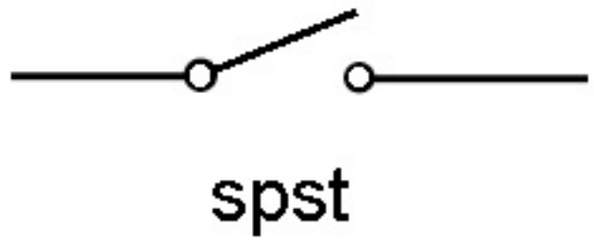
Electronic Components

Conductors

» A low resistance path for current to flow
» Insulated by plastic
» Diameter expressed by a "gauge"
Larger gauge = smaller wire
» Solid or Stranded

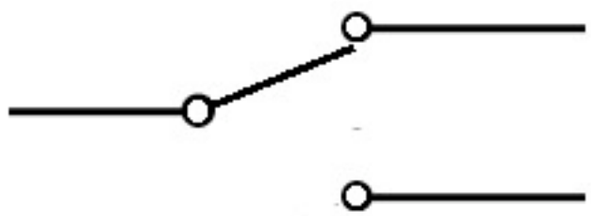
Switches

» Interrupt the flow of current, mechanically
» Characterized by the number of "poles" and "throws"



Single Pole - Single Throw

spst



Single Pole - Double Throw

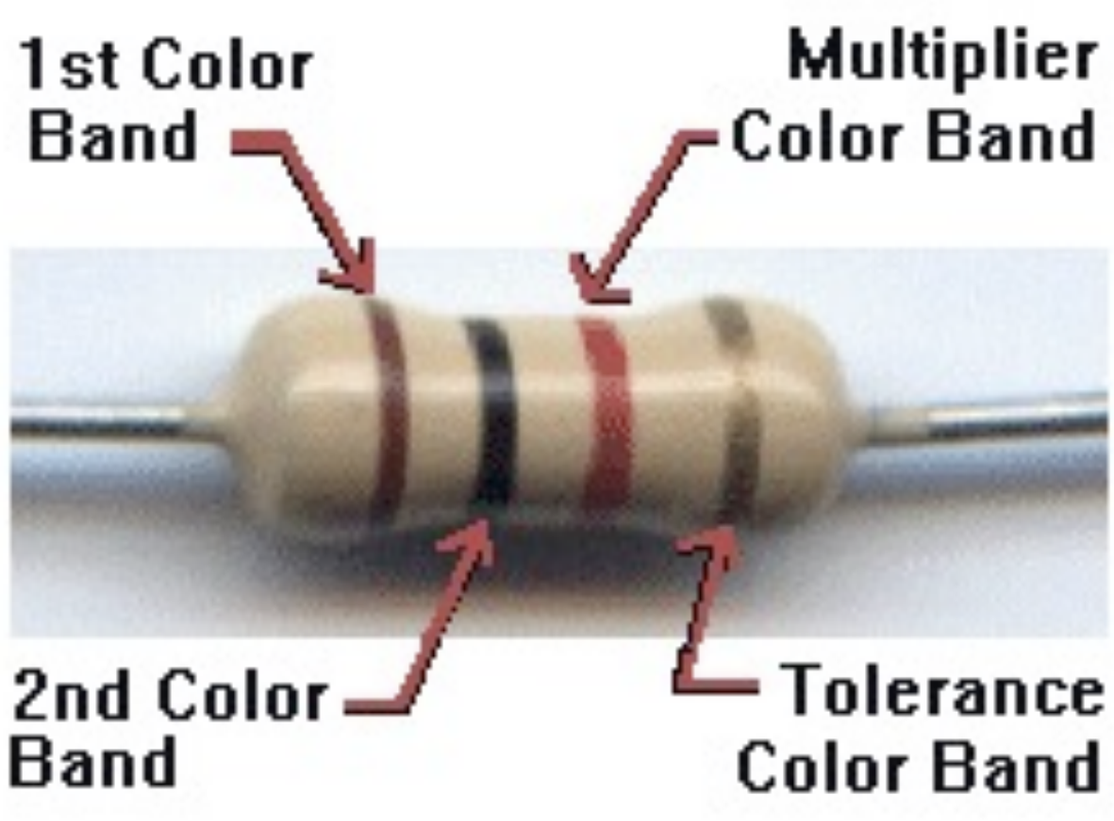
spdt

» "momentary" vs. "toggle"

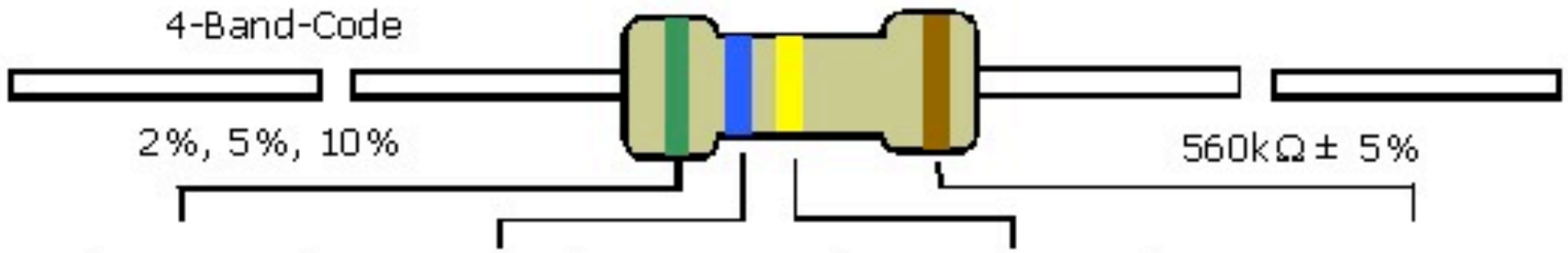
Resisters

» Conductive material that impedes current flow.
» Converts electrical energy into heat energy
» Typical Power rating: 1/4 to 2 Watts
» Color Bands on the resister tell you the value

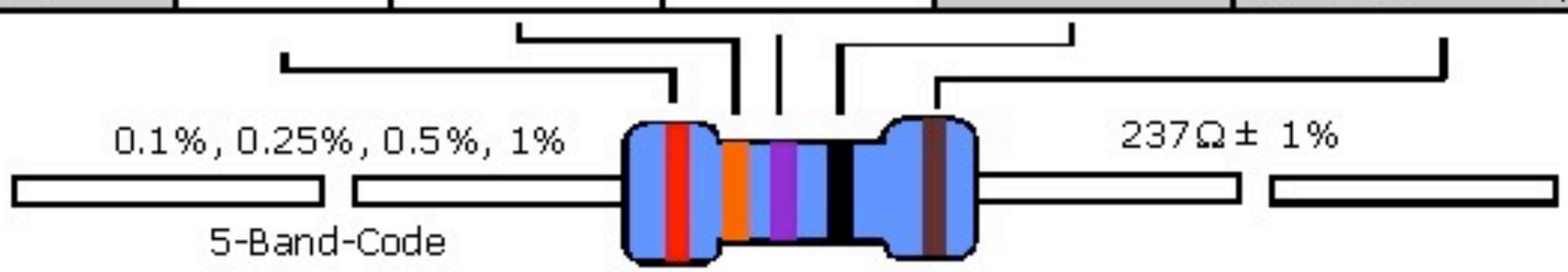
Resister Symbol



Resister Color Bands

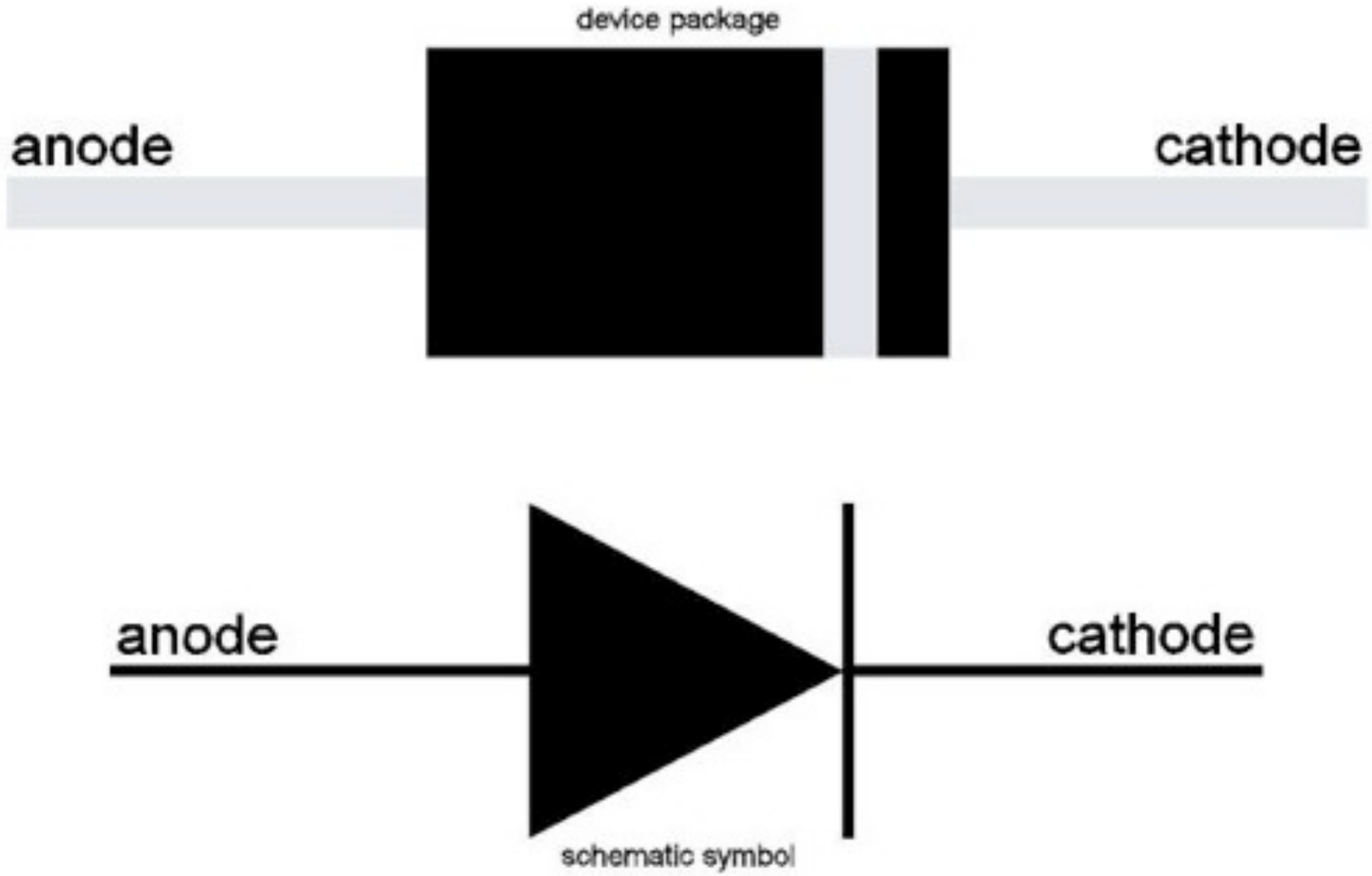


COLOR	1st BAND	2nd BAND	3rd BAND	MULTIPLIER	TOLERANCE
Black	0	0	0	1Ω	
Brown	1	1	1	10Ω	± 1% (F)
Red	2	2	2	100Ω	± 2% (G)
Orange	3	3	3	1KΩ	
Yellow	4	4	4	10KΩ	
Green	5	5	5	100KΩ	±0.5% (D)
Blue	6	6	6	1MΩ	±0.25% (C)
Violet	7	7	7	10MΩ	±0.10% (B)
Grey	8	8	8		±0.05%
White	9	9	9		
Gold				0.1	± 5% (J)
Silver				0.01	± 10% (K)



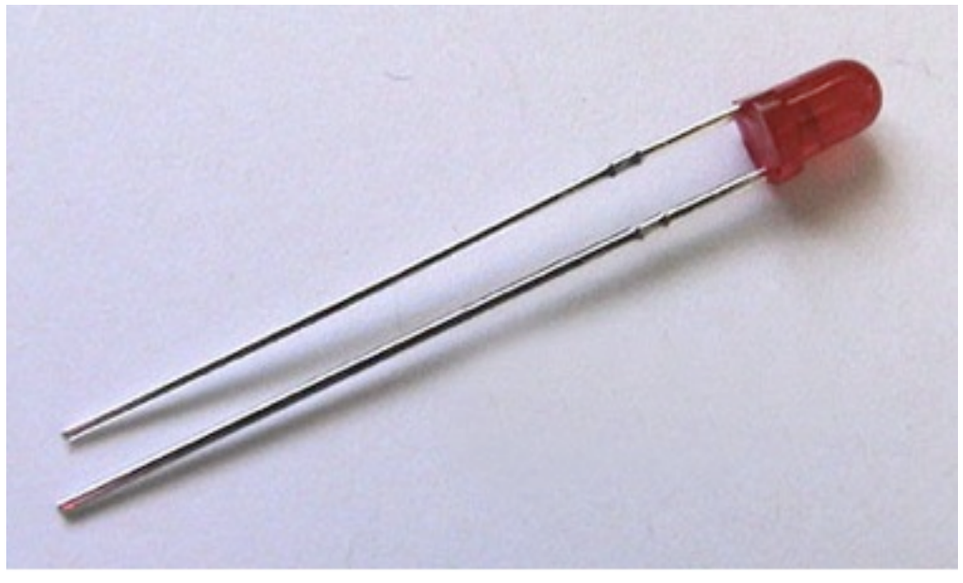
Diodes

» Allows current to flow in only one direction (from anode to cathode only)
» Cathode usually marked by a band



LED

» "Light Emitting Diode"
» Converts electrical energy into light
» Directional (anode and cathode)
Remember: "short things are closer to the ground"
» Requires a nominal 0.6V to work (barely).
Prefers 1.6–2V for optimal awesomeness.

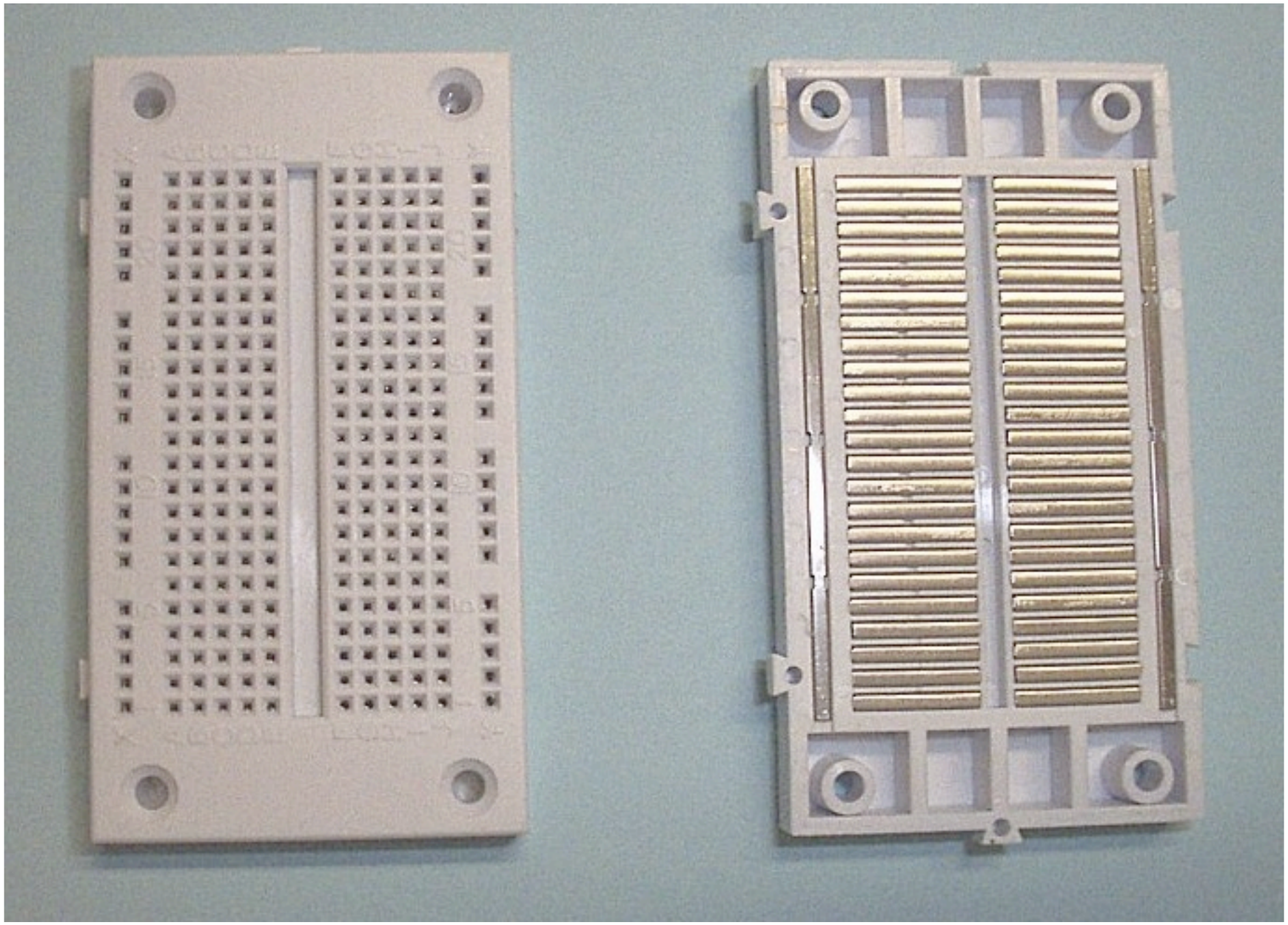


Usefulness of LEDs

- Power Indicator
- Fun Displays
- Trouble-shooting / Pin status

Connecting Components to make a Circuit

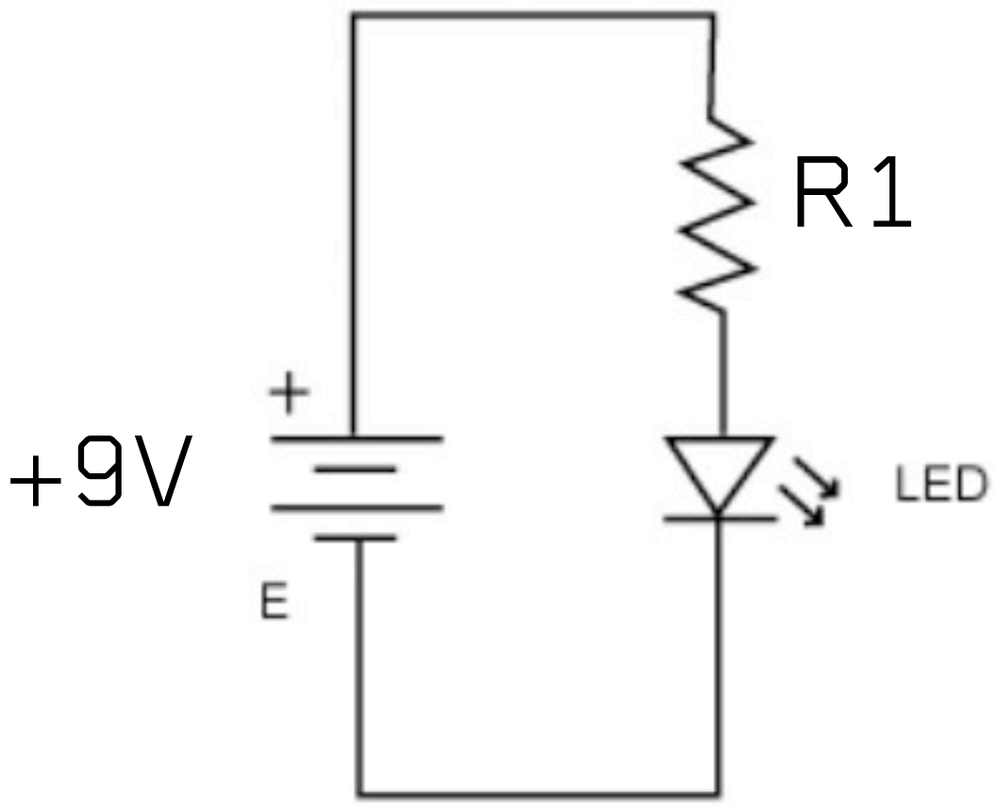
» We'll use a BREADBOARD

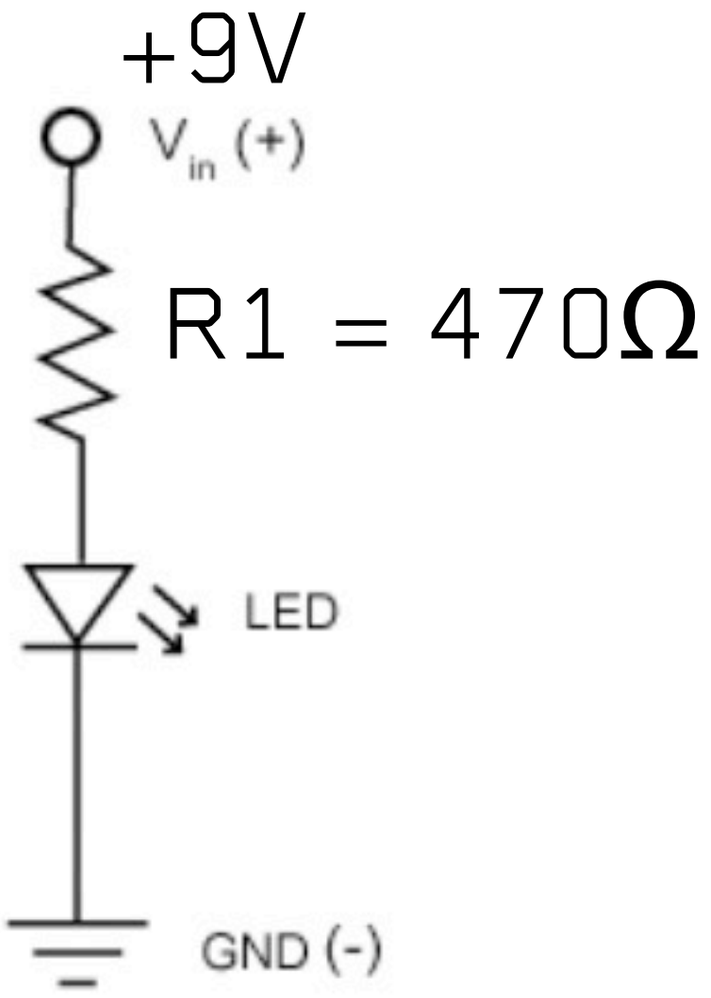


Power Supplies

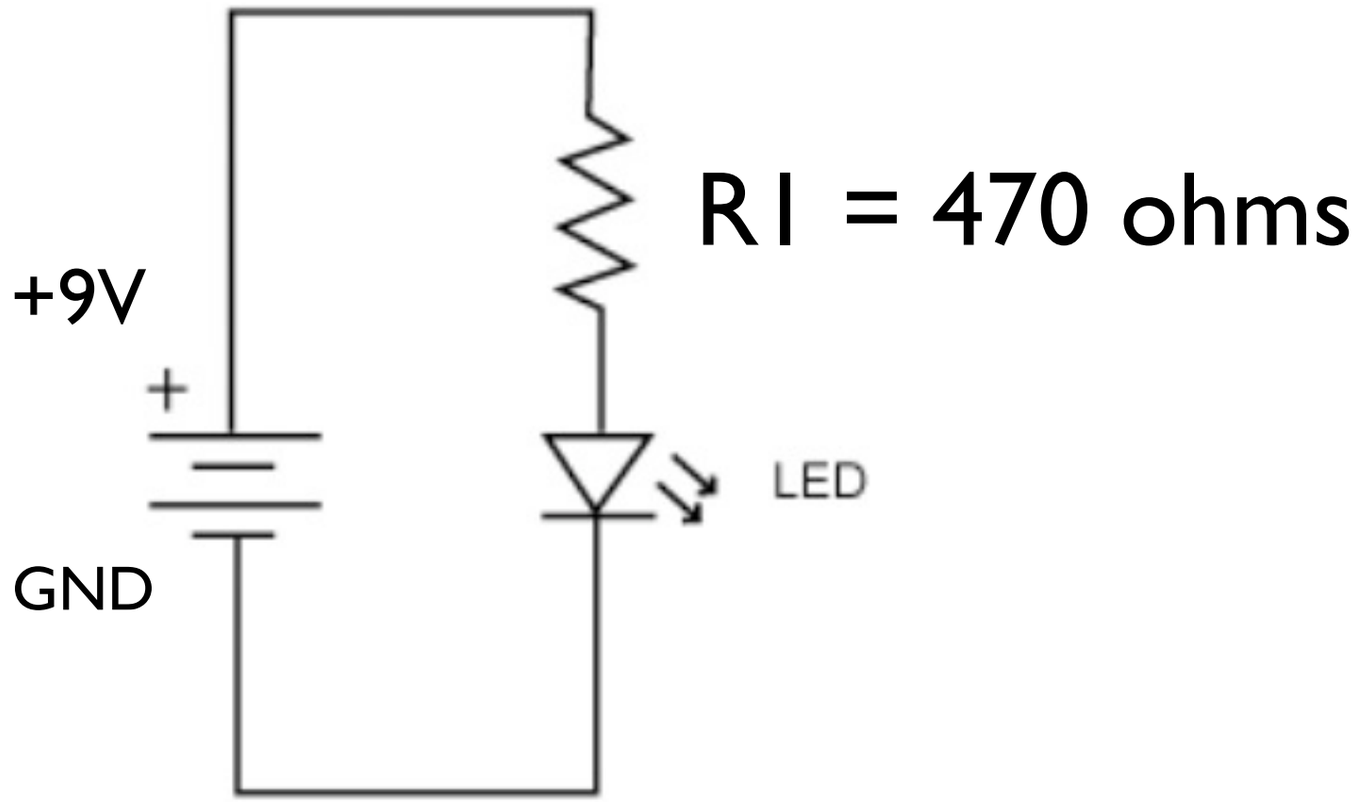
- Converts AC to DC
- Check V and I ratings
- Up to 1A is good, but 300-500mA is usually sufficient

These are identical





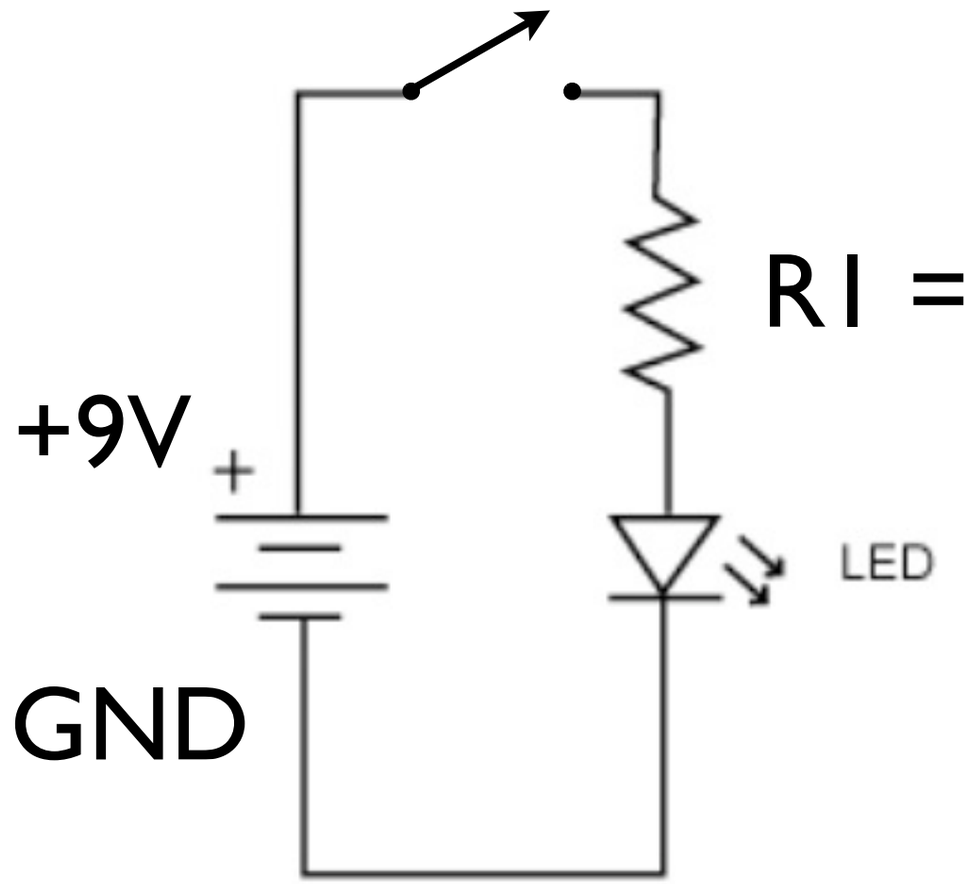
Lighting an LED



R1 = 470 ohms

BUILD IT!

Add a switch



YES!

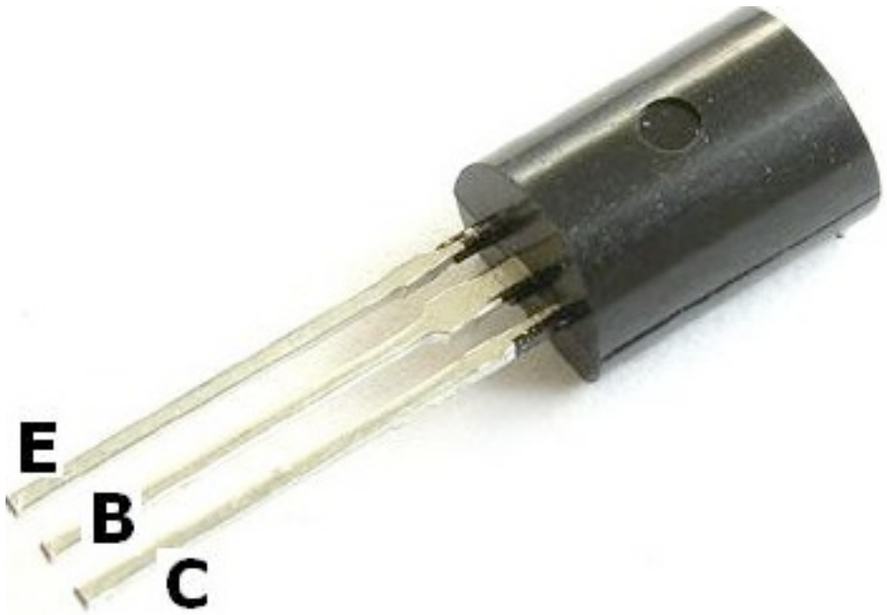
Transistors

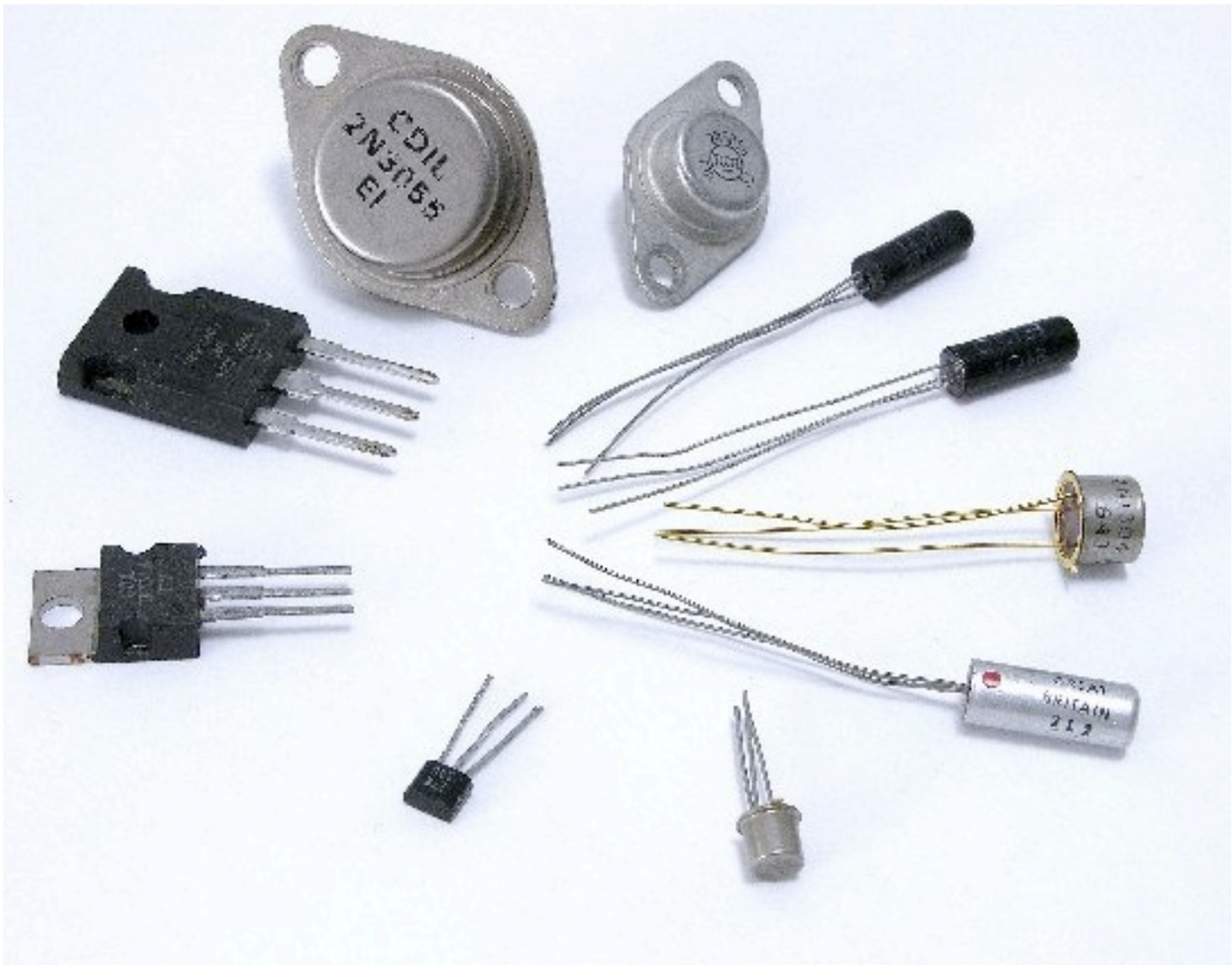
1) A type of "semiconductor" -- The heart of modern computing. Diodes, LEDs and microprocessors are all types of semiconductors.

2) Can be used as a SWITCH or an AMPLIFIER.

3) Processor chips are lots and lots of transistors in one package.

4) Transistors have three leads - the BASE, COLLECTOR and EMITTER.



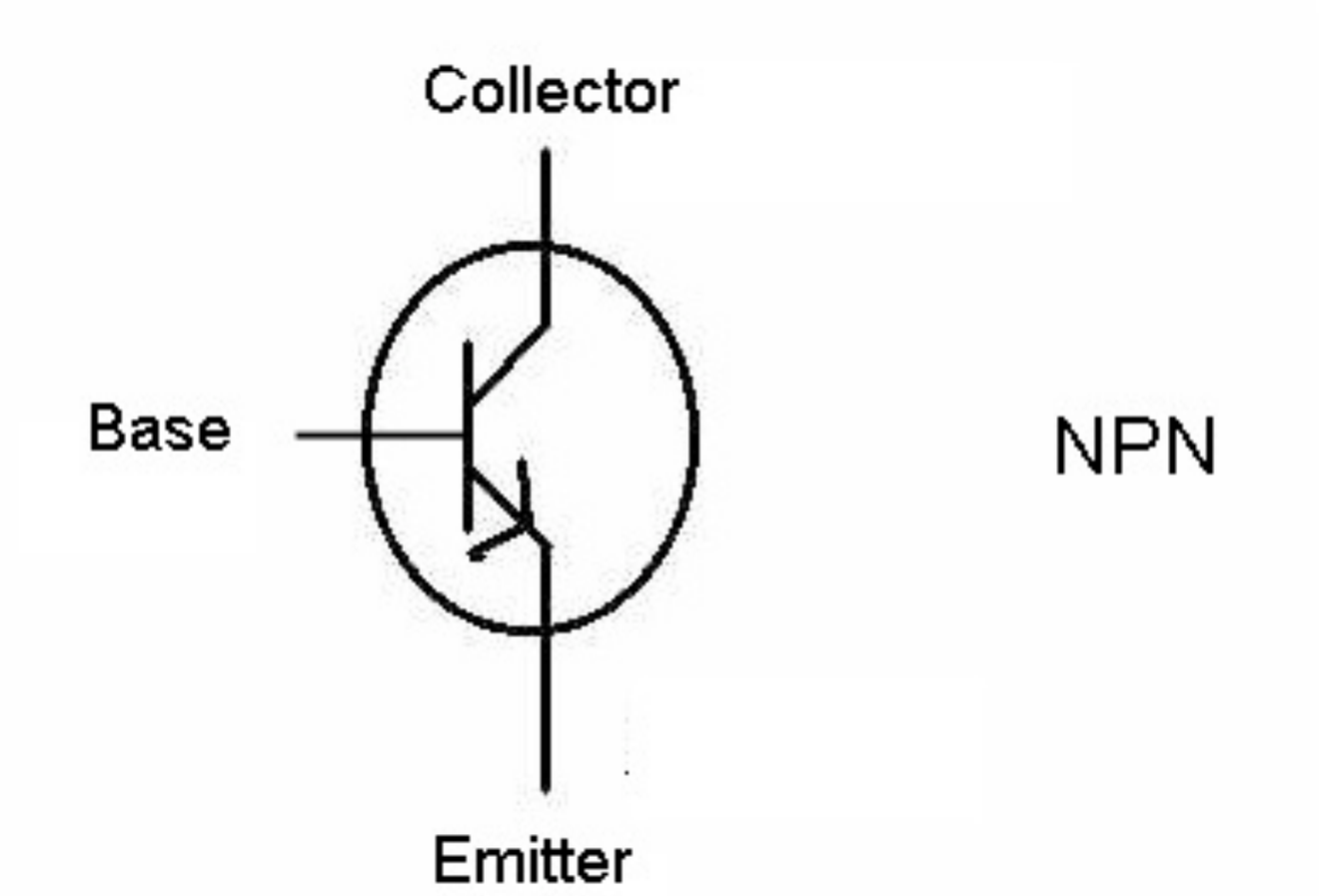


NPN vs PNP

1) NPN. If the base is at a higher voltage than the emitter, current flows from collector to emitter.

2) NPN. Small amount of current also flows from base to emitter.

3) NPN. Voltage at base controls amount of current flow through transistor (collector to emitter).



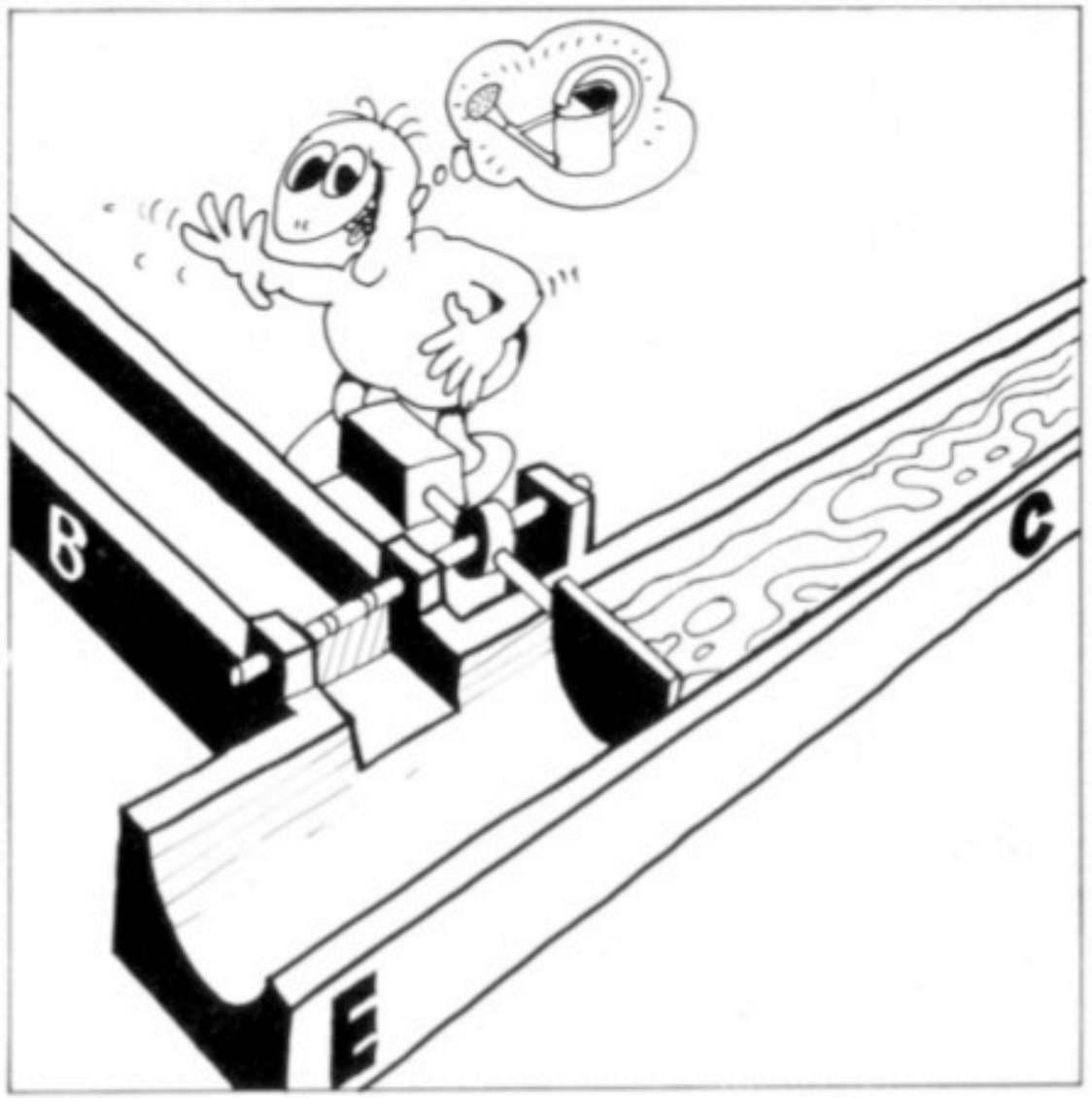
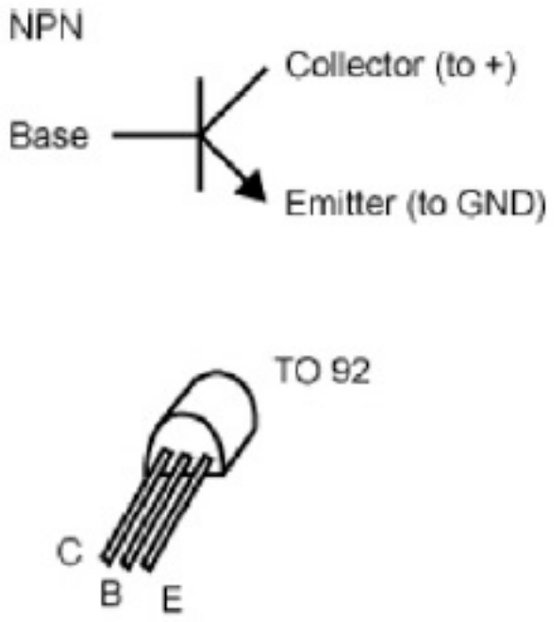
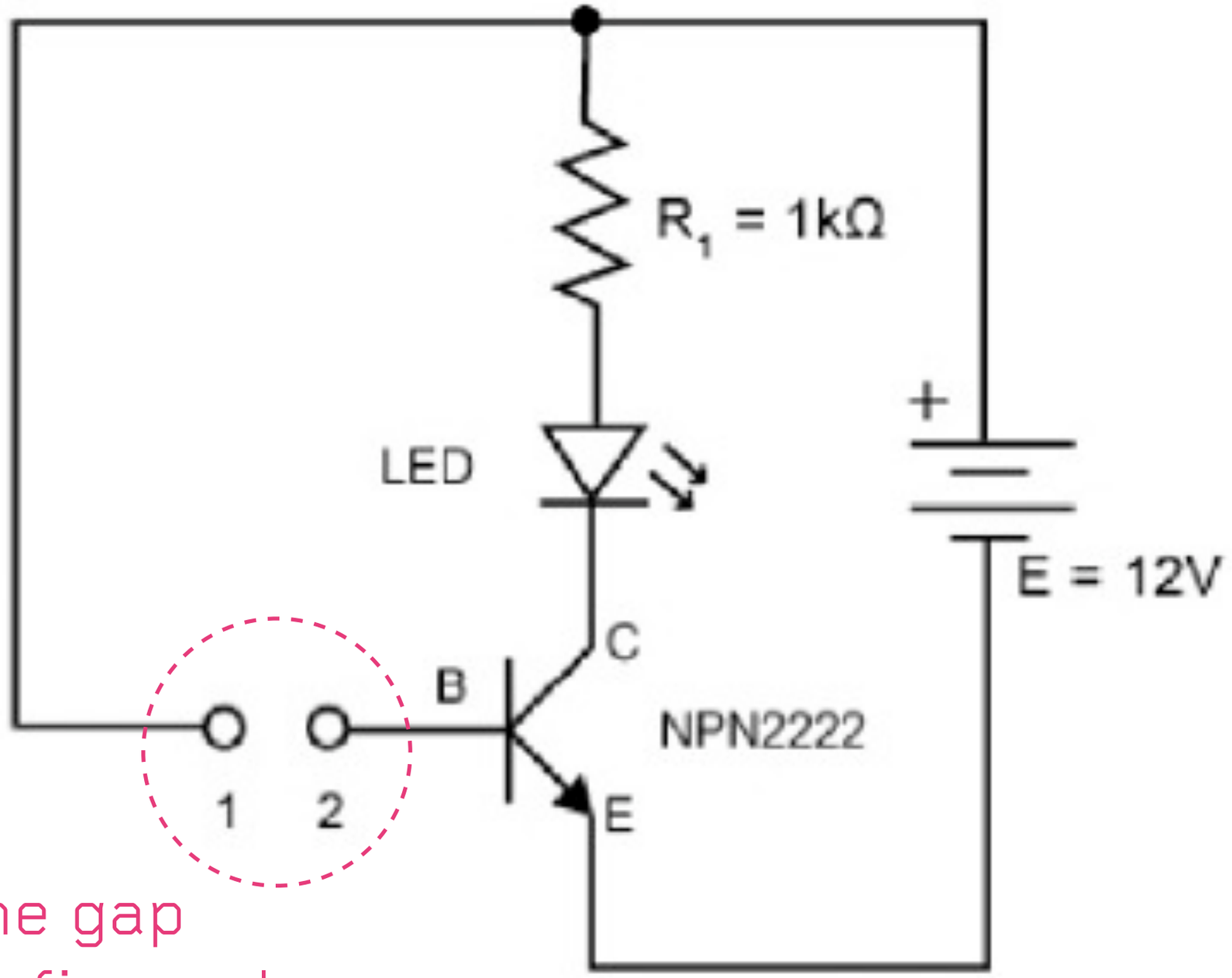


Bild 60. „Wasser-Transistor" (gesperrter Zustand)

Bild 61. „Wasser-Transistor" (leitender Zustand)

Bild 61. «Wasser-Transister» leitender Zu-stand





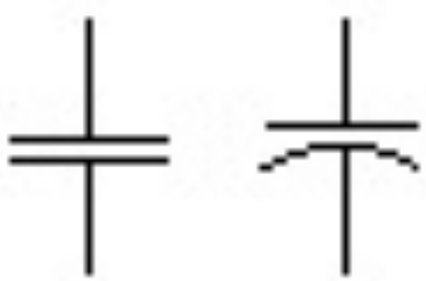
Bridge the gap
with your fingers!

Warning: Don't connect
with a wire...

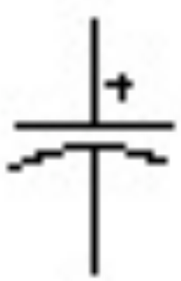
Capacitors

-Caps can store and release voltage
-When connected to DC voltage, the capacitor "pulls" and stores voltage.
-They hold charge when disconnected from power supply.
-When given the opportunity, they release the stored voltage.

Ceramic Caps



non-polarized



polarized

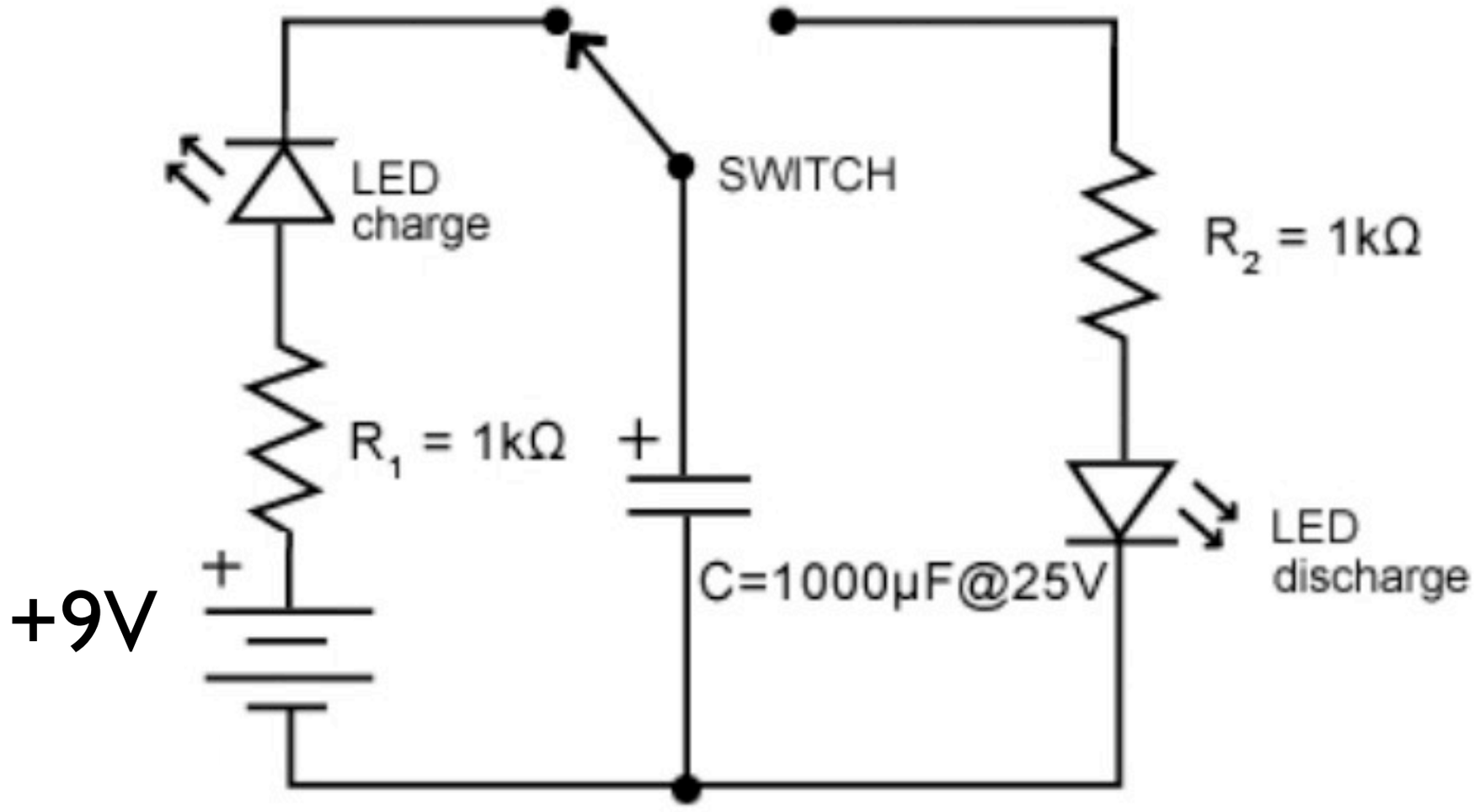
Electrolytic Caps

» Amount of charge a capacitor can hold is measured in Farads.

» 1 Farad is equal to 1 amp of current at 1 volt for 1 second.

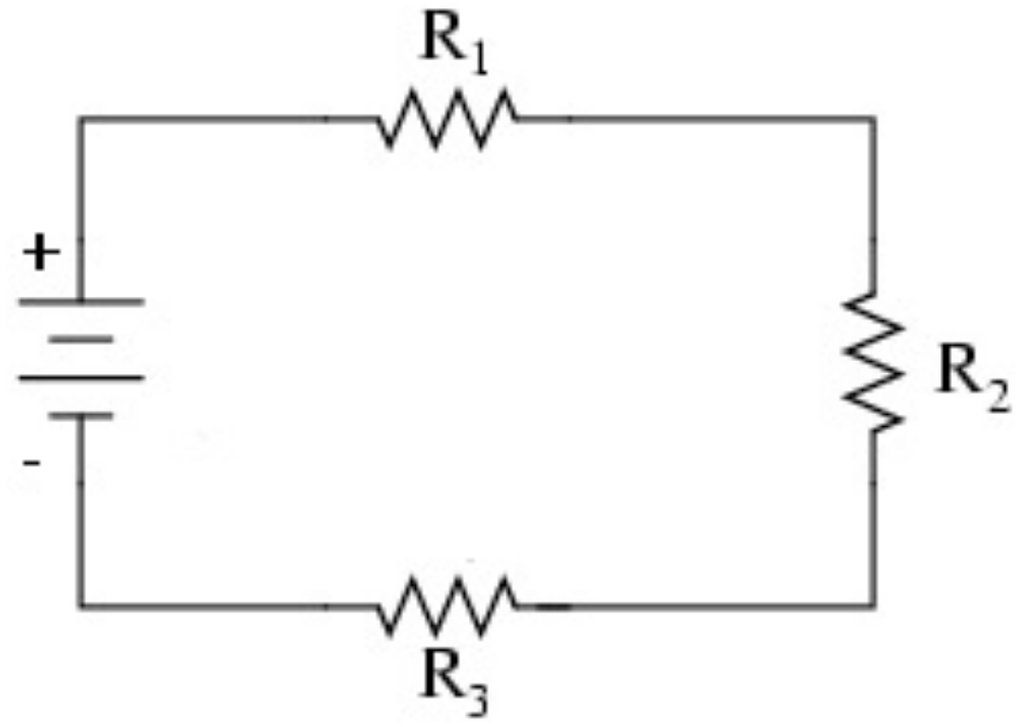
» 1 Farad is a lot of charge. Capacitors we work with are typically measured in Micro Farads (μF) and Pico Farads (pF).

Capacitor Lab



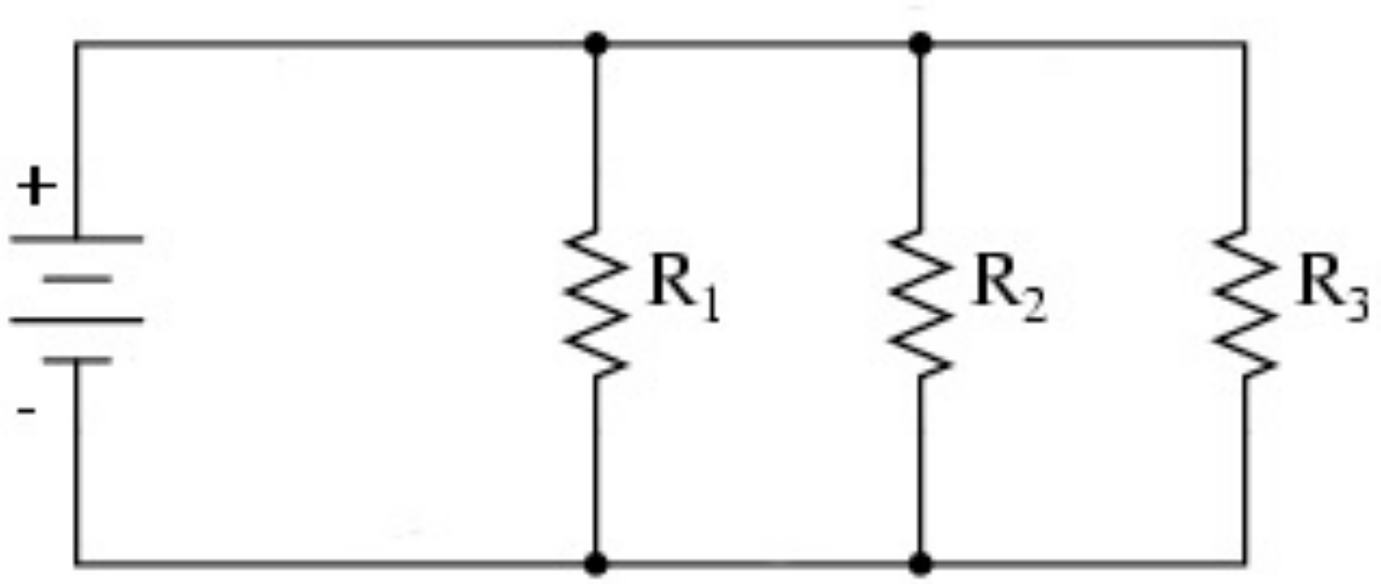
Circuits in SERIES

- Components connect end-to-end
- Single path for electrons to flow
  All components share the same current
- Total Resistance of the circuit is equal to sum of individual resisters.
- Total Voltage of the circuit equal to all the individual "voltage drops"



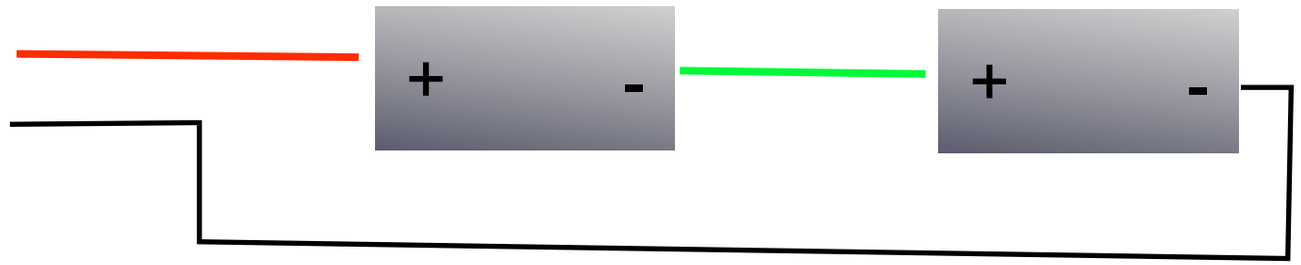
Circuits in PARALLEL

- Components connect parallel to one another
- Multiple paths for electrons to flow
  All components share the same voltage
- Total Current of the circuit is equal to sum of individual branch currents.



Batteries in SERIES

Double the Voltage
Same Current



Batteries in PARALLEL

Double the Current
Same Voltage