Double-Balanced Mixer
17 - 47 GHz

MAMX-011148
Rev. V1

Features

- Low Conversion Loss: 7 dB
- LO Drive Level: +15 dBm
- IIP3: +20 dBm
- 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
- Satellite Communications

Description

MAMX-011148 is a double-balanced passive diode mixer housed in a 3 mm, 12-lead AQFN package. The mixer offers low conversion loss, and a wide IF bandwidth. The double-balanced circuit configuration provides excellent port isolation while internal 50 Ω matching simplifies its application.

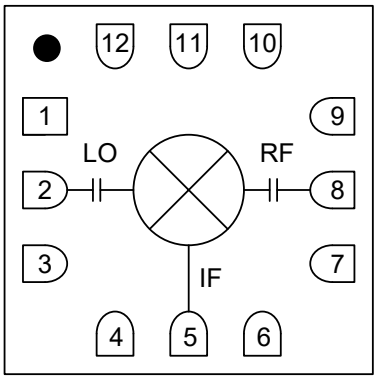
This mixer is well suited for applications such as test and measurement, microwave radio, and satellite communications.

Ordering Information[1]

Part Number	Package
MAMX-011148	Cut Tape or Tray
MAMX-011148-TR0100	100 Piece Reel
MAMX-011148-TR0500	500 Piece Reel
MAMX-011148-SB1	Sample Board

1. Reference Application Note M513 for reel size information.

Functional Schematic



Pin Names

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

2. MACOM recommends connecting non connect or 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.

Pin Description

Pin #	Name	Description
1, 3, 4, 6, 7, 9	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.
10 - 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.

Electrical Specifications[4]: F_{IF} = 1 GHz, P_{LO} = +15 dBm, T_A = +25°C, Z_0 = 50 Ω

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 - 46 GHz	dB	—	7	10
Input P1dB	18 - 24 GHz 24 - 40 GHz 40 - 46 GHz	dBm	—	10 12 14	—
Input IP3	P_{RF} = -15 dBm/tone, Δf = 1 MHz 18 - 24 GHz 24 - 40 GHz 40 - 46 GHz	dBm	—	 20 21 19	—
Input IP2	P_{RF} = -15 dBm/tone, Δf = 1 MHz	dBm	—	50	—
LO-to-RF Isolation	—	dB	—	35	—
LO-to-IF Isolation	18 - 24 GHz 24 - 40 GHz 40 - 46 GHz	dB	—	38 45 45	—
RF-to-IF Isolation	18 - 24 GHz 24 - 40 GHz 40 - 46 GHz	dB	—	9 30 35	—
RF Return Loss	RF = 40 GHz	dB	—	8	—
IF Return Loss	RF = 1 GHz	dB	—	16	—

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

Recommended Operating Conditions

Parameter	Minimum	Nominal	Maximum
LO Power	+13 dBm	+15 dBm	+19 dBm
RF/IF Power	—	-15 dBm	10 dBm
Temperature	-55°C	+25°C	+100°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°C will ensure MTTF > 1 x 10^6 hours.

Handling Procedures

Please observe the following precautions to avoid damage:

Static Sensitivity

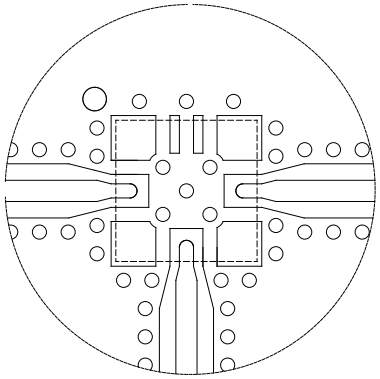
These electronic devices are sensitive to electrostatic discharge (ESD) and can be damaged by static electricity. Proper ESD control techniques should be used when handling these devices with the following rating: HBM Class 1B; CDM Class C3.

MxN Spurious Rejection at IF Port (dBc IF)

RF = 25 GHz @ -15 dBm
LO = 24 GHz @ +15 dBm

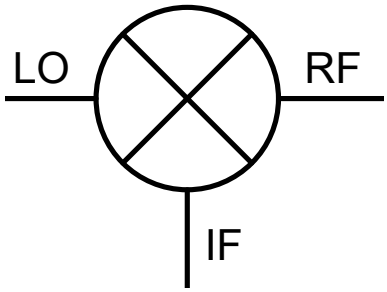
	nxLO				
mxRF	**0**	**1**	**2**	**3**	**4**
0	X	-3.2	-31.6	X	X
1	-12.1	0	-27.6	-52.6	X
2	-88.6	-88.6	-68.7	-71.7	-91
3	X	-90	-102.2	-92.5	-84.9
4	X	X	-97.3	-97.8	-108.8

PCB Layout



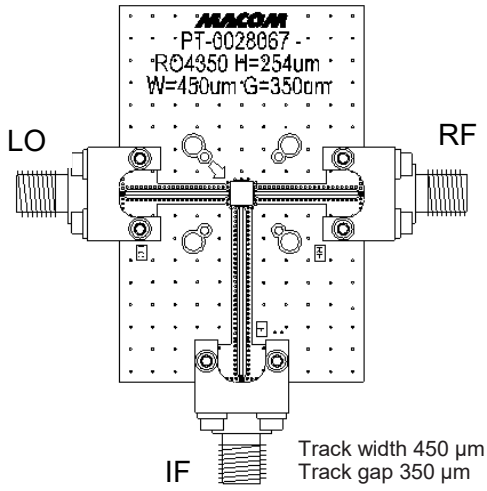
DXF/Gerber available on request based on 10 mil RO4350

Application Schematic



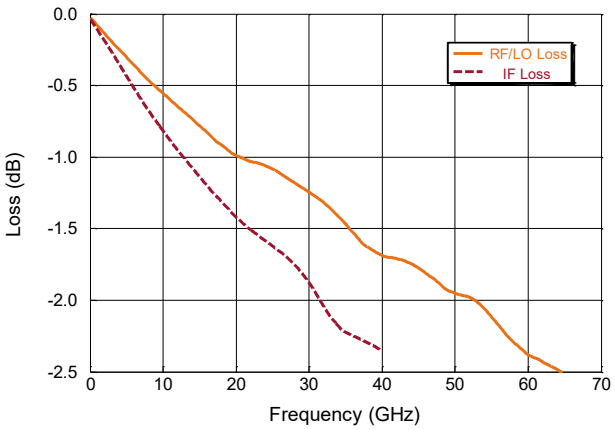
No external parts required for operation of MAMX-011148

Evaluation Board



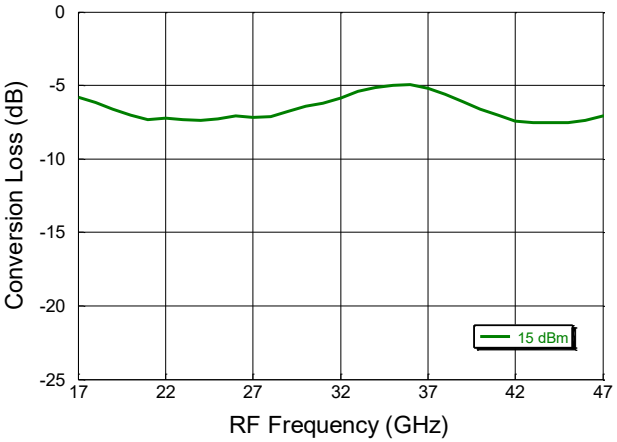
Track width 450 µm
Track gap 350 µm

Evaluation Board Losses

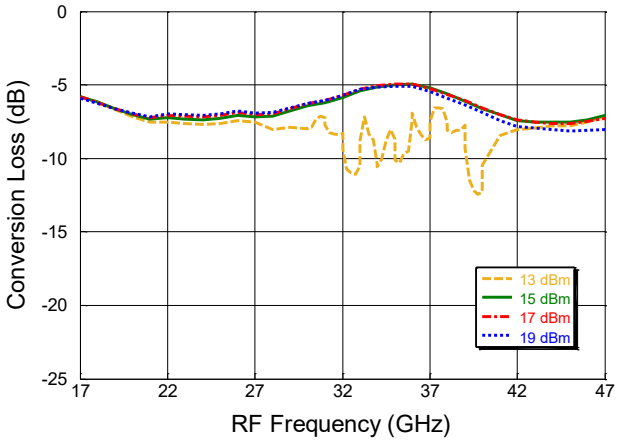


Typical Performance Curves: Down Conversion Mode, Upper Side Band (USB), Low Side LO @ 25°C. I_F = 1 GHz

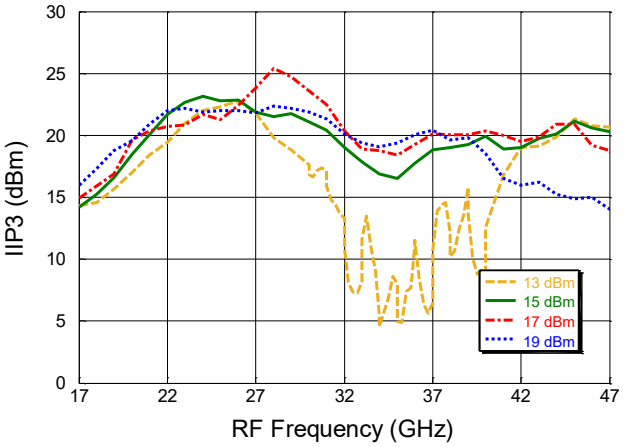
Conversion Loss vs. Frequency



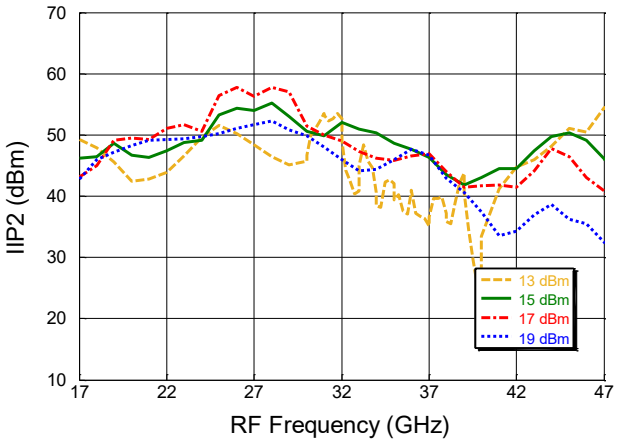
Conversion Loss over LO Drive



IIP3 over LO Drive vs. RF Frequency

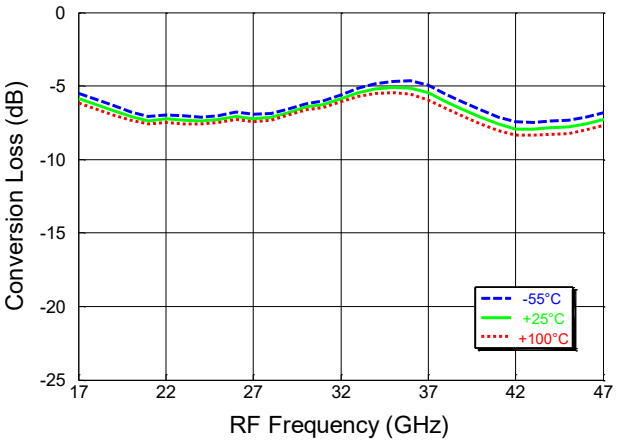


IIP2 over LO Drive vs. RF Frequency

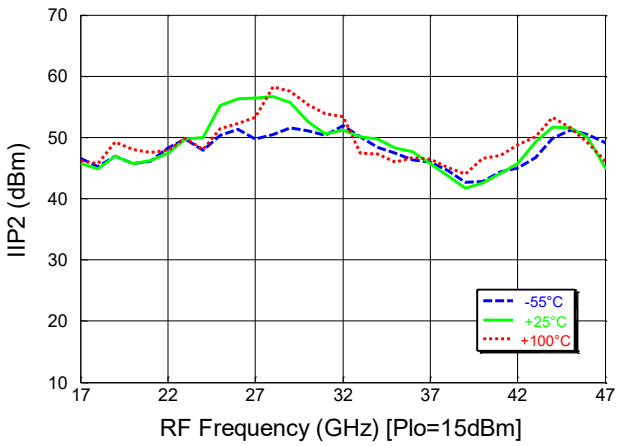


Typical Performance Curves: Down Conversion Mode, Upper Side Band (USB), Over Temperature. I_F = 1 GHz

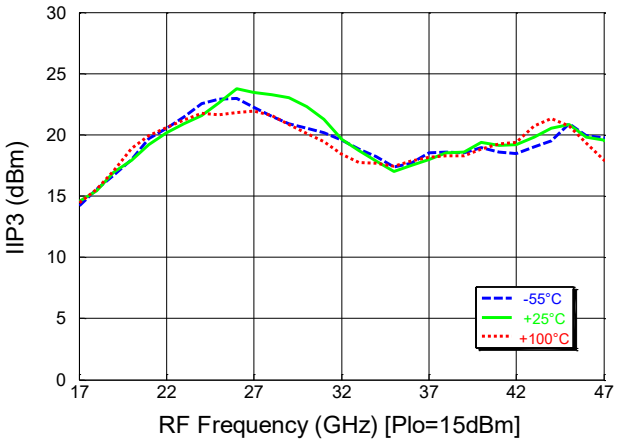
Conversion Loss over Temperature @ P_{LO} = +15 dBm



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

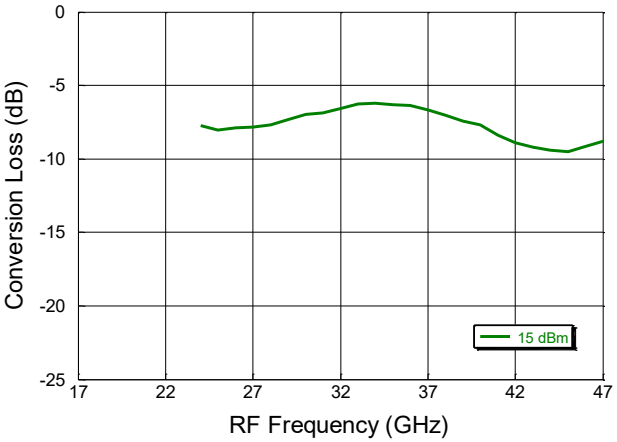


IIP3 over Temperature @ P_{LO} = +15 dBm

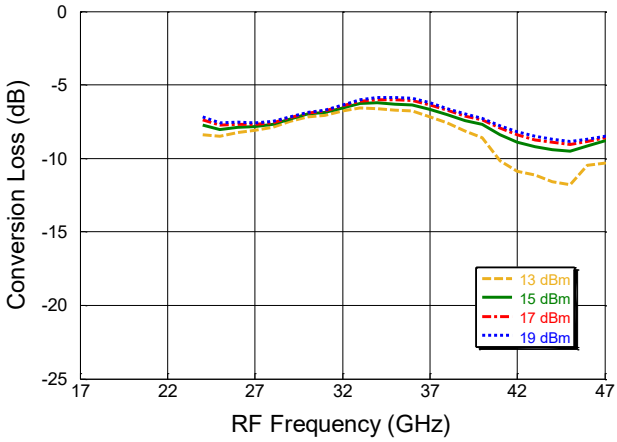


Typical Performance Curves: Down Conversion Mode, Upper Side Band (USB), Low Side LO @ 25°C. I_F = 10 GHz

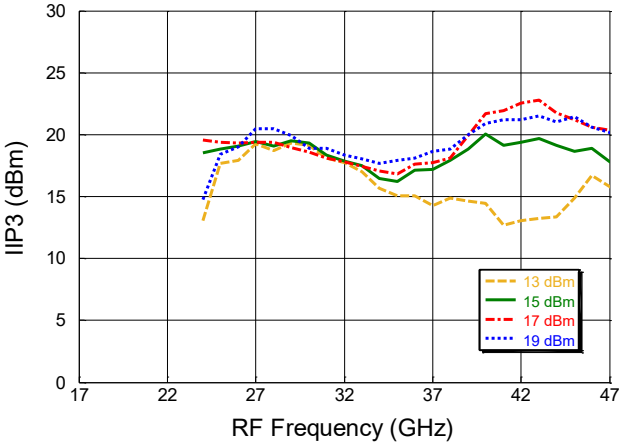
Conversion Loss vs. Frequency



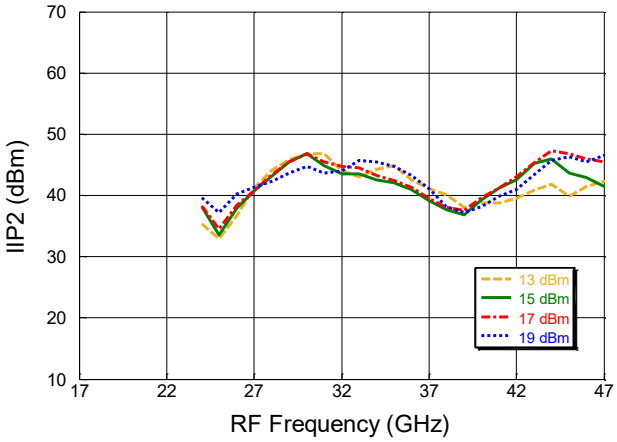
Conversion Loss over LO Drive



IIP3 over LO Drive vs. RF Frequency

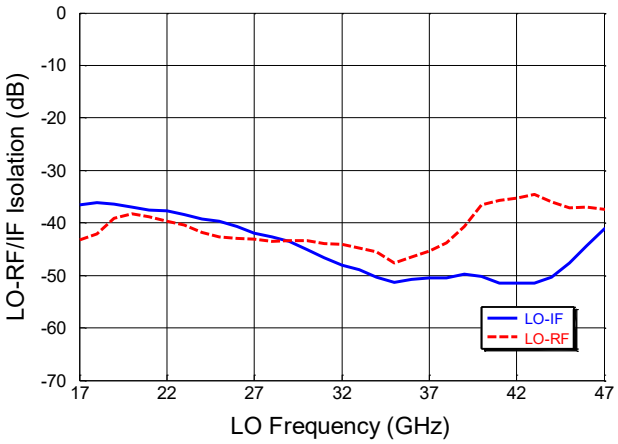


IIP2 over LO Drive vs. RF Frequency

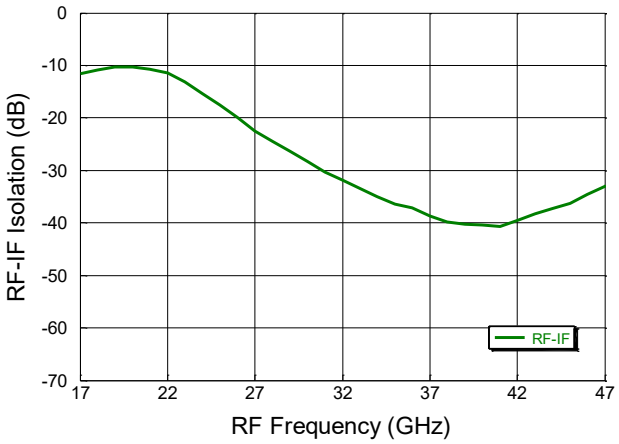


Typical Performance Curves: Down Conversion Mode, Upper Side Band (USB), Low Side LO @ 25°C

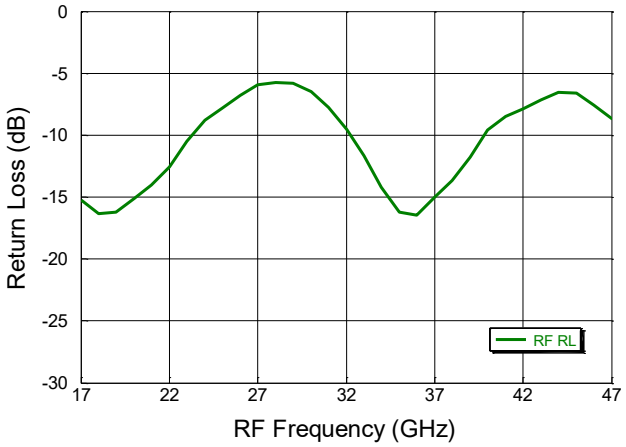
LO to RF/IF Isolation vs. LO Frequency



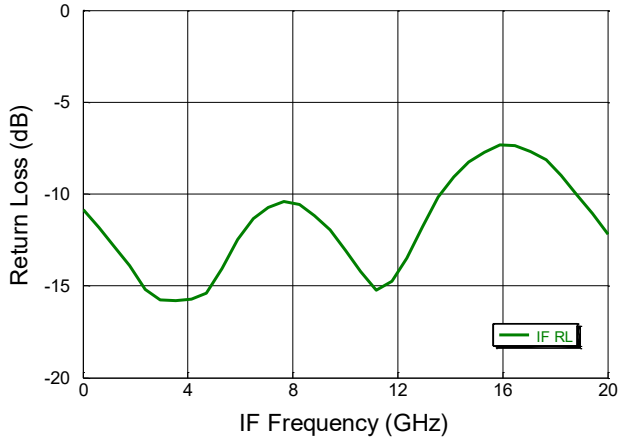
RF to IF Isolation vs. RF Frequency



RF Return Loss vs. RF Frequency

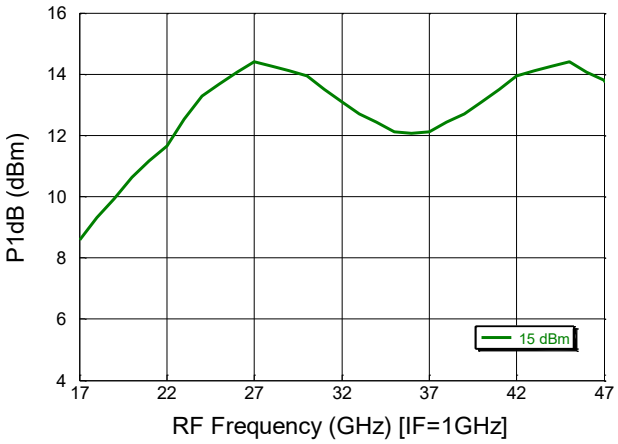


IF Return Loss vs. RF Frequency

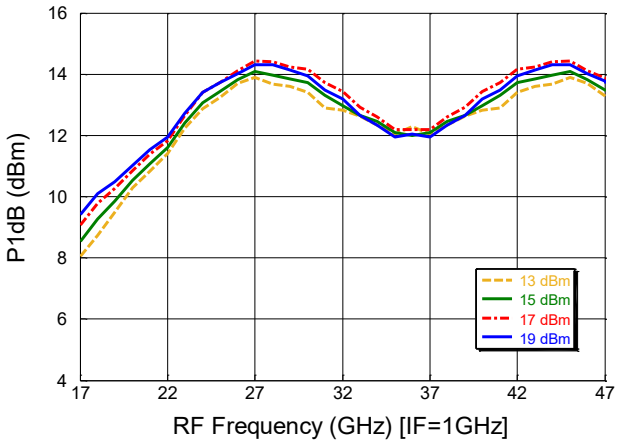


Typical Performance Curves: Down Conversion Mode, Upper Side Band (USB), Low Side LO @ 25°C

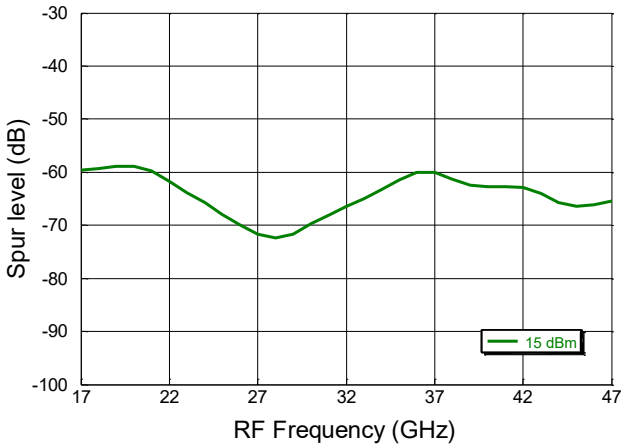
P1dB vs. RF Frequency



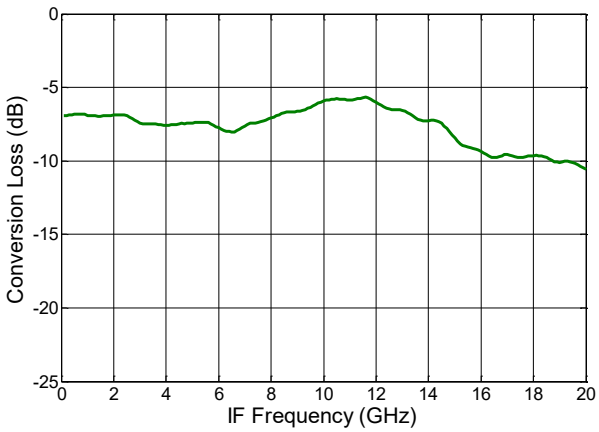
P1dB over LO Drive



2RF x 2LO Spurious Suppression

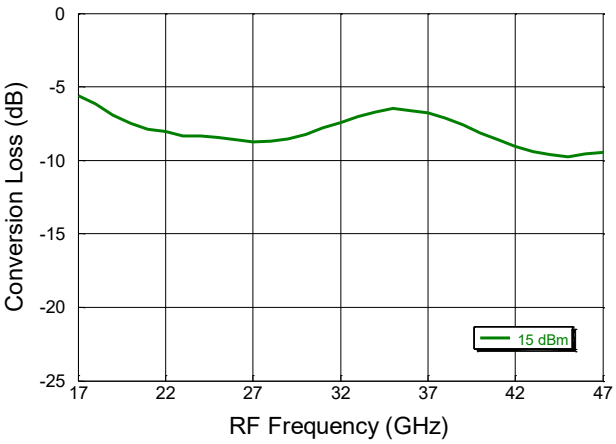


IF Bandwidth vs. IF Frequency

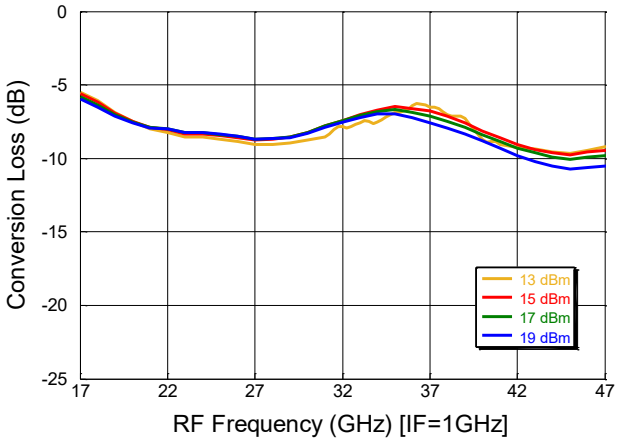


Typical Performance Curves: Up Conversion Mode, Upper Side Band (USB), Low side LO @ 25°C. I_F = 1 GHz

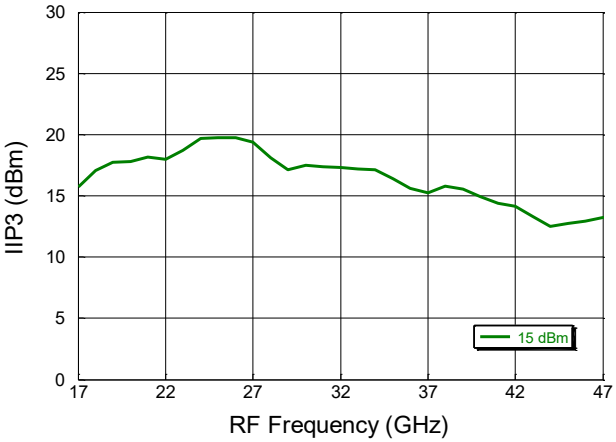
Conversion Loss vs. Frequency



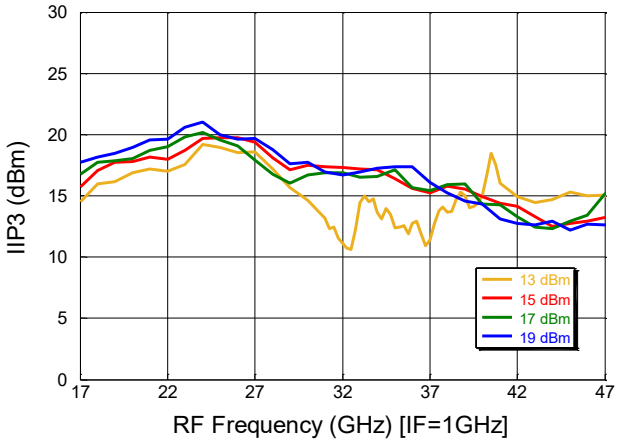
Conversion Loss over LO Drive



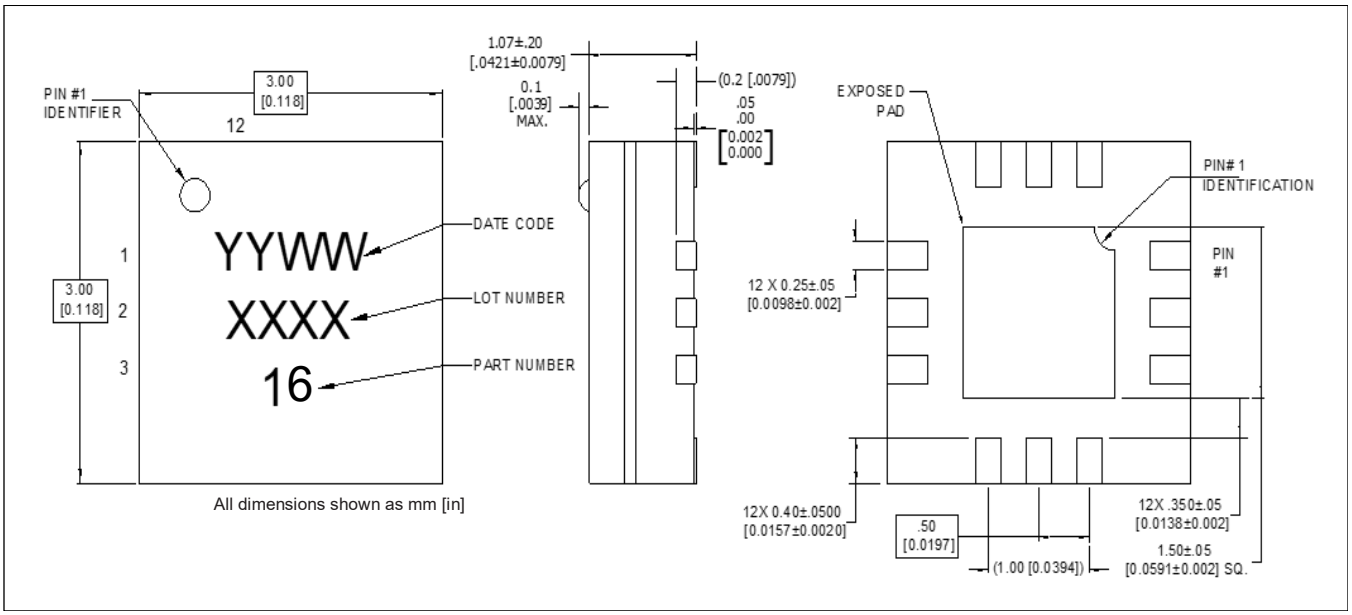
IIP3 vs. RF Frequency



IIP3 over LO Drive



Lead-Free 3 mm 12-Lead AQFN†



† Reference Application Note S2083 for lead-free solder reflow recommendations.
Meets JEDEC moisture sensitivity level 3 requirements.
Plating is NiPdAu.

Revision History

Rev	Date	Change Description
V1	Feb 2025	Initial Release