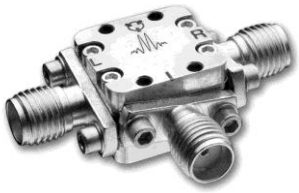
TWO-TONE-TERMINATOR MIXER T3H-20G

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, $P_{1dB,}$ 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. For a list of recommended LO driver amps for all mixers and IQ mixers, see here.



Features

- Ultra-Broadband RF, LO, and IF
- Compatible with Sine or Square-Wave LO
- Square-Wave LO delivers Industry-Leading Spurious, IP3, and P_{1dB} Performance
- Application Note: T3 Mixer Primer

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

Parameter	LO (GHz)	RF (GHz)	IF (GHz)	Min	Typ	Max	Diode Option LO drive level (dBm)
Conversion Loss (dB)	.01-20	.01-20	1-9 .01-18		8.5 9.5	14.0 15.5	
Isolation (dB) LO-RF LO-IF RF-IF	.01-20	.01-20		 15 15	 See Plots		
Input 1 dB Compression (dBm)	.01-20	.01-20			See Plot		L (+15 to +25)
Input Two-Tone Third Order Intercept Point (dBm)	.01-20	.01-20			See Plots		L (+15 to +25)

Part Number Options

Please specify diode level and package style by adding to model number.

Package Styles		Examples			
Connectorized	S	T3H-20GLS, T3H-20GLES-2			
Microstrip[1,2]	ES	T3H-20G	L	ES	-2
Surface Mount [1,2] (RoHS only)	CTG	(Model)	(Diode Option)	(Package)	(I-Port Configuration)

[1]Connectorized test fixtures available for most microstrip and surface mount packages. Consult factory.
[2]For non-connectorized packages, specify I-port configuration by adding –1 or –2 suffix to model number. Default is –2 configuration when not specified.

215 Vineyard Court, Morgan Hill, CA 95037 | Ph: 408.778.4200 | Fax 408.778.4300 | info@markimicrowave.com

TWO-TONE-TERMINATOR MIXER

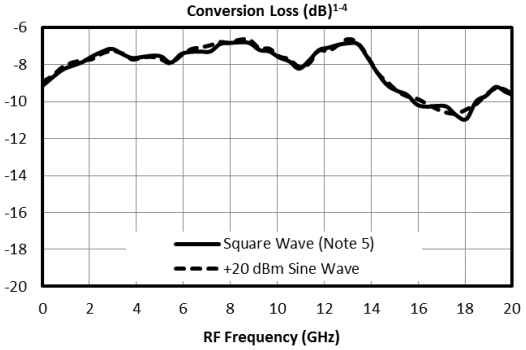
T3H-20G

Page 2

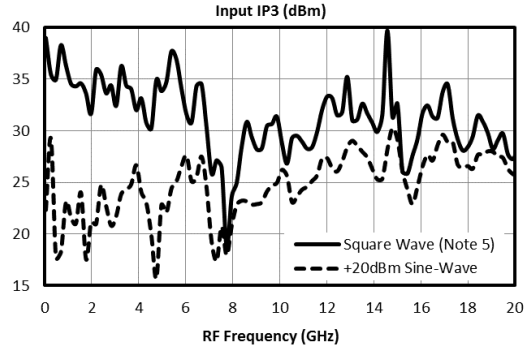
LO/RF 10 MHz to 20 GHz
IF 10 MHz to 18 GHz

Typical Performance

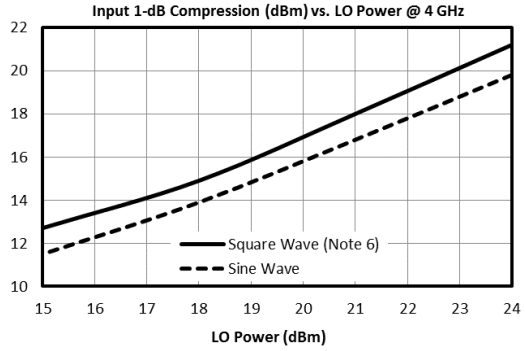
Conversion Loss (dB)[1-4]



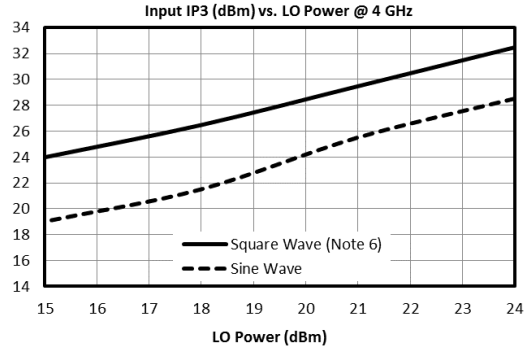
Input IP3 (dBm)



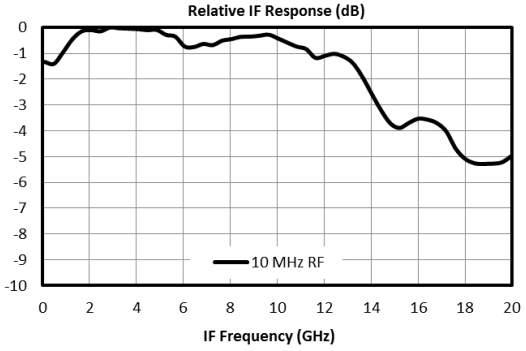
Input 1-dB Compression (dBm) vs. LO Power @ 4 GHz



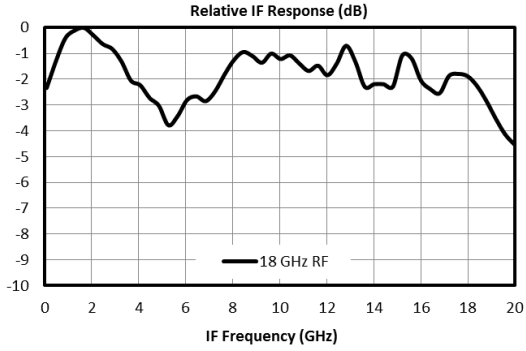
Input IP3 (dBm) vs. LO Power @ 4 GHz



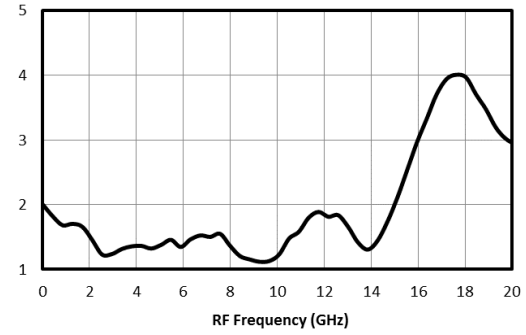
Relative IF Response (dB)



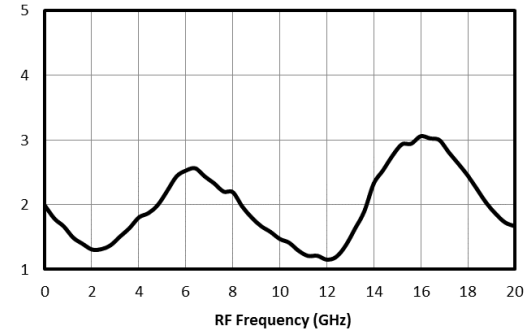
Relative IF Response (dB)



RF VSWR



LO VSWR

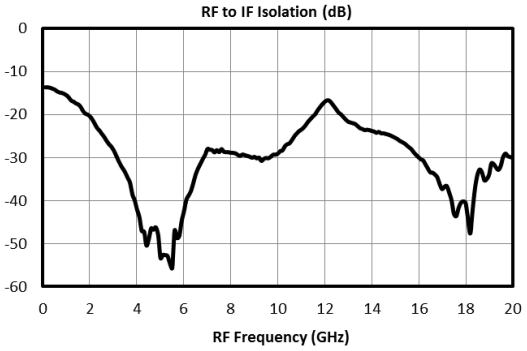


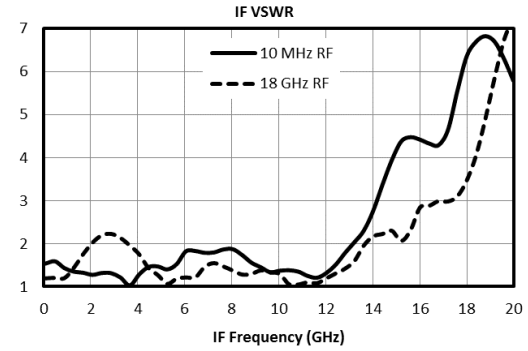
TWO-TONE-TERMINATOR MIXER

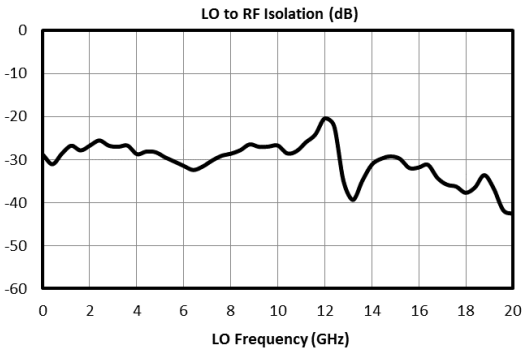
T3H-20G

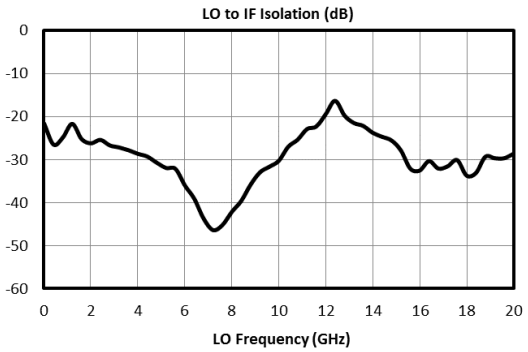
LO/RF 10 MHz to 20 GHz
IF 10 MHz to 18 GHz

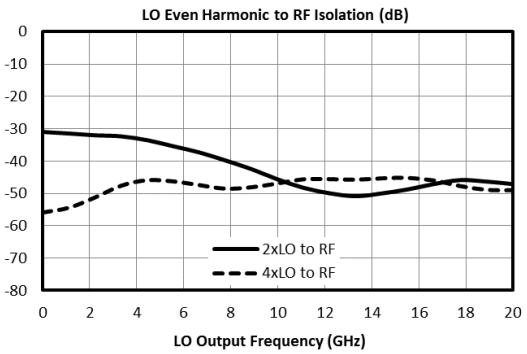
Typical Performance

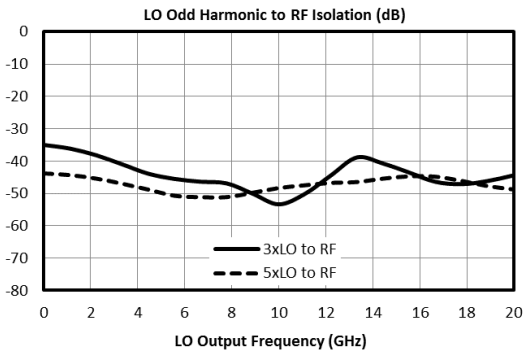


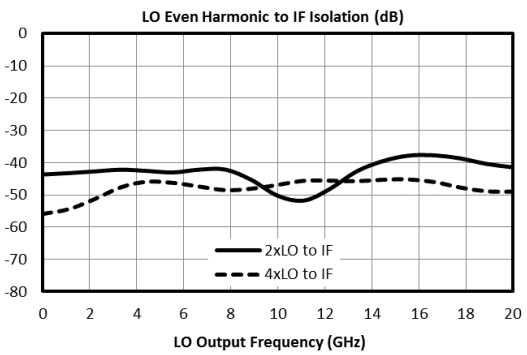


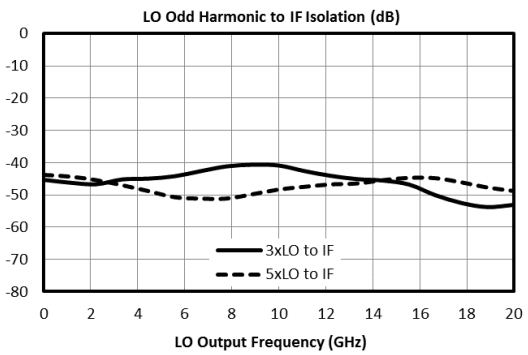












215 Vineyard Court, Morgan Hill, CA 95037 | Ph: 408.778.4200 | Fax 408.778.4300 | info@markimicrowave.com

TWO-TONE-TERMINATOR MIXER

T3H-20G

LO/RF 10 MHz to 20 GHz
IF 10 MHz to 18 GHz

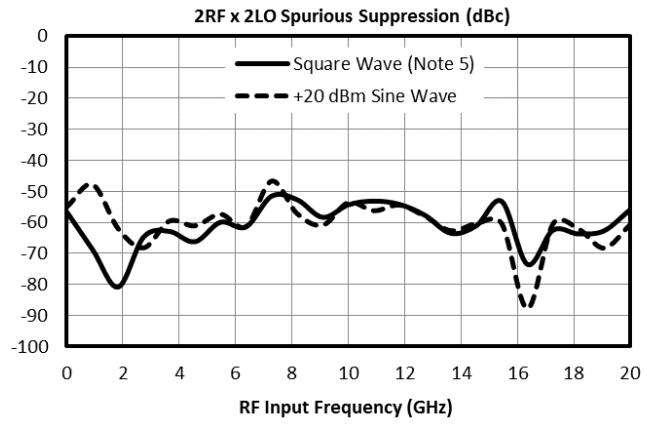
Downconversion Spurious Suppression

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[5]

-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

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.



Downconversion 2RFx2LO Spurious Data Example:

RF Input: 10 MHz to 20.0 GHz @ -10 dBm
LO for Reference: 110 MHz to 20.1 GHz
LO for Spurious: 60 MHz to 20.05 GHz
IF Output: 100 MHz

LO/RF 10 MHz to 20 GHz
IF 10 MHz to 18 GHz

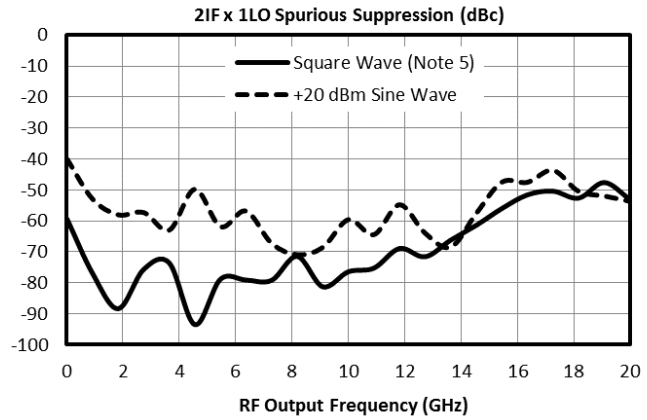
Upconversion Spurious Suppression

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[5]

-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

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.



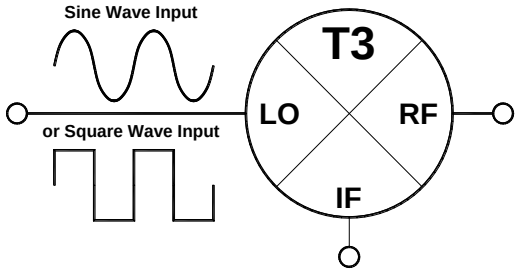
Upconversion 2IF x 1LO Spurious Data Example:

IF Input: 100 MHz @ -10 dBm
LO for Reference: 110 MHz to 20.1 GHz
LO for Spurious: 210 MHz to 20.2 GHz
RF Output: 10 MHz to 20 GHz

TWO-TONE-TERMINATOR MIXER

T3H-20G

LO/RF 10 MHz to 20 GHz
IF 10 MHz to 18 GHz



Port	Description	DC Interface Schematic
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	The RF port is DC short to ground and AC matched to 50 Ohms from 10 MHz to 20 GHz. Blocking capacitor is optional.	
IF	The IF port is DC blocked and AC matched to 50 Ohms from 1 MHz to 10 GHz.	

Absolute Maximum Ratings	
Parameter	**Maximum Rating**
RF DC Current	1 Amp
LO DC Current	1 Amp
RF Power Handling (RF+LO)	+25 dBm (L-Version)
Operating Temperature	-55ºC to +100ºC
Storage Temperature	-65ºC to +125ºC
ESD Sensitivity (HBM)	Class 1A

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.

215 Vineyard Court, Morgan Hill, CA 95037 | Ph: 408.778.4200 | Fax 408.778.4300 | info@markimicrowave.com

Revision History

Revision code	Revision Date	Comment
-	8/25/2020	Initial Release