



**5dB Directional Coupler**



**Description:**

The X3C09P1-05S is a low profile, high performance 5dB directional coupler in a new easy to use, manufacturing friendly surface mount package. It is designed for DC, WCDMA, LTE and PCS applications. The X3C09P1-05S is designed particularly for non-binary split and combine in high power amplifiers, e.g. used along with a 3dB to get a 3-way, plus other signal distribution applications where low insertion loss is required. It can be used in high power applications up to 70 Watts.

Parts have been subjected to rigorous qualification testing and they are manufactured using materials with coefficients of thermal expansion (CTE) compatible with common substrates such as FR4, G-10, RF-35, RO4003 and polyimide. Produced with 6 of 6 RoHS compliant tin immersion finish.

**Electrical Specifications\*\***

**Features:**

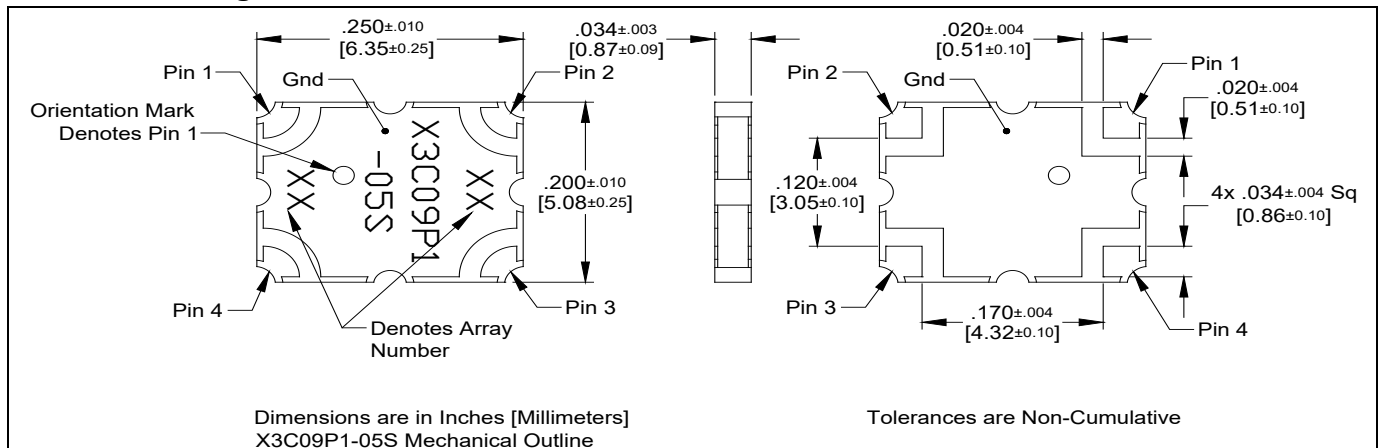
- 800-1000 MHz
- DCS,PCS, WCDMA and LTE
- High Power
- Very Low Loss
- Tight Coupling
- High Directivity
- Production Friendly
- Tape and Reel
- Lead Free

Frequency	Mean Coupling	Insertion Loss	VSWR	Phase Balance
<i>MHz</i>	<i>dB</i>	<i>dB Max</i>	<i>Max : 1</i>	<i>Degrees</i>
800-1000	5.0 ± 0.3	0.2	1.15	90±4.0
869-894	5.0 ± 0.2	0.16	1.12	90±3.0
925-960	5.0 ± 0.2	0.18	1.12	90±3.0
	Directivity	Frequency Sensitivity	Power	Operating Temp.
	<i>dB Min</i>	<i>dB Max</i>	<i>Avg. CW Watts @ 95 °C</i>	<i>°C</i>
	23	± 0.25	70	-55 to +150
	25	± 0.05	70	-55 to +150
	25	± 0.05	70	-55 to +150

\*\*Specification based on performance of unit properly installed on TTM

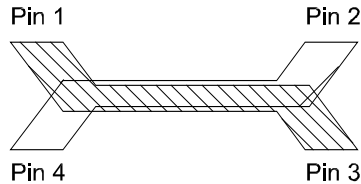
Test Board 54147-0001. Refer to Specifications subject to change without notice. Refer to parameter definitions for details

**Outline Drawing:**



## Directional Coupler Pin Configuration

The X3C09P1-05S has an orientation marker to denote Pin 1. Once port one has been identified the other ports are known automatically. Please see the chart below for clarification:

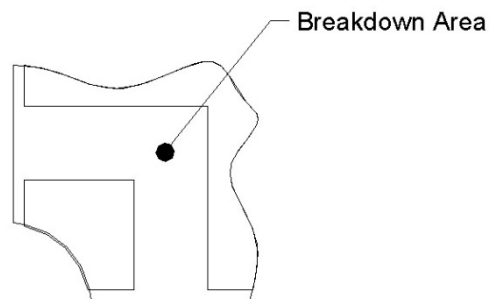


Pin 1	Pin 2	Pin 3	Pin 4
Input	Isolated	Direct	Coupled
Isolated	Input	Coupled	Direct
Direct	Coupled	Input	Isolated
Coupled	Direct	Isolated	Input

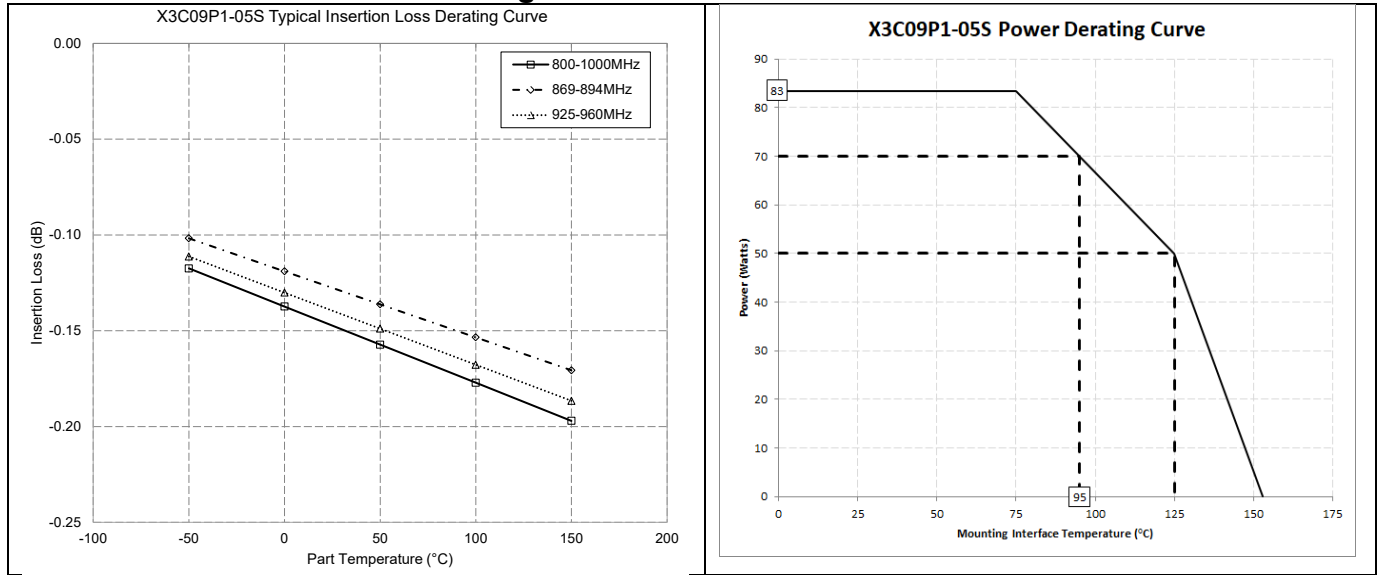
Note: The direct port has a DC connection to the input port and the coupled port has a DC connection to the isolated port.

## Peak Power Handling

High-Pot testing of these couplers during the qualification procedure resulted in a minimum breakdown voltage of 0.61Kv (minimum recorded value). This voltage level corresponds to a breakdown resistance capable of handling at least 12dB peaks over average power levels, for very short durations. The breakdown location consistently occurred across the air interface at the coupler contact pads (see illustration below). The breakdown levels at these points will be affected by any contamination in the gap area around these pads. These areas must be kept clean for optimum performance. It is recommended that the user test for voltage breakdown under the maximum operating conditions and over worst case modulation induced power peaking. This evaluation should also include extreme environmental conditions (such as high humidity)



## Insertion Loss and Power Derating Curves



### Insertion Loss Derating:

The insertion loss, at a given frequency, of a group of couplers is measured at 25°C and then averaged. The measurements are performed under small signal conditions (i.e. using a Vector Network Analyzer). The process is repeated at 95°C and 150°C. A best-fit line for the measured data is computed and then plotted from -55°C to 150°C

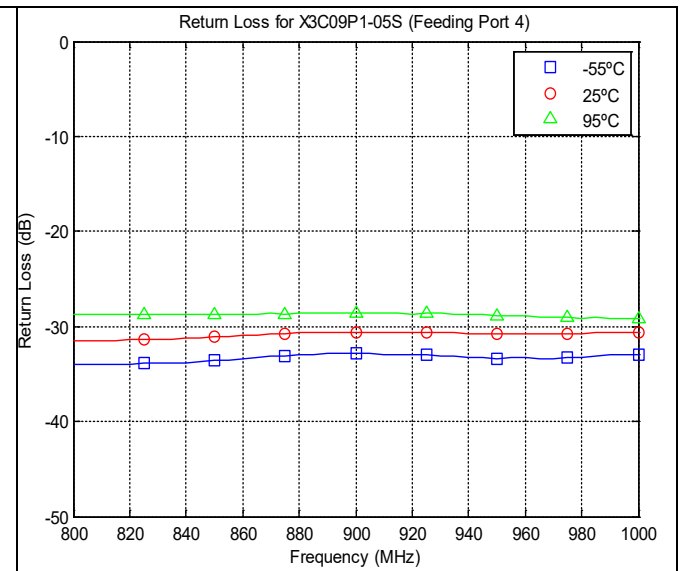
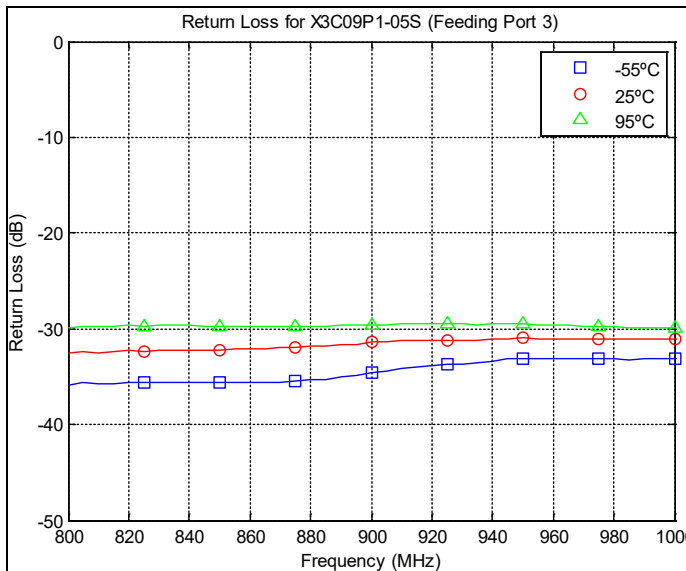
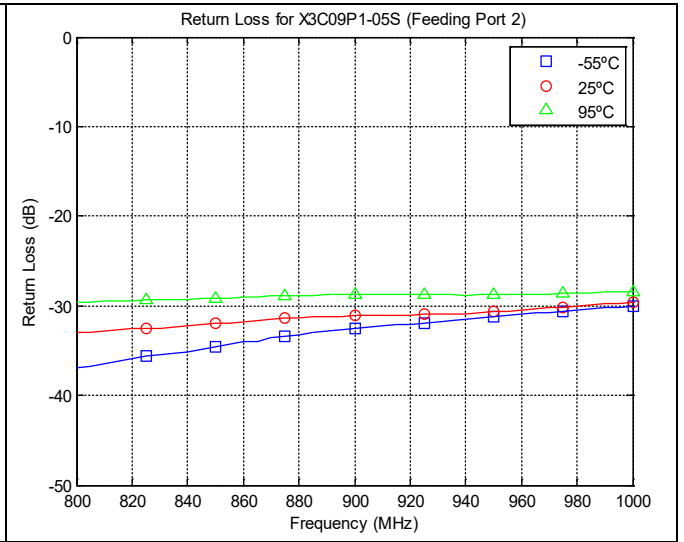
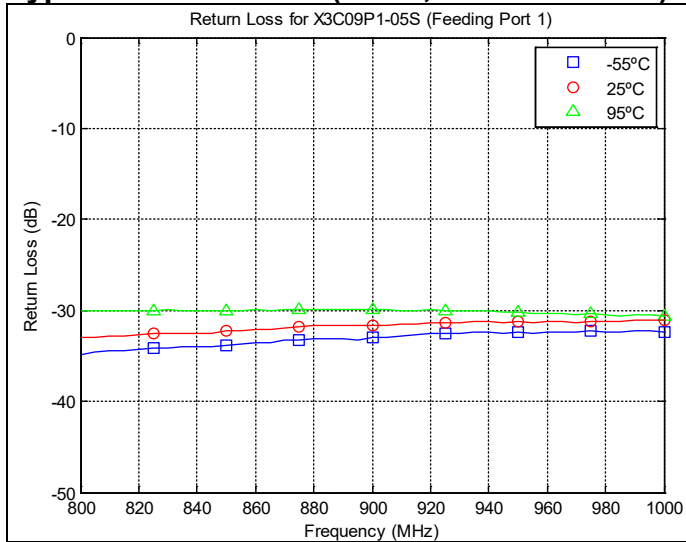
### Power Derating:

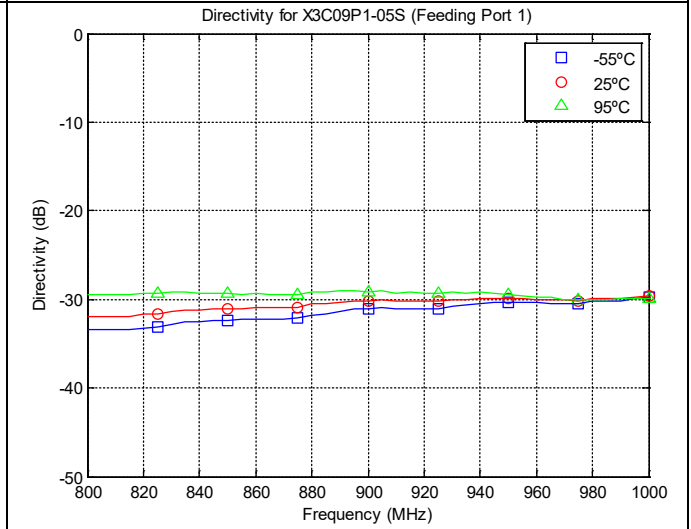
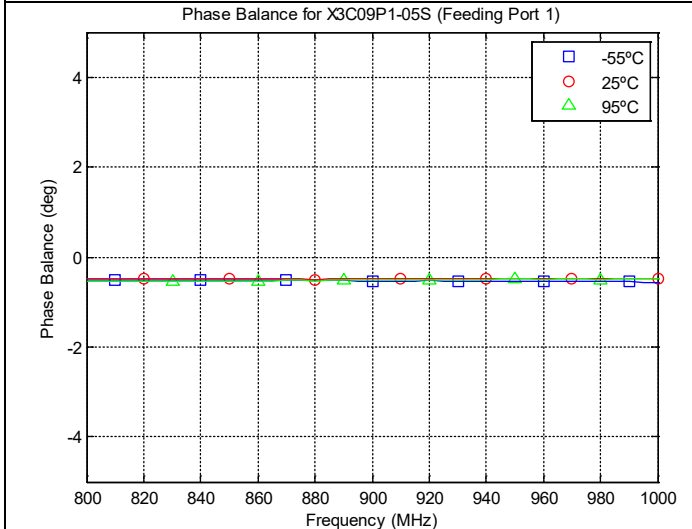
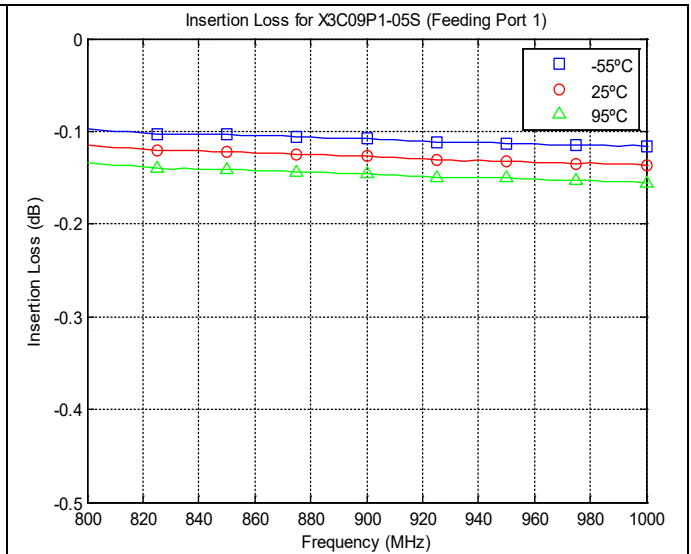
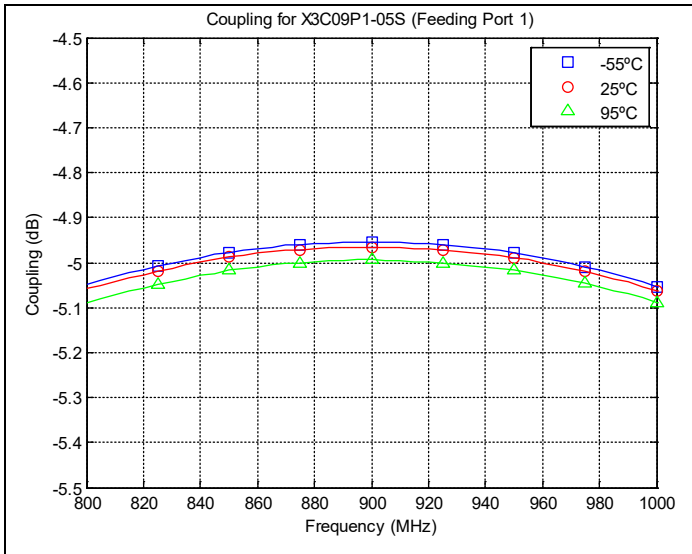
The power handling and corresponding power derating plots are a function of the thermal resistance, mounting surface temperature (base plate temperature), maximum continuous operating temperature of the coupler, and the thermal insertion loss. The thermal insertion loss is defined in the Power Handling section of the data sheet.

As the mounting interface temperature approaches the maximum continuous operating temperature, the power handling decreases to zero.

If mounting temperature is greater than 95°C, Xinger coupler will perform reliably as long as the input power is derated to the curve above.

**Typical Performance (-55°C, 25°C and 95°C): 800-1000 MHz**





## Definition of Measured Specifications

Parameter	Definition	Mathematical Representation
<b>VSWR</b> (Voltage Standing Wave Ratio)	The impedance match of the coupler to a 50Ω 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
<b>Return Loss</b>	The impedance match of the coupler to a 50Ω system. Return Loss is an alternate means to express VSWR.	$\text{Return Loss(dB)} = 20 \log \frac{VSWR + 1}{VSWR - 1}$
<b>Mean Coupling</b>	At a given frequency ( $\omega_n$ ), coupling is the input power divided by the power at the coupled port. Mean coupling is the average value of the coupling values in the band. N is the number of frequencies in the band.	$\text{Coupling(dB)} = C(\omega_n) = 10 \log \frac{P_{in}(\omega_n)}{P_{cpl}(\omega_n)}$ $\text{Mean Coupling(dB)} = \frac{\sum_{n=1}^N C(\omega_n)}{N}$
<b>Insertion Loss</b>	The input power divided by the sum of the power at the two output ports.	$\text{Insertion Loss(dB)} = 10 \log \frac{P_{in}}{P_{cpl} + P_{direct}}$
<b>Directivity</b>	The power at the coupled port divided by the power at the isolated port.	$\text{Directivity(dB)} = 10 \log \frac{P_{iso}}{P_{cpl}}$
<b>Phase Balance</b>	The difference in phase angle between the two output ports.	Phase at coupled port – Phase at direct port
<b>Frequency Sensitivity</b>	The decibel difference between the maximum in band coupling value and the mean coupling, and the decibel difference between the minimum in band coupling value and the mean coupling.	(Max Coupling (dB) – Min Coupling (dB))/2