

TWO-TONE-TERMINATOR MIXER

T3H-20

The T3H-20 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 +27 dBm. The T3H-20 is offered in connectorized, surface mount, and drop-in style packaging, suitable for any type of system level integration. 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](#)

Note: Not recommended for new design due to material obsolescence (see [EOL letter](#)). The T3H-20G is a form-fit-function replacement using GaAs diodes, with a target release date of September 2020 for the L-diode and December 2020 for a possible I-diode.

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		I (+18 to +27)
Input Two-Tone Third Order Intercept Point (dBm)	.01-20	.01-20			See Plots		I (+18 to +27)

Part Number Options

Please specify diode level and package style by adding to model number.							
Package Styles		Examples					
Connectorized	S	T3H-20IS, T3H-20IES-2					
Microstrip ^{1,2}	ES	T3H-20	I	ES	-2		
Surface Mount ^{1,2} (RoHS only)	CTG	(Model)	(Diode Option)	(Package)	(I-Port Configuration)		

¹Connectorized test fixtures available for most microstrip and surface mount packages. Consult factory.

²For non-connectorized packages, specify I-port configuration by adding -1 or -2 suffix to model number. Default is -2 configuration when not specified

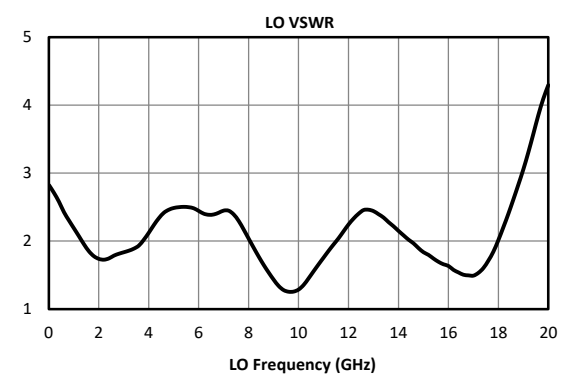
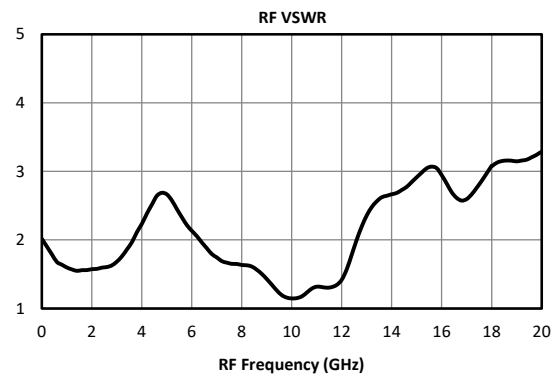
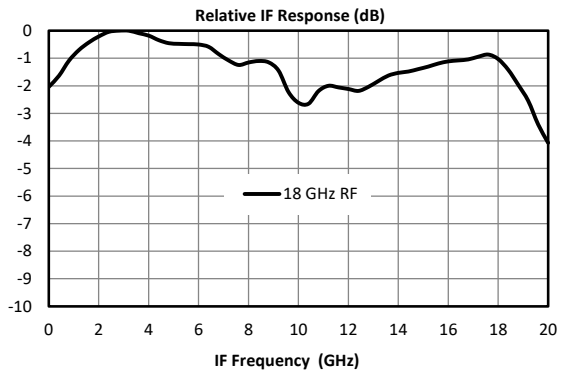
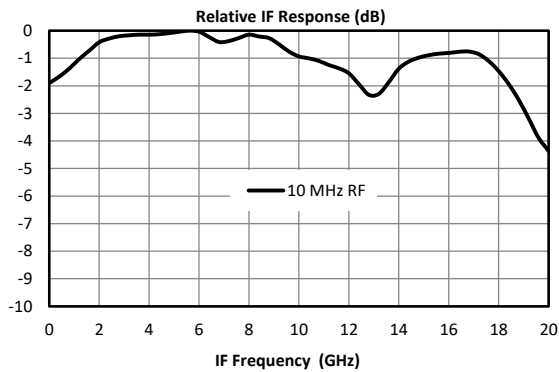
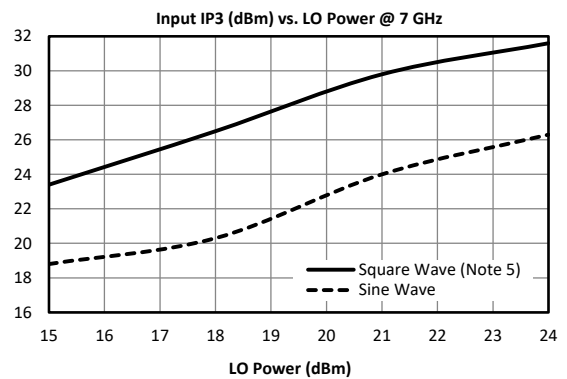
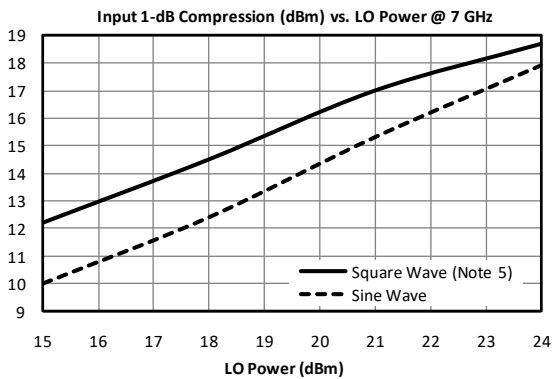
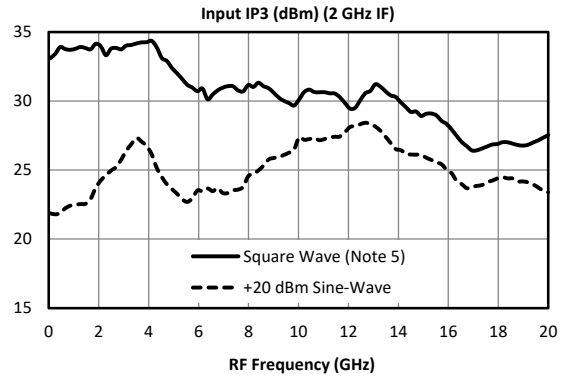
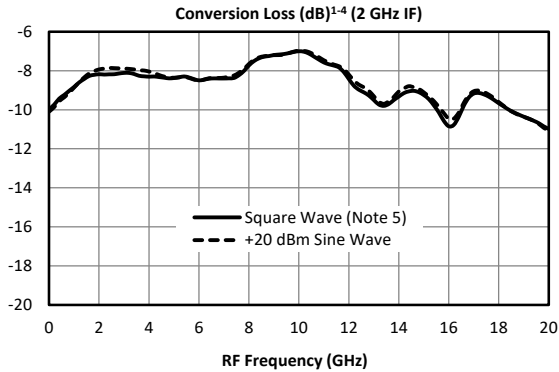
TWO-TONE-TERMINATOR MIXER

T3H-20

Page 2

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

Typical Performance



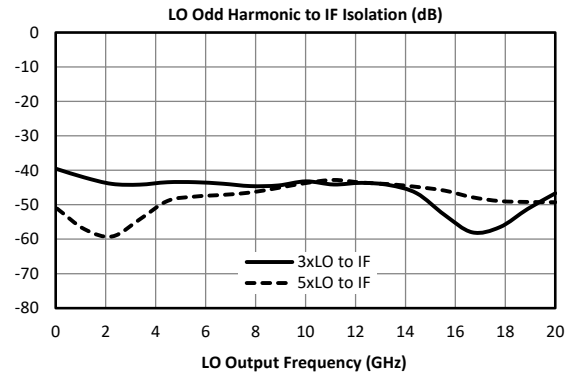
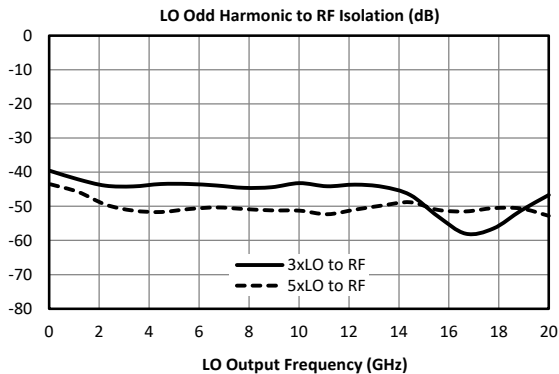
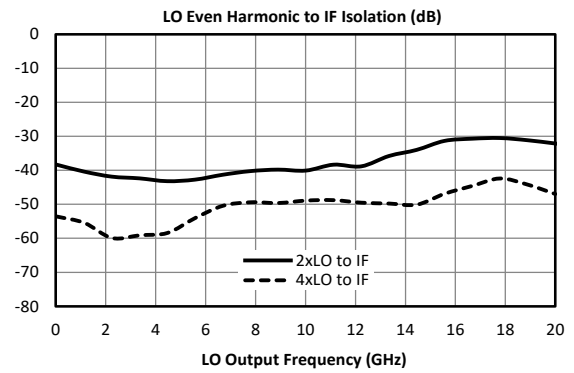
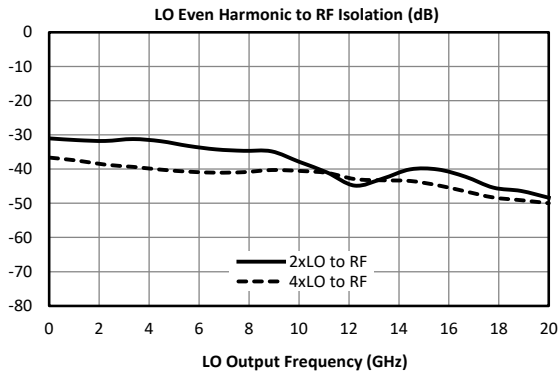
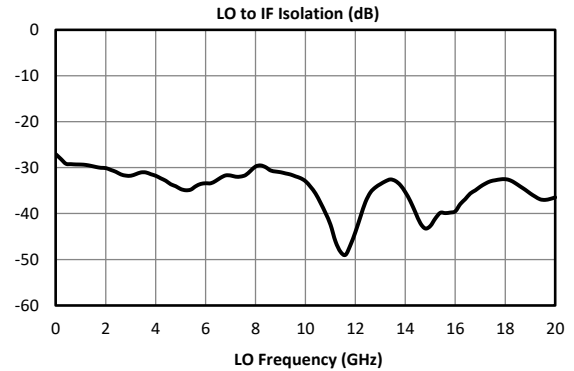
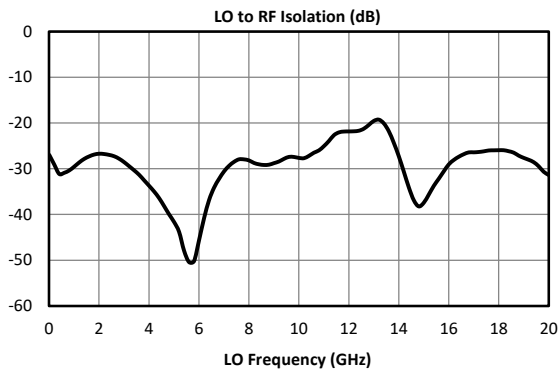
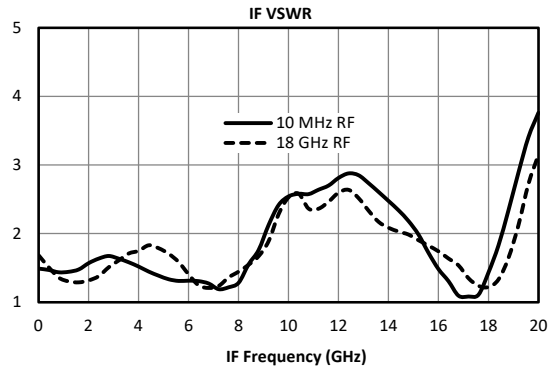
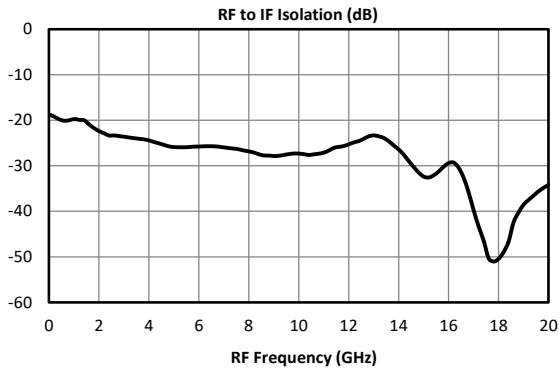
TWO-TONE-TERMINATOR MIXER

T3H-20

Page 3

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

Typical Performance





TWO-TONE-TERMINATOR MIXER

T3H-20

Page 4

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

Downconversion Spurious Suppression

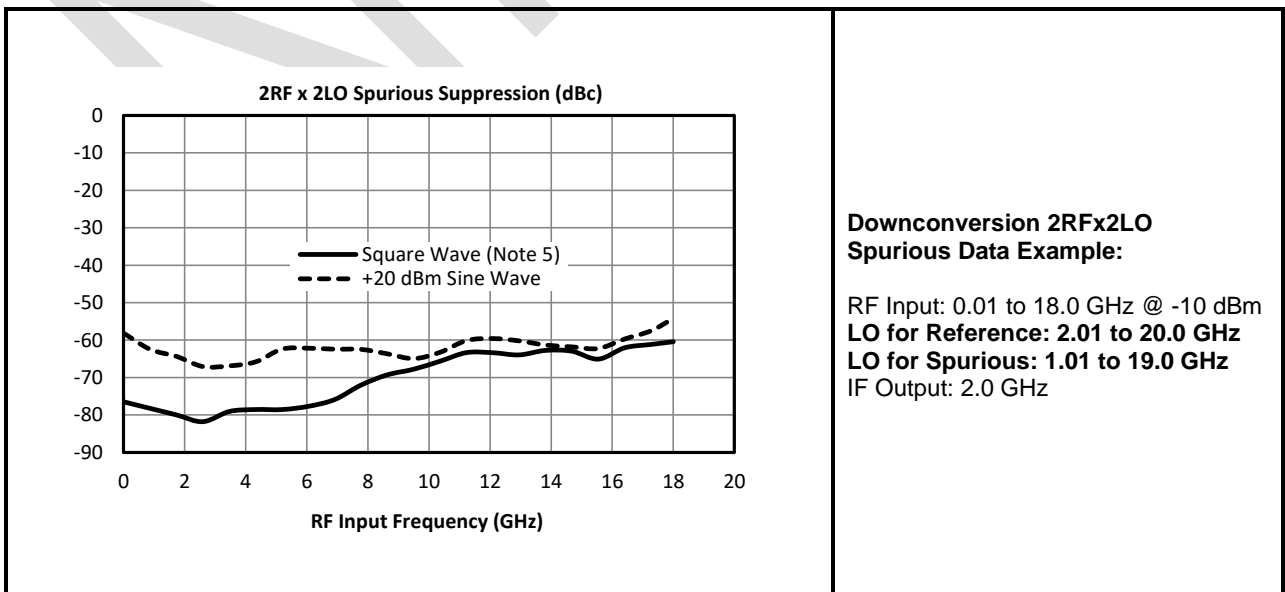
Spurious data is taken by selecting RF and LO frequencies ($\pm mLO \pm nRF$) within the 10 MHz to 20 GHz RF/LO bands, which create a 2.0 GHz IF spurious output. The mixer is swept across the full spurious band and the mean is calculated.

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 70 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 80 dBc.

Typical Downconversion Spurious Suppression (dBc): Square Wave (Sine Wave) LO⁵

-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	19 (19)	Reference	20 (25)	11 (11)	20 (33)	17 (18)
2xRF	70 (66)	69 (63)	70 (62)	71 (64)	69 (57)	70 (62)
3xRF	97 (95)	92 (82)	99 (90)	90 (77)	97 (87)	98 (75)
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 2.0 GHz higher than the RF is used to create a 2.0 GHz reference IF. A second LO is used to create a 2x2 spurious IF, also at 2.0 GHz (1.0 GHz fundamental IF). The difference between these two output levels is the spurious suppression in dBc. The RF band is limited to 18 GHz so that the LO does not exceed 20 GHz.. The mean value across the RF input band is the number shown in the table above.



TWO-TONE-TERMINATOR MIXER

T3H-20

Page 5

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

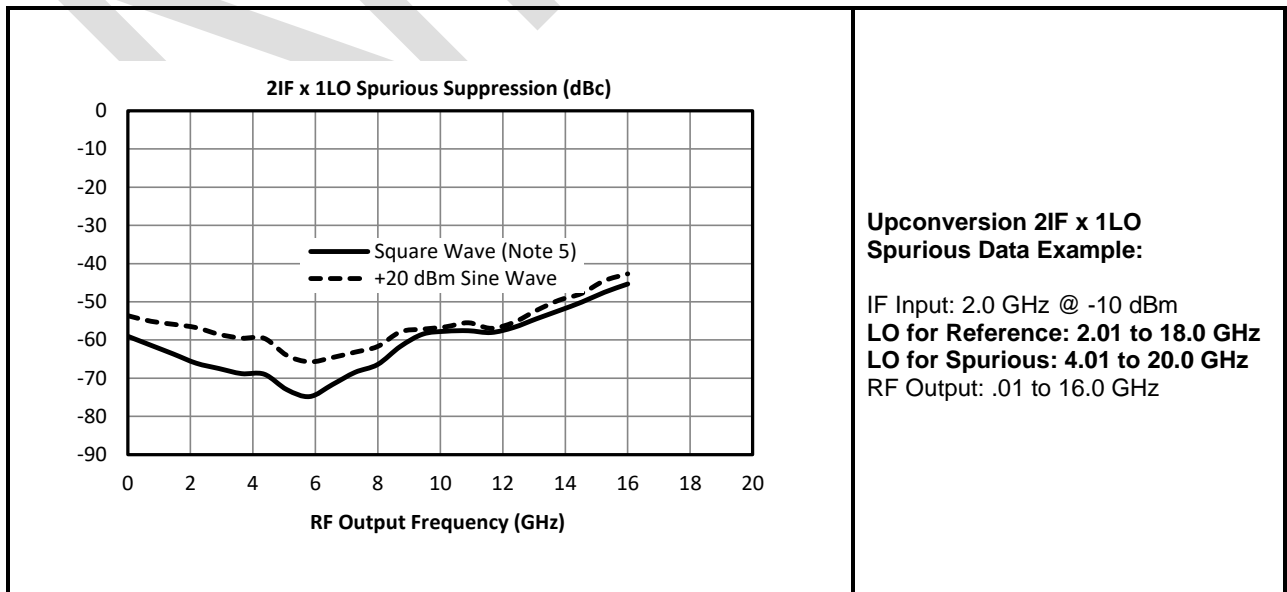
Upconversion Spurious Suppression

Spurious data is taken by mixing a 2.0 GHz 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 61 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 71 dBc.

Typical Upconversion Spurious Suppression (dBc): Square Wave (Sine Wave) LO⁵

-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	16 (16)	Reference	21 (25)	11 (11)	20 (31)	16 (18)
2xIF	65 (61)	61 (56)	71 (61)	71 (57)	76 (58)	75 (55)
3xIF	96 (90)	88 (80)	96 (86)	95 (76)	97 (80)	97 (71)
4xIF	>110	>110	>110	>110	>110	>110
5xIF	>120	>120	>120	>120	>120	>120

A sample upconversion spurious sweep is shown below. A 2.0 GHz reference IF input is used to create an RF output that is 2.0 GHz below the LO input (LO-IF=RF). A second LO (2.0 GHz higher) is combined with the same 2.0 GHz IF input (LO-2xIF=RF) to create the same 10 MHz to 16.0 GHz RF output band. The RF band is limited to 16 GHz so that the LO does not exceed 20 GHz. 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.

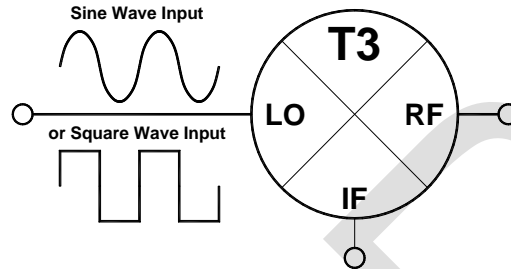





TWO-TONE-TERMINATOR MIXER

T3H-20

Page 6

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 10 MHz to 18 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) +27 dBm (I-Version)
Operating Temperature	-55°C to +100°C
Storage Temperature	-65°C to +125°C
ESD Sensitivity (HBM)	Class 0

DATA SHEET NOTES:

- Mixer Conversion Loss Plot IF frequency is 2.0 GHz.
- Mixer Noise Figure typically measures within 0.5 dB of conversion loss for IF frequencies greater than 5 MHz.
- 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.
- Conversion Loss typically degrades less than 0.5 dB at +100°C and improves less than 0.5 dB at -55°C.
- Square Wave Drive created with an A0020, biased at + 6 Volts, with a +10 dBm input. Sine Wave data is taken with a +20 dBm LO input.
- Specifications are subject to change without notice. Contact Marki Microwave for the most recent specifications and data sheets.
- Catalog mixer circuits are continually improved. Configuration control requires custom mixer model numbers and specifications.

Marki Microwave reserves the right to make changes to the product(s) or information contained herein without notice. Marki Microwave makes no warranty, representation, or guarantee regarding the suitability of its products for any particular purpose, nor does Marki Microwave assume any liability whatsoever arising out of the use or application of any product.