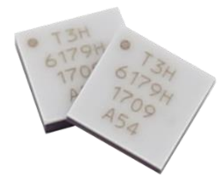
GaAs MMIC High Dynamic Range Mixer — MT3H-0113HSM

The MT3H-0113HSM is a triple balanced passive diode 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 +16 dBm to +24 dBm. RF, LO, and IF ports are all operated single ended due to integrated baluns. The MT3H-0113HSM is available in a 4x4mm QFN, or in an SMA connectorized evaluation fixture. The MT3H-0113HSM is a superior alternative to Marki Microwave carrier and packaged T3 mixers.



Features

- Industry-Leading Spurious, IP3, and P_{1dB} Performance
- RoHS Compliant
- Broadband, Overlapping RF, LO and IF
- Application Note: T3 Mixer Primer
- Recommended Surface Mount Amplifier: ADM-0026-5929SM, ADM-0012-5931SM
- Recommended Amplifier Modules: ADM1-0026PA

Electrical Specifications - Specifications guaranteed from -55 to +100°C, measured in a 50Ω system. Specifications are shown for Configurations A (B). See page 2 for port locations. All bare die are 100% DC tested and 100% visually inspected. RF testing is performed on a sample basis to verify conformance to datasheet guaranteed specifications. 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	0.8-1		8	12	+20 (+20)
			1-8.5		11.5		
Isolation (dB) LO-RF LO-IF RF-IF			0.8-8.5		See Plots		Config. A: +16 to +24 Config. B: +16 to +24
Input 1 dB Compression (dBm)					See Plots		
Input Two-Tone Third Order Intercept Point (dBm)[2]					+29 (+30)		

[1]Measured Conversion Loss measured at 1 GHz fixed IF

[2]IP3 depends on LO drive conditions, see plots for more details

Part Number Options

Model Number	Description
MT3H-0113HSM-2 [1]	Surface Mount, IF Port Configuration -2
EVAL-MT3H-0113H	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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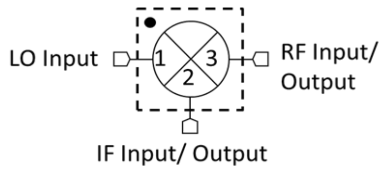
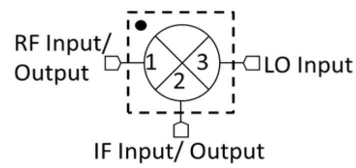


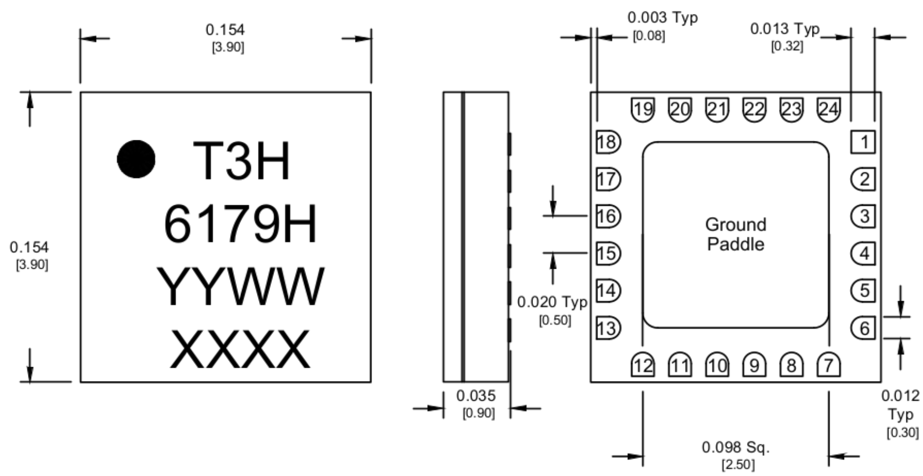
Configuration A



Configuration B

1. Configuration A/B refer to the same part number (MT3H-0113H) used in one of two different ways for optimal spurious performance. For the lowest conversion loss, use the mixer in Configuration A (pin 4 as the LO input, pin 15 as the RF input or output). If you need to use a lower LO drive, use the mixer in Configuration B (pin 15 as the RF input or output, pin 4 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.

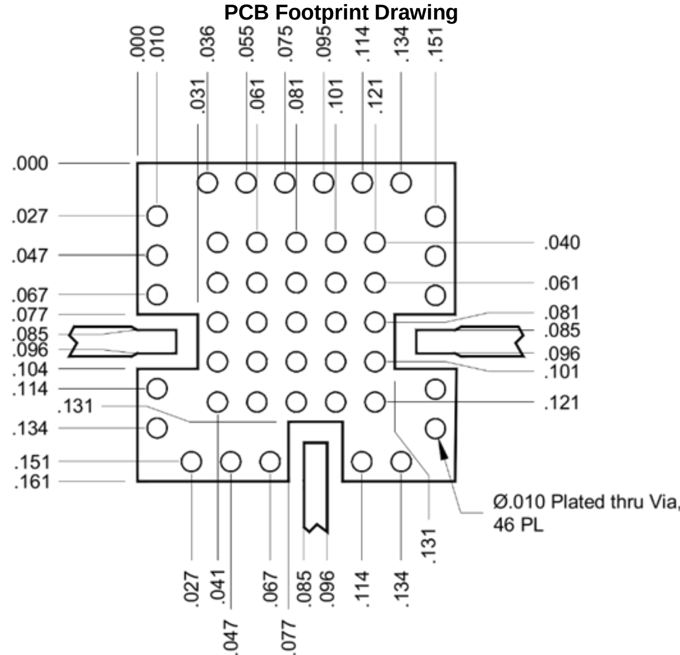
Outline Drawing



Pad #	Configuration A Function	Configuration B Function
1	N/C	N/C
2	N/C	N/C
3	N/C	N/C
4	LO	RF
5	N/C	N/C
6	N/C	N/C
7	N/C	N/C
8	N/C	N/C
9	N/C	N/C
10	IF	IF
11	N/C	N/C
12	N/C	N/C
13	N/C	N/C
14	N/C	N/C
15	RF	LO
16	N/C	N/C
17	N/C	N/C
18	N/C	N/C
19	N/C	N/C
20	N/C	N/C
21	N/C	N/C
22	N/C	N/C
23	N/C	N/C
24	N/C	N/C

1. Substrate material is Ceramic.
2. All unconnected pads should be connected to PCB RF ground.
3. ENEPIG Plating/Finish: Ni: 8.89 micron max, 1.27 micron min. Pd: 0.17 micron max, 0.07 micron min. Au: 0.254 micron max, 0.03 micron min.

PCB Footprint Drawing



QFN-Package Surface-Mount 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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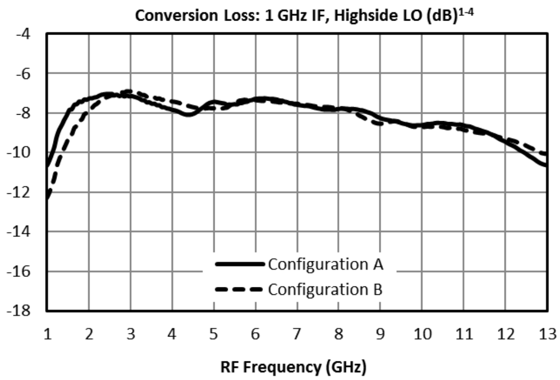
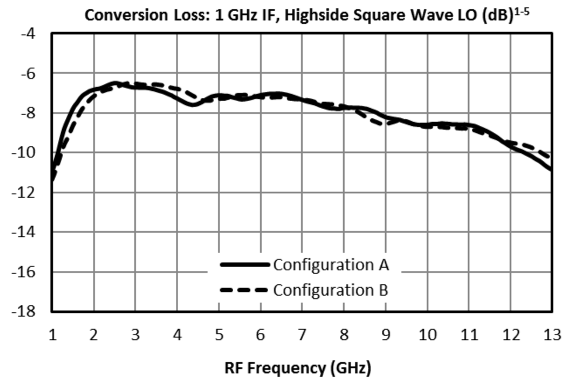
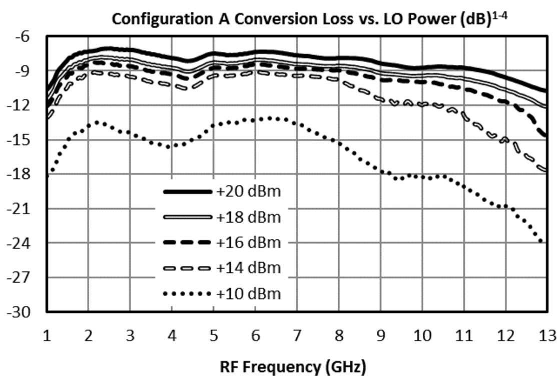
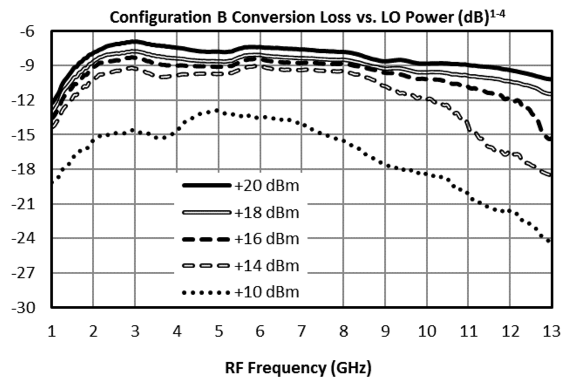
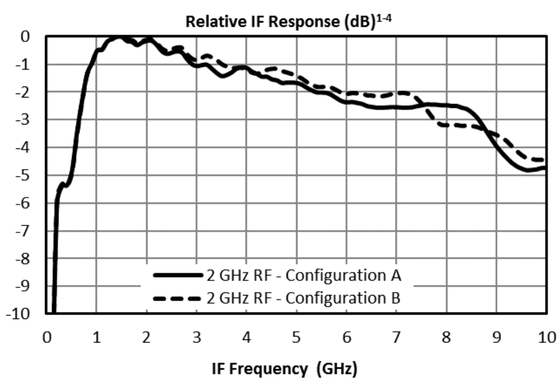
Typical Performance

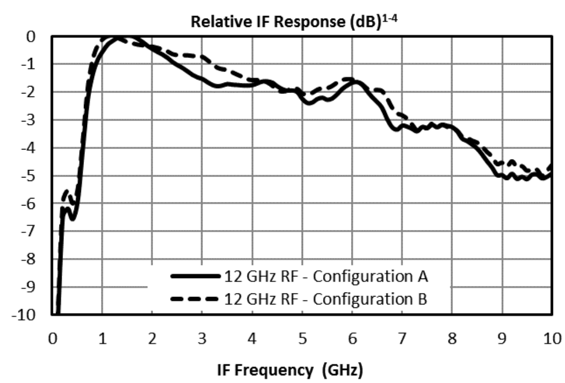












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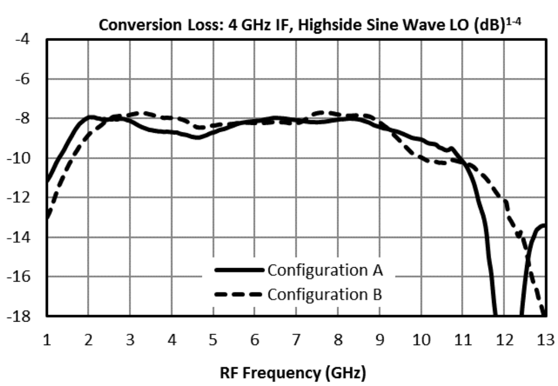

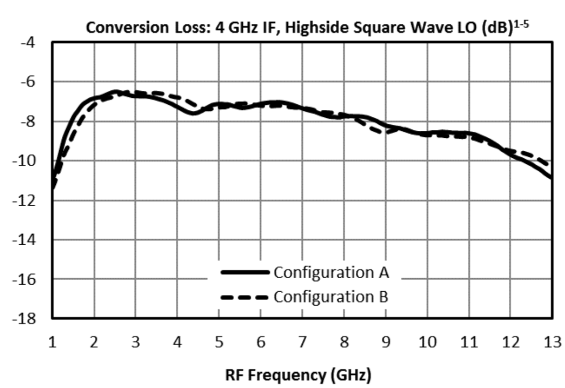

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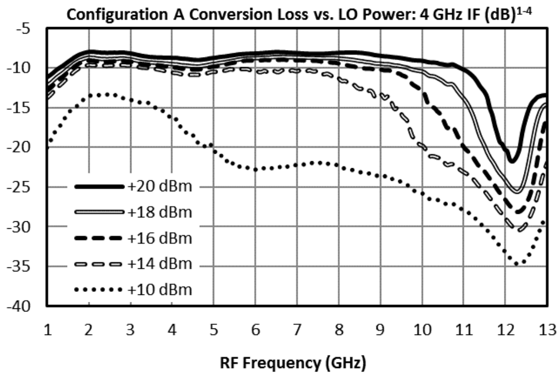

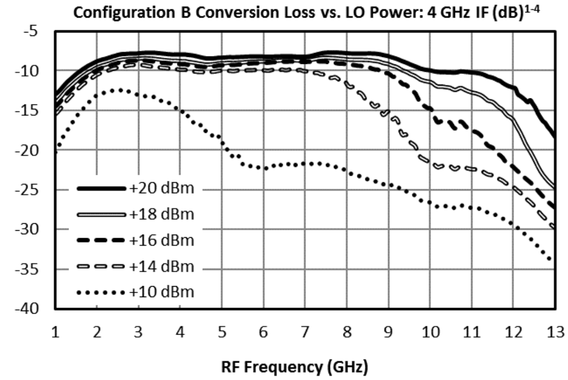

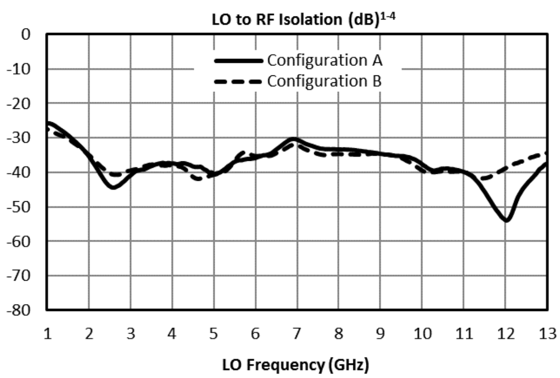

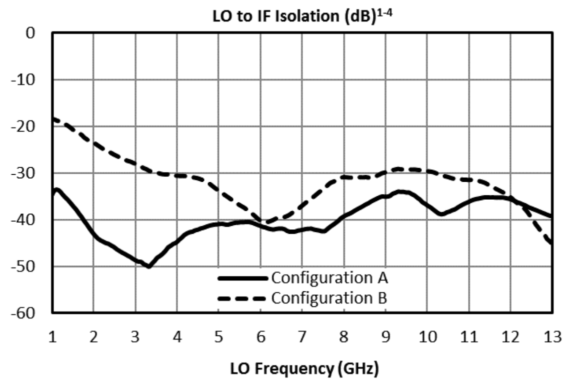

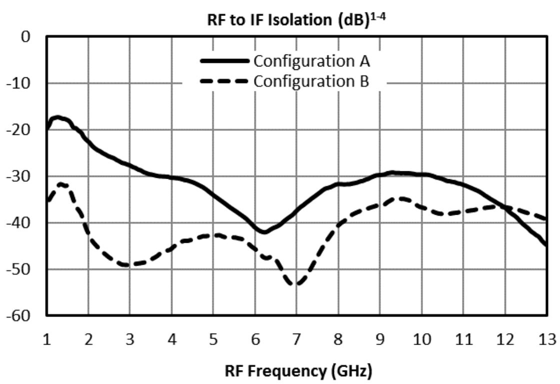

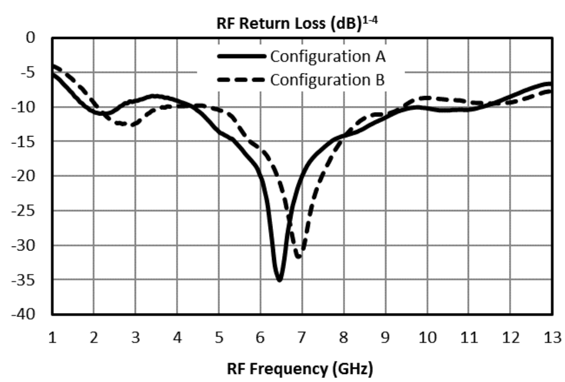

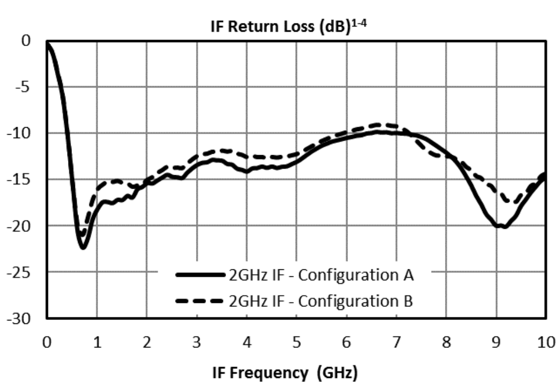

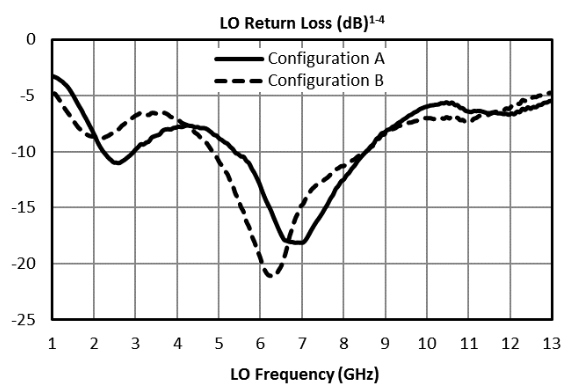

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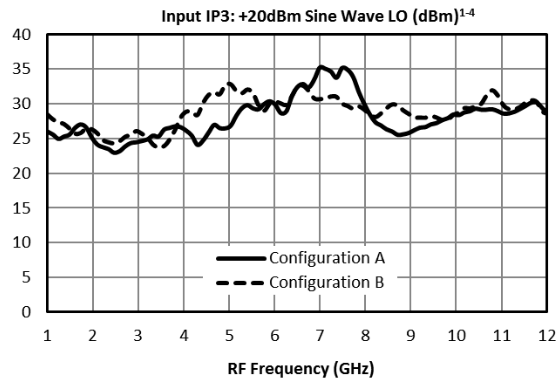

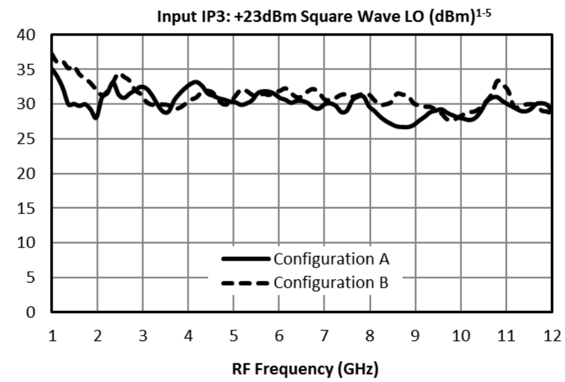

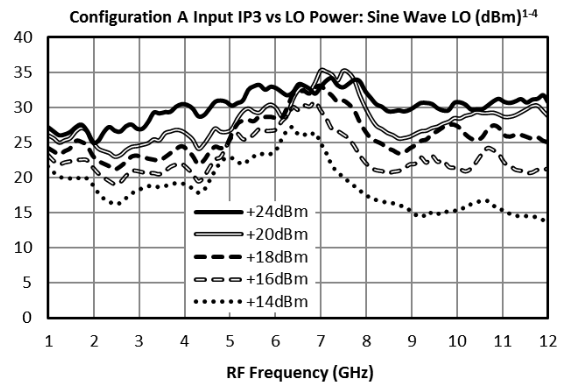

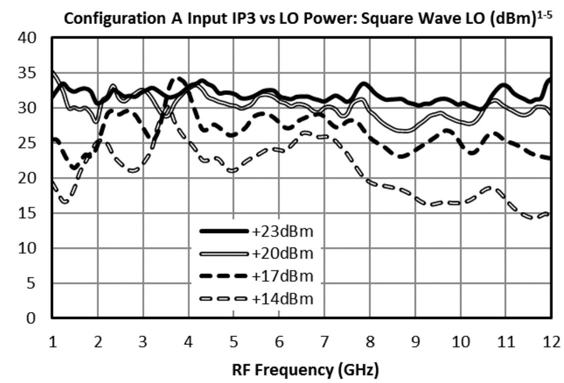

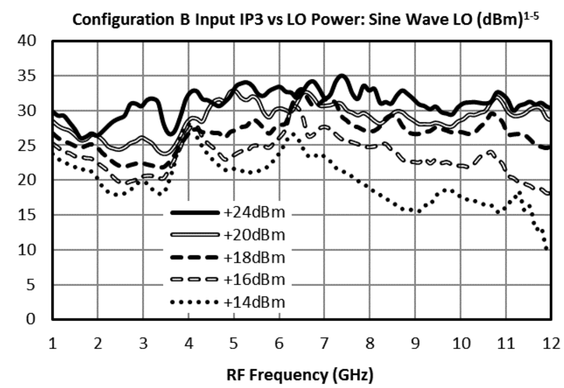

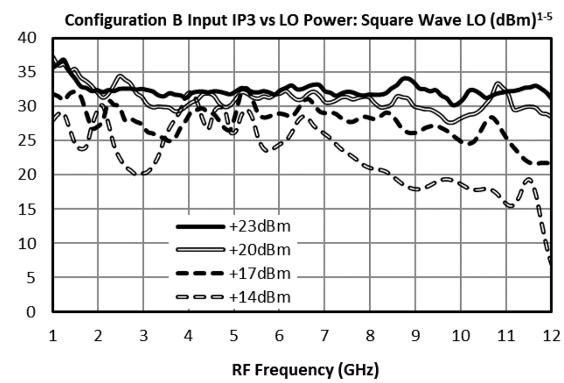

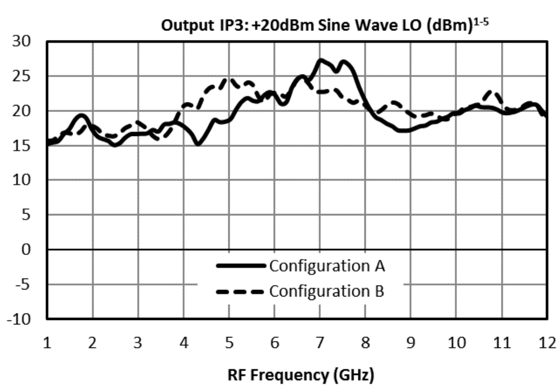

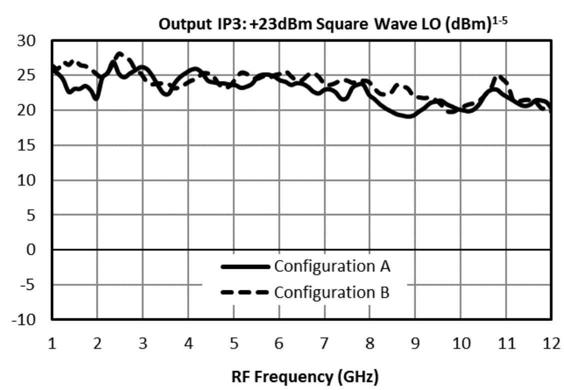

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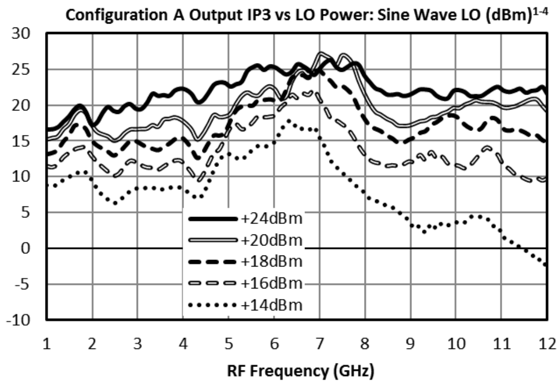
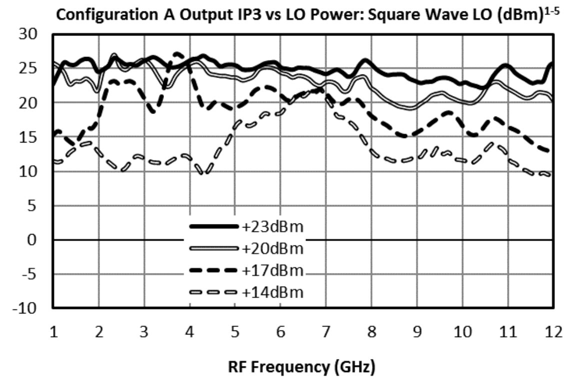
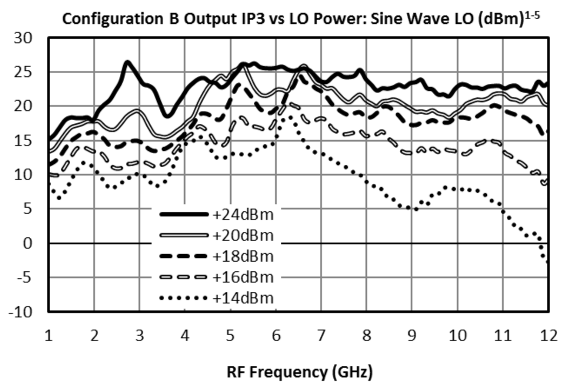
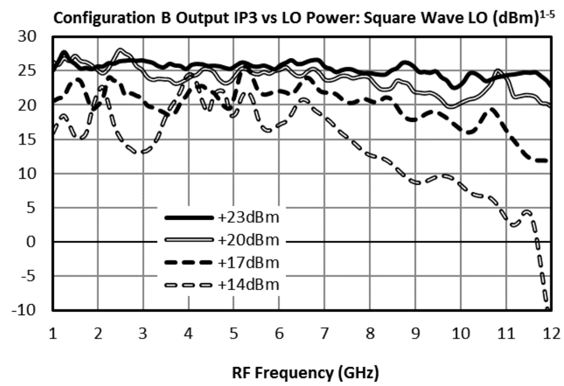
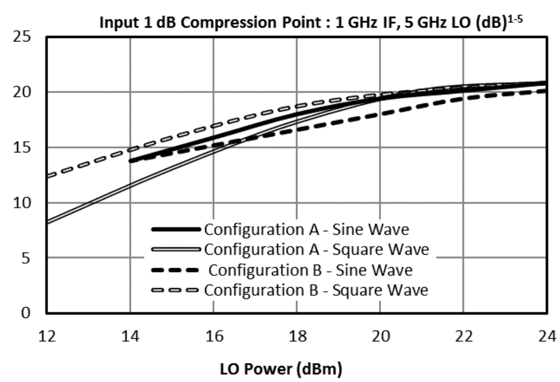
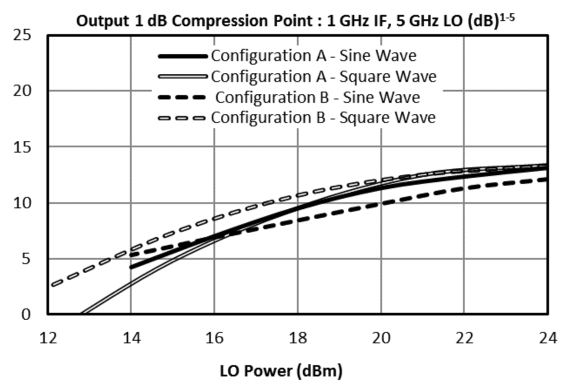






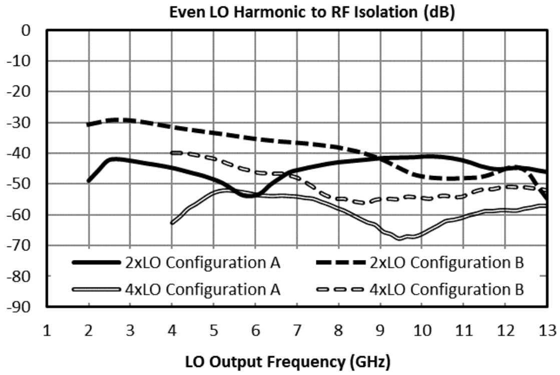




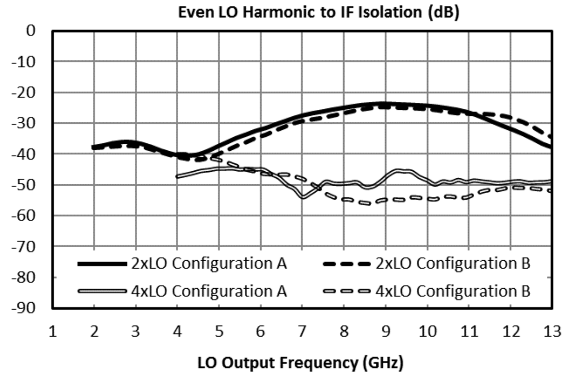


Typical Performance

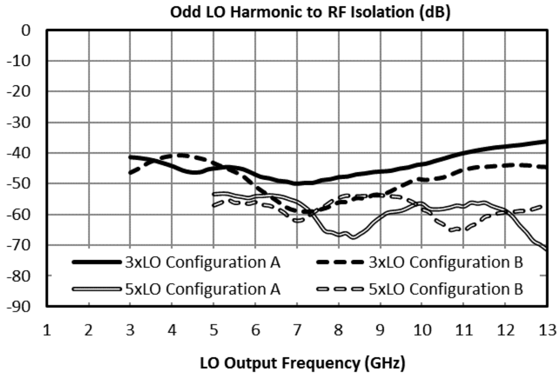
Even LO Harmonic to RF Isolation (dB)



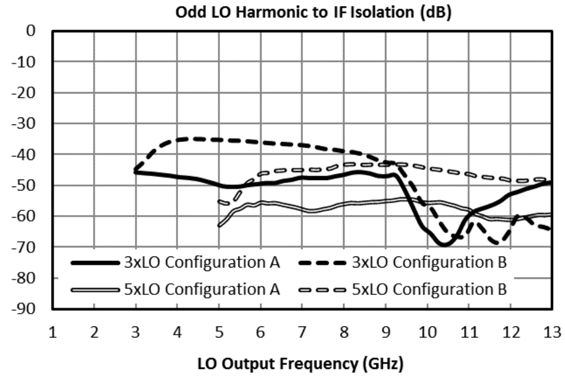
Even LO Harmonic to IF Isolation (dB)



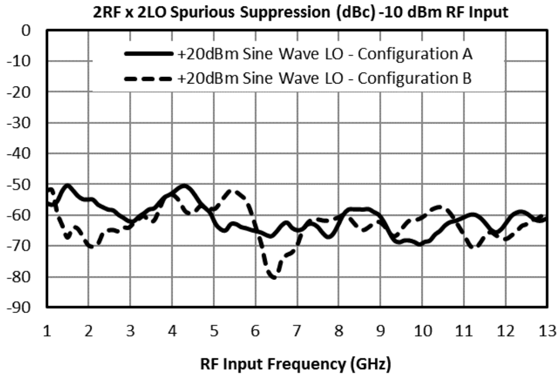
Odd LO Harmonic to RF Isolation (dB)



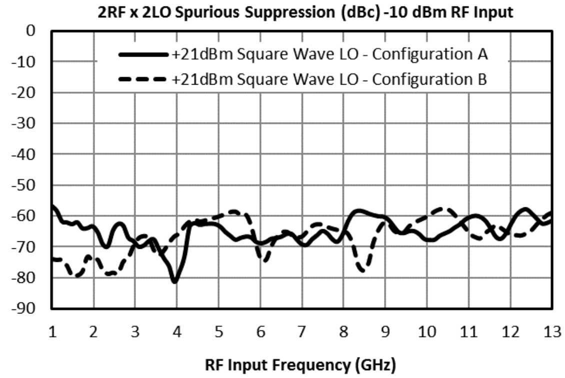
Odd LO Harmonic to IF Isolation (dB)



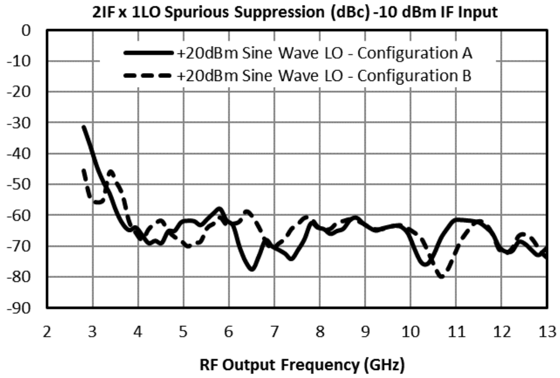
2RF x 2LO Spurious Suppression (dBc) -10 dBm RF Input



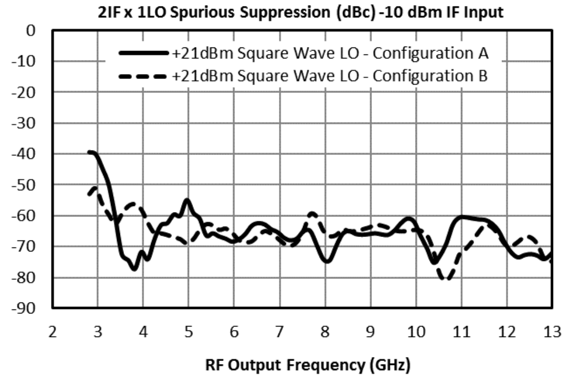
2RF x 2LO Spurious Suppression (dBc) -10 dBm RF Input



2IF x 1LO Spurious Suppression (dBc) -10 dBm IF Input



2IF x 1LO Spurious Suppression (dBc) -10 dBm IF Input



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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 61 dBc for the A configuration 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): A Configuration (B Configuration), Sine Wave LO [6]

-10 dBm RF Input	0xLO	1xLO	2xLO	3xLO	4xLO	5xLO
1xRF	27 (31)	Reference	30 (36)	21 (19)	22 (33)	20 (24)
2xRF	60 (59)	66 (62)	61 (63)	63 (59)	61 (64)	66 (58)
3xRF	105 (97)	83 (86)	91 (93)	77 (78)	94 (93)	118 (120)
4xRF	126 (128)	125 (126)	123 (123)	122 (121)	119 (121)	121 (124)
5xRF	152 (157)	149 (154)	148 (149)	144 (144)	147 (149)	140 (141)

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

-10 dBm RF Input	0xLO	1xLO	2xLO	3xLO	4xLO	5xLO
1xRF	27 (32)	Reference	29 (36)	15 (13)	24 (39)	19 (20)
2xRF	62 (58)	67 (63)	65 (67)	66 (62)	64 (67)	68 (64)
3xRF	104 (103)	97 (99)	103 (108)	91 (94)	100 (107)	129 (128)
4xRF	126 (127)	131 (134)	128 (134)	130 (131)	128 (134)	126 (129)
5xRF	163 (162)	164 (169)	164 (168)	163 (163)	166 (170)	160 (165)

Upconversion Spurious Suppression

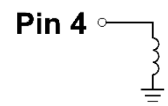
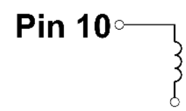
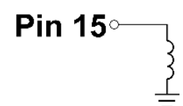
Spurious data is taken by mixing an input within the IF band, with LO frequencies (±mLO±nIF), to create a spurious output within the RF output band. The mixer is swept across the full spurious output band and the mean is calculated. The numbers shown in the table below are for a -10 dBm IF input. Spurious 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 65 dBc for the A configuration for a -10 dBm input, so a -20 dBm IF input creates a spur that is (2-1) x (-10 dB) dB lower, or 75 dBc.

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

-10 dBm RF Input	0xLO	1xLO	2xLO	3xLO	4xLO	5xLO
1xIF	22 (27)	Reference	29 (34)	19 (18)	26 (38)	21 (22)
2xIF	69 (61)	65 (65)	62 (56)	61 (63)	56 (49)	56 (58)
3xIF	92 (78)	98 (98)	98 (99)	85 (87)	87 (95)	79 (84)
4xIF	119 (116)	128 (129)	122 (124)	120 (124)	120 (120)	113 (119)
5xIF	149 (140)	158 (163)	162 (161)	152 (153)	155 (154)	146 (144)

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

-10 dBm RF Input	0xLO	1xLO	2xLO	3xLO	4xLO	5xLO
1xIF	22 (27)	Reference	31 (37)	15 (13)	24 (39)	19 (20)
2xIF	69 (61)	65 (65)	61 (57)	66 (62)	64 (67)	68 (64)
3xIF	92 (78)	97 (99)	98 (106)	91 (94)	100 (107)	129 (128)
4xIF	119 (116)	128 (129)	124 (128)	130 (131)	128 (134)	126 (129)
5xIF	149 (140)	158 (163)	163 (166)	163 (163)	166 (170)	160 (165)

Pin Number	Function	Description	DC Interface Schematic
1-3, 5-9, 11-14, 16-24	Non-connect (NC)	These pins are not connected internally. Datasheet performance is tested with NC pins grounded.	
4	RF/LO	Pin 4 is DC short and AC matched to 50 Ω from 0.8 to 13 GHz. Blocking capacitor is optional.	
10	IF	Pin 10 is DC open. Blocking capacitor is optional.	
15	RF/LO	Pin 15 is DC short and AC matched to 50 Ω from 0.8 to 13 GHz. Blocking capacitor is optional.	
Paddle	Ground (GND)	Ground pad should be connected to RF/DC ground with low electrical and thermal resistance.	

Absolute Maximum Ratings	
Parameter	**Maximum Rating**
Pin 4 DC Current	TBD
Port 10 DC Current	N/A
Port 15 DC Current	TBD
RF Power Handling (RF+LO)	+30 dBm (H -Version)
Operating Temperature	-55ºC to +100ºC
Storage Temperature	-65ºC to +125ºC

DATA SHEET NOTES: 1
1. Mixer Conversion Loss Plot IF frequency is 1 GHz 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, data is taken with highside, +20 dBm sine wave LO drive.
5. Square wave LO generated using 2x ADM1-0026PA with +10 dBm input into the first stage. LO Power reported in plots is of the fundamental tone only. Square wave LO power in plots is stepped down using broadband DC-40 GHz attenuators.
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
.

Note: Exposure to maximum rating conditions for extended periods may reduce device reliability. There is no damage to device with only one parameter set at the limit and all other parameters set at or below their nominal value. Exceeding any of the limits listed here may result in permanent damage to the device.

Revision History

Revision Code	Revision Date	Comment
-	2017	Initial Release
A	January 2019	Revised square wave LO IP3 plots. End note 5 updated to reflect new test condition.

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