Doherty Combiner

Xinger®

Description:

The X3D3C09E120S is a low profile, high performance three way Doherty Combiner in a new easy to use, manufacturing friendly surface mount package. The X3D3C09E120S is designed particularly for Doherty Amplifier applications, where tightly controlled phase and amplitude imbalance as well as low insertion loss are required for maximum and low power condition. It can be used in high power applications up to 150 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, RO4350 and polyimide. Produced with 6 of 6 RoHS compliant tin immersion finish

Features:

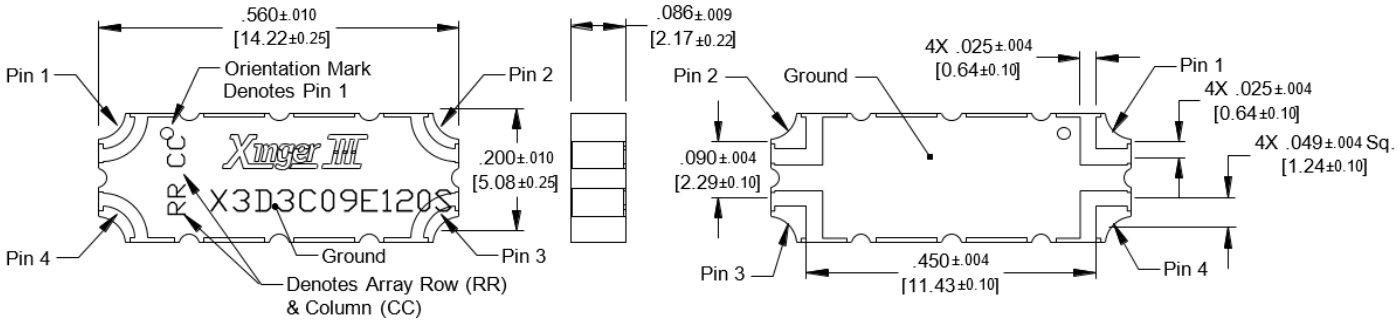
- **920 - 960 MHz**
- **High Power**
- **Low Amp Imbalance**
- **Very Low Loss**
- **Production Friendly**
- **Tape and Reel**
- **Lead Free**

Electrical Specifications**

Frequency	Return Loss [1]	Insertion Loss [1]	Amplitude Imbalance[1]	Phase Imbalance[1]
MHz	*dB Min*	*dB Max*	*dB Max*	*Degrees*
925 – 960	20	0.25	±0.20	± 5.0
	Return Loss [2]	**Insertion Loss [2]**	**Power [2]**	**Operating Temp.**
	dB Min	*dB Max*	*Avg. Watts @95°C*	*°C*
	22	0.25	150	-55 to +150

**Specification based on performance of unit properly installed on a TTM test board
[1] At maximum power condition, Doherty combiner functions as an equal-split power combiner.
[2] At backoff condition, Doherty combiner functions as an impedance transformer

Mechanical Outline:

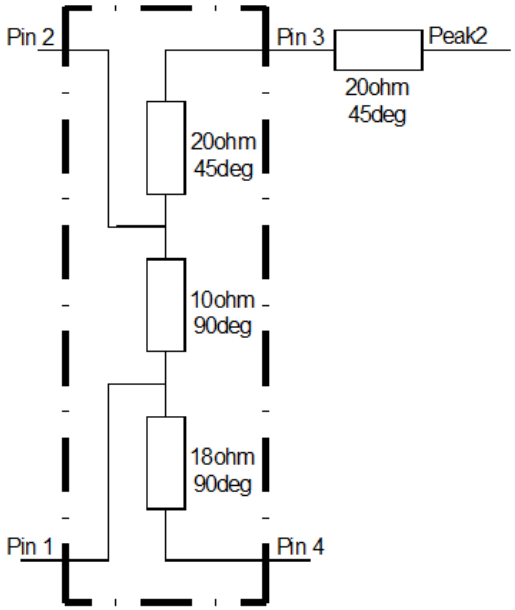


Dimensions are In Inches [Millimeters]
X3D3C09E120S Mechanical Outline

Tolerances are Non-Cumulative

Doherty Combiner Pin Configuration

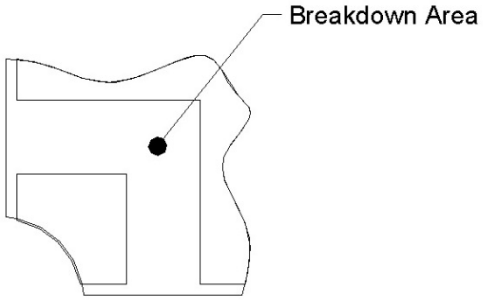
The X3D3C09E120S has an orientation marker to denote Pin 1. Once port one has been identified the other ports are known automatically. Please see the chart below for clarification:



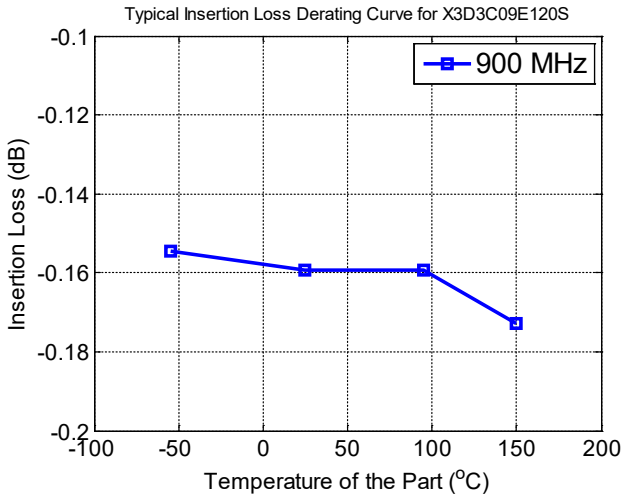
Pin 1	Pin 2	Pin 3	Pin 4
Main Amp Port 20 Ohm	Peak 1 Amp Port 20 Ohm	Peak 2 Amp Port 20 Ohm	Combined Port 50 Ohm

Peak Power Handling

High-Pot testing of these couplers during the qualification procedure resulted in a minimum breakdown voltage of 1.3Kv (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).

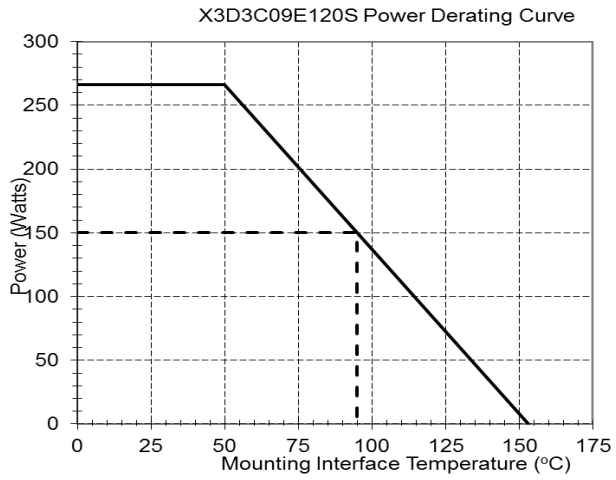


Insertion Loss and Power Derating Curves



Insertion Loss Derating

The insertion loss, at a given frequency, of a group of components 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 85°C and 150°C. A best-fit line for the measured data is computed and then plotted from -55°C to 150°C.



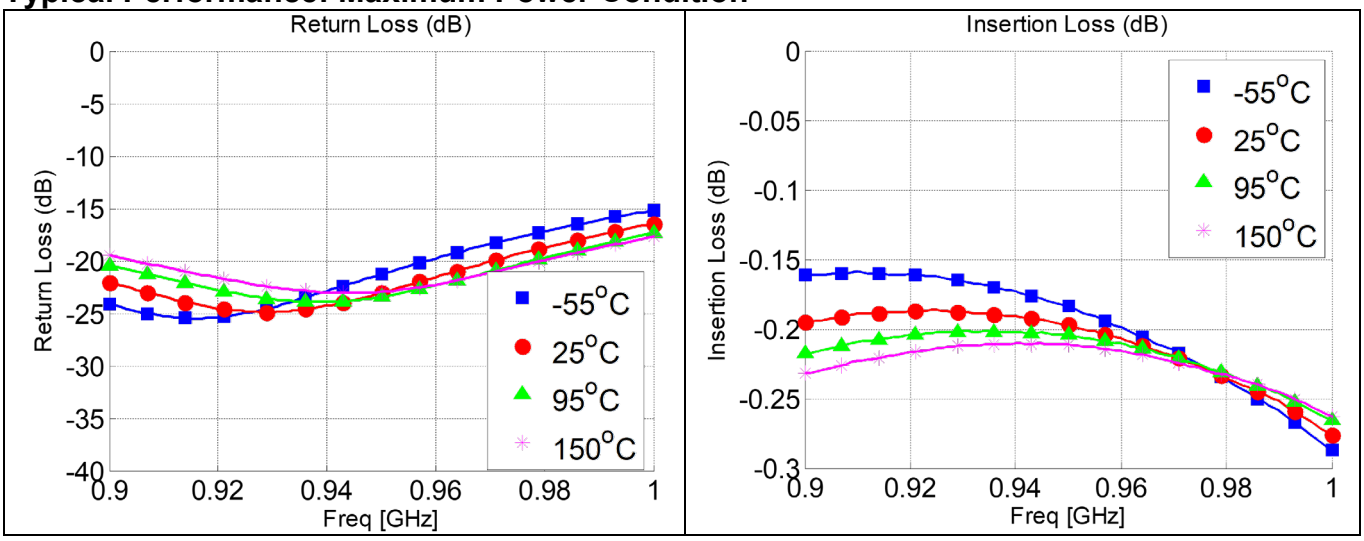
Power Derating

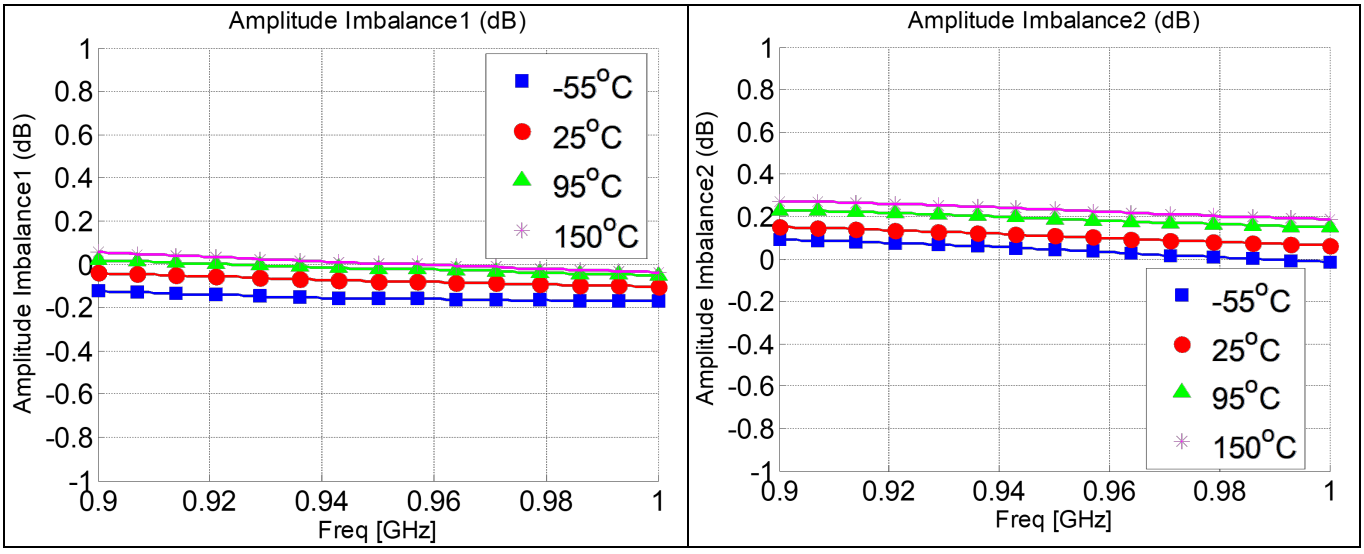
The power handling and corresponding power derating plots are a function of the thermal resistance, mounting surface temperature (base plate temperature), maximum continuous operating temperature of the coupler, and the thermal insertion loss. The thermal insertion loss is defined in the Power Handling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

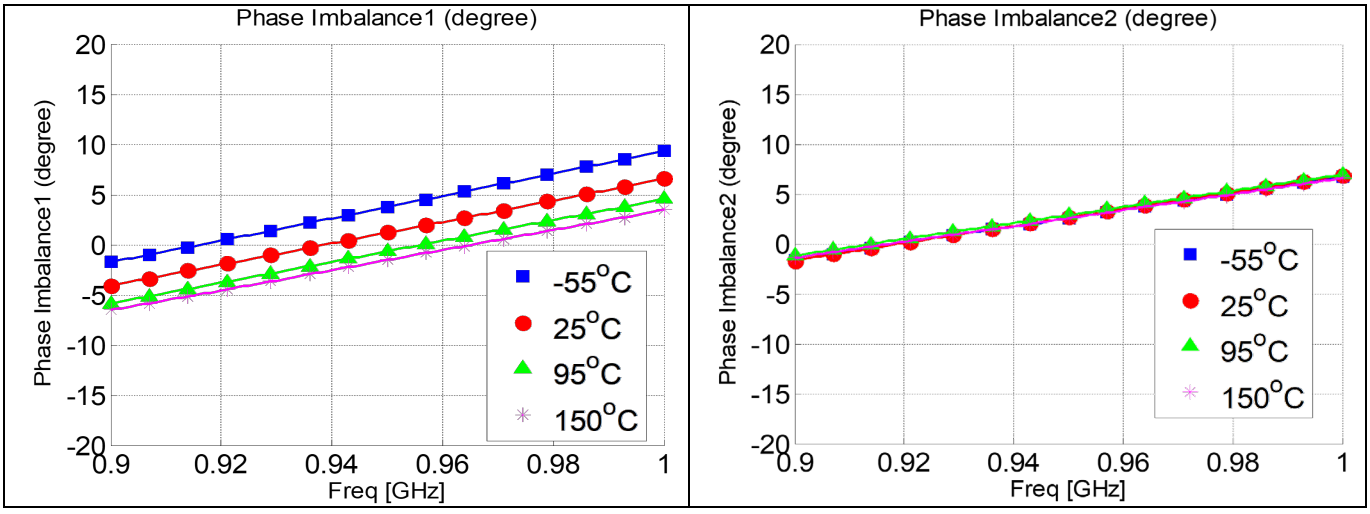
As the mounting interface temperature approaches the maximum continuous operating temperature, the power handling decreases to zero.

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

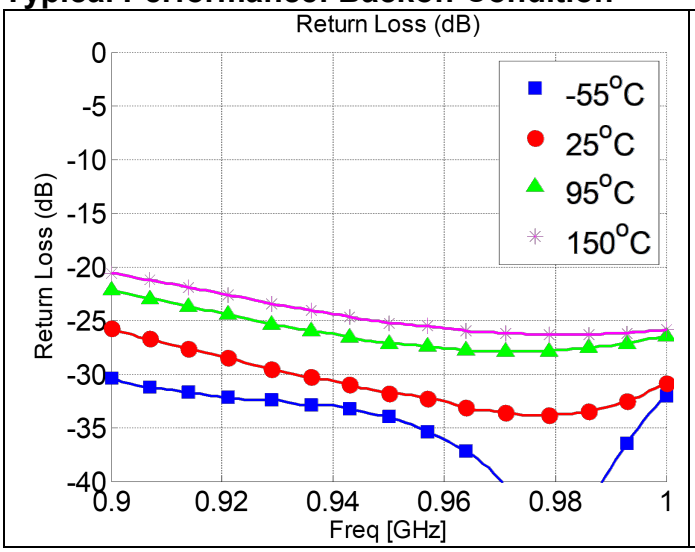
Typical Performance: Maximum Power Condition

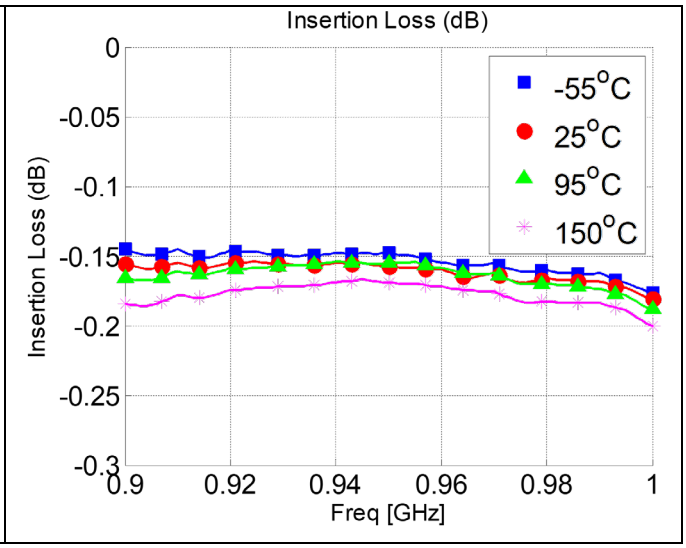






Typical Performance: Backoff Condition





Definition of the Specifications

To guarantee the part performance in Doherty architecture, the part is specified in Doherty operation for maximum power condition and low power condition. The parts is measured with Pin n connected to Port n (where n=1, 2, 3, 4).

Maximum power condition

Under the maximum power condition, the Doherty combiner functions as a three way combiner and supplies the required phase compensation. The following specification is defined with 50 Ω port impedance at Port4 and 20ohm at Port 1,2 and 3 for this condition.

Parameter	Definition	Mathematical Representation
Return Loss	The impedance match at the combining port to a 50Ω system.	$20\log\lvert S_{44}\rvert$
Insertion Loss	The combined power divided by the sum of input power under the perfect combining condition.	$10\log(\lvert S_{14}\rvert^2 + \lvert S_{24}\rvert^2 + \lvert S_{34}\rvert^2)$
Phase Imbalance	The phase difference between Peak-Combined path and Main-Combined path at ω_c= 942.5MHz	$\text{Phase Imbalance 1} = \text{Phase}\,(S_{14}(\omega_c)) - \text{Phase}\,(S_{24}(\omega_c)) - 90°$ $\text{Phase Imbalance 2} = \text{Phase}\,(S_{24}(\omega_c)) - \text{Phase}\,(S_{34}(\omega_c)) - 45°$
Amplitude Imbalance	The magnitude difference between Peak-Combined path and Main-Combined path.	$Amplitude\ Imbalance\ 1 = (10\log\lvert S_{14}\rvert - 10\log\lvert S_{24}\rvert)$ $Amplitude\ Imbalance\ 2 = (10\log\lvert S_{24}\rvert - 10\log\lvert S_{34}\rvert)$

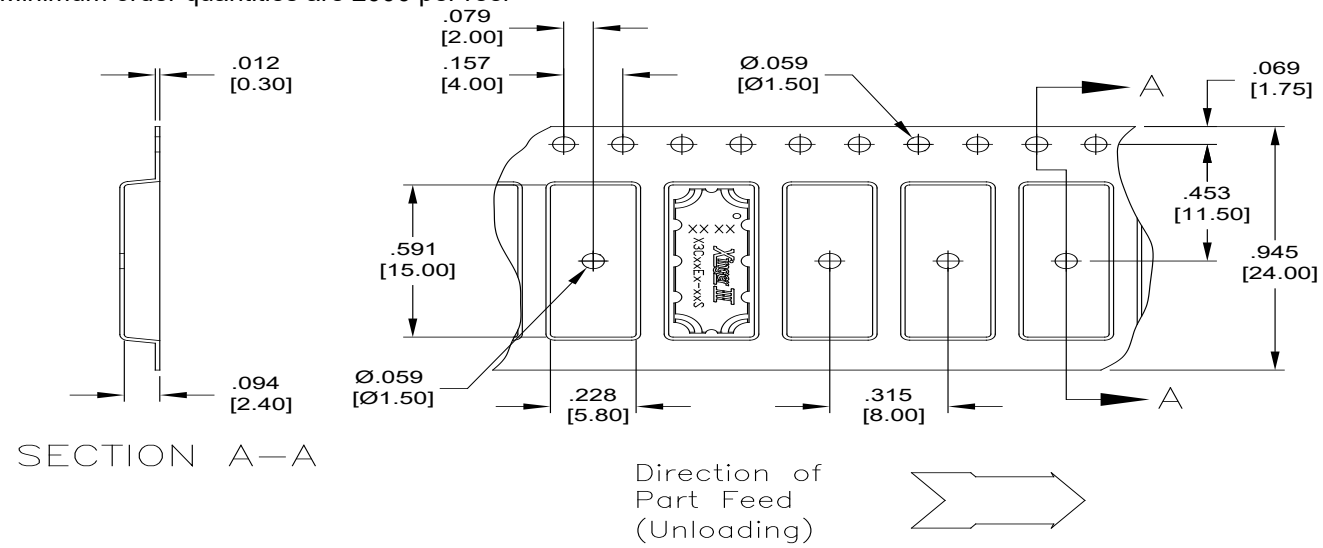
Backoff condition

Under backoff condition, the Doherty combiner servers as an impedance transformer transforming 50 Ω at combining port to 6.7 Ω at main amplifier port. The following specification is defined under the port impedance condition of Port 1 6.7 Ω, Port 4 50 Ω and Port 3 and Port 2 are open.

Parameter	Definition	Mathematical Representation
Return Loss	The impedance match of the 50 to 6.7 Ω transformer.	$20\log\lvert S_{44}\rvert$
Insertion Loss	The output power divided by input power.	$20\log\lvert S_{41}\rvert$

Packaging and Ordering Information:

Parts are available in reel. Packaging follows EIA 481-2. Parts are oriented in tape and reel as shown below.
Minimum order quantities are 2000 per reel



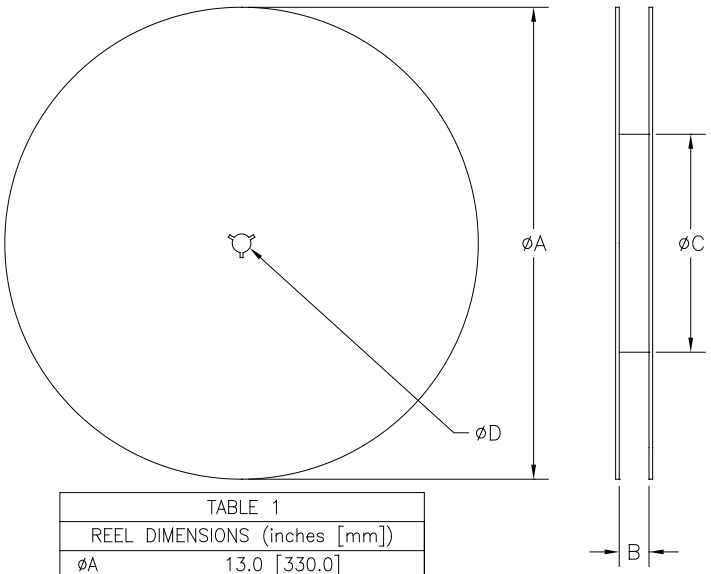


TABLE 1	
REEL DIMENSIONS (inches [mm])	
øA	13.0 [330.0]
B	.945 [24.0]
øC	4.017 [102.03]
øD	0.512 [13.0]

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