2 mm Image-Reject Mixer
32 - 37 GHz

MAMX-011116
Rev. V2

Features

- Passive Mixer - No Bias Required
- 9 dB Conversion Loss
- Nominal LO drive of +13 dBm
- 16 dBm Input IP3
- 35 dB LO to RF Isolation
- 30 dBc of Image Rejection
- IF Bandwidth: DC to 5 GHz
- 2 mm, 8-Lead PDFN
- RoHS* Compliant

Applications

- Test & Measurement
- Microwave Radio
- Radar
- Single Side Band & Image Rejection Mixing

Description

MAMX-011116 is an image reject mixer in a miniature 2 mm package. This mixer offers a conversion loss of 9 dB and high linearity of 16 dBm input IP3. The typical image rejection is 30 dBc.

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

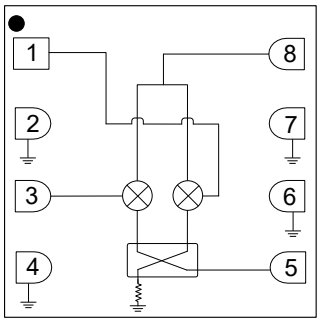
The mixer considered as a part of a chip set that includes mixer and LO buffer amplifier MAAL-011198 LNA.

Ordering Information[1,2]

Part Number	Package
MAMX-011116	Bulk
MAMX-011116-TR0100	100 Piece Reel
MAMX-011116-TR0500	500 Piece Reel
MAMX-011116-SMB	Sample Board

1. Reference Application Note M513 for reel size information.
2. All sample boards include 5 loose parts.

Functional Schematic



Pin Configuration and Description[3]

Pin #	Function	Description
1	IF2	DC diode coupled and IF matched
2, 4, 6, 7	GND	Ground
3	IF1	DC diode coupled and IF matched
5	LO	DC short and LO matched
8	RF	DC short and RF matched
9	Ground[3]	Ground paddle

3. The exposed paddle 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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Electrical Specifications[4]: F_{IF} = 1 GHz, P_{LO} = 13 dBm, T_A = +25°C, Z_0 = 50 Ω

Parameter	Test Conditions	Units	Min.	Typ.	Max.
RF Frequency	RF LO IF	GHz	32 27 0	—	37 42 5
LO Power	—	dBm	9	13	15
Conversion Loss	—	dB	—	9	12
Image Rejection	—	dBc	15	30	—
Input P1dB	—	dBm	—	6	—
Input IP3	P_{RF} = -10 dBm/tone, Δf = 1 MHz	dBm	—	16	—
Input IP2	P_{RF} = -10 dBm/tone, Δf = 1 MHz	dBm	—	47	—
Isolation	LO-to-RF LO-to-IF RF-to-IF	dB	—	35 40 30	—
Return Loss	RF LO IF	dB	—	12 10 12	—

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

Maximum Operating Conditions

Parameter	Absolute Maximum
LO Power	18 dBm
RF or IF Power	10 dBm
Junction Temperature	+150°C
Operating Temperature	-40°C to +85°C

Absolute Maximum Ratings[5,6]

Parameter	Absolute Maximum
LO Power	23 dBm
RF or IF Power	20 dBm
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.

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

Conversion Loss over LO drive

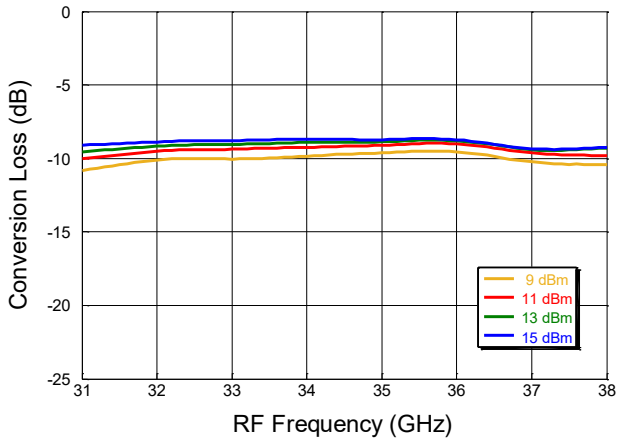
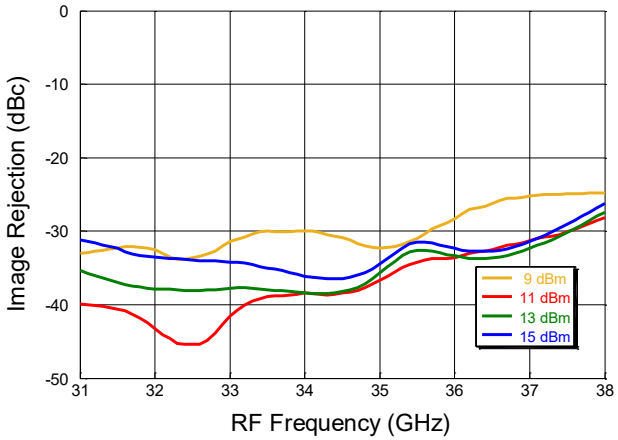
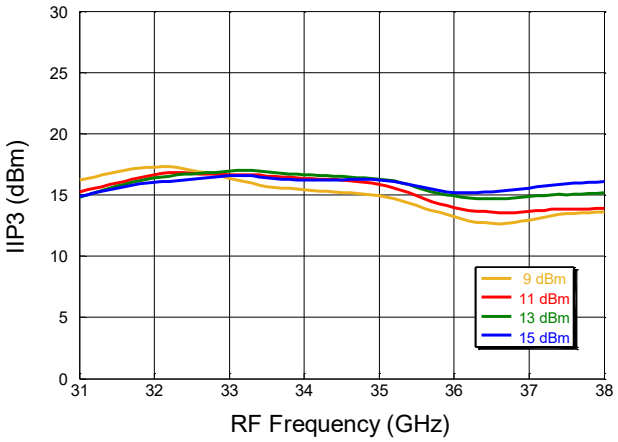


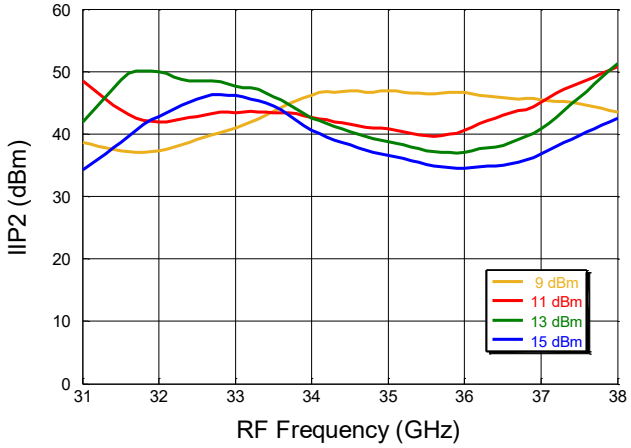
Image Rejection over LO drive



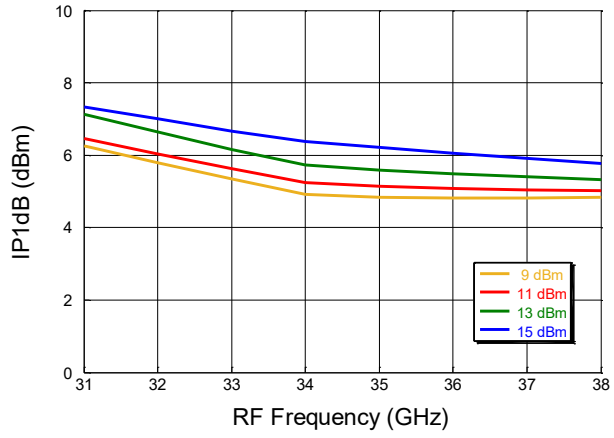
IIP3 over LO drive vs. RF Frequency



IIP2 over LO drive vs. RF Frequency



IP1dB over LO drive vs. RF Frequency



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Typical Performance: Down Conversion, Lower Side Band (LSB), IF = 1 GHz, @ 25°C

Conversion Loss over LO drive

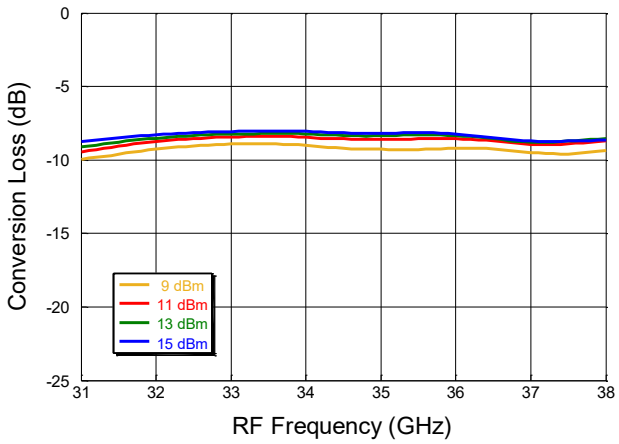
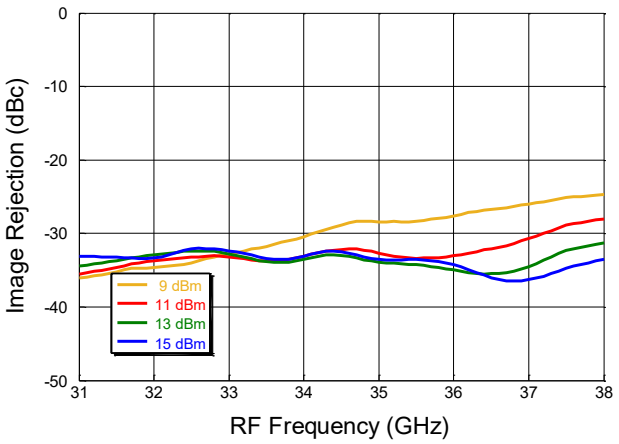
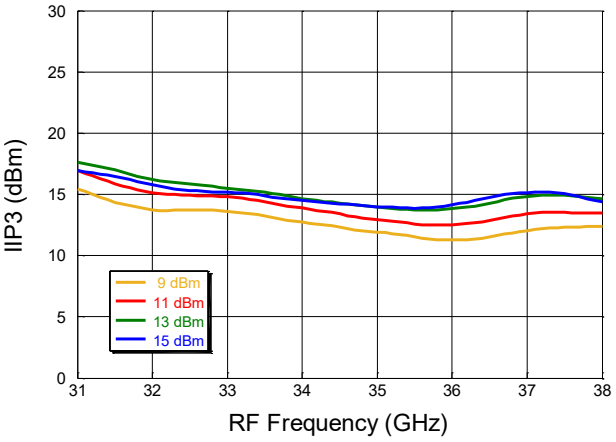


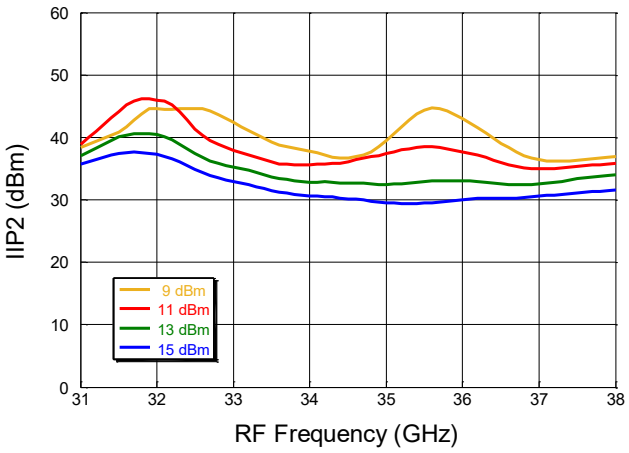
Image Rejection over LO drive



IIP3 over LO drive vs. RF Frequency



IIP2 over LO drive vs. RF Frequency



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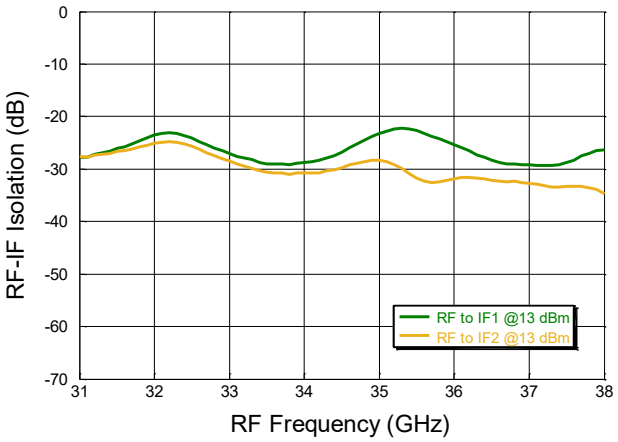
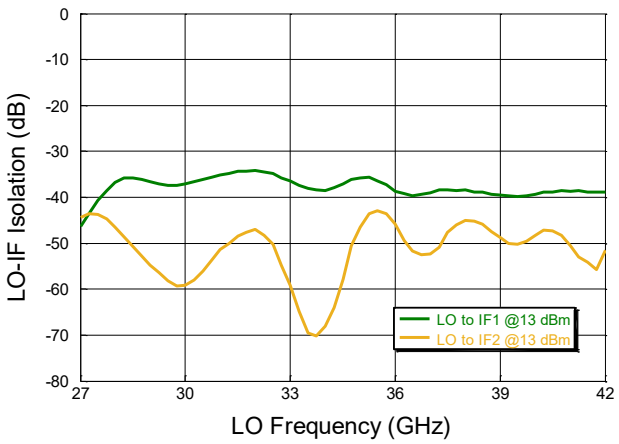
Typical Performance: Measured without hybrid

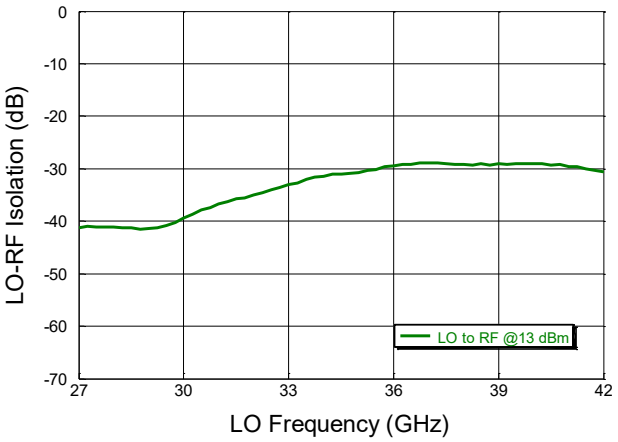
RF to IF Isolation vs. RF Frequency



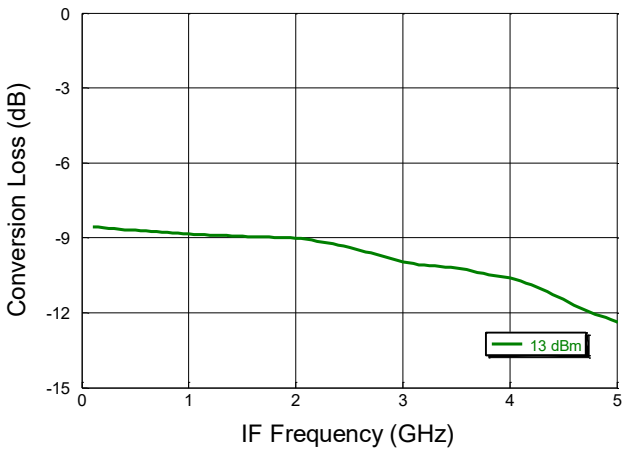
LO to IF Isolation vs. LO Frequency



LO to RF Isolation vs. LO Frequency



Conversion loss vs. IF Frequency (LO 32 GHz)



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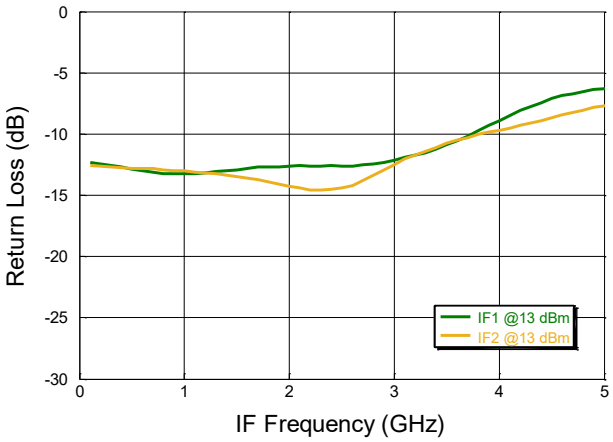
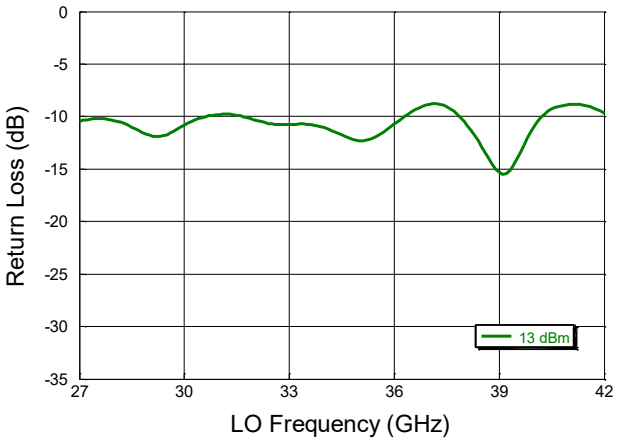
Typical Performance: Port Return Losses

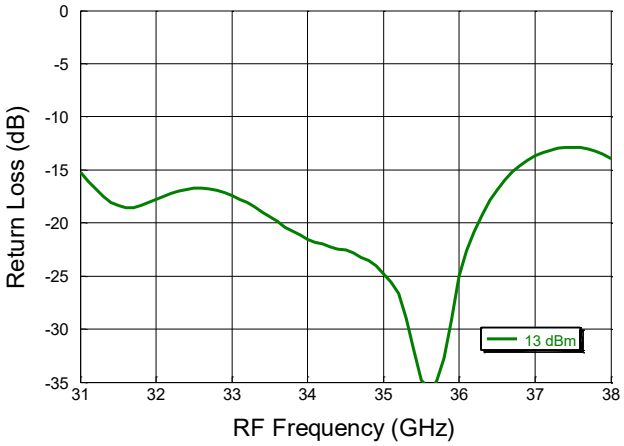
IF1 & IF2 Return Loss vs. IF Frequency



LO Return Loss vs. LO Frequency



RF Return Loss vs. RF Frequency



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Typical Performance: Down Conversion, Upper Side band (USB), IF = 1 GHz, over Temp.

Conversion Loss vs. Frequency

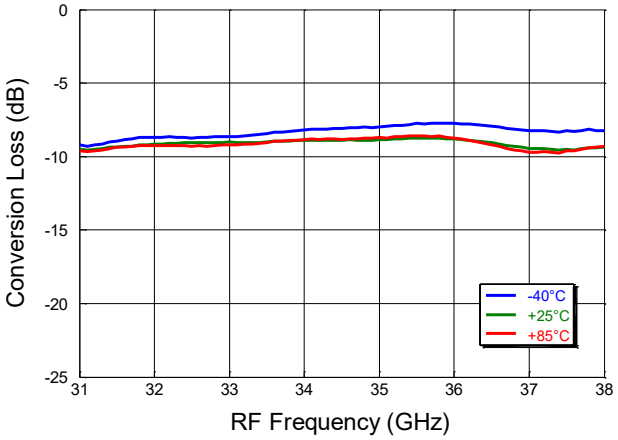
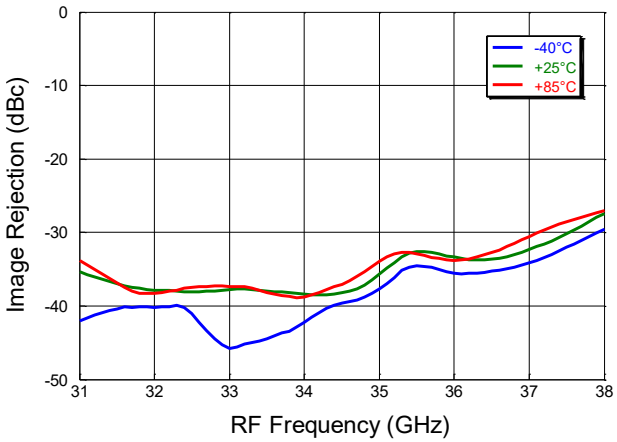
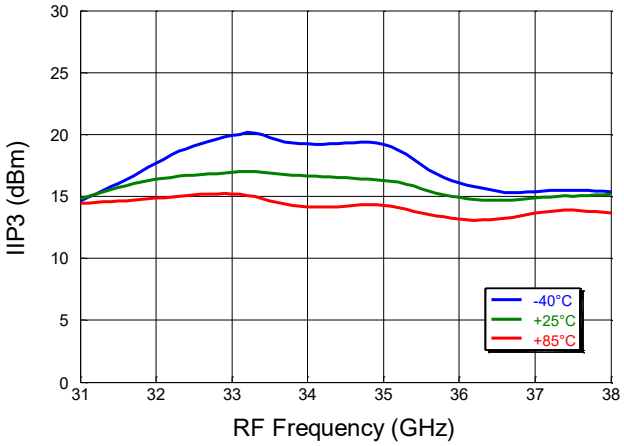


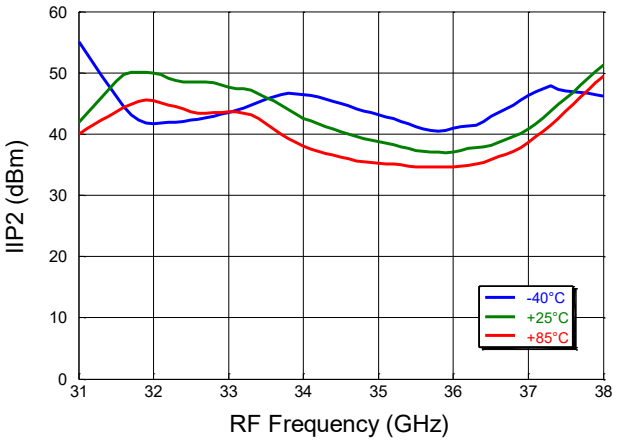
Image Rejection vs. Frequency



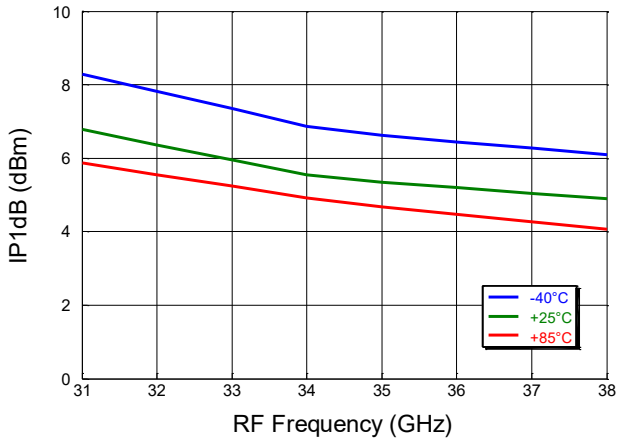
IIP3 vs. RF Frequency



IIP2 vs. RF Frequency



IP1dB vs. RF Frequency



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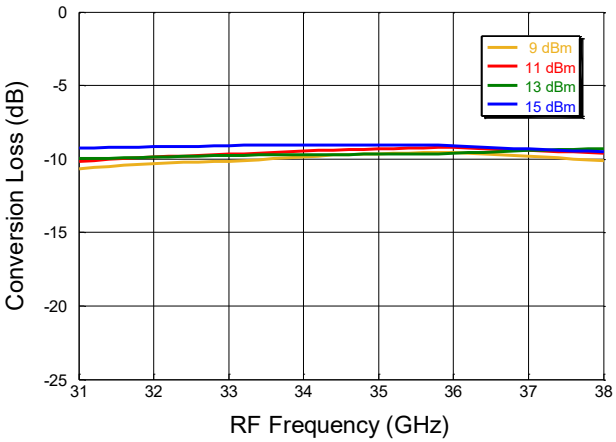
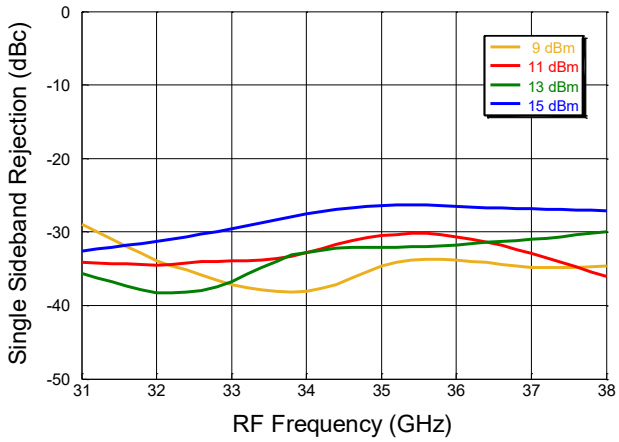
Typical Performance: Up conversion, Upper Side Band (USB), IF = 1 GHz, @ 25°C

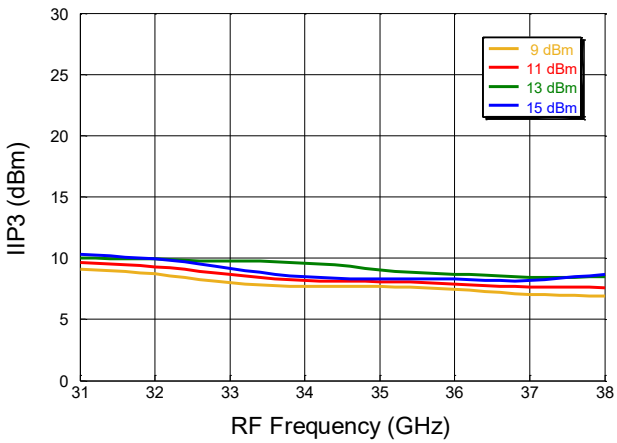
Conversion Loss over LO drive



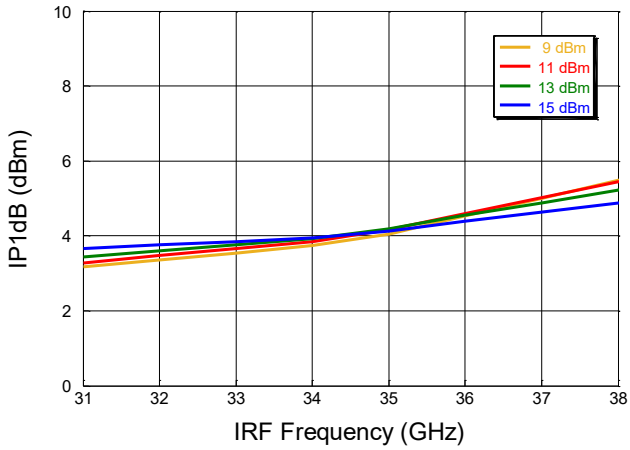
Single Sideband Rejection over LO drive



IIP3 over LO drive vs. RF Frequency



IP1dB over LO drive vs. RF Frequency



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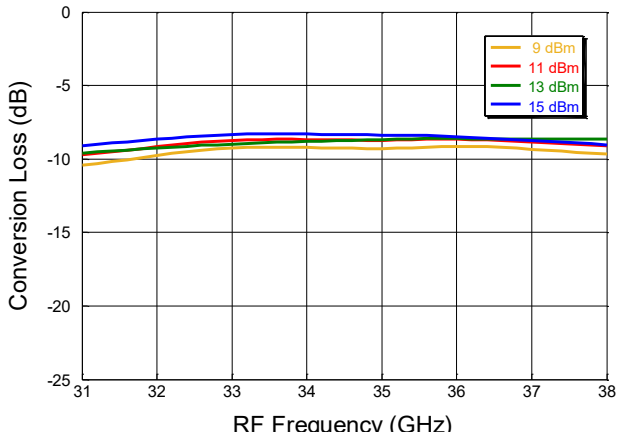
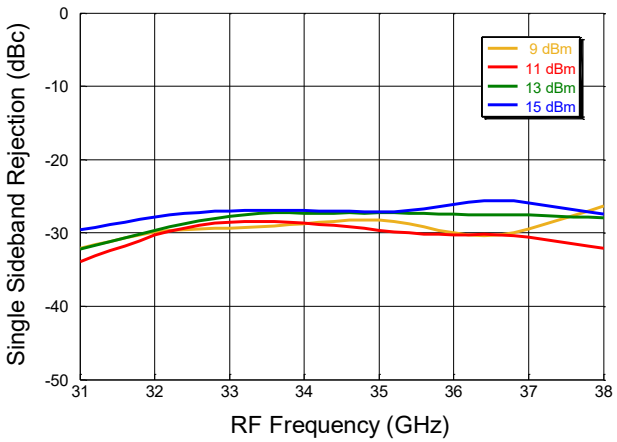
Typical Performance: Up Conversion, Lower Side Band (LSB), IF = 1 GHz @ 25°C

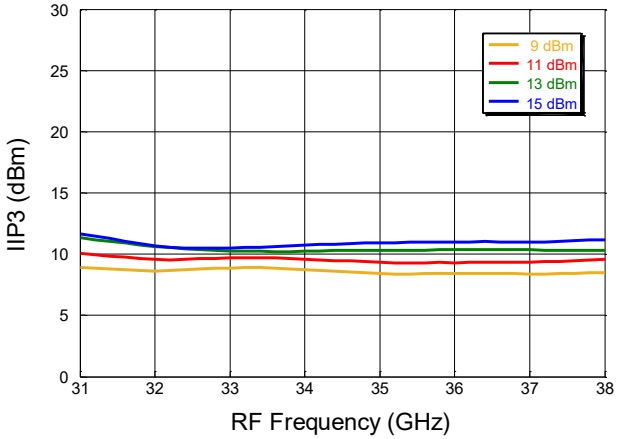
Conversion Loss over LO drive



Single Sideband Rejection over LO drive



IIP3 over LO drive vs. RF Frequency



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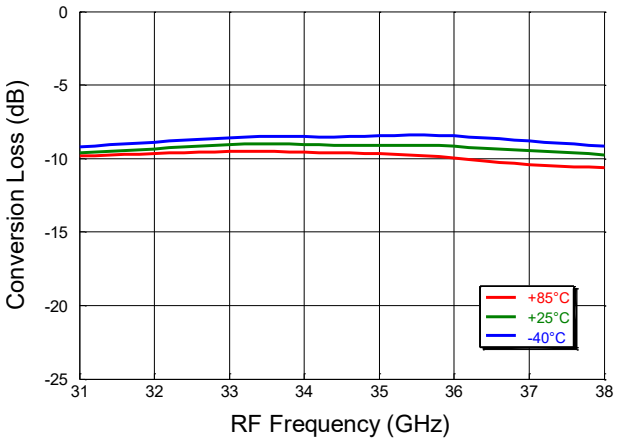
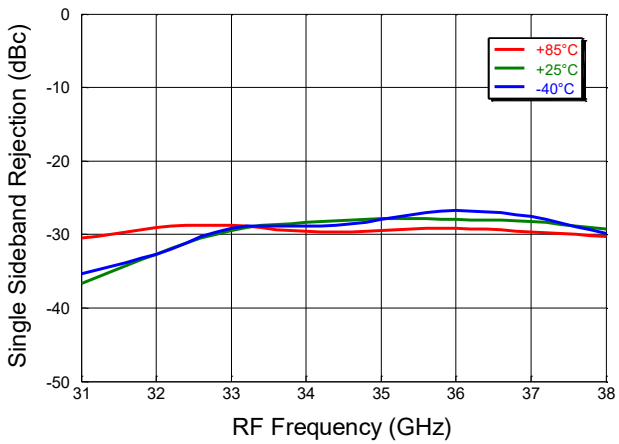
Typical Performance: Up Conversion, Upper side band (USB), IF = 1 GHz, over Temp.

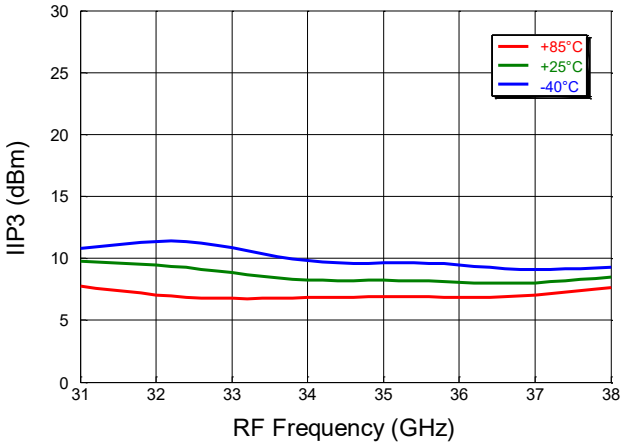
Conversion Loss vs. Frequency (Up Conversion)



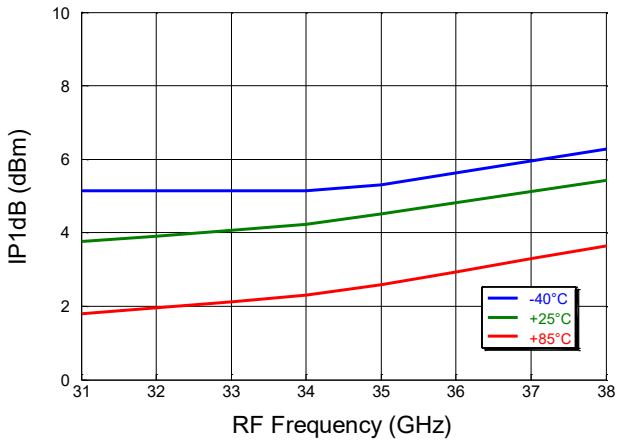
Single Sideband Rejection vs. Frequency



IIP3 vs. RF Frequency (Up Conversion)



IP1dB vs. RF Frequency (Up Conversion)



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Typical Performance: Down conversion, Upper Side Band (USB), @ 25°C, IF = 2 GHz

Conversion Loss over LO drive

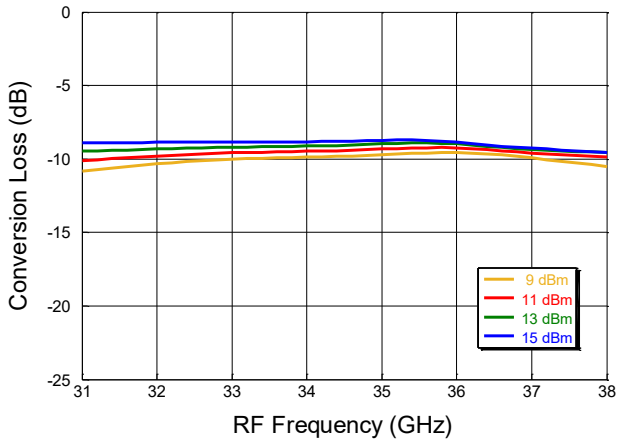
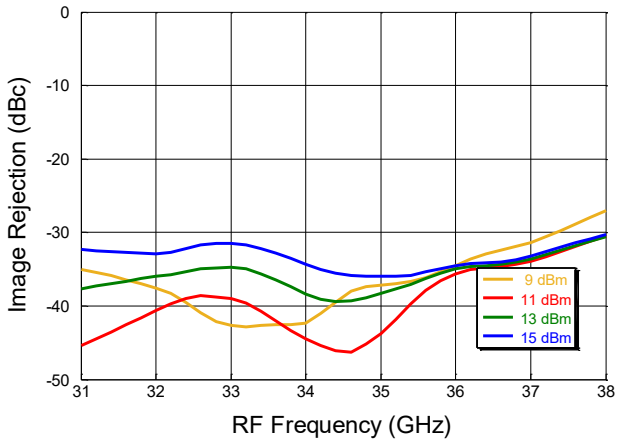
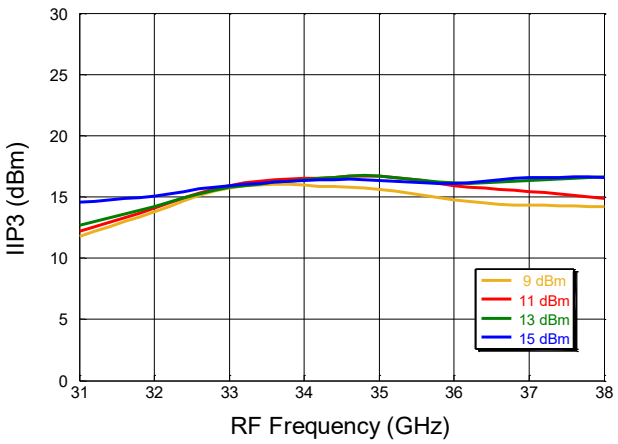


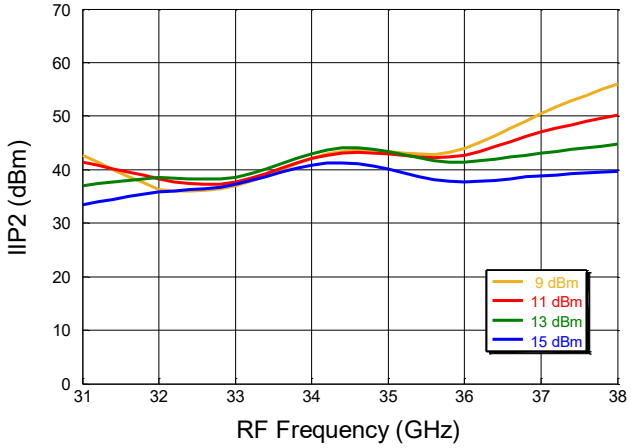
Image Rejection over LO drive



IIP3 over LO drive vs. RF Frequency



IIP2 over LO drive vs. RF Frequency



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Typical Performance: Down Conversion, Lower Side Band (LSB), @ 25°C, IF = 2 GHz

Conversion Loss over LO drive

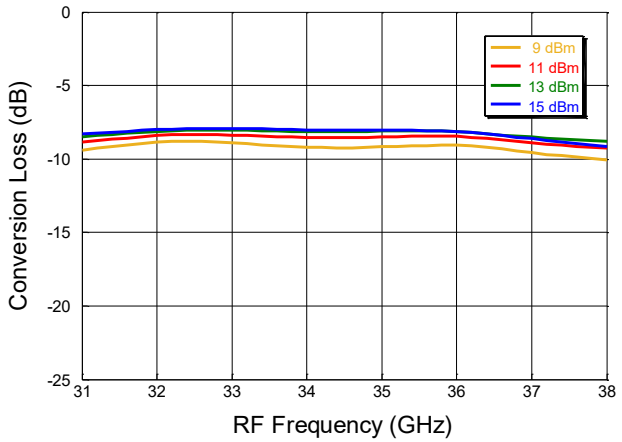
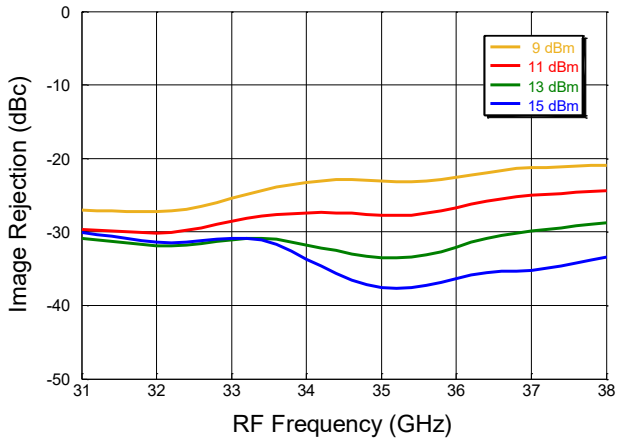
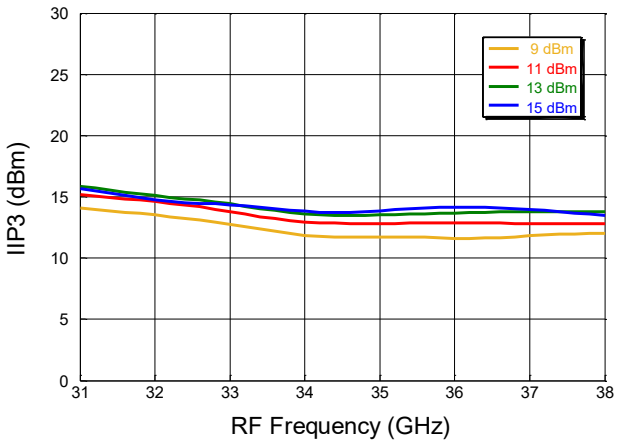


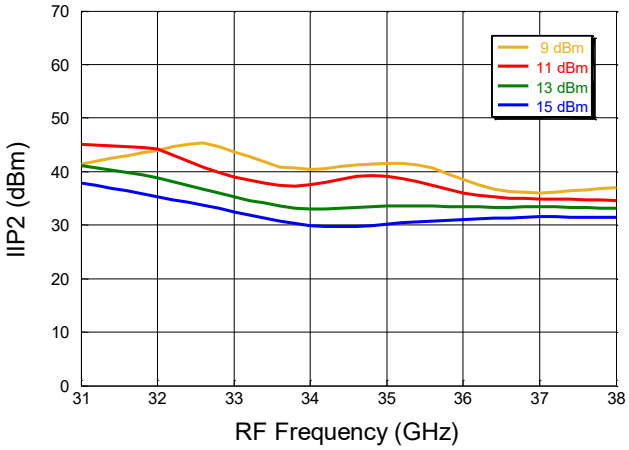
Image Rejection over LO drive



IIP3 over LO drive vs. RF Frequency



IIP2 over LO drive vs. RF Frequency



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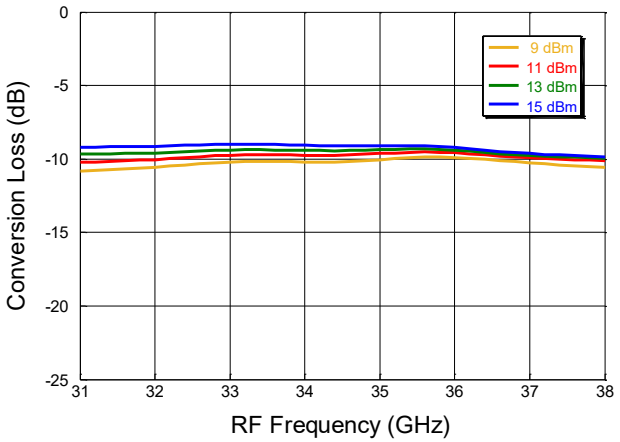
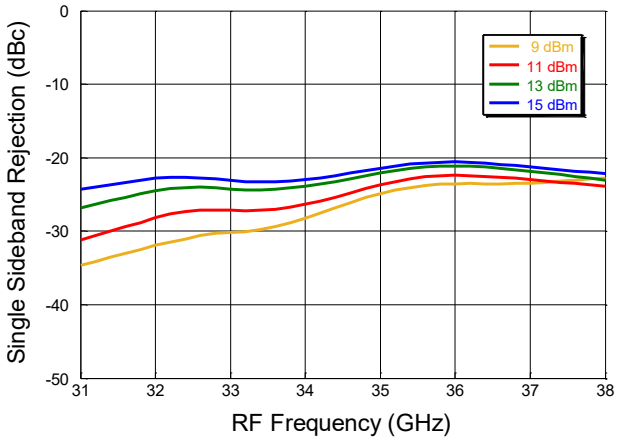
Typical Performance: Up Conversion, Upper Side Band (USB), @ 25°C, IF = 2 GHz

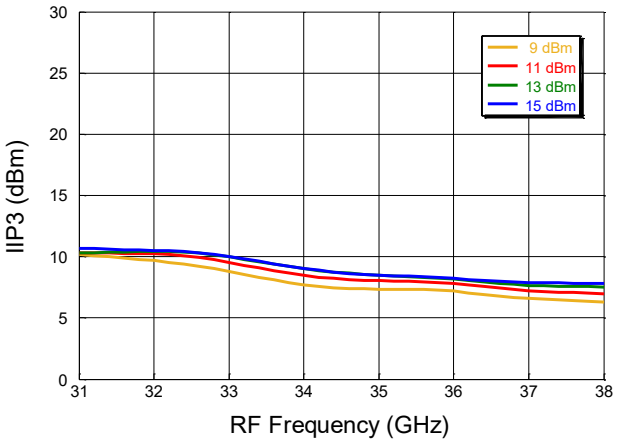
Conversion Loss over LO drive



Single Sideband Rejection over LO drive



IIP3 over LO drive vs. RF Frequency



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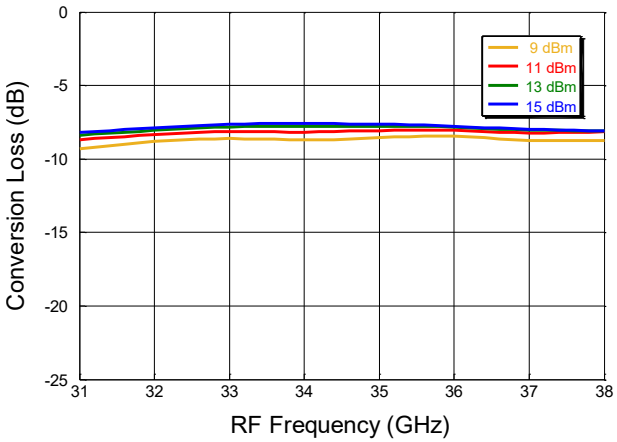
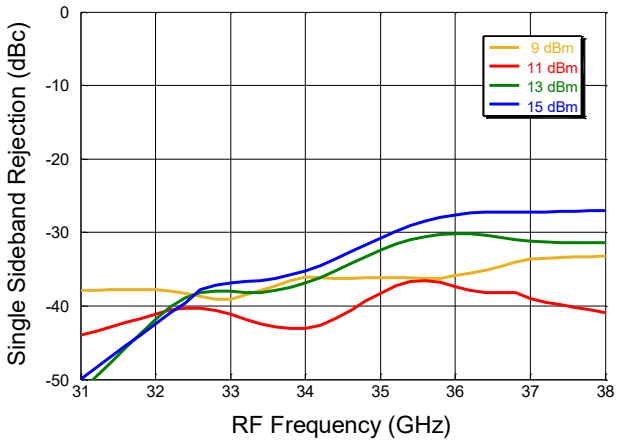
Typical Performance: Up Conversion, Lower Side Band (LSB), @ 25°C, IF = 2 GHz

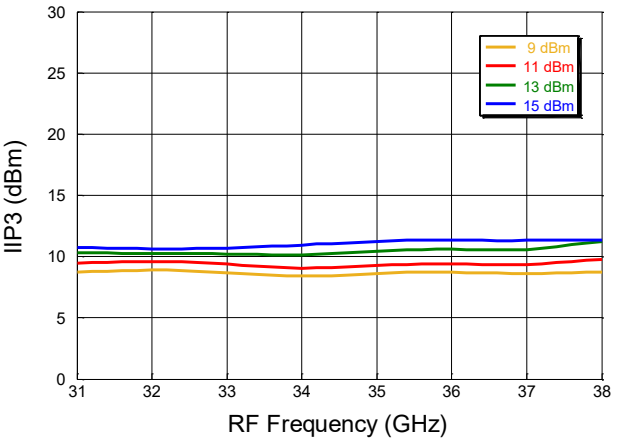
Conversion Loss over LO drive



Single Sideband Rejection over LO drive



IIP3 over LO drive vs. RF Frequency



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Typical Performance: Down Conversion, Upper Side Band (USB), @ 25°C, IF = 5 GHz

Conversion Loss over LO drive

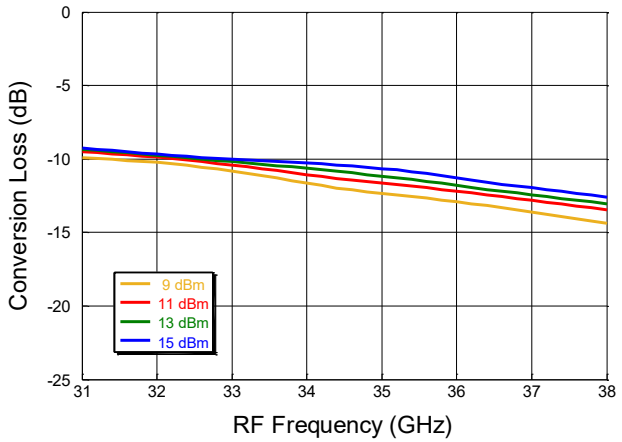
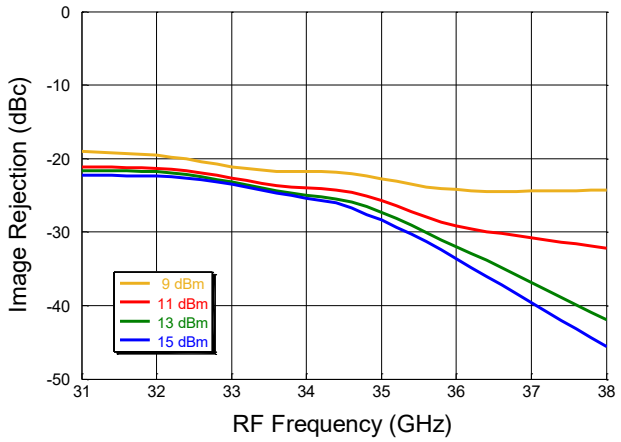
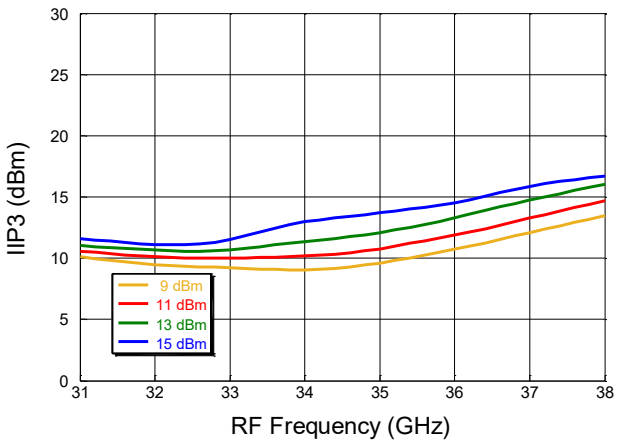


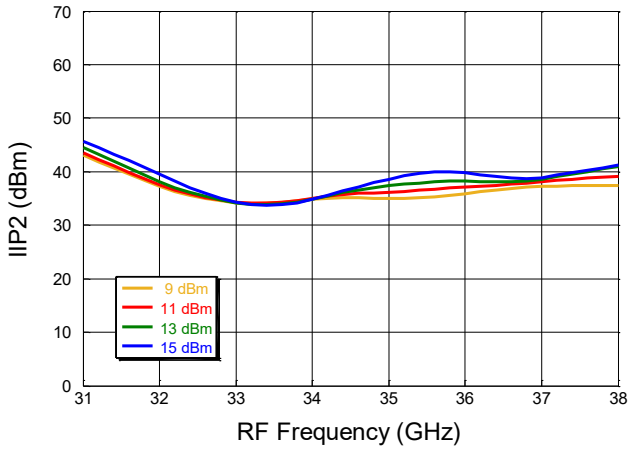
Image Rejection over LO drive



IIP3 over LO drive vs. RF Frequency



IIP2 over LO drive vs. RF Frequency



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Typical Performance: Down Conversion, Lower Side Band (LSB), @ 25°C, IF = 5 GHz

Conversion Loss over LO drive

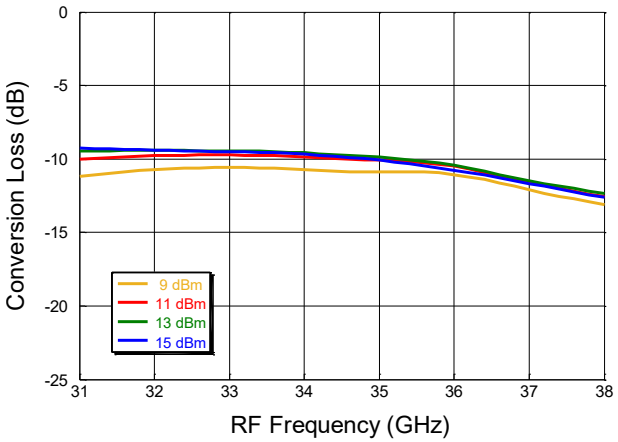
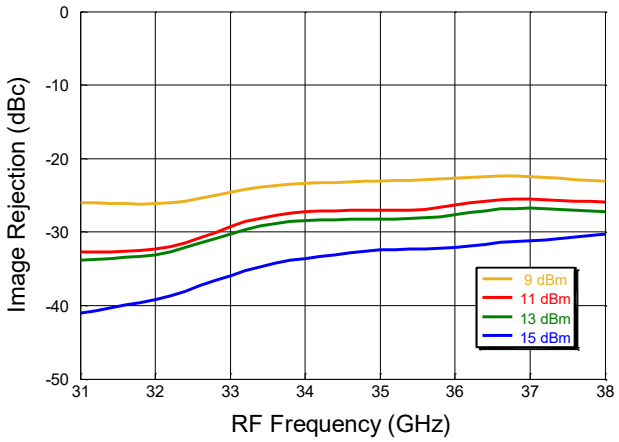
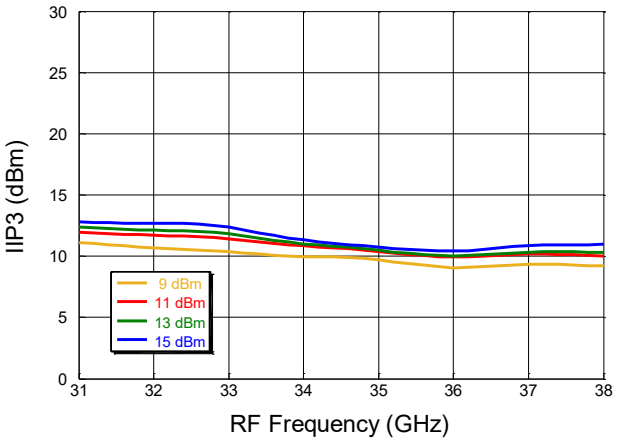


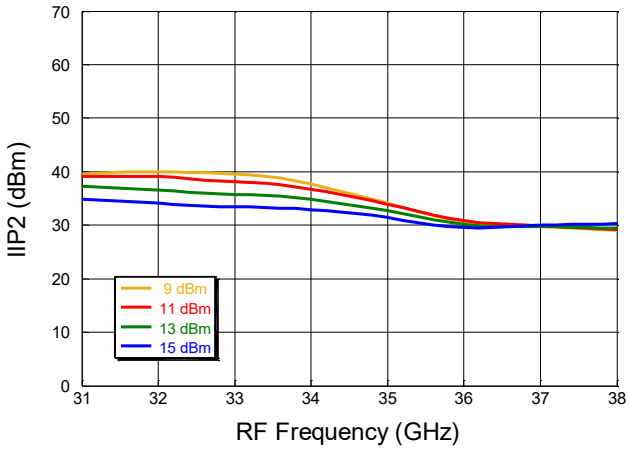
Image Rejection over LO drive



IIP3 over LO drive vs. RF Frequency



IIP2 over LO drive vs. RF Frequency



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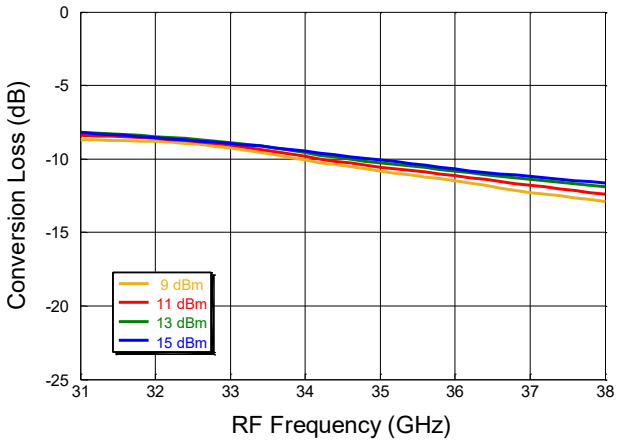
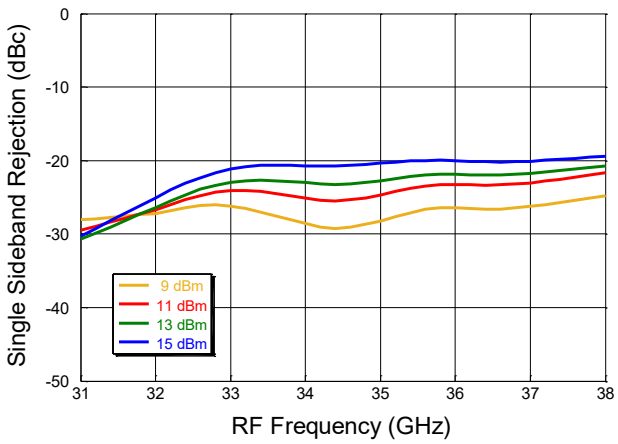
Typical Performance: Up Conversion, Upper Side Band (USB), @ 25°C, IF = 5 GHz

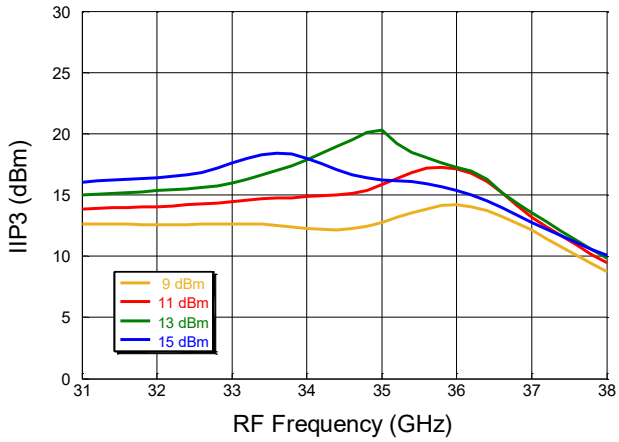
Conversion Loss over LO drive



Single Sideband Rejection over LO drive



IIP3 over LO drive vs. RF Frequency



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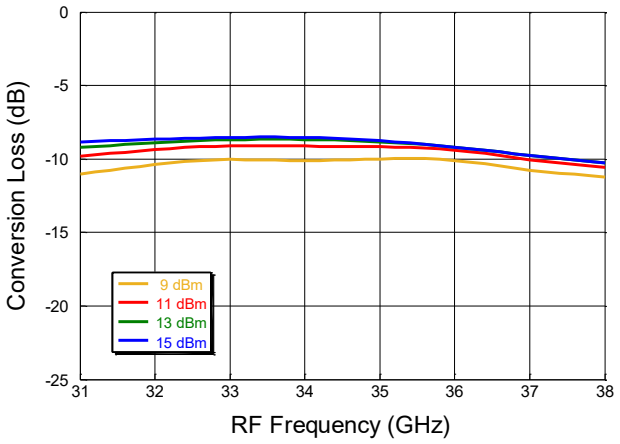
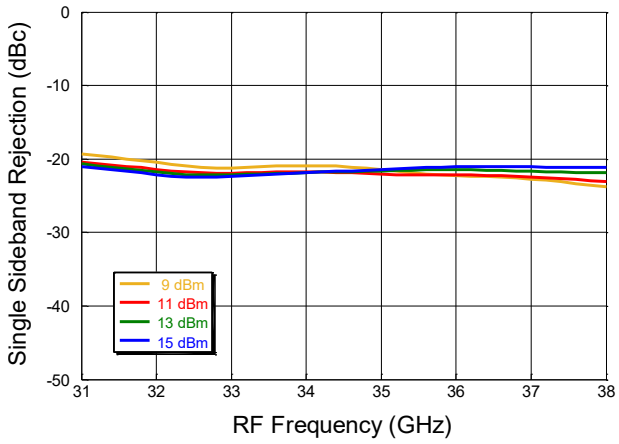
Typical Performance: Up Conversion, Lower Side Band (LSB), @ 25°C, IF = 5 GHz

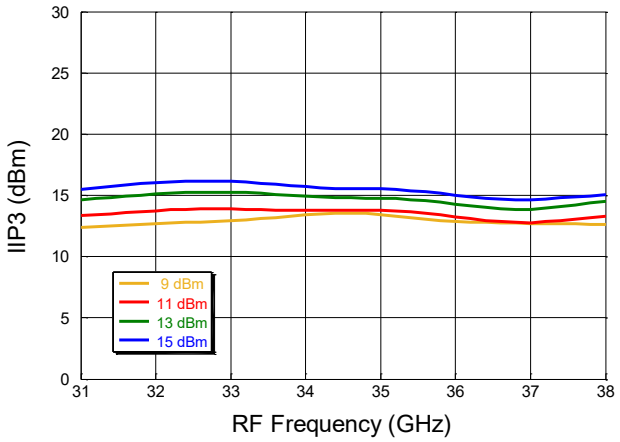
Conversion Loss over LO drive



Single Sideband Rejection over LO drive



IIP3 over LO drive vs. RF Frequency



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MxN Spurious Rejection at IF port (dBc IF)

RF = 35 GHz @ -10 dBm
LO = 34 GHz @ +13 dBm
Measured without Hybrid
'x' denotes level too low to measure

	nxLO				
mxRF	**0**	**1**	**2**	**3**	**4**
0	x	10	x	x	x
1	13	0	28	x	x
2	x	57	52	53	x
3	x	x	x	66	67
4	x	x	x	x	x

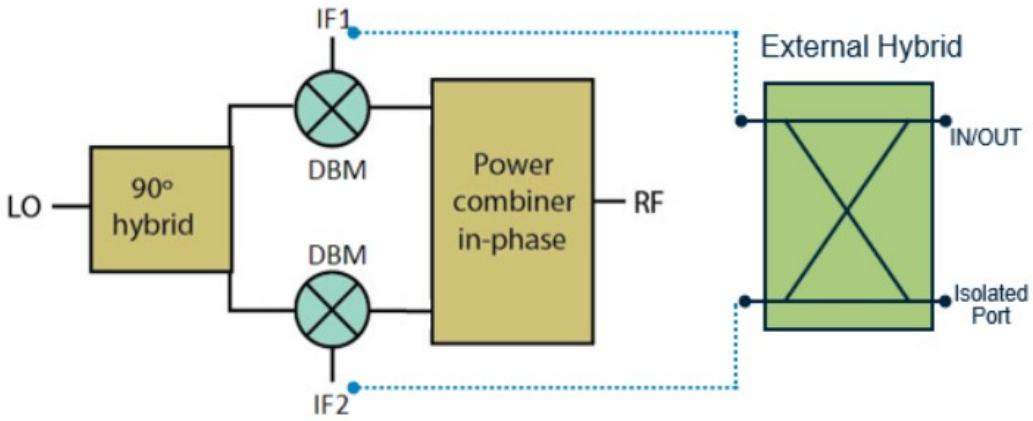
Handling Procedures

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 levels are HBM Class 1C and CDM Class 3C.

Application Schematic



External Hybrid Operation

- Mixer data captured with external 90° hybrid. Connections in down converter mode as follows:
  - RF Upper Side Band (USB) mode attach hybrid 0° port to IF1 mixer port, and 90° hybrid port to IF2 mixer port.
  - RF Lower Side Band (LSB) mode attach hybrid 0° port to IF2 mixer port, and 90° hybrid port to IF1 mixer port.
  - Combined or wanted signal measured at input port, cancelled or image terminated at isolated port.
  - Connections are swapped in up conversion mode.

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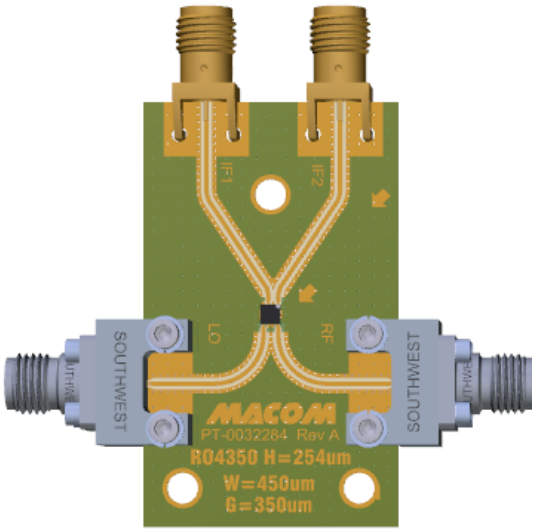
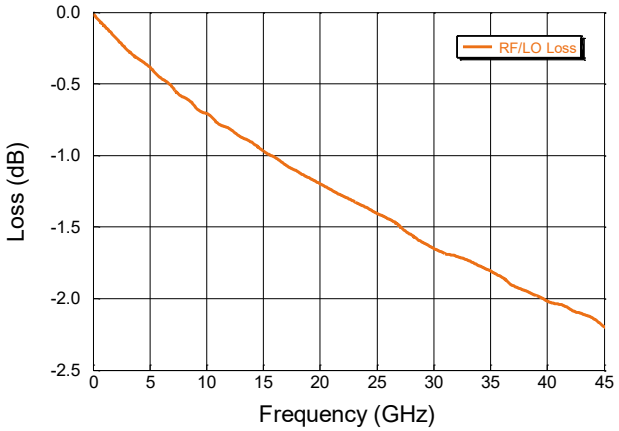
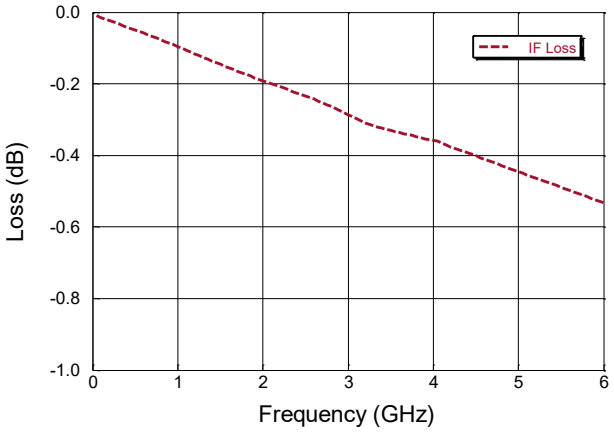
Evaluation Board



Evaluation Board RF/LO Loss



Evaluation Board IF Loss



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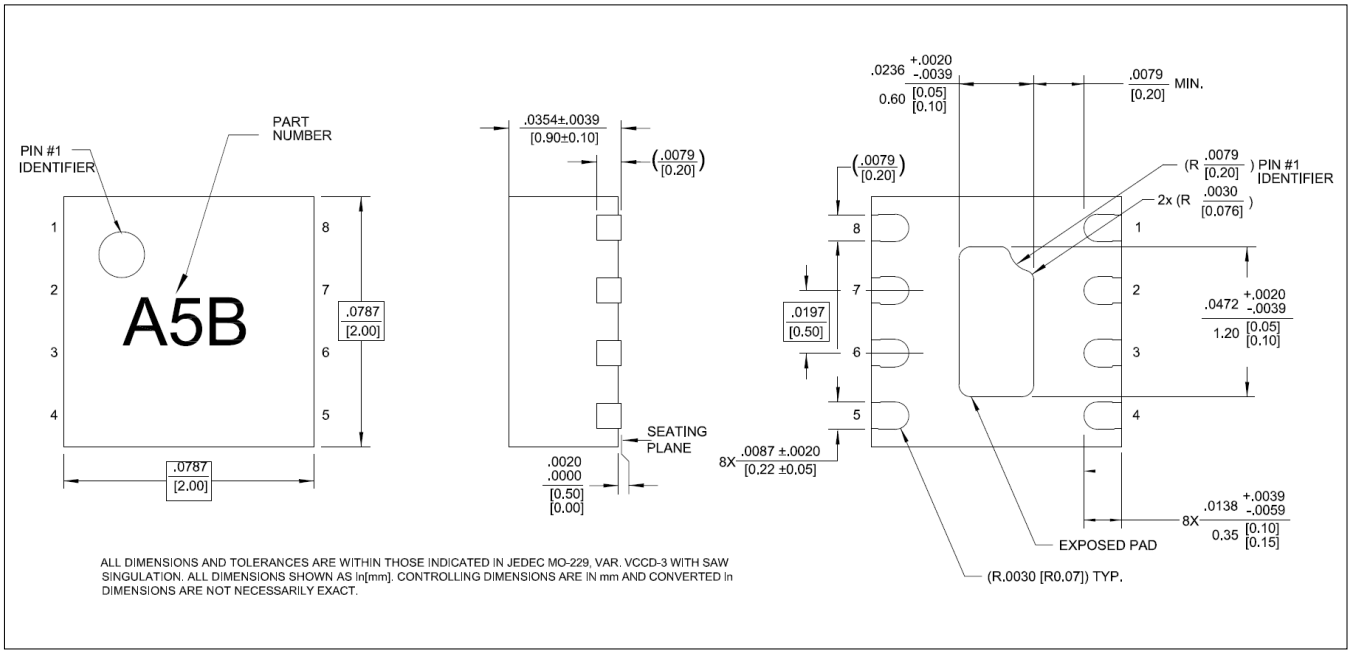
Lead-Free 2 mm, 8 lead PDFN package†



† 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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