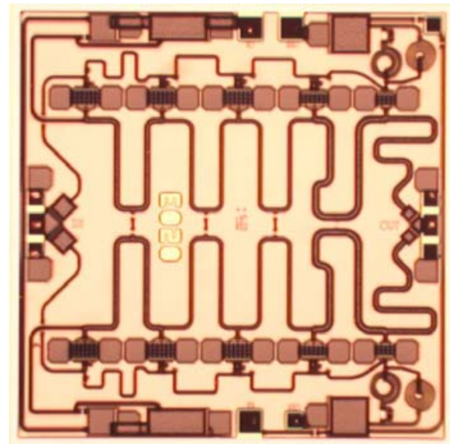
2.0-13.0 GHz 1.2 W Power Amplifier

MAAPGM0057-DIE
RO-P-DS-3089 A
Preliminary Information

Features

- **1.2 Watt Saturated Output Power Level**
- **Variable Drain Voltage (4-10V) Operation**
- **MSAG™ Process**
- **Proven Manufacturability and Reliability**
  - **No Airbridges**
  - **Polyimide Scratch Protection**
  - **No Hydrogen Poisoning Susceptibility**



Description

The MAAPGM0057-Die is a single-stage distributed power amplifier with an on chip bias network. 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.

Primary Applications

- **SatCom**
- **Test Instrumentation**
- **Military EW/ECM**
- **UltraWideband (UWB)**
- **Point-to-Point**

Electrical Characteristics: T_B = 40°C[1], Z_0 = 50Ω, V_{DD} = 10V, I_{DQ} ≈ 510 mA[2], P_{in} = 25 dBm

Parameter	Symbol	Typical	Units
Bandwidth	f	2.0-13.0	GHz
Output Power	P_{OUT}	31	dBm
1-dB Compression Point	P1dB	30	dBm
Small Signal Gain	G	7	dB
Input VSWR	VSWR	2.2:1	
Output VSWR	VSWR	2.2:1	
Gate Supply Current	I_{GG}	< 5.0	mA
Drain Supply Current	I_{DD}	< 900	mA
Noise Figure	NF	8	dB

1. **T_B = MMIC Base Temperature**
2. **Adjust V_{GG} between –2.5 to –1.4 V.**

- **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

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Maximum Operating Conditions [3]

Parameter	Symbol	Absolute Maximum	Units
Input Power	P_{IN}	27.0	dBm
Gate Supply Voltage	V_{GG}	-3.5	V
Drain Supply Voltage	V_{DD}	+12.0	V
Quiescent Drain Current (No RF, 40% Idss)	I_{DQ}	810	mA
Quiescent DC Power Dissipated (No RF)	P_{DISS}	6.1	W
Junction Temperature	T_J	180	°C
Storage Temperature	T_{STG}	-55 to +150	°C
Die Attach Temperature		310	°C

3. Operation outside of these ranges may reduce product reliability. Operation at other than the typical values may result in performance outside the guaranteed limits.

Recommended Operating Conditions

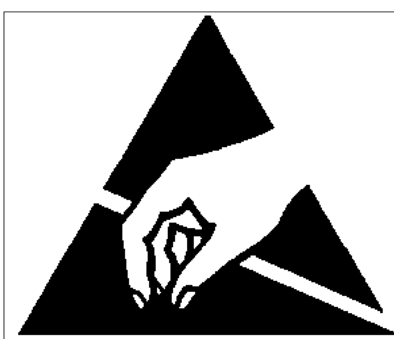
Characteristic	Symbol	Min	Typ	Max	Unit
Gate Supply Voltage	V_{GG}	-2.5	-2	-1.4	V
Drain Supply Voltage	V_{DD}	4.0	10.0	10.0	V
Input Power	P_{IN}		25.0	27.0	dBm
Junction Temperature	T_J			150	°C
Thermal Resistance	Θ_{JC}		15		°C/W
MMIC Base Temperature	T_B			Note 4	°C

4. Maximum MMIC Base Temperature = 150°C —Θ_{JC}* V_{DD} * I_{DQ}

Operating Instructions

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

1. Apply V_{GG} = -2 V, V_{DD}= 0 V.
2. Ramp V_{DD} to desired voltage, typically 10 V.
3. Adjust V_{GG} to set I_{DQ}, (approximately @ –2 V).
4. Set RF input.
5. Power down sequence in reverse. Turn V_{GG} off last.



ATTENTION
Static-Sensitive Devices
Handling Precautions Required

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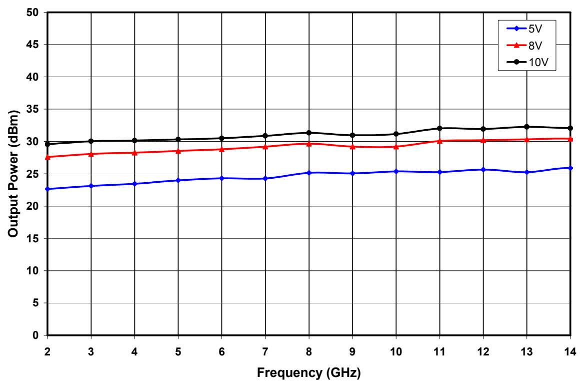

Figure 1. 1dB Compression Point vs. Frequency and Drain Voltage at 25% IDSS.

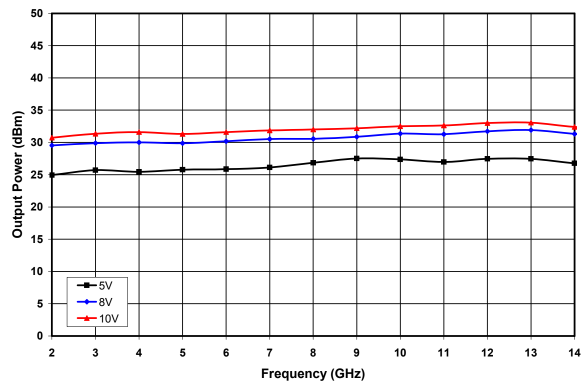

Figure 2. Saturated Output Power vs. Frequency and Drain Voltage at 25% IDSS.

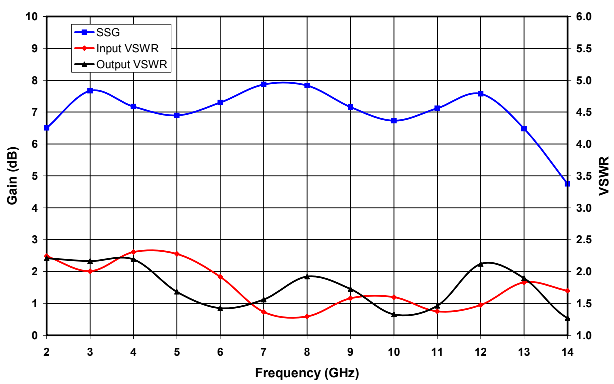

Figure 3. Small Signal Gain and Input and Output VSWR at V_D=8V.

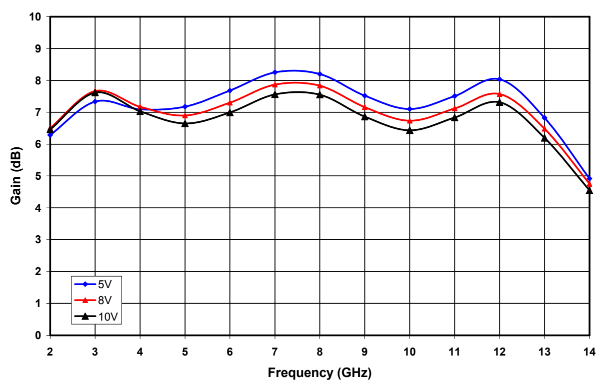

Figure 4. Small Signal Gain vs. Frequency and Drain Voltage.

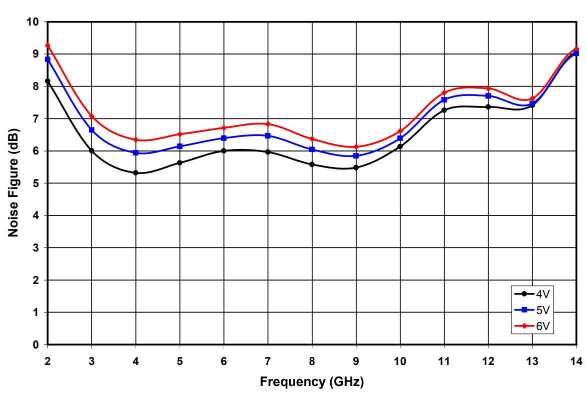

Figure 5. Noise Figure vs. Frequency and Drain Voltage.

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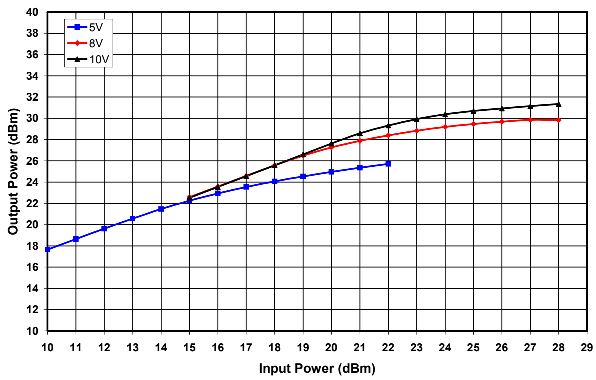

Figure 6. Output Power vs. Input Power and Drain Voltage at 3 GHz.

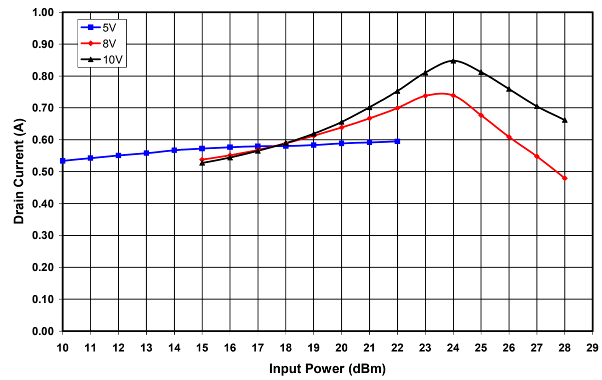

Figure 7. Drain Current vs. Input Power and Drain Voltage at 3 GHz.

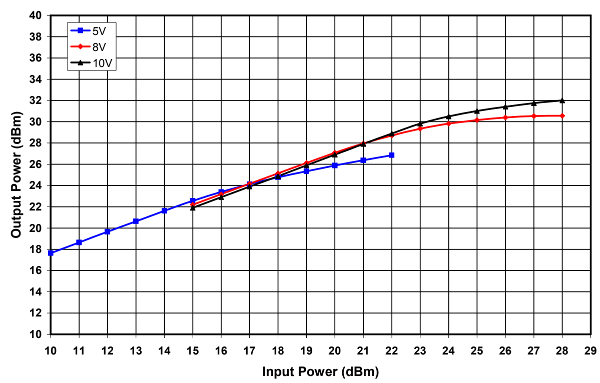

Figure 8. Output Power vs. Input Power and Drain Voltage at 8 GHz.

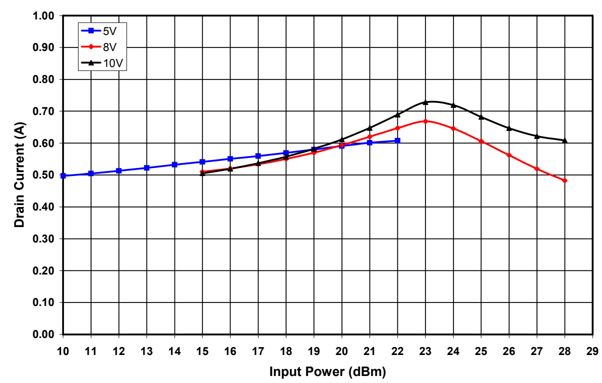

Figure 9. Drain Current vs. Input Power and Drain Voltage at 8 GHz.

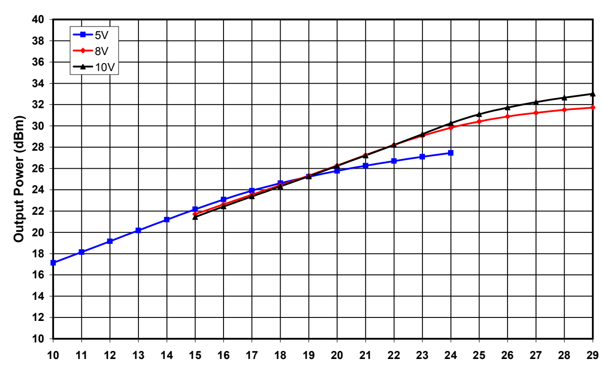

Figure 10. Output Power vs. Input Power and Drain Voltage at 12 GHz.

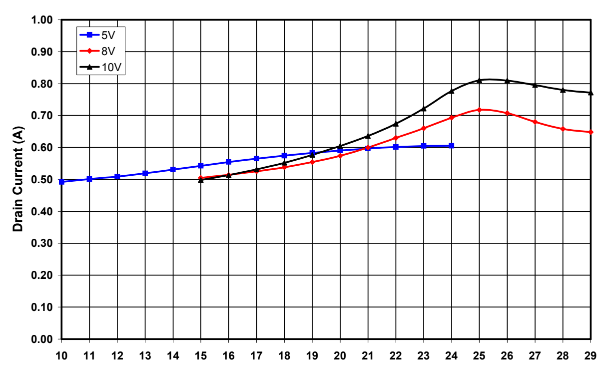

Figure 11. Drain Current vs. Input Power and Drain Voltage at 12 GHz.

Mechanical Information

Chip Size: 4.46 x 4.46 x 0.075 mm (176 x 176 x 3 mils)

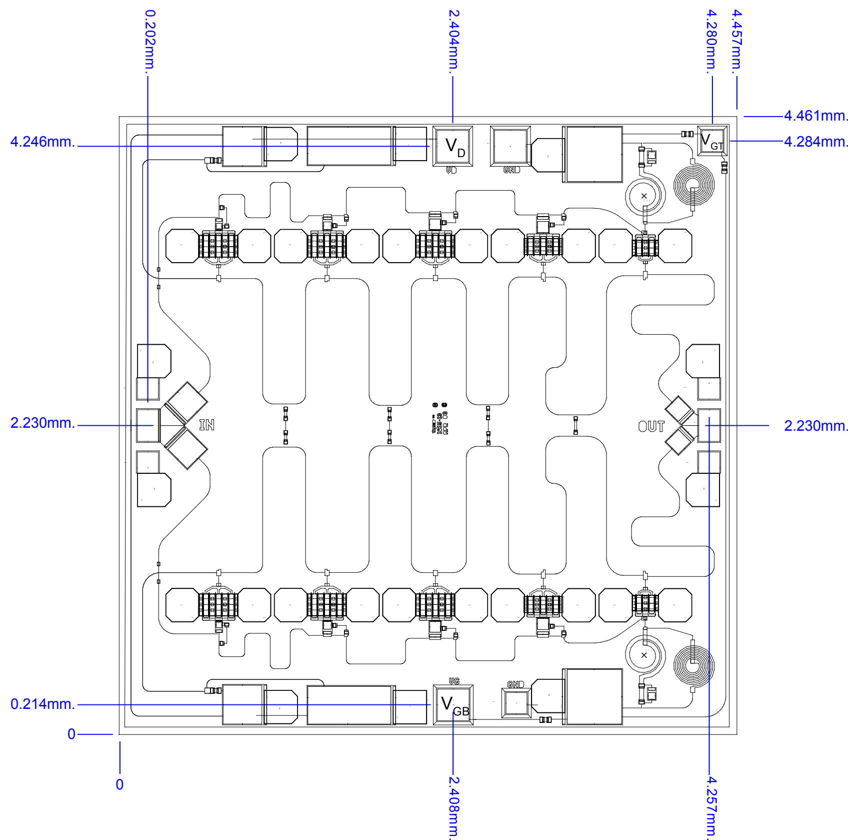

Figure 12. Die Layout

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

Bond Pad Dimensions

Pad	Size (μm)	Size (mils)
RF In and Out	100 x 150	4 x 6
Gate Supply Voltage V_{GT}	100 x 100	4 x 4
Gate Supply Voltage V_{GB}	150 x 150	6 x 6
Drain Supply Voltage V_{DD}	150 x 150	6 x 6

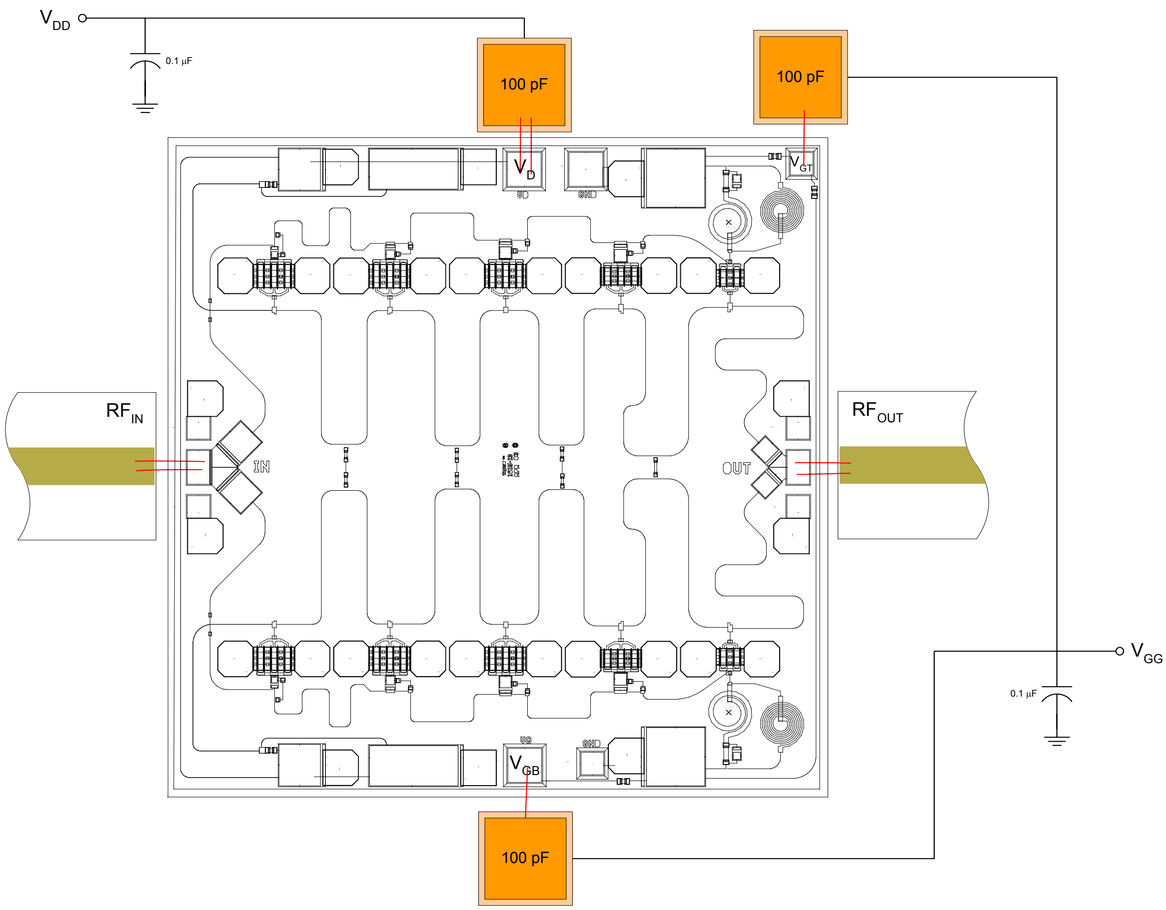

Figure 13. Recommended bonding diagram for pedestal mount.
Support circuitry typical of MMIC characterization fixture for CW test-

Assembly Instructions:

Die attach: Use AuSn (80/20) 1-2 mil. preform solder. Limit time @ 300 °C to less than 5 minutes.

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.

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