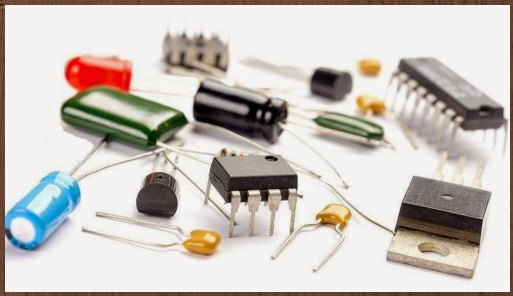
Electronics snippets- Capacitors



Complex Permittivity

- The product of the relative permittivity (εr) of the dielectric material which is used between the metal plates of a capacitor and the permittivity of the free space (εo) is known as “Complex permittivity” or “Actual permittivity” of the dielectric material. The expression for the complex permittivity is given as follows,

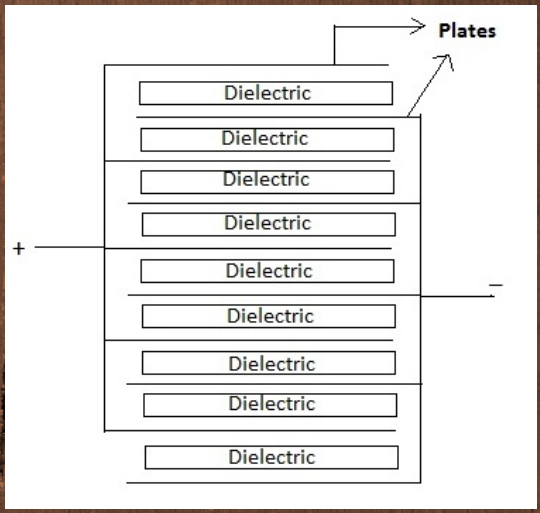
$$\varepsilon = \varepsilon 0 * \varepsilon r$$

- The value of complex permittivity will always be equal to the relative permittivity because the permittivity of free space is equal to ‘one’.
- The value of dielectric constant or complex permittivity varies from one dielectric material to another.
- Some standard values of complex permittivity (ε) for common dielectric materials are: Air = 1.0005, Pure Vacuum = 1.0000, Mica = 5 to 7, Paper = 2.5 to 3.5, Wood = 3 to 8, Glass = 3 to 10 and Metal Oxide Powders = 6 to 20 and etc.

- The final equation for the capacitance of a capacitor using a dielectric constant or complex permittivity is given by,

$$C = \varepsilon o * \varepsilon r\ (A/d)$$

- The method of interleaving more plates together within a single capacitor's body is very useful to increase the capacitance of a capacitor.


Plates
Dielectric
Dielectric
Dielectric
Dielectric
Dielectric
Dielectric
Dielectric
Dielectric
Dielectric
+
–

- In this method a capacitor can have many individual metal plates connected together instead of only one set of parallel plates, this cause increasing the surface area (A) of the plates.
- Here the capacitance will increase because the capacitance of a capacitor is directly proportional to the surface area of the plates.

Presently existing capacitors can be classified according to the properties and characteristics of their insulating or dielectric material, they are given below as :

- High Stability & Low Loss Capacitors - Mica, Low-K Ceramic, and Polystyrene capacitors are examples of this type.
- Medium Stability & Medium Loss Capacitors - Paper, Plastic Film, and High-K Ceramic capacitors are examples of this type.
- Polarized Capacitors – Examples for this type of capacitors are Electrolytic, Tantalum's.