GaAs Gunn Diodes

MA49000

V 2.00

Features

- Low Noise Characteristics From 5 to 100 GHz
- Catalog or Custom Tailored Diodes
- Pulse or CW Operation

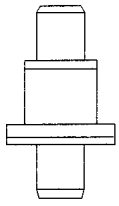
Description

The MA49000 series of Gallium Arsenide Gunn diodes is designed to operate at a fixed frequency under pulsed or CW conditions within a specified band. These diodes feature low FM and AM noise and provide a one step conversion from dc to microwave oscillators using low voltage power supply. Gunn diodes have cathode heat sinks unless otherwise specified.

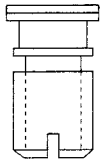
Applications

Gunn diodes are useful for low FM noise moderate power oscillators used for microwave links, commercial marine and weather radar, local oscillators, microwave door openers, motion and speed detectors, and ground speed and distance sensors at frequencies from 10-90 GHz.

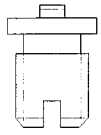
Case Styles (See appendix for complete dimensions)



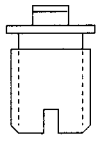
30



111



138



148

North America: Tel. (800) 366-2266 Fax (800) 618-8883 ■ Asia/Pacific: Tel. +81 (03) 3226-1671 Fax +81 (03) 3226-1451 ■ Europe: Tel. +44 (1344) 869 595 Fax +44 (1344) 300 020

Fixed Frequency CW Gunn Diodes (5-18 GHz)[7]
Specifications @ T_A = +25°C

Model Number	Case Style	Operating[2,3] Frequency Min./Max. (GHz)	Min. CW[1,3,5] Output Power (mW)	Operating Voltage Min./Max. (Volts)	Operating[5] Current Min./Max. (mA)	Maximum Thermal Resistance (°C/W)
MA49135	111	5.0/8.0	25	10.0/14.0	150/250	45
MA49151	30	5.0/8.0	25	10.0/14.0	150/250	45
MA49136	111	5.0/8.0	50	10.0/14.0	250/350	35
MA49152	30	5.0/8.0	50	10.0/14.0	250/350	35
MA49153	30	5.0/8.0	100	10.0/14.0	350/500	17
MA49137	111	5.0/8.0	100	10.0/14.0	350/500	25
MA49138	111	5.0/8.0	250	10.0/14.0	500/700	24
MA49154	30	5.0/8.0	250	10.0/14.0	500/700	17
MA49104	111	8.0/12.4	25	8.0/12.0	200/300	45
MA49156	30	8.0/12.4	25	8.0/12.0	200/300	45
MA49157	30	8.0/12.4	50	8.0/12.0	300/450	35
MA49106	111	8.0/12.4	50	8.0/12.0	300/450	35
MA49107	111	8.0/12.4	100	8.0/12.0	450/650	24
MA49158	30	8.0/12.4	100	8.0/12.0	450/650	24
MA49159	30	8.0/12.4	250	8.0/12.0	750/1050	15
MA49109	111	8.0/12.4	250	8.0/12.0	750/1050	15
MA49161	30	12.4/18.0	25	6.0/10.0	200/300	45
MA49121	111	12.4/18.0	25	6.0/10.0	200/300	45
MA49162	30	12.4/18.0	50	6.0/10.0	300/500	35
MA49122	111	12.4/18.0	50	6.0/10.0	300/500	35
MA49123	111	12.4/18.0	100	6.0/10.0	500/750	24
MA49163	30	12.4/18.0	100	6.0/10.0	500/750	24
MA49124	111	12.4/18.0	250	6.0/10.0	850/1150	15
MA49164	30	12.4/18.0	250	6.0/10.0	850/1150	15

Notes:
1. This power is delivered at a specified single frequency in the specified band .
2. The customer MUST species the desired operating frequency within the indicated range.
3. Power is measured into a critically coupled load at a customer specified single frequency in the indicated range. Typical bandwidth is ±5%. The minimum indicated output power is guaranteed into a critically coupled load over the indicated bandwidth centered around the frequency specified by the customer. Higher power diodes are available on special request.
4. These diodes are designed to operate within a heat sink temperature -30°C to +70°C. However, for higher operating temperatures, please contact the factory.
5. The maximum threshold current is approximately 1.3 times the maximum operating current.

North America: Tel. (800) 366-2266 Fax (800) 618-8883 ■ Asia/Pacific: Tel. +81 (03) 3226-1671 Fax +81 (03) 3226-1451 ■ Europe: Tel. +44 (1344) 869 595 Fax +44 (1344) 300 020

Fixed Frequency CW Gunn Diodes (18-94 GHz)[7]
Specifications @ T_A = +25°C

Model Number	Case Style	Operating[2] Frequency Min./Max. (GHz)	Min. CW[1,2,3,4] Output Power (mW)	Operating Voltage Min./Max. (Volts)	Maximum[5] Operating Current (mA)
MA49190*	148	18.0/26.5	10	4.0/7.0	250
MA49179	138	18.0/26.0	50	5.0/8.0	600
MA49179	148	18.0/26.5	50	5.0/8.0	600
MA49180	138	18.0/26.5	100	5.0/8.0	1000
MA49180	148	18.0/26.5	100	5.0/8.0	1000
MA49178	148	18.0/26.5	250	5.0/8.0	1600
MA49191*	138	26.5/40.0	10	3.0/6.0	250
MA49172	138	26.5/40.0	50	3.5/6.0	800
MA49173	138	26.5/40.0	100	3.5/6.0	1200
MA49177	138	26.5/35.0	150	4.0/8.0	1400
MA49837	138	26.5/35.0	250	4.0/8.0	1600
MA49838	138	40.0/50.0	100	2.5/4.5	1600
MA49181	138	40.0/50.0	50	2.5/4.5	1200
MA49193	138	40.0/50.0	75	2.5/4.5	1400
MA49182	138	50.0/60.0	50	2.5/4.5	1200
MA49839	138	50.0/60.0	100	2.5/4.5	1600
MA49840	138	94.0	10	2.5/4.5	1400
MA49149	138	94.0	30	2.5/4.5	1400
MA49148	138	94.0	50	2.5/4.5	1400

* These diodes are flip chip devices. The heat sink (threaded end) is the anode.

CW Broadband Gunn Diodes[7]

These Gunn diodes are useful for use in low power, fast tuning oscillators such as an ECM local oscillator or a broadband tunable source for an instrument. These diodes will deliver full rated power over the specified bandwidth.

Model Number	Case Style	Frequency[9] Min./Max. (GHz)	Min. CW[9] Output Power (mW)	Maximum Operating Voltage (Volts)	Operating[5] Current Min./Max. (mA)	Nominal Operating Voltage (Volts)
MA49117	148	8.0/12.4	100	12.0	450/60	8.0
MA49126	148	12.4/18.0	100	10.0	500/750	6.0

Notes:
1. This power is delivered at a specified single frequency in the specified band .
2. The customer MUST species the desired operating frequency within the indicated range.
3. Power is measured into a critically coupled load at a customer specified single frequency in the indicated range. Typical bandwidth is ±5%. The minimum indicated output power is guaranteed into a critically coupled load over the indicated bandwidth centered around the frequency specified by the customer. Higher power diodes are available on special request.
4. These diodes are designed to operate within a heat sink temperature -30°C to +70°C. However, for higher operating temperatures, please contact the factory.
5. The maximum threshold current is approximately 1.3 times the maximum operating current.
6. All diodes are burned in for a minimum period of 8 hours at diode case temperature (Tc) of 70 ± 5°C and a dc bias voltage of (Vop + 1.0 volts). upon request and for an additional charge, these diodes can be burned in for longer periods.
7. The polarity is cathode heat sink, unless otherwise specified.
8. M/A-COM, will provide technical assistance in specification, interpretation and selection of Gunn diodes.
9. These diodes will deliver the specified Output power over the full frequency range, i e., the MA49117 will deliver 100 mW minimum at 25°C ambient from 5-8 GHz.

North America: Tel. (800) 366-2266 Fax (800) 618-8883 ■ Asia/Pacific: Tel. +81 (03) 3226-1671 Fax +81 (03) 3226-1451 ■ Europe: Tel. +44 (1344) 869 595 Fax +44 (1344) 300 020

Commercial Fixed Frequency CW Gunn Diodes

These Gunn diodes are useful for low power transmitters and local oscillators used in the detection of moving targets in such applications as speed control radars, radar detectors, intrusion alarm systems, door openers and commercial marine navigational radar. These low power diodes can also be used in control applications such as near object direction for vehicles, traffic light control, anti-skid braking systems for vehicles, and door openers.

Specifications @ T_A = +25°C

Model Number	Case Style	Frequency[2,3] Min./Max. (GHz)	Min. CW[1,3] Output Power (mW)	Maximum[5] Operating Current (mA)	Nominal Operating Voltage (Volts)
MA49618*	30	9.0/12.0	5.0	80	8.0
MA49508*	30	9.0/12.0	10.0	160	8.0
MA49628*	30	18.0/26.0	10.0	200	5.0
MA49499*	30	18.0/26.0	5.0	100	5.0

* The heat sink is the anode.

Notes:

1. This power is delivered at a specified single frequency in the specified band .
2. The customer MUST species the desired operating frequency within the Indicated range.
3. Power is measured into a critically coupled load at a customer specified single frequency in the indicated range. Typical bandwidth is ±5%. The minimum indicated output power is guaranteed into a critically coupled load over the indicated bandwidth centered around the frequency specified by the customer. Higher power diodes are available on special request.
4. These diodes are designed to operate within a heat sink temperature -30°C to +70°C. However, for higher operating temperatures, please contact the factory.
5. The maximum threshold current is approximately 1.3 times the maximum operating current.
6. All diodes are burned in for a minimum period of 8 hours at diode case temperature (Tc) of 70 ± 5°C and a dc bias voltage of (Vop + 1.0 volts). upon request and for an additional charge, these diodes can be burned in for longer periods.

Screening of Gunn Diodes for High Reliability

M/A-COM's Gunn diodes have proven to have a high reliability when operated properly in oscillator systems at junction temperatures not exceeding 260°C. The following prescreening procedure is suggested as a means of further guaranteeing Gunn diode reliability over long periods of time.

Environmental and Lot Sampling Tests

M/A-COM's Environmental Laboratory has complete capability for all Group B and C test requirements including life test as required by MIL-STD19500 and MIL-STD-750.

Available Procedures for JANTX Equivalency

100% Screening	MIL-STD-750 Method	Conditions/Comments
High Temperature Storage	1032	200°C for 24 hours
Temperature Cycle	1051	-65°C to +200°C, 20 Cycles for 30 minutes
Acceleration	2006	20,000 g's
Fine Leak	1071	5 x 10^{-8} cm3/sec
Gross Leak	1071	Fluorocarbon or penetrative dye
Burn-In	1038	70°C heat sink temp. and V_{OP} + 1 volt (or 10%) for 96 hours

North America: Tel. (800) 366-2266 Fax (800) 618-8883 ■ Asia/Pacific: Tel. +81 (03) 3226-1671 Fax +81 (03) 3226-1451 ■ Europe: Tel. +44 (1344) 869 595 Fax +44 (1344) 300 020

Commercial Pulsed Gunn Diodes

This series of pulsed Gunn diodes have very low average current drain and are used in motion detection systems, burglar alarms and door openers.

Specifications @ T_A = +25°C

Model Number	Case Style	Frequency[2,3,8] Min./Max. (GHz)	Minimum[1,3,8] Peak Power (mW)	Maximum Operating Voltage (Volts)	Maximum[5] Operating Current (mA)
MA49870*	30	9.0/11.0	10.0	8.5	120

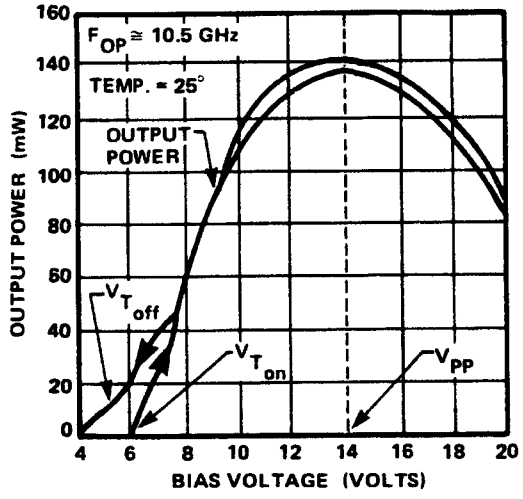
* Heat sink is anode.

Notes:

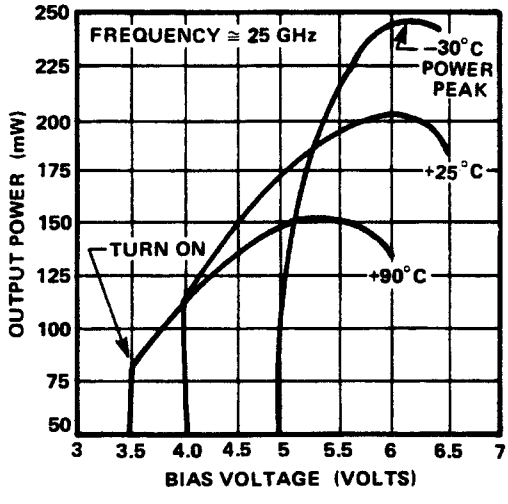
1. This power is delivered at a specified single frequency in the specified band .
2. The customer MUST specify the desired operating frequency within the indicated range.
3. Power is measured into a critically coupled load at a customer specified single frequency in the indicated range. Typical bandwidth is ± 5%. The minimum indicated output power is guaranteed into a critically coupled load over the indicated bandwidth centered around the frequency specified by the customer. Higher power diodes are available upon special request.
4. These diodes are designed to operate within a heat sink temperature -30°C to +70°C. However, for higher operating temperatures, please contact the factory.
5. The minimum threshold current is approximately 1.3 times the maximum operating current.
6. All diodes are burned in for a minimum period of 8 hours at diode case temperature (T_c) of 70 ± 5°C and with CW dc bias.
7. Frequency chirp during 0.5 (µs) is typically less than 10 MHz in a waveguide cavity.
8. Maximum duty cycle is 1%. Maximum pulse width is 1 (µs).

Typical Performance Curves

OUTPUT POWER vs BIAS VOLTAGE OF A TYPICAL X-BAND GUNN DIODE



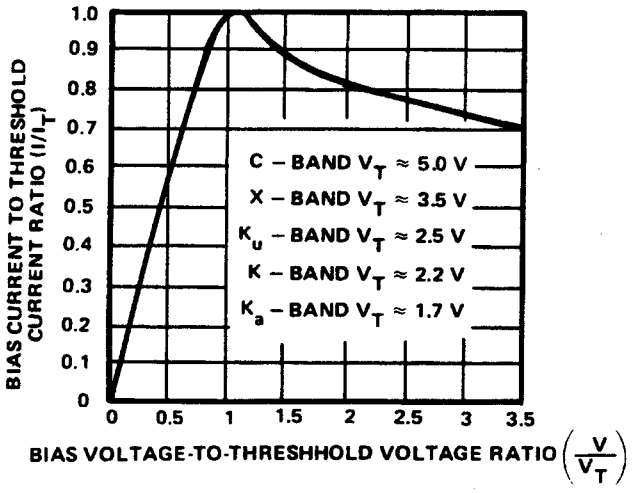
OUTPUT POWER vs BIAS VOLTAGE AND TEMPERATURE OF TYPICAL K-BAND GUNN DIODE



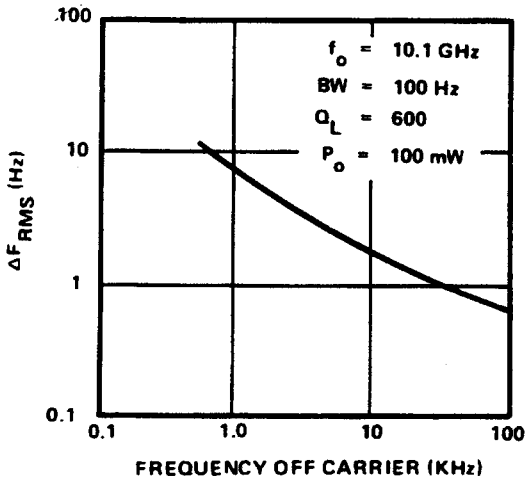
North America: Tel. (800) 366-2266 Fax (800) 618-8883 ■ Asia/Pacific: Tel. +81 (03) 3226-1671 Fax +81 (03) 3226-1451 ■ Europe: Tel. +44 (1344) 869 595 Fax +44 (1344) 300 020

Typical Performance Curves (Con't)

CURRENT vs VOLTAGE CHARACTERISTICS



FM NOISE SPECTRUM



Gunn Diode Mounting and Heat Sink Considerations

The rise in temperature between the diode case and the active region is defined by AT - Rq, (Pin—Pout) In actual use the thermal drop between the ambient and the diode case must be taken into account in order to avoid exceeding the maximum active temperature of 260°C. The maximum active region temperature may be computed as follows:

Maximum active region temperature:

$$T_{AL} = T_A + \Delta T_{CA} + (P_{in} - P_{out})\ R\text{ø}$$

where:

T_A = Ambient temperature

ΔT_{CA} = Temperature difference between the diode case and the ambient at operating power.

Rø = Thermal resistance

T_{AL} = Active region temperature

In well designed heat sinks, the thermal difference ΔT_{CA} is usually less than 30°C for a power input of about 15 watts. This is an important factor in the design of Gunn oscillators and must be carefully considered.

Our technique for measuring thermal resistance is available upon request.

North America: Tel. (800) 366-2266 ■ Asia/Pacific: Tel. +81 (03) 3226-1671 ■ Europe: Tel. +44 (1344) 869 595
Fax (800) 618-8883 Fax +81 (03) 3226-1451 Fax +44 (1344) 300 020