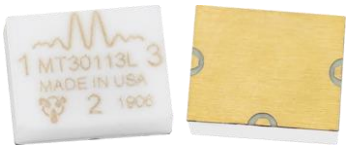
GaAs MMIC High Dynamic Range Mixer

MT3-0113LCQG

The MT3-0113LCQG is a triple balanced passive diode GaAs MMIC mixer offering high dynamic range, low conversion loss, and excellent repeatability. As with all T3 mixers, this mixer offers unparalleled nonlinear performance in terms of IIP3, $P_{1dB,}$ and spurious performance with a flexible LO drive requirement from +11 dBm to +24 dBm. The MT3-0113LCQG is available in a surface-mount outline, or in an SMA connectorized evaluation fixture. The MT3-0113LCQG is a superior alternative to Marki Microwave carrier and packaged T3 mixers, and is form-fit compatible with legacy T3's in the CQ and CQG footprints.



Features

- Form-Fit Compatible with Legacy CQ and CQG T3 Mixers
- Broadband, Overlapping RF, LO and IF
- Suitable for Up or Down Conversion
- Compatible with Sine or Square-Wave LO
- Square-Wave LO delivers Industry-Leading Spurious, IP3, and P_{1dB} Performance
- Application Note: T3 Mixer Primer
- Recommended Surface Mount LO Buffer Amplifiers: ADM-0012-5931SM, ADM-0026-5929SM
- Recommended LO Buffer Amplifier Modules: ADM1-0026PA

Electrical Specifications - Specifications guaranteed over -40 to +100°C temperature range, measured in a 50Ω system. Specifications are shown for Configurations A (B). See page 2 for port locations. Consult factory for more information.

Parameter	LO (GHz)	RF (GHz)	IF (GHz)	Min	Typ	Max	LO drive level (dBm)
Conversion Loss (dB) [1]	1.5-13	1.5-13	0.01-0.5		7.5 (7.5)	10.5	+15 (+15)
			0.5-7.0		10 (10)		
Isolation (dB) LO-RF LO-IF RF-IF			0.01-7		See Plots		
Input 1 dB Compression (dBm) [2]					See Plots		Config. A: +11 to +24 Config. B: +11 to +24
Input Two-Tone Third Order Intercept Point (dBm) [3]					+24 +23		Config. A: +11 to +24 Config. B: +11 to +24

[1]Unless otherwise specified, Conversion Loss and Spurious data is measured with a 100 MHz fixed IF.

[2]P1dB is typically within 1-2 dB of LO drive power.

[3]The typical value is for a +15 dBm Sine-Wave LO. IP3 is dependent on LO drive and waveform. See plots and data sheet notes on page 10 for more details.

Part Number Options

Model Number	Description
MT3-0113LCQG-2 [1]	RoHS Compliant Surface Mount, IF Port Configuration -2
EVAL-MT3-0113L	Connectorized Evaluation Fixture

[1]Note: For port locations and I/O designations, refer to the drawings on page 2 of this document.

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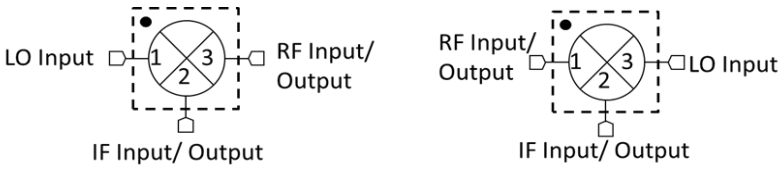
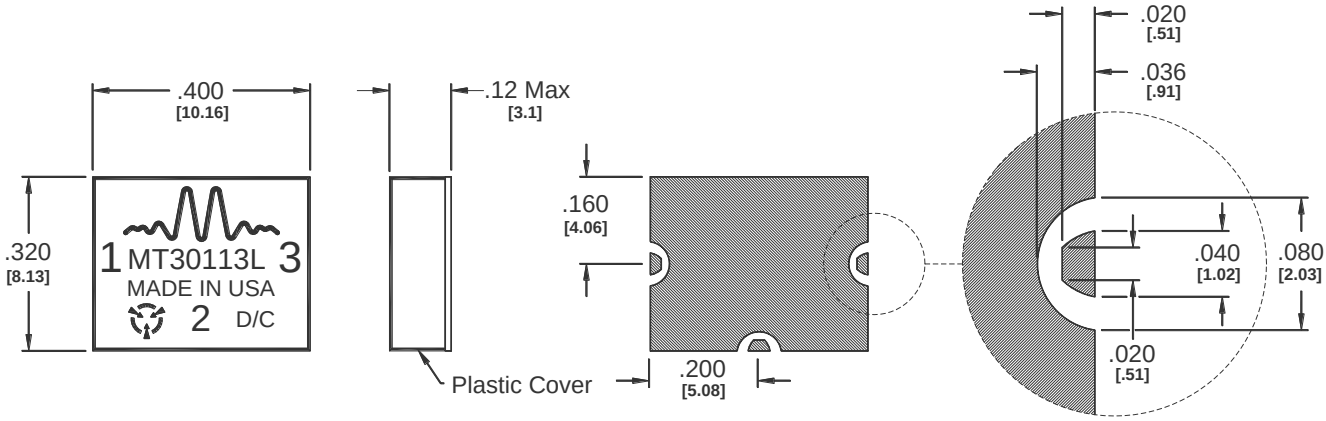
GaAs MMIC High Dynamic Range Mixer MT3-0113LCQG



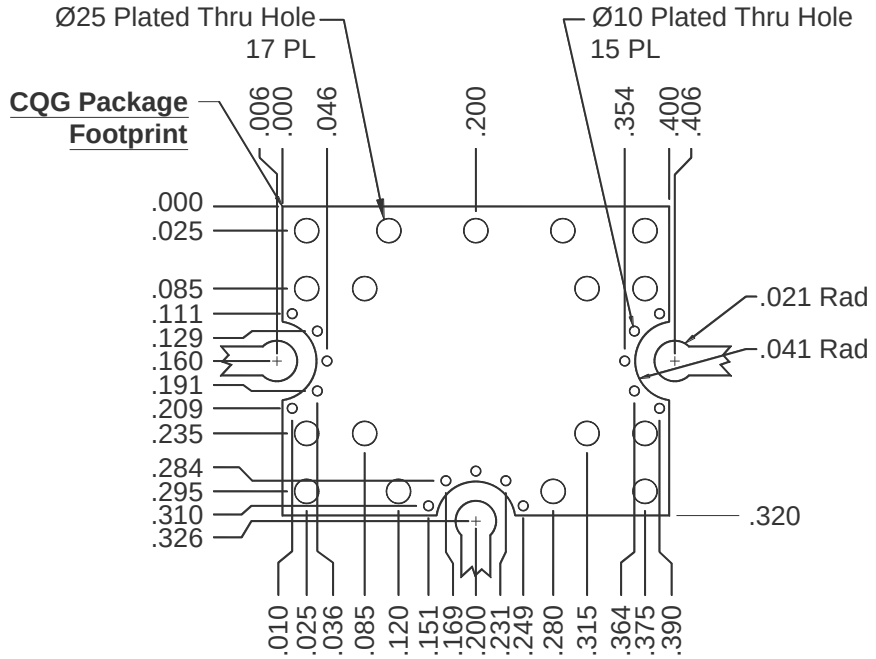
Configuration A **Configuration B**

1. Configuration A/B refer to the same part number (MT3-0113LCQG) used in one of two different ways for optimal spurious performance. For the lowest conversion loss, use the mixer in Configuration A (port 1 as the LO input, port 3 as the RF input or output). If you need to use a lower LO drive, use the mixer in Configuration B (port 1 as the RF input or output, port 3 as the LO input). For optimal spurious suppression, experimentation or simulation is required to choose between Configuration A and B. For more information, see here.



I/O Connections & Ground Plane Finish is Gold Flash, 5 to 10 µ-inches, over Solderable Nickel, 100-200 µ-inches, over Cu.

Outline Drawing – CQG-2 Package



CQG-Package Landing Pattern

Click here for a DXF of the above layout.

Click here for leaded solder reflow. Click here for lead-free solder reflow.

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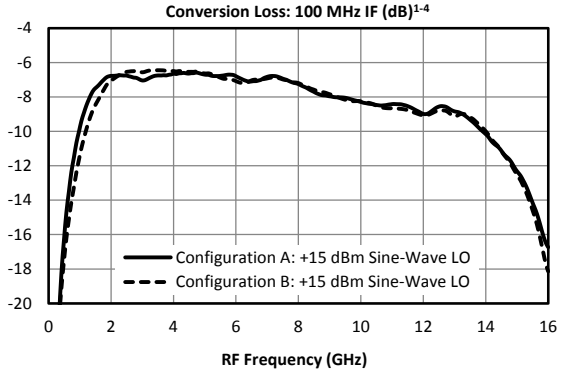
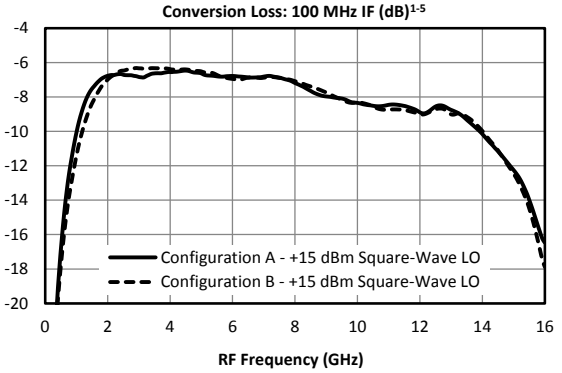
Typical Performance

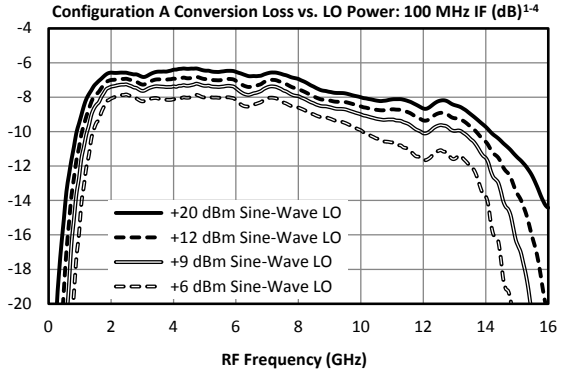
Conversion Loss: 100 MHz IF (dB)[1-4]



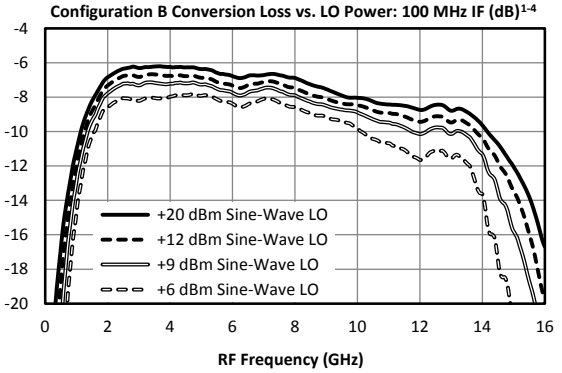
Conversion Loss: 100 MHz IF (dB)[1-5]



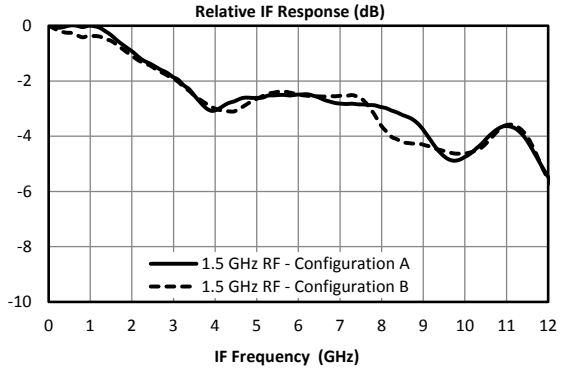
Configuration A Conversion Loss vs. LO Power: 100 MHz IF (dB)[1-4]



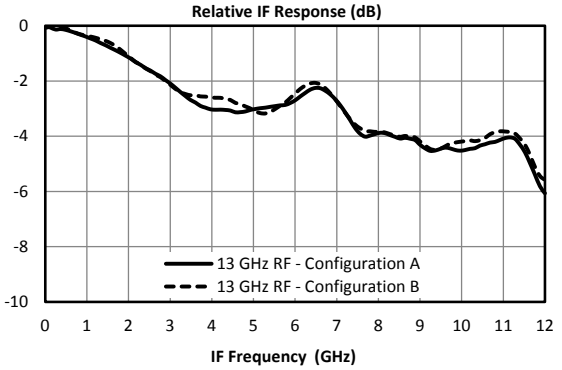
Configuration B Conversion Loss vs. LO Power: 100 MHz IF (dB)[1-4]



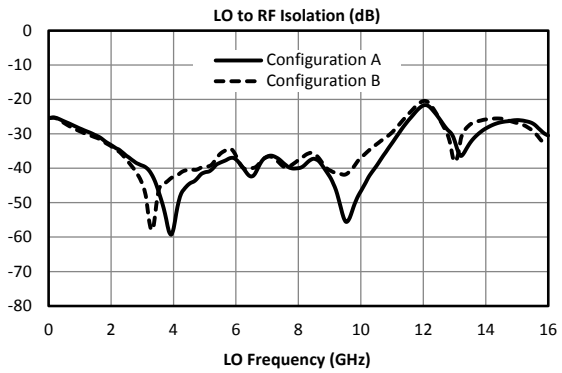
Relative IF Response (dB)



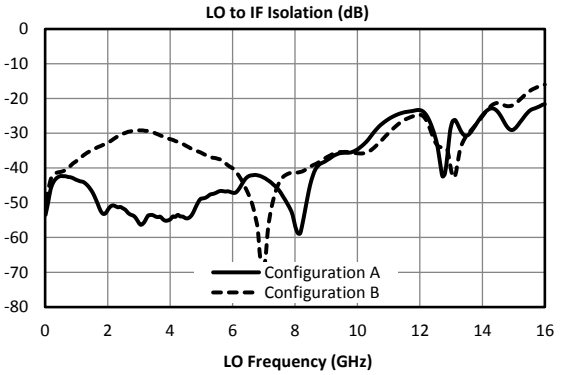
Relative IF Response (dB)



LO to RF Isolation (dB)



LO to IF Isolation (dB)



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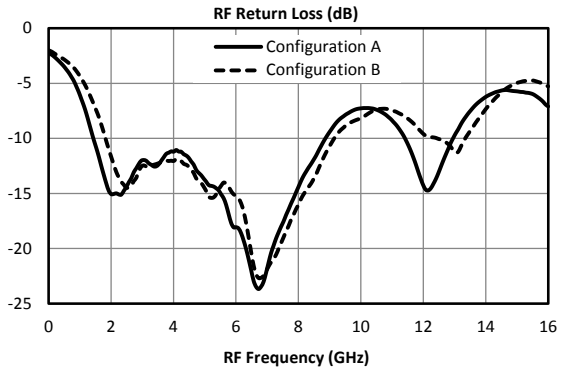
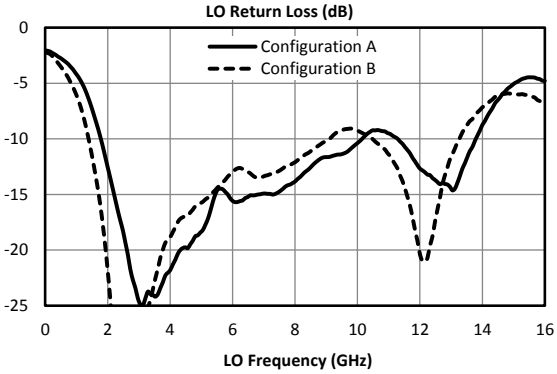
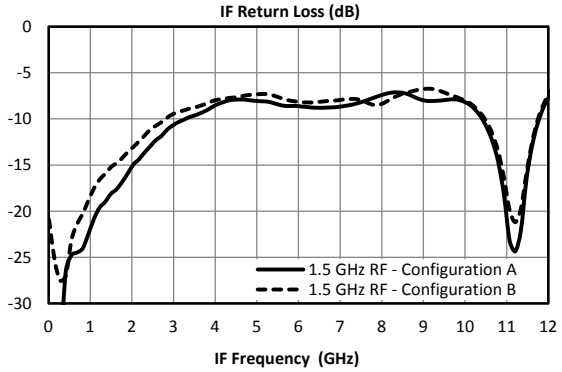
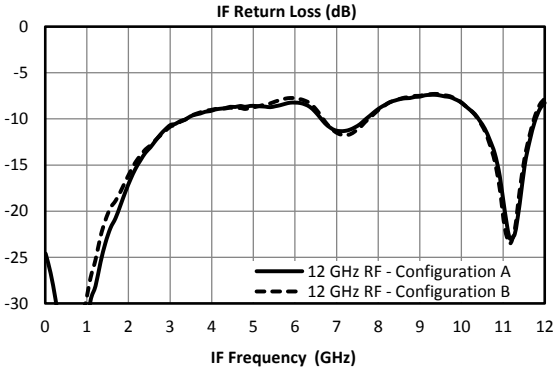
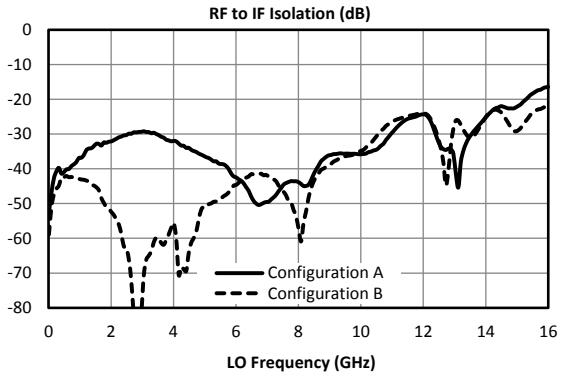
Typical Performance

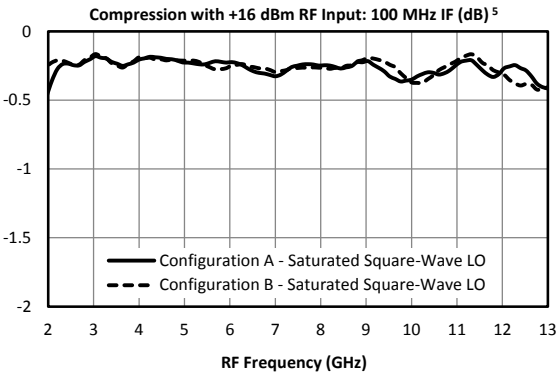


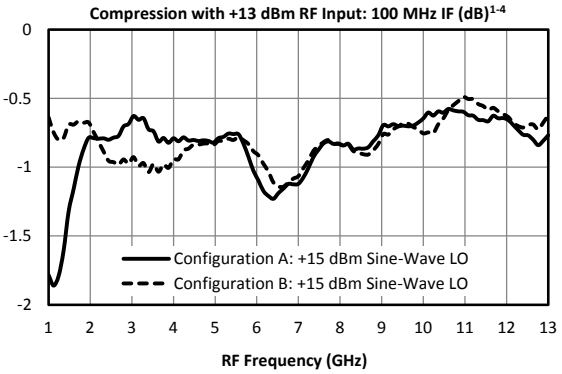


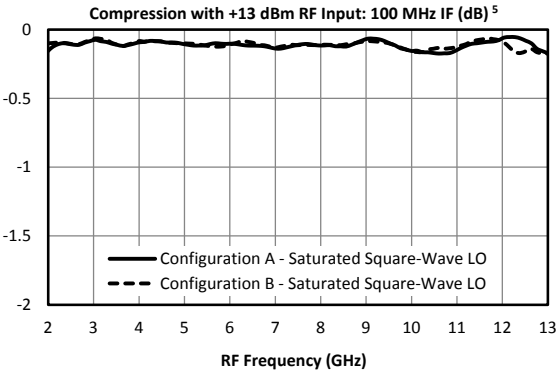












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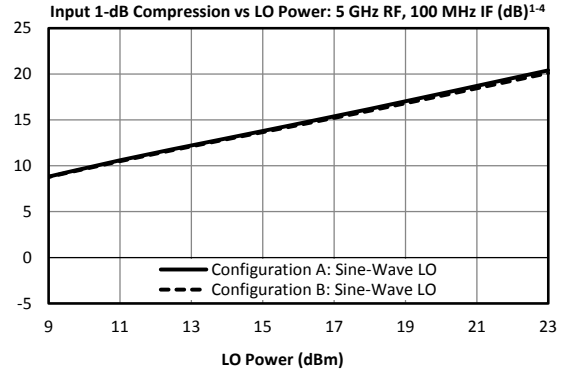
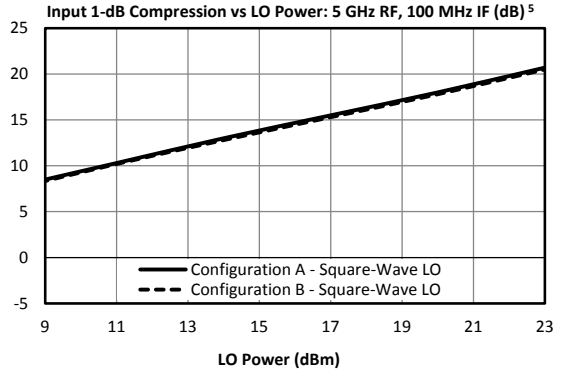
Typical Performance

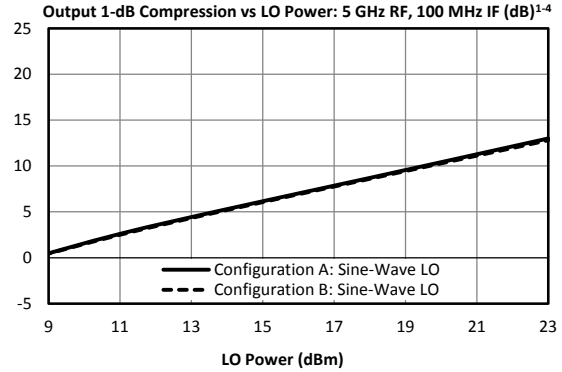
Input 1-dB Compression vs LO Power: 5 GHz RF, 100 MHz IF (dB)[1-4]



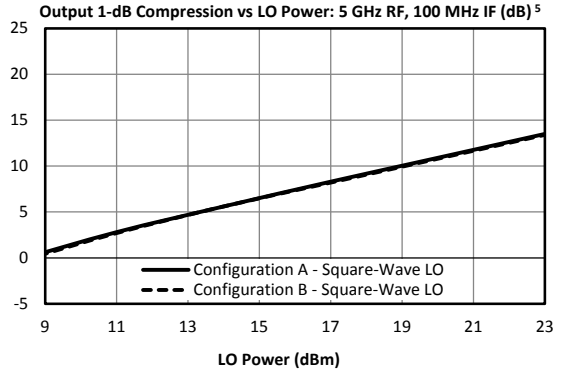
Input 1-dB Compression vs LO Power: 5 GHz RF, 100 MHz IF (dB)[5]



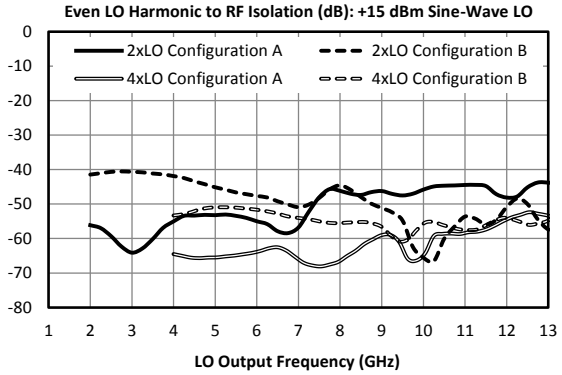
Output 1-dB Compression vs LO Power: 5 GHz RF, 100 MHz IF (dB)[1-4]



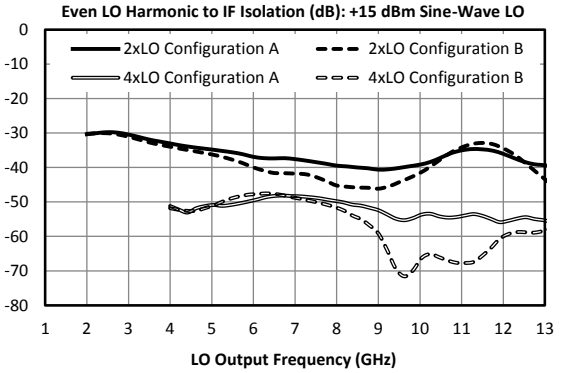
Output 1-dB Compression vs LO Power: 5 GHz RF, 100 MHz IF (dB)[5]



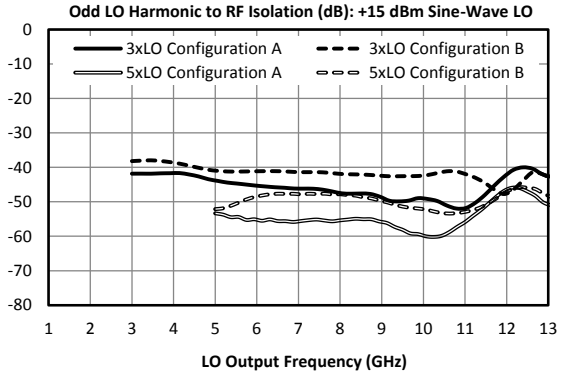
Even LO Harmonic to RF Isolation (dB): +15 dBm Sine-Wave LO



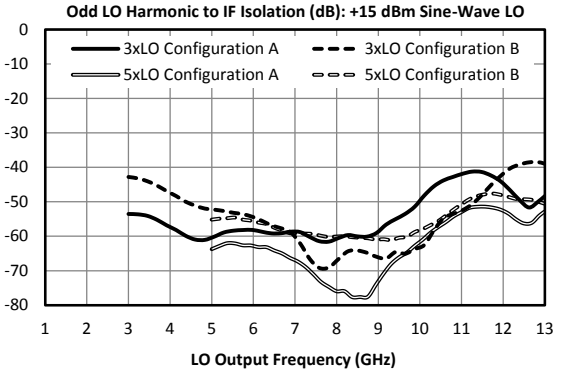
Even LO Harmonic to IF Isolation (dB): +15 dBm Sine-Wave LO



Odd LO Harmonic to RF Isolation (dB): +15 dBm Sine-Wave LO

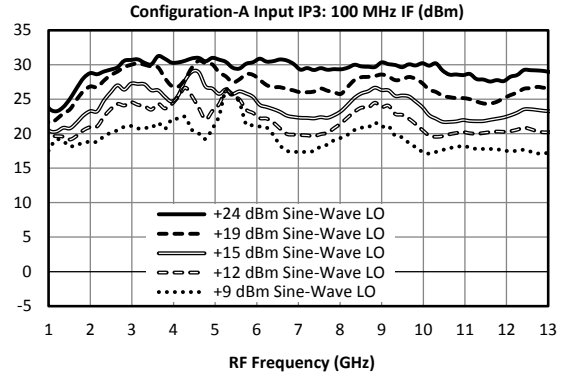


Odd LO Harmonic to IF Isolation (dB): +15 dBm Sine-Wave LO

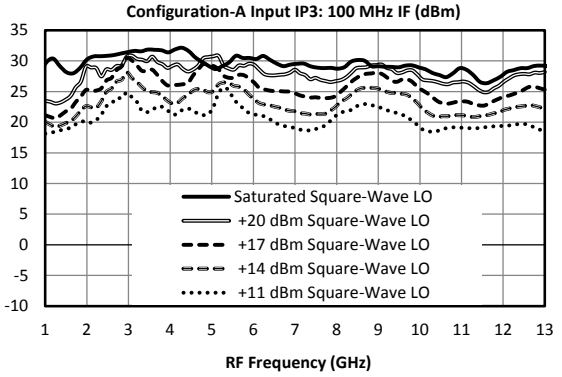


Typical Performance

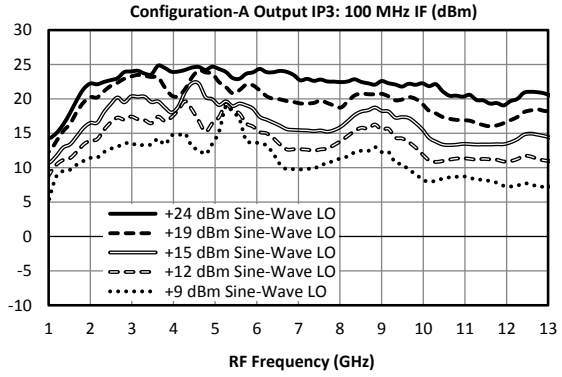
Configuration-A Input IP3: 100 MHz IF (dBm)



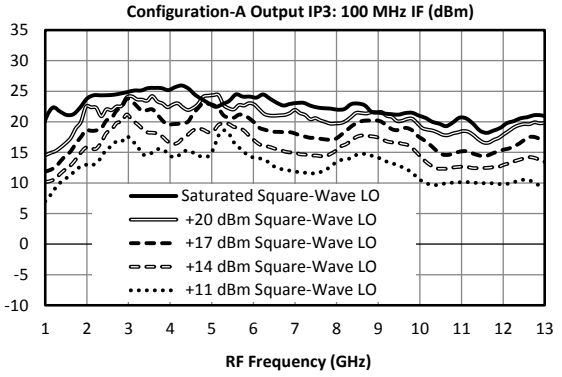
Configuration-A Input IP3: 100 MHz IF (dBm)



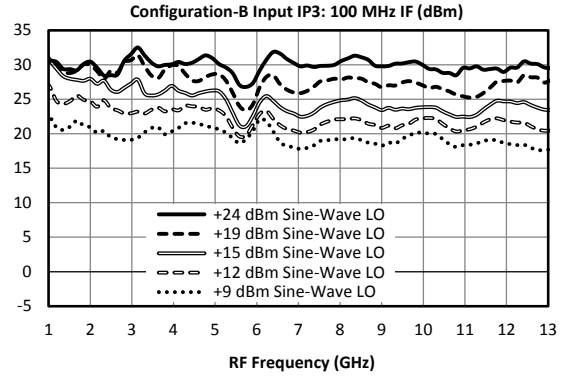
Configuration-A Output IP3: 100 MHz IF (dBm)



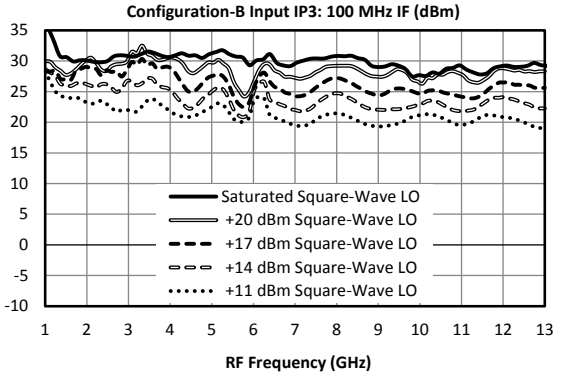
Configuration-A Output IP3: 100 MHz IF (dBm)



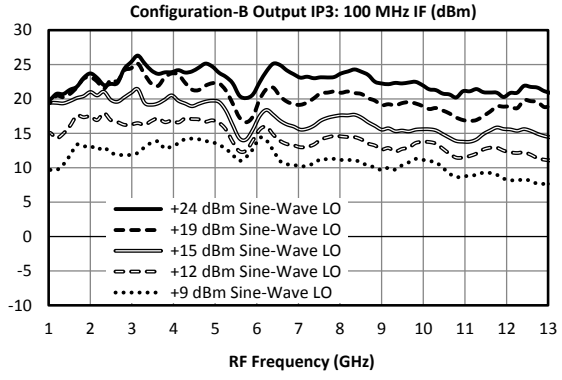
Configuration-B Input IP3: 100 MHz IF (dBm)



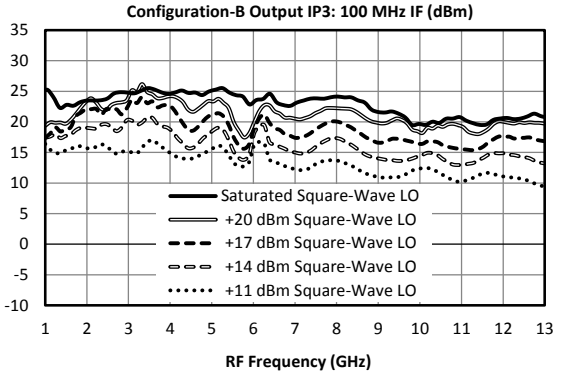
Configuration-B Input IP3: 100 MHz IF (dBm)



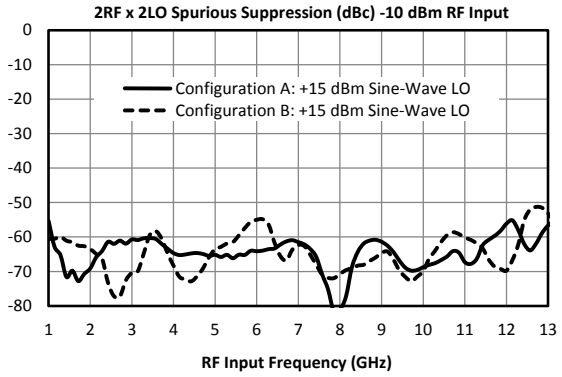
Configuration-B Output IP3: 100 MHz IF (dBm)

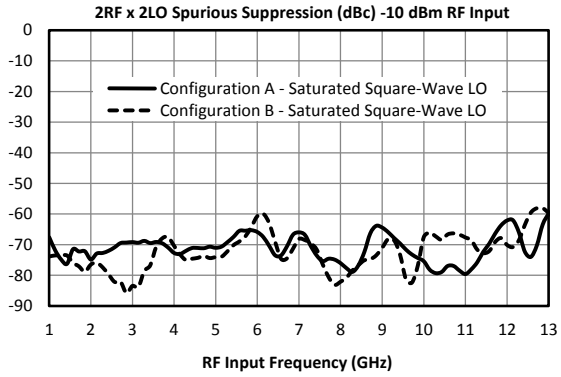


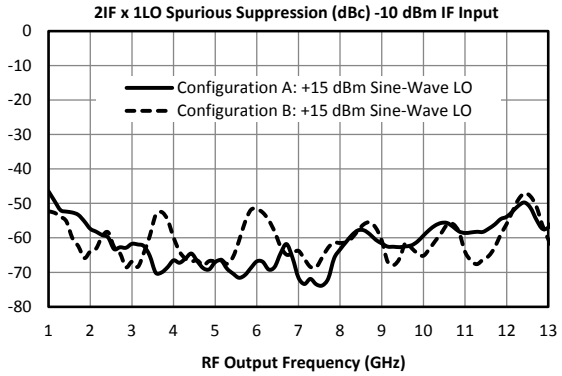
Configuration-B Output IP3: 100 MHz IF (dBm)

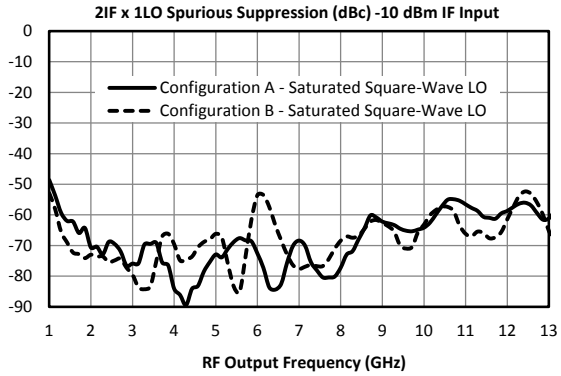


Typical Performance









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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 65 dBc for the A configuration for a -10 dBm input with a sine-wave LO, so a -20 dBm RF input creates a spur that is (2-1) x (-10 dB) dB lower, or 75 dBc.

Typical Downconversion Spurious Suppression (dBc): A Configuration (B Configuration), Sine Wave LO [6]

-10 dBm RF Input	0xLO	1xLO	2xLO	3xLO	4xLO	5xLO
1xRF	29 (33)	Reference	42 (43)	14 (14)	44 (50)	26 (27)
2xRF	63 (65)	67 (65)	65 (65)	70 (67)	63 (62)	71 (65)
3xRF	112 (112)	74 (74)	91 (94)	74 (75)	92 (96)	76 (77)
4xRF	117 (121)	117 (118)	114 (113)	120 (118)	116 (111)	120 (117)
5xRF	152 (146)	127 (130)	140 (141)	125 (127)	139 (140)	126 (128)

Typical Downconversion Spurious Suppression (dBc): A Configuration (B Configuration), Square Wave LO [6]

-10 dBm RF Input	0xLO	1xLO	2xLO	3xLO	4xLO	5xLO
1xRF	30 (33)	Reference	26 (26)	11 (11)	25 (25)	17 (17)
2xRF	64 (71)	70 (67)	71 (72)	71 (73)	68 (64)	73 (73)
3xRF	112 (113)	88 (85)	99 (101)	86 (87)	98 (102)	91 (91)
4xRF	130 (130)	127 (127)	126 (121)	130 (127)	129 (130)	133 (134)
5xRF	166 (169)	146 (148)	151 (146)	146 (144)	151 (152)	151 (151)

Upconversion Spurious Suppression

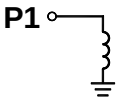
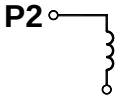
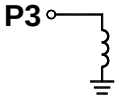
Spurious data is taken by mixing an input within the IF band, with LO frequencies (±mLO±nIF), to create a spurious output within the RF output band. The mixer is swept across the full spurious output band and the mean is calculated. The numbers shown in the table below are for a -10 dBm IF input. Spurious 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 the A configuration 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) dB lower, or 72 dBc.

Typical Upconversion Spurious Suppression (dBc): A Configuration (B Configuration), Sine Wave LO [6]

-10 dBm IF Input	0xLO	1xLO	2xLO	3xLO	4xLO	5xLO
1xIF	26 (35)	Reference	40 (46)	14 (14)	44 (47)	25 (26)
2xIF	70 (63)	62 (61)	66 (62)	62 (61)	70 (62)	61 (60)
3xIF	112 (112)	72 (72)	89 (97)	70 (69)	88 (96)	70 (68)
4xIF	124 (124)	112 (108)	121 (112)	108 (107)	122 (106)	104 (104)
5xIF	145 (137)	126 (124)	133 (138)	118 (117)	130 (136)	108 (107)

Typical Upconversion Spurious Suppression (dBc): A Configuration (B Configuration), Square Wave LO [6]

-10 dBm IF Input	0xLO	1xLO	2xLO	3xLO	4xLO	5xLO
1xIF	28 (35)	Reference	27 (27)	11 (11)	25 (25)	17 (17)
2xIF	77 (69)	69 (68)	65 (66)	67 (68)	64 (66)	62 (69)
3xIF	112 (113)	84 (84)	97 (98)	83 (84)	94 (95)	82 (83)
4xIF	135 (138)	125 (123)	122 (123)	129 (130)	119 (124)	123 (126)
5xIF	154 (154)	146 (146)	151 (153)	149 (148)	151 (152)	132 (137)

Port	Description	DC Interface Schematic
Port 1	Port 1 is DC short and AC matched to 50 Ω from 1.5 to 13 GHz. Blocking capacitor is optional.	
Port 2	Port 2 is DC open. Blocking capacitor is optional.	
Port 3	Port 3 is DC short and AC matched to 50 Ω from 1.5 to 13 GHz. Blocking capacitor is optional.	

Absolute Maximum Ratings (see note 8)	
Parameter	**Maximum Rating**
Port 1 DC Current	TBD mA
Port 2 DC Current	N/A
Port 3 DC Current	TBD mA
RF Power Handling (RF+LO)	+30 dBm
Operating Temperature	-40 to +100ºC
Storage Temperature	-40 to +150ºC

Revision History

Revision Code	Revision Date	Comment
-	October 2018	Pre-release
A	February 2019	Active - Full Production

DATA SHEET NOTES:
1. Mixer Conversion Loss Plot IF frequency is 100 MHz unless otherwise specified.
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 at +100°C and improves less than 0.5 dB at -55°C.
4. Unless otherwise specified, sine-wave data is taken with +15 dBm LO drive.
5. The square-wave LO is generated using an ADM-0012-5931SM pre-amplifier and an ADM-0026-5929SM output amplifier. The two amplifiers are biased with +7V, -0.25V. When specified, square-wave output power is the total of the fundamental plus harmonics. Unspecified square-wave LO (unspecified output power) is generated by saturating the amplifier chain with a +12 dBm input.
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.
8. Environmental specifications are currently under evaluation. Contact support for more information.

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