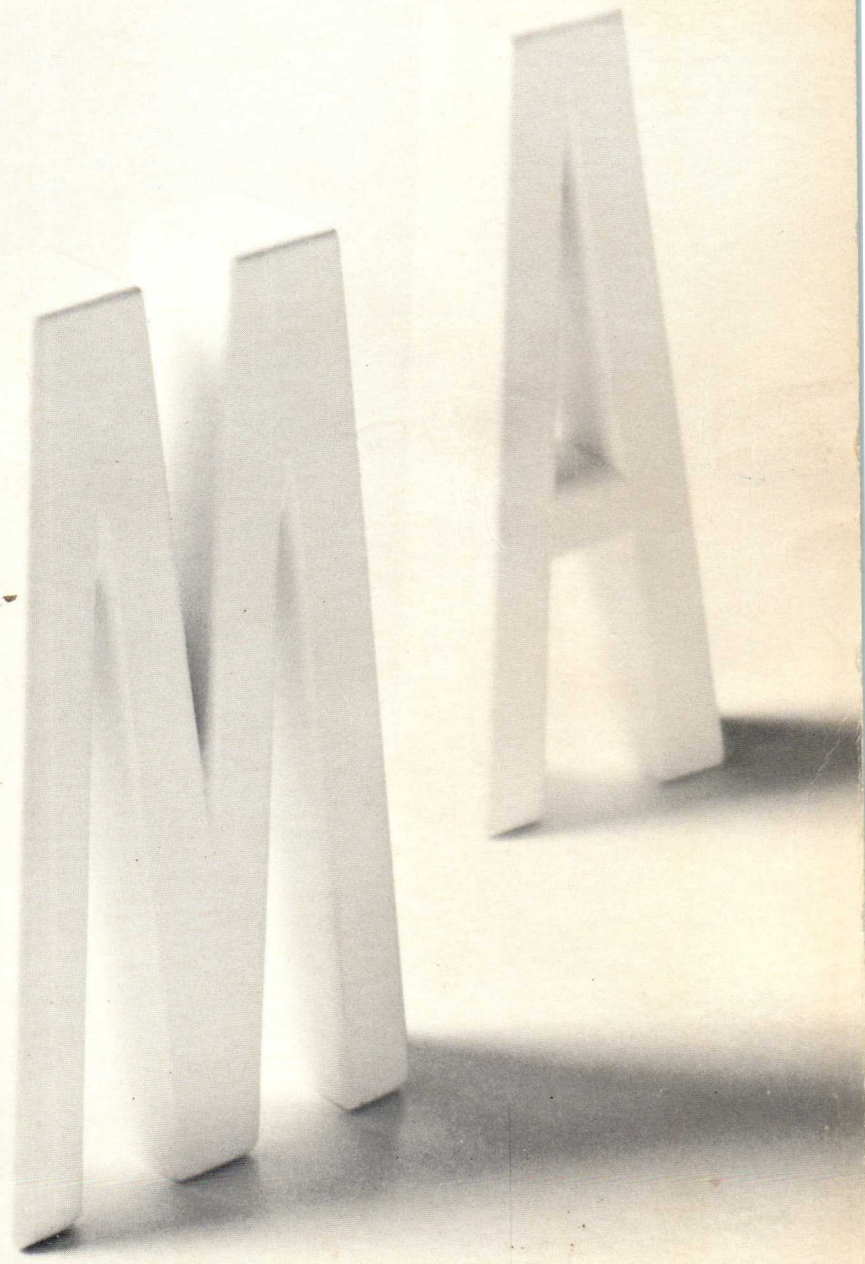
MASTER CATALOG

SEMICONDUCTORS
TUBES
SOLID-STATE CIRCUITS
TRANSMISSION LINE DEVICES
SUBASSEMBLIES



MICROWAVE ASSOCIATES® CATALOG C-15

MASTER CATALOG
OF COMPONENTS AND SUBASSEMBLIES

MICROWAVE ASSOCIATES, INC. BURLINGTON, MASSACHUSETTS 01803

CONTENTS

FOREWORD

Fifteen years ago Microwave Associates was founded by three young engineers of varying backgrounds with the aim of supplying high quality microwave components to the radar and communications industry. Although our path since has led us through many widely separated areas of physics and technology, our present aims are substantially the same. The year 1966 finds Microwave among the leaders in the microwave component market and, as this catalog indicates, the proud producers of a very wide line of products still largely devoted to our original markets. Our annual sales, currently at $15,000,000, have grown at an average rate of just under $1,000,000 per year and for the past thirteen years have been profitable.

Most of our products are concerned with the generation, switching, amplification, detection, and transmission of microwave energy. During the course of our career the methods for accomplishing these important functions have undergone many radical changes. However, we consider no single technology sacred and pride ourselves in our multi-disciplined approach. Our approximately 1,000 employees are relatively evenly divided between our tube, semiconductor and circuits activities emphasizing the common denominator of microwave technology.

Our aim has always been to produce no product unless it represents a true contribution to the marketplace. Such an aim has, for the most part, caused an emphasis on state-of-the-art, hard-to-make products employing a high degree of scientific skills per sales dollar. Thus, although we are one of the largest suppliers of microwave components, perusal of our catalog will occasionally indicate obvious product gaps in areas where we consider the market need more than adequately filled by other companies. We also tend, in our search for profitable products, to avoid the obsolescent.

Our multifaceted talents, ranging from such widely dispersed technologies as YIG filters, PIN switches, Ferri-gas duplexers to high power TWT's, have allowed us gradually to assemble a group of compatible complementary products. Thus from us you can usually purchase all the mating parts for a receiver, an all-solid-state transmitter, etc. In doing so, we can provide more than the usual attention to interface problems often not foreseen in a "bare bones" individual product specification. A more obvious advantage to you, our customer, is that often in such cases, due to the "trade-offs", we can give you true cost savings in package purchases. You will always find our sales engineers keen to assist you in those portions of your systems problems involving microwave components.

We have endeavored, through our history, to upgrade our personnel and facilities in a consistent and effective manner. Naturally our greatest attention has been to attract truly creative talent to our Company. On the other hand such personnel are not effective unless they are provided with matching talents in sales, production, finance and supporting technical staff. We believe that we have the highest assets/employee ratio in the microwave industry. Although the technical flavor of our Company pervades, we have a demonstrated production capability and are producing many items in large quantities at very competitive prices.

Not obvious by reading this catalog is the large research effort underway at Microwave. For the past four years we have devoted well over $1,000,000 per year to corporate sponsored research. This has been more than matched by customer support. Not all of this effort results in viable products, but the yield is sufficiently great to have provided growth in the face of the rapid obsolescence of products typical in our field. Since most of our research effort is customer inspired, if not endowed, please let us know the nature of your future needs. Perhaps our scientific team can be of some help.

Although at present not of sufficient complexity to rate the "systems" title, approximately 20% of our sales can be classified as subassemblies. These subassemblies range from complete RF front ends, including solid-state local oscillators, to high power phase shifter-driver combinations. We have listed in this catalog only subassemblies of potential interest to the OEM marketplace. We have found in the past that among the better ways to prove-in and stimulate the sales of a state-of-the-art component is to use the component in one of our practical circuits. Further, we hope that we have anticipated a trend already now prevalent at the lower frequencies to integrated circuits wherein the pure component must give way to an integrated assembly for optimum performance.

Lastly, it should be pointed out that we wish to spread our products over the widest market base possible; hence, in recent years we have increased our effort to sell, and in the case of England, to produce abroad with the result that in 1965, 12% of our sales were abroad. As respectful as we are of the U. S. defense market, we realize that the long range future of Microwave lies in the growth of the telecommunications market. This present catalog reflects this interest; future catalogs will do so even more.

We thank you, our customer, for your past interest in our products and hope our future and yours will prosper together.

Microwave Associates

INTRODUCTION

This catalog outlines the complete microwave component and custom-engineered subassembly capability of Microwave Associates. It specifically excludes our newer product line of television relay equipment which is described in detail in a separate publication available on request.

The major sections of this catalog are listed in the table of contents on pages 2 and 3. One index in the back of the catalog provides a product reference listed alphabetically; specific information on an individual Microwave Associates' product may be found through the use of the model number cross reference index.

If you do not find a device to fit your exact needs in this publication, please feel free to call on our nearest representative or contact the factory direct to get a custom-designed unit to meet your specific mechanical, electrical and environmental specifications.

Sales, Shipping and Service Information

HOW TO ORDER — UNITED STATES — MICROWAVE ASSOCIATES. Orders for Microwave Associates' products may be placed with either our sales representatives or directly with Microwave Associates' sales department:
Microwave Associates, Inc.
Northwest Industrial Park
Burlington, Massachusetts 01803
Telephone: (617) 272-3000
TWX: 617-272-1492
Western Union FAX
TELEX: 094-599

SEMICONDUCTOR DISTRIBUTORS. For the convenience of our many semiconductor customers, we have established a group of stocking franchised distributors for this product line only. Semiconductor products may be ordered either direct from these distributors or from the factory.

INTERNATIONAL MICROWAVE CORPORATION. Orders for International Microwave Corporation's products, identified by the symbol "IMC" in the catalog, may be placed with either our sales representative or directly with IMC's sales department:
International Microwave Corporation
Division of Microwave Assoc., Inc.
33 River Road
Cos Cob, Connecticut 06807
Telephone: (203) 661-6277
TELEX: 096-5938

HOW TO ORDER — INTERNATIONAL. Customers outside the United States are served by Microwave Associates' subsidiaries: Microwave Associates International, Inc., and Microwave Associates, Ltd., as well as by international sales representatives.

MICROWAVE ASSOCIATES INTERNATIONAL. All international orders (excluding the United Kingdom) may be placed with either our international sales representatives or directly with Microwave Associates International sales department:
Microwave Associates International, Inc.
Northwest Industrial Park
Burlington, Massachusetts 01803 (U.S.A.)
Telephone: (617) 272-3000
TWX: 617-272-1492
TELEX: 094-599
Cable: MICROWAVE BURLINGTON

UNITED KINGDOM. Orders in the United Kingdom may be placed directly with Microwave Associates, Ltd., sales department.
Microwave Associates, Ltd.
Cradock Road
Luton, Bedfordshire
England
Telephone: Luton 53363
TELEX: 82295

TECHNICAL ASSISTANCE. Microwave Associates maintains a large support staff of technical sales engineers, both domestically and internationally, who are expert in specific areas of microwave technology. Each has an engineering background that combines formal engineering education with training in microwave specialties — often with many years of product design experience. As further technical support, Microwave Associates makes available the services of its engineering and scientific staff who may be consulted on more advanced circuit designs or application problems. You may request technical assistance through any sales office or representative.

SHIPPING INSTRUCTIONS. Shipments will be made via parcel post or express, whichever is less expensive, unless other instructions are received. For rush service, we will ship by Air Freight, Air Express, or Air Parcel Post on request.

PRICES AND TERMS. The price and delivery of any item in this catalog is available from either our sales representatives or Microwave Associates sales department. Quotations are F.O.B. factory origin, and are subject to change without notice. Terms are net 30 days if credit has been extended.

QUANTITY DISCOUNTS. Discounts are allowed on large quantity orders. The amount of the discount is based upon our cost savings, which in turn is affected by the delivery schedule and other factors. Our sales department will supply firm quotations upon request.

INTRODUCTION

PACKAGING. There is no charge for standard commercial packaging, which is suitable for export products.

WARRANTY. We warrant to the original purchaser all products sold by us to be free of defects in material and workmanship. Our obligation under this warranty is limited to repair, exchange or credit. The warranty does not apply to any product which has been subject to accident, alteration or abuse. Detailed warranty provisions appear on each sales order.

SPECIFICATIONS. We reserve the right to discontinue items and change specifications without notice.

GOVERNMENT SOURCE INSPECTION. Government source inspection is available on any item upon receipt of the complete written confirmation of purchase order items, including the prime government contract number. Government source inspection with respect to some products increases unit price and extends delivery because of duplicate standard final inspection and testing. It is recommended wherever possible that a Certificate of Compliance be substituted for government source inspection to minimize price and delivery delay.

RETURNED MATERIAL. When returning material for repair or replacement, it is necessary first to contact the sales department. We require that complete information be included with the shipment giving a detailed description of the reason for its return, the date and purchase order on which it was obtained, the number of hours of operational use, and the exact address to which the material is to be re-shipped. Repairs are made at estimated cost, except when covered by the warranty. Estimates will be supplied on receipt of material when requested.

TECHNICAL PUBLICATIONS. A monthly technical publication, *Micronotes,* discusses new products and applications as well as general microwave subjects. Sent free upon request, this publication is distributed to over 40,000 readers throughout the world. To receive your copy, just ask your local sales representative to add your name to the *Micronotes* mailing list.

Other Microwave Associates publications include a wide selection of short form product catalogs and reprinted technical articles covering many different microwave subjects. If you are interested in these publications, simply contact the sales representative nearest you for a complete listing.

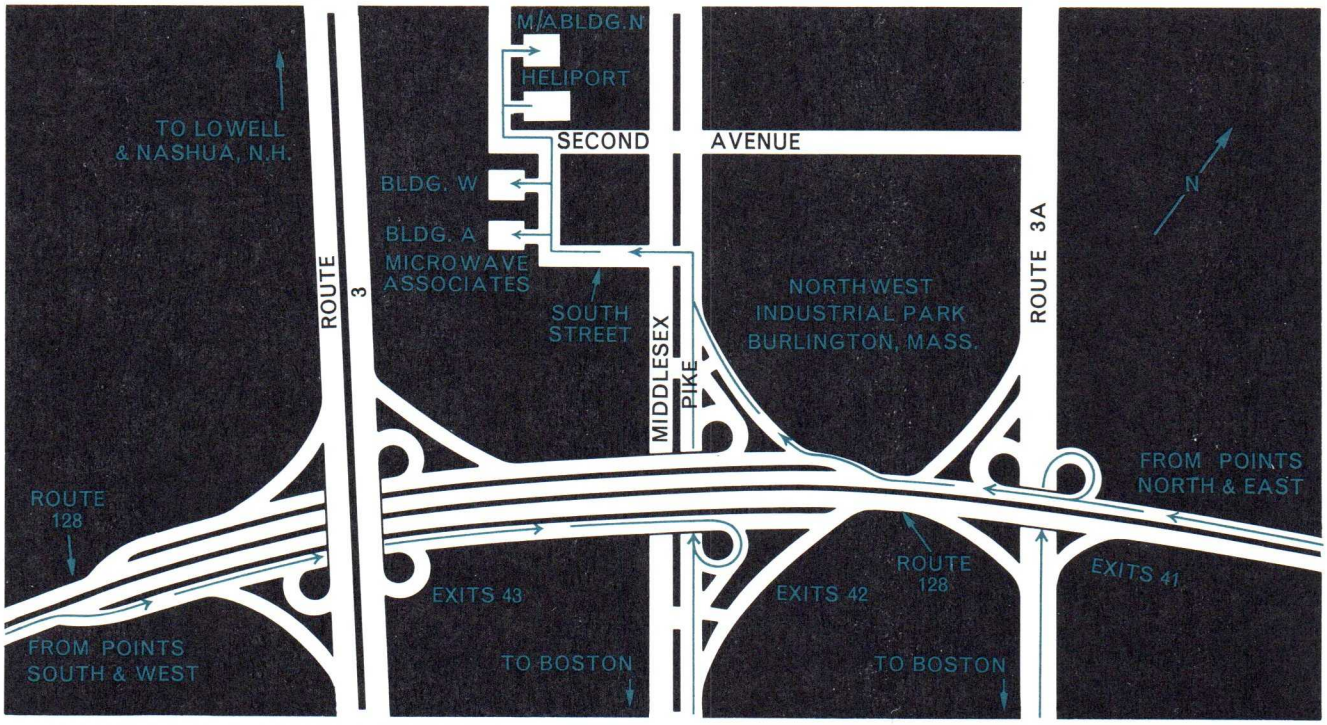
DATA SHEETS. Detailed data sheets on almost all products listed in this catalog are available. The sheets contain complete electrical and physical information, and performance curves. Requests for specific data sheets should be addressed to the sales department and the product by the identified MA-model number.

OUTLINE DRAWINGS. All outline drawings in this catalog are provided for engineering assistance in prototype design. For applications involving production quantities, it is recommended that current outline drawings be obtained. Outline drawings will be supplied on any product upon request.

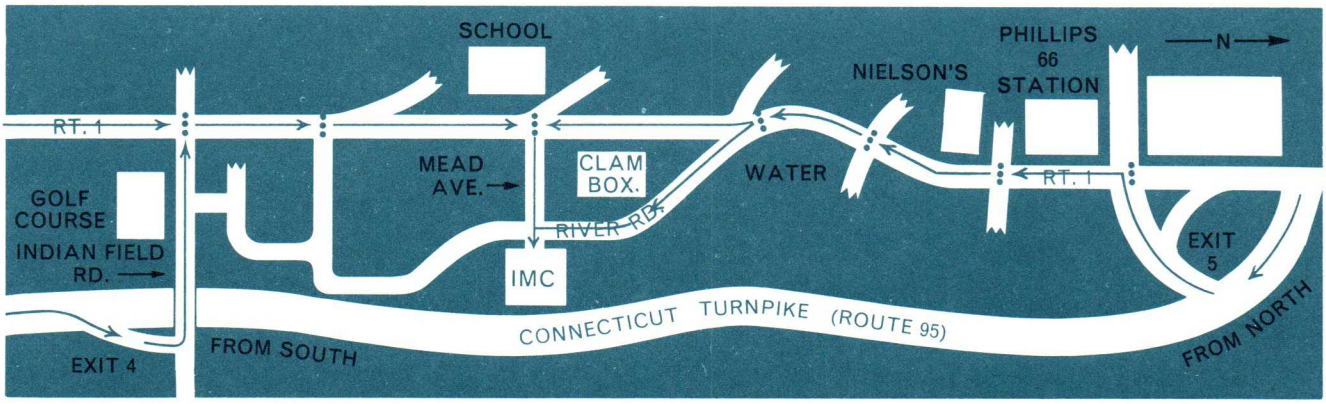
FINANCIAL INFORMATION. Microwave Associates, Inc. issues annual and quarterly reports to its shareholders.These reports contain balance sheet and profit and loss statements and may be obtained by writing the Treasurer, Microwave Associates, Inc., Burlington, Mass.

Customers are encouraged to visit our plants, to inspect our facilities or confer with our technical staff. To assist you, we have included the following directions.

MICROWAVE ASSOCIATES, INC. Take the exit from the airport, following signs reading "Boston" to the Sumner Tunnel. Once through the tunnel, turn right, following signs reading "Downtown Boston, Expressway South." These will direct you along a U-shaped path which parallels the elevated expressway, passes under it, then parallels it in the opposite direction to an access ramp marked "Downtown Boston, Expressway South." Take this access ramp up onto the Expressway, and follow signs to the Massachusetts Turnpike entrance (the second exit following the tunnel-underpass). Proceed west on the Turnpike to Exit 15. Take Exit 15 to Route 128 North. Follow Route 128 North to the Middlesex Turnpike, Exit 42. Turn right off Exit 42 onto the Middlesex Turnpike and proceed west. Take the first left across the Turnpike into Northwest Industrial Park.



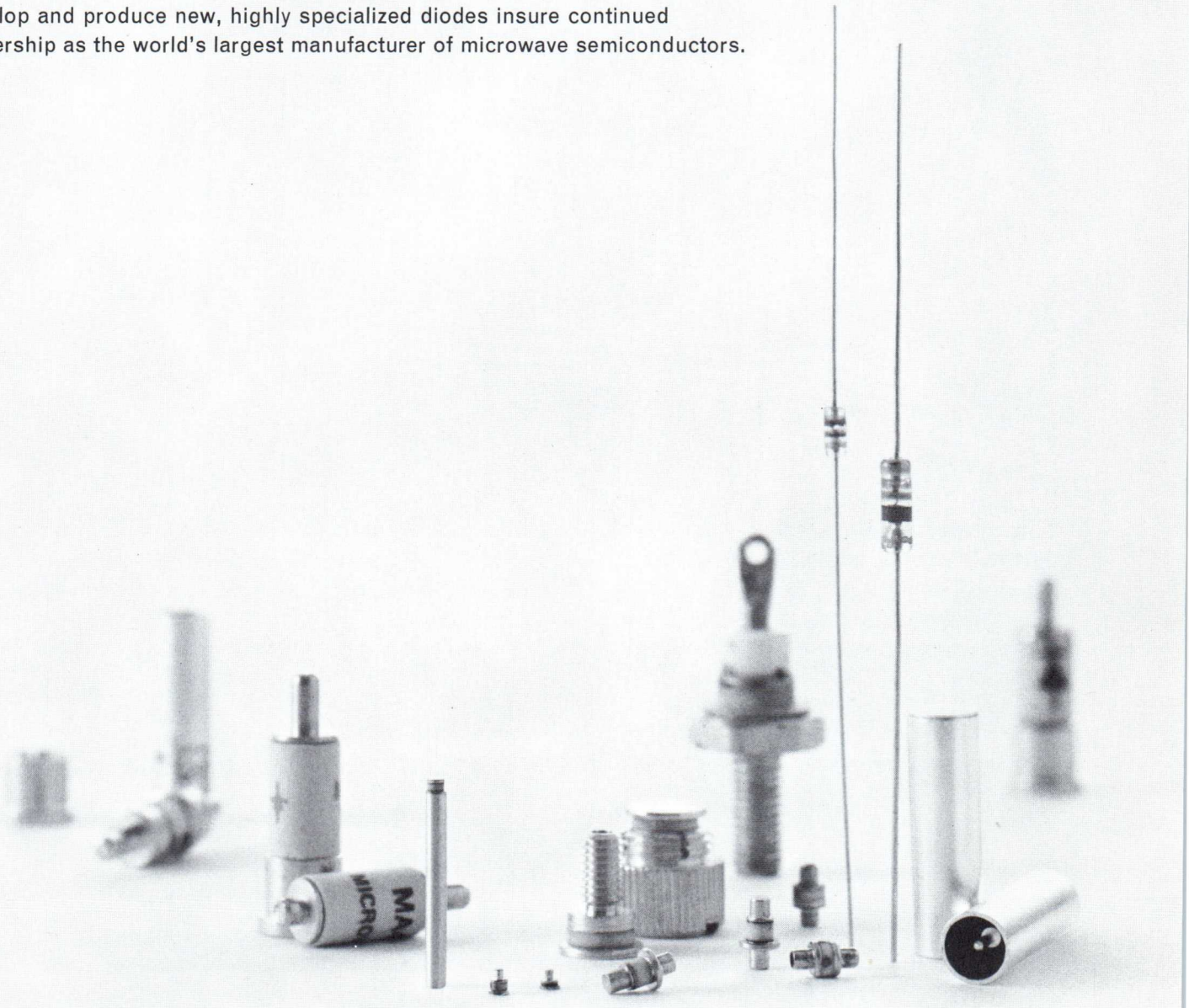
INTERNATIONAL MICROWAVE CORP. Take the Connecticut Turnpike (Route 95) to Exit 4. Turn off Exit 4 onto Indian Field Road. At the first traffic light, turn right onto Route 1. Turn right at the second traffic light onto Mead Avenue. Our plant is located at the end of the street.



MICROWAVE ASSOCIATES, LTD. From the airport, take the M4 motorway exit in the direction of London; leave the motorway at the exit marked North Circular Road in the direction of Ealing. Continue along North Circular Road until you come to the Brent Cross interchange. Follow the blue signs M1. Leave this Birmingham Motorway at the A505 exit in the direction of Dunstable. About one mile from the exit, turn left at Skimpot Road to the Luton factory.

SEMICONDUCTORS

Microwave Associates designs and manufactures a wide variety of semiconductor diodes that are used in current microwave systems to detect, amplify, switch and control microwave energy. Applications for these diodes include airborne, groundbase, and shipboard radar, communication equipment, missiles, test equipment, satellites, etc. Microwave Associates has led in microwave semiconductor technology, developing in 1958 the first commercial varactor diodes and establishing test methods that have been universally adopted. Other significant company "firsts" have been nanosecond silicon diffused junction diodes in 1959; the development of epitaxial silicon mixer diodes; the production of PIN diodes for high power, microwave switching; and broadband, coaxial diodes in fused-glass packages. Constant efforts to develop and produce new, highly specialized diodes insure continued leadership as the world's largest manufacturer of microwave semiconductors.

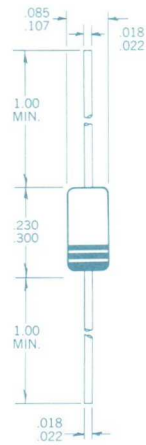


Pico-Min Silicon Mixer and Detector Diodes

The Pico-Min series are microminiature, silicon, point-contact diodes housed in hermetically sealed, glass, microminiature cases with axial or ribbon wire leads. Pico-Min diodes are intended for series mounting in strip transmission line applications including mixing, detecting, and switching. They supplement subminiature glass (1N831, 1N832, etc.) and standard cartridge (1N21, 1N23, etc.) models.

PICO-MIN SILICON MIXER DIODES

Model Number	Case Style	Test Freq. MHz	Max. Noise Fig. dB	IF Imp. ohms	Burnout Rating ergs	Elect. Equiv. Case Style 4
MA-4811	57	3060	8.3	300-600	2.0	1N831
MA-4811A	57	3060	7.0	350-550	2.0	1N831A
MA-4811B	57	3060	6.5	350-550	2.0	1N831B
MA-4811C	57	3060	6.0	350-550	2.0	—
MA-4811D	57	3060	5.5	350-550	2.0	—
MA-4812	57	9375	9.5	300-600	2.0	1N832
MA-4812A	57	9375	7.5	350-550	2.0	1N832A
MA-4812B	57	9375	7.0	350-550	2.0	1N832B
MA-4812C	57	9375	6.5	350-550	2.0	—



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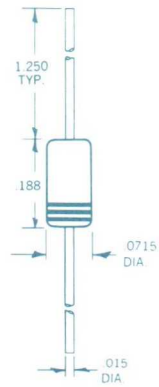
PICO-MIN SILICON DETECTOR DIODES

Model Number	Case Style	Test Freq. MHz	Tangential Sensitivity[1] —dBm	Video Imp. ohms	Min. Rect. Eff. %	Min. Peak Rev. Volt.	Burnout Rating ergs	Elect. Equiv. Case Style 4
MA-4815	57	100	—	—	65	2.0	2.0	1N830
MA-4815A	57	100	—	—	65	5.0	2.0	1N830A
MA-4813	57	3060	45	4.5-18	—	—	2.0	MA-4123
MA-4813A	57	3060	48	4.5-18	—	—	2.0	MA-4123A
MA-4813B	57	3060	50	4.5-18	—	—	2.0	MA-4123B
MA-4814	57	9375	40	4.5-18	—	—	2.0	1N833
MA-4814A	57	9375	45	4.5-18	—	—	2.0	1N833A
MA-4814B	57	9375	48	4.5-18	—	—	2.0	—



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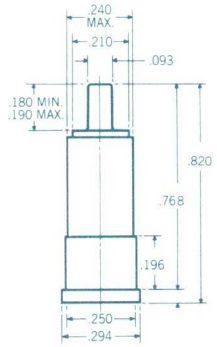
SEMICONDUCTORS

Cartridge Silicon Mixer Diodes

Unless otherwise indicated, these mixer diodes are also available in reverse polarity, forward polarity matched pairs, and forward and reverse polarity matched pairs, indicated by adding the suffixes "R", "M", and "MR", respectively, to the basic, forward polarity model number. For example, 1N21B, a basic model number, designates a forward polarity diode. 1N21BR is a 1N21B with its case polarity reversed, 1N21BM is a matched pair of 1N21B's, and 1N21BMR is a 1N21B and a 1N21BR that are matched.

Model Number	Case Style	Style 3 Reversible Model Number	Test Freq. MHz	Max.[22] Noise Fig. dB	Conv. Loss dB	Output Noise Ratio	Max. VSWR	IF Imp. ohms	Burnout Rating ergs (mW, CW)
1N21B	D7-1	1N416B	3060	10.3	6.5	2.0	—	200-800[15]	2.0
MA-449B	D7-1	MA-459B	3060	10.3	6.5	2.0	—	200-800[15]	5.0
1N21C	D7-1	1N416C	3060	8.3	5.5	1.5	—	200-800[15]	2.0
MA-449C	D7-1	MA-459C	3060	8.3	5.5	1.5	—	200-800[15]	5.0
MA-4127[16]	D7-1	MA-4132 / 1N3655 [16]	3060	8.3	5.5	1.5	1.6	300-500[15]	10.0
1N831	4	—	3060	8.3	5.5	1.5	—	350-450[15]	(375)
1N831A	4	—	3060	7.0	—	—	—	350-450[15]	(375)
1N21D	D7-1	1N416D	3060	7.3	5.0	1.3	1.5	325-475	2.0
MA-449D	D7-1	MA-459D	3060	7.3	5.0	1.3	1.5	325-475	5.0
1N21E	D7-1	1N416E	3060	7.0	—	—	1.3	350-450	5.0
MA-449E	D7-1	1N21WE	3060	7.0	5.5	1.5	1.3	350-450	5.0
MA-4127A[16]	D7-1	MA-4132A / 1N3655A [16]	3060	7.0	—	—	1.3	350-450	10.0
MA-421A	D7-1	—	3060	6.5	—	—	1.3	350-450	5.0
1N21F	D7-1	1N416F	3060	6.0	—	—	1.3	350-450	5.0
MA-449F	D7-1	MA-459F	3060	6.0	—	—	1.3	350-450	5.0
—	D7-1	1N3655B[16]	3060	6.0	5.5	1.5	1.5	350-450	10.0
1N21G	D7-1	1N416G	3060	5.5	—	—	1.3	350-450	5.0
MA-4126[17]	D7-1	MA-4131[17]	3060	18.0[3]	5.5	—	—	200-800[15]	2.0
MA-4126A[17]	D7-1	MA-4131A[17]	3060	15.0[3]	5.5	—	—	200-800[15]	2.0
MA-4136[2, 17]	4	—	3060	18.0[3]	5.5	—	—	200-800[15]	(375)
MA-4136A[2, 17]	4	—	3060	15.0[3]	5.5	—	—	200-800[15]	(375)
1N831B	4	—	3060	6.5	—	—	—	350-550	2.0
1N150	D7-1	MA-419A	6750	9.8	6.0	2.0	1.5	200-500	1.0
1N160	D7-1	MA-419	6750	11.4	6.5	2.7	—	200-500[15]	1.0
1N23B	D7-1	1N415B	9375	11.4	6.5	2.7	—	300-600[15]	1.0
MA-451B	D7-1	MA-458B	9375	11.4	6.5	2.7	—	300-600[15]	2.0



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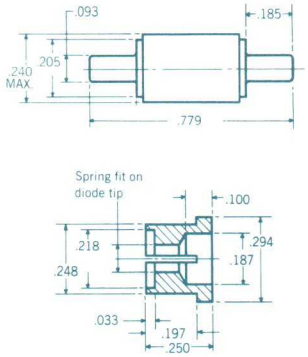

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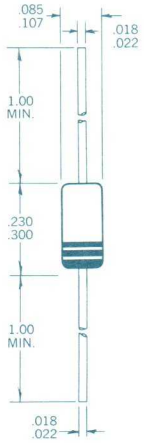

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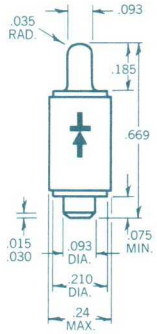

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Model Number	Case Style	Style 3 Reversible Model Number	Test Freq. MHz	Max.[22] Noise Fig. dB	Conv. Loss dB	Output Noise Ratio	Max. VSWR	IF Imp. ohms	Burnout Rating ergs (mW, CW)
1N832[1]	4	—	9375	10.0	6.0	2.0	—	325-475[15]	(325)
1N23C	D7-1	1N415C	9375	9.8	6.0	2.0	1.5	325-475	1.0
MA-451C	D7-1	MA-458C	9375	9.8	6.0	2.0	1.5	325-475	2.0
MA-4133[16]	D7-1	MA-4134 / 1N3745 [16]	9375	9.8	6.0	2.0	—	325-475	5.0
1N149	D7-1	MA-414	9375	8.3	5.5	1.5	1.5	325-475	1.0
1N23D	D7-1	1N415D	9375	8.2	5.0	1.7	1.3	350-450	1.0
MA-451D	D7-1	MA-458D	9375	8.2	5.0	1.7	1.3	350-450	2.0
1N23E	D7-1	1N415E	9375	7.5	—	—	1.3	335-465	2.0
MA-451E	D7-1	MA-458E[4]	9375	7.5	6.0	1.4	1.3	335-465	2.0
—	D7-1	1N23WE[4]	9375	7.5	6.0	1.4	1.3	335-465	2.0
—	D7-1	1N3747[4, 16]	9375	7.5	—	—	1.3	335-465	5.0
1N832A[1]	4	—	9375	7.5	—	—	1.5	335-465	(325)
MA-457[18]	20	—	9375	7.5	—	—	1.3	335-465	2.0
1N23F	D7-1	1N415F	9375	7.0	—	—	1.3	335-465	2.0
MA-451F	D7-1	MA-458F	9375	7.0	—	—	1.3	335-465	2.0
1N832B[1]	4	—	9375	7.0	—	—	—	335-465	(250)
1N23G	D7-1	1N415G	9375	6.5	—	—	1.3	335-465	2.0
MA-4125[17]	D7-1	MA-4130[17]	9375	23.0[3]	6.0	—	1.5	300-600	2.0
MA-4125A	D7-1	MA-4130A	9375	20.0[3]	6.0	—	1.5	300-600	2.0

NOTES:
1. Available in forward polarity only, as singles or matched pairs.
2. Available in forward polarity only; no matched pairs.
3. Noise figure measured with 20 kHz IF.
4. Available in forward or forward and reverse matched pairs in D7-1 cases.
15. Typical value.
16. High burnout.
17. Low noise doppler.
18. Designed for use in Varian Associates' Orthomode® mixer.
22. Noise figure measured with 30 NHz at N_{IF} = 1.5 dB.

SEMICONDUCTORS

Coaxial Silicon Mixer Diodes

The coaxial series are silicon point-contact diodes available in reverse polarity, forward polarity matched pairs and forward-reverse polarity matched pairs, indicated by adding the suffixes "R", "M" and "MR", respectively. They are intended for broadband coaxial mixers including the Microwave Associates' ORTHOTEE™ hybrid balanced mixer series.

Model Number	Case Style	Test Freq. MHz	Max.[22] Noise Fig. dB	Conv. Loss dB	Output Noise Ratio	Max. VSWR	IF Imp. ohms	Burnout Rating ergs
1N1132	13	3000-12000	9.5	—	—	2.0	100-200	1.0
MA-4400[20]	13	9375	9.5	—	—	2.0	100-200	1.0
MA-4400A[20]	13	9375	8.5	—	—	2.0	100-200	1.0
MA-492C[21]	11	9375	9.5	—	—	1.7[5]-2.5[6]	200-300	1.0
MA-492D[21]	11	9375	8.5	—	—	1.7[5]-2.5[6]	200-300	1.0
MA-492E[21]	11	9375	7.5	—	—	1.7[5]-2.5[6]	200-300	1.0
MA-491[21]	11	13300	13.0	7.5	—	2.5	325-625	1.0
MA-491A[21]	11	13300	11.0	7.0	—	1.6[7]-2.5[8]	365-565	1.0
MA-491B[21]	11	13300	10.0	6.5	—	1.6[7]-2.5[8]	365-565	1.0
MA-491C[21] / 1N4603	11	13300	9.5	6.0	—	1.5[7]-2.5[8]	400-565	1.0
MA-491D[21] / 1N4604	11	13300	8.8	6.0	—	1.5[7]-2.5[8]	400-565	1.0
MA-491E[21] / 1N4605	11	13300	8.0	—	—	1.5[7]-2.5[8]	400-565	1.0
MA-4124[17]	11	13300	27.0[3]	7.5	—	—	325-625	1.0
MA-4124A[17]	11	13300	24.0[3]	7.5	—	—	325-625	1.0
1N78	11	16000	12.0[9]	7.5	2.5[10]	—	325-625	1.0
MA-490[21]	11	16000	12.0[9]	7.5	2.5[10]	1.5[11]-2.5[12]	325-625	1.0
1N78A	11	16000	9.8[9]	7.0	1.5[13]	1.6	365-565	1.0
MA-490A[21]	11	16000	9.8[9]	7.0	1.5[10]	1.5[11]-2.5[12]	365-565	1.0
1N78B	11	16000	10.0[14]	6.5	—	1.6	365-565	1.0
MA-490B[21]	11	16000	8.8	6.5	1.5[13]	1.5[11]-2.5[12]	365-565	1.0
1N3205	11	16000	9.75	6.3	—	1.6	365-565	1.0
1N78C	11	16000	9.5	6.0	1.9[10]	1.5	400-565	1.0
MA-490C[21] / 1N4600	11	16000	9.5	6.0	1.9[10]	1.5[11]-2.5[12]	400-565	1.0
1N78D	11	16000	8.8	6.0	1.9[10]	1.5	400-565	1.0
MA-490D[21] / 1N4601	11	16000	8.8	6.0	1.9[10]	1.5[11]-2.5[12]	400-565	1.0
1N78E	11	16000	8.0	—	—	1.5	400-565	1.0

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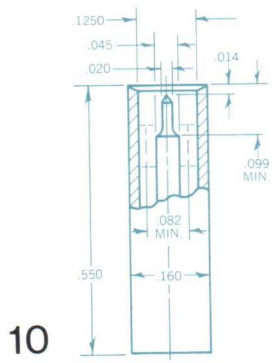

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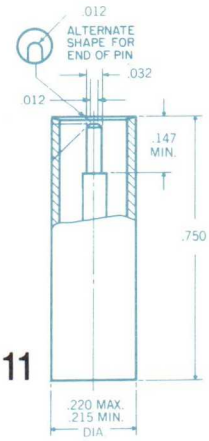

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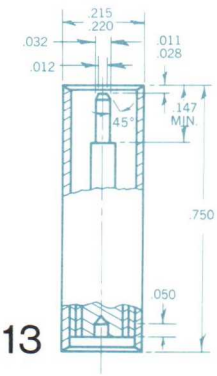

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Model Number	Case Style	Test Freq. MHz	Max.[22] Noise Fig. dB	Conv. Loss dB	Output Noise Ratio	Max. VSWR	IF Imp. ohms	Burnout Rating ergs
MA-490E[21]	11	16000	8.0	—	—	1.5[11]-2.5[12]	400-565	1.0
1N4602[21]	11	16000	7.5	6.0	1.9[10]	1.5	400-565	1.0
1N78F	11	16000	7.5	—	—	1.5[11]-2.5[12]	400-565	1.0
MA-490F[21]	11	16000	7.5	8.5	2.5[13]	—	300-600	0.1
1N26	11	23984	13.1	8.5	2.5[13]	—	300-600	0.1
	11	23984	13.1	7.5	2.0[13]	1.6	300-600	0.1
1N26A	11	23984	11.3	7.5	2.0[13]	1.6	300-600	0.1
MA-493A	11	23984	11.3	7.5	1.5[13]	1.5	400-600	0.3
1N26B	11	23984	10.0	7.5	1.5[13]	1.5	400-600	0.3
MA-493B	11	23984	10.0	8.5	2.5[13]	1.6	400-800	0.3
1N53	10	34860	13.1	8.5	2.5[13]	1.6	400-800	0.3
MA-494	10	34860	13.1	8.5	2.5[13]	1.6	400-800	0.3
1N53A	10	34860	11.1	8.5	2.5[13]	1.6	400-800	0.3
MA-494A	10	34860	11.1	6.5	2.0[13]	1.6	400-800	0.3
1N53B	10	34860	10.0	6.5	2.0[13]	1.6	400-800	0.3
MA-494B	10	34860	10.0					

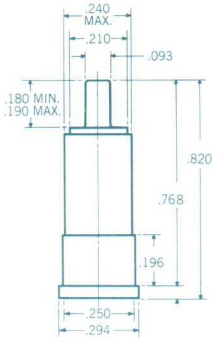
NOTES:
1. Available in forward polarity only, as singles or matched pairs.
3. Noise figure measured with 20 kHz IF.
5. VSWR at test frequency.
6. VSWR at 8.2 and 12.4 GHz band limits. Maximum VSWR with holder terminated by 65 ohm matched load is 1.1 at all test frequencies.
7. VSWR at test frequency.
8. VSWR at 10 and 16 GHz band limits. Maximum VSWR with holder terminated by 65 ohm matched load is 1.1 at all test frequencies.
9. Calculated from conversion loss and noise ratio measurements.
10. At test frequency.
11. VSWR at test frequency with JAN 201 holder.
12. VSWR at 12.5 and 17.5 GHz band limits. Maximum VSWR with holder terminated by 65 ohm matched load is 1.1 at all test frequencies.
13. At 9375 MHz.
14. Calculated for 16 GHz.
17. Low noise doppler.
20. +100°C.
21. Broadband coaxial.
22. Noise figure measured with 30 NHz at N_{IF} = 1.5 dB.

SEMICONDUCTORS

Silicon Video Detector Diodes

The video detector series are silicon point-contact diodes intended for the direct demodulation of RF signals. Increased sensitivity may be obtained by the addition of forward bias. Selected units are also available.

Model Number	Case Style	Test Freq. MHz	Tangential Sensitivity[1] −dBm	Min. Figure of Merit	Output Volt. mV	Video Resist. K ohms	DC Bias +μA	Burnout Rating ergs	Comments
1N830	4	100	65[4]	—	—	—	—	—	$V_{br} = 2V$
1N830A	4	100	65[4]	—	—	—	—	—	$V_{br} = 5V$
MA-4140	4	100	65[4]	—	—	—	—	5	$V_{br} = 4V$
1N358[2]	13	—	40	15	15	4.5-18	—	—	
1N358A[2]	13	—	45	30	30	4.5-18	—	—	
1N369[2]	13	—	40	15	15	4.5-18	—	—	
1N369A[2]	13	—	40	15	15	4.5-18	—	—	
1N630[2]	25	—	40	15	15	4.5-18	—	—	
1N1610[2]	13	—	40	15	15	4.5-18	—	—	
1N2127[2]	12	—	—	70, 30, 30[3]		—	—	—	
MA-4142	3	3060	—	100	—	5-25	—	5	High Burnout
MA-4142A	3	3060	—	200	—	5-25	—	5	High Burnout
MA-4123	4	3060	45	—	—	4.5-18	—	—	
MA-4123A	4	3060	48	—	—	4.5-18	—	—	
MA-4139 / 1N4379	4	3060	—	100	—	5-25	—	5	High Burnout
1N32[2]	D7-1	3295	—	85	—	4-22	—	1	
MA-417 / 1N2102	3	3295	—	85	—	4-22	—	1	
MA-408[2] / 1N1611	D7-1	9000	50	130	—	1.7-3.1	50	1	
MA-418	3	9000	50	130	—	1.7-3.1	50	1	



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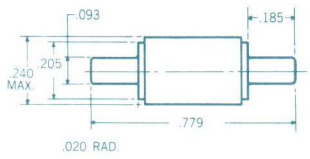

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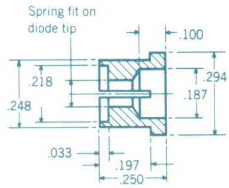

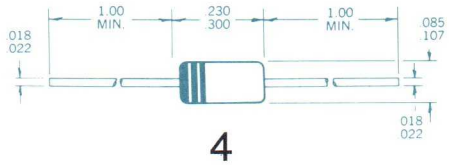

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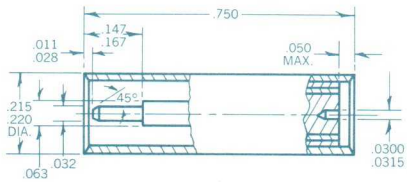

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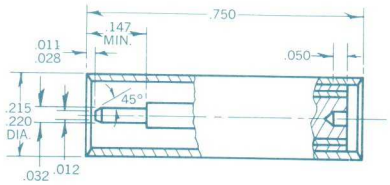

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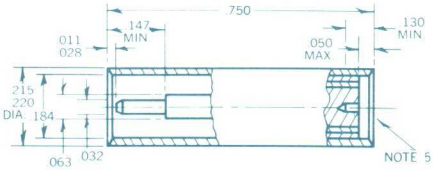

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Model Number	Case Style	Test Freq. MHz	Tangential Sensitivity[1] −dBm	Min. Figure of Merit	Output Volt. mV	Video Resist. K ohms	DC Bias +μA	Burnout Rating ergs	Comments
MA-452[2]	D7-1	9000	50	130	—	1.7-3.1	50	1	
MA-461	3	9000	50	130	—	1.7-3.1	50	1	
MA-408A[2]	D7-1	9000	51	160	—	1.7-3.1	50	1	
MA-418A	3	9000	51	160	—	1.7-3.1	50	1	
MA-452A[2]	D7-1	9000	51	160	—	1.7-3.1	50	1	
MA-461A	3	9000	51	160	—	1.7-3.1	50	1	
MA-408B[2] / 1N1611A	D7-1	9000	52	220	—	1.7-3.1	50	1	
MA-418B	3	9000	52	220	—	1.7-3.1	50	1	
MA-452B[2] / 1N1611B	D7-1	9000	52	220	—	1.7-3.1	50	1	
MA-461B	3	9000	52	220	—	1.7-3.1	50	1	
MA-4128[2]	D7-1	9000	50	130	—	1.7-3.1	50	5	High Burnout
MA-4129	3	9000	50	130	—	1.7-3.1	50	5	
1N833	4	9375	40	15	—	4.5-18	—		
1N833A	4	9375	45	30	—	4.5-18	—	—	

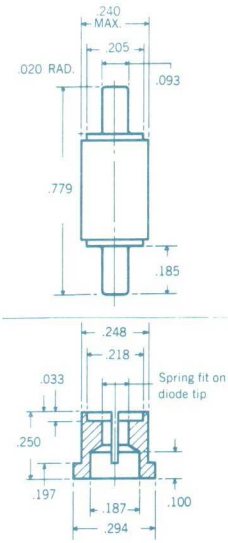
NOTES: 1. Video bandwidth 10 MHz.
2. Also available in reverse polarity, indicated by adding suffix "R".
3. At 9375, 6750, and 1000 MHz respectively.
4. Minimum rectification efficiency in percent.
5. Spring fingers to hold .031/.033 dia. PIN.

SEMICONDUCTORS

High Reliability Silicon Mixer Diodes

High reliability, point contact silicon mixer diodes meet MIL-S-19500 and MIL-STD-750 test procedures and MIL-S-19500 sampling procedures. Quality and reliability assurance provisions of these specifications include 100 percent processing and screening.

Model Number	Case Style	Test Freq. MHz	Max. Noise Figure dB	Conv. Loss dB	Max. Output Noise Ratio	Max. VSWR	IF Imp. ohms	Elect. Equiv.
MA-4171	4	3060	7.0	—	—	—	350-450	1N831A
MA-4172	3	3060	7.0	5.5	1.5	1.3	350-450	1N21WE
MA-4173	4	9375	7.5	—	—	1.5	335-465	1N832A
MA-4174	3	9375	7.5	6.0	1.4	1.3	335-465	1N23WE



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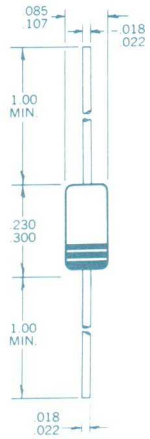
Backward Diode-Doppler Mixer Diodes

Model Number	Case Style	Test Freq. MHz	Max. Noise Figure[2] dB	Max. Output Noise Ratio	Max. VSWR	IF Imp. ohms	Burnout Rating ergs
MA-4610	33	8800, 13300	15	6	2.0	50-200	3
MA-4610A	33	8800, 13300	12	3	2.0	50-200	3
MA-4623[1]	11	8800	15	—	2.0[3]	50-150	—
MA-4623A[1]	11	8800	12	—	2.0[3]	50-150	—
MA-4624	11	13300	15	—	2.0[4]	50-150	—
MA-4624A	11	13300	12	—	2.0[4]	50-150	—
MA-4625	11	16000	15	—	2.0[5]	50-150	—
MA-4625A	11	16000	12	—	2.0[5]	50-150	—



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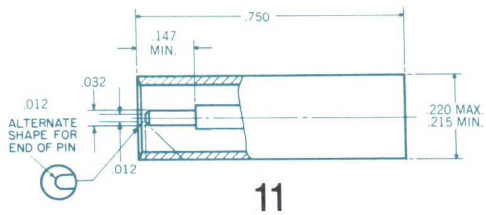
Backward/Tunnel Diode Detectors

Model Number	Case Style	Freq. MHz	Typ. Open Circ. Volt. Sens. mV/mW	Typ. Video Resist. ohms	Typ. Fig. of Merit σ/VRv	Tangential Sensitivity at O Bias[6] —dBm
BACKWARD DIODES						
MA-4613	33	3060	3000	100	300	55
MA-4614	33	9375	1000	75	100	50
MA-4615	33	13300	400	60	50	47
TUNNEL DIODES						
MA-4616	33	3060	17350	300	1000	60
MA-4617	33	9375	3700	150	300	55
MA-4618	33	13300	1600	100	160	52

NOTES:

1. Also available mounted in mixers. Mixer MA-4630 contains diode MA-4623, mixer MA-4630A contains diode MA-4623A. Unless otherwise specified in ordering, both mixers made with 2 GHz bandwidth about 9.8 GHz center frequency. Within the 8.2 to 11.5 GHz total frequency range other 2 GHz bandwidths may be specified.
2. 20 kHz IF.
3. With 1.5 GHz bandwidth anywhere in X-band, when mounted in MA-model mounts.
4. With 1.5 GHz bandwidth in Ke-band, when mounted in MA-model mounts.
5. With 1.5 GHz bandwidth in Ku-band, when mounted in MA-model mounts.
6. Video bandwidth 10 MHz.



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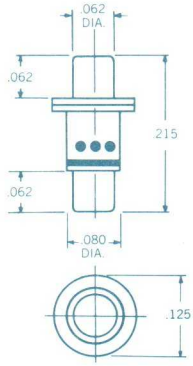

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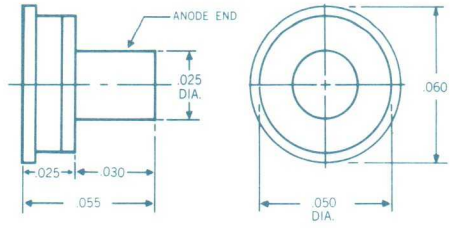

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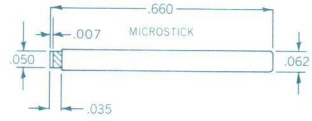

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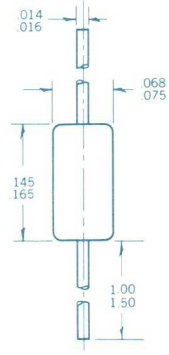
Schottky-Barrier Diodes

Schottky-barrier diodes are controlled metal-silicon semiconductor junctions housed in hermetically sealed, glass, microminiature cases. Repeatability in the manufacturing process and inherent reliability guarantee uniform quality and dependable performance in mixer applications. Microminiature size suits these diodes to series mounting in strip transmission line applications.

Model Number	Case Style	Test Freq. MHz	Max. Noise Fig. dB	Max. Total Capac.[1] pf	Fwd. Cur. at 1V mA	IF Imp. at 1mW RF ohms	Typ. RF Imp. ohms
MA-4850	54	3060	9.0	1.0	50	200-400	50
MA-4851	54	3060	7.5	0.7	25	300-450	50
MA-4855	54	3060	6.5	0.5	20	350-550	50
MA-4855A	54	3060	6.0	0.5	20	350-550	50
MA-4856	54	9375	7.5	0.35	20	200-500	50



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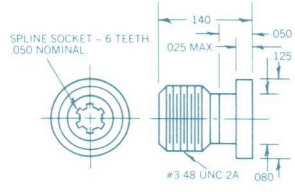
Limiter Varactors

Limiter varactors are silicon epitaxial, diffused junction devices designed for high cutoff frequency at zero bias. They are housed in hermetically sealed miniature ceramic cases for use from L-band through Ku-band.

Model Number	Case Style	Min-Max Junction Capac.[2] at 0V pf	Max. Series Resist.[3] ohms	Max. Thermal Resist. °C/W	Min. Break-down Volt[4] V	Cut-off Freq. at 0V GHz
MA-4684	72	1.8-2.8	0.8	75	8	35
MA-4685	72	0.4-0.8	1.2	150	8	70
MA-4686	30	0.3-0.6	1.4	250	8	90
MA-4687	30	0.2-0.4	1.8	500	8	100
MA-4688	38	0.1-0.2	2.5	1000	8	100



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NOTES:
1. Total capacitance at f = 1 MHz and V_R = 0V.
2. Junction capacitance at f = 1 MHz and V_R = 0V.
3. Measured at f = 500 MHz and I_F = 100 mA.
4. Breakdown voltage at I_R = 10 μA.

Parametric Amplifier Varactors

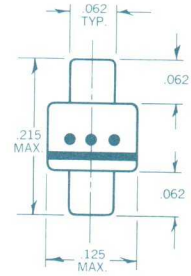
Available in case style 32 on special order.

SILICON

Model Number	Case Style	Min-Max Junction Capac. at 0V pf	Min. f_c'[1] GHz	Min. Beta[2] β	Max. Leak. Cur. at 3V μA
MA-4534	18	0.8-1.2	50	5.0	1
MA-4034	38	0.8-1.2	50	5.0	1
MA-4535	18	0.6-0.9	60	5.0	1
MA-4035	38	0.6-0.9	60	5.0	1
MA-4536	18	0.4-0.65	70	5.0	1
MA-4036	38	0.4-0.65	70	5.0	1
MA-4537	18	0.4-0.6	80	5.0	1
MA-4037	38	0.4-0.6	80	5.0	1
MA-4538	18	0.4-0.6	100	3.5	1
MA-4038	38	0.4-0.6	100	3.5	1
MA-4539	18	0.3-0.5	120	3.5	1
MA-4039	38	0.3-0.5	120	3.5	1

NOTES:

1. $f_c' = f_c(-3V) - f_c(+1\mu A)$
2. $\beta = \frac{C(+1\mu A)}{C(-3V)}$



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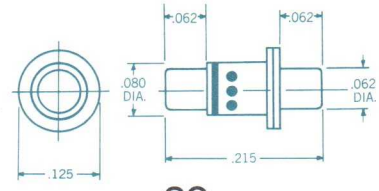

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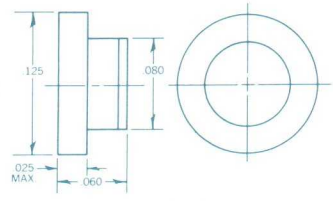
GALLIUM ARSENIDE

Model Number	Case Style	Min-Max Junction Capac. at −6V pf	Min. Cut-off Freq. at −2V GHz	Min. Cut-off Freq. at −6V GHz	Min. Break-down Volt. at −10μA V	Max. Thermal Resist. °C/W
MA-4644A	30	0.15-0.3	240	300	6	800
MA-4644B	30	0.15-0.3	190	250	6	800
MA-4644C	30	0.15-0.3	160	200	6	800
MA-4644D	30	0.15-0.3	120	150	6	800
MA-4644E	30	0.15-0.3	80	100	6	800
MA-4645B	30	0.3-0.6	190	250	6	400
MA-4645C	30	0.3-0.6	160	200	6	400
MA-4645D	30	0.3-0.6	120	150	6	400
MA-4645E	30	0.3-0.6	80	100	6	400
MA-4646C	30	0.6-1.2	160	200	6	200
MA-4646D	30	0.6-1.2	120	150	6	200
MA-4646E	30	0.6-1.2	80	100	6	200



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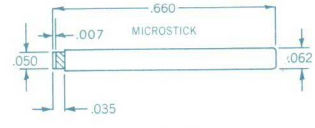

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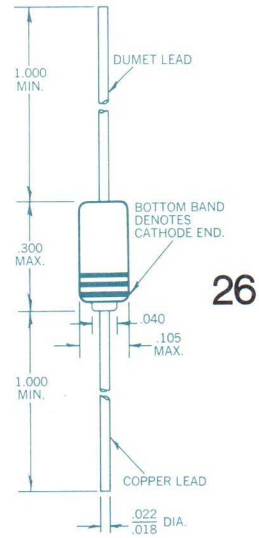
Silicon PIN Diodes[1]

The PIN diode is a silicon junction device designed for RF switching, limiting, duplexing, phase-shifting, variable attenuation, modulation, and pulse-forming. They are housed in hermetically sealed miniature cases for maximum reliability and ruggedness.

Model Number	Case Style	Max. Total Capac.[2] pf	Max. Series Resist.[3] ohms	Max. Thermal Resist. °C/W	Min. Breakdown Volt.[4] V
MA-4826B1	30	0.6	2.0	40	800
MA-4826B2	30	0.6	1.5	40	800
MA-4826C1	30	0.8	1.7	35	800
MA-4826C2	30	0.8	1.2	35	800
MA-4826D1	30	1.1	1.5	30	800
MA-4826D2	30	1.1	1.0	30	800
MA-4571B1	30	0.6	1.4	40	600
MA-4571B2	30	0.6	1.1	40	600
MA-4571C1	30	0.8	1.1	35	600
MA-4571C2	30	0.8	0.9	35	600
MA-4571D1	30	1.1	1.0	30	600
MA-4571D2	30	1.1	0.8	30	600
MA-4571E1	30	1.7	0.9	25	600
MA-4571E2	30	1.7	0.7	25	600
MA-4825B1	30	0.6	1.2	40	400
MA-4825B2	30	0.6	0.9	40	400
MA-4825C1	30	0.8	0.9	35	400
MA-4825C2	30	0.8	0.7	35	400
MA-4825D1	30	1.1	0.8	30	400
MA-4825D2	30	1.1	0.6	30	400
MA-4825E1	30	1.7	0.7	25	400
MA-4825E2	30	1.7	0.5	25	400
MA-4497A	30	0.4	1.5	25	200
MA-4497B	30	0.6	1.2	20	200
MA-4497C	30	0.8	1.0	20	200
MA-4583B	26	1.0	2.5	400	200
MA-4583C	26	1.5	2.0	400	200
MA-4733A	54	0.1	3.0	500	150
MA-4733B	54	0.2	2.5	500	150
MA-4733C	54	0.3	2.0	500	150
MA-4732A	54	0.1	3.0	500	75
MA-4732B	54	0.2	2.5	500	75
MA-4732C	54	0.3	2.0	500	75



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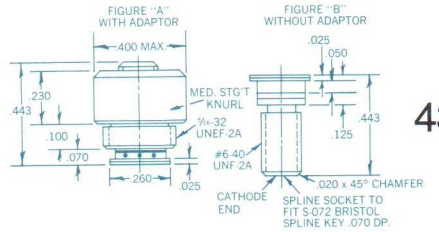

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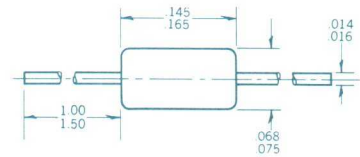

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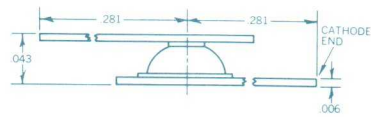

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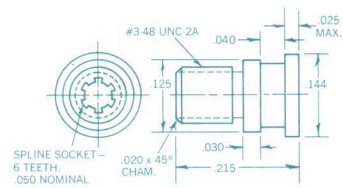

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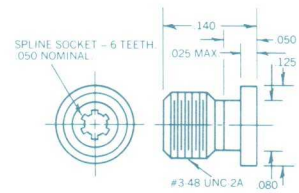

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NOTES:

1. Also available in case styles 43, 60, 71 and 72.
2. Measured at f = 1 MHz and V_R = 50 V except MA-4733 and MA-4732 series at V_R = 30 V.
3. Measured at f = 500 MHz and I_F = 100 mA except MA-4733 and MA-4732 series at I_F = 30 mA.
4. Breakdown voltage at I_R = 10μA.

SEMICONDUCTORS

Snap-off Varactors

Snap-off varactors are silicon epitaxial diffused junction devices designed for single-stage, high-order harmonic generation. Efficiencies exceeding 1/n are obtainable at frequencies from S-band through Ke-bands. Snap-off varactors can also be used for pulse shaping and pulse amplification.

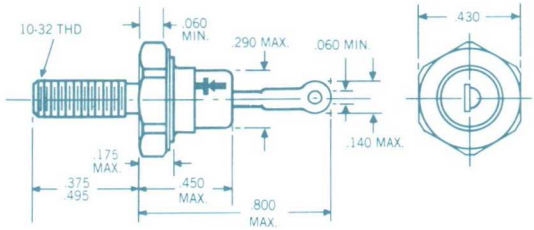
Model Number	Case Style	Min. Breakdown Volt.[1] V	Min-Max Junction Capac. at 0V pf	Min.[2] Lifetime ns	Max.[2] Snap-off Time ns	Max. Thermal Resist. °C/W	Min.[3] Fwd. Cur. mA
MA-4748	30	25	0.3-0.6	10	0.15	150	40
MA-4749	30	25	0.5-1.1	10	0.10	125	40
MA-4750	30	25	0.5-1.1	10	0.15	125	40
MA-4751	30	25	0.5-1.1	10	0.20	125	40
MA-4752	30	25	1.0-1.6	10	0.15	100	40
MA-4753	30	25	1.5-2.0	10	0.15	75	40
MA-4754	26	20	0.5-1.5	20	0.20	500	40
MA-4755	26	35	1.0-3.0	30	0.30	500	150
MA-4756	26	35	2.5-10.0	50	0.50	500	200

Harmonic Generator Circuit-Characterized Varactors

Circuit-characterized varactors are tested in typical harmonic generator circuits at VHF through Ku-band frequencies to insure their performance in practical application. Although test circuits are not always the same as the circuits in which the varactors will be used, test frequency and power level are similar enough to provide a basis for selection.

Model Number	Case Style	Dynamic Test Input, Output Frequencies MHz	Input Power W	Min. Overall Eff. %	Min-Max Junction Capac. at −6V pf	Min. Breakdown Volt.[1] V	Max. Thermal Resist. °C/W
MA-4762	24	150-450	50	50	15-30	250	5
MA-4064	24	150-450	11	55	20-30	90	6
MA-4065	24	450-900	6	50	3-6	80	15
MA-4764	30	1-4 GHz	2	45	1-2	40	75
MA-4765	30	4-12 GHz	1	30	0.6-1.2	24	125
MA-4086	30	12-24 GHz	0.15	15	0.2-0.4	8	500

NOTES: 1. Breakdown voltage at $I_R = 10\mu A$.
2. Test conditions $I_F = 10$ mA, $V_R = 10$ V, and $R_L = 50\ \Omega$.
3. Measured at $V_F = 1$ V.



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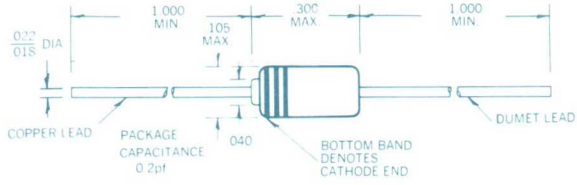
Peak-Pak Power Varactors

These high power varactors feature higher operating frequency (to 3 GHz) through reduced package inductance — 0.6 nh.

Model Number	Case Style	Min-Max Junction Capac.[1] pf	Max. Series Resist.[2] ohms	Max. Therm. Resist.[3] °C/W	Break-down Volt.[4] V
MA-4760AA	43	80-160	1.2	6	90
MA-4760A	43	40-80	1.5	6	90
MA-4760B	43	20-40	2.0	9	90
MA-4760C	43	10-20	2.5	12	90
MA-4760D	43	5-10	3.5	15	90
MA-4761AA	43	80-160	1.2	6	120
MA-4761A	43	40-80	1.5	6	120
MA-4761B	43	20-40	2.0	9	120
MA-4761C	43	10-20	2.5	12	120
MA-4761D	43	5-10	3.5	15	120
MA-4763	43	15-30	1.0	5	250



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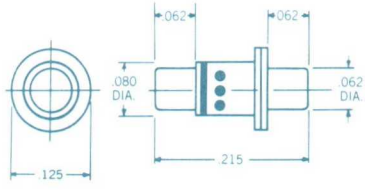

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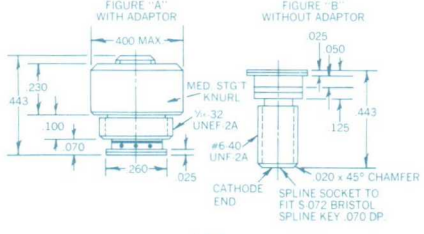
High Power, VHF-UHF Varactors

These high power varactors are designed for VHF-UHF multipliers where high input and output power levels are required.

Model Number	Case Style	Min-Max Junction Capac.[1] pf	Max. Series Resist.[2] ohms	Max. Therm. Resist.[3] °C/W	Break-down Volt.[4] V	Dynamic Test Power[5] W
MA-4060AA	24	80-160	1.2	6	90	—
MA-4060A	24	40-80	1.5	6	90	12
MA-4060B	24	20-40	2.0	9	90	12
MA-4060C	24	10-20	2.5	12	90	6
MA-4060D	24	5-10	3.5	15	90	6
MA-4061AA	24	80-160	1.2	6	120	—
MA-4061A	24	40-80	1.5	6	120	12
MA-4061B	24	20-40	2.0	9	120	12
MA-4061C	24	10-20	2.5	12	120	6
MA-4061D	24	5-10	3.5	15	120	6
MA-4762	24	15-30	1.0	5	250	50



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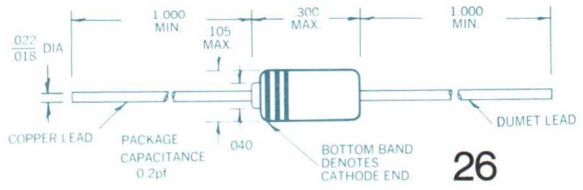
NOTES:

1. Junction capacitance at f = 1 MHz and V_R = 0 V except MA-4763 and MA-4762 at V_R = 6 V.
2. Measured at f = 500 MHz and V_R = 0 V.
3. Maximum ratings: I_F = 1.0 A
   T_{OP} = −65° to +150°C.
4. Breakdown voltage at I_R = 10μA.
5. Tested in a tripler, 150 to 450 MHz for 50 percent efficiency with the input power listed above.

SEMICONDUCTORS



26

Silicon Varactor Diodes

Microwave Associates pioneered the development of the silicon varactor in 1959.

Continued improvement and variations of the original varactor concept have led to the development and manufacture of highest quality harmonic generator circuit characterized varactors, gallium arsenide varactors, parametric amplifier varactors, tuning varactors, and snap-off varactors.

A full range of models of each type is available in many different package styles to handle a wide range of power levels in the microwave spectrum.

Building a Part Number

Suppose you require a 48 volt, cartridge style varactor with a junction capacitance range of 1.6 to 3.0 pf and a cutoff frequency of 40 GHz. The varactor model is MA-4045C1. Here is how the number is constructed.

Select voltage from column 1 and select case style from column 2. This yields a base number, to which two suffixes will be added. In the above example, a 48 volt, cartridge style varactor has a base number of MA-4045.

Now, the junction capacitance range of 1.6 to 3.0 pf is found in bold type in the chart. This junction capacitance is in a vertical column headed by a letter, which letter is the first suffix added to the base number. In our example, the varactor model number, so far, is MA-4045C.

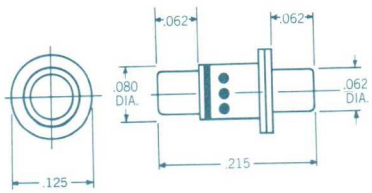
The cutoff frequency (or, in some cases, the R_S) is listed in light face type in the chart. In our example, a cutoff frequency of 40 GHz is on the same horizontal line as "quality level" 1 found in column 5. The final suffix, therefore, is "1" and the final varactor number is MA-4045C1.

1	2	3	4	5
Select Voltage	Select Case Style	This is Base Number	Select Capacitance designator (letter) above your C_j.	Select Quality level number on same horizontal line as f_c or R_S.

1	2	3
Voltage	Case Style	Base Model Number
6 volt	26	MA-4321
	34	MA-4041
	30	MA-4051
12 volt	26	MA-4322
	34	MA-4042
	30	MA-4052
24 volt	26	MA-4324
	34	MA-4044
	30	MA-4054
48 volt	26	MA-4325
	34	MA-4045
	30	MA-4055
60 volt	26	MA-4326
	34	MA-4046
	30	MA-4056
90 volt	26	MA-4327
	34	MA-4047
	30	MA-4057
120 volt	26	MA-4328
	34	MA-4048
	30	MA-4058

NOTES:

1. All values of junction capacitance and cut-off frequency are specified at −6 volts.
2. Minimum breakdown voltage measured at 10μA reverse current point.
3. Series resistance, R_s, is measured at 500 MHz. Cut-off frequency, f_c, is measured at 10 GHz.
4. Standard junction capacitance tolerance is ±33⅓%. Closer tolerance of ±15% or ±10% are available on special request. In no case can the tolerance be held closer than ±0.1 pf.



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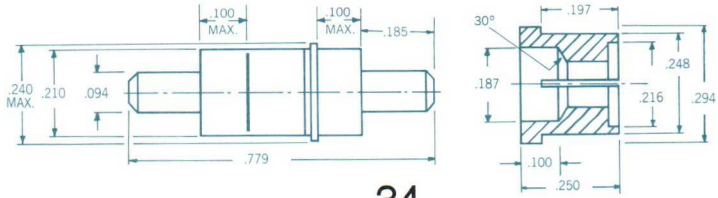

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Rs designations appearing in blue apply to case style 26 only.
Cut-off frequency designations appearing in black apply to case styles 30 and 34 only.

4 5

Capacitance Designators

AA	A	B	C	D	E	F	G	Quality Level
0.2 – 0.4 pf	0.4 – 0.8 pf	0.8 – 1.6 pf	1.6 – 3.0 pf	3.0 – 6.0 pf	6.0 – 12 pf	12 – 25 pf	25 – 50 pf	
11.0Ω 80 GHz 8.0 125 160	6.0Ω 60 GHz 4.0 90 120	3.5Ω 50 GHz 2.0 80	2.3Ω 35 GHz 1.2 60	1.7Ω 1.7Ω 0.6 0.9	1.3Ω 1.3Ω 0.6 0.5	0.6Ω 1.2Ω 0.5	0.6Ω 1.1Ω 0.5	— 1 2
0.2 – 0.5 pf	0.5 – 1.0 pf	1.0 – 2.0 pf	2.0 – 4.0 pf	4.0 – 8.0 pf	8.0 – 16 pf	16 – 32 pf	32 – 64 pf	
11.0 80 8.0 125 160	6.0 60 4.0 90 120	3.5 50 2.0 80	2.3 35 1.2 60	1.7 1.7 0.6 0.9	1.3 1.3Ω 0.6 0.5	0.6 1.2Ω 0.5	0.6 1.1Ω 0.5	— 1 2
0.15 – 0.3 pf	0.3 – 0.6 pf	0.6 – 1.2 pf	1.2 – 2.5 pf	2.5 – 5.0 pf	5.0 – 10 pf	10 – 20 pf	20 – 40 pf	
21.0 75 12.0 120 150	11.0 55 8.0 80 110	6.0 45 4.0 70 90	3.5 30 2.0 50	2.3 25GHz 1.2 40	1.7 1.7Ω 0.6 0.9	1.3 1.3Ω 0.6 0.5	0.6 1.0Ω 0.5	— 1 2
0.2 – 0.4 pf	0.4 – 0.8 pf	0.8 – 1.6 pf	1.6 – 3.0 pf	3.0 – 6.0 pf	6.0 – 12 pf	12 – 25 pf	25 – 50 pf	
21.0 60 12.0 80 100	11.0 50 8.0 70 90	6.0 40 4.0 60 80	3.5 25 2.0 40	2.3 2.3Ω 1.2 1.3	1.7 1.7Ω 0.6 0.8	1.3 1.3Ω 0.6 0.8	0.6 1.0Ω	— 1 2
0.2 – 0.5 pf	0.5 – 1.0 pf	1.0 – 2.0 pf	2.0 – 4.0 pf	4.0 – 8.0 pf	8.0 – 16 pf	16 – 32 pf	32 – 64 pf	
21.0 50 12.0 70	11.0 40 8.0 60	6.0 30 4.0 50	3.5 25 2.2 40	2.3 2.3 1.2 1.3	1.7 1.7 0.7 0.8	1.3 1.3 0.6 0.8	0.6 1.0	— 1 2
	0.25 – 0.5 pf	0.5 – 1.0 pf	1.0 – 2.0 pf	2.0 – 4.0 pf	4.0 – 8.0 pf	8.0 – 16 pf	16 – 32 pf	
	21.0 40 12.0 60	11.0 30 8.0 50	6.0 25 4.0 40	3.5 20 2.2 30	2.3 2.3 1.2 1.8	1.7 1.7 1.2 1.2	1.3 1.3 1.0 1.0	— 1 2
	0.3 – 0.6 pf	0.6 – 1.2 pf	1.2 – 2.5 pf	2.5 – 5.0 pf	5.0 – 10 pf	10 – 20 pf	20 – 40 pf	
	21.0 30 12.0 50	11.0 25 8.0 40	6.0 20 4.0 30	3.5 3.5 2.2 2.8	2.3 2.3 1.8 1.8	1.7 1.7	1.3 1.3	— 1 2

Tuning Varactors

Tuning varactors are manufactured by both epitaxial growth and diffusion. Abrupt junction epitaxial types offer greater capacitance swing for the amount of bias applied; diffused types offer higher Q and low leakage current. Two packages are available for some types (as noted): the glass, subminiature style 26 for capacitance up to 100 pf and 100 mW dissipation, and the micropill, style 52 for capacitance below 15 pf. There are also passivated chips mounted on carriers for integrated circuit packages for all values from 15 to 100 pf. Maximum operating temperature for all types is +150°C. Special types incorporating lower voltage and higher Q, specific values of capacitance (other than those shown), specific capacitance tolerance over a bias range, or diffused types with higher voltage and greater capacitance ratios are available on special order.

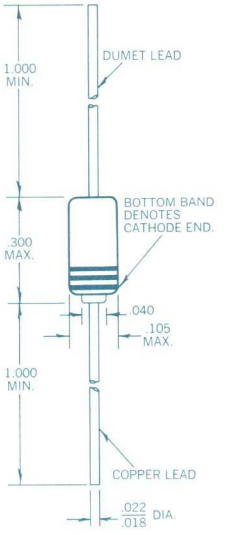
DIFFUSED, EPITAXIAL, LOW VOLTAGE, HIGH Q

Model Number	Case Style	Total Capac.[1] at −4V pf	Min.[2] Q at −4V[2]	Min. Breakdown Volt.[3] V	Rev. Cur. at −25V	Min-Max Capac. Ratio C(−2V)-C(−30V)
MA-4701B	26, 52	6.8 (±10%)	200	35	0.5	2.5-2.9
MA-4701B1	26, 52	6.8 (±10%)	400	35	0.5	2.5-2.9
MA-4701C	26, 52	8.2 (±10%)	175	35	0.5	2.5-2.9
MA-4701C1	26, 52	8.2 (±10%)	350	35	0.5	2.4-2.7
MA-4701D	26, 52	10 (±10%)	175	35	0.5	2.7-3.1
MA-4701D1	26, 52	10 (±10%)	350	35	0.5	2.7-3.1
MA-4701E	26, 52	12 (±10%)	150	35	0.5	2.7-3.1
MA-4701E1	26, 52	12 (±10%)	300	35	0.5	2.7-3.1
MA-4701F	26, 52	15 (±10%)	150	35	0.5	2.7-3.1
MA-4701F1	26, 52	15 (±10%)	300	35	0.5	2.7-3.1
MA-4701G	26	18 (±10%)	125	35	0.5	2.7-3.1
MA-4701G1	26	18 (±10%)	225	35	0.5	2.7-3.1
MA-4701H	26	22 (±10%)	125	35	0.5	2.7-3.1
MA-4701H1	26	22 (±10%)	225	35	0.5	2.7-3.1
MA-4701I	26	27 (±10%)	75	35	0.5	2.7-3.1
MA-4701I1	26	27 (±10%)	150	35	0.5	2.7-3.1
MA-4702A	26	33 (±10%)	75	35	0.5	2.7-3.1
MA-4702A1	26	33 (±10%)	150	35	0.5	2.7-3.1
MA-4702B	26	39 (±10%)	75	35	0.5	2.7-3.1
MA-4702B1	26	39 (±10%)	125	35	0.5	2.7-3.1
MA-4702C	26	47 (±10%)	75	35	0.5	2.7-3.1
MA-4702C1	26	47 (±10%)	125	35	0.5	2.7-3.1
MA4702D	26	56 (±10%)	50	35	0.5	2.7-3.1
MA-4702D1	26	56 (±10%)	100	35	0.5	2.7-3.1
MA-4702E	26	68 (±10%)	50	35	9.5	2.7-3.1
MA-4702E1	26	68 (±10%)	100	35	0.5	2.7-3.1
MA-4702F	26	82 (±10%)	40	35	0.5	2.7-3.1
MA-4702F1	26	82 (±10%)	75	35	0.5	2.7-3.1
MA-4702G	26	100 (±10%)	40	35	0.5	2.7-3.1
MA-4702G1	26	100 (±10%)	75	35	0.5	2.7-3.1

NOTES:
1. Total capacitance is junction plus case.
2. Calculated at 50 MHz from total capacitance and series resistance.
3. Breakdown voltage at I_R = 10μA.

ABRUPT-JUNCTION, EPITAXIAL, HIGH VOLTAGE, HIGH Q

Model Number	Case Style	Total Capac.[1] at −4V pf	Min.[2] Q at −4V	Min. Break-down Volt.[3] V	Rev. Cur. at −75V	Min-Max Capac. Ratio C(−2V): C(−100V)
MA-4273B	26, 52	6.5 (±20%)	100	110	0.5	4.5
MA-4273C	26, 52	10 (±20%)	100	110	0.5	5.2
MA-4273D	26, 52	15 (±20%)	100	110	0.5	5.2
MA-4273E	26	22 (±20%)	100	110	0.5	5.2
MA-4273F	26	33 (±20%)	100	110	0.5	5.2
MA-4273G	26	47 (±20%)	100	110	0.5	5.2
MA-4019B	26, 52	6.5 (±10%)	100	110	0.5	4.5
MA-4019C	26, 52	10 (±10%)	100	110	0.5	5.2
MA-4019D	26, 52	15 (±10%)	100	110	0.5	5.2
MA-4019E	26	22 (±10%)	100	110	0.5	5.2
MA-4019F	26	33 (±10%)	100	110	0.5	5.2
MA-4019G	26	47 (±10%)	100	110	0.5	5.2



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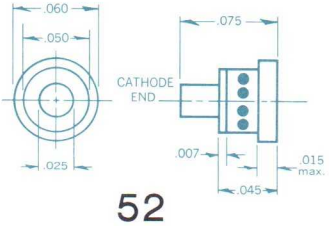
Model Number	Case Style	Total Capac.[1] at −4V pf	Min.[2] Q at −4V	Min. Break-down Volt.[3] V	Rev. Cur. at −60V	Min-Max Capac. Ratio C(−2V): C(−60V)
MA-4703B	26, 52	6.5 (±20%)	150	75	0.5	3.5
MA-4703C	26, 52	10 (±20%)	150	75	0.5	4.0
MA-4703D	26, 52	15 (±20%)	150	75	0.5	4.0
MA-4703E	26	22 (±20%)	150	75	0.5	4.0
MA-4703F	26	33 (±20%)	125	75	0.5	4.0
MA-4703G	26	47 (±20%)	100	75	0.5	4.0

Model Number	Case Style	Total Capac.[1] at −4V pf	Min.[2] Q at −4V	Min. Break-down Volt.[3] V	Rev. Cur. at −40V	Min-Max Capac. Ratio C(−2V): C(−40V)
MA-4704B	26, 52	6.5 (±20%)	150	50	0.5	3.0
MA-4704C	26, 52	10 (±20%)	150	50	0.5	3.0
MA-4704D	26, 52	15 (±20%)	150	50	0.5	3.0
MA-4704E	26	22 (±20%)	150	50	0.5	3.0
MA-4704F	26	33 (±20%)	125	50	0.5	3.0
MA-4704G	26	47 (±20%)	100	50	0.5	3.0



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Tunnel Diodes

Microwave Associates manufactures both germanium tunnel diodes and gallium arsenide tunnel diodes. The germanium tunnel diodes offer high current density along with low capacitance for microwave amplifiers, oscillators, mixers, and high speed switching circuits. The gallium arsenide tunnel diodes are designed specifically for logic circuits, oscillators, memory units and other applications requiring high voltage swing and high operating temperature.

GERMANIUM

Model Number	Case Style	Min-Max Neg. Resist. ohms	Typ. Peak Cur. mA	Max. Series Resist. ohms	Min-Max Junction Capac. pf	Min. Resist. Cut-off Freq. GHz	Min. Self-Reson. Freq. GHz	Typ. Peak Volt. mV	Min. Peak to Valley Ratio	Max. Noise Volt. mV
MA-4604A	33	60-80	1.5	8	— 0.8	15	17	55	5	60
MA-4604A1	33	60-80	1.5	8	— 0.5	25	22	55	5	60
MA-4604B	33	60-80	1.5	6	0.8-1.5	10	12	55	5	65
MA-4604C	33	60-80	1.5	6	1.5-3.2	3	6	55	5	85
MA-4605A	33	40-60	2.0	8	— 0.9	15	15	55	6	60
MA-4605B	33	40-60	2.0	6	0.9-2.0	10	11	55	6	65
MA-4605C	33	40-60	2.0	5	2.0-4.0	3	6	55	6	85
MA-4606A	33	25-35	4.0	4	— 1.2	15	13	55	6	—
MA-4606A1	33	25-35	4.0	4	— 0.8	22	18	55	6	—
MA-4606A2	33	25-35	4.0	4	— 0.6	30	21	55	6	—
MA-4606B	33	25-35	4.0	4	1.2-2.5	10	10	55	6	—
MA-4606C	33	25-35	4.0	4	2.5-4.0	3	5	55	6	—
MA-4607A	33	8-12	10.0	3	— 2.0	15	9	60	6	—
MA-4607A1	33	8-12	10.0	3	— 1.2	22	16	60	6	—
MA-4607A2	33	8-12	10.0	3	— 1.0	30	18	60	6	—
MA-4607B	33	8-12	10.0	3	2.0-4.0	8	6	60	6	—
MA-4607C	33	8-12	10.0	3	4.0-8.0	3	4	60	6	—
MA-4608A	33	3.5-4.5	30.0	2	— 6.0	10	6	80	6	—
MA-4608B	33	3.5-4.5	30.0	2	6.0-12.0	5	4	80	6	—
MA-4608C	33	3.5-4.5	30.0	2	12.0-25.0	3	2	80	6	—
MA-4609A	33	1.6-2.4	60.0	1	— 15.0	8	5	80	6	—
MA-4609B	33	1.6-2.4	60.0	1	15.0-30.0	4	3	80	6	—
MA-4609C	33	1.6-2.4	60.0	1	30.0-60.0	2	2	80	6	—

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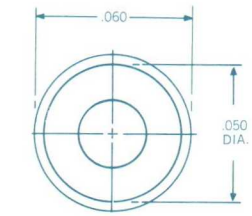
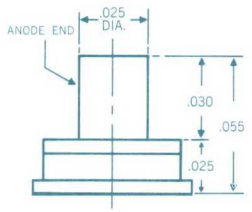




GALLIUM ARSENIDE

Model Number	Case Style	Min-Max Neg. Resist. ohms	Typ. Peak Cur. mA	Max. Series Resist. ohms	Min-Max Junction Capac. pf	Min. Resist. Cut-off Freq. GHz	Min. Self-Reson. Freq. GHz	Typ. Peak Volt. mV	Min. Peak to Valley Ratio	Calc. Osc. Power Avail. mW
MA-4651A	33	35-55	5	4.0	0.8-1.5	10.0	10.0	150	15	0.25
MA-4651B	33	35-55	5	3.0	1.5-2.5	8.0	7.5	150	15	0.25
MA-4651C	33	35-55	5	2.0	2.5-5.0	5.0	6.0	150	15	0.25
MA-4652A	33	15-25	10	3.0	1.5-2.5	9.0	9.0	150	15	0.50
MA-4652B	33	15-25	10	2.0	2.5-5.0	6.0	7.0	150	15	0.50
MA-4652C	33	15-25	10	2.0	5.0-0.0	4.0	5.0	150	15	0.50
MA-4653A	33	8-12	20	2.0	2.0-4.0	8.0	7.0	180	15	1.0
MA-4653B	33	8-12	20	1.5	4.0-8.0	6.0	5.0	180	15	1.0
MA-4653C	33	8-12	20	1.5	8.0-0.0	4.0	4.0	180	15	1.0
MA-4654A1	33	3-5	50	2.0	— 4.0	15.0	8.0	180	10	2.5
MA-4654A	33	3-5	50	1.5	5.0-10.0	6.0	6.0	180	10	2.5
MA-4654B	33	3-5	50	1.2	10.0-15.0	4.0	5.0	180	10	2.5
MA-4654C	33	3-5	50	1.2	15.0-30.0	3.0	4.0	180	10	2.5
MA-4655	33	— 13	20	3.0	— 1.2	25.0	20.0	150	10	—

MICROWAVE POWER TUBES

Microwave Associates is a leading supplier of traveling wave tubes and beacon magnetrons. Traveling wave tubes, which utilize the latest state-of-the-art techniques range from UHF through S-band, with CW power output from watts to kilowatts. The units have proven high reliability in actual field use; one type exceeding 15,000 hours average life.

Significant advances in beacon magnetron development in the area of positive pulsing, fast warm up, new tuning techniques and integral isolators have been achieved by Microwave Associates. Continued development efforts are being conducted in the areas of klystrons, beam plasma amplification and crossed-field amplifiers.

Traveling Wave Tubes

Microwave Associates traveling wave tubes are high power, high performance, CW types that feature hollow beam techniques, solenoid focusing, and helix-type construction. Hollow beam design provides greater gain per length with higher perveance than conventional techniques. Solenoid focusing permits precise beam control, and helix construction produces wider bandwidth than any other known slow wave structure. Other outstanding features are ruggedness, compactness, and operational reliability. Applications include ECM, penaids, radar, telemetry, test equipment, and communication systems.

Complete facilities feature an enclosed area with limited access doors and dust control filter system. Specialized hydrogen and vacuum firing equipment, a chemical analysis laboratory, a modern machine shop, and high power test equipment are also part of TWT facilities. Tube design and production is supported by related advance work being conducted in beam plasma research, high power CW broadband techniques, and cathode and beam focusing studies.

Model Number	Freq. MHz	CW Power Out W	Sat. Gain dB	Focus[1]	Helix Volt. Vdc	Cath-ode Cur. mAdc	Approx. Weight lb.	Size[6] len. in.	Size[6] dia. in.	Cooling
MA-2015	200-400	1100	25	S	2400	1800	25	32	3.75	Air
MA-2016	200-400	10	25	S	500	175	5.5	13.5	2	Air
MA-2010	350-700	250	27	S	1750	800	31	23	3.5	Air
MA-2003	300-900	1000	25	S	2600	1600	40	24	4	Liquid
MA-2014	400-1000	1100	27	S	2400	1800	25	22	3.5	Air
MA-2009	400-1000	300	27	S	2100	650	31	23	3.5	Air
MA-2017	500-1000	5000	27	S	6000	4600	40	27	4.5	Liquid
MA-2030[2]	600-1200	1300	27	S	2750	1800	12	16	3	Liquid
MA-2026[2]	600-1200	5	33	S	450	90	4	7.5	2	Liquid
MA-2019[5]	700-1400	2000	27	S	3600	2100	10	17	2.4	Liquid
MA-2011[5]	700-1400	350	28	S	2200	800	8	16	2.5	Liquid
MA-2012[5]	2000-4000	300	27	S	3000	500	8	10	2.5	Liquid
MA-2002[3]	5925-6425	12	34[4]	PPM	2450	40	13	14.3	4.0	Convect.

NOTES: 1. "S" indicates solenoid.
2. Contains grid or modulating anode for pulsing.
3. Communications TWT.
4. Small signal gain.
5. Also available with self contained heat sink for short term operation.
6. Includes focusing structure.

MICROWAVE POWER TUBES

Beacon Magnetrons

Microwave Associates' beacon magnetrons are designed for a wide variety of applications including airborne, missile, and ground based radar equipment, beacon navigation systems, ground support equipment, and missile transponders. These rugged, compact units are built to withstand severe environmental conditions of low and high temperatures, shock, vibration, and acceleration. Grounded cathode, isolated-anode electrical design of positive pulsed models provides improved spectrum performance, virtual elimination of arcing and leakage current, elimination of bifilar transformer and heater transformer capacitance to ground problems, and improved efficiency.

FIXED FREQUENCY

All units positive-pulsed except those indicated by an asterisk.

Model Number	Freq. GHz	Min. Peak Power w	Duty Cycle	Pulse Width μs	Peak Anode Volt. kV	Peak Anode Cur. A	Approx. Weight oz
MA-259	7.0-7.5	1kw	0.005	0.5	2.00	2.00	21
MA-221B	8.0-8.8	1.5	CW	—	0.45	0.02	11
MA-231B	8.0-8.8	20	CW	—	0.93	0.06	11
MA-221A	8.0-8.8	10	0.01	1.0	0.50	0.15	11
MA-221C	8.0-8.8	10	0.01	5.0	0.50	0.15	11
MA-221D	8.0-8.8	20	0.005	1.0	0.53	0.30	11
MA-231A	8.0-8.8	200	0.05	1.0	1.00	0.75	11
MA-250	8.5-9.6	4kw	0.005	0.5	3.75	4.00	21
MA-212B	8.8-9.6	1.5	CW	—	0.46	0.02	11
MA-212A	8.8-9.6	10	0.01	1.0	0.52	0.15	11
MA-232B	8.8-9.6	15	CW	—	0.93	0.06	11
MA-212C	8.8-9.6	10	0.01	5.0	0.52	0.15	11
MA-212D	8.8-9.6	20	0.005	1.0	0.56	0.30	11
MA-232A	8.8-9.6	150	0.05	1.0	1.00	0.75	11
MA-252A	8.8-9.6	250	0.005	0.5	1.15	0.65	11
MA-222*	9.3-9.4	7kw	0.002	1.0	5.50	4.50	48
MA-239	13.28-13.37	40	0.25	2.5	0.85	0.24	23
MA-239B	13.0-13.6	10	CW	—	0.95	0.06	23
MA-240	13.7-14.6	500	0.013	1.0	1.70	1.40	16
MA-240A	13.7-14.6	700	0.013	1.0	1.75	1.80	16
MA-245	15.4-15.6	20	0.50	5.0	1.00	0.14	23
MA-257	16.0-16.5	1kw	0.002	0.5	2.50	1.80	16
MA-256*	16.4-16.6	10kw	0.001	0.2	9.00	5.25	22
MA-246A	16.5-16.8	100	0.005	0.5	1.15	0.45	16

*Negative-pulsed

TUNABLE

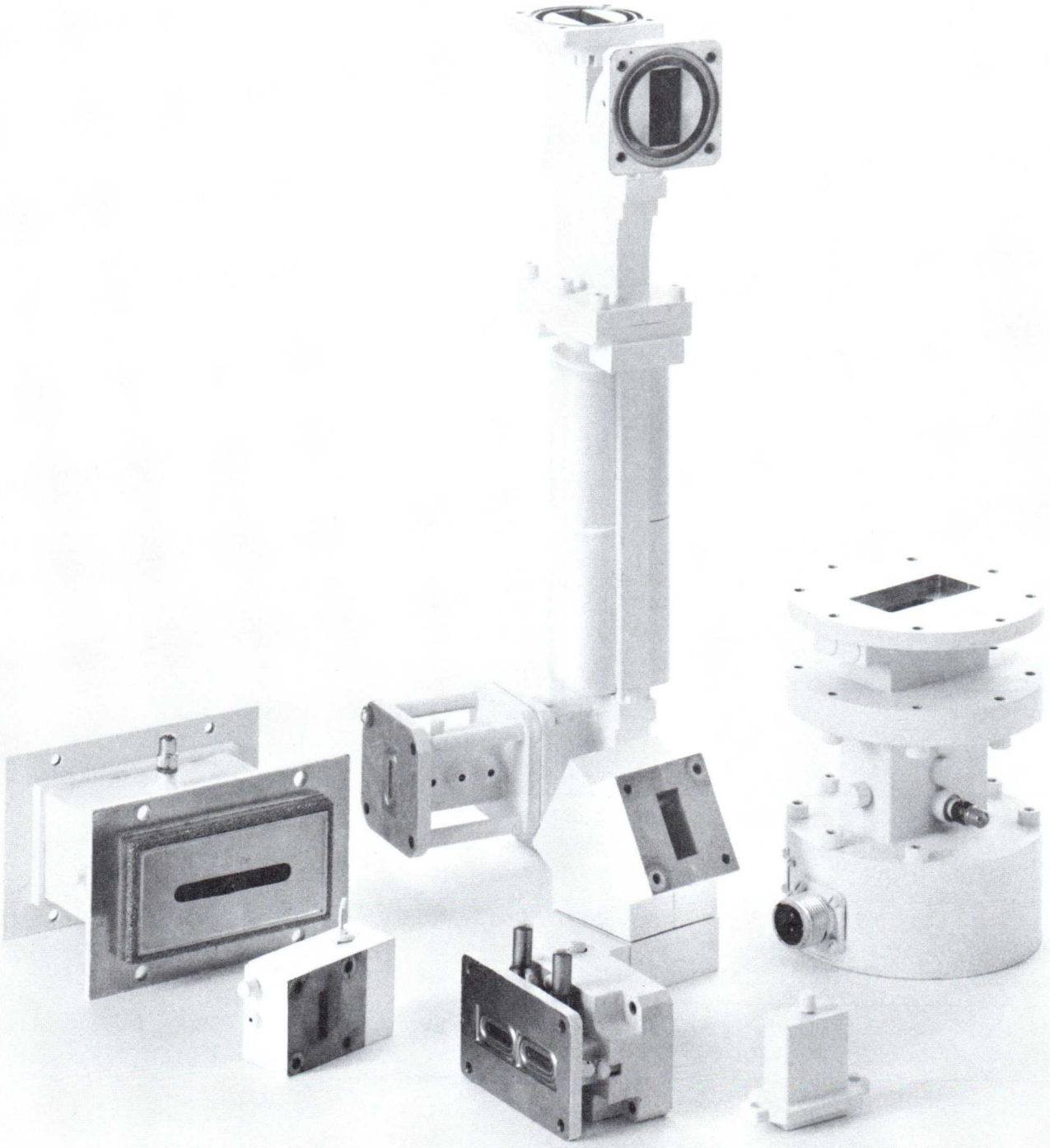
All units positive-pulsed except those indicated by an asterisk.

Model Number	Freq. GHz	Min. Peak Power w	Duty Cycle	Pulse Width μs	Peak Anode Volt. kV	Peak Anode Cur. A	Approx. Weight oz
MA-219F	8.5-9.0	3	CW	—	0.63	0.02	13
MA-219B	8.5-9.6	1	CW	—	0.47	0.02	13
MA-214H	9.0-9.5	3	CW	—	0.65	0.02	13
MA-214B	9.0-10.0	1	CW	—	0.47	0.02	13
MA-249	9.25-9.45	17	CW	—	1.00	0.05	13
MA-219A	8.5-9.6	10	0.005	1.0	0.53	0.15	13
MA-219C	8.5-9.6	20	0.01	1.0	0.56	0.30	13
MA-261	8.5-9.6	50	0.003	1.0	0.82	0.45	13
6229*	8.9-9.4	400	0.0005	0.25	4.00	0.5	24
6230*	8.9-9.4	900	0.003	1.0	4.30	0.8	24
7521*	8.9-9.4	800	0.001	0.2	4.30	0.9	24
MA-214C	9.0-10.0	8	0.005	1.0	0.54	0.15	13
MA-214D	9.0-10.0	16	0.005	1.0	0.57	0.30	13
MA-241	9.1-9.4	150	0.001	1.0	2.75	1.0	24
MA-218*	9.3-10.0	7kw	0.002	1.0	5.90	4.5	48
MA-232T	9.5-9.8	150	0.002	1.0	1.00	0.7	13
MA-260	16.0-16.5	1kw	0.001	0.5	3.00	1.6	18

*Negative-pulsed

DUPLEXERS AND DUPLEXER TUBES

Microwave Associates manufactures a wide variety of gas switching duplexers, duplexer tubes, and receiver protector tubes in many power levels and frequency ranges. Tubes are available to meet extra long life, wide temperature ranges, or extreme power handling requirements. In addition a solid background in ferrite design, combined with this gas device experience, has led to the development of highly efficient Ferri-gas duplexers. This unique combination of technologies provides duplexing devices for new, sophisticated, high power radar and communication systems.



Gas Tube Duplexers

Model Number	Freq. GHz	Input Power Peak Mw	Input Power Avg kW	Pulse Width μs	Low Level Loss[1] dB	High Level Loss dB	Recov. Time μs	Comments
MA-3212	0.4-0.45	5	400	2000	0.5	0.1	500	tunable
MA-3213	0.4-0.45	25	75	10	0.5	0.1	150	
MA-3228[2]	0.4-0.45	30	30	10	0.5	0.1	100	
MA-3235[2]	0.43-0.44	20	100	30	0.5	0.1	50	
MA-3200	0.51-0.69	4	20	8	0.8	0.1	100	
MA-3222	1.215-1.365	10	50	30	0.3	0.1	10	
MA-3206[2]	1.25-1.35	25	50	6	0.5	0.1	200	
MA-3218[2]	1.25-1.35	50	100	6	0.7	0.1	200	
MA-3244[2]	1.3-1.4	7	45	25	0.4	0.1	15	
MA-3230	2.5-3.6	6	30	10	0.2	0.1	20	any 200 MHz within frequency range
MA-3215	2.9-3.1	1	5	5	0.4	0.3	60	
MA-3246	2.925-3.260	2	30	150	0.2	0.5	50	
MA-3233	3.0-3.2	3	30	30	0.2	0.4	20	Ferri-gas
MA-3225	3.4-3.6	5	15	5	0.1	0.25	10	
MA-3226	5.25-5.75	5	5	1	0.1	0.25	10	
MA-3205A	5.25-5.75	7	3.5	6	0.3	0.1	25	
MA-3241	5.4-5.9	2	10	10	0.2	0.5	20	Ferri-gas
MA-3243[2]	5.4-5.9	5	10	10	0.6	0.2	30	
MA-3214[2]	8.5-9.6	500kw	500W	1	1.0	0.2	5	
MA-3232[2]	8.5-9.6	300kw	300W	0.3	1.0	0.2	2	
MA-3236[2]	8.5-9.6	350kw	350W	1	0.6	0.2	3	
MA-3208[2]	15.0-17.0	100kw	100W	1	1.2	0.3	5	
MA-3248[2]	15.5-17.5	125kw	150W	3	1.0	0.5	5	

NOTES: 1. At center frequency.
2. Duplexer circuit provides receiver protector.

DUPLEXERS AND DUPLEXER TUBES

Ferrite Duplexers

Each model includes a receiver protector.

Model Number	Freq. GHz	Input Power Peak Mw	Input Power Avg kW	Pulse Width μs	Low Level Loss dB	High Level Loss dB	Recov. Time μs
MA-136T	2.7-2.9	3	6	10	0.9	0.5	25
MA-136AT	2.7-2.9	3	15	10	1.0	0.6	25
MA-132T	5.4-5.9	5	5	6	0.8	0.3	20
MA-120T	8.5-9.6	250kw	250W	1	1.0	0.4	2
MA-121T	8.5-9.6	500kw	500W	1	1.2	0.3	2
MA-124T	8.5-9.6	1	1	1	1.2	0.3	2
MA-140BT	13.5-15.5	150kw	150W	1	1.2	0.4	5
MA-122AT	15.5-17.5	150kw	150W	1	1.2	0.3	2
MA-141AT	17.5-19.5	100kw	100W	1	1.2	0.4	5
MA-125T	34.7-35.0	50kw	50W	1	1.2	0.5	3

TR Tubes

Model Number	Freq. GHz	Life Test Input Power Peak kw	Life Test Input Power Avg W	Life Test hrs.	Max. Recov. Time μs	Max. Insert. Loss dB	Comments
MA-3170	0.4-0.45	15Mw	15kW	1000	100	0.2	replaceable cells and windows
MA-336 / 7166	1.22-1.365	2Mw	2kW	1000	20	0.5	replaces 6633
MA-378	2.665-2.965	750	600	500	15	0.5	replaces 1B58 — short length
MA-3147A	2.7-2.95	1Mw	1kW	1000	30	0.35	replaces 1B58
MA-3160	2.9-3.1	500	500	1000	15	0.3	
MA-351	8.49-9.61	200	200	500	3	0.9	replaces 1B63A — operation to +85°C
MA-352	8.49-9.61	200	200	500	3	0.9	short version of MA-351
MA-3176	8.5-9.6	75	75	1000	2	0.3	
MA-3178	8.5-9.6	75	75	1000	2	0.8	1000-hr. version of 1B63A
MA-3172	8.5-9.6	200	200	2000	5	0.7	+350°C version of 1B63A
MA-3174	8.5-9.6	200	200	2000	5	0.7	phase controlled operation to +350°C (6164 type)
6164	8.5-9.6	200	200	500	10	1.0	phase controlled
MA-3167	8.5-9.8	50	50	500	4	1.0	

ATR Tubes

Model Number	Freq. GHz	Life Test Input Power Peak Mw	Life Test Input Power Avg kW	Life Test hrs	Max. Recov. Time μs	Comments
MA-3117	0.425	2	200	1000	500	tunable 400 to 450 MHz
MA-339 / 6962	1.285	2	2	2000	—	half-height waveguide
MA-337A	1.30	2	4	2000	—	
MA-333	2.80	1	1.2	1000	50	replaces 6024
MA-345A	2.80	1	6	500	150	
MA-331A	2.95	1	2.4	1000	60	replaces 5792
MA-331B	3.05	1	2.4	1000	60	replaces 5793
6163	9.05	200kw	200W	500	8	
MA-363	9.05	250kw	250W	500	—	contact mount
MA-381	9.50	2.2kw	650W	150	0.1	high duty cycle — operation to +150°C

DUPLEXERS AND DUPLEXER TUBES

Pre-TR Tubes

Unless otherwise noted, all models are dual sidewall construction.

Model Number	Freq. GHz	Life Test Input Power Peak Mw	Life Test Input Power Avg kW	Life Test hrs	Max. Recov. Time μs	Max. Insert. Loss dB	Comments
MA-390	0.51-0.69	4	20	500	100	0.3	topwall
MA-3109	0.51-0.69	4	20	500	100	0.3	
MA-394	1.105-1.495	6	13	1000	50	0.4	topwall
MA-3168	1.2-1.3	30	30	1000	100	0.5	
MA-346 6605	1.25-1.35	2	2	1000	20	0.4	single
MA-348A 7152	1.25-1.35	3	6	2000	30	0.3	single
MA-355	1.25-1.35	2	2.4	1000	25	0.3	
MA-355A	1.25-1.35	6	12	1000	100	0.3	
MA-355C	1.25-1.35	25	50	500	200	0.3	
MA-385	2.65-2.95	1	5	500	30	0.4	
MA-3137	2.7-2.9	6	30	500	30	0.1	
MA-396A	5.25-5.75	7	3.5	1000	25	0.2	liquid cooled
MA-399	5.4-5.9	40kw	40W	500	12	0.8	
MA-373	8.5-9.6	200kw	200W	500	10	0.6	
MA-3129	8.5-9.6	1	1	2000	5	0.3	
MA-3138	8.5-9.6	500kw	500W	500	3	0.3	
MA-371A	15.5-17.5	150kw	150W	500	10	0.5	operation to +85°C

Dual TR Tubes

Unless otherwise noted all models are sidewall construction.

Model Number	Freq. GHz	Life Test Input Power Peak kw	Life Test Input Power Avg W	Life Test hrs	Max. Recov. Time μs	Max. Insert. Loss dB	Comments
MA-3120	1.25-1.35	40	2000	150	500	0.5	
MA-376 / 6636	2.665-2.965	750	600	500	15	0.5	
MA-391	2.7-2.9	500	500	500	15	0.5	
MA-398	2.7-2.9	1000	1000	500	15	0.5	topwall
MA-377	5.22-5.34	625	625	500	12	0.6	
MA-3713	5.25-5.75	1000	1000	1000	10	0.7	
MA-306B / 7379	8.49-9.61	500	500	500	5	1.1	
MA-338A / 7381	8.49-9.61	150	150	500	3	1.2	replaces 6334 — operation to +125°C
MA-3107	8.49-9.61	500	500	500	3	1.2	phase controlled — high temp. oper.
MA-3158B	8.55-8.65	100	100	1000	3	0.3	
MA-358	8.5-9.6	300	200	500	3	1.2	short length — operation to +85°C
MA-358AS	8.5-9.6	400	400	500	3	1.2	with shutter
MA-370AS	8.5-9.6	200	200	500	5	1.2	with shutter
MA-3135	8.5-9.6	150	150	700	3	0.5	phase controlled
MA-3158	8.5-9.6	80	80	1000	4	0.5	operation to +100°C
MA-3173	8.5-9.6	200	200	2000	5	1.0	operation to +350°C
MA-3706	8.6-9.6	125	125	2100	5	0.7	phase controlled
MA-324B	8.6-9.6	500	500	500	5	1.0	
MA-3162	8.6-9.6	500	500	1200	2	0.65	phase controlled operation to +100°C
MA-3180	8.6-9.6	500	500	1500	3	0.5	operation to +125°C
6560	15.0-17.0	100	150	500	10	1.0	
MA-375 / 7563	16.0-17.0	90	135	500	5	1.0	
MA-375B	16.0-17.0	100	150	500	5	1.0	phase controlled
MA-382A	16.0-17.0	4	4	500	—	0.5	dynamic and static phase controlled

DUPLEXERS AND DUPLEXER TUBES

Crystal Protector Tubes

Model Number	Freq. GHz	Life Test Input Power Peak kw	Avg W	Life Test hrs	Max. Recov. Time μs	Max. Insert. Loss dB	Comments
MA-395	1.105-1.495	10	10	1000	10	0.3	
MA-356	1.25-1.35	100	100	1000	6	0.5	
MA-378C	2.665-2.965	100	100	1000	15	0.5	
MA-350	2.7-2.9	50	50	500	15	0.5	
MA-354	2.9-3.1	500	500	500	15	0.5	replaces 5853
MA-354B	2.9-3.1	500	500	1000	15	0.5	
MA-328	3.1-3.5	50	50	500	15	0.5	
MA-3154	3.35-3.65	750	3500	1000	30	0.5	TWT protector
MA-369	3.4-3.7	50	50	500	15	0.5	
MA-3124S	5.25-5.75	350	425	1000	1	0.5	with shutter
MA-397A	5.25-5.75	10	10	500	7	0.3	phase controlled TWT protector
MA-379	5.395-5.905	10	10	500	7	0.6	operation to +85°C
MA-3148S	5.4-5.85	10	10	2500	5	0.3	paramp protector with shutter
MA-3161S	5.45-5.825	100	500	500	15	0.5	with shutter
MA-3108	8.49-9.61	20	20	500	3	0.7	phase controlled
MA-340B	8.49-9.61	10	10	500	2	0.7	operation to +85°C
MA-340D	8.5-9.6	10	10	500	2	0.6	
MA-340N	8.5-9.6	10	10	1000	2	0.5	available with phase control
MA-3175	8.5-9.6	10	10	2000	3	0.75	operation to +350°C
MA-3163	8.6-9.6	5	5	2000	2	0.7	phase controlled operation to +125°C
MA-349	8.7-8.9	200w	10	500	1.2	0.9	
MA-349B	8.7-8.9	125w	6	500	0.4	0.9	operation to +85°C
MA-361	9.275-9.375	10	10	500	4	0.8	operation to +85°C
MA-366	9.4-9.6	20w	4	250	0.25	0.6	operation to +85°C, high prr
MA-3101	13.5-15.5	10	10	500	5	0.7	operation to +85°C
MA-372	15.5-17.5	10	10	500	5	0.7	operation to +85°C
MA-362	16.0-17.0	5	5	500	5	0.7	operation to +125°C
MA-362C	16.0-17.0	10	10	500	3	0.5	phase controlled
MA-362D	16.0-17.0	5	10	500	1	0.6	phase controlled
MA-362E	16.0-17.0	10	5	500	5	0.7	wide temperature range
MA-362B	16.2-16.6	5	5	500	5	0.6	
MA-3102	17.5-19.5	10	10	500	5	0.7	operation to +85°C
MA-365B	32.9-33.5	6	3.6	500	3	0.8	operation to +75°C
MA-365A	34.5-35.2	6	3.6	500	3	0.8	operation to +75°C
MA-365	34.7-35.0	6	3.6	500	3	0.8	operation to +75°C
MA-365C	34.7-35.0	8	8	500	3	0.8	operation to +75°C

Low Loss, Long Life Crystal Protector Tubes

Model Number	Freq. GHz	Life Test Input Power Peak kw	Avg W	Life Test hrs	Max. Recov. Time μs	Max. Insert. Loss[1] dB	Noise Ratio	Comments
MA-3139	1.21-1.38	100	100	1000	5	0.4	1.3	
MA-356E	1.25-1.35	500	500	1000	20	0.4	1.3	
MA-3140	2.9-3.1	50	50	1000	5	0.4	1.3	
MA-3141	5.25-5.75	25	25	1000	5	0.4	1.3	
MA-3703	5.4-5.9	5	50	1000	20	0.4	1.1	
MA-3153S	5.4-5.9	50	350	1000	20	0.5	1.3	with shutter
MA-3142	8.5-9.6	10	10	1000	2	0.5	1.3	
MA-3143	8.5-9.6	10	10	1000	2	0.4	1.3	
MA-3157	8.5-9.6	20	20	1000	3	0.5	1.3	
MA-3157B	8.5-9.6	30	30	500	3	0.2*	1.3	
MA-3705	8.6-9.6	20	20	2100	5	0.7	1.3	phase controlled
MA-3189	9.0-10.0	25	20	1000	3	0.4	1.3	
MA-3144	15.5-17.5	5	5	1000	2	0.5	1.3	

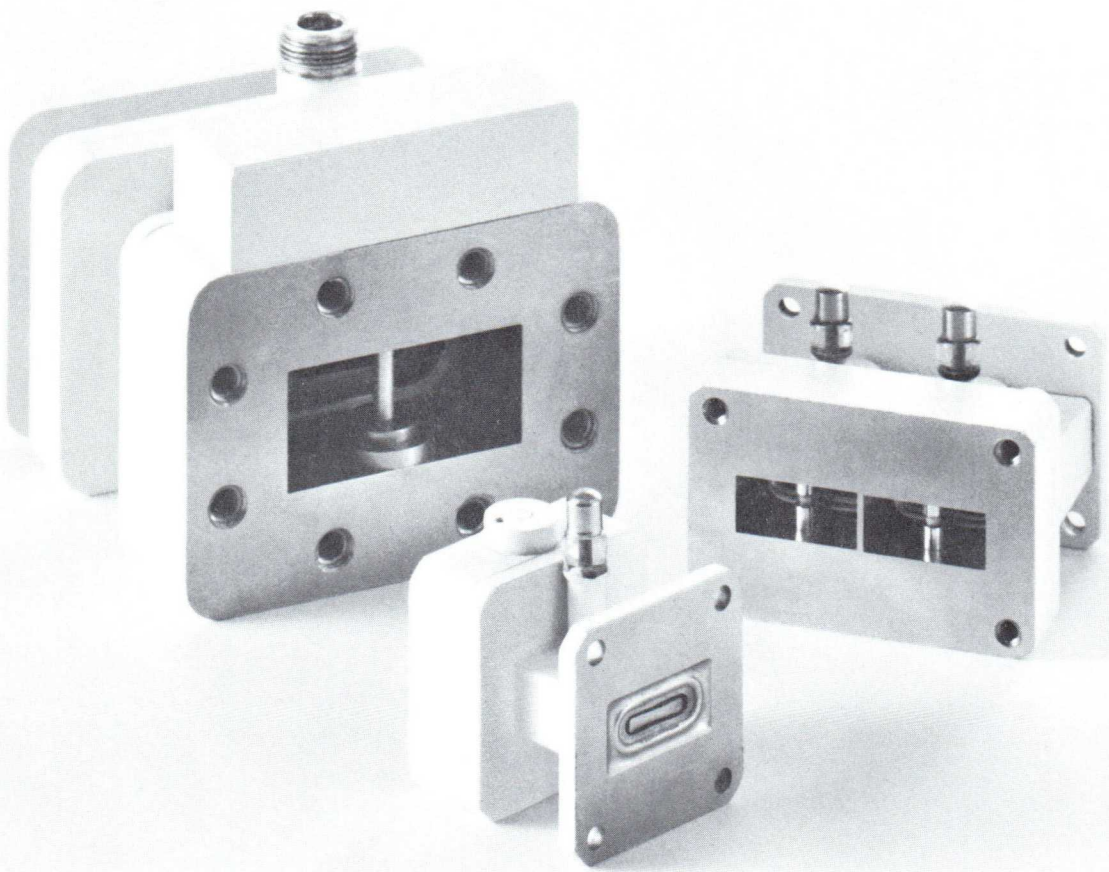
NOTE: 1. Insertion loss measured with ignitor on for all types except those asterisked.

Low Loss, Long Life Parametric Amplifier Protectors

Model Number	Freq. GHz	Life Test Input Power Peak kw	Avg W	Life Test hrs	Max. Recov. Time μs	Max. Insert. Loss dB	Noise Ratio	Comments
MA-3114	0.4-0.45	100	10	1000	50	0.5	1.05	waveguide type
MA-3171	0.4-0.45	30	30	1000	25	0.5	1.05	includes solid-state limiter and low pass filter
MA-3146	1.25-1.35	100	100	2500	7	0.4	1.02	
MA-3192	1.25-1.35	1	2	2000	30	0.3	1.05	
MA-356H	1.35-1.45	500	500	1000	25	0.5	1.05	
MA-3147	2.9-3.1	500	500	2500	7	0.35	1.02	
MA-3159	2.9-3.1	50	50	2500	6	0.35	1.05	
MA-3148	5.1-5.75	25	25	2500	5	0.35	1.02	

TR-LIMITERS

TR-limiters combine in a single package a gas TR tube and a solid-state diode limiter. These unique units can perform a duplexing function at the same time providing positive protection from spike leakage energy for standard crystal receivers and tunnel diode amplifiers. In many cases these units are exact retrofits for earlier model TR tubes.



Single Tubes

Model Number	Freq. GHz	Input Power Peak kw	Input Power Avg. W	Max. Low Level Loss[1] dB	Recov. Time μs	Spike Leak. ergs	Comments
MA-3816L	1.25-1.35	100	1000	0.5	8	0.05	
MA-3811S	2.9-3.2	50	50	0.7	5	0.05	
MA-3815S	2.9-3.2	500	500	0.8	15	0.05	
MA-3800	5.4-5.9	100	100	0.8	2	0.05	
MA-3806	5.4-5.9	10	100	0.7	3	0.05	high duty cycle
MA-3810C	5.4-5.9	25	25	0.6	4	0.05	
MA-3805	8.5-9.6	50	200	1.0	3	0.05	high duty cycle
MA-3810X	8.5-9.6	10	10	0.8	2	0.05	
MA-3820X	8.5-9.6	35	35	1.2	2	0.02	ultra-low spike
MA-3817X	8.6-9.6	20	20	0.8	3	0.05	phase matched to MA-3818X
MA-3803	8.91-9.01	10	10	0.7	1.5	0.05	
MA-3804	9.2-9.4	250	250	1.0	2	0.05	for branched duplexer
MA-3819X	9.2-9.5	35	35	1.0	2	0.02	ultra-low spike
MA-3810Z	16.0-17.0	10	10	1.0	2	0.05	short length — 0.807 inches
MA-3811Z	16.0-17.0	10	10	0.9	2	0.05	0.950-inch length
MA-3802	16.4-16.6	10	10	1.0	2	0.05	
MA-3801	32.9-36.0	10	10	1.5	2	0.02	TR-switch

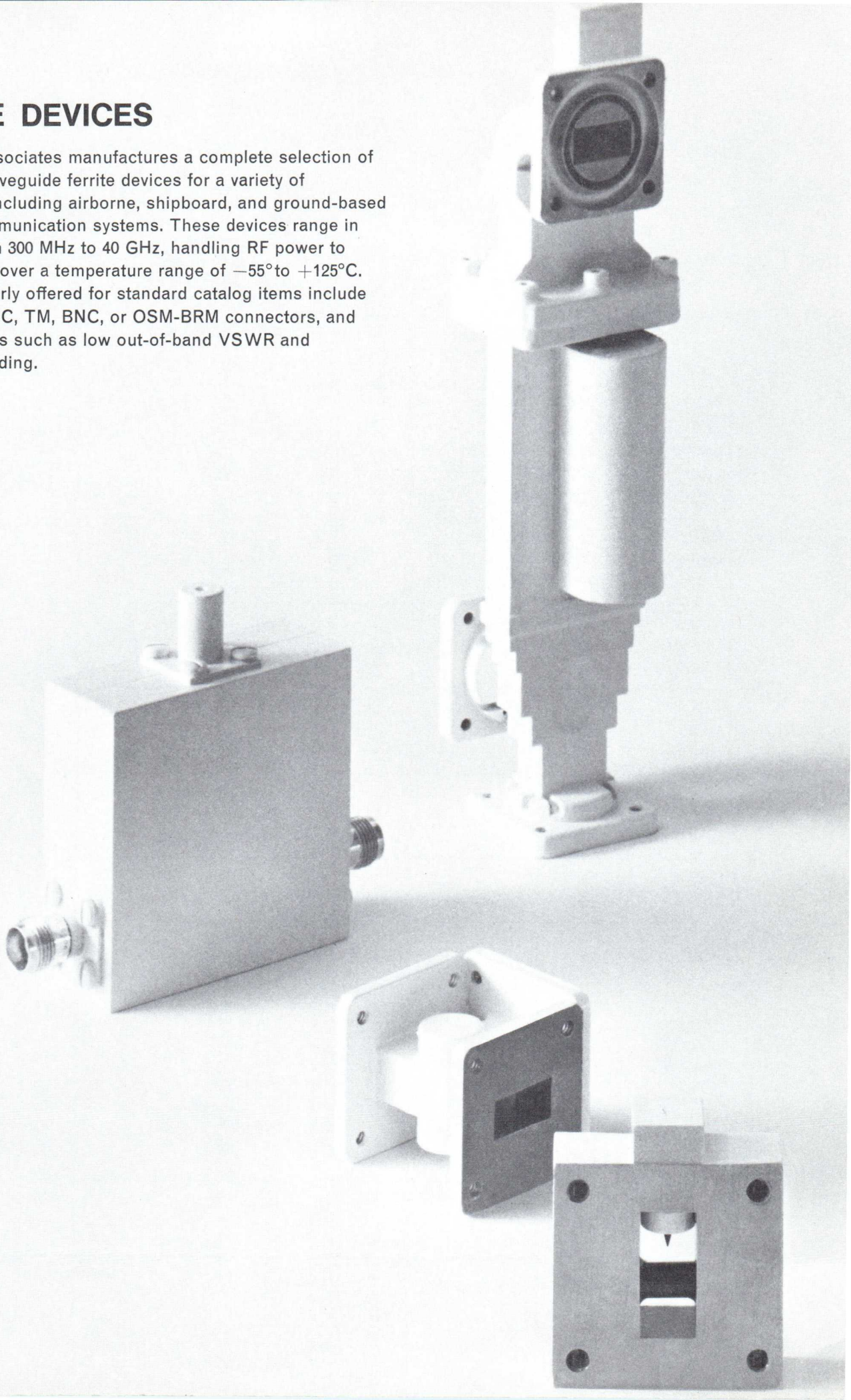
Dual Tubes

Model Number	Freq. GHz	Input Power Peak kw	Input Power Avg. W	Max. Low Level Loss[1] dB	Recov. Time μs	Spike Leak. ergs	Comments
MA-3812X	8.5-9.6	150	150	1.0	3	0.05	
MA-3813X	8.5-9.6	250	250	1.2	5	0.05	
MA-3818X	8.6-9.6	125	125	0.8	3	0.05	phase matched to MA-3817X
MA-3813Z	16.0-17.0	40	40	1.0	3	0.05	
MA-3802Z	16.4-16.6	50	50	1.0	2	0.05	

NOTE: 1. Typical loss 0.2 dB less than specified.

FERRITE DEVICES

Microwave Associates manufactures a complete selection of coaxial and waveguide ferrite devices for a variety of applications, including airborne, shipboard, and ground-based radar and communication systems. These devices range in frequency from 300 MHz to 40 GHz, handling RF power to 20 megawatts, over a temperature range of −55°to +125°C. Options regularly offered for standard catalog items include a choice of TNC, TM, BNC, or OSM-BRM connectors, and special features such as low out-of-band VSWR and magnetic shielding.



3-Port Coaxial Tee Isolators and Circulators

All units rated at 5W average power.

Isolator Model Number	Circulator Model Number	Freq. GHz	Max. Insert. Loss dB	Min. Isol. dB	Max. VSWR
MA-8A90	MA-8B90	.350-.365	0.50	17	1.30
MA-8A91	MA-8B91	.400-.450	0.50	17	1.30
MA-8A92	MA-8B92	.500-.550	0.50	17	1.30
MA-8A93	MA-8B93	.600-.650	0.50	17	1.30
MA-8A94	MA-8B94	.800-.850	0.50	17	1.30
MA-8A01	MA-8B01	.875-.975	0.50	15	1.30
MA-8A02	MA-8B02	.950-1.050	0.50	15	1.30
MA-8A03	MA-8B03	1.1-1.2	0.50	17	1.25
MA-8A04	MA-8B04	1.25-1.35	0.50	17	1.25
MA-8A05	MA-8B05	1.435-1.535	0.45	17	1.25
MA-8A06	MA-8B06	1.66-1.84	0.40	20	1.20
MA-8A07	MA-8B07	1.9-2.1	0.30	20	1.20
MA-8A08	MA-8B08	2.175-2.325	0.30	20	1.20
MA-8A09	MA-8B09	2.4-2.7	0.30	20	1.20
MA-8A10	MA-8B10	2.7-3.0	0.30	20	1.20
MA-8A11	MA-8B11	3.0-3.3	0.30	20	1.20
MA-8A12	MA-8B12	3.4-4.3	0.30	20	1.20
MA-8A13	MA-8B13	4.4-5.0	0.30	20	1.20
MA-8A14	MA-8B14	4.8-5.4	0.30	20	1.20
MA-8A15	MA-8B15	5.0-5.6	0.30	20	1.20
MA-8A16	MA-8B16	5.4-5.9	0.30	20	1.20
MA-8A17	MA-8B17	5.925-6.425	0.30	20	1.20
MA-8A18	MA-8B18	6.425-7.125	0.30	20	1.20
MA-8A19	MA-8B19	7.1-7.7	0.30	20	1.20
MA-8A20	MA-8B20	7.7-8.4	0.30	20	1.20
MA-8A21	MA-8B21	8.5-9.6	0.30	20	1.20
MA-8A22	MA-8B22	9.5-10.5	0.30	20	1.20
MA-8A41	MA-8B41	1.2-2.0[1]	0.35	20	1.20
MA-8A42	MA-8B42	2.0-2.4[1]	0.35	20	1.20
MA-8A43	MA-8B43	2.4-4.0[1]	0.35	20	1.20
MA-8A44	MA-8B44	4.0-8.0[1]	0.35	20	1.20
MA-8A45	MA-8B45	8.0-12.0[1]	0.35	20	1.20
MA-8A61	MA-8B61	1.1-1.4	0.40	20	1.20
MA-8A62	MA-8B62	1.4-1.7	0.40	20	1.20
MA-8A63	MA-8B63	1.7-2.3	0.40	20	1.20
MA-8A64	MA-8B64	2.0-3.0	0.40	20	1.20
MA-8A65	MA-8B65	2.5-3.5	0.40	20	1.20
MA-8A66	MA-8B66	3.0-4.5	0.40	20	1.20
MA-8A67	MA-8B67	4.5-6.0	0.40	20	1.20
MA-8A68	MA-8B68	5.0-7.0	0.40	20	1.20
MA-8A69	MA-8B69	6.0-8.0	0.40	20	1.20
MA-8A70	MA-8B70	7.0-9.0	0.40	20	1.20
MA-8A71	MA-8B71	7.0-10.0	0.40	20	1.20
MA-8A72	MA-8B72	8.0-11.0	0.40	20	1.20
MA-8A73	MA-8B73	8.5-10.5	0.40	20	1.20
MA-8A74	MA-8B74	9.0-11.0	0.40	20	1.20
MA-8A75	MA-8B75	8.2-12.0	0.40	20	1.20
MA-8A81	MA-8B81	1-2	0.50	17	1.30
MA-8A82	MA-8B82	2-4	0.50	17	1.30
MA-8A83	MA-8B83	4-8	0.50	17	1.30

NOTE: 1. All units 20% bandwidth — specify center frequency.

4-Port and 5-Port Standard Coaxial Circulators

All units rated at 5W average power.

4-Port Model Number	5-Port Model Number	Freq. GHz	Max. Insert. Loss 4-Port 1-2 dB	4-Port 2-3 dB	5-Port 1-2 or 2-3 dB	Minimum Isolation 4-Port 2-1 dB	4-Port 3-2 dB	5-Port 2-1 dB	5-Port 3-2 dB	Max. VSWR
MA-8C01	MA-8D01	875-975 MHz	0.50	0.80	0.80	15	30	30	30	1.30
MA-8C02	MA-8D02	950-1050 MHz	0.50	0.80	0.80	15	30	30	30	1.30
MA-8C03	MA-8D03	1.1-1.2	0.45	0.70	0.70	17	35	35	35	1.25
MA-8C04	MA-8D04	1.25-1.35	0.45	0.70	0.70	17	35	35	35	1.25
MA-8C05	MA-8D05	1.435-1.535	0.40	0.60	0.60	17	35	35	35	1.25
MA-8C06	MA-8D06	1.66-1.84	0.30	0.50	0.50	20	40	40	40	1.20
MA-8C07	MA-8D07	1.9-2.1	0.30	0.50	0.50	20	40	40	40	1.20
MA-8C08	MA-8D08	2.175-2.325	0.30	0.50	0.50	20	40	40	40	1.20
MA-8C09	MA-8D09	2.4-2.7	0.30	0.50	0.50	20	40	40	40	1.20
MA-8C10	MA-8D10	2.7-3.0	0.30	0.50	0.50	20	40	40	40	1.20
MA-8C11	MA-8D11	3.0-3.3	0.30	0.50	0.50	20	40	40	40	1.20
MA-8C12	MA-8D12	3.4-4.3	0.30	0.50	0.50	20	40	40	40	1.20
MA-8C13	MA-8D13	4.4-5.0	0.30	0.50	0.50	20	40	40	40	1.20
MA-8C14	MA-8D14	4.8-5.4	0.30	0.50	0.50	20	40	40	40	1.20
MA-8C15	MA-8D15	5.0-5.6	0.30	0.50	0.50	20	40	40	40	1.20
MA-8C16	MA-8D16	5.4-5.9	0.30	0.50	0.50	20	40	40	40	1.20
MA-8C17	MA-8D17	5.9-6.4	0.30	0.50	0.50	20	40	40	40	1.20
MA-8C18	MA-8D18	6.4-7.1	0.30	0.50	0.50	20	40	40	40	1.20
MA-8C19	MA-8D19	7.1-7.7	0.30	0.50	0.50	20	40	40	40	1.20
MA-8C20	MA-8D20	7.7-8.4	0.30	0.50	0.50	20	40	40	40	1.20
MA-8C21	MA-8D21	8.5-9.6	0.30	0.50	0.50	20	40	40	40	1.20
MA-8C22	MA-8D22	9.5-10.5	0.30	0.50	0.50	20	40	40	40	1.20

Waveguide Junction Circulators

Model Number	Freq. GHz	Max. Operating Power Peak kw	Max. Operating Power Average W	Max. Insert. Loss dB	Minimum Isolation 1-3 dB	Minimum Isolation 2-1 dB	Max. Input VSWR	W.G. Size WR-	Approx. Length in.	Temp. Range °C	Approx. Weight lbs.
MA-8L01	4.8-5.7	1	100	0.4	20	20	1.20	187	—	−20 to +70	3.0
MA-8L02	5.4-5.8	1	100	0.5	20	20	1.20	187	5.00	−20 to +70	5.0
MA-8L11	5.0-6.0	1	100	0.4	20	20	1.20	137	—	−40 to +100	2.0
MA-8L12	5.9-7.1	1	100	0.4	20	20	1.20	137	—	−40 to +100	2.0
MA-8L21	7.7-8.4	CW	2	0.3	25	25	1.15	112	2.62	−40 to +40	1.2
MA-8K31	8.4-8.6	1	200	0.3	20	20	1.20	90	1.75	−40 to +100	1.0
MA-8L31	8.5-9.6	1	200	0.4	20	20	1.20	90	—	−40 to +100	0.6
MA-8L32	8.5-9.6	10	10	0.4	21	21	1.15	90	—	−55 to +85	1.0
MA-8K32	9.2-9.4	10	20	0.5	20	40	1.15	90	2.25	−40 to +100	1.2
MA-8L33	10.0-10.6	1	200	0.4	20	20	1.20	90	—	−40 to +100	0.6
MA-8M31	9.7-9.9	1	200	0.25/0.50	20	40	1.20	90	4.50	—	—
MA-8N31	8.5-9.6	1	200	0.25/0.50	25	45	1.15	90	—	—	1.2
MA-8L34	9.46-9.56	CW	10	0.5	20	45	1.20	90	3.12	0 to +100	—
MA-8M61	13.295-13.355	100w	25	0.4	20	20	1.15	62	3.25	−55 to +85	0.3
MA-8L61	16.0-17.0	1	50	0.4	20	20	1.20	62	—	−40 to +100	1.0

Miniature Waveguide Isolators

Model Number	Freq. GHz	Max. Operating Power Peak kw	Max. Operating Power Average W	Max. Insert. Loss dB	Min. Isol. dB	Max. Input VSWR	W.G. Size WR-	Approx. Length in.	Temp. Range °C	Approx. Weight oz.
MA-8R01	7.0-7.3	1	1	0.5	20	1.30	112	0.62	−40 to +85	3
MA-8R02	7.2-7.5	1	1	0.5	20	1.30	112	0.62	−40 to +85	3
MA-8R21	9.25-9.45	1	1	0.3	20	1.20	90	0.50	−40 to +85	2
MA-8R22	9.3-9.5	1	1	0.3	20	1.20	90	0.50	−40 to +85	2
MA-8R23	9.34-9.53	1	1	0.3	20	1.30	90	0.62	−40 to +85	2
MA-8R24	9.4-9.6	1	1	0.3	20	1.20	90	0.75	−40 to +85	3
MA-8R25	9.9-10.1	1	1	0.3	25	1.20	90	0.75	−40 to +85	2
MA-8R26	10.5-10.6	1	1	0.4	30	1.15	90	0.75	−40 to +85	2
MA-8R27	8.2-11.0	10	10	0.4	30	1.15	90	1.50	−40 to +85	—
MA-8R41	13.305-13.325	1	10	0.35	35	1.15	62	0.39	−40 to +85	1.5
MA-8R42	13.5-13.7	50w	10	0.3	25	1.20	62	0.39	−40 to +85	1.5
MA-8R43	14.9-15.1	1	10	0.3	20	1.20	62	0.39	−40 to +85	1.5
MA-8R44	13.27-13.405	CW	10	0.40	25	1.15	62	0.50	−40 to +85	1.5
MA-8R45	13.27-13.405	CW	10	1.5	90	1.15	62	3.50	−40 to +85	8.7
MA-8R46	17.95-18.05	15	3	0.75	45	1.15	62	1.50	−40 to +85	3.0
MA-8R61	24.9-25.1	1	1	0.5	25	1.20	42	0.50	—	1.0
MA-8R62	22.2-22.3	1	1	0.3	25	1.15	42	0.40	—	1.0

FERRITE DEVICES

Differential Phase Shift Circulators

Model Number	Freq. GHz	Max. Operating Power Peak kw	Max. Operating Power Average W	Max. Insert. Loss dB	Minimum Isolation 1-3 dB	Minimum Isolation 2-1 dB	Max. Input VSWR	W.G. Size WR-	Approx. Length in.	Temp. Range °C	Approx. Weight lbs.
MA-8H01	2.7-2.9	3,000	15,000	0.6	25	20	1.15	284	—	0 to +65	70.0
MA-8H02	2.7-2.9	5,000	4,000	0.5	25	20	1.20	284	24.00	—	35.0
MA-8H03	2.9-3.1	3,000	15,000	0.5	25	20	1.15	284	—	0 to +60	70.0
MA-8H04	2.9-3.1	11,000	55,000	0.4	25	16	1.15	284	54.00	0 to +45	130.0
MA-8H05	3.4-3.6	3,000	15,000	0.5	25	20	1.15	284	—	0 to +65	70.0
MA-8H21	4.5-5.0	CW	1,000	1.0	18	18	1.15	187	23.00	—	15.0
MA-8H22	5.25-5.65	300	300	0.5	25	20	1.15	187	22.00	−40 to +100	9.0
MA-8H23	5.25-5.65	300	300	0.5	25	20	1.15	187	22.00	−40 to +100	30.0
MA-8H24	5.4-5.9	300	300	0.5	25	20	1.15	187	22.00	—	12.0
MA-8H25	5.4-5.9	5,000	5,000	0.4	25	17	1.15	187	25.00	—	45.0
MA-8H41	7.5-8.5	CW	1,500	0.3	25	20	1.15	112	14.50	−20 to +50	8.0
MA-8H45	8.0-8.5	CW	10,000	0.3	25	20	1.15	112	12.50	—	10.0
MA-8H42	8.5-9.6	500	500	0.3	25	20	1.15	112	12.50	−50 to +85	4.5
MA-8H43	8.5-9.6	300	120	0.5	25	20	1.20	112	12.50	−54 to +68	2.0
MA-8H44	8.5-9.6	1,000	1,000	0.3	25	20	1.15	112	12.50	−50 to +85	4.5
MA-8H60	8.5-9.6	10	10	0.3	25	20	1.15	90	8.50	—	1.3
MA-8H61	8.5-9.6	250	250	0.4	25	20	1.15	90	—	−50 to +85	1.3
MA-8H62	8.5-9.6	250	250	0.4	25	20	1.15	90	—	−50 to +85	1.3
MA-8H63	10.25-10.50	CW	8,000	0.4	—	15	1.20	90	11.00	−29 to +66	15.0
MA-8H81	13.5-15.5	170	170	0.4	25	20	1.15	62	—	−50 to +125	1.3
MA-8H82	15.4-15.7	150	150	0.4	20	20	1.15	62	—	0 to +150°F	—
MA-8H83	15.5-17.5	150	150	0.4	25	20	1.15	62	7.12	−50 to +125	1.3
MA-8H84	16.2-16.6	400	400	0.4	20	20	1.15	62	9.30	—	1.5
MA-8H91	26.3-27.1	CW	200	1.0	20	20	1.25	28	5.87	—	1.5
MA-8H93	33.1-34.5	100	50	0.5	20	20	1.20	28	4.87	—	1.5
MA-8H94	34.5-36.5	50	50	0.5	25	20	1.20	28	—	—	1.5

Waveguide Absorption Isolators

Model Number	Freq. GHz	Max. Operating Power Peak kw	Max. Operating Power Average W	Max. Insert. Loss dB	Min. Isol. dB	Max. Input VSWR	W.G. Size WR-	Approx. Length in.	Temp. Range °C	Approx. Weight lbs.
MA-8P11	2.4-2.8	CW	800	0.5	10	1.15	284	11.00	—	36.0
MA-8P12	2.7-2.9	1,000	1,000	0.4	10	1.15	284	4.75	−40 to +65	18.0
MA-8P13	2.7-2.9	5,000	4,000	0.4	10	1.10	284	12.00	—	50.0
MA-8P14	2.9-3.1	3,000	15,000	0.4	10	1.10	284	12.02	—	50.0
MA-8P15	3.4-3.6	3,000	10,000	0.4	10	1.10	284	—	—	50.0
MA-8Q11	2.6-3.95	20	20	1.0	20	1.15	284	14.00	−55 to +100	10.0
MA-8Q31	3.7-4.2	10	10	1.0	40	1.15	229	9.00	—	4.0
MA-8P41	5.2-5.4	1,000	1,000	0.4	10	1.10	187	6.75	−50 to +100	20.0
MA-8P42	5.25-5.75	5,000	2,500	0.5	16	1.05	187	16.75	—	55.0
MA-8P43	5.4-5.9	1,000	1,000	0.4	10	1.10	187	6.75	−50 to +100	20.0
MA-8Q41	3.95-5.85	20	20	1.0	20	1.15	187	10.58	−55 to +100	6.0
MA-8Q42	5.1-5.9	20	20	0.8	25	1.15	187	8.37	−55 to +100	4.0
MA-8Q51	5.85-8.2	20	20	1.0	20	1.15	137	9.50	−55 to +100	5.0
MA-8Q52	6.175-6.425	10	10	0.6	36	1.06	137	—	−29 to +54	2.0
MA-8Q53	7.0-7.5	1	10	0.5	25	1.06	137	4.50	—	—
MA-8P61	8.5-9.6	300	300	0.5	10	1.10	112	2.50	−55 to +100	2.5
MA-8P62	8.5-9.6	250	250	0.4	20	1.15	112	4.50	−55 to +100	3.0
MA-8P63	8.5-9.6	500	500	0.4	10	1.10	112	4.50	−55 to +100	3.0
MA-8Q61	6.9-7.5	10	10	0.8	30	1.06	112	—	—	4.0
MA-8Q62	7.05-10.0	20	20	1.0	30	1.15	112	6.50	−55 to +100	4.0
MA-8Q63	7.1-8.4	1	1	1.0	60	1.15	112	—	−40 to +100	3.5
MA-8Q64	8.5-9.6	10	10	1.0	40	1.15	112	—	—	2.0
MA-8P71	8.5-9.6	125	125	0.5	10	1.10	90	—	—	1.0
MA-8P72	8.5-9.6	250	250	0.5	20	1.15	90	3.25	−55 to +100	2.5
MA-8Q71	8.2-12.4	10	10	1.0	30	1.15	90	6.00	−55 to +100	4.0
MA-8Q72	8.5-9.6	10	10	1.2	40	1.15	90	3.25	−55 to +100	2.0
MA-8Q73	11.0-12.0	10	10	1.2	40	1.15	90	2.75	−55 to +100	2.0
MA-8P81	15.4-15.7	150	150	0.3	20	1.20	62	2.50	—	—
MA-8P82	16.0-17.0	150	150	0.5	20	1.10	62	2.50	−55 to +100	2.5
MA-8Q81	12.4-18.0	10	10	1.0	20	1.20	62	4.50	−55 to +100	6.0
MA-8Q82	16.0-17.0	10	10	1.0	30	1.15	62	2.50	−55 to +100	1.5
MA-8Q91	18.0-26.0	10	10	1.0	22	1.15	42	4.00	—	6.0
MA-8P91	28.0-28.5	CW	10	1.0	20	1.15	28	2.22	—	6.0
MA-8P92	32.0-36.0	20	20	1.5	20	1.15	28	2.22	—	3.0
MA-8P93	34.0-36.0	50	50	1.0	20	1.25	28	2.22	—	—

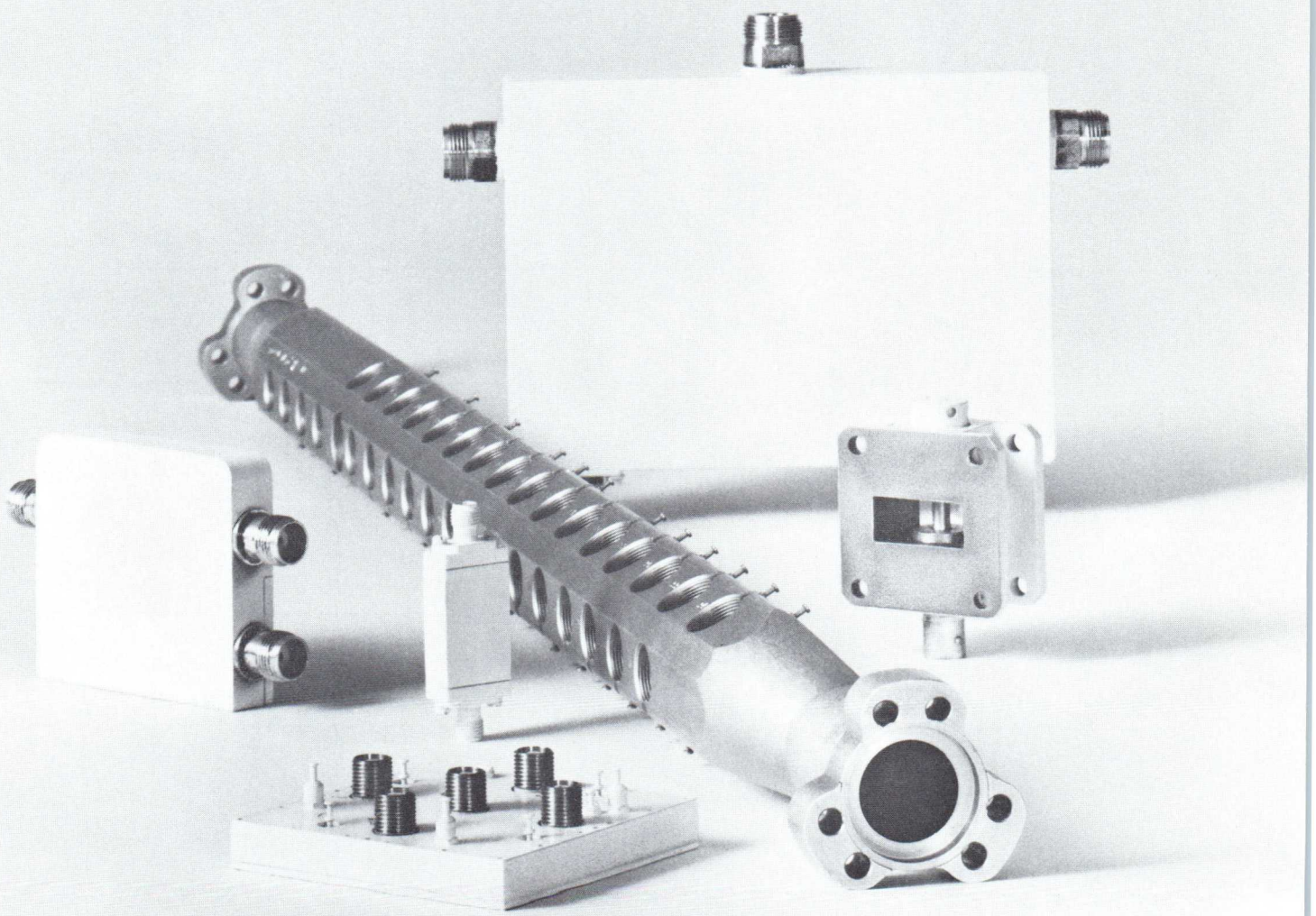
SOLID-STATE CONTROL DEVICES

Microwave Associates is the leading manufacturer of solid-state control devices for control RF signals either in level, direction or phase shift. Solid-state control devices are used widely in ground based, shipboard, and airborne radar (including IFF and ECM), telemetry, and communication systems. Typical functions include pulse shaping, attenuating, AGC, duplexing, and receiver protection.

The diode switch, with its high reliability and performance, is a well established building block of system design. Along with faster switching speed than their mechanical counterparts, diode switches offer impressively high isolation, low insertion loss, and high power handling.

Our achievements in RF power limiter and duplexers provide the system designer with greater flexibility and protection for all existing receiver systems which incorporate gas TR tubes, ferrite circulators and other duplexing and diplexing networks.

High and low power microwave phase shifting can be accomplished by semiconductor techniques. Low drive powers and small variations of phase accuracy and stability with temperature are some major advantages. Continuous and binary step types with microsecond switching speed are available for large phased array antenna systems and other receiver and transmitter applications.



Coaxial Diode Switches

Digit following second hyphen in model number denotes number of throws, e.g., -2 is double throw.

Model Number	Freq. GHz	Switch. Time ns	Max. Power Peak (.001 duty cycle) w	Max. Power CW W	Max. Insert. Loss dB	Min. Isol. dB	Bias Low Loss V	Bias Low Loss mA	Isolation V	Isolation μA
MA-8304-1W1N[5]	10-100 MHz	1000	50	0.1	1.0	40	+2	100	−50	10
MA-8301-10W1M	25-75 MHz	150	—	0.05	0.75	40	+1	10	−10	10mA
MA-8304-2L15N	50-1500 MHz	10	10	0.3	1.5	20	+2	100	−50	10
MA-8304-1P7N[5]	0.10-0.25	100	50	0.1	1.0	40	+2	100	−50	10
MA-8304-1P12N[5]	0.20-0.50	50	50	0.1	1.0	40	+2	100	−50	10
MA-8304-1P16N	0.215-0.26	200	—	25	0.5	30	+2	100	−50	10
MA-8304-2P16N	0.215-0.26	200	—	50	0.75	35	+2	100	−50	10
MA-8304-1P17N	0.40-0.45	200	—	25	0.5	30	+2	100	−50	10
MA-8304-2P17N	0.40-0.45	200	—	50	0.75	35	+2	100	−50	10
MA-8304-1T2N[5]	0.5-1.0	10	50	0.1	1.0	40	+2	100	−50	10
MA-8304-1L4N[5]	1.0-2.0	10	50	0.1	1.5	35	+2	100	−50	10
MA-8306-1L(*)N[1]	1.0-2.0	200	1000	5	1.0	30	+2	100	−50	10
MA-8306-2L13N	1.005-1.055	200	5000	10	1.0	30	+2	100	−50	10
MA-8305-2L15S	1.03-1.09	200	100	1	0.75	25	+2	100	−50	10
MA-8306-1L5N	1.03-1.09	200	1000	5	1.0	30	+2	100	−50	10
MA-8306-2L12N	1.03-1.09	200	2000	10	1.0	30	+2	100	−50	10
MA-8306-2L16N	1.03-1.09	200	5000	10	1.0	30	+2	100	−50	10
MA-8306-2L21N	1.03-1.09	200	5000	10	0.7	25	+2	100	−50	10
MA-8304-1L10N	1.2-1.4	200	—	25	0.5	30	+2	100	−50	10
MA-8304-2L10N	1.2-1.4	200	—	50	0.75	30	+2	100	−50	10
MA-8302-1S6N	1.0-4.0	10	—	0.5	1.0	40	−25	0.01	+2	30mA
MA-8306-1S6N	1.0-4.0	200	1000	1.0	1.0	40	−75	0.01	+2	200mA
MA-8304-1S2N[5]	2.0-4.0	10	50	0.1	1.5	30	+2	100	−50	10
MA-8306-1S(*)N[2]	2.0-4.0	200	1000	5.0	1.0	30	+2	100	−50	10
MA-8306-1S5N	2.9-3.1	200	1000	5.0	1.0	30	+2	100	−50	10
MA-8302-1C6N	4.0-8.0	10	—	0.5	1.0	35	+25	0.01	−2	30mA
MA-8306-1C6N	4.0-8.0	200	1000	1.0	1.0	35	+75	0.01	−2	200mA
MA-8304-1C9T	4.5-4.7	10	25	1.0	2.0	30	−50	0.10	+2	75
MA-8304-1C1N	5.4-5.9	50	50	1.0	1.0	30	+2	75	−50	10
MA-8304-2C1N	5.4-5.9	50	50	1.0	1.5	30	+2	75	−50	10
MA-8306-4C4M	5.715-5.815	300	6000	6.0	1.2	23	−2	75	+100	10
MA-8302-1X6N	7.0-11.0	10	—	0.5	1.5	30	+25	0.01	−2	30
MA-8306-1X6N	7.0-11.0	200	1000	1.0	1.0	30	+75	0.01	−2	200
MA-8304-2X2S[4]	7.0-12.0	10	25	2.0	1.0	23	+25	0.01	−2	25mA
MA-8306-1X1S[4]	7.0-12.0	200	1000	5.0	1.0	20	+75	0.01	−2	50mA
MA-8306-2X1S[3]	7.0-12.0	200	1000	5.0	1.0	23	+75	0.01	−2	50mA
MA-8304-1X1S[4]	7.0-12.0	10	25	2.0	1.0	20	+25	0.01	−2	50mA

NOTES: 1. Any 10% within specified range. 3. Any 300 MHz within specified range. 5. Also available in SPDT configuration.
2. Any 5% within specified range. 4. Any 500 MHz within specified range. *Specify center freq.

SOLID-STATE CONTROL DEVICES

Waveguide Diode Switches

Digit following second hyphen in model number denotes number of throws, e.g., -2 is double throw.

Model Number	Freq. GHz	Switch. Time ns	Max. Power Peak (.001 duty cycle) w	CW W	Max. Insert. Loss dB	Min. Isol. dB	Bias Low Loss V	Bias Low Loss mA	Isolation V	Isolation mA
MA-8321-1C2	5.4-5.9	200	500	1.0	1.0	20	+2	50	−50	10μA
MA-8319-1X(*)[3]	7.2-10.0	5	5	0.2	0.75	25	−35	0.01	+2	25
MA-8319-2X(*)[3]	7.2-10.0	5	5	0.2	1.0	28	−35	0.01	+2	25
MA-8321-1X(*)[3]	7.2-10.0	50	100	1.0	0.75	25	−50	0.01	+2	50
MA-8321-2X(*)[3]	7.2-10.0	50	100	1.0	1.0	28	−50	0.01	+2	50
MA-8322-1X(*)[3]	7.2-10.0	200	1000	4.0	0.75	25	−75	0.01	+2	50
MA-8322-2X(*)[3]	7.2-10.0	200	1000	4.0	1.0	28	−75	0.01	+2	50
MA-8319-1X16	8.5-9.6	5	5	0.2	1.5	17	−35	0.01	+2	25
MA-8319-1X17	8.5-9.6	5	5	0.2	1.0	30	−35	0.01	+4	50
MA-8321-1X16	8.5-9.6	50	100	1.0	1.5	17	−50	0.01	+2	50
MA-8321-1X17	8.5-9.6	50	100	1.0	1.0	30	−50	0.01	+4	100
MA-8322-1X16	8.5-9.6	200	1000	4.0	1.5	17	−75	0.01	+2	50
MA-8322-1X17	8.5-9.6	200	1000	4.0	1.0	30	−75	0.01	+4	100
MA-8319-1X20	9.2-9.5	5	5	1.0	1.3	80	−25	0.02	+4	75
MA-8321-2X1	9.2-9.6	50	100	1.0	1.5	40	−50	0.02	+4	100
MA-8321-2X2	9.2-9.6	50	100	1.0	2.5	60	−50	0.03	+4	150
MA-8319-1Z(*)[4]	12.4-18.0	5	5	0.2	1.0	35	−35	0.02	+4	50
MA-8319-2Z(*)[3]	12.4-18.0	5	5	0.2	1.2	28	−35	0.01	+2	25
MA-8321-1Z(*)[4]	12.4-18.0	50	100	1.0	1.0	35	−50	0.02	+4	100
MA-8321-2Z(*)[3]	12.4-18.0	50	100	1.0	1.2	28	−50	0.01	+2	50
MA-8322-1Z(*)[4]	12.4-18.0	200	1000	4.0	1.0	35	−75	0.02	+4	100
MA-8322-2Z(*)[3]	12.4-18.0	200	1000	4.0	1.2	28	−75	0.01	+2	50
MA-8319-1Z5	13.0-13.5	5	5	0.2	1.0	25	−35	0.01	+2	25
MA-8321-1Z5	13.0-13.5	50	100	1.0	1.0	25	−50	0.01	+2	50
MA-8321-2Z1	13.0-13.5	50	100	1.0	1.5	40	−50	0.02	+4	100
MA-8322-1Z5	13.0-13.5	200	1000	4.0	1.0	25	−75	0.01	+2	50
MA-8319-1Z6	16.0-16.5	5	5	0.2	1.0	25	−35	0.01	+2	25
MA-8321-1Z6	16.0-16.5	50	100	1.0	1.0	25	−50	0.01	+2	50
MA-8321-2Z2	16.0-16.5	50	100	1.0	1.5	40	−50	0.02	+4	100
MA-8322-1Z6	16.0-16.5	200	1000	4.0	1.0	25	−75	0.01	+2	50
MA-8319-1Q3(*)[4]	33.0-35.0	200	50	1.0	1.0	20	+1	50	−50	10

NOTES: 1. Any 10% within specified range.
2. Any 5% within specified range.
3. Any 300 MHz within specified range.
4. Any 500 MHz within specified range.
*Specify center frequency within specified range.

Diode Limiters

COAXIAL LIMITERS All models have spike leakage less than 0.2 ergs.

Model Number	Freq. GHz	Max. Power In Peak w	Max. Power In Avg. W	Max. Insert. Loss dB	Max. Flat Peak Leakage mw	Max. Recov. Time ns
MA-8444-P11N	1-450 MHz	10	1	0.3	50	50
MA-8445-P11N	1-450 MHz	100	10	0.3	300	50
MA-8446-P11N	1-450 MHz	1000	10	0.5	500	50
MA-8446-P12N	200-250 MHz	1000	1	0.3	10W	50
MA-8446-P13N	400-450 MHz	1000	1	0.3	10W	50
MA-8444-T11N	1-1000 MHz	10	1	0.5	50	50
MA-8445-T11N	1-1000 MHz	100	10	0.5	300	50
MA-8446-T11N	1-1000 MHz	1000	10	0.7	500	50
MA-8444-S10N	1.0-4.0	100	5	0.75	250	100
MA-8444-T2S[1]	1.0-5.0	20	0.2	1.0	75	50
MA-8444-L6N	1.2-1.4	10	1	0.5	100	50
MA-8445-L6N	1.2-1.4	100	10	0.5	300	50
MA-8446-L6N	1.2-1.4	1000	10	0.7	500	50
MA-8444-S5N	2.0-4.0	40	2	0.5	50	50
MA-8446-S1N	2.9-3.1	1000	5	0.6	75	500
MA-8444-S9N	3.1-3.4	20	1	0.5	100	100
MA-8444-C5N	4.0-7.0	20	1.5	1.0	100	50
MA-8444-C10N	4.0-7.0	75	2	1.0	200	100
MA-8444-X5N	7.0-11.0	10	1	1.6	100	50
MA-8444-X10N	7.0-11.0	50	1	1.0	250	100
MA-8445-X5S[2]	7.0-12.0	600	5	1.0	50	100

Diode limiters are available in the 1 MHz to 25 GHz range with peak power from 10 watts to 300 kw. These units provide passive RF power control for protection of receiver systems through elimination of spike leakage from existing gas type duplexing circuits. All solid-state duplexers feature extra long life and extremely fast recovery time.

WAVEGUIDE LIMITERS All models have spike leakage less than 0.2 ergs.

Model Number	Freq. GHz	Max. Power In Peak w	Max. Power In Avg. W	Max. Insert. Loss dB	Max. Flat Peak Leakage mw	Max. Recov. Time ns
MA-8451-X(*)[3]	7.2-10.0	10	1	0.75	50	50
MA-8452-X(*)[3]	7.2-10.0	50	2	0.75	250	50
MA-8453-X(*)[4]	7.4-9.6	500	2	1.0	75	500
MA-8451-X4	8.5-9.6	10	1	0.5	1W	50
MA-8452-X9	8.5-9.6	50	2	1.0	50	50
MA-8451-Z(*)[3]	12.4-18.0	10	0.5	0.75	100	50
MA-8452-Z(*)[3]	12.4-18.0	50	2	0.75	500	50
MA-8453-Z(*)[5]	12.4-18.0	500	2	1.2	75	500
MA-8451-Z4	16.0-17.0	10	1	0.5	1W	50
MA-8451-K1	24.0-25.0	10	1	0.5	50	50

NOTES:
*Specify center frequency within specified range.
1. Sub-miniature design.
2. Any 200 MHz within specified range.
3. Any 300 MHz within specified range.
4. Any 400 MHz within specified range.
5. Any 500 MHz within specified range.

SOLID-STATE CONTROL DEVICES

Diode Duplexers

All models have spike leakage less than 0.1 ergs.

Model Number	Freq. MHz	Max. Power In Peak kw	Max. Power In Avg. kW	Pulse Width μs	Max. Ins. Loss dB	Trans. Loss dB	Max. Flat Peak Leakage mw	Max. Recov. Time ns
COAXIAL								
MA-8476-P9T	100-200	1.5	75W	2	1.0	0.5	1.5W	50
MA-8476-P8T	135-145	1.5	75W	2	1.0	0.5	1.5W	50
MA-8475-P6S[1]	136-165	250	12.5	60	0.4	0.1	100	1000
MA-8477-P2S	200-225	200	10	200	2.0	0.1	75	1000
MA-8475-T2N	300-1000	250w	1W	2	1.0	1.0	50	50
MA-8475-P7S[1]	400-450	300	6	60	1.0	0.2	100	1000
MA-8476-P13T	400-450	1	10W	2	1.0	0.5	2W	200
MA-8801	400-450	300	3	60	2.0	0.5	200	1000
WAVEGUIDE								
MA-8484-X(*)[2]	8.2-9.6	1	1W	1	1.0	0.5	20	500
MA-8484-Z(*)[3]	12.4-18.0	1	1W	1	1.2	0.7	20	500

NOTES: *Specify center frequency.

1. Model can be supplied with solid-state driver on request.
2. Any 400 MHz within specified range.
3. Any 500 MHz within specified range.

Phase Shifters

Guidance, tracking and interception, performing simultaneously at extremely high speeds, is an essential design parameter of the newer types of radar systems. Conventional electro-mechanically driven antennas are in many instances being replaced by electrically steerable arrays which employ hundreds of individual antenna radiating elements whose phase relationships are controlled by computer-programmed phase shifters. Semiconductor phase shifters at many frequency/power combinations represent the optimum performance/cost phase shifter solution and are available in both continuous and binary step types. Microwave Associates maintains a large continuing development and production effort in this field.

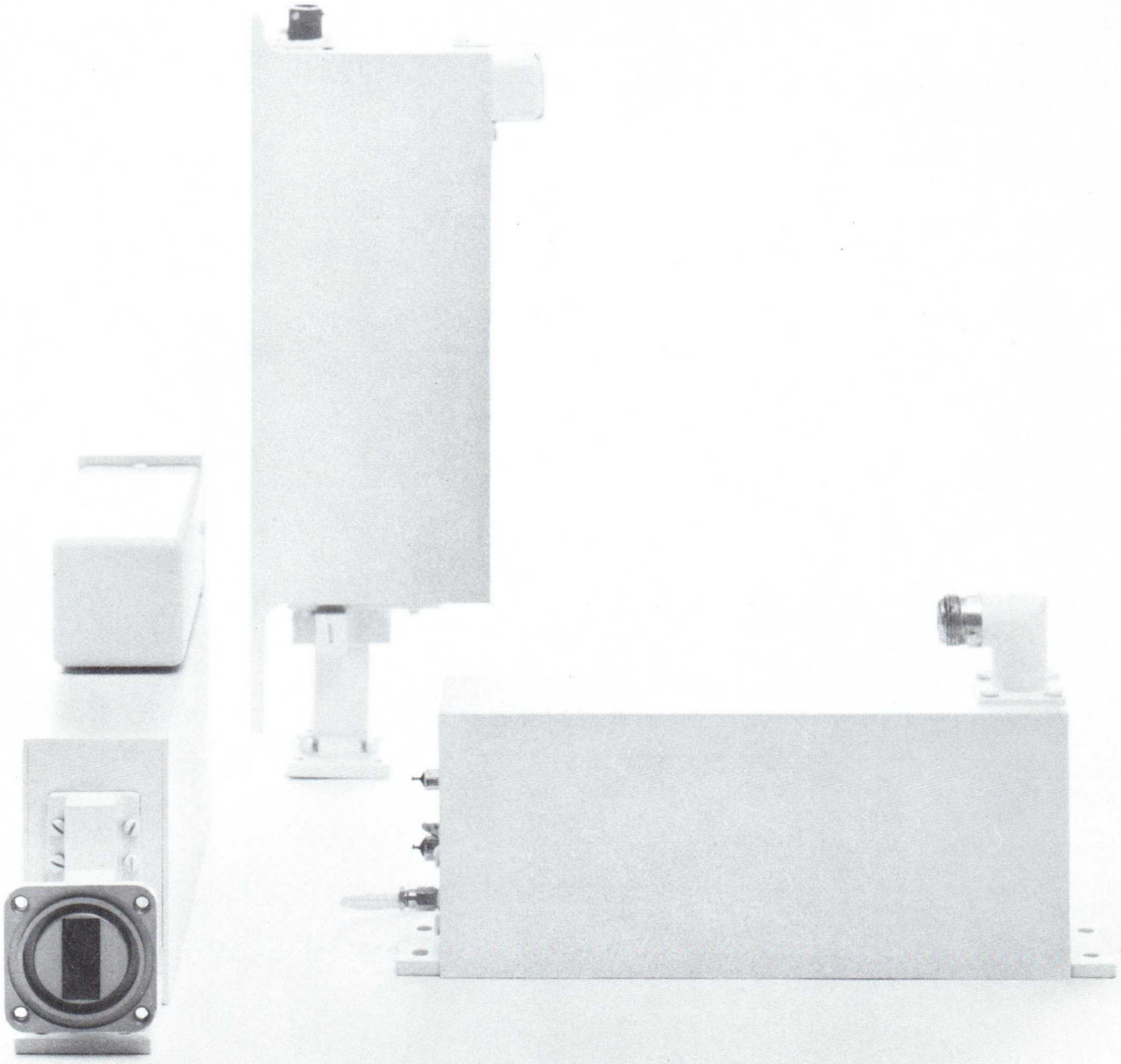
Model Number	Freq. GHz	Max. Power[1] Peak (.001 duty cycle) w	Avg. W	Max. Phase Shift °	Min. Phase Increm. °	Number of Phase States	Max. Insert. Loss dB	Max.[1] VSWR	Control Bias	Control Time μs
MA-8352-2L1T	0.8-1.6	1	0.1	90	—	Cont.	2.0	1.6	0 to 90V	0.1
MA-8356-0L2X	1.25-1.35	7500	250	22.5	22.5	2	0.4	1.5	+5V at 200 mA −200V at 1 mA	0.4
MA-8356-1L2X	1.25-1.35	7500	250	45	22.5	3	0.5	1.5	+5V at 400 mA −200V at 1 mA	0.4
MA-8356-2L2X	1.25-1.35	7500	250	90	22.5	5	0.7	1.5	+5V at 800 mA −200V at 1 mA	0.4
MA-8356-4L2X	1.25-1.35	7500	250	180	22.5	9	1.0	1.5	+5V at 1.6 A −200V at 1 mA	0.4
MA-8356-8L2X	1.25-1.35	7500	250	360	22.5	16	2.0	1.5	+5V at 3.0 A −200V at 1 mA	0.4
MA-8356-8S2S	2.0-4.0[2]	5000	125	360	5.6	64	2.0	1.5	+5V at 3.4 A −200V at 1 mA	0.5
MA-8356-0S1X	2.9-3.1	2000	125	22.5	22.5	2	1.0	1.7	+5V at 200 mA −200V at 1 mA	0.4
MA-8356-1S1X	2.9-3.1	2000	125	45	22.5	3	1.0	1.7	+5V at 400 mA −200V at 1 mA	0.4
MA-8356-2S1X	2.9-3.1	2000	125	90	22.5	5	1.5	1.7	+5V at 800 mA −200V at 1 mA	0.4
MA-8356-4S1X	2.9-3.1	2000	125	180	22.5	9	2.0	1.7	+5V at 1.6 mA −200V at 1 mA	0.4
MA-8356-8S1X	2.9-3.1	2000	125	360	22.5	16	2.5	1.7	+5V at 3.0 mA −200V at 1 mA	0.4
MA-8361-4X(*)	7.4-9.6[3]	100	1	180	180	2	1.0	1.3	+2V at 25 mA −30V at 10 μA	0.01
MA-8364-4X(*)	7.4-9.6[3]	500	4	180	180	2	1.0	1.3	+2V at 50 mA −75V at 10 μA	0.4

NOTES: *Specify center frequency.

1. With output terminated in matched load.
2. Specify any center frequency — bandwidth 10%.
3. Any 100 MHz within specified range.

SOLID-STATE RF SOURCES

Solid-state design is one of the newer, more popular methods of microwave signal generation. Utilizing the unique ability of certain microwave semiconductors to produce microwave harmonics, solid-state devices are smaller, more compact than their tube counterparts and more reliable under severe environmental conditions. Freed from dependence on bulky, high voltage power supplies, solid-state signal generators are especially well suited to missile and aircraft applications where space and weight are at a premium. They exhibit impressive stability characteristics and the inherent long life feature of semiconductor elements translates to excellent life potential.



MA-Series Crystal Controlled Sources and Amplifier-Multipliers

CRYSTAL CONTROLLED SOURCES

Crystal controlled source stability is $\pm 3 \times 10^{-8}$/ms, short term, and $\pm 1 \times 10^{-7}$/day, long term. Bandwidth is one percent. Operating temperature range is 0 to +50°C. The proportional control oven requires 600 mA maximum from a 28-volt dc supply. (After warmup, current drops to approximately 300 mA at +25°C nominal ambient temp.)

AMPLIFIER-MULTIPLIERS

Amplifier-multipliers and passive multipliers are intended to be driven by separate exciters or oscillators. Such exciters may be fixed frequency, tunable, or swept. Examples include FM or phase modulated exciters, frequency standard and coherent transmitter-receiver exciters. Normal bandwidth in standard amplifier-multipliers is one percent. (Applications requiring sweep rates in excess of bandwidth capabilities for standard designs require factory engineering review.) Operating temperature range is 0 to +50°C. Input frequency range is 80 to 130 MHz. The instantaneous bandwidth of units in this frequency range is one percent. Power input requirement is 40 mW minimum, into a nominal 50-ohm impedance with a maximum VSWR of 1.5.

Source Model Number	Amplifier-Multiplier Model Number	Freq.[1] Output GHz	Min. Power Out.[2] W	Max. Cur. (28V Supply) A	Spurious Bandwidth[3]
MA-86V01	MA-87V01	30-100 MHz	15.0	1.3	20 MHz-1 GHz
MA-86V02	MA-87V02	30-100 MHz	5.0	0.5	20 MHz-1 GHz
MA-86V03	MA-87V03	30-100 MHz	1.0	0.2	20 MHz-1 GHz
MA-86U01	MA-87U01	100-400 MHz	10.0	1.4	20 MHz-1 GHz
MA-86U02	MA-87U02	100-400 MHz	5.0	0.6	20 MHz-1 GHz
MA-86U03	MA-87U03	100-400 MHz	0.5	0.3	20 MHz-1 GHz
MA-86U04	MA-87U04	400-1000 MHz	5.0	1.5	20 MHz-2 GHz
MA-86U05	MA-87U05	400-1000 MHz	1.0	0.7	20 MHz-2 GHz
MA-86U06	MA-87U06	400-1000 MHz	0.5	0.5	20 MHz-2 GHz
MA-86L01	MA-87L01	1.0-1.3	5.0	1.5	100 MHz-2 GHz
MA-86L02	MA-87L02	1.0-1.3	1.0	0.7	100 MHz-2 GHz
MA-86L03	MA-87L03	1.0-1.3	0.5	0.5	100 MHz-2 GHz
MA-86L04	MA-87L04	1.0-1.3	0.1	0.3	100 MHz-2 GHz
MA-86L05	MA-87L05	1.0-1.3	0.05	0.2	100 MHz-2 GHz
MA-86L06	MA-87L06	1.0-1.3	0.01	0.15	100 MHz-2 GHz
MA-86L07	MA-87L07	1.3-1.7	3.0	1.5	100 MHz-2 GHz
MA-86L08	MA-87L08	1.3-1.7	1.0	0.7	100 MHz-2 GHz
MA-86L09	MA-87L09	1.3-1.7	0.5	0.5	100 MHz-2 GHz
MA-86L10	MA-87L10	1.3-1.7	0.1	0.3	100 MHz-2 GHz
MA-86L11	MA-87L11	1.3-1.7	0.05	0.2	100 MHz-2 GHz
MA-86L12	MA-87L12	1.3-1.7	0.01	0.15	100 MHz-2 GHz

NOTES: 1. Specify center frequency.
2. Into 50-ohm load with a maximum VSWR of 1.5.
3. First order sidebands of oscillator down 45 dB from output power level. All others within specified limits down 30 dB from output power level.

SOLID-STATE RF SOURCES

MA-Series Crystal Controlled Sources and Amplifier-Multipliers (cont.)

Source Model Number	Amplifier-Multiplier Model Number	Freq.[1] Output GHz	Min. Power Out.[2] W	Max. Cur. (28V Supply) A	Spurious Bandwidth[3]
MA-86S01	MA-87S01	1.7-2.2	2.0	1.5	100 MHz-3 GHz
MA-86S02	MA-87S02	1.7-2.2	1.0	0.9	100 MHz-3 GHz
MA-86S03	MA-87S03	1.7-2.2	0.5	0.7	100 MHz-3 GHz
MA-86S04	MA-87S04	1.7-2.2	0.1	0.5	100 MHz-3 GHz
MA-86S05	MA-87S05	1.7-2.2	0.05	0.3	100 MHz-3 GHz
MA-86S06	MA-87S06	1.7-2.2	0.01	0.2	100 MHz-3 GHz
MA-86S07	MA-87S07	2.2-2.3	2.0	1.5	400 MHz-4 GHz
MA-86S08	MA-87S08	2.2-2.3	1.0	0.9	400 MHz-4 GHz
MA-86S09	MA-87S09	2.2-2.3	0.5	0.7	400 MHz-4 GHz
MA-86S10	MA-87S10	2.2-2.3	0.1	0.5	400 MHz-4 GHz
MA-86S11	MA-87S11	2.2-2.3	0.05	0.03	400 MHz-4 GHz
MA-86S12	MA-87S12	2.2-2.3	0.01	0.2	400 MHz-4 GHz
MA-86S13	MA-87S13	2.3-2.7	1.0	1.5	400 MHz-4 GHz
MA-86S14	MA-87S14	2.3-2.7	0.5	0.9	400 MHz-4 GHz
MA-86S15	MA-87S15	2.3-2.7	0.1	0.7	400 MHz-4 GHz
MA-86S16	MA-87S16	2.3-2.7	0.05	0.5	400 MHz-4 GHz
MA-86S17	MA-87S17	2.3-2.7	0.01	0.3	400 MHz-4 GHz
MA-86S18	MA-87S18	2.7-3.1	1.0	1.5	400 MHz-5 GHz
MA-86S19	MA-87S19	2.7-3.1	0.5	0.9	400 MHz-5 GHz
MA-86S20	MA-87S20	2.7-3.1	0.1	0.7	400 MHz-5 GHz
MA-86S21	MA-87S21	2.7-3.1	0.05	0.5	400 MHz-5 GHz
MA-86S22	MA-87S22	2.7-3.1	0.01	0.3	400 MHz-5 GHz
MA-86S23	MA-87S23	3.1-3.7	1.0	1.5	±2 GHz
MA-86S24	MA-87S24	3.1-3.7	0.5	0.9	±2 GHz
MA-86S25	MA-87S25	3.1-3.7	0.1	0.7	±2 GHz
MA-86S26	MA-87S26	3.1-3.7	0.05	0.5	±2 GHz
MA-86S27	MA-87S27	3.1-3.7	0.01	0.3	±2 GHz
MA-86S28	MA-87S28	3.7-4.4	1.0	1.5	±2 GHz
MA-86S29	MA-87S29	3.7-4.4	0.5	0.9	±2 GHz
MA-86S30	MA-87S30	3.7-4.4	0.1	0.7	±2 GHz
MA-86S31	MA-87S31	3.7-4.4	0.05	0.5	±2 GHz
MA-86S32	MA-87S32	3.7-4.4	0.01	0.3	±2 GHz
MA-86C01	MA-87C01	4.4-5.0	1.0	1.5	±2 GHz

Source Model Number	Amplifier-Multiplier Model Number	Freq.[1] Output GHz	Min. Power Out.[2] W	Max. Cur. (28V Supply) A	Spurious Bandwidth[3]
MA-86C02	MA-87C02	4.4-5.0	0.5	0.9	±2 GHz
MA-86C03	MA-87C03	4.4-5.0	0.1	0.7	±2 GHz
MA-86C04	MA-87C04	4.4-5.0	0.05	0.3	±2 GHz
MA-86C05	MA-87C05	4.4-5.0	0.01	0.2	±2 GHz
MA-86C06	MA-87C06	5.4-5.9	1.0	1.5	±2 GHz
MA-86C07	MA-87C07	5.4-5.9	0.5	0.9	±2 GHz
MA-86C08	MA-87C08	5.4-5.9	0.1	0.7	±2 GHz
MA-86C09	MA-87C09	5.4-5.9	0.05	0.3	±2 GHz
MA-86C10	MA-87C10	5.4-5.9	0.01	0.2	±2 GHz
MA-86C11	MA-87C11	5.9-7.1	1.0	1.5	±2 GHz
MA-86C12	MA-87C12	5.9-7.1	0.5	0.9	±2 GHz
MA-86C13	MA-87C13	5.9-7.1	0.1	0.7	±2 GHz
MA-86C14	MA-87C14	5.9-7.1	0.05	0.3	±2 GHz
MA-86C15	MA-87C15	5.9-7.1	0.01	0.2	±2 GHz
MA-86X01	MA-87X01	7.1-8.5	0.5	1.5	±2 GHz
MA-86X02	MA-87X02	7.1-8.5	0.1	0.9	±2 GHz
MA-86X03	MA-87X03	7.1-8.5	0.05	0.7	±2 GHz
MA-86X04	MA-87X04	7.1-8.5	0.01	0.3	±2 GHz
MA-86X05	MA-87X05	8.5-9.6	0.5	1.5	±2 GHz
MA-86X06	MA-87X06	8.5-9.6	0.1	0.9	±2 GHz
MA-86X07	MA-87X07	8.5-9.6	0.05	0.7	±2 GHz
MA-86X08	MA-87X08	8.5-9.6	0.01	0.3	±2 GHz
MA-86X09	MA-87X09	9.6-12.0	0.2	1.5	±2 GHz
MA-86X10	MA-87X10	9.6-12.0	0.1	1.0	±2 GHz
MA-86X11	MA-87X11	9.6-12.0	0.05	0.8	±2 GHz
MA-86X12	MA-87X12	9.6-12.0	0.01	0.4	±2 GHz
MA-86K01	MA-87K01	12.0-14.0	0.2	1.5	±3 GHz
MA-86K02	MA-87K02	12.0-14.0	0.1	1.0	±3 GHz
MA-86K03	MA-87K03	12.0-14.0	0.05	0.8	±3 GHz
MA-86K04	MA-87K04	12.0-14.0	0.01	0.4	±3 GHz
MA-86K05	MA-87K05	14.0-18.0	0.05	0.8	±3 GHz
MA-86K06	MA-87K06	14.0-18.0	0.01	0.4	±3 GHz
MA-86Q01	MA-87Q01	22.0-26.0	0.01	1.5	±3 GHz
MA-86Q02	MA-87Q02	22.0-26.0	0.005	1.0	±3 GHz
MA-86Q03	MA-87Q03	33.0-36.0	0.01	1.5	±3 GHz
MA-86Q04	MA-87Q04	33.0-36.0	0.005	1.0	±3 GHz

NOTES:

1. Specify center frequency.
2. Into 50-ohm load with a maximum VSWR of 1.5.
3. First order sidebands of oscillator down 45 dB from output power level. All others within specified limits down 30 dB from output power level.

SOLID-STATE RF SOURCES

MA- Series Tunable Sources

Model Number	Freq. GHz	Tunable Band-width MHz	Power Output mW	Input Current (28V Supply) mA	Output Connectors
MA-82L01	0.9-1.3	100	250	100	TNC
MA-82L02	0.9-1.3	100	100	80	TNC
MA-82L03	0.9-1.3	100	50	60	TNC
MA-82L04	0.9-1.3	200	10	40	TNC
MA-82L05	1.3-1.8	100	100	100	OSM
MA-82L06	1.3-1.8	150	50	80	OSM
MA-82L07	1.3-1.8	200	10	60	OSM
MA-82S01	1.8-3.2	100	50	100	OSM
MA-82S02	1.8-3.2	200	20	80	OSM
MA-82S03	1.8-3.2	200	5	60	OSM
MA-82C01	5.4-5.9	100	30	100	OSM
MA-82C02	5.4-5.9	300	10	100	OSM
MA-82C03	5.4-5.9	500	5	100	OSM
MA-82C04	5.9-7.1	100	20	100	OSM
MA-82C05	5.9-7.1	300	10	100	OSM
MA-82C06	5.9-7.1	500	5	100	OSM
MA-82X01	7.1-11.0	100	20	100	TNC
MA-82X02	7.1-11.0	200	10	100	TNC
MA-82X03	7.1-11.0	300	5	100	TNC
MA-82K01	13.0-17.0	200	3	100	UG136A/U

Tuning sensitivity 7 MHz/volt. Spurious response out of band is 50 dB down and in band 70 dB down. Stability for all units is $\pm 1 \times 10^{-3}$ over a 0 to +71° C temperature range. Full operating temperature range is —40° to +71° C. Storage temperature is —55° to +100° C.

FM Tunable Sources for Communications and Other FM-CW Requirements

Model Number	Freq. GHz	Peak Deviation MHz	Power Output mW	Output Connector
MA-82S04	1.99-2.11	8	1W	TNC
MA-82C07	4.4-5.0	8	250	TNC
MA-82C08	5.9-6.4	8	20	TNC or waveguide
MA-82C09	5.9-6.4	8	500	TNC
MA-82X04	10.5-11.0	8	20	TNC

These solid-state sources feature excellent modulation characteristics. Modulation linearity of one percent with provisions for AFC. AM and FM noise is kept to a minimum. Frequency response flat within ±0.5 dB from 30 Hz to 4.5 MHz. Modulation sensitivity is 8 MHz/volt into 75 ohms.

ML- Series Crystal Controlled Sources

Model Number	Freq.[1] Output GHz	Min. Output Power[3] mW	Max. Current (24V supply) mA	Output Connector[4]
ML-1421	0.5-1.0	8W	500[2]	TNC or equivalent
ML-1237[5]	1.0-2.0	40	100	TNC or equivalent
ML-1322	1.4-1.7	3W	1A	TNC or equivalent
ML-1332	2.0-2.1	1.5W	1A	TNC or equivalent
ML-1247[5]	2.0-4.0	20	100	TNC or equivalent
ML-1342	2.1-3.0	1W	1A	TNC or equivalent
ML-1352	3.0-4.0	500	1A	TNC or equivalent
ML-1287[5]	4.0-8.0	10	100	TNC or equivalent
ML-1383	6.0-8.0	500	1A	TNC or equivalent
ML-1297-5[5]	8.0-10.0	5	100	TNC or equivalent
ML-1296-10[6]	8.2-10.0	10	—	WR-90
ML-1296-20	8.2-10.0	20	140	WR-90
ML-1394	8.8-10.0	300	1A	WR-90
ML-12106-5[6]	10.0-12.5	5	—	WR-90
ML-12106-10	10.0-12.5	10	140	WR-90
ML-13104	10.0-12.5	150	1A	WR-90
ML-13115	12.5-15.0	100	1A	WR-62
ML-13125	15.0-18.0	50	1A	WR-62

ML- series sources are manufactured by Microwave Associates in Luton, England, to which all inquiries should be directed. See page 7 for address and ordering information.

NOTES:

1. Instantaneous bandwidth one percent.
2. 250 mA with 48-volt supply also required.
3. Harmonically related spurious responses −30 dB down.
4. Specify coaxial connector type.
5. Low power coaxial sources have optional crystal oven. Oven supply requires 24-volt, 200 mA, dc or ac. Nominal operating temperature 0 to +55°C.
6. D. C. supply 12V @ 140 mA.

Tunnel Diode Oscillators

Tunnel diode oscillators are low power RF sources. The mechanically and electronically tuned OME-series is used where broadband tuning is required along with narrowband electronic tuning for AFC or sweeping. The fixed-tuned OF-series is used where a high degree of frequency stability is not required (e.g. system checkout). The mechanically tuned OM-series is used where wideband tuning and good frequency stability are required. Minimum input power requirement for all units is 0.7 volts at 20 milliamperes. Tunnel diode oscillators are manufactured by International Microwave Corporation, to which all inquiries should be directed. See page 6 for address and ordering information.

IMC Model Number	Freq. GHz	Frequency Stability Push.[1] ±%	Pull.[2] ±%	Temp.[3] ±%	Tuning Range Mech. %	Elect. MHz	Tuning Volt. V	Min. Output Power μW
OME-(*)B	2.0-11.0	.01	.02	.02	35	40	−0.4 to +8	50
OME-(*)C	2.0-9.0	.01	.03	.04	25	40	−0.4 to +8	100
OME-(*)D	2.0-7.0	.01	.03	.04	25	40	−0 4 to +8	200
OM-(*)B	2.0-11.0	.01	.02	.02	35	—	—	50
OM-(*)C	2.0-9.0	.01	.02	.04	25	—	—	100
OM-(*)D	2.0-7.0	.01	.02	.04	25	—	—	200
OF-(*)A	1.5-12.4	2.0	2.0	5	—	—	—	10
OF-(*)B	1.5-10.5	2.0	2.0	5	—	—	—	50
OF-(*)C	1.5-7.5	2.0	2.0	5	—	—	—	100

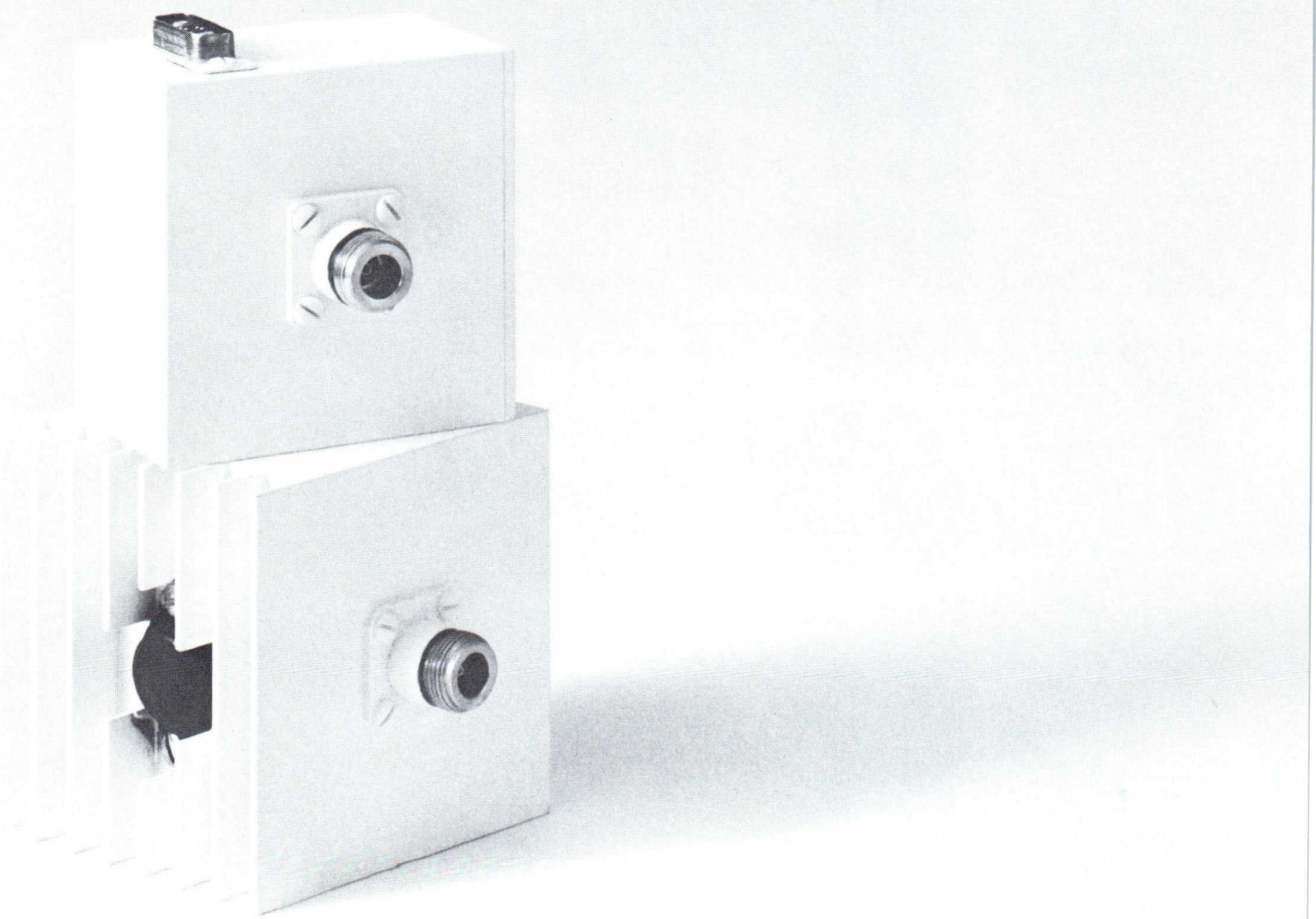
NOTES:

*Specify center frequency within indicated frequency range.

1. ±20% ΔV.
2. Any phase (Load VSWR 1.5 mA).
3. −30° to +60°C.

YIG DEVICES

Microwave Associates makes a full range of YIG filters, delay lines, discriminators, limiters and oscillators. The outstanding virtue of these devices, specifically electronic tuning, is the creation of new design opportunities that substantially improve system performance. Single or multi-section filters are available from 50 MHz to 40 GHz. Limiters at levels as low as 1 microwatt are being manufactured. Discriminators, delay lines and oscillators are being offered on a custom engineered basis. Swept receivers, test equipment, and ECM systems have been successful applications of YIG devices.



2-Section and 4-Section Filters

Microwave bandpass YIG filters use highly polished, single crystalline spheres of yttrium-iron garnet (YIG) or similar ferrite material as gyromagnetic tuning elements. The center frequency of the low loss, narrow "window" of these filters can be swept rapidly over wide ranges by applying a small sine wave or sawtooth voltage to the coils of the self-contained electromagnet. The filters feature low insertion loss and high off-band rejection as well as freedom from spurious responses. Accessory driver-amplifiers and power supplies are available for use with these units. The driver amplifier allows the filters to be driven from the bottom to the top of their respective ranges by means of a 0 to 10-volt signal from a high impedance (100 kΩ) source. Heater-controllers are available for those units for which heating is required.

Maximum VSWR: 1.5

Selectivity: 2 section filters, 12 dB/octave; 4 section filters, 24 dB/octave

Linearity: ±.1% (except ±.25% for 9A23 and 9A24)

Model Number	Freq. GHz	Off-Band Reject. dB	Band-width MHz	Insert. Loss dB	Max. Spur. Res. Reject. dB	Sweep Rate Sine Wave kHz	Sweep Rate Saw-Tooth Hz	Max. Power W
2 SECTION								
MA-9A1	0.125-0.250	30	10-20	5.0	40	—	—	—
MA-9A2	0.25-0.5	35	20-30	4.0	40	—	—	—
MA-9A23[1]	0.3-3.0	40	10-25	5.0	40	—	—	—
MA-9A3	0.5-1.0	40	20-30	2.5	40	—	—	—
MA-9A4	1.0-2.0	45	30-40	2.0	40	—	—	—
MA-9A24[1]	1.0-10.0	40	35-50	4.0	40	—	—	—
MA-9A5	2.0-4.0	50	30-40	2.0	40	—	—	—
MA-9A13	2.6-3.95	50	30	2.5	50	5	100	5
MA-9A14	3.95-5.85	55	30	2.0	50	5	100	5
MA-9A6	4.0-8.0	50	40-50	2.0	40	—	—	—
MA-9A16	5.3-8.2	60	40	1.5	50	5	100	5
MA-9A15	5.4-5.9	60	25	2.0	50	5	100	5
MA-9A17	8.0-10.0	60	40	1.5	50	5	100	5
MA-9A7	8.0-12.0	50	40-50	2.0	40	—	—	—
4 SECTION								
MA-9A8	0.5-1.0	70	20-25	5.0	60	5	100	5
MA-9A9	1.0-2.0	70	20-25	4.5	60	5	100	5
MA-9A10	2.0-4.0	80	25-30	4.0	60	5	100	5
MA-9A18	2.6-3.95	80	20	4.0	70	5	100	5
MA-9A19	3.95-5.85	80	20	4.0	70	5	100	5
MA-9A11	4.0-8.0	80	25-30	4.0	60	5	100	5
MA-9A21	5.3-8.2	80	30	4.0	70	5	100	5
MA-9A20	5.4-5.9	80	40	3.0	70	5	100	5
MA-9A22	8.0-10.0	80	30	4.0	70	5	100	5
MA-9A12	8.0-12.0	80	25-30	4.0	60	5	100	5

NOTE: 1. Decade-range type VSWR 2.0.

YIG DEVICES

Electronically Tuned, Coaxial YIG Limiters, with "Look-Around"

YIG limiters perform at very low limiting levels. They employ highly polished single crystalline spheres of yttrium-iron garnet (YIG) or other low loss ferrite material as the limiting element. Limiting occurs within the bandwidth, which can be swept over the frequency ranges by means of the self-contained electromagnet. If the unit is fixed tuned or manually adjusted, rather than electronically tuned, drastic size and weight reductions can be attained. The units are not damaged by high level signals that considerably exceed their dynamic range. "Look around" feature enables detection of low level signals near in frequency to interfering high level signals.

Maximum drive power for all units is 5 Watts.

Model Number	Freq. GHz	Max. Limit. Level dBm	Insert. Loss dB	Spike Leak. ergs	Band-width MHz	Dynam-ic Range dB	Sweep Rate Sine-wave kHz	Saw-tooth Hz
MA-9B1[1]	1.45-2.20	−15	1.0	20.0	15	25	5	100
MA-9B2	2.20-3.30	−25	1.0	20.0	15	30	5	100
MA-9B3	3.95-5.85	+30	1.0	2.0	25	30	5	100
MA-9B4	5.40-5.90	−25	2.0	20.0	30	30	5	100
MA-9B5	5.40-5.90	−25	2.5	0.5	45	60	5	100
MA-9B6	5.40-5.90	−25	3.0	0.5	30	60	5	100
MA-9B7	5.40-5.90	+30	2.0	2.0	40	30	5	100

NOTE: 1. Heater power of 10 W required.

Dual Channel Filters

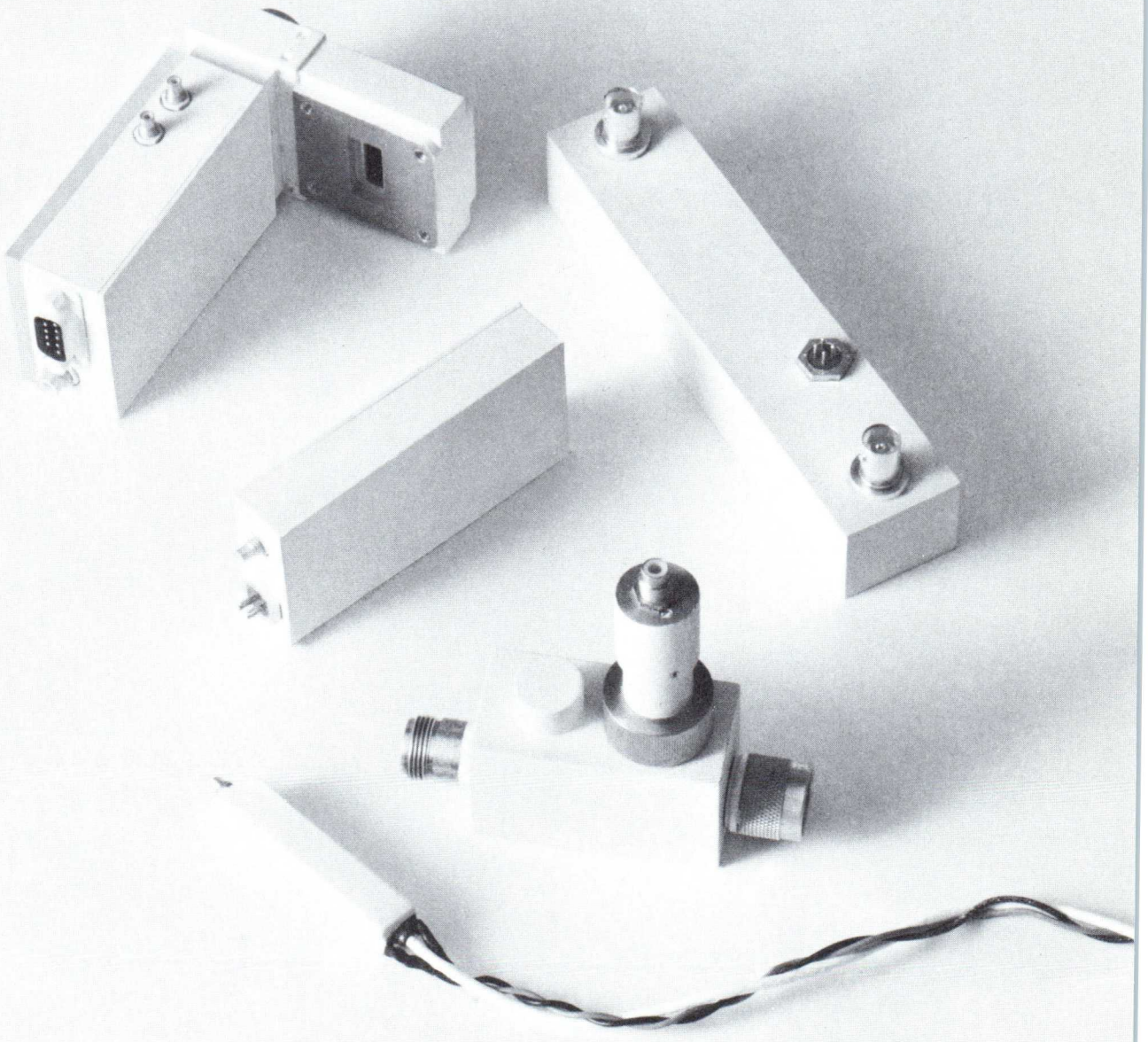
There are two kinds of dual channel filters: 4 section and 6 section. The 4 section filter consists of two, 2 section channels; the 6 section filter consists of one, 2 section channel and one, 4 section channel. In both cases the two channels can be cascaded. Linearity for each channel is ±0.1 percent maximum; VSWR is 1.5. Selectivity is 6 dB/octave for each section (e.g., 12 dB/octave for two sections, 36 dB/octave for six sections made by cascading 2 sections and 4 section channels.)

	2-SECTION CHANNEL			4-SECTION CHANNEL		
Freq. GHz	Band-width MHz	Insert. Loss dB	Off-Band Reject. dB	Band-width MHz	Insert. Loss dB	Off-Band Reject. dB
0.5-1.0	15-20	3.0	50	10-15	4.5	70
1.0-2.0	15-20	3.0	55	10-15	4.5	70
2.0-4.0	20-30	2.5	55	15-20	4.0	70
4.0-8.0	30-35	2.0	55	20-25	3.5	70
8.0-12.0	30-35	2.0	55	20-25	3.5	70

Model Number	Freq. GHz	Band-width MHz	Insert. Loss dB	Min. Off-Band Reject. dB	Min. Spur. Resp. dB
4-SECTION FILTERS, BOTH CHANNELS IN CASCADE					
MA-9A31	0.5-1.0	12-15	6	70	60
MA-9A32	1.0-2.0	12-15	6	70	60
MA-9A33	2.0-4.0	15-22	5	70	60
MA-9A34	4.0-8.0	22-30	4	70	60
MA-9A35	8.0-12.0	22-30	4	70	60
6-SECTION FILTERS, BOTH CHANNELS IN CASCADE					
MA-9A26	0.5-1.0	8-12	7.5	90	90
MA-9A27	1.0-2.0	8-12	7.5	90	90
MA-9A28	2.0-4.0	12-16	6.5	90	90
MA-9A29	4.0-8.0	16-20	5.5	90	90
MA-9A30	8.0-12.0	16-20	5.5	90	90

SOLID-STATE AMPLIFIERS

Microwave Associates offers the system design engineer a broad selection of solid-state RF and IF amplifiers from 3 MHz to 16 GHz. Microwave Associates' product line ranges from universal transistor amplifiers for test equipment applications to microminiature amplifiers for applications involving critical size, weight and environmental requirements. Integrated mixer preamplifiers which combine our transistor amplifiers and stripline mixer capabilities permit new design opportunities. Tunnel diode amplifiers with bandwidths up to one octave have found successful applications involving airborne radars, troposcatter and television relays.



Tunnel-Diode Amplifiers

Tunnel-diode amplifiers are production engineered for application in microwave systems where cost is a critical factor, yet high performance is required. Present pricing places these TDA's in the same range as transistorized IF amplifiers without compromising performance and retaining low-noise, flat-band characteristics.

ORDERING TDA's

TDA's are products of International Microwave Corporation, and may be ordered directly from that division. See page 6 for address and ordering information.

In ordering TDA's always give the complete model number. Be sure to specify characteristics fully by giving the proper prefixes and suffixes as shown in the following example.

To determine the model number, the following designations will be used:

PREFIXES

1st Letter:	A	Amplifier
2nd Letter:	C	Coaxial
	W	Waveguide
3rd Letter:	P	π — configuration
	H	H — configuration
4th Letter: (if required)	F	Includes additional input isolator for improved input VSWR
5th Letter: (if required)	S	Subminiature model
SUFFIXES (if required)	C	Case-enclosed model (weatherproof)
	CA	110-Vac operation
	CB	Self-contained battery
	CC	Special power-supply requirements
	CD	Extended temperature range
	CE	Extra-broadband model

To complete the part number, specify the following parameters:

PREFIX — CENTER FREQUENCY (MHz) — GAIN (dB) — SUFFIX (IF REQUIRED)

EXAMPLE:

AWP-9350-15	Amplifier, Waveguide, π — Configuration, Center Frequency 9350 MHz, 15 dB Gain.
ACH-6000-18-CA	Amplifier, Coaxial, H-Configuration, Center Frequency 6000 MHz, 18 dB Gain, 110 Vac operation.

Freq. Range GHz	Noise Figure[1] dB	Min. Gain dB	Band-width[2] MHz
1.7-2.2	4.5	13	250
	4.5	15	180
	4.5	20	100
2.2-2.3	4.5	15	100
2.7-3.1	4.5	15	100
3.1-4.5	5.0	12	500
	5.0	15	300
	5.0	18	250
3.7-4.2	5.0	12	500
	5.0	15	350
4.4-5.0	5.0	13	600
	5.0	20[3]	600
4.4-5.9	5.0	13	600
	5.0	15	350
	5.0	18	250
5.0-7.0	5.0	12	600
	5.0	15	500
	5.0	18	300
5.4-5.9	5.0	15	500
5.9-6.4	5.0	15	500
6.4-6.8	5.0	15	400
6.8-7.1	5.0	15	300
7.0-8.5	5.0	15	700
	5.0	17	500
	5.0	20	350
7.1-7.7	5.0	15	600
	5.0	18	300
8.2-10.0	5.2	13	900
	5.2	15	600
	5.2	18	450
10.0-12.0	5.5	12	1000
	5.5	15	750
	5.5	18	500

NOTES:

1. Based on T_d = Argon-discharge tube temperature of 10, 100 °K.
2. Bandwidth for ±1 dB gain variation.
3. Double-section amplifier, 1 dB compression point −40 dBm.

SOLID-STATE AMPLIFIERS

System-Engineered Mixer-Preamplifiers and IF Amplifiers

New, high quality, temperature-stable, integrated mixer-preamplifiers and IF amplifiers are an outgrowth of IMC's broadband transistor circuit capability. The integration of high quality coaxial and waveguide balanced mixers with the broadband, highly stable transistor amplifiers has resulted in a superior mixer-preamplifier package. The MIL-approved printed circuits of these all solid-state silicon mixer-preamplifiers and IF amplifiers are suited to high reliability, military, ground, aircraft, and satellite receiver applications.

MIXER-PREAMPLIFIERS

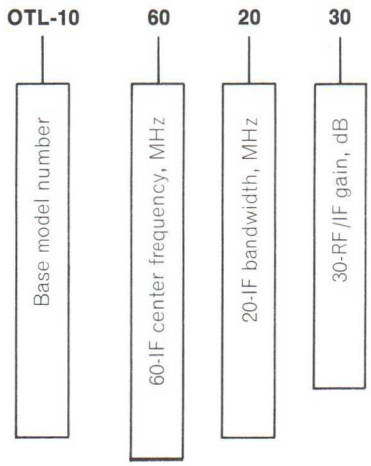
The IMC mixer-preamplifier line is designed around ORTHOTEE™ hybrid, short slot coupler, and coaxial hybrid mixers. The OTI model is an in-line mixer with the same geometry as other cross-field mixers, but with superior performance in noise figure and LO rejection.

RF/IF Gain: 20 dB, 30 dB
LO Rejection: CH 6 dB
SS 10 dB
OT 15 dB
Operating Temperature: −55°C to +85°C
Power Supply: ±12 Vdc, 20 mA

Also available for operation from ±22 Vdc. Single-polarity-voltage models also available.

IMC Base Model Number[1]	Freq. GHz	Noise Figure[2] dB
CH-1	1.0-2.0	8.5
CH-2	2.0-4.0	8.5
CH-4	4.0-8.0	8.5
SS-9,	8.5-9.6	8.5
OTI-9,	8.5-9.6	8.5
OTL-9	8.5-9.6	8.5
OTL-10	10.0-11.0	9.0
OTL-11	10.7-11.7	9.0
SS-13, OTL-13	13.0-14.0	9.5
SS-16, OTL-16	15.5-17.5	10.5
SS-23	23.0-25.0	11.5
SS-35	34.0-36.0	13.0

NOTES: 1. Suffix "P" to all models denotes addition of 4-pole IF preselector filter for high selectivity at low-level stages.
2. The typical noise figures for the 10 MHz and 20 MHz bandwidths are 0.25 dB better than the figures listed.



IF AMPLIFIERS

The design of IF amplifiers affords great flexibility in tailoring the basic amplifier to many specific needs. The case and circuit boards can incorporate a variety of gain-control, special gating and band-limiting functions, video-detection, and video amplification. These amplifiers are wired to conform to MIL specs and have excellent environmental characteristics. Selected standard models are listed below; many alternate and special models are available.

The following standard models exhibit 60 ±2 dB gain and are available with 35 dB manual or automatic gain control.

System-engineered IF amplifiers are manufactured by International Microwave Corporation, to which all inquiries should be directed. See page 6 for address and ordering information.

IMC Model Number	Center Freq. MHz	IF Bandwidth[1] MHz
SE 3010	30	10
SE 6020	60	20
SE 6040	60	40
SE 7020	70	20
SE 7040	70	40
SE 10520	105	20
SE 10540	105	40

NOTES:

1. Bandwidth is defined to the 1 dB points with flatness of ±0.25 dB.
2. Time constant must be specified for AGC models. Use suffix "A" for specifying these models, e.g. SE 3010A.
3. Higher voltage and single-polarity models available.
4. Noise Figure: 4.0 dB maximum. (Lower noise figure units also available.)
5. Output power: +6 to +15 dBm (AGC models held to ±1 dB).
6. All models can be specified to have matched input impedance of 52, 72 or 93 ohms.
7. Power Supply: ±12 Vdc, 70 mA. (AGC models 100 mA.)
8. Operating temperature: —55° to +85°C.

SOLID-STATE AMPLIFIERS

Universal Transistor Amplifiers

Solid-state universal transistor amplifiers are low cost compact units with reliable broadband gain — the result of the amplifier gain being independent of transistor parameters. Universal transistor amplifiers are available as fixed-gain units, or with broadband electronic gain control. The gain control maintains the entire bandwidth flat to ±0.7 dB for 25 dB of gain variation. The band flatness is also maintained over the specified operating temperature range.

Universal transistor amplifiers are manufactured by International Microwave Corporation, to which all inquiries should be directed. See page 6 for address and ordering information.

IMC Model Number[1]	Nominal[2,3] Gain dB	Nominal Bandwidth[4] MHz	Noise Figure[5] dB	Output Power dBm	Matching Conditions[6]	Case Size[7,8]	Upper Temp. Limit[9] °C
S22PS	46	10-100	3	+9	UI-MO	1	70
S22PT				+7			100
S23PS	46	10-100	5	+9	UI-MO	1	60
S23PT				+7			85
S24MS	48	10-100	8	+15	MI-UO	1	70
S24MT				+13			100
S26MS	65	10-100	8	+15	MI-UO	1	70
S26MT				+13			100
S27MS	72	10-100	8	+9	MI-MO	2	70
S27MT				+7			100
S30AS	62	3-70	5	+9	UI-MO	1	70
31MS	30	30-200	4.7	+3	UI-UO	1	60
31MT				−3			85
32MS	30	30-280	4.7	+3	UI-UO	1	60

NOTES: 1. Power supply voltages for models S22PS through S30AS, −5.6 Vdc and +15 Vdc; for 31 MS and 32 MS; +5.6 Vdc and −10 Vdc. Amplifier models are available for operation from single polarity at ±20 Vdc.

2. Models listed here are fixed-gain amplifiers. For electronic-gain-control models, use prefix G: e.g., G22PS or G22PT. Prefix "S" indicates all-silicon-transistor models; the absence of a prefix indicates germanium units.

3. Gain is specified to ±1 dB; variation in gain from −55° to +85°C is approximately 3 dB. Models with electronic gain control have a maximum gain that is 4 dB less than the fixed-gain models listed above.

4. Bandwidth edges are down by no more than 3 dB.

5. Noise figure given is the maximum for the lower end of the band.

6. Matching-condition code; MI, matched input; MO, matched output; UI, unmatched input; UO, unmatched output. The unmatched input impedance is approximately 25 ohms. The unmatched output is approximately 10 pf.

7. Case-size code: size 1, 4.75 by 1.063 by 1.25;
size 2, 5.75 by 1.063 by 1.25 inches.

8. Tapped mounting holes are provided on request.

9. Lower temperature limit of all models is −55°C.

Microminiature Amplifiers

Microminiature amplifiers offer size reductions of 30:1 and weight reductions of 20:1 over conventional solid-state amplifiers yet exhibit comparable electrical performance. IF amplifiers, pulse amplifiers, combined IF-pulse amplifiers, broadband pulse amplifiers, and custom-made logarithmic and dual channel amplifiers comprise the complete selection. Discrete component, hybrid, or thin film integrated circuits form single stages; stages are then combined for catalog items or modified for custom designs. Amplifiers are completely encapsulated to operate in extreme environments, some operating at shock levels of 15,000 G and continuous acceleration of 7,000 G.

IF AMPLIFIERS Typical size 0.5 by 0.5 by 2.5 inches.

Model Number	Center Freq. MHz	Bandwidth MHz	Gain dB	Dynamic Range dB	Sat. Power mW	Max. Noise Fig. dB	Supply Volt. V	Supply Cur. mA	Input Imp. ohms	Output Imp. ohms
MA-9E1	30	5	80	25	1	4	15±1	15	50	50
MA-9E2	60	8	75	25	1	4	15±1	15	50	50
MA-9E3	100	20	70	30	1	5	15±1	15	50	50
MA-9E4	200	30	60	35	1	6	15±1	15	50	50

IF-PULSE AMPLIFIERS All units have positive output polarity. Typical size 0.5 by 0.5 by 4.0 inches.

Model Number	Center Freq. MHz	Bandwidth MHz	Gain dB	Max. Noise Fig. dB	Tangential Sensitivity dBm	Input Imp. ohms	Output Imp. ohms	Max. Output Pulse Volt. V	Output Pulse Rise Time ns	Supply Volt. V	Max. Supply Cur. mA
MA-9G1	30	5	100	4	−95	50	100	6	70	15 ± 0.5	30
MA-9G2	60	8	95	4	−93	50	100	6	45	15 ± 0.5	30
MA-9G3	100	20	90	5	−88	50	100	6	45	15 ± 0.5	25
MA-9G4	200	30	80	6	−85	50	100	6	45	15 ± 0.5	25

BROADBAND AMPLIFIERS Typical size 0.625 by 0.625 by 3.5 inches.

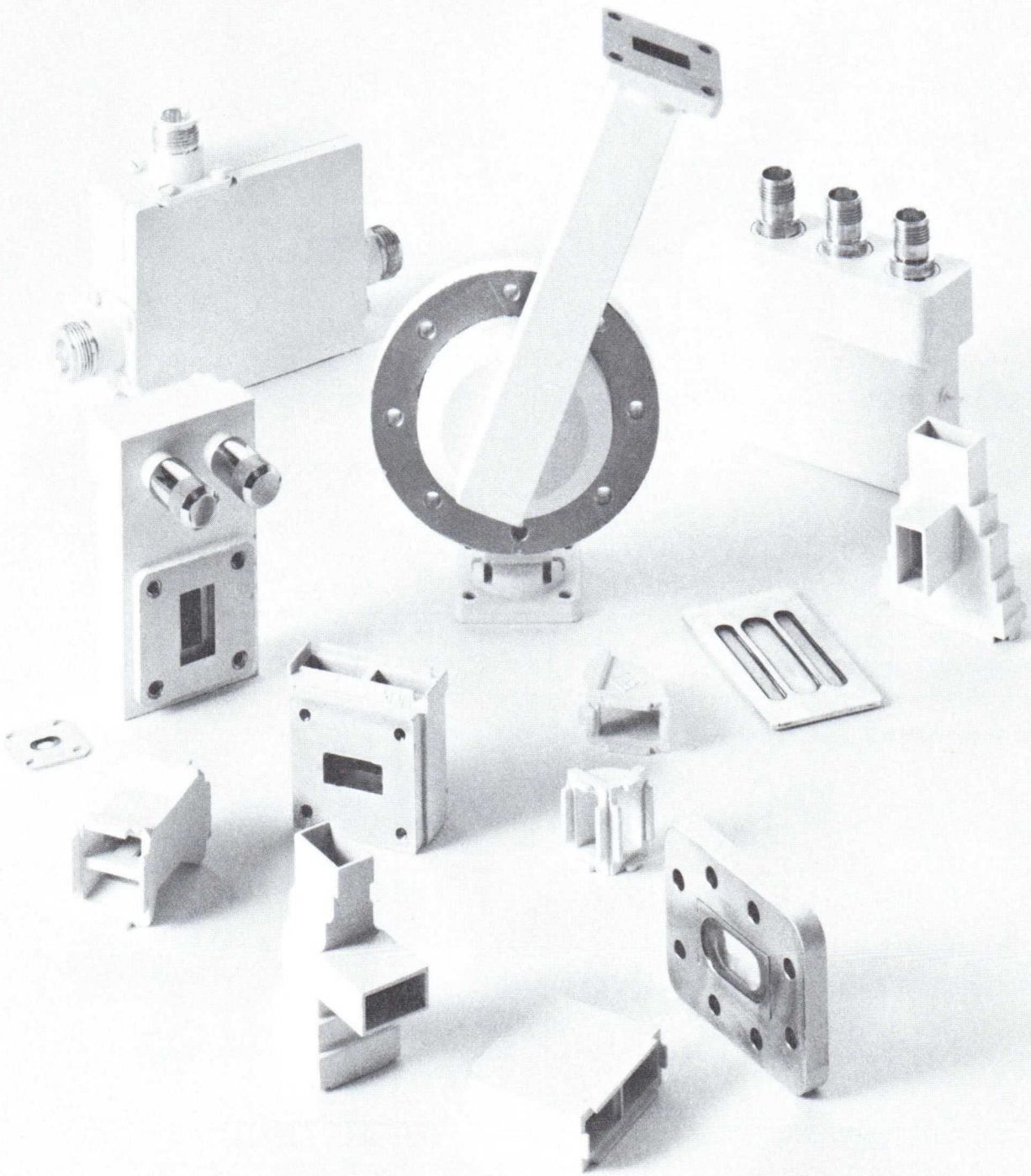
Model Number	Bandwidth (3 dB) MHz	Bandwidth (10 dB) MHz	Gain dB	Min. Sat. Power Output dBm	Nom. Input Imp. ohms	Nom. Output Imp. ohms	Noise Fig. dB	Supply Volt. V	Max. Supply Cur. mA
MA-9E5	65-135	—	70 ± 2	+10	200	50	4	24 ± 1	60
MA-9K1	100-350	80-400	30 ± 1.5	+5	50	50	8	32 ± 2	50

PULSE AMPLIFIERS Typical size 0.5 by 0.5 by 2.0 inches.

Model Number	Freq. Res.	Volt. Gain dB	Rise Time ns	Input Imp. ohms	Output Imp. ohms	Pulse Width (50% droop) μs	Output Amplitude V	Input and Output Waveform	Supply Volt. V	Max. Supply Cur. mA
MA-9F1	50 kHz-8 MHz	80	45	300	150	20	12	pos.	25 ± 0.5	15

TRANSMISSION LINE DEVICES

Microwave Associates offers one of the most comprehensive selections of transmission line devices. This selection includes not only straightforward microwave hardware, but also more complex components that are the products of two or more microwave technologies. This truly unique capability — the integration of diverse materials and techniques — is the reason for the breadth and depth of Microwave Associates' waveguide component selection.



Sidewall Hybrid Balanced Mixers

Standard units supplied in brass. Aluminum can be used on special request.

Model Number	Freq. GHz	W.G. Size WR-	Connectors RF UG-( )/U	Connectors IF	Recommended Diode Model	Nominal VSWR with Dummy Crystal Terminator
MA-809A	5.1-5.9	137	149A	BNC	1N23	1.5
MA-959A	5.92-6.43	137	344	BNC	1N23	1.5
MA-966	6.42-7.13	137	344	BNC	1N23	1.5
MA-964	7.05-7.8	112	51	BNC	1N23	1.5
MA-992A	7.5-8.5	112	51	BNC	1N23	1.5
MA-810	8.5-9.6	90	39	BNC	1N23	1.5
MA-969	9.25-10.25	90	39	BNC	MA-492	1.5
MA-970	10.5-11.9	90	39	BNC	MA-492	1.5
MA-811A	12.4-14.0	62	419	BNC	MA-490	1.3
MA-700A	15.0-18.0	62	419	BNC	MA-490	1.3
MA-812A	21.0-27.0	42	595	A27	1N26	1.3
MA-813D	33.0-38.0	28	599	A27	1N53	2.0

Miniaturized Stripline Mixers

All models are available in aluminum only and are supplied with OSM or BRM connectors.

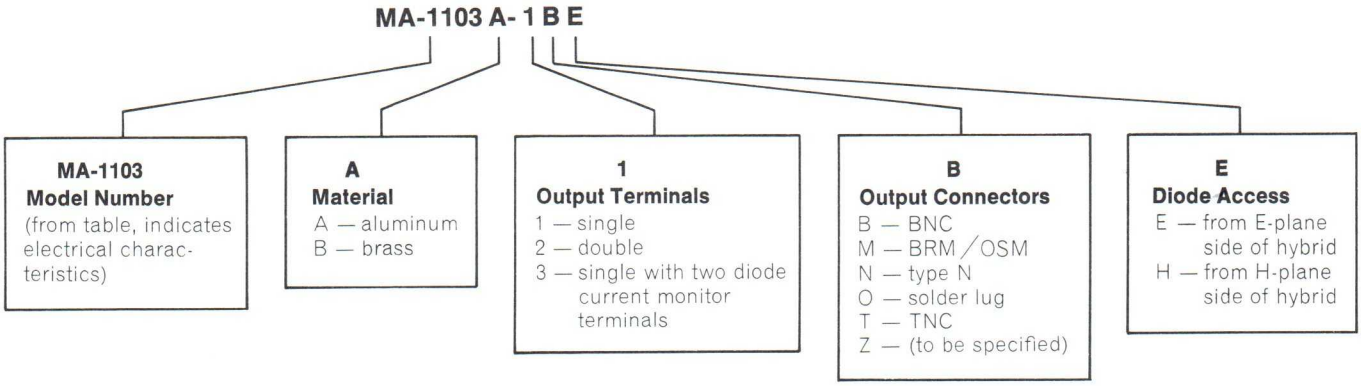
Model Number	Freq. GHz	Max. Noise Fig. dB	Isol. dB	Diode Model Supplied	Max. VSWR
MA-7032	2.9-3.4	8	20	MA-70298	1.7
MA-7036	5.4-6.4	8	20	MA-4187	1.6
MA-7039	8.5-10.5	8	20	MA-490EMR	2.0

TRANSMISSION LINE DEVICES

Specify material by adding suffix "A" for aluminum, "B" for beryllium copper.

HOW TO ORDER ORTHOTEE™ MIXERS AND MODULATORS

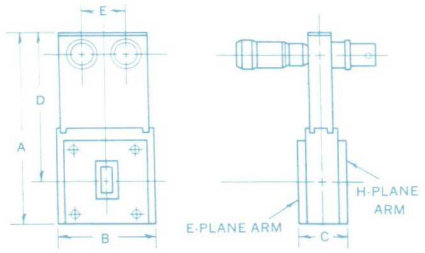
In ordering ORTHOTEE mixers and modulators always give the complete part number. Be sure to specify fully all characteristics by giving the proper suffix letters and numerals as shown in the example that follows.



ORTHOTEE Hybrid Balanced Mixers

Typical VSWR for all models is less than 2:1, Typical isolation between LO and signal is greater than 20 dB.

Model Number	Freq. GHz	W.G. Size WR-	Type	Signal, LO Connectors	Diode Type	DIMENSIONS (inches) A ±0.040	B ±0.020	C ±0.005	D ±0.005	E ±0.015
MA-1108-20H	2.85-3.25	284	Special	CPR	1N23	—	—	—	—	—
MA-1116-1BE	4.34-5.06	187	7	149A	1N23	6.024	4.128	1.500	2.000	3.525
MA-1116-2BE	4.34-5.06	187	8	149A	1N23	6.024	4.128	1.500	2.000	3.525
MA-1106-1BE	5.4-5.9	187	7	149	1N23	6.024	4.128	1.500	2.000	3.525
MA-1106-2BE	5.4-5.9	187	8	149	1N23	6.024	4.128	1.500	2.000	3.525
MA-1105-1BE	5.92-6.43	137	7	344	1N23	5.000	3.144	1.375	1.522	2.875
MA-1105-2BE	5.92-6.43	137	8	344	1N23	5.000	3.144	1.375	1.522	2.875
MA-1115-1BE	6.42-7.13	137	7	344	1N23	5.000	3.144	1.375	1.522	2.875
MA-1115-2BE	6.42-7.13	137	8	344	1N23	5.000	3.144	1.375	1.522	2.875
MA-1110-1BE	7.05-7.8	112	2	51	1N23	3.906	2.625	1.125	1.272	2.187
MA-1110-2BE	7.05-7.8	112	4	51	1N23	3.906	2.625	1.125	1.272	2.187
MA-1104-1BE	7.5-8.5	112	2	51	1N23	3.906	2.625	1.125	1.272	2.187
MA-1104-2BE	7.5-8.5	112	4	51	1N23	3.906	2.625	1.125	1.272	2.187
MA-1114-1BE	8.5-9.6	112	2	51	1N23	3.068	2.050	1.125	0.950	1.490
MA-1114-2BE	8.5-9.6	112	4	51	1N23	3.068	2.050	1.125	0.950	1.490
MA-1118-1BE[1]	8.2-12.4	90	3	39	MA-492	3.914	2.062	0.750	0.950	2.414
MA-1118-2BE[1]	8.2-12.4	90	1	39	MA-492	3.914	2.062	0.750	0.950	2.414
MA-1103-1BE	8.5-9.6	90	2	39	1N23	2.930	2.050	0.750	0.950	1.475
MA-1103-2BE	8.5-9.6	90	4	39	1N23	2.930	2.050	0.750	0.950	1.475
MA-1120-1ZE	8.5-9.6	90	Special	39	1N23WE	—	—	—	—	—
MA-1117-1BE	8.5-11.0	90	3	39	MA-492	3.926	2.050	0.750	0.950	2.687



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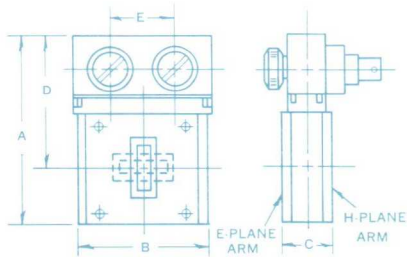

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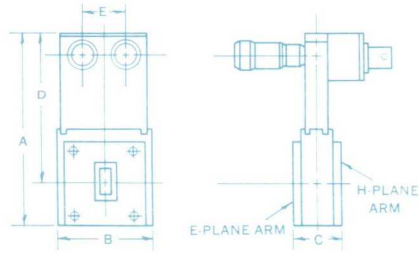

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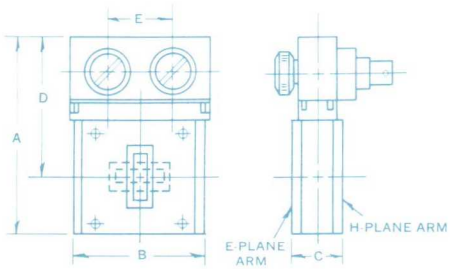

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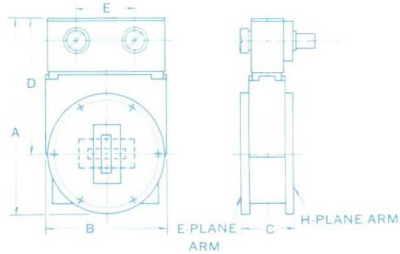

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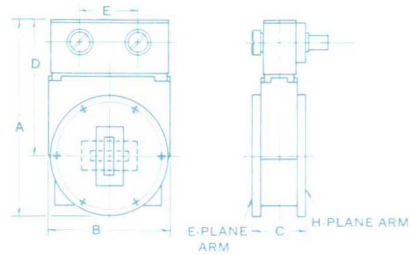

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Model Number	Freq. GHz	W.G. Size WR-	Type	Signal, LO Connectors	Diode Type	DIMENSIONS (inches) A ±0.040	B ±0.020	C ±0.005	D ±0.005	E ±0.015
MA-1117-2BE	8.5-11.0	90	1	39	MA-492	3.836	2.050	0.750	0.950	2.687
MA-1107-1BE	9.0-10.0	90	2	39	1N23	2.930	2.050	0.750	0.950	1.475
MA-1107-2BE	9.0-10.0	90	4	39	1N23	2.930	2.050	0.750	0.950	1.475
MA-1109-1BE	9.5-10.6	90	2	39	1N23	2.930	2.050	0.750	0.950	1.475
MA-1109-2BE	9.5-10.6	90	4	39	1N23	2.930	2.050	0.750	0.950	1.475
MA-1113-1BE	10.0-11.0	90	2	39	1N23	2.930	2.050	0.750	0.950	1.475
MA-1113-2BE	10.0-11.0	90	4	39	1N23	2.930	2.050	0.750	0.950	1.475
MA-1124-1BE	10.0-11.0	90	2	CMR	1N23	2.930	2.050	0.750	0.950	1.475
MA-1124-2BE	10.0-11.0	90	4	CMR	1N23	2.930	2.050	0.750	0.950	1.475
MA-1123-1BE	10.2-12.2	90	3	39	MA-492	3.836	2.050	0.750	0.950	2.687
MA-1123-2BE	10.2-12.2	90	3	39	MA-492	3.926	2.050	0.750	0.950	2.687
MA-1119-1BE[1]	12.4-18.0	62	3	419	MA-490	2.802	1.534	0.670	0.712	1.677
MA-1119-2BE[1]	12.4-18.0	62	1	419	MA-490	2.802	1.534	0.670	0.712	1.677
MA-1102-1BE	13.0-14.0	62	3	419	MA-490	2.970	1.500	0.750	0.712	2.015
MA-1102-2BE	13.0-14.0	62	1	419	MA-490	2.970	1.500	0.750	0.712	2.015
MA-1112-1BE	16.0-17.0	62	3	419	MA-490	2.970	1.500	0.750	0.712	2.015
MA-1112-2BE	16.0-17.0	62	1	419	MA-490	2.970	1.500	0.750	0.712	2.015
MA-1101-1BE[1]	18.0-26.5	42	3	595	1N26	2.027	1.093	0.530	0.460	1.152
MA-1101-2BE[1]	18.0-26.5	42	1	595	1N26	2.027	1.093	0.530	0.460	1.152
MA-1100-1BE	26.5-40.0	28	3	599	1N53	1.687	0.812	0.500	0.320	0.930
MA-1100-2BE	26.5-40.0	28	1	599	1N53	1.687	0.812	0.500	0.320	0.930

NOTE: 1. Not available with diode access from the H-plane side of the hybrid.

TRANSMISSION LINE DEVICES

Specify material by adding suffix "A" for aluminum, "B" for beryllium copper.

ORTHOTEE™ Hybrid Balanced Modulators

Typical VSWR for all models is less than 2:1, typical isolation is greater than 20 dB. See page 74 for ordering instructions.

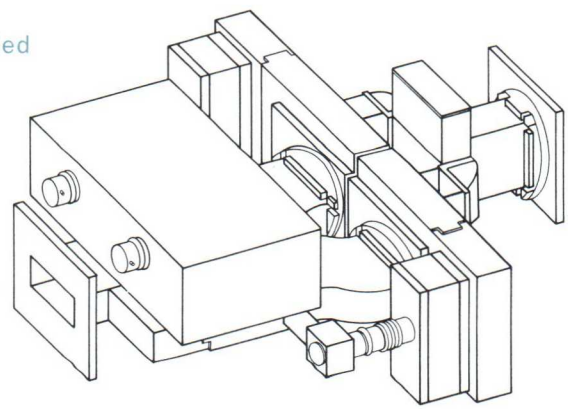
Model Number	Freq. GHz	W.G. Size WR-	Connectors UG-( )/U	Power In mW	Power Out mW	Diode Type Supplied
MA-1133-1BE	8.5-9.6	90	39	20	2	MA-4165
MA-1133-2BE	8.5-9.6	90	39	20	2	MA-4165
MA-1134-1BE	9.0-10.0	90	39	20	2	MA-4165
MA-1134-2BE	9.0-10.0	90	39	20	2	MA-4165
MA-1135-1BE	10.0-11.0	90	39	20	2	MA-4165
MA-1135-2BE	10.0-11.0	90	39	20	2	MA-4165
MA-1131-1BE	13.0-14.0	62	419	20	2	MA-490
MA-1131-2BE	13.0-14.0	62	419	20	2	MA-490
MA-1132-1BE	16.0-17.0	62	419	20	2	MA-490
MA-1132-2BE	16.0-17.0	62	419	20	2	MA-490

Image Rejection Mixers

Waveguide image rejection mixers combine two miniature ORTHOTEE hybrid balanced mixers with signal, LO and IF combining networks to provide broadband rejection of image signals and improved mixer performance. Units can be supplied for all bands from 4 to 40 GHz. For frequencies below 6 GHz, equivalent units in strip-transmission line can be supplied. Specifications for a typical unit, the MA-68480, an Xs-band image rejection mixer are:

Frequency — 8.5 to 9.6 GHz
Typical Noise Figure — 8.5 dB
Image Rejection — 20 dB
IF Frequency[1] — 30 or 60 MHz

NOTE: 1. Other IF frequencies are available on special request.



Electromechanical Switches

COAXIAL

Model Number	Freq. GHz	Description	Min. Isol. dB	Actuation
MA-7506 series	0-1.0	Single channel, multi-throw, high power	60	Remote
MA-7501 series	0-11.0	Single channel, multi-throw	40	Remote or manual
MA-7502T series	0-11.0	Transfer	60	Remote
MA-7521 series	0-11.0	Single channel, multi-throw, miniature	40	Remote
MA-7524 series	0-11.0	Single channel, double-throw	60	Remote
MA-7525 series	0-11.0	Transfer	60	Remote

Insertion loss varies from 0.1 to 0.5 dB and VSWR from 1.3 to 1.5 max. Coaxial switches available with choice of connectors and actuation voltage, 28-volt dc, or 115-volt ac. Indicator circuits available.

WAVEGUIDE

All remote models offer choice of actuation voltage, 28-volt dc or 115-volt ac, with or without indicator circuits.

Model Number	Freq. GHz	W.G. Size WR-	Description	Insert. Loss dB	Min. Isol. dB	VSWR	Actuation
MA-7517 series	7.0-11.0	102	SPDT or transfer	0.2	50	1.10	Remote
MA-7509 series	8.2-12.4	90	SPDT or transfer	0.2	60	1.10	Remote or Manual
MA-7514 series	8.2-12.4	90	SPDT or transfer	0.2	40	1.10	Remote
MA-1063	8.5-10.0	112	SPDT	0.15	35	1.10	Manual
MA-1064	8.5-10.0	112	SPDT	0.15	35	1.10	Remote
MA-1064A	8.5-10.0	112	SPDT	0.15	35	1.10	Remote with indicating microswitches
MA-7515 series	10.0-15.0	75	SPDT or transfer	0.2	60	1.10	Remote
MA-7510 series	12.4-18.0	62	SPDT or transfer	0.2	60	1.10	Remote or Manual
MA-7518 series	26.5-40.0	28	SPDT or transfer	0.2	50	1.25	Remote
MA-1041B	26.5-40.0	28	SPDT	0.25	25	1.15	Manual

SHUTTERS

Model Number	Freq. GHz	W.G. Size WR-	Min. Isol. (closed position) dB
MA-788A	2.7-3.1	284	30
MA-710	8.5-9.6	90	30
MA-710F[1]	8.5-9.6	90	30
MA-763	8.5-9.6	112	30
MA-750A[2]	8.5-9.6	90	30
MA-750B[2]	9.2-10.0	90	30
MA-704	8.5-9.6	90	30
MA-705[2]	8.5-9.6	90	30
MA-760	16.0-17.0	62	30
MA-761	33.0-36.0	28	28

All shutters remotely actuated by 28 Vdc, insertion loss 0.2 dB max., VSWR 1.10 max. in open position.

NOTES:
1. MA-710F normally open. Other models normally closed.
2. Dual shutters.

TRANSMISSION LINE DEVICES

Mica windows are normally supplied in copper alloy but can be supplied in the smaller sizes (WR-112 or smaller) in aluminum on special order. Kovar glass and ceramic window assemblies must be made with kovar or similar alloys to provide highest reliability.

Flange Mounted Mica Windows

Model Number	Freq. GHz	Max. VSWR	Peak Power kw	W.G. Size RG-( )/U	Max. Press.[1] PSI	Mates with UG-( )/U	Flange Thick. in.
MA-1476	1.1-1.5	1.10	5000	69	45/30	418	0.625
MA-1426	2.6-3.95	1.10	2000	48	45/30	54A	0.250
MA-1474	3.7-4.2	1.04	2000	WR-229	45/30	CPR-229	0.250
MA-1479	3.7-4.2	1.04	2000	WR-229	45/30	Special	0.250
MA-1458	3.95-5.85	1.08	1500	49	45/30	148B	0.187
MA-1458B	3.95-4.65	1.05	1500	49	45/30	148B	0.187
MA-1458A	4.65-5.85	1.05	1500	49	45/30	148B	0.187
MA-1452	5.85-8.2	1.08	750	50	50/30	343A	0.125
MA-1452B	5.85-7.12	1.05	750	50	50/30	343A	0.125
MA-1477	5.92-6.43	1.05	600	50	45/30	CPR-137	0.187
MA-1483	5.92-6.43	1.04	1000	WR-159	45/30	CPR-159	0.250
MA-1429	7.05-10.0	1.08	500	51	60/30	52A	0.125
MA-1452A	7.12-8.2	1.05	750	50	50/30	343A	0.125
MA-1439C	7.95-8.55	1.10	75	52	45/30	1.185 dia	0.084
MA-1430	8.20-12.4	1.08	300	52	60/30	40A	0.125
MA-1429A	8.5-9.6	1.05	500	51	60/30	52A	0.125
MA-1430A	8.5-9.6	1.05	300	52	60/30	40A	0.125
MA-1481	10.0-15.0	1.08	200	WR-75	60/30	B66364	0.125
MA-1482	10.7-11.7	1.04	300	WR-90	60/30	CPR-90	0.250
MA-1433	12.4-18.0	1.08	150	91	60/30	541	0.125
MA-1433A	15.5-17.5	1.05	150	91	60/30	541	0.125

Flange Mounted Kovar-Glass Windows

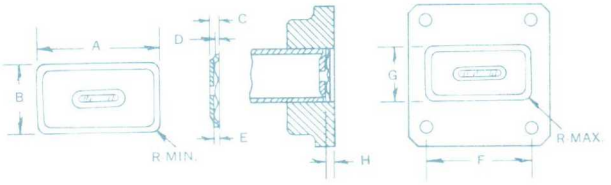
Model Number	Center Freq. GHz	Freq. GHz	Max. VSWR	Peak Power kw	W.G. Size RG-( )/U	Max. Press.[1] PSI	Mates with UG-( )/U	Flange Thick. in.
MA-1326	2.8	2.45-3.15	1.25	1200	48	45/30	54A	0.250
MA-1393	2.8	2.45-3.15	1.25	1200	48	45/30	54A[2]	0.375
MA-1360	3.0	2.65-3.35	1.25	1200	48	45/30	54A	0.250
MA-1377	3.0	2.9-3.1	1.10	1200	48	45/30	Special	0.250
MA-1377A	3.0	2.9-3.1	1.10	1200	48	45/30	Special	0.246
MA-1358	4.65	3.95-5.85	1.20	800	49	30/20	148B	0.187
MA-1358A	5.65	5.25-5.85	1.10	800	49	30/20	148B	0.187
MA-1352B	6.5	5.85-7.125	1.15	500	50	30/20	343A	0.125
MA-1352	6.8	5.85-8.2	1.15	500	50	30/20	343A	0.125
MA-1352A	7.6	7.125-8.2	1.06	500	50	30/20	343A	0.125
MA-1329	9.0	7.5-10.0	1.15	500	51	30/20	52A	0.060
MA-1329A	9.0	7.5-10.0	1.15	320	51	30/20	52A	0.125
MA-1330A	9.0	8.4-9.6	1.15	200	52	60/30	40A	0.156
MA-1344	9.0	8.5-9.6	1.08	300	52	30/20	40A	0.060
MA-1330B	9.8	8.2-12.4	1.20	200	52	60/30	40A	0.156
MA-1345	9.8	8.2-12.4	1.20	300	52	30/20	40A	0.060
MA-1380A	9.8	8.2-12.4	1.20	300	52	30/20	CPR-90	0.250
MA-1394	11.1	11.0-11.2	1.10	50	52	45/30	CPR-90	0.125
MA-1333B	13.5	12.8-14.2	1.10	125	91	45/30	541	0.125
MA-1340	13.5	12.8-14.2	1.10	125	91	45/30	541	0.060
MA-1333A	15.0	12.4-18.0	1.20	125	91	45/30	541	0.125
MA-1342	15.0	12.4-18.0	1.20	125	91	30/20	541	0.060
MA-1333C	16.0	15.2-16.8	1.10	125	91	45/30	541	0.125
MA-1341	16.0	15.2-16.8	1.10	125	91	45/30	541	0.060
MA-1356	17.8	16.0-21.0	1.15	70	53	45/30	596	0.030
MA-1348	24.0	18.0-26.5	1.15	70	53	45/30	596	0.030
MA-1334	34.86	33.25-36.5	1.15	40	96	45/30	600	0.030

NOTES: 1. Higher pressure rating applies when glassed side of window faces highest pressure.
2. Over-all assembly length 4.5 inches.

TRANSMISSION LINE DEVICES

Mica windows are normally supplied in copper alloy but can be supplied in the smaller sizes (WR-112 or smaller) in aluminum on special order. Kovar glass and ceramic window assemblies must be made with kovar or similar alloys to provide highest reliability.

1



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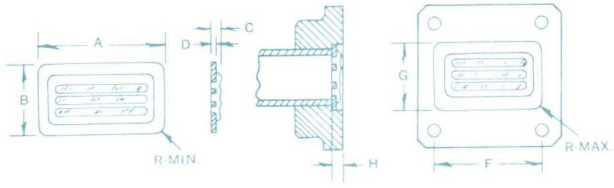
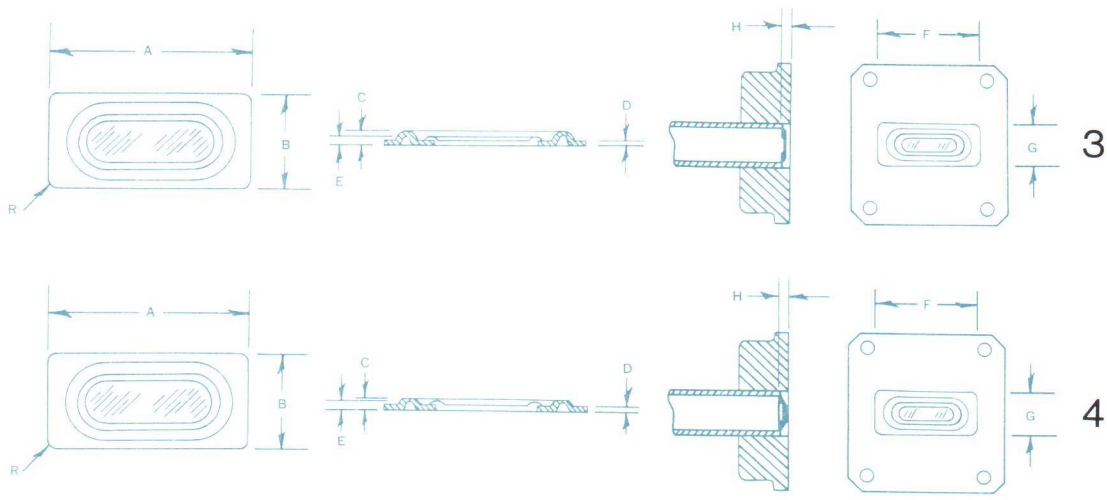


Solderable Kovar-Glass Windows

Model Number	Type	Center Freq. GHz	Frequency Range GHz	Max. VSWR Band Edges	Peak Power kw	W.G. Size RG-( )/U	Max.[1] Pressure PSI
MA-1366	1	2.45	2.4-2.5	1.25	170	48	60/45
MA-1318	1	2.8	2.75-2.85	1.25	170	48	60/45
MA-1325	2	2.8	2.45-3.15	1.25	1200	48	45/30
MA-1361	2	3.0	2.65-3.35	1.25	1200	48	45/30
MA-1306	1	3.3	3.25-3.35	1.25	170	48	60/45
MA-1357	2	4.65	3.95-5.85	1.20	800	49	30/20
MA-1369	1	5.0	4.95-5.05	1.08	375	49	60/30
MA-1359	1	5.28	5.25-5.31	1.08	375	49	60/30
MA-1357A	2	5.65	5.25-5.85	1.10	800	49	30/20
MA-1372	4	5.9	5.85-5.95	1.08	150	49	45/30
MA-1351C	2	6.0	5.2-8.2	1.50	500	50	30/20
MA-1351B	2	6.5	5.85-7.125	1.15	500	50	30/20
MA-1351	2	7.0	5.85-8.2	1.25	500	50	30/20
MA-1351A	2	7.6	7.125-8.2	1.06	500	50	30/20
MA-1321	1	8.8	8.5-9.1	1.25	100	52	60/45
MA-1301	1	9.0	8.8-9.2	1.25	20	52	60/45
MA-1301A	3	9.0	8.8-9.2	1.25	20	52	60/45
MA-1301B	4	9.0	8.8-9.2	1.25	20	52	45/30
MA-1301C	4	9.0	8.6-9.4	1.25	50	52	45/30
MA-1310	1	9.0	8.8-9.2	1.25	20	52	45/30
MA-1320	1	9.0	8.7-9.3	1.25	100	52	60/45
MA-1327	1	9.0	8.4-9.6	1.25	150	52	30/20
MA-1338	2	9.0	8.4-9.6	1.08	200	52	60/30
MA-1350	2	9.0	7.5-10.0	1.15	320	51	30/20
MA-1302	1	9.2	8.9-9.5	1.25	100	52	60/45
MA-1302A	3	9.2	9.0-9.4	1.25	20	52	60/45
MA-1302B	4	9.2	9.0-9.4	1.25	20	52	45/30



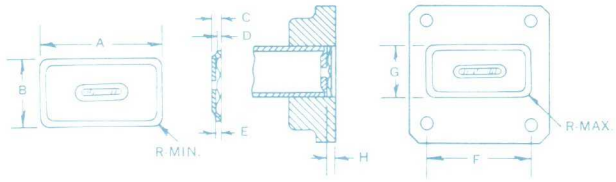
Outline Dimensions (inches)					Flange Recess Dimensions			
A	B	C	D	E	R	F +.005 −.000	G +.005 −.000	H +.005 −.000
3.000	1.500	0.120	0.060	—	0.015	3.000	1.500	0.080
2.975	1.500	0.120	0.060	—	0.015	3.000	1.500	0.080
3.000	1.500	0.120	0.060	—	0.032	3.005	1.505	0.080
3.000	1.500	0.120	0.060	—	0.032	3.005	1.505	0.080
3.000	1.500	0.120	0.060	—	0.015	3.000	1.500	0.080
2.250	1.250	0.093	0.060	—	0.063	2.250	1.250	0.093
1.937	0.937	0.130	0.060	—	1.09	1.945	0.945	0.065
1.872	1.000	0.116	0.060	—	—	1.872	1.000	0.120
2.250	1.250	0.093	0.060	—	0.063	2.250	1.250	0.093
1.996	0.996	0.060	0.030	0.030	0.063	2.005	1.005	0.070
2.000	1.000	0.085	0.045	—	0.063	2.005	1.005	0.085
2.000	1.000	0.075	0.045	—	0.063	2.005	1.005	0.075
2.000	1.000	0.075	0.045	—	0.063	2.005	1.005	0.075
2.000	1.000	0.075	0.045	—	0.063	2.005	1.005	0.075
1.000	0.500	0.075	0.030	0.005	0.032	1.000	0.500	0.050
0.990	0.491	0.050	0.020	—	0.032	1.000	0.500	0.040
0.990	0.491	0.050	0.020	0.030	0.015	1.000	0.500	0.055
0.990	0.491	0.050	0.020	0.030	0.015	1.000	0.500	0.055
0.990	0.491	0.045	0.020	0.030	0.015	1.000	0.500	0.055
0.985	0.491	0.055	0.020	0.030	0.032	1.000	0.500	0.040
1.000	0.500	0.075	0.030	0.005	0.032	1.000	0.500	0.050
1.000	0.500	0.065	0.020	0.005	0.032	1.000	0.500	0.040
1.100	0.600	0.050	0.030	—	0.032	1.105	0.605	0.055
1.500	0.750	0.050	0.030	—	0.032	1.505	0.755	0.055
1.000	0.500	0.075	0.030	0.005	0.032	1.000	0.500	0.050
0.990	0.491	0.050	0.020	0.030	0.015	1.000	0.500	0.055
0.990	0.491	0.050	0.020	0.030	0.015	1.000	0.500	0.055

NOTE: 1. Higher pressure rating applies when glassed side of window faces the higher pressure.

TRANSMISSION LINE DEVICES

Mica windows are normally supplied in copper alloy but can be supplied in the smaller sizes (WR-112 or smaller) in aluminum on special order. Kovar glass and ceramic window assemblies must be made with kovar or similar alloys to provide highest reliability.

1



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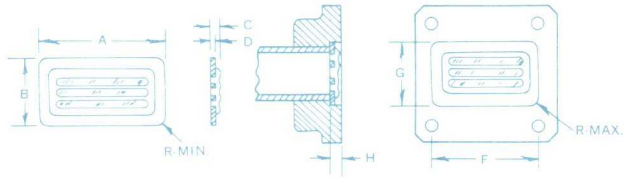
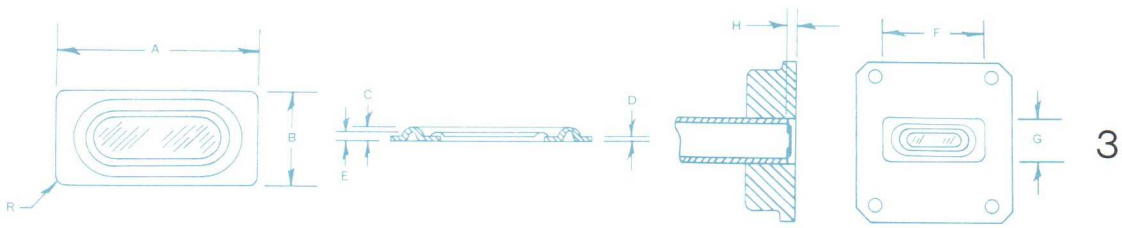


Solderable Kovar-Glass Windows (continued)

Model Number	Type	Center Freq. GHz	Frequency Range GHz	Max. VSWR Band Edges	Peak Power kw	W.G. Size RG-( )/U	Max.[1] Pressure PSI
MA-1302C	4	9.2	8.8-9.6	1.25	50	52	45/30
MA-1312	1	9.31	9.0-9.6	1.25	100	52	60/30
MA-1312A	3	9.31	9.1-9.5	1.25	20	52	60/45
MA-1312B	4	9.31	9.1-9.5	1.25	20	52	45/30
MA-1312C	4	9.31	8.9-9.7	1.25	50	52	45/30
MA-1353	1	9.31	9.1-9.7	1.25	100	52	60/45
MA-1319	1	9.375	9.1-9.7	1.25	100	52	60/45
MA-1317	2	9.6	8.35-11.0	1.25	200	52	60/30
MA-1322	1	9.6	9.3-9.9	1.25	100	52	60/45
MA-1303	1	9.8	9.5-10.2	1.25	150	52	45/30
MA-1324	1	9.8	9.6-10.0	1.25	20	52	45/30
MA-1324A	3	9.8	9.6-10.0	1.25	20	52	45/30
MA-1324B	4	9.8	9.6-10.0	1.25	20	52	45/30
MA-1324C	4	9.8	9.4-10.2	1.25	50	52	45/30
MA-1331	1	9.8	9.6-10.2	1.10	150	52	30/20
MA-1350A	2	9.8	8.6-10.6	1.15	320	51	30/20
MA-1311	2	9.9	8.2-12.4	1.25	200	52	60/30
MA-1323	1	9.9	9.6-10.2	1.25	100	52	60/45
MA-1354	1	10.125	9.8-10.4	1.25	100	52	60/45
MA-1314	1	10.15	9.8-10.55	1.25	150	52	45/30
MA-1373	4	10.4	10.0-10.8	1.25	50	52	45/30
MA-1328	1	10.7	10.0-11.4	1.25	150	52	30/20
MA-1336	1	13.5	13.0-14.0	1.25	40	91	45/30
MA-1337	1	16.0	15.4-16.6	1.25	40	91	45/30



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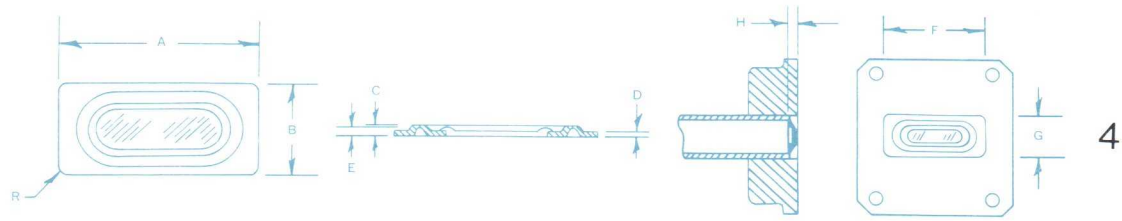

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Outline Dimensions (inches)					Flange Recess Dimensions			
A	B	C	D	E	R	F +.005 −.000	G +.005 −.000	H +.005 −.000
0.990	0.491	0.045	0.020	0.030	0.015	1.000	0.500	0.055
1.000	0.500	0.075	0.030	0.005	0.032	1.000	0.500	0.050
0.990	0.491	0.050	0.020	0.030	0.015	1.000	0.500	0.055
0.990	0.491	0.050	0.020	0.030	0.015	1.000	0.500	0.055
0.990	0.491	0.045	0.020	0.030	0.015	1.000	0.500	0.055
1.000	0.500	0.075	0.030	0.005	0.032	1.000	0.500	0.050
1.000	0.500	0.075	0.030	0.005	0.032	1.000	0.500	0.050
1.100	0.600	0.050	0.030	—	0.032	1.105	0.605	0.055
1.000	0.500	0.075	0.030	0.005	0.032	1.000	0.500	0.050
1.000	0.500	0.075	0.030	0.005	0.032	1.000	0.500	0.050
0.985	0.491	0.055	0.020	0.030	0.032	1.000	0.500	0.040
0.990	0.491	0.050	0.020	0.030	0.015	1.000	0.500	0.055
0.990	0.491	0.050	0.020	0.030	0.015	1.000	0.500	0.055
0.990	0.491	0.045	0.020	0.030	0.015	1.000	0.500	0.055
1.000	0.500	0.065	0.020	0.032	0.032	1.000	0.500	0.040
1.500	0.750	0.050	0.030	—	0.032	1.505	0.755	0.055
1.100	0.600	0.050	0.030	—	0.032	1.105	0.605	0.055
1.000	0.500	0.075	0.030	0.005	0.032	1.000	0.500	0.050
1.000	0.500	0.075	0.030	0.005	0.032	1.000	0.500	0.050
1.000	0.500	0.075	0.030	0.005	0.032	1.000	0.500	0.050
0.990	0.491	0.045	0.020	0.030	0.015	1.000	0.500	0.055
1.000	0.500	0.065	0.020	0.005	0.032	1.000	0.500	0.040
0.690	0.380	0.045	0.020	0.005	0.032	0.702	0.391	0.040
0.690	0.380	0.045	0.020	0.005	0.032	0.702	0.391	0.040

NOTE: 1. Higher pressure rating applies when glassed side of window faces the higher pressure.

TRANSMISSION LINE DEVICES

Mica windows are normally supplied in copper alloy but can be supplied in the smaller sizes (WR-112 or smaller) in aluminum on special order. Kovar glass and ceramic window assemblies must be made with kovar or similar alloys to provide highest reliability.

Solderable Flange Mounted Windows

Model Number	Center Freq. GHz	Freq. GHz	Max. VSWR	Peak Power kw	W.G. Size RG-( )/U	Max. Press.[1] PSI	Out-side Dia. in.	Flange Thick.
MA-1375	9.0	8.4-9.6	1.08	200	52	60/30	1.500	0.125
MA-1335	9.8	8.2-12.4	1.20	200	52	60/30	1.562	0.156
MA-1367	9.8	8.2-12.4	1.20	200	52	60/30	1.750	0.150
MA-1339	9.8	9.5-10.1	1.10	20	—[2]	45/30	1.187	0.060
MA-1371	24.0	23.6-24.4	1.10	70	53	45/30	0.750	0.060

NOTES:
1. Higher pressure rating applies when glassed side of window faces highest pressure.
2. 0.2 by 0.90-inch inside dimensions.

Ceramic High Power Windows

Model Number	Freq. GHz	Max. VSWR	Power Peak kw	Power Avg. kW	W.G. Size WR-	Max. Press. PSI	Mates with UG-( )/U	Window Length in.
MA-1502	2.8-3.5	1.25	6000	9/90[2]	340	30	CPR-340	2.450
MA-1507	3.0-3.2	1.25	4500	6/60[2]	284	30	CPR-284	2.0
MA-1501	2.96-3.12 / 3.2-3.45	1.25	4500	6/60[2]	284	30	54A	1.386
MA-1504[1]	5.4-5.9	1.20	2000	4/40[2]	187	30	148B	—
MA-1503[1]	7.5-8.5	1.20	750	3/30[2]	112	30	52A	0.805
MA-1500	9.0-9.8 / 10.0-11.2	1.15	450	2 —	90	30	40B	0.532
MA-1505	9.0-9.8 / 10.0-11.2	1.15	450	2/20[2]	90	30	40B	0.532
MA-1506	9.0-9.8 / 10.0-11.2	1.15	450	2 —	90	30	40B/CPR-90	0.532

NOTES:
1. In development.
2. When water-cooled.

Low Power Windows (Dust and Moisture Seals)

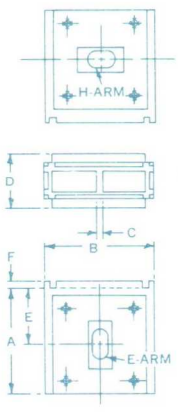
Model Number	Freq. GHz	Max. VSWR	Mates with UG-( )/U
MA-1606	3.95-5.85	1.08	148B

Pressure Window, Waveguide Assemblies

Model Number	Center Freq. GHz	Freq. GHz	Max. VSWR	Peak Power kw	W.G. Size RG-( )/U	Max. Press. PSI	Mates with UG-( )/U	Overall Length in.
MA-1364	9.0	7.5-10.0	1.15	320	51/U	30/20	52A	2.500
MA-1363	9.0	8.4-9.60	1.08	200	52/U	60/30	40A	2.500
MA-1376	11.2	10.7-11.7	1.10	200	52/U	60/30	CMR-90	1.188

CAST COMPONENTS

Specify material by adding suffix "A" for aluminum, "B" for beryllium copper.



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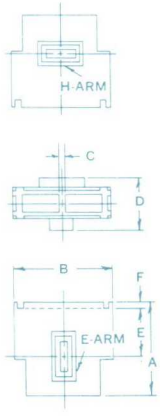

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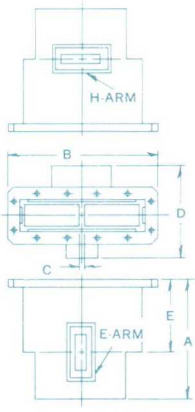

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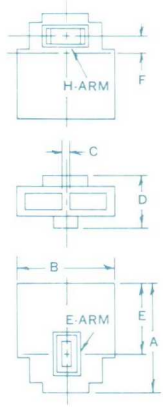

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ORTHOTEE™ Hybrids[1]

Isolation E to H 40 dB (min.); unbalance dB (max.) is 0.1.

Model Number	Type	Freq. GHz	W.G. Size WR-	Max. VSWR E & H Arms	Dimensions (inches) A ±1/64	B ±1/64	C ±.005	D ±.005	E ±.005	F ±1/64
MA-5176	2 or 3	4.05-4.55	187	1.15	3.843	4.125	0.128	1.750	2.150	0.093
MA-5177[2]	2 or 3	4.34-5.06	187	1.15	3.843	4.125	0.128	1.750	2.150	0.093
MA-5166	2 or 3	5.4-5.9	187	1.15	3.843	4.125	0.128	1.750	2.150	0.093
MA-5167	1	5.5-6.1	159/2	1.15	3.125	3.562	0.128	1.125	0.781	0.187
MA-5155	2	5.92-6.43	137	1.15	3.063	3.140	0.150	1.375	1.875	0.125
MA-5165[2]	2	6.42-7.13	137	1.15	3.063	3.140	0.150	1.375	1.875	0.125
MA-5154	2	7.05-7.8	112	1.15	3.406	2.625	0.150	1.171	1.250	0.125
MA-5174	2	7.5-8.5	112	1.15	2.406	2.625	0.150	1.171	1.250	0.125
MA-5164	2	8.5-9.7	112/90	1.15	1.718	2.046	0.050	1.125	0.950	0.125
MA-5153	1	8.5-9.6 / 8.2-10.0	90	1.15 / 1.40	1.750	2.046	0.050	0.750	0.937	0.125
MA-5157	1	9.0-10.0	90	1.15	1.750	2.046	0.050	0.750	0.937	0.125
MA-5180	2	9.0-10.0	90	1.15	1.718	2.046	0.050	1.000	0.937	0.125
MA-5179	1	9.5-10.6	90	1.15	1.750	2.046	0.050	0.750	0.937	0.125
MA-5163	1	10.0-11.0 / 9.6-11.4	90	1.15 / 1.40	1.750	2.046	0.050	0.750	0.937	0.125
MA-5173	1	10.7-11.7 / 10.5-11.8	90	1.15 / 1.30	1.750	2.046	0.050	0.750	0.937	0.125
MA-5152	1	13.0-14.0 / 12.4-14.5	62	1.15 / 1.40	1.406	1.500	0.090	0.750	0.750	0.093
MA-5181	4	13.2-13.5	62	1.15	1.312	1.434	0.090	1.187	1.369	0.150
MA-5162	1	15.8-17.2 / 15.5-17.5	62	1.15 / 1.30	1.406	1.500	0.090	0.750	0.750	0.093

NOTES: 1. U. S. Patent No. 3,192,489.
2. In development.

TRANSMISSION LINE DEVICES (CAST COMPONENTS)

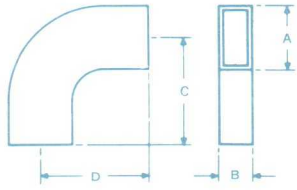
Specify material by adding suffix "A" for aluminum, "B" for beryllium copper.

Bends

Compensated cast bends are manufactured under U.S. patent 3,072,870. Maximum VSWR for all models (except those marked by an asterisk) is 1.05 maximum.

Model Number	Type	Freq. GHz	W.G. Size WR-	Dimensions (inches) A	B	C	D
180°							
MA-5503	2/E	3.95-5.85	187	1.406	2.125	1.125	—
90°							
MA-5410	4/E	0.75-1.12	975	13.250	8.375	5.500	5.500
MA-5310	4/H	0.75-1.12	975	13.250	8.375	8.000	8.000
MA-5309	4/H	1.12-1.70	650	8.687	5.437	6.000	6.000
MA-5409	4/E	1.12-1.70	650	8.687	5.437	4.000	4.000
MA-5408	2/E	2.60-3.95	284	3.125	1.625	0.781	0.781
MA-5458	3/E	2.60-3.95	284	3.125	1.625	2.406	2.406
MA-5308	2/H	2.60-3.95	284	3.125	1.625	1.531	1.531
MA-5328	3/H	2.60-3.95	284	3.125	1.625	2.375	2.375
MA-5459	5/E	2.60-3.95	284	3.125	1.625	1.625	1.625
MA-5307	3/H	3.30-4.30	229	2.546	1.468	2.250	2.250
MA-5457	3/E	3.30-4.30	229	2.546	1.406	1.875	1.875
MA-5456	2/E	3.95-5.95	187	2.125	1.125	1.063	1.063
MA-5306	2/H	3.95-5.95	187	2.125	1.125	1.063	1.063
MA-5406	2/E	3.95-5.95	187	2.125	1.125	0.562	0.562
MA-5316	2/H	4.90-7.05	159	1.843	1.063	1.000	1.000
MA-5469	5/E	4.90-7.05	159	1.843	1.063	1.000	1.000
MA-5405	2/E	5.85-8.20	137	1.625	0.875	0.437	0.437
MA-5305	2/H	5.85-8.20	137	1.625	0.875	0.812	0.812
MA-5455	5/E	5.85-8.20	137	1.625	0.875	0.656	0.656
MA-5404	2/E	7.05-10.00	112	1.390	0.765	0.343	0.343
MA-5304	2/H	7.05-10.00	112	1.390	0.765	0.656	0.656
MA-5454	5/E	7.05-10.00	112	1.343	0.718	0.593	0.593
MA-5354	5/H	7.05-10.00	112	1.328	0.703	1.187	1.187
MA-5465	1/E	7.05-10.00	112	1.250	0.625	0.687	1.468
MA-5403	2/E	8.20-12.40	90	1.125	0.625	0.328	0.328
MA-5303	2/H	8.20-12.40	90	1.125	0.625	0.578	0.578
MA-5417(A1)	3/E	8.20-12.40	90	1.125	0.625	0.875	0.687
MA-5417(B2)	3/E	8.20-12.40	90	1.125	0.625	1.187	0.937
MA-5417(C3)	6/E	8.20-12.40	90	1.125	0.625	1.437	0.328
MA-5417(C6)	3/H	8.20-12.40	90	1.125	0.625	1.375	0.328

1/H



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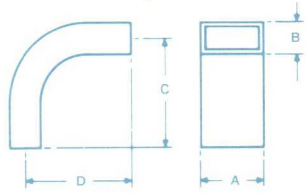

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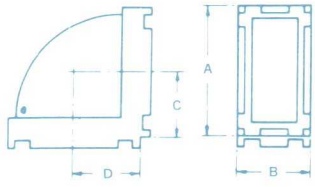

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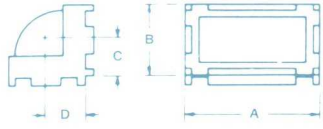

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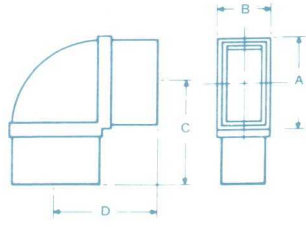

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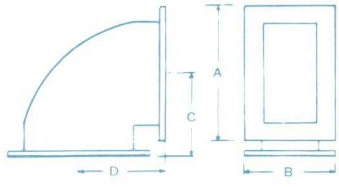
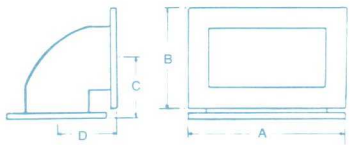
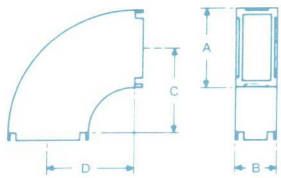


Model Number	Type	Freq. GHz	W.G. Size WR-	Dimensions (inches) A	B	C	D
MA-5317(A1)	3/H	8.20-12.40	90	1.125	0.625	2.187	0.640
MA-5317(B2)	3/H	8.20-12.40	90	1.125	0.625	1.375	0.953
MA-5317(C3)	3/H	8.20-12.40	90	1.125	0.625	1.250	1.328
MA-5317(D4)	6/H	8.20-12.40	90	1.125	0.625	2.063	0.578
MA-5317(D5)	6/H	8.20-12.40	90	1.125	0.625	2.359	0.578
MA-5322	2/H	8.20-12.40	90/2	1.125	0.406	0.575	0.575
MA-5418	2/E	8.20-12.40	90/2	1.093	0.406	0.215	0.215
MA-5464	1/E	8.20-12.40	90	1.000	0.500	0.687	2.500
MA-5462*	1/E	8.20-12.40	90	1.000	0.500	1.125	1.125
MA-5362*	1/H	8.20-12.40	90	1.000	0.500	1.375	1.375
MA-5453	5/E	8.20-12.40	90	1.125	0.625	0.453	0.453
MA-5413	2/E	10.00-15.00	75	0.937	0.562	0.312	0.312
MA-5313	2/H	10.00-15.00	75	0.937	0.562	0.500	0.500
MA-5402	2/E	12.40-18.00	62	0.812	0.500	0.281	0.281
MA-5302	2/H	12.40-18.00	62	0.812	0.500	0.437	0.437
MA-5466	1/E	12.40-18.00	62	0.703	0.390	2.078	0.656
MA-5461*	1/E	12.40-18.00	62	0.703	0.390	1.406	1.406
MA-5361*	1/H	12.40-18.00	62	0.703	0.390	1.562	1.562
MA-5452	5/E	12.40-18.00	62	0.812	0.500	0.812	0.406
MA-5401	2/E	18.00-26.50	42	0.609	0.359	0.210	0.210
MA-5301	2/H	18.00-26.50	42	0.609	0.359	0.335	0.335
MA-5400	2/E	30.00-40.00	28	0.437	0.296	0.140	0.140
MA-5300	2/H	30.00-40.00	28	0.437	0.296	0.210	0.210
MA-5320	3/H	30.00-40.00	28	0.437	0.296	0.625	0.625
MA-5450	5/H	30.00-40.00	28	0.437	0.296	0.230	0.230
45° (±15′)							
MA-5512	2/H	8.12-12.40	90	1.125	0.625	—	—
MA-5511	2/E	8.20-12.40	90	1.125	0.625	—	—
MA-5505	2/E	12.40-18.00	137	1.625	0.875	—	—
MA-5506	2/E	12.40-18.00	112	1.375	0.750	—	—
MA-5509	2/H	12.40-18.00	112	1.375	0.750	—	—
MA-5510	2/H	12.40-18.00	90/2	1.125	0.406	—	—
MA-5507	2/E	12.40-18.00	75	0.937	0.562	—	—
MA-5508	2/H	12.40-18.00	75	0.937	0.562	—	—
MA-5500	2/E	12.40-18.00	62	0.812	0.500	—	—
MA-5501	2/H	12.40-18.00	62	0.812	0.500	—	—
30° (±15′)							
MA-5502	2/E	12.40-18.00	62	0.812	0.500	—	—

4/E



5/H



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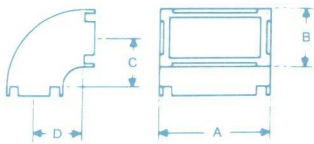
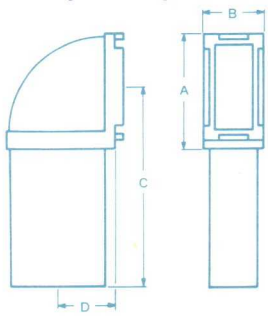
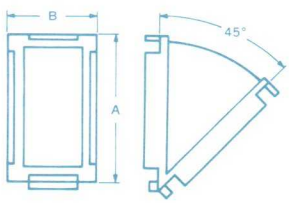


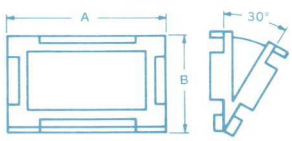
6/H, 6/E



45°



30°



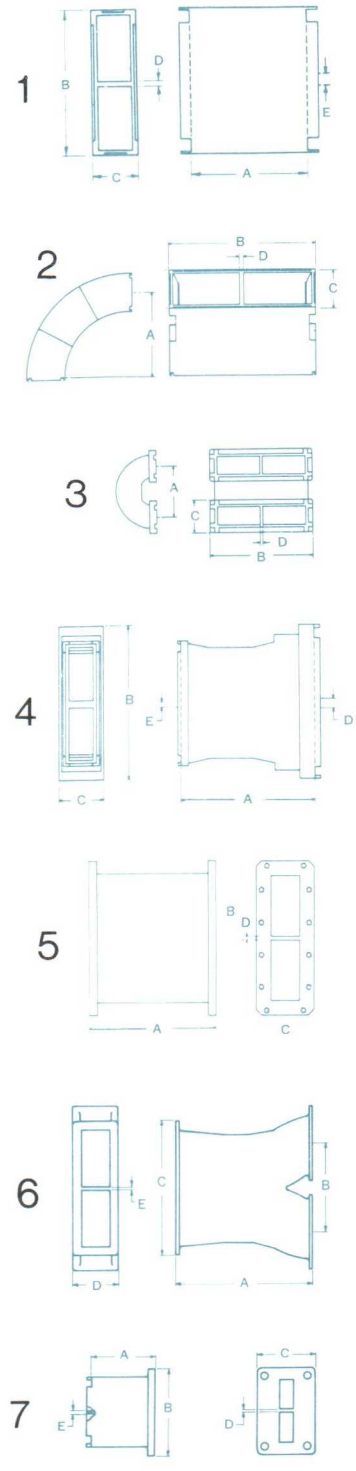
TRANSMISSION LINE DEVICES (CAST COMPONENTS)

Specify material by adding suffix "A" for aluminum, "B" for beryllium copper.

Sidewall Hybrid Couplers (3 dB)

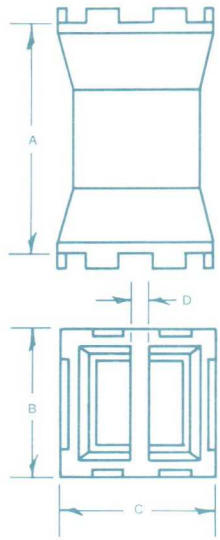
In all cases the terminated VSWR is less than 1.07, isolation is 30 dB and power division is ±0.25 dB.

Model Number	Type	Freq. GHz	W.G. Size WR-	Dimensions (inches) A	B	C	D	E
MA-5034	6	1.25-1.35	650	16.000	10.000	15.375	5.437	0.160
MA-5035	6[1]	1.25-1.35	650	16.000	10.000	15.375	5.437	0.160
MA-5017	1	2.4-2.8	284	6.000	6.390	1.625	0.160	0.160
MA-5008	1	2.85-3.15	284	5.500	6.109	1.281	0.160	0.160
MA-5021	2	2.85-3.15	284	3.500	6.093	1.562	0.160	0.160
MA-5007	5	3.7-4.2	229	5.250	6.296	2.750	0.128	0.128
MA-5006	1	5.2-5.9	187	3.250	4.125	1.125	0.128	0.128
MA-5039	1	5.35-6.05	159	3.250	3.562	1.063	0.128	0.128
MA-5005	1	5.9-6.5	137	2.625	3.093	0.843	0.150	0.150
MA-5047	5	5.92-6.43	159	3.250	4.250	1.750	0.150	0.150
MA-5015	1	6.42-7.13	137	2.625	3.156	0.875	0.150	0.150
MA-5044	1	7.0-7.8	112	2.187	2.656	0.750	0.150	0.150
MA-5032	1	7.5-8.5	112	2.187	2.625	0.750	0.150	0.150
MA-5004	1	8.5-9.6	112	2.187	2.578	0.718	0.150	0.150
MA-5014	4	8.5-9.6	112/90	2.187	2.625	0.718	0.150	0.120
MA-5003	1	8.5-9.6	90	1.735	2.063	0.593	0.050	0.050
MA-5012	2	8.5-9.6	90	1.125	2.063	0.609	0.050	0.050
MA-5013	3	8.5-9.6	90	1.109	2.156	0.703	0.050	0.050
MA-5041	1	8.5-9.6	90	1.735	2.125	0.609	0.120	0.120
MA-5040	7	8.5-9.6	90	1.735	2.578	1.625	0.050	0.050
MA-5030	1	8.7-9.9	90	2.000	2.125	0.609	0.120	0.120
MA-5027	1	9.2-10.0	90	1.735	2.046	0.609	0.050	0.050
MA-5046	7	9.2-10.0	90	1.735	2.046	1.625	0.050	0.050
MA-5045	1	9.25-10.25	90	1.500	2.046	0.609	0.050	0.050
MA-5024	1	10.2-11.2	90	1.500	2.000	0.562	0.050	0.050
MA-5043	1	10.5-11.9	90	1.735	2.125	0.609	0.120	0.120
MA-5031	1	12.4-14.0	62	1.110	1.453	0.484	0.040	0.040
MA-5025	1	15.0-17.5	62	1.110	1.481	0.453	0.090	0.090
MA-5026	7	15.0-17.5	62	1.110	1.750	1.312	0.090	0.090
MA-5002	1	15.5-17.5	62	1.110	1.468	0.484	0.040	0.040
MA-5010	1	15.5-17.5	62	1.319	1.531	0.531	0.090	0.090
MA-5011	2	15.5-17.5	62	0.755	1.546	0.546	0.040	0.040
MA-5049	1	17.6-18.8	42	0.900	1.093	0.343	0.040	0.090
MA-5001	1	23.1-24.9	42	0.900	1.093	0.328	0.040	0.090
MA-5000	1	34.0-36.0	28	0.550	0.781	0.312	0.040	0.040



NOTE:
1. Same as MA-5034 with cooling fins added.

1



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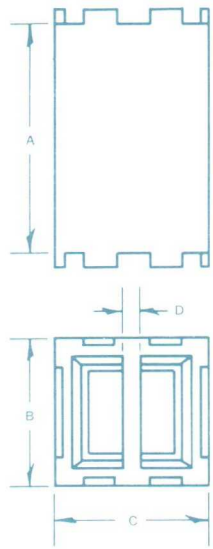

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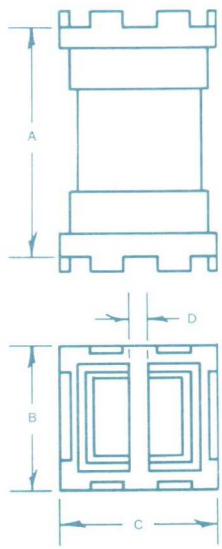


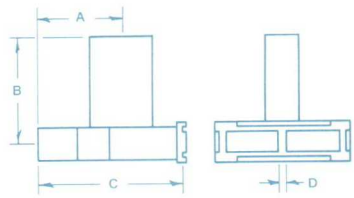
Topwall Hybrid Couplers (3 dB)

Model Number	Type	Freq. GHz	W.G. Size WR-	Dimensions (inches) A	B	C	D
MA-5212	3	2.70-2.90	284	4.750	3.200	3.200	0.160
MA-5205	2	5.20-6.00	137	2.625	1.625	1.656	0.150
MA-5203	1	8.50-9.60	90	1.735	1.140	1.156	0.120
MA-5210	1	9.20-11.0	90	1.735	1.140	1.156	0.120
MA-5211	1	9.90-11.3	90	1.735	1.140	1.156	0.120
MA-5202	1	16.0-17.0	62	1.110	0.906	0.812	0.090

TRANSMISSION LINE DEVICES (CAST COMPONENTS)

Specify material by adding suffix "A" for aluminum, "B" for beryllium copper.

1



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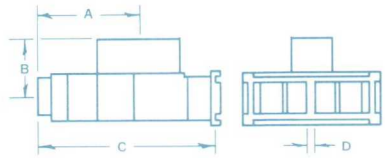

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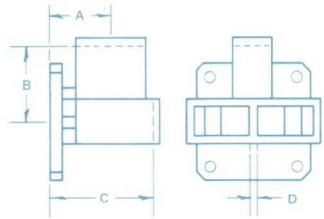

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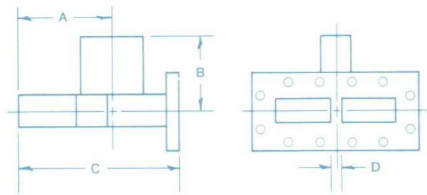
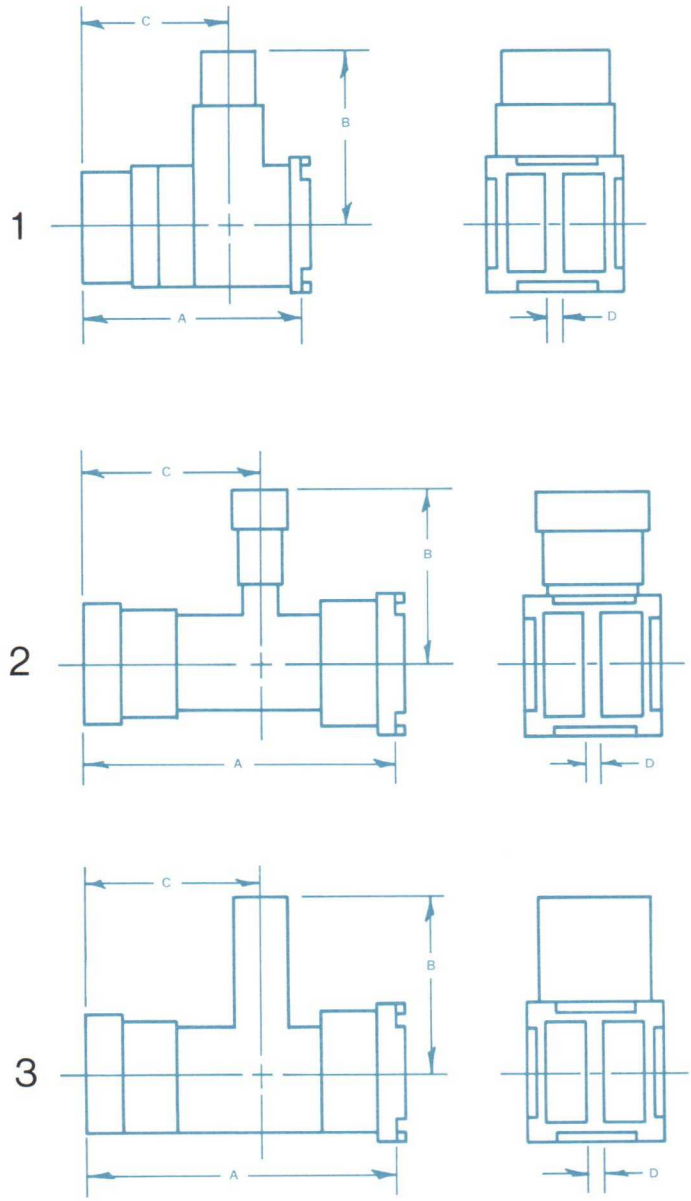


H-Plane Folded Hybrid Tees

Model Number	Type	Freq. GHz	W.G. Size WR-	Max. VSWR E&H Arms	Isolation E&H Arms	Isolation Parallel Arms	Max. Unbal. dB	Dimensions (inches) A	B	C	D
MA-5108	1	2.70-3.15	284	1.10	40	28	0.10	3.555	2.570	6.095	0.160
MA-5106	1	5.0-6.0	187	1.10	40	28	0.10	2.056	2.375	3.975	0.128
MA-5111	2	5.4-5.9	187	1.08	40	30	0.10	2.379	1.319	4.227	0.150
MA-5124	1	5.6-5.9	159	1.10	40	28	0.10	1.844	2.000	3.625	0.128
MA-5105	1	5.9-6.5	137	1.10	40	28	0.10	2.250	1.743	3.812	0.150
MA-5119	1	7.5-8.5	112	1.10	40	28	—	1.569	1.482	2.875	0.150
MA-5103	1	8.5-9.6	90	1.10	40	28	0.10	1.505	1.750	2.225	0.050
MA-5125	4	8.5-9.6	90	1.10	40	28	0.10	1.500	1.750	2.225	0.050
MA-5110	2	8.5-10.8	90	1.10	40	28	0.10	1.443	1.250	2.407	0.120
MA-5115	3	9.8-10.8	90	1.10	40	—	0.10	0.925	1.090	1.562	0.050
MA-5102	1	15.5-17.5	62	1.10	40	28	0.10	0.946	0.812	1.810	0.090
MA-5100	1	34.0-36.0	28	1.15	35	22	0.25	0.483	0.733	0.965	0.040



E-Plane Folded Hybrid Tees

Model Number	Type	Freq. GHz	W.G. Size WR-	Max. VSWR E&H Arms	Isolation E&H Arms	Isolation Parallel Arms	Max. Unbal. dB	Dimensions (inches) A	B	C	D
MA-5258	1	2.90-3.20	284	1.20	40	25	0.10	4.640	4.670	2.970	0.160
MA-5256	2	5.40-5.90	187	1.10	40	28	0.10	4.000	2.562	2.230	0.128
MA-5255	1	5.40-5.90	137	1.10	40	28	0.10	2.625	2.360	1.562	0.150
MA-5253	1	8.50-9.60	90	1.15	40	28	0.10	1.937	1.500	1.312	0.120
MA-5252	3	16.0-17.0	62	1.15	35	25	0.10	1.875	0.968	0.937	0.090
MA-5251[1]	2	20.0-24.0	42	1.20	35	22	0.20	1.143	0.984	0.727	0.040

NOTE: 1. In development.

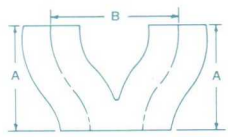
TRANSMISSION LINE DEVICES (CAST COMPONENTS)

Specify material by adding suffix "A" for aluminum, "B" for beryllium copper.

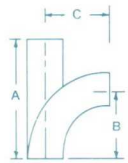
Adapters

Model Number	Type	Freq. GHz	W.G. Size WR-	Dimensions (inches) A	B	C	Common Wall
MA-5656	Dual H	3.95-5.85	187	5.625	1.600	—	0.128
MA-5640	Panty	4.9-7.05	159	2.750	3.500	—	0.128
MA-5635	Panty	5.85-8.2	137	2.375	2.375	—	0.150
MA-5655	Dual H	5.85-8.2	137	4.500	1.328	—	0.150
MA-5643	Panty	8.2-12.4	90	1.312	1.681	—	0.050
MA-5603	H & Straight	8.2-12.4	90	1.570	0.750	0.920	0.050
MA-5613	H & Straight	8.2-12.4	90	1.570	0.750	0.920	0.120
MA-5645	Panty	8.2-12.4	90	1.312	1.751	—	0.120
MA-5646	Panty	8.2-12.4	90	1.130	1.751	—	0.120
MA-5644	Panty	8.2-12.4	90	1.130	1.681	—	0.050
MA-5602	H & Straight	12.4-18.0	62	1.200	0.586	0.657	0.040
MA-5612	H & Straight	12.4-18.0	62	1.200	0.586	0.657	0.090
MA-5702	E & Straight	12.4-18.0	62	2.281	0.844	2.125	0.040
MA-5722	E & Straight	12.4-18.0	62	1.374	0.421	0.827	0.040
MA-5632	Panty	12.4-18.0	62	1.500	2.000	—	0.090
MA-5650	Dual H	26.5-40.0	28	1.570	0.625	—	0.040
MA-5630	Panty	26.5-40.0	28	1.156	0.812	—	0.040
MA-5600	H & Straight	26.5-40.0	28	1.000	0.625	0.625	0.040
MA-5700	E & Straight	26.5-40.0	28	0.910	0.400	0.400	0.040

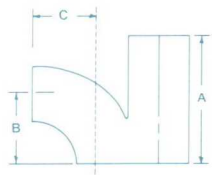
Panty



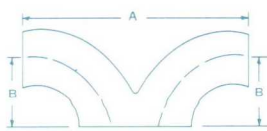
E & Straight



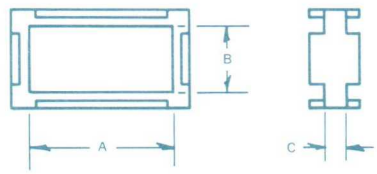
H & Straight

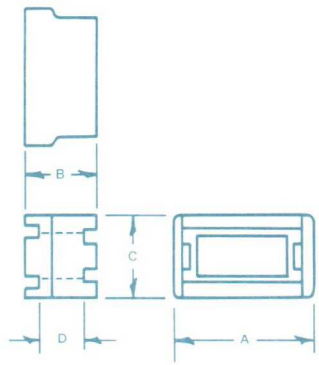


Dual H



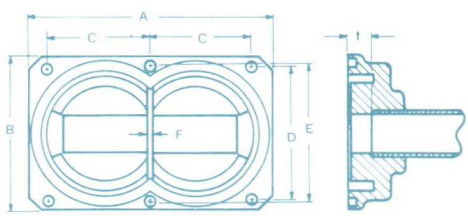
Couplings and Transitions





Model Number	Freq. GHz	W.G. Size WR-	Dimensions (inches) A	B	C	D
MA-5905	5.85-8.20	137	1.372	0.622	0.125	—
MA-5904	7.05-10.0	112	1.112	0.497	0.125	—
MA-5903	8.2-12.4	90	0.900	0.400	0.093	—
MA-5912	8.5-9.6	90 to 112	1.359	0.687	0.750	0.443
MA-5902	12.4-18.0	62	0.622	0.311	0.102	—
MA-5901	18.0-26.5	42	0.420	0.170	0.063	—
MA-5900	26.5-40.0	42	0.280	0.140	0.063	—

Dual Choke Flanges



Model Number	Type	Freq.	W.G: Size WR-	No., Size of holes	Dimensions (inches) A	B	C	D	E	F	t
MA-6054	2	7.05-10.0	112	6-8/32	3.063	1.875	1.269	1.474	1.610	0.064	0.437
MA-6053	2	8.2-12.4	90	4-8/32	2.578	1.625	1.085	1.280	—	0.050	0.312
MA-6052	2	12.4-18.0	62	9-6/32	1.750	1.312	0.750	0.956	—	0.040	0.250

TRANSMISSION LINE DEVICES

Fabricated devices are supplied in brass (or aluminum) for intermediate waveguide sizes (WR-42 or WR-187). Larger sizes are normally supplied in aluminum but can be supplied in brass on special order. WR-28 size is normally supplied in brass or coin silver.

E-Plane and H-Plane Bends

In all cases VSWR is less than 1.05

Model Numbers 90° E-Plane	90° H-Plane	45° E-Plane	45° H-Plane	Freq. GHz	W.G. Size RG-( )/U	W.G. Connect. UG-( )/U
MA-899[1]	MA-905[1]	MA-895	MA-897	2.6-3.95	48	53
MA-828[1]	MA-745[1]	MA-814	MA-821	3.95-5.85	49	149
MA-900[1]	MA-906[1]	MA-896	MA-898	5.85-8.2	50	344
MA-829	MA-801[1]	MA-815	MA-822	7.05-10.0	51	51
MA-635	MA-636	MA-816	MA-823	8.2-12.4	52	39
MA-632	MA-633	MA-817	MA-824	12.4-18.0	91	419
MA-555	MA-533	MA-818	MA-825	18.0-26.5	53	595
MA-556A	MA-557A	MA-819	MA-826	26.5-40.0	96	599

NOTE: 1. Also supplied with CPR flanges. Specify in ordering by adding suffix "A".

Twists and Straights

When ordering straight sections, add suffix indicating length in inches. (MA-892-12 is a 12 inch section RG-69/U).

Twist Model Number	Straight Model Number	Frequency GHz	W.G. Size RG-( )/U	W.G. Connect. UG-( )/U
—	MA-892	1.12-1.7	69	417A
MA-907	MA-885	2.6-3.95	48	53
MA-777	MA-868	3.95-5.85	49	149A
MA-908	MA-867	5.85-8.2	50	344
MA-808	MA-866	7.05-10.0	51	51
MA-642	MA-773	8.2-12.4	52	39
MA-643	MA-858	12.4-18.0	91	419
MA-644	MA-859	18.0-26.5	53	595
MA-558A	MA-860	26.5-40.0	96	599

Adapters

Model Number		Freq. GHz	W.G. Size RG-( )/U	Both Faces Mate With UG-( )/U	
Choke to Choke	Cover to Cover			Choke to Choke	Cover to Cover
MA-507	MA-510	3.95-5.85	49	149A	148B
MA-508	MA-574	5.85-8.2	50	344	343A
MA-676A	MA-676B	7.05-10.0	51	51	52A
MA-660A	MA-660B	8.2-12.4	52	39	40A
MA-661A	MA-661B	12.4-18.0	91	419	541
MA-674A	MA-674B	18.0-26.5	53	595	596
MA-675A	MA-675B	26.5-40.0	96	599	600

Transitions

WAVEGUIDE TO TYPE N

Model Number	Frequency GHz	W.G. Size RG-( )/U	W.G. Connect. UG-( )/U	Max. VSWR
MA-502	1.12-1.70	103	418A	1.25
MA-543C,D	2.6-3.95	48	53, 54A	1.25
MA-735	3.95-5.85	49	149A	1.25
MA-909	5.85-8.2	50	344	1.25
MA-765	7.05-10.0	51	51	1.25
MA-562C,D	8.2-12.4	52	39, 40A	1.25

WAVEGUIDE TO SMALLER WAVEGUIDE

In all cases VSWR is less than 1.05.

Model Number	Freq. GHz	W.G. Size RG-( )/U	to	W.G. Size RG-( )/U
MA-845-229	3.30-4.16	48		WR-229
MA-844-49	3.95-5.15	WR-229		49
MA-846-159	4.90-6.30	49		WR-159
MA-847-51	7.05-8.60	50		51
MA-807-52	8.20-10.5	51		52
MA-848-75	10.0-13.1	52		WR-75
MA-849-51	15.0-19.0	91		WR-51
MA-850-34	22.0-28.1	53		WR-34

TRANSMISSION LINE DEVICES

Fabricated devices are supplied in brass (or aluminum) for intermediate waveguide sizes (WR-42 or WR-187). Larger sizes are normally supplied in aluminum but can be supplied in brass on special order. WR-28 size is normally supplied in brass or coin silver.

Tees

E-PLANE, H-PLANE AND MAGIC

Model Numbers			Frequency	W.G. Size
E-Plane	H-Plane	Magic	GHz	RG-( )/U
MA-869	MA-874	MA-878	1.12-1.7	69
MA-870	MA-875	MA-879	2.6-3.95	48
MA-871	MA-876	MA-880	3.95-5.85	49
MA-872	MA-928	MA-881	5.85-8.2	50
MA-873	MA-877	MA-882	7.05-10.0	51
MA-620	MA-621	MA-637	8.2-12.4	52
MA-616	MA-617	MA-638	12.4-18.0	91
MA-618	MA-619	MA-639	18.0-26.5	53
MA-560A	MA-561A	MA-640	26.5-40.0	96

MATCHED MAGIC

In all cases, minimum isolation between the E and H arms is 40 dB.

Model Number	Frequency GHz	W.G. Size RG-( )/U	Maximum VSWR E-Plane	H-Plane	Side
MA-991	2.6-3.0	48	1.20	1.20	1.15
MA-994	7.5-8.5	51	1.20	1.20	1.15
MA-541	8.5-9.6	52	1.20	1.20	1.15
MA-971	12.5-14.5	91	1.20	1.20	1.20
MA-883	15.5-17.5	91	1.20	1.20	1.15
MA-884	23.5-24.5	53	1.30	1.30	1.30
MA-759	34.0-36.0	96	1.40	1.40	1.40

Directional Couplers

Model number suffix indicates desired nominal coupling value. In ordering, specify nominal coupling value by adding the proper suffix, i.e. MA-929B has a nominal coupling value of 20 (± 0.4).

TOPWALL, MULTIHOLE

In all cases minimum directivity is 40 dB.

Model Number	Frequency GHz	W.G. Size RG-( )/U	Nominal Coupling dB
MA-929A,B,C	3.95-5.85	49	10,20,30(±0.4)
MA-930A,B,C	5.85-8.2	50	10,20,30(±0.4)
MA-931A,B,C	7.05-10.0	51	10,20.30(±0.4)
MA-766A,B,C	8.2-12.4	52	10,20,30(±0.4)
MA-706A,B,C	12.4-18.0	91	10,20,30(±0.4)
MA-757A,B,C	18.0-26.5	53	10,20,30(±0.7)
MA-772A,B,C	26.5-40.0	96	10,20,30(±0.7)

SIDEWALL, MULTIHOLE

Model Number	Frequency GHz	Cal. Freq. GHz	W.G. Size RG-( )/U	Nominal Coupling[1] dB	Minimum Directivity dB
MA-663A,B	8.2-12.4	9.375	52	20,30	20,20
MA-552A,B,C,D	18.0-26.5	24.0	53	10,20,30,40	10,20,20,20
MA-662A,B	26.5-40.0	34.86	96	30,40	20,20

NOTE: 1. Nominal coupling is within ±1.0 dB of this value at the calibration frequency.

BRANCHGUIDE

Model Number	Frequency GHz	Cal. Freq. GHz	W.G. Size RG-( )/U	Nominal Coupling dB	Minimum Directivity dB
MA-524A	8.8-9.9	9.375	52	10	10
MA-1036A,B,C,D	34.0-36.0	34.86	96	10,15,20,25	10,15,18,18

CROSSGUIDE

In all cases minimum directly is 20 dB.

Model Number	Frequency GHz	W.G. Size RG-( )/U	Nominal Coupling[1] dB
MA-695A,B,C,D	1.12-1.70	69	20,30,40,50
MA-764A,B,C	2.60-3.95	48	30,45,60
MA-932A,B,C	3.95-5.85	49	20,30,40
MA-933A,B,C	5.85-8.20	50	20,30,40
MA-934A,B,C	7.05-10.0	51	20,30,40
MA-886A,B,C	8.2-12.4	52	20,30,40
MA-887A,B,C	12.4-18.0	91	20,30,40

NOTE:
1. Coupling variation less than ±1.7 dB.

TRANSMISSION LINE DEVICES

All models available in aluminum only.

Coaxial Directional Couplers

Model Number	Freq. Range MHz	Coup. Value dB	Coup. Mean Value dB	Coup. Flat. dB	Direct. Min. dB	VSWR Main Line	VSWR Branch Line	Weight ozs.
MA-7004-10	125-250	10	.2	.5	27	1.10	1.10	7.5
MA-7004-20	125-250	20	.2	.5	27	1.10	1.10	7.5
MA-7004-30	125-250	30	.3	.5	27	1.10	1.10	7.5
MA-7011-10	145-278	10	.15	.5	23	1.10	1.10	42.0
MA-7011-20	145-278	20	.15	.5	25	1.10	1.10	42.0
MA-7005-1-6	205-338	6	.2	.3	25	1.10	1.10	6.0
MA-7012-10	250-495	10	.15	.5	22	1.10	1.10	28.0
MA-7012-20	250-495	20	.15	.5	22	1.10	1.10	28.0
MA-7005-10	250-500	10	.2	.5	27	1.10	1.10	5.0
MA-7005-20	250-500	20	.2	.5	27	1.10	1.10	5.0
MA-7005-30	250-500	30	.3	.5	27	1.10	1.10	5.0
MA-7005-2-6	320-525	6	.2	.3	25	1.10	1.10	6.0
MA-7005-2-10	320-525	10	.15	.4	23	1.15	1.15	6.0
MA-7013-10	420-900	10	.15	.5	22	1.10	1.10	21.0
MA-7013-20	420-900	20	.15	.5	22	1.10	1.10	21.0
MA-7006-1-6	450-910	6	.2	.5	25	1.15	1.15	4.0
MA-7006-1-10	450-910	10	.15	.5	23	1.15	1.15	4.0
MA-7006-10	500-1000	10	.2	.5	27	1.10	1.10	3.0
MA-7006-20	500-1000	20	.2	.5	27	1.10	1.10	3.0
MA-7006-30	500-1000	30	.3	.5	27	1.10	1.10	3.0
MA-7014-10	775-1450	10	.15	.5	20	1.10	1.10	18.0
MA-7014-20	775-1450	20	.15	.5	20	1.15	1.15	18.0
MA-7007-1-6	825-1460	6	.2	.3	25	1.10	1.10	4.0
MA-7007-1-10	825-1460	10	.15	.4	23	1.15	1.15	4.0
MA-7007-10	1-2 GHz	10	.2	.5	22	1.10	1.10	2.5
MA-7007-20	1-2 GHz	20	.2	.5	22	1.10	1.10	2.5
MA-7007-30	1-2 GHz	30	.3	.5	22	1.10	1.10	2.5
MA-7008-10	2-4 GHz	10	.2	.6	20	1.15	1.15	2.0
MA-7008-20	2-4 GHz	20	.2	.6	20	1.15	1.15	2.0
MA-7008-30	2-4 GHz	30	.3	.6	20	1.15	1.15	2.0
MA-7009-10	4-8 GHz	10	.2	.7	20	1.20	1.20	2.0
MA-7009-20	4-8 GHz	20	.2	.7	20	1.20	1.20	2.0
MA-7009-30	4-8 GHz	30	.3	.7	20	1.20	1.20	2.0

Crystal Mounts

Model Number	Frequency GHz	W.G. Size WR-	Connectors in UG-( )/U	Connectors out UG-( )/U	Recommended Crystal Type	VSWR Using Coax Dummy Load
MA-832	3.95-5.85	187	149A	89	1N23	tunable
MA-965	4.20-5.10	187	149A	89	1N23	1.50
MA-702A	5.00-5.90	187	149A	89	1N23	—
MA-963	5.40-6.80	137	344	89	1N23	1.50
MA-967	6.20-7.30	137	344	89	1N23	1.50
MA-833	7.05-10.0	112	51	89	1N23	tunable
MA-981A	7.05-8.5	112	51	89	1N23	—
MA-703	8.5-9.6	112	51	89	1N23	—
MA-536	8.5-9.6	90	40A	89	1N23	—
MA-536A	8.5-9.6	90	40A	89	1N23	—
MA-536B	8.5-9.6	90	40A	89	1N23	tunable
MA-536C	8.5-9.6	90	40A	89	1N23	tunable
MA-611	8.5-9.6	90	40A	89	MA-408	—
MA-982	8.2-12.4	90	40A	89	MA-492	1.30
MA-595C	12.4-18.0	62	39	89	MA-490	1.30
MA-851	12.4-18.0	62	419	89	1N78	tunable
MA-789A	18.0-26.5	42	595	89	1N26	1.50
MA-915	18.0-26.5	42	596	89	1N26	tunable
MA-513A	26.0-40.0	28	600	89	1N53	tunable
MA-513E	26.0-40.0	28	599	89	1N53	tunable
MA-961	26.0-40.0	28	599	89	1N53	1.50
MA-513B	34.0-36.0	28	600	89	1N53	1.50
MA-513C	34.0-36.0	28	599	89	1N53	1.50
MA-539C	34.0-36.0	28	600	89	1N53	tunable
MA-539D	34.0-36.0	28	600	Pin	1N53	tunable

Fabricated devices are supplied in brass (or aluminum) for intermediate waveguide sizes (WR-42 or WR-187). Larger sizes are normally supplied in aluminum but can be supplied in brass on special order. WR-28 size is normally supplied in brass or coin silver.

Coaxial Diode Dummy Loads

In all cases VSWR is less than 1.10.

Model Number	Frequency GHz	Simulates Diode Type	Coaxial Characteristic Imped. ohms
MA-698	12.4-18.0	1N78, MA-490	64.5
MA-708	18.0-26.5	1N26	64.5
MA-709	26.5-40.0	1N53	61.4

TRANSMISSION LINE DEVICES

Fabricated devices are supplied in brass (or aluminum) for intermediate waveguide sizes (WR-42 or WR-187). Larger sizes are normally supplied in aluminum but can be supplied in brass on special order. WR-28 size is normally supplied in brass or coin silver.

Attenuators

FIXED In all cases VSWR is 1.10; maximum CW power dissipation 2 watts. Model number suffix indicates desired nominal attenuation value. In ordering, specify nominal attenuation value by adding the proper suffix, i.e. MA-694C has a nominal attenuation value of 10.

Model Number	Freq. GHz	W.G. Size RG-( )/U	W.G. Connect. UG-( )/U	Nominal Attenuation dB
MA-694A B,C,D,E	1.12-1.7	69	4174	3,6,10,12,20
MA-834A,B,C	2.6-3.95	48	53	10,20,30
MA-835A,B,C	3.95-5.85	40	149A	10,20,30
MA-836A,B,C	5.85-8.2	50	344	10,20,30
MA-652A,B,C	7.05-10.0	51	51	10,20,30
MA-609A,B,C	8.2-12.4	52	39	10,20,30
MA-577A,B,C	12.4-18.0	91	419	10,20,30
MA-575A,B,C	18.0-26.5	53	595	10,20,30
MA-576A,B,C	26.5-40.0	96	599	10,20,30

VARIABLE

In all cases VSWR less than 1.25; maximum CW power dissipation, 2 watts.

Model Number	Frequency GHz	W.G. Size RG-( )/U	W.G. Connect. UG-( )/U	Min. Attenu-ation dB
MA-957	8.5-9.6	51	51	0-20
MA-534A	8.5-9.6	52	39	0-15
MA-578A	12.4-18.0	91	419	0-25
MA-586A	18.0-26.5	53	595, 596	0-20
MA-1023A	34.0-36.0	96	600, 599	0-15

CALIBRATED VARIABLE

In all cases VSWR less than 1.2.

Model Number	Frequency GHz	Cal. Freq GHz	W.G. Size RG-( )/U	Max. CW Power W	Attenu-ation dB
MA-580A	12.4-18.0	16.5	91	2	0-20
MA-587	18.0-26.5	24.0	53	1	0-20
MA-527A	34.0-36.0	34.86	96	1	0-25
MA-527D[1]	34.0-36.0	34.86	96	1	0-20

NOTE:
1. Direct reading in dB.

Low Power and Precision Low Power Terminations

Maximum CW power dissipation 1 watt.

Model Number	Frequency GHz	W.G. Size RG-( )/U	Max. VSWR
LOW POWER			
MA-693	1.12-1.70	69	1.05
MA-841A	2.7-2.9	48	1.15
MA-841B	2.85-3.15	48	1.15
MA-946	5.20-5.90	49	1.15
MA-945	5.90-6.50	50	1.15
MA-944A	8.5-9.6	51	1.15
MA-944B	7.5-8.5	51	1.15
MA-648A	8.5-9.6	52	1.15
MA-648B	10.2-10.6	52	1.15
MA-648C	10.7-11.7	52	1.15
MA-646A	12.7-14.3	91	1.15
MA-646B	15.5-17.5	91	1.15
MA-629	18.0-26.5	53	1.15
MA-540A	26.5-40.0	96	1.15
MA-540B	26.5-40.0	96	1.15
PRECISION LOW POWER			
MA-837	2.60-3.95	48	1.02
MA-838	3.95-5.85	49	1.02
MA-839	5.85-8.20	50	1.02
MA-771	7.05-10.0	51	1.02
MA-684	8.2-12.4	52	1.02
MA-685	12.4-18.0	91	1.02
MA-686	18.0-26.5	53	1.02
MA-687	26.5-40.0	96	1.03

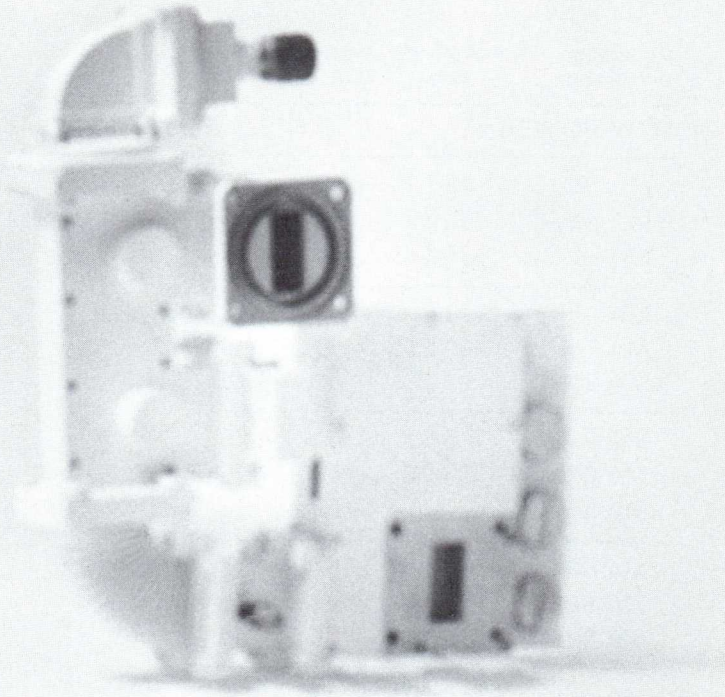
Rotary Joints

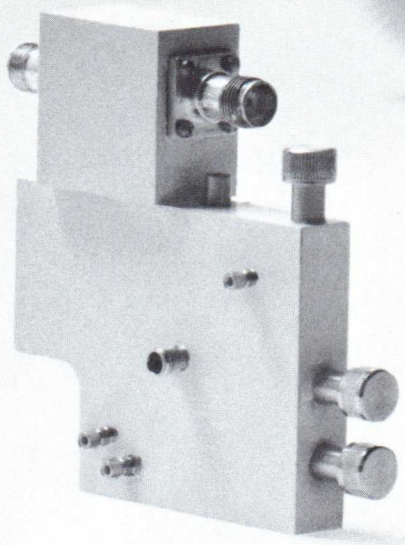
Model Number	Frequency GHz	W.G. Size RG-( )/U
MA-1057[1]	8.5-9.6	52
MA-751	13.3-13.7	91
MA-651	16.3-16.7	91
MA-1037A	34.5-35.225	96
MA-1037B	34.5-35.225	96
MA-1037C	34.5-35.225	96
MA-998	16.0-17.0	91

NOTE:
1. Dual.

CUSTOM ENGINEERED SUBASSEMBLIES

Microwave Associates has developed a wide capability in the design, development and production of microwave subassemblies in coaxial line, strip-transmission line, waveguide, and combinations of all three systems. Our list of microwave products is the most extensive in the industry including those shown by this catalog as well as hundreds of classified and special purpose components. Fifteen years of microwave component specialization has provided a library of proven designs for essentially all types of components used in microwave radar and communication equipment. During this period we have introduced many new components to improve system performance. Due to this continually increasing backlog of proven component designs we are ideally qualified to package complete RF subassemblies with the best possible delivery. Typical examples of our more recently developed subassemblies follow.

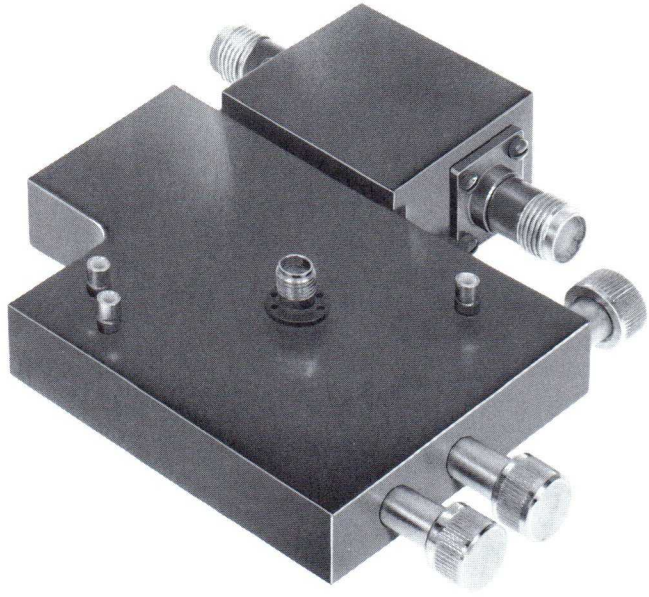




MA-70237 Mixer-Duplexer (Strip-Transmission Line)

The MA-70237 is an all-solid-state subassembly containing an extremely compact ferrite circulator, an AFC coupler, an AFC mixer, a varactor limiter, a balanced mixer, and an LO power divider. The 10-ounce assembly utilizes the latest technological advances in both mixer and high-power limiter varactors.

Frequency 9.3 to 9.5 GHz
Peak Power 5 kw
Duty Ratio .001
Noise Figure 8.5 dB
Weight 10 ounces
Size 4 by 3½ by ½ inches



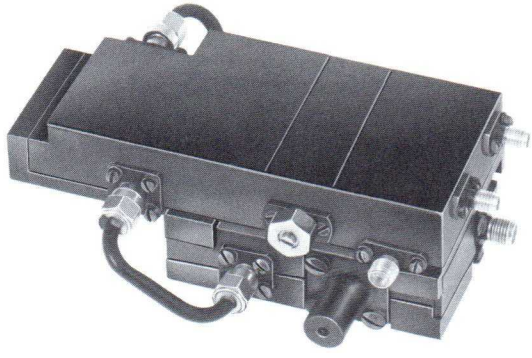
MA-70301 Mixer-Duplexer (Strip-Transmission Line)

The MA-70301, a compact, rugged mixer-duplexer strip-transmission line assembly, is operational in a pulsed C-band beacon transponder. Integrated in this package are a terminated four-port ferrite circulator, a varactor limiter, local oscillator variable attenuator, and balanced mixer.

The terminated four-port circulator presents a constant load to the transmitter. Reflected power from the antenna is blocked from damaging the receiver by a sophisticated, passive, feedback varactor limiter.

Short-circuited antenna conditions can exist with no damage to the overall system. Receiver life with no degradation in noise figures has been demonstrated in thousands of hours with this style receiver protection.

Frequency 5 GHz
Bandwidth 100 MHz
Transmitter Peak Power Input 5 kw
Duty Cycle .001
Pulse Width 1 microsecond
Transmitter-to-Antenna Insertion Loss 0.4 dB
Input VSWR 1.15
System Noise Figure 9.5 dB ($N_{if} = 1.5$ dB)
Local Oscillator Adjust 0 to 14 dB
IF Output, Balanced 60 MHz

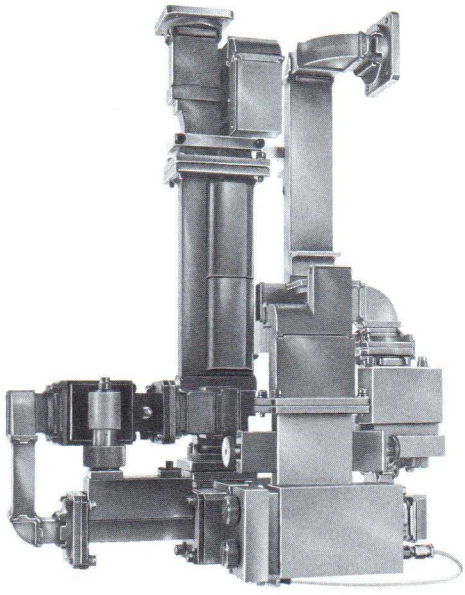


CUSTOM ENGINEERED SUBASSEMBLIES

MA-68844 Radar Front End

The MA-68844 assembly includes a ferrite duplexer, TR-limiter, AFC coupler, AFC mixer, preamplifier, test coupler, solid-state LO, LO power divider and level set attenuator, signal mixer-preamplifier, image filter, and tunnel diode amplifier. All components are the latest solid-state devices except the TR tube. The unit is designed to work with a 2:1 antenna mismatch. Complete receiver protection is provided under active and passive conditions.

Frequency 9.1 to 9.2 GHz
Peak Power 300 kilowatts
Average Power 300 watts
IF Frequency 70 MHz
IF Bandwidth 20 MHz
Noise Figure 6.7 dB
Image Rejection 20 dB
RF to IF Amp 35 dB
Duplexer Recovery Time 2 microseconds
Standby Protection 2 kilowatts
Duplexer Leakage 0.05 ergs spike
50 mW flat

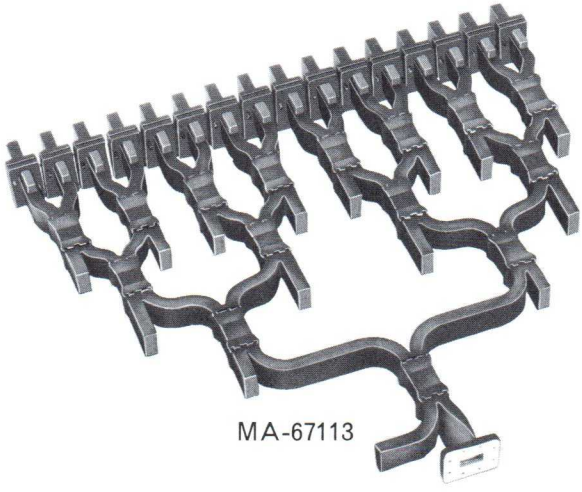


MA-67113 and MA-67191 Power Dividers

The MA-67113 and MA-67191 are power distribution networks for a multi-function array radar.

The MA-67191 is a 10-way, high power, pressurized unit which is fed by a klystron at 10 kilowatts CW. The unit is water-cooled and sealed by MA-1500 series high-power pressure windows at the input and outputs. These units were produced by standard brazing techniques and by electro-forming with equal performance.

The MA-67191 unit feeds a series of directional couplers which in turn feed MA-67113 power dividers to provide over one thousand output channels. Both units feature low VSWR and equal power division at X-band.



MA-67113

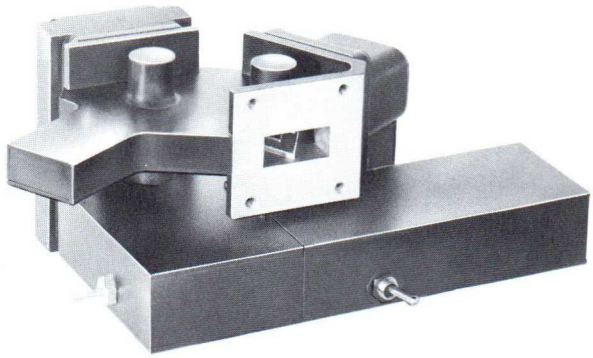
CUSTOM ENGINEERED SUBASSEMBLIES (RECEIVERS)

Microwave Associates and its division, International Microwave Corporation, has developed a unique microwave receiver capability. Low noise, solid-state designs feature lightweight, compact packaging and low power drain. Typical subassemblies incorporate tunnel diode amplifiers. YIG preselectors, solid-state oscillators, and transistorized solid-state mixer preamplifiers and postamplifiers.

RCV-9029 Low Noise, High Gain, X-Band Receiver

This receiver assembly consists of a tunnel-diode amplifier, image rejection filter, ORTHOTEE™ hybrid balanced mixer, IF amplifier with video detected output, and AGC. Light weight, low d-c power drain, and RF/IF gain stable to ±2 dB over the temperature range are outstanding receiver features.

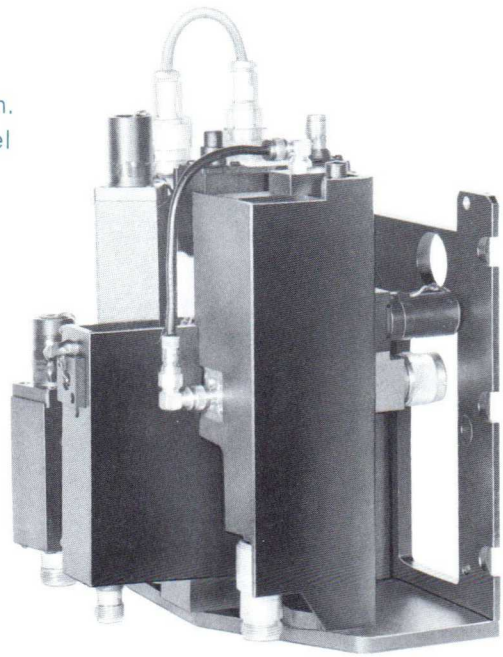
Input Frequency 9.7 GHz (±50 MHz)
Output Frequency 30 MHz
Maximum Noise Figure: 5.5 dB
RF/IF Gain 125 dB (±2 dB)



RCV-9030 Broadband Tunnel Diode Amplifier, Video Receiver Subassembly

This 3-channel subassembly provides instantaneous, high sensitivity signal detection over most of the microwave spectrum. It consists of three cascaded tunnel-diode amplifiers per channel with solid-state limiters for diode protection from spurious high power RF signals. The unit also includes a power supply for 110-volt a-c operation.

Frequency 2 to 4 GHz
4 to 7 GHz
7 to 11 GHz
Receiver Sensitivity —72 dBm
Gain per Channel 18 dB
Noise Figure per Channel 6 dB
Peak Power Protection 100w at S-band
50w at C-band
10w at X-band

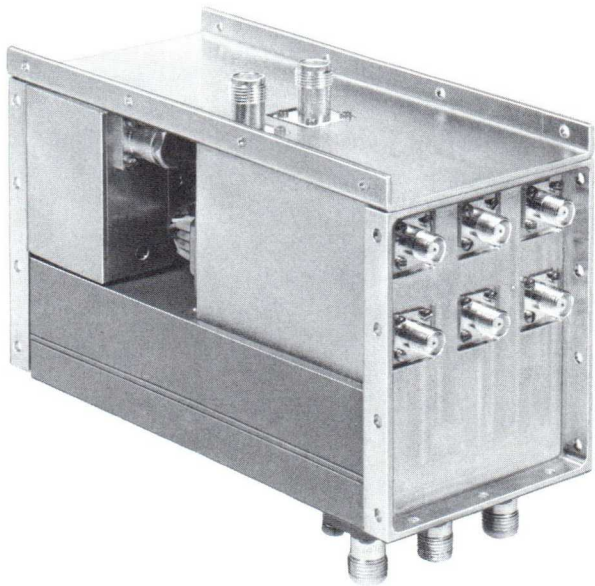


CUSTOM ENGINEERED SUBASSEMBLIES (RECEIVERS)

RCV-9031 Integrated AFC Receiver

This integrated AFC receiver contains mixer, preamplifier, local oscillator, and AFC circuits for both pulse and CW signals integrated in a single package. Additional limiter, amplifier, and filter can be provided when the receiver is used with a TR input.

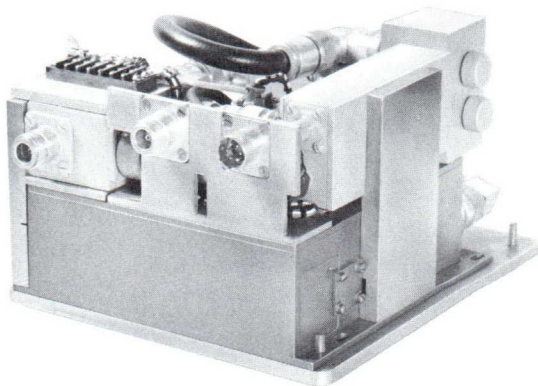
Input Center Frequency 1 to 12 GHz
Output Frequency 60 to 90 MHz
Noise Figure
  with additional input circuits 8.5 dB
  with tunnel diode amplifier at input 5.5 dB
Typical AFC Lock-on ±100 kHz



RCV-9002 Telemetry Down Converter

This compact, all-solid-state down converter is designed for direct telemetry conversion from S-band to VHF telemetry frequencies. Precise frequency conversion is insured by a crystal-controlled oscillator. Because net gain is high enough to overcome cable losses, the converter can be attached directly to antenna feeds.

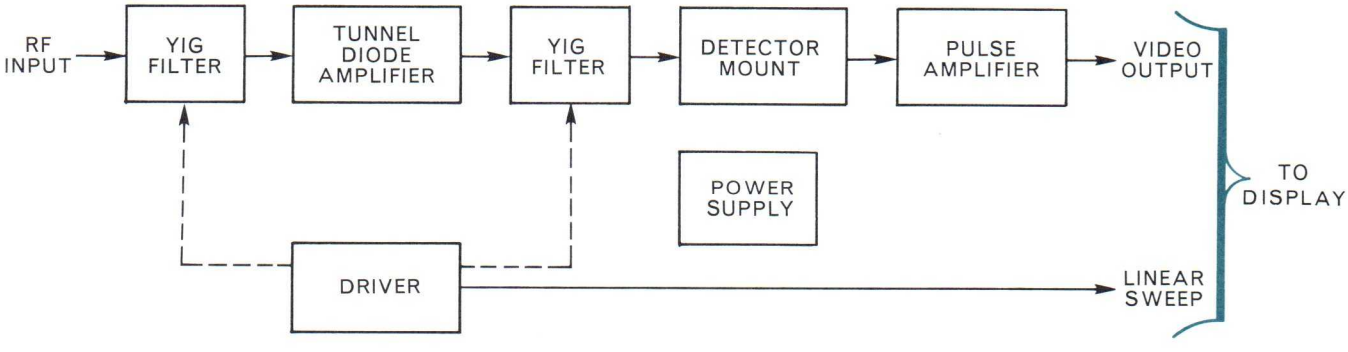
Input Frequency 2.2 to 2.3 GHz
Output Frequency 200 to 300 MHz
Noise Figure 5.5 dB
RF/IF Gain 35 dB
Image Rejection 30 dB



All Solid-State Tunable Receivers

All solid-state tunable RF receivers combine electronically tunable YIG filters, tunnel diode amplifiers, miniature detectors, and microminiature video amplifiers in lightweight, compact, low-power consuming units for reconnaissance, counter-measures and search radar. The tunnel diode amplifier (transistor amplifiers up to 2 GHz) replaces equivalent tube components to reduce amplifier and power supply size and weight. Other elements include a standard solid-state detector and a video amplifier of micro-miniature, integrated design. Receivers are made to specific system requirements within the following range of specifications.

Tuning range One octave within range 50 MHz to 11 GHz
Instantaneous RF Bandwidth 5 to 100 MHz
Video Bandwidth 0.5 to 20 MHz
Tuning Rate 0 to 10 KHz
Sensitivity —75 dBm
Size 25 to 250 cubic inches
Weight 2 to 10 pounds
DC Power 0.1 to 4 watts
Tuning Power 0.1 to 5 watts
Environmental MIL-E-5400



GOVERNMENT-SPONSORED RESEARCH AND DEVELOPMENT

In order to develop the over 4,000 products listed in this catalog, Microwave Associates has sustained a major development effort for many years. A major portion of these products can attribute a significant portion of their early ancestry to work done on Government contracts either here at Microwave or at similar industrial or laboratory organizations in the past decade,e.g. the development of the varactor diode by the U.S. Army Electronics Command Laboratories. The funds expended by the various Government agencies have had a profound effect on the expansion of the frequency/power/noise figure/instantaneous bandwidth/efficiency, etc. of our products. We are most grateful for the opportunity to have participated in these advances. It is perhaps of interest to note that historically for every dollar of externally sponsored development at Microwave Associates, a comparable amount of company funds has been expended during the same period. Obviously as a product departs from the basic research stage and progresses through the breadboard to a specific application, the proportion of company sponsorship increases. Although the bulk of the externally sponsored contracts are with Government agencies rather than industrial customers, the nature of the tasks involved often forecasts the component trends of the future. Hence, our efforts in these areas are of possible interest to the planning segment of the OEM customer community.
Most of our efforts are devoted to obvious extrapolations of the capabilities of the products listed in this catalog. Several programs which are less obvious, of a more avant-garde nature, include —

. . . A continuing investigation for the U.S. Army Electronics Command Laboratories of high power microwave amplifiers in which the conventional helix-beam interaction is replaced by a beam interacting with a gaseous plasma. The end aim of this effort is to produce a lighter, shorter amplifier suitable for military purposes.

. . . The study of a novel microwave delay technique supported by the Rome Air Development Center involving a special TWT. It is hoped to produce delays electrically variable from 10 to 200 nanoseconds over octave bandwidths.

. . . An extensive effort sponsored by the Air Force Avionics Laboratory to adapt and modify the low frequency integrated circuit technology for use at microwaves. It is our hope to produce useful integrated microwave circuits such as multipole octave switches, varactor harmonic generators, limiters, and mixers. This effort also includes the investigation of bulk effect microwave oscillators constructed from various semiconductor materials.

. . . Crystal-controlled varactor harmonic generator sources are being extensively used for high-resolution and Doppler radar systems because of their high signal purity. Substantial improvements are predicted from theory and research work is now being conducted under U.S. Navy, Bureau of Ships sponsorship to approach the ultimate theoretical limits on stability, noise, and signal purity for such systems.

. . . The development under Army and Navy, Bureau of Ships sponsorship of multi-kilowatt semiconductor phase shifters for phased-array radar systems.

Since much of our externally sponsored development effort is in the public domain, you may be interested in receiving information on this work. If you will let us know your specific areas of interest, we shall be pleased to direct you to the sponsoring agency.

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