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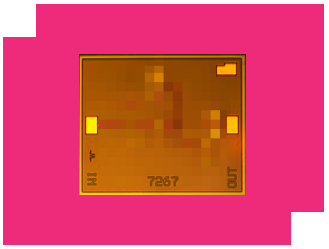
MMQ-40125HCH

GaAs MMIC Millimeter Wave 4x Multiplier

DEVICE OVERVIEW

General Description

MMQ-40125H is a MMIC millimeter wave 4x multiplier fabricated with GaAs Schottky diodes. MMQ-40125H operates over a 10 to 31.25 GHz input frequency range or a quadrupled output frequency range of 40 to 125 GHz. Operation past 125GHz is pending verification. Contact factory for information. MMQ-40125H is available as a connectorized coaxial module using 1.0 mm connectors on the output. Wire bondable die are also available.



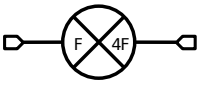
Features

- Low loss die and package
- Up to 125GHz 4th harmonic output tone
- Convenient +0 dBm output level
- Coax connector module

Applications

- mmWave frequency synthesis
- LO signal chain for mmWave mixers

Functional Block Diagram



Part Ordering Options

Part Number	Description	Package	Connectors	Green Status	Product Lifecycle	Export Classification
MMQ-40125HCH	GaAs MMIC Millimeter Wave 4x Multiplier	CH	-	RoHS REACH REACH	Released	3A001.b.7.b.1
MMQ-40125HM	GaAs MMIC Millimeter Wave 4x Multiplier	M	Standard	RoHS REACH REACH	Released	3A001.b.7.b.1

Table Of Contents

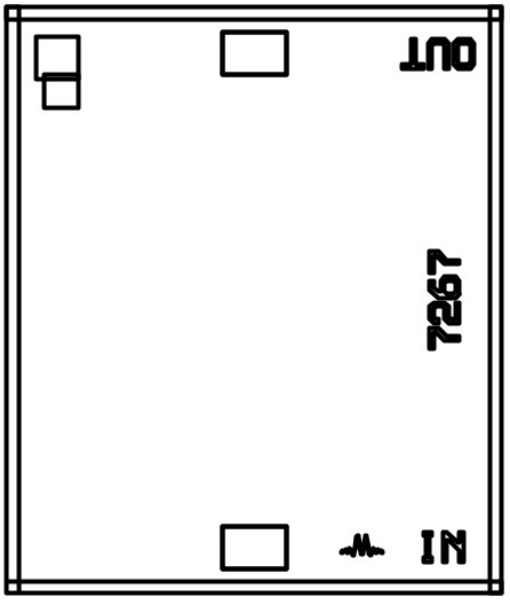
Revision History

Revision Code	Revision Date	Comment
-	2020-10-01	Initial Datasheet Release
A	2021-06-01	Export Classification Updated

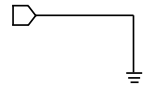
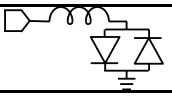
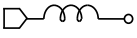
Port Configuration and Functions

Port Diagram

A top-down view of the MMQ-40125H's CH package outline drawing is shown below



Port Functions

Port	Function	Description	Equivalent Circuit for Package
GND	Ground	CH package ground path is provided through the substrate and ground bond pads.	
Port 1	Input	Input 1x Frequency Port. Port 1 is DC coupled to the diodes for the CH and M packages. Blocking capacitor is optional.	
Port 2	Output	Port 2 is DC open for the CH and M package. 2x Input Frequency output port.	

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 be inoperable or have a reduced lifetime.

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	25	mA
Power Handling, any Port	25	dBm

Package Information

Parameter	Details	Rating
Dimensions	-	1.17 x 1.38 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
Input Power	-	20	23	dBm
Ambient Temperature	-55	25	100	°C

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 doubler that requires no DC bias.

Electrical Specifications

The electrical specifications apply at TA=+25°C in a 50Ω system. Typical data shown is for the connectorized M package quadrupler used in the forward direction with a nominal +20 dBm sine wave input . Min and Max limits apply only to our connectorized units and are guaranteed at TA=+25°C. RF testing of our die is performed on a sample basis to verify conformance to datasheet guaranteed specifications.

Parameter	Test Conditions	Minimum Frequency (GHz)	Maximum Frequency (GHz)	Min	Typ	Max	Unit
4F Conversion Loss	Input = 10 – 12.5 GHz Output = 40 - 50 GHz	-	-	-	28	-	dB
4F Conversion Loss	Input = 12.5 - 15 GHz Output = 50 - 60 GHz	-	-	-	23	-	dB
4F Conversion Loss	Input = 15 - 27.5 GHz Output = 60 - 110 GHz	-	-	-	20	23	dB
4F Conversion Loss	Input = 27.5 - 31.25 GHz Output = 110 - 125 GHz	-	-	-	25	-	dB
4F Output Power	Input = 10 – 12.5 GHz Output = 40 - 50 GHz	-	-	-	-8	-	dBm
4F Output Power	Input = 12.5 - 15 GHz Output = 50 - 60 GHz	-	-	-	-3	-	dBm
4F Output Power	Input = 15 - 27.5 GHz Output = 60 - 110 GHz	-	-	-3	0	-	dBm
4F Output Power	Input = 27.5 - 31.25 GHz Output = 110 - 125 GHz	-	-	-	-5	-	dBm
Input Frequency Range	-	-	-	10	-	31.25	GHz
Input Power	-	-	-	-	20	23	dBm
Isolation, 1F [1]	Input = 10 – 31.25 GHz Output = 10 – 31.25 GHz	-	-	-	41	-	dB
Isolation, 2F [2]	Input = 10 – 31.25 GHz Output = 20 – 62.5 GHz	-	-	-	38	-	dB
Isolation, 3F [3]	Input = 10 – 31.25 GHz Output = 30 – 93.75 GHz	-	-	-	34.5	-	dB
Output Frequency Range [4]	-	-	-	40	-	125	GHz
Suppression, 1F [5]	Input = 10 – 31.25 GHz Output = 10 – 31.25 GHz	-	-	-	19	-	dBc
Suppression 2F [6]	Input = 10 – 31.25 GHz Output = 20 – 62.5 GHz	-	-	-	17	-	dBc
Suppression, 3F [7]	Input = 10 – 31.25 GHz Output = 30 – 93.75 GHz	-	-	-	12	-	dBc

[1][2][3] Isolation is defined as the harmonic power relative to the 1F fundamental input power.
[4] Output return loss measured with a fixed frequency large signal 31.25 GHz input.
[5] Suppressions and isolations figures reported include measurement amplifier's harmonic's leakage tones. Suppression is defined as the harmonic power relative to the 4F quadrupled output power.
[6][7] Suppressions and isolations figures reported include measurement amplifier's harmonic's leakage tones. Suppression is defined as the harmonic power relative to the 4F quadrupled output power.

MMQ-40125HCH

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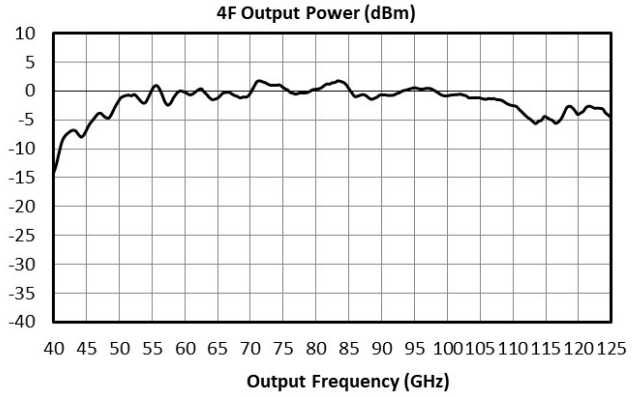
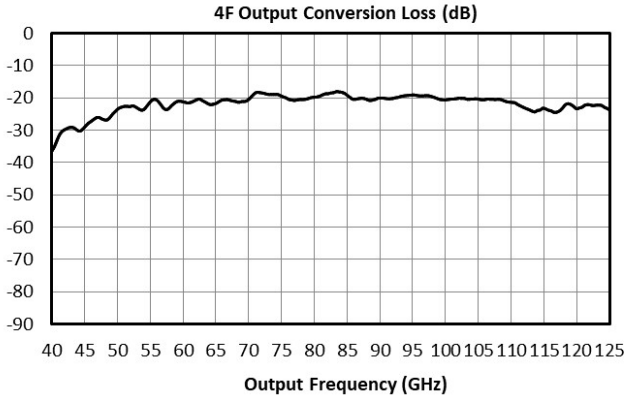
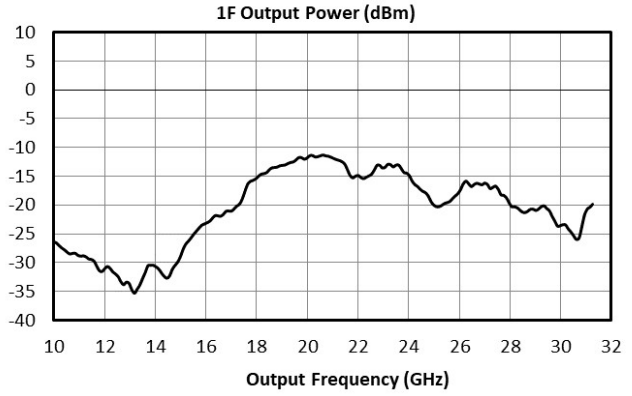
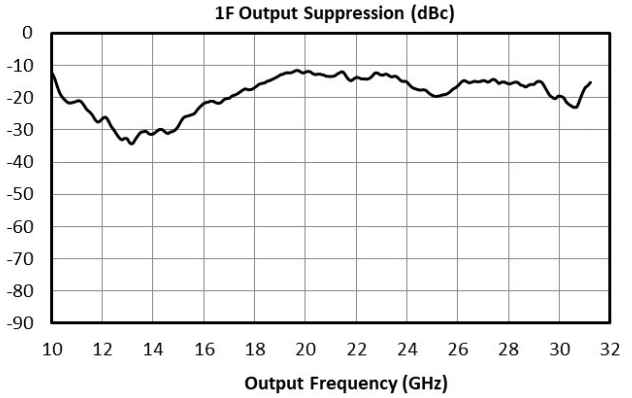
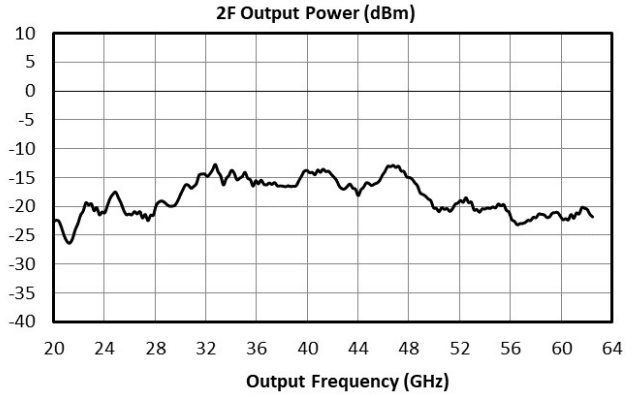
Typical Performance Plots

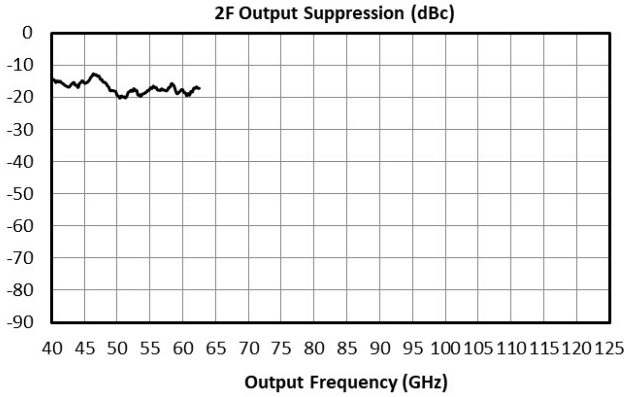


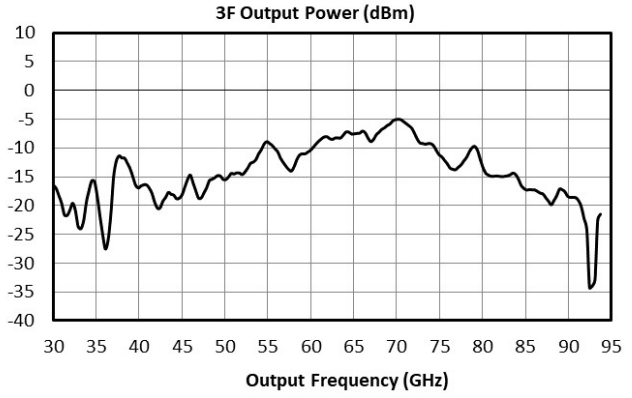


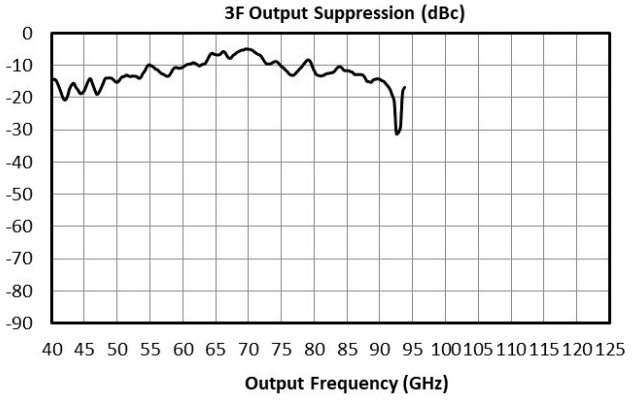








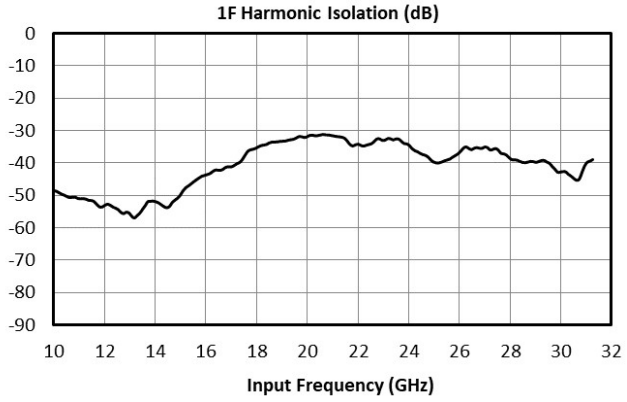




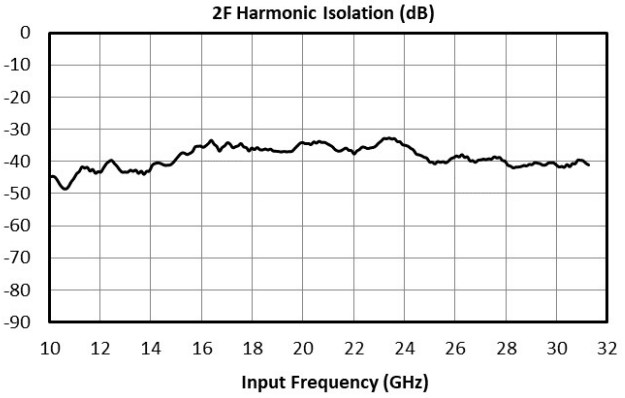
MMQ-40125HCH

GaAs MMIC Millimeter Wave 4x Multiplier

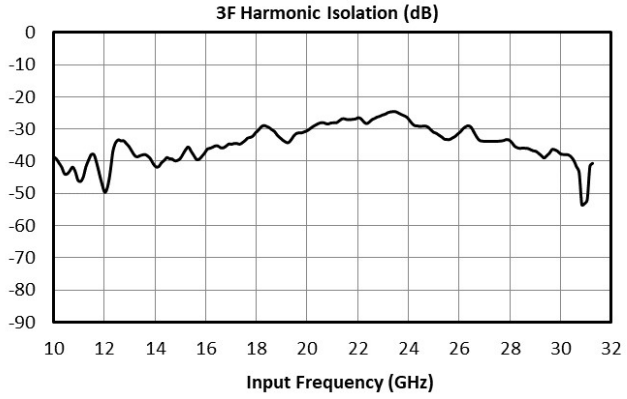
1F Harmonic Isolation (dB)



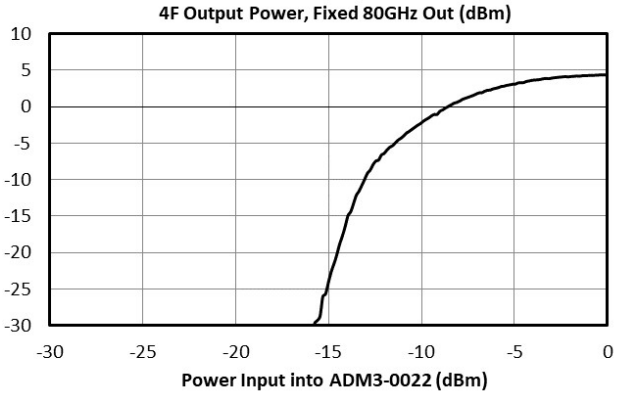
2F Harmonic Isolation (dB)



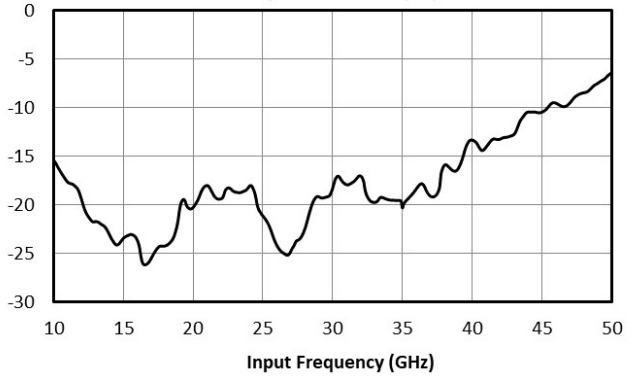
3F Harmonic Isolation (dB)



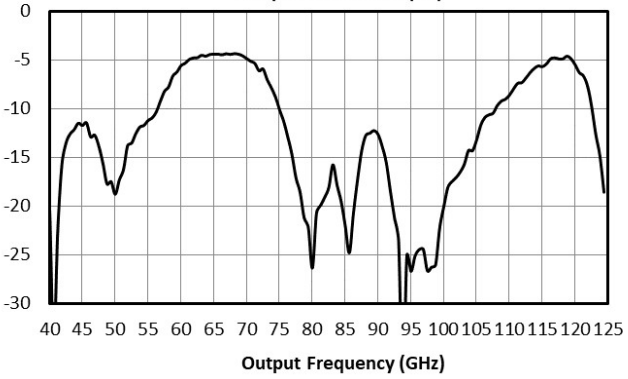
4F Output Power, Fixed 80GHz Out (dBm)



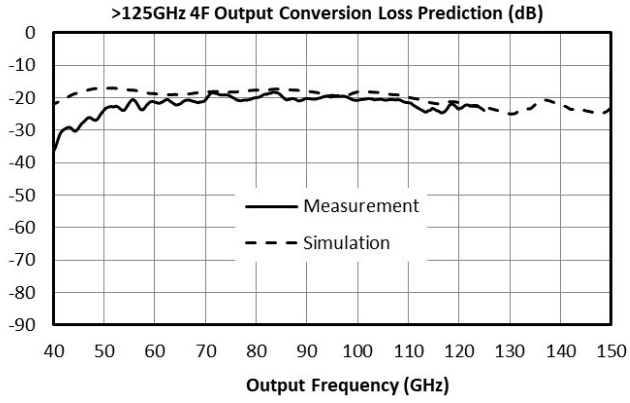
Input Return Loss (dB)



Output Return Loss (dB)



>125GHz 4F Output Conversion Loss Prediction (dB)



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.

Bonding Diagram


Mmq 40125 Hch Bonding Diagram

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.

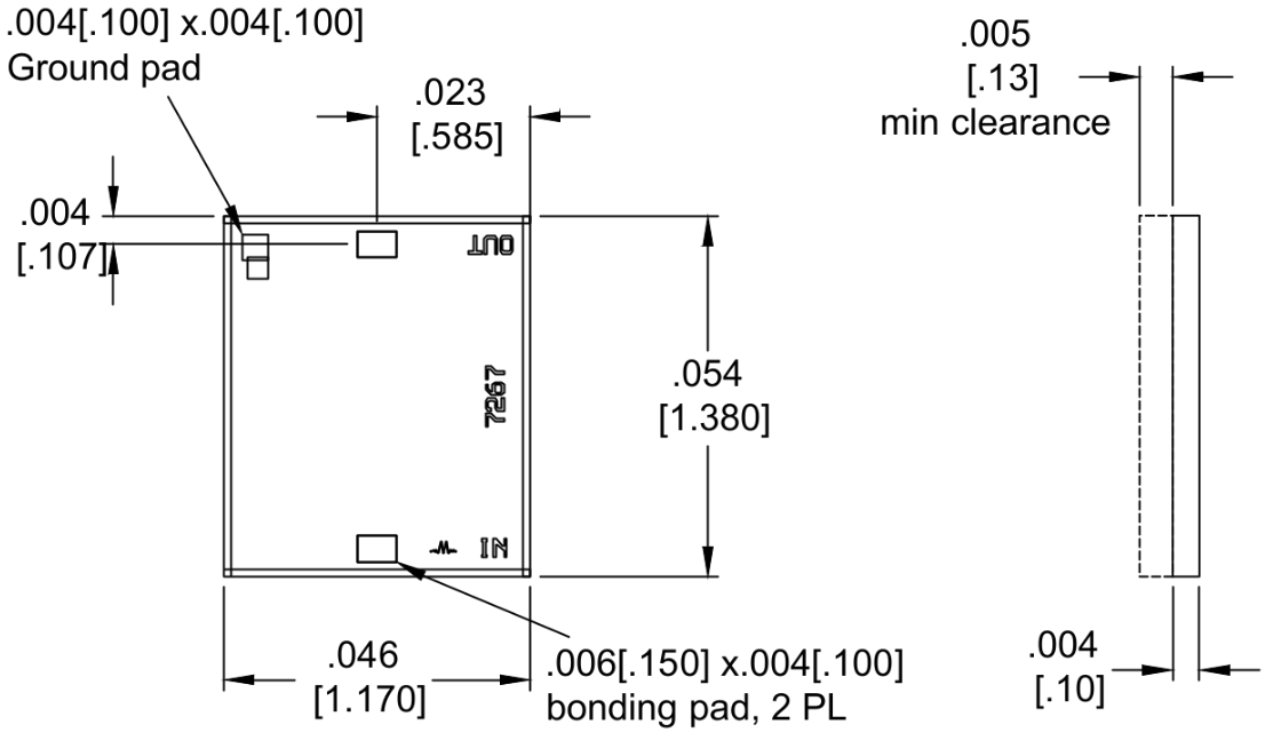
Static Sensitivity

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.

Mechanical Data

Outline Drawing



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