Double-Balanced Mixer
8 - 36 GHz

Features
- Low Conversion Loss: 9.5 dB
- High Linearity: 20 dBm IIP3
- Wide IF Bandwidth: DC to 8 GHz
- High Isolation
- Lead-Free 3 mm, 12-lead PQFN package
- RoHS* Compliant

Applications
- Test & Measurement
- Microwave Radio
- Radar

Description
MAMX-011071 is a GaAs double-balanced passive diode mixer housed in a lead-free 3 mm, 12-lead PQFN package. The mixer offers low conversion loss, high linearity and a wide IF bandwidth. The double-balanced circuit configuration provides excellent port isolation while internal 50 Ω matching simplifies its application.

This mixer is well suited for applications such as test and measurement, microwave radio and radar.

Ordering Information

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Package</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAMX-011071</td>
<td>Bulk</td>
</tr>
<tr>
<td>MAMX-011071-TR0500</td>
<td>500 Piece Reel¹</td>
</tr>
<tr>
<td>MAMX-011071-SB1</td>
<td>Sample Board²</td>
</tr>
</tbody>
</table>

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

* Restrictions on Hazardous Substances, compliant to current RoHS EU directive.

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Electrical Specifications\(^5\): \(f_{IF} = 500\,\text{MHz}, P_{LO} = 15\,\text{dBm}, T_A = +25^\circ\text{C}, Z_0 = 50\,\Omega\)

<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>LO and RF Frequency</td>
<td>—</td>
<td>GHz</td>
<td>8</td>
<td>—</td>
<td>36</td>
</tr>
<tr>
<td>IF Frequency</td>
<td>—</td>
<td>GHz</td>
<td>0</td>
<td>—</td>
<td>10</td>
</tr>
<tr>
<td>LO Power</td>
<td>—</td>
<td>dBm</td>
<td>—</td>
<td>15</td>
<td>—</td>
</tr>
<tr>
<td>Conversion Loss</td>
<td>8 - 20 GHz</td>
<td>dB</td>
<td>—</td>
<td>9.5</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>20 - 36 GHz</td>
<td></td>
<td>10.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Input P1dB</td>
<td>8 - 36 GHz</td>
<td>dBm</td>
<td>—</td>
<td>13</td>
<td>—</td>
</tr>
<tr>
<td>Input IP3</td>
<td>(P_{RF} = -10,\text{dBm/tone}, \Delta f = 1,\text{MHz})</td>
<td>dBm</td>
<td>—</td>
<td>20</td>
<td>—</td>
</tr>
<tr>
<td>Input IP2</td>
<td>(P_{RF} = -10,\text{dBm/tone}, \Delta f = 1,\text{MHz})</td>
<td>dBm</td>
<td>—</td>
<td>45</td>
<td>—</td>
</tr>
<tr>
<td>LO-to-RF Isolation</td>
<td>8 - 36 GHz</td>
<td>dB</td>
<td>—</td>
<td>35</td>
<td>—</td>
</tr>
<tr>
<td>LO-to-IF Isolation</td>
<td>8 - 20 GHz</td>
<td>dB</td>
<td>—</td>
<td>34</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>20 - 36 GHz</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>RF-to-IF Isolation</td>
<td>8 - 20 GHz</td>
<td>dB</td>
<td>—</td>
<td>9</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>20 - 36 GHz</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RF Return Loss</td>
<td>RF = 25 GHz</td>
<td>dB</td>
<td>—</td>
<td>7</td>
<td>—</td>
</tr>
<tr>
<td>IF Return Loss</td>
<td>IF = 500 MHz</td>
<td>dB</td>
<td>—</td>
<td>12</td>
<td>—</td>
</tr>
</tbody>
</table>

5. All specifications refer to down-conversion operation, unless otherwise noted.

Absolute Maximum Ratings\(^6,7\)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Absolute Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>LO Power</td>
<td>23 dBm</td>
</tr>
<tr>
<td>RF or IF Power</td>
<td>20 dBm</td>
</tr>
<tr>
<td>Junction Temperature(^8)</td>
<td>+150°C</td>
</tr>
<tr>
<td>Operating Temperature</td>
<td>-55°C to +85°C</td>
</tr>
<tr>
<td>Storage Temperature</td>
<td>-65°C to +150°C</td>
</tr>
</tbody>
</table>

6. Exceeding any one or combination of these limits may cause permanent damage to this device.
7. MACOM does not recommend sustained operation near these survivability limits.
8. Operating at nominal conditions with \(T_J \leq 150^\circ\text{C}\) will ensure MTTF > 1 x 10\(^6\) hours. Thermal resistance, \(\Theta_{JC}\) is 85°C/W.

Handling Procedures
Please observe the following precautions to avoid damage:

Static Sensitivity
These electronic devices are sensitive to electrostatic discharge (ESD) and can be damaged by static electricity. Proper ESD control techniques should be used when handling these devices with the following JEDEC rating:
HBM Class 1B
CDM Class C3
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MAMX-011071
Rev. V2

MxN Spurious Rejection at IF Port (dBc IF)
RF = 17.5 GHz @ -10 dBm
LO = 18.0 GHz @ +15 dBm

<table>
<thead>
<tr>
<th>mxF</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>x</td>
<td>20</td>
<td>32</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>1</td>
<td>4</td>
<td>0</td>
<td>31</td>
<td>53</td>
<td>x</td>
</tr>
<tr>
<td>2</td>
<td>61</td>
<td>80</td>
<td>61</td>
<td>63</td>
<td>75</td>
</tr>
<tr>
<td>3</td>
<td>x</td>
<td>78</td>
<td>81</td>
<td>70</td>
<td>88</td>
</tr>
<tr>
<td>4</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>105</td>
<td>90</td>
</tr>
</tbody>
</table>

PCB Layout

Application Schematic

DXF available on request based on 10 mil RO4350 substrate.

No external parts required for operation of MAMX-011067.

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**Typical Performance Curves**

1. **Conversion Loss USB (Down Conversion)**
   @ +25°C, \( I_F = 500 \text{ MHz} \)

2. **Conversion Loss USB (Up Conversion)**
   @ +25°C, \( I_F = 500 \text{ MHz} \)

3. **Conversion Loss Over Temperature**
   @ \( P_{LO} = 15 \text{ dBm}, I_F = 500 \text{ MHz} \)

4. **IF Bandwidth**
   @ +25°C, \( F_{LO} = 13 \text{ GHz}, P_{LO} = 15 \text{ dBm} \)

5. **RF Return Loss**
   @ +25°C, \( F_{LO} = 17 \text{ GHz}, P_{LO} = 15 \text{ dBm} \)

6. **IF Return Loss**
   @ +25°C, \( F_{LO} = 17 \text{ GHz}, P_{LO} = 15 \text{ dBm} \)

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Typical Performance Curves

**IIP3 vs. LO Drive, \( I_F = 500 \text{ MHz} \)**

![IIP3 vs. LO Drive, \( I_F = 500 \text{ MHz} \)](image)

**IIP3 vs. Temperature @ \( P_{LO} = 15 \text{ dBm}, I_F = 500 \text{ MHz} \)**

![IIP3 vs. Temperature @ \( P_{LO} = 15 \text{ dBm}, I_F = 500 \text{ MHz} \)](image)

**IIP2 vs. LO Drive \( I_F = 500 \text{ MHz} \)**

![IIP2 vs. LO Drive \( I_F = 500 \text{ MHz} \)](image)

**IIP2 vs. Temperature @ \( P_{LO} = 15 \text{ dBm}, I_F = 500 \text{ MHz} \)**

![IIP2 vs. Temperature @ \( P_{LO} = 15 \text{ dBm}, I_F = 500 \text{ MHz} \)](image)

**P1dB vs. LO Drive, \( I_F = 500 \text{ MHz} \)**

![P1dB vs. LO Drive, \( I_F = 500 \text{ MHz} \)](image)

**Isolation (Down Conversion) @ \( IF = 500 \text{ MHz}, P_{LO} = 15 \text{ dBm}; P_{RF} = -10 \text{ dBm} \)**

![Isolation (Down Conversion) @ \( IF = 500 \text{ MHz}, P_{LO} = 15 \text{ dBm}; P_{RF} = -10 \text{ dBm} \)](image)
Lead-Free 3 mm 12-Lead QFN†

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