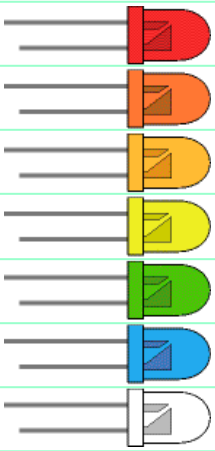
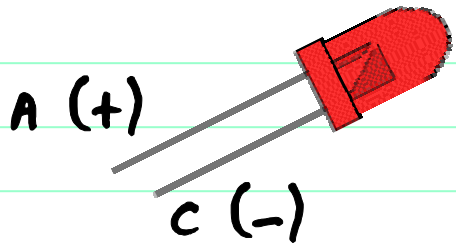
# Engineering note: leds and how to use them

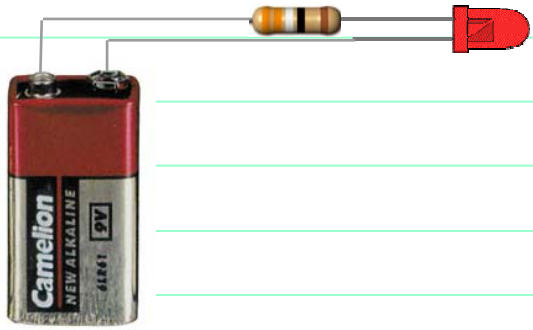
Leds feature a specific voltage drop, depending on type and colour:

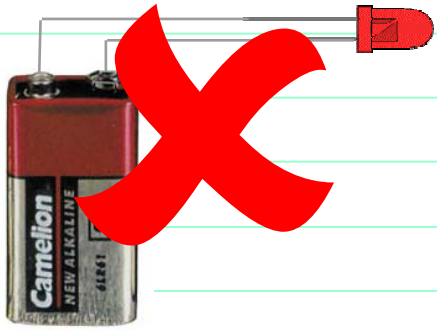



Check the datasheet for exact voltage drop and rated current !




Always use a series resistor:




## How to calculate the series resistor:

Example: operate a red led (1.7v) on a 9vdc source.

Required led current for full brightness: 5mA

(this can be found in the datasheet of the led)

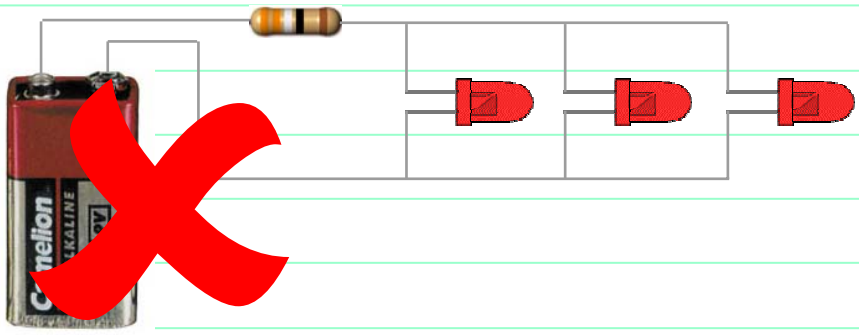
Solution: (supply voltage - led voltage)/required current = series resistance in ohms

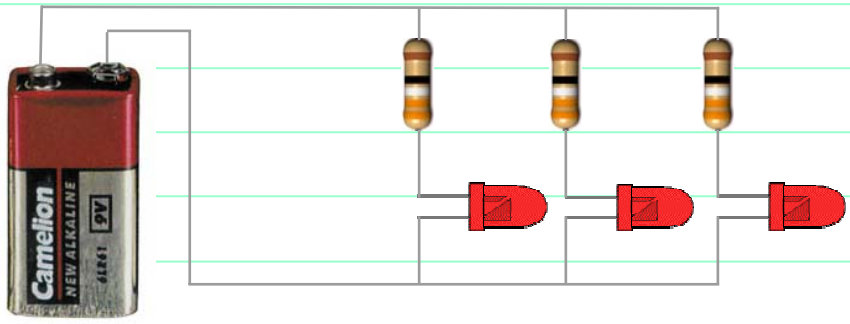
(9 - 1.7)/0.005 = 1460 (closest value : use a 1k5 resistor)

Required resistor power handling = voltage over resistor x current passed trough resistor

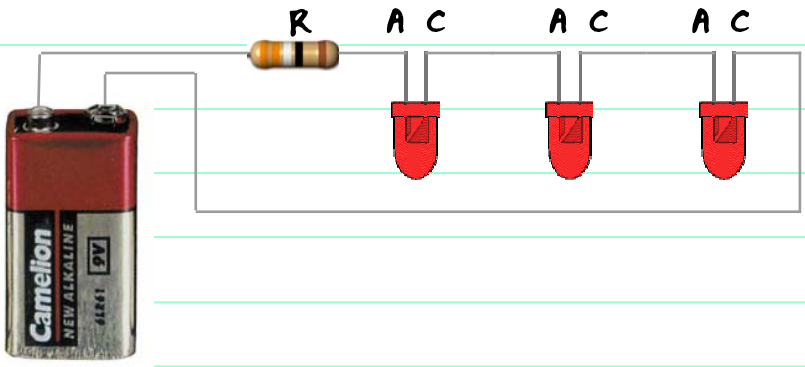
(9-1.7)x 0.005 = 0.036w (a standard 1/4w resistor will do the job)

Never connect leds in parallel without series resistor !





LEDs in series:




How to calculate the series resistor:

Example: 3 x red led (1.7v) on 9v battery

Required led current for full brightness: 5mA

(this can be found in the datasheet of the led)

Solution: (supply voltage - number of leds x led voltage)/required current = series resistance in ohms

(9 - 3x1.7)/0.005 = 780 (use an 820 ohm resistor)

# Engineering note: power leds do's and dont's

Do:

Screw the led firmly onto an appropriate heatsink

Use a series resistor or current limit circuit

Don't:

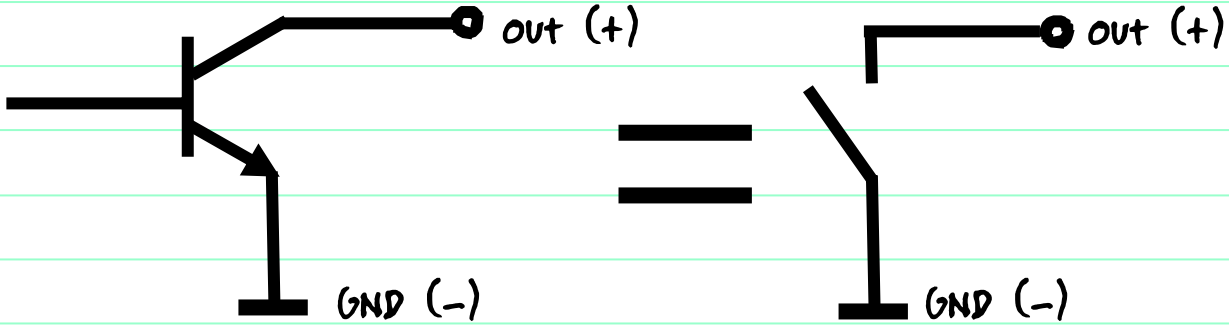
Use the led without a heatsink !

Use the led beyond the max. operating current

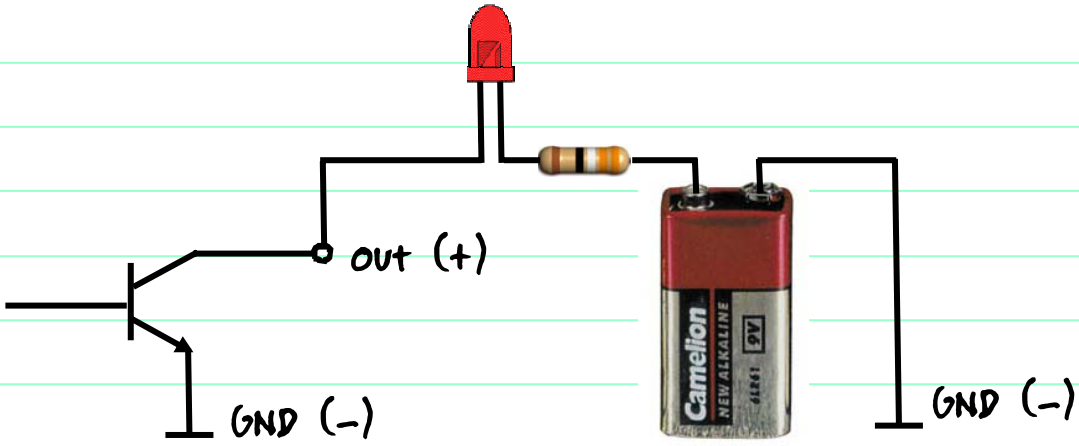
Look directly into the lightsource

# Engineering note: open collector outputs

An open collector output can be compared to a switch which switches to ground when operated

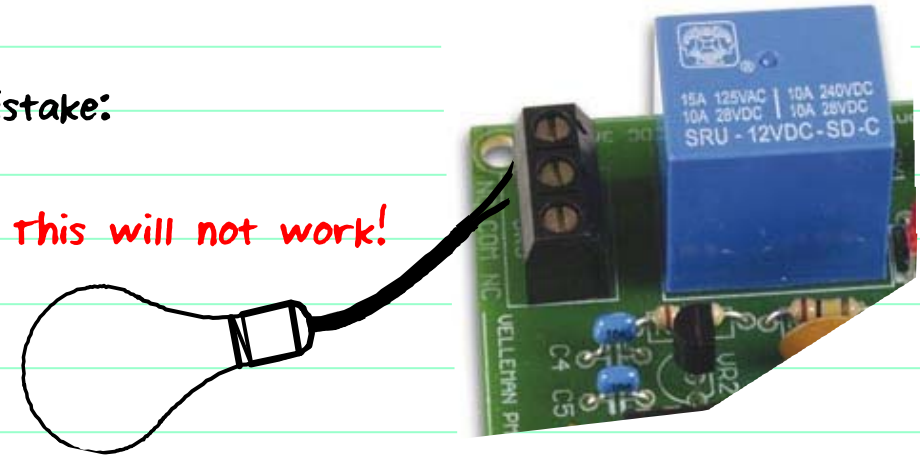



Example: How to switch an LED by means of an open collector output



# Engineering note: Relay contacts and how to use

common mistake:




Remember: Relay outputs are switches i.e. there is NO voltage coming out of them. You have to apply an external source.

SO, how to you connect a load to a relay output: