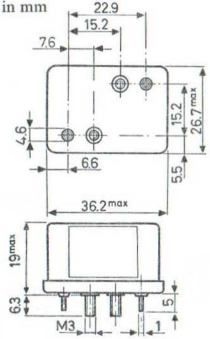
10.7 MHz-90 dB types

channel spacing (kHz)	*pass-band width (kHz)*	*terminating impedances (Ω//pF)*	*dimensions Fig.*	*type number*	*catalog number for ordering*
±50	±15 at 3 dB	2000//25	1	YL3620	9573 136 20000
		2000//25	2	YL3670	9573 136 70000
		910//25	1	YL3680	9573 136 80000
		910//25	2	YL3690	9573 136 90000
±25	±7.5 at 3 dB	910//25	1	YL3622	9573 136 22000
			2	YL3672	9573 136 72000
±20	±6 at 3 dB	825//25	1	YL3678	9573 136 78000
	±6 at 6 dB	825//25	2	YL3687	9573 136 87000
±12.5	±3.75 at 3 dB	560//25	1	YL3682	9573 136 82000
			2	YL4200	9573 142 00000

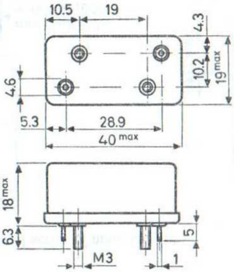
11.5 MHz–80/90 dB types

channel spacing (kHz)	*pass-band width (kHz)*	*terminating impedances (Ω//pF)*	*dimensions Fig.*	*type number*	*catalog number for ordering*
±50	±17.5 at 3 dB	2200//20	2	YL3619	9573 136 19000
		2700//41	1	YL3621	9573 136 21000

Dimensions in mm



mm	*inches*
1	0.04
4.6	0.18
5	0.2
5.5	0.22
6.3	0.25
6.6	0.26
7.6	0.300
15.2	0.600
19.0	0.75
22.9	0.900
26.7	1.05
36.2	1.42



mm	*inches*
1	0.04
4.3	0.17
4.6	0.18
5	0.2
5.3	0.21
6.3	0.25
10.2	0.400
10.5	0.41
18	0.71
19	0.75
28.9	1.140
40	1.57

MICROWAVE DEVICES

Coaxial 3-port circulators

frequency MHz	*catalog number*	*insertion loss*	*isolation*	*V.VW.R.*	*max. power*	*dimensions (mm)*	
		< (dB)	*>(dB)*	*max.*	*(W)*	*diameter*	*height*
170– 200	2722 162 01191	0.4	20	1.2	500	185[1]	96
200– 230	2722 162 01201	0.4	20	1.2	500	185[1]	96
370– 402	2722 162 01221	0.3	20	1.2	100	80	57
406– 470	2722 162 01051	0.6	20	1.2	100	110	71
406– 470	2722 162 01151	0.4	20	1.2	100	80	57
445– 485	2722 162 01231	0.3	22	1.2	100	80	57
450– 550	2722 162 01091	0.6	20	1.2	100	110	71
470– 590	2722 162 01251	0.35	22	1.2	100	80	57
470– 600	2722 162 01061	0.6	20	1.2	100	110	71
470– 600	2722 162 01121	0.35	22	1.2	500	110	71
590– 720	2722 162 01131	0.35	22	1.2	500	110	71
590– 720	2722 162 01071	0.6	20	1.2	100	110	71
590– 720	2722 162 01171	0.35	22	1.2	100	80	57
608– 783	2722 162 01101	0.75	20	1.2	100	110	71
710– 860	2722 162 01081	0.6	20	1.2	100	110	71
710– 860	2722 162 01141	0.35	22	1.2	500	110	71
710– 860	2722 162 01181	0.35	22	1.2	100	80	57
710– 860	2722 162 01241	0.35	22	1.2	100	80	57
1900–2300	2722 162 01001	0.75	20	1.15	50	110	30
2200–3000	2722 162 01041	0.6	20	1.2	50	110	30
3600–4300	2722 162 01111	0.5	25	1.15	50	72	27

All circulators have N-type 50 Ω female connectors.

[1] Triangular shape.

Waveguide 3-port circulators

frequency GHz	*catalog number*	*insertion loss* < *(dB)*	*isolation* > *(dB)*	*V.S.W.R.* *max.*	*max. power* *(W)*	*dimensions (mm)* 1)	*height*	*flange type*
3.4 –3.7	2722 161 02031	0.3	25	1.1	50	F–C = 50	74	C.C.T.U.no.6
3.6 –3.9	02041	0.3	25	1.1	50	F–C = 50	55	C.C.T.U.nc.6
3.6 –4.2	02001	0.4	25	1.12	100	F–C = 58	55	I.E.C.–UER 40
3.6 –4.2	02011	0.3	28	1.1	50	◫ 120	82	I.E.C.–UER 40
5.925–6.425	02051	0.3	25	1.12	100	◫ 82.5	52	I.E.C.–UER 70
5.925–6.425	02101	0.2	30	1.06	100	◫ 83	53	I.E.C.–UER 70
6.425–7.125	02081	0.15	30	1.07	100	◫ 83	53	I.E.C.–UER 70
7.125–7.750	02091	0.2	30	1.06	100	◫ 83	53	I.E.C.–UER 70
7.7 –8.5	02021	0.3	25	1.1	50	57 × 65	58	I.E.C.–UER 84 UBR 84

Waveguide 4-port circulators

frequency GHz	*catalog number*	*insertion loss* $< (dB)$	*isolation* $\alpha_{1-3} > (dB)$	*isolation* $\alpha_{1-4} > (dB)$	*V.S.W.R.* *max.*	*max. power* *(W)*	*dimensions (mm)* ⌷	 *height*	*flange type* *(I.E.C.)*
5.925– 6.175	2722 161 03081	0.1	33	20	1.05	150	70	57	UER 70
5.925– 6.175	2722 161 03071	0.4	30	20	1.1	100	70	57	UER 70
6.125– 6.425	2722 161 03021	0.4	30	18	1.1	100	70	57	UER 70
6.125– 6.425	2722 161 03091	0.1	30	20	1.06	150	70	57	UER 70
6.575– 6.875	2722 161 03031	0.4	25	20	1.1	100	70	57	UER 70
6.825– 7.125	2722 161 03011	0.4	25	18	1.08	100	70	57	UER 70
7.125– 7.425	2722 161 03001	0.3	25	18	1.1	100	70	57	UER 70
7.425– 7.725	2722 161 03041	0.4	30	20	1.1	100	70	53	UER 70
10.700–11.700	2722 161 03061	0.3	30	18	1.1	25	44.5	46	UBR 100
12.500–13.500	2722 161 03051	0.3	25	20	1.1	25	38	45	UER 140 UBR 140

Coaxial isolators

frequency GHz	*catalog number*	*insertion* *loss* $< (dB)$	*isolation* $> (dB)$	*V.S.W.R.* *max.*	*max. power* *(W)*	*dimensions (mm)* *diameter*	 *height*
0.740–0.810	2722 162 02001	0.3	22	1.2	100	80	57.5
0.890–0.970	02011	0.3	22	1.2	100	80	57.5
1.48 –1.95	02041	0.3	20	1.2	50	65 × 70[2])	33
2.96 –3.22	02021	0.3	20	1.2	100	72	28
3.56 –3.90	02031	0.3	20	1.2	100	72	28

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[1]) F–C = flange to centre. [2]) Rectangular shape.

Waveguide isolators

frequency MHz	*catalog number*	*insertion loss* < (*dB*)	*isolation* > (*dB*)	*V.S.W.R.* *max.*	*max. power* (*W*)	*length* (*mm*)	*flange type* *I.E.C.*
3.650– 3.950	2722 161 01011	0.5	30	1.05	15	140	UER 40
3.800– 4.200	2722 161 01081	0.5	30	1.05	10	180	UER 40
3.800– 4.200	2722 161 01071	0.8	30	1.05	10	140	UER 48
3.900– 4.200	2722 161 01021	0.5	30	1.05	15	140	UER 40
4.200– 4.600	2722 161 01091	0.5	30	1.05	10	140	UER 48
4.600– 5.000	2722 161 01101	0.8	30	1.05	10	140	UER 48
5.925– 6.425	2722 161 01191	0.3	30	1.05	20	115	UER 70
6.425– 7.150	2722 161 01251	0.3	30	1.05	20	115	UER 70
6.825– 7.425	2722 161 01231	0.3	30	1.05	20	115	UER 70
7.125– 7.750	2722 161 01291	0.3	30	1.05	20	115	UER 70
7.125– 7.750	1722 161 01281	0.3	30	1.05	20	115	UER 70
7.250– 7.750	2722 161 01241	0.3	30	1.05	20	115	UER 70
7.400– 8.025	2722 161 01151	0.5	30	1.05	10	115	UER 70
7.700– 8.500	2722 161 01161	0.5	30	1.05	10	100	UBR 84
7.700– 8.500	2722 161 01051	0.5	30	1.05	10	100	UER 84
8.500– 9.600	2722 161 01211	0.5	30	1.05	10	76.2	UBR 100
8.500– 9.600	2722 161 01221	0.6	15	1.15	1	35	UBR 100
8.500– 9.600	2722 161 01261	1.2	55	1.20	10	99	UER 100
8.500– 9.600	2722 161 01271	1.0	20	1.15	10	42.5	UBR 100
10.700–11.700	2722 161 01171	0.8	30	1.05	5	80	UBR 100
12.500–13.500	2722 161 01181	0.5	30	1.05	10	60	UBR 140

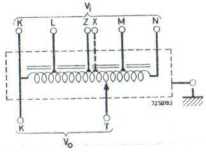
VARIABLE MAINS TRANSFORMERS

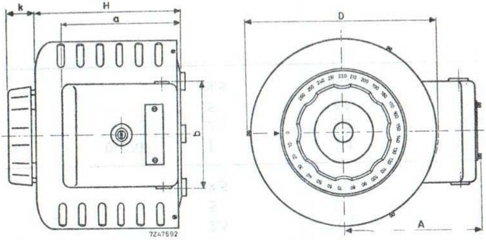
1–10 A (conventional types)

input voltage (V)	*output voltage (V)*	*nom. output current (A)*	*max. output current for const. Z_{load} (A)*	*catalog number 2422 530 . . . . .*			
				bench model with knob	*panel model without knob*	*laboratory model with terminals*	*laboratory model with socket*
130	0–150	2.5	3.2		02306		
		5	6.3		03306		
		10	12.6		04306		
220	0–220	6.5	7.5		14406		
		10	12		15406		
220	0–260	1	1.4	02401	02406		
		2.5	3.2	03401	03406		03405
		5	6.3	03301	04406	04404	04405
		8.5	11.2	05401	05406	05404	05405
240	0–270	1	1.4	02501	02506		
		2.5	3.2	03501	03506		
		5	6.3	04501	04506		
		8.5	11.2	05501	05506		

VARIABLE MAINS TRANSFORMERS

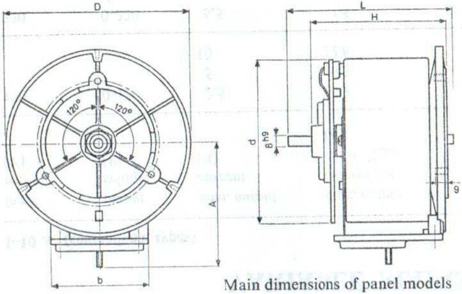
K-L = M-N = 18 % of K-N
Z = centre tap
X = optional tap





Main dimensions of bench models and laboratory models

catalog number		dimensions (mm)					
2422 530 0		H	D	A	a	b	k
2401	2501	122	113	79	99	77	21
3401	3501	123	134	93	100	77	21
4401	4501	131	166	117	106	92	24
5401	5501	133	193	134	106	92	24

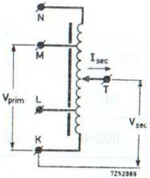


Main dimensions of panel models

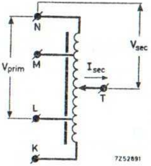
catalog number				dimensions (mm)					
2422 530				H	D	A	d	b	L
02306	02406	02506	14406	110	106	63	93	71	153
03306	03406	03506	15406	112	127	74	110	71	153
04306	04406	04506		117	158	92	140	84	157
	05406	05506		120	185	106	168	84	157

12-15 A (conventional types)

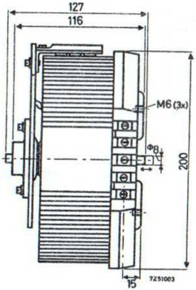
input voltage (*V*)	output voltage (*V*)	nom. output current (*A*)	max. output current for const. Z_{load} (*A*)	catalog number 2422 530 . . . . . (*transformer*)	catalog number of knob with dial
220	0–220	15	18	16407	2922 511 90058
220	0–260	12	15	06407	2922 511 90056
240	0–260	12	15	06507	2922 511 90058



bottom mounting



panel mounting

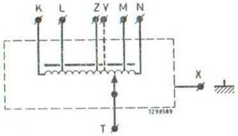


VARIABLE MAINS TRANSFORMERS

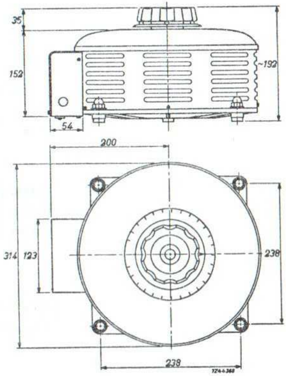
20 A (conventional types)

input voltage (V)	*output voltage (V)*	*nom. output current (A)*	*max output current for const. Z_{load} (A)*	*catalog number 2422 530 . . . . .*	
				bench model with knob	*panel model without knob*[1]
220	0–260	23	30	07401	07406
240	0–260	23	30	07501	07506

[1] And without feet. A knob is separately available under No. 2911 511 90028, a dial under Cat. No. 4322 026 18560.



K-L = M-N = 18 % of K-N
Z = centre tap
Y = optional tap

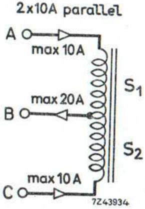


Main dimensions of bench models

Accessories for conventional transformers

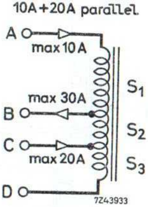
Chokes

For parallel mounting of two or three transformers, chokes should be inserted between the secondaries to prevent high interchange currents caused by small differences in the ganging.



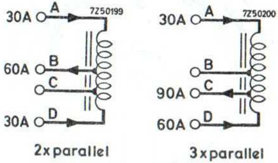
$S_1:S_2=1:1$

Catalog number
2422 532 00014



$S_1:S_2:S_3=2:1:1$

Catalog number
2422 532 00013



Catalog number
2422 532 00017

Ganging units

For ganging two or three transformers, sets of standard ganging units are available for bench and panel models.

Motor drive modules

All transformers, either stacked or individual, can be provided with remote controlled motor drives. These motor drives are supplied as kits with easy to assemble loose parts. Two types of synchronous motors together with a series of gear boxes permit a choice out of a large range of speeds.

A.C. stabiliser module BEY 801

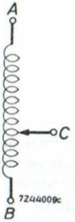
This module is capable of stabilising voltages to a value set by means of a control potentiometer.
Accuracy of stabilisation: ±1 V.
The voltage to be stabilised can vary between −15% and +10% of the desired value.

VARIABLE MAINS TRANSFORMERS

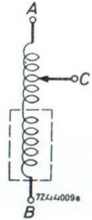
Moulded transformers

input voltage (*V*)	*output voltage* (*V*)	*nom. output current* (*A*)	*direction of rotation* [1])	*output connections*	*catalog number*
60	0–60	1.2	CW	CB	2422 530 00007
			CCW	CA	
220	110–220	0.5	CW	CB	2422 530 00407
	0–110		CCW	CA	
240	120–240		CW	CB	
	0–120		CCW	CA	

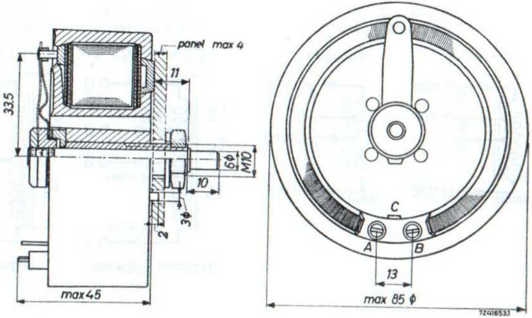
[1]) Seen from extending spindle end;
CW = clockwise,
CCW = counter clockwise.



Transformer
2422 530 00007

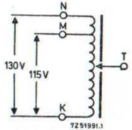


Transformer
2422 530 00407

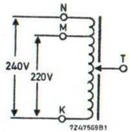


Moulded transformers (continued)

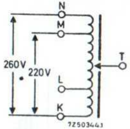
input voltage (V)	*output voltage (V)*	*nom. output current (A)*	*max. output current for const Z_{load} (A)*	*catalog number*
70	0–70	5.5	5.5	2422 530 13707
115/ 130	0–130	1.2 1.4	1.4 1.7	2422 530 01607 2422 530 11607
220	0–220	0.83 1.4 2.5	1.0 1.7 3.0	2422 530 11407 2422 530 18407 2422 530 13407
220/ 240	0–240	0.7	0.83	2422 530 01407
220/ 260	0–260	1.2 2.0	1.4 2.4	2422 530 08407 2422 530 03407
240/ 260	0–260	2.0	2.4	2422 530 03507



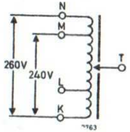
Transformer
2422 530 01607



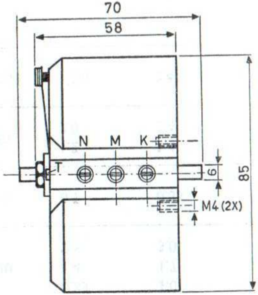
Transformer
2422 530 01407



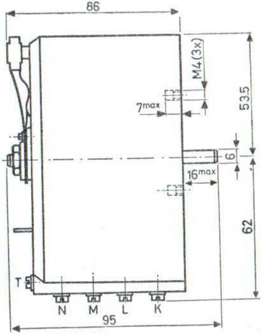
Transformer
2422 530 03407



Transformer
2422 530 03507



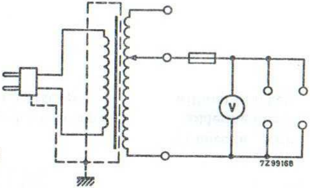
Transformers 2422 530 01407
and 2422 530 01607



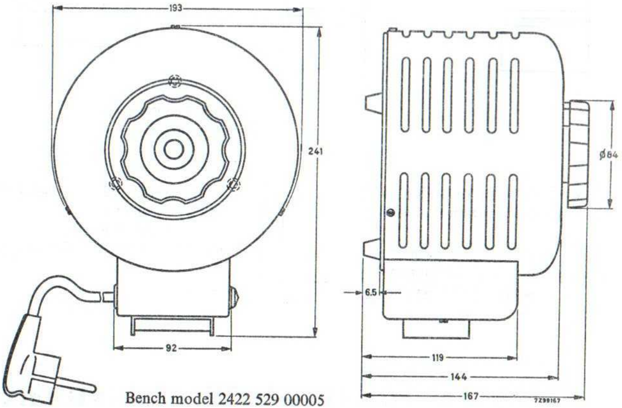
Transformers 2422 530 03407
2422 530 03507
2422 530 13407
2422 530 13707

Transformers with separate windings electrostatically screened

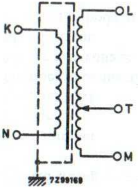
Input voltage	220 V
Output voltage (no load)	248 V
Nom. output current	3 A



Bench model 2422 529 00005



Bench model 2422 529 00005



Panel model
2422 529 00006

ELECTRO-MECHANICAL COMPONENTS

Printed-wiring connectors

Type number : F 044
Colour : black
Contact pitch : 0.1″ (2.54 mm)
Number of connections : 4 to 39 (double-sided bridged)
Max. r.m.s. voltage : 100 V
Max. current : 4 A
Material of body at ≤ 65°C : tropic proof phenolic resin

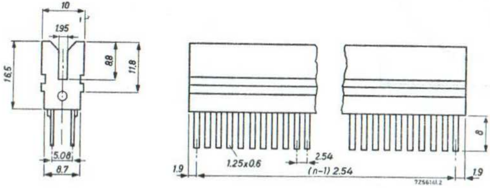
Catalog number : 2422 02 . . . . . .

termination conde
1 = short pins
2 = wire-wrap pins
3 = soldering lugs

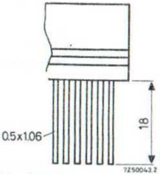
3 = with fixed brackets
4 = without brackets

number of contact chambers (n)
06, 07, 08, 09, 10, 11 or up to 39

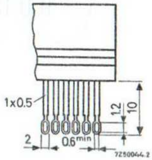
16 = double-sided bridged
18 = double-sided bridged, minus on contact at either end



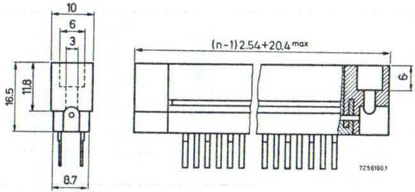
Connector with short pins, without brackets



Connector with wire-wrap pins, without brackets

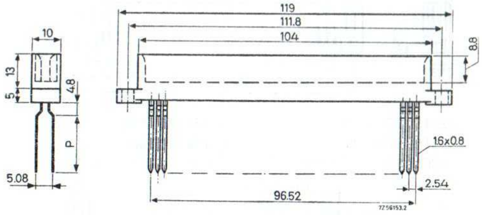


Connector with soldering lugs, without brackets



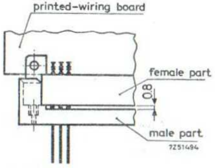
Connector with short pins and fixed brackets

Type number : F 059
Colour : black
Contact pitch : 0.1" (2.54 mm)
Number of connections : 39 (double-sided bridged)
Max. r.m.s. voltage : 100 V
Max. current at ≤ 65°C : 4 A
Material of body : tropic proof phenolic resin
Catalog number : 2422 022 03916, connector with wire-wrap pins
2422 023 03916, connector with soldering lugs

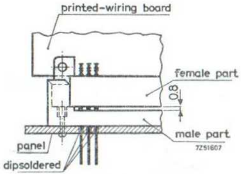


P = 19.6mm for wire-wrap terminations
4.6mm for solder terminations

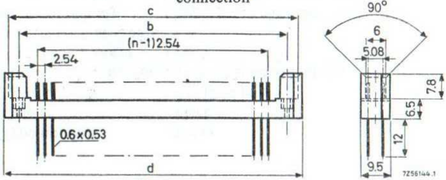
Type number : F 054
Colour : green
These connectors are composed of a male part and a female part.
Contact pitch : 0.1″ (2.54 mm)
Number of connections: 32, 48, 64 (double sided)
Max. current : 1.5 A
Material of body : glass fibre filled diallylphthalate
Contact termination of male part : for mini wire-wrap connection



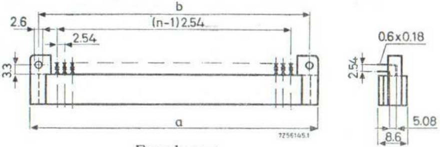
Connectors 2422 025 89082
2422 025 89109
2422 025 89112



Connectors 2422 025 89083
2422 025 89111
2422 025 89113



Male part



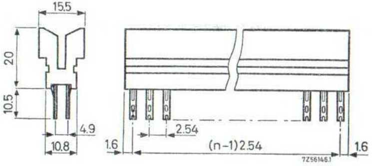
Female part

number of connections	*dimensions (mm)*				*catalog number*	
	a	*b*	*c*	*d*	*male part*	*female part*
32	54.5	48.3	55.2	58.3	2422 025 89117	2422 025 89114
48	74.8	68.6	69.3	72.4	89123	89115
64	95	88.9	95.8	98.9	89128	89116
32	54.5	48.3	55.2	58.3	89118 } for	89114
48	74.8	68.6	69.3	72.4	89124 } panel	89115
64	95	88.9	95.8	98.9	89129 } mounting	89116

Type number : F 058
Colour : black
Contact pitch : 0.1″ (2.54 mm)
Number of connections : 4 to 45, single-sided
: 8 to 90, double-sided
Max. r.m.s. voltage : 100 V
Max. current at ⩽ 100°C : 5 A
Material of body : tropic proof phenolic resin
Catalog number : 2422 023 1 . . . .

version, see table

number of chambers (n)
contact 06, 07,
08, 09, 10 or up to 45



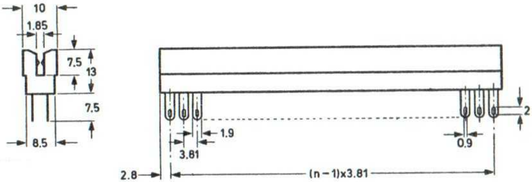
version	*number of contact chambers containing a contact*	*version indication*
single-sided	all	02
double-sided	all	12
single-sided	all but the two outermost	04
double-sided	all but the two outermost	14

Type number : F 046
Colour : black
Contact pitch : 0.15″ (3.81 mm)
Number of connections: 4 to 45, single sided
8 to 90, double sided
Max. r.m.s. voltage : 250 V
Max. current at ≤43°C: 5 A
Material of body : tropic proof phenolic resin
Catalog number : 2422 0 . . 6 . . . .

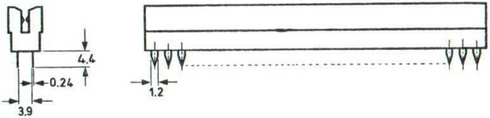
termination code
36 = soldering lugs
42 = dipsoldering pins

number of contact chambers (n) 06, 07, 08, 09, 10 or up to 45

version
see table



Connector with soldering lugs



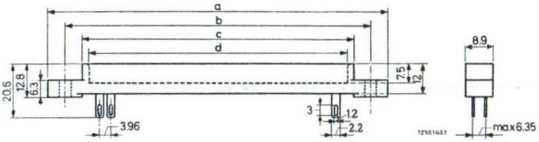
Connector with dipsoldering pins

version	*number of contact chambers containing a spring*	*version indication*
single-sided	all	02
double-sided	all	12
single-sided	all but the two outermost	04
double-sided	all but the two outermost	14

Type number : F 047
Colour : blue
Contact pitch : 0.156″ (3.96 mm)
Number of connections : 6, 10, 15, 18, 22, single-sided
12, 20, 30, 36, 44, double-sided
Max. r.m.s. voltage : 250 V
Max. current at ⩽ 85°C : 5 A
Material of body : glass fibre filled diallylphthalate
Contact termination : with lug
Catalog number : 2422 037 . . . . .

mounting holes or bushes
4 = threaded bushes } ⩾ 2.5 μm gold plate on contact face
5 = plain holes
6 = threaded bushes } ⩾ 1.3 μm gold plate on contact face
7 = plain holes
number of contacts per row, 06, 10 etc.

02 = single-sided
12 = double-sided
16 = double-sided, bridged opposite contacts



number of contact springs per row	$a_{\max}$	b	$c_{\max}$	d
6	47.3	38.9	32.6	27.9
10	63.2	54.8	48.4	43.8
15	83.0	74.6	68.3	63.6
18	94.9	86.5	80.2	75.5
22	107.7	102.4	96.2	91.3

Type number : F 050
Colour : green
Material of body : glass fibre filled polyester
For further data, see F 047

Catalog numbers: 2422 037 . . . . .

mounting holes or bushes
0 = plain holes } ≥ 0.2 μm goldflash
1 = threaded bushes } on contact face
2 = plain holes } ≥ 2.5 μm gold plate
3 = threaded bushes } on contact face
number of contacts per row,
06, 10 etc.

02 = single-sided
12 = double-sided
16 = double-sided,
bridged opposite contacts

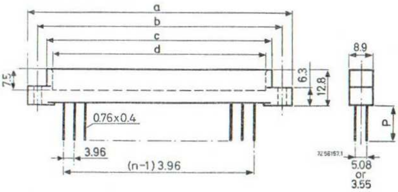
2422 040 . . . . .

mounting holes or bushes
0 = plain holes } ≥ 1.3 μm gold plate
1 = threaded bushes } on contact face
(to MIL-C-21097-1) }

02 = single-sided
12 = double-sided
16 = double-sided
bridged opposite
contacts

number of contacts per row,
06, 10, etc.

Type number : F 053
Colour : red
Contact pitch : 0.156″ (3.96 mm)
Number of connections
single-sided : 6, 10, 15, 18, 22, 28, 36, 43
double-sided : 12, 20, 30, 36, 44, 56, 72, 86
Max. r.m.s. voltage : 250 V
Max. current at ⩽ 23°C : 5 A
Material of body : glass fibre filled polycarbonate



P = 13mm for wire-wrap terminations
3.75mm for dipsolder terminations

Catalog number : 2422 0. . . . . . .

termination code
39 – pins for wire-wrapping
44 dipsolder pins

0 = plain holes } pitch of opposite
1 = threaded bushes } terminations 5.08 mm
4 = plain holes } pitch of opposite
5 = threaded bushes } terminations 3.55 mm

number of contacts
per row 06, 10, etc.

02 = single-sided } ⩾1.3 μm gold plate
12 = double-sided } on contact face
42 = single-sided } ⩾0.2 μm gold flash
52 = double-sided } on contact face

number of contacts per row (*n*)	a_{max}	b	c_{max}	d
6	47.34	38.91	32.56	27.94
10	63.19	54.76	48.43	43.79
15	83.00	74.62	68.27	63.60
18	94.89	86.51	80.18	75.49
22	107.74	102.41	96.16	91.34
28	134.21	126.09	118.97	115.11
36	166.19	157.99	150.67	146.76
43	193.82	185.47	178.61	174.55

ELECTRO-MECHANICAL COMPONENTS

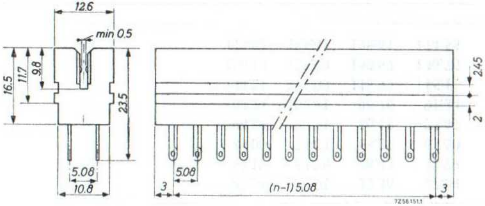
Type number : F 045
Colour : black
Contact pitch : 0.2″ (5.08 mm)
Number of connections: 1 to 54, single-sided
2 to 108, double-sided
Max. r.m.s. voltage : 250 V
Max. current at ⩽ 58°C: 5 A
Material of body : tropic proof phenolic resin
Catalog number : 2422 0 . . 5 . . . .

termination code
20 = soldering lugs
35 = wire-wrap pins

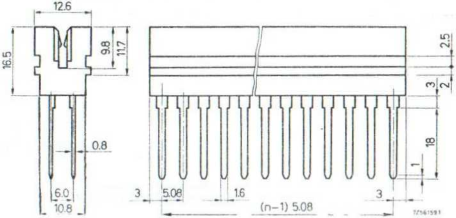
number of contact chambers (n) 0.3, 0.4, etc., 10 or up to 54

version, see table

version	number of contact chambers containing a contact	version indication
single-sided	all	02 for a
double-sided	all	12 board
single-sided	all but the two outermost	04 thickness
double-sided	all but the two outermost	14 of 1.6 mm
single-sided	all	22 for a
double-sided	all	32 board
single-sided	all but the two outermost	24 thickness
double-sided	all but the two outermost	34 of 2.4 mm



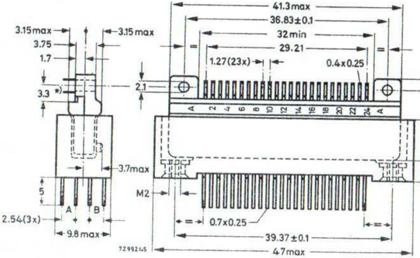
Connector with soldering lugs



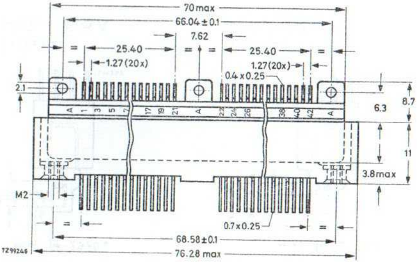
Connector with wire-wrap pins

Type number : F 057
Colour : blue
Contact pitch : 0.05″ (1.27 mm)
Number of connections : 48, 84, 116 (double-sided)
Max. r.m.s. voltage : 100 V
Max. current at ⩽ 65°C : 2 A
Material of body : glass fibre filled diallylyphthalate

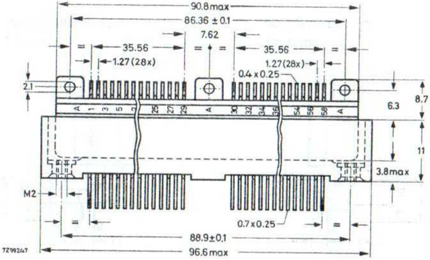
These connectors consist of a board part and a panel part.



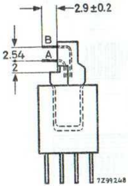
Connector with 48 connections
*) See various terminal configurations



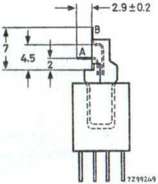
Connector with 84 connections



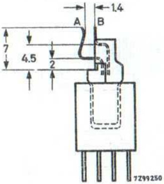
Connector with 116 connections



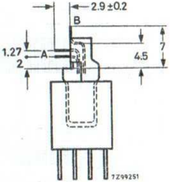
Terminal configuration A



Terminal configuration B



Terminal configuration C



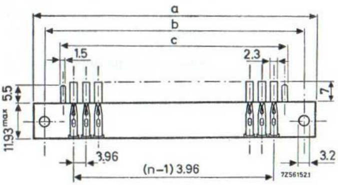
Terminal configuration D

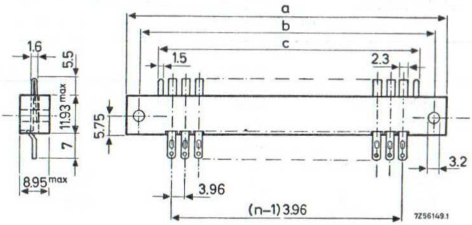
number	*terminal configuration*	*catalog number*	
connections	*of the board part*	*board part*	*panel part*
48	A	2422 025 89136	2422 025 89139
	B	89137	
	C	89142	
	D	89167	
84	A	89157	2422 025 89162
	B	89158	
	C	89161	
	D	89169	
116	A	89147	2422 025 89152
	B	89148	
	C	89151	
	D	89172	

Multi-pin connectors

Type number : F 049
Colour : blue
Contact pitch : 0.156″ (3.96 mm)
Max. r.m.s. voltage : 250 V
Max. current : 5 A
Material of body : glass fibre filled diallylphthalate

number of pins(n)	*a (max) (mm)*	*b (mm)*	*c (max) (mm)*	*catalog number of connectors with*	
				straight terminations	*hooked terminations*
6	47.0	38.94	27.73	2422 025 89002	2422 025 89026
10	62.9	54.77	43.63	89003	89027
12	70.7	62.74	51.56	89004	89028
15	82.5	74.65	63.47	89005	89029
18	94.5	86.56	75.35	89006	89031
22	110.5	102.43	91.23	89007	89032





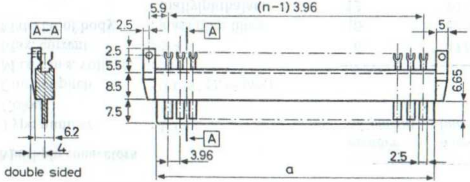
Type number : F 052
Colour : green
Contact pitch : 0.156″ (3.96 mm)
Max. r.m.s. voltage : 250 V
Max. current : 5 A
Material of body : glass fibre filled polyester

number of pins(n)	*a (max) (mm)*	*b (mm)*	*c (max) (mm)*	*catalog number of connectors with straight terminations (see F049)*
6	47.0	38.94	27.73	2422 025 89084
10	62.9	54.77	43.63	89085
12	70.7	62.74	51.56	89086
15	82.5	74.65	63.47	89087
18	94.5	86.56	75.35	89088
22	110.5	102.43	91.23	89089

Printed-wiring interconnectors

Type number : F048
Colour : blue
Contact pitch : 0.156″ (3.96 mm)
Max. r.m.s. voltage : 250 V
Max. curr. at ⩽ 80°C : 5 A
Material of body : glass fibre filled diallylphthalate

number of contact springs per row (n)	*a (mm)*	*catalog number*	
		single-sided version	*double-sided version*
6	27.74	2422 025 89033	2422 025 89038
10	43.58	89034	89039
15	63.40	89035	89041
18	75.30	89036	89042
22	91.10	89037	89043



Type number : F 051
Colour : green
Material of body: thermosetting, glass fibre filled polyester

For further data, see F 048

number of	*catalog number*	
contact springs per row(n)	*single-sided version*	*double sided version*
6	2422 025 89.71	2422 025 89.76
10	2422 025 89·72	2422 025 89.77
15	2422 025 89.73	2422 025 89.78
18	2422 025 89.74	2422 025 89.79
22	2422 025 89.75	2422 025 89.81

$0 = \geqslant 3\ \mu m$ rolled gold $\left.\right\}$ finish of
$2 = \geqslant 0.2\ \mu m$ goldflash $\left.\right\}$ contact face

Mounting chassis for printed-wiring boards

All chassis are metal frames which can be mounted in standard 19 inch racks. Board thickness always 1.6 ± 0.2 mm.

connectors				*printed-wiring boards*			
type	*contact pitch (mm)*	*numbers of contacts*	*method of connection*	*dimensions h × l (mm)*	*min. pitch in chassis (mm)*	*max. number*	*chassis (cat. number)*
F054[1]	2.54	2 × 32	mini wire-wrap back panel dip soldering	116.8 × 98	10.16	41	4322 026 38250 4322 026 38280
F047 or F050 F053	3.96	1 or 2 × 22	hand soldering mini wire-wrap	116.8 × 110	10.16	41	4322 026 38310
F047 or F050	3.96	1 or 2 × 22	hand soldering	121.8 × 204	19.35 12.9	21 30	4322 026 38230 4322 026 38260
F053	3.96	1 or 2 × 22	mini wire-wrap	121.8 × 204	19.35 12.9	21 30	4322 026 38230 4322 026 38260
special F045	5.08	1 or 2 × 23	hand soldering or wire-wrap	121.8 × or $\left\{\begin{matrix}204\\180\end{matrix}\right.$	19.35 12.9	21 30	4322 026 38240 4322 026 38270

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[1] Using F054 connectors the boards are to be provided with metallized contact holes, instead of the usually expensive contact pads. The female part of the two-part F054 connector has right-angled pins which are to be soldered into the holes.

Printed-wiring boards

	to fit chassis 4322 026	ma-terial	con-tacts	contact pitch	hole ø (mm)	with extractor	dimensions (mm)	cat. number 4322 026 .....
For general purposes								
exp., 0.1″ grid	38230	gl.	2 × 22	0.156″	0.8	×	121.8 × 207.0	38640
exp., 0.1″ grid	38240	gl.	2 × 23	0.2″	0.8	×	121.8 × 207.0	38650
exp., 0.2″ grid	—	ph.	2 × 38	0.2″	1.3	–	200 × 396	34900
exp., 0.2″ grid	—	ph.	4 × 38	0.2″	—	–	200 × 396	34910
exp., 0.2″ grid	38240	ph.	1 × 23	0.2″	1.3	–	121.8 × 180.3	34940
exp., 0.2″ grid	38230	ph.	2 × 22	0.156″	1.3	×	121.8 × 207.0	38620
exp., 0.2″ grid	38240	ph.	2 × 23	0.2″	1.3	×	121.8 × 207.0	38630
exp., 0.2″ grid	38240	gl.	2 × 23	0.2″	1.3	×	121.8 × 207.0	38690
exp.	—	ph.	2 × 10	0.2″	1.3 p.t.	–	50.8 × 58.4	73780
exp.1)	38250 38280	gl.	2 × 32	0.1″	0.8 p.t.	–	98.2 × 116.8	39880
exp.2)	38250 38280	gl.	2 × 32	0.1″	0.8 p.t.	–	98.2 × 116.8	39890
For **1-*Series* circuit blocks (0.2″ grid)**								
exp.	—	ph.	2 × 38	0.2″	1.3	–	200 × 396	34900
exp.	—	ph.	4 × 38	0.2″	—	–	200 × 396	34910
exp.	38230	ph.	2 × 22	0.156″	1.3	×	121.8 × 207.0	38620
exp.	38240	ph.	2 × 23	0.2″	1.3	×	121.8 × 207.0	38630
exp.	38240	gl.	2 × 23	0.2″	1.3	×	121.8 × 207.0	38690
exp.	38240	ph.	1 × 23	0.2″	1.3	—	121.8 × 180.3	34940
univ.	38240	ph.	1 × 23	0.2″	1.3	—	121.8 × 180.3	34920
univ. (8 blocks)	38240	ph.	1 × 23	0.2″	1.2 p.t.	—	121.8 × 180.3	34960
univ.		ph.	1 × 23	0.2″	1.2 p.t.	—	121.8 × 180.3	36310
for 4 blocks PA 1		gl.	1 × 23	0.2″	1.2 p.t.	—	121.8 × 180.3	33630
for 4 blocks PD 1		gl.	1 × 23	0.2″	1.2 p.t.	—	121.8 × 180.3	34710

	to fit chassis 4322 026	*ma-terial*	*con-tacts*	*contact pitch*	*hole Ø (mm)*	*with extractor*	*dimensions (mm)*	*cat. number* 4322 026.....
For 10-Series circuit blocks (0.1″ grid)								
univ. (8 blocks)	38240	ph.	1 × 23	0.2″	1.2 p.t.	–	121.8 × 180.3	34950
exp. (20 blocks)	38240	gl.	2 × 23	0.2″	1.2 p.t.	×	121.8 × 207.0	38600
exp. (20 blocks)	38240	ph.	2 × 23	0.2″	1.2 p.t.	×	121.8 × 207.0	38610
exp. (10 low cases)	38220 38240	ph.	2 × 23	0.2″	1.2 p.t.	—	121.8 × 200.6	36270
for 4 blocks PA10	38240	gl.	2 × 23	0.2″	p.t.	×	121.8 × 207.0	38680
of assembly DCA10	38240	gl.	2 × 23	0.2″	p.t.	×	121.8 × 207.0	38700
of assembly 2.DCA11	38240	gl.	2 × 23	0.2″	p.t.	×	121.8 × 207.0	38710
of assembly 2.DCA12	38240	gl.	2 × 23	0.2″	p.t.	×	121.8 × 207.0	38720
of assembly BCA10	38240	gl.	2 × 23	0.2″	p.t.	×	121.8 × 207.0	38730
of assembly 2.SRA10	38240	gl.	2 × 23	0.2″	p.t.	×	121.8 × 207.0	38740
of assembly RSR10	38240	gl.	2 × 23	0.2″	p.t.	×	121.8 × 207.0	38750
For 20-Series								
exp. (20 blocks)	38240	ph.	2 × 23	0.2″	1.2 p.t.	×	121.8 × 207.0	38660
exp. (20 blocks)	38240	gl.	2 × 23	0.2″	1.2 p.t.	×	121.8 × 207.0	38670

1) For dual-in-line packages with 2 × 7 pins. 2) For dual-in-line packages with a different number of pins.

For Norbits 60-Series								
exp.	38240	gl.	2×23	0.2″	1.2 p.t.	×	121.8×207.0	38600
exp.	38240	ph.	2×23	0.2″	1.2 p.t.	×	121.8×207.0	38610
with 0 V and + tracks[1])	38230	gl.	2×22	0.156″	1.3 p.t.	×	121.8×207.0	38790
with 0 V and + tracks[1])	38230	ph.	2×22	0.156″	1.3 p.t.	×	121.8×207.0	38800
with 0 V and + tracks[1])	38240	gl.	2×23	0.2″	1.3 p.t.	×	121.8×207.0	38810
with 0 V and + tracks[1])	38240	ph.	2×23	0.2″	1.3 p.t.	×	121.8×207.0	38820
with 0 V and + tracks, and F054 connector[2])	38250	gl.	2×32	0.1″	1.2	×	116.8×98	38780

The p.w. board thickness is 1.6 mm
The contacts are gold plated.

Abbreviations: exp. = experimenters' p.w. board
univ. = p.w. board universal for the given series of circuit blocks
gl. = glass epoxy
ph. = phenol paper
p.t. = plated-through

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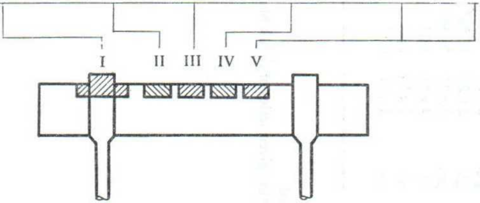
[1]) Accommodation 10 size A [2]) Accommodation 4 size A

CERAMIC CAPACITORS

Colour code

	temperature coefficient	*first digit*	*second digit*	*multiplier for the capacitance*	*tolerance on capacitance*	
					$C \leqslant 10$ *pF* (*pF*)	$C > 10$ *pF* (%)
red/violet	P100					
black	NP0		0	1		±20
brown		1	1	10	±0.1	±1
red		2	2	10^2	±0.25	±2
orange	N150	3	3	10^3		
yellow		4	4	10^4		
green		5	5		±0.5	±5
blue		6	6			
violet	N750	7	7			
grey		8	8	10^{-2}		
white		9	9	10^{-1}	±1	±10



Miniature plate types, class IB

Temperature range: −55 to +85°C
Max. working voltage: 63 V
Tolerance on capacitance
for $C < 10$ pF: ±0.25 pF
for $C \geqslant 10$ pF: ±2%
Solderability: 250°C, 5 s
Catalog number:

size	$B \times H$ (*mm*) *Fig.* 1 *and* 2	*Fig.* 3
I	3×4	6×5
II	4×5	6×6
III	5×6	6×7
IV	6×7	6×8
V	6×9	6×10

2222 632 . . . . ., with flexible connecting leads ($d = 0.4$ mm), lead spacing 2.54 mm. Fig. 1
2222 631 . . . . ., with rigid connecting leads ($d = 0.6$ mm), lead spacing 2,54 mm. Fig. 2
2222 638 . . . . ., with rigid connecting leads ($d = 0.6$ mm), lead spacing 5.08 mm. Fig. 3
2222 641 . . . . ., similar to 2222 631 . . . . ., however the lead length is 6^{-2} mm
2222 642 . . . . ., similar to 2222 638 . . . . ., however the lead length is 6^{-2} mm

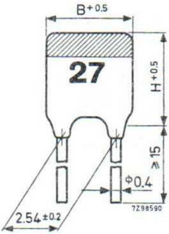


Fig. 1

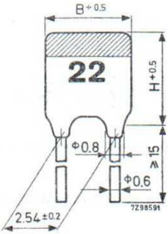


Fig. 2

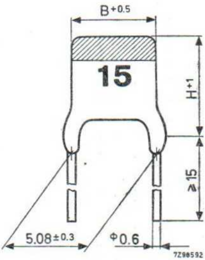


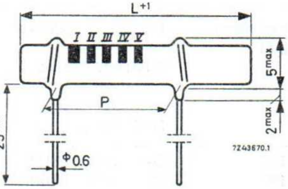
Fig. 3

CERAMIC CAPACITORS

capacitance (pF)	*temperature coefficient*											
	P100: $+100.10^{-6}$ deg C			*NP0: 0.10^{-6}/deg C*			*N150: -150.10^{-6}/deg C*			*N750: -750.10^{-6}/deg C*		
	marking	*size*	*suffix*	*marking*	*size*	*suffix*	*marking*	*size*	*suffix*	*marking*	*size*	*suffix*
0.68	R	I	03687									
0.82	S	I	03827									
1.0	T	I	03108									
1.2	U	I	03128									
1.5	V	I	03158									
1.8	W	I	03188	W	I	09188						
2.2	X	I	03228	X	I	09228						
2.7	Y	I	03278	Y	I	09278						
3.3	Z	I	03338	Z	I	09338						
3.9	A	II	03398	A	I	09398	A	I	33398	A	I	57398
4.7	B	II	03478	B	I	09478	B	I	33478	B	I	57478
5.6	5.6	II	03568	C	I	09568	C	I	33568	C	I	57568
6.8	6.8	II	03688	D	I	09688	D	I	33688	D	I	57688
8.2	8.2	III	03828	E	I	09828	E	I	33828	E	I	57828
10	10	III	04109	F	I	10109	F	I	34109	F	I	58109
12	12	IV	04129	G	I	10129	G	I	34129	G	I	58129
15	15	IV	04159	H	I	10159	H	I	34159	H	I	58159
18	18	V	04189	J	I	10189	J	I	34189	J	I	58189
22	22.	V	04229	K	II	10229	K	I	34229	K	I	58229
27				L	II	10279	L	II	34279	L	I	58279
33				33	II	10339	M	II	34339	M	I	58339
39				39	II	10399	39	II	34399	N	I	58399
47				47	III	10479	47	II	34479	P	I	58479
56				56	III	10569	56	III	34569	Q	II	58569
68				68	IV	10689	68	III	34689	R	II	58689
82				82	IV	10829	82	IV	34829	82	II	58829
100				100	V	10101	100	IV	34101	100	II	58101
120				120	V	10121	120	V	34121	120	III	58121
150							150	V	34151	150	III	58151
180										180	IV	58181
220										220	IV	58221
270										270	V	58271
330										330	V	58331

Tubular type, class IB

Temperature range: -40 to $+85\,^{\circ}\mathrm{C}$
Max. working voltage: 500 $\mathrm{V_{d.c.}}$
Tolerance on capacitance
for $C \leqslant 2.2$ pF : ± 0.25 pF
for $C = 2.7$–10 pF : ± 0.5 pF
for $C > 10$ pF : $\pm 5\%$
Catalog number 2222 555 . . . . .

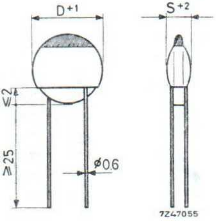


capacitance (pF)	*temperature coefficient*								
	NP0: 0.10^{-6}*/deg C*			*N150*: -150.10^{-6}*/deg C*			*N750*: -750.10^{-6}*/deg C*		
	L (mm)	*P (mm)*	*suffix*	*L (mm)*	*P (mm)*	*suffix*	*L (mm)*	*P (mm)*	*suffix*
0.8							12	7.6	57807
1							12	7.6	57108
1.2							12	7.6	57128
1.5							12	7.6	57158
1.8	12	7.6	09188				12	7.6	57188
2.2	12	7.6	09228				12	7.6	57228
2.7	12	7.6	08278				12	7.6	56278
3.3	12	7.6	08338				12	7.6	56338
3.9	12	7.6	08398				12	7.6	56398
4.7	12	7.6	08478				12	7.6	56478
5.6	12	7.6	08568	12	7.6	32568	12	7.6	56568
6.8	12	7.6	08688	12	7.6	32688	12	7.6	56688
8.2	10	5.1	08828	10	5.1	32828	10	5.1	56828
10	10	5.1	08109	10	5.1	32109	10	5.1	56109
12	10	5.1	08129	10	5.1	32129	10	5.1	56129
15	10	5.1	08159	10	5.1	32159	10	5.1	56159
18	10	5.1	08189	10	5.1	32189	10	5.1	56189
22	10	5.1	08229	10	5.1	32229	10	5.1	56229
27	12	7.6	08279	12	7.6	32279	10	5.1	56279
33	12	7.6	08339	12	7.6	32339	10	5.1	56339
39	12	7.6	08399	12	7.6	32399	10	5.1	56399
47	14	7.6	08479	12	7.6	32479	10	5.1	56479
56	14	7.6	08569	14	7.6	32569	12	7.6	56569
68	16	10.2	08689	16	10.2	32689	12	7.6	56689
82	18	12.7	08829	16	10.2	32829	12	7.6	56829
100	20	15.2	08101	18	12.7	32101	12	7.6	56101
120	22	17.7	08121	20	15.2	32121	14	7.6	56121

CERAMIC CAPACITORS

capacitance *(pF)*	*temperature coefficient*								
	NP0: 0.10^{-6}/*deg C*			*N150*: -150.10^{-6}/*deg C*			*N750*: -750.10^{-6}/*deg C*		
	L (*mm*)	*P* (*mm*)	*suffix*	*L* (*mm*)	*P* (*mm*)	*suffix*	*L* (*mm*)	*P* (*mm*)	*suffix*
150	26	20.3	08151	24	17.7	32151	16	10.2	56151
180	30	20.3	08181	26	20.3	32181	18	12.7	56181
220	34	25.4	08221	30	20.3	32221	20	15.2	56221
270				36	25.4	32271	22	17.7	56271
330							24	17.7	56331
390							28	20.3	56391
470							32	25.4	56471
560							38	30.5	56561
680							44	35.6	56681
820							52	40.6	56821

Disc type, class IB



Temperature range: −40 to +85 °C
Max. working voltage: 500 $V_{d.c.}$
Tolerance on capacitance
for $C \leqslant 2.2$ pF : ±0.25 pF
for $C = 2.7$–10 pF : ±0.5 pF
for $C > 10$ pF : ±5%
Catalog number: 2222 625 . . . . .

cap. *(pF)*	*temperature coefficient*											
	P100: $+100.10^{-6}$/°*C*			*NP0*: 0.10^{-6}/°*C*			*N150*: -150.10^{-6}/°*C*			*N750*: -750.10^{-6}/°*C*		
	D (*mm*)	*S* (*mm*)	*suffix*	*D* (*mm*)	*S* (*mm*)	*suffix*	*D* (*mm*)	*S* (*mm*)	*suffix*	*D* (*mm*)	*S* (*mm*)	*suffix*
0.5	5	4.5	03507									
0.75	5	3.5	03757									
1.0	5	3	03108									
1.2	5	3	03128									
1.5	5	2.5	03158									
1.8	5	3.5	03188	5	6	09188				5	5.5	56188
2.2	5	3	03228	5	5	09228	5	5.5	33228	5	5	56228
2.7	5	3	02278	5	4.5	08278	5	5	32278	5	4.5	56278

cap. (pF)	temperature coefficient											
	P100: $+100.10^{-6}/^{\circ}C$			NP0: $0.10^{-6}/^{\circ}C$			N150: $-150.10^{-6}/^{\circ}C$			N750: $-750.10^{-6}/^{\circ}C$		
	D (mm)	S (mm)	suffix	D (mm)	S (mm)	suffix	D (mm)	S (mm)	suffix	D (mm)	S (mm)	suffix
3.3	5	2.5	02338	5	4.5	08338	5	4.5	32338	5	4	56338
3.9	8	3	02398	5	4	08398	5	4	32398	5	3.5	56398
4.7	8	3	02478	5	3.5	08478	5	3.5	32478	5	3.5	56478
5.6	8	3	02568	5	3	08568	5	3.5	32568	5	3	56568
6.8				5	3	08688	5	3	32688	5	3	56688
8.2				5	2.5	08828	5	3	32828	5	2.5	56828
10				8	3	08109	5	2.5	32109	5	3.5	56109
12				8	3	08129	8	3	32129	5	3.5	56129
15				8	3	08159	8	3	32159	5	3	56159
18							8	3	32189	5	2.5	56189
22										8	3	56229
27										8	3	56279
33										8	3	56339

Miniature plate types, class II

Temperature range
629-series: −10 to +55°C
630-series: −25 to +85°C
Max. working voltage: 629-series: 40 V
630-series: 100 V
Tolerance on capacitance
629-series: −20 to +100%
630-series: ±10%
Solderability: 250°C, 5 s
Catalog numbers: 2222 629 .....
2222 630 .....

size	B × H (mm) Fig. 1 and 2	Fig. 3
I	3 × 4	6 × 5
II	4 × 5	6 × 6
III	5 × 6	6 × 7
IV	6 × 7	6 × 8
V	6 × 9	6 × 10

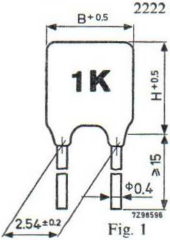


Fig. 1

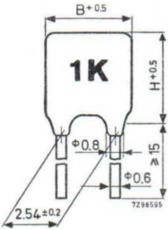


Fig. 2

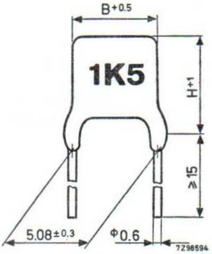


Fig. 3

CERAMIC CAPACITORS

Capacitors 629-series

capacitance (pF)	*size*	*cat. number suffix*			*marking*
		Fig. 1 version	*Fig. 2 version*	*Fig. 3 version*	
1000	I	02102	01102	03102	T
2200	I	02222	01222	03222	X
4700	II	02472	01472	03472	Z
10000	II	02103	01103	03103	10K
22000	IV	02223	01223	03223	22K

Capacitors 2222 629 05 ... and 2222 629 06 ... are similar to capacitors 2222 629 01 ... and 2222 629 03 ... resp., however the lead length is 6^{-2} mm.

Capacitors 630-series

180	I	02181	01181	03181	J
220	I	02221	01221	03221	K
270	I	02271	01271	03271	L
330	I	02331	01331	03331	M
390	I	02391	01391	03391	N
470	I	02471	01471	03471	P
560	I	02561	01561	03501	Q
680	II	02681	01681	03681	680
820	II	02821	01821	03821	820
1000	II	02102	01102	03102	1K
1200	II	02122	01122	03122	1K2
1500	II	02152	01152	03152	1K5
1800	II	02182	01182	03182	1K8
2200	III	02222	01222	03222	2K2
2700	III	02272	01272	03272	2K7
3300	IV	02332	01332	03332	3K3
3900	IV	02392	01392	03392	3K9
4700	V	02472	01472	03472	4K7

Capacitors 2222 630 05 ... and 2222 630 06 ... are similar to capacitors 2222 630 01 ... and 2222 630 03 ... resp., however the lead length is 6^{-2} mm.

Barrier layer type, class II

Temperature range: −10 to +55°C
Max. working voltage: 6 $V_{d.c.}$
Tolerance on capacitance: −20 to +100%
Solderability: 250°C, 5 s
Catalog number: 2222 675 .....

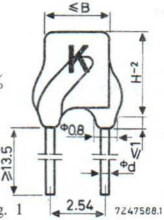


Fig. 1

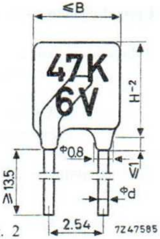
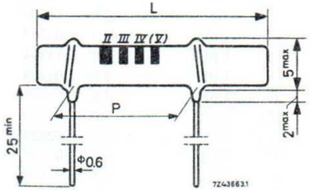


Fig. 2

capacitance (pF)	*dimensions*			*cat. number suffix*		*marking*
	B (mm)	*H (mm)*	*Fig.*	*version with d = 0.6 mm*	*version with d = 0.4 mm*	
22000	3.7	5.2	1	01223	02223	K
47000	5.0	6.5	2	01473	02473	47 K, 6 V
100000	5.0	10.5	2	01104	02104	0.1, 6 V

Tubular type, class II

Temperature range: −40 to +85°C
Max. working voltage: 500 $V_{d.c.}$
Tolerance on capacitance
552-series: −20 to +50%
561-series: ±10%
Catalog numbers: 2222 552 ....., class II
2222 561 ....., class IIA



Capacitors 552-series

capacitance (pF)	*L (mm)*	*P (mm)*	*cat. number suffix*
680	12	7.6	04681
1000	12	7.6	04102
1500	12	7.6	04152
2200	12	7.6	04222
3300	12	7.6	04332
4700	16	10.2	04472
6800	20	15.2	04682
10000	22	17.7	04103
15000	30	20.3	04153
22000	40	30.5	04223

Capacitors 561-series

capacitance (pF)	*L (mm)*	*P (mm)*	*cat. number suffix*
1000	12	7.6	01102
1500	12	7.6	01152
2200	14	7.6	01222
3300	18	12.7	01332
4700	22	17.7	01472
6800	28	20.3	01682
10000	38	30.5	01103

CERAMIC CAPACITORS

Upright-mounting types, class II

Temperature range
563-series: −40 to +85°C
565-series: −25 to +85°C
Max. working voltage
563-series: 500 $V_{d.c.}$
565-series: 125 $V_{d.c.}$
Catalog numbers: 2222 563 . . . . .
2222 565 . . . . .

Capacitors 563-series

cap. (*pF*)	*tol.*	*L* (*mm*)	*suffix of Fig. 1 versions*	*suffix of Fig. 2 versions*
1.5	1 pF	6.5	01158	05158
2	1 pF	8.5	01208	05208
3	1 pF	8.5	01308	05308
4	1 pF	6.5	01408	05408
5	1 pF	8.0	01508	05508
6	1 pF	7.5	01608	05608
7	1 pF	8.5	01708	05708
8	1 pF	9.0	01808	05808
9	1 pF	6.5	01908	05908
10	1 pF	7.0	01109	05109
15	20%	9.0	02159	06159
22	20%	7.5	02229	06229
33	20%	8.5	02339	06339
47	20%	6.5	02479	06479
68	20%	7.0	02689	06689
100	20%	9.0	02101	06101
150	20%	7.5	02151	06151
220	20%	8.0	02221	06221
330	20%	11.0	02331	06331
470	20%	8.0	02471	06471
680	20%	8.5	02681	06681
1000	−20/+50%	8.0	03102	07102
1500	−20/+50%	9.0	03152	07152
2200	−20/+50%	12.0	03222	07222
3300	−20/+50%	15.0	03332	07332
4700	−20/+50%	19.0	03472	07472
6800	−20/+50%	23.0	03682	07682
10000	−20/+50%	29.0	03103	07103

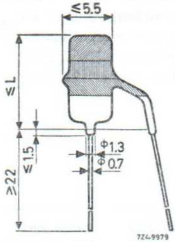


Fig. 1

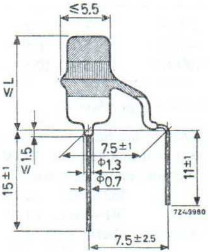


Fig. 2

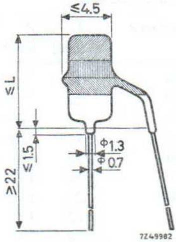


Fig. 3

Capacitors 565-series

cap. (*pF*)	*tol.*	*L* (*mm*)	*suffix of Fig. 3 versions*	*suffix of Fig. 4 versions*
2200	−20/+50 %	8	01222	02222
3300	−20/+50 %	9	01332	02332
4700	−20/+50 %	9.5	01472	02472
6800	−20/+50 %	12	01682	02682
10000	−20/+50 %	16.5	01103	02103

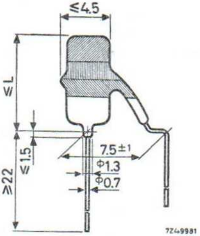
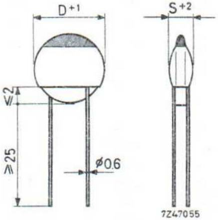


Fig. 4

Disc type, class II

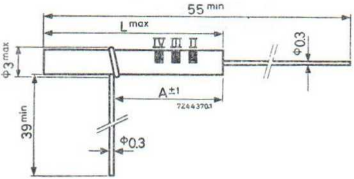
Temperature range: −40 to +85 °C
Max. working voltage: 500 $V_{d.c.}$
Tolerance on capacitance: −20 to +50 %
Catalog number: 2222 627 . . . . .



cap. (*pF*)	*D* (*mm*)	*S* (*mm*)	*cat. number suffix*
220	5	5	14221
330	5	4.5	14331
470	5	3.5	14471
680	5	3	14681
1000	8	3.5	14102
1500	8	3	14152

Midget tubular type, class IC

Temperature range: −25 to +85 °C
Max. working voltage at
a frequency > 100 kHz: 70 $V_{a.c.}$
Tolerance on capacitance
for $C \leqslant 5.6$ pF : ±0.5 pF
for $C = 6.8$–27 pF : ±1 pF
for $C \geqslant 33$ pF : ±3 %
Catalog number: 2222 553 . . . . .

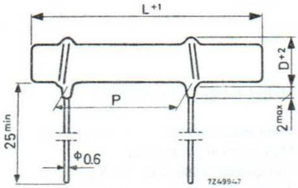


CERAMIC CAPACITORS

cap. (*pF*)	*temp. coeff.* (10^{-6}/*deg C*	*L* (*mm*)	*A* (*mm*)	*cat. number suffix*
3.9	+100	9	5	01398
4.7	+100	9	5	01478
5.6	+100	9	5	01568
6.8	+100	9	5	02688
8.2	+100	9	5	02828
10	0	9	5	02109
12	0	9	5	02129
15	0	9	5	02159
18	0	9	5	02189
22	0	9	5	02229
27	0	9	5	02279
33	−150	9	5	03339
39	−150	9	5	03399
47	−150	9	5	03479
56	−150	9	5	03569
68	−150	9	5	03689
82	−150	9	5	03829
100	−150	11	7	03101
120	−150	13.5	7	03121
150	−150	16.5	11	03151
180	−150	20	11	03181

Tubular type (safety)

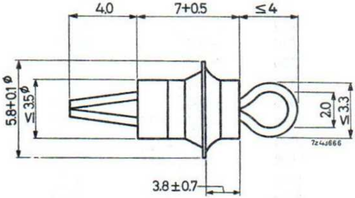
Temperature range: −40 to +85°C
Max. working voltage: 700 $V_{d.c.}$
Tolerance on capacitance: ±10%
Catalog number: 2222 562 .....



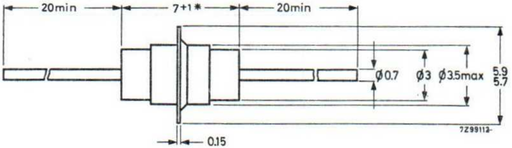
cap. (*pF*)	*D* (*mm*)	*L* (*mm*)	*P* (*mm*)	*cat. number suffix*
10	3	18	10.2	01109
12	3	18	10.2	01129
15	3	18	10.2	01159
18	3	18	10.2	01189
22	3	18	10.2	01229
27	3	18	10.2	01279
33	3	18	10.2	01339
39	3	18	10.2	01399
47	3	18	10.2	01479
56	4	18	10.2	01569
68	4	18	10.2	01689
82	4	18	10.2	01829
100	4	20	10.2	01101
120	4	20	10.2	01121
150	4	22	12.7	01151
180	4	24	12.7	01181
220	4	28	17.7	01221
270	4	32	20.3	01271
330	4	36	25.4	01331
390	4	40	30.5	01391
470	4	46	35.6	01471
560	4	52	40.6	01561

Feed-through types, classes I and II

Temperature range: −40 to +85 °C
Max. working voltage: 350 $V_{d.c.}$
Catalog numbers: 2222 700 . . . . ., split pen feed-through capacitors
2222 702 . . . . ., lead feed-through capacitors



Split pen feed-through capacitors



*) 10^{+1} mm for the 3300pF capacitor
12^{+1} mm for the 4700pF capacitor

Lead feed-through capacitors

CERAMIC CAPACITORS

Capacitors 700-*series*

cap. (pF)	*tol.*	*temp. coeff.* $(10^{-6}/^{\circ}C)$	*class*	*cat. number suffix*
⩽2.5		+100	IC	00258
3.3	±0.5 pF	+100	IC	01338
4.7	±0.5 pF	+100	IC	01478
6.8	±1 pF	+100	IC	02688
10	±1 pF	+100	IC	02109
15	±10%	−150	IC	03159
22	±10%	−150	IC	03229
33	±10%	−750	IC	03339
47	±10%	−750	IC	03479

cap. (pF)	*tol.*	*class*	*cat. number suffix*
68	±20%	II	04689
100	±20%	II	04101
150	±20%	II	04151
220	±20%	II	04221
330	±20%	II	04331
470	±20%	II	04471
680	±20%	II	04681
1000	−20/+50%	II	05102
1500	−20/+50%	II	05152
2200	−20/+50%	II	05222

Capacitors 702-*series*, class II

cap. (pF)	*tol.*	*cat. number suffix*
2.5	±0.5 pF	04258
3.3	±0.5 pF	04338
4.7	±0.5 pF	04478
6.8	±1 pF	04688
10	±10%	05109
15	±10%	07159
22	±10%	07229
33	±10%	07339
47	±10%	07479

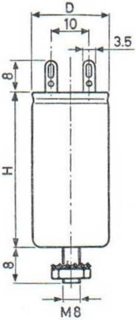
cap. (pF)	*tol.*	*cat. number suffix*
68	±10%	08689
100	±20%	08101
150	±20%	08151
220	±20%	08221
330	±20%	08331
470	±20%	08471
680	−20/+50%	09681
1000	−20/+50%	09102
1500	−20/+50%	09152
2200	−20/+50%	09222
3300	−20/+50%	09332
4700	−20/+50%	09472

METALLISED FILM CAPACITORS

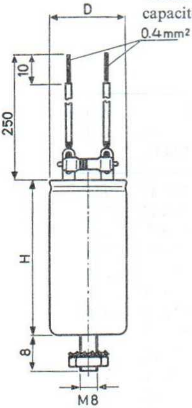
A. C. types

Dielectric: metallised polycarbonate

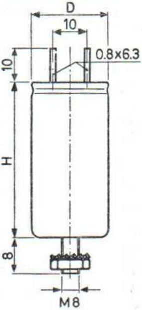
Version A
capacitors with
soldering tags



Version B
capacitors with leads and discharging resistor



Version C
capacitors with
flat connections



METALLISED FILM CAPACITORS

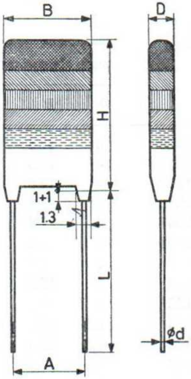
Temperature range: −40 to +85°C
capacitors 2222 325 . . . . .: 160 $V_{a.c.}$
Max. working voltage (40–60 Hz)
capacitors 2222 326 . . . . . : 220 $V_{a.c.}$
capacitors 2222 327 . . . . . : 280 $V_{a.c.}$
Tolerance on capacitance: ±10%
Catalog number: 2222 325 . . . . . ; max. working voltage 160 $V_{a.c.}$
2222 326 . . . . . ; max. working voltage 220 $V_{a.c.}$
2222 327 . . . . . : max. working voltage 280 $V_{a.c}$

version code — capacitance code, see table
50 = version A
52 = version B
70 = version C

capacitance (μF)	*dimensions in mm D × H*			*capacitance code*
	160 $V_{a.c.}$	220 $V_{a.c.}$	280 $V_{a.c.}$	
1.5	—	30 × 40	30 × 40	155
2	30 × 40	30 × 40	30 × 40	205
2.5	30 × 40	30 × 40	30 × 40	255
3	30 × 40	30 × 40	30 × 40	305
3.5	30 × 40	30 × 40	30 × 40	355
4	30 × 40	30 × 40	30 × 52	405
4.5	30 × 40	30 × 40	30 × 52	455
5	30 × 40	30 × 40	30 × 52	505
6	30 × 40	30 × 52	35 × 52	605
7	30 × 40	30 × 52	35 × 52	705
8	30 × 40	30 × 52	35 × 52	805
9	30 × 52	30 × 52	40 × 52	905
10	30 × 52	35 × 52	40 × 52	106
12	30 × 52	35 × 52	—	126
14	35 × 52	40 × 52	—	146
16	35 × 52	40 × 52	—	166
18	35 × 52	40 × 52	—	186
20	40 × 52	—	—	205
25	40 × 52	—	—	206

Flat film type

colour	1st figure of cap. value	2nd figure of cap. value	multiplying factor	capacitance tolerance	working voltage
black	–	0	1	±20 %	
brown	1	1	10		
red	2	2	10^2		250 V
orange	3	3	10^3		
yellow	4	4	10^4		400 V
green	5	5	10^5		
blue	6	6			630 V
violet	7	7			
grey	8	8			
white	9	9		±10 %	



Temperature range: −40 to +100°C

Maximum working voltage: 250 $V_{d.c.}$, 400 $V_{d.c.}$, 630 $V_{d.c.}$

Maximum alternating voltage (50–60 Hz)

250 $V_{d.c.}$ version: 160 $V_{a.c.}$
400 $V_{d.c.}$ version: 200 $V_{a.c.}$
630 $V_{d.c.}$ version: 220 $V_{a.c.}$

Tolerance on capacitance

for $C \leqslant 0.22$ μF: ±20 %
for $C > 0.22$ μF: ±10 %

Solder conditions for printed-wiring boards: 250°C, 5 s

Catalog number: 2222 342 . . . . .

capacitance code, see table

Code for dielectric material, nom. voltage and capacitance tol.:

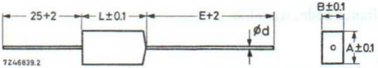
polyethyleneterephthalate:	polycarbonate:
44 = 20 %, 250 V	50 = 20 %, 400 V
45 = 10 %, 250 V	51 = 10 %, 400 V
54 = 20 %, 400 V	60 = 20 %, 630 V
55 = 10 %, 400 V	61 = 10 %, 630 V

METALLISED FILM CAPACITORS

cap. (*μF*)	250 $V_{\mathrm{d.c.}}$ *max. dimensions* (*mm*)			400 $V_{\mathrm{d.c.}}$ *max. dimensions* (*mm*)			630 $V_{\mathrm{d.c.}}$ *max. dimensions* (*mm*)			*cap code*
	D	*B*	*H*	*D*	*B*	*H*	*D*	*B*	*H*	
0.010	4	12.5	9	4	12.5	9	4	12.5	9	103
0.015	4	12.5	9	4	12.5	9	5	12.5	10	153
0.022	4	12.5	9	4	12.5	9	6	12.5	11	223
0.033	4	12.5	9	5	12.5	10	6	17.5	11	333
0.047	4	12.5	9	6	12.5	11	7	17.5	12	473
0.068	5	12.5	10	6	17.5	11	6.5	22.5	11.5	683
0.10	6	12.5	11	7	17.5	12	7.5	22.5	12.5	104
0.15	6	17.5	11	6.5	22.5	11.5	9.5	22.5	14.5	154
0.22	7	17.5	12	7.5	22.5	12.5	9.5	30	14.5	224
0.33	6.5	22.5	11.5	9.5	22.5	14.5	10	30	18	334
0.47	7.5	22.5	12.5	9.5	30	14.5	12	30	20	474
0.68	9.5	22.5	14.5	10	30	18				684
1.0	9.5	30	14.5	12	30	20				105
1.5	10	30	18							155
2.2	12.5	30	20.5							225

If $B=12.5$	$d=0.6$	$A=10.2\pm0.5$	$L=22\pm3$
17.5	0.8	15.2 ± 0.3	32 ± 3
22.5	0.8	20.3 ± 0.3	32 ± 3
30	0.8	27.9 ± 0.3	32 ± 3

Moulded type ("Mepolesco")



Temperature range: −55 to +125°C

Max. working voltage: 100 $V_{\mathrm{d.c.}}$, 250 $V_{\mathrm{d.c.}}$, 400 $V_{\mathrm{d.c.}}$, 630 $V_{\mathrm{d.c.}}$, 1000 $V_{\mathrm{d.c.}}$, 1600 $V_{\mathrm{d.c.}}$

Max. alternating voltage (50–60 Hz)

100 $V_{\mathrm{d.c.}}$ version: 63 $V_{\mathrm{a.c.}}$

250 $V_{\mathrm{d.c.}}$ version: 160 $V_{\mathrm{d.c.}}$

400 $V_{\mathrm{d.c.}}$ version: 200 $V_{\mathrm{d.c.}}$

630 $V_{\mathrm{d.c.}}$ version: 220 $V_{\mathrm{a.c.}}$

1000 and 1600 $V_{\mathrm{d.c.}}$ versions: 250 $V_{\mathrm{a.c.}}$

Tolerance on capacitance

for $C \leqslant 0.22\ \mu F$: $\pm 20\%$
for $C > 0.22\ \mu F$: $\pm 10\%$

Catalog number: 2222 341 . . . . .

capacitance code, see tables

Code for max. working voltage, capacitance tolerance and dielectric:

all polycarbonate:

28 = 100 $V_{d.c.}$, 20%
29 = 100 $V_{d.c.}$, 10%
88 = 250 $V_{d.c.}$, 20%
89 = 250 $V_{d.c.}$, 10%
58 = 400 $V_{d.c.}$, 20%
59 = 400 $V_{d.c.}$, 10%

60 = 630 $V_{d.c.}$, 20%
61 = 630 $V_{d.c.}$, 10%
70 = 1000 $V_{d.c.}$, 20%
71 = 1000 $V_{d.c.}$, 10%
80 = 1600 $V_{d.c.}$, 20%
81 = 1600 $V_{d.c.}$, 10%

all polyethyleneterephthalate

26 = 100 $V_{d.c.}$, 20%
27 = 100 $V_{d.c.}$, 10%
88 = 250 $V_{d.c.}$, 20%
89 = 250 $V_{d.c.}$, 10%

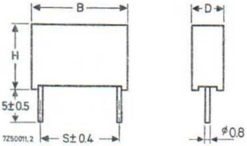
cap. (*μF*)	100 $V_{d.c.}$			250 $V_{d.c.}$			400 $V_{d.c.}$			*cap code*
	dimensions (mm)			*dimensions (mm)*			*dimensions (mm)*			
	A	*B*	*L*	*A*	*B*	*L*	*A*	*B*	*L*	
0.010				8.7	4.7	14.5	8.7	4.7	14.5	103
0.015				8.7	4.7	14.5	8.7	4.7	14.5	153
0.022				8.7	4.7	14.5	8.7	4.7	14.5	223
0.033				8.7	4.7	14.5	9.4	5.5	14.5	333
0.047				8.7	4.7	14.5	10.4	6.5	14.5	473
0.068	8.7	4.7	14.5	9.4	5.5	14.5	10.4	6.5	18	683
0.10	8.7	4.7	14.5	10.4	6.5	14.5	11.5	7.6	18	104
0.15	9.4	5.5	14.5	10.4	6.5	18	11.5	7.4	23.5	154
0.22	10.4	6.5	14.5	11.5	7.6	18	12.8	8.7	23.5	224
0.33	10.4	6.5	18	11.5	7.4	23.5	14.4	10.4	23.5	334
0.47	11.5	7.6	18	12.8	8.7	23.5	14.6	10.4	31	474
0.68	11.5	7.4	23.5	14.4	10.4	23.5	19.5	12.4	31	684
1.0	12.8	8.7	23.5	14.6	10.4	31	22	15	31	105
1.5	14.4	10.4	23.5	19.5	12.4	31				155
2.2	14.6	10.4	31	22	15	31				225
3.3	19.5	12.4	31							335
4.7	22	15	31							475

METALLISED FILM CAPACITORS

cap. (μF)	630 $V_{d.c.}$ dimensions (mm)			1000 $V_{d.c.}$ dimensions (mm)			1600 $V_{d.c.}$ dimensions (mm)			cap. code
	A	*B*	*L*	*A*	*B*	*L*	*A*	*B*	*L*	
0.001							9.4	5.5	14.5	102
0.0015							10.4	6.5	14.5	152
0.0022							10.4	6.5	18	222
0.0033							10.4	6.5	18	332
0.0047							10.4	6.5	18	472
0.0068							11.5	7.6	18	682
0.01	8.7	4.7	14.5	10.4	6.5	18	11.5	7.4	23.5	103
0.015	9.4	5.5	14.5	11.5	7.6	18	12.8	8.7	23.5	153
0.022	10.4	6.5	14.5	11.5	7.4	23.5	14.4	10.4	23.5	223
0.033	10.4	6.5	18	12.8	8.7	23.5	14.6	10.4	31	333
0.047	11.5	7.6	18	14.4	10.4	23.5	19.5	12.4	31	473
0.068	11.5	7.4	23.5	14.6	10.4	31	22	15	31	683
0.1	12.8	8.7	23.5	19.5	12.4	31				104
0.15	14.4	10.4	23.5	22	15	31				154
0.22	14.6	10.4	31							224
0.33	19.5	12.4	31							334
0.47	22	15	31							474
0.68										684
1.0										105
1.5										155

If $L<30$ mm: $E=40$ mm, $d=0.8$ mm
$L=30$ mm: $E=50$ mm, $d=1$ mm

Moulded type ("Nugget")



Temperature range: -55 to $+100$°C
Max. working voltage: 100 $V_{d.c.}$, 250 $V_{d.c.}$, 400 $V_{d.c.}$, 630 $V_{d.c.}$
Max. alternating voltage (50–60 Hz)
100 $V_{d.c.}$ version: 63 $V_{a.c.}$
250 $V_{d.c.}$ version: 160 $V_{a.c.}$
400 $V_{d.c.}$ version: 200 $V_{a.c.}$
630 $V_{d.c.}$ version: 300 $V_{a.c.}$
Tolerance on capacitance
for $C \leqslant 0.22$ μF: ±20%
for $C > 0.22$ μF: ±10%
Solder conditions for printed-wiring boards: 250°C, 5 s
Catalog number: 2222 344 . . . . .

capacitance code, see tables

Code for dielectric material, max. working voltage and capacitance tolerance:

polyethyleneterephthalate:
24 = 100 $V_{d.c.}$, 20%
25 = 100 $V_{d.c.}$, 10%
40 = 250 $V_{d.c.}$, 20%
41 = 250 $V_{d.c.}$, 10%

polycarbonate
20 = 100 $V_{d.c.}$, 20%
21 = 100 $V_{d.c.}$, 10%
50 = 400 $V_{d.c.}$, 20%
51 = 400 $V_{d.c.}$, 10%
60 = 630 $V_{d.c.}$, 20%
61 = 630 $V_{d.c.}$, 10%

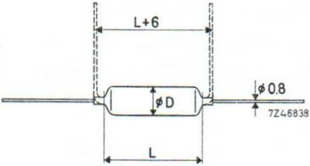
METALLISED FILM CAPACITORS

capacitance (μF)	100 $V_{\text{d.c.}}$				250 $V_{\text{d.c.}}$				*capacitance code*
	dimensions (*mm*)				*dimensions* (*mm*)				
	D	*B*	*H*	*A*	*D*	*B*	*H*	*A*	
0.01					4.5	13	10	10	103
0.015					4.5	13	10	10	153
0.022					4.5	13	10	10	223
0.033					4.5	13	10	10	333
0.047					4.5	13	10	10	473
0.068	4.5	13	10	10	5	13	11	10	683
0.1	4.5	13	10	10	5	17.5	11	15	104
0.15	4.5	13	10	10	6	17.5	11.5	15	154
0.22	5	13	11	10	7	17.5	13	15	224
0.33	5	17.5	11	15	8.5	17.5	14.5	15	334
0.47	6	17.5	11	15	6.5	26	15.5	22.5	474
0.68	7	17.5	13	15	7.5	26	16.5	22.5	684
1.0	8.5	17.5	14.5	15	9.5	26	19	22.5	105
1.5	6.5	26	15.5	22.5	11	30	19.5	27.5	155
2.2	7.5	26	16.5	22.5	13.5	30	22.5	27.5	225
3.3	9.5	26	19	22.5					335
4.7	11	30	19.5	27.5					475
6.8	13.5	30	22	27.5					685

capacitance (μF)	400 $V_{\text{d.c.}}$				630 $V_{\text{d.c.}}$				*capacitance code*
	dimensions (*mm*)				*dimensions* (*mm*)				
	D	*B*	*H*	*A*	*D*	*B*	*H*	*A*	
0.01	4.5	13	10	10	4.5	13	10	10	103
0.015	4.5	13	10	10	5	13	11	10	153
0.022	4.5	13	10	10	6	13	12	10	223
0.033	5	13	11	10	6	17.5	11.5	15	333
0.047	5	17.5	11	15	7	17.5	13	15	473
0.068	6	17.5	11.5	15	8.5	17.5	14.5	15	683
0.1	7	17.5	13	15	6.5	26	15.5	22.5	104
0.15	8.5	17.5	14.5	15	7.5	26	16.5	22.5	154
0.22	6.5	26	15.5	22.5	9.5	26	19	22.5	224
0.33	7.5	26	16.5	22.5	11	30	19.5	27.5	334
0.47	9.5	26	19	22.5	13.5	30	22.5	27.5	474
0.68	11	30	19.5	27.5					684
1.0	13.5	30	22.5	27.5					105

POLYESTER CAPACITORS

Tubular foil type

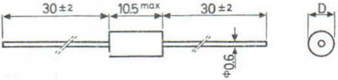


Temperature range: −40 to +85°C
Max. working voltage: 160 $V_{d.c.}$ and 400 $V_{d.c.}$
Max. alternating voltage (50–60 Hz)
160 $V_{d.c.}$ version: 90 $V_{a.c.}$
400 $V_{d.c.}$ version: 150 $V_{a.c.}$
Tolerance on capacitance: ±10%
Solderability according to I.E.C. 68–2, test T3.2
Catalog number: 2222 311 31 . . ., working voltage 160 $V_{d.c.}$
2222 311 51 . . . working voltage 400 $V_{d.c.}$

capacitance	*max. dimensions (mm)*				*catalog number suffix*
	160 $V_{d.c.}$		400 $V_{d.c.}$		
	D	*L*	*D*	*L*	
1000 pF			7.5	18	102
1500			7.5	18	152
2200			7.5	18	222
3300			7.5	18	332
4700			7.5	18	472
6800			7.5	18	682
0.010 μF	7.5	18	7.5	18	103
0.015	7.5	18	7.5	18	153
0.022	7.5	18	8.5	18	223
0.033	7.5	18	10	18	333
0.047	8	18	11.5	18	473
0.068	9	18	9.5	32	683
0.10	10.5	18	11	32	104
0.15	12	18	12.5	32	154
0.22	10	32	14.5	32	224
0.33	12	32	17	32	334
0.47	14	32	19.5	32	474
0.68	16	32			684
1.0	18.5	32			105

POLYSTYRENE CAPACITORS

Miniature type ("Micropoco")



Temperature range
63 $V_{d.c.}$ version: −40 to +70°C
125 $V_{d.c.}$ version: −40 to +85°C
Max. working voltage: 63 $V_{d.c.}$ and 125 $V_{d.c.}$
Max. alternating voltage
63 $V_{d.c.}$ version: 25 $V_{a.c.}$
125 $V_{d.c.}$ version: 63 $V_{a.c.}$
Tolerance on capacitance: ±1%, ±2% and ±5%
Solder conditions for printed-wiring boards: 230°C, 2 s
Catalog number: 2222 42 . . . . . .

max. working voltage code
4 = 63 $V_{d.c.}$
5 = 125 $V_{d.c.}$

capacitance code, see table

capacitance tolerance code
2 = ±5%
3 = ±2%
4 = ±1%

63 $V_{d.c.}$ *version*

capacitance (pF)	D_{max} *(mm)*	*capacitance code*
820	3.0	8201
910	3.0	9101
1000	3.0	1002
1100	3.0	1102
1200	3.0	1202
1300	3.0	1302
1500	3.0	1502
1600	3.5	1602
1800	3.5	1802

63 $V_{d.c.}$ *version*

capacitance (pF)	D_{max} *(mm)*	*capacitance code*
2000	3.5	2002
2200	4.0	2202
2400	4.0	2402
2700	4.0	2702
3000	4.0	3002
3300	4.5	3302

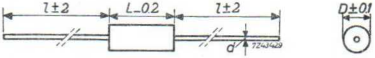
125 $V_{d.c.}$ version

capacitance (pF)	D_{max} *(mm)*	*capacitance code*
100	3.5	1001
110	3.5	1101
120	3.5	1201
130	3.5	1301
150	3.5	1501
160	3.5	1601
180	3.5	1801
200	3.5	2001
220	3.5	2201
240	3.5	2401
270	3.5	2701
300	3.5	3001
330	3.5	3301
360	3.5	3601
390	3.5	3901

125 $V_{d.c.}$ version

capacitance (pF)	D_{max} *(mm)*	*capacitance code*
430	3.0	4301
470	3.0	4701
510	3.0	5101
560	3.0	5601
620	3.0	6201
680	3.0	6801
820	3.5	8201
860	3.5	8601
910	3.5	9101
1000	3.5	1002
1100	3.5	1102
1200	3.5	1202
1300	4.0	1302
1500	4.0	1502

Tubular moulded type ("Minipoco")



If $L=15$ mm: $l=35$ mm, $d=0.7$ mm
$L=25$ mm: $l=45$ mm, $d=0.8$ mm

Temperature range
63 $V_{d.c.}$ version: −40 to +70°C
125, 250 and 500 $V_{d.c.}$ versions: −40 to +85°C
Max. working voltage: 63 $V_{d.c.}$, 125 $V_{d.c.}$, 250 $V_{d.c.}$, 500 $V_{d.c.}$
Max. alternating voltage
63 $V_{d.c.}$ version: 30 $V_{a.c.}$
125 $V_{d.c.}$ version: 63 $V_{a.c.}$
250 $V_{d.c.}$ version: 125 $V_{a.c.}$
500 $V_{d.c.}$ version: 250 $V_{a.c.}$
Tolerance on capacitance: ±1%, ±2%, ±5%
Solder conditions for printed-wiring boards: 250°C, 5 s
Catalog number: 2222 43 . . . . . .

capacitance code, see table

maximum working voltage code
5 = 63 $V_{d.c.}$
6 = 125 $V_{d.c.}$
7 = 250 $V_{d.c.}$
8 = 500 $V_{d.c.}$

capacitance tolerance code
1 = ±10%
2 = ±5%
3 = ±2%
4 = ±1%

POLYSTYRENE CAPACITORS

capacitance	*dimensions in mm* ($D \times L$)				*capacitance code*
	63 $V_{\mathrm{d.c.}}$	125 $V_{\mathrm{d.c.}}$	250 $V_{\mathrm{d.c.}}$	500 $V_{\mathrm{d.c.}}$	
680 pF				7.5 × 15	6801
750				7.5 × 15	7501
820				7.5 × 15	8201
910				7.5 × 15	9101
1000				7.5 × 15	1002
1100				7.5 × 15	1102
1200				7.5 × 15	1202
1300			7.5 × 15	9 × 15	1302
1500		6 × 15	7.5 × 15	9 × 15	1502
1600		6 × 15	7.5 × 15	9 × 15	1602
1800		6 × 15	7.5 × 15	9 × 15	1802
2000		6 × 15	7.5 × 15	9 × 15	2002
2200		6 × 15	7.5 × 15	9 × 15	2202
2400		7.5 × 15	7.5 × 15	10 × 15	2402
2700		7.5 × 15	9 × 15	10 × 15	2702
3000		7.5 × 15	9 × 15	10 × 15	3002
3300		7.5 × 15	9 × 15	10 × 15	3302
3600	6 × 15	7.5 × 15	9 × 15	12.5 × 15	3602
3900	6 × 15	7.5 × 15	9 × 15	12.5 × 15	3902
4300	6 × 15	7.5 × 15	9 × 15	12.5 × 15	4302
4700	6 × 15	9 × 15	9 × 15	12.5 × 15	4702
5100	6 × 15	9 × 15	10 × 15	12.5 × 15	5102
5600	6 × 15	9 × 15	10 × 15	12.5 × 15	5602
6200	7.5 × 15	9 × 15	10 × 15	10 × 25	6202
6800	7.5 × 15	9 × 15	12.5 × 15	10 × 25	6802
7500	7.5 × 15	9 × 15	12.5 × 15	10 × 25	7502
8200	7.5 × 15	10 × 15	12.5 × 15	10 × 25	8202
9100	7.5 × 15	10 × 15	12.5 × 15	12.5 × 25	9102
0.010 μF	9 × 15	10 × 15	12.5 × 15	12.5 × 25	1003
0.011	9 × 15	12.5 × 15	12.5 × 15	12.5 × 25	1103
0.012	9 × 15	12.5 × 15	10 × 25	12.5 × 25	1203
0.013	9 × 15	12.5 × 15	10 × 25	12.5 × 25	1303
0.015	9 × 15	12.5 × 15	10 × 25	12.5 × 25	1503
0.016	9 × 15	12.5 × 15	10 × 25	12.5 × 25	1603
0.018	10 × 15	10 × 25	12.5 × 25	15 × 25	1803
0.020	10 × 15	10 × 25	12.5 × 25	15 × 25	2003
0.022	10 × 15	10 × 25	12.5 × 25	15 × 25	2203
0.024	10 × 15	10 × 25	12.5 × 25	15 × 25	2403
0.027	12.5 × 15	12.5 × 25	12.5 × 25		2703
0.030	12.5 × 15	12.5 × 25	15 × 25		3003

capacitance	*dimensions in mm* $(D \times L)$				*capacitance code*
	63 $V_{\text{d.c.}}$	125 $V_{\text{d.c.}}$	250 $V_{\text{d.c.}}$	500 $V_{\text{d.c.}}$	
0.033 μF	12.5 × 15	12.5 × 25	15 × 25		3303
0.036	12.5 × 15	12.5 × 25	15 × 25		3603
0.039	12.5 × 15	12.5 × 25	15 × 25		3903
0.043	10 × 25	12.5 × 25	15 × 25		4303
0.047	10 × 25	12.5 × 25	15 × 25		4703
0.051	10 × 25	12.5 × 25			5103
0.056	12.5 × 25	15 × 25			5603
0.062	12.5 × 25	15 × 25			6203
0.068	12.5 × 25	15 × 25			6803
0.075	12.5 × 25	15 × 25			7503
0.082	12.5 × 25	15 × 25			8203
0.091	12.5 × 25				9103
0.10	15 × 25				1004
0.11	15 × 25				1104
0.12	15 × 25				1204
0.13	15 × 25				1304
0.15	15 × 25				1504
0.16	15 × 25				1604

PAPER D.C. CAPACITORS

Rectangular box type

Temperature range : −40 to +70°C
Max. d.c. working voltages : 250 V, 500 V, 1000 V, 2000 V, 3400 V
Max. a.c. voltage (50–60 Hz): 175 V, 250 V, 330 V, 484 V, 825 V
Tolerance on capacitance : ±10%
Capacitance drift during life: <5%

Insulation resistance at 20°C

$C < 0.2\,\mu\text{F}$	$R \geqslant 10\,000\ \text{M}\Omega$
$C \geqslant 0.2\,\mu\text{F}$	$RC \geqslant 2\,000\ \text{s}$
Climatic category (*IEC*)	40/070/56

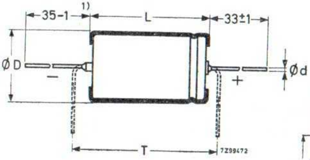
Available versions:
Capacitance values: 0.1, 0.16, 0.25, 0.5, 1, 2, 4, 6, 8, 10, 12, 16, 20, 25 μF.

250 V range:	2 to 16 μF	soldering lugs	2222 230 01 ...
	20 to 25 μF	screw terminals	2222 230 05 ...
500 V range:	1 to 10 μF	soldering lugs	2222 230 21 ...
	12 to 20 μF	screw terminals	2222 230 25 ...
1000 V range:	0.5 to 6 μF	soldering lugs	2222 230 41 ...
	8 to 12 μF	screw terminals	2222 230 45 ...
2000 V range:	0.1 to 2 μF	soldering lugs	2222 230 51 ...
	4 to 6 μF	screw terminals	2222 230 55 ...
3400 V range:	0.1 to 1 μF	soldering lugs	2222 230 61 ...
	2 μF	screw terminals	2222 230 65 ...

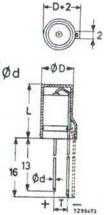
ELECTROLYTIC CAPACITORS

Miniature and small types for general purposes

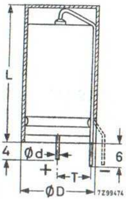
style	case size	IEC 68 category	IEC 103 type	capac. tol. (%)
1 and 2	1	25/070/56	2	−10/+100
1 and 2	2, 3 and 5a	25/085/56	2	−10/+50
3 and 4	4, 5 and 6	25/085/56	1	−10/+50
3 and 4	00 to 03	40/085/56	1	−10/+50



Style 1

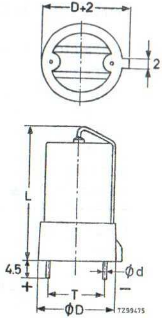


Style 2



Style 3

case size	d (mm)	style 1 D (mm) max.	style 1 L (mm) max.	style 1 T [2]	style 2 D (mm) max.	style 2 L (mm) max.	style 2 T [2]	style 3 D (mm) max.	style 3 L (mm) max.	style 3 T [2]	style 4 D (mm) max.	style 4 L (mm) max.	style 4 T [2]
1	0.6	3.5	10.5	6E	4.1	12.5	E						
2	0.6	4.8	12.5	6E	5.6	14.5	E						
3	0.6	6.1	12.5	6E	6.9	14.5	$E\sqrt{2}$						
5a	0.6	8.3	12.5	6E	9.1	14.5	2E						
4	0.6	6.7	20	10E				8.5	24.5	2E			
5	0.6	8.3	20	10E				10.2	24.5	2E			
6	0.6	10.3	20	10E				12.1	24.5	3E			
00	0.8	10.4	32.5	14E				11.2	34.5	3E	12.8	41	4E
01	0.8	12.9	32.5	14E				13.6	34.5	3E	15.2	41	4E
02	0.8	15.4	32.5	14E				16	34.5	4E	17.8	41	5E
03	0.8	18.4	32.5	14E				19	34.5	4E	20.8	41	6E



Style 4

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[1] 55 ± 1 for case sizes 00, 01, 02 and 0.3

[2] $E = 2.5 + 0.04$ mm.

ELECTROLYTIC CAPACITORS

U_R (*V*)	*capacitance at 100 Hz* (*μF*)	*max. ripple current at 100 Hz, upper cat. temp.* (*mA*)	*leakage current*[1] (*μA*) *max.*	*tan δ at 100 Hz*	*impedance at 100 kHz* (*Ω*)	*case size*	*catalog number 2222 followed by*		
							style 1	*styles 2+3*	*style 4*
4	15	10	5	0.25	12	1	015 12159	015 42159	
4	47	26	9	0.25	4	2	015 12479	015 42479	
4	100	44	20	0.25	2	3	015 12101	015 42101	
4	220	70	44	0.25	1	5a	015 12221	015 42221	
4	220	85	9	0.25	0.5	4	016 12221	016 42221	
4	330	125	13	0.25	0.35	5	016 12331	016 42331	
4	1000	325	40	0.25	0.2	00	017 12102	017 42102	017 52102
4	4700	920	170	0.25	0.3	03	017 12472	017 42472	017 52472
6.3	10	12	5	0.20	12	1	015 13109	015 43109	
6.3	33	26	10	0.20	4	2	015 13339	015 43339	
6.3	68	44	21	0.20	2	3	015 13689	015 43689	
6.3	150	70	47	0.20	1	5a	015 13151	015 43151	
6.3	150	85	10	0.20	0.5	4	016 13151	016 43151	
6.3	470	190	30	0.20	0.2	6	016 13471	016 43471	
6.3	680	325	43	0.20	0.2	00	017 13681	017 43681	017 53681
6.3	1500	470	95	0.20	0.2	01	017 13152	017 43152	017 53152
6.3	2200	630	140	0.20	0.25	02	017 13222	017 43222	017 53222
6.3	3300	920	210	0.20	0.3	03	017 13332	017 43332	017 53332

[1] After 5 min. (20°C).

U_R (V)	*capacitance at 100 Hz* (μF)	*max. ripple current at 100 Hz, upper cat. temp.* (mA)	*leakage current*[1] (μA) *max.*	*tan* δ *at 100 Hz*	*impedance at 100 kHz* (Ω)	*case size*	*catalog number 2222 followed by*		
							style 1	*styles 2+3*	*style 4*
10	6.8	12	5	0.16	12	1	015 14688	015 44688	
10	22	26	11	0.16	4	2	015 14229	015 44229	
10	47	44	24	0.16	2	3	015 14479	015 44479	
10	100	70	50	0.16	1	5a	015 14101	015 44101	
10	100	85	10	0.16	0.5	4	016 14101	016 44101	
10	220	125	22	0.16	0.35	5	016 14221	016 44221	
10	330	190	33	0.16	0.2	6	016 14331	016 44331	
10	470	325	43	0.16	0.2	00	017 14471	017 44471	017 54471
10	1000	470	100	0.16	0.2	01	017 14102	017 44102	017 54102
10	1500	630	150	0.16	0.25	02	017 14152	017 44152	017 54152
10	2200	920	220	0.16	0.3	03	017 14222	017 44222	017 54222
16	4.7	12	5	0.12	12	1	015 15478	015 45478	
16	15	26	12	0.12	4	2	015 15159	015 45159	
16	33	44	26	0.12	2	3	015 15339	015 45339	
16	68	70	54	0.12	1	5a	015 15689	015 45689	
16	68	85	11	0.12	0.5	4	016 15689	016 45689	
16	150	125	24	0.12	0.35	5	016 15151	016 45151	
16	220	190	35	0.12	0.2	6	016 15221	016 45221	
16	330	325	53	0.12	0.2	00	017 15331	017 45331	017 55331
16	680	470	109	0.12	0.2	01	017 15681	017 45681	017 55681
16	1000	630	160	0.12	0.25	02	017 15102	017 45102	017 55102
16	1500	920	240	0.12	0.3	03	017 15152	017 45152	017 55152

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[1] After 5 min. (20° C).

ELECTROLYTIC CAPACITORS

U_R (V)	capacitance at 100 Hz (μF)	max. ripple current at 100 Hz, upper cat. temp. (mA)	leakage current[1] (μA) max.	tan δ at 100 Hz	impedance at 100 kHz (Ω)	case size	catalog number 2222 followed by		
							style 1	styles 2+3	style 4
25	3.3	11	5	0.10	12	1	015 16338	015 46338	
25	10	23	13	0.10	4	2	015 16109	015 46109	
25	22	37	28	0.10	2	3	015 16229	015 46229	
25	47	60	59	0.10	1	5a	015 16479	015 46479	
25	47	72	12	0.10	0.5	4	016 16479	016 46479	
25	100	105	25	0.10	0.35	5	016 16101	016 46101	
25	150	155	38	0.10	0.2	6	016 16151	016 46151	
25	220	270	55	0.10	0.2	00	017 16221	017 46221	017 56221
25	470	360	118	0.10	0.2	01	017 16471	017 46471	017 56471
25	680	500	170	0.10	0.25	02	017 16681	017 46681	017 56681
25	1000	650	250	0.10	0.3	03	017 16102	017 46102	017 56102
40	2.2	11	5	0.08	12	1	015 17228	015 47228	
40	6.8	23	14	0.08	4	2	015 17688	015 47688	
40	15	37	30	0.08	2	3	015 17159	015 47159	
40	33	60	66	0.08	1	5a	015 17339	015 47339	
40	33	72	14	0.08	0.5	4	016 17339	016 47339	
40	47	105	19	0.08	0.35	5	016 17479	016 47479	
40	100	155	40	0.08	0.2	6	016 17101	016 47101	
40	150	270	60	0.08	0.2	00	017 17151	017 47151	017 57151
40	220	360	88	0.08	0.2	01	017 17221	017 47221	017 57221
40	470	500	188	0.08	0.25	02	017 17471	017 47471	017 57471
40	680	650	272	0.08	0.3	03	017 17681	017 47681	017 57681

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[1] After 5 min. (20°C).

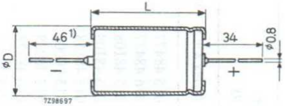
U_R (*V*)	*capacitance at 100 Hz* (*μF*)	*max. ripple current at 100 Hz upper cat. temp.* (*mA*)	*leakage current*[1]) (*μA*) *max.*	*tan δ at 100 Hz*	*impedance at 100 kHz* (*Ω*)	*case size*	*catalog number 2222 followed by*		
							style 1	*styles 2 + 3*	*style 4*
63	0.47	7	5	0.06	5	3	015 18477	015 48477	
63	0.47	6	1	0.06	4	4	016 18477	016 48477	
63	1	10	5	0.06	3	3	015 18108	015 48108	
63	1	12	1	0.06	2	4	016 18108	016 48108	
63	1.5	9	5	0.06	12	1	015 18158	015 48158	
63	1.5	12	5	0.06	2.5	3	015 90001	015 90002	
63	2.2	15	7	0.06	2	3	015 18228	015 48228	
63	2.2	21	1.5	0.06	1.4	4	016 18228	016 48228	
63	3.3	17	11	0.06	2	3	015 18338	015 48338	
63	4.7	22	15	0.06	2	3	015 90003	015 90004	
63	4.7	18	15	0.06	4	2	015 18478	015 48478	
63	4.7	31	3	0.06	1.2	4	016 18478	016 48478	
63	6.8	25	22	0.06	2	3	015 18688	015 48688	
63	10	30	32	0.06	2	3	015 18109	015 48109	
63	10	44	6.5	0.06	0.6	4	016 18109	016 48109	
63	15	43	47	0.06	1	5a	015 18159	015 48159	
63	15	55	10	0.06	0.5	4	016 18159	016 48159	
63	22	80	14	0.06	0.35	5	016 18229	016 48229	
63	47	115	30	0.06	0.2	6	016 18479	016 48479	
63	68	195	43	0.06	0.2	00	017 18689	017 48689	017 58689
63	100	240	63	0.06	0.2	01	017 18101	017 48101	017 58101
63	150	280	95	0.06	0.2	01	017 18151	017 48151	017 58151
63	220	360	139	0.06	0.25	02	017 18221	017 48221	017 58221
63	330	495	208	0.06	0.3	03	017 18331	017 48331	017 58331

[1]) After 5 min. (20° C).

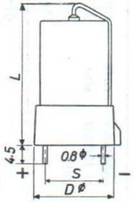
ELECTROLYTIC CAPACITORS

Small type for high voltages

can size	*axial version*		*printed-wiring version*		
	D (*mm*)	*L* (*mm*)	*D* (*mm*)	*L* (*mm*)	*S* (*mm*)
0	10.4	18.5	12.8	26	10.16
00	10.4	30.5	12.8	39.3	10.16
01	12.9	30.5	15.2	39.3	10.16
02	15.4	30.5	17.8	39.3	12.70
03	18.5	30.5	20.8	39.3	15.24



Axial version



Printed-wiring version

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[1]) 34 mm for can size 00

Temperature range: −40 to +70°C
Tolerance on capacitance: −10 to +30%
Catalog number: 2222 040 1 . . . ., axial version
2222 040 4 . . . ., printed-wiring version

can size	*working voltage* ($V_{\text{d.c.}}$)	*capacitance* (μF)	*leakage current*1) (μA)	*ripple current*2) (mA)	*dissipation factor*3)	*impedance*4) (Ω)	*catalog number suffix*
00	100	20	85	50	0.15	6.4	0209
01	100	32	130	75	0.15	4.0	0329
02	100	50	180	100	0.15	2.5	0509
03	100	80	270	125	0.15	1.6	0809
0	150	6.4	55	25	0.15	15.0	1648
00	150	12.5	85	50	0.15	8.0	1139
01	150	20	130	75	0.15	5.0	1209
02	150	32	180	100	0.15	3.0	1329
03	150	50	270	125	0.15	2.0	1509
00	200	10	85	25	0.15	8.0	2109
01	200	16	130	50	0.15	5.0	2169
02	200	25	180	75	0.15	3.0	2259
03	200	40	270	100	0.15	2.0	2409
0	250	4	55	25	0.15	20.0	3408
00	250	8	85	25	0.15	10.0	3808
01	250	12.5	130	50	0.15	6.4	3139
02	250	20	180	75	0.15	4.0	3209
03	250	32	270	100	0.15	2.5	3329
00	300	6.4	85	25	0.15	20.0	4648
01	300	10	130	50	0.15	15.0	4109
02	300	16	180	75	0.15	8.0	4169
03	300	25	270	100	0.15	5.0	4259
0	350	2.5	55	25	0.15	60.0	5258
00	350	5	85	25	0.15	30.0	5508
01	350	8	110	25	0.15	20.0	5808
02	350	12.5	160	50	0.15	15.0	5139
03	350	20	240	75	0.15	8.0	5209
00	400	4	85	25	0.15	45.0	6408
01	400	6.4	110	25	0.15	30.0	6648
02	400	10	160	50	0.15	20.0	6109
03	400	16	240	75	0.15	12.5	6169

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1) Maximum leakage current at 20°C after 5 minutes.

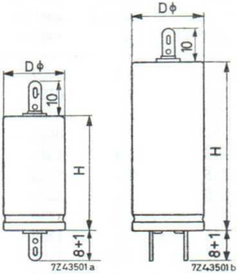
2) Maximum permissible ripple current at 100 Hz and 70°C.

3) Maximum dissipation factor (tan δ) at 20°C and 50 Hz.

4) Maximum impedance at 20°C and 100 kHz.

ELECTROLYTIC CAPACITORS

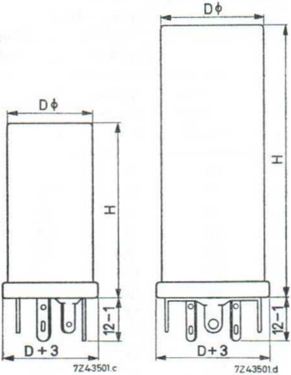
Large types for high and low voltages



Can sizes 4, 5, 6

Can sizes 3, 4, 5, 6

Capacitors with soldering terminals

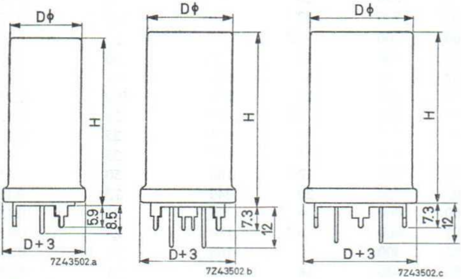


Can sizes 6T, 7

Can sizes 8, 9

Capacitors with twistable mounting lugs

can size	*D (mm)*	*H (mm)*
3	19	34
4	19	50
5	22	50
6	26	50
6T	26	52
7	26	81
8	31	81
8A	31	52
9	36	81
9A	36	52



Can sizes 4, 5

Can size 6T

Can sizes 8A, 9A

Capacitors for printed-wiring boards

Temperature range: −40 to +70°C
Tolerance on capacitance
6.4– 64 V types: −10 to +50%
100–500 V types: −10 to +30%
Catalog number: 2222 . . . .

Capacitors with soldering terminals

Single capacitors

can size	*working voltage* ($V_{d.c.}$)	*capacitance* (μF)	*leakage current*[1] (μA)	*ripple current*[2] (mA)	*dissipation factor*[3]	*impedance*[4] (Ω)	*catalog number suffix*
4	6.4	1600	220	600	0.50	0.63	063 13162
5	6.4	2500	500	850	0.45	0.40	252
6	6.4	4000	770	1000	0.45	0.25	402
4	10	1250	400	600	0.30	0.63	063 14132
5	10	2000	630	850	0.30	0.40	202
6	10	3200	1000	1000	0.40	0.25	322
4	16	800	400	500	0.25	0.63	063 15801
5	16	1250	600	700	0.25	0.40	132
6	16	2000	1000	1000	0.25	0.25	202
4	25	500	400	450	0.20	0.63	063 16501
5	25	800	600	650	0.20	0.40	801
6	25	1250	1000	850	0.20	0.25	132
4	40	320	400	450	0.15	0.63	063 17321
5	40	500	600	650	0.15	0.40	501
6	40	800	1000	800	0.15	0.25	801
4	64	200	400	400	0.10	0.63	063 18201
5	64	320	600	500	0.10	0.40	321
6	64	500	1000	800	0.10	0.25	501
4	100	100	330	250	0.15	1.25	080 10101
6	100	250	780	450	0.15	0.63	251
4	150	64	330	200	0.15	1.5	080 11649
5	150	100	500	250	0.15	1.0	101
4	250	50	400	150	0.15	2.0	080 13509
5	300	64	600	200	0.15	1.25	080 14649
6	300	100	930	250	0.15	4.5	101
4	350	32	360	100	0.15	2.8	080 15329
5	350	50	550	150	0.15		509

[1] Maximum leakage current at 20°C after 5 minutes.
[2] Maximum permissible ripple current at 100 Hz and 70°C.
[3] Maximum dissipation factor (tan δ) at 20°C and 50 Hz.
[4] Maximum impedance at 20°C and 100 kHz.

ELECTROLYTIC CAPACITORS

can size	*working voltage* ($V_{\text{d.c.}}$)	*capacitance* (μF)	*leakage current*[1] (μA)	*ripple current*[2] (mA)	*dissipation factor*[3]	*impedance*[4] (Ω)	*catalog number suffix*
6	350	64	700	200	0.15	2.3	649
4	400	25	330	100	0.30	5.85	080 16259
5	400	32	410	150	0.30	7.3	329
6	400	50	630	200	0.30	4.55	509
4	500	16	270	100	0.30	15	080 18169
5	500	25	400	100	0.30	10	259
6	500	32	500	150	0.30	7.9	329

Double capacitors

can size	*working voltage* ($V_{\text{d.c.}}$)	*capacitance* (μF)	*leakage current*[1] (μA)	*ripple current*[2] (mA)	*dissipation factor*[3]	*impedance*[4] (Ω)	*catalog number suffix*
4	10	640 + 640	2 × 200	2 × 300	0.30	2 × 1.25	064 14641
5	10	1000 + 1000	2 × 330	2 × 425	0.30	2 × 0.8	102
6	10	1600 + 1600	2 × 500	2 × 500	0.40	2 × 0.5	162
4	25	250 + 250	2 × 200	2 × 225	0.20	2 × 1.25	064 16251
5	25	400 + 400	2 × 300	2 × 325	0.20	2 × 0.8	401
6	25	640 + 640	2 × 500	2 × 425	0.20	2 × 0.5	641
4	64	100 + 100	2 × 200	2 × 200	0.10	2 × 1.25	064 18101
5	64	160 + 160	2 × 300	2 × 250	0.10	2 × 0.8	161
6	64	250 + 250	2 × 500	2 × 400	0.10	2 × 0.5	251
3	100	25 + 25	2 × 100	2 × 50	0.15	2 × 5.0	081 10259
4	100	50 + 50	2 × 180	2 × 125	0.15	2 × 2.5	509
6	100	125 + 125	2 × 400	2 × 225	0.15	2 × 1.25	131
4	150	32 + 32	2 × 115	2 × 100	0.15	2 × 3.0	081 11329
5	150	50 + 50	2 × 265	2 × 125	0.15	2 × 2.0	509
3	200	16 + 16	2 × 125	2 × 50	0.15	2 × 4.5	081 12169
3	250	12 5 + 12.5	2 × 100	2 × 50	0.15	2 × 6.3	081 13139
4	250	25 + 25	2 × 100	2 × 75	0.15	2 × 3.0	259
5	300	32 + 32	2 × 330	2 × 100	0.15	2 × 4.0	081 14329
6	300	50 + 50	2 × 500	2 × 125	0.15	2 × 2.5	509
3	350	8 + 8	2 × 100	2 × 25	0.15	2 × 18	081 15808
4	350	16 + 16	2 × 200	2 × 50	0.15	2 × 9.0	169
5	350	25 + 25	2 × 300	2 × 75	0.15	2 × 5.5	259
6	350	32 + 32	2 × 360	2 × 100	0.15	2 × 4.5	329
4	400	12.5 + 12.5	2 × 165	2 × 50	0.30	2 × 18.2	081 16139
5	400	16 + 16	2 × 200	2 × 75	0.30	2 × 14.5	169

can size	working voltage ($V_{d.c.}$)	capacitance (μF)	leakage current[1] (μA)	ripple current[2] (mA)	dissipation factor[3]	impedance[4] (Ω)	catalog number suffix
6	400	25+25	2×330	2×100	0.30	2×9.1	259
3	500	4+4	2×80	2×25	0.30	2×81	081 18408
4	500	8+8	2×135	2×50	0.30	2×39	808
5	500	12.5+12.5	2×200	2×50	0.30	2×26	139
6	500	16+16	2×270	2×75	0.30	2×20	169

Capacitors with twistable mounting lugs
Single capacitors

can size	working voltage ($V_{d.c.}$)	capacitance (μF)	leakage current[1] (μA)	ripple current[2] (mA)	dissipation factor[3]	impedance[4] (Ω)	catalog number suffix
6T	25	1250	1000	850	0.20	0.25	063 36132
7	25	2000	1500	1100	0.20	0.15	202
8	25	2500	2000	1200	0.20	0.15	252
6T	40	800	1000	800	0.15	0.25	063 37801
7	40	1250	1500	1100	0.15	0.15	132
8	40	1600	2000	1200	0.15	0.15	162
6T	64	500	1000	800	0.10	0.25	063 38501
7	64	800	1500	1100	0.10	0.15	801
8	64	1000	2000	1200	0.10	0.15	102
6T	100	250	780	450	0.15	0.63	080 30251
7	100	500	1500	650	0.15	0.63	501
7	150	250	1150	450	0.15	0.63	080 31251
8	150	500	2300	650	0.15	0.63	501
6T	300	100	930	250	0.15	1.25	080 34101
8	300	250	2300	450	0.15	0.63	251
6T	350	64	700	200	0.15	2.3	080 35649
9	350	250	2650	500	0.15	0.63	251
6T	400	50	630	200	0.30	3.5	080 36509

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[1] Maximum leakage current at 20°C after 5 minutes.

[2] Maximum permissible ripple current at 100 Hz and 70°C.

[3] Maximum dissipation factor (tan δ) at 20°C and 50 Hz.

[4] Maximum impedance at 20°C and 100 kHz.

ELECTROLYTIC CAPACITORS

can size	*working voltage* ($V_{\text{d.c.}}$)	*capacitance* (μF)	*leakage current*[1]) (μA)	*ripple current*[2]) (mA)	*dissipation factor*[3])	*impedance*[4]) (Ω)	*catalog number suffix*
7	400	100	1100	200	0.30	1.75	101
7	450	64	900	200	0.30	3.65	080 37649
8	450	100	1300	200	0.30	2.3	101
6T	500	32	500	150	0.30	10.3	080 38329
7	500	50	780	200	0.30	6.5	509
8	500	64	1000	200	0.30	5.2	649
9	500	100	1500	300	0.30	3.25	101

Double capacitors

can size	*working voltage* ($V_{\text{d.c.}}$)	*capacitance* (μF)	*leakage current*[1]) (μA)	*ripple current*[2]) (mA)	*dissipation factor*[3])	*impedance*[4]) (Ω)	*catalog number suffix*
6T	25	640 + 640	2 × 500	2 × 425	0.20	2 × 0.5	064 36641
7	25	1000 + 1000	2 × 780	2 × 550	0.20	2 × 0.3	102
8	25	1250 + 1250	2 × 1000	2 × 600	0.50	2 × 0.3	132
6T	64	250 + 250	2 × 500	2 × 400	0.10	2 × 0.5	064 38251
7	64	400 + 400	2 × 750	2 × 550	0.10	2 × 0.3	401
8	64	500 + 500	2 × 1000	2 × 600	0.10	2 × 0.3	501
6T	100	125 + 125	2 × 400	2 × 225	0.15	2 × 1.25	081 30131
7	100	250 + 250	2 × 780	2 × 325	0.15	2 × 1.25	251
6T	150	125 + 125	2 × 650	2 × 225	0.15	2 × 1.25	081 31131
8	150	250 + 250	2 × 1150	2 × 325	0.15	2 × 1.25	251
6T	300	50 + 50	2 × 500	2 × 125	0.15	2 × 2.5	081 34509
8	300	125 + 125	2 × 1150	2 × 225	0.15	2 × 1.25	031
6T	350	32 + 32	2 × 360	2 × 100	0.15	2 × 4.5	081 35329
9	350	125 + 125	2 × 1350	2 × 250	0.15	2 × 1.25	131
6T	400	25 + 25	2 × 330	2 × 100	0.30	2 × 9.1	081 36259
7	400	50 + 50	2 × 630	2 × 100	0.30	2 × 4.55	509
7	450	32 + 32	2 × 460	2 × 100	0.30	2 × 7.2	081 37329
8	450	50 + 50	2 × 700	2 × 100	0.30	2 × 4.55	509
6T	500	16 + 16	2 × 270	2 × 75	0.30	2 × 20	081 38169
7	500	25 + 25	2 × 400	2 × 100	0.30	2 × 13	259
8	500	32 + 32	2 × 500	2 × 100	0.30	2 × 10.4	329
9	500	50 + 50	2 × 780	2 × 150	0.30	2 × 6.5	509

Capacitors for printed-wiring boards

Single capacitors

can size	*working voltage* ($V_{\mathrm{d.c.}}$)	*capacitance* (μF)	*leakage current*[1] (μA)	*ripple current*[2] (mA)	*dissipation factor*[3]	*impedance*[4] (Ω)	*catalog number suffix*
4	6.4	1600	220	600	0.50	0.63	063 53162
5	6.4	2500	500	850	0.45	0.40	252
6T	6.4	4000	770	1000	0.45	0.25	402
8A	6.4	6400	1220	1300	0.45	0.15	642
9A	6.4	8000	1550	1500	0.45	0.15	802
4	10	1250	400	600	0.30	0.63	063 54132
5	10	2000	630	850	0.30	0.40	202
6T	10	3200	1000	1000	0.40	0.25	322
9A	10	6400	2000	1500	0.40	0.15	642
4	16	800	400	500	0.25	0.63	063 55801
5	16	1250	600	700	0.25	0.40	132
6T	16	2000	1000	1000	0.25	0.25	063 55202
8A	16	3200	1500	1200	0.35	0.15	322
9A	16	4000	2000	1300	0.35	0.15	402
4	25	500	400	450	0.20	0.63	063 56501
5	25	800	600	650	0.20	0.40	801
6T	25	1250	1000	850	0.20	0.25	132
8A	25	2000	1500	1100	0.20	0.15	202
9A	25	2500	2000	1200	0.20	0.15	252
4	40	320	400	450	0.15	0.63	063 57321
5	40	500	600	650	0.15	0.40	501
6T	40	800	1000	800	0.15	0.25	801
8A	40	1250	1500	1100	0.15	0.15	132
9A	40	1600	2000	1200	0.15	0.15	162
4	64	200	400	400	0.10	0.63	063 58201
5	64	320	600	500	0.10	0.40	321
6T	64	500	1000	800	0.10	0.25	501
8A	64	800	1500	1100	0.10	0.15	801
9A	64	1000	2000	1200	0.10	0.15	102
4	100	100	330	250	0.15	1.25	080 50101
6T	100	250	780	450	0.15	0.63	251
8A	100	500	1500	650	0.15	0.63	501

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[1] Maximum leakage current at 20°C after 5 minutes.

[2] Maximum permissible ripple current at 100 Hz and 70°C.

[3] Maximum dissipation factor (tan δ) at 20°C and 50 Hz.

[4] Maximum impedance at 20°C and 100 kHz.

ELECTROLYTIC CAPACITORS

can size	*working voltage* ($V_{d.c.}$)	*capacitance* (μF)	*leakage current*1) (μA)	*ripple current*2) (mA)	*dissipation factor*3)	*impedance*4) (Ω)	*catalog number suffix*
4	150	64	330	200	0.15	1.5	080 51649
5	150	100	500	250	0.15	1.0	101
8A	150	250	1150	450	0.15	0.63	251
9A	200	250	1500	450	0.15	0.63	080 52251
5	300	64	600	200	0.15	2.0	080 54649
6T	300	100	930	250	0.15	1.25	101
4	350	32	360	100	0.15	4.5	080 55329
5	350	50	550	150	0.15	2.8	509
6T	350	64	700	200	0.15	2.3	649
4	400	25	330	100	0.30	5.85	080 56259
5	400	32	410	150	0.30	7.3	329
6T	400	50	630	200	0.30	4.55	509
8A	400	100	1200	200	0.30	2.3	101
8A	450	64	900	200	0.30	3.65	080 57649
4	500	16	270	100	0.30	19.5	080 58169
5	500	25	400	100	0.30	13	259
6T	500	32	500	150	0.30	10.3	329
8A	500	50	780	200	0.30	6.5	509
9A	500	64	1000	200	0.30	5.2	649

Double capacitors

can size	*working voltage* ($V_{d.c.}$)	*capacitance* (μF)	*leakage current*1) (μA)	*ripple current*2) (mA)	*dissipation factor*3)	*impedance*4) (Ω)	*catalog number suffix*
4	10	640 + 640	2 × 200	2 × 300	0.30	2 × 1.25	064 54641
5	10	1000 + 1000	2 × 330	2 × 425	0.30	2 × 0.8	102
6T	10	1600 + 1600	2 × 500	2 × 500	0.40	2 × 0.5	162
8A	10	2500 + 2500	2 × 750	2 × 650	0.40	2 × 0.3	252
9A	10	3200 + 3200	2 × 1000	2 × 750	0.40	2 × 0.3	322
4	25	250 + 250	2 × 200	2 × 225	0.20	2 × 1.25	064 56251
5	25	400 + 400	2 × 300	2 × 325	0.20	2 × 0.8	401
6T	25	640 + 640	2 × 500	2 × 425	0.20	2 × 0.5	641
8A	25	1000 + 1000	2 × 780	2 × 550	0.20	2 × 0.3	102
9A	25	1250 + 1250	2 × 1000	2 × 600	0.50	2 × 0.3	132
4	64	100 + 100	2 × 200	2 × 200	0.10	2 × 1.25	064 58101
5	64	160 + 160	2 × 300	2 × 250	0.10	2 × 0.8	161
6T	64	250 + 250	2 × 500	2 × 400	0.10	2 × 0.5	251
8A	64	400 + 400	2 × 750	2 × 550	0.10	2 × 0.3	401

can size	*working voltage* ($V_{\text{d.c.}}$)	*capacitance* (*μF*)	*leakage current*[1] (*μA*)	*ripple current*[2] (*mA*)	*dissipation factor*[3]	*impedance*[4] (Ω)	*catalog number suffix*
9A	64	500 + 500	2 × 1000	2 × 600	0.10	2 × 0.3	501
4	100	50 + 50	2 × 180	2 × 125	0.15	2 × 2.5	081 50509
6T	100	125 + 125	2 × 400	2 × 225	0.15	2 × 1.25	131
8A	100	250 + 250	2 × 780	2 × 325	0.15	2 × 1.25	251
4	150	32 + 32	2 × 115	2 × 100	0.15	2 × 3.0	081 51329
5	150	50 + 50	2 × 265	2 × 125	0.15	2 × 2.0	509
8A	150	125 + 125	2 × 650	2 × 225	0.15	2 × 1.25	131
4	250	25 + 25	2 × 200	2 × 75	0.15	2 × 3.0	081 53259
6T	250	50 + 50	2 × 400	2 × 125	0.15	2 × 1.5	509
5	300	32 + 32	2 × 330	2 × 100	0.15	2 × 4.0	081 54329
6T	300	50 + 50	2 × 500	2 × 125	0.15	2 × 2.5	509
4	350	16 + 16	2 × 200	2 × 50	0.15	2 × 9.0	081 55169
5	350	25 + 25	2 × 300	2 × 75	0.15	2 × 5.5	259
6T	350	32 + 32	2 × 360	2 × 100	0.15	2 × 4.5	329
6T	400	25 + 25	2 × 330	2 × 100	0.30	2 × 9.1	081 55259
8A	400	50 + 50	2 × 630	2 × 100	0.30	2 × 4.55	509
8A	450	32 + 32	2 × 460	2 × 100	0.15	2 × 5.5	081 57329
4	500	8 + 8	2 × 135	2 × 50	0.30	2 × 39	081 58808
5	500	12.5 + 12.5	2 × 200	2 × 50	0.30	2 × 26	139
6T	500	16 + 16	2 × 270	2 × 75	0.30	2 × 20	169
8A	500	25 + 25	2 × 400	2 × 100	0.30	2 × 13	259
9A	500	32 + 32	2 × 500	2 × 100	0.30	2 × 10.4	329

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[1] Maximum leakage current at 20°C after 5 minutes.

[2] Maximum permissible ripple current at 100 Hz and 70°C.

[3] Maximum dissipation factor (tan δ) at 20°C and 50 Hz.

[4] Maximum impedance at 20°C and 100 kHz.

ELECTROLYTIC CAPACITORS

Multiple types for high voltages

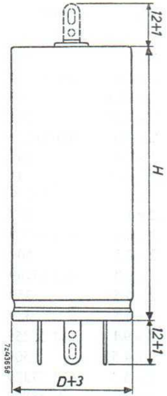


Fig. 1

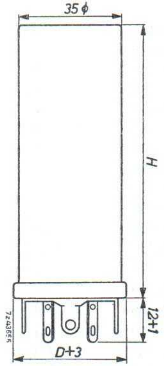


Fig. 2

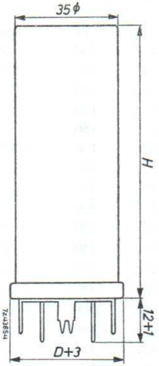


Fig. 3

capacitance (*μF*)	*max. voltage* ($V_{d.c.}$)	*Fig.*	*D* (*mm*)	*H* (*mm*)	*cat. number* 2222 … …..
50 + 50 + 50	350	1 2	35	80	063 90027
	300	2	35	80	063 90022
100 + 100 + 50	300	2	35	80	067 90003
200 + 100 + 50 + 25	300	1	35	80	067 90012
200 + 100 + 50 + 25	300	2	35	80	067 90013
200 + 100 + 50 + 25	300	3	35	80	067 90014

Large long life type (I.E.C. type 1)

Fig.	*can size*	*D (mm)*	*L (mm)*	*t (mm)*
1	5	21.3	49.3	8
1	6	25.3	49.3	8
1	7	25.3	80.3	12
1	8a	30.3	50.3	12
1	8	30.3	80.3	12
2	9a	35.3	50.3	12
2	9	35.3	80.3	12
2	10	40.5	80.3	12

Temperature range: −40 to +85°C
Tolerance on capacitance: −10 to +50%
Catalogue numbers: 2222 071 . . . . ., 2222 072 . . . . ., 2222 073 . . . . .
Max (d.c. + peak a.c.) voltage at ⩽40°C: 1.1 × rated voltage

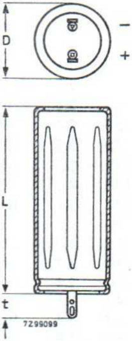


Fig. 1
(single)

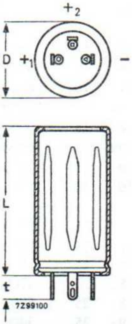


Fig. 2
(double)

ELECTROLYTIC CAPACITORS

can size	*rated voltage (V)*	*capacitance (μF)*	*max. ripple current (A)*[1]		*leakage current*[2] *(μA) max.*	*tan δ at 100 Hz max.*	*impedance at 100 kHz (mΩ) max.*	*catal. No. 2222 followed by*
			50°C	85°C				
6	6.3	10000	4.0	1.8	380	0.50	60	071 13103
7	6.3	15000	6.1	2.7	570	0.50	50	071 13153
8a	6.3	15000	5.5	2.5	570	0.50	50	073 13153
8	6.3	22000	8.3	3.7	835	0.50	50	071 13223
9a	6.3	11000+11000	7.5	3.3	420+420	0.50	60+60	072 13113
9	6.3	16500+16500	11	4.9	625+625	0.50	50+50	072 13173
10	6.3	23500+23500	14.2	6.3	890+890	0.50	50+50	072 13243
5	10	4700	2.5	1.1	280	0.35	80	071 14472
6	10	6800	4.0	1.8	410	0.35	60	071 14682
7	10	10000	6.0	2.7	600	0.35	50	071 14103
8a	10	10000	5.4	2.4	600	0.35	50	073 14103
8	10	15000	8.2	3.7	900	0.35	50	071 14153
9a	10	7500+7500	7.3	3.3	450+450	0.35	60+60	072 14752
9	10	11000+11000	10.6	4.8	660+660	0.35	50+50	072 14113
10	10	16500+16500	13.4	6.0	990+990	0.35	50+50	072 14173
5	16	3300	2.4	1.1	320	0.25	80	071 15332
6	16	4700	3.9	1.7	450	0.25	60	071 15472
7	16	6800	5.8	2.6	655	0.25	50	071 15682
8a	16	6800	5.3	2.4	655	0.25	50	073 15682
8	16	10000	7.9	3.5	960	0.25	50	071 15103
9a	16	5000+5000	7.1	3.2	480+480	0.25	60+60	072 15502
9	16	7500+7500	10.5	4.7	720+720	0.25	50+50	072 15752
10	16	11000+11000	13.8	6.1	1060+1060	0.25	50+50	072 15113
5	25	2200	2.2	1.0	330	0.20	80	071 16222
6	25	3300	3.7	1.7	495	0.20	60	071 16332
7	25	4700	5.4	2.4	705	0.20	50	071 16472
8a	25	4700	4.9	2.2	750	0.20	50	073 16472
8	25	6800	7.3	3.3	1020	0.20	50	071 16682
9a	25	3400+3400	6.5	2.9	510+510	0.20	60+60	072 16342
9	25	5000+5000	9.6	4.3	750+750	0.20	50+50	072 16502
10	25	7500+7500	12.6	5.7	1125+1125	0.20	50+50	072 16752

Notes to the table:

[1]) Max. permissible r.m.s. values of riple current, of any frequency and with the rated voltage applied, for single capacitors and for paralleled double capacitors. When both sections of a double capacitor carry ripple current, $\frac{1}{2} \times$ stated limits apply to each section; when only one section carries ripple current, $\frac{1}{2}\sqrt{2} \times$ stated limits apply.

[2]) Leakage current 5 min after application of the rated voltage.

can size	*rated voltage (V)*	*capacitance (μF)*	*max. ripple current (A)* 1)		*leakage current* 2) *(μA) max.*	*tan δ at 100 Hz max.*	*impedance at 100 kHz (mΩ) max.*	*catal. No. 2222 followed by*
			50°C	*85°C*				
5	40	1000	2.1	1.0	240	0.15	125	071 17102
6	40	2200	2.9	1.3	530	0.15	100	071 17222
7	40	3300	5.2	2.4	795	0.15	80	071 17332
8a	40	3300	3.8	1.7	795	0.15	80	073 17332
8	40	4700	7.0	3.1	1130	0.15	80	071 17472
9a	40	2350+2350	5.3	2.4	560+560	0.15	100+100	072 17242
9	40	3400+3400	9.1	4.1	820+820	0.15	80+80	072 17342
10	40	5000+5000	12.0	5.3	1200+1200	0.15	80+80	072 17502
5	63	680	2.1	0.8	260	0.10	125	071 18681
6	63	1000	2.9	1.3	380	0.10	100	071 18102
7	63	1500	4.3	2.0	570	0.10	80	071 18152
8a	63	1500	3.8	1.7	570	0.10	80	073 18152
8	63	2200	5.8	2.6	835	0.10	80	071 18222
9a	63	1100+1100	5.3	2.4	415+415	0.10	100+100	072 18112
9	63	1650+1650	7.8	3.5	625+625	0.10	80+80	072 18172
10	63	2350+2350	10	4.5	890+890	0.10	80+80	072 18242

Notes to the table:

1) Max. permissible r.m.s. values of ripple current, of any frequency and with the rated voltage applied, for single capacitors and for paralleled double capacitors. When both sections of a double capacitor carry ripple current, $\frac{1}{2}\times$ stated limits apply to each section; when only one section carries ripple current, $\frac{1}{2}\sqrt{2}\times$ stated limits apply.

2) Leakage current 5 min after application of the rated voltage.

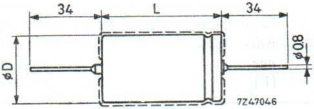
Mounting clamps for 071 and 073 series

can size	*catalog number*
5	4322 043 03290
6.7	03300
8	03310
9	03320
10	03330

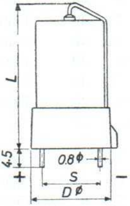
ELECTROLYTIC CAPACITORS

Small long life type

can size	*axial version*		*printed-wiring version*		
	D (*mm*)	*L* (*mm*)	*D* (*mm*)	*L* (*mm*)	*S* (*mm*)
1	8.3	22.5	11.3	30	10.16
2	10.5	22.5	12.9	31	10.16
3	10.5	30.5	12.9	39	10.16
4	13	30.5	15.3	39	10.16



Axial version



Printed-wiring version

Temperature range: −40 to +70°C
Tolerance on capacitance: −10 to +50%
Catalog number: 2222 101 1 . . . ., axial version
2222 101 4 . . . ., printed-wiring version

can size	*working voltage* ($V_{d.c.}$)	*capacitance* (μF)	*leakage current*[1]) (μA)	*ripple current*[2]) (*mA*)	*dissipation factor*[3])	*impedance*[4]) (Ω)	*catalog number suffix*
1	4	25	6	20	0.20	6	2259
1	4	50	7	40	0.30	6	2509
2	4	80	8	55	0.30	4	2809
3	4	160	11.5	90	0.30	2	2161
4	4	320	18	145	0.30	1	2321
1	6.4	20	6.5	25	0.20	6	3209
1	6.4	40	7.5	40	0.25	6	3409
2	6.4	64	9	55	0.25	4	3649
3	6.4	125	13	90	0.25	2	3131
4	6.4	250	21	145	0.25	1	3251
1	10	16	6.5	25	0.15	6	4169
1	10	32	8	40	0.20	6	4329
2	10	50	10	55	0.20	4	4509
3	10	100	15	90	0.20	2	4101
4	10	200	25	145	0.20	1	4201
1	16	10	6.5	25	0.15	6	5109
1	16	20	8	40	0.15	6	5209
2	16	32	10	55	0.15	4	5329
3	16	64	15.5	90	0.15	2	5649

can size	*working voltage* ($V_{d.c.}$)	*capacitance* (μF)	*leakage current*[1]) (μA)	*ripple current*[2]) (mA)	*dissipation factor*[3])	*impedance*[4]) (Ω)	*catalog number suffix*
4	16	125	25	145	0.15	1	5131
1	25	6.4	6.5	25	0.10	6	6648
1	25	12.5	8	40	0.10	6	6139
2	25	20	10	55	0.10	4	6209
3	25	40	15	90	0.10	2	6409
4	25	80	25	145	0.10	1	6809
1	40	4	6.5	15	0.10	6	7408
1	40	8	8	25	0.10	6	7808
2	40	12.5	10	35	0.10	4	7139
3	40	25	15	55	0.10	2	7259
4	40	50	25	90	0.10	1	7509
1	64	2.5	6.5	15	0.10	6	8258
1	64	5	8	25	0.10	6	8508
2	64	8	10	35	0.10	4	8808
3	64	16	15.5	55	0.10	2	8169
4	64	32	25.5	90	0.10	1	8329

---

[1]) Maximum leakage current at 20°C after 5 minutes.

[2]) Maximum permissible ripple current at 100 Hz and 70°C.

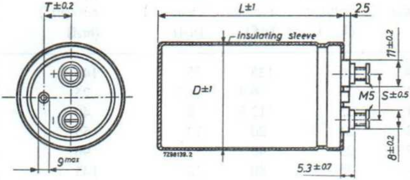
[3]) Maximum dissipation factor (tan δ) at 20°C and 50 Hz.

[4]) Maximum impedance at 20°C and 100 kHz.

ELECTROLYTIC CAPACITORS

Large long life type (I.E.C. type 1)

can size	$D_{\text{max.}}$ (*mm*)	*L* (*mm*)	*S* (*mm*)
11	35.8	82	15
12	35.8	114	15
14	50.8	82	22
15	50.8	114	22
16	65.8	114	31



Temperature range: −40 to +70°C

Tolerance on capacitance: −10 to +50%

Catalog number: 2222 106 . . . . ., working voltage 6.3 to 63 $V_{\text{d.c.}}$

2222 107 . . . . ., working voltage 100 $V_{\text{d.c.}}$

Mounting clamps for 106 and 107 series

For cans with 35 mm dia.: 4322 043 04270

50 mm dia.: 04280

65 mm dia.: 04290

can size	*rated voltage (V)*	*capacitance (µF)*	*leakage current*[1] *(mA)*	*ripple current (A)*[2]		*tan δ at 100 Hz max.*	*cat. number 2222 followed by*
				50°*C*	85°*C*		
11	6.3	22000	0.9	7	3.1	0.45	106 13223
12	6.3	33000	1.3	10	4.5	0.55	106 13333
14	6.3	47000	1.8	12	5.4	0.60	106 13473
15	6.3	68000	2.6	17	7.7	0.70	106 13683
16	6.3	150000	5.7	28	12.6	1.0	106 13154
11	10	15000	0.9	7	3.1	0.30	106 14153
12	10	22000	1.4	10	4.5	0.35	106 14223
14	10	33000	2.0	12	5.4	0.40	106 14333
15	10	47000	2.9	17	7.7	0.45	106 14473
16	10	100000	6.0	28	12.6	0.70	106 14104
11	16	10000	1.0	7	3.1	0.20	106 15103
12	16	15000	1.5	10	4.5	0.25	106 15153
14	16	22000	2.2	12	5.4	0.25	106 15223
15	16	3300	3.2	17	7.7	0.30	106 15333
16	16	68000	6.6	28	12.6	0.45	106 15683
11	25	6800	1.1	7	3.1	0.15	106 16682
12	25	10000	1.5	10	4.5	0.16	106 16103
14	25	15000	2.3	12	5.4	0.19	106 16153
15	25	22000	3.3	17	7.7	0.20	106 16223
16	25	47000	7.1	28	12.6	0.32	106 16473
11	40	4700	1.2	7	3.1	0.10	106 17472
12	40	6800	1.7	10	4.5	0.11	106 17682
14	40	10000	2.4	12	5.4	0.12	106 17103
15	40	15000	3.6	17	7.7	0.14	106 17153
16	40	33000	8.0	28	12.6	0.20	106 17333
11	63	2200	0.9	7	3.1	0.050	106 18222
12	63	3300	1.3	10	4.5	0.055	106 18332
14	63	4700	1.8	12	5.4	0.050	106 18472
15	63	6800	2.6	17	7.7	0.060	106 18682
16	63	15000	5.7	28	12.6	0.100	106 18153
11	100	1500	0.9	7	3.1	0.40	107 10152
12	100	2200	1.4	10	4.5	0.40	107 10222
14	100	3300	2.0	12	5.4	0.40	107 10332
15	100	4700	2.9	17	7.7	0.40	107 10472
16	100	10000	6.0	28	12.6	0.40	107 10103

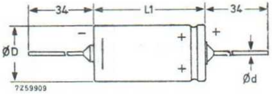
[1] Max. leakage current at 20°C after 5 minutes. [2] Max. permissible ripple current at 100 Hz.

Note: Mounting position not with terminals down.

ELECTROLYTIC CAPACITORS

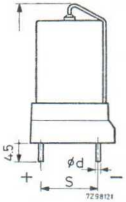
Small solid aluminium type

can size	*axial version*		*printed-wiring version*	
	D *(mm)*	*L* *(mm)*	*S* *(mm)*	*L* *(mm)*
1	6.6	14.5	7.62	24.5
2	6.6	21	7.62	30.5
3	8.3	21	7.62	30.5
4	10.4	21	10.16	30.5
5	10.4	27	10.16	39.3
6	12.9	27	10.16	39.3



Axial version (insulated)

d = 0.6 for can size 1 and 2
d = 0.8 for 3 to 6



Printed-wiring version

Temperature range: −80 to +85 °C
Tolerance on capacitance: ±20 %
Catalog number: 2222 121 1 . . . ., axial version
2222 121 4 . . . ., printed-wiring version

can size	*working voltage* $(V_{d.c.})$	*capacitance* (μF)	*leakage current*[1] (μA)	*ripple current*[2] *(mA)*	*dissipation factor*[3]	*impedance*[4] (Ω)	*catalog number suffix*
1	4	27	9	100	0.20	2.5	2279
2	4	56	32	155	0.20	1.25	2569
3	4	100	57	235	0.20	0.75	2101
4	4	180	80	350	0.20	0.5	2181
5	4	270	105	505	0.20	0.4	2271
6	4	390	120	685	0.20	0.4	2391
1	6.3	22	12	90	0.18	2.5	3229
2	6.3	47	43	150	0.18	1.25	3479
3	6.3	82	73	225	0.18	0.75	3829
4	6.3	150	107	340	0.18	0.5	3151
5	6.3	220	140	480	0.18	0.4	3221
6	6.3	330	160	670	0.18	0.4	3331
1	10	15	15	80	0.16	2.5	4159
2	10	33	53	135	0.16	1.25	4339
3	10	56	90	195	0.16	0.75	4569
4	10	100	133	290	0.16	0.5	4101

can size	*working voltage* ($V_{\text{d.c.}}$)	*capacitance* (μF)	*leakage current*[1] (μA)	*ripple current*[2] (mA)	*dissipation factor*[3]	*impedance*[4] (Ω)	*catalog number suffix*
5	10	150	175	420	0.16	0.4	4151
6	10	220	200	575	0.16	0.4	4221
1	16	8.2	18	65	0.14	2.5	5828
2	16	18	57	105	0.14	1.25	5189
3	16	33	105	160	0.14	0.75	5339
4	16	56	160	240	0.14	0.5	5569
5	16	82	210	335	0.14	0.4	5829
6	16	120	240	465	0.14	0.4	5121
1	25	5.6	21	55	0.14	5.0	6568
2	25	12	60	95	0.14	2.5	6129
3	25	22	110	140	0.14	1.5	6229
4	25	39	185	210	0.14	1.0	6399
5	25	56	245	295	0.14	0.8	6569
6	25	82	280	405	0.14	0.5	6829
1	40	2.7	24	45	0.10	5.0	7278
2	40	5.6	84	70	0.10	2.5	7568
3	40	10	145	105	0.10	1.5	7109
4	40	18	212	160	0.10	1.0	7189
5	40	27	280	230	0.10	0.8	7279
6	40	39	320	305	0.10	0.5	7399

---

[1] Maximum leakage current at 20°C after 5 minutes.

[2] Maximum permissible ripple current at 100 Hz and 70°C.

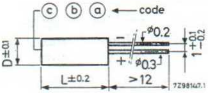
[3] Maximum dissipation factor (tan δ) at 20°C and 100 Hz.

[4] Maximum impedance at 20°C and 100 kHz.

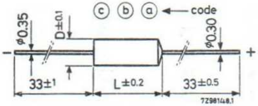
ELECTROLYTIC CAPACITORS

Miniature solid tantalum type

can size		*D* (*mm*)	*L* (*mm*)
1	single-ended version	1.9	2.5
2		1.9	3.8
3	axial version	1.9	4.7
4		2.4	5.2
5		3.4	7.2



Single-ended version



Axial-lead version

Colour code: capacitance = a × b μF; rated voltage = cV

colour	*a* (*μF*)	*b*	*c* (*V*)
black	1	1	2.5
brown	1.2	10	4
red	1.5	10^2	6.3
orange	1.8	10^3	10
yellow	2.2		16
green	2.7		25
blue	3.3		40
violet	3.9		63
grey	4.7		1
white	5.6		1.6
silver	6.8	10^{-2}	
gold	8.2	10^{-1}	

Temperature range: −40 to +85°C
Max. temperature 1 h per 24 h: 125°C
Tolerance on capacitance: −20 to +50%
Catalogue number 2222 142 . . . . .

Single-ended version

can size	*working voltage (V)*	*capacitance (μF)*	*leakage current* 1) *(μA)*	*ripple current* 2) *(mA)*	*tan δ* 3)	*impedance* 4) *(Ω)*	*catalog number suffix*
1	1.6	0.82	0.5	0.1	0.15	75	10827
1		2.2	0.5	0.25	0.15	60	10228
2		4.7	1	0.5	0.15	50	10478
1	2.5	0.47	0.5	0.1	0.10	75	11477
1		1.5	0.5	0.25	0.10	60	11158
2		2.7	1	0.5	0.10	50	11278
1	4	0.33	0.5	0.1	0.10	75	12337
1		1.00	0.5	0.25	0.10	60	12108
2		1.8	1	0.5	0.10	50	12188
1	6.3	0.22	0.5	0.1	0.08	75	13227
1		0.56	0.5	0.25	0.08	60	13567
2		1.2	1	0.5	0.08	50	13128
1	10	0.12	0.5	0.1	0.08	75	14127
1		0.39	0.5	0.25	0.08	60	14397
2		0.82	1	0.5	0.08	50	14827
1	16	0.015	0.5	0.02	0.08	150	90004
1		0.039	0.5	0.04	0.08	150	90005
1		0.082	0.5	0.1	0.08	100	90006
1		0.22	0.5	0.25	0.08	75	15227
2		0.47	1	0.5	0.08	50	15477
1	25	0.047	0.5	0.1	0.08	75	90014
1		0.15	0.5	0.25	0.08	60	16157
2		0.27	1	0.5	0.08	50	16277

1) Maximum leakage current after 5 minutes.

2) Maximum permissible ripple current at 100 Hz and 85°C.

3) Maximum dissipation factor at 100 Hz

4) Maximum impedance at 100 kHz.

ELECTROLYTIC CAPACITORS

Axial-lead version

can size	*working voltage* (*V*)	*capacitance* (*μF*)	*leakage current* [1] (*μA*)	*ripple current* [2] (*mA*)	*tan δ* [3]	*impedance* [4] (Ω)	*catalog number suffix*
3	1.6	10	1	1	0.15	10	20109
4		22	1.5	2.5	0.15	7.5	20229
5		56	2.5	7	0.15	3.5	20569
3	2.5	6.8	1	1	0.10	10	21688
4		15	1.5	2.5	0.10	7.5	21159
5		39	2.5	7	0.10	3.5	21399
3	4	3.9	1	1	0.10	10	22398
4		10	1.5	2.5	0.10	7.5	22109
5		22	2.5	7	0.10	3.5	22229
3	6.3	2.7	1	1	0.08	10	23278
4		6.8	1.5	2.5	0.08	7.5	23688
5		15	2.5	7	0.08	3.5	23159
3	10	1.5	1	1	0.08	10	24158
4		3.9	1.5	2.5	0.08	7.5	24398
5		10	2.5	7	0.08	3.5	24109
3	16	1	1	1	0.08	10	25108
4		2.7	1.5	2.5	0.08	7.5	25278
5		6.8	2.5	7	0.08	3.5	25688
3	25	0.68	1	1	0.08	10	26687
4		1.5	1.5	2.5	0.08	7.5	26158
5		4.7	2.5	7	0.08	3.5	26478

---

1) Maximum leakage current after 5 minutes.

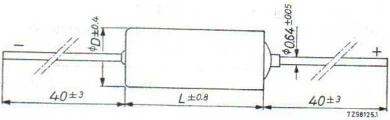
2) Maximum permissible ripple current at 100 Hz and 85°C.

3) Maximum dissipation factor at 100 Hz.

4) Maximum impedance at 100 kHz.

Solid tantalum type

can size	D (mm)	L (mm)	d (mm)
1	3.45	7.25	0.64
2	4.7	12.05	0.64
3	7.35	17.4	0.64
4	8.9	19.95	0.64



ELECTROLYTIC CAPACITORS

Temperature range: −55 to +85°C
Tolerance on capacitance: ±20% (10% on request)
Catalog number: 2222 143 .....

can size	*d.c. rated voltage at 85°C (V)*	*capacitance (μF)*	*leakage current*[1] *(μA)*	*catalog number suffix*
1	6	5.6	1	13568
1	6	6.8	1	13688
2	6	47	6	13479
2	6	56	7	13569
3	6	150	18	13151
3	6	180	21	13181
4	6	270	32	13271
4	6	330	40	13331
1	10	3.9	1	14398
1	10	4.7	1	14478
2	10	27	5	14279
2	10	33	7	14339
2	10	39	8	14399
3	10	82	16	14829
3	10	100	20	14101
3	10	120	24	14121
4	10	180	36	14181
4	10	220	44	14221
1	15	2.7	1	15278
1	15	3.3	1	15338
2	15	18	5	15189
2	15	22	7	15229
3	15	56	17	15569
3	15	68	20	15689
4	15	120	36	15121
4	15	150	45	15151
1	20	1.2	1	16128
1	20	1.5	1	16158
1	20	1.8	1	16188
1	20	2.2	1	16228
2	20	8.2	3	16828
2	20	10	4	16109

can size	*d.c. rated voltage at 85°C (V)*	*capacitance (μF)*	*leakage current*[1]) *(μA)*	*catalog number suffix*
2	20	12	5	16129
2	20	15	6	16159
3	20	27	11	16279
3	20	33	13	16339
3	20	39	16	16399
3	20	47	19	16479
4	20	56	22	16569
4	20	68	27	16689
4	20	82	33	16829
4	20	100	40	16101
1	35	0.33	1	17337
1	35	0.39	1	17397
1	35	0.47	1	17477
1	35	0.56	1	17567
1	35	0.68	1	17687
1	35	0.82	1	17827
1	35	1	1	17108
2	35	1.2	1	17128
2	35	1.5	1	17158
2	35	1.8	1	17188
2	35	2.2	2	17228
2	35	2.7	2	17278
2	35	3.3	2	17338
2	35	3.9	3	17398
2	35	4.7	3	17478
2	35	5.6	4	17568
2	35	6.8	5	17688
3	35	8.2	6	17828
3	35	10	7	17109
3	35	12	8	17129
3	35	15	11	17159
3	35	18	13	17189
3	35	22	15	17229
4	35	27	19	17279
4	35	33	23	17339
4	35	39	27	17399
4	35	47	33	17479

---

[1]) Maximum leakage current at 25°C after 5 minutes.

VARIABLE CAPACITORS

Tubular ceramic trimmers

Temperature range: −50 to +100°C
Temperature coefficient: $(-200 \pm 200)\ 10^{-6}$/deg C
Maximum working voltage: 500 $V_{d.c.}$
Min. parallel damping at 1.5 MHz: 3 MΩ
Soldering: 260°C, 4 s
Operating torque: 0.4–5 N cm

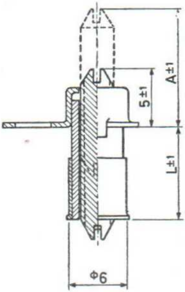


Fig. 1

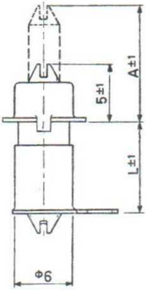
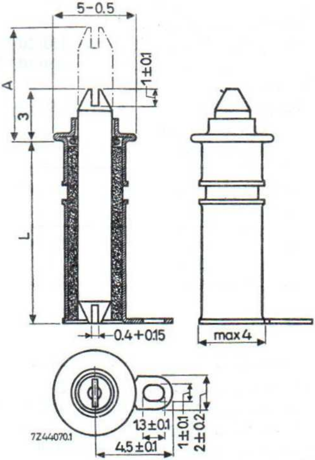


Fig. 2

cap. swing	*zero cap.*	*dimensions (mm)*		*Fig.*	*catalog number*
(pF)	*(pF)*	*L*	*A*		
⩾3	⩽0.8	5.5	13.5	1	2222 801 20001
⩾6	⩽0.8	8.5	16.5	1	20002
⩾9	⩽0.9	11.5	19.5	1	20003
⩾12	⩽1	14.5	22.5	1	20004
⩾3	⩽0.8	5.5	13.5	2	20005
⩾6	⩽0.8	8.5	16.5	2	20006
⩾9	⩽0.9	11.5	19.5	2	20007
⩾12	⩽1	14.5	22.5	2	20008

Temperature range: -50 to $+180$°C
Max. working voltage: 400 $V_{d.c.}$
Min. parallel damping at 1.0 MHz: 3 MΩ
Soldering:
stator tag: in conformity with I.E.C. 68, test T
cap: the soldering temperature must lie between 240°C and 260°C, maximum soldering time is 10 s.
Operating torque 0.1–2 N cm



cap. swing (pF)	*zero cap. (pF)*	*temp. coeff. 10^{-6}/deg C*	*dimensions (mm)*		*catalog number*
			L	*A*	
⩾3	⩽0.8	-200 ± 200	7.8	10.5	2222 801 20051
⩾6	⩽0.8	-300 ± 200	10.8	13.5	20052

VARIABLE CAPACITORS

Temperature range: −50 to +100°C
Temperature coefficient:
trimmers 2222 801 96003: (150±150) 10^{-6}/deg C
2222 801 96002: (150±100) 10^{-6}/deg C
Max. working voltage: 500 $V_{d.c.}$
Min. parallel damping at 1.0 MHz: 10 MΩ
Soldering: 250°C, 4 s
Operating torque: 0.4–5 Ncm

cap. swing (*pF*)	*zero cap.* (*pF*)	*Fig.*	*catalog number*
⩾3	⩽0.5	1	2222 801 96003
⩾6	⩽0.7	2	96002

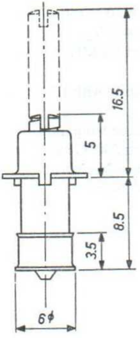


Fig. 1

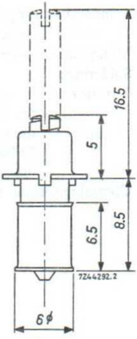
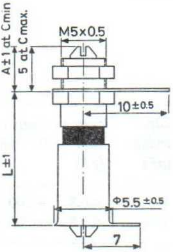


Fig. 2

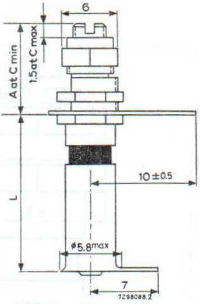
Temperature range: −50 to +100°C
Temperature coefficient: (−200±200) 10^{-6}/deg C
Max. working voltage: 500 $V_{d.c.}$
Min. parallel damping at 1.0 MHz: 3MΩ
Operating torque: 0.4–5 Ncm

cap. swing (*pF*)	*zero cap.* (*pF*)	*dimensions* (*mm*) *L*	*A*	*catalog number*
⩾3	⩽0.8	11	14.5	2222 802 20001
⩾6	⩽0.8	14	17.5	20002
⩾9	⩽0.9	17	20.5	20003
⩾12	⩽1.0	20	23.5	20004
⩾18	⩽1.7	20	23.5	20005



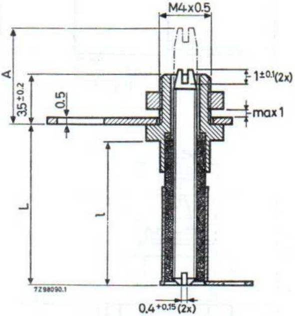
Temperature range: −50 to +100°C
Max. working voltage: 500 $V_{d.c.}$
Min. parallel damping at
1.0 MHz: 10 MΩ
Operating torque: 0.4–4 Ncm

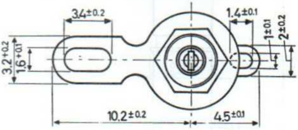
cap. swing (pF)	*zero cap. (pF)*	*temp. coeff. (10^{-6}/deg C)*	*dimensions (mm)* L	A	*catalog number*
⩾3	⩽0.5	−10±60	12.4	22.5	2222 802 20011
⩾4.5	⩽0.6	−10±60	15.4	25.5	20012
⩾6	⩽0.7	−10±60	17.9	28.0	20013
⩾9	⩽0.9	−250±250	15.4	25.5	20014
⩾12	⩽1.0	−250±250	18.4	28.0	20015



Temperature range: −50 to +100°C
Temperature coefficient:
trimmers 2222 802 96035: (−200±200) 10^{-6}/deg C
2222 802 96036: (−300±200) 10^{-6}/deg C
Max. working voltage: 400 $V_{d.c.}$
Min. parallel damping
at 1.0 MHz: 10 MΩ
Operating torque: 0.1–2 Ncm
Catalog number: 2222 802 .....

cap. swing (pF)	*zero cap. (pF)*	*dimensions (mm)* L	l	A	*catalog number suffix*
⩾3	⩽0.8	8.3	7.3	9	96035
⩾6	⩽0.8	11.3	10.3	12	96036





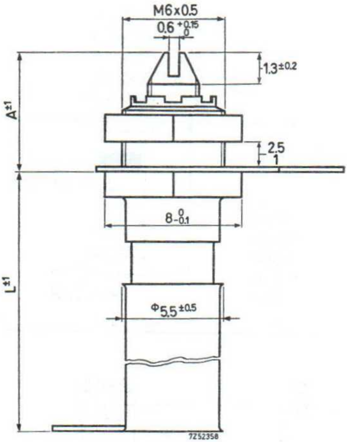


Fig. 1

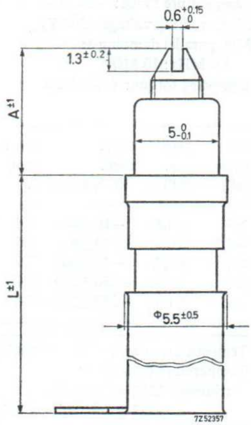


Fig. 2

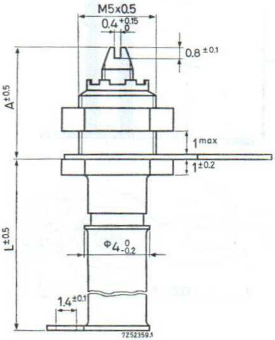


Fig. 3

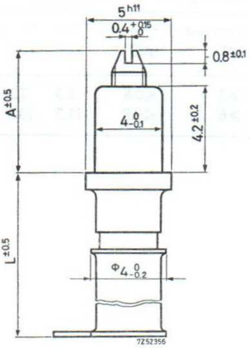


Fig. 4

These trimmers are available with a low dielectric constant (class A types) and with a high dielectric constant (class B types).

Temperature range: -50 to $+100$°C

Temperature coefficient

class A types: $(-10 \pm 60)\ 10^{-6}$/deg C
class B types: $(-200 \pm 150)\ 10^{-6}$/deg C

Max. working voltage

class A types (according Figs. 1 and 2): 500 $V_{d.c.}$
class B types (according Figs. 1 and 2): 500 $V_{d.c.}$
class B types (according Figs. 3 and 4): 400 $V_{d.c.}$

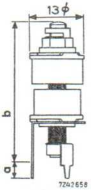
Min. parallel damping at 1.5 MHz: 10 MΩ

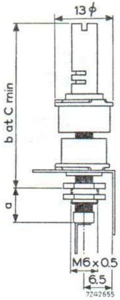
class A types: 10 MΩ
class B types: 3 MΩ

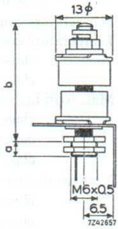
cap. swing (pF)	*zero cap. (pF)*	*class*	*dimensions (mm) see Figs. 1 and 2*		*catalog number* 2222 802 960 . .	
			L	*A at* C_{min}	*Fig.* 1	*Fig.* 2
⩾3	⩽0.8	B	11	14.5	44	51
⩾6	⩽0.8		14	17.5	45	52
⩾9	⩽0.9		17	20.5	46	53
⩾12	⩽1.0		20	23.5	47	54
⩾3	⩽0.5	A	14	14	66	69
⩾4.5	⩽0.6		17	17	67	71
⩾6	⩽0.7		19	20	68	72

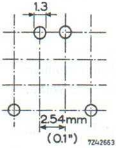
cap. swing (pF)	*zero cap. (pF)*	*class*	*dimensions (mm) see Figs. 3 and 4*		*catalog number* 2222 802 960 . .	
			L	*A at* C_{min}	*Fig.* 3	*Fig.* 4
⩾3	⩽0.8	B	8.8	7.8	55	57
⩾6	⩽0.8		11.8	10.8	56	58

Concentric air dielectric trimmers









Temperature range: −40 to +85 °C
Min. parallel damping at 1.5 MHz: 10 MΩ
Tolerance on capacitance swing: +20%
Operating torque: 0.5–6.5 Ncm

cap. swing (pF)	*zero cap. (pF)*	*max. working voltage_ ($V_{d.c.}$)*	*temp. coeff. (10^{-6}/deg C)*
⩾6.4	⩽3.5	500	40 ± 100
⩾10	⩽3.5	325	30 ± 75
⩾16	⩽3.5	250	20 ± 75
⩾25	⩽3.5	250	10 ± 50

type		*maximum dimensions (mm)*		*catalog number 2222 804 .....*			
		below chassis (a)	*above chassis (b)*	6.4 *pF*	10 *pF*	16 *pF*	25 *pF*
with tags trim-key adjustment	non-insulated rotor	3.5	27	20021	20022	20023	20024
	insulated rotor	7.5	27	20001	20002	20003	20004

type		*maximum dimensions (mm)*		*catalog number 2222 804 . . . . .*			
		below chassis (a)	*above chassis (b)*	6.4 *pF*	10 *pF*	16 *pF*	25 *pF*
with tags, screw-driver adjustment	non-insulated rotor	3.5	41.5	20031	20032	20033	20034
	insulated rotor	7.5	41.5	20011	20012	20013	20014
with pins, trim-key adjustment	non-insulated rotor	3.5	29	20041	20042	20043	20044
with pins, screw-driver adjustment	non-insulated rotor	3.5	43.5	20051	20052	20053	20054

Air dielectric trimmers

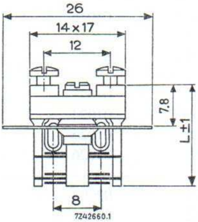


Fig. 1

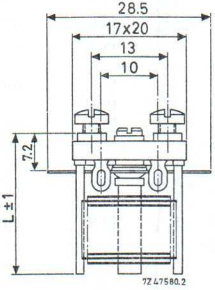


Fig. 2

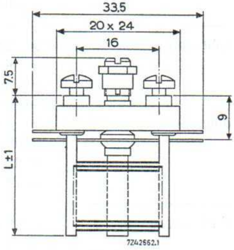


Fig. 3

Temperature range: −40 to +85°C
Temperature coefficient: (150±150) 10^{-6}/deg C
Min. parallel damping at 1.5 MHz: 10 MΩ
Tolerance on capacitance: +20 % with a minimum of 1 pF
Operating torque: 2–6 Ncm

type	*Fig.*	*cap. swing (pF)*	*zero cap. (pF)*	*dimension L (mm)*	*catalog number* 2222 804	
					without locking device	*with locking device*
single-stator	1	≥ 2.5	≤3	17.5	00001	
		≥ 4	≤3	17.5	00002	
		≥ 6.4	≤3 1)	17.5	00003	
		≥ 10	≤3	21	00004	
		≥ 16	≤3	21	00005	
split-stator	1	≥ 1.6	≤2	17.5	00006	
		≥ 2.5	≤2 2)	21	00007	
		≥ 4	≤2.5	21	00008	
differential	1	≥ 10	≤3.5 3)	21	00009	
		≥ 16	≤3.5	21	00011	
single-stator	2	≥ 6.4	≤3	16	01001	01006
		≥ 10	≤3	16	01002	01007
		≥ 16	≤3.5 1)	19.5	01003	01008
		≥ 25	≤3.5	19.5	01004	01009
		≥ 40	≤4	19.5	01005	01011
split-stator	2	≥ 2.5	≤2	16	01012	01015
		≥ 4	≤2.5 2)	19.5	01013	01016
		≥ 6.4	≤2.5	19.5	01014	01017
differential	2	≥ 6.4	≤3	16	01018	01023
		≥ 10	≤3 3)	16	01019	01024
		≥ 16	≤3.5	19.5	01021	01025
		≥ 25	≤3.5	19.5	01022	01026
single-stator	3	≥ 10	≤3.5	23	02001	02007
		≥ 16	≤3.5	23	02002	02008
		≥ 25	≤4 1)	23	02003	02009
		≥ 40	≤4.5	26.5	02004	02011
		≥ 64	≤5	26.5	02005	02012
		≥100	≤5.5	36.5	02006	02013

1) Measured between stator and rotor

2) Measured between the two stators

3) Measured between stators and rotor

type	*Fig.*	*cap. swing (pF)*	*zero cap. (pF)*	*dimension L (mm)*	*catalog number 2222 804 . . . . .* *without locking device*	*with locking device*
split-stator	3	⩾ 2.5	⩽2	23	02014	02021
		⩾ 4	⩽2	26.5	02015	02022
		⩾ 6.4	⩽2 [1]	26.5	02016	02023
		⩾ 10	⩽2.5	26.5	02017	02024
		⩾ 16	⩽3	36.5	02018	02025
		⩾ 25	⩽3	36.5	02019	02026

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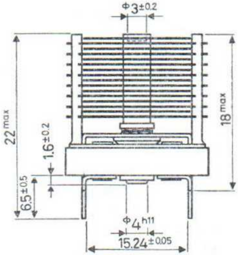
[1] Measured between the two stators

Temperature range: −40 to +85 °C
Temperature coefficient: ⩽150.10⁻⁶/deg C
Min. parallel damping at 1.5 MHz: 10 MΩ
Tolerance on capacitance: +10% with a minimum of 1 pF
Operating torque: 2–6 Ncm



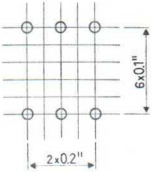


Fig. 7

type	*capacitance swing (pF)*	*zero capacitance (pF)*	*catalog number 2222 804 . . . . .*
single-stator	⩾ 6.4	⩽3	01027
	⩾10	⩽3	01028
	⩾16	⩽3.5 [1]	01029
	⩾25	⩽3.5	01031
	⩾40	⩽4	01032

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[1] Measured between stator and rotor

VARIABLE CAPACITORS

type	*capacitance swing (pF)*	*zero capacitance (pF)*	*catalog number 2222 804.....*
split-stator	≥ 2.5	≤2	01033
	≥ 4	≤2.5 1)	01034
	≥ 6.4	≤2.5	90541
differential	≥ 6.4	≤3	01035
	≥10	≤3 2)	01036
	≥16	≤3.5	01037
	≥25	≤3.5	01038

1) Measured between the two stators. 2) Measured between stators and rotor.

Film dielectric trimmers

Temperature range: −40 to +70°C
Max. working voltage: 100 $V_{d.c.}$
Soldering: 260°C, 3 s

max. cap. (pF)	*min. cap. (pF)*	*temp. coeff. (10^{-6}/deg C)*	*par. damping at 1.0 MHz (MΩ)*	*operating torque (Ncm)*	*Fig.*	*catalog number 2222 808.....*	
						top adjustment	*top and bottom adjustment*
≥ 3.5	≤1.2	−550±250	>10	0.1–1.5	1	00014	
≥ 5.5	≤1.4	−750±300	>10	0.1–1.5	1	00004	00011
≥10	≤2	−200±300	>3	0.1–1.5	1	00005	00012
≥22	≤2	−350±250	>3	0.1–1.5	1	00006	00013
≥40	≤5.5	−400±300	>3	0.2–2.5	2	91503	
≥65	≤5.5	−200±300	>3	0.2–2.5	2	01001	01004

Temperature range: −40 to +150°C
Max. working voltage: 500 V

max. cap. (pF)	*min. cap. (pF)*	*temp. coeff. (10^{-6}/deg C)*	*tan δ 1.0 MHz (MΩ)*	*operating torque (Ncm)*	*Fig.*	*catalog number 2222 809*
≥3	≤1	−200±150	$<10.10^{-4}$	0.1–1.5	3	05001
≥9	≤1.8	−250±75	$<10.10^{-4}$	0.25–2.0	3	05002
≥18	≤2	−250±75	$<25.10^{-4}$	0.25–2.0	3	05003

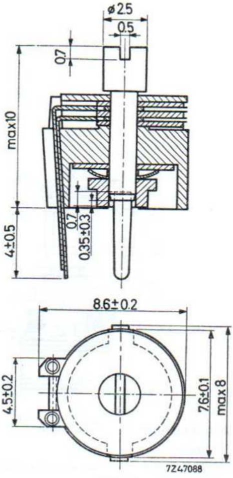


Fig. 1

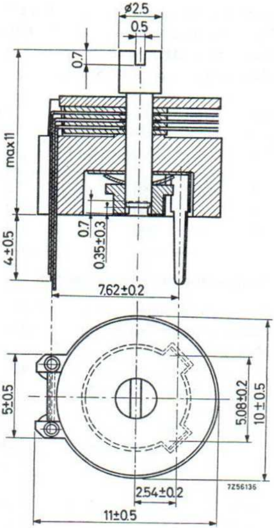


Fig. 2

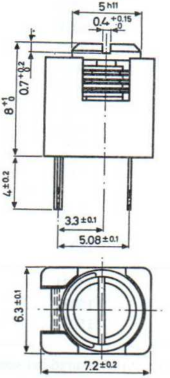


Fig. 3

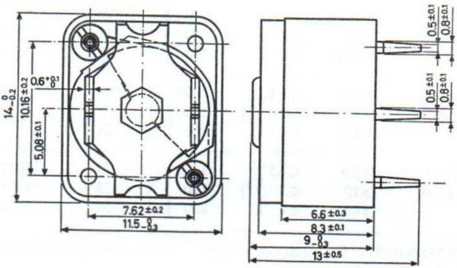


Fig. 4

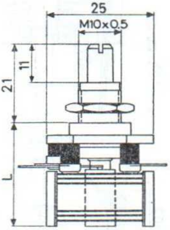
VARIABLE CAPACITORS

Temperature range: −40 to +150°C
Temperature coefficient: $(-150 \pm 150)\ 10^{-6}$/deg C
Tan δ at 1.0 MHz: $<10.10^{-4}$
Operating torque: 1.0–3.5 Ncm

cap. swing (pF)	*zero cap. (pF)*	*Max. working voltage ($V_{d.c.}$)*	*Fig.*	*catalog number* 2222 809 .....
⩾40	⩽4	350	4	07008
⩾40	⩽4	200	4	07011
⩾100	⩽4	200	4	07015

Air dielectric correcting capacitors

Temperature range: −40 to +85°C
Temperature coefficient: 25.10^{-6}/deg C
Max. working voltage: 75% of test voltage
Tolerance on capacitance: +10% with a minimum of 1 pF
Operating torque: 1.5–4 Ncm



type	*cap. swing (pF)*	*zero cap. (pF)*	*test voltage ($V_{d.c.}$)*	*dim. L (mm)*	*catalog number with non-insulated rotor*	2222 804 ..... *with insulated rotor*
single-stator	⩾2.5	⩽2.5	1500	23	15001	15017
	⩾4	⩽2.5	1500	23	15002	15018
	⩾6.4	⩽3	1500	23	15003	15019
	⩾10	⩽3	1000	23	15004	15021
	⩾16	⩽3 1)	1000 1)	23	15005	15022
	⩾25	⩽4	1000	28	15006	15023
	⩾40	⩽4	800	28	15007	15024
	⩾64	⩽4	800	28	15008	15025
	⩾100	⩽4	650	28	15009	15026
split-stator	⩾1.6	⩽1.5	2000	23		15027
	⩾4	⩽2.0 2)	1250 2)	28		15028
	⩾10	⩽2.5	800	28		15029
differ-ential	⩾2.5	⩽2.5	1500	23	15014	15031
	⩾10	⩽3 3)	800 3)	23	15015	15032
	⩾40	⩽4	800	28	15016	15033

1) Measured between stator and rotor. 2) Measured between the two stators. 3) Measured between stators and rotor.

Film dielectric variable capacitors

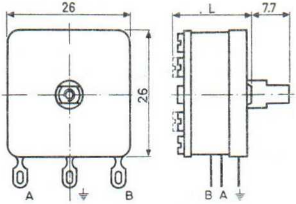


Fig. 1

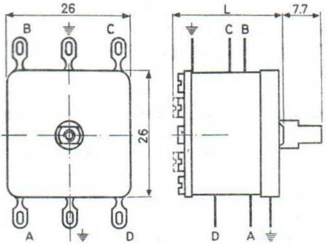


Fig. 2

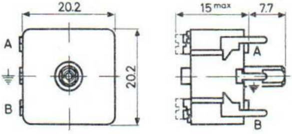


Fig. 3

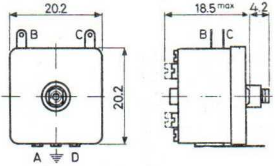


Fig. 4

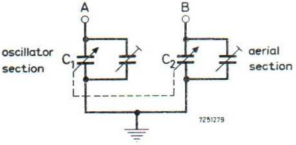


Fig. 5

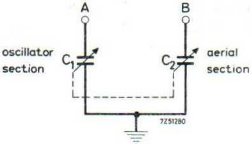


Fig. 6

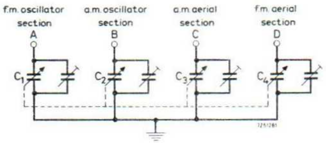


Fig. 7

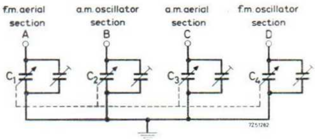


Fig. 8

VARIABLE CAPACITORS

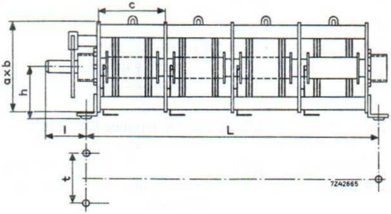
Temperature range: −25 to +70°C
Max. working voltage: 50 V_p
Min. parallel damping at 1.5 MHz: 3 MΩ

sections	*cap. swing (pF)*	*zero cap. (pF)*	*law and ganging tol. (%)*	*temp. coeff.* (10^{-6}/*deg C*)	*operating torque (Ncm)*	*Figs.*	L_{max} *(mm)*	*cat. number* 2222 807 .....
a.m. aerial	385	5	±2	−50±200	0.4–4	1,6	19	10048
a.m. oscillator	385	5	±2					
a.m. aerial	195	6	±3	−100±400	0.4–4	3,5		10066
a.m. oscillator	195	5.5	±3					
a.m. aerial	195	6	±3	−100±400	0.4–4	3,5		10103
a.m. oscillator	80	5.5	±3					
a.m. aerial	195	6	±3	−100±400	0.4–4	3,5		10039
a.m. oscillator	80	5.5	±3					
a.m. aerial	280	7	±2	−50±350	0.4–4.5	2,7	25	10055
a.m. oscillator	280	7	±2					
f.m. aerial	12	7	±2					
f.m. oscillator	12	7	±2					
a.m. aerial	195	6	±3	−200±200	0.4–4.5	4,8		10043
a.m. oscillator	80	5.5	±3					
f.m. aerial	9.5	5.5	±3					
f.m. oscillator	9.5	5.5	±3					

Precision tuning capacitors

Temperature range: −40 to +85 °C
Min. parallel damping at 1.5 MHz: 10 MΩ
Law and ganging tolerances: ±0.7 %

temp. coeff. (10^{-6}/*deg C*)		*number of gangs*
$a \times b =$ 40 × 40 *mm*	$a \times b =$ 60 × 60 *mm*	
20 ± 20	30 ± 30	1
20 ± 20	30 ± 30	2
30 ± 30	50 ± 50	3
50 ± 50	50 ± 50	4



dimensions in mm		$a \times b$	*number of gangs*					
			normal gap				*wide gap*	
			1	2	3	4	1	2
distance between mounting holes (±0.5)	L	40 × 40	45	76.5	108	139.5	65	116.5
		60 × 60	67	117.5	168	218.5	103	189.5
	t	40 × 40	22	22	22	22	22	22
		60 × 60	35	35	35	35	35	35
compartment length (±0.2)	c	40 × 40	31.5	31.5	31.5	31.5	51.5	51.5
		60 × 60	50.5	50.5	50.5	50.5	86.5	86.5
shaft length (±0.5)	l	40 × 40	16	16	16	16	16	16
		60 × 60	18	18	18	18	18	18
shaft height (±0.5)	h	40 × 40	22.5	22.5	22.5	22.5	22.5	22.5
		60 × 60	32.5	32.5	32.5	32.5	32.5	32.5

VARIABLE CAPACITORS

size a × b = 40 × 40 mm, linear capacitance law, insulated or non-insulated rotor

single-stator (1–4 gangs) or differential$^{1)}$ (1 gang)	C_{var} (pF)	16	25	40	64	100	160	250
	$C_0 \pm 1$ (pF)$^{2)}$ normal gap	8	8.5	9	9	10	11	11.5
	wide gap			14	15	15.5	16	18.5
split-stator (1–4 gangs)	C_{var} (pF)	6.4	10	16	25	40	64	
	$C_0 \pm 1$ (pF) normal gap	3	3	3.6	4	4	4	
	wide gap		4	4.5	4.5	5	5	

size a × b = 60 × 60 mm, linear capacitance law, insulated or non-insulated rotor

single-stator (1–4 gangs)	C_{var} (pF)	100	125	160	200	250	320	400	500	640
	$C_0 \pm 1$ (pF) normal gap	14.5	15	15.5	16	16	17.5	19	20.5	21.5
	wide gap				26	26.5	27.5	28	29.5	30.5
split-stator (1–4 gangs)	C_{var} (pF)	25	32	40	50	64	80	100	125	
	$C_0 \pm 1$ (pF) normal gap	5	5	5	5	5.5	5.5	5.5	6	
	wide gap				7	8.5	8	8	8	

---

1) Differential type only up to and including $C_{var} = 160$ pF.

2) For the differential version the C_0 values are 1 pF less than the tabulated values.

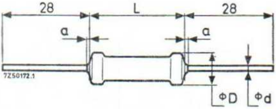
size a × b = 60 × 60 mm, logarithmic capacitance law, insulated or non-insulated rotor

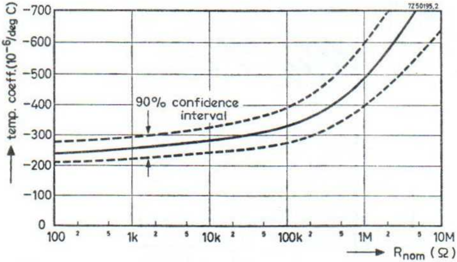
single-stator (1–4 gangs)	C_{var} (pF)	100	125	160	200	250	320	400	500
	$C_0 \pm 1$ (pF) normal gap	13	13	14.5	14.5	14	14	14	14
	wide gap				23	22.5	22.5	22.5	21.5
split-stator (1–4 gangs)	C_{var} (pF)	25	32	40	50	64	80	100	125
	$C_0 \pm 1$ (pF) normal gap	5	5	5.5	5.5	5.5	5.5	5.5	5.5
	wide gap				6.5	6.5	6.5	7	6.5

FIXED RESISTORS

Carbon film resistors

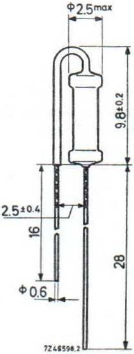
style	$D_{max.}$	$L_{max.}$	$a_{max.}$	d
CR16	1.6	4.5	1.0	0.4
CR25	2.5	7.5	1.0	0.6
CR37	3.7	10	1.0	0.7
CR52	5.2	18	1.2	0.8
CR68	6.8	18	1.2	0.8
[1]) CR93 (5 %)	9.3	32	1.2	0.8
CR93 (1 %)	9.3	38.5	3.2	1





Temperature coefficient as a function of the resistance value, applicable to all resistor styles.

Style CR25A
The bent lead is partly covered with an insulating lacquer having a breakdown voltage of minimum 50 $V_{d.c.}$



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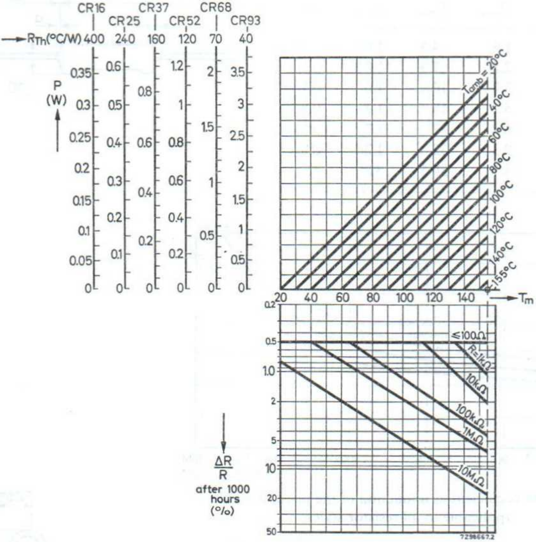
[1]) Lead length 36 mm.

Minimum ambient temperature $-55\,^\circ\mathrm{C}$
Max. hot-spot temperature $155\,^\circ\mathrm{C}$



Performance nomogram for the different styles of resistor, showing the relationship between power dissipation P, ambient temperature T_{amb}, hot-spot temperature T_m, resistance value R and max. resistance drift $\Delta R/R$ after 1000 hours operation; maximum voltage not being taken into account.

Standard range

style	*limiting voltage* V_{rms}	*resistance range*	*tolerance* ±	*series*	*catalog number*
CR16	150	10 Ω–220 kΩ	5%	E24	2322 210 03 . . .
		270 kΩ–1 MΩ	10%	E12	2322 210 02 . . .
CR25	250	1 Ω–1 MΩ	5%	E24	2322 101 33 . . .
		10 Ω–220 kΩ	2%	E24	2322 101 34 . . .
		1.2 MΩ–10 MΩ	10%	E12	2322 101 32 . . .
CR25A	250	1 Ω–1 MΩ	5%	E24	2322 106 33 . . .
		10 Ω–220 kΩ	2%	E24	2322 106 34 . . .
		1.2 MΩ–10 MΩ	10%	E12	2322 106 32. . .
CR37	350	1 Ω–1 MΩ	5%	E24	2322 212 13 . . .
		10 Ω–1 MΩ	2%	E24	2322 212 14 . . .
		10 Ω–1 MΩ	1%	E24	2322 222 0. . 0.
		1.2 MΩ–10 MΩ	10%	E12	2322 212 12 . . .
CR52	500	1 Ω–1 MΩ	5%	E24	2322 101 63 . . .
		10 Ω–1 MΩ	1%	E24	2322 223 8. . 0.
		1.2 MΩ–22 MΩ	10%	E12	2322 101 62 . . .
CR68	750	1 Ω–1.6 MΩ	5%	E24	2322 214 13 . . .
		10 Ω–1.6 MΩ	1%	E24	2322 224 0. . 0.
		1.8 MΩ–22 MΩ	10%	E12	2322 214 12 . . .
CR93	1000	10 Ω–22 MΩ	5%	E24	2322 215 13 . . .
		10 Ω–1.6 MΩ	1%	E24	2322 225 8. . 0.

Composition of the catalog number

In the above mentioned catalog number replace the first two dots by the first two digits of the resistance value. Replace the third dot by a figure according to the following table:

1– 9.1 Ω	8	10– 91 kΩ	3
10– 91 Ω	9	100–910 kΩ	4
100–910 Ω	1	1– 9.1 MΩ	5
1– 9.1 kΩ	2	10– 22 MΩ	6

Metal film resistors

	style	*Fig.*	$D_{max.}$	$L_{max.}$	*d*
moulded type	MR31	1	3.1	7.0	0.6
	MR39	1	3.9	11.1	0.6
	MR58	1	5.8	16.6	0.6
	MR81	1	8.1	20.6	0.8
lacquered type	MR25	2	2.5	7.0	0.6
	MR30	2	3.0	10.0	0.6

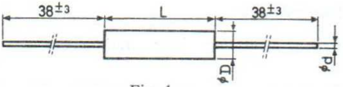


Fig. 1

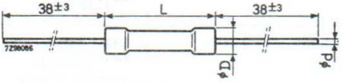
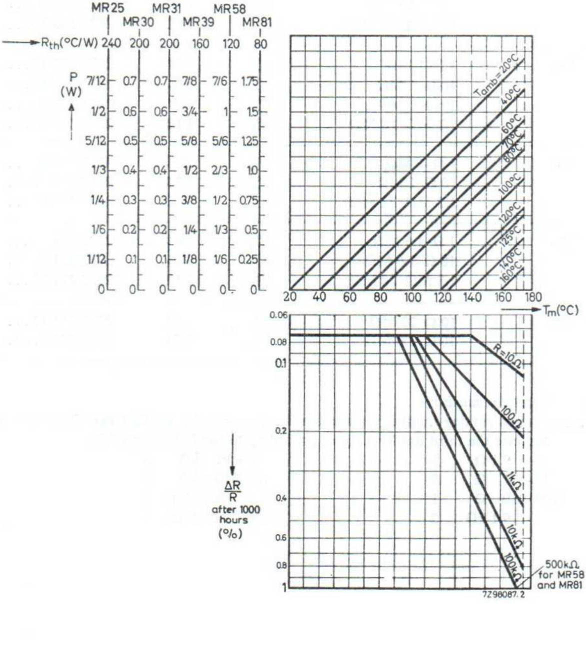


Fig. 2



Standard range

	max. temp. coeff. (10⁻⁶/°C)	*resistance range*	*tolerance ± %*	*series*	*limiting voltage*	*cat. number 2322 followed by*
MR31E	+ 25	49.9 Ω–100 kΩ	0.1/0.25/0.5/1	E192	250	123 . . . . .
C	+ 50	49.9 Ω–100 kΩ	0.1/0.25/0.5/1	E192	250	124 . . . . .
D	+100	10 Ω–100 kΩ	1	E96	250	125 5 . . . .
MR39E	+ 25	49.9 Ω–499 kΩ	0.1/0.25/0.5/1	E192	350	126 . . . . .
C	+ 50	49.9 Ω–499 kΩ	0.1/0.25/0.5/1	E192	350	127 . . . . .
D	+100	10 Ω–301 kΩ	1	E96	350	128 5 . . . .
MR58E	+ 25	49.9 Ω–1 MΩ	0.1/0.25/0.5/1	E192	500	129 . . . . .
C	+ 50	49.9 Ω–1 MΩ	0.1/0.25/0.5/1	E192	500	130 . . . . .
D	+100	10 Ω–681 kΩ	1	E96	500	131 5 . . . .
MR81E	+ 25	24.9 Ω–1 MΩ	0.1/0.25/0.5/1	E192	750	132 . . . . .
C	+ 50	24.9 Ω–1 MΩ	0.1/0.25/0.5/1	E192	750	133 . . . . .
D	+100	10 Ω–1 MΩ	1	E96	750	134 5 . . . .
MR25	+100	4.99 Ω–100 kΩ	1	E96	250	151 5 . . . .
MR25	+100	5.1 Ω–100 kΩ	2	E24	250	151 4 . . . .
MR30	+100	5.1 Ω–300 kΩ	2	E24	350	152 4 . . . .
MR30	+100	4.99 Ω–301 kΩ	1	E96	350	152 5 . . . .

Catalog number suffix

2322 . . . .

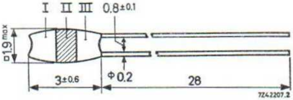
code for tolerance:

±2	% = 4
±1	% = 5
±0.5	% = 6
±0.25	% = 7
±0.1	% = 8

code for resistance value: three significant digits of the resistance value followed by a digit for the multiplier,

8 for R of 4.99 to 9.88 Ω
9 for R of 10 to 98.8 Ω
1 for R of 100 to 988 Ω
2 for R of 1 to 9.88 kΩ
3 for R of 10 to 98.8 kΩ
4 for R of 100 to 988 kΩ
5 for R of 1 MΩ

Insulated pin-head carbon resistors



Max. dissipation at 70°C	0.05 W
Resistance values	47 Ω to 120 kΩ, E12 series
Tolerance	±10% and ±20%
Noise	< 10 μV/V
Limiting voltage, peak value	50 V_p
Temperature coefficient (from +25 to +70°C)	(+1000 to −2000) 10^{-6}/deg C
Ambient temperature range	−10 to +100°C
International colour code	

FIXED RESISTORS

Composition of the catalog number

For tolerance +10%: 2322 120 22 . . .

For tolerance +20%: 2322 120 21 . . .

The first two digits of
the resistance value,
neglecting a decimal point.

digit for multiplying factor:

9 = × 1

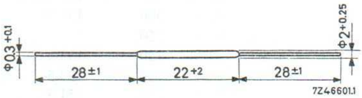
1 = × 10

2 = × 100

3 = × 1000

4 = × 10000

Low-ohmic glass-sealed wire resistors



Maximum dissipation at 40°C	1 W
Resistance values	0.1 to 6.8 Ω, E12 series
Tolerance	±10%
Temperature coefficient	$(-50$ to $+150)\ 10^{-6}$/deg C
Operating body temperature	−25 to +275°C

Composition of the catalog number

2322 327 61 . . .

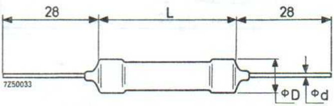
The first two digits of
the resistance value,
neglecting a decimal point.

digit for multiplying factor:

7 = × 0.01

8 = × 0.1

Precision wire-wound resistors



Max. dissipation at 40°C	0.4 to 1.8 W
Resistance values	1 Ω to 57 kΩ, E192 series
Tolerance	±0.5% and ±0.25%
Temperature coefficient (±)	$<20.10^{-6}$/deg C
Ambient temperature range	−55 to +110°C

P_{nom} (*W*)	*nominal resistances* *min.* (Ω)	*nominal resistances* *max.* (*k*Ω)	$D_{\text{max.}}$	$L_{\text{max.}}$	*d*	*catalog series number*
0.4	1	3.2	4	13	0.8	260
0.6	3	7	5	19	0.8	261
0.7	6	12.5	5	28	0.8	262
1.2	17	33	7	43	1	263
1.8	25	57	7	67	1	264

Composition of the catalog number

2322 . . . .

Series number, see above

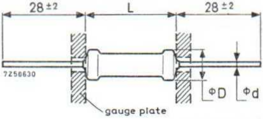
Tolerance code: 5 = ±0.5 %
6 = ±0.25 %

Multiplier code: 8 = ×0.01 Ω
9 = ×0.1 Ω
1 = ×1 Ω
2 = ×10 Ω
3 = ×100 Ω

The first three digits of the resistance value, neglecting a decimal point

Cemented wire-wound resistors

style	$D_{\text{max.}}$	$L_{\text{max.}}$	*d*
WR0617	6	19	0.6
WR0825	8	27	0.8
WR0842	8	44	0.8
WR0865	8	67	0.8



FIXED RESISTORS

Max. permissible surface temperature	400 °C
Ambient temperature range	−40 to +155 °C
Temperature coefficient	-50 to $+160\cdot10^{-6}$/degC

style	*dissipation at 40 °C*	*resistance range (E12 series)*	*tolerance*	*catalog number*
WR0617	4 W	5.6–47 Ω 56–4700 Ω	±10% ±5%	2322 325 36 . . . 2322 325 37 . . .
WR0825	7 W	6.8–27 Ω 33–10000 Ω	±10% ±5%	2322 325 26 . . . 2322 325 27 . . .
WR0842	9.5 W	10–15000 Ω	±5%	2322 325 17 . . .
WR0865	15 W	15–27000 Ω	±5%	2322 325 07 . . .

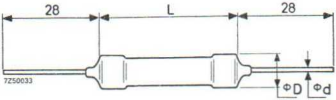
Catalog number suffix

In the above mentioned catalog number replace the first two dots by the first two digits of the resistance value. Replace the third dot by a figure according to the following table:

5.6– 9.1 Ω: 8
10 – 91 Ω: 9
100 – 910 Ω: 1
1000 – 9100 Ω: 2
10000 –27000 Ω: 3

Enamelled wire-wound resistors

Max. dissipation at 40 °C (P_{nom})	5.5, 8, 10 and 16 W
Resistance values	4.7 Ω–100 kΩ, E12 series
Tolerances	±10% and ±5%
Temperature coefficient	-50 to $+140\cdot10^{-6}$/deg C
Ambient temperature range	−55 to +155 °C



d = 1.0 mm

P_{nom} (*W*)	*resistance values* *tolerance* (± . . %)	*min.* (Ω)	*max.* (Ω)	$D_{max.}$	$L_{max.}$	*catalog number:* 2322 320 *followed by*
5.5	10	4.7	180	8	20	31 . . .
5.5	5	220	15000	8	20	32 . . .
8	10	4.7	47	8	29	21 . . .
8	5	56	33000	8	29	22 . . .
10	5	10	56000	8	44	12 . . .
16	5	15	100000	8	67	02 . . .

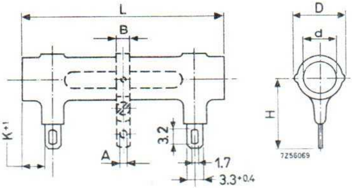
Catalog number suffix

This is formed by the first two digits of the resistance value, neglecting a decimal point, followed by a multiplier

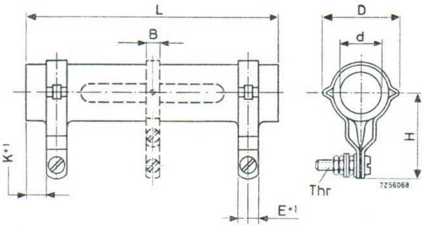
Multiplier code: × 0.1 Ω = 8   × 10^2 Ω = 2
× 1 Ω = 9   × 10^3 Ω = 3
× 10 Ω = 1   × 10^4 Ω = 4

Fixed and adjustable wire-wound resistors with side terminations

	cemented	*enamelled*
Max. dissipation at 40 °C (P_{nom})	8(10)–250 W	8(10)–100 W
Resistance values (E12 series)	1 Ω–11 kΩ	160 Ω–120 kΩ (47 kΩ)
Tolerance	±5 % (±10 %)	±5 %
Temperature coefficient	(−50 to +140) 10^{-6}/deg C	
Ambient temperature range	−55 to +155 °C	



Resistors with $P_{nom} \leqslant 40$ W



Resistors with $P_{nom} \geqslant 60$ W

P_{nom} (W)	*dimensions in mm*								
	$D_{max.}$	$d_{min.}$	*H*	*K*	*E*	$L_{max.}$	*B*	*A*	*Thr*
8	11.5	5	14	2.5	—	26	—	—	—
10	11.5	5	14	4	—	41	5	2.8	—
16	11.5	5	14	4	—	63	5	2.8	—
25	16	8	14	4	—	64	6	3.2	—
40	16	8	14	4	—	103	6	3.2	—
60	32	12.5	33	6	9	103	6	—	M4
100	32	12.5	33	6	9	165	6	—	M4
160	44	20	40	8	11	165	8	—	M4
250	44	20	40	8	11	256	8	—	M4

coating	P_{nom} 1)	*resistance values* R_{nom} 1)				*short circuit* 1)	$D_{max.}$	$L_{max.}$	*catalog number 2322 followed by*	
		tol. (± .. %)	*min.* (Ω)	*maxim.* (Ω)						
	(*W*)			*fixed*	*adjust.*	(% R_{nom})	*mm*	*mm*	*fixed*	*adjust.*
cement	8	10	1	100			11.5	26	323 14 . . .	
		5	110	150					323 34 . . .	
enamel		5	160	6800					321 34 . . .	
cement	10	10	1.2	27	27	9	11.5	41	323 12 . . .	324 12 . . .
		5	30	300	300				323 32 . . .	324 32 . . .
enamel		5	330	12000	3300				321 32 . . .	322 32 . . .
cement	16	10	1.5	2.7	2.7	5	11.5	63	323 10 . . .	324 10 . . .
		5	3	620	620				323 30 . . .	324 30 . . .
enamel		5	680	24000	6800				321 30 . . .	322 30 . . .
cement	25	10	2.7	15	15	4	16	64	323 08 . . .	324 08 . . .
		5	16	820	820				323 28 . . .	324 28 . . .
enamel		5	1000	39000	9100				321 28 . . .	322 28 . .
cement	40	5	4.7	1600	1600	2.5	16	103	323 26 . . .	324 26 . . .
enamel		5	1800	75000	18000				321 26 . . .	322 26 . . .
cement	60	5	3	2200	2200	3	32	103	323 24 . . .	324 24 . . .
enamel		5	2400	68000	24000				321 24 . . .	322 24 . . .
cement	100	5	6.8	4300	4300	1.5	32	165	323 23 . . .	324 23 . . .
enamel		5	4700	120000	47000				321 23 . . .	322 23 . . .
cement	160	5	10	6800	6800	1.5	44	165	323 22 . . .	324 22 . . .
cement	250	5	16	11000	11000	1	44	256	323 21 . . .	324 21 . . .

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1) The adjustable contact short-circuits a number of windings. The maximum resistance loss has been given as a percentage of the nominal resistance. Nominal dissipation and nominal resistance values apply if no contact strap were connected.

FIXED RESISTORS

Composition of the catalog number

2322 . . . .

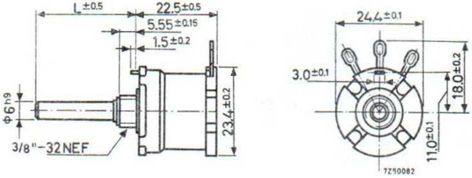
See table

The first two digits of the resistance value, neglecting a decimal point.

Multiplier code: 8 = × 0.1 Ω
9 = × 1 Ω
1 = × 10 Ω
2 = × 10^2 Ω
3 = × 10^3 Ω
4 = × 10^4 Ω

VARIABLE RESISTORS

Wire-wound trimming potentiometers



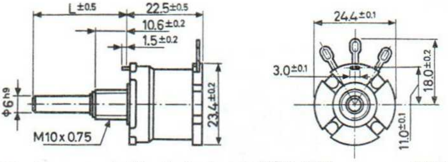
Maximum permissible dissipation	at 40°C	3 W
	at 70°C	2 W

adjustment	*spindle length*	*catalog number*
screw driver	9 mm	2322 000 02 . . .
knob	15 mm	2322 000 22 . . .
knob	20 mm	2322 000 32 . . .

resistance values (Ω) ±5%	*catalog number suffix*
47	479
50	509
68	689
75	759
100	101
150	151
200	201
220	221
250	251
330	331

resistance values (Ω) ±5%	*catalog number suffix*
470	471
500	501
680	681
750	751
1000	102
1500	152
2000	202
2200	222
2500	252
3300	332

Wire-wound potentiometers



Maximum permissible dissipation at 40°C: 3 W
at 70°C: 2 W

adjustment	*spindle length L*	*catalog number*
screw driver	14 mm	2322 003 0 ....[1])
		010 0 ....[2])
knob	17 mm	2322 003 2 ....
		010 2 ....
knob	20 mm	2322 003 3 ....
		010 3 ....
knob	30 mm	2322 003 4 ....
		010 4 ....
knob	60 mm	2322 003 5 ....
		010 5 ....

1 = R ± 10%
2 = R ± 5%
6 = R ± 10% with center tap
7 = R ± 5% with center tap

resistance value in Ω	*temperature coefficient in 10^{-6}/deg C*	*catalog number suffix*
2.2	0 to +600	228
3.3	0 to +600	338
4.7	0 to +600	478
6.8	0 to +600	688
10	0 to +600	109
15	0 to +600	159
22	0 to +600	229
33	−25 to +600	339
47	−25 to +600	479
68	−25 to +25	689
100	−25 to +25	101
150	−25 to +25	151
220	−25 to +25	221
330	−25 to +140	331
470	−25 to +140	471
680	0 to +140	681
1000	0 to +140	102
1500	0 to +140	152
2200	0 to +140	222
3300	0 to +140	332
4700	0 to +140	472
6800	0 to +140	682
10000	−20 to +140	103
15000	−20 to +140	153
22000	−20 to +140	223

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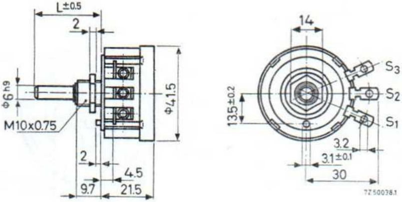
[1]) 2322 003 for radial soldering tags
[2]) 2322 010 for tags in axial direction

Wire-wound potentiometers



Maximum permissible dissipation at 40°C: 3 W

adjustment	*spindle length L*	*catalog number*
screwdriver	14	2322 004 2 . . . .
knob	20	3 . . . .
knob	25	4 . . . .
knob	30	5 . . . .
knob	35	6 . . . .
knob	80	7 . . . .

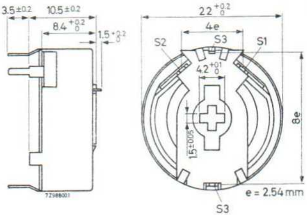
1 for $R \pm 10\%$
2 for $R \pm 5\%$ (only for $R > 75\ \Omega$)

resistance value in Ω	*T.C. in 10^{-6}/deg C*	*catalog number suffix*
10	0 to +600	109
15	0 to +600	159
20	0 to +600	209
25	0 to +600	259
35	0 to +600	359
50	0 to +600	509
75	0 to +600	759
100	−25 to +25	101
150	−25 to +25	151
200	−25 to +25	201
250	−25 to +25	251
350	−25 to +25	351
500	−25 to +25	501
750	−25 to +25	751
1000	−25 to +25	102

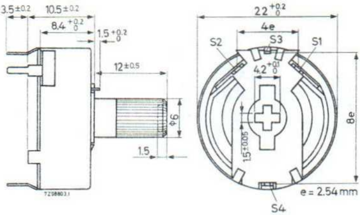
resistance value in Ω	*T.C. in 10^{-6}/deg C*	*catalog number suffix*
1500	0 to +140	152
2000	0 to +140	202
2500	0 to +140	252
3500	0 to +140	352
5000	0 to +140	502
7500	0 to +140	752
10000	0 to +140	103
15000	0 to +140	153
20000	0 to +140	203
25000	0 to +140	253
35000	−20 to +20	353
50000	−20 to +20	503

VARIABLE RESISTORS

Wire-wound trimming potentiometers



Non-tapped potentiometer without knob



Tapped potentiometer with knob

For mounting on printed-wiring boards
Maximum permissible dissipation at 40°C: 2 W
at 70°C: 1 W

Catalog number: 2322 011 . . . . .

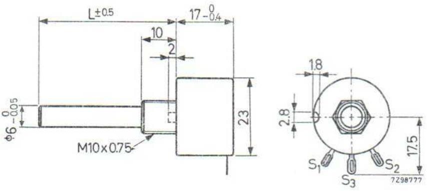
02 = without tap, without knob
03 = with tap, without knob
22 = without tap, with knob
23 = with tap, with knob

resistance code, see table

resistance value ±10 % (Ω)	*resistance code*
2.2	228
3.3	338
4.7	478
6.8	688
10	109
15	159
22	229
33	339
47	479
68	689
100	101

resistance value ±10 % (Ω)	*resistance code*
120	121
150	151
180	181
220	221
330	331
470	471
680	681
1000	102
11 + 11	229
50 + 50	101
150 + 150	301

Wire-wound potentiometers



Maximum permissible dissipation at 70°C: 1 W

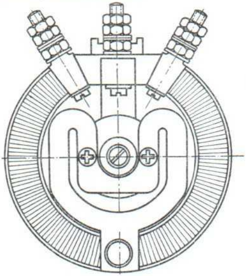
adjustment	*spindle length L*	*catalog number*	
screwdriver	14	2322 01 0....	2 = plastic spindle
knob	17	2....	3 = steel spindle
knob	25	3....	
knob	50	4....	
knob	60	5....	1 = $R \pm 10\%$
knob	20	6....	2 = $R \pm 5\%$ ($R > 47\ \Omega$)
knob	30	7....	

resistance value in Ω	*temperature coefficient in 10^{-6}/deg C*	*catalog number suffix*
2.2	0 to +600	228
3.3	0 to +600	338
4.7	0 to +600	478
6.8	0 to +600	688
10	0 to +600	109
15	0 to +600	159
22	−25 to +25	229
33	−25 to +25	339
47	−25 to +25	479
68	−25 to +25	689
100	−25 to +25	101
150	−25 to +25	151

resistance value in Ω	*temperature coefficient in 10^{-6}/deg C*	*catalog number suffix*
220	0 to +140	221
330	0 to +140	331
470	0 to +140	471
680	0 to +140	681
1000	0 to +140	102
1500	0 to +140	152
2200	0 to +140	222
3300	0 to +140	332
4700	0 to +140	472
6800	0 to +140	682
10000	−20 to +140	103
15000	−20 to +140	153
22000	−20 to +140	223

VARIABLE RESISTORS

Load potentiometers



max. perm. dissipation	*dimensions in mm diameter*	*length*)*	*catalog number*
25 W	36	26	2322 095 . . . . .
40 W	46	32	2322 096 . . . . .
100 W	66	48	2322 097 . . . . .

*) behind mounting panel

Temperature coefficient	$(-140 \text{ to } +140)10^{-6}$/deg C
Ambient temperature range	−55 to +100°C

Composition of the catalog number

2322 . . . .

code for nominal dissipation

code for resistance value, see Table

21 for spindle length = 17 mm

31 for spindle length = 36 mm

resistance values ±10%	*resistance code*	*resistance values* ±10%	*resistance code*
0.5 Ω [1]	507	100 Ω	101
0.75 [2]	757	150	151
1	108	200	201
1.5	158	250	251
2	208	350	351
2.5	258	500	501
3.5	358	750	751
5	508	1000	102
7.5	758	1500	152
10	109	2000	202
15	159	2500	252
20	209	3500	352
25	259	5000	502
35	359	7500	752
50	509	10000 [2]	103
75	759		

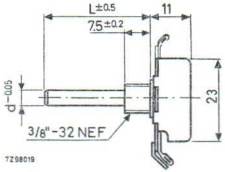
[1] Not available in 25 W and 100 W.

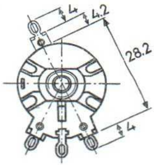
[2] Not available in 25 W.

Ganging units

For ganging two load potentiometers ganging units are available.

23 mm single carbon potentiometers





Max. permissible dissipation at 70°C

linear resistance law 0.125 W

logarithmic resistance law 0.0625 W

VARIABLE RESISTORS

types	*catalog number*
without switch	2322 350 . . . . .
with SPDT rotary switch	2322 352 . . . . .
with SPST rotary switch	2322 353 . . . . .
with DPST push-pull switch, 1A	2322 354 . . . . .
with DPST push-pull switch, 2A	2322 355 . . . . .
with DPDT push-pull switch	2322 356 . . . . .
with DPST rotary switch	2322 357 . . . . .

The catalog number prefix is followed by 3 digits for terminal and spindle type and then by 2 digits for resistance value and law.

spindle type (plastic)		*8th to 10th digit in catalog number*	
		tags	*pins*
plain, $d = 6$ mm,	$L = 18$ mm	706	756
	$L = 30$	703	753
	$L = 60$	707	757
with screw driver slot	$L = 11$ ¹)	710	760
with flat face	$L = 18$	740	790
	$L = 30$	743	793
	$L = 60$	747	797
plain, $d = \frac{1}{4}''$	$L = 30$	723	773
	$L = 60$	727	777

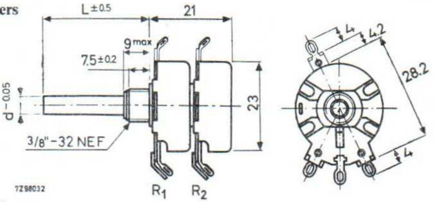
¹) not for potentiometers with a **push-pull** switch

resistance value ±20%	*11th and 12th digit in catalog number*		
	linear	*logarithmic*	
220 Ω	02		
300 Ω	19		59*)
470 Ω	03		43*)
1 kΩ	04	24	44*)
2.2 kΩ	05	25	45*)
4.7 kΩ	06	26	46*)
10 kΩ	07	27	47*)
22 kΩ	08	28	48*)
47 kΩ	09	29	49*)
100 kΩ	11	31	51*)
220 kΩ	12	32	52*)
470 kΩ	13	33	53*)
1 MΩ	14	34	54*)
2.2 MΩ	15	35	55*)

*) negative logarithmic

resistance value ±20%	*11th and 12th digit in catalog number*	
	linear	*logarithmic*
4.7 MΩ	16	
400 + 600 kΩ	89	
0.5 + 1.7 kΩ		81
5 + 17 kΩ		82
10 + 37 kΩ		86
20 + 80 kΩ		77
20 + 200 kΩ		67
50 + 170 kΩ		83
50 + 420 kΩ		73
100 + 370 kΩ		87
100 + 900 kΩ		64
200 + 800 kΩ		78
0.2 + 2 MΩ		68
0.5 + 1.7 MΩ		84

23 mm tandem carbon potentiometers



Max. permissible dissipation at 70°C

linear resistance law	0.125	W
logarithmic resistance law	0.0625	W

types	*catalog number*
without switch	2322 360 . . . . .
with SPST rotary switch	2322 362 . . . . .
with DPST push-pull switch, 1 A	2322 364 . . . . .
with DPST push-pull switch, 2 A	2322 365 . . . . .
with DPST rotary switch	2322 366 . . . . .

VARIABLE RESISTORS

The catalog number prefix is followed by 3 digits for terminal and spindle type and then by 2 digits for resistance value and law.

spindle type (plastic)		*8th to 10th digit in catalog number*	
		tags	*pins*
plain, $d=6$ mm,	$L=18$ mm	706	756
	$L=30$ mm	703	753
	$L=60$ mm	707	757
with screwdriver slot,	$L=11$ mm[1]	710	760
with flat face	$L=18$ mm	740	790
	$L=30$ mm	743	793
	$L=60$ mm	747	797
plain, $d=\frac{1}{4}''$,	$L=30$ mm	723	773
	$L=60$ mm	727	777

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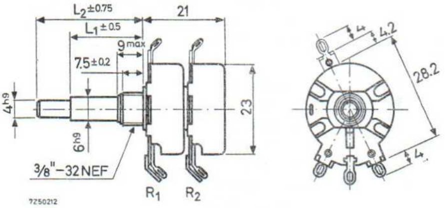
[1]) not applicable to types 2322 364, 2322 365, 2322 366

resistance value ±20%	*11th and 12th digit in catalog number*	
	linear	*logarithmic*
1 kΩ	04	24
2.2 kΩ	05	25
4.7 kΩ	06	26
10 kΩ	07	27
22 kΩ	08	28
22 kΩ*)	92	
47 kΩ	09	29
47 kΩ*)	93	
100 kΩ	11	31
100 kΩ*)	94	
220 kΩ	12	32
220 kΩ*)	95	
470 kΩ	13	33
470 kΩ*)	96	

resistance value ±20%	*11th and 12th digit in catalog number*	
	linear	*logarithmic*
1 MΩ	14	34
1 MΩ*)	97	
2.2 MΩ	15	35
4.7 MΩ	16	
5+17 kΩ		82
10+37 kΩ		86
20+80 kΩ		77
20+200 kΩ		67
50+170 kΩ		83
50+420 kΩ		73
100+900 kΩ		64
200+800 kΩ		78
400+600 kΩ	89	
0.2+2 MΩ		68
0.5+1.7 MΩ		84

*) balance potentiometer

23 mm twin carbon potentiometers



Max. permissible dissipation at 70 °C
linear resistance law 0.125 W
logarithmic resistance law 0.0625 W

types	*catalog number*
without switch	2322 470 . . . . .
with DPST rotary switch	2322 476 . . . . .

Composition of the catalog number suffix
2322 47 . .. ..
code for spindle length
code for resistance value and law of R_2
code for resistance value and law of R_1

spindle length	*code in catalog number*
$L_1 =$ 18 mm, $L_2 =$ 30.5 mm	0
$L_1 =$ 30 mm, $L_2 =$ 42.5 mm	1
$L_1 =$ 60 mm, $L_2 =$ 72.5 mm	2

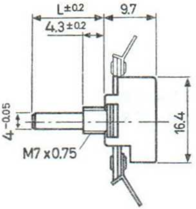
VARIABLE RESISTORS

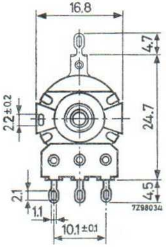
resistance value of R_1 and R_2, ±20%	*code in catalog number*		
	linear	*logarithmic*	
220 Ω	02		
300 Ω	19		59*
470 Ω	03		
1 kΩ	04	24	
2.2 kΩ	05	25	
4.7 kΩ	06	26	
10 kΩ	07	27	
22 kΩ	08	28	
47 kΩ	09	29	
100 kΩ	11	31	
220 kΩ	12	32	
470 kΩ	13	33	

resistance value of R_1 and R_2, ±20%	*code in catalog number*		
	linear	*logarithmic*	
1 MΩ	14	34	54*
2.2 MΩ	15	35	55*
4.7 MΩ	16		
5+17 kΩ		82	
50+170 kΩ		83	
50+420 kΩ		73	
400+600 kΩ	89		
200+800 kΩ		78	
100+900 kΩ		64	
0.2+2 MΩ		68	
0.5+1.7 MΩ		84	

*) negative logarithmic.

16 mm single carbon potentiometers





Max. permissible dissipation at 40 °C
linear resistance law 0.1 W
logarithmic resistance law 0.05 W

types	*catalog number*
without switch, with soldering tags or printed-wiring pins, with mounting bushing	2322 380 . . . . .
with s.p.s.t. rotary switch, with soldering tags or printed-wiring pins, with mounting bushing	2322 387 . . . . .
with s.p.s.t. rotary switch, with soldering tags or printed-wiring pins, with twist tags for mounting	2322 388 . . . . .
without switch, with bent printed-wiring pins, with mounting bushing	2322 389 . . . . .

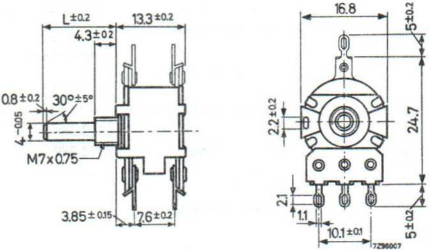
The catalog number prefix is followed by 3 digits for terminal and spindle type and then by 2 digits for resistance value and law.

spindle type (plastic)		*8th to 10th digit in catalog number*	
		tags	*pins*
with screwdriver slot	$L = 8$ mm	710	760
plain	$L = 10$ mm	711	761
	$L = 15$ mm	712	762
	$L = 20$ mm	715	765
	$L = 30$ mm	703	753
with flat face	$L = 10$ mm	742	792
	$L = 15$ mm	744	794
	$L = 20$ mm	746	796

resistance value ±20%	*11th and 12 th digit in catalog number*	
	linear	*logarithmic*
1 kΩ	04	24
2.2 kΩ	05	25
4.7 kΩ	06	26
10 kΩ	07	27
22 kΩ	08	28
47 kΩ	09	29
100 kΩ	11	31
220 kΩ	12	32
470 kΩ	13	33

resistance value ±20%	*11th and 12th digit in catalog number*	
	linear	*logarithmic*
1 MΩ	14	34
2.2 MΩ	15	
2+8 kΩ		76
5+17 kΩ		82
50+170 kΩ		83
5+42 kΩ		72
10+37 kΩ		86
20+80 kΩ		77
0.5+1.7 MΩ		84

16 mm tandem carbon potentiometers



Max. permissible dissipation at 40°C

linear resistance law 0.1 W

logarithmic resistance law 0.05 W

Catalog number 2322 390 . . . . .

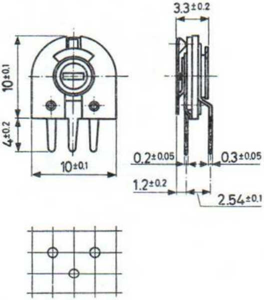
The catalog number prefix is followed by 3 digits for terminal and spindle type and then by 2 digits for resistance value and law.

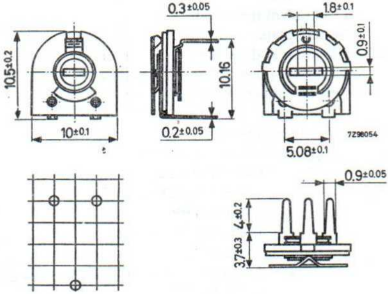
spindle type (plastic)		*8th to 10th digit in catalog number*	
		tags	*pins*
plain,	$L = 10$ mm	711	761
	$L = 15$ mm	712	762
	$L = 20$ mm	715	765
	$L = 30$ mm	703	753
with flat face,	$L = 10$ mm	742	792
	$L = 15$ mm	744	794
	$L = 20$ mm	746	796

resistance value ±20%	*11th and 12th digit in catalog number*	
	linear	*logarithmic*
1 kΩ	04	24
2.2 kΩ	05	25
4.7 kΩ	06	26
10 kΩ	07	27
10 kΩ*)	91	
22 kΩ	08	28
22 kΩ*)	92	
47 kΩ	09	29
47 kΩ*)	93	
100 kΩ	11	31
100 kΩ*)	94	
220 kΩ	12	32
220 kΩ*)	95	
470 kΩ	13	33
470 kΩ*)	96	
1 MΩ	14	34
2.2 MΩ	15	
2 + 8 kΩ		76
5 + 17 kΩ		82
50 + 170 kΩ		83

*) balance potentiometers

Miniature carbon trimming potentiometers





Max. permissible dissipation at 40°C: 0.1 W

types	*catalog number*
for vertical mounting, without knob	2322 410 050 . .
for vertical mounting, with knob	2322 410 450 . .
for horizontal mounting, without knob	2322 410 033 . .
for horizontal mounting, with knob	2322 410 433 . .

resistance value ±20%	*catalog number suffix*
100 Ω	01
220 Ω	02
470 Ω	03
1 kΩ	04
2.2 kΩ	05
4.7 kΩ	06
10 kΩ	07
22 kΩ	08
47 kΩ	09
100 kΩ	11
220 kΩ	12
470 kΩ	13
1 MΩ	14
2.2 MΩ	15
4.7 MΩ	16

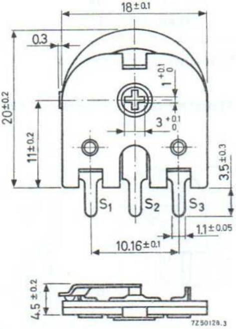
Carbon trimming potentiometers

Max. permissible dissipation at 40°C: 0.25 W

Composition of the catalog number
2322 411 . . . . .

0 = without knob
1 = with knob at the side of the base plate
2 = with knob at the side of the carbon track
4 = with adjustment wheel

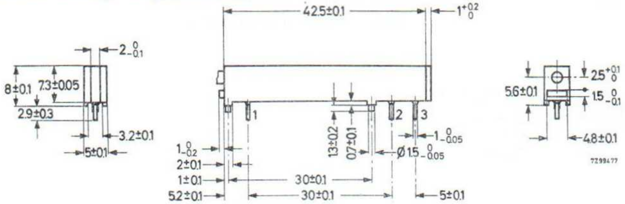
00 = with soldering tags
22 = with pins for vertical mounting
33 = with pins for horizontal mounting
72 = with pins for vertical mounting (according to DIN 44 150)
83 = with pins for horizontal mounting (according to DIN 44 150)
84 = with pins for horizontal mounting (according to DIN 44 151)



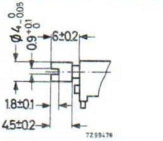
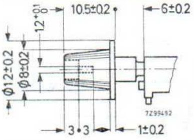
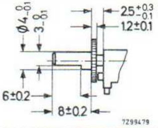
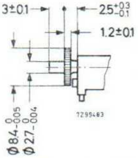
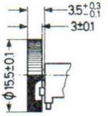
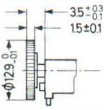
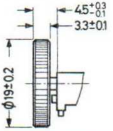
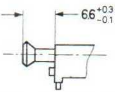
code for resistance value, see table

resistance value ±20%	*code in catalog number*	*resistance value* ±20%	*code in catalog number*
100 Ω	01	47 kΩ	09
220 Ω	02	100 kΩ	11
470 Ω	03	220 kΩ	12
1 kΩ	04	470 kΩ	13
2.2 kΩ	05	1 MΩ	14
4.7 kΩ	06	2.2 MΩ	15
10 kΩ	07	4.7 MΩ	16
22 kΩ	08	10 MΩ	17

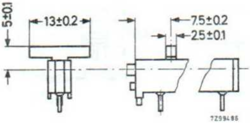
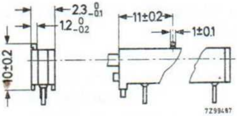
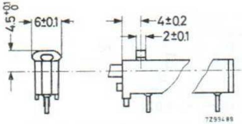
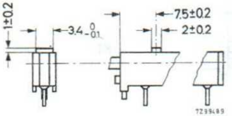
Multiturn carbon pre-set potentiometers



Housing without adjustment provision and scale indicator. Terminals 1 and 2 are connected to the ends of the carbon track, terminal 3 is connected to the slider contact.

adjustment provision	*code in catalog number*	*adjustment provision*	*code in catalog number*
 	51	 	63
 	52	 	81
 	61	 	82
 	62	 	83

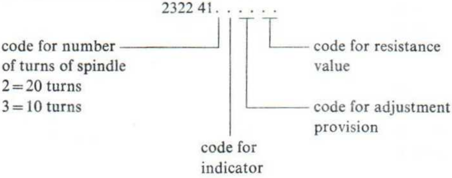
VARIABLE RESISTORS

indicator	*with/without dust cover*	*code in catalog number*
	without	1
	without	2
	without	3
	without	4
without indicator	without	0
without indicator	which	8

Max. permissible dissipation at 40°C

linear resistance law	0.4 W
logarithmic resistance law	0.3 W

Composition of the catalog number



resistance value ±20%	*code in catalog number*	
	linear	*logarithmic*
220 Ω	02	
470 Ω	03	
1 kΩ	04	24
2.2 kΩ	05	25
4.7 kΩ	06	26
10 kΩ	07	27
22 kΩ	08	28
47 kΩ	09	29
100 kΩ*	11	31
220 kΩ	12	32
470 kΩ	13	33
1 MΩ	14	34
2.2 MΩ	15	35
4.7 MΩ	16	

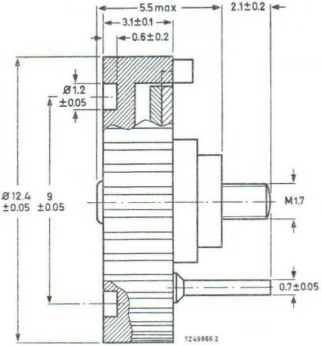
*) Also available with special law; code: 38

VARIABLE RESISTORS

Miniature carbon potentiometers

Maximum voltage over the resistance element	10 $V_{d.c.}$
Current through slider	$\leqslant$ 1 mA
Working-temperature range	-10 to $+70$ °C

resistance value ±20 %	*catalog number suffix* 2322 440 000 . .	
	linear	*logarithmic*
4700 Ω	06	26
10000 Ω	07	27
22000 Ω	08	28

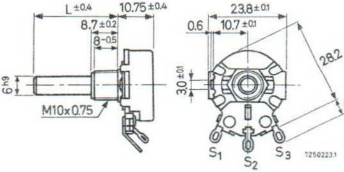


Single carbon potentiometers

Max. permissible dissipation at 40 °C

linear resistance law 1 W

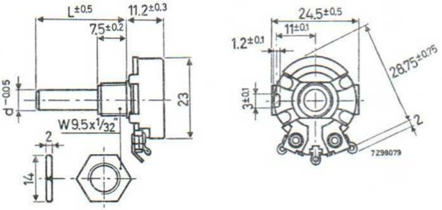
logarithmic resistance law 0.5 W



spindle type (plastic)	*catalog number*
plain, L = 17 mm	2322 450 013 . .
L = 30 mm	003 . .
L = 60 mm	007 . .
with screwdriver slot,	
Ø 6.35 mm, L = 12.7 mm	904 . .
L = 22.2 mm	907 . .
L = 31.8 mm	910 . .
L = 63.5 mm	920 . .

resistance values ±20 %	*catalog number suffix*	
	linear	*logarithmic*
100 Ω	01	
220 Ω	02	
470 Ω	03	23
1 kΩ	04	24
2.2 kΩ	05	25
4.7 kΩ	06	26
10 kΩ	07	27
22 kΩ	08	28
47 kΩ	09	29
100 kΩ	11	31
220 kΩ	12	32
470 kΩ	13	33
1 MΩ	14	34
2.2 MΩ	15	35
4.7 MΩ	16	

23 mm single carbon potentiometers



Max. permissible dissipation at 40 °C
linear resistance law 1 W
logarithmic resistance law 0.5 W

spindle type (plastic)		*catalog number*
plain, $d=6$ mm,	$L=18$ mm	2322 460 706 . .
	$L=30$ mm	703 . .
	$L=60$ mm	707 . .
plain, $d=\frac{1}{4}''$,	$L=30$ mm	723 . .
	$L=60$ mm	727 . .
with screwdriver slot, $d=6$ mm,		
	$L=11$ mm	710 . .
with flat face, $d=6$ mm,		
	$L=18$ mm	740 . .
	$L=30$ mm	743 . .
	$L=60$ mm	747 . .

resistance value ±20 %	*catalog number suffix*	
	linear	*logarithmic*
220 Ω	02	
300 Ω	19	
470 Ω	03	
1 kΩ	04	24
2.2 kΩ	05	25
4.7 kΩ	06	26
10 kΩ	07	27
22 kΩ	08	28

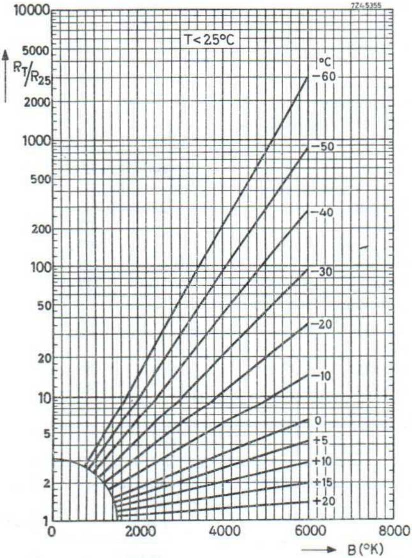
resistance value ±20 %	*catalog number suffix*	
	linear	*logarithmic*
47 kΩ	09	29
100 kΩ	11	31
220 kΩ	12	32
470 kΩ	13	33
1 MΩ	14	34
2.2 MΩ	15	35
4.7 MΩ	16	

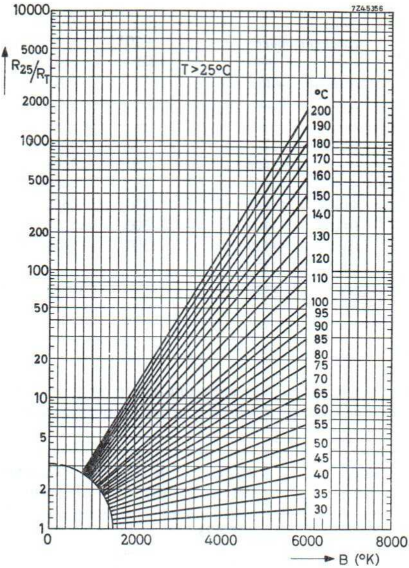
NTC THERMISTORS

NTC thermistors are resistors with a high negative temperature coefficient of resistance.
The relation between resistance and temperature can be approximated by:

$$R = A\,e^{B/T}$$

where R is the resistance value at an absolute temperature T, A and B being constants for a given resistor and e the base of the natural logarithm ($e = 2.718$).



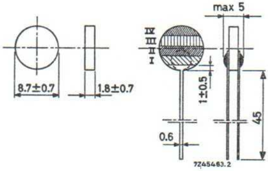


Standard disc types

Catalog number 2322 610 . . . . .
For the suffix of this number see table.

Maximum dissipation	1 W
Maximum temperature	120°C
Dissipation factor	10 mW/deg C
Thermal time constant	60 s

International colour code for resistors.



R_{25} ±20% (Ω)	*B-value* ±5% *at* 25°C (°*K*)	*suffix of catalog number*	
		without leads	*with leads*
2.2	2650	01228	11228
4	2800	01408	11408
6	2800	01608	11608
8	2900	01808	11808
10	2950	01109	11109
12	2950	01129	11129
15	3000	01159	11159

R_{25} ±20% (Ω)	*B-value* ±5% *at* 25°C (°*K*)	*suffix of catalog number*	
		without leads	*with leads*
33	3250	01339	11339
50	3300	01509	11509
82	4400	01829	11829
130	4600	01131	11131
500	5200	01501	11501
1300	5450	01132	11132

Types for motor cars

This range of discs has been developed for temperature sensors for the cooling water in motor cars. They are also suitable for temperature control in household appliances, such as washing machines.

R_{25} (Ω)	R_{40} (Ω)	R_{50} (Ω)	$R_{96.5}$ (Ω)	R_{100} (Ω)	*diameter* (*mm*)	*catalog number*
2200	1030–1310		147–173		7.0	2322 611 90003
500		175 –215		35 –43	6.9	90013
500		92.5–134		12 –15	6.9	90001
1000		221.5–318.5		30 –36	6.9	90004
270		97 –143		29.5–36.5	6.9	90009
700		207 –264		41.4–48.6	6.9	90011
800		244 –315		48.0–58.6	6.9	90008

Types for radio and television

application	R_{25} (Ω)	*B at 25°C approx.*	$W_{max.}$ (*W*)	*normal operating conditions*		*dissipation factor approx.*	*max. dia-meter*	*max. body length*	*catalog number*
		(°K)		(*mA*)	(Ω)	(*mW/deg C*)	(*mm*)	(*mm*)	
compensation	1.1±20%	2650	1	2200	0.15–0.25	14	9	21	2322 619 90002
positive tem-	32±30%/−20%	4200	1	1000	0.7–1.1	14	9	21	619 90003
perature	6±20%	2800	1	1000	~1	10			2322 610
coeff. of	10±20%	2950	1	900	~1.1	10			610
deflection	12±20%	2950	1	800	~1.2	10			610 *
coils	15±20%	3000	1	800	~1.2	10			610
	33±20%	3250	1	700	~1.4	10			610
shunt dial lamp	3870 – 7750	3000	3	200	60–90	10	5	16	2322 620 90001
heater chain	800 – 1315	3800	2	200	36–52	16	9	13	2322 621 90004
protection	6700 – 12600	3000	3	100	200–280	10	5	16	621 90003
	300 – 500	3700	2.5	300	25–32	30	13	23	622 90005
	645 – 1210	3600	5	300	35–48	60	13	37	622 90004
	1750 – 3250	3000	3	100	200–250	20	7	37	622 90002
	2470 – 5370	4000	4	300	38–50	24	11	37	622 90001
protection of	82±20%	4650		1700	<0.85	19	16		2322 644 9004
switch and	≥15	3350		2200	<1	17	16		644 9005
Si-diode									

* See Standard disc types 2322 610

Miniature types

Miniature NTC thermistors are available in 7 versions all built around the same NTC-bead. The range of resistance values and the resistance temperature characteristics for all versions are the same.

versions	*max. body dimensions mm*	*terminations at*		*catalog number*
		one side	*two sides*	
naked bead	1 ⌀		×	2322 634 01 . . .
naked bead	1 ⌀	×		2322 634 11 . . .
glass encapsulated bead	12 × 2.5		×	2322 634 21 . . .
vacuum mounted	31 × 6	×		2322 634 31 . . .
vacuum gauge	87 × 6	×		2322 634 41 . . .
thermometer	33 × 2.5	×		2322 627 11 . . .
thermometer	5 × 1.5	×		2322 627 21 . . .

R_{25} ±10% (Ω)	*B-value* ±5% *at* 25°*C* (°*K*)	*catalog number suffix*
1000	2350	102
1500	2450	152
2200	2600	222
3300	2775	332
4700	3650	472
6800	3725	682
10000	3800	103
15000	3750	153
22000	3800	223

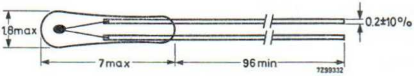
R_{25} ±10% (Ω)	*B-value* ±5% *at* 25°*C* (°*K*)	*catalog number suffix*
33000	3750	333
47000	3800	473
68000	3850	683
100000	3900	104
150000	3975	154
220000	4075	224
330000	4175	334
470000	4225	474
680000	4300	684

Maximum dissipation	60 mW
Maximum temperature	200°C
Dissipation factor	approximately 0.4 mW/deg C
Stability after 1000 hrs at T_{max}	<1%

International colour code for resistors

Miniature type 2322 627 3 . . . . .

For high temperature control



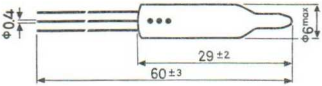
R_{25} ±20% (Ω)	$B_{25/85}$ ±5% (°K)	*catalog number*
100 000	3800	2322 627 31104
150 000	3850	31154
220 000	3850	31224
330 000	3900	31334
470 000	3950	31474
680 000	3975	31684
1 000 000	4025	31105

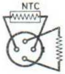
Maximum dissipation	0.1 W
Dissipation factor	approx. 0.95 mW/deg C
Operating temperature range	
at zero power	−55 to +300°C
at max. power	0 to +55°C

NTC THERMISTORS

Indirectly heated types

Vacuum mounted in glass

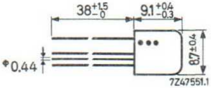


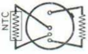


catalog number	2322 628 01332,	2322 628 01334
R_{25}	3300 Ω ± 20 %	330 kΩ
B-value	2775°K ± 10 %	4175°K ± 10 %
Colour code	orange-orange-red	orange-orange-yellow

$W_{\text{max.}}$ heater	30 mW
$T_{\text{max.}}$	200°C
Resistance heater	100 Ω ± 10 %
$W_{\text{max.}}$ NTC	25 mW
Dissipation factor	0.18 mW/deg C
Heater efficiency	97.5 %
Thermal time constant	2.2 s
Dielectric strength heater/bead	⩾200 V

Mounted in air-filled metal casing





catalog number	2322 628 11332	2322 628 11334
R_{25}	3300 Ω ± 20 %	330 kΩ
B-value	2775°K ± 5 %	4175°K ± 5 %
Colour code	orange-orange-red	orange-orange-yellow

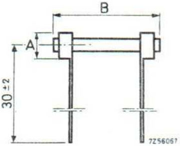
$W_{\text{max.}}$ heater	80 mW
$T_{\text{max.}}$	125°C
Resistance heater	100 Ω ± 10 %
$W_{\text{max.}}$ NTC	60 mW
Dissipation factor	0.50 mW/deg C
Heater efficiency	90 %
Thermal time constant	1.2 s
Dielectric strength heater/bead	⩾200 V

NTC THERMISTORS

Standard rod types

Dimensions in mm

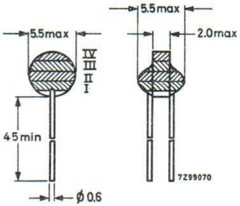
series	*A*	*B*
2322 635	3.2 ± 0.5	11 ± 1
2322 636	4.7 ± 0.5	21 ± 1
2322 637	6.2 ± 0.5	31 ± 1



R_{25} ± 20% (kΩ)	*B-value* ± 5% *at 25°C (°K)*	$W_{\max.}$ *at 25°C amb (W)*	*dissipation factor (mW/deg C)*	*thermal time constant (s)*	*colour code*	*catalog number*
4.7	3250	0.6	5.5	28	orange	2322 635 01472
15	3550				green	153
47	3925				blue	473
150	4075				white	154
330	4200				yellow/blue	334
4.7	3250	1.5	12	55	orange	2322 636 01472
15	3550				green	153
47	4000				blue	473
150	4150				white	154
4.7	3250	2.3	17	105	orange	2322 637 01472
15	3650				green	153
47	4050				blue	473
150	4200				white	154

Maximum temperature	150°C
Stability ΔR_{25} after 1000 hrs at $W_{\max.}$	$<5\%$
ΔR_{25} after 1000 hrs at $\frac{2}{3}$ $W_{\max.}$	$<3\%$

Standard disc type



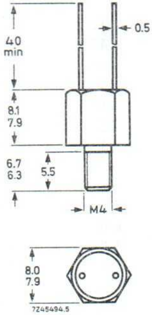
R_{25} ±20% (Ω)	$B_{25/85}$ (°K)	*dissipation factor* (*mW/deg C*)	*thermal time constant* (*s*)	*catalog number*
3.3	2650	9	30	2322 642 11338
4.7	2650	9	30	11478
6.8	2675	9	30	11688
10	2775	9	30	11109
15	2875	9	30	11159
22	2950	9	25	11229
33	3050	9	25	11339
47	3200	9	25	11479
68	3225	8	25	11689
100	3250	8	25	11101
150	3275	8	25	11151
220	3325	8	25	11221
330	3375	8	25	11331
470	3425	8	25	11471
680	3575	8	25	11681
1000	3650	8	25	11102
1500	3700	8	25	11152
2200	3750	8	25	11222
3300	4000	8	25	11332
4700	4225	8	25	11472
6800	4225	8	25	11682
10000	4250	8	25	11103
15000	4250	8.5	25	11153
22000	4300	8.5	25	11223
33000	4325	8.5	25	11333
47000	4350	8.5	25	11473
68000	4350	8.5	25	11683
100000	4350	8.5	25	11104
150000	4350	8.5	25	11154
220000	—	8.5	25	11224
330000	—	8.5	25	11334

Max. dissipation at 55°C	0.5 W
Operating temperature range at zero power	−25 to +125°C
International colour code for resistors	

NTC THERMISTORS

2322 642 1... with mounting stud

Dissipation factor	
without heatsink	9.5 mW/degC approx.
mounted on a heatsink of 1 dm^2, thickness 1.5 mm	19 mW/degC approx.
Thermal time constant	
without heatsink	80 s approx.
mounted on a heatsink of 1 dm^2, thickness 1.5 mm	15 s approx.
Max. dissipation at 55°C	0.5 W
Operating temperature range at zero power	−25 to +100 °C
Dielectric withstanding voltage	>100 V
Insulation resistance	>100 MΩ



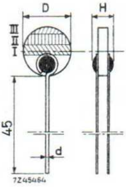
Dimensions in mm

R_{25} ±20% (Ω)	$B_{25/85}$ (°K)	*catalogue number*	R_{25} (Ω)	$B_{25/85}$ (°K)	*catalogue number*
3.3	2650	2322 642 21338	1500	3700	2322 642 21152
4.7	2650	21478	2200	3750	21222
6.8	2675	21688	3300	4000	21332
10	2775	21109	4700	4225	21472
15	2875	21159	6800	4225	21682
22	2950	21229	10000	4250	21103
33	3050	21339	15000	4250	21153
47	3200	21479	22000	4300	21223
68	3225	21689	33000	4325	21333
100	3250	21101	47000	4350	21473
150	3275	21151	68000	4350	21683
220	3325	21221	100000	4350	21104
330	3375	21331	150000	4350	21154
470	3425	21471	220000	—	21224
680	3575	21681	330000	—	21334
1000	3650	21102			

Standard disc types

Dimensions in mm

series	*D*	H_{max}	*d*
2322 643	9 ± 0.5	6	0.6
2322 644	16 ± 0.5	7	0.8



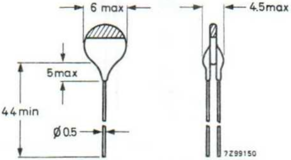
R_{25} $\pm 20\%$ (Ω)	*B-value at 25° C* (°*K*)	P_{max} *at* $T_{amb} = 25°C$ (*W*)	*dissipation factor* (*mW/deg C*)	*thermal time constant* (*s*)	*catalog number*
150	3400	1	10	55	2322 643 11151
470	3800	1	10	55	11471
1500	4100	1	10	55	11152
4700	4200	1	10	55	11472
150	3400	1.5	13	120	2322 644 11151
470	3900	1.5	13	120	11471
1500	4050	1.5	13	120	11152
4700	4200	1.5	13	120	11472

Operating temperature range at zero power −25 to +125°C

International colour code for resistors

PTC THERMISTORS

Standard disc type



R_{25} ±30% (Ω)	R_{125} (kΩ)	R_{150} (MΩ)	T_s[1]) approx. (°C)	max. temp. coeff. (%/deg C)	colour code	catalog number
60	3– 15		+ 30	+ 7	red	2322 660 91006
50	100–500		+ 50	+16	orange	91007
50	50–500		+ 80	+23	yellow	91008
50		0.1–1.2	+105	+40	green	91009

Maximum voltage 25 $V_{d.c.}$

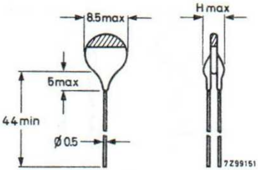
Dissipation factor: approx. 7 mW/deg C

The above resistance values are measured at 1.5 V [2])

[1]) The switch temperature T_s is the higher of the two temperatures at which the resistance is twice the minimum resistance.

[2]) Higher voltages may yield different values due to self-heating and voltage-dependency.

Standard disc type



For 2322 661 90005 $H_{max} = 5.5$ mm
For other types $H_{max} = 6.5$ mm

R_{25} ±15 (Ω)	*R at other temperatures*		*T_s¹) approx. (°C)*	*max. temp. coeff. (%/deg C)*	*$V_{max.}$ ($V_{d.c.}$)*	*colour code*	*catalog number*
50	60°C	<100 Ω	+80	+18	50	yellow	2322 661 91002
	100°C	>1 kΩ					
40	95°C	<80 Ω	+110	+75	50	green	2322 661 91003
	130°C	>10 kΩ					
30	40°C	<90 Ω	+45	+16	50	orange	2322 661 91004
	100°C	>10 kΩ					
50	100°C	3–20 kΩ	+25	+9	40	red	2322 661 91005

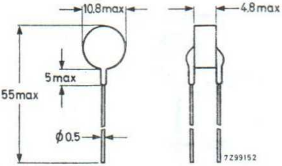
Dissipation factor: approx. 10 mW/deg C
The above resistance values are measured at 1.5 V²)

[1] The switch temperature T_s is the higher of the two temperatures at which the resistance is twice the minimum resistance.

[2] Higher voltages may yield different values due to self-heating and voltage-dependency.

PTC thermistor 2322 662 91001

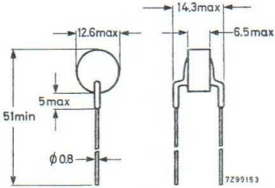
Resistance value at +25°C	36 to 50 Ω
Resistance value at +175°C $V_{\text{pulse}} = 180$ V	>25 kΩ
Switch temperature	115 °C approx.
Temperature coefficient	46%/deg C approx.
Max. voltage	180 $V_{\text{d.c.}}$
Dissipation factor	11 mW/deg C approx.
Operating temperature range	
at zero power	0 to +155°C
at $V_{\max}$	0 to +55°C



For the protection of telegraphy relay contacts

PTC thermistor 2322 662 93036

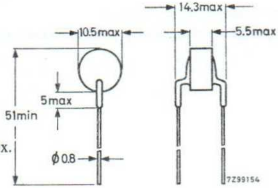
Resistance value at + 25 °C	45 to 60 Ω
Resistance value at +150 °C $V_{\text{pulse}} = 340$ V	>45 kΩ
Switch temperature	+75 °C approx
Temperature coefficient	+23%/deg C approx.
Max. voltage at $T_{\text{amb}} < +60$°C	245 V_{rms}
Dissipation factor	17 mW/deg C approx.
Operating temperature range	
at zero power	0 to +155 °C
at $V_{\max}$	0 to +60 °C



For use in the degaussing circuit of colour TV sets

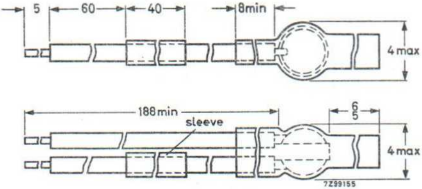
PTC thermistor 2322 662 93066

Resistance value at +25 °C	100 Ω±20%
Resistance value at +150 °C $V_{\text{pulse}} = 340$ V	>40 kΩ
Switch temperature	80 °C
Max. voltage at $T_{\text{amb}} < +60$ °C	245 V_{rms}
Dissipation factor	15.3 mW/deg C approx.
Operating temperature range	
at zero power	0 to +150°C
at $V_{\max}$	0 to +60 °C



The thermistor is marked with a red dot
For use in the degaussing circuit of colour TV sets

PTC thermistor for motor protection



Resistance value at −20 and $T_{ref}-10$ °C	20 to 150 Ω
Resistance value at $T_{ref}+15$ °C	
$V_{pulse}=15$ V	>3500 Ω
Max. voltage	15 V
Dissipation factor	7 mW/deg C approx.
Operating temperature range	
at zero power	−25 to $T_{ref}+30$ °C
at V_{max}	−25 to $T_{ref}+15$ °C

T_{ref} [1] (°C)	T_s (°C)	*temperature coefficient %/deg C*	*catalogue number*
90	75	21	2322 672 92046
100	88	31	92047
110	99	33	92048
120	113	38	92049
130	113	27	92051
140	130	33	92052
150	137	33	92053

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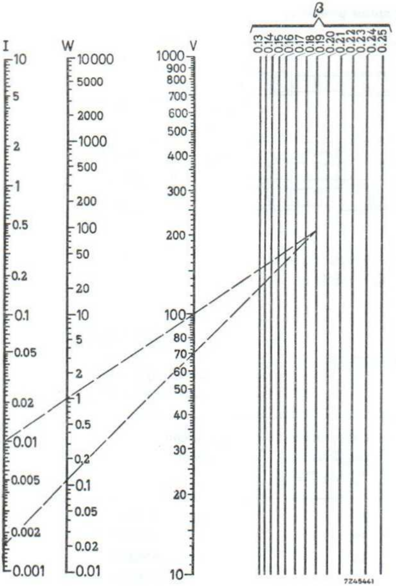
[1] The temperature at which the thermistor has to make the protection system operative.

VOLTAGE DEPENDENT RESISTORS

The relation between voltage and current of a VDR resistor can be approximated by:

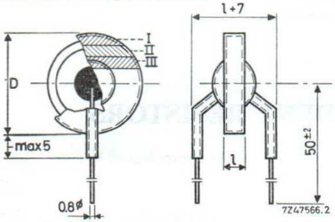
$$V = C \cdot I^{\beta} \tag{1}$$

where V is the voltage in volts, I the current in amperes and C and β are constants. This equation is illustrated in the figure on next page.



Nomogram giving the relation between voltage, current, power dissipation and β-value of any VDR.

Standard disc types with leads



Temperature range:

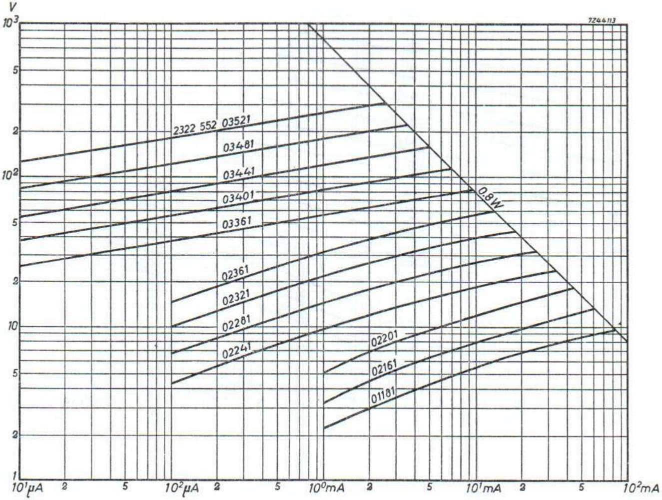
at zero power −25 to +125°C

at max. power 0 to +55°C

Tolerance on voltage ±20%

Tolerance on voltage is ±20%.

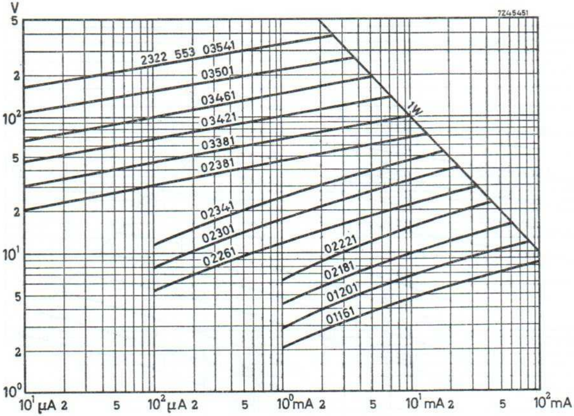
$W_{max.} = 0.8$ W
$D_{max.} = 14.5$ mm



I (mA)	E (V)	β	C approx.	$l_{max.}$ (mm)	colour code I	 II	 III	catalog number
100	10	0.25–0.40	18	5	brown	brown	grey	2322 552 01181
10	8	0.25–0.40	25	5	red	brown	blue	02161
10	12	0.25–0.40	40	5	red	red	black	02201
10	18	0.21–0.35	57	5	red	red	yellow	02241
10	27	0.21–0.35	70	5	red	red	grey	02281
10	39	0.18–0.25	100	5	red	orange	red	02321
10	56	0.18–0.25	150	5	red	orange	blue	02361
1	56	0.14–0.23	190	5	orange	orange	blue	03361
1	82	0.14–0.21	300	5	orange	yellow	black	03401
1	120	0.14–0.21	400	6	orange	yellow	yellow	03441
1	180	0.14–0.21	600	7	orange	yellow	grey	03481
1	270	0.14–0.21	900	8	orange	green	red	03521

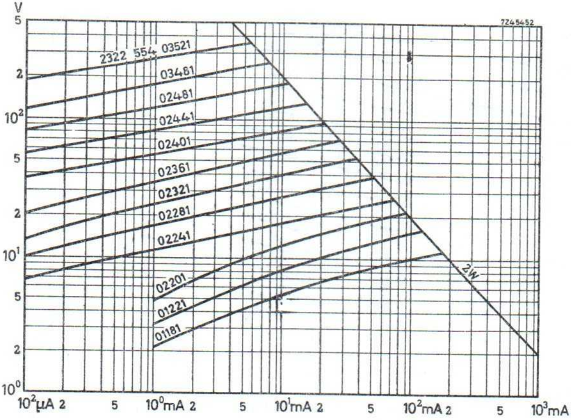
VOLTAGE DEPENDENT RESISTORS

$W_{\text{max.}} = 1$ W
$D_{\text{max.}} = 20$ mm



I	*E*	*β*	*C*	$l_{\text{max.}}$	*colour code*			*catalog*
(mA)	*(V)*		*approx.*	*(mm)*	*I*	*II*	*III*	*number*
100	8	0.25–0.40	14	5	brown	brown	blue	2322 553 01161
100	12	0.25–0.40	21	5	brown	red	black	01201
10	10	0.25–0.40	32	5	red	brown	grey	02181
10	15	0.25–0.40	48	5	red	red	red	02221
10	22	0.21–0.35	60	5	red	red	blue	02261
10	33	0.18–0.25	85	5	red	orange	black	02301
10	47	0.18–0.25	130	5	red	orange	yellow	02341
10	68	0.18–0.25	180	5	red	orange	grey	02381
1	68	0.14–0.23	230	5	orange	orange	grey	03381
1	100	0.14–0.21	350	5.5	orange	yellow	red	03421
1	150	0.14–0.21	500	6.5	orange	yellow	blue	03461
1	220	0.14–0.21	750	7.5	orange	green	black	03501
1	330	0.14–0.21	1100	9	orange	green	yellow	03541

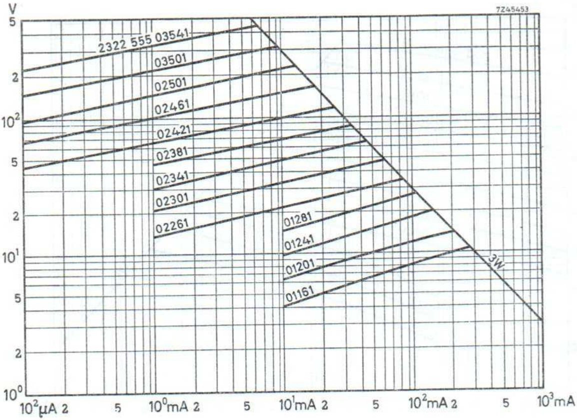
$W_{\text{max.}} = 2$ W
$D_{\text{max.}} = 27.5$ mm



I	*E*	*β*	*C*	$l_{\text{max.}}$	*colour code*			*catalog*
(*mA*)	(*V*)		*approx.*	(*mm*)	*I*	*II*	*III*	*number*
100	10	0.25–0.40	18	5	brown	brown	grey	2322 554 01181
100	15	0.25–0.40	26	5	brown	red	red	01221
10	12	0.25–0.40	38	5	red	red	black	02201
10	18	0.21–0.35	57	5	red	red	yellow	02241
10	27	0.21–0.35	70	5	red	red	grey	02281
10	39	0.18–0.25	97	5	red	orange	red	02321
10	56	0.18–0.25	140	5	red	orange	blue	02361
10	82	0.14–0.23	170	5	red	yellow	black	02401
10	120	0.14–0.21	250	5	red	yellow	yellow	02441
10	180	0.14–0.21	380	6	red	yellow	grey	02481
1	180	0.14–0.21	540	7	orange	yellow	grey	03481
1	270	0.14–0.21	810	8	orange	green	red	03521

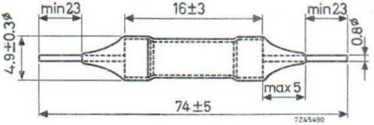
VOLTAGE DEPENDENT RESISTORS

$W_{\text{max.}} = 3$ W
$D_{\text{max.}} = 42.5$ mm



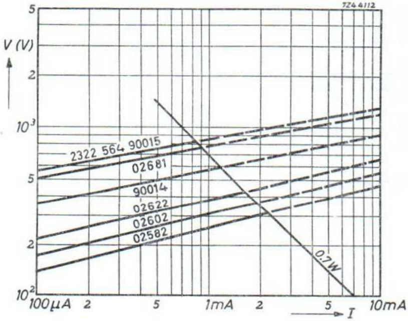
I	E	β	C	$l_{\text{max.}}$	colour code			catalog
(mA)	(V)		approx.	(mm)	I	II	III	number
100	8	0.25–0.40	14	5	brown	brown	blue	2322 555 01161
100	12	0.25–0.40	21	5	brown	red	black	01201
100	18	0.25–0.40	32	5	brown	red	yellow	01241
100	27	0.25–0.40	48	5	brown	red	grey	01281
10	22	0.21–0.35	60	5	red	red	blue	02261
10	33	0.18–0.25	84	5	red	orange	black	02301
10	47	0.18–0.25	125	5	red	orange	yellow	02341
10	68	0.18–0.25	175	5	red	orange	grey	02381
10	100	0.14–0.23	210	5	red	yellow	red	02421
10	150	0.14–0.21	320	5.5	red	yellow	blue	02461
10	220	0.14–0.21	460	6.5	red	green	black	02501
1	220	0.14–0.21	660	7.5	orange	green	black	03501
1	330	0.14–0.21	980	9	orange	green	yellow	03541

Standard rod types



$W_{max.} = 0.7$ W

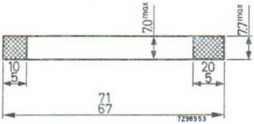
I (*mA*)	*E* (*V*)	*β*	*colour code*	*catalog number*
10	470 ± 10%	0.20–0.25	green	2322 564 02582
10	560 ± 10%	0.18–0.23	blue	02602
10	680 ± 10%	0.18–0.23	violet	02622
10	910 ± 10%	0.18–0.23	white	90014
10	1200 ± 20%	0.17–0.22	grey	02681
10	1300 ± 10%	0.16–0.21	red	90015
1	300 ± 20%	0.18–0.25	yellow	90016
2	950 ± 10%	0.16–0.21	black/blue	90005



VOLTAGE DEPENDENT RESISTORS

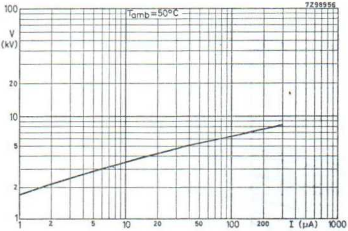
Rod type without leads, 2322 564 92003

For focus tracking in line time-base circuits of colour television sets.



Measurements and ratings are given at an ambient temperature of +50°C + 2°C unless otherwise stated.

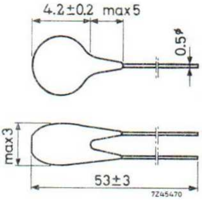
Current at $V_{\text{d.c.}} = 7$ kV	100 to 150 μA
Maximum current	175 μA
β-value between 4 kV and 7 kV	0.17 to 0.25
Dissipation factor	22 mW/deg C
Operating temperature range	
at zero power	−25 to +125°C
at max. power	0 to +50°C



Small disc types

For use in colour television

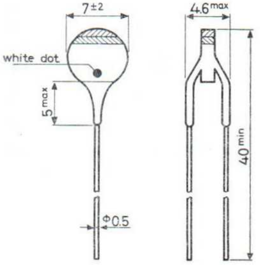
I (mA)	E (V)	*tolerance on voltage*	*catalog number*
1	6	±20%	2322 565 90002
1	9	±20%	90003
1	12	±15%	90004
1	15	±15%	90005
1	18	±12%	90006



Asymmetric types

at $T_{amb} = 25\,°C$		*catalog number*	
		2322 574 90001	2322 574 90002
forward direction	voltage at 1 mA	1.0 V ± 10%	1.35 V ± 10%
	temp. coeff.	> −0.2%/deg C	> −0.2%/deg C
	β	0.05–0.08	0.06–0.09
	capacitance at 0 mA	~0.15 μF	~0.15 μF
	at 5 mA	~10 μF	~10 μF
	max. permissible current	25 mA	20 mA
reverse direction	current at 5 V	< 2 μA	< 2 μA
	capacitance at 0 V	~0.15 μF	~0.15 μF
	at 5 V	~0.05 μF	~0.05 μF
	max. permissible voltage	5 V	5 V

Temperature range: −30 to +70 °C
Cathode is indicated by a white dot.
Colour code 2322 574 90001 black and brown band
2322 574 90002 black and red band

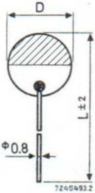


VOLTAGE DEPENDENT RESISTORS

Disc types for contact protection

Marking

Discs without leads:
white colourband, colour dot indicates 10th digit of cat. number.
Discs with leads:
body colour white, colourband indicates 10th digit of cat. number.



Colour code:

0 = black
1 = brown
2 = red
3 = orange
4 = yellow
5 = green
6 = blue

$W_{max.}$ (*W*)	*L*	*Catalog number prefix*	*Additional marking*
0.25	58.5	2322 575	VAP3
0.40	62	2322 576	VAP2
1.0	65	2322 577	VAP1

These VDR's are developed for contact protection of relays in telephone exchanges.

$V_{d.c.}$ (*V*)	*I* (*mA*)	V_{pulse} (*V*)	*I* (*mA*)	$W_{max.}$ (*W*)	*D* (*mm*)	*catalog number suffix* without leads	with leads
48	<1.7	150	> 52	0.25	9.5	30272	00272
48	< 3	150	> 72	0.25	9.5	30372	00372
48	< 5	150	>121	0.25	9.5	30472	00472
48	< 0.5	150	> 27	0.4	12.5	30072	00072
48	< 0.9	150	> 34	0.4	12.5	30172	00172
48	< 1.7	150	> 65	0.4	12.5	30272	00272
48	< 3	150	> 91	0.4	12.5	30372	00372
48	< 5	150	>152	0.4	12.5	30472	00472
48	< 0.5	150	> 42	1	17	30072	00072
48	< 0.9	150	> 76	1	17	30172	00172
48	< 1.7	150	>115	1	17	30272	00272
48	< 3	150	>180	1	17	30372	00372
48	< 5	150	>268	1	17	30472	00472
48	< 9	150	>430	1	17	30572	00572
48	<15	150	>455	1	17	30672	00672

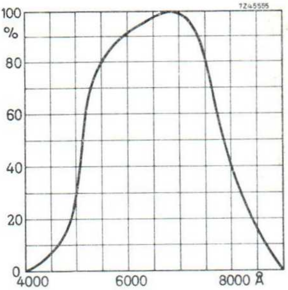
LIGHT DEPENDENT RESISTORS

The light dependent resistors are virtually small photoconductive cells, provided with two tinned copper connecting leads.

The relationship between resistance value and illumination can be expressed with good approximation by the formula:

$$R = AL^{-\alpha}$$

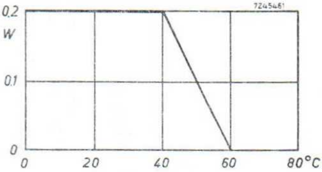
where R = resistance value in Ω
L = illumination in lux
A and α are constants



Spectral response characteristic of an LDR

Electrical performance

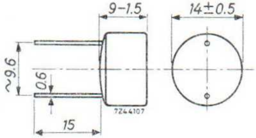
dark value	> 10 MΩ
light value	75–300 Ω (measured at 1000 lux)
recovery rate	> 200 kΩ/s
permissible voltage	150 V_{peak}
capacitance	< 6 pF



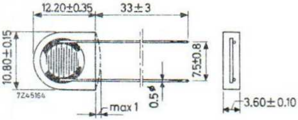
Permissible dissipation

Three versions are available differing mainly in shape and coating.

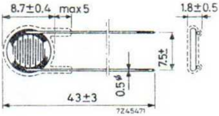
Version 2322 600 95001
Encapsulated in plastic case and synthetic resin
Ambient temperature range −20 to +60°C



Version 2322 600 93001
This cell is sealed by means of a plastic coating
Ambient temperature range −30 to +60°C



Version 2322 600 94001
This cell is covered with lacquer.
Ambient temperature range −30 to +60°C



STANDARD SERIES OF VALUES IN A DECADE

for resistances and capacitances according to I.E.C. publication 63

E192	*E96*	*E48*	*E192*	*E96*	*E48*	*E192*	*E96*	*E48*	*E192*	*E96*	*E48*	*E192*	*E96*	*E48*
100	100	100	169	169	169	284			481			816		
101			172			287	287	287	487	487	487	825	825	825
102	102		174	174		291			493			835		
104			176			294	294		499	499		845	845	
105	105	105	178	178	178	298			505			856		
106			180			301	301	301	511	511	511	866	866	866
107	107		182	182		305			517			876		
109			184			309	309		523	523		887	887	
110	110	110	187	187	187	312			530			898		
111			189			316	316	316	536	536	536	909	909	909
113	113		191	191		320			542			920		
114			193			324	324		549	549		931	931	
115	115	115	196	196	196	328			556			942		
117			198			332	332	332	562	562	562	953	953	953
118	118		200	200		336			569			965		
120			203			340	340		576	576		976	976	
												988		

121	121	121	205	205	205	344			583		
123			208			348	348	348	590	590	590
124	124		210	210		352			597		
126			213			357	357		604	604	
127	127	127	215	215	215	361			612		
129			218			365	365	365	619	619	619
130	130					370			626		
132			221	221		374	374		634	634	
133	133	133	223			379			642		
135			226	226	226	383	383	383	649	649	649
137	137		229			388			657		
138			232	232		392	392		665	665	
140	140	140	234			397			673		
142			237	237	237	402	402	402	681	681	681
143	143		240			407			690		
145			243	243		412	412		698	698	
147	147	147	246			417			706		
149			249	249	249	422	422	422	715	715	715
150	150		252			427			723		
152			255	255		432	432		732	732	
154	154	154	258			437			741		
156			261	261	261	442	442	442	750	750	750
158	158		264			448			759		
160			267	267		453	453		768	768	
162	162	162	271			459			777		
164			274	274	274	464	464	464	787	787	787
165	165		277			470			796		
167			280	280		475	475		806	806	

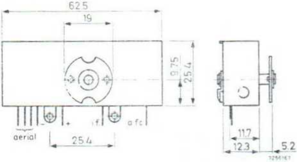
E24	E12	E6
10	10	10
11		
12	12	
13		
15	15	15
16		
18	18	
20		
22	22	22
24		
27	27	
30		
33	33	33
36		
39	39	
43		
47	47	47
51		
56	56	
62		
68	68	68
75		
82	82	
91		

F.M. TUNERS

F.M. tuners AP2151/..

type	*catalog number*
AP2151/00, F.M. tuner for European band	3122 108 68870
AP2151/01, F.M. tuner for American band	3122 107 13430

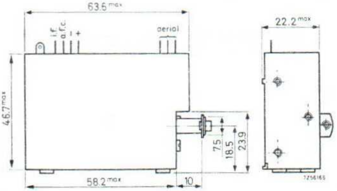
Supply voltage : 9 $V_{d.c.}$
Frequency range
AP2151/00 : 87–104 MHz
AP2151/01 : 87–108 MHz
Total gain AP2151/00 : 4.5 ×
AP2151/01 : 4 ×
Intermediate frequency : 10.7 MHz



F.M. tuners AP 2152/ . .

type	*catalog number*
AP2152/00, F.M. tuner for European band; with soldering lugs	3122 108 69400
AP2152/01, as AP2152/00, but with pins for printed-wiring connection	3122 108 81760
AP2152/02, F.M. tuner for American band; with soldering lugs	3122 108 68730

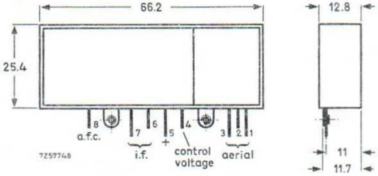
Supply voltage : 14 $V_{d.c.}$
Frequency range
AP2152/00 and AP2152/01 : 87–104 MHz
AP2152/02 : 87–108.9 MHz
Total gain : 4 ×
Intermediate frequency : 10.7 MHz



F.M. tuners with diode tuning AP 2153/...

type	*catalog number*
AP2153/01, F.M. tuner for European band	3122 108 86460
AP2153/02, F.M. tuner for American band	3122 108 89640

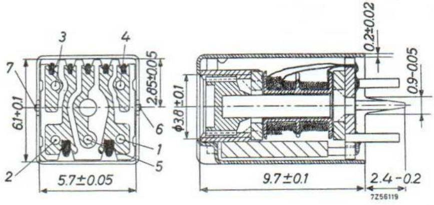
Supply voltage : 15 $V_{d.c.}$
Frequency range
  AP2153/01 : 87–105 MHz
  AP2153/02 : 87–108 MHz
Total gain : 4×
Intermediate frequency : 10.7 MHz



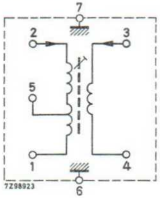
COILS FOR TRANSISTORISED RADIO RECEIVERS

For use on printed-wiring boards with a grid of 0.635 mm

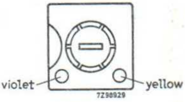
Inductance adjustment range	±10%
Temperature coefficient	100 to 400 · 10^{-6}/deg C



Oscillator coil for m.w. and l.w. receivers AP1051/11

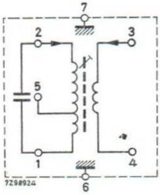


$L_{1\text{-}2}$	260 μH
$C_{o\,1\text{-}2}$	2.5 pF
$Q_{1\text{-}2}$ (600 kHz)	125
$\frac{V_{1\text{-}5}}{V_{1\text{-}2}} \times 100\%$	1.5%
$\frac{V_{3\text{-}4}}{V_{1\text{-}2}} \times 100\%$	8%
Catalog number	3122 107 30940

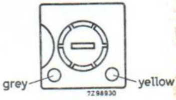


Marking

I.F. circuit for a.m. receivers AP1051/12

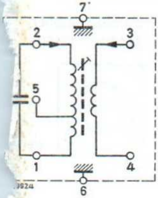


$L_{1\text{-}2}$	775 μH
$C_{1\text{-}2}$	150 pF
$C_{o\,1\text{-}2}$	6 pF
$Q_{1\text{-}2}$ (460 kHz)	85
$\frac{V_{1\text{-}5}}{V_{1\text{-}2}} \times 100\%$	21.2%
$\frac{V_{3\text{-}4}}{V_{1\text{-}2}} \times 100\%$	3.75%
$f_{1\text{-}2}$	460 kHz
Catalog number	3122 107 30950



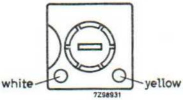
Marking

I.F. circuit for a.m. receivers AP1051/13



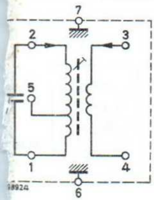
$L_{1\text{-}2}$	775 μH
$C_{1\text{-}2}$	150 pF
$C_{o\,1\text{-}2}$	6 pF
$Q_{1\text{-}2}$ (460 kHz)	85
$\frac{V_{1\text{-}5}}{V_{1\text{-}2}} \times 100\%$	24%
$\frac{V_{3\text{-}4}}{V_{1\text{-}2}} \times 100\%$	4.2%
$f_{1\text{-}2}$	460 kHz

Catalog number
3122 107 30960



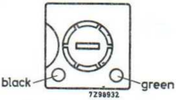
Marking

.F. circuit for a.m. receivers AP1051/14



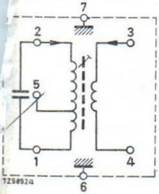
$L_{1\text{-}2}$	775 μH
$C_{1\text{-}2}$	150 pF
$C_{o\,1\text{-}2}$	6 pF
$Q_{1\text{-}2}$ (460 kHz)	110
$\frac{V_{1\text{-}5}}{V_{1\text{-}2}} \times 100\%$	20.5%
$\frac{V_{3\text{-}4}}{V_{1\text{-}2}} \times 100\%$	11.8%
$f_{1\text{-}2}$	460 kHz

Catalog number
3122 107 30970



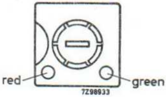
Marking

F. circuit for a.m. receivers AP1051/15



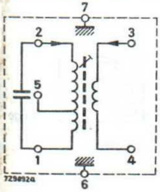
$L_{1\text{-}2}$	775 μH
$C_{1\text{-}2}$	150 pF
$C_{o\,1\text{-}2}$	6 pF
$Q_{1\text{-}2}$ (460 kHz)	85
$\frac{V_{1\text{-}5}}{V_{1\text{-}2}} \times 100\%$	14.6%
$\frac{V_{3\text{-}4}}{V_{1\text{-}2}} \times 100\%$	2.68%
$f_{1\text{-}2}$	460 kHz

Catalog number
3122 107 30980



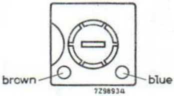
Marking

I.F. circuit for f.m. receivers AP1051/17



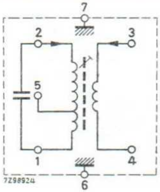
$L_{1\text{-}2}$	2.6 μH
$C_{1\text{-}2}$	82 pF
$C_{o\,1\text{-}2}$	3.5 pF
$Q_{1\text{-}2}$ (10.7 MHz)	110
$\frac{V_{1\text{-}5}}{V_{1\text{-}2}} \times 100\%$	32%
$\frac{V_{3\text{-}4}}{V_{1\text{-}2}} \times 100\%$	12.5%
$f_{1\text{-}2}$	10.7 MHz

Catalog number
3122 108 20570



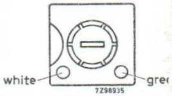
Marking

Detector circuit for f.m. receivers AP1051/18



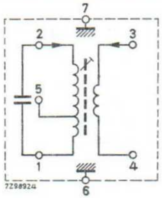
L_{1-2}	2.6 μH
C_{1-2}	82 pF
$C_{o\,1-2}$	3.5 pF
Q_{1-2} (10.7 MHz)	105
$\frac{V_{1-5}}{V_{1-2}} \times 100\%$	50%
$\frac{V_{3-4}}{V_{1-2}} \times 100\%$	32%
f_{1-2}	10.7 MHz

Catalog number
3122 108 20550



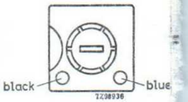
Marking

Detector circuit for f.m. receivers AP1051/19



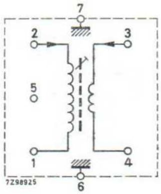
L_{1-2}	2.6 μH
C_{1-2}	82 pF
$C_{o\,1-2}$	3.5 pF
Q_{1-2} (10.7 MHz)	110
$\frac{V_{1-5}}{V_{1-2}} \times 100\%$	50%
$\frac{V_{3-4}}{V_{1-2}} \times 100\%$	12.5%
f_{1-2}	10.7 MHz

Catalog number
3122 108 20560

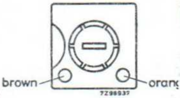


Marking

I.F. coil for a.m. receivers AP1051/20

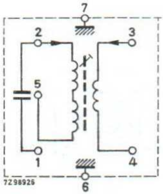


L_{1-2}	33 μH
$C_{o\,1-2}$	7 pF
Q_{1-2} (460 kHz)	100
$\frac{V_{3-4}}{V_{1-2}} \times 100\%$	6.2%
f_{1-2}	450–470 kHz
Catalog number	3122 994 93890

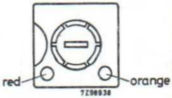


Marking

I.F. circuit for a.m. receivers AP1051/21

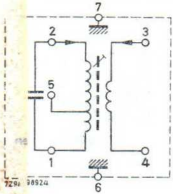


L_{2-5}	1300 μH
C_{1-2}	82 pF
$C_{o\,2-5}$	7.5 pF
$Q_{1/5-2}$ (460 kHz)	110
$\frac{V_{3-4}}{V_{2-5}} \times 100\%$	1.9%
$f_{1/5-2}$	460 kHz
Catalog number	3122 994 93900



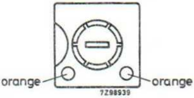
Marking

.F. circuit for a.m. receivers AP1051/22



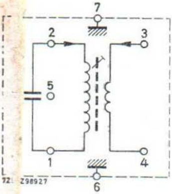
$L_{1\text{-}2}$	775 μH
$C_{1\text{-}2}$	150 pF
$C_{o\,1\text{-}2}$	7.5 pF
$Q_{1\text{-}2}$ (460 kHz)	110
$\frac{V_{1\text{-}5}}{V_{1\text{-}2}} \times 100\%$	22.2%
$\frac{V_{3\text{-}4}}{V_{1\text{-}2}} \times 100\%$	1.3%
$f_{1\text{-}2}$	460 kHz

Catalog number
3122 994 93910

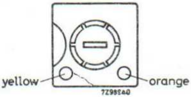


Marking

etector circuit for a.m. receivers AP1051/23

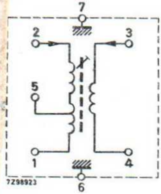


$L_{1\text{-}2}$	945 μH
$C_{1\text{-}2}$	100 pF
$C_{o\,1\text{-}2}$	7.5 pF
$Q_{1\text{-}2}$ (460 kHz)	80
$\frac{V_{3\text{-}4}}{V_{1\text{-}2}} = 100\%$	66.6%
$f_{1\text{-}2}$	460 kHz
Catalog number	3122 994 93920

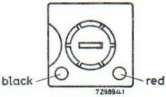


Marking

I.F. coil for a.m. receivers AP 1051/24

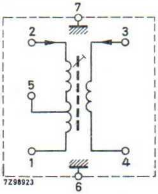


$L_{1\text{-}2}$	775 μH
$C_{o\,1\text{-}2}$	6 pF
$Q_{1\text{-}2}$ (460 kHz)	140
$\frac{V_{1\text{-}5}}{V_{1\text{-}2}} \times 100\%$	34.4%
$\frac{V_{3\text{-}4}}{V_{1\text{-}2}} \times 100\%$	2.6%
$f_{1\text{-}2}$	450–470 kHz
Catalog number	3122 107 30990

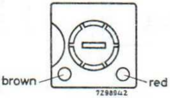


Marking

Detector coil for a.m. receivers AP 1051/25



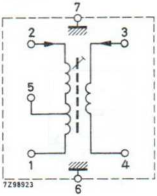
$L_{1\text{-}2}$	775 μH
$C_{o\,1\text{-}2}$	6 pF
$Q_{1\text{-}2}$ (460 kHz)	125
$\frac{V_{1\text{-}5}}{V_{1\text{-}2}} \times 100\%$	33.3%
$\frac{V_{3\text{-}4}}{V_{1\text{-}2}} \times 100\%$	21.3%
$f_{1\text{-}2}$	450–470 kHz
Catalog number	3122 107 31000



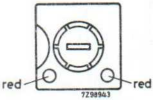
Marking

COILS FOR TRANSISTORISED RADIO RECEIVERS

Oscillator coil for m.w. and l.w. receivers AP 1051/26

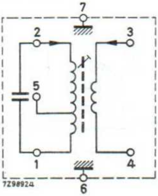


$L_{1\text{-}2}$	200 μH
$C_{o\,1\text{-}2}$	2.5 pF
$Q_{1\text{-}2}$ (600 kHz)	125
$\frac{V_{1\text{-}5}}{V_{1\text{-}2}} \times 100\%$	1.6%
$\frac{V_{3\text{-}4}}{V_{1\text{-}2}} \times 100\%$	9%
Catalog number	3122 107 31010



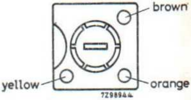
Marking

I.F. circuit for a.m. receivers AP1051/27



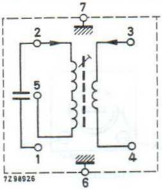
$L_{1\text{-}2}$	800 μH
$C_{1\text{-}2}$	150 pF
$C_{o\,1\text{-}2}$	6 pF
$Q_{1\text{-}2}$ (460 kHz)	125
$\frac{V_{1\text{-}5}}{V_{1\text{-}2}} \times 100\%$	47%
$\frac{V_{3\text{-}4}}{V_{1\text{-}2}} \times 100\%$	1.3%
$f_{1\text{-}2}$	460 kHz

Catalog number
3122 107 31020

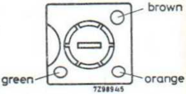


Marking

I.F. circuit for a.m. receivers AP1051/28

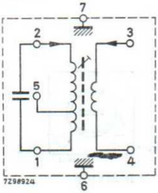


$L_{2\text{-}5}$	1180 μH
$C_{1\text{-}2}$	100 pF
$C_{o\,2\text{-}5}$	6 pF
$Q_{1/5\text{-}2}$ (460 kHz)	120
$\frac{V_{3\text{-}4}}{V_{2\text{-}5}} \times 100\%$	2.2%
$f_{1/5\text{-}2}$	460 kHz
Catalog number	3122 107 31030

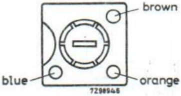


Marking

I.F. circuit for f.m. receivers AP1051/29

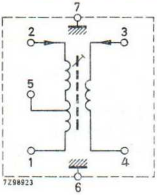


$L_{1\text{-}2}$	2.6 μH
$C_{1\text{-}2}$	82 pF
$C_{o\,1\text{-}2}$	3 pF
$Q_{1\text{-}2}$ (10.7 MHz)	68
$\frac{V_{1\text{-}5}}{V_{1\text{-}2}} \times 100\%$	60%
$\frac{V_{3\text{-}4}}{V_{1\text{-}2}} \times 100\%$	13.3%
$f_{1\text{-}2}$	10.7 MHz
Catalog number	3122 107 31040

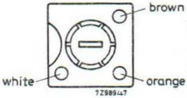


Marking

Oscillator coil for m.w. and l.w. receivers AP1051/30

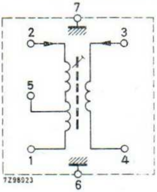


$L_{1\text{-}2}$	135 μH
$C_{o\,1\text{-}2}$	2.8 pF
$Q_{1\text{-}2}$ (1200 kHz)	145
$\frac{V_{1\text{-}5}}{V_{1\text{-}2}} \times 100\%$	2%
$\frac{V_{3\text{-}4}}{V_{1\text{-}2}} \times 100\%$	9.3%
Catalog number	3122 107 31050

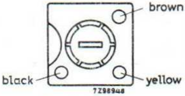


Marking

Oscillator coil for m.w. and l.w. receivers AP1051/31

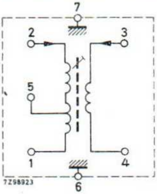


$L_{1\text{-}2}$	200 μH
$C_{o\,1\text{-}2}$	2.5 pF
$Q_{1\text{-}2}$ (1200 kHz)	145
$\frac{V_{1\text{-}5}}{V_{1\text{-}2}} \times 100\%$	1.6%
$\frac{V_{3\text{-}4}}{V_{1\text{-}2}} \times 100\%$	8.2%
Catalog number	3122 107 31060

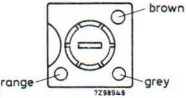


Marking

I.F. coil for f.m. receivers AP1051/32

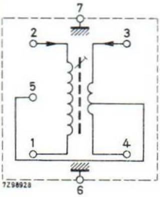


$L_{1\text{-}2}$	2.6 μH
$C_{o\,1\text{-}2}$	3 pF
$Q_{1\text{-}2}$ (10.7 MHz)	70
$\frac{V_{1\text{-}5}}{V_{1\text{-}2}} \times 100\%$	60%
$\frac{V_{3\text{-}4}}{V_{1\text{-}2}} \times 100\%$	13.3%
$f_{1\text{-}2}$	10.7 MHz
Catalog number	3122 107 31700

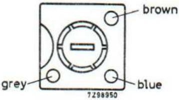


Marking

I.F. coil assembly for a.m. receivers AP1051/33

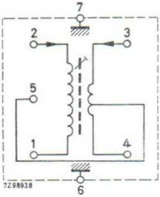


$L_{1\text{-}2}$	40 μH
$C_{o\,1\text{-}2}$	6 pF
$Q_{1\text{-}2}$ (460 kHz)	130
$\frac{V_{3\text{-}4}}{V_{1\text{-}2}} \times 100\%$	19.8%
$\frac{V_{3\text{-}5}}{V_{1\text{-}2}} \times 100\%$	11.6%
$f_{1\text{-}2}$	450–470 kHz
Catalog number	3122 108 91490

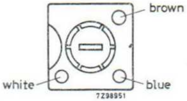


Marking

I.F. coil assembly for a.m. receivers AP1051/34

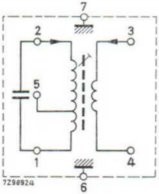


$L_{1\text{-}2}$	120 μH
$C_{o\,1\text{-}2}$	6 pF
$Q_{1\text{-}2}$ (460 kHz)	135
$\frac{V_{3\text{-}4}}{V_{1\text{-}2}} \times 100\%$	6.66%
$\frac{V_{3\text{-}5}}{V_{1\text{-}2}} \times 100\%$	5.56%
$f_{1\text{-}2}$	450–470 kHz
Catalog number	3122 108 91500

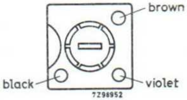


Marking

I.F. circuit for a.m. receivers AP1051/35



$L_{1\text{-}2}$	775 μH
$C_{1\text{-}2}$	150 pF
$C_{o\,1\text{-}2}$	6 pF
$Q_{1\text{-}2}$ (460 kHz)	112
$\frac{V_{1\text{-}5}}{V_{1\text{-}2}} \times 100\%$	36.1%
$\frac{V_{3\text{-}4}}{V_{1\text{-}5}} \times 100\%$	59%
$f_{1\text{-}2}$	460 kHz
Catalog number	3122 108 91510

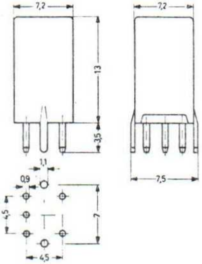


Marking

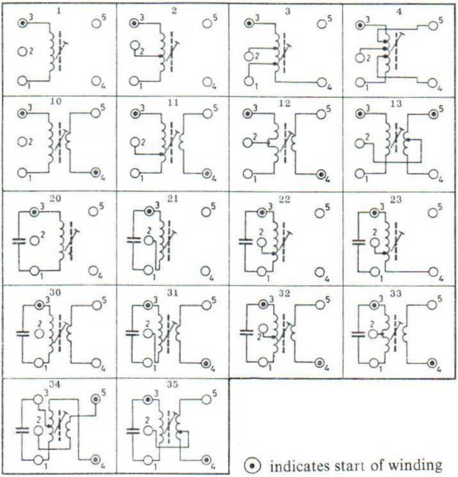
7 × 7 Filter coils

7 × 7 mm filter coils find application as i.f. single circuits and band-pass filters and as preselector and oscillator circuits in radio and television receivers, and also as input and output coils in hybrid filters.
A great number of standard coils are available, all colour coded.

Dimensions in mm



Standard circuits



⊙ indicates start of winding

Some examples of the standard types

Primary I.F. coil, circuit 32, $f = 0.46$ MHz, $L = 1150\ \mu$H, $Q = 125$; 185/95/3 turns, capacitor = 100 pF, colour code black/violet, catalog number 3112 348 20070.

I.F. coil, circuit 10, $f = 10.7$ MHz, $L = 2.03\ \mu$H, $Q = 104$; 14/1 turns, external capacitor 110 pF, colour code red/yellow, catalog number 3112 348 20240.
R.F. coil, circuit 2, $f = 27.12$ MHz, $L = 1.63\ \mu$H; 17/7 turns, external capacitor 17 pF, colour code yellow/red, catalog number 3112 348 20420.

PIEZOELECTRIC CERAMIC RESONATORS AND FILTERS

Piezoelectric ceramic resonators for A.M. receivers

resonant frequency (kHz) ±1 kHz	*capacitance at 100 kHz (pF)*	*catalog number* 2422 540	
		versions according to fig. 1	*versions according to fig. 2*
452	190	00101	00201
455	180	00102	00202
460	180	00103	00203
468	180	00104	00204
470	180	00105	00205

Quality factor : >800
Inductance : 8.5 mH
Ambient temperature range : −25 to +85°C
Temperature coefficient of resonant frequency : $<85 \cdot 10^{-6}$/deg C

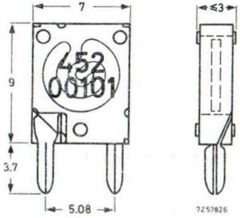


Fig. 1. Version for printed-wiring boards, with holes of 1.3 mm

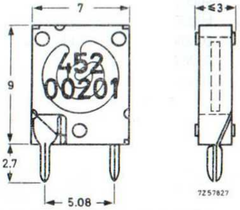


Fig. 2. Version for printed-wiring boards with holes of 0.8 mm

PIEZOELECTRIC CERAMIC RESONATORS AND FILTERS

Third order hybrid filters with ceramic resonators

midband frequency f_m *(kHz)* ±1 *kHz*	*bandwidth (kHz)*			*attenuation (dB)*		*impedance levels (kΩ)*		*transfer-impedance at* f_m *(kΩ)*	*transducer loss (dB)*	*insertion loss (dB)*	*diagram Fig.*	*catalog number* 2422 540
	at an attenuation of		*at* $f_m \pm 9$ *kHz*	*in the stopband*		*output preceding stage*	*input succeeding stage*					
	3 dB	*60 dB*		*up to 5 MHz*	*between 5 and 30 MHz*							
452	>4	60	33	>90	>70	680	680	63	14.5	14.5	1	50001
455												50002
460												50003
468												50004
470												50005
452	>4	—	33	>90	>70	200	1.2	0.6	22	6	2	50051
455												50052
460												50053
468												50054
470												50055

Operating temperature range: -25 to $+75$°C
Temperature coefficient of
midband frequency : $<85.10^{-6}$/deg C

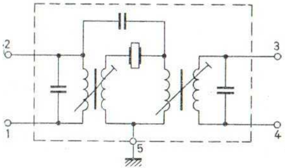

2
1
3
4
5

Fig. 1

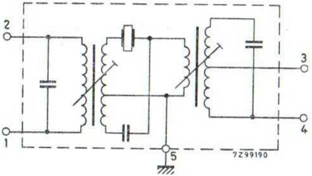
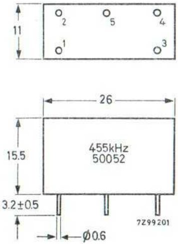
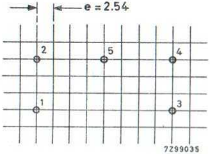

2
1
3
4
5
7Z99190

Fig. 2


11
2
5
4
1
3
26
15.5
455kHz
50052
3.2±0.5
7Z99201
Ø0.6


e = 2.54
2
5
4
1
3
7Z99035

LOUDSPEAKERS

Standard loudspeakers

overall diameter	*total depth*	*max. power*	*resonance frequency*	*impedance*	*catalog number*	*new commercial type number*	*old commercial type number*	*main applications*
2½″								
64 mm ∅	20 mm	0.5 W	360 Hz	4 Ω	2422 257 23801	AD2070/Z4	AD3207 Z	portable sets intercom
				8 Ω	2422 257 23802	Z8	SZ	
				15 Ω	2422 257 23803	Z15	PZ	
				25 Ω	2422 257 23804	Z25	HZ	
3″								
81 mm ∅	28 mm	1 W	250 Hz	4 Ω	2422 257 23701	AD3070/Y4		portable sets intercom
				8 Ω	2422 257 23702	Y8		
				15 Ω	2422 257 23703	Y15		
				25 Ω	2422 257 23704	Y25		
81 mm ∅	28 mm	1 W	250 Hz	150 Ω	2422 257 23705	AD3370/Y150		
3″ × 5″								
76 × 131 mm	42 mm	2 W	200 Hz	4 Ω	2422 256 30301	AD3590/X4	AD3359 RX	portable sets television
				50 Ω	2422 256 30302	X50	NX	
				400 Ω	2422 256 30303	X400	BX	
				8 Ω	2422 256 30304	X8	SX	
				15 Ω	2422 256 30305	X15	PX	

105 mm Ø	29 mm	1 W	200 Hz	4 Ω	2422 257 24201	AD4070/Y4		portable sets
				8 Ω	2422 257 24202	Y8		
				15 Ω	2422 257 24203	Y15		
				25 Ω	2422 257 24204	Y25		
105 mm Ø	39 mm	3 W	165 Hz	4 Ω	2422 257 34301	AD4080/X4		portable sets
			165 Hz	8 Ω	2422 257 34302	X8		
			165 Hz	15 Ω	2422 257 34303	X15		
			165 Hz	25 Ω	2422 257 34304	X25		
			185 Hz	4 Ω	2422 257 34305	Z4		
			185 Hz	8 Ω	2422 257 34306	Z8		
			185 Hz	15 Ω	2422 257 34307	Z15		
			185 Hz	25 Ω	2422 257 34308	Z25		
105 mm Ø	37 mm	2 W	190 Hz	8 Ω	2422 256 34301	AD4090/X8	AD3419 SX	portable sets, television
		2 W	190 Hz	15 Ω	2422 256 34302	X15	PX	
		0.6 W	190.Hz	400 Ω	2422 256 34303	X400	BX	
3″ × 8″								
82 × 205 mm	50 mm	2 W	120 Hz	4 Ω	2422 257 30301	AD3880/X4		television
				8 Ω	2422 257 30302	X8		tape recorders
				15 Ω	2422 257 30303	X15		portable sets
82 × 205 mm	54 mm	2 W	120 Hz	4 Ω	2422 256 30501	AD3890/X4		radio,
			120 Hz	8 Ω	2422 256 30503	X8		colour
			125 Hz	800 Ω	2422 256 30502	X800		television

LOUDSPEAKERS

overall diameter	*total depth*	*max. power*	*resonance frequency*	*impedance*	*catalog number*	*new commercial type number*	*old commercial type number*	*main applications*
4″ × 6″ 103 × 154 mm	48 mm	3 W	155 Hz	4 Ω	2422 257 30201	AD4680/Z4		radio tape recorders record players
				8 Ω	2422 257 30202	Z8		
				15 Ω	2422 257 30203	Z15		
				25 Ω	2422 257 30204	Z25		
		6 W	140 Hz	4 Ω	2422 257 30205	X4		
				8 Ω	2422 257 30206	X8		
				15 Ω	2422 257 30207	X15		
				25 Ω	2422 257 30208	X25		
		4 W	125 Hz	4 Ω	2422 257 30209	M4		
				8 Ω	2422 257 30211	M8		
				15 Ω	2422 257 30212	M15		
				25 Ω	2422 257 30213	M25		
103 × 154 mm	51 mm	4 W	135 Hz	400 Ω	2422 256 30101	AD4690/M400	AD3469 BM	
				800 Ω	2422 256 30103	M800	AM	
				4 Ω	2422 256 30104	M4	RM	
				4 Ω	2422 256 30105	X4	RX	
				8 Ω	2422 256 30106	M8	SM	
5″ 129 mm ∅	48 mm	3 W	155 Hz	4 Ω	2422 257 35201	AD5080/Z4		radio tape recorders record players intercom car radios
				8 Ω	2422 257 35202	Z8		
				15 Ω	2422 257 35203	Z15		
				25 Ω	2422 257 35204	Z25		
		6 W	130 Hz	4 Ω	2422 257 35205	X4		
				8 Ω	2422 257 35206	X8		
				15 Ω	2422 257 35207	X15		
				25 Ω	2422 257 35208	X25		
		4 W	130 Hz	4 Ω	2422 257 35209	M4		
				8 Ω	2422 257 35211	M8		
				15 Ω	2422 257 35212	M15		
				25 Ω	2422 257 35213	M25		

5″ × 7″								
134 × 184 mm	58 mm	3 W	115 Hz	4 Ω	2422 257 36101	AD5780/X4		
				8 Ω	2422 257 36102	X8		
				15 Ω	2422 257 36103	X15		radio
				25 Ω	2422 257 36104	X25		tape recorders
		4 W	100 Hz	4 Ω	2422 257 36105	M4		record players
				8 Ω	2422 257 36106	M8		car radios
				15 Ω	2422 257 36107	M15		
				25 Ω	2422 257 36108	M25		
6½″								
166 mm	56 mm	6 W	110 Hz	4 Ω	2422 257 37801	AD7080/X4		radio
			110 Hz	8 Ω	2422 257 37802	X8		tape recorders
		4 W	105 Hz	4 Ω	2422 257 37803	M4		record players
			105 Hz	8 Ω	2422 257 37804	M8		
166 mm	47 mm	3 W	115 Hz	4 Ω	2422 256 37005	AD7091/X4	AD3729 RX	
			95 Hz	4 Ω	2422 256 37004	M4	RM	television
			115 Hz	800 Ω	2422 256 37002	X800	AX	
			95 Hz	800 Ω	2422 256 37001	M800	AM	
			115 Hz	8 Ω	2422 256 37008	X8		
			95 Hz	8 Ω	2422 256 37009	M8		
6″ × 9″								
161 × 234 mm	68 mm	6 W	90 Hz	4 Ω	2422 257 39101	AD6980/X4		radio
			90 Hz	8 Ω	2422 257 39102	X8		record players
			77 Hz	4 Ω	2422 257 39103	M4		
			77 Hz	8 Ω	2422 257 39104	M8		
8″								
206 mm	68 mm	6 W	95 Hz	4 Ω	2422 257 38201	AD8080/X4		radio
			95 Hz	8 Ω	2422 257 38202	X8		television
			75 Hz	4 Ω	2422 257 38203	M4		
			75 Hz	8 Ω	2422 257 38204	M15		

Tweeters and woofers for Hi-Fi equipment

overall diameter	*total depth*	*max. power*	*resonance frequency*	*impedance*	*catalog number*	*new commercial type number*	*old commercial type number*	*main applications*
1″ dome tweeters								
93 mm	26 mm	20 W	1000 Hz	4 Ω 8 Ω	2422 257 33001 2422 257 33002	AD0160/T4 T8		combinations
2¼″ tweeters								
58 mm	29 mm	10 W 1)	<800 Hz	4 Ω 8 Ω	2422 257 22001 2422 257 22002	AD2070/T4 T8		combinations
5″ woofers								
129 mm	56 mm	10 W 2)	50 Hz	4 Ω 8 Ω	2422 257 35301 2422 257 35302	AD5060/W4 W8	AD3503 R S	enclosures
7″ woofers								
166 mm	74 mm	20 W 2)	28 Hz	4 Ω 8 Ω	2422 257 37702 2422 257 37701	AD7065/W4 W8	— AD3703 S	enclosures
8″ woofers								
206 mm	93 mm	20 W 2)	28 Hz	4 Ω 8 Ω	2422 257 38102 2422 257 38101	AD8065/W4 W8	— AD3803 S	enclosures
10″ woofer								
261 mm	153 mm	40 W 2)	20 Hz	8 Ω	4304 078 70261	AD1055/W8		enclosures
12″ woofers								
315 mm	169 mm	40 W 2)	15 Hz	4 Ω 8 Ω	2422 256 41301 2422 256 41302	AD1256/W4 W8		enclosures

High quality full-range loudspeakers

5″								
129 mm	56 mm	4 W	85 Hz	4 Ω 8 Ω	2422 257 35101 2422 257 35102	AD5060/M4 M8	AD3501 RM SM	enclosures
7″								
166 mm	70 mm	10 W	55 Hz	5 Ω 8 Ω	2422 257 37119 2422 257 37118	AD7060/M5 M8	— —	enclosures
8″								
206 mm	124 mm	6 W	60 Hz	5 Ω	2422 256 48002	AD8050/M5	AD4800 M	enclosures
8½″								
217 mm	116 mm	10 W	50 Hz	7 Ω 800 Ω	2422 258 48002 2422 258 48004	9710M/01 AM/01		enclosures
10″								
261 mm	136 mm	10 W	50 Hz	7 Ω 800 Ω	2422 256 41003 2422 256 41002	AD1050/M7 M800	AD4000 M AM	enclosures
12″								
315 mm	123 mm	10 W	45 Hz	5 Ω	2422 257 31002	AD1260/M5	AD4201 M	electronic organs bass guitars enclosures public address
315 mm	160 mm	20 W	45 Hz	7 Ω 800 Ω	2422 256 41103 2422 256 41102	AD1250/M7 M800	AD4200 M AM	
315 mm	170 mm	20 W	45 Hz	7 Ω 800 Ω	2422 258 51004 2422 258 51003	AD1255/M7 M800	AD5200 M AM	
12″ special high power								
315 mm	170 mm	>40 W	60 Hz	4 Ω 8 Ω	2422 256 51101 2422 256 51102	AD1255/HP4 /HP8		guitar amplifiers electronic organs

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[1] With 5 μF in series of 8 Ω version and 12 μF of 4 Ω version.

[2] In closed acoustic box.

Recommended loudspeaker combinations

Woofer	*Squawker*	*Tweeter*	*Enclosure volume*	*Power handling capacity*	*Cross-over frequencies*
AD5060/W	—	AD0160/T	3 l	10 W	1000 Hz
AD5060/W	—	AD2070/T	3 l	10 W	2000 Hz
AD7065/W	—	AD0160/T	7 l	20 W	1500 Hz
AD8065/W	—	AD0160/T	15 l	20 W	1500 Hz
AD8065/W	AD5060/W	AD0160/T	25 l	20 W	700 Hz, 3000 Hz
AD1055/W	AD5060/W	AD0160/T	35 l	40 W	700 Hz, 3000 Hz
AD1055/W	2 × AD5060/W	2 × AD0160/T	40 l	40 W	700 Hz, 3000 Hz
AD1256/W	2 × AD5060/W	2 × AD0160/T	50 l	40 W	700 Hz, 3000 Hz
AD1256/W	4 × AD5060/W	4 × AD0160/T	80 l	40 W	700 Hz, 3000 Hz

Commercial coding system for our loudspeakers

AD . . . ./. .

size and shape			magnet system		frequency characteristic		impedance
20	round	$2\frac{1}{4}''$–$2\frac{1}{2}''$	90[1]	sinterpot	Z	Notably higher sensitivity around a response peak at about 3 kHz	4 ohm
30	round	3″	80	ferroxdure standard round	Y	Notably higher response level in the region of 2–6 kHz	8 ohm
33	square	3″	70	ferroxdure square	X	Same as Y but a wider frequency range	15 ohm
40	round	4″	65	ferroxdure big, high quality	M	Smooth response over wide frequency range	25 ohm
44	square	4″	60	ferroxdure small, high quality	T	Tweeter, high frequency range	50 ohm
35	oval	3″ × 5″	56	Ticonal, 50 mm coil, core magnet	W	Woofer, extremely low resonance frequency	150 ohm
38	oval	3″ × 8″	55	Ticonal, 35 mm coil, ring magnet	P	Same as M but cut off at a high frequency	400 ohm
46	oval	4″ × 6″	50	Ticonal small, high quality			800 ohm
57	oval	5″ × 7″					etc.
69	oval	6″ × 9″					
50	round	5″					
70	round	$6\frac{1}{2}''$					
80	round	8″					
10	round	10″					
12	round	12″					

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[1] Mechanical or acoustical variations are indicated by replacing 0 or 5 by some other figure (91 = Sinterpot Wafer)

RELAYS

Operating (for d.c. voltage)

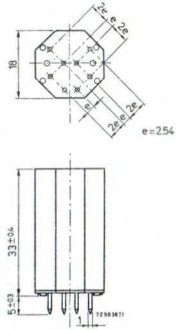
		ER1000	ER1010	ER1020	ER1030	ER1040	ER1050
Voltage	($V_{d.c.}$)	72	36	24	12	6	3
Current	(mA)	14.5	27	44	80	146	300
Power	(mW)	1040	970	1050	960	880	900
Resistance	(Ω)	5000	1950	550	150	40	10
Temperature	(°C)	⩽100	⩽100	⩽100	⩽100	⩽100	⩽100

Contact

Pressure : $\geqslant 0.1$ N/cm^2
Voltage : 300 $V_{d.c.}$
Current : 40 mA
Resistance : ⩽100 MΩ
Capacitance : ⩽2 pF
Insulation resistance : ⩾40 MΩ

Catalog numbers

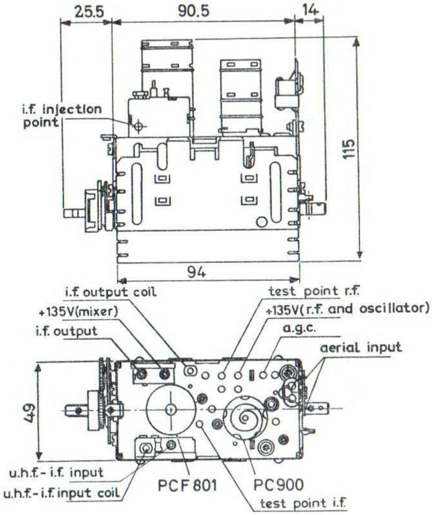
ER1000: 3122 107 95940
ER1010: 3122 108 86520
ER1020: 3122 108 86510
ER1030: 3122 108 86500
ER1040: 3122 108 86490
ER1050: 3122 108 86480



TELEVISION TUNERS

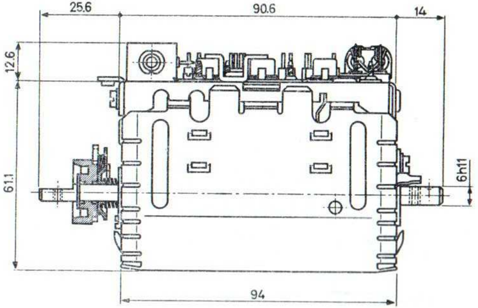
V.H.F. tuner AT 7650/90

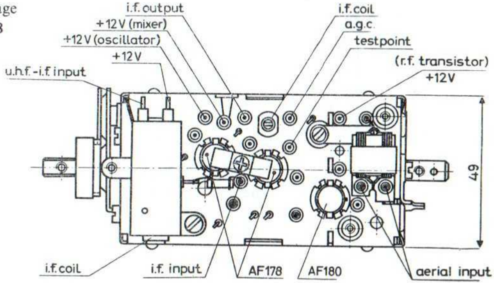
Catalog number : 3122 996 68400
System : C.C.I.R.
Tubes, r.f. amplifier : PC900
oscillator : PCF 801, triode part
mixer : PCF 801, pentode part
$\left.\begin{matrix}\text{oscillator}\\ \text{mixer}\end{matrix}\right\} V_f = 12\ \text{V},\ I_{f\,\text{nom}} = 300\ \text{mA}$
Supply, r.f. amplifier and
oscillator : $V_b = 135$ V
$I_{\max} = 25$ mA
mixer : $V_b = 135$ V
$I_{\max} = 11$ mA
Frequency ranges : 47–68 MHz (band I)
174–223 MHz (band III)
Intermediate frequencies
picture : 38.9 MHz
sound : 33.4 MHz
Aerial input impedance : 300 Ω symmetrical
Gain : 35 dB from aerial-emf to the grid of the first i.f. stage (for an i.f. bandwidth of 6.5 MHz at 3 dB and flat within 5%)
Gain of the pentode part of the PCF801 used as an i.f. amplifier : 20 dB
Noise, band I : $\leqslant 3.5\ kT_0$
band III : $\leqslant 6.5\ kT_0$



V.H.F. tuner AT7652/80T

Catalog number : 3122 108 60160
System : C.C.I.R.
Transistors, r.f. amplifier : AF180; $I_B \sim 50$ μA
$I_E = 2.5$ mA
$V_{agc} = 12$ V
oscillator : AF178; $I_E \sim 1.85$ mA
$I_B \sim 0.92$ mA
$V_b = 12$ V
mixer : AF178; $I_E \sim 1.9$ mA
$I_B \sim 1.15$ mA
$V_b = 12$ V
Frequency ranges : 47–68 MHz (band I)
174–223 MHz (band III)
Intermediate frequencies
picture : 38.9 MHz
sound : 33.4 MHz
Aerial input impedance : 300 Ω symmetrical
Gain : 26 dB from aerial - emf to the first i.f. stage (for an i.f. bandwidth of 6.5 MHz at 3 dB and flat within 5 %)
Noise, band I : $\leqslant 5\,kT_0$
band III : $\leqslant 9\,kT_0$

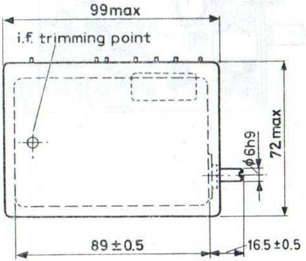


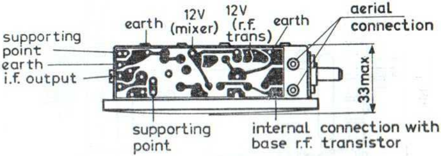


TELEVISION TUNERS

U.H.F. tuner AT6382/01

Catalog number : 3122 108 59470
System : C.C.I.R.
Transistors, r.f. amplifier : AF239
mixer-oscillator : AF139
Supply, r.f. amplifier : +12 V (min. +9.5 V)
oscillator : +12 V (min. +9.5 V)
Total supply current without a.g.c. : approx. 8 mA
Frequency range : 470–890 MHz (bands IV and V)
Intermediate frequencies
picture : 38.9 MHz
sound : 33.4 MHz
Aerial impedance : 300 Ω
Gain for an i.f. bandwidth of 7 MHz at 3 dB : >18 dB
Noise, at 470 MHz : average value 7.0 dB (max. 8.5 dB)
at 600 MHz : average value 7.0 dB (max. 8.0 dB)
at 800 MHz : average value 7.0 dB (max. 8.5 dB)
at 860 MHz : average value 8.5 dB (max. 10.0 dB)
at 890 MHz : average value 9.0 dB (max. 11.0 dB)

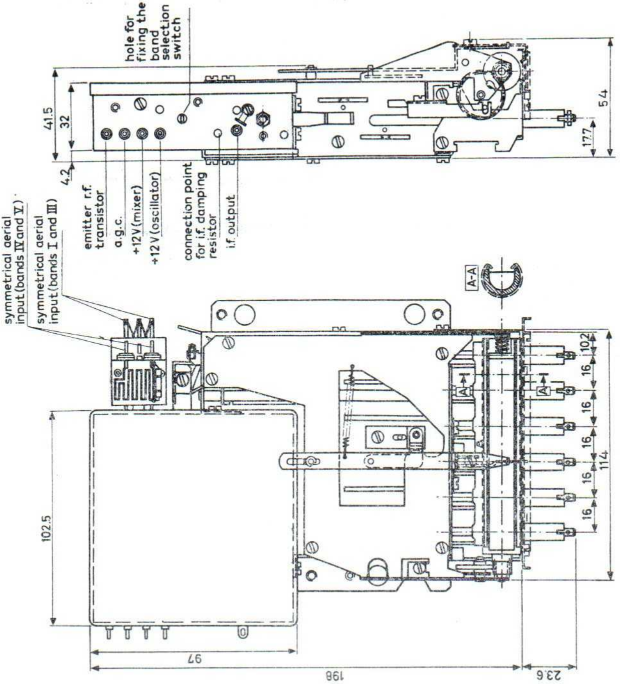




V.H.F./U.H.F. tuner AT7672/90

This tuner is fitted with a push-button unit. Up to six selections are possible, each of which may be pre-adjusted to any v.h.f. or u.h.f. channel.

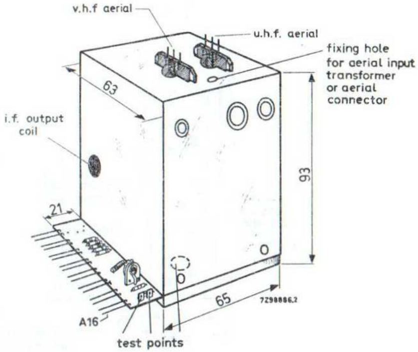
Catalog number	: 3122 108 65520
System	: C.C.I.R.
Transistors, r.f. amplifier	: AF239
mixer	: AF139
oscillator	: AF139
Supply, r.f. amplifier	: +12 V (min. +9.5 V)
oscillator	: +12 V (min. +9.5 V)
Total supply current	
without a.g.c.	: approx. 11 mA
with a.g.c.	: approx. 17 mA
Frequency ranges	: 47–68 MHz (band I) 174–230 MHz (band III) 470–890 MHz (bands IV and V)
Intermediate frequencies	
picture	: 38.9 MHz
sound	: 33.4 MHz
Aerial impedance	: 300 Ω, symmetrical
Gain for an i.f. bandwidth of 7 MHz at 3 dB	
bands I and III	: ⩾22 dB (average value 26 dB)
bands IV and V	: ⩾18 dB (average value 24 dB)
Noise, band I	: average value 5.5 dB (max. 7.0 dB)
band III	: average value 6 dB (max. 7.5 dB)
at 470 MHz	: average value 6 dB (max. 9.0 dB)
at 650 MHz	: average value 7 dB (max. 9.0 dB)
at 800 MHz	: average value 8 dB (max. 10.0 dB)
at 860 MHz	: average value 9.5 dB (max. 11.0 dB)
at 890 MHz	: average value 10 dB (max. 12.0 dB)



symmetrical aerial input (bands IV and V)
symmetrical aerial input (bands I and III)
emitter r.f. transistor
a.g.c.
+12 V (mixer)
+12 V (oscillator)
connection point for i.f. damping resistor
i.f. output
hole for fixing the band selection switch
41.5
32
4.2
17.7
54
A-A
A
A
102.5
10.2
16
16
16
16
16
114
97
198
23.6

V.H.F./U.H.F. tuner with diode tuning ELC 1004

Catalog number	: 2422 542 10041	
System	: C.C.I.R.	
Semiconductors		
band I	: 2 × BF196, BF194, 3 × BB105G (triplet)	
band III	: BF200, BF195, 3 × BB105B (triplet)	
bands IV and V	: BF180, BF181, 3 × BB105B (triplet) BAX13	
Supply voltage	: −12 V ± 10%	
A.G.C. voltage	: from −8.8 V (bands I, III, IV and V) for nominal gain to −1.5 V (band I), −4 V (band III) and −5 V (bands IV and V) for minimum gain	
Tuning voltages	: variable between +3 and +28 V	
Supply current	*without a.g.c.*	*with max. a.g.c.*
band I	: 10 mA	20 mA
band III	: 10 mA	16 mA
bands IV and V	: 12.5 mA	17 mA
Frequency ranges	: 47– 68 MHz (band I) 174–230 MHz (band III) 470–854 MHz (bands IV and V)	
Intermediate frequencies		
picture	: 38.9 MHz	
sound	: 33.4 MHz	
Aerial impedance		
asymmetrical	: 75 Ω	
symmetrical	: 300 Ω, with input transformer	



Gain with double tuned i.f. circuit, having a 3 dB bandwidth of 7 MHz and a dip of 0.5 dB

		average	*minimum*
band I	channel 3	: 30 dB	27 dB
band III	channel 5	: 32 dB	29 dB
band III	channel 10	: 33 dB	30 dB
bands IV and V	channel 21	: 27 dB	24 dB
	channel 50	: 32 dB	29 dB

with single tuned i.f. circuit, having a 3 dB bandwidth of 3 MHz (v.h.f.) or about 4 MHz (u.h.f.)

		average	*minimum*
band I	channel 3	: 35 dB	32 dB
band III	channel 5	: 36 dB	33 dB
band III	channel 10	: 37 dB	34 dB
bands IV and V	channel 21	: 31 dB	28 dB
	channel 50	: 36 dB	33 dB

Noise

	average	*maximum*
band I	: 6.5 dB	8.5 dB
band III	: 7.5 dB	9.5 dB
bands IV and V	: 9.0 dB	12.0 dP

TELEVISION TUNERS

V.H.F./U.H.F. tuner with diode ELC 1024

Dimensions		: see ELC1004
Catalog number		: 2422 542 10241
System		: C.C.I.R.
Semiconductors	band I	: 2 × BF196, BF194, 3 × BB105 (triplet)
	band III	: BF200, BF195, 3 × BB105 (triplet)
	bands IV and V	: BF180, BF181, 3 × BB105B (triplet), BAX13
Supply voltage		: -12 V ± 10%
A.G.C. voltage		: from -8.8 V (bands I, III, IV and V) for nominal gain to -1.5 V (band I), -4 V (band III) and -5 V (bands IV and V) for minimum gain
Tuning voltages		: variable between $+1.5$ and $+28$ V

		without a.g.c.	*with max. a.g.c.*
Supply current	band I	: 10 mA	20 mA
	band III	: 10 mA	16 mA
	bands IV and V	: 12.5 mA	17 mA

Frequency ranges		: 47– 88 MHz (band I) 174–230 MHz (band III) 470–854 MHz (bands IV and V)
Intermediate frequencies	picture	: 38.9 MHz
	sound	: 33.4 MHz
Aerial impedance	asymmetrical	: 75 Ω
	symmetrical	: 300 Ω, with input transformer

Gain with double tuned i.f. circuit, having a 3 dB bandwidth of 7 MHz and a dip of 0.5 dB

		average	*minimum*
band I	channel B	: 30 dB	27 dB
band III	channel D	: 32 dB	29 dB
band III	channel H	: 33 dB	30 dB
bands IV and V	channel 21	: 27 dB	24 dB
	channel 50	: 32 dB	29 dB

Gain with single tuned i.f. circuit, having a 3 dB bandwidth of 3 MHz (v.h.f.) or about 4 MHz (u.h.f.)

		average	*minimum*
band I	channel B	: 35 dB	32 dB
band III	channel D	: 36 dB	33 dB
band III	channel H	: 37 dB	34 dB
bands IV and V	channel 21	: 31 dB	28 dB
	channel 50	: 36 dB	33 dB

Noise

		average	*maximum*
band I		: 7.0 dB	8.5 dB
band III	channels D–H1	: 7.5 dB	9.5 dB
bands IV and V	channels 21–61	: 9.0 dB	12.0 dB

V.H.F./U.H.F. tuner with diode tuning ELC 1034

Dimensions		: see ELC1004	
Catalog number		: 2422 542 10341	
System		: Italian with italian i.f.	
Semiconductors	band I	: 2 × BF196, BF194, 3 × BB105 (triplet)	
	band III	: BF200, BF195, 3 × BB105 (triplet)	
	bands IV and V	: BF180, BF181, 3 × BB105B (triplet), BAX13	
Supply voltage		: $-12\ \text{V} \pm 10\%$	
A.G.C. voltage		: from -8.8 V (bands I, III, IV and V) for nominal gain to 1.5 V (band I), -4 V (band III) and -5 V (bands IV and V) for minimum gain	
Tuning voltages		: variable between $+3$ and $+28$ V	
		without a.g.c.	*with max. a.g.c.*
Supply current	band I	: 10 mA	20 mA
	band III	: 10 mA	16 mA
	bands IV and V	: 12.5 mA	17 mA
Frequency ranges		: 52.5–88 MHz (band I) 174–230 MHz (band III) 470–854 MHz (bands IV and V)	
Intermediate frequencies	picture	: 45.9 MHz	
	sound	: 40.4 MHz	
Aerial impedance	asymmetrical	: 75 Ω	
	symmetrical	: 300 Ω, with input transformer	

Gain with double tuned i.f. circuit, having a 3 dB bandwidth of 7 MHz and a dip of 0.5 dB

		average	*minimum*
band I	channel B	: 29 dB	26 dB
band III	channel D	: 31 dB	28 dB
band III	channel H	: 32 dB	29 dB
bands IV and V	channel 21	: 26 dB	23 dB
	channel 50	: 31 dB	28 dB

Gain with single tuned i.f. circuit, having a 3 dB bandwidth of 3 MHz (v.h.f.) or about 4 MHz (u.h.f.)

		average	*minimum*
band I	channel B	: 31 dB	28 dB
band III	channel D	: 33 dB	30 dB
band III	channel H	: 34 dB	31 dB
bands IV and V	channel 21	: 28 dB	25 dB
	channel 50	: 33 dB	30 dB

Noise

		average	*maximum*
band I		: 7.0 dB	8.5 dB
band III	channels D–H1	: 7.5 dB	9.5 dB
bands IV and V	channels 21–61	: 9.0 dB	12.0 dB

V.H.F./U.H.F. tuner with diode tuning ELC 1054

Dimensions : see ELC1004
Catalog number : 2422 542 10541
System : French
Semiconductors band I : BF196, BF194, BF197, 3 × BB105 (triplet)
band III : BF200, BF195, 3 × BB105B (triplet), BA182, BAX13
bands IV and V : BF180, BF181, 3 × BB105B (triplet), BA182
Supply voltage : −12 V ± 10%
A.G.C. voltage : from −8.8 V (bands I, III, IV and V) for nominal gain to −1.5 V (band I), −4 V (band III) and −5 V (bands IV and V) for minimum gain
Switching voltage, band III
odd channels : +28 V (no load)
even channels : −12 V
Tuning voltages : variable between +3 and +28 V

	without a.g.c.	*with max. a.g.c.*
Supply current band I	: 10.5 mA	20 mA
band III, odd channels	: 10 mA	16 mA
even channels	: 17 mA	23 mA
bands IV and V	: 13.5 mA	18 mA

Frequency ranges : 41– 68 MHz (band I)
162–215 MHz (band III)
470–854 MHz (bands IV and V)

Intermediate frequencies
v.h.f. picture : 28.05 MHz
sound : 39.2 MHz
u.h.f. picture : 32.7 MHz
sound : 39.2 MHz

Aerial impedance asymmetrical : 75 Ω
symmetrical : 300 Ω, with input transformer

Gain with double tuned i.f. circuit, having a 3 dB bandwidth of 12 MHz and a dip of 1 dB

band I	: ⩾25 dB		band III, even channels	: ⩾26 dB	
channel F2	: 31 dB	average	channel F6	: 29 dB	average
channel F4	: 28 dB	values	channel F10	: 30 dB	values
band III, odd channels	: ⩾22 dB		bands IV and V	: ⩾24 dB	
channel F5	: 25 dB	average	channel 21	: 27 dB	average
channel F9	: 28 dB	values	channel 50	: 30 dB	values

Noise

	average	*maximum*
band I	: 6.5 dB	8.5 dB
band III	: 8.5 dB	10.0 dB
bands IV and V channels 21–61	: 9.0 dB	12.0 dB

DEFLECTION COMPONENTS FOR BLACK AND WHITE TELEVISION

Deflection unit AT 1040

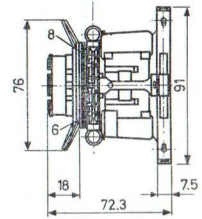
Catalog number 3122 108 69990
For use with a 110° picture tube with a neck diameter of 28 mm in conjunction with the AT2036/01, AT3513 and the AT4042/02.

Line deflection coils, parallel connected

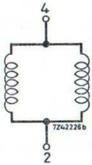
Inductance	2.1 mH
Resistance	3.9 Ω
Deflection current at 18 kV	2.82 A_{p-p}

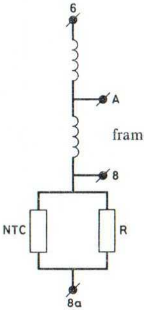
Frame deflection coils, series connected

Inductance	66 mH
Resistance	30 Ω (6–8)
at 25°C	44 Ω (6–8a)
Deflection current	545 mA_{p-p}



Order of contacts
8, 8a, 2, 4, A, 6





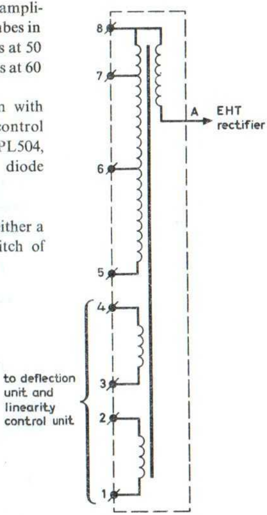
frame deflection coils

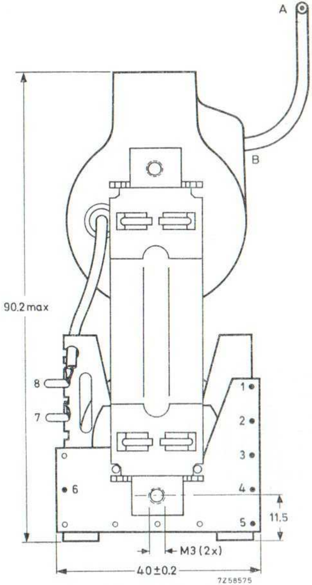
DEFLECTION COMPONENTS FOR BLACK AND WHITE TELEVISION

Line-output transformer AT 2036/10

Catalog number: 3122 138 30100
This line-output transformer has been developed to provide the required scanning amplitude for 17, 19, 20, 23 or 24 in picture tubes in television receivers presenting 625 lines at 50 frames per second (C.C.I.R.) or 525 lines at 60 frames per second (USA).
It is intended for use in conjunction with deflection unit AT 1040, linearity control unit AT 4042/02, line-output tube PL504, rectifying tube DY802 and booster diode PY88. The EHT is stabilised at 18 kV.

The transformer can be mounted on either a printed-wiring board (with a grid pitch of 2.54 or 2.50 mm) or on a metal chassis



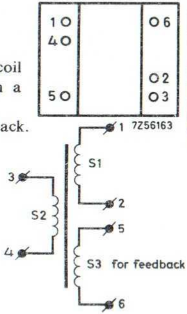


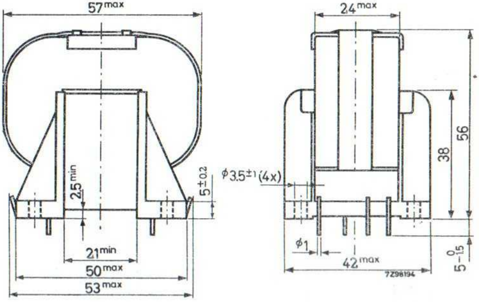
mounting height = 66.5 mm
length A – B = 65 mm

Frame-output transformer AT 3513

Catalog number: 3122 107 31740
For use in conjunction with the deflection coil AT1040. It is suitable for mounting on a printed-wiring board and on a chassis.
One winding can be used for voltage feedback.

S1: Inductance,	$I_{\text{prim.}} = 55$ mA	7.54 H
	$I_{\text{prim.}} = 70$ mA	6 H
Resistance		230 Ω
S2: Resistance		9.7 Ω
Transformer ratio N_1/N_2		5.6
S3: Resistance		165 Ω
Transformer ratio N_1/N_3		3.9



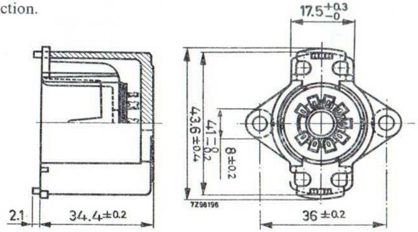


Adjustable linearity control unit AT 4042/02

Catalog number: 3122 108 39450
For use in TV sets equipped with tubes, to adjust the linearity of the line deflection.
It can be used in combination with the AT1040 and the AT2036 or AT2045.
For further data see section "Components for colour television".

E.H.T. tube socket AT 7130

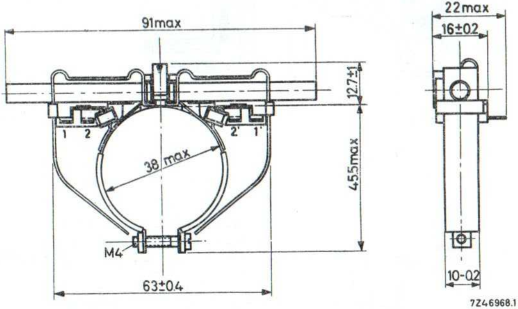
This tube socket for rectifier tube DY802 is equipped with a resistor of 1.6 Ω to be connected in series with the heater.



COMPONENTS FOR COLOUR TELEVISION

Blue lateral unit AT 1025/05

Catalog number: 3122 107 30020
For use with a 90° shadow mask colour picture tube in conjunction with a deflection unit AT1027/04 and a convergence unit AT4045/07 or AT4046/07 for static and dynamic lateral adjustment.



Coils, series connected (2 to 1')

Inductance	3.2 mH
Resistance	36 Ω

Coils, parallel connected (1 to 1' and 2 to 2')

Inductance	0.63 mH
Resistance	9 Ω

The unit must be positioned on the colour picture tube as close as possible to the convergence unit.

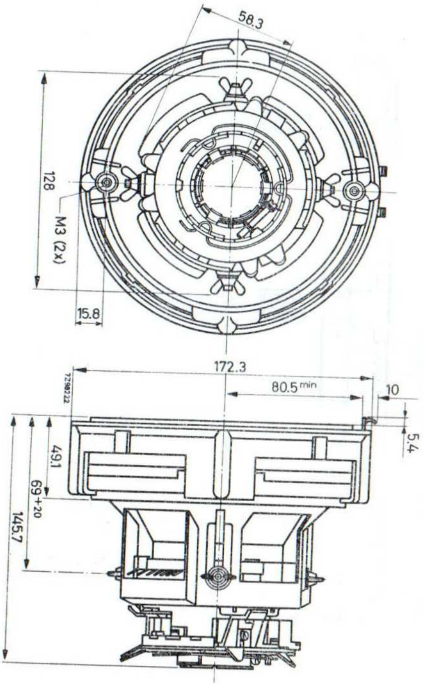
Deflection unit AT 1027/04

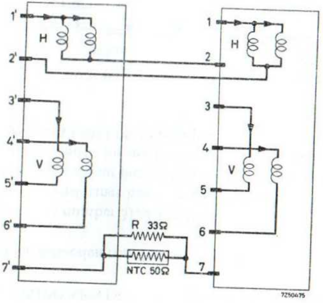
Catalog number: 3122 107 31510
For use with a 90° shadow mask colour picture tube, in conjunction with line-deflection transformer AT2051/00, E.H.T. transformer AT2052/03, convergence unit AT4045/07 or AT4046/07, blue lateral unit AT1025/05, linearity control unit AT4042/.. and transductor AT4041/06.

Electrical data

Line deflection coils, parallel connected	
Inductance	2.95 mH
Resistance at 25°C	2.9 Ω
Deflection current at 25 kV, edge to edge scan in both directions	2.6 A_{p-p}
Frame deflection coils, series connected	
Inductance	114 mH
Resistance at 25°C	56 + 20* Ω
Deflection current at 25 kV, edge to edge scan in both directions	0.415 A_{p-p}
Maximum working temperature	95°C

* NTC thermistor in parallel with a resistor of 33 Ω.



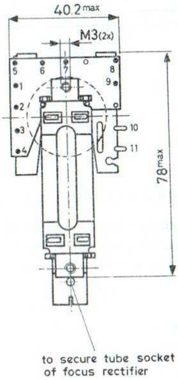


Circuit diagram
H = line coils
V = frame coils

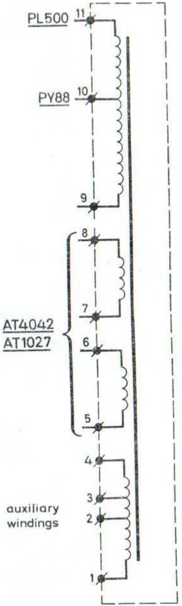
Connections

Line-deflection transformer AT 2051/90

Catalog number 3122 108 39390
This transformer has been designed to be used in combination with the E.H.T. transformer AT2052/03 to drive a colour picture tube with a deflection angle of 90° and an E.H.T. of 25 kV.
It is intended for use in conjunction with deflection unit AT1027/04, linearity control AT4042/02, transductor AT4041/06, line-output tube PL500, focus voltage rectifier DY51 and booster diode PY88.



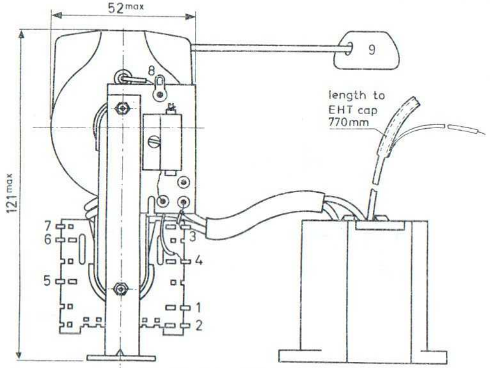
The transformer can be mounted on either a printed-wiring board (with a grid pitch of 2.54 or 2.50 mm) or a metal chassis.
Mounting height 66.5 mm



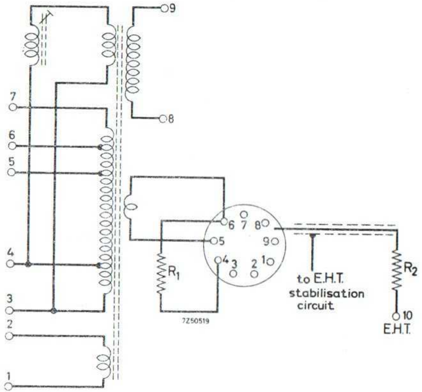
E.H.T. transformer AT 2052/03

Catalog number 3122 108 39850

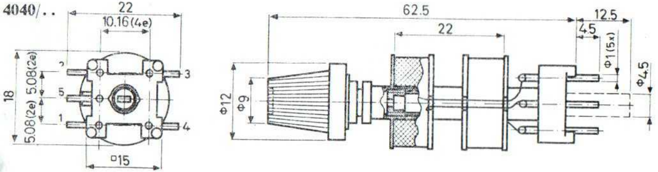
For use in combination with the line deflection transformer AT2051/00, and the tubes PL505 and PY500, to generate the E.H.T.



Mounting height 121 mm

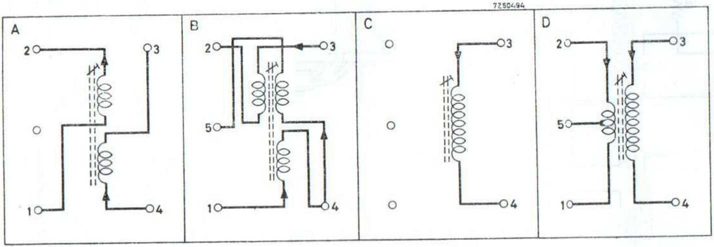


Convergence and pin-cushion adjustors AT 4040/..



COMPONENTS FOR COLOUR TELEVISION

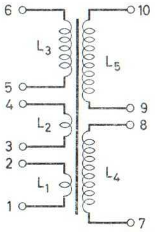
Type number	*circuit*	*L-range (mH)*	*d.c. resistance (Ω)*	*catalog number*
Convergence adjustors (with knob)				
AT4040/49	A	0.32–1.08	2.4	3122 107 30030
AT4040/53	D	0.635–3.725	3.65	30060
AT4040/56	B	1–4 = 5–4 : 0.00575–0.0225 2–3 : 0.0295–0.0105	1–4 = 5–4 : 0.11 2–3 : 0.165	30080
AT4040/57	A	0.1–0.32	0.66	30090
AT4040/63	A	0.117–0.44	1.35	30480
Pin-cushion adjustor (without knob)				
AT4040/55	C		4.1	31220

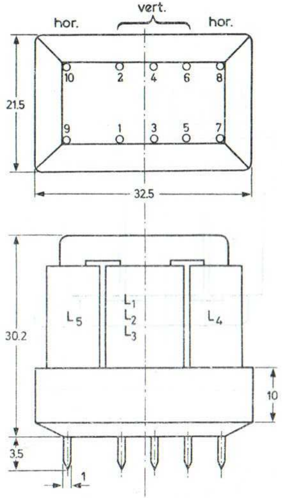


Transductor AT 4041/07

Catalog number 3122 107 13410
For use in conjunction with the AT1027/04, AT2051/00, AT4040/ . . and the frame-output transformer to correct pin-cushion distortion.

The transductor can be mounted on a printed-wiring board with grid pitch of 2.54 mm.

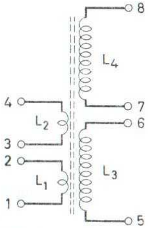


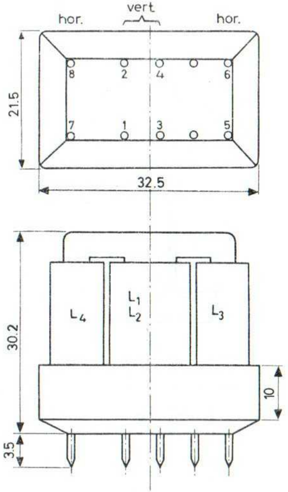


Transductor AT 4041/08

Catalog number 3122 107 13420
For use in conjunction with the AT1027/04, AT2051/00, AT4040/. . and the frame-output transformer to correct pin-cushion distortion.

The transductor can be mounted on a printed-wiring board with grid pitch of 2.54 mm.



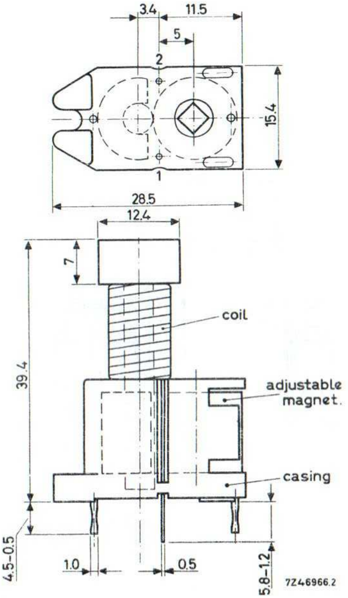


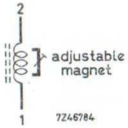
Adjustable linearity control unit AT 4042/02

Catalog number 3122 108 39450
For use in colour TV sets equipped with tubes, to adjust the linearity of the line deflection. It can be used in combination with AT1027/04 and AT2051/00.

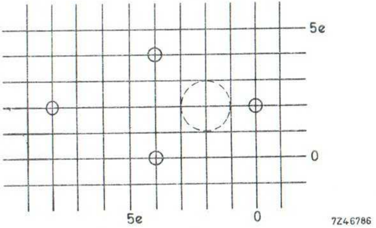
Electrical data

When a saw-tooth current (without S-correction) of 2.8 A_{p-p}, frequency 15,625 Hz, flyback ratio 18 %, flows through the linearity control unit (one connection point to earth), the correction voltage is adjustable between 15 V and 26 V.





Circuit diagram



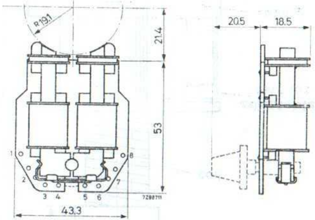
Hole pattern for mounting
on a printed-wiring board ($e = 0.1''$ or 2.50 mm)

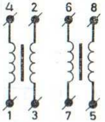
Convergence unit AT 4045/07, catalog number 3122 108 83130
Convergence unit AT 4046/07, catalog number 3122 108 83150

This unit is intended to be used with a 90° shadow mask colour picture tube, in conjunction with the deflection unit AT1027/04 and the blue lateral unit AT1025/05 to converge the three colour pictures statically and dynamically and to adjust the purity.

The AT4046/07 has a permanent magnet for static convergence

	Line coils		*Frame coils*			
	in series	*in parallel*	*in series*		*in parallel*	
			AT4045	AT4046	AT4045	AT4046
Connections	3 and 7	2 and 3	1 and 5	1 and 5	1 and 4	1 and 4
Interconnection	2–6	2–7 3–6	4–8	4–8	1–8 4–5	1–8 4–5
Inductance	0.4	0.1	1.41	1.27	0.35	0.32
Resistance	3.1	0.8	170	182	42.5	45.5





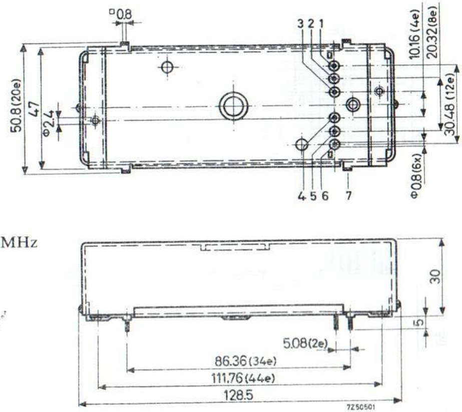
Delay line DL1E

Catalog number: 2722 121 00051

For use in the decoder circuits of television receivers.

Electrical data

Nominal frequency f_{nom}	4.433619 MHz
Nominal phase delay-time (V_{in}-V_{out}) at f_{nom} (unmodulated sinewave voltage)	63.943 μs
Accuracy of adjustment	±3 ns at 25°C
Bandwidth (−3 dB points)	better than from 3.43 to 5.23 MHz
Insertion loss	13 ± 4 dB at f_{nom}
Temperature drift (relative to 25°C)	
phase delay	max. ±5 ns between +25°C and +50°C
insertion loss	typical ± <0.3 dB
Maximum input at f_{nom}	10 V_{p-p}
Termination impedances	100 Ω



Connections: V_{in} to 4 and 6
V_{out} to 3 and 1

COMPONENTS FOR COLOUR TELEVISION

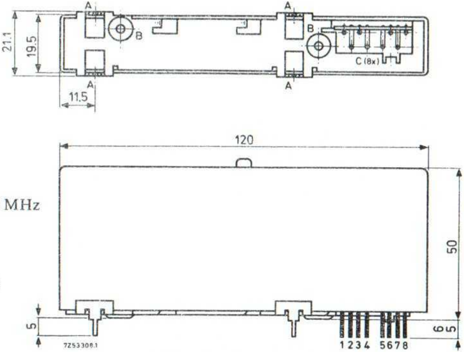
Delay line DL 20

Catalog number: 2722 121 00061

For use in the decoder circuits of television receivers.

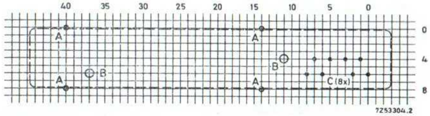
Electrical data

Nominal frequency f_{nom}	4.433619 MHz
Nominal phase delay-time (V_{in}-V_{out}) at f_{nom} (unmodulated sinewave voltage)	63.943 μs
Accurracy of adjustment	±5 ns at 25°C
Bandwidth (−3 dB points)	better than from 3.43 to 5.23 MHz
Insertion loss	11 ± 3 dB at f_{nom}
Temperature drift (relative to 25°C)	
phase delay	max. ±5 ns between +20°C and +50°C
insertion loss	typical ± <0.3 dB
Maximum input at f_{nom}	10 V_{p-p}
Termination impedances	100 Ω



Connections: V_{in} to 4 and 3
V_{out} to 5 and 6

A = Fastening pins
B = Fixing holes (M3)
C = Connecting pins (0.8 mm diam.)



Hole pattern for mounting on a printed-wiring board. e = 2.54 mm.

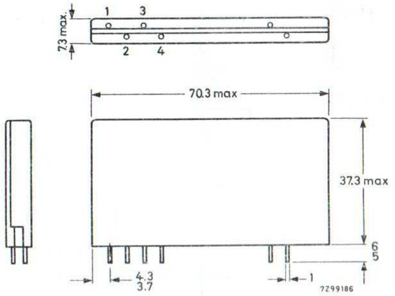
Delay line DL 40

Catalog number: 4322 026 68300

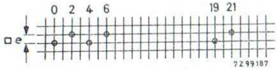
For use in the decoder circuits of television receivers

Electrical data

Nominal frequency f_{nom}	4.433619 MHz
Phase delay-time ($V_{in} - V_{out}$) at f_{nom} (unmodulated sinewave voltage)	63.943 ± 0.005 μs
Bandwidth (−3 dB points)	better than from 3.43 to 5.23 MHz
Insertion loss at f_{nom}	8 ± 3 dB
Drift of phase delay with temperature (relative to 25°C)	max. 5 ns
Maximum input voltage at f_{nom}	15 V_{p-p}



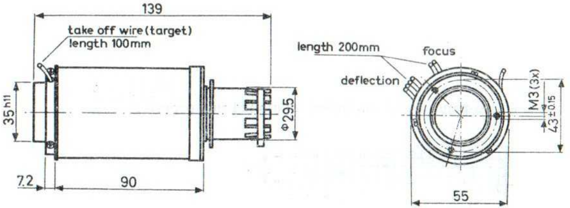
Connections: V_{in} to 2 and 1
V_{out} to 4 and 3



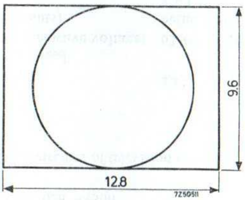
Recommended hole pattern for mounting on a printed-wiring board.
e = 2.54 mm.

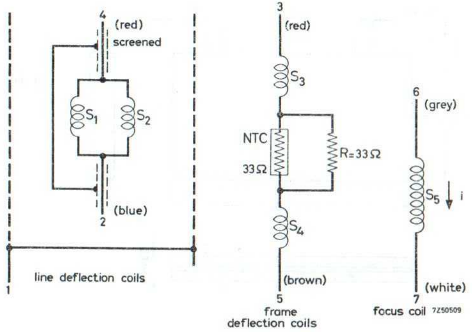
DEFLECTION ASSEMBLIES FOR CAMERA TUBES

Vidicon deflection unit AT 1102



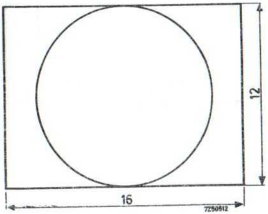
Catalog number: 3122 107 30580
Distortions inside the circle: about 1 % of picture height
Distortions outside the circle: about 2 % of picture height

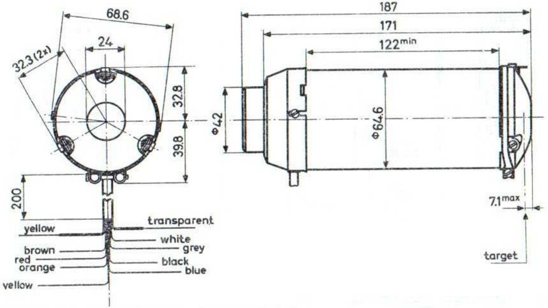




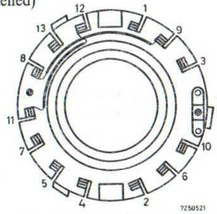
Plumbicon deflection unit AT 1113/01

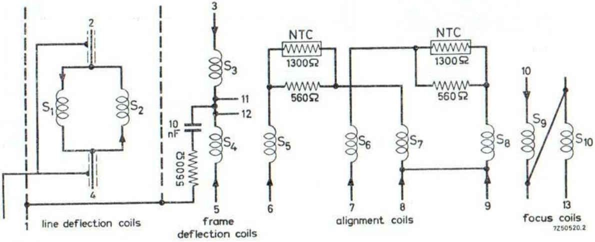
Catalog number: 3122 108 84401
Distortions inside the circle: max. 0.5 % of picture height
Distortions outside the circle: max. 1 % of picture height





1 = black
2 = transparent (screened)
3 = brown
4 = yellow (screened)
5 = red
6 = orange
7 = yellow
8 = 9 = blue
10 = white
11 = –
12 = –
13 = grey

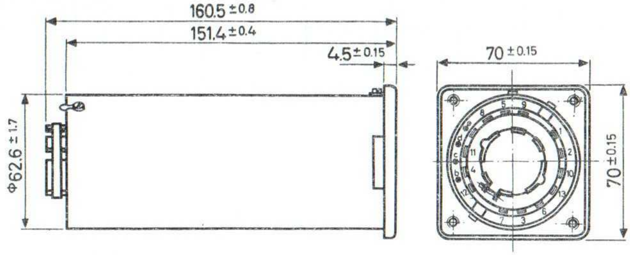


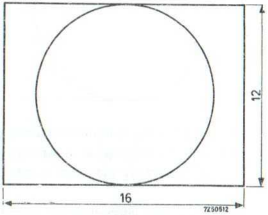


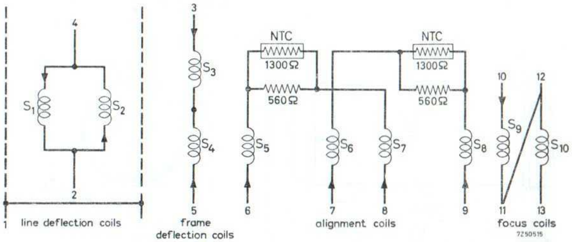
DEFLECTION ASSEMBLIES FOR CAMERA TUBES

Plumbicon deflection units AT 1122

Catalog number 3122 108 39350
Distortions inside the circle : max. 1 % of picture height
Distortions outside the circle: max. 2 % of picture height

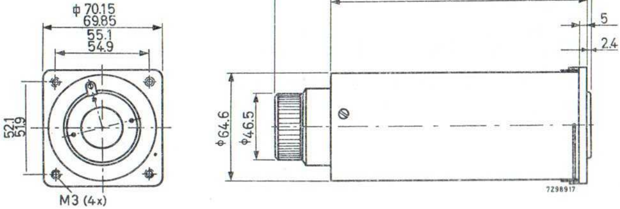




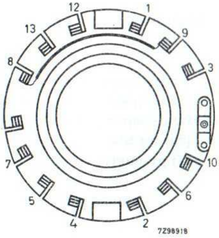


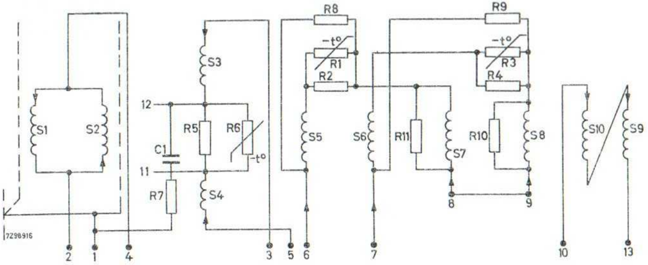
Plumbicon deflection unit AT1132/01

Catalog number 2122 108 87440
Distortions inside the circle : max. 0.5 % of picture height
Distortions outside the circle: max. 1 % of picture height



S_1–S_2 = line deflection coils
S_3–S_4 = frame deflection coils
S_5–S_8 = alignment coils
S_9–S_{10} = focus coils





SYNCHRONOUS MOTORS[1])

Unidirectional motors

9904 110 02 . . .: standard type
9904 110 03 . . .: type for high ambient temperature
9904 110 04 . . .: under voltage type
9904 110 05 . . .: small type
9904 110 06 . . .: silent type

When ordering or inquiring please indicate: – catalog number
– voltage and frequency of the supply
– direction of rotation
– version with or without pinion.

		Catalog number 9904 110				
		02 . . . (Fig. 1)	03 . . . (Fig. 2)	04 . . . (Fig. 1)	05 . . . (Fig. 3)	06 . . . (Fig. 3)
Voltage[2])	(V)	220	220	220	220	220
Permissible voltage fluctuations	(%)	−15 to +10	−15 to +10	−30 to +10	−15 to +10	−15 to +10
Frequency	(Hz)	50	50	50	50	50
Speed	(rev/min)	250	250	250	250	250
Starting torque	(gcm)	25	15	15	5	2.5
Working torque	(gcm)	30	15	15	5	2.5
Power consumption	(W)	1.6	2.2	1.7	1.8	2.5
Temperature increase	(deg C)	30	40	30	20	35
Ambient temperature range	(°C)	−20 to +70	−20 to +120	−20 to +50	−20 to +70	−5 to +50

FRANCE

POLYMOTOR SEDELEM
14, Passage Charles Dallery
PARIS XIe

UNITED KINGDOM

IMPEX ELECTRICAL LTD.
Market Road
RICHMOND - Surrey

UNITED STATES

A. W. HAYDON COMPANY
232, North Elm Street
WATERBURY 20 - Conn.

ITALY

POLYMOTOR ITALIANA
31, Via Victor Pisani
MILANO

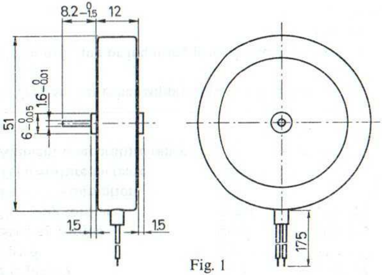


Fig. 1

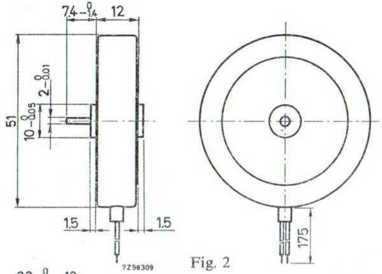
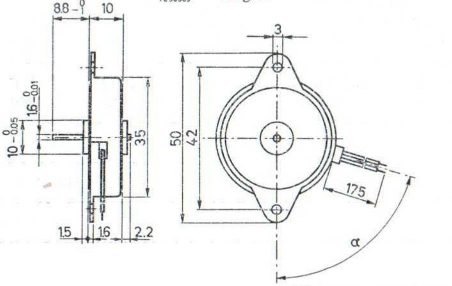


Fig. 2



α=35° for clockwise rotation
=75° for counterclockwise rotation

Fig. 3

1) Contrary to the information given on the final pages, in the countries above-mentioned firms deal with motors:

2) Versions for other supply voltages (117, 110, 48, 24, 12 V) are available on request.

SYNCHRONOUS MOTORS

Reversible motors (to be used with phasing capacitor)

		Catalog number 9904 111						
		04 . . . (Fig. 1)		05 . . . (Fig. 2)		06 . . . (Fig. 3)	07 . . . (Fig. 4)	
		coils in		coils in			coils in	
		parallel (Fig. 5)	series (Fig. 6)	parallel (Fig. 7)	series (Fig. 8)		parallel (Fig. 5)	series (Fig. 6)
Voltage 1)	(V)	220	380	220	380	220	110	220
Permissible voltage fluctuations	(%)	−15 to +10		−15 to +10		−15 to +10	−15 to +10	
Frequency	(Hz)	50/60		50		50/60	50/60	
Speed	(rev/min)	250/300		250		250/300	250/300	
Starting torque	(gcm)	100/150		325		300	25	
Working torque	(gcm)	100/150		375		375	25	
Power consumption	(W)	1.8	3.5	3.3	6	5	0.5	1.3
Temperature increase	(deg C)	25	30	40	60	35	10	25
Ambient temperature range	(°C)	−20 to +70	−20 to +50	−20 to +70	−20 to +40	−20 to +70	−20 to +70	

---

1) Versions for other supply voltages (117, 110, 48, 24, 12 V) are available on request.

When ordering or inquiring please indicate: – catalog number
– voltage and frequency of the supply
– version with or without pinion.

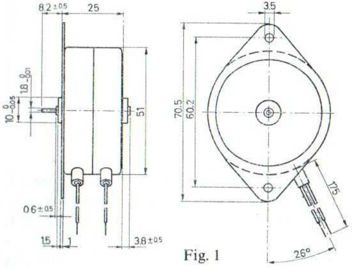


Fig. 1

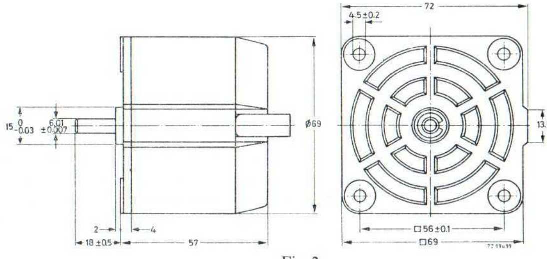


Fig. 2

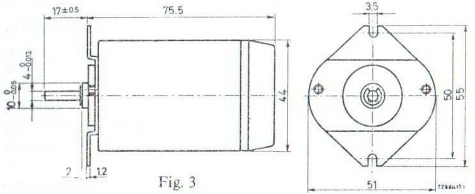


Fig. 3

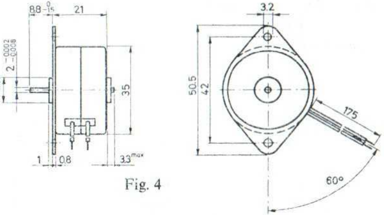


Fig. 4

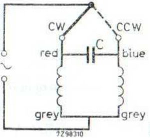


Fig. 5

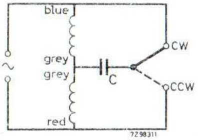


Fig. 6

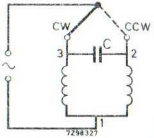


Fig. 7

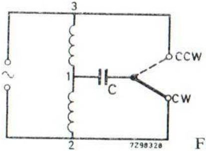


Fig. 8

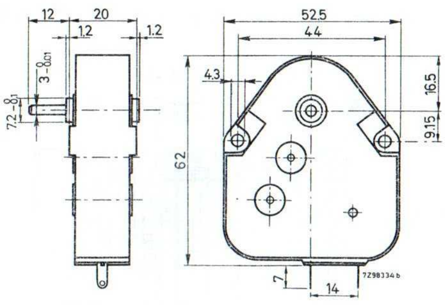
Synchrodrivers

		Catalog number 9904 115				
		standard type (Fig. 1)			special type (Fig. 2)	
clockwise rotation		01061	02061	04061	03002	05002
counterclockwise rotation		01071	02071	04071	03012	05012
Voltage	(V)	220	110	117	220	117
Permissible voltage fluctuations	(%)	−15 to +10	−15 to +10	−15 to +10	−15 to +10	−15 to +10
Frequency	(Hz)	50	50	60	50	60
Speed	(rev/min)	8	8	9.6	1	1.2
Power consumption	(W)	2	2	2.5	2	2.5
Working torque	(gcm)	400	400	380	300[1]/1500[2]	300[1]/1500[2]
Temperature increase	(deg C)	50	50	60	50	60
Permissible ambient temperature	(°C)	−5 to +50	−5 to +50	−5 to +40	−5 to +120[1] −5 to +50[2]	−5 to +120[1] −5 to +50[2]
Maximum radial force	(g)	1000	1000	1000	100[1]/1000[2]	100[1]/1000[2]

---

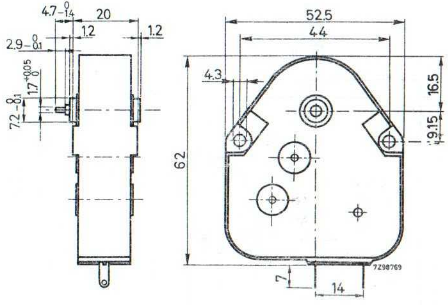
[1] Used in the temperature range 50–120°C intermittently, the maximum permissible torque and the maximum radial force decrease; at 120°C the values for the maximum permissible torque and the maximum radial force are 300 gcm and 100 g respectively.

[2] Used in the temperature range −5 to +50°C the maximum permissible torque is 1500 gcm, the maximum radial force is 1000 g.



clockwise rotation

Fig. 1



clockwise rotation

Fig. 2

UNIVERSAL PROGRAMME SWITCH ASSEMBLY KIT (UPAK)[1]

This assembly kit is used to construct a programme switch from a limited number of components for many different timing cycles. Two types of kits are available:

- for use with 50 Hz supply, catalog number 9904 131 02001
- for use with 60 Hz supply, catalog number 9904 131 02002.

The universal programme switch has four basic parts, which are indicated by a number, see the figure.

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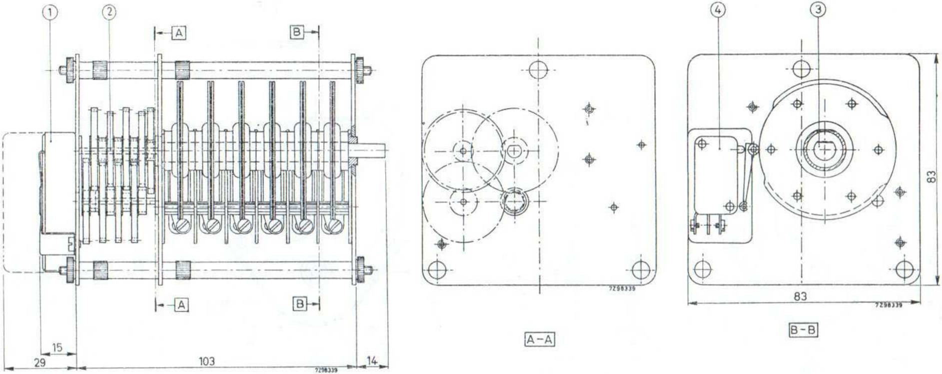
[1] For addresses of dealers, see section "Synchronous motors".



1. *The motor*

Each kit contains two motors (one unidirectional, the other reversible) chosen from the wide range available. The essential characteristics of two possible choices are listed below.

	catalog number of kit			
	9904 131 02001		9904 131 02002	
Catalog number of motor	9904 110 02124	9904 111 04134	9904 110 02223	9904 111 04332
Type of motor	unidirectional	reversible	unidirectional	reversible
Supply voltage required (V)	220	220	117	117
Supply frequency required (Hz)	50	50	60	60
Speed of rotation (rev/min)	250	250	300	300
Working torque (gcm)	30	100	30	100

2. *The reduction gear*

A large number of gear ratios can be obtained from the selection of pinions and gear-wheels provided, giving spindle speeds of between 1 rev/min and 1 rev/24 h.

3. *The camshaft and cams*

The camshaft carries up to six adjustable cams, each cam comprising two separate discs which can be mutually adjusted (by means of a special tool on which the angle of adjustment is indicated) in order to obtain the required switching time.

4. *The switch assembly*

Consisting of six microswitches with alternating contacts, insulator plates, operating levers and rollers.

STEPPER MOTORS 1)

The data given below for the different motors were obtained using the electronic switch cat. no. 9904 131 03003 for the four-phase motors, and the switch cat. no. 9904 131 03004 for the eight-phase motor. It is recommended that these units be used with the motors, as motor performance is then assured. The switches are very compact, highly reliable, and inexpensive, the logic section employing integrated circuits and the output stages power transistors. The board supply voltage is 5 V ± 5%.

Industrial Digital (ID) motors, catalog number 9904 112 . . . . .

	ID 04 (*Fig.* 1)	*ID* 05 (*Fig.* 2)	*ID* 06 (*Fig.* 3)	*ID* 07 (*Fig.* 4)	*ID* 08 (*Fig.* 2)
Maximum torque (gcm)	150	650	500	60	350
Holding torque (gcm)	225	900	700	80	650
Maximum pull-in rate (steps/s)	350	240	200	500	160
Maximum pull-out rate (steps/s)	550	360	320	10000	450
Number of steps per revolution	48	48	48	48	24
Step angle	7°30′	7°30′	7°30′	7°30′	15°
Power consumption (W)	3.3	5.5	4	1.7	5.5
Permissible ambient temperature (°C)	−20 to +70	−20 to +70	−20 to +70	−20 to +70	−20 to +70
Permissible storage temperature (°C)	−40 to +85	−40 to +100	−40 to +100	−40 to +100	−40 to +100
Permissible motor temperature (°C)	100	100	100	100	100
Bearings	sleeve	roller	sleeve	sleeve	roller
Rotor inertia (gcm)^2	11	93	90	2.6	93
Catalog number	9904 112 04101	9904 112 05101	9904 112 06101	9904 112 07101	9904 112 08101

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1) For addresses of dealers, see section "Synchronous motors"

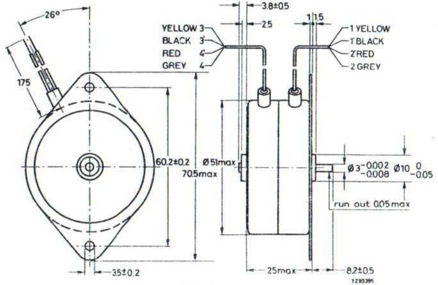

26°
175
YELLOW 3
BLACK 3'
RED 4'
GREY 4
3.8±0.5
2.5
1 1.5
1 YELLOW
1' BLACK
2' RED
2 GREY
60.2±0.2
70.5max
Ø 51max
Ø 3 $^{-0.002}_{-0.008}$ Ø10 $^{0}_{-0.05}$
run out 0.05max
3.5±0.2
25max
8.2±0.5
7Z99395

Fig. 1

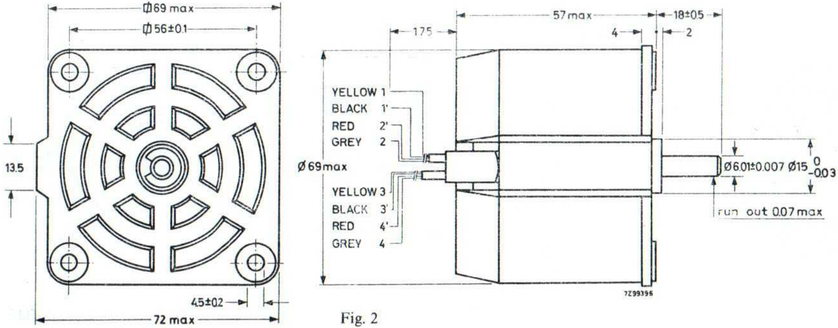

Ø69 max
Ø56±0.1
13.5
4.5±0.2
72 max
57max
18±0.5
175
4
2
YELLOW 1
BLACK 1'
RED 2'
GREY 2
Ø69max
YELLOW 3
BLACK 3'
RED 4'
GREY 4
Ø6.01±0.007 Ø15 $^{0}_{-0.03}$
run out 0.07max
7Z99396

Fig. 2

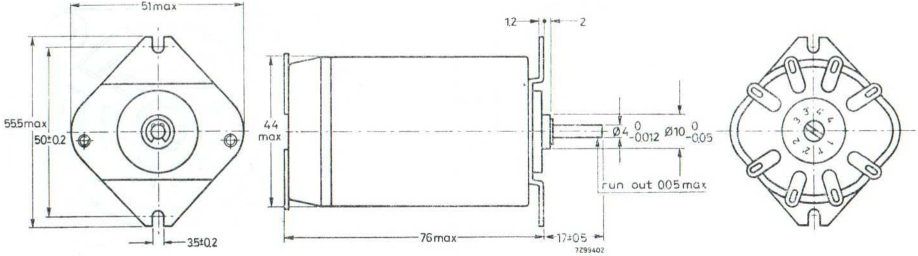

51max
55.5max
50±0.2
3.5±0.2
44 max
76max
1.2
2
17±0.5
Ø4 $^{0}_{-0.012}$
Ø10 $^{0}_{-0.05}$
run out 0.05max
1 1' 2 2' 3 3' 4 4'
7Z99402

Fig. 3

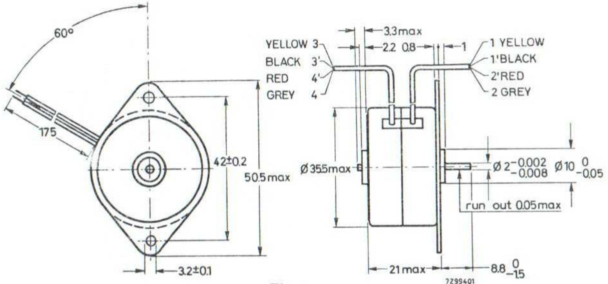

60°
175
42±0.2
50.5max
3.2±0.1
YELLOW 3
BLACK 3'
RED 4'
GREY 4
3.3max
2.2
0.8
1
1 YELLOW
1' BLACK
2' RED
2 GREY
Ø35.5max
Ø2 $^{-0.002}_{-0.008}$
Ø10 $^{0}_{-0.05}$
run out 0.05max
21max
8.8 $^{0}_{-1.5}$
7Z99401

Fig. 4

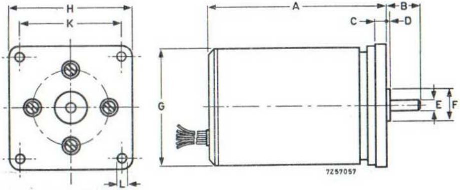
STEPPER MOTORS

Professional Digital (PD) and Servo Mount Digital (SMD) motors, catalog number 9904 112 . . . . .

(4 phases)

	type number, followed by suffix of catalog number between brackets			
	PD 10 (10001) *SMD* 11 (11001)	*PD* 14 (14001) *SMD* 15 (15001)	*PD* 18 (18001) *SMD* 19 (19001)	*PD* 22 (22001) *SMD* 23 (23001)
Maximum torque (gcm)	40	250	1000	600
Holding torque (gcm)	75	350	1400	800
Maximum pull-in rate (steps/s)	350	360	260	140
Maximum pull-out rate (steps/s)	1100	550	340	460
Number of steps per revolution	48	48	48	24
Step angle	7°30′	7°30′	7°30′	15°
Power consumption (W)	2	3.7	6.5	6.5
Permissible ambient temperature (°C)	−54 to +85	−54 to +85	−54 to +85	−54 to +85
Permissible storage temperature (°C)	−62 to +110	−62 to +110	−62 to +110	−62 to +110
Permissible motor temperature (°C)	125	125	125	125
Bearings	ball	ball	ball	ball
Rotor inertia (gcm^2)	3.5	18	110	110

Professional digital motors

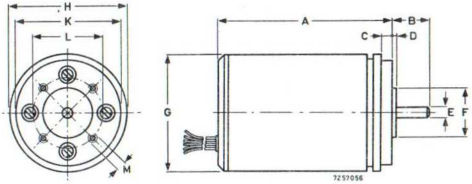


Dimensions in millimeters

Fig. 5

Type number	*PD* 10	*PD* 14	*PD* 18	*PD* 22
A	50	55	75	75
B	12	15	20	20
C	4	5	6	6
D	1.5	2	2	2
E	4h6	5h6	7h6	7h6
F	15	15	20	20
G	37	57	70	70
H	38	58	72	72
K	31	47	60	60
L	3.5	4.6	5.5	5.5
M				
Lead length	175	175	175	175

Servo mount digital motors



Dimensions in inches

Fig. 6

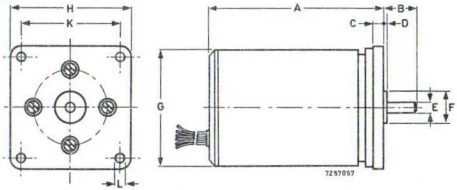
Type number	*SMD* 11	*SMD* 15	*SMD* 19	*SMD* 23
A	1.96	2.166	2.973	2.973
B	0.472	0.590	0.787	0.787
C	0.134	0.200	0.185	0.185
D	0.039	0.065	0.062	0.062
E	0.15625	0.1875	0.2500	0.2500
F	0.8750	0.9375	0.9375	0.9375
G	1.437	2.240	2.756	2.756
H	1.437	2.250	2.734	2.734
K	1.312	2.000	2.500	2.500
L	1.00	1.578	1.578	1.578
M	4–40 UNC	4–40 UNC	4–40 UNC	4–40 UNC
Lead length	7	7	7	7

Professional Digital (PD) and Servo Mount Digital (SMD) motors, catalog number 9904 112 . . . . .

(8 phases)

	type number, followed by suffix of catalog number between brackets			
	PD 12 (12001) *SMD* 13 (13001)	*PD* 16 (16001) *SMD* 17 (17001)	*PD* 20 (20001) *SMD* 21 (21001)	*PD* 24 (24001) *SMD* 25 (25001)
Maximum torque (gcm)	100	400	1600	900
Holding torque (gcm)	125	500	1900	1100
Maximum pull-in rate (steps/s)	1200	900	650	350
Maximum pull-out rate (steps/s)	14000	7500	6000	3500
Number of steps per revolution	96	96	96	48
Step angle	3°45′	3°45′	3°45′	7°30′
Power consumption (W)	5	6.5	11	11
Permissible ambient temperature (°C)	−54 to +85	−54 to +85	−54 to +85	−54 to +85
Permissible storage temperature (°C)	−62 to +110	−62 to +110	−62 to +110	−62 to +110
Permissible motor temperature (°C)	125	125	125	125
Bearings	ball	ball	ball	ball
Rotor inertia (gcm^2)	7	32	220	220

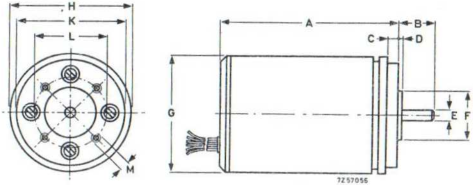
Professional digital motors



Dimensions in millimeters

Fig. 7

Servo mount digital motors



Dimensions in inches

Fig. 8

Type number	*PD* 12	*PD* 16	*PD* 20	*PD* 24
A	64	78	108	108
B	12	15	20	20
C	4	5	6	6
D	1.5	2	2	2
E	4h6	5h6	7h6	7h6
F	15	15	20	20
G	37	57	70	70
H	38	58	72	72
K	31	47	60	60
L	3.5	4.6	5.5	5.5
M				
Lead length	175	175	175	175

Type number	*SMD* 13	*SMD* 17	*SMD* 21	*SMD* 25
A	2.520	3.071	4.270	4.270
B	0.472	0.590	0.787	0.787
C	0.134	0.200	0.185	0.185
D	0.039	0.065	0.062	0.062
E	0.15625	0.1875	0.2500	0.2500
F	0.8750	0.9375	0.9375	0.9375
G	1.437	2.240	2.756	2.756
H	1.437	2.250	2.734	2.734
K	1.312	2.000	2.500	2.500
L	1.100	1.578	1.578	1.578
M	4–40 UNC	4–40 UNC	4–40 UNC	4–40 UNC
Lead length	7	7	7	7

DIRECT CURRENT MOTORS 1)

Governed d.c. motors

	catalog number 9904 120.			
	01501 2) (*Fig.* 1)	03101 (*Fig.* 2)	04301 (*Fig.* 3)	53101 3) (*Fig.* 4)
Nominal voltage ($V_{d.c.}$)	4.5	3.2	5	3
Nominal torque (gcm)	⩾11	⩾18	⩾3	150
Speed at nominal load (rev/min)	2000	2000	1100	96
at no load (rev/min)	2650	3500	1350	110
Current at nominal load (A)	0.110	0.265	0.025	⩽0.15
at no load (A)	0.035	0.05	0.015	⩽0.05
Input power (W)	⩽0.6	⩽0.85	⩽0.125	⩽0.45
Permissible ambient temperature (°C)	−10 to +50	−10 to +50	−10 to +50	−10 to +50

---

1) For addresses of dealers, see section "Synchronous motors".

2) A version of this motor with interference-suppression filter is available under catalog number 9904 120 01502.

3) 4 different gear ratios available giving: – speeds from 96 to 1600 rev/min
– torques between 11 and 150 gcm

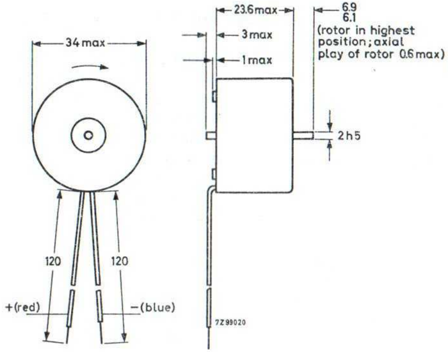


Fig. 1

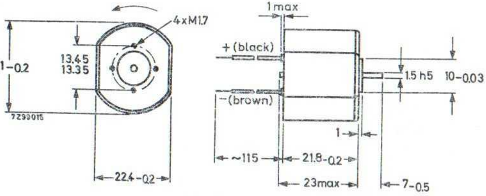


Fig. 2

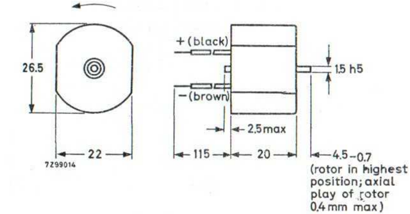


Fig. 3

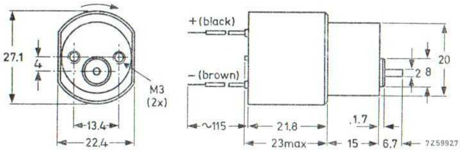


Fig. 4

DIRECT CURRENT MOTORS

The data given below are valid for the combination of the electronic speed control unit 9904 132 01006 and the motor 9904 120 01501 or 9904 120 01502

Voltage range : 5 to 9 $V_{d.c.}$
Torque at 5 $V_{d.c.}$: $\geqslant$6 gcm
Speed at nominal load : 2000 rev/min
Current at no load : $\leqslant$35 mA (motor) +8 mA (control unit)
Starting torque at 5 $V_{d.c.}$: $\geqslant$30 gcm
at 9 $V_{d.c.}$: $\geqslant$60 gcm
Speed control range for variations of: supply voltage between 5 and 9 $V_{d.c.}$ and load between 3 and 6 gcm and temperature between 0 and 45°C : 2000 rev/min + or −3%
Ambient temperature range : −10 to +50°C

Non-governed d.c. motors

	catalog number 9904 120.					
	02401 (*Fig.* 1)	51401 1) (*Fig.* 2)	51601 (*Fig.* 2)	07401 (*Fig.* 3) 08401 (*Fig.* 4)	07601 (*Fig.* 3) 08601 (*Fig.* 4)	54301 (*Fig.* 5)
Nominal voltage ($V_{d.c.}$)	6	6	12	6	12	4.5
Nominal torque (gcm)	6	100	100	30	30	200
Speed at nominal load (rev/min)	5800	690	690	3900	3900	225
at no load (rev/min)	8500	845	845	4900	4900	280
Current at nominal load (A)	0.195	0.340	0.170	0.375	0.190	0.36
at no load (A)	0.075	0.100	0.055	0.095	0.055	0.135
Input power (W)	1	2.1	2.1	2	2	1.7
Permissible ambient temperature (°C)	−20 to +50	−20 to +60	−20 to +60	−20 to +60	−20 to +60	−10 to +50

1) 10 different gear ratios available giving: – speeds from 6 to 690 rev/min
– torques between 100 and 1500 gcm

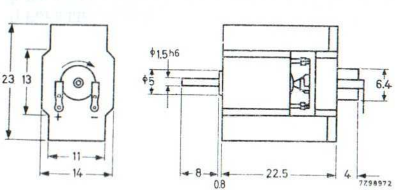


Fig. 1

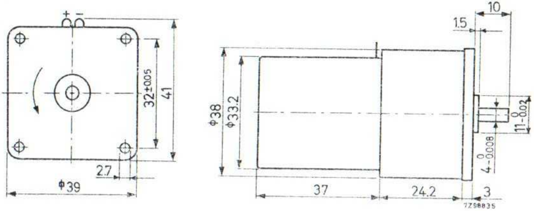


Fig. 2

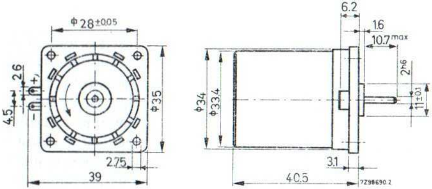


Fig. 3

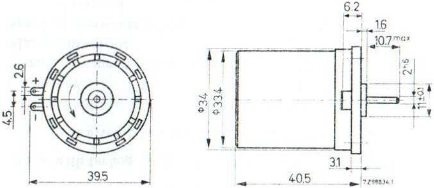


Fig. 4

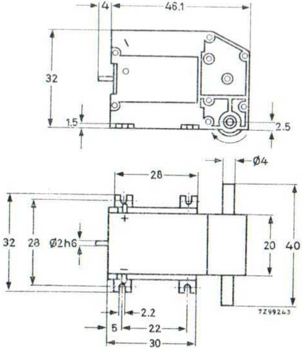


Fig. 5

ASYNCHRONOUS MOTORS 1)

Motor with tachogenerator, catalog number 9904 121 00011

The values given below are measured at a nominal voltage of 220 $V_{a.c.}$

Nominal voltage 2)	: 110/220 $V_{a.c.}$ main phase; 9/18 V control phase
Frequency	: 50 Hz
Starting torque at 150 rev/min	: $\geqslant$135 gcm
Maximum torque	: 135 gcm
Speed at maximum torque	: 150 rev/min
at no load	: $\geqslant$2400 rev/min
at maximum output	: 1400 rev/min
Maximum output power	: $\geqslant$1.2 W
Input power at no load	: $\leqslant$3 W main phase; $\leqslant$3 W control phase
Current at no load	: $\leqslant$35 mA main phase; $\leqslant$375 mA control phase
Direction of rotation	: reversible
Insulation according to	: I.E.C. 65, class E
Voltage of the field coil	: 50 V, 50 Hz
Generator voltage at 2400 rev/min	: $\geqslant$250 mV
Generator voltage at 0 rev/min	: $\leqslant$1.5 mV

---

1) For addresses of dealers, see section "Synchronous motors".

2) Versions for other supply voltages are available on request.

Shaded pole motors

The values given below are measured at a nominal voltage of 220 $V_{a.c.}$
Arrow P in the dimensional drawings indicate the direction of viewing the coils, when making the connecting diagrams.

	catalog number 9904 122.....					
	01311 (*Figs.* 1, 2)	02311 (*Figs.* 3, 4)	03141 (*Fig.* 5)	04101 (*Fig.* 6)	05311 (*Figs.* 7, 8)	06101 2) (*Figs.* 9, 10)
Nominal voltage 1) ($V_{a.c.}$)	110/220	110/220	220	220	110/220	110/220
Frequency (Hz)	50	50	50	50	50	50
Starting torque at 150 rev/min (gcm)	≥280	≥100	≥60	≥53	≥20	≥26
Maximum torque (gcm)	≥400	≥270	≥75	≥80	≥30	≥50
Speed at maximum torque (rev/min)	1800	2200	1700	1800	2000	1900
at no load (rev./min)	≥2880	≥2900	≥2700	≥2850	≥2825	≥2700
at maximum output power (rev/min)	2000	2300	1800	2000	2200	2000
Maximum output power (W)	≥8	≥6	≥1.35	≥1.5	≥0.6	≥1
Input power at no load (W)	≤33	≤40	≤17	≤13	≤6	≤13
Current at no load (mA)	≤230	≤300	≤130	≤110	≤45	≤85
Insulation according to	I.E.C. 65, class E	I.E.C. 65, class E	I.E.C. 65, class E	I.E.C. 65, class E	I.E.C. 65, class E	C.E.E. 10, class E

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1) Versions for other supply voltages are available on request.

2) Also available with fan under catalog number 9904 122 06102

ASYNCHRONOUS MOTORS

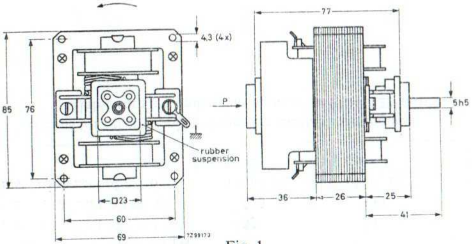

Fig. 1

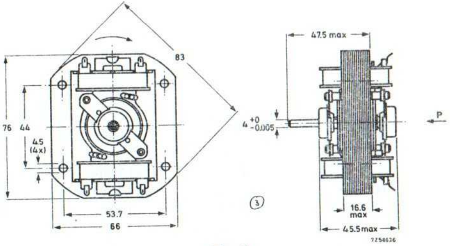

Fig. 3

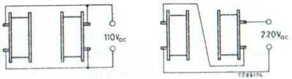

Fig. 2

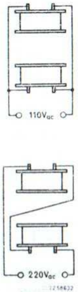

Fig. 4

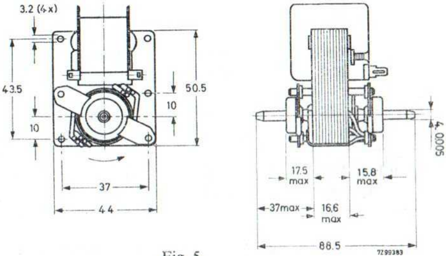

Fig. 5

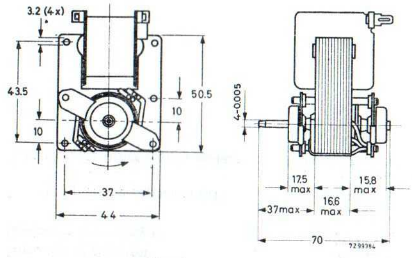

Fig. 6

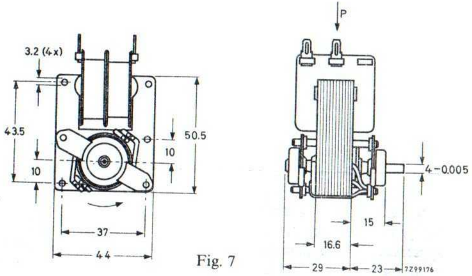

Fig. 7

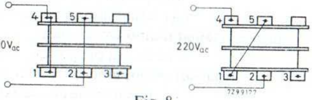

Fig. 8

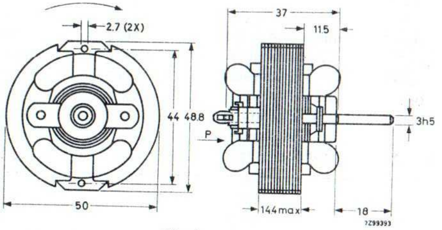

Fig. 9

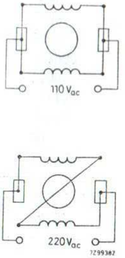

Fig. 10

ASYNCHRONOUS MOTORS

Motors with phasing capacitor

The values given below are measured at a nominal voltage of 220 $V_{a.c.}$

	catalog number 9904 123.....				
	01101 (*Fig.* 1, 2)	02101 (*Fig.* 3, 4)	02102 (*Fig.* 5, 6)	03101 (*Fig.* 7, 8)	04301 (*Fig.* 9, 10)
Nominal voltage 1) ($V_{a.c.}$)	110/220	110/220	Industrial centrifugal blower with motor 9904 123 02101. At an air pressure of 13 mm wg it delivers an air displacement of 130 m^3/h.	110/220	110/220
Frequency (Hz)	50	50		50	50
Starting torque at 150 rpm (gcm)	$\geqslant 155$	$\geqslant 550$		$\geqslant 280$	$\geqslant 450$
Maximum torque (gcm)	$\geqslant 155$	$\geqslant 800$		$\geqslant 330$	$\geqslant 1150$
Speed at maximum torque (rev/min)	150	2000		1800	2200
at no load (rev/min)	$\geqslant 2500$	$\geqslant 2800$		$\geqslant 2650$	$\geqslant 2900$
at maximum output power (rev/min)	1800	2200		2000	2400
Maximum output power (W)	$\geqslant 2$	$\geqslant 17$		$\geqslant 6$	$\geqslant 28$
Input power at no load (W)	$\leqslant 14$	$\leqslant 45$		$\leqslant 27$	$\leqslant 40$
Current at no load (mA)	$\leqslant 60$	$\leqslant 225$		$\leqslant 175$	$\leqslant 150$
Direction of rotation	reversible	reversible		reversible	reversible
Insulation according to	I.E.C. 65, class E	I.E.C. 65, class E		I.E.C. 65, class E	I.E.C. 65, class E
Required phasing capacitor (μF)	0.5	2		1	2

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1) Version for other supply voltages are available on request.

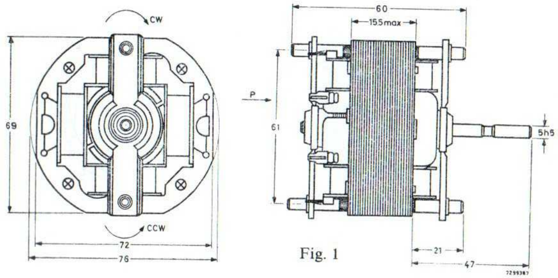

Fig. 1

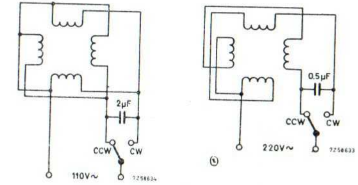

Fig. 2

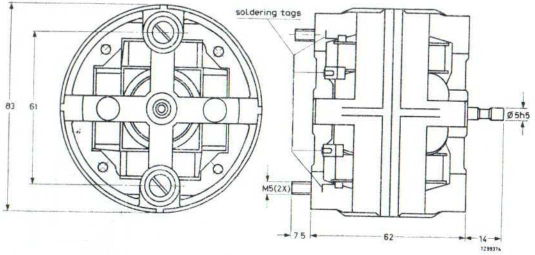

Fig. 3

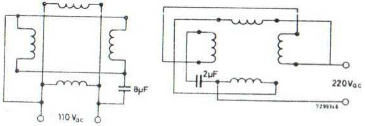

Fig. 4

ASYNCHRONOUS MOTORS

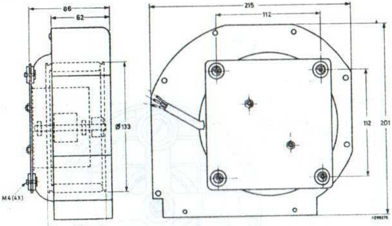

Fig. 5

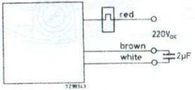

Fig. 6

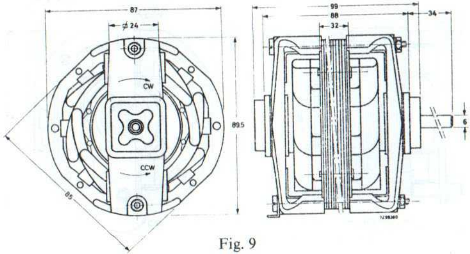

Fig. 9

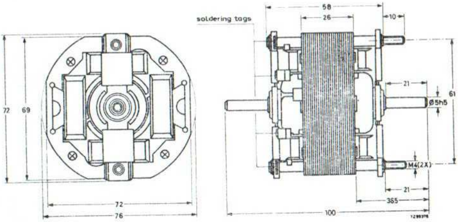

Fig. 7

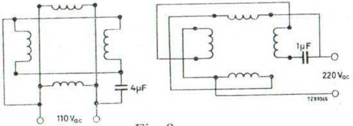

Fig. 8

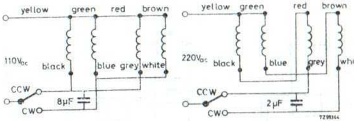

Fig. 10

MANGANESE ZINC AND NICKEL ZINC FERRITES

Introduction

The predominant feature of ferroxcube lies in its high resistivity that allows cores to be made of solid material without the eddy current losses becoming prohibitively high, even if the cores are used in the megacycle range. Compared with the powder-iron, the permeability of ferroxcube is high, whereas the losses remain comparatively low.

Ferroxcube cores are available in convenient shapes such as potcores, square cores*, E- and I-cores, X-cores, toroids, U-cores, aerial rods, yoke rings, screw cores, rods and tubes.

Potcores, E-I cores and X cores enable well-defined air gaps to be used without introducing appreciable stray fields. In this way the permeability of the material may be reduced to an effective value at which core and copper losses are matched. The dependence of the permeability on temperature and time is furthermore reduced to values that guarantee correct operation of the equipment.

This section contains comprehensive data on manganese zinc ferrites (ferroxcube 3) and nickel zinc ferrites (ferroxcube 4) and their various grades. The latter material in general shows higher specific resistance values, lower values of permeability and saturation flux density, higher coercivities and higher Curie points.

Application

grade	*application*
3B	potcores, cores for small coils
3B3	frames for i.f. transformers, potcores, rods, screw cores
3B5	potcores
3B7	potcores and square cores
3C1	erasing heads
3C2	yoke rings, L-cores, erasing heads
3C6	E- and U-cores
3C8	U- and I-cores
3D3	potcores, square cores, screw cores
3E1	E- and I-cores, toroids, potcores
3E2	H-cores and toroids
3E3	toroids
3H1	potcores, square cores, small toroids, cross cores, erasing heads
4A3	aerial rods
4A4	frames for i.f. transformers
4B1	aerial rods, frames for i.f. transformers
4C1	rods and tubes
4C6	potcores, square cores, toroids, frames for i.f. transformers
4C7	aerial rods
4D1, 4D2, 4E1	frames for i.f. transformers, screw cores, tubes and rods
4H1 $4L_1$ $4L_2$ 4MX	These are special-purpose NiZn ferrites developed for one type of application, namely resonant cavities for particle accelerators. In this field, usually a technical discussion is necessary before the correct material can be determined.

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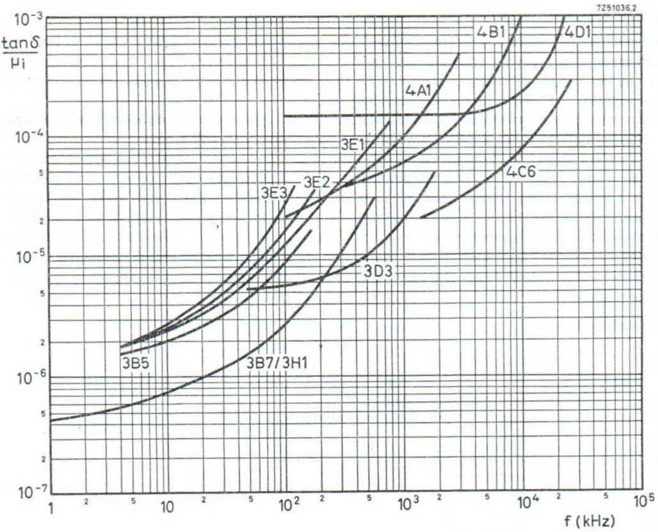
*) Square cores actually are square potcores.



Eddy current losses and residual losses as a function of the frequency at low induction level

FERRITES FOR RADIO, AUDIO AND TELEVISION

Antenna rods and plates

Standard types

Rods

Grade 4A3

dimensions (mm)	*catalog number*
∅ 10 × 240	3122 104 93440
× 230	4311 020 53120
× 220	4311 020 52740
× 210	3122 104 93700
× 200	3122 104 93420
× 190	4311 020 53230
× 180	3122 104 93450
× 170	4311 020 52760
× 160	4311 020 52610
× 150	4311 020 52770
× 140	3122 104 93460
× 130	4311 020 52780
× 120	4311 020 53300
× 100	4311 020 52590
∅ 7.8 × 190	4311 020 52700
× 140	4311 020 52690
× 130	4311 020 52680
× 100	4311 020 52790
∅ 6.35 × 130	4311 020 52800
× 100	4311 020 52810

Grade 4B1

dimensions (mm)	*catalog number*
∅10 × 204	3122 104 91250
× 175	4311 020 52240
× 140	3122 104 91240
× 130	4311 020 52230
∅9.8 × 200	4311 020 50040
× 160	4311 020 50250
× 100	4311 020 52170
∅6.5 × 165	4311 020 52160

FERRITES FOR RADIO, AUDIO AND TELEVISION

Grade 4C7 (for medium and short wave reception)

dimensions (*mm*)	*catalog number*
Ø 10 × 140	4311 020 53530
10 × 160	4311 020 53490
10 × 180	4311 020 53450
10 × 200	4311 020 53540
10 × 210	4311 020 53550
10 × 220	4311 020 53560
10 × 240	4311 020 53510

Plates

Grade 4B1

dimensions (*mm*)	*catalog number*
19 × 3.8 × 150	4311 020 52410
× 125	4311 020 52400
× 100	4311 020 52390
× 75	4311 020 52380
13.4 × 4.15 × 120	3122 104 92140
× 94	3122 104 92120
× 62	3122 104 92150

Cores for small coils, e.g. i.f. transformers

Preferred types

To be used as cores in r.f. and h.f. coils with an open magnetic circuit such as in i.f. transformers.

Rods

dia. (*mm*)	*length* (*mm*)	*grade*	*catalog number*
0.95	10	3B	3522 200 03750
1.25	6.2	3B	4322 020 32080
1.65	9.2	3B	3122 104 91070
	9.2	4B1	3122 104 91060
	11.5	3B	4322 020 32100
	11.5	4E1	4322 020 32110
	12.2	3B	3122 104 91100
	12.2	4B1	3122 104 91110

dia. (mm)	*length (mm)*	*grade*	*catalog number*
1.65	19.2	3B	3122 104 91230
	25.2	3B	3122 104 91170
	25.2	4B1	3122 104 91180
	28.2	3B	3122 104 91090
	28.2	4B1	4322 020 32090
1.7	15.2	4D1	4322 020 32170
	28.2	4C1	4322 020 32120
	28.2	4D1	4322 020 32130
	30.5	3B	3122 104 91200
1.75	10.2	3B	3122 104 91130
	18.5	3B	3122 104 91140
	18.5	4B1	3122 104 91150
6	46.2	3C	3122 104 91310
6.65	40.4	3B	4322 020 32160

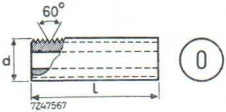
Tubes

outer dia. (mm)	*inner dia. (mm)*	*length (mm)*	*grade*	*catalog number*
2.8	1.2 +0.1	8.2	3B	4322 020 34340
3.7	1.2 +0.2	3.5	3B	4322 020 34400
			4B1	4322 020 34420
		6.5	3B	4022 101 80010
	1.7 +0.2	13.7	4E1	4322 020 34330
4.15	2 +0.2	7.2	4A	4322 020 34440
		12.2	4B1	4322 020 34450
			4C1	4322 020 34460
			4D1	4322 020 34470
		15.2	4B1	4322 020 34380
			4C1	4322 020 34370
		21.2	4A	4322 020 34390
			4B1	4322 020 34480
4.3	2 +0.2	7.2	3B	3122 104 92900
		12.5	3B	4322 020 34490
		15.2	4D1	4322 020 36760
		15.4	3B	4322 020 36750
		18.5	3B	4322 020 36770
		25.5	3B	4322 020 36780
			4B1	3122 104 90810
			4C1	3522 200 10950

outer dia. (mm)	*inner dia. (mm)*	*length (mm)*	*grade*	*catalog number*
4.3	2 +0.2	25.5	4D1	3522 200 10960
			4E1	3522 200 10970
		30.2	3B	4322 020 36790
		40.5	3B	3122 104 90800
		55.5	3B	4322 020 36800
4.95	1.3 +0.2	40.5	3C3	3122 104 93110
5.3	3 +0.2	22.4	3B	4322 020 36810
6.2	2.85 +0.3	30.2	4C1	4322 020 36820
8	4.2 +0.6	51.4	3B	4322 020 34310
			4B1	4322 020 34320

Screw cores

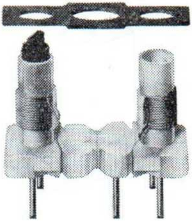
FXC grade 3D3
$\mu_i = 750 \pm 20\%$



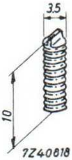
screw thread	*l* (*mm*)	*d* (*mm*)	*catalog number*
M4 × 0.50	12	3.65 + 0.05	4312 020 32040
M5 × 0.75	12	4.55 + 0.05	4312 020 32050
M5 × 1	20	5.0 − 0.1	4312 020 32130
M6 × 0.5 [1]	12	5.9 − 0.04	4312 020 32010
M6 × 0.75	25	5.55 + 0.05	4312 020 32070
M6 × 0.75	13	5.55 + 0.05	4312 020 32060
M6 × 1	25	5.5 ± 0.02	4312 020 32030
M8 × 1.25	25	7.35 + 0.05	4312 020 32120
M8 × 1.25	16	7.35 ± 0.05	4312 020 32110

[1]) Grade 3B

Piece parts and mounting parts for small i.f. coils (lilliput type)



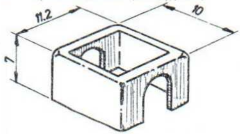
Screw core (ferroxcube)



max. frequency (MHz)	*grade*	*catalog number*
0.6	3B	3122 104 90550
2	4B1	3122 104 93020
12	4D1	3122 104 90590
100	powder iron	3122 104 91630

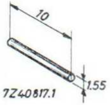
A version with a trimming grip on both sides is also available

Ferroxcube frame (lacquered)



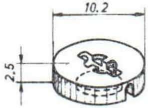
max. frequency (MHz)	*colour*	*type number*	*catalog number*
0.6	black	AP3014/00/3B	3122 104 91460
2	green	AP3014/01/4B1	3122 104 91470
12	light blue	AP3014/02/4D1	3122 104 91480
ratio detector	light blue	AP3014/03/4D1	3122 104 91630

Coupling rod (3*B*)



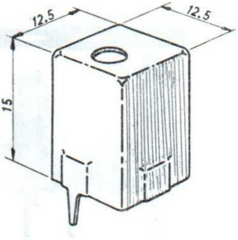
For coupling between primary and secondary windings, to be inserted in disc AP3018.
Catalog number:
3122 104 91130

Coupling disc



Type number AP3018
Catalog number
3122 108 38160

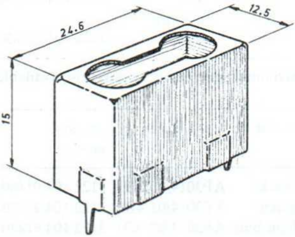
Can for one coil



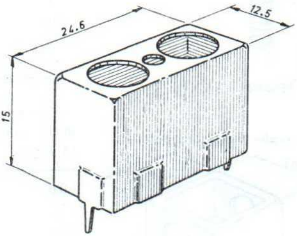
Polystyrene can for mechanical shielding, to be used when screening is not required. The Q-factor is not affected. Type number AP3015/00. Cat. No. 3122 104 03290.

Copper can for mechanical and electrical shielding.
Symmetric hole:
type number AP3015/01. Cat. no. 3122 990 94120
Asymmetric hole:
type number AP3015/02. Cat. no. 3122 990 94130

Can for two coils

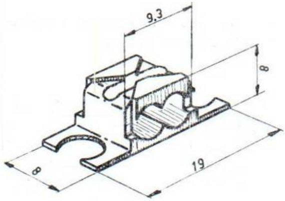


Tinned copper can
Type number AP3015/03
Cat. No. 3122 998 22260



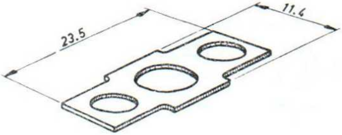
Tinned copper can
Type number AP3015/04
Cat. No. 3122 991 91170

Block
(for ratio detector only)



Type number AP3019
Cat. no. 4322 021 20700

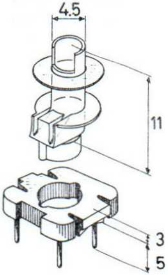
Spacer plate

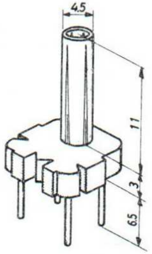


Type number AP3017
Cat. no. 3122 995 32070

Coil formers (polyethylene)

with base	*version*	*type number*	*catalog number*
symmetric:			
for use without	4 pins	AP3016/00	3122 999 60230
ferroxcube frame	5 pins	AP3016/01	3122 991 35830
asymmetric:			
for use with	4 pins	AP3016/02	3122 999 60430
ferroxcube frame	4 pins	AP3016/03	3122 991 80420





AP 3016/02

Coil former (without base), asymmetric, for use with ferroxcube frame AP3014, type number AP3016/05.
Cat. no. 3122 794 31430
Base with 4 pins for above coil former, type number AP3016/07.
Cat. no. 3122 992 63220

FERRITES FOR RADIO, AUDIO AND TELEVISION

Beads for screening and damping, and wide-band h.f. chokes

APPLICATION

They are used in v.h.f. radio and TV receivers and in electric motors, ignition systems etc. to reduce in- or outgoing interference, and also in v.h.f. circuits to avoid troublesome coupling.

Beads (without wire)

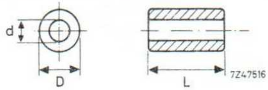


Fig. 1

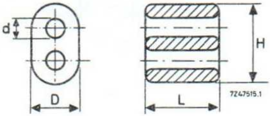


Fig. 2

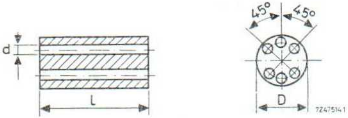
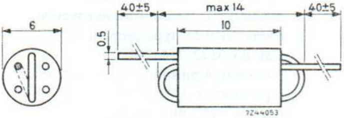


Fig. 3

Fig.	*grade*	*L* (*mm*)	*D* (*mm*)	*H* (*mm*)	*d* (*mm*)	*catalog number*
1	3B	3	3.5	—	1.3 ± 0.2	4322 020 34400
1	4B1	3	3.5	—	1.3 ± 0.2	4322 020 34420
1	3B	5	3.5	—	1.3 ± 0.2	4312 020 31060
2	4B1	8	8.5	14	3.5 + 0.5	4312 020 31570
2	4B1	14	8.5	14	3.5 + 0.5	4312 020 31520
3	3B	10	6	—	0.7 + 0.2	4312 020 31500
3	4B1	10	6	—	0.7 + 0.2	4312 020 31550

H.F. chokes

Dimensions in mm

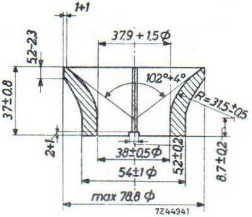


number *of turns*	Z_{opt} ($k\Omega$)	*f at* Z_{opt} *(MHz)*	*decrease of impedance* *in the freq. range* *(MHz)*	*dB*	*FXC grade*	*catalog number*
1.5	0.25	120	10–300	⩽7	3B	4312 020 36630
1.5	0.35	250	80–300	⩽3	4B1	4312 020 36690
2.5	0.60	50	10–220, 30–100	⩽7, ⩽3	3B	4312 020 36640
2.5	0.65	180	50–300, 80–220	⩽6, ⩽3	4B1	4312 020 36700
2 × 1.5	0.70	50	10–220, 30–100	⩽7, ⩽3	3B	4312 020 36650
2 × 1.5	0.80	110	50–300, 80–220	⩽7, ⩽3	4B1	4312 020 36710

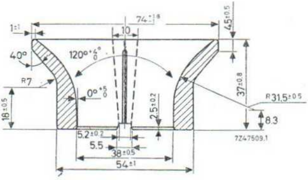
Yoke-rings for use in deflection coils for picture tubes

For 110° black and white picture tubes

Dimensions in mm

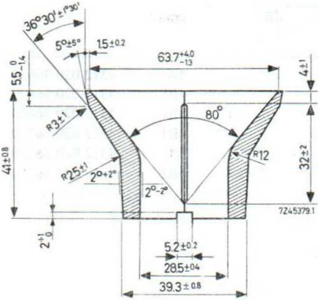


European technique
Material : Ferroxcube 3C2
Catalog number: 3122 104 92180
(standard type)



European technique
Material : Ferroxcube 3C2
Catalog number: 4322 020 35070

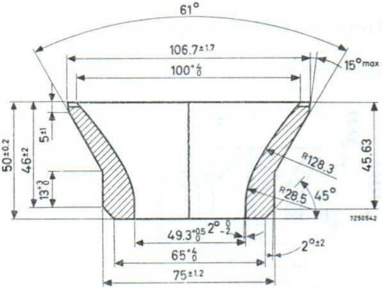
For tinyvision picture tubes (90°, 11 *inch*)

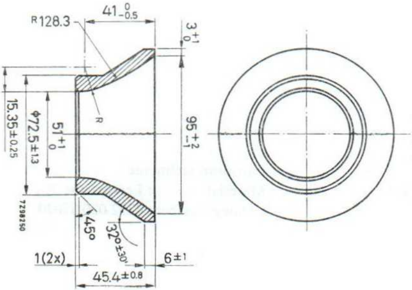


Material : Ferroxcube 3C2
Catalog number: 3122 104 90514

For 90° colour picture tubes

Material : Ferroxcube 3C2
Catalog number: 3122 108 12160
The inner surface has been lacquered.





Material : Ferroxcube 3C2
Catalog number: 3122 104 99170
The inner surface has been lacquered.

Cores for line-output transformers

U-cores (for black and white television)

The difference in splay between two U-cores taken at random from one packing will never exceed half the total tolerance on dimension B_1.

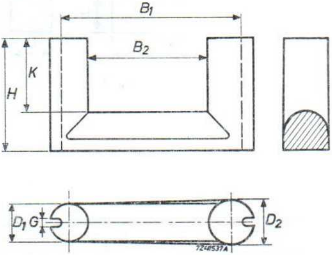


Fig. 1

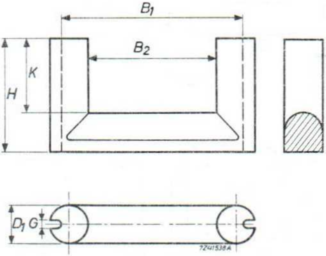


Fig. 2

$D_2 = 15.9 \pm 0.4$

Types

dimensions (mm)						*grade*	*catalog number*
B_1	B_2	D_1	G	H	K		
							Fig. 1
49.8 ± 0.8	> 26.9	15.5 ± 0.4	4.8 ± 0.2	28.4 ± 0.2	15.5 + 1	3C6	4312 020 33300
						3C8	4312 020 33190
							Fig. 2
56.7 ± 0.75	> 36.1	13.8 ± 0.2	3.6 ± 0.2	29.5 ± 0.2	17.6 + 1	3C6	4312 020 33320
60.35 ± 0.9	> 37.05	15.9 ± 0.4	4.8 ± 0.2	28.75 ± 0.2	15.55 + 1	3C6	4312 020 33310
60.35 ± 0.9	> 37.05	15.9 ± 0.4	4.8 ± 0.2	31.8 ± 0.2	18.55 + 1	3C6	4312 020 33330

U- and I-cores

Shapes

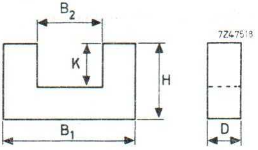


Fig. 3

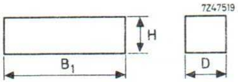


Fig. 4

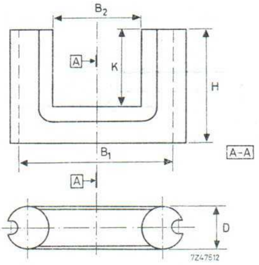


Fig. 5

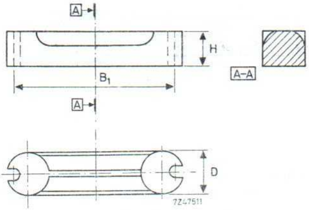


Fig. 6

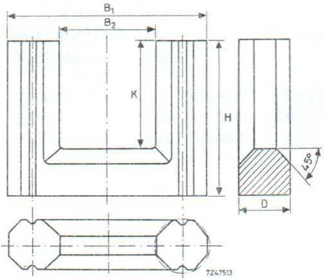


Fig. 7

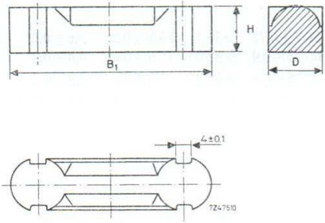


Fig. 8

Types for black and white television

Material: ferroxcube grade 3C6

B_1 (*mm*)	B_2 (*mm*)	*H* (*mm*)	*K* (*mm*)	*D* (*mm*)	*Fig.*	*catalog number*
40.7 ± 1.3	24.4 + 1.2	33 ± 0.2	23.1 + 0.9	11.4 − 0.5	5	3122 104 90480
39.6 ± 0.4		9.5 ± 0.2		11.4 − 0.5	6	3122 104 90470
49.6 ± 0.8	27 ± 1	44.2 ± 0.2	> 31	15.6 ± 0.4	5	4312 020 33380
50 ± 0.8		12.6 ± 0.2		15.6 ± 0.4	6	4312 020 33390
58 + 1.3	28 ± 1	44.6 ± 0.5	31.5 ± 0.5	15 ± 0.4	7	4312 020 33340
58 + 1.3	28 ± 1	34.6 ± 0.5	21.5 ± 0.8	15 ± 0.4	7	4312 020 33350
59.4 ± 0.8		13.5 ± 0.2		15 + 0.4 − 0.2	8	4312 020 33360
72 ± 1	44 ± 1.4	33.1 ± 0.15	19 ± 0.4	14.1 ± 0.3	3[1])	4312 020 33000
93 ± 1.8	36.2 + 1.6	52 ± 0.5	24 ± 0.45	30 ± 0.6	3	4312 020 33100
93 ± 1.8		27.5 ± 0.5		30 ± 0.6	4	4312 020 33110
93 ± 1.8	36.2 + 1.6	76 ± 0.5	48 ± 0.9	30 ± 0.6	3	4312 020 33090
93 ± 1.8	36.2 + 1.6	76 ± 0.5	48 ± 0.9	16 ± 0.5	3	4312 020 33070
93 ± 1.8		27.5 ± 0.5		16 ± 0.5	4	4312 020 33080
101.6 ± 2	> 47	57.1 ± 0.4	31.7 ± 0.75	25.4 ± 0.8	3	4312 020 33120

[1]) Notches in back.

Types for colour television

Material: ferroxcube grade 3C6

B_1 (*mm*)	B_2 (*mm*)	*H* (*mm*)	*K* (*mm*)	*D* (*mm*)	*Fig.*	*catalog number*
73 − 1.8	45.3 ± 1.2	65 − 1.5	49.9 ± 0.8	18.2 ± 0.4	5	3122 104 93120
73 − 1.8		14.8 ± 0.2		18.2 ± 0.4	6	3122 104 93130

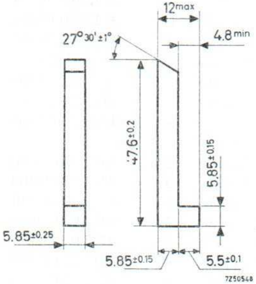
Material: ferroxcube grade 3C8

60.35 ± 0.9	35.4 ± 1.2	33.35 ± 0.2	19.05 ± 0.5	17.25 ± 0.4	5	3122 104 93950

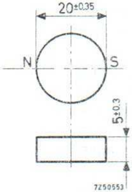
Ferrites for colour tv components

For *yoke rings* and *U-cores* see previous pages

Special ferrite parts are:
Ferroxcube L-core and ferroxdure magnet for convergence units



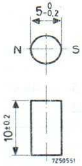
L-core
Ferroxcube 3C6
Catalog number: 3122 104 90680



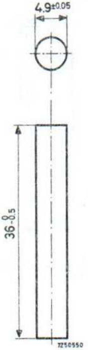
Disc magnet, diametrically magnetized
Ferroxdure 100
Catalog number: 3122 104 90620

Ferroxdure magnet for lateral convergency

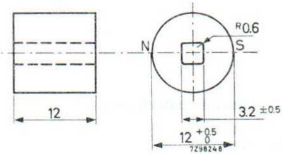
Rod magnet, diametrically magnetized
Ferroxdure 100
Catalog number: 3122 104 92850



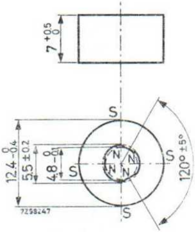
Ferroxcube rod and ferrite magnets for linearity-control units



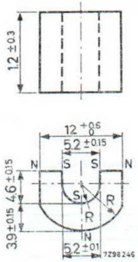
Rod core
Ferroxcube 3C6
Catalog number: 3122 104 90490



Ring magnet, diametrically magnetized
Ferroxdure 100. Catalog number 3122 104 92690



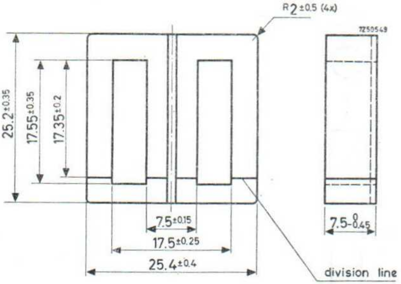
Ring magnet, radially magnetized
Plastic bonded ferroxdure P40
Catalog number: 3122 104 93530



Magnet segment, radially magnetized
Plastic bonded ferroxdure P40
Catalog number: 3122 104 90440

Ferroxcube E+I core for a raster correction transductor

E+I core
Ferroxcube 3C6
$l_e = 5.75$ cm
$A_e = 0.55$ cm^2
Catalog number: 3122 104 93210



Powder iron cores for small i.f. coils

Material properties

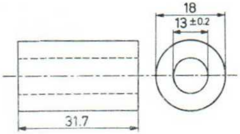
Main properties of the various grades of powder iron: 1P1, 1P2, 1P3.

freq. range	*grade*	*Q-factor measured on a small ring*	μ_i	*particle size*
up to 10 MHz	1P1	300 at 10 MHz	10 appr.	6–8 μm
up to 40–80 MHz	1P2	350 at 30 MHz	8.5 appr.	4–6 μm
up to 40–80 MHz	1P3 1)	350 at 30 MHz	8.5 appr.	4–6 μm

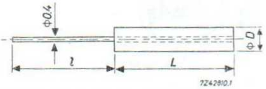
1) Only for cast parts

Tube

Grade 1P1
Catalog number:
4322 020 69520



Cores with a tinned copper wire



Grade 1P3

l (*mm*)	*L* (*mm*)	*D* (*mm*)	*catalog number*
30+4	30	4.00	3122 997 70400
33+4	28	4.95	3122 108 70060
40+4	22	4.95	3122 108 70050

Screw cores

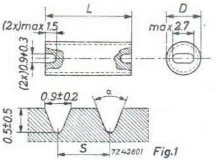


Fig.1

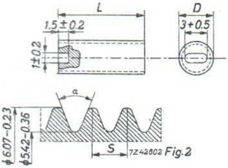


Fig.2

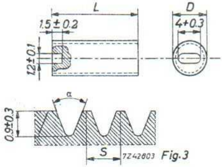


Fig.3

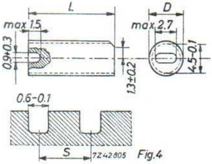


Fig.4

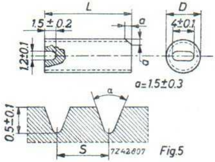


Fig.5

L (*mm*)	*D* (*mm*)	α	*S* (*mm*)	*tol.*[1]) (*mm*)	*n*	*grade*	*Fig.*	*catalog number*
5	4.95–0.1	⩽85°	1.5	0.1	1	1P1	1	3122 104 01580
6	6.07–0.23	60°	0.5			1P1	2	4322 020 69500
8	4.95–0.1	⩽85°	1.5	0.2	4	1P2	1	3122 104 91610
10	7 −0.1	60° ±10°	1	0.1	1	1P2	3	3122 104 91590
12.25	4.95–0.1	⩽85°	1.5	0.2	5	1P2	1	3122 104 91600
12.25	4.95–0.1	—	1.5	0.05	1	1P1	4	3122 104 93140
12.25	4.95–0.1	⩽85°	1.5	0.2	5	1P1	1	3122 104 90970
13	6.07–0.23	60°	0.5	—	—	1P1	2	3122 104 90990
15	4.95–0.1	70° + 15°	1.5	—	—	1P1	1	3122 104 92970
16.5	7 −0.1	60°	1.5	0.05	1	1P2	5	3122 104 91000
16.5	7 −0.1	60° + 10°	1	0.1	1	1P2	3	3122 104 91660
20.25	4.95–0.1	⩽85°	1.5	0.2	5	1P1	1	3122 104 90980

[1]) Tolerance on *S* in mm over *n* grooves

FERRITES FOR RADIO, AUDIO AND TELEVISION

Cores for erasing heads

Material properties

low eddy current losses at frequencies up to 500 kHz
the initial permeability is approximately 900 for 3C1 and 3C2, 2300 for 3H1
the saturation flux at 23 °C is of ferroxcube 3C1 approximately 3300 gauss
of ferroxcube 3C2 approximately 3800 gauss
of ferroxcube 3H1 approximately 4400 gauss

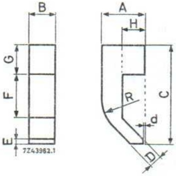


Fig. 1

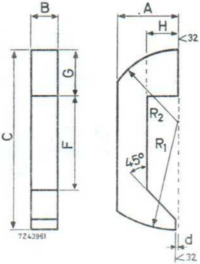


Fig. 2

Cores in ferroxcube grade 3C1 and in shape according to Fig. 1.

catalog number	*nominal dimensions in mm*										*weight in g*
	A	*B*	*C*	*D*	*d*	*E*	*F*	*G*	*H*	*R*	
4322 020 30550	4.7	1.7	11	1.4	0	0.5	4.8	3.2	2.4	5	0.23
3104 101 80230	4.7	3.6	11	1.4	0	0.5	4.8	3.2	2.4	5	0.54
3922 860 20550	4.7	7.1	11	1.4	0	0.5	4.8	3.2	2.4	5	1.02
4322 020 30560	4.7	1.2	11	1.4	0	0.5	4.8	3.2	2.4	5	0.15
4322 020 30630	4.7	2.8	11	1.4	0+0.2	0.5	4.8	3.2	2.4	5	0.44
3122 104 92540	4.7	1.4	11	1.4	0+0.2	0.5	4.8	3.2	2.4	5	0.22
4322 020 30600	3.1	1.6	9.2	1.4	0+0.1	0.5	3.8	3.2	1.4	2	0.12

Cores in ferroxcube grade 3C2 and in shape according to Fig. 2.

catalog number	*nominal dimensions in mm*									*weight in g*
	A	*B*	*C*	*d*	*F*	*G*	*H*	R_1	R_2	
4322 020 30580	5.8	3.6	18	0.1	9.4	4.5	3	11	7	1.22
4322 020 30590	5.8	1.6	18	0.1	9.4	4.5	3	11	7	0.52
4322 020 30610	5.8	2.6	18	0.1	9.4	4.5	3	11	7	0.87

Core in ferroxcube grade 3H1 (Fig. 3)
Catalog number 3104 101 80400
Completely machined type.

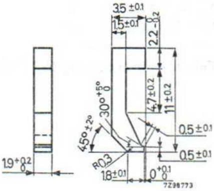
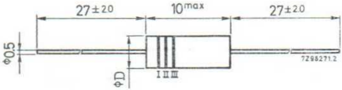


Fig. 3

MICROCHOKES

Dimensions (in mm)



inductance	*D*
0.1–1000 μH	4 mm
1.5– 100 mH	6.5 mm

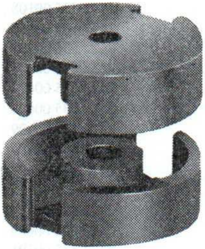
Colour code according to I.E.C. publ. 63, but expressed in μH.

nominal inductance (μH)	*quality factor*		*max. d.c. resistance (Ω)*	*max. C_0 (pF)*	*catalogue number*
	Q	*at freq. (MHz)*			
0.10	45	25	0.10	1	2422 535 00107
0.15	45	25	0.12	1	2422 535 00157
0.22	45	25	0.14	1	2422 535 00227
0.33	45	25	0.17	1	2422 535 00337
0.47	45	25	0.21	1	2422 535 00477
0.68	45	25	0.25	1	2422 535 00687
1.0	45	25	0.31	1	2422 535 00108
1.5	40	8	0.38	1	2422 535 00158
2.2	40	8	0.45	1	2422 535 00228
3.3	40	8	0.53	1	2422 535 00338
4.7	40	8	0.63	1	2422 535 00478
6.8	40	8	1.00	1	2422 535 00688
10	40	8	1.70	1	2422 535 00109
15	40	2	0.55	1	2422 535 00159
22	40	2	0.70	1	2422 535 00229
33	40	2	0.90	1	2422 535 00339
47	40	2	1.35	1	2422 535 00479
68	40	2	1.6	1	2422 535 00689
100	40	2	1.9	1	2422 535 00101
150	45	0.8	3.5	1	2422 535 00151
220	45	0.8	6.5	1	2422 535 00221
330	45	0.8	11	1	2422 535 00331
470	50	0.8	20	1	2422 535 00471
680	50	0.8	41	1	2422 535 00681
1000	50	0.8	48	1	2422 535 00102
1500	50	0.25	25	4	2422 535 01152
2200	50	0.25	30	4	2422 535 01222
3300	45	0.25	50	4.5	2422 535 01332
4700	45	0.25	60	5	2422 535 01472
6800	40	0.25	75	4.5	2422 535 01682
10000	40	0.1	90	4	2422 535 01103
15000	40	0.1	110	3.5	2422 535 01153
22000	40	0.1	130	3	2422 535 01223
33000	35	0.1	275	3	2422 535 01333
47000	35	0.1	400	3.5	2422 535 01473
68000	30	0.1	470	3.5	2422 535 01683
100000	25	0.1	720	3.5	2422 535 01104

PRE-ADJUSTED FERROXCUBE POTCORES, P-SERIES

Introduction

Ferroxcube potcores have been developed for stable low loss filters, coils and transformers. Due to their closed shape they combine a low weight with a small volume.
The principal properties of a potcore with a given inductance value are the quality factor Q, the temperature coefficient T.F., the disaccommodation factor D.F. and, if the potcore is used on higher induction values, the generation of third harmonics.



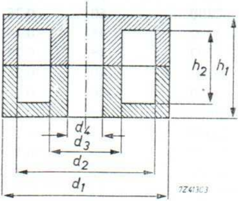
application	*approximate frequency range*	*ferroxcube grade*
filter coils	from 0.1 to 200 kHz 200 kHz to 2 MHz 2 MHz to 20 MHz	3B7, 3H1 3D3 4C6
loading coils, transformers chokes	up to 60 kHz 200 Hz to 10 MHz	3H1 3H1

Potcore dimensions

The main dimensions of the potcores are in conformity with the following standardisation specifications:

IEC publication 133
CCTU 06–04 and 06–08 (France)
DIN 41 293 (Germany) and B.S. 4061 (Gr. Britain)

available types	*nominal dimensions (mm)*					
	d_1	d_2	d_3	d_4	h_1	h_2
P9/5	9.3	7.6	3.8	2.05	5.3	3.45
P11/7	11.1	9.20	4.60	2.05	6.50	4.55
P14/8	14.0	11.8	5.90	3.10	8.40	5.80
P18/11	17.9	15.1	7.45	3.10	10.6	7.40
P22/13	21.5	18.2	9.25	4.50	13.4	9.40
P26/16	25.5	21.6	11.3	5.50	16.0	11.2
P30/19	30.0	25.4	13.3	5.50	18.9	13.2
P36/22	35.5	30.4	15.8	5.50	21.9	14.8
P42/29	42.4	36.3	17.4	5.50	29.4	20.5



Accessories

Coil formers

The dimensions of the coil formers are in conformity with the following standardisation specifications:

IEC publication 133
CCTU 06–02 (France)
DIN 41 294 (Germany)

Inductance adjustors

The inductance of a pre-adjusted potcore can be increased by inserting an adjustor. For each type of potcore the corresponding type of adjustor, which will increase the published μ_e-value by a minimum of 9% and a maximum of 14% approximately is given below. For potcores P26/16, P30/19, P36/22 and P42/29 a series of step-by-step adjustor is available. These adjustors are used when a continuous adjustment of the inductance is not necessary. For instance, they are applied in loading coils to bring the inductance within a certain tolerance.

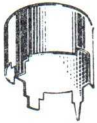
A range of 13 flexible conical step-by-step adjustors is available under the catalog numbers 4322 021 32000 up to 4322 021 32120. The higher this number the greater the effect. An adhesive is used as sliding and fixing material.

The values of μ_e, α or A_L mentioned in the tables are to be used for the potcores without the adjusting mechanism.

The inductance will only be within the given tolerance if the winding space of the coil former is completely filled.

Coil former

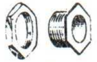
adjustor
with nut



container

spring

tag plate



fixing bush
with nut

Mounting parts

Potcored coils can be mounted on conventional panels, as well as on printed-wiring boards, the location of the soldering tags being matched to the 0.1 in as well as to the 2.50 mm grid. The insulating material of the tag plate can fully withstand the temperatures occurring during dip-soldering.

After placing the spring in the container, the core is brought under the correct pressure by pressing the tag plate down to the rim of the container. It will be held in place after the three ears have been folded over. For conventional panel mounting, a fixing bush and nut are separately available. Types P9/5 and P11/7 do not possess this mounting facility.

Further information on the design of simple tools for potcore assembly will be gladly supplied on request.

For several potcore types coil formers are available provided with p.w. pins, which make the use of mounting parts superfluously.

PRE-ADJUSTED POTCORES P9/5

$\Sigma \frac{l_e}{A_e} = 12.4\ \text{cm}^{-1}$ $\qquad V_e = 0.126\ \text{cm}^3$

Potcores with standard A_L factors

A_L (nH)	*corresponding μ_e-value*	*tolerance on inductance* (%)	*with nut catalog number* 4322 022 6 . . . . *without nut catalog number* 4322 022 4		
			3*B*7	3*H*1	4C6
16	16	±1	—	—	1800
25	25	±1	—	—	1810
63	63	±1	1030	1230	—
100	100	±1.5	1040	1240	—
160	160	±2	1050	1250	—

Inductance $L = N^2 A_L$ (in 10^{-9} H)

Coil former

1 section catalog number 4322 021 31700

Continuous inductance adjustors

available types	
colour	*catalog number*
green	4322 021 31250
yellow	4322 021 31270
brown	4322 021 31540

recommended application	
A_L	3*B*7/3*H*1/3*D*3
63	4322 021 31250
100	4322 021 31270
160	4322 021 31540

PRE-ADJUSTED POTCORES P11/7

$\Sigma \frac{l_e}{A_e} = 9.56 \text{ cm}^{-1}$ $V_e = 0.251 \text{ cm}^3$

Potcores with standard μ_e-values

μ_e	α	*tolerance on inductance* (%)	*catalog number* 4322 022 ..... (*with nut*)			
			3*B*7	3*H*1	3*D*3	4*C*6
15	225	±1	—	—	—	20810
22	186	±1	—	—	—	20820
33	152	±1	—	—	20430	20830
47	127	±1	—	—	20440	—
68	105.8	±1	20050	20250	20450	—
100	87.2	±1.5	20060	20260	—	—
150	71.2	±2	20070	20270	—	—
220	58.8	±5	20080	20280	—	—
660	33.9	±25	—	—	20400	—
1300	24.2	±25	20000	20200	—	—

Number of turns $N = \alpha \sqrt{L}$ (L in 10^{-3} H)

Potcores with standard A_L-factors

A_L (*nH*)	*corresponding* μ_e-*value*	*tolerance on inductance* (%)	*catalog number* 4322 022 ..... (*with nut*)			
			3*B*7	3*H*1	3*D*3	4*C*6
16	12.2	±1	—	—	—	21800
25	19.0	±1	—	—	—	21810
40	30.5	±1	—	—	21420	21820
63	48	±1	—	—	21430	—
100	76	±1	21040	21240	21440	—
160	122	±1.5	21050	21250	—	—
250	190	±3	21060	21260	—	—

Inductance $L = N^2 A_L$ (in 10^{-9} H)

Coil former

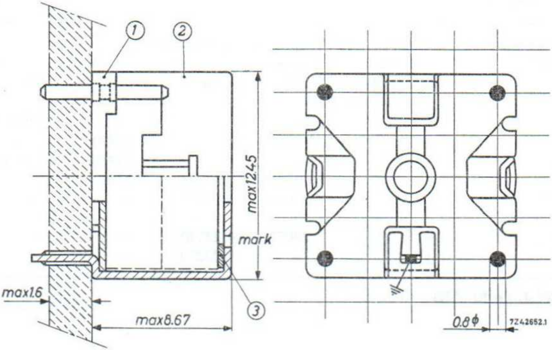
1 section catalog number 4322 021 30240

Continuous inductance adjustors

available types	
catalog number	*colour*
4322 021 31250	green
4322 021 31260	red
4322 021 31270	yellow
4322 021 31280	grey
4322 021 31540	brown

recommended application		
μ_e	A_L	3*B*7/3*H*1/3*D*3
	40	4322 021 31250
33		4322 021 31250
	63	4322 021 31260
47		4322 021 31260
68		4322 021 31270
	100	4322 021 31270
100		4322 021 31540
150	160	4322 021 31540
	250	4322 021 31280
220		4322 021 31280

Mounting parts



(1) tag plate	4322 021 30180
(2) brass container	4322 021 30510
(3) spring	4322 021 30620

PRE-ADJUSTED POTCORES P14/8

$\Sigma \frac{l_e}{A_e} = 7.89 \text{ cm}^{-1}$ $\qquad V_e = 0.495 \text{ cm}^3$

Potcores with standard μ_e-values

μ_e	α	*tolerance on inductance (%)*	*catalog number* 4322 022			
			3B7	*3H1*	*3D3*	*4C6*
15	205	± 1	—	—	—	22810
22	169	± 1	—	—	—	22820
33	137.9	± 1	22030	22230	22430	22830
47	115.5	± 1	22040	22240	22440	—
68	96.1	± 1	22050	22250	22450	—
100	79.2	± 1.5	22060	22260	—	—
150	64.6	± 2	22070	22270	—	—
220	53.3	± 3	22080	22280	—	—
680	30.3	±25	—	—	02400 [1]	—
1400	21.2	±25	02000 [1]	02200 [1]	—	—

Number of turns $N = \alpha \sqrt{L}$ (L in 10^{-3} H)

[1] Supplied without nut for adjustor

Potcores with standard A_L-factors

A_L (*nH*)	*corresponding* μ_e-value	*tolerance on inductance (%)*	*catalog number* 4322 022			
			3B7	*3H1*	*3D3*	*4C6*
25	15.7	±1	—	—	—	23810
40	25	±1	—	—	23420	23820
63	39.5	±1	—	—	23430	23830
100	63	±1	23040	23240	23440	—
160	100.5	±1.5	23050	23250	—	—
250	157	±2	23060	23260	—	—
315	198	±2	23070	23270	—	—
400	252	±2	—	23280	—	—

Inductance $L = N^2 A_L$ (in 10^{-9} H)

Coil formers

Single section	catalog number 4322 021 30250
Two sections	4322 021 30260
Single section with p.w. pins	4322 021 30070

Continuous inductance adjustors

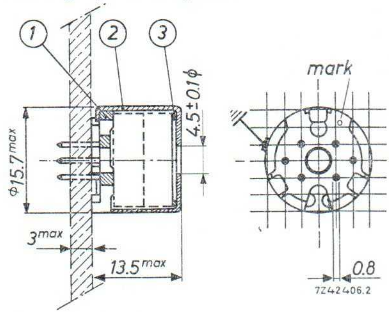
available types

catalog number	*colour*
4322 021 30740	red
4322 021 30750	green
4322 021 30940	yellow
4322 021 30950	white
4322 021 31070	brown
4322 021 31130	grey

recommended application

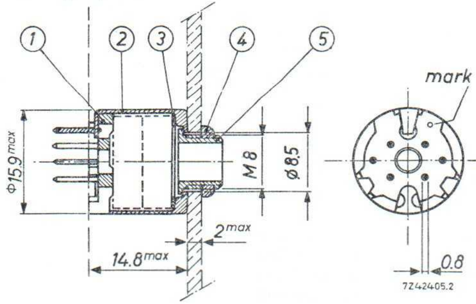
μ_e	A_L	*cat. number* 4322 021	
		3*B*7/3*H*1/3*D*3	4*C*6
15		—	30740
	25	—	30740
22		—	30740
	40	30750	30940
33		30750	30950
	63	30740	30940
47		30740	—
	100	30940	—
68		30940	—
100		30950	—
	160	30950	—
150		31070	—
	250	31070	—
220		31130	—
	315	31130	—

Mounting on printed-wiring boards



(1) tag plate	4322 021 30440
(2) brass container	4322 021 30520
(3) spring	4322 021 30630

Mounting on panels



(1) tag plate
4322 021 30440
(2) aluminium container
4322 021 30600
(3) spring
4322 021 30630
(4) nut
4322 021 30710
(5) fixing bush
4322 021 30720

PRE-ADJUSTED POTCORES P18/11

$\Sigma \frac{l_e}{A_e} = 5.97\ \text{cm}^{-1}$ $V_e = 1.12\ \text{cm}^3$

Potcores with standard μ_e-values

μ_e	α	*tolerance on inductance (%)*	*catalog number* 4322 022			
			3B7	*3H1*	*3D3*	*4C6*
15	178	± 1	—	—	—	24810
22	147	± 1	—	—	—	24820
33	120	± 1	24030	24230	24430	24830
47	100.5	± 1	24040	24240	24440	—
68	83.6	± 1	24050	24250	24450	—
100	68.9	± 1.5	24060	24260	—	—
150	56.3	± 2	24070	24270	—	—
220	46.5	± 3	24080	24280	—	—
705	25.9	±25	—	—	04400 1)	—
1750	16.5	±25	04000 1)	04200 1)	—	—

Number of turns $N = \alpha\sqrt{L}$ (L in 10^{-3} H)

1) Supplied without nut for adjustor

Potcores with standard A_L-factors

A_L (*nH*)	*corresponding μ_e-value*	*tolerance on inductance (%)*	*catalog number* 4322 022			
			3B7	*3H1*	*3D3*	*4C6*
25	11.9	±1	—	—	—	25810
40	19.0	±1	—	—	25420	25820
63	30.0	±1	25030	25230	25430	25830
100	47.5	±1	25040	25240	25440	—
160	76	±1	25050	25250	25450	—
250	119	±1.5	25060	25260	—	—
315	149	±2	25070	25270	—	—
400	190	±2	25080	25280	—	—
630	298	±3	25100	25300	—	—

Inductance $L = N^2 A_L$ (in 10^{-9} H)

Coil formers

single section	catalog number 4322 021 30270
two sections	4322 021 30280
three sections	4322 021 30290
single section, with p.w. pins	4322 021 30090

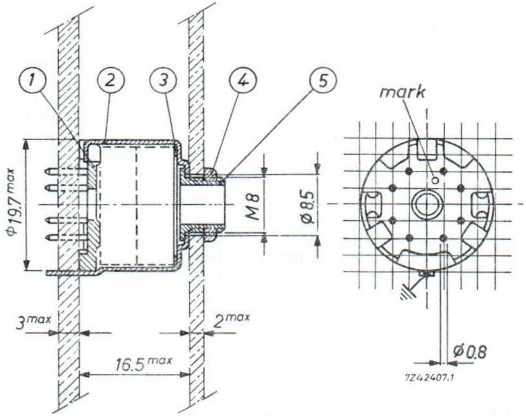
Continuous inductance adjustors

available types	
catalog number	*colour*
4322 021 30730	brown
4322 021 30760	green
4322 021 30770	red
4322 021 30960	yellow
4322 021 30970	white
4322 021 31080	grey

recommended application			
μ_e	A_L	*cat. number* 4322 021	
		3*B*7/3*H*1/3*D*3	4*C*6
15		—	30760
	25	—	30760
	40	—	30770
22		—	30770
	63	30760	—
33		30760	30970
	100	30770	
47		30770	
68		30960	
	160	30960	
	250	30970	
100		30970	
150		30730	
	400	31080	
220		31080	

Mounting on P.W. board or on panel

(1) tag plate	4322 021 30450
(2) brass container	4322 021 30530
(3) spring	4322 021 30640
(4) nut	4322 021 30710
(5) fixing bush	4322 021 30720



PRE-ADJUSTED POTCORES P22/13

$\Sigma \frac{l_e}{A_e} = 4.97 \text{ cm}^{-1}$ $\quad V_e = 2.00 \text{ cm}^3$

Potcores with standard μ_e-values

μ_e	α	*tolerance on inductance* (%)	*catalog number* 4322 022			
			3*B*7	3*H*1	3*D*3	4*C*6
15	162	± 1	—	—	—	26810
22	134	± 1	—	—	—	26820
33	109.4	± 1	—	—	26430	26830
47	91.7	± 1	—	—	26440	—
68	76.2	± 1	26050	26250	26450	—
100	62.8	± 1.5	26060	26260	—	—
150	51.3	± 2	26070	26270	—	—
220	42.4	± 3	26080	26280	—	—
330	34.6	± 3	26090	26290	—	—
720	23.4	±25	—	—	06400 ^{1})	—
1840	14.6	±25	06000 ^{1})	06200 ^{1})	—	—

Number of turns $N = \alpha\sqrt{L}$ (L in 10^{-3} H)

^{1}) Supplied without nut for adjustor

Potcores with standard A_L-factors

A_L (*nH*)	*corresponding* μ_e-*value*	*tolerance on inductance* (%)	*catalog number* 4322 022			
			3*B*7	3*H*1	3*D*3	4*C*6
25	9.9	±1	—	—	—	27810
40	15.8	±1	—	—	—	27820
63	25	±1	—	—	27430	27830
100	39.5	±1	27040	27240	27440	27840
160	63.5	±1	27050	27250	27450	—
250	99	±1.5	27060	27260	—	—
315	124.5	±2	27070	27270	—	—
400	158	±2	27080	27280	—	—
630	249	±3	27100	27300	—	—
1000	395	±3	27110	27310	—	—

Inductance $L = N^2 A_L$ (in 10^{-9} H)

Coil formers

single section	catalog number 4322 021 30300
two sections	4322 021 30310
three sections	4322 021 30320
single section, with p.w. pins	4322 021 30110

Continuous inductance adjustors

available types

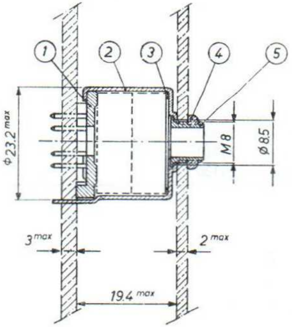
catalog number	*colour*
4322 021 31000	yellow
4322 021 31020	white
4322 021 31040	green
4322 021 31060	red
4322 021 31100	brown
4322 021 31240	black

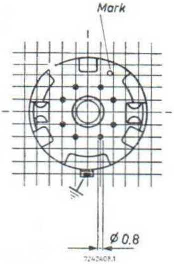
recommended application

μ_e	A_L	*cat. number* 4322 021	
		3*B*7/3*H*1/3*D*3	4*C*6
15		—	31060
	40	—	31060
22		—	31000
	63	31040	31000
33		31040	31020
	100	31060	—
47		31060	—
68		31000	—
	160	31000	—
	250	31020	—
100		31020	—
150		31100	—
	400	31100	—
220		31100	—
	630	31100	—
330		31240	—

Mounting on P.W. board or on panel

(1) tag plate	4322 021 30460
(2) brass container	4322 021 30540
(3) spring	4322 021 30650
(4) nut	4322 021 30710
(5) fixing bush	4322 021 30720





PRE-ADJUSTED POTCORES P26/16

$\Sigma \frac{l_e}{A_e} = 4.00 \text{ cm}^{-1}$ $\qquad V_e = 3.53 \text{ cm}^3$

Potcores with standard μ_e-values

μ_e	α	*tolerance on inductance (%)*	*catalog number* 4322 022			
			3B7	*3H1*	*3D3*	*4C6*
15	146	± 1	—	—	—	28810
22	120	± 1	—	—	—	28820
33	98.2	± 1	28030	28230	28430	28830
47	82.3	± 1	28040	28240	28440	—
68	68.4	± 1	28050	28250	28450	—
100	56.4	± 1.5	28060	28260	—	—
150	46.1	± 2	28070	28270	—	—
220	38.1	± 3	28080	28280	—	—
330	31.0	± 3	28090	28290	—	—
730	20.8	±25	—	—	08400 1)	—
1910	12.9	±25	08000 1)	08200 1)	—	—

Number of turns $N = \alpha\sqrt{L}$ (L in 10^{-3} H)

1) Supplied without nut for adjustor

Potcores with standard A_L-factors

A_L *(nH)*	*corresponding μ_e-value*	*tolerance on inductance (%)*	*catalog number* 4322 022			
			3B7	*3H1*	*3D3*	*4C6*
63	20	± 1	29030	29230	39430	29830
100	31.8	± 1	29040	29240	29440	29840
160	51	± 1	29050	29250	29450	—
250	79.5	± 1	29060	29260	29460	—
315	100.2	± 1.5	29070	29270	—	—
400	127	± 2	29080	29280	—	—
630	200	± 3	29100	29300	—	—
1000	318	± 3	29110	29310	—	—
1600	510	±3	29120	29320	—	—

Inductance $L = N^2 A_L$ (in 10^{-9} H)

Coil formers

single section	catalog number 4322 021 30330
two sections	4322 021 30340
three sections	4322 021 30350
single section, with p.w. pins	4322 021 30130

Continuous inductance adjustors

available types

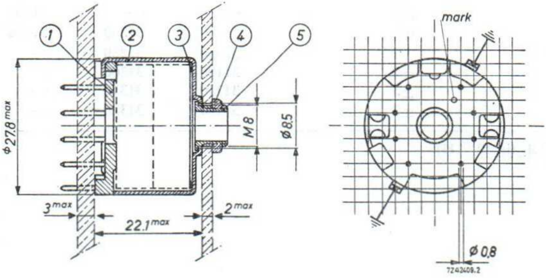
catalog number	*colour*
4322 021 30780	green
4322 021 30790	yellow
4322 021 30800	red
4322 021 30810	brown
4322 021 30980	white
4322 021 31090	grey

recommended application

μ_e	A_L	*cat. number 4322 021 .....*	
		3B7/3H1/3D3	4C6
15		—	30780
22		—	30780
	63	—	30780
33		30780	30790
	100	30780	30790
47		30800	
	160	30800	
68		30980	
	250	30980	
100	315	30980	
150		30810	
	400	30810	
220		30810	
	630	30810	
330		31090	
	1000	31090	

Mounting on P.W. board or on panel

(1) tag plate	4322 021 30470
(2) brass container	4322 021 30550
(3) spring	4322 021 30660
(4) nut	4322 021 30710
(5) fixing bush	4322 021 30720



PRE-ADJUSTED POTCORES P30/19

$\Sigma \frac{l_e}{A_e} = 3.30\ \text{cm}^{-1}$ $V_e = 6.19\ \text{cm}^3$

Potcores with standard μ_e-values

μ_e	α	*tolerance on inductance* (%)	*catalog number* 4322 022		
			3B7	*3H1*	*3D3*
33	89.2	± 1	30030	30230	30430
47	74.7	± 1	—	—	30440
68	62.1	± 1	30050	30250	30450
100	51.3	± 1.5	30060	30260	—
150	41.8	± 2	30070	30270	—
220	34.6	± 3	30080	30280	—
330	28.2	± 3	30090	30290	—
740	18.9	±25	—	—	10400 [1])
1990	11.5	±25	10000 [1])	10200 [1])	—

Number of turns $N = \alpha\sqrt{L}$ (L in $10^{-3}\cdot$H)

[1]) Supplied without nut for adjustor

Potcores with standard A_L-factors

A_L (*nH*)	*corresponding* μ_e-*value*	*tolerance on inductance* (%)	*catalog number* 4322 022		
			3B7	*3H1*	*3D3*
100	26.2	±1	—	—	31440
160	42	±1	—	—	31450
250	65.5	±1	31060	31260	31460
400	105	±1.5	31080	31280	—
630	165	±2	31100	31300	—
1000	263	±3	31110	31310	—
1600	420	±3	31120	31320	—

Inductance $L = N^2 A_L$ (in 10^{-9} H)

Coil formers

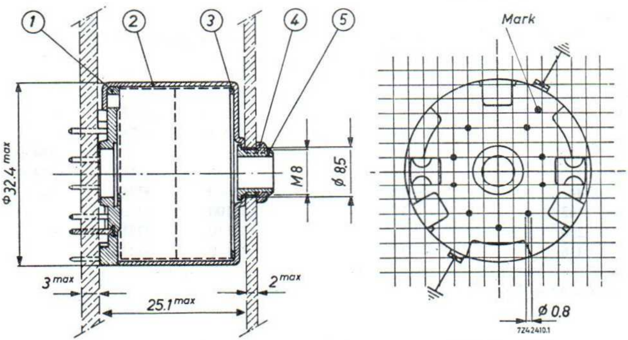
Single section	catalog number 4322 021 30360
two sections	4322 021 30370
three sections	4322 021 30380

Continuous inductance adjustors

Available types and recommended applications

colour	*catalog number* 4322 021	*potcore*	
		μ_e	A_L
green	30780	33	100
red	30800	47	160
white	30980	68	250
white	30980	100	400
brown	30810	150	630
grey	31090	220	1000
black	31120	330	1600

Mounting on P.W. board or on panel



(1) tag plate	4322 021 30480
(2) brass container	4322 021 30560
(3) spring	4322 021 30670
(4) nut	4322 021 30710
(5) fixing bush	4322 021 30720

PRE-ADJUSTED POTCORES P36/22

$\Sigma \frac{l_e}{A_e} = 2.64\ \text{cm}^{-1}$ $V_e = 10.7\ \text{cm}^3$

Potcores with standard μ_e-values

μ_e	α	*tolerance on inductance (%)*	*catalog number* 4322 022		
			3*B*7	3*H*1	3*D*3
33	79.7	± 1	—	—	32430
47	66.8	± 1	—	—	32440
68	55.6	± 1	32050	32250	32450
100	45.8	± 1.5	32060	32260	—
150	37.4	± 2	32070	32270	—
220	30.9	± 3	32080	32280	—
330	25.2	±25	32090	32290	—
750	16.7	±25	—	—	12400 [1]
2030	10.2	±25	12000 [1]	12200 [1]	—

Number of turns $N = \alpha\sqrt{L}$ (L in 10^{-3} H)

[1] Supplied without nut for adjustor

Potcores with standard A_L-factors

A_L (*nH*)	*corresponding* μ_e*-value*	*tolerance on inductance (%)*	*catalog number* 4322 022		
			3*B*7	3*H*1	3*D*3
40	8.39	±1	33020	33220	—
100	21	±1	33040	33240	—
160	33.6	±1	—	—	33450
250	52.5	±1	33060	33260	33460
400	84	±1.5	33080	33280	33480
630	132	±2	33100	33300	—
1000	210	±3	33110	33310	—
1600	336	±3	33120	33320	—

Inductance $L = N^2 A_L$ (in 10^{-9} H)

Coil formers

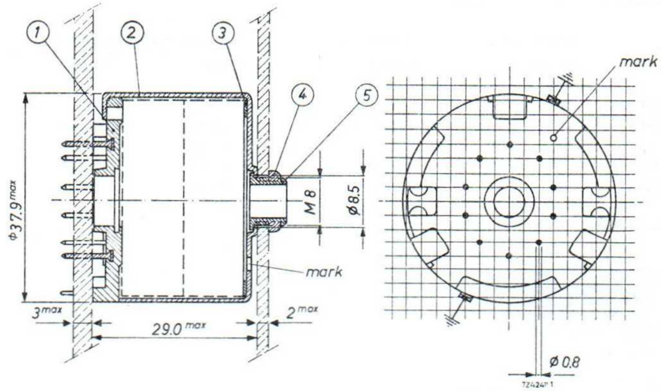
single section	catalog number	4322 021 30390
two sections		4322 021 30400
three sections		4322 021 30410

Continuous inductance adjustors

Available types and recommended applications for potcores with grade 3B7, 3H1 *and* 3D3

colour	*catalog number*	*potcore*	
	4322 021	μ_e	A_L
yellow	30790	33	160
white	30980	47	250
white	30980	68	—
brown	30810	100	400
brown	30810	—	630
grey	31110	150	—
grey	31090	220	1000
black	31120	330	1600

Mounting on P.W. board or on panel



(1) tag plate	4322 021 30490
(2) brass container	4322 021 30570
(3) spring	4322 021 30680
(4) nut	4322 021 30710
(5) fixing bush	4322 021 30720

PRE-ADJUSTED POTCORES P42/29

$\Sigma \frac{l_e}{A_e} = 2.59 \text{ cm}^{-1}$ $V_e = 18.2 \text{ cm}^3$

Potcores with standard μ_e-values

μ_e	α	*tolerance on inductance* (%)	*catalog number* 4322 022	
			3*B*7	3*H*1
33	78.4	± 1	—	—
47	65.7	± 1	—	—
68	55.0	± 1	—	34250
100	45.0	± 1.5	34060	34260
150	36.8	± 2	34070	34270
220	30.4	± 3	34080	34280
330	24.8	± 3	34090	34290
2120	9.85	±25	14000 [1])	14200 [1])

Number of turns $N = \alpha\sqrt{L}$ (L in 10^{-3} H)

[1]) Supplied without nut for adjustor

Potcores with standard A_L-factors

A_L (*nH*)	*corresponding* μ_e-*value*	*tolerance on inductance* (%)	*catalog number* 4322 020	
			3*B*7	3*H*1
250	51	±1	35060	35260
400	81	±1	35080	35280
630	130	±2	35100	35300
1000	205	±3	35110	35310
1600	325	±3	35120	35320

Inductance $L = N^2 A_L$ (in 10^{-9} H)

Coil formers

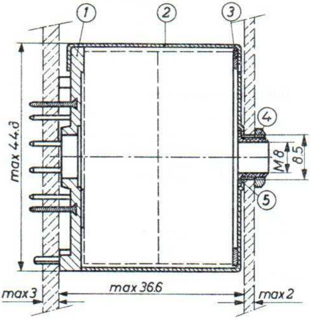
single section catalog number	4322 021 30420
two sections	4322 021 30430

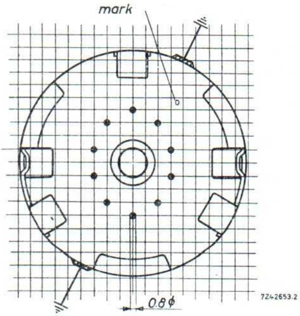
Continuous inductance adjustors

Available types and recommended applications

colour	*catalog number*	*potcore*	
	4322 021	μ_e	A_L
white	30980	68	250
brown	30810	100	400
brown	30810	—	630
grey	31090	150	1000
grey	31090	220	—
black	31120	330	1600

Mounting on P.W. board or on panel





(1) tag plate	4322 021 30500
(2) brass container	4322 021 30580
(3) spring	4322 021 30690
(4) nut	4322 021 30710
(5) fixing bush	4322 021 30720

PRE-ADJUSTED SQUARE CORES R6

$$\sum \frac{l_e}{A_e} = 7.84 \text{ cm}^{-1} \quad V_e = 0.799 \text{ cm}^3$$

Cores with standard A_L values

A_L	*corre-sponding μ_e*	*tol. on induct-ance* (%)	*cat. No.* 4322 022 7.... with nut 4322 022 5.... without nut					
			3B7	3H1	3D3	4C6	3E2	impr. 3E1
25	15.6	±1						
40	24.9	±1	5020					
63	39.4	±1	5030					
100	62.4	±2	—					
160	100	±2	5050	5250				
250	156	±2	5060	5260				
315	197	±2	—	5270				
400	249	±2	5080	5280				
630	394	±3	5100	5300				
1000	624	±10	—	5310				
1250	780	±10	—	5390				
4750	3000	±25	—	—	—	—	—	5800*
6000	3750	±25	—	—	—	—	5900*	—

Inductance $L = N^2 A_L$ (in 10^{-9} H)

* Only available without nut.

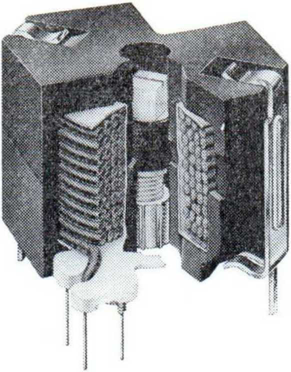
Coil formers

sections	*pins*	*catalog number*
1	4	4322 021 31720
1	6	4322 021 31710
2	4	4322 021 31740
2	6	4322 021 31730

Inductance adjustors

A_L of core in 3B7/3H1	*recommended adjustor*	
	cat. No.	*colour*
160, 250	4322 021 30970	white
250, 315	4322 021 30730	brown
400	4322 021 30730	brown
630	4322 021 31080	grey

Assembly



Mounting parts

Clip 4322 021 31780 with earthing tag.

PRE-ADJUSTED SQUARE CORES SM6

$$\sum \frac{l_e}{A_e} = 8.6\ \text{cm}^{-1} \quad V_e = 0.84\ \text{cm}^3$$

Cores with standard A_L values

A_L	corresponding μ_e value	tol. on inductance (%)	cat. No. 4322 022 6.... with nut 4322 022 4.... *without nut*					
			3B7	3H1	3D3	4C6	3E2	impr. 3E1
25	17.1	±1						
40	27.4	±1						
63	43.1	±1						
100	62.0	±2						
160	110	±2	7050	7250				
250	171	±2	—	7260				
315	216	±2	—	7270				
400	274	±2	—	7280				
630	431	±3	—	7300				
1000	620	±10	—	—				
1250	856	±10	—	7390				
4400	3010	±25	—	—	—	—	—	7800*
5500	3770	±25	—	—	—	—	7900*	—

Inductance $L = N^2 A_L$ (in 10^{-9} H)
* Only available without nut

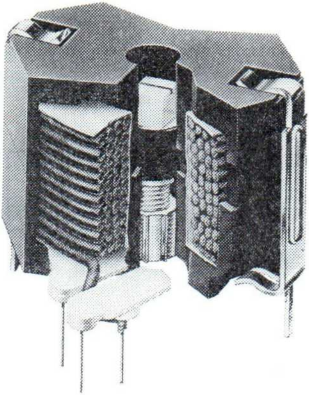
Coil formers

sections	pins	catalog number
1	4	4312 021 29240
1	6	4312 021 29250

Inductance adjustors

A_L of core	recommended adjustor	
	catalog number	colour
160	4322 021 30960	yellow
250	4322 021 30970	white
315, 400	4322 021 30730	brown
630	4322 021 31080	grey

Assembly



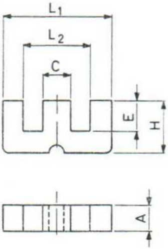
Mounting parts

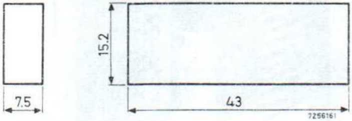
Clip 4322 021 31780 with earthing tag.

TRANSFORMER CORES

E- and I-cores

These cores are typical transformer cores. They can be used from voice frequencies up to some MHz.





type	*dimensions*						*ferroxcube*	*air gap*	*catalog number*
	L_1	*L_2*	*C*	*A*	*H*	*E*	*grade*	*(mm)*	
E13/7/3	12.95	9.43	3.3	3.3	6.7	4.95	3H7	0	4322 020 34510
E20/10/5	20.7	12.8	5.2	5.3	10	6.3	3E1	0	4322 020 34530
								0.15	34550
							improved 3E1	0	34830
E30/15/7	30.8	19.5	7.2	7.3	15	9.7	3E1	0	4322 020 34630
								0.15	34650
								0.30	34660
							improved 3E1	0	34840
E42/21/15	43	29.5	12.2	15.2	21	14.8	3E1	0	4322 020 34720
								0.25	34740
								0.5	34750
							improved 3E1	0	34850
I42/7.5/15	see figure above						3E1	0	4322 020 37320
E55/28/21	56.2	37.5	17.2	21	27.5	18.5	3E1	0	4322 020 34780
E65/32/13	66.5	44.2	20	13.7	32.5	22.2	3E1	0	4322 020 34820

The dimensions are according to D.I.N. 41295

With two E-cores or one E-core and one I-core a shell type transformer can be composed.

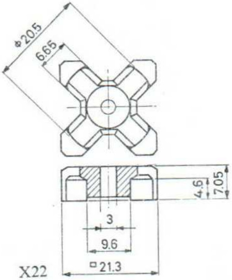
shell type transformer	*composed of*	A_e (cm^2)	$\Sigma \frac{l_e}{A_e}$ (cm^{-1})	V_e (cm^3)	μ_e	A_L (nH)	*cat. number of coil former* *without pins* 4312 021	*with pins* 4322 021 .....
13/13/3	2 × E13/7/3	0.101	30.9	0.318	⩾1390	⩾566		
20/20/5	2 × E20/10/5	0.312	13.7	1.34	1650–2760	1515–2520	28431	20240
30/30/7	2 × E30/15/7	0.597	11.2	4.00	1795–2990	2010–3350	28550	20250
42/42/15	2 × E42/21/15	1.82	5.34	17.6	1910–3140	4425–7380	28622	21830
42/29/15	1 × E42/21/15 + 1 × I42/7.5/15	1.83	3.67	12.3	>1820	>6300		
55/55/21	2 × E55/28/21	3.54	3.48	43.7	1950–3250	7050–11700	28711	
65/65/13	2 × E65/32/13	2.66	5.51	39.1	1980–3290	4500–7500		
65/65/27	4 × E65/32/13	5.32	2.75	78.2	1835–3050	8400–14000	28721	

TRANSFORMER CORES

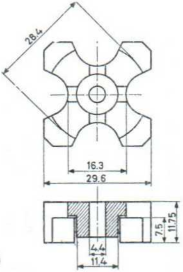
Cross cores

These cores have been developed for transformers to be used on printed-wiring boards. The soldering pins are positioned according to a grid of 2.52 mm.

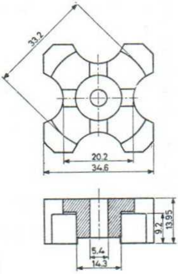
core half	*ferroxcube grade*	*air gap (mm)*	*catalog number*
X22	3E1	0	3522 200 03470
		0.15	4322 020 23700
	improved 3E1	0	4322 020 23530
	3H1	0	4322 020 23510
		0.02	4322 020 23710
		0.05	4322 020 23720
		0.15	4322 020 23730
		0.25	4322 020 23740
	3B7	0	3522 200 08770
	3D3	0	3522 200 03480
	4C6	0	3522 200 03490
X30	improved 3E1	0	4322 020 23760
	3H1	0	4322 020 23750
		0.02	4322 020 23960
		0.05	4322 020 23970
		0.15	4322 020 23980
		0.25	4322 020 23990
X35	3H1	0	4322 020 24000
		0.02	4322 020 24210
		0.05	4322 020 24220
		0.15	4322 020 24230
		0.25	4322 020 24240



X22

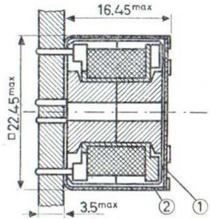


X30

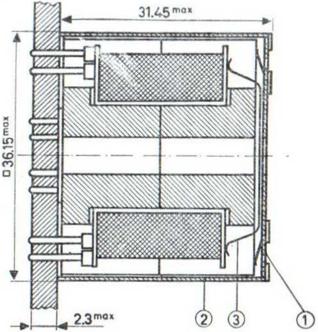


X35

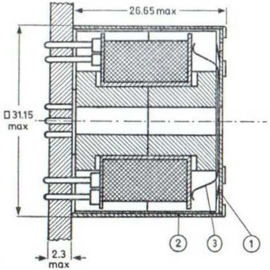
Cross-core	*ferroxcube grade*	A_e (cm^2)	$\Sigma \frac{l_e}{A_e}$ (cm^{-1})	V_e (cm^3)	μ_e	*catalog number of coil former*
X22	3E1	0.66	5.75	2.51	$\geqslant 1495$	4322 021 31770
	improved 3E1	0.66	5.75	2.51	2000– 3325	
	3H1	0.66	5.75	2.51	$\geqslant 1440$	
	3B7	0.66	5.75	2.51	$\geqslant 1440$	
	3D3	0.66	5.75	2.51		
	4C6	0.66	5.75	2.51		
X30	improved 3E1	1.14	4.90	6.36	2200– 3675	
	3H1	1.14	4.90	6.36	$\geqslant 1525$	4322 021 31190
X35	3H1	1.64	4.10	11.0	$\geqslant 1580$	4322 021 31200 (16 pins) 4322 021 30190 (8 pins)



Core assembly X22
(1) Cover 4322 021 30230
(2) Container 4322 021 30040



Core assembly X35
(1) Cover 4322 021 31160
(2) Container 4322 021 31180
(3) Spring 4322 021 30220



Core assembly X30
(1) Cover 4322 021 31150
(2) Container 4322 021 31170
(3) Spring 4322 021 30210

Pre-adjusted cross cores X22
Cross cores with standard A_L factors

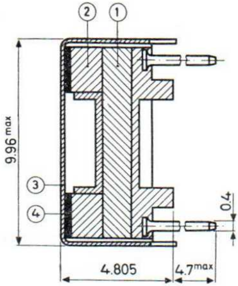
A_L	*corresponding μ_e-value*	*tolerance on inductance (%)*	*catalog number* 4322 022 6. . . ., *with nut* 4322 022 4. . . ., *without nut*
			ferroxcube grade 3*H*1
160	73	±1	5250
250	115	±1.5	5260
400	180	±2	5280
630	290	±3	5300

Inductance $L = N^2 A_L$ (in 10^{-9} H)

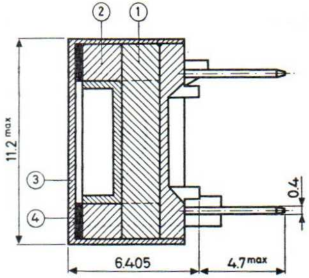
H-cores

These cores have been developed for small transformers to be used on printed-wiring boards. The soldering pins are positioned according to a grid of 2.52 mm. The material grade is FXC3E2.

type	A_e (cm^2)	$\Sigma \frac{l_e}{A_e}$ (cm^{-1})	V_e (cm^3)	μ_e	A_L (nH)	*catalog number*
H7	0.0325	54	0.0571	$\geqslant 3000$	$\geqslant 700$	4322 020 33020
H10	0.075	30	0.17	$\geqslant 3820$	$\geqslant 1600$	4322 020 33010
H16	0.349	10.2	1.24		> 4500	4322 020 33030
H20	0.47	8.8	1.93	$\geqslant 3850$	$\geqslant 5500$	4322 020 33000

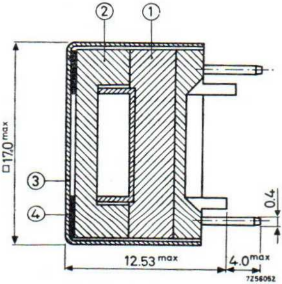


Core assembly H7
Max. length = 7.46 mm

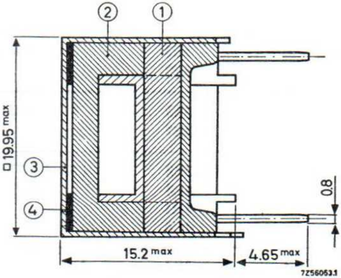


Core assembly H10
Max. length = 12.4 mm

(1) Ferroxcube H-shape with reinforced polyester coil former
(2) Ferroxcube window
(3) Brass container
(4) Silicon rubber washer



Core assembly H16



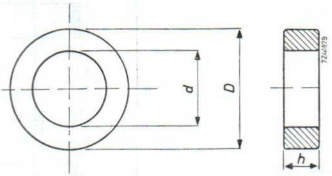
Core assembly H20

(1) Ferroxcube H-shape with reinforced polyester coil former
(2) Ferroxcube U-shape
(3) Brass container
(4) Silicon rubber washer

TRANSFORMER CORES

Toroids

Toroids are mainly used in broadband transformers, pulse transformers and chokes.



dimensions (mm) $D \times d \times h$	ferroxcube grade	l_e (cm)	$\sum \frac{l_e}{A_e}$ (cm^{-1})	V_e (cm^3)	μ_{tor}	catalog number
2 × 1.3 × 0.7	3E3	0.511	208	0.00125	> 10 000	8222 293 03230
3.93 × 2.23 × 1.27	3E3		87.4		10000–15000	4322 020 90780
	3B7					4322 020 90820
4 × 2.2 × 1.1	3E2	0.946	95.6	0.00937	> 5000	4322 020 36650
	3E3				> 10000	4322 020 36700
	3H1				[1])	4322 020 36590
4.83 × 2.28 × 1.27	3E3		66.3		10000–15000	4322 020 90790
	3B7					4322 020 90830
5.84 × 3.05 × 1.52	3E3		63.4		10000–15000	4322 020 90800
	3B7					4322 020 90840
6 × 4 × 2	3E2	1.55	77.5	0.0310	> 5000	4322 020 36660
	3E3				> 10000	4322 020 36710
	3H1				[1])	4322 020 36600
	4C6				> 100	4322 020 36500
9 × 6 × 3	3E2	2.33	51.7	0.105	> 5000	4322 020 36670
	3E3				> 10000	4322 020 36720
	3H1				[1])	4322 020 36610
	4C6				> 100	4322 020 91010

dimensions (mm) $D \times d \times h$	*ferroxcube grade*	l_e (*cm*)	$\sum \frac{l_e}{A_e}$ (*cm*$^{-1}$)	V_e (*cm*^{3})	μ_{tor}	*catalog number*
9.53 × 4.75 × 3.18	3E3 3B7		28.4		10000–15000	4322 020 90810 4322 020 90850
14 × 9 × 5	3E2 3H1 4C6	3.55	28.5	0.445	> 5000 1) > 100	4322 020 36680 4322 020 36620 4322 020 91020
23 × 14 × 7	3E2 3H1 4C6	5.70	18.1	1.79	> 5000 1) > 100	4322 020 36690 4322 020 36630 4322 020 91070
29 × 19 × 7.5	3E1	7.50	20.1	2.58	2700 ± 20%	4322 020 36550
36 × 23 × 10	3E1	9.20	14.2	5.60	2700 ± 20%	4322 020 36560
36 × 23 × 15	3E1 4C6	9.20	9.42	8.50	2700 ± 20% > 100	4322 020 36570 4322 020 91090

1) μ_{tor} is indicated by the colour of the circumference of the core. see table below,

group	μ_{tor}	*colour*
1	2000–2200	brown
2	2140–2360	red
3	2300–2540	orange
4	2480–2740	yellow
5	2680–2960	green

group	μ_{tor}	*colour*
6	2900–3210	blue
7	3150–3480	violet
8	3420–3780	grey
9	3720–4110	white
10	> 4050	black

The sorting into μ groups is done merely for the convenience of the user. The toroids are not available per separate group.

PIEZOXIDE

Piezoxide materials are piezoelectric ceramic materials, suitable for almost any electro-mechanical or mechano-electrical energy conversion. Because of their ceramic nature elements in these materials can be preshaped. The material grades are PXE4, PXE5, PXE7, PXE11 and PXE21.

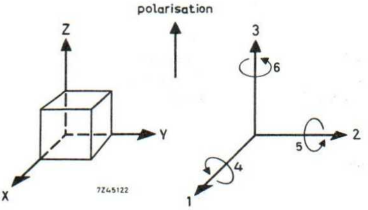
		PXE4	*PXE5*
Mechanical data			
Specific mass		7.45×10^3	7.55×10^3
Curie temperature		265	285
Modulus of elasticity	Y^E_{11}	0.77×10^{11}	0.65×10^{11}
	Y^E_{33}	0.79×10^{11}	0.59×10^{11}
	Y^E_{55}		0.26×10^{11}
Specific heat		420	420
Heat conductivity		1.2	1.2
Compressive strength		$>6 \times 10^8$	$>6 \times 10^8$
Electrical data			
Relative dielectric constants	$\varepsilon^T_{33}/\varepsilon_0$	1750	1750
	$\varepsilon^T_{11}/\varepsilon_0$		1800
Volume resistivity ρ_{el} at 25° C		10^{11}	10^{14}
Time constant $\tau = RC = \rho_{el} \cdot \varepsilon^T_{33}$		>30	>300
Dielectric dissipation factor $\tan \delta$		0.6×10^{-2}	2.0×10^{-2}
Electro-mechanical data			
Coupling coefficients	k_p	0.55	0.62
	k_{31}	0.32	0.36
	k_{33}	0.65	0.70
	k_{15}		0.66
Piezoelectric charge constants	d_{31}	-141×10^{-12}	-178×10^{-12}
	d_{33}	305×10^{-12}	356×10^{-12}
	d_{15}		515×10^{-12}
Piezoelectric voltage constants	g_{31}	-9.4×10^{-3}	-11.3×10^{-3}
	g_{33}	17.5×10^{-3}	23.2×10^{-3}
	g_{15}		32.5×10^{-3}
Quality factor	Q^E_M	500	80
Frequency constants	N_p	2200	2000
	N_1	1620	1460
	N_3	1610	1390
	N_5		930

PXE7	PXE11	PXE21	
7.6×10^3	4.5×10^3	7.7×10^3	kg/m^3
320	400	270	°C
0.82×10^{11}	1.2×10^{11}		N/m^2
		0.61×10^{11}	N/m^2
0.28×10^{11}	0.41×10^{11}		N/m^2
420	420	420	J/kg.deg C
1.2	1.2	1.2	W/m.deg C
$>6 \times 10^8$	$>6 \times 10^8$	$>6 \times 10^8$	N/m^2
680	450	1800	
1050	600		
			Ωm
			min
2.0×10^{-2}	2.5×10^{-2}	1.6×10^{-2}	
0.53	0.43	0.62	
	0.25		
		0.73	
0.66	0.65		
-84×10^{-12}	-44.5×10^{-12}		C/N
		370	C/N
350×10^{-12}	235×10^{-12}		C/N
-14.0×10^{-3}	-11.2×10^{-3}		Vm/N
		24.0×10^{-3}	Vm/N
44.2×10^{-3}	44.0×10^{-3}		Vm/N
80	270	80	
2250	3600	2000	Hz.m
1640	2650	1390	Hz.m
		1400	Hz.m
970	1500		Hz.m

Key to subscripts

For polarised ceramic materials the direction of positive polarisation is usually taken to be that of the *Z*-axis of a right-hand orthogonal crystallographic axial set *X*, *Y*, *Z*. Since these materials have polar symmetry the senses of *X* and *Y* chosen in an element are unimportant and planes parallel to the Z-axis are reflection planes.

If the directions of *X*, *Y* and *Z* are represented as 1, 2 and 3 respectively, and the shear directions to these axes as 4, 5 and 6 respectively then the various related parameters may be written with subscripts referred to these.



4 = shear in 23-plane
5 = shear in 31-plane
6 = shear in 12-plane

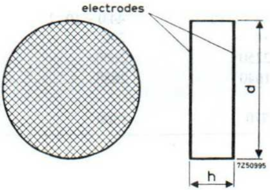
Axial notation

Piezoelectric constants	The first subscript refers to the direction of the electric field, the second subscript refers to the direction of the strain. (k_p is the planar coupling coefficient.)
Elasticity constants	The first subscript refers to the direction of the strain, the second subscript refers to the direction of the stress.
Dielectric constants	The first subscript refers to the direction of the dielectric displacement, the second subscript refers to the direction of the electric field.
Frequency constants	The subscript refers to the direction of resonance vibration.

Types of PXE elements

Discs and cylinders

Direction of polarisation : axial
Standard tolerance on the diameter (*d*): ±2.5 %
Standard tolerance on the height (*h*)
for $h \geqslant 0.5$ mm: ±0.1 mm
for $h < 0.5$ mm: ±0.05 mm



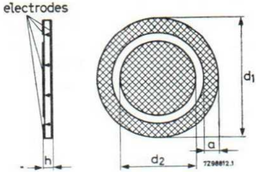
dimensions (mm) $d \times h$	*catalog number*		
	*PXE*4	*PXE*5	*PXE*21
3×0.5		8222 293 01100	
3×8		4322 020 05120	
5×0.2		8222 293 01130	
5×0.3		8222 293 01140	
5×0.5	8222 293 10330	8222 293 06060	
5×1	8222 293 08580	8222 293 06070	
5×2	8222 293 08590	8222 293 08650	
5×8			4322 020 05090
6.35×16	4322 020 05060		4322 020 05070
10×0.2		8222 293 01270	
10×0.3		8222 293 01280	
10×0.5		8222 293 07670	
10×1	8222 293 06050	4322 020 02330	
10×2	8222 293 08600	8222 293 07680	
10×3		8222 293 07740	
10×5	8222 293 00890	8222 293 07750	
10×10	8222 293 08610	8222 293 07690	
10×20	8222 293 06030	8222 293 08660	
16×0.2		8222 293 01300	
16×0.3		8222 293 01310	
16×0.5		8222 293 04300	
16×1.1	8222 293 04110	4322 020 02250	
16×2		8222 293 06010	
16×3	8222 293 08630	4322 020 02300	
25.4×0.5		8222 293 01410	
25.4×1	8222 293 08640	8222 293 08680	
25.4×2	8222 293 07710	8222 293 06020	
25.4×6.35	4322 020 02440		
38.1×6.35	4322 020 05000		

PIEZOXIDE

Three-electrode disc

Direction of polarisation: indicated by arrows, see figure (side of full electrode negative)

Material : PXE 5

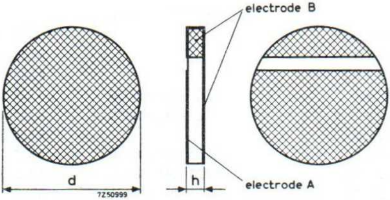


dimensions (mm) $d1 \times d2 \times a \times h$	*catalog number*
10 × 3 × 2.8 × 1	8222 293 09400
16 × 10 × 2 × 11	8222 293 07780

Feedback plates

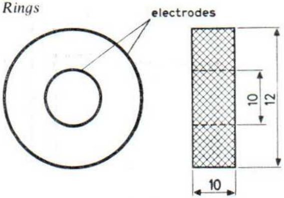
Direction of polarisation: axial

Material : PXE 5

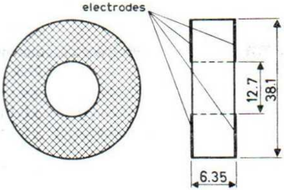


dimensions (mm) $d \times h$	*polarity of electrode A*	*catalog number*
16 × 1.1	−	4322 020 02260
16 × 1.1	+	4322 020 02270

Rings



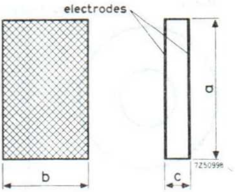
Direction of polarisation: radial
(outer electrode negative)
Material : PXE5
Catalog number : 8222 293 01870



Direction of polarisation: axial
Material : PXE4
Catalog number : 4322 020 06000

Standard tolerance on the outer diameter: ±2.5%
on the inner diameter: ±2.5%
on the concentricity : 0.1 mm
on the height : ±0.1 mm

Rectangular plates



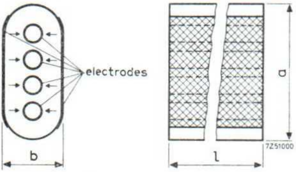
Direction of polarisation : parallel to dimension c

Material : PXE 5

Standard tolerance on the length (*a*) : ±0.1 mm
on the width (*b*) : ±0.1 mm
on the thickness (*c*) ±0.1 mm

dimensions (*mm*) *a* × *b* × *c*	*catalog number*
12 × 6 × 0.5	8222 293 02760
12 × 6 × 1	8222 293 02770
16 × 12 × 1	4322 020 02310

Multimorph strips



Direction of polarisation : indicated by arrows, see figure (outer electrodes negative)

Material : PXE 5

dimensions (*mm*) *a* × *b* × *l*	*catalog number*
1.6 × 0.67 × 9.6	4322 020 04760
1.6 × 0.67 × 12.7	4322 020 02480
1.6 × 0.67 × 15.5	4322 020 02490
1.6 × 0.67 × 70	8222 293 02940

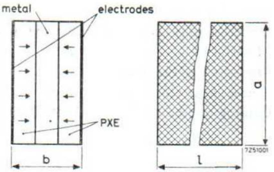
Direction of polarisation: opposite to direction given in the Fig. above (outer electrodes positive)

dimensions (*mm*) *a* × *b* × *l*	*catalog number*
1.6 × 0.67 × 9.6	4322 020 04750
1.6 × 0.67 × 12.7	4322 020 02460
1.6 × 0.67 × 15.5	4322 020 02470

Bimorph strips

Direction of
polarisation : indicated by arrows, see figure (outer electrodes negative)
Material : PXE 5

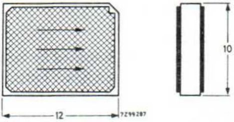
dimensions (*mm*) $a \times b \times l$	*catalog number*
$1.27 \times 0.50 \times 8.9$	4322 020 04250
$1.6 \times 0.60 \times 12.7$	8222 293 03020
$1.6 \times 0.67 \times 15.5$	4322 020 04290
$6.35 \times 0.50 \times 11.6$	8222 293 08010
$8.0 \times 0.60 \times 8.0$	8222 293 10980



PIEZOXIDE

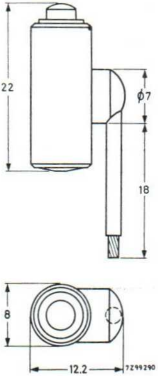
Delay-line transducer

Direction of polarisation : indicated by arrows, see figure
Material : PXE 7
Frequency of the thickness shear vibration : approx. 4.2 MHz
Catalog number : 4322 040 00640



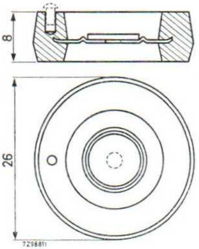
Ignition unit

Material : PXE 21
Catalog number : 4322 020 08010



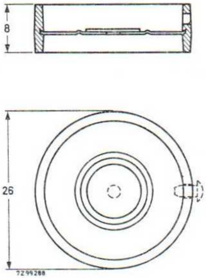
Flexure elements

Detector
Material : PXE 5
Resonance frequency : 6 ± 0.4 kHz
Capacitance at 100 Hz : ⩾4300 pF
Catalog number : 4322 020 08750



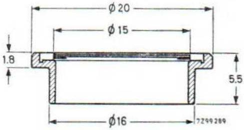
Detector

Material : PXE5
Resonance frequency : 2.85 ± 0.35 kHz
Capacitance at 100 Hz : ⩾4300 pF
Catalog number : 8222 293 07950



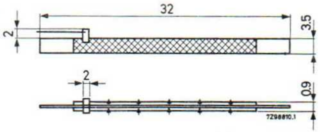
Mounted flexure disc for microphones

To be used with integrated circuit amplifier TAA970
Sensitivity : 100 μV/μbar
Catalog number : 8222 410 30070



Drive element for low-power synchronous motors

Direction of polarisation : indicated by arrows, see figure
Material : PXE 4
Catalog number : 8222 410 30060



PERMANENT MAGNET MATERIALS

Introduction

Permanent magnets – either isotropic* or anisotropic* – can be classified as being basically either
metallic alloy
ceramic material or
plastic bonded ceramic material
The table shows the class to which each of our materials belongs.

	metallic alloy	*ceramic material*	*plastic bonded ceramic material*
isotropic*	reco	ferroxdure	ferroxdure
anisotropic*	"Ticonal"**	ferroxdure	ferroxdure

The most obvious differences between the groups are that the ferroxdure magnets are characterised by high values of coercivity and resistivity while "Ticonal" magnets possess higher values of remanent magnetism and energy product.

Ferroxdure is therefore most suitable for applications in which demagnetising influences (either from external sources or resulting from the use of short magnets) are large and also in high frequency applications.

"Ticonal" is particularly suitable for applications in which high values of magnetic energy are required from small volumes of magnetic material.

The isotropic materials in general are inferior in magnetic properties to the anisotropic ones but are particularly suitable for applications in which multipolar magnets are to be used or where less expensive magnets are necessary giving a reasonable performance.

The plastic bonded ferroxdure magnets combine the characteristic magnetic properties of isotropic ferroxdure (however on a lower level) with the mechanical properties of the plastic material used. These magnets open a new field of applications, especially where the price is of prime importance.

Each of the permanent magnet materials is manufactured in a variety of grades possessing different properties that result from differences in composition and treatment.

The grades are distinguished by the addition of letters and numbers to the name of the material. The numbers are approximately relative to the nominal energy product of the grade.

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* Isotropic materials can be magnetised equally well in any direction. Anisotropic materials have optimal magnetic properties in one direction only.

** "Ticonal" is a registered trade name.

permanent magnet material typical chemical composition	*$(BH)_{max.}$ $(MGs.Oe)$*		*occurs at* *Bd (Gs)*	*Hd (Oe)*	*B_r (Gs)*		*H_{cb} (Oe)*		*H_{ci} (Oe)*	
	min.	*typ.*	*typ.*	*typ.*	*min.*	*typ.*	*min.*	*typ.*	*min.*	*typ.*
ISOTROPIC PLASTIC-BONDED FERROXDURE Ferroxdure P30, P40 and SP50 magnets are extruded, injection moulded and punched, D55 magnets are pressed and cured.										
Ferroxdure P30 KPN-K-992 85% ferroxdure powder $(M)Fe_{12}O_{19}$ 15% thermoplastic material	0.3	0.35	700	500	1150	1250	1050	1100	2500	2700
Ferroxdure P40 KPN-K-989 90% ferroxdure powder $(M)Fe_{12}O_{19}$ 10% thermoplastic material	0.4	0.45	800	550	1350	1450	1150	1200	2300	2500
Ferroxdure SP50 KPN-K-7028 93% ferroxdure powder $(M)Fe_{12}O_{19}$ 7% thermoplastic material	0.5	0.55	800	690	1550	1600	1225	1275	2300	2400
Ferroxdure D55 KPN-V-815 95% ferroxdure powder $(M)Fe_{12}O_{19}$ 5% thermosetting material	0.55	0.60	850	700	1650	1700	1300	1400	2500	2750
ISOTROPIC FERROXDURE All magnets are pressed, sintered and can be ground.										
Ferroxdure 100 KPN-K-359 100% ferroxdure powder $(M)Fe_{12}O_{19}$	0.9	0.95	1200	800	2100	2200	1600	1650	2600	2700

PERMANENT MAGNET MATERIALS

permanent magnet material typical chemical composition	*(BH)*$_{max.}$ *(MGs.Oe)*		*occurs at* *Bd (Gs)*	*Hd (Oe)*	B_r *(Gs)*		H_{cb} *(Oe)*		H_{ci} *(Oe)*	
	min.	*typ.*	*typ.*	*typ.*	*min.*	*typ.*	*min.*	*typ.*	*min.*	*typ.*
ISOTROPIC ALLOYS-RECO All magnets are cast and can only be ground.										
Reco 100 24% Ni, 14% Al, bal. Fe	1.00	1.20	4000	300	5800	6200	460	480	480	530
Reco 120 1% Ti, 4% Co, 26% Ni, 13% Al, 3% Cu, bal. Fe	1.10	1.30	3100	400	5300	5900	500	600	550	650
Reco 140 0.8% Ti, 5% Co, 25% Ni, 10% Al, 7% Cu, bal. Fe	1.30	1.40	3500	400	6200	6500	530	565	550	600
Reco 160 1.9% Ti, 13% Co, 18.5% Ni, 10% Al, 7.5% Cu, bal. Fe	1.50	1.65	4150	400	6000	6600	600	680	650	750
Reco 170 5% Ti, 10% Co, 24% Ni, 9.5% Al, 6% Cu, bal. Fe	1.50	1.65	3300	500	5200	5600	830	890	900	1000
Reco 220 7% Ti, 26% Co, 15% Ni, 7% Al, 5% Cu, bal. Fe	2.00	2.30	3750	600	5600	6300	1100	1200	1200	1300
ANISOTROPIC PLASTIC-BONDED FERROXDURE All magnets are injection moulded.										
Ferroxdure SP130 KPN-K·7049 89% ferroxdure powder (M)$Fe_{12}O_{19}$ 11% thermoplastic material	1.3	1.4	1250	1100	2300	2400	2100	2200	2800	3000

permanent magnet material typical chemical composition	*$(BH)_{max.}$ $(MGs.Oe)$*		*occurs at Bd (Gs)*	*Hd (Oe)*	*B_r (Gs)*		*H_{cb} (Oe)*		*H_{ci} (Oe)*	
	min.	*typ.*	*typ.*	*typ.*	*min.*	*typ.*	*min.*	*typ.*	*min.*	*typ.*
ANISOTROPIC FERROXDURE										
All magnets are pressed, sintered and can only be ground.										
Ferroxdure 260 1) KBN 100 % ferroxdure powder $(M)Fe_{12}O_{19}$	2.4	2.6	1650	1600	3250	3350	2800	2900	3600	3800
Ferroxdure 280 1) KBN-K-1152 100 % ferroxdure powder $(M)Fe_{12}O_{19}$	2.6	2.8	1750	1600	3400	3500	2800	3000	3000	3200
Ferroxdure 330 KBN-V-252 100 % ferroxdure powder $(M)Fe_{12}O_{19}$	3.0	3.2	1900	1700	3600	3700	2800	3000	2900	3100
Ferroxdure 300 KBN-K-434 100 % ferroxdure powder $(M)F_{12}O_{19}$	3.2	3.4	2200	1550	3800	3900	1600	1800	1700	1900
Ferroxdure 360 2) KBN-V-254 100 % ferroxdure powder $(M)Fe_{12}O_{19}$	3.4	3.5	1950	1800	3800	3900	2000	2200	2100	2300

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1) Ferroxdure 260 and 280 are especially suitable for radially orientated segments.

2) Ferroxdure 360 is only small quantity production

PERMANENT MAGNET MATERIALS

permanent magnet material typical chemical composition	*$(BH)_{max.}$ (MGs.Oe)*		*occurs at Bd (Gs)*	*Hd (Oe)*	*B_r (Gs)*		*H_{cb} (Oe)*		*H_{ci} (Oe)*	
	min.	*typ.*	*typ.*	*typ.*	*min.*	*typ.*	*min.*	*typ.*	*min.*	*typ.*
ANISOTROPIC ALLOYS-TICONAL All magnets are cast and can only be ground.										
Ticonal 190 14% Co. 21% Ni. 12% Al. 3% Cu, balance Fe	1.80	2.10	5000	400	7400	8000	650	730	670	800
Ticonal 360 1.5% Ti, 24% Co, 15% Ni, 8.5% Al, 3% Cu, bal. Fe	3.20	3.60	7200	500	10500	10700	680	710	700	760
Ticonal 400 0.8% Ti, 24% Co, 14% Ni, 8.5% Al, 3% Cu, bal. Fe	3.80	4.00	8000	500	11200	11600	610	640	620	680
Ticonal 450 5% Ti, 34% Co, 14.5% Ni, 7.5% Al, 4.5% Cu, bal. Fe	4.00	4.25	5300	800	8000	8500	1200	1335	1300	1500
Ticonal 500 24% Co, 14% Ni, 8.5% Al, 3% Cu, balance Fe	4.50	4.80	9600	500	12300	12800	600	630	610	650
Ticonal 600 24% Co, 14% Ni, 8.5% Al, 3% Cu, balance Fe	5.50	5.77	10500	550	13000	13100	630	645	640	680
Ticonal 650 24% Co, 14% Ni, 8.5% Al, 3% Cu, balance Fe	6.20	6.50	11000	565	12800	13000	640	700	650	780
Ticonal 750[1] 24% Co, 14% Ni, 8.5% Al, 3% Cu, balance Fe	7.00	7.50	11500	650	13200	13400	720	760	730	780
Ticonal 900[2] 5% Ti, 34% Co, 14.5% Ni, 7.5% Al, 4.5% Cu, bal. Fe	7.50	9.00	8000	1100	10000	10600	1300	1400	1350	1500

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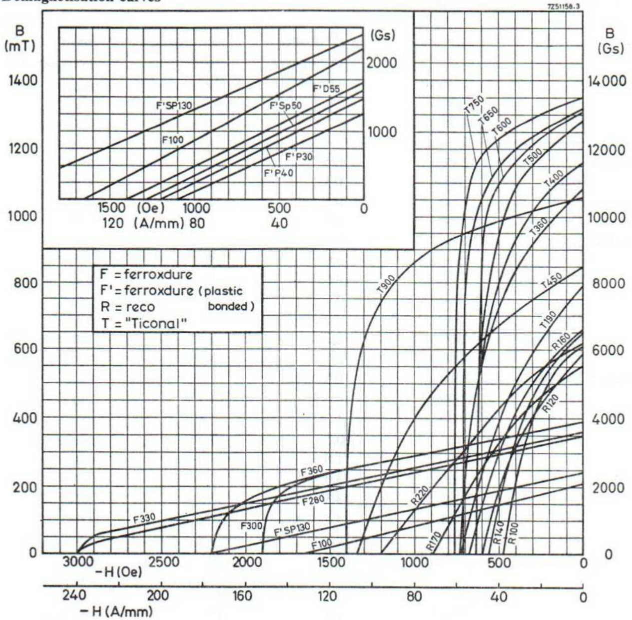
[1]) Cross section circular ⩾10 and ⩽25 mm dia.; rectangular sides ⩾10 and ⩽20 mm.

[2]) Only for very small rectangular magnets.

Demagnetisation curves



Conversion table for S.I. units (Giorgi units)

1000 Gs $= 100$ mT $(= 0.1\ \mathrm{Wb/m^2})$

1 Oe $= \dfrac{10^3}{4\pi}\ \mathrm{A/m} \approx 0.08\ \mathrm{A/mm}$

1 MGs · Oe $= 8\ \mathrm{kJ/m^3}$

1 Mx $= 0.01\ \mu\mathrm{Wb}$

$\mu_0 = 4\pi \cdot 10^{-7}\ \mathrm{H/m} = 1\ \mathrm{Gs/Oe}$

Other magnetic and physical properties

Grade		*saturation field strength* H_{sat} (Oe)	*L/D ratio for open circuits*	*permeance coefficient* ¹)	*recoil permeability* μ_{rec}
Ferroxdure	P30	12000	0.5	1.4	1.10
	P40	12000	0.5	1.5	1.15
	SP50	12000	0.5	1.2	1.19
	D55	12000	0.5	1.2	1.15
Ferroxdure	100	12000	0.5	1.5	1.112–1.118
Reco	100	2500	3.0	13	4.0–6.5
	120	2500	3.0	8	4.4–5.0
	140	2500	3.0	9	5.0–6.0
	160	2500	3.0	11	4.0–5.0
	170	3000	2.2	7	3.4–4.0
	220	5000	2.2	6	3.2–3.8
Ferroxdure	SP130	12000	0.5	1.14	1.10
	280	10000	0.5	1.1	1.01–1.05
	300	8000	1.0	1.4	1.01–1.05
	330	10000	0.5	1.1	1.01–1.05
	360	8000	1.0	1.1	1.01–1.05
Ticonal	190	2500	3.0	13	3.8–5.0
	360	2500	3.5	15	4.0–5.0
	400	2500	4.5	16	4.0–5.0
	450	5000	2.2	7	2.5–3.0
	500	2500	4.5	20	4.0–5.0
	600	2500	5.0	19	3.0–4.0
	650	2500	4.5	20	3.0–4.0
	750	2500	4.3	17	3.0–4.0
	900	5000	2.2	7	1.7–2.5

Conversion of electrical resistivity: $1\ \Omega\ \mathrm{mm}^2/\mathrm{m} = 10^{-4}\ \Omega\mathrm{cm} = 10^{-6}\ \Omega\mathrm{m}$.

¹) Permeance coefficient $= -B/\mu_0 H$ at $(BH)_{max}$.

density (g/cm^3)	*specific electrical resistivity* $(\Omega\ mm^2/m)$	*temperature coefficient of remanence* (%/*deg C*)	*Curie temperature* (°*C*)	*coefficient of thermal expansion* $(10^{-6}/deg\ C)$
3.2	10^{13}	−0.2	—	—
3.6	10^{11}	−0.2	—	—
4.05	10^{10}	−0.2	—	—
4.10	10^{10}	−0.2	—	—
4.9	10^{10}	−0.2	450	8.5
6.9	0.7	−0.015	730	12.5
6.9	—	−0.015	700	12.5
7.0	0.75	−0.015	770	11.5
7.0	0.65	−0.015	810	11.5
7.0	0.60	−0.015	790	11.5
7.2	—	−0.015	750	11.5
3.4	10^{11}	−0.2	—	—
4.6	10^{12}	−0.2	450	—
5.0	10^{12}	−0.2	450	—
4.8	10^{14}	−0.2	450	—
4.9	10^{12}	−0.2	450	—
7.0	—	−0.015	750	11.5
7.3	0.50	−0.015	860	10.8
7.3	0.50	−0.015	800	10.8
7.3	0.50	−0.015	850	10.8
7.3	0.45	−0.015	850	10.8
7.3	0.45	−0.015	850	10.8
7.3	0.45	−0.015	850	10.8
7.3	0.45	−0.015	850	10.8
7.3	0.50	−0.015	850	10.8

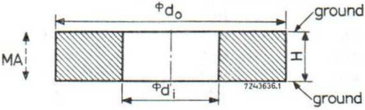
PREFERRED TYPES

A "selection" of our preferred types is given below. A complete list of preferred types, comprising the shapes and sizes of permanent magnets from existing moulds and dies, is available on request. We offer every assistance in the primary and secondary aspects of permanent magnets and their systems.

Anisotropic ferroxdure

Ring magnets for loudspeakers etc.

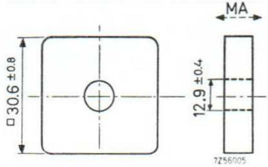
Material: Fxd 300R
Magnetic axis: axial
Supplied unmagnetised



dimensions						*catalog number*
outer diam.		*inner diam.*		*H*		
mm	*tolerance*	*mm*	*tolerance*	*mm*	*tolerance*	
36	±0.8	18	±0.5	8	±0.1	4322 020 60070
45	±1	22	±0.6	9	±0.1	60110
51	±1.2	24	±0.6	9	±0.1	60150
53	±1.2	24	±0.5	11	±0.1	4304 071 80620
55	±1.2	24	±0.6	12	±0.1	4322 020 60170
60	±1.5	24	±0.6	13	±0.1	60200
72	±1.5	32	±0.7	15	±0.1	60240
90	±1.8	36	±0.9	17	±0.15	60280
102	±3	51	±1.5	10	±0.15	60300
121	±3.6	57	±1.7	12	±0.2	60320
134	±4	57	±1.7	14	±0.2	60330
184	±5.5	73	±2.2	18.5	±0.2	60350

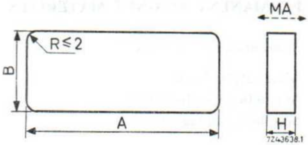
Square magnet for loudspeakers

Material: Fxd 300R
Magnetic axis: axial
Supplied: unmagnetised
Catalog number: 4322 020 63010



Blocks

Material: see below
Magnetic axis: ⊥ A × B
Supplied: magnetised

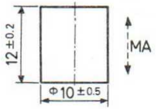


dimensions						*material*	*catalog number*
A		*B*		*H*			
mm	*tolerance*	*mm*	*tolerance*	*mm*	*tolerance*		
15	±0.3	9	±0.5	5	±0.25	280K	3122 104 92700
50	±1.3	19	±0.5	4.9	−0.25	280K	62100[1]
50	±1.3	19	±0.5	6.1	±0.1	280K	62120[1]
131	±3	51	±1.5	17.5	±0.2	330K	62140[1]

[1] Supplied unmagnetised.

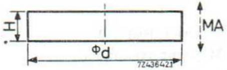
Solid cylinders

Material: Fxd 280
Magnetic axis: axial
Supplied: magnetised
Catalog number: 4322 020 61010



Discs

Material: see below
Magnetic axis: axial
Supplied: unmagnetised



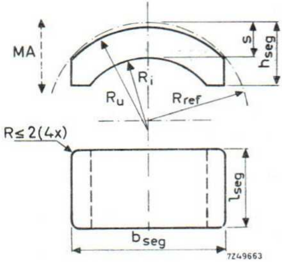
dimensions				*material*	*catalog number*
d		*H*			
mm	*tolerance*	*mm*	*tolerance*		
5.5	±0.05	1.8	±0.03	330K	4322 020 62590
12	±0.3	6	±0.25	300R	62540[1]
40.6	±1	9	±0.1	280K	62550

[1] Supplied magnetised.

PERMANENT MAGNET MATERIALS

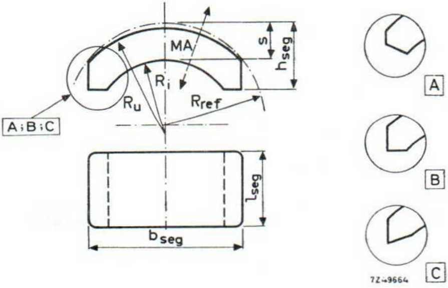
Segments for d.c. motors

Material: Fxd 330
Magnetic axis: diametrical
Supplied: unmagnetised



R_i	R_u	s	h_{seg}		b_{seg}		l_{seg}		catalog number
mm	*tol.*	*mm*	*mm*	*tol.*	*mm*	*tol.*	*mm*	*tol.*	
≥ 8.315	≥ 12.025	≤ 3.66	8	±0.6	18	±0.5	15	±1	4322 020 61850
≥ 20.3	≥ 29	≤ 8.8	16	±0.3	42	±1	41	±1	4311 021 30660

Material: Fxd 280
Magnetic axis: radial
Supplied: unmagnetised



R_i	R_u	s	h_{seg}		b_{seg}		l_{seg}		*catalog number*	*Fig.*
mm	*mm*	*mm*	*mm*	*tol.*	*mm*	*tol.*	*mm*	*tol.*		
⩾28.58	⩾35.13	⩽6.55	25.5	±0.6	62.4	+0.4	26.7	±0.75	4322 020 61510	A
⩾28.50	⩾35.55	⩽7.35	21.4	−1.2	60.3	+3.0	49.4	±1	61820	C
⩾29.03	⩾36.02	⩽7.49	21.79	±0.38	62.7	+3.0	27.88	±1.25	61590	B

Isotropic ferroxdure

Discs and bars

Material: Fxd 100
a) axially magnetised

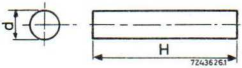


Fig. 1

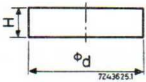
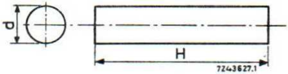


Fig. 2

dimensions				*catalog number*	*Fig.*
diam. d		*H*			
mm	*tolerance*	*mm*	*tolerance*		
3	±0.2	7.5	±0.25	4312 020 60130	1
6	±0.3	40	±0.6	60170	1
4	±0.2	3.5	±0.2	65950	2
25	±0.5	5	±0.4	65870	2

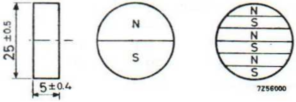
b) diametrically magnetised rods



dimensions				*catalog number*
diam. d		*H*		
mm	*tolerance*	*mm*	*tolerance*	
4	±0.1	10	±0.2	4312 020 60040
6	−0.05	12	±0.2	3122 104 94330

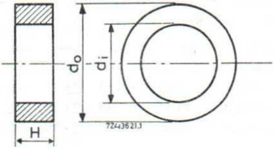
c) laterally magnetised disc

6 poles on 1 face
Catalog number 4312 020 65780



Rings

Material: Fxd 100



a) diametrically magnetised

dimensions						*catalog number*
outer diam.		*square hole*		*H*		
mm	*tolerance*	*mm*	*tolerance*	*mm*	*tolerance*	
12.25	±0.25	3.2	±0.5	10	±0.5	4312 020 62110
12	+0.5	3.2	±0.5	12	±0.5	62120

b) axially magnetised

dimensions						*catalog number*
outer diam.		*inner diam.*		*H*		
mm	*tolerance*	*mm*	*tolerance*	*mm*	*tolerance*	
14	±0.5	1.5	±0.5	5	±0.5	4312 020 62180
29.9	−0.05	10	±0.3	5	−0.1	62270[1])

[1]) 4p axially magnetised.

c) radially magnetised

dimensions						*magnetisation*	*catalog number*
outer diam.		*inner diam.*		*H*			
mm	*tolerance*	*mm*	*tolerance*	*mm*	*tolerance*		
12	±0.5	4.05	±0.3	7	±0.5	S pole on circ.	4312 020 63150
27	±0.7	20	±0.6	3.5	±0.5	N pole on circ.	62340

d) laterally magnetised

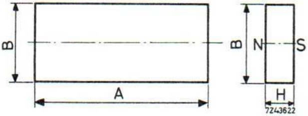
dimensions						*magnetisation*	*catalog number*
outer diam.		*inner diam.*		*H*			
mm	*tol.*	*mm*	*tol.*	*mm*	*tol.*		
21	±0.3	10	±0.5	24	+0.7	8 poles on outer diam.	4312 020 63160
37	±0.8	25	±0.5	3.5	−0.5	4 poles on one surface	62400

e) rings for couplings (laterally magnetised)

dimensions						*magnetisation*	*catalog number*
outer diam.		*inner diam.*		*H*			
mm	*tol.*	*mm*	*tol.*	*mm*	*tol.*		
55	±0.05	15	±0.5	13	±0.1	12 poles on outer ∅	4312 020 62430
78	±1.5	58	±0.05	13	±0.1	12 poles on inner ∅	62420

Blocks

Material: Fxd 100
magnetised ⊥ A × B

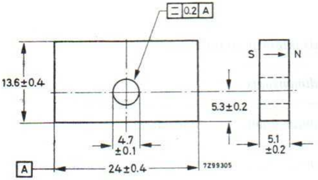


dimensions						*catalog number*
A		*B*		*H*		
mm	*tolerance*	*mm*	*tolerance*	*mm*	*tolerance*	
50	±1.25	43	±1.1	11	±0.28	4312 020 66960
10	±0.5	5	±0.5	3	±0.5	66760

PERMANENT MAGNET MATERIALS

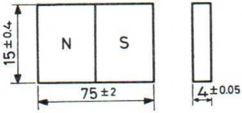
Block with holes

Material: Fxd 100
magnetised ⊥ A × B
Catalog number 4312 020 66710



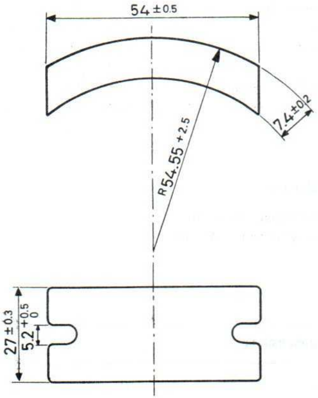
Block

Material: Fxd 100
laterally magnetised
8 poles on 75 × 15
Catalog number 4312 020 66860



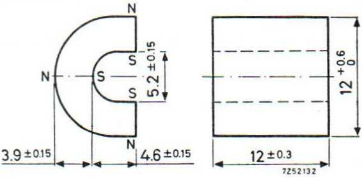
Segment

Material: Fxd 100
not magnetised
Catalog number 4312 020 61500



Special parts for colour TV sets

Material: see below
Supplied: magnetised



article	*dimensions in mm*		*material*	*magnetic axis*	*catalog number*
	diameter d	*H*			
Disc	20 ± 0.35	5 ± 0.3	Fxd100	diametric	3122 104 90620
Bar	5–0.2	10 ± 0.2	Fxd100	diametric	92850
Segment	see drawing		P40	radial	93770

Isotropic plastic-bonded ferroxdure

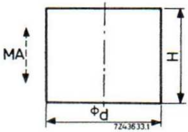
Material: see below
Supplied: magnetised

article	*dimensions*	*material*	*magnetic axis*	*catalog number*
Strip	$(9 \pm 0.3) \times (3 \pm 0.1)$	P40	2 poles lateral	4312 020 70020
Ring	$\varnothing(28 \pm 0.1) \times (20.5 \pm 0.1) \times (16.5 \pm 0.25)$	D55	2 poles on int. circ.	4312 020 72040
Block	$(10.6 - 0.6) \times (10.6 - 0.6) \times (3 \pm 0.15)$	P30	diametrical	3122 104 93540
Bar	$\varnothing(5 \pm 0.2) \times (40 - 1)$	P40	axial	3122 104 90360
Rings with 1 to 3 lobes for T.V. deflection units		SP10 or P40	2 poles on int. circ.	

Anisotropic "Ticonal"

Solid cylinders

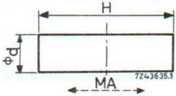
Material: see below
Direction of magnetisation: axial
Supplied: unmagnetised



dimensions				*material*	*catalog number*
d		*H*			
mm	*tolerance*	*mm*	*tolerance*		
12.9	−0.3	10	−0.05	'Ticonal' 750	4322 059 75060
15.8	−0.1	13	±0.1	'Ticonal' 750	75030
18	−0.4	12	−0.1	'Ticonal' 600	60000
19.4	±0.3	9.4	±0.1	'Ticonal' 750	75080
21	±0.5	16	±0.05	'Ticonal' 600	60010
28.3	±0.4	19.45	±0.05	'Ticonal' 600	61060
34.7	±0.4	19	±0.05	'Ticonal' 600	61080

Cylindrical slugs in "Ticonal" 750 can be supplied in any length. Standard diameters are between 12 and 22 mm; others available if required

Rods



Material: 'Ticonal' 500
Direction of magnetisation: axial

dimensions				*condition*	*catalog number*
d		*H*			
mm	*tolerance*	*mm*	*tolerance*		
4	±0.2	6	±0.2	unmagnetised	4322 059 50070[1])
5.5	−1	25	±0.5	magnetised	50100[1])
8.1	−1	65	±0.5	magnetised	50110[1])

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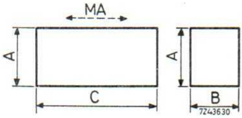
[1]) Rods in these and other small diameters can be supplied in any length between 6 and 100 mm.

Blocks



Material: see below
Direction of magnetization: ⊥ face A × B
Version: see below

dimensions						*material*	*version*	*catalog number*
A		*B*		*C*				
mm	*tol.*	*mm*	*tol.*	*mm*	*tol.*			
2	±0.05	2.6	±0.05	2.25	−0.03	'Ticonal' 900	unmagnetised	4322 059 90000
4	±0.05	4	±0.05	5	±0.02	'Ticonal' 900	unmagnetised	90010
27	−1	20	±0.5	17	±0.05	'Ticonal' 450	unmagnetised	45130
100	±1	12	±0.05	29.1	±0.05	'Ticonal' 500	unmagnetised	50130[1]
10.5	±0.2	17	±0.3	40	±0.05	'Ticonal' 500	unmagnetised	50170

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[1] with two mounting holes.

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series 800–899: digital techniques and data processing.

Product Information bulletins on practical aspects and properties of products are consecutively numbered.

Application Books compile a wide range of information on specific groups of products. They deal with circuit information and applications of the products and very often also give a treatment of theoretical and practical aspects.

Another group of publications is **Product Surveys** and **Product News,** which may be regarded as specialized catalogues on various products or groups of products.

Requests for any of these publications should be addressed to the organisation concerned. A list of addresses is given in the next pages.

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