Capacitor

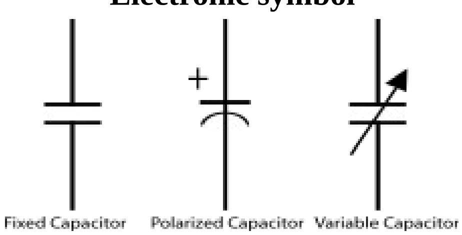
Information

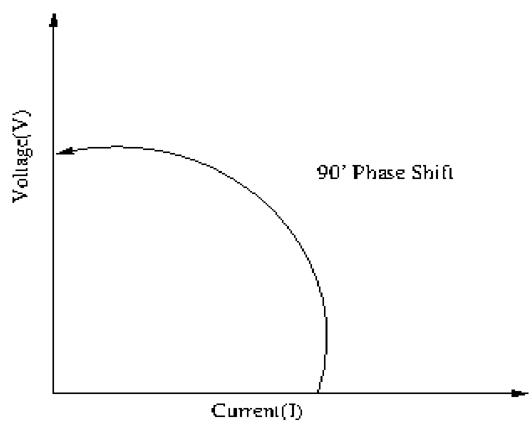
A **capacitor** (originally known as a **condenser**) is a passive two-terminal electrical component used to store energy electro statically in an electric field. The forms of practical capacitors vary widely, but all contain at least two electrical conductors (plates) separated by a dielectric (i.e. insulator). The conductors can be thin films, foils or sintered beads of metal or conductive electrolyte, etc. The "nonconducting" dielectric acts to increase the capacitor's charge capacity. A dielectric can be glass, ceramic, plastic film, air, vacuum, paper, mica, oxide layer etc. Capacitors are widely used as parts of electrical circuits in many common electrical devices. Unlike a resistor, an ideal capacitor does not dissipate energy. Instead, a capacitor stores energy in the form of an electrostatic field between its plates.

When there is a potential difference across the conductors (e.g., when a capacitor is attached across a battery), an electric field develops across the dielectric, causing positive charge $+Q$ to collect on one plate and negative charge $-Q$ to collect on the other plate. If a battery has been attached to a capacitor for a sufficient amount of time, no current can flow through the capacitor. However, if a time-varying voltage is applied across the leads of the capacitor, a displacement current can flow.

Capacitor

Electronic symbol





Capacitors are widely used in electronic circuits for blocking direct current while allowing alternating current to pass. In analog filter networks, they smooth the output of power supplies. In resonant circuits they tune radios to particular frequencies. In electric power transmission systems, they stabilize voltage and power flow.

An ideal capacitor is wholly characterized by a constant capacitance *C*, defined as the ratio of charge ±*Q* on each conductor to the voltage *V* between them

$$C = \frac{Q}{V}$$

Application

The current given the above equation is

$$I = \frac{dQ}{dt} = \frac{d(CV)}{dt}$$

If C is constant then this reduces to

$$= \frac{Cd(V)}{dt}$$

$$V = Asin(\omega t)$$

$$I = \frac{Cd(Asin(\omega t))}{dt}$$

$$I = C\omega Acos(\omega t)$$

$$Prms = \frac{1}{T}\int_T VIdt$$

$$= \frac{1}{\omega T}\int_T A^2 C\omega sin(\omega t)cos(\omega t)dt$$

$$= \frac{1}{2\pi}\int_0^{2\pi} A^2 C\omega sin(\theta)cos(\theta)d\theta$$

$$= \frac{1}{2\pi}\int_0^{2\pi} \frac{A^2 C\omega}{2} sin(2\theta)d\theta$$

$Prms = 0$ (Hence it consumes no Power)