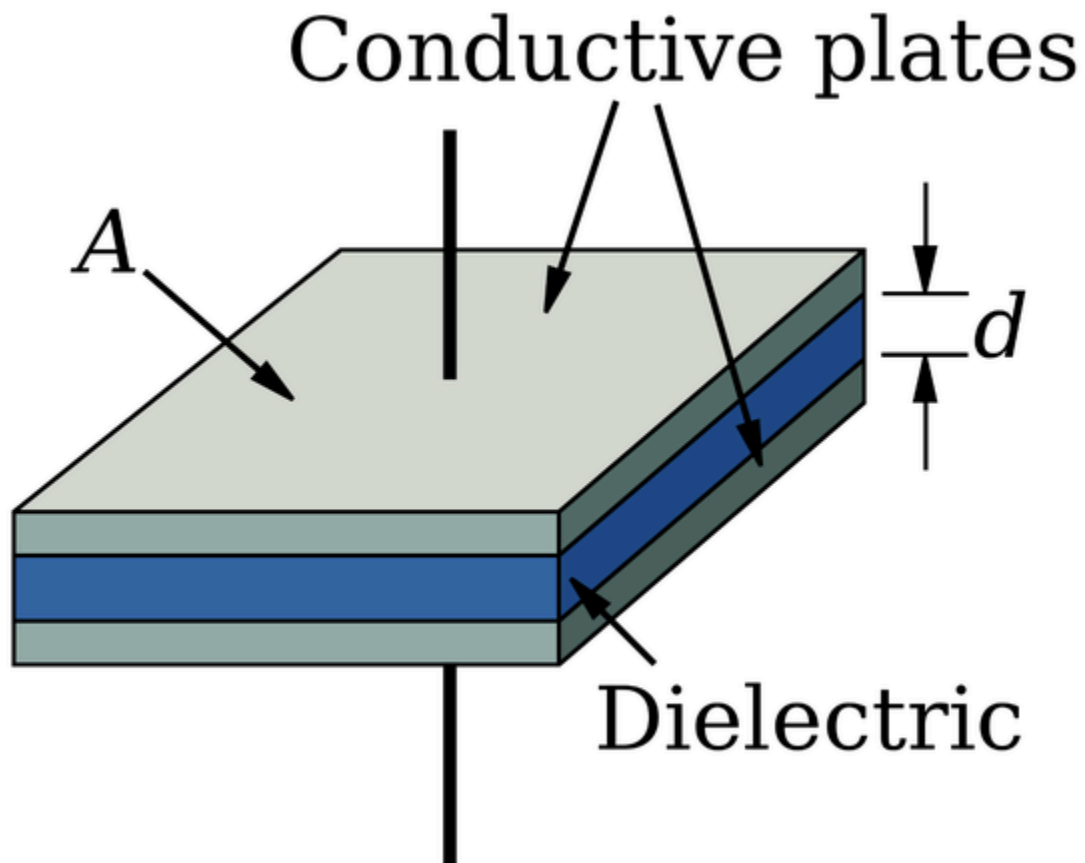


Step 1: What Is Capacitance?



Capacitance is an object's ability to store an electric charge.

Reasonably, this object is referred to as a capacitor. A capacitor that stores this charge in an electric field between two conductive plates is known as a parallel plate capacitor. The non-conductive material that is between these two plates is known as a dielectric. Dielectrics change the amount of charge a capacitor can hold and , in practice,

what the particular capacitor would be used for (e.g. high frequency circuits, high voltage circuits, etc).

The equation for the capacitance of a parallel plate capacitor is:

$$C = (\epsilon A) / d$$

where ϵ is the permittivity of free space or dielectric, A is the surface area of overlap between the plates, and d is the distance between the plates.

Step 2: How Is Capacitance Measured?

An RC (Resistor-Capacitor) circuit has a property known as a "RC Time Constant" or T (Tau). The equation for which is given below:

$$T = RC$$

Tau can be simplified from a more complicated equation (shown in images above) to represent the time it takes a capacitor to be

charged, through a resistor, to reach 63.2% of its total voltage. This can also be measured by the time it takes the capacitor to reach 36.8% of its total voltage upon discharging.

The Arduino will be programmed to time how long it takes for a capacitor to reach 63.2% of its total charge. It will then use the equation for Tau to calculate the capacitance since the value of the resistor is already known.