

**30 dB Directional Coupler**

**Xinger**<sup>®</sup>



**Description:**

The X4C09F1-30S is a low profile, high performance 30dB directional coupler in a new easy to use, manufacturing friendly surface mount package. It is designed for AMPS, GSM, WCDMA and LTE band applications. The X4C09F1-30S is designed particularly for power and frequency detection, as well as for VSWR monitoring, where tightly controlled coupling and low insertion loss is required. It can be used in high power applications up to 100 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, RO4003 and polyimide. Produced with 6 of 6 RoHS compliant tin immersion finish.

**Features:**

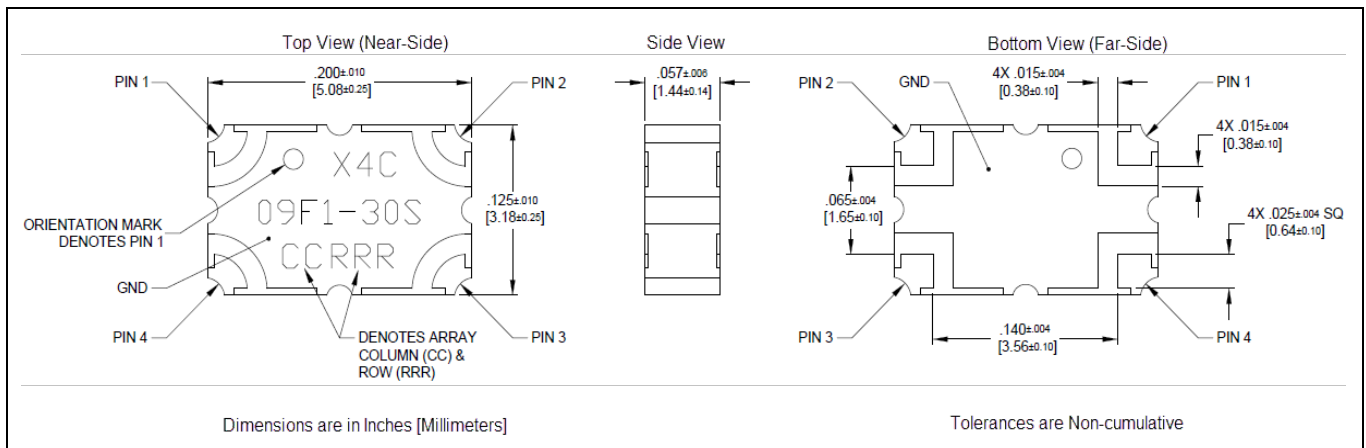
- 420 - 1000 MHz
- AMPS, GSM, WCDMA and LTE band
- High Power
- Very Low Loss
- Tight Coupling
- High Directivity
- Production Friendly
- Tape and Reel
- Lead Free

**Electrical Specifications\*\***

| Frequency             | Mean Coupling        | Insertion Loss | VSWR            | Directivity |
|-----------------------|----------------------|----------------|-----------------|-------------|
| MHz                   | dB                   | dB Max         | Max : 1         | dB Min      |
| 420 - 468             | 33.0 ± 1.50          | 0.075          | 1.15            | 20          |
| 460 - 470             | 32.0 ± 1.50          | 0.100          | 1.15            | 20          |
| 600 - 1000            | 30.0 ± 1.50          | 0.150          | 1.15            | 20          |
| Frequency Sensitivity | Power                | Group Delay    | Operating Temp. |             |
| dB Max                | Avg. CW Watts @105°C | DC-DC          | °C              |             |
| ± 0.60                | 100                  | 0.05 ± 0.02    | -55 to +150     |             |
| ± 1.00                | 100                  | 0.05 ± 0.02    | -55 to +150     |             |
| ± 1.60                | 100                  | 0.05 ± 0.02    | -55 to +150     |             |

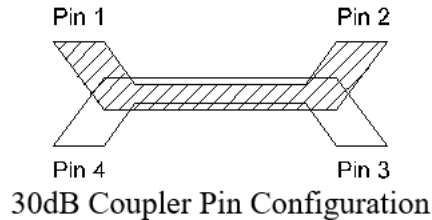
\*\*Specification based on performance of unit properly installed on TTM Test Board. Refer to Specifications subject to change without notice. Refer to parameter definitions for details.

**Mechanical Outline:**



## Directional Coupler Pin Configuration

The X4C09F1-30S 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:



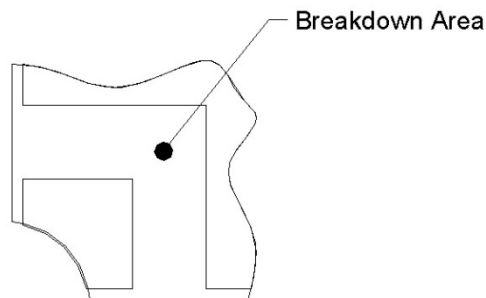
| Pin 1  | Pin 2  | Pin 3    | Pin 4    |
|--------|--------|----------|----------|
| Input  | Direct | Isolated | Coupled  |
| Direct | Input  | Coupled  | Isolated |

Note: The direct port has a DC connection to the input port and the coupled port has a DC connection to the isolated port.

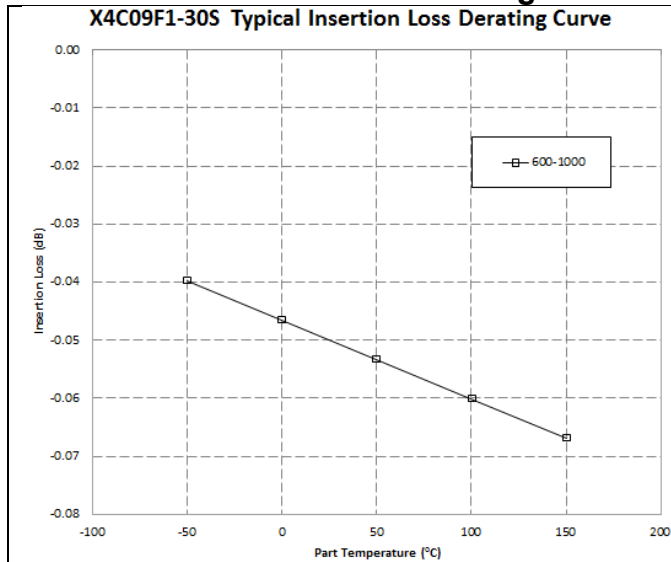
For optimum IL and power handling performance, use Pin 1 or Pin 2 as inputs.

## Peak Power Handling

High-Pot testing of these couplers during the qualification procedure resulted in a minimum breakdown voltage of 0.87Kv (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).

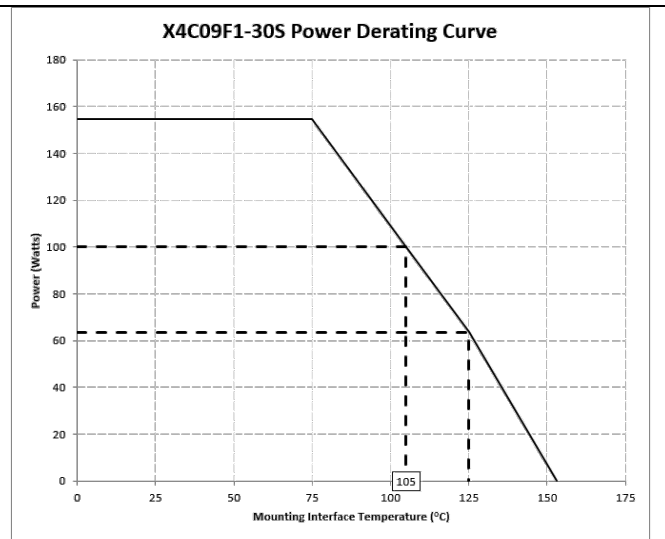


## Insertion Loss and Power Derating Curves



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



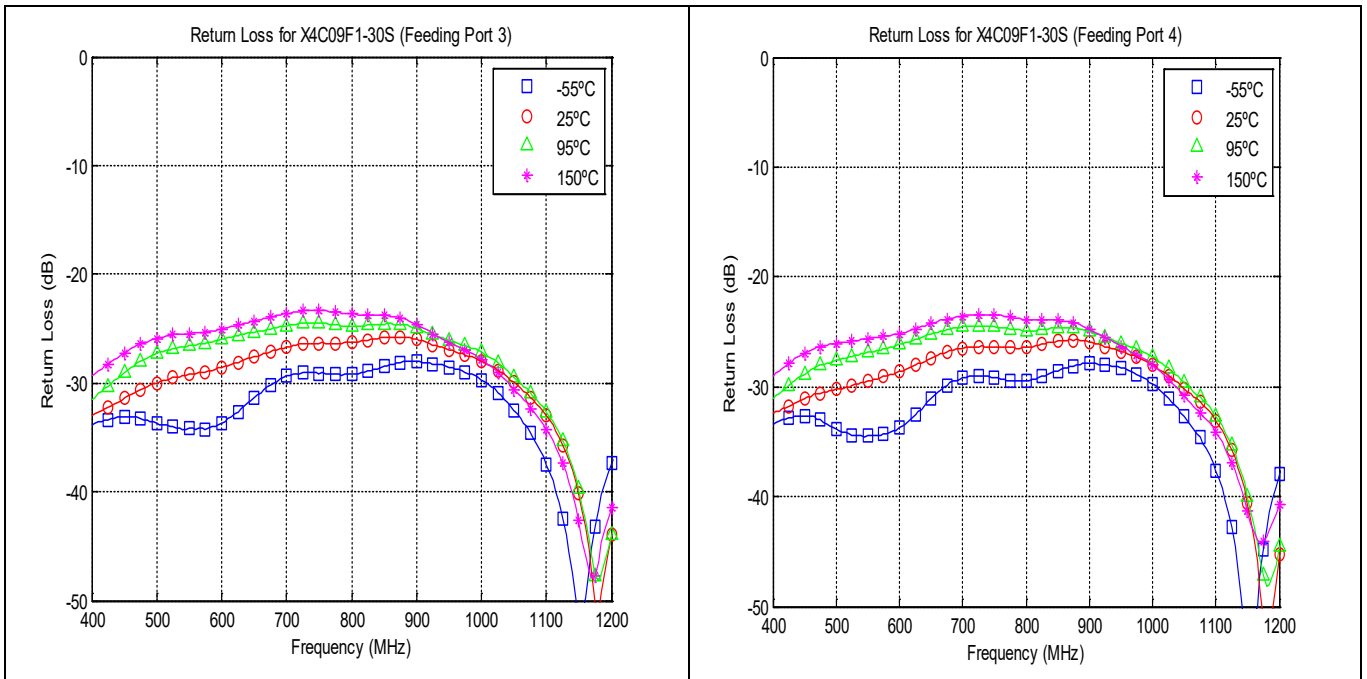
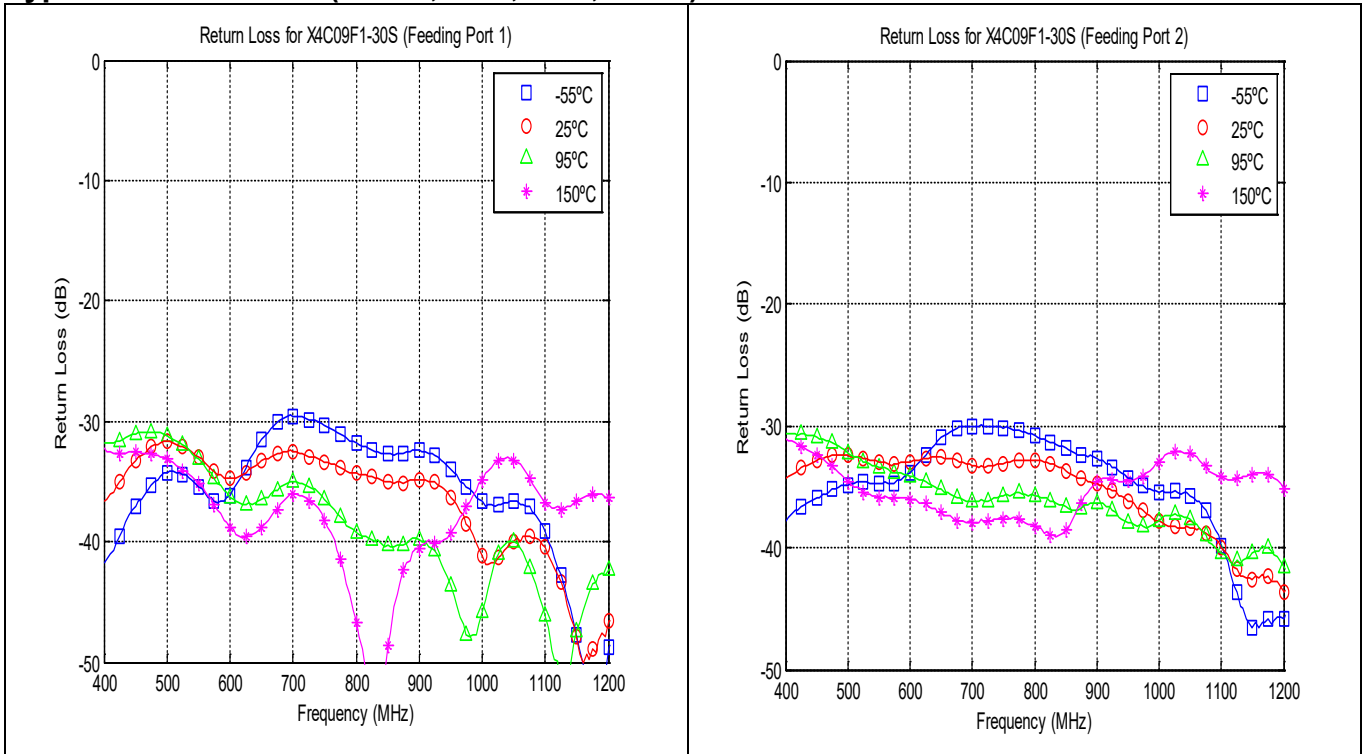
### Power Derating

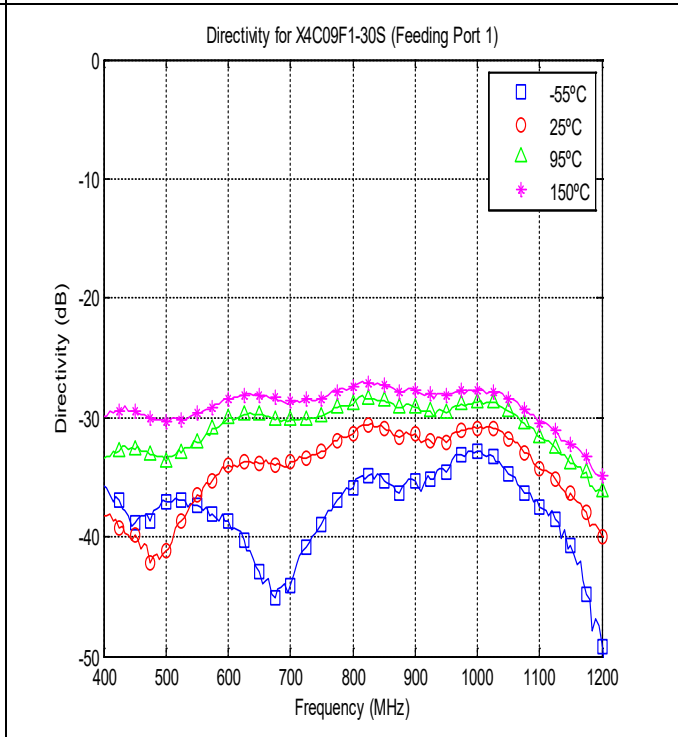
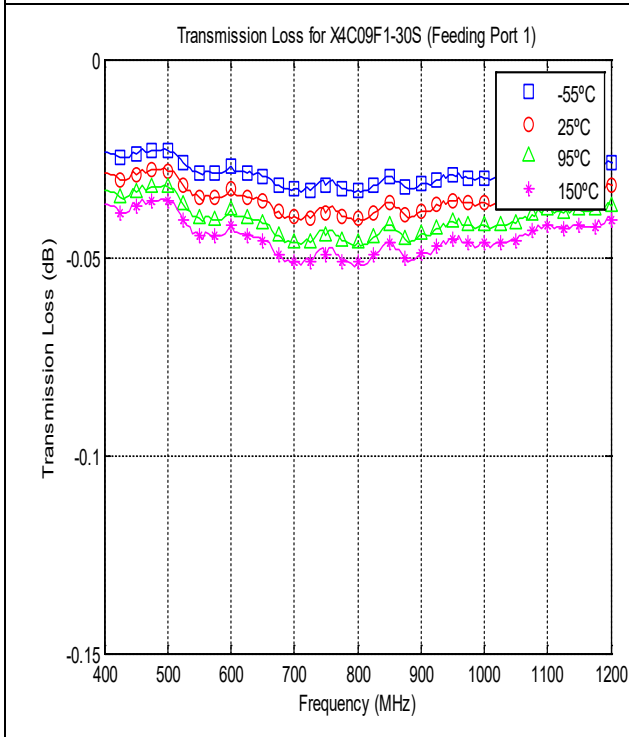
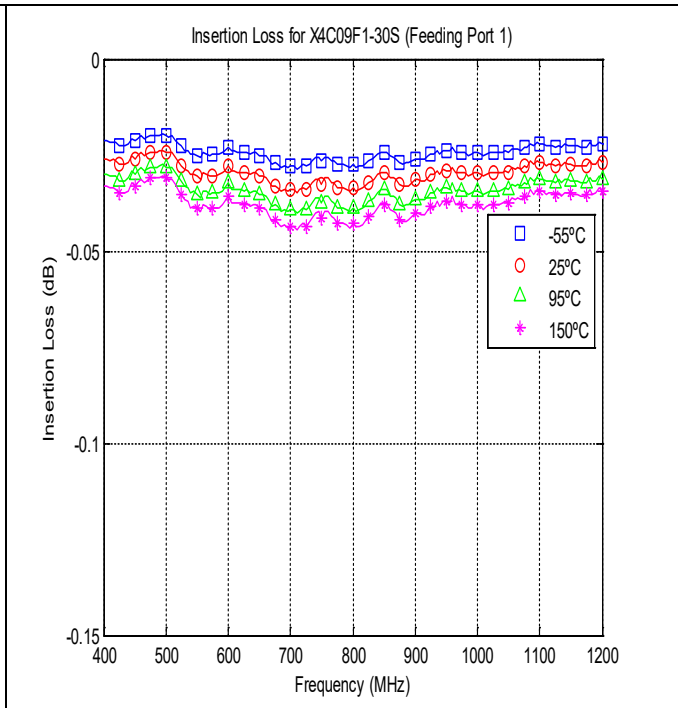
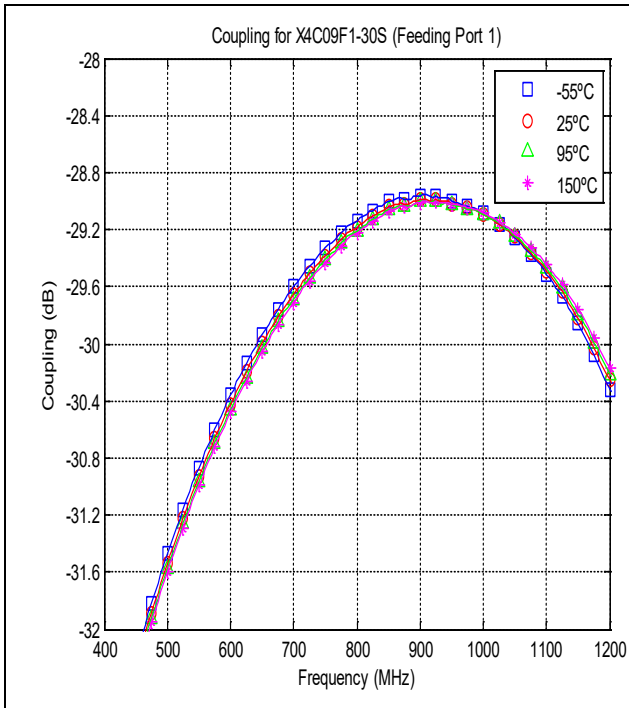
The power handling and corresponding power derating plots are a function of the thermal resistance, mounting surface temperature (base plate temperature), maximum continuous operating temperature of the coupler, and the thermal insertion loss. The thermal insertion loss is defined in the Power Handling 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 105°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): 400-1200 MHz**



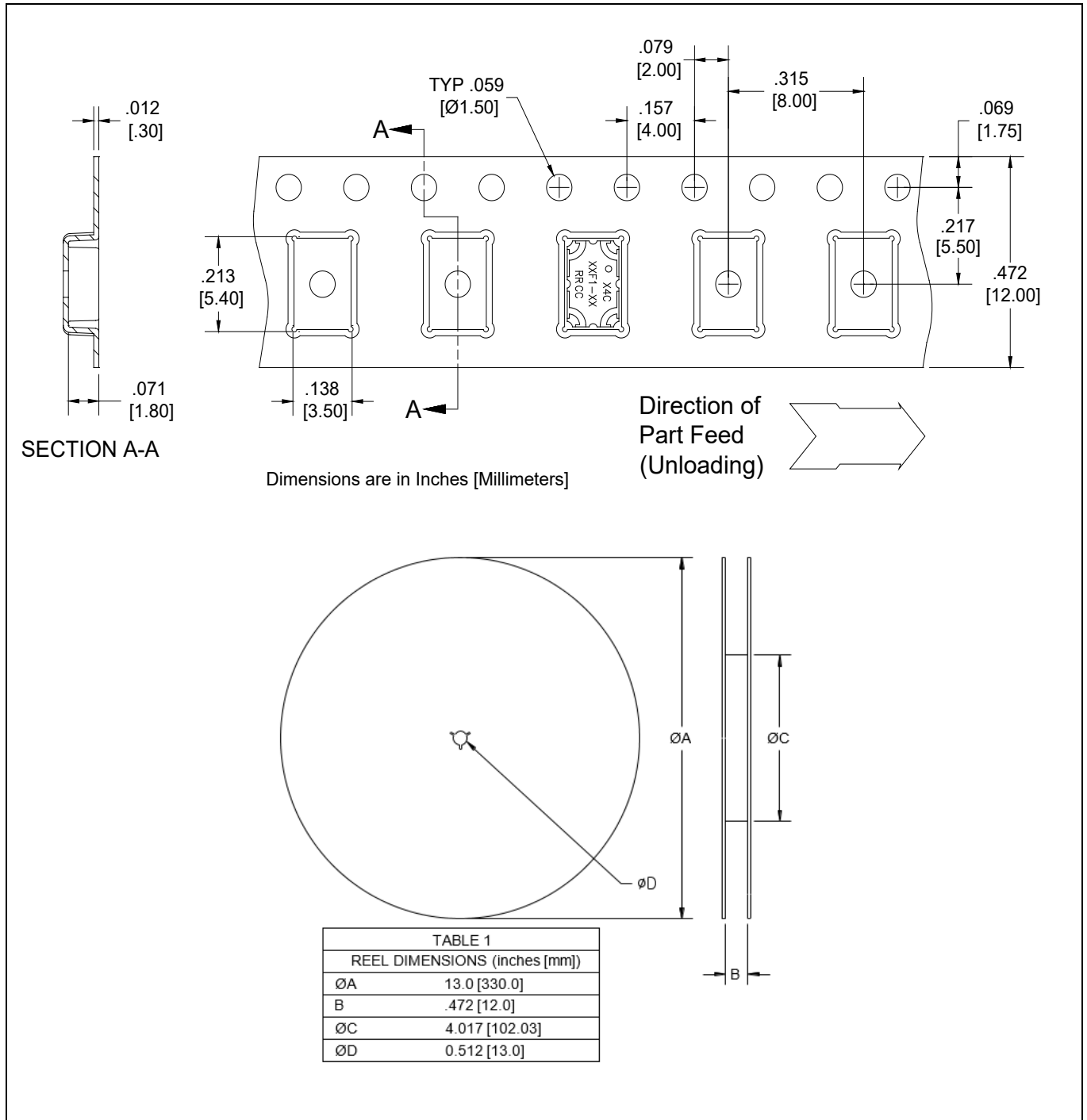


## Definition of Measured Specifications

| Parameter                                    | Definition                                                                                                                                                                                                                    | Mathematical Representation                                                                                                                |
|----------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|
| <b>VSWR</b><br>(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<br>Vmin = voltage minima of a standing wave                      |
| <b>Return Loss</b>                           | The impedance match of the coupler to a 50Ω system. Return Loss is an alternate means to express VSWR.                                                                                                                        | $Return\ Loss(dB) = 20\log \frac{VSWR + 1}{VSWR - 1}$                                                                                      |
| <b>Mean Coupling</b>                         | At a given frequency ( $\omega_n$ ), 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. | $Coupling(dB) = C(\omega_n) = 10\log \frac{P_{in}(\omega_n)}{P_{cpl}(\omega_n)}$ $Mean\ Coupling(dB) = \frac{\sum_{n=1}^N C(\omega_n)}{N}$ |
| <b>Insertion Loss</b>                        | The input power divided by the sum of the power at the two output ports.                                                                                                                                                      | $Insertion\ Loss(dB) = 10\log \frac{P_{in}}{P_{cpl} + P_{direct}}$                                                                         |
| <b>Transmission Loss</b>                     | The input power divided by the power at the direct port.                                                                                                                                                                      | $10\log \frac{P_{in}}{P_{direct}}$                                                                                                         |
| <b>Directivity</b>                           | The power at the coupled port divided by the power at the isolated port.                                                                                                                                                      | $10\log \frac{P_{cpl}}{P_{iso}}$                                                                                                           |
| <b>Frequency Sensitivity</b>                 | 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)<br>and<br>Min Coupling (dB) – Mean Coupling (dB)                                                    |
| <b>Group Delay</b>                           | 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-D for reels. Parts are oriented in tape and reel as shown below. Tape and reel is available in 4000 pcs per reel.



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