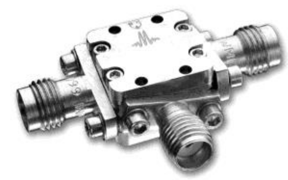
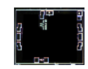
GaAs DOUBLE-BALANCED MIXER　　MM1-1140H

The MM1-1140H is a passive double balanced MMIC mixer. It features excellent conversion loss, superior isolations and spurious performance across a broad bandwidth, in a highly miniaturized form factor. Accurate, nonlinear simulation models are available for Microwave Office® through the Marki Microwave PDK. The MM1-1140H is available as a wire bondable chip or in a connectorized package. The MM1-1140H is a superior alternative to Marki Microwave carrier and packaged M1 and M9 mixers.





Features

- Compact Chip Style Package (0.055" x 0.043"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

Electrical Specifications

- Specifications guaranteed from -55 to +100°C, measured in a 50Ω system. Specifications are shown for Configurations A (B). See page 2 for port locations. All bare die are 100% DC tested and 100% visual inspected. RF testing is performed on a sample basis to verify conformance to datasheet guaranteed specifications. Consult factory for more information.

Parameter	LO (GHz)	RF (GHz)	IF (GHz)	Min	Typ	Max	LO drive level (dBm)
Conversion Loss	11-40		DC-12		7 (8)	14 (16)	
Isolation (dB) LO-RF LO-IF RF-IF					See Plots		
Input 1 dB Compression (dBm)					+9 +9		Config. A: +13 to +20 Config. B: +12 to +17
Input Two-Tone Third Order Intercept Point (dBm)					+21 +22		Config. A: +13 to +20 Config. B: +12 to +17

Part Number Options

Please specify diode level and package style by adding to model number.				
Package Styles		**Examples**		
Connectorized[1, 3]	S	MM1-1140HCH-2, MM1-1140HS		
Chip[2, 3] (RoHS)	CH-2	MM1-1140 (Model)	H (Diode Option)	CH-2 (Package)

[1]Connectorized package consists of chip package wire bonded to a substrate, equivalent to an evaluation board.
[2]Chip package connects to external circuit through wire bondable gold pads.
[3]Note: For port locations and I/O designations, refer to the drawings on page 2 of this document.

GaAs DOUBLE-BALANCED MIXER **MM1-1140H**

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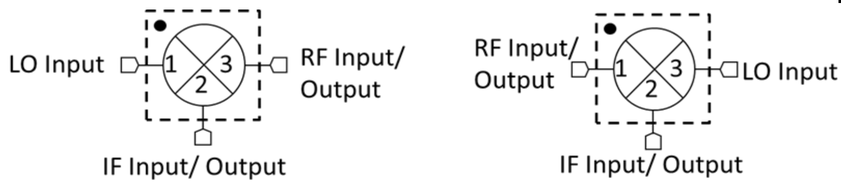
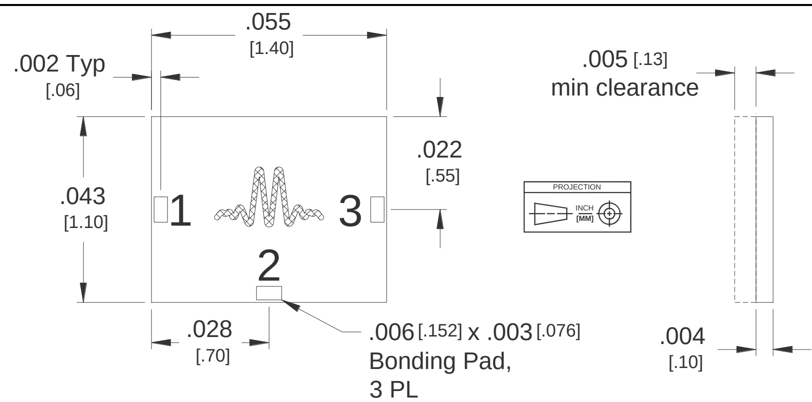
LO/RF 11 to 40 GHz
IF DC to 12 GHz

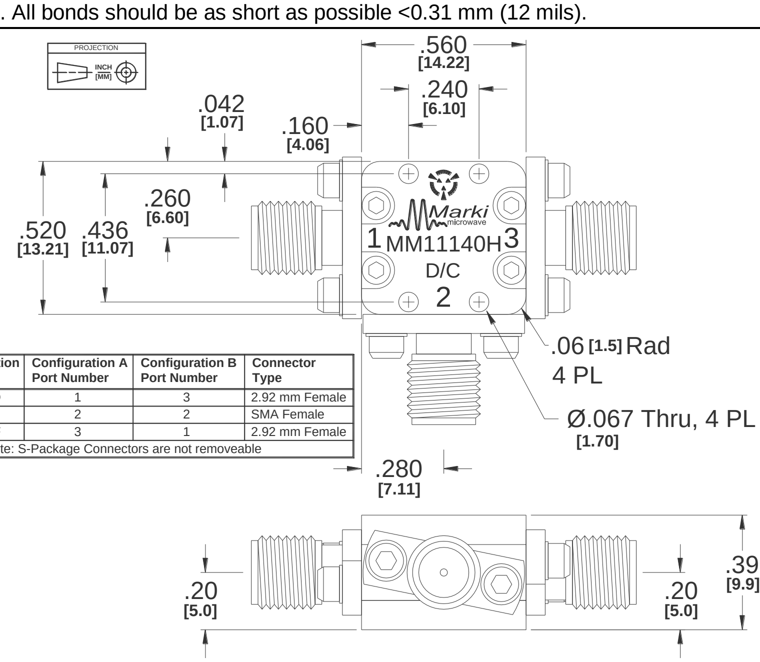


Configuration A **Configuration B**

1. Configuration A/B refer to the same part number (MM1-1140H) 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. For more information, see here.



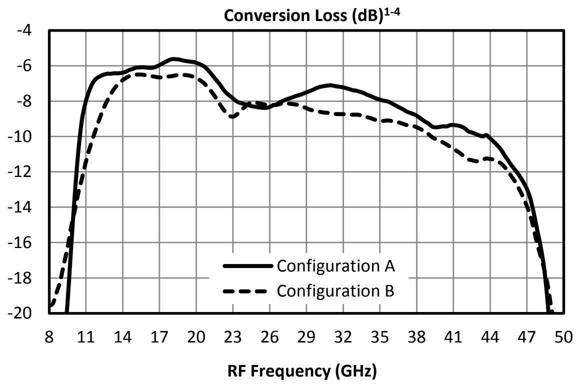
1. CH Substrate material is .004 thick GaAs.
2. I/O traces and ground plane finish are 2 microns Au.
3. Wire Bonding - Ball or wedge bond with 0.025 mm (1 mil) diameter pure gold wire. Thermosonic wirebonding with a nominal stage temperature of 150 °C and a ball bonding force of 40 to 50 grams or wedge 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).

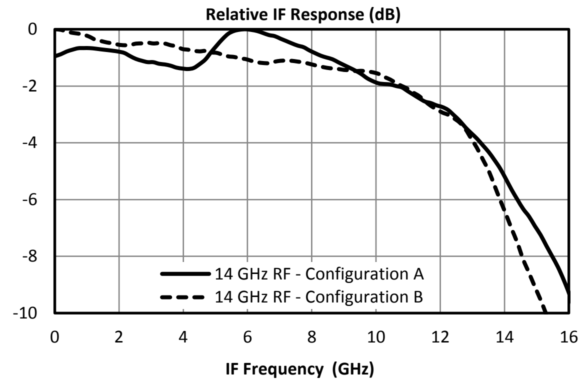


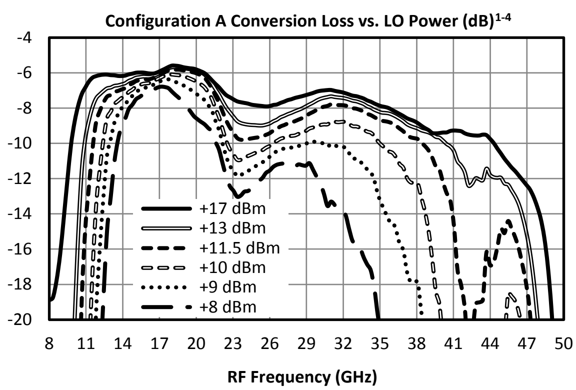
Function	Configuration A Port Number	Configuration B Port Number	Connector Type
LO	1	3	2.92 mm Female
IF	2	2	SMA Female
RF	3	1	2.92 mm Female
Note: S-Package Connectors are not removeable			

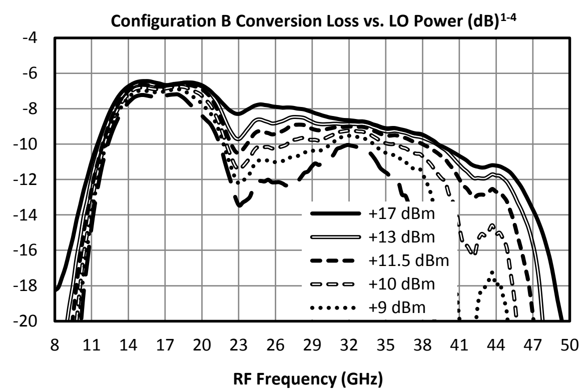
LO/RF 11 to 40 GHz
IF DC to 12 GHz

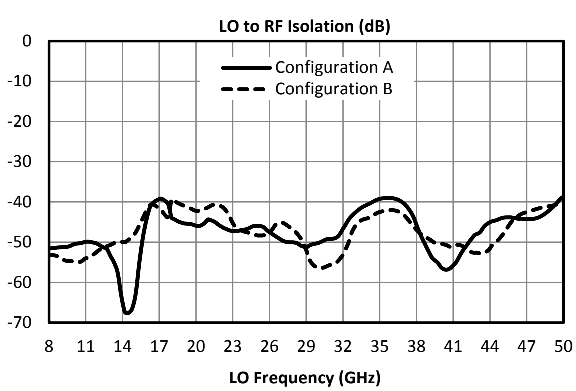
Typical Performance

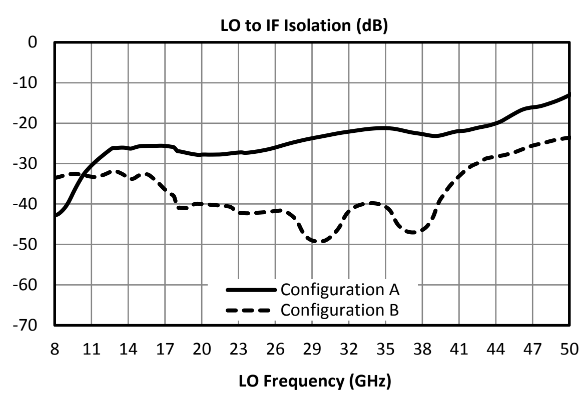






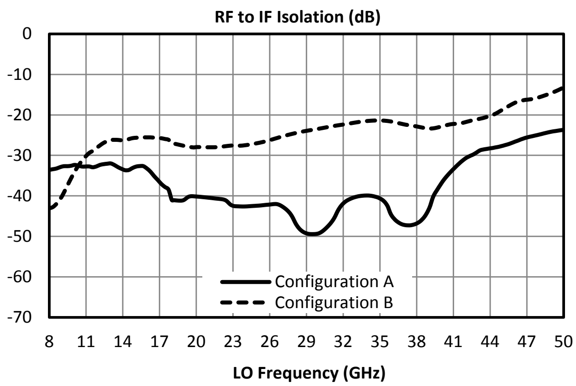


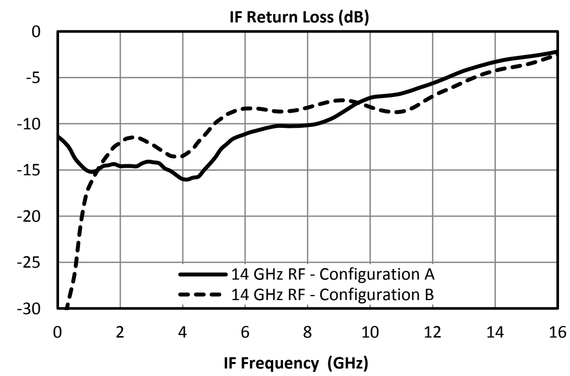


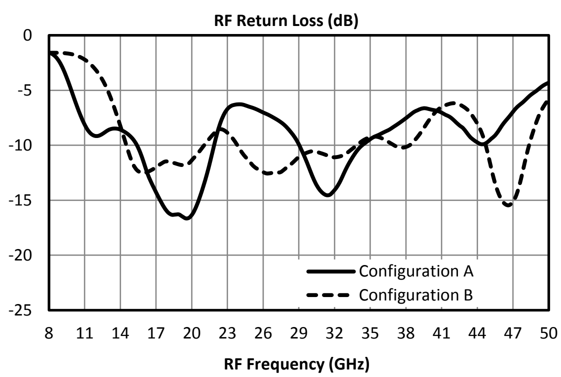


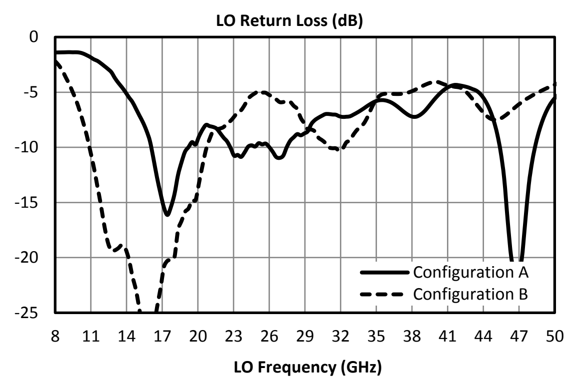
LO/RF 11 to 40 GHz
IF DC to 12 GHz

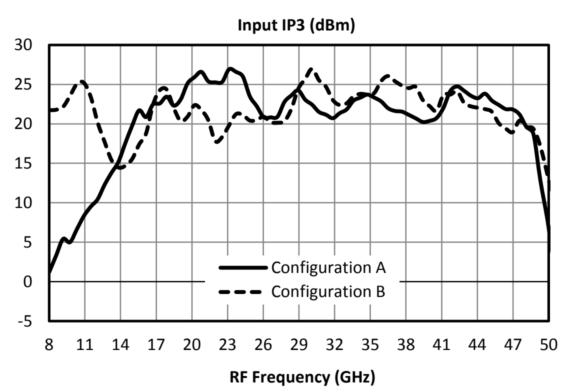
Typical Performance

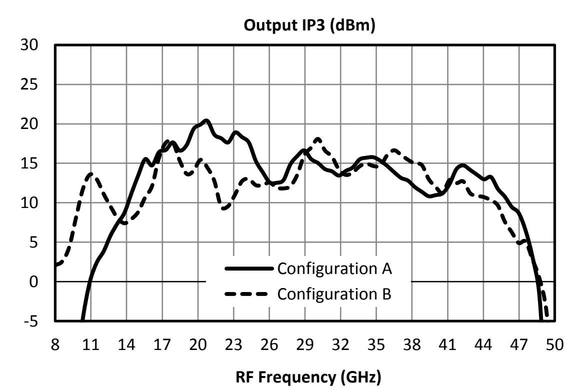












GaAs DOUBLE-BALANCED MIXER

MM1-1140H

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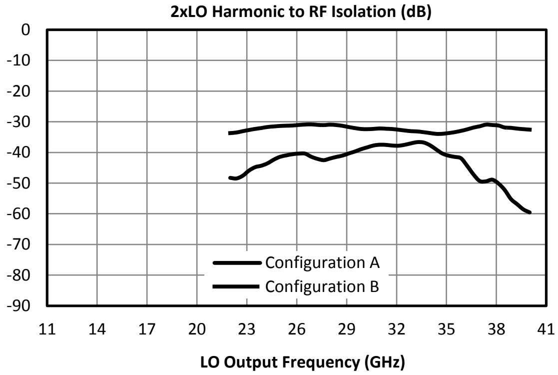
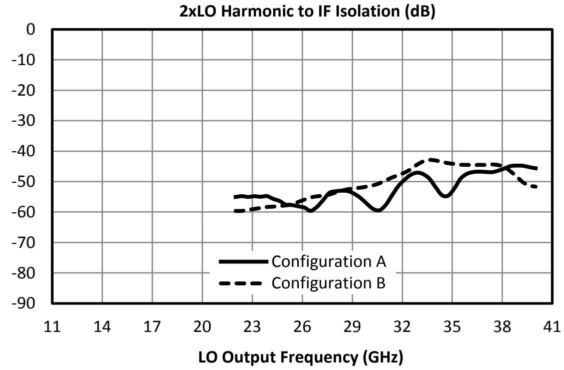
LO/RF 11 to 40 GHz
IF DC to 12 GHz

Typical Performance

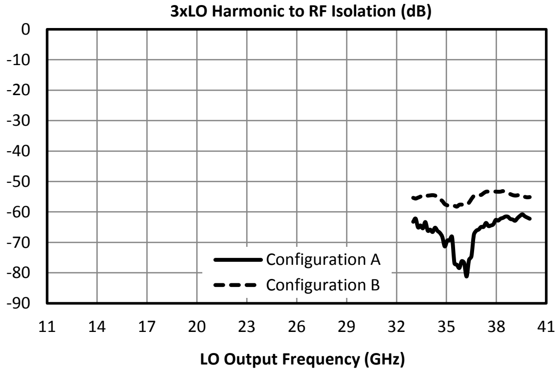
2xLO Harmonic to RF Isolation (dB)



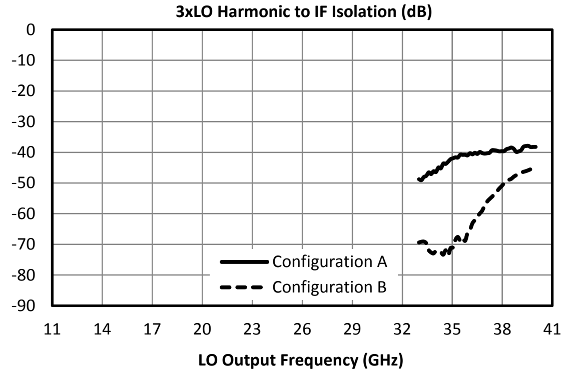
2xLO Harmonic to IF Isolation (dB)



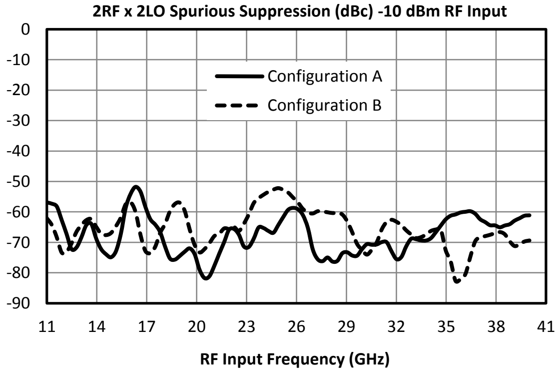
3xLO Harmonic to RF Isolation (dB)



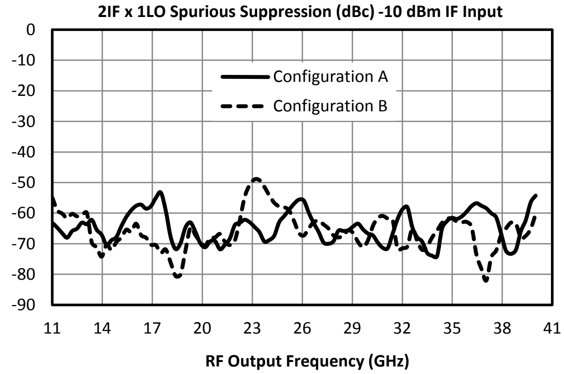
3xLO Harmonic to IF Isolation (dB)



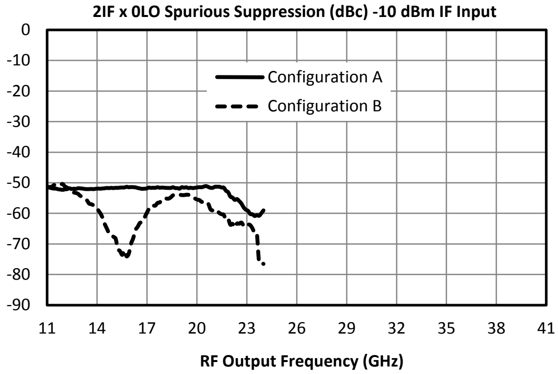
2RF x 2LO Spurious Suppression (dBc) -10 dBm RF Input



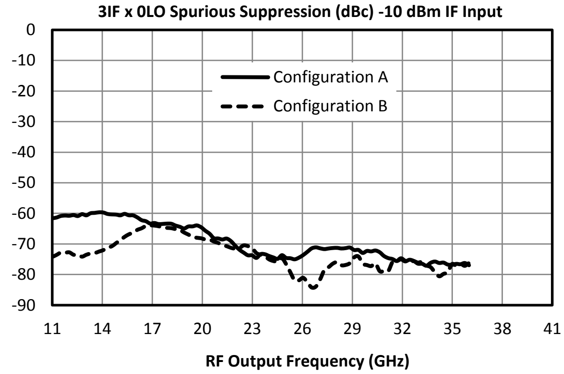
2IF x 1LO Spurious Suppression (dBc) -10 dBm IF Input



2IF x 0LO Spurious Suppression (dBc) -10 dBm IF Input



3IF x 0LO Spurious Suppression (dBc) -10 dBm IF Input



Downconversion Spurious Suppression

Spurious data is taken by selecting RF and LO frequencies (±mLO±nRF) within the 11 to 40 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 68 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 78 dBc.

Typical Downconversion Spurious Suppression (dBc): A Configuration (B Configuration) [5]

-10 dBm RF Input	0xLO	1xLO	2xLO	3xLO	4xLO	5xLO
1xRF	33 (17)	Reference	30 (35)	14 (11)	36 (32)	22 (20)
2xRF	68 (71)	55 (52)	68 (66)	63 (52)	62 (66)	61 (52)
3xRF	84 (89)	57 (73)	74 (84)	69 (70)	76 (85)	65 (70)
4xRF	N/A	98 (115)	101 (107)	106 (99)	109 (109)	106 (99)
5xRF	N/A	N/A	106 (125)	116 (126)	115 (128)	114 (122)

Upconversion Spurious Suppression

Spurious data is taken by mixing a 100 MHz IF with LO frequencies (±mLO±nIF), which creates an RF within the 11 to 40 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 65 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 75 dBc.

Typical Upconversion Spurious Suppression (dBc): A Configuration (B Configuration) [5]

-10 dBm IF Input	0xLO	1xLO	2xLO	3xLO	4xLO	5xLO
1xIF	33 (21)	Reference	35 (34)	13 (10)	38 (36)	19 (24)
2xIF	53 (60)	64 (65)	59 (54)	65 (62)	52 (55)	65 (66)
3xIF	69 (73)	67 (69)	77 (82)	67 (66)	70 (84)	63 (67)
4xIF	102 (104)	106 (106)	102 (94)	105 (106)	97 (90)	102 (106)
5xIF	114 (122)	112 (116)	116 (120)	117 (115)	113 (117)	96 (110)

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 and the epoxy should have high thermal conductivity. 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. MMICs with high power dissipation, particularly those with high DC power requirements, also require a thermally conductive ground plane with a thermally conductive epoxy attachment.

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 ohm 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.

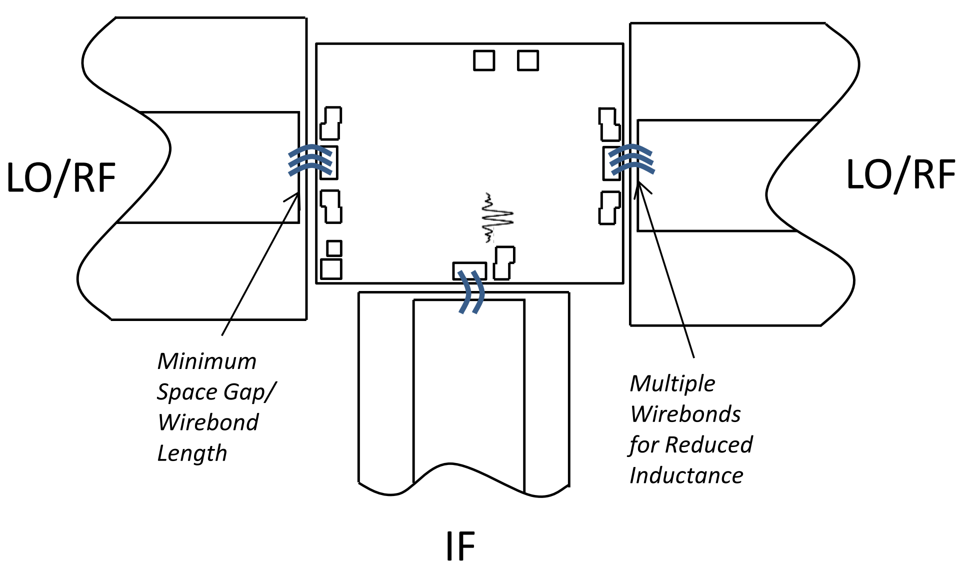
Handling Precautions

General Handling: Chips should be handled with a vacuum collet when possible, or with sharp tweezers using well trained personnel. The surface of the chip is fragile and should not be contacted if possible.

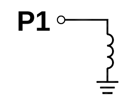
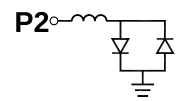
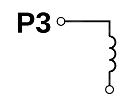
Static Sensitivity: GaAs MMIC devices are subject to static discharge, and should be handled, assembled, tested, and transported only in static protected environments.

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



LO/RF 11 to 40 GHz
IF DC to 12 GHz

Port	Description	DC Interface Schematic
Port 1	Port 1 is DC short to ground and AC matched to 50 Ohms from 11 to 40 GHz. Blocking capacitor is optional.	
Port 2	Port 2 is DC coupled to the diodes. Blocking capacitor is optional.	
Port 3	Port 3 is DC open and AC matched to 50 Ohms from 11 to 40 GHz. Blocking capacitor is optional.	

Absolute Maximum Ratings	
Parameter	**Maximum Rating**
Port 1 DC Current	15 mA
Port 3 DC Current	N/A
Port 2 DC Current	22 mA
RF Power Handling (RF+LO)	+25 dBm at +25°C, derated linearly to +21 dBm at +100°C
Operating Temperature	-55ºC to +100ºC
Storage Temperature	-65ºC to +125ºC

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 +15 dBm 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.

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