MMIC Double-Balanced I/Q Mixer

MMIQ-0205HSM

The MMIQ-0205HSM is a miniaturized, surface-mount multi-octave 1.75-5.0 GHz IQ mixer. It features matched double balanced mixers connected with an integrated LO hybrid and RF power divider. It can be used for either upconversion or downconversion. Applications include communications or radar systems with advanced digital modulation formats and phase modulated signals, test and measurement, or electronic warfare. Image reject or single sideband modulation with excellent suppression is possible with use of an external IF quadrature (90°) hybrid. For a list of recommended LO driver amps for all mixers and IQ mixers, see here.

Features

- 5mm QFN Surface-Mount Package
- CAD Optimized for Superior Isolation, Spurious Response, and Image Rejection/Sideband Suppression
- Broadband Performance
- Excellent Unit-to-Unit Repeatability
- Fully nonlinear software models available with Marki Circuit Models for Microwave Office
- RoHS Compliant

Electrical Specifications - Specifications guaranteed from -55 to +100°C, measured in a 50Ω system.

Parameter	LO (GHz)	RF (GHz)	IF (GHz)	Min	Typ	Max	Diode Option LO drive level (dBm)
Conversion Loss (dB) (Combined IF with Test Hybrid)	1.75-5.0		DC-0.2 0.2-2.0		8.0 10.5	10.5	+14 to +20
Image Rejection (dB) (Combined IF with Test Hybrid)			DC-2.0		See Plots		
I/Q Amplitude Balance (dB)					0.16		
I/Q Quadrature Phase Balance (Degrees)					3		
Isolation (dB) LO-RF LO-IF RF-IF					See Plots		
Input 1 dB Compression (dBm) (Combined IF with Test Hybrid)					+12		
Input Two-Tone Intercept (dBm) (Combined IF with Test Hybrid)					+20		

Part Number Options

Model Number	Description
MMIQ-0205HSM-2 [1]	Surface Mount
EVAL-MMIQ-0205H	Connectorized Evaluation Fixture
MMIQ-0205HXA	Connectorized Module

[1] For port locations and I/O designations, refer to the drawing on page 3 of this document.

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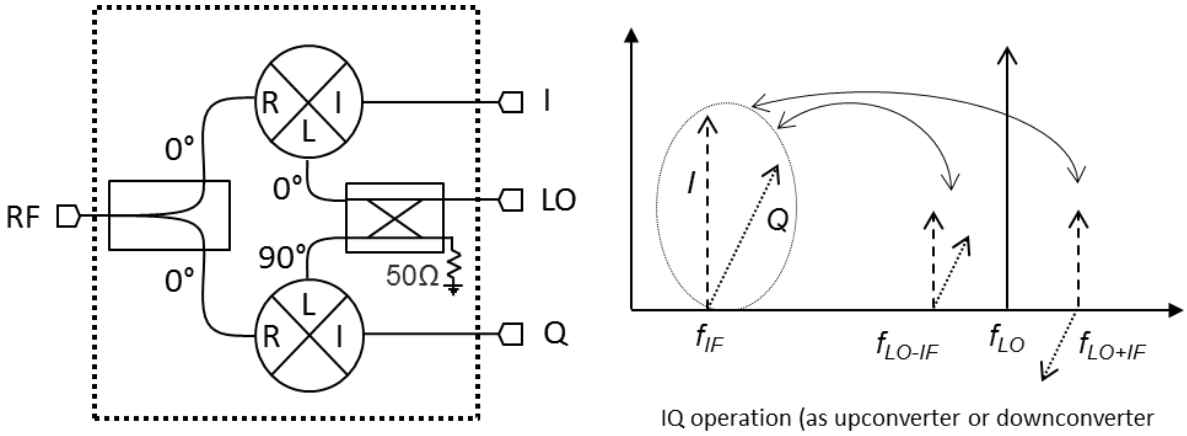


Figure 1a. I/Q Mixer Schematic

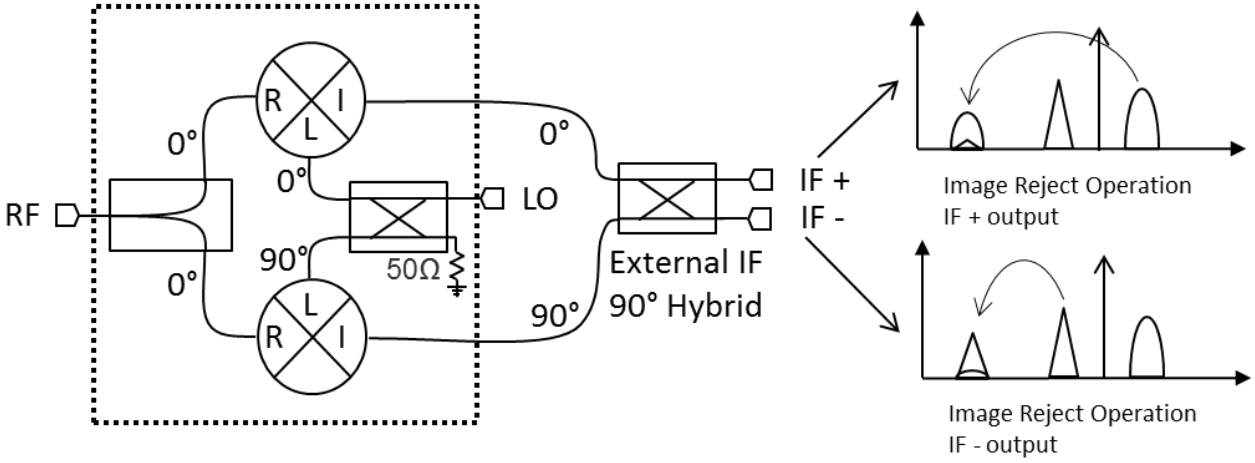
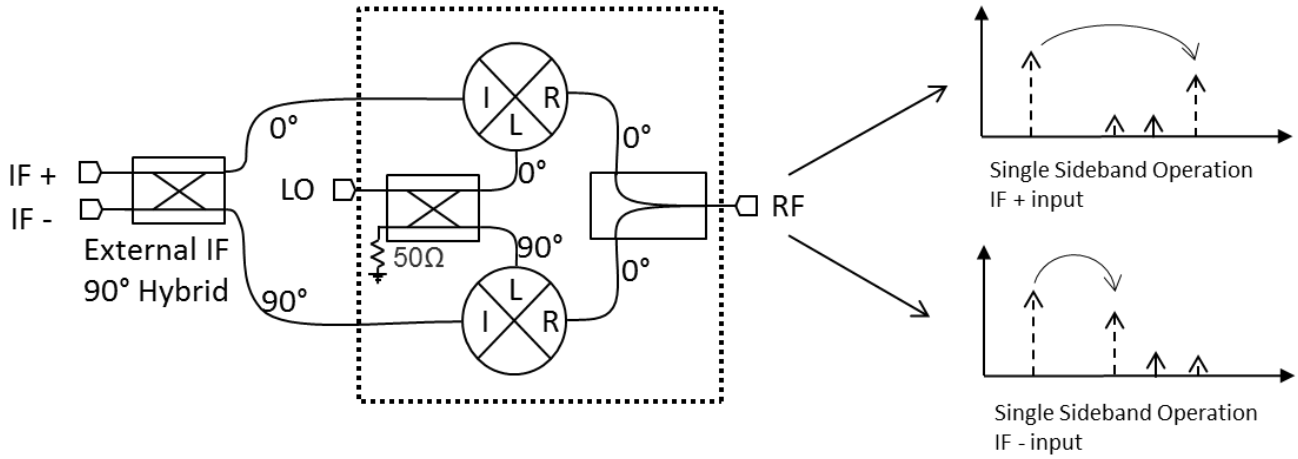
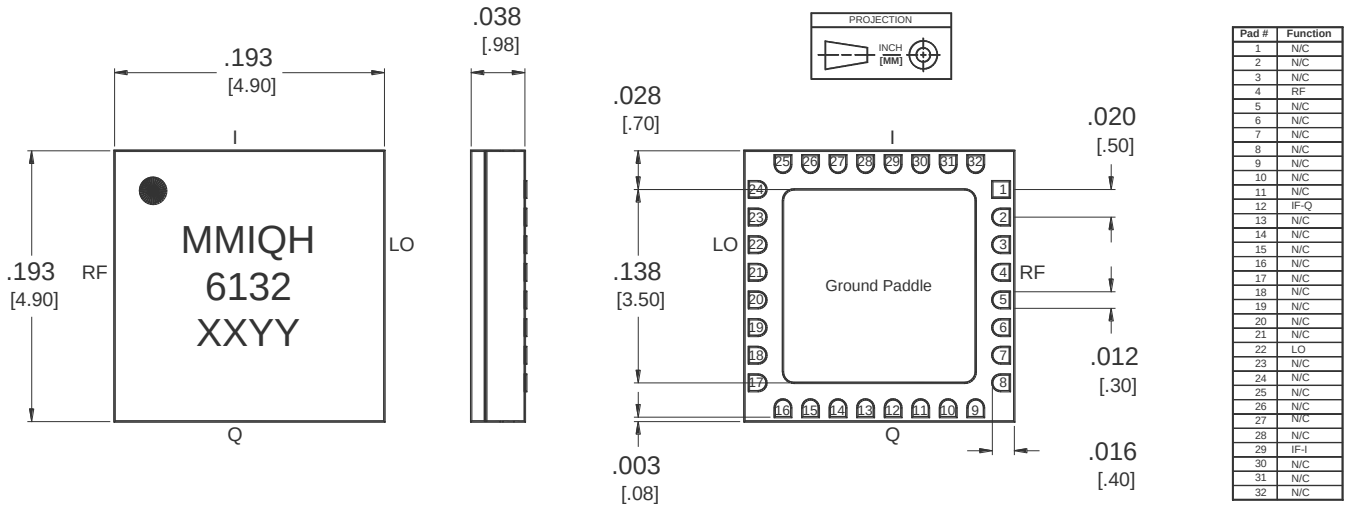


Figure 1b. Image Reject Mixer Schematic

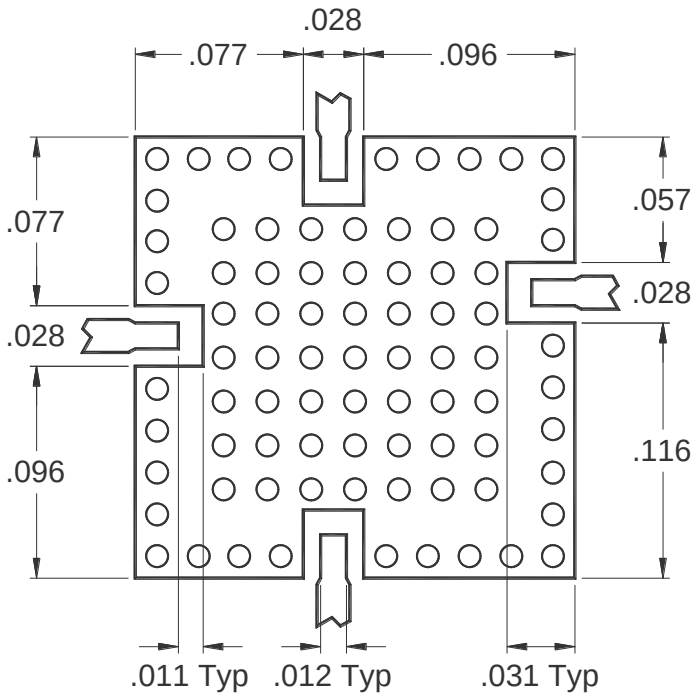




Pad #	Function
1	N/C
2	N/C
3	N/C
4	RF
5	N/C
6	N/C
7	N/C
8	N/C
9	N/C
10	N/C
11	N/C
12	IF-Q
13	N/C
14	N/C
15	N/C
16	N/C
17	N/C
18	N/C
19	N/C
20	N/C
21	N/C
22	LO
23	N/C
24	N/C
25	N/C
26	N/C
27	N/C
28	N/C
29	IF-I
30	N/C
31	N/C
32	N/C

Outline Drawing – 5mm QFN Package

Substrate material is Ceramic.
I/O Leads and Ground Paddle are 1.4±0.6 microns (55±24 micro-inches) Au over 1.3 microns (51 micro-inches) Ni.
All unconnected pads should be connected to PCB RF ground.



QFN-Package Surface-Mount Landing Pattern
Click here for a DXF of the above layout.
Click here for leaded solder reflow. Click here for lead-free solder reflow

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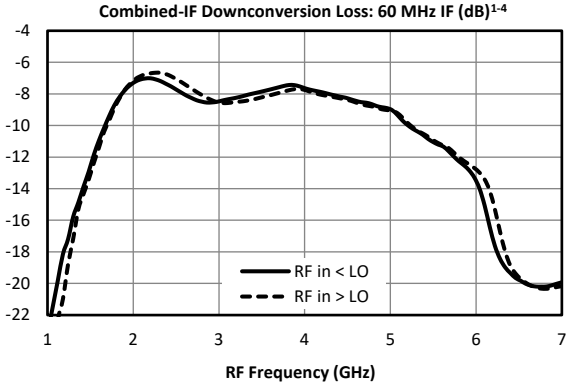
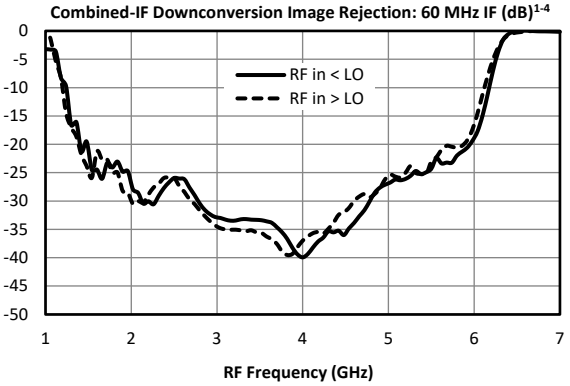
Typical Performance

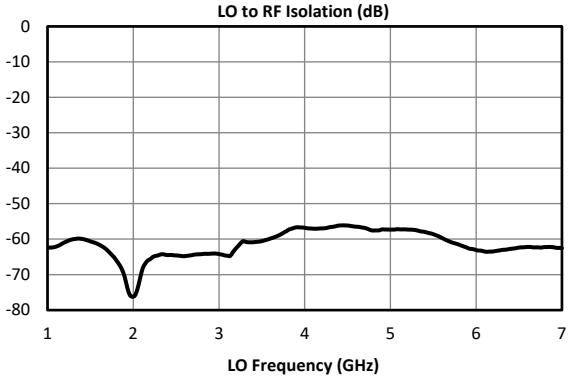
Combined-IF Downconversion Loss: 60 MHz IF (dB)[1-4]



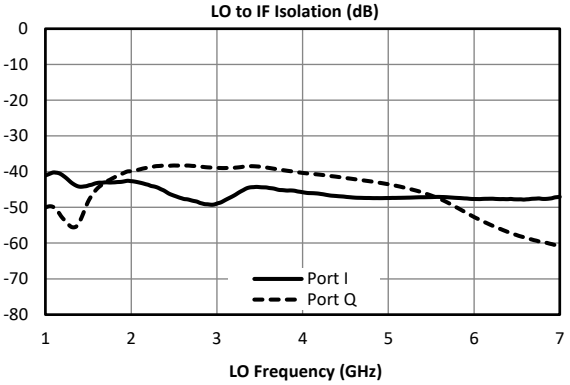
Combined-IF Downconversion Image Rejection: 60 MHz IF (dB)[1-4]



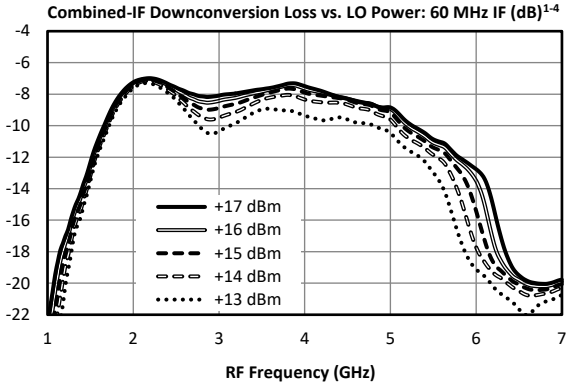
LO to RF Isolation (dB)



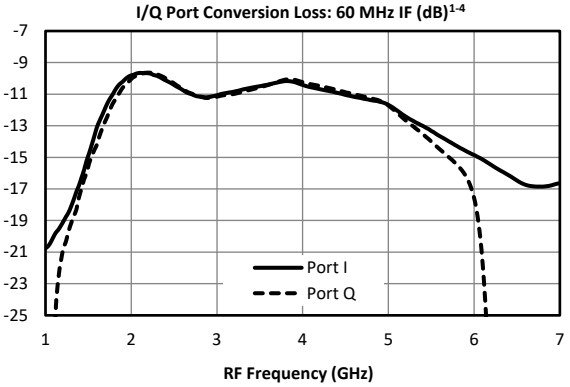
LO to IF Isolation (dB)



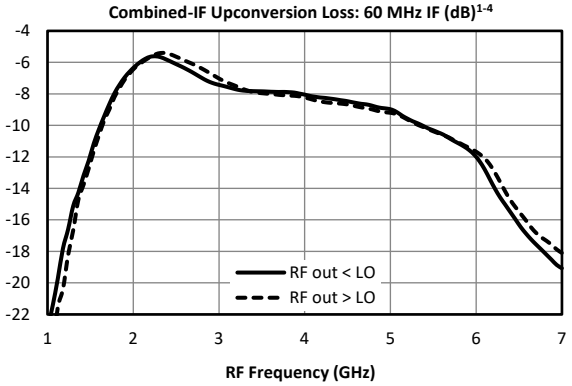
Combined-IF Downconversion Loss vs. LO Power: 60 MHz IF (dB)[1-4]



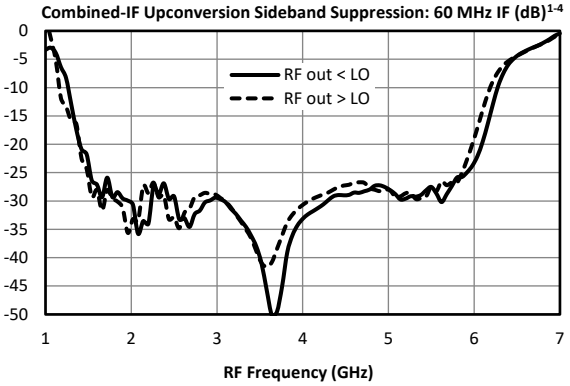
I/Q Port Conversion Loss: 60 MHz IF (dB)[1-4]



Combined-IF Upconversion Loss: 60 MHz IF (dB)[1-4]

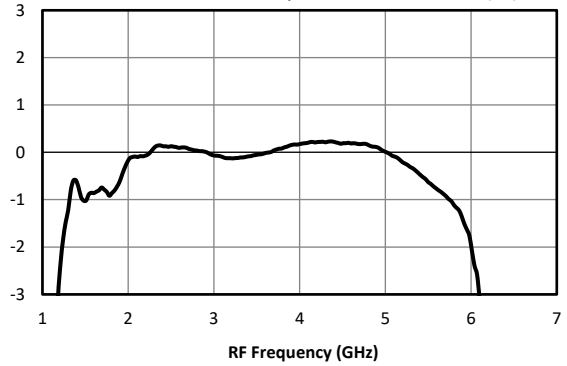


Combined-IF Upconversion Sideband Suppression: 60 MHz IF (dB)[1-4]

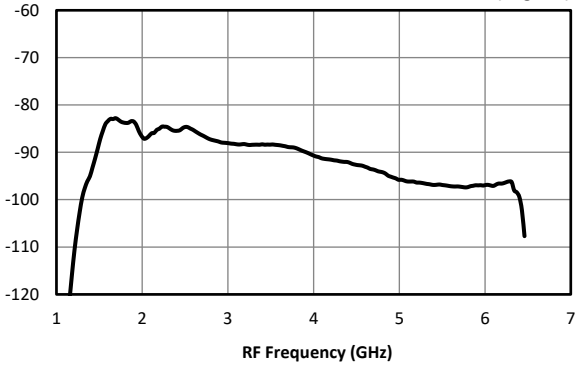


Typical Performance

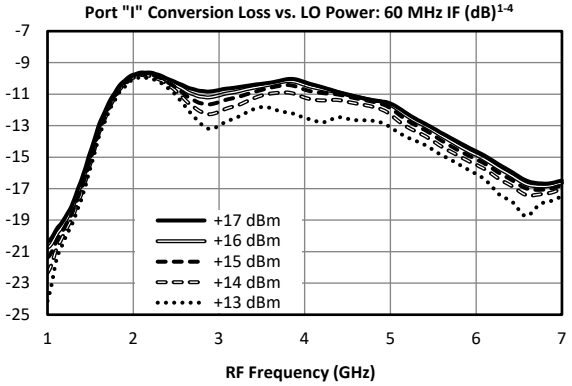
Port "I" to Port "Q" IF Amplitude Match: 60 MHz IF (dB)



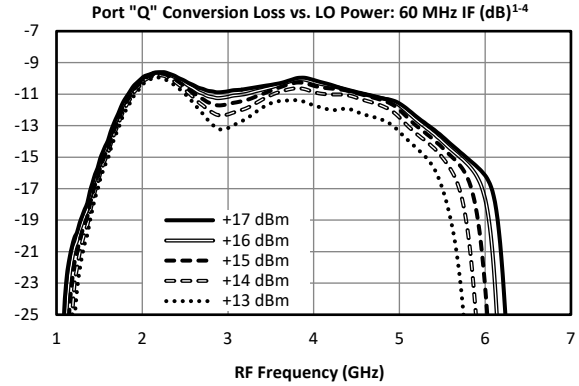
Port "I" to Port "Q" IF Quad. Phase Deviation: 60 MHz IF (Degrees)



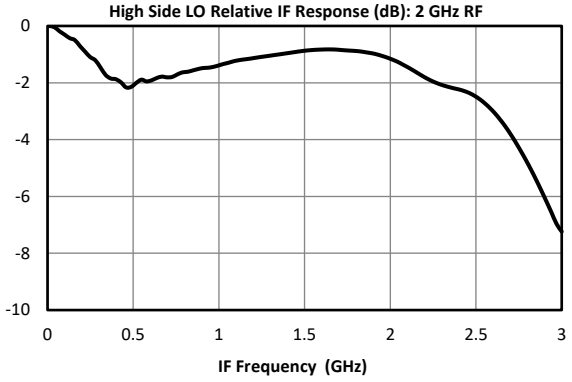
Port "I" Conversion Loss vs. LO Power: 60 MHz IF (dB)[1-4]



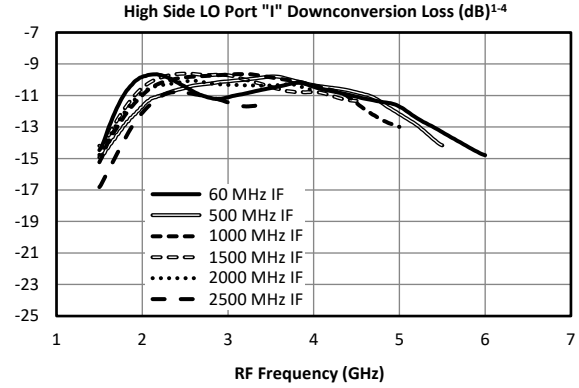
Port "Q" Conversion Loss vs. LO Power: 60 MHz IF (dB)[1-4]



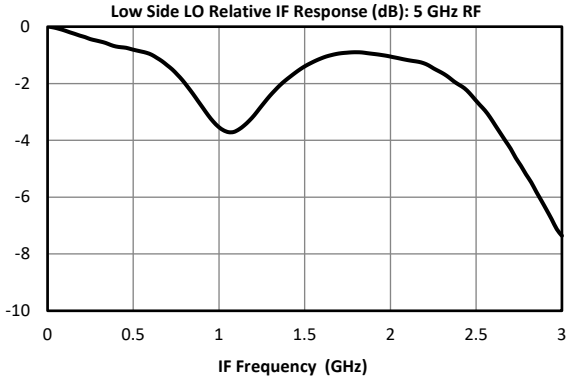
High Side LO Relative IF Response (dB): 2 GHz RF



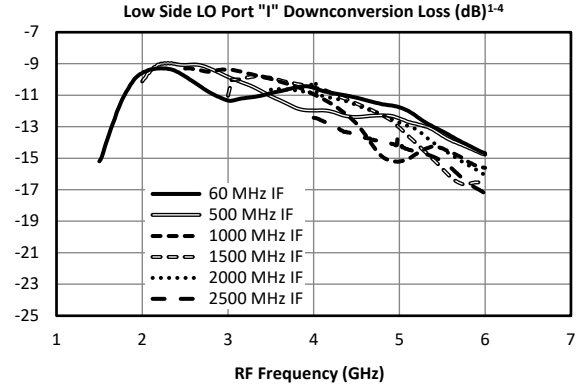
High Side LO Port "I" Downconversion Loss (dB)[1-4]



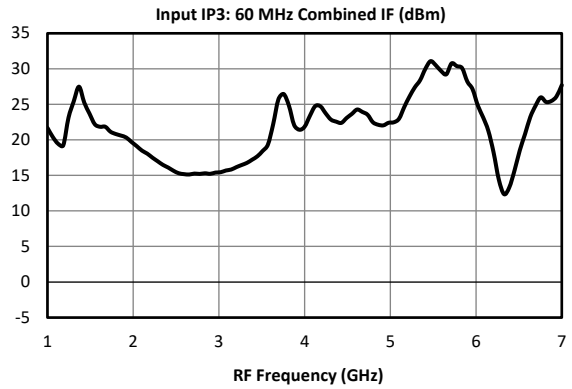
Low Side LO Relative IF Response (dB): 5 GHz RF

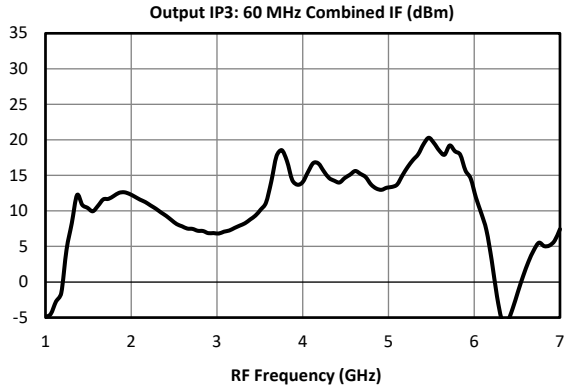


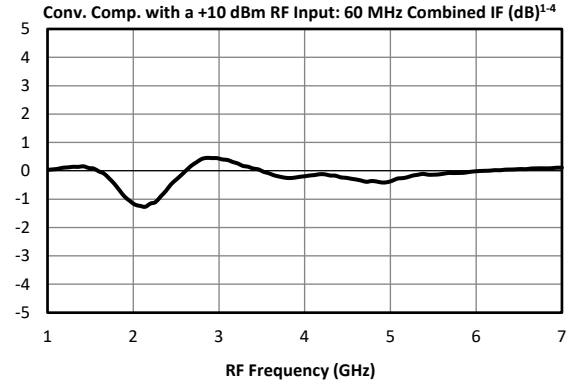
Low Side LO Port "I" Downconversion Loss (dB)[1-4]

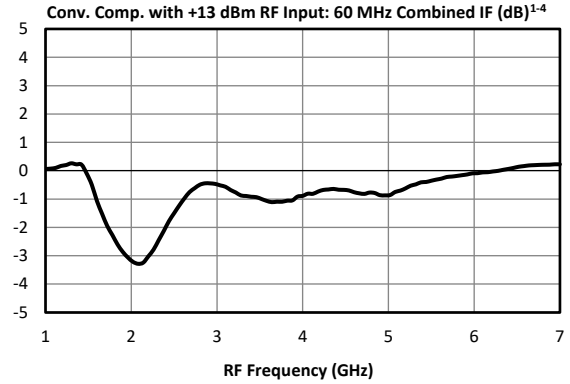


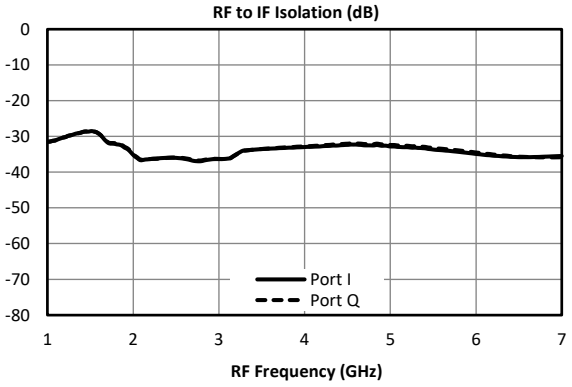
Typical Performance

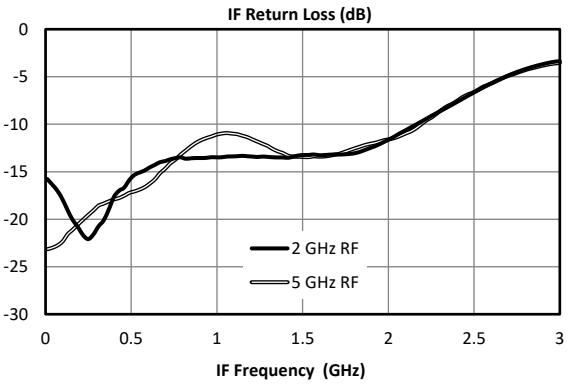


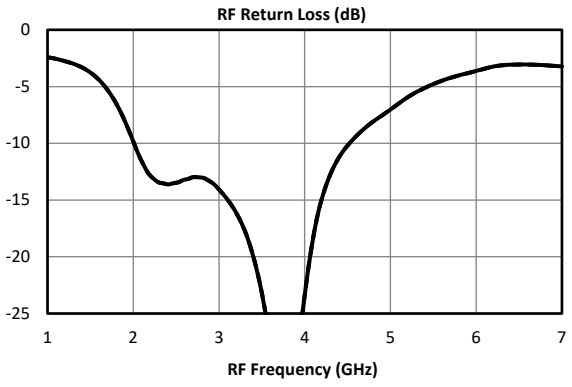


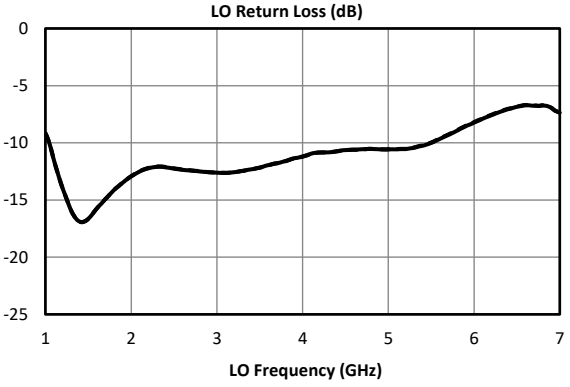




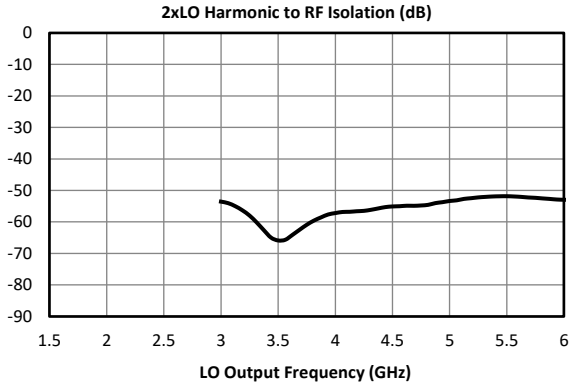


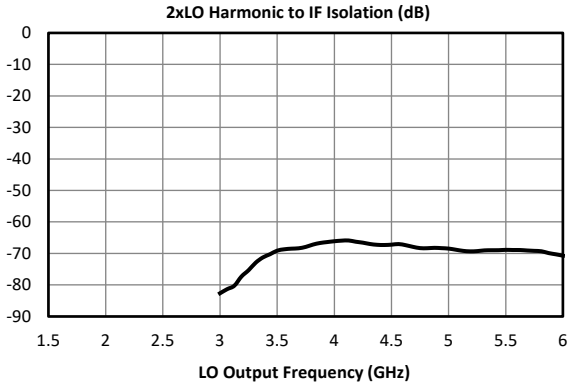


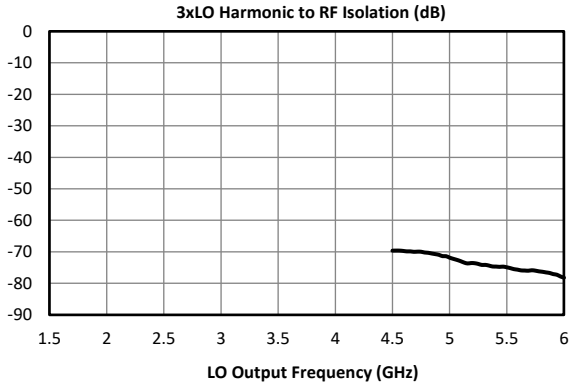


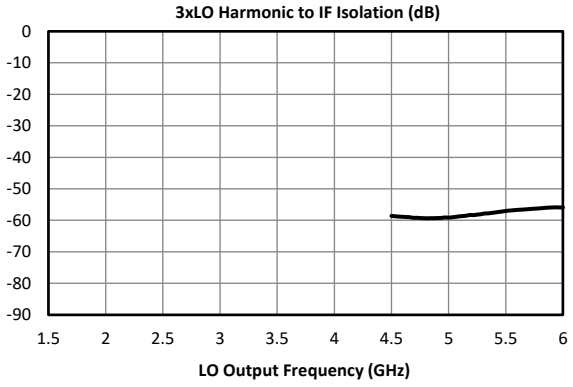


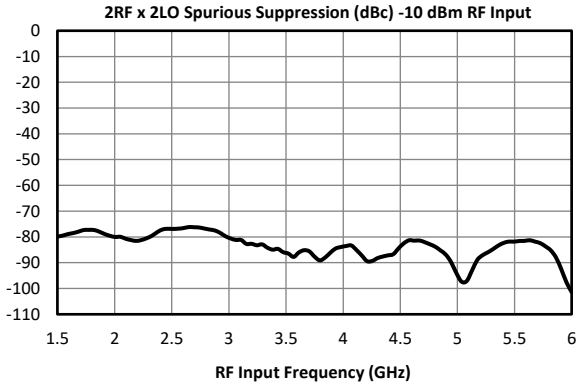
Typical Performance

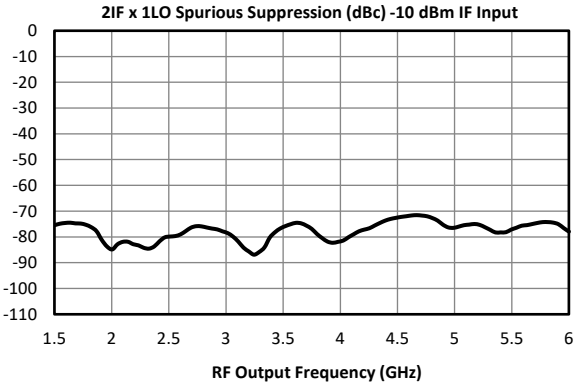












Downconversion Spurious Suppression

Spurious data is taken by selecting RF and LO frequencies (±mLO±nRF) within the RF/LO bands, to create a spurious output within the IF band. The mixer is swept across the full spurious band and the mean is calculated. The numbers shown in the table below are for a -10 dBm RF input. Spurious suppression is scaled for different RF power levels by (n-1), where "n" is the RF spur order. For example, the 2RFx2LO spur is 83 dBc for a -10 dBm input, so a -20 dBm RF input creates a spur that is (2-1) x (-10 dB) dB lower, or 93 dBc.

Typical Downconversion Spurious Suppression (dBc) [4]

-10 dBm RF Input	0xLO	1xLO	2xLO	3xLO	4xLO	5xLO
1xRF	23	Reference	42	15	55	18
2xRF	91	63	83	64	78	67
3xRF	92	76	88	68	94	68
4xRF	142	110	118	109	119	103
5xRF	155	126	134	121	129	115

Upconversion Spurious Suppression

Spurious data is taken by mixing an input within the IF band, with LO frequencies (±mLO±nIF), to create a spurious output within the RF output band. The mixer is swept across the full spurious output band and the mean is calculated. The numbers shown in the table below are for a -10 dBm IF input. Spurious suppression is scaled for different IF input power levels by (n-1), where "n" is the IF spur order. For example, the 2IFx1LO spur is typically 78 dBc for the A configuration for a -10 dBm input, so a -20 dBm IF input creates a spur that is (2-1) x (-10 dB) dB lower, or 88 dBc.

Typical Upconversion Spurious Suppression (dBc) [4]

-10 dBm IF Input	0xLO	1xLO	2xLO	3xLO	4xLO	5xLO
1xIF	23	Reference	39	9	51	33
2xIF	59	78	59	84	59	81
3xIF	92	58	84	54	84	60
4xIF	107	124	97	120	101	120
5xIF	135	103	127	106	123	103