

# Bi-Directional Coupler

## 5 - 55 GHz



MACP-011096  
Rev. V2

### Features

- Broadband: 5 to 55 GHz
- Low Insertion Loss: 1 dB @ 50 GHz
- High Isolation: 40 dB @ 30 GHz
- Coupling Factor: 18 dB
- Miniature Lead-Free Surface Mount Package
- RoHS\* Compliant

### Applications

- Test and Measurement

### Description

The MACP-011096 is a fully integrated 5 - 55 GHz bi-directional coupler, offering best in class RF performance in a miniature package.

MACOM's proprietary HMIC™ process enables market leading lightweight passive components. MACP-011096 weighs just 2 mg.

### Ordering Information<sup>1,2</sup>

Part Number	Package
MACP-011096	Gel Pack
MACP-011096-TR0100	100 Piece Reel
MACP-011096-TR0500	500 Piece Reel
MACP-011096-SB1	Sample Board

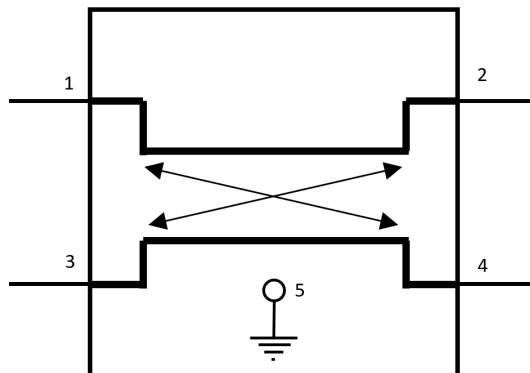
1. Reference Application Note M513 for reel size information.
2. All sample boards include 5 loose parts.

### Pin Description

Configuration	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5
Configuration 1	Input	Output	Coupled	Isolated	Ground
Configuration 2	Output	Input	Isolated	Coupled	Ground
Configuration 3	Coupled	Isolated	Input	Output	Ground
Configuration 4	Isolated	Coupled	Output	Input	Ground

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

### Functional Schematic



### Pin Names

Pin #	Function
1 - 4	$R_{FIN} / R_{FOUT}$
5	GND <sup>3</sup>

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

# Bi-Directional Coupler

## 5 - 55 GHz



MACP-011096

Rev. V2

### AC Electrical Specifications: Freq. = 5 - 55 GHz, T<sub>A</sub> = 25°C, Z<sub>0</sub> = 50 Ω, All Configurations

Parameter	Frequency Test Conditions (GHz)	Units	Min.	Typ.	Max.
Insertion Loss	5 - 15	dB	—	0.3	—
	15 - 45			0.6	
	45 - 55			1.0	
Coupling	5 - 15	dB	—	23	—
	15 - 45			18	
	45 - 55			25	
Return Loss, all ports	5 - 15	dB	—	30	—
	15 - 45			25	
	45 - 55			17	
Isolation	5 - 15	dB	—	50	—
	15 - 45			40	
	45 - 55			35	
Directivity	5 - 15	dB	—	27	—
	15 - 45			22	
	45 - 55			10	

### Recommended Operating Conditions<sup>4</sup>

Parameter	Unit	Min.	Typ.	Max.
RF Input Power <sup>5</sup>	dBm	—	—	33
DC Current <sup>5</sup>	A	—	—	1.8
Operating Temperature	°C	-55	—	+105

4. All pins and frequencies.

5. See derating graph.

### Absolute Maximum Ratings<sup>6,7</sup>

Parameter	Unit	Min	Max
RF Input Power	dBm	—	41
DC Current	A	—	4
Storage Temperature	°C	-55	+105

6. Exceeding any one or combination of these limits may cause permanent damage to this device.

7. MACOM does not recommend sustained operation near these survivability limits.

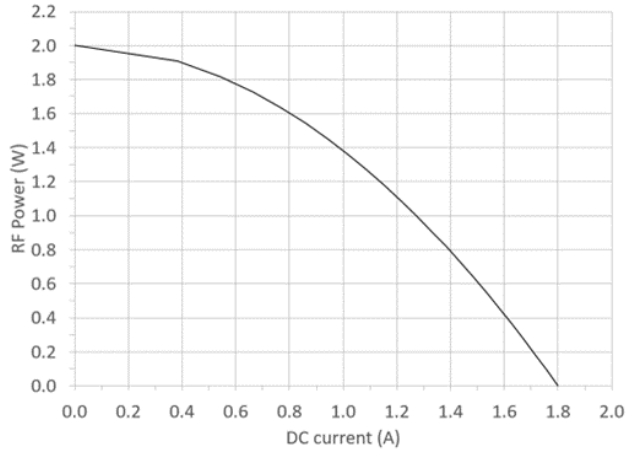
# Bi-Directional Coupler

## 5 - 55 GHz



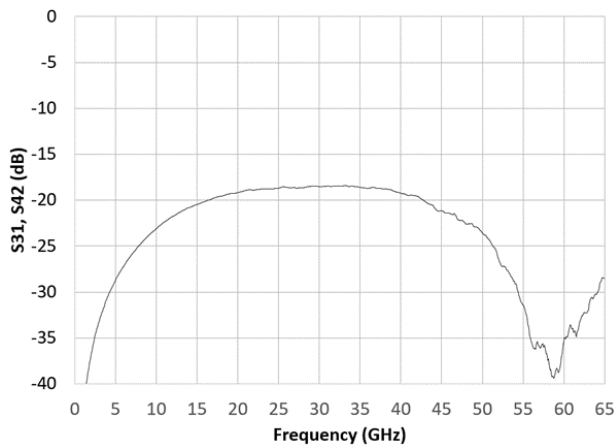
MACP-011096  
Rev. V2

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

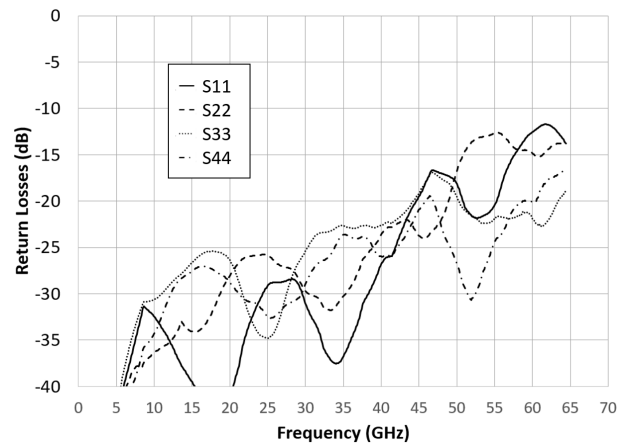


### Typical Performance Curves: All Configurations

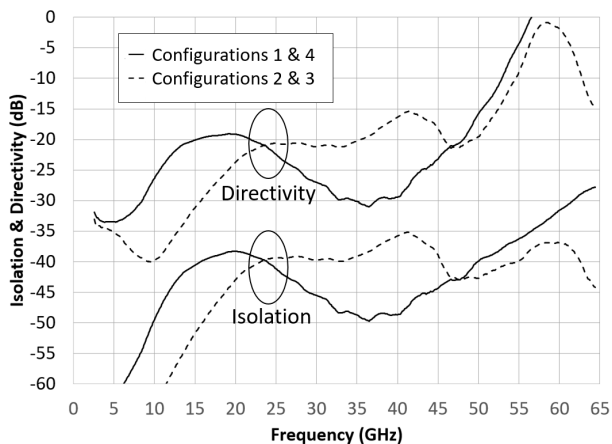
**Coupling**



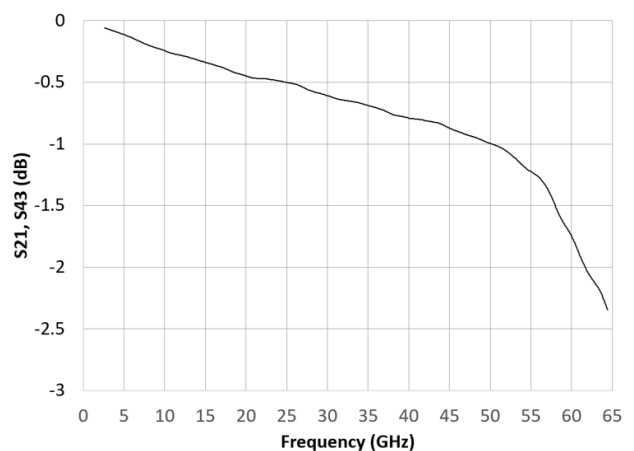
**Return Loss**



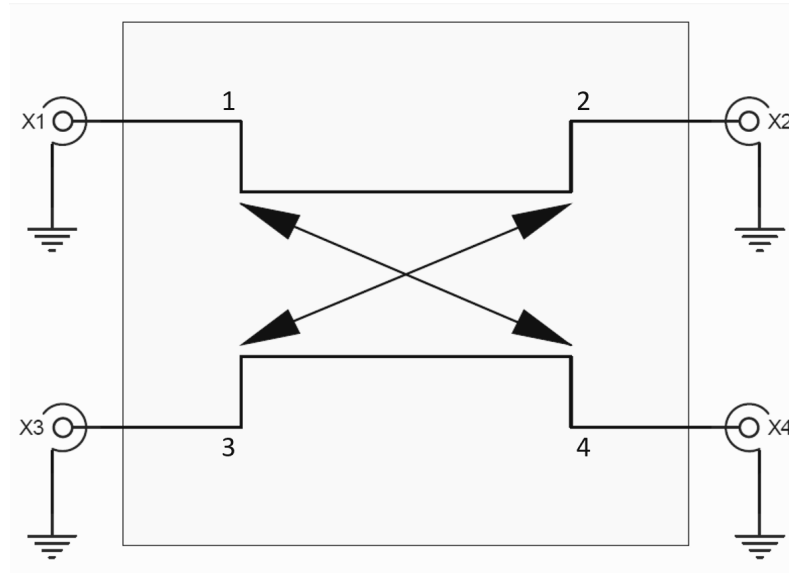
**Isolation**



**Insertion Loss**



### Application Schematic



### 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  $\mu\text{m}$  thick. For a suitable solder attach ensure the PCB is gold plated with a thickness of between 0.05 - 0.15  $\mu\text{m}$ .

### 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.

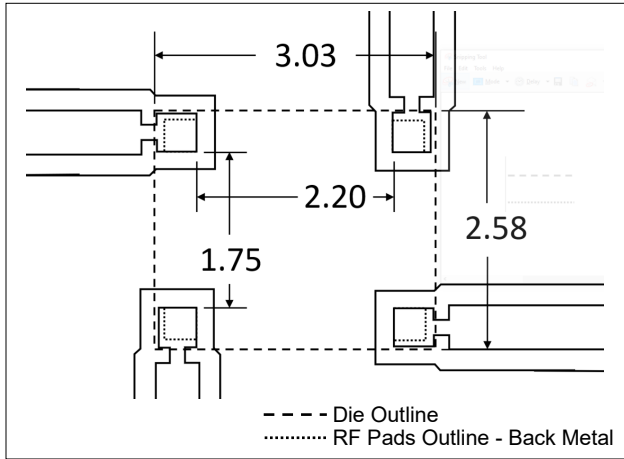
# Bi-Directional Coupler

## 5 - 55 GHz

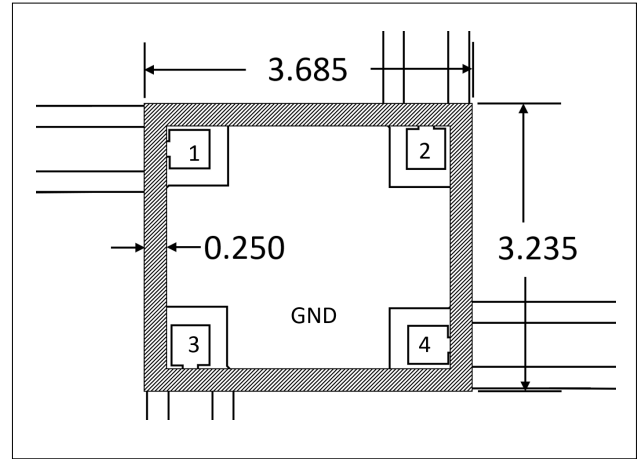


MACP-011096  
Rev. V2

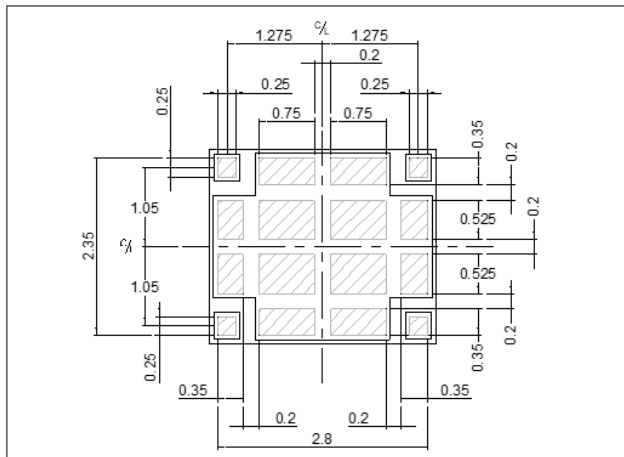
### Recommended PCB footprint<sup>8,9</sup>



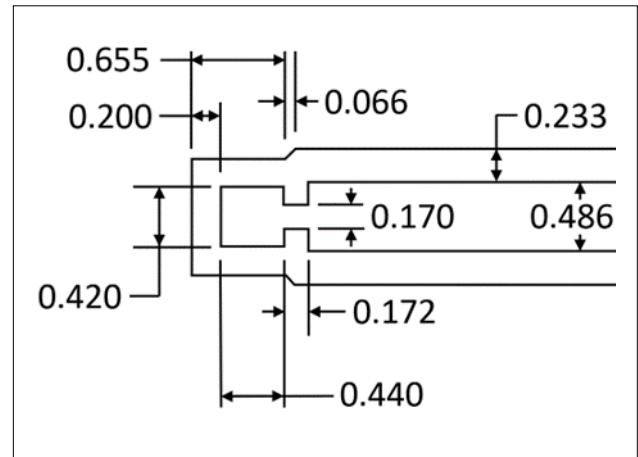
### Solder Mask Coverage<sup>8</sup>



### GND Metal Solder Paste Template<sup>8,9</sup>



### RF Line Dimensions<sup>8,10</sup>



- 8. Dimensions in mm.
- 9. The exposed die backside GND metal must be connected to RF, DC and thermal ground.
- 10. Track dimensions apply to 44  $\mu$ m thick copper on 0.254 mm Rogers 4350B.

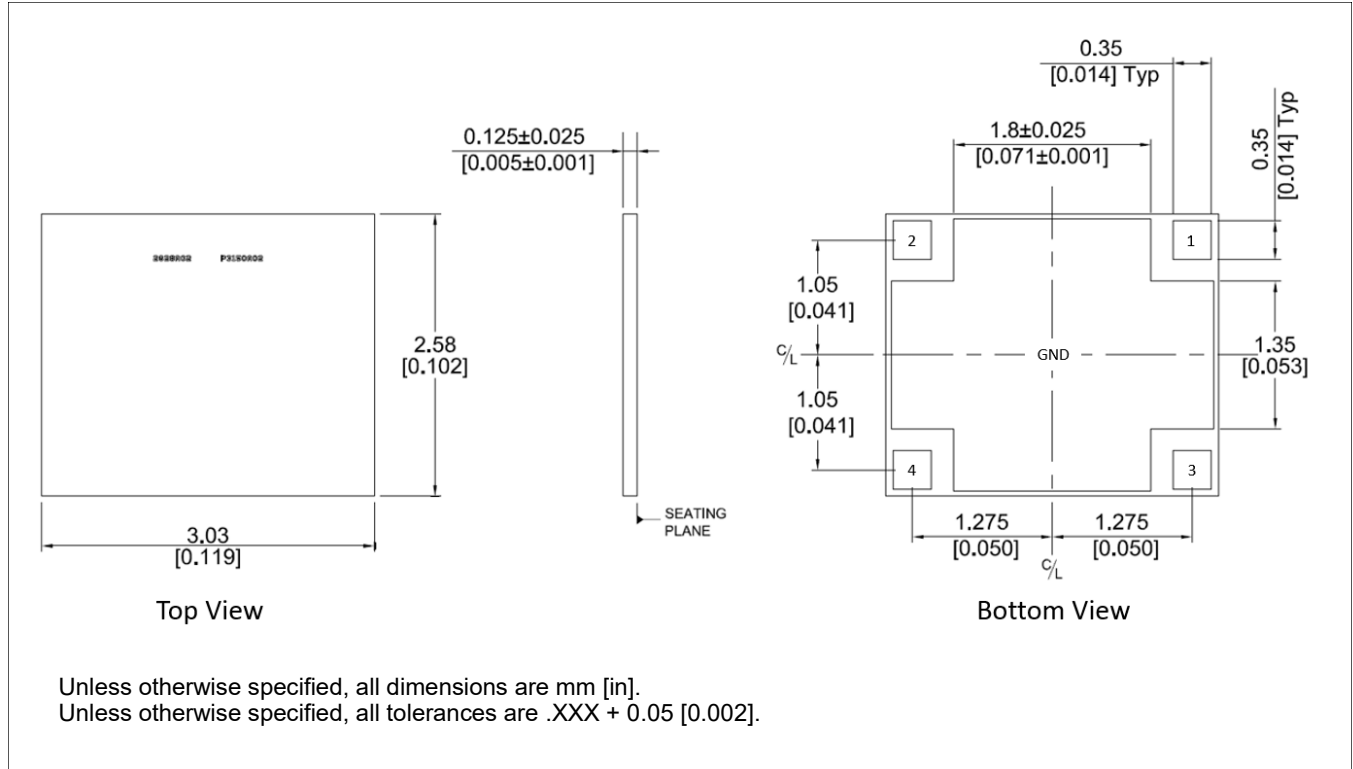
# Bi-Directional Coupler

## 5 - 55 GHz



**MACP-011096**  
Rev. V2

### Die Outline Drawing



# Bi-Directional Coupler

## 5 - 55 GHz



MACP-011096  
Rev. V2

MACOM Technology Solutions Inc. ("MACOM"). All rights reserved.

These materials are provided in connection with MACOM's products as a service to its customers and may be used for informational purposes only. Except as provided in its Terms and Conditions of Sale or any separate agreement, MACOM assumes no liability or responsibility whatsoever, including for (i) errors or omissions in these materials; (ii) failure to update these materials; or (iii) conflicts or incompatibilities arising from future changes to specifications and product descriptions, which MACOM may make at any time, without notice. These materials grant no license, express or implied, to any intellectual property rights.

THESE MATERIALS ARE PROVIDED "AS IS" WITH NO WARRANTY OR LIABILITY, EXPRESS OR IMPLIED, RELATING TO SALE AND/OR USE OF MACOM PRODUCTS INCLUDING FITNESS FOR A PARTICULAR PURPOSE, MERCHANTABILITY, INFRINGEMENT OF INTELLECTUAL PROPERTY RIGHT, ACCURACY OR COMPLETENESS, OR SPECIAL, INDIRECT, INCIDENTAL, OR CONSEQUENTIAL DAMAGES WHICH MAY RESULT FROM USE OF THESE MATERIALS.

MACOM products are not intended for use in medical, lifesaving or life sustaining applications. MACOM customers using or selling MACOM products for use in such applications do so at their own risk and agree to fully indemnify MACOM for any damages resulting from such improper use or sale.