Microwave Tubes from Microwave Associates

MA-231A

Pulsed X-Band Magnetron

Bulletin 1510A

DESCRIPTION

A sturdy, lightweight unit incorporating positive anode design. The MA-231A provides efficient fixed frequency operation for X-band applications requiring a minimum peak power of 200 watts.

APPLICATIONS

Beacon and navigation systems, radar detection systems, missile ground support equipment, transponders, and airborne radar equipment.

Microwave Associates, Inc. *Burlington, Massachusetts Tel. (617) 272-3000*

Western Union Fax
TWX: 710-332-6789
Telex: 94-9464

SPECIFICATIONS

Electrical Characteristics

Peak Power	200 W
Fixed Frequency	8000 to 8800 MHz
Pulling Factor (1.5:1 VSWR)	20 MHz Max.
Pushing Factor (±10% 1_b)	3 MHz Max.
Missing Pulse Rate	0.1% Max.
Side Lobes	8 dB Min.
Thermal Coefficient	0.2 MHz/°C Max.

Mechanical Characteristics

Size	See Outline Drawing
Weight	11 oz. Nom.
Mounting Position	Any
Output Connector	Mates with UG/39U Flange

Operating Conditions

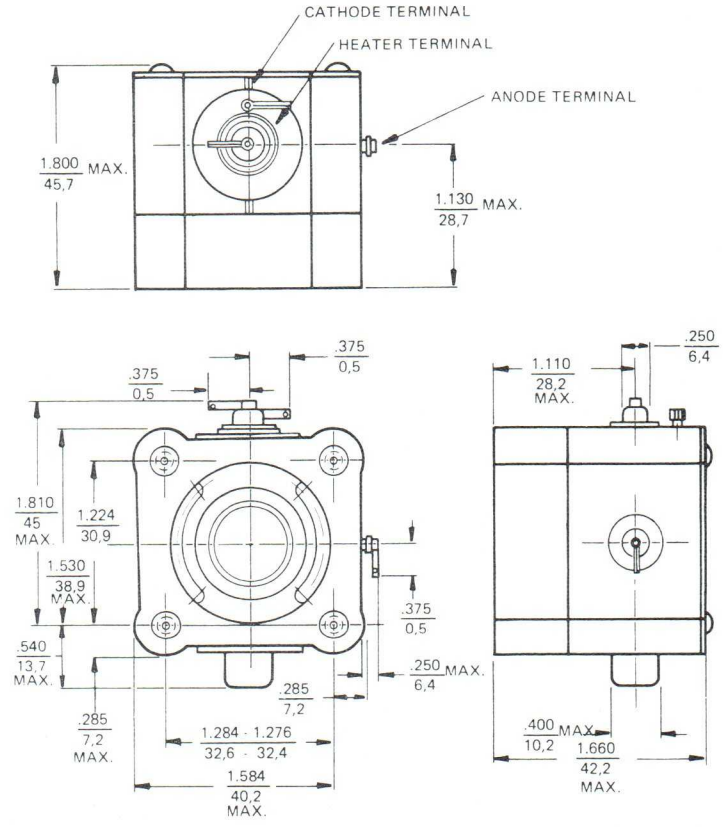
Heater Voltage*	6.3 V
Heater Current	0.7 A Max.
Preheat Time	15 Sec. Min.
Pulse Voltage	+950 to +1050 V
Pulse Current	0.75 A
Anode-Cathode Capacitance	16 pF Nom.
Duty Cycle	0.05 Ratio Max.

Environmental Characteristics

Cooling	Conduction and/or Convection
Ambient Temperature	-54°C to 85°C
Altitude	50,000 Ft.
Vibration (40 to 2,000 cps)	15 G
Shock (11 ±1 ms)	60 G

*Heater voltage is reduced during oscillation to a value specified on each magnetron.

OUTLINE DRAWING



NOTE:

INCH / MM

MA-231B

CW X-Band Magnetron

Bulletin 1511

Microwave Associates, Inc.
Burlington
Massachusetts
Tel. (617) 272-3000
Western Union Fax
TWX: 710-332-6789
Telex: 94-9464

MA-231B

DESCRIPTION

A sturdy, lightweight unit incorporating positive anode design. The MA-231B provides efficient fixed-frequency operation for X-band applications requiring a minimum power output of 20 watts CW.

APPLICATIONS

Beacon and navigation systems, radar detection systems, missile ground support equipment, transponders, and airborne radar applications.

SPECIFICATIONS

Operating Conditions

heater voltage*	6.3 v
heater current	0.7 a max.
preheat time	15 sec. min.
anode voltage	+900 to +1,000 v
anode current	0.06 a
anode-cathode capacitance	16 pf nom.
duty cycle	CW

Performance Data

min. power output	20 W, CW
fixed frequency	8000 to 8800 MHz
pulling factor (1.3:1 VSWR)	16 MHz max.
pushing factor (±10% I_b)	4 MHz max.
thermal coefficient	0.2 MHz/°C max.

Mechanical

size	See outline drawing
weight	11 oz. nom.
mounting position	any
output connector	mates with UG/39U flange

Environmental

cooling	conduction and convection
ambient temperature	−54°C to +85°C
altitude	40,000 ft.
vibration (40 to 2,000 cps)	15 G
shock (11 ± 1 ms)	60 G

*Heater voltage is reduced during oscillation to a value specified on each magnetron.

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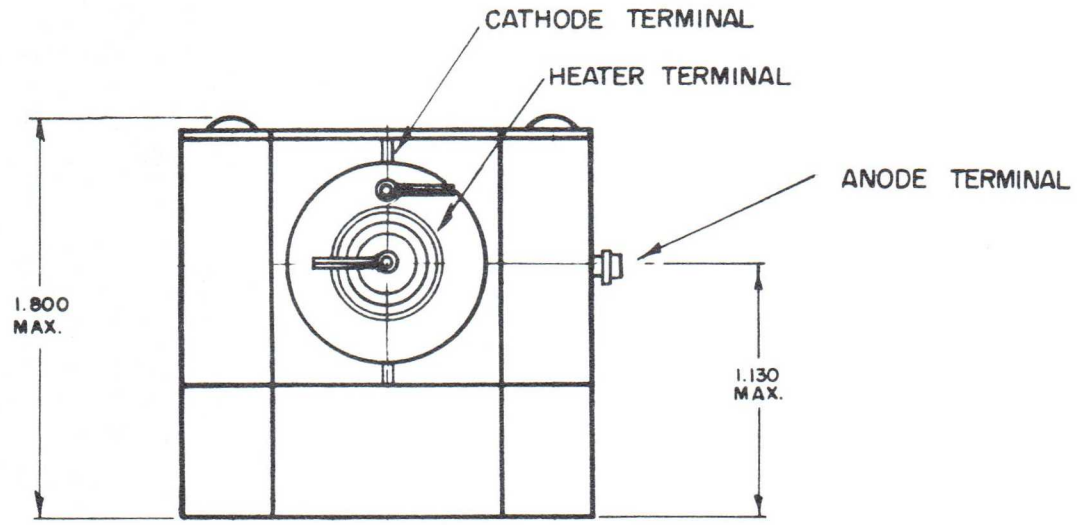
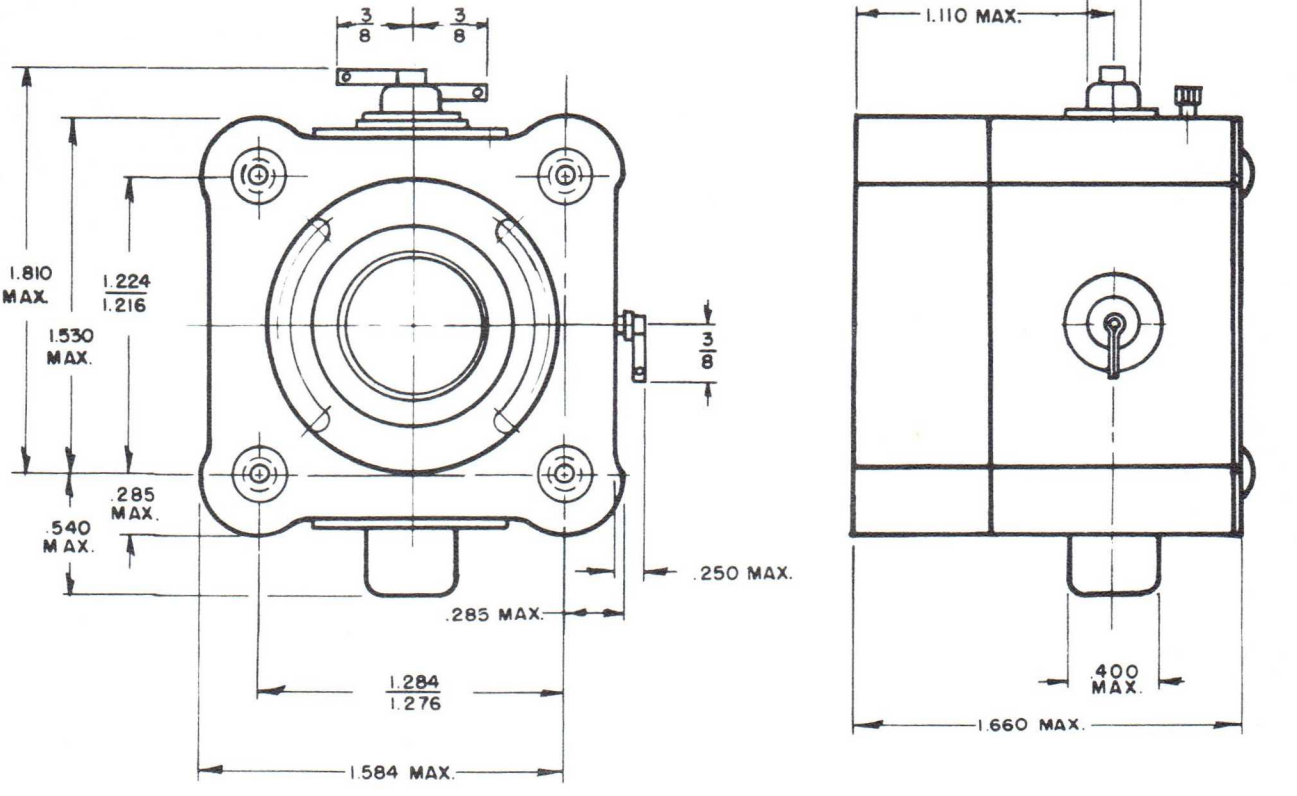
OUTLINE DRAWING

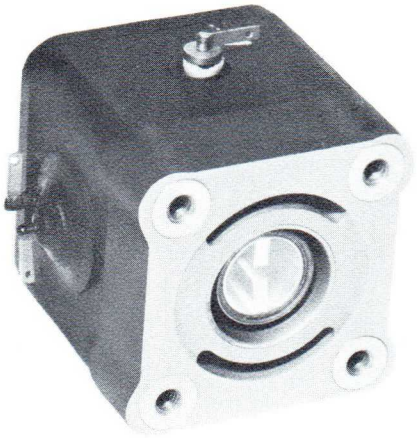




MA-212A, MA-212C & MA-212D

BEACON MAGNETRONS

Bulletin 1515



DESCRIPTION

The MA-212A, MA-212C, and MA-212D compact, fixed frequency magnetrons provide typically 20-watt peak power output (35 watts for the MA-212D) between 8.8 and 10 GHz. These rugged, lightweight units are of isolated-anode, grounded-cathode design for reliable, long-life operation.

APPLICATIONS

The MA-212A, MA-212C, and MA-212D offer excellent performance in beacon and navigation systems, radar detection systems, missile ground support equipment, missile transponders, and airborne radar.

Microwave Associates, Inc. Burlington, Massachusetts Tel. (617) 272-3000
Western Union Fax
TWX: 710-332-6789
Telex: 94-9464

SPECIFICATIONS

Electrical Characteristics

Fixed Frequency	8.8 to 10 GHz
Peak Power Output	
MA-212A	10 W (Min.) to 20 W
MA-212C	10 W (Min.) to 20 W
MA-212D	20W (Min.) to 35 W
Pulling Figure	15 MHz (1.5 VSWR)
RF Bandwidth	2/tp
Thermal Coefficient	0.2 MHz/°C
Minimum Life	300 Hr.
Maximum Missing Pulse Rate	0.1%

Operating Conditions

Pluse Width	1 μs
MA-212A	5 μs
MA-212C	1 μs
MA-212D	
Duty Ratio	
MA-212A	0.01
MA-212C	0.01
MA-212D	0.005
Peak Anode Voltage	
MA-212A	520 V
MA-212C	520 V
MA-212D	560 V
Peak Anode Current	
MA-212A	150 mA
MA-212C	150 mA
MA-212D	300 mA
Filament Voltage*	6.3 V
Filament Current	0.55 A

Mechanical Characteristics

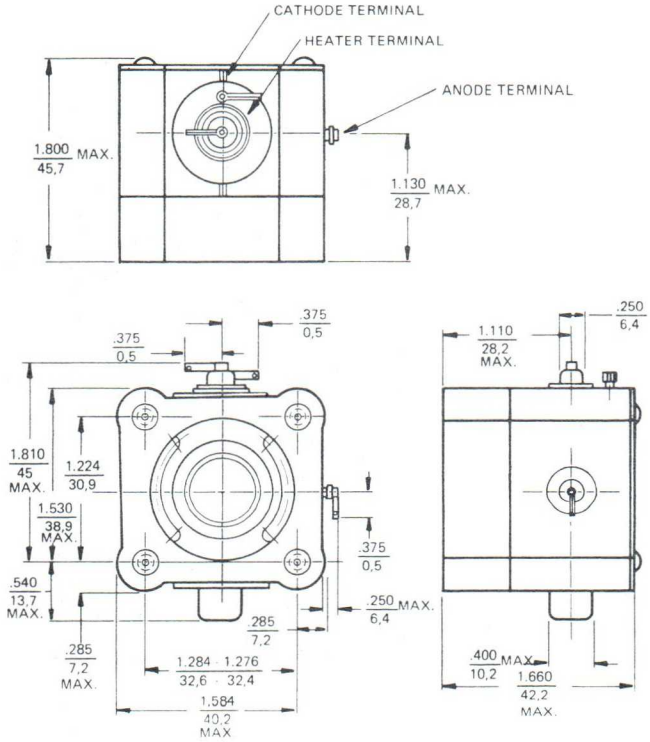
Size	See outline drawing.
Weight	11 oz.
Output Connector	Mates with UG-39/U flange. Can be made for full or half-height waveguide.
Input Connector	Solder terminals
Cooling	Convection and conduction

Environmental Characteristics

Shock	60 G for 10 ms
Vibration	20 G at 50 to 2000 cps
Ambient Temperature	−55 to +125°C
Altitude	100,000 ft

*Power can be applied to filaments and anode simultaneously.

OUTLINE DRAWING



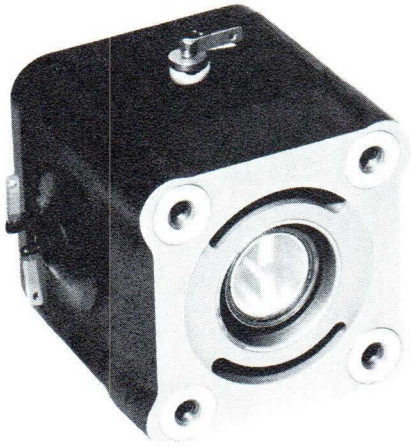
NOTE:

INCH / MM

MA-221A, MA-221C & MA-221D

Beacon Magnetrons

Bulletin 1517A



DESCRIPTION

The MA-221A, MA-221C, and MA-221D compact, fixed frequency magnetrons provide typically 20-watt peak power output (35 watts for the MA-221D) between 7.5 and 8.8 GHz. These rugged, lightweight units are of isolated anode, grounded cathode design for reliable, long life operation.

APPLICATIONS

The MA-221A, MA-221C and MA-221D offer excellent performance in beacon and navigation systems, radar detection systems, missile ground support equipment, missile transponders, and airborne radar.

Microwave Associates, Inc. Burlington, Massachusetts Tel. (617) 272-3000
Western Union Fax
TWX: 710-332-6789
Telex: 94-9464

SPECIFICATIONS

Electrical Characteristics

Fixed Frequency	7.5 to 8.8 GHz
Peak Power Output	
MA-221A	10 W (Min.) to 20 W
MA-221C	10 W (Min.) to 20 W
MA-221D	20 W (Min.) to 35 W
Pulling Figure	13 MHz (1.5 VSWR)
RF Bandwidth	2.5/tp
Thermal Coefficient	0.2 MHz/°C
Minimum Life	300 Hr.
Maximum Missing Pulse Rate	0.1%

Operating Conditions

Pulse Width	
MA-221A	1 μs
MA-221C	5 μs
MA-221D	1 μs
Duty Ratio	
MA-221A	0.01
MA-221C	0.01
MA-221D	0.005
Peak Anode Voltage	
MA-221A	500 V
MA-221C	500 V
MA-221D	530 V
Peak Anode Current	
MA-221A	150 mA
MA-221C	150 mA
MA-221D	300 mA
Filament Voltage*	6.3 V
Filament Current	0.55 A

Mechanical Characteristics

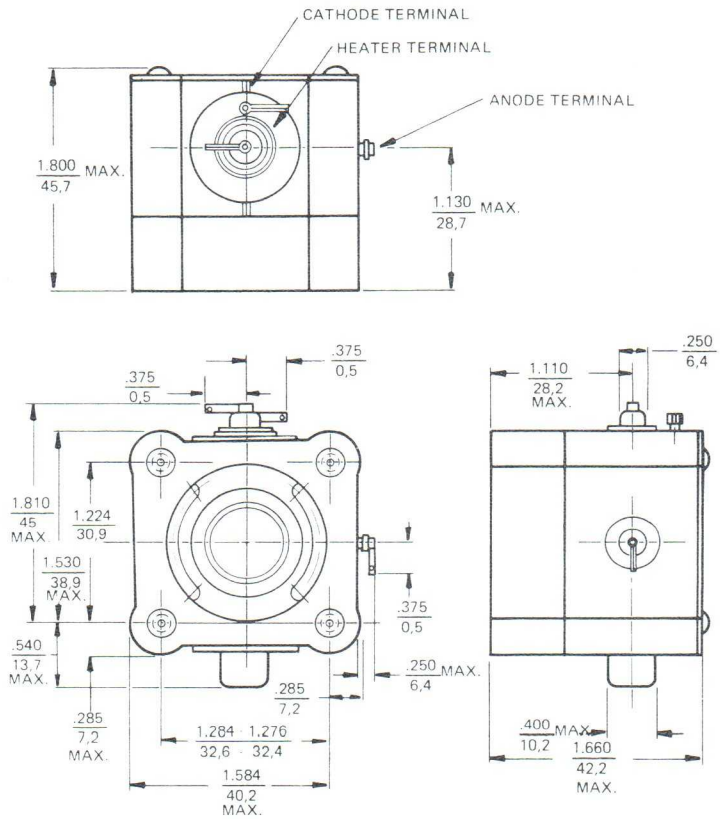
Size	See outline drawing.
Weight	11 oz.
Output Connector	Mates with UG-39/U Flange. Can be made for full- or half- height Waveguide.
Input Connector	Solder terminals
Cooling	Convection and conduction

Environmental Characteristics

Shock	60 G for 10 ms
Vibration	20 G at 50 to 2000 Hz
Ambient Temperature	-55 to 125°C
Altitude	100,000 Ft.

*Power can be applied to filaments and anode simultaneously.

OUTLINE DRAWING



NOTE:

INCH / MM

MA-240
MA-240A
Beacon Magnetrons

Bulletin 1518

Microwave Associates, Inc.
Burlington
Massachusetts
Tel. (617) 272-3000
Western Union Fax
TWX: 710-332-6789
Telex: 94-9464

MA-240, MA-240A Beacon Magnetrons

DESCRIPTION

The MA-240 and MA-240A compact, fixed frequency magnetrons provide typically 700-watt peak power output between 13.7 and 14.6 Gc. Both are of isolated-anode, grounded-cathode design and lightweight, rugged, metal and ceramic construction. Their heater-cathode structure provides long life and fast starting, reliable operation.

APPLICATIONS

The MA-240 and MA-240A are designed for airborne pulsed radar. They are ideally suited for compact airborne, missile, and ground test radar equipment. They provide excellent performance in radar systems designed for extremely short pulse operation.

SPECIFICATIONS

Performance Data

Fixed Frequency	13.7 to 14.6 Gc
Minimum Peak Power Output	500 W (700 W)*
Maximum RF bandwidth	2.5/tp
Pulling Figure	22 Mc
Thermal Coefficient	120 kc/°C
Minimum Life	300 hr
Maximum Missing Pulse Rate	0.1%

Operating Conditions

Pulse Width	1 μs
Duty Ratio	0.013 (0.010)*
Peak Anode Voltage	1650 V (1750 V)*
Peak Anode Current	1.4 A (1.8 A)*
Filament Preheat Time	15 sec
Filament Voltage	6.3 V
Filament Current	0.9 A

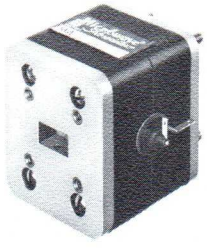
Mechanical

Size	See outline drawing.
Weight	16 oz
Output Connector	Mates with UG-541/U choke flange.
Input Connectors	
Cathode and Filament	Solder lugs
Anode	Wire lead
Cooling	Conduction and convection

Environmental

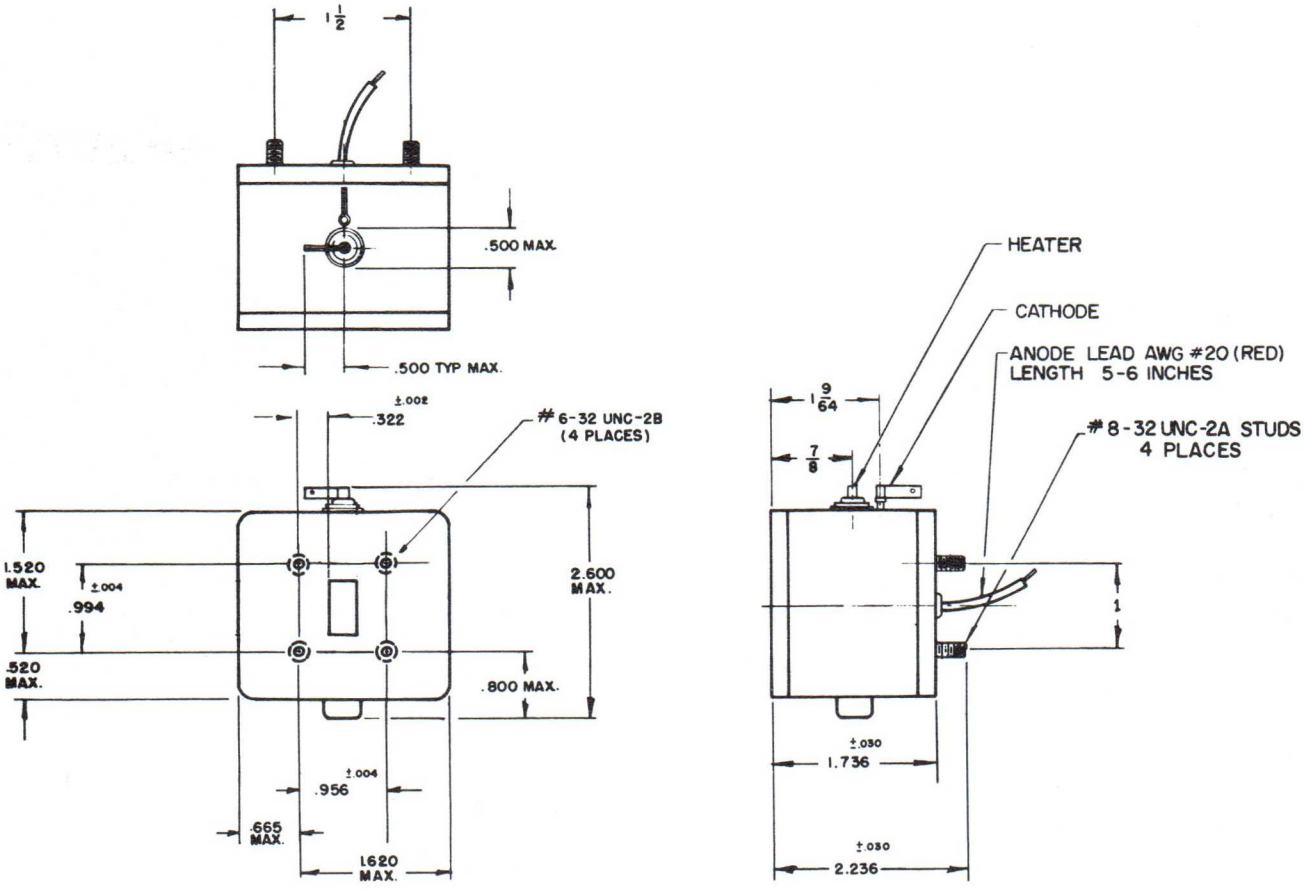
Shock	60 G for 10 ms
Vibration	15 G at 50 to 2000 cps

*Figures in parentheses refer to MA-240A only.



5M—6-65-G Printed in U.S.A.

OUTLINE DRAWING



MA-221B Beacon Magnetron

Bulletin 1519

Microwave Associates, Inc.
Burlington
Massachusetts
Tel. (617) 272-3000
Western Union Fax
TWX: 710-332-6789
Telex: 94-9464

MA-221B Beacon Magnetron

DESCRIPTION

The MA-221B compact, fixed frequency magnetron provides typically 2-watt CW power between 7.5 and 8.8 Gc. This rugged, lightweight unit is of isolated-anode, grounded-cathode design for reliable, long life operation.

APPLICATIONS

The MA-221B offers excellent performance in beacon and navigation systems, radar detection systems, missile ground support equipment, missile transponders, and airborne radar.

SPECIFICATIONS

Performance Data

Fixed Frequency	7.5 to 8.8 Gc
CW Power Output	1.5 W (min) to 2.2 W
Pulling Figure	16 Mc/°C
Thermal Coefficient	0.2 Mc/°C
Minimum Life	300 hr

Operating Conditions

Mode of Operation	CW
Anode Voltage	450 V
Anode Current	20 mAdc
Filament Voltage*	6.3 V
Filament Current	0.55 A

*Filament voltage reduced during operation.

Mechanical

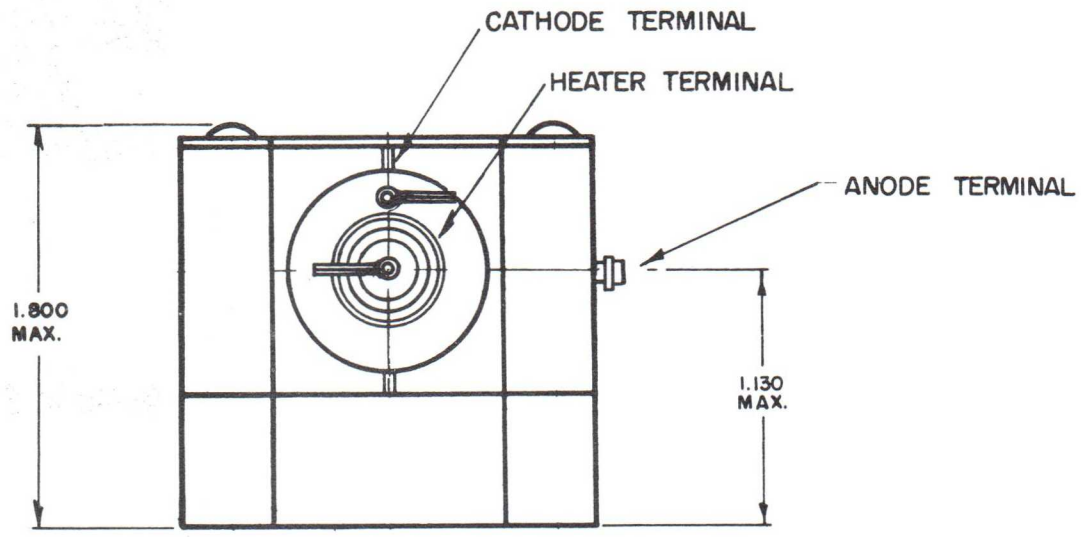
Size	See outline drawing.
Weight	11 oz
Output Connector	Mates with UG-39/U flange. Can be made for full- or half-height waveguide.
Input Connector	Solder terminals
Cooling	Convection and conduction

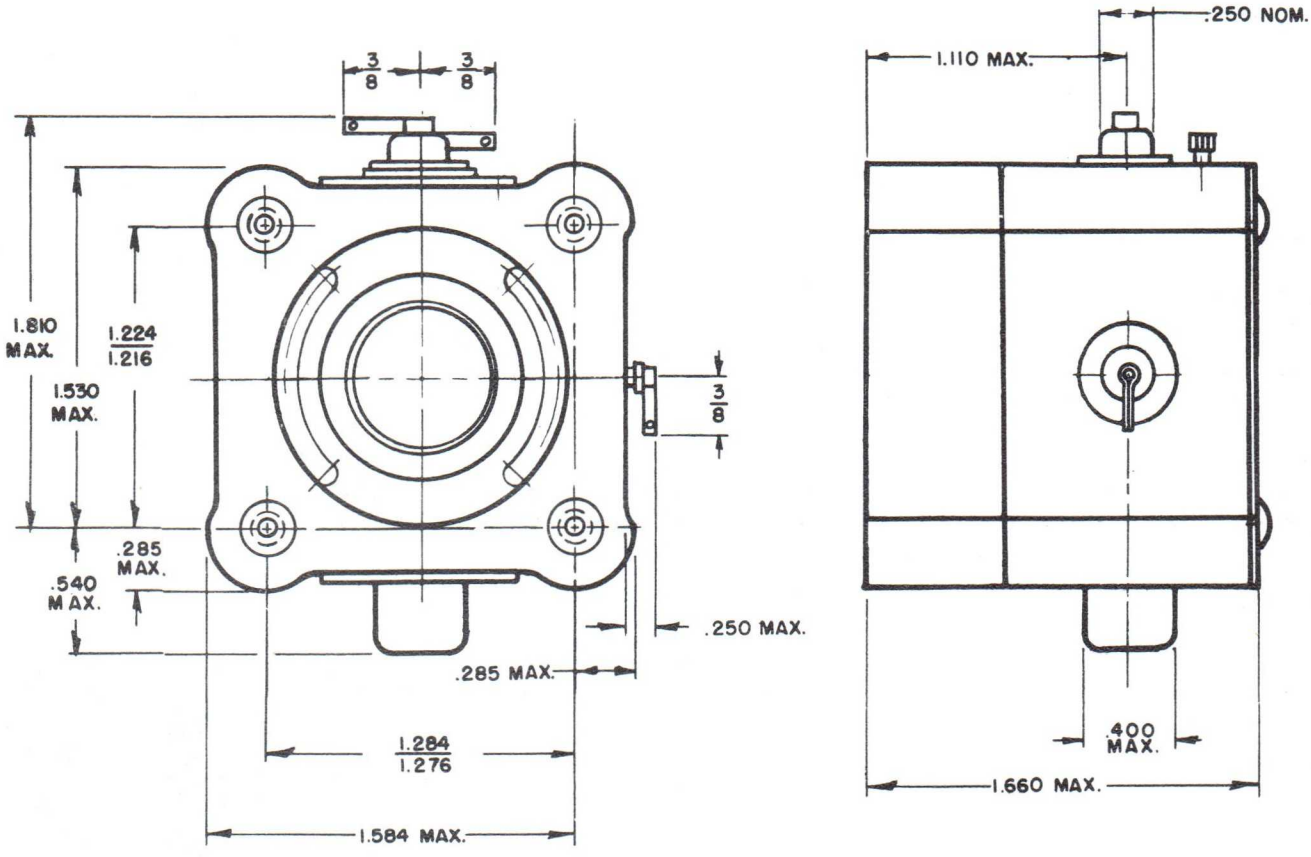
Environmental

Shock	60 G for 10 ms
Vibration	20 G at 50 to 2000 cps
Ambient Temperature	−55 to +125°C
Altitude	100,000 ft

5M—6-65-G Printed in U.S.A.

OUTLINE DRAWING





MA-252 Beacon Magnetron

Bulletin 1521

Microwave Associates, Inc.
Burlington
Massachusetts
Tel. (617) 272-3000
Western Union Fax
TWX: 710-332-6789
Telex: 94-9464

MA-252 Beacon Magnetron

DESCRIPTION

The MA-252 compact, tunable, fixed frequency, pulsed magnetron provides a 250-watt output at 8 to 10 Gc. The unit is of grounded-cathode, isolated-anode design and lightweight, ceramic and metal construction. Although fundamentally a fixed-frequency device, the MA-252 can be tuned and set within 15 Mc of the specified center frequency.

APPLICATIONS

The MA-252 offers excellent performance in beacon and navigation systems, radar detection systems, missile and ground support equipment, missile transponders, and airborne radar.

SPECIFICATIONS

Performance Data

Fixed Frequency	8 to 10 Gc
Tuning Range	±15 Mc
Minimum Peak Power Output	250 W
Pulling Figure	10 Mc (1.25 VSWR)
RF Bandwidth	2.5/tp
Thermal Coefficient	80 kc/°C
Minimum Life	300 hr
Maximum Missing Pulse Rate	0.1%

Operating Conditions

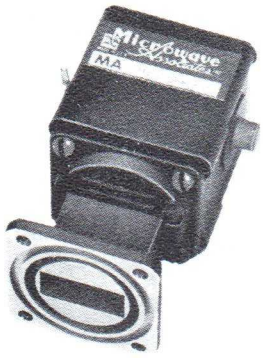
Pulse Width	0.5 μs
Duty Ratio	0.005
Peak Anode Voltage	1150 V
Peak Anode Current	0.65 A
Filament Preheat Time	20 sec
Filament Preheat Voltage	6.3 V
Filament Preheat Current	0.6 A

Mechanical

Size	See outline drawing.
Weight	13 oz
Output Connector	Mates with UG-39/U.
Input Connector	Solder lugs
Cooling	Conduction and convection
Tuning	Post in attached waveguide

Environmental

Shock	60 G for 10 ms
Vibration	15 G at 500 cps
Ambient Temperature	—55 to +90°C
Altitude	70,000 ft



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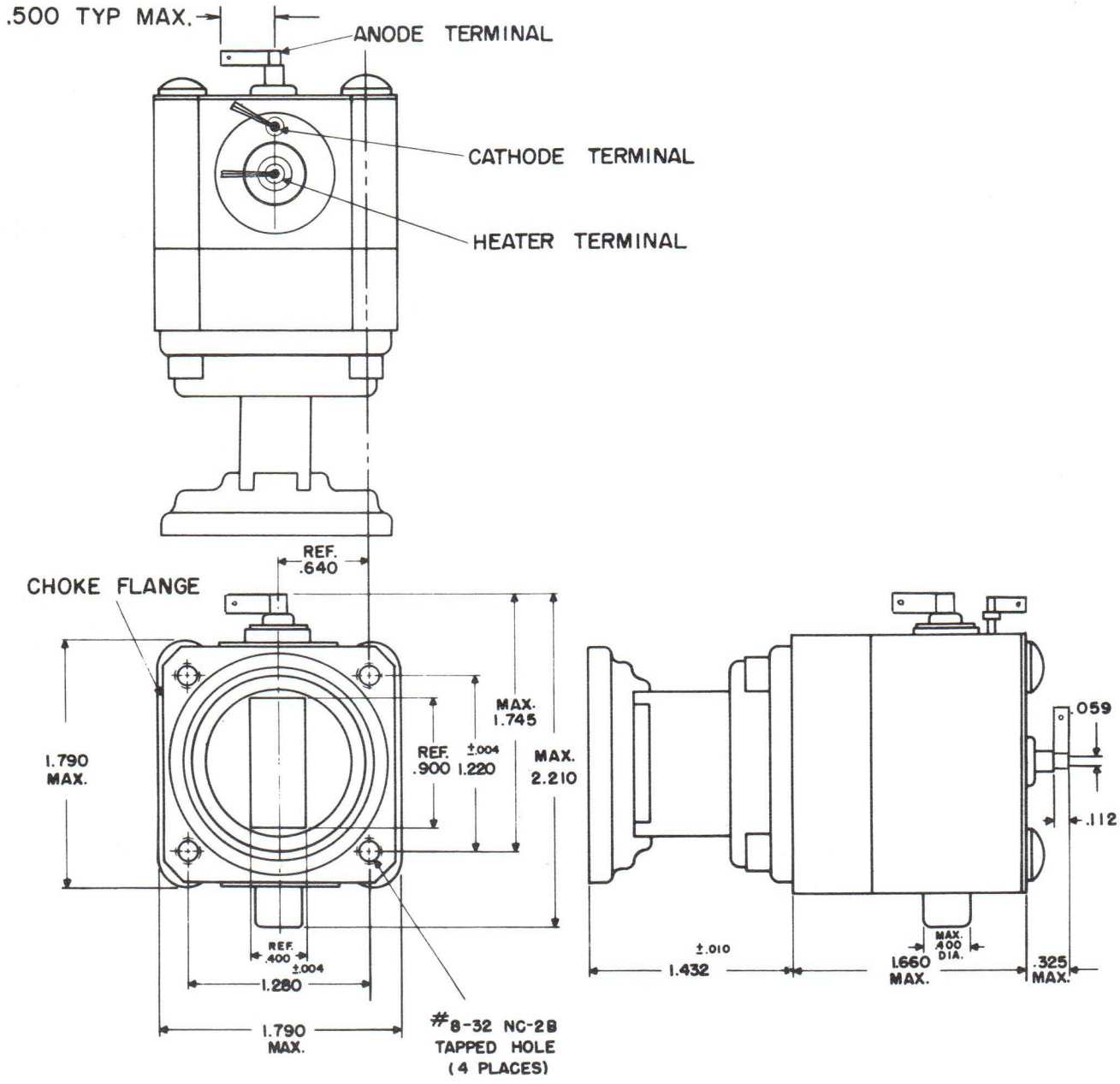
OUTLINE DRAWING



MA-212B Beacon Magnetron

Bulletin 1522

Microwave Associates, Inc.
Burlington
Massachusetts
Tel. (617) 272-3000
Western Union Fax
TWX: 710-332-6789
Telex: 94-9464

MA-212B Beacon Magnetron

DESCRIPTION

The MA-212B compact, fixed frequency magnetron provides typically 2-watt CW power between 8.8 and 10 Gc. This rugged, lightweight unit is of isolated-anode, grounded-cathode design for reliable, long life operation.

APPLICATIONS

The MA-212B offers excellent performance in beacon and navigation systems, radar detection systems, missile ground support equipment, missile transponders, and airborne radar.

SPECIFICATIONS

Performance Data

Fixed Frequency	8.8 to 10 Gc
CW Power Output	1.5 W (min) to 2.2 W
Pulling Figure	16 Mc (1.5 VSWR)
Thermal Coefficient	0.2 Mc/°C
Minimum Life	300 hr

Operating Conditions

Mode of Operation	CW
Anode Voltage	460 V
Anode Current	20 mAdc
Filament Voltage*	6.3 V
Filament Current	0.55 A

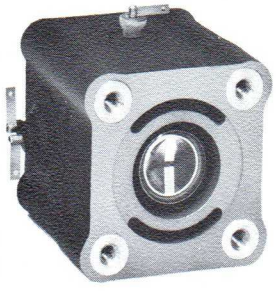
*Filament voltage reduced during operation.

Mechanical

Size	See outline drawing.
Weight	11 oz
Output Connector	Mates with UG-39/U flange. Can be made for full- or half-height waveguide.
Input Connector	Solder terminals
Cooling	Convection and conduction

Environmental

Shock	60 G for 10 ms
Vibration	20 G at 50 to 2000 cps
Ambient Temperature	—55 to +125°C
Altitude	100,000 ft



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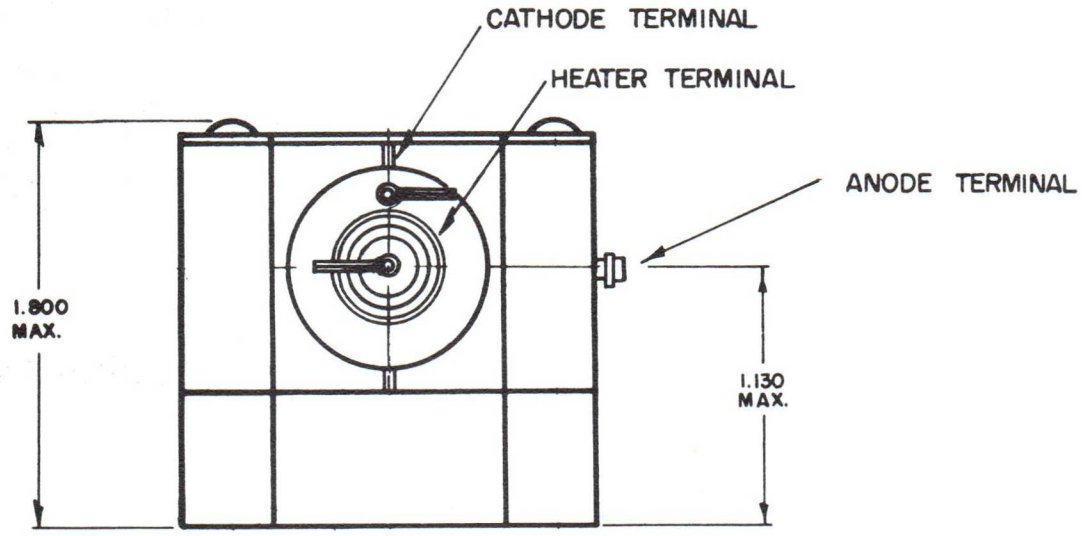
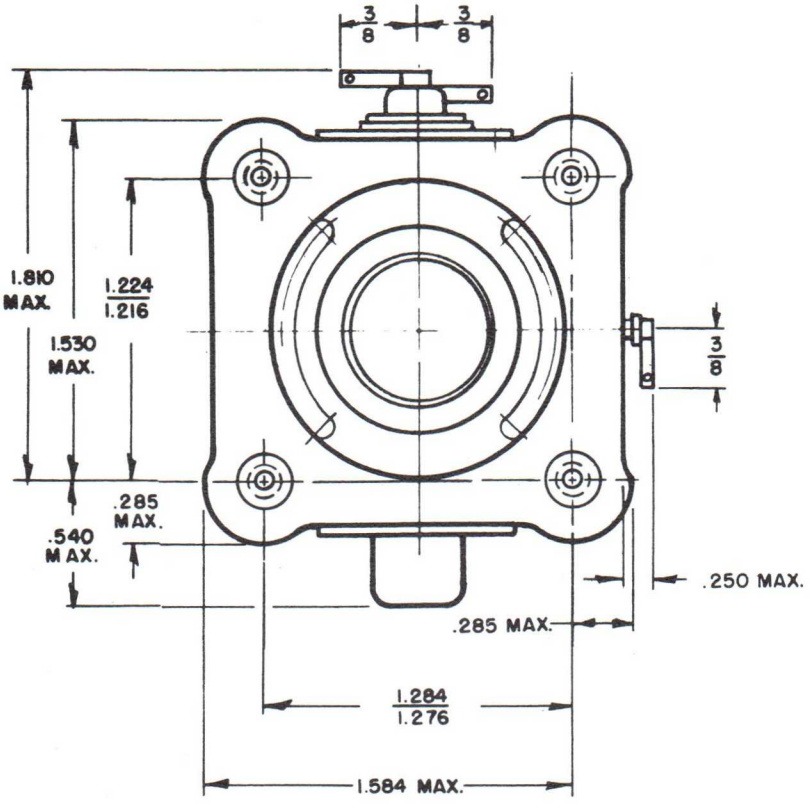
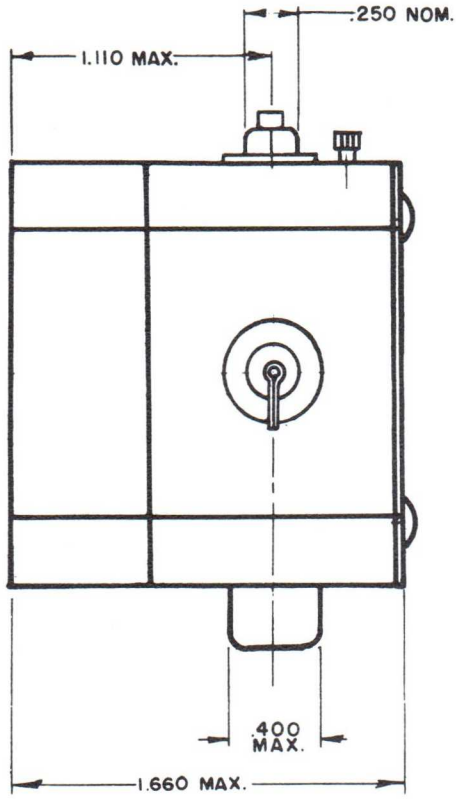
OUTLINE DRAWING







MA-245

Ku-Band Fixed Frequency Magnetron

Bulletin 1524A

Microwave Associates, Inc.
Burlington
Massachusetts
Tel. (617) 272-3000
Western Union Fax
TWX: 710-332-6789
Telex: 94-9464

MA-245 Ku-Band Fixed Frequency Magnetron

DESCRIPTION

The MA-245, Ku-band fixed-frequency magnetron provides a minimum of 20 W peak power, and 10 W average at 15.0 to 16.0 GHz. This rugged, compact and lightweight power tube features extremely high duty cycle operation, a grounded heater, metal and ceramic construction and positive-pulse design.

APPLICATIONS

The MA-245 offers excellent performance in landing, navigation and radar detection systems. It is equally suited for use in missile ground support equipment, missile transponders and airborne radar systems.

SPECIFICATIONS

Electrical Characteristics

Frequency Range, Fixed	15 to 16 GHz
Peak Power Output	20 W, Min.
Average Power Output	10 W, Min.
RF Bandwidth	2/tp, Max.
Thermal Coefficient	120 kHz/°C
Missing Pulse Rate	0.1%, Max.

Operating Conditions

Heater Voltage*	6.3 V
Heater Current	0.9 A
Pulse Voltage	+1050 V
Pulse Current	0.14 A
Duty Cycle (Ratio)	0.5
Pulse Width	5.0 μs

* Heater voltage reduced during oscillation.

Mechanical Characteristics

Size	See Outline Drawing
Weight	23 oz.
Output Connector	Mates With UG–419 U Cover Flange or UG–541/U Choke Flange With Threads Removed
Input Connectors	
Cathode & Filament	Potted Wire Leads
Anode	Cap

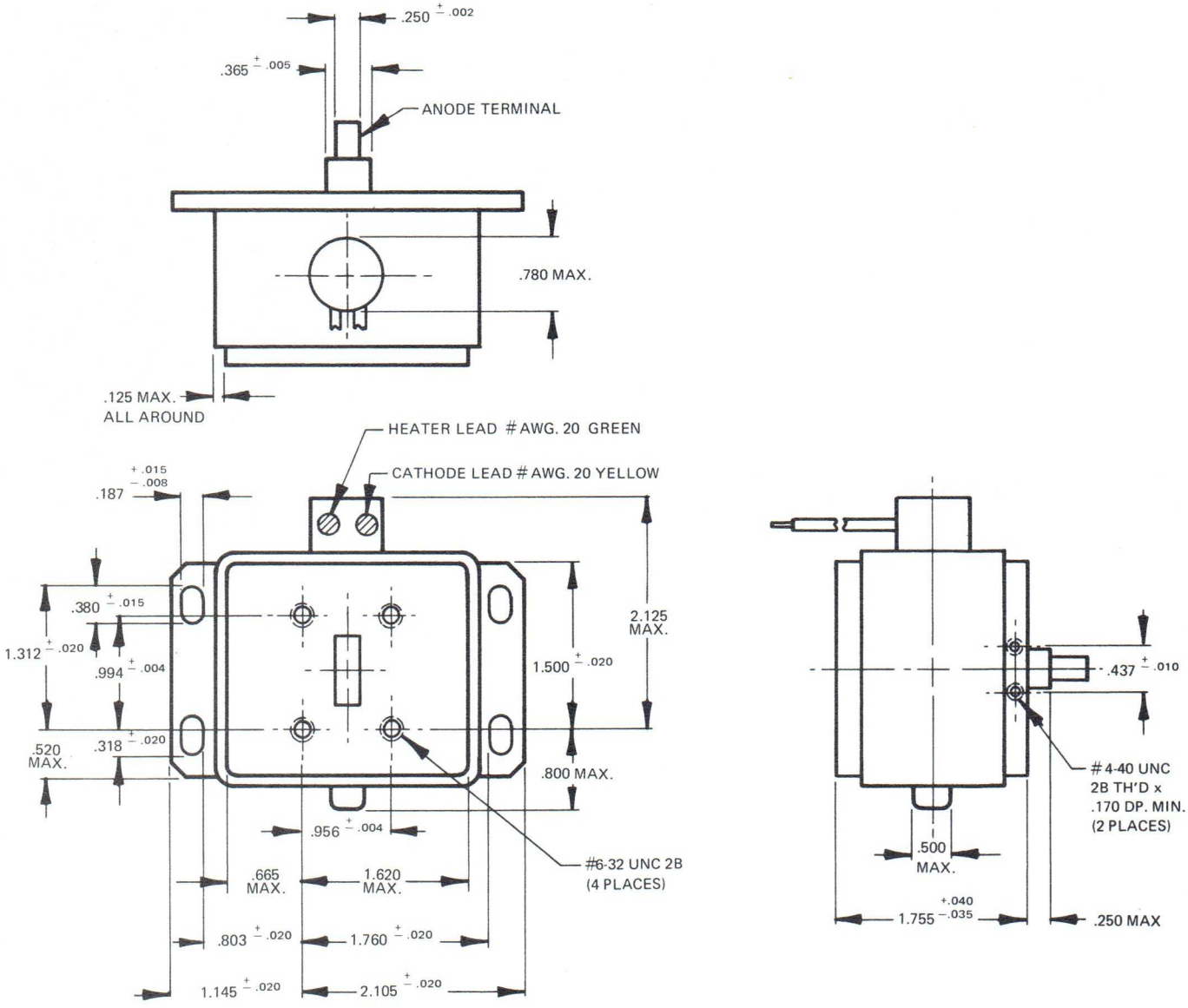
Environmental Characteristics

Cooling	Conduction/Convection
Ambient Temp.	–55° to +90°C
Altitude	50,000 ft.
Vibration (70 to 500 cps)	15 G
Shock (10 ms)	60 G
Life Test	500 hrs.

All specifications are subject to change without notice.

6/71 Printed in U.S.A.

OUTLINE DRAWING



MA-246A Beacon Magnetron

Bulletin 1525

Microwave Associates, Inc.
Burlington
Massachusetts
Tel. (617) 272-3000
Western Union Fax
TWX: 710-332-6789
Telex: 94-9464

MA-246A Beacon Magnetron

DESCRIPTION

The MA-246A compact, fixed frequency, pulsed magnetron provides typically 150-watt peak power output at 16.5 to 16.8 Gc. The unit is of isolated-anode, grounded-cathode design and lightweight metal and ceramic construction.

APPLICATIONS

The MA-246A offers excellent performance in beacon and navigation systems, radar detection systems, missile ground support equipment, missile transponders, and airborne radar.

SPECIFICATIONS

Performance Data

Fixed Frequency	16.5 to 16.8 Gc
Peak Power Output	100 W (min) to 150 W
Pulling Figure	30 Mc (1.5 VSWR)
RF Bandwidth	2/tp
Thermal Coefficient	120 kc/°C
Minimum Life	300 hr
Maximum Missing Pulse Rate	0.1%

Operating Conditions

Pulse Width	0.5 μs
Duty Ratio	0.005
Peak Anode Voltage	1100 V
Peak Anode Current	0.45 A
Filament Preheat Time	30 sec
Filament Voltage	6.3 V
Filament Current	0.9 A

Mechanical

Size	See outline drawing.
Weight	16 oz
Output Connector	Mates with UG-419/U cover flange or UG-541/U choke flange with threads removed.
Input Connectors	
Cathode and Filament	Solder lugs
Anode	Wire lead
Cooling	Conduction and convection

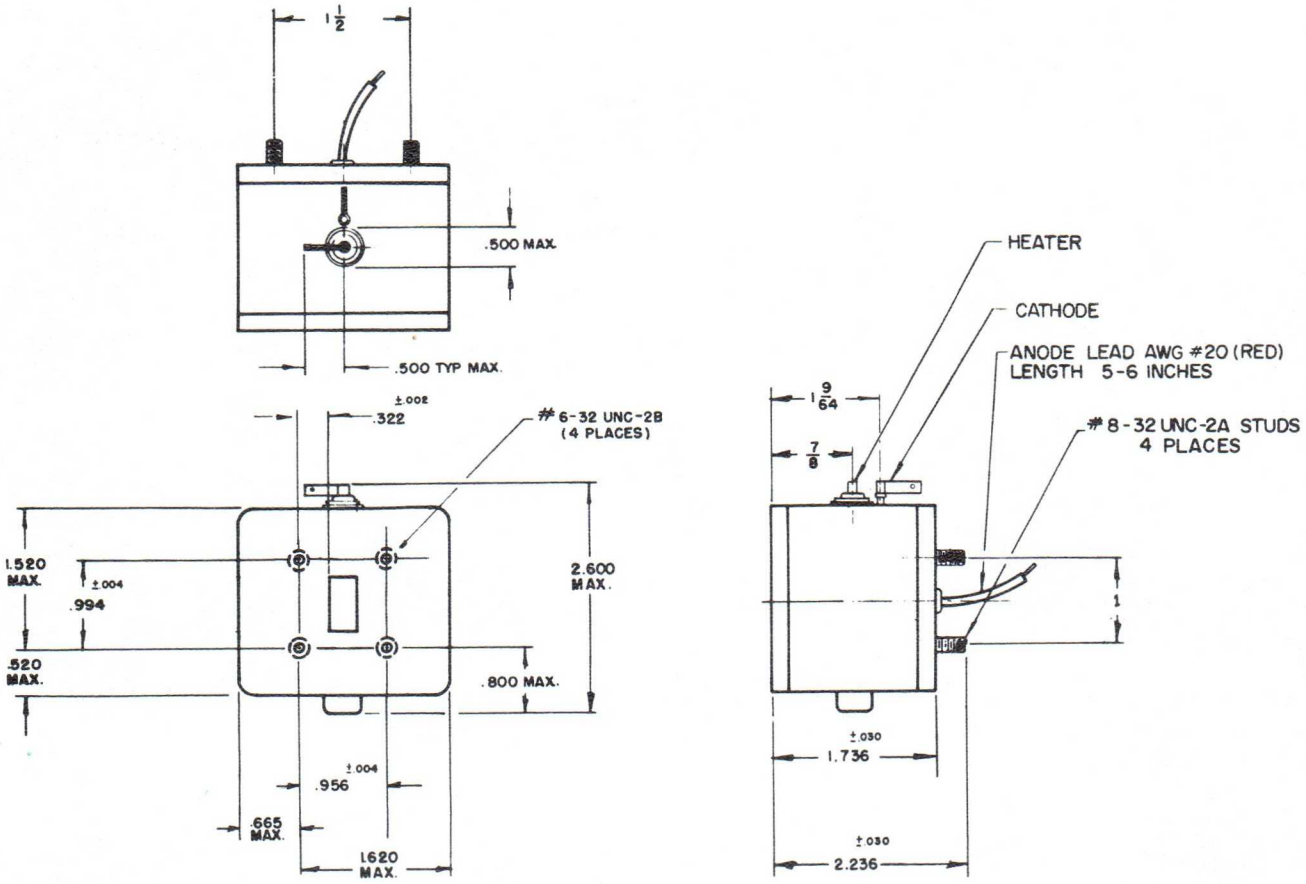
Environmental

Shock	60 G for 10 ms
Vibration	20 G at 50 to 2000 cps
Ambient Temperature	−55 to +125°C
Altitude	70,000 ft

All specifications subject to change without notice.

5M—6-65-G Printed in U.S.A.

OUTLINE DRAWING



MA-257 Beacon Magnetron

Bulletin 1526

Microwave Associates, Inc.
Burlington
Massachusetts
Tel. (617) 272-3000
Western Union Fax
TWX: 710-332-6789
Telex: 94-9464

MA-257 Beacon Magnetron

DESCRIPTION

The MA-257 is a compact, fixed frequency, Ku-band beacon magnetron. Peak power design goal for this 16-ounce, positively pulsed unit is 1 kw.

APPLICATIONS

When completed, the MA-257 will be ideally suited for beacon and navigation systems, radar detection systems, missile ground support equipment, transponders, and airborne radar.

SPECIFICATIONS

Performance Data

Fixed Frequency	16 to 16.5 Gc
Minimum Peak Power Output	1 Kw
Pulling Figure	25 Mc (1.5 VSWR)
Minimum Side Lobe Ratio	—8 db

Operating Conditions

Pulse Width	0.5 μs
Duty Ratio	0.002
Peak Anode Voltage	2200 V
Peak Anode Current	1.8 A
Filament Voltage	5 V
Filament Preheat Current	0.7 A

Mechanical

Size	See outline drawing.
Weight	16 oz
Output Connector	Mates with UG-541/U choke flange.
Input Connector	Flexible leads or solder lugs
Cooling	Conduction and convection

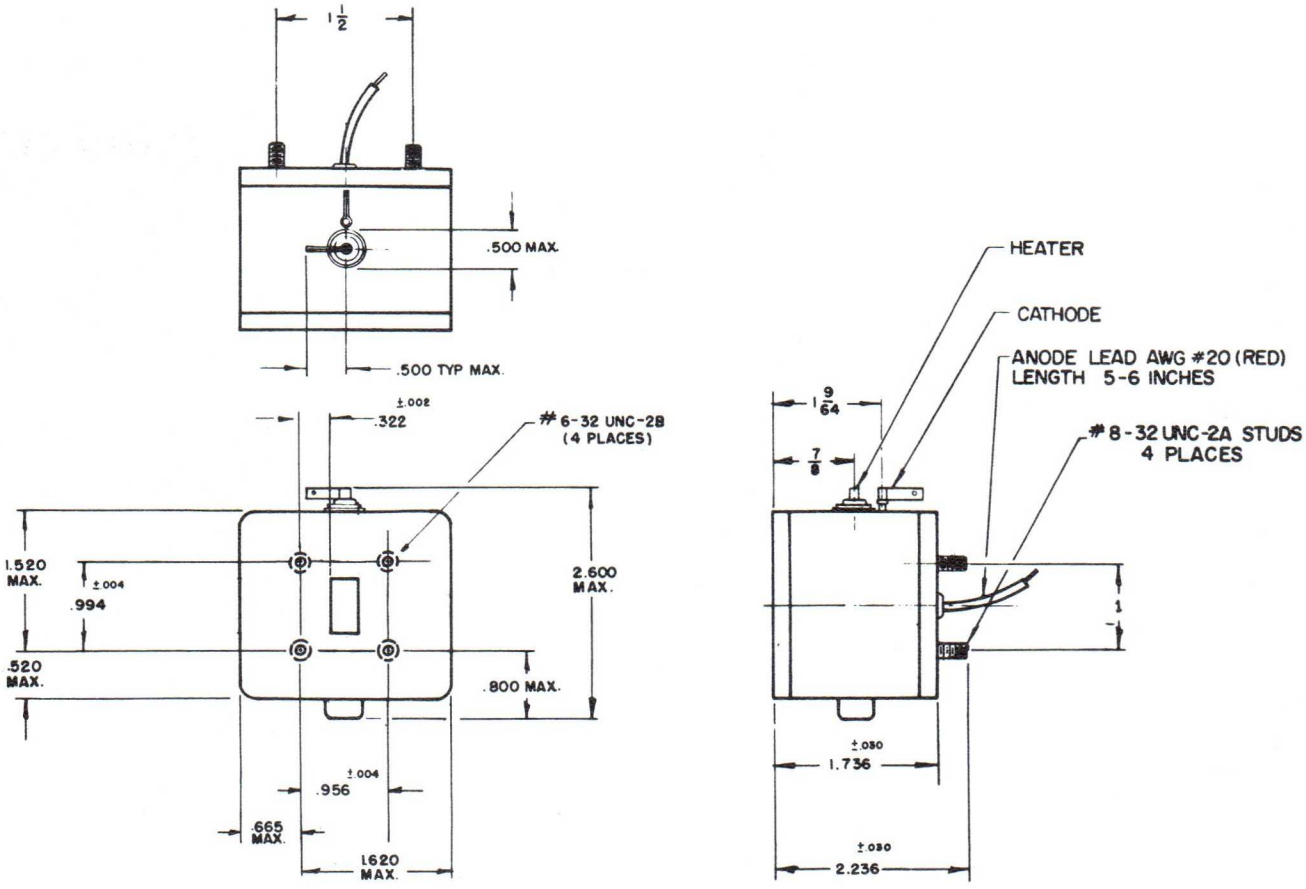
Environmental

Shock	60 G for 10 ms
Vibration	15 G at 50 to 2000 cps

The MA-257 is currently under development. For further information contact the nearest MA representative.

5M—6-65-G Printed in U.S.A.

OUTLINE DRAWING



MA-260

Tunable KU-Band Magnetron

Bulletin 1535
Revised

Microwave Associates, Inc.
Burlington
Massachusetts
Tel. (617) 272-3000
Western Union Fax
TWX: 710-332-6789
Telex: 94-9464

MA-260 Tunable KU-Band Magnetron

DESCRIPTION

The MA-260 is a positive pulse, Ku-Band tunable magnetron capable of providing a minimum of 1 kW peak power. This compact, lightweight, ruggedized power tube has a tuning range of 16.0–16.5 GHz and operates at pulse widths as short as 50 nanoseconds. Operation at longer pulse widths up to and including CW operation is limited only by maximum average power dissipation requirements, typically 5 watts for convection cooling.

APPLICATIONS

The MA-260 is ideally suited for use in beacon, navigation and manpack radar systems. It is equally suited for use in missile ground support equipment, transponders and airborne radar.

SPECIFICATIONS

Electrical Characteristics

Frequency Range, Tunable	16.0 to 16.5 GHz
Peak Power	1 kw, min.
Pulling Factor 20 MHz (1.3:1 VSWR), max.	
Pushing Factor (± 10% I b)	3.5 MHz, max.
Missing Pulse Rate	0.1%, max.
Side Lobes	8dB, min.
*Thermal Coefficient	0.1 MHz/°C, max.

Operating Conditions

Heater Voltage	4.75 V
Heater Current	0.8 A, max.
Preheat Time	10 sec. nom.
Pulse Voltage	+2900 to +3100 V
Pulse Current	1.6 A
Anode-Cathode Capacitance	18 pF, nom.
Duty Cycle	0.005 ratio, max.

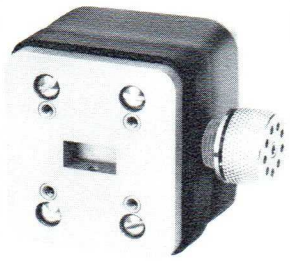
Mechanical Characteristics

Size	Refer to outline drawing
Weight	20 oz., max.
Mounting Position	Any
Output Connector	Mates with UG-419/U Flange

Environmental Characteristics

Cooling	Conduction and/or Convection
Ambient Temperature Range	−54°C to +85°C
Vibration (40 to 2000 cps)	10 G
Shock (11 ± 1 ms)	60 G

All specifications are subject to change without notice.
*The thermal coefficient is adjustable upon special order to 0 ± .040 MHz/°C.



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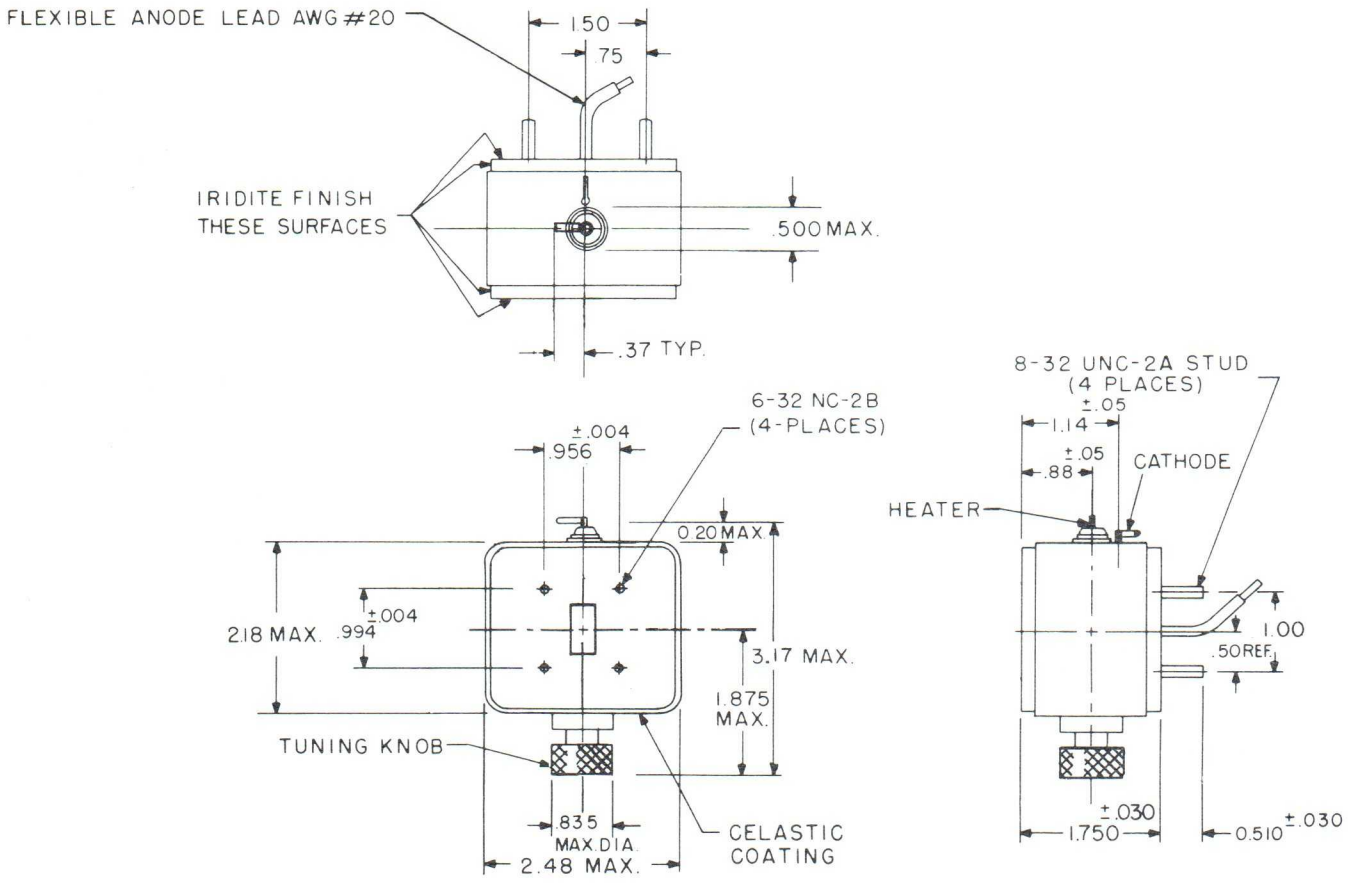


MA-270 Tunable X-Band Magnetron

DESCRIPTION

The MA-270 is a tunable frequency, pulsed, X-band magnetron. This compact, lightweight power tube provides a 150 watt minimum peak power output over the tuning range of 9000 to 9500 MHz. The MA-270 features a rugged design capable of excellent frequency stability.

APPLICATIONS

The MA-270 is designed for use in beacon and transponder systems. It is equally suited for use in airborne, missile and ground support radar equipment.

SPECIFICATIONS

Electrical Characteristics

Frequency Range, Tunable	9000 to 9500 MHz
Peak Power	150 w, min.
Pulling Factor	15 MHz (1.5:1 VSWR), max.
Pushing Factor	4.5 MHz (± 10% ib), max.
Missing Pulse Rate	0.25%, max.
Side Lobes (ratio)	−6 dB, min.
Thermal Coefficient	±0.08 MHz/°C, max.

Operating Conditions

Heater Voltage	5.0 V
Heater Current	0.5 A
Pulse Voltage	1300 to 1500 V
Pulse Current	0.9 A
Anode-Cathode Capacitance	15 pF
Duty Cycle (ratio)	0.002, max.

Mechanical Characteristics

Size	Refer to outline drawing
Weight (approx.)	6.0 oz.
Mounting Position	Any
Output Connector	Mates with TNC female

Environmental Characteristics

Cooling	Conduction/Convection
Ambient Temperature	−55°C to +71°C
Altitude	60,000 ft.
Vibration (60 to 2000 cps)	15 G
Shock (11 ± 1 ms)	60 G

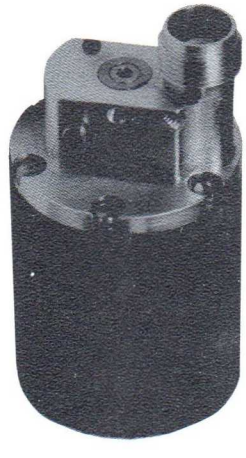
All specifications are subject to change without notice.

MA-270

Tunable X-Band Magnetron

Bulletin 1536

Microwave Associates, Inc.
Burlington
Massachusetts
Tel. (617) 272-3000
Western Union Fax
TWX: 710-332-6789
Telex: 94-9464



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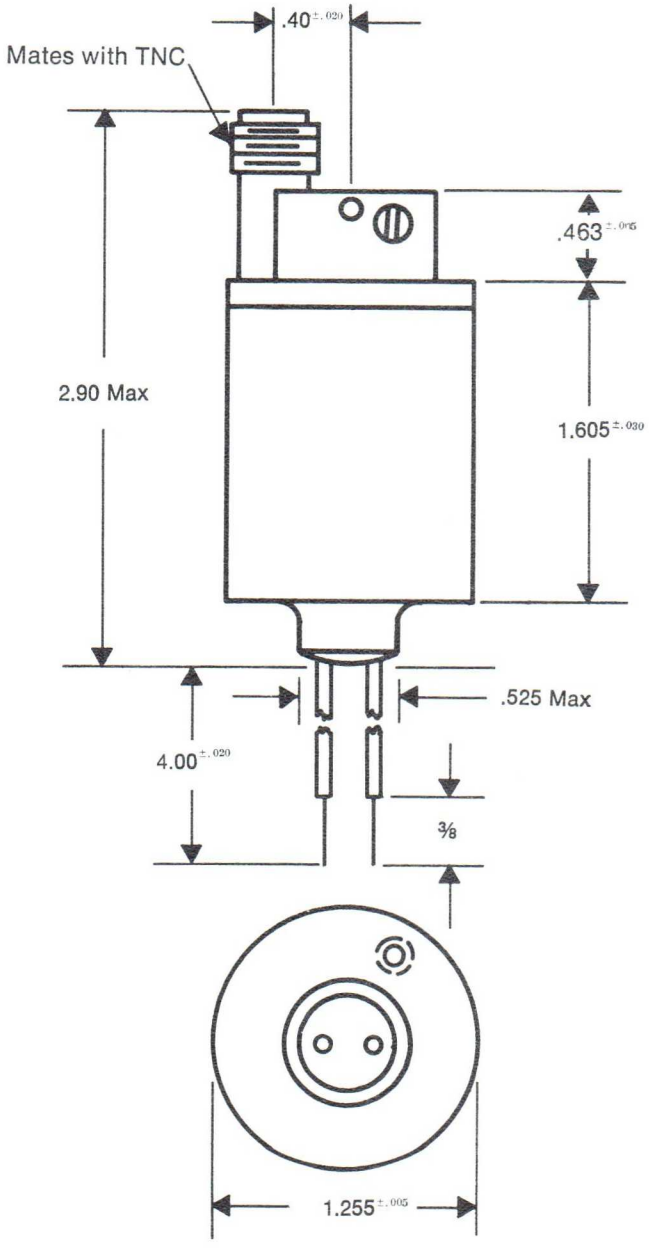


Bulletin 1537

Microwave Associates, Inc.
Burlington
Massachusetts
Tel. (617) 272-3000
Western Union Fax
TWX: 710-332-6789
Telex: 94-9464

MA-272 7Kw, X-Band Miniature Magnetron

DESCRIPTION

The MA-272, X-band miniature magnetron features a very small and lightweight package, low voltage and positive anode design.

APPLICATIONS

This miniature magnetron is ideally suited for transponder, beacon and manpack radar systems. It is equally suited for use in missile ground support equipment, missiles, high performance aircraft and battlefield environments.

SPECIFICATIONS

Electrical Characteristics

Frequency Range, Fixed	8500 to 9600 MHz
Peak Power	7kw, min.
Pulling Factor	20 MHz (1.5:1 VSWR), max.
Pushing Factor	3 MHz (±10% ib), max.
Missing Pulse Rate	0.1%, max.
Side Lobes (ratio)	−8dB, min.
Thermal Coefficient	0.1 MHz/°C, max.

Operating Conditions

Heater Voltage	5.5 V
Heater Current	1.0 A, nom.
Preheat Time	10 sec., min.
Pulse Voltage	4300 V to 4700 V
Pulse Current	5.5 A
Anode-Cathode Capacitance	18 pF, nom.
Duty Cycle (ratio)	.002, max.
Pulse Width	1 μsec.

Mechanical Characteristics

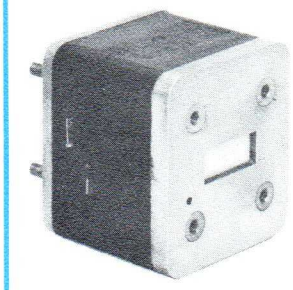
Size	Refer to outline drawing
Weight (approx.)	21 oz.
Mounting Position	Any
Output Connector	Mates with UG-39/U Flange

Environmental Characteristics

Cooling	Conduction/Convection to .001 duty
Ambient Temperature	−54°C to +85°C
[1]Vibration (55 to 2000 cps)	20 G
Shock (6 ms)	100 G

[1]100 G provided upon request

All specifications are subject to change without notice.



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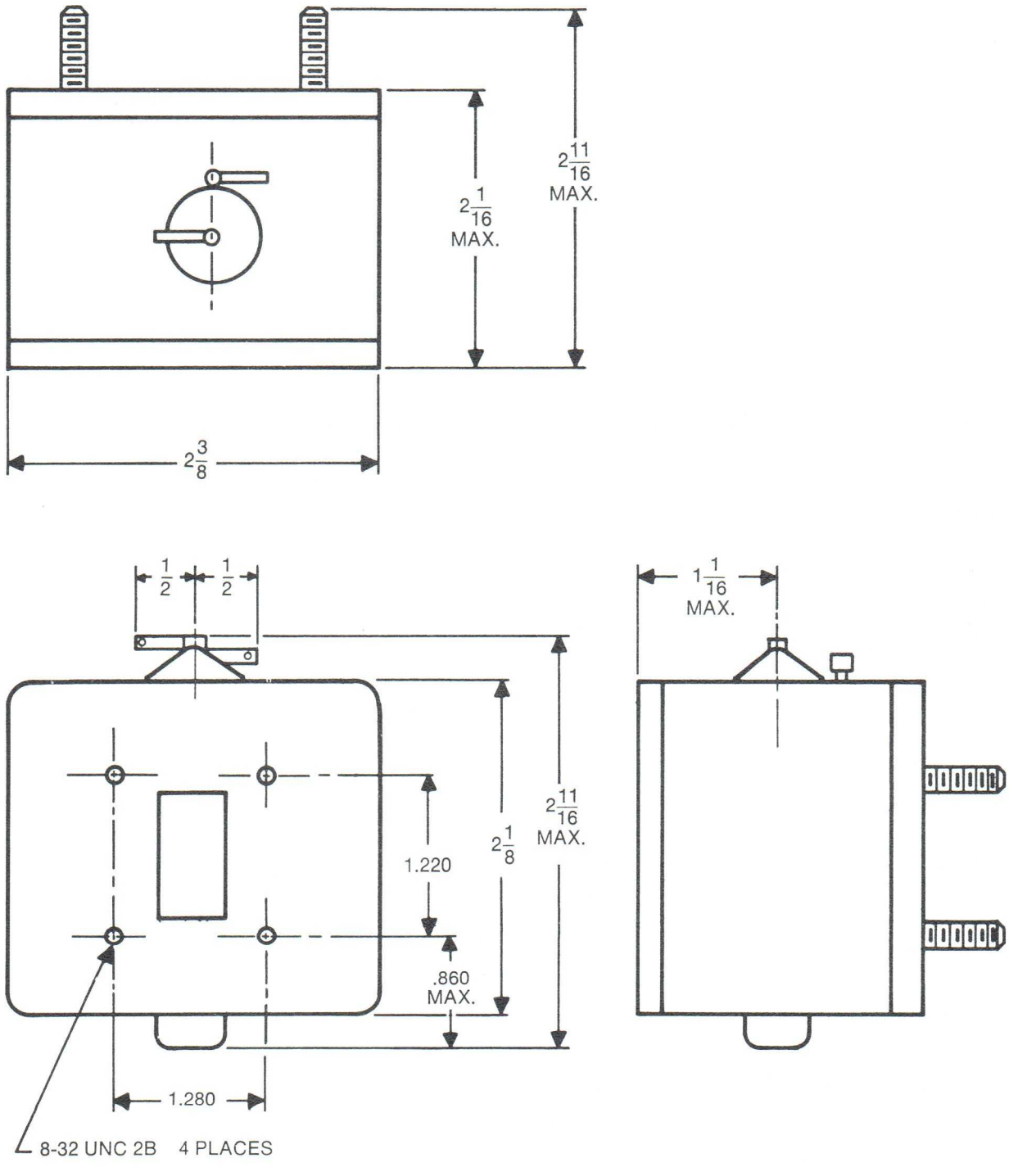


MA-274

KU-Band Tunable Frequency Magnetron

Bulletin 1538

Microwave Associates, Inc.
Burlington
Massachusetts
Tel. (617) 272-3000
Western Union Fax
TWX: 710-332-6789
Telex: 94-9464

MA-274 KU-Band Tunable Frequency Magnetron

DESCRIPTION

The MA-274 is a tunable frequency Ku-band magnetron. This compact, lightweight power tube provides a 800 watt minimum peak power output over the bandwidth of 15,700 to 16,100 MHz. This power tube also features an integral isolator which makes the tube nearly impervious to load variations.

APPLICATIONS

The MA-274 is suited for use in various types of surface and airborne transmitter and transponder applications.

SPECIFICATIONS

Electrical Characteristics

Frequency Range, Tunable	15,700 to 16,100 MHz
Peak Power	800 w, min.
Pulling Factor	2.5 MHz (1.5:1 VSWR), max.
Pushing Factor	3.0 MHz (±10% ib), max.
Missing Pulse Rate	0.1%, max.
Side Lobes (ratio)	−8dB, min.
Thermal Coefficient	0.1 MHz/°C, max.

Operating Conditions

Heater Voltage	6.3 V
Heater Current	0.85 A, nom.
Pulse Voltage	2300 to 2500 V
Pulse Current	2.0 A
Preheat Time	15 sec. nom.

Anode Cathode Capacitance	20 pF, max.
Duty Cycle (ratio)	.005, max.

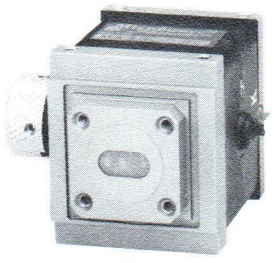
Mechanical Characteristics

Size	Refer to outline drawing
Weight (approx.)	19 oz.
Mounting Position	Any
Output Connector	Mates with UG-419/U

Environmental Characteristics

Cooling	Conduction/Convection
Ambient Temperature	−54°C to +72°C
Vibration (40 to 2000 cps)	15 G
Shock (11±1 ms)	60 G

All specifications are subject to change without notice.



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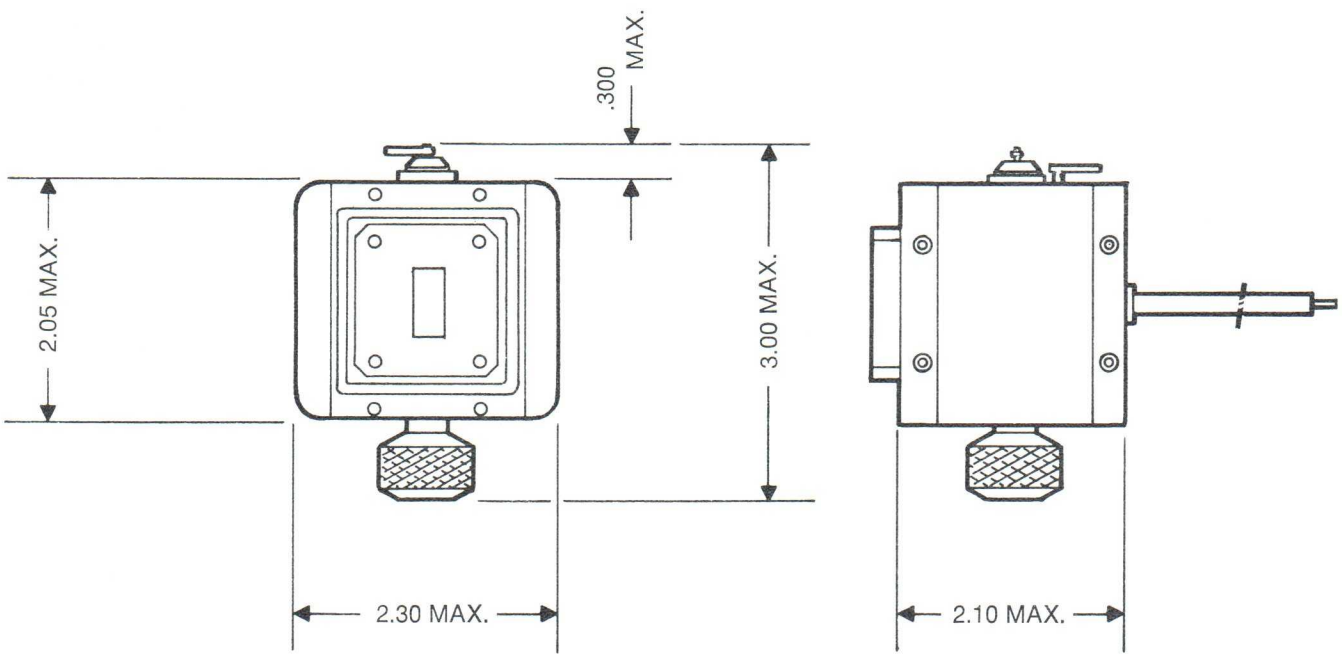

MA-232B

CW X-Band Magnetron

Bulletin 1539

Microwave Associates, Inc.
Burlington
Massachusetts
Tel. (617) 272-3000
Western Union Fax
TWX: 710-332-6789
Telex: 94-9464

MA-232B CW X-Band Magnetron

DESCRIPTION

A sturdy, lightweight unit incorporating positive anode design. The MA-232B provides efficient fixed-frequency operation for X-band applications requiring a minimum power of 15 watts CW.

APPLICATIONS

Beacon and navigation systems, radar detection systems, missile ground support equipment, transponders, and airborne radar applications.

SPECIFICATIONS

Electrical Characteristics

Frequency Range, Fixed	8800 to 9600 MHz
Power, Output	15 W, CW, min.
Pulling Factor (1.3:1 VSWR)	16 MHz, max.
Pushing Factor	4 MHz (± 10% I_b), max.
Thermal Coefficient[1]	0.2 MHz/°C, max.

Operating Conditions

Heater Voltage[2]	6.3 V
Heater Current	0.7A, max.
Preheat Time	15 sec., min.
Anode Voltage	+900 to +1000 V
Anode Current	0.06 A
Anode-Cathode Capacitance	16 pF, nom.
Duty Cycle (ratio)	CW

Mechanical Characteristics

Size	Refer to Outline drawing
Weight (approx.)	11 oz.
Mounting Position	Any
Output Connector	Mates with UG-39/U

Environmental Characteristics

Cooling	Conduction/Convection
Ambient Temperature	−54°C to +85°C
Altitude	40,000 ft.
Vibration (40 to 2,000 cps)	15 G
Shock (11 ±1 ms)	60 G

1. Thermal coefficient .050 MHz/°C max. available on special request.
2. Heater voltage is reduced during oscillation to a value specified on each magnetron.

All specifications are subject to change without notice.

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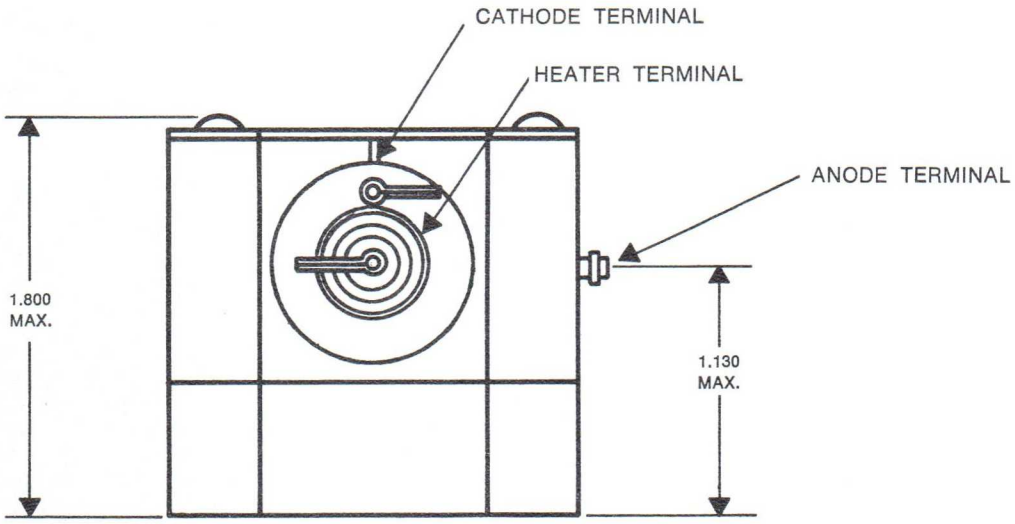
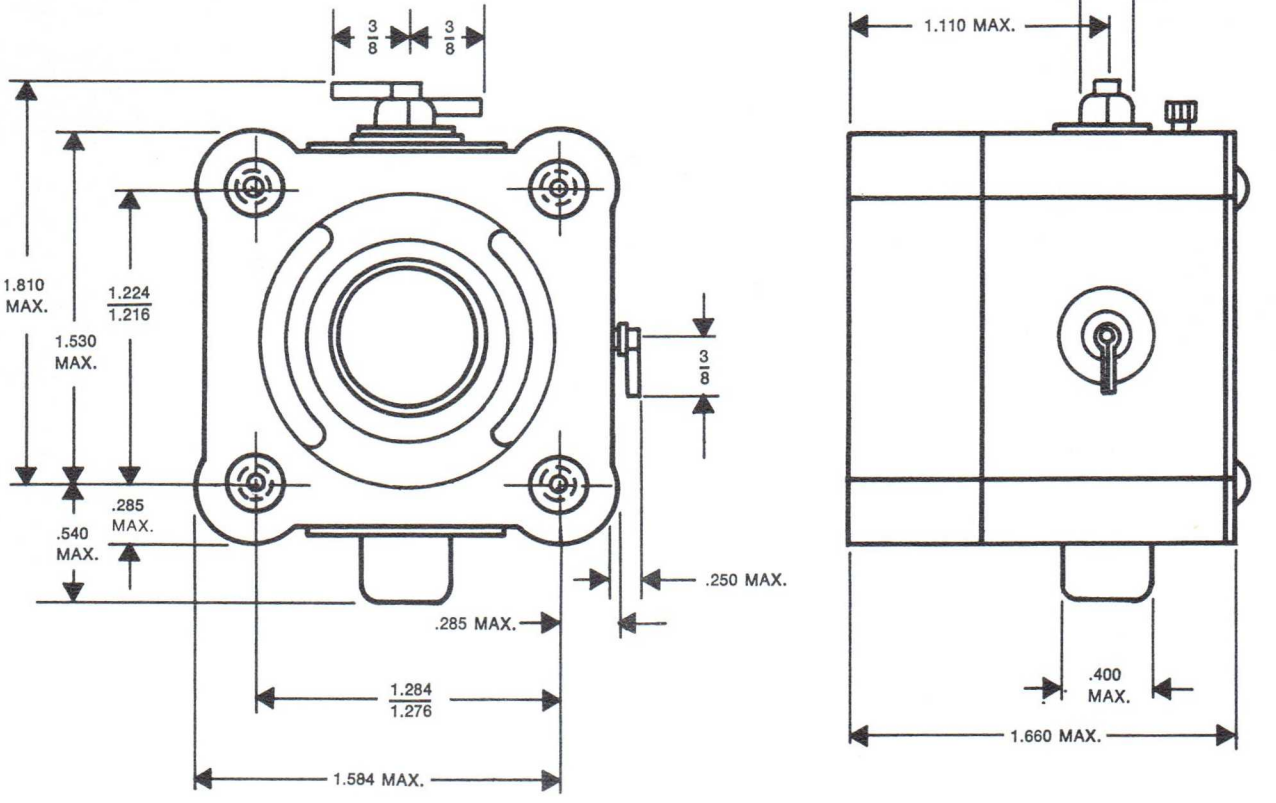
OUTLINE DRAWING





MA-259

Fixed Frequency Magnetron

Bulletin 1540

Microwave Associates, Inc.
Burlington
Massachusetts
Tel. (617) 272-3000
Western Union Fax
TWX: 710-332-6789
Telex: 94-9464

MA-259 Fixed Frequency Magnetron

DESCRIPTION

The MA-259 is a positive pulse, fixed frequency magnetron which provides a minimum of 1 kw peak power over the bandwidth of 7000 to 7300 MHz. This rugged, compact and lightweight power tube features a grounded cathode, isolated-anode electrical design that improves spectrum performance, virtually eliminates arcing and leakage current, and increases operating efficiency.

APPLICATIONS

The MA-259 magnetron is particularly suited for short pulse applications in high resolution radar systems. This power tube is designed for a wide variety of additional applications including airborne, missile, and ground-based radar equipment, beacon navigation systems, ground support equipment and missile transponders.

SPECIFICATIONS

Electrical Characteristics

Frequency Range, Fixed	7000 to 7300 MHz
Peak Power	1 kw, min.
Pulling Factor	15 MHz (1.5:1 VSWR), max.
Pushing Factor 4 MHz ($\pm$10% I_b), max.	
Missing Pulse Rate	0.1%, max.
Side Lobes (ratio)	−8dB, min.
Thermal Coefficient	0.1 MHz/°C, max.

Operating Conditions

Heater Voltage	6.3 V
Heater Current	0.65 A, max.
Pulse Voltage	+1800 to +2200 V
Pulse Current	2.0 A
Preheat Time	10 sec., min.

Anode-Cathode Capacitance	18 pF, nom.
Duty Cycle[1] (ratio)	0.001, nom.

Mechanical Characteristics

Size	Refer to outline drawing
Weight	21 oz.
Mounting Position	Any
Output Connector	Mates with UG-51/U Flange

Environmental Characteristics

Cooling	Conduction/Convection
Ambient Temperature	−55°C to +85°C
Vibration (50 to 2000 cps)	15 G
Shock (11 $\pm$ 1 ms)	60 G

NOTE

1. For duty cycles over .0015 the heater voltage should be reduced.

All specifications are subject to change without notice.

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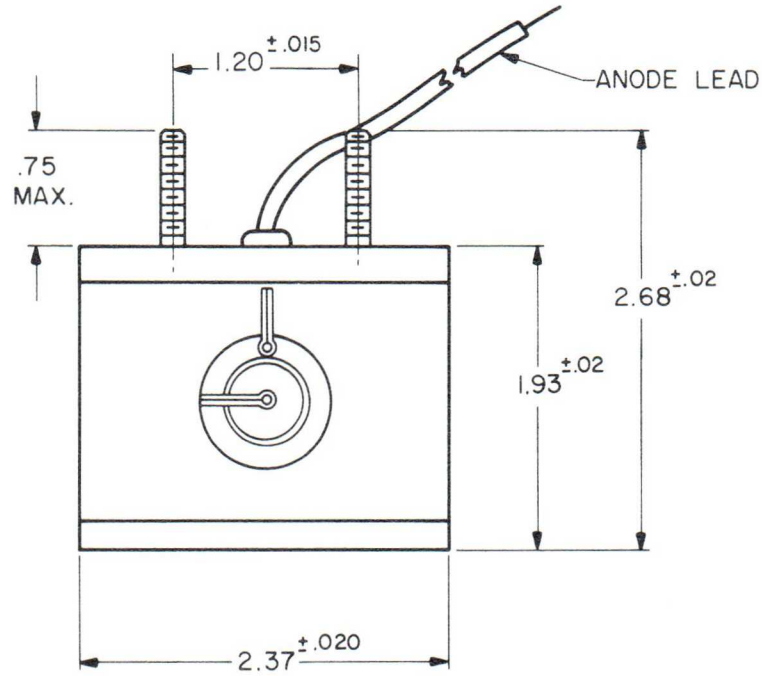
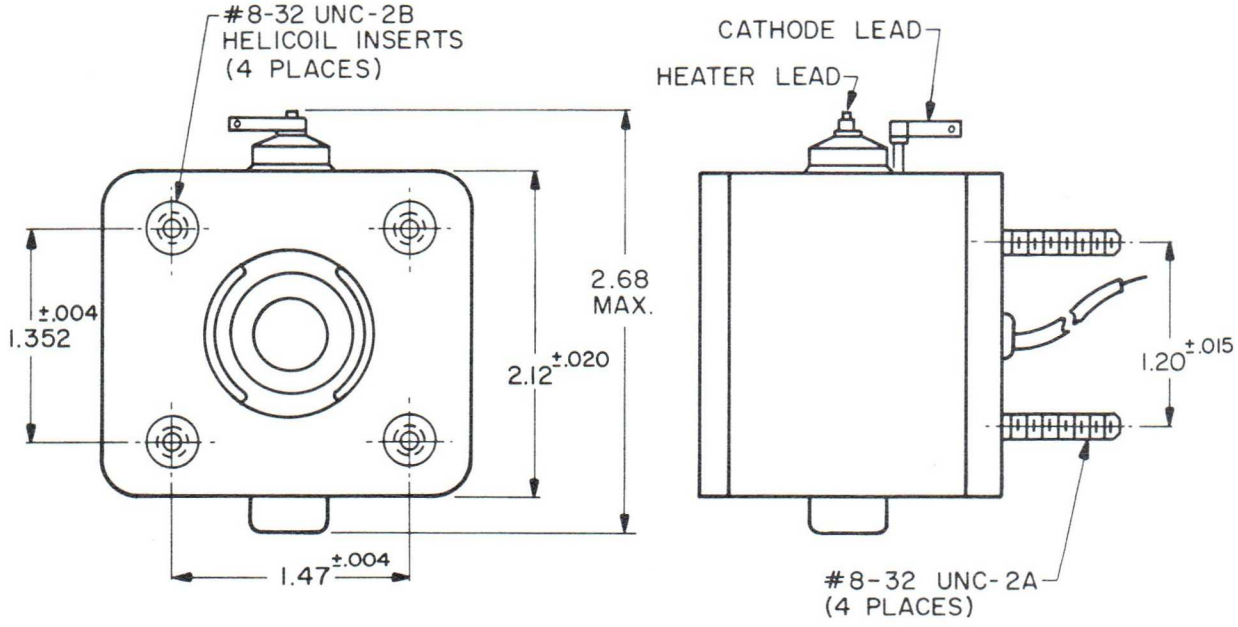
OUTLINE DRAWING





MA-250

Fixed Frequency X-Band Magnetron

Bulletin 1541

Microwave Associates, Inc.
Burlington
Massachusetts
Tel. (617) 272-3000
Western Union Fax
TWX: 710-332-6789
Telex: 94-9464

MA-250 Fixed Frequency X-Band Magnetron

DESCRIPTION

The MA-250 is a positive pulse, fixed frequency, X-band magnetron which provides a minimum of 4 kw peak power over the bandwith of 8500 to 9600 MHz. This rugged, compact and lightweight power tube features grounded cathode, isolated-anode electrical design which improves spectrum performance, virtually eliminates arcing and leakage current, and increases the operating efficiency of the tube.

APPLICATIONS

The MA-250 magnetron is particularly suited for applications including airborne, missile, and ground based radar equipment, beacon navigation systems, ground support equipment and missile transponders.

SPECIFICATIONS

Electrical Characteristics

Frequency Range, Fixed	8500 to 9600 MHz
Peak Power	4 kw, min.
Pulling Factor	20 MHz (1.5:1 VSWR), max.
Pushing Factor	3 MHz (±10% I_b), max.
Missing Pulse Rate	0.1%, max.
Side Lobes (ratio)	−8dB, min.
Thermal Coefficient	0.1 MHz/°C, max.

Operating Conditions

Heater Voltage	6.3 V
Heater Current	1.15 A, max.
Pulse Voltage	+3800 to +4200 V
Pulse Current	4.0 A
Preheat Time	10 sec., min.
Anode-Cathode Capacitance	18 pF, nom.
Duty Cycle (ratio)	0.005
Pulse Width	0.5μs

Mechanical Characteristics

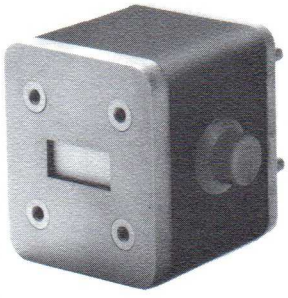
Size	Refer to outline drawing
Weight	21 oz.
Mounting Position	Any
Output Connector	Mates with UG-39/U flange

Environmental Characteristics

Cooling	Conduction/Convection
Ambient Temperature	54°C to +85°C
Vibration (50 to 2000 cps)	*20 G
Shock (6 ms)	100 G

*100 G available on request.

All specifications are subject to change without notice.



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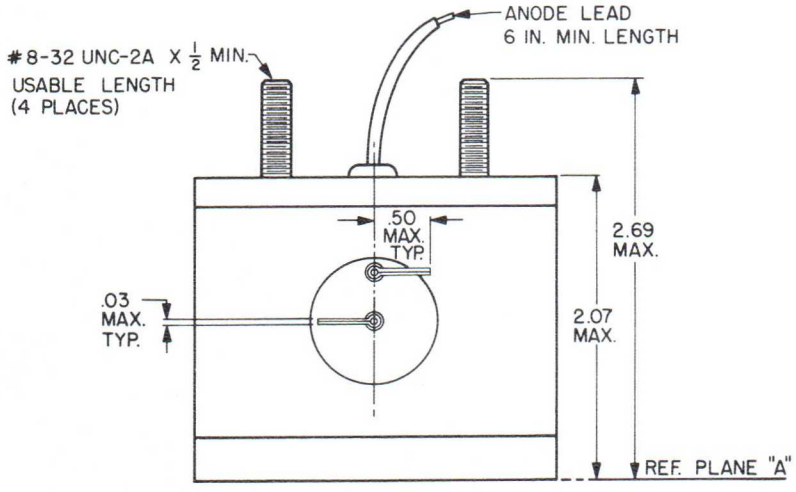
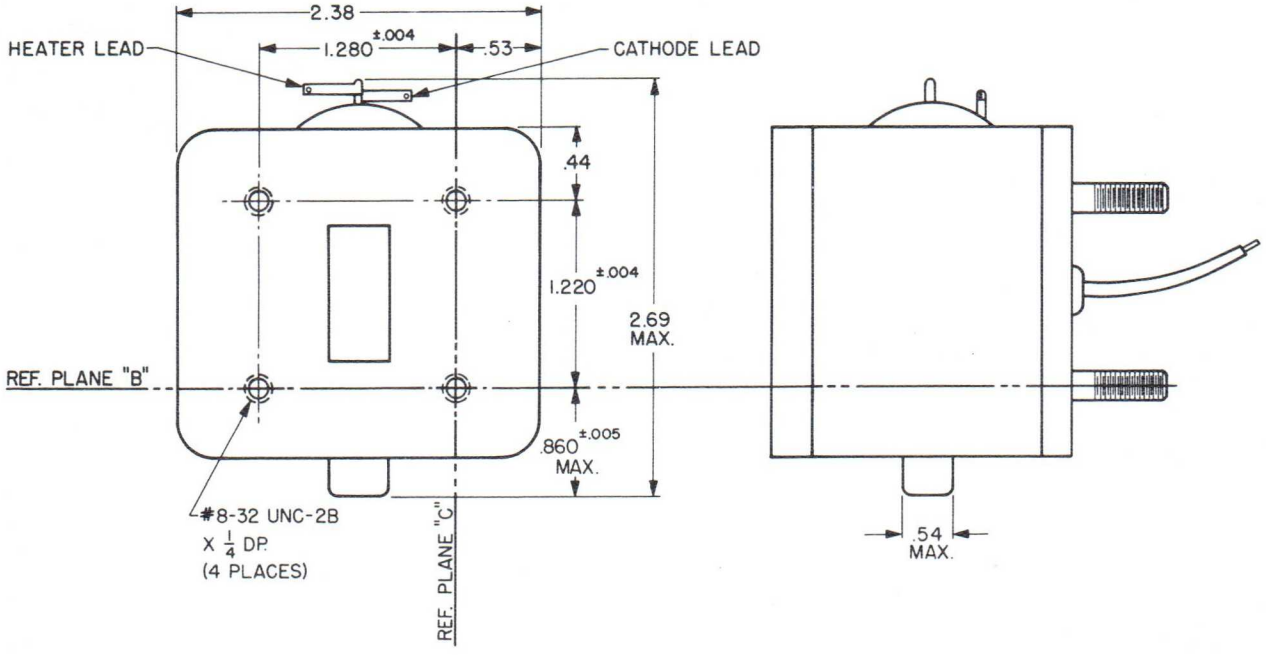




MA-249B

X-Band Tunable Magnetron

Bulletin 1542

Microwave Associates, Inc.
Burlington
Massachusetts
Tel. (617) 272-3000
Western Union Fax
TWX: 710-332-6789
Telex: 94-9464

MA-249B X-Band Tunable Magnetron

DESCRIPTION

The MA-249B is a positive anode, tunable magnetron which provides a minimum of 17 watts-CW power over the bandwidth of 9250 to 9450 MHz. This rugged, compact and lightweight power tube features grounded cathode, isolated-anode electrical design which eliminates leakage current, and increases operating efficiency.

APPLICATIONS

The MA-249B magnetron is particularly suited for CW applications where high efficiency and small size are important design criteria. It is particularly useful as a highly stable RF source when injection locked with a stable external oscillator. This power tube is designed for a wide variety of additional applications including airborne, missile, and ground based radar equipment, beacon navigation systems and ground support equipment.

SPECIFICATIONS

Electrical Characteristics

Frequency, tunable	9250 to 9450 MHz
Peak Power	17 w, min.
Pulling Factor	20 MHz (1.3:1 VSWR), max.
Pushing Factor (± 10% Ib)	4MHz, max.
Thermal Coefficient	0.2 MHz/°C, max.

Operating Conditions

Heater Voltage[1]	6.3 V
Heater Current	0.6A, max.
Anode Voltage	+960 to +1020 V
Anode Current	.050A
Anode-Cathode Capacitance	18 pF, nom.
Duty Cycle (ratio)	1.0

Mechanical Characteristics

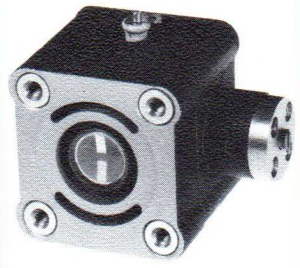
Size	Refer to outline drawing
Weight (nom.)	12 oz.
Mounting Position	Any
Output Connector	Mates with UG-39/U flange

Environmental Characteristics

Cooling	Conduction/Convection
Ambient Temperature	54°C to +71°C
Vibration (50 to 2000 cps)	10G
Shock (11 ±1 ms)	60G

1. Reduce heater voltage during operation to the value stamped on tube.

All specifications are subject to change without notice.



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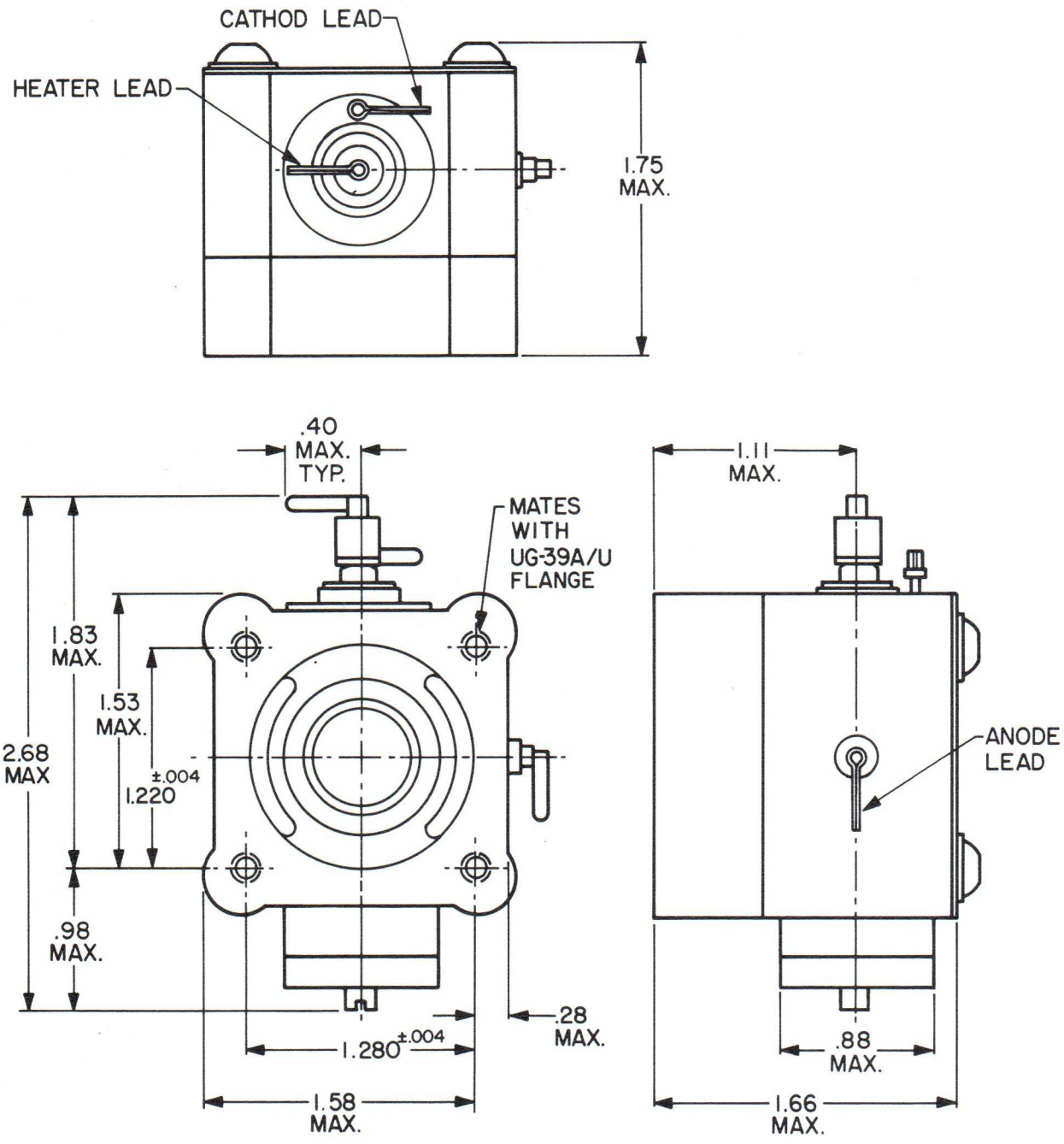


MA-277

Tunable Magnetron

Bulletin 1543

Microwave Associates, Inc.

Burlington
Massachusetts
Tel. (617) 272-3000
Western Union Fax
TWX: 710-332-6789

MA-277 Tunable Magnetron

DESCRIPTION

The MA-277 is a negative pulse, mechanically tunable magnetron that provides a minimum of 3.0 kw peak power over the bandwidth of 8900 to 9400 MHz. This very rugged, compact and lightweight power tube features excellent thermal frequency stability.

APPLICATIONS

The MA-277 magnetron is particularly suited for portable and marine applications. This power tube is designed for a wide variety of additional applications including airborne, missile, and ground based radar equipment, beacon navigation systems, ground support equipment and missile transponders.

SPECIFICATIONS

Electrical Characteristics

Frequency, Tunable	8900 to 9400 MHz
Peak Power	3.0 kw, min.
Pulling Factor	20 MHz (1.5:1 VSWR), max.
Missing Pulse Rate	0.25% max.
Side Lobes (ratio)	−8dB, min.
Thermal Coefficient	0.1 MHz/°C, max.

Operating Conditions

Heater Voltage	5.0 V
Heater Current	0.5 A, max.
Pulse Voltage	−5000 to −5400 V
Pulse Current	2.5 A
Preheat Time	30 sec., min.
Anode-Cathode Capacitance	10pF, max.
Duty Cycle (ratio)	.0005

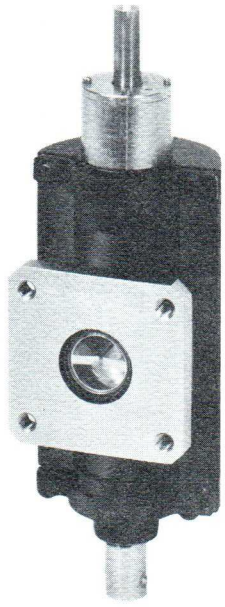
Mechanical Characteristics

Size	Refer to outline drawing
Weight	24 oz.
Mounting Position	Any
Output Connector	Mates with UG-39/U flange

Environmental Characteristics

Cooling	Conduction/Convection
Ambient Temperature	−54°C to +75°C
Vibration (50 to 1000 cps)	15 G
Shock (11 ± 1 ms)	60 G

All specifications are subject to change without notice.



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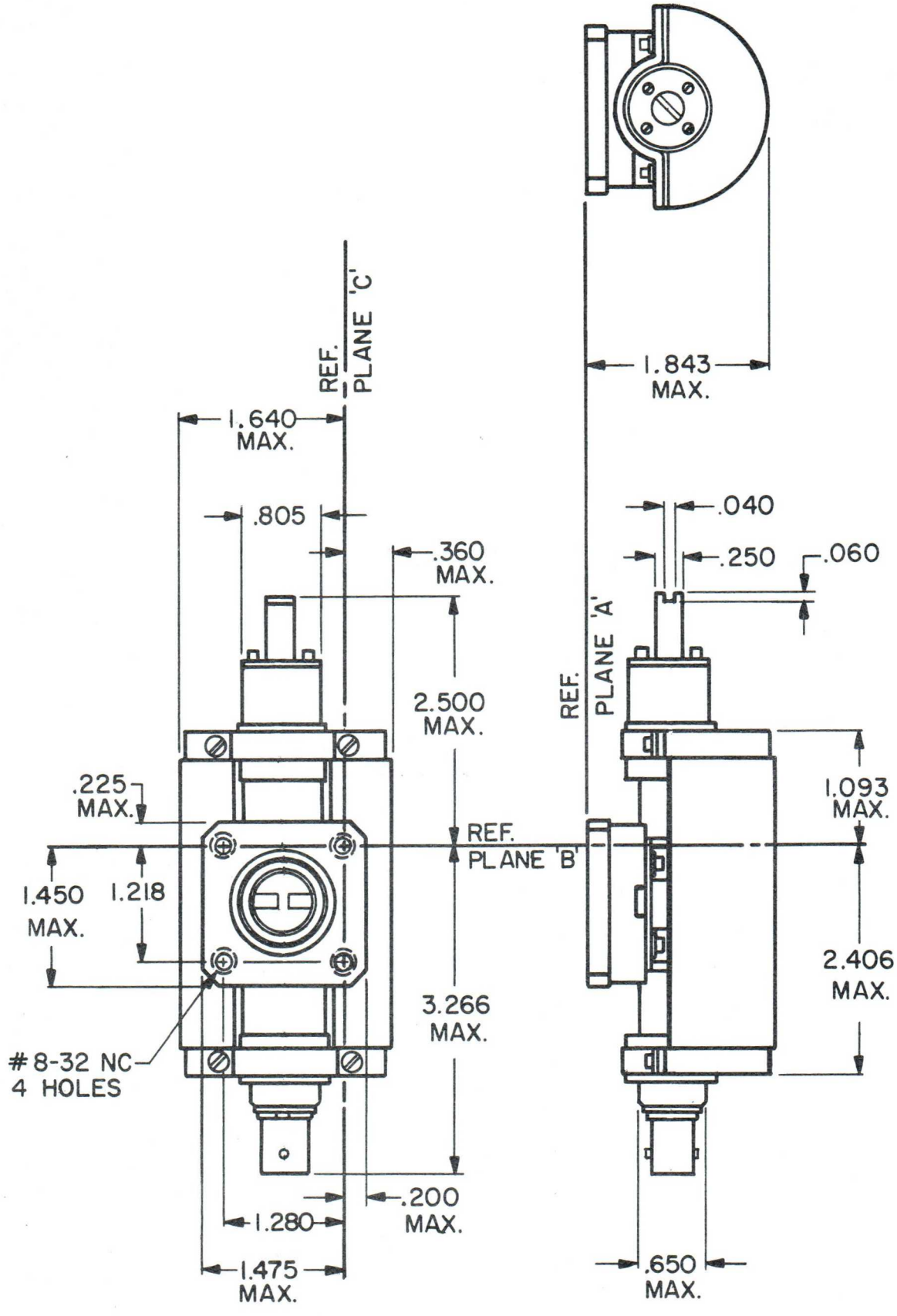

MA-278

X-Band Positive-Pulsed Magnetron

Bulletin 1546

Microwave Associates, Inc.
Burlington
Massachusetts
Tel. (617) 272-3000
Western Union Fax
TWX: 710-332-6789
Telex: 94-9464

MA-278 X-Band Positive-Pulsed Magnetron

DESCRIPTION

The MA-278, 1 kW peak power, X-band positive-pulsed magnetron features frequency-stability, high duty cycle performance in a very small and lightweight package.

APPLICATIONS

This miniature magnetron is ideally suited for transponder, beacon and manpack radar systems. It is equally suited for use in missiles, high performance aircraft, or ground support equipment.

SPECIFICATIONS

Electrical Characteristics

Frequency Range, Fixed	9600-9800 MHz
Peak Power	1 kW, Min.
Pulling Factor (1.5 VSWR)	20 MHz, Max.
Pushing Factor ($\pm$ 10% i_b)	3 MHz, Max.
Thermal Coefficient	.08 MHz/°C, Max.
Side Lobes (Ratio)	–8 dB, Min.

Operating Conditions

Heater Voltage	5.5 V
Heater Current	1.0 A, Max.
Preheat Time	30 sec.
Peak Anode Voltage	+2700 –2900 V
Peak Anode Current	1.3 A
Anode-Cathode Capacitance	18 pF, Nom.
Pulse Width	0.5 μs
Duty Cycle (Ratio)	.01, Max.

Mechanical Characteristics

Size	Refer to outline drawing
Weight	21 oz. Nom.
Mounting Position	Any
Output Connector	Mates with UG 39/U Flange
Input Connectors	
Anode	Wire lead
Cath. & Heater	Terminals

Environmental Characteristics

Altitude	50,000 ft.
Cooling	Conduction/Convection
Ambient Temp.	–54°C to +95°C
Vibration (55 to 2000 cps)	20 G
Shock (6 ms)	100 G
Life	500 hrs., Min.

All specifications are subject to change without notice.

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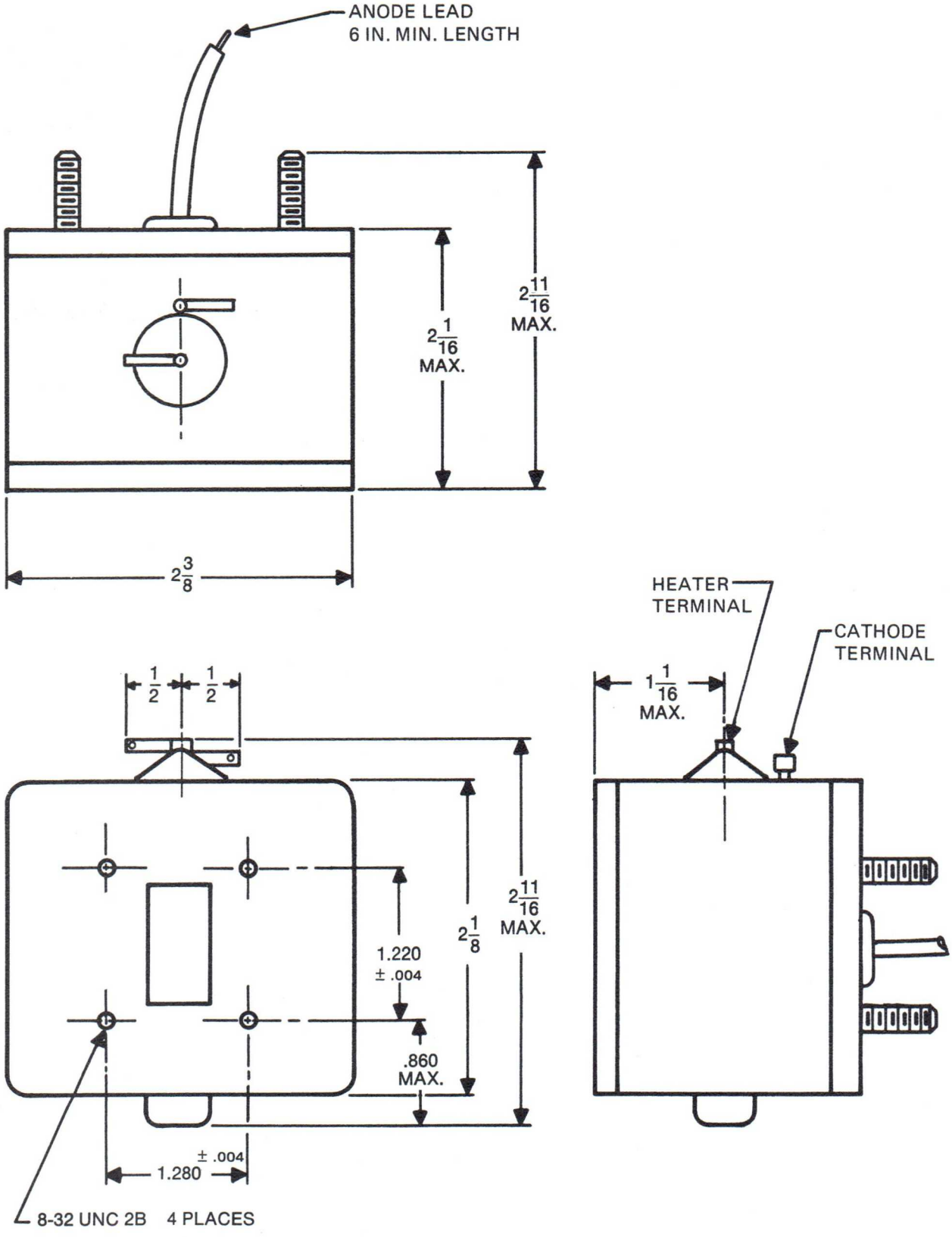
OUTLINE DRAWING



MA-271

Fixed Frequency X-Band Magnetron

Bulletin 1547

Microwave Associates, Inc.

Burlington
Massachusetts
Tel. (617) 272-3000
Western Union Fax
TWX: 710-332-6789
Telex: 94-9464

MA-271 Fixed Frequency X-Band Magnetron

DESCRIPTION

The MA-271 is a fixed frequency, positive pulsed, X-band magnetron. This compact, lightweight power tube provides 50 Watts peak power over the frequency range 9150 to 9450 MHz. The MA-271 also features excellent frequency stability in a rugged design package.

APPLICATIONS

The MA-271 is ideally suited for use in missile ground support equipment, missiles, high performance aircraft, transponder radar systems and test equipment.

SPECIFICATIONS

Electrical Characteristics

Frequency Range, Fixed	9150 to 9450 MHz
Power, Peak	50 W, Min.
Pulling Factor	15 MHz
Side Lobes (Ratio)	−8 dB, Min.
Thermal Coefficient	0.2 MHz/°C, Max.
Anode-Cathode Capacitance	25 pF, Max.

Operating Conditions

Heater Voltage	6.3 V
Heater Current	0.55A, Max.
Anode Voltage	650 to 750 V
Anode Current	0.4A, Peak

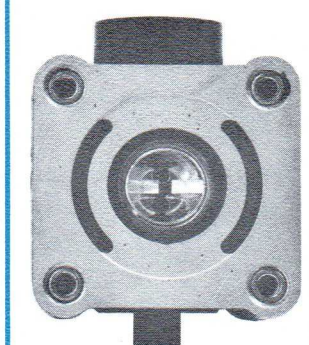
Mechanical Characteristics

Size	Refer to Outline Drawing
Weight (approx.)	12 oz.
Mounting Position	Any

Environmental Characteristics

Cooling	Conduction/Convection
Ambient Temperature	−55°C to +100°C
Vibration (55 to 2000 cps)	20 G
Shock (6 ms)	60 G

All specifications are subject to change without notice.



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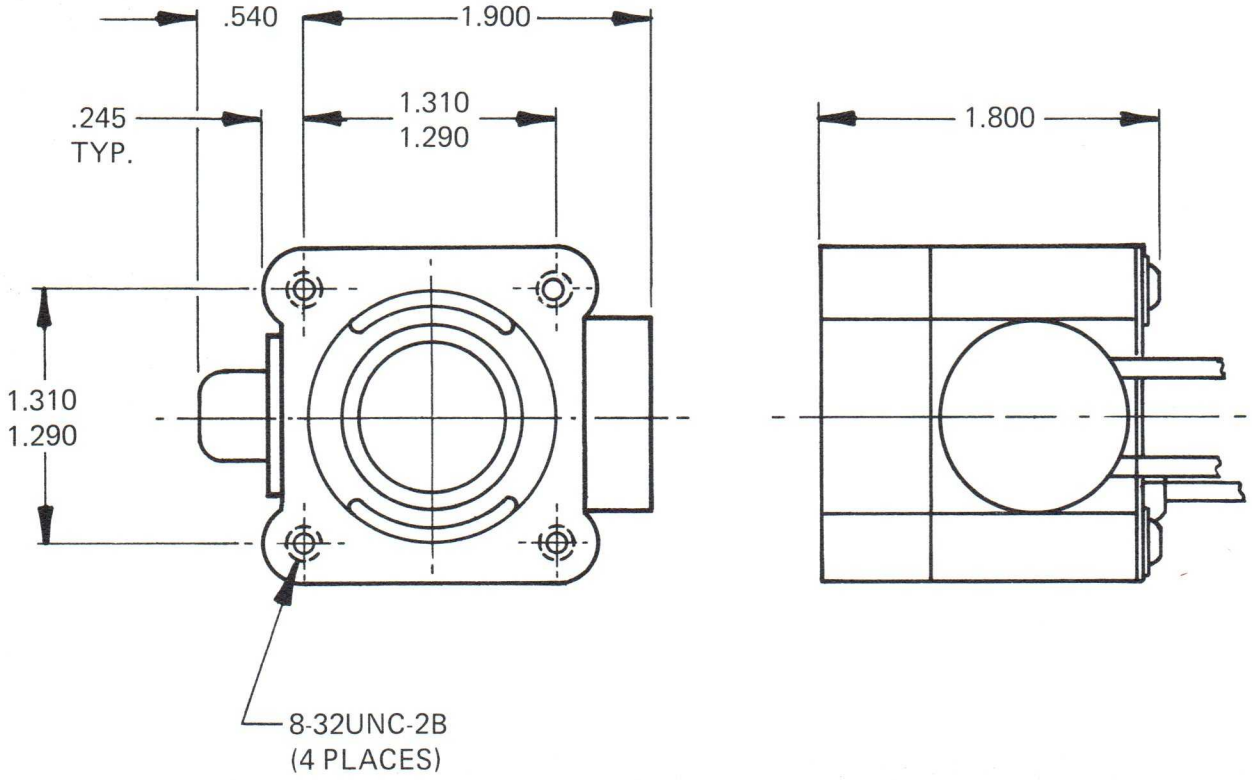
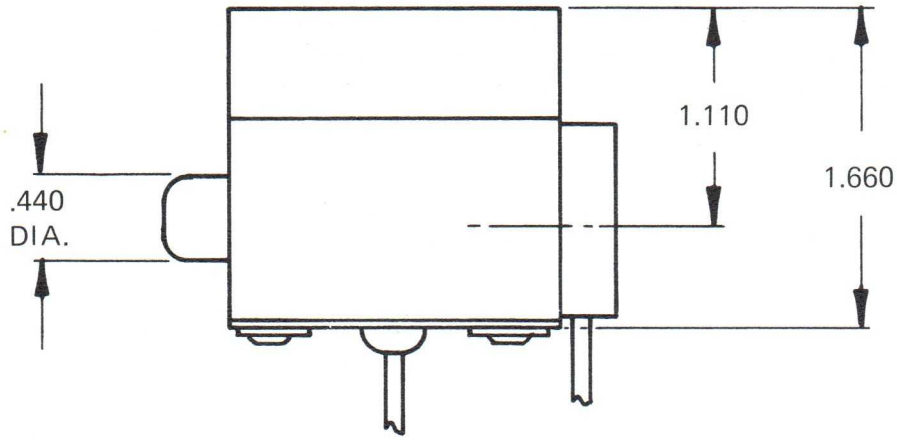
OUTLINE DRAWING





MA-217A and MA-217C

X-Band Tunable Magnetrons

Bulletin 1548

Microwave Associates, Inc.
Burlington
Massachusetts
Tel. (617) 272-3000
Western Union Fax
TWX: 710-332-6789
Telex: 94-9464

MA-217A and MA-217C
X-Band Tunable Magnetrons

DESCRIPTION

These rugged, positively-pulsed 10 and 20 peak watt beacon magnetrons provide mechanical tuning over the 7.5 to 8.5 GHz range. Pulse width capability from 50 ns to at least 50 μs combined with duty cycle capability of .005 make these tubes versatile power sources.

APPLICATIONS

The MA-217A and MA-217C offer excellent performance in beacon navigation systems, radar detection systems, missile ground support equipment, missile transponders, and airborne radar systems.

SPECIFICATIONS

Electrical Characteristics

Tunable Frequency	7.5 to 8.5 GHz
Peak Power Output	
MA-217A	10W, min.
MA-217C	20W, min.
Pulling Figure (1.5:1 VSWR)	20 MHz, max.
RF Bandwidth	2.0/tp, max.
Thermal Coefficient	0.20 MHz/°C, max.
Missing Pulse Rate	0.1% max.

Typical Operating Conditions

Pulse Repetition rage	50,000 pps
Pulse Width	0.1 μs
Duty Ratio	.005
Peak Anode Voltage*	
MA-217A	530 V
MA-217C	560 V
Peak Anode Current	
MA-217A	.15A
MA-217C	.30A
Filament Voltage*	6.3V
Filament Current	.55A
Warm-Up Time	10 sec.

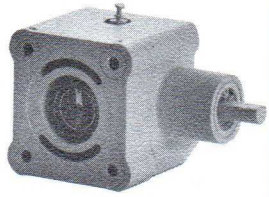
Environmental Characteristics

Life	300 Hrs., min.
Ambient Temperature	−55°C to +100°C
Altitude	50,000 ft.

Mechanical Characteristics

Size	Refer to Outline Drawing
Weight (Approx.)	12 oz.
Connector, Output	Mates with UG-39/U Flange
Connector, Input	Solder Terminals
Cooling	Conduction

*Filament and Pulse Voltages may be snapped on simultaneously.
All specifications subject to change without notice.



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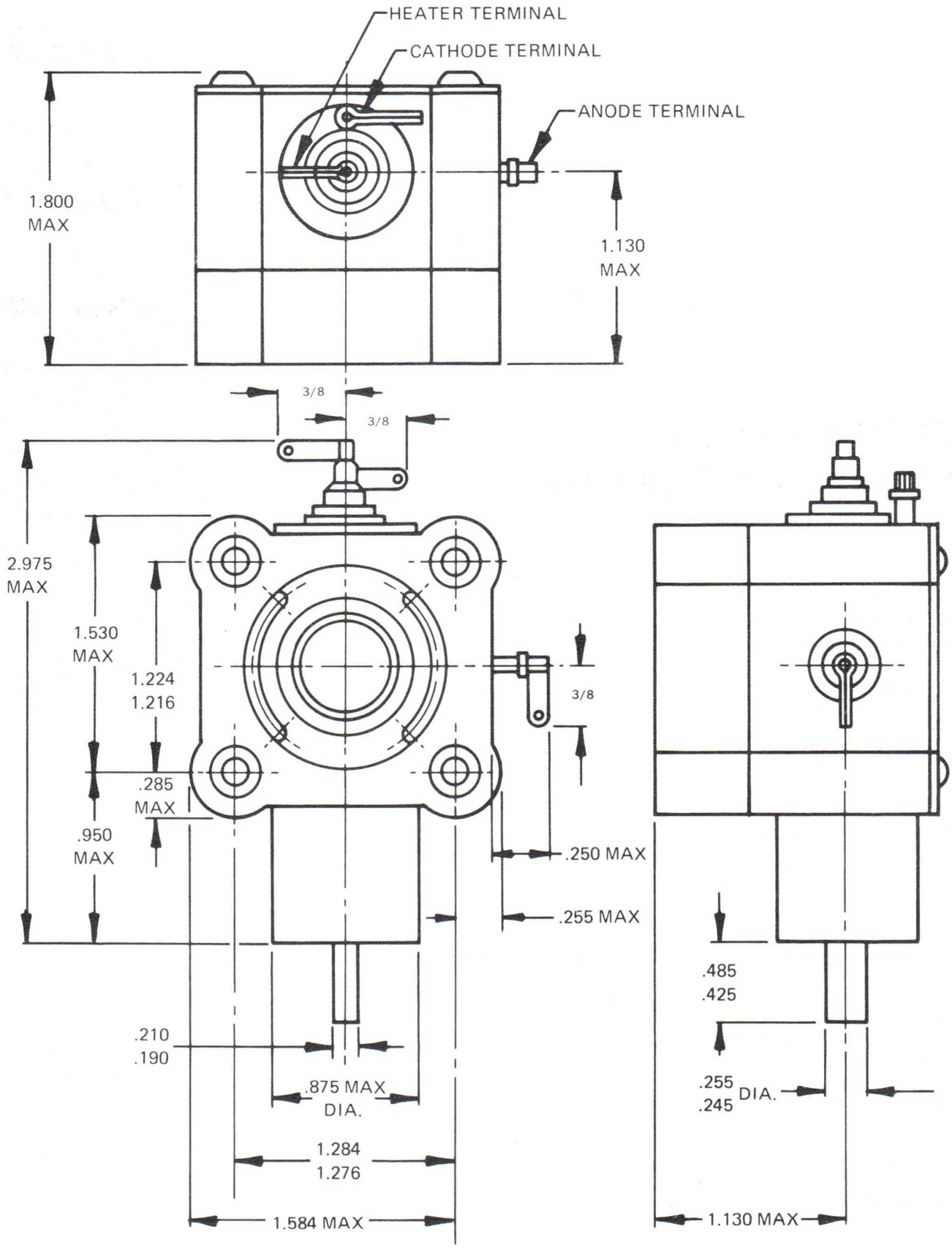
OUTLINE DRAWING



MA-219A and MA-219C

X-Band Tunable Magnetrons

Bulletin 1549

Microwave Associates, Inc.
Burlington
Massachusetts
Tel. (617) 272-3000
Western Union Fax
TWX: 710-332-6789

MA-219A and MA-219C X-Band Tunable Magnetrons

DESCRIPTION

These rugged, positively-pulsed 10 and 20 peak watt beacon magnetrons provide mechanical tuning over the 8.5 to 9.6 GHz range. Pulse width capability from 50 ns to at least 50 μs combined with duty cycle capability of .005 make these tubes versatile power sources.

APPLICATIONS

The MA-219A and MA-219C offer excellent performance in beacon navigation systems, radar detection systems, missile ground support equipment, missile transponders, and airborne radar.

SPECIFICATIONS

Electrical Characteristics

Tunable Frequency	8.5 to 9.6 GHz
Peak Power Output	
MA-219A	10W, min.
MA-219C	20W, min.
Pulling Figure (1.5:1 VSWR)	20 MHz, max.
RF Bandwidth	2.0/tp, max.
Thermal Coefficient	0.20 MHz/°C, max.
Missing Pulse Rate	0.1%, max.

Typical Operating Conditions

Pulse Repetition	50,000 pps
Pulse Width	0.1μs
Duty Ratio	0.005
Peak Anode Voltage*	
MA-219A	550 V
MA-219C	560 V
Peak Anode Current	
MA-219A	.15A
MA-219C	.30A
Filament Voltage*	6.3V
Filament Current	.55A
Warm-Up Time	10 sec.

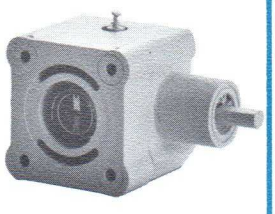
Environmental Characteristics

Life	300 Hrs., Min.
Ambient Temperature	−55°C to +100°C
Altitude	50,000 ft.

Mechanical Characteristics

Size	Refer to Outline Drawing
Weight (Approx.)	12 oz.
Connector, Output	Mates With UG-39/U Flange
Connector Input	Solder Terminals
Cooling	Conduction

*Filament and Pulse Voltages may be snapped on simultaneously.
All specifications subject to change without notice.



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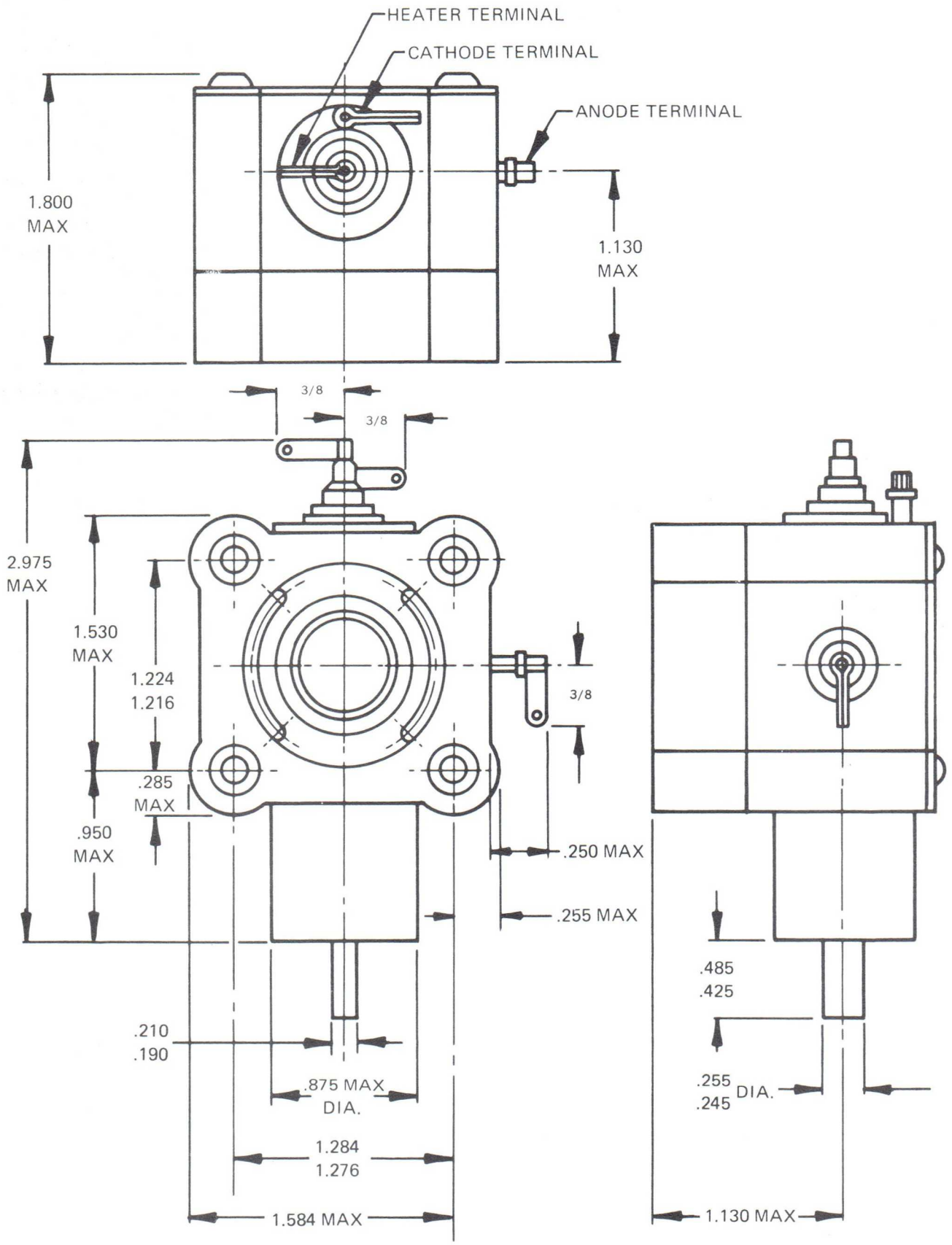


PRELIMINARY

MA-286

Ka-Band Positive Anode Magnetron

Bulletin 1545

Microwave Associates, Inc.
Burlington
Massachusetts
Tel. (617) 272-3000
Western Union Fax
TWX: 710-332-6789

MA-286 Ka-Band Positive Anode Magnetron

DESCRIPTION

The MA-286 is a positive pulse, tunable frequency magnetron which provides a minimum of 1 kW peak power. This rugged, compact and lightweight power tube features a grounded cathode, isolated-anode design.

APPLICATION

The MA-286 is particularly suited for use in beacon, navigation and radar detection systems. It is equally suited for use in missile ground support equipment, transponders and airborne radar systems.

SPECIFICATIONS

Electrical Characteristics

Frequency Range	+50 to −50 MHz
Peak Power	1.0 kW, min.
Pulling Factor	40 MHz (1.5:1 VSWR)
Missing Pulse Rate	0.1%, max.
Side Lobes (ratio)	−8dB, min.

Mechanical Characteristics

Size	Refer to outline drawing
Weight	16 oz., max.
Mounting Position	Any
Output Connector	Mates with UG-600/U Flange

Operating Conditions

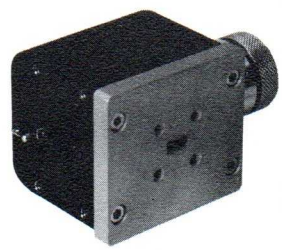
Heater Voltage	6.3V
Heater Current	0.9A
Pulse Voltage	3400 to 3600V
Pulse Current	1.75A
Preheat Time	20 sec., min.
Anode-Cathode Capacitance	18 pF, nom.
Duty Cycle (ratio)	.002 max.
Pulse Length	.03 to 1.2μs

Environmental Characteristics

Cooling	Conduction/Convection
Ambient Temperature	−55°C to + 100°C
Vibration	(50 to 2500 cps) 15 G, max.
Shock (11 ± 1 ms)	50 G

Note: 1. Range of tuning where f_o is center frequency to be chosen within the band 34.5 to 36.5 GHz.

All specifications are subject to change without notice.



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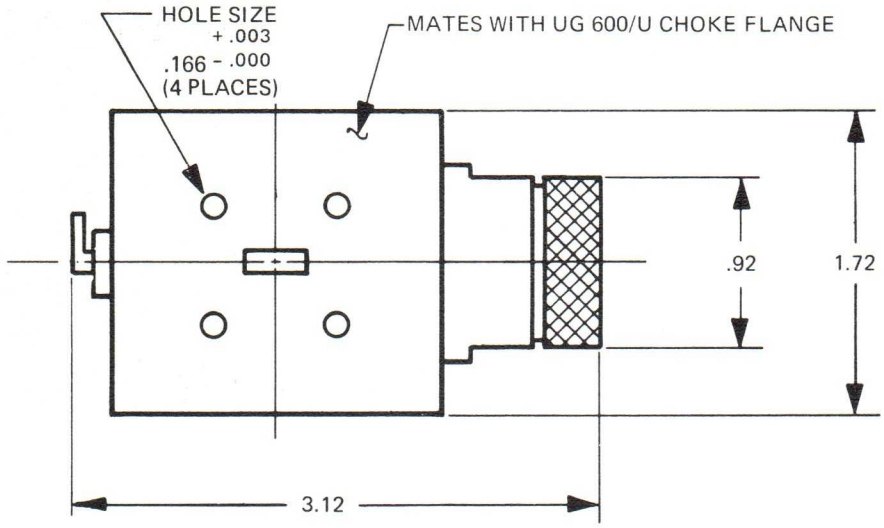
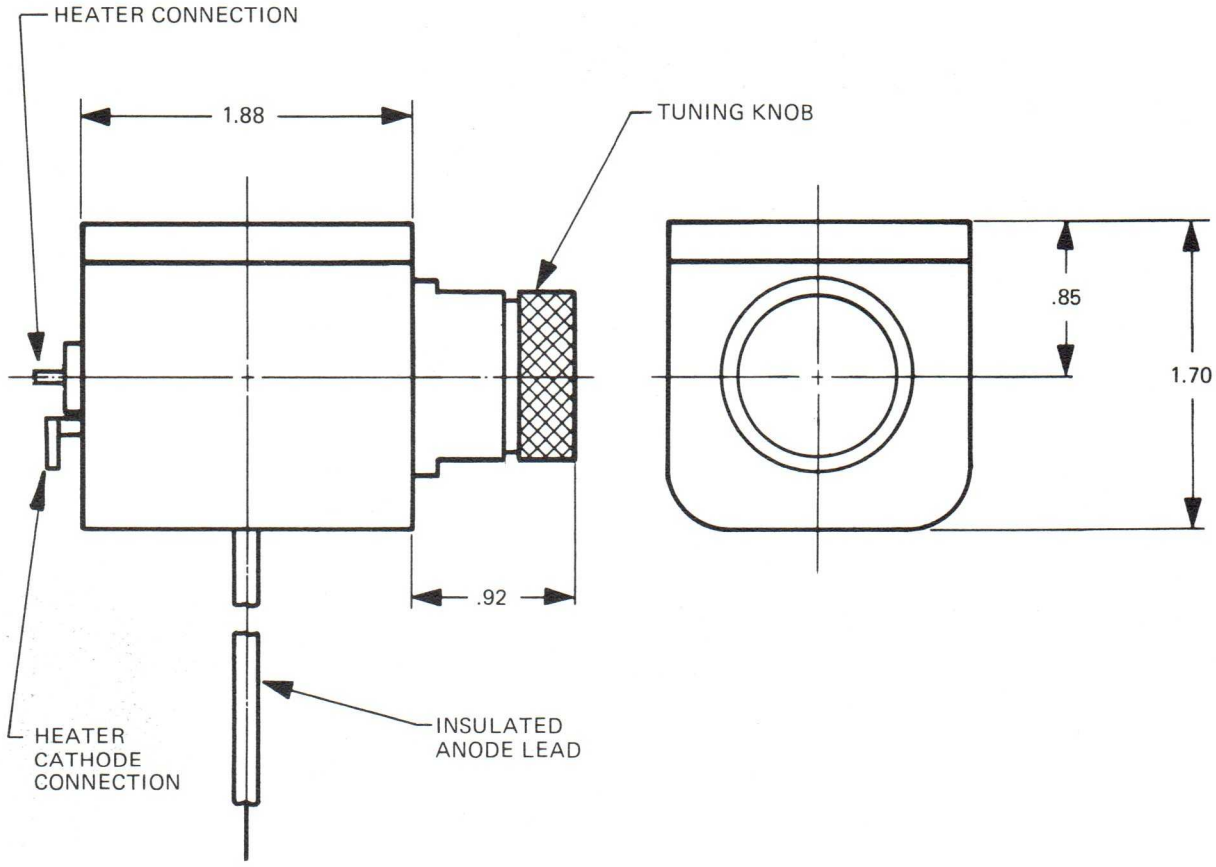
OUTLINE DRAWING

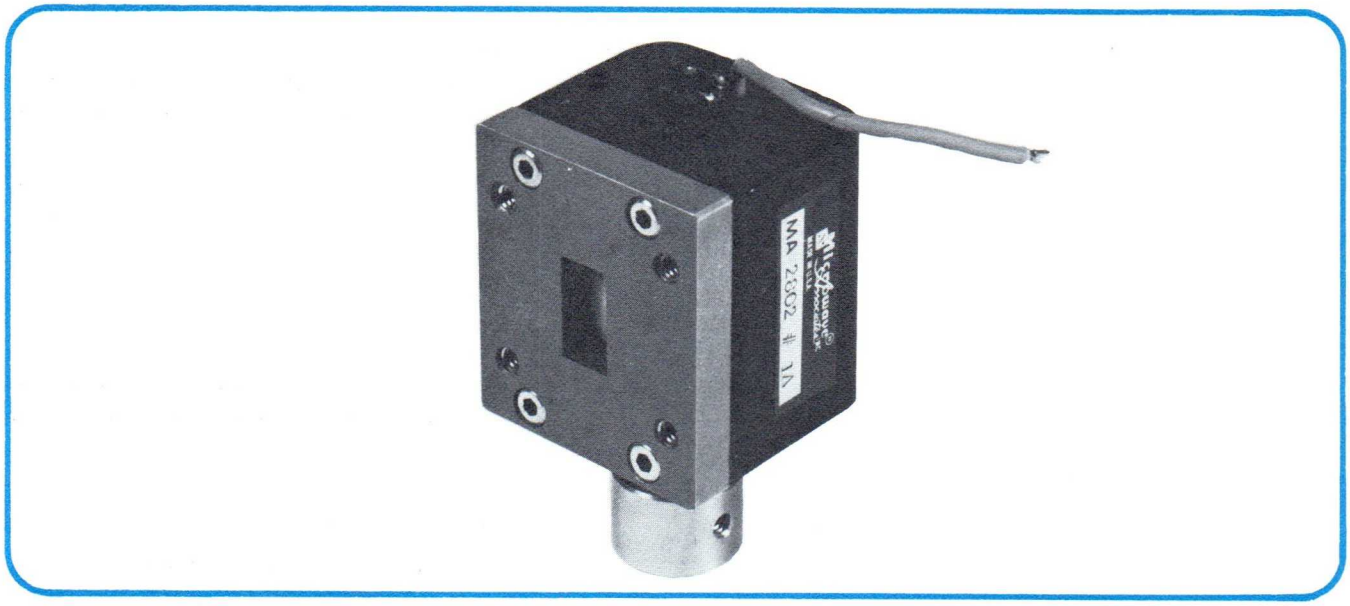




MA-2802

TUNABLE Ku-BAND MAGNETRON

Bulletin 1552



DESCRIPTION

The MA-2802 is an extremely small 500 watt, tunable Ku-band magnetron featuring the grounded cathode, pulsed anode design. The tube, a light weight, rugged unit of ceramic and metal construction, features fast warm-up and very low thermal coefficient. Operating temperature is from -55° to $+100^{\circ}$C.

APPLICATIONS

The MA-2802 is especially designed for missile, airborne or ground transponder systems, radar detection applications where compactness and frequency stability are prime considerations, or missile ground support equipment.

Microwave Associates, Inc. Burlington, Massachusetts Tel. (617) 272-3000
Western Union Fax
TWX: 710-332-6789
Telex: 94-9464

SPECIFICATIONS

Electrical Characteristics

Frequency Range, Tunable	16.1 to 16.5 GHz	Missing Pulse Rate	0.1%, Max.
Peak Power Output	500 W, Min.	Side Lobes (Ratio)	–8 dB, Min.
Thermal Coefficient	±50 kHz/°C, Max.	Preheat Time[1]	20 sec.
Pushing Factor	(±10% I_b) 3.5 GHz, Max.	Anode-Cathode Capacitance	19 pF, Nom.

Operating Conditions

Pulse Current	1.4 A	Duty Cycle (Ratio)	.002, Max.
Pulse Voltage	+2100 to +2400 V	Heater Voltage	5.0 V
Pulse Length	0.1 to 1.2 μs	Heater Current	.75 A, Nom.

Mechanical Characteristics

Size	Refer to Outline Drawing	Mounting Position	Any
Weight	13 oz., Max.	Output Connector	Mates with UG-541/U Flange

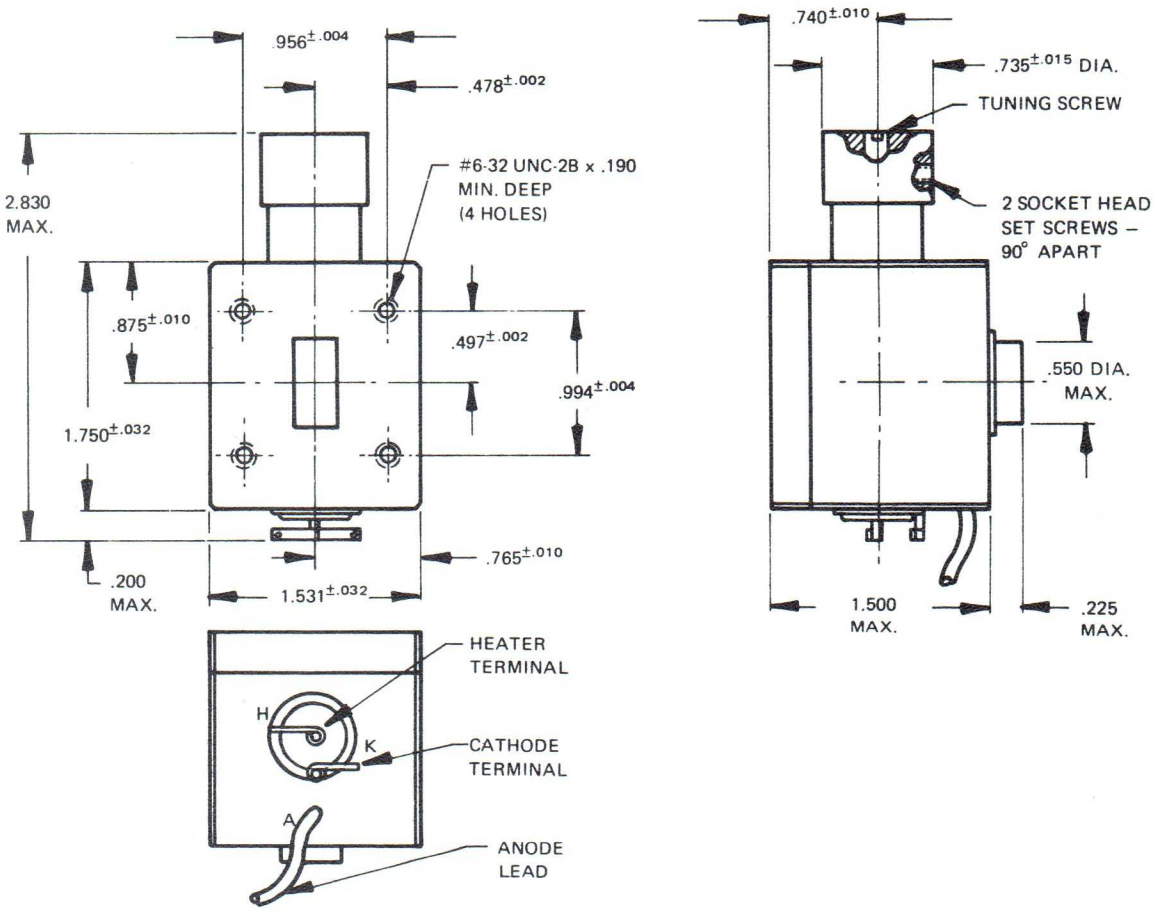
Environmental Characteristics

Cooling	Conduction/Convection	Vibration (50 to 2000 cps)	15 g
Ambient Temperature	–55° to +100°C	Shock (11 ±1 ms)	50 g
Altitude	15,000 Ft., Max.		

NOTE:

1. Pulse voltage and heater voltage may be applied simultaneously; check with manufacturer.

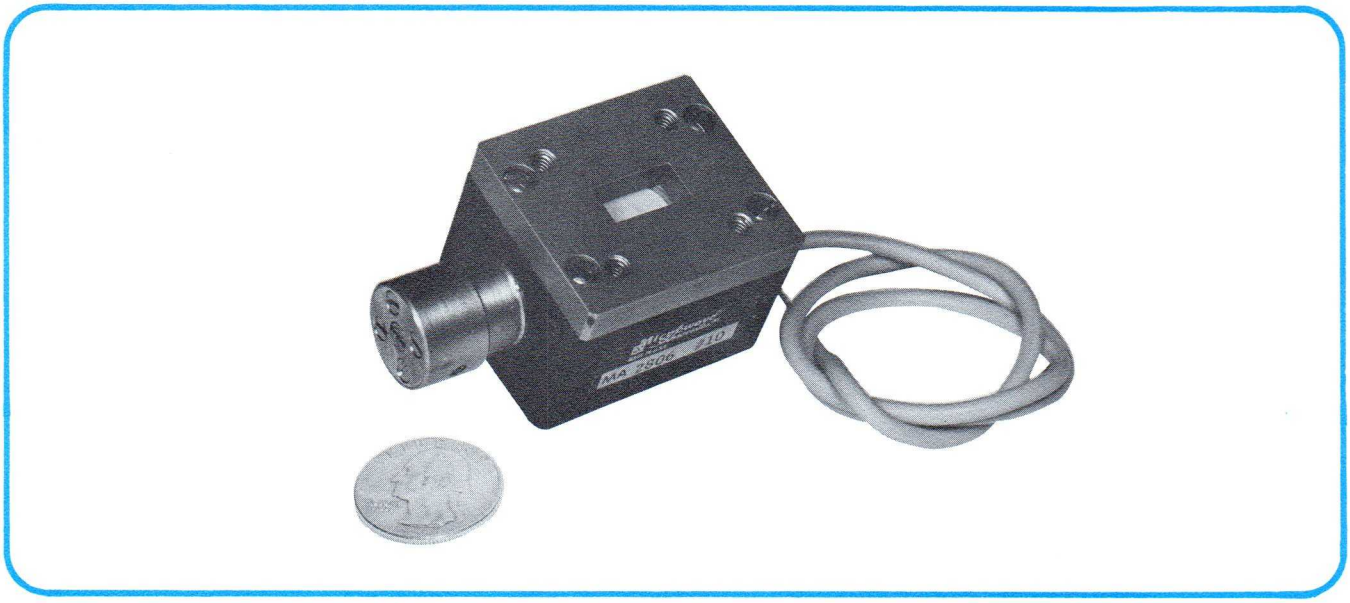
OUTLINE DRAWING



MA-2806

TUNABLE Ku-BAND MAGNETRON

Bulletin 1556



DESCRIPTION

The MA-2806 is a small, lightweight, tunable Ku-Band magnetron incorporating a high efficiency grounded cathode, pulsed anode design. The tube is a rugged, compact unit of ceramic and metal construction, which features fast cathode warm up.

APPLICATIONS

The MA-2806 is designed for missile, airborne or ground transponder systems, radar detection applications, and missile ground support equipment applications.

Microwave Associates, Inc. Burlington, Massachusetts Tel. (617) 272-3000
Western Union Fax
TWX: 710-332-6789
Telex: 94-9464

SPECIFICATIONS

Electrical Characteristics

Frequency Range, Tunable	16.1 to 16.5 GHz	Pushing Factor	(+10% I_b) 4.0 MHz max.
Peak Power Output	500 W, min.	Missing Pulse Rate	0.1%, max.
Pulling Factor	(1.5:1 VSWR) 25 MHz	Side Lobes (ratio)	-8 dB, min.
		Thermal Coefficient	140 kHz/°C, max.

Operating Conditions

Heater Voltage	5.0 V	Preheat Time*	15 sec., min.
Heater Current	.8 A	Anode-Cathode Capacitance	19 pF, nom.
Pulse Voltage	2100 to 2400 V	Duty Cycle (ratio)	.002, max.
Pulse Current	1.4 A	Pulse Length	0.1 to 1.2 μs

Mechanical Characteristics

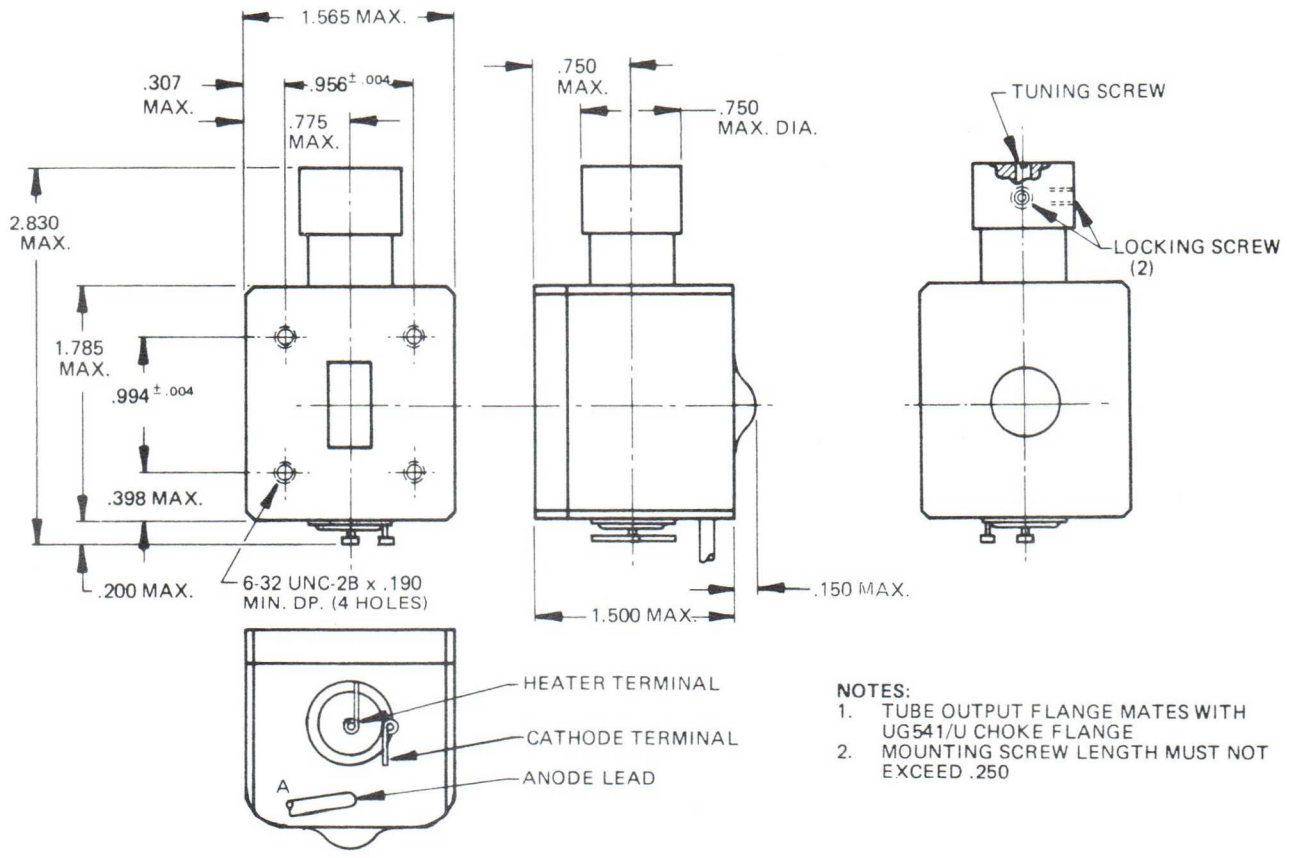
Size	Refer to outline drawing	Mounting Position	Any
Weight	13 oz., max.	Output Connector	Mates with UG-541/U Flange

Environmental Characteristics

Cooling	Conduction/Convection	Vibration (50 to 2000 cps)	15 G
Ambient Temperature	-55° to +100°C	Shock (11 ± 1 ms)	50 G
Altitude	15,000 ft., max.		

*Pulse voltage and heater voltage may be applied simultaneously, check with manufacturer.

OUTLINE DRAWING



NOTES:
1. TUBE OUTPUT FLANGE MATES WITH UG541/U CHOKE FLANGE
2. MOUNTING SCREW LENGTH MUST NOT EXCEED .250

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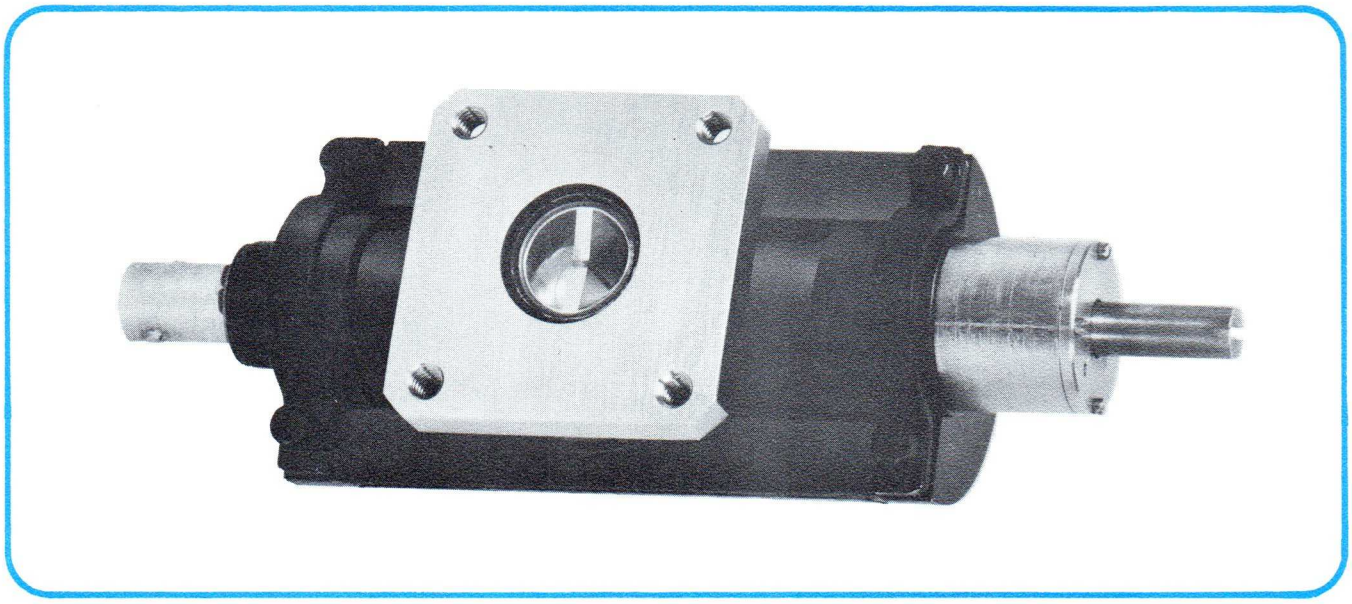
MA-6230
TUNABLE MAGNETRON

Bulletin 1557



DESCRIPTION

The MA-6230 is a negative pulse, mechanically tunable magnetron that provides a minimum of 900W peak power over the bandwidth of 8900 to 9400 MHz. This very rugged, compact and lightweight power tube features excellent thermal frequency stability.

APPLICATIONS

The MA-6230 magnetron is particularly suited for portable and marine applications. This power tube is designed for a wide variety of additional applications including airborne, missile and ground based radar equipment, beacon navigation systems, ground support equipment and missile transponders.

Microwave Associates, Inc. Burlington, Massachusetts Tel. (617) 272-3000
Western Union Fax
TWX: 710-332-6789
Telex: 94-9464

SPECIFICATIONS

Electrical Characteristics

Frequency, Tunable	8900 to 9400 MHz	Missing Pulse Rate	0.5% max.
Peak Power	900 W min.	Side Lobes (ratio)	-8 dB, min.
Pulling Factor	20 MHz (1.5:1 VSWR), max.	Thermal Coefficient	0.15 MHz/°C, max.

Operating Conditions

Heater Voltage	5.0 V	Preheat Time	25 sec., min.
Heater Current	0.5 A, max.	Anode-Cathode Capacitance	10 pF, max.
Pulse Voltage	-4000 to -4500 V	Duty Cycle (ratio)	.003
Pulse Current	2.5 A	Pulse Length (typical)	.2 to 1 μs

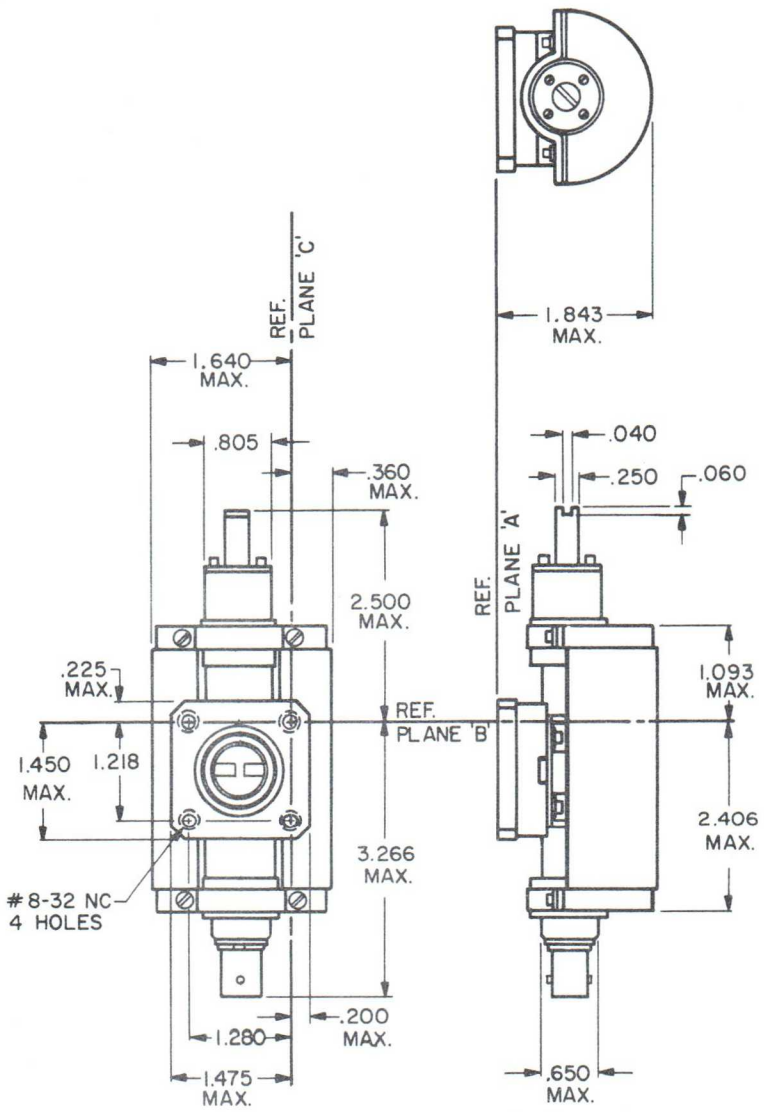
Mechanical Characteristics

Size	Refer to outline drawing	Mounting Position	Any
Weight	24 oz.	Output Connector	Mates with UG-39/U flange

Environmental Characteristics

Cooling	Conduction/Convection	Vibration (50 to 1000 cps)	15G
Ambient Temperature	-54°C to +75°C	Shock (11 ± 1 ms)	60G

OUTLINE DRAWING



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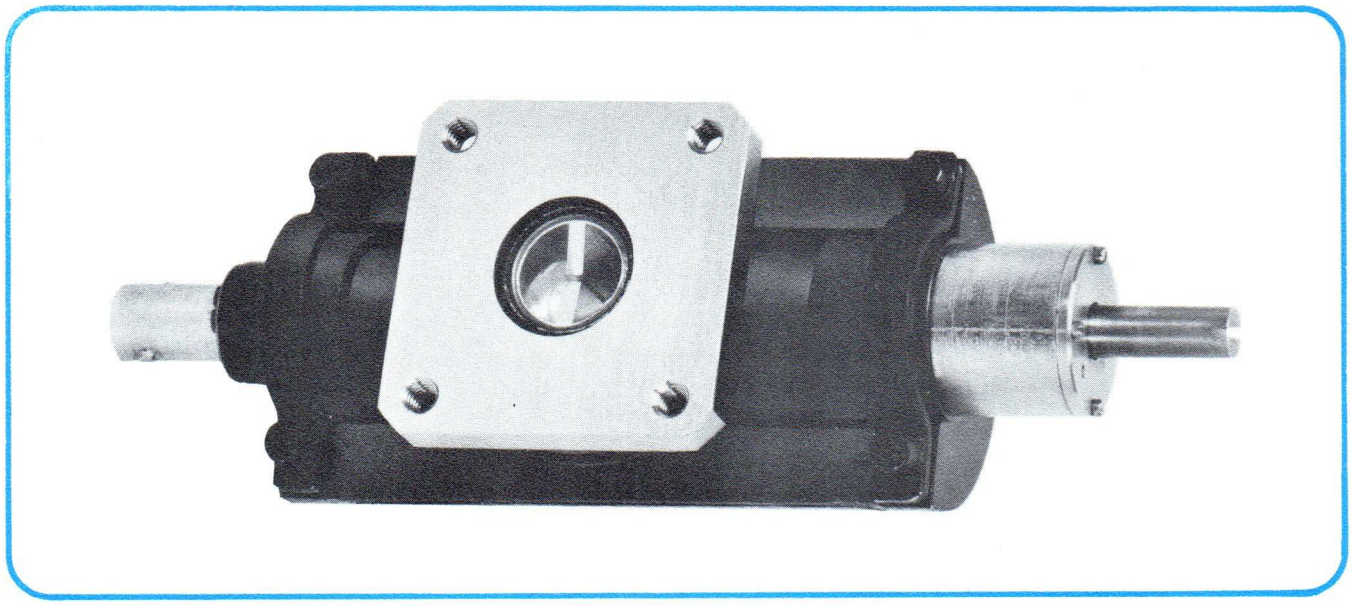
MA-2807
TUNABLE MAGNETRON

Bulletin 1558



DESCRIPTION

The MA-2807 is a negative pulse, mechanically tunable magnetron that provides a minimum of 1.2 kW peak power over the bandwidth of 9350 to 9450 MHz. This very rugged, compact and lightweight power tube features excellent thermal frequency stability.

APPLICATIONS

The MA-2807 magnetron is particularly suited for portable and marine applications. This power tube is designed for a wide variety of additional applications including airborne, missile and ground based radar equipment, beacon navigation systems, ground support equipment and missile transponders.

Microwave Associates, Inc. Burlington, Massachusetts Tel. (617) 272-3000
Western Union Fax
TWX: 710-332-6789
Telex: 94-9464

SPECIFICATIONS

Electrical Characteristics

Frequency, Tunable	9350 to 9450 MHz	Missing Pulse Rate	0.5% max.
Peak Power	1.2 kW, min.	Side Lobes (ratio)	-8 dB, min.
Pulling Factor	20 MHz (1.5:1 VSWR), max.	Thermal Coefficient	0.15 MHz/°C, max.

Operating Conditions

Heater Voltage	5.0 V	Preheat Time	25 sec., min.
Heater Current	0.5 A, max.	Anode-Cathode Capacitance	10 pF, max.
Pulse Voltage	-4000 to -4500 V	Duty Cycle (ratio)	.003
Pulse Current	3.6 A	Pulse Length (typical)	1.0 μs

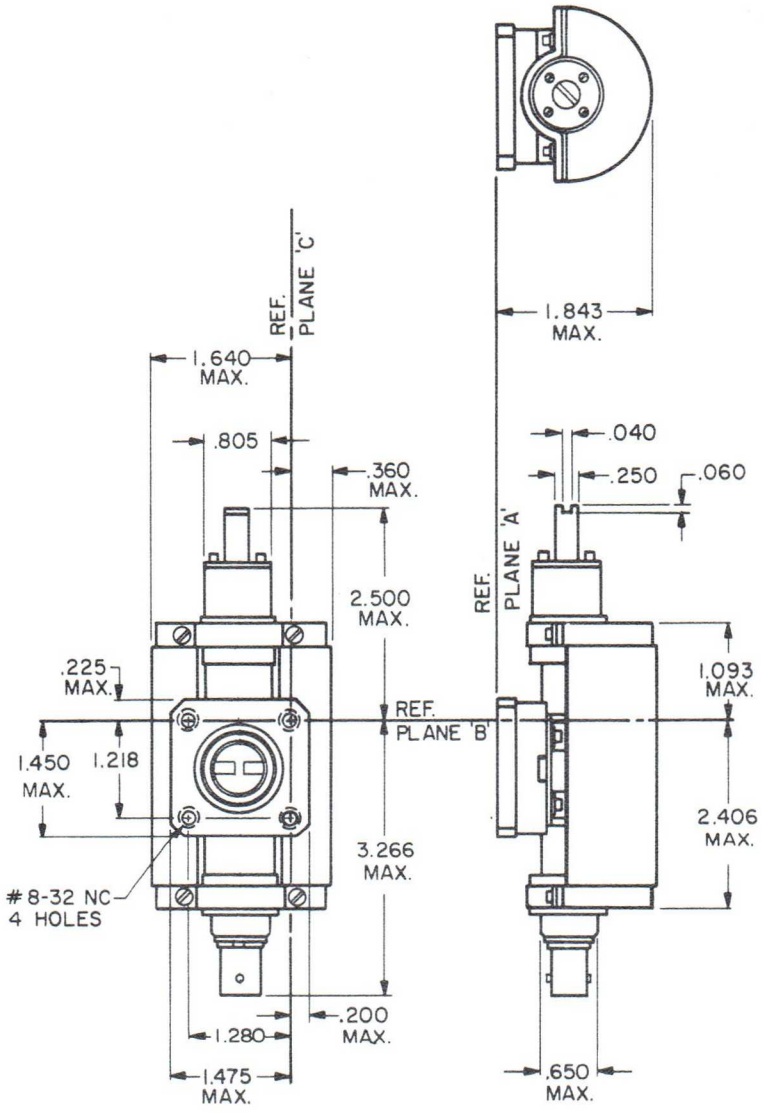
Mechanical Characteristics

Size	Refer to outline drawing	Output Connector	Mates with UG-39/U flange
Weight	24 oz.		

Environmental Characteristics

Cooling	Conduction/Convection	Vibration (50 to 1000 cps)	15G
Ambient Temperature	-54°C to +75°C	Shock (11 ± 1 ms)	60G

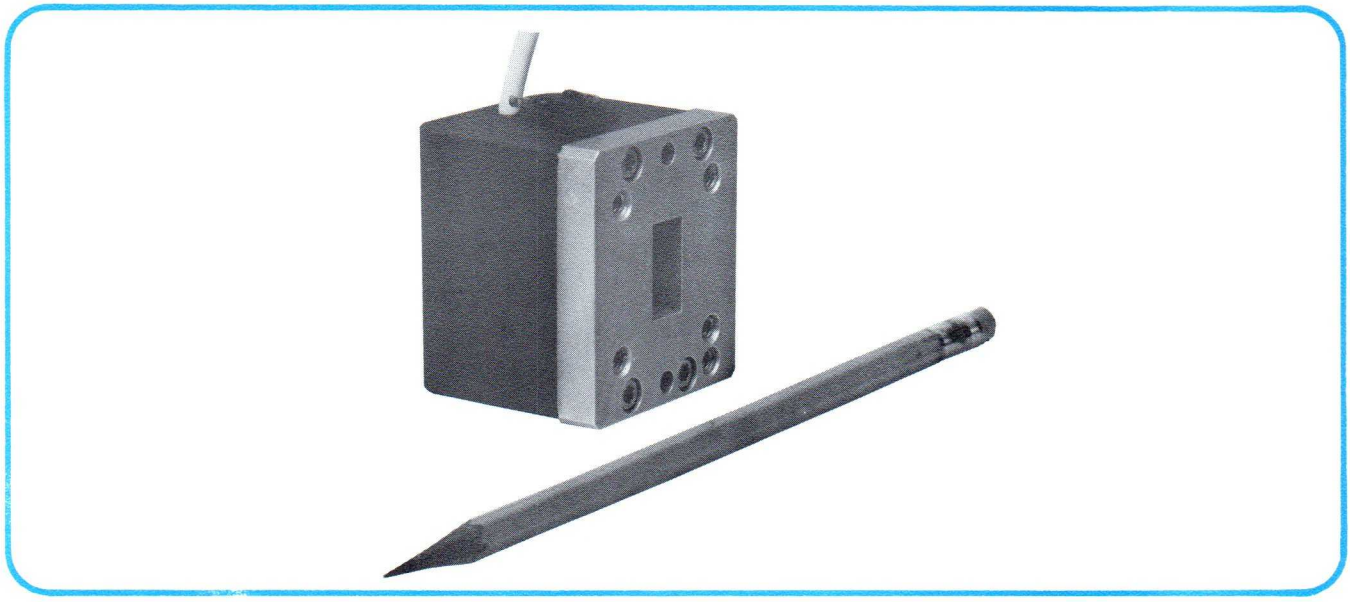
OUTLINE DRAWING



MA-287

1 kW Fixed Frequency Ku-Band Miniature 11 oz. Magnetron

Bulletin 1559



DESCRIPTION

The MA-287 is a compact, fixed frequency, Ku-Band magnetron incorporating a grounded cathode, pulsed anode design. These rugged, compact units are built to withstand severe environmental conditions of low and high temperatures, shock, vibration and acceleration. The tube is a sturdy, light weight device of ceramic and metal construction. It is rated for 1000 watts minimum peak power output, at duty cycles of up to 0.2%.

APPLICATIONS

The MA-287 is especially designed for beacon and navigation systems, radar detection applications, missile ground support equipment, transponders and airborne radar systems. With its exceptionally small size, 11 oz. weight and direct coupling to waveguide, it can provide major amounts of Ku-Band power while minimizing space and weight usage.

Microwave Associates, Inc. Burlington, Massachusetts Tel. (617) 272-3000

Western Union Fax
TWX: 710-332-6789
Telex: 94-9464

SPECIFICATIONS

Electrical Characteristics

Frequency Range, Fixed	16.23 to 16.32 GHz*	Missing Pulse Rate	0.1%, max.
Peak Power Out	1000 W, min.	Side Lobes (ratio)	-8 dB, min.
Pulling Factor	25 MHz (1.5:1 VSWR)	Thermal Coefficient	130 kHz/°C, max.
Pushing Factor	3.5 MHz (±10% I_b), max.		

*Other center frequency values may be provided in the 15.5 to 17.0 GHz region.

Mechanical Characteristics

Size	Refer to outline drawing	Mounting Position	Any
Weight	11½ oz., max.	Output Connector	Mates with UG-541/U Flange

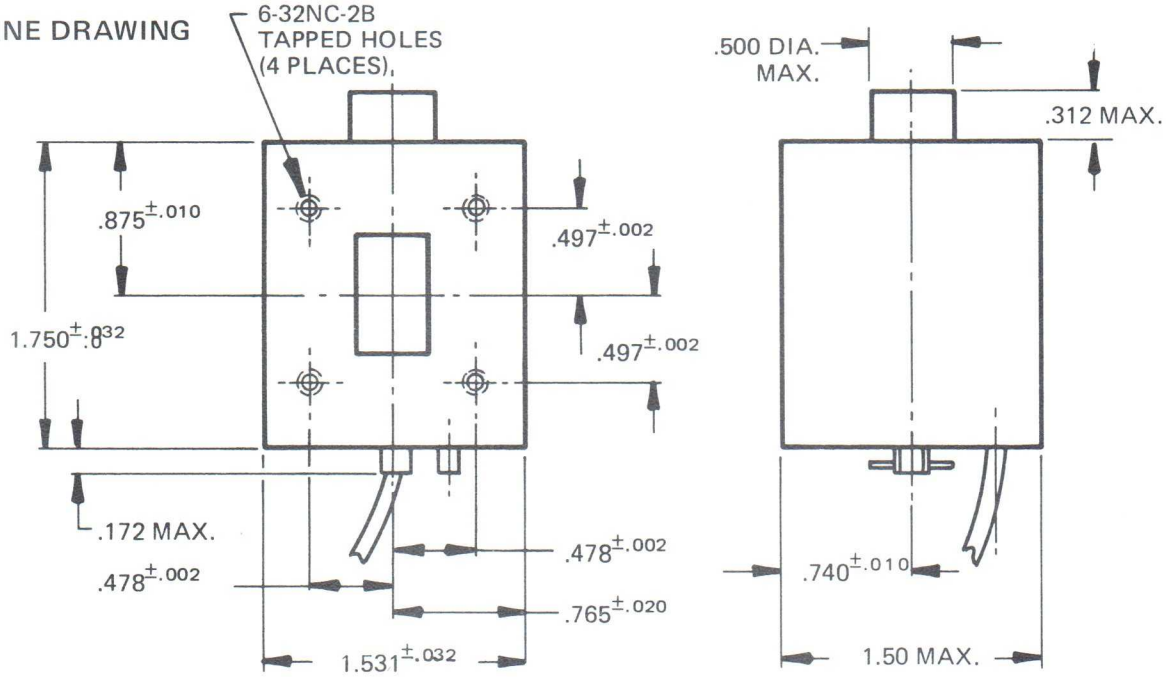
Operating Conditions

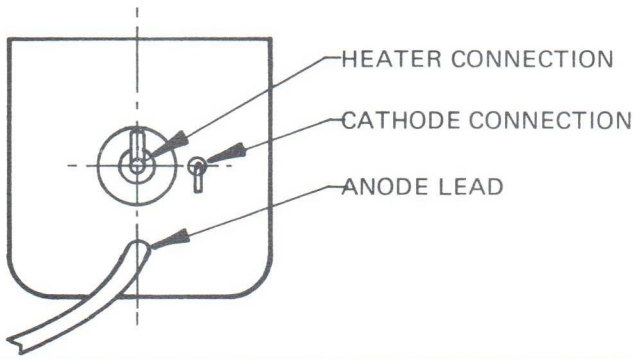
Heater Voltage	5.0V	Preheat Time	15 sec., min.
Heater Current	.8 A	Anode-Cathode Capacitance	19 pF, nom.
Pulse Voltage	2100 to 2400V	Duty Cycle (ratio)	.002, max.
Pulse Current	2A	Pulse Length	0.1 to 1.2 μs

Environmental Characteristics

Cooling	Conduction/Convection	Vibration (50 to 2500 cps)	15 G, max.
Ambient Temperature	-55°C to +100°C	Shock (11 ± 1 ms)	50 G, max.
Altitude	15,000 ft., max.		

OUTLINE DRAWING





MA-285 SERIES

FIXED FREQUENCY X-BAND MAGNETRONS

(MA–285, MA–285A, MA–293A, MA–294A)

Bulletin 1560

DESCRIPTION

The MA-285 series of fixed frequency, positive pulsed, X-band magnetrons includes tubes at several frequencies. These compact, light weight tubes provide 85 watts peak power. They feature rugged ceramic and metal construction, and maintain excellent frequency stability in a wide range of environments. Other tubes, similar to the ones listed in this bulletin, can be provided at any specified frequency in X-band.

APPLICATIONS

The MA-285 series of magnetrons is ideally suited for use in ground support equipment, missiles, high performance aircraft, transponder radar systems and test equipment.

Microwave Associates, Inc. Burlington, Massachusetts Tel. (617) 272-3000
Western Union Fax
TWX: 710-332-6789
Telex: 94-9464

SPECIFICATIONS

Mechanical Characteristics

Size	Refer to Outline Drawing
Weight (approx.)	14 oz., See Note 1.
Mounting Position	Any
Output Connector	Type N, see Note 1.

Electrical Characteristics

Power, Peak	85 W, Min.
Pulling Factor	15 MHz
Thermal Coefficient	0.2 MHz/^{o}C, Max.
Anode-Cathode Capacitance	25 pF, Max.

Operating Conditions

Heater Voltage	6.3 V
Heater Current	0.55A, Max.
Anode Voltage	700 to 750 V
Anode Current	0.4A, Peak
Duty Cycle (typ.)	.001
Pulse Width (typ.)	50 ns to 2 μs

Environmental Characteristics

Cooling	Conduction/Convection
Ambient Temperature	-55^{o}C to +100^{o}C
Vibration (55 to 2000 cps)	20 G
Shock (11 ms)	60 G

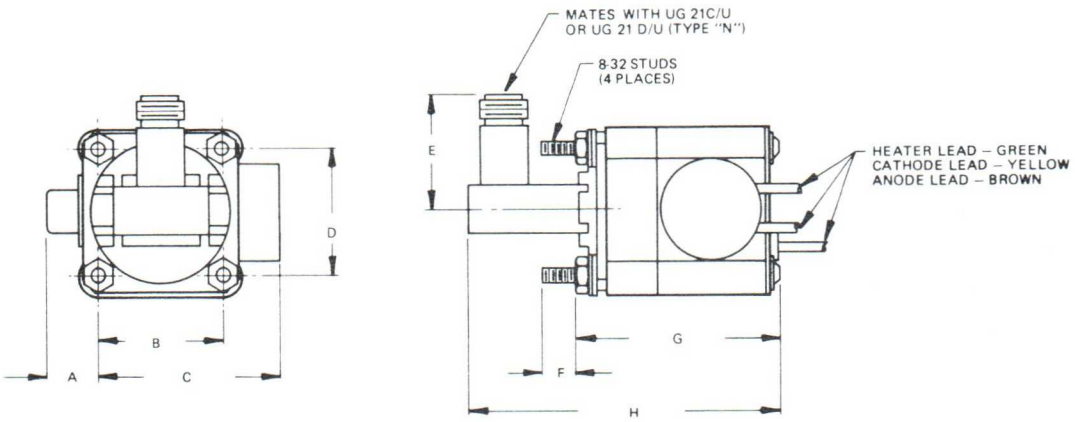
FREQUENCY TABLE

Model Number	Frequency (fixed)
MA-285	9.30 ± 0.15 GHz
MA-285A	9.37 ± 0.15 GHz
MA-293A	8.30 ± 0.30 GHz
MA-294A	9.08 ± 0.05 GHz

NOTE:

1. These tubes are constructed with an integral transition providing them output through a female Type N connector. Tubes with similar performance specifications can be provided with output directly to WR-90 waveguide; these tubes have a maximum weight of 12 oz. (See Bulletin 1547).

OUTLINE DRAWING

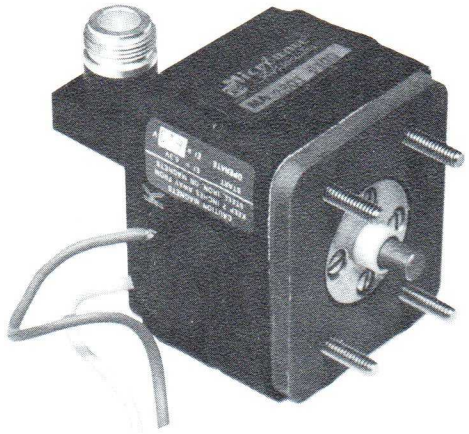


DIM.	DIMENSIONS					
	INCHES			MM		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A			.540			13,7
B	1.290	1.300	1.310	32,8	33	33,3
C			1.900			48,3
D	1.290	1.300	1.310	32,8	33	33,3
E	1.19	1.21	1.23	30,2	30,7	31,3
F	.343	.375	.407	8,7	9,5	10,3
G			2.10			53,3
H			3.250			82,6

MA-2801 SERIES

FIXED FREQUENCY
Ku-BAND MAGNETRONS
(MA-2801, MA-2810, MA-2811)

Bulletin 1561



DESCRIPTION

The MA-2801 series of compact, fixed frequency, positive pulsed magnetrons provides 50 watt peak power output at several Ku-band frequencies. These light weight tubes are of isolated anode, grounded cathode design. They feature rugged ceramic and metal construction and maintain excellent frequency stability in a wide range of environments. Other tubes, similar to the ones listed in this bulletin, can be provided at any specified frequency in Ku-band.

APPLICATIONS

The MA-2801 series of magnetrons is ideally suited for use in missile ground support equipment, high performance aircraft, transponder radar systems and test equipment.

Microwave Associates, Inc. Burlington, Massachusetts Tel. (617) 272-3000
Western Union Fax
TWX: 710-332-6789
Telex: 94-9464

SPECIFICATIONS

Mechanical Characteristics

Size	Refer to Outline Drawing
Weight (approx.)	24 oz., See Note 1.
Mounting Position	Any
Output Connector	Type N, see Note 1.

Electrical Characteristics

Power, Peak	50 W, Min.
Pulling Factor	22 MHz
Thermal Coefficient	0.12 MHz/^{o}C, Max.
Anode-Cathode Capacitance	25 pF, Max.

Operating Conditions

Heater Voltage	6.3 V
Heater Current	1A, Max.
Anode Voltage	700 to 750 V
Anode Current	0.4A, Peak
Duty Cycle (typ.)	.001
Pulse Width (typ.)	50 ns to 2 μs

Environmental Characteristics

Cooling	Conduction/Convection
Ambient Temperature	-55^{o}C to +100^{o}C
Vibration (55 to 2000 cps)	20 G
Shock (11 ms)	60 G

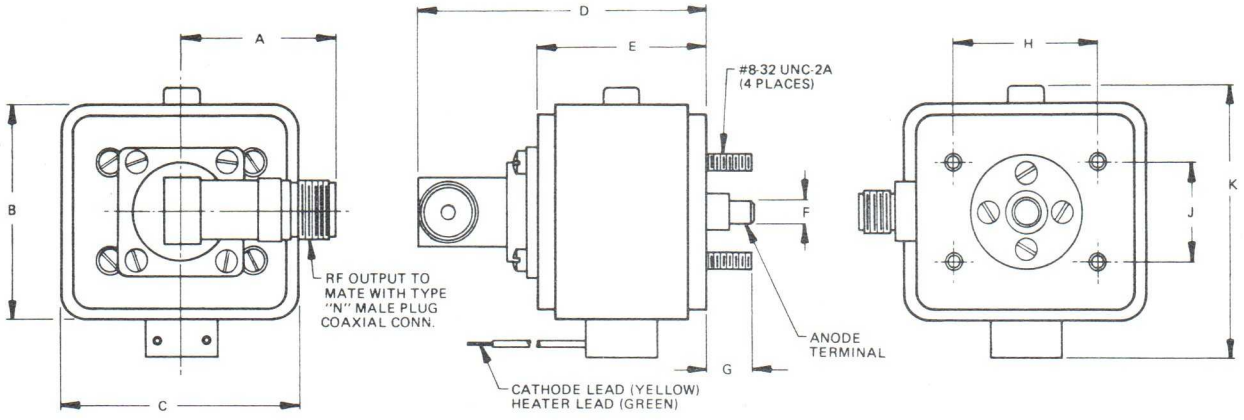
FREQUENCY TABLE

Model Number	Frequency (fixed)
MA-2801	15.50 ± 0.50 GHz
MA-2810	13.00 ± 0.50 GHz
MA-2811	15.00 ± 0.50 GHz

NOTE:

1. These tubes are constructed with an integral transition providing their output through a female Type N connector. Tubes with similar performance specifications can be provided with output directly to WR-62 waveguide; these tubes have a maximum weight of 16 oz.

OUTLINE DRAWING



DIM.	DIMENSIONS					
	INCHES			MM		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	.905	.965	1.025	23	24,5	26
B			2.275			57,8
C			2.500			63,5
D			3.300			83,8
E			1.812			46
F	.248	.250	.252	6,3	6,4	6,4
G	.450	.500	.550	11,4	12,7	14
H	1.485	1.500	1.515	37,2	38,1	38,5
J	.985	1.000	1.015	25	25,4	25,8
K			3.025			76,8

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MA-2009
Traveling Wave Tube

Bulletin 1814B

Microwave Associates, Inc.
Burlington
Massachusetts
Tel. (617) 272-3000
Western Union Fax
TWX: 710-332-6789
Telex: 94-9464

MA-2009 Traveling Wave Tube

DESCRIPTION

The MA-2009 CW traveling wave tube is a high performance power amplifier featuring metal to ceramic construction, solenoid focusing, 200W power output and minimum saturated gain of 20dB.

APPLICATIONS

The MA-2009 traveling wave tube is ideally suited for applications in ECM systems either in the broadband noise mode or selected frequency operation. This device may also be effectively employed as an RF power source, driver or intermediate amplifier.

SPECIFICATIONS

Electrical Characteristics

Frequency Range	400 to 1000 MHz
Duty Cycle	100%
Output Power, Saturated	200 W, Min.
Gain, Saturated	24 dB, Typ.

Power Supply Requirements

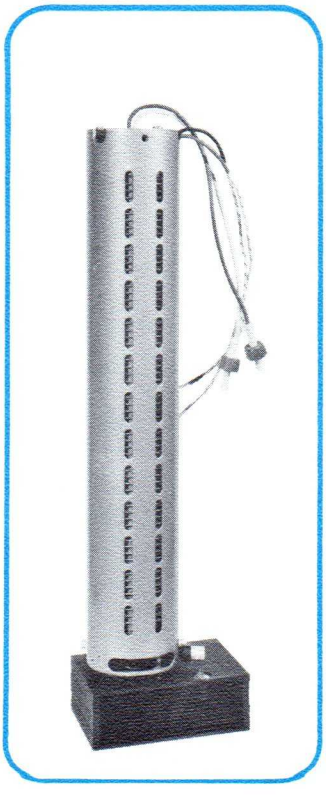
Element	Voltage	Current
Heater	12.6 V	2.8 A
Helix	2100 Vdc	5 mAdc
Cathode		650 mAdc
Solenoid	28 Vdc	9 Adc

Environmental Characteristics

Applicable Military Specification	MIL-E-5400, Class I
Altitude	55,000 ft.
Vibration (at 500 cps)	10 G
Shock (at 11 ms)	15 G

Mechanical Characteristics

Size	Refer to Outline Drawing
Focusing	Solenoid
Weight	31 lb.
Flow Rate at 20°C	
Solenoid at sea level	100 cfm
at 55,000 ft.	200 cfm
Collector at sea level	150 cfm
at 55,000 ft.	300 cfm
Body at sea level	60 cfm
at 55,000 ft.	120 cfm
RF Connectors	
Input	Type BNC
Output	Type C
Mounting Position	Any



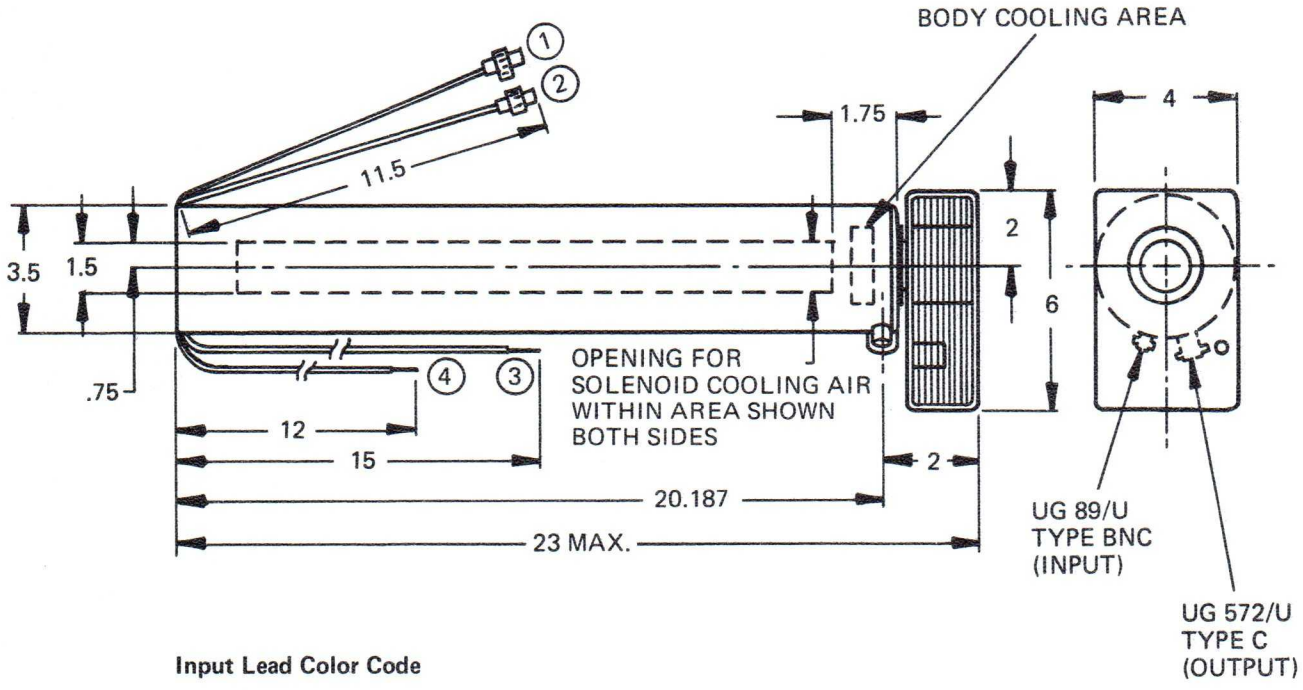
NOTES:

1. All tube electrode voltages are with respect to the cathode helix and collector at chassis ground.
2. The helix and/or solenoid voltages may be altered to maximize RF performance for a given bandwidth within the specified frequency range.

All specifications are subject to change without notice.

9/70 Printed in U.S.A.

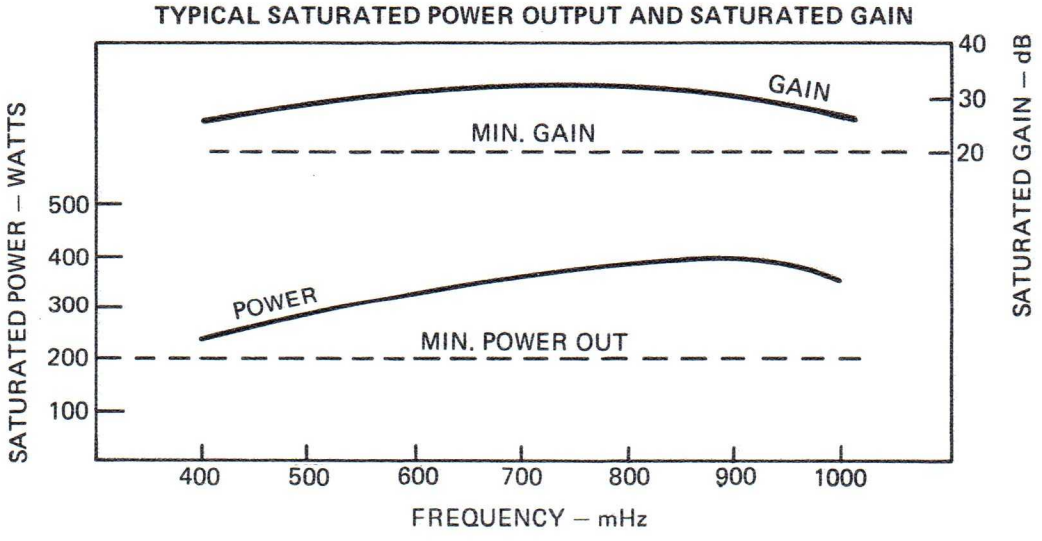
OUTLINE DRAWING



Input Lead Color Code

1. Yellow: Heater Cathode
2. Brown: Heater
3. White-Red: Positive Solenoid
4. White-Black: Negative Solenoid

TYPICAL PERFORMANCE CURVE



MA-2010
Traveling Wave Tube

Bulletin 1815A

Microwave Associates, Inc.
Burlington
Massachusetts
Tel. (617) 272-3000
Western Union Fax
TWX: 710-332-6789
Telex: 94-9464

MA-2010 Traveling Wave Tube

DESCRIPTION

The MA-2010 is an efficient and reliable CW power amplifier featuring metal to ceramic construction, forced air cooling, 200 Watts power output and high gain performance of 24 dB without tuning.

APPLICATIONS

The MA-2010 traveling wave tube is ideally suited for applications in ECM systems either in the broadband noise mode or selected frequency operation. This power amplifier may also be used as an RF power source, driver, or intermediate amplifier.

SPECIFICATIONS

Electrical Characteristics

Frequency Range	350 to 700 MHz
Duty Cycle	100%
Output Power, Saturated	200 W, Min.
Gain, Saturated	24 dB, Min.

Power Supply Requirements

Element	Voltage	Current
Heater	12.6 V	2.8 A
Helix	1750 Vdc	5 mAdc
Cathode		800 mAdc
Solenoid	28 Vdc	9 Adc

Environmental Characteristics

Applicable Military Specification	MIL-E-5400, Class I
Altitude	55,000 ft.
Vibration (at 500 cps)	10 G
Shock (at 11 ms)	15 G

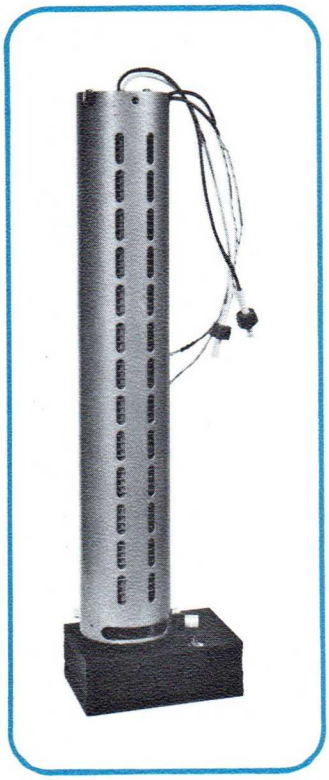
Mechanical Characteristics

Size	Refer to Outline Drawing
Focusing	Solenoid
Weight	31 lbs.
Flow Rate at 20°C	
Solenoid at sea level	100 cfm
at 55,000 ft.	200 cfm
Collector at sea level	150 cfm
at 55,000 ft.	300 cfm
Body at sea level	60 cfm
at 55,000 ft.	120 cfm
RF Connectors:	
Input	Type BNC
Output	Type C
Mounting Position	Any

NOTE:

1. All tube electrode voltages are with respect to the cathode helix and collector at chassis ground.

All specifications are subject to change without notice.



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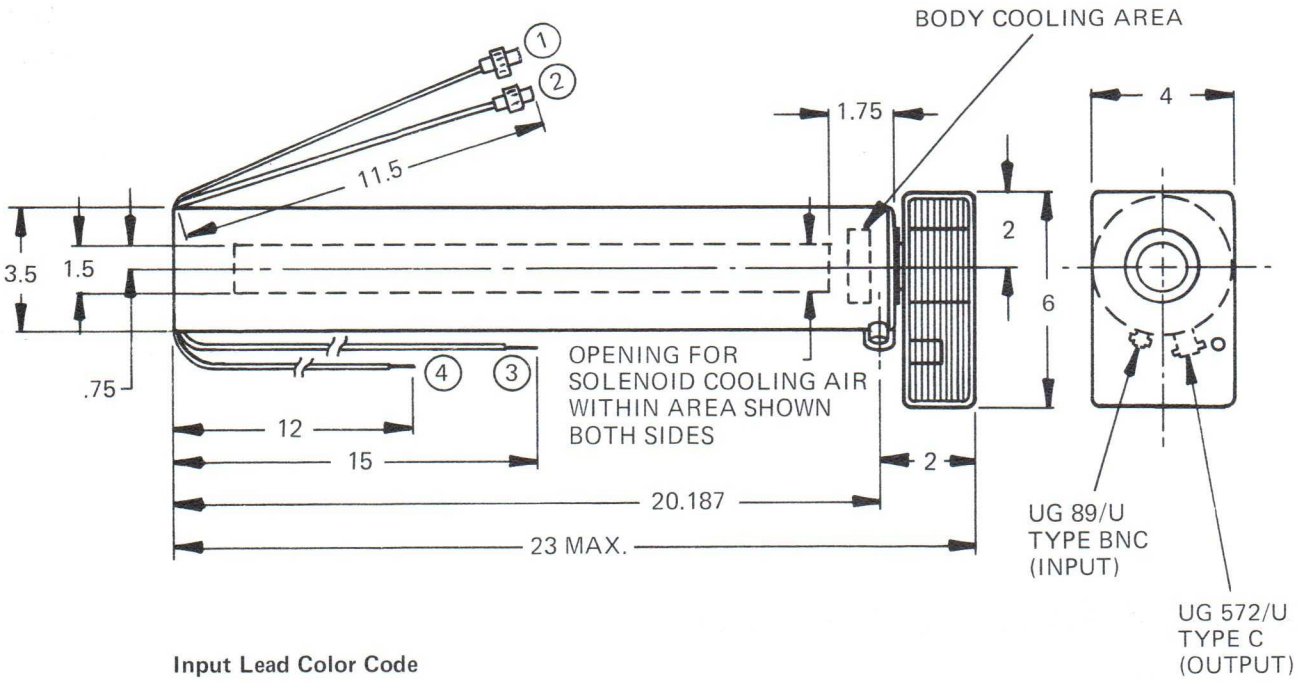
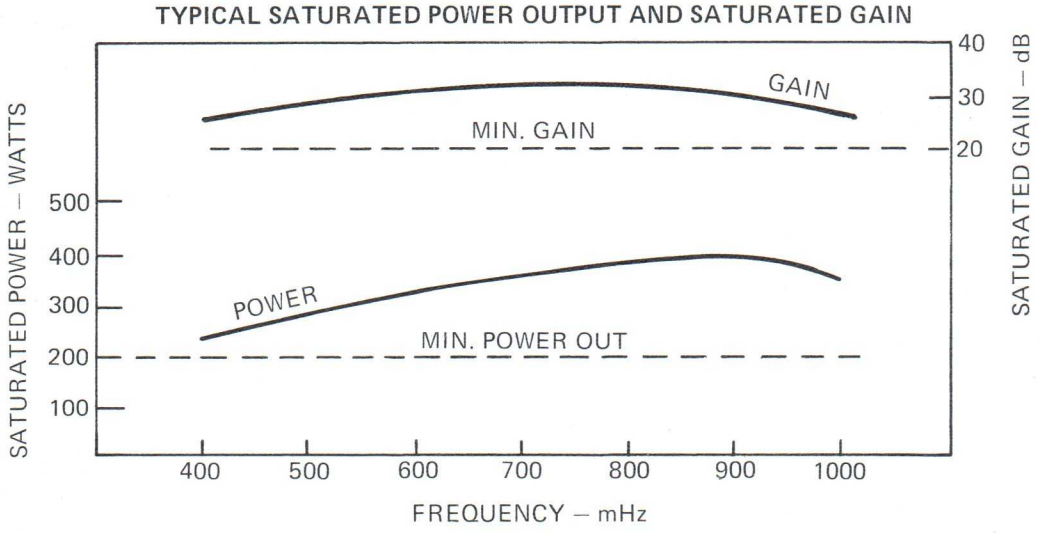
OUTLINE DRAWING



Input Lead Color Code

1. Yellow: Heater Cathode
2. Brown: Heater
3. White-Red: Positive Solenoid
4. White-Black: Negative Solenoid

TYPICAL PERFORMANCE CURVE



MA-2011 Traveling Wave Tube

DESCRIPTION

The MA-2011 is a highly efficient and reliable CW power amplifier traveling wave tube featuring metal to ceramic construction for operation in aircraft equipments. This tube utilizes a hollow electron beam and collector depression to provide efficient operation in a small package size.

The electromagnet focusing circuit (solenoid) forms an integral part of the traveling wave tube package. The electro-mechanical design of the tube and solenoid, coupled with an efficient cooling design will provide long life performance.

The basic design concept of the MA-2011 readily permits adaptation for operation with no cooling over short time periods in aircraft and missile environments.

APPLICATIONS

The high power output and wide bandwidth of the MA-2011 makes this device particularly suited for electronic countermeasures (ECM) applications either in the broadband noise mode or selected frequency CW operations. It can be effectively utilized in portable or stationary ground service equipment.

SPECIFICATIONS

Electrical Characteristics

Frequency Range	700-1400 MHz
Duty Cycle	100%
Output Power, Saturated	350 W
Gain, Saturated	28 dB

Mechanical Characteristics

Size	Refer to outline drawing
Weight	18 lbs.
Connectors	
Input	Type SMA
Output	Type C
High Voltage Leads	Flexible
Cooling	Liquid

Power Supply Requirements

Element	Voltage	Current Max.	Power
Filament	12.6 V	1.7 A	
Helix	2000 Vdc	50 mAc	
Collector	1800 Vdc	800 mAdc	
Solenoid			400 W

Environmental Characteristics

Applicable Mil-Spec.	Mil-E-5400, Class I
Ambient Temp.	–54°C to +55°C
Vibration (@ 500 cps)	10 G
Shock (@ 11 ms)	15 G
Altitude	50,000 ft.

NOTES

1. All voltages are with respect to the cathode.
2. Cooling connections will be provided to mate with system requirements.
3. This tube may be supplied in a no-cooling configuration with rated output for a period of three minutes under missile environmental conditions as a MA-2006. Approximate weight is 8 lbs.
4. The helix, collector, and solenoid voltages may be altered to maximize RF performance for a given bandwidth within the specified frequency range.

All specifications are subject to change without notice.

MA-2011

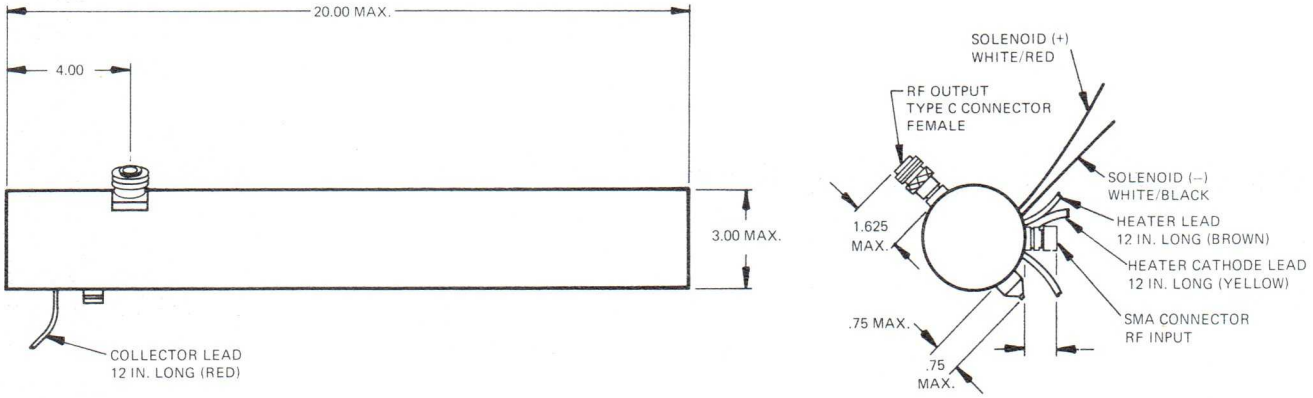
Traveling Wave Tube

Bulletin 1817A

Microwave Associates, Inc.
Burlington
Massachusetts
Tel. (617) 272-3000
Western Union Fax
TWX: 710-332-6789
Telex: 94-9464

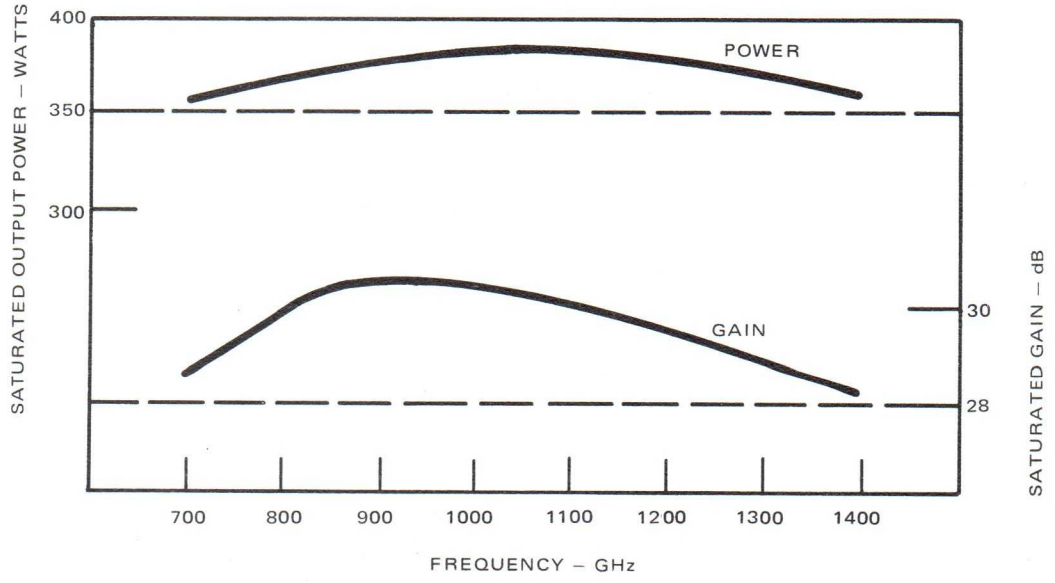
10/70 Printed in U.S.A.

OUTLINE DRAWING



NOTES:
1. ALL DIMENSIONS ARE NOMINAL IN INCHES.
2. COOLANT CONNECTIONS ARE NOT SHOWN.

TYPICAL PERFORMANCE CURVE



MA-2023

UHF Traveling Wave Tube

Bulletin 1825A

Microwave Associates, Inc.
Burlington
Massachusetts
Tel. (617) 272-3000
Western Union Fax
TWX: 710-332-6789
Telex: 94-9464

MA-2023 UHF Traveling Wave Tube

DESCRIPTION

The MA-2023 TWT provides efficient and reliable performance over the 250 to 500 MHz bandwidth. This air-cooled, 100W power tube features metal-to-ceramic construction in a rugged and compact package.

APPLICATION

The MA-2023 is ideally suited for use in ECM systems, either in the broadband noise mode or selected frequency operation. This power tube is equally suited for use as a driver, intermediate or final amplifier.

SPECIFICATIONS

Electrical Characteristics

Frequency Range	250 to 500 MHz
Duty Cycle	100%
Power Output, Saturated	100 W, Min.
Gain, Saturated	27 dB, Min.

Power Supply Requirements

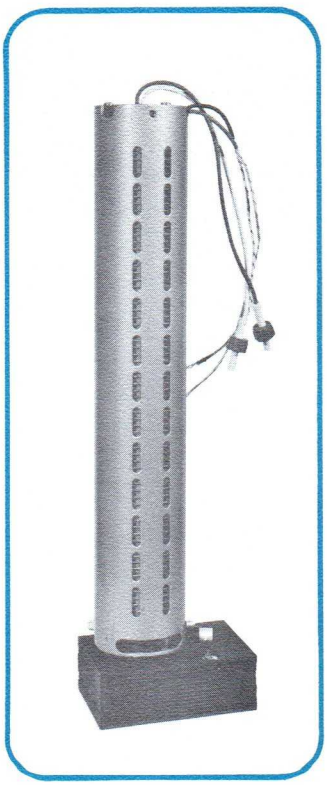
Element	Voltage	Current	Power
Heater	12.6 V	2.8 A	
Helix	1200 Vdc	10 mAdc	
Cathode		500 mAdc	
Solenoid		9 Adc	300 Wdc

Mechanical Characteristics

Size	Refer to outline drawing
Weight (Approx.)	31 lbs.
RF Connectors	
Input	Type BNC
Output	Type C
Focusing	Solenoid
Cooling	Air

Environmental Characteristics

Ambient Temperature	−54°C to +71°C
Altitude	50,000 ft.
Vibration (a + 500 cps)	10 G
Shock (11 ± 1 ms)	15 G
Mil Specifications	Mil-E-5400, Class I



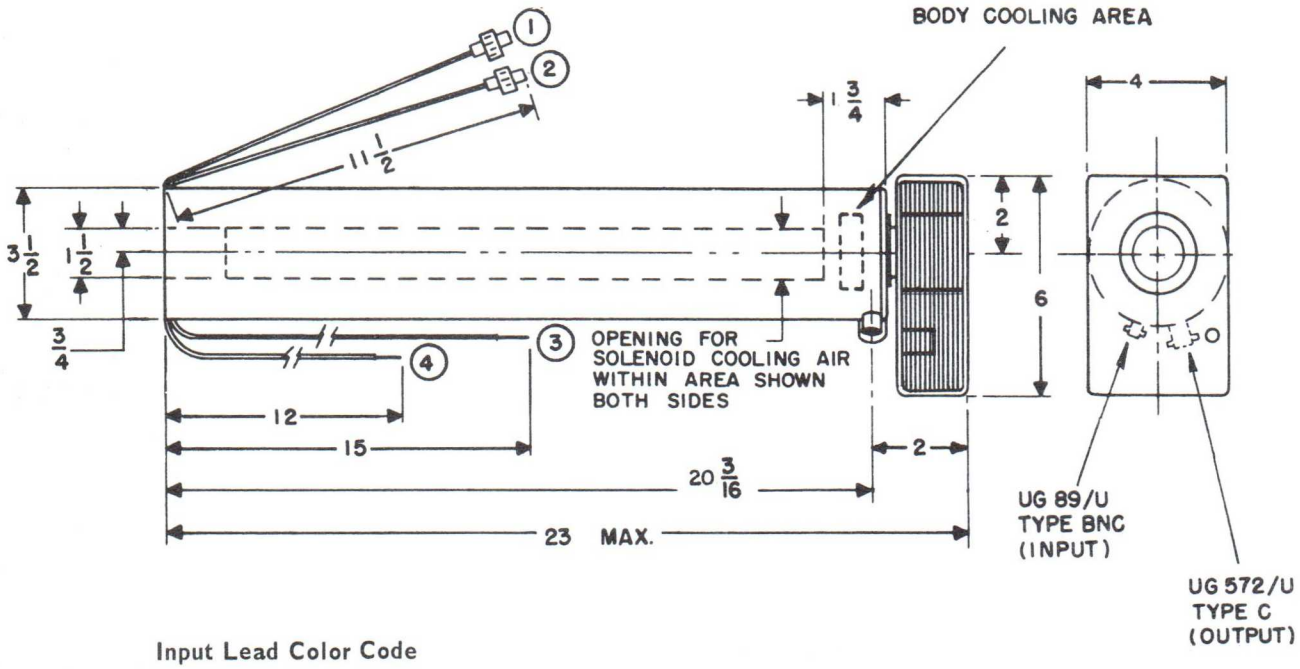
NOTES

1. All tube electrode voltages are with respect to the cathode. Helix is at ground potential.
2. The helix and/or solenoid voltages may be adjusted to maximize RF performance for a given bandwidth within the frequency range specified.

All specifications are subject to change without notice.

6/70 Printed in U.S.A.

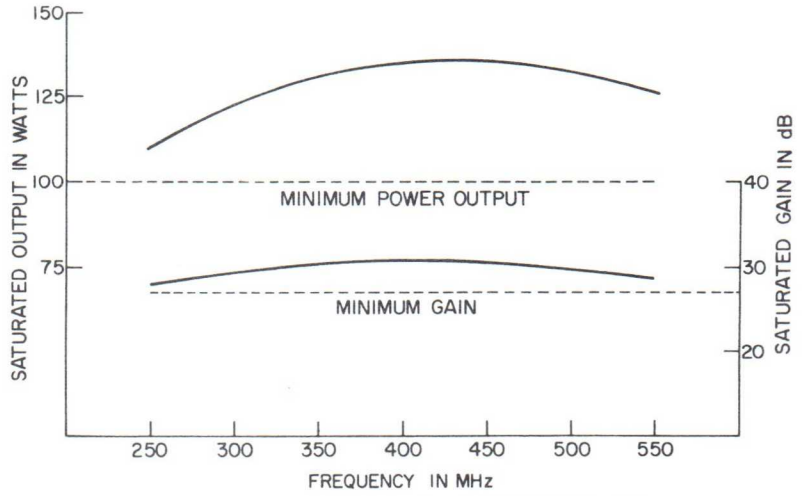
OUTLINE DRAWING



Input Lead Color Code

1. yellow: heater cathode
2. brown: heater
3. white-red: positive solenoid
4. white-black: negative solenoid

TYPICAL PERFORMANCE CURVE



MA-2015

UHF Traveling Wave Tube

Bulletin 1826A

Microwave Associates, Inc.
Burlington
Massachusetts
Tel. (617) 272-3000
Western Union Fax
TWX: 710-332-6789
Telex: 94-9464

MA-2015 UHF Traveling Wave Tube

DESCRIPTION

The MA-2015 TWT provides highly reliable performance over the 200 to 400 MHz bandwidth. This liquid-cooled, 1000-Watt TWT features metal-to-ceramic construction and utilizes a hollow electron beam coupled with a solenoid to provide efficient performance in a compact package.

APPLICATIONS

High power output and octave bandwidth make the MA-2015 TWT ideally suited for use in ECM systems and as a driver or intermediate amplifier in megawatt radar systems.

SPECIFICATIONS

Electrical Characteristics

Frequency Range	200 to 400 MHz
Duty Cycle	100%
Power Output, Saturated	1000W, Min.
Gain, Saturated	27 dB, Min.

Power Supply Requirements:

Element	Voltage	Current	Power
Heater	12.6 V	6.5A	
Helix	2450 Vdc	50 mAdc	
Collector	2200 Vdc	1.75 Adc	
Solenoid		14.0 Adc	650 Wdc

Mechanical Characteristics

Size	Refer to Outline Drawing
Weight (Approx.)	50 lbs.
RF Connectors	
Input	Type TNC
Output	Type HN
Focusing	Solenoid
Cooling[2]	Liquid

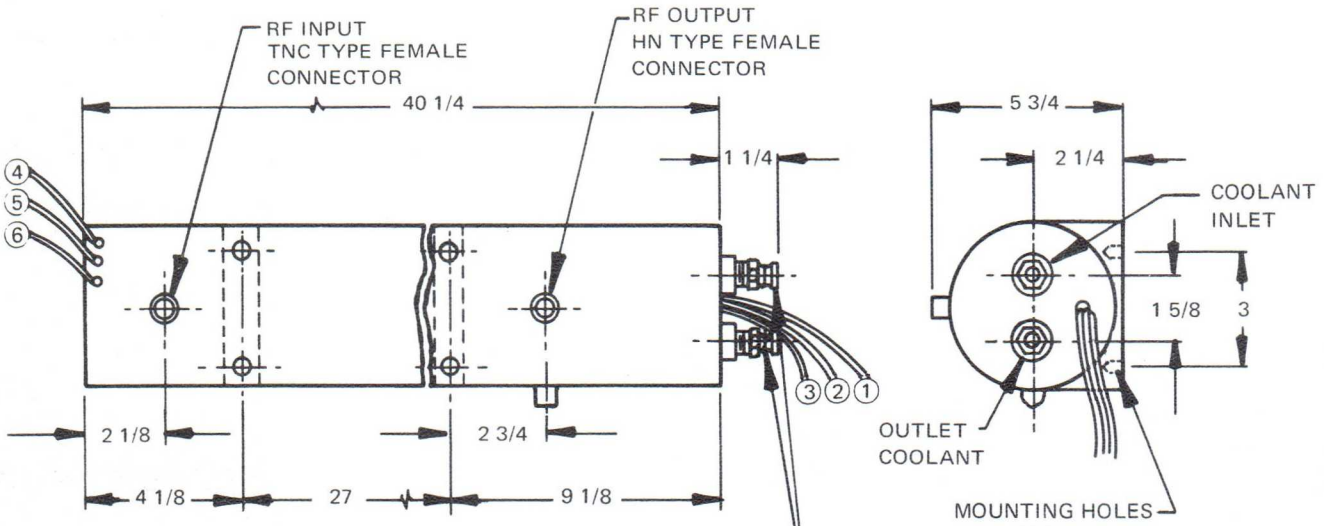
NOTES:

1. All tube electrode voltages are with respect to the cathode. Helix at ground potential.
2. This tube may be supplied in an air cooled version upon request MA-2015B.
3. The tube can be supplied with an appendage vacuum pump as MA2015C.

All specifications are subject to change without notice.

6/70 Printed in U.S.A.

OUTLINE DRAWING

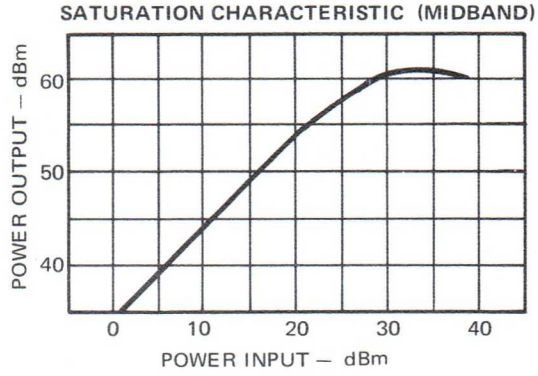


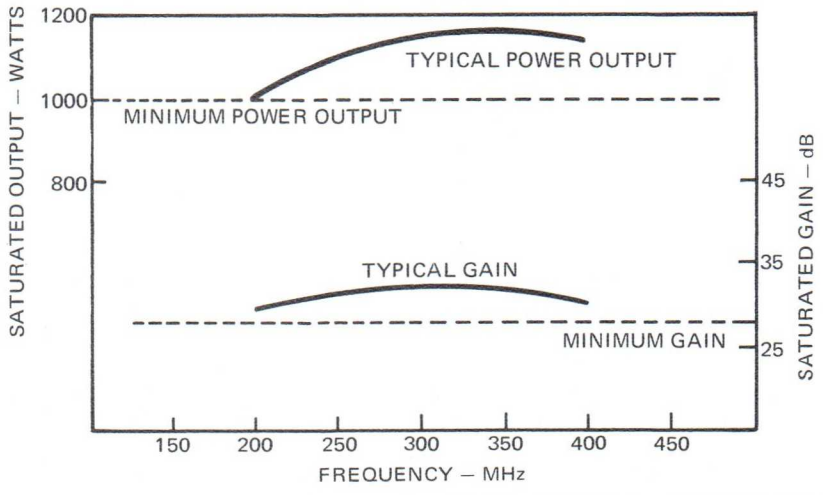
INPUT LEAD COLOR CODE

1 COLLECTOR – RED
2 GROUND – BLACK
3 SOLENOID (+) – WHITE/RED
4 SOLENOID (–) – WHITE BLACK
5 CATHODE-HEATER – YELLOW
6 HEATER – BROWN

NOTE: DIMENSIONS IN INCHES

TYPICAL PERFORMANCE CURVES





MA-2014

Traveling Wave Tube

Bulletin 1827A

Microwave Associates, Inc.
Burlington
Massachusetts
Tel. (617) 272-3000
Western Union Fax
TWX: 710-332-6789
Telex: 94-9464

MA-2014 Traveling Wave Tube

DESCRIPTION

The MA-2014 traveling wave tube is a highly efficient and reliable power amplifier featuring metal to ceramic construction. It utilizes a hollow electron beam coupled with a solenoid in a rugged and compact package.

APPLICATIONS

The high power output and greater-than octave bandwidth make the MA-2014 traveling wavestubes ideally suited for applications in ECM systems or as a driver, or intermediate amplifier in mega-watt radar systems.

SPECIFICATIONS

Electrical Characteristics

Frequency Range	400 to 1000 MHz
Duty Cycle	100%
Output Power, Saturated	1000 W, Min.
Gain, Saturated	26 dB, Min.

Power Supply Requirements

Element	Voltage	Current Max.
Heater	12.6 $\pm$ 5% V	3.0 A
Helix	2450 Vdc	40 mAdc
Collector	2200 Vdc	1.8 Adc
Solenoid	600 Wdc	

Mechanical Characteristics

Size	Refer to outline drawing
Weight	26 lbs.
RF Connectors:	
Input	Type SMA
Output	1 5/8 EIA
High Voltage Leads	Flexible
Mounting Position	Any
Cooling[1]	Liquid

NOTES:

1. MA-2014B forced air-cooled tube also available upon request. Weight 35 pounds.
2. All tube electrode voltages are with respect to the cathode. Helix at ground potential.
3. Other types of input, output, and/or cooling connections can be provided to mate with system requirements.

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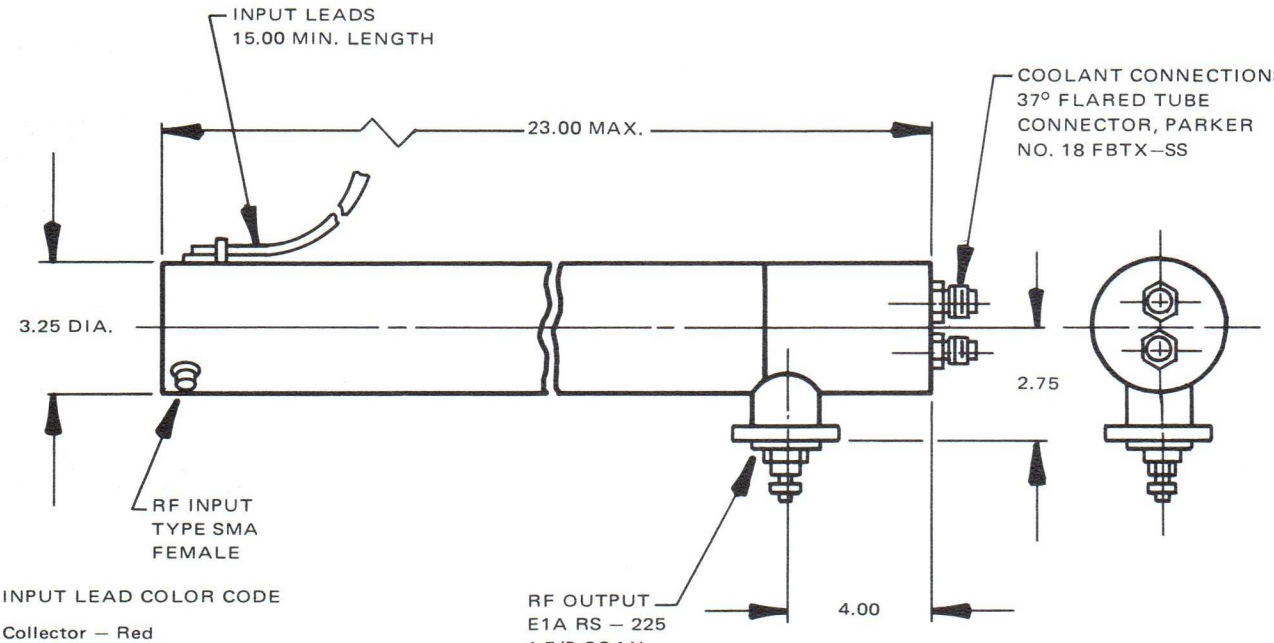
OUTLINE DRAWING

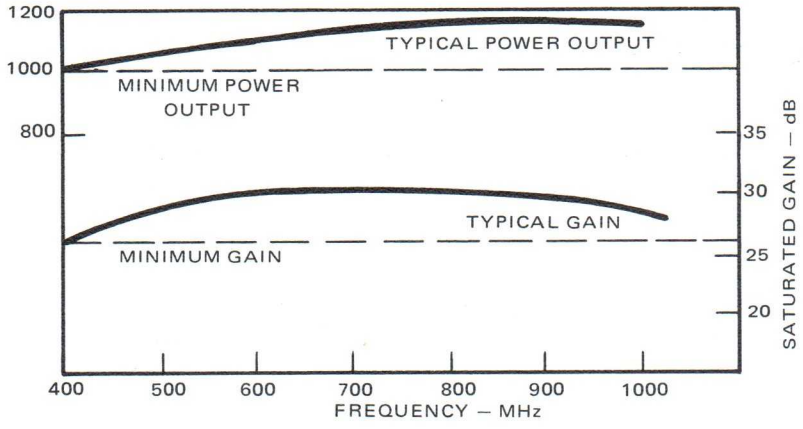


INPUT LEAD COLOR CODE

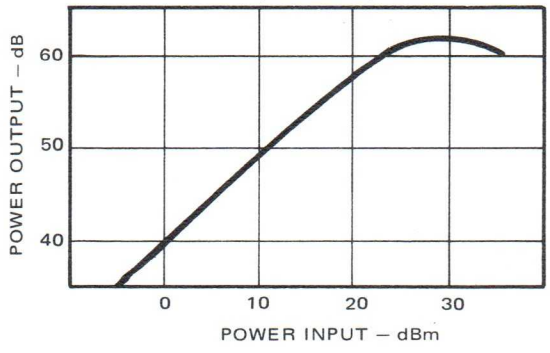
Collector – Red
Ground – Case
Solenoid (+) – White/Red
Solenoid (-) – White/Black
Cathode – Heater – Yellow
Heater – Brown

DIMENSIONS IN INCHES

TYPICAL PERFORMANCE CURVES



SATURATION CHARACTERISTIC
(MIDBAND)



MA-2033 CW UHF-Broadband TWT

DESCRIPTION

The MA-2033 traveling wave tube is a highly efficient and reliable CW power amplifier featuring metal to ceramic construction. This is the smallest amplifier tube offered at this bandwidth and power level. It also features a solenoid focused hollow electron beam and an efficient liquid cooling design.

APPLICATION

The small size of the MA-2033 is ideal for use as a driver in electronic countermeasures (ECM) transmitter applications for missile and high performance airborne systems. The MA-2033 is particularly well suited as a driver for the 2kW MA-2024.

SPECIFICATIONS

Electrical Characteristics

Frequency Range	550 to 1000 MHz
Duty Cycle	100%
Output Power, Saturated	5 W, min.
Gain at Saturated Output Power	30 dB, min.

Power Supply Requirements

Element	Voltage Range	Current, Max.
Heater	12.6 ±5% V	.53 A
Helix	350 to 550 V	10 mA
Grid	70 V	15 mA
Solenoid	6 to 10 V	17.0 A
Cathode	0 V	100 mA

Environmental Characteristics

Temperature Range	−54°C to +110°C
Vibration, Operating	10 G to 500 cps
Shock	15 G @ 11 ms
Altitude	50,000 ft
Cooling	Liquid

Mechanical Characteristics

Size	Refer to outline drawing
Weight (approx.)	4 lbs.
R. F. Connectors [3]	
Input	OSM
Output	OSM
High Voltage Leads	Flexible
Mounting Position	Any

NOTES:

1. All tube electrode voltages are with respect to the cathode. Helix is at ground potential.
2. The helix, grid, and/or solenoid voltages may be adjusted to maximize R.F. performance for a given bandwidth within the specified frequency range.
3. Other types of input, output and/or cooling connections can be provided to mate with systems requirements.
4. Data contained in this bulletin is subject to modification and should not be used for final equipment design.

MA-2033

CW UHF-Broadband TWT

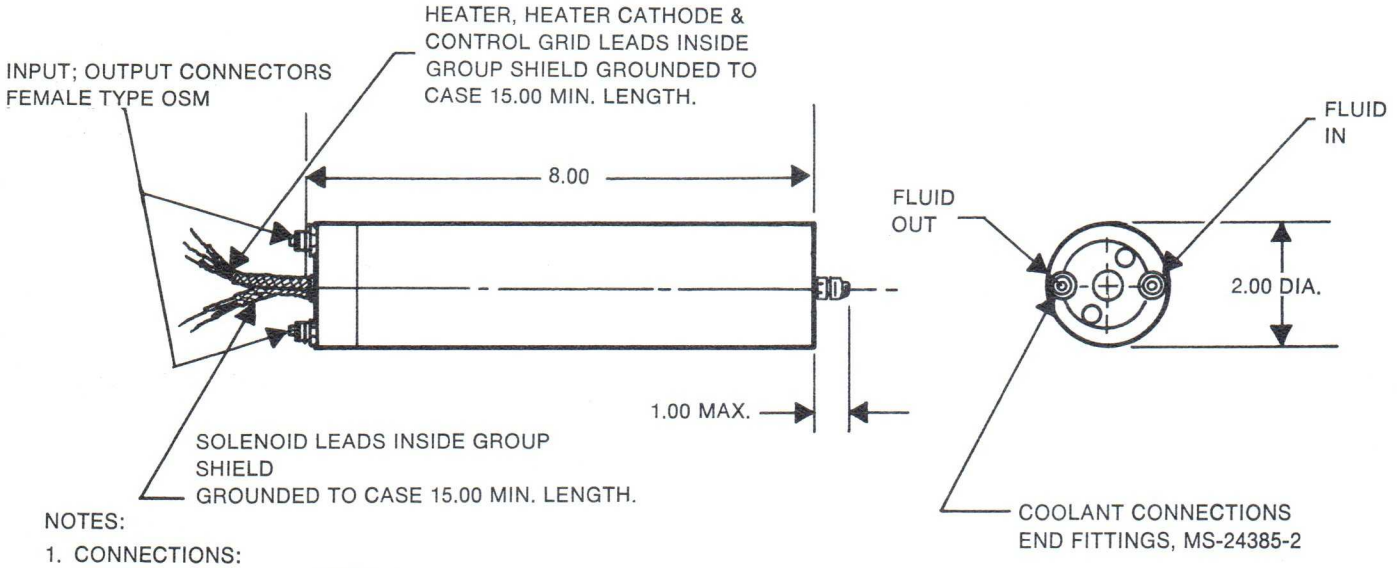
Bulletin 1828

Microwave Associates, Inc.

Burlington
Massachusetts
Tel. (617) 272-3000
Western Union Fax
TWX: 710-332-6789
Telex: 94-9464

3/68 Printed in U.S.A.

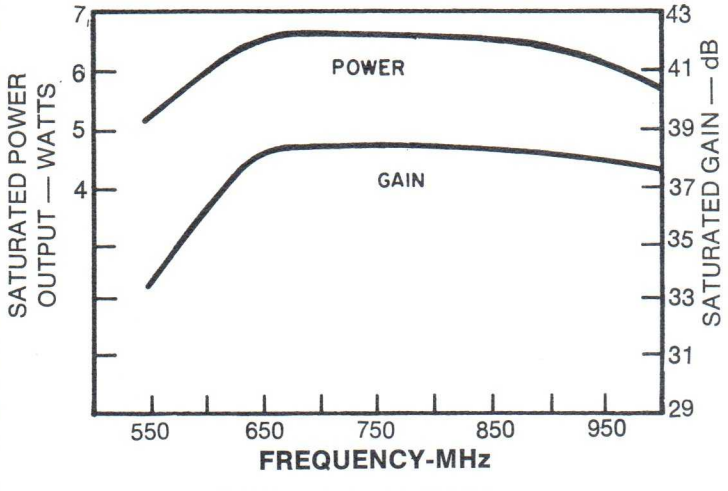
OUTLINE DRAWING



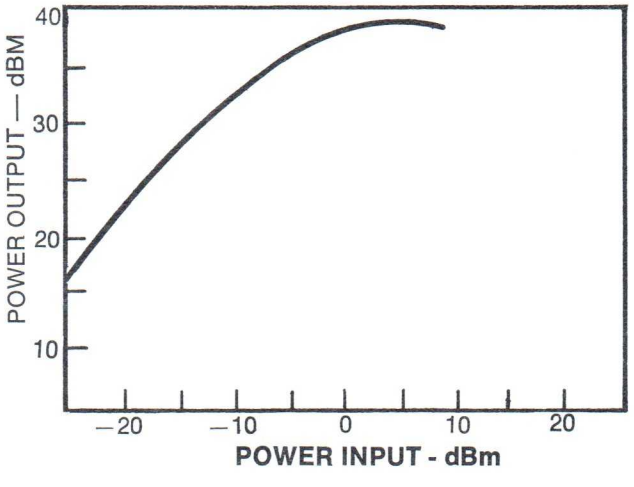
NOTES:

1. CONNECTIONS:
   HEATER . . . . . BROWN
   HEATER-CATH. . . . . YELLOW
   CONTROL GRID . . . . . GREEN
   SOLENOID-POS. . . RED-ORANGE
   SOLENOID-NEG. . . BLK.-ORANGE

TYPICAL PERFORMANCE CURVES



SMALL-SIGNAL GAIN NOISE FIGURE AND POWER OUTPUT



SATURATION MID-BAND CHARACTERISTICS

MA-2024

CW UHF-Broadband TWT

Bulletin 1829A

Microwave Associates, Inc.
Burlington
Massachusetts
Tel. (617) 272-3000
Western Union Fax
TWX: 710-332-6789
Telex: 94-9464

MA-2024 CW UHF-Broadband TWT

DESCRIPTION

The MA-2024 traveling wave tube is a highly efficient and reliable CW power amplifier featuring metal to ceramic construction. This tube utilizes a solenoid focused hollow electron beam and an efficient liquid cooling system which will assure long life performance. The non-intercepting anode may be used to modulate or cut-off the beam and hence the output power.

APPLICATIONS

The high power output and broadband characteristics of the MA-2024 makes this device particularly suited for electronic countermeasures (ECM), UHF-TV translator or transmitter applications and broadband testing of components.

SPECIFICATIONS

Electrical Characteristics

Frequency Range	550 to 1000 MHz
Duty Cycle	100%
Output Power, Saturated	2 kW, Min.
Gain, Saturated	26 dB, Min.

Power Supply Requirements

Element	Voltage	Current, Max.
Heater	12.6 V $\pm$ 5%	3.0 A, Typ.
Helix	3500 V $\pm$ 100	40 mA
Anode	0 to 3600 V	10 mA
Collector	3200 to 3600 V	2.5 A
Solenoid	35 V, Typ.	17 A $\pm$ .5

Mechanical Characteristics

Size	See outline drawing
Weight	27 lbs.
RF Connectors	
Input	Type SMA
Output	1 5/8 EIA
High Voltage Leads	Flexible
Mounting Position	Any

Environmental Characteristics

Temperature Range	−54°C to +110°C
Vibration (@ 500 cps)	10 G
Shock (@ 11 ms)	15 G
Altitude	50,000 ft.
Cooling	Liquid

NOTES

1. All tube electrode voltages are with respect to the cathode. Helix at ground potential.
2. The helix, collector, and/or solenoid voltages may be adjusted to maximize RF performance for a given bandwidth within the specified frequency range.
3. Tube may be supplied with collector non-depressed.
4. Data contained in this bulletin subject to modification and should not be used for final equipment design.
5. Other types of input, output, and/or cooling connections can be provided to mate with system requirements.

All specifications are subject to change without notice.

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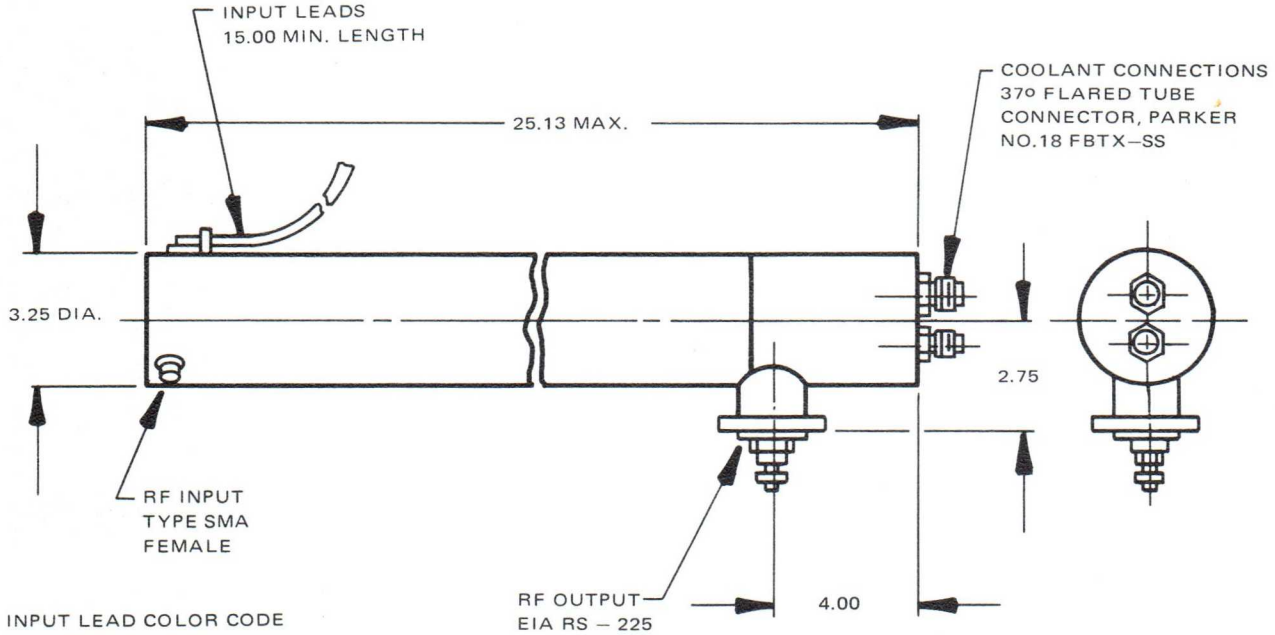
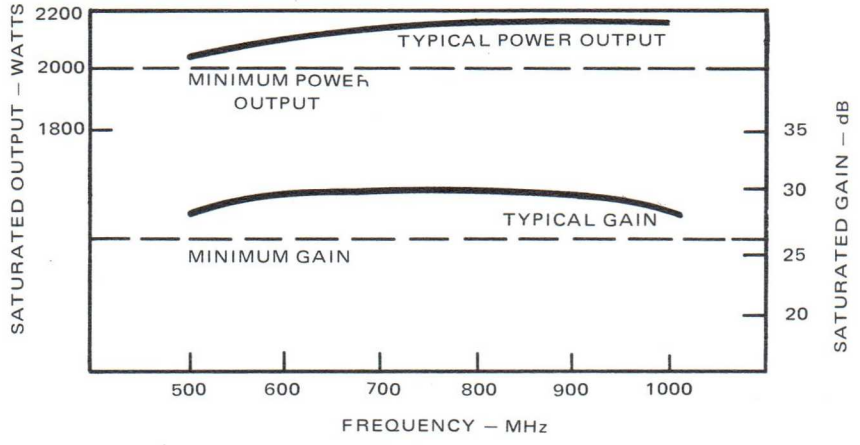
OUTLINE DRAWING

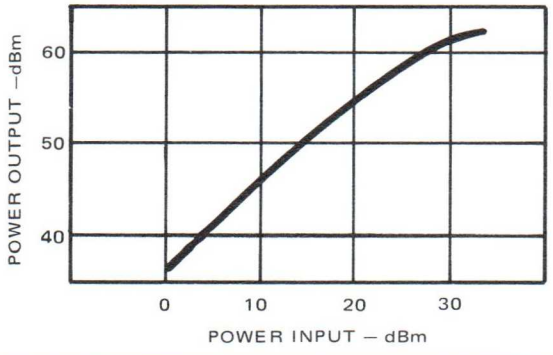


INPUT LEAD COLOR CODE
COLLECTOR – RED
GROUND – CASE
SOLENOID (+) – WHITE /RED
SOLENOID (–) – WHITE/BLACK
CATHODE–HEATER – YELLOW
HEATER – BROWN
ANODE – GREEN

TYPICAL PERFORMANCE CURVES



SATURATION CHARACTERISTIC
(MIDBAND)

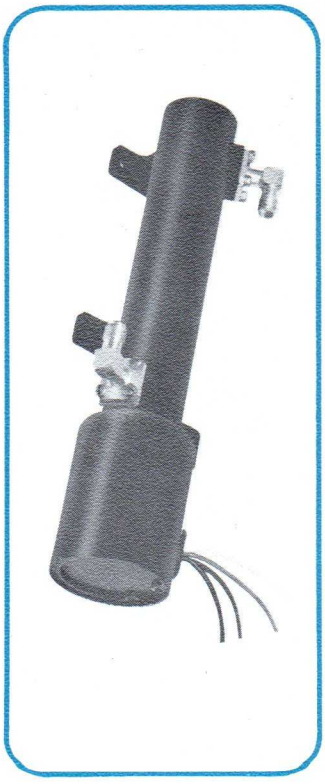


MA-2044
MA-2045
MA-2046

Broadband Electron Beam Switch Modulators

Bulletin 1833

Microwave Associates, Inc.
Burlington
Massachusetts
Tel. (617) 272-3000
Western Union Fax
TWX: 710-332-6789
Telex: 94-9464



MA-2044, MA-2045, MA-2046 Broadband Electron Beam, Switch Modulators

DESCRIPTION

This series of PPM focussed electron beam switch modulators (EBSM) are designed to operate at a temperature of 100°C. These highly efficient and reliable modulators combine metal to ceramic construction which feature good cathode construction and permitting excellent tube to tube reproducibility, modulation and fast switching capabilities. All units meet the requirements of MIL-E-5400.

APPLICATIONS

This series of broadband TWT's are particularly suited for electronic countermeasures (ECM) and airborne applications where rapid switching (10 ns, max.) and controlled modulation characteristics are design requirements.

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MA-2044, MA-2045, MA-2046

SPECIFICATIONS

Electrical Characteristics

Frequency Range	
MA-2044	2000 to 4000 MHz
MA-2045	4000 to 8000 MHz
MA-2046	8000 to 12000 MHz
Duty Cycle	0 to 10%
Power Input, CW	
MA-2044	5.0 W, max.
MA-2045	0.2 W, max.
MA-2046	0.2 W, max.
Power Output, Peak Pulsed	
MA-2044	1.0 W, max.
MA-2045	0.1 W, max.
MA-2046	0.1 W, max.
Switching Time	10 ns, max.
Attenuation	0 to 60 dB, min.

Environmental Characteristics

Temperature Range	−54°C to +100°C

Operating Conditions

Element	Voltage Range	Current, Max.
Heater	6.3 V	0.4 A
Helix		
MA-2044	1100 V	
MA-2045	1300 V	
MA-2046	1500 V	
Grid	−70 to 0 V	50 μA
Grid (cathode capacitance including flying leads)		20 pF
Cathode		
MA-2044		40 mA
MA-2045		10 mA
MA-2046		10 mA

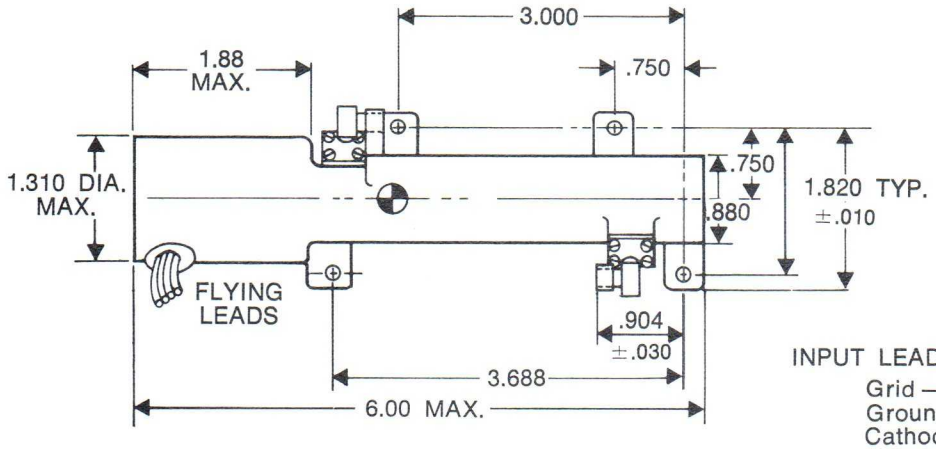
Mechanical Characteristics

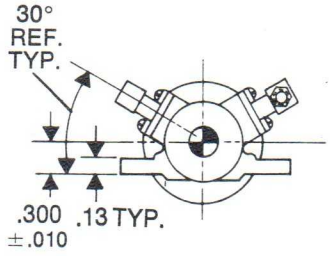
Size	Refer to outline drawing
Weight (approx.)	10.0 oz.
RF Connectors	
Input and Output	OSM
High Voltage Leads	Flexible
Mounting Position	Any

NOTES:

1. All tube electrode voltages are with respect to the cathode. Helix is at ground potential.
2. All specifications are subject to change without notice.

OUTLINE DRAWING





INPUT LEAD COLOR CODE

Grid — Green
Ground — Black
Cathode-heater — Yellow
Heater — Brown

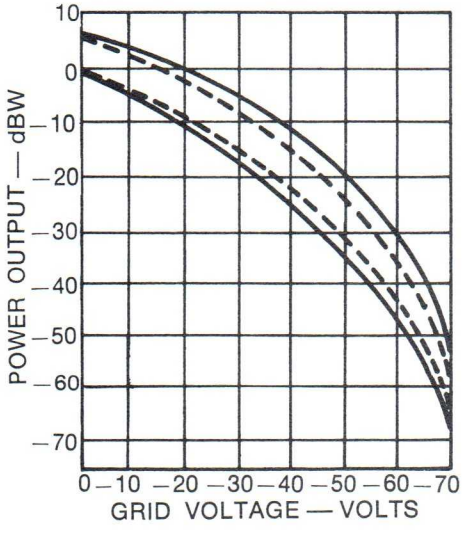
TYPICAL PERFORMANCE CURVES

MA-2044

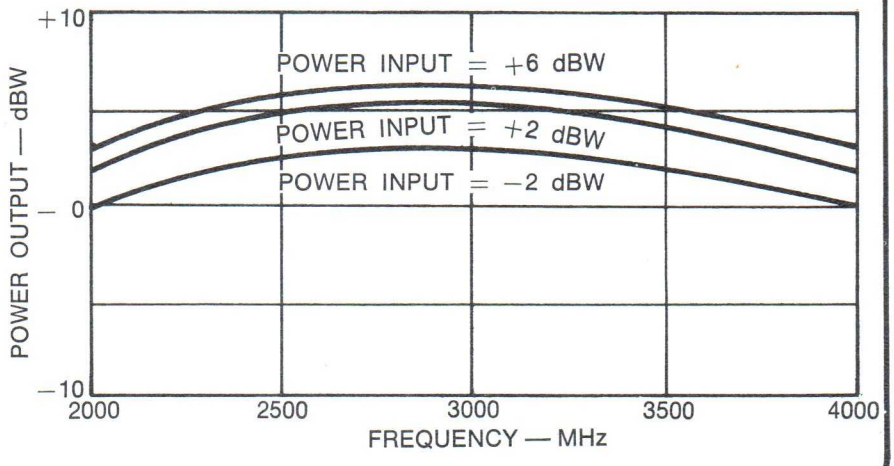
POWER OUTPUT VS. GRID VOLTAGE FOR ANY INPUT POWER LEVEL BETWEEN +6 dBW AND −2 dBW AT ANY FREQUENCY IN THE BAND.

— EXTREME VARIATION MEASURED IN LARGE SAMPLE OF TUBES

– – – TYPICAL VARIATION MEASURED IN A SINGLE TUBE



POWER OUTPUT VS. FREQUENCY FOR THREE DRIVE LEVELS



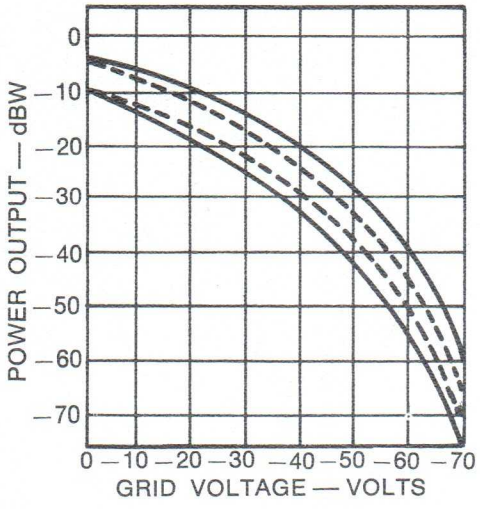
TYPICAL PERFORMANCE CURVES

MA-2045

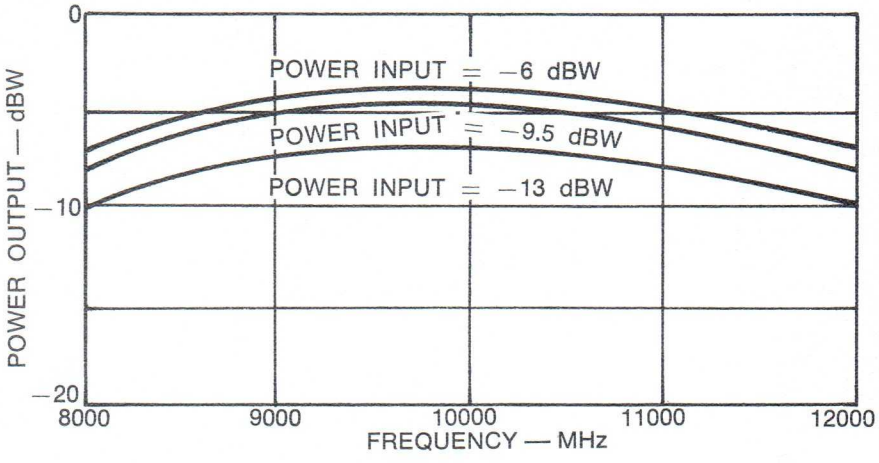
POWER OUTPUT VS. GRID VOLTAGE FOR ANY INPUT POWER LEVEL BETWEEN −6 dBW AND −13 dBW AT ANY FREQUENCY IN THE BAND.

— EXTREME VARIATION MEASURED IN LARGE SAMPLE OF TUBES

– – TYPICAL VARIATION MEASURED IN A SINGLE TUBE



POWER OUTPUT VS. FREQUENCY FOR THREE DRIVE LEVELS

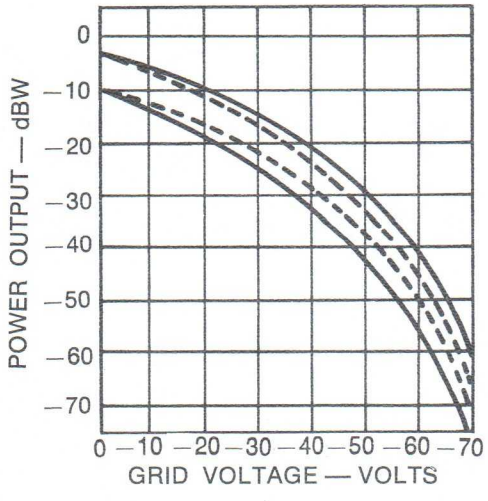


MA-2046

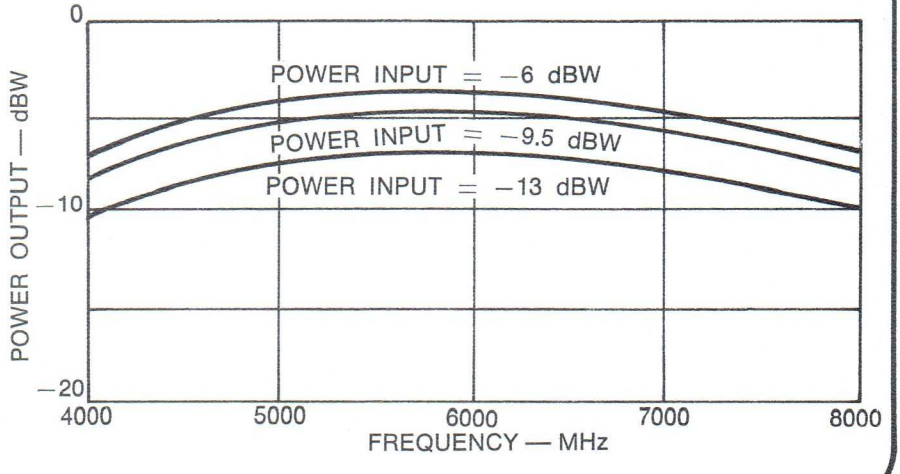
POWER OUTPUT VS. GRID VOLTAGE FOR ANY INPUT POWER LEVEL BETWEEN −6 dBW AND −13 dBW AT ANY FREQUENCY IN THE BAND.

— EXTREME VARIATION MEASURED IN LARGE SAMPLE OF TUBES

– – – TYPICAL VARIATION MEASURED IN A SINGLE TUBE



POWER OUTPUT VS. FREQUENCY FOR THREE DRIVE LEVELS



MA-2016

Traveling Wave Tube

Bulletin 1861A

Microwave Associates, Inc.

Burlington
Massachusetts
Tel. (617) 272-3000
Western Union Fax
TWX: 710-332-6789
Telex: 94-9464

MA-2016 Traveling Wave Tube

DESCRIPTION

The MA-2016 features metal-ceramic construction and utilizes a hollow electron beam coupled with a solenoid to provide reliable and efficient performance in a compact package. The electromechanical design concept employed has been system proven in other Microwave Associates TWT's.

APPLICATIONS

The medium power output and octave bandwidth makes the MA-2016 ideally suited for a variety of applications such as a driver in broadband ECM systems, as an amplifier in test equipment and communications systems.

SPECIFICATIONS

Electrical Characteristics

Frequency Range	200 to 400 MHz
Duty Cycle	100%
Output Power, Saturated	10 W, nom.
Gain, Saturated	25 dB

Power Supply Requirements

Element	Voltage	Current	Power
Heater	12.6 V	2.75 A	
Helix	575 Vdc	10 mAdc	
Cathode		175 mAdc	
Solenoid		14 Adc	140 W

Mechanical Characteristics

Size	
Length	16.5″
Tube and Solenoid O.D.	2⅜″
Weight	6 lbs.
RF Connectors	
Input	Type TNC
Output	Type TNC
Focusing	Solenoid
High Voltage Leads	Flexible
Cooling	Forced Air

Environmental Characteristics

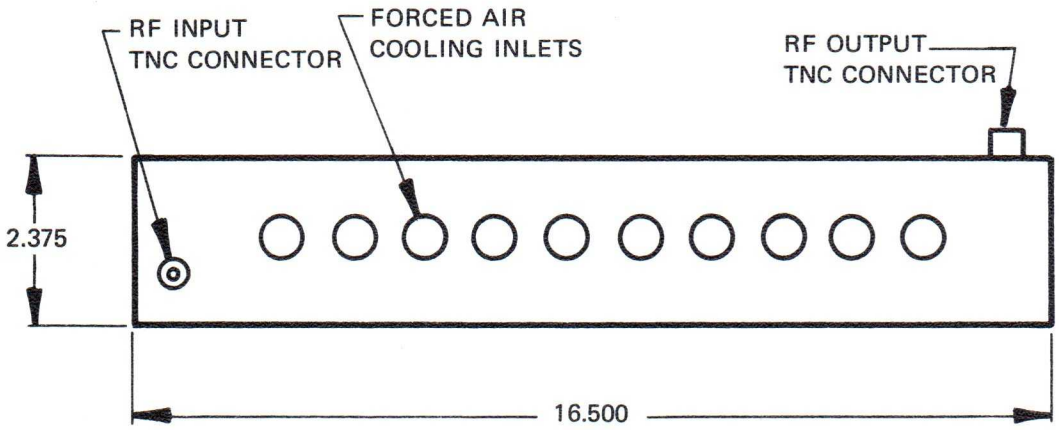
Applicable Military Specification
MIL-E-5400

NOTES:

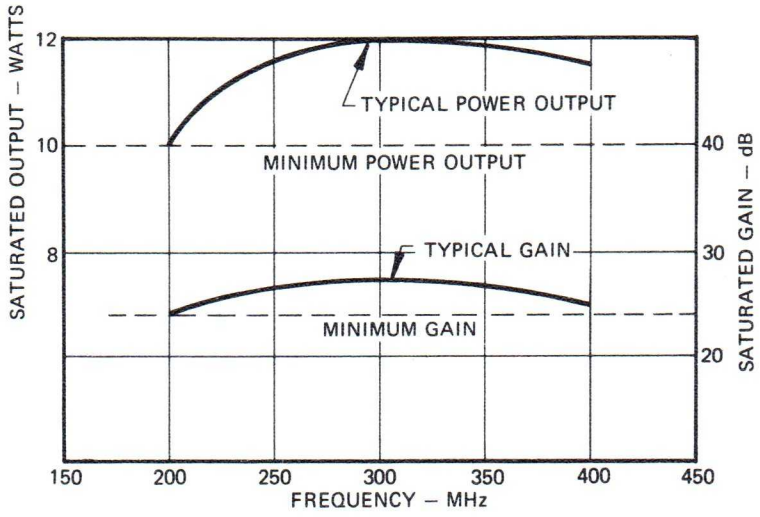
1. Data contained in this bulletin subject to modification and should not be used for final equipment design.
2. All tube electrode voltages are with respect to the cathode. Helix at ground potential.
3. The helix, collector, and/or solenoid voltages may be adjusted to maximize RF performance for a given bandwidth within the frequency range specified.

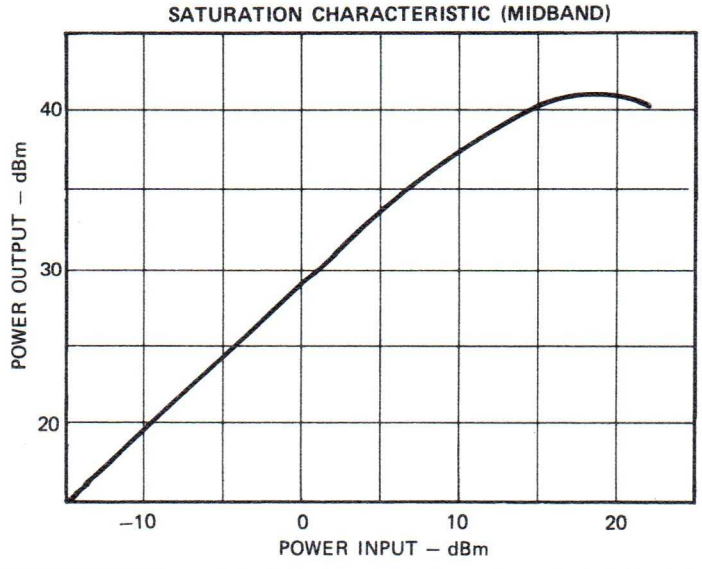
3/72 Printed in U.S.A.

OUTLINE DRAWING



TYPICAL PERFORMANCE CURVES





MA-2017

Broadband CW Traveling Wave Tube

Bulletin 1862A

Microwave Associates, Inc.

Burlington
Massachusetts
Tel. (617) 272-3000
Western Union Fax
TWX: 710-332-6789
Telex: 94-9464

MA-2017 Broadband CW Traveling Wave Tube

DESCRIPTION

The MA-2017 represents the latest in high power broadband CW traveling wave tubes. Utilization of a high perveance hollow electron beam, advanced mechanical and thermal design concepts developed at Microwave Associates, coupled with a solenoid for precise control of the electron beam has yielded a compact and efficient device. These new concepts still employ the system proven basic electromechanical design of other Microwave Associates high power TWT's, to ensure reliable performance of the MA-2017.

APPLICATIONS

The high power and octave bandwidth makes the MA-2017 ideally suited for a variety of applications either in the CW or pulsed mode, i.e., ECM, Radar and T.V. systems.

All specifications are subject to change without notice.

2/72 Printed in U.S.A.

SPECIFICATIONS

Typical Performance Data

Frequency Range	500-1000 MHz
Duty Cycle	100%
Saturated Power Output	5000 W
Saturated Gain	27 dB

Electrical Characteristics

Element	Power	Voltage	Current
Heater		12.6 V	5.0 A
Collector		5000 V dc	4.5 A dc
Helix		6000 V dc	50 mA dc
Solenoid Power	1000 W		
Mod Anode		0-6000 V dc	20 mA dc

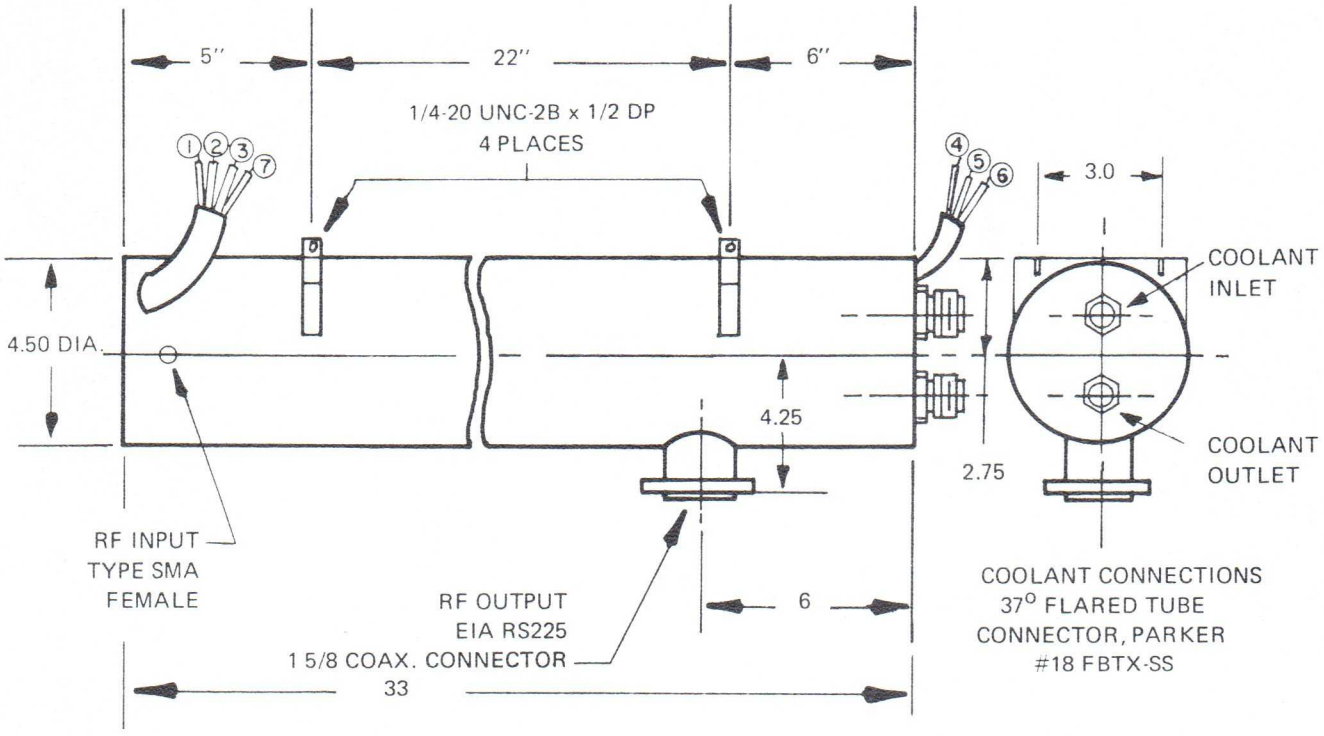
Mechanical Characteristics

RF Connectors:	
Input	Type SMA
Output	Type 1-5/8 EIA
Tube and Solenoid O.D.	4-1/2 Inches
Weight	45 Lbs.
High Voltage Leads	Flexible
Cooling	Liquid
Length	33 Inches

NOTES:

1. Data contained in this bulletin subject to modification and should not be used for final equipment design.
2. All tube electrode voltages are with respect to the cathode. Helix at ground potential.
3. The helix, collector and/or solenoid voltages may be adjusted to maximize R.F. performance for a given bandwidth within the frequency range specified.

OUTLINE DRAWING



DIMENSIONS IN INCHES

POWER LEADS

1. YELLOW – HEATER CATHODE
2. BROWN – HEATER
3. WHITE (RED) – SOLENOID (+)
4. WHITE (BLACK) – SOLENOID (–)
5. RED – COLLECTOR
6. BLACK – GROUND
7. GREEN – MOD. ANODE

MA-2003 Traveling Wave Tube

DESCRIPTION

The MA-2003 TWT provides high performance operation over the 300 to 900 MHz bandwidth. Collector depression, coupled with a hollow electron beam, yields efficiency approaching 40 percent. This tube employs mechanical design proven in other Microwave Associates power TWT's which permits operation in extreme environments. The electromechanical design of the MA-2003 readily permits scaling to adjacent frequency bands.

APPLICATIONS

Ideally suited for operation as driver, transmitting tube or intermediate power amplifier in electronic warfare, search and surveillance, test equipment and communications systems.

SPECIFICATIONS

Electrical Characteristics

Frequency Range	300 to 900 MHz
Duty Cycle	100%
Power, Output Saturated	1000 W, min.
Gain, Saturated	25 dB, max.

Power Supply Requirements

Element	Voltage	Current,	Power
Heater	12.6 V	3.0 A	
Helix	2600 Vdc	40 mAdc	
Collector	2200 Vdc	1.6 Adc	
Solenoid			520 W

Mechanical Characteristics

Size	Refer to Outline Drawing
Weight (Approx.)	26 lbs.
RF Connectors	
Input	Type SMA
Output	Type 1⅝ EIA
Focusing	Solenoid
Cooling	Liquid

Environmental Characteristics

Applicable Military Specification	MIL-E-5400, Class I Equipment
Altitude	50,000 ft.
Vibration	10 G at 500 cps
Shock	15 G at 11 ms

NOTES:

1. Data contained in this bulletin subject to modification and should not be used in final equipment design.
2. All tube voltages are with respect to cathode, helix at chassis ground.
3. The helix, collector, and/or solenoid voltage can be adjusted to maximize RF performance for a given bandwidth within the specified frequency range.

All specifications are subject to change without notice.

MA-2003

Traveling Wave Tube

Bulletin 1863A

Microwave Associates, Inc.

Burlington
Massachusetts
Tel. (617) 272-3000
Western Union Fax
TWX: 710-332-6789
Telex: 94-9464

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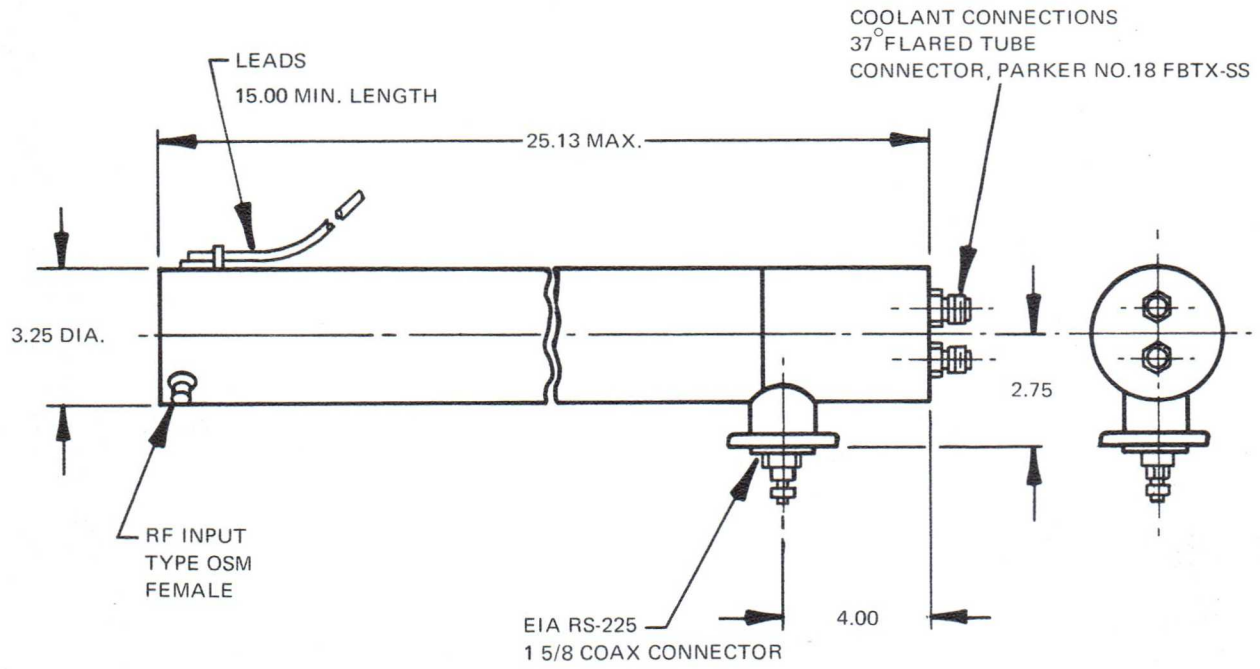
OUTLINE DRAWING

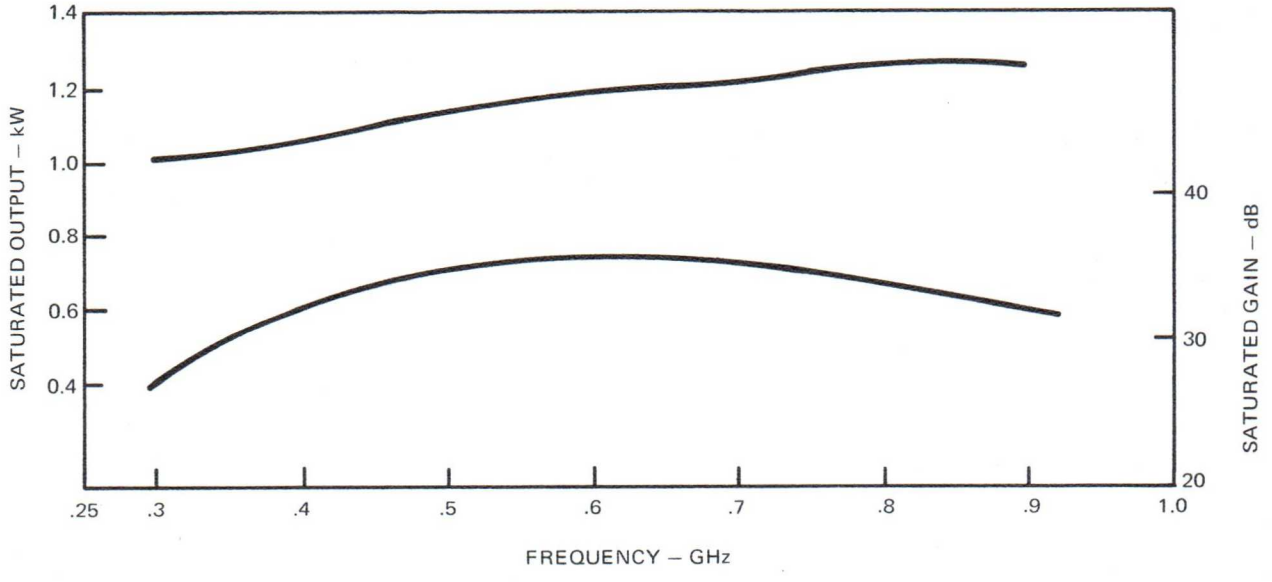


INPUT LEAD COLOR CODE

COLLECTOR – RED
GROUND – CASE
SOLENOID (+) – WHITE/RED
SOLENOID (–) – WHITE/BLACK
CATHODE-HEATER – YELLOW
HEATER – BROWN

NOTE: DIMENSIONS IN INCHES

TYPICAL PERFORMANCE CURVE



MA-2037

CW Traveling Wave Tube

Bulletin 1864

Microwave Associates, Inc.
Burlington
Massachusetts
Tel. (617) 272-3000
Western Union Fax
TWX: 710-332-6789
Telex: 94-9464

MA-2037 CW Traveling Wave Tube

DESCRIPTION

The MA-2037 is a high performance CW traveling wave tube which features a hollow electron beam, specially designed solenoid and metal to ceramic construction to provide reliable and efficient operation in extreme airborne and ground system environments. Rated output is obtained over an octave or greater bandwidth without tuning.

APPLICATIONS

The MA-2037 is ideally suited for applications in ECM systems, either in the broadband noise mode or at selected frequencies. This power tube may also be effectively employed as a driver or intermediate amplifier.

SPECIFICATIONS

Electrical Characteristics

Frequency Range	500 to 1000 MHz
Duty Cycle	100%
Output Power, Saturated	400 W
Gain Saturated	26 dB

Power Supply Requirements

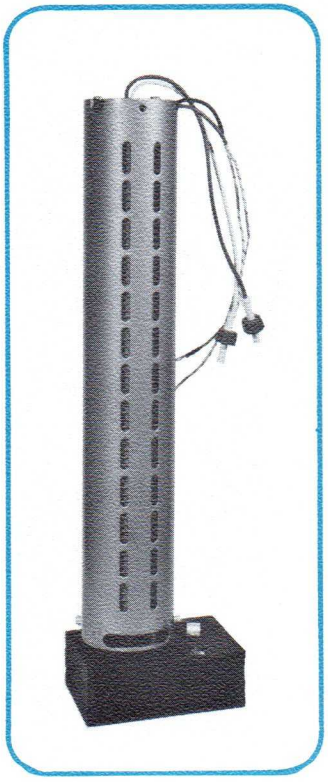
Element	Voltage	Current Max.
Heater	12.6 V	2.8 A
Helix	2100 Vdc	15 mAdc
Cathode		1000 mAdc
Solenoid	28 Vdc	12.5 Adc

Mechanical Characteristics

Size	Refer to Outline Drawing
Weight	31 lbs.
Flow Rate (@ 20° C)	
Solenoid @ sea level	200 cfm
@ 55,000 ft.	400 cfm
Collector @ sea level	200 cfm
@ 55,000 ft.	400 cfm
Body @ sea level	100 cfm
@ 55,000 ft.	200 cfm
RF Connectors	
Input	Type BNC
Output	Type C

Environmental Characteristics

Applicable Mil-Spec.	Mil-E-5400, Class I
Altitude	55,000 Ft.
Vibration (@ 500 cps)	10 G
Shock (@ 11 ms)	15 G



NOTES

1. All tube electrode voltages are with respect to the cathode. Helix is at ground potential.
2. The helix, grid and/or solenoid voltages may be adjusted to maximize RF performance for a given bandwidth within the specified frequency range.

All specifications are subject to change without notice.

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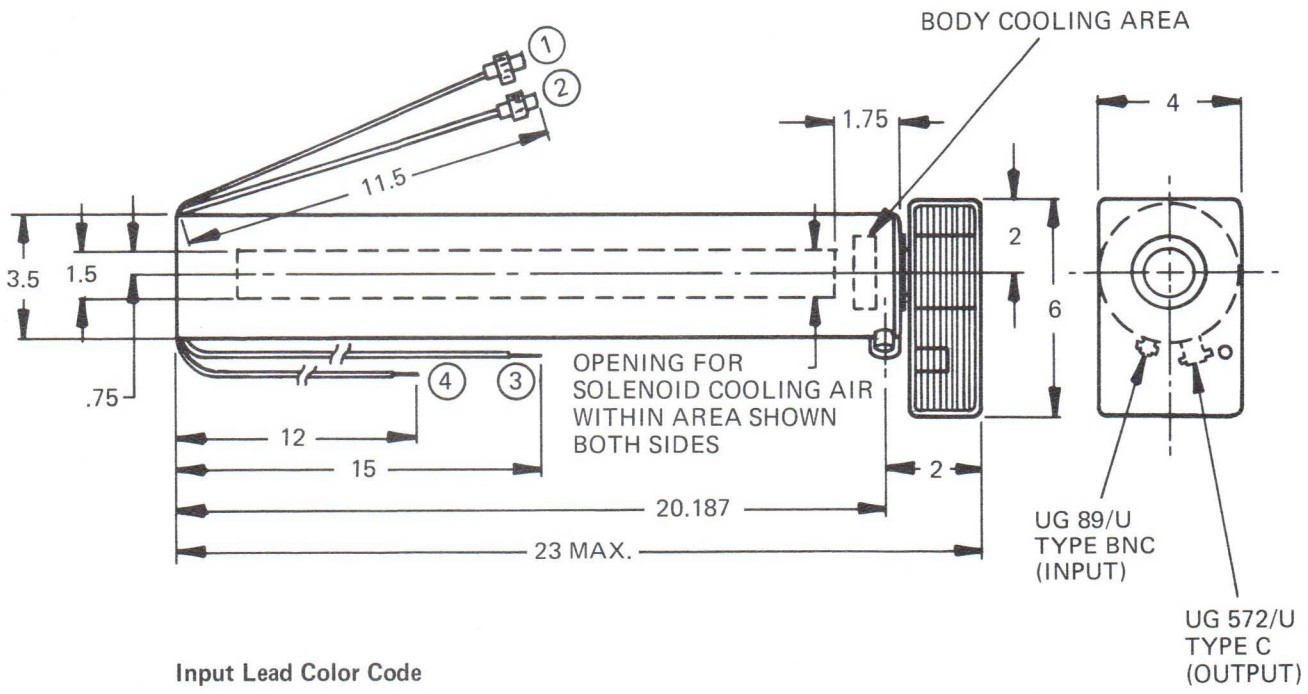
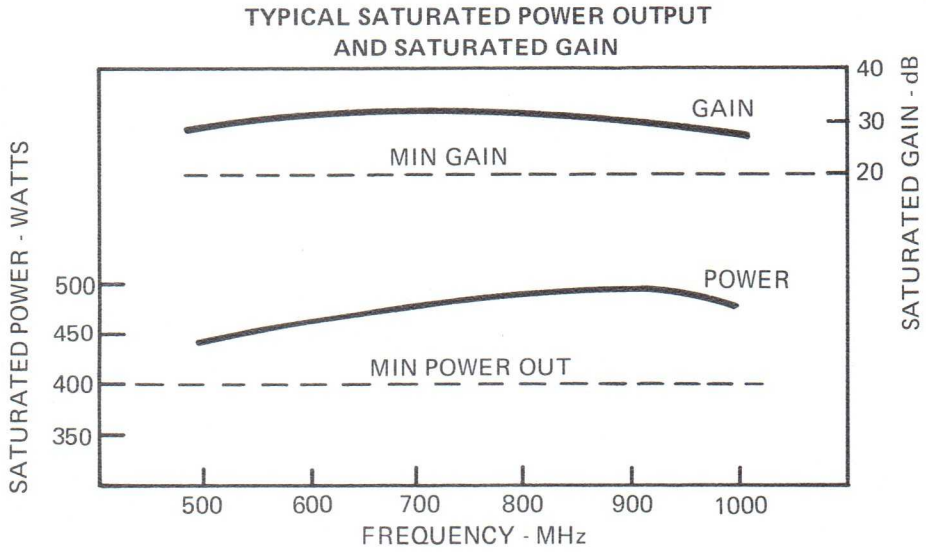
OUTLINE DRAWING



Input Lead Color Code

1. Yellow: Heater Cathode
2. Brown: Heater
3. White-Red: Positive Solenoid
4. White-Black: Negative Solenoid

TYPICAL PERFORMANCE CURVE



MA-2030

High Power TWT

Bulletin 1865

Microwave Associates, Inc.
Burlington
Massachusetts
Tel. (617) 272-3000
Western Union Fax
TWX: 710-332-6789
Telex: 94-9464

MA-2030 High Power TWT

DESCRIPTION

The MA-2030 features metal-ceramic construction and utilizes a high density hollow electron beam coupled with solenoid focusing to provide efficient performance in a compact package. This design features a non-intercepting modulating anode for control of duty cycle up to 100%.

APPLICATIONS

The high power output and octave bandwidth makes the MA-2030 suitable for operation in ECM systems or as a driver or intermediate amplifier for megawatt radar systems.

SPECIFICATIONS

Electrical Characteristics

Frequency Range	600-1200 MHz
Duty Cycle	100%
Output Power, Saturated	1000 W
Gain, Saturated	26 dB

Power Supply Requirements

Element	Voltage	Current Max.
Heater	12.6 V	2.8 A
Helix	2750 Vdc	
Cathode		1.8 Adc
Anode	2750 Vdc	

Mechanical Characteristics

Size	Refer to Outline Drawing
Weight	23 lbs.
RF Connectors	
Input	Type SMA
Output	1 5/8 EIA
High Voltage Leads	Flexible
Cooling	Liquid

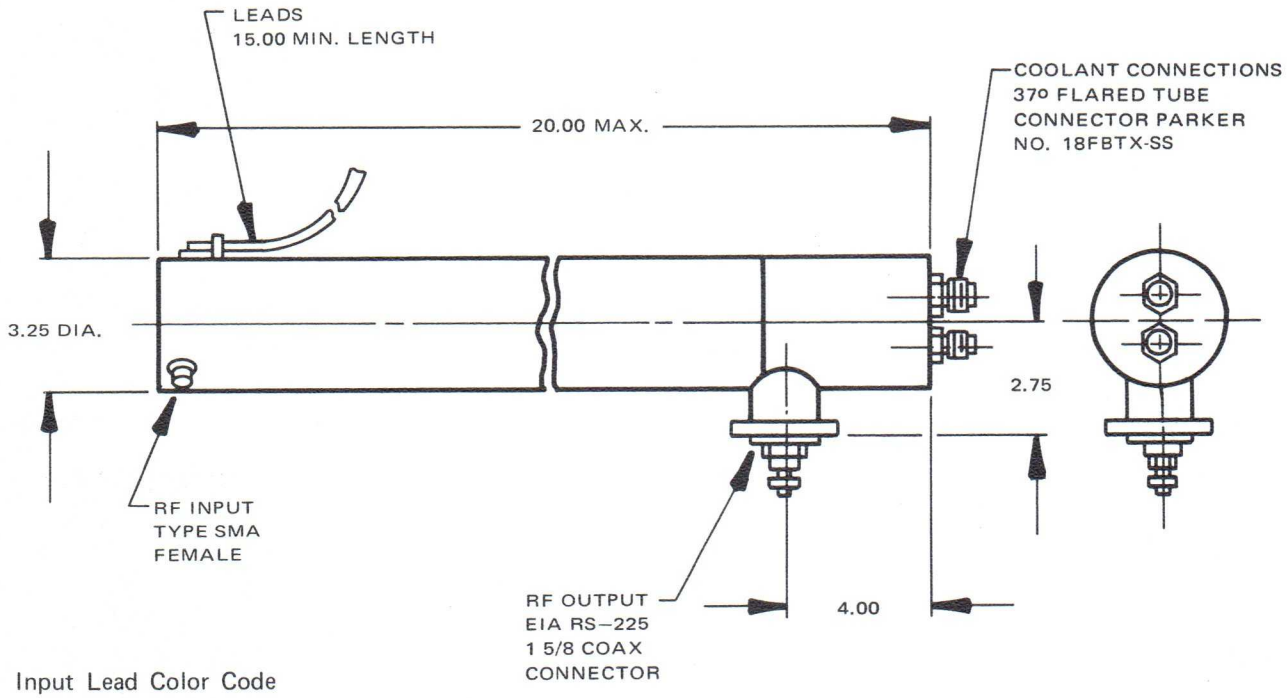
NOTES

1. All tube electrode voltages are with respect to cathode. Helix at ground level.
2. The Helix and/or solenoid voltages may be adjusted to maximize RF performance for a given bandwidth in the frequency range specified.
3. Data contained in this bulletin subject to modification and should not be used for final equipment design.

All specifications are subject to change without notice.

10/70 Printed in U.S.A.

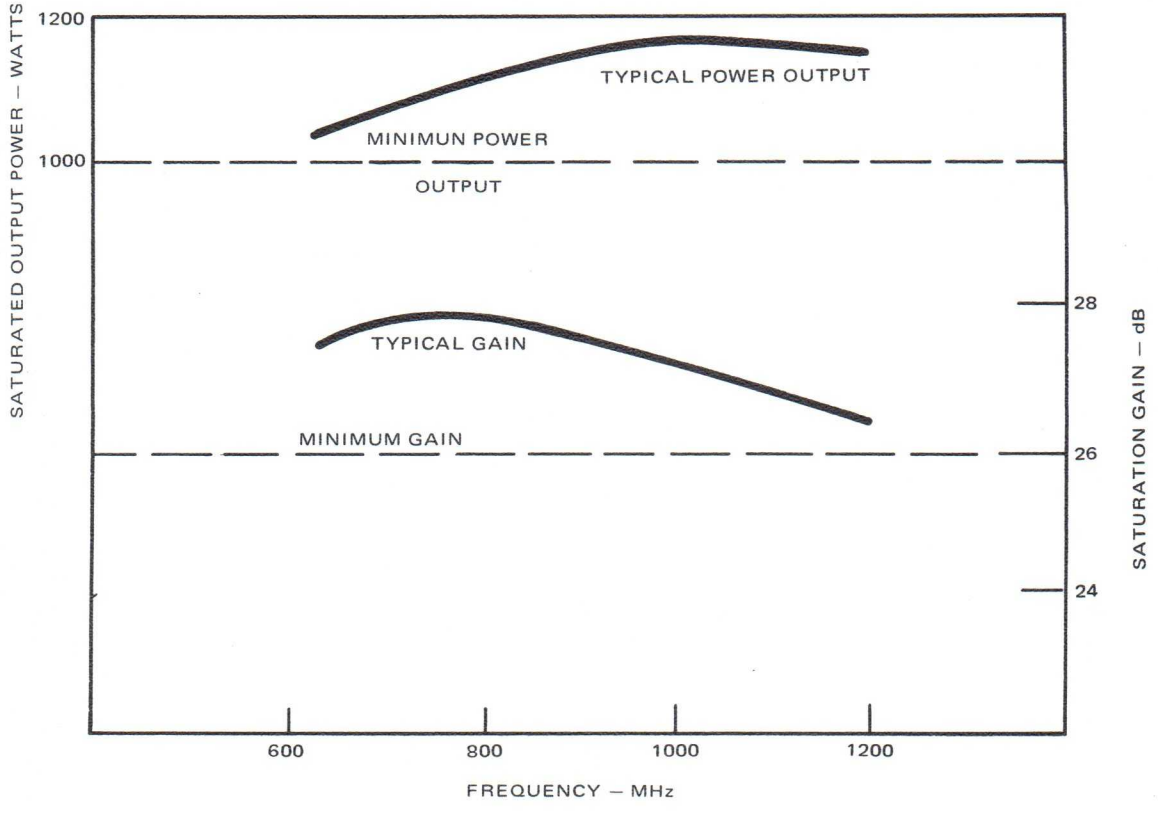
OUTLINE DRAWING



Input Lead Color Code

Ground - Black
Solenoid(+) - Red/Orange
Solenoid(-) - Black/Orange
Cathode - Heater - Yellow
Heater - Brown
Anode - Green

TYPICAL PERFORMANCE CURVE



MA-2019

CW Traveling Wave Tube

Bulletin 1866

Microwave Associates, Inc.
Burlington
Massachusetts
Tel. (617) 272-3000
Western Union Fax
TWX: 710-332-6789
Telex: 94-9464

MA-2019 CW Traveling Wave Tube

DESCRIPTION

The MA-2019 TWT features metal-ceramic construction and utilizes a high perveance hollow electron beam to provide efficient performance in an extremely compact package.

APPLICATIONS

The high CW power output and octave bandwidth makes the MA-2019 ideally suited for operation in ECM systems or as a driver or intermediate amplifier in megawatt radar systems.

SPECIFICATIONS

Electrical Characteristics

Frequency Range	700-1400 MHz
Duty Cycle	100%
Output Power, Saturated	1800 W
Gain, Saturated	26 dB

Power Supply Requirements

Element	Voltage	Current Max.	Power
Heater	12.6 V	2.8 A Max.	
Collector	3400 Vdc	2.1 Adc	
Helix	3600 Vdc	40 mAdc	
Solenoid			750 W

Mechanical Characteristics

Size	See Outline Drawing
Weight	24 lbs.
Cooling	Liquid
High Voltage Leads	Flexible
RF Connectors:	
Input	Type SMA
Output	1 5/8 EIA

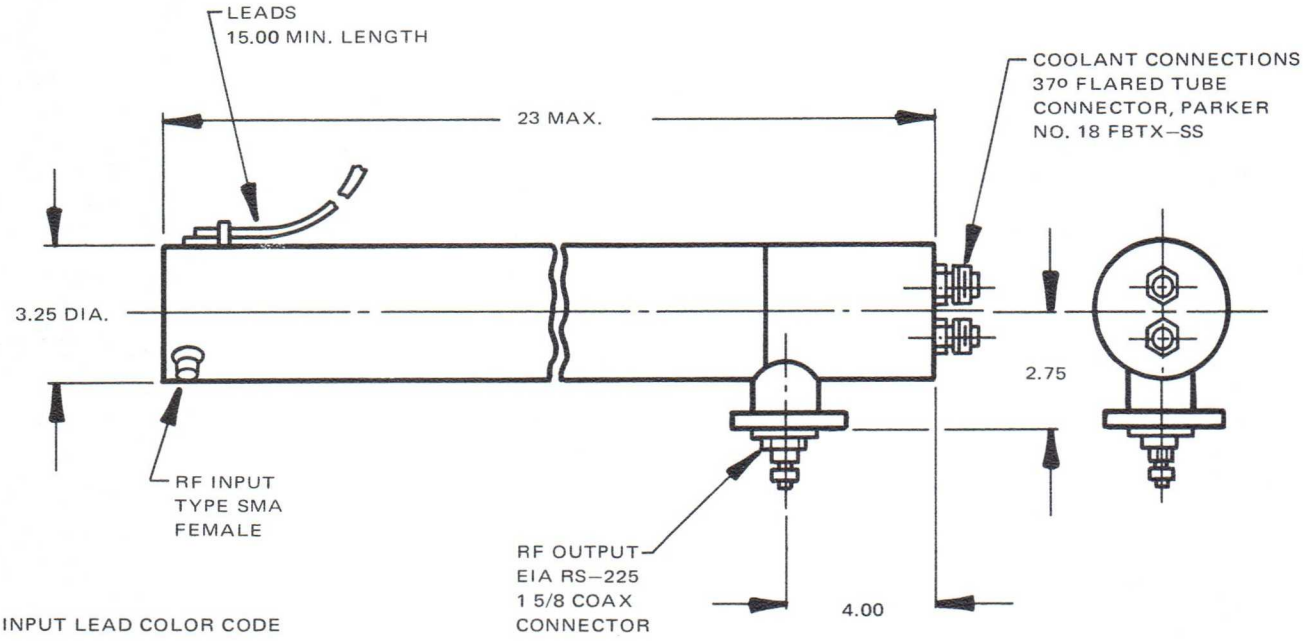
Environmental Characteristics

Airborne environment

NOTES

1. All tube electrode voltages are with respect to the cathode. Helix at ground potential.
2. This type can be supplied with integral heat sink cooling for short term operation.

OUTLINE DRAWING

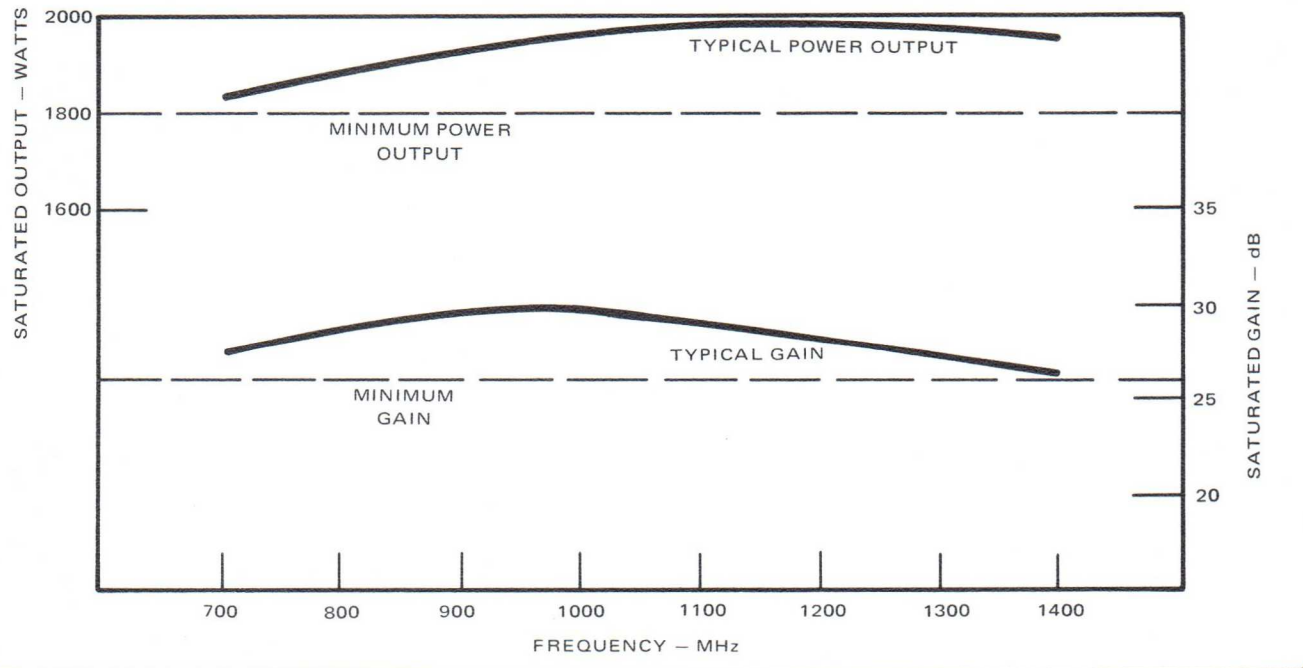


INPUT LEAD COLOR CODE

COLLECTOR – RED
GROUND – BLACK
SOLENOID (+) – WHITE/RED
SOLENOID (–) – WHITE/BLACK
CATHODE–HEATER – YELLOW
HEATER – BROWN

ALL DIMENSIONS IN INCHES

TYPICAL PERFORMANCE CURVE



MA-2019

CW Traveling Wave Tube

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Microwave Associates, Inc.
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Western Union Fax
TWX: 710-332-6789
Telex: 94-9464

MA-2019 CW Traveling Wave Tube

DESCRIPTION

The MA-2019 TWT features metal-ceramic construction and utilizes a high perveance hollow electron beam to provide efficient performance in an extremely compact package.

APPLICATIONS

The high CW power output and octave bandwidth makes the MA-2019 ideally suited for operation in ECM systems or as a driver or intermediate amplifier in megawatt radar systems.

SPECIFICATIONS

Electrical Characteristics

Frequency Range	.700-1400 MHz
Duty Cycle	100%
Output Power, Saturated	1800 W
Gain, Saturated	26 dB

Power Supply Requirements

Element	Voltage	Current Max.	Power
Heater	12.6 V	2.8 A Max.	
Collector	3400 Vdc	2.1 Adc	
Helix	3600 Vdc	40 mAdc	
Solenoid			750 W

Mechanical Characteristics

Size	See Outline Drawing
Weight	24 lbs.
Cooling	Liquid
High Voltage Leads	Flexible
RF Connectors:	
Input	Type SMA
Output	1 5/8 EIA

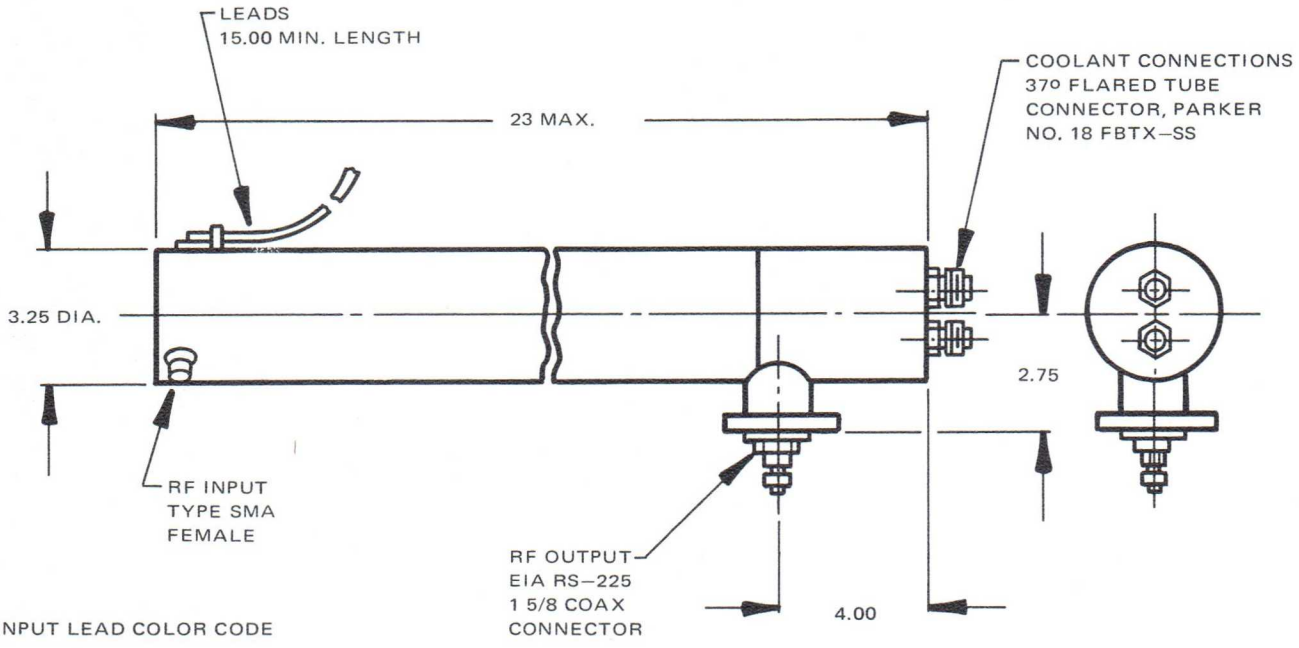
Environmental Characteristics

Airborne environment

NOTES

1. All tube electrode voltages are with respect to the cathode. Helix at ground potential.
2. This type can be supplied with integral heat sink cooling for short term operation.

OUTLINE DRAWING

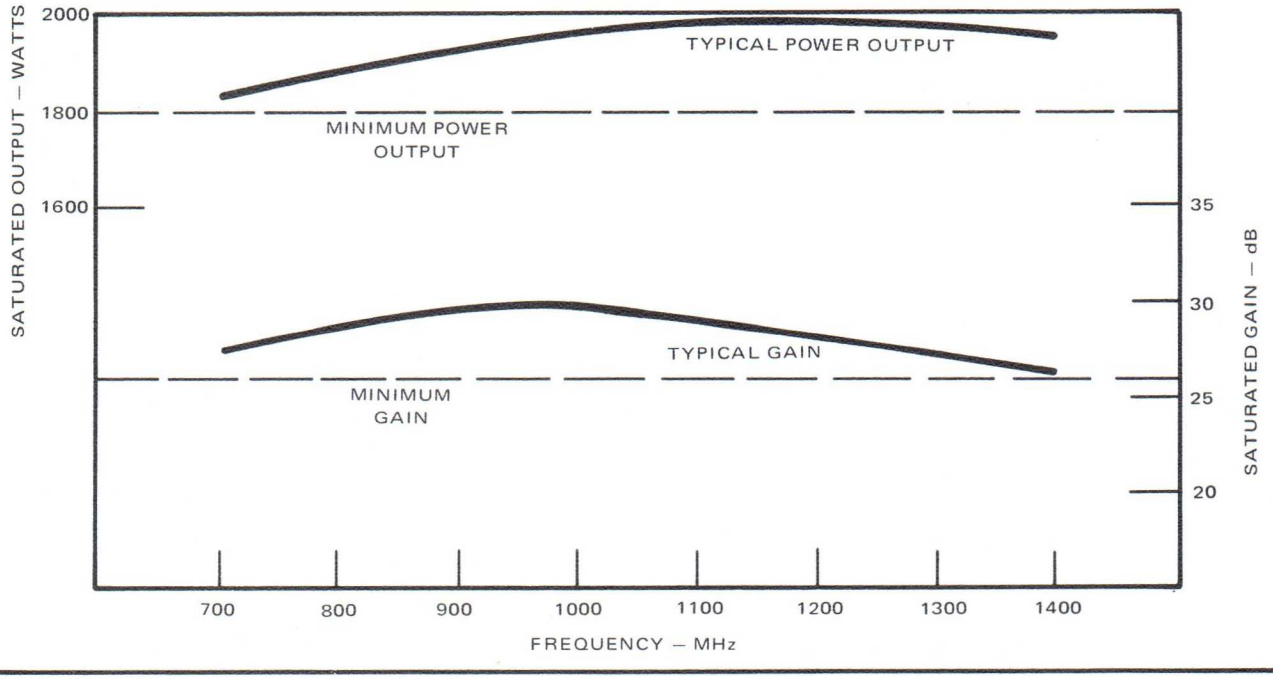


INPUT LEAD COLOR CODE

COLLECTOR – RED
GROUND – BLACK
SOLENOID (+) – WHITE/RED
SOLENOID (–) – WHITE/BLACK
CATHODE–HEATER – YELLOW
HEATER – BROWN

ALL DIMENSIONS IN INCHES

TYPICAL PERFORMANCE CURVE



MA-2032

Traveling Wave Tube

Bulletin 1867

Microwave Associates, Inc.
Burlington
Massachusetts
Tel. (617) 272-3000
Western Union Fax
TWX: 710-332-6789
Telex: 94-9464

MA-2032 Traveling Wave Tube

DESCRIPTION

The MA-2032 TWT features metal-ceramic construction and utilizes a hollow electron beam coupled with a solenoid to provide reliable and efficient performance in a compact package.

APPLICATIONS

The high power output makes the MA-2032 suitable for operation in ECM systems or as a driver or intermediate in megawatt radar systems.

SPECIFICATIONS

Electrical Characteristics

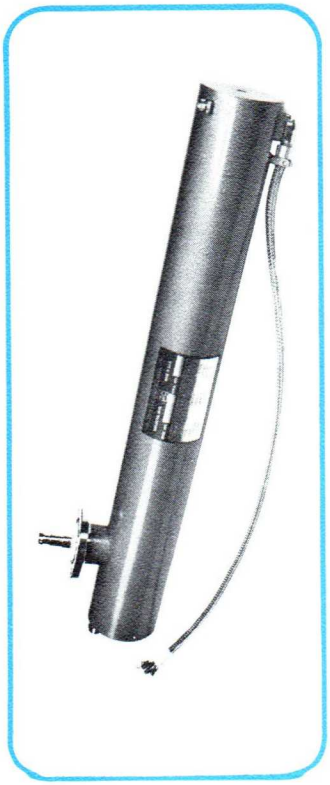
Frequency Range	1600 to 2500 MHz
Duty Cycle	100%
Output Power, Saturated	800 W
Gain, Saturated	24 dB

Power Supply Requirements

Element	Voltage	Power	Current Max.
Heater	12.6 V		2.0 A
Helix	4600 Vdc		30 mAdc
Cathode			1.3 Adc
Solenoid		1000 Wdc	

Mechanical Characteristics

Size	Refer to outline drawing
Weight	35 lbs.
RF Connectors	
Input	Type TNC
Output	7/8 Coax EIA
High Voltage Leads	Flexible
Cooling	Liquid
Mounting Position	Any



All specifications are subject to change without notice.

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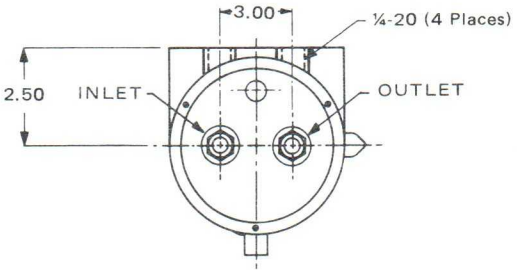
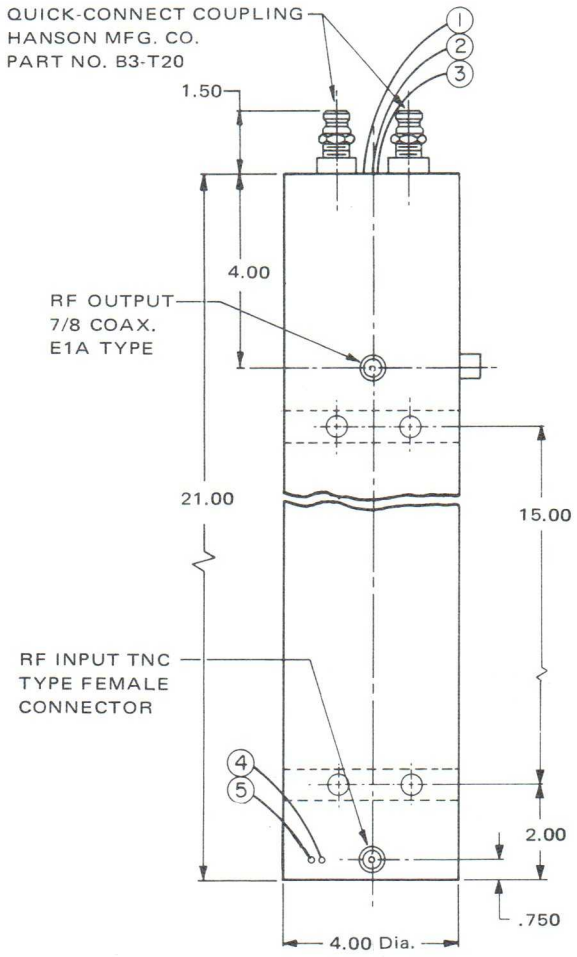
OUTLINE DRAWING





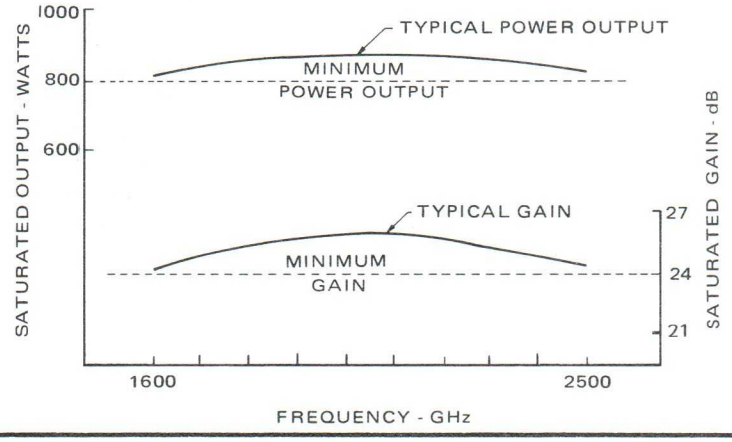
Notes:

1. All tube electrode voltages are with respect to the cathode. Helix at ground potential.
2. The helix and/or solenoid voltages may be adjusted to maximize R.F. performance for a given bandwidth within the specified frequency range.
3. Data contained in this bulletin subject to modification.

Input Lead Color Code:

1. Ground - Black
2. Solenoid (+) - White-Red
3. Solenoid (-) - White-Black
4. Cathode-Heater - Yellow
5. Heater - Brown

TYPICAL PERFORMANCE CURVE



MA-2038

CW S-Band TWT

Bulletin 1868

Microwave Associates, Inc.
Burlington
Massachusetts
Tel. (617) 272-3000
Western Union Fax
TWX: 710-332-6789
Telex: 94-9464

MA-2038 CW S-Band TWT

DESCRIPTION

The MA-2038 traveling wave tube is a highly efficient and reliable CW power amplifier featuring metal-ceramic construction. This tube utilizes a solenoid focused hollow electron beam and an efficient liquid cooling design which will assure long life performance. The non-intercepting anode may be used to modulate or cut-off the beam and hence the output power.

APPLICATIONS

The high power output and broadband characteristics of the MA-2038 makes this device particularly suited for electronic countermeasures (ECM) or transmitter applications and broadband testing of components.

SPECIFICATIONS

Electrical Characteristics

Frequency Range	2500 to 3500 MHz
Duty Cycle	100%
Output Power, Saturated	1.0 kW, Min.
Gain, Saturated	25 dB, Min.

Power Supply Requirements

Element	Voltage	Current, Max.	Power
Heater	12.6 ± 5% V	3.5 A	
Helix	8000 V	25 mA	
Anode	0 to 8000 V	15 mA	
Collector	7500 V	1100 mA	
Solenoid			800 W

Mechanical Characteristics

Size	Refer to Outline Drawing
Weight	25 lbs.
RF Connectors	
Input	Type SMA
Output	1 1/4 Coaxial
High Voltage Leads	Flexible
Mounting Position	Any

Environmental Characteristics

Temperature Range	−54°C to +110°C
Vibration (@ 500 cps)	10 G
Shock (@ 11 ms)	15 G
Altitude	50,000 ft.
Cooling	Liquid

NOTES

1. All tube electrode voltages are with respect to the cathode. Helix at ground potential.
2. The helix, collector, and/or solenoid voltages may be adjusted to maximize RF performance for a given bandwidth within the specified frequency range.
3. Other types of input, output, and/or cooling connections can be provided to mate with system requirements.

All specifications are subject to change without notice.

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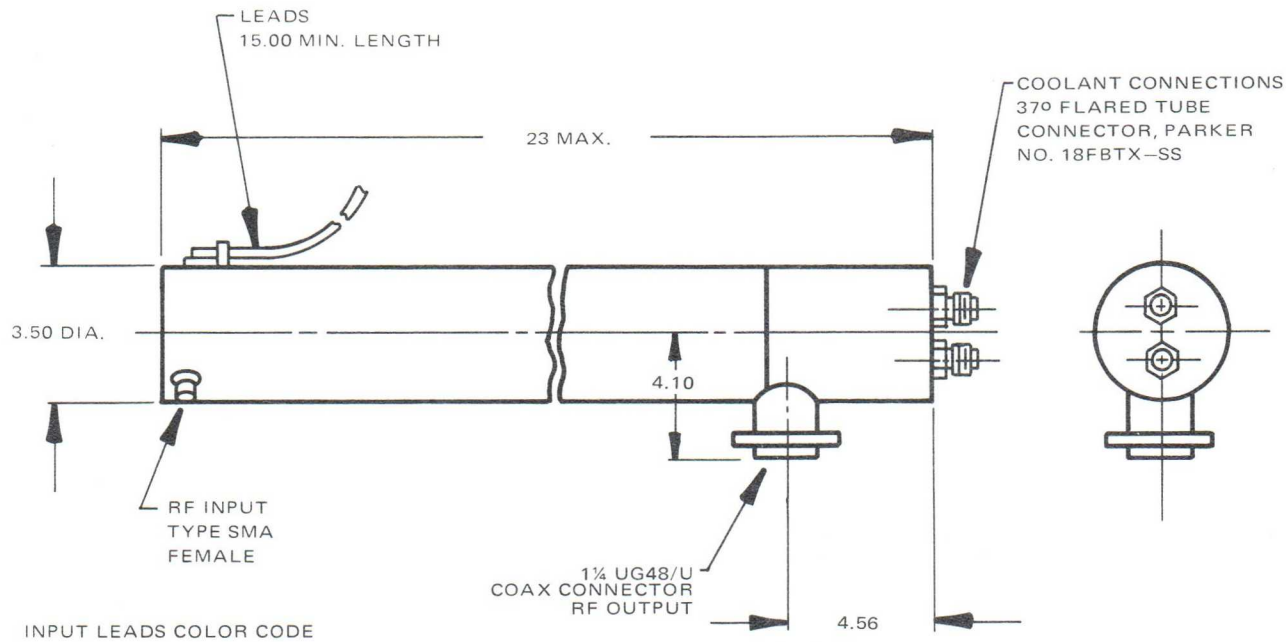
OUTLINE DRAWING

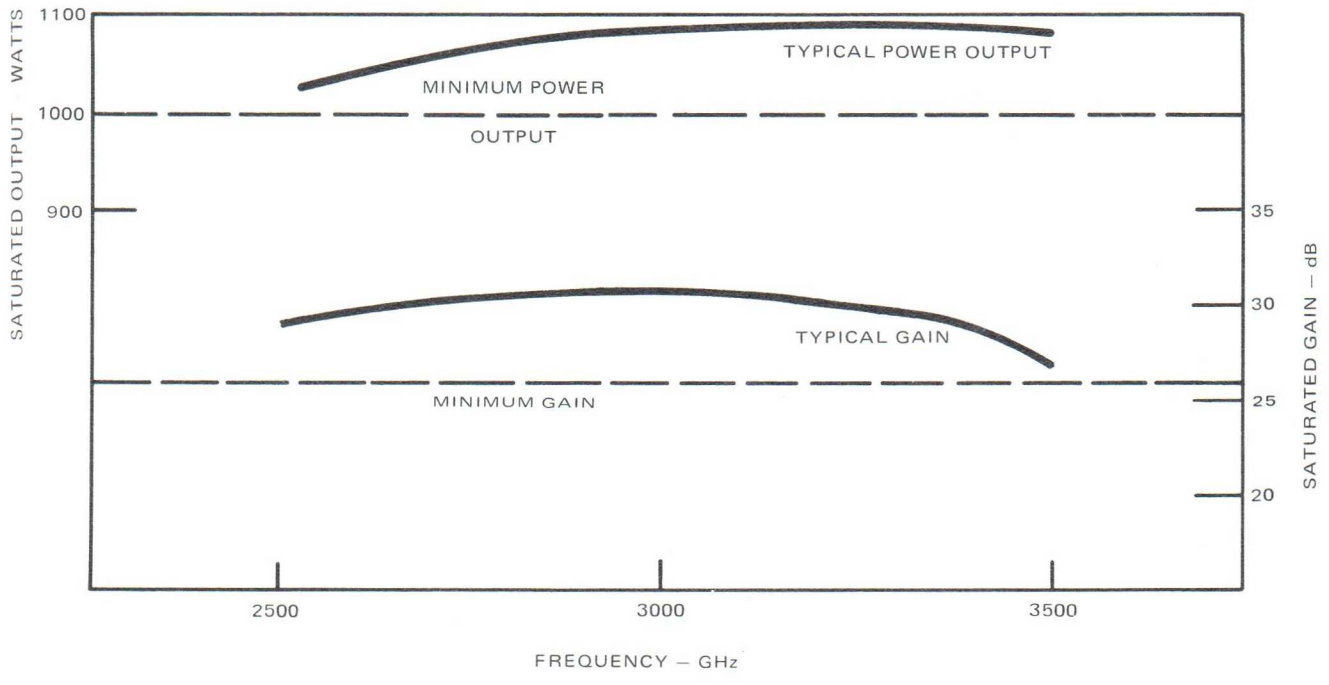


INPUT LEADS COLOR CODE

COLLECTOR – RED
GROUND – BLACK
SOLENOID (+) – WHITE/RED
SOLENOID (–) – WHITE/BLACK
CATHODE–HEATER – YELLOW
HEATER – BROWN
ANODE – GREEN

NOTE: DINEMSIONS IN INCHES

TYPICAL PERFORMANCE CURVE



Bulletin 1869

Microwave Associates, Inc.
Burlington
Massachusetts
Tel. (617) 272-3000
Western Union Fax
TWX: 710-332-6789
Telex: 94-9464

MA-2055 CW L-Band TWT

DESCRIPTION

The MA-2055 traveling wave tube is a broadband CW power amplifier. The tube utilizes a hollow electron beam focused by an integral solenoid. A non-intercepting anode may be used to modulate or cut off the beam and hence the output power. The tube features metal-ceramic construction and efficient liquid cooling for long life and high reliability.

SPECIFICATIONS

Electrical Characteristics

Frequency Range	1000 to 2500 MHz
Duty Cycle	Up to 100%
Output Power	1500 Watts Min.; 2000 Watts Typical
Gain at Rated Power	26 dB Nominal

Power Supply Requirements

Heater Supply	12.6V ±5% @1.2A
Helix Supply	5700V-6100V ±1% @50 mA Max.
Collector Supply	5800V ±5% @1.4A
Solenoid Supply	60V @16 ±1A

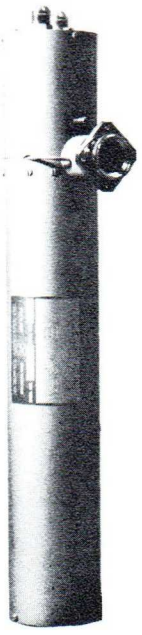
Helix and collector voltages referenced to cathode, helix at ground potential, collector isolated.

Mechanical Characteristics

Size	25" Long x 3.25" Diameter
Weight	33 Lbs. Including Solenoid
High Voltage Leads	Flexible
RF Connectors	
Input	Type SMA
Output	1" Coax.
Mounting Position	Any

Environmental Characteristics

Ambient Temperature Range	
Non-Operating	-54°C to +110°C
Operating	To +110°C
Coolant Temperature Range	
Operating	To +110°C
Suggested Coolant	Monsanto Coolanol 35 (TM), 3.0 gal/min.
Vibration	15 g's
Shock	15 g's
Altitude	50,000 Ft.



All specifications are subject to change without notice.

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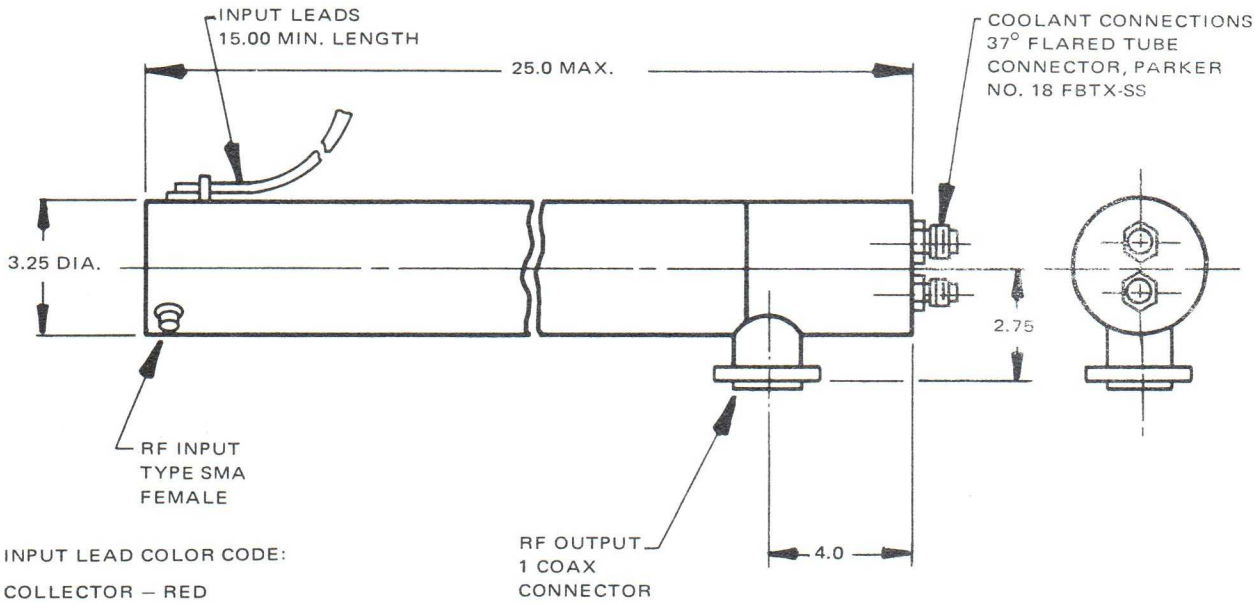
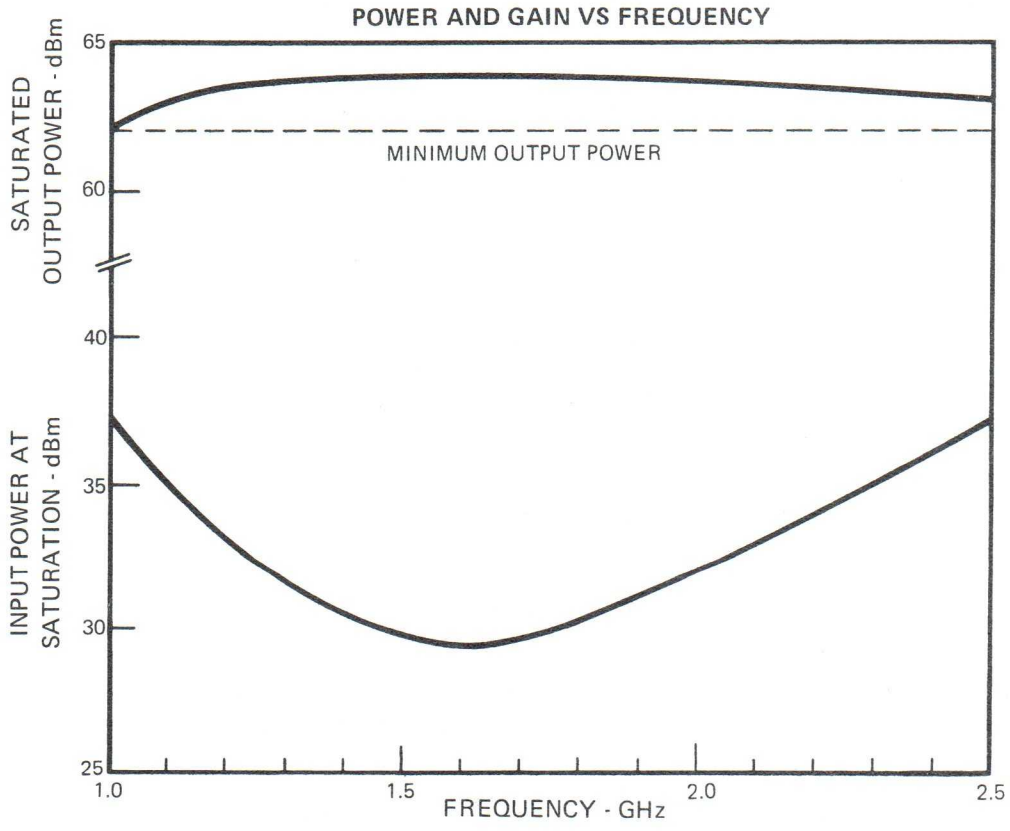
OUTLINE DRAWING



INPUT LEAD COLOR CODE:

COLLECTOR – RED
GROUND – CASE
SOLENOID (+) – WHITE/RED
SOLENOID (–) – WHITE/BLACK
CATHODE–HEATER – YELLOW
HEATER – BROWN
ANODE – GREEN

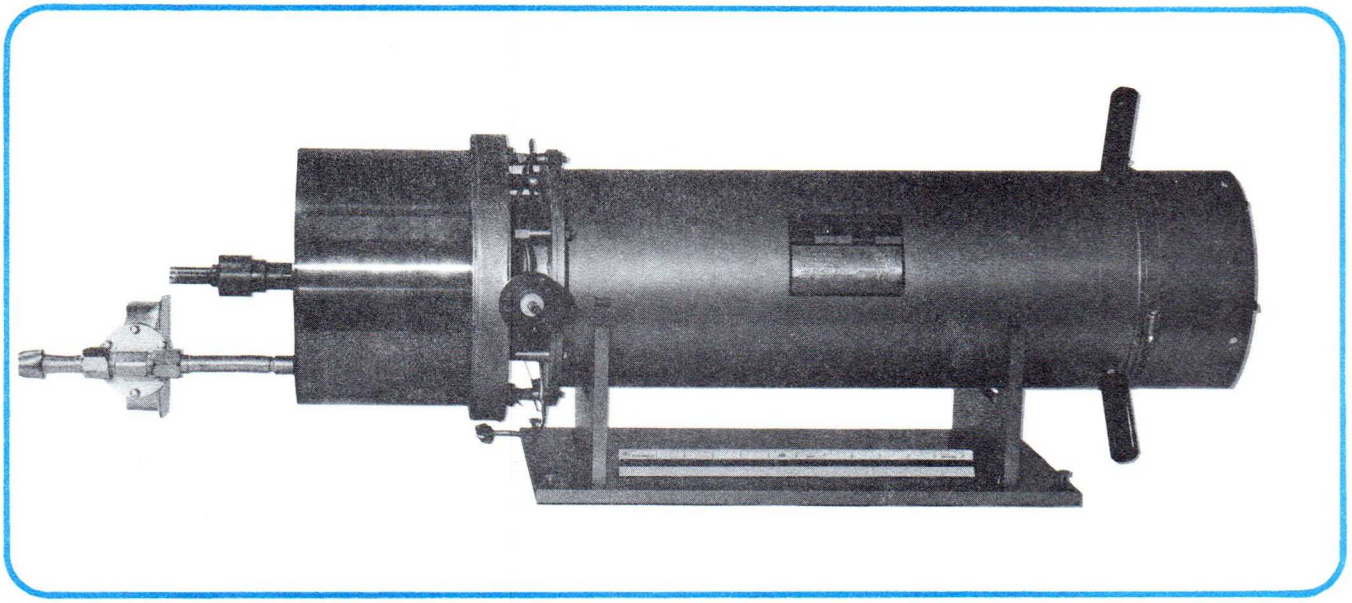
TYPICAL PERFORMANCE CURVES



MA-2050 TWT

HIGH CW POWER

Bulletin 1870



DESCRIPTION

The MA-2050 is a very high CW power traveling wave amplifier tube. This tube will deliver 10 kilowatts CW over the frequency band of 200-400 MHz with a gain of 10 dB. As a power booster, it can amplify the signals provided by a driver tube such as the 1 kW MA-2015.

FEATURES

- Hollow electron beam
- Solenoid focusing
- Exceptionally good thermal characteristics
- Liquid cooling
- Metal ceramic construction

Microwave Associates, Inc. Burlington, Massachusetts Tel. (617) 272-3000

Western Union Fax
TWX: 710-332-6789
Telex: 94-9464

SPECIFICATIONS

Typical RF Performance Data

Frequency Range	200-400 MHz
Duty Cycle	100%
Saturated Output Power	10,000 Watts
Gain at Saturation	10 dB

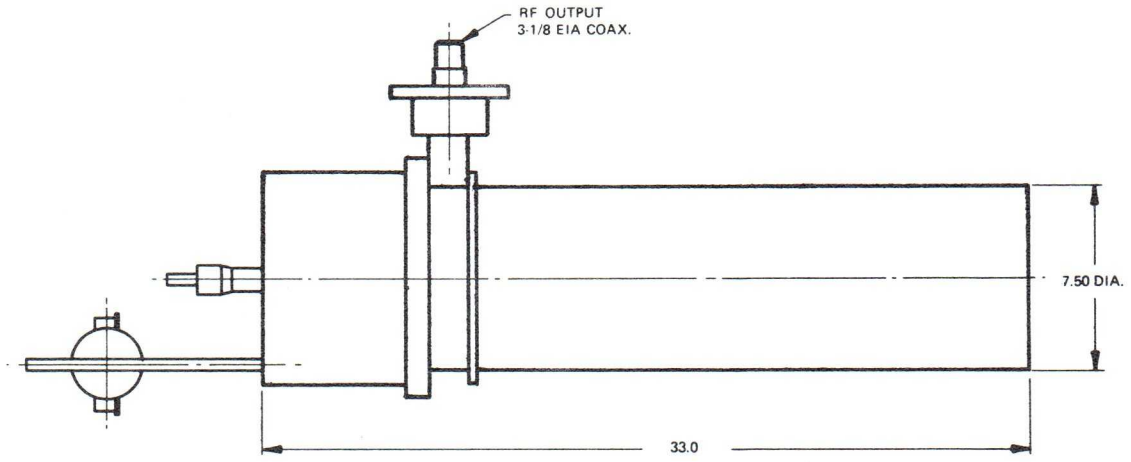
Power Supply Requirements

Element	Voltage	Current	Power
Heater	30 V dc	5.0 A	
Helix	9000 V dc	30 mA dc	
Collector	8000 V dc	8.5 A dc	
Solenoid			2500 W

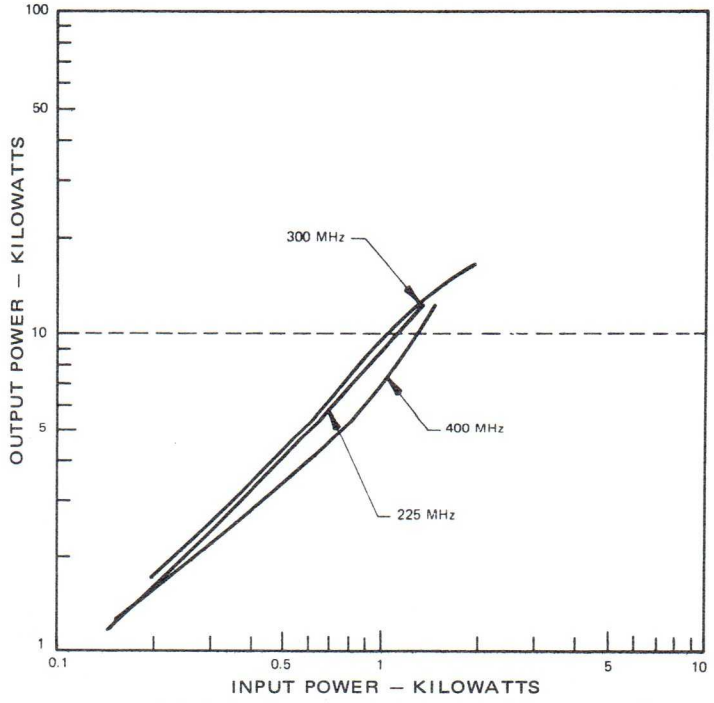
Mechanical Characteristics

Cooling	Water, 30 GPM @ 30 PSI
Dimensions	See Outline Drawing
Weight	100 Lbs.
Connectors:	
Input	7/8 Coax.
Output	3-1/8 Coax.
High Voltage Leads	Flexible

OUTLINE DRAWING



TYPICAL PERFORMANCE CURVE



OUTPUT POWER VS. INPUT POWER – MA-2050

All specifications are subject to change without notice.

8/72 Printed in U.S.A.

MA-2047 Broadband Electron Beam, Switch Modulators

DESCRIPTION

The MA-2047 is one of a series of PPM focused electron beam switch modulator (EBSM) tubes. These devices are basically low gain traveling wave tubes with carefully controlled grid characteristics. EBSM tubes can be switched in nanoseconds over a dynamic range of more than 60 dB. All units meet the requirements of Mil-E-5400.

APPLICATIONS

This series of broadband TWT's are particularly suited for electronic counter-measures (ECM) and airborne applications where rapid switching (10 ns, max.) and controlled modulation characteristics are design requirements.

SPECIFICATIONS

Electrical Characteristics

Frequency Range	7.6-16.0 GHz
Duty Cycle	0 to 10%
Power Input CW	0.2 Watts, Max.
Power Output, Peak Pulsed	0.25 Watts, Max.
Switching Time	10 ns, Max.
Attenuation	0 to 60 dB, Min.

Operating Conditions

Element	Voltage Range	Current, Max.
Heater	6.3 V	0.4 A
Helix	2300 V	
Grid	−70 to 0 V	50 μA
Grid (cathode capacitance including flying leads)		20 pF
Cathode		15 mA

Mechanical Characteristics

Size	Refer to Outline Drawing
Weight (Approx.)	10.0 oz.
R.F. Connectors: Input and Output	SMA
High Voltage Leads	Flexible
Mounting Position	Any

Environmental Characteristics

Temperature Range	−54°C to +100°C

NOTE:

1. All tube electrode voltages are with respect to the cathode. Helix is at ground potential.

All specifications are subject to change without notice.

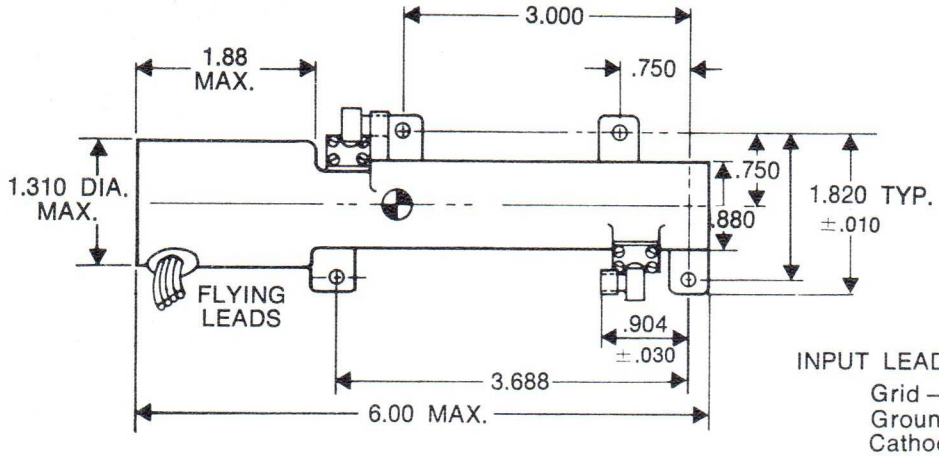
MA-2047
Broadband Electron Beam, Switch Modulators

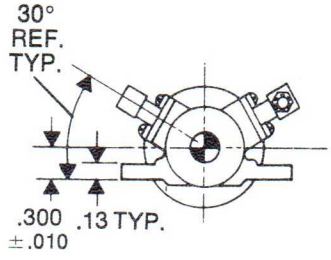
Bulletin 1871

Microwave Associates, Inc.
Burlington
Massachusetts
Tel. (617) 272-3000
Western Union Fax
TWX: 710-332-6789
Telex: 94-9464

2/72 Printed in U.S.A.

OUTLINE DRAWING



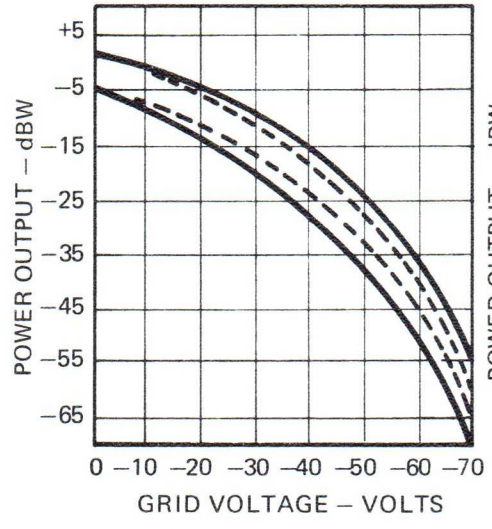


INPUT LEAD COLOR CODE

Grid — Green
Ground — Black
Cathode-heater — Yellow
Heater — Brown

TYPICAL PERFORMANCE CURVES

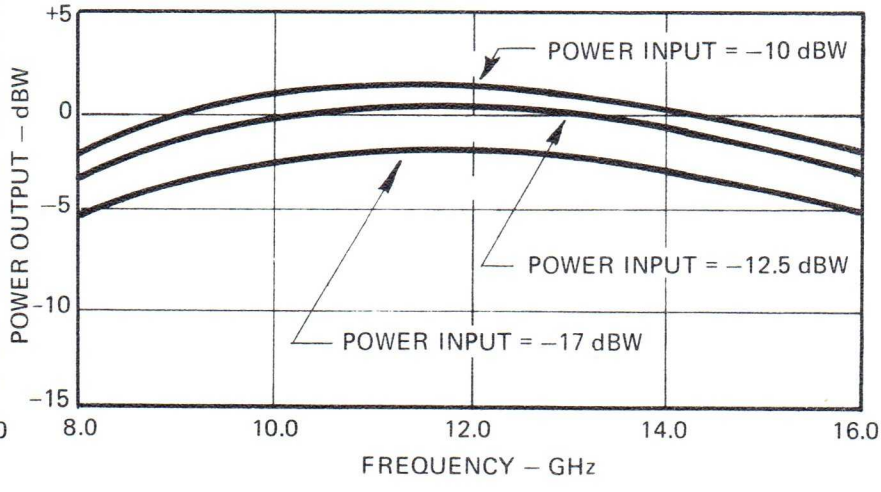
POWER OUTPUT VS. GRID VOLTAGE FOR ANY INPUT POWER LEVEL BETWEEN –10 dBW AND –17 dBW AT ANY FREQUENCY IN THE BAND



EXTREME VARIATION MEASURED IN LARGE SAMPLE OF TUBES

TYPICAL VARIATION MEASURED IN A SINGLE TUBE

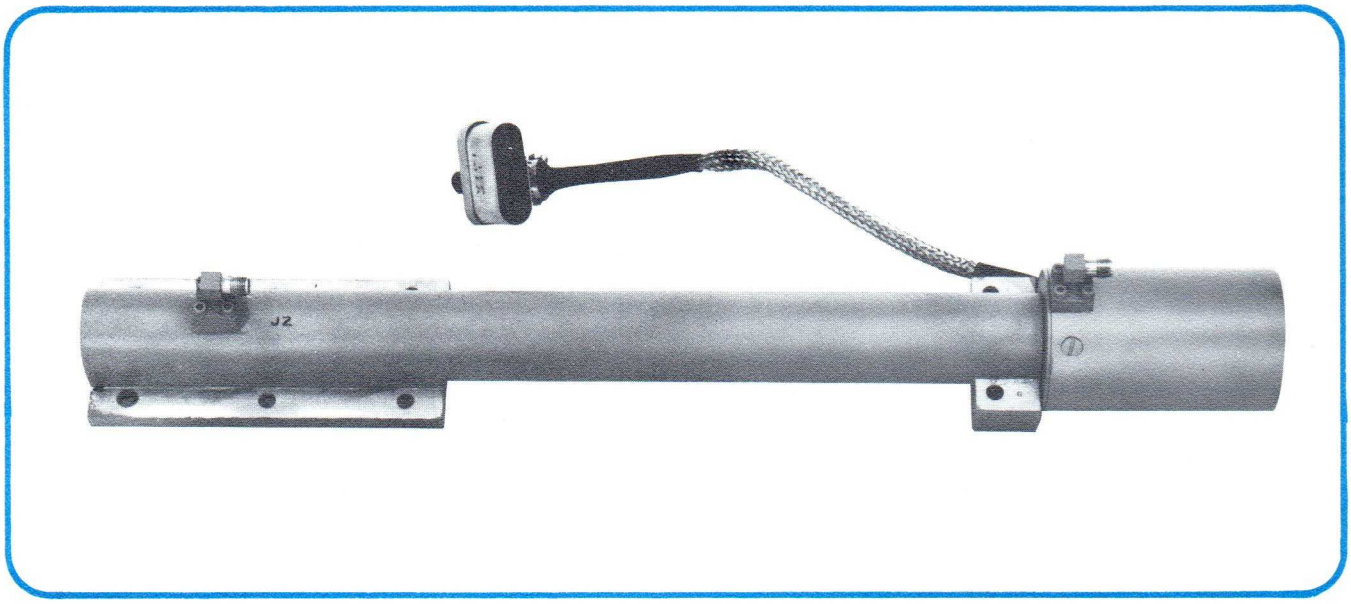
POWER OUTPUT VS. FREQUENCY FOR THREE DRIVE LEVELS



MA-2063 TWT

MEDIUM CW POWER

Bulletin 1872



DESCRIPTION

The MA-2063 is a very broadband medium power traveling wave tube. This tube delivers 5 watts of CW power over a 1-1/4 octave bandwidth. The MA-2063 utilizes a PPM focused solid beam with a high mu control grid for gain control or gating.

FEATURES

- Broadband operation
- High mu control grid
- Conduction cooling
- Compact lightweight design

Microwave Associates, Inc. Burlington, Massachusetts Tel. (617) 272-3000

Western Union Fax
TWX: 710-332-6789
Telex: 94-9464

SPECIFICATIONS

RF Performance

Frequency	1.0-2.5 GHz	Gain:	
Output Power	5 W, Min.	At Saturation	33 dB
Input Power for Rated Output	1 mW, Max.	Small Signal	40 dB
		Duty Ratio	0-1.0

Power Supply Requirements

Element	Voltage	Current			
Heater	6.3 V ± 5%	1.5 A, Max.	Cathode	Reference	100 mA, Max.
Helix	1250 V	15 mA, Max.	Grid	75 V	25 mA, Max.

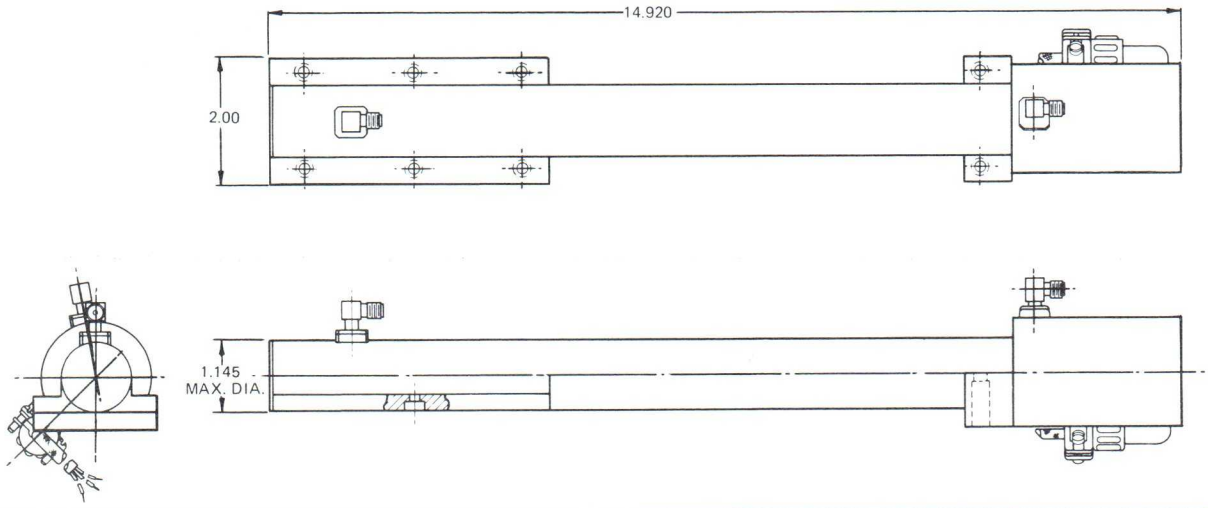
Mechanical Characteristics

Size	Approx. 15 x 2 x 2 Inches	Power Supply Leads	Flexible
Weight	4 lbs.	Mounting Position	Any
RF Connectors	SMA	Cooling	Conduction to Mounting Surfaces

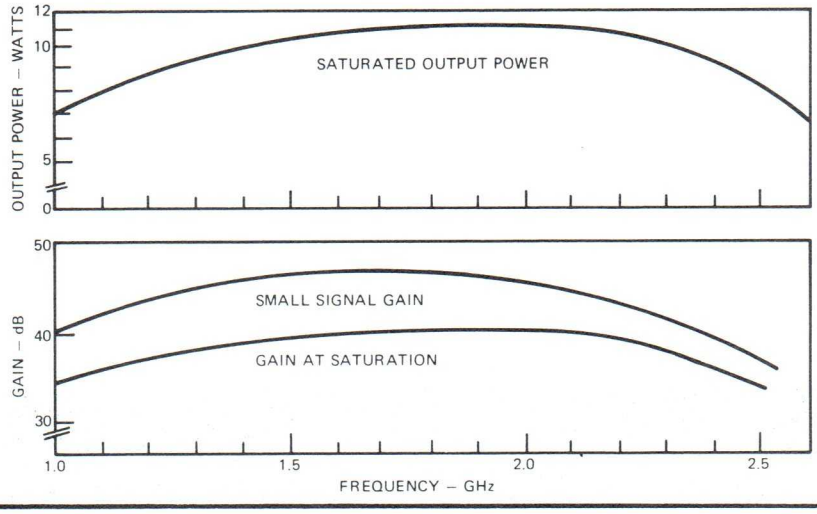
Environmental Characteristics

Temperature Range	−54 to +110°C	Shock	20 g's @ 11 ms
Vibration	15 g's to 500 Hz	Altitude	50,000 Ft.

OUTLINE DRAWING



TYPICAL PERFORMANCE CURVE

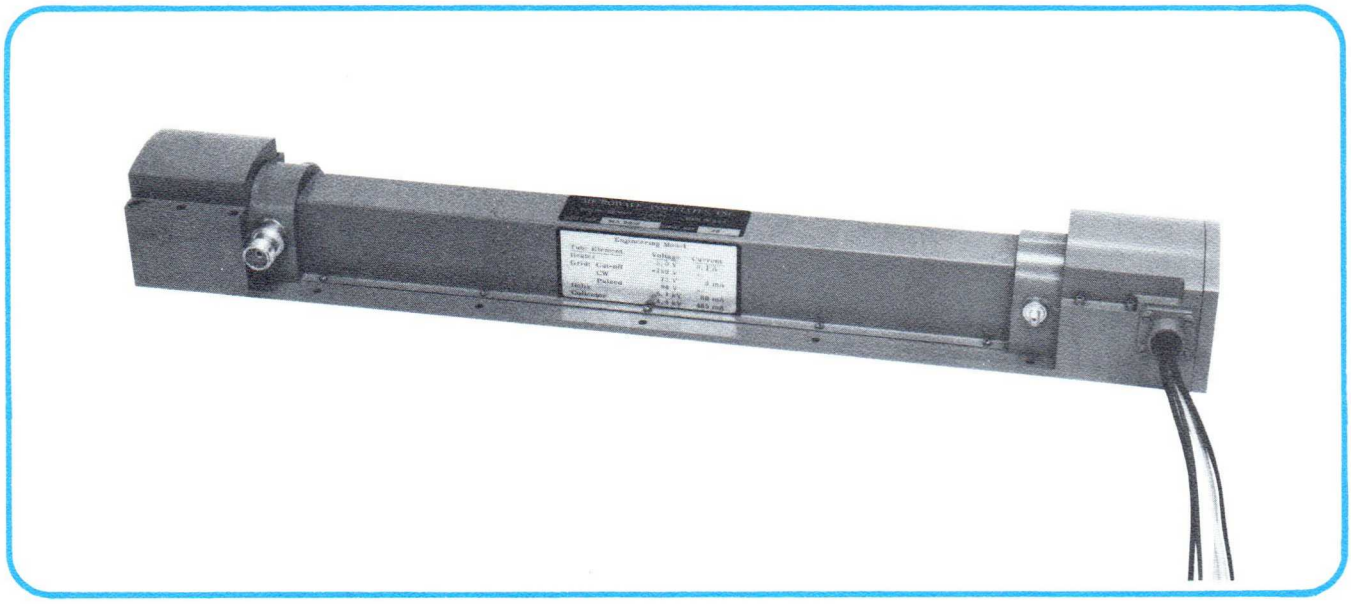


1/73 Printed in U. S. A.

MA-2064 TWT

HIGH CW POWER

Bulletin 1873A



DESCRIPTION

The MA-2064 is a high performance CW amplifier delivering 500 watts over the frequency range of 1.6 to 3.2 GHz. The saturated gain of the tube is 27 dB. The tube includes a non-intercepting control grid which permits gated or CW operation and an RF circuit of unique thermal capability.

FEATURES

- PPM focusing
- High mu non-intercepting control grid
- Conduction cooling
- Depressed collector
- Metal ceramic construction
- Designed for airborne environment

Microwave Associates, Inc. Burlington, Massachusetts Tel. (617) 272-3000
Western Union Fax
TWX: 710-332-6789
Telex: 94-9464

SPECIFICATIONS

Typical RF Performance

Frequency Range	1.6 to 3.2 GHz	Output Power, Saturated	500 W, Min.
Duty Cycle	0.1 to 100%	Gain, Saturated	27 dB, Min.

Power Supply Requirements

Element	Voltage	Current	Element	Voltage	Current
Heater	6.3 V	8.0 A	Grid, Cut-off	-150 V	0.0002 A
Helix	5.5 kV	0.050 A	Grid, CW Operation	+100 V	0.005 A
Collector	4.0 kV	0.540 A	Grid-to-Cathode Capacitance		55 pF

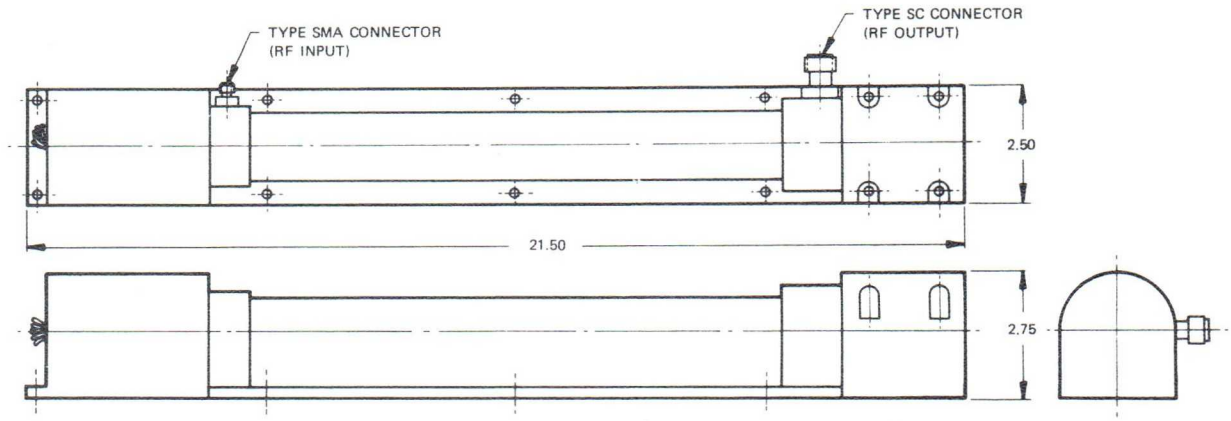
Mechanical Characteristics

Size	See Outline Drawing	RF Connectors:	
Weight	8.5 Lbs.	Input	SMA
Focusing	PPM	Output	S/C
Cooling	Conduction	Electrical Connectors	Flying Leads
	Max. Heat Sink Temperature 105°C	Mounting Position	Any

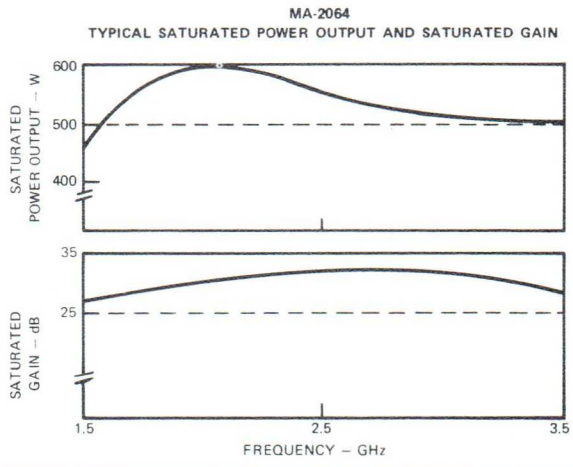
Environmental Characteristics

Applicable Military Spec.	MIL-E-5400, Class 1	Vibration (@ 500 cps)	10 G
Altitude	70,000 Ft.	Shock (@ 11 ms)	15 G

OUTLINE DRAWING



TYPICAL PERFORMANCE CURVES



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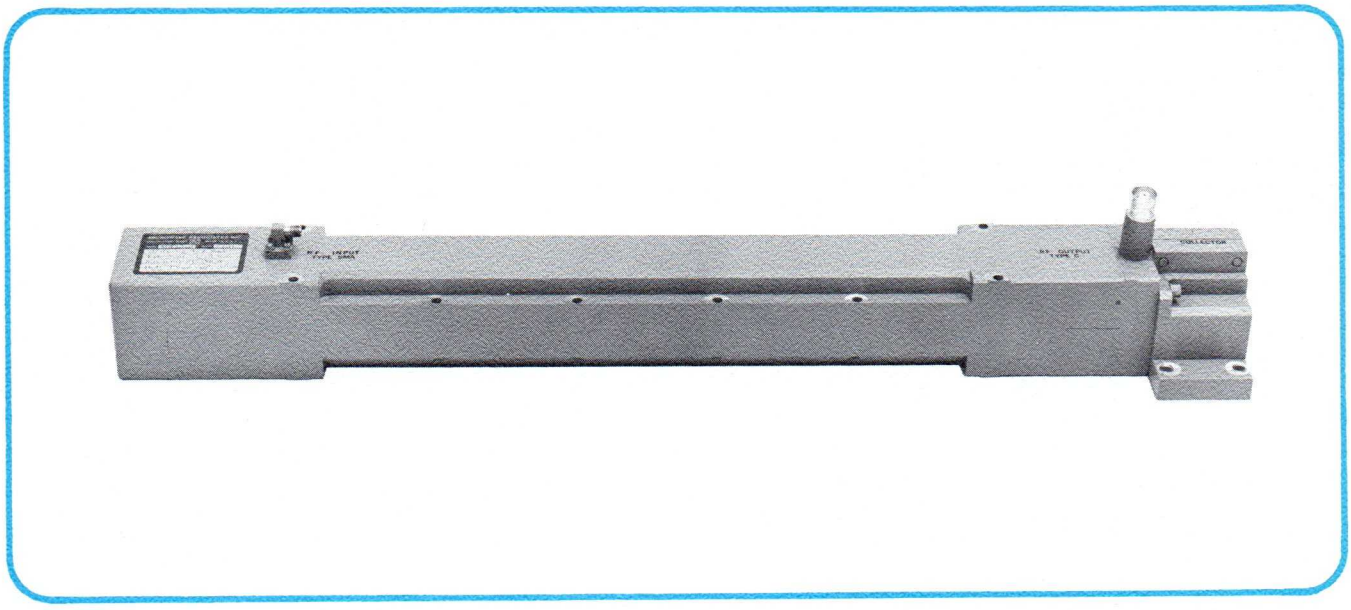
MA-2070 TWT

HIGH CW POWER

Bulletin 1874



DESCRIPTION

The MA-2070 is a high performance CW amplifier tube which delivers 450 W over the frequency range of 500-1000 MHz. The gain of the tube is 25 dB at rated power. The tube has a very compact conduction cooled package with an integral solenoid.

FEATURES

- Hollow electron beam
- Solenoid focusing
- Metal ceramic construction
- Conduction cooling
- Compact package
- Airborne environment

Microwave Associates, Inc. Burlington, Massachusetts Tel. (617) 272-3000

Western Union Fax
TWX: 710-332-6789
Telex: 94-9464

SPECIFICATIONS

Typical RF Performance

Frequency Range	500 to 1000 MHz
Duty Cycle	CW
Output Power	450 W, Min.
Gain at 450 W	25 dB, Min.

Power Supply Requirements

Element	Voltage	Current
Heater	12.6 V	3.0 A
Helix	2.2 kV	0.83 A
Solenoid	24 V	17 A
(30°C Heat Sink)		

Mechanical Characteristics

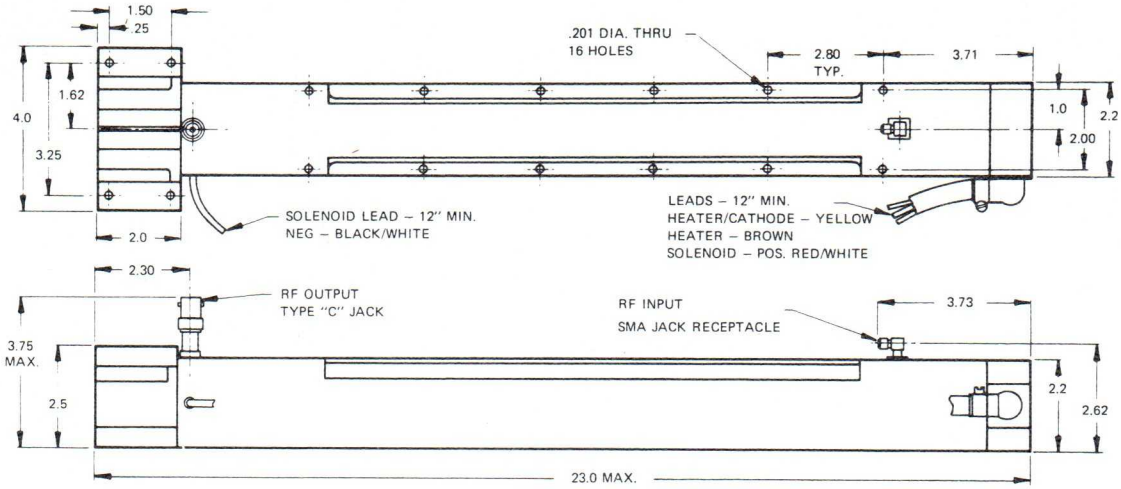
Size	See Outline Drawing
Weight	16 lbs.
Focusing	Solenoid, Internal
Cooling	Conduction to Heat Sink
	Max. Heat Sink Temperature 105°C

RF Connectors:	
Input	SMA
Output	C
Electrical Connectors	Flying Leads
Mounting Position	Any

Environmental Characteristics

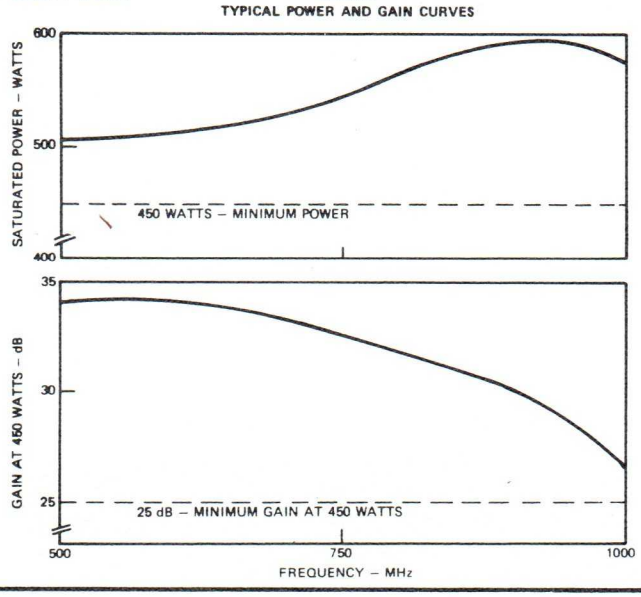
Applicable Military Spec.	MIL-E-5400, Class 1
Altitude	70,000 ft.
Vibration (@ 500 cps)	10 g's
Shock (@ 11 ms)	15 g's

OUTLINE DRAWING



NOTE:
1. WEIGHT – 16 LBS., MAX.

TYPICAL PERFORMANCE CURVES



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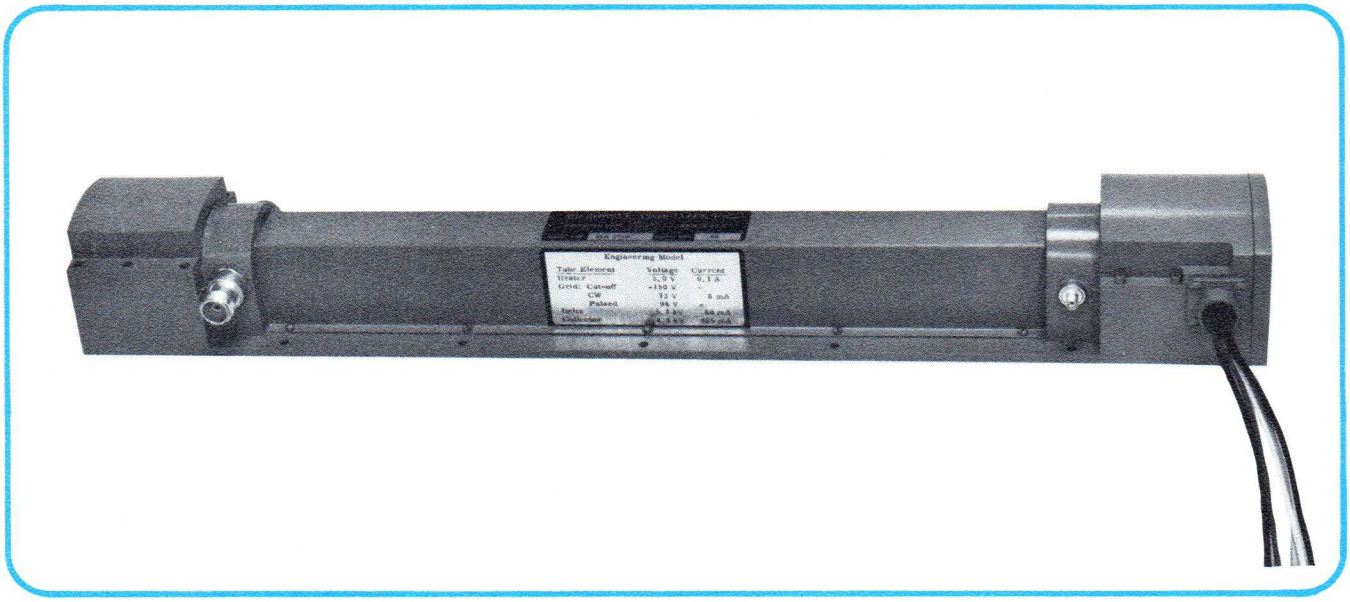
MA-2060 TWT

DUAL-MODE

Bulletin 1875



DESCRIPTION

The MA-2060 is a high power traveling wave tube with an exceptionally large bandwidth. A high mu shadowed control grid in the tube permits operation in a variety of mode ranges, such as dualmode, grated or CW. The tube employs a helix with superior thermal characteristics, making it possible for operation at a high duty cycle in the high power mode.

FEATURES

- High mu low current shadowed control grid
- Dual mode operation
- High duty operation in either high or low power mode
- PPM focusing
- Depressed collection for high efficiency

Microwave Associates, Inc. Burlington, Massachusetts Tel. (617) 272-3000
Western Union Fax
TWX: 710-332-6789
Telex: 94-9464

SPECIFICATIONS

RF Performance

Frequency Range (Varies with Mode)	1.5-4.0 GHz
Output Power:	
Maximum Power Mode	700W .5 Duty Ratio
3 dB Dual Mode	300/600 W CW/.5 Duty Ratio
Gain at Saturation:	
Maximum Power Mode	36 dB .5 Duty Ratio
3 dB Dual Mode	30/36 dB CW/.5 Duty Ratio
Minimum Efficiency:	
Maximum Power Mode	22%
3 dB Dual Mode	20% CW/25% .5 Duty Ratio

Mechanical Characteristics

Size	24 x 2.75 x 3.0 Inches (See Outline Drawing)
Weight	10.5 lbs.
Cooling	Liquid, Dielectric Heat Transfer Fluid, 1.5 GPM
RF Connectors:	
Input	SMA
Output	SC

Power Supply Requirements

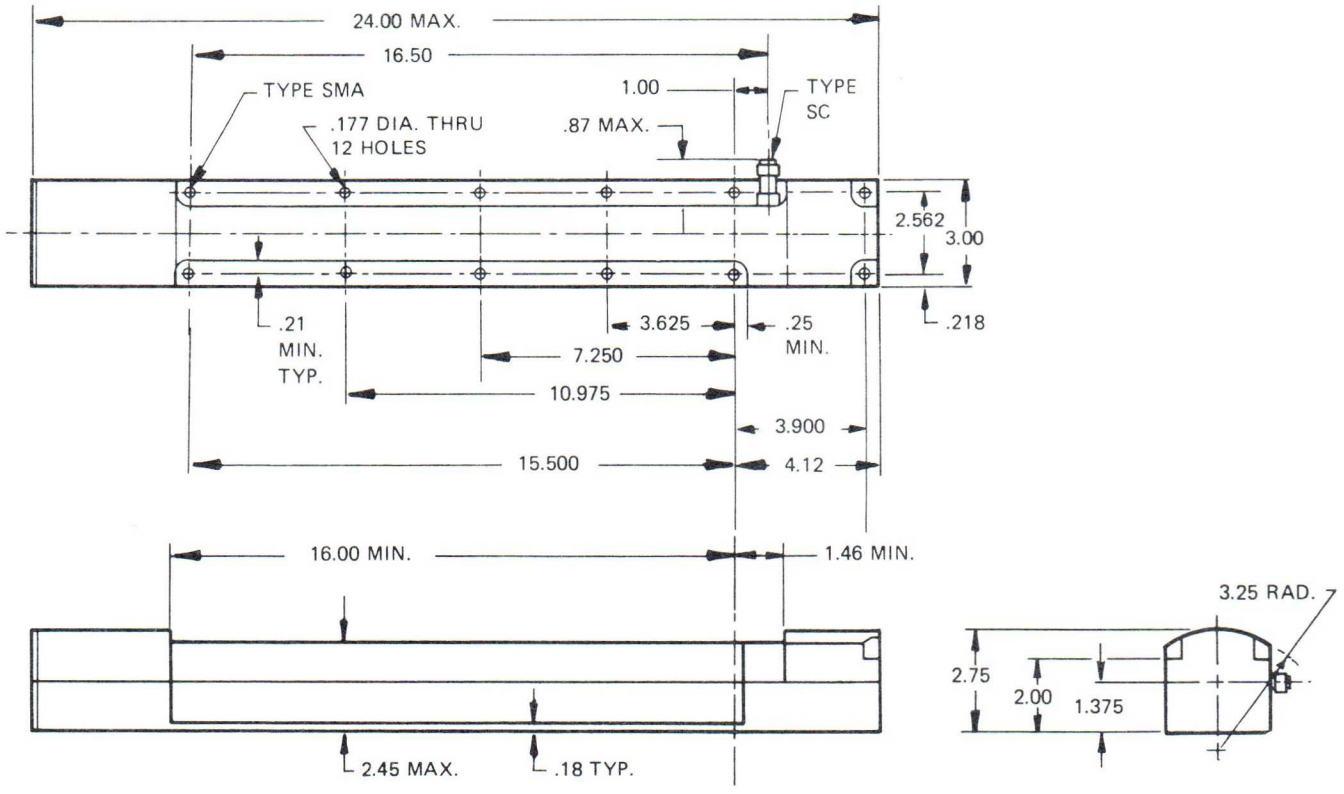
Element	Voltage	Current
Heater	6.3 V	8.0 A
Helix	5.2-5.8 kV	.050-.080 A
Collector	3.7-4.2 kV	.400-.600 A[1]
Grid:		
Cut-Off	−200 V	0
Full Power	75-200 V[1]	.003-.006 A
Cathode Capacitance	55pF	

Environmental Characteristics

Designed for MIL-E-5400 Class II Environment

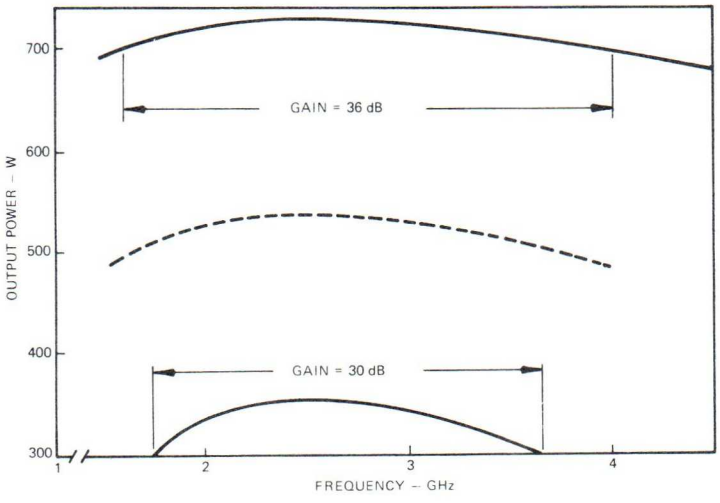
NOTE: 1. Voltage and current requirements vary with mode. Dual mode performance is achieved by varying only the grid voltage and the collector current.

OUTLINE DRAWING

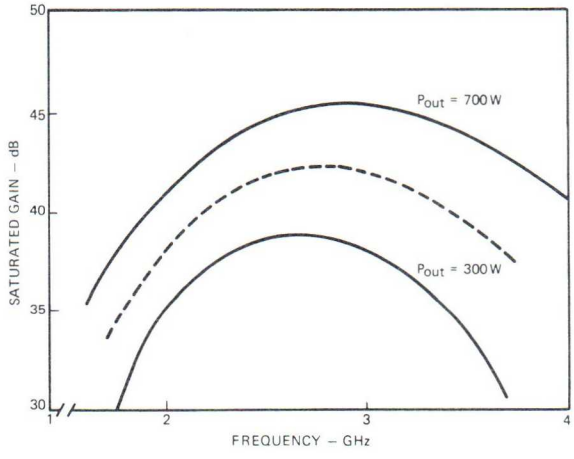


TYPICAL PERFORMANCE CURVES

POWER VS. FREQUENCY FOR DIFFERENT OUTPUT POWER LEVELS



SATURATED GAIN VS. FREQUENCY FOR DIFFERENT OUTPUT POWER LEVELS



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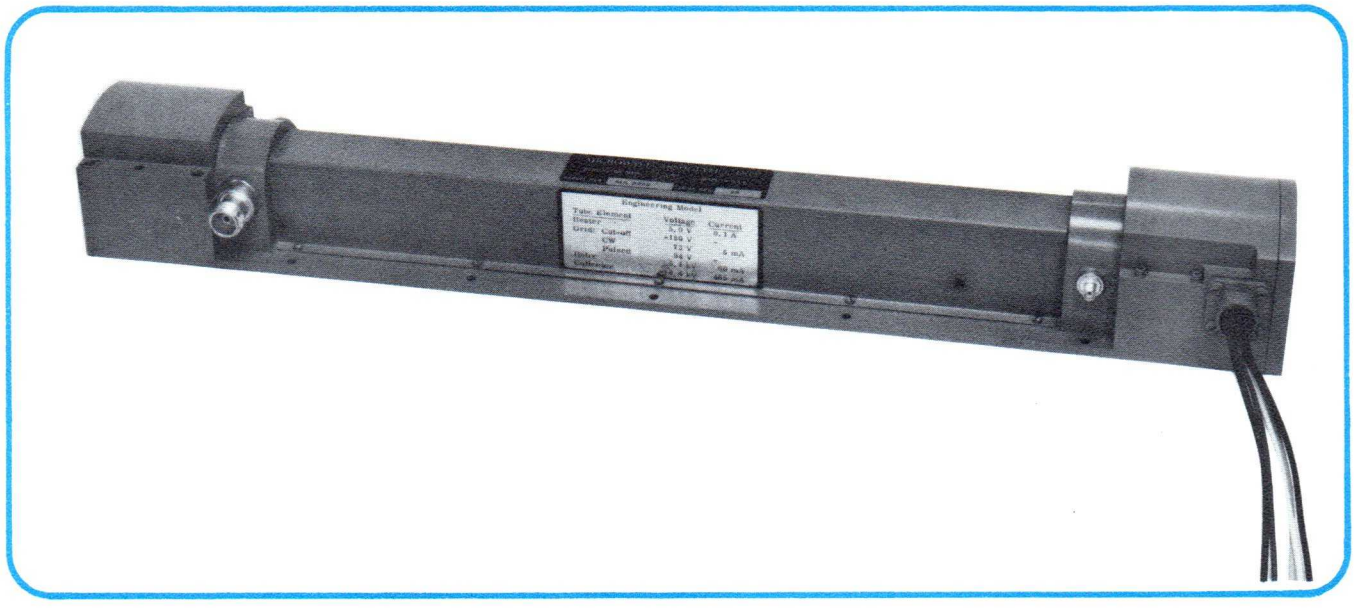
MA-2067 TWT

Bulletin 1876



DESCRIPTION

The MA-2067 traveling wave tube is a high performance power amplifier featuring rugged metal-to-ceramic construction, lightweight PPM focusing, an RF circuit of unique thermal capability and a non-intercepting control grid. The nominal CW power output of the tube is 450 watts and the minimum saturated gain 40 dB. The non-intercepting grid permits pulse operation of the tube at any duty cycle up to 100%. This tube is a modified version of the MA-2074 dual-mode TWT.

APPLICATIONS

The MA-2067 traveling wave tube is ideally suited for applications in ECM systems either in the broadband noise mode or selected frequency application. It may also be employed effectively as RF power source, driver or intermediate amplifier. The tube is designed to withstand stresses of an airborne environment.

Microwave Associates, Inc. Burlington, Massachusetts Tel. (617) 272-3000
Western Union Fax
TWX: 710-332-6789
Telex: 94-9464

SPECIFICATIONS

Electrical Characteristics

Frequency Range	2.7 to 5.4 GHz	Output Power, Rated	450 W, Min.
Duty Cycle	0.1 to 100%	Gain, Rated Power	30 dB, Min.

Power Supply Requirements

Element	Voltage	Current, Max.
Heater	6.3 V	5.5 A
Helix	5.5 kV	0.050 A
Collector	4.0 kV	0.390 A

Grid, Cut-off	−150 V	0.0002 A
Grid, CW Operation	+110 V	0.005 A
Grid-to-Cathode Capacitance		33 pF

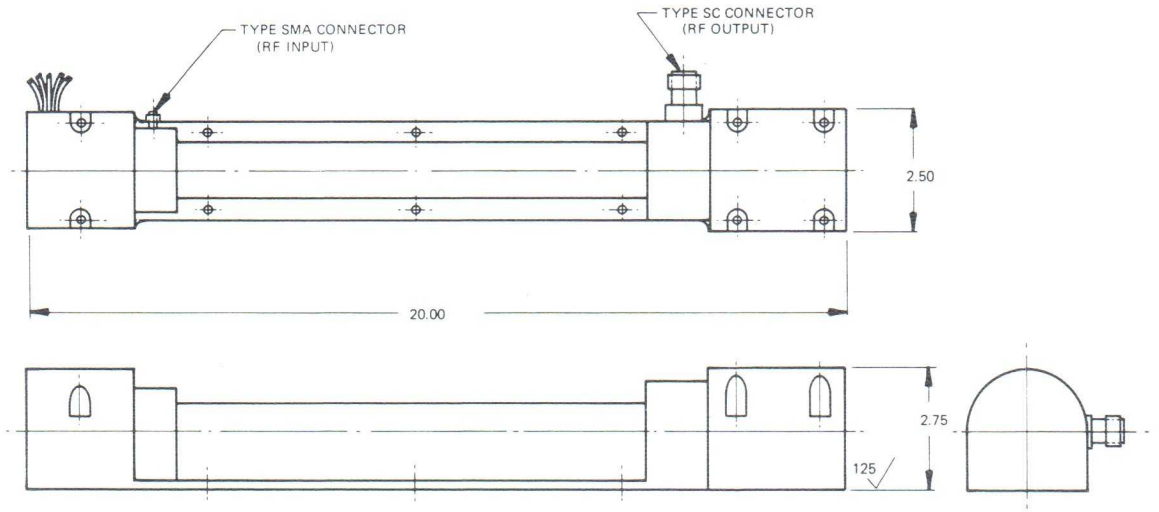
Mechanical Characteristics

Size	Refer to Outline Drawing	RF Connectors:	
Weight	8.5 lbs.	Input	SMA
Focusing	PPM	Output	S/C
Cooling	Conduction	Electrical	Flying Leads
		Mounting Position	Any

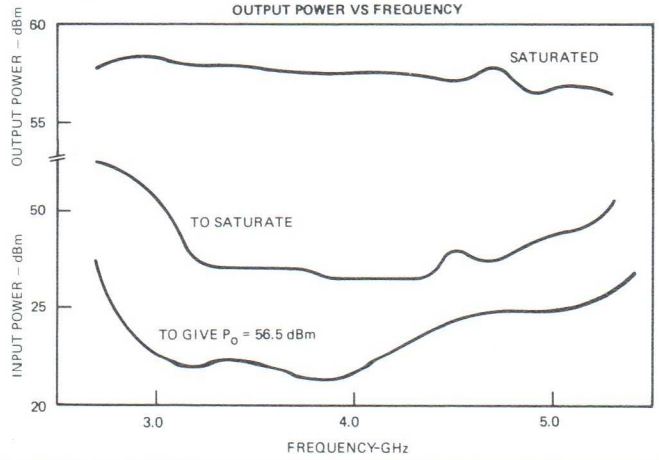
Environmental Characteristics

Applicable Military Spec.	MIL-E-5400, Class 1	Vibration (@ 500 cps)	10 g's
Altitude	70,000 Ft.	Shock (@ 11 ms)	15 g's

OUTLINE DRAWING



TYPICAL PERFORMANCE CURVES



All specifications are subject to change without notice.

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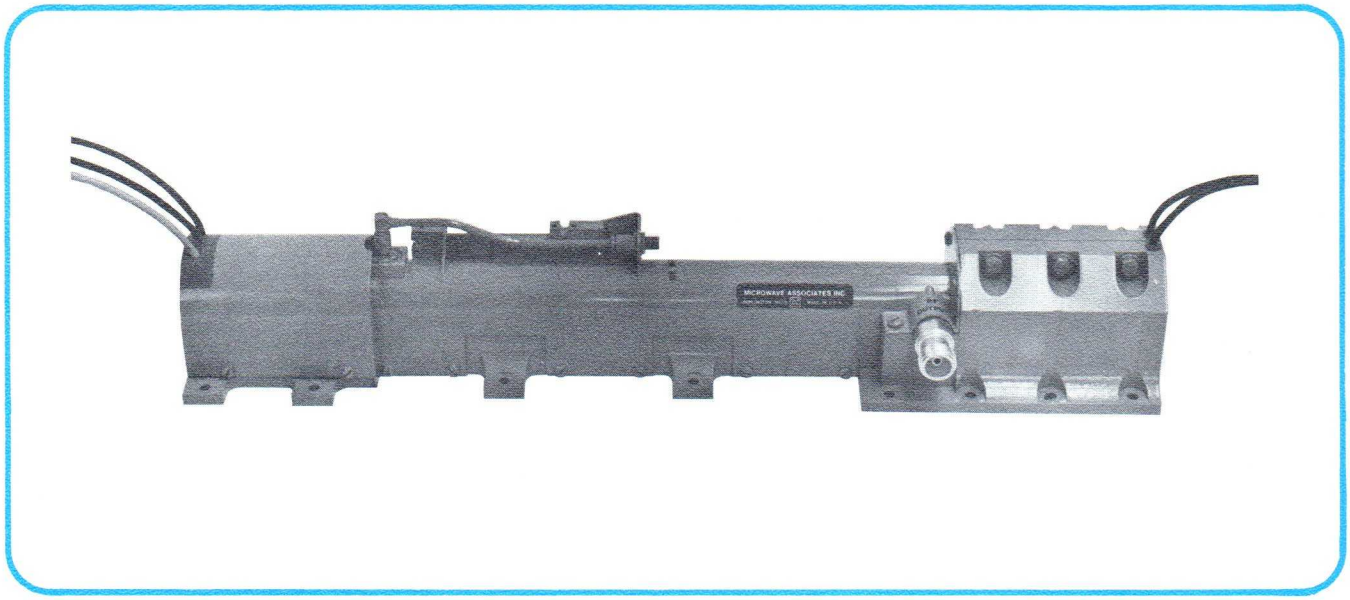
MA-2074 TWT

DUAL-MODE

Bulletin 1877



DESCRIPTION

The MA-2074 traveling wave tube is a high performance dual-mode power amplifier featuring rugged metal-to-ceramic construction, lightweight PPM focusing, an RF circuit of unique thermal capability and a non-intercepting control grid. The nominal CW power output of the tube is 300 watts with a minimum gain of 30 dB. The non-intercepting grid permits 3 dB pulse-up operation at any duty cycle up to 50%.

APPLICATIONS

The MA-2074 traveling wave tube is ideally suited for applications in ECM systems either in the broadband noise mode or selected frequency application. It may also be employed effectively as RF power source, driver or intermediate amplifier. The tube is designed to withstand the stress of an airborne environment.

Microwave Associates, Inc. Burlington, Massachusetts Tel. (617) 272-3000
Western Union Fax
TWX: 710-332-6789
Telex: 94-9464

SPECIFICATIONS

Electrical Characteristics

Frequency Range	2.7 to 5.4 GHz	
	C-Mode	**P-Mode**
Duty Cycle	0.1 to 100%	0.1 to 50%
Output Power	300 W, Min.	600 W, Min.
Gain at Rated Output	30 dB, Min.	33 dB, Min.

Power Supply Requirements

Element	**Voltage**	**Current, Max.**	
Heater	6.3 V	5.5 A	
		C-Mode	**P-Mode (Peak)**
Helix	5.4 kV	.050 A	.100 A
Collector	3.5 kV	.350 A	.425 A
Grid, Cut-Off	−150 V	.0002 A	
Grid, C-Mode	+80 V	.002 A	
Grid, P-Mode	+110 V		.003 A
Grid to Cathode Capacitance			35 pF

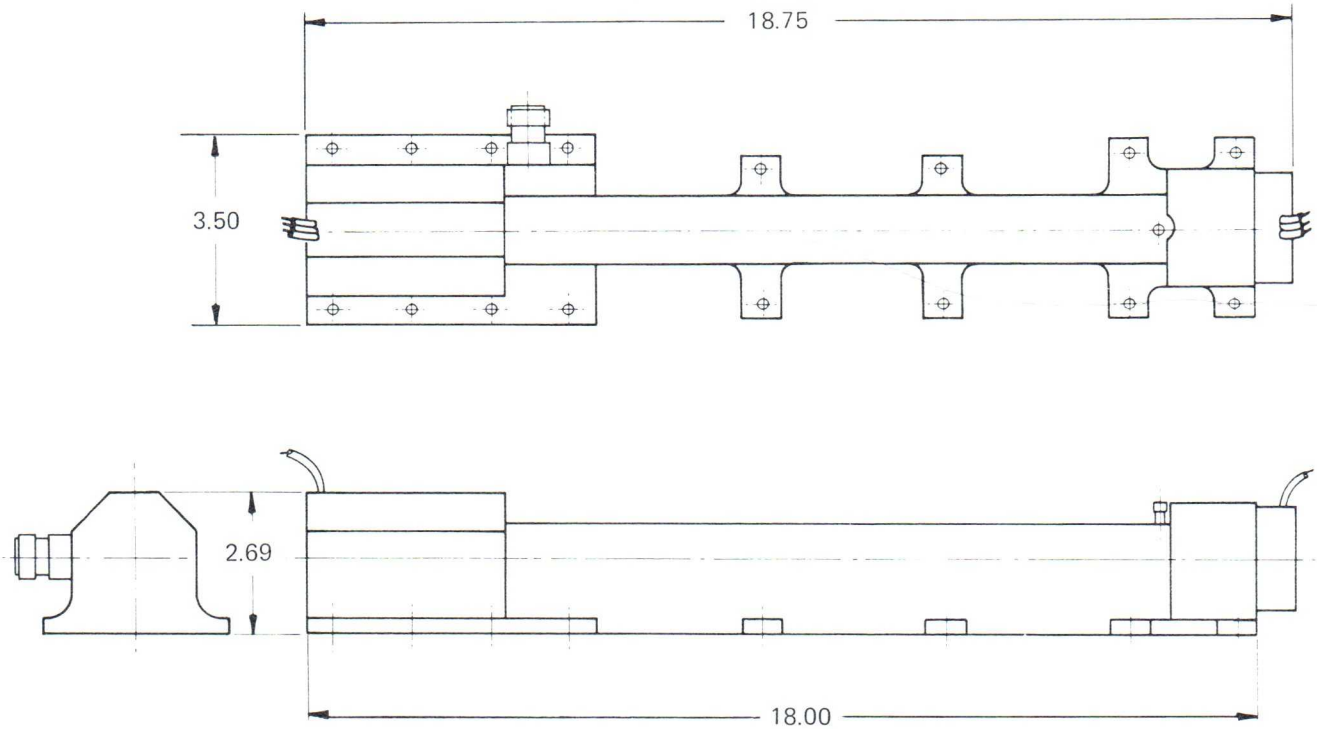
Mechanical Characteristics

Size	Refer to Outline Drawing	RF Connectors:	
Weight	8.5 lbs.	Input	SMA
Focusing	PPM	Output	S/C
Cooling	Conduction	Electrical	Flying Leads
		Mounting Position	Any

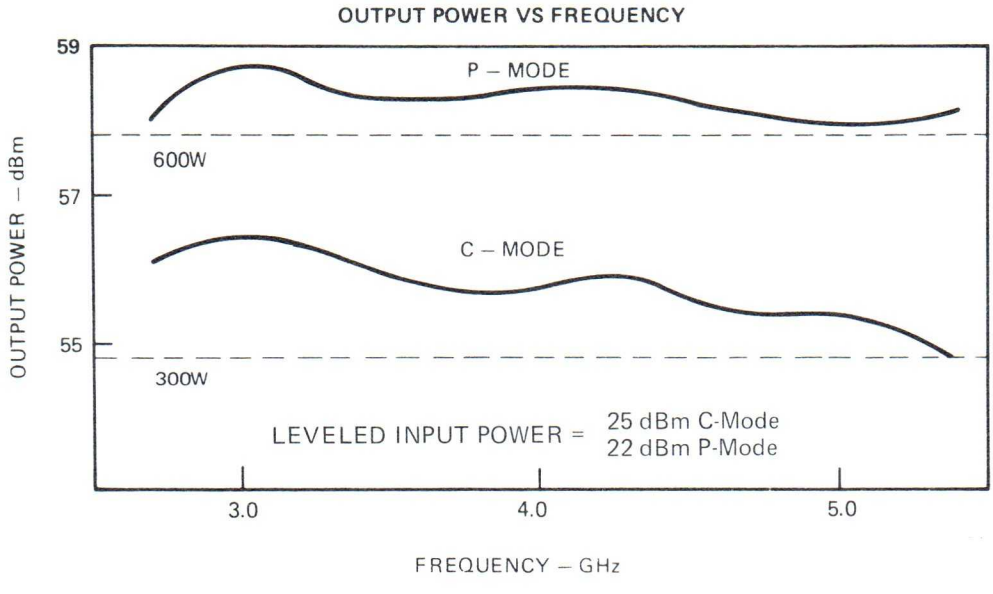
Environmental Characteristics

Applicable Military Spec.	MIL-E-5400, Class 1	Vibration (@ 500 cps)	10 g's
Altitude	70,000 Ft.	Shock (@ 11 ms)	15 g's

OUTLINE DRAWING



TYPICAL PERFORMANCE CURVE



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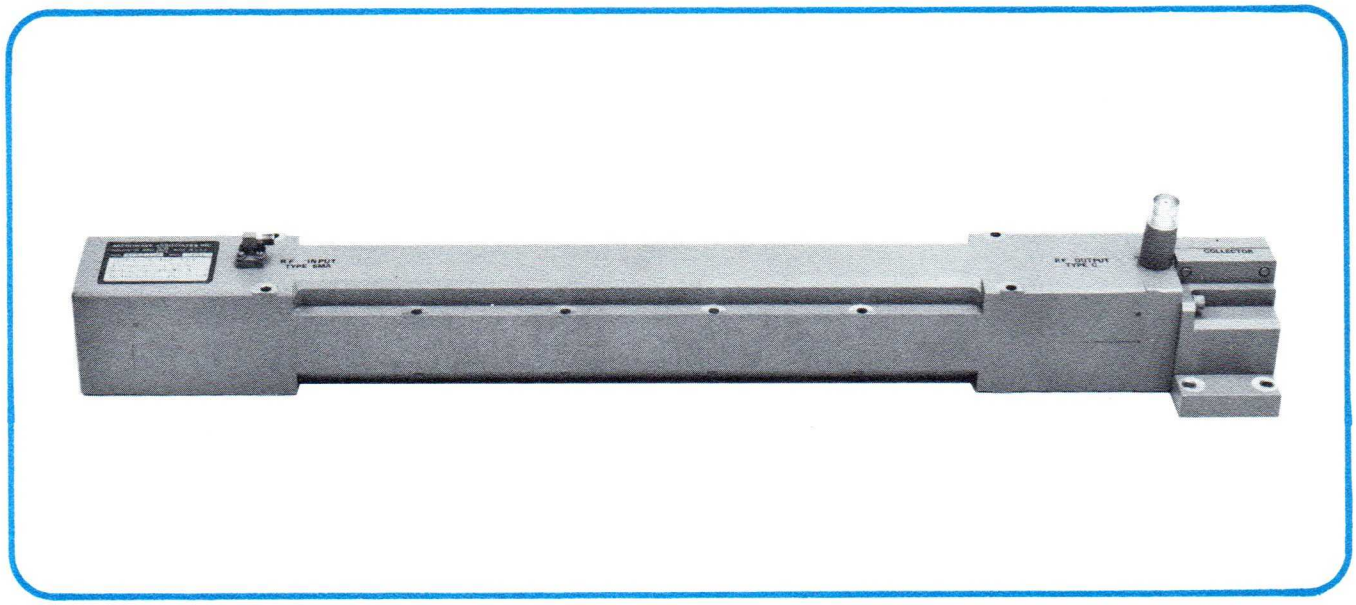
MA-2072 TWT

CONDUCTION COOLED

Bulletin 1878



DESCRIPTION

The MA-2072 is a high performance CW traveling wave tube which features a hollow electron beam tube, a specially designed internal solenoid, and metal to ceramic construction. Used in either airborne or ground systems, it provides reliable and efficient operation in extreme environments. Rated output is obtained over an octave or greater bandwidth without tuning. The electron gun contains a high Mu, low current, shadowed control grid for gating or gain control. This tube can be supplied with an integral gain equalizer for leveled drive operation.

APPLICATIONS

In either the broadband noise mode or at selected frequencies, the MA-2072 is ideally suited for applications in ECM systems. This power tube can also be effectively employed as a driver or intermediate amplifier.

Microwave Associates, Inc. Burlington, Massachusetts Tel. (617) 272-3000
Western Union Fax
TWX: 710-332-6789
Telex: 94-9464

SPECIFICATIONS

Typical RF Performance

Frequency Range	500 to 1000 MHz
Duty Cycle	CW
Output Power	500 W, Min.
Gain at 500 W	27 dB, Min.

Power Supply Requirements

Element	Voltage	Current
Heater	12.6 V	3.0 A
Helix	2.5 kV	1.10 A
Solenoid (30°C Heat Sink)	28 V	17 A
Control Grid — on	+300 V	5 mA
off	-200 V	0

Mechanical Characteristics

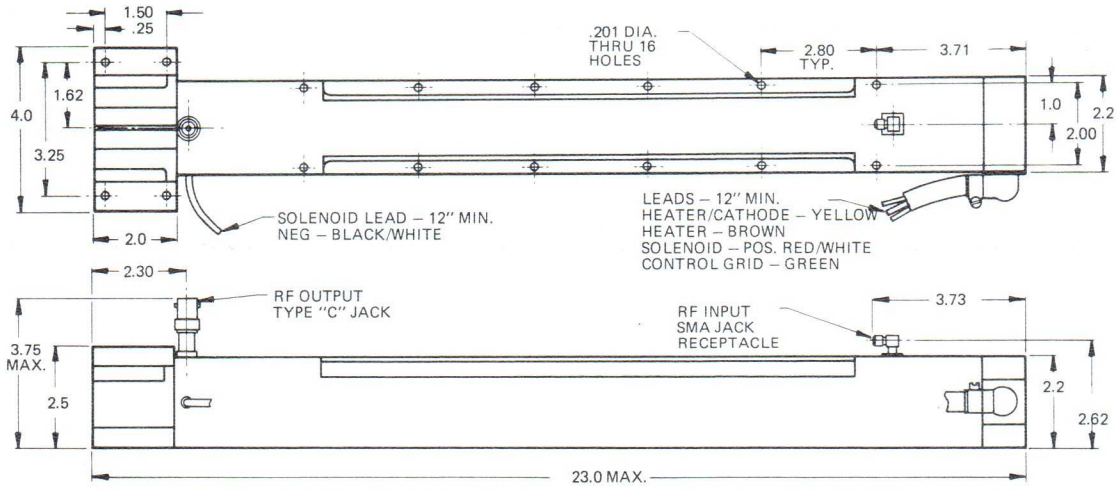
Size	See Outline Drawing
Weight	17.5 lbs.
Focusing	Solenoid, Internal
Cooling	Conduction to Heat Sink
	(Max. Heat Sink Temperature 105°C)

RF Connectors:	
Input	SMA
Output	C or SC
Electrical Connectors	Flying Leads
Mounting Position	Any

Environmental Characteristics

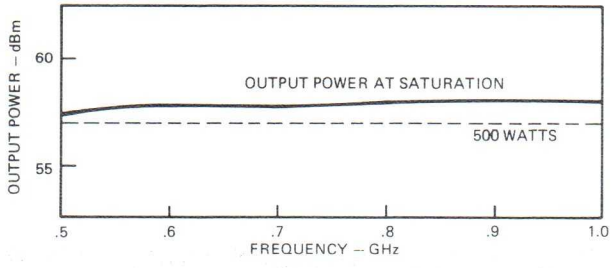
Applicable Military Spec.	MIL-E-5400, Class 1
Altitude	70,000 ft.
Vibration (@ 500 cps)	10 g's
Shock (@ 11 ms)	15 g's

OUTLINE DRAWING

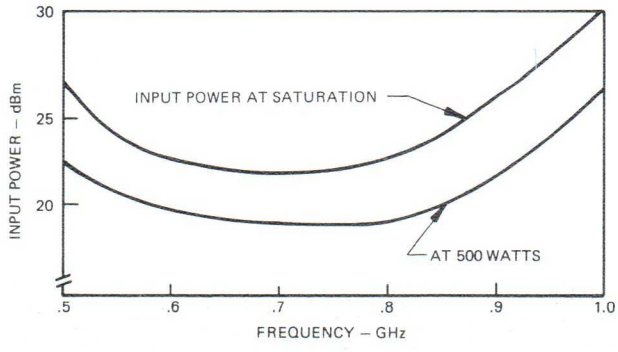


TYPICAL PERFORMANCE CURVES

POWER OUTPUT VS. FREQUENCY



DRIVE VS. FREQUENCY



All specifications are subject to change without notice.

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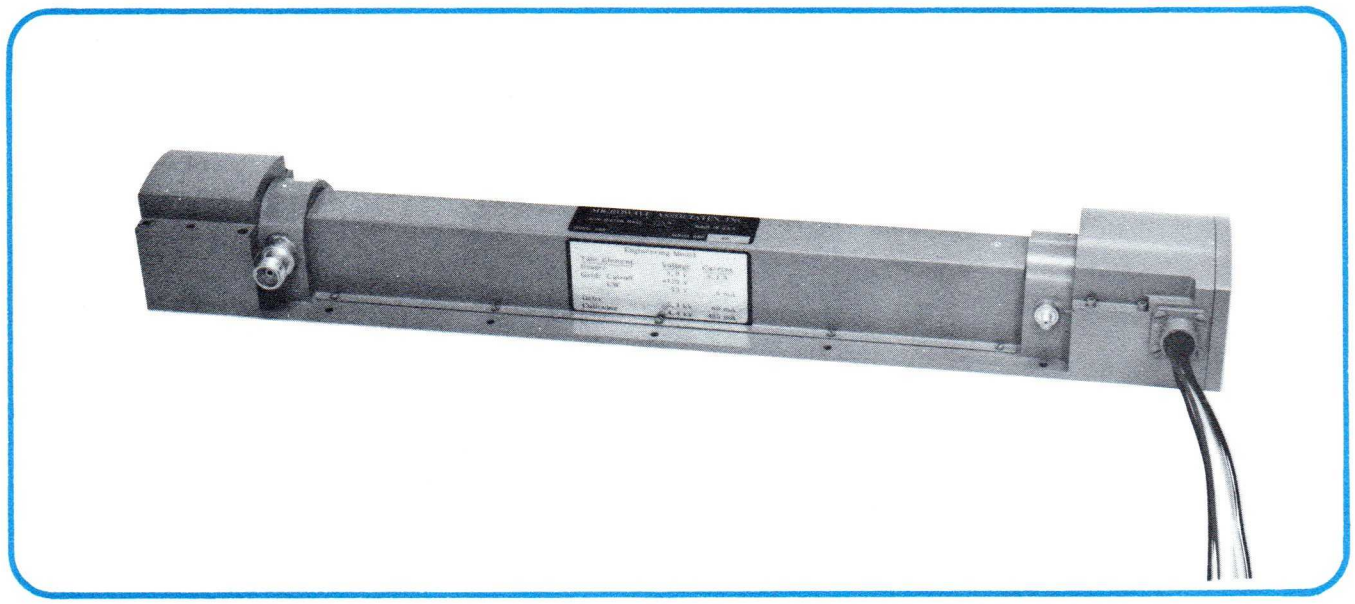
MA-2086 TWT

HIGH CW POWER

Bulletin 1879



DESCRIPTION

The MA-2086 is a high performance CW amplifier delivering 500 watts over the frequency range of 1.5 to 3.9 GHz. The saturated gain of the tube is 26 dB. The tube includes a non-intercepting control grid which permits gated or CW operation and an RF circuit of unique thermal capability.

FEATURES

- PPM focusing
- High mu non-intercepting control grid
- Conduction cooling
- Depressed collector
- Metal ceramic construction
- Designed for airborne environment

Microwave Associates, Inc. Burlington, Massachusetts Tel. (617) 272-3000
Western Union Fax
TWX: 710-332-6789
Telex: 94-9464

SPECIFICATIONS

Typical RF Performance

Frequency Range	1.5 to 3.9 GHz	Output Power, Saturated	500 W, Min.
Duty Cycle	0.1 to 100%	Gain, Saturated	26 dB, Min.

Power Supply Requirements

Element	Voltage	Current	Element	Voltage	Current
Heater	6.3 V	8.0 A	Grid, Cut-off	-200 V	0.0002 A
Helix	5.7 kV	0.050 A	Grid, CW Operation	+140 V	0.005 A
Collector	4.0 kV	0.540 A	Grid-to-Cathode Capacitance		60 pF

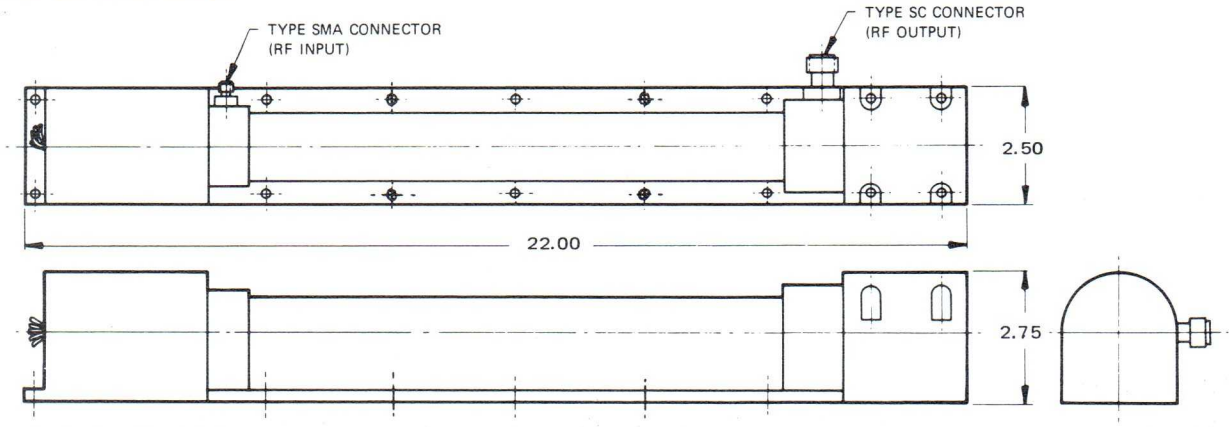
Mechanical Characteristics

Size	See Outline Drawing	RF Connectors:	
Weight	10 Lbs.	Input	SMA
Focusing	PPM	Output	S/C
Cooling	Conduction	Electrical Connectors	Flying Leads
	Max. Heat Sink Temperature 105°C	Mounting Position	Any

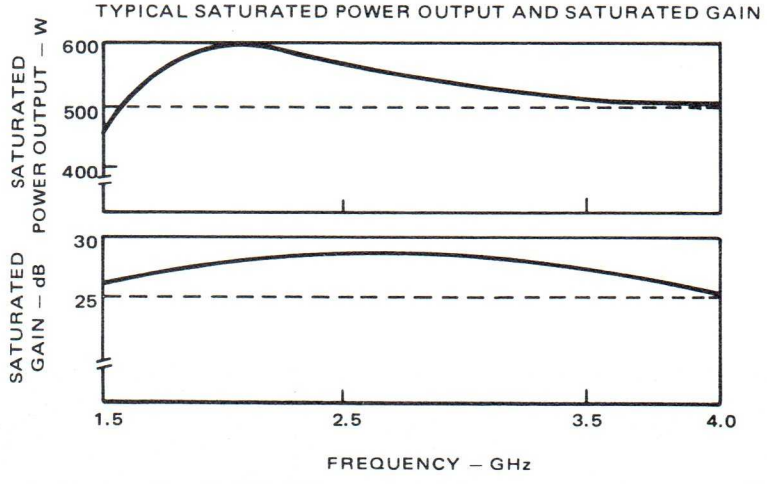
Environmental Characteristics

Applicable Military Spec.	MIL-E-5400, Class 1	Vibration (@ 500 cps)	10 G
Altitude	70,000 Ft.	Shock (@ 11 ms)	15 G

OUTLINE DRAWING



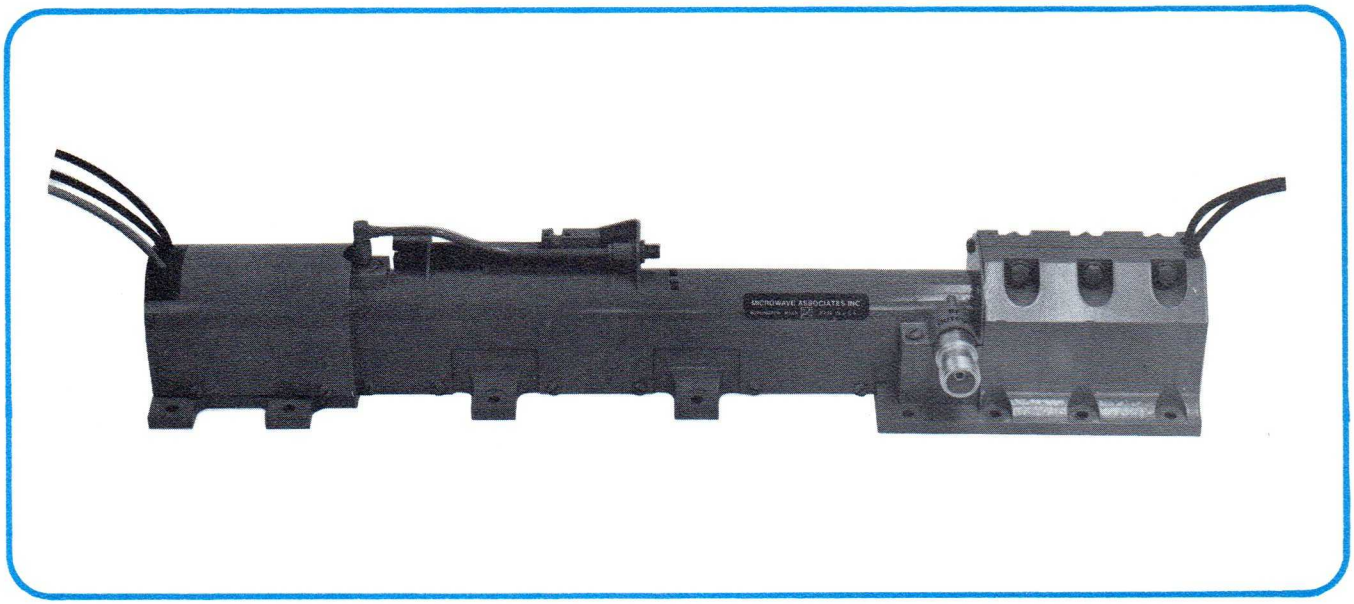
TYPICAL PERFORMANCE CURVES



MA-2089 TWT

DUAL-MODE

Bulletin 1880



DESCRIPTION

The MA-2089 traveling wave tube is a high performance dual-mode power amplifier featuring rugged metal-to-ceramic construction, lightweight PPM focusing, an RF circuit of unique thermal capability and a non-intercepting control grid. The nominal CW power output of the tube is 300 watts with a minimum gain of 33 dB. The non-intercepting grid permits 3 dB pulse-up operation at any duty cycle up to 40%.

APPLICATIONS

The MA-2089 traveling wave tube is ideally suited for applications in ECM systems either in the broadband noise mode or selected frequency application. It may also be employed effectively as RF power source, driver or intermediate amplifier. The tube is designed to withstand the stress of an airborne environment.

Microwave Associates, Inc. Burlington, Massachusetts Tel. (617) 272-3000
Western Union Fax
TWX: 710-332-6789
Telex: 94-9464

SPECIFICATIONS

Electrical Characteristics

Frequency Range	2.4 to 4.8 GHz	
	C-Mode	**P-Mode**
Duty Cycle	0.1 to 100%	0.1 to 40%
Output Power	300 W, Min.	600 W, Min.
Gain at Rated Output	33 dB, Min.	39 dB, Min.

Power Supply Requirements

Element	**Voltage**	**Current, Max.**	
Heater	6.3 V	5.5 A	
		C-Mode	**P-Mode (Peak)**
Helix	5.6 kV	.050 A	.100 A
Collector	3.5 kV	.350 A	.425 A
Grid, Cut-Off	-250 V	.0002 A	
Grid, C-Mode	+100 V	.002 A	
Grid, P-Mode	+150 V		.003 A
Grid to Cathode Capacitance			35 pF

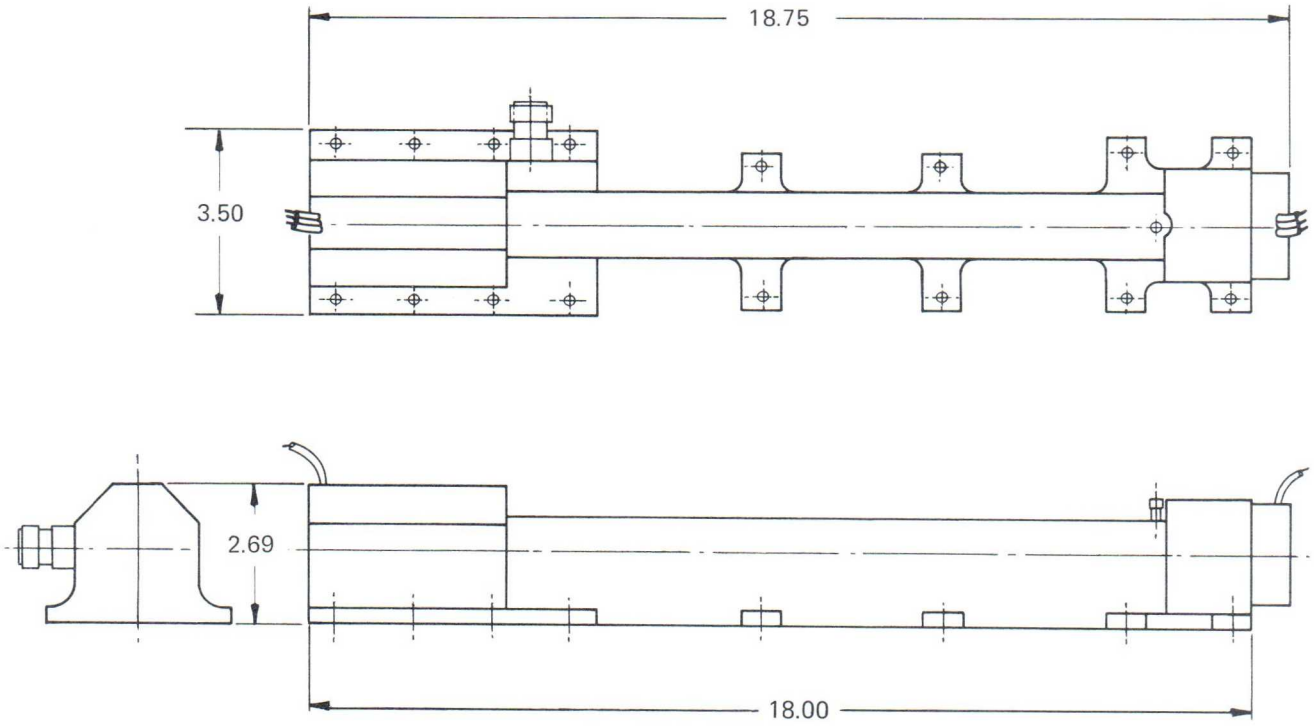
Mechanical Characteristics

Size	Refer to Outline Drawing	RF Connectors:	
Weight	8.5 lbs.	Input	SMA
Focusing	PPM	Output	S/C
Cooling	Conduction	Electrical	Flying Leads
		Mounting Position	Any

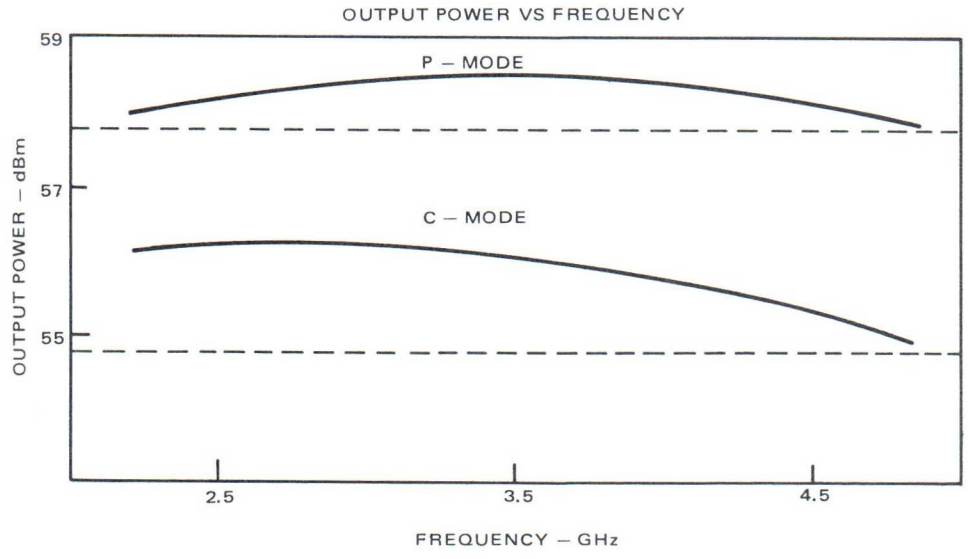
Environmental Characteristics

Applicable Military Spec.	MIL-E-5400, Class 1	Vibration (@ 500 cps)	10 g's
Altitude	70,000 Ft.	Shock (@ 11 ms)	15 g's

OUTLINE DRAWING



TYPICAL PERFORMANCE CURVE



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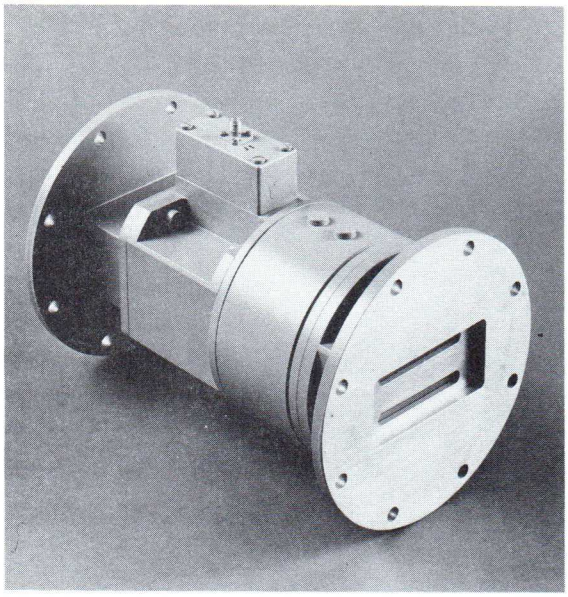
Microwave Associates
A M/A-COM COMPANY

MA-39062S

S-Band Passive TR Limiter, Attenuator



Description

The MA-39062S is a single channel, hardbrazed, passive Pre-TR Limiter Attenuator designed to provide receiver protection in the 2.9 to 3.1 GHz frequency range.

Application

The MA-39062S is specifically designed with a two stage limiter to protect low noise radar receivers where long life, extended temperature range and reliable receiver protector operation are required. The device can also be externally biased to provide 40 dB of excess attenuation.

Features

- **PASSIVE OPERATION**
  No Ignitor Bias or Shutter Required.
- **HARDBRAZED CONSTRUCTION**
  Performance Independent of Temperature.
- **TWO STAGE LIMITER**
  Spike Amplitude Less Than One Watt.
- **PRE-TR**
  Can Handle Full Transmitter Overloads.
- **STC**
  40 dB Minimum Attenuation When Externally Biased.

DUPLEXER PRODUCTS
Burlington, Massachusetts 01803 ■ Telephone (617) 272-3000 ■ TWX: 710-332-6789 ■ Telex: 94-9464
Bulletin No. 153

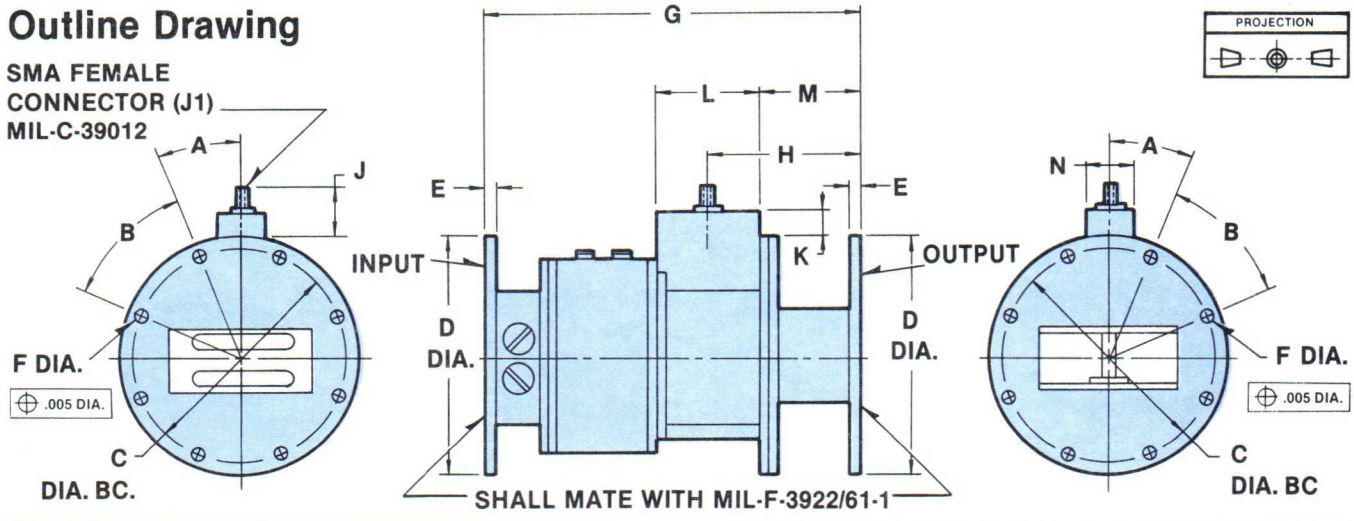
Specifications

ELECTRICAL CHARACTERISTICS	Min.	Typ.	Max.	Units
Frequency Range	2.9	—	3.1	GHz
Peak Power	0	—	180	kW
Average Power	0	—	180	W
Pulse Width	—	—	5	μs
Spike Leakage Amplitude	—	0.5	1.0	W
Spike Leakage Energy	—	.01	.02	ergs
Flat Leakage Power	—	10	30	mW
Breakdown Power	—	50	100	mW
Recovery Time, 3 dB	—	2.0	3.0	μs
Insertion Loss	—	0.4	0.7	dB
Low Level VSWR	—	1.3	1.4	—
Life	2000	4000	—	Hours
Excess Attenuation	40	—	—	dB
Bias Voltage				
Bias Current				

ENVIRONMENTAL CHARACTERISTICS				
Operating Temperature	−55	—	+71	°C
Storage Temperature	−55	—	+80	°C

MECHANICAL CHARACTERISTICS	
Finish	
Input Flange	Aluminum, Iridite
Output Flange	Aluminum, Iridite
Body	Black Lacquer
Dimensions	See Outline Drawing

Outline Drawing



DIM.	MIN.	MAX.	BASIC
A	— —	— —	22°30'
B	— —	— —	45°
C	— —	— —	4.750
D	5.297	5.327	— —
E	.235	.265	— —
F	.256	.286	— —
G	7.902	7.942	— —

DIM.	MIN.	MAX.	BASIC
H	2.800	3.300	— —
J	— —	.900	— —
K	— —	.500	— —
L	— —	2.500	— —
M	1.900	— —	— —
N	— —	1.050	— —

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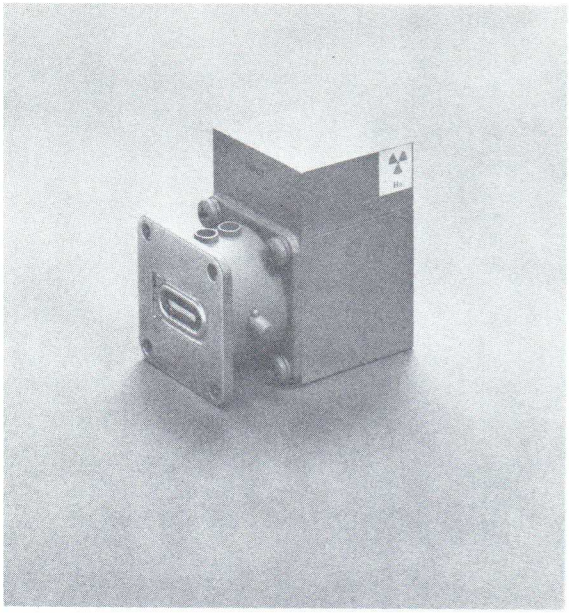
MA-39063X

X-Band Passive TR Limiter

or Low Noise for Tunnel Diode Amplifier Schottky Barrier Diode Protection



Description

The MA-39063X is a single channel, hardbrazed, passive TR Limiter designed to provide positive receiver protection in the 8.5 to 9.6 GHz frequency range.

Application

The MA-39063X is specifically designed with a two stage limiter to protect either tunnel diode amplifiers or low noise Schottky barrier diodes in radars where long life, extended temperature range, and reliable receiver protector operation are required.

Features

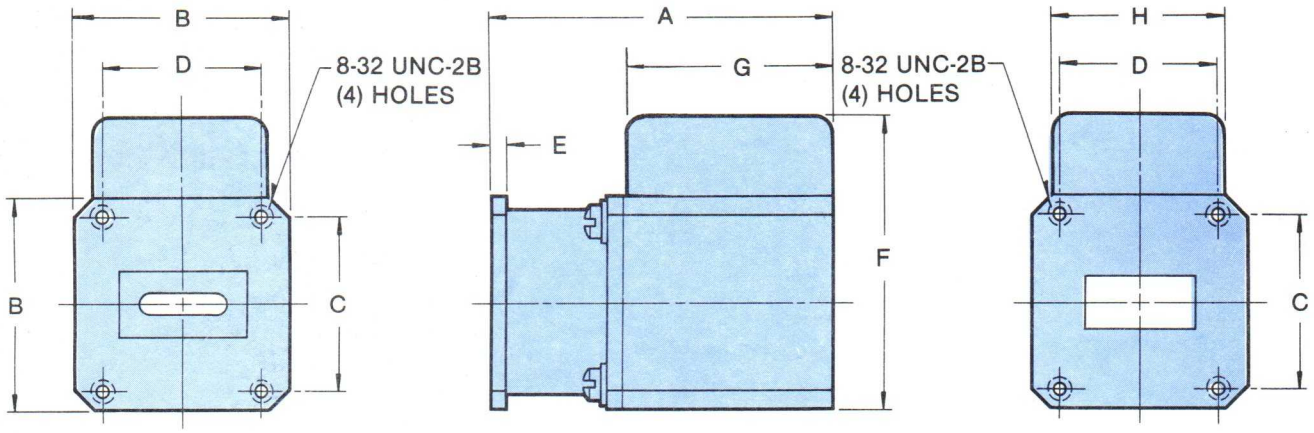
- **PASSIVE OPERATION**
  No Ignitor Bias Or Shutter Required.
- **HARDBRAZED CONSTRUCTION**
  Performance Independent Of Temperature.
- **TWO STAGE LIMITER**
  Spike Amplitude Less Than One Watt.

Burlington, Massachusetts 01803 ■ Telephone (617) 272-3000 ■ TWX: 710-332-6789 ■ Telex: 94-9464
Bulletin No. 154

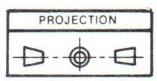
Specifications

ELECTRICAL CHARACTERISTICS	Min.	Typ.	Max.	Units
Frequency Range	8.5	—	9.6	GHz
Peak Power	0	10	50	kW
Average Power	0	10	50	W
Pulse Width	—	—	5	μs
Spike Leakage Amplitude	—	0.5	1.0	W
Spike Leakage Energy	—	.01	.02	ergs
Flat Leakage Power	—	10	20	mW
Breakdown Power	—	20	40	mW
Recovery Time, 3 dB	—	0.5	1.0	μs
Insertion Loss	—	0.8	1.2	dB
Low Level VSWR	—	1.3	1.4	—
Life	2000	4000	—	Hours
ENVIRONMENTAL CHARACTERISTICS				
Operating Temperature	−55	—	+71	°C
Storage Temperature	−55	—	+80	°C
MECHANICAL CHARACTERISTICS				
Finish				
Input Flange	Cadmium Plate, Iridite			
Output Flange	Aluminum, Iridite			
Body	Black Lacquer			
Dimensions	See Outline Drawing			
Weight	10.8 oz., (302 gr.)			

Outline Drawing



DIM.	INCHES		MM	
	MIN.	MAX.	MIN.	MAX.
A	2.375	2.425	60.33	61.60
B	1.610	1.640	40.89	41.66
C	1.276	1.284	32.41	32.61
D	1.215	1.225	30.86	31.12
E	.090	— —	2.29	— —
F	— —	2.250	— —	57.15
G	— —	1.45	— —	36.83
H	— —	1.400	— —	35.56



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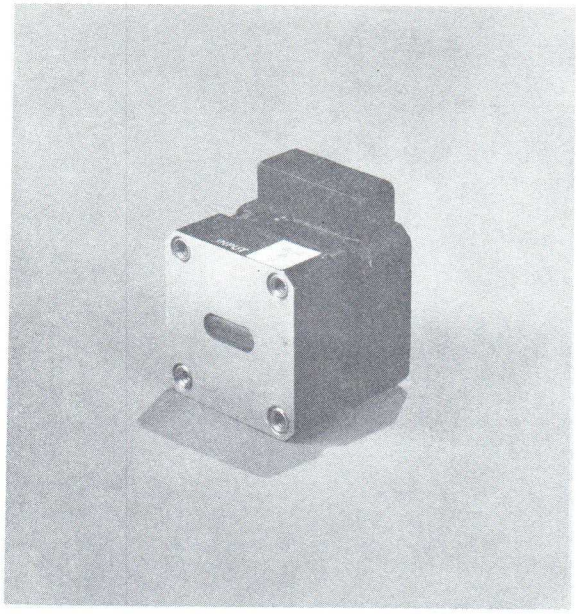


MA-39111X

X-Band Passive TR Limiter

Phase Controlled

Description

The MA-39111X is a single channel, hardbrazed, phase controlled, passive TR Limiter designed to provide positive mixer diode protection in the 8.5 to 9.6 GHz frequency range.

Application

The MA-39111X is specifically designed to be used in conjunction with the dual TR Limiter MA-439110X in monopulse radars where long life, extended temperature range, and reliable receiver protector operation are required.

Features

- **PASSIVE OPERATION**
  No Ignitor Bias or Shutter Required.
- **HARDBRAZED CONSTRUCTION**
  Performance Independent of Temperature.
- **MIXER DIODE PROTECTION**
  Spike Amplitude 5 Watts Maximum.
- **PHYSICAL CONFIGURATION**
  1.555 Inch Length Fits Most Conventional TR Sockets.

Burlington, Massachusetts 01803 ■ Telephone (617) 272-3000 ■ TWX: 710-332-6789 ■ Telex: 94-9464

Bulletin No. 155

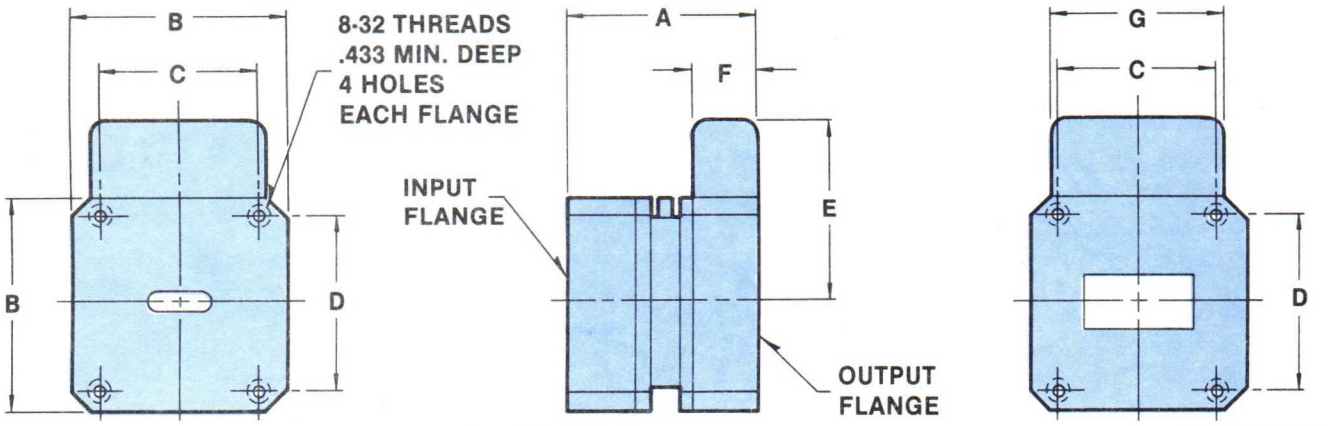
Specifications

ELECTRICAL CHARACTERISTICS	Min.	Typ.	Max.	Units
Frequency Range	8.5	—	9.6	GHz
Peak Power	0	10	100	kW
Average Power	0	10	100	W
Pulse Width	—	—	5	μs
Spike Leakage Amplitude	—	2	5	W
Spike Leakage Energy	—	.04	.10	ergs
Flat Leakage Power	—	25	100	mW
Breakdown Power	—	50	150	mW
Recovery Time, 3 dB	—	0.5	1.0	μs
Insertion Loss	—	0.7	1.0	dB
Low Level VSWR	—	1.2	1.4	—
Phase Equality	—5	—	+5	Degrees
Life	2000	4000	—	Hours

ENVIRONMENTAL CHARACTERISTICS				
Operating Temperature	—55	—	+71	°C
Storage Temperature	—55	—	+80	°C

MECHANICAL CHARACTERISTICS	
Finish	
Input Flange	Cadmium Plate, Iridite
Output Flange	Aluminum, Iridite
Body	Black Lacquer
Dimensions	See Outline Drawing
Weight	10.0 oz. (284 gr.)

Outline Drawing



DIM.	INCHES		MM	
	MIN.	MAX.	MIN.	MAX.
A	1.545	1.565	39.24	39.75
B	1.610	1.640	40.89	41.66
C	1.216	1.224	30.89	31.09
D	1.276	1.284	32.41	32.61
E	— —	1.310	— —	33.27
F	— —	.600	— —	15.24
G	— —	1.640	— —	41.66

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MA-39112X

X-Band Passive TR Limiter

Description

The MA-39112X is a single channel, hardbrazed, passive TR Limiter designed to provide positive mixer diode protection in the 8.5 to 9.6 GHz frequency range.

Application

The MA-39112X is specifically designed to retrofit existing 1.070 inch conventional TR tube sockets in airborne and other radars where long life, extended temperature range, and reliable receiver protector operation is required.

Features

- **PASSIVE OPERATION**
  No Ignitor Bias or Shutter Required.
- **HARDBRAZED CONSTRUCTION**
  Performance Independent of Temperature.
- **MIXER DIODE PROTECTION**
  Spike Amplitude 5 Watts Maximum.
- **PHYSICAL CONFIGURATION**
  1.070 Inch Length Fits Conventional TR Sockets.

Burlington, Massachusetts ■ Telephone (617) 272-3000 ■ TWX: 710-332-6789 ■ Telex: 94-9464
Bulletin No. 156

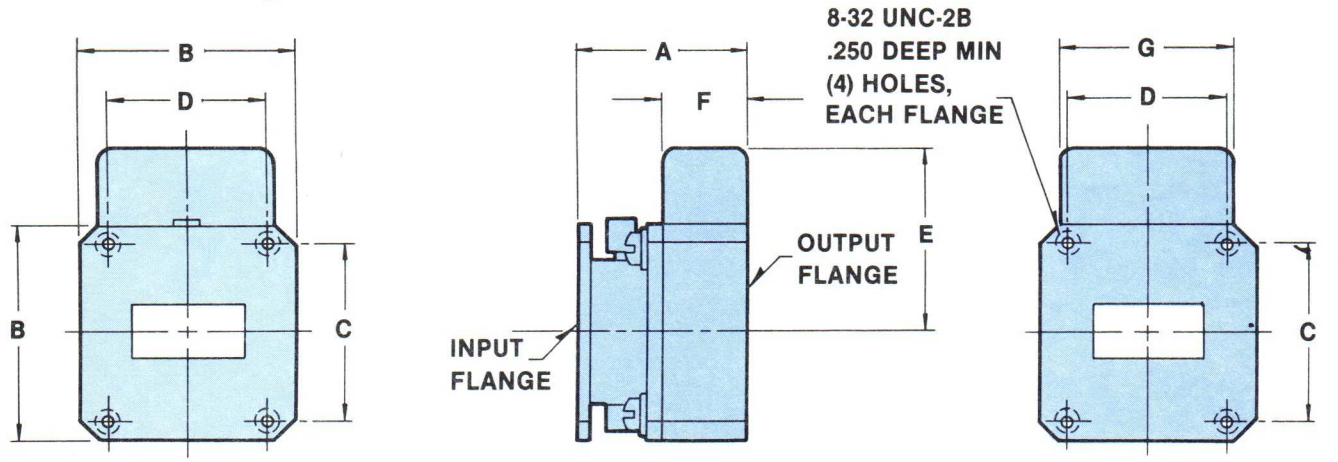
Specifications

ELECTRICAL CHARACTERISTICS	Min.	Typ.	Max.	Units
Frequency Range	8.5	—	9.6	GHz
Peak Power	0	10	50	kW
Average Power	0	10	50	W
Pulse Width	—	1	5	μs
Spike Leakage Amplitude	—	2	5	W
Spike Leakage Energy	—	.04	.10	ergs
Flat Leakage Power	—	25	50	mW
Breakdown Power	—	50	100	mW
Recovery Time, 3 dB	—	0.5	1.5	μs
Insertion Loss	—	0.5	0.8	dB
Low Level VSWR	—	1.2	1.4	—
Life	2000	4000	—	Hours

ENVIRONMENTAL CHARACTERISTICS				
Operating Temperature	−55	—	+71	°C
Storage Temperature	−55	—	+80	°C

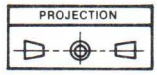
MECHANICAL CHARACTERISTICS	
Finish	
Input Flange	Cadmium Plate, Iridite
Output Flange	Aluminum, Iridite
Body	Black Lacquer
Dimensions	See Outline Drawing
Weight	5.3 oz. (145 gr.)

Outline Drawing



DIM.	INCHES		MM	
	MIN.	MAX.	MIN.	MAX.
A	1.060	1.080	26.92	27.43
B	1.610	1.640	40.89	41.66
C	1.276	1.284	32.41	32.61
D	1.216	1.224	30.89	31.09
E	— —	1.228	— —	31.19
F	— —	.600	— —	15.24
G	— —	1.640	— —	41.66

PROJECTION



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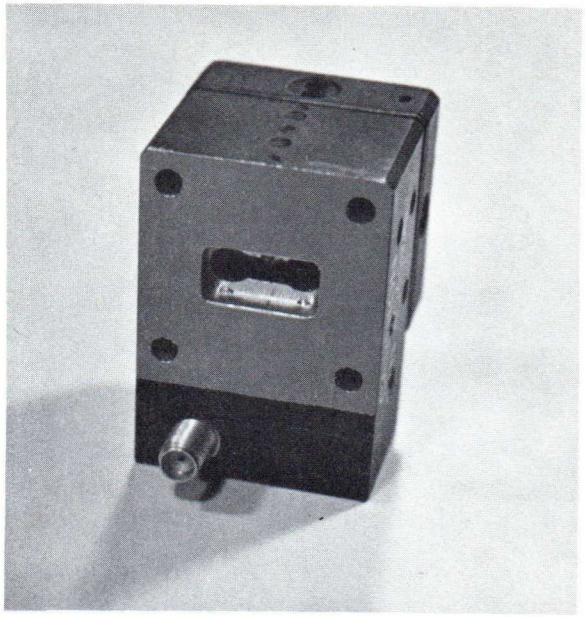


MA-39117Z

Ku-Band Passive TR Limiter

STC Attenuator

Description

The MA-39117Z is a single channel, hardbrazed, pasive TR Limiter attenuator designed to provide positive receiver protection in the 15.7 to 16.2 GHz frequency range.

Application

The MA-39117Z is specifically designed with a two stage limiter to protect low noise receivers in radars where long life, extended temperature range, and reliable receiver protector operation is required. It is designed to allow external biasing of the limiter diodes to provide a continuously variable attenuation function.

Features

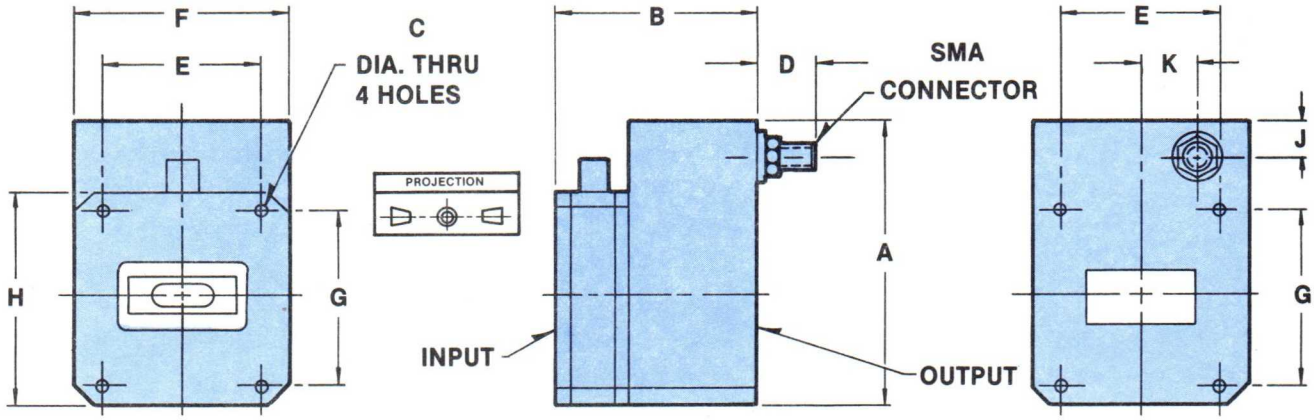
- **STC ATTENUATION**
  Up to 20 dB With External Bias.
- **TWO STAGE LIMITER**
  Spike Amplitude Less Than One Watt, Typical.
- **HARDBRAZED CONSTRUCTION**
  Performance Independent of Temperature.
- **PASSIVE OPERATION**
  No Ignitor Bias or Shutter Required.

DUPLEXER PRODUCTS
Burlington, Massachusetts 01803 ■ Telephone: (617-272-3000 ■ TWX: 710-332-6789 ■ Telex: 94-9464
Bulletin No. 160

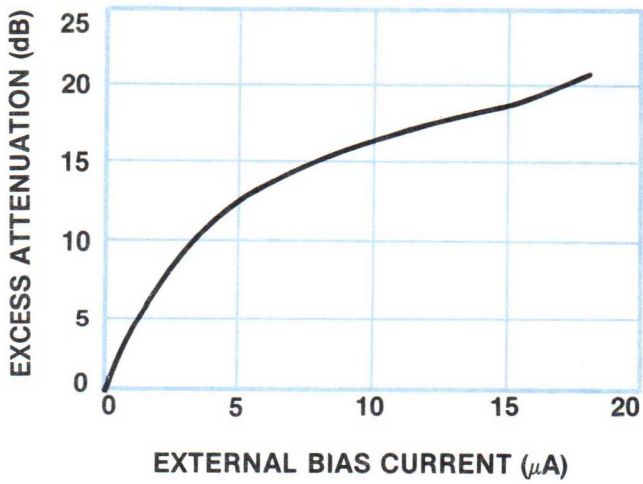
Specifications

ELECTRICAL CHARACTERISTICS	Min.	Typ.	Max.	Units
Frequency Range	15.7	—	16.2	GHz
Peak Power	0	—	20	kW
Average Power	0	—	20	W
Pulse Width	—	—	1.0	μs
Spike Leakage Amplitude	—	1.0	2.5	W
Spike Leakage Energy	—	.02	.05	ergs
Flat Leakage Power	—	20	50	mW
Breakdown Power	—	50	100	mW
Recovery Time, 3 dB	—	0.5	1.0	μs
Insertion Loss	—	0.8	1.2	dB
Low Level VSWR	—	1.3	1.4	—
Life	2000	4000	—	Hours
STC Attenuation	See Curve			
ENVIRONMENTAL CHARACTERISTICS				
Operating Temperature	−55	—	+71	°C
Storage Temperature	−55	—	+80	°C
MECHANICAL CHARACTERISTICS				
Finish				
Input Flange	Cadmium Plate, Iridite			
Output Flange	Aluminum, Iridite			
Body	Black Lacquer			
Dimensions	See Outline Drawing			

Outline Drawing



DIM.	AQL (%) DEFECTIVE	INSPECT. LEVEL	LIMITS MIN.	LIMITS NOM.	LIMITS MAX.
ACCEPTANCE INSPECTION PART I (PROD.)					
A	NOTE #1	I	— —	— —	1.90
B			1.297	1.307	1.317
C			.142	.147	.152
D			— —	— —	.435
ACCEPTANCE INSPECTION PART II (DESIGN)					
E	6.5	L6	.990	.994	.998
F			1.302	1.312	1.322
G			.952	.956	.960
H			1.302	1.312	1.322
J			.215	.285	.335
K			.250	.300	.350



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MA-8010-XF Series

Gunn Effect, X-Band High Stability Local Oscillators

Description

The MA-8010-XF Series of Gunn effect local oscillators is designed to meet the requirements of the communications industry for remodulation-type link equipment receiver local oscillators. These oscillators offer low noise, cost effectiveness and simplicity. This series features frequency stability approaching that of a crystal controlled multiplier source and excellent FM noise characteristics in a compact and rugged package. The devices are field tunable over the band, minimizing the ordering variety imposed on equipment manufacturers — and giving the lowest spares investment for the system user.

Features

- **FULL BAND COVERAGE, FIELD TUNABLE**
- **LOW NOISE**
- **HIGH STABILITY**
- **LOW COST**
- **LOW VOLTAGE OPERATION**
- **HIGH RELIABILITY**

Applications

New solid-state design retrofits to eliminate klystron or T.O.M. local oscillators in services for CCIR 300, 960 and 1800 channel telephony bands; broadcast auxiliary, fixed and mobile; common carrier, fixed remote pick-up and mobile; and operational fixed communications.

TELECOMMUNICATION SOURCES DIVISION
Burlington, Massachusetts 01803 ■ Telephone (617) 272-3000 ■ TWX: 710-332-6789 ■ Telex: 94-9464

Bulletin No. 7603B

Specifications

TYPICAL PERFORMANCE CHARACTERISTICS

Frequency Range	
MA-8010-XF1	10.63 - 11.13 GHz
MA-8010-XF2	11.13 - 11.63 GHz
MA-8010-XF3	11.63 - 12.13 GHz
MA-8010-XF4	12.13 - 12.63 GHz
MA-8010-XF5	12.63 - 13.13 GHz
MA-8010-XF6	13.02 - 13.27 GHz
Power Output	3 mW, nominal
Tuning Resolution Mechanical	100 KHz
Frequency Stability	
±50 ppm	−30°C to +55°C
±25 ppm	−20°C to +55°C
±20 ppm	0°C to +55°C
Power Output Stability	±0.5 dB (−20° to +55°C)
AM Noise	Refer to Figure 1
FM Noise	Refer to Figure 2

DC REQUIREMENTS[1]

Option I	
DC-RF	−20V ±1V at 125 mA, max.
DC-Oven	−20V ±1V at 700 mA @ −30°C (Start) 225 mA @ 25°C (Idle)
Option II	
DC-RF	−12V ±0.5V at 125 mA, max.
DC-Oven	−24V ±1V at 800 mA @ −30°C (Start) 200 mA @ 25°C (Idle)
Option III	Above DC, input conditions can be positive polarity or alternate voltage levels.

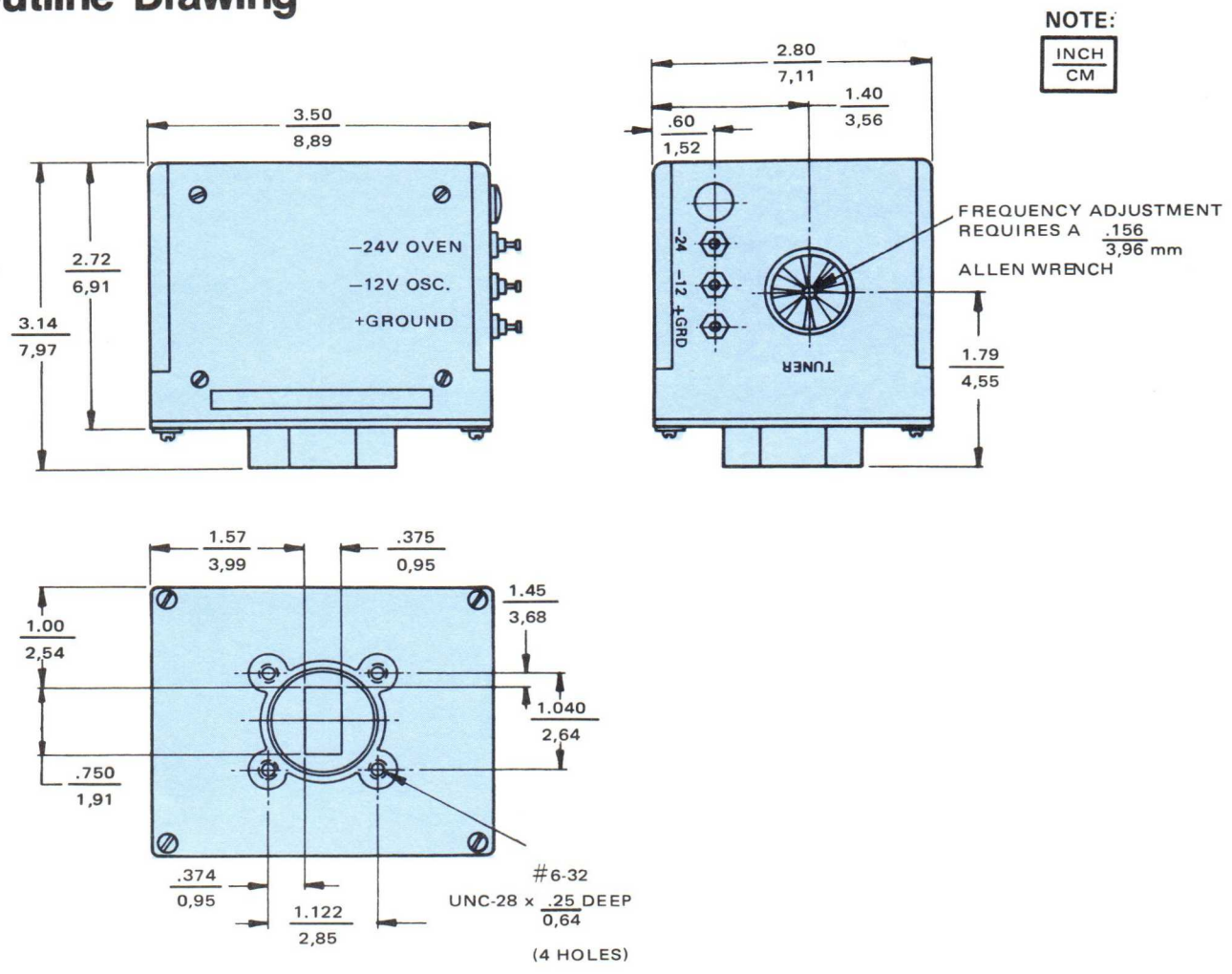
MECHANICAL CHARACTERISTICS

Size	Refer to outline drawing
Connectors	
Input	Solder terminals
Output	WR-75 flange, UER-(120)
Weight	18 oz./510 g

NOTE:

1. At the option of purchaser, oven power input pin can be eliminated if both oscillator and oven supplies are of the same voltage and polarity.

Outline Drawing



X-BAND HIGH STABILITY LOCAL OSCILLATOR SHORT TERM STABILITY

Introductory note: f_O denotes the frequency of operation after all short term instabilities due to start-up effects have disappeared. Typically, f_O is the frequency of operation after 10 days.

After 1 Month Off
within 50 ppm of f_O: 4 days typical
within 25 ppm of f_O: 7 days typical

After 24 Hours Off
within 50 ppm of f_O: 1 hour typical
within 25 ppm of f_O: 3 hours typical

After 1 Hour Off
within 50 ppm of f_O: 10 min typical
within 25 ppm of f_O: ½ hour typical

After one week of continuous "on" time, the frequency can be reset and will be within 50 ppm of the final f_O. ½ hour after resetting, the frequency will be within 25 ppm of the final f_O. After 24 hours the frequency can be trimmed (less than 500 KHz change) and set within 100 KHz of any desired frequency.

Typical Performance Curves

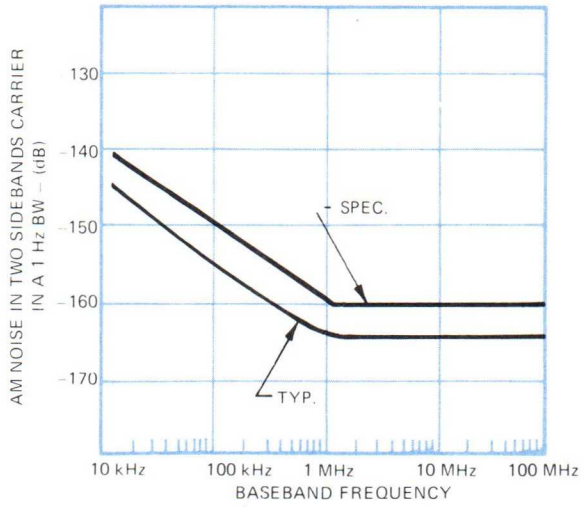


FIGURE 1. AM Noise

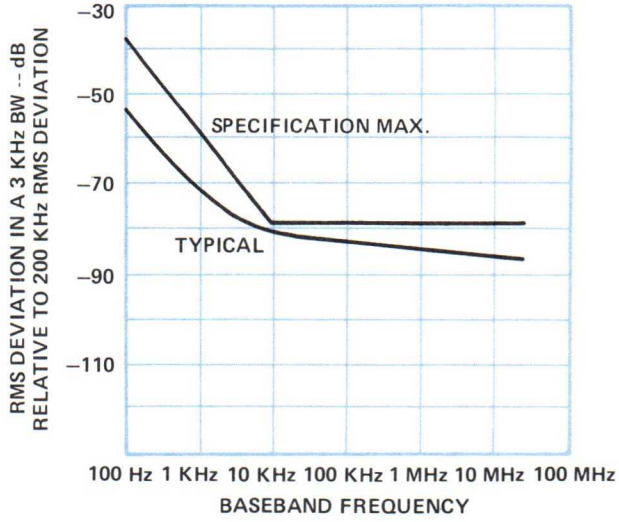


FIGURE 2. FM Noise

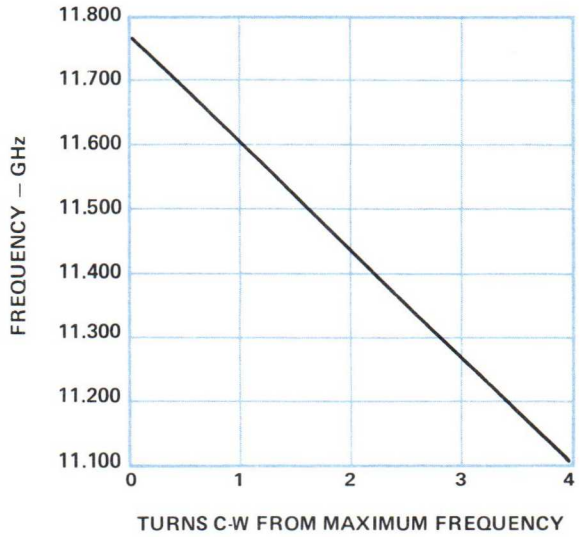


FIGURE 3. Typical Tuning Rate Curve

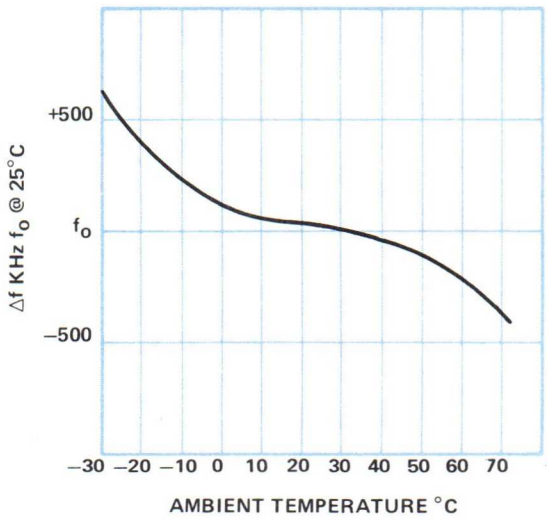


FIGURE 4. Typical Frequency Deviation vs Temperature

Typical Performance Curves (Cont'd)

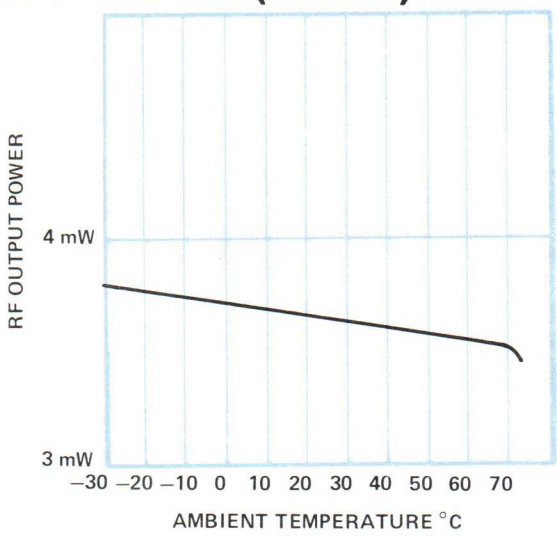


FIGURE 5. Typical Power vs Temperature

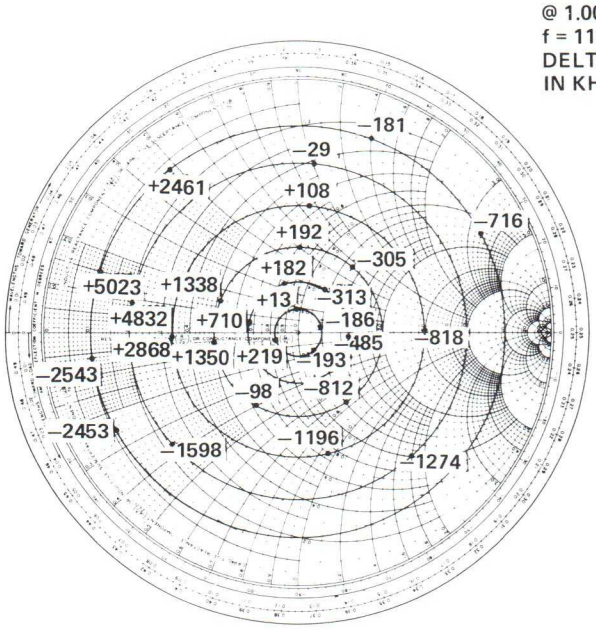


FIGURE 6. Typical Frequency Pulling Characteristics with Load Impedance

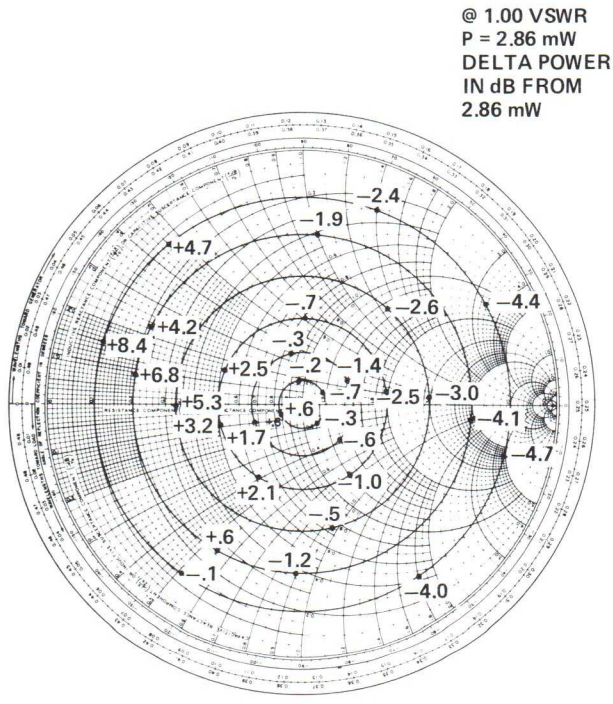
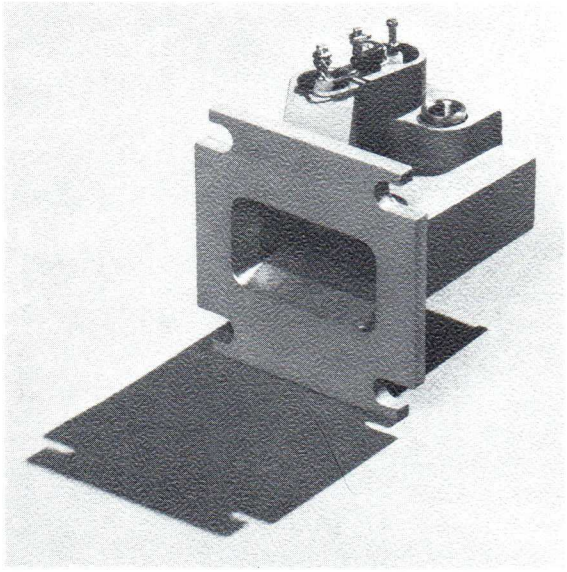


FIGURE 7. Typical Power Pulling Characteristics with Load Impedance

Microwave Associates



MA-86503 Series
Doppler Transceiver

Description

The MA-86503 microwave Doppler transceiver is a low cost sensor with integral antenna, designed for any speed measurement or motion sensing application. It can be used to provide an audio output signal whose frequency is proportional to the velocity of an object moving toward or away from the antenna.

Each unit consists of a Gunn oscillator, mixer and antenna assembled into a compact waveguide package. The standard model employs a fixed tuned CW oscillator and Schottky Barrier mixer diode. The mixer diode is field replaceable.

Applications

The MA-86503 transceiver is specifically designed for applications in CW Doppler radar systems, speed radars, intrusion alarms, traffic control, braking systems, industrial process controls and other motion detecting systems.

Features

- INTEGRAL ANTENNA
- LOW COST
- HIGH SENSITIVITY
- INTEGRATED ASSEMBLY (INCLUDES MIXER DIODE)
- MEETS FCC PART 15 AND/OR PART 89 AND 93 REQUIREMENTS

POWER GENERATION GROUP
Burlington, Massachusetts 01803 ■ Telephone (617) 272-3000 ■ TWX: 710-332-6789 ■ Telex: 94-9464
Bulletin No. 7629

SPECIFICATIONS

ELECTRICAL CHARACTERISTICS

Center Frequency	10.525 GHz
Mechanical Tuning Range	±25 MHz
Power Output	5 to 10 mW typical @ 25°C Flange Temp;
Frequency Stability	40 PPM/°C (Max.) between end points
Nominal Antenna Gain	4 dB
H-Plane Beam Width	80° at 10 dB points
E-Plane Beam Width	120° at 10 dB points
Spurious, harmonic	−35 dBm (Max.)
non-harmonic	−50 dBm (Max.)
Detector Sensitivity	−95 dBc minimum for an IF bandwidth of 10 Hz to 150 Hz
Operating Voltage	+7.5 ±0.5 Volts DC
Operating Current	120 mA typical, 150mA max.

MECHANICAL CHARACTERISTICS

Input Connector	Solder Lug
RF Output	10.525 GHz Antenna

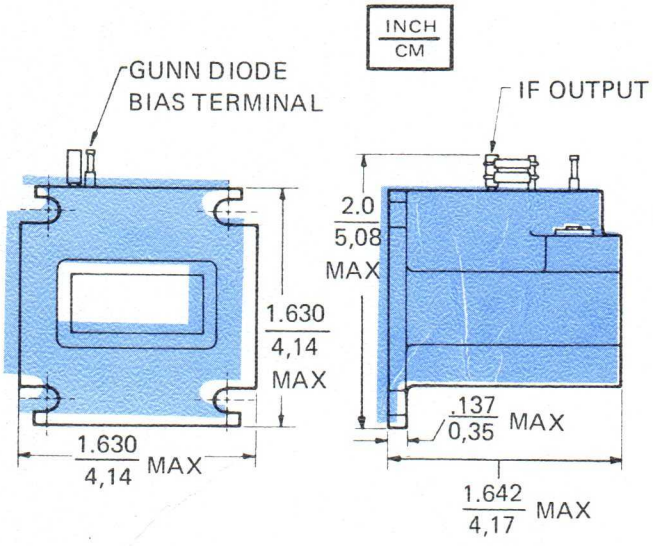
ENVIRONMENTAL CHARACTERISTICS

Operating Temperature	−30° to +70°C

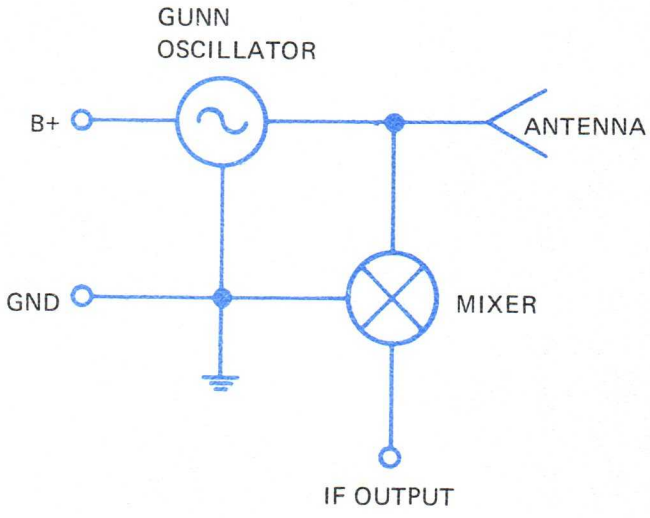
APPLICATION NOTES

1. Optimum IF load impedance is 500 ohms. All units are supplied with a 1000 ohm load resistor in place to protect the mixer diode. Recommended input impedance to IF amplifier is 1000 ohms. The two 1000 ohm resistors in parallel provide the optimum load.
2. RF power for the L.O. signal is obtained directly from the transmitter signal as it "passes" the detector diode near the antenna. The detector bias is factory adjusted.
3. Each unit is factory tuned to the specified frequency within ±5 MHz. Operating frequency can be mechanically adjusted over a range of ±25 MHz.
4. Scale factor is 31.4 Hz per mile/per hour of radial velocity.
5. An operating voltage of −7.5 volts typical is available.
6. Spurious and harmonic emission levels are determined in a radiative measurement as required under part 15 of the FCC rules and regulations.
7. An electrolytic capacitor (between 1 and 10μF) is required between the Gunn bias terminal and ground.

OUTLINE DRAWING



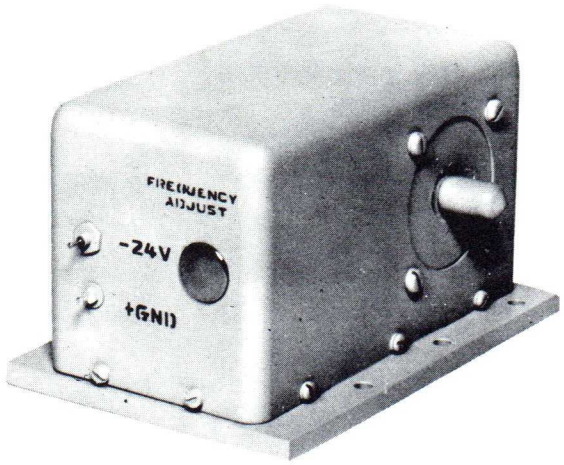
BLOCK DIAGRAM



Microwave Associates
A M/A-COM COMPANY

MA-86515 & MA-86047 Series

Gunn Effect, C-Band, High Stability Local Oscillators



Description

The MA-86515 through MA-86517 and MA-86047 through MA-86049 series of Gunn oscillators have been designed to meet the needs of the communications industry for remodulation-type link equipment receiver local oscillators. These oscillators offer low noise, cost effectiveness and simplicity. The design incorporates temperature compensation to maintain the output frequency consistent with the group delay equalization tolerances of receivers for services in these bands. These oscillators are field tunable over the band, minimizing the ordering variety imposed on equipment manufacturers — plus the lowest spares investment for the system user.

The use of a single active frequency generating element, a Gunn diode, insures minimum spurious output; unlike transistor oscillator designs.

Features

- FULL BAND COVERAGE, FIELD TUNABLE
- LOW NOISE
- TEMPERATURE COMPENSATED, NO OVEN
- LOW COST
- LOW VOLTAGE OPERATION
- HIGH RELIABILITY

Applications

New solid-state receiver designs retrofit to eliminate klystron or T.O.M. local oscillators in services for CCIR 300, 960 and 1800 channel telephony bands; broadcast auxiliary, fixed and mobile; common carrier, fixed remote pick-up and mobile; operational fixed communication.

TELECOMMUNICATION SOURCES DIVISION
Burlington, Massachusetts 01803 ■ Telephone (617) 272-3000 ■ TWX: 710-332-6789 ■ Telex: 94-9464
Bulletin No. 7602B

Specifications

ELECTRICAL CHARACTERISTICS

RF Frequency	
MA-86515	5.855 - 6.495 GHz
MA-86516	6.355 - 6.945 GHz
MA-86517	6.805 - 7.195 GHz
MA-86048	7.055 - 7.870 GHz
MA-86049	7.730 - 8.470 GHz
MA-86047	8.400 - 8.570 GHz
RF Output Power	+4 to +9 dBm, absolute
Output Power Temperature Stability	(—30 to +60°C) 2 dB, typ. (+10 to +40°C) 1 dB, typ.
Output Power Variation with Tuning	3 dB, typ.
Frequency-Temperature Stability	±50 ppm, 10 to +40°C ±150 ppm, —30 to +60°C
Frequency-Time Stability	50 ppm/year, typ.
Pulling Figure	0.5 MHz/load 22 dB return loss, typ.
FM Thermal Noise	See Figure 2
AM Thermal Noise	See Figure 3
Spurious Output	—30 dBc, harmonically rel'd —60 dBc, non-harmonically rel'd
Leakage	MIL-STD-461A, Notice 4 (RE-01, figure 1 at 1 m)
Supply Voltage	—20 to —24V at 200 mA, max.; 150 mA, typ. 300 mA, max., threshold current (Internal regulator supplied with unit.)

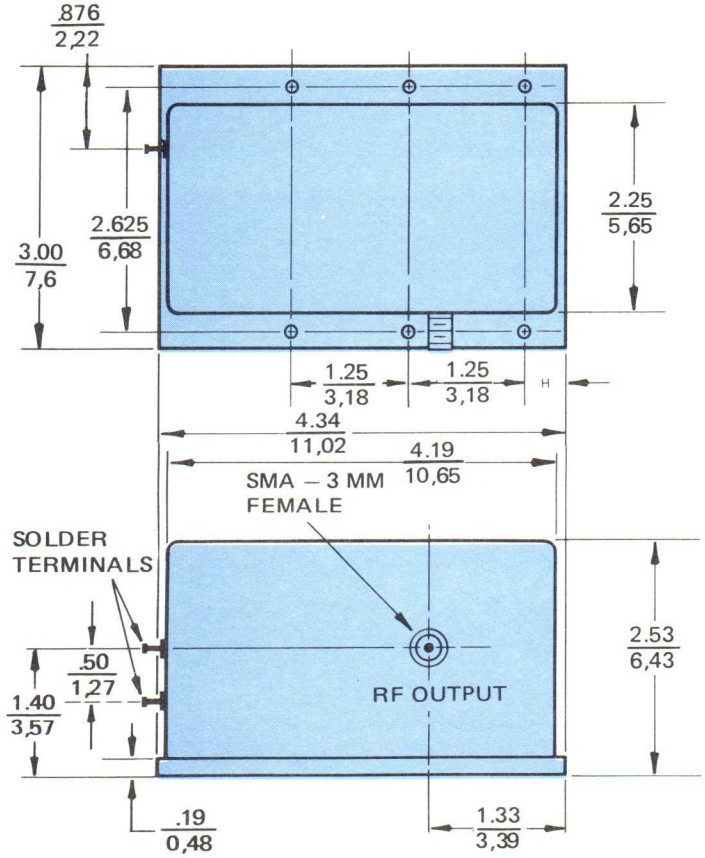
MECHANICAL CHARACTERISTICS

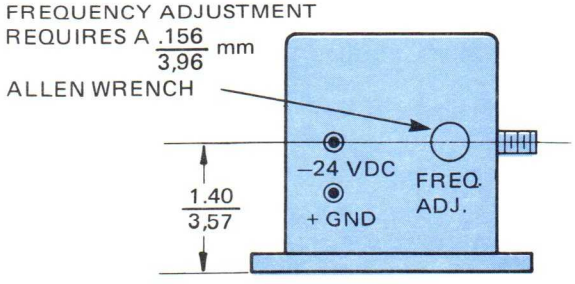
Size	See outline drawing
Weight	25 oz./708 g
Connectors	RF Output SMA-3 mm female DC: Solder terminals
Tuner	Hex, socket 5/32"/3.96 mm (Tuning rate ≈ 100 MHz/turn)
Resolution	100 KHz
Cooling	Conduction

ENVIRONMENTAL CHARACTERISTICS

Temperature	
Operating to full spec	+10 to +40°C Humidity to 95% Altitude to 15,000 ft/4572 m
Operating to reduced spec.	—30 to +60°C
Storage	—40 to +80°C Altitude to 40,000 ft /12196 m

Outline Drawing





C-BAND HIGH STABILITY LOCAL OSCILLATOR SHORT TERM STABILITY

Introductory note: f_o denotes the frequency of operation after all short term instabilities due to start-up effects have disappeared. Typically, f_o is the frequency of operation after 10 days.

After the power input has been shut off or disconnected at room temperature storage conditions, the unit takes varying amounts of time to reach the stated stability. The period of time required to reach a given stability will depend upon the length of time the unit has been shut off.

After 1 Month Off
within 50 ppm of f_o: 30 min typical
within 25 ppm of f_o: 1 hour typical

After 24 Hours Off
within 50 ppm of f_o: 1 min typical
within 25 ppm of f_o: 1 min typical

After one week of continuous "on" time, the frequency can be reset and will be within 25 ppm of the new f_o immediately.

Typical Performance Curves

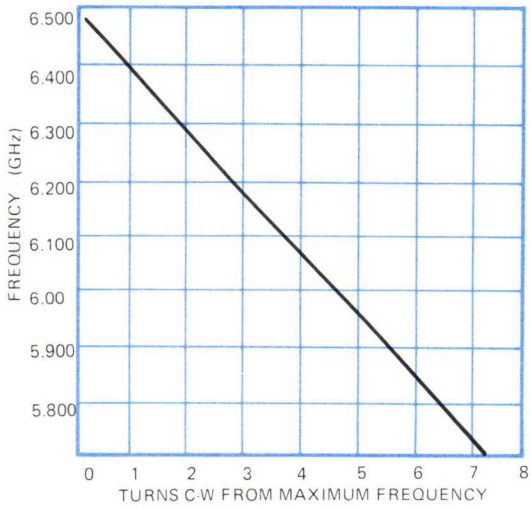


FIGURE 1. Typical Tuning Rate

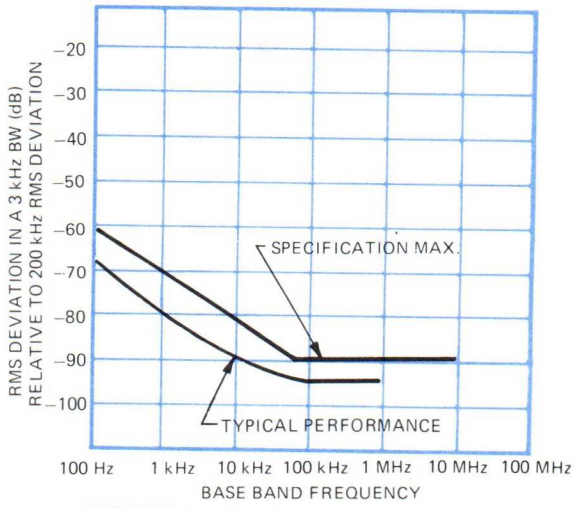


FIGURE 2. FM Noise

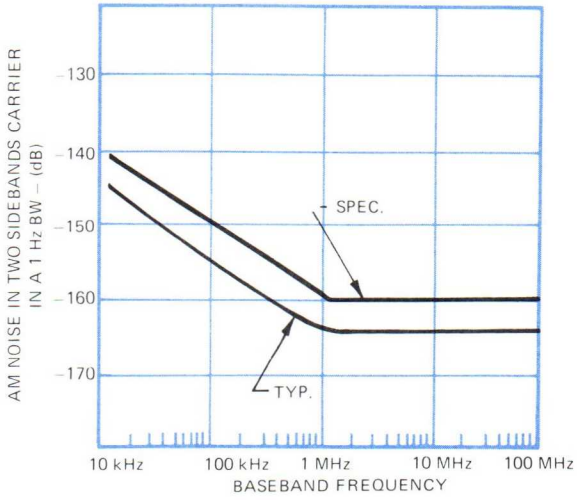


FIGURE 3. AM Noise

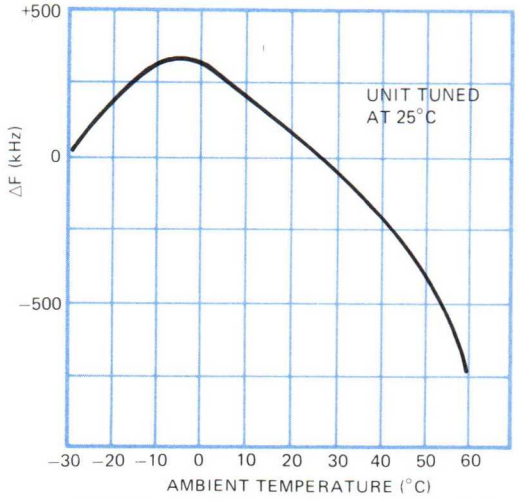


FIGURE 4. Typical Frequency Deviation vs Temperature

Typical Performance Curves (Cont'd)

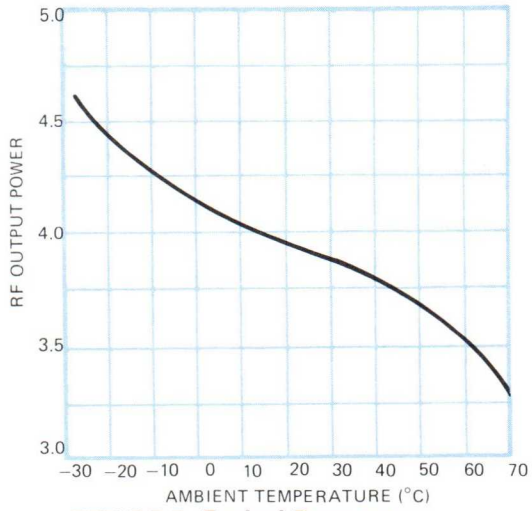


FIGURE 5. Typical Power vs Temperature

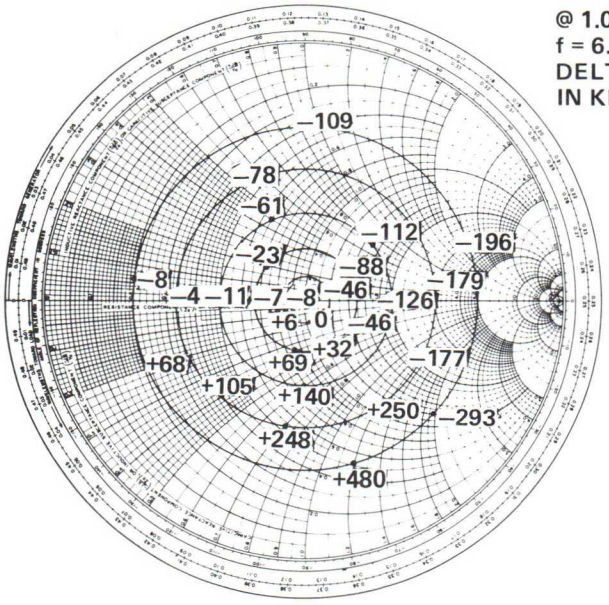


FIGURE 6. Typical Frequency Pulling Characteristics with Load Impedance

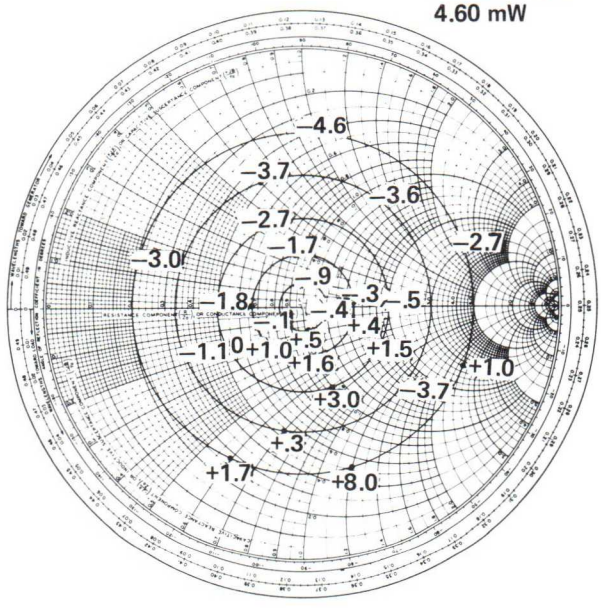


FIGURE 7. Typical Power Pulling Characteristics with Load Impedance

MA-86674, MA-86675, MA-86676, MA-86677

X-BAND COMMERCIAL GUNN OSCILLATORS

Bulletin 7621A

FEATURES

- LOW COST
- HIGH RELIABILITY
- LOW NOISE
- LOW BIAS VOLTAGE REQUIREMENTS
- TEMPERATURE COMPENSATED

DESCRIPTION

The MA-86674, MA-86675, MA-86676 and MA-86677 waveguide cavity Gunn oscillators offer inexpensive and reliable sources of microwave power in the X-band commercial radiolocation band. Each oscillator consists of a waveguide cavity containing a low noise Gunn diode. This series of devices also features mechanically adjustable operating frequency.

APPLICATIONS

This oscillator series is specifically designed for applications in: CW Doppler radar systems, police speed radars, braking systems, traffic control, industrial process controls, and intrusion alarms.

Microwave Associates, Inc. Burlington, Massachusetts Tel. (617) 272-3000 TWX: 710-332-6789 Telex: 94-9464

SPECIFICATIONS

Electrical Characteristics

Model	Center Frequency[1,2,3]
MA-86674	8.875 GHz
MA-86675	9.250 GHz
MA-86676	9.470 GHz
MA-86677	9.900 GHz
Power Output[3] @ +25°C	50 mW

DC Bias Voltage[3]	+12.0 V
Bias Current	350 mA Typ.
Power Output Stability	30 mW Min.
Frequency Stability[4]	±25 MHz
AM Noise	See Figure 2

Mechanical Characteristics

Mating Flange	UG-39/U
Weight	3 oz.
Cooling	Conduction

Environmental Characteristics

Operating Temperature	-25°C to +70°C

NOTES:

1. Factory set ±5 MHz @ +25°C flange temperature.
2. Mechanical Tuning of ±25 MHz or wider available on request.
3. Other output powers, frequency, operating voltages available.
4. Over operating temperature.
5. Figure 1 illustrates a typical circuit arrangement commonly employed for the previously listed applications.

TYPICAL MICROWAVE FRONT-END CIRCUIT

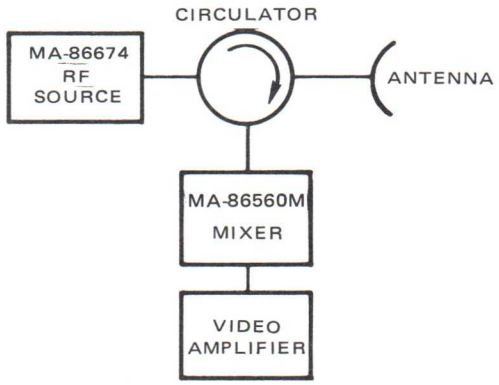


FIGURE 1 HOMODYNE TRANSCEIVER

TYPICAL PERFORMANCE CURVE

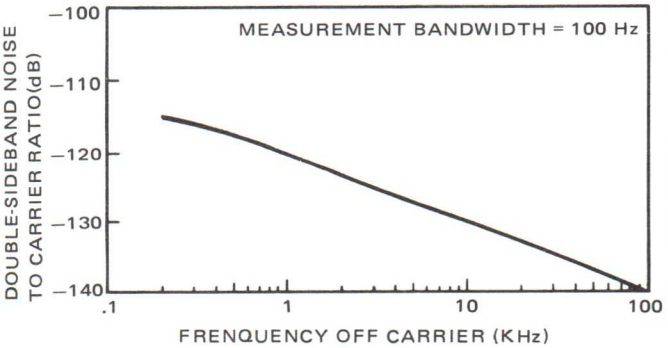
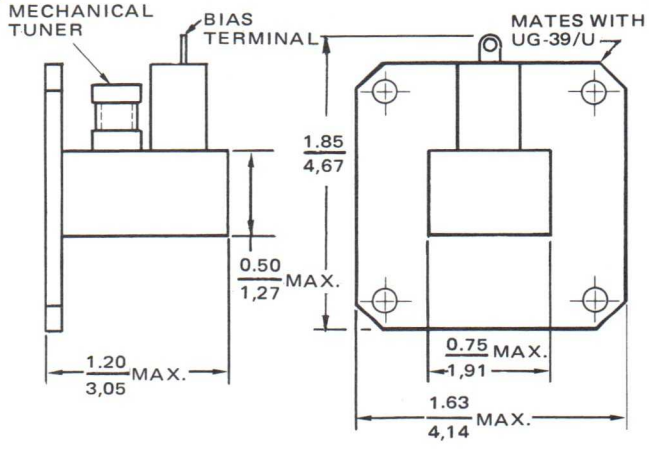


FIGURE 2 TYPICAL AM NOISE

OUTLINE DRAWING



NOTES:

1. Case is Electrical Ground.
2. An electrolytic capacitor (between 1 and 10 μF) is required between bias terminal and ground.

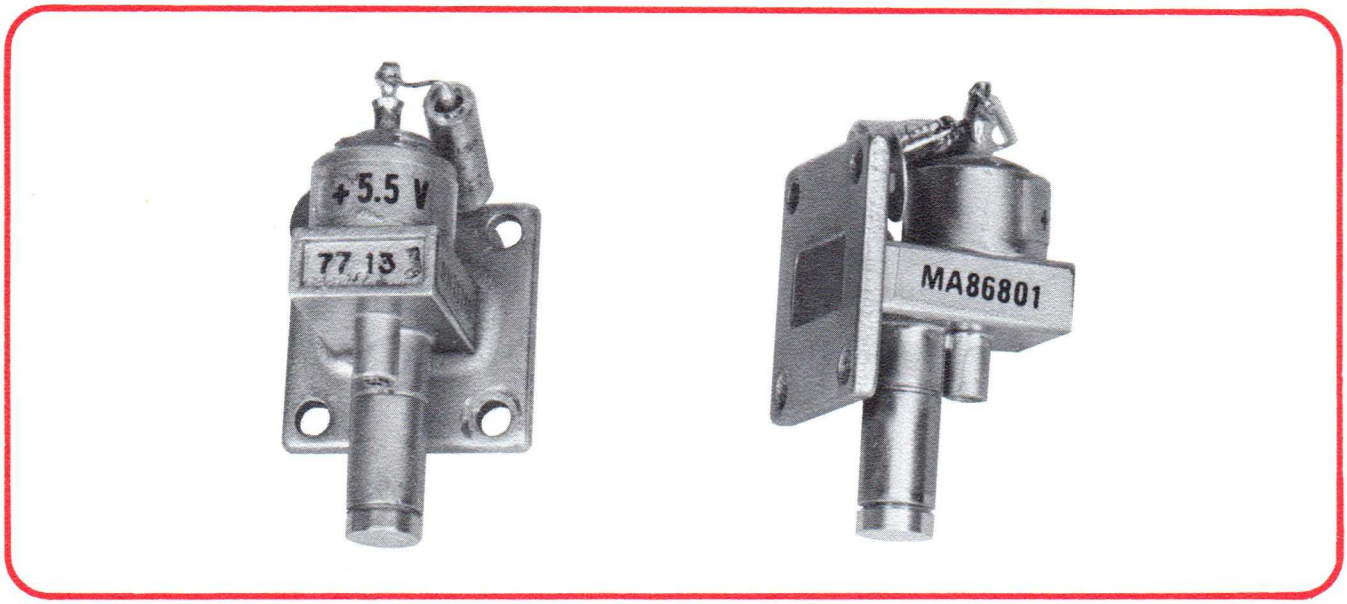
KEY

INCH
CM

MA-86801 Series

LOW COST COMMERCIAL K-BAND GUNN OSCILLATOR

Bulletin 7627A



FEATURES

- LOW COST
- LOW AM NOISE
- SIMPLE TO USE
- MEETS FCC PART 15 AND/OR PART 89 AND 93 REQUIREMENTS

DESCRIPTION

This oscillator utilizes a new concept of microwave cavity design for Gunn diodes which inherently suppresses harmonic power generation.

APPLICATIONS

The MA-86801 K-Band Gunn oscillator is specifically designed to be an inexpensive and reliable source of microwave power in the 24.150 GHz commercial radiolocation band. This oscillator is ideal for application to CW Doppler radar systems such as speed radars, braking systems, traffic control, industrial process control, intrusion alarms, and various motion detection systems. This unit may also be selected to operate in a pulse modulation mode for ranging measurements, identification and amplitude sensitive systems.

Microwave Associates, Inc. Burlington, Massachusetts Tel. (617) 272-3000 TWX: 710-332-6789 Telex: 94-9464

SPECIFICATIONS

Electrical Characteristics

Frequency	24.150 GHz
Mechanical Tuning Range	±100 MHz
Power Output	40mW[1]
Frequency Stability	550 kHz/°C Max.[2]
DC Bias Voltage	6.0 ± 1 Volt
Operating Current	1.0 A[3]
Threshold Current	1.5 A[3]
Harmonic and Spurious Power	−13 dBm Max.

NOTES:

1. Min. at +25°C Flange Temp.
2. Average Slope −30°C to +50°C.
3. Max. at +60°C.

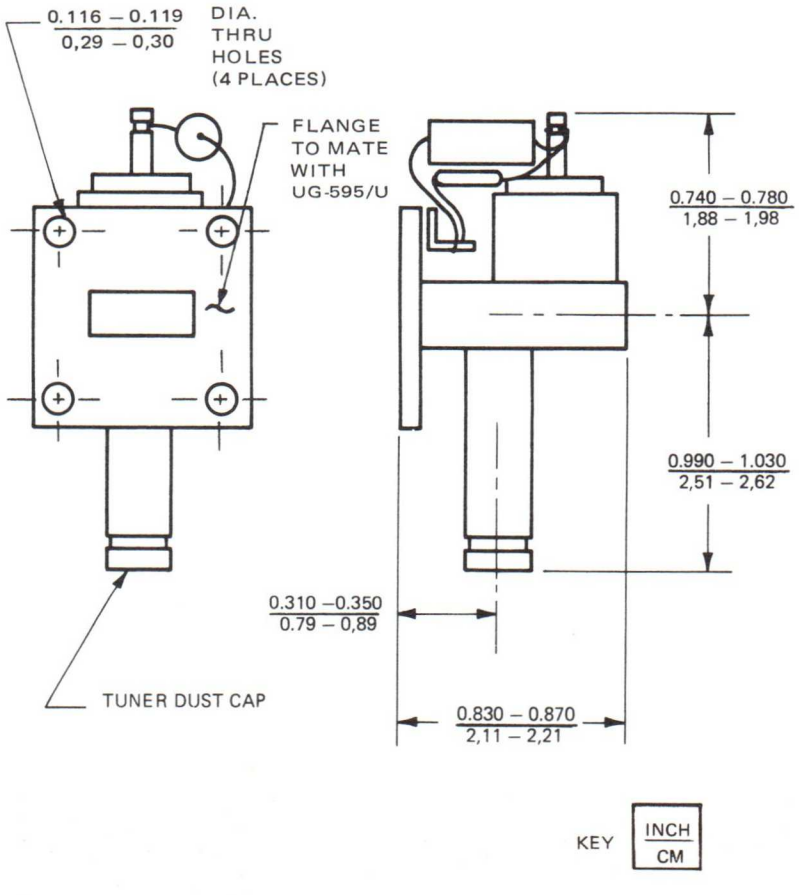
Environmental Characteristics

Operating Temperature:	−30 to +70°C

Mechanical Characteristics

Mating Flange	UG-595/U
Weight	2.3 ozs. (65 grams) Max.
Cooling	Conduction

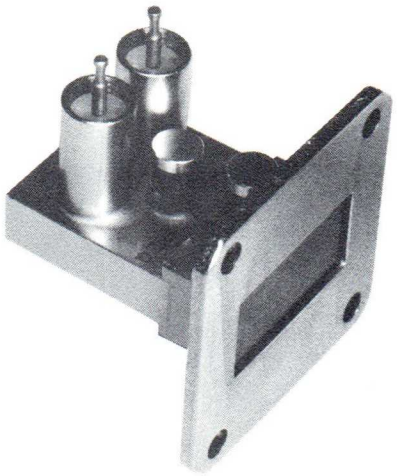
OUTLINE DRAWING



MA-87601

GUNN LOCAL OSCILLATOR FOR MARINE AND WEATHER RADAR

Bulletin 7604A



DESCRIPTION

The MA-87601 is a varactor-tuned waveguide cavity Gunn oscillator which has been specifically designed for use as a local oscillator in the 9.3 to 9.5 GHz frequency range of commercial marine or weather radars. This oscillator frequency is mechanically tunable over 200 MHz to center the frequency for a given magnetron, and electronically tunable over a minimum of 20 MHz for automatic frequency control. Optimization of local oscillator power is accomplished via an internal power attenuator. The frequency/temperature coefficient is maintained at 400 KHz/^{o}C maximum. Variations of this oscillator design are available without the built-in attenuator, and with modified values of electronic tuning range and frequency/temperature coefficients.

FEATURES

- High reliability
- Low cost
- Integral attenuator
- Electronically tunable
- Low voltage power supplies

Microwave Associates, Inc. Burlington, Massachusetts Tel. (617) 272-3000
Western Union Fax
TWX: 710-332-6789
Telex: 94-9464

SPECIFICATIONS

Electrical Characteristics

Frequency Range (mechanically adjustable)	9.3 - 9.5 GHz Min.
RF Output Power (1)	1 - 3.5 mW
Tuning	
Mechanical tuning range	200 MHz Min.
Electronic tuning range	20 MHz min., 50 MHz max.
Frequency pushing	15 MHz/v max.
Temperature Coefficient	— 400 KHz/°C max.
Input Requirements	
DC Gunn Bias Voltage (2)	-9.0 ± 0.5 volts DC
DC Gunn Bias Current	200 mA max.
Tuning voltage (2)	-1 volt to -8 volts DC

Mechanical Characteristics

Size	See Outline Drawing
Connectors	
RF	Mates with UG-39/U
Gunn Bias	Solder pin
Tuning	Solder pin
Mechanical adjustments available	for center frequency for attenuation

Environmental Ratings

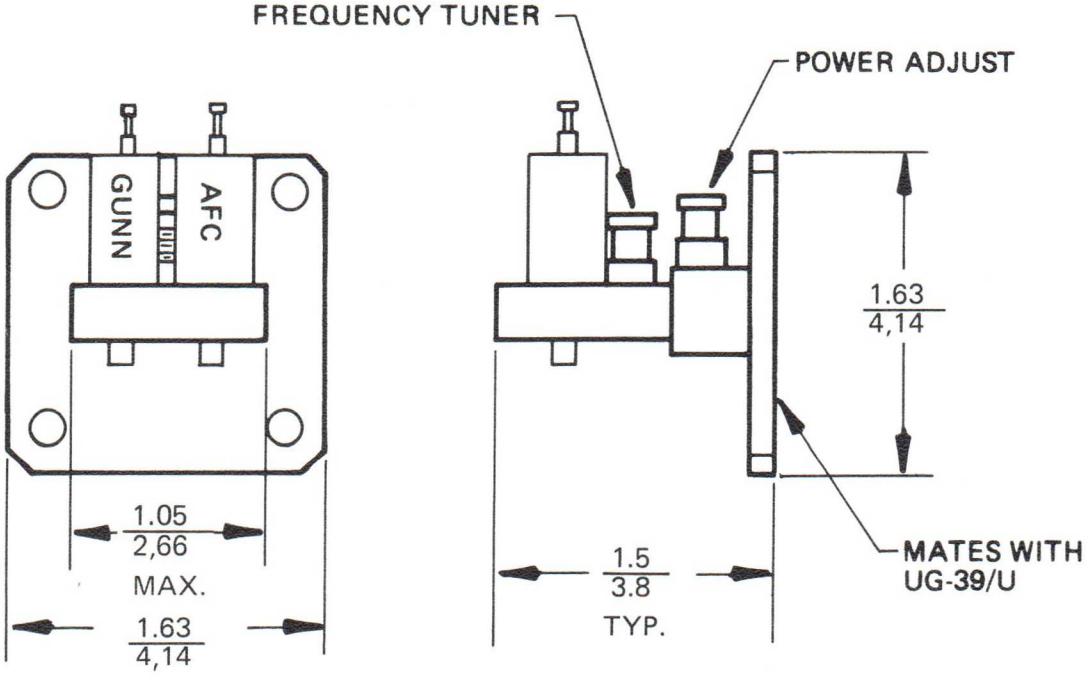
Temperature Range	-25°C to +70°C
Vibration	1 G max. from 5 Hz to 50 Hz
Shock	15 G max. for 11 msec in any direction
Humidity (at 55°C)	95%

NOTES: 1. The power output is variable between 1 mW and 3.5 mW as measured with a tuning voltage of -3 volts at room temperature.
2. Above DC input conditions can be positive polarity or alternate voltage levels upon request.

OUTLINE DRAWING

NOTE:

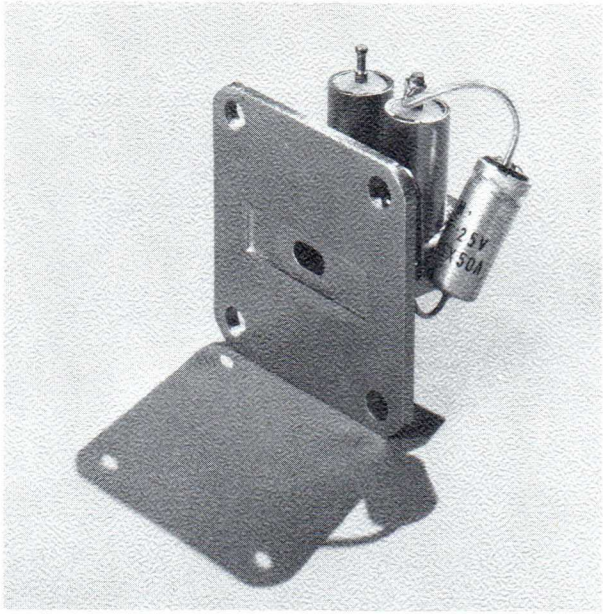
INCHES
CM



Microwave Associates

MA-87635

Gunn Local Oscillator for Marine and Weather Radar



Description

The MA-87635 Gunn Oscillator has been specially designed as a local oscillator with 100 MHz of mechanical tuning around a center frequency of 9470 MHz and a minimum of 30 MHz of electronic tuning via a varactor diode for automatic frequency control (AFC).

The waveguide cavity of the MA-87635 is tightly temperature compensated to control the frequency/temperature coefficient between the limits of −100 kHz/°C and −200 kHz/°C. The frequency temperature drift window of the local oscillator has been selected to match the frequency drift of the transmitter, thereby minimizing the required AFC range.

Alternate oscillator designs are available with different frequency/temperature coefficients, expanded electronic tuning ranges, negative tuning voltages, or wider mechanical tuning ranges.

Features

- HIGH RELIABILITY
- LOW COST
- TEMPERATURE COMPENSATED
- ELECTRONICALLY TUNABLE
- LOW VOLTAGE POWER REQUIREMENTS

Applications

The MA-87635 is a varactor-tuned waveguide Gunn oscillator operating at 9470 MHz center frequency which has been specifically designed for local oscillator use in commercial marine or weather radars.

POWER GENERATION GROUP
Burlington, Massachusetts 01803 ■ Telephone (617) 272-3000 ■ TWX: 710-332-6789 ■ Telex: 94-9464
Bulletin No. 7606A

SPECIFICATIONS

ELECTRICAL CHARACTERISTICS

Center Frequency	9470 MHz
RF output power	10 mW minimum[1]
Tuning	
Mechanical tuning range	±50 MHz minimum
Electronic tuning range	30 MHz minimum
Frequency temperature	–200 KHz/°C maximum
coefficient	–100 KHz/°C minimum
Frequency pushing	15 MHz/v typical
Input requirements (at 25°C)	
DC Gunn bias voltage	+11.5 volts DC
DC Gunn bias current	
(Operating)	200 mA maximum
(Threshold)	250 mA maximum
Tuning voltage	+1 volts to +20 volts DC
Tuning voltage maximum range	0 volts to +24 volts DC

MECHANICAL CHARACTERISTICS

Size	See outline drawing
Connectors	
RF	Mates with UG-39/U
Gunn bias	solder pin
Tuning	solder pin

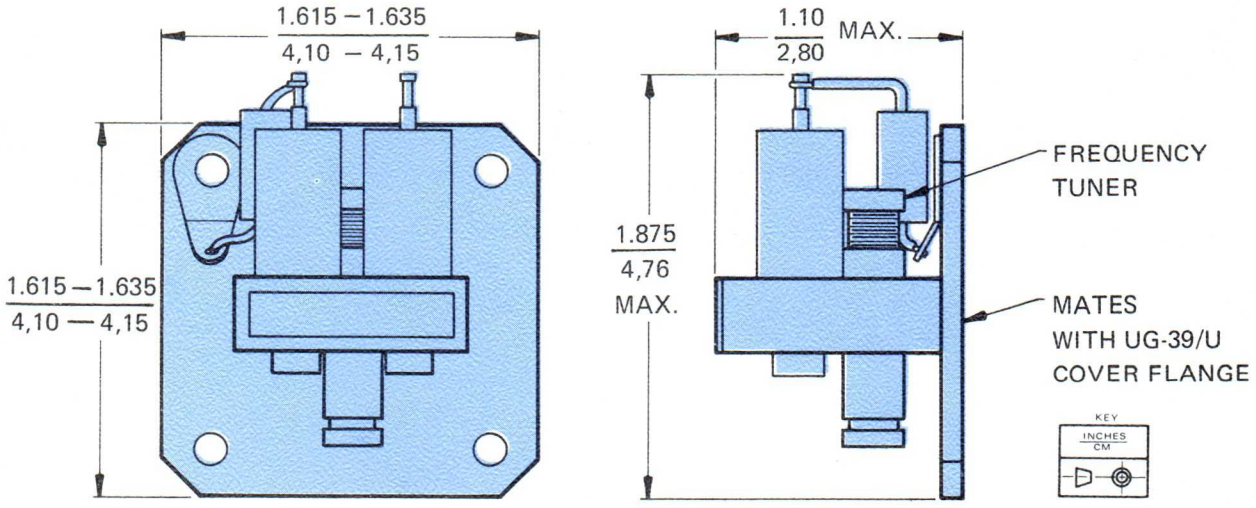
Mechanical adjustment available for center frequency control

ENVIRONMENTAL RATINGS

Temperature Range (operating)	–25°C to +75°C
(storage)	–55°C to +100°C
Vibration	0.020 inch D.A., 5 Hz to 38 Hz, ±1.5 G, 38 Hz to 2000 Hz
Shock	15 G maximum for 11 msec
Humidity (at 55°C)	95%

NOTE: [1]RF Power output is a minimum of 10 mW under all conditions.

OUTLINE DRAWING

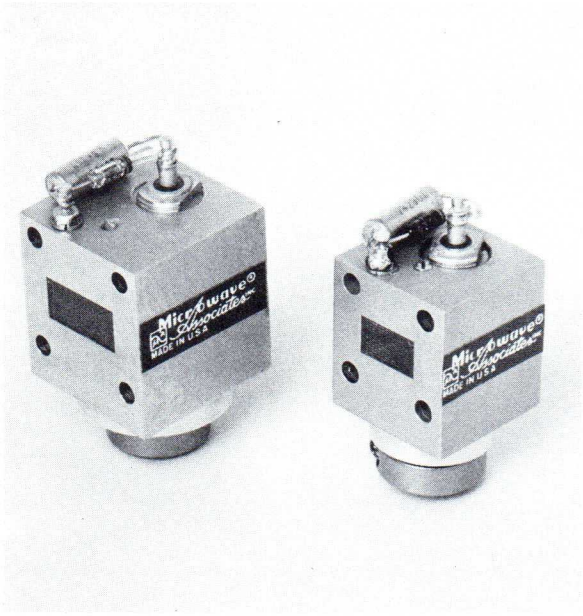


Microwave Associates

MA-86300, MA-86400 Series

High Power Parametric Amplifier Pumps

K-BAND, Ka-BAND



Description

The MA-86300 and MA-86400 series of CW Gunn oscillators are specially designed to satisfy requirements as pumps (in K and Ka-Band, respectively) for parametric amplifiers. Although low cost, each of these units features a low noise Gunn diode mounted in a high Q waveguide cavity for optimum control of frequency and power stability, and reduction of external loading effects.

Applications

This family of oscillators is specifically designed to be used as pumps for single or multistage parametric amplifiers. To ensure gain stability, the user would normally temperature stabilize these oscillators at some convenient point within their marked operating temperature range. The low cost of these devices makes them ideal for commercial and laboratory applications.

Features

- LOW COST
- LOW AM NOISE
- EXCELLENT POWER STABILITY
- SMALL SIZE
- LIGHTWEIGHT
- LOW BIAS VOLTAGE REQUIREMENTS

POWER GENERATION GROUP
Burlington, Massachusetts 01803 ■ Telephone (617) 272-3000 ■ TWX: 710-332-6789 ■ Telex: 94-9464
Bulletin No. 7607C

ELECTRICAL CHARACTERISTICS

Model Number	Frequency Range[1] (GHz)	Wave-guide Size	Min. Mech. Tuning Range (MHz)	Min. Output Power[2] (mW)	Nom. Bias DC Voltage[3] (Volts)	Max. Bias Current (mA)	Max. Threshold Current (mA)	Max. Power Deviation With Temp.[4] (dB/°C)	Max. Freq. Deviation With Temp. (KHz/°C)
MA-86320	18.0 – 21.9	WR-(42)	±100	75	6.0	1250	1600	.05	400
MA-86322	22.0 – 26.4	WR-(42)	±100	75	5.5	1250	1600	.05	500
MA-86330	18.0 – 21.9	WR-(42)	±100	100	6.0	1500	1800	.05	400
MA-86331	22.0 – 26.4	WR-(42)	±100	100	5.5	1500	1800	.05	500
MA-86340	18.0 – 21.9	WR-(42)	±100	150	6.0	1900	2300	.05	400
MA-86341	22.0 – 26.4	WR-(42)	±100	150	5.5	1900	2300	.05	500
MA-86420	26.5 – 32.4	WR-(28)	±150	75	5.0	1300	1700	.05	700
MA-86421	32.5 – 36.4	WR-(28)	±150	75	4.5	1500	1800	.05	850
MA-86422	26.5 – 39.9	WR-(28)	±150	75	3.75	1500	1800	.05	1000
MA-86423	40.0 – 42.0	WR-(28)	±200	75	3.5	1500	2000	.05	1200
MA-86430	26.5 – 32.4	WR-(28)	±150	100	5.0	1700	2200	.05	700
MA-86431	32.5 – 36.4	WR-(28)	±150	100	4.5	1500	2000	.05	850
MA-86432	36.5 – 39.9	WR-(28)	±150	100	3.75	1500	2000	.05	1000
MA-86433	40.0 – 42.0	WR-(28)	±200	100	3.5	2000	2500	.05	1200

NOTES:

1. Specify any center frequency within this range.
2. The oscillator will not be damaged by any RF load from a short to an open circuit.
3. Actual bias voltage is within ±1 volt of the listed nominal with the exception of the MA-86023 and MA-86433, which are within ±0.75 volts. Exact operating voltage is factor set. All bias voltages are positive. A zener diode to protect against brief voltage transients is included.
4. For further voltage stability information, consult factory.
5. The operating temperature range is defined as the range of temperature over which application of the DC bias voltage will cause no degradation of the RF performance at 50°C. Because parametric amplifier pump oscillators are usually stabilized over a very narrow temperature range, the electrical parameters specified in the table are guaranteed from +30°C to +50°C.

Mechanical Characteristics

DC Connector	Solder Pin
Mating Flange (MA-86300 Series)	UG-595/U
Mating Flange (MA-86400 Series)	UG-599/U
Weight	4 oz. Maximum
Cooling	Conduction

Maximum Ratings

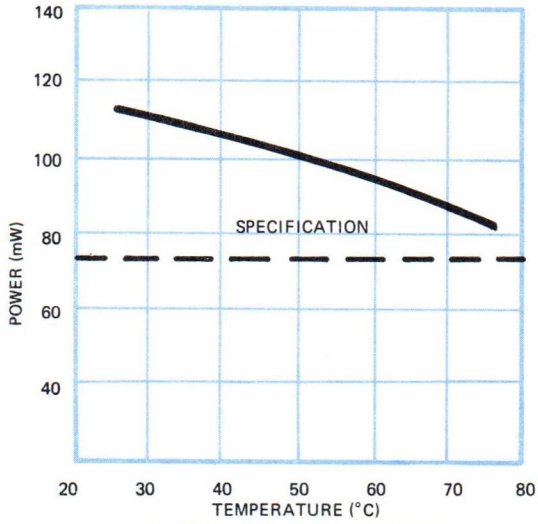
Temperature Range	
Operating[5]	–30°C to +70°C
Storage	–50°C to +85°C

Environmental Capabilities

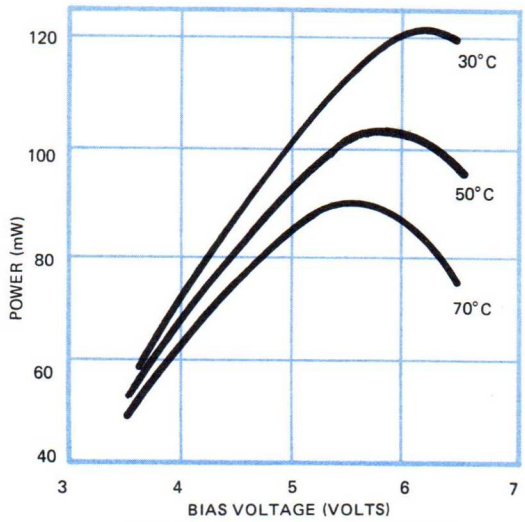
The MA-86300 and MA-86400 Series of Microwave Associates Gunn Oscillators are capable of passing the following MIL-STD-202 tests:

Test Description	Test Method	Test Condition
Vibration (High Frequency)	204B	10G Peak, 10-2000 Hz
Acceleration (Non-Operating)	212	11G, three mutually perpendicular axis
Temperature Cycling	102A	–50°C to +85°C, 5 cycles, ½ hour per cycle

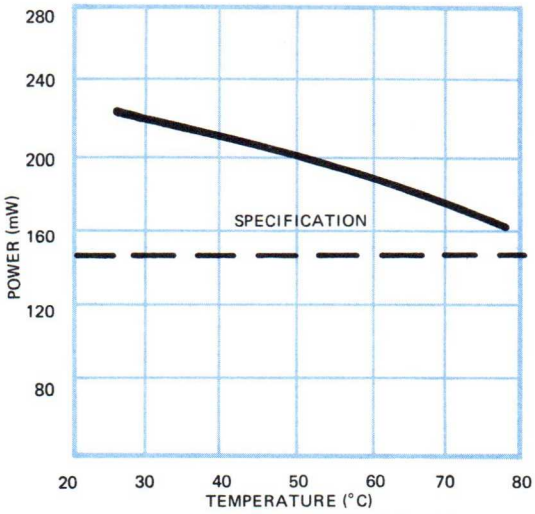
TYPICAL PERFORMANCE CURVES



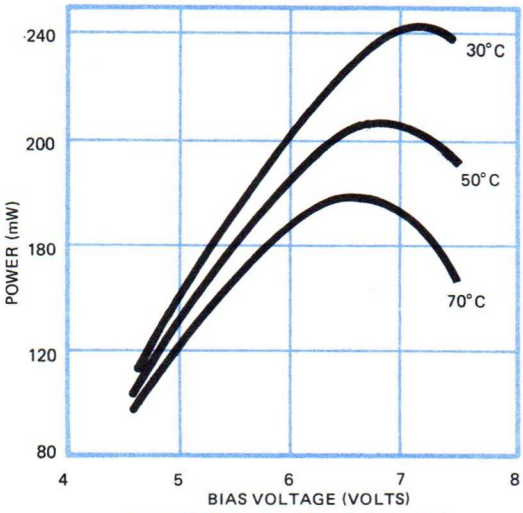
MA-86320 OUTPUT POWER vs. TEMPERATURE



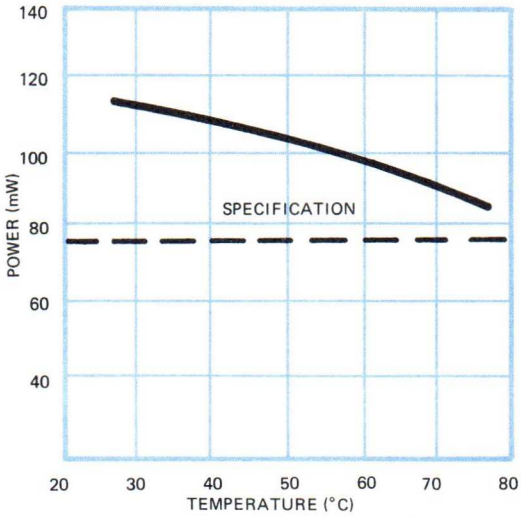
MA-86320 OUTPUT POWER vs. BIAS VOLTS



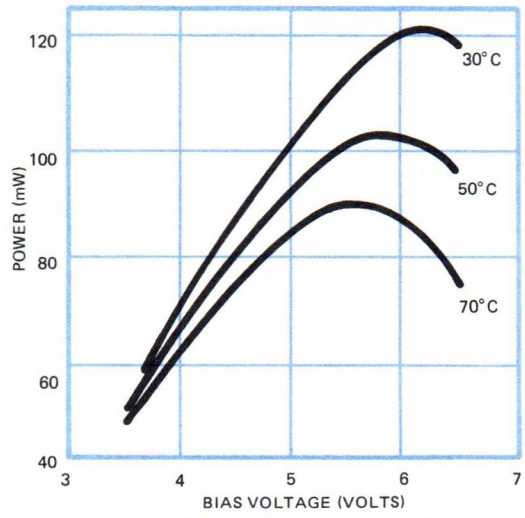
MA-86340 OUTPUT POWER vs. TEMPERATURE



MA-86340 OUTPUT POWER vs. BIAS VOLTS

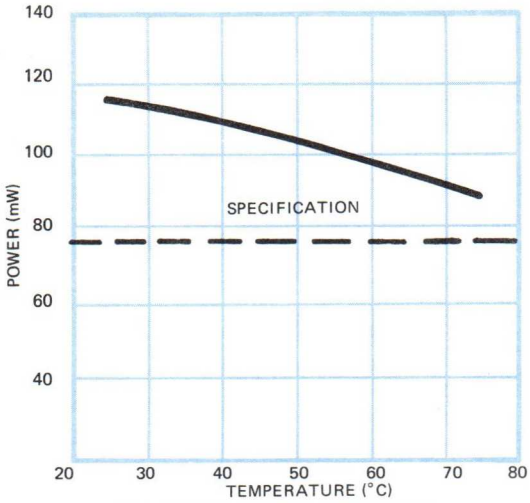


MA-86420 OUTPUT POWER vs. TEMPERATURE

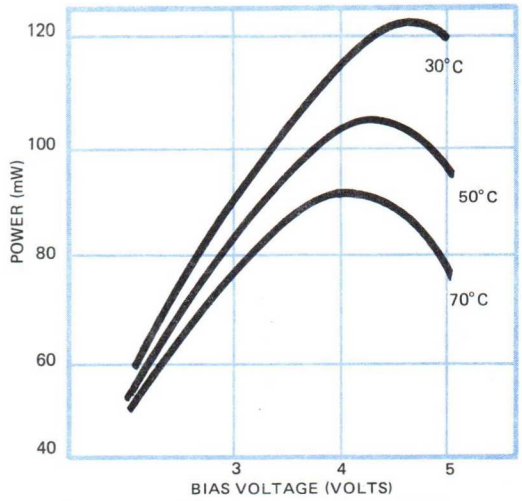


MA-86420 OUTPUT POWER vs. BIAS VOLTS

TYPICAL PERFORMANCE CURVES (Con't)



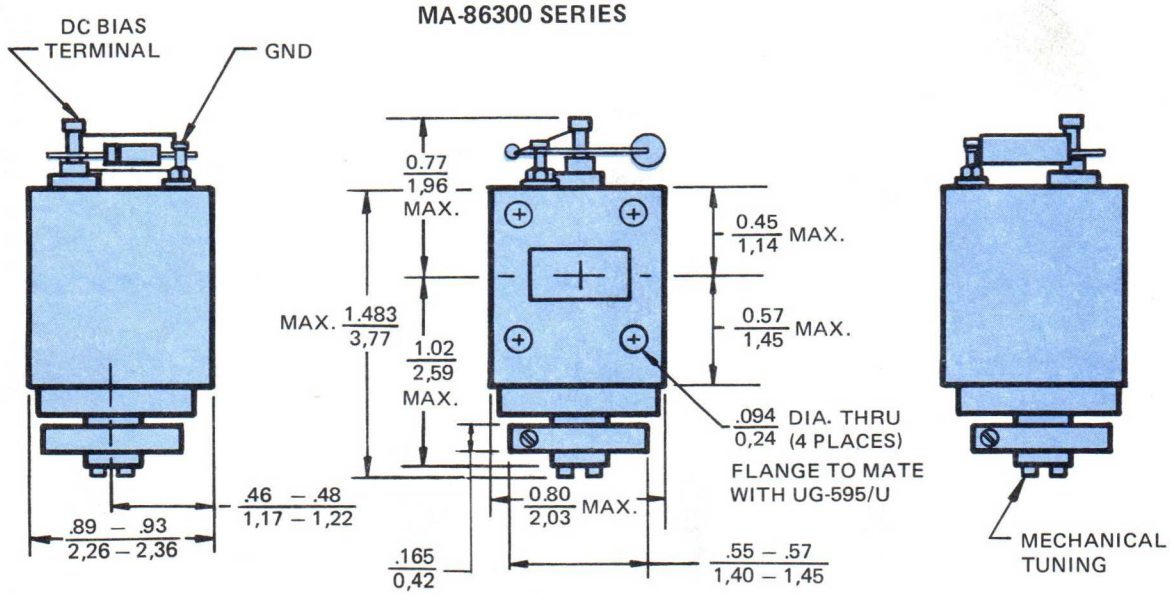
MA-86422 OUTPUT POWER vs. TEMPERATURE



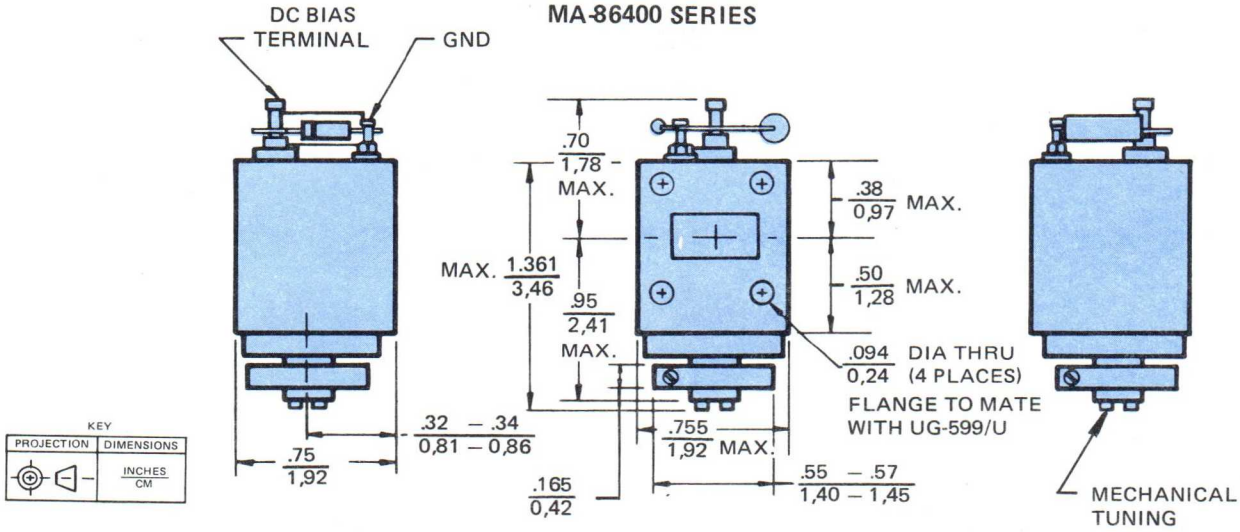
MA-86422 OUTPUT POWER vs. BIAS VOLTS

OUTLINE DRAWINGS

MA-86300 SERIES



MA-86400 SERIES



Microwave Associates, Inc.
South Avenue
Burlington, Mass. 01803
Tel. (617) 272-3000
TWX 710-332-6789
Western Union FAX
TELEX 94-9464