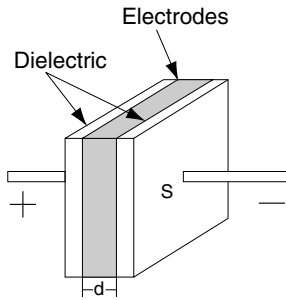


1. Capacitance of capacitors



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

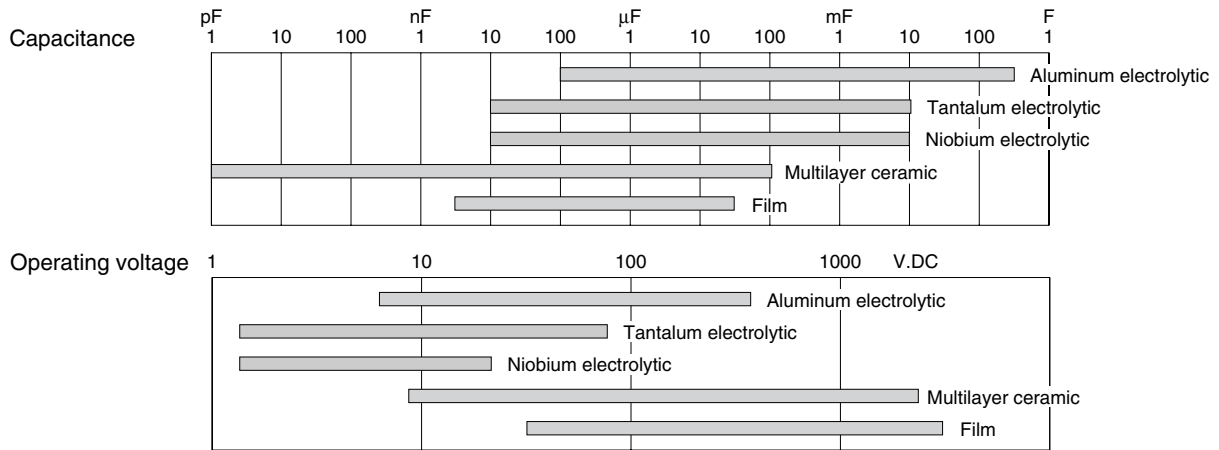
$$C = \epsilon \frac{S}{d} \quad \epsilon = \epsilon_r \epsilon_0$$

ϵ_r : specific dielectric constant. ϵ_0 : dielectric constant of vacuum ($8.85 \times 10^{-12} \text{F/m}$)

d : distance between electrodes (m). S : electrode surface (m^2)

Fig. 1 Basic structure of capacitor

2. Ranges of capacitance and operating voltage of various capacitors



3. Characteristics of various capacitors

	Aluminum	Film	Tantalum	Niobium	Ceramic
Dielectric	Aluminum oxide (Al ₂ O ₃)	Polyester, polypropylene, etc.	Tantalum pentoxide (Ta ₂ O ₅)	Niobium pentoxide (Nb ₂ O ₅)	Based on barium titanate, etc.
Specific dielectric constant	8~10	2.1~3.1	27	41	1500~15000 (barium titanate)
Shape	Screw terminal type, snap-in type, lead terminal type, chip type	Dip type (main power), For SMD. case type	Chip type (main power) Dip type	Chip type	Chip type (main power), dip type
Advantages	<ul style="list-style-type: none"> Cheap Small-size and large-capacity 	<ul style="list-style-type: none"> Good characteristics Can be made for low- to high-voltage applications High reliability 	<ul style="list-style-type: none"> Small and comparatively large capacitance Semi-permanent service life 	<ul style="list-style-type: none"> Small and comparatively large capacitance Semi-permanent service life 	<ul style="list-style-type: none"> Small-size (particularly multilayer types) No polarity
Disadvantages	<ul style="list-style-type: none"> Short service life in hot environment Large capacitance tolerance Polarity 	<ul style="list-style-type: none"> Large outside dimensions 	<ul style="list-style-type: none"> To be used with some voltage leeway Polarity 	<ul style="list-style-type: none"> To be used with some voltage leeway Polarity 	<ul style="list-style-type: none"> Great changes in capacitance due to changes in temperature and DC voltage