Low Noise Amplifier
0.5 - 3.0 GHz

MAAL-007304

Features
- Low Noise Figure: 0.7 dB at 2.3 GHz
- Single +3 to +5 V Supply Bias
- Low Current: 11.5 mA typical
- Lead-Free SOT-26 Plastic Package
- RoHS* Compliant and 260°C Reflow Compatible

Description
M/A-COM's MAAL-007304 low noise amplifier is a GaAs MMIC amplifier in a lead-free SOT-26 surface mount plastic package. The MAAL-007304 employs a monolithic 2-stage self-biased design and can be biased between +3 to +5 volts, depending on system requirements. The MAAL-007304 offers low noise, low current, and high gain. It can be tuned for various applications from 0.5 to 3 GHz.

M/A-COM fabricates the MAAL-007304 using a low noise pHEMT process to realize low noise and high gain. The process features full passivation for performance and reliability.

Ordering Information

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Package</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAAL-007304-000000</td>
<td>Bulk Packaging</td>
</tr>
<tr>
<td>MAAL-007304-TR3000</td>
<td>3000 piece reel</td>
</tr>
<tr>
<td>MAAL-007304-001SMB</td>
<td>Sample Board 2.3 - 2.5 GHz Tuning</td>
</tr>
</tbody>
</table>

1. Reference Application Note M513 for reel size information.
2. All sample boards include 5 loose parts.

Functional Schematic

Pin Configuration

<table>
<thead>
<tr>
<th>Pin No.</th>
<th>Pin Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>V_DD</td>
<td>Bias</td>
</tr>
<tr>
<td>2</td>
<td>GND</td>
<td>Ground</td>
</tr>
<tr>
<td>3</td>
<td>RF_IN</td>
<td>RF Input</td>
</tr>
<tr>
<td>4</td>
<td>SRC</td>
<td>Source</td>
</tr>
<tr>
<td>5</td>
<td>GND</td>
<td>Ground</td>
</tr>
<tr>
<td>6</td>
<td>RF_OUT</td>
<td>RF Output</td>
</tr>
</tbody>
</table>

Absolute Maximum Ratings

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Absolute Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>RF Input Power</td>
<td>+10 dBm</td>
</tr>
<tr>
<td>Voltage</td>
<td>6.0 volts</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>

3. Exceeding any one or combination of these limits may cause permanent damage to this device.
4. M/A-COM does not recommend sustained operation near these survivability limits.

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Electrical Specifications: \( F = 2.3 \, \text{GHz}, V_{DD} = +3 \, \text{V}, T_A = +25^\circ \text{C}, Z_O = 50 \, \Omega \)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Units</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gain</td>
<td>dB</td>
<td>24.0</td>
<td>25.5</td>
<td>27.0</td>
</tr>
<tr>
<td>Noise Figure</td>
<td>dB</td>
<td>—</td>
<td>0.7</td>
<td>0.85</td>
</tr>
<tr>
<td>Current</td>
<td>mA</td>
<td>—</td>
<td>11.5</td>
<td>13.0</td>
</tr>
</tbody>
</table>

Typical Performance: \( F = 2.3 \, \text{GHz}, V_{DD} = +3 \, \text{V}, T_A = +25^\circ \text{C}, Z_O = 50 \, \Omega \)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Units</th>
<th>Typ.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input Return Loss</td>
<td>dB</td>
<td>15</td>
</tr>
<tr>
<td>Output Return Loss</td>
<td>dB</td>
<td>10</td>
</tr>
<tr>
<td>Input IP&lt;sub&gt;3&lt;/sub&gt;</td>
<td>dBm</td>
<td>-6</td>
</tr>
<tr>
<td>Output IP&lt;sub&gt;3&lt;/sub&gt;</td>
<td>dBm</td>
<td>19</td>
</tr>
<tr>
<td>Output P1dB</td>
<td>dBm</td>
<td>7</td>
</tr>
</tbody>
</table>

Recommended PCB Configuration

External Parts List

<table>
<thead>
<tr>
<th>Component</th>
<th>Value</th>
<th>Footprint</th>
<th>Manufacturer</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1</td>
<td>3 pF</td>
<td>0603</td>
<td>ATC</td>
</tr>
<tr>
<td>C2</td>
<td>8.2 pF</td>
<td>0603</td>
<td>ATC</td>
</tr>
<tr>
<td>C3, C4</td>
<td>0.1 µF</td>
<td>0402</td>
<td>Panasonic</td>
</tr>
<tr>
<td>L1</td>
<td>5.6 nH</td>
<td>0402</td>
<td>Panasonic</td>
</tr>
<tr>
<td>L2, L5</td>
<td>6.8 nH</td>
<td>0402</td>
<td>Coilcraft</td>
</tr>
<tr>
<td>L3</td>
<td>1.5 nH</td>
<td>0402</td>
<td>Toko</td>
</tr>
<tr>
<td>L4</td>
<td>3.9 nH</td>
<td>0402</td>
<td>Toko</td>
</tr>
<tr>
<td>L6</td>
<td>7.5 nH</td>
<td>0402</td>
<td>Coilcraft</td>
</tr>
<tr>
<td>TL1</td>
<td>47.5 Ω, 34° @ 2.3 GHz</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TL2</td>
<td>47.5 Ω, 15.5° @ 2.3 GHz</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Schematic
Low Noise Amplifier
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Typical Performance Curves

**Gain**

![Gain Graph]

**Input Return Loss**

![Input Return Loss Graph]

**Output Return Loss**

![Output Return Loss Graph]

**Noise Figure**

![Noise Figure Graph]

**Output IP3**

![Output IP3 Graph]

**Input IP3**

![Input IP3 Graph]
Typical Performance Curves

$P_{1dB} @ 2.3 \text{ GHz}$

![Graph showing typical performance curves](image)

**Lead-Free SOT-26 Plastic Package†**

![Schematic diagram of lead-free SOT-26 plastic package](image)

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

**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.