MAAP-010512

Amplifier, Power, 0.8 W
40.5 - 43.5 GHz
Rev. V4

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.

Ordering Information

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Package</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAAP-010512-000000</td>
<td>Bulk quantity</td>
</tr>
<tr>
<td>MAAP-010512-TR0200</td>
<td>200 Piece Reel</td>
</tr>
<tr>
<td>MAAP-010512-TR0500</td>
<td>500 Piece Reel</td>
</tr>
<tr>
<td>MAAP-010512-001SMB</td>
<td>Sample Evaluation board</td>
</tr>
</tbody>
</table>

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.

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

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

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)

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: VD = 4 V, ID1 = 217 mA, ID2 = 300 mA, ID3 = 600 mA, TA = 25°C
Amplifier, Power, 0.8 W
40.5 - 43.5 GHz

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

**$P_{1dB}$**

![Graph of $P_{1dB}$ vs. Frequency (GHz)]

**$P_{sat}$**

![Graph of $P_{sat}$ vs. Frequency (GHz)]

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

![Graph of Detector Output vs. Output Power (dBm)]

M/A-COM Technology Solutions Inc. (MACOM) and its affiliates reserve the right to make changes to the product(s) or information contained herein without notice.

Visit [www.macom.com](http://www.macom.com) for additional data sheets and product information.

For further information and support please visit:
[https://www.macom.com/support](https://www.macom.com/support)
**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 $-0.3 \text{ V}$. 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 ($10 \text{ nF}/1 \mu\text{F}$) 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†**

All dimensions are in mm.

Markings:
- Line 1: MACOM Part Number
- Line 2: Lot Wafer Number
- Line 3:
  - P = Philippines (Country of Origin)
  - yyyy: Date Stamp (year-year-week-week)
  - N = Nickel/Gold plating

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