

# 0.5W X/Ku-Band Power Amplifier

## 8.0-12.5 GHz

Preliminary Information

MAAPGM0034-DIE

### Features

- ◆ 8.0-12.5 GHz Operation
- ◆ 0.5 Watt Saturated Output Power Level
- ◆ Variable Drain Voltage (4-10V) Operation
- ◆ Self-Aligned MSAG<sup>®</sup> MESFET Process

### Primary Applications

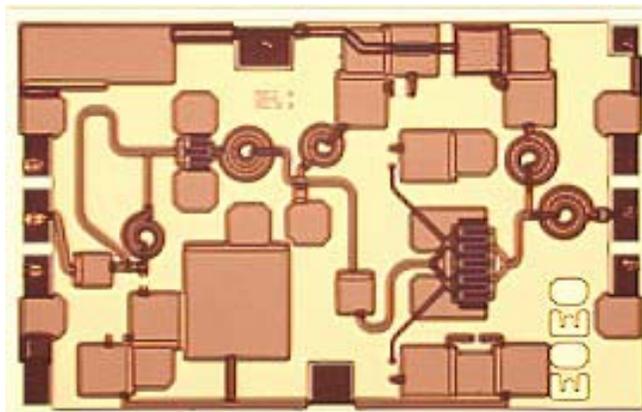
- ◆ Point-to-Point Radio
- ◆ Weather Radar
- ◆ Military Radar

### Description

The MAAPGM0034-Die is a 2-stage 0.5 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.

Each device is 100% RF tested on wafer to ensure performance compliance. The part is fabricated using M/A-COM's repeatable, high performance and highly reliable GaAs Multifunction Self-Aligned Gate (MSAG<sup>®</sup>) MESFET Process. This process provides polyimide scratch protection.

### 8.0-12.5 GHz GaAs MMIC Amplifier



**Electrical Characteristics:  $T_B = 40^\circ\text{C}^1$ ,  $Z_0 = 50\Omega$ ,  $V_{DD} = 10\text{V}$ ,  $V_{GG} = -2\text{V}$ ,  $P_{in} = 18\text{ dBm}$**

Parameter	Symbol	Typical	Units
Bandwidth	f	8.0-12.5	GHz
Output Power	$P_{OUT}$	28	dBm
Power Added Efficiency	PAE	35	%
1-dB Compression Point	P1dB	26	dBm
Small Signal Gain	G	15	dB
Input VSWR	Input VSWR	2:1	
Gate Current	$I_{GG}$	< 2	mA
Drain Current	$I_{DD}$	< 200	mA
Output Third Order Intercept	OTOI	33	dBm
Noise Figure	NF	8	dB
2 <sup>nd</sup> Harmonic	2f	-28	dBc
3 <sup>rd</sup> Harmonic	3f	-35	dBc

1.  $T_B$  = MMIC Base Temperature

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

Parameter	Symbol	Absolute Maximum	Units
Input Power	$P_{IN}$	21.0	dBm
Drain Supply Voltage	$V_{DD}$	+12.0	V
Gate Supply Voltage	$V_{GG}$	-3.0	V
Quiescent Drain Current (No RF)	$I_{DQ}$	190	mA
Quiescent DC Power Dissipated (No RF)	$P_{DISS}$	1.2	W
Junction Temperature	$T_J$	180	°C
Storage Temperature	$T_{STG}$	-55 to +150	°C

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

## Recommended Operating Conditions

Characteristic	Symbol	Min	Typ	Max	Unit
Drain Voltage	$V_{DD}$	4.0	10.0	10.0	V
Gate Voltage	$V_{GG}$	-2.3	-2.0	-1.5	V
Input Power	$P_{IN}$		18.0	19.0	dBm
Junction Temperature	$T_J$			150	°C
Thermal Resistance	$\Theta_{JC}$		64.1		°C/W
MMIC Base Temperature	$T_B$			Note 2	°C

2. Maximum MMIC Base Temperature =  $150^{\circ}\text{C} - \Theta_{JC} * V_{DD} * I_{DQ}$

## Operating Instructions

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

1. Apply  $V_{GG} = -2\text{ V}$ ,  $V_{DD} = 0\text{ V}$ .
2. Ramp  $V_{DD}$  to desired voltage, typically 10.0 V.
3. Adjust  $V_{GG}$  to set  $I_{DQ}$ , (approximately @  $-2\text{ V}$ ).
4. Set RF input.
5. Power down sequence in reverse. Turn gate voltage off last.



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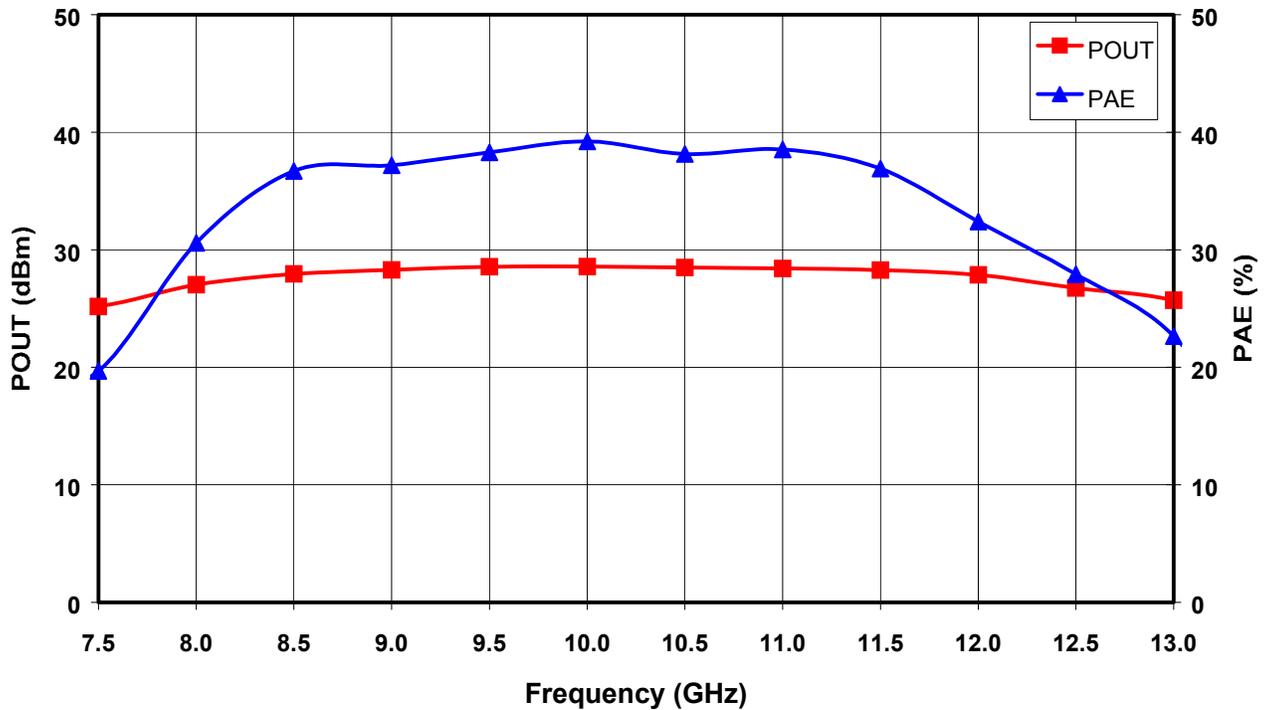


Figure 1. Output Power and Power Added Efficiency vs. Frequency at  $V_{DD} = 10V$  and  $P_{in} = 18 \text{ dBm}$ .

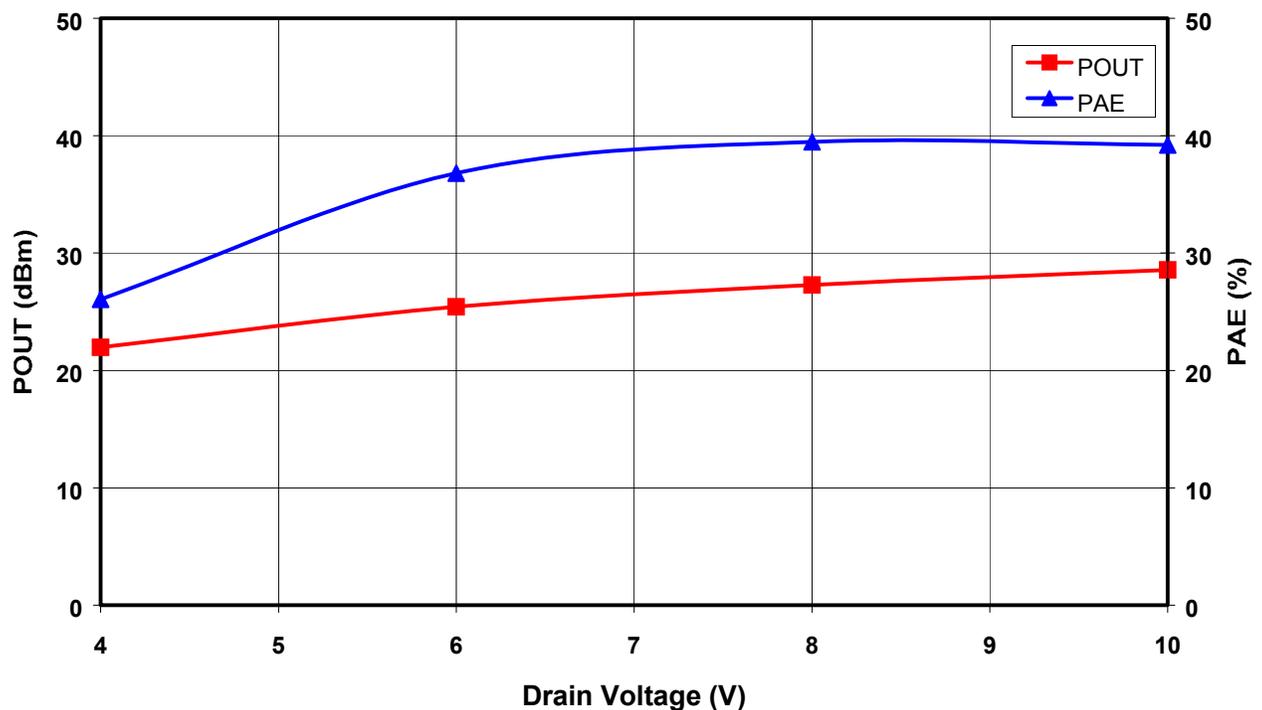


Figure 2. Saturated Output Power and Power Added Efficiency vs. Drain Voltage at  $f_o = 10 \text{ GHz}$ .

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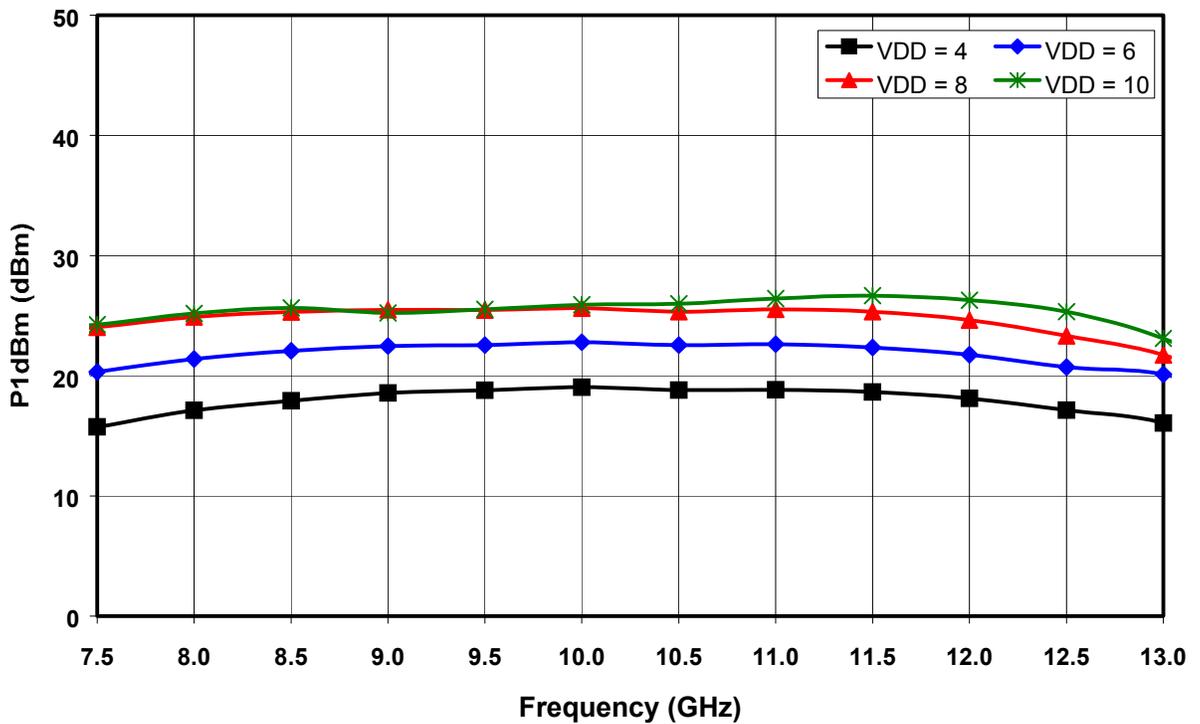


Figure 3. 1dB Compression Point vs. Drain Voltage

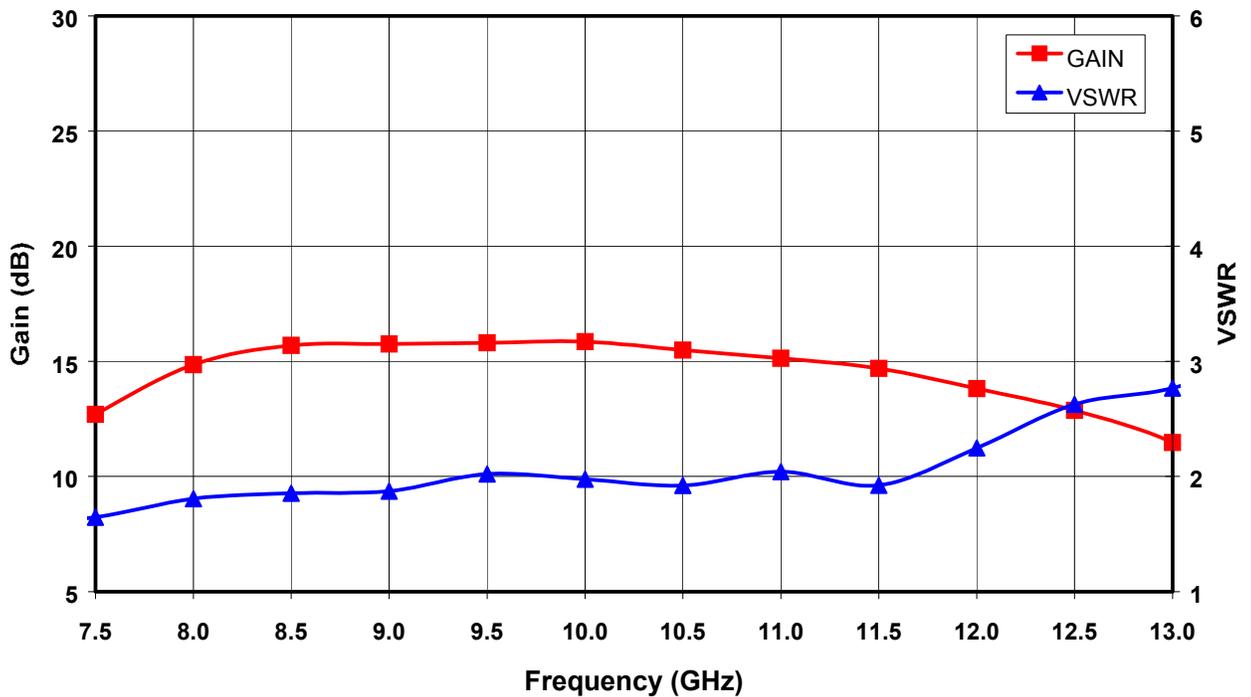


Figure 4. Small Signal Gain and Input VSWR vs. Frequency at V<sub>DD</sub> = 10V.

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## Mechanical Information

Chip Size: 2.480 x 1.580 x 0.075 mm (98 x 62 x 3 mils)

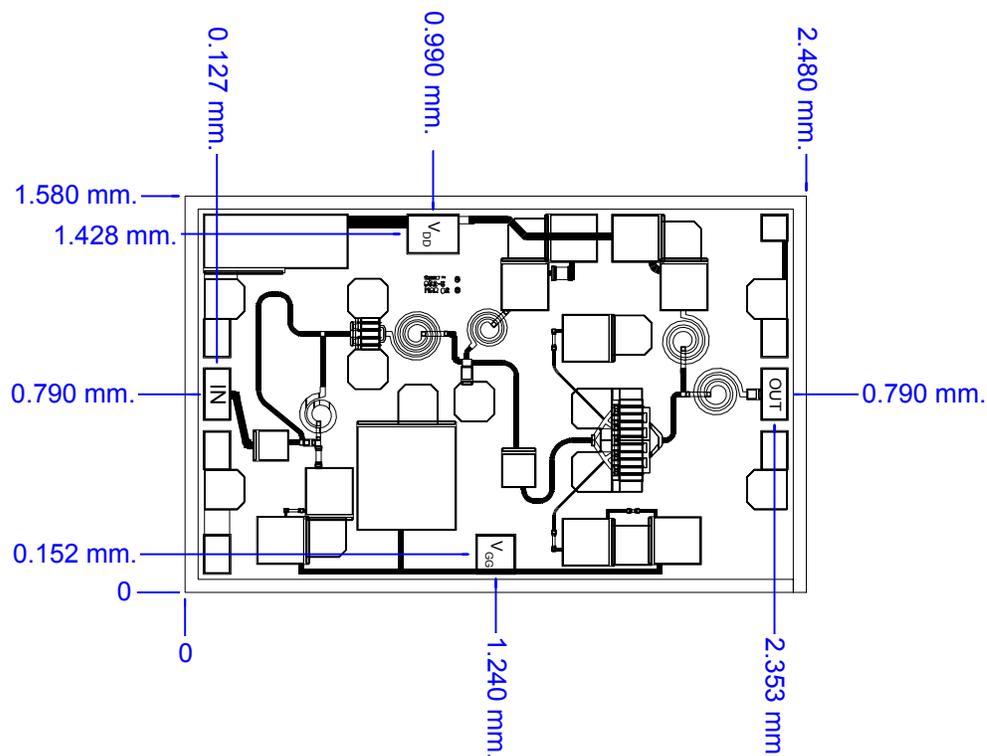


Figure 5. Die Layout

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

## Bond Pad Dimensions

Pad	Size ( $\mu\text{m}$ )	Size (mils)
RF In and Out	100 x 200	4 x 8
DC Drain Supply Voltage VDD	200 x 150	8 x 6
DC Gate Supply Voltage VGG	150 x 150	6 x 6

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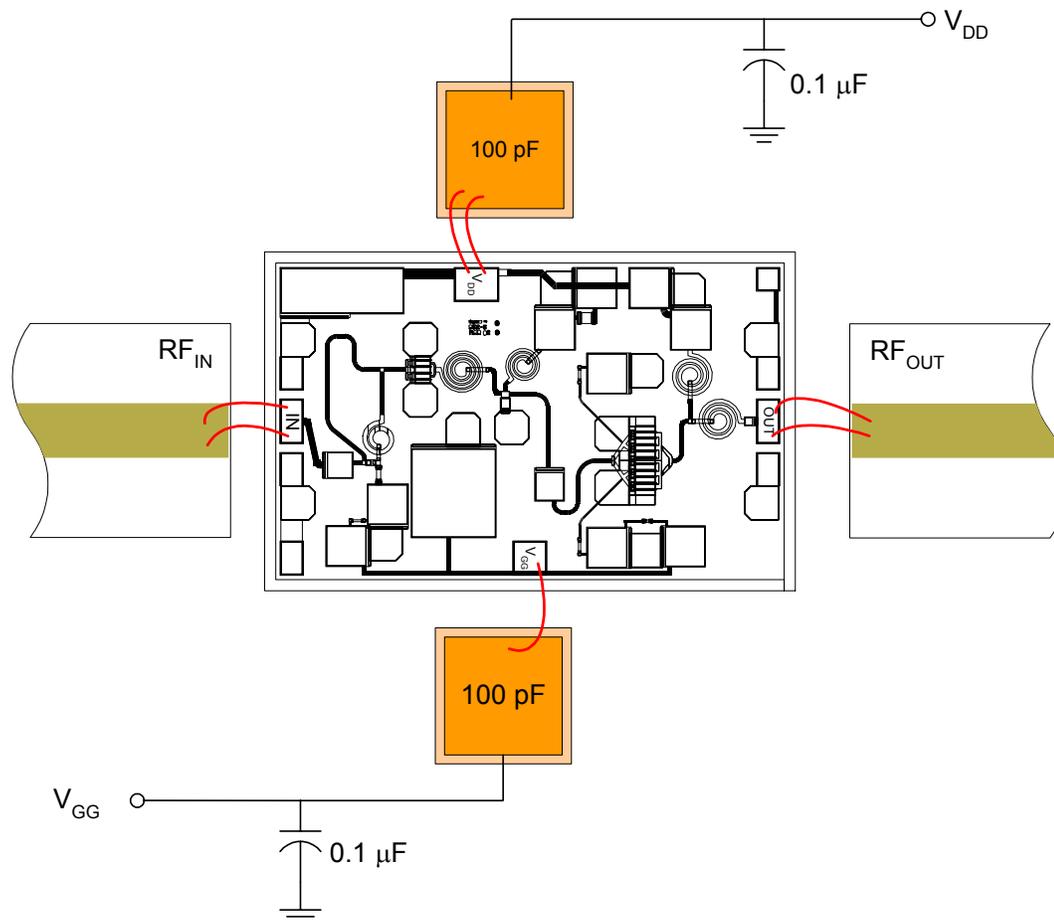
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**Figure 6. Recommended bonding diagram** for pedestal mount.  
Support circuitry typical of MMIC characterization fixture for CW testing.

#### 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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