Image-Reject Mixer
2.5 - 9.0 GHz

Features
- Low Conversion Loss: 7.5 dB
- High Linearity: 22 dBm IIP3
- High Image Rejection: 22 dBc
- Wide IF Bandwidth: DC to 3.5 GHz
- High Isolation
- Die Size: 1.85 × 2.00 × 0.10 mm
- RoHS* Compliant

Applications
- Test & Measurement, Microwave Radio, and Radar

Description
MAMX-011044-DIE is an image-reject passive diode mixer MMIC. The mixer offers low conversion loss, high linearity and a wide IF bandwidth. The image-reject circuit configuration provides excellent port isolation while internal 50-ohm matching simplifies its application.

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

MAMX-011044-DIE is also available in a 4 mm QFN package. Refer to datasheet MAMX-011044.

Features

Ordering Information

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Package</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAMX-011044-DIE</td>
<td>Vacuum Release Gel Pack¹</td>
</tr>
<tr>
<td>MAMX-011044-SB2</td>
<td>Sample Board</td>
</tr>
</tbody>
</table>

1. Die quantity varies.

* Restrictions on Hazardous Substances, compliant to current RoHS EU directive.
### Electrical Specifications\(^5\): \(F_{IF} = 500\text{ MHz}, P_{LO} = 18\text{ dBm}, T_A = 25\text{°C}, Z_0 = 50\text{ Ω}\)

<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>LO and RF Frequency</td>
<td>—</td>
<td>GHz</td>
<td>2.5</td>
<td>—</td>
<td>9</td>
</tr>
<tr>
<td>IF Frequency</td>
<td>—</td>
<td>GHz</td>
<td>0</td>
<td>—</td>
<td>3.5</td>
</tr>
<tr>
<td>LO Power</td>
<td>—</td>
<td>dBm</td>
<td>—</td>
<td>18</td>
<td>—</td>
</tr>
<tr>
<td>Conversion Loss</td>
<td>2.5 - 5.0 GHz</td>
<td>dB</td>
<td>7.5</td>
<td>7.5</td>
<td>8.5</td>
</tr>
<tr>
<td></td>
<td>5.0 - 7.0 GHz</td>
<td></td>
<td>7.5</td>
<td>10.0</td>
<td>11.0</td>
</tr>
<tr>
<td></td>
<td>7.0 - 9.0 GHz</td>
<td></td>
<td>7.5</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Input P1dB</td>
<td>—</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>22</td>
<td>—</td>
</tr>
<tr>
<td>Input IP2 (Half IF)</td>
<td>(P_{RF} = -10\text{ dBm})</td>
<td>dBm</td>
<td>—</td>
<td>58</td>
<td>—</td>
</tr>
<tr>
<td>LO-to-RF Isolation</td>
<td>—</td>
<td>dB</td>
<td>—</td>
<td>45</td>
<td>—</td>
</tr>
<tr>
<td>LO-to-IF Isolation</td>
<td>—</td>
<td>dB</td>
<td>—</td>
<td>45</td>
<td>—</td>
</tr>
<tr>
<td>RF-to-IF Isolation</td>
<td>—</td>
<td>dB</td>
<td>—</td>
<td>45</td>
<td>—</td>
</tr>
<tr>
<td>Image Rejection</td>
<td>—</td>
<td>dBc</td>
<td>—</td>
<td>20</td>
<td>—</td>
</tr>
<tr>
<td>Amplitude Imbalance</td>
<td>—</td>
<td>dB</td>
<td>—</td>
<td>±0.5</td>
<td>—</td>
</tr>
<tr>
<td>Phase Imbalance</td>
<td>—</td>
<td>°</td>
<td>—</td>
<td>±5.0</td>
<td>—</td>
</tr>
<tr>
<td>RF Return Loss</td>
<td>(RF = 3.5\text{ GHz})</td>
<td>dB</td>
<td>—</td>
<td>8</td>
<td>—</td>
</tr>
<tr>
<td>IF Return Loss</td>
<td>(IF = 2\text{ GHz})</td>
<td>dB</td>
<td>—</td>
<td>13</td>
<td>—</td>
</tr>
</tbody>
</table>

5. All specifications refer to down-conversion USB 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 \(T_J \leq +150\text{°C}\) will ensure \(MTTF > 1 \times 10^6\) hours.

### 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 HBM Class 1B devices.
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Typical Performance Curves: 90° Hybrid @ 500 MHz IF

Down Conversion Gain (Upper Side Band) over LO Drive

Down Conversion Image Rejection (Upper Side Band) over LO Drive

Down Conversion Gain (Upper Side Band) over Temperature

Down Conversion Image Rejection (Upper Side Band) over Temperature

Down Conversion Gain (Lower Side Band) over LO Drive

Down Conversion Image Rejection (Lower Side Band) over LO Drive

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DC-0017464
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Typical Performance Curves:

**Amplitude Imbalance**

![Amplitude Imbalance Graph]

**Phase Imbalance**

![Phase Imbalance Graph]

**RF Return Loss**

![RF Return Loss Graph]

**IF Return Loss**

![IF Return Loss Graph]

**IF Bandwidth**

![IF Bandwidth Graph]
**Image-Reject Mixer**

**2.5 - 9.0 GHz**

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**MxN Spurious Rejection at IF Port (dBc IF)**

RF = 5.5 GHz at -10 dBm  
LO = 5.0 GHz at +18 dBm

<table>
<thead>
<tr>
<th>MxRF</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>8</td>
<td>20</td>
<td>8</td>
<td>15</td>
</tr>
<tr>
<td>1</td>
<td>5</td>
<td>0</td>
<td>26</td>
<td>81</td>
<td>44</td>
</tr>
<tr>
<td>2</td>
<td>X</td>
<td>98</td>
<td>75</td>
<td>82</td>
<td>95</td>
</tr>
<tr>
<td>3</td>
<td>88</td>
<td>X</td>
<td>90</td>
<td>75</td>
<td>90</td>
</tr>
<tr>
<td>4</td>
<td>X</td>
<td>100</td>
<td>X</td>
<td>102</td>
<td>106</td>
</tr>
</tbody>
</table>

**Outline Drawing**

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Notes:

Units are in microns with a tolerance of ±5 µm, except for die exterior dimensions which are street-center-to-street-center, nominal kerf, ±20 µm.  
Die thickness is 100 ±10 µm.  
RF and LO bond-pads are 160 × 100 µm.  
IF bond-pads are 100 × 100 µm.
Assembly Guideline

Notes:
- Attach bare die to PCB or carrier using conductive epoxy. Bond die signal pads to PCB 50 \( \Omega \) traces using 1.0 mil gold wire.
- Two bond wires are recommended on each signal pad for optimal performance. There is no need to bond the die ground pads.

Hybrid Configuration

External Hybrid
- Down conversion and Up conversion data captured with external hybrid 90° coupler part number: ATM PNR H912.
- RF Upper Side Band (USB) mode connect hybrid 0° port to IF1 mixer port, 90° hybrid port to IF2 mixer port.
- RF Lower Side Band (LSB) mode connect hybrid 0° port to IF2 mixer port, 90° hybrid port to IF1 mixer port.
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