MAAP-011193

4 W Power Amplifier
7.7 - 8.5 GHz

Rev. V1

Features
- 20 dB Small Signal Gain
- 46.5 dBm Third Order Intercept Point (OIP3)
- >36.5 dBm Saturated Output Power (P_{SAT})
- Bias 2000 mA at 8 V
- Lead-Free 7mm Copper Coin Air Cavity Package
- RoHS* Compliant

Description
The MAAP-011193 is a packaged linear power amplifier that operates from 7.7 - 8.5 GHz. The device provides 20 dB gain and 46.5 dBm Output Third Order Intercept Point (OIP3) with >35.5 dBm saturated output power (P_{SAT}).

The packaged amplifier comes in an air cavity 7 mm surface mount package with a copper coin paddle and is comprised of a two stage power amplifier MMIC. 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 8 GHz point-to-point radios for cellular backhaul applications.

Ordering Information

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Package</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAAP-011193</td>
<td>Bulk Quantity</td>
</tr>
<tr>
<td>MAAP-011193-TR0500</td>
<td>500 Piece Reel</td>
</tr>
<tr>
<td>MAAP-011193-001SMB</td>
<td>Sample Board</td>
</tr>
</tbody>
</table>

1. Reference Application Note M513 for reel size information.

2. Drain 2 Bias can be connected from either pins 6 or 12.
3. The exposed pad centered on the package bottom must be connected to RF and DC ground.

Electrical Specifications: Freq. = 7.7 - 8.5 GHz, $V_D = 8$ V, $I_{DQ}^4 = 2000$ mA, $T_A = +25^\circ$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>17</td>
<td>20</td>
<td>22.5</td>
</tr>
<tr>
<td>Input Return Loss</td>
<td>dB</td>
<td>—</td>
<td>12</td>
<td>—</td>
</tr>
<tr>
<td>Output Return Loss</td>
<td>dB</td>
<td>—</td>
<td>12</td>
<td>—</td>
</tr>
<tr>
<td>Power @ 1 dB Gain Compression, P1dB</td>
<td>dB</td>
<td>—</td>
<td>35.5</td>
<td>—</td>
</tr>
<tr>
<td>Power @ 3 dB Gain Compression, P3dB</td>
<td>dBm</td>
<td>—</td>
<td>36</td>
<td>—</td>
</tr>
<tr>
<td>Saturated Output Power, $P_{SAT}$</td>
<td>dBm</td>
<td>35.5</td>
<td>36.5</td>
<td>—</td>
</tr>
<tr>
<td>Output IP3, 25.5 dBm SCL @ Freq = 8.1 GHz</td>
<td>dBm</td>
<td>43.5</td>
<td>46.5</td>
<td>—</td>
</tr>
<tr>
<td>Drain Bias voltage</td>
<td>V</td>
<td>—</td>
<td>8.0</td>
<td>—</td>
</tr>
<tr>
<td>Drain Current</td>
<td>mA</td>
<td>—</td>
<td>2000</td>
<td>—</td>
</tr>
<tr>
<td>Gate Voltage</td>
<td>V</td>
<td>-1.5</td>
<td>—</td>
<td>-0.5</td>
</tr>
</tbody>
</table>

4. Adjust $V_{G1}$ and $V_{G2}$ between -1.2 and -0.7 V to achieve specified $I_{DQ}$ ($I_{DQ} = I_{D1} + I_{D2}$). $V_{G1}$ and $V_{G2}$ should be the same voltage.

Absolute Maximum Ratings$^5,6,7$

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Absolute Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input Power</td>
<td>25 dBm</td>
</tr>
<tr>
<td>Drain Voltage ($V_{D1,2}$)</td>
<td>+9 V</td>
</tr>
<tr>
<td>Gate Voltage ($V_{G1,2}$)</td>
<td>-3 V</td>
</tr>
<tr>
<td>Continuous Power Dissipation @ 85°C</td>
<td>33.3 W</td>
</tr>
<tr>
<td>Junction Temperature (max.)</td>
<td>+175°C</td>
</tr>
<tr>
<td>Junction Temperature</td>
<td>+150°C</td>
</tr>
<tr>
<td>Operating Temperature</td>
<td>-40°C to +85°C</td>
</tr>
<tr>
<td>Storage Temperature</td>
<td>-65°C to +150°C</td>
</tr>
</tbody>
</table>

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 HBM devices.
4 W Power Amplifier
7.7 - 8.5 GHz

Recommended PCB Layout

Schematic

Parts List

<table>
<thead>
<tr>
<th>Component</th>
<th>Value</th>
<th>Package</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1, C4, C7, C9, C12</td>
<td>2.2 µF</td>
<td>0603</td>
</tr>
<tr>
<td>C3, C10</td>
<td>0.47 µF</td>
<td>0603</td>
</tr>
<tr>
<td>C2, C5, C6, C8, C11</td>
<td>1.0 nF</td>
<td>0603</td>
</tr>
</tbody>
</table>
Typical Performance Curves: $V_D = 8\, V$, $I_{DQ} = 2\, A$, $V_G = -1.05 \sim -0.95\, V$, $T_A = +25^\circ C$

- **Broadband Gain ($S_{21}$) vs. Freq (GHz), $V_d = 8V, I_d = 2A$**
  - Frequency (GHz) vs. $S_{21}$ (dB)
  - Frequency (GHz)

- **Gain ($S_{21}$) vs. Freq (GHz), $V_d = 8V, I_d = 2A$**
  - Frequency (GHz) vs. $S_{21}$ (dB)
  - Frequency (GHz)

- **IP/OP Return Loss ($S_{11}/S_{22}$) vs. Freq (GHz), $V_d = 8V, I_d = 2A$**
  - Frequency (GHz) vs. $S_{11}$ ($S_{22}$) (dB)
  - Frequency (GHz)

- **P1dB/P3dB/Psat Pwr (dBm) vs. Freq (GHz), $V_d = 8V, I_d = 2A$**
  - Frequency (GHz) vs. P1dB/P3dB/Psat Pwr (dBm)
  - Frequency (GHz)

- **Output IP3 (dBm) vs. SCL O/P Pwr (dBm), $V_d = 8V, I_d = 2A$**
  - SCL Output Power (dBm) vs. Output IP3 (dBm)
  - SCL Output Power (dBm)

- **Output IP3 (dBm) vs. Freq (GHz), $V_d = 8V, I_d = 2A$**
  - Frequency (GHz) vs. Output IP3 (dBm)
  - Frequency (GHz)
Typical Performance Curves: $V_D = 8\,\text{V}$, $I_{DQ} = 2\,\text{A}$, $V_G = -1.05 \sim -0.95\,\text{V}$, $T_A = +25^\circ\text{C}$

- Output Power (dBm) and Power Gain vs. Input Power (dBm) @ 7.7GHz, $V_d = 8\,\text{V}$, $I_d = 2\,\text{A}$
- Power Gain/PAE @ 7.7GHz vs. OP Pwr (dBm), $V_d = 8\,\text{V}$, $I_d = 2\,\text{A}$
- Output Power (dBm) and Power Gain vs. Input Power (dBm) @ 8.1GHz, $V_d = 8\,\text{V}$, $I_d = 2\,\text{A}$
- Power Gain/PAE @ 8.1GHz vs. OP Pwr (dBm), $V_d = 8\,\text{V}$, $I_d = 2\,\text{A}$
- Output Power (dBm) and Power Gain vs. Input Power (dBm) @ 8.5GHz, $V_d = 8\,\text{V}$, $I_d = 2\,\text{A}$
- Power Gain/PAE @ 8.5GHz vs. OP Pwr (dBm), $V_d = 8\,\text{V}$, $I_d = 2\,\text{A}$
Typical Performance Curves: $V_D = 8\, \text{V}$, $I_{DQ} = 2\, \text{A}$, $V_G = -1.05 \sim -0.95\, \text{V}$, $T_A = +25\, ^\circ\text{C}$

![IMD3 (dBc) vs. SCL O/P Pwr (dBm), $V_d = 8\, \text{V}, I_d = 2\, \text{A}$](image1)

![Noise Figure (dB) vs. Freq (GHz), $V_d = 8\, \text{V}, I_d = 2\, \text{A}$](image2)

Typical Performance Curves: $V_D = 8\, \text{V}$, $I_{DQ} = 2\, \text{A}$, $V_G = -1.05 \sim -0.95\, \text{V}$, $T_A = -40\, ^\circ\text{C} \sim +85\, ^\circ\text{C}$

![Psat Power (dBm) over Temp vs. Freq (GHz), $V_d = 8\, \text{V}, I_d = 2\, \text{A}$](image3)

![P1dB Power (dBm) over Temp vs. Freq (GHz), $V_d = 8\, \text{V}, I_d = 2\, \text{A}$](image4)

![Power Gain (dB) over Temp vs. Output Power (dBm), $V_d = 8\, \text{V}, I_d = 2\, \text{A}$](image5)

![Output IP3 at 17.5dBm SCL O/P Pwr (dBm) over Temp vs. Freq (GHz), $V_d = 8\, \text{V}, I_d = 2\, \text{A}$](image6)
Typical Performance Curves: $V_D = 8$ V, $I_{DQ} = 2$ A, $V_G = -1.05 \sim -0.95$ V, $T_A = -40^\circ C \sim +85^\circ C$

![Typical Performance Curves: $V_D = 8$ V, $I_{DQ} = 2$ A, $V_G = -1.05 \sim -0.95$ V, $T_A = -40^\circ C \sim +85^\circ C$](image)

Typical Performance Curves: $V_D = 8$ V, $I_{DQ} = \text{Various}$, $V_G = -0.9 \sim 1.65$ V, $T_A = +25^\circ C$

![Typical Performance Curves: $V_D = 8$ V, $I_{DQ} = \text{Various}$, $V_G = -0.9 \sim 1.65$ V, $T_A = +25^\circ C$](image)

Typical Performance Curves: $V_D = 8$ V, $I_{DQ} = 1.5$ A, 1.65 A, 2.0 A, $V_G = -0.9 \sim 1.65$ V

![Typical Performance Curves: $V_D = 8$ V, $I_{DQ} = 1.5$ A, 1.65 A, 2.0 A, $V_G = -0.9 \sim 1.65$ V](image)
Typical Performance Curves: $V_D = 8\, \text{V},\ I_{DQ} = 1.5\, \text{A}, 1.65\, \text{A}, 2.0\, \text{A},\ V_G = -0.9\sim 1.65\, \text{V}$
Lead Free 7 mm Laminate Package (16 pin)

1. All Dimensions as mm.
2. Dimension Tolerance ±0.05mm.
3. Plating is Nickel/Palladium/Gold over Copper.
4. Reference Application Note S2083 for lead-free solder reflow recommendations.

† Meets JEDEC moisture sensitivity level 3 requirements.