Features

- 21 dB Adjustable Gain
- 2.25 dB Noise Figure
- +5 V, 95 mA Adjustable Bias
- Low Distortion
- Wide Bandwidth for DOCSIS 3.1
- Lead-Free MSOP8-EP Package
- RoHS* Compliant and 260°C Reflow Compatible

Description

The MAAM-011184 is a 75 Ω single ended GaAs MMIC amplifier assembled in a lead-free MSOP8-EP package. This device provides high gain, low noise, and excellent linearity from 5 - 300 MHz.

This amplifier is ideally suited for use in CATV return path applications, including DOCSIS 3.1 systems: it typically provides 2.25 dB noise figure, 64 dBm OIP2 and 43 dBm OIP3 while drawing 95 mA DC current at 5 V bias.

Ordering Information

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Package</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAAM-011184-TR1000</td>
<td>1000 piece reel</td>
</tr>
<tr>
<td>MAAM-011184-TR3000</td>
<td>3000 piece reel</td>
</tr>
<tr>
<td>MAAM-011184-001SMB</td>
<td>Sample Board</td>
</tr>
</tbody>
</table>

1. All sample boards include 5 loose parts.

**Electrical Specifications**

$T_A = 25^\circ C, V_{CC} = 5\, V, Z_0 = 75\, \Omega$

<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>$P_{IN} = -21, dBm, 5 - 300, MHz$ $P_{IN} = -21, dBm, 205, MHz$</td>
<td>dB</td>
<td>—</td>
<td>21</td>
<td>—</td>
</tr>
<tr>
<td>Input Return Loss</td>
<td>$P_{IN} = -21, dBm, 5 - 300, MHz$</td>
<td>dB</td>
<td>—</td>
<td>26</td>
<td>—</td>
</tr>
<tr>
<td>Output Return Loss</td>
<td>$P_{IN} = -21, dBm, 5 - 300, MHz$</td>
<td>dB</td>
<td>—</td>
<td>23</td>
<td>—</td>
</tr>
<tr>
<td>Reverse Isolation</td>
<td>$P_{IN} = -21, dBm, 5 - 300, MHz$</td>
<td>dB</td>
<td>—</td>
<td>23</td>
<td>—</td>
</tr>
<tr>
<td>Noise Figure</td>
<td>5 - 205 MHz $205 - 300, MHz$</td>
<td>dB</td>
<td>—</td>
<td>2.25</td>
<td>2.5</td>
</tr>
<tr>
<td>P1dB</td>
<td>5 - 300 MHz</td>
<td>dBm</td>
<td>—</td>
<td>21.7</td>
<td>—</td>
</tr>
<tr>
<td>OIP3$^5$</td>
<td>$P_{IN} = -21, dBm per tone, 3, MHz$ spacing, $f_1 = 5 - 205, MHz$ $P_{IN} = -21, dBm per tone, 3, MHz$ spacing, $f_1 = 205, MHz$</td>
<td>dBm</td>
<td>—</td>
<td>43</td>
<td>41</td>
</tr>
<tr>
<td>OIP2$^6$</td>
<td>$P_{IN} = -21, dBm per tone, 3, MHz$ spacing, $f_1 = 5 - 205, MHz$</td>
<td>dBm</td>
<td>—</td>
<td>64</td>
<td>—</td>
</tr>
<tr>
<td>Output Power at 30 dB MER$^6$</td>
<td>16 Channels, 5 - 205 MHz</td>
<td>dBm/Channel</td>
<td>—</td>
<td>51</td>
<td>—</td>
</tr>
<tr>
<td>$I_{CC}^7$</td>
<td>$V_{CC} = 5, V$</td>
<td>mA</td>
<td>—</td>
<td>95</td>
<td>115</td>
</tr>
</tbody>
</table>

4. Data corresponds to the typical application circuit shown on page 3 of this datasheet. See pages 4 and 5 for typical performance using this application circuit.
5. $f_1$ is the frequency of the lower of the two input tones. Higher tone $f_2 = f_1 + 3\, MHz$. OIP2 is measured at intermodulation frequency $f_1 + f_2$.
6. Modulation Error Ratio, 64 QAM 5.12 MS/s.
7. $I_{CC}$ is the total DC current draw from the $V_{CC}$ supply. As shown on page 3 of this datasheet, it is distributed to device pins 1, 6, and 8.

**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.
MAAM-011184

CATV Return Path Amplifier
5 - 300 MHz

Typical Application Circuit: Schematic

<table>
<thead>
<tr>
<th>Component</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1 - C6</td>
<td>100 nF</td>
</tr>
<tr>
<td>C7</td>
<td>0.5 pF</td>
</tr>
<tr>
<td>R1</td>
<td>330 Ω</td>
</tr>
<tr>
<td>R2</td>
<td>SHORT - 0 Ω</td>
</tr>
<tr>
<td>L1</td>
<td>22 µH</td>
</tr>
<tr>
<td>L2</td>
<td>27 nH</td>
</tr>
<tr>
<td>L3</td>
<td>10 nH</td>
</tr>
</tbody>
</table>

12. Designers may decrease resistor R1 to reduce the gain of the amplifier by approximately 1 dB per 164 Ohms. Below 19.8 dB gain, typical input and output return losses fall below 20 dB. Resistor R2 may be increased in order to reduce bias current Icc (at the cost of large-signal performance) by approximately 1 mA per 42 Ohms.

13. Low-ESR inductor LQH2MCN220K02 from Murata.

Typical Application Circuit: Sample Board Layout

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Typical Performance Curves: Small-Signal

**Gain**

- $S_{21} \text{ (dB)}$
  - Frequency (MHz): 0 - 400
  - Temperature: +25 °C, -40 °C, +85 °C

**Reverse Isolation**

- $S_{12} \text{ (dB)}$
  - Frequency (MHz): 0 - 400
  - Temperature: +25 °C, -40 °C, +85 °C

**Input Return Loss**

- $S_{11} \text{ (dB)}$
  - Frequency (MHz): 0 - 400
  - Temperature: +25 °C, -40 °C, +85 °C

**Output Return Loss**

- $S_{22} \text{ (dB)}$
  - Frequency (MHz): 0 - 400
  - Temperature: +25 °C, -40 °C, +85 °C

**Noise Figure**

- $NF \text{ (dB)}$
  - Frequency (MHz): 0 - 400
  - Temperature: +25 °C, -40 °C, +85 °C

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MAAM-011184

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Typical Performance Curves: Large-Signal

**P1dB**

![P1dB Graph](image)

**OIP2**

![OIP2 Graph](image)

**OIP3**

![OIP3 Graph](image)

**MER, 16 Channels 64-QAM**

![MER Graph](image)
Lead-Free MSOP8-EP Package†

†Dimensions shown as inches over millimeters [in/mm].  
Meets JEDEC moisture sensitivity level 1 requirements.  
Plating is 100% matte tin over copper.
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