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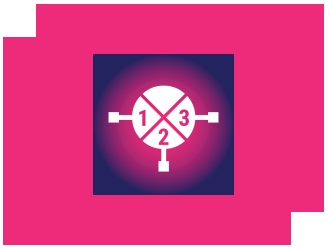
M9-0942LES-2

Double-Balanced Mixers

DEVICE OVERVIEW

General Description

M9 mixers double balanced mixers are hybrid assemblies that offer ultra-broadband RF, LO and IF bandwidths. M9 mixers have generally been replaced with MM1 mixers with superior performance, repeatability, and availability. M9 mixers are still used in legacy systems and where an MM1 mixer is not available.



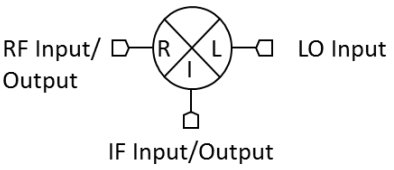
Features

- LO/RF 9.0 to 42.0 GHz
- IF 1.0 to 22.0 GHz
- 10 dB Typical Conversion Loss
- Ultra-Broadband RF, LO, and IF
- 2.40 mm Connectors

Applications

N/A

Functional Block Diagram



Part Ordering Options

Part Number	Description	Package	Green Status	Product Lifecycle	Export Classification	Recommended Replacement
M9-0942LES-2	Double-Balanced Mixers	ES	Consult Factory	Not Recommended for New Design	EAR99	MM1-1040HPSM-2MM1A-1040HPSM-2
M9-0942LES-1	Double-Balanced Mixers	ES	Consult Factory	Not Recommended for New Design	EAR99	MM1-1040HPSM-2MM1A-1040HPSM-2
M9-0942IES-1	Double-Balanced Mixers	ES	Non-RoHS	End of Life	EAR99	MM1-1040HPSM-2MM1A-1040HPSM-2
M9-0942IES-2	Double-Balanced Mixers	ES	Consult Factory	End of Life	EAR99	MM1-1040HPSM-2MM1A-1040HPSM-2

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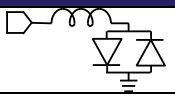
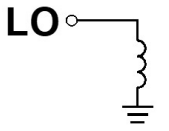
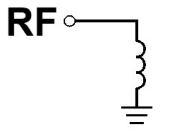
Revision History

Revision Code	Revision Date	Comment
A	2024-05-02	Updated Conversion Loss specification in electrical specifications table.

Port Configuration and Functions

Port Functions

Port	Function	Description	Equivalent Circuit for Package
IF	IF	The IF port is DC coupled to the diodes and AC matched to 50 Ohms from 1 to 22 GHz. Blocking capacitor is optional.	
LO	LO	The LO port is DC coupled to ground and AC matched to 50 Ohms from 9 to 42 GHz. Blocking capacitor is optional.	
RF	RF	The RF port is DC coupled to ground and AC matched to 50 Ohms from 9 to 42 GHz. Blocking capacitor is optional.	

Specifications

Absolute Maximum Ratings

Parameter	Maximum Rating	Unit
IF DC Current	1	Amp
LO DC Current	1	Amp
Maximum Operating Temperature	100	°C
Maximum Storage Temperature	125	°C
Minimum Operating Temperature	-55	°C
Minimum Storage Temperature	-65	°C
RF DC Current	1	Amp
RF Power Handling (RF+LO), 100°C	20	dBm
RF Power Handling (RF+LO), 25°C	23	dBm

Package Information

Parameter	Details	Rating
ESD	< 250 Volts	HBM Class 0
Weight	Package name: ES	1g
Dimensions	-	8.13 x 8.13 mm

Recommended Operating Conditions

Parameter	Min	Nominal	Max	Unit
LO Input Power	9	-	14	-
LO Input Power	9	-	14	-

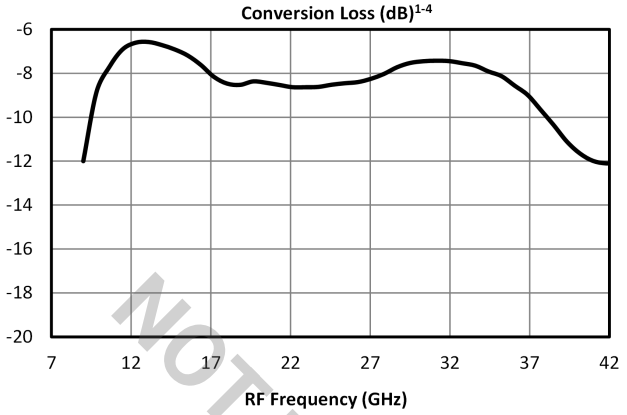
Electrical Specifications

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

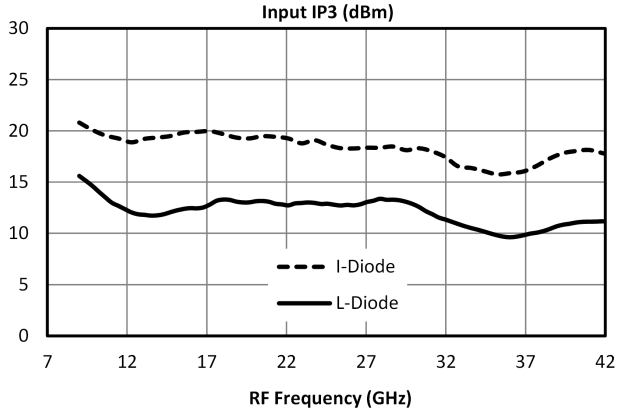
Parameter	Test Conditions	Min	Typ	Max	Unit
Conversion Loss	LO/RF=9-42 GHz IF=1-2 GHz	-	9	18	dB
Conversion Loss	LO/RF=9-42 GHz IF=2-22 GHz	-	9	16	dB
Input 1 dB Compression	LO/RF=9-42 GHz LO drive level, L Diode Option=9-14 dBm	-	2	-	dBm
IF Frequency Range	-	1	-	22	GHz
Input IP3	-	-	19	-	dBm
Isolation, LO to RF	-	-	28	-	dB
RF Frequency Range	-	9	-	42	GHz

Typical Performance Plots

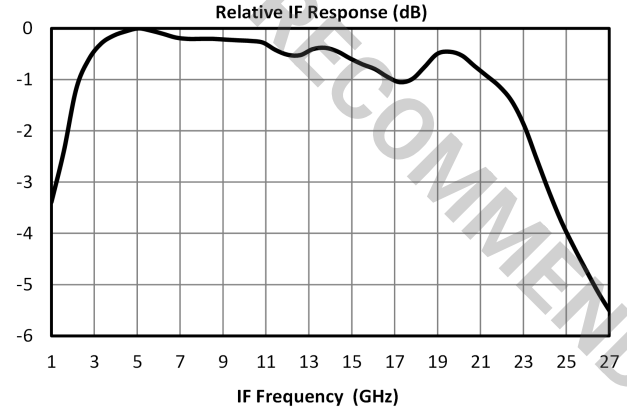
Conversion Loss (dB)[1-4]



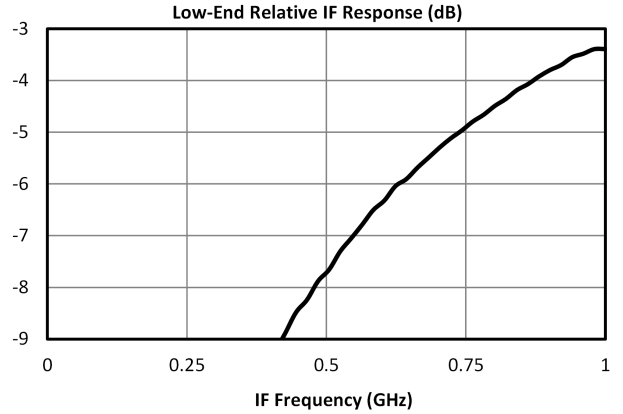
Input IP3 (dBm)



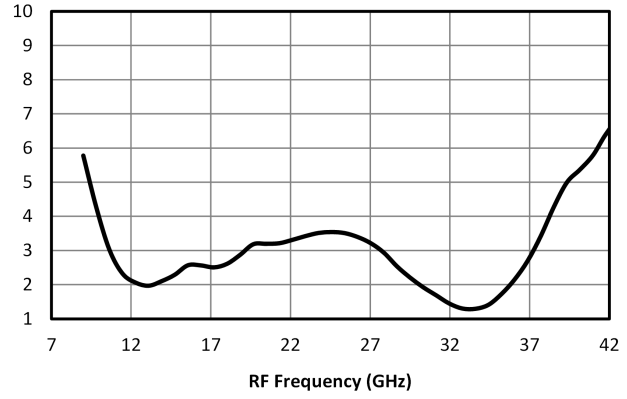
Relative IF Response (dB)



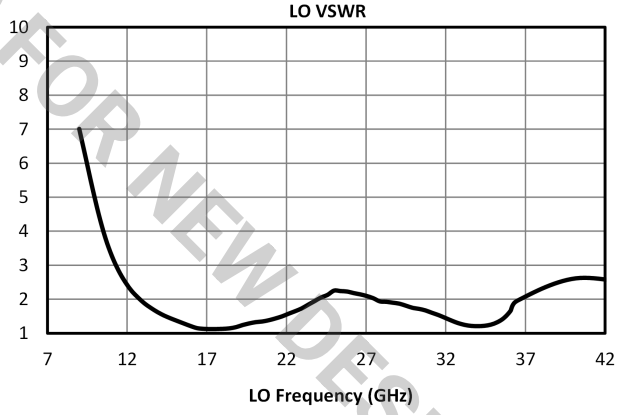
Low-End Relative IF Response (dB)



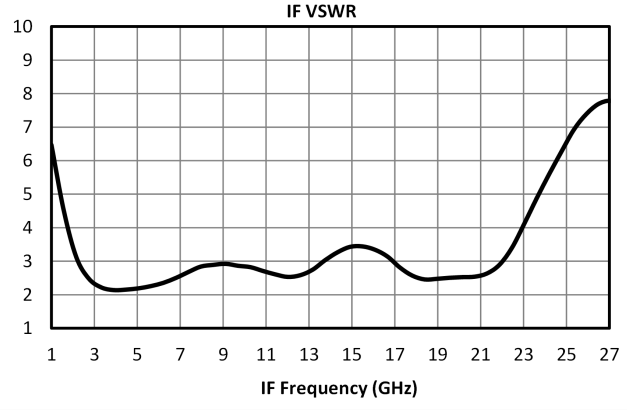
RF VSWR



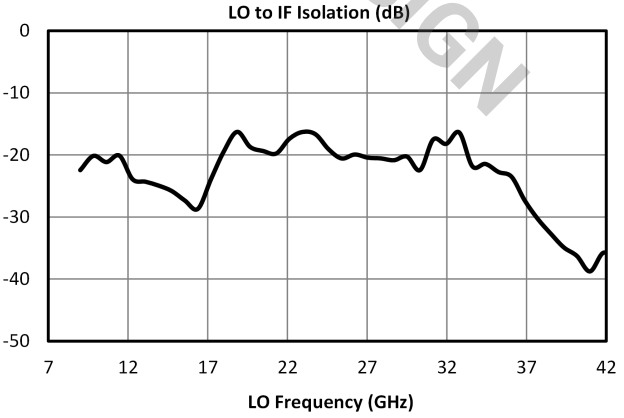
LO VSWR

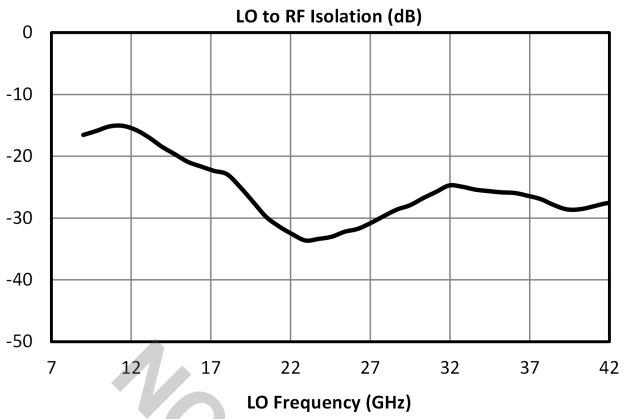


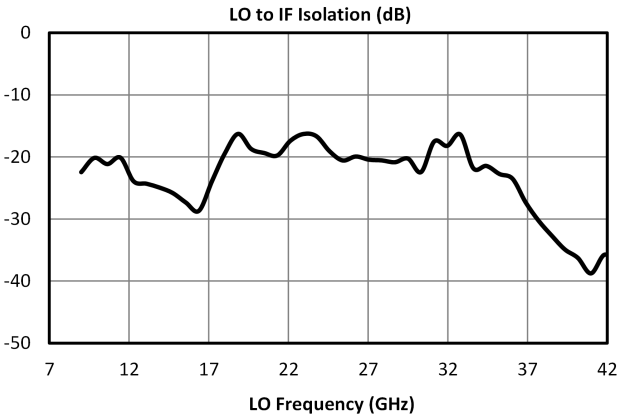
IF VSWR

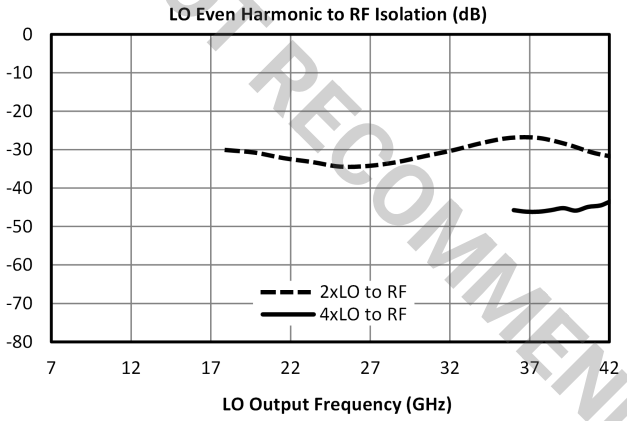


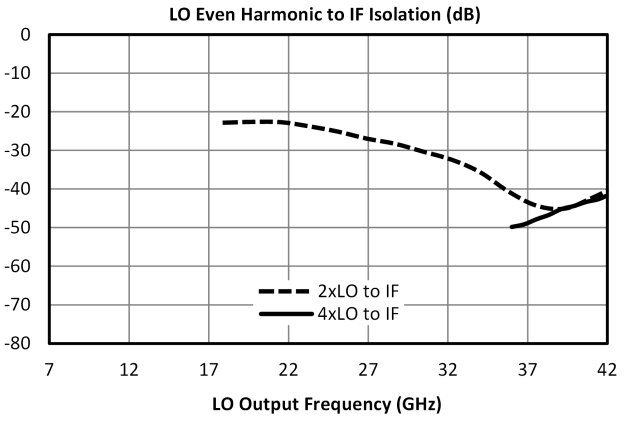
LO to IF Isolation (dB)

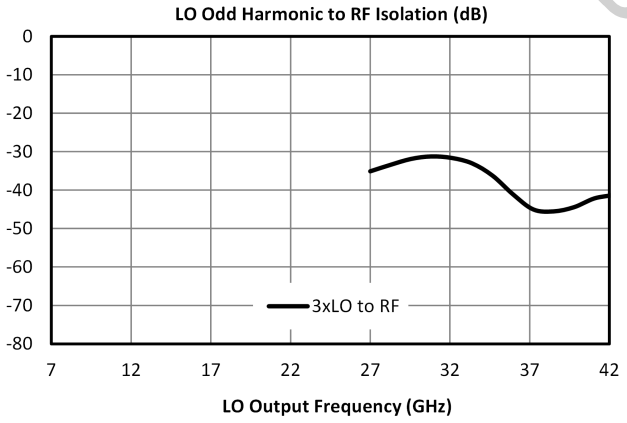


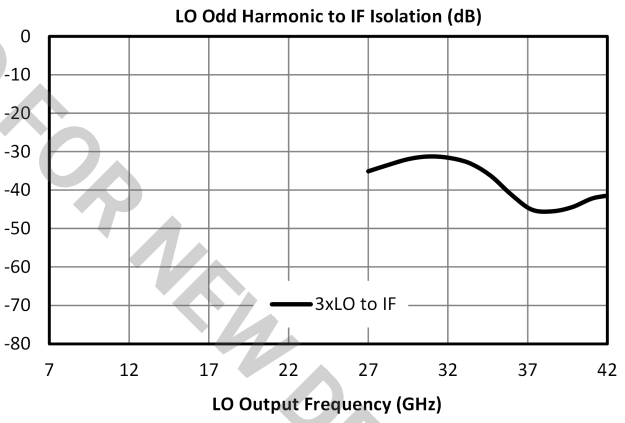












Spur Table

Downconversion Spurious Suppression

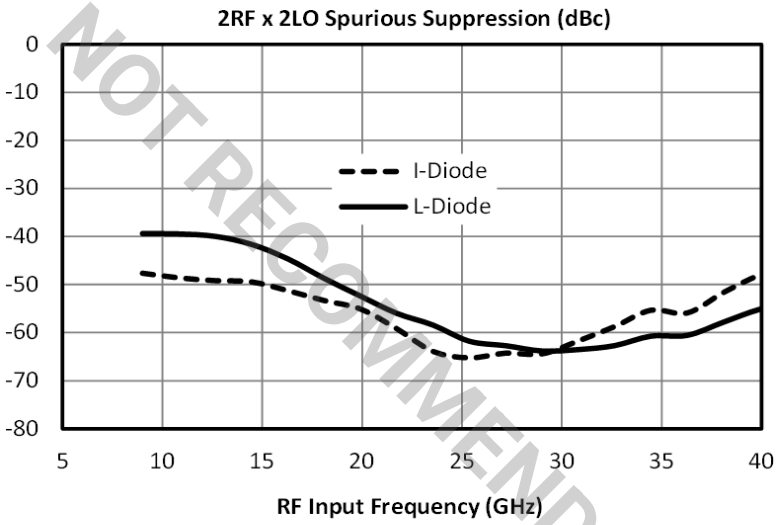
Spurious data is taken by selecting RF and LO frequencies (+mLO+nRF) within the 9 to 42 GHz RF/LO bands, which create a 2.0 GHz IF spurious output. The mixer is swept across the spurious band and the mean is calculated. The numbers shown in the table below are for a -10 dBm RF input. Spurious suppression is scaled for different RF power levels by (n-1), where "n" is the RF spur order. For example, the 2RFx2LO spur is 55 dBc for a -10 dBm input (I-Diode), so a -20 dBm RF input creates a spur that is (2-1) x (-10 dB) dB lower, or 65 dBc.

Typical Downconversion Spurious Suppression (dBc): I-Diode (L-Diode)

-10 dBm RF Input	0xLO	1xLO	2xLO	3xLO	4xLO	5xLO
0xRF	----------	See LO to IF Isolation and LO Harmonic to IF Isolation Plots				
1xRF	18 (18)	Reference	30 (30)	14 (13)	32 (32)	22 (27)
2xRF	56 (52)	56 (55)	55 (52)	59 (49)	54 (42)	60 (53)
3xRF	79 (78)	53 (50)	77 (72)	66 (58)	84 (72)	66 (56)
4xRF	105 (105)	90 (92)	94 (84)	100 (89)	100 (87)	106 (91)
5xRF	117 (115)	104 (101)	114 (106)	106 (89)	118 (107)	111 (98)

Unless otherwise specified, L-diode data is taken with +11 dBm LO drive, and I-diode data is taken with +16 dBm drive.

A sample downconversion spurious sweep is shown below. An LO which is 2.0 GHz higher than the RF is used to create a 2.0 GHz reference IF. A second LO is used to create a 2x2 spurious IF, also at 2.0 GHz (1.0 GHz fundamental IF).The difference between these two output levels is the spurious suppression in dBc.The mean value across the 9 to 40 GHz RF input band is the number shown in the table above.



Downconversion 2RFx2LO Spurious Data Example:

RF Input: 9 to 40 GHz @ -10 dBm
LO for Reference: 11 to 42 GHz
LO for Spurious: 10 to 41 GHz
IF Output: 2.0 GHz

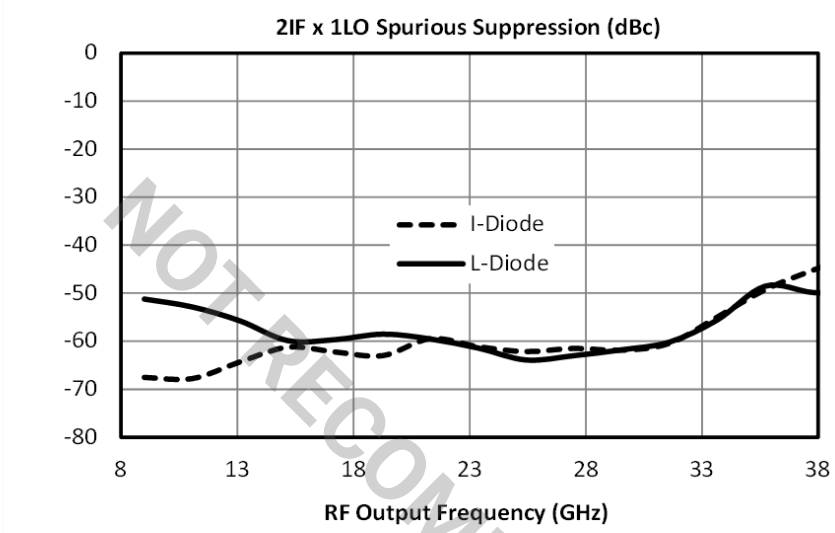
Upconversion Spurious Suppression

Spurious data is taken by mixing a 2.0 GHz IF with LO frequencies (+mLO+nIF) which create an RF within the 9 to 42 GHz RF band. The mixer is swept across the 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 57 dBc for a -10 dBm input (I-Diode), so a -20 dBm IF input creates a spur that is (2-1) x (-10 dB) dB lower, or 67 dBc.

Typical Upconversion Spurious Suppression (dBc): I-Diode (L-Diode)

-10 dBm IF Input	0xLO	1xLO	2xLO	3xLO	4xLO	5xLO
0xIF	----------	See LO to RF Isolation and LO Harmonic to RF Isolation Plots				
1xIF	18 (20)	Reference	27 (26)	12 (11)	31 (33)	36 (30)
2xIF	57 (50)	57 (58)	56 (60)	54 (44)	50 (55)	52 (48)
3xIF	90 (81)	77 (68)	87 (76)	68 (61)	79 (72)	72 (69)
4xIF	116 (98)	109 (106)	110 (98)	100 (94)	101 (92)	95 (83)
5xIF	127 (126)	123 (119)	129 (122)	118 (109)	118 (108)	113 (102)

Unless otherwise specified, L-diode data is taken with +11 dBm LO drive, and I-diode data is taken with +16 dBm drive.



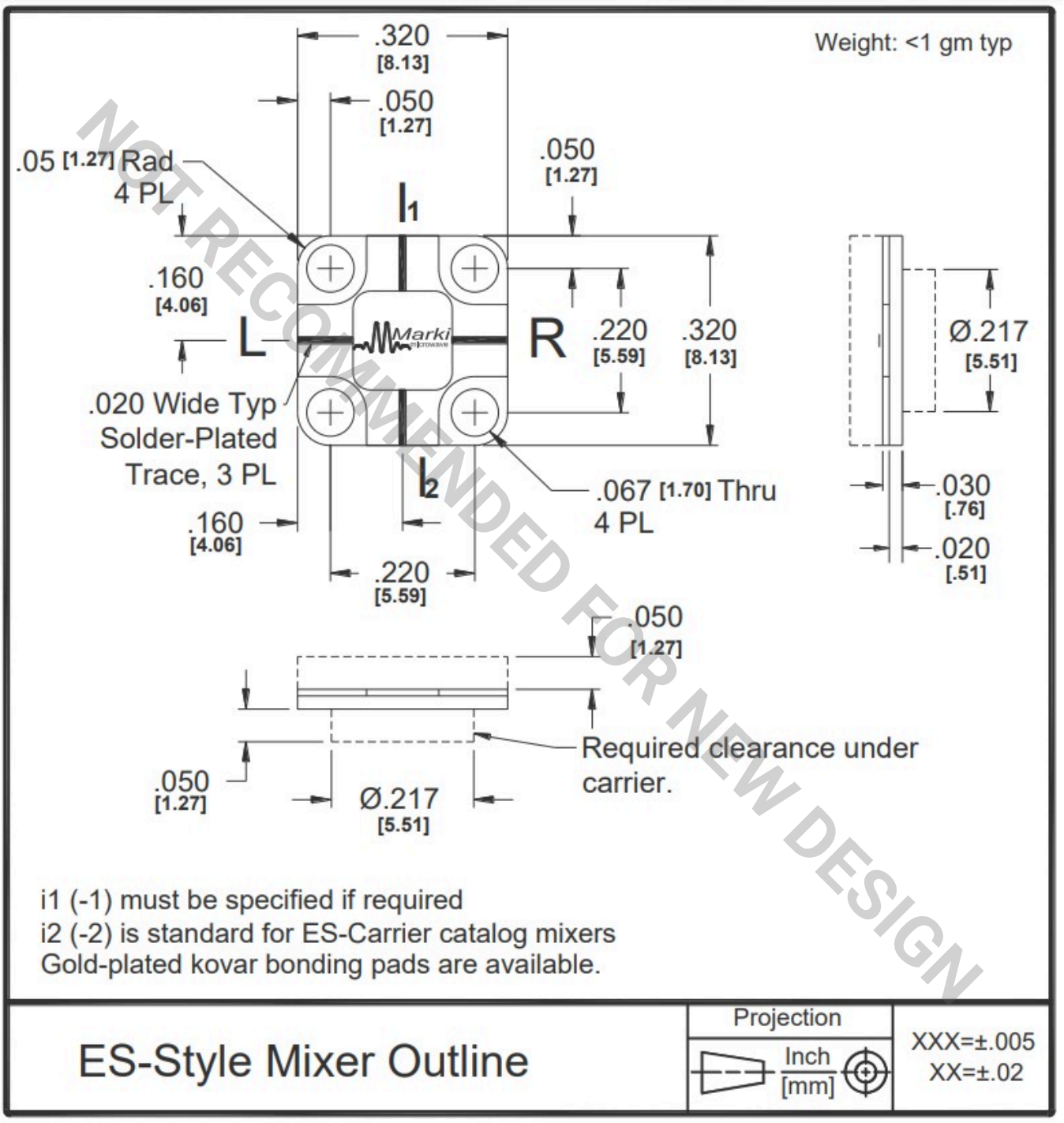
Upconversion 2IF x 1LO Spurious Data Example:

IF Input: 2.0 GHz @ -10 dBm
LO for Reference: 11 to 40 GHz
LO for Spurious: 13 to 42 GHz
RF Output: 9 to 38 GHz

A sample upconversion spurious sweep is shown below. A 2.0 GHz reference IF input is used to create an RF output that is 2.0 GHz below the LO input (LO-IF=RF). A second LO (2.0 GHz higher) is combined with the same 2.0 GHz IF input (LO-2xIF=RF) to create the same 9 to 38 GHz RF output band.The difference between these two output levels is the spurious suppression in dBc.The mean value across the RF output band is the number shown in the table above.

Mechanical Data

Outline Drawing



Notes

1. Mixer Conversion Loss Plot IF frequency is 4.0 GHz.
2. Mixer Noise Figure typically measures within 0.5 dB of conversion loss.
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 is taken with +11 dBm LO drive, and I-diode data is taken with +16 dBm 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.

DISCLAIMER