MHC45S03

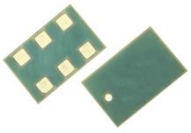
3dB 90° Directional Coupler

MiPD®

MEGSINE兆讯

Applications

1, Low Insertion Loss For Power Combining
2, Doherty Power Amplifier
3, Small Cell & Pico



Features

1, Low Insertion Loss
2, High Isolation, 20 dB typ.
3, Excellent high-power capacity up to 5W
4, RoHS compliance (Pb-Free)
5, AEC-Q200 qualified

Description

The MHC45S03 is a low cost, high performance 3 dB hybrid coupler in an easy used surface mount package. The MHC45S03 is ideal for doherty power amplifier, circular polarized antenna and other applications where low insertion loss and tight amplitude and phase balance are required. MHC45S03 is constructed from ceramic filled PTFE composites which possess excellent electrical and mechanical stability. All components are 100% RF tested.

Characteristics

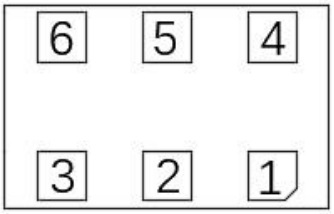
Table 1. MHC45S03 Characteristics

Item	Min.	Type	Max.	Unit
Frequency Range	3000		6000	MHz
Isolation	18	20		dB
Insertion Loss		0.4	0.5	dB
Phase Unbalance	-3		+3	degrees
Amplitude	-0.5		+0.5	dB
Return Loss	18	20		dB
Operating Temp.	-40		+125	°C
Power			5	W

All the above data are based on specified demo board and tested in 25° environment.

Port Configuration

Figure 1. MHC45S03 (Bottom View)



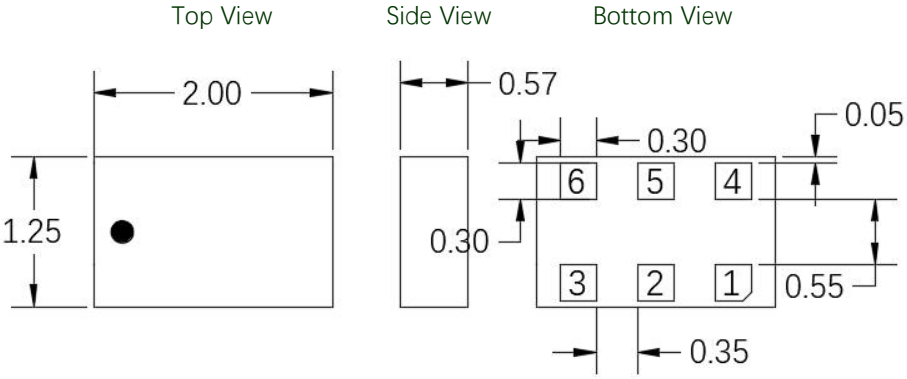
The MHC45S03 port configurations depending on how input signals are split. The Case 1, Case 2, Case 3, and Case 4, configurations mean that one input signal is split into two output signals. When port 1 is defined, the other ports are defined automatically

Table 2. MHC45S03 Port Configurations

Configuration	Port 1	Port 3	Port 4	Port 6
Case1.	Input	Isolated	Direct -3dB, -90°	Coupling -3dB, 0°
Case2.	Isolated	Input	Coupling -3dB, 0°	Direct -3dB, -90°
Case3.	Direct -3dB, -90°	Coupling -3dB, 0°	Input	Isolated
Case4.	Coupling -3dB, 0°	Direct -3dB, -90°	Isolated	Input

Outline Drawing

Figure 2. MHC45S03 Outline Drawing



Unit: mm

Typical Performance (25°C, 3000-6000 MHz)

Figure 3. MHC45S03 Coupling

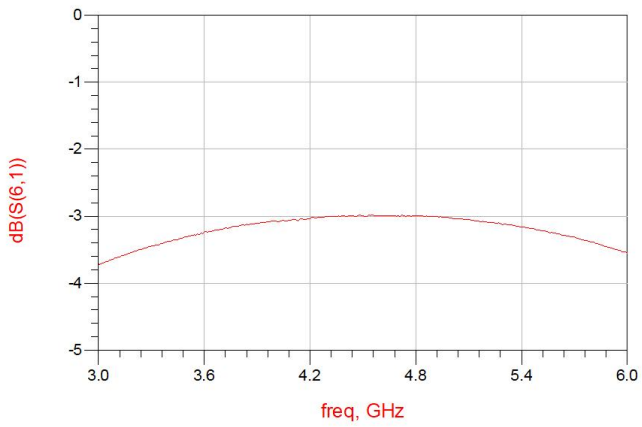


Figure 4. MHC45S03 Transmission

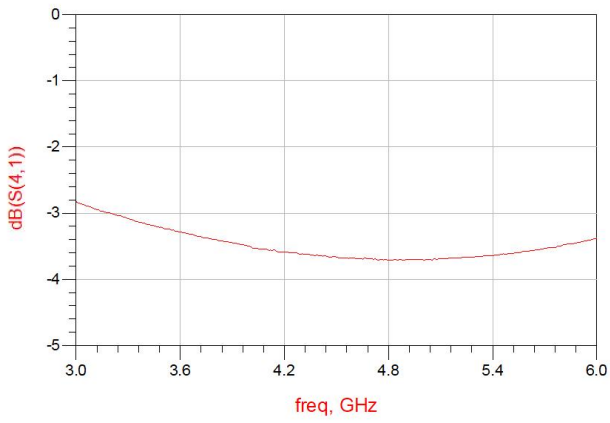


Figure 5. MHC45S03 Return Loss (S11)

Figure 6. MHC45S03 Return Loss (S33)

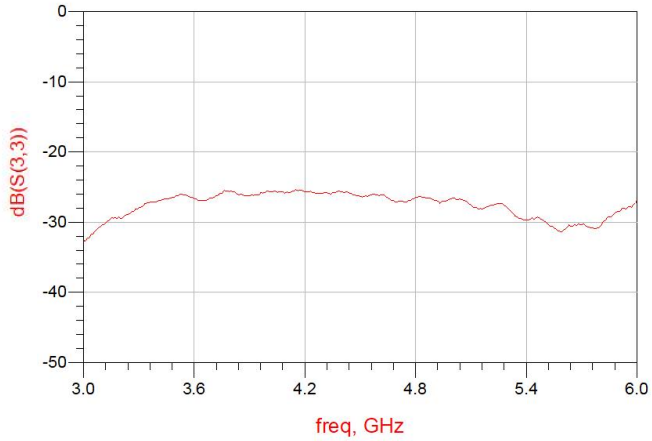


Figure 7. MHC45S03 Return Loss (S44)

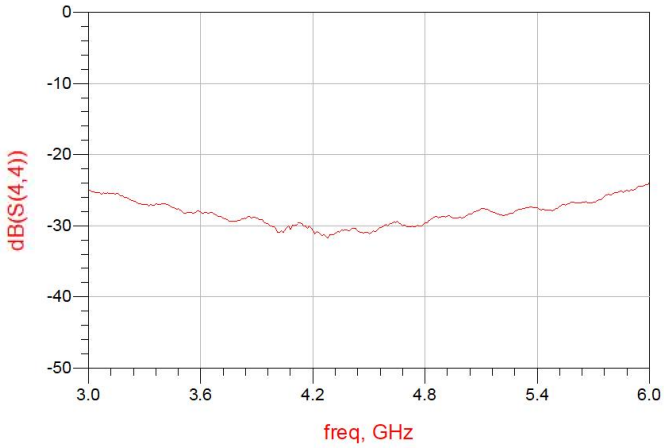


Figure 8. MHC45S03 Return Loss (S66)

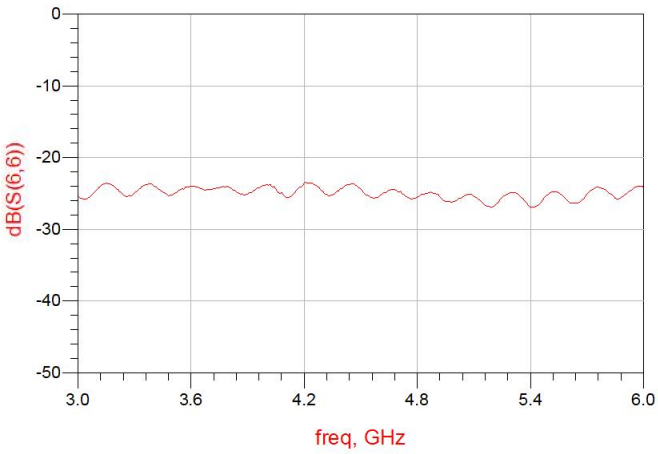


Figure 9. MHC45S03 Isolation

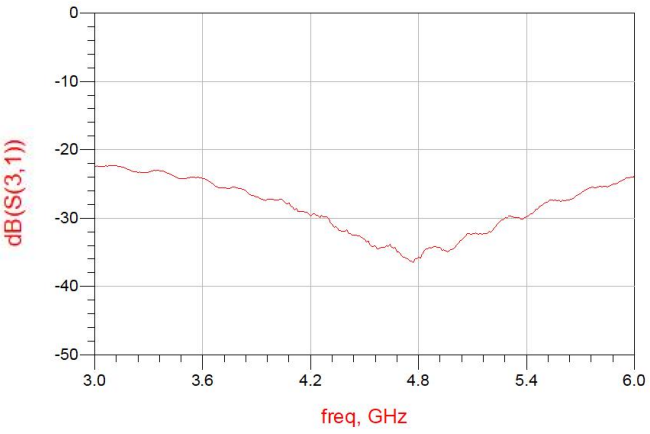


Figure 10. MHC45S03 Phase

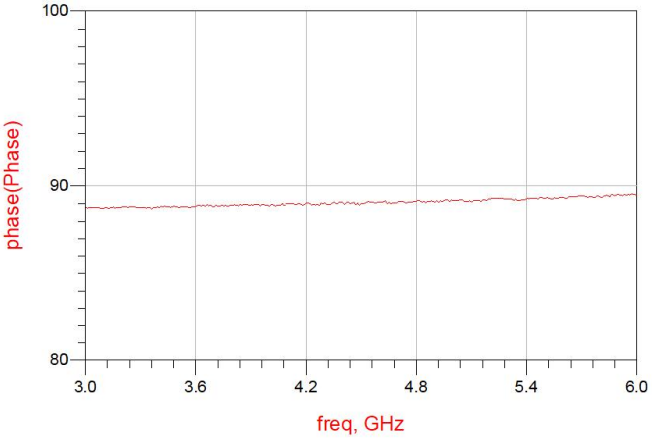
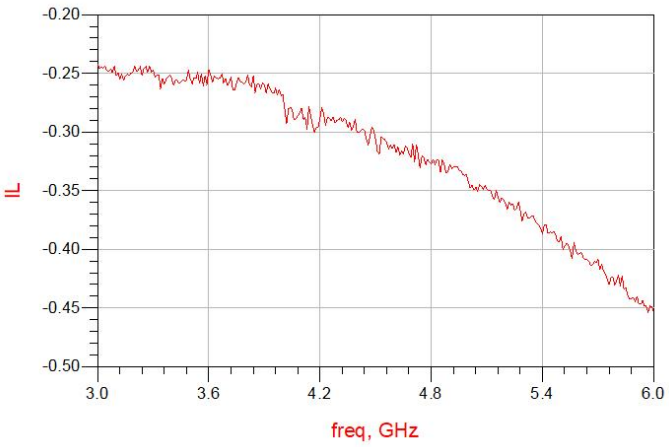


Figure 10. MHC45S03 IL



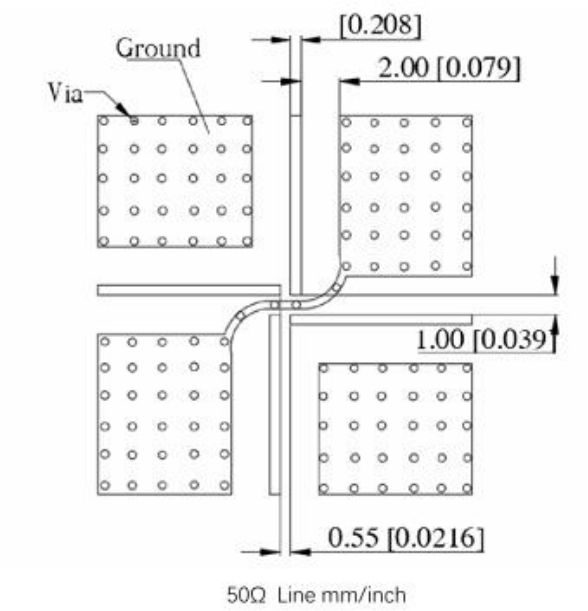
Definition of Measured Specifications

Table 3. Mathematical Formula for the MHC45S03 Parameters

Parameter	Definition	Mathematical Representation
VSWR (Voltage Standing Wave Ratio)	The impedance match of the coupler to a 5W system. A VSWR of 1:1 is optimal.	$VSWR = \frac{V_{max}}{V_{min}}$ Vmax = voltage maxima of a standing wave Vmin = voltage minima of a standing wave
Return Loss	The impedance match of the coupler to a 5W system. Return Loss is an alternate means to express VSWR.	Return Loss (dB)= $20\log\frac{VSWR+1}{VSWR-1}$
Insertion Loss	The input power divided by the sum of the power at the two output ports.	Insertion Loss(dB)= $10\log\frac{P_{in}}{P_{cp1}+P_{transmission}}$
Isolation	The input power divided by the power at the isolated port.	Isolation(dB)= $10\log\frac{P_{in}}{P_{iso}}$
Phase Balance	The difference in phase angle between the two output ports.	Phase at coupled port – Phase at transmisson port
Amplitude Balance	The power at each output divided by the average power of the two outputs.	$10\log\frac{P_{cp1}}{\frac{P_{cp1}+P_{transmission}}{2}}$ and $10\log\frac{P_{transmission}}{\frac{P_{cp1}+P_{transmission}}{2}}$

Recommended PCB Layout

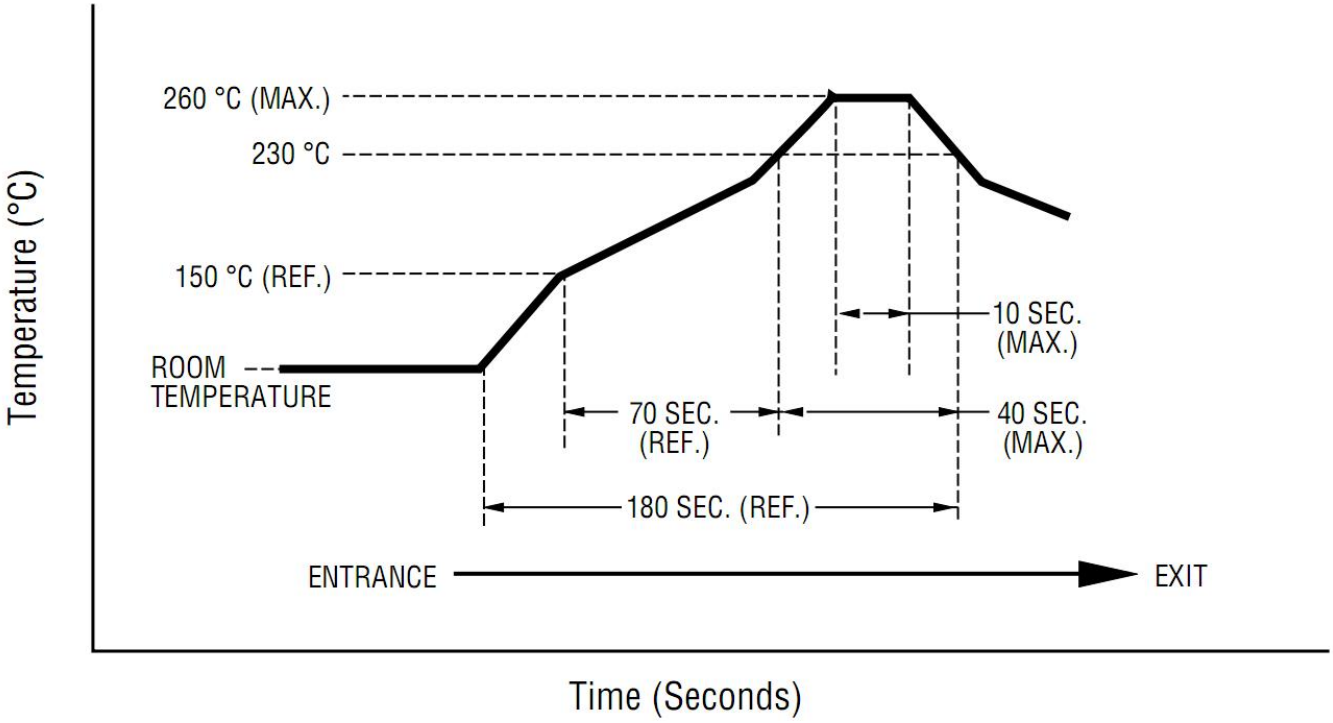
Figure 11. Recommended PCB Layout



50Ω Line mm/inch

Reflow Profile

Figure 12. MHC45S03 Thermal Reflow Profile



Packaging and Ordering Information

Table 4. MHC45S03 Ordering Information

Device	Package	Reel	Shipping
MHC45S03	2.0*1.25mm	7''	4000 Reel

Revison	Description	Date
Rev0	Preliminary	2024/5/21
Rev1	Update	2025/10/31