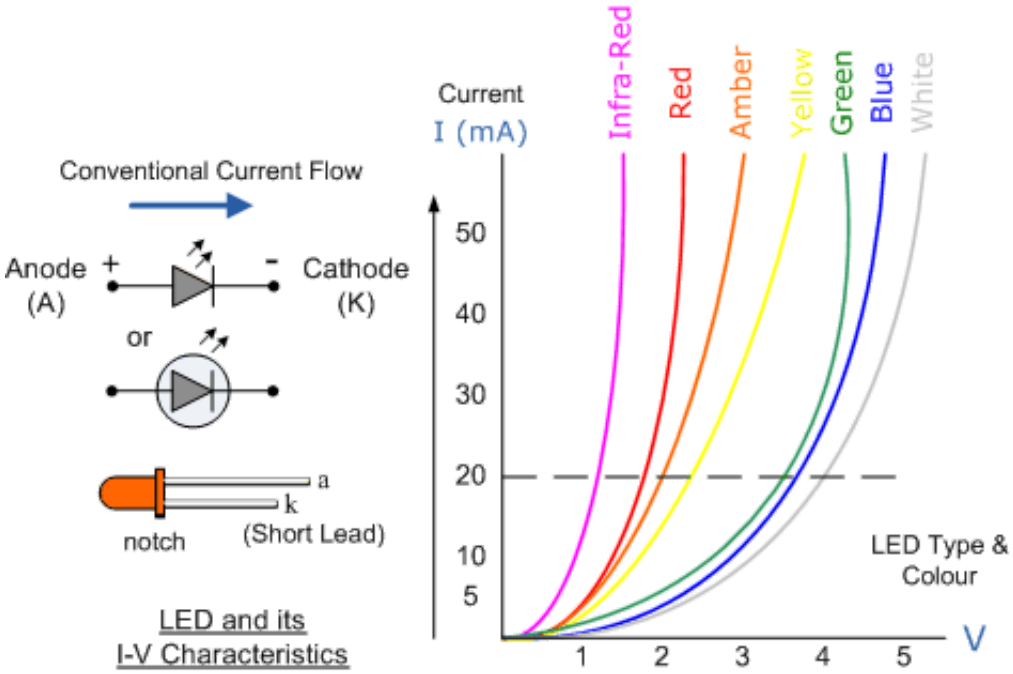
Light Emmitting Diodes

Light Emitting Diodes (LED) emit a fairly narrow bandwidth of either visible coloured light, invisible infra-red or laser type light when a forward current is passed through them. A LED is just a specialised type of PN-junction diode, made from a very thin layer of fairly heavily doped semiconductor material.

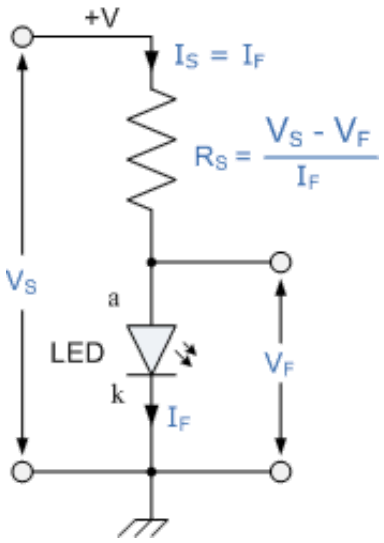
Light Emitting Diodes I-V Characteristics:



For a Light Emitting Diode to emit any form of light it needs a current to flow through it, as it is a current dependant device. As the LED is to be connected in a forward bias condition across a power supply it should be current limited using a series resistor to protect it from excessive current flow. From the graph above we can see that each LED has its own forward voltage drop across the PN-junction and this parameter, which is determined by the semiconductor material used, is the forward voltage drop for a given amount of forward conduction current.

LED Series Resistance:

The series resistor value RS is calculated by simply using Ohm´s Law, knowing the required Forward Current (IF), the Supply Voltage (VS) and the expected forward voltage drop of the LED, VF at this current level as shown below.



A LED is to be connected to a 5 Volt D.C. power supply. Using the circuit above calculate the series resistor required to limit the forward current to less than 10mA:

$$R_S = \frac{V_S - V_F}{I_F} = \frac{5v - 2v}{10mA} = \frac{3}{10 \times 10^{-3}} = 300\Omega$$

Resistors come in standard preferred values. The calculation shows to limit the current flowing through the LED to 10mA exactly, we would require a 300Ω resistor. In the E12 series of resistors there is no 300Ω resistor so we would need to choose the next highest value, which is 330Ω. A quick re-calculation shows the new forward current value is now 9.1mA.