Capacitors

Paper

Polystyrene

Bipolar

Electrolytic

Polycarbonate

Polyester

Mylar

Silver Mica

Ceramic

Tantalum Electrolyte

Feed Through

Trimmer

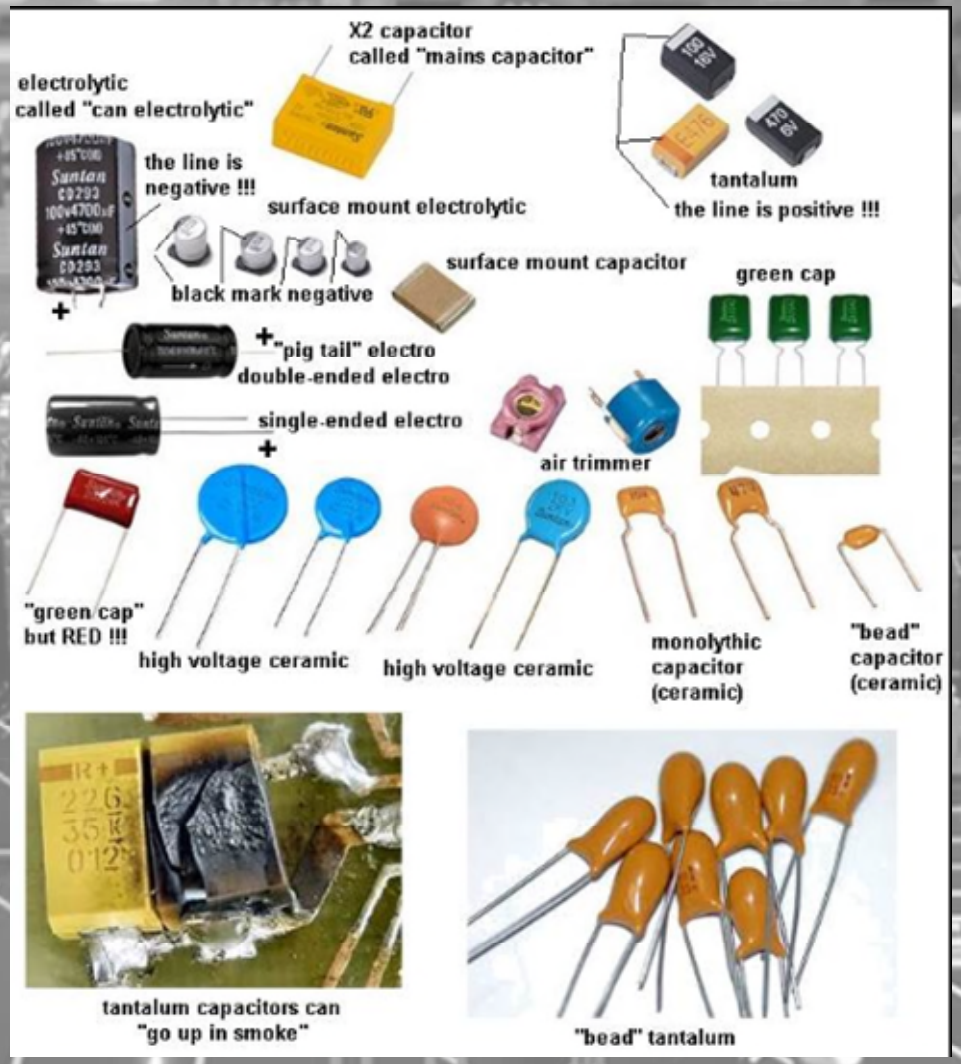
Variable

Of the passive components Capacitors are the most numerous and diverse

Fixed capacitors
- Polarized
- Unpolarized

Electrolytic capacitor **
- Tantalum
- Niobium
- Aluminium
  - Wet
  - Manganese dioxide
  - Polymer

Super capacitors **
- Double layer
- Pseudo
- Hybrid



Ceramic capacitor **
- Class 1
- Class 2
- Class 3

Film capacitors

Paper capacitor

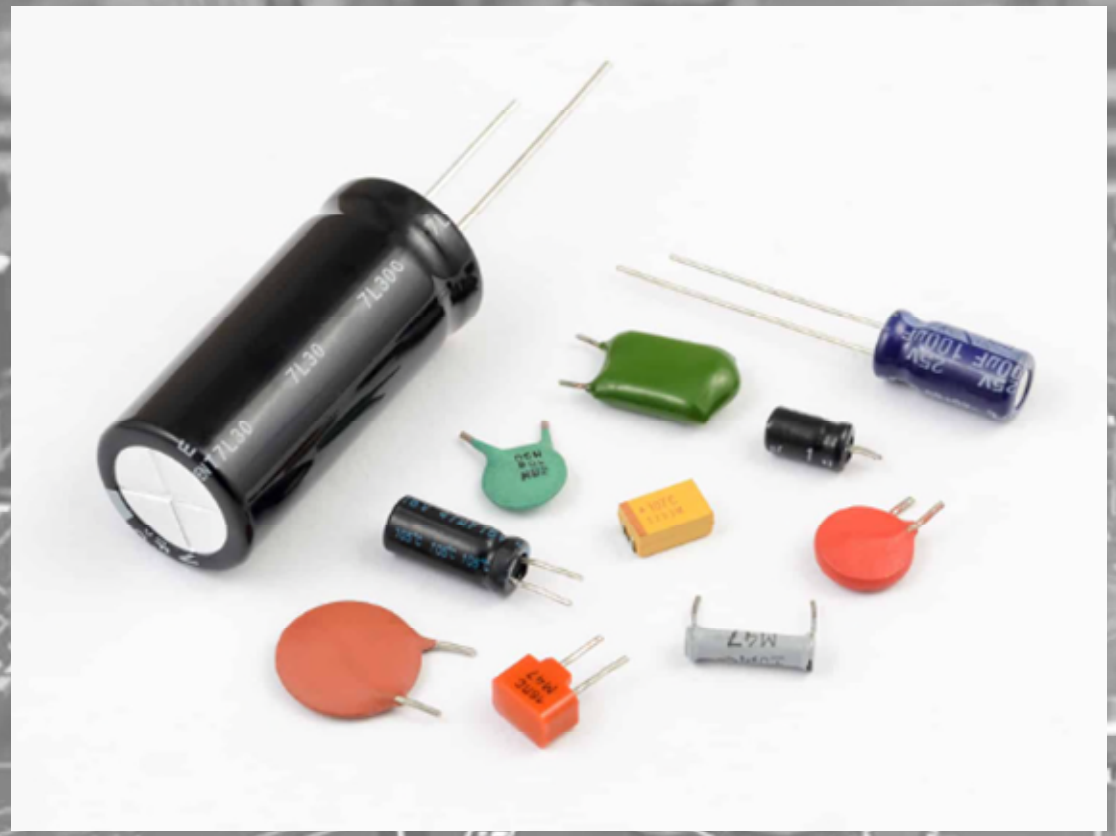
Mica capacitor
- Stacked
- Silvered

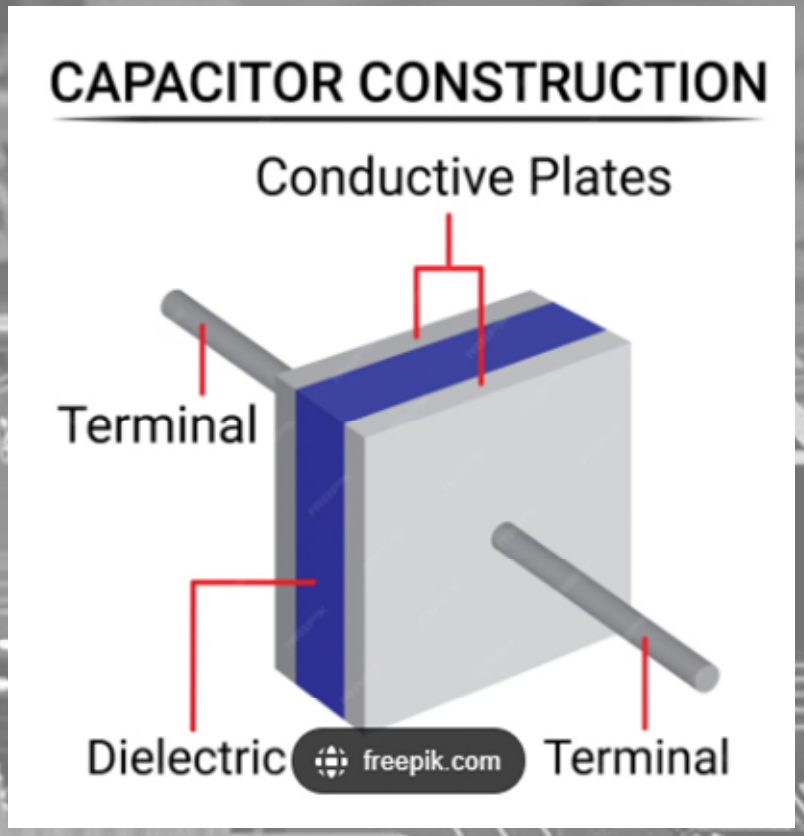
Air capacitors

Glass capacitors

Variable capacitor
- Tuning
- Trimmer
  - Air trimmer
  - Ceramic trimmer

Capacitor





A **capacitor** is a component used to store energy in an electric field. It has two electrical conductors separated by a dielectric material that both accumulate charge when connected to a power source. One plate gets a negative charge, and the other gets a positive charge.

There are many different types of capacitors using different materials in their construction
The 2 common ones that we use most are non-polarised ceramic and polarised electrolytic

Ceramic capacitors (non-polarized) use ceramic for the dielectric material. A ceramic capacitor is encapsulated with two leads that emanate from the bottom then form a disc. A ceramic disc capacitor does not have a polarity and connects in any direction on the printed circuit board. In ceramic capacitors, a relatively high capacitance is achievable in a small physical size because of its high dielectric constant

Electrolytic capacitors (polarized) are often used when large capacitance values are needed. They are commonly used to help reduce ripple voltages or for coupling and decoupling applications. Electrolytic capacitors are constructed using two thin films of aluminum foil with an oxide layer as an insulator. They are polarized, and can be damaged or explode when connected incorrectly. This type of capacitor has a wide tolerance but does not operate well at high frequencies

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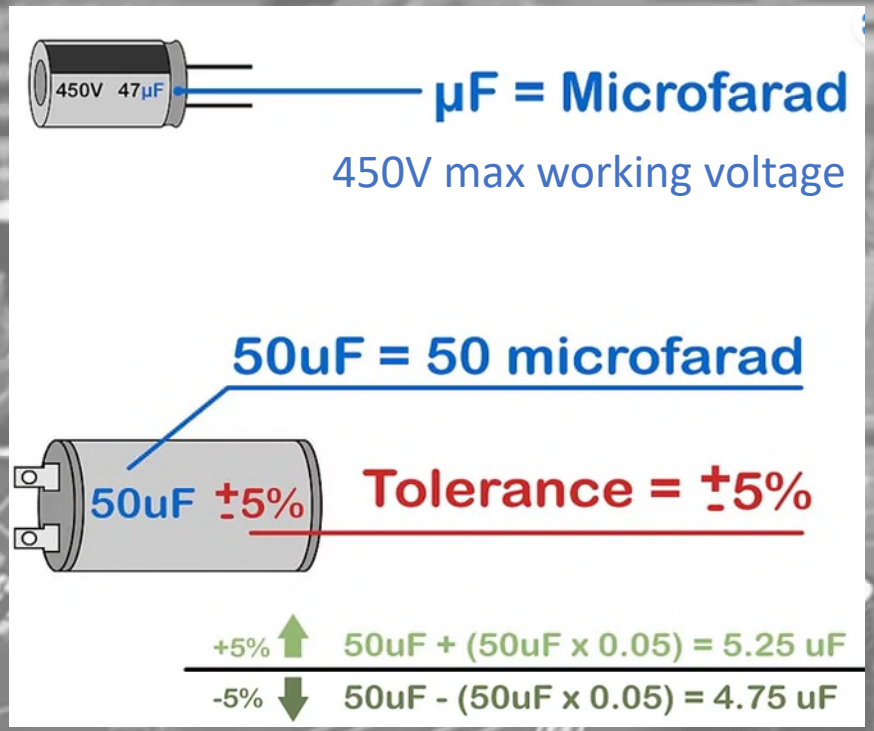
Ceramic Capacitors - Non polarised
Typical Use

As decoupling capacitors to filter out any noise on the power lines supplying an IC, typically a 0.1uF would be mounted across the power supply close to each IC. Also used in oscillator and timing circuits

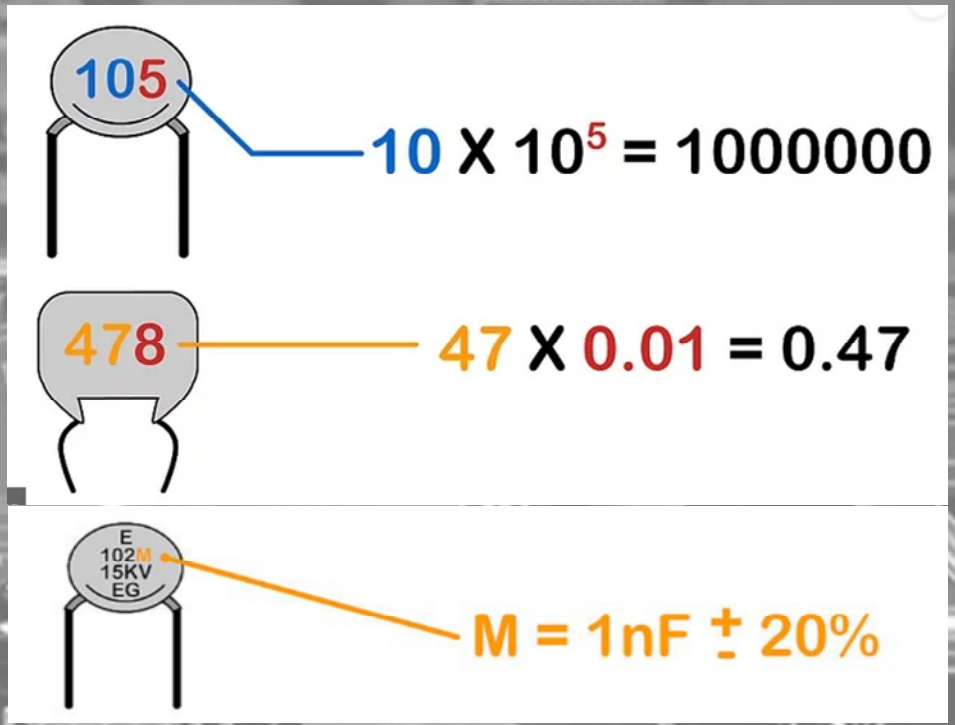
Electrolytic Capacitors – Polarised
Typical Use

To smooth out DC supplies when there is and ripple present. Can also be used in timing circuits though there inherent wide tolerance is not always desirable and instead a Tantalum Capacitor may be used

Capacitor Values



The unit of capacitance is the Farad. Since this is too large for most electronic work we tend to work in Microfarads (uF) – 1/1000 of a Farad, Smaller values for non polarised capacitors are measured in NanoFarads (nF) – F/1^-9 and PicoFrarads (pF) – F/^-12



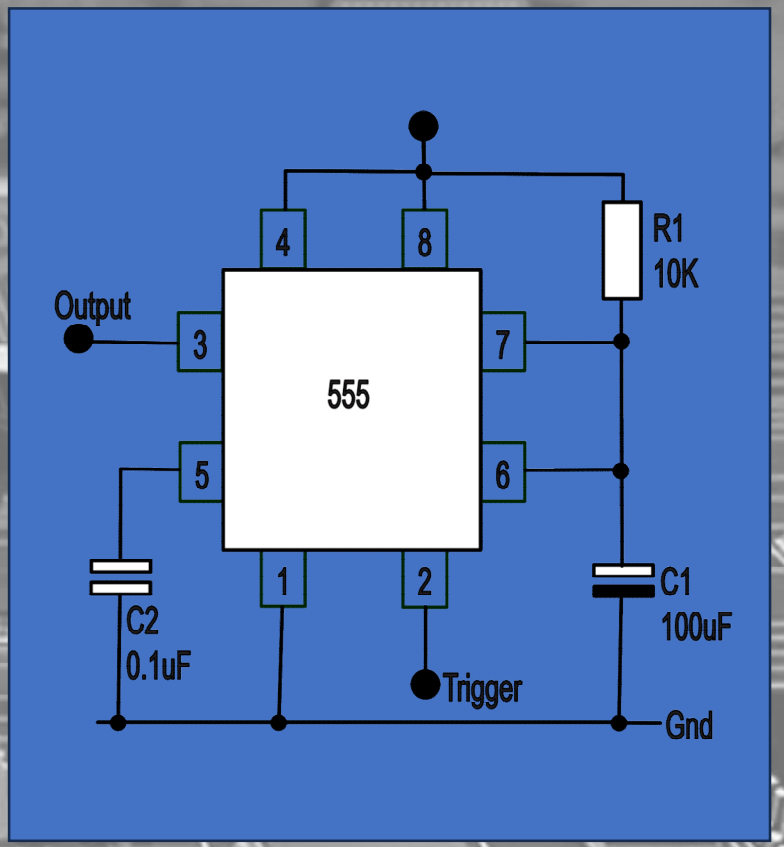
Unlike resistors, capacitors use a wide variety of codes to describe their characteristics. Physically small capacitors are especially difficult to read, due to the limited space available for printing. The information in this article should help you read almost all modern consumer capacitors. Don't be surprised if your information is printed in a different order than the one described here, or if voltage and tolerance info is missing from your capacitor. For many low-voltage DIY circuits, the only information you need is the capacitance.

Capacitor Tolerances

Electrolytic capacitors have large tolerances of 20%. This means that the capacitance of electrolytic capacitors drifts from the nominal value as time passes. For example, an aluminum electrolytic capacitor with a nominal capacitance of 47µF is expected to have a measured value of anywhere between 37.6µF and 56.4µF. Tantalum capacitors can also be made with higher tolerances, but their maximum operating voltage is low.

555 Monostable Circuit
Output pulse
T = 1.1 x R1 x C1
Where T = milliseconds
R = Kilohms
C = Microfarads
1.1 x 10 x 100 = 1.1seconds

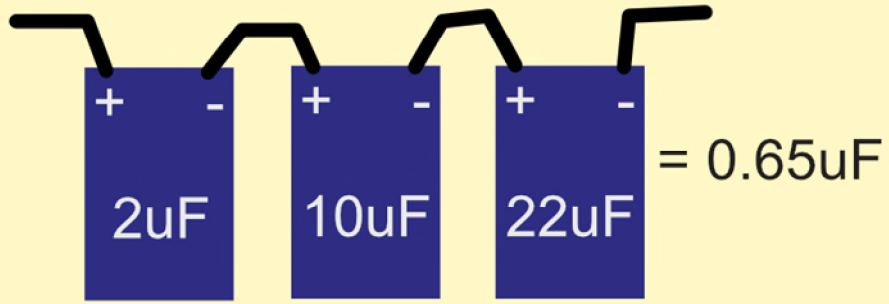
Now since an Electrolytic could be 20%, the actual value of C1 could be 80 to 120uF, resulting in a pulse width of 1.32s to 880ms.



Combining Capacitors

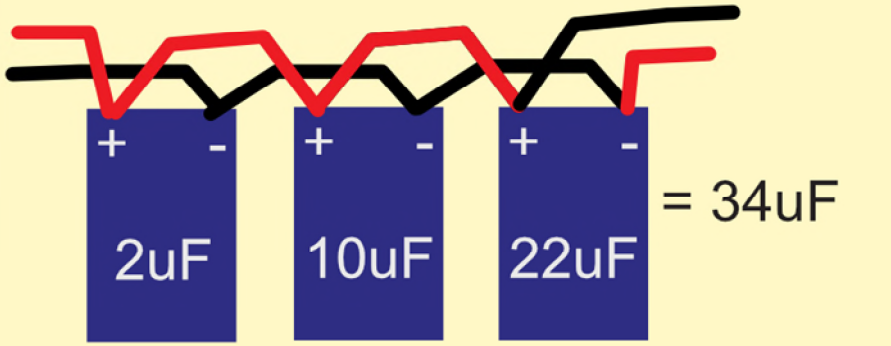
When adding together **Capacitors in Series**, the reciprocal (1/C) of the individual capacitors are all added together (just like resistors in parallel) Then the total value for capacitors in series equals the reciprocal of the sum of the reciprocals of the individual capacitances

$$\frac{1}{C_T} = \frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3} + \ldots$$



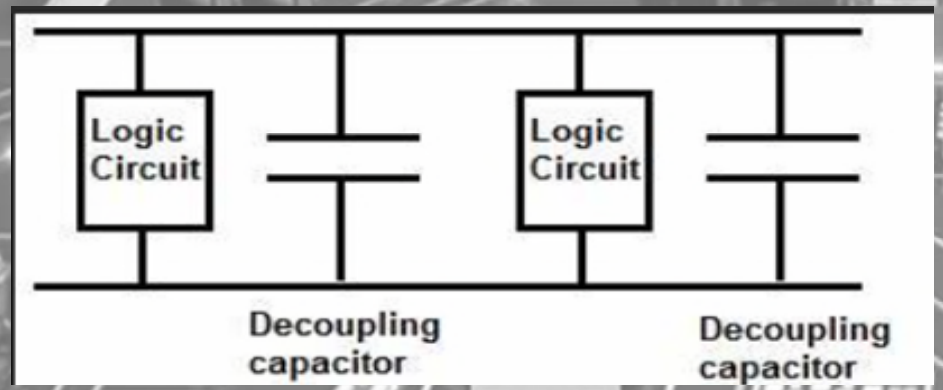
When adding together **Capacitors in Parallel**, life becomes a lot easier as the total value is the sum of the capacitors used

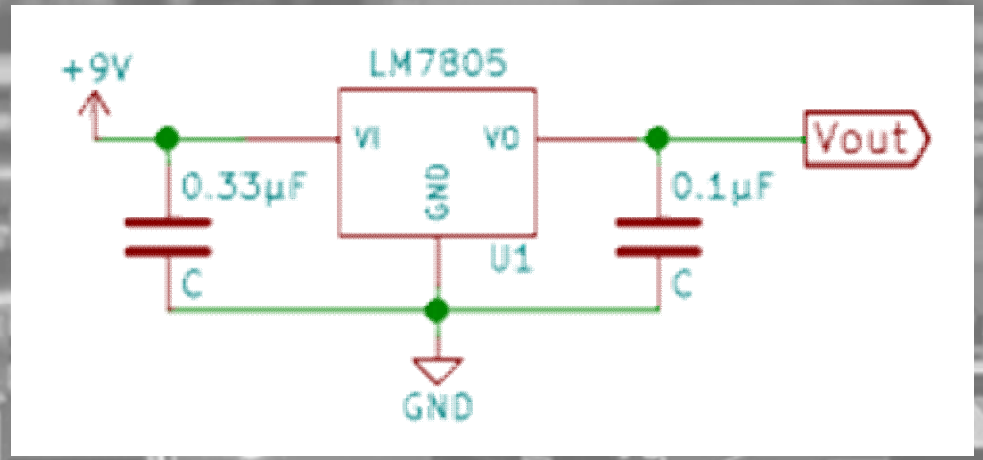
$$C_T = C_1 + C_2 + C_3 + \ldots$$

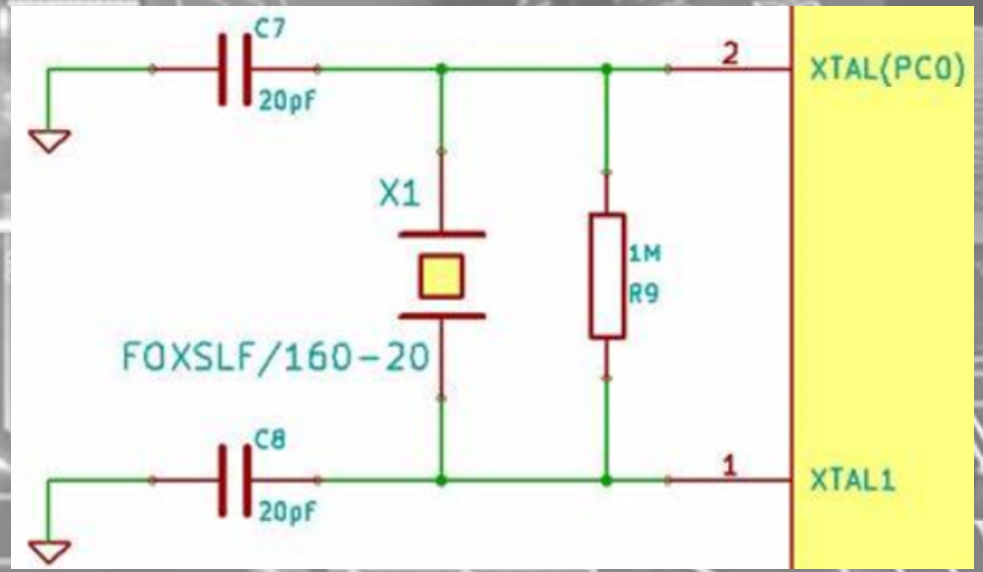


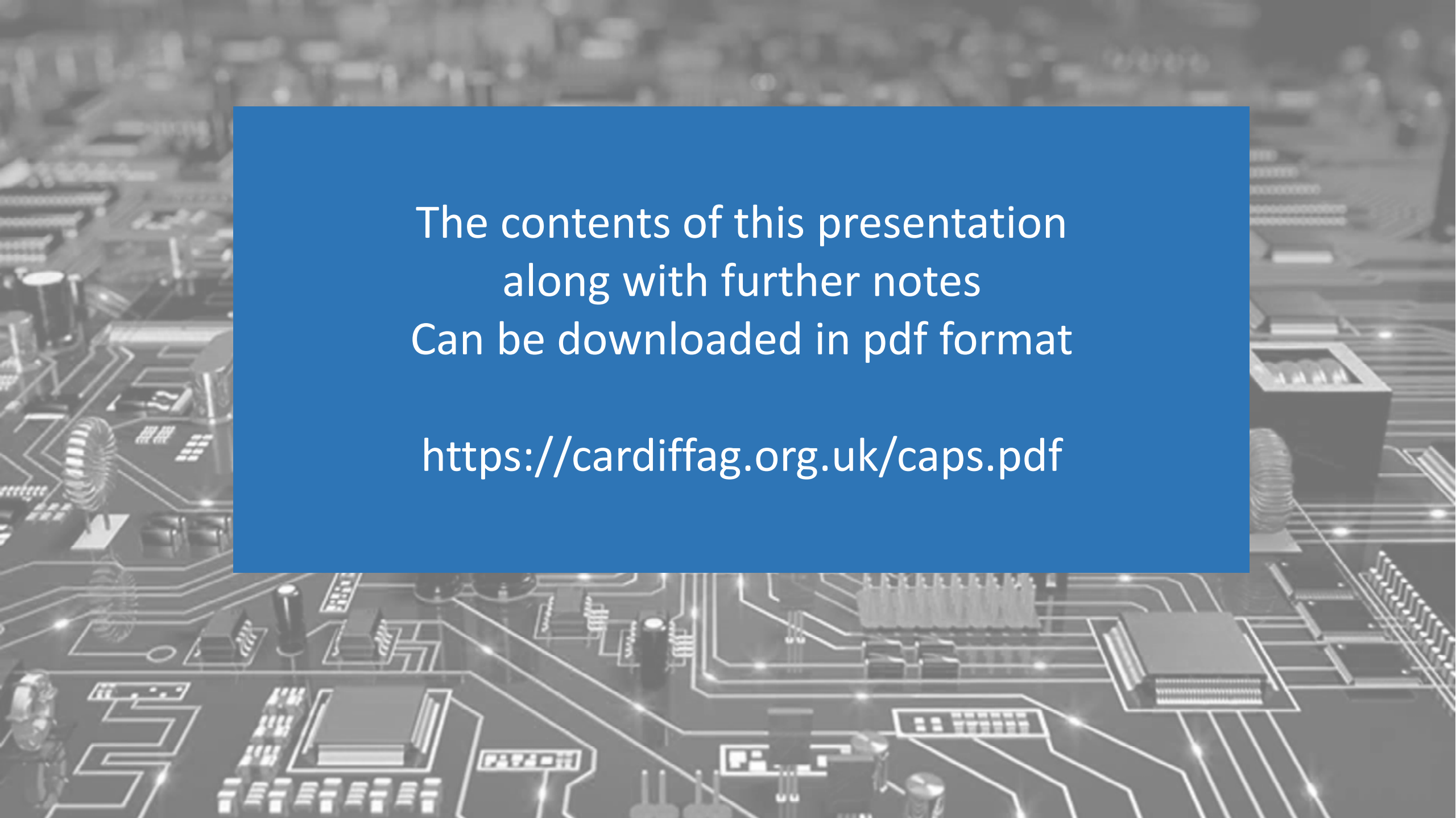
Non Polarised Typical Use

Non-Polarised decoupling capacitor is a capacitor used to decouple (i.e. prevent electrical energy from transferring to) one part of a circuit from another. Noise caused by other circuit elements is shunted through the capacitor, reducing its effect on the rest of the circuit. For higher frequencies, an alternative name is bypass capacitor as it is used to bypass the power supply or other high-impedance component of a circuit.









The contents of this presentation
along with further notes
Can be downloaded in pdf format

https://cardiffag.org.uk/caps.pdf

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