

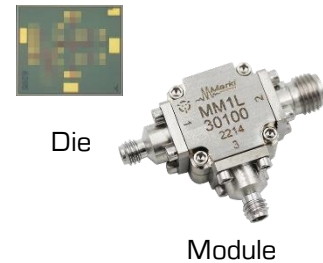
GaAs MMIC Double Balanced mmWave Mixer

MM1-30100L

1. Device Overview

1.1 General Description

MM1-30100L is a GaAs MMIC double balanced mixer that features excellent conversion loss, superior isolations, and spurious performance across an incredibly broad bandwidth. The MM1-30100L works well as both an up and down converter from the Ka band through mmWave/W band. The MM1-30100L is recommended for mmWave frequency conversion applications that require low loss. It is available as both wire bondable die and as a connectorized module.



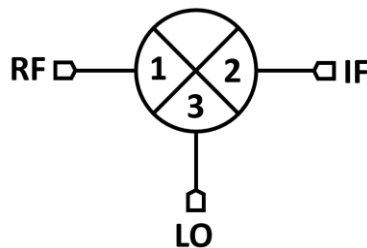
1.2 Features

- Ultra broadband, low loss mmWave frequency conversion
- High LO to RF isolation
- Up or down conversion

1.3 Applications

- mmWave Frequency Conversion
- Test and Measurement Equipment
- Automotive Radar
- 5G Test Receivers
- mmWave Tuner Mixer

1.4 Functional Block Diagram



1.5 Part Ordering Options¹

Part Number	Description	Package	Green Status	Product Lifecycle	Export Classification
MM1-30100LCH-2	Wire bondable die	CH	RoHS	Active	EAR99
MM1-30100LM	Connectorized module	M		Active	EAR99

¹ Refer to our [website](#) for a list of definitions for terminology presented in this table.

Table of Contents

1. Device Overview	1	3.3 Recommended Operating Conditions .	4
1.1 General Description	1	3.4 Sequencing Requirements	4
1.2 Features	1	3.5 Electrical Specifications	5
1.3 Applications	1	4. Typical Performance Plots	6
1.4 Functional Block Diagram	1	5. Die Mounting Recommendations	7
1.5 Part Ordering Options.....	1	5.1 Mounting and Bonding	
2. Port Configurations and Functions	3	Recommendations	7
2.1 Port Diagram	3	5.2 Handling Precautions	7
2.2 Port Functions	3	5.3 Bonding Diagram	8
3. Specifications	4	6. Mechanical Data	9
3.1 Absolute Maximum Ratings.....	4	6.1 CH Package Outline Drawing	9
3.2 Package Information	4	6.2 M Package Outline Drawing	9

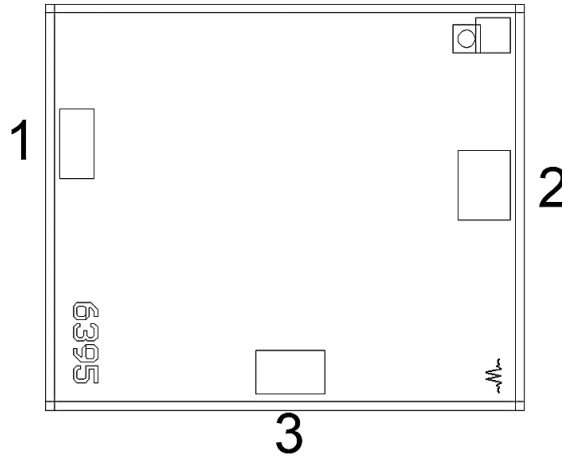
Revision History

Revision Code	Revision Date	Comment
-	May 2022	Datasheet Initial Release

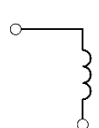
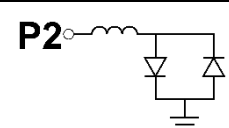
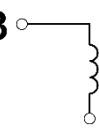
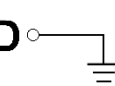
2. Port Configurations and Functions

2.1 Port Diagram

A top-down view of the MM1-30100L's CH package outline drawing is shown below. The MM1-30100L has the input and output ports given in Port Functions. The MM1-30100L can be used in either an up or down conversion. For configuration A, input the LO into port 3, use port 1 for the RF, and port 2 for the IF. For configuration B, input the LO into port 1, use port 3 for the RF, and port 2 for the IF.



2.2 Port Functions

Port	Function	Description	Equivalent Circuit for Package
Port 1	RF (Configuration A) LO (Configuration B)	Port 1 is DC open for the CH and M packages.	P1 
Port 2	IF	Port 2 is diode connected for the CH and M package.	P2 
Port 3	LO (Configuration A) RF (Configuration B)	Port 3 is DC open for the CH and M packages.	P3 
GND	Ground	CH package ground path is provided through the substrate and ground bond pads. M package ground provided through metal housing and outer coax conductor.	GND 

3. Specifications

3.1 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 be inoperable or have a reduced lifetime.

Parameter	Maximum Rating	Units
Port 1 DC Current	N/A	mA
Port 3 DC Current	N/A	mA
Power Handling, at any Port	+30	dBm
Operating Temperature	-55 to +100	°C
Storage Temperature	-65 to +125	°C

3.2 Package Information

Parameter	Details	Rating
ESD	Human Body Model (HBM), per MIL-STD-750, Method 1020	1A
Weight	M package	22 g

3.3 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.

	Min	Nominal	Max	Units
T _A , Ambient Temperature	-55	+25	+100	°C
LO Input Power	+14	+16		dBm

3.4 Sequencing Requirements

There is no requirement to apply power to the ports in a specific order. However, it is recommended to provide a 50Ω termination to each port before applying power. This is a passive diode mixer that requires no DC bias.

3.5 Electrical Specifications

The electrical specifications apply at $T_A=+25^{\circ}\text{C}$ in a 50Ω system. Typical data shown is for the connectorized M package mixer used in the forward direction with a sine wave LO input.² Specifications shown for configuration A.

Min and Max limits apply only to our connectorized units and are guaranteed at $T_A=+25^{\circ}\text{C}$. All bare die are 100% DC tested and visually inspected.

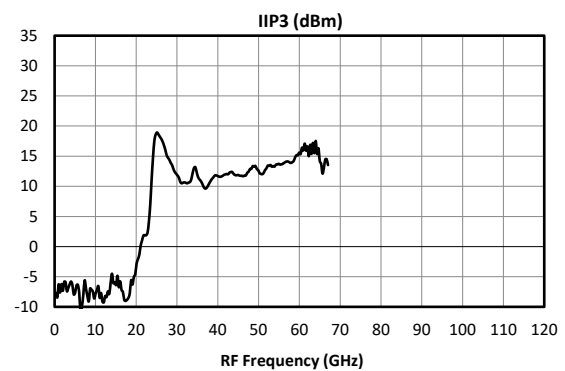
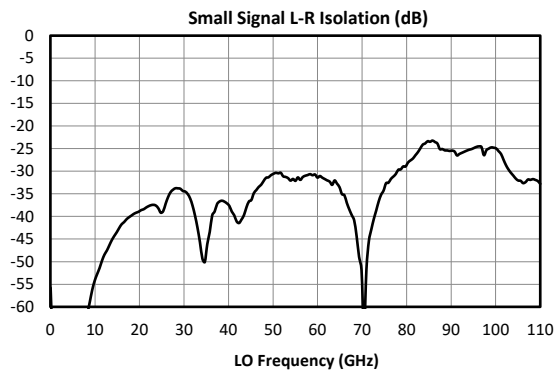
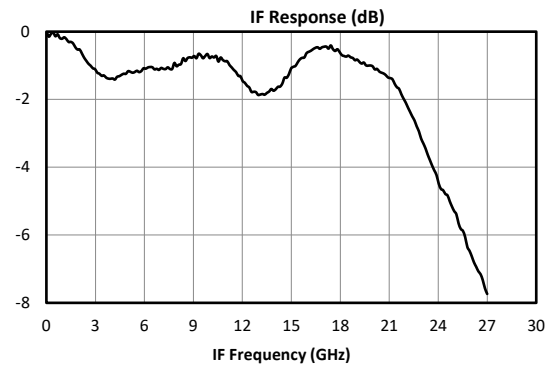
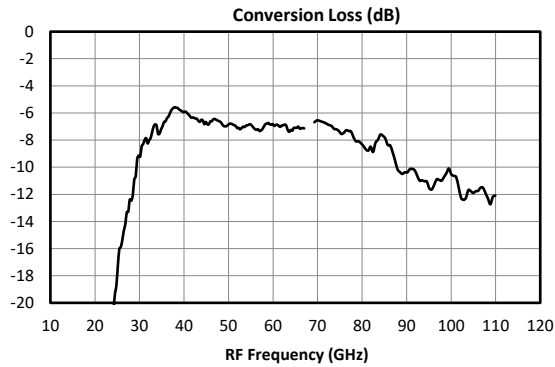
Parameter	Test Conditions	Min	Typical	Max	Units
RF (Port 1) Frequency Range		30		100	GHz
LO (Port 3) Frequency Range		30		100	
I (Port 2) Frequency Range		0		20	
Conversion Loss (CL) ³	RF/LO = 30 - 130 GHz I = DC - 0.2 GHz		8.5		dB
Noise Figure (NF) ⁴	RF/LO = 30 - 130 GHz I = DC - 0.2 GHz		8.5		dB

² LO power used for characterization varies by band. Saturated amplifiers used were AMM-6702 and A-3567

³ Measured as a down converter to a fixed 91MHz IF.

⁴ Mixer Noise Figure typically measures within 0.5 dB of conversion loss for IF frequencies greater than 5 MHz.

4. Typical Performance Plots⁵



⁵ Due to difficulty generating strong LO signals at mmWave frequencies LR Isolation is measured with a small signal LO. Isolation will improve with a stronger LO signal. Discontinuity in conversion loss measurement is due to splitting the measurement into multiple bands. IIP3 is only measured up to 67GHz due to limitations in measurement setup.

5. Die Mounting Recommendations

5.1 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.

5.2 Handling Precautions

General Handling

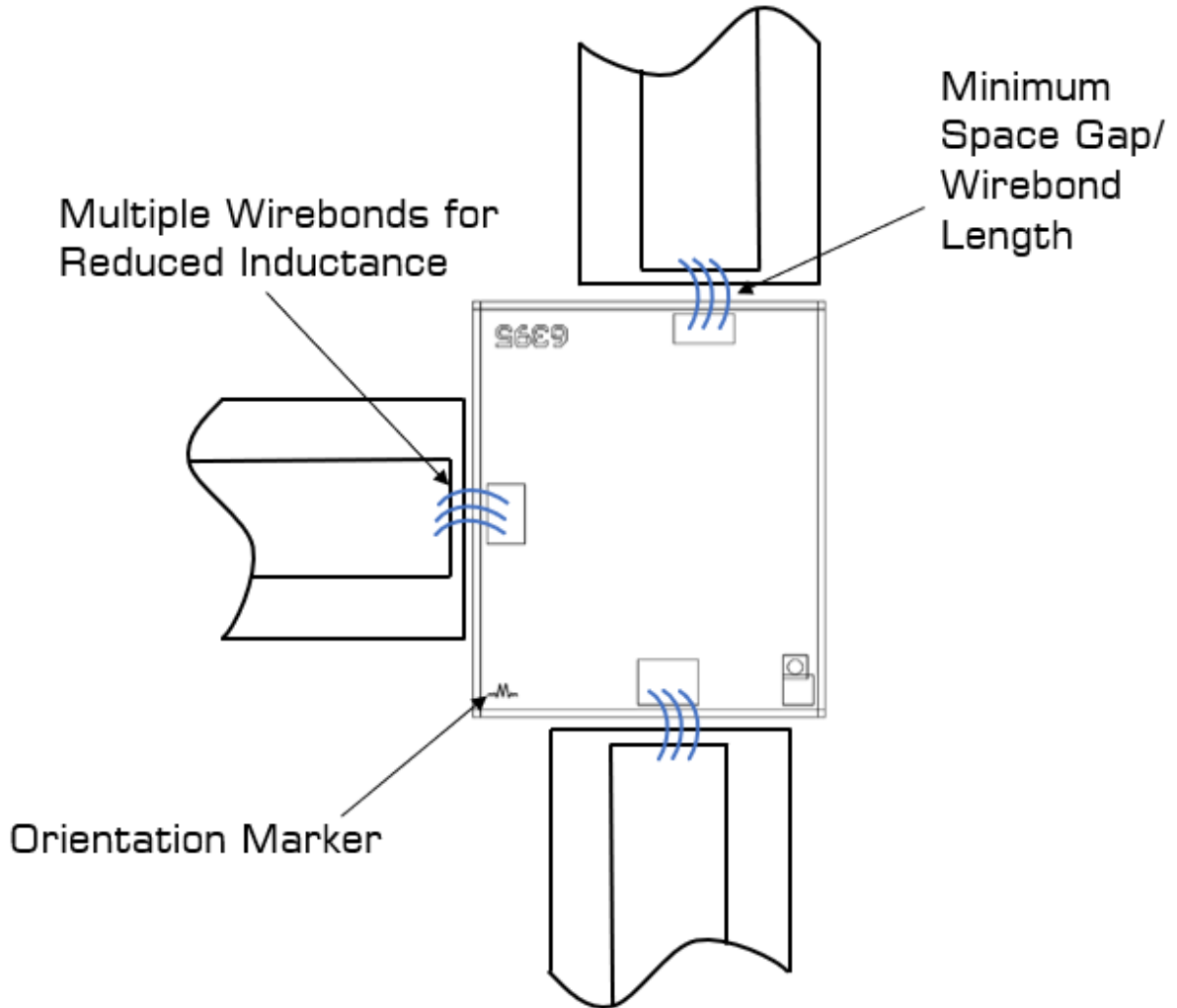
Chips should be handled with care using tweezers or a vacuum collet. Users should take precautions to protect chips from direct human contact that can deposit contaminants, like perspiration and skin oils on any of the chip's surfaces.

Static Sensitivity

GaAs MMIC devices are sensitive to ESD and should be handled, assembled, tested, and transported only in static protected environments.

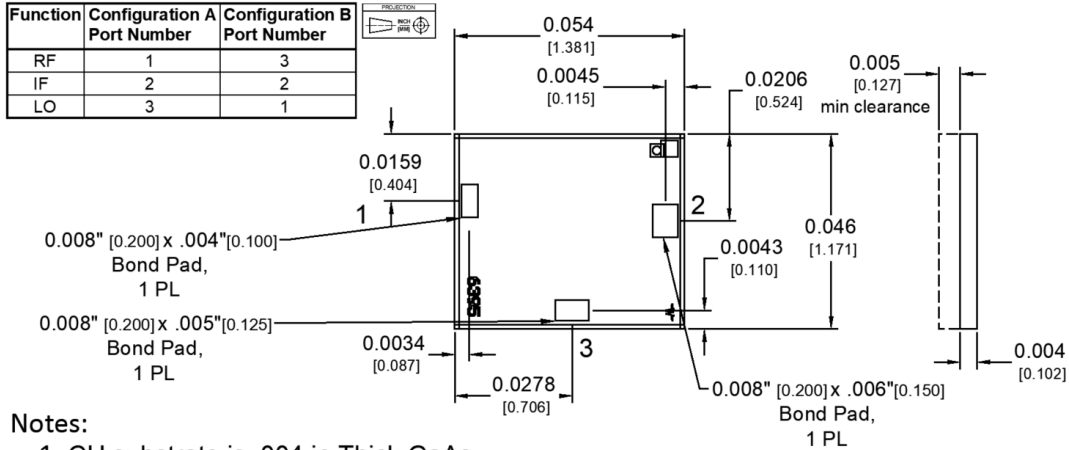
Cleaning and Storage: Do not attempt to clean the chip with a liquid cleaning system or expose the bare chips to liquid. Once the ESD sensitive bags the chips are stored in are opened, chips should be stored in a dry nitrogen atmosphere.

5.3 Bonding Diagram



6. Mechanical Data

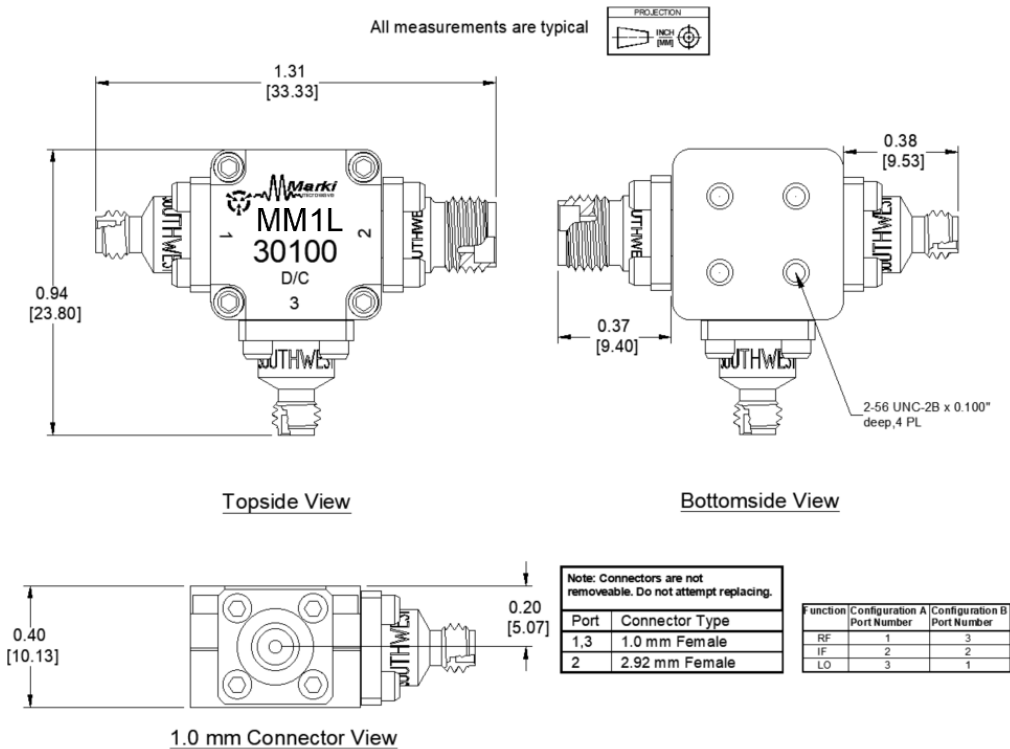
6.1 CH Package Outline Drawing



Notes:

1. CH substrate is .004 in Thick GaAs.
2. I/O traces plane finish is 4 microns Au. 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.
4. Die cannot be directly RF probed.

6.2 M Package Outline Drawing



Marki Microwave reserves the right to make changes to the product(s) or information contained herein without notice. Marki Microwave makes no warranty, representation, or guarantee regarding the suitability of its products for any particular purpose, nor does Marki Microwave assume any liability whatsoever arising out of the use or application of any product.