MAAL-011111

Low Noise Amplifier
22 - 38 GHz

Features
- 19 dB Small Signal Gain
- 2.5 dB Noise Figure
- Single 3.3 V Bias
- Lead-Free 3 mm 16-Lead PQFN Package
- 100% RF Tested
- RoHS Compliant

Description
The MAAL-011111 is a three stage 22 - 38 GHz GaAs MMIC low noise amplifier. This device has a small signal gain of 19 dB with a noise figure of 2.5 dB.

This lead-free, 3 mm QFN package requires only a single positive bias supply. The devices uses MACOM’s GaAs transistor technology, ensuring high repeatability and uniformity.

The device is well suited to multiple receiver applications which require broadband performance with simple bias requirements and the ease of volume manufacturing with 3 mm QFN packaging.

Ordering Information\(^1,2\)

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Package</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAAL-011111-TR0500</td>
<td>500 pc reel</td>
</tr>
<tr>
<td>MAAL-011111-TR1000</td>
<td>1K pc reel</td>
</tr>
<tr>
<td>MAAL-011111-000SMB</td>
<td>Sample Evaluation board</td>
</tr>
</tbody>
</table>

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

* Restrictions on Hazardous Substances, compliant to current RoHS EU directive.
Electrical Specifications: Freq: 22 - 38 GHz, \( V_D = 3.3 \text{ V} \), \( T_A = +25^\circ\text{C} \)

<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(^4)</td>
<td>dB</td>
<td>17</td>
<td>19</td>
<td>—</td>
</tr>
<tr>
<td>Gain Flatness</td>
<td>dB</td>
<td>—</td>
<td>±2</td>
<td>—</td>
</tr>
<tr>
<td>Input Return Loss</td>
<td>dB</td>
<td>—</td>
<td>10</td>
<td>—</td>
</tr>
<tr>
<td>Output Return Loss</td>
<td>dB</td>
<td>—</td>
<td>13</td>
<td>—</td>
</tr>
<tr>
<td>Reverse isolation</td>
<td>dB</td>
<td>—</td>
<td>45</td>
<td>—</td>
</tr>
<tr>
<td>Noise Figure</td>
<td>dB</td>
<td>—</td>
<td>2.5</td>
<td>—</td>
</tr>
<tr>
<td>Output P1dB</td>
<td>dBm</td>
<td>—</td>
<td>5</td>
<td>—</td>
</tr>
<tr>
<td>Supply Current (I(_o))</td>
<td>mA</td>
<td>—</td>
<td>55</td>
<td>65</td>
</tr>
</tbody>
</table>

4. Specified over 24-36 GHz

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Absolute Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply Voltage</td>
<td>7 VDC</td>
</tr>
<tr>
<td>Supply Current</td>
<td>70 mA</td>
</tr>
<tr>
<td>Input Power</td>
<td>12.0 dBm</td>
</tr>
<tr>
<td>Storage Temperature</td>
<td>-65°C to +165°C</td>
</tr>
<tr>
<td>Operating Temperature</td>
<td>-40°C to +85°C</td>
</tr>
<tr>
<td>Channel Temperature(^7)</td>
<td>+150°C</td>
</tr>
</tbody>
</table>

5. Exceeding any one or combination of these limits may cause permanent damage to this device.
6. MACOM does not recommend sustained operation near these survivability limits.
7. Channel temperature directly affects a device's MTTF. It is recommended to keep channel temperature as low as possible to maximize lifetime.

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 devices.
Low Noise Amplifier

22 - 38 GHz

Typical Performance Curves

**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)

MACOM Technology Solutions Inc. (MACOM) and its affiliates reserve the right to make changes to the product(s) or information contained herein without notice. Visit [www.macom.com](http://www.macom.com) for additional data sheets and product information.

For further information and support please visit: [https://www.macom.com/support](https://www.macom.com/support)
Typical Performance Curves

**Noise Figure**

![Noise Figure Graph]

**Gain Over Temperature**

![Gain Over Temperature Graph]
Biasing - The device is operated with a single, positive bias supply. The device performance is insensitive to changes in bias condition; however, gain and power handling can be slightly improved with higher bias conditions without significantly affecting the noise figure performance. Typical biasing conditions within the specified performance ranges are $V_D = 3\, \text{V}$, $50\, \text{mA}$, $V_D = 3.3\, \text{V}$, $55\, \text{mA}$, $V_D = 3.6\, \text{V}$, $60\, \text{mA}$.

8. Ground plane conductor should be removed under the corners of the package, as shown.
Lead-Free 3 mm 16-Lead PQFN†

† Reference Application Note S2083 for lead-free solder reflow recommendations.
Meets JEDEC moisture sensitivity level 1 requirements.
Plating is NiPdAuAg
MACOM Technology Solutions Inc. All rights reserved.

Information in this document is provided in connection with MACOM Technology Solutions Inc ("MACOM") products. These materials are provided by MACOM as a service to its customers and may be used for informational purposes only. Except as provided in MACOM's Terms and Conditions of Sale for such products or in any separate agreement related to this document, MACOM assumes no liability whatsoever. MACOM assumes no responsibility for errors or omissions in these materials. MACOM may make changes to specifications and product descriptions at any time, without notice. MACOM makes no commitment to update the information and shall have no responsibility whatsoever for conflicts or incompatibilities arising from future changes to its specifications and product descriptions. No license, express or implied, by estoppels or otherwise, to any intellectual property rights is granted by this document.

THESE MATERIALS ARE PROVIDED "AS IS" WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESS OR IMPLIED, RELATING TO SALE AND/OR USE OF MACOM PRODUCTS INCLUDING LIABILITY OR WARRANTIES RELATING TO FITNESS FOR A PARTICULAR PURPOSE, CONSEQUENTIAL OR INCIDENTAL DAMAGES, MERCHANTABILITY, OR INFRINGEMENT OF ANY PATENT, COPYRIGHT OR OTHER INTELLECTUAL PROPERTY RIGHT. MACOM FURTHER DOES NOT WARRANT THE ACCURACY OR COMPLETENESS OF THE INFORMATION, TEXT, GRAPHICS OR OTHER ITEMS CONTAINED WITHIN THESE MATERIALS. MACOM SHALL NOT BE LIABLE FOR ANY SPECIAL, INDIRECT, INCIDENTAL, OR CONSEQUENTIAL DAMAGES, INCLUDING WITHOUT LIMITATION, LOST REVENUES OR LOST PROFITS, WHICH MAY RESULT FROM THE USE OF THESE MATERIALS.

MACOM products are not intended for use in medical, lifesaving or life sustaining applications. MACOM customers using or selling MACOM products for use in such applications do so at their own risk and agree to fully indemnify MACOM for any damages resulting from such improper use or sale.