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Sales & Customer Support: sales@markimicrowave.com
Tech Support: support@markimicrowave.com

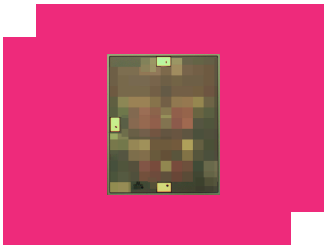
MM1-0626SCH-2

GaAs MMIC Double Balanced Mixer

DEVICE OVERVIEW

General Description

The MM1-0626S is a high linearity passive double balanced MMIC mixer. The S diode offers superior 1 dB compression, two tone intermodulation performance, and spurious suppression to other GaAs MMIC mixers. It features excellent conversion loss, superior isolations and spurious performance across a broad bandwidth, in a miniature form factor. Accurate, nonlinear simulation models are available for Microwave Office® through the Marki Microwave PDK. The MM1-0626S is available as a wire bondable chip or an SMA connectorized package. The MM1-0626S is a superior alternative to Marki Microwave carrier and packaged M1 and M3 mixers.



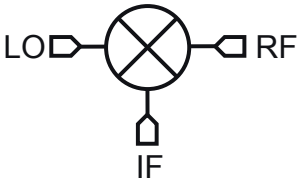
Features

- Compact Chip Style Package (0.054” x 0.046”x0.004”)
- CAD Optimized for Superior Isolation and Spurious Response
- Broadband Performance
- Excellent Unit-to-Unit Repeatability
- Fully nonlinear software models available with Marki PDK for Microwave Office®
- RoHS Compliant

Applications

N/A

Functional Block Diagram



Part Ordering Options

Part Number	Description	Package	Connectors	Green Status	Product Lifecycle	Export Classification
MM1-0626SS	GaAs MMIC Double Balanced Mixer	S	Standard	REACH RoHS	Released	EAR99
MM1-0626SCH-2	GaAs MMIC Double Balanced Mixer	CH	-	REACH RoHS	Released	EAR99

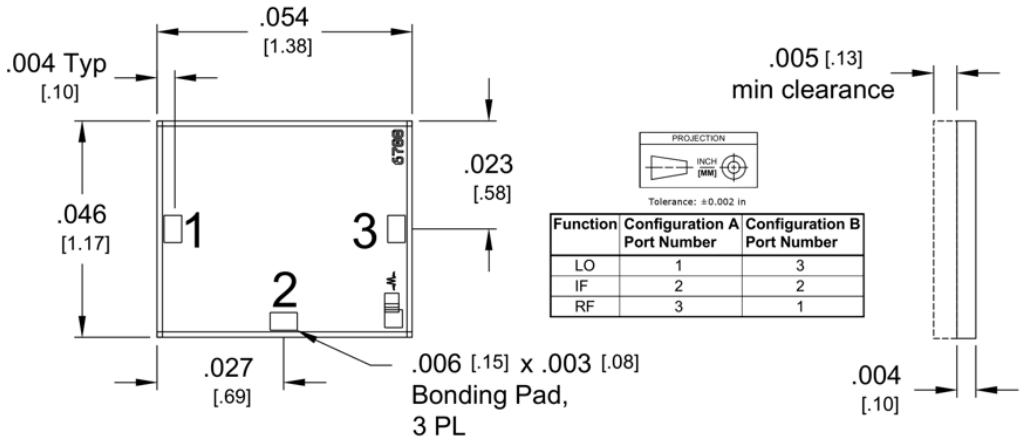
Table Of Contents

Revision History

Revision Code	Revision Date	Comment
A	2019-02-01	Die shrunk from 1.47 x 1.18 mm2 to 1.38 x 1.17 mm2. CH package tolerance added.
B	2022-08-01	Recommended LO Drive Range Updated

Port Configuration and Functions

Port Diagram

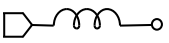
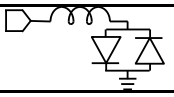
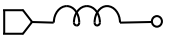


Function	Configuration A Port Number	Configuration B Port Number
LO	1	3
IF	2	2
RF	3	1

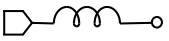
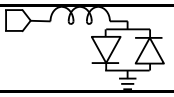
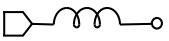
1. CH Substrate material is .004 in thick GaAs.
2. I/O traces finish is 4.2 microns Au. Ground plane finish is 5 microns Au.
3. Wire Bonding - Ball or wedge bond with 0.025 mm (1 mil) diameter pure gold wire. Thermosonic wirebonding with a nominal stage temperature of 150 °C and a ball bonding force of 40 to 50 grams or wedge bonding force of 18 to 22 grams is recommended. Use the minimum level of ultrasonic energy to achieve reliable wirebonds. Wirebonds should be started on the chip and terminated on the package or substrate. All bonds should be as short as possible <0.31 mm (12 mils).

Port Functions

Configuration A

Port	Function	Description	Equivalent Circuit for Package
Port 1	LO	Port 1 is DC open and AC matched to 50 Ohms from 6 to 26.5 GHz. Blocking capacitor is optional.	
Port 2	IF	Port 2 is DC coupled to the diodes. Blocking capacitor is optional.	
Port 3	RF	Port 3 is DC open and AC matched to 50 Ohms from 6 to 26.5 GHz. Blocking capacitor is optional.	

Configuration B

Port	Function	Description	Equivalent Circuit for Package
Port 1	RF	Port 1 is DC open and AC matched to 50 Ohms from 6 to 26.5 GHz. Blocking capacitor is optional.	
Port 2	IF	Port 2 is DC coupled to the diodes. Blocking capacitor is optional.	
Port 3	LO	Port 3 is DC open and AC matched to 50 Ohms from 6 to 26.5 GHz. Blocking capacitor is optional.	

Specifications

Absolute Maximum Ratings

Specifications guaranteed from -55 to +100°C, measured in a 50Ω system. Specifications are shown for Configurations A (B). All bare die are 100% DC tested and 100% visually inspected. RF testing is performed on a sample basis to verify conformance to datasheet guaranteed specifications. Consult factory for more information.

Parameter	Maximum Rating	Unit
Maximum Operating Temperature	100	°C
Maximum Storage Temperature	125	°C
Minimum Operating Temperature	-55	°C
Minimum Storage Temperature	-65	°C
Port 2 DC Current	15	mA
RF Power Handling (RF+LO), 100°C	20	dBm
RF Power Handling (RF+LO), 25°C	32	dBm

Package Information

Parameter	Details	Rating
Dimensions	-	1.38 x 1.17 mm

Recommended Operating Conditions

Parameter	Min	Nominal	Max	Unit
LO Input Power	17	-	23	-

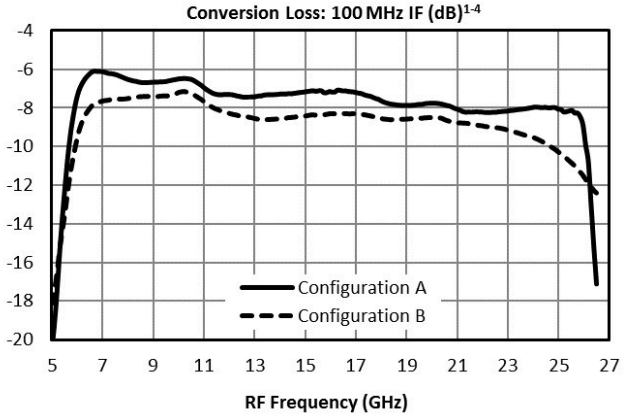
Electrical Specifications

Specifications guaranteed from -55 to +100°C, measured in a 50Ω system. Specifications are shown for Configurations A (B). All bare die are 100% DC tested and 100% visually inspected. RF testing is performed on a sample basis to verify conformance to datasheet guaranteed specifications. Consult factory for more information.

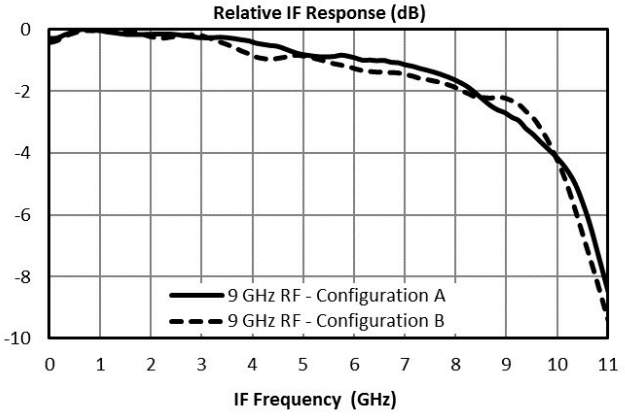
Parameter	Port Configuration	Test Conditions	Min	Typ	Max	Unit
Conversion Loss	A	LO=6-26GHz RF=6-26.5GHz IF=DC-9GHz LO drive level=20dBm	-	7.5	-	dB
Input 1 dB Compression	A	LO=6-26GHz RF=6-26.5GHz IF=DC-9GHz LO drive level=17-23dBm	-	14	-	dBm
Input IP3	A	LO=6-26GHz RF=6-26.5GHz IF=DC-9GHz LO drive level=17-23dBm	-	27	-	dBm
Conversion Loss	B	LO=6-26.5GHz RF=6-26GHz IF=DC-9GHz LO drive level=20dBm	-	8.5	-	dB
Input 1 dB Compression	B	LO=6-26.5GHz RF=6-26GHz IF=DC-9GHz LO drive level=17-23dBm	-	14	-	dBm
Input IP3	B	LO=6-26.5GHz RF=6-26GHz IF=DC-9GHz LO drive level=17-23dBm	-	28	-	dBm
IF Frequency Range	-	-	0	-	9	GHz
Isolation, LO to IF	-	LO=6-26GHz RF=6-26.5GHz IF=DC-9GHz LO drive level=17-23dBm	-	34	-	dB
Isolation, LO to RF	-	LO=6-26GHz RF=6-26.5GHz IF=DC-9GHz LO drive level=17-23dBm	-	47	-	dB
Isolation, RF to IF	-	LO=6-26GHz RF=6-26.5GHz IF=DC-9GHz LO drive level=17-23dBm	-	34	-	dB
LO Frequency Range	-	-	6	-	26.5	GHz
RF Frequency Range	-	-	6	-	26.5	GHz
RF Frequency Range	-	-	6	-	26	GHz

Typical Performance

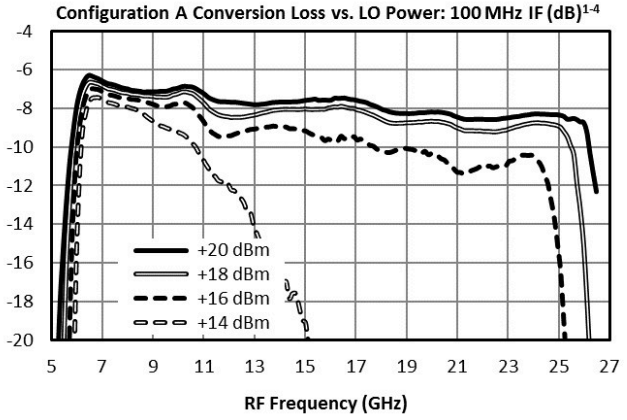
Conversion Loss: 100 MHz IF (dB)[1-4]



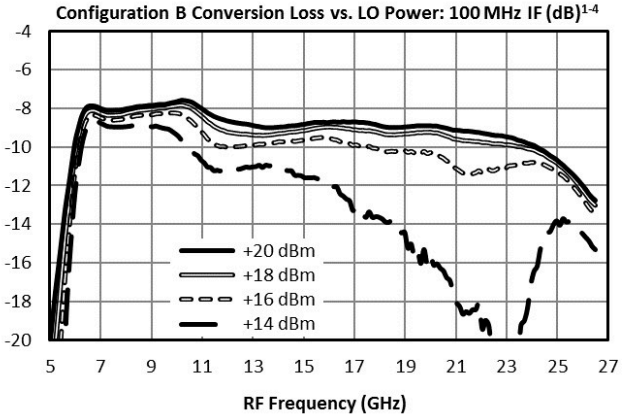
Relative IF Response (dB)



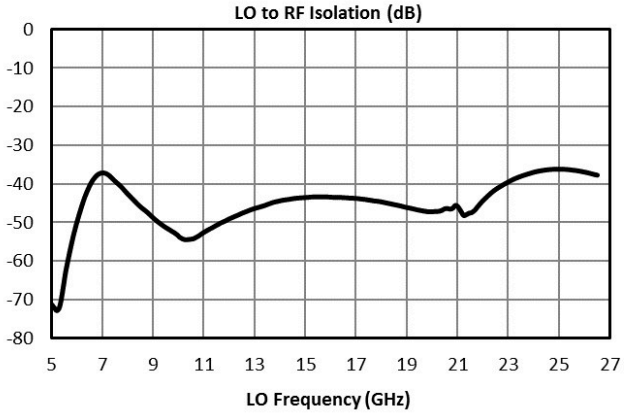
Configuration A Conversion Loss vs. LO Power: 100 MHz IF (dB)[1-4]



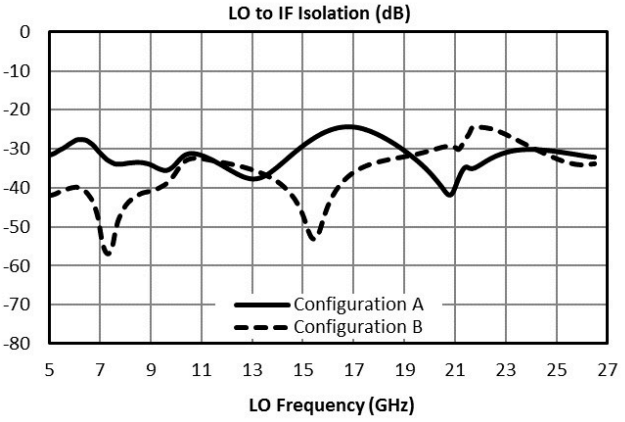
Configuration B Conversion Loss vs. LO Power: 100 MHz IF (dB)[1-4]



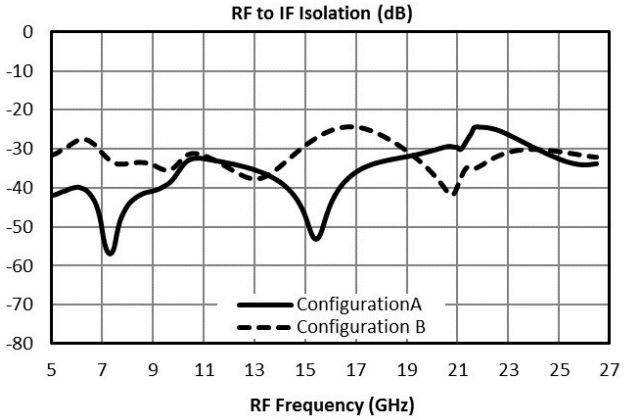
LO to RF Isolation (dB)



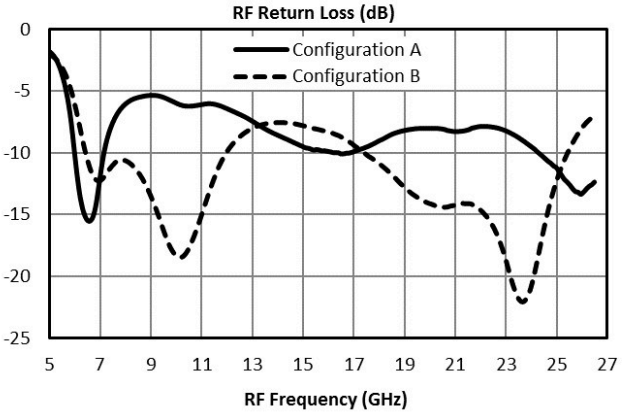
LO to IF Isolation (dB)



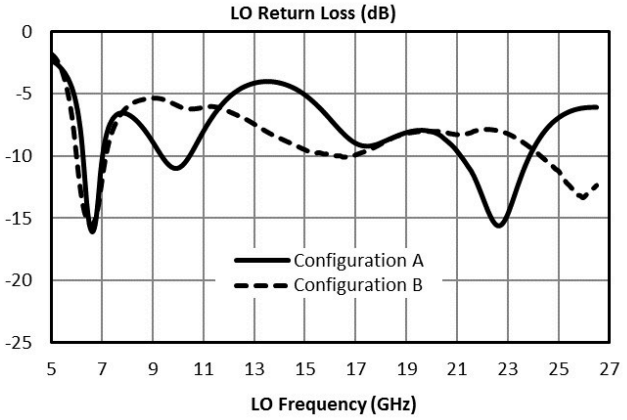
RF to IF Isolation (dB)



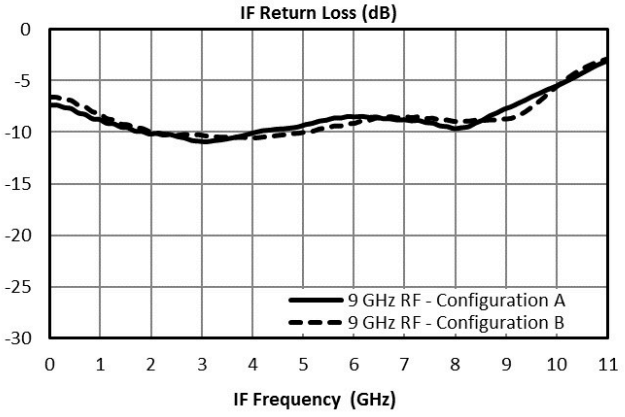
RF Return Loss (dB)



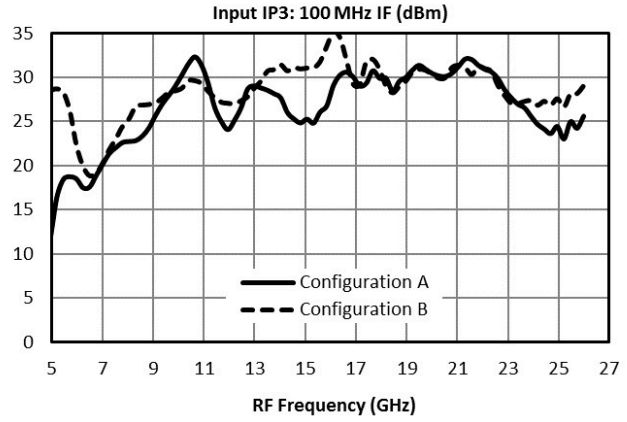
LO Return Loss (dB)



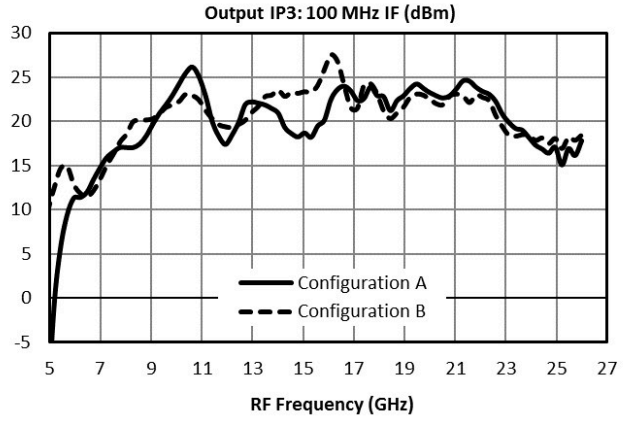
IF Return Loss (dB)



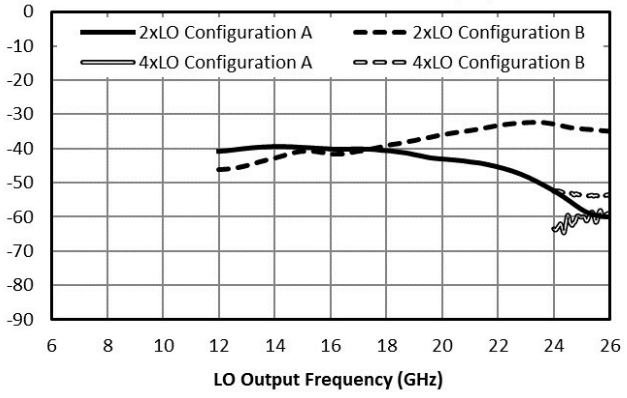
Input IP3: 100 MHz IF (dBm)



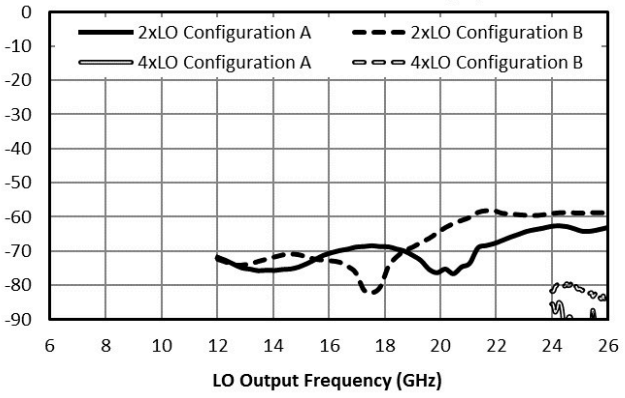
Output IP3: 100 MHz IF (dBm)



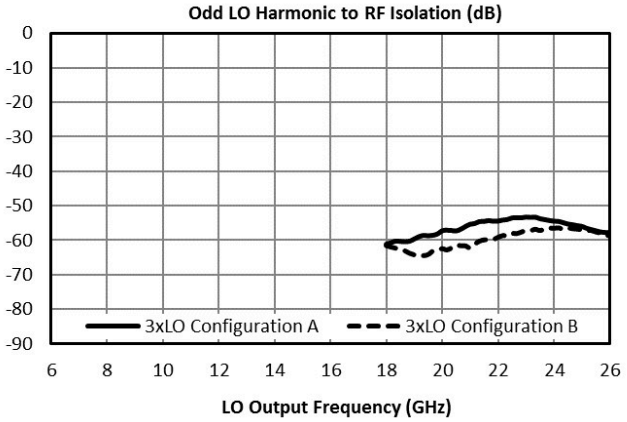
Even LO Harmonic to RF Isolation (dB)



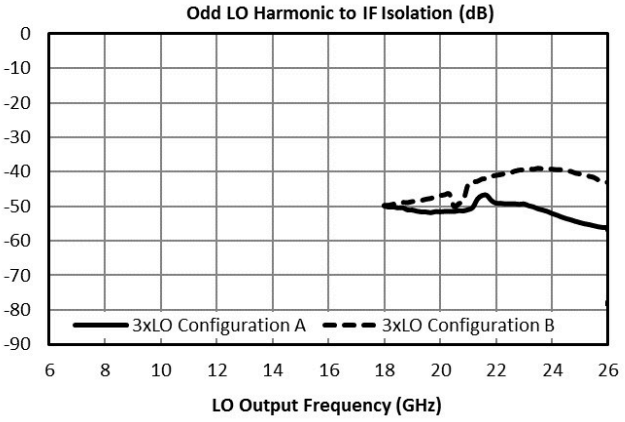
Even LO Harmonic to IF Isolation (dB)

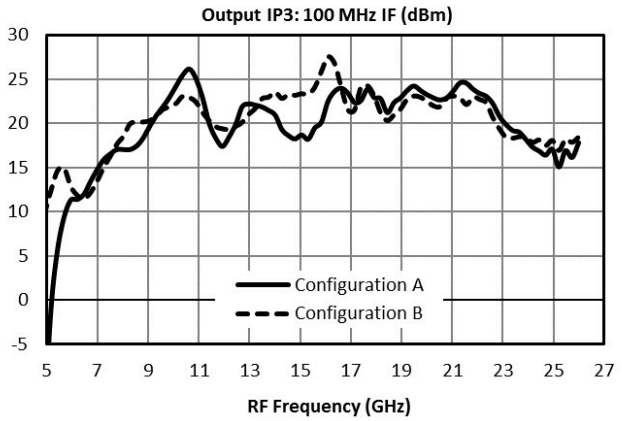


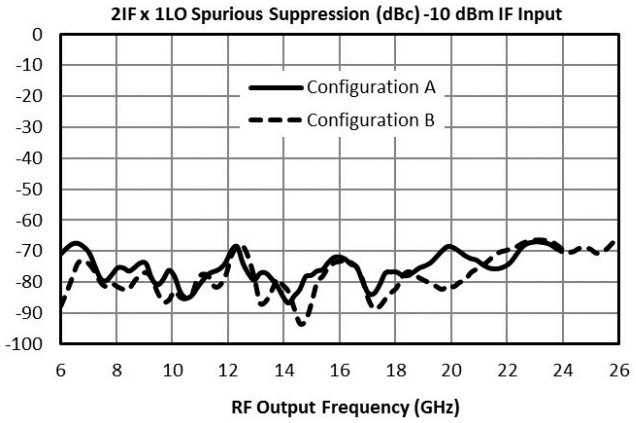
Odd LO Harmonic to RF Isolation (dB)



Odd LO Harmonic to IF Isolation (dB)

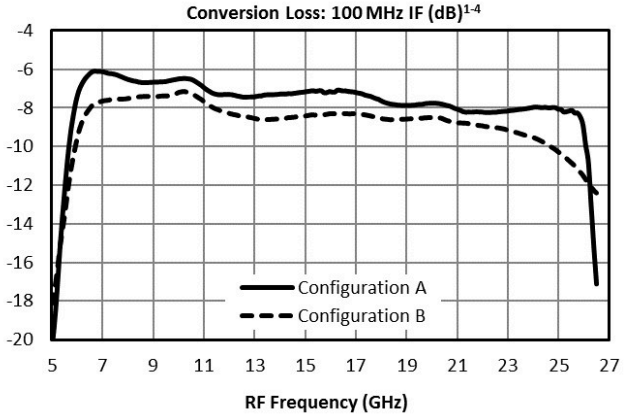


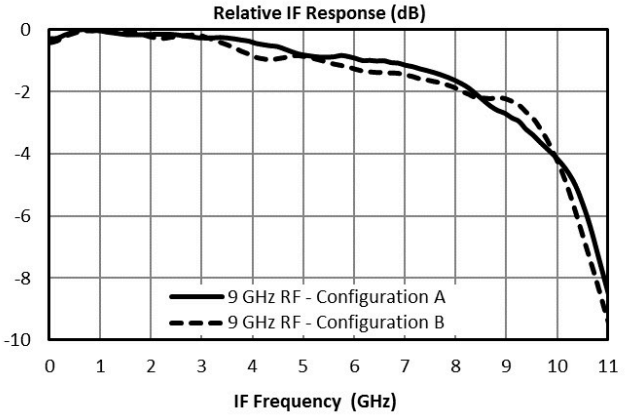


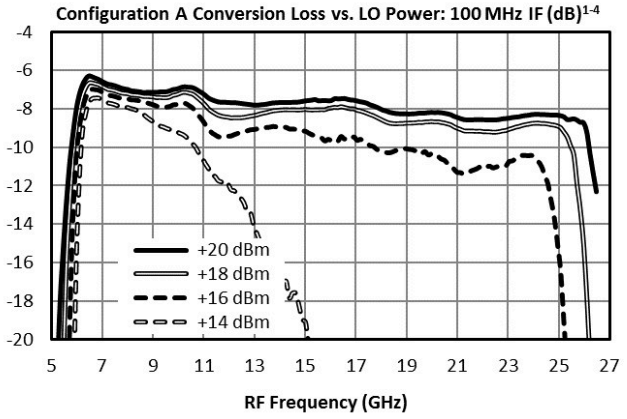


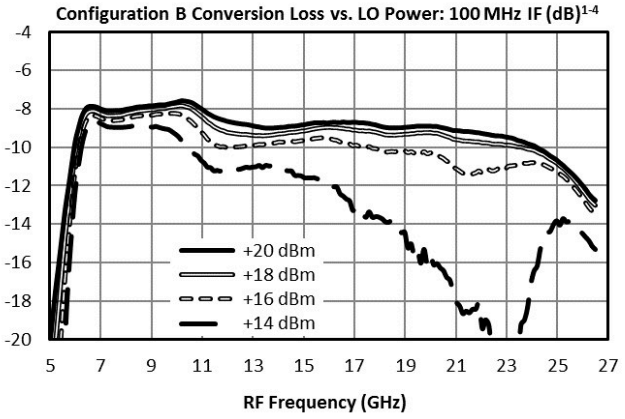
MM1-0626SS - Typical Performance Plots

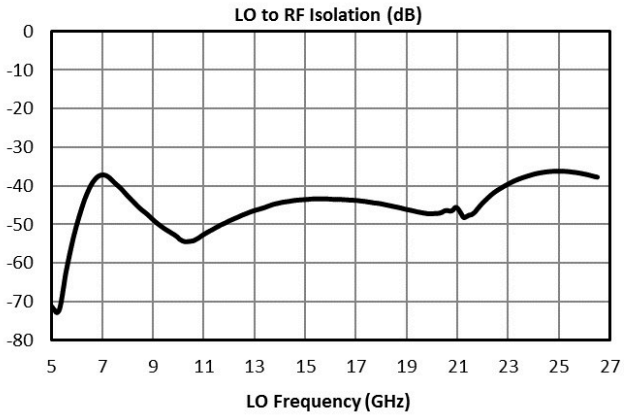
Performance plots for the connectorized module are shown for measurements where directly probed measurements of the die are unavailable. Note that the following measurements include losses from connectors and microstrip traces.

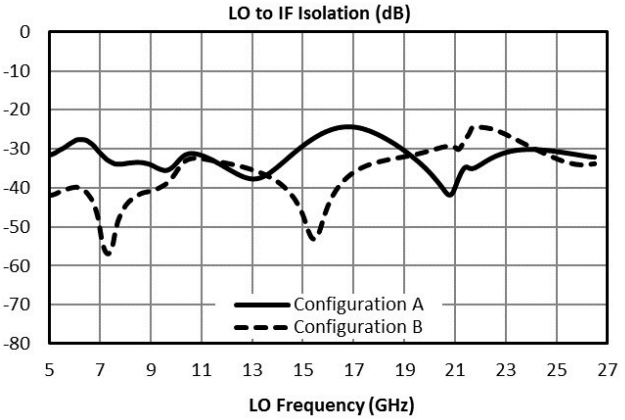


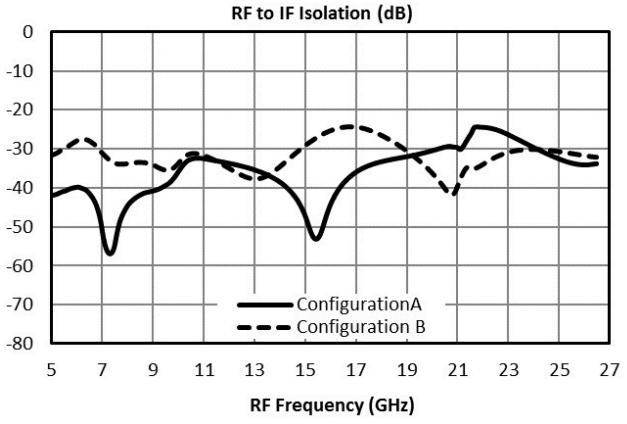


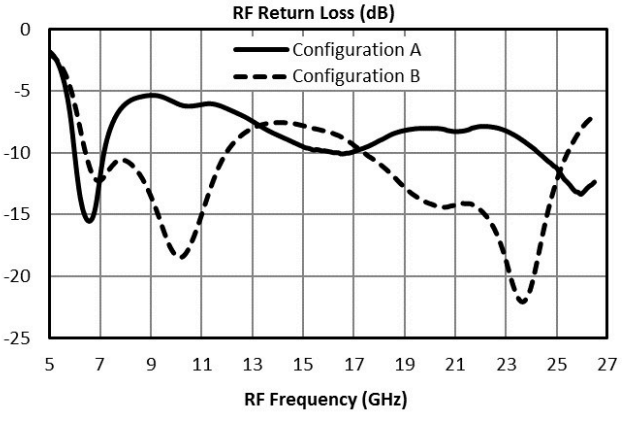




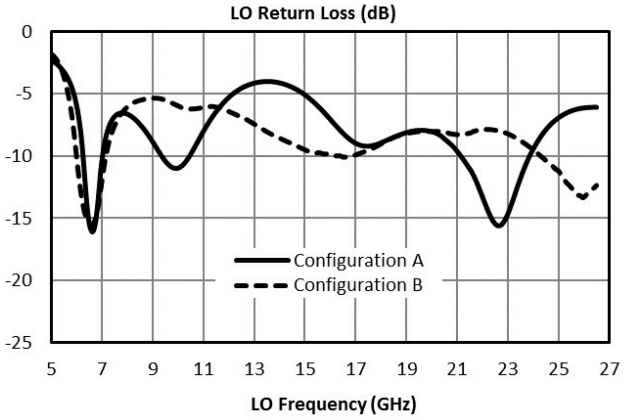




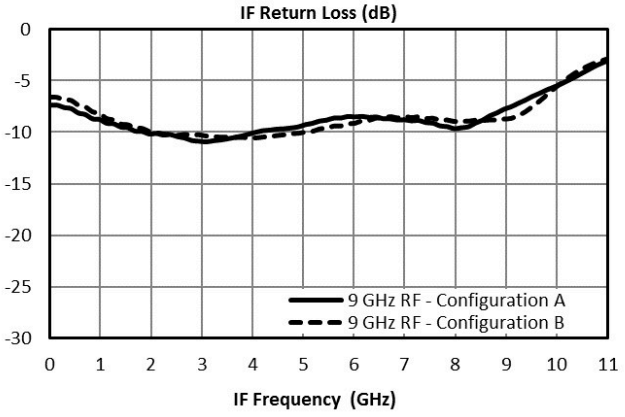




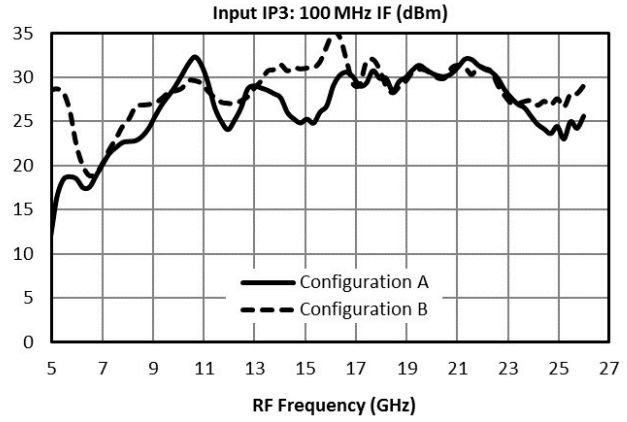
LO Return Loss (dB)



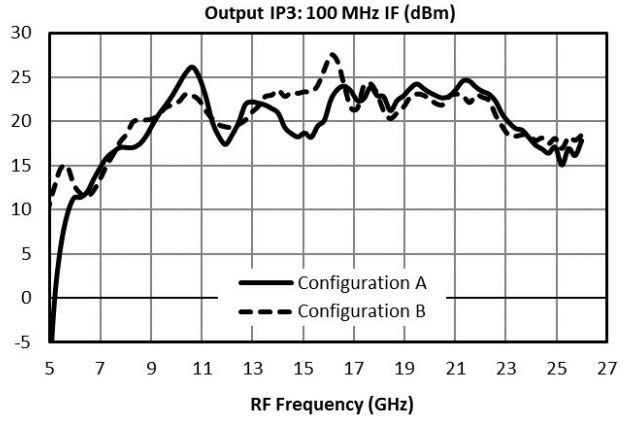
IF Return Loss (dB)



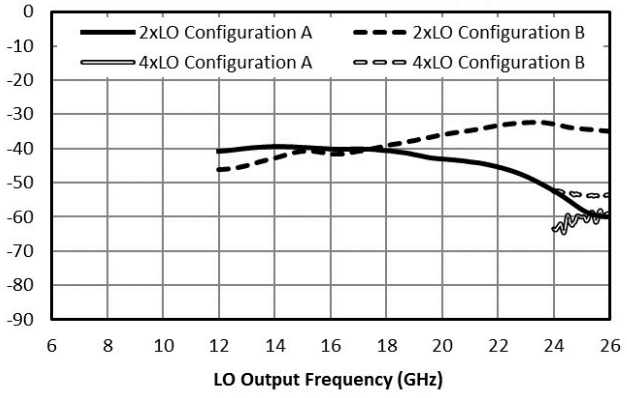
Input IP3: 100 MHz IF (dBm)



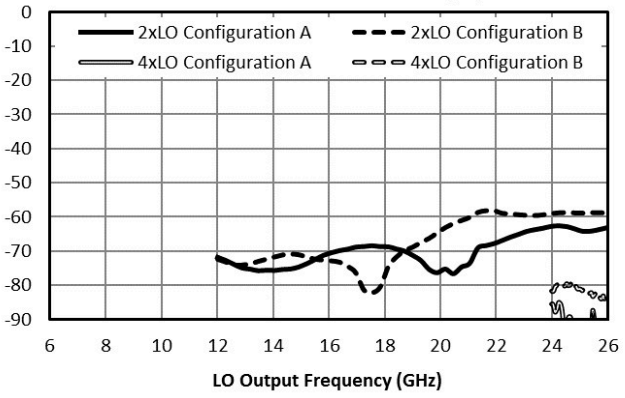
Output IP3: 100 MHz IF (dBm)



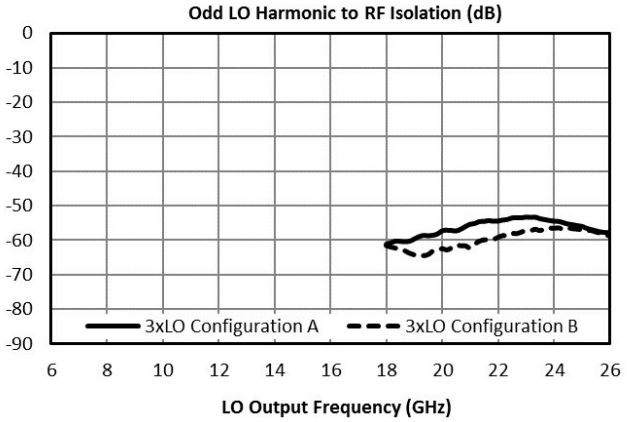
Even LO Harmonic to RF Isolation (dB)



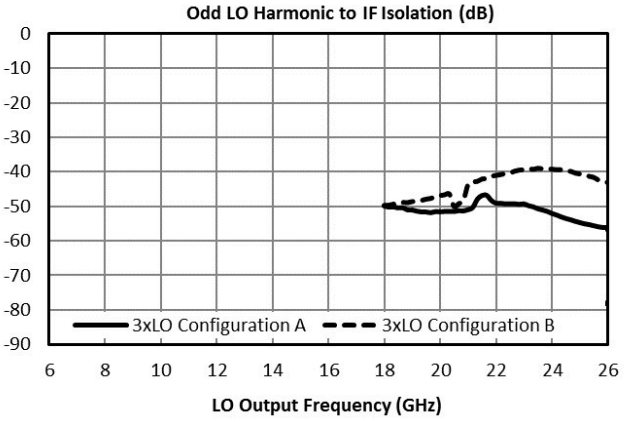
Even LO Harmonic to IF Isolation (dB)

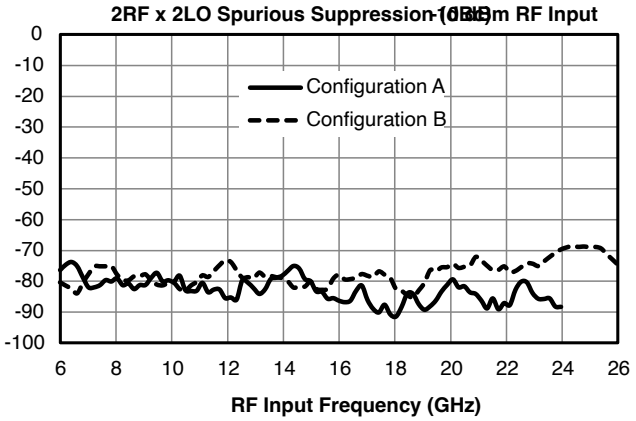


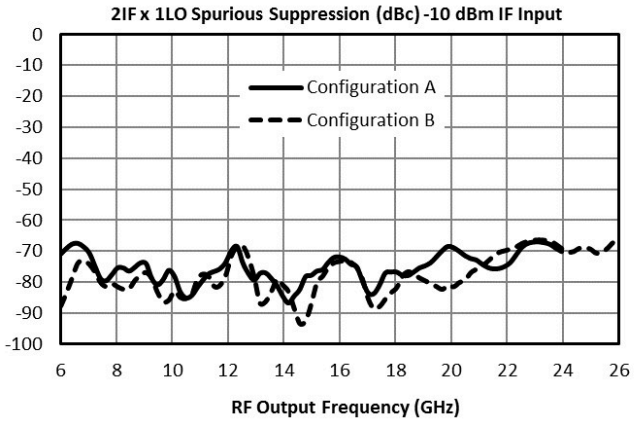
Odd LO Harmonic to RF Isolation (dB)



Odd LO Harmonic to IF Isolation (dB)







Spur Table

Downconversion Spurious Suppression

Spurious data is taken by selecting RF and LO frequencies (+mLO+nRF) within the 6 to 26 GHz RF/LO bands, which create a 91 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 83 dBc for the A configuration for a -10 dBm input, so a -20 dBm RF input creates a spur that is (2-1) x (-10 dB) dB lower, or 93 dBc.

Typical Downconversion Spurious Suppression (dBc): A Configuration (B Configuration), Sine Wave LO

-10 dBm RF Input	0xLO	1xLO	2xLO	3xLO	4xLO	5xLO
1xRF	30 (25)	Reference	32 (43)	12 (12)	33 (39)	15 (17)
2xRF	81 (85)	70 (59)	83 (77)	70 (63)	79 (80)	74 (67)
3xRF	112 (113)	70 (74)	88 (94)	80 (84)	86 (97)	74 (78)
4xRF	140 (146)	117 (112)	116 (114)	114 (114)	117 (116)	120 (116)
5xRF	N/A	125 (135)	129 (131)	124 (131)	131 (136)	126 (123)

Specifications are subject to change without notice. Contact Marki Microwave for the most recent specifications and data sheets.

Upconversion Spurious Suppression

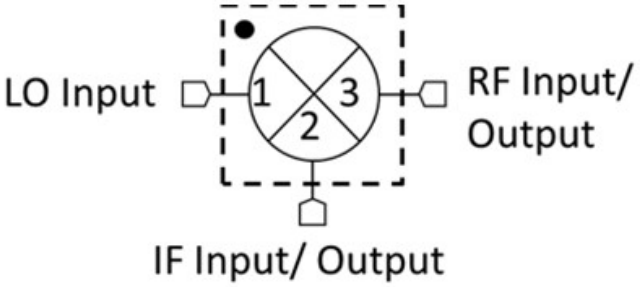
Spurious data is taken by mixing a 91 MHz IF with LO frequencies (+mLO+nIF), which creates an RF within the 6 to 26 GHz RF band. The mixer is swept across the full spurious output band and the mean is calculated. The numbers shown in the table below are for a -10 dBm IF input. Spurious suppression is scaled for different IF input power levels by (n-1), where "n" is the IF spur order. For example, the 2IFx1LO spur is typically 75 dBc for the A configuration for a -10 dBm input, so a -20 dBm IF input creates a spur that is (2-1) x (-10 dB) dB lower, or 85 dBc.

Typical Upconversion Spurious Suppression (dBc): A Configuration (B Configuration), Sine Wave LO

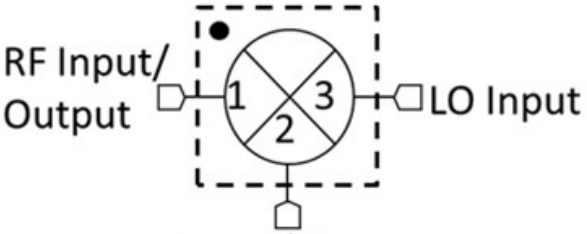
-10 dBm RF Input	0xLO	1xLO	2xLO	3xLO	4xLO	5xLO
1xIF	40 (22)	Reference	32 (42)	10 (10)	31 (43)	22 (23)
2xIF	63 (60)	75 (77)	70 (64)	73 (76)	68 (62)	70 (72)
3xIF	111 (112)	74 (81)	87 (100)	72 (72)	84 (94)	72 (73)
4xIF	125 (112)	119 (121)	120 (110)	120 (124)	116 (108)	122 (121)
5xIF	132 (151)	124 (128)	132 (132)	126 (132)	129 (136)	120 (123)

Specifications are subject to change without notice. Contact Marki Microwave for the most recent specifications and data sheets.

Application Circuit



Configuration A



Configuration B

Application Circuit Description

Configuration A/B refer to the same part number (MM1-0626S) used in one of two different ways for optimal spurious performance. For the lowest conversion loss, use the mixer in Configuration A (port 1 as the LO input, port 2 as the RF input or output). If you need to use a lower LO drive, use the mixer in Configuration B (port 1 as the RF input or output, port 2 as the LO input). For optimal spurious suppression, experimentation or simulation is required to choose between Configuration A and B.

Die Mounting Recommendations

Mounting and Bonding Recommendations

Marki MMICs should be attached directly to a ground plane with conductive epoxy. The ground plane electrical impedance should be as low as practically possible. This will prevent resonances and permit the best possible electrical performance. Datasheet performance is only guaranteed in an environment with a low electrical impedance ground.

Mounting- To epoxy the chip, apply a minimum amount of conductive epoxy to the mounting surface so that a thin epoxy fillet is observed around the perimeter of the chip. Cure epoxy according to manufacturer instructions.

Wire Bonding - Ball or wedge bond with 0.025 mm (1 mil) diameter pure gold wire. Thermosonic wirebonding with a nominal stage temperature of 150 °C and a ball bonding force of 40 to 50 grams or wedge bonding force of 18 to 22 grams is recommended. Use the minimum level of ultrasonic energy to achieve reliable wirebonds. Wirebonds should be started on the chip and terminated on the package or substrate. All bonds should be as short as possible <0.31 mm (12 mils).

Circuit Considerations – 50 Ω transmission lines should be used for all high frequency connections in and out of the chip. Wirebonds should be kept as short as possible, with multiple wirebonds recommended for higher frequency connections to reduce parasitic inductance. In circumstances where the chip more than .001” thinner than the substrate, a heat spreading spacer tab is optional to further reduce bondwire length and parasitic inductance.

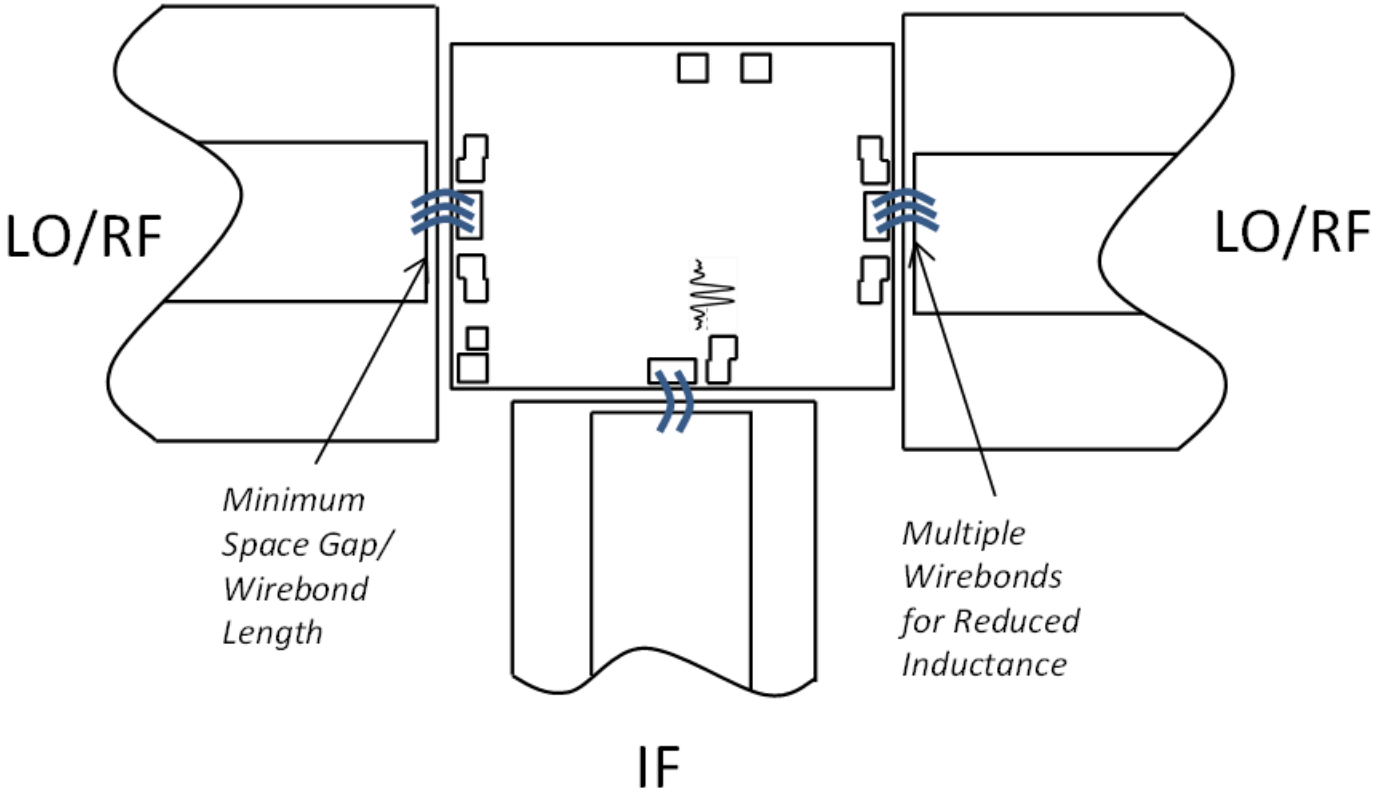
Handling Precautions

General Handling: Chips should be handled with care using tweezers or a vacuum collet. Users should take precautions to protect chips from direct human contact that can deposit contaminants, like perspiration and skin oils on any of the chip's surfaces.

Static Sensitivity: GaAs MMIC devices are subject to static discharge, and should be handled, assembled, tested, and transported only in static protected environments.

Cleaning and Storage: Do not attempt to clean the chip with a liquid cleaning system or expose the bare chips to liquid. Once the ESD sensitive bags the chips are stored in are opened, chips should be stored in a dry nitrogen atmosphere.

Bonding Diagram



Mechanical Data

Outline Drawing

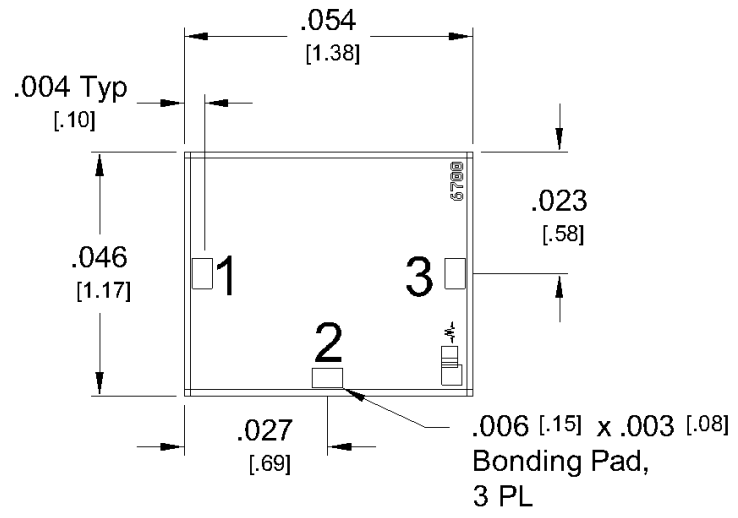
Download : Outline 2D Drawing

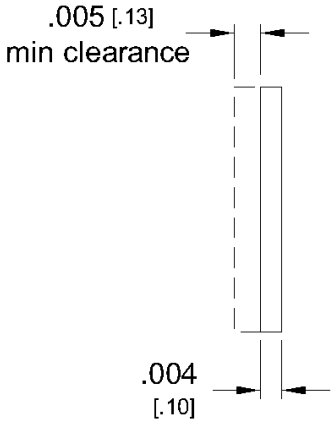
Function	Configuration A Port Number	Configuration B Port Number
LO	1	3
IF	2	2
RF	3	1

PROJECTION: INCH [MM]

REVISIONS

REV.	DESCRIPTION	DATE	APPROVALS
C	ECN 24096 remove gel-pak info.	10/17/24	AT





Notes:

1. CH substrate is .004 in Thick GaAs.
2. I/O trace finish is 4.2 um. Ground plane finish 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.

MATERIAL: 210-06700-1R4
FINISH:
DO NOT SCALE DRAWING

NOTES:

DRAWN BY	DATE
STR	2/24/17
3	

Marki microwave www.markimicrowave.com
Outline
MMIC Mixer
SIZE A | CAGE CODE 0UC32 | DWG. NO. MM1-0626SCH-2
SCALE 40/1 | SHEET 1 OF 1

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 at +100°C and improves less than 0.5 dB at -55°C.
4. Unless otherwise specified, data is taken with +20 dBm lowside LO drive.
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.

Note: Exposure to maximum rating conditions for extended periods may reduce device reliability. There is no damage to device with only one parameter set at thelimit and all other parameters set at or below their nominal value. Exceeding any of the limits listed here may result in permanent damage to the device.

DISCLAIMER