XM1002-BD

Image Reject Mixer
34 - 46 GHz

Features
- Fundamental Image Reject Mixer
- 7.0 dB Conversion Loss
- 20.0 dB Image Rejection
- +24 dBm Input Third Order Intercept
- 100% On-Wafer RF Testing
- 100% Visual Inspection to MIL-STD-883 Method 2010
- RoHS* Compliant and 260°C Reflow Compatible

Description
M/A-COM Tech’s 34.0-46.0 GHz GaAs MMIC fundamental image reject mixer can be used as an up- or down-converter. The device has a conversion loss of 7.0 dB with a 20.0 dB image rejection across the band. I and Q mixer outputs are provided and an external 90 degree hybrid is required to select the desired sideband. This MMIC uses M/A-COM Tech’s 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>
</tr>
</thead>
<tbody>
<tr>
<td>XM1002-BD-000V</td>
<td>“V” - vacuum release gel paks</td>
</tr>
<tr>
<td>XM1002-BD-EV1</td>
<td>evaluation module</td>
</tr>
</tbody>
</table>

Absolute Maximum Ratings

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Absolute Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gate Bias Voltage (Vg)</td>
<td>+0.3 VDC</td>
</tr>
<tr>
<td>Input Power (RF Pin)</td>
<td>+20.0 dBm</td>
</tr>
<tr>
<td>Input Power (IF Pin)</td>
<td>+20.0 dBm</td>
</tr>
<tr>
<td>Storage Temperature (Tstg)</td>
<td>-65 °C to +165 °C</td>
</tr>
<tr>
<td>Operating Temperature (Ta)</td>
<td>-55 °C to +125 °C</td>
</tr>
</tbody>
</table>
Electrical Specifications: 34-46 GHz (Upper Side Band) (Ambient Temperature T = 25°C)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Units</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency Range (RF) Lower Side Band</td>
<td>GHz</td>
<td>34.0</td>
<td>-</td>
<td>46.0</td>
</tr>
<tr>
<td>Frequency Range (LO)</td>
<td>GHz</td>
<td>30.0</td>
<td>-</td>
<td>50.0</td>
</tr>
<tr>
<td>Frequency Range (IF)</td>
<td>GHz</td>
<td>DC</td>
<td>-</td>
<td>4.0</td>
</tr>
<tr>
<td>RF Return Loss (S11)</td>
<td>dB</td>
<td>-</td>
<td>18.0</td>
<td>-</td>
</tr>
<tr>
<td>IF Return Loss (S22)</td>
<td>dB</td>
<td>-</td>
<td>10.0</td>
<td>-</td>
</tr>
<tr>
<td>LO Return Loss (S33)</td>
<td>dB</td>
<td>-</td>
<td>8.0</td>
<td>-</td>
</tr>
<tr>
<td>Conversion Loss (S21)</td>
<td>dB</td>
<td>-</td>
<td>7.0</td>
<td>8.0</td>
</tr>
<tr>
<td>LO Input Drive (P_{LO})</td>
<td>dBm</td>
<td>-</td>
<td>+12.0</td>
<td>-</td>
</tr>
<tr>
<td>Image Rejection</td>
<td>dBC</td>
<td>15.0</td>
<td>20.0</td>
<td>-</td>
</tr>
<tr>
<td>Isolation LO/RF</td>
<td>dB</td>
<td>-</td>
<td>11.0</td>
<td>-</td>
</tr>
<tr>
<td>Isolation LO/IF</td>
<td>dB</td>
<td>-</td>
<td>30.0</td>
<td>-</td>
</tr>
<tr>
<td>Isolation RF/IF</td>
<td>dB</td>
<td>-</td>
<td>30.0</td>
<td>-</td>
</tr>
<tr>
<td>Input Third Order Intercept (IIP3)</td>
<td>dBm</td>
<td>-</td>
<td>+24.0</td>
<td>-</td>
</tr>
<tr>
<td>Gate Bias Voltage (V_{g1})</td>
<td>VDC</td>
<td>-2.0</td>
<td>-0.5</td>
<td>+0.1</td>
</tr>
</tbody>
</table>

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.
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Typical Performance Curves

XM1002-BD, USB Conversion Gain (6566 devices)

XM1002-BD, USB Image Rejection (6566 devices)

XM1002-BD, LSB Conversion Gain (6566 devices)

XM1002-BD, LSB Image Rejection (6566 devices)

RF Return Loss (dB)

LO Return Loss (dB)
Typical Performance Curves (cont.)

IF Return Loss

LO to RF Isolation (dB)
Typical Performance Curves (cont.)

**XM1002-BD**

- **Image Reject Mixer**
- **34 - 46 GHz**

**Rev. V1**

XM1002-BD: USB Down Conversion gain (dB) vs. RF USB (GHz)

- **LO = 12 and 15dBm, IF = 2GHz, RF = -25dBm, Vg = -0.5V**

**IF=2 GHz**

XM1002-BD: LSB Down Conversion gain (dB) vs. RF LSB (GHz)

- **LO = 12 to 15dBm, IF = 2GHz, RF = -25dBm, Vg = -0.5V**

**IF=2 GHz**

XM1002-BD: USB Down Conversion gain (dB) vs. RF USB (GHz)

- **LO = 12 and 15dBm, IF = 200MHz, RF = -25dBm, Vg = -0.5V**

**IF=200 MHz**

XM1002-BD: LSB Down Conversion gain (dB) vs. RF LSB (GHz)

- **LO = 12 to 15dBm, IF = 200MHz, RF = -25dBm, Vg = -0.5V**

**IF=200 MHz**

XM1002-BD: USB Down Conversion gain (dB) vs. RF USB (GHz)

- **LO = 12 and 15dBm, IF = 20MHz, RF = -25dBm, Vg = -0.5V**

**IF=20 MHz**

XM1002-BD: LSB Down Conversion gain (dB) vs. RF LSB (GHz)

- **LO = 12 to 15dBm, IF = 20MHz, RF = -25dBm, Vg = -0.5V**

**IF=20 MHz**

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Typical Performance Curves (cont.)

XM1002-BD, 4 samples: USB Down Conversion gain (dB) vs. RF USB (GHz)
LO = 12 and 15 dBm, IF = 26 GHz, RF = -25 dBm, Vg = -0.3 V

XM1002-BD, 4 samples: LSB Down Conversion gain (dB) vs. RF LSB (GHz)
LO = 12 to 15 dBm, IF = 26 GHz, RF = -25 dBm, Vg = -0.3 V

XM1002-BD, 3 samples: IIP3 (dBm) in USB down-conversion vs. RF freq
LO = 15 dBm, IF = 2 GHz, IFout = -14 dBm per tone, 100 MHz separation, Vg = -0.9 V

LO to IF Isolation (dB)

RF to IF Isolation (dB)
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Mechanical Drawing

(Note: Engineering designator is 40IRM0421)

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: 1.215 mg.

Bond Pad #1 (RF) Bond Pad #3 (Vg) Bond Pad #5 (IF2)
Bond Pad #2 (IF1) Bond Pad #4 (LO)

Bias Arrangement

Bypass Capacitors - See App Note [2]
App Note [1] Biasing - As shown in the bonding diagram, the pHEMT mixer devices are operated using a separate gate voltage Vg1. Set Vg1=-0.5V for optimum conversion loss performance.

App Note [2] Bias Arrangement - Each DC pad (Vg1) needs to have DC bypass capacitance (~100-200 pF) as close to the device as possible. Additional DC bypass capacitance (~0.01 uF) is also recommended.

App Note [3] USB/LSB Selection -

For Upper Side Band Operation (USB): With IF1 and IF2 connected to the direct port (0°) and coupled port (90°) respectively as shown in the diagram, the USB signal will reside on the isolated port. The input port must be loaded with 50 ohms.

For Lower Side Band Operation (LSB): With IF1 and IF2 connected to the direct port (0°) and coupled port (90°) respectively as shown in the diagram, the LSB signal will reside on the input port. The isolated port must be loaded with 50 ohms.

Note: The coupled port can be used as an alternative input but the port location of the Coupled and Direct ports reverse.

An alternate method of Selection of USB or LSB:

For USB:

For LSB: