MMIC SURFACE MOUNT

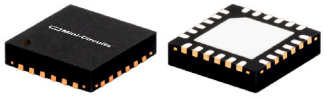
IQ Mixer

SMIQ-1844H+

50Ω Level 18 (LO Power +18 dBm) 18 to 40 GHz

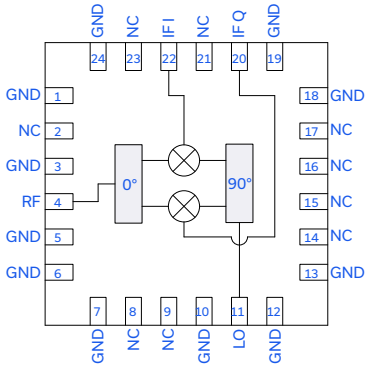
THE BIG DEAL

- Wideband RF & LO, 18 to 40 GHz
- Wideband IF, DC to 7 GHz
- Excellent Image Rejection, Typ. 30 dB
- High LO-RF Isolation, Typ. 38 dB
- High Input IP3, Typ. +31 dBm
- Usable as Image Reject Mixer & SSB Converter
- 4x4 mm, 24-Lead QFN-Style Package



Generic photo used for illustration purposes only

FUNCTIONAL DIAGRAM



APPLICATIONS

- Test and Measurement Equipment
- 5G mmWave and Back Haul Radio
- Satellite Communications
- Radar, EW, and ECM Defense Systems

PRODUCT OVERVIEW

The SMIQ-1844H+ is a passive wideband in-phase/quadrature (I/Q) mixer fabricated using GaAs HBT technology. The SMIQ-1844H+ is usable as a single-sideband upconverter for transmit applications or an image rejection mixer for receiver applications. The SMIQ-1844H+ is ideal for wideband frequency translation applications that require inherent rejection of image signals and spurious mixing products. The mixer covers a broad band with RF and LO frequency ranges of 18 to 40 GHz and an IF frequency range of DC to 7 GHz. As a passive mixer, the SMIQ-1844H+ offers 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, 30 dB typ.	Provides inherent rejection of unwanted image signals without the need for external filtering.
High Isolation, • LO-RF, 38 dB typ. • LO-IF, 40 dB typ.	Enables excellent carrier rejection in single-sideband upconverter transmit applications. Minimizes filtering requirements needed to ensure signal integrity.
Wide RF/LO Bandwidth, 18 to 40 GHz	Useful in wideband systems or in reconfigurable narrowband systems across multiple bands with minimal component changes.
Wide IF Bandwidth, DC to 7 GHz	Enables use of high IF conversion to reduce filtering requirements. IF operation as low as DC enables use in phase detector applications.
Small Size, 4x4 mm QFN-Style Package	Tiny 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-020345
SMIQ-1844H+
MCL NY
231220

IQ Mixer

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50Ω Level 18 (LO Power +18 dBm) 18 to 40 GHz

ELECTRICAL SPECIFICATIONS[1] AT +25°C, Z_0 = 50Ω, LO POWER = +18 dBm, UNLESS OTHERWISE NOTED.

Parameter	Frequency (GHz)	Min.	Typ.	Max.	Unit
RF Frequency Range		18		40	GHz
LO Frequency Range		18		40	GHz
IF Frequency Range		DC		7	GHz
LO Power		+17	+18	+19	dBm
Conversion Loss[2]	18 - 26.5 26.5 - 40		8.9 9.4		dB
Amplitude Unbalance	18 - 26.5 26.5 - 40		±0.2 ±0.3	±0.9 ±1.4	dB
Phase Unbalance (Relative to 90°)	18 - 26.5 26.5 - 40		2 3	8 14	deg
Image Rejection[3] (Tested as a Downconverter)	18 - 26.5 26.5 - 40		30 31		dBc
Single Sideband Rejection[4] (Tested as an Upconverter)	18 - 26.5 26.5 - 40		26 25		dBc
LO-RF Isolation	18 - 26.5 26.5 - 40	25 24	38 37		dB
LO-I Isolation	18 - 26.5 26.5 - 40	27 24	42 38		dB
LO-Q Isolation	18 - 26.5 26.5 - 40	29 17	47 36		dB
RF-I Isolation	18 - 26.5 26.5 - 40	12 12	26 29		dB
RF-Q Isolation	18 - 26.5 26.5 - 40	19 30	30 40		dB
Input Power at 1dB Compression	18 - 40		+10		dBm
Input IP3 (I) Lower Side Band	18 - 26.5 26.5 - 40		+31 +31		dBm
Input IP3 (Q) Lower Side Band	18 - 26.5 26.5 - 40		+31 +31		dBm
Input IP3 (I) Upper Side Band	18 - 26.5 26.5 - 40		+30 +29		dBm
Input IP3 (Q) Upper Side Band	18 - 26.5 26.5 - 40		+29 +29		dBm

1. Measured on Mini-Circuits Characterization Test Board TB-SMIQ-1844HC+. See Figures 2, 3, & 4. Board loss de-embedded to the device. Unless otherwise specified, IF = 200MHz
2. Conversion loss (dB) = RF Power (dBm) minus worse of I/Q Port Power (dBm) minus 3 dB theoretical loss of an Ideal External Hybrid, measured as a Downconverter. 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 3.

IQ Mixer

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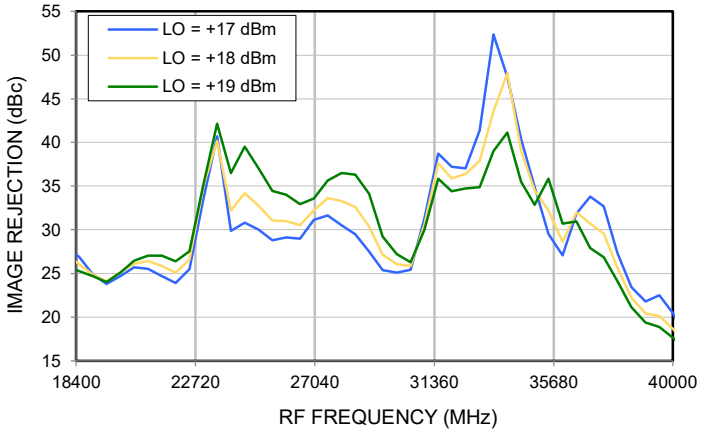
50Ω Level 18 (LO Power +18 dBm) 18 to 40 GHz

TYPICAL PERFORMANCE GRAPHS

IMAGE REJECTION (DOWNCONVERTER) @ IF = 200 MHz



SSB REJECTION (UPCONVERTER) @ IF = 200 MHz

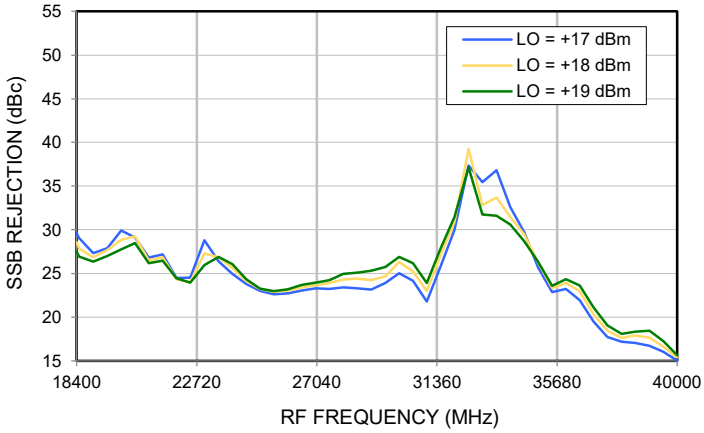
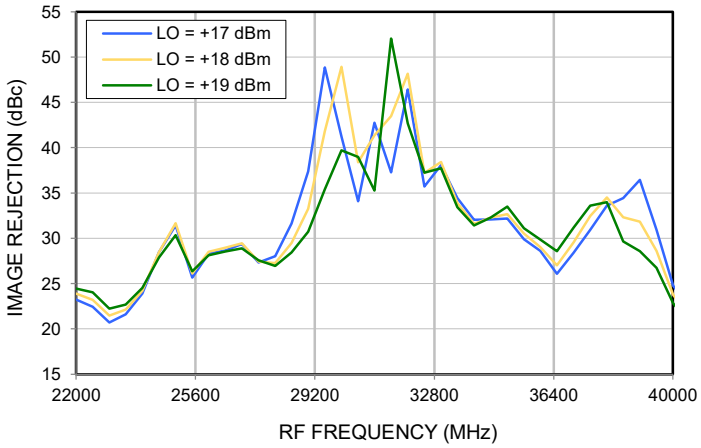


IMAGE REJECTION (DOWNCONVERTER) @ IF = 2 GHz



SSB REJECTION (UPCONVERTER) @ IF = 2 GHz

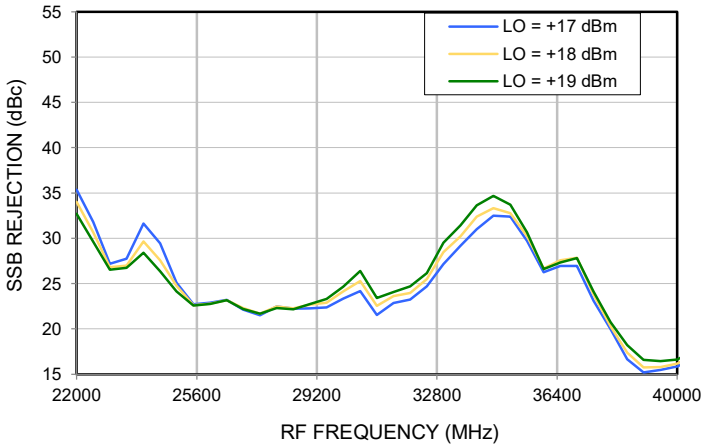
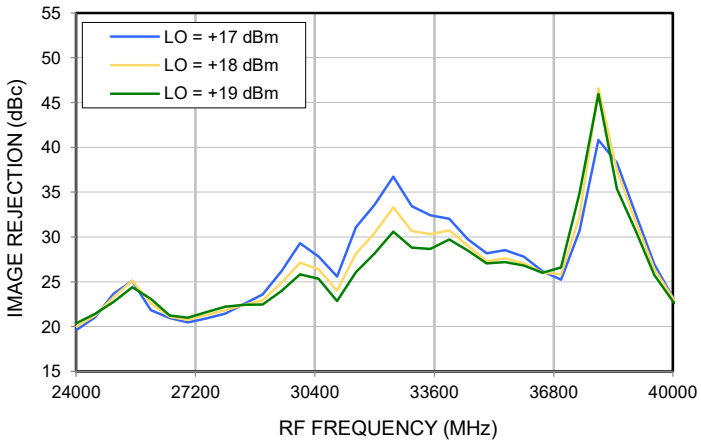
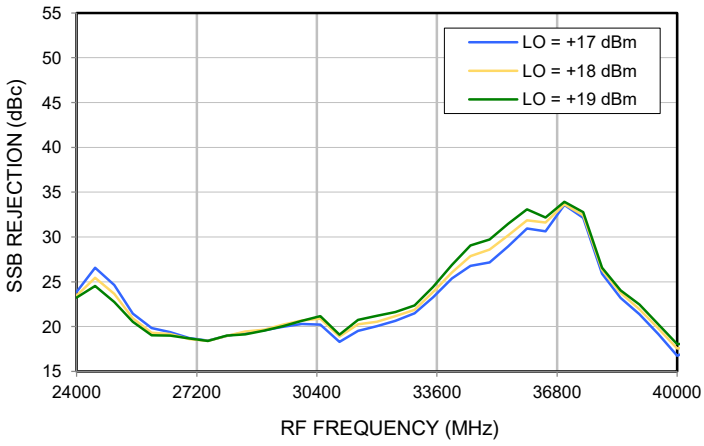


IMAGE REJECTION (DOWNCONVERTER) @ IF = 3 GHz



SSB REJECTION (UPCONVERTER) @ IF = 3 GHz



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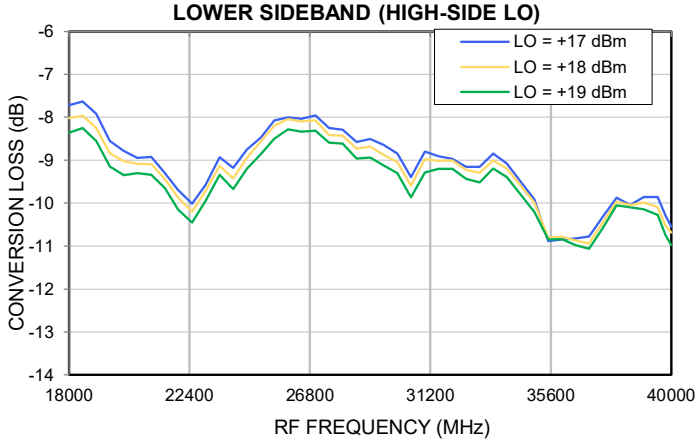
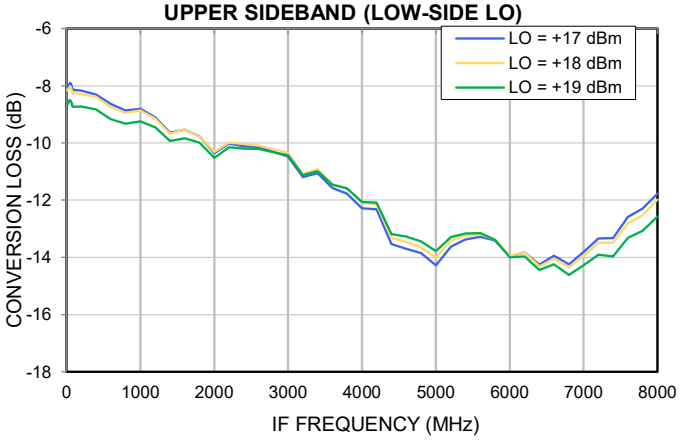
TYPICAL PERFORMANCE GRAPHS

Note: Conversion loss (dB) = RF Power (dBm) minus worse of I/Q Port Power (dBm) minus 3 dB theoretical loss of an Ideal External Hybrid, measured as a Downconverter.

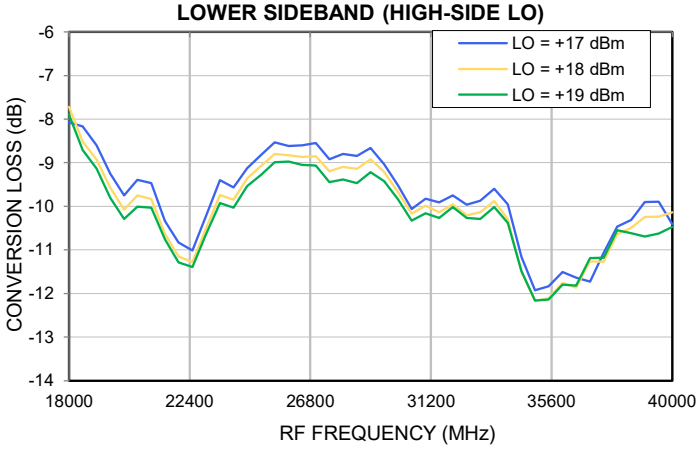
CONVERSION LOSS VS. RF @ IF = 200 MHz
LOWER SIDEBAND (HIGH-SIDE LO)



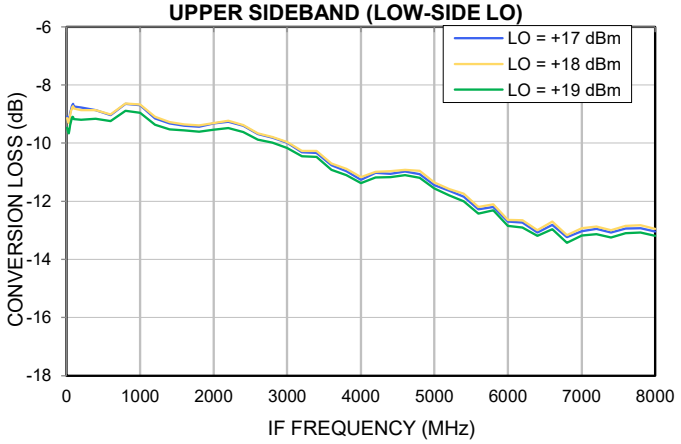
CONVERSION LOSS VS. IF @ FIXED LO = 18 GHz
UPPER SIDEBAND (LOW-SIDE LO)



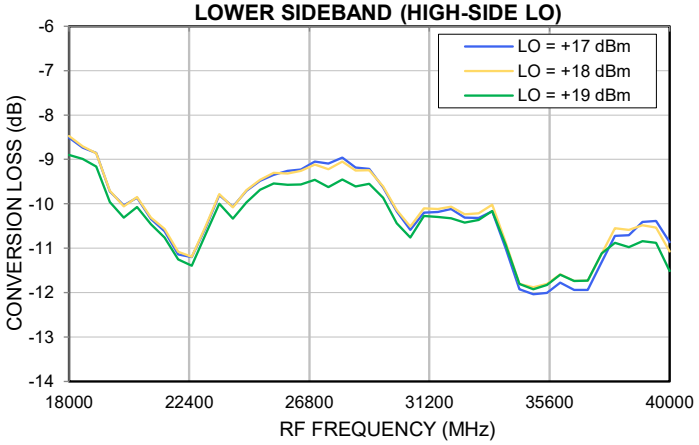
CONVERSION LOSS VS. RF @ IF = 2 GHz
LOWER SIDEBAND (HIGH-SIDE LO)



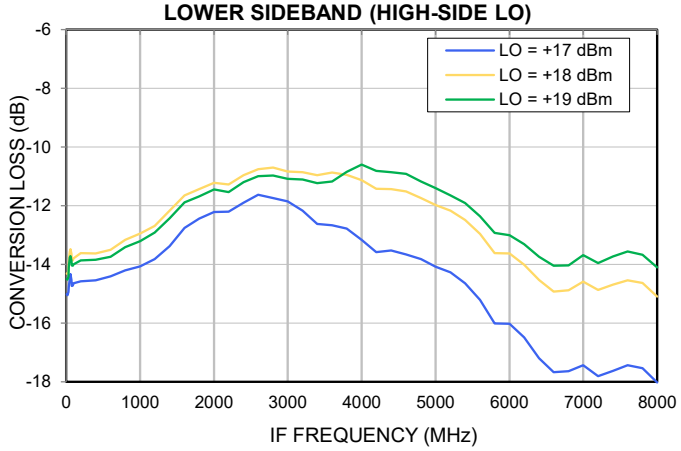
CONVERSION LOSS VS. IF @ FIXED LO = 30.75 GHz
UPPER SIDEBAND (LOW-SIDE LO)



CONVERSION LOSS VS. RF @ IF = 3 GHz
LOWER SIDEBAND (HIGH-SIDE LO)



CONVERSION LOSS VS. IF @ FIXED LO = 43.5 GHz
LOWER SIDEBAND (HIGH-SIDE LO)



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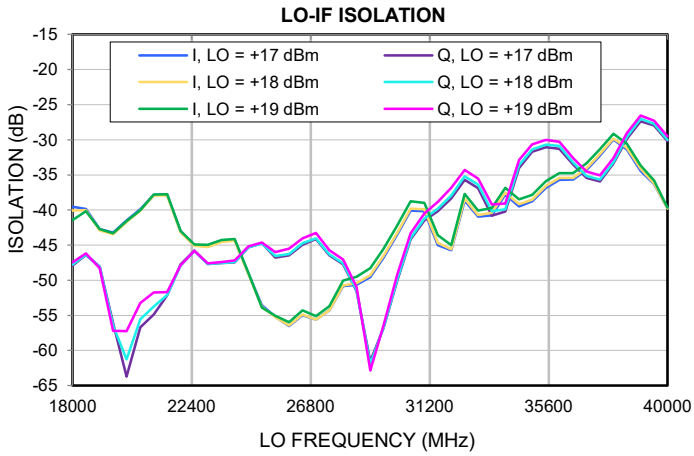
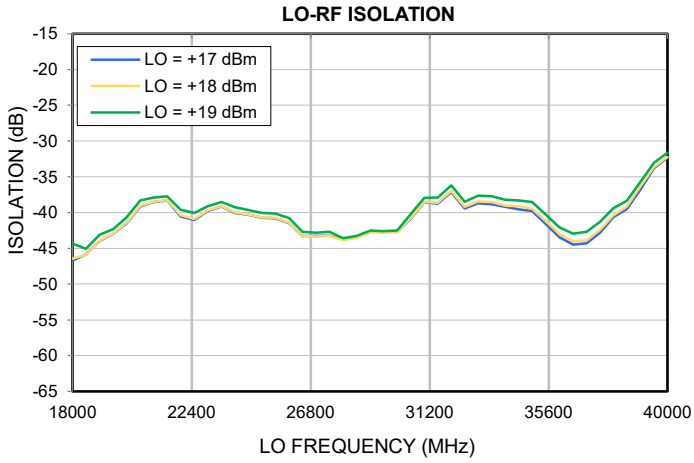
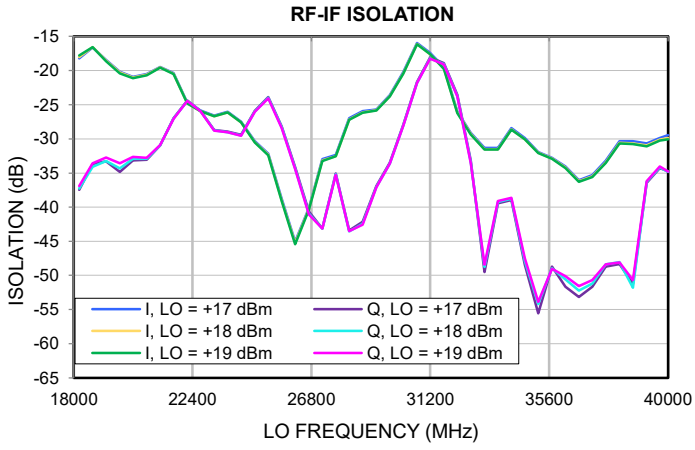
50Ω Level 18 (LO Power +18 dBm) 18 to 40 GHz

TYPICAL PERFORMANCE GRAPHS







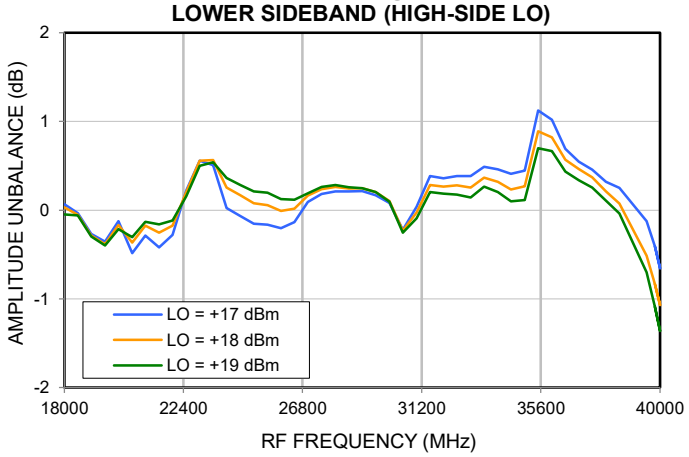
IQ Mixer

SMIQ-1844H+

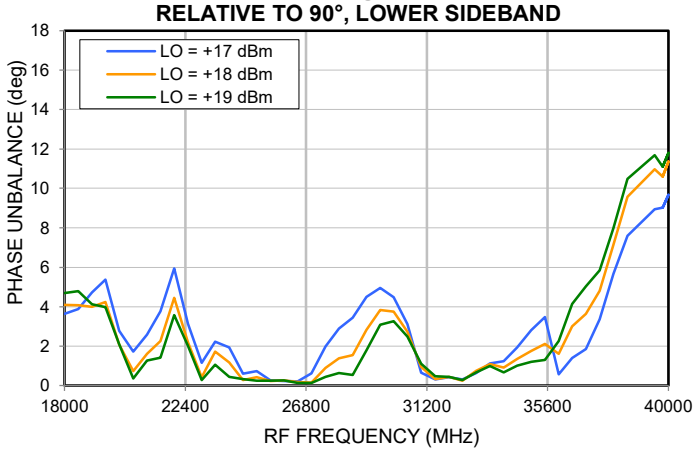
50Ω Level 18 (LO Power +18 dBm) 18 to 40 GHz

TYPICAL PERFORMANCE GRAPHS

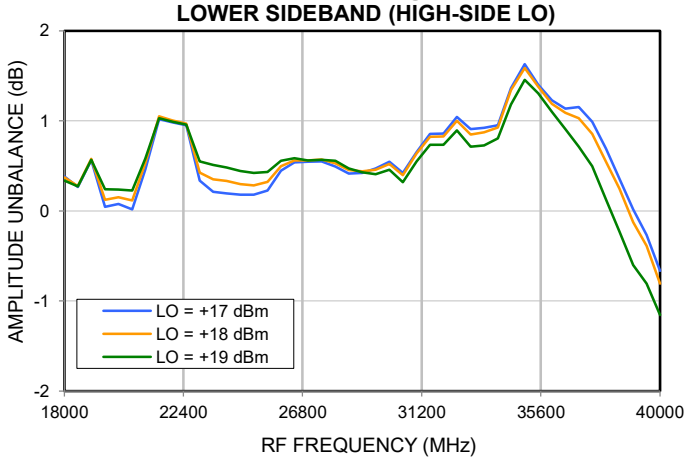
AMPLITUDE UNBALANCE @ FIXED IF = 200 MHz LOWER SIDEBAND (HIGH-SIDE LO)



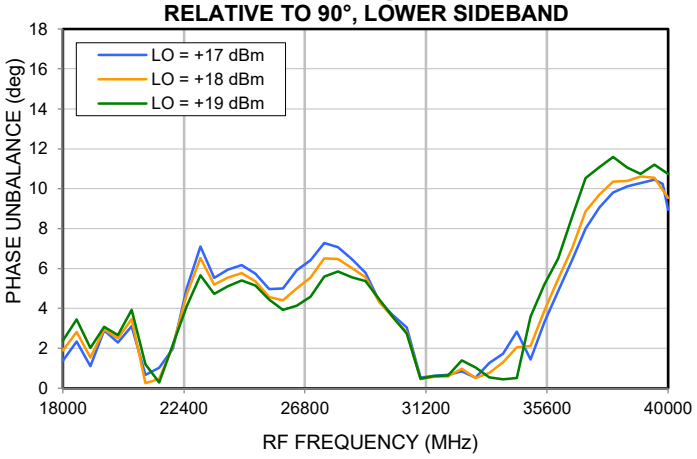
PHASE UNBALANCE @ FIXED IF = 200 MHz RELATIVE TO 90°, LOWER SIDEBAND



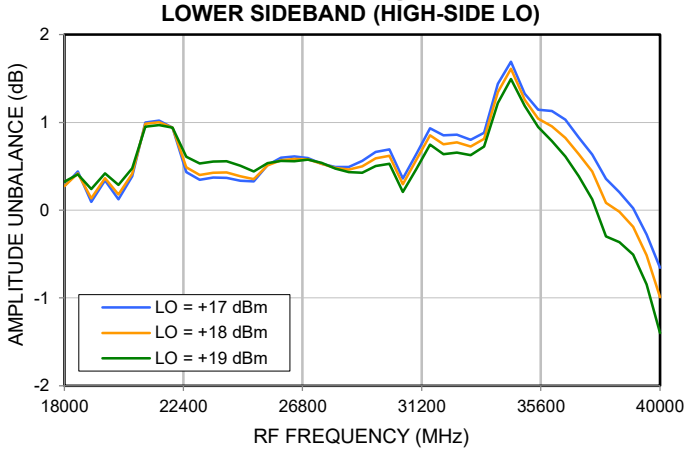
AMPLITUDE UNBALANCE @ FIXED IF = 2 GHz LOWER SIDEBAND (HIGH-SIDE LO)



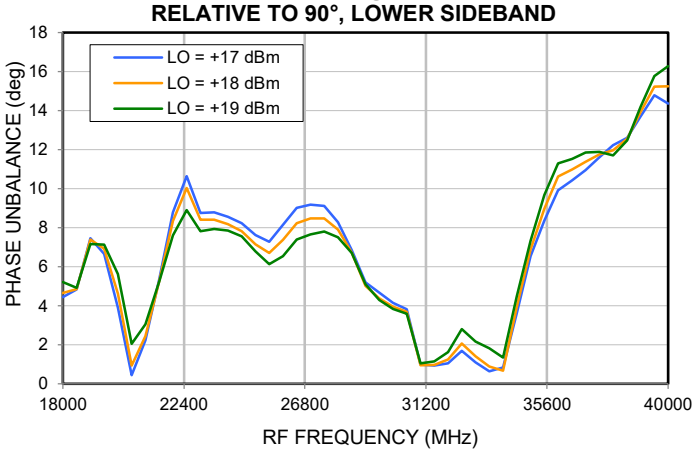
PHASE UNBALANCE @ FIXED IF = 2 GHz RELATIVE TO 90°, LOWER SIDEBAND



AMPLITUDE UNBALANCE @ FIXED IF = 3 GHz LOWER SIDEBAND (HIGH-SIDE LO)



PHASE UNBALANCE @ FIXED IF = 3 GHz RELATIVE TO 90°, LOWER SIDEBAND



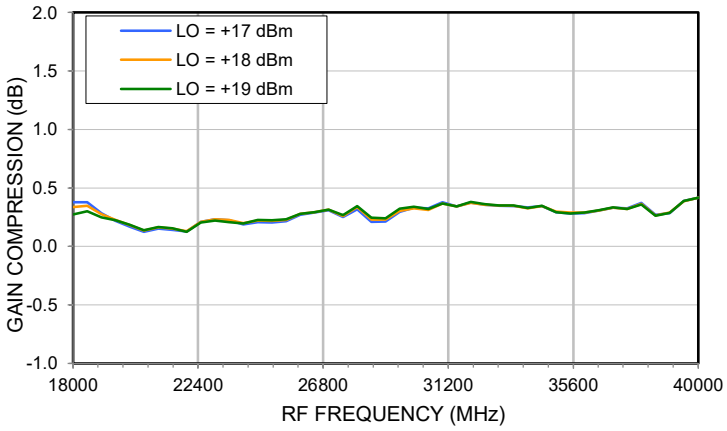
IQ Mixer

SMIQ-1844H+

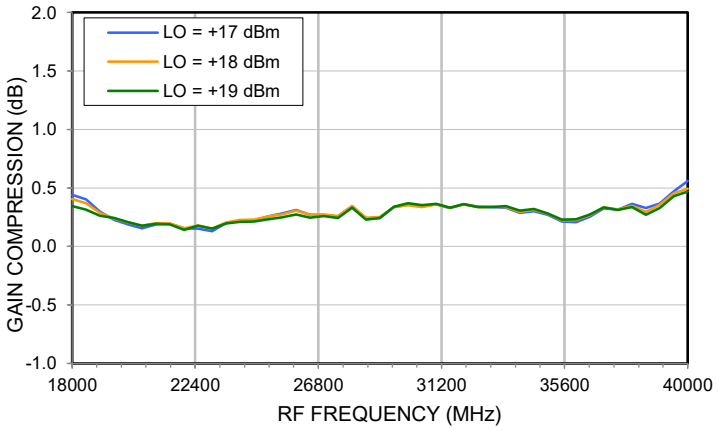
50Ω Level 18 (LO Power +18 dBm) 18 to 40 GHz

TYPICAL PERFORMANCE GRAPHS

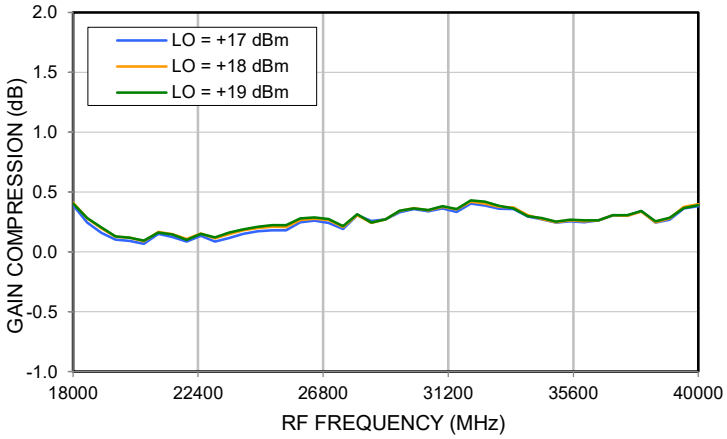
GAIN COMPRESSION (I) @ FIXED IF = 200 MHz
RF INPUT POWER = +10 dBm, LOWER SIDEBAND



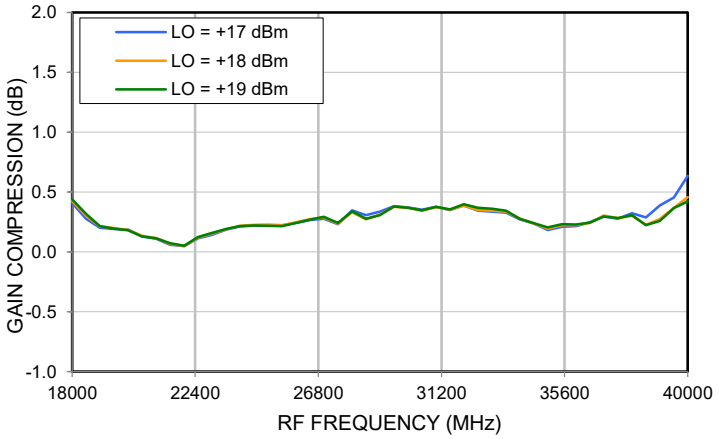
GAIN COMPRESSION (Q) @ FIXED IF = 200 MHz
RF INPUT POWER = +10 dBm, LOWER SIDEBAND



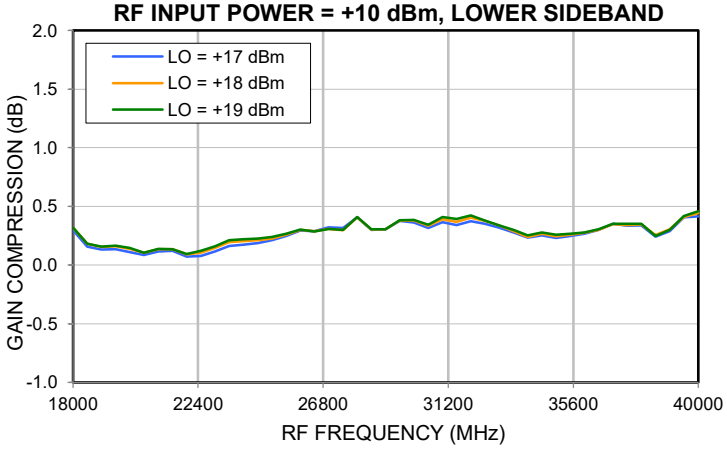
GAIN COMPRESSION (I) @ FIXED IF = 2 GHz
RF INPUT POWER = +10 dBm, LOWER SIDEBAND



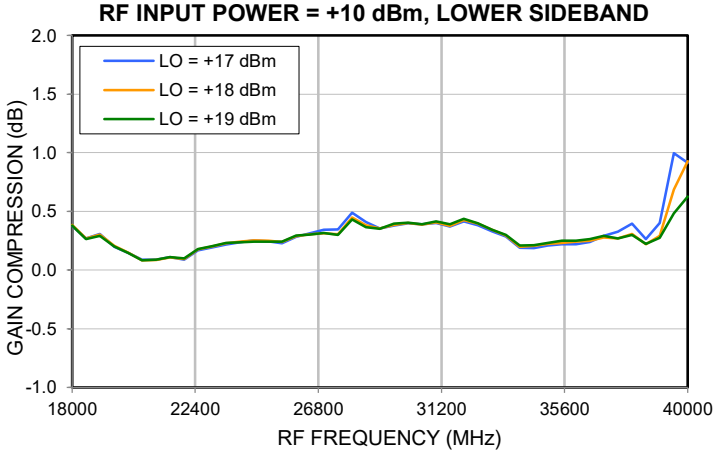
GAIN COMPRESSION (Q) @ FIXED IF = 2 GHz
RF INPUT POWER = +10 dBm, LOWER SIDEBAND



GAIN COMPRESSION (I) @ FIXED IF = 3 GHz
RF INPUT POWER = +10 dBm, LOWER SIDEBAND



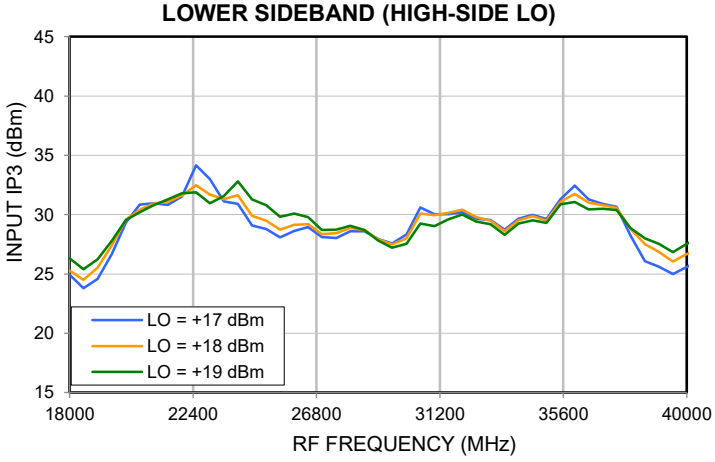
GAIN COMPRESSION (Q) @ FIXED IF = 3 GHz
RF INPUT POWER = +10 dBm, LOWER SIDEBAND



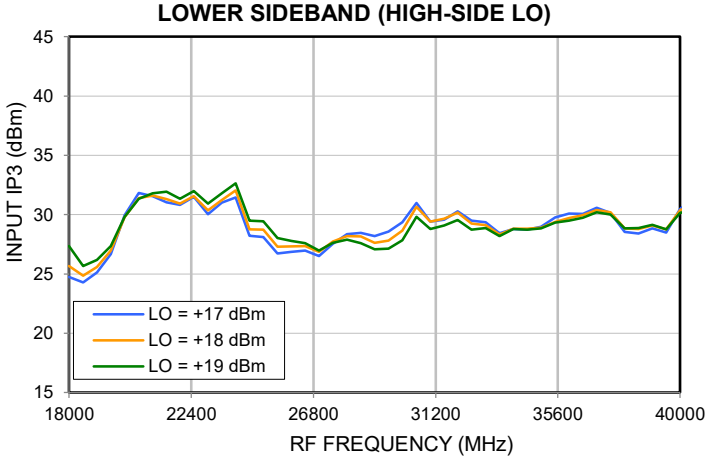
TYPICAL PERFORMANCE GRAPHS

P_{IN} = 0 dBm/Tone with 1 MHz spacing (RF2 = RF1 + 1 MHz)

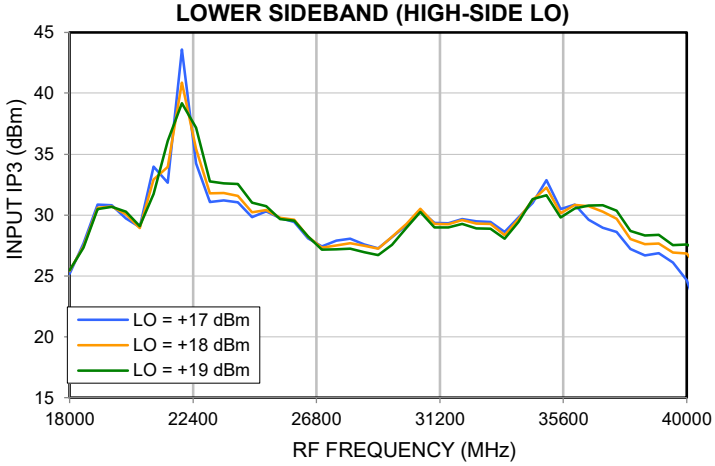
**INPUT IP3 (I) @ FIXED IF = 200 MHz
LOWER SIDEBAND (HIGH-SIDE LO)**



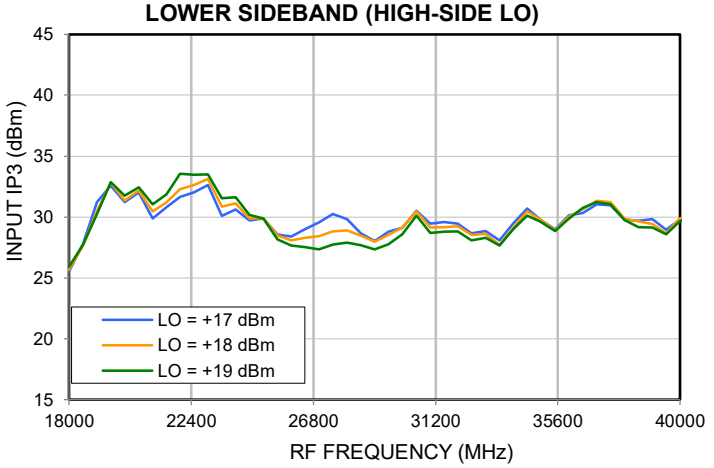
**INPUT IP3 (Q) @ FIXED IF = 200 MHz
LOWER SIDEBAND (HIGH-SIDE LO)**



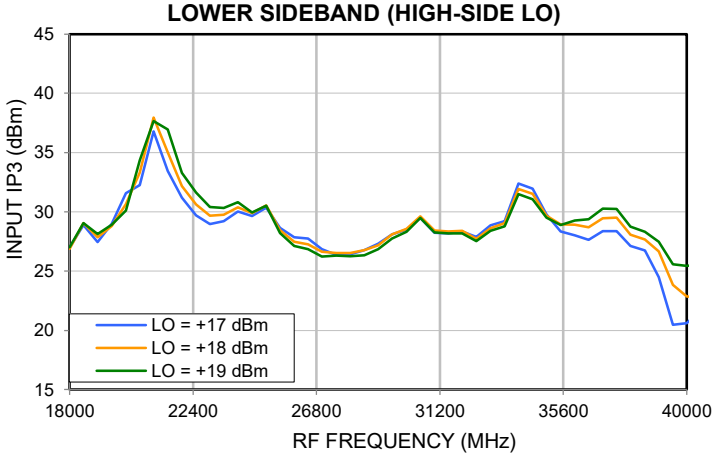
**INPUT IP3 (I) @ FIXED IF = 2 GHz
LOWER SIDEBAND (HIGH-SIDE LO)**



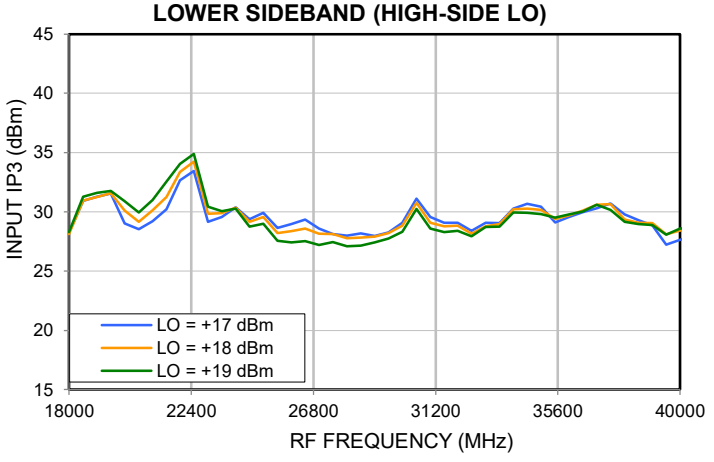
**INPUT IP3 (Q) @ FIXED IF = 2 GHz
LOWER SIDEBAND (HIGH-SIDE LO)**



**INPUT IP3 (I) @ FIXED IF = 3 GHz
LOWER SIDEBAND (HIGH-SIDE LO)**



**INPUT IP3 (Q) @ FIXED IF = 3 GHz
LOWER SIDEBAND (HIGH-SIDE LO)**



ABSOLUTE MAXIMUM RATINGS[5]

Parameter	Ratings
Operating Temperature	-55°C to +105°C
Storage Temperature	-65°C to +150°C
Junction Temperature	+175°C
RF Power	+24 dBm
LO Power	+24 dBm
I/Q Power	+23 dBm
IF Current	16 mA

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

ESD RATING

	Class	Voltage Range	Reference Standard
HBM	1A	250 to < 500 V	ANSI/ESDA/JEDEC JS-001-2017
CDM	C3	≥ 1000 V	JESD22-C101F

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

IQ Mixer

SMIQ-1844H+

50Ω Level 18 (LO Power +18 dBm) 18 to 40 GHz

FUNCTIONAL DIAGRAM

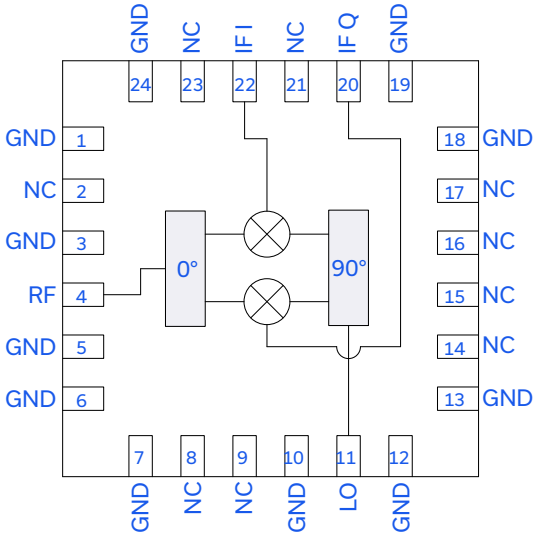
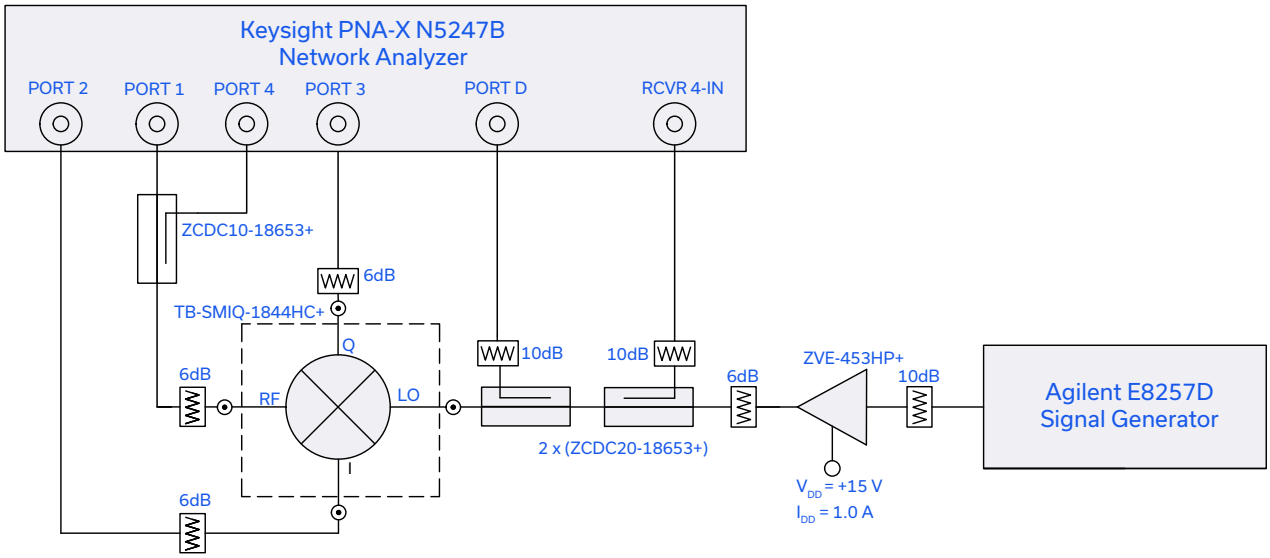


Figure 1. SMIQ-1844H+ Functional Diagram

PAD CONNECTIONS

Function	Pad #	Description
RF	4	RF Port. Connects to RF Output for Upconverters or RF Input for Downconverters.
LO	11	LO Port. Connects to LO Input.
IF I	22	IF I Port. Connects to the IF I Input for Upconverters or IF I Output for Downconverters.
IF Q	20	IF Q Port. Connects to the IF Q Input for Upconverters or IF Q Output for Downconverters.
GND	1, 3, 5-7, 10, 12-13, 18-19, 24, Paddle	Connects to ground.
NC	2, 8-9, 14-17, 21, 23	No connection. Grounded on test board.

CHARACTERIZATION TEST CIRCUITS



10 dB attenuators P/N BW-E10-1W653+
6 dB attenuators P/N BW-E6-1W653+

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, Return Loss, and Isolation:
RF Input Power = -10 dBm, LO Input Power = +17 to +19 dBm, IF = 200 MHz, 2 GHz, and 3 GHz
For Input IP3:
RF Input Power = 0 dBm/Tone, LO Input Power = +17 to +19 dBm. Two tones, spaced 1 MHz apart.

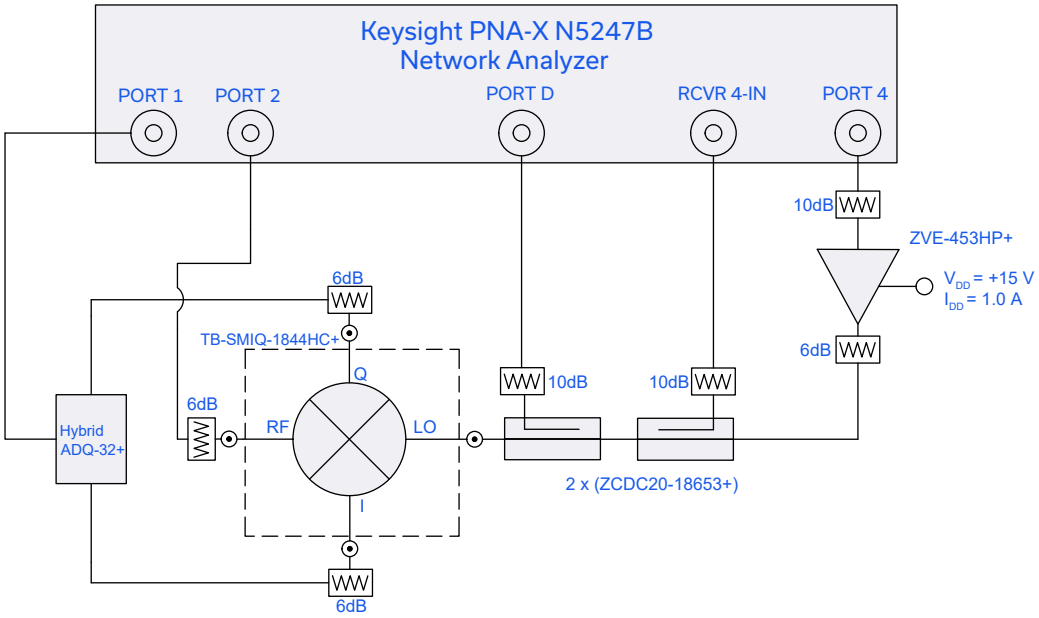


Figure 3. Block diagram of Test Circuit used for characterization of Image Rejection and Single Side Band Rejection

Test conditions:
RF Input Power = -10 dBm, LO Input Power = +17 to +19 dBm, IF = 200 MHz, 2 GHz, and 3 GHz

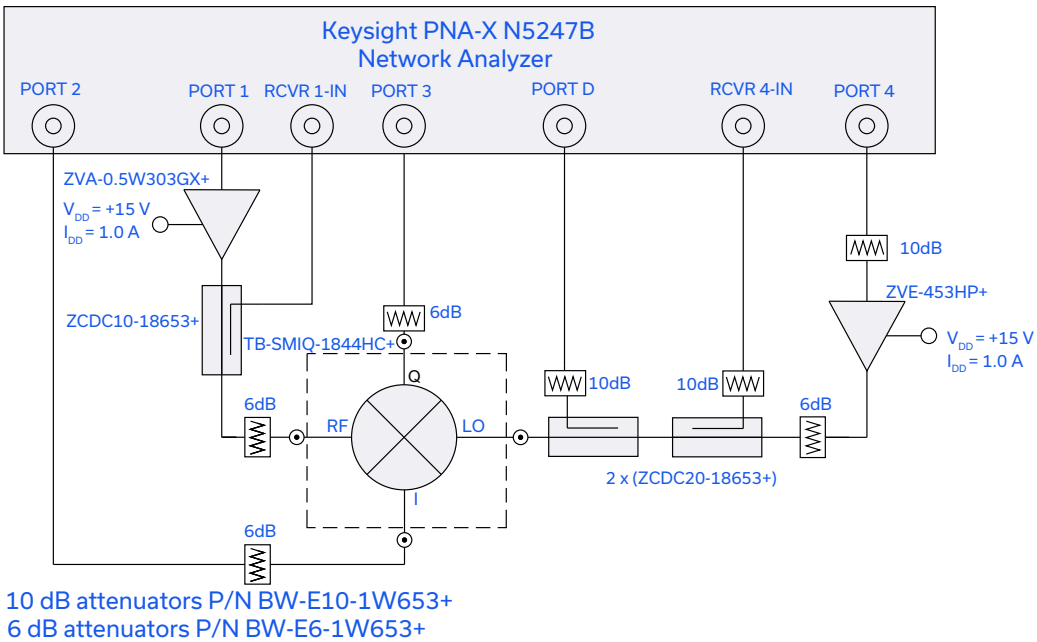


Figure 4. Block diagram of test circuit used to characterize: Compression

Test conditions:
RF Input Power = -10 dBm and +10 dBm, LO Input Power = +17 to +19 dBm, IF = 200 MHz, 2 GHz, and 3 GHz
Compression = (Conversion Loss @ RF Power = +10 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

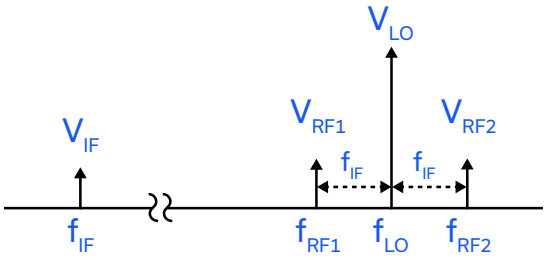


Figure 5. Spectral representation of Signals

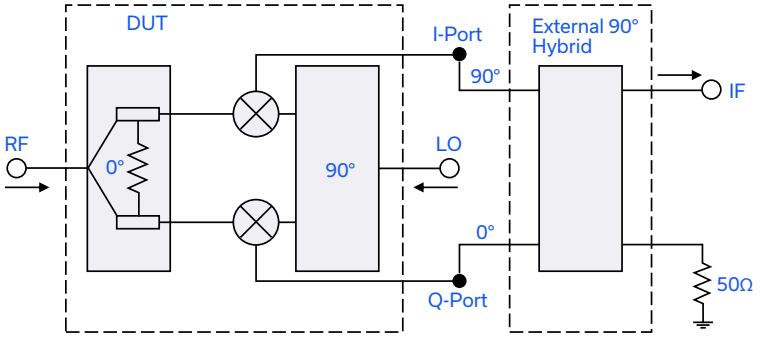


Figure 6. Block Diagram of Image Reject Mixer

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 IF 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.

SINGLE SIDE BAND (SSB) UPCONVERTER APPLICATION

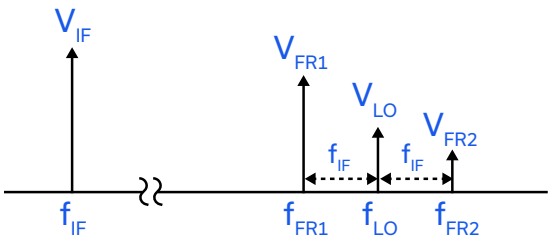


Figure 7. Spectral representation of Signals

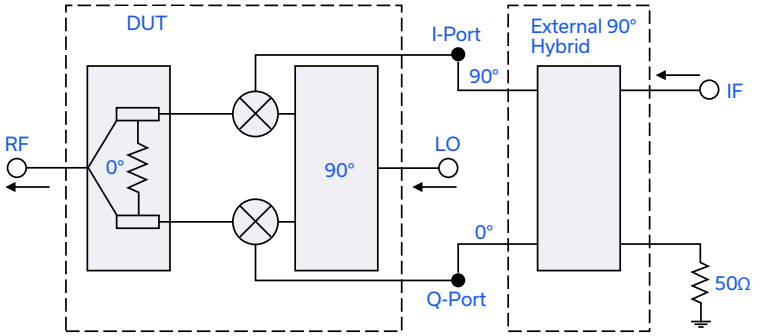


Figure 8. Block Diagram of Single Side Band Mixer

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 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 port.

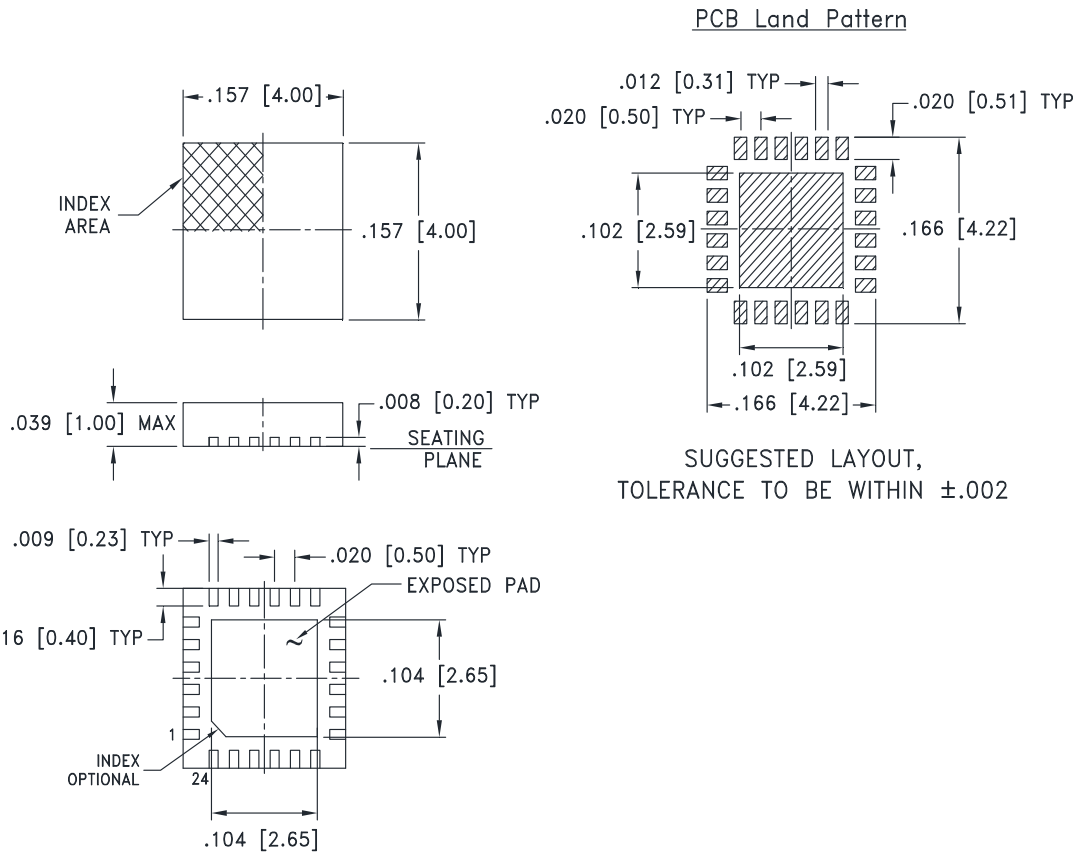
Refer to Mini-Circuits blog, I&Q Mixers, Image Reject Down-Conversion & Single Sideband (SSB) Up-Conversion for a detailed explanation.

IQ Mixer

SMIQ-1844H+

50Ω Level 18 (LO Power +18 dBm) 18 to 40 GHz

CASE STYLE DRAWING



Weight: .04 Grams

Dimensions are in inches [mm]. Tolerances (values are in inches): 2 Pl. + .01; 3 Pl. + .005

PRODUCT MARKING

Marking may contain other features or characters for internal lot control

IQ Mixer

SMIQ-1844H+

50Ω Level 18 (LO Power +18 dBm) 18 to 40 GHz

ADDITIONAL DETAILED INFORMATION IS AVAILABLE ON OUR DASH BOARD CLICK HERE

Performance Data	Data Graphs Data Set (.zip file)
Case Style	DG1847 Plastic package, exposed paddle, lead finish: Matte-Tin
RoHS Status	Compliant
Tape & Reel **Standard quantities available on reel**	F68 7" reels with 20, 50, 100, 200, 500, or 1K devices
Suggested Layout for PCB Design	PL-763
Evaluation Board	TB-SMIQ-1844HC+
Environmental Ratings	ENV08T1