

90° Hybrid Coupler 2 - 5 GHz



MACP-011097
Rev. V3

Features

- Broadband: 2 - 5 GHz
- Low Insertion Loss: 1 dB
- Excellent Phase Balance: 5°
- Miniature Lead-Free Surface Mount Package
- RoHS* Compliant

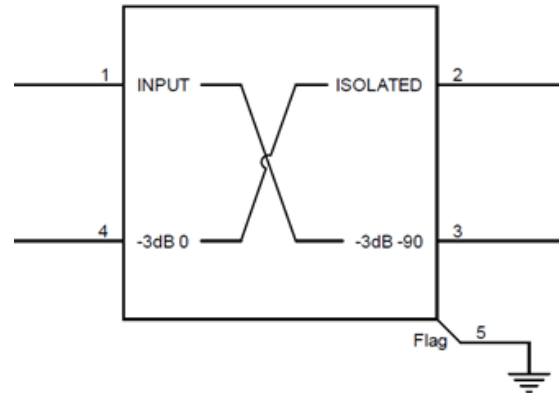
Applications

- Test and Measurement

Description

The MACP-011097 is a fully integrated 2 - 5 GHz 90° hybrid coupler. Offering best in class RF performance in a miniature package.

Functional Schematic



Ordering Information^{1,2}

Part Number	Package
MACP-011097	Gel Pack
MACP-011097-W00001	Wafer Frame
MACP-011097-TR0100	100 Piece Reel
MACP-011097-TR0500	500 Piece Reel
MACP-011097-SB1	Sample Board

1. Reference Application Note M513 for reel size information.
2. All sample boards include 5 loose parts.

Pin Names

Pin #	Function
1 - 4	R_{FIN} / R_{FOUT}
5	GND ³

3. The exposed die backside GND metal must be connected to RF, DC and thermal ground.

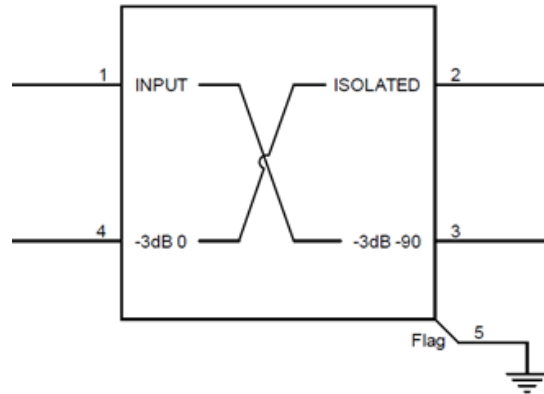
* Restrictions on Hazardous Substances, compliant to current RoHS EU directive.

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Pin Description⁴



Configuration	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5
Configuration 1	Input	Isolated	-3dB -90°	-3dB 0°	GND
Configuration 2	Isolated	Input	-3dB 0°	-3dB -90°	GND

4. Pin descriptions shown on diagram for Configuration 1.

AC Electrical Specifications: Freq. = 2 - 5 GHz, T_A = 25°C, Z₀ = 50 Ω

Parameter	Test Conditions	Units	Min.	Typ.	Max.
Insertion Loss	Configurations 1 & 2	dB	—	0.75	1.2
Amplitude Balance	Configurations 1 & 2	dB	—	1	—
Phase Balance from 90°	Configurations 1 & 2	°	—	3.5	6
Isolation	Configurations 1 & 2	dB	—	30	—
Return Loss	All ports & Configurations	dB	—	20	—

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Recommended Operating Conditions⁵

Parameter	Unit	Min.	Typ.	Max.
RF Input Power ⁶	dBm	—	—	30
DC Current ⁶	mA	—	—	140
Operating Temperature	°C	-55	—	+105

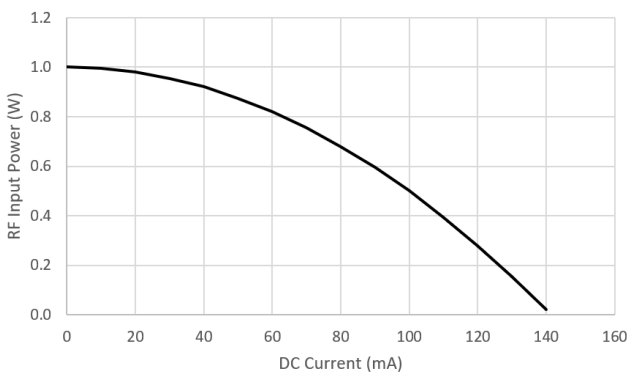
5. All pins and frequencies
6. See derating graph below

Absolute Maximum Ratings^{7,8}

Parameter	Unit	Min	Max
RF Input Power	dBm	—	+34
DC current	mA	—	200
Storage Temperature	°C	-55	+105

7. Exceeding any one or combination of these limits may cause permanent damage to this device.
8. MACOM does not recommend sustained operation near these survivability limits.

Maximum RF vs. DC Input De-Rating Curve @
 $T_A = +105^\circ\text{C}$

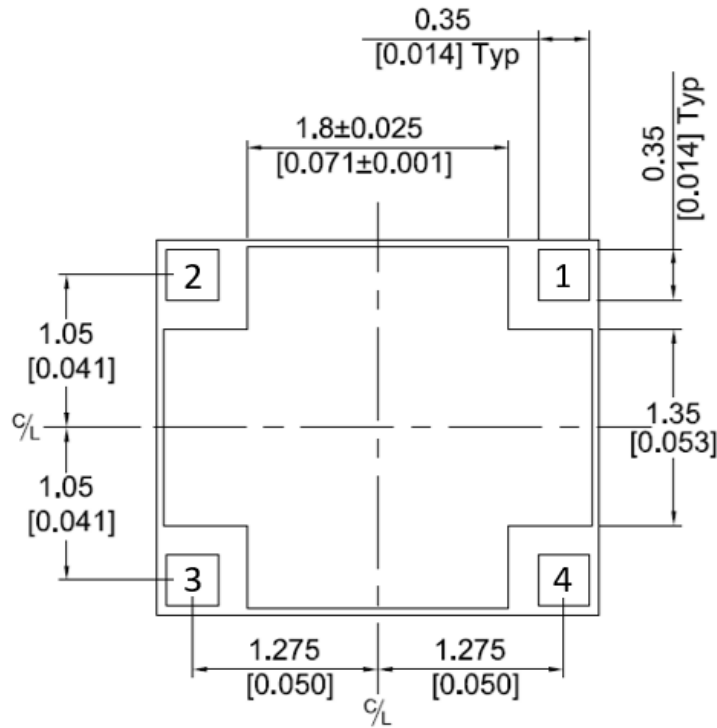


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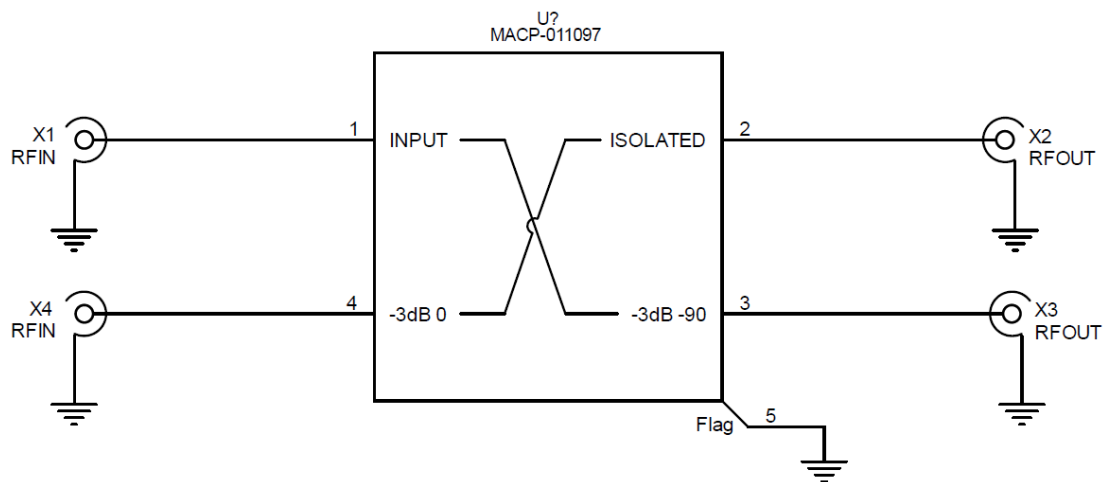


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Die Back Metallization



Application Schematic

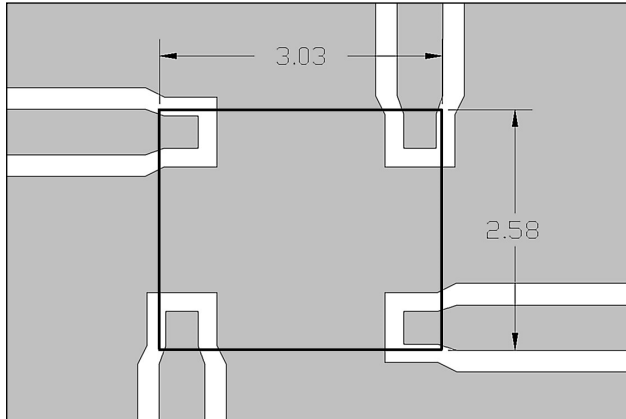


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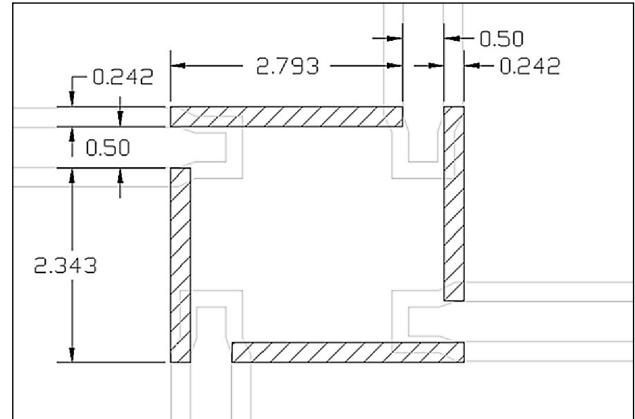


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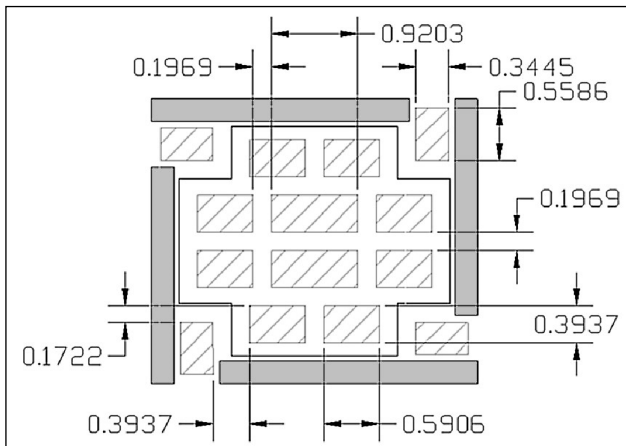
Recommended PCB footprint⁹



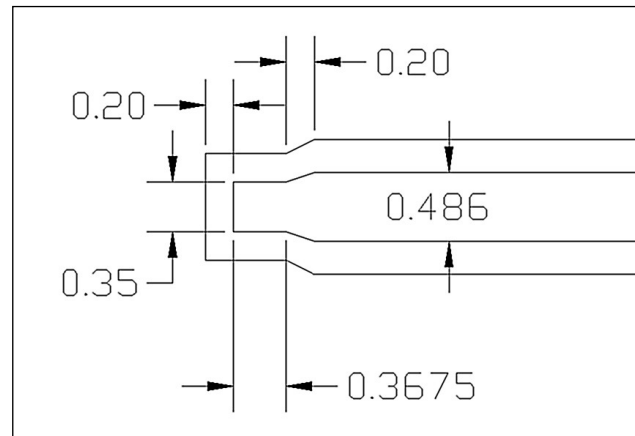
Solder mask coverage⁹



Solder paste template⁹



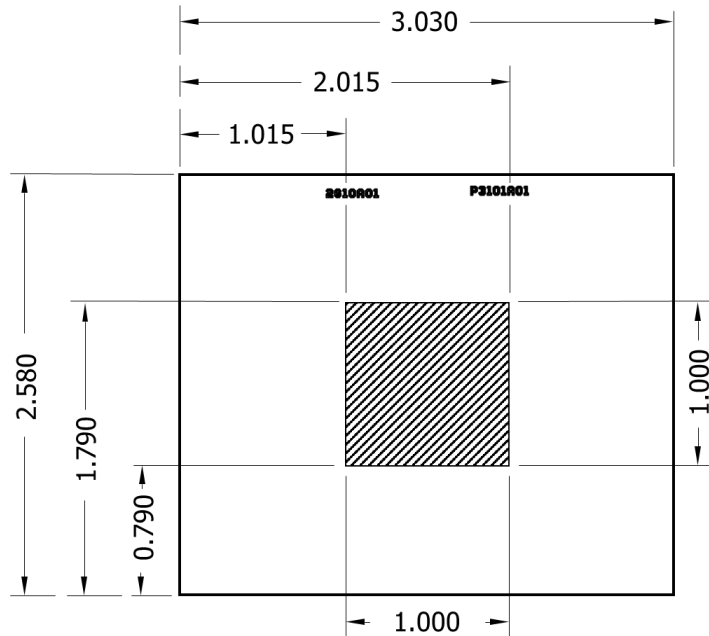
RF line dimensions⁹



9. Dimensions in mm.

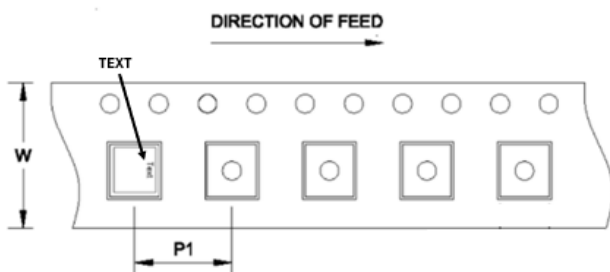
Die Exclusion Area For Pickup Tool

Keep out area for surface contact type pickup collets



EXCLUSION AREA FOR PICKUP
Dimensions in mm

Carrier Tape Orientation



Tape & Reel Information

Parameter	Units	Value
Qty per reel	—	100/500
Reel Size	mm	178
Tape Width	mm	12
P1	mm	8
Orientation	—	F3
Reference Application Note ANI-019 for orientation		

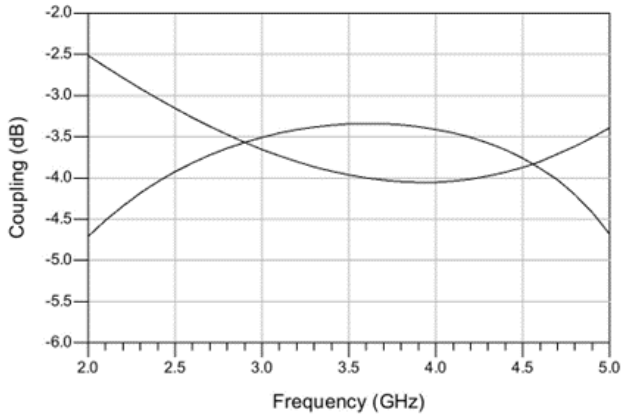
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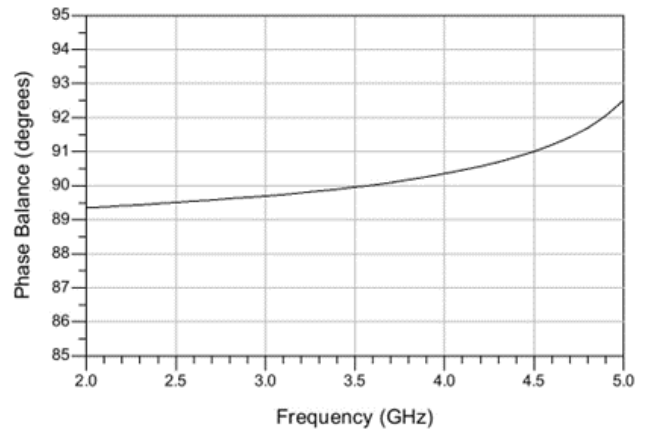
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Typical Performance Curves: Configuration 1

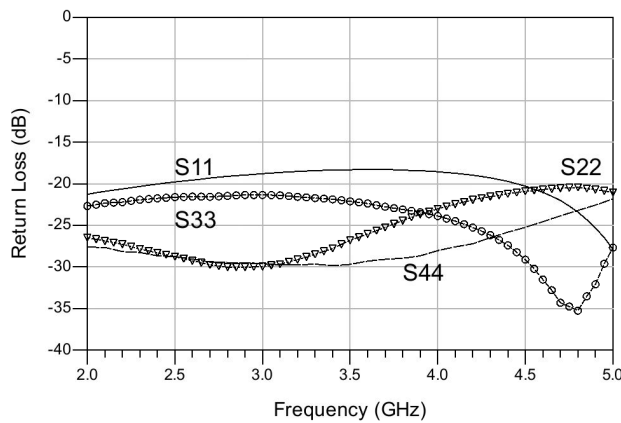
Coupling



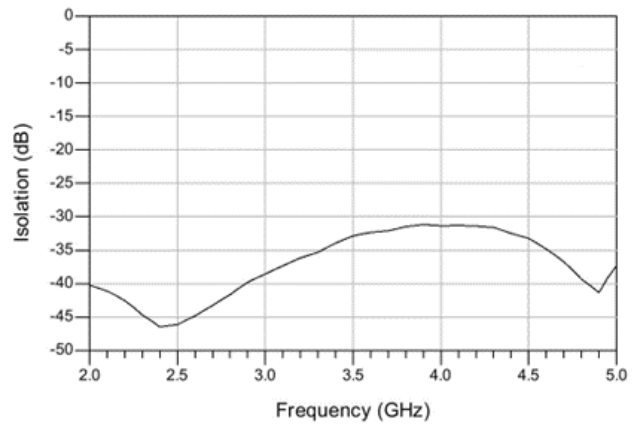
Phase Balance



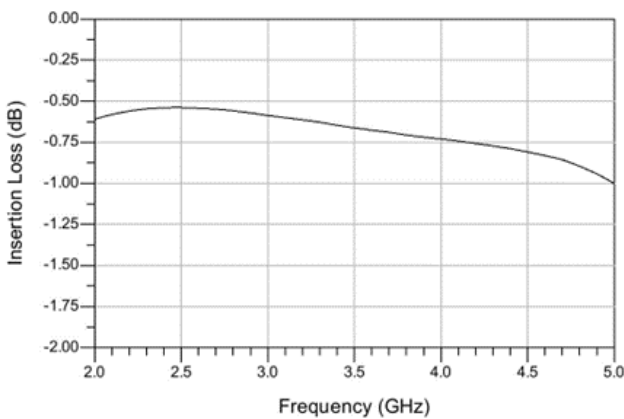
Return Losses



Isolation



Insertion Loss



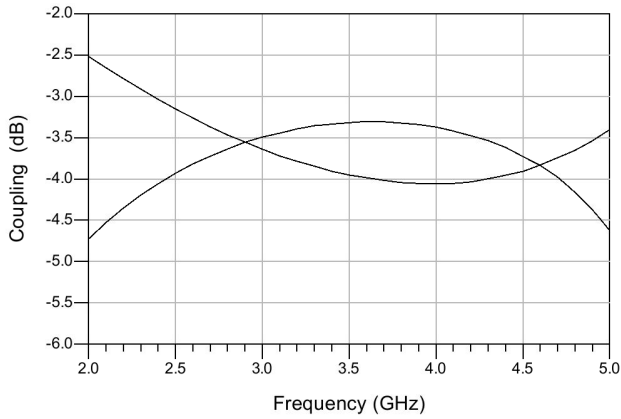
90° Hybrid Coupler 2 - 5 GHz



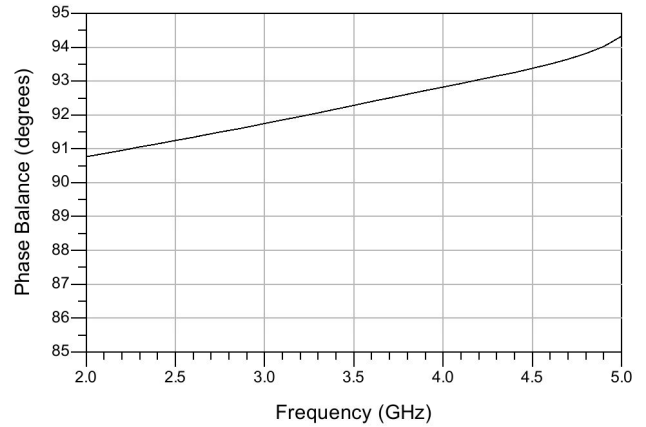
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Typical Performance Curves: Configuration 2

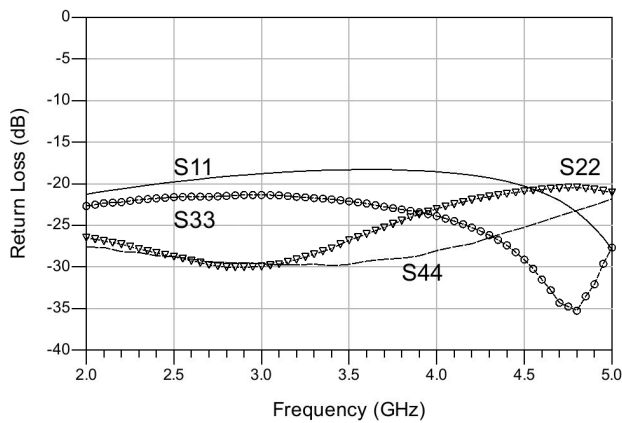
Coupling



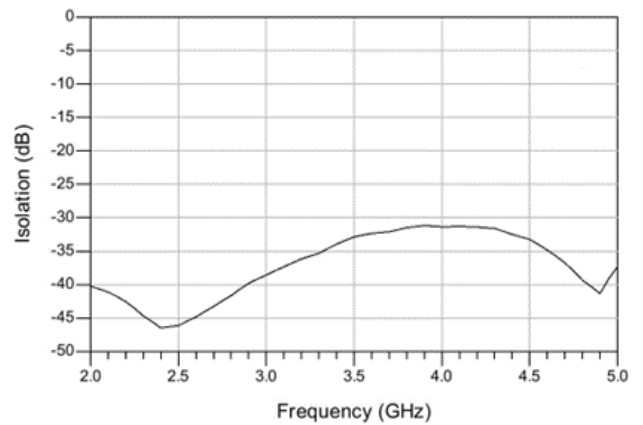
Phase Balance



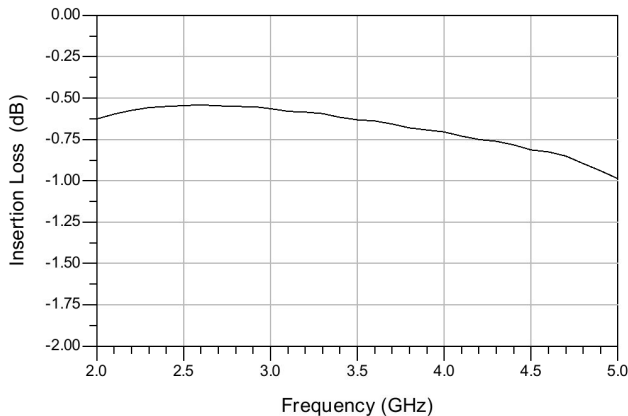
Return Losses



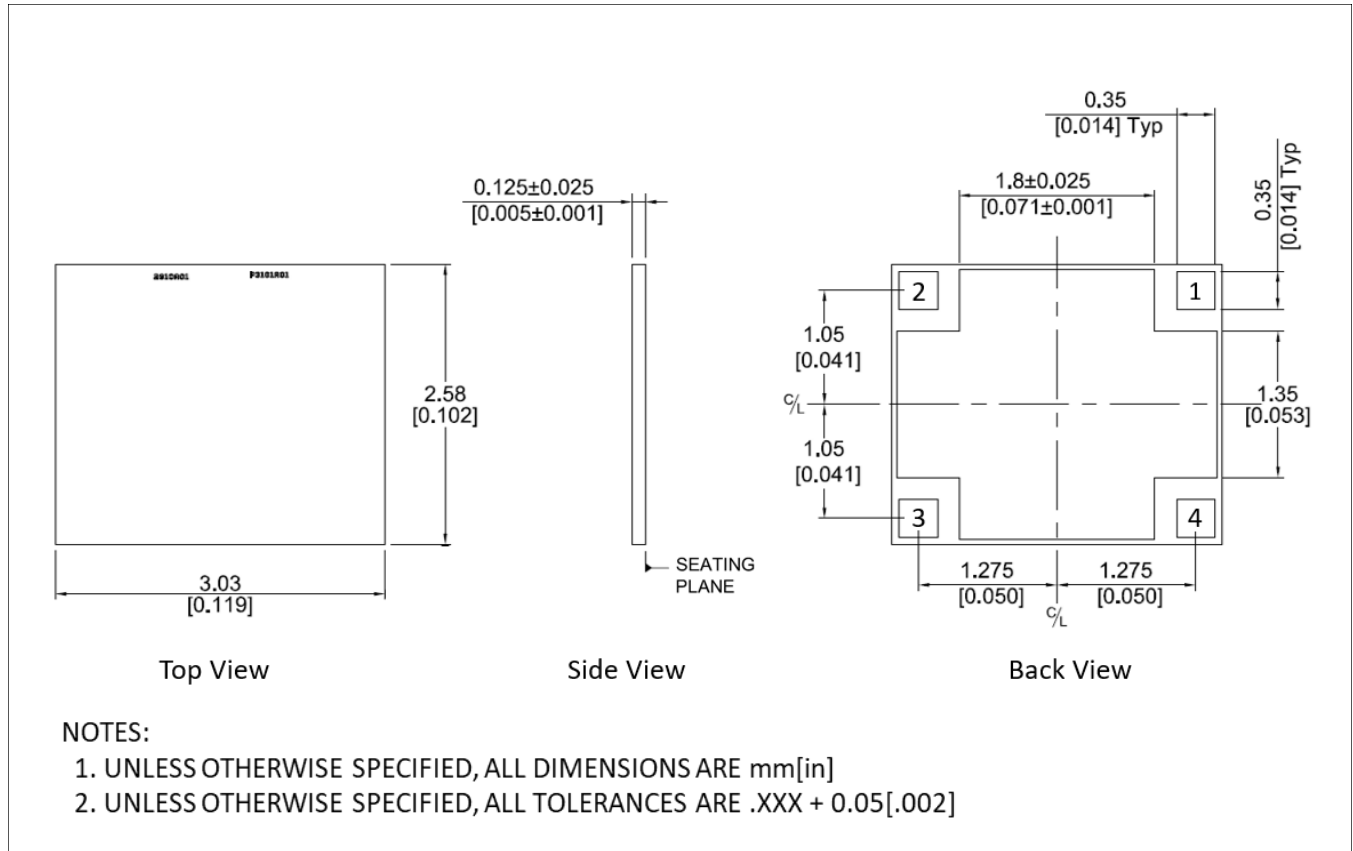
Isolation



Insertion Loss



Die Outline Drawing



Mounting Techniques

Reference MACOM Application Note M538 for lead-free solder reflow recommendations. The gold plating on the back side of the die is 0.1 μm thick. For a suitable solder attach ensure the PCB is gold plated with a thickness of between 0.05 - 0.15 μm.

Static Sensitivity

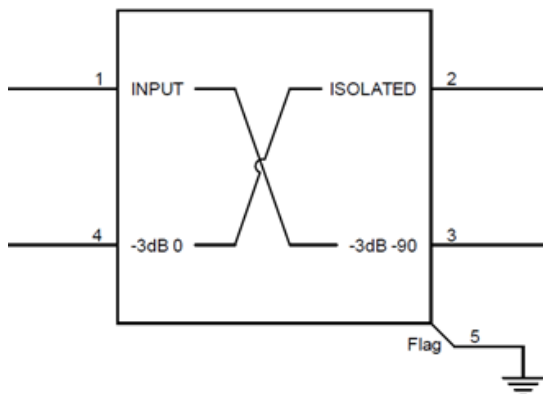
These electronic devices are sensitive to electrostatic discharge (ESD) and can be damaged by static electricity. Proper ESD control techniques should be used when handling these devices.

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Application Note¹⁰



Configuration	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5
Configuration 1	Input	Isolated	-3dB -90°	-3dB 0°	GND
Configuration 2	Isolated	Input	-3dB 0°	-3dB -90°	GND
Configuration 3	-3dB -90°	-3dB 0°	Input	Isolated	GND
Configuration 4	-3dB 0°	-3dB -90°	Isolated	Input	GND

10. Pin descriptions shown on diagram for Configuration 1.

AC Electrical Specifications: Freq. = 2 - 5 GHz, T_A = 25°C, Z₀ = 50 Ω

Parameter	Test Conditions	Units	Min.	Typ.	Max.
Insertion Loss	All Configurations	dB	—	0.75	—
Amplitude Balance	All Configurations	dB	—	1	—
Phase Balance from 90°	Configuration 1 Configuration 2	°	—	3 5	—
Isolation	Configurations 1 & 2	dB	—	30	—
Return Loss	All Ports & Configurations	dB	—	20	—

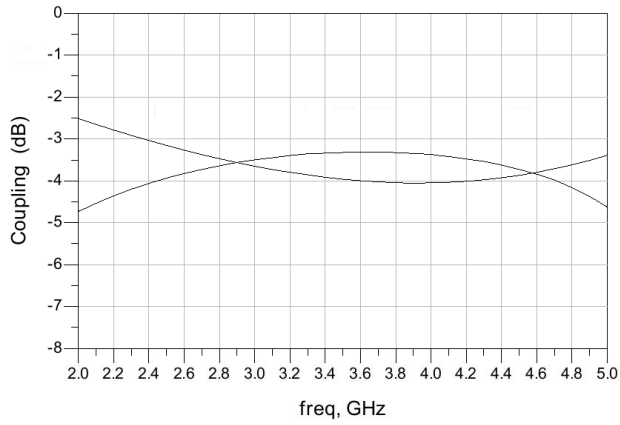
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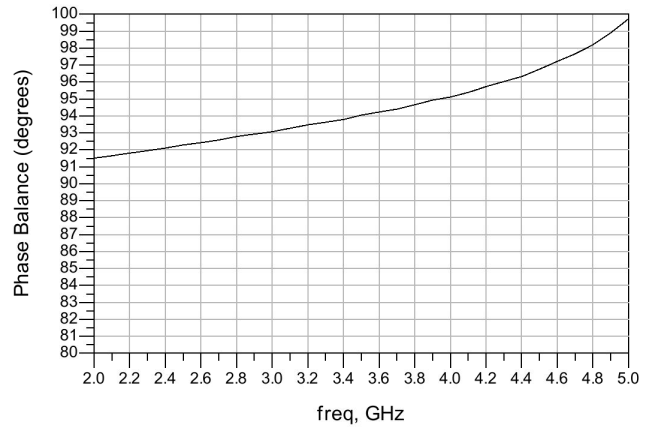
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Typical Performance Curves: Configuration 3

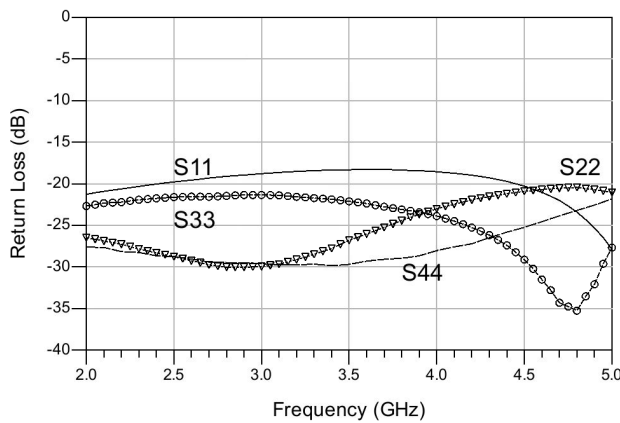
Coupling



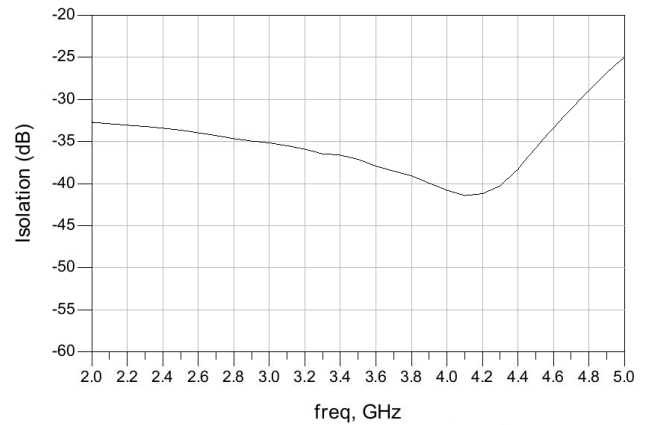
Phase Balance



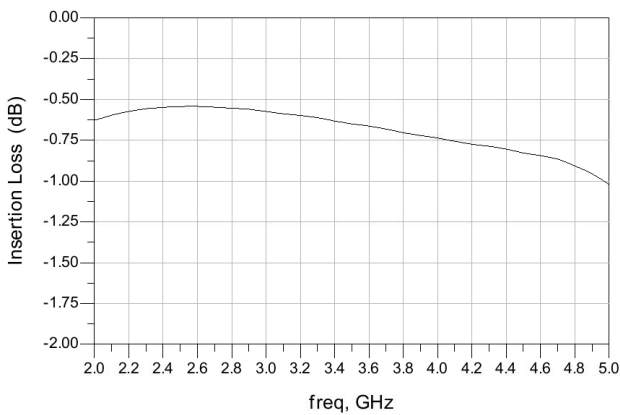
Return Losses



Isolation



Insertion Loss



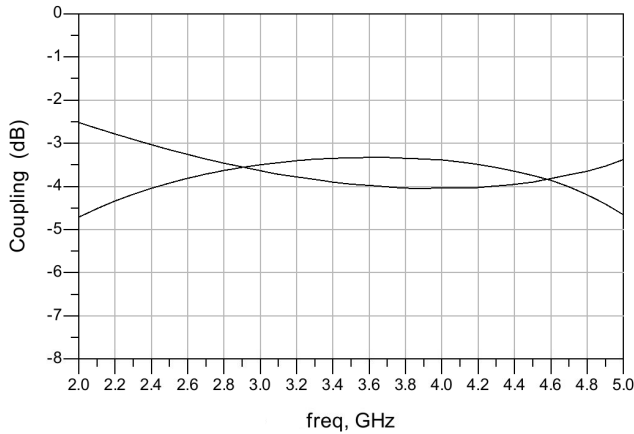
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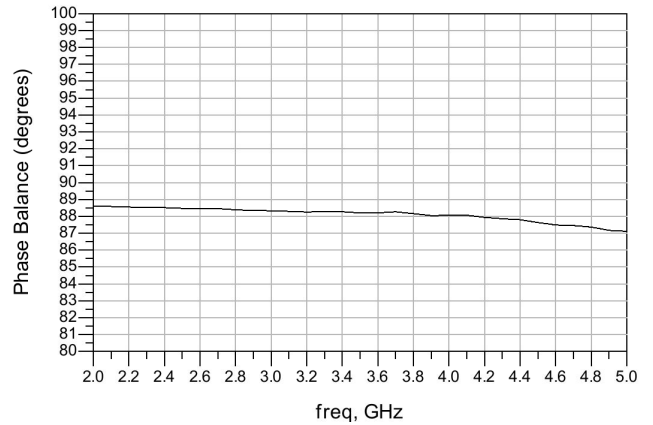
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Typical Performance Curves: Configuration 4

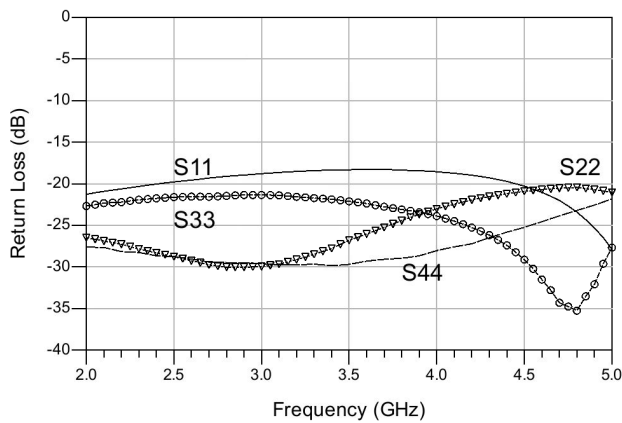
Coupling



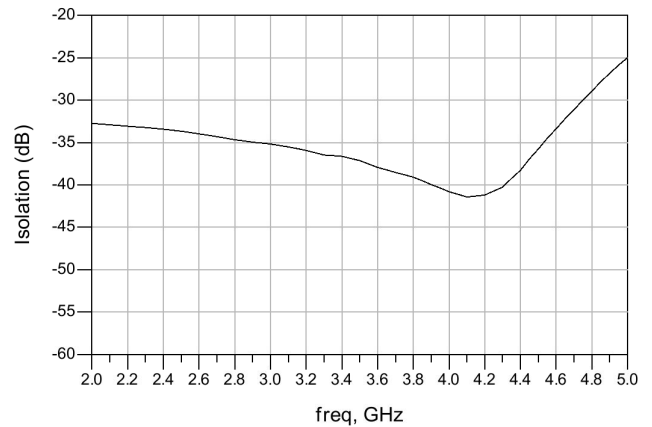
Phase Balance



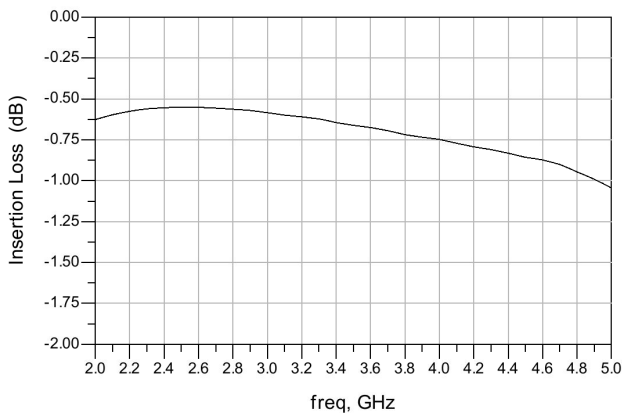
Return Losses



Isolation



Insertion Loss



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