TTM Technologies
Time-To-Market Interconnect Solutions

X3C35F1-023S

Rev A

Xinger III

Uneven Split Quadrature Coupler
2.3dB, 90º

Description:

The X3C35F1-023S is a low profile, high performance uneven split quadrature 2.3dB hybrid coupler, with a power rating of 9 Watts Broadband and 11 Watts Narrowband (AVG) and a peak to average ratio of 12dB in a new easy to use, Xinger® style manufacturing friendly surface mount package. It is designed for 5G telecom and applications in all end markets including COTS Mil-Aero. The X3C35F1-023S is designed particularly for power splitters in Doherty power amplifiers, where low insertion loss, tight power splitting ratio control and phase balance control are required.

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, G-10, RF-35, RO4003 and polyimide. Produced with 6 of 6 RoHS compliant tin immersion finish.

Features:

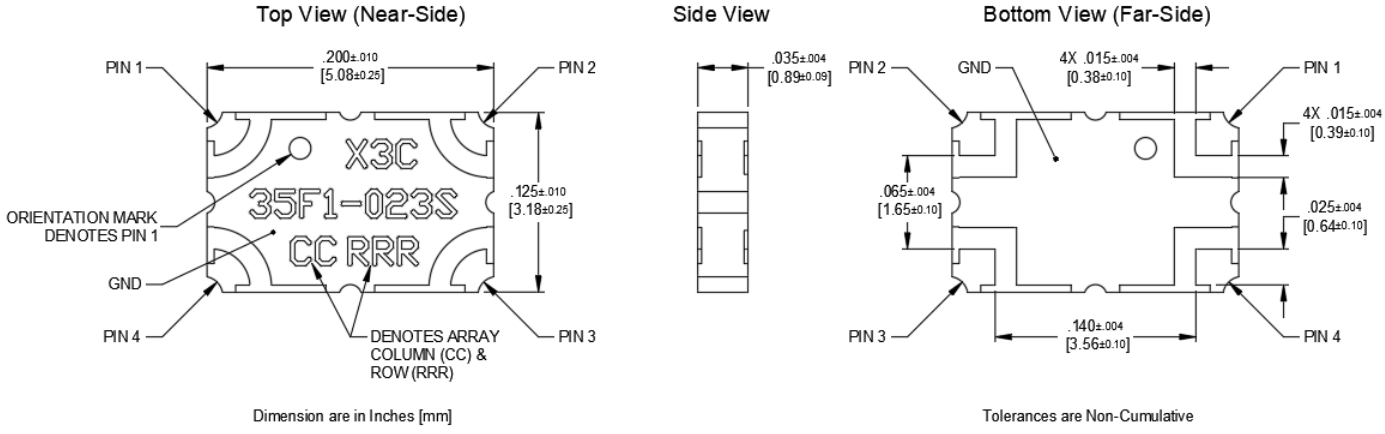
- **3300-4200 MHz**
- **5G, and COTS Mil-Aero**
- **Power 9W & 11W (AVG)**
- **Peak to Average Ratio 12dB**
- **Very Low Loss (<0.2dB)**
- **Tight Coupling (+/- 0.20dB)**
- **High Isolation (>23dB)**
- **Production Friendly**
- **Tape and Reel**
- **Lead-Free**
- **Made in the USA**

Electrical Specifications*:

Frequency	Isolation	Insertion Loss	Return Loss	Mean Coupling
MHz	*dB Min*	*dB Max*	*dB Min*	*dB*
3300 - 3800	23	0.20	-23	2.35 ± 0.15
3300 – 4200	23	0.30	-20	2.40 ± 0.20
Phase	**Group Delay**	**Power**	**Operating Temp.**	
Degrees	*ns*	*Avg. Watts @ 95 ºC*	*ºC*	
90 ± 4.0	0.095 ± 0.01	11	-55 to +140	
90 ± 5.0	0.095± 0.01	9	-55 to +140	

*Specification based on performance of unit properly installed on TTM Technologies Test Board with small signal applied. Specifications subject to change without notice. Refer to parameter definitions for details.

Mechanical Outline:

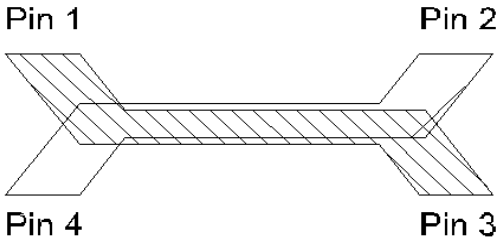


Dimension are in Inches [mm]

Tolerances are Non-Cumulative

Directional Coupler Pin Configuration

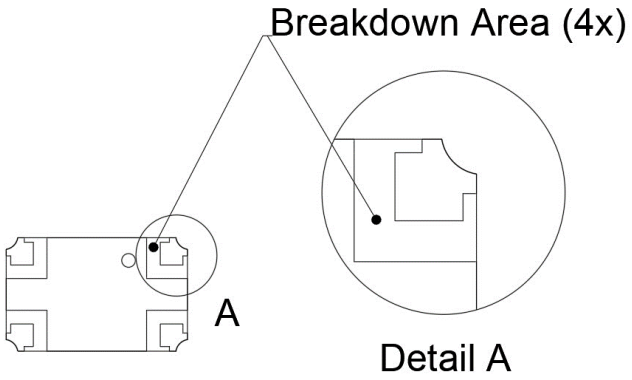
The X3C35F1-023S has an orientation marker to denote Pin 1. Once port one has been identified the other ports are known automatically. Please see the chart below for clarification:



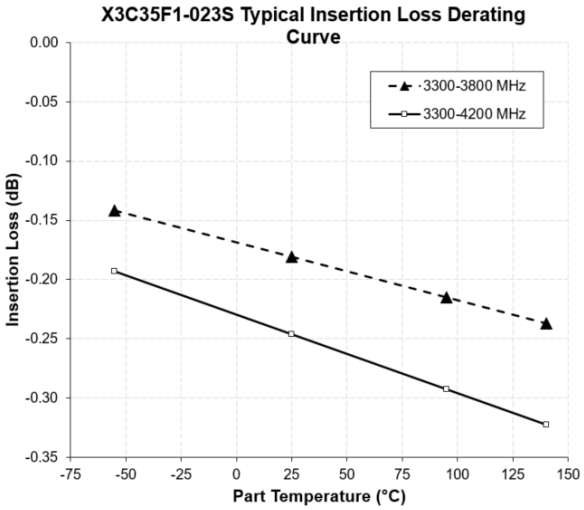
Configuration	Pin 1	Pin 2	Pin 3	Pin 4
Splitter	Input	Isolated	-4dB < Θ-90	-2.3dB < Θ
Splitter	Isolated	Input	-2.3dB < Θ	-4dB < Θ-90
Splitter	-4dB < Θ-90	-2.3dB < Θ	Input	Isolated
Splitter	-2.3dB < Θ	-4dB < Θ-90	Isolated	Input

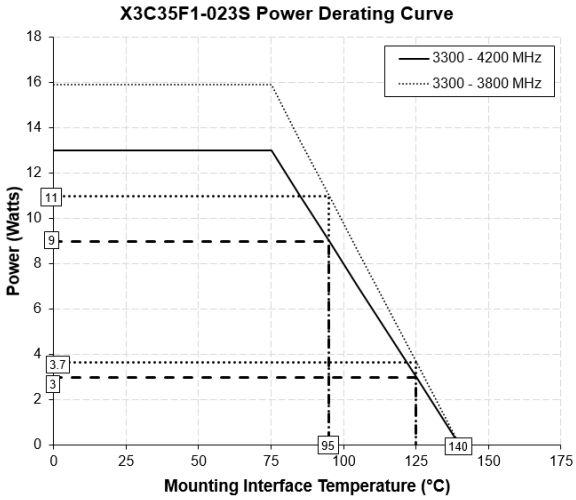
Peak Power Handling

High-Pot testing of these couplers during the qualification procedure resulted in a minimum breakdown voltage of 1.22KV (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 -55°C, 95°C and 140°C. A best-fit line for the measured data is computed and then plotted from -55°C to 140°C.

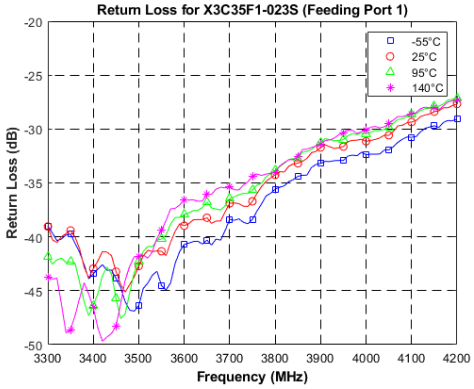
Power Derating:

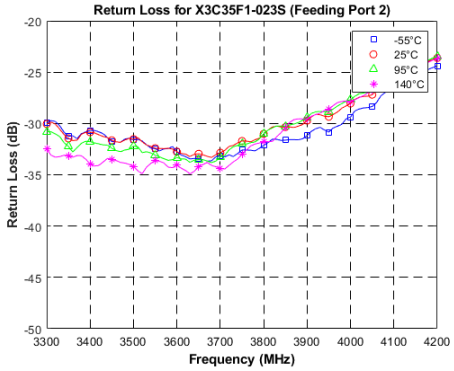
The power derating plots above are a function of the thermal resistance, mounting interface temperature (base plate temperature), maximum continuous operating temperature of the coupler, thermal insertion loss, and the maximum operating temperature of the solder type used for mounting. The thermal insertion loss is defined in the Power Handling section of the data sheet.

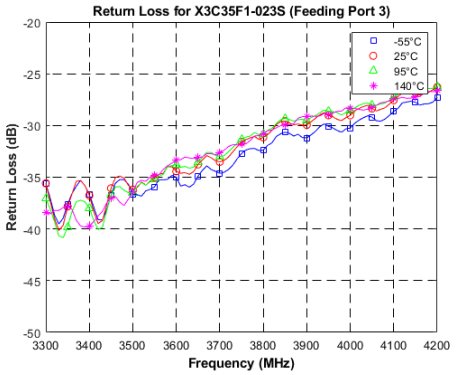
As the mounting interface temperature approaches the maximum continuous operating temperature of the coupler or the maximum operating temperature of the solder, the power handling decreases to zero.

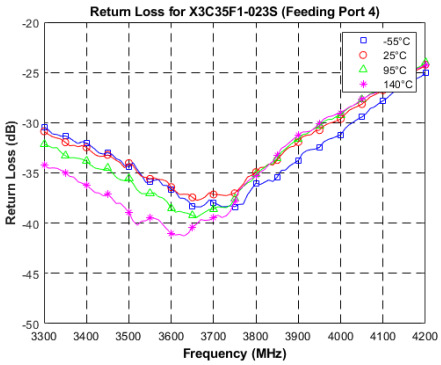
If the mounting temperature is greater than 95°C, the Xinger® coupler will perform reliably as long as the input power is derated to the curve above.

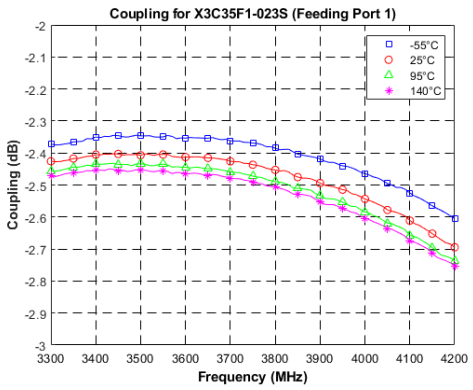
Typical Performance: 3300 - 4200 MHz

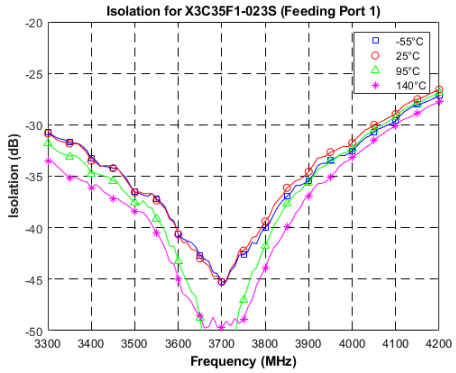


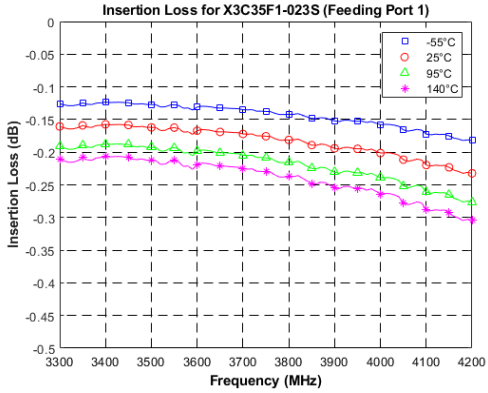


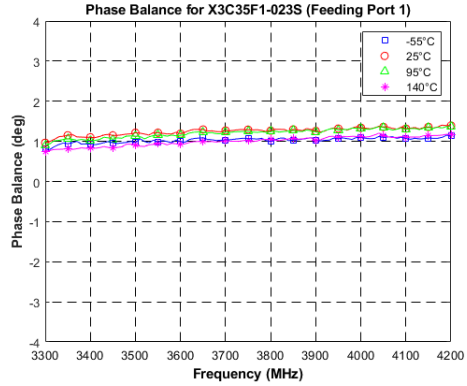










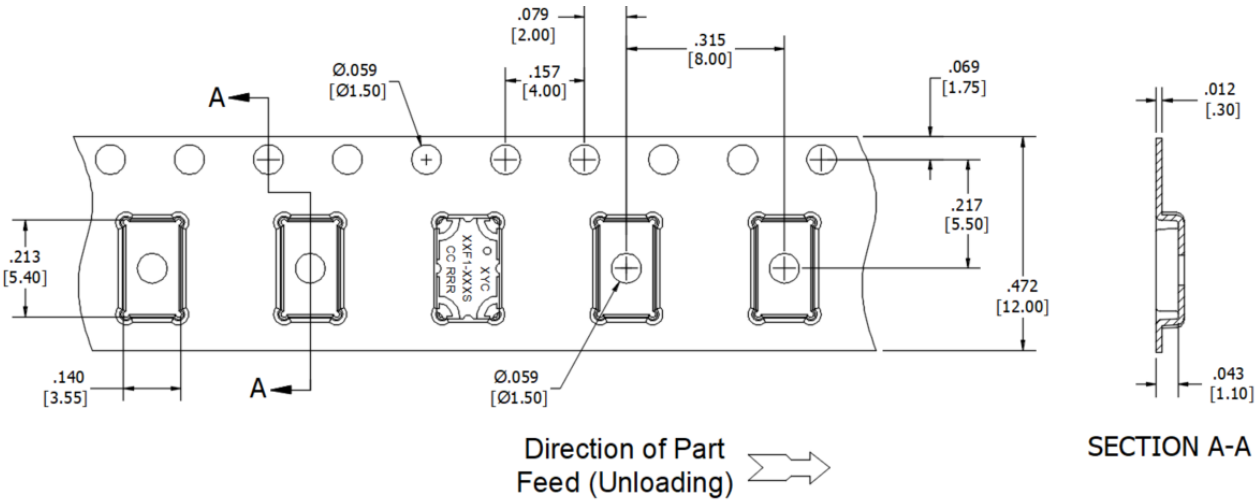


Definition of Measured Specifications

Parameter	Definition	Mathematical Representation
VSWR (Voltage Standing Wave Ratio)	The impedance match of the coupler to a 50Ω system. A VSWR of 1:1 is optimal.	$\mathrm{VSWR} = \frac{V_{max}}{V_{min}}$ Vmax = voltage maxima of a standing wave Vmin = voltage minima of a standing wave
Return Loss	The impedance match of the coupler to a 50Ω system. Return Loss is an alternate means to express VSWR.	$\mathrm{Return\ Loss(dB)} = 20\log\frac{\mathrm{VSWR}+1}{\mathrm{VSWR}-1}$
Insertion Loss	The input power divided by the sum of the power at the two output ports.	$\mathrm{Insertion\ Loss(dB)} = 10\log\frac{P_{in}}{P_{cpl}+P_{direct}}$
Isolation	The input power at divided by the power at the isolated port.	$10\log\frac{P_{in}}{P_{iso}}$
Phase Balance	The difference in phase angle between the two output ports.	Phase at coupled port – Phase at direct port
Mean Coupling	At a given frequency (ω_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.	$\mathrm{Coupling(dB)} = C(\omega_n) = 10\log\frac{P_{in}(\omega_n)}{P_{cpl}(\omega_n)}$ $\mathrm{Mean\ Coupling(dB)} = \frac{\sum_{n=1}^{N} C(\omega_n)}{N}$
Group Delay	Group delay is average of group delay's from input port to the coupled port	Average (GD-C)

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 4000 pcs per reel.



Dimensions are in Inches [Millimeters]

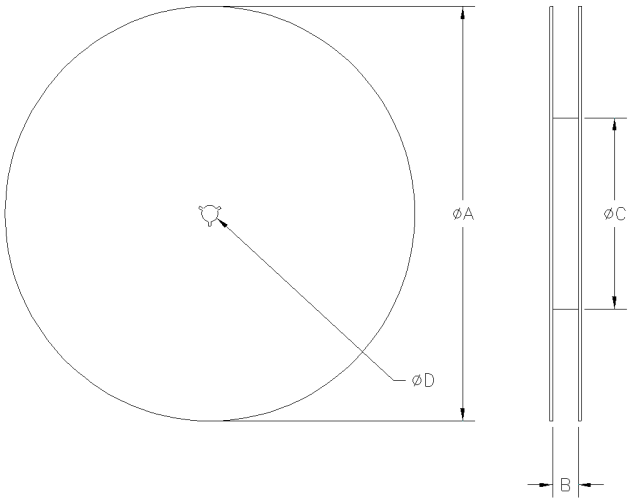


TABLE 1	
REEL DIMENSIONS (inches [mm])	
ØA	13.0 [330.0]
B	.472 [12.0]
ØC	4.017 [102.03]
ØD	0.512 [13.0]

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