

Formulas



Attenuation at any Frequency

$$\alpha = (k_1 \times \sqrt{\text{freq}(\text{GHz})}) + (k_2 \times \text{freq}(\text{GHz})) \quad (\text{dB}/100 \text{ ft})$$

Wavelength

$$\lambda = \frac{11.803 \times V_p}{\text{freq}(\text{GHz})} \quad (\text{in})$$

Length Given Delay

$$L = .9835 \times T \times V_p \quad (\text{ft})$$

Time Delay

$$T = \frac{1.016}{V_p} \quad (\text{ns}/\text{ft})$$

Characteristic Impedance

$$Z_o = 60 \times V_p \times \ln\left(\frac{D}{d}\right) \quad (\text{ohms})$$

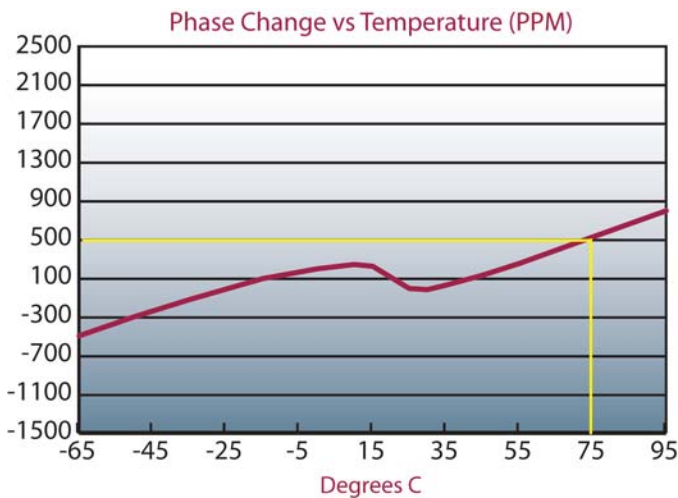
Cut Off Frequency

$$F_c = \frac{7.5 \times V_p}{D + d} \quad (\text{GHz})$$

Phase Length

$$\delta = \frac{5.904 \times V_p}{180 \times \text{freq}(\text{GHz})} \quad (\text{in}/^\circ)$$

PPM Calculations



To calculate the anticipated phase change over temperature using the Parts per Million (PPM) graph:

1. Determine the absolute phase (ω) of the assembly at 25°C.
2. Determine the PPM value at the required temperature.
3. Plug the two values into the PPM formula to calculate the anticipated phase value:

PPM Conversion Formula

$$\phi = \omega \times \frac{(\text{PPM})}{10^6} \quad (^\circ)$$

Example: To determine the phase change of a 10 ft LA290 assembly at 75°C for 18 GHz:

1. Absolute phase is determined by first calculating the phase length:

$$\delta = \frac{5.904 \times V_p}{180 \times \text{freq}(\text{GHz})} = \frac{5.904 \times .85}{180 \times 18} = .00155 \text{ in}/^\circ$$

$$\omega = \frac{10 \text{ ft}}{\delta} = \frac{120 \text{ in}}{.00155 \text{ in}/^\circ} = 77,419.35^\circ$$

2. From the chart, 75°C yields 500 PPM.

3. Phase change is calculated from the PPM conversion formula as follows:

$$\phi = \omega \times \frac{(\text{PPM})}{10^6} = 77,419.35^\circ \times \frac{500}{10^6} = 38.71^\circ$$