

**Amplifier, Power, 13W  
0.7-2.5 GHz**

**MAAPGM0077-DIE**  
Rev B  
Preliminary Datasheet

**Features**

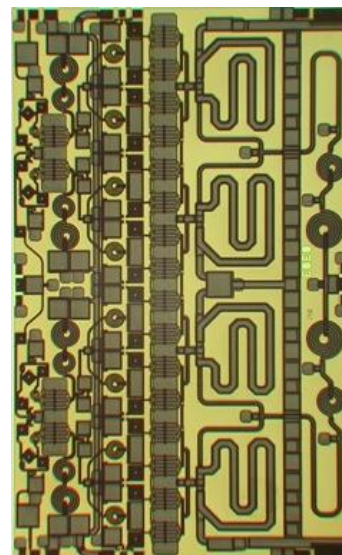
- ◆ **13 Watt Saturated Output Power Level**
- ◆ **Variable Drain Voltage (6-10V) Operation**
- ◆ **MSAG™ Process**

**Description**

The MAAPGM0077-DIE is a 2-stage 13W power amplifier with on-chip bias networks. 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 (MSAG™) 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.



**Primary Applications**

- ◆ **Point-to-Point Radio**
- ◆ **SatCom**
- ◆ **Radio Location**
- ◆ **Radar**

**Also Available in:**

Description	Ceramic Package	Sample Board (Die)	Sample Board (Pkg)	Mechanical Sample (Die)
Part Number	MAAP-000077-PKG001	MAAP-000077-SMB004	MAAP-000077-SMB001	MAAP-000077-MCH000

**Electrical Characteristics:  $T_B = 60^\circ C^1$ ,  $Z_0 = 50 \Omega$ ,  $V_{DD} = 10V$ ,  $I_{DQ} = 3.8A^2$ ,  $P_{in} = 22 dBm$ ,  $R_G=30 \Omega$**

Parameter	Symbol	Typical	Units
Bandwidth	f	0.7-2.5	GHz
Output Power	$P_{OUT}$	41	dBm
1-dB Compression Point	$P_{1dB}$	41	dBm
Small Signal Gain	G	23	dB
Power Added Efficiency	PAE	26	%
Input VSWR	VSWR	1.7:1	
Output VSWR	VSWR	1.6:1	
Gate Current	$I_{GG}$	20	mA
Drain Current	$I_{DD}$	4.9	A
2 <sup>nd</sup> Harmonic (1.5GHz)	2f	26	dBc
2 <sup>nd</sup> Harmonic (2.0GHz)	2f	47	dBc

1.  $T_B$  = MMIC Base Temperature
2. Adjust  $V_{GG}$  between -2.6 and -1.5V to achieve specified  $I_{dq}$ .

M/A-COM Inc. and its affiliates reserve the right to make changes to the product(s) or information contained herein without notice. M/A-COM makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does M/A-COM assume any liability whatsoever arising out of the use or application of any product(s) or information.

- **North America** Tel: 800.366.2266 / Fax: 978.366.2266
- **Europe** Tel: 44.1908.574.200 / Fax: 44.1908.574.300
- **Asia/Pacific** Tel: 81.44.844.8296 / Fax: 81.44.844.8298

Visit [www.macom.com](http://www.macom.com) for additional data sheets and product information.

### Maximum Ratings<sup>3</sup>

Parameter	Symbol	Absolute Maximum	Units
Input Power	P <sub>IN</sub>	28	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)	I <sub>DQ</sub>	6.1	A
Quiescent DC Power Dissipated (No RF)	P <sub>DISS</sub>	68	W
Junction Temperature	T <sub>J</sub>	17	°C
Storage Temperature	T <sub>STG</sub>	-55 to +150	°C

3. Operation beyond these limits may result in permanent damage to the part.

### Recommended Operating Conditions<sup>4</sup>

Characteristic	Symbol	Min	Typ	Max	Unit
Drain Voltage	V <sub>DD</sub>	6.0	10.0	10.0	V
Gate Voltage	V <sub>GG</sub>	-2.6	-2.0	-1.2	V
Input Power	P <sub>IN</sub>		22	25	dBm
Thermal Resistance	Θ <sub>JC</sub>		1.7		°C/W
MMIC Base Temperature	T <sub>B</sub>			Note 5	°C

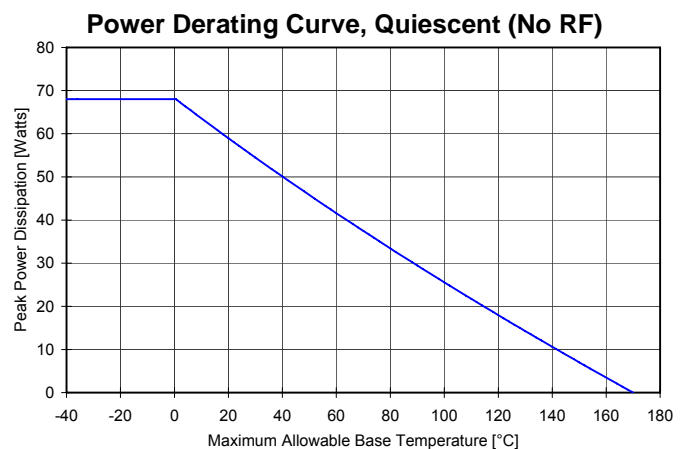
4. Operation outside of these ranges may reduce product reliability.

5. MMIC Base Temperature = 170°C — Θ<sub>JC</sub> \* V<sub>DD</sub> \* I<sub>DQ</sub>

### Operating Instructions

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

1. Apply V<sub>GG</sub> = -2.7 V, V<sub>DD</sub> = 0 V.
2. Ramp V<sub>DD</sub> to desired voltage, typically 10.0 V.
3. Adjust V<sub>GG</sub> to set I<sub>DQ</sub>, (approximately @ -2.2 V).
4. Set RF input.
5. Power down sequence in reverse. Turn V<sub>GG</sub> off last.



**Amplifier, Power, 13W  
0.7-2.5 GHz**

**MAAPGM0077-DIE**  
Rev B  
Preliminary Datasheet

All Data is at 60°C MMIC base temperature, CW stimulus, unless otherwise noted.

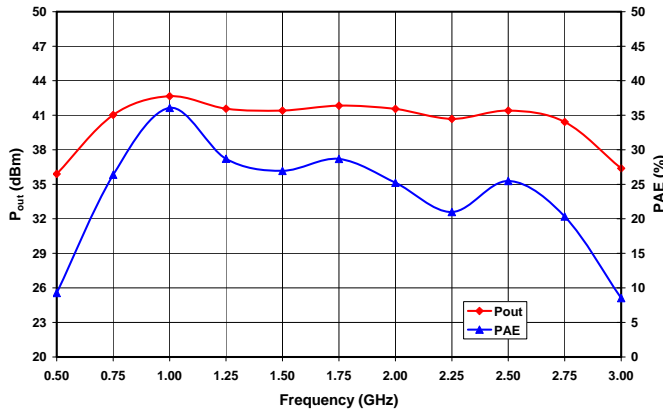


Figure 1. Output Power and Power Added Efficiency at  $V_D = 10V$ ,  $P_{in} = 22dBm$ , and 25% IDSS

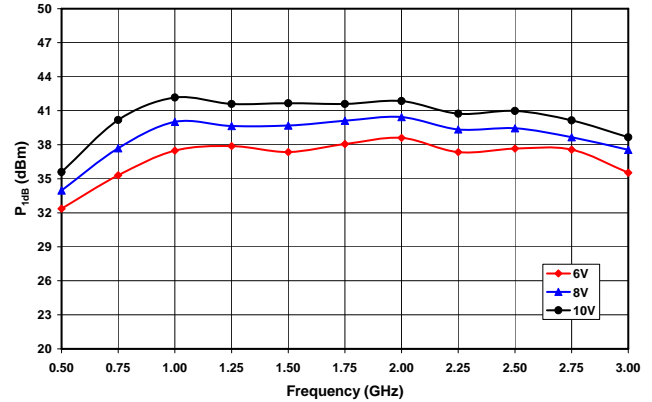


Figure 2. 1dB Compression Point and Drain Voltage at 25% IDSS

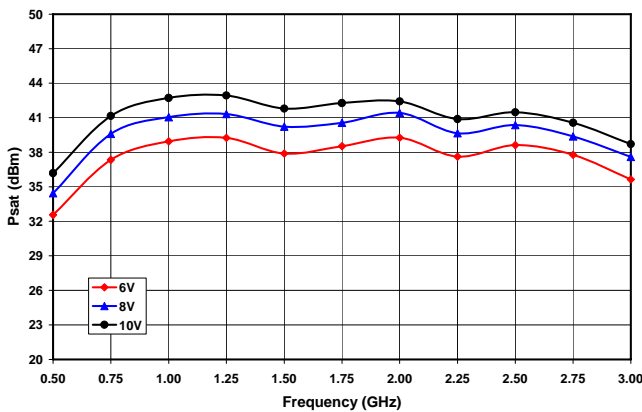


Figure 3. Saturated Output Power vs. Frequency and Drain Voltage at 25% IDSS

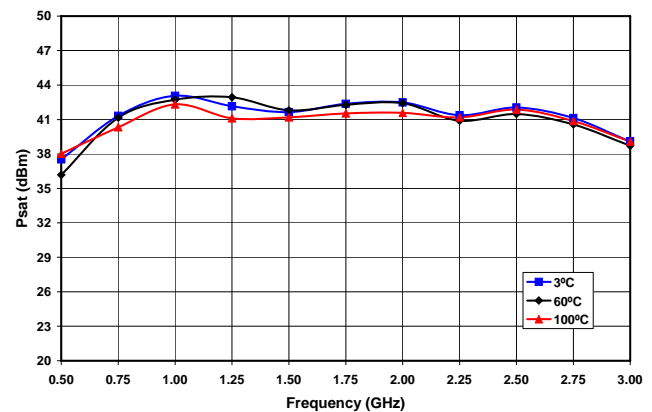


Figure 4. Saturated Output Power vs. Frequency and Temperature at 10V and 25% IDSS

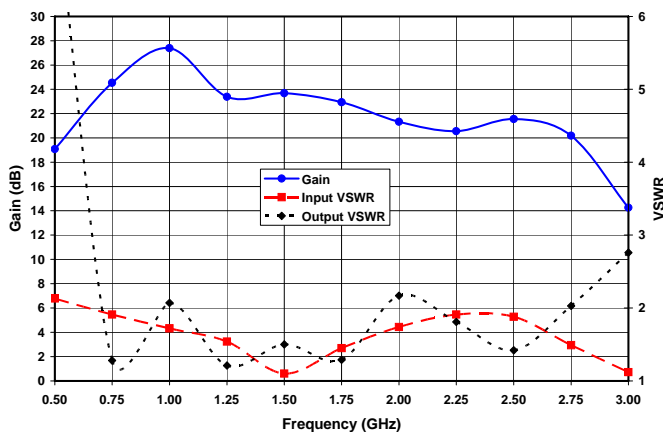


Figure 5. Small Signal Gain and Input and Output VSWR at 25% IDSS,  $V_D = 10V$

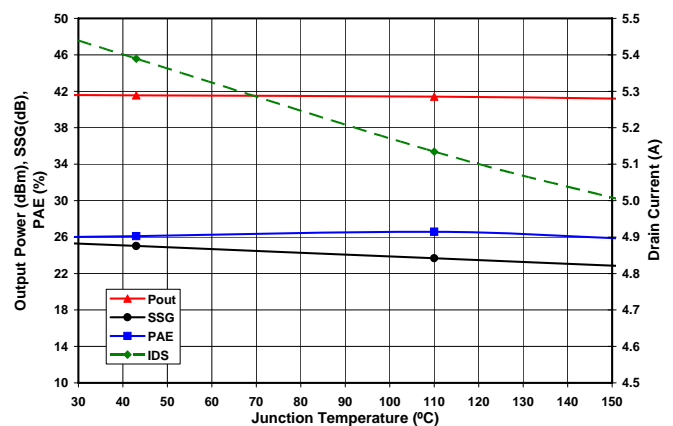


Figure 6. Output Power, Small Signal Gain, Power Added Efficiency, and Drain Current vs. Junction Temperature at 10V, 1.5 GHz, and 25% IDSS

**Amplifier, Power, 13W  
0.7-2.5 GHz**

**MAAPGM0077-DIE**  
Rev B  
Preliminary Datasheet

All Data is at 60°C MMIC base temperature, CW stimulus, unless otherwise noted.

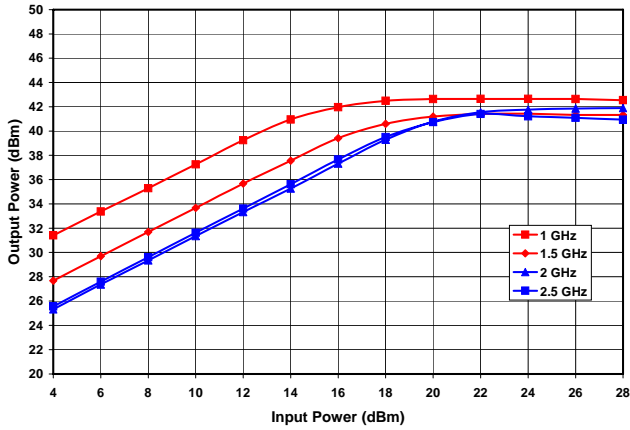


Figure 7. Output Power vs. Input Power and Frequency at 10V and 25% IDSS

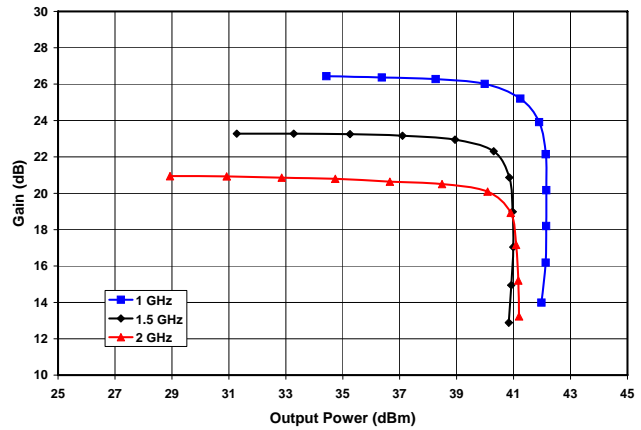


Figure 8. Gain vs. Output Power and Frequency at 10V and 25% IDSS

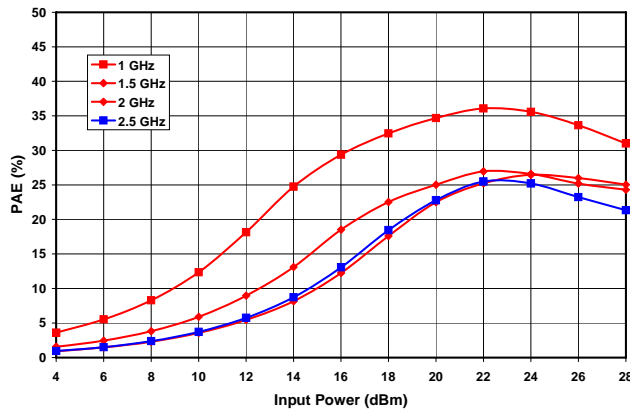


Figure 9. Power Added Efficiency vs. Input Power and Frequency at 10V and 25% IDSS

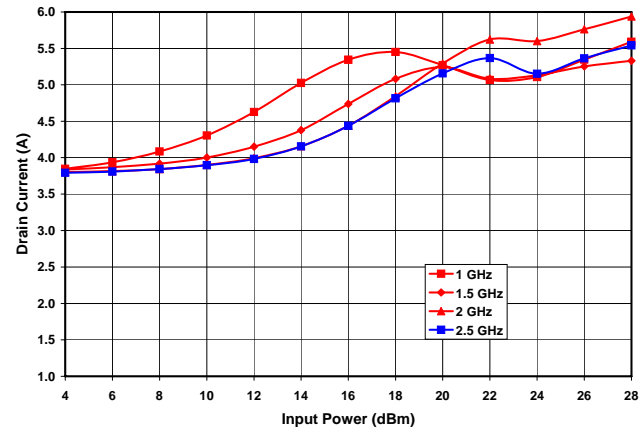


Figure 10. Drain Current vs. Input Power and Frequency at 10V and 25% IDSS

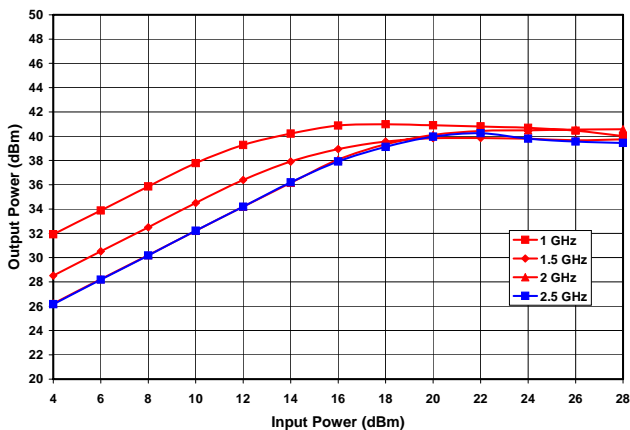


Figure 11. Output Power vs. Input Power and Frequency at 8V and 25% IDSS

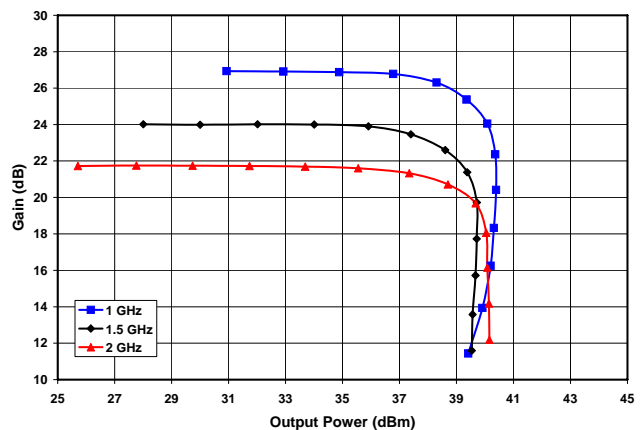


Figure 12. Gain vs. Output Power and Frequency at 8V and 25% IDSS

**Amplifier, Power, 13W  
0.7-2.5 GHz**

**MAAPGM0077-DIE**  
Rev B  
Preliminary Datasheet

All Data is at 60°C MMIC base temperature, CW stimulus, unless otherwise noted.

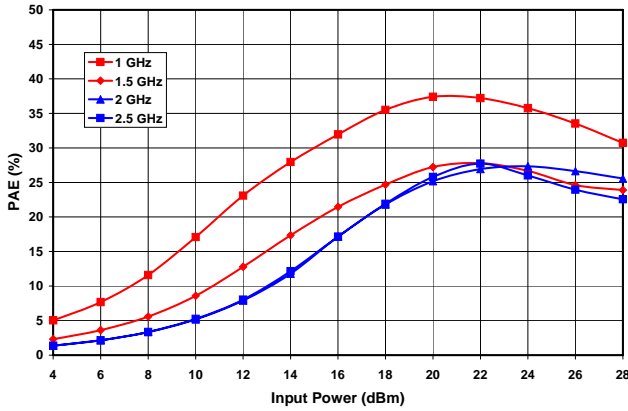


Figure 13. Power Added Efficiency vs. Input Power and Frequency at 8V and 25% IDSS

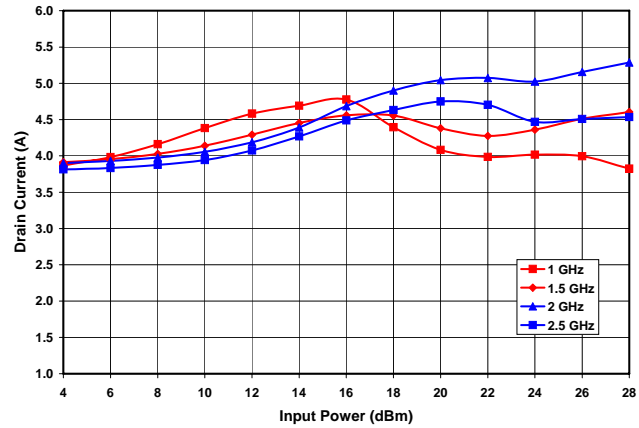


Figure 14. Drain Current vs. Input Power and Frequency at 8V and 25% IDSS

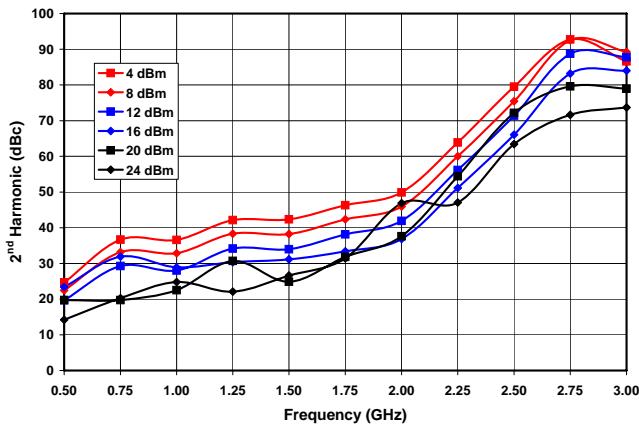


Figure 15. Second Harmonic vs. Frequency and Input Power at 10V and 25% IDSS

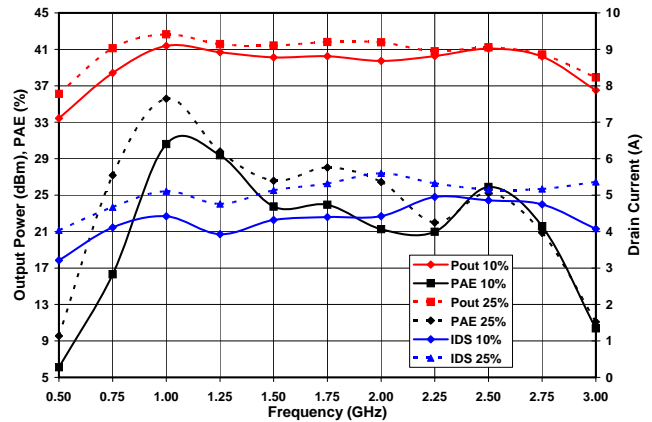
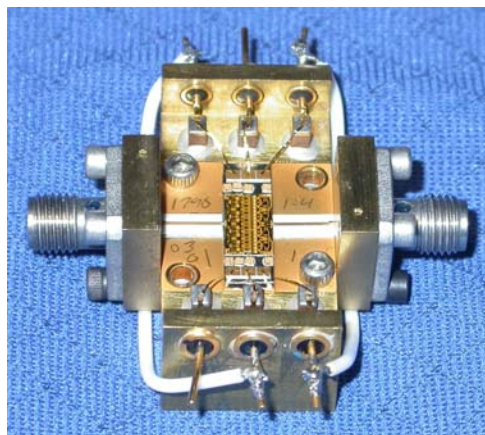


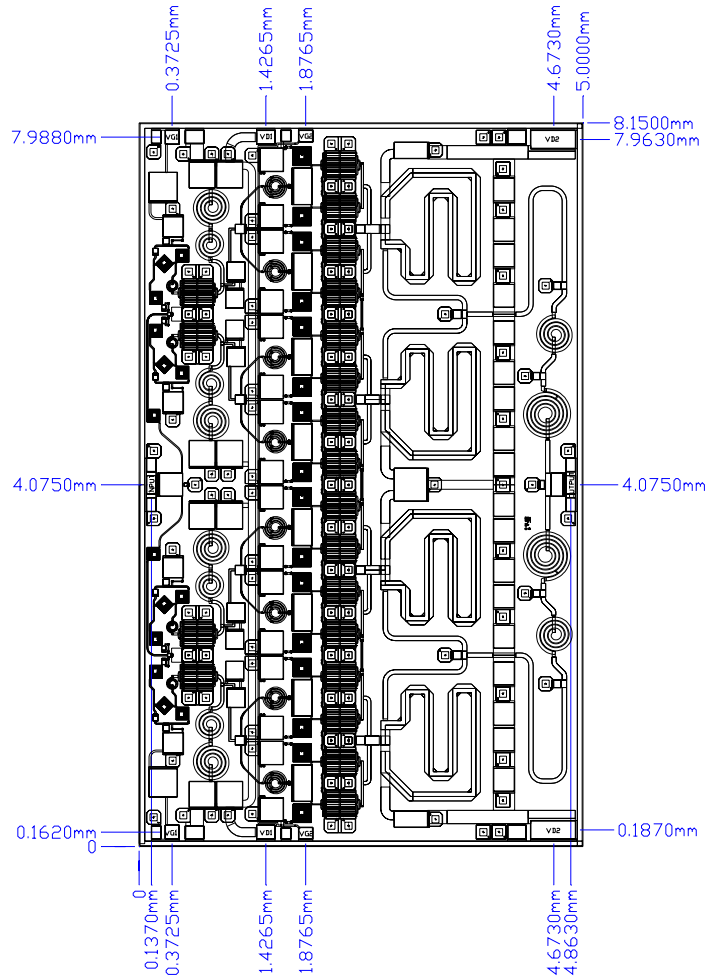
Figure 16. Output Power, Power Added Efficiency, and Drain Current vs. Frequency and %IDSS at 10V.



**Figure 17. Fixture used to characterize MAAPGM0077-DIE under CW stimulus.**

**Mechanical Information**

Chip Size: 5.000 x 8.150 x 0.075 mm (197 x 321 x 3 mils)



Chip edge to bond pad dimensions are shown to the center of the bond pad.

**Figure 18. Die Layout**

**Bond Pad Dimensions**

Pad	Size (µm)	Size (mils)
RF In and Out	100 x 200	4 x 8
DC Drain Supply Voltage VD1	200 x 150	8 x 6
DC Drain Supply Voltage VD2	500 x 200	20 x 8
DC Gate Supply Voltage VG1	150 x 150	6 x 6
DC Gate Supply Voltage VG2	150 x 125	6 x 5

## Assembly and Bonding Diagram

**Thermal Management is critical on this part. Refer to Application Note AN3019 for applicable guidelines.**

**NOTE 1:** All Application Notes may be accessed by going to <http://www.macom.com/Application%20Notes/index.htm>.

**NOTE 2:** In implementing the DC/ RF crossover shown, the following rules must be applied.

1. the DC crossovers should approach and cross the RF trace at a 90 degree angle;
2. the printed DC traces that approach the RF line should be stopped 2 substrate heights from the RF line edge;
3. the rated current capability of the DC crossovers should be greater than the maximum current of the device;
4. the wires or ribbons used to make the DC crossovers should clear the RF trace by ~ 1 substrate height.

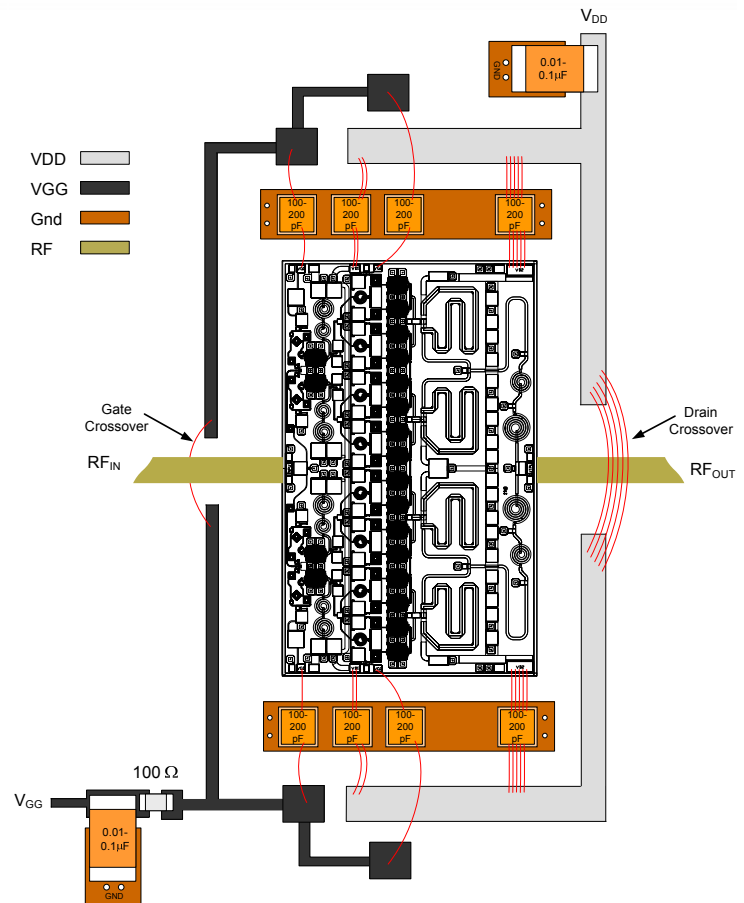


Figure 19. Recommended operational configuration. Wire bond as shown.

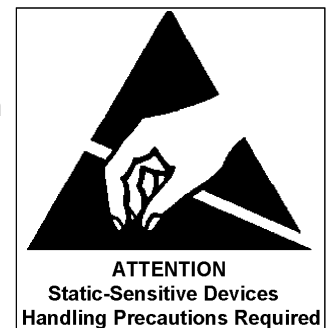
## Die Handling:

Refer to Application Note AN3016.

## Assembly Instructions:

**Die Attach:** Use AuSn (80/20) 1 mil. preform solder. Limit time @ 310 °C to less than 7 minutes. Refer to Application Note AN3017 for more detailed information.

**Wirebonding:** Bond @ 160 °C using standard ball or thermal compression wedge bond techniques. For DC pad connections, use either ball or wedge bonds. For best RF performance, use wedge bonds of shortest length, although ball bonds are also acceptable.



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