

## 1. Capacitance of capacitors

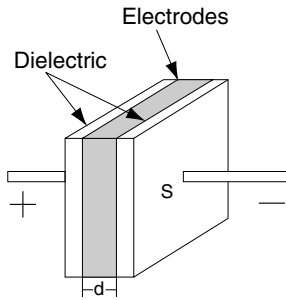


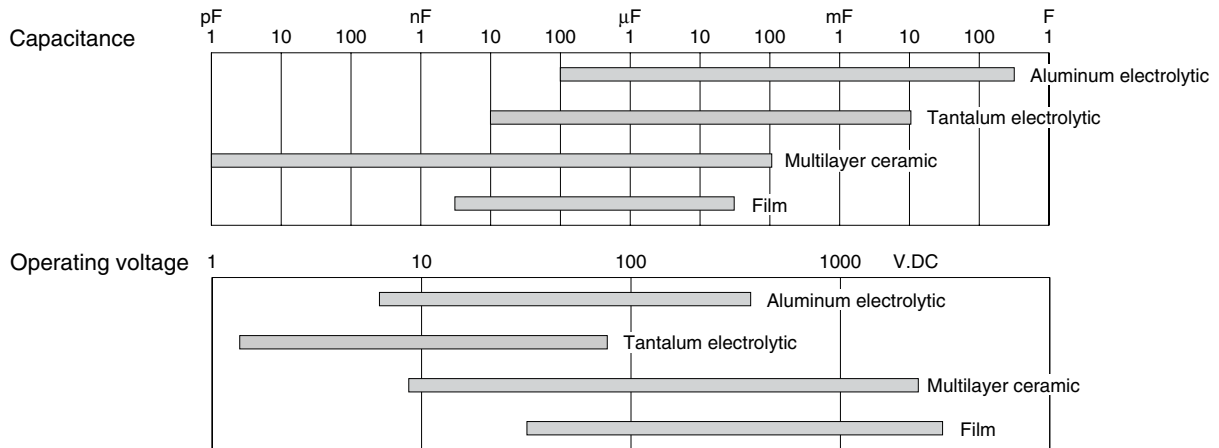
Fig. 1 Basic structure of capacitor

A capacitor is so designed that a dielectric is sandwiched between two electrodes as shown in Fig. 1. The capacitance (C) is expressed as:

$$C = \epsilon \frac{S}{d} \quad \epsilon = \epsilon_r \epsilon_0$$

$\epsilon_r$  : specific dielectric constant.  $\epsilon_0$  : dielectric constant of vacuum ( $8.85 \times 10^{-12} \text{F/m}$ )  
 $d$  : distance between electrodes (m).  $S$  : electrode surface ( $\text{m}^2$ )

## 2. Ranges of capacitance and operating voltage of various capacitors



## 3. Characteristics of various capacitors

	Tantalum	Aluminum	Ceramic	Film
Dielectric	Tantalum pentoxide (Ta <sub>2</sub> O <sub>5</sub> )	Aluminum oxide (Al <sub>2</sub> O <sub>3</sub> )	Based on barium titanate, etc.	Polyester, polypropylene, etc.
Specific dielectric constant	27	8~10	1500~15000 (barium titanate)	2.1~3.1
Shape	Chip type (main power) Dip type	Screw terminal type, snap-in type, lead terminal type, chip type	Chip type (main power), dip type	Dip type (main power), chip type, case type
Advantages	<ul style="list-style-type: none"> <li>Small and comparatively large capacitance</li> <li>Semi-permanent service life</li> </ul>	<ul style="list-style-type: none"> <li>Cheap</li> <li>Small-size and large-capacity</li> </ul>	<ul style="list-style-type: none"> <li>Small-size (particularly multilayer types)</li> <li>No polarity</li> </ul>	<ul style="list-style-type: none"> <li>Good characteristics</li> <li>Can be made for low- to high-voltage applications</li> <li>High reliability</li> </ul>
Disadvantages	<ul style="list-style-type: none"> <li>To be used with some voltage leeway</li> <li>Polarity</li> </ul>	<ul style="list-style-type: none"> <li>Short service life in hot environment</li> <li>Large capacitance tolerance</li> <li>Polarity</li> </ul>	<ul style="list-style-type: none"> <li>Great changes in capacitance due to changes in temperature and DC voltage</li> </ul>	<ul style="list-style-type: none"> <li>Large outside dimensions</li> </ul>