

Features

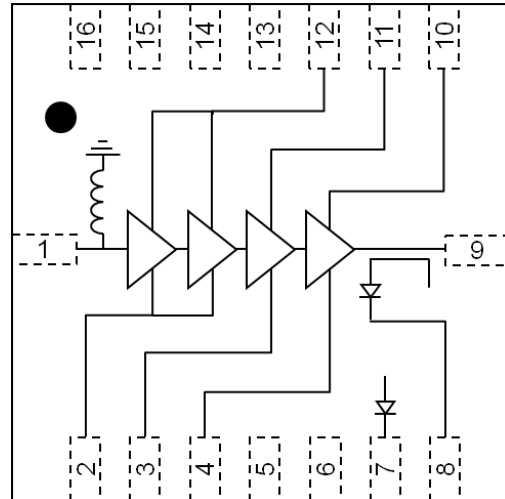
- Gain: 22 dB
- P1dB: 27 dBm
- High Linearity, OIP3: 38 dBm
- Integrated Power Detector
- Lead-Free 7 mm Laminate Package
- RoHS* Compliant and 260°C Reflow Compatible

Description

The MAAP-010512 is a 4-stage, high linearity 1W power amplifier in a 7x7 mm laminate package, allowing easy assembly. This PA product is fully matched to 50 ohms on both the input and output. It is designed for use as a power amplifier stage in transmit chains and is ideally suited for 42 GHz band point-to-point radios.

Each device is 100% RF tested to ensure performance compliance. The part is fabricated using an efficient pHEMT process.

Functional Schematic



Pin Configuration ^{1,2}

| Pin No. | Function | Pin No. | Function |
|---------|------------------------|---------|-------------------|
| 1 | RF _{IN} | 9 | RF _{OUT} |
| 2 | V _{G1} | 10 | V _{D3} |
| 3 | V _{G2} | 11 | V _{D2} |
| 4 | V _{G3} | 12 | V _{D1} |
| 5 | No Connection | 13 | No Connection |
| 6 | No Connection | 14 | No Connection |
| 7 | V _{REFERENCE} | 15 | No Connection |
| 8 | V _{DETECTOR} | 16 | No Connection |
| | | Paddle | Ground |

1. MACOM recommends connecting unused package pins to ground.
2. The exposed pad centered on the package bottom must be connected to RF and DC ground.

Ordering Information

| Part Number | Package |
|--------------------|-------------------------|
| MAAP-010512-000000 | Bulk quantity |
| MAAP-010512-TR0200 | 200 Piece Reel |
| MAAP-010512-TR0500 | 500 Piece Reel |
| MAAP-010512-001SMB | Sample Evaluation board |

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

Electrical Specifications:

Freq: 40.5 - 43.5 GHz, VD = 4 V, ID1 = 217 mA, ID2 = 300 mA, ID3 = 600 mA, T_A = 25°C

| Parameter | Units | Min. | Typ. | Max. |
|--------------------------------------|-------|------|--------|------|
| Small Signal Gain | dB | 18.0 | 22.0 | 27.0 |
| Gain Flatness cross Band | dB | - | +/-1.0 | - |
| Input Return Loss | dB | - | 15 | - |
| Output Return Loss | dB | - | 12 | - |
| Reverse Isolation | dB | - | 50 | - |
| Output P1dB | dBm | - | 27.0 | - |
| Output IP3 | dBm | 32.5 | 38.0 | - |
| Saturated Output Power | dBm | 25.0 | 29.0 | - |
| Output IMD3 with Pout (scl) = 14 dBm | dBc | 37.0 | 48.0 | - |
| Supply Current ³ | mA | - | 1117 | 1300 |

3. Adjust Vgs between -1.0 V and -0.1 V to achieve specified supply current. Typical current 1117 mA = 217 (ID1) + 300 (ID2) + 600 (ID3)

Absolute Maximum Ratings^{4,5,6}

| Parameter | Absolute Max. |
|-----------------------------------|-------------------|
| Drain Voltage | +4.3 V |
| Gate Bias Voltage | -1.5 V < Vg < 0 V |
| Input Power | 15 dBm |
| Junction Temperature ⁷ | 150°C |
| Operating Temperature | -40°C to +85°C |
| Storage Temperature | -55°C to +150°C |

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

5. M/A-COM Technology Solutions does not recommend sustained operation near these survivability limits.

6. Operating at nominal conditions with T_J ≤ 150°C will ensure MTTF > 1 x 10⁶ hours.

7. Junction Temperature (T_J) = T_C + Θ_{jc} * (V * I)
Typical thermal resistance (Θ_{jc}) = 11.2° C/W.

a) For T_C = 25°C,

T_J = 75°C @ 4 V, 1117 mA

b) For T_C = 85°C,

T_J = 135°C @ 4 V, 1117 mA

Handling Procedures

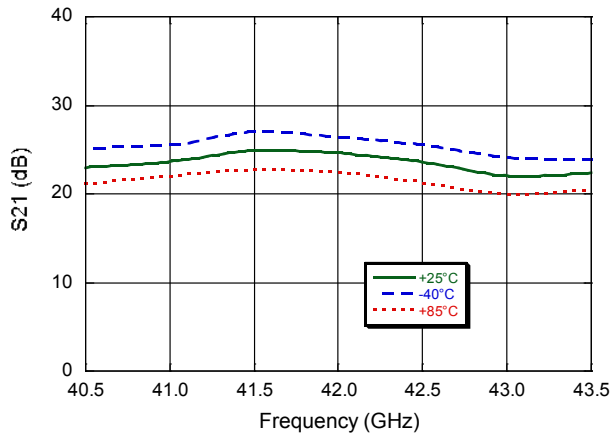
Please observe the following precautions to avoid damage:

Static Sensitivity

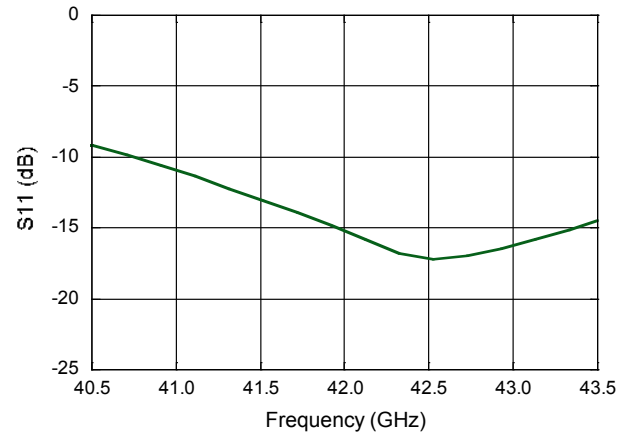
Gallium Arsenide Integrated Circuits are sensitive to electrostatic discharge (ESD) and can be damaged by static electricity. Proper ESD control techniques should be used when handling these Human Body Model Class 1A devices.

Typical Performance Curves: $V_D = 4\text{ V}$, $I_{D1} = 217\text{ mA}$, $I_{D2} = 300\text{ mA}$, $I_{D3} = 600\text{ mA}$, $T_A = 25^\circ\text{C}$

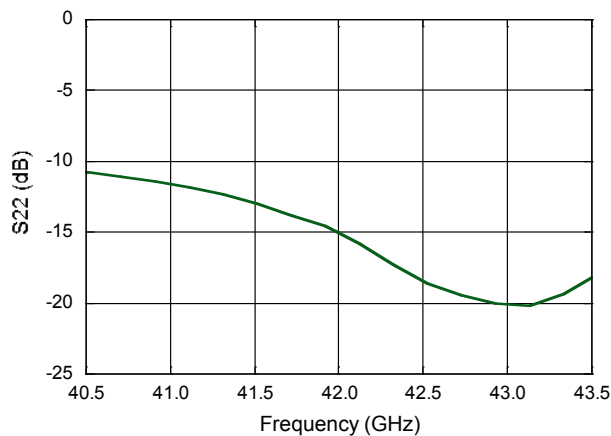
Small Signal Gain



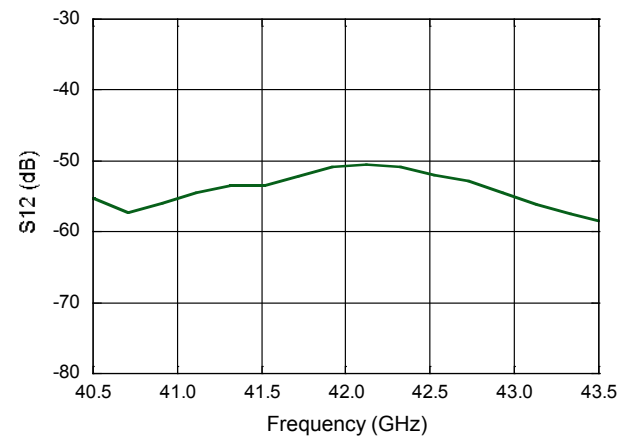
Input Return Loss



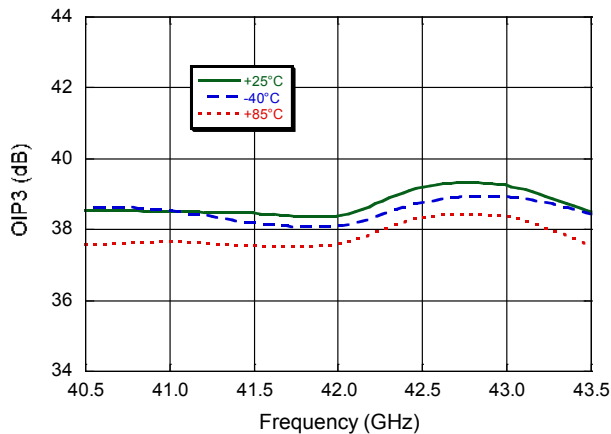
Output Return Loss



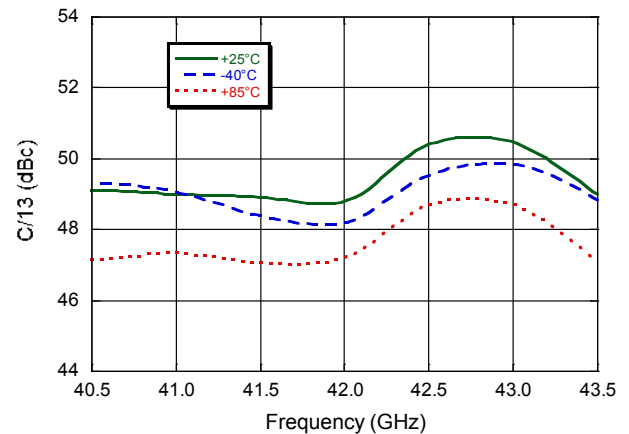
Reverse Isolation



Output IP3 (Pout = 14 dBm SCL)

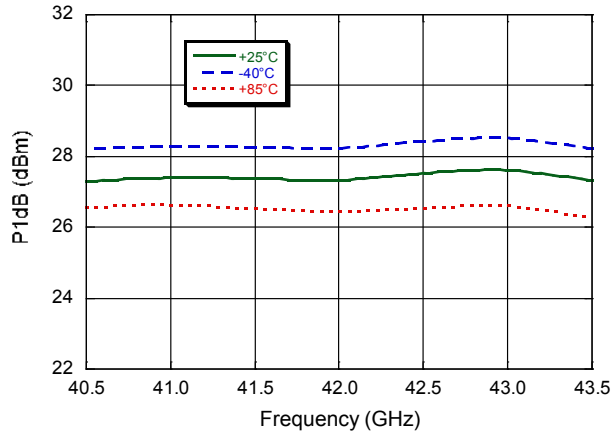


C/I3 (Pout = 14 dBm SCL)

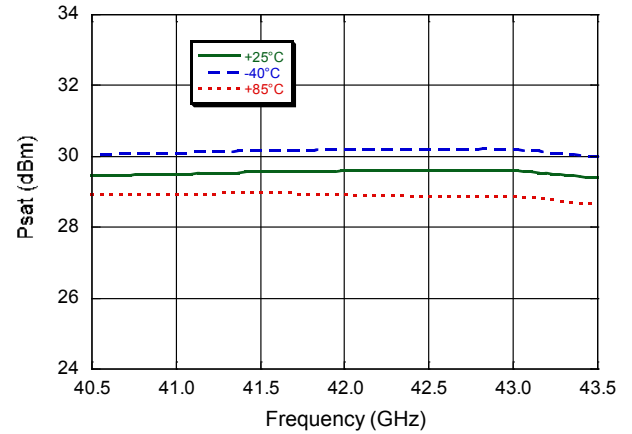


Typical Performance Curves: $V_D = 4\text{ V}$, $I_{D1} = 217\text{ mA}$, $I_{D2} = 300\text{ mA}$, $I_{D3} = 600\text{ mA}$, $T_A = 25^\circ\text{C}$

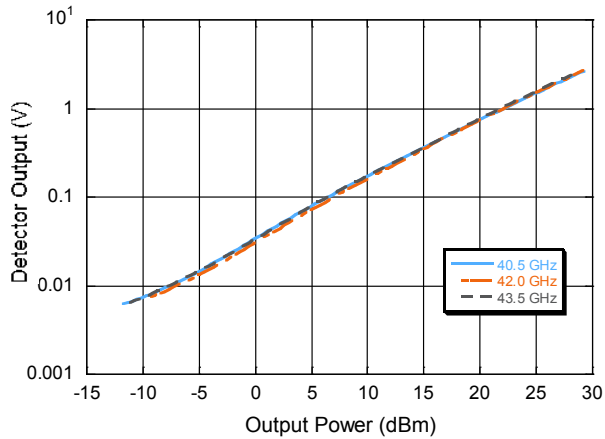
P1dB



Psat



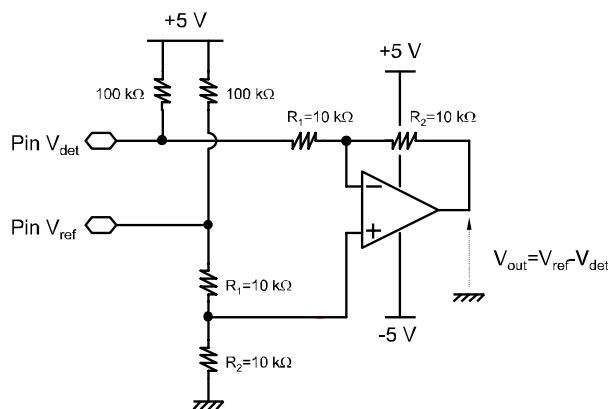
Detector Output (Diff), $V_{det/ref}\text{ Bias} = +5\text{V}100\text{k}$



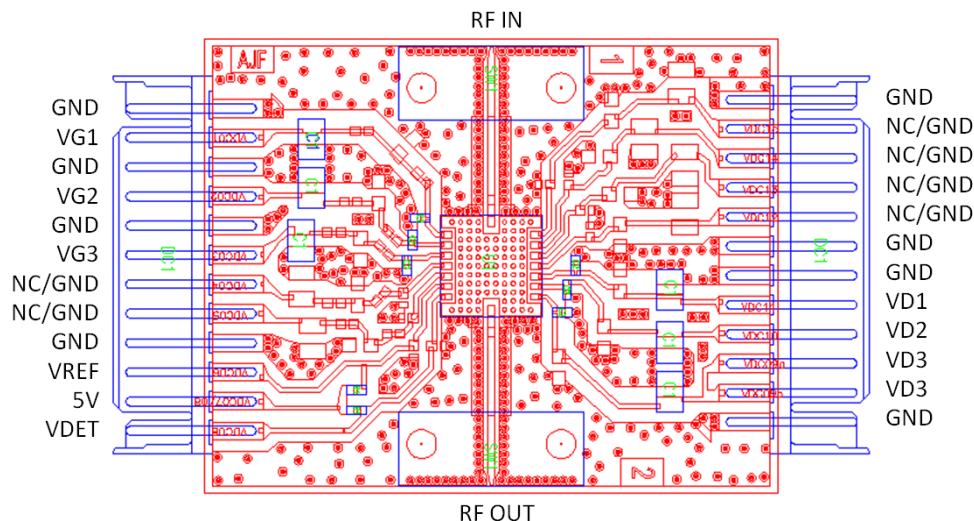
App Note [1] Biasing - It is recommended to bias the amplifier with $V_d=4.0\text{ V}$ and $I_d=1117\text{ mA}$. It is also recommended to use active biasing to keep the currents constant as the RF power and temperature vary; this gives the most reproducible results. Depending on the supply voltage available and the power dissipation constraints, the bias circuit may be a single transistor or a low power operational amplifier, with a low value resistor in series with the drain supply used to sense the current. The gate of the pHEMT is controlled to maintain correct drain current and thus drain voltage. The typical gate voltage needed to do this is -0.3 V . Typically the gate is protected with Silicon diodes to limit the applied voltage. Also, make sure to sequence the applied voltage to ensure negative gate bias is available before applying the positive drain supply.

App Note [2] Bias Arrangement - Each DC pin ($V_{d1,2,3}$ and $V_{g1,2,3}$) needs to have DC bypass capacitance ($10\text{ nF}/1\text{ }\mu\text{F}$) as close to the package as possible.

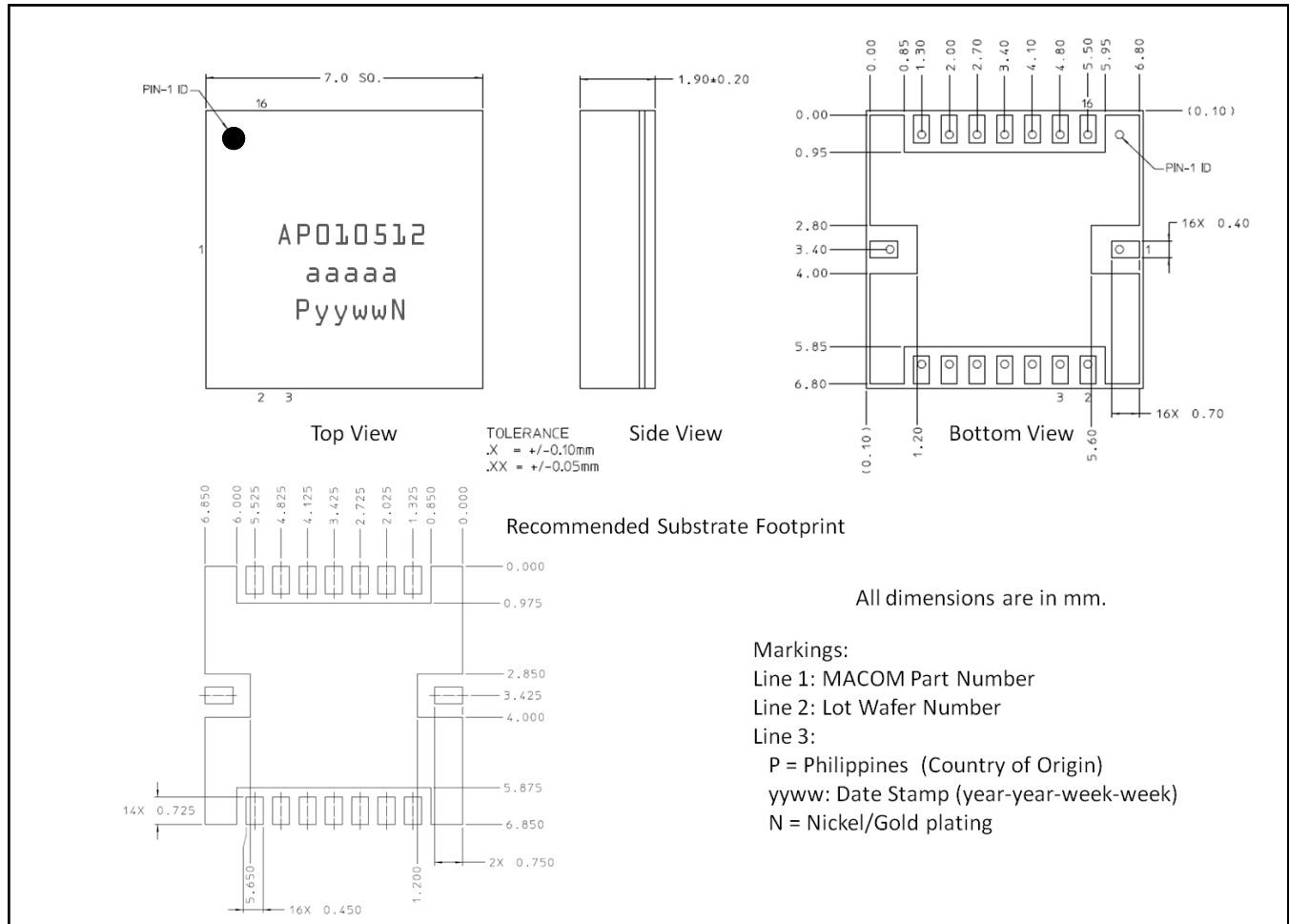
App Note [3] Power Detector - As shown in the schematic below, the power detector is implemented by providing $+5\text{ V}$ bias and measuring the difference in output voltage with standard op-amp in a differential mode configuration.



Recommended Board Layout



Lead-Free 7 mm x 7mm Laminate Package[†]



[†] Reference Application Note S2083 for lead-free solder reflow recommendations.
 Meets JEDEC moisture sensitivity level 3 requirements.

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