

FACTFILE: GCSE

Technology and Design

OPTION A: ELECTRONIC AND MICROELECTRONIC CONTROL SYSTEMS



2.2 Electronic Concepts and Ohm's Law: Capacitors

Learning Outcomes

You should be able to:

- identify polarised and non-polarised capacitors by their circuit symbol;
- show that they understand and can explain the use of polarised and non-polarised capacitors;
- select appropriate capacitors to suit applications;
- apply and demonstrate knowledge and understanding of the units used to measure capacitance:
 - farads;
 - microfarads;
 - nanofarads; and
 - picofarads.

Course Content



Capacitors

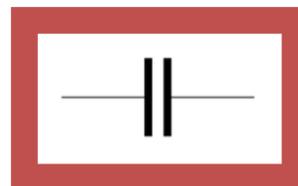
Capacitors store electric charge.

Capacitance is a measure of a capacitor's ability to store charge. A large capacitance means that more charge can be stored. Capacitance is measured in farads, symbol F. However 1F is very large, so prefixes are used to show the smaller values. Three prefixes (multipliers) are used, μ (micro), n (nano) and p (pico):

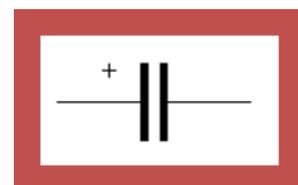
- μ means 10^{-6} (millionth), so $1000000\mu\text{F} = 1\text{F}$
- n means 10^{-9} (thousand-millionth), so $1000\text{nF} = 1\mu\text{F}$
- p means 10^{-12} (million-millionth), so $1000\text{pF} = 1\text{nF}$

There are many types of capacitor but they can be split into two groups; polarised and non-polarised. Each group has its own circuit symbol.

Circuit symbols



Non – polarised capacitor



Polarised capacitor

Non-polarised capacitors (small values, up to about $1\mu\text{F}$)

Small value capacitors are unpolarised which means that they may be connected either way round. They are used in providing short delays in timing circuits. They generally have high voltage ratings – perhaps 250 V and so may be used in any battery powered circuit.

Polarised capacitors (values from about $1\mu\text{F}$)

Polarised capacitors must be connected the correct way round. Their leads will be marked + or -. The voltage rating can be quite low (6 V for example) and it should always be checked when selecting a polarised capacitor. If the project parts list does not specify a voltage, choose a capacitor with a rating which is greater than the project's power supply voltage. A sensible minimum would be 25 V for most battery circuits. They are physically much smaller and also cheaper than non-polarised capacitors of the same value which is why they are used. They are often connected in parallel with a DC supply and act as a reservoir to prevent sudden drops in voltage when a large current is suddenly drawn from the supply. They are also used to provide long delays in timing circuits.



Aluminium electrolytic capacitor

Worked Example

A circuit diagram shows a capacitor of value $1000\mu\text{F}$.

- Would it be more appropriate to use a polarised or non-polarised capacitor?
- Re-write the value of the capacitor in Farads.
- Suggest a suitable application for this value of capacitor.
- Draw the symbol for a non-polarised capacitor.

Answers

- Polarised
- 0.001F
- A timer circuit with a long time delay
- (d)

