Active Doubler
7.5-25.0/15.0-50.0 GHz

Features
- Excellent Broadband Mixer Driver
- Single Ended Fed Doubler with Distributed Buffer Amplifier
- Excellent LO Driver for M/A-COM Tech Receivers
- +15 dBm Output Drive
- 100% On-Wafer RF, DC and Output Power Testing
- 100% Visual Inspection to MIL-STD-883 Method 2010
- RoHS* Compliant and 260°C Reflow Compatible

Description
M/A-COM Tech’s single ended fed (no external balun required) 7.5-25.0/15.0-50.0 GHz GaAs MMIC doubler has a +15.0 dBm output drive and is an excellent LO doubler that can be used to drive fundamental mixer devices. It is also well suited to drive M/A-COM Tech’s XR1002 receiver device. 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.

Ordering Information

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Package</th>
</tr>
</thead>
<tbody>
<tr>
<td>XX1000-BD-000V</td>
<td>vacuum release gel paks</td>
</tr>
<tr>
<td>XX1000-BD-EV1</td>
<td>evaluation board</td>
</tr>
</tbody>
</table>

M/A-COM 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 for additional data sheets and product information.

For further information and support please visit: https://www.macom.com/support
### Electrical Specifications: 7.5-25 GHz (fin) (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>Output Frequency Range (fout)</td>
<td>GHz</td>
<td>15.0</td>
<td>-</td>
<td>50.0</td>
</tr>
<tr>
<td>Input Return Loss (S11)</td>
<td>dB</td>
<td>-</td>
<td>TBD</td>
<td>-</td>
</tr>
<tr>
<td>Output Return Loss (S22)</td>
<td>dB</td>
<td>-</td>
<td>12.0</td>
<td>-</td>
</tr>
<tr>
<td>Harmonic Gain (fout)</td>
<td>dB</td>
<td>-</td>
<td>13</td>
<td>-</td>
</tr>
<tr>
<td>Fundamental Rejection (fin)</td>
<td>dBc</td>
<td>-</td>
<td>20</td>
<td>-</td>
</tr>
<tr>
<td>Saturated Output Power (Psat)</td>
<td>dBm</td>
<td>-</td>
<td>+15</td>
<td>-</td>
</tr>
<tr>
<td>RF Input Power (RF Pin)</td>
<td>dBm</td>
<td>-10.0</td>
<td>-</td>
<td>+10.0</td>
</tr>
<tr>
<td>Output Power at +0.0 dBm Pin (Pout)</td>
<td>dBm</td>
<td>-</td>
<td>+13.0</td>
<td>-</td>
</tr>
<tr>
<td>Drain Bias Voltage (Vd1,2)</td>
<td>VDC</td>
<td>-</td>
<td>+5.0</td>
<td>+5.5</td>
</tr>
<tr>
<td>Gate Bias Voltage (Vg1)</td>
<td>VDC</td>
<td>-1.2</td>
<td>-0.6</td>
<td>+0.1</td>
</tr>
<tr>
<td>Gate Bias Voltage (Vg2)</td>
<td>VDC</td>
<td>-1.2</td>
<td>0.0</td>
<td>+0.1</td>
</tr>
<tr>
<td>Drain Supply Current (Id1,2)</td>
<td>mA</td>
<td>-</td>
<td>220</td>
<td>250</td>
</tr>
<tr>
<td>(Vd=5.0 V, Vg1=0.6 V, Vg2=0.0 V Typical)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Source Voltage (Vss)</td>
<td>VDC</td>
<td>-5.5</td>
<td>-5.0</td>
<td>-2.0</td>
</tr>
<tr>
<td>Source Current (Iss)</td>
<td>mA</td>
<td>25</td>
<td>50</td>
<td>60</td>
</tr>
</tbody>
</table>

### Block Diagram & Schematics

![Block Diagram & Schematics](image_url)
Typical Performance Curves (cont.)

XX1000-BD: Input Return Loss (dB)

XX1000-BD

Active Doubler
7.5-25.0/15.0-50.0 GHz

Rev. V1
Active Doubler
7.5-25.0/15.0-50.0 GHz

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: 1.566 mg.

Bias Arrangement

Bypass Capacitors - See App Note [2]
MTTF is calculated from accelerated life-time data of single devices and assumes isothermal back-plate.

Bias Conditions: Vd1,2 = 5.0V, Id1,2 = 220 mA, Vss = -5.0V, Iss = 50 mA
App Note [1] Biasing - It is recommended to separately bias each doubler stage with fixed voltages of Vd(1,2) =5.0V, Vss=-5.0V and Vg1=-0.6V. The typical DC currents are Id1=80mA, Id2=140mA and Iss=50mA. Vg2 can be used for active control biasing of Vd2, or it can be left open and Vd2 will self bias at approximately 140mA. Maximum output power is achieved with Vss=-5.0V and Iss=50mA but the device will operate with reduced bias to Vss=-2.0V and Iss=25mA. It is also recommended to use active biasing on Vd2 with Vg2 to keep the currents constant as the RF power and temperature vary; this gives the most reproducible results. Depending on the supply voltage available and the power dissipation constraints, the bias circuit may be a single transistor or a low power operational amplifier, with a low value resistor in series with the drain supply used to sense the current. The gate of the pHEMT is controlled to maintain correct drain current and thus drain voltage. The typical gate voltage for Vg2=-0.1V. Typically the gate is protected with Silicon diodes to limit the applied voltage. Also, make sure to sequence the applied voltage to ensure negative gate bias is available before applying the positive drain supply.

App Note [2] Bias Arrangement -
For Individual Stage Bias (Recommended for doubler applications) -- Each DC pad (Vd1, 2, Vss and Vg1, 2) 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.

Typical Application

M/A-COM Tech MMIC-based 18.0-34.0 GHz Doubler/Receiver Block Diagram

(Moving LO and IF frequencies as required allows design to operate as high as 34 GHz)
Lead-Free Package Dimensions/Layout

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.
Active Doubler
7.5-25.0/15.0-50.0 GHz

M/A-COM Technology Solutions Inc. All rights reserved.
Information in this document is provided in connection with M/A-COM 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.