

**APPLICATION NOTE**

# Characteristic Impedance of Coaxial Resonators

The characteristic impedance of a dielectric-filled coaxial transmission line with a square outer conductor can be found using the following formula:

$$Z_0 = \text{Characteristic Impedance} = Z_0 = \frac{60}{\sqrt{\epsilon_R}} \ln \left( 1.079 \frac{W}{d} \right)$$

Where:

W = Width of the resonator

d = Diameter of the inner conductor

$\epsilon_R$  = Dielectric constant

The above formula shows that changes in W, d, and  $\epsilon_R$  affect the characteristic impedance. The following table provides an analysis of characteristic impedance using Skyworks manufacturing tolerances.

Profile	Width (W)	Diameter (d)	Z <sub>0</sub> for Materials ( $\epsilon_R$ )			
			1000	2000	8800	9000
HP	0.476 ± 0.005	0.131 ± 0.004	25.3 Ω	18.1 Ω	13.1 Ω	8.6 Ω
EP	0.316 ± 0.005	0.101 ± 0.004	22.5 Ω	16.1 Ω	11.7 Ω	7.7 Ω
SP	0.237 ± 0.004	0.095 ± 0.004	18.3 Ω	13.1 Ω	9.5 Ω	6.3 Ω
LS	0.155 ± 0.004	0.062 ± 0.004	18.4 Ω	13.1 Ω	9.5 Ω	6.3 Ω
LP	0.155 ± 0.004	0.038 ± 0.003	27.4 Ω	19.6 Ω	14.2 Ω	9.4 Ω
SP	0.119 ± 0.004	0.032 ± 0.003	25.7 Ω	18.4 Ω	13.3 Ω	8.8 Ω
SM	0.080 ± 0.003	0.032 ± 0.003	18.4 Ω	13.1 Ω	9.5 Ω	6.3 Ω

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