MICROLITHIC® DOUBLE-BALANCED I/Q MIXER MLIQ-1845

The MLIQ-1845 is a miniaturized, multi-octave 18-45 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 up or downconversion. Applications include optical communications systems with advanced modulation formats, 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.

Features

- Compact Chip Style Package (0.240" x 0.240"x0.010")
- CAD Optimized for Superior Amplitude / Phase Balance and Image Rejection
- Broadband Performance
- Excellent Unit-to-Unit Repeatability
- Fully nonlinear software models available with Marki PDK 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[1] LO drive level (dBm)
Conversion Loss (dB) (Combined IF with Test Hybrid)	18-45		DC-6 6-20		8 10	13 15	
Image Rejection (dB) (Combined IF with Test Hybrid)					See Plots		
I/Q Amplitude Balance (dB)					0.11		
I/Q Quadrature Phase Balance (Degrees)					5		
Isolation (dB) LO-RF LO-IF RF-IF					See Plots		
Input 1 dB Compression (dBm)					+8		L (+11 to +18)
Input Two-Tone Intercept (dBm)					+16		L (+11 to +18)

[1]Contact factory for other diode options.

Part Number Options

Model Number	Description
MLIQ-1845LCH-2 [1, 3]	Low Barrier Diode, I Port Configuration -2
MLIQ-1845L [2, 3]	Low Barrier Diode, Connectorized

[1] Chip package connects to external circuit through wire bondable gold pads. See page 6 for plating details.
[2] Connectorized package consists of chip package wire bonded to a substrate, equivalent to an evaluation board.
[3] Note: For port locations and I/O designations, refer to the drawing on page 6 of this document.

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LO/RF 18 to 45 GHz
IF DC to 20 GHz

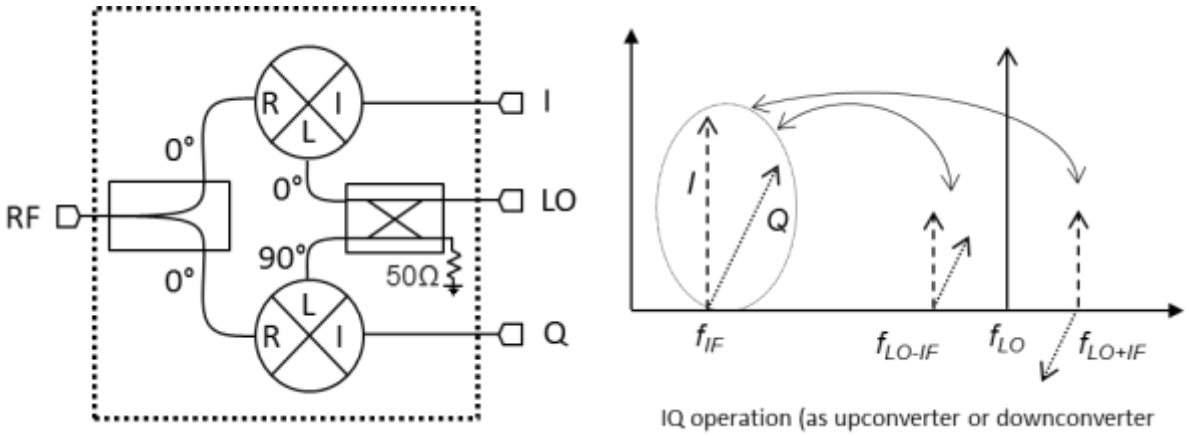


Figure 1a. I/Q Mixer Schematic

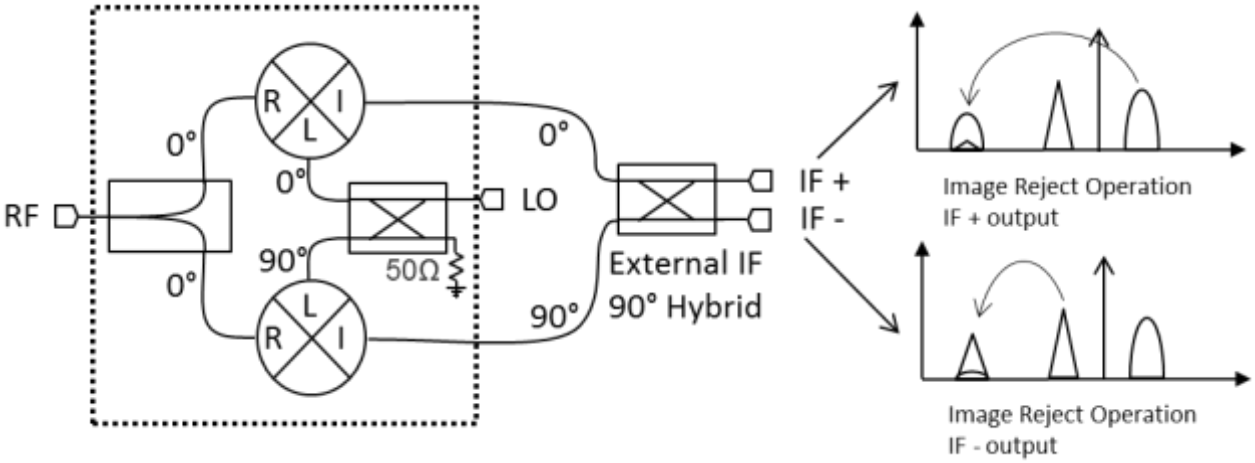


Figure 1b. Image Reject Mixer Schematic

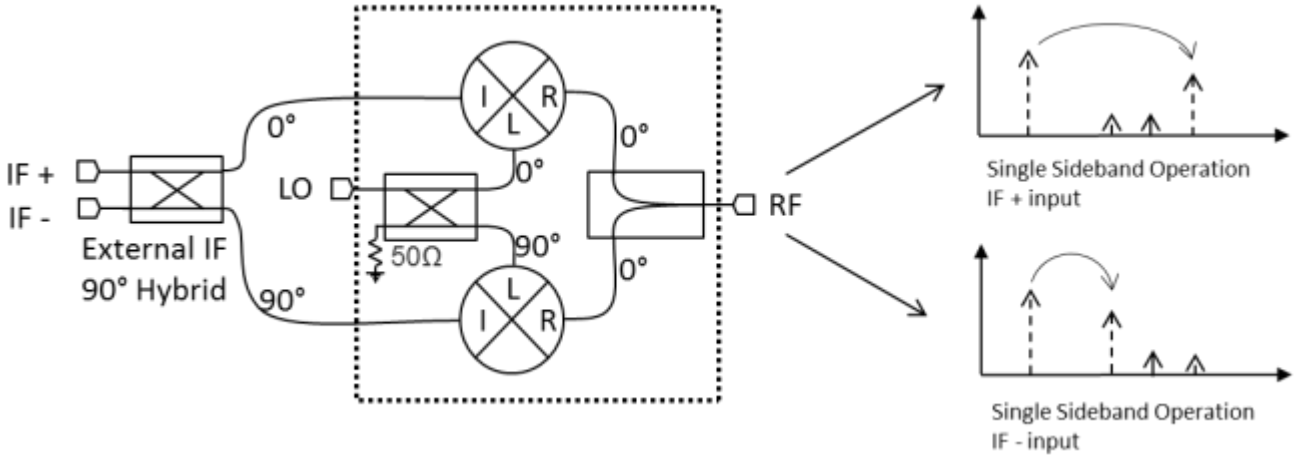
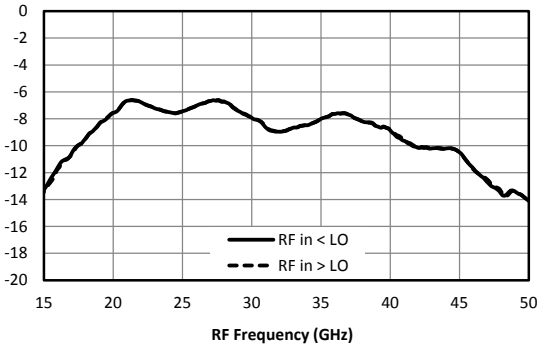


Figure 1c. Single Sideband Mixer Schematic

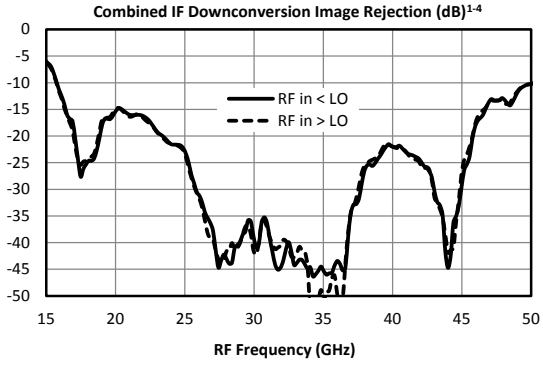
LO/RF 18 to 45 GHz
IF DC to 20 GHz

Typical Performance

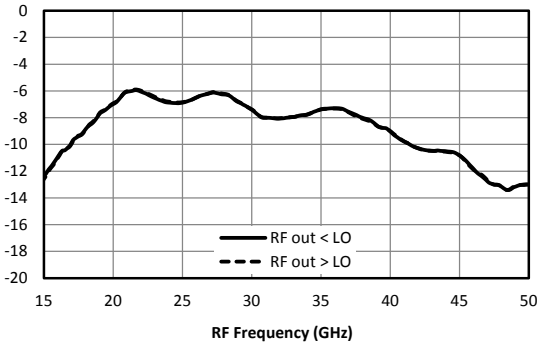
Combined IF Downconversion Loss (dB)[1-4]



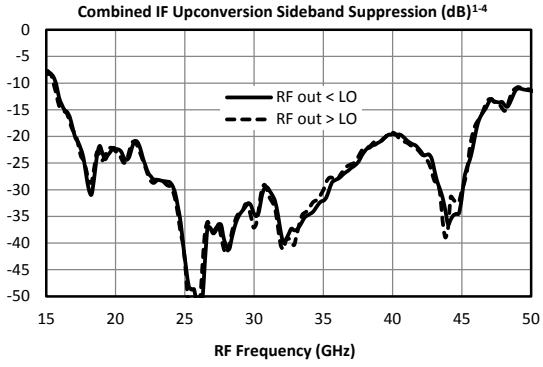
Combined IF Downconversion Image Rejection (dB)[1-4]



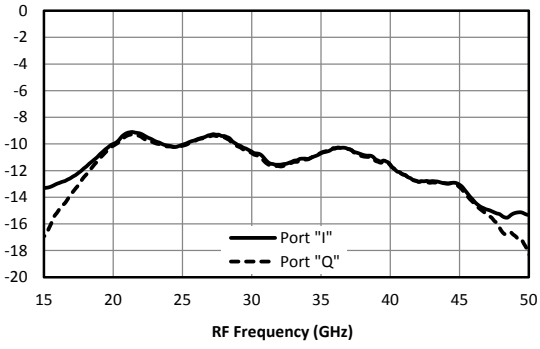
Combined IF Upconversion Loss (dB)[1-4]



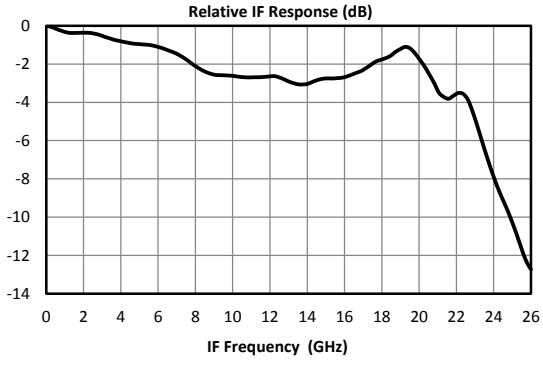
Combined IF Upconversion Sideband Suppression (dB)[1-4]



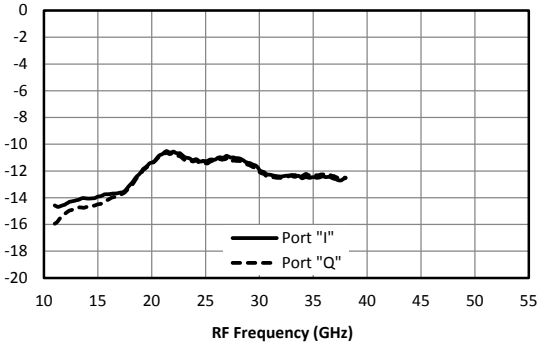
Individual I/Q 100 MHz IF Conversion Loss (dB)[1-4]



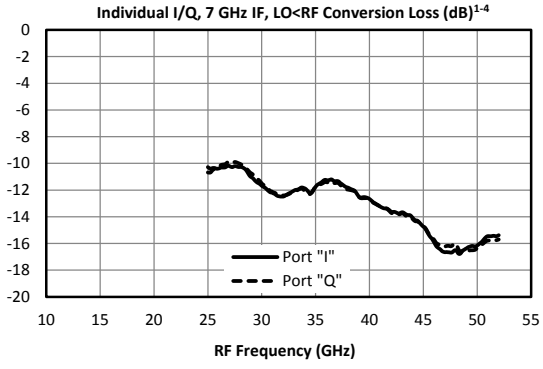
Relative IF Response (dB)



Individual I/Q, 7 GHz IF, LO>RF Conversion Loss (dB)[1-4]



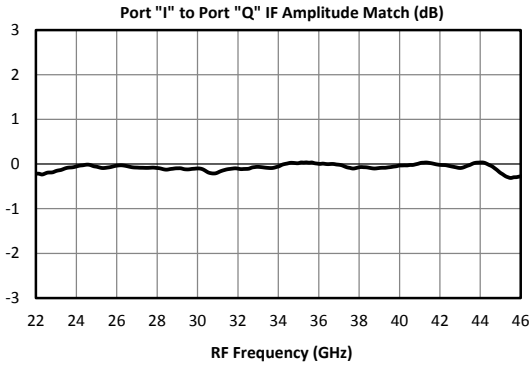
Individual I/Q, 7 GHz IF, LO<RF Conversion Loss (dB)[1-4]

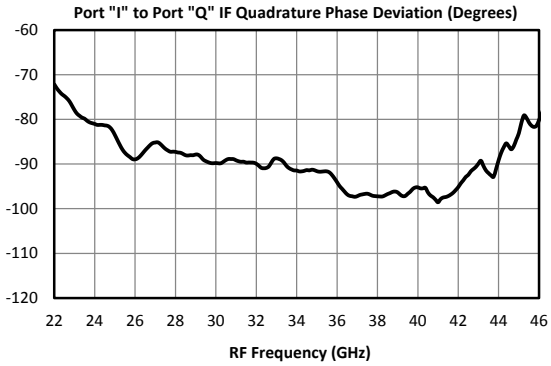


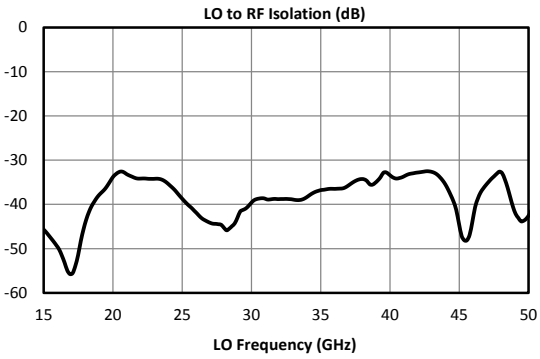
MICROLITHIC® DOUBLE-BALANCED I/Q MIXER MLIQ-1845

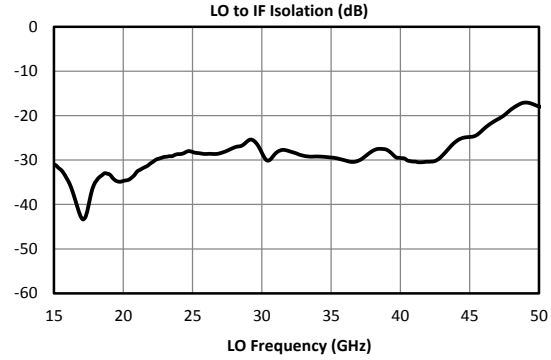
LO/RF 18 to 45 GHz
IF DC to 20 GHz

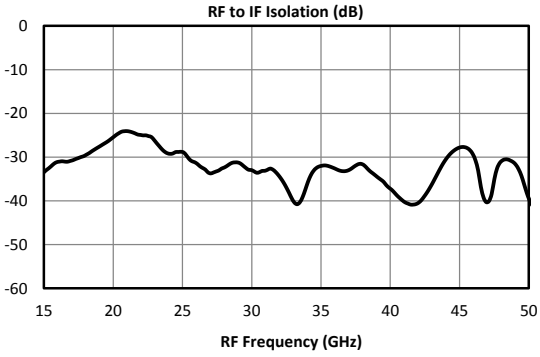
Typical Performance (cont.)

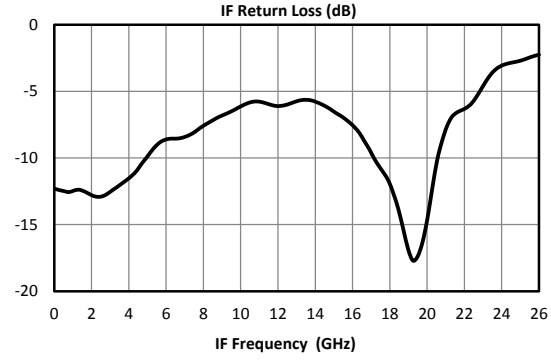


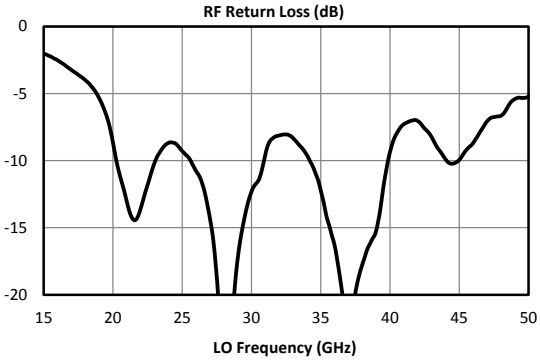


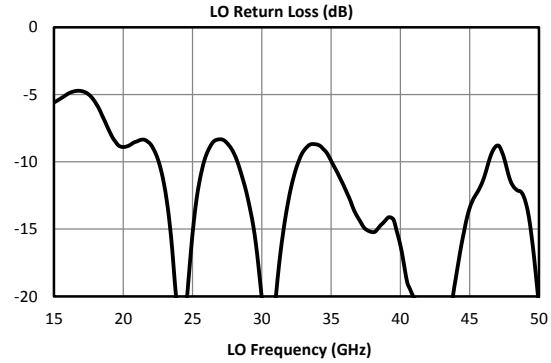






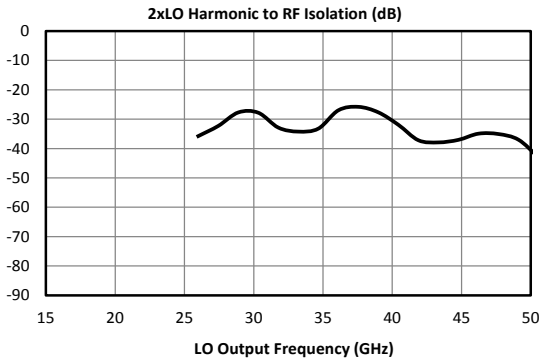


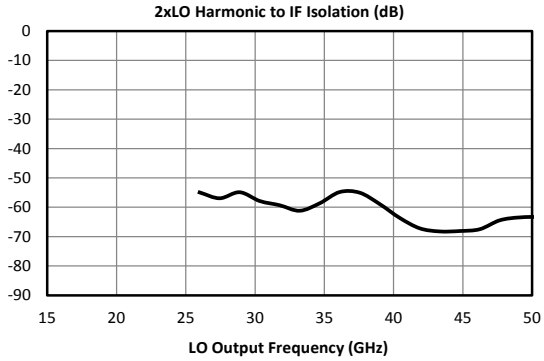


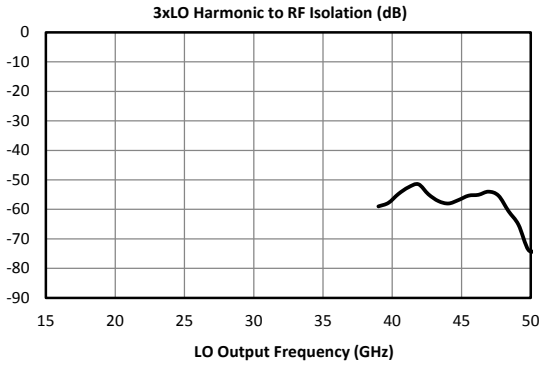


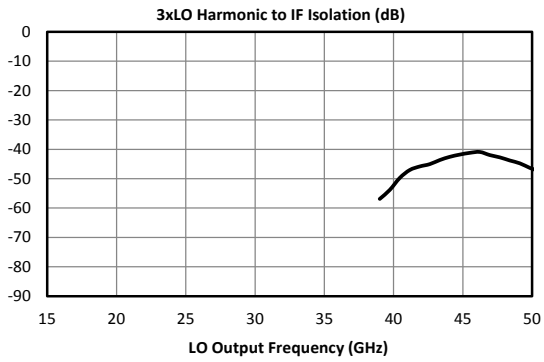
LO/RF 18 to 45 GHz
IF DC to 20 GHz

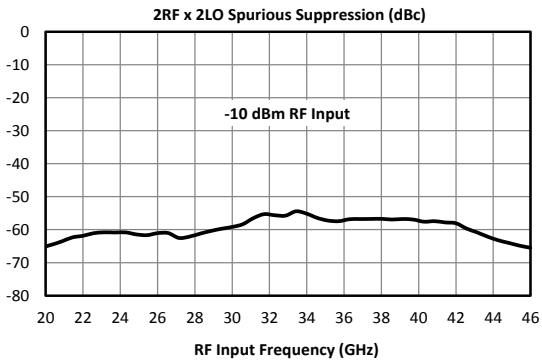
Typical Performance (cont.)

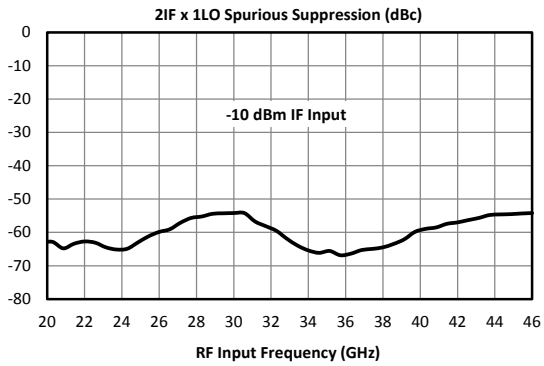












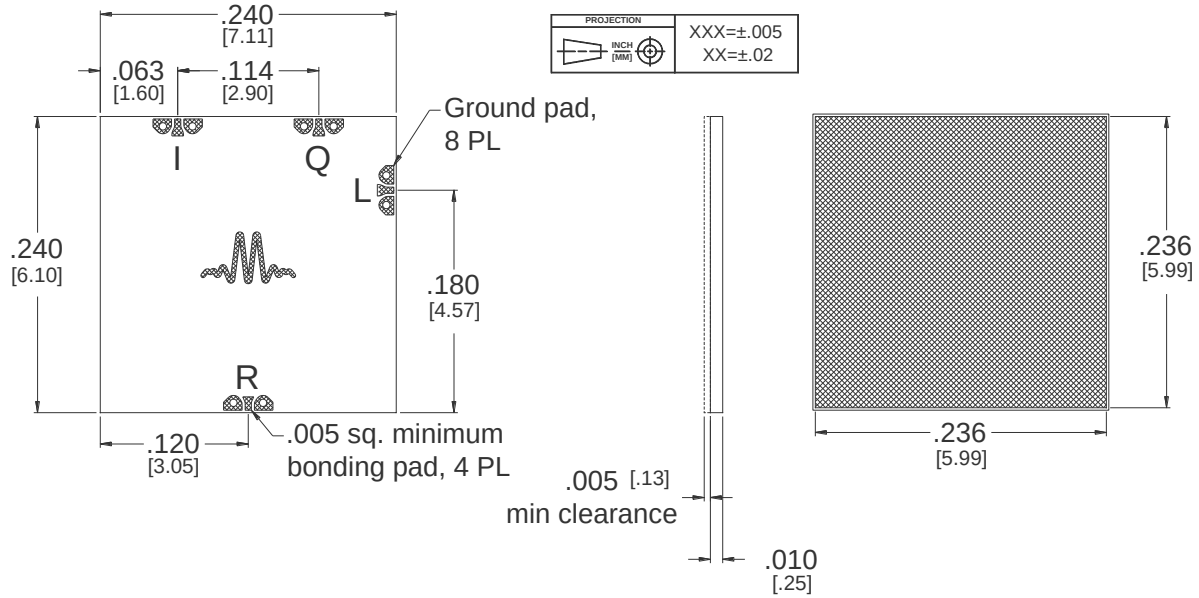
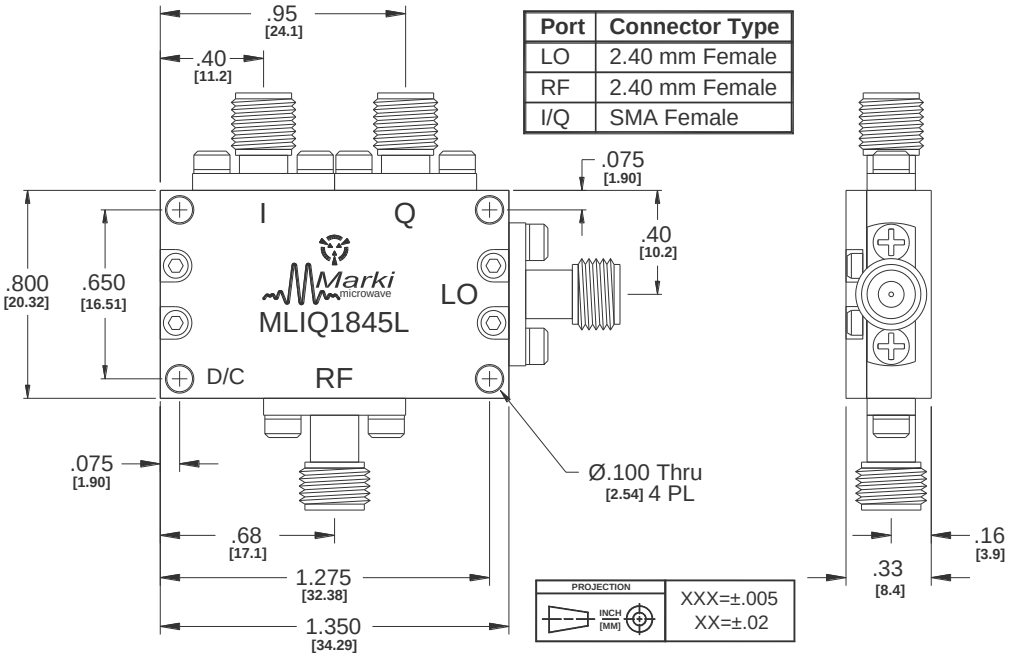


Figure 2a. Outline Drawing – CH-2

*CH Substrate material is .010 thick Ceramic.
I/O traces and ground plane finish is 2.5 microns Au over .05 microns WTi.
Wire Bonding - Ball or wedge bond with 0.025 mm (1 mil) diameter pure gold wire. Thermosonic wirebonding with a nominal stage temperature of 150 °C and a ball bonding force of 40 to 50 grams or wedge bonding force of 18 to 22 grams is recommended. Use the minimum level of ultrasonic energy to achieve reliable wirebonds. Wirebonds should be started on the chip and terminated on the package or substrate. All bonds should be as short as possible <0.31 mm (12 mils).



Port	Connector Type
LO	2.40 mm Female
RF	2.40 mm Female
I/Q	SMA Female

Figure 2b. Outline Drawing - Connectorized

Downconversion Spurious Suppression

Spurious data is taken by selecting RF and LO frequencies (±mLO±nRF) within the 18 to 45 GHz RF/LO bands, which create a 100 MHz IF spurious output. 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 60 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 70 dBc.

Typical Downconversion Spurious Suppression (dBc): L-diode[5]

-10 dBm RF Input	0xLO	1xLO	2xLO	3xLO	4xLO	5xLO
1xRF	21	Reference	28	11	37	25
2xRF	58	60	60	58	63	60
3xRF	82	56	75	62	76	65
4xRF	N/A	105	96	102	100	102
5xRF	N/A	N/A	104	103	113	105

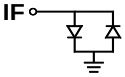
Upconversion Spurious Suppression

Spurious data is taken by mixing a 100 MHz IF with LO frequencies (±mLO±nIF), which creates an RF within the 18 to 45 GHz RF 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 individual IF input, with the unused port terminated in 50 ohms. 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 60 dBc for a -10 dBm input, so a -20 dBm IF input creates a spur that is (2-1) x (-10 dB) dB lower, or 70 dBc.

Typical Upconversion Spurious Suppression (dBc): L-diode[5]

-10 dBm IF Input	0xLO	1xLO	2xLO	3xLO	4xLO	5xLO
1xIF	25	Reference	21	16	44	N/A
2xIF	59	60	55	53	58	N/A
3xIF	81	70	67	52	72	60
4xIF	106	100	98	100	99	95
5xIF	117	106	112	111	112	102

LO/RF 18 to 45 GHz
IF DC to 20 GHz

Port	Description	DC Interface Schematic
LO	The LO port is DC short to ground and AC matched to 50 Ohms from 18 to 45 GHz. Blocking capacitor is optional.	
RF	The RF port is DC short to ground and AC matched to 50 Ohms from 18 to 45 GHz. Blocking capacitor is optional.	
I/Q	The I/Q ports are DC coupled to the diodes. Blocking capacitor is optional.	

Absolute Maximum Ratings	
Parameter	**Maximum Rating**
RF DC Current	1 Amp
LO DC Current	1 Amp
IF DC Current	50 mA
RF Power Handling (RF+LO)	+25 dBm at +25°C, derated linearly to +20 dBm at +100°C
Operating Temperature	-55ºC to +100ºC
Storage Temperature	-65ºC to +125ºC

DATA SHEET NOTES:
1. Unless othewise noted, Mixer Conversion Loss and Rejection plots IF frequency is 60 MHz.
2. Mixer Noise Figure typically measures within 0.5 dB of conversion loss for IF frequencies greater than 5 MHz.
3. Conversion Loss typically degrades less than 0.5 dB for LO drives 2 dB below the lowest and 3 dB above highest nominal LO drive levels.
4. Conversion Loss typically degrades less than 0.5 dB at +100°C and improves less than 0.5 dB at -55°C.
5. Unless otherwise specified L diode data taken with +15 dBm LO drive.
6. Specifications are subject to change without notice. Contact Marki Microwave for the most recent specifications and data sheets.
7. Catalog mixer circuits are continually improved. Configuration control requires custom mixer model numbers and specifications.

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