Effective Dielectric Constant

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Part I: Introduction

The effective dielectric constant K_{eff} is somewhat less than the substrate's dielectric constant due to part of the fields from the microstrip conductor existing in air.

Part II: Calculation

When $\left(\frac{W}{H}\right) < 1$:

$$K_{eff} = \frac{K_r+1}{2} + \frac{K_r-1}{2} * \left(\frac{1}{\sqrt{1+12\left(\frac{H}{W}\right)}} + 0.04\left(1 - \left(\frac{W}{H}\right)\right)^2\right) \quad (1)$$

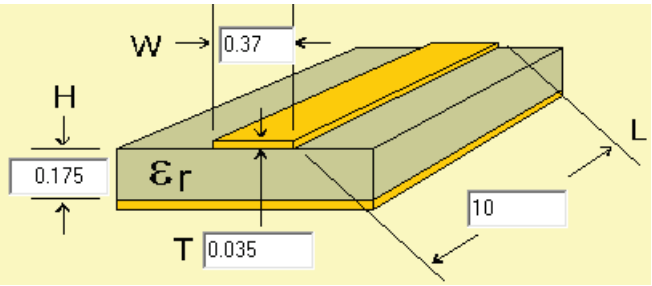
When $\left(\frac{W}{H}\right) \geq 1$:

$$K_{eff} = \frac{K_r+1}{2} + \frac{K_r-1}{2} * \frac{1}{\sqrt{1+12\left(\frac{H}{W}\right)}} \quad (2)$$

All microstrip equations are approximate. The above equations ignore strip thickness, so we wouldn't recommend relying on them for critical designs on thick copper boards [1].

Part III: Using effective dielectric constant

When $\left(\frac{W}{H}\right) \geq 1$:



Length Units: mm $K_r = 4.16$