### 10 W Power Amplifier

2 - 6 GHz

#### Features

- +41 dBm Saturated Output Power
- Linear Gain: 18 dB
- Power Added Efficiency: 30% at P<sub>SAT</sub>
- 50 Ω Input / Output Match
- Ceramic Flange Mount Package
- RoHS\* Compliant and 260°C Re-flow Compatible

#### Description

The MAAP-010169 is a two stage MMIC power amplifier designed for broadband high power applications. It can be used as either a driver or an output stage amplifier. This device is fully matched input and output to 50  $\Omega$  which eliminates any sensitive external RF tuning components.

The device is packaged in a lead free 10-lead flanged package for high volume manufacturing.

The MAAP-010169 is fabricated using a high reliability pHEMT process, to realize good power added efficiency and gain. The pHEMT process features full passivation for high performance and reliability.

#### **Functional Schematic**



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

| Pin No. | Function          |
|---------|-------------------|
| 1       | V <sub>GG</sub> 2 |
| 2       | V <sub>GG</sub> 1 |
| 3       | RF Input          |
| 4       | V <sub>GG</sub> 1 |
| 5       | V <sub>GG</sub> 2 |
| 6       | V <sub>DD</sub> 1 |
| 7       | V <sub>DD</sub> 2 |
| 8       | RF Output         |
| 9       | V <sub>DD</sub> 2 |
| 10      | V <sub>DD</sub> 1 |

2. Flange is DC and RF ground.

#### **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 devices.

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

| Part Number        | Package |
|--------------------|---------|
| MAAP-010169-000000 | Bulk    |

1. Reference Application Note M567 for package handling and mounting procedure.

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

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V1

#### Electrical Specifications: Freq. = 2 - 6 GHz, $V_{DD}$ = 10 V, $I_{DQ}$ = 3.5 A, $T_A$ = +25 °C, $Z_0$ = 50 $\Omega$ Parameter **Test Conditions** Units Min. Max. Typ. Gain dB 14 18 Input Return Loss dB 8 \_ **Output Return Loss** dB 10 \_\_\_\_ \_ \_\_\_\_ P1dB dBm 38 **P**<sub>SAT</sub> dBm 40 PAE % 30 **P**SAT **Duty Cycle** % 100 V Gate Bias Voltage -0.56\_\_\_\_ IDQ 3.5 Current А 5.5 PSAT

#### Absolute Maximum Ratings <sup>3,4,5</sup>

| Parameter                          | Absolute Maximum             |
|------------------------------------|------------------------------|
| Input Power                        | +26 dBm                      |
| Operating Supply Voltage           | +11 Volts                    |
| Operating Gate Voltage             | -2 V < V <sub>GG</sub> < 0 V |
| Operating Temperature <sup>6</sup> | -40°C to +25°C               |
| Channel Temperature <sup>7</sup>   | +150 °C                      |
| Storage Temperature                | -65°C to +150°C              |

3. Exceeding any one or combination of these limits may cause permanent damage to this device.

- 4. M/A-COM Technology Solutions does not recommend sustained operation near these survivability limits.
- 5. Operating at nominal conditions with  $T_{\rm J}$   $\leq$  +150°C will ensure MTTF > 1 x 10 $^6$  hours.
- 6. Operating temperatures >25°C will require regulation of dissipated power to maintain  $T_J \le 150$ °C. Refer to the Max. Power Dissipation vs. Base Plate Temperature curve on page 6.
- 7. Junction Temperature  $(T_J) = T_C + \Theta_{JC} * ((V * I) (P_{OUT} P_{IN}))$ Typical thermal resistance  $(\Theta_{JC}) = 2.8$ °C/W a) For  $T_C = 25$ °C, 4 GHz

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T_J = +130°C @ +10 V, 5.3 A, P_{OUT} = 42 dBm, P_{IN} = 24 dBm
```

### **Recommended Bias Configuration**



#### **Operating the MAAP-010169**

The MAAP-010169 is static sensitive. Please handle with care. To operate the device, follow these steps. Ramp down or shutdown in reverse order (gate bias on first and off last). All  $V_{GG}$  pins should have the same voltage applied at all times.

- 1. Apply  $V_{GG}$  (-1.5 V).
- 2. Apply V<sub>DD</sub> (10 V Typical).
- 3. Set  $I_{DQ}$  by adjusting  $V_{GG}$ .
- 4. Apply RF<sub>IN</sub>.

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### 10 W Power Amplifier 2 - 6 GHz





Input Return Loss



Output Power (dBm)



Reverse Isolation



**Output Return Loss** 





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### 10 W Power Amplifier 2 - 6 GHz

#### **Typical Performance Curves**



Power Added Efficiency



Drain Current







Efficiency @ 4 GHz







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### 10 W Power Amplifier 2 - 6 GHz

#### **Typical Performance Curves**

Power Gain @ 2 GHz



#### Power Gain @ 4 GHz







Output Power Sweep @ 2 GHz



Output Power Sweep @ 4 GHz







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### 10 W Power Amplifier 2 - 6 GHz

#### **Typical Performance Curves**

#### Max. Power Dissipation vs. Base Plate Temperature<sup>8</sup>



 Power dissipation should not exceed the maximum plot shown above to maintain T<sub>J</sub> <150°C. It is recommended to monitor power dissipation and decrease power dissipation in the device as required.

Junction Temperature vs. Base Plate Temperature with 45 W Power Dissipation



### Ceramic Flange Mount Package<sup>†</sup>



<sup>†</sup> Reference Application Note M538 for lead-free solder reflow recommendations.

This is a high frequency, low thermal resistance package. The package consists of a cofired ceramic construction with a copper-tungsten base and iron-nickel-cobalt leads. The finish consists of electrolytic gold over nickel plate.

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