

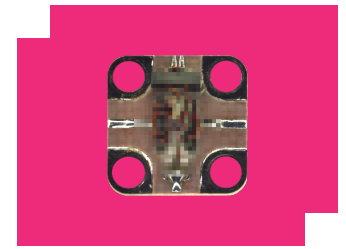
# T3H-20GIES-2

## Two-Tone-Terminator .01 - 20 GHz Mixer

### DEVICE OVERVIEW

#### General Description

The T3H-20G is a high performance mixer featuring LO/RF from 10 MHz to 20 GHz and IF from 10 MHz to 18 GHz. As with all T3 mixers, this mixer offers unparalleled nonlinear performance in terms of IIP3, P1dB, and spurious performance with a flexible LO drive requirement from +15 dBm to +25 dBm. The T3H-20G is offered in connectorized, surface mount, and drop-in style packaging, suitable for any type of system level integration. The T3H-20G is a form-fit-function replacement for the obsolete T3H-20, built using GaAs diodes instead of Si.



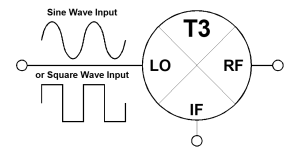
#### Features

- Ultra-Broadband RF, LO, and IF
- Compatible with Sine or Square-Wave LO
- Square-Wave LO delivers Industry-Leading Spurious, IP3, and P1dB Performance

#### Applications

N/A

#### Functional Block Diagram



#### Part Ordering Options

Part Number	Description	Package	Green Status	Product Lifecycle	Export Classification
T3H-20GIES-2	Two-Tone-Terminator .01 - 20 GHz Mixer	ES	Non-RoHS	Released	EAR99
<u>T3H-20GLES-2</u>	Two-Tone-Terminator .01 - 20 GHz Mixer	ES	Non-RoHS	Released	EAR99

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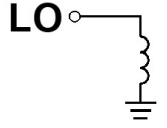
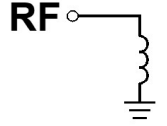
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### Revision History

Revision Code	Revision Date	Comment
-	2020-08-25	Initial Release
A	2023-12-21	Revised conversion loss test conditions in the electrical specifications table.

**Port Configuration and Functions**

**Port Functions**

Port	Function	Description	Equivalent Circuit for Package
IF	IF	The IF port is DC blocked and AC matched to 50 Ohms from 1 MHz to 10 GHz.	
LO	LO	The LO port is DC short to ground and AC matched to 50 Ohms from 10 MHz to 20 GHz. Blocking capacitor is optional.	
RF	RF	The RF port is DC short to ground and AC matched to 50 Ohms from 10 MHz to 20 GHz. Blocking capacitor is optional.	

**Specifications**

**Absolute Maximum Ratings**

Parameter	Maximum Rating	Unit
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

**Package Information**

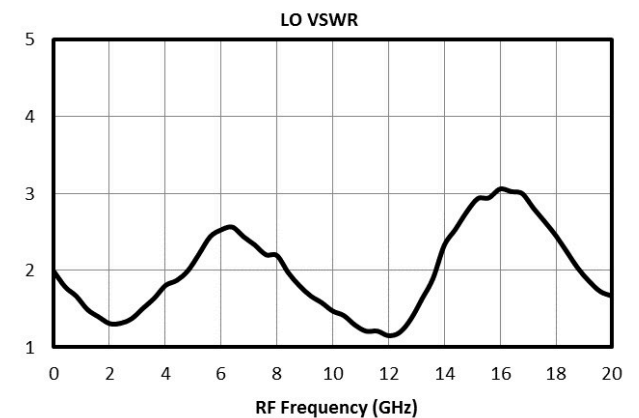
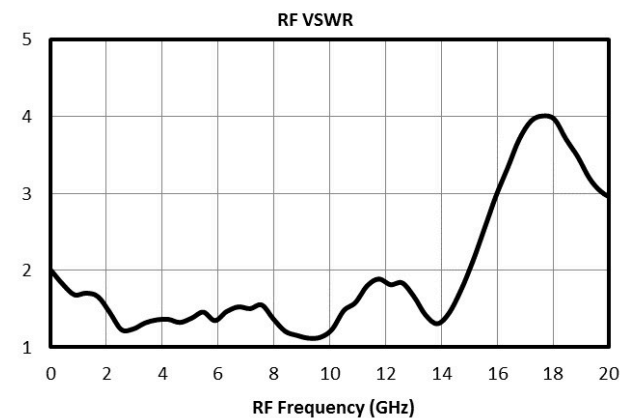
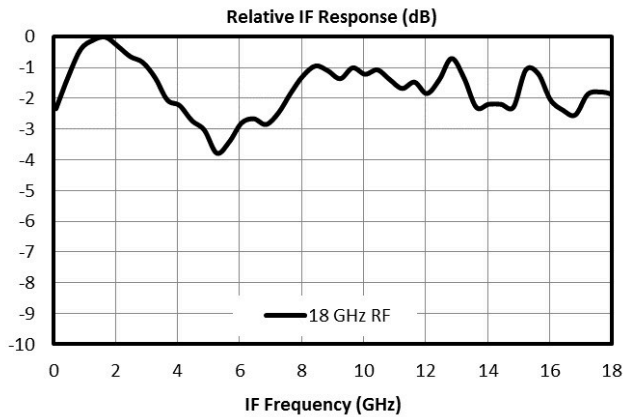
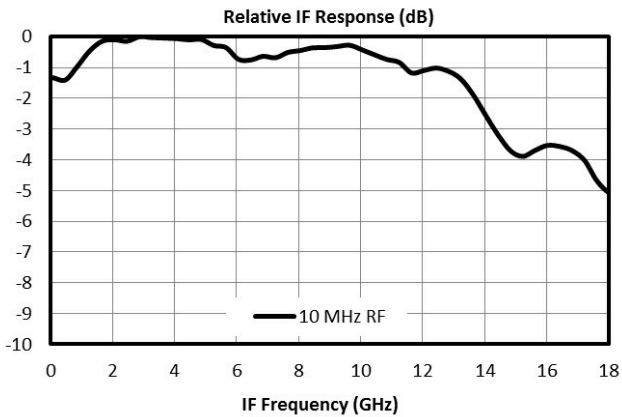
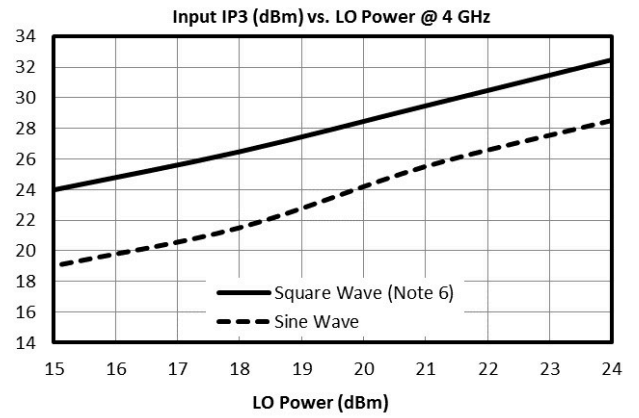
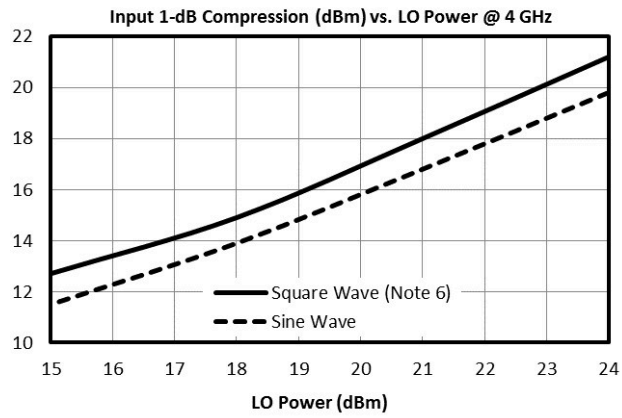
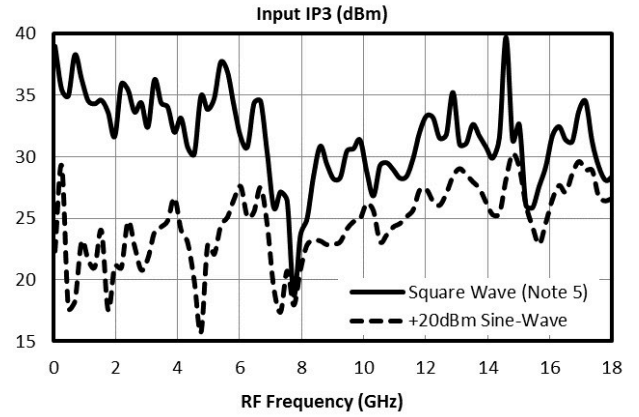
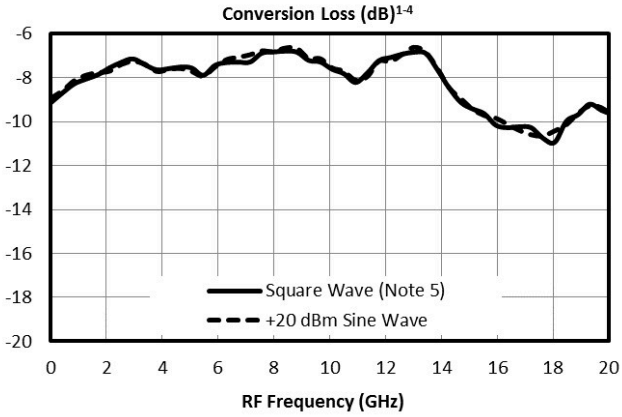
Parameter	Details	Rating
ESD	250 to < 500 Volts	HBM Class 1A
Dimensions	-	8.13 x 8.13mm

**Electrical Specifications**

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

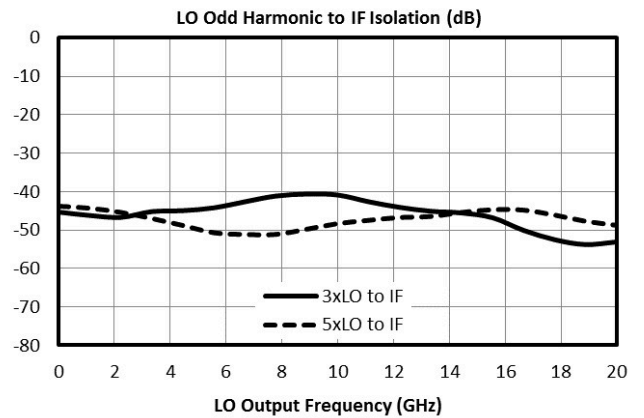
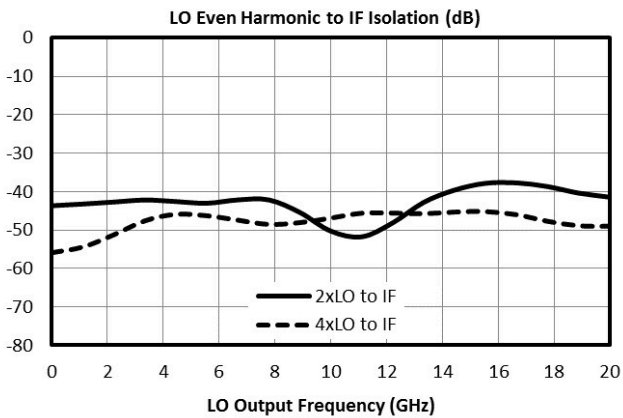
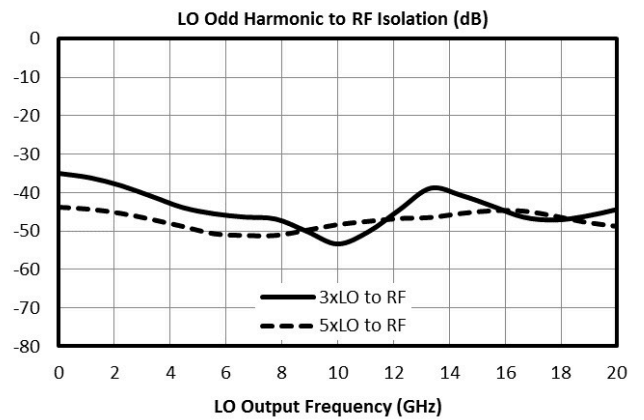
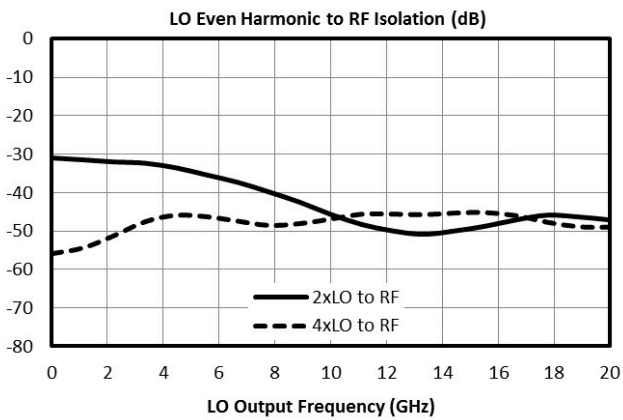
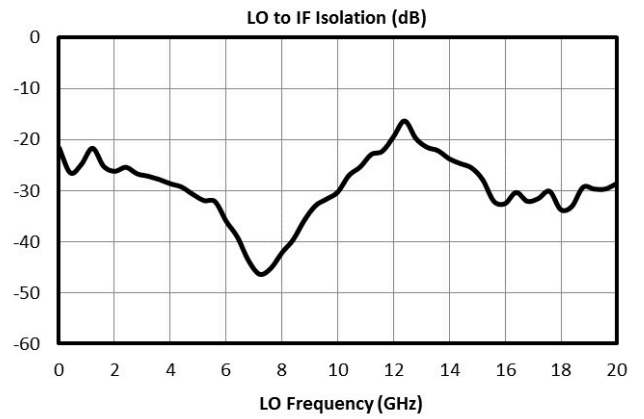
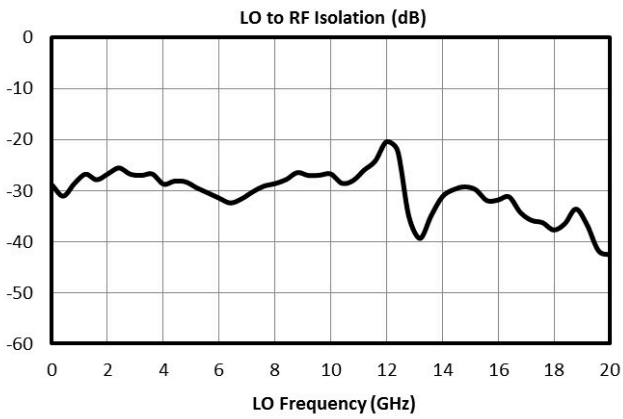
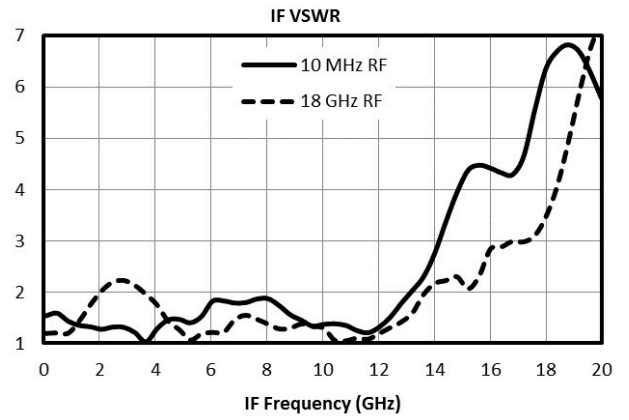
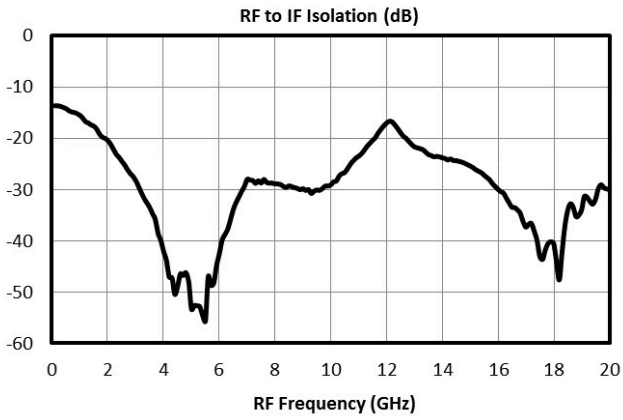
Parameter	Test Conditions	Min	Typ	Max	Unit
Conversion Loss	LO/RF = 0.01-18 GHz, IF = 91 MHz	-	9.5	15.5	dB
Conversion Loss	RF = 14 GHz, LO = 13.99-0.01 GHz, IF = 0.01-13.99 GHz	-	9.5	15.5	dB
Isolation, LO to IF	LO/RF= 0.01-20 GHz	15	-	-	dB
Isolation, LO to RF	LO/RF= 0.01-20 GHz	15	-3	-	dB
IF Frequency Range	-	0.01	-	18	GHz
Input IP3	-	-	32	-	dBm
RF Frequency Range	-	0.01	-	20	GHz

### Typical Performance Plots



# T3H-20GIES-2

## Two-Tone-Terminator .01 - 20 GHz Mixer



### Spur Table

#### Downconversion Spurious Suppression

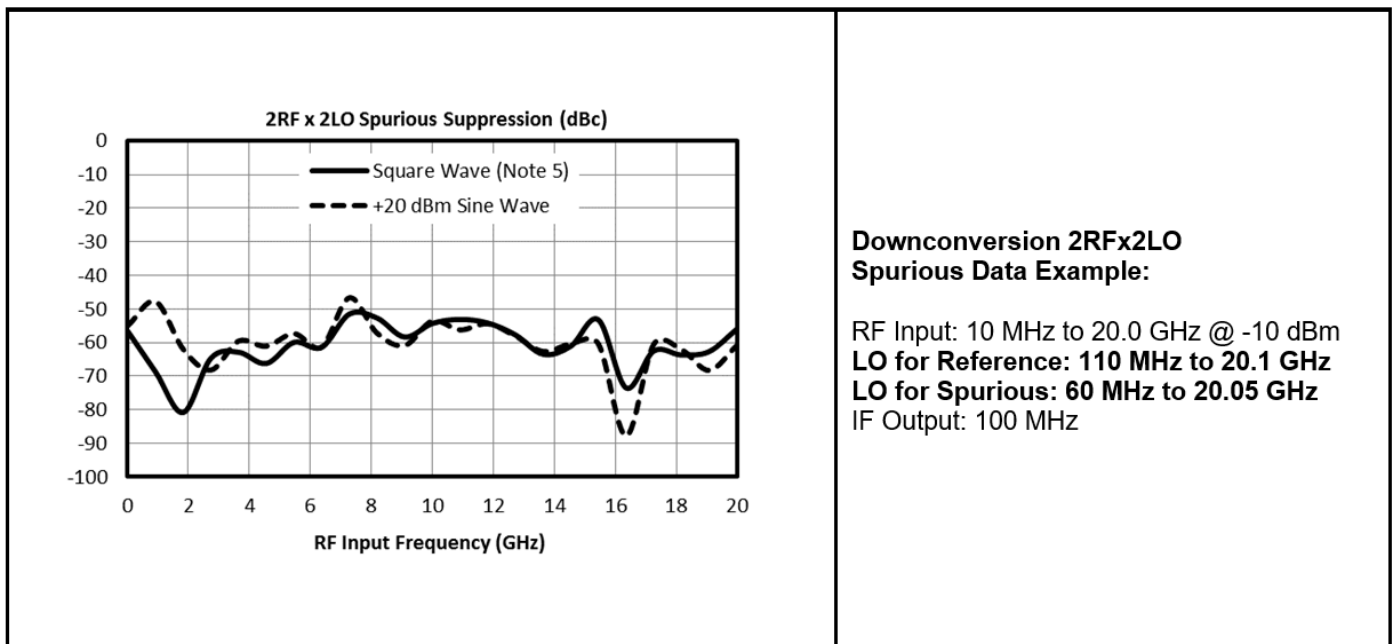
Spurious data is taken by selecting RF and LO frequencies (+mLO+nRF) within the 10 MHz to 20 GHz RF/LO bands, which create a 100 MHz IF spurious output. The mixer is swept across the full spurious band and the mean is calculated. The numbers shown in the table below are for a -10 dBm RF input. Spurious 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 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): Square Wave (Sine Wave) LO<sup>5</sup>**

-10 dBm RF Input	0xLO	1xLO	2xLO	3xLO	4xLO	5xLO
0xRF	-----	See LO to IF Isolation and LO Harmonic to IF Isolation Plots (Page 3)				
1xRF	17 (18)	Reference	19 (27)	10 (11)	19 (34)	16 (18)
2xRF	60 (59)	65 (60)	61 (57)	65 (62)	63 (53)	64 (55)
3xRF	101 (96)	85 (75)	92 (86)	88 (81)	97 (92)	90 (76)
4xRF	>110	>110	>110	>110	>110	>110
5xRF	>120	>120	>120	>120	>120	>120

Square Wave Drive created with a chain to two ADM1-0026PA, biased at +7/-0.25 Volts, with a +10 dBm input. Sine Wave data is taken with a +20 dBm LO input.

A sample downconversion spurious sweep is shown below. An LO which is 100 MHz higher than the RF is used to create a 100 MHz reference IF. A second LO is used to create a 2x2 spurious IF, also at 100 MHz (50 MHz fundamental IF). The difference between these two output levels is the spurious suppression in dBc. The mean value across the full 10 MHz to 20 GHz RF input band is the number shown in the table above.



**Upconversion Spurious Suppression**

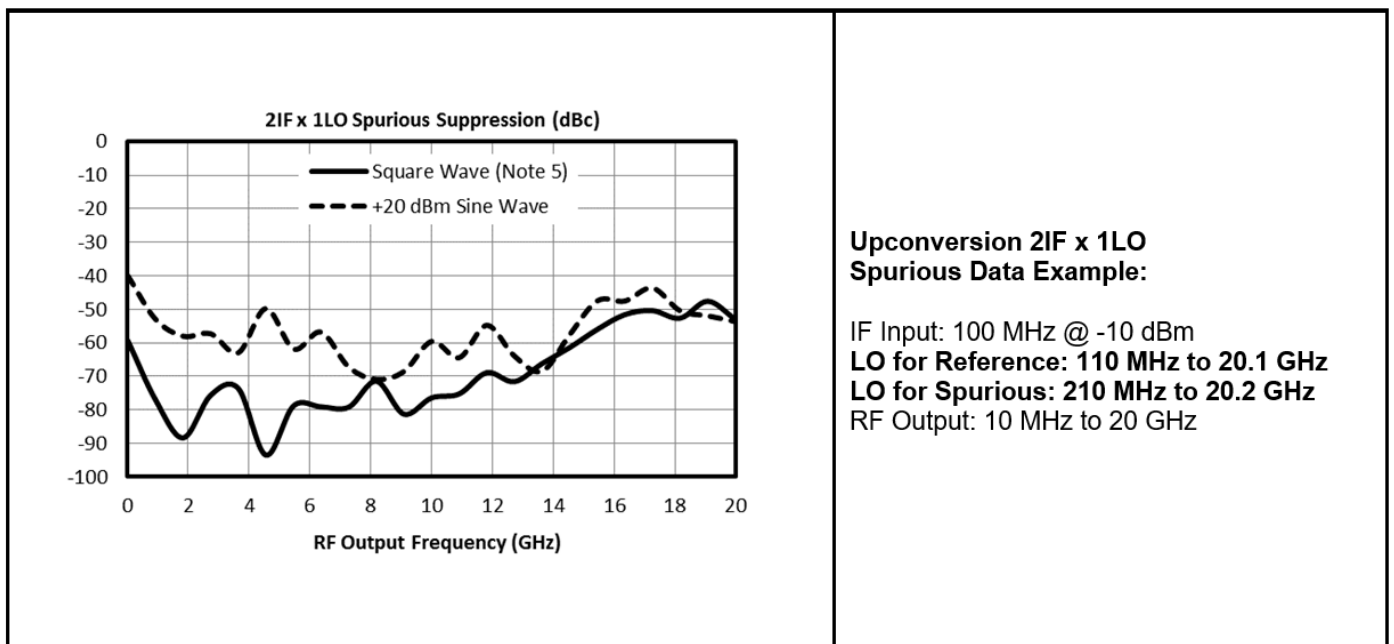
Spurious data is taken by mixing a 100 MHz IF with LO frequencies (+mLO+nIF), which creates an RF within the 10 MHz to 20 GHz RF band. The mixer is swept across the full spurious output band and the mean is calculated. The numbers shown in the table below are for a -10 dBm IF input. Spurious suppression 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 60 dBc for a -10 dBm input, so a -20 dBm IF input creates a spur that is (2-1) x (-10 dB) dB lower, or 70 dBc.

**Typical Upconversion Spurious Suppression (dBc): Square Wave (Sine Wave) LO<sup>5</sup>**

-10 dBm IF Input	0xLO	1xLO	2xLO	3xLO	4xLO	5xLO
0xIF	-----	See LO to RF Isolation and LO Harmonic to RF Isolation Plots (Page 3)				
1xIF	18 (17)	Reference	18 (22)	11 (11)	18 (27)	16 (18)
2xIF	62 (62)	60 (54)	60 (49)	67 (55)	61 (48)	64 (52)
3xIF	73 (72)	86 (72)	95 (78)	90 (66)	95 (69)	91 (65)
4xIF	>110	>110	>110	>110	>110	>110
5xIF	>120	>120	>120	>120	>120	>120

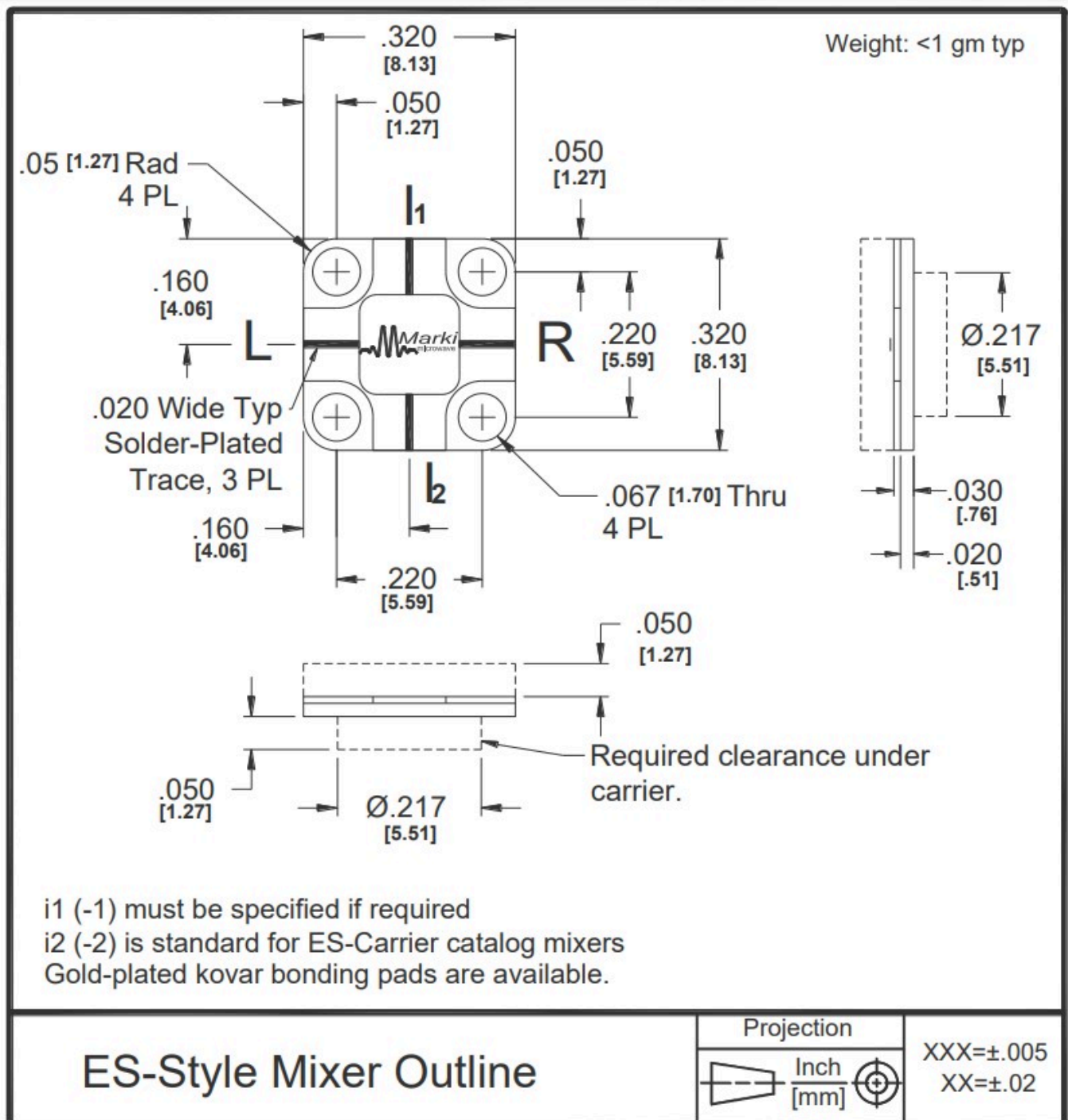
Square Wave Drive created with a chain to two ADM1-0026PA, biased at + 7/-0.25 Volts, with a +10 dBm input. Sine Wave data is taken with a +20 dBm LO input.

A sample upconversion spurious sweep is shown below. A 100 MHz reference IF input is used to create an RF output that is 100 MHz below the LO input (LO-IF=RF). A second LO (100 MHz higher) is combined with the same 100 MHz IF input (LO-2xIF=RF) to create the same 10 MHz to 20 GHz RF output band. The difference between these two output levels is the spurious suppression in dBc. The mean value across the full RF output band is the number shown in the table above.



**Mechanical Data**

**Outline Drawing**



## Notes

### DATA SHEET NOTES:

1. Mixer Conversion Loss Plot IF frequency is 100 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. Square Wave Drive created with a chain to two ADM1-0026PA, biased at + 7/-0.25 Volts, with a +10 dBm input. Sine Wave data is taken with a +20 dBm LO input.
6. Square Wave Drive created with an ADM1-0026PA, biased at + 7/-0.25 Volts, driving an ADM3-0022PA, biased at +7/+15/-0.25/-0.65V.
7. Specifications are subject to change without notice. Contact Marki Microwave for the most recent specifications and data sheets.
8. Catalog mixer circuits are continually improved. Configuration control requires custom mixer model numbers and specifications.

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