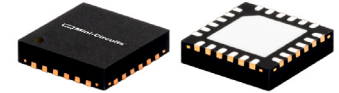




### THE BIG DEAL

- Wideband RF & LO, 2000 to 6000 MHz
- Wideband IF, DC to 3000 MHz
- Image Rejection, Typ. 25 dBc
- High LO-RF Isolation, Typ. 42 dB
- High Input IP3, Typ. +20 dBm
- Usable as Image Reject Mixer & SSB Converter
- 4x4 mm, 24-Lead QFN-Style Package

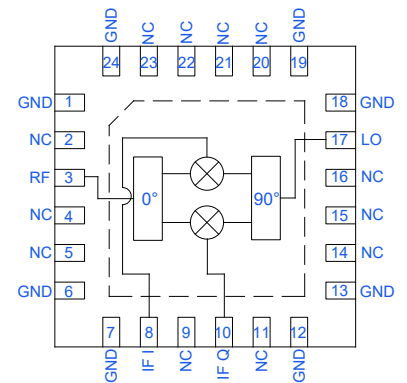


Generic photo used for illustration purposes only

### APPLICATIONS

- Test and Measurement Equipment
- Back Haul Radio
- Satellite Communications
- Radar, EW, and ECM Defense Systems

### FUNCTIONAL DIAGRAM



### PRODUCT OVERVIEW

The SMIQ-263H+ is a passive, wideband, in-phase/quadrature (I/Q) mixer fabricated using GaAs HBT technology. The SMIQ-263H+ is usable as a single-sideband upconverter for transmitter applications or an image rejection mixer for receiver applications. The SMIQ-263H+ is ideal for wideband frequency translation applications that require inherent rejection of image signals and spurious mixing products. The mixer covers a broad RF and LO frequency range of 2000 to 6000 MHz and an IF frequency range of DC to 3000 MHz. As a passive mixer, the SMIQ-263H+ offers a lower noise figure than active mixers, enabling superior dynamic range for high performance applications. The mixer is housed in a compact 4x4 mm 24-Lead QFN-style package, and no DC bias is needed for operation.

### KEY FEATURES

Feature	Advantages
High Image Rejection, Typ. 25 dBc	Provides inherent rejection of unwanted image signals without the need for external filtering.
High Isolation, <ul style="list-style-type: none"> <li>• LO-RF, Typ. 42 dB</li> <li>• LO-IF, Typ. 32 dB</li> </ul>	Enables excellent carrier rejection in single-sideband upconverter transmit applications. Minimizes filtering requirements needed to ensure signal integrity.
Wide RF/LO Bandwidth, 2000 to 6000 MHz	Useful in both wideband and narrowband systems across a broad frequency range, minimizing component changes in reconfigurable systems.
Wide IF Bandwidth, DC to 3000 MHz	High IF conversion reduces filtering requirements. With IF operation as low as DC, this mixer is also usable for phase detector applications.
Small Size, 4x4 mm QFN-Style Package	Small footprint saves space in dense layouts while providing low inductance and repeatable transitions. Industry standard packaging allows for ease of assembly in high volume manufacturing processes.

REV. OR  
ECO-023963  
SMIQ-263H+  
MCL NY  
241216



MMIC SURFACE MOUNT

# IQ Mixer

## SMIQ-263H+

50Ω Level 18 (LO Power +18 dBm) 2000 to 6000 MHz

**ELECTRICAL SPECIFICATIONS<sup>1</sup> AT +25°C, Z<sub>0</sub> = 50Ω, LO POWER = +18 dBm, IF = 200 MHz, UNLESS OTHERWISE NOTED.**

Parameter	Frequency (MHz)	Min.	Typ.	Max.	Unit
RF Frequency Range		2000		6000	MHz
LO Frequency Range		2000		6000	MHz
IF Frequency Range		DC		3000	MHz
LO Power		+17	+18	+19	dBm
Conversion Loss <sup>2</sup>	2000 - 3000		6.4	12.4	dB
	3000 - 4000		8.4	13.3	
	4000 - 5000		8.7	13.3	
	5000 - 6000		8.0	13.2	
Amplitude Unbalance	2000 - 3000		±1.2	±2.9	dB
	3000 - 4000		±0.3	±1.3	
	4000 - 5000		±0.1	±0.9	
	5000 - 6000		±0.7	±2.3	
Phase Unbalance (Relative to 90°)	2000 - 3000		11	18	deg
	3000 - 4000		7	16	
	4000 - 5000		9	26	
	5000 - 6000		11	26	
Image Rejection <sup>3</sup> (Tested as a Downconverter)	2000 - 3000		20		dBc
	3000 - 4000		23		
	4000 - 5000		27		
	5000 - 6000		18		
Single Sideband Rejection <sup>4</sup> (Tested as an Upconverter)	2000 - 3000		26		dBc
	3000 - 4000		26		
	4000 - 5000		27		
	5000 - 6000		14		
LO-RF Isolation	2000 - 3000	29	36		dB
	3000 - 4000	31	37		
	4000 - 5000	39	46		
	5000 - 6000	47	60		
LO-I Isolation	2000 - 3000	25	31		dB
	3000 - 4000	25	30		
	4000 - 5000	26	31		
	5000 - 6000	27	33		
LO-Q Isolation	2000 - 3000	22	29		dB
	3000 - 4000	24	30		
	4000 - 5000	26	33		
	5000 - 6000	31	40		
RF-I Isolation	2000 - 3000	6	16		dB
	3000 - 4000	6	13		
	4000 - 5000	11	19		
	5000 - 6000	18	23		





MMIC SURFACE MOUNT

# IQ Mixer

## SMIQ-263H+

50Ω Level 18 (LO Power +18 dBm) 2000 to 6000 MHz

**ELECTRICAL SPECIFICATIONS<sup>1</sup> AT +25°C, Z<sub>o</sub> = 50Ω, LO POWER = +18 dBm, IF = 200 MHz, UNLESS OTHERWISE NOTED.**

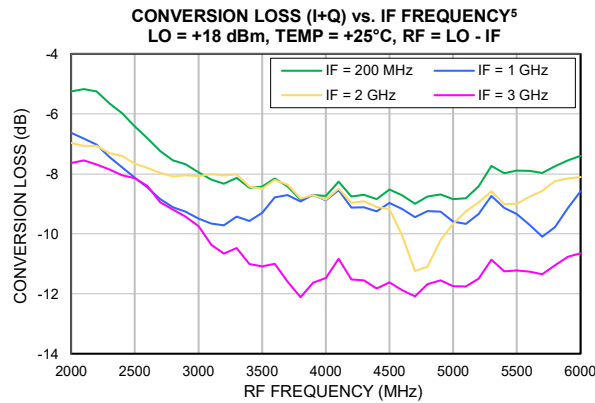
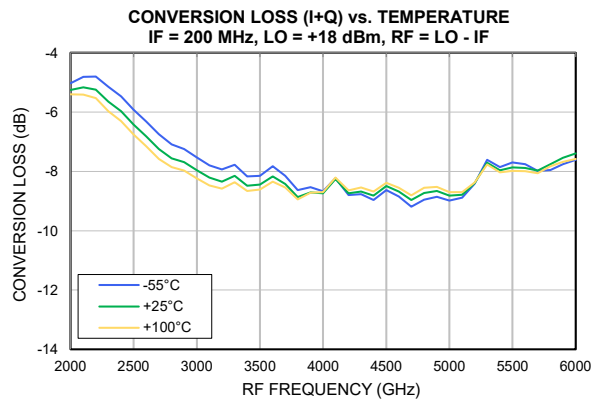
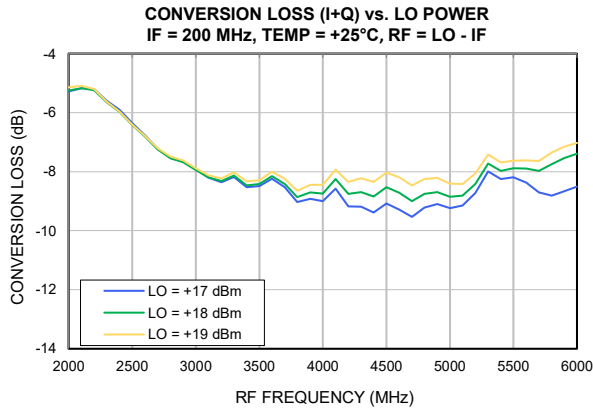
Parameter	Frequency (MHz)	Min.	Typ	Max.	Unit
RF-Q Isolation	2000 - 3000	8	15		dB
	3000 - 4000	7	13		
	4000 - 5000	10	19		
	5000 - 6000	18	23		
Input Power at 1dB Compression	2000 - 6000		+15		dBm
Input IP3 (I) Lower Side Band	2000 - 3000		+18		dBm
	3000 - 4000		+20		
	4000 - 5000		+20		
	5000 - 6000		+19		
Input IP3 (Q) Lower Side Band	2000 - 3000		+19		dBm
	3000 - 4000		+19		
	4000 - 5000		+20		
	5000 - 6000		+23		
Input IP3 (I) Upper Side Band	2000 - 3000		+17		dBm
	3000 - 4000		+20		
	4000 - 5000		+20		
	5000 - 6000		+19		
Input IP3 (Q) Upper Side Band	2000 - 3000		+18		dBm
	3000 - 4000		+19		
	4000 - 5000		+20		
	5000 - 6000		+22		

1. Measured on Mini-Circuits Characterization Test Board TB-SMIQ-263HC+. See Figures 2, 3, 4 & 5. Board loss de-embedded to the device. Unless otherwise specified, IF = 200 MHz.
2. Conversion loss (dB) = RF Power (dBm) minus the sum of I and Q Port Power (dBm), measured as a Downconverter. Ideal combining; does not take into account 3 dB theoretical loss from internal Network Analyzer hybrid. See measurement block diagram Figure 2.
3. Level of undesired image signal below desired RF signal. See measurement block diagram Figure 3.
4. Level of undesired sideband below desired sideband. See measurement block diagram Figure 4





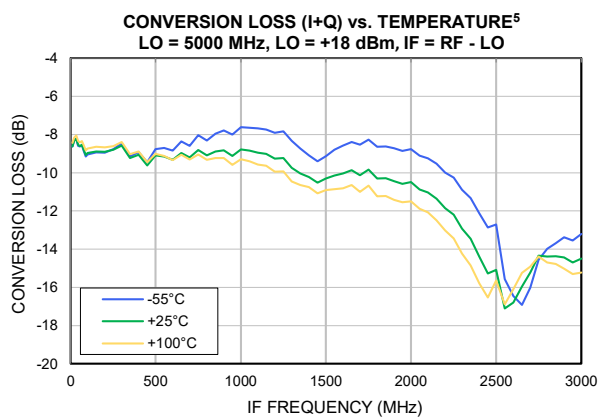
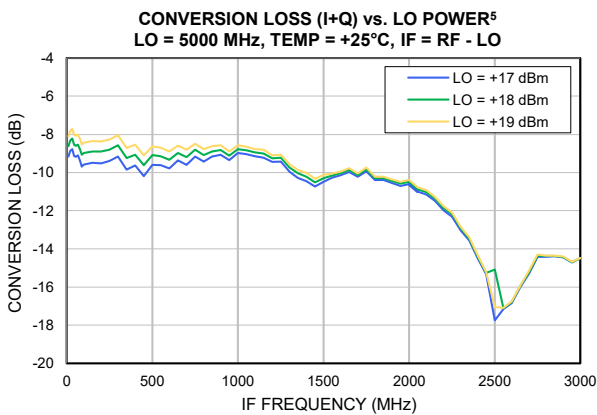
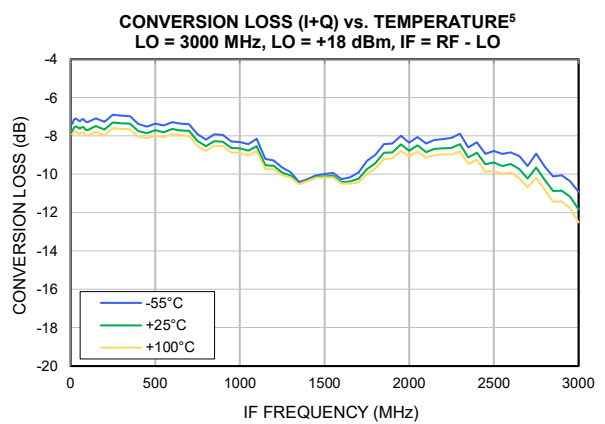
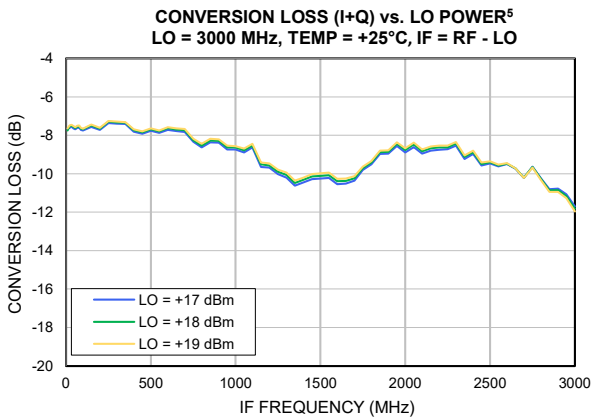
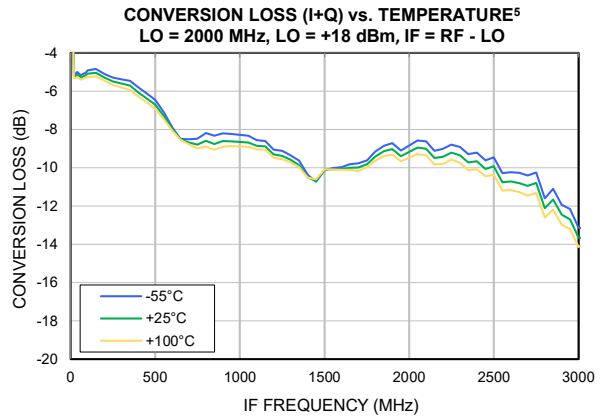
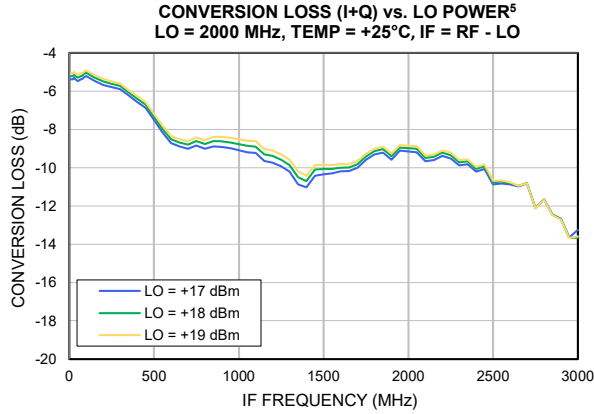
### TYPICAL PERFORMANCE GRAPHS



5. Performance degrades when LO or RF is outside of the specified 2 GHz to 6 GHz range.



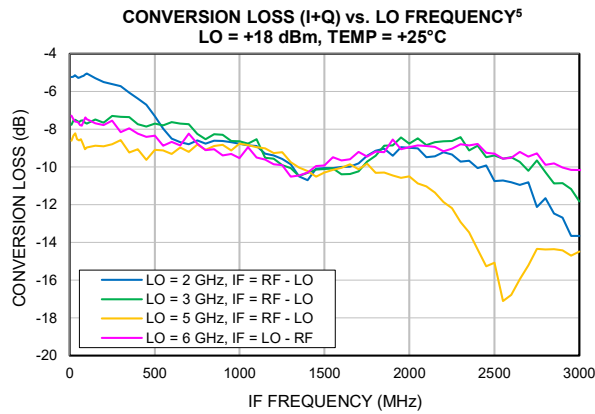
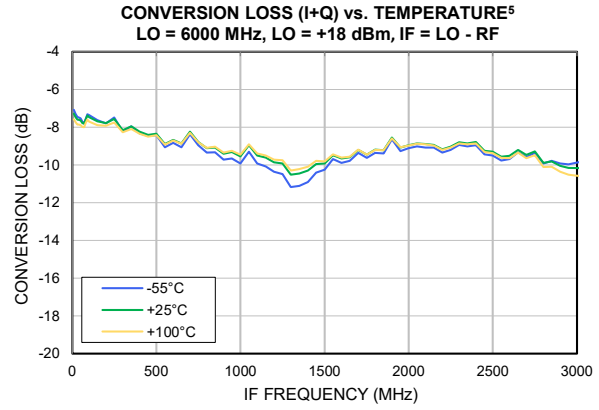
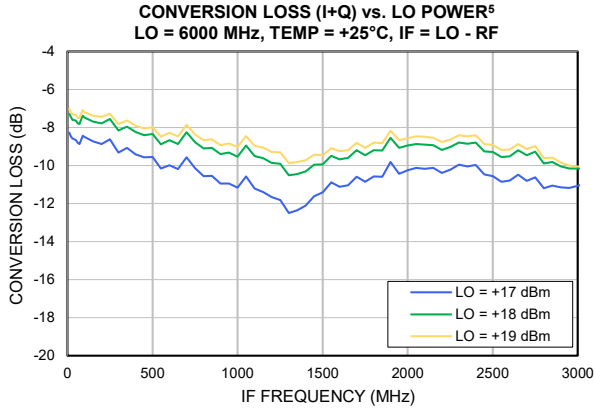
### TYPICAL PERFORMANCE GRAPHS



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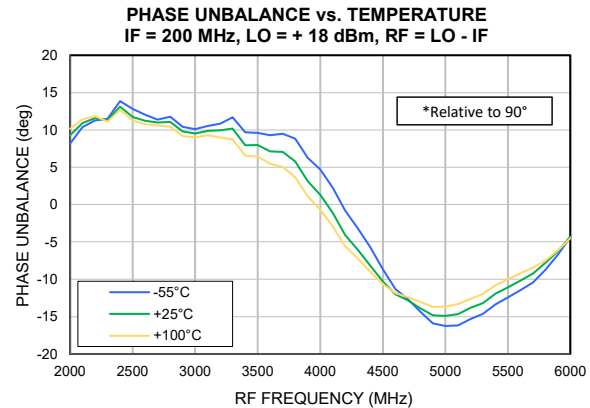
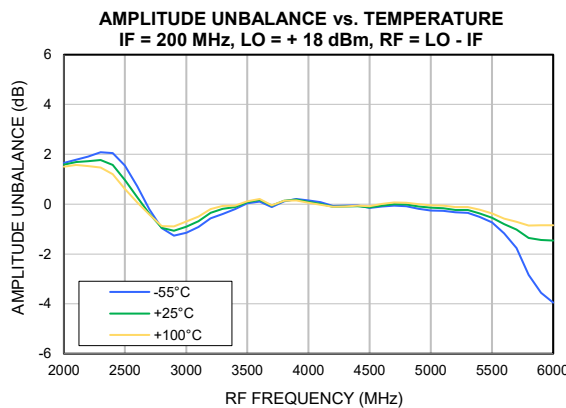
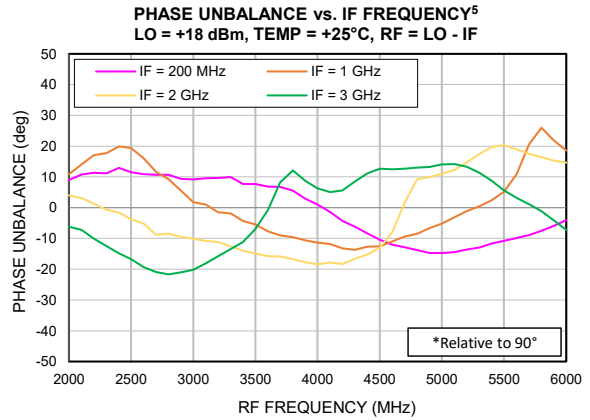
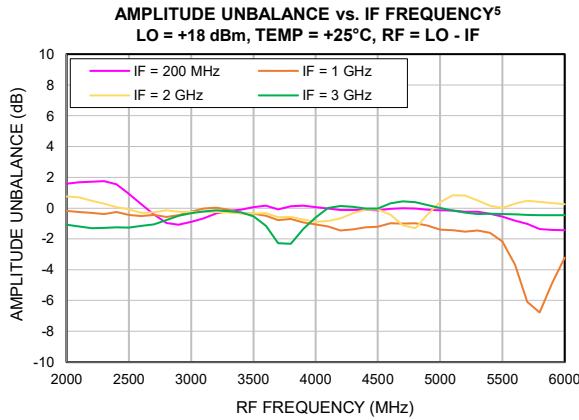
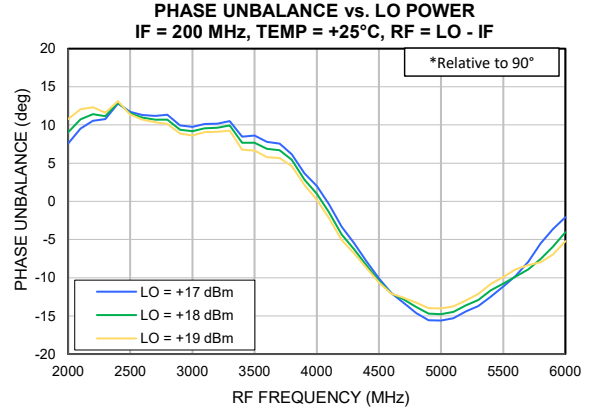
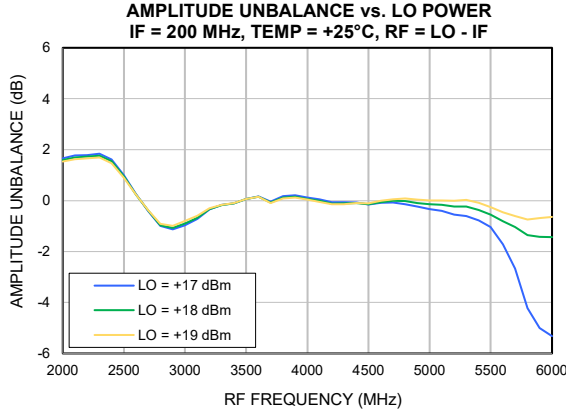
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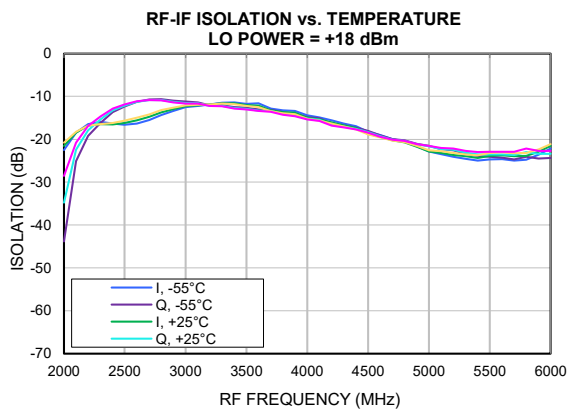
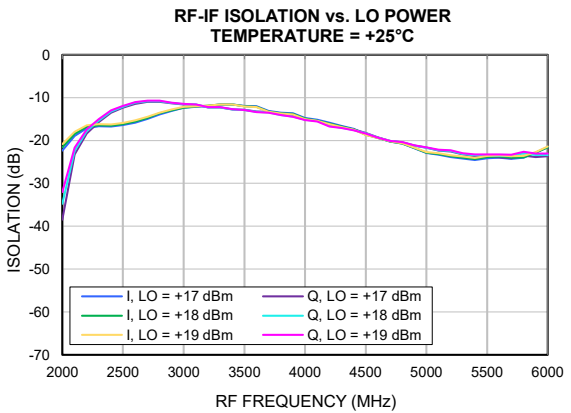
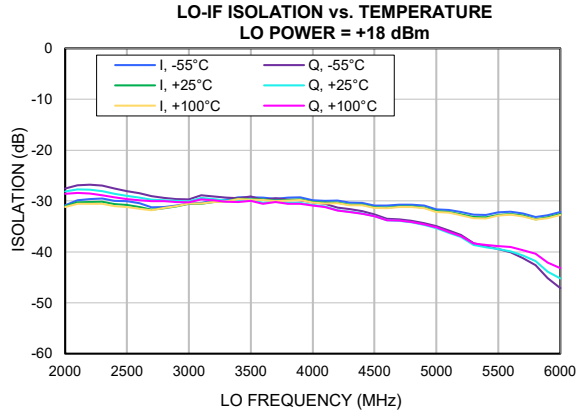
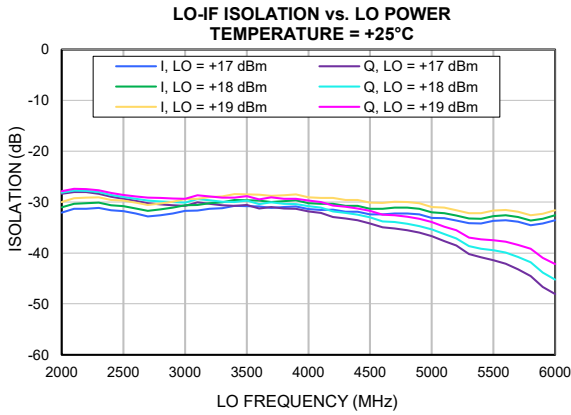
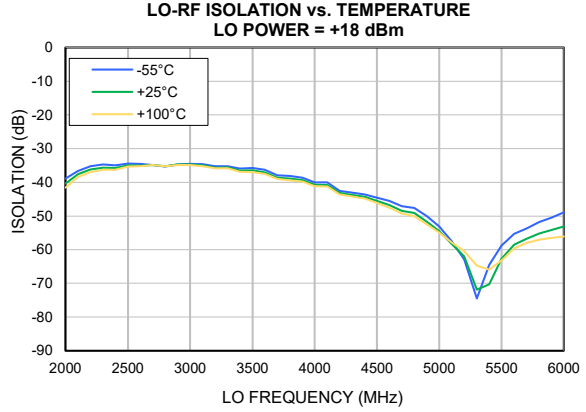
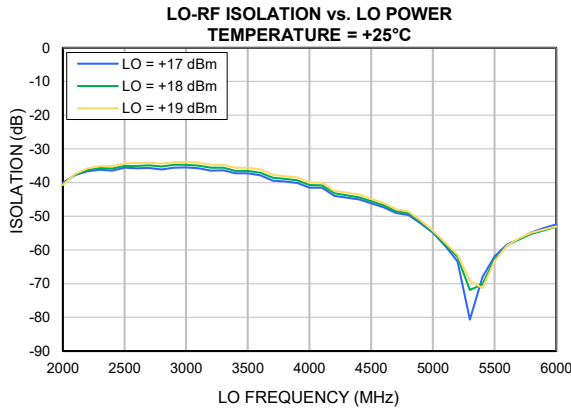
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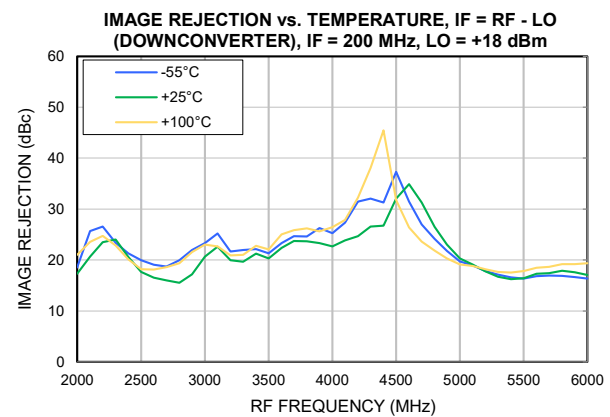
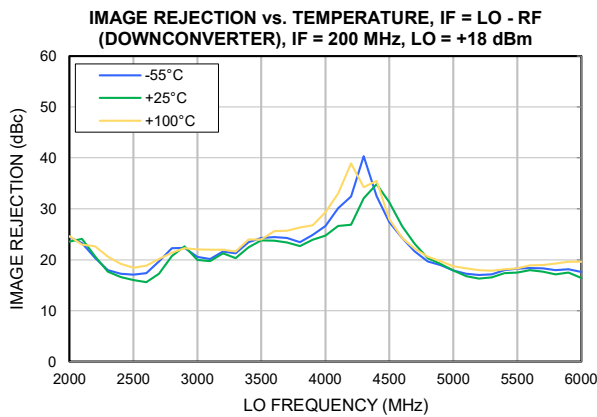
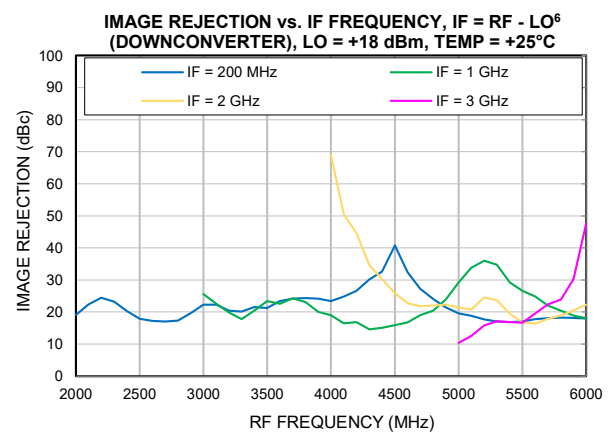
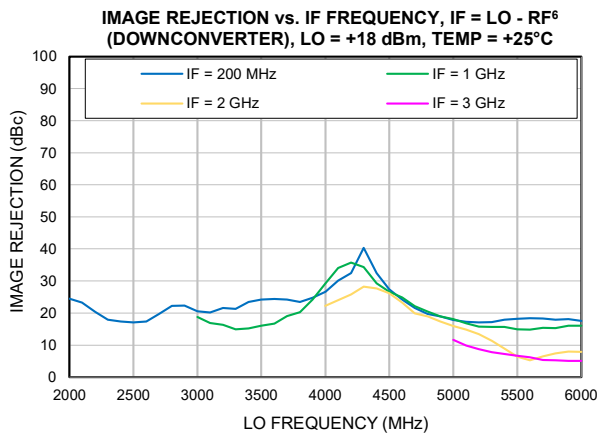
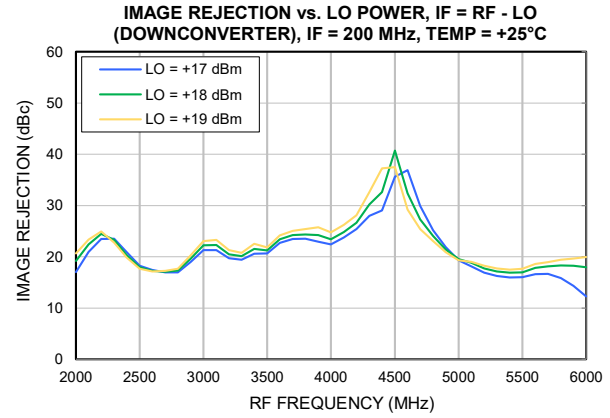
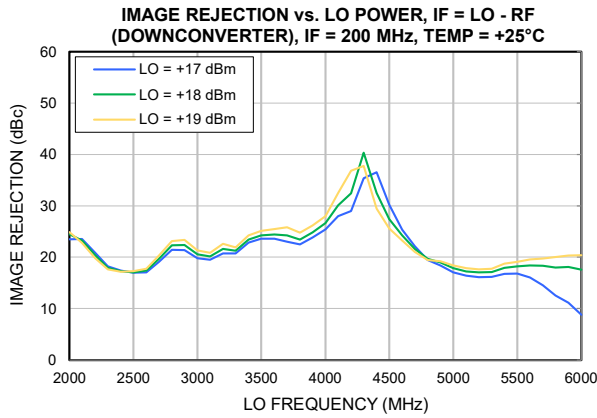
### TYPICAL PERFORMANCE GRAPHS







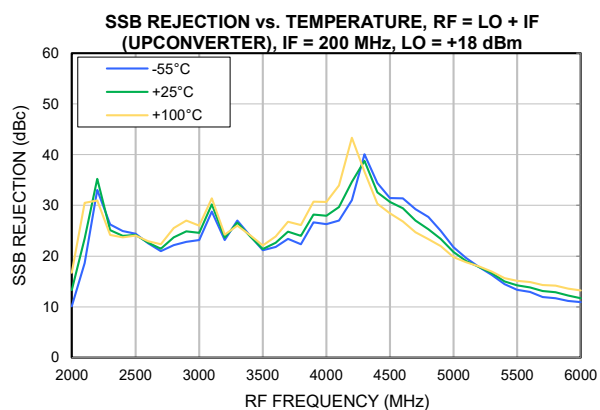
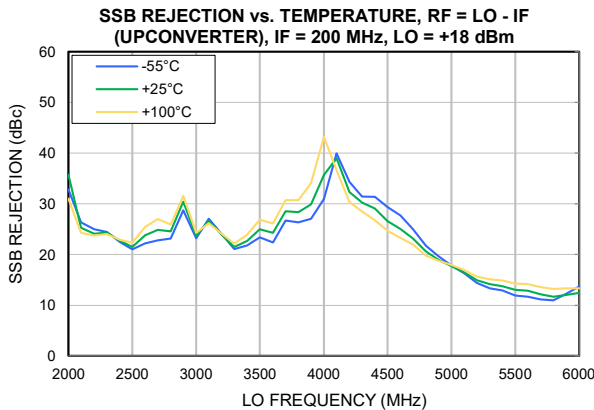
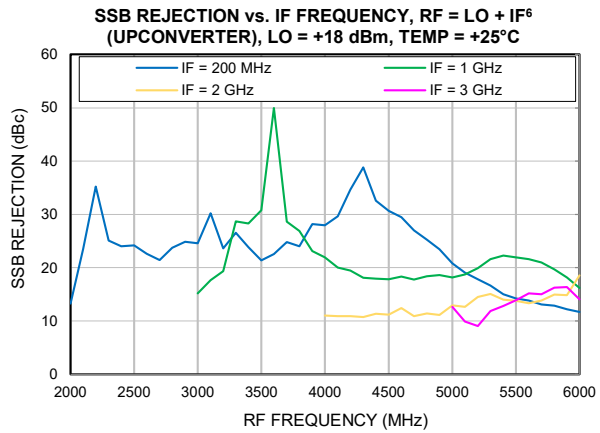
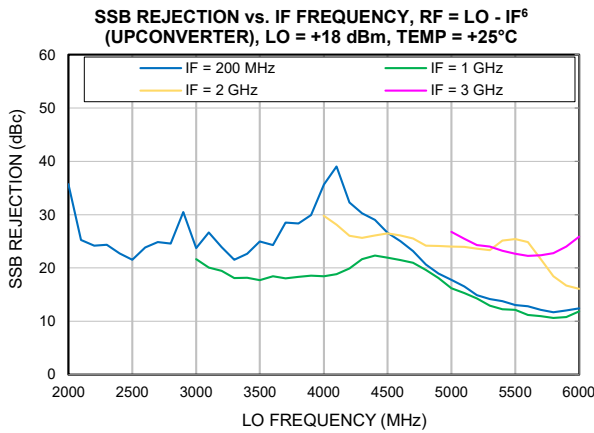
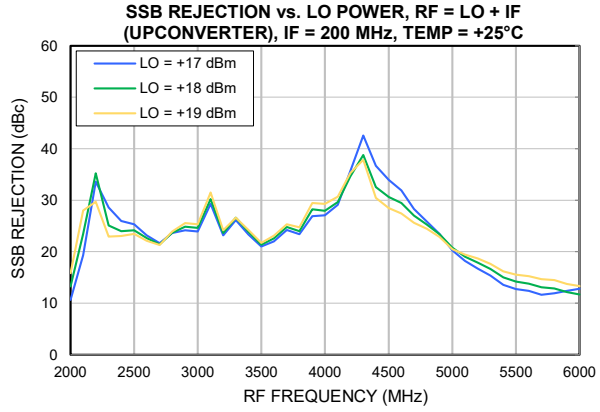
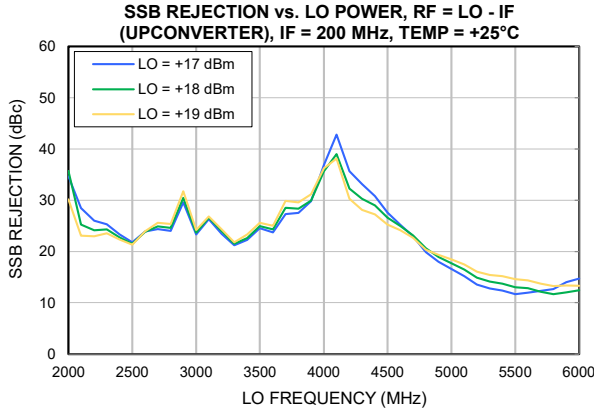
### TYPICAL PERFORMANCE GRAPHS



6. Plot truncated when LO or RF is outside of the specified 2 GHz to 6 GHz range.



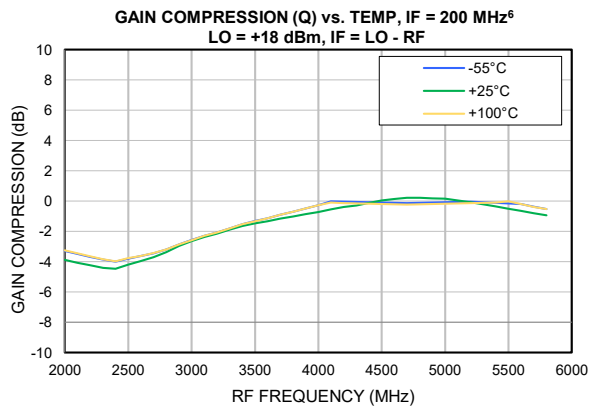
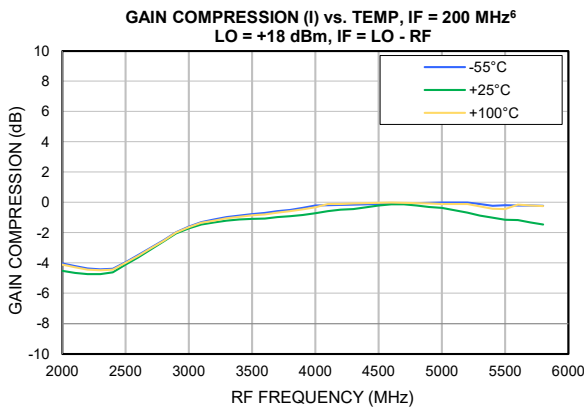
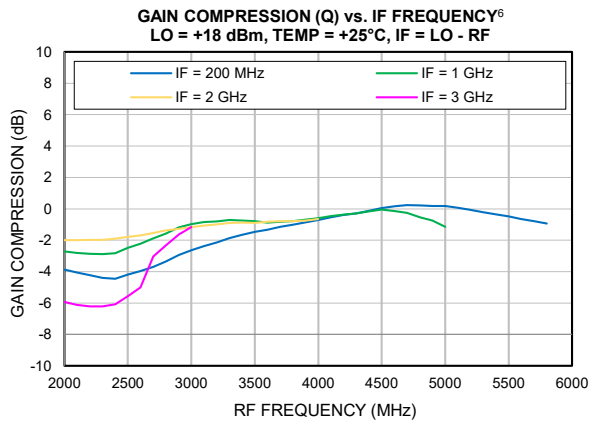
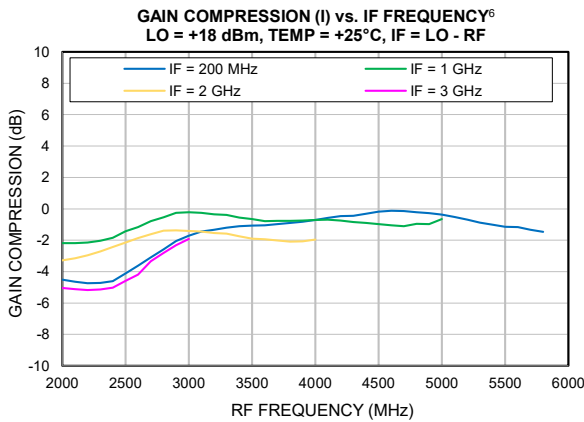
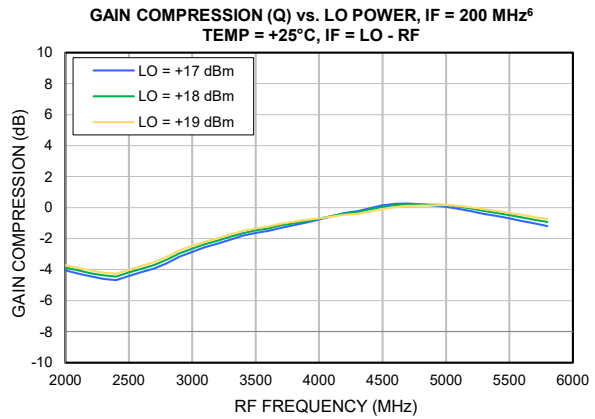
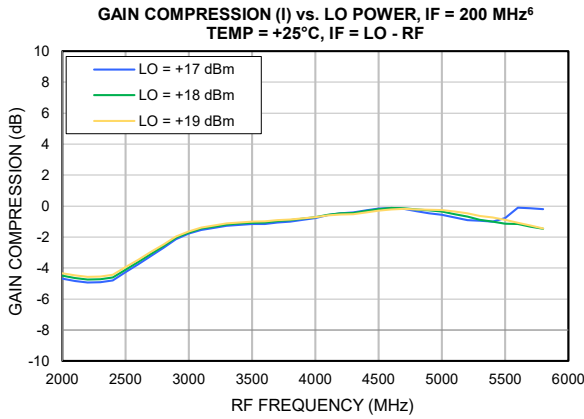
### TYPICAL PERFORMANCE GRAPHS



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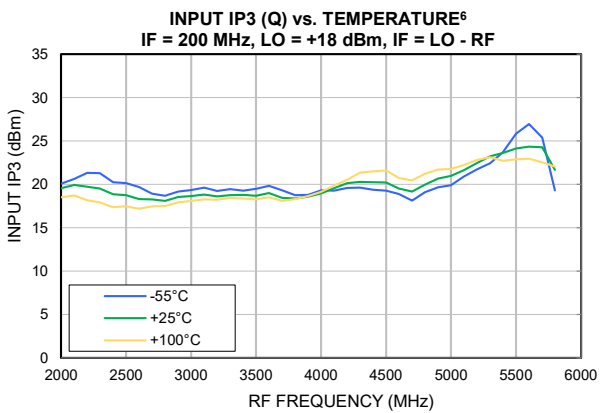
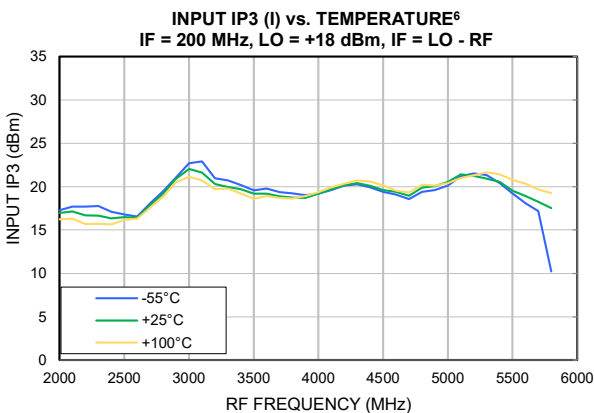
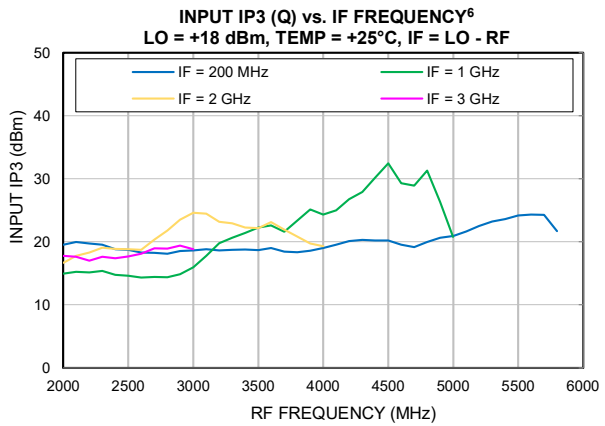
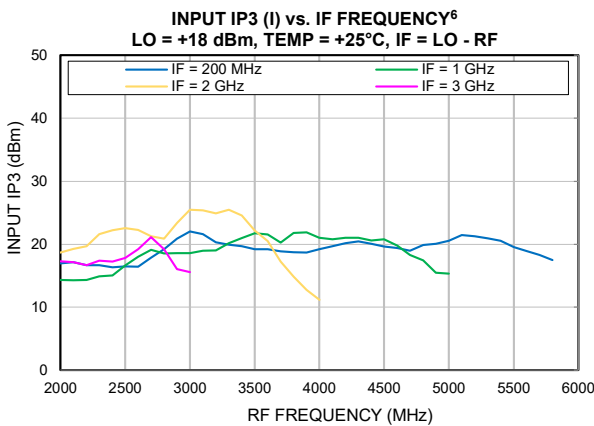
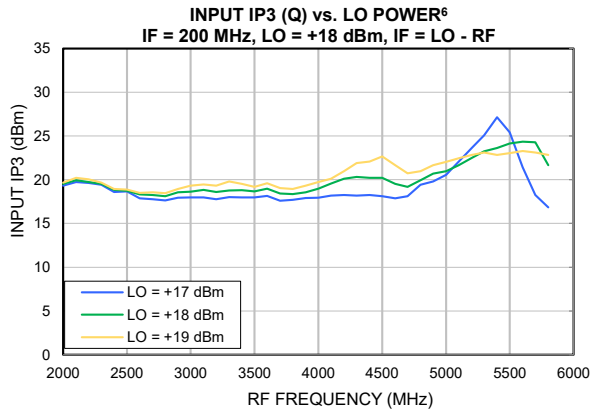
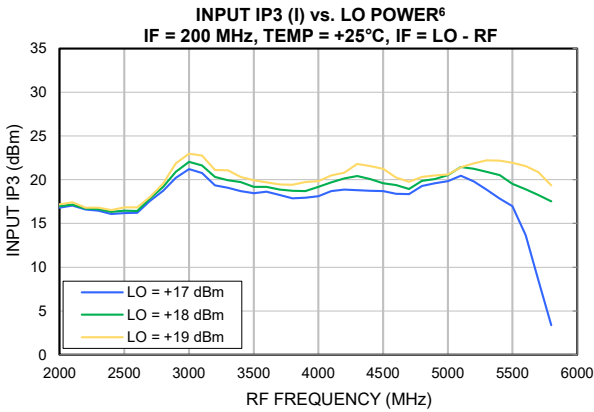
### TYPICAL PERFORMANCE GRAPHS



6. Plot truncated when LO or RF is outside of the specified 2 GHz to 6 GHz range.



### TYPICAL PERFORMANCE GRAPHS



6. Plot truncated when LO or RF is outside of the specified 2 GHz to 6 GHz range.



### ABSOLUTE MAXIMUM RATINGS<sup>7</sup>

Parameter	Ratings
Operating Temperature	-55°C to +105°C
Storage Temperature	-65°C to +150°C
Junction Temperature	+175°C
RF Power	+27 dBm
LO Power	+27 dBm
I/Q Power	+27 dBm
IF Current	144 mA

7. Permanent damage may occur if any of these limits are exceeded. Electrical maximum ratings are not intended for continuous normal operation.

### ESD RATING

	Class	Voltage Range	Reference Standard
HBM	1A	250 V to < 500 V	ANSI/ESDA/JEDEC JS-001-2023
CDM	C2B	750 V to < 1,000 V	ANSI/ESDA/JEDEC JS-002-2022



ESD HANDLING PRECAUTION: This device is designed to be Class 1A for HBM. Static charges may easily produce potentials higher than this with improper handling and can discharge into DUT and damage it. As a preventive measure Industry standard ESD handling precautions should be used at all times to protect the device from ESD damage

### MSL RATING

Moisture Sensitivity: MSL1 in accordance with IPC/JEDEC J-STD-020E /JEDEC J-STD-033C



### FUNCTIONAL DIAGRAM

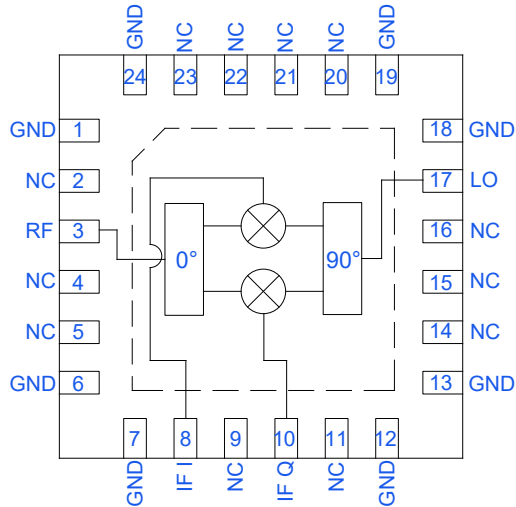


Figure 1. SMIQ-263H+ Functional Diagram

### PAD CONNECTIONS

Function	Pad #	Description
RF	3	RF Port. Connects to RF Output for Upconverters or RF Input for Downconverters.
LO	17	LO Port. Connects to LO Input.
IF I	8	IF I Port. Connects to the IF I Input for Upconverters or IF I Output for Downconverters.
IF Q	10	IF Q Port. Connects to the IF Q Input for Upconverters or IF Q Output for Downconverters.
GND	1, 6, 7, 12, 13, 18, 19, 24 & Paddle	Connects to ground.
NC	2, 4, 5, 9, 11, 14-16, 20-23	No connection. Grounded on test board.

### CHARACTERIZATION TEST CIRCUITS

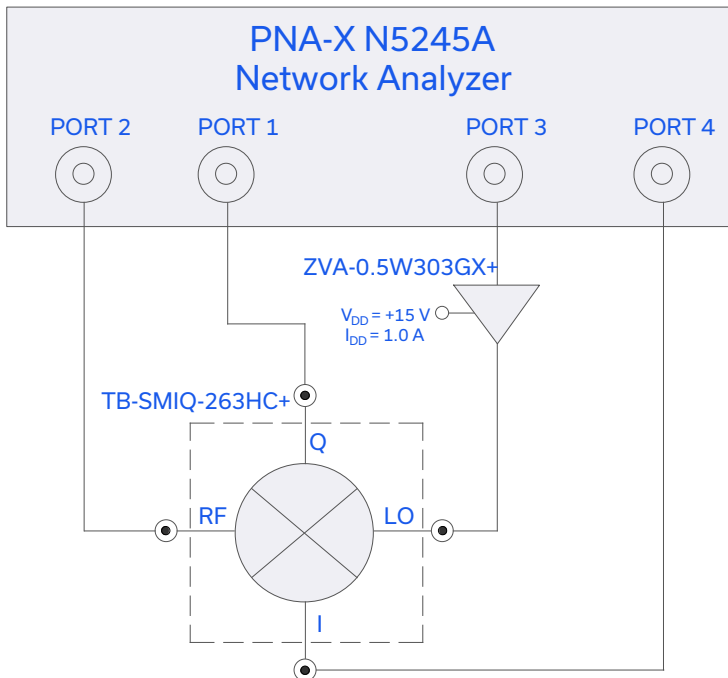


Figure 2. Block diagram of test circuit used to characterize: Conversion Loss, Amplitude Unbalance, Phase Unbalance, Isolation, Return Loss, and Input IP3

**Test conditions (For Conversion Loss, Amplitude Unbalance, Phase Unbalance, Isolation, and Return Loss):**  
RF Input Power = -10 dBm, LO Input Power = +17 to +19 dBm, IF = 200 MHz, 1000 MHz, 2000 MHz, and 3000 MHz

**Test conditions (For Input IP3):**  
RF Input Power = -10 dBm/Tone, LO Input Power = +17 to +19 dBm. Two tones, spaced 1 MHz apart

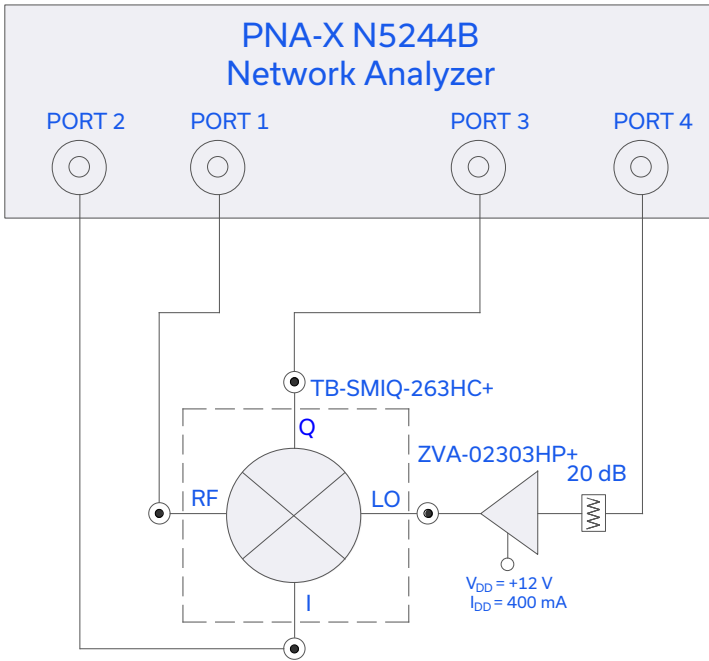


Figure 3. Block diagram of Test Circuit used for characterization of Image Rejection (Downconverter)

**Test conditions:**

RF Input Power = -10 dBm, LO Input Power = +17 to +19 dBm, IF = 200 MHz, 1000 MHz, 2000 MHz, and 3000 MHz

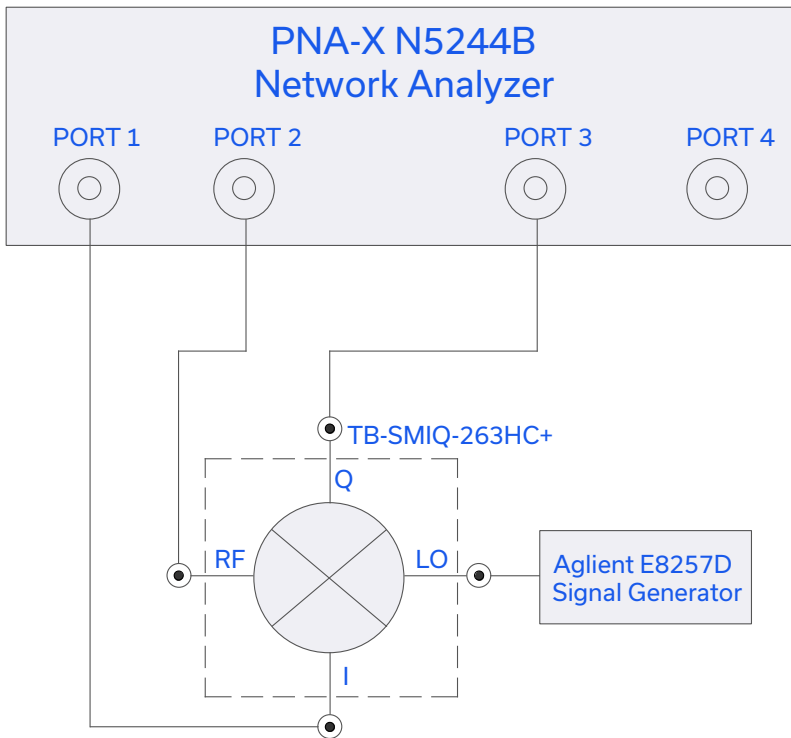
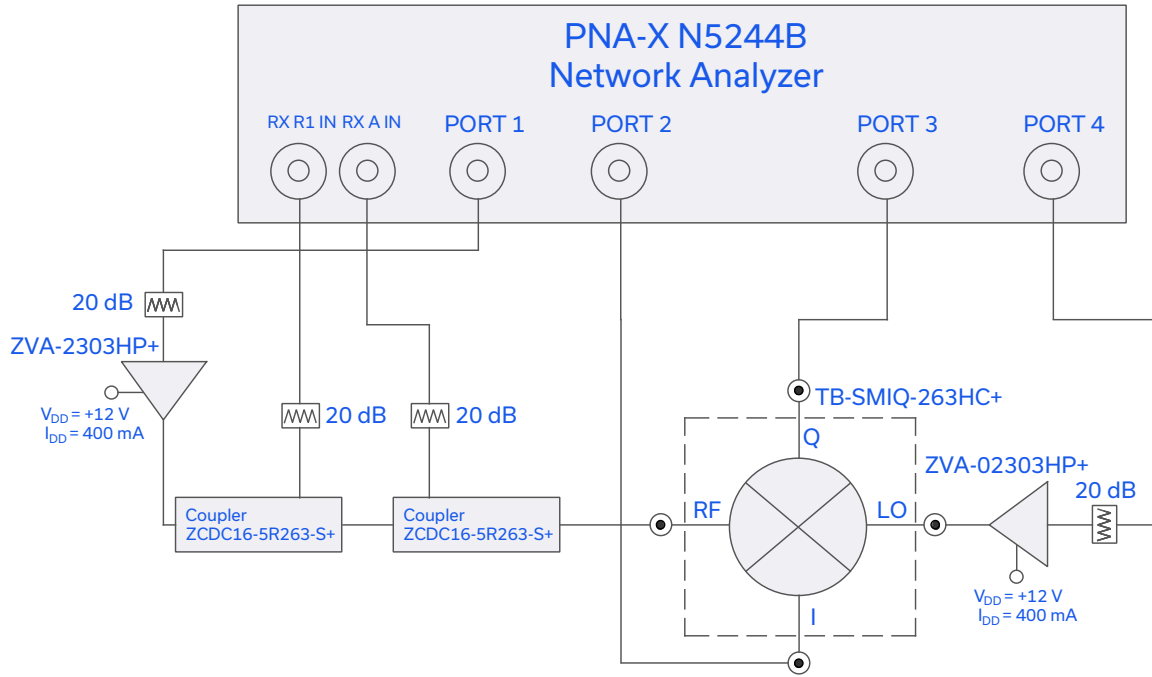


Figure 4. Block diagram of Test Circuit used for characterization of Single Side Band Rejection (Upconverter)

**Test conditions (For Single Side Band Rejection):**

IF Input Power = -10 dBm, LO Input Power = +17 to +19 dBm, IF = 200 MHz, 1000 MHz, 2000 MHz, and 3000 MHz



**Figure 5. Block diagram of Test Circuit used for characterization of Compression:**  
 RF Input Power = +15 dBm and -10 dBm, LO Input Power = +17 to +19 dBm, IF = 200 MHz, 1000 MHz, 2000 MHz, and 3000 MHz  
 Compression = (Conversion Loss @ RF Power = +15 dBm) - (Conversion Loss @ RF Power = -10 dBm)





### APPLICATION CONFIGURATION FOR IMAGE REJECT AND SINGLE SIDE BAND MIXER

In Image Reject or Single Sideband Upconverter applications an external 90° Hybrid is needed. Refer to Mini-Circuits extensive portfolio of 90° Hybrids.

#### IMAGE REJECT MIXER APPLICATION

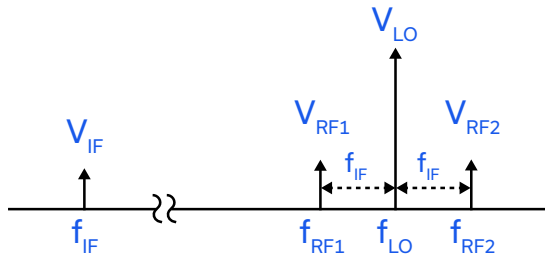


Figure 6. Spectral representation of Signals

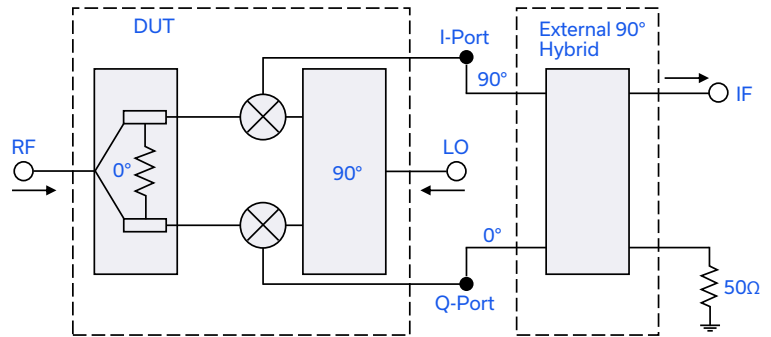


Figure 7. Block Diagram of Image Reject Mixer

If  $f_{RF1}$  is the desired signal and  $f_{RF2}$  is the image, connect the I port of DUT to the 90° port of the external hybrid and the Q port to the 0° port of the hybrid. This will send the  $f_{RF2} - f_{LO}$  IF signal to the terminated output of the external 90° hybrid and desired IF signal  $f_{LO} - f_{RF1}$  to the IF output port.

If  $f_{RF2}$  is the desired signal and  $f_{RF1}$  is the image signal, connect the I port of DUT to the 0 deg port of the external 90° hybrid and the Q port to the 90° port of the external hybrid. This will send  $f_{LO} - f_{RF1}$  IF signal to the terminated output of the external 90° hybrid and desired IF signal  $f_{RF2} - f_{LO}$  to IF port.

° port of the external 90° hybrid and the Q port to the 90° port of the external hybrid. This will send  $f_{LO} - f_{RF1}$  IF signal to the terminated output of the external 90° hybrid and desired IF signal  $f_{RF2} - f_{LO}$  to the IF output port.

#### SINGLE SIDE BAND (SSB) UPCONVERTER APPLICATION

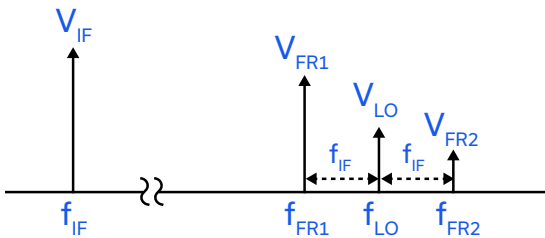


Figure 8. Spectral representation of Signals

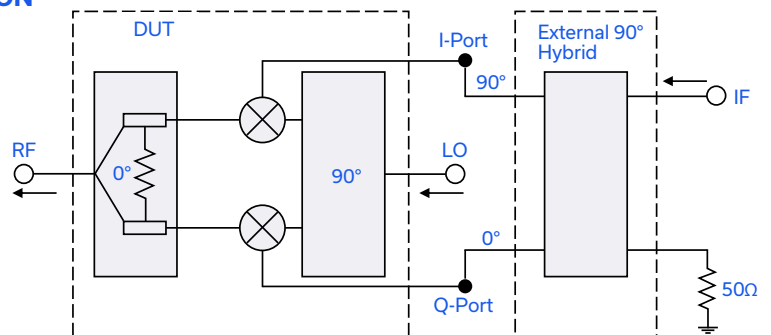


Figure 9. Block Diagram of Single Side Band Mixer

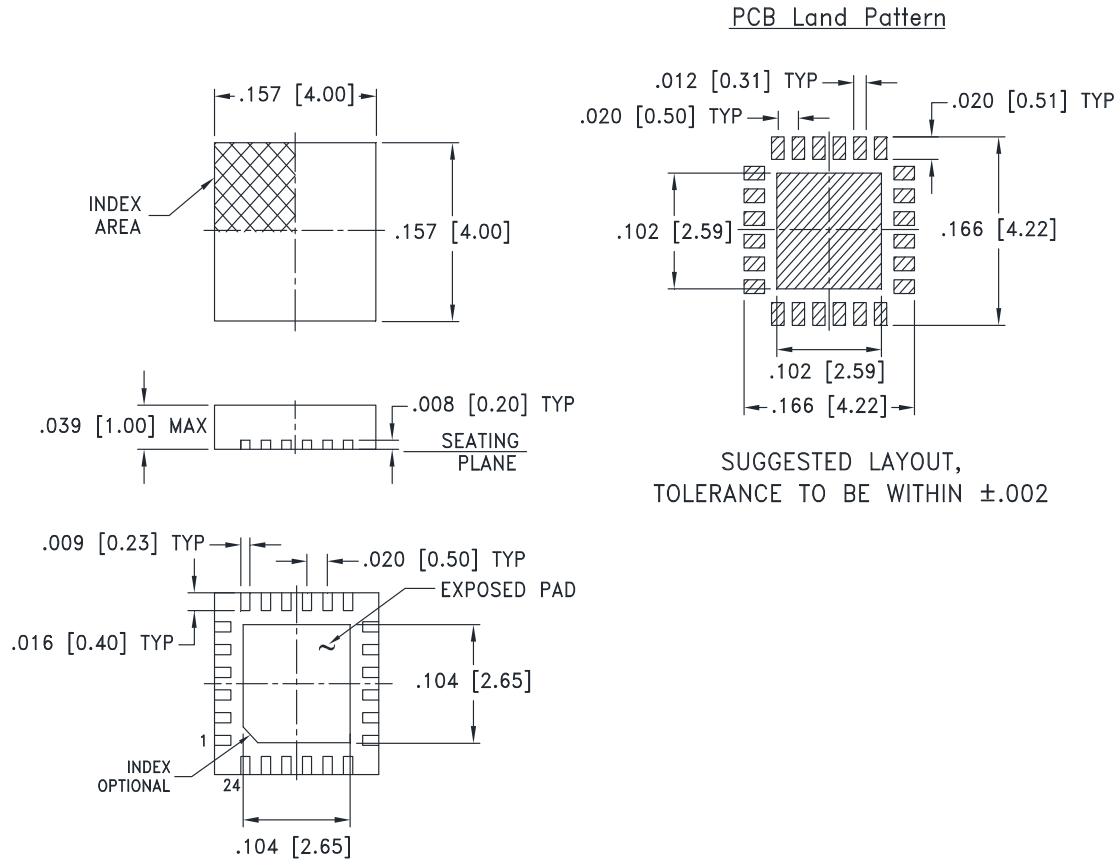
For upper sideband selection connect the I port to the 90° port of the external 90° hybrid and the Q port to the 0° port of the external hybrid. This will cause cancellation of the lower sideband signal in the 0° RF splitter of the DUT and the upper sideband signal will be present at the RF output port.

For lower sideband selection connect the I port to the 0° port of the external 90° hybrid and the Q port to the 90° port of the hybrid. This will cause cancellation of the upper sideband signal in the 0° RF splitter of the DUT and the lower sideband signal will be present at the RF output port.

Refer to Mini-Circuits blog, I&Q Mixers, Image Reject Down-Conversion & Single Sideband (SSB) Up-Conversion for a detailed explanation.

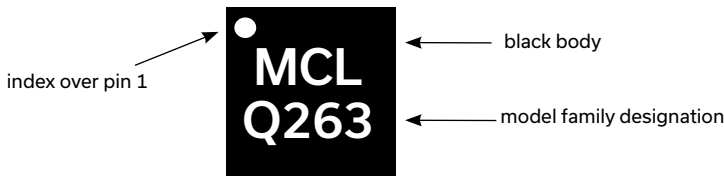


### CASE STYLE DRAWING



Weight: .04 Grams  
Dimensions are in inches [mm]. Tolerances in inches: 2 Pl. ± .01; 3 Pl. ± .005 inches

### PRODUCT MARKING



Marking may contain other features or characters for internal lot control



MMIC SURFACE MOUNT

# IQ Mixer

## SMIQ-263H+

50Ω Level 18 (LO Power +18 dBm) 2000 to 6000 MHz

ADDITIONAL DETAILED INFORMATION IS AVAILABLE ON OUR DASH BOARD [CLICK HERE](#)

<b>Performance Data and Graphs</b>	Data Graphs Data Set (.zip file)
<b>Case Style</b>	DG1847 Plastic package, exposed paddle, lead finish: Matte-Tin
<b>RoHS Status</b>	Compliant
<b>Tape &amp; Reel</b> Standard quantities available on reel	F68 7" reels with 20, 50, 100, 200, 500, or 1K devices 13" reels with 2K, 3K, or 4K devices
<b>Suggested Layout for PCB Design</b>	PL-805
<b>Evaluation Board</b>	TB-SMIQ-263HC+
<b>Environmental Ratings</b>	ENV08T1

Notes

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