30 dB Directional Coupler

Description:

The XEC24P3-30G is a low profile, high performance 30dB directional coupler in an easy to use, manufacturing friendly surface mount package. It is designed for IMS band, RF heating applications in the 2400 MHz to 2500 MHz range. It can be used in high power applications up to 300 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. Available in 6 of 6 ENIG (XEC24P3-30G) RoHS compliant finish.

Features:

- **2400 - 2500 MHz**
- **High Power**
- **Very Low Loss**
- **Tight Coupling**
- **High Directivity**
- **Production Friendly**
- **Tape and Reel**
- **ENIG Finish**

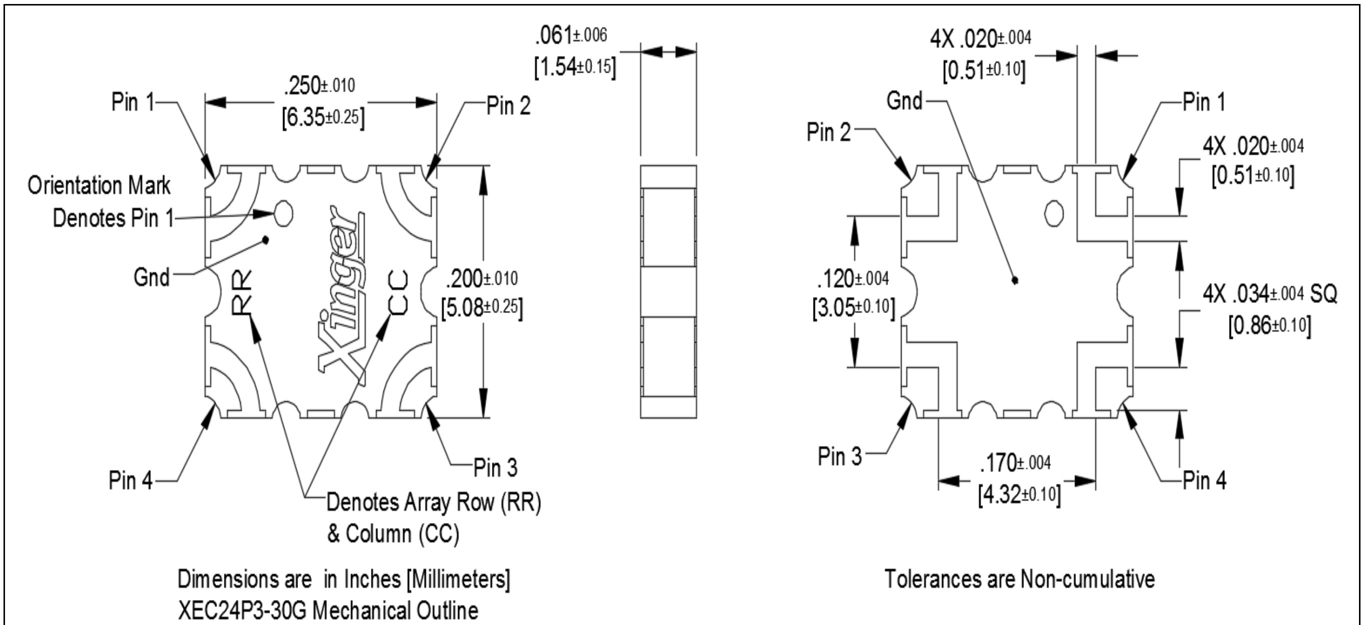
Electrical Specifications**

Frequency	Mean Coupling	Insertion Loss	VSWR
MHz	*dB*	*dB Max*	*Max : 1*
2400 – 2500	30.0 ± 1.0	0.1	1.15
Directivity	**Frequency Sensitivity**	**Power**	**Operating Temp.**
dB Min	*dB Max*	*Avg. CW Watts*	*ºC*
20	± 0.25	300	-55 to +95

*Power Handling for commercial, non-life critical applications. See derating chart for other applications

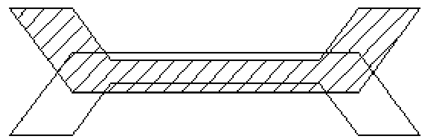
**Specification based on performance of unit properly installed on a TTM test board. Refer to Specifications subject to change without notice. Refer to parameter definitions for details.

Mechanical Outline:



Directional Coupler Pin Configuration

The XEC24P3-30G 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.

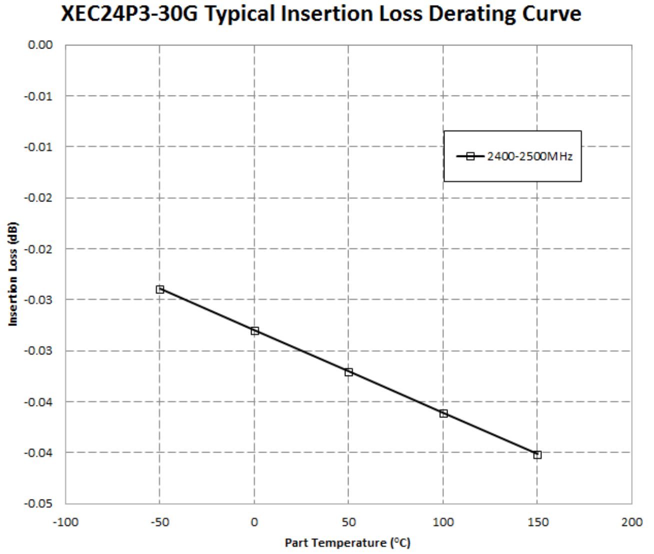


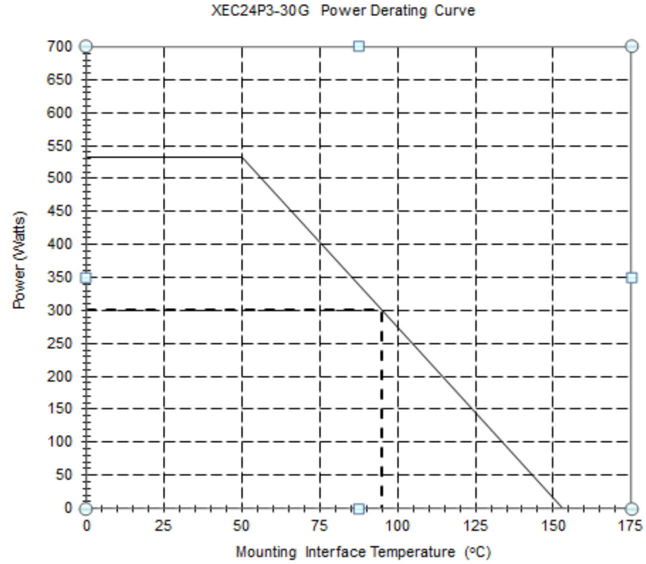
30dB Coupler Pin Configuration

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

Note: The direct port has a DC connection to the input port and the coupled port has a DC connection to the isolated port.
For optimum IL and power handling performance, use Pin 1 or Pin 2 as inputs.

Insertion Loss and Power Derating Curves





Insertion Loss Deating

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 85°C and 150°C. A best-fit line for the measured data is computed and then plotted from -55°C to 150°C.

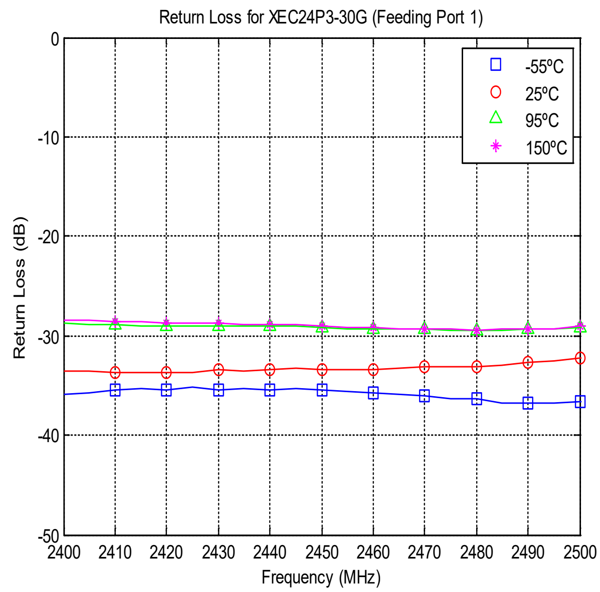
Power Derating

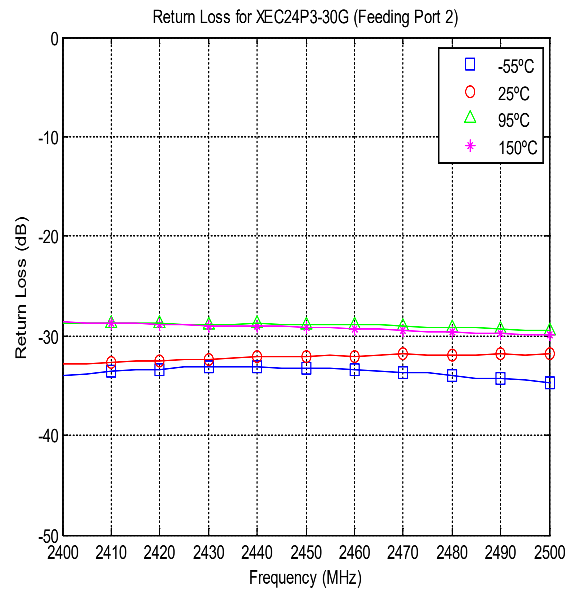
The power handling and corresponding power derating plots are a function of the thermal resistance, mounting surface temperature (base plate temperature), maximum continuous operating temperature of the coupler, and the thermal insertion loss. The thermal insertion loss is defined in the Power Handling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

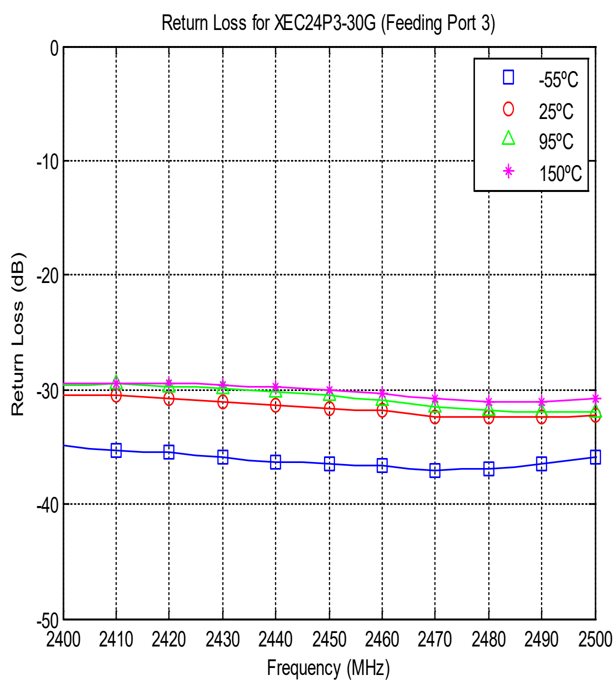
As the mounting interface temperature approaches the maximum continuous operating temperature, the power handling decreases to zero.

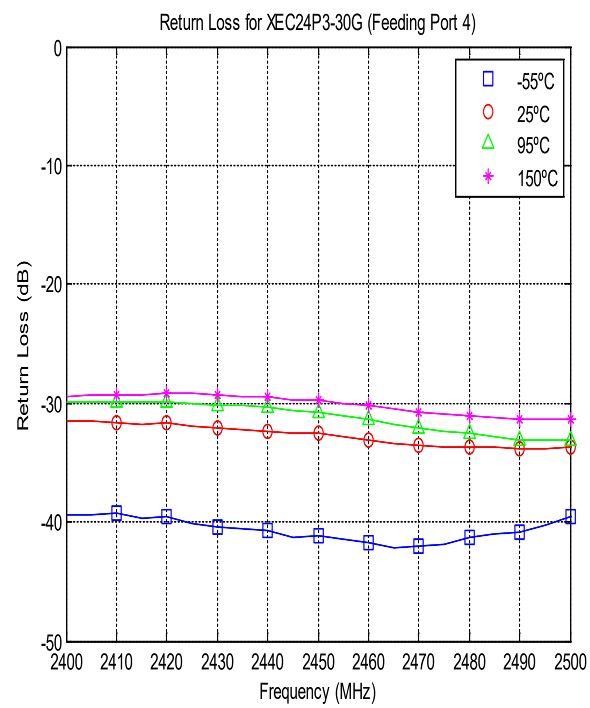
If mounting temperature is greater than 95°C, Xinger coupler will perform reliably as long as the input power is derated to the curve above.

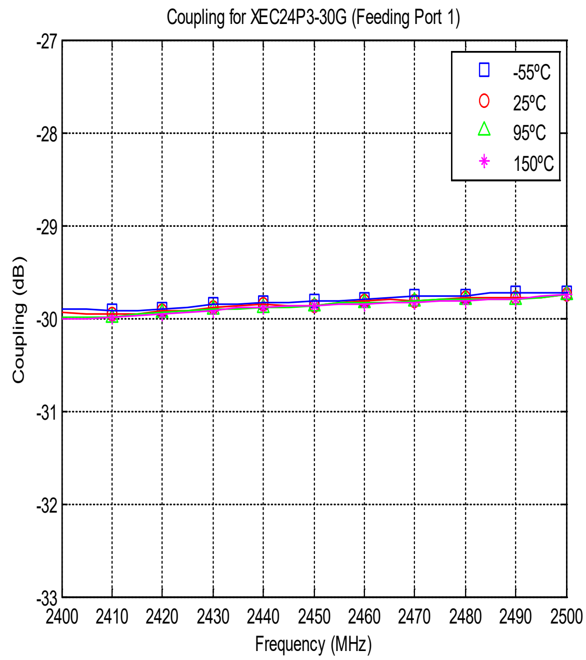
Typical Performance: (-55°C, 25°C, 95°C & 150°C): 2400-2500 MHz

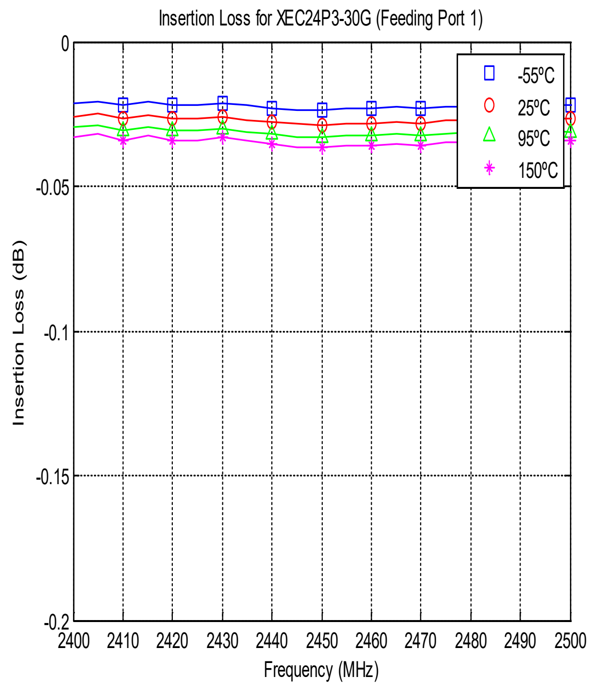


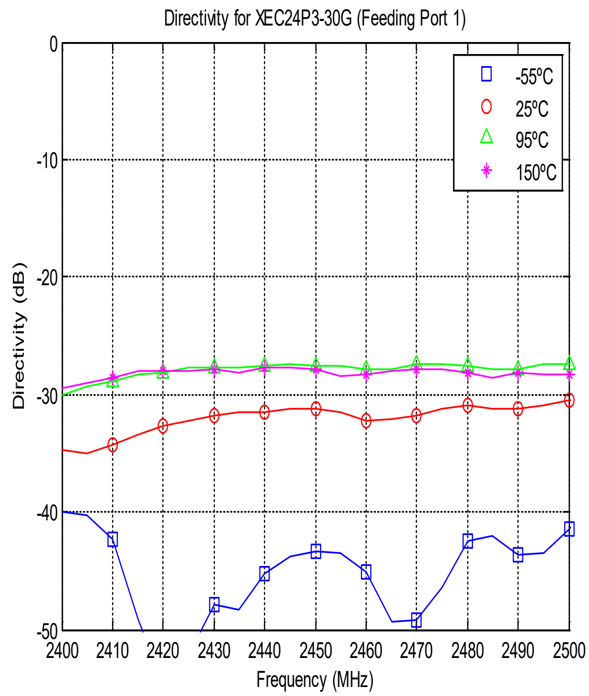


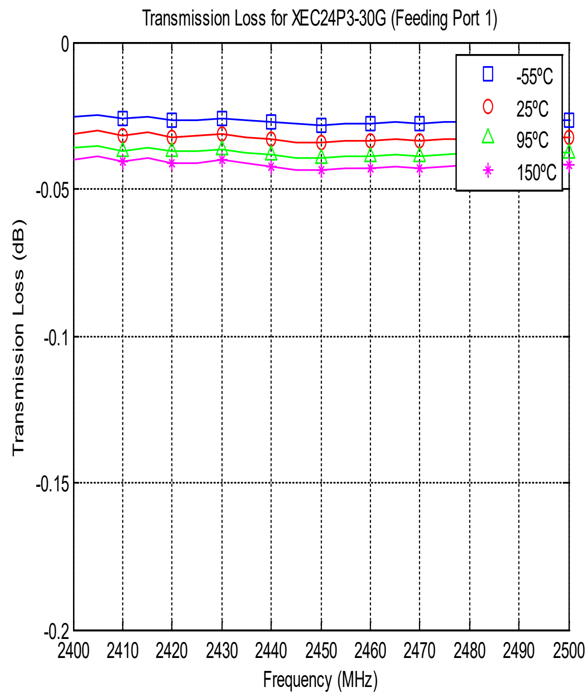





Coupling for XEC24P3-30G (Feeding Port 1)
Coupling (dB)
Frequency (MHz)
-55ºC
25ºC
95ºC
150ºC


Insertion Loss for XEC24P3-30G (Feeding Port 1)
Insertion Loss (dB)
Frequency (MHz)
-55ºC
25ºC
95ºC
150ºC


Directivity for XEC24P3-30G (Feeding Port 1)
Directivity (dB)
Frequency (MHz)
-55ºC
25ºC
95ºC
150ºC


Transmission Loss for XEC24P3-30G (Feeding Port 1)
Transmission Loss (dB)
Frequency (MHz)
-55ºC
25ºC
95ºC
150ºC

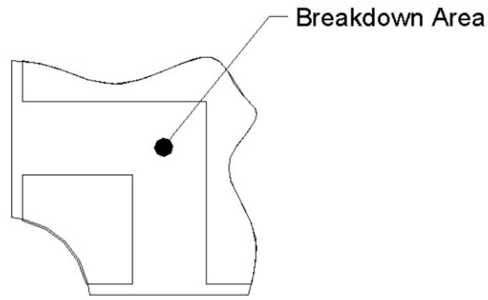
Definition of Measured Specifications

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.	$Return\ Loss(dB) = 20log\frac{VSWR + 1}{VSWR - 1}$
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.	$\mathrm{Coupling(dB)} = \mathrm{C}(\omega_n) = 10\log\frac{\mathrm{P_{in}}(\omega_n)}{\mathrm{P_{cpl}}(\omega_n)}$ $\mathrm{Mean\ Coupling(dB)} = \frac{\sum_{n=1}^{N}\mathrm{C}(\omega_n)}{\mathrm{N}}$
Insertion Loss	The input power divided by the sum of the power at the two output ports.	$10\log\frac{\mathrm{P_{in}}}{\mathrm{P_{cpl}} + \mathrm{P_{direct}}}$
Transmission Loss	The input power divided by the power at the direct port.	$10\log\frac{\mathrm{P_{in}}}{\mathrm{P_{direct}}}$
Directivity	The power at the coupled port divided by the power at the isolated port.	$10\log\frac{\mathrm{P_{cpl}}}{\mathrm{P_{iso}}}$
Frequency Sensitivity	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) – Mean Coupling (dB) and Min Coupling (dB) – Mean Coupling (dB)

Peak Power Handling

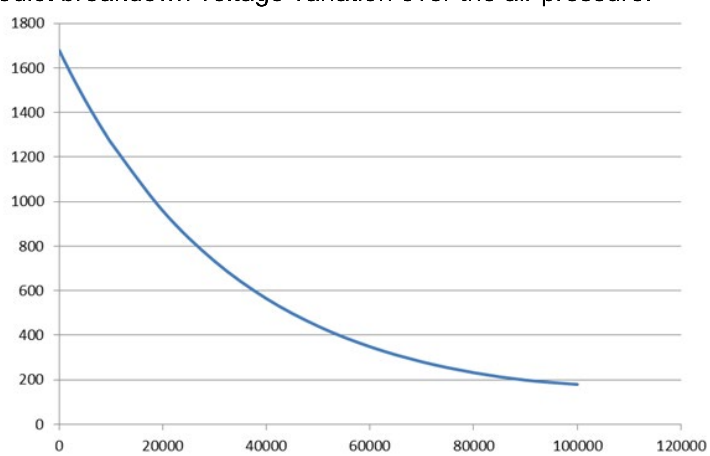
At Sealevel

High-Pot testing of these couplers during the qualification procedure resulted in a minimum breakdown voltage of 1.44kV (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.



At High Altitudes

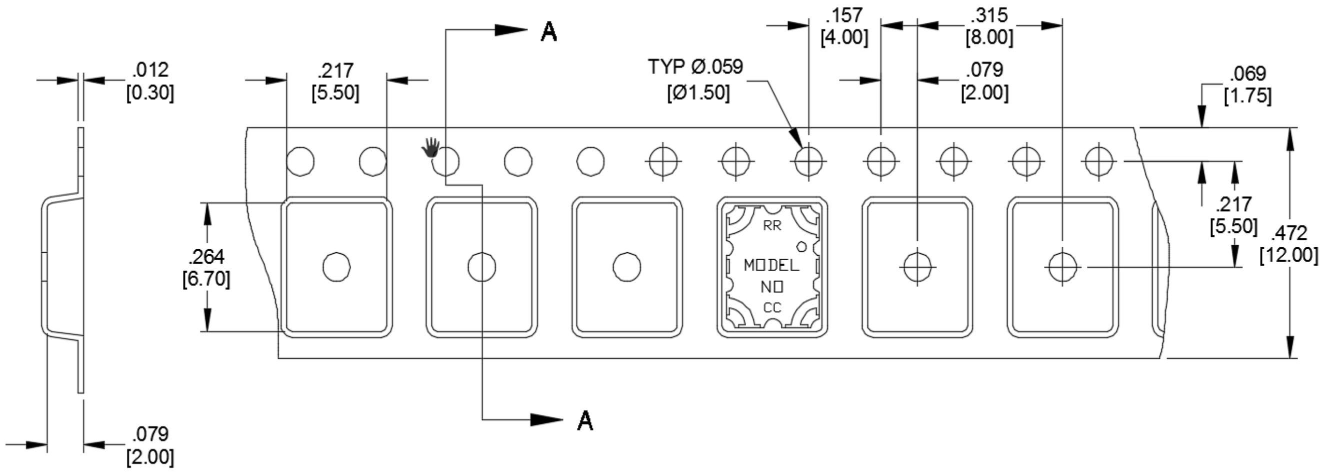
Breakdown voltage at high altitude reduces significantly comparing with the one at sea level. As an example, plot below illustrates reduction in breakdown voltage of 1700 V at sea level with increasing altitude. The plot uses Paschen's Law to predict breakdown voltage variation over the air pressure.



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) and physical conditions such as alignment of part to carrier board, cleanliness of carrier board etc.

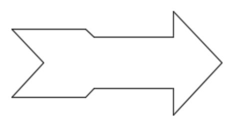
Packaging and Ordering Information:

Parts are available in a reel and as loose parts in a bag. Packaging follows EIA 481-D for reels. Parts are oriented in tape and reel as shown below.



SECTION A-A

Dimensions are in Inches [Millimeters]



Direction Of
Part Feed
(Unloading)

XEC24P3-30GR & XEC24P3-30GR1

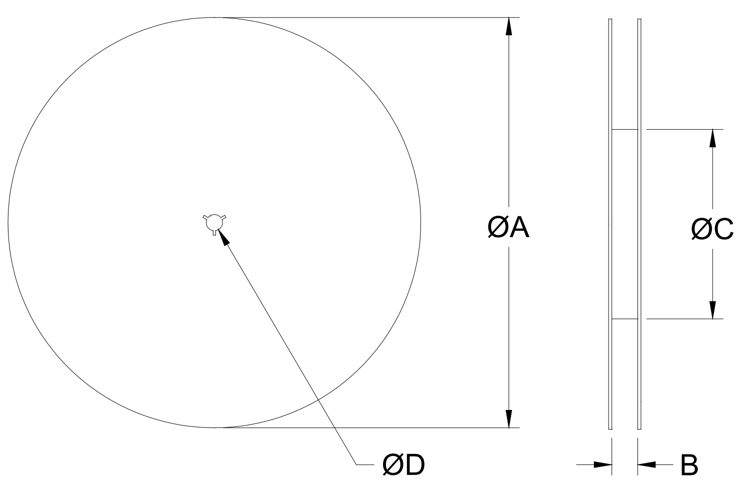


TABLE 1: REEL DIMENSIONS (mm)					
	QUANTITY/REEL	ØA	B	ØC	ØD
XEC24P3-30GR	2000	330.0	12.0	102.03	13.00
XEC24P3-30GR1	250	177.80	12.0	50.80	13.00

Contact us:
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