

# Double Balanced Mixer

## 17 - 53 GHz



MAMX-011122

Rev. V3

### Features

- Passive Mixer - No Bias Required
- Low Conversion Loss: 8 dB
- Nominal LO drive of +15 dBm
- 20 dBm IIP3
- 40 dB LO to IF Isolation
- Wide IF Bandwidth: DC to 20 GHz
- 3 mm 12-Lead AQFN
- RoHS\* Compliant

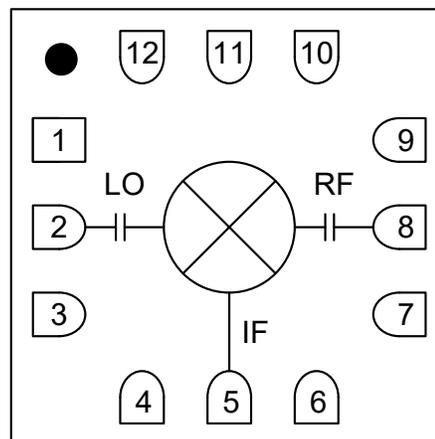
### Applications

- Test & Measurement
- Microwave Radio
- Radar

### Description

MAMX-011122 is a double balanced mixer MMIC. The mixer offers wide bandwidth, low conversion loss and high linearity.

### Functional Schematic



### Pin Configuration

Pin #	Function
1,3,4,6,7,9	GND
2	LO
5	IF
8	RF
10 - 12	NC <sup>3</sup>
13	GND <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.

### Ordering Information

Part Number	Package
MAMX-011122	Bulk
MAMX-011122-TR0100	100 Piece Reel <sup>1</sup>
MAMX-011122-TR0500	500 Piece Reel <sup>1</sup>
MAMX-011122-SMB	Sample Board <sup>2</sup>

1. Reference Application Note M513 for reel size information.
2. All sample boards include 3 loose parts.

\* 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	17	—	53
IF Frequency	—	GHz	0	—	20
LO Power	—	dBm	—	15	—
Conversion Loss	17 - 50 GHz 50 - 53 GHz	dB	—	8 10	12 —
Input P1dB	17 - 53 GHz	dBm	—	9	—
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	—	40	—
Isolation LO-to-RF	17 - 53 GHz	dB	—	40	—
Isolation LO-to-IF	17 - 53 GHz	dB	—	40	—
Isolation RF-to-IF	17 - 30 GHz 30 - 53 GHz	dB	—	25 40	—
RF Return Loss	RF = 41 GHz	dB	—	6	—
LO Return Loss	LO = 41 GHz	dB	—	8	—
IF Return Loss	IF = 1 GHz	dB	—	12	—

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
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.

### Maximum Operating Condition

Parameter	Maximum
LO Power	19 dBm
Junction Temperature <sup>8</sup>	+150°C
Operating Temperature	-40°C to +85°C

8. Operating at nominal conditions with  $T_J \leq +150^\circ\text{C}$  will ensure  $MTTF > 1 \times 10^6$  hours. Thermal resistance,  $\Theta_{JC}$  is TBD° C/W.

### 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. The ESD JEDEC classification is Class 1B HBM.

# Double Balanced Mixer

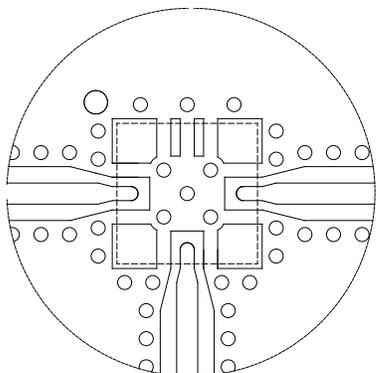
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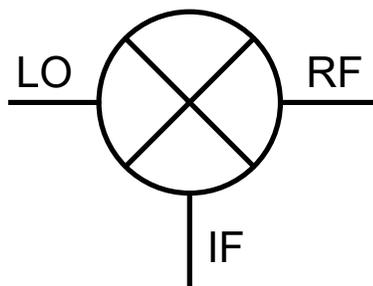
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### PCB Layout



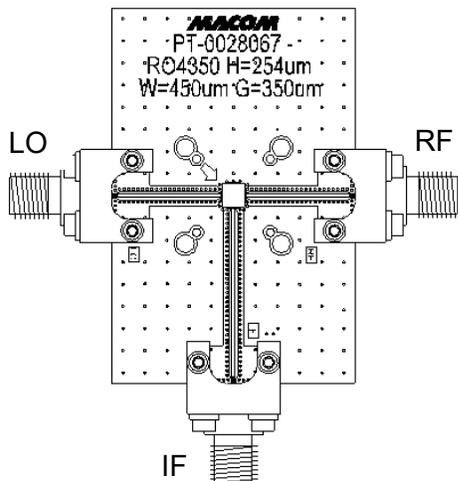
DXF available on request based on 10 mil RO4350 substrate.

### Application Schematic

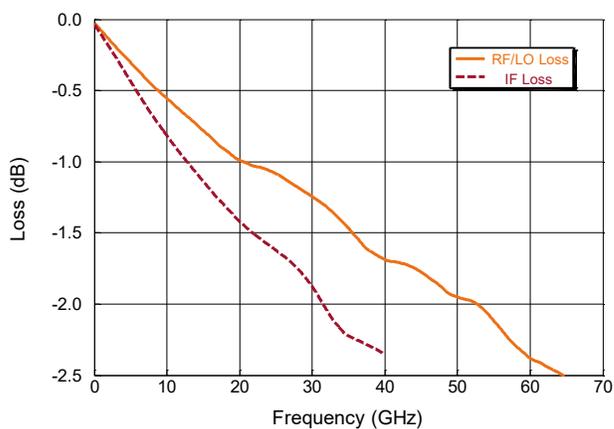


No external parts required for operation of MAMX-011088.

### Evaluation Board



### Evaluation Board Losses



# Double Balanced Mixer

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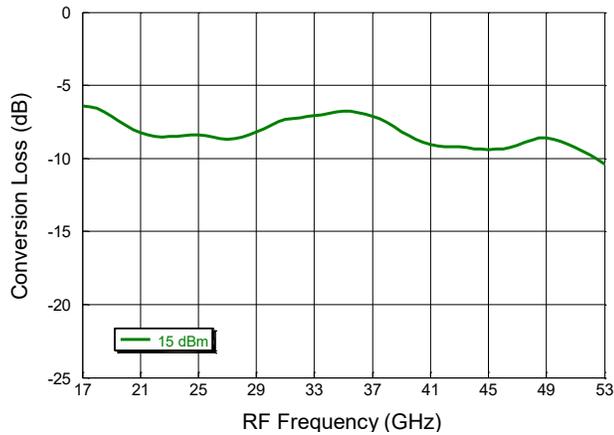


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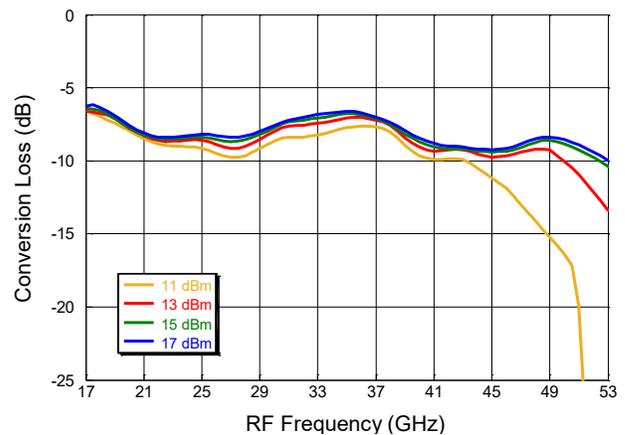
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Typical Performance Curves: Down Conversion Mode, Upper Side Band (USB), Low Side LO @ 25°C. IF = 1 GHz

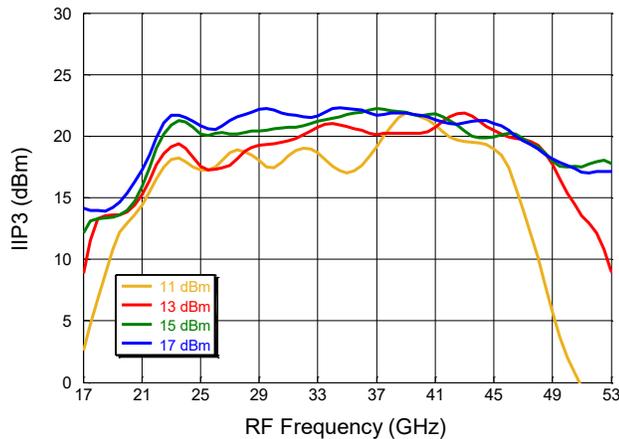
Conversion Loss vs. Frequency



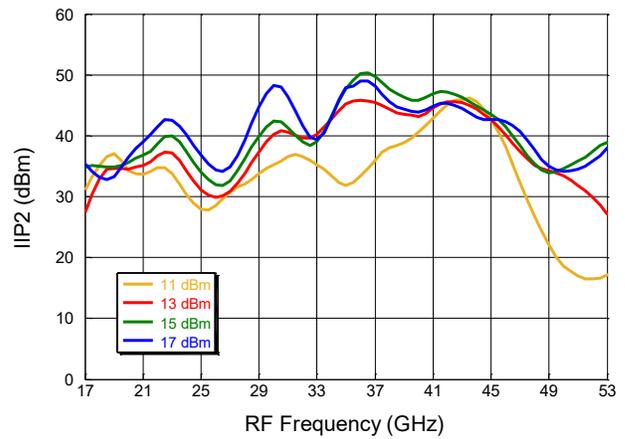
Conversion Loss over LO Drive



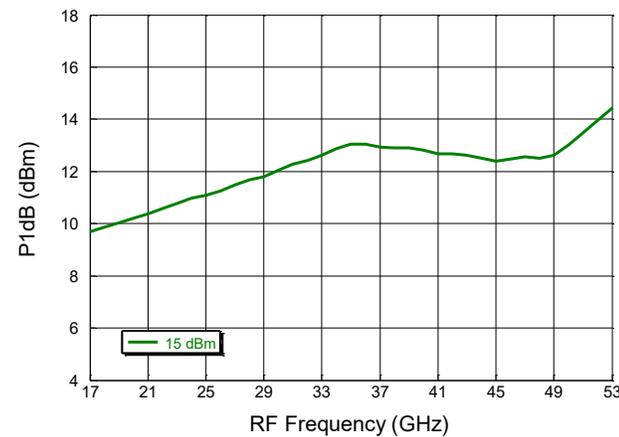
IIP3 over LO Drive vs. RF Frequency



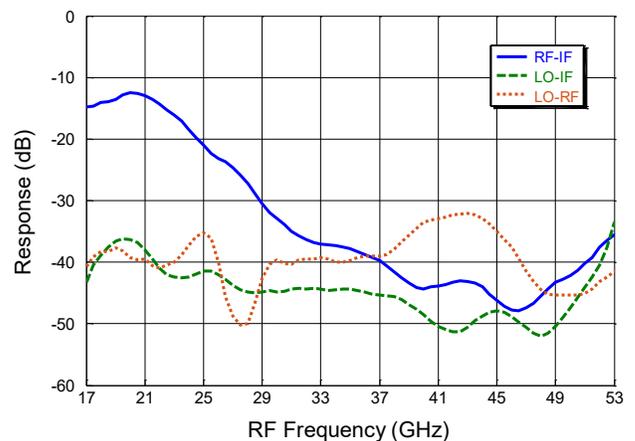
IIP2 over LO Drive vs. RF Frequency



P1dB vs. RF Frequency



Isolations vs. RF Frequency



# Double Balanced Mixer

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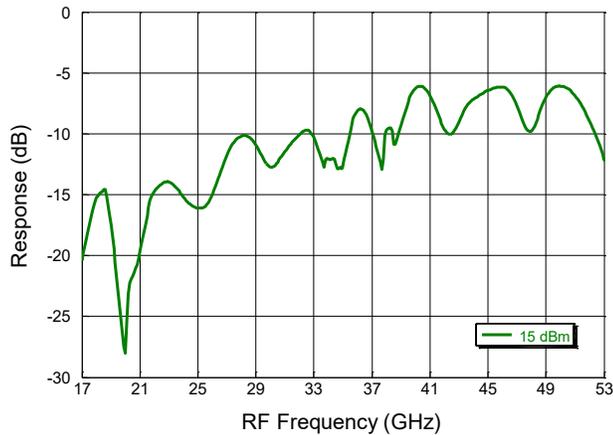


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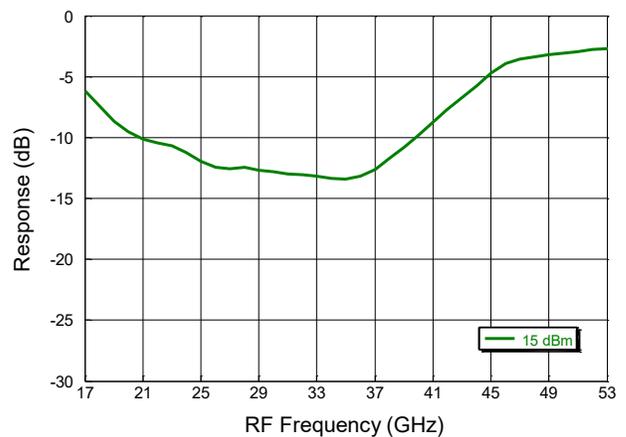
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### Typical Performance Curves: Down Conversion Mode, Upper Side Band (USB), Low Side LO @ 25°C. IF = 1 GHz

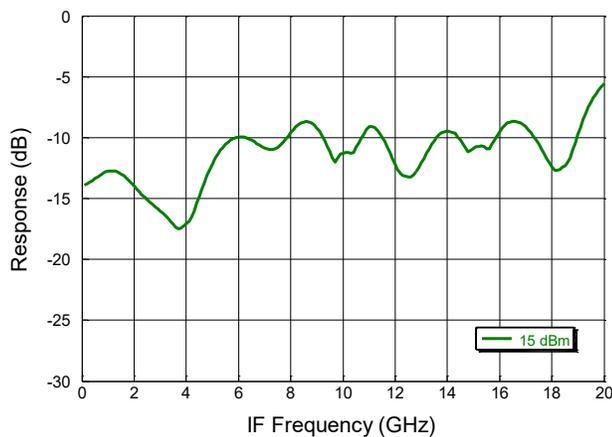
**RF Return Loss vs. RF Frequency**



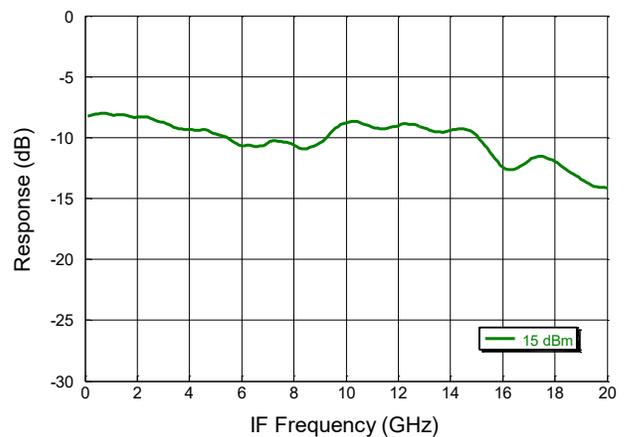
**LO Return Loss vs. RF Frequency**



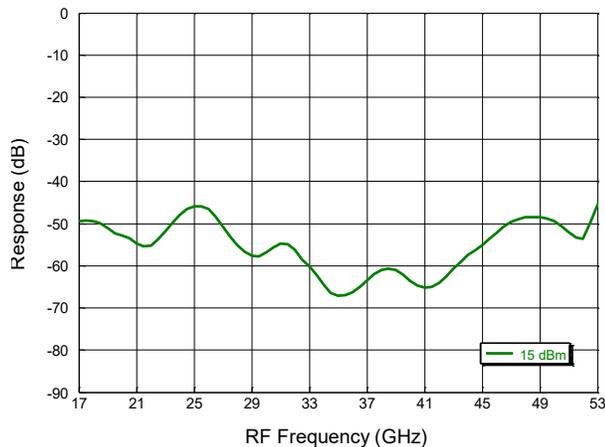
**IF Return Loss vs. IF Frequency**



**IF Bandwidth vs. IF Frequency**



**2RF x 2LO Spurious Suppression**



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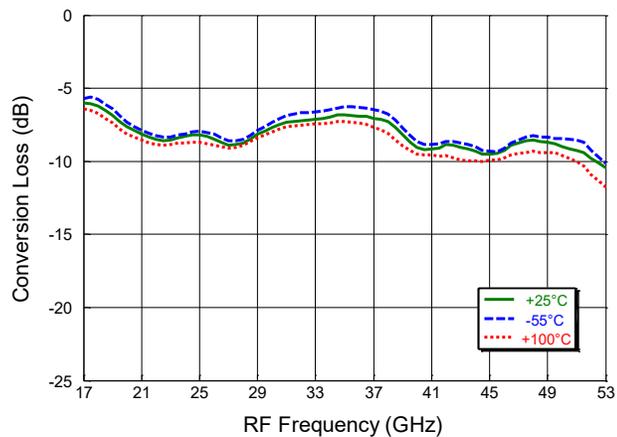


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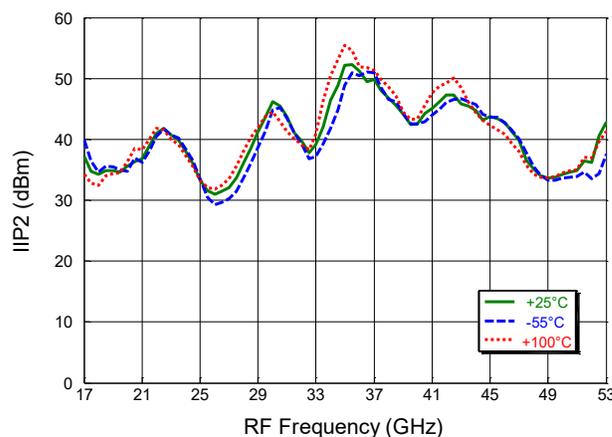
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### Typical Performance Curves: Down Conversion Mode, Upper Side Band (USB), Over Temperature. IF = 1 GHz

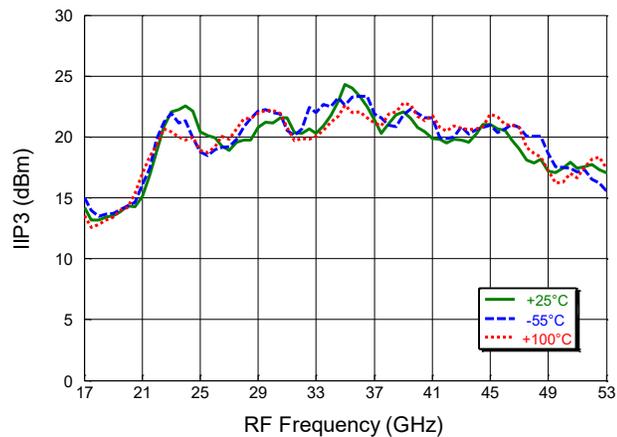
Conversion Loss over Temperature @  $P_{LO} = 15$  dBm



IIP2 over Temperature @  $P_{LO} = 15$  dBm



IIP3 over Temperature @  $P_{LO} = 15$  dBm



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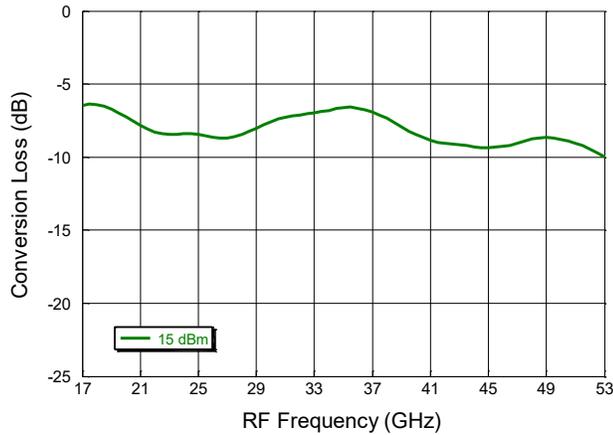


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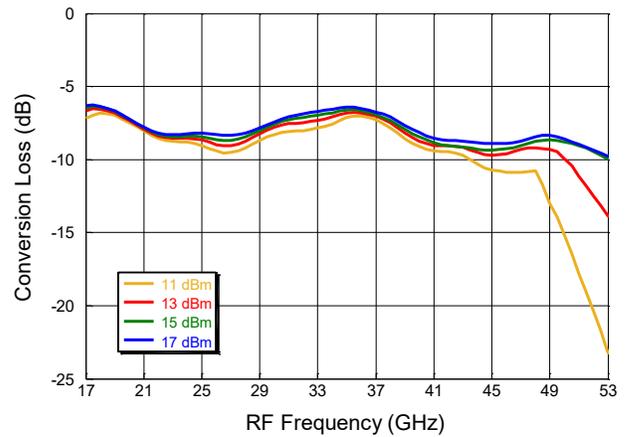
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### Typical Performance Curves: Down Conversion Mode, Upper Side Band (USB), Low Side LO @ 25°C. IF = 100 MHz

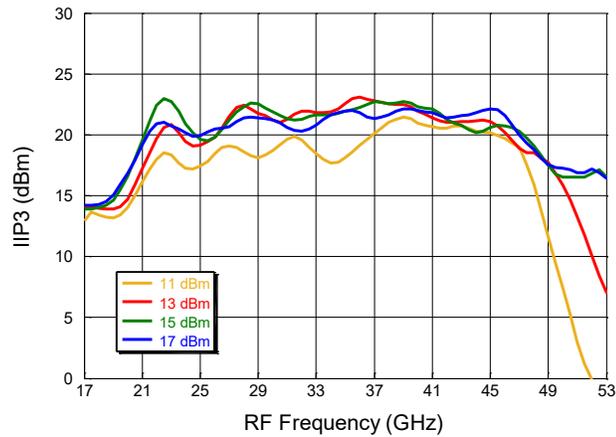
Conversion Loss vs. Frequency



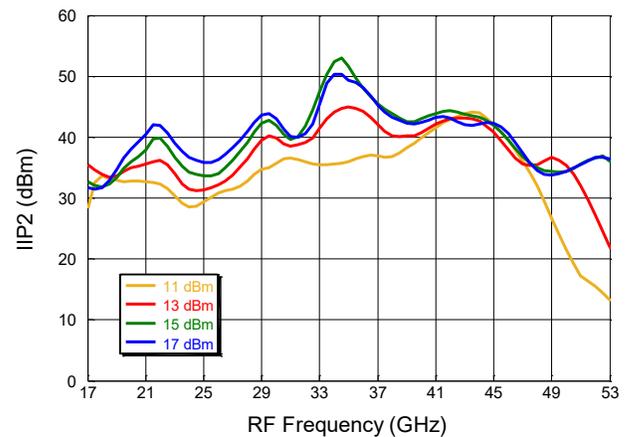
Conversion Loss over LO Drive



IIP3 over LO Drive vs. RF Frequency



IIP2 over LO Drive vs. RF Frequency



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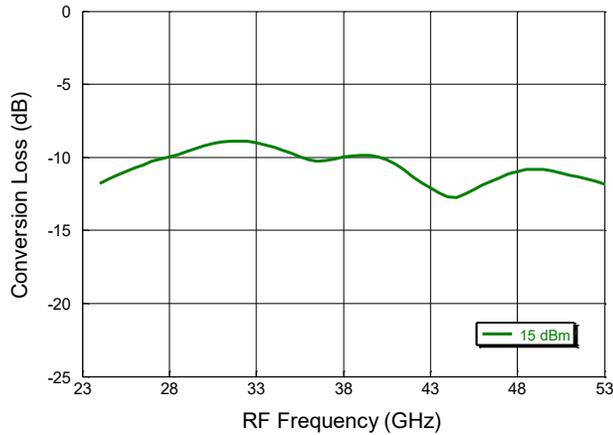


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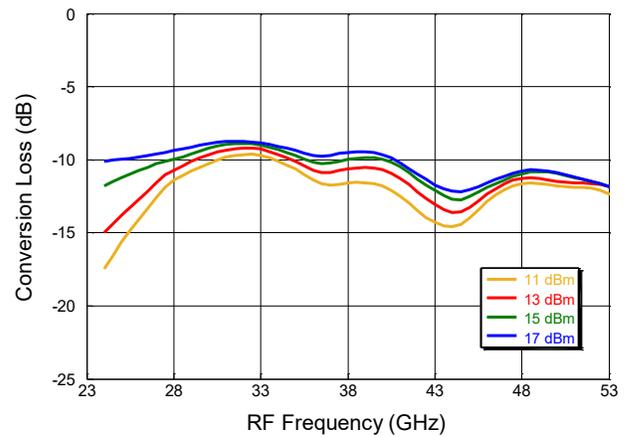
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Typical Performance Curves: Down Conversion Mode, Upper Side Band (USB),  
Low Side LO @ 25°C. IF = 10 GHz

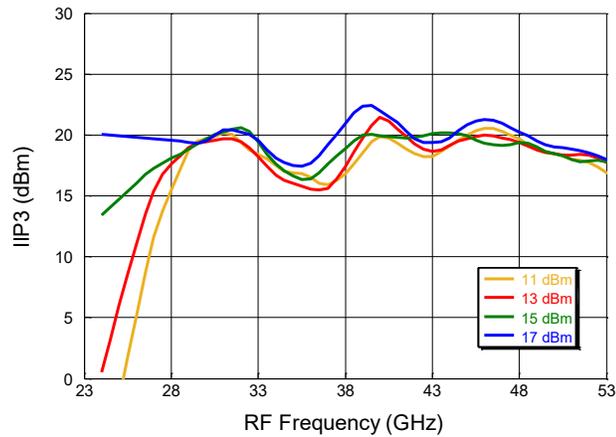
Conversion Loss vs. Frequency



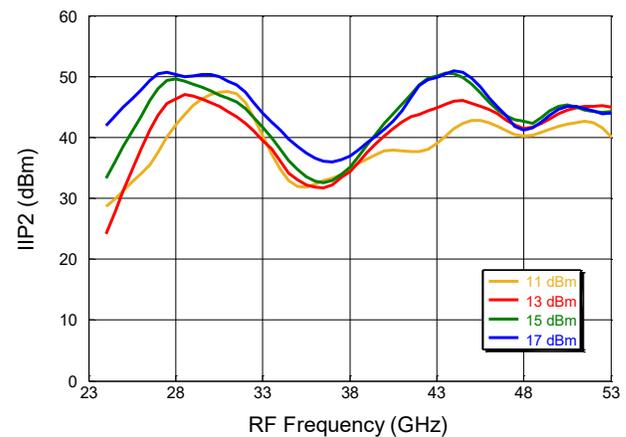
Conversion Loss over LO Drive



IIP3 over LO Drive vs. RF Frequency



IIP2 over LO Drive vs. RF Frequency



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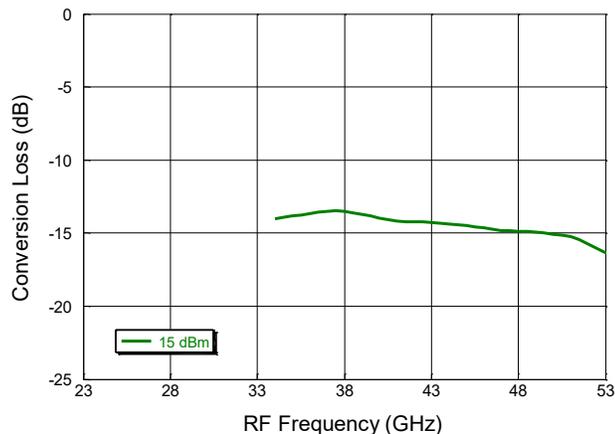


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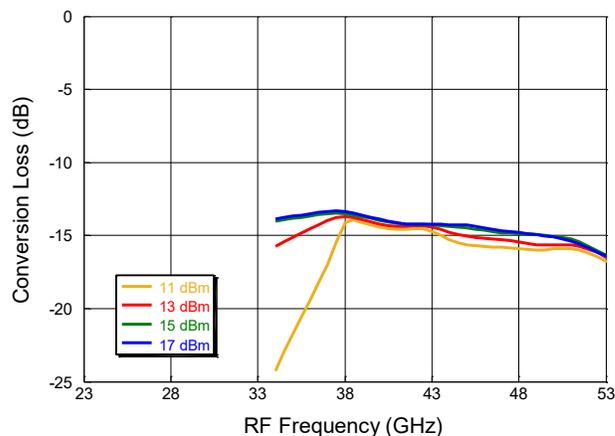
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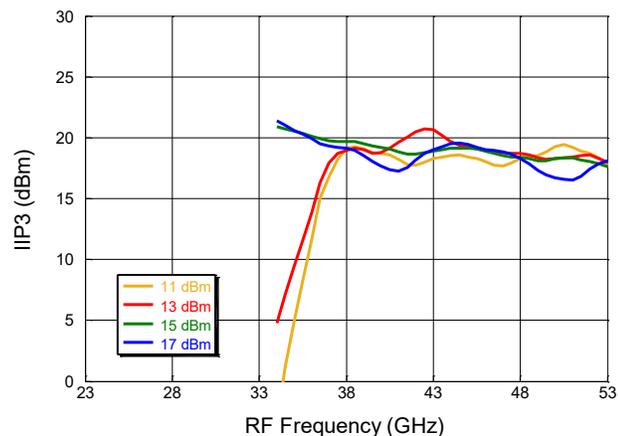
Conversion Loss vs. Frequency



Conversion Loss over LO Drive



IIP3 over LO Drive vs. RF Frequency



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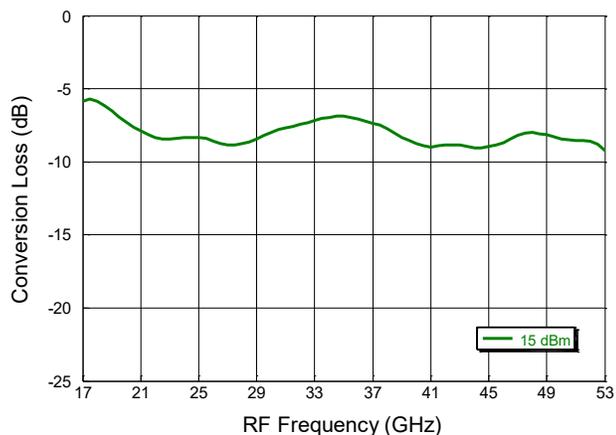


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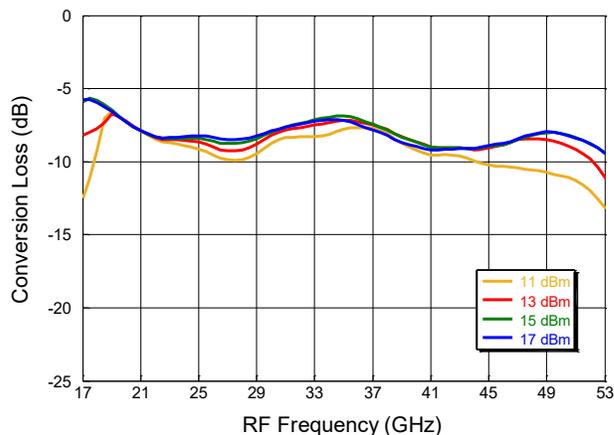
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Typical Performance Curves: Up Conversion Mode, Upper Side Band (USB),  
Low Side LO @ 25°C. IF = 1 GHz

Conversion Loss vs. Frequency



Conversion Loss over LO Drive



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

RF = 25 GHz @ -15 dBm

LO = 24 GHz @ +15 dBm

mxRF	nxLO				
	0	1	2	3	4
0	X	5	16	X	X
1	14	0	12	48	X
2	X	66	46	54	X
3	X	X	84	55	71
4	X	X	X	X	X

RF = 35 GHz @ -15 dBm

LO = 34 GHz @ +15 dBm

mxRF	nxLO				
	0	1	2	3	4
0	X	7	X	X	X
1	30	0	38	X	X
2	X	85	71	77	X
3	X	X	X	86	90
4	X	X	X	X	X

RF = 45 GHz @ -15 dBm

LO = 44 GHz @ +15 dBm

mxRF	nxLO				
	0	1	2	3	4
0	X	6	X	X	X
1	35	0	51	X	X
2	X	82	56	80	X
3	X	X	X	81	X
4	X	X	X	X	X

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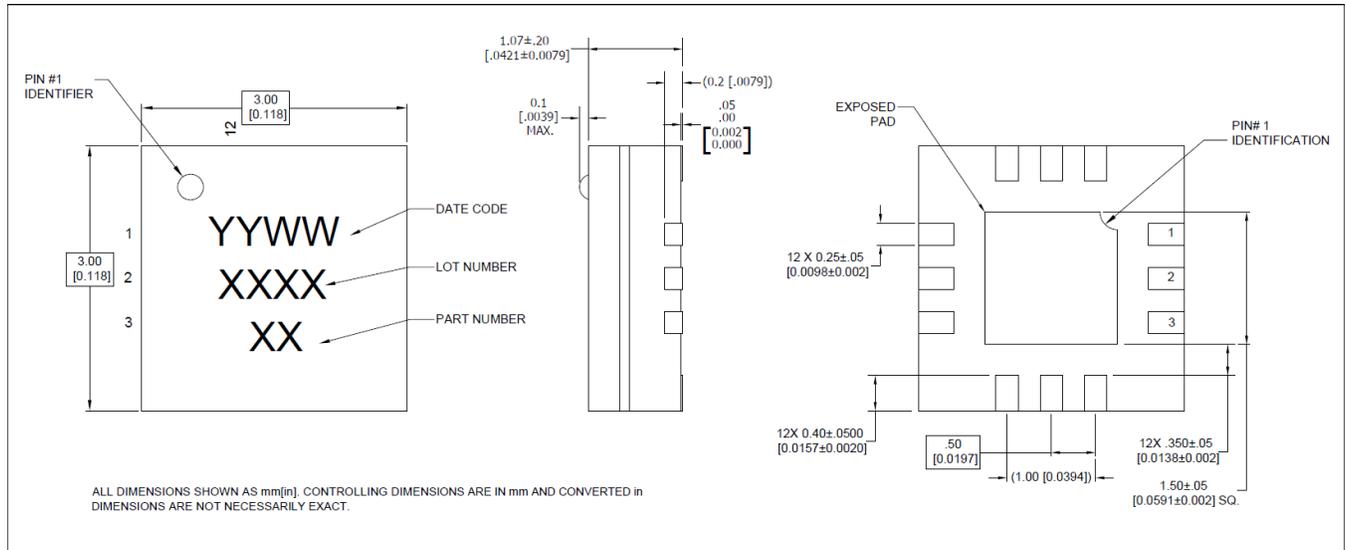
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### Lead-Free 3 mm 12-Lead QFN<sup>†</sup>



<sup>†</sup> Reference Application Note S2083 for lead-free solder reflow recommendations.  
 Meets JEDEC moisture sensitivity level 1 requirements.  
 Plating is 100% matte tin over copper.

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