

## 9.8-13.0 GHz 1.6 W Power Amplifier

**MAAPGM0019**

RO-P-DS-3073 B

Preliminary Information

### Features

- ◆ 1.6 Watt Saturated Output Power Level
- ◆ Variable Drain Voltage (4-10V) Operation
- ◆ MSAG™ Process

### Primary Applications

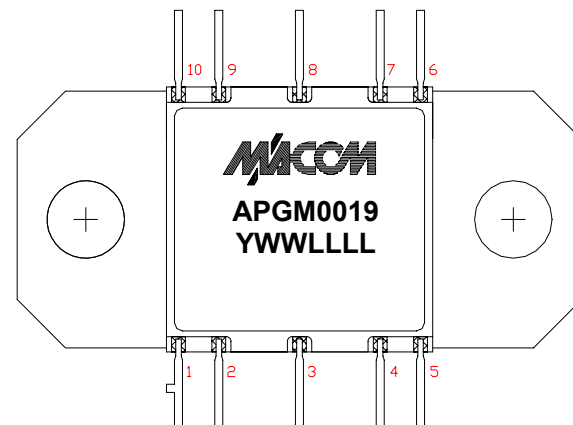
- ◆ 11 GHz Point-to-Point Radio
- ◆ 13 GHz Point-to-Point Radio
- ◆ SatCom

### Description

The MAAPGM0019 is a packaged, 3-stage, 1.6 W power amplifier with on-chip bias networks in a bolt down ceramic package, allowing easy assembly. This product is fully matched to 50 ohms on both the input and output. It can be used as a power amplifier stage or as a driver stage in high power applications.

Fabricated using M/A-COM's repeatable, high performance and highly reliable GaAs Multifunction Self-Aligned Gate MESFET Process, each device is 100% RF tested on wafer to ensure performance compliance.

M/A-COM's MSAG™ process features robust silicon-like manufacturing processes, planar processing of ion implanted transistors, multiple implant capability enabling power, low-noise, switch and digital FETs on a single chip, and polyimide scratch protection for ease of use with automated manufacturing processes. The use of refractory metals and the absence of platinum in the gate metal formulation prevents hydrogen poisoning when employed in hermetic packaging.



Pin Number	RF Designator
1	No Connection
2	V <sub>GG</sub>
3	RF IN
4	V <sub>GG</sub>
5	No Connection
6	V <sub>DD1/2</sub>
7	V <sub>DD3</sub>
8	RF OUT
9	V <sub>DD3</sub>
10	V <sub>DD1/2</sub>

### Maximum Operating Conditions <sup>1</sup>

Parameter	Symbol	Absolute Maximum	Units
Input Power	P <sub>IN</sub>	25.0	dBm
Drain Supply Voltage	V <sub>DD</sub>	+12.0	V
Gate Supply Voltage	V <sub>GG</sub>	-3.0	V
Quiescent Drain Current (No RF, 40% IDSS)	I <sub>DQ</sub>	1.33	A
Quiescent DC Power Dissipated (No RF)	P <sub>DISS</sub>	8.8	W
Junction Temperature	T <sub>J</sub>	180	°C
Storage Temperature	T <sub>STG</sub>	-55 to +150	°C

1. Operation outside of these ranges may reduce product reliability.

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RO-P-DS-3073 B  
Preliminary Information

## Recommended Operating Conditions

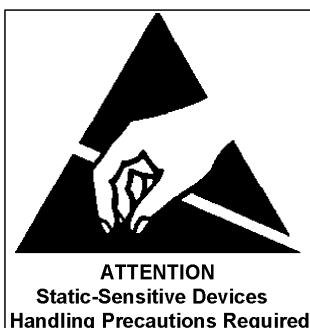
Characteristic	Symbol	Min	Typ	Max	Unit
Drain Supply Voltage	$V_{DD}$	4.0	8.0	10.0	V
Gate Supply Voltage	$V_{GG}$	-2.4	-2.0	-1.5	V
Input Power	$P_{IN}$		20	23	dBm
Junction Temperature	$T_J$			150	°C
Thermal Resistance	$\Theta_{JC}$		11.0		°C/W
Package Base Temperature	$T_B$			Note 2	°C

2. Maximum Package Base Temperature = 150°C —  $\Theta_{JC} * V_{DD} * I_{DQ}$

**Electrical Characteristics:**  $T_B = 40^\circ\text{C}^2$ ,  $Z_0 = 50 \Omega$ ,  $V_{DD} = 8\text{V}$ ,  $I_{DQ} \approx 830 \text{ mA}^3$ ,  $P_{in} = 20 \text{ dBm}$ ,  $R_G = 86.6 \Omega$

Parameter	Symbol	Typical	Units
Bandwidth	f	9.8-13.0	GHz
Output Power	POUT	32	dBm
Power Added Efficiency	PAE	20	%
1-dB Compression Point	P1dB	31	dBm
Small Signal Gain	G	19	dB
Input VSWR	VSWR	2:1	
Output VSWR	VSWR	2.5:1	
Gate Supply Current	$I_{GG}$	< 10	mA
Drain Supply Current	$I_{DD}$	< 1.3	A
Noise Figure	NF	10	dB
2 <sup>nd</sup> Harmonic	2f	-37	dBc
3 <sup>rd</sup> Harmonic	3f	-40	dBc
Output Third Order Intercept	OTOI	38	dBm
3 <sup>rd</sup> Order Intermodulation Distortion, Single Carrier Level = 21 dBm	IM3	-9	dBm
5 <sup>th</sup> Order Intermodulation Distortion, Single Carrier Level = 21 dBm	IM5	-27	dBm

3. Adjust  $V_{GG}$  between -2.4 to -1.8V to achieve indicated  $I_{DQ}$



## Operating Instructions

This device is static sensitive. Please handle with care. To operate the device, follow these steps.

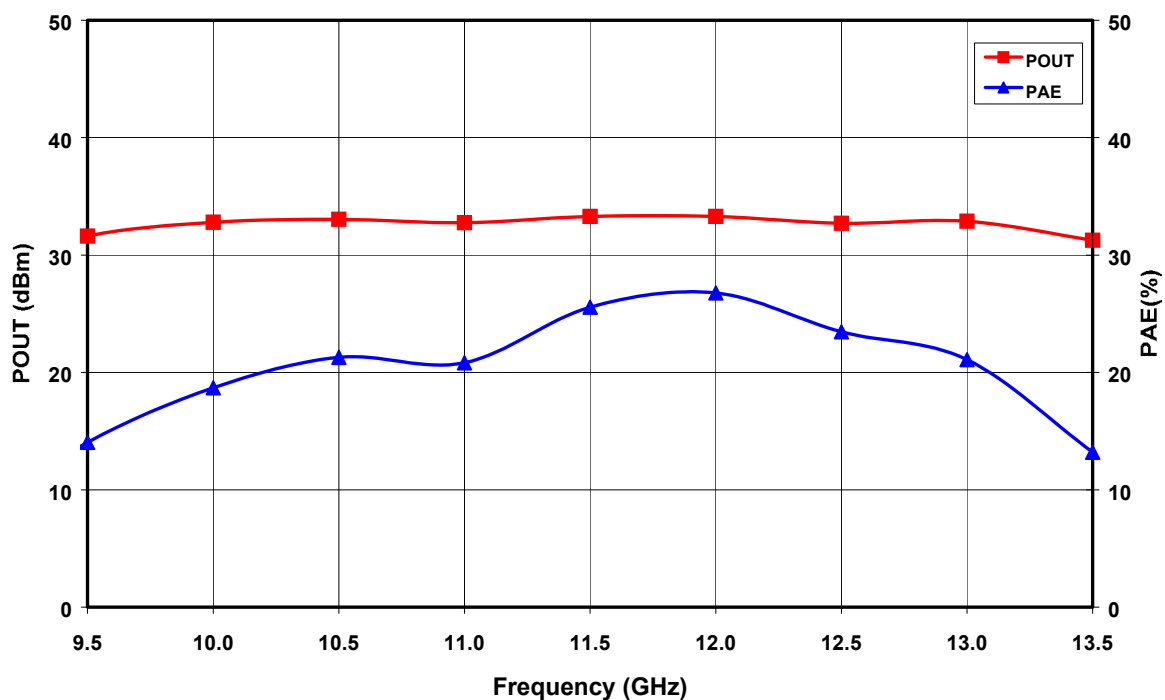
1. Apply  $V_{GG} \approx -1.8\text{V}$ ,  $V_{DD} = 0 \text{ V}$ .
2. Ramp  $V_{DD}$  to desired voltage, typically 8 V.
3. Adjust  $V_{GG}$  to set  $I_{DQ}$ . (See Note 3 above).
4. Set RF input.
5. Power down sequence in reverse. Turn  $V_{GG}$  off last.

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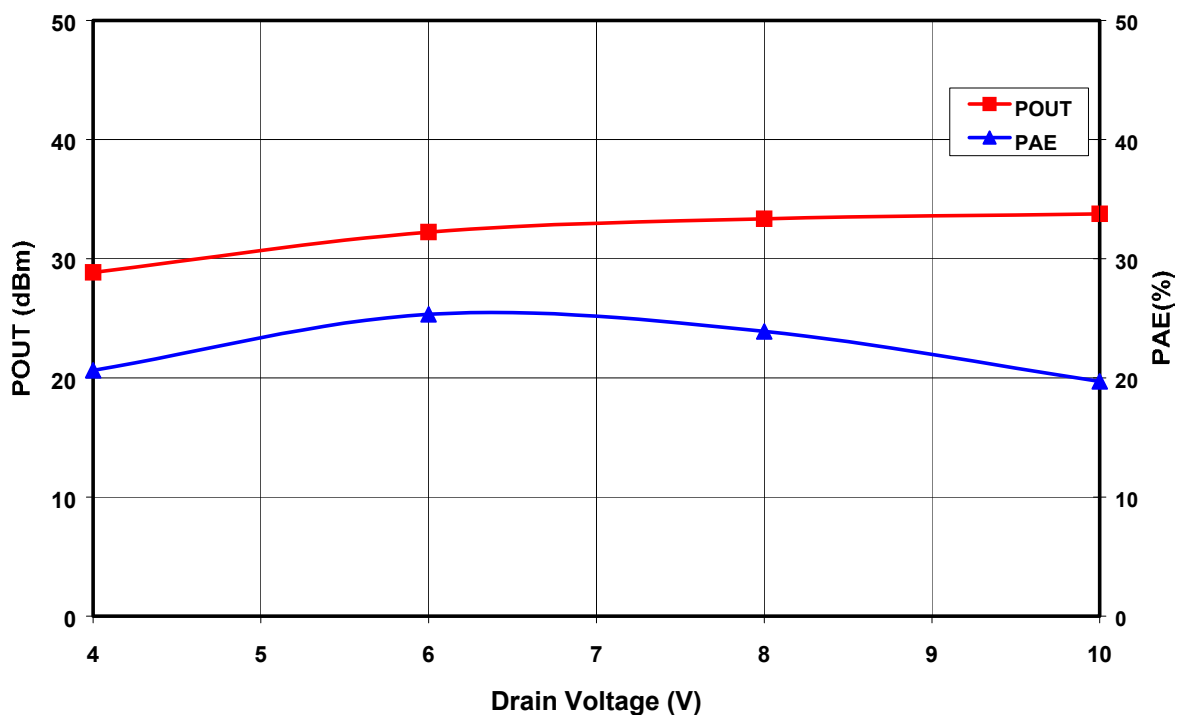
**MAAPGM0019**

RO-P-DS-3073 B

Preliminary Information



**Figure 1. Output Power and Power Added Efficiency vs. Frequency at  $V_{DD} = 8V$  and  $P_{in} = 20$  dBm.**



**Figure 2. Saturated Output Power and Power Added Efficiency vs. Drain Voltage at  $f_0 = 11.5$  GHz.**

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**MAAPGM0019**

RO-P-DS-3073 B

Preliminary Information

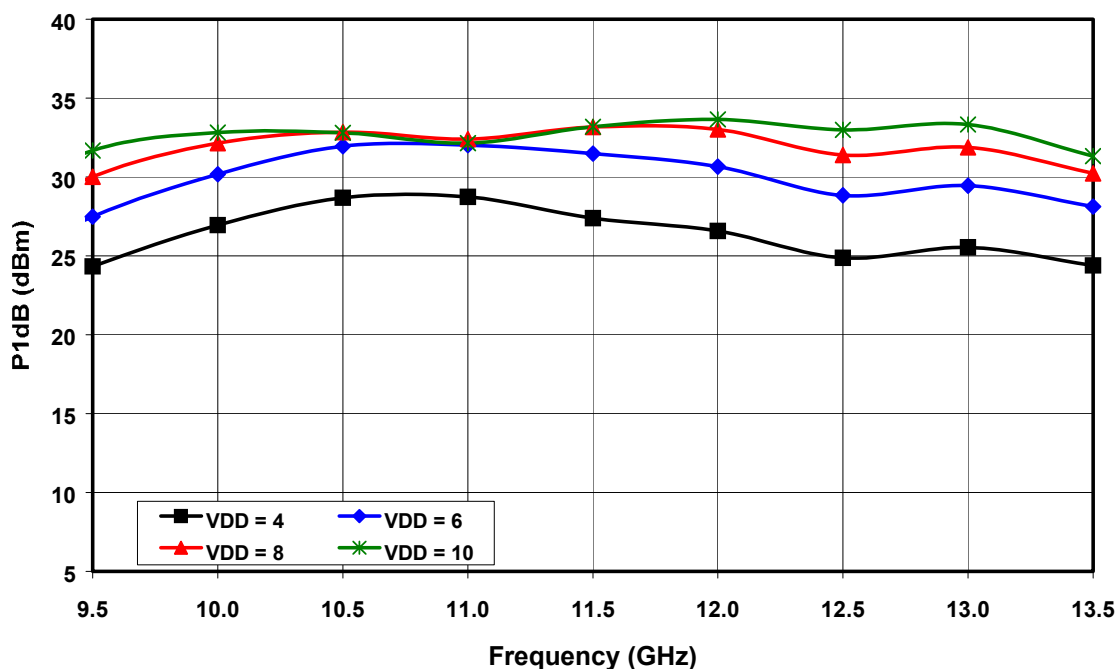


Figure 3. 1dB Compression Point vs. Drain Voltage

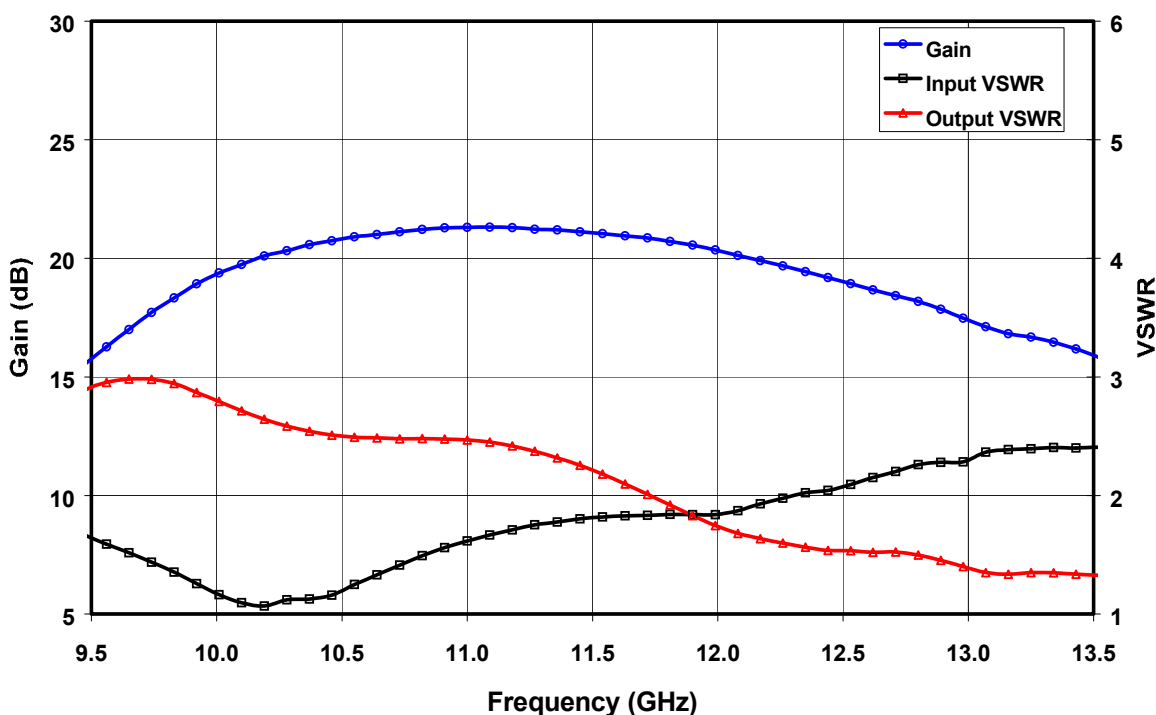


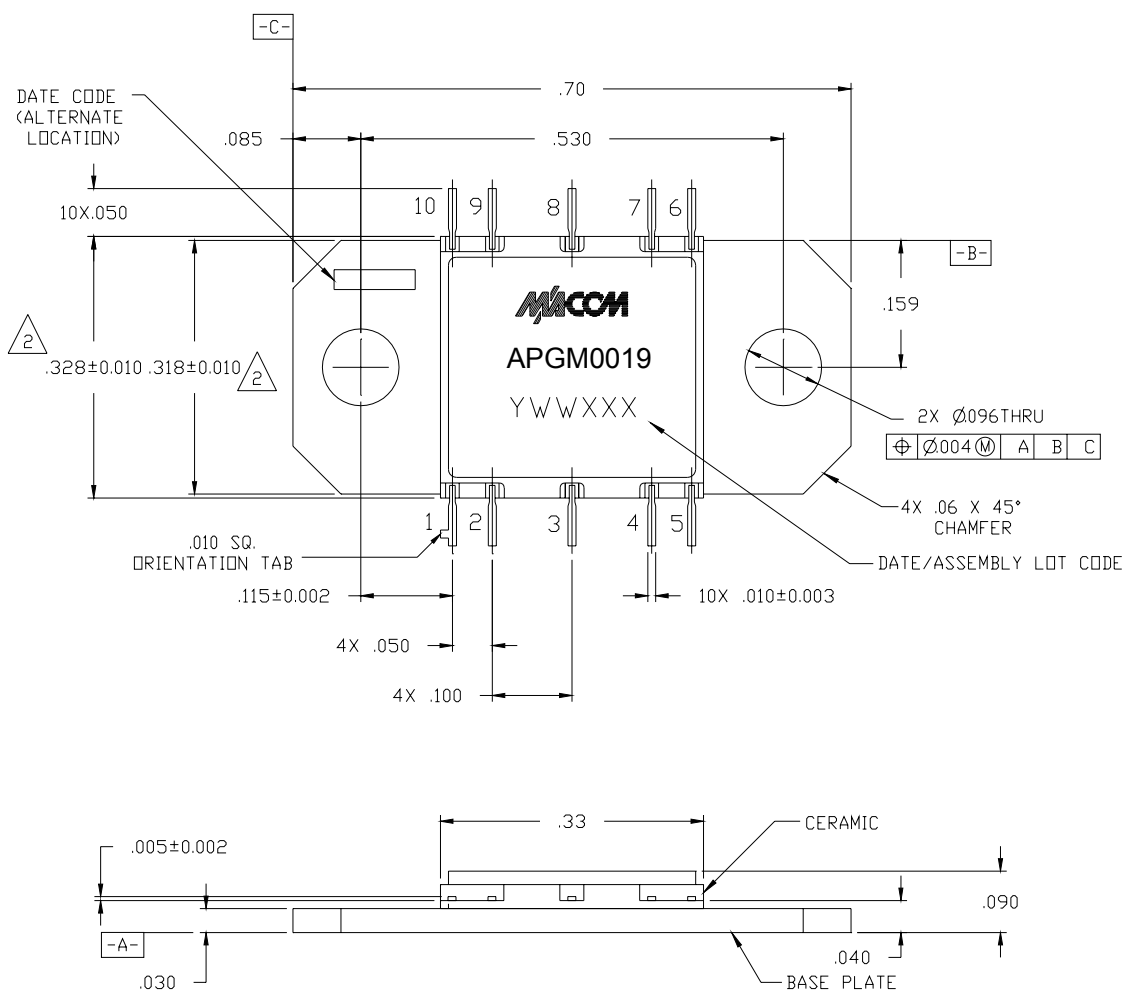
Figure 4. Small Signal Gain and VSWR vs. Frequency at VDD = 8V.

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**MAAPGM0019**

RO-P-DS-3073 B

Preliminary Information



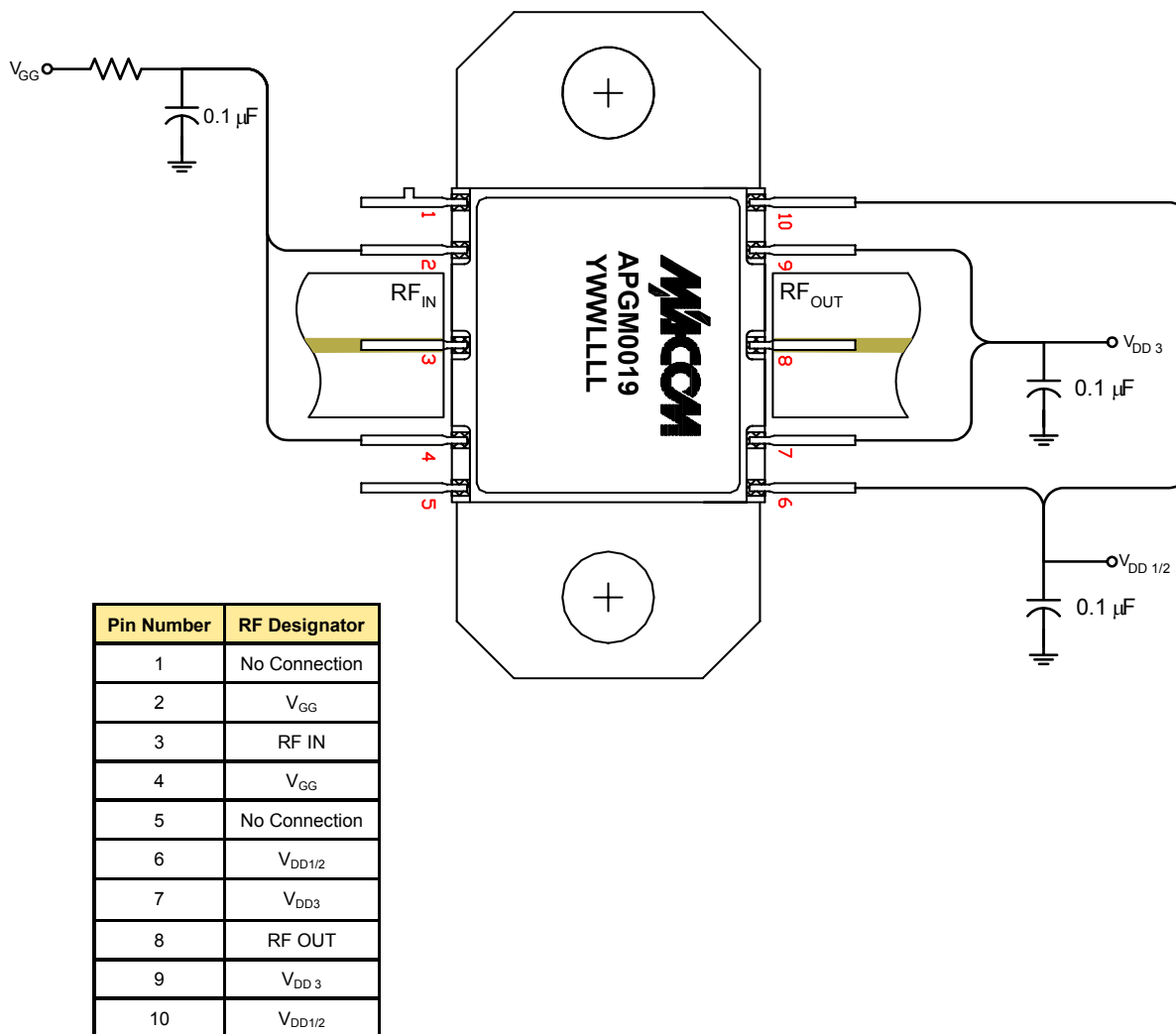
**Figure 5. CR-15 Package Dimensions**

The CR-15 is a high frequency, low thermal resistance package. The package consists of a cofired ceramic construction with a copper-tungsten base and iron-nickel-cobalt leads. The finish consists of electrolytic gold over nickel plate.

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**Figure 6. Recommended Bias Configuration**



## Assembly Instructions:

This flange mount style package provides a robust interface between a highly integrated GaAs MMIC device and a circuit board which may be assembled using conventional surface mount techniques. A thin shim made of a thermally and electrically conductive, ductile material should be used prior to installation of the CR-15 to improve the thermal and electrical performance of the package to housing interface. Refer to **M/A-COM Application Note #M567\*** for more information.

For applications where surface mount components are to be installed after the CR-15 installation, this package will not be damaged when subjected to typical convection or IR oven reflow profiles. Refer to **M/A-COM Application Note #M538\*** for maximum allowable reflow time and temperature. Alternatively, the package leads may be individually soldered. Whether an iron or hot gas soldering equipment is used, care should be taken to insure that the temperature is well controlled and electric static discharge (ESD) safe.

**Biasing Note:** Must apply negative bias to  $V_{GG}$  before applying positive bias to  $V_{DD}$  to prevent damage to amplifier.

\* Application Notes can be found by going to the Site Search Page on M/A-COM's web page (<http://www.macom.com/search/search.jsp>) and searching for the required Application Note.