

## Double-Balanced Mixer 18 to 46 GHz

Rev. V3

### Features

- Low Conversion Loss: 6.5 dB
- High Linearity: 20 dBm IIP3
- Wide IF Bandwidth: DC to 20 GHz
- High Isolation
- Lead-Free 3 mm 12-lead AQFN Package
- RoHS\* Compliant

### Description

MAMX-011054 is a double-balanced passive diode mixer housed in a 3 mm, 12-lead AQFN 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  $\Omega$  matching simplifies its application.

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

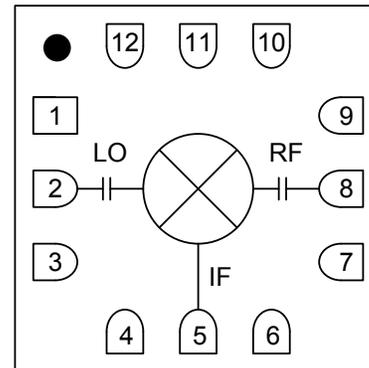
MAMX-011054 is also available in die form. Refer to datasheet MAMX-011037-DIE.

### Ordering Information<sup>1,2</sup>

| Part Number        | Package        |
|--------------------|----------------|
| MAMX-011054        | Bulk           |
| MAMX-011054-TR0100 | 100 Piece Reel |
| MAMX-011054-TR0500 | 500 Piece Reel |
| MAMX-011054-SB1    | Sample Board   |

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

### Functional Schematic



### Pin Configuration<sup>3</sup>

| Pin #            | Function                   |
|------------------|----------------------------|
| 1, 3, 4, 6, 7, 9 | Ground                     |
| 2                | LO                         |
| 5                | IF                         |
| 8                | RF                         |
| 10 - 12          | No Connection <sup>3</sup> |
| 13               | Paddle <sup>4</sup>        |

3. MACOM recommends connecting unused package pins to ground.
4. The exposed pad centered on the package bottom 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<sup>5</sup>:  $F_{IF} = 1 \text{ GHz}$ ,  $P_{LO} = +15 \text{ dBm}$ ,  $T_A = 25^\circ\text{C}$ ,  $Z_0 = 50 \Omega$

| Parameter           | Test Conditions   | Units | Min. | Typ.        | Max. |   |
|---------------------|---|-------|------|-------------|------|---|
| LO and RF Frequency | —   | GHz   | 18   | —           | 46   |   |
| IF Frequency        | —   | GHz   | 0    | —           | 20   |   |
| LO Power            | —   | dBm   | —    | 15          | —    |   |
| Conversion Loss     | 18 - 24 GHz   | dB    | —    | 6.5         | 11   |   |
|                     | 24 - 40 GHz   |       |      | 6.5         | 11   |   |
|                     | 40 - 46 GHz   |       |      | 7.5         | 11   |   |
| Input P1dB          | 18 - 24 GHz   | dBm   | —    | 10          | —    |   |
|                     | 24 - 40 GHz   |       |      | 12          | —    |   |
|                     | 40 - 46 GHz   |       |      | 10          | —    |   |
| Input IP3           | $P_{RF} = -10 \text{ dBm/tone}$ , $\Delta f = 1 \text{ MHz}$<br>18 - 24 GHz | dBm   | —    | 20          | —    |   |
|                     |   |       |      | 24 - 40 GHz | 21   | — |
|                     |   |       |      | 40 - 46 GHz | 19   | — |
|                     |   |       |      | —           | —    | — |
| Input IP2           | $P_{RF} = -10 \text{ dBm/tone}$ , $\Delta f = 1 \text{ MHz}$                | dBm   | —    | 50          | —    |   |
| LO-to-RF Isolation  | —   | dB    | —    | 35          | —    |   |
| LO-to-IF Isolation  | 18 - 24 GHz   | dB    | 25   | 38          | —    |   |
|                     | 24 - 40 GHz   |       | 27   | 45          | —    |   |
|                     | 40 - 46 GHz   |       | 27   | 45          | —    |   |
| RF-to-IF Isolation  | 18 - 24 GHz   | dB    | —    | 9           | —    |   |
|                     | 24 - 40 GHz   |       | 11   | 30          | —    |   |
|                     | 40 - 46 GHz   |       | 25   | 35          | —    |   |
| RF Return Loss      | RF = 40 GHz   | dB    | —    | 8           | —    |   |
| IF Return Loss      | RF = 1 GHz  | dB    | —    | 16          | —    |   |

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

### Absolute Maximum Ratings<sup>6,7</sup>

| Parameter                         | Absolute Maximum |
|-----------------------------------|------------------|
| LO Power                          | 23 dBm           |
| RF or IF Power                    | 20 dBm           |
| Junction Temperature <sup>8</sup> | +150°C           |
| Operating Temperature             | -55°C to +85°C   |
| Storage Temperature               | -65°C to +150°C  |

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  $\text{MTTF} > 1 \times 10^6$  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 devices with the following rating:

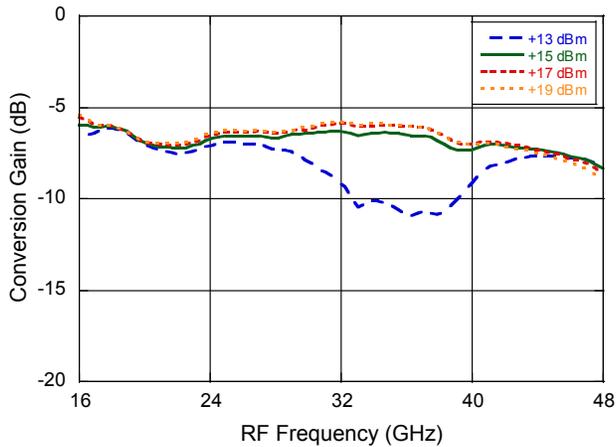
HBM Class 1B  
CDM Class C5

### Assembly Information

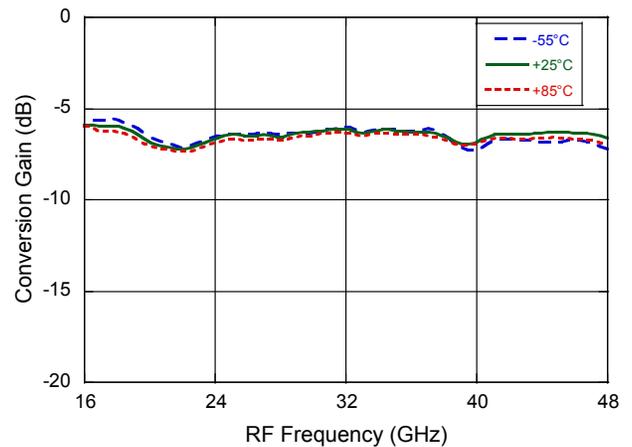
- Do not subject the device to excessive force, especially at elevated temperatures  $> 60^\circ\text{C}$ .
- No-clean flux is required for assembly. Post SMT washing is not recommended.

## Typical Performance Curves

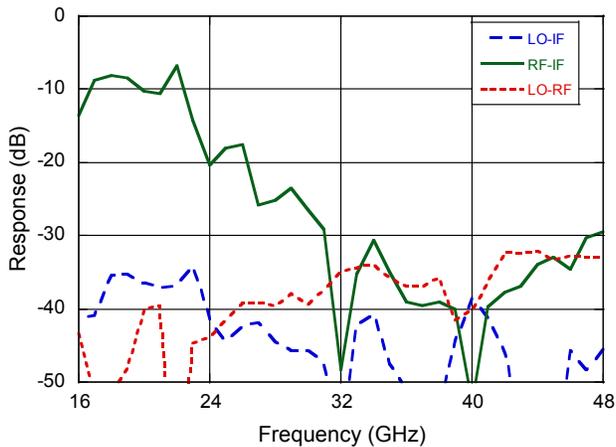
**Conversion Gain vs. LO Drive**



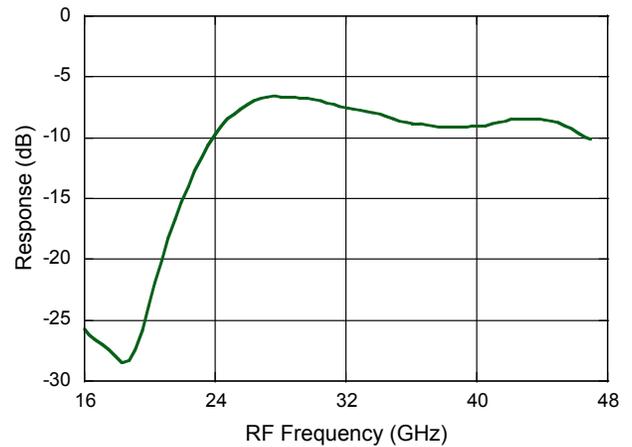
**Conversion Gain vs. Temperature**



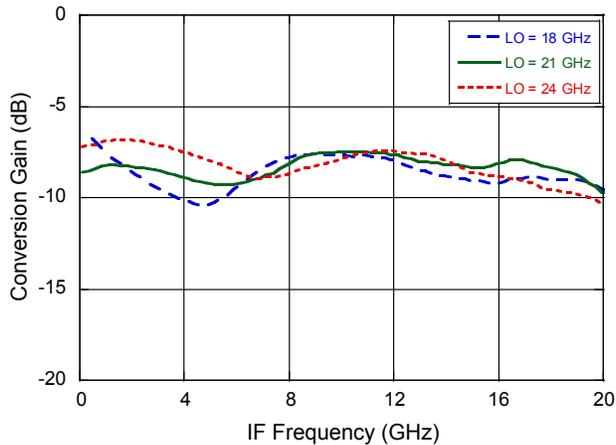
**Isolation**



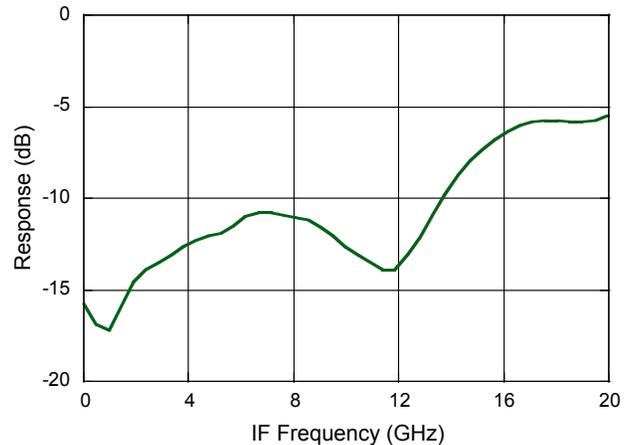
**RF Return Loss**



**IF Bandwidth**

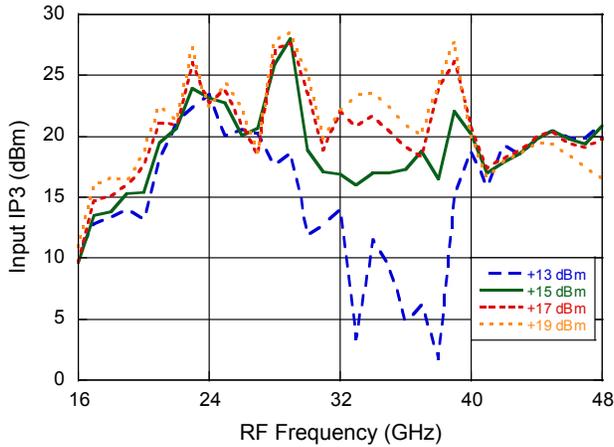


**IF Return Loss**

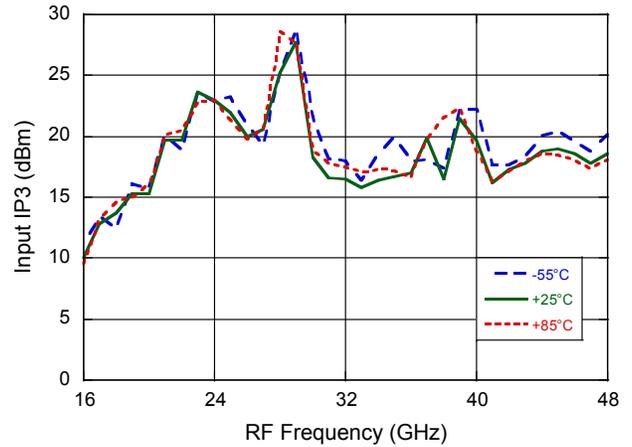


## Typical Performance Curves

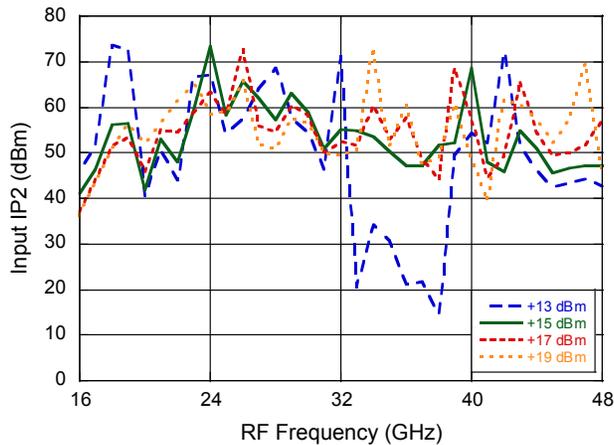
**Input IP3 vs. LO Drive**



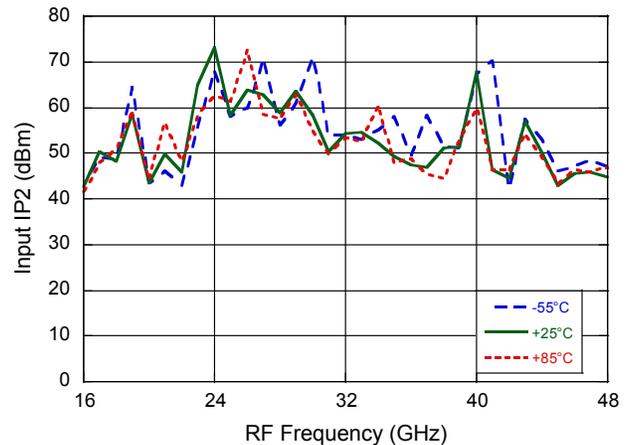
**Input IP3 vs. Temperature**



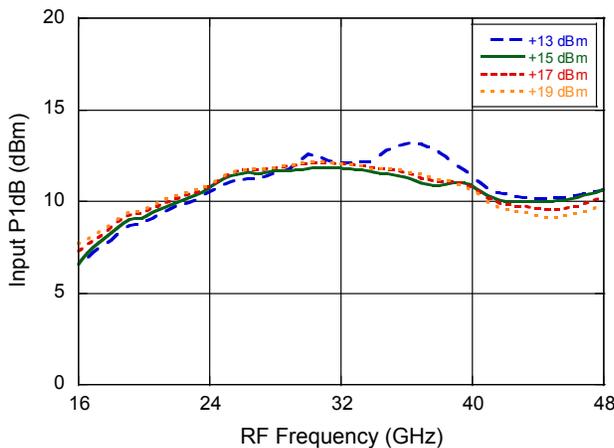
**Input IP2 vs. LO Drive**



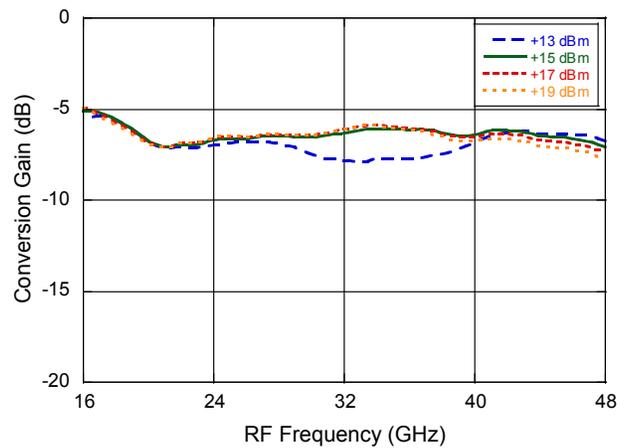
**Input IP2 vs. Temperature**



**Input P1dB vs. LO Drive**



**Up Conversion Gain vs. LO Drive**



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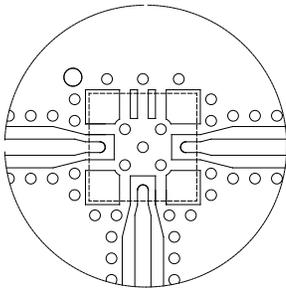
### MxN Spurious Rejection at IF Port (dBc IF)

RF = 24 GHz at -10 dBm

LO = 25 GHz at +15 dBm

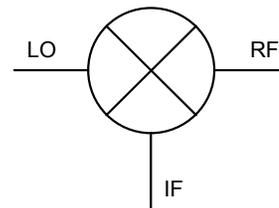
| MxRF | NxLO |    |    |    |    |
|------|------|----|----|----|----|
|      | 0    | 1  | 2  | 3  | 4  |
| 0    | x    | 7  | 34 | x  | x  |
| 1    | 4    | 0  | 23 | x  | x  |
| 2    | 56   | 59 | 61 | 67 | x  |
| 3    | x    | 56 | 70 | 78 | 67 |
| 4    | x    | x  | 57 | 69 | 74 |

### PCB Layout



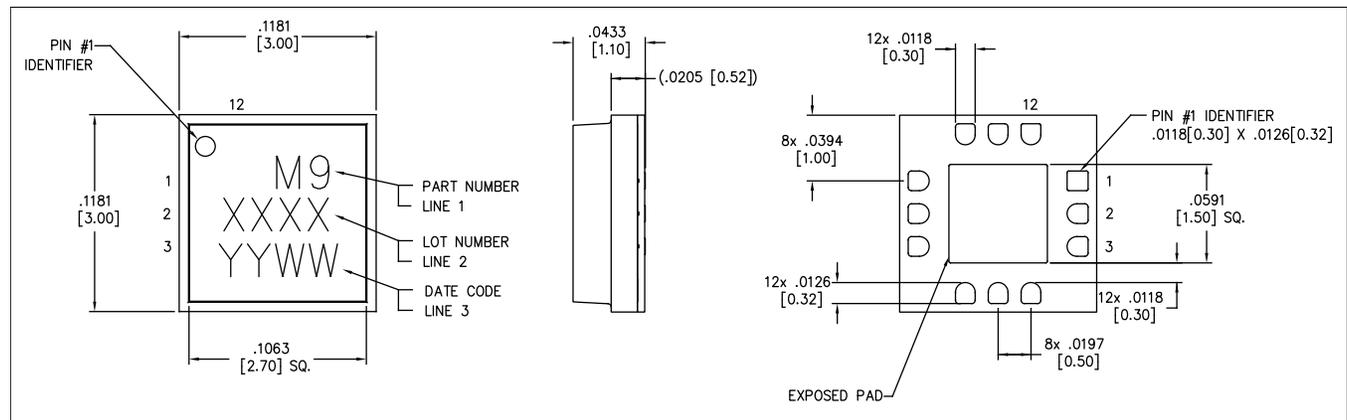
DXF available on request based on 10 mil RO4350 substrate.

### Application Schematic



No external parts required for operation of MAMX-011054.

### Lead-Free 3 mm 12-Lead AQFN<sup>†</sup>



<sup>†</sup> Reference Application Note S2083 for lead-free solder reflow recommendations.  
Meets JEDEC moisture sensitivity level 3 requirements.  
Plating is NiPdAu.  
All dimensions are inches [mm].

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