

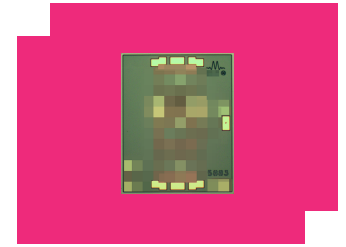
MM1-1857LCH-2

GaAs MMIC Double Balanced Mixer

DEVICE OVERVIEW

General Description

The MM1-1857L 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. Low LO drive requirement allows operation at as low as +7dBm inputs. The MM1-1857L is available as a wire bondable chip or an SMA connectorized package. The MM1-1857H is a superior alternative to Marki Microwave carrier and packaged M9 mixers.



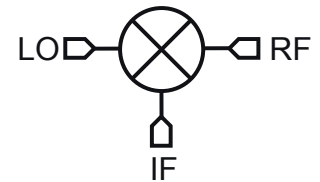
Features

- Compact Chip Style Package (0.054" x 0.046"x0.004")
- CAD Optimized for Superior Isolation and Spurious Response
- Broadband Performance
- Low LO Drive Requirement
- Excellent Unit-to-Unit Repeatability
- RoHS Compliant

Applications

N/A

Functional Block Diagram



Part Ordering Options

Part Number	Description	Package	Connectors	Green Status	Product Lifecycle	Export Classification
<u>MM1-1857LS</u>	GaAs MMIC Double Balanced Mixer	S	<u>Standard</u>	REACH RoHS	Released	EAR99
MM1-1857LCH-2	GaAs MMIC Double Balanced Mixer	CH	-	REACH RoHS	Released	EAR99

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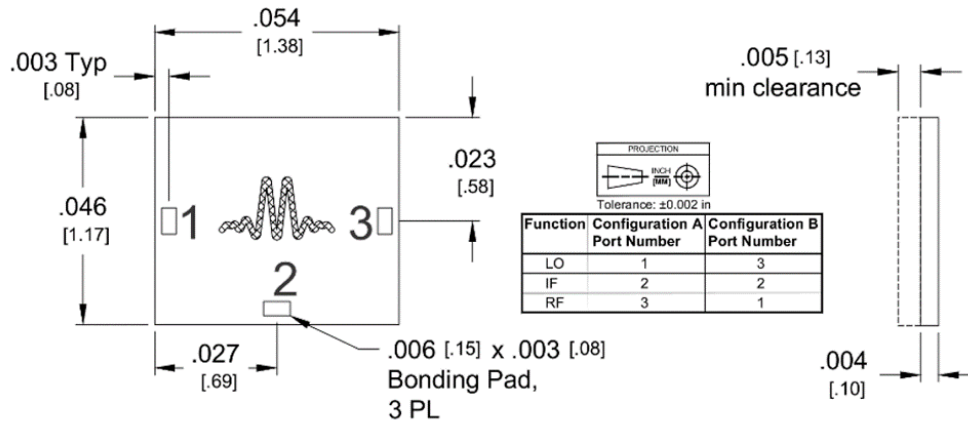
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Revision History

Revision Code	Revision Date	Comment
A	2017-11-01	Die shrunk from 1.48 x 1.18 mm ² to 1.37 x 1.17 mm ² . CH package tolerance added.
B	2018-10-01	Power Handling rating changed from +25dBm to +28dBm

Port Configuration and Functions

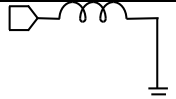
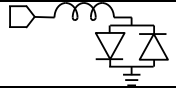
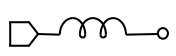
Port Diagram



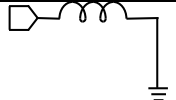
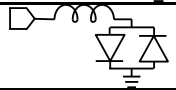

1. CH Substrate material is .004 mil thick GaAs.
2. I/O traces finish is 2.6 microns Au. Ground plane finish is 5 microns Au.
3. Wire Bonding - Ball or wedge bond with 0.025 mm (1 mil) diameter pure gold wire. Thermosonic wirebonding with a nominal stage temperature of 150 °C and a ball bonding force 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 short to ground and AC matched to 50 Ohms from 18 to 57 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 18 to 57 GHz. Blocking capacitor is optional.	

Configuration B

Port	Function	Description	Equivalent Circuit for Package
Port 1	RF	Port 1 is DC short to ground and AC matched to 50 Ohms from 18 to 57 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 18 to 57 GHz. Blocking capacitor is optional.	

Specifications

Absolute Maximum Ratings

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 1 DC Current	30	mA
Port 2 DC Current	22.5	mA
RF Power Handling (RF+LO), 100°C	23	dBm
RF Power Handling (RF+LO), 25°C	28	dBm

Package Information

Parameter	Details	Rating
Dimensions	-	1.38 x 1.17 mm

Recommended Operating Conditions

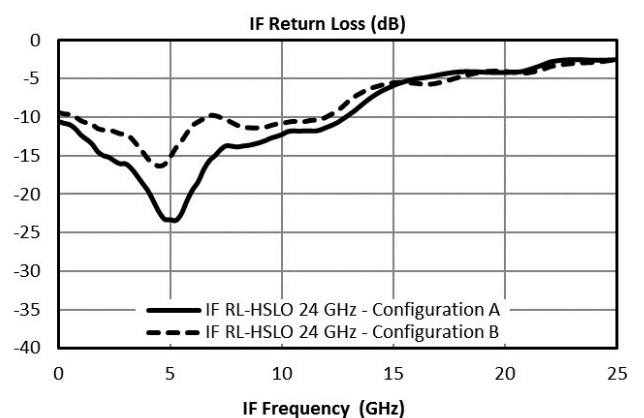
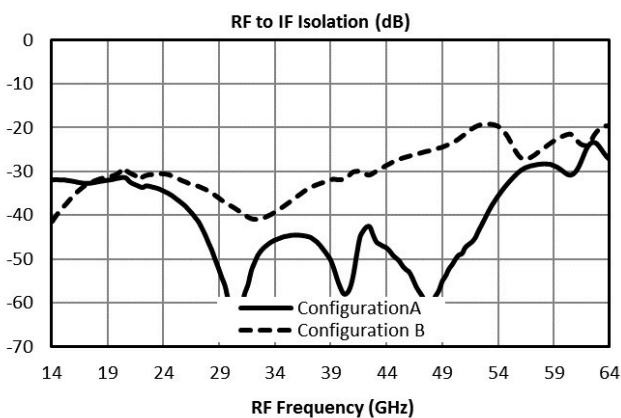
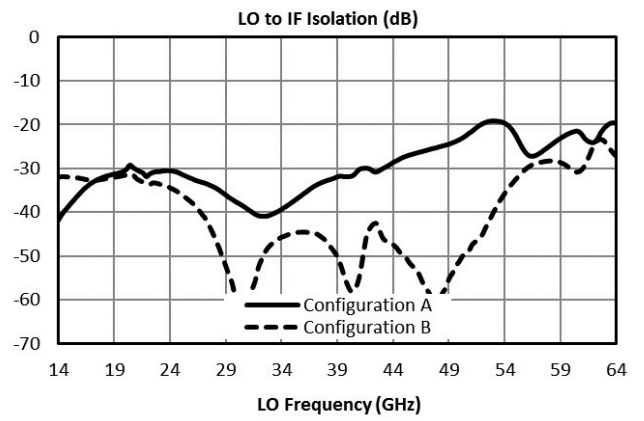
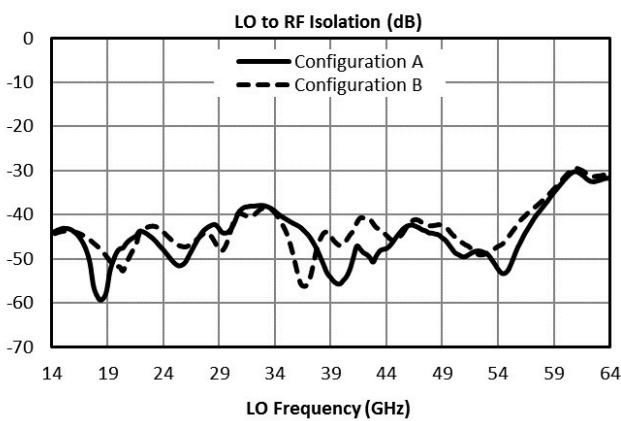
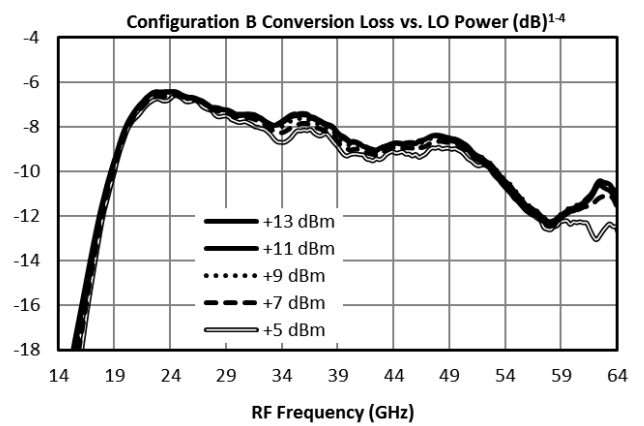
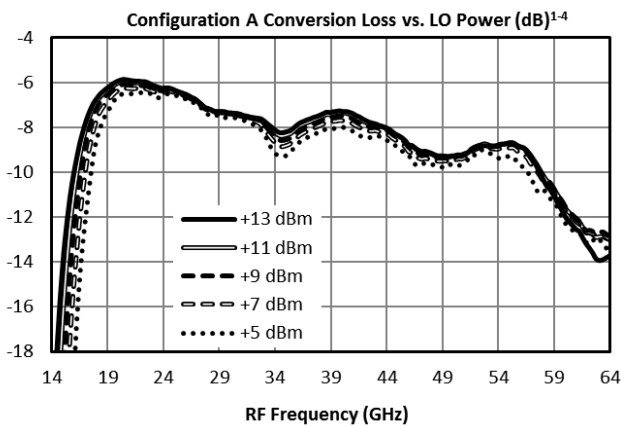
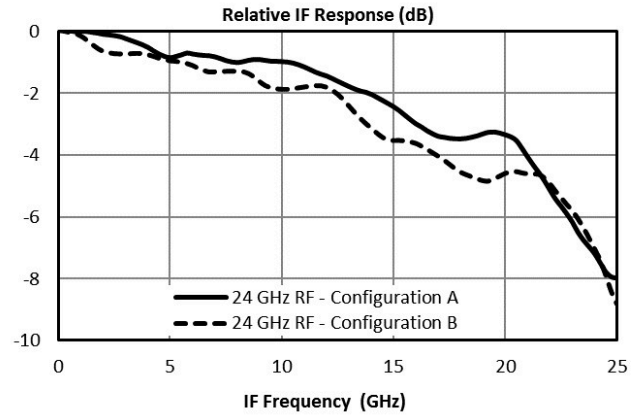
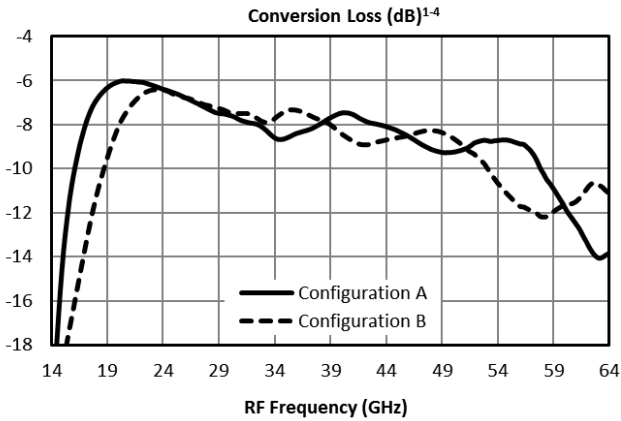
Parameter	Min	Nominal	Max	Unit
LO Input Power	7	-	15	-

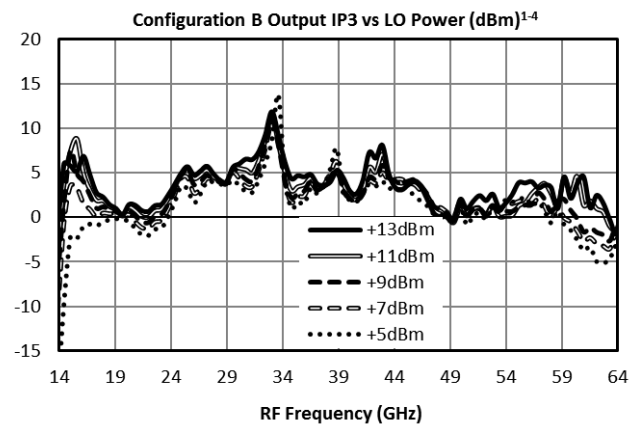
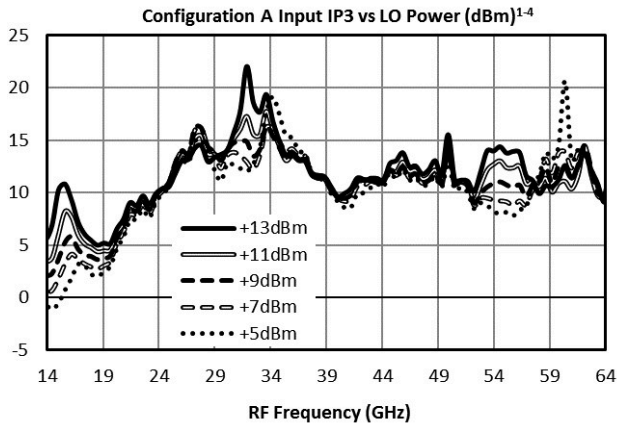
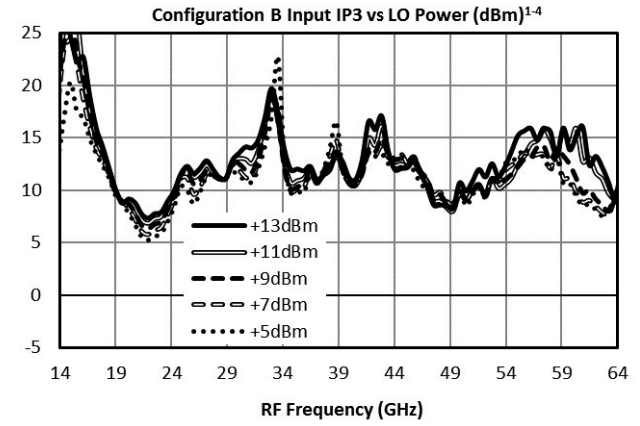
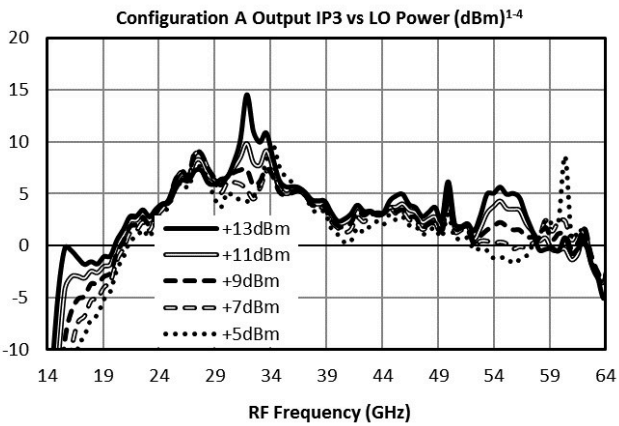
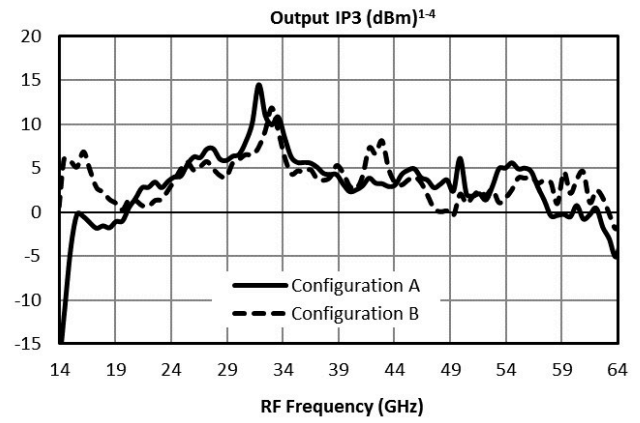
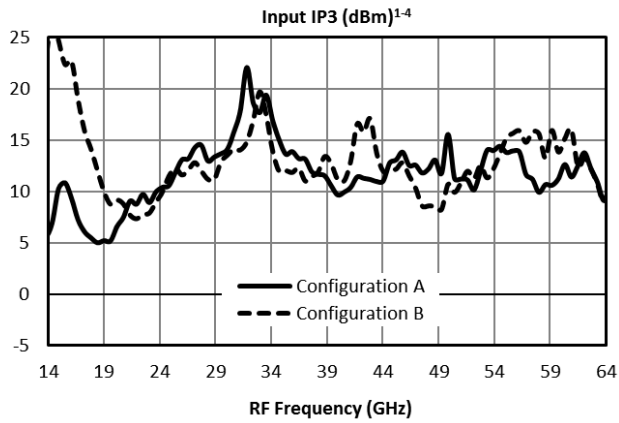
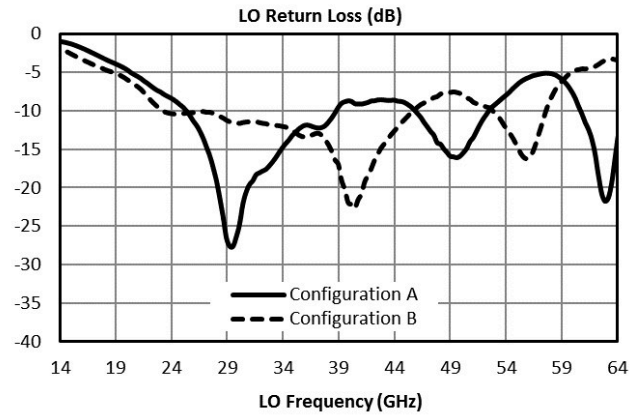
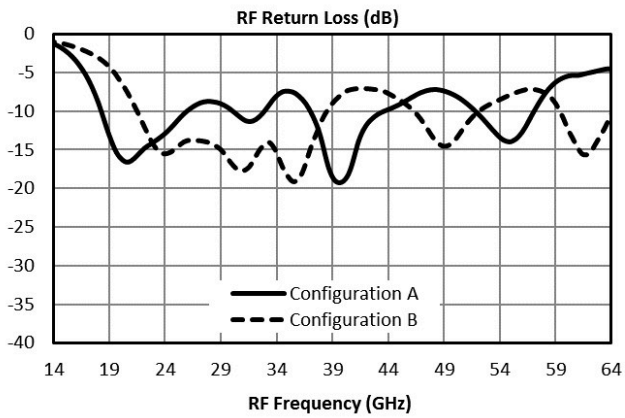
Electrical Specifications

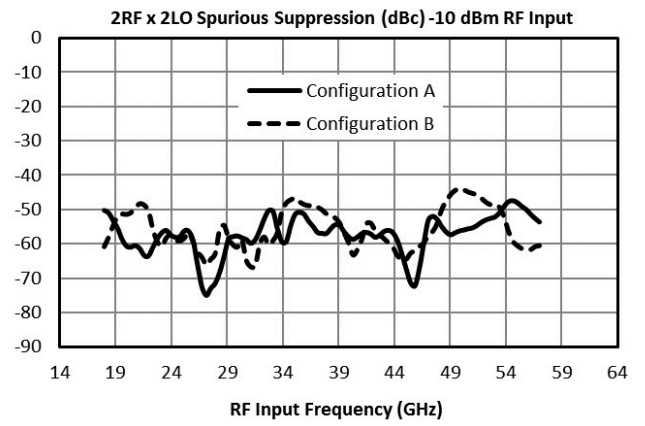
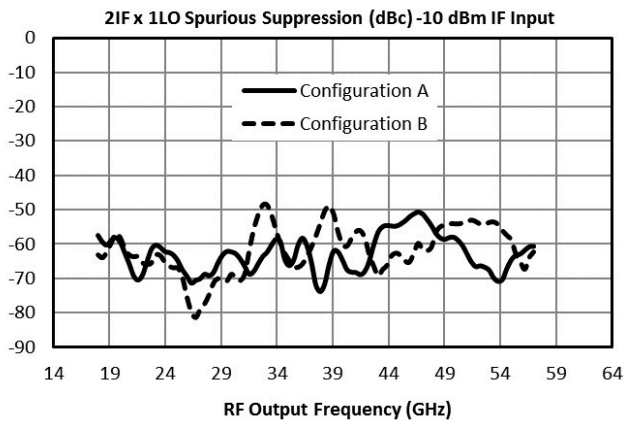
Specifications guaranteed from -55 to +100°C, measured in a 50Ω system. Specifications are shown for Configurations A (B). All bare die are 100% DC tested and 100% visually inspected. RF testing is performed on a sample basis to verify conformance to datasheet guaranteed specifications. Consult factory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

Parameter	Port Configuration	Test Conditions	Min	Typ	Max	Unit
Conversion Loss	A	LO/RF=18-57 GHz IF=0.2-21 GHz LO drive level=13 dBm	-	12	-	dB
Conversion Loss	A	LO/RF=18-57 GHz IF=DC-0.2 GHz LO drive level=13 dBm	-	8	11	dB
Input 1 dB Compression	A	LO/RF=18-57 GHz IF=DC-21 GHz LO drive level=7-15 dBm	-	4	-	dBm
Isolation, LO to RF	A	-	-	35	-	dB
Conversion Loss	B	LO/RF=18-57 GHz IF=0.2-21 GHz LO drive level=13 dBm	-	13	-	dB
Conversion Loss	B	LO/RF=18-57 GHz IF=DC-0.2 GHz LO drive level=13 dBm	-	9	12.5	dB
Input 1 dB Compression	B	LO/RF=18-57 GHz IF=DC-21 GHz LO drive level=7-15 dBm	-	4	-	dBm
IF Frequency Range	-	-	0	-	21	GHz
Input IP3	-	-	-	13	-	dBm
LO Frequency Range	-	-	18	-	57	GHz
RF Frequency Range	-	-	18	-	57	GHz

Typical Performance

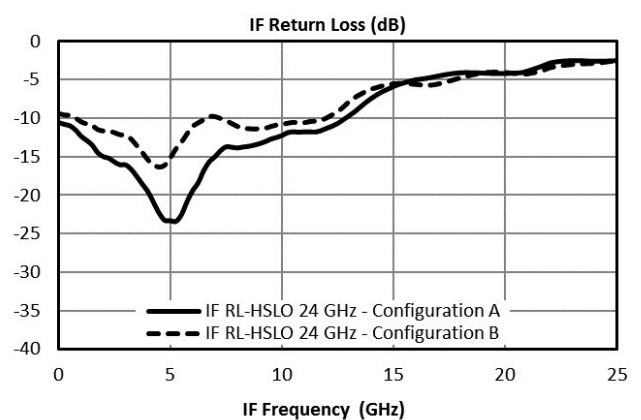
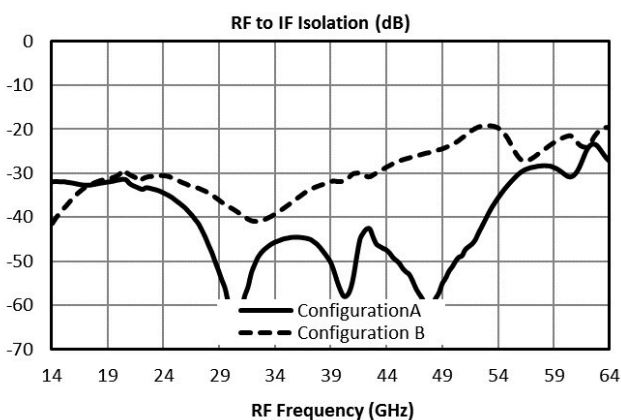
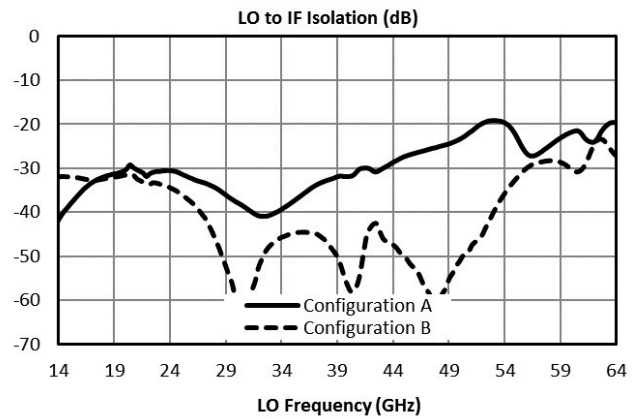
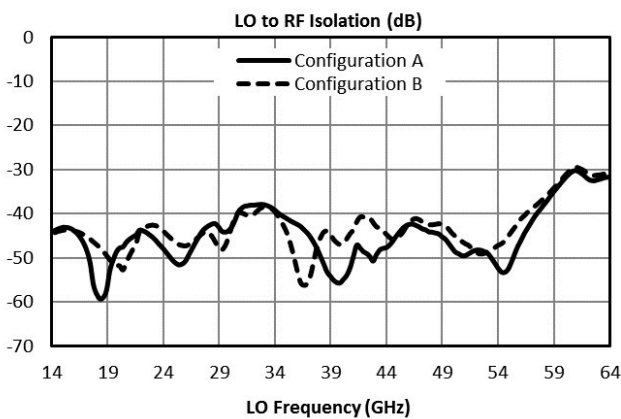
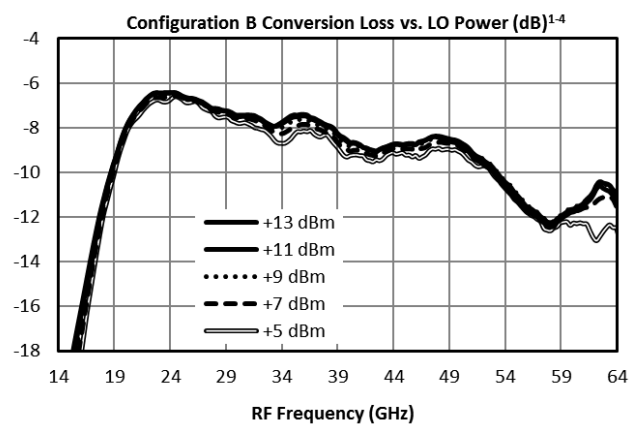
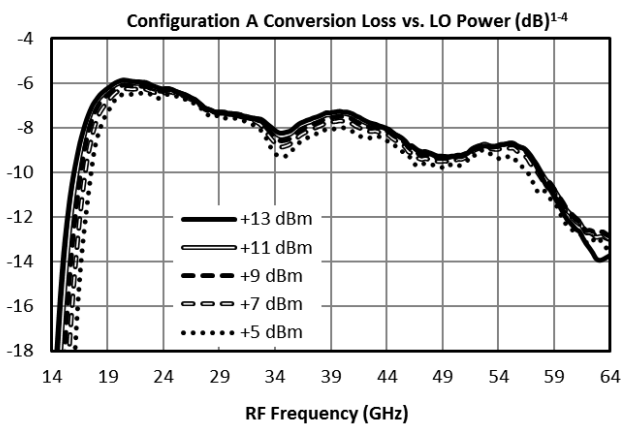
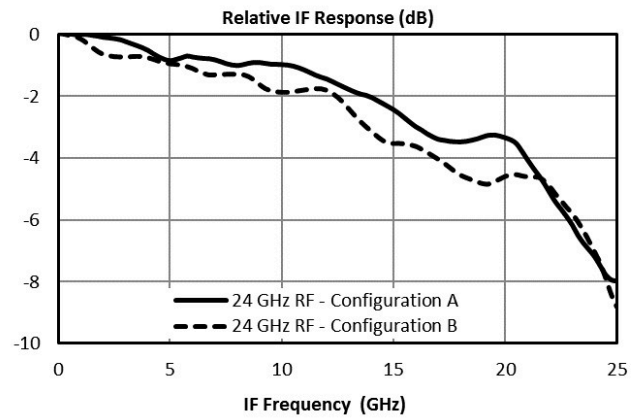
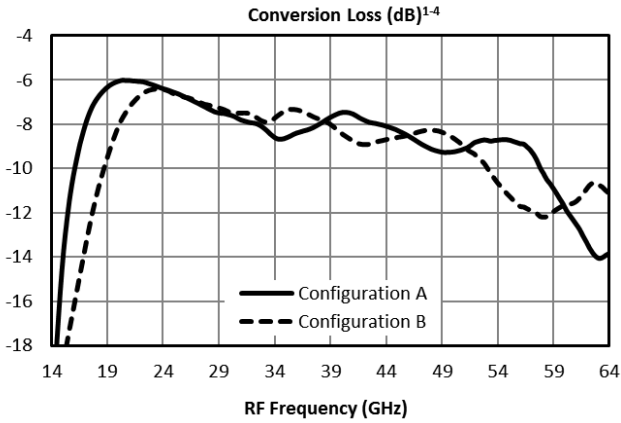


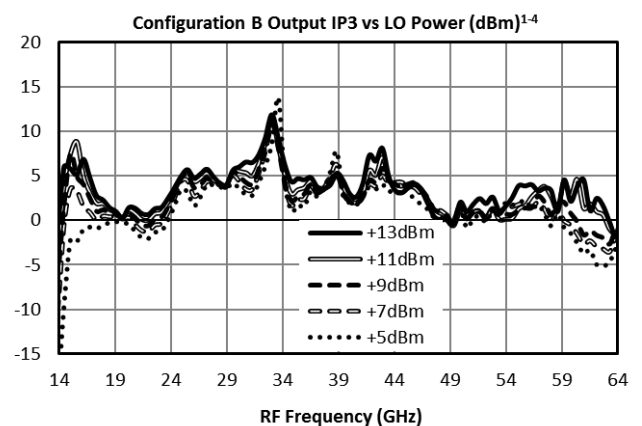
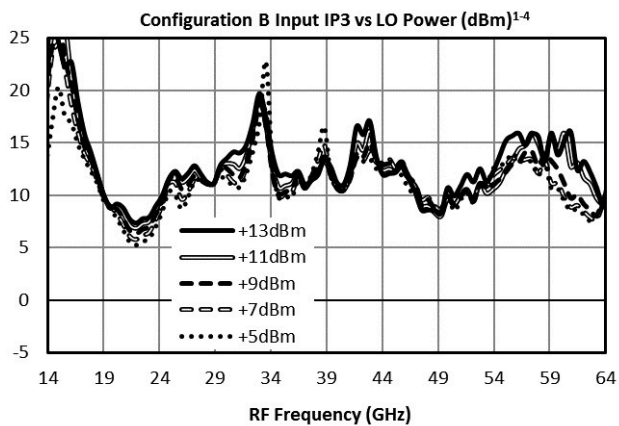
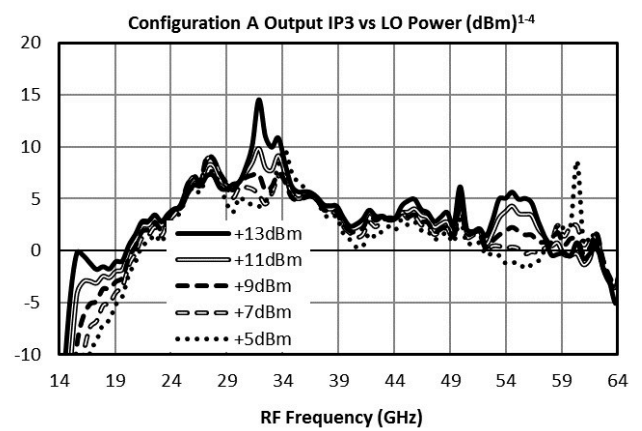
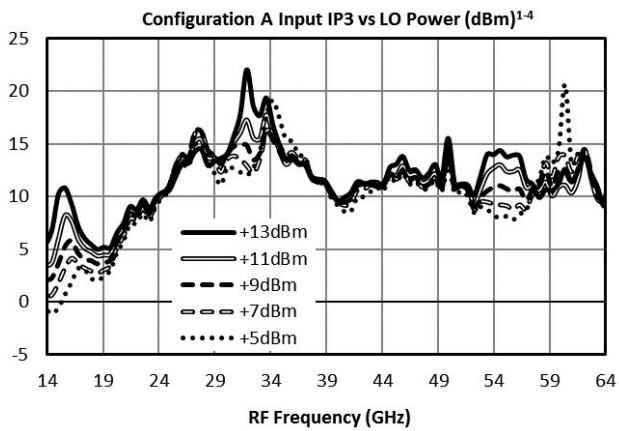
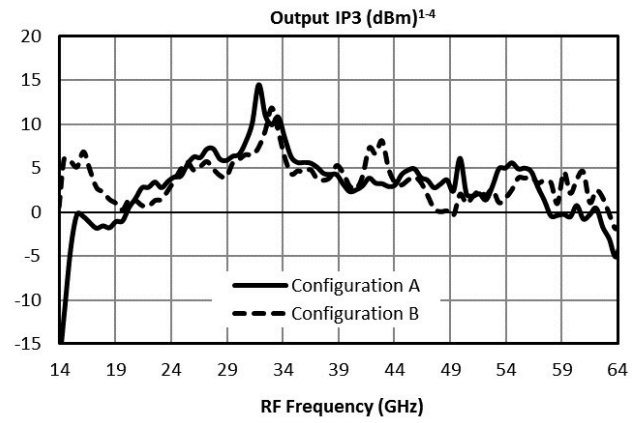
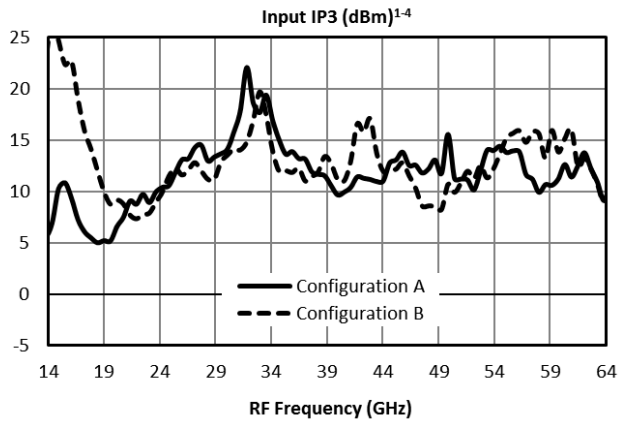
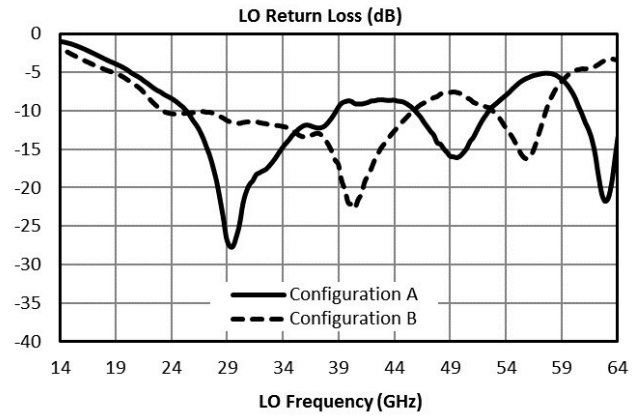
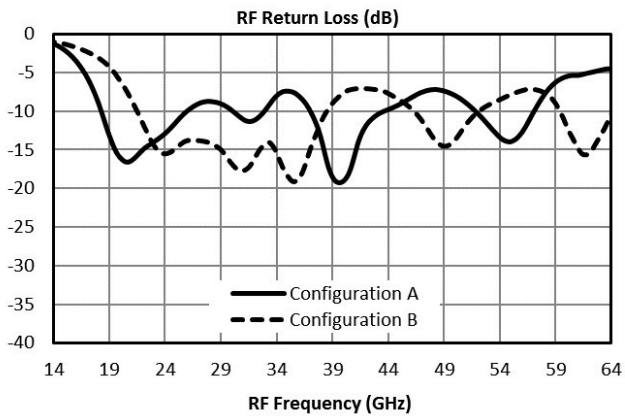


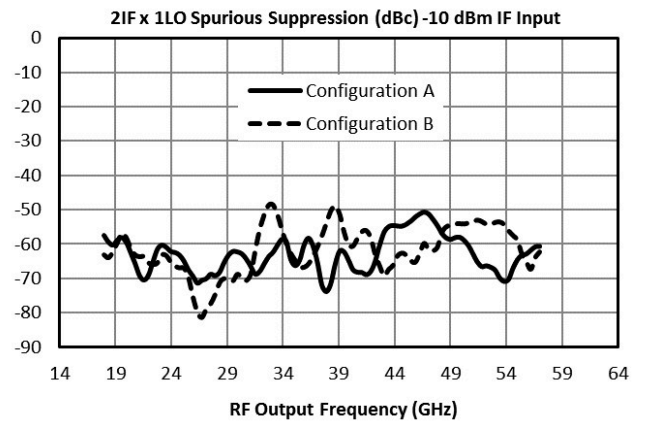
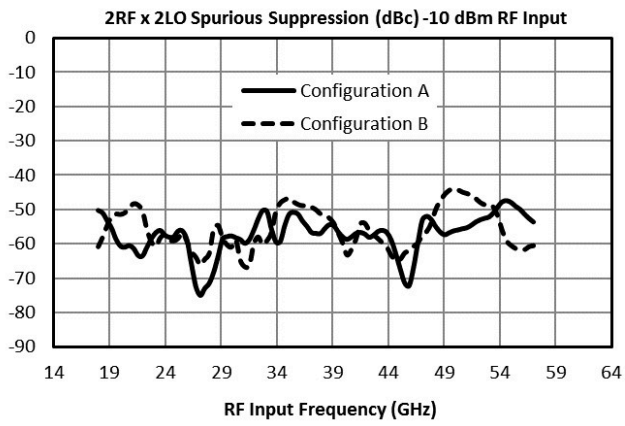


MM1-1857LS - Typical Performance Plots

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.







Spur Table

Downconversion Spurious Suppression

Spurious data is taken by selecting RF and LO frequencies (+mLO+nRF) within the 18 to 57 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 57 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 67 dBc.

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

-10 dBm RF Input	0xLO	1xLO	2xLO	3xLO	4xLO	5xLO
1xRF	35 (23)	Reference	26 (35)	11 (9)	35 (41)	N/A
2xRF	64 (68)	46 (46)	57 (56)	52 (42)	60 (59)	50 (50)
3xRF	80 (82)	51 (58)	69 (71)	55 (56)	68 (72)	56 (57)
4xRF	N/A	84 (90)	89 (88)	88 (82)	91 (92)	91 (78)
5xRF	N/A	N/A	92 (101)	98 (99)	98 (105)	92 (93)

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

Upconversion Spurious Suppression

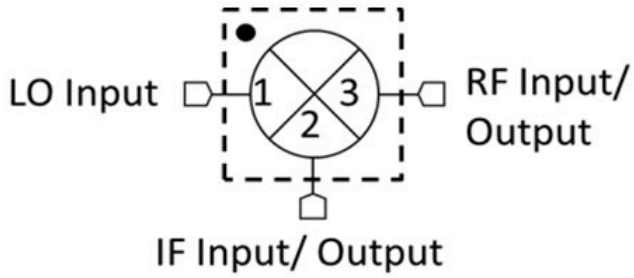
Spurious data is taken by mixing a 91 MHz IF with LO frequencies (+mLO+nIF), which creates an RF within the 18 to 57 GHz RF band. The mixer is swept across the full spurious output band and the mean is calculated. The numbers shown in the table below are for a -10 dBm IF input. Spurious suppression is scaled for different IF input power levels by (n-1), where “n” is the IF spur order. For example, the 2IFx1LO spur is typically 63 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 73 dBc.

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

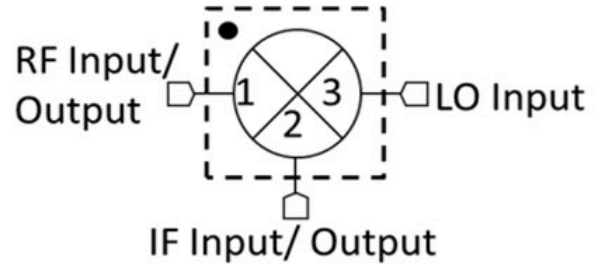
-10 dBm RF Input	0xLO	1xLO	2xLO	3xLO	4xLO	5xLO
1xIF	28 (25)	Reference	31 (31)	9 (8)	34 (43)	N/A
2xIF	59 (60)	63 (62)	59 (48)	67 (66)	60 (58)	74 (72)
3xIF	69 (79)	57 (56)	61 (64)	60 (57)	74 (77)	71 (70)
4xIF	88 (95)	95 (90)	85 (77)	100 (98)	94 (86)	104 (103)
5xIF	100 (113)	100 (96)	99 (99)	99 (100)	110 (108)	95 (102)

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 (MM1-1857L) 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.

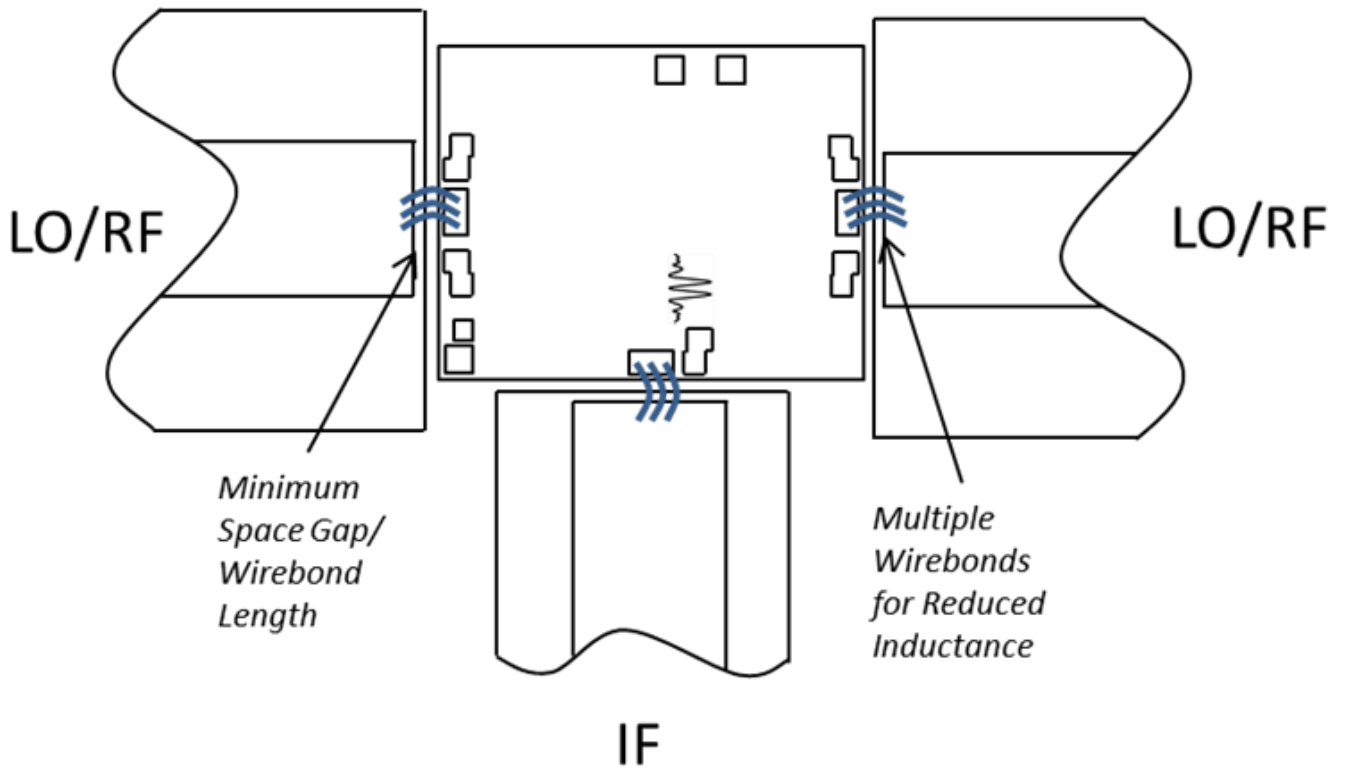
Handling Precautions

General Handling: Chips should be handled with 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



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