Hybrid Coupler
3 dB, 90°

Description:

The X3C45F1-03S is a low profile, medium power, high performance 3dB Hybrid coupler in a new easy to use, Xinger style manufacturing friendly surface mount package. It is designed for 5G band (n46,48,77 & 78) applications. The X3C45F1-03S is designed for 5G signal dividing and combining, and where low insertion loss and tight amplitude balance is required. It can be used in medium power applications up to 25 Watts (CW).

Parts have been subjected to industry standard Xinger 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.

Features:

- **3600-5100 MHz**
- **5G (n46,48,77&78)**
- **Medium Power 25W (CW)**
- **Very Low Loss**
- **High Isolation**
- **Production Friendly**
- **Tape and Reel**
- **Lead-Free**

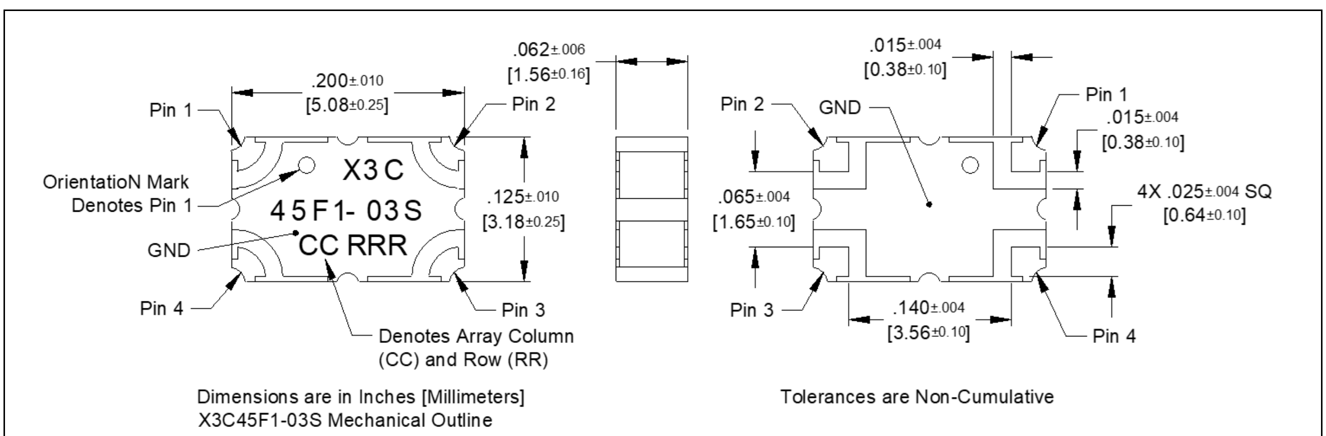
Detailed Electrical Specifications:

Frequency	**Isolation**	**Insertion Loss**	**VSWR**	**Phase**
MHz	*dB Min*	*dB Max*	*Max : 1*	*Degrees*
3600-5100	23	0.20	1.15	90 ± 4.0
4400-5000	23	0.20	1.15	90 ± 4.0

Amplitude Balance	**Group Delay**	**Power**	**Operating Temp.**
dB Max	*ns*	*Avg. CW Watts @ 105°C*	*°C*
± 0.20	0.084±0.005	25	-55 to +150
± 0.20	0.084±0.005	25	-55 to +150

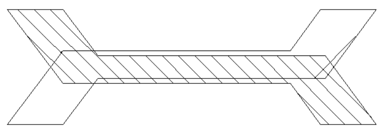
*Specification based on performance of unit properly installed on TTM Technologies Test Board with small signal applied. **Specifications subject to change without notice. Refer to parameter definitions for details.

Outline Drawing:



Hybrid Coupler Pin Configuration

The X3C45F1-03S 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:



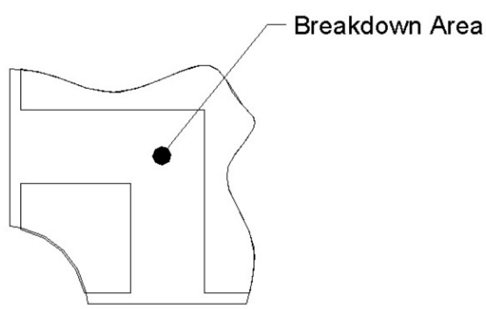
Configuration	Pin 1	Pin 2	Pin 3	Pin 4
Splitter	Input	Isolated	-3dB $\angle\theta-90$	-3dB $\angle\theta$
Splitter	Isolated	Input	-3dB $\angle\theta$	-3dB $\angle\theta-90$
Splitter	-3dB $\angle\theta-90$	-3dB $\angle\theta$	Input	Isolated
Splitter	-3dB $\angle\theta$	-3dB $\angle\theta-90$	Isolated	Input
***Combiner**	A $\angle\theta-90$	A$\angle\theta$	Isolated	Output
***Combiner**	A $\angle\theta$	A $\angle\theta-90$	Output	Isolated
***Combiner**	Isolated	Output	A $\angle\theta-90$	A $\angle\theta$
***Combiner**	Output	Isolated	A $\angle\theta$	A $\angle\theta-90$

*Notes: “A” is the amplitude of the applied signals. When two quadrature signals with equal amplitudes are applied to the coupler as described in the table, they will combine at the output port. If the amplitudes are not equal, some of the applied energy will be directed to the isolated port.

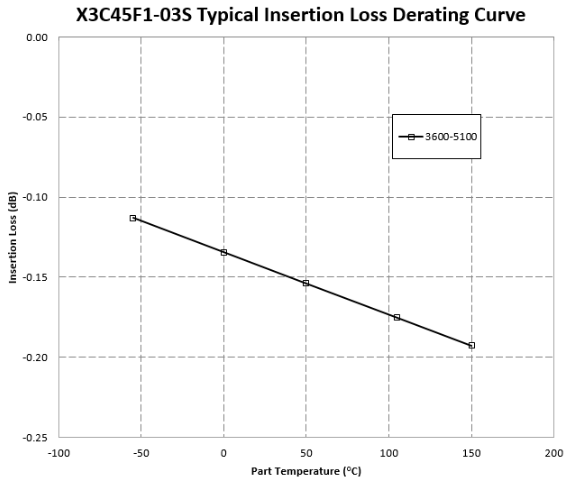
The actual phase, $\angle\theta$, or amplitude at a given frequency for all ports, can be seen in our de-embedded S-parameters, that can be downloaded at www.TTM.com

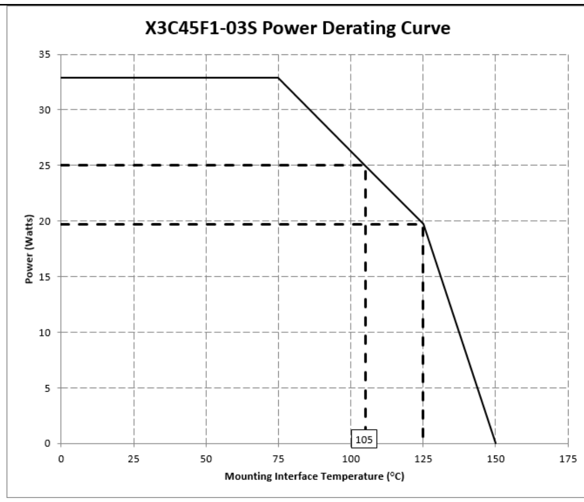
Peak Power Handling

High-Pot testing of these couplers during the qualification procedure resulted in a minimum breakdown voltage of 1.47Kv (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 105°C and 150°C. A best-fit line for the measured data is computed and then plotted from -55°C to 150°C.

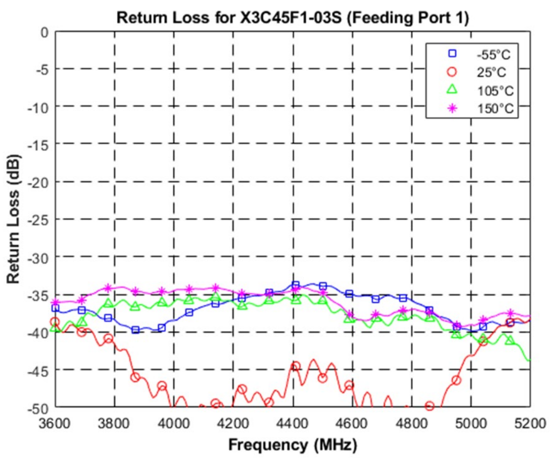
Power Derating:

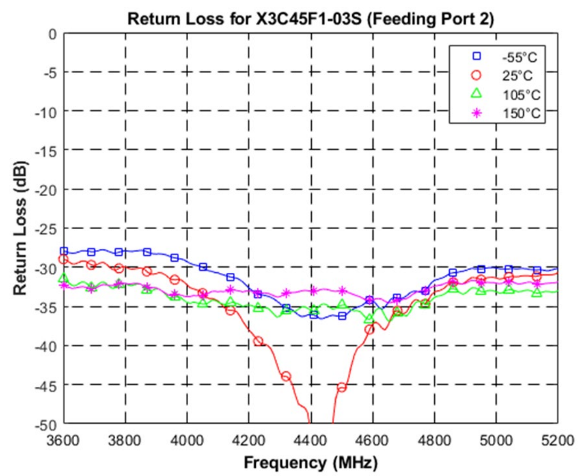
The power handling and corresponding power derating plots are a function of the thermal resistance, mounting surface temperature (base plate temperature), maximum continuous operating temperature of the coupler, and the thermal insertion loss. The thermal insertion loss is defined in the Power Handling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

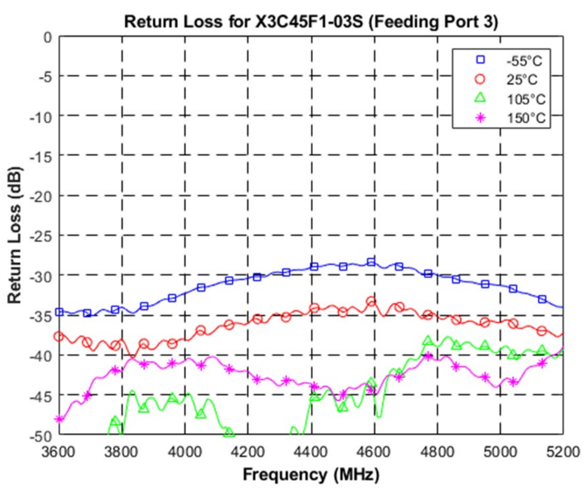
As the mounting interface temperature approaches the maximum continuous operating temperature, the power handling decreases to zero.

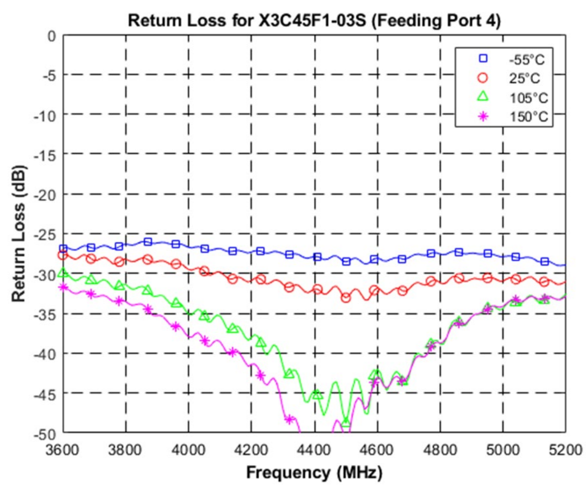
If mounting temperature is greater than 105°C, Xinger couplers will perform reliably as long as the input power is derated to the curve above.

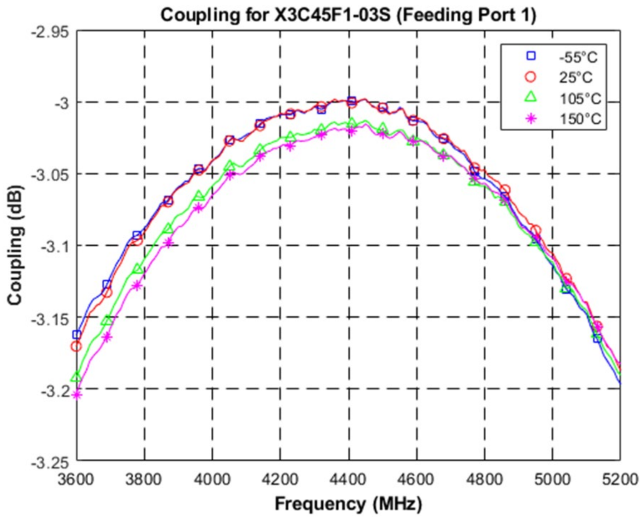
Typical Performance: (-55°C, 25°C, 105°C, 150°C): 3600 – 5200 MHz

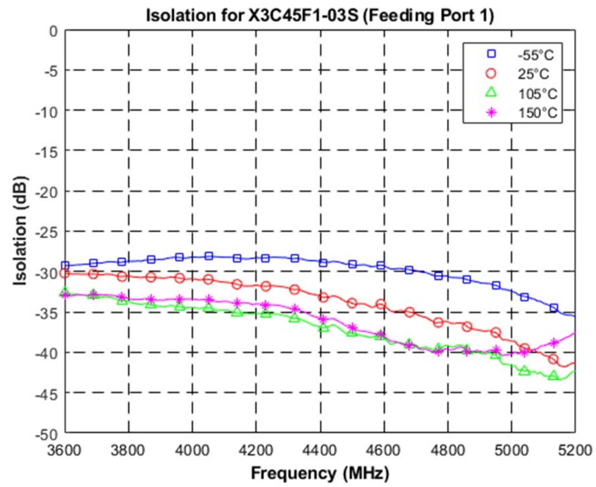


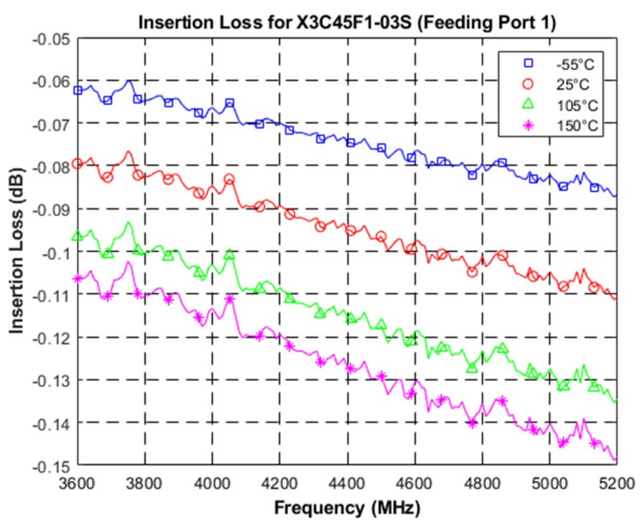


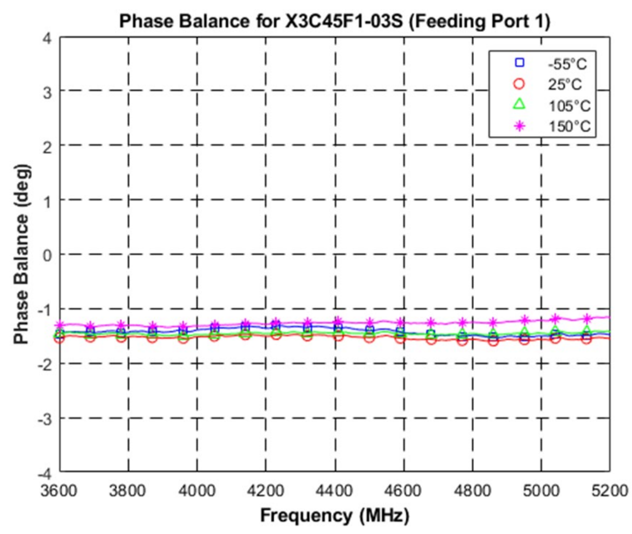





Coupling for X3C45F1-03S (Feeding Port 1)
-55°C
25°C
105°C
150°C
Coupling (dB)
Frequency (MHz)


Isolation for X3C45F1-03S (Feeding Port 1)
-55°C
25°C
105°C
150°C
Isolation (dB)
Frequency (MHz)


Insertion Loss for X3C45F1-03S (Feeding Port 1)
-55°C
25°C
105°C
150°C
Insertion Loss (dB)
Frequency (MHz)

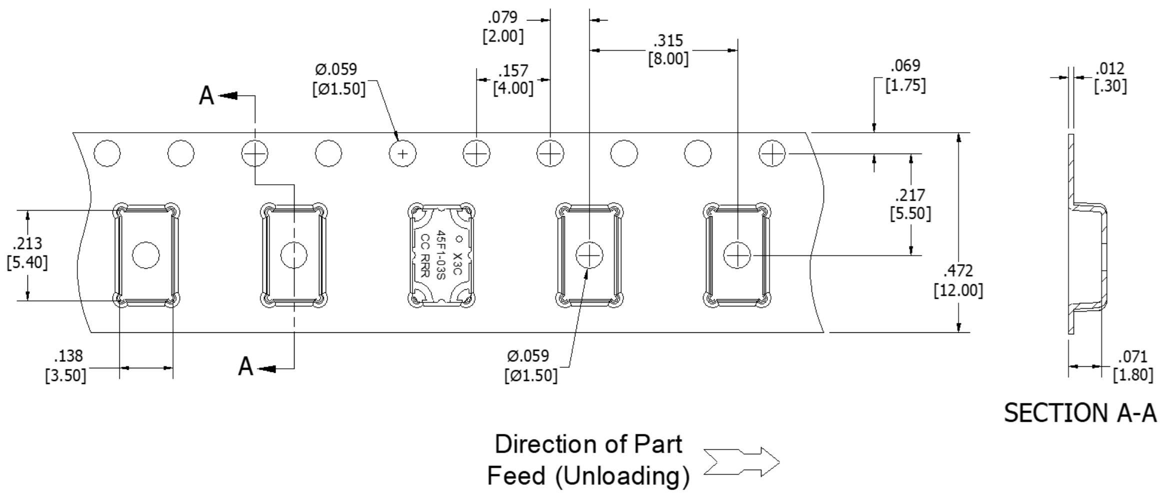

Phase Balance for X3C45F1-03S (Feeding Port 1)
-55°C
25°C
105°C
150°C
Phase Balance (deg)
Frequency (MHz)

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.	$VSWR = \frac{V_{max}}{V_{min}}$ 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.	$Return\ Loss(dB) = 20log\ \frac{VSWR + 1}{VSWR - 1}$
Insertion Loss	The input power divided by the sum of the power at the two output ports.	$Insertion\ Loss(dB) = 10log\ \frac{P_{in}}{P_{cpl} + P_{direct}}$
Isolation	The input power divided by the power at the isolated port.	$Isolation(dB) = 10log\ \frac{P_{in}}{P_{iso}}$
Phase Balance	The difference in phase angle between the two output ports.	Phase at coupled port – Phase at direct port
Amplitude Balance	The power at each output divided by the average power of the two outputs.	$10\log \frac{P_{cpl}}{(P_{cpl}+P_{direct})/2}$ and $10\log \frac{P_{direct}}{(P_{cpl}+P_{direct})/2}$
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]

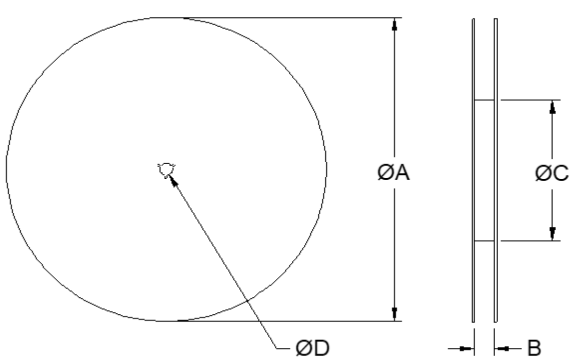


TABLE 1	
REEL DIMENSIONS (Inches[mm])	
ØA	13.0 [330.0]
B	.472 [12.0]
ØC	4.017 [102.03]
ØD	.512 [13.0]

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