

# Double Balanced Mixer

## 17 - 55 GHz



**MAMX-011088**  
Rev. V2

### Features

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

### Applications

- Test & Measurement
- Microwave Radio
- Radar
- SATCOM
- 5G

### Description

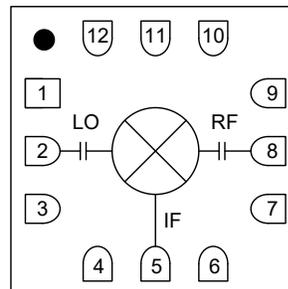
The MAMX-011088 is a high frequency double balanced mixer MMIC. This mixer offers wide bandwidth, low conversion loss and high linearity. The mixer can be used as an up and down convertor.

### Ordering Information

Part Number	Package
MAMX-011088	Bulk
MAMX-011088-TR0100	100 Piece Reel <sup>1</sup>
MAMX-011088-TR0500	500 Piece Reel <sup>1</sup>
MAMX-011088-SMB	Sample Board <sup>2</sup>

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

### 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.

\* Restrictions on Hazardous Substances, compliant to current RoHS EU directive.

### 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	—	55
IF Frequency	—	GHz	0	—	20
LO Power	—	dBm	—	15	—
Conversion Loss	17 - 50 GHz 50 - 55 GHz	dB	—	8 9	12 —
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	—	40	—
LO-to-RF Isolation	—	dB	—	35	—
LO-to-IF Isolation	—	dB	—	40	—
Isolation RF-to-IF	17 - 33 GHz 33 - 55 GHz	dB	—	25 40	—
RF Return Loss	—	dB	—	6	—
LO Return Loss	—	dB	—	8	—
IF Return Loss	—	dB	—	6	—

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	-40°C to +85°C
Storage Temperature	-65°C to +150°C

- Exceeding any one or combination of these limits may cause permanent damage to this device.
- MACOM does not recommend sustained operation near these survivability limits.
- 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. The ESD JEDEC classification is Class 1A HBM .

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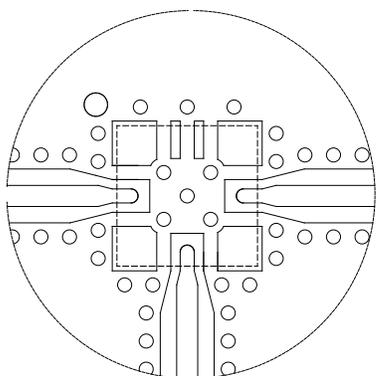
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### MxN Spurious Rejection at IF Port (dBc IF)

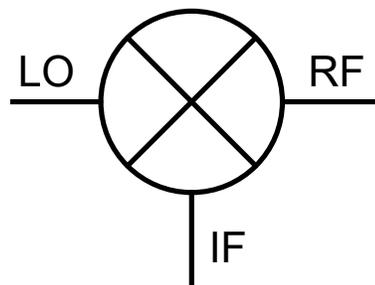
RF = 24 GHz @ -10 dBm  
LO = 23 GHz @ +15 dBm

mxRF	nxLO				
	0	1	2	3	4
0	X	5	28	X	X
1	14	0	20	47	X
2	X	80	60	71	X
3	X	X	93	80	82
4	X	X	X	X	X

### PCB Layout



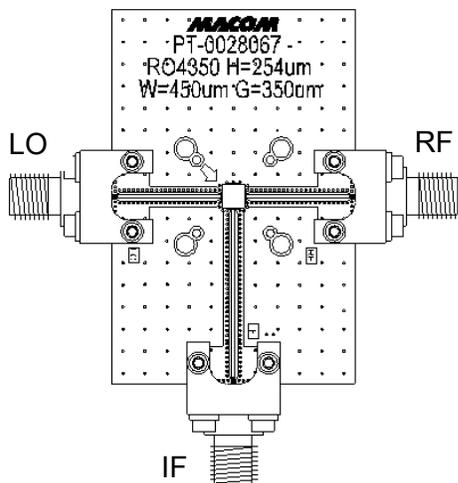
### Application Schematic



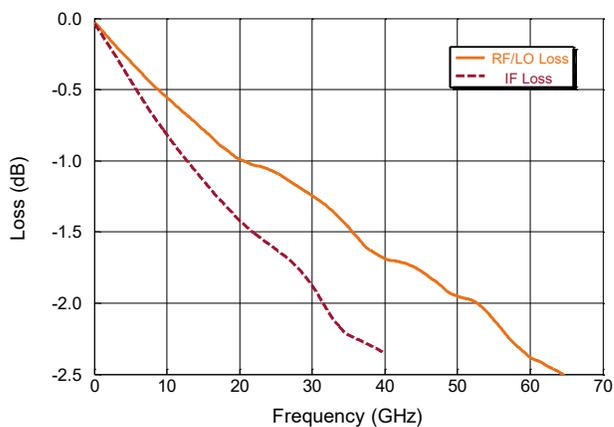
DXF available on request based on 10 mil RO4350 substrate.

No external parts required for operation of MAMX-011088.

### Evaluation Board



### Evaluation Board Losses



# Double Balanced Mixer

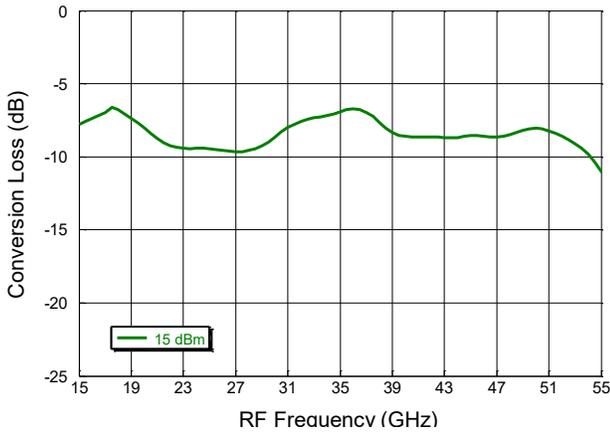
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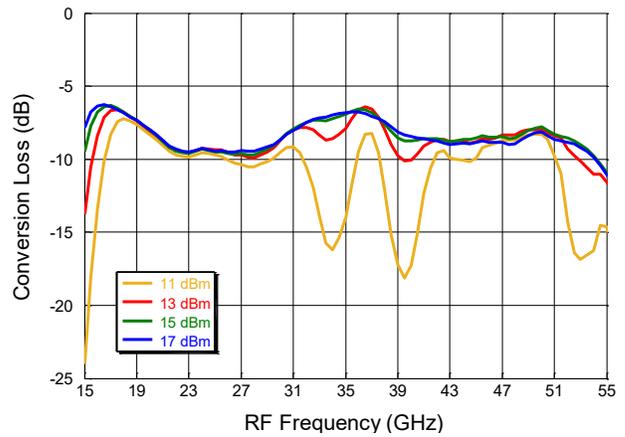
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### Typical Performance Curves: Down Conversion Mode, Upper Side Band (USB), Low Side LO @ 25°C. IF = 1 GHz

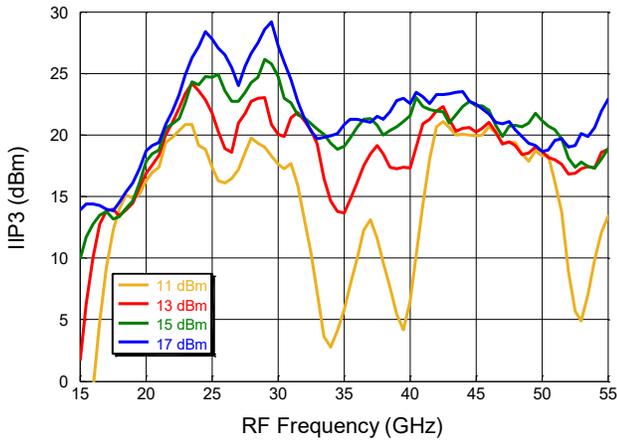
Conversion Loss vs. Frequency



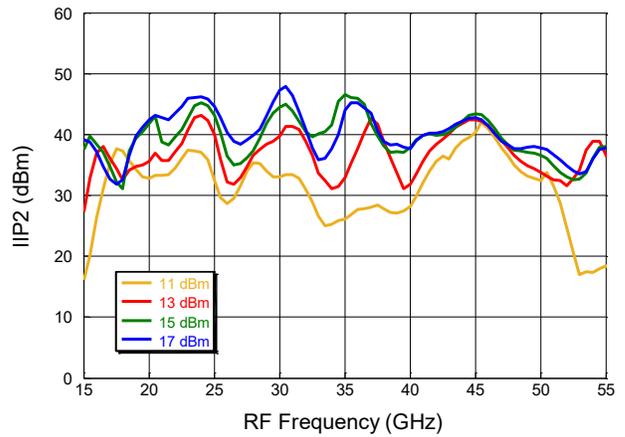
Conversion Loss over LO Drive



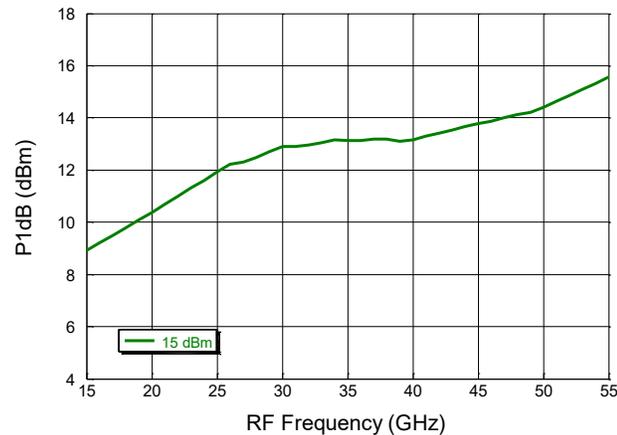
IIP3 over LO Drive vs. RF Frequency



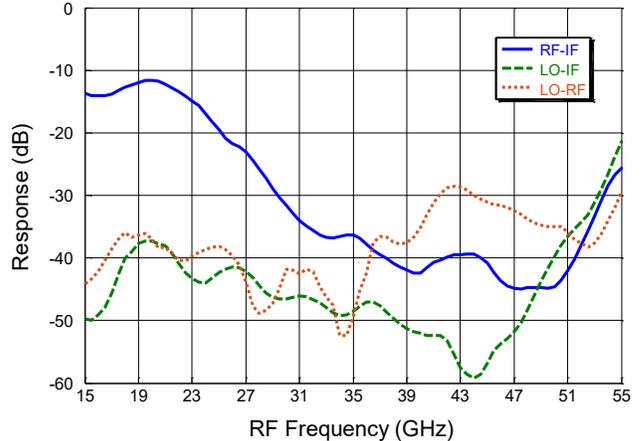
IIP2 over LO Drive vs. RF Frequency



P1dB vs. RF Frequency



Isolations vs. RF Frequency



# Double Balanced Mixer

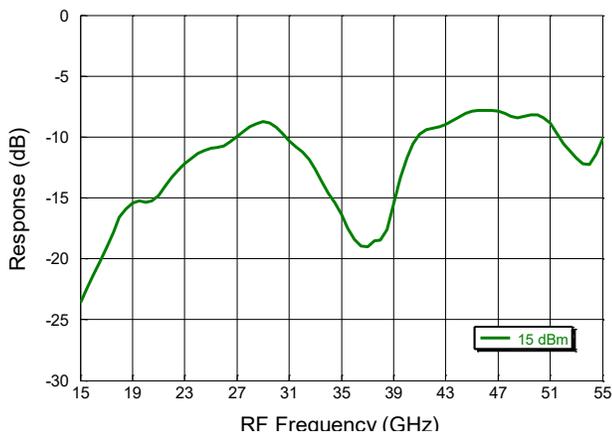
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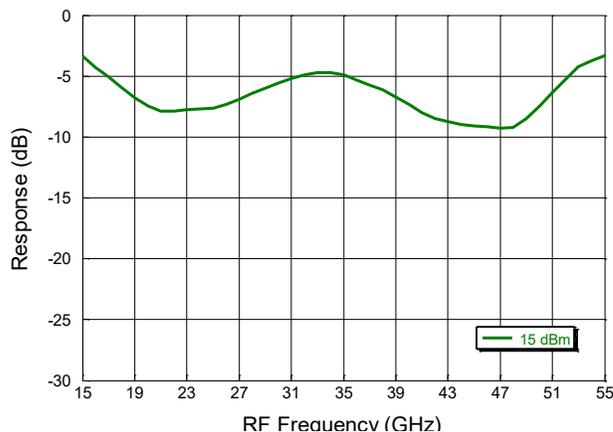
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### Typical Performance Curves: Down Conversion Mode, Upper Side Band (USB), Low Side LO @ 25°C. IF = 1 GHz

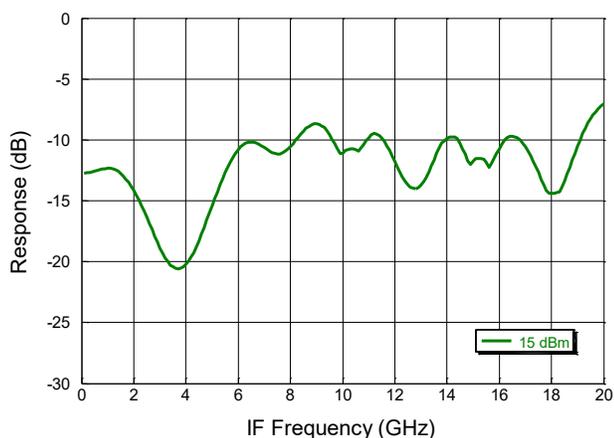
**RF Return Loss vs. RF Frequency**



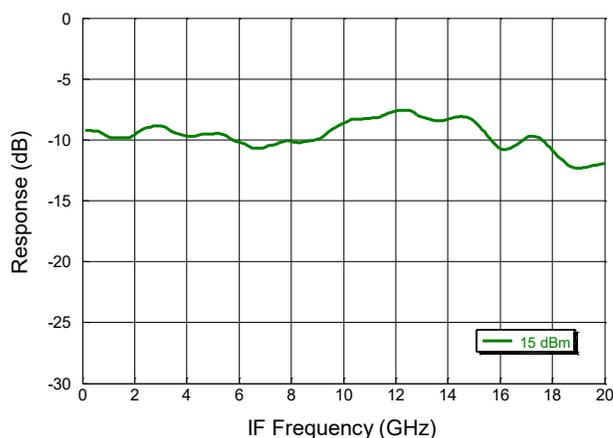
**LO Return Loss vs. RF Frequency**



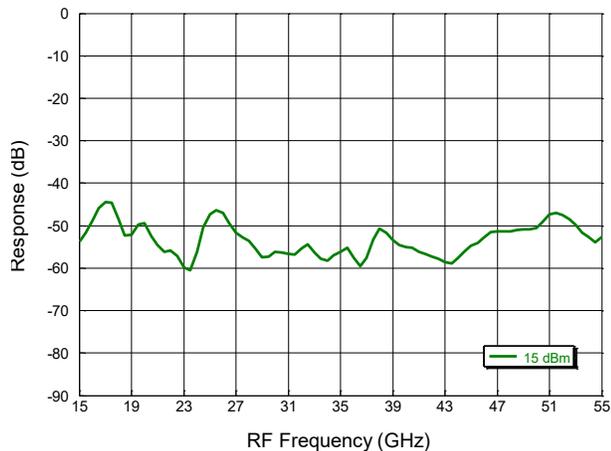
**IF Return Loss vs. IF Frequency**



**IF Bandwidth vs. IF Frequency**

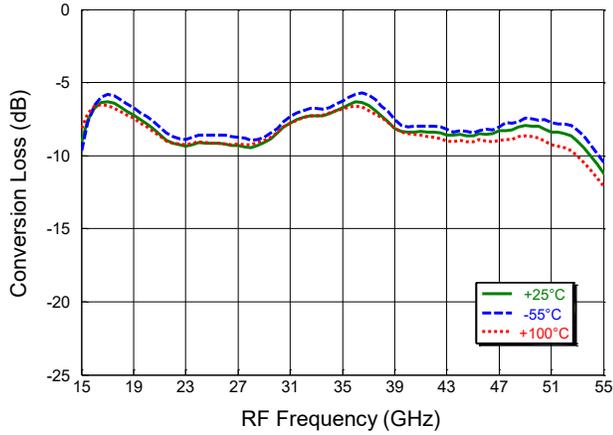


**2RF x 2LO Spurious Suppression**

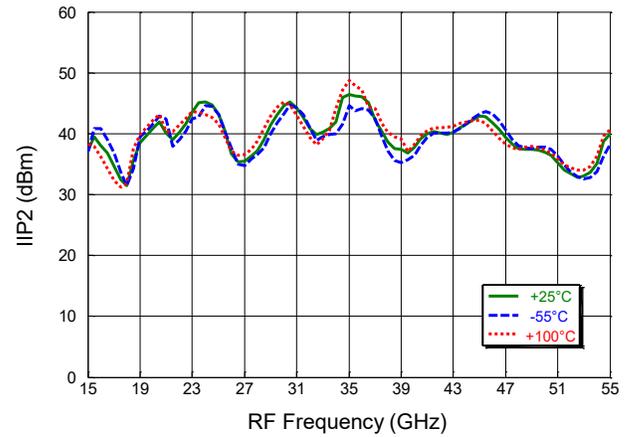


### Typical Performance Curves: Down Conversion Mode, Upper Side Band (USB), Over Temperature. IF = 1 GHz

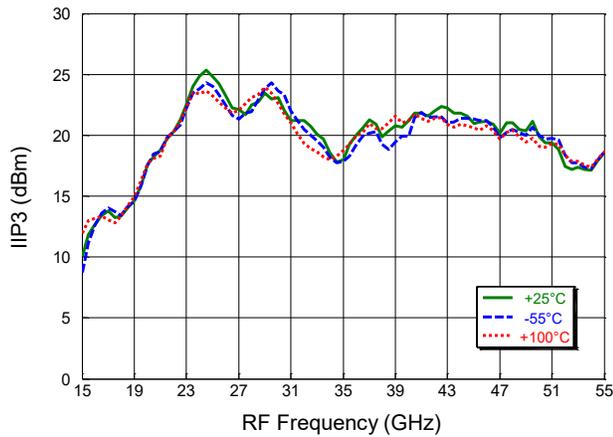
Conversion Loss over Temperature @  $P_{LO} = 15 \text{ dBm}$



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



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



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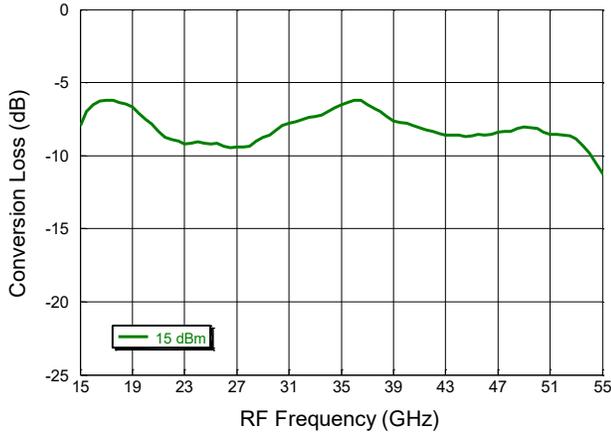
## 17 - 55 GHz



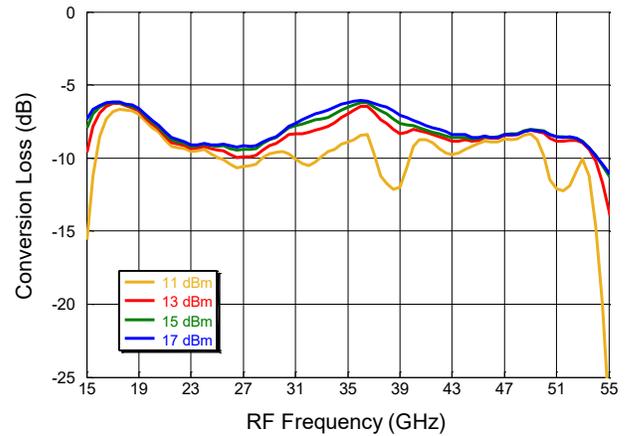
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### Typical Performance Curves: Down Conversion Mode, Upper Side Band (USB), Low Side LO @ 25°C. IF = 100 MHz

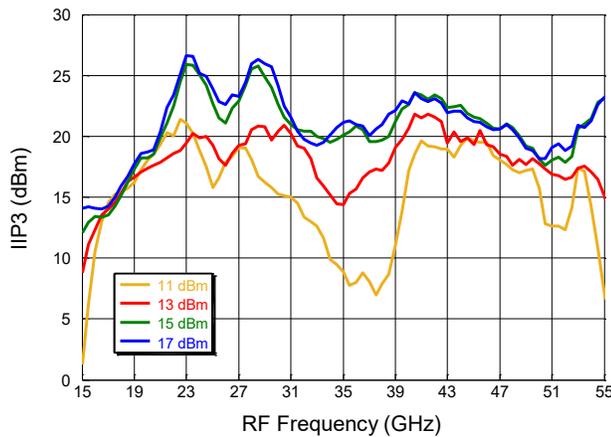
Conversion Loss vs. Frequency



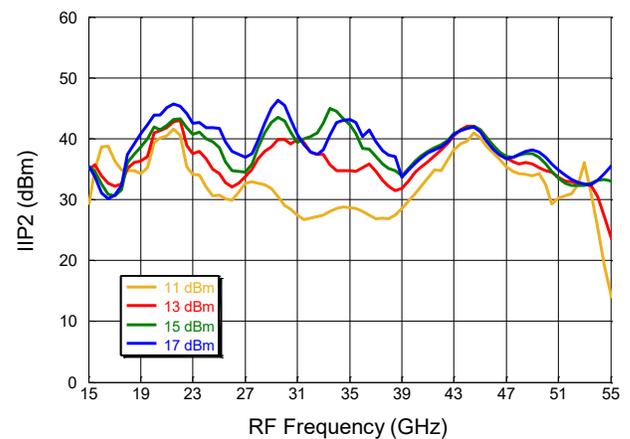
Conversion Loss over LO Drive



IIP3 over LO Drive vs. RF Frequency



IIP2 over LO Drive vs. RF Frequency



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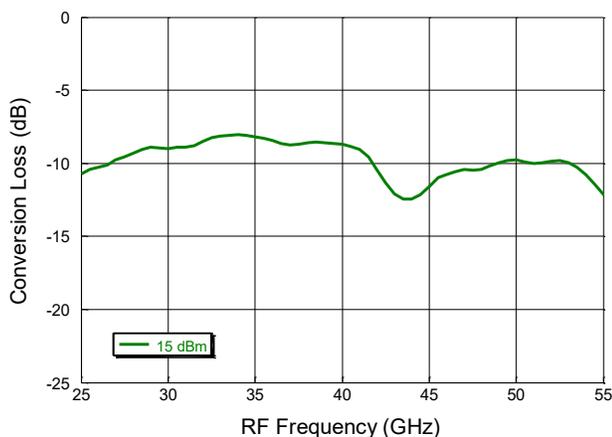
## 17 - 55 GHz



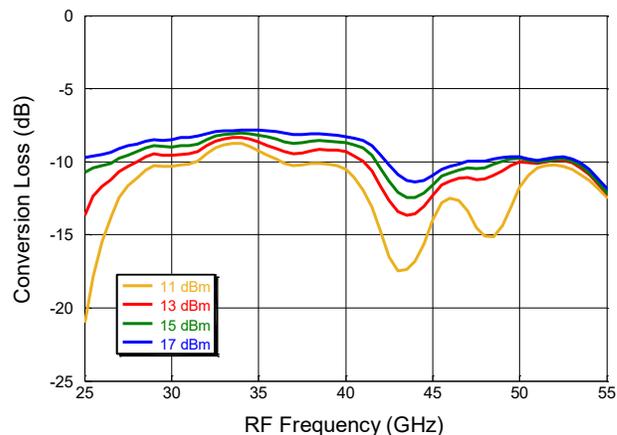
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### Typical Performance Curves: Down Conversion Mode, Upper Side Band (USB), Low Side LO @ 25°C. IF = 10 GHz

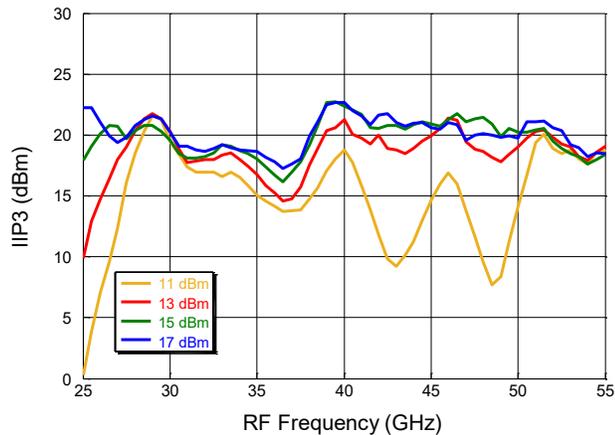
Conversion Loss vs. Frequency



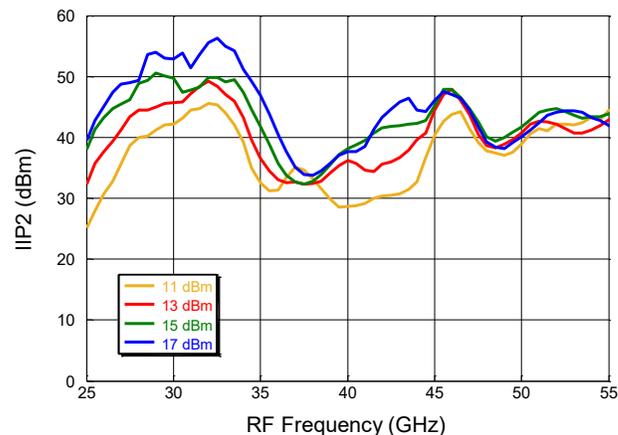
Conversion Loss over LO Drive



IIP3 over LO Drive vs. RF Frequency



IIP2 over LO Drive vs. RF Frequency



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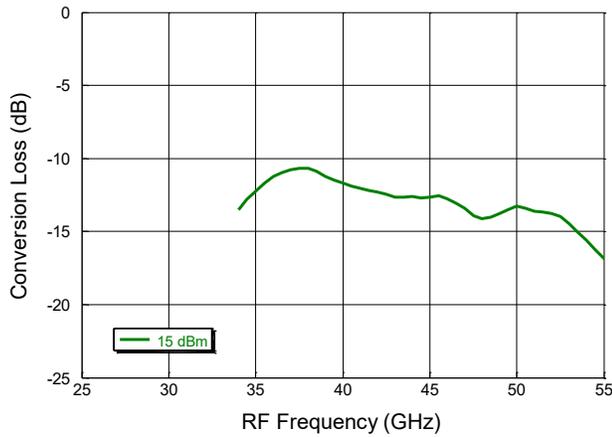
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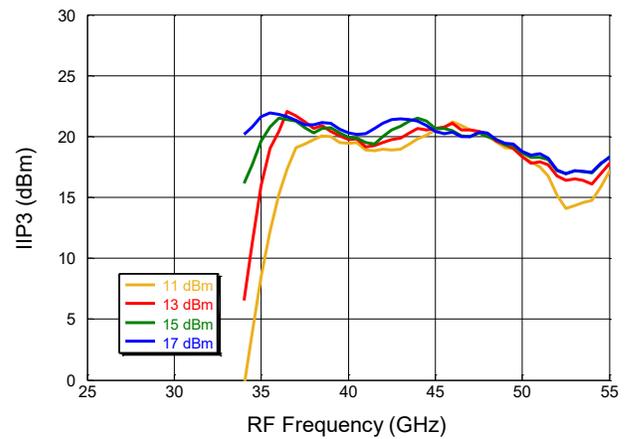
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### Typical Performance Curves: Down Conversion Mode, Upper Side Band (USB), Low Side LO @ 25°C. IF = 20 GHz

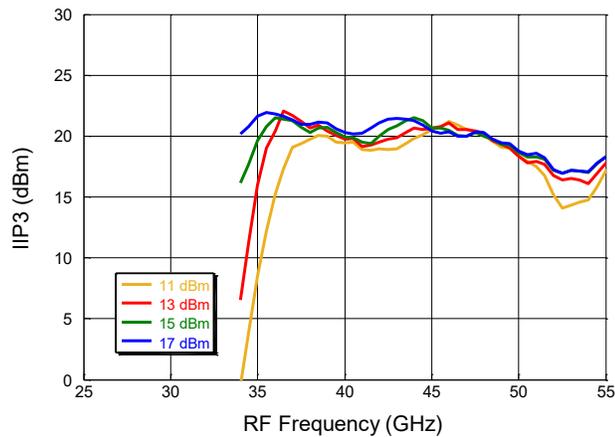
Conversion Loss vs. Frequency



Conversion Loss over LO Drive

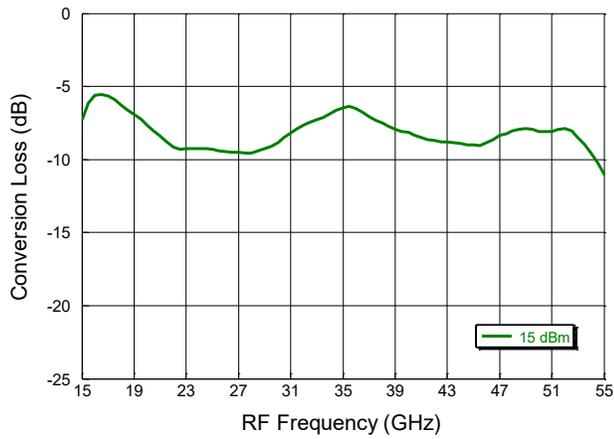


IIP3 over LO Drive vs. RF Frequency

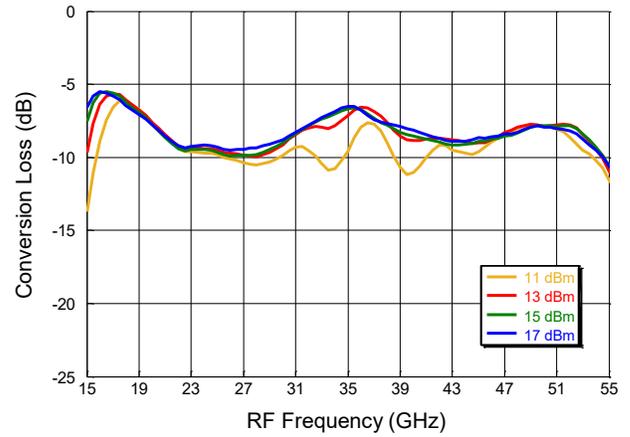


**Typical Performance Curves: Up Conversion Mode, Upper Side Band (USB),  
Low Side LO @ 25°C. IF = 1 GHz**

**Conversion Loss vs. Frequency**



**Conversion Loss over LO Drive**



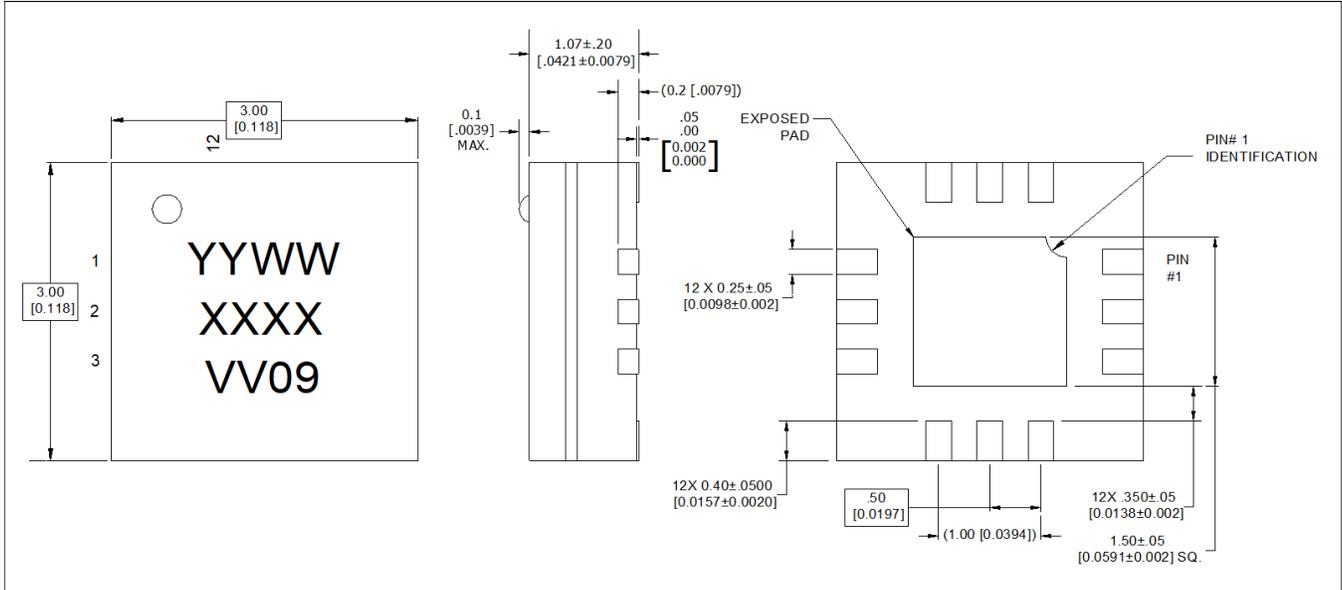
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### Lead-Free 3 mm 12-Lead QFN<sup>†</sup>



<sup>†</sup> Reference Application Note S2083 for lead-free solder reflow recommendations.  
Meets JEDEC moisture sensitivity level 3 requirements.  
Plating is 100% matte tin over copper.

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