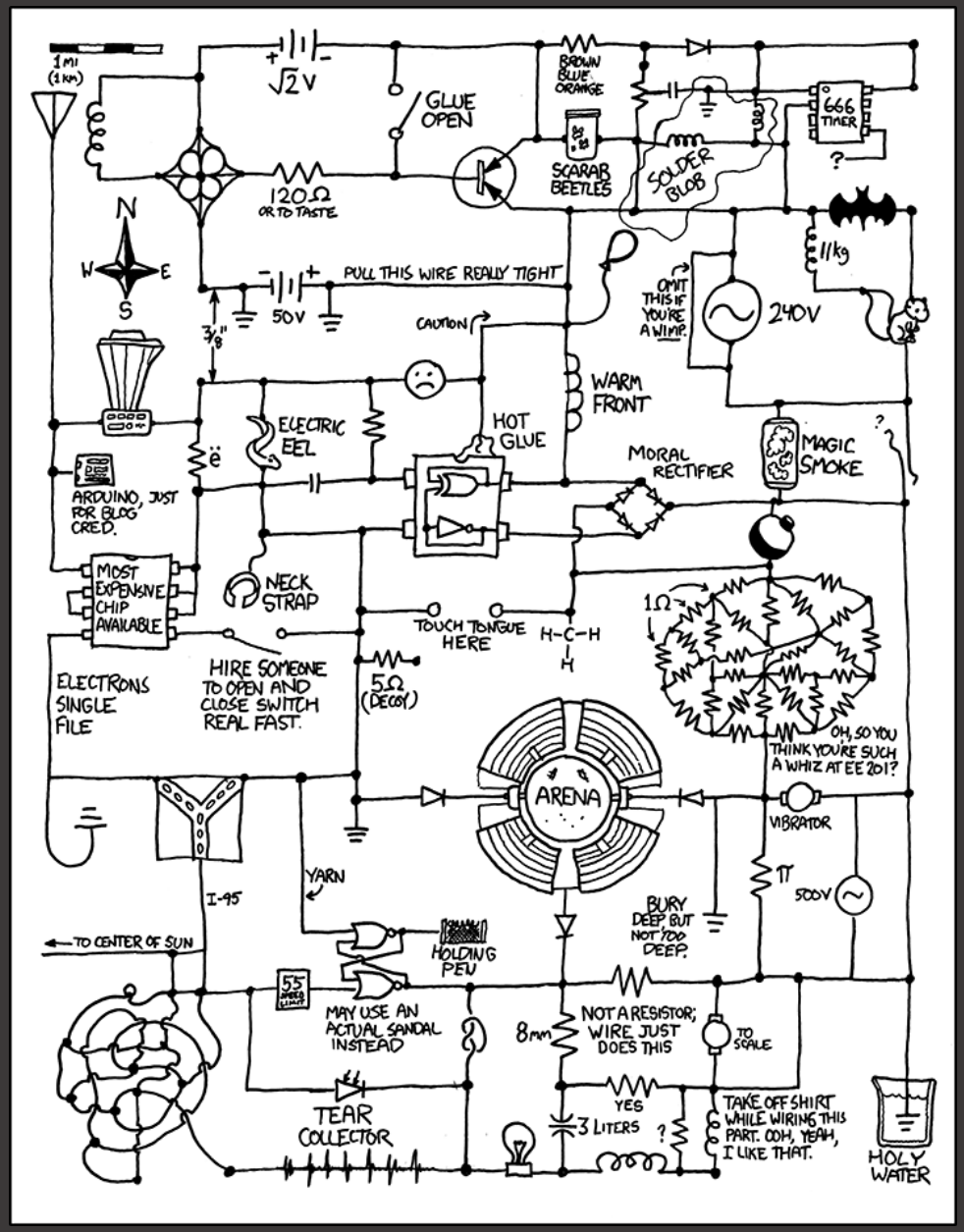
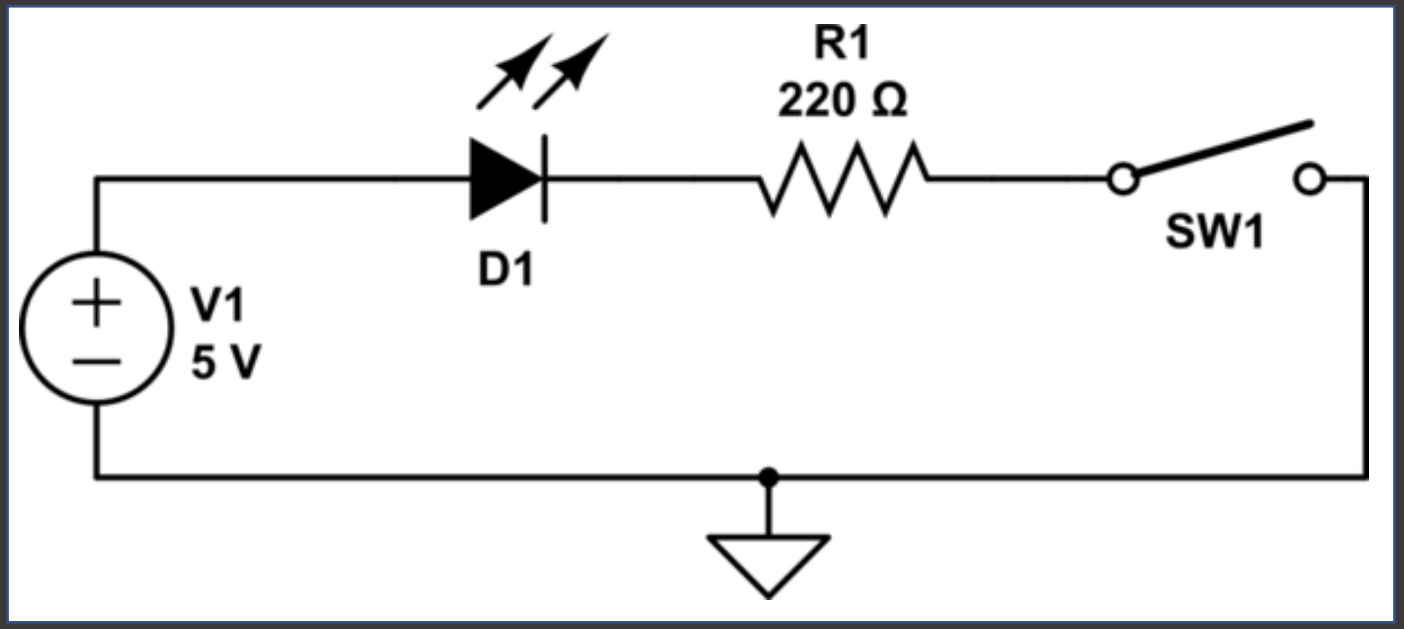
Schematics to Breadboards

Sept-2019

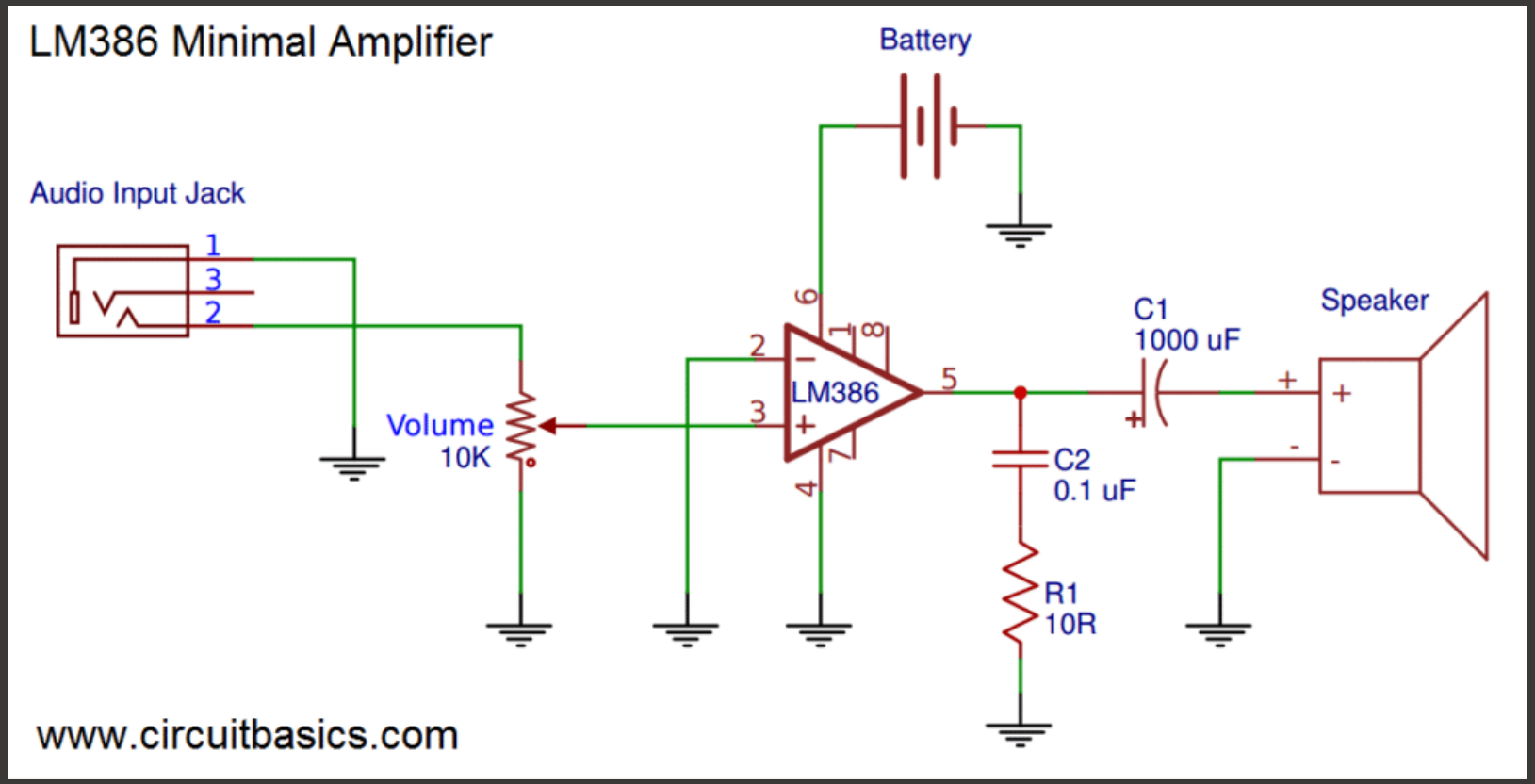


What's a Schematic?

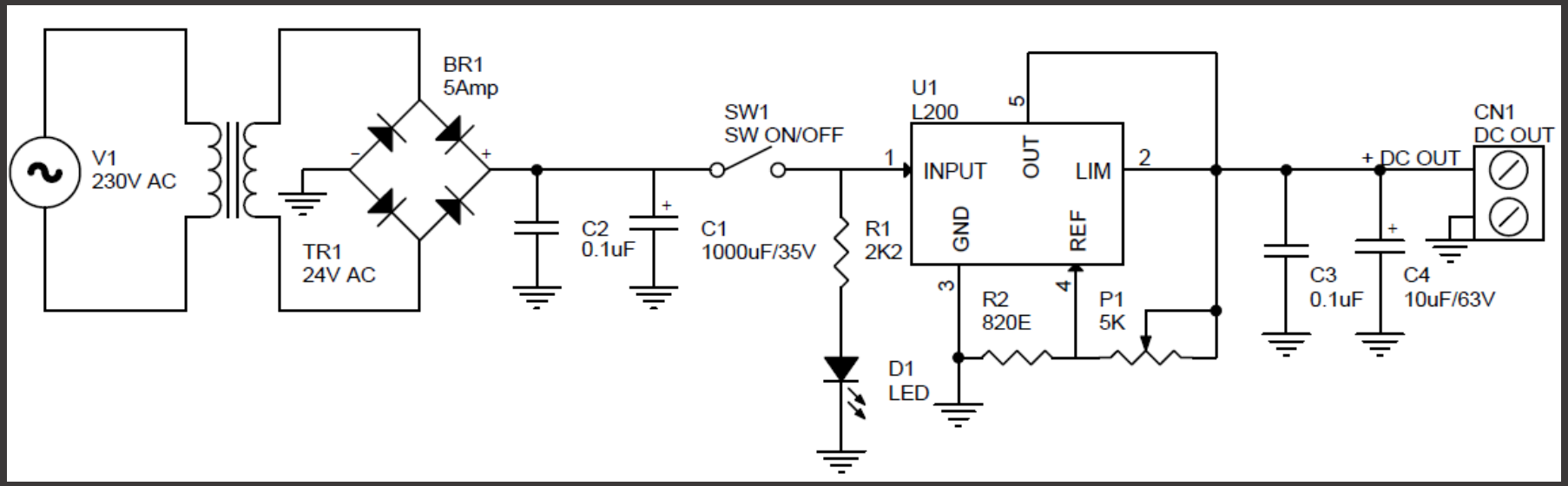
A diagram showing electrical components and their connections



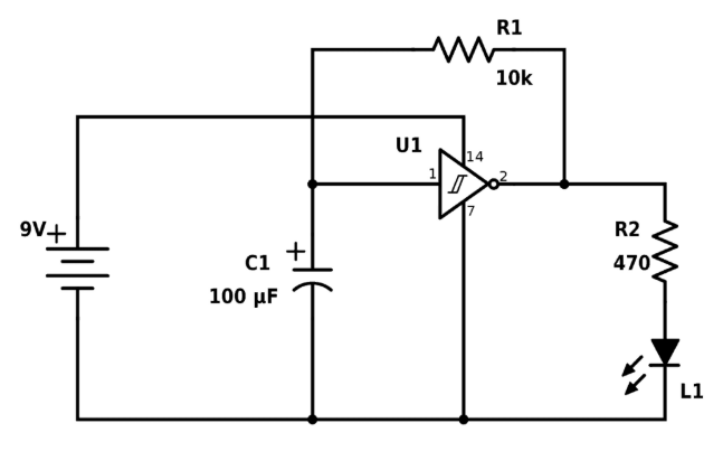
Drawn from logical/signal flow point of view



Power Supply



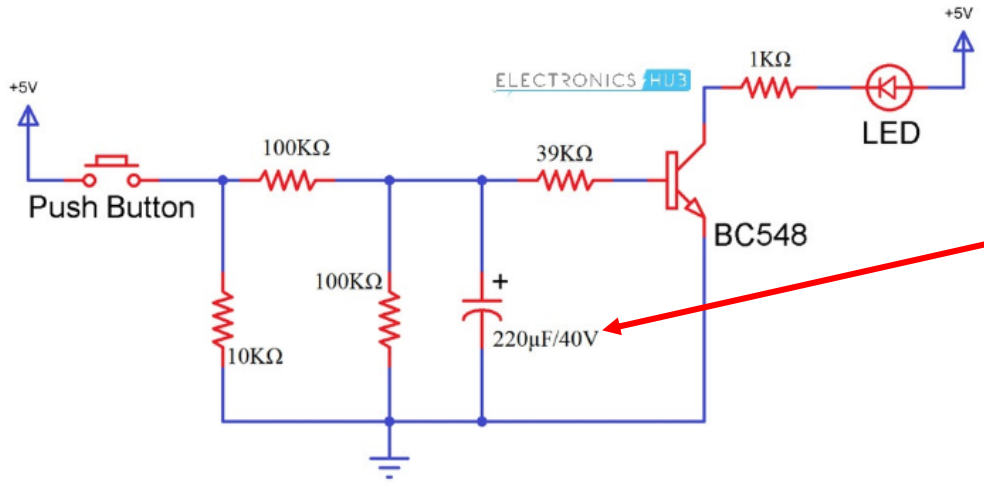
Schematic Usually has a BOM



Part	Value	Note
–	–	Breadboard
U1	74C14	Hex Schmitt Trigger Inverter
C1	100µF	Polarized capacitor
R1	10 kΩ	Standard Resistor
R2	470 Ω	Standard Resistor
LED	–	Standard output light-emitting diode

Source: https://www.build-electronic-circuits.com/build-blinking-light-circuit/

Typical Schematic/BOM Issues



Components Required

- Capacitor – 220µF
- Resistors
  - 2 X 100KΩ
  - 10KΩ
  - 39KΩ
  - 100Ω
- BC 548 (any NPN Transistor)
- LED
- ON/OFF switch (Push Button)
- Mini Breadboard
- 5V Power Supply
- Connecting Wires

40V? 6V would be fine

Resistor power rating?

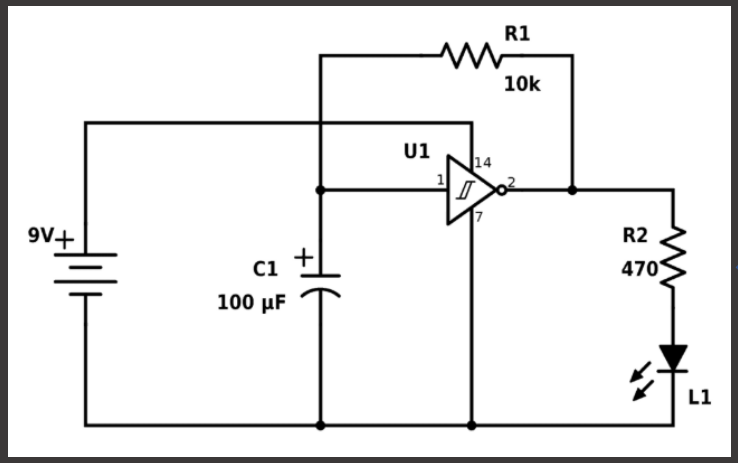
What kind of LED?

What kind of switch?

Power supply current?
Wall wart?
Lab supply?

Source: https://www.electronicshub.org/updown-fading-led-lights/

Practicality of Breadboarding



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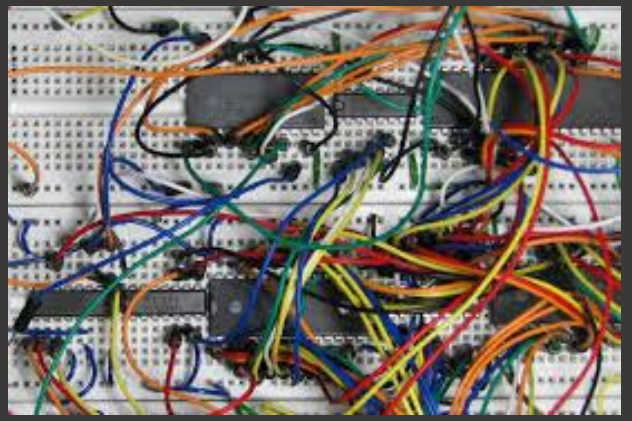
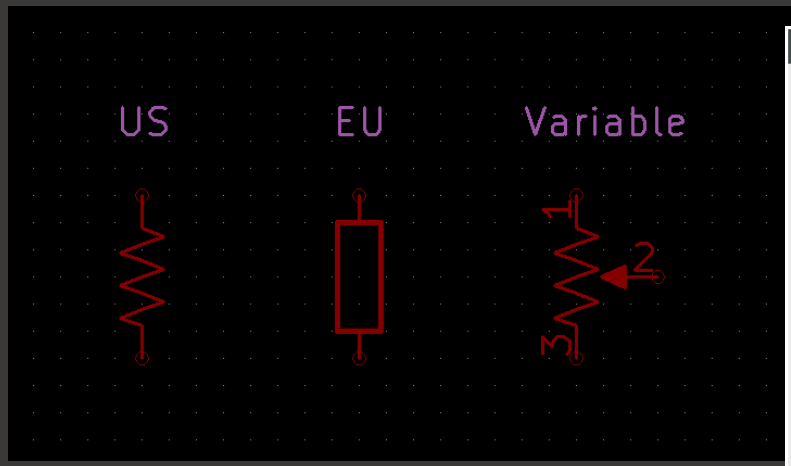
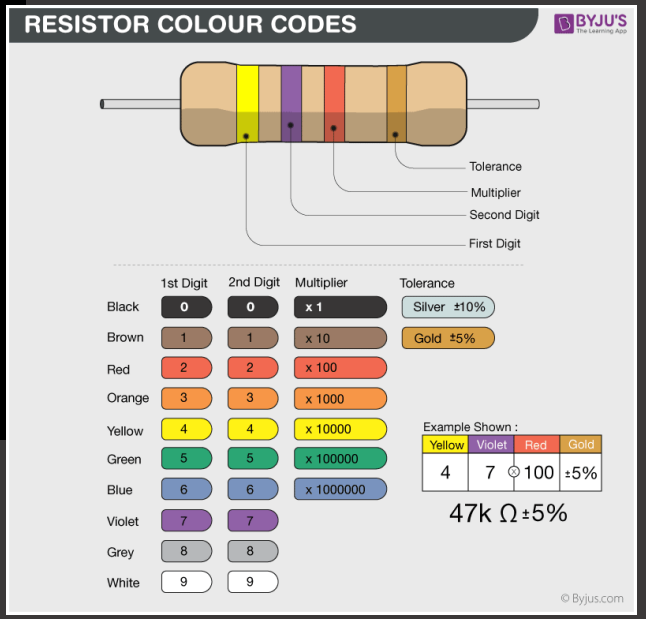


Source: https://www.build-electronic-circuits.com/build-blinking-light-circuit/

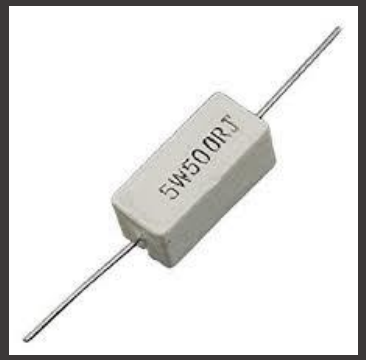
Resistors

If not otherwise specified, ≥ 1/8W of these work

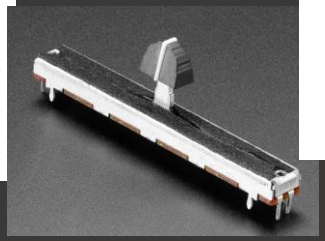




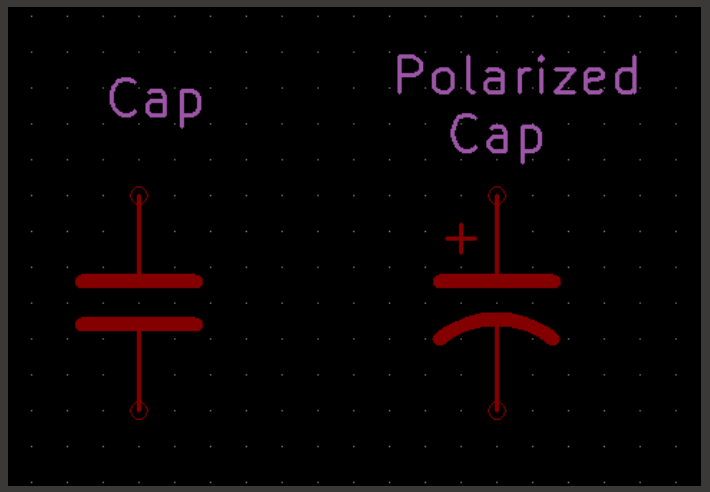
Fixed Value



Variable/Potentiometer

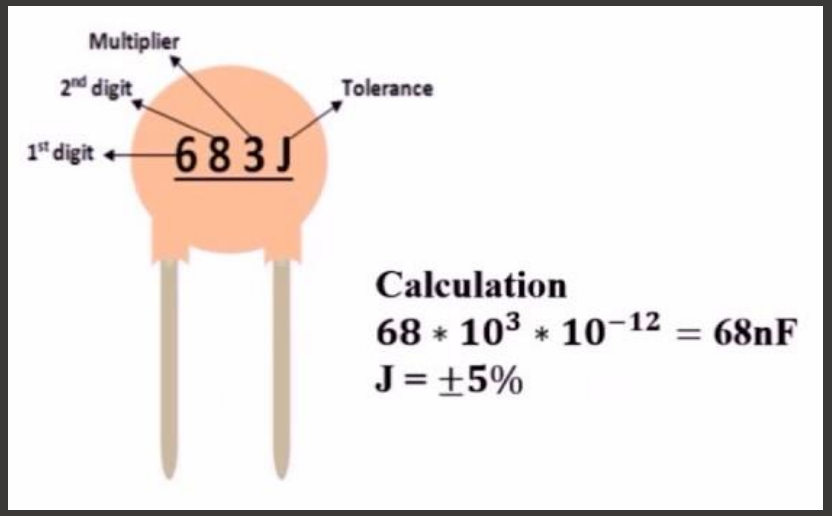


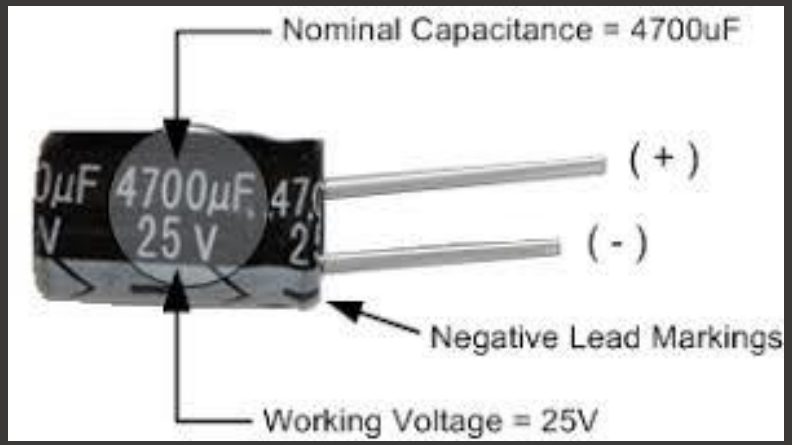
Capacitors



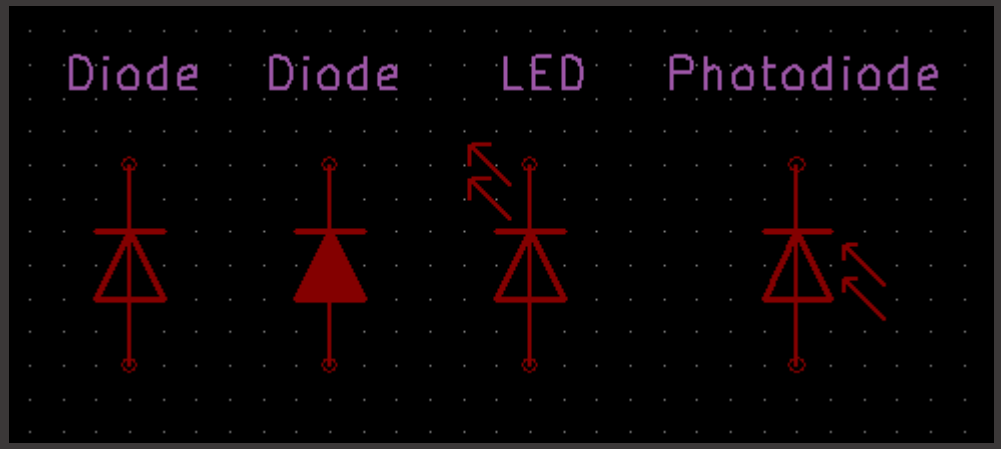
Polarity:

- Stripe
- Lead Length (short is negative)
- Other marking



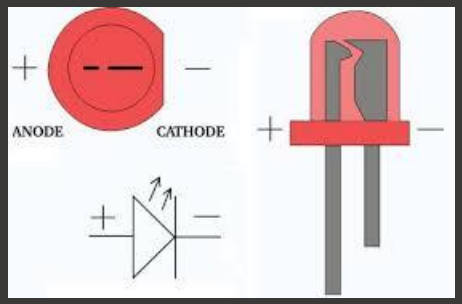


Diodes (Always Polarized)

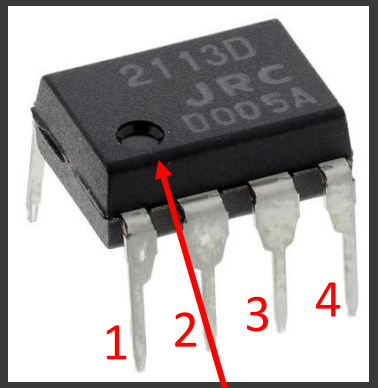


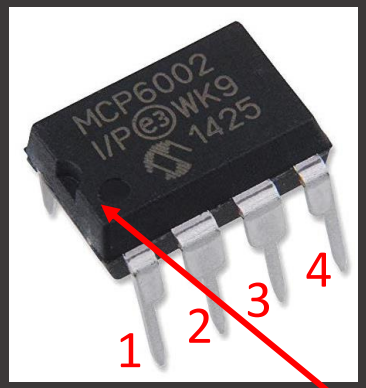
Polarity:

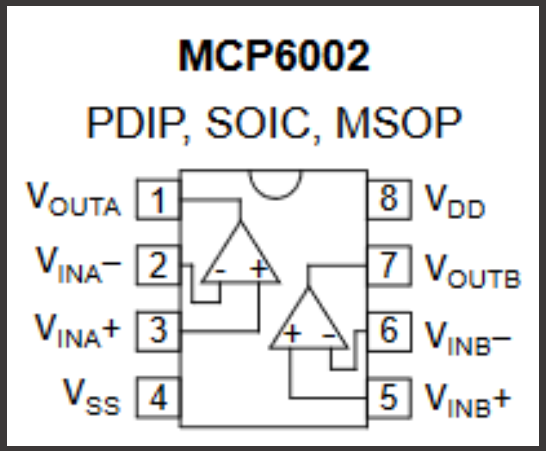
- Band
- Lead Length
- Flat Edge



ICs (Always Polarized)





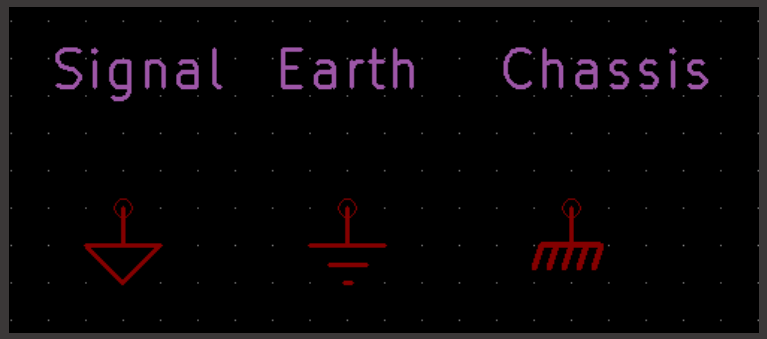


Dot or
Round Depression

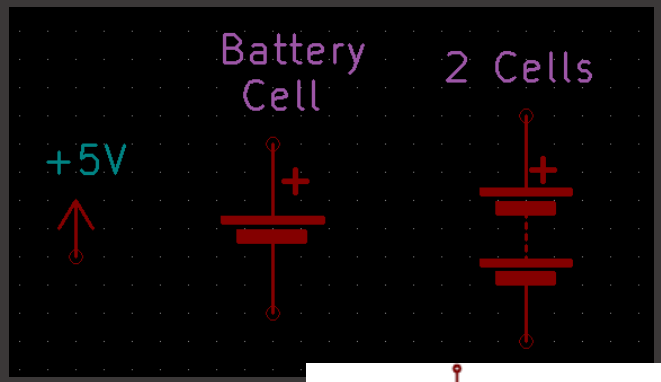
Semicircle
Depression

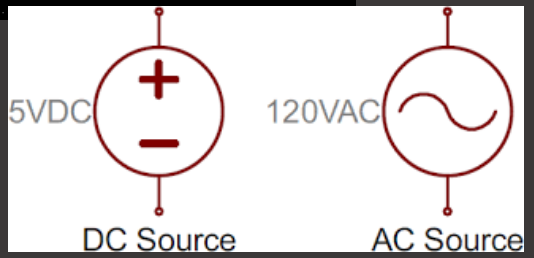
Other Common Schematic Symbols

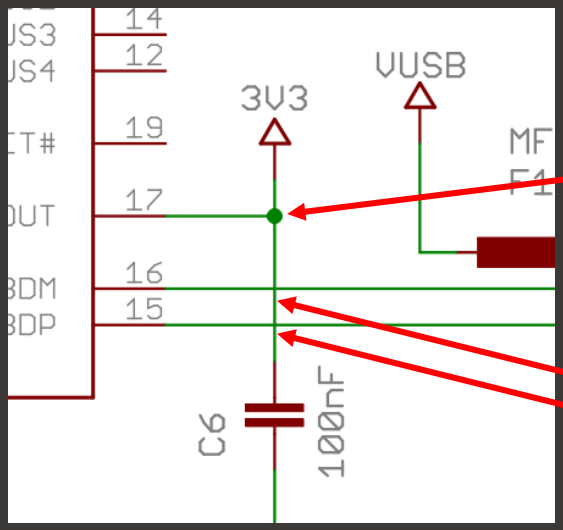
Grounds (Used Imprecisely)



Sources (Used Imprecisely)



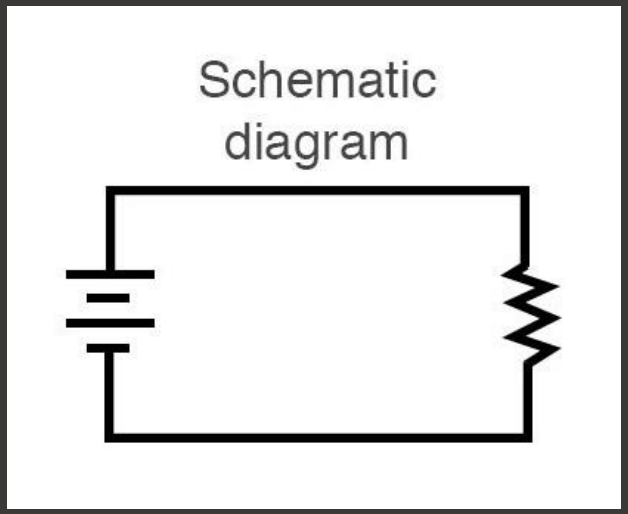




Connected

Not Connected

What's a Schematic ***ISN'T***: Physical Implementation



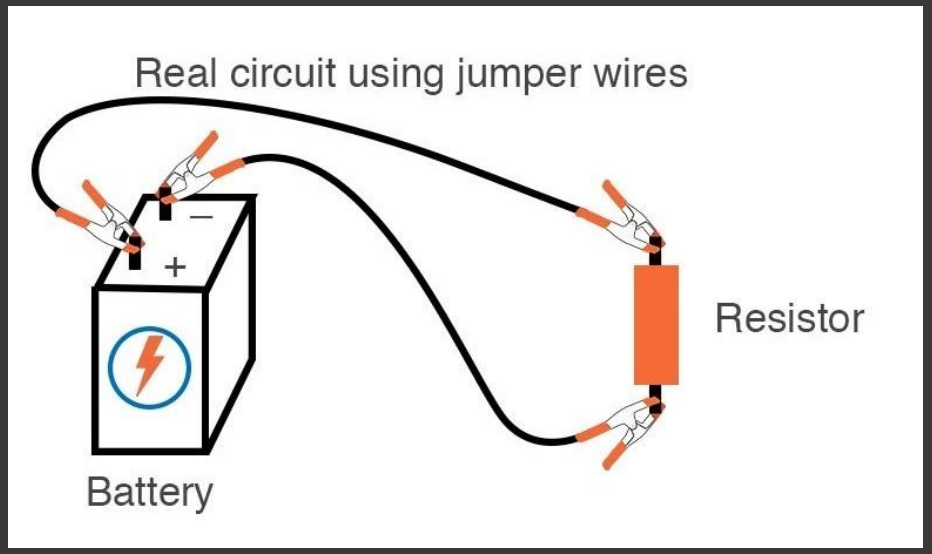
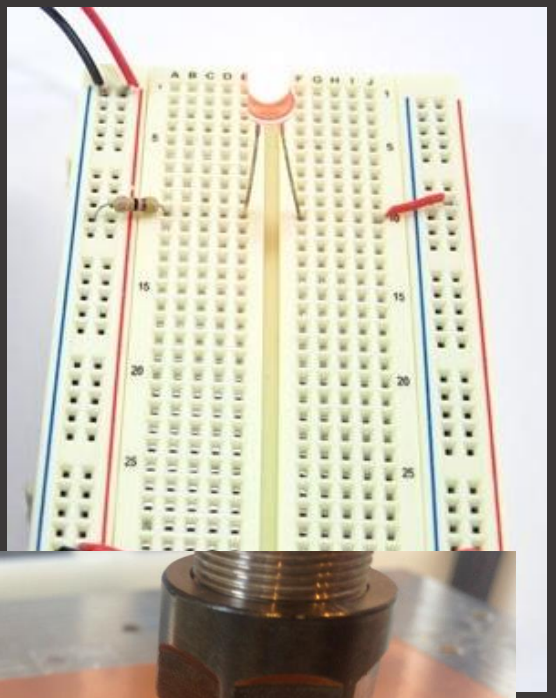
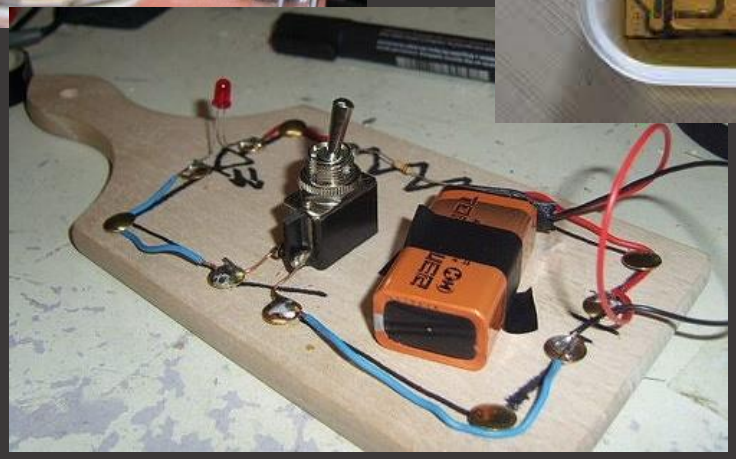
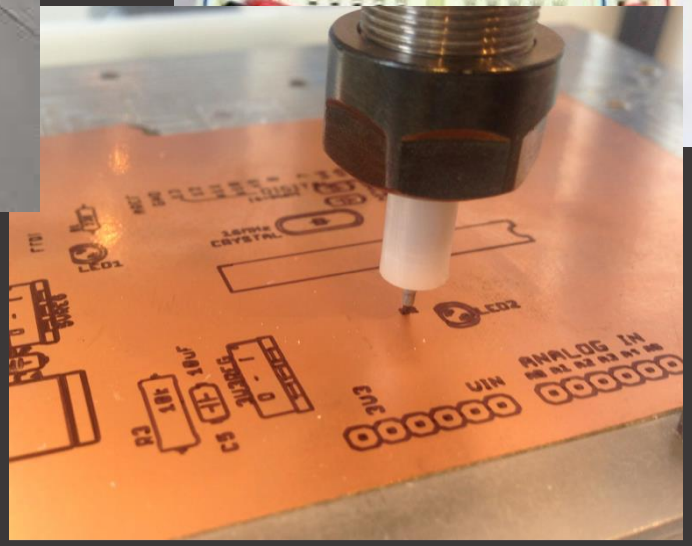


Image source: allaboutcircuits.com

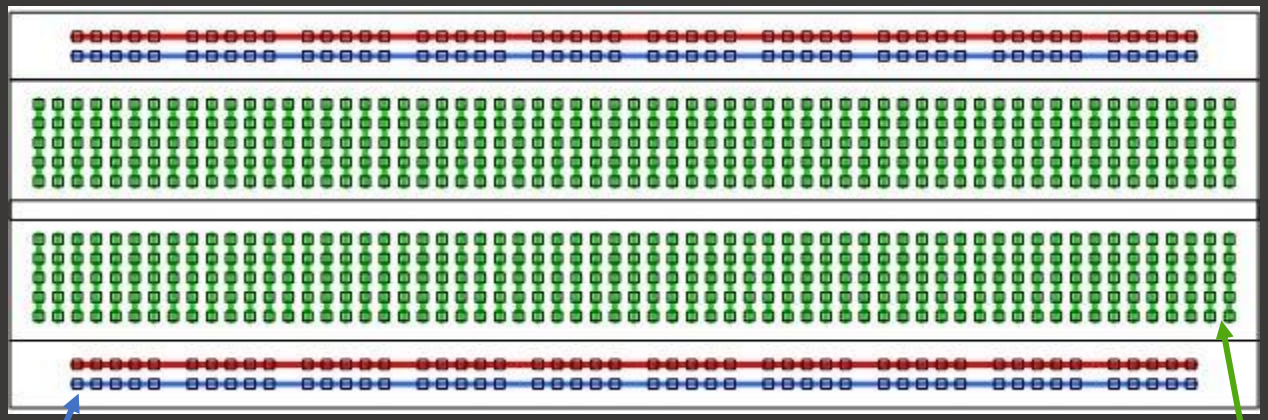
Prototyping Techniques







Using a Solderless Breadboard

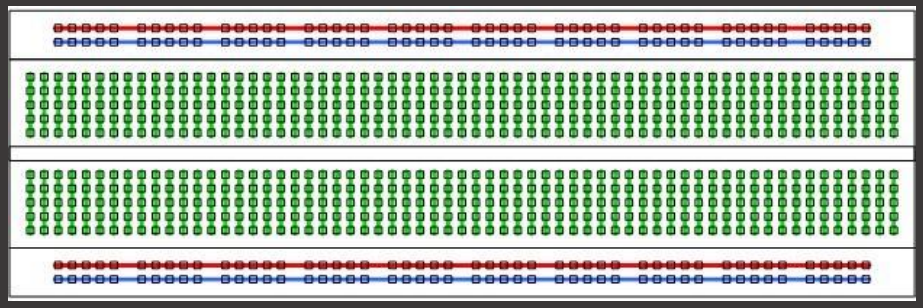


Power Supply Buses

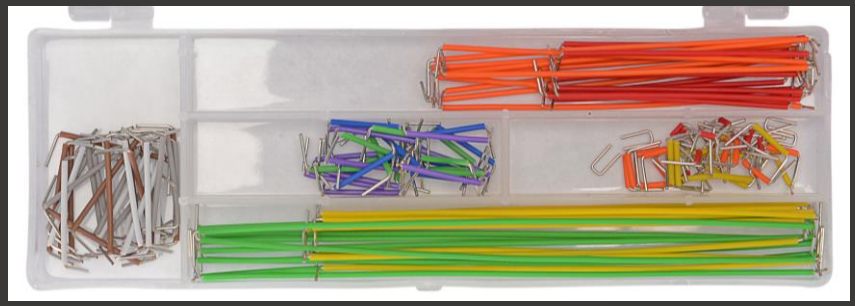
Circuit Connections

Things You Need for Breadboarding

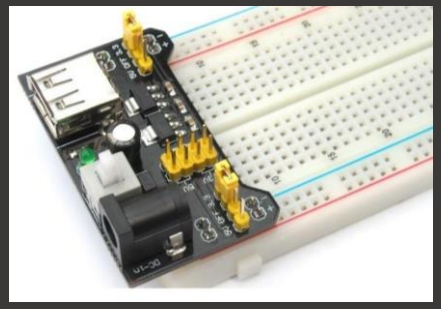
Breadboard

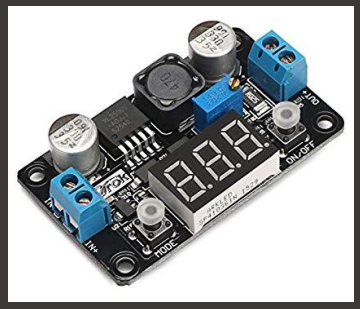


Jumper Wire Kit

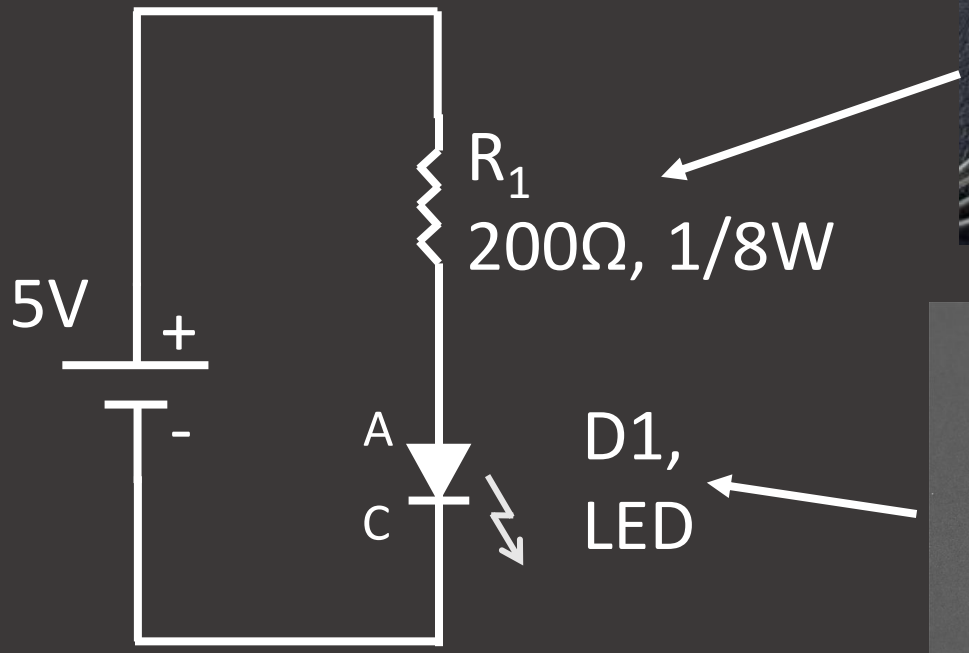


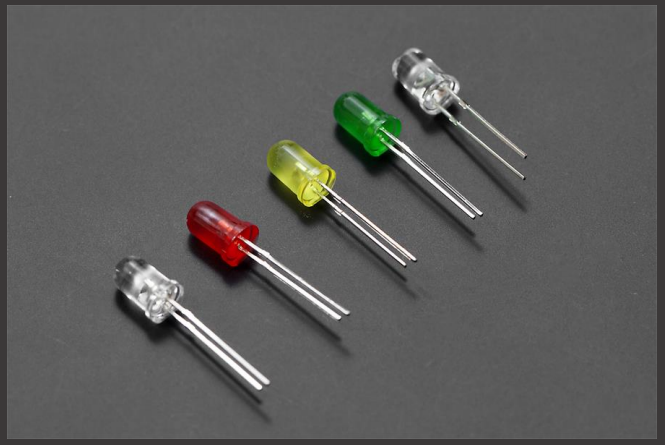
Power supply(ies)





Let’s Build a Circuit





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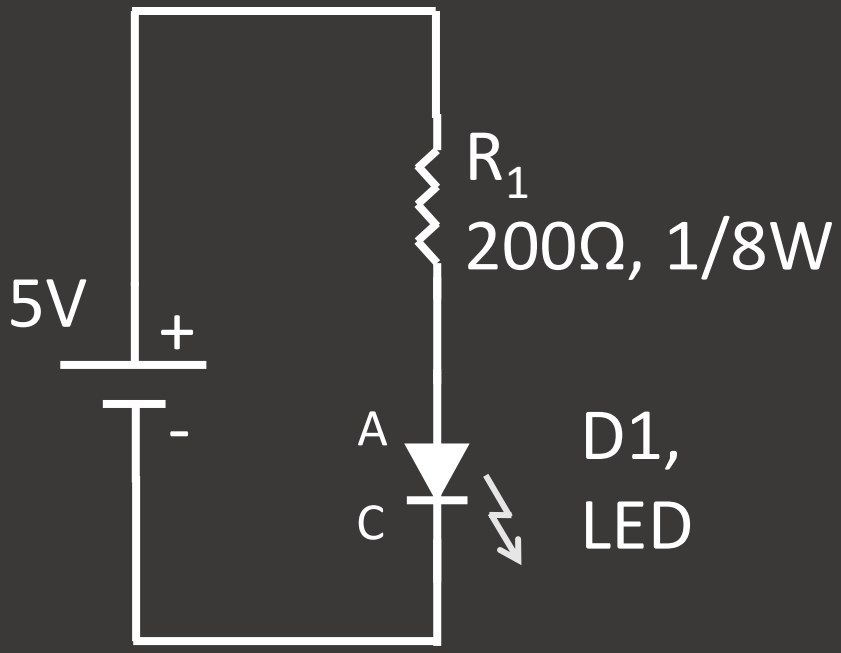
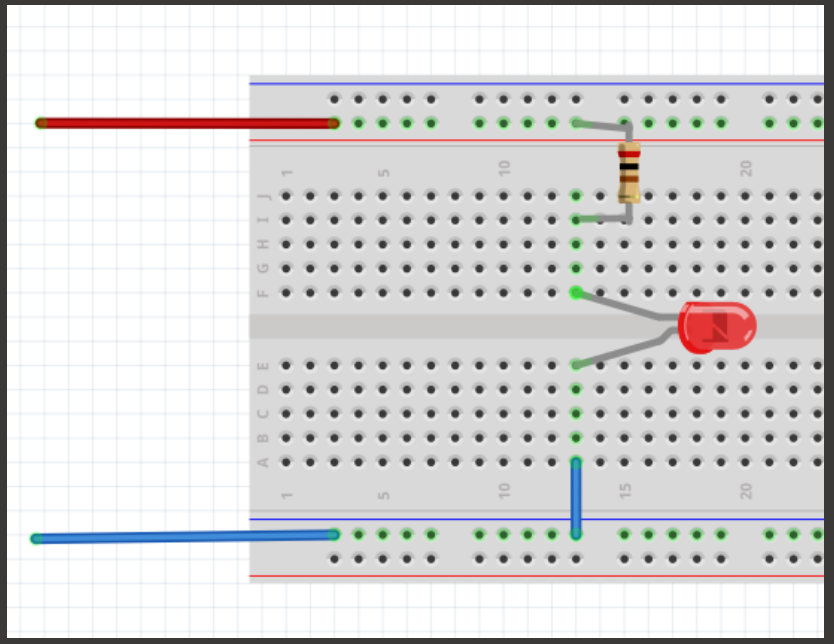
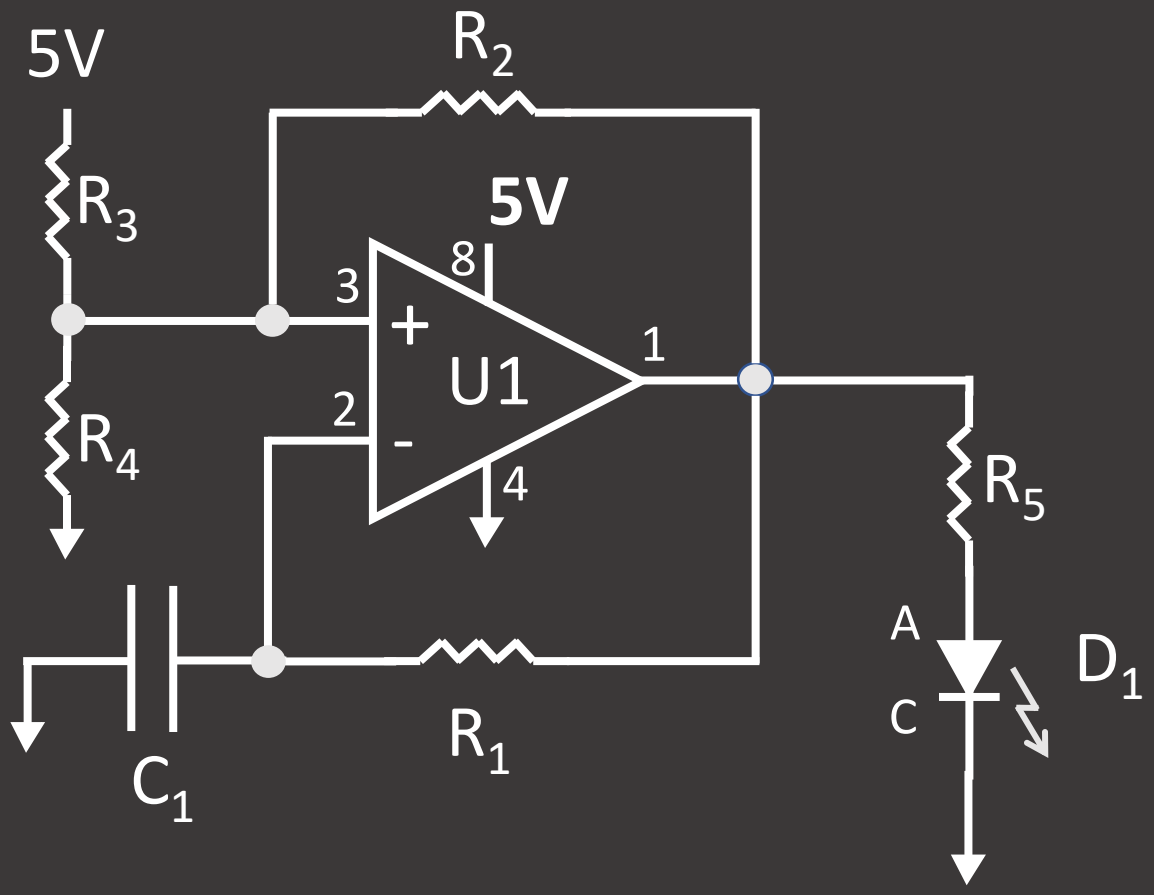




Build an Oscillating Blinker



C_1 = 1µF
D_1 = LED
R_1 = 120kΩ
$R_{2,3,4}$ = 47kΩ
R_5 = 200Ω
U_1 = MCP6002

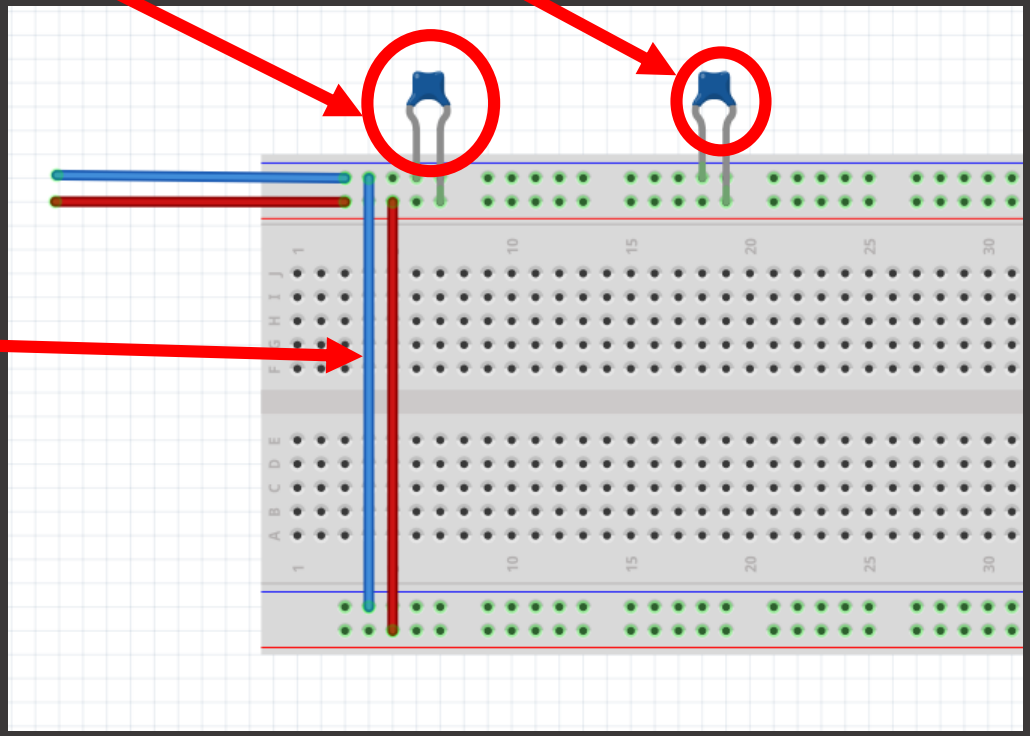
$$f \approx {}^{1}/_{2R_1C_1}$$

Set Up Power Supply Rails

10µF cap where supply enters

0.1µF capacitors near integrated circuits

Tie alike colored supply rails together



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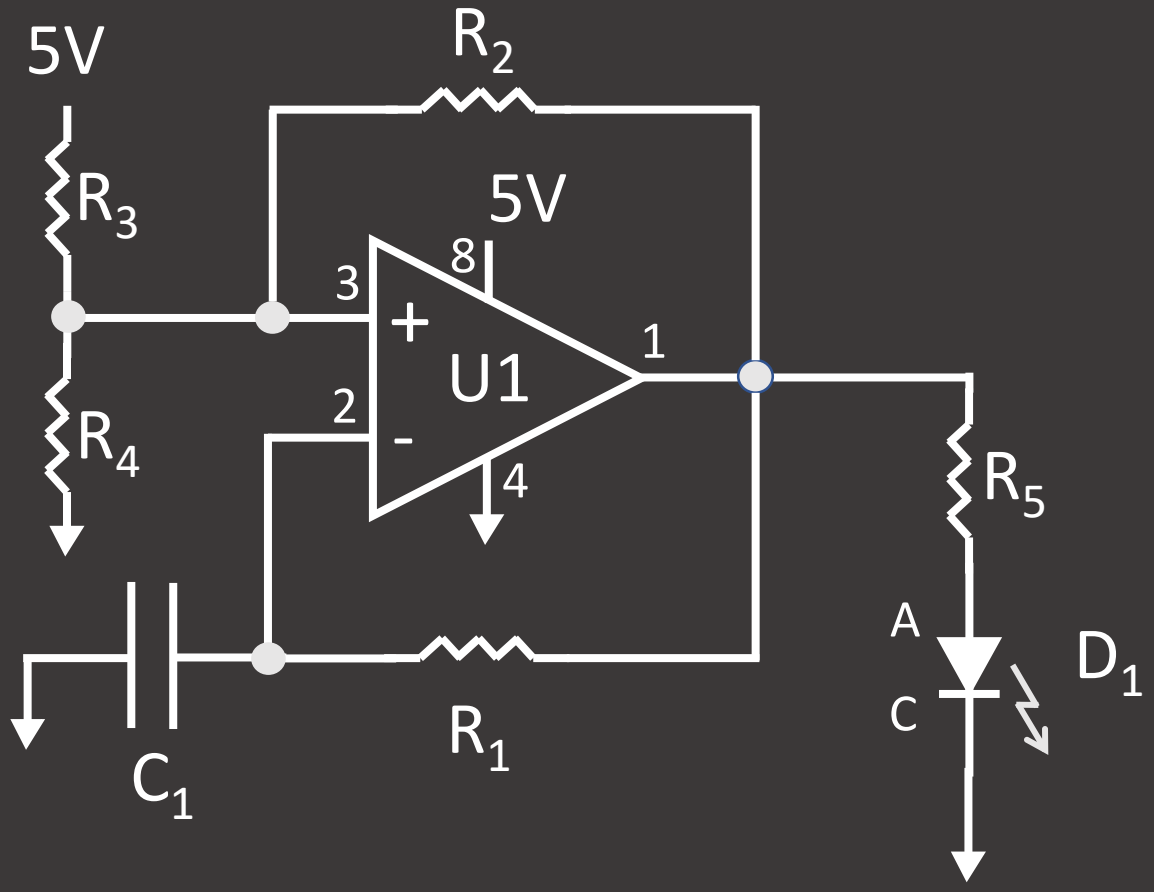

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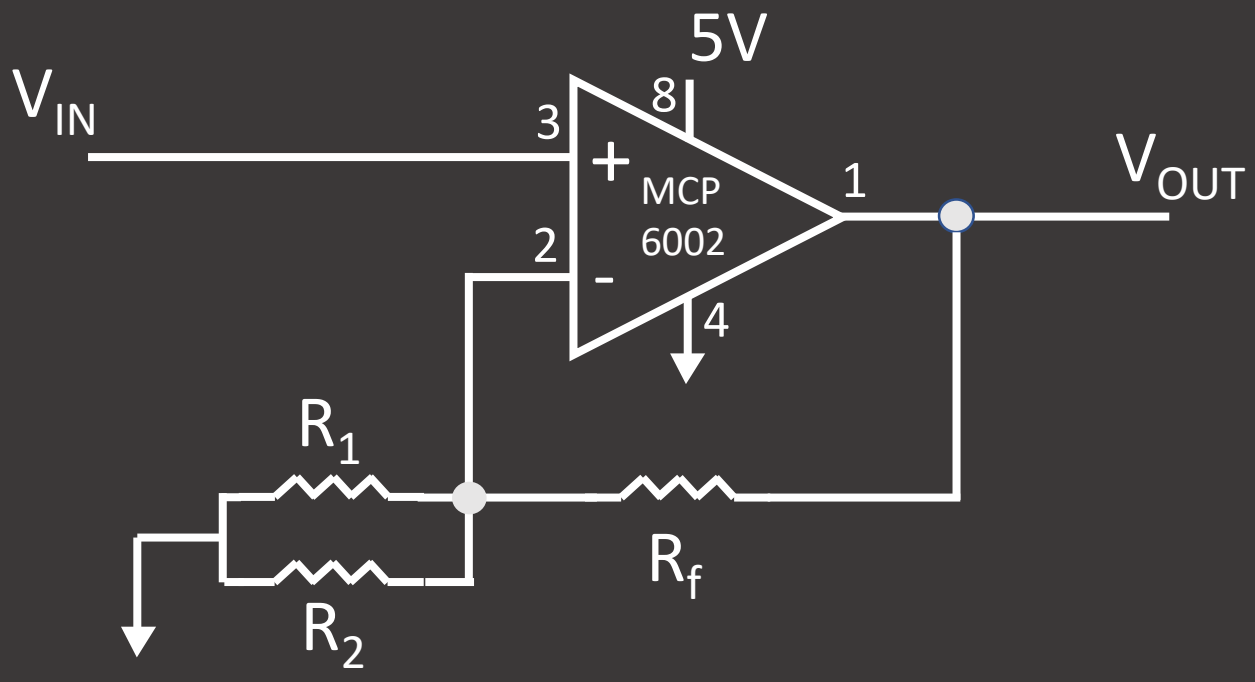
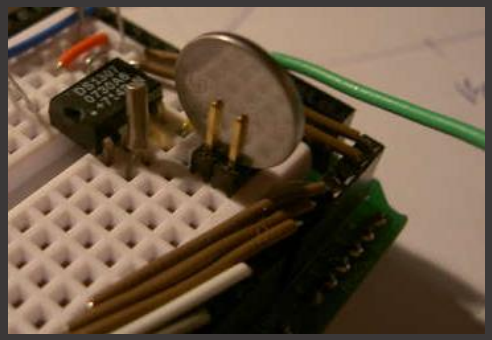
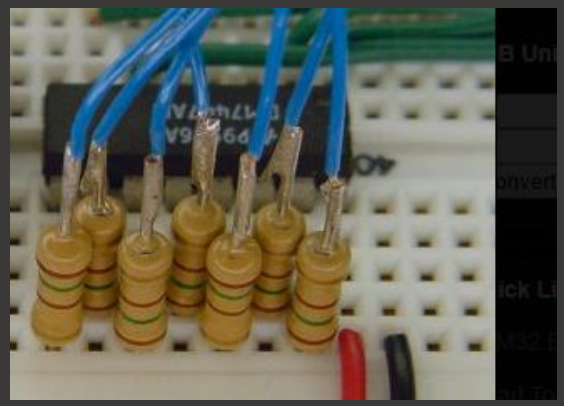
Build a x3 Amplifier



More Hints and Tips

- Power Supplies
  - Watch power supply polarity!
  - Connect the two power rails to each other
  - Add a large (10F) bypass where power comes in
  - Add 0.1µF bypass to each rail, near supply pins
- Trim component leads so they don't short into each other
- Dupont wires make cheap, long jumpers
- Drop an LED and resistor on the board to use as a logic probe






"That's all Folks!"
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