MAAM-011240

75 Ω, Differential RF Amplifier
5 - 1218 MHz

Features
- Single Stage, Differential Amplifier
- 5 V, 290 mA Operation
- 17 dB Flat Gain
- Low Noise
- Low Distortion Performance
- ESD Class 1B for HBM
- Lead-Free SOIC-8EP Plastic Package
- Halogen-Free “Green” Mold Compound
- RoHS* Compliant

Description
The MAAM-011240 is high gain, high linearity and low noise differential RF amplifier assembled in a SOIC-8EP plastic package. This amplifier provides 17 dB of flat gain with very low noise figure. The differential push-pull topology provides superior 2nd order intermodulation performance.

The MAAM-011240 provides high gain, low noise and low distortion making it ideally suited for 75 Ω infrastructure applications.

The MAAM-011240 is fabricated using GaAs pHEMT technology.

Ordering Information

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Package</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAAM-011240</td>
<td>Bulk Packaging</td>
</tr>
<tr>
<td>MAAM-011240-TR1000</td>
<td>1000 Part Reel</td>
</tr>
<tr>
<td>MAAM-011240-TR3000</td>
<td>3000 Part Reel</td>
</tr>
<tr>
<td>MAAM-011240-001SMB</td>
<td>Sample Board, 45 - 1218 MHz</td>
</tr>
<tr>
<td>MAAM-011240-002SMB</td>
<td>Sample Board, 5 - 300 MHz</td>
</tr>
</tbody>
</table>

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

**75 Ω, Differential RF Amplifier**

5 - 1218 MHz

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**Electrical Specifications:** $T_A = 25°C$, $V_{DD} = 5 \text{ V}$, $Z_0 = 75 \text{ Ω}$

*Performance specified with input/output balun MABA-009210-CT1760*

<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>1218 MHz</td>
<td>dB</td>
<td>16.2</td>
<td>17</td>
<td>18.5</td>
</tr>
<tr>
<td>Tilt</td>
<td>45 - 1218 MHz</td>
<td>dB</td>
<td>—</td>
<td>0</td>
<td>—</td>
</tr>
<tr>
<td>Reverse Isolation</td>
<td>45 - 1218 MHz</td>
<td>dB</td>
<td>—</td>
<td>21</td>
<td>—</td>
</tr>
<tr>
<td>Input Return Loss</td>
<td>45 - 1218 MHz</td>
<td>dB</td>
<td>—</td>
<td>20</td>
<td>—</td>
</tr>
<tr>
<td>Output Return Loss</td>
<td>45 - 1218 MHz</td>
<td>dB</td>
<td>—</td>
<td>20</td>
<td>—</td>
</tr>
<tr>
<td>Noise Figure</td>
<td>45 MHz, 1218 MHz</td>
<td>dB</td>
<td>—</td>
<td>1.7</td>
<td>2.6</td>
</tr>
<tr>
<td>Output IP2</td>
<td>45 - 1218 MHz, 6 MHz</td>
<td>dBm</td>
<td>—</td>
<td>63</td>
<td>—</td>
</tr>
<tr>
<td>Output IP3</td>
<td>45 - 1218 MHz, 6 MHz</td>
<td>dBm</td>
<td>—</td>
<td>44</td>
<td>—</td>
</tr>
<tr>
<td>P1dB</td>
<td>45 - 1218 MHz</td>
<td>dBm</td>
<td>—</td>
<td>25</td>
<td>—</td>
</tr>
<tr>
<td>Composite Triple Beat, CTB</td>
<td>79 channels, 0 dB Tilt, 39 dBmV per channel output, QAM to 1000 MHz</td>
<td>dBc</td>
<td>—</td>
<td>-75</td>
<td>—</td>
</tr>
<tr>
<td>Composite Second Order, CSO</td>
<td>79 channels, 0 dB Tilt, 39 dBmV per channel output, QAM to 1000 MHz</td>
<td>dBc</td>
<td>—</td>
<td>-77</td>
<td>—</td>
</tr>
<tr>
<td>ACPR²</td>
<td>62 dBmV output, Single Channel: 79 MHz, 1218 MHz</td>
<td>dBc</td>
<td>—</td>
<td>-70</td>
<td>-64</td>
</tr>
<tr>
<td>$I_{DD}$</td>
<td>$V_{DD} = 5 \text{ V}$</td>
<td>mA</td>
<td>—</td>
<td>290</td>
<td>350</td>
</tr>
</tbody>
</table>

4. Adjacent Channel (750 kHz from channel block edge to 6 MHz from channel block edge), 256 QAM, 5.36 Msym/sec.

**Absolute Maximum Ratings**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Absolute Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max Input Power</td>
<td>10 dBm</td>
</tr>
<tr>
<td>Operating Voltage</td>
<td>8 V</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>
<tr>
<td>Junction Temperature</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. Operating at nominal conditions with $T_J < 150°C$ will ensure $\text{MTTF} > 1 \times 10^8$ hours.

8. Junction Temperature ($T_J$) = Case Temperature ($T_C$) + $\Theta_{JC}$($V^*$)

Typical thermal resistance ($\Theta_{JC}$) = 29°C/W.

a) For $T_C = 25°C$,
- $T_J = 67°C @ 5 \text{ V}$, 290 mA
b) For $T_C = 85°C$,
- $T_J = 127°C @ 5 \text{ V}$, 290 mA

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**Handling Procedures**

Please observe the following precautions to avoid damage:

**Static Sensitivity**

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 (HBM) Class 1B devices.

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MAAM-011240

75 Ω, Differential RF Amplifier
5 - 1218 MHz

Recommended PCB Layout

Schematic Including Off-Chip Components

Parts List

<table>
<thead>
<tr>
<th>Component</th>
<th>Value</th>
<th>Package</th>
<th>Component</th>
<th>Value</th>
<th>Package</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1, C4</td>
<td>270 pF</td>
<td>0402</td>
<td>L1, L2</td>
<td>33 nH</td>
<td>0402</td>
</tr>
<tr>
<td>C2, C3, C5, C6, C10</td>
<td>10 nF</td>
<td>0402</td>
<td>R1, R2</td>
<td>62 Ω</td>
<td>0402</td>
</tr>
<tr>
<td>C7</td>
<td>0.5 pF</td>
<td>0402</td>
<td>R3, R4</td>
<td>316 Ω</td>
<td>0402</td>
</tr>
<tr>
<td>C8</td>
<td>1.0 pF</td>
<td>0402</td>
<td>T1, T2</td>
<td>1:1 Balun⁹</td>
<td>—</td>
</tr>
<tr>
<td>C9</td>
<td>Do Not Install</td>
<td>0402</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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Typical Performance Curves: $V_{DD} = 5\, V$

**Gain**

- $S_{21}$ (dB) vs. Frequency (GHz)

**Gain to 3 GHz**

- $S_{21}$ (dB) vs. Frequency (GHz)

**Input Return Loss**

- $S_{11}$ (dB) vs. Frequency (GHz)

**Output Return Loss**

- $S_{22}$ (dB) vs. Frequency (GHz)

**Reverse Isolation**

- $S_{12}$ (dB) vs. Frequency (GHz)

**Noise Figure**

- Noise Figure (dB) vs. Frequency (GHz)
75 Ω, Differential RF Amplifier
5 - 1218 MHz

Typical Performance Curves: \( V_{DD} = 5 \) V

**OIP3, \( P_{\text{OUT}} = +13 \) dBm/tone**

**OIP2, \( P_{\text{OUT}} = +13 \) dBm/tone**

**\( P_{1\text{dB}} \)**

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DC-0011769
Typical Performance Curves: $V_{DD} = 5\, V$

**CSO Lower, 79 channels + QAM to 1 GHz, 0 dB tilt, 39 dBmV per channel**

-90 dBmV to 1 GHz, 0 dB tilt, 39 dBmV per channel

**CSO Upper, 79 channels + QAM to 1 GHz, 0 dB tilt, 39 dBmV per channel**

-90 dBmV to 1 GHz, 0 dB tilt, 39 dBmV per channel

**CTB, 79 channels + QAM to 1 GHz, 0 dB tilt, 39 dBmV per channel**

-90 dBmV to 1 GHz, 0 dB tilt, 39 dBmV per channel
**Typical Performance Curves: \( V_{DD} = 5 \text{ V}, \) Temp = +25°C**

**ACPR vs. \( P_{OUT} \), Single Channel**

![ACPR vs. \( P_{OUT} \), Single Channel Graph](image)

**ACPR vs. Frequency, \( P_{OUT} = +62 \text{ dBmV} \), Single Channel**

![ACPR vs. Frequency Graph](image)
**SOIC-8EP†**

All dimensions shown as inches/mm.

† Reference Application Note S2083 for lead-free solder reflow recommendations.
Meet JEDEC moisture sensitivity level 1 requirements.
Plating is 100% matte tin over copper.

**Recommended PCB Land Pattern**

70 ground vias
0.008 inch finished hole diameter
Applications Section: 5 - 300 MHz Application

The MAAM-011240 may be tuned for operation in the 5 - 300 MHz band for CATV reverse path (upstream) applications using an alternate balun and other external tuning components as identified in the table below. The recommended PCB layout and schematic are the same as identified on page 4.

Recommended PCB Layout for Upstream

![PCB Layout Image]

Parts List : 5 - 300 MHz Tune

<table>
<thead>
<tr>
<th>Component</th>
<th>Value</th>
<th>Package</th>
<th>Component</th>
<th>Value</th>
<th>Package</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1, C2, C4 - C6</td>
<td>10 nF</td>
<td>0402</td>
<td>C3</td>
<td>0.1 µF</td>
<td>0402</td>
</tr>
<tr>
<td>C10</td>
<td>2200 pF</td>
<td>0402</td>
<td>R1, R2</td>
<td>150 Ω</td>
<td>0402</td>
</tr>
<tr>
<td>T1, T2</td>
<td>1:1 Balun(^\text{10})</td>
<td>—</td>
<td>R3, R4</td>
<td>180 Ω</td>
<td>0402</td>
</tr>
</tbody>
</table>

10. MABA-011085

Electrical Specifications: 5 - 300 MHz Tune, \(T_A = 25^\circ \text{C}, V_{DD} = 5 \text{ V}, Z_0 = 75 \text{ Ω}\)

<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>5 - 300 MHz</td>
<td>dB</td>
<td>—</td>
<td>17</td>
<td>—</td>
</tr>
<tr>
<td>Reverse Isolation</td>
<td>5 - 300 MHz</td>
<td>dB</td>
<td>—</td>
<td>21</td>
<td>—</td>
</tr>
<tr>
<td>Input Return Loss</td>
<td>5 - 300 MHz</td>
<td>dB</td>
<td>—</td>
<td>23</td>
<td>—</td>
</tr>
<tr>
<td>Output Return Loss</td>
<td>5 - 300 MHz</td>
<td>dB</td>
<td>—</td>
<td>21</td>
<td>—</td>
</tr>
<tr>
<td>Noise Figure</td>
<td>5 - 10 MHz, 20 - 300 MHz</td>
<td>dB</td>
<td>2.3</td>
<td>—</td>
<td>2.0</td>
</tr>
<tr>
<td>Output IP2</td>
<td>5 - 300 MHz, tone spacing 6 MHz</td>
<td>dBm</td>
<td>—</td>
<td>75</td>
<td>—</td>
</tr>
<tr>
<td>Output IP3</td>
<td>5 - 300 MHz, tone spacing 6 MHz</td>
<td>dBm</td>
<td>—</td>
<td>45</td>
<td>—</td>
</tr>
<tr>
<td>P1dB</td>
<td>5 - 300 MHz</td>
<td>dBm</td>
<td>—</td>
<td>25</td>
<td>—</td>
</tr>
<tr>
<td>(I_{DD})</td>
<td>(V_{DD} = 5 \text{ V})</td>
<td>mA</td>
<td>—</td>
<td>290</td>
<td>—</td>
</tr>
<tr>
<td>Noise Power Ratio</td>
<td>5 - 85 MHz, 41 MHz Notch, Peak NPR</td>
<td>dB</td>
<td>72</td>
<td>—</td>
<td>71</td>
</tr>
</tbody>
</table>

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75 Ω, Differential RF Amplifier
5 - 1218 MHz

Typical Performance Curves: 5 - 300 MHz Tune, V_{DD} = 5 V, +25°C

Gain

Noise Figure

Input Return Loss

Output Return Loss

OIP3

NPR

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