Chapter 12

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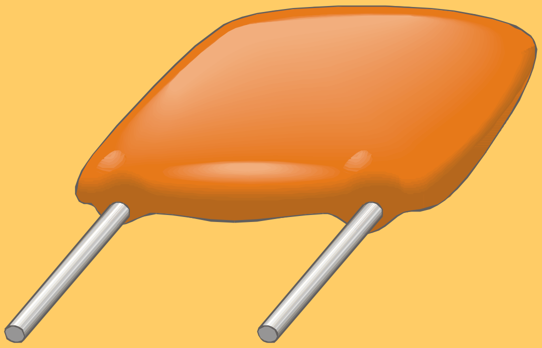
# Summary

## Capacitor types

**Mica**

Mica capacitors are small with high working voltage. The **working voltage** is the voltage limit that cannot be exceeded.

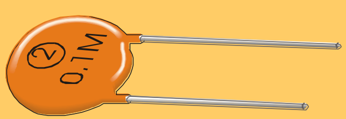


# Summary

## Capacitor types

**Ceramic disk**

Ceramic disks are small nonpolarized capacitors They have relatively high capacitance due to high $\varepsilon_r$.

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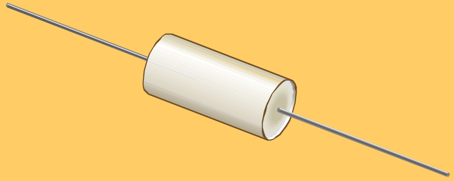
# Summary

## Capacitor types

**Plastic Film**

Plastic film capacitors are small and nonpolarized. They have relatively high capacitance due to larger plate area.

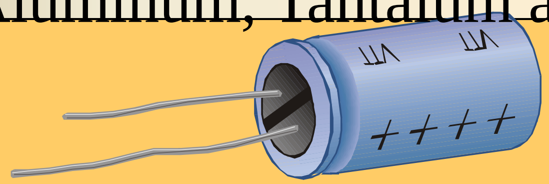


# Summary

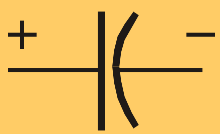
## Capacitor types

**Electrolytic** (two types)

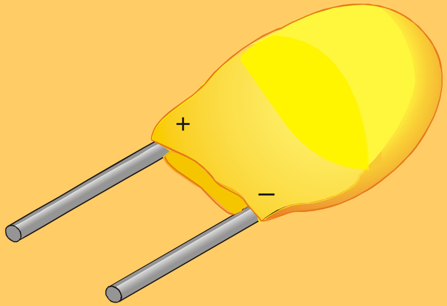
Electrolytic capacitors have very high capacitance but they are not as precise as other types and tend to have more leakage current. Electrolytic types are polarized. Aluminum, Tantalum are used as electrodes or plates




Al electrolytic




Symbol for any electrolytic capacitor



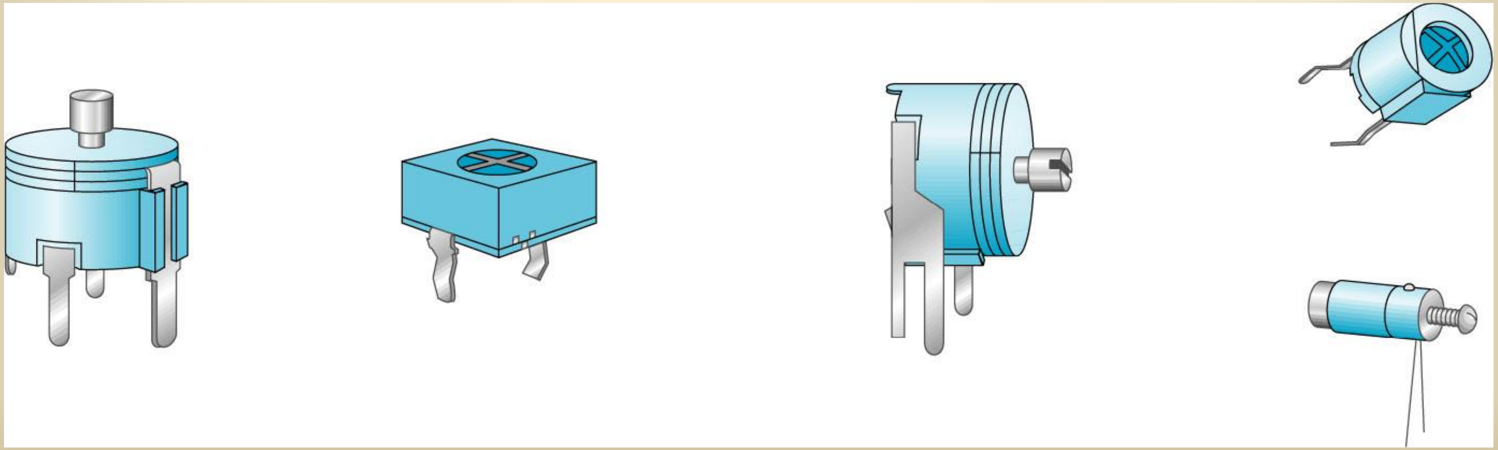

Ta electrolytic

# Summary

## Capacitor types

**Variable**

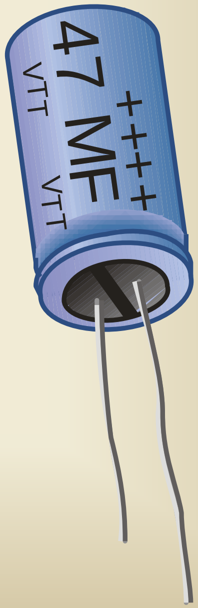
Variable capacitors typically have small capacitance values and are usually adjusted manually.



## Capacitor labeling

Capacitors use several labeling methods. Small capacitors values are frequently stamped on them such as .001 or .01, which have units of microfarads.

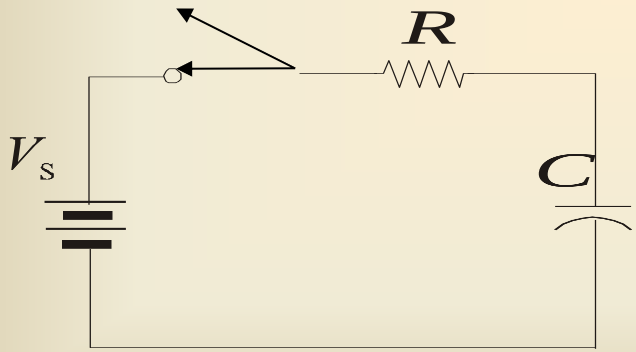
Electrolytic capacitors have larger values, so are read as μF. The unit is usually stamped as μF).

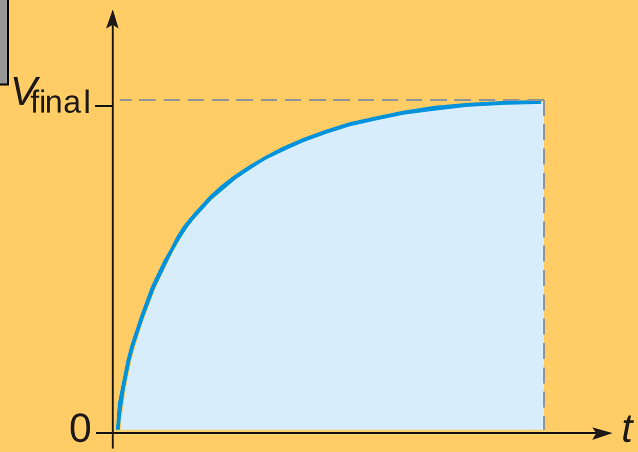



# Summary

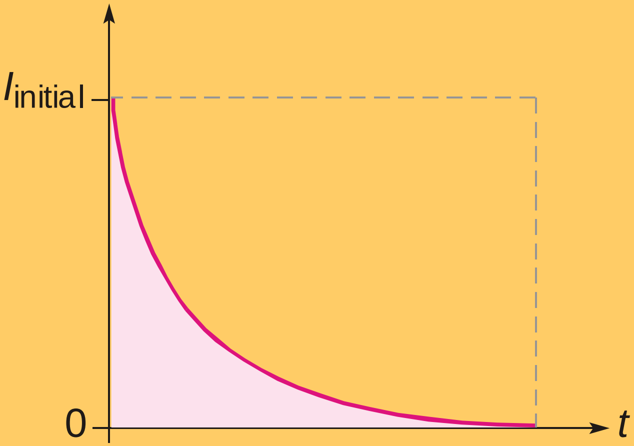
## Capacitors in dc circuits

When a capacitor is charged through a series resistor and dc source, the charging curve is exponential.




(a) Capacitor charging voltage

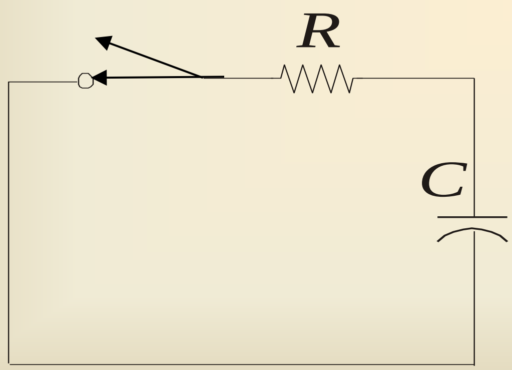


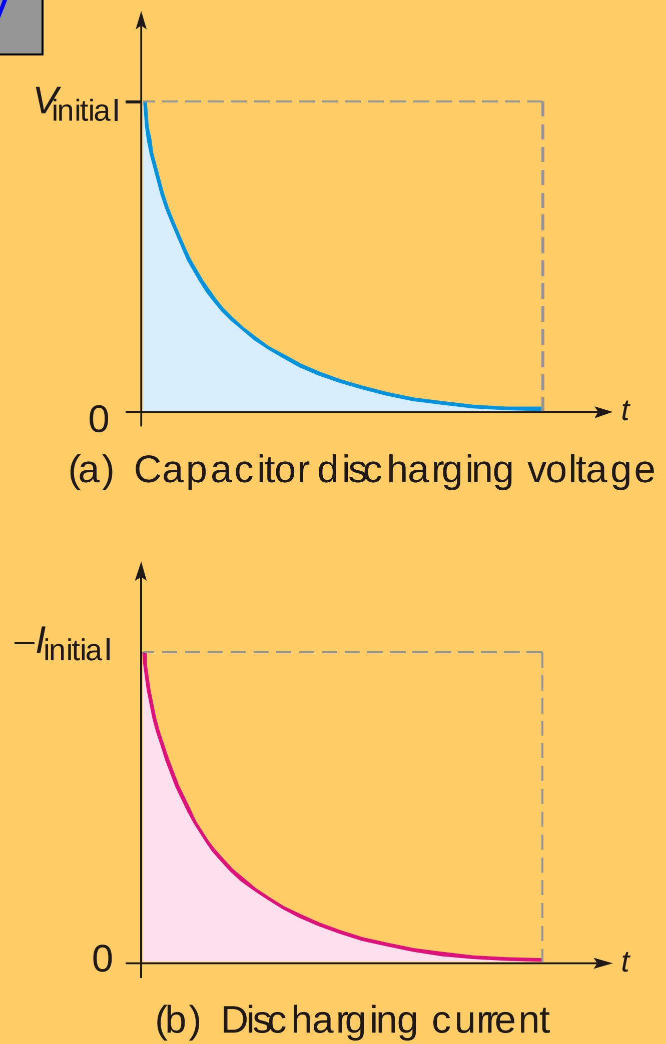

(b) Charging current

# Summary

## Capacitors in dc circuits

When a capacitor is discharged through a resistor, the discharge curve is also an exponential. (Note that the current is negative.)



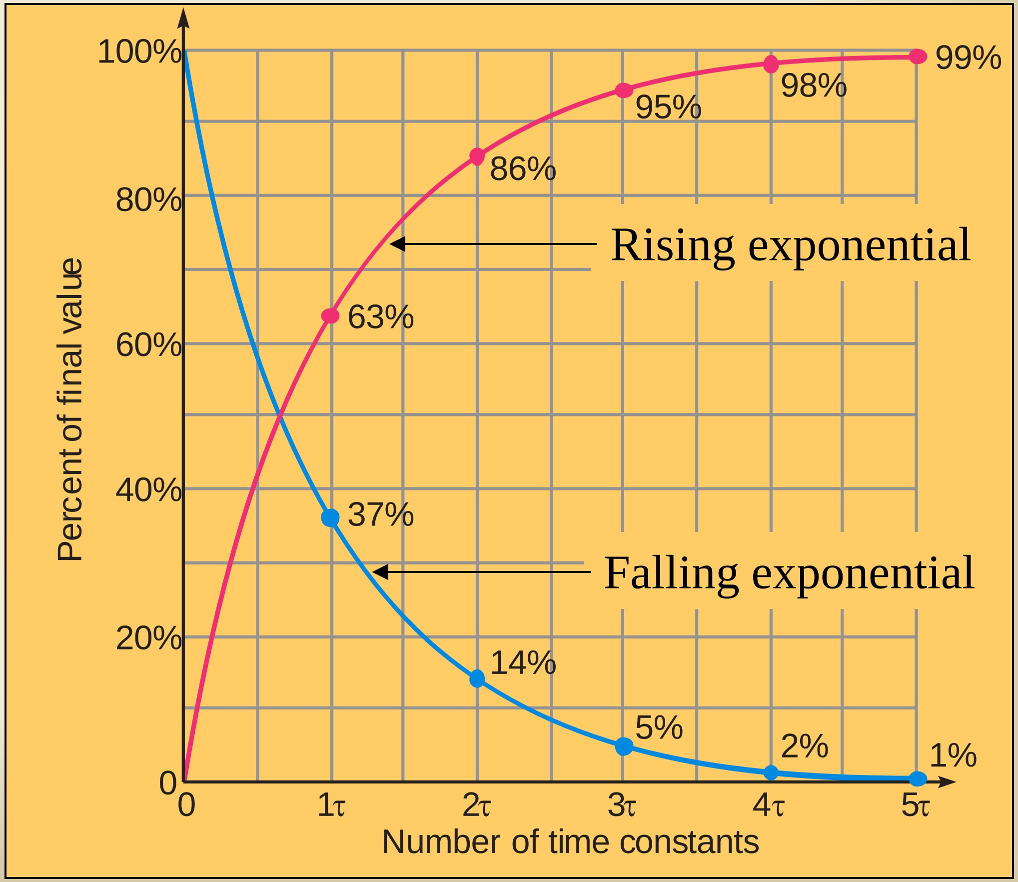



# Summary

## Universal exponential curves

Specific values for current and voltage can be read from a universal curve. For an *RC* circuit, the time constant is

$$\tau = RC$$



# Summary

## Capacitive reactance

**Capacitive reactance** is the opposition to ac by a capacitor. The equation for capacitive reactance is

$$X_C = \frac{1}{2\pi f C}$$

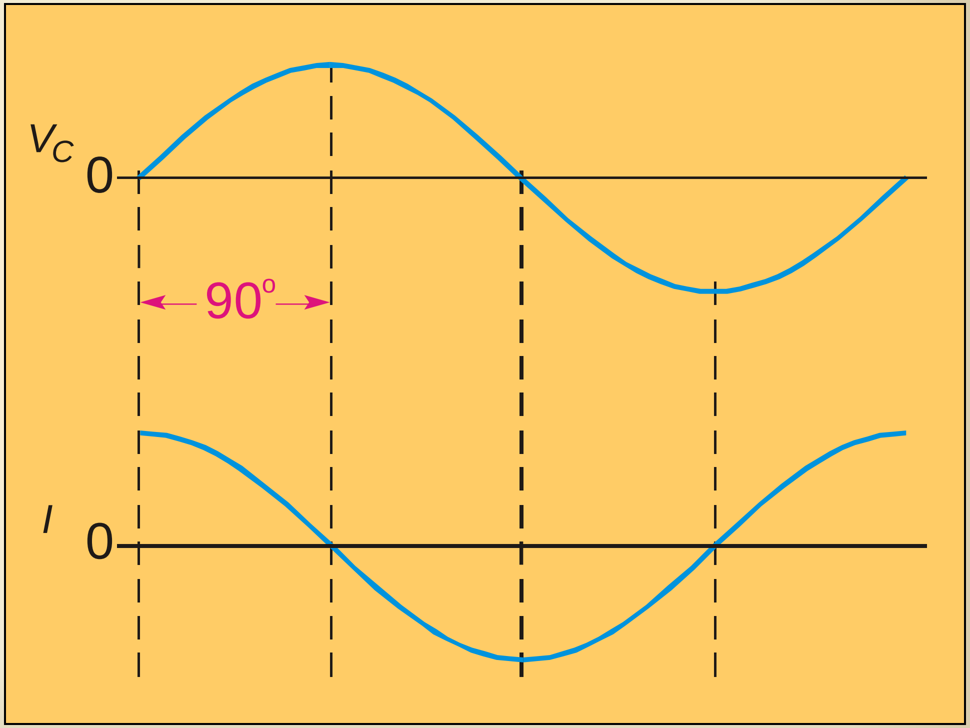
Example

The reactance of a 0.047 μF capacitor when a frequency of 15 kHz is applied is 226 Ω

# Summary

## Capacitive phase shift

When a sine wave is applied to a capacitor, there is a phase shift between voltage and current such that current always leads the voltage by 90º.




Thank you