

# Double-Balanced Mixer

## 18 - 46 GHz



MAMX-011054

Rev. V4

### 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

### Applications

- Test & Measurement,
- Microwave Radio
- Radar

### 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.

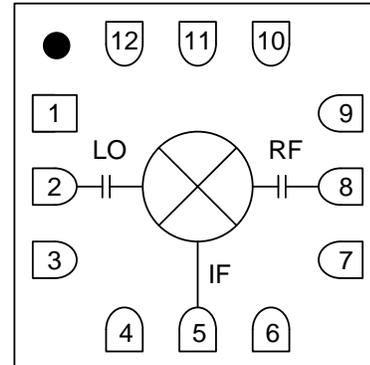
MAMX-011054 is also available in die form. Refer to datasheet MAMX-011037-DIE.

### 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.

# Double-Balanced Mixer

## 18 - 46 GHz



MAMX-011054

Rev. V4

### 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	$P_{RF} = -10 \text{ dBm/tone}$ , $\Delta f = 1 \text{ MHz}$	dBm	—	20	—	
				18 - 24 GHz	21	—
				24 - 40 GHz	19	—
				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.

# Double-Balanced Mixer

## 18 - 46 GHz

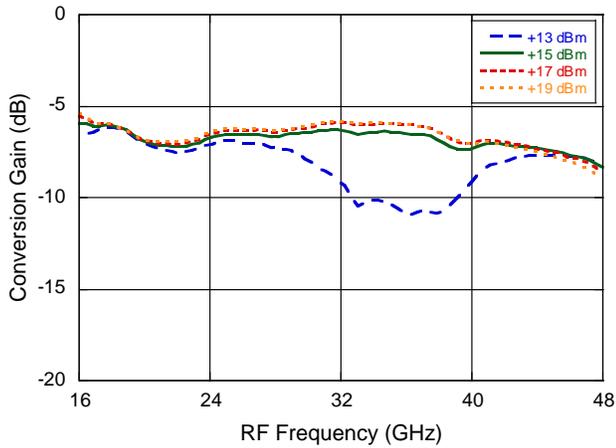


MAMX-011054

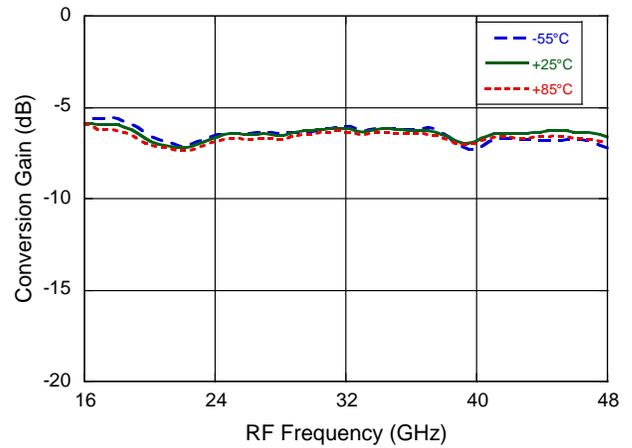
Rev. V4

### Typical Performance Curves

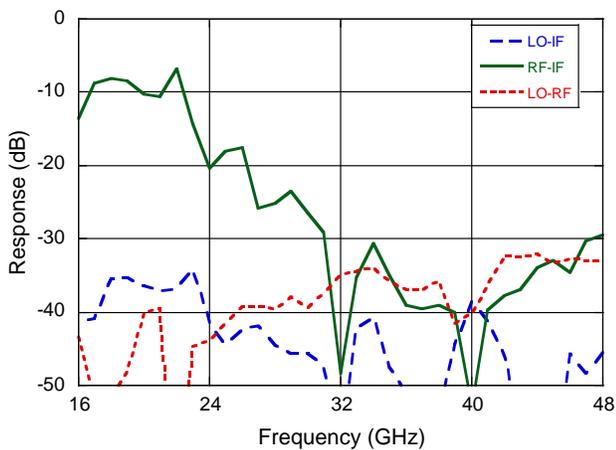
**Conversion Gain vs. LO Drive**



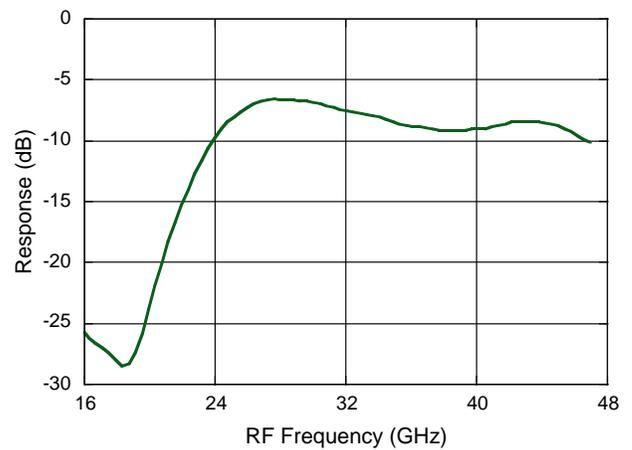
**Conversion Gain vs. Temperature**



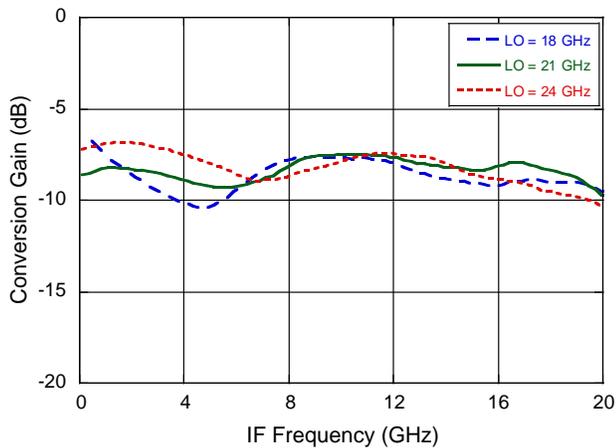
**Isolation**



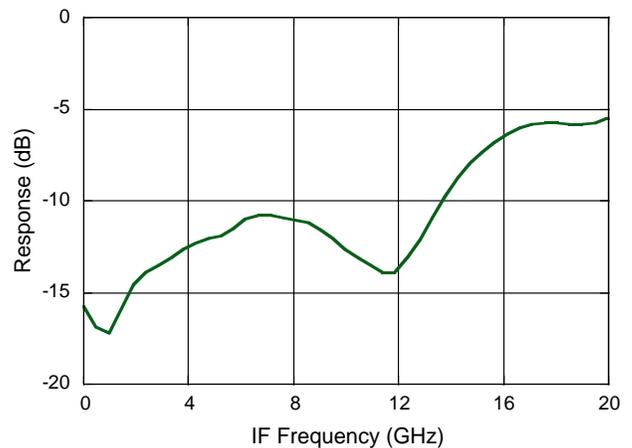
**RF Return Loss**



**IF Bandwidth**

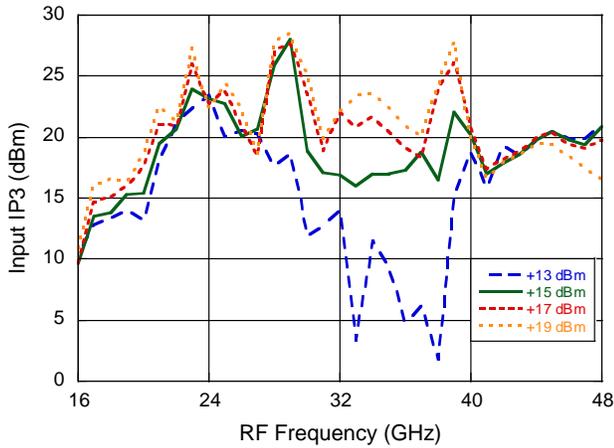


**IF Return Loss**

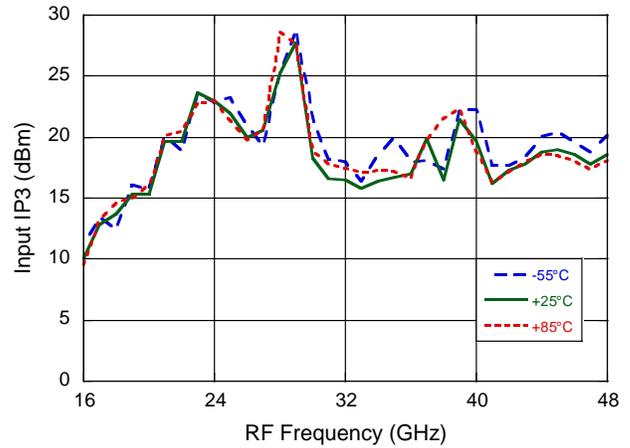


### Typical Performance Curves

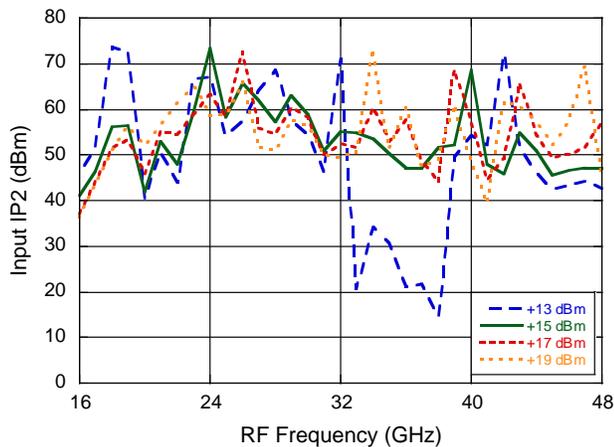
**Input IP3 vs. LO Drive**



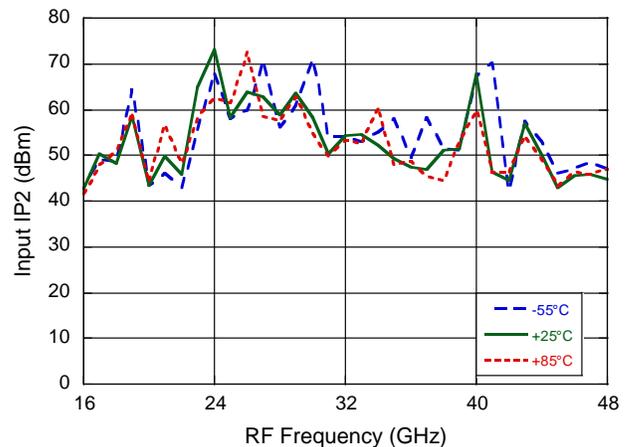
**Input IP3 vs. Temperature**



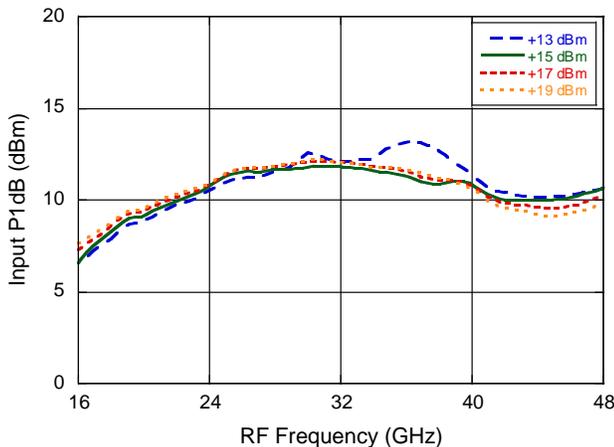
**Input IP2 vs. LO Drive**



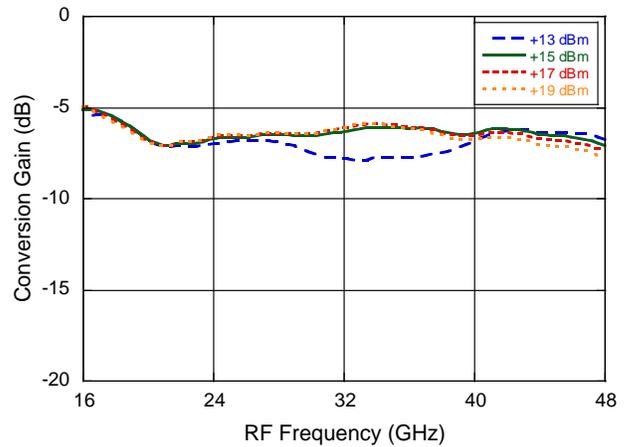
**Input IP2 vs. Temperature**



**Input P1dB vs. LO Drive**



**Up Conversion Gain vs. LO Drive**



# Double-Balanced Mixer

## 18 - 46 GHz



MAMX-011054

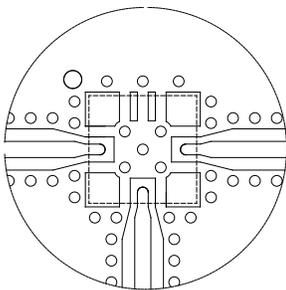
Rev. V4

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

RF = 24 GHz at -10 dBm  
LO = 25 GHz at +15 dBm

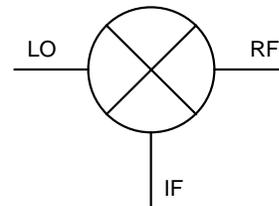
MxRF	NxLO				
	0	1	2	3	4
0	x	7	34	x	x
1	4	0	23	x	x
2	56	59	61	67	x
3	x	56	70	78	67
4	x	x	57	69	74

### PCB Layout



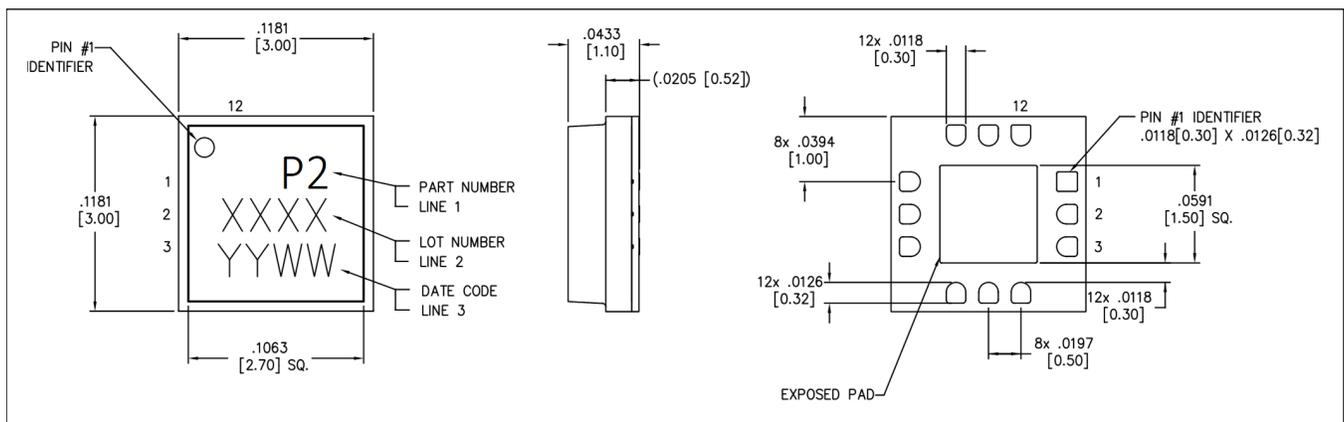
DXF available on request based on 10 mil RO4350 substrate.

### 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].

# Double-Balanced Mixer

## 18 - 46 GHz



MAMX-011054

Rev. V4

MACOM Technology Solutions Inc. ("MACOM"). All rights reserved.

These materials are provided in connection with MACOM's products as a service to its customers and may be used for informational purposes only. Except as provided in its Terms and Conditions of Sale or any separate agreement, MACOM assumes no liability or responsibility whatsoever, including for (i) errors or omissions in these materials; (ii) failure to update these materials; or (iii) conflicts or incompatibilities arising from future changes to specifications and product descriptions, which MACOM may make at any time, without notice. These materials grant no license, express or implied, to any intellectual property rights.

THESE MATERIALS ARE PROVIDED "AS IS" WITH NO WARRANTY OR LIABILITY, EXPRESS OR IMPLIED, RELATING TO SALE AND/OR USE OF MACOM PRODUCTS INCLUDING FITNESS FOR A PARTICULAR PURPOSE, MERCHANTABILITY, INFRINGEMENT OF INTELLECTUAL PROPERTY RIGHT, ACCURACY OR COMPLETENESS, OR SPECIAL, INDIRECT, INCIDENTAL, OR CONSEQUENTIAL DAMAGES WHICH MAY RESULT FROM USE OF THESE MATERIALS.

MACOM products are not intended for use in medical, lifesaving or life sustaining applications. MACOM customers using or selling MACOM products for use in such applications do so at their own risk and agree to fully indemnify MACOM for any damages resulting from such improper use or sale.