TWO-TONE-TERMINATOR MIXER/LO-AMPLIFIER

MT3A-0113H

Die

Module

The MT3A-0113H is a versatile, robust, and broadband Two-Tone-Terminator mixer integrated with a low phase noise LO driver amplifier. The MT3A-0113H employs the most sophisticated mixer on the market today and offers unparalleled performance when compared to all other mixer technologies. The MT3A-0113H delivers exceptional IMD suppression with low conversion loss and high IP3. The integrated positive bias only LO amplifier allows for high linearity with LO drive levels down to just +5dBm.

Features

- Ultra-Broadband RF, LO, and IF
- Integrated Low Phase Noise LO Amplifier
- Up to +30dBm IIP3
- LO drive requirements down to +5dBm
- Application Note: T3 Mixer Primer

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

Parameter	LO (GHz)	RF (GHz)	IF (GHz)	Min	Typ	Max
Conversion Loss (dB)	1.0 – 13.0	1.0 – 13.0	0.5 – 2.0 2.0 – 8.5		9.5 11.5	14
LO Drive Level (dBm)				+5	+8	+15
LO Leakage (dBm) LO-RF LO-IF	 1.0 – 13.0 1.0 – 13.0	 1.0 – 13.0	 1.0 – 13.0		 See Plots	
RF-IF Isolation (dB)		1.0 – 13.0	1.0 – 13.0		See Plot	
Input 0.1 dB Compression (dBm)	1.0 – 13.0	1.0 – 13.0			+13	
Input Two-Tone Third Order Intercept Point (dBm)	1.0 – 13.0	1.0 – 13.0			See Plot	
Bias Requirements (mA) +6.0VB/+7.0VC				80	120	150

Part Number Options

Model Number	Description	Export Classification
MT3A-0113HPA	Connectorized Package	EAR99
MT3A-0113HCH-2	Bare Die	EAR99

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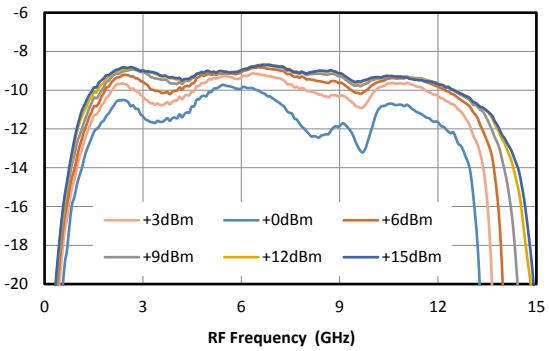
TWO-TONE-TERMINATOR MIXER/LO AMPLIFIER

MT3A-0113H

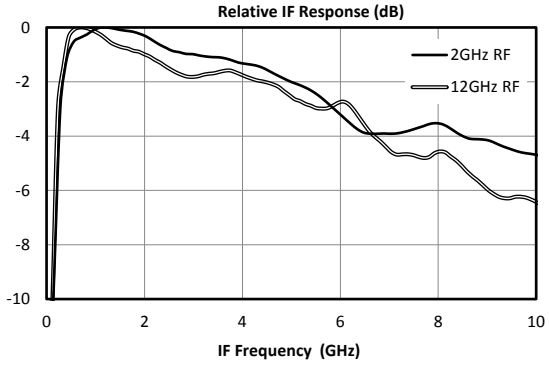
LO/RF 1 GHz to 13 GHz
IF 0.5 GHz to 8.5 GHz

Typical Performance

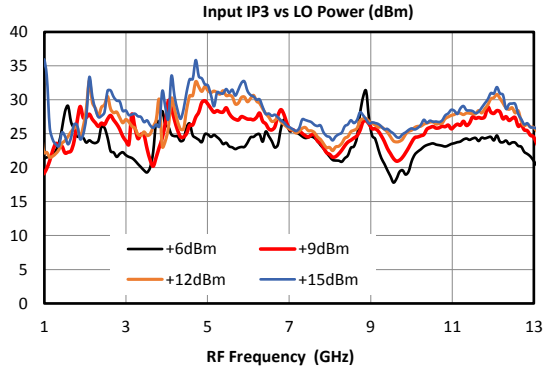
Conversion Loss vs LO Power (dB)



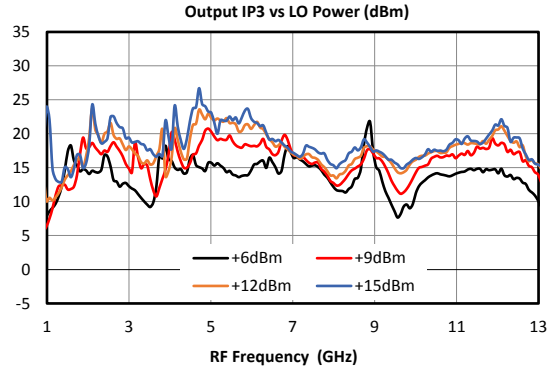
Relative IF Response (dB)



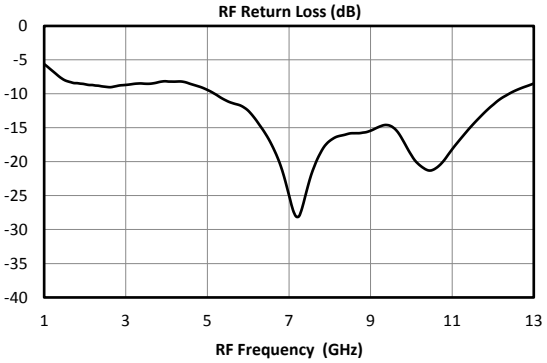
Input IP3 vs LO Power (dBm)



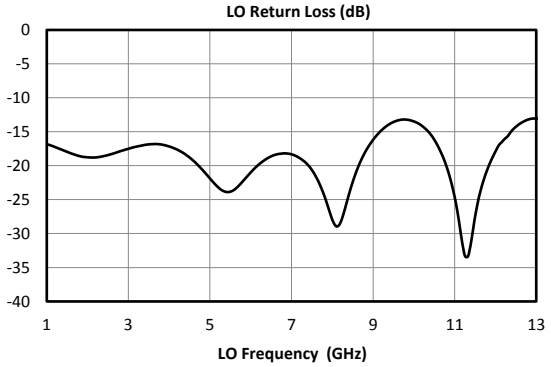
Output IP3 vs LO Power (dBm)



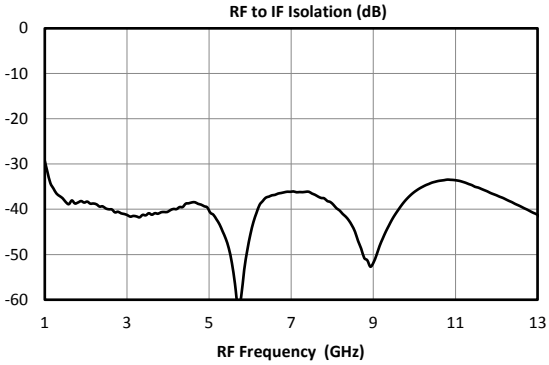
RF Return Loss (dB)



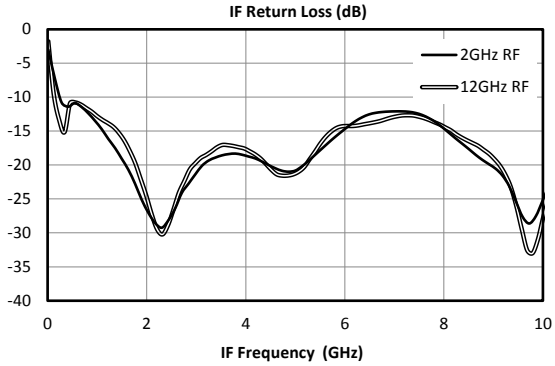
LO Return Loss (dB)



RF to IF Isolation (dB)



IF Return Loss (dB)



TWO-TONE-TERMINATOR MIXER

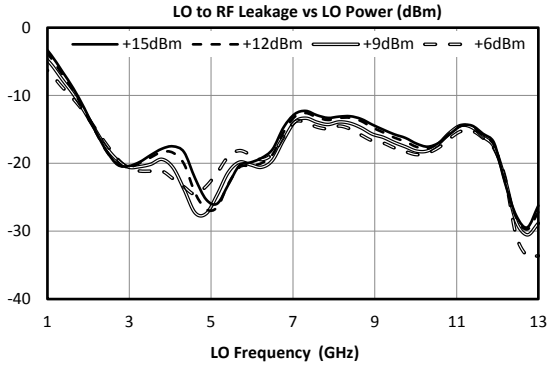
MT3A-0113H

Page 3

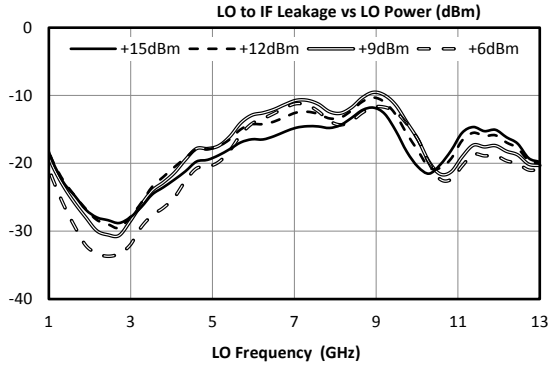
LO/RF 1 GHz to 13 GHz
IF 0.5 GHz to 8.5 GHz

Typical Performance

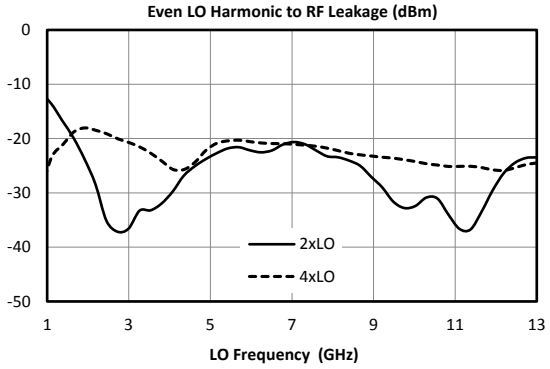
LO to RF Leakage vs LO Power (dBm)



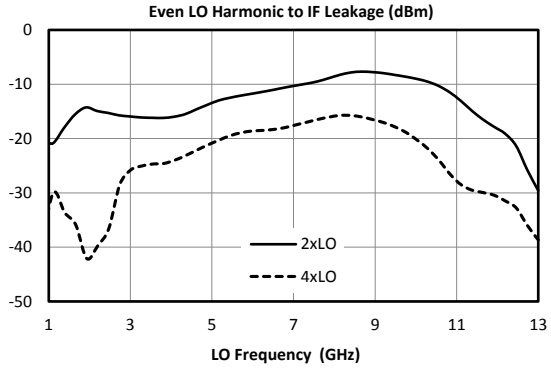
LO to IF Leakage vs LO Power (dBm)



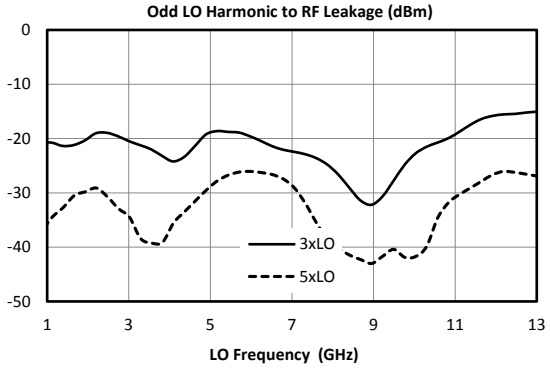
Even LO Harmonic to RF Leakage (dBm)



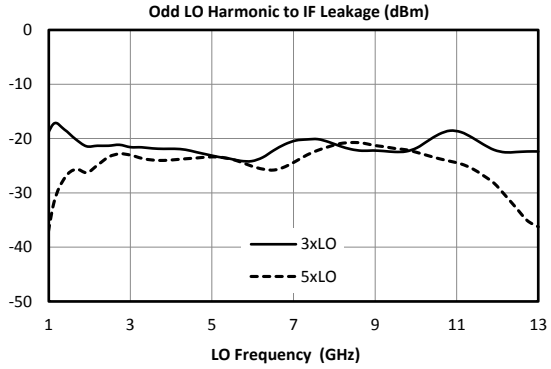
Even LO Harmonic to IF Leakage (dBm)



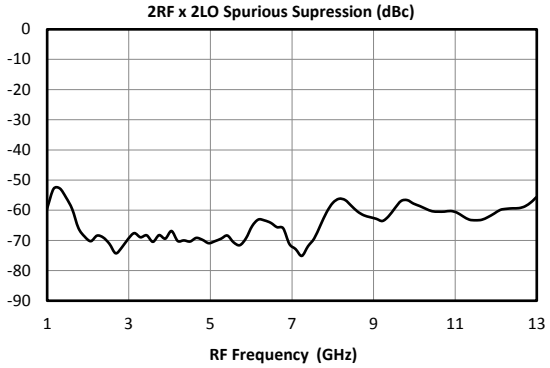
Odd LO Harmonic to RF Leakage (dBm)



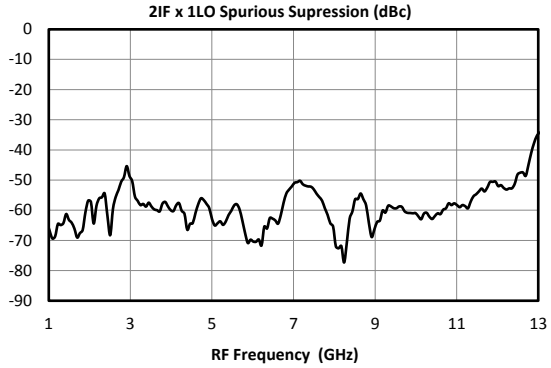
Odd LO Harmonic to IF Leakage (dBm)



2RF x 2LO Spurious Supression (dBc)



2IF x 1LO Spurious Supression (dBc)



LO/RF 1 GHz to 13 GHz
IF 0.5 GHz to 8.5 GHz

Upconversion Spurious Suppression

Spurious data is taken by mixing a 1 GHz IF with LO frequencies (±mLO±nIF), which creates an RF within the 1 GHz to 13 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 66 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 76 dBc.

Typical Upconversion Spurious Suppression (dBc): +12 dBm Sine Wave LO Input

-10 dBm RF Input	0xLO	1xLO	2xLO	3xLO	4xLO	5xLO
0xIF	----------	See LO to RF Isolation and LO Harmonic to RF Isolation Plots (Page 3)				
1xIF	29	Reference	20	17	17	21
2xIF	65	66	64	41	65	64
3xIF	102	81	57	80	84	83
4xIF	122	112	113	112	112	111
5xIF	147	132	127	127	128	128

Downconversion Spurious Suppression

Spurious data is taken by selecting RF and LO frequencies (±mLO±nRF) within the 1 GHz to 13 GHz RF/LO bands, which create a 1 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 63 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 73 dBc.

Typical Downconversion Spurious Suppression (dBc): +12 dBm Sine Wave LO Input

-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	23	Reference	20	16	17	25
2xRF	71	63	67	41	63	53
3xRF	91	80	56	78	75	73
4xRF	118	109	112	109	108	100
5xRF	129	124	129	123	124	119

Recommended Operating Conditions

The Recommended Operating Conditions indicate the limits, inside which the device should be operated, to guarantee the performance given in Electrical Specifications Operating outside these limits may not necessarily cause damage to the device, but the performance may degrade outside the limits of the electrical specifications. For limits, above which damage may occur, see Absolute Maximum Ratings.

Parameter	Min	Nominal	Max	Units
T_A, Ambient Temperature	-40	+25	+85	°C
Positive DC Voltage (VC)	+5	+7	+8	V
Quiescent DC Current (Ic)	26	44	65	mA
DC Current with RF Input (Ic)	-	-	150	mA
Positive DC Current Mirror Voltage (VB)	+5	+6	+8	V
Input Power for Saturation	-	+10	+16	dBm

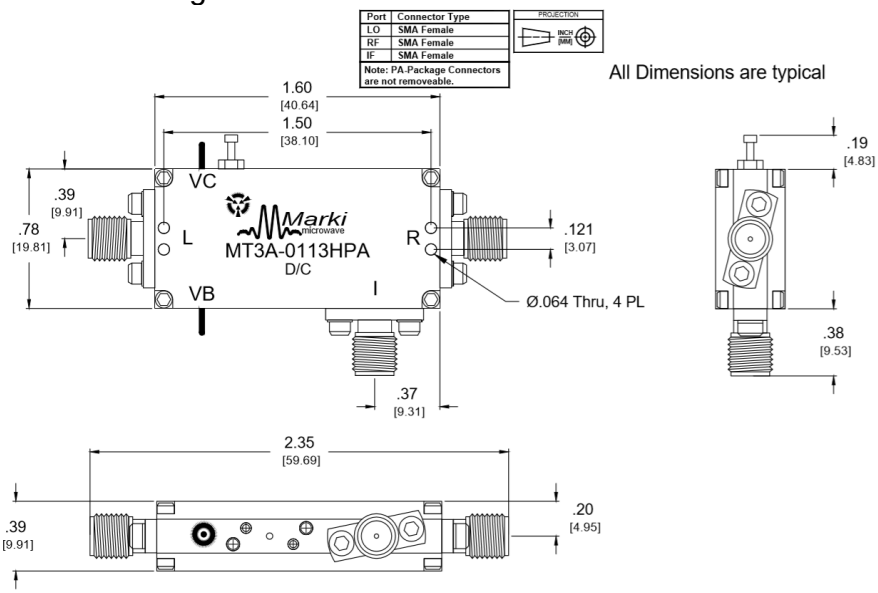
Absolute Maximum Ratings

The Absolute Maximum Ratings indicate limits beyond which damage may occur to the device. If these limits are exceeded, the device may become inoperable or have a reduced lifetime

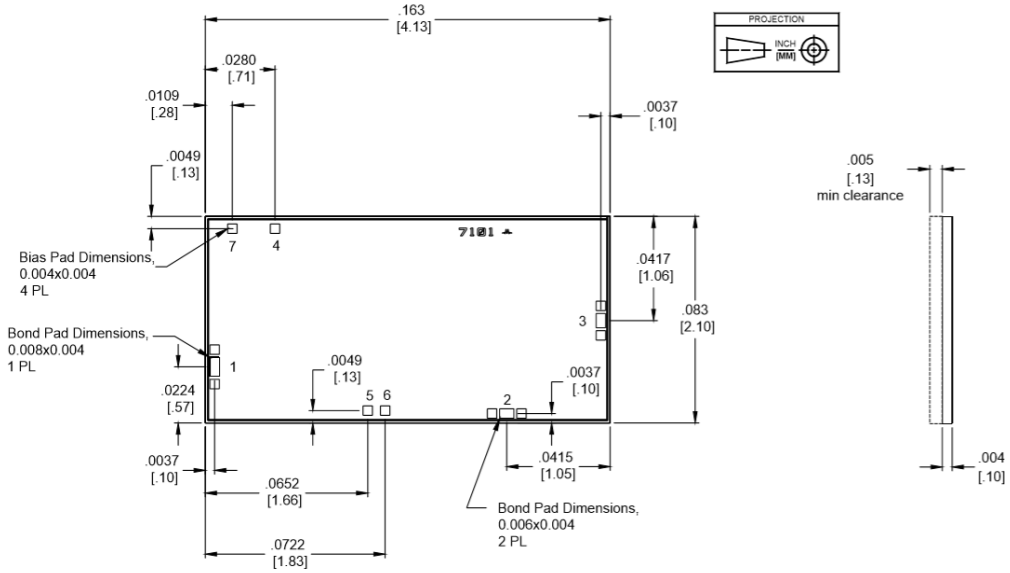
Absolute Maximum Ratings	
Parameter	**Maximum Rating**
DC Voltage on VB or VC	+8V
DC Bias Current	150mA
RF Power Handling	+16dBm
LO Power Handling	+16dBm
Operating Temperature	-55ºC to +85ºC
Storage Temperature	65ºC to +125ºC
θJC, Junction to Case Thermal Resistance	TBD ºC/W
Max Junction Temperature for MTTF> 1E6 hours	TBD ºC
Max Power Dissipation for MTTF of 1E6 hours at 85˚C Baseplate Temperature	TBD mW
ESD Sensitivity (HBM)	TBD

LO/RF 1 GHz to 13 GHz
IF 0.5 GHz to 8.5 GHz

Connectorized Outline Drawing



Bare Die Outline Drawing



Notes:

1. CH substrate is .004 in Thick GaAs.
2. I/O trace is 4.2 microns and ground plane is 5 microns Au.
3. Tolerance for X, Y dimensions is ± 0.002 in.
   Tolerance for Z dimension is ± 0.0005 in.
   Tolerance for pad location is ± 0.0001 in.

All Dimensions are typical

Function	Port Number
LO	1
IF	2
RF	3
Vc	4
Vb	5, 6
External caps for waveform tuning	7

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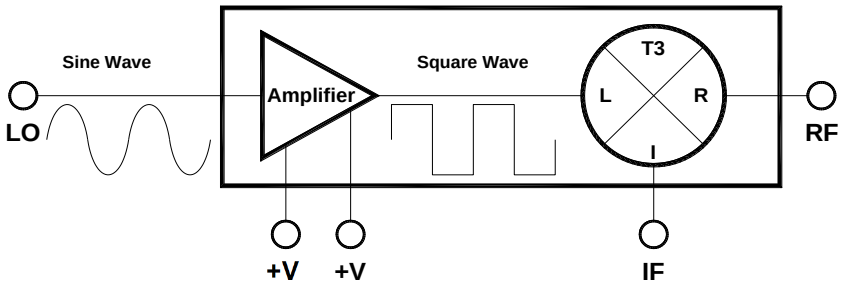
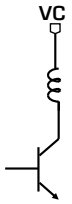
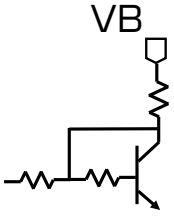


See T3 Mixer Primer for benefits of square wave LO drive

Port	Description	DC Interface Schematic
LO	The LO port is DC blocked and AC matched to 50 Ohms from 1 GHz to 13 GHz.	
RF	The RF port is DC short to ground and AC matched to 50 Ohms from 1 GHz to 13 GHz. Blocking capacitor is optional.	
IF	The IF port is DC blocked and AC matched to 50 Ohms from 500 MHz to 8.5 GHz.	
VC	Port VC is the DC voltage supply for that supplies the amplifier's collector current. It is connected internally through the amplifier die's RF output port.	
VB	Port VB is the DC voltage bias for the current mirror that controls collector current supplied to the amplifier. Larger voltages result in a higher current draw through port VC, effectively functioning as a gain control pin of the amplifier	
GND	CH package ground path is provided through the substrate and ground bond pads. PA package ground provided through metal housing and outer coax conductor.	

Revision Code	Revision Date	Comment
–	11/10/2020	Datasheet Initial Release
A	11/17/2020	Connector changed from 2.92mm to SMA
B	4/23/2021	LO to RF/IF Leakage Plots Updated
C	6/9/21	RF/LO Absolute Maximum Power Handling Updated

DATA SHEET NOTES:

1. Mixer Conversion Loss Plot IF frequency is 1 GHz and LO power is +12dBm.
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. There are no sequencing requirement for powering the integrated LO driver amplifier on or off.
5. Specifications are subject to change without notice. Contact Marki Microwave for the most recent specifications and data sheets.
6. Catalog mixer circuits are continually improved. Configuration control requires custom mixer model numbers and specifications.

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