### 3 W Power Amplifier 12.7 - 13.3 GHz

#### Features

- 23 dB Small Signal Gain
- 42 dBm Third Order Intercept Point (OIP3)
- >2.5 W Output P1dB
- Integrated Power Detector
- Bias 1200 mA @ 6 V
- Lead-Free 5 mm 24-lead QFN Package
- RoHS\* Compliant and 260°C Reflow Compatible

### Description

The MAAP-010516 is a packaged linear power amplifier that operates from 12.7 - 13.3 GHz. The device provides 23 dB gain and 42 dBm Output Third Order Intercept Point (OIP3) with 34 dBm output P1dB.

The packaged amplifier comes in an industry standard, fully molded 5 mm QFN package and is comprised of a three stage power amplifier with an integrated, temperature compensated on-chip power detector. The device includes on-chip ESD protection structures and DC by-pass capacitors to ease the implementation and volume assembly of the packaged part.

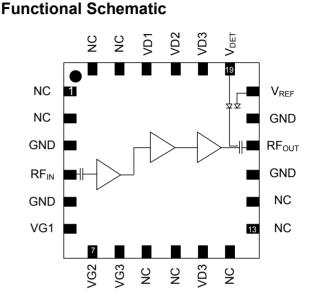
The device is specifically designed for use in 13 GHz point-to-point radios for cellular backhaul applications.

## Ordering Information<sup>1</sup>

Part Number	Package	
MAAP-010516-000000	bulk quantity	
MAAP-010516-TR0500	500 piece reel	
MAAP-010516-001SMB	evaluation module	

1. Reference Application Note M513 for reel size information.

### omotio



## Pin Configuration<sup>2</sup>

Pin No.	Function	Pin No.	Function
1	No Connection	13	No Connection
2	No Connection	14	No Connection
3	Ground	15	Ground
4	RF Input	16	RF Output
5	Ground	17	Ground
6	Gate 1 Bias	18	Pwr Det Ref
7	Gate 2 Bias	19	Pwr Det
8	Gate 3 Bias	20 <sup>2</sup>	Drain 3 Bias
9	No Connection	21	Drain 2 Bias
10	No Connection	22	Drain 1 Bias
11 <sup>2</sup>	Drain 3 Bias	23	No Connection
12	No Connection	24	No Connection
		25 <sup>3</sup>	Paddle

2. Drain 3 Bias can be connected from either pins 11 or 20.

3. The exposed pad centered on the package bottom must be connected to RF and DC ground.

\* Restrictions on Hazardous Substances, European Union Directive 2002/95/EC.

1

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### 3 W Power Amplifier 12.7 - 13.3 GHz

Rev. V1

#### Electrical Specifications: Freq. = 12.7 - 13.3 GHz, $V_D = 6 V$ , $I_{DQ}^4 = 1200 mA$ , $T_A = +25^{\circ}C$ Units Parameter Min. Typ. Max. Small Signal Gain dB 20.5 23 Input Return Loss dB 15 \_ \_ **Output Return Loss** dB 12 Noise Figure dB 7 \_\_\_\_ P1dB dBm 34 PSAT dBm 34 34.5 Output IP3, +20 dBm SCL dBm 39.5 42 Detector Bias Voltage (V<sub>DET</sub>, V<sub>REF</sub>) VDC 5.0

4. Adjust  $V_{G1}$ ,  $V_{G2}$  and  $V_{G3}$  between -1.0 and -0.1 V to achieve specified  $I_{DQ}$  ( $I_{DQ}$ = $I_{D1}$ + $I_{D2}$ + $I_{D3}$ ).  $V_{G1}$ ,  $V_{G2}$  and  $V_{G3}$  should be the same voltage.

### Maximum Operating Ratings<sup>5,6,7</sup>

Parameter	Absolute Max.	
Input Power	+18 dBm	
Drain Supply Voltage	+7 Volts	
Junction Temperature <sup>8</sup>	+160°C	
Operating Temperature	-40°C to +85°C	
Storage Temperature	-65°C to +150°C	

- 5. Exceeding any one or combination of these limits may cause permanent damage to this device.
- 6. M/A-COM Technology Solutions does not recommend sustained operation near these survivability limits.
- 7. Operating at nominal conditions with  $T_J$   $\leq$  160°C will ensure MTTF > 1 x 10^6 hours.
- 8. Junction Temperature (T<sub>J</sub>) = T<sub>C</sub> +  $\Theta_{JC}$  \* ((V \* I) (P<sub>OUT</sub> P<sub>IN</sub>)) Typical thermal resistance ( $\Theta_{JC}$ ) = 7.9°C/W

a) For  $T_C = 25^{\circ}C$ ,

 $T_J$  = 91°C @ 6 V, 1.85 A, P<sub>OUT</sub> = 34.5 dBm, P<sub>IN</sub> = 14 dBm b) For  $T_C$  = 85°C,

T<sub>J</sub> = 146°C @ 6 V, 1.75 A, P<sub>OUT</sub> = 34.5 dBm, P<sub>IN</sub> = 14 dBm

#### Absolute Maximum Ratings<sup>9,10</sup>

Parameter	Absolute Max.
Supply Gate Voltage	-3 V
Supply Current	2200 mA
Drain to Gate Voltage	10 V
Detector Pin	6 V
Detector Ref Pin	6 V
Continuous Power Dissipation @ 85°C	11.3 W
Junction Temperature	175°C

9. Channel temperature directly affects device MTTF. Channel temperature should be kept as low as possible to maximize lifetime.

10. For saturated performance it is recommended that the sum of (2\*V\_{DD} + abs(V\_{GG})) <17 V.

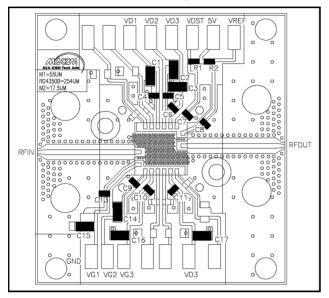
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Rev. V1

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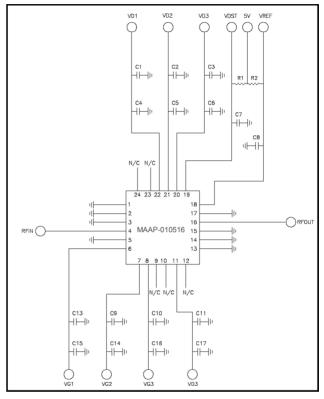
### **Recommended PCB Layout**



### Parts List

Component	Value	Package
C1,C2,C3,C14, C15,C16,C17	2.2 µF	0603
C4,C5,C6,C7,C8, C9,C10,C11,C13	1000 pF	0402
R1	100 ΚΩ	0402
R2	91 KΩ	0402

### Schematic



### **Handling Procedures**

Please observe the following precautions to avoid damage:

### **Static Sensitivity**

Gallium Arsenide Integrated Circuits are sensitive to electrostatic discharge (ESD) and can be damaged by static electricity. Proper ESD control techniques should be used when handling these Class 1A devices.

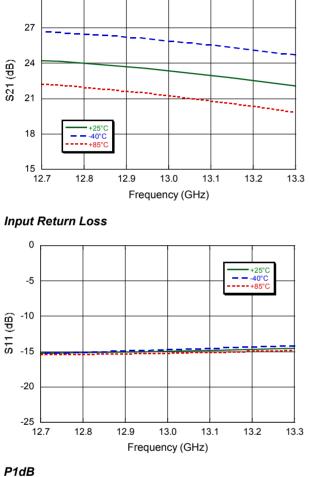
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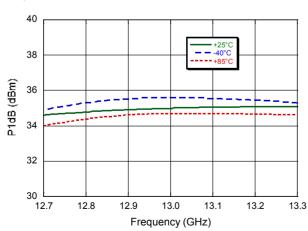
**Typical Performance Curves** 

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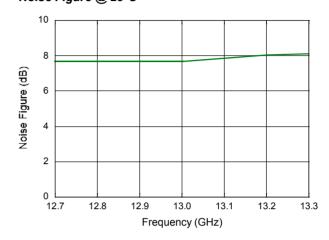
Gain

30

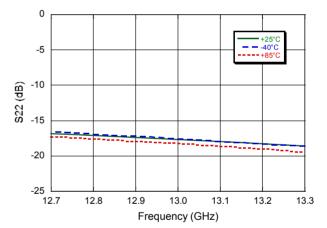




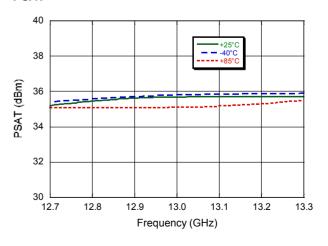
Noise Figure @ 25°C



Output Return Loss



PSAT



4

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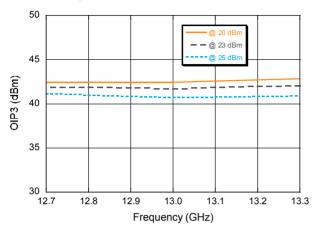


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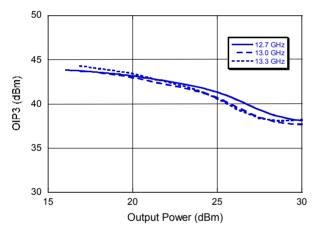
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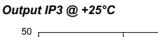
### **Typical Performance Curves**

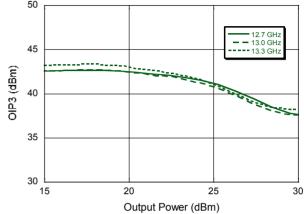
Output IP3 @ +25°C



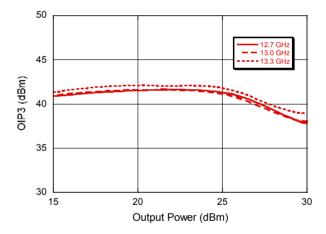
Output IP3 @ -40°C







Output IP3 @ +85°C



5

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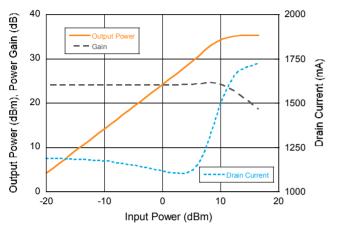
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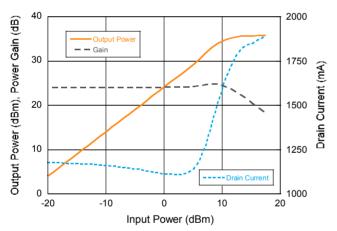
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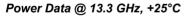
### **Typical Performance Curves**

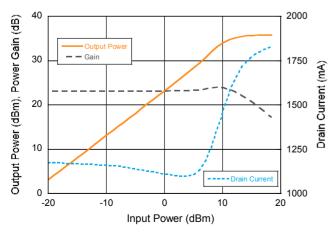
Power Data @ 12.7 GHz, +25°C



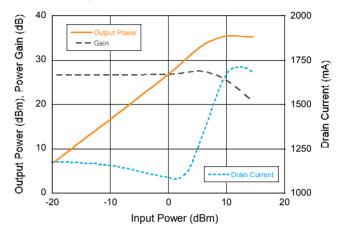
#### Power Data @ 13.0 GHz, +25°C



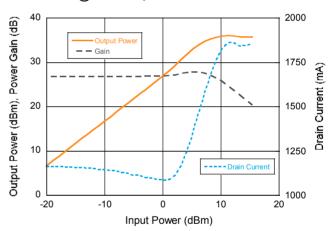


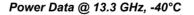


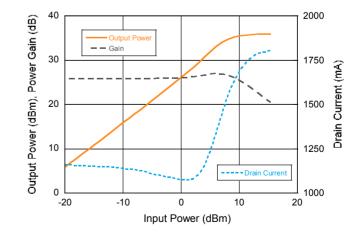




#### Power Data @ 13.0 GHz, -40°C







6

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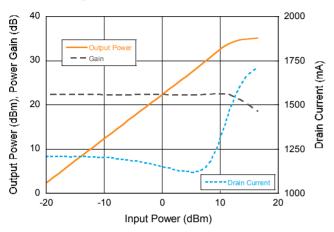
# **3 W Power Amplifier** 12.7 - 13.3 GHz

Rev. V1

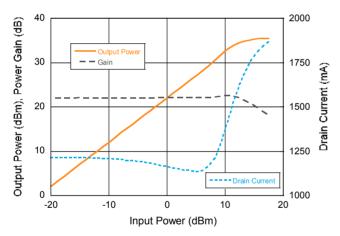
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### **Typical Performance Curves**

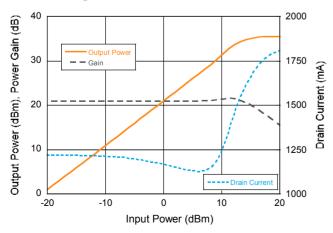
Power Data @ 12.7 GHz, +85°C



#### Power Data @ 13.0 GHz, +85°C



Power Data @ 13.3 GHz, +85°C

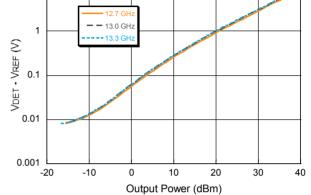




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# 10 = 13.0 GH 1 0.1

Detected Voltage (VDET-VREF) @ 25°C



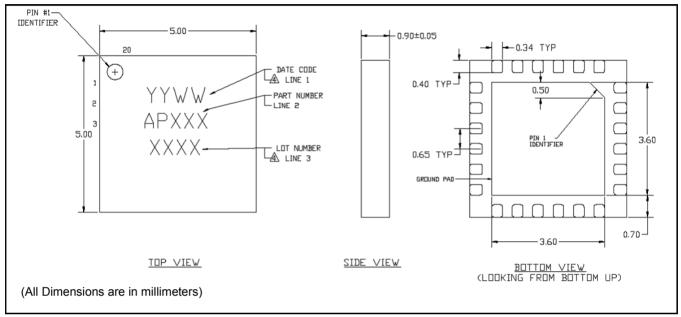
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### Lead-Free 5mm 24-lead PQFN



<sup>†</sup> Reference Application Note S2083 for lead-free solder reflow recommendations. Meets JEDEC moisture sensitivity level 1 requirements. Plating is matte tin over Copper.

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Rev. V1

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