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.

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 Pack</td>
</tr>
<tr>
<td>MAMX-011044-SB2</td>
<td>Sample Board</td>
</tr>
</tbody>
</table>

2. These pads are internally connected to ground, and they can be left unconnected.
3. Only one side IF1 and IF2 need to be connected, and leave the other side IF1 and IF2 unconnected.
4. The backside of the die must be connected to RF, DC and thermal ground.

* Restrictions on Hazardous Substances, compliant to current RoHS EU directive.
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Electrical Specifications: $F_{IF} = 500$ MHz, $P_{LO} = 18$ dBm, $T_A = 25^\circ$C, $Z_0 = 50$ 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></td>
<td>10.0</td>
</tr>
<tr>
<td></td>
<td>7.0 - 9.0 GHz</td>
<td></td>
<td>7.5</td>
<td></td>
<td>11.0</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>$P_{RF} = -10$ dBm/tone, $\Delta f = 1$ MHz</td>
<td>dBm</td>
<td>—</td>
<td>22</td>
<td>—</td>
</tr>
<tr>
<td>Input IP2 (Half IF)</td>
<td>$P_{RF} = -10$ 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>$RF = 3.5$ GHz</td>
<td>dB</td>
<td>—</td>
<td>8</td>
<td>—</td>
</tr>
<tr>
<td>IF Return Loss</td>
<td>$IF = 2$ 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:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Absolute Maximum</th>
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</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</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>

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.
**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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Typical Performance Curves: 90° Hybrid @ 500 MHz IF

**Up Conversion Gain (USB) over LO Drive**

**Up Conversion Image Rejection (USB) over LO Drive**

**Down Conversion IIP2 (USB) over LO Drive**

**Down Conversion IIP3 (USB) over LO Drive**

**Down Conversion P1dB (USB) Over LO Drive**

**Down Conversion Isolation**
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Typical Performance Curves:

**Amplitude Imbalance**

**Phase Imbalance**

**RF Return Loss**

**IF Return Loss**

**IF Bandwidth**

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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>
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<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

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 Ω 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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