Sales: 408-778-9952 | General: 408-778-4200 | Fax: 408-778-4300
Sales & Customer Support: sales@markimicrowave.com
Tech Support: support@markimicrowave.com

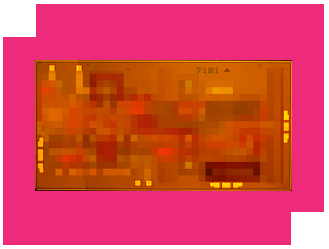
MT3A-0113HCH-2

Two-Tone-Terminator Mixer/LO-Amplifier

DEVICE OVERVIEW

General Description

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.



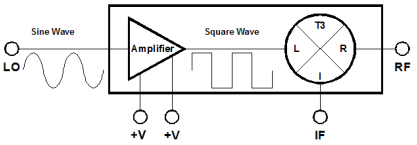
Features

- Ultra-Broadband RF, LO, and IF
- Integrated Low Phase Noise LO Amplifier
- Up to +30dBm IIP3
- LO drive requirements down to +5dBm

Applications

N/A

Functional Block Diagram



Part Ordering Options

Part Number	Description	Package	Connectors	Green Status	Product Lifecycle	Export Classification
MT3A-0113HPA	Two-Tone-Terminator Mixer/LO-Amplifier	PA	Standard	REACH RoHS REACH RoHS	Released	EAR99
MT3A-0113HCH-2	Two-Tone-Terminator Mixer/LO-Amplifier	CH	-	REACH RoHS REACH RoHS	Released	EAR99

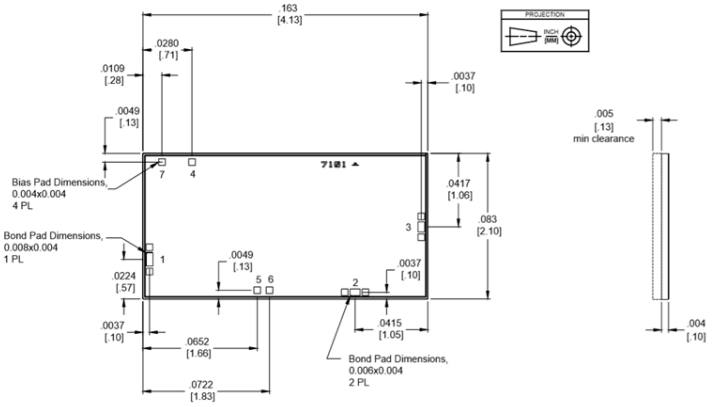
Table Of Contents

Revision History

Revision Code	Revision Date	Comment
-	2020-11-10	Datasheet Initial Release
A	2020-11-17	
B	2021-04-23	LO to RF/IF Leakage Plots Updated
C	2021-06-09	RF/LO Absolute Maximum Power Handling Updated

Port Configuration and Functions

Port Diagram



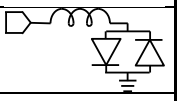
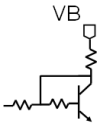
Notes:

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

Port Functions

Port	Function	Description	DC Equivalent Circuit
GND	Ground	CH package ground path is provided through the substrate and ground bond pads.	
Port 1	LO	The LO port is DC blocked and AC matched to 50 Ohms from 1 GHz to 13 GHz.	
Port 2	IF	The IF port is DC blocked and AC matched to 50 Ohms from 500 MHz to 8.5 GHz.	
Port 3	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.	-
Port 4	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.	
Port 5	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	

Specifications

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

Parameter	Maximum Rating	Unit
DC Bias Current	150	mA
DC Voltage on VB or VC	8	V
LO Power Handling	16	dBm
Maximum Operating Temperature	85	°C
Maximum Storage Temperature	125	°C
Minimum Operating Temperature	-55	°C
Minimum Storage Temperature	65	°C
RF Power Handling	16	dBm

Package Information

Parameter	Details	Rating
Dimensions	-	4.13 x 2.10 mm

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	Unit
Ambient Temperature	-40	25	85	°C
Positive DC Voltage	5	7	1	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
LO Input Power	3	-	15	-

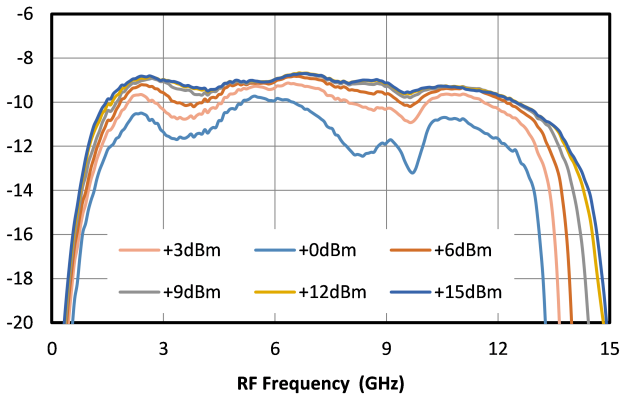
Electrical Specifications

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

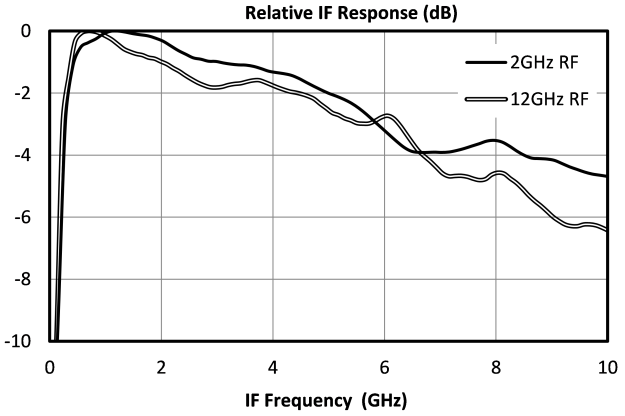
Parameter	Test Conditions	Min	Typ	Max	Unit
Conversion Loss	LO/RF=1-13 GHz IF= 0.5-2.0 GHz	-	9.5	14	dB
Conversion Loss	LO/RF=1-13 GHz IF= 2.0-8.5 GHz	-	11.5	-	dB
Current Consumption	+6.0VB/+7.0VC	80	120	150	mA
IF Frequency Range	-	0.5	-	8.5	GHz
Input P0.1 dB	LO/RF=1-13 GHz	-	13	-	dBm
LO Drive Level	-	5	8	15	dBm
LO Frequency Range	-	1	-	13	GHz
RF Frequency Range	-	1	-	13	GHz
Input IP3	-	-	28	-	dBm

Typical Performance Plots

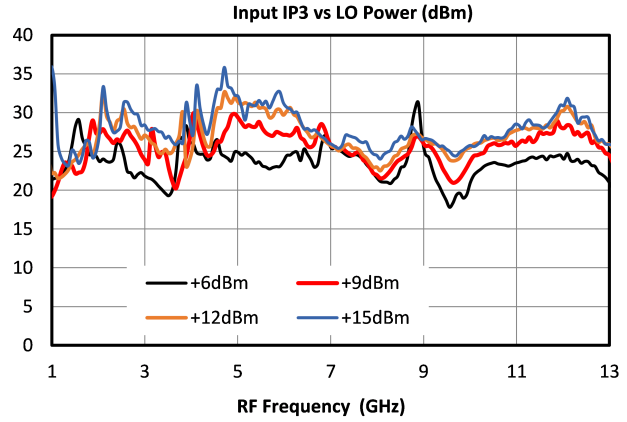
Conversion Loss vs LO Power (dB)



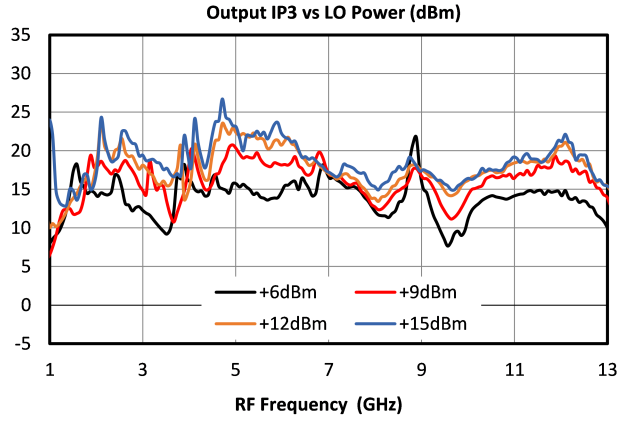
Relative IF Response (dB)



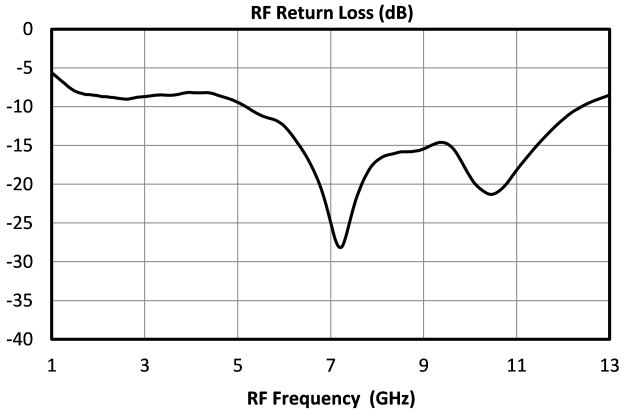
Input IP3 vs LO Power (dBm)



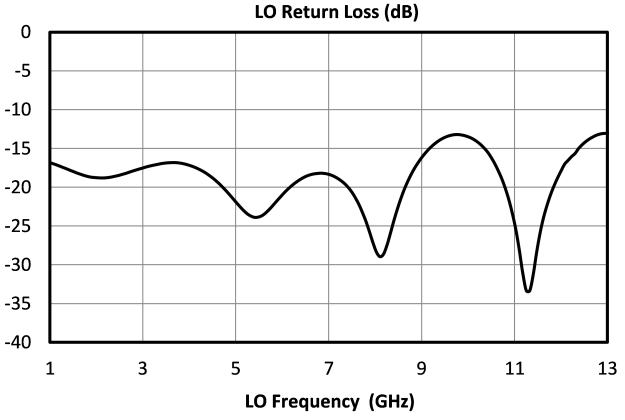
Output IP3 vs LO Power (dBm)



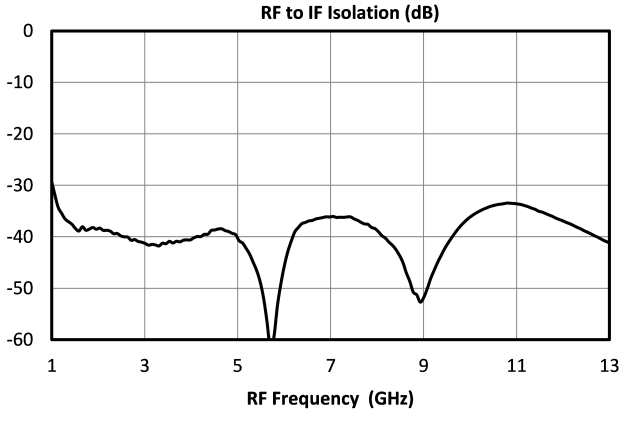
RF Return Loss (dB)



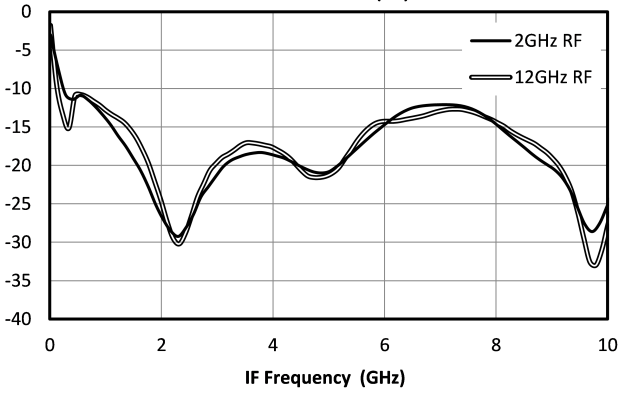
LO Return Loss (dB)



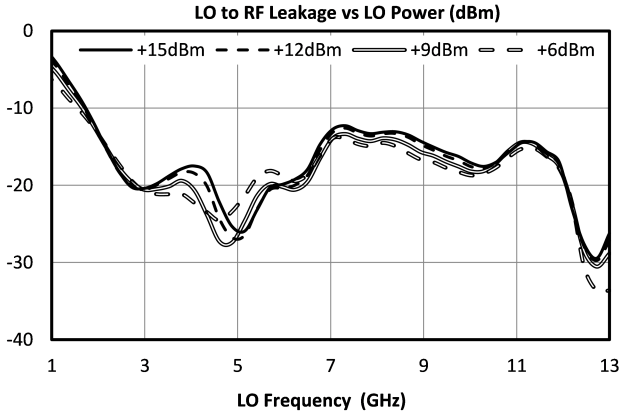
RF to IF Isolation (dB)



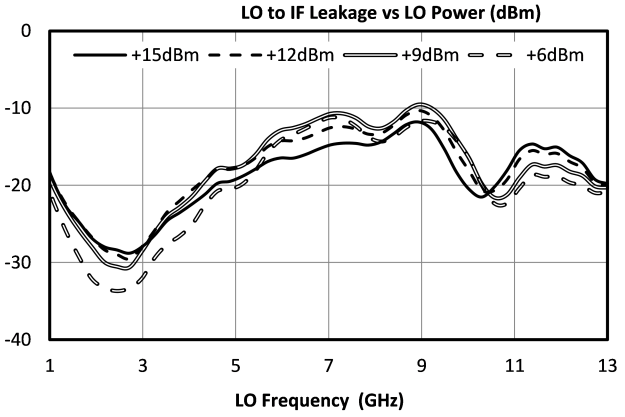
IF Return Loss (dB)



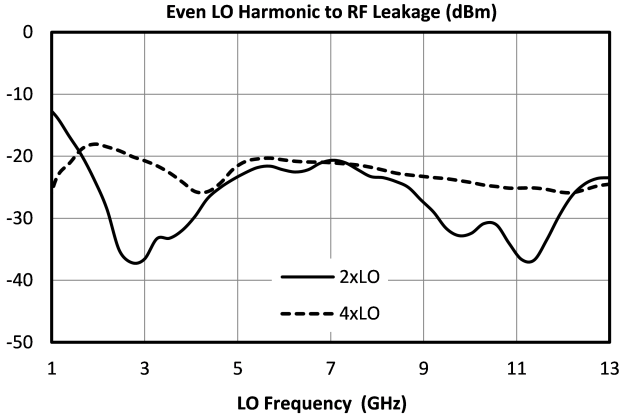
LO to RF Leakage vs LO Power (dBm)



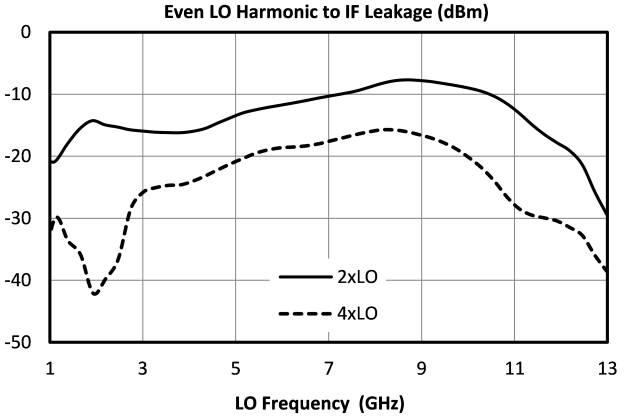
LO to IF Leakage vs LO Power (dBm)



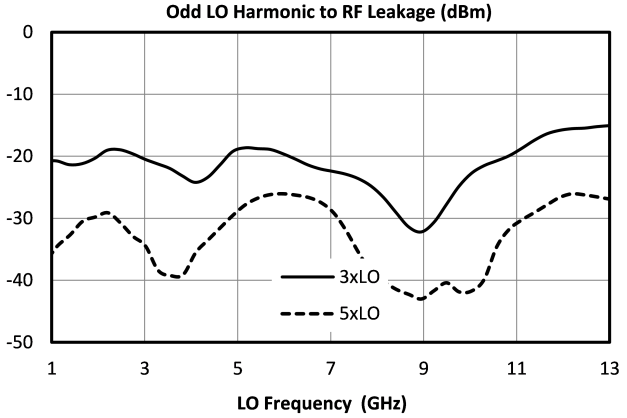
Even LO Harmonic to RF Leakage (dBm)



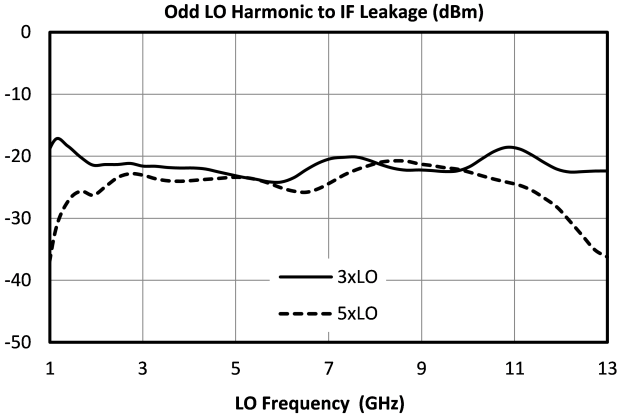
Even LO Harmonic to IF Leakage (dBm)



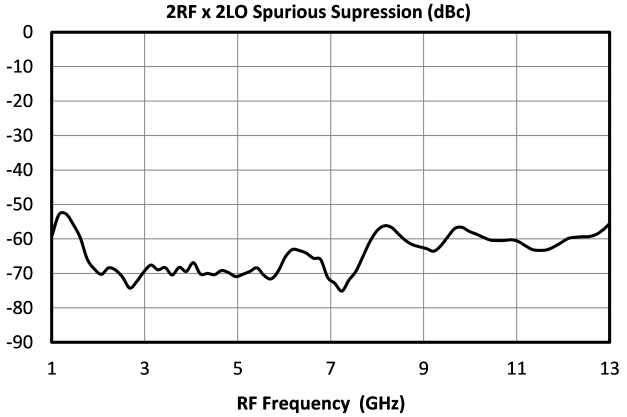
Odd LO Harmonic to RF Leakage (dBm)



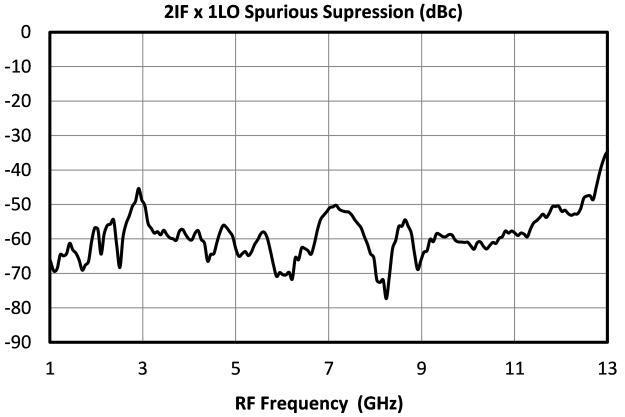
Odd LO Harmonic to IF Leakage (dBm)



2RF x 2LO Spurious Supression (dBc)

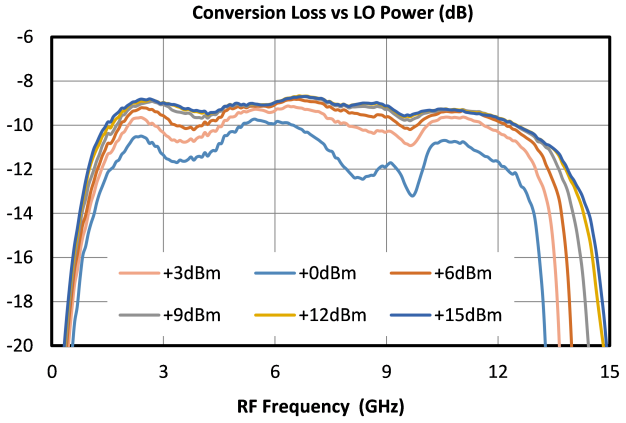


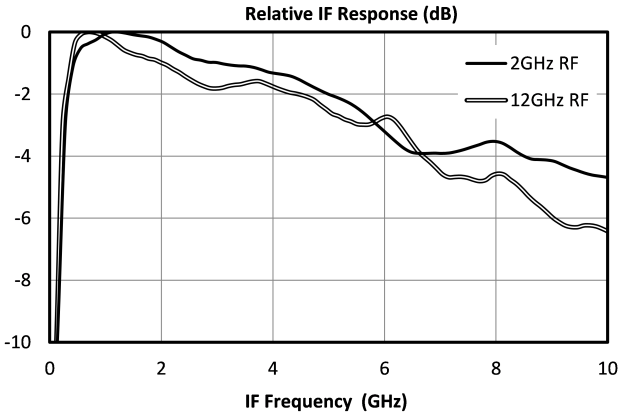
2IF x 1LO Spurious Supression (dBc)

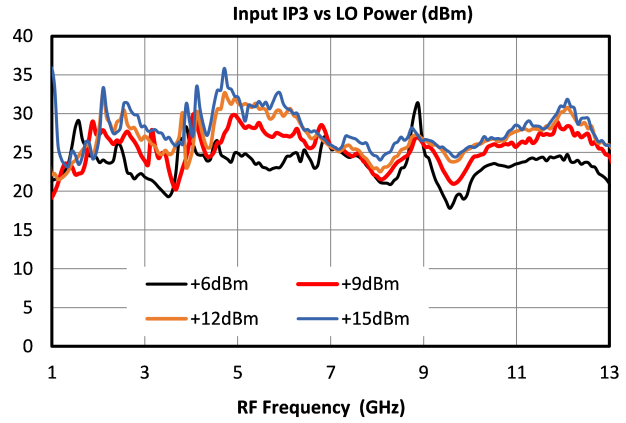


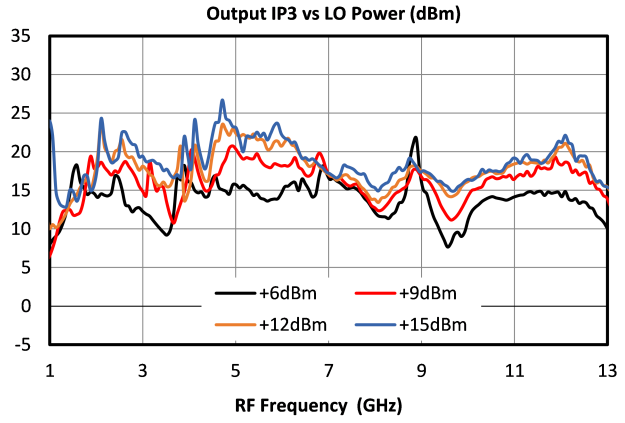
MT3A-0113HPA - Typical Performance Plots

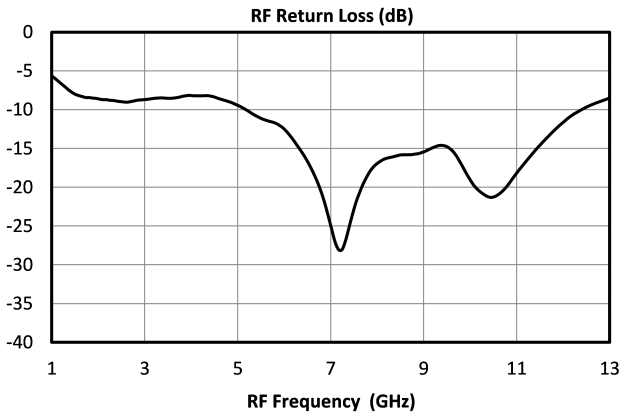
Performance plots for the connectorized module are shown for measurements where directly probed measurements of the die are unavailable. Note that the following measurements include losses from connectors and microstrip traces.

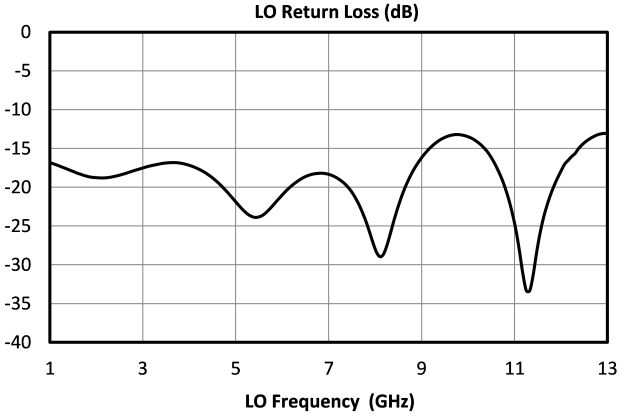


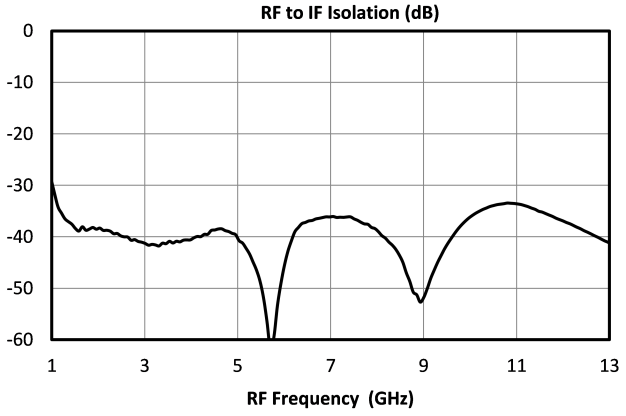


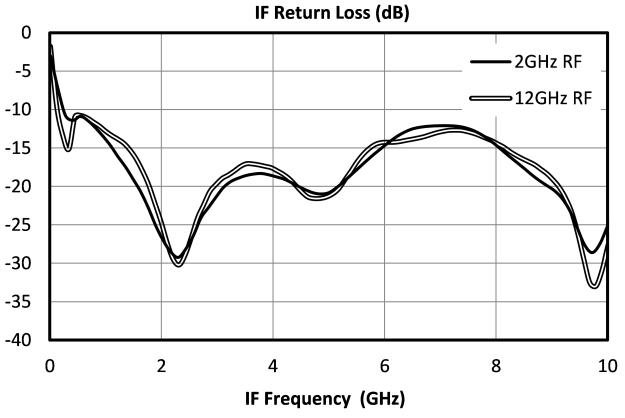




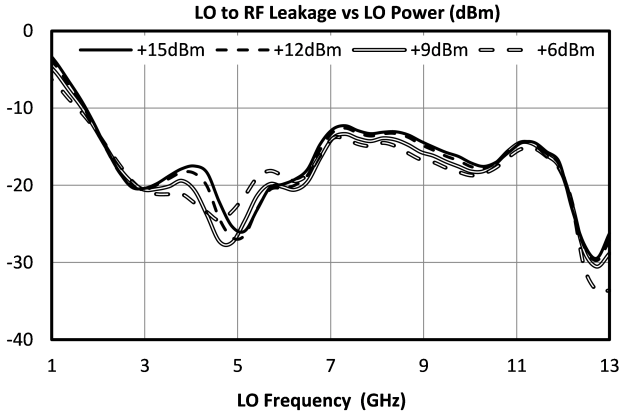




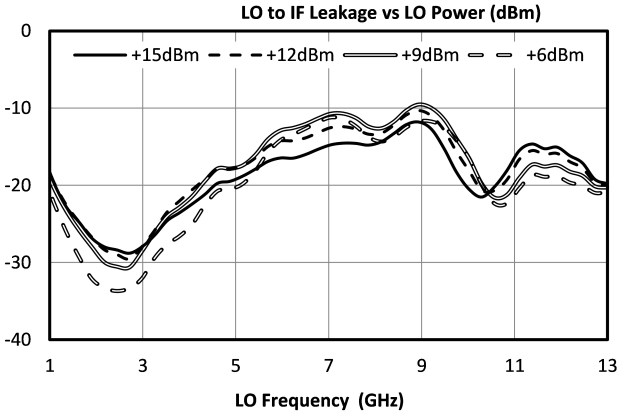




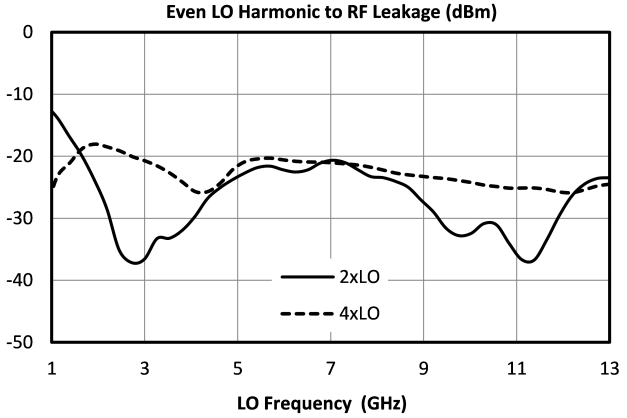
LO to RF Leakage vs LO Power (dBm)



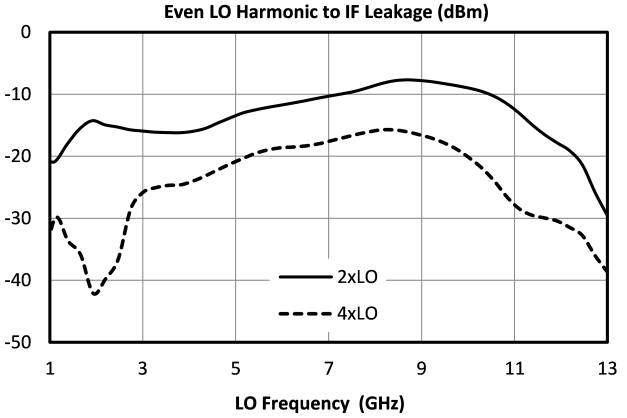
LO to IF Leakage vs LO Power (dBm)



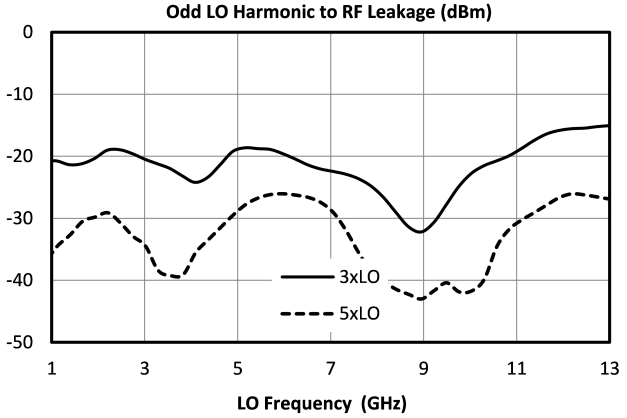
Even LO Harmonic to RF Leakage (dBm)



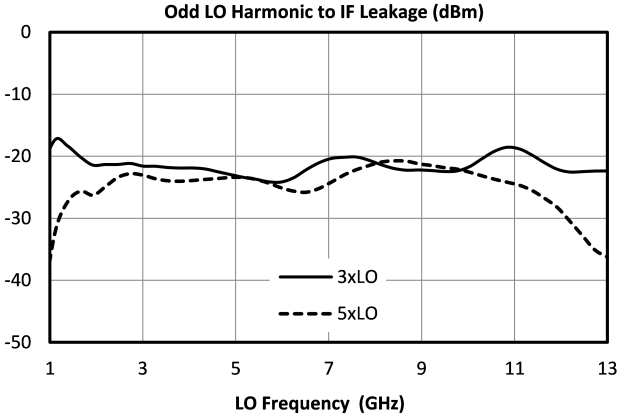
Even LO Harmonic to IF Leakage (dBm)



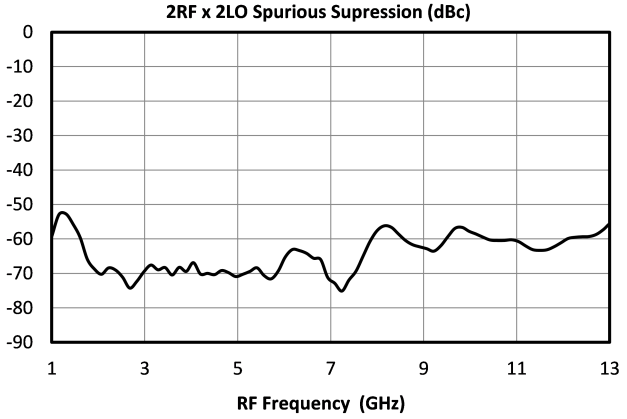
Odd LO Harmonic to RF Leakage (dBm)



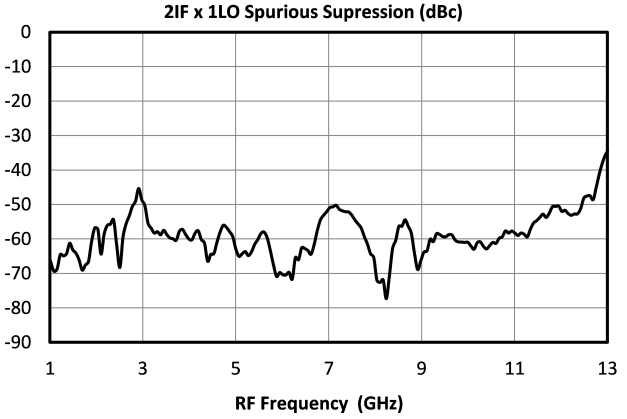
Odd LO Harmonic to IF Leakage (dBm)



2RF x 2LO Spurious Supression (dBc)



2IF x 1LO Spurious Supression (dBc)



Spur Table

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

Mechanical Data

Outline Drawing

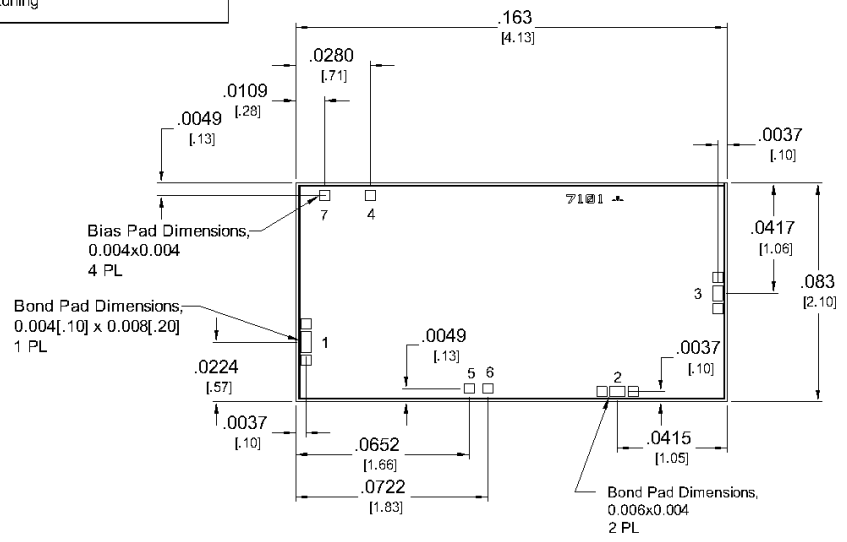
Download : Outline 2D Drawing

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

PROJECTION INCH [MM]

REVISIONS			
REV.	DESCRIPTION	DATE	APPROVALS
B	ECN 24096 remove gel-pak info.	10/25/24	AT

All Dimensions are typical



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.

NOTES:		Marki microwave www.markimicrowave.com
DRAWN BY	DATE	Outline MMIC Mixer
HB	8/11/20	
MATERIAL: 221-07101		SIZE A / CAGE CODE 0UC32 / DWG. NO. MT3A-0113HCH-2
FINISH: Note		SCALE 20/1 / SHEET 1 OF 1
DO NOT SCALE DRAWING		

Notes

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.

DISCLAIMER