

## Double-Balanced Mixer 18 - 46 GHz

Rev. V2

### Features

- Low Conversion Loss: 6.5 dB
- High Linearity: 20 dBm IIP3
- Wide IF Bandwidth: DC to 20 GHz
- High Isolation
- Die Size: 1.15 × 0.97 × 0.10 mm
- RoHS\* Compliant

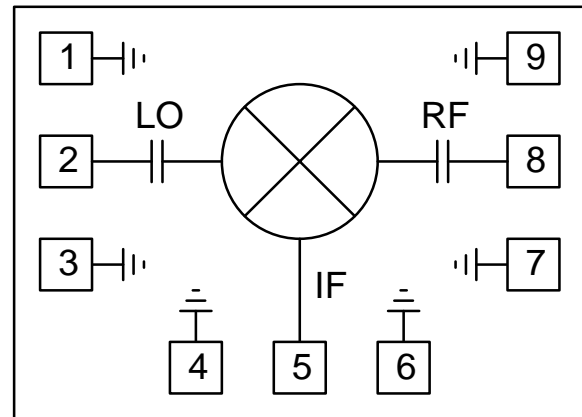
### Description

MAMX-011037-DIE is a double-balanced passive diode mixer MMIC. 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-ohm matching simplifies its application.

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

MAMX-011037-DIE is also available in a 3 mm QFN package. Refer to datasheet MAMX-011054.

### Functional Schematic



### Ordering Information

| Part Number     | Package                              |
|-----------------|--------------------------------------|
| MAMX-011037-DIE | Vacuum Release Gel Pack <sup>1</sup> |
| MAMX-011037-SB2 | Sample Board                         |

1. Die quantity varies.

### Bond-pad Configuration

| Pad No. | Function         | Pad No. | Function         |
|---------|------------------|---------|------------------|
| 1       | GND <sup>2</sup> | 6       | GND <sup>2</sup> |
| 2       | LO               | 7       | GND <sup>2</sup> |
| 3       | GND <sup>2</sup> | 8       | RF               |
| 4       | GND <sup>2</sup> | 9       | GND <sup>2</sup> |
| 5       | IF               | 10      | GND <sup>3</sup> |

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, European Union Directive 2011/65/EU.

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**Electrical Specifications<sup>4</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  | 12   |
|                     | 24 - 40 GHz   |       |      | 6.5  | 10   |
|                     | 40 - 46 GHz   |       |      | 6.5  | 11   |
| Input P1dB          | —   | dBm   | —    | 12   | —    |
| Input IP3           | $P_{RF} = -10\text{ dBm/ tone}$ , $\Delta f = 1\text{ MHz}$ | dBm   | —    | 20   | —    |
| 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   | 37   | —    |
|                     | 24 - 40 GHz   |       | 27   | 45   |      |
|                     | 40 - 46 GHz   |       | 23   | 44   |      |
| RF-to-IF Isolation  | 18 - 24 GHz   | dB    | —    | 10   | —    |
|                     | 24 - 40 GHz   |       | 8    | 24   |      |
|                     | 40 - 46 GHz   |       | 13   | 27   |      |
| RF Return Loss      | RF = 40 GHz   | dB    | —    | 5    | —    |
| IF Return Loss      | IF = 1 GHz  | dB    | —    | 15   | —    |

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

### Absolute Maximum Ratings<sup>5,6</sup>

| Parameter                         | Absolute Maximum |
|-----------------------------------|------------------|
| LO Power                          | 23 dBm           |
| RF or IF Power                    | 20 dBm           |
| Junction Temperature <sup>7</sup> | +150°C           |
| Operating Temperature             | -55°C to +85°C   |
| Storage Temperature               | -65°C to +150°C  |

5. Exceeding any one or combination of these limits may cause permanent damage to this device.
6. MACOM does not recommend sustained operation near these survivability limits.
7. 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 HBM Class 1B devices.

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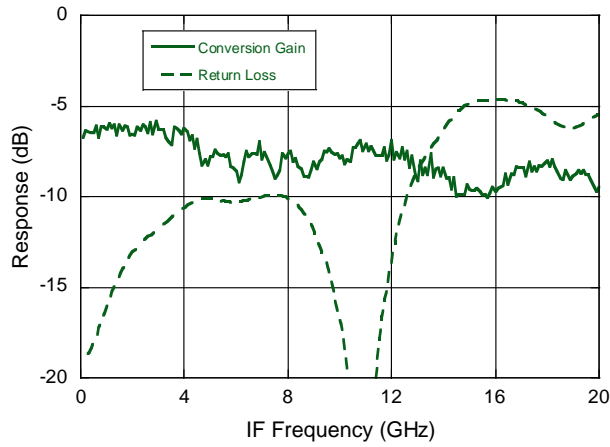
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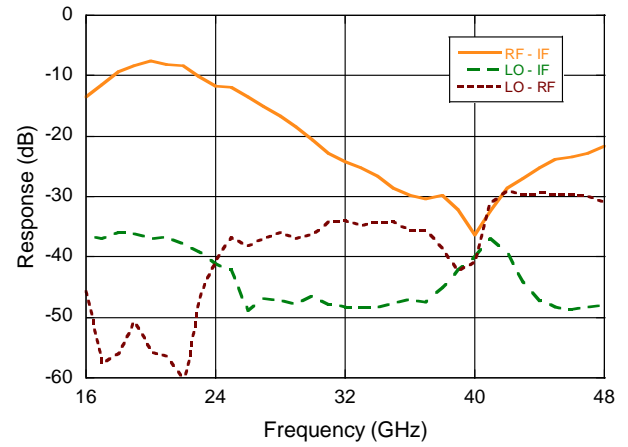
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Typical Performance Curves,  $P_{LO} = +15 \text{ dBm}$ ,  $T_A = 25^\circ\text{C}$

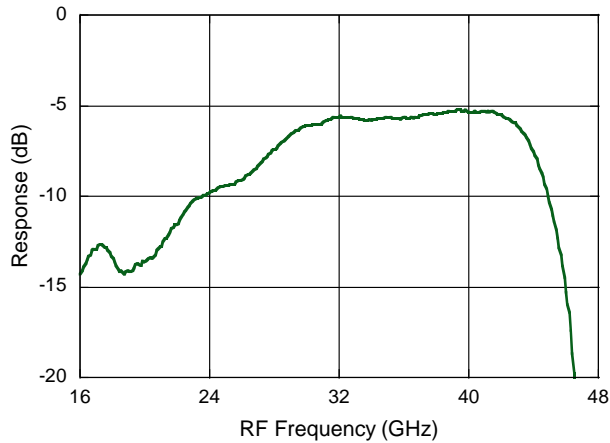
**IF Bandwidth & Return Loss**



**Isolation**



**RF Return Loss**

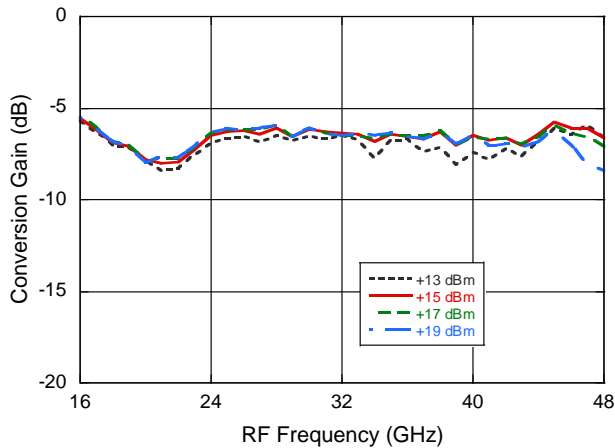


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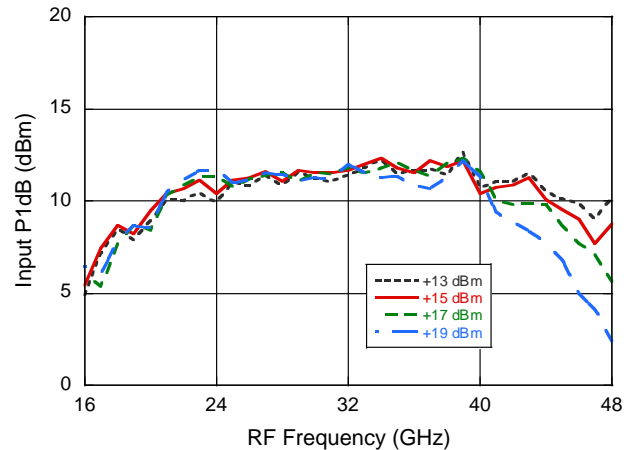
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### Typical Performance Curves vs. LO Power, $T_A = 25^\circ\text{C}$

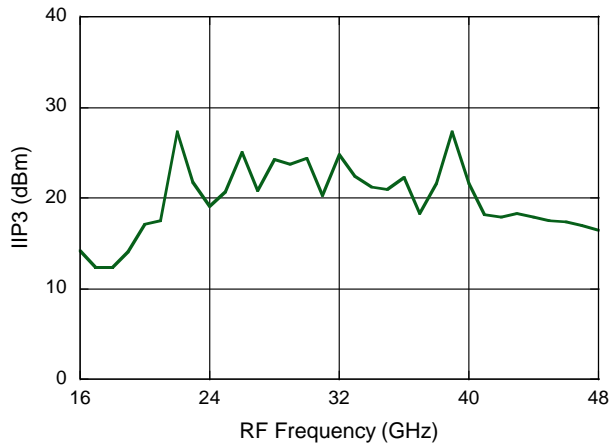
**Conversion Gain**



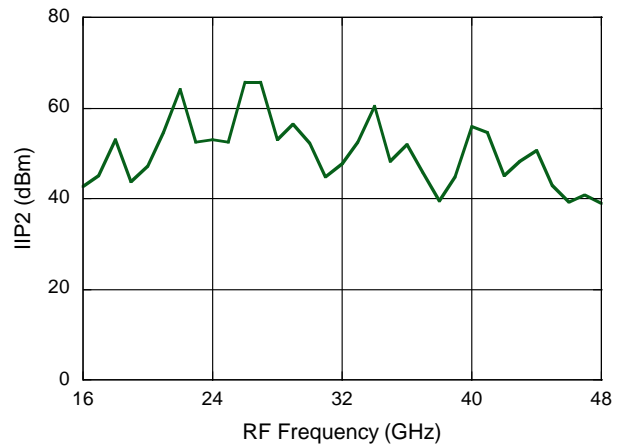
**Input P1dB**



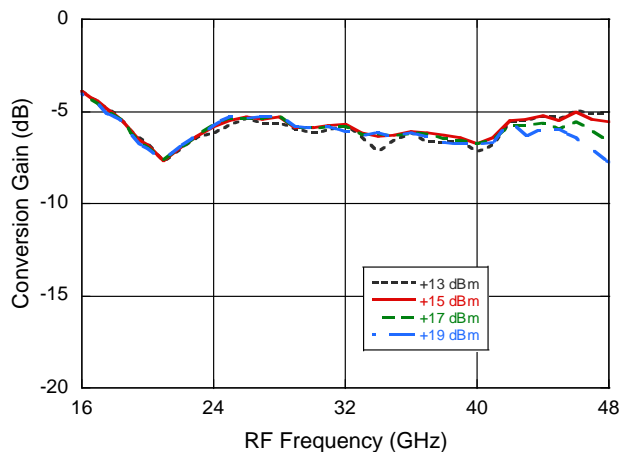
**Input IP3 at  $P_{LO} = +15$  dBm**



**Input IP2 at  $P_{LO} = +15$  dBm**



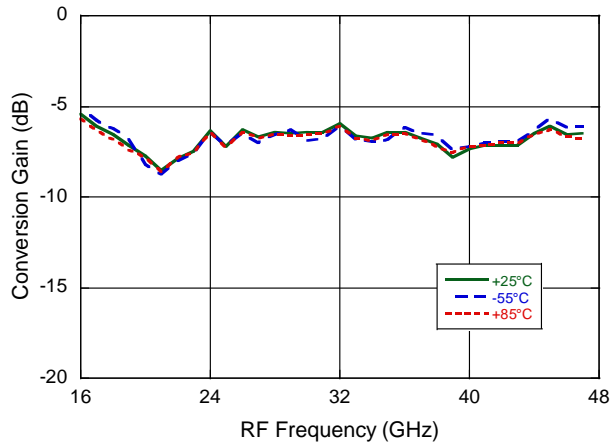
**Up Conversion Gain**



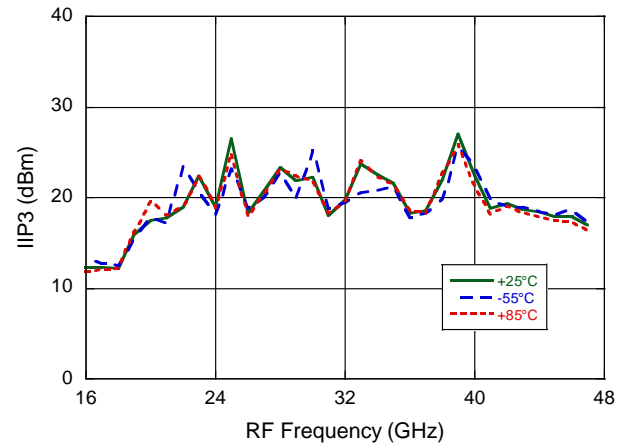
All performance curves refer to down-conversion operation, unless otherwise noted.  
Two-tone input power = -10 dBm each tone, 1 MHz spacing.

**Typical Performance Curves vs. Temperature,  $P_{LO} = +15$  dBm**

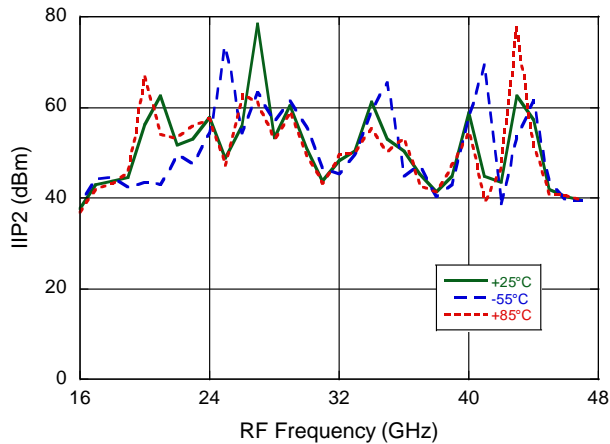
**Conversion Gain**



**Input IP3**



**Input IP2**



All performance curves refer to down-conversion operation, unless otherwise noted.  
Two-tone input power = -10 dBm each tone, 1 MHz spacing.

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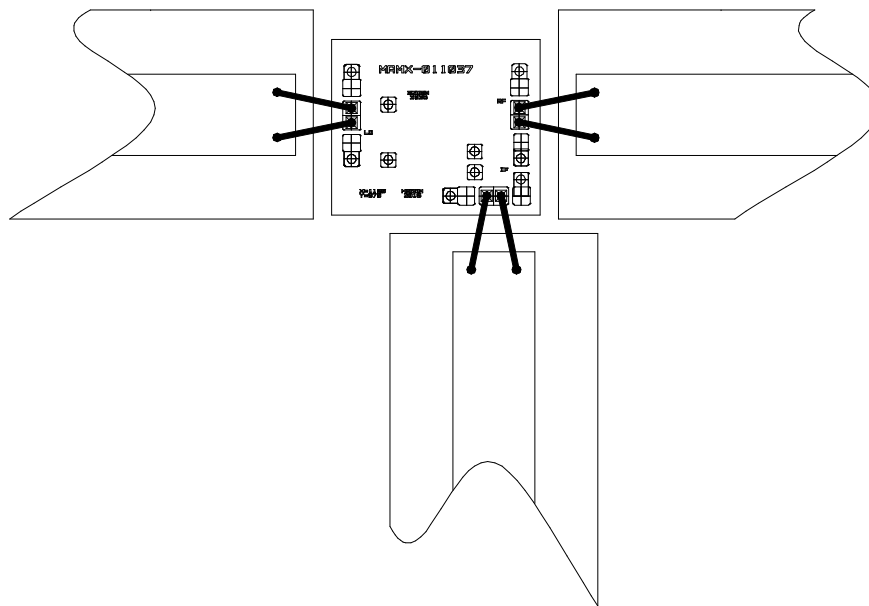
### MxN Spurious Rejection @ IF Port (dBc IF)

RF = 24 GHz @ -10 dBm

LO = 25 GHz @ +15 dBm

| MxRF | NxLO |    |    |    |    |
|------|------|----|----|----|----|
|      | 0    | 1  | 2  | 3  | 4  |
| 0    | x    | 14 | 24 | x  | x  |
| 1    | 4    | 0  | 22 | x  | x  |
| 2    | 75   | 61 | 67 | 66 | x  |
| 3    | x    | 86 | 66 | 71 | 75 |
| 4    | x    | x  | 88 | 99 | 95 |

### 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 GND pads.

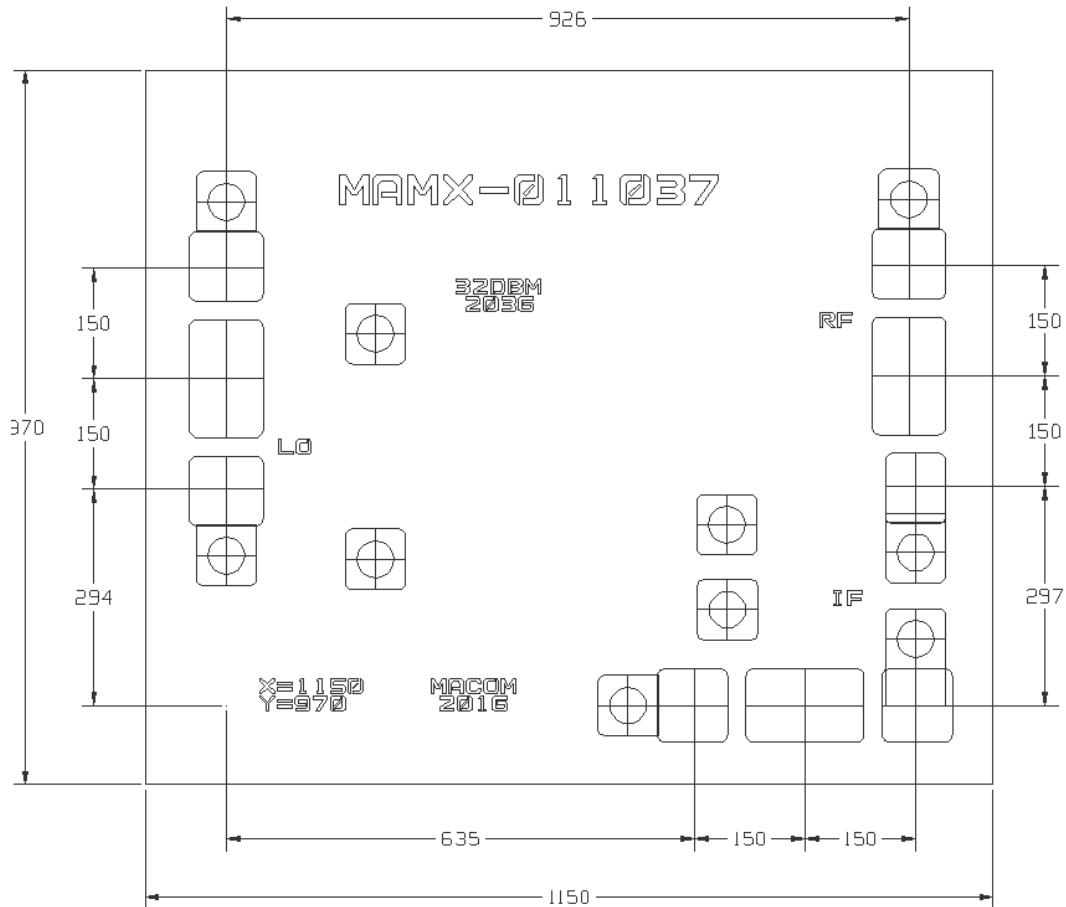
# MAMX-011037-DIE



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## Outline Drawing



### Notes:

Units are in microns with a tolerance of  $\pm 5 \mu\text{m}$ , except for die exterior dimensions which are street-center-to-street-center – nominal kerf,  $\pm 20 \mu\text{m}$  tolerance.

Die thickness is  $100 \pm 10 \mu\text{m}$ .

RF, LO and IF Bond-pads are  $160 \times 100 \mu\text{m}$ .

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