Features
- Low Conversion Loss: 9 dB
- High Linearity: 18 dBm IIP3
- High Image Rejection: 20 dBc
- Wide IF Bandwidth: DC to 10 GHz
- High Isolation
- Die Size: 1.40 × 1.90 × 0.10 mm
- RoHS* Compliant

Applications
- Test & Measurement, Microwave Radio, and Radar

Description
MAMX-011043-DIE is an image-reject passive diode mixer MMIC. The mixer offers low conversion loss, high linearity, high image rejection and a wide IF bandwidth. The image-reject 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.

MAMX-011043-DIE is also available in a 4 mm QFN package. Refer to datasheet MAMX-011043.

Ordering Information

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Package</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAMX-011043-DIE</td>
<td>Vacuum Release Gel Pack¹</td>
</tr>
<tr>
<td>MAMX-011043-SB2</td>
<td>Sample Board</td>
</tr>
</tbody>
</table>

¹ Die quantity varies.

Functional Schematic

Bond-pad Configuration

<table>
<thead>
<tr>
<th>Pin #</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>LO</td>
</tr>
<tr>
<td>1, 3, 4, 7, 8, 10</td>
<td>Ground²</td>
</tr>
<tr>
<td>5</td>
<td>IF1</td>
</tr>
<tr>
<td>6</td>
<td>IF2</td>
</tr>
<tr>
<td>9</td>
<td>RF</td>
</tr>
<tr>
<td>11</td>
<td>Ground³</td>
</tr>
</tbody>
</table>

² These pads are internally connected to ground, and they can be left unconnected.
³ The backside of the die must be connected to RF, DC and thermal ground.

* Restrictions on Hazardous Substances, compliant to current RoHS EU directive.
Image-Reject Mixer
15 - 45 GHz

Electrical Specifications\(^4,5\): \(f_{\text{IF}} = 100\) MHz, \(P_{\text{LO}} = +16\) dBm, \(T_A = 25^\circ\)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>15</td>
<td>—</td>
<td>45</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>16</td>
<td>—</td>
</tr>
<tr>
<td>Conversion Loss</td>
<td>15 - 45 GHz</td>
<td>dB</td>
<td>—</td>
<td>9</td>
<td>10.5</td>
</tr>
<tr>
<td>Input P1dB</td>
<td>—</td>
<td>dBm</td>
<td>—</td>
<td>8</td>
<td>—</td>
</tr>
<tr>
<td>Input IP3</td>
<td>(P_{\text{RF}} = -10) dBm/tone, (\Delta f = 1) MHz</td>
<td>dBm</td>
<td>—</td>
<td>18</td>
<td>—</td>
</tr>
<tr>
<td>Input IP2 (Half IF)</td>
<td>(P_{\text{RF}} = -10) dBm/tone, (\Delta f = 1) MHz</td>
<td>dBm</td>
<td>—</td>
<td>40</td>
<td>—</td>
</tr>
<tr>
<td>LO-to-RF Isolation</td>
<td>—</td>
<td>dB</td>
<td>—</td>
<td>40</td>
<td>—</td>
</tr>
<tr>
<td>LO-to-IF Isolation</td>
<td>—</td>
<td>dB</td>
<td>—</td>
<td>40</td>
<td>—</td>
</tr>
<tr>
<td>RF-to-IF Isolation</td>
<td>—</td>
<td>dB</td>
<td>—</td>
<td>30</td>
<td>—</td>
</tr>
<tr>
<td>Image Rejection</td>
<td>15 - 42 GHz</td>
<td>dBc</td>
<td>15</td>
<td>20</td>
<td>—</td>
</tr>
<tr>
<td>Amplitude Imbalance</td>
<td>—</td>
<td>dBc</td>
<td>—</td>
<td>±1</td>
<td>—</td>
</tr>
<tr>
<td>Phase Imbalance</td>
<td>—</td>
<td>°</td>
<td>—</td>
<td>±10</td>
<td>—</td>
</tr>
<tr>
<td>RF Return Loss</td>
<td>(RF = 36) GHz</td>
<td>dB</td>
<td>—</td>
<td>7</td>
<td>—</td>
</tr>
<tr>
<td>IF Return Loss</td>
<td>(IF = 2) GHz</td>
<td>dB</td>
<td>—</td>
<td>10</td>
<td>—</td>
</tr>
</tbody>
</table>

4. All specifications refer to down-conversion operation, unless otherwise noted.
5. Characterization measurements were taken using RF probes, with I/O port configuration shown in Assembly Guideline Diagram on page 7.

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 \(T_J \leq +150^\circ\)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.
Image-Reject Mixer
15 - 45 GHz

Typical Performance Curves: 90° Hybrid @ 100 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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https://www.macom.com/support

DC-0022931
Typical Performance Curves: 90° Hybrid @ 100 MHz IF

Up Conversion Gain (USB) over LO Drive

![Graph showing Up Conversion Gain (USB) over LO Drive](image)

Up Conversion SSB (USB) over LO Drive

![Graph showing Up Conversion SSB (USB) over LO Drive](image)

Down Conversion IIP2 (USB) over LO Drive

![Graph showing Down Conversion IIP2 (USB) over LO Drive](image)

Down Conversion IIP3 (USB) over LO Drive

![Graph showing Down Conversion IIP3 (USB) over LO Drive](image)

Down Conversion P1dB (USB) Over LO Drive

![Graph showing Down Conversion P1dB (USB) Over LO Drive](image)

Down Conversion Isolation

![Graph showing Down Conversion Isolation](image)
Typical Performance Curves:

**Amplitude Imbalance**

**Phase Imbalance**

**RF Return Loss**

**IF Return Loss**

**IF Bandwidth**
**Image-Reject Mixer**

**15 - 45 GHz**

**MxN Spurious Rejection @ IF Port**

RF = 15.1 GHz @ -10 dBm  
LO = 15 GHz @ +16 dBm  
*All values in dBc below, the IF output power level*

<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>14</td>
<td>53</td>
<td>56</td>
<td>X</td>
</tr>
<tr>
<td>1</td>
<td>17</td>
<td>0</td>
<td>36</td>
<td>57</td>
<td>57</td>
</tr>
<tr>
<td>2</td>
<td>81</td>
<td>62</td>
<td>49</td>
<td>59</td>
<td>97</td>
</tr>
<tr>
<td>3</td>
<td>87</td>
<td>97</td>
<td>57</td>
<td>53</td>
<td>61</td>
</tr>
<tr>
<td>4</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>95</td>
<td>80</td>
</tr>
</tbody>
</table>

**LO Harmonics**

LO = +16 dBm  
*All values in dBc below, input LO level measured at RF*

<table>
<thead>
<tr>
<th>LO GHz</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>14</td>
<td>62</td>
<td>59</td>
<td>51</td>
<td>N/A</td>
</tr>
<tr>
<td>16</td>
<td>54</td>
<td>61</td>
<td>58</td>
<td>N/A</td>
</tr>
<tr>
<td>18</td>
<td>49</td>
<td>50</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>20</td>
<td>48</td>
<td>48</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>22</td>
<td>49</td>
<td>44</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>24</td>
<td>48</td>
<td>45</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>26</td>
<td>47</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>30</td>
<td>44</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>45</td>
<td>40</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>

**Hybrid Configuration**

- Down conversion and Up conversion data captured with external hybrid 90° coupler part number: Innovative IPP-2345.
- 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.

**External Hybrid**

- Down conversion and Up conversion data captured with external hybrid 90° coupler part number: Innovative IPP-2345.
- 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.
Assembly Guideline

Attach bare die to PCB or carrier using conductive epoxy. Bond die signal pads to PCB 50 Ω traces using 1 mil gold wire. Double bond wire is recommended on RF and LO pads for optimal performance. There is no need to bond the die ground pads.

Caution: Exposed airbridges are incorporated in the circuit layout on the top surface of this die. These airbridges are sensitive in structure and due care should be taken when handling the die.

Outline Drawing

Bondpad Table

<table>
<thead>
<tr>
<th>Pad #</th>
<th>Pad Name</th>
<th>Size-X</th>
<th>Size-Y</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>GND1</td>
<td>90 μm</td>
<td>90 μm</td>
</tr>
<tr>
<td>2</td>
<td>LO</td>
<td>150 μm</td>
<td>90 μm</td>
</tr>
<tr>
<td>3</td>
<td>GND2</td>
<td>90 μm</td>
<td>90 μm</td>
</tr>
<tr>
<td>4</td>
<td>GND3</td>
<td>90 μm</td>
<td>90 μm</td>
</tr>
<tr>
<td>5</td>
<td>IF1</td>
<td>90 μm</td>
<td>90 μm</td>
</tr>
<tr>
<td>6</td>
<td>IF2</td>
<td>90 μm</td>
<td>90 μm</td>
</tr>
<tr>
<td>7</td>
<td>GND4</td>
<td>90 μm</td>
<td>90 μm</td>
</tr>
<tr>
<td>8</td>
<td>GND5</td>
<td>90 μm</td>
<td>90 μm</td>
</tr>
<tr>
<td>9</td>
<td>RF</td>
<td>150 μm</td>
<td>90 μm</td>
</tr>
<tr>
<td>10</td>
<td>GND6</td>
<td>90 μm</td>
<td>90 μm</td>
</tr>
</tbody>
</table>

9. 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 tolerance.
10. Die thickness is 100 ±10 μm.
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