MAAL-007304

Low Noise Amplifier
0.5 - 3.0 GHz

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.

Low Noise Amplifier
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Electrical Specifications: F = 2.3 GHz, V_{DD} = +3 V, T_A = +25°C, Z_O = 50 Ω

<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 GHz, V_{DD} = +3 V, T_A = +25°C, Z_O = 50 Ω

<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_3</td>
<td>dBm</td>
<td>-6</td>
</tr>
<tr>
<td>Output IP_3</td>
<td>dBm</td>
<td>19</td>
</tr>
<tr>
<td>Output P1dB</td>
<td>dBm</td>
<td>7</td>
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</tbody>
</table>

Recommended PCB Configuration

<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</td>
<td>34° @ 2.3 GHz</td>
<td></td>
</tr>
<tr>
<td>TL2</td>
<td>47.5 Ω</td>
<td>15.5° @ 2.3 GHz</td>
<td></td>
</tr>
</tbody>
</table>

External Parts List

Schematic
Typical Performance Curves

**Gain**

- **Frequency (GHz)**
  - 2.1
  - 2.2
  - 2.3
  - 2.4
  - 2.5
- **Gain (dB)**
  - 15
  - 20
  - 25
  - 30
  - 35

- Temperature points: 25°C, -40°C, +85°C

**Input Return Loss**

- **Frequency (GHz)**
  - 2.1
  - 2.2
  - 2.3
  - 2.4
  - 2.5
- **S11 (dB)**
  - -10
  - -15
  - -20

- Temperature points: 25°C, -40°C, +85°C

**Output Return Loss**

- **Frequency (GHz)**
  - 2.1
  - 2.2
  - 2.3
  - 2.4
  - 2.5
- **S22 (dB)**
  - -10
  - -15
  - -20

- Temperature points: 25°C, -40°C, +85°C

**Noise Figure**

- **Frequency (GHz)**
  - 2.1
  - 2.2
  - 2.3
  - 2.4
  - 2.5
- **Noise Figure (dB)**
  - 0.0
  - 0.5
  - 1.0
  - 1.5
  - 2.0

- Temperature points: 25°C, -40°C, +85°C

**Output IP3**

- **Frequency (GHz)**
  - 2.1
  - 2.2
  - 2.3
  - 2.4
  - 2.5
- **IP3 (dBm)**
  - 10
  - 15
  - 20
  - 25
  - 30

- Temperature points: 25°C, -40°C, +85°C

**Input IP3**

- **Frequency (GHz)**
  - 2.1
  - 2.2
  - 2.3
  - 2.4
  - 2.5
- **IP3 (dBm)**
  - -10
  - -15

- Temperature points: 25°C, -40°C, +85°C
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Typical Performance Curves

$P_{1dB} @ 2.3$ GHz

Lead-Free SOT-26 Plastic Package†

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.

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