Low Noise Amplifier
20 - 40 GHz

Features
- Self Bias Architecture
- Small Size
- 3 or 5 V Operation
- 20 dB Small Signal Gain
- 2 dB Noise Figure
- 9 dBm P1dB Compression Point
- 100% On-Wafer RF, DC and Noise Figure Testing
- 100% Visual Inspection to MIL-STD-883 Method 2010
- RoHS* Compliant and 260°C Reflow Compatible

Description
The XL1000-BD is a 3-stage 20 - 40 GHz GaAs MMIC low noise amplifier that has a small signal gain of 20 dB with a noise figure of 2 dB across the band. This MMIC uses a GaAs pHEMT device model technology, and is based upon electron beam lithography to ensure high repeatability and uniformity. The chip has surface passivation to protect and provide a rugged part with backside via holes and gold metallization to allow either a conductive epoxy or eutectic solder die attach process.

This device is well suited for Millimeter-wave Point-to-Point Radio, LMDS, SATCOM and VSAT applications.

Chip Device Layout

Ordering Information

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Package</th>
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<tbody>
<tr>
<td>XL1000-BD-000V</td>
<td>“V” - vacuum release gel paks</td>
</tr>
</tbody>
</table>
**Low Noise Amplifier**

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**Absolute Maximum Ratings**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Absolute Maximum</th>
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<tbody>
<tr>
<td>Supply Voltage</td>
<td>7 V&lt;sub&gt;DC&lt;/sub&gt;</td>
</tr>
<tr>
<td>Supply Current</td>
<td>70 mA</td>
</tr>
<tr>
<td>Input Power</td>
<td>12 dBm</td>
</tr>
<tr>
<td>Storage Temperature</td>
<td>-65°C to +165°C</td>
</tr>
<tr>
<td>Operating Temperature</td>
<td>-55°C to +85°C</td>
</tr>
<tr>
<td>Channel Temperature</td>
<td>+175°C</td>
</tr>
</tbody>
</table>

1. Channel temperature directly affects a device’s MTTF. Channel temperature should be kept 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 2 devices.

**Electrical Specifications: Freq. = 20 - 40 GHz, V<sub>D</sub> = 5 V, I<sub>D</sub> = 50 mA, T<sub>A</sub> = +25°C**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Test Conditions</th>
<th>Units</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
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<tbody>
<tr>
<td>Input Return Loss</td>
<td>22 - 36 GHz</td>
<td>dB</td>
<td>6</td>
<td>12</td>
<td>—</td>
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<tr>
<td>Output Return Loss</td>
<td>22 - 36 GHz</td>
<td>dB</td>
<td>4</td>
<td>10</td>
<td>—</td>
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<tr>
<td>Small Signal Gain</td>
<td>—</td>
<td>dB</td>
<td>12</td>
<td>20</td>
<td>—</td>
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<tr>
<td>Gain Flatness</td>
<td>—</td>
<td>dB</td>
<td>—</td>
<td>+/-4</td>
<td>—</td>
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<tr>
<td>Reverse Isolation</td>
<td>—</td>
<td>dB</td>
<td>30</td>
<td>45</td>
<td>—</td>
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<tr>
<td>Noise Figure</td>
<td>24 - 40 GHz</td>
<td>dB</td>
<td>—</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Output Power for 1dB Compression Point</td>
<td>5 V</td>
<td>dBm</td>
<td>—</td>
<td>9</td>
<td>—</td>
</tr>
<tr>
<td>Output Third Order Intercept Point</td>
<td>5 V</td>
<td>dBm</td>
<td>—</td>
<td>16</td>
<td>—</td>
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<tr>
<td>Drain Bias Voltage</td>
<td>—</td>
<td>VDC</td>
<td>—</td>
<td>3</td>
<td>5</td>
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<tr>
<td>Supply Current</td>
<td>V&lt;sub&gt;D&lt;/sub&gt; = 3 V or 5 V</td>
<td>mA</td>
<td>—</td>
<td>35</td>
<td>50</td>
</tr>
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</table>
Typical Performance Curves (On-Wafer¹)

XL1000-BD, Vd=3.0 V, Id=35 mA (~1000 devices)

XL1000-BD, Vd=3.0 V, Id=35 mA (~1000 devices)

XL1000-BD, Vd=3.0 V, Id=50 mA (~130 devices)

XL1000-BD, Vd=3.0 V (18,935 devices)

Note [¹] Measurements – On-Wafer data has been taken using bias conditions as shown. Measurements are referenced 150 um in from RF In/Out pad edge. For optimum performance M/A-COM-Tech T-pad transition is recommended. For additional information see the M/A-COM-Tech “T-Pad Transition” application note.
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Typical Performance Curves (On-Wafer\(^1\)) (cont.)

Note [1] Measurements – On-Wafer data has been taken using bias conditions as shown. Measurements are referenced 150 um in from RF In/Out pad edge. For optimum performance M/A-COM-Tech T-pad transition is recommended. For additional information see the M/A-COM-Tech “T-Pad Transition” application note.

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### XL1000-BD

**Low Noise Amplifier**

**20 - 40 GHz**

**S-Parameters (On-Wafer\(^1\)):** \(V_D = 5\) V, \(I_B = 52\) mA

<table>
<thead>
<tr>
<th>frequency (GHz)</th>
<th>S11 (mag.)</th>
<th>S11 (ang.)</th>
<th>S21 (mag.)</th>
<th>S21 (ang.)</th>
<th>S12 (mag.)</th>
<th>S12 (ang.)</th>
<th>S22 (mag.)</th>
<th>S22 (ang.)</th>
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<td>18</td>
<td>0.746</td>
<td>-165.97</td>
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<td>168.35</td>
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<td>0.660</td>
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<td>126.40</td>
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<tr>
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<td>0.0020</td>
<td>-8.93</td>
<td>0.210</td>
<td>143.72</td>
</tr>
</tbody>
</table>

**Note [1]** S-Parameters – On-Wafer S-Parameters have been taken using bias conditions as shown. Measurements are referenced 150 µm in from RF In/Out pad edge.
Bias Arrangement

App Note [1]
Biasing - As shown in the bonding diagram, this device operates using a self-biased architecture and only requires one drain bias.
Bias is nominally:
$V_D = 3 \, \text{V}$, $I_D = 35 \, \text{mA}$ or $V_D = 5 \, \text{V}$, $I_D = 50 \, \text{mA}$

App Note [2]
Bias Arrangement - Each DC pad ($V_D$) needs to have DC bypass capacitance (~100 - 200 pF) as close to the device as possible. Additional DC bypass capacitance (~0.01 μF) is also recommended.

Mechanical Drawing

Units: millimeters (inches) Bond pad dimensions are shown to center of bond pad.
Thickness: 0.110 +/- 0.010 (0.0043 +/- 0.0004), Backside is ground, Bond Pad/Backside Metallization: Gold
All Bond Pads are 0.100 x 0.100 (0.004 x 0.004).
Bond pad centers are approximately 0.109 (0.004) from the edge of the chip.
Dicing tolerance: +/- 0.005 (+/- 0.0002). Approximate weight: 1.239 mg.

For further information and support please visit: https://www.macom.com/support
MTTF Graphs
These numbers were calculated based upon accelerated life test information received from the fabricating foundry and extensive thermal modeling/finite element analysis done at MACOM. The values shown here are only to be used as a guideline against the end application requirements and only represent reliability information under one bias condition. Ultimately bias conditions and resulting power dissipation along with the practical aspects, i.e. thermal material stack-up, attach method of device placement are the key parts in determining overall reliability for a specific application, see previous pages. If the data shown below does not meet your reliability requirements or if the bias conditions are not within your operating limits please contact technical sales for additional information.