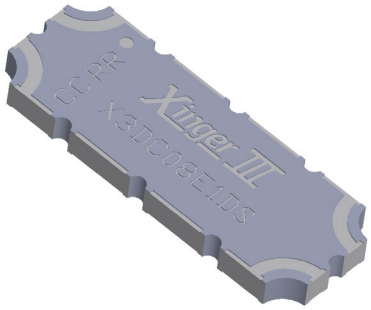
1:1.5 Doherty Combiner

Xinger III



Description:

The X3DC08E1DS is a low profile, high performance Doherty Combiner, with a high power rating of 100 Watts (AVG) with a peak to average performance of 12dB in a new easy to use, Xinger style manufacturing friendly surface mount package. The X3DC08E1DS is designed particularly for Doherty Amplifier applications, where a tightly controlled phase of 90 degrees, 1:1.5 splitting ratio and low insertion loss are required for maximum and low power condition.

Parts have been subjected to rigorous Xinger qualification testing and they are manufactured using materials with coefficients of thermal expansion (CTE) compatible with common substrates such as FR4, RF-35, RO4350 and polyimide. Produced with 6 of 6 RoHS compliant tin immersion finish.

Features:

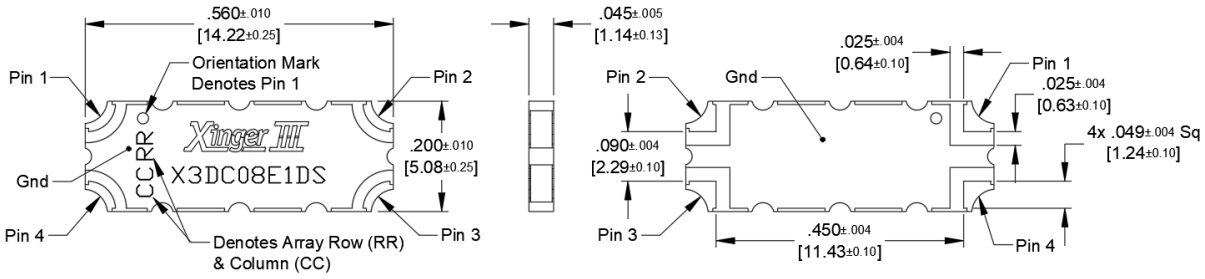
- **728-869 MHz**
- **Doherty Amplifier Applications**
- **1:1.5 Splitting**
- **High power 100W (AVG)**
- **Low Loss (<0.50dB)**
- **Production Friendly**
- **Tape and Reel**
- **Lead Free**
- **Tin-Immersion Finish**

Electrical Specifications*:

Frequency	Return Loss [1]	Insertion Loss Main [1]	Insertion Loss Peak [1]	Phase Imbalance [1]
MHz	*dB Min*	*dB Max*	*dB Max*	*Degrees*
728-869	20	4.4±0.55	2.7±0.40	90±4.0
Return Loss [2]	**Insertion Loss [2]**	**Port Extension[3]**	**Power**	**Operating Temp.**
dB Min	*dB Max*	*Degrees*	*Avg.Watts @105°C*	*°C*
20	0.50	0	100	-55 to +150

*Specification based on performance of unit properly installed on TTM Technologies Test Board
[1] At maximum power condition, Doherty combiner functions as a 1:1.5 power combiner.
[2] At low power condition, Doherty combiner works as an impedance transformer (see page 4)
[3] At low power condition, the offset lines at the input need to be adjusted by 0 deg. (if required) (see page 4)

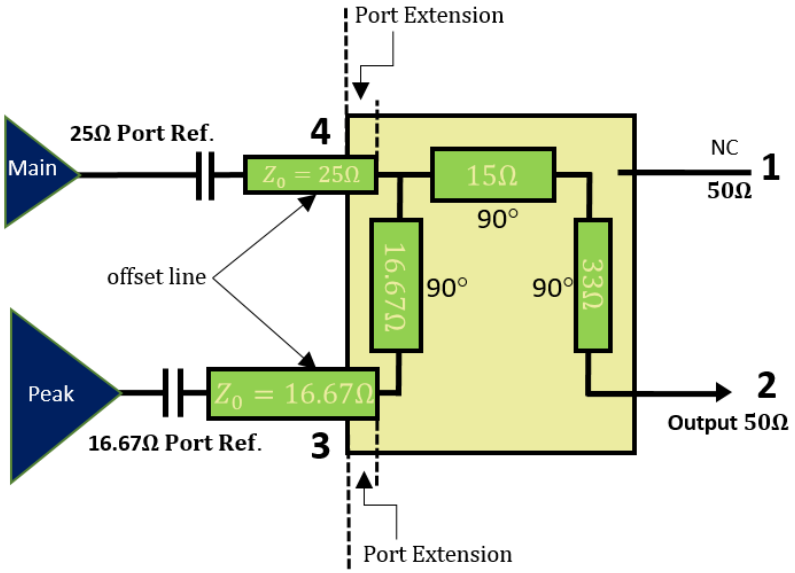
Outline Drawing:



Dimensions are in Inches [Millimeters]
X3DC08E1DS Mechanical Outline

Tolerances are Non-cumulative

Doherty Amplifier Configuration:



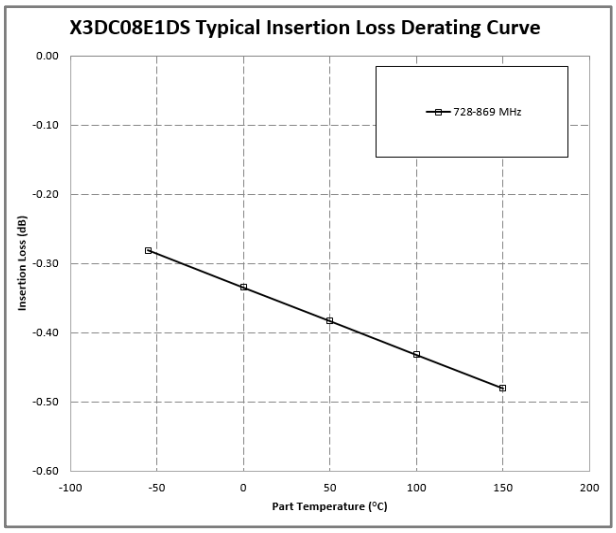
1:1.5 Inverted Doherty Combiner

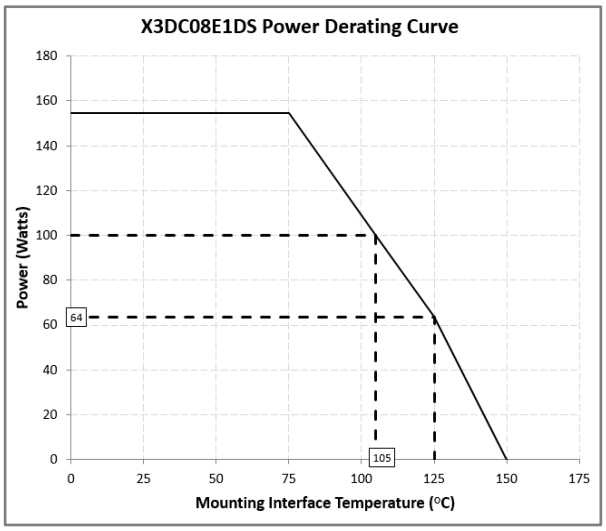
Doherty Combiner Pin Configuration:

The X3DC08E1DS 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
Not Connected	Combining Port	Peak Amp Port	Main Amp Port

Insertion Loss and Power Derating Curves:





Insertion Loss Derating:

The insertion loss, at a given frequency, of the doherty combiner 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 105°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:

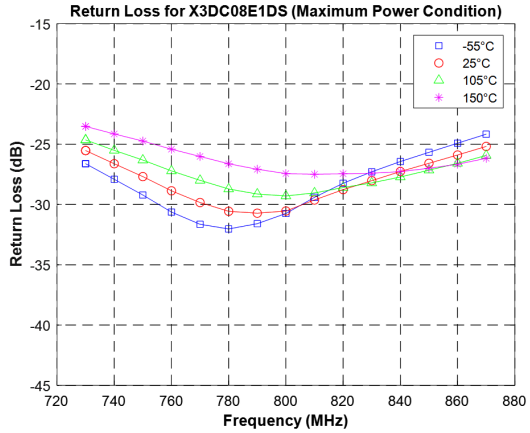
The power handling and corresponding power derating plots are a function of the thermal resistance, mounting surface temperature (base plate temperature), maximum continuous operating temperature of the doherty combiner, and the thermal insertion loss. The thermal insertion loss is defined in the Power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

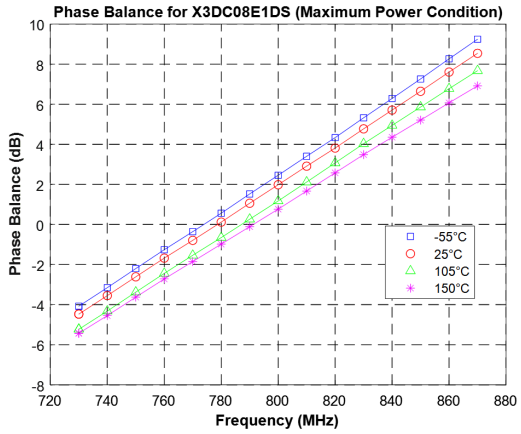
As the mounting interface temperature approaches the maximum continuous operating temperature, the power handling decreases to zero.

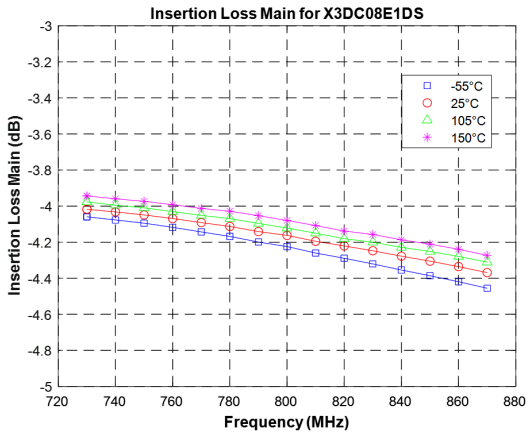
If mounting temperature is greater than 105°C, the Xinger doherty combiner will perform reliably as long as the input power is derated to the curve above.

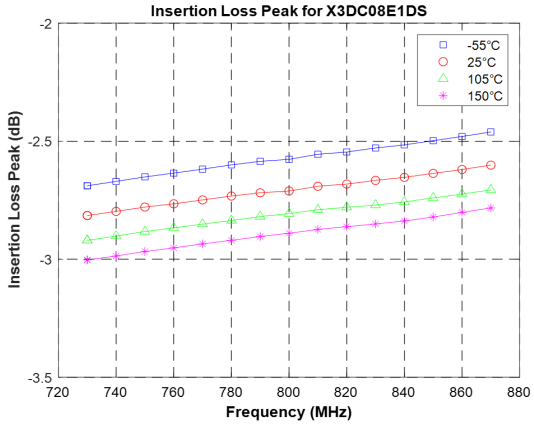
Typical Performance: 728-869 MHz

Typical Performance Under Maximum Power Conditions:

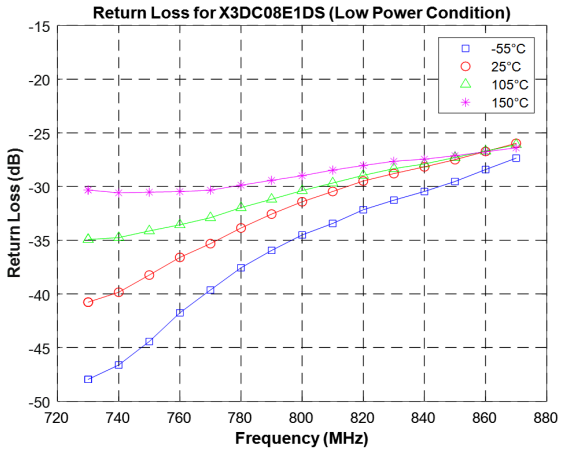


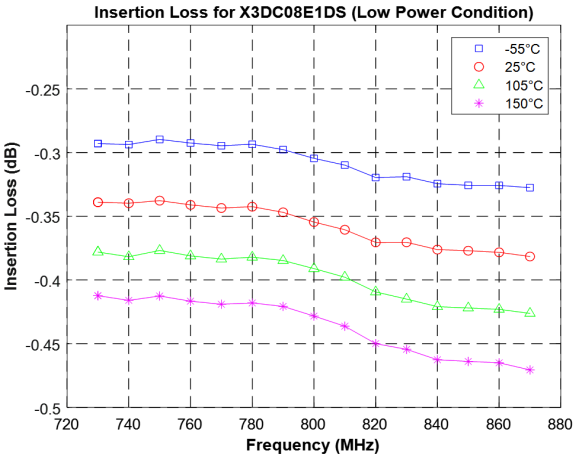






Typical Performance Under Low Power Conditions:





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 following specification definition assumes the extra port extension is already applied to the raw S parameter and 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 architecture requires main amplifier and peak amplifier to work at full capacity with Main at 25Ω and Peak at 16.67Ω. The two amplifiers should deliver RF power ratio of 1:1.5 (Main:Peak) and 90 degree phase difference.

Parameter	Definition	Mathematical Representation
Return Loss	The impedance match at the combining port to a 50Ω system.	$20\log\lvert S_{22}\rvert$
Insertion Loss	The combined power divided by the sum of input power under the perfect combining condition.	$10\log(\lvert S_{23}\rvert^2 + \lvert S_{24}\rvert^2)$
Amplitude Imbalance	The magnitude difference between Main-Combined path and Peak-Combined path under the perfect combining condition.	$\frac{1}{2}(20\log\lvert S_{24}\rvert - 20\log\lvert S_{23}\rvert)$
Phase Imbalance	The phase difference between Peak-Combined path and Main-Combined path at ω_c =798.5MHz.	$\text{Phase}\,(S_{24}(\omega_c)) - \text{Phase}\,(S_{23}(\omega_c))$

Low power condition:

Under low power condition, the Doherty operation turns off peak amplifier and requires main amplifier to be terminated with impedance of 10 Ω. In this configuration, Doherty combiner serves as an impedance transformer, transforming 50 Ω at combining port to 10 Ω at main amplifier port. The following specification is defined under the port impedance condition of Port 2 (Combining Port) 50 Ω, Port 4 (Main Amp Port) 10 Ω and Port 3 (Peak Amp Port) terminated with a short (low impedance).

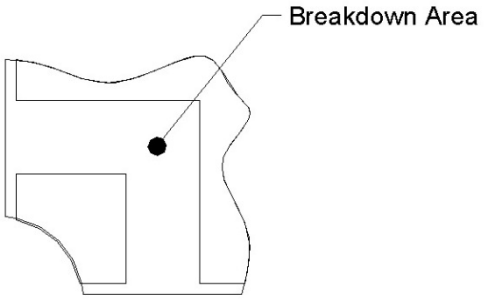
Port Extension:

There are inevitably short lines associating with input ports in some high frequency band parts. The length of the short line is specified as electrical length at center frequency and referred as port extension in this datasheet. The designer should take this length into the account to optimize the offset line length. The return loss and insertion loss specified in the Electrical Specifications table are after incorporating port extension.

Parameter	Definition	Mathematical Representation
Return Loss	The impedance match of the 50 Ω to 10 Ω transformer.	$20\log\lvert S_{22}\rvert$
Insertion Loss	The output power divided by input power.	$20\log\lvert S_{24}\rvert$

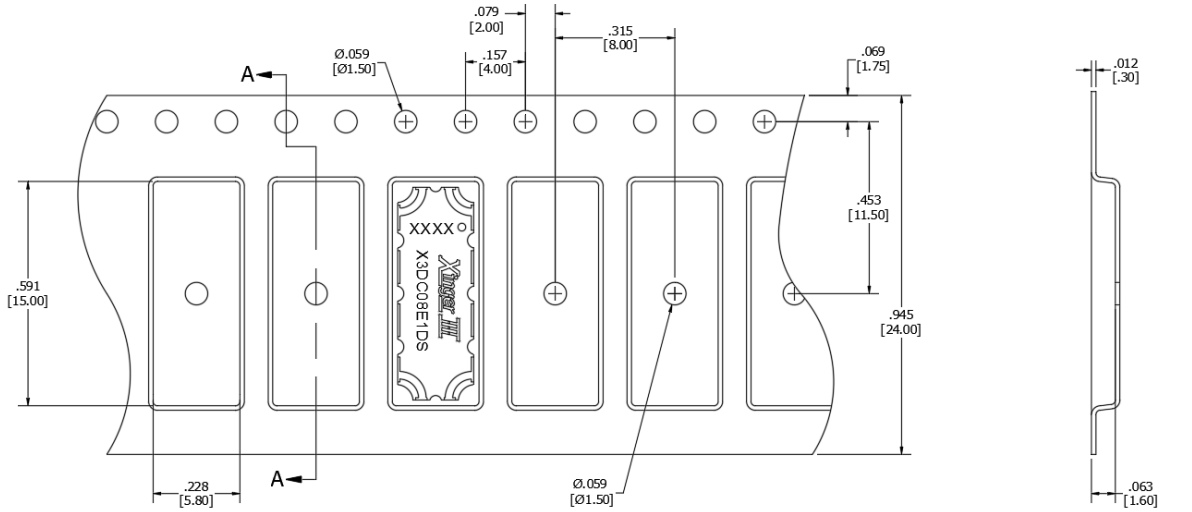
Peak Power Handling:

High-Pot testing of these couplers during the qualification procedure resulted in a minimum breakdown voltage of 1.96Kv (minimum recorded value). This voltage level corresponds to a breakdown resistance capable of handling at least 12dB peak 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).



Packaging and Ordering Information:

Parts are available in reels. Packaging follows EIA 481 for reels. Parts are oriented in tape and reel as shown below. Tape and reel is available in 2000 pcs per reel.



Direction of Part Feed (Unloading)

Dimensions are in Inches [Millimeters]

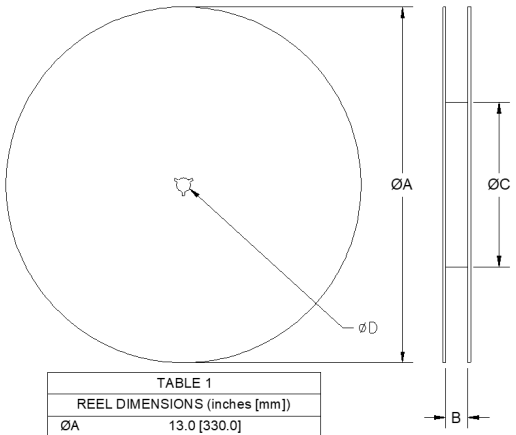


TABLE 1	
REEL DIMENSIONS (inches [mm])	
ØA	13.0 [330.0]
B	.945 [24.0]
ØC	4.017 [102.03]
ØD	0.512 [13.0]

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