

Double-Balanced Mixer

6 - 26 GHz



MAMX-011038

Rev. V2

Features

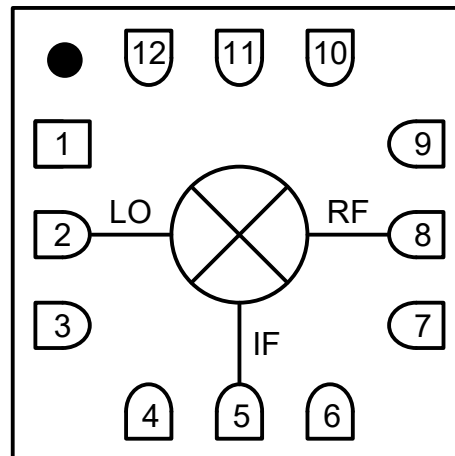
- Low conversion loss: 7 dB
- High linearity: 20 dBm IIP3
- Wide IF bandwidth: DC to 4 GHz
- High isolation
- 3 mm 12-lead QFN package
- Lead-free and RoHS* compliant

Description

MAMX-011038 is a GaAs double-balanced passive diode mixer housed in a 3 mm, 12-lead QFN 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-ohm matching simplifies its application.

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

Functional Schematic



Ordering Information¹

Part Number	Package
MAMX-011038	Cut Tape or Tray
MAMX-011038-TR0100	100 Piece Reel
MAMX-011038-TR0500	500 Piece Reel
MAMX-011038-SB1	Sample Board

1. Reference Application Note M513 for reel size information.

Pin Configuration²

Pin #	Function
1, 9, 10, 11, 12	NC ²
2	LO
3, 4, 6, 7	GND
5	IF
8	RF
13	GND ³

2. MACOM recommends connecting unused package pins to ground.
3. 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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Pin Description

Pin #	Name	Description
3, 4, 6, 7	Ground	Ground Connection pads must be connected to ground.
2	LO	LO input matched and DC open, AC coupled.
5	IF	DC coupled to diodes and IF matched.
8	RF	RF matched and DC open, AC coupled.
1, 9, 10, 11, 12	Non connect	No internal connection. Recommended these pins are connected to ground.
13	Paddle	Package ground paddle and must be connected to RF and DC ground to ensure best possible RF performance.

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Electrical Specifications⁴: $F_{IF} = 100 \text{ MHz}$, $P_{LO} = +15 \text{ dBm}$, $T_A = 25^\circ\text{C}$, $Z_0 = 50 \Omega$

Parameter	Test Conditions	Units	Min.	Typ.	Max.
LO and RF Frequency	—	GHz	6	—	26
IF Frequency	—	GHz	0	—	4
LO Power	—	dBm	—	15	—
Conversion Loss	6 - 23 GHz 23 - 26 GHz	dB	—	7 9	9 11.5
Input P1dB	$P_{LO} = +15 \text{ dBm}$	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	—	dB	—	38	—
RF-to-IF Isolation	—	dB	—	20	—

4. All specifications refer to down-conversion operation.

Recommended Operating Conditions

Parameter	Minimum	Nominal	Maximum
LO Power	+11 dBm	+15 dBm	+17 dBm
RF/IF Power	—	-10 dBm	+8 dBm
Temperature	-55°C	+25°C	+85°C

Absolute Maximum Ratings^{5,6}

Parameter	Absolute Maximum
LO Power	23 dBm
RF or IF Power	20 dBm
Junction Temperature ⁷	+150°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 devices with the following rating: HBM Class 1B

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MxN Spurious Rejection at IF Port

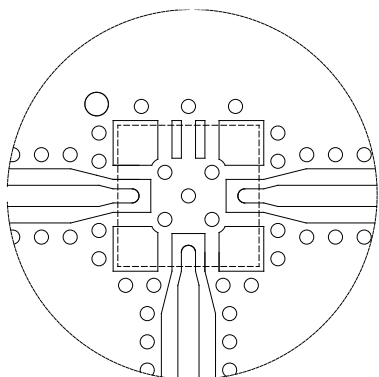
RF = 14.1 GHz @ -10 dBm

LO = 14 GHz @ +15 dBm

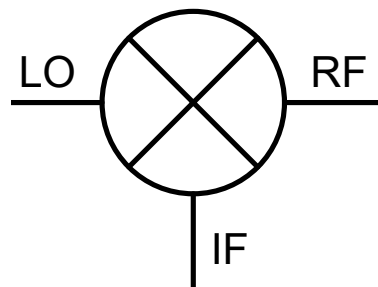
Levels shown referenced to the IF output (dBc)

mxRF	nxLO				
	0	1	2	3	4
0	X	-7	-34	-36	X
1	-15	0	-47	-53	-62
2	-85	-76	-67	-76	-82
3	-78	-87	-90	-74	-86
4	X	-81	-83	-87	-92

PCB Layout



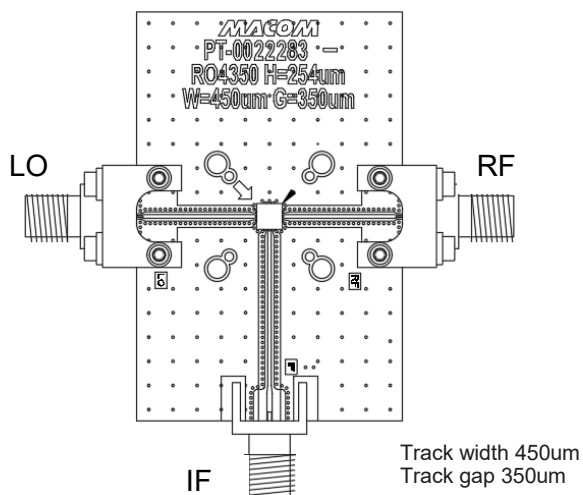
Application Schematic



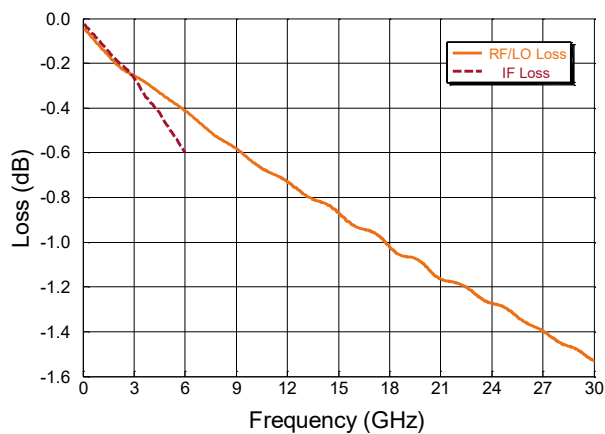
DXF/Gerber available on request based on 10 mil RO4350

No external parts required for operation of MAMX-011038.

Evaluation Board



Evaluation Board Losses



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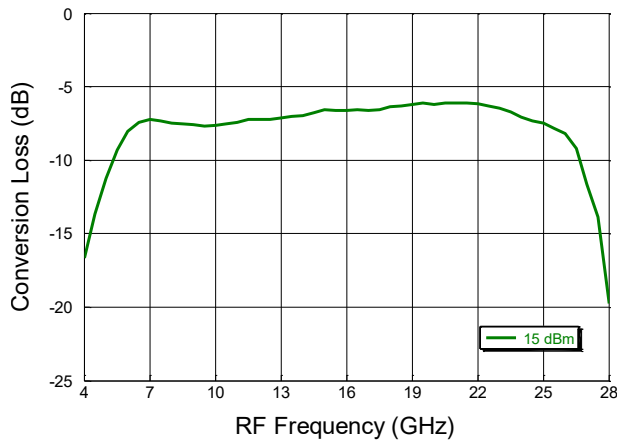


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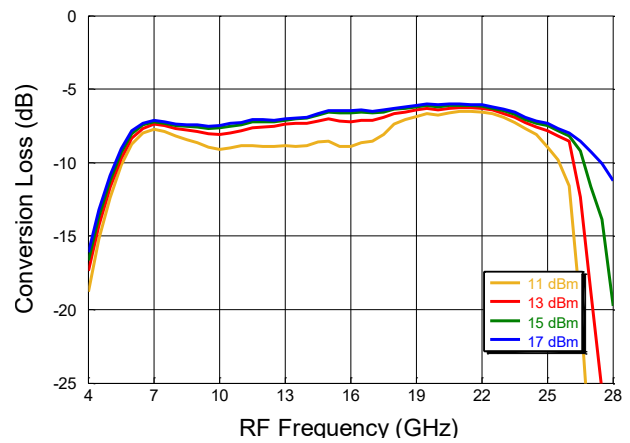
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Typical Performance Curves: Down Conversion Mode, RF = -10dBm, Upper Side Band (USB), Low Side LO @ 25°C. IF = 100 MHz

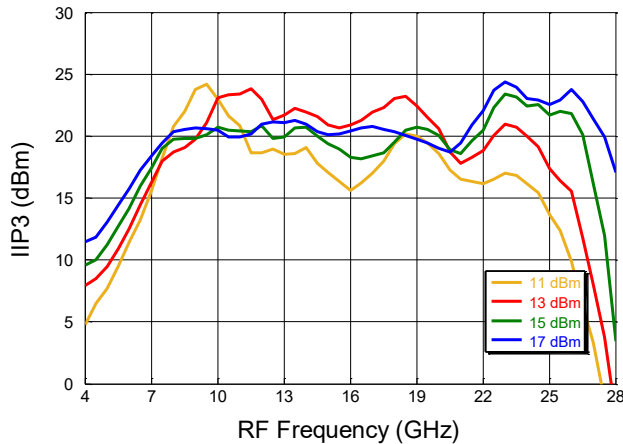
Conversion Loss vs. Frequency



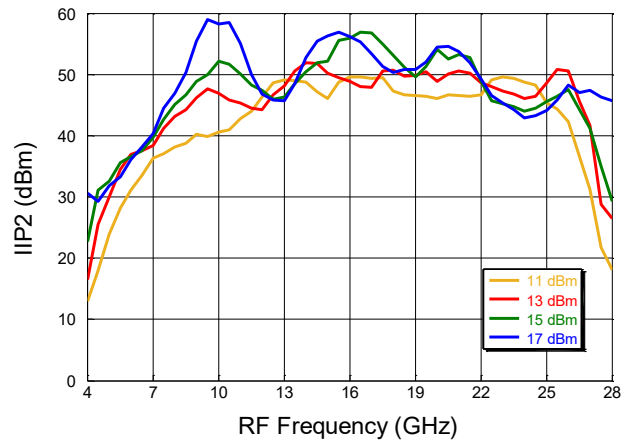
Conversion Loss over LO Drive



IIP3 over LO Drive vs. RF Frequency



IIP2 over LO Drive vs. RF Frequency



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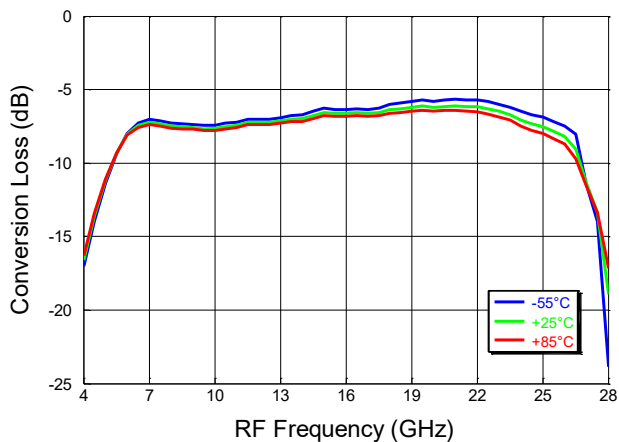


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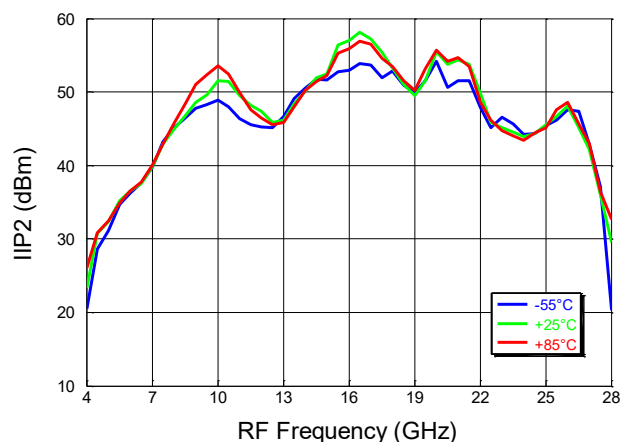
Rev. V2

Typical Performance Curves: Down Conversion Mode, RF = -10dBm, Upper Side Band (USB), Over Temperature. IF = 100 MHz

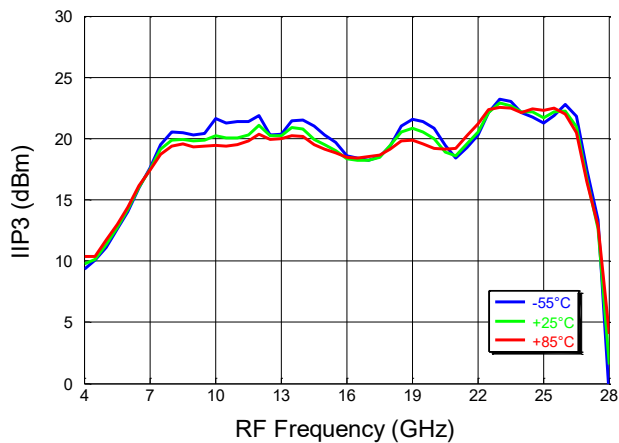
Conversion Loss over Temperature @ $P_{Lo} = +15$ dBm



IIP2 over Temperature @ $P_{Lo} = +15$ dBm



IIP3 over Temperature @ $P_{Lo} = +15$ dBm



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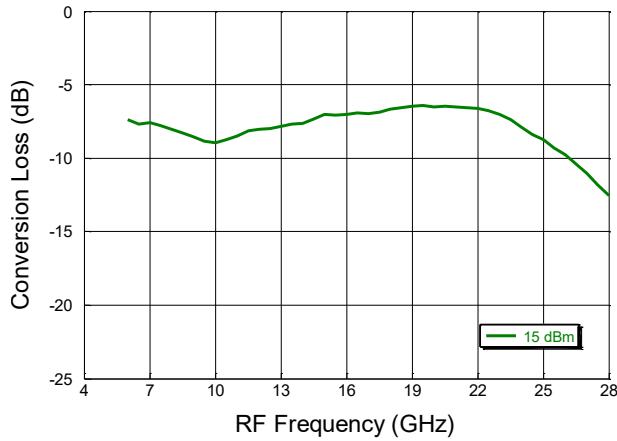


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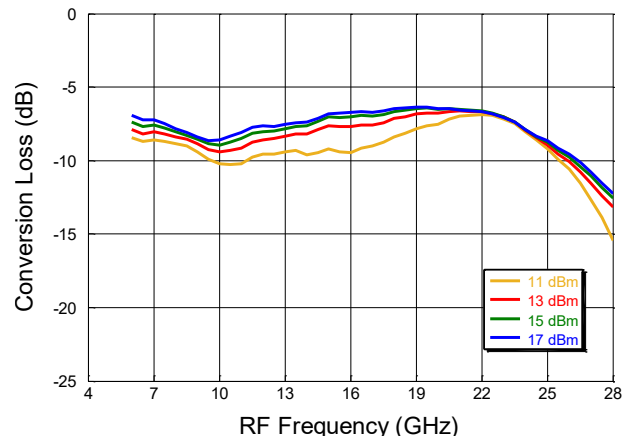
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Typical Performance Curves: Down Conversion Mode, RF = -10dBm, Upper Side Band (USB), Low Side LO @ 25°C. IF = 2 GHz

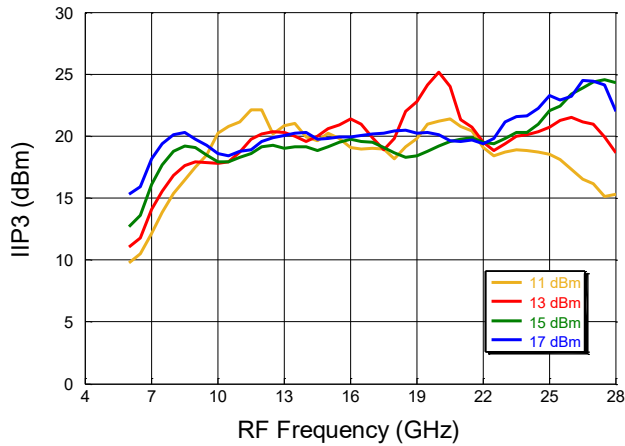
Conversion Loss vs. Frequency



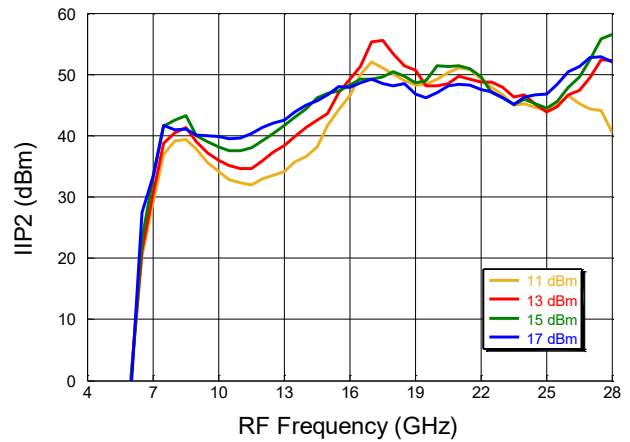
Conversion Loss over LO Drive



IIP3 over LO Drive vs. RF Frequency



IIP2 over LO Drive vs. RF Frequency



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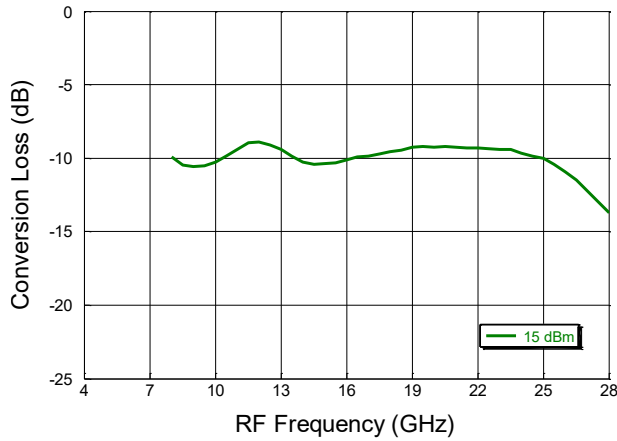


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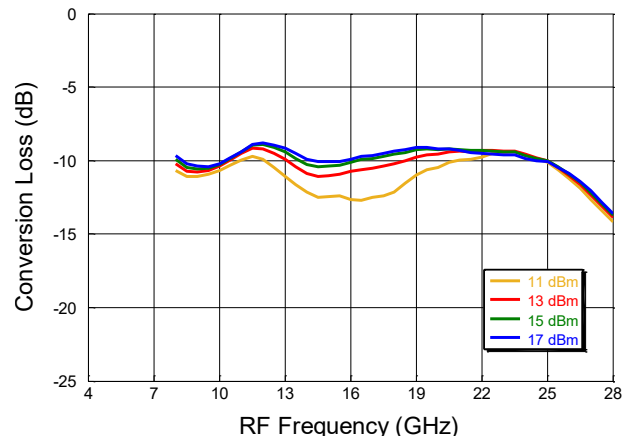
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Typical Performance Curves: Down Conversion Mode, RF = -10dBm, Upper Side Band (USB), Low Side LO @ 25°C. IF = 4 GHz

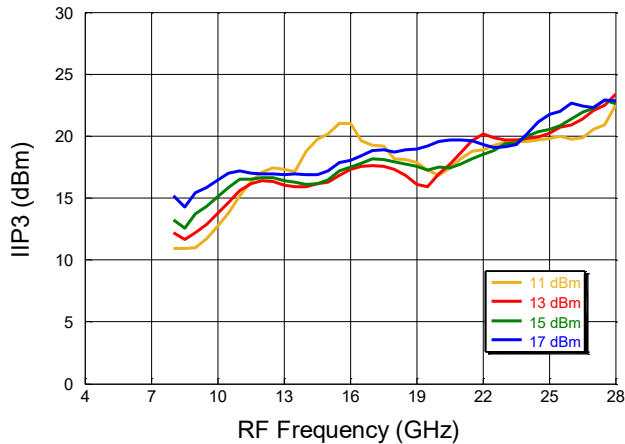
Conversion Loss vs. Frequency



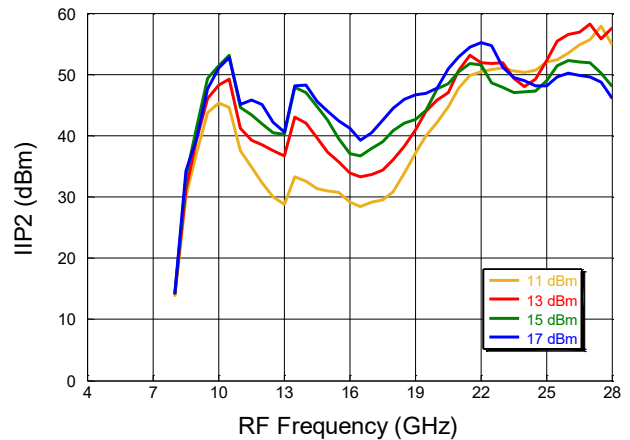
Conversion Loss over LO Drive



IIP3 over LO Drive vs. RF Frequency



IIP2 over LO Drive vs. RF Frequency



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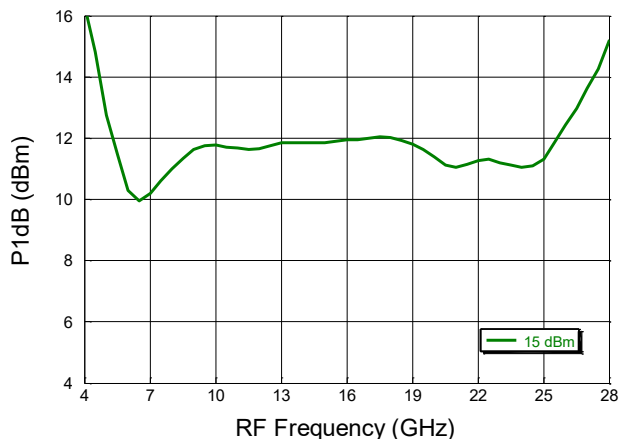


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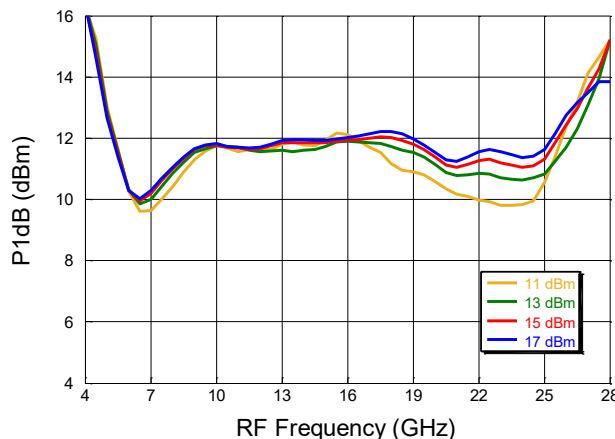
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Typical Performance Curves: Down Conversion Mode, Upper Side Band (USB), Low Side LO @ 25°C.

P1dB vs. RF Frequency

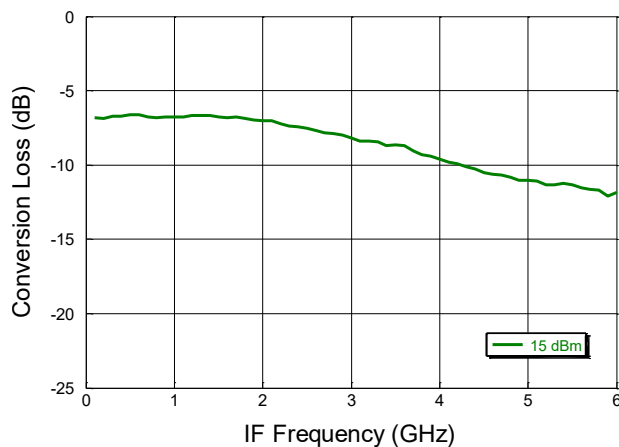


P1dB over LO drive



IF Bandwidth vs. IF Frequency

RF -10dBm, USB, LO +15dBm @ 14GHz



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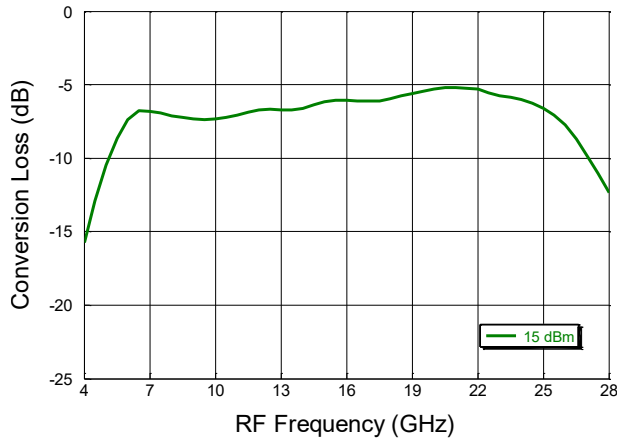


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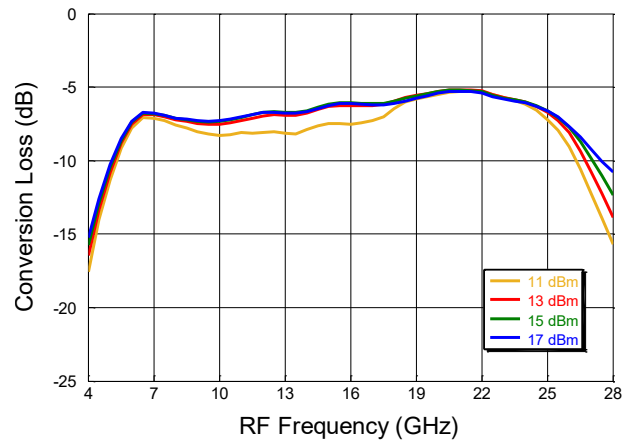
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**Typical Performance Curves: Up Conversion Mode, Upper Side Band (USB),
Low side LO @ 25°C. IF = 100 MHz @ -10dBm**

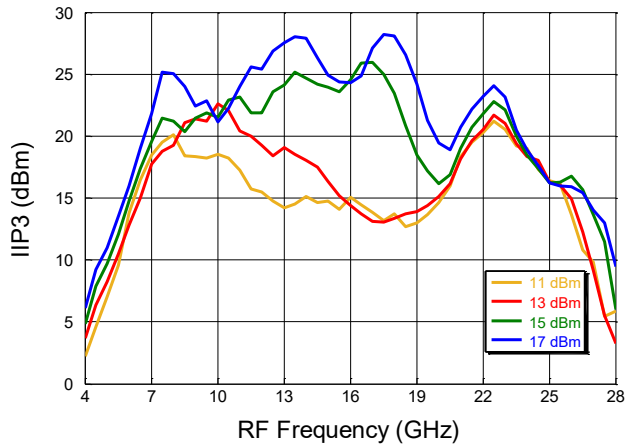
Conversion Loss vs. Frequency



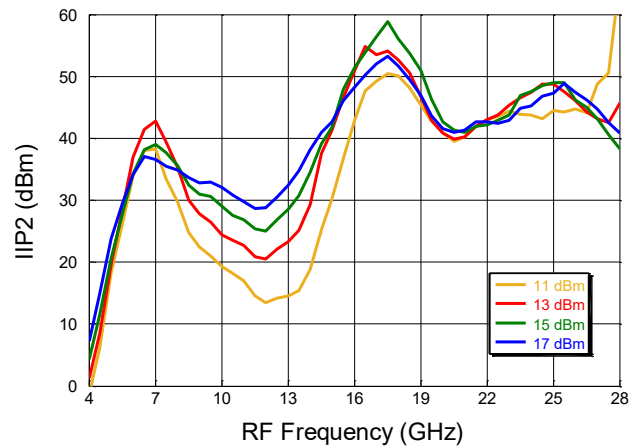
Conversion Loss over LO Drive



IIP3 over LO Drive vs. RF Frequency



IIP2 over LO Drive vs. RF Frequency



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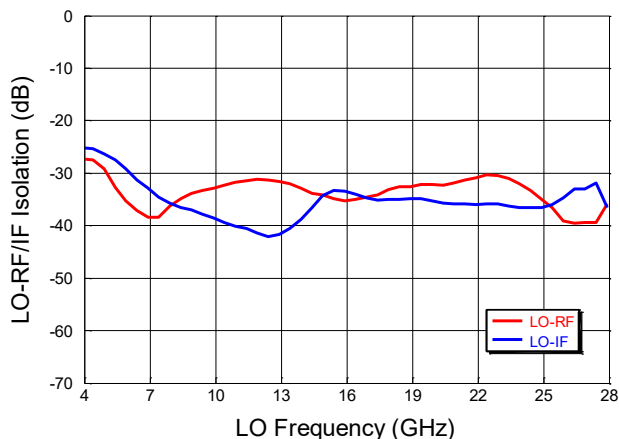


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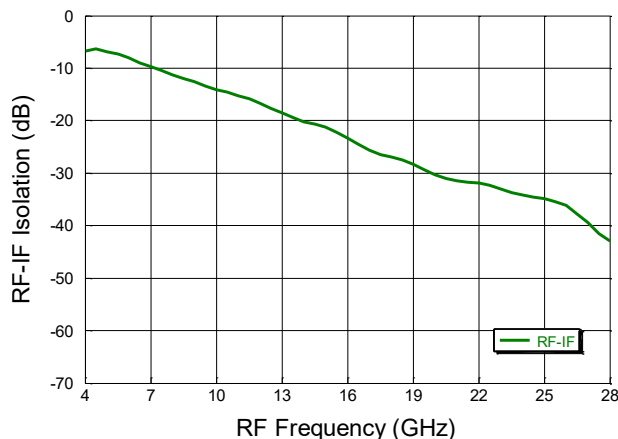
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Typical Performance Curves: LO +15dBm, RF= -10dBm @ 25°C.

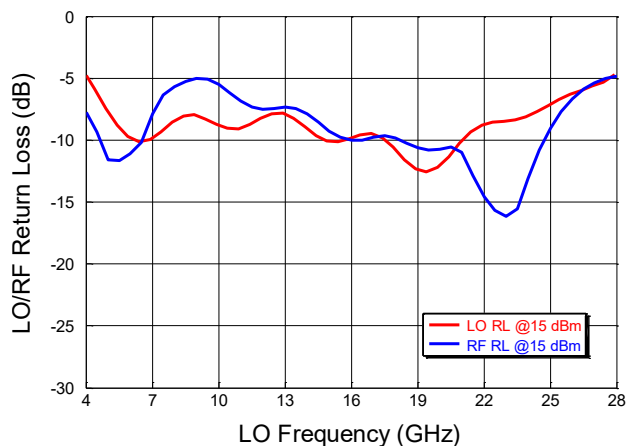
LO to RF/IF Isolation vs. LO Frequency



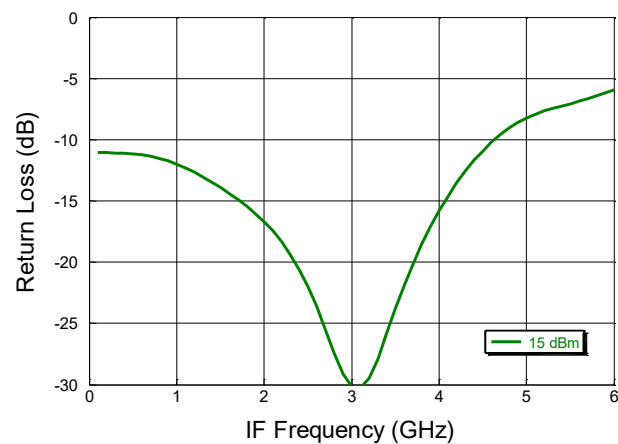
RF to IF Isolation vs. RF Frequency



LO/RF Return Loss vs. RF Frequency



IF Return Loss vs. RF Frequency



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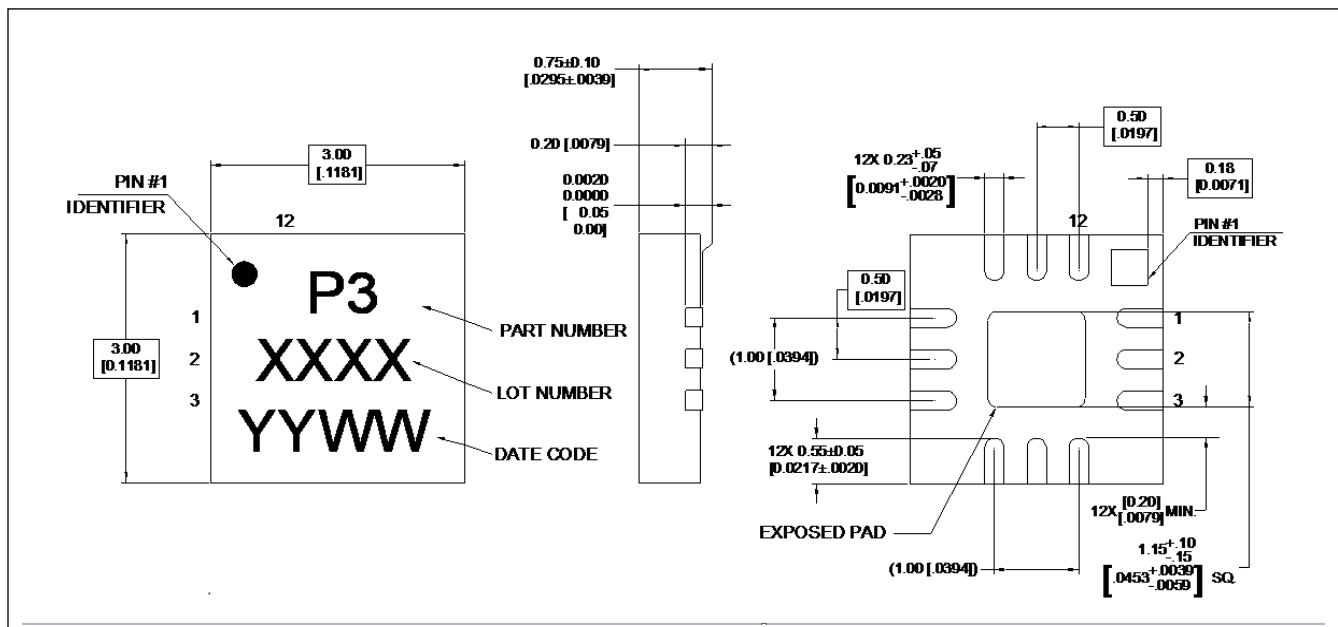
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Lead-Free 3 mm 12-Lead PQFN[†]



[†] Reference Application Note S2083 for lead-free solder reflow recommendations.
 Meets JEDEC moisture sensitivity level 1 requirements.
 100% Matte Sn Plating

Revision History

Rev	Date	Change Description
V1	June 2024	Production Release
V2	July 2024	SMB update. Use SMB with SMA connector on IF port

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