MICROLITHIC™ DOUBLE-BALANCED I/Q MIXER MLIQ-0416

The MLIQ-0416 is a miniaturized, multi-octave 4-16 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 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 (0.280" x 0.160"x0.010")
- CAD Optimized for Superior Isolation and Spurious Response
- Broadband Performance
- Excellent Unit-to-Unit Repeatability
- Fully nonlinear software models available with Marki PDK for Microwave Office
- RoHS Compliant

Note: This part is being discontinued due to material obsolescence. Please see this EOL letter for recommended replacements.

Mixer Line	Suitable Alternative for Models
I/Q	IQ-0307, IQ-0318, IQ-4509, IQ-0618, IQ-0714, IQ-0917

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)	4-16		DC-2 2-3.5		8.5 10.5	10.5 12.5	
Image Rejection (dB) (Combined IF with Test Hybrid)					See Plots		
I/Q Amplitude Balance (dB)					0.13		
I/Q Quadrature Phase Balance (Degrees)					3.5		
Isolation (dB) LO-RF LO-IF RF-IF					See Plots		
Input 1 dB Compression (dBm) (Combined IF with Test Hybrid)					+8 +13		L (+11 to +18) I (+18 to +24)
Input Two-Tone Intercept (dBm) (Combined IF with Test Hybrid)					+18 +23		L (+11 to +18) I (+18 to +24)

[1]Contact factory for other diode options.

Part Number Options[1]

Part Number	Description	Package	Green Status	Product Lifecycle	Export Classification
MLIQ-0416LCH-2	Chip	CH	RoHS Compliant	EOL	EAR99
MLIQ-0416ICH-2	Chip	CH			
MLIQ-0416L	Connectorized	-			
MLIQ-0416I	Connectorized	-			

[1]Refer to our website for a list of definitions for terminology presented in this table.

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LO/RF 4 to 16 GHz
IF DC to 3.5 GHz

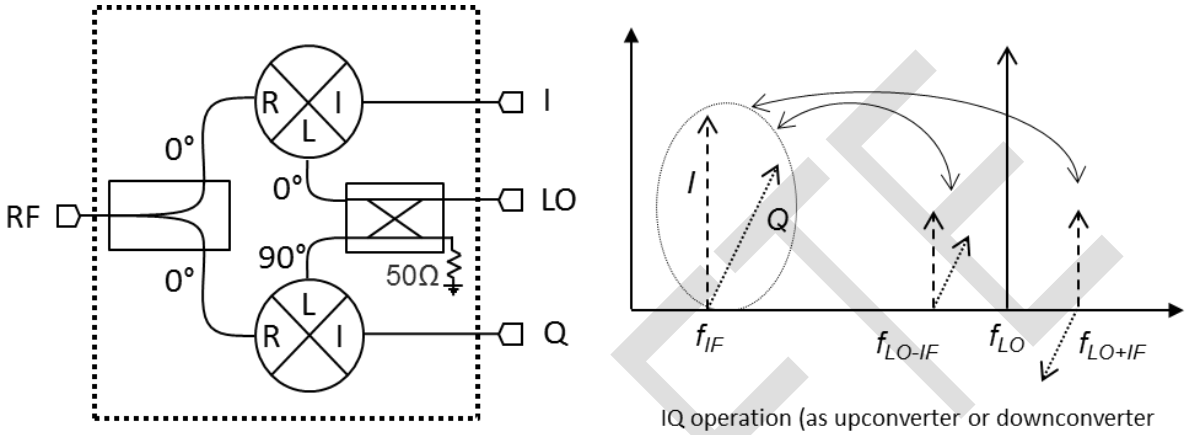


Figure 1a. I/Q Mixer Schematic

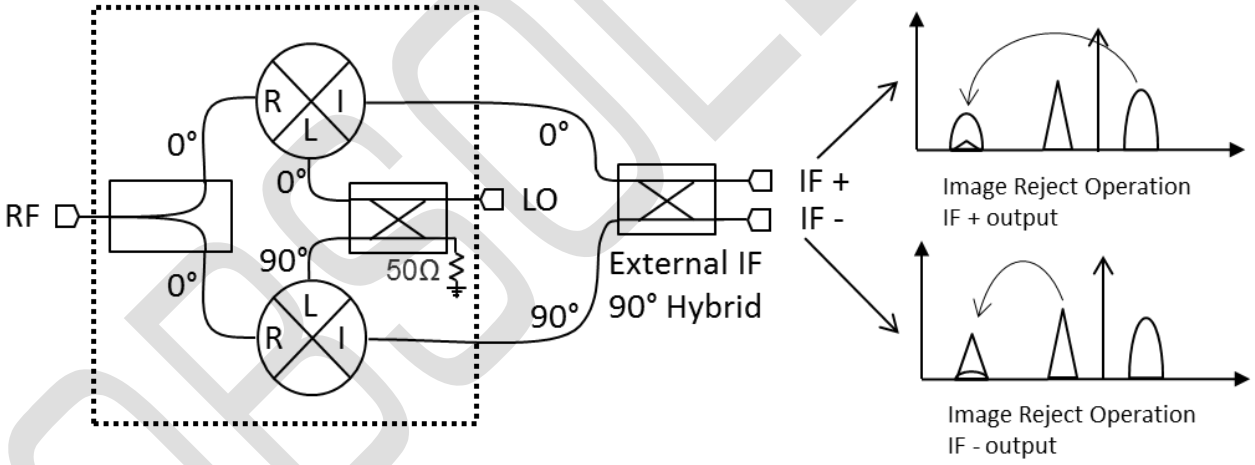


Figure 1b. Image Reject Mixer Schematic

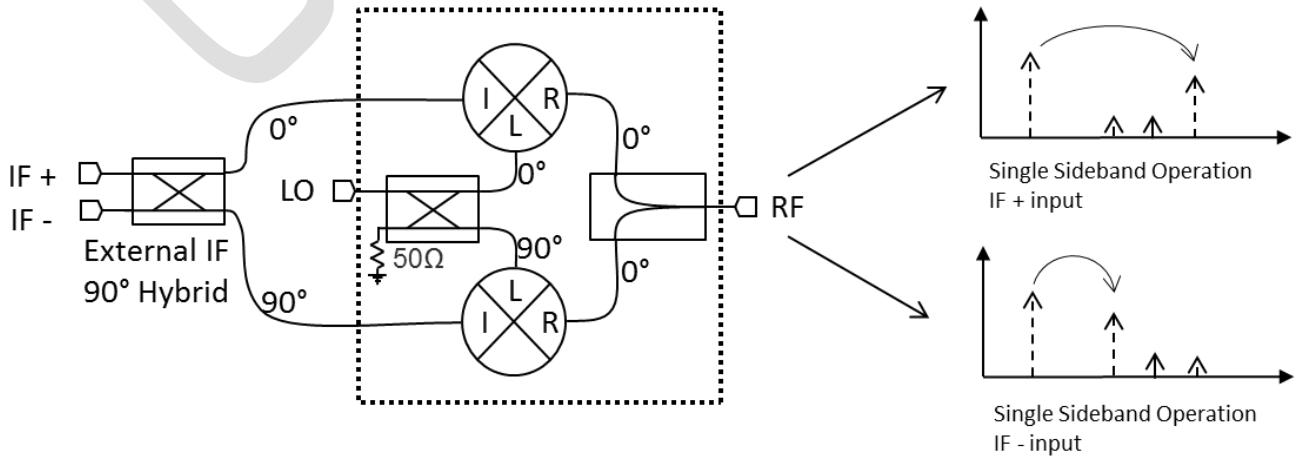


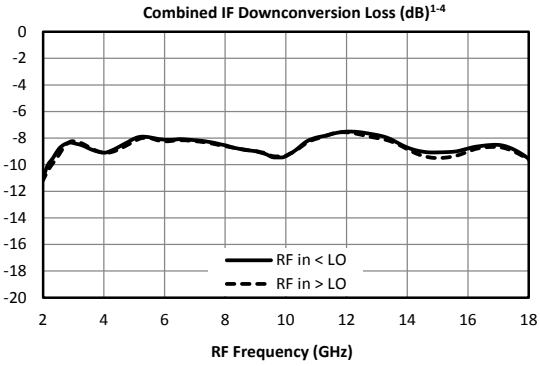
Figure 1c. Single Sideband Mixer Schematic

MICROLITHIC™ DOUBLE-BALANCED I/Q MIXER MLIQ-0416

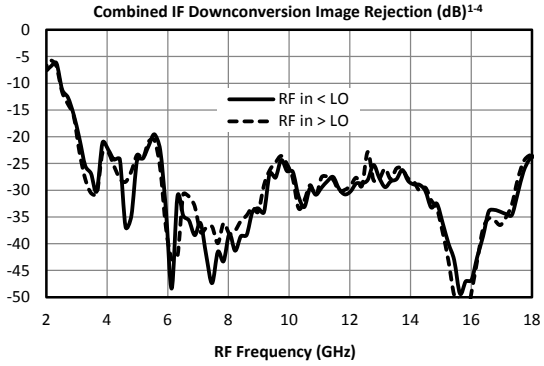
LO/RF 4 to 16 GHz
IF DC to 3.5 GHz

Typical Performance

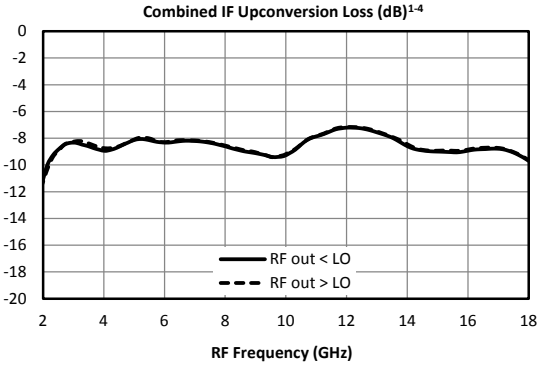
Combined IF Downconversion Loss (dB)[1-4]



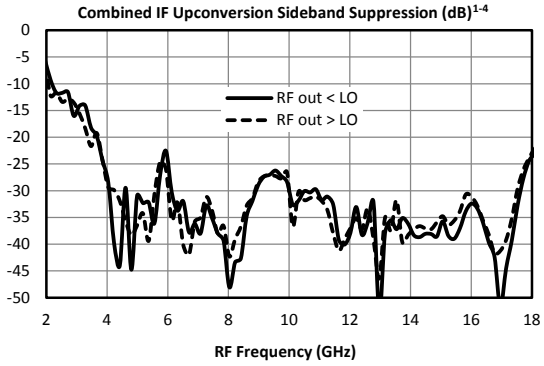
Combined IF Downconversion Image Rejection (dB)[1-4]



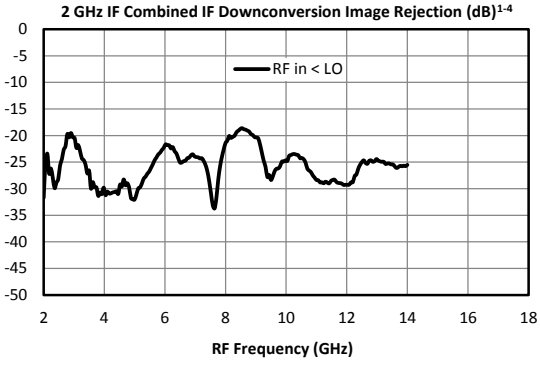
Combined IF Upconversion Loss (dB)[1-4]



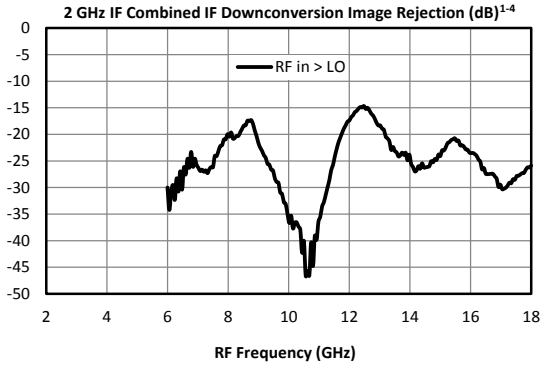
Combined IF Upconversion Sideband Suppression (dB)[1-4]



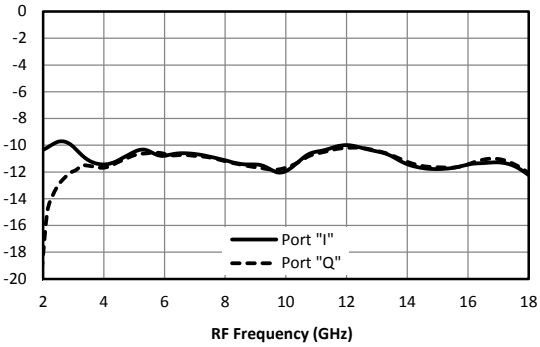
2 GHz IF Combined IF Downconversion Image Rejection (dB)[1-4]



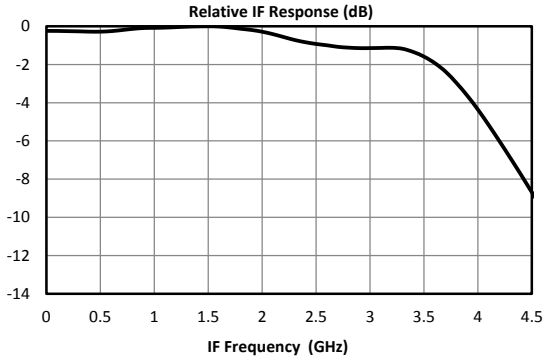
2 GHz IF Combined IF Downconversion Image Rejection (dB)[1-4]



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

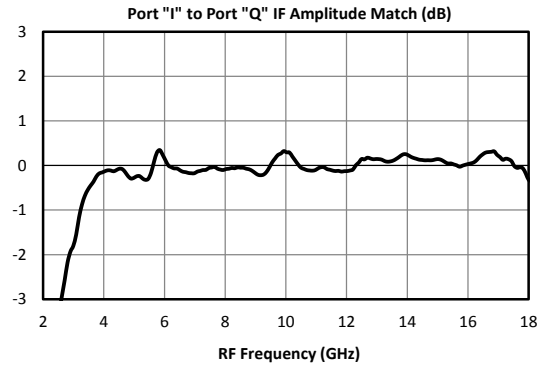


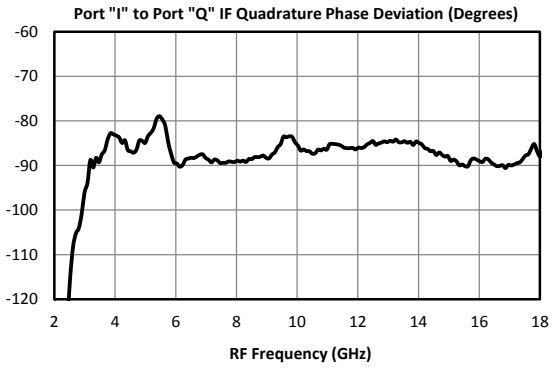
Relative IF Response (dB)

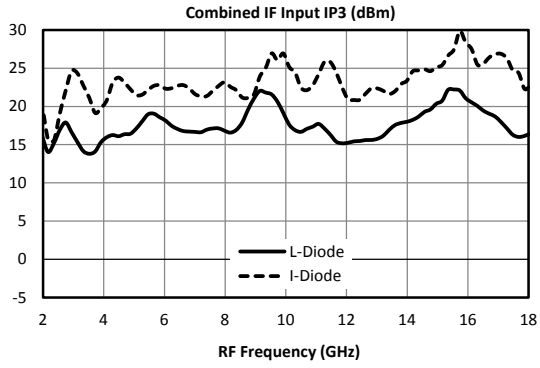


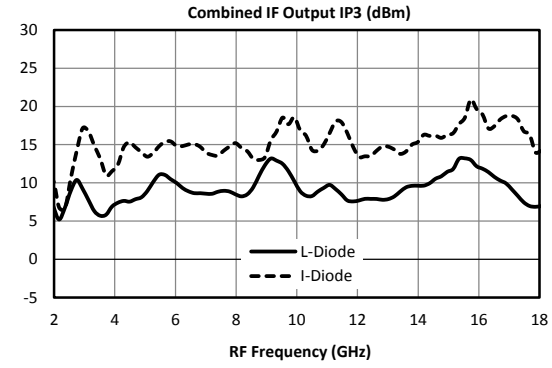
LO/RF 4 to 16 GHz
IF DC to 3.5 GHz

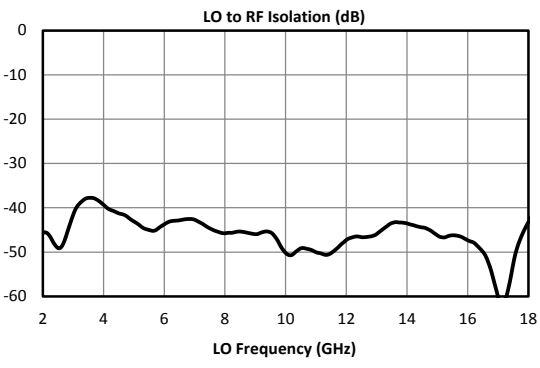
Typical Performance (cont.)

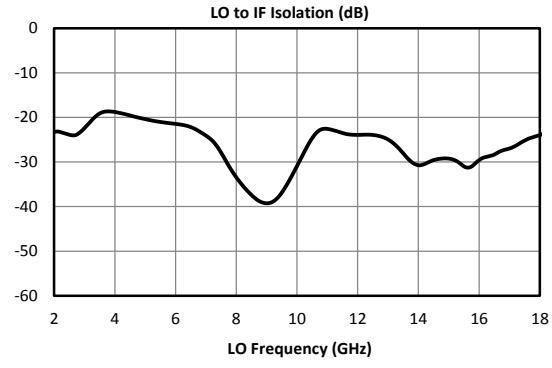


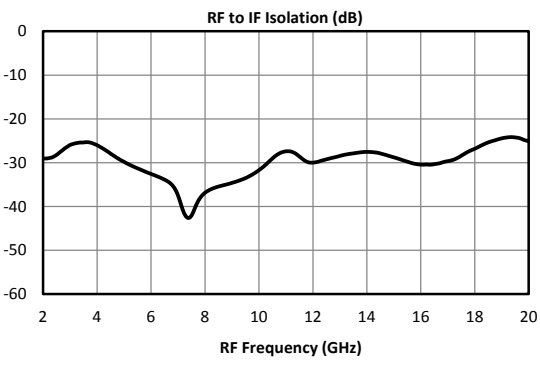


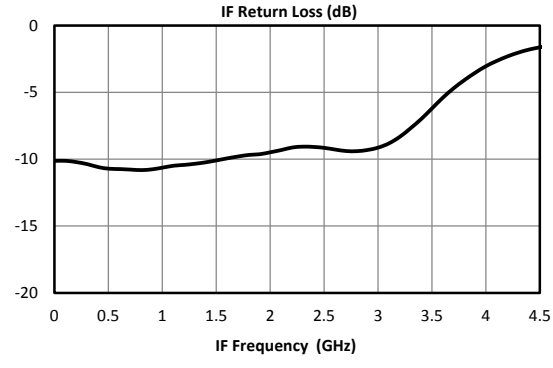






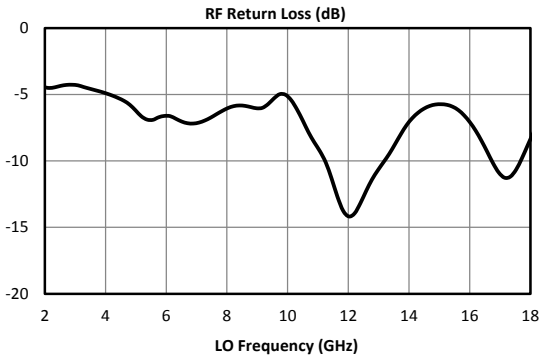


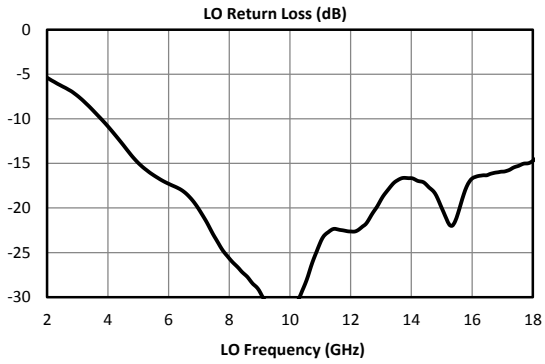


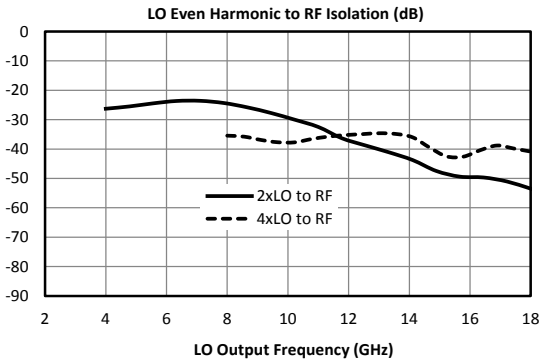


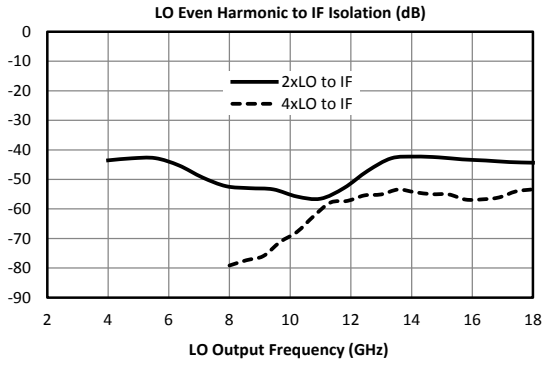
LO/RF 4 to 16 GHz
IF DC to 3.5 GHz

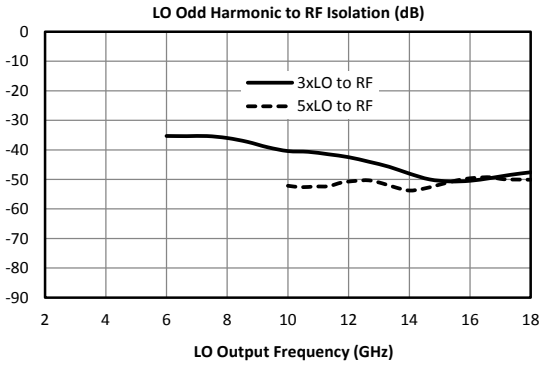
Typical Performance (cont.)

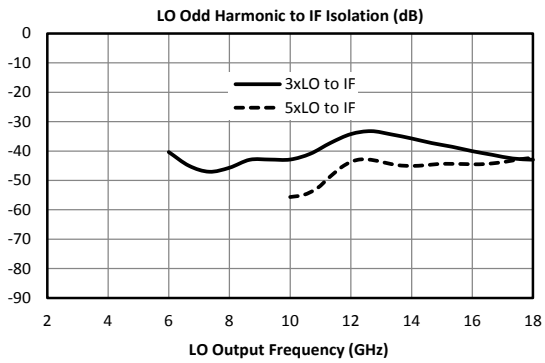


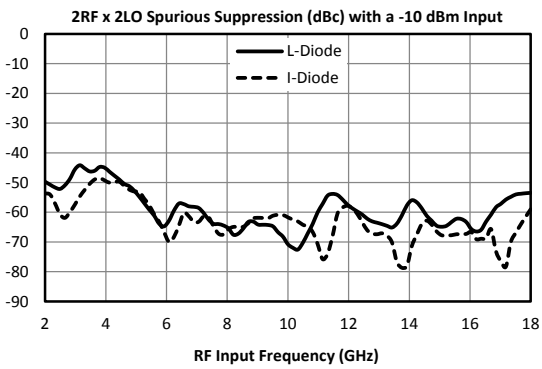


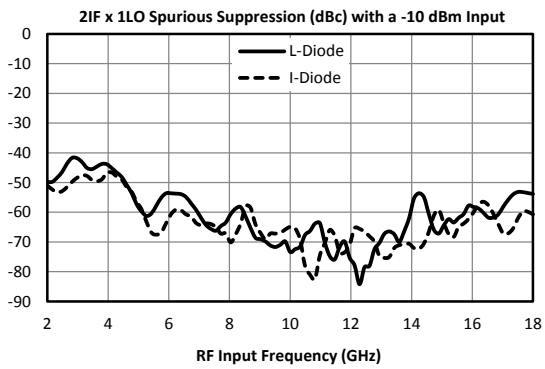












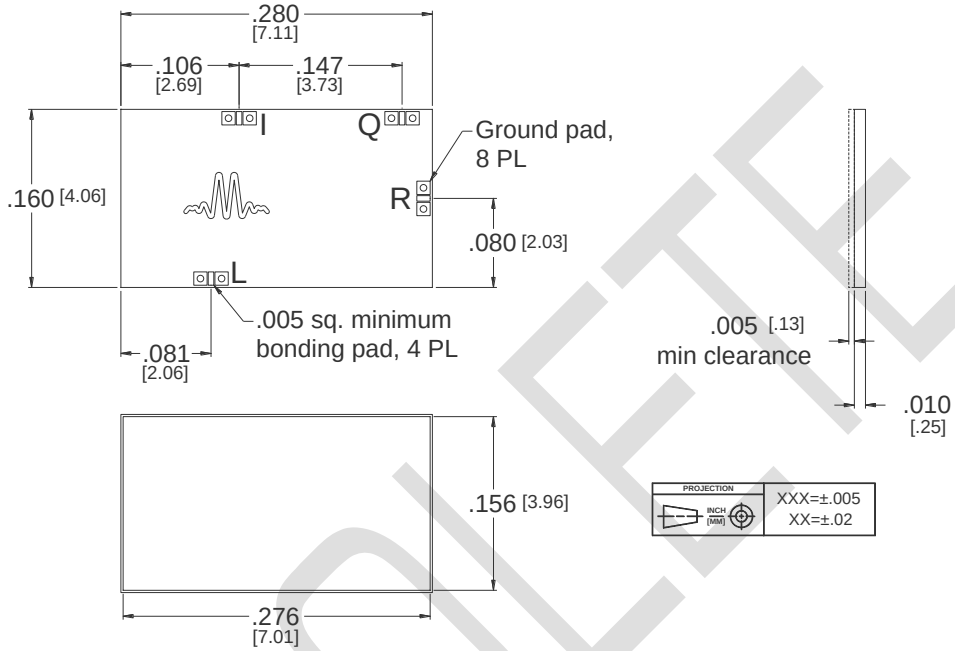


Figure 2a. Outline Drawing – CH-2

*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).

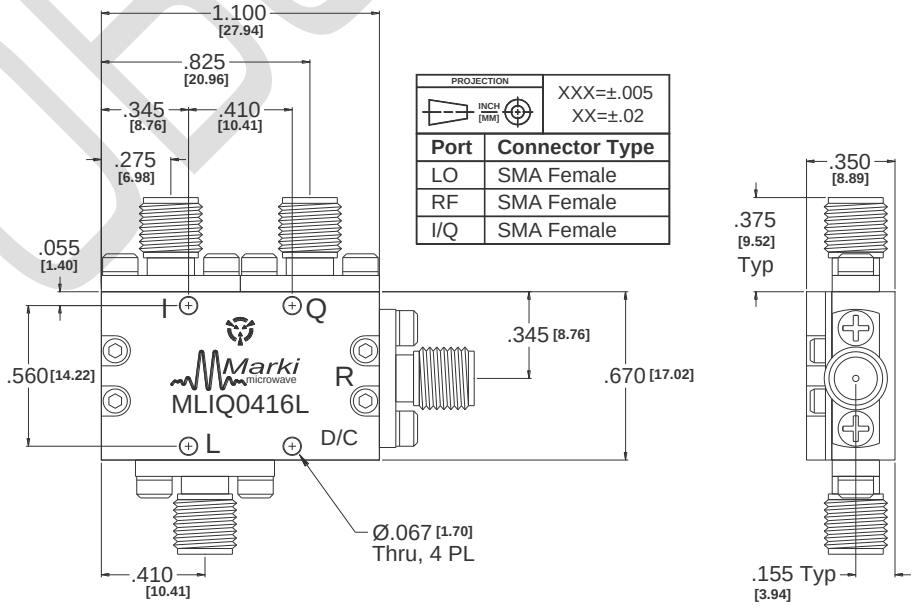


Figure 2b. Outline Drawing - Connectorized

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 61 dBc with an L-Diode for a -10 dBm input, so a -20 dBm RF input creates a spur that is (2-1) x (-10 dB) dB lower, or 71 dBc.

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

-10 dBm RF Input	0xLO	1xLO	2xLO	3xLO	4xLO	5xLO
1xRF	18 (19)	Reference	19 (19)	10 (10)	30 (32)	18 (18)
2xRF	70 (70)	53 (58)	61 (64)	54 (58)	57 (57)	51 (54)
3xRF	80 (90)	61 (75)	74 (85)	67 (77)	72 (83)	69 (75)
4xRF	118 (125)	102 (110)	102 (116)	101 (112)	105 (114)	101 (110)
5xRF	128 (131)	106 (124)	112 (127)	112 (127)	119 (130)	117 (129)

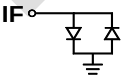
Upconversion Spurious Suppression

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 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 64 dBc with an L-Diode for a -10 dBm input, so a -20 dBm IF input creates a spur that is (2-1) x (-10 dB) dB lower, or 74 dBc.

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

-10 dBm IF Input	0xLO	1xLO	2xLO	3xLO	4xLO	5xLO
1xIF	17 (17)	Reference	23 (23)	10 (10)	30 (31)	18 (18)
2xIF	57 (60)	64 (66)	53 (55)	60 (66)	47 (52)	60 (72)
3xIF	72 (90)	64 (75)	66 (76)	59 (68)	68 (77)	55 (61)
4xIF	108 (110)	101 (107)	93 (98)	95 (105)	81 (88)	89 (97)
5xIF	118 (127)	103 (119)	109 (118)	98 (107)	107 (117)	93 (99)

LO/RF 4 to 16 GHz
IF DC to 3.5 GHz

Port	Description	DC Interface Schematic
LO	The LO port is DC short to ground and AC matched to 50 Ohms from 4 to 16 GHz. Blocking capacitor is optional.	
RF	The RF port is DC short to ground and AC matched to 50 Ohms from 4 to 16 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[1]	50 mA
RF Power Handling (RF+LO)	+29 dBm at +25°C, derated linearly to +24 dBm at +100°C
IF Power Handling (each IF port, with +24 dBm maximum LO)	+25 dBm at +25°C, derated linearly to +20 dBm at +100°C
Operating Temperature	-55ºC to +100ºC
Storage Temperature	-65ºC to +125ºC

[1]Application of DC current has been known to damage mixer diodes. Application of DC current in excess of 50 mA will void the warranty.

DATA SHEET NOTES:
1. Mixer Conversion Loss, Rejection, Sideband Suppression, and IP3 plot 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 and I diode data taken with +21 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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