



# Electronic Constructions

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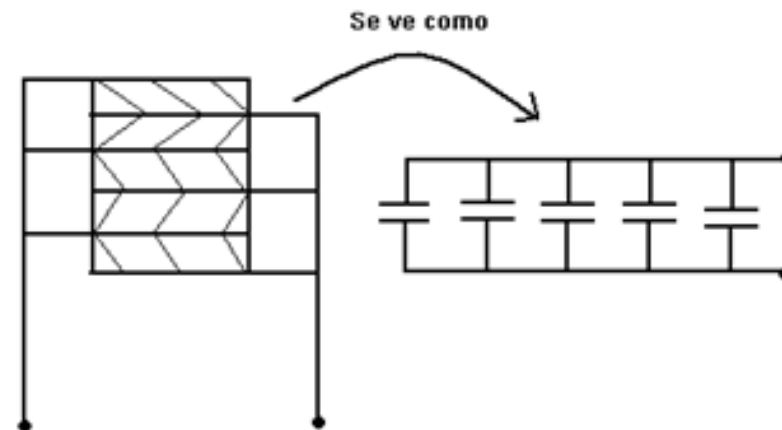
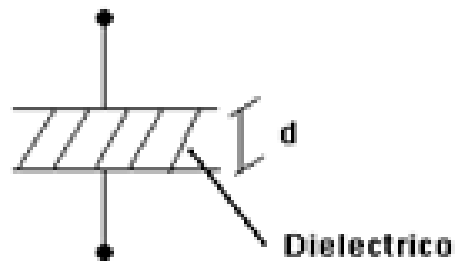
# Course program

1. Introduction
2. Resistors
3. Capacitors
4. Inductors
5. Electromechanical Devices
6. Semiconductors
7. Cooling Techniques in Electronic Circuits
8. Technology of Printed Circuits
9. Final Project

# Capacitors

Passive element / stores electrical charge

For rigid dielectric



For flexible dielectric



# Capacitors

Energy loss for serial model:

Ohmic

Dielectric absorption

Energy loss for parallel model:

Insulation

Fuge current

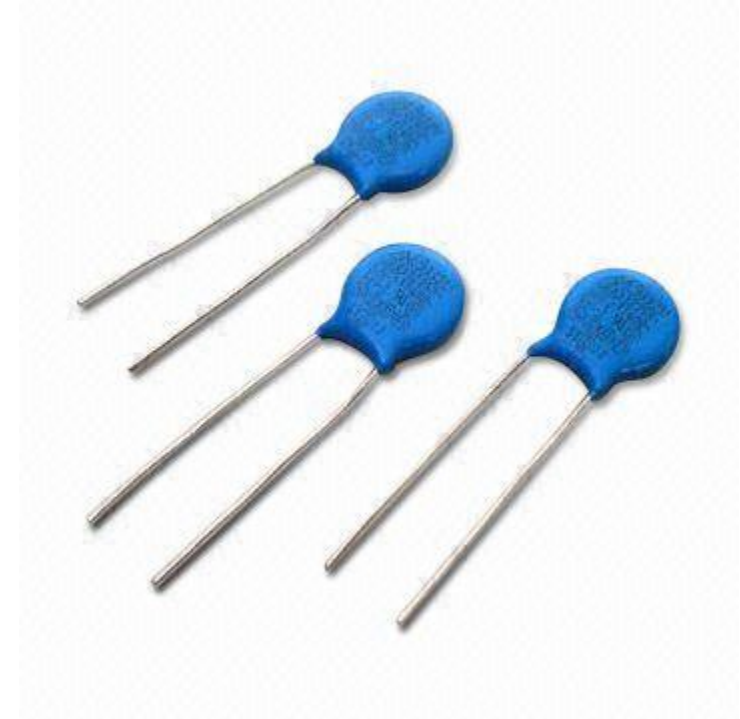
Classification:

- Low loss and high stability
- Med loss
- Electrolytic

# Capacitors: Low loss

## Ceramic

- linear temperature behaviour
  - magnesium titanate ( $\alpha_T+$ )
  - calcium titanate ( $\alpha_T-$ )
- $C_1 = C_0(1 + \alpha_T \Delta T)$
- No variations for voltage or frequency changes
- Low dielectric constant for temperature compensation applications



# Capacitors: Low loss

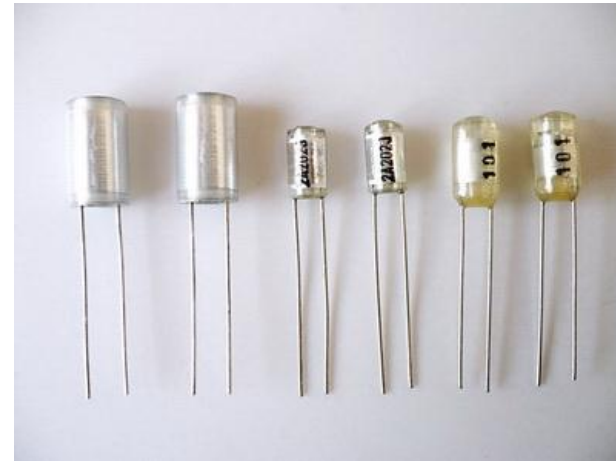
## Polystyrene

- Low  $\epsilon_n$
- C and  $\tan \delta$  values are not temperature dependent
- Non polar
- $V_{rupt} = 500 \text{ V}$



## Glass

- Similar to ceramic, but  $\alpha_T$  cannot be higher than 1440 ppm / °C



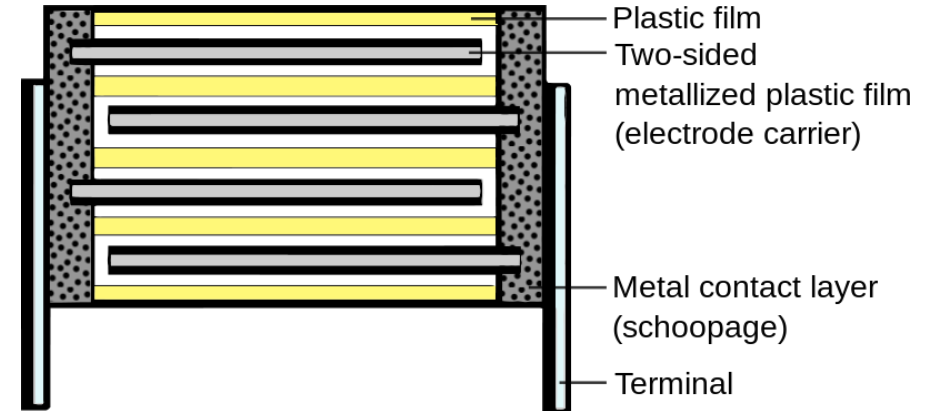
# Capacitors: Med loss

## Plastic film

- Polyethylene or mylar
  - $\epsilon_n = 2.3$  a  $25\text{ }^{\circ}\text{C}$
  - $\tan \delta = 2 \times 10^{-4}$  a  $1\text{Mhz}$
- Polycarbonat
  - $\epsilon_n = 2.96$  a  $25\text{ }^{\circ}\text{C}$
  - $\tan \delta = 0.01$  a  $1\text{Mhz}$

Higher dielectric polarity, higher losses

For coupling applications



# Capacitors: Med loss

Paper

Conductor material: Aluminium

Insulator material

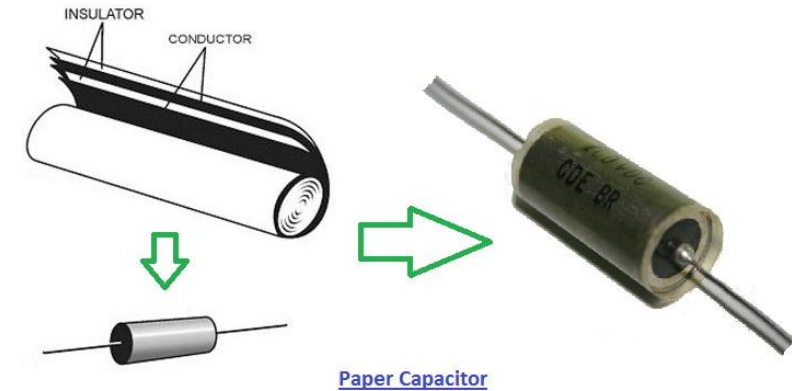
- Polychlorinated naphthalene / DC applications
- Oils / AC and DC / non polars
- Chlorodifeny (Askarel) / polars / AC applications

Applications:

Power source filters

DC: stable and med loss

AC: engine starts and PF correction





# Capacitors: Electrolytic

No inverse polarization!!

Aluminium

for commutated power sources  
applications

Tantalum:

Low loss currents

Better ratio capacitance/volume

