

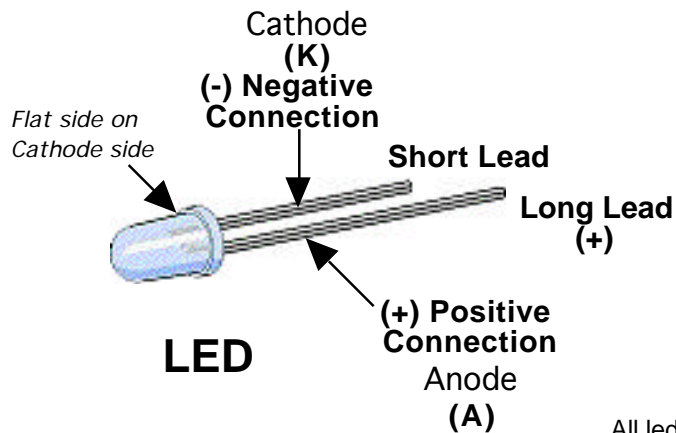
## LED Data

An LED is a Light Emitting Diode, like an electronics diode it lets electricity flow in only one direction. The little wire encapsulated in the epoxy center emits light when electricity flows from the Cathode (negative lead) to the Anode (positive lead). Photons are then released to travel to your eye which are detected by your rods and cones within you eye and then sent as sensor inputs to your brain where it interprets the input as light.

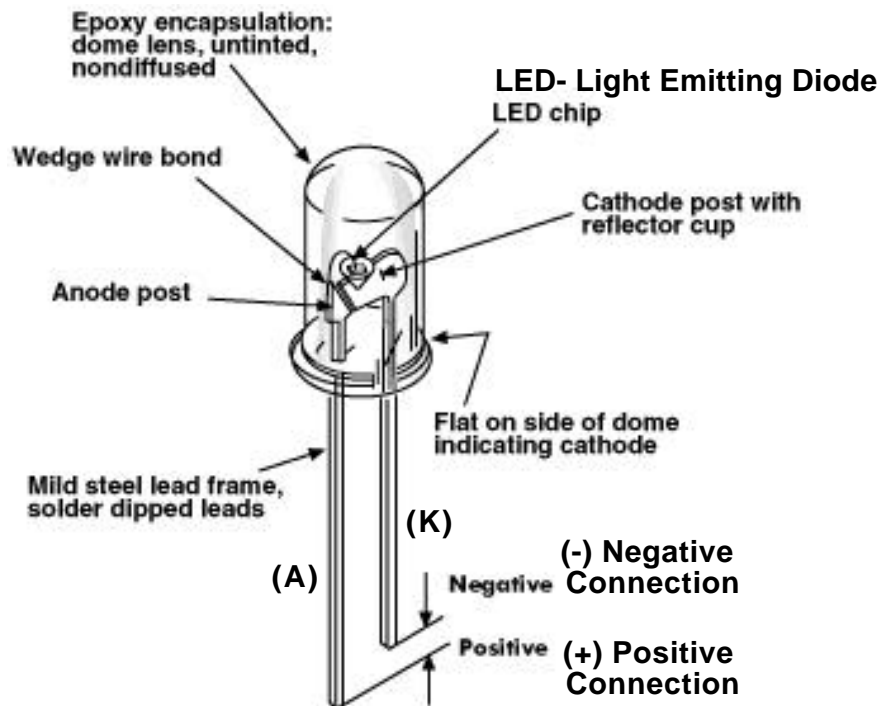
CAUTION: LEDs can be extremely bright; do NOT look directly into them. LEDs are static sensitive, use static handling precautions. If you are driving several LEDs, you must use a separate series resistor for each LED.

Each LED must have it's own current limiting series resistor. ( See *Calculate Resistors Needed Mathematically* )

A single White or Blue LED will last from 1000 to 10,000 hours. LED, In a dark room can illuminate a full 8 1/2 x 11 sheet of paper for reading. Two LED's can be used to light an entire computer keyboard.



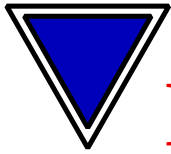
All leds must be used with current limiting resistor



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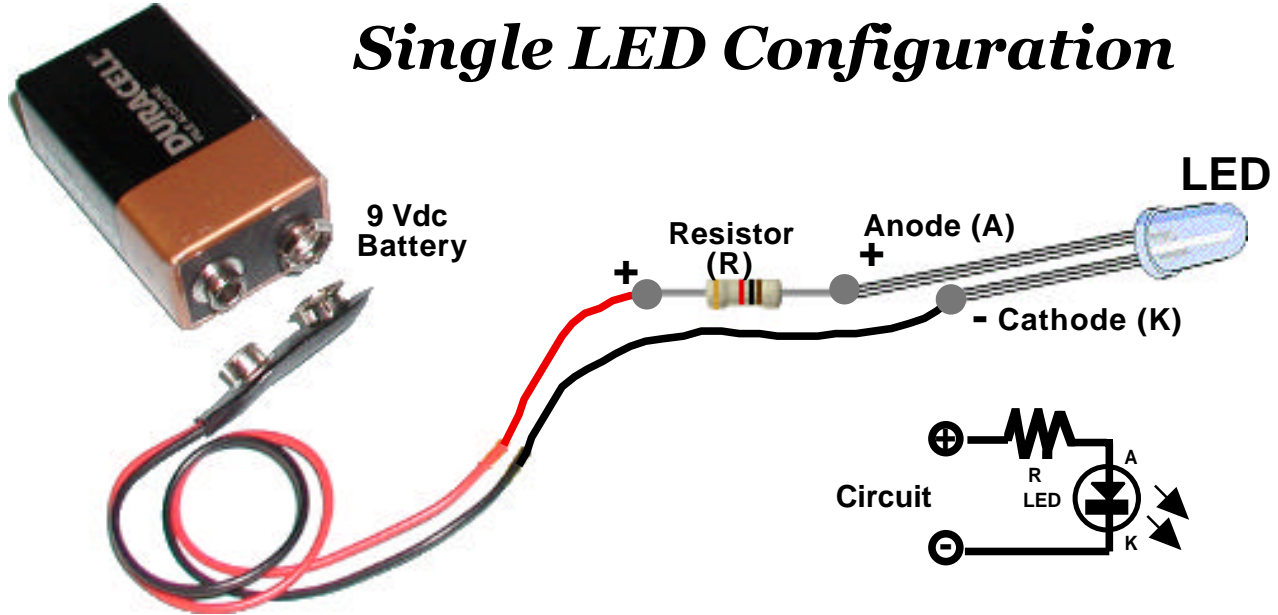
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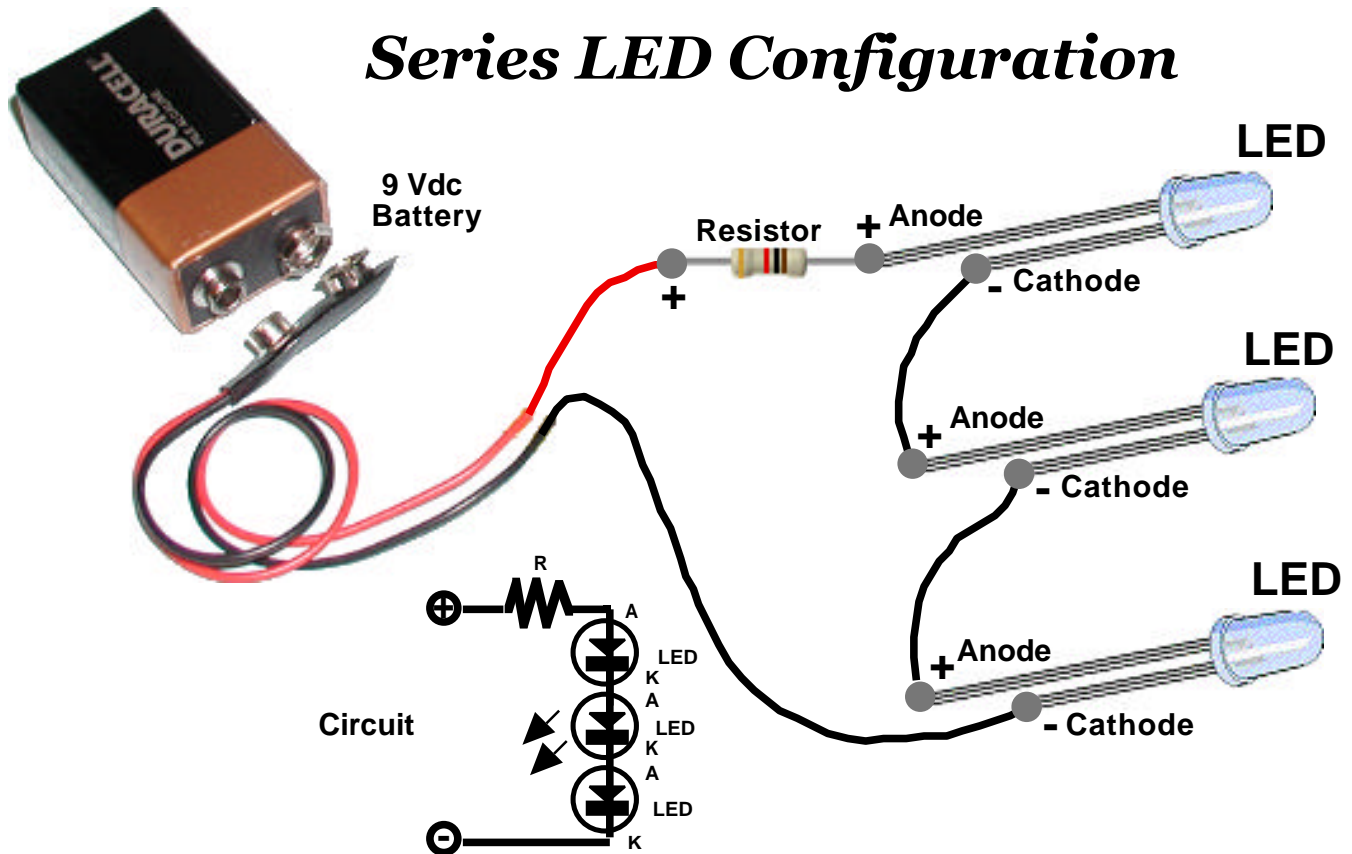
## LED Information

LED's

### Single LED Configuration



### Series LED Configuration

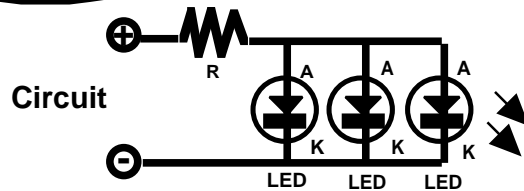
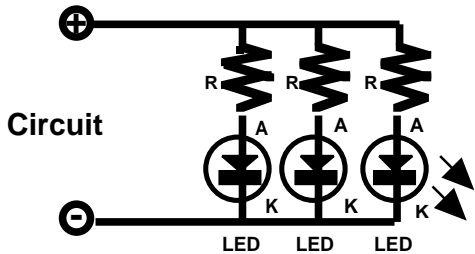
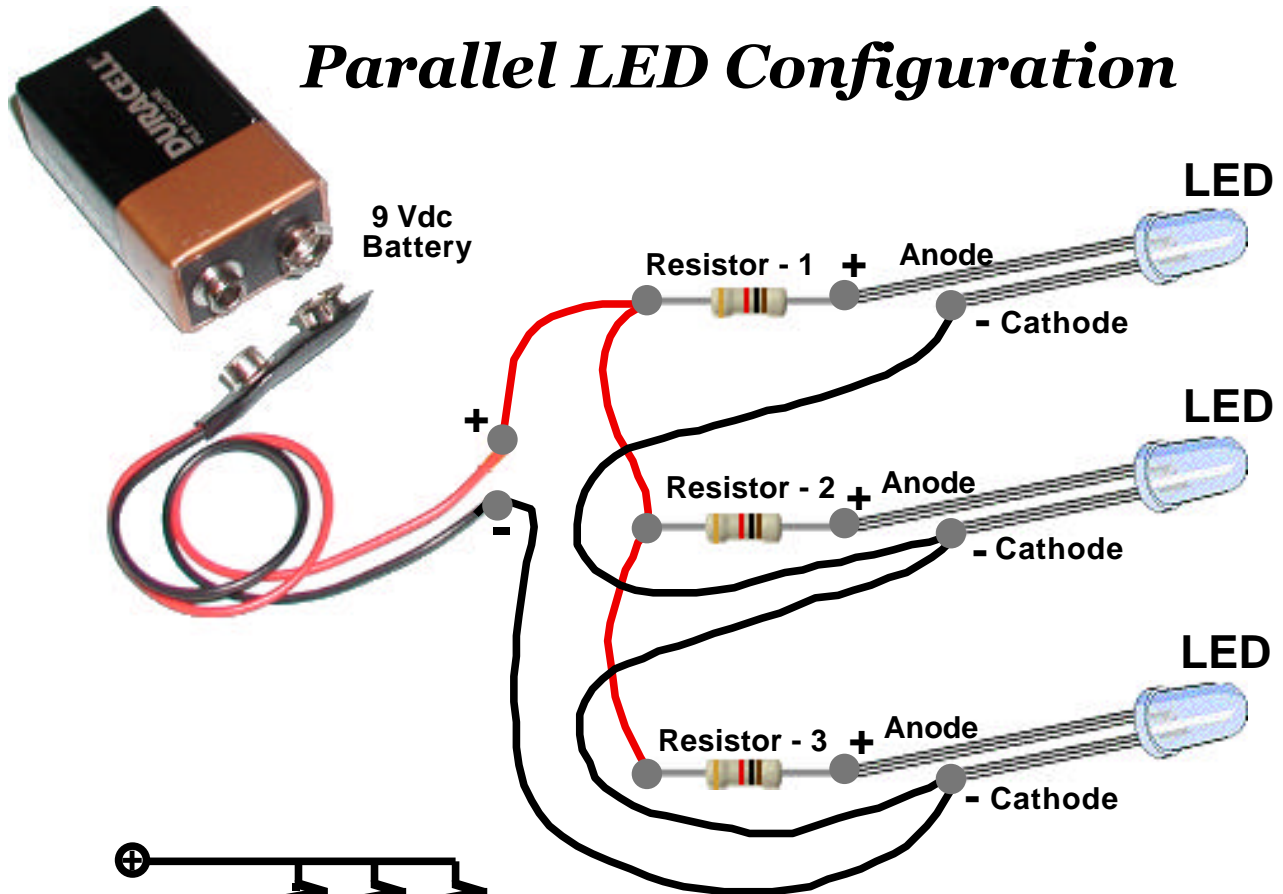


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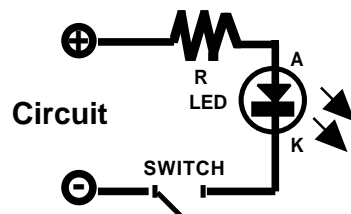
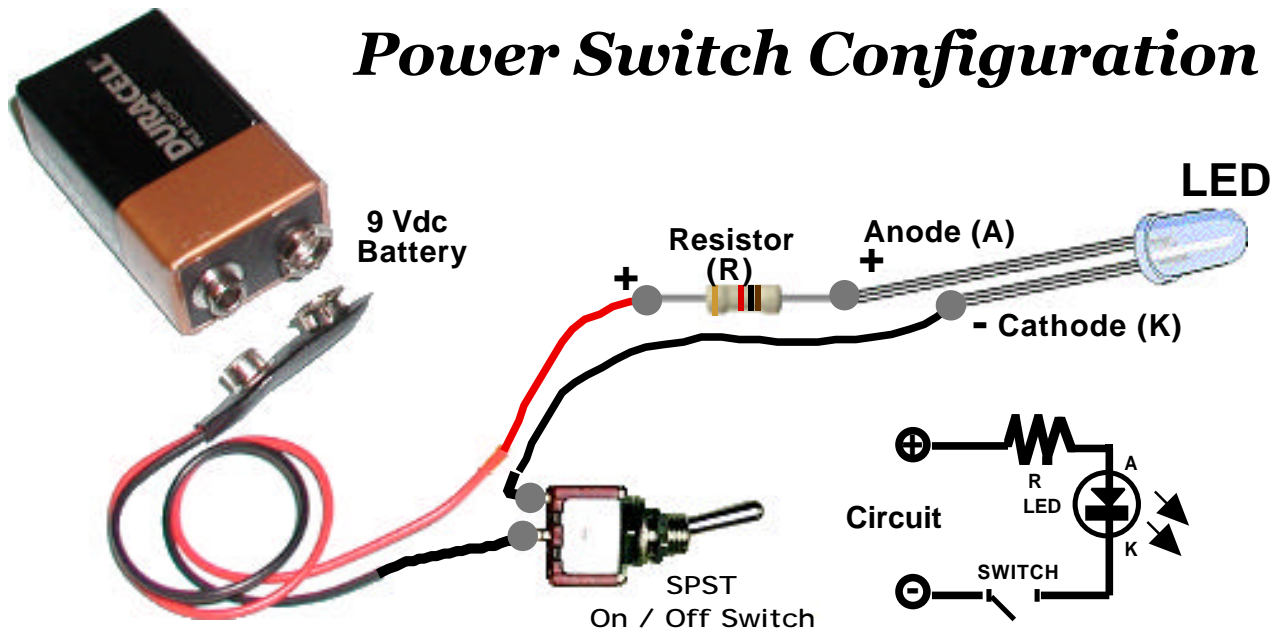
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# Parallel LED Configuration



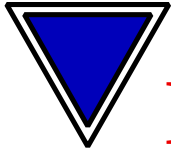
# Power Switch Configuration



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## LED Information

Controller

LED	Voltage Drop Vf	Foward Current mA	LED Intensity Level mcd
White	3.3 Vdc	20 mA	8000 mcd
Blue	3.1 vdc	20 mA	6000 mcd
Green	3.3 vdc	20 mA	4000 mcd
Red	2.25 Vdc	20 mA	8000 mcd
Yellow	1.9 Vdc	20 mA	3000 mcd
Blue-Green	3.2 Vdc	20 mA	2000 mcd
Orange	2.3 Vdc	20 mA	3000 mcd
RGB	3.1 Vdc	30 mA	800 mcd
Ultra Violet	3.6 Vdc	30 mA	1000 mcd

### Calculate Resistors Needed Mathematically

To calculate resistance. Ohms law is  $V=IR$ . Solving for R yields  $R=V/I$   
 V is voltage in volts, I is current in amps, and R is resistance in Ohms.  
 V is the difference between the supplied voltage and the required voltage.

Since we're using milliamps instead of amps, we need a multiplication factor of 1000.  
 Since we're using the difference in supplied voltage and required LED voltage we need to subtract. The formula becomes  $R = (9 \text{ volts} - \text{LED voltage required}) / (\text{current in milliamps}) * 1000$   
 Once you've calculated the resistance, you will use the closest resistor value you can find.

**Example:** White LED = **3.3 Vf 30mA** Power Supply- **9Vdc**  
 $9\text{Vdc} - 3.3\text{Vdc} / 20\text{mA} \times 1000 = 285$

Resistor Needed = **330 Ohm 1/4 Watt**  
 ( Nearest Resistor Value (330) Orange/Orange/Brown/Gold )

Calculated resistance value = 285 Ohms  
 Next standard 10% resistor = 330 Ohm  
 Power dissipated in LED = 0.114 Watts  
 Power dissipated in resistor = 0.19 Watts

### LED Intensity

The unit of measure commonly used to describe LED intensity is the millicandela (mcd).  
 1000mcd = 1cd. Candelas measure how much light is produced as measured at the light source in a specific direction.

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