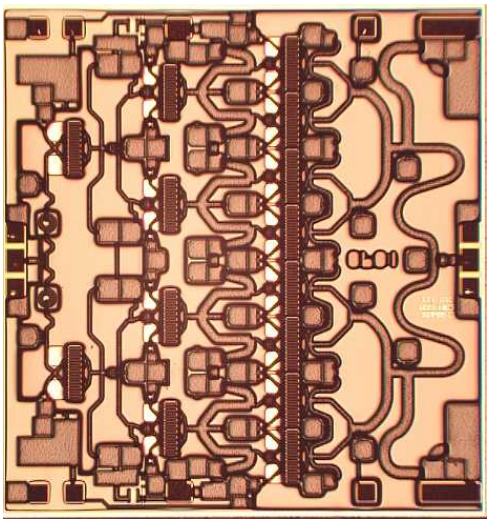
5W Ku-Band Power Amplifier 12.0-15.0 GHz

MAAPGM0016-DIE
Rev A
Preliminary Datasheet

Features

- **12.0-15.0 GHz Operation**
- **5 Watt Saturated Output Power Level**
- **Variable Drain Voltage (4-10V) Operation**
- **Self-Aligned MSAG® MESFET Process**



Description

The MAAPGM0016-DIE is a 3-stage 5 W 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**
- **DBS**

Electrical Characteristics: T_B = 40°C[1], Z_0 = 50 Ω, V_{DD} = 8V, I_{DQ} = 2.4 A[2], P_{in} = 21 dBm, R_G=25 Ω

Parameter	Symbol	Typical	Units
Bandwidth	f	12.0-15.0	GHz
Output Power	P_{OUT}	37	dBm
Power Added Efficiency	PAE	24	%
1-dB Compression Point	P1dB	36	dBm
Small Signal Gain	Gn	20	dB
Input VSWR	VSWR	3:1	
Gate Current	I_{GG}	<2	mA
Drain Current	I_{DD}	<3.5	A
2nd Harmonic	2f	-40	dBc
3rd Harmonic	3f	-75	dBc

1. **T_B = MMIC Base Temperature**
2. **Adjust V_{GG} between –2.5 and –1.2V to achieve specified Idq.**

- **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 Ratings [3]

Parameter	Symbol	Absolute Maximum	Units
Input Power	P_{IN}	28.0	dBm
Drain Supply Voltage	V_{DD}	+12.0	V
Gate Supply Voltage	V_{GG}	-3.0	V
Quiescent Drain Current (No RF)	I_{DQ}	2.5	A
Quiescent DC Power Dissipated (No RF)	P_{DISS}	20.3	W
Junction Temperature	T_J	170	°C
Storage Temperature	T_{STG}	-55 to +150	°C

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

Recommended Operating Conditions[4]

Characteristic	Symbol	Min	Typ	Max	Unit
Drain Voltage	V_{DD}	4.0	8.0	10.0	V
Gate Voltage	V_{GG}	-2.5	-2.0	-1.2	V
Input Power	P_{IN}		6.0	25.0	dBm
Thermal Resistance	Θ_{JC}		3.9		°C/W
MMIC Base Temperature	T_B			Note 5	°C

4. Operation outside of these ranges may reduce product reliability.
5. MMIC Base Temperature = 170°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} = -2.7 V, V_{DD}= 0 V.
2. Ramp V_{DD} to desired voltage, typically 8.0 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.

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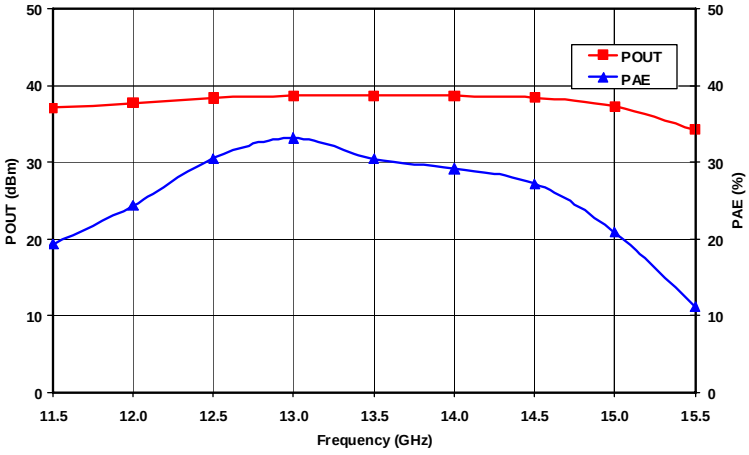

Figure 1. Output Power and Power Added Efficiency vs. Frequency at VDD = 8V.

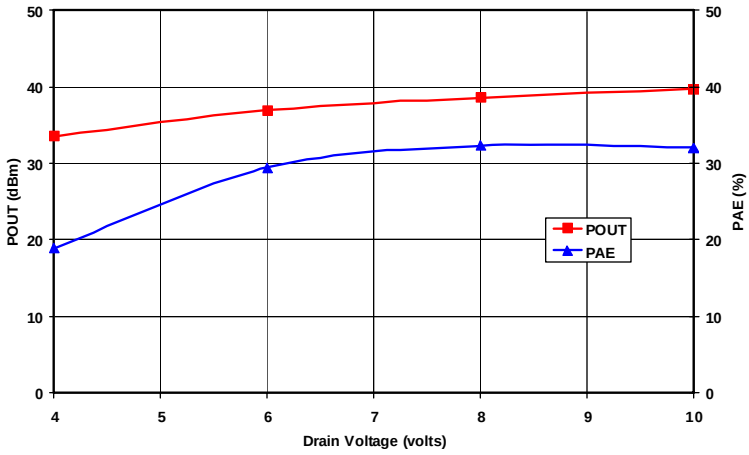

Figure 2. Saturated Output Power and Power Added Efficiency vs. Drain Voltage at fo = 13 GHz.

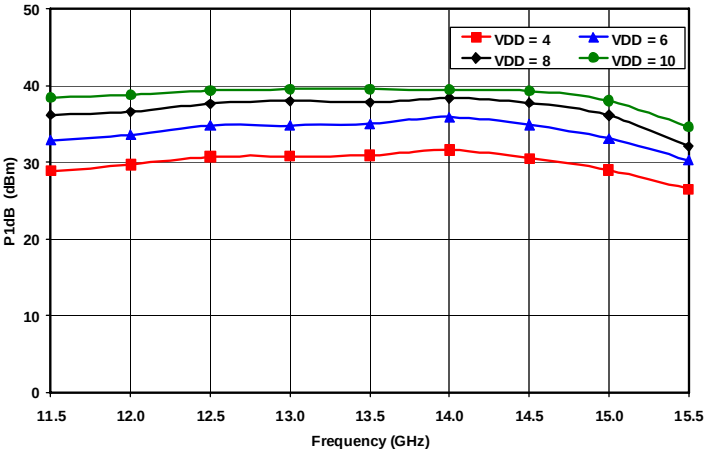

Figure 3. 1dB Compression Point vs. Drain Voltage

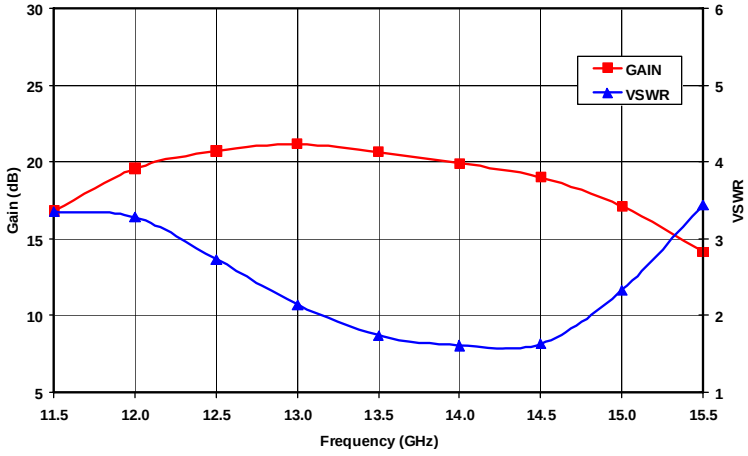

Figure 4. Small Signal Gain and VSWR vs. Frequency at VDD = 8V.

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Mechanical Information

Chip Size: 4.206 x 4.404 x 0.075 mm (166 x 173 x 3 mils)

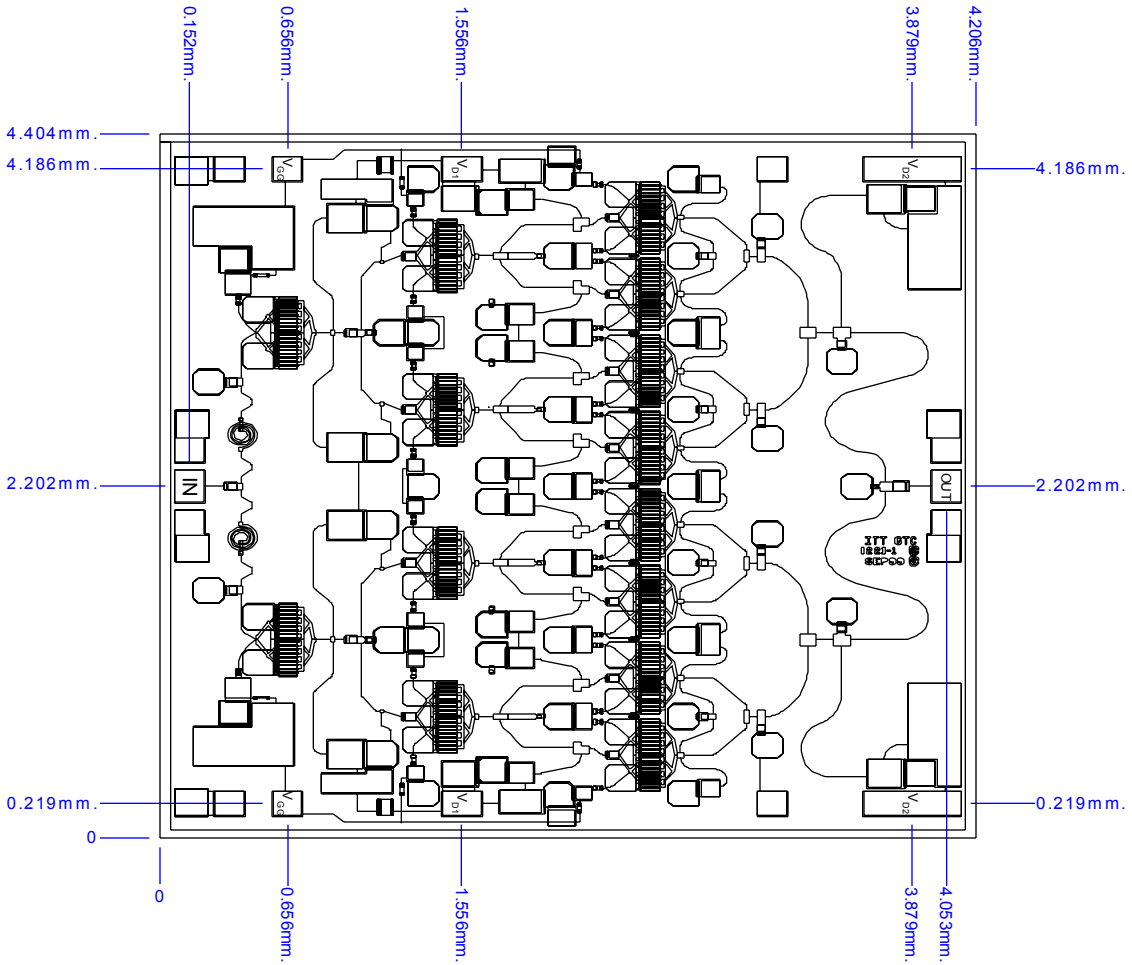

Figure 5. Die Layout

Bond Pad Dimensions

Pad	Size (µm)	Size (mils)
RF In and Out	100 x 200	4 x 8
DC Drain Supply Voltage V_{D1}	200 x 150	8 x 6
DC Drain Supply Voltage V_{D2}	500 x 150	20 x 6
DC Gate Supply Voltage V_{GG}	150 x 150	6 x 6

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Assembly and Bonding Diagram

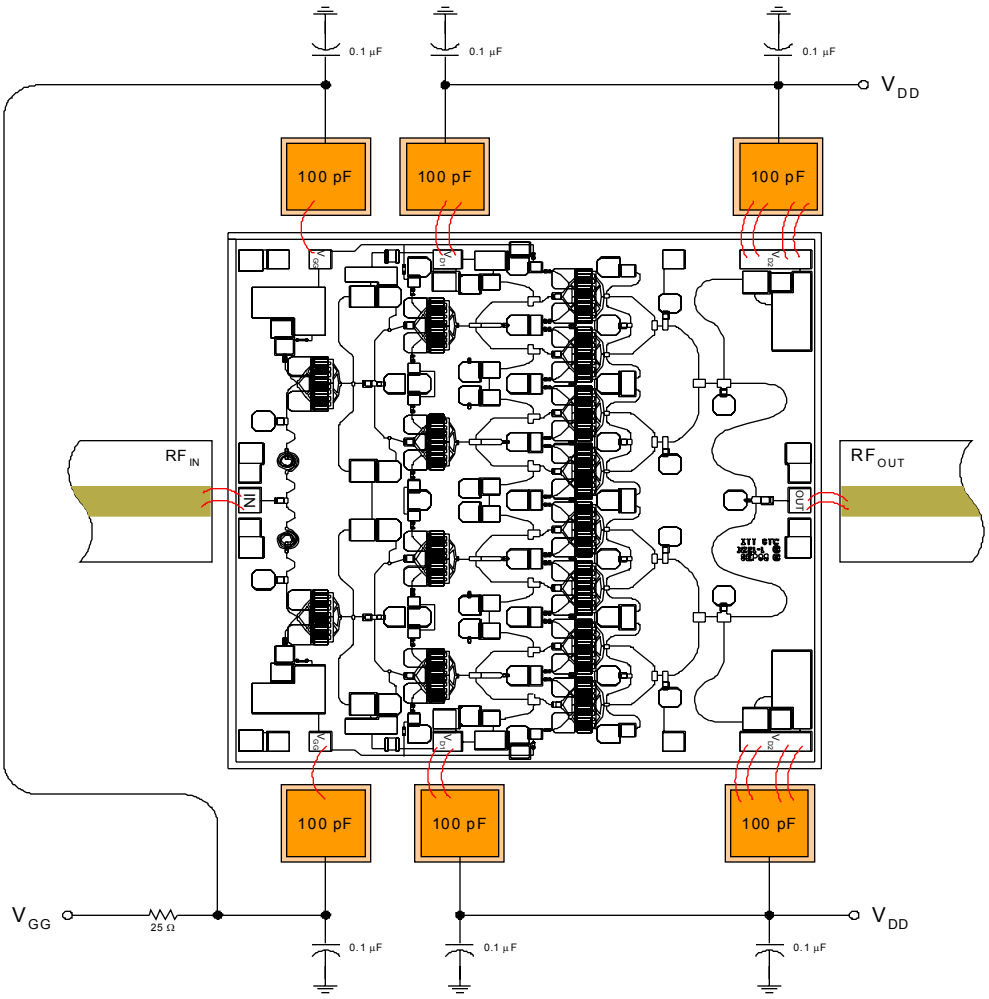

Figure 6. Die Layout

Assembly Instructions:

Die attach: Use AuSn (80/20) 1 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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