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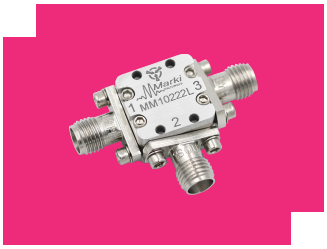
MM1-0222LS

GaAs MMIC Double Balanced Mixer

DEVICE OVERVIEW

General Description

MM1-0222L is a GaAs MMIC double balanced mixer that features excellent conversion loss, superior isolations, and spurious performance across a broad bandwidth. The MM1 0222L works well as both an up and down converter through the Ku band and beyond. The MM1-0222L is recommended for low power frequency conversion applications that require high linearity. It is available as both wire bondable die and as a connectorized module.



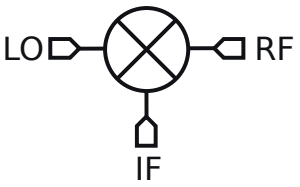
Features

- High LO to RF isolation
- Up or down conversion
- Broadband performance

Applications

- Test and Measurement Equipment
- SATCOM
- Radar
- Electronic Warfare

Functional Block Diagram



Part Ordering Options

Part Number	Description	Package	Connectors	Green Status	Product Lifecycle	Export Classification
MM1-0222LS	GaAs MMIC Double Balanced Mixer	S	Standard	REACH RoHS	Released	EAR99

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Table Of Contents

Revision History

Revision Code	Revision Date	Comment
Draft	2019-12-01	Draft
A	2020-01-01	Update Spur Table
B		Power Handling Updated

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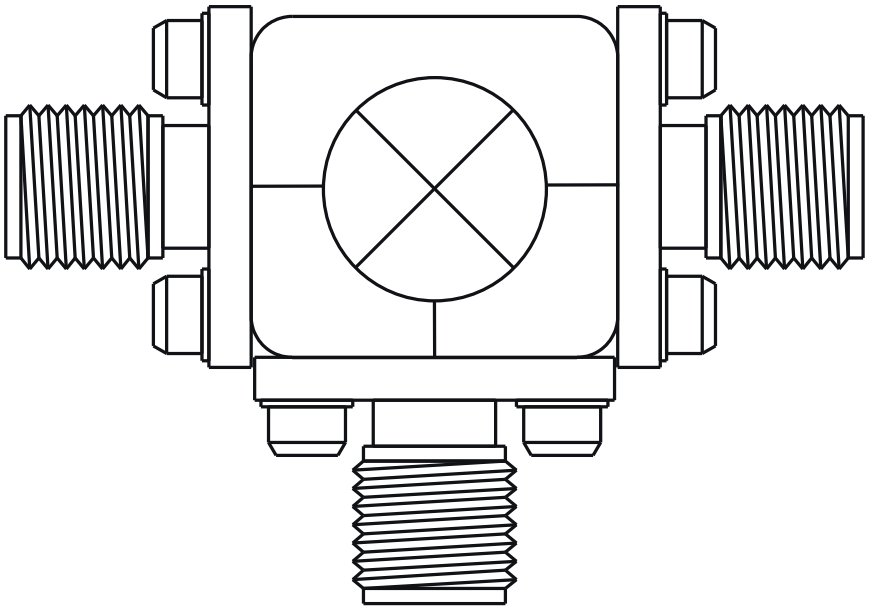
Port Configuration and Functions

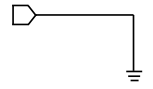
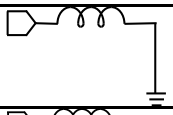
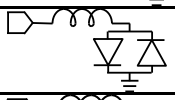
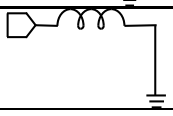
Port Diagram

The MM1-0222L has the input and output ports given in Port Functions. The MM1-0222L can be used in either an up or down conversion. For configuration A, input the LO into port 1, use port 3 for the RF, and port 2 for the IF. For configuration B, input the LO into port 3, use port 1 for the RF, and port 2 for the IF.



Port Functions

Configuration A

Port	Function	Connector Type	Description	DC Equivalent Circuit
GND	Ground	-	S package ground provided through metal housing and outer coax conductor.	
Port 1	LO	SMAF	Port 1 is DC short for the CH and S packages	
Port 2	IF	SMAF	Port 2 is diode connected for the CH and S package.	
Port 3	RF	SMAF	Port 3 is DC short for the CH and S packages.	

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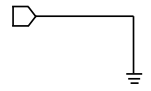
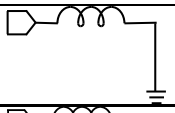
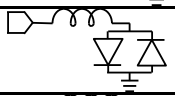
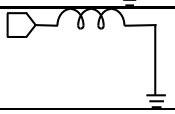
Configuration B

Port	Function	Connector Type	Description	DC Equivalent Circuit
GND	Ground	-	S package ground provided through metal housing and outer coax conductor.	
Port 1	RF	SMAF	Port 1 is DC short for the CH and S packages.	
Port 2	IF	SMAF	Port 2 is diode connected for the CH and S package.	
Port 3	LO	SMAF	Port 3 is DC short for the CH and S packages.	

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Specifications

Absolute Maximum Ratings

The Absolute Maximum Ratings indicate limits beyond which damage may occur to the device. If these limits are exceeded, the device may be inoperable or have a reduced lifetime.

Parameter	Maximum Rating	Unit
Maximum Operating Temperature	100	°C
Maximum Storage Temperature	125	°C
Minimum Operating Temperature	-55	°C
Minimum Storage Temperature	-65	°C
Port 1 DC Current	30	mA
Port 2 DC Current	30	mA
Port 3 DC Current	30	mA

Package Information

Parameter	Details	Rating
ESD	250 to < 500 Volts	HBM Class 1A
Weight	Package name: S	12g
Dimensions	-	14.22 x 13.21 mm

Recommended Operating Conditions

The Recommended Operating Conditions indicate the limits, inside which the device should be operated, to guarantee the performance given in Electrical Specifications Operating outside these limits may not necessarily cause damage to the device, but the performance may degrade outside the limits of the electrical specifications. For limits, above which damage may occur, see Absolute Maximum Ratings.

Parameter	Min	Nominal	Max	Unit
Ambient Temperature	-55	25	100	°C
LO Input Power	7	-	15	dBm

Sequencing Requirements

There is no requirement to apply power to the ports in a specific order. However, it is recommended to provide a 50Ω termination to each port before applying power. This is a passive diode mixer that requires no DC bias.

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Electrical Specifications

The electrical specifications apply at TA=+25°C in a 50Ω system. Typical data shown is for the connectorized S package mixer used in the forward direction with a +13 dBm sine wave input. Min and Max limits apply only to our connectorized units and are guaranteed at TA=+25°C. All bare die are 100% DC tested and visually inspected.

Parameter	Port Configuration	Test Conditions	Min	Typ	Max	Unit
Conversion Loss [1]	A	RF/LO = 2 – 22 GHz I = 0.2 – 3.5 GHz	-	8.5	-	dB
Conversion Loss [2]	A	RF/LO = 2 - 22 GHz I = DC - 0.2 GHz	-	7	10	dB
Input IP3	A	RF/LO = 2 - 12 GHz I = DC - 0.2 GHz	-	11.5	-	dBm
Input P1dB	A	-	-	3.5	-	dBm
Conversion Loss [3]	B	RF/LO = 2 – 22 GHz I = 0.2 – 3.5 GHz	-	10	-	dB
Conversion Loss [4]	B	RF/LO = 2 - 22 GHz I = DC - 0.2 GHz	-	9	12	dB
Input IP3	B	RF/LO = 2 - 12 GHz I = DC - 0.2 GHz	-	13	-	dBm
Input P1dB	B	-	-	6	-	dBm
IF Frequency Range	-	-	0	-	3.5	GHz
LO Frequency Range	-	-	2	-	22	GHz
LO-IF Isolation	-	IF/LO = 2 - 22 GHz	-	29	-	dB
LO-RF Isolation	-	RF/LO = 2 - 22 GHz	-	51	-	dB
Noise Figure [5]	-	RF/LO = 2 - 22 GHz I = DC - 0.2 GHz	-	7	-	dB
RF Frequency Range	-	-	2	-	22	GHz
RF-IF Isolation	-	RF/IF = 2 - 22 GHz	-	32	-	dB

[1][2][3][4] Measured as a down converter to a fixed 91MHz IF.
[5] Mixer Noise Figure typically measures within 0.5 dB of conversion loss for IF frequencies greater than 5 MHz.

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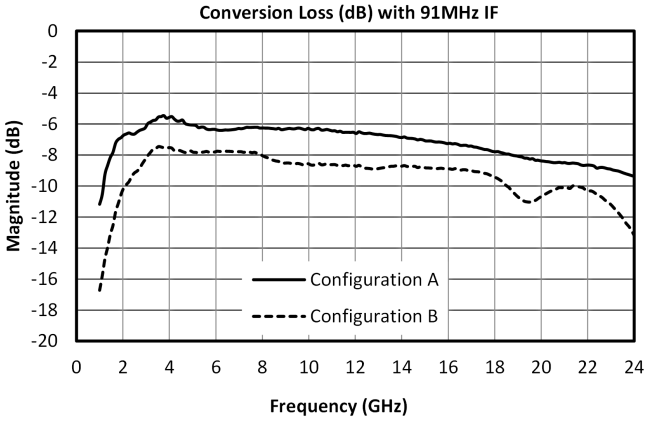
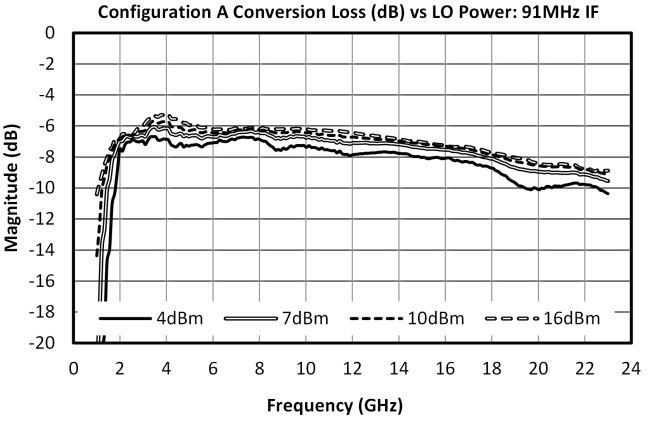
Typical Performance Plots

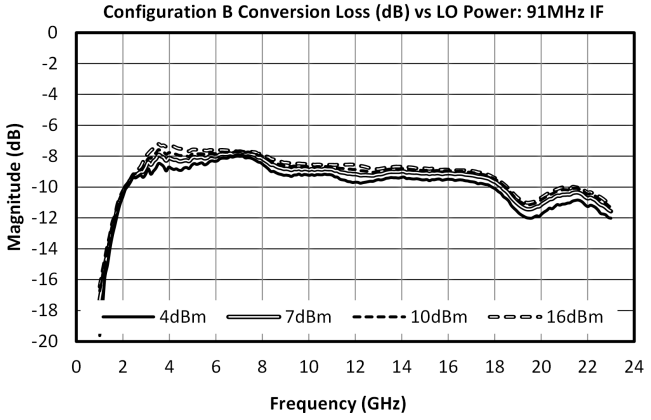
Conversion Loss (dB) with 91MHz IF



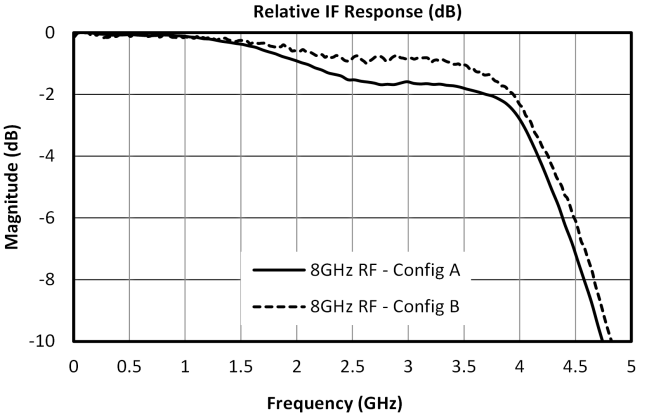
Configuration A Conversion Loss (dB) vs LO Power: 91MHz IF



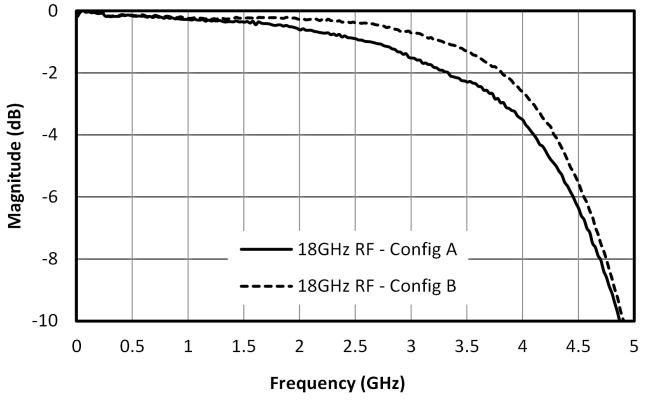
Configuration B Conversion Loss (dB) vs LO Power: 91MHz IF



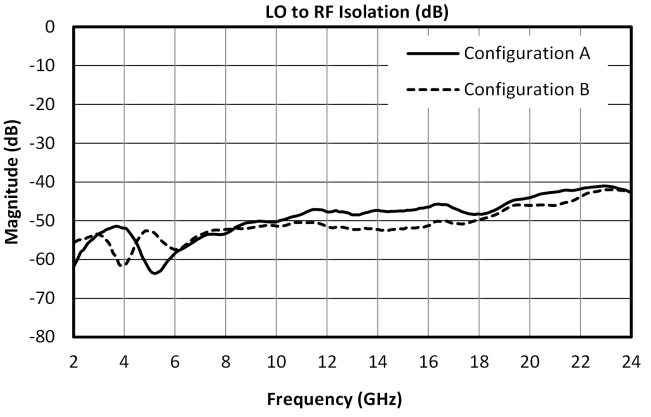
Relative IF Response (dB)



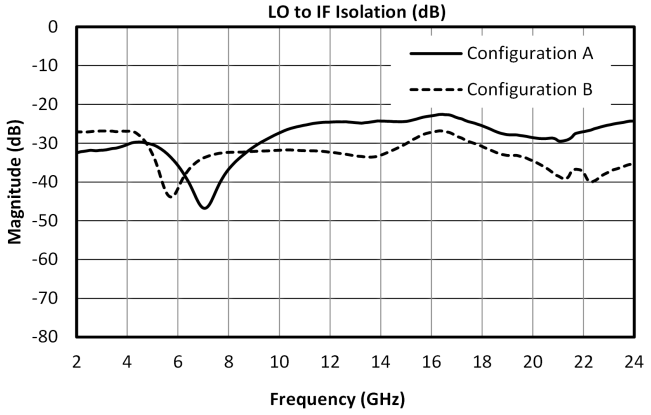
Relative IF Response (dB)



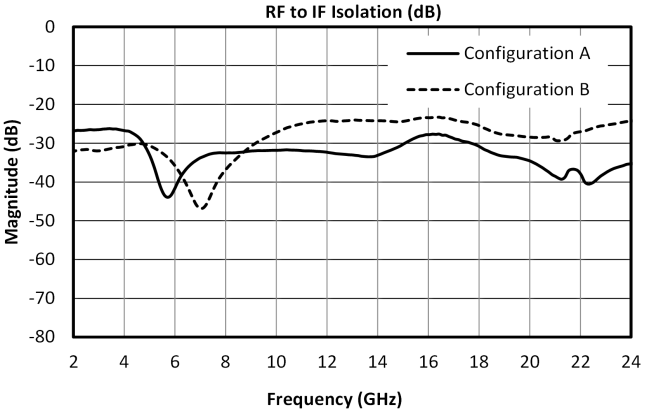
LO to RF Isolation (dB)



LO to IF Isolation (dB)



RF to IF Isolation (dB)



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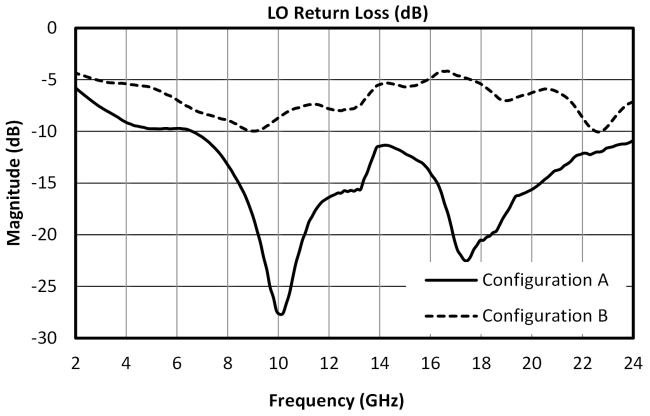

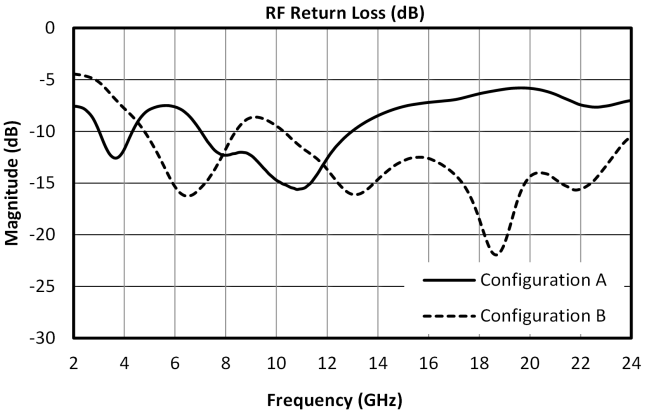

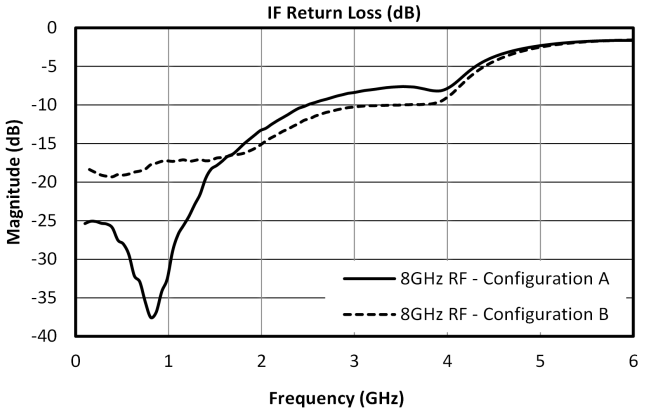

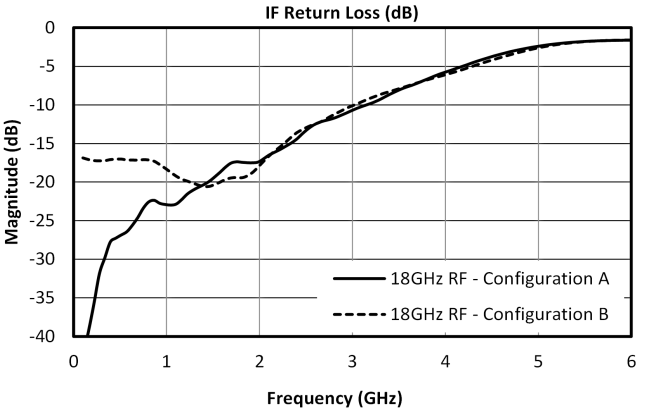

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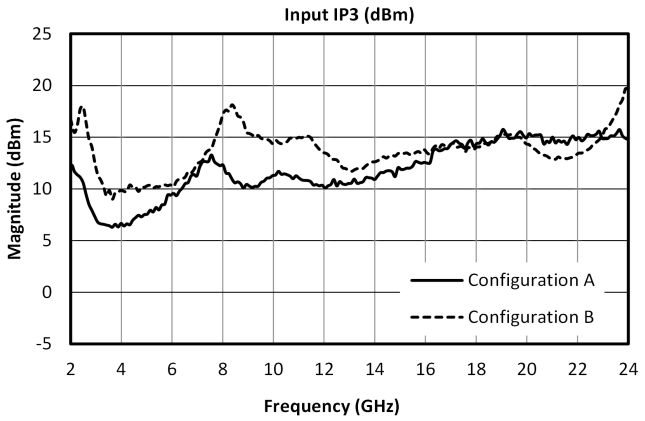
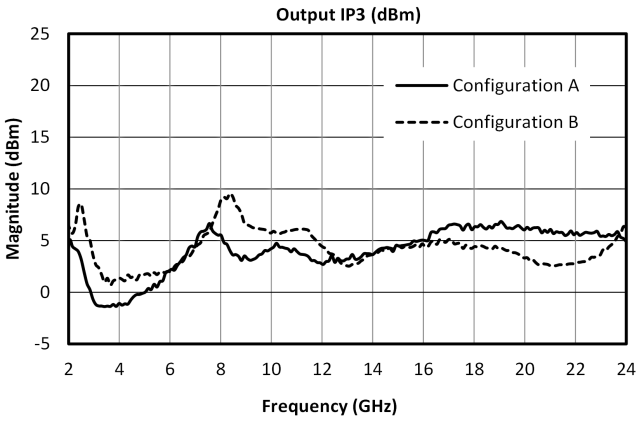
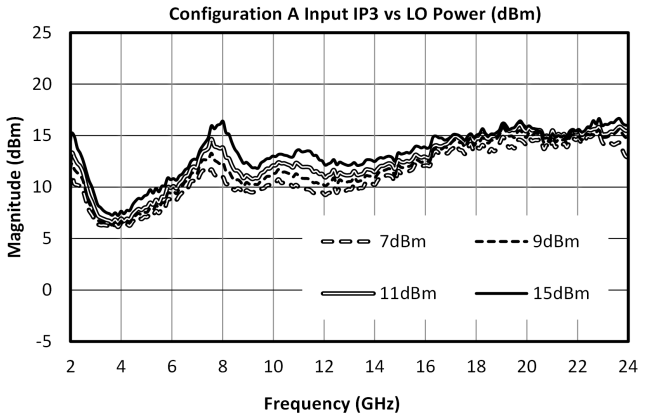
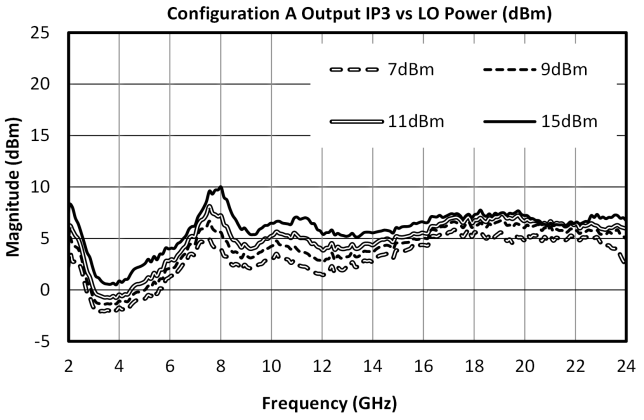
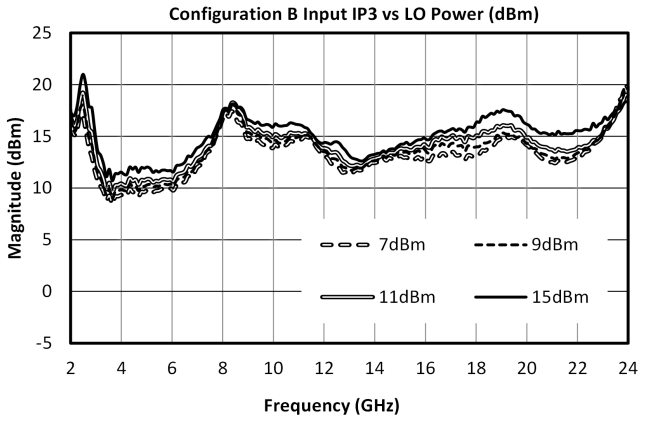
Typical Performance Plots: IP3

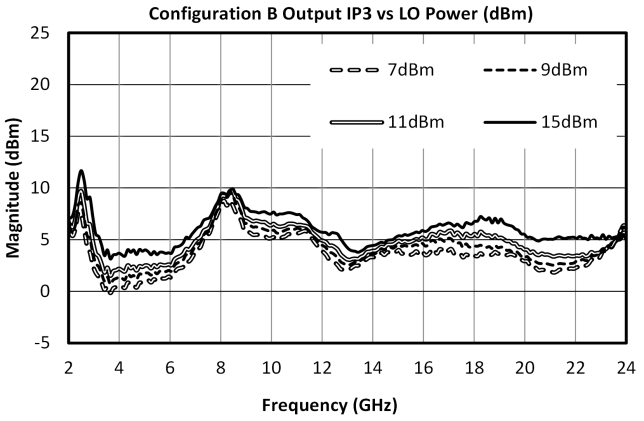












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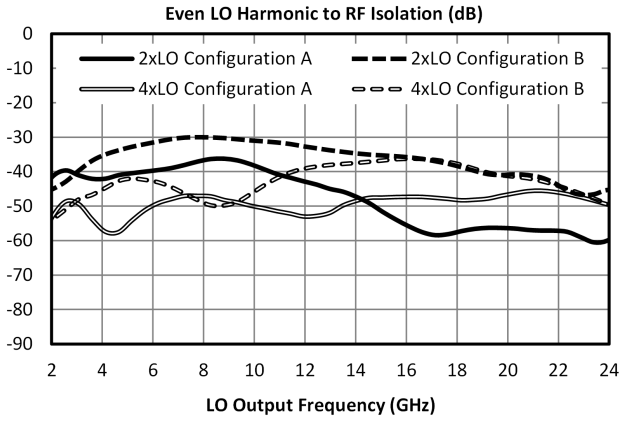
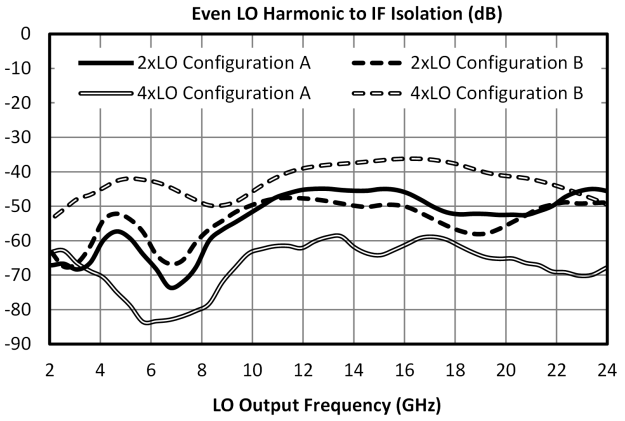
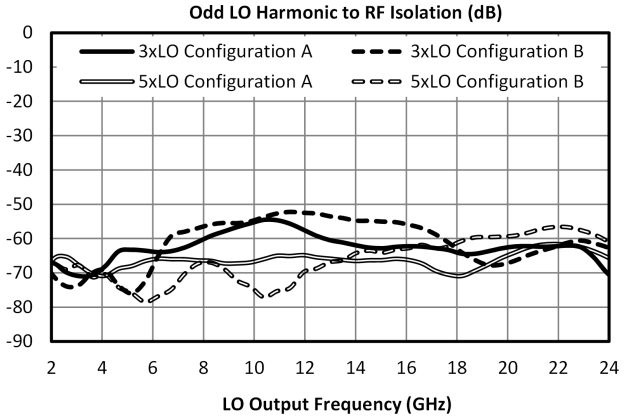
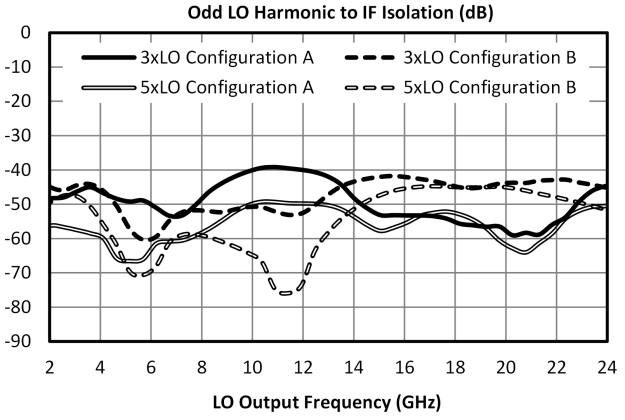
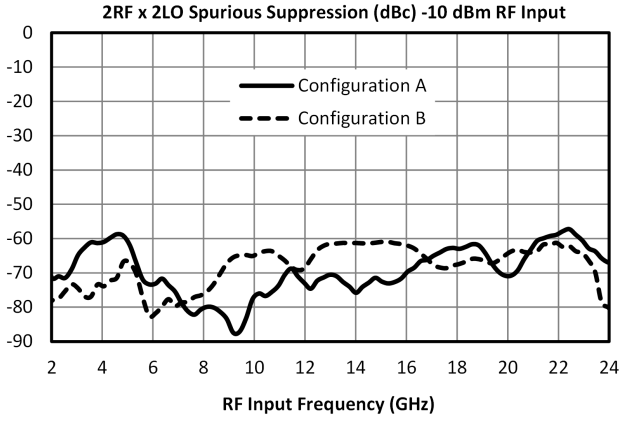
Typical Performance Plots: LO Harmonic Isolation

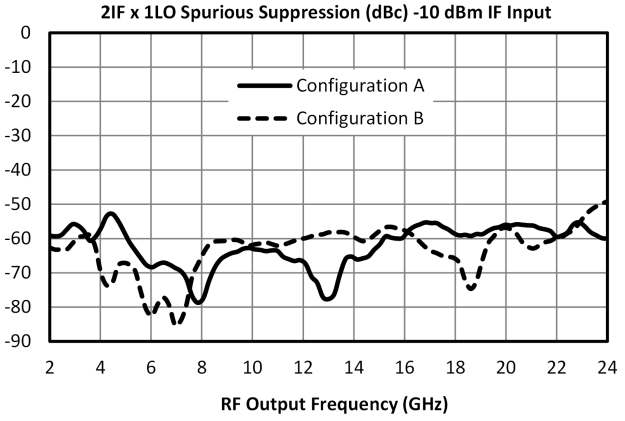












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Spur Table

Typical Spurious Performance: Down-Conversion

Typical spurious data is provided by selecting RF and LO frequencies (± m*LO ± n*RF) 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 2RF x 2LO spur is 69 dBc for a -10 dBm input, so a -20 dBm RF input creates a spur that is (2-1) x (-10 dB) lower, or 79 dBc. Data is shown for the frequency plan in 3.6 Typical Performance. mLOx0RF plots can be found in section 3.6.2 Typical Performance Plots: LO Harmonic Isolation. 0LOx1RF plot is identical to the plot of LO-RF isolation.

Typical Down-conversion spurious suppression (dBc): Config A (B)

-10 dBm RF Input	0xLO	1xLO	2xLO	3xLO	4xLO	5xLO
1xRF	23 (15)	Reference	28 (38)	12 (10)	35 (43)	18 (12)
2xRF	59 (67)	44 (45)	69 (70)	54 (48)	66 (62)	58 (46)
3xRF	74 (77)	59 (68)	78 (93)	69 (72)	83 (92)	72 (74)
4xRF	115 (121)	105 (110)	108 (117)	108 (108)	119 (120)	112 (109)
5xRF	125 (135)	113 (127)	118 (134)	107 (120)	126 (138)	116 (123)

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Spurious Performance: Up-Conversion

Typical spurious data is taken by mixing an input within the IF band, with LO frequencies (± m*LO ± n*IF), 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 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 62 dBc for a -10 dBm input with a sine-wave LO, so a -20 dBm IF input creates a spur that is (2-1) x (-10 dB) lower, or 72 dBc. Data is shown for the frequency plan in 3.6 Typical Performance

Typical Up-conversion spurious suppression (dBc): Config A (B)

-10 dBm IF Input	0xLO	1xLO	2xLO	3xLO	4xLO	5xLO
1xIF	27 (17)	Reference	52 (60)	41 (48)	54 (62)	50 (54)
2xIF	46 (44)	62 (63)	54 (45)	60 (66)	49 (46)	70 (62)
3xIF	77 (77)	67 (71)	76 (91)	62 (67)	76 (87)	66 (65)
4xIF	130 (120)	112 (120)	107 (106)	113 (122)	97 (98)	109 (114)
5xIF	142 (147)	113 (120)	123 (143)	104 (115)	120 (132)	110 (110)

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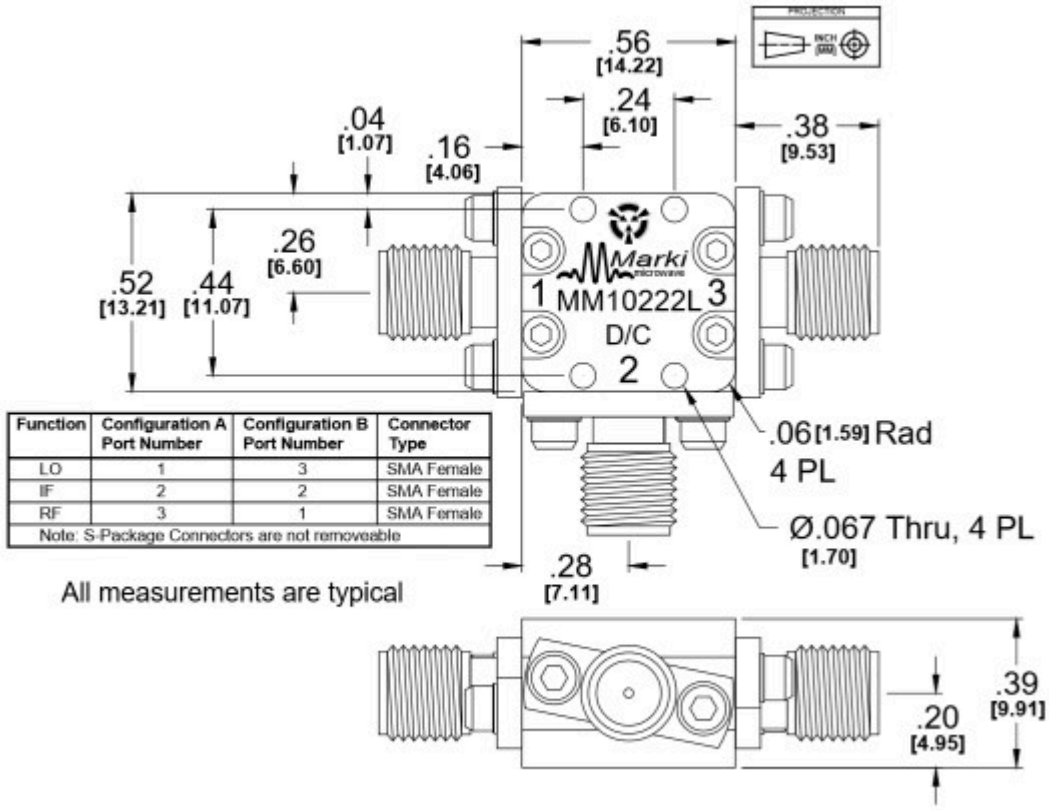
Mechanical Data

Outline Drawing

Download : Outline 2D Drawing | Outline 3D Drawing | Outline 3D STP



Function	Configuration A Port Number	Configuration B Port Number	Connector Type
LO	1	3	SMA Female
IF	2	2	SMA Female
RF	3	1	SMA Female
Note: S-Package Connectors are not removeable			

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