MAAL-008624

High Dynamic Range Low Noise Amplifier
400 - 500 MHz

Features

- Low Noise Figure: 0.9 dB
- High OIP3: +28 dBm at 5 V, 60 mA bias
- High Gain: 21 dB
- Single Supply: +3 to +8 VDC
- Lead-Free SOIC-8 Package
- 100% Matte Tin Plating over Copper
- Halogen-Free “Green” Mold Compound
- 260°C Reflow Compatible
- RoHS* Compliant Version of MAALSS0025
- Adjustable current: 20 to 80 mA with external resistor

Description

M/A-COM’s MAAL-008624 is a high dynamic range, low noise GaAs MMIC amplifier in a low cost, surface mount package. It employs external input matching to obtain optimum noise figure performance and operating frequency flexibility.

The MAAL-008624 also features flexible biasing to control the current consumption vs. dynamic range trade-off. The MAAL-008624 can operate from any supply voltage in the 3 V to 8 V range. Its current can be controlled over a range of 20 mA to 80 mA with an external resistor.

The MAAL-008624 is ideally suited for use where low noise figure, high gain, high dynamic range, and low power consumption are required. Typical applications include receiver front ends in CDMA450 base stations. It is also useful as a gain block, buffer, driver, and IF amplifier in both fixed and portable cellular and 450 MHz ISM systems.

The MAAL-008624 is fabricated using a low-cost 0.5-micron gate length GaAs process. The process features full passivation for increased performance reliability.

Ordering Information

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Package</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAAL-008624-000000</td>
<td>Bulk Packaging</td>
</tr>
<tr>
<td>MAAL-008624-TR3000</td>
<td>3000 piece reel</td>
</tr>
</tbody>
</table>

1. Reference Application Note M513 for reel size information.

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Electrical Specifications: \( T_A = +25^\circ \text{C} \), \( Z_0 = 50 \ \Omega \), \( F = 450 \ \text{MHz} \), \( P_{in} = -30 \ \text{dBm} \)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Test Conditions</th>
<th>Units</th>
<th>Min</th>
<th>Typ</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gain</td>
<td>5 V, 60 mA(^5)</td>
<td>dB</td>
<td>19</td>
<td>21</td>
<td>24</td>
</tr>
<tr>
<td>Noise Figure</td>
<td>5 V, 60 mA(^5)</td>
<td>dB</td>
<td>—</td>
<td>0.9</td>
<td>1.4</td>
</tr>
<tr>
<td>Input Return Loss</td>
<td>—</td>
<td>dB</td>
<td>—</td>
<td>9</td>
<td>—</td>
</tr>
<tr>
<td>Output Return Loss</td>
<td>—</td>
<td>dB</td>
<td>—</td>
<td>11</td>
<td>—</td>
</tr>
<tr>
<td>Output 1 dB Compression</td>
<td>5 V, 60 mA(^5)</td>
<td>dBm</td>
<td>—</td>
<td>16.5</td>
<td>—</td>
</tr>
<tr>
<td>Output IP3</td>
<td>5 V, 60 mA(^5)</td>
<td>dBm</td>
<td>—</td>
<td>28</td>
<td>—</td>
</tr>
<tr>
<td>Input IP3</td>
<td>5 V, 60 mA(^5)</td>
<td>dBm</td>
<td>3</td>
<td>7</td>
<td>—</td>
</tr>
<tr>
<td>Reverse Isolation</td>
<td>—</td>
<td>dB</td>
<td>—</td>
<td>34</td>
<td>—</td>
</tr>
</tbody>
</table>


Handling Procedures
The following precautions should be observed 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.

External Circuity Parts List

<table>
<thead>
<tr>
<th>Part</th>
<th>Value</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1</td>
<td>100 pF</td>
<td>DC Block</td>
</tr>
<tr>
<td>C2</td>
<td>8 pF</td>
<td>Input Matching</td>
</tr>
<tr>
<td>C3</td>
<td>470 pF</td>
<td>Bypass</td>
</tr>
<tr>
<td>C4</td>
<td>4 pF</td>
<td>Output Bypass</td>
</tr>
<tr>
<td>L1</td>
<td>22 nH</td>
<td>Input Matching</td>
</tr>
<tr>
<td>L2</td>
<td>43 nH</td>
<td>Input Matching</td>
</tr>
<tr>
<td>L3</td>
<td>12 nH</td>
<td>RF Choke</td>
</tr>
<tr>
<td>L4</td>
<td>11 nH</td>
<td>Output Matching</td>
</tr>
<tr>
<td>R1</td>
<td>15 Ohms</td>
<td>Optional current control(^6)</td>
</tr>
</tbody>
</table>

6. Pin 2 allows use of an external resistor to ground for optional, higher current. For 20 mA operation, no resistor is used.
   - For IDD ~ 40 mA, \( R_2 = 43 \ \text{ohms} \);
   - IDD ~ 60 mA, \( R_2 = 15 \ \text{ohms} \);
   - IDD ~ 80 mA, \( R_2 = 10 \ \text{ohms} \).
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Typical Performance Curves over Temperature

**Gain**

\[ S_{21}(\text{dB}) \]

\[ \text{Frequency (MHz)} \]

\[ 400 \quad 420 \quad 440 \quad 460 \quad 480 \quad 500 \]

\[ +25^\circ C \quad +85^\circ C \]

\[ -40^\circ C \]

**Reverse Isolation**

\[ S_{12}(\text{dB}) \]

\[ \text{Frequency (MHz)} \]

\[ 400 \quad 420 \quad 440 \quad 460 \quad 480 \quad 500 \]

\[ +25^\circ C \quad +85^\circ C \]

\[ -40^\circ C \]

**Input Return Loss**

\[ S_{11}(\text{dB}) \]

\[ \text{Frequency (MHz)} \]

\[ 400 \quad 420 \quad 440 \quad 460 \quad 480 \quad 500 \]

\[ +25^\circ C \quad +85^\circ C \]

\[ -40^\circ C \]

**Output Return Loss**

\[ S_{22}(\text{dB}) \]

\[ \text{Frequency (MHz)} \]

\[ 400 \quad 420 \quad 440 \quad 460 \quad 480 \quad 500 \]

\[ +25^\circ C \quad +85^\circ C \]

\[ -40^\circ C \]

**Noise Figure**

\[ \text{Noise Figure (dB)} \]

\[ \text{Frequency (MHz)} \]

\[ 400 \quad 420 \quad 440 \quad 460 \quad 480 \quad 500 \]

\[ +25^\circ C \quad +85^\circ C \]

\[ -40^\circ C \]

**Output IP3**

\[ \text{Output IP3 (dBm)} \]

\[ \text{Frequency (MHz)} \]

\[ 400 \quad 420 \quad 440 \quad 460 \quad 480 \quad 500 \]

\[ +25^\circ C \quad +85^\circ C \]

\[ -40^\circ C \]

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Lead-Free SOIC-8†

Reference Application Note M538 for lead-free solder reflow recommendations.
Meets JEDEC moisture sensitivity level 1 requirements.

Recommended PCB Configuration

Cross Section View

The PCB dielectric between RF traces and RF ground layers should be chosen to reduce RF discontinuities between 50-ohm lines and package pins. M/A-COM recommends an FR-4 dielectric thickness of 0.008” (0.20 mm) yielding a 50-ohm line width of 0.015” (0.38 mm). The recommended RF metalization thickness is 1 ounce copper.
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