Features
- Low Noise Figure
- Excellent Input Return Loss
- Single Voltage Bias 4 V
- Integrated Active Bias Circuit
- Current Adjustable 20 - 80 mA with an External Resistor
- High Linearity, OIP3 >32 dBm
- 8-Lead Hermetic Package
- RoHS* Compliant

Description
The MAAL-010705-CR10 is a high dynamic range single stage MMIC LNA with excellent linearity and low noise figure designed for operation from 0.5 to 3 GHz. The LNA is packaged in an RoHS compliant, 8-lead hermetically sealed ceramic package.

This MMIC has an integrated active bias circuit allowing direct connection to 4 V voltage supply and minimizing variation over temperature and process. The bias current and gain can be set with external resistors to allow the user to customize the current and gain value to fit the application.

The MAAL-010705-CR10 offers less than 0.7 dB noise figure, more than 32 dBm OIP3 and 20 dB output return loss. The excellent match, low noise figure and high OIP3 along with the flexibility of setting current and gain make this LNA ideal UHF, L, and S-band satellite applications.

Ordering Information

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Package</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAAL-010705-CR10</td>
<td>Chip Scale Package</td>
</tr>
</tbody>
</table>

Low Noise Amplifier
0.5 - 3 GHz

Electrical Specifications\(^2\): Freq = 0.9 GHz, \(V_D = 4\) V, 25° C, \(Z_0 = 50\) Ω

<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>—</td>
<td>dB</td>
<td>18</td>
<td>21</td>
<td>—</td>
</tr>
<tr>
<td>Input Return Loss</td>
<td>—</td>
<td>dB</td>
<td>—</td>
<td>15</td>
<td>—</td>
</tr>
<tr>
<td>Output Return Loss</td>
<td>—</td>
<td>dB</td>
<td>—</td>
<td>27</td>
<td>—</td>
</tr>
<tr>
<td>Noise Figure</td>
<td>—</td>
<td>dB</td>
<td>—</td>
<td>0.7</td>
<td>—</td>
</tr>
<tr>
<td>Output IP3</td>
<td>(P_{OUT} = 5) dBm, Tone Spacing = 1 MHz</td>
<td>dBm</td>
<td>—</td>
<td>33</td>
<td>—</td>
</tr>
<tr>
<td>Output P1dB</td>
<td>—</td>
<td>dBm</td>
<td>17.5</td>
<td>18.5</td>
<td>—</td>
</tr>
<tr>
<td>Total Current</td>
<td>(I_{DD} = I_D + I_{BIAS})</td>
<td>mA</td>
<td>—</td>
<td>60</td>
<td>70</td>
</tr>
</tbody>
</table>

2. \(V_D\) and \(V_{BIAS}\) are connected together to 4 V, \(R_3 = 150\) Ω and \(R_4 = 240\) Ω; reference recommended schematic on page 5.

Absolute Maximum Ratings\(^3,4\)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Absolute Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage</td>
<td>5.5 V</td>
</tr>
<tr>
<td>Current</td>
<td>100 mA</td>
</tr>
<tr>
<td>RF Input Power</td>
<td>20 dBm</td>
</tr>
<tr>
<td>Storage Temperature</td>
<td>-55°C to +150°C</td>
</tr>
<tr>
<td>Operating Temperature</td>
<td>-40°C to +85°C</td>
</tr>
<tr>
<td>Junction Temperature(^5)</td>
<td>+150°C</td>
</tr>
</tbody>
</table>

3. Exceeding any one or combination of these limits may cause permanent damage to this device.
4. MACOM does not recommend sustained operation near these survivability limits.
5. Typical thermal resistance (\(\Theta_c\)) = 45°C/W.

Handling Procedures
Please observe the following precautions to avoid damage:

Static Sensitivity
These electronic devices are sensitive to electrostatic discharge (ESD) and can be damaged by static electricity. Proper ESD control techniques should be used when handling these devices.
Low Noise Amplifier
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Typical Performance Curves: 4 V (over temperature)

**Gain**

![Gain Graph](image)

**Reverse Isolation**

![Reverse Isolation Graph](image)

**Input Return Loss**

![Input Return Loss Graph](image)

**Output Return Loss**

![Output Return Loss Graph](image)

**Noise Figure**

![Noise Figure Graph](image)
Low Noise Amplifier
0.5 - 3 GHz

Typical Performance Curves @ 900 MHz, 4 V

- **OIP3 High vs. Output Power**
  - Graph showing OIP3 vs. Output Power for different temperatures.

- **OIP3 Low vs. Output Power**
  - Graph showing OIP3 vs. Output Power for different temperatures.

- **Gain vs. Output Power**
  - Graph showing Gain vs. Output Power for different temperatures.

- **P1dB vs. Frequency**
  - Graph showing P1dB vs. Frequency for different temperatures.

- **OIP3 vs. Frequency**
  - Graph showing OIP3 vs. Frequency for different temperatures.

For further information and support please visit: [https://www.macom.com/support](https://www.macom.com/support)
Low Noise Amplifier
0.5 - 3 GHz

Recommended Layout

Off-Chip Component Values

<table>
<thead>
<tr>
<th>Component</th>
<th>Value</th>
<th>Package</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1</td>
<td>3.3 pF</td>
<td>0402</td>
</tr>
<tr>
<td>C7, C8, C10</td>
<td>1000 pF</td>
<td>0402</td>
</tr>
<tr>
<td>C12, C13</td>
<td>100 pF</td>
<td>0402</td>
</tr>
<tr>
<td>C2, C14</td>
<td>4.7 µF</td>
<td>Tantalum, 1210</td>
</tr>
<tr>
<td>L1</td>
<td>9 nH</td>
<td>0402</td>
</tr>
<tr>
<td>L2</td>
<td>15 nH</td>
<td>0402</td>
</tr>
<tr>
<td>R3</td>
<td>150 Ω</td>
<td>0402</td>
</tr>
<tr>
<td>R4</td>
<td>240 Ω</td>
<td>0402</td>
</tr>
</tbody>
</table>

Bias Information

$V_{\text{BIAS}}$ and $V_D$ are separate connections on the evaluation board to give the option of varying $I_D$ without changing $R4$. They can be connected together to a single voltage supply during the measurement and in the final layout implementation of the PCB. If two different voltage supplies are used then apply $V_D$ first and then $V_{\text{BIAS}}$ to turn on the LNA. To turn off the LNA disconnect $V_{\text{BIAS}}$ first and then $V_D$. $R3$ is varied to obtain different levels of gain. $R4$ is varied to change the drain current $I_D$.

Schematic
Low Noise Amplifier
0.5 - 3 GHz

Lead-Free Hermetic CR10 Package†

Reference Application Note S2083 for lead-free solder reflow recommendations.
Meets JEDEC moisture sensitivity level 1 requirements.
Plating is Au over Ni.
Low Noise Amplifier
0.5 - 3 GHz

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