

# TechResort Cheat Sheet

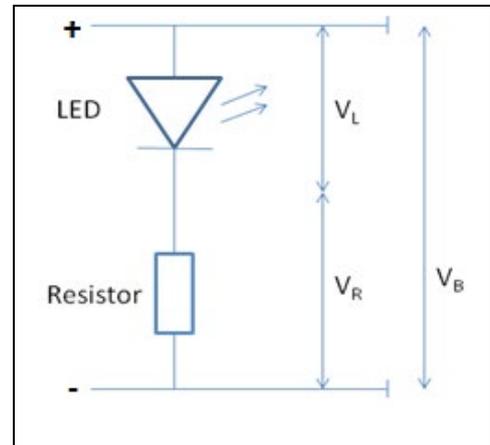
## Advanced LED Usage



To make an LED work with a specific voltage and current we need to add a resistor in series with it like this Note that order of the resistor and the LED does not matter. The resistor can come first. The only thing to be sure of is that the positive (longer) leg of the LED is closer to the positive (+) side of the power supply or battery.

The circuit is very easy to understand so working out how to optimise it is quite a simple process.

The battery or power supply applies its voltage  $V_B$  to the two components chain and each will have a different voltage between its terminals, i.e.  $V_L$  and  $V_R$



As they are in series there is a simple relationship here:

$$V_B = V_L + V_R$$

Similarly the same Current  $I$  flow through both the resistor and the LED.

Ohm's law says the voltage is proportional to the current:

Voltage = Current (in Amps) x Resistance (in Ohms)

$$V = I \cdot R$$

*But* only the Resistor obeys Ohm's law here! The LED is what is called *non-linear* so we can't usefully apply Ohm's law to it. No matter...

Look at the specification for your LED. On the packet or data sheet we'll see that it is designed to work at a specific voltage and current. These are the values of  $V_L$  and  $I$  that we'll design our circuit for. If we don't have the specification for our LED we can test it (carefully!) using a power supply to see what values of  $V_L$  and  $I$  will work well.

Now, all we need to know is what value of resistor we need to ensure the LED has the right voltage and current.

This is very easy as we already know the current through the resistor should be the same as for the LED,

The voltage across the resistor is our total voltage, less the voltage across the LED:  $V_R = V_B - V_L$

As the resistor obeys Ohms law, the value of resistance we need is:

$$R = V_R / I = (V_B - V_L) / I$$

In practice, we won't have a resistor of exactly that value, instead we should choose the next *highest* value.