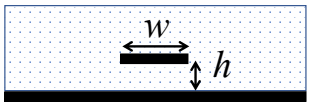
E-Mimeo – P. Blondy

Transmission Lines

Transmission line

A transmission line embedded in a polymer is presented below:



The relative permittivity of the polymer is 3. The line width is 40 µm. The distance to the ground plane is 20 µm.

1- Give the expression of the capacitance per unit length of the transmission line, using a parallel plane approximation, and compute using the given dimensions.

2- Give the expression of the inductance per unit length from the question 1 and the wave velocity on the line.

3- Deduce the expression of the characteristic impedance of the transmission line from the width, w, the distance to the ground plane, h, and the relative permittivity, ε_r, of the polymer.

4- Compute the width of a 50 Ohms transmission line.

E-MIMEO – Integrated passives – Short Transmission Lines

1- A transmission line with a characteristic impedance of 10 Ohms has a line length of 1 mm. Its effective permittivity is 2.8. Compute the equivalent shunt capacitance of this transmission line section.

2- A transmission line with a characteristic impedance of 100 Ohms has a line length of 1 mm. Its effective permittivity is 2.8. Compute the equivalent series inductance of this transmission line section.

3- Synthetic transmission line. A transmission line can be made from the cascade of short transmission lines, allowing to synthetize transmission line sections.

3.a To realize a synthetic transmission line, one have to cascade high/low impedance sections. On the drawing above, which metal level would you choose for the high impedance section? Which metal level would you choose for the low impedance sections?

3.b Compute the width of the 10 Ohms line

3.c Compute the width of the 100 Ohms line

3.d. If the 10 Ohms line is 150 µm long, what should be the length of the 100 Ohms line to obtain a 50 Ohm composite transmission line?