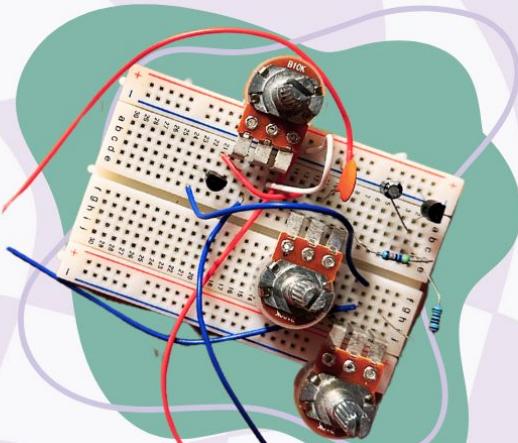


# SUPER SIMPLE DIY SYNTH WORKSHOP



W/ MIR JEFFRES  
&  
CHRISTINE HOANG



# Mir Jeffres



- Mir received his Master's degree in Music Technology at Georgia Tech
- Audio applications engineer for Texas Instruments
- He can be found hacking electronics, performing live with his homemade synths, and sharing his passion for music and audio

# Christine Hoang

- Software engineer, maker, synth geek, dj, and musician
- Avid supporter of the music community in the Dallas, Texas area through music organizations and events coordination
- She can be found programming and hacking for creative and educational pursuits



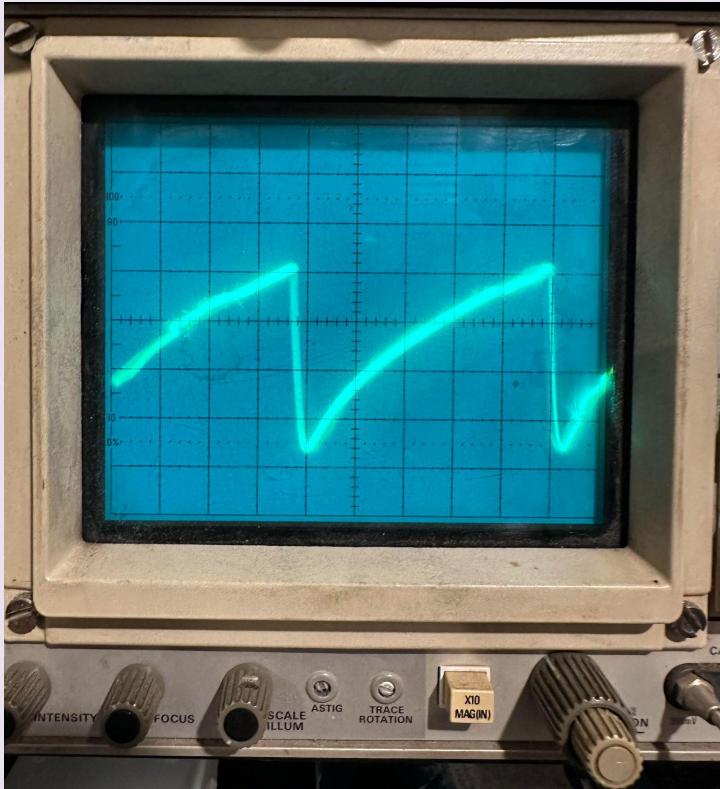
# What are we learning?

- Reverse Avalanche Oscillator Synthesis
- How to read a circuit schematic
  - Transistor operation and reverse avalanche breakdown
  - RC filters and Audio Amplifier
- Components and Materials
- Building the synth and sound testing

# Demo of synthesizer



# What kind of sounds are we making?

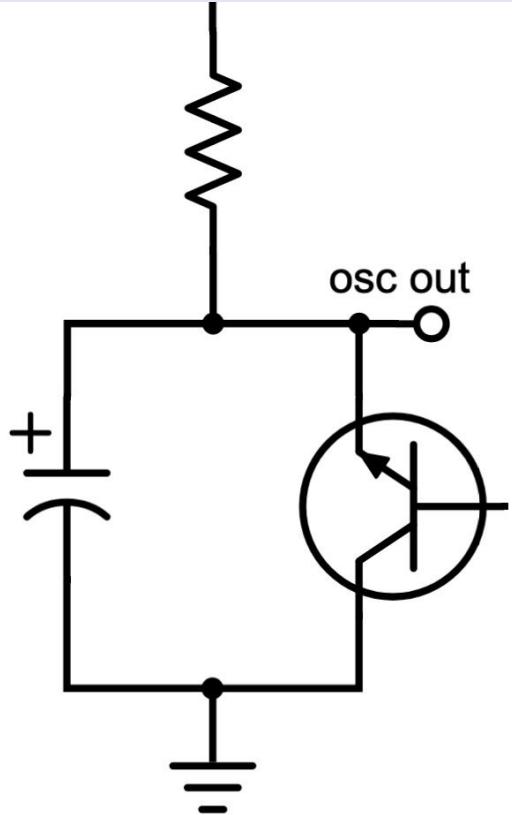


## Sawtooth Waves!

Sawtooth waves have a buzzier sound than a sine wave due to its teeth-like shape

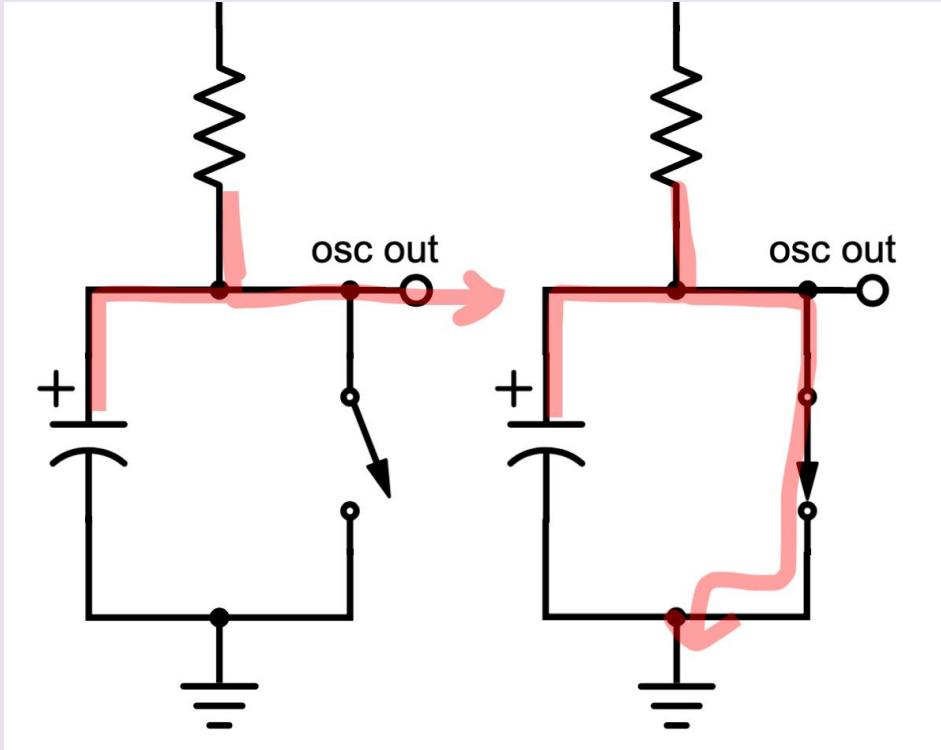
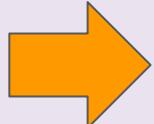
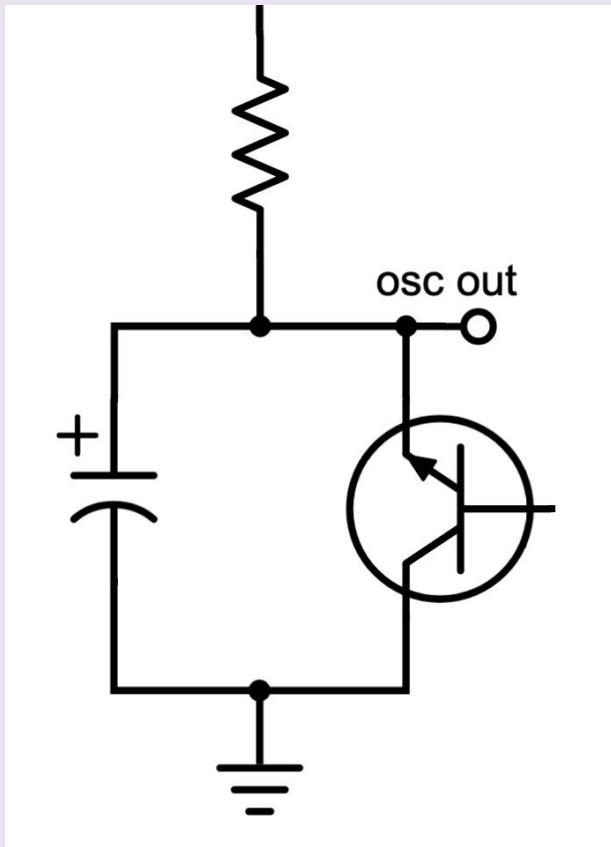
# What is a Reverse Avalanche Oscillator?



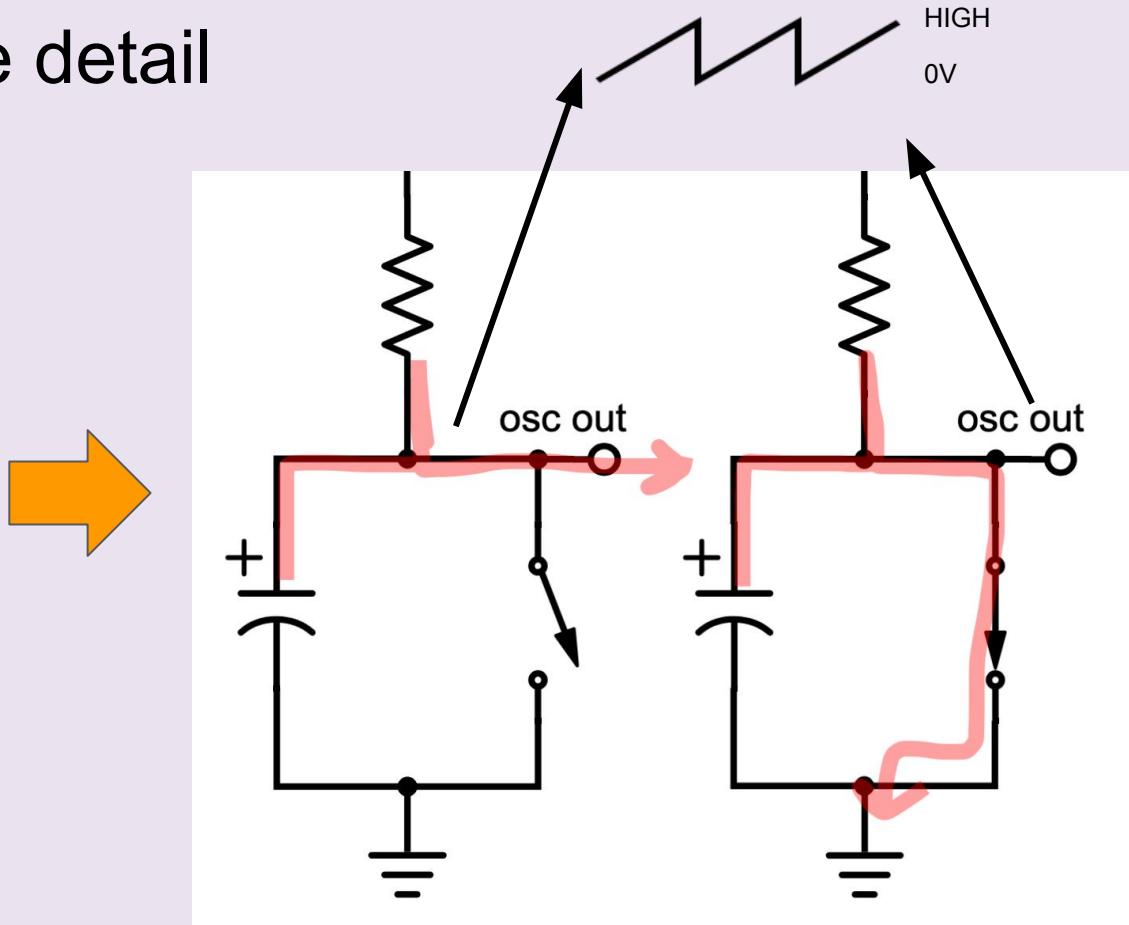
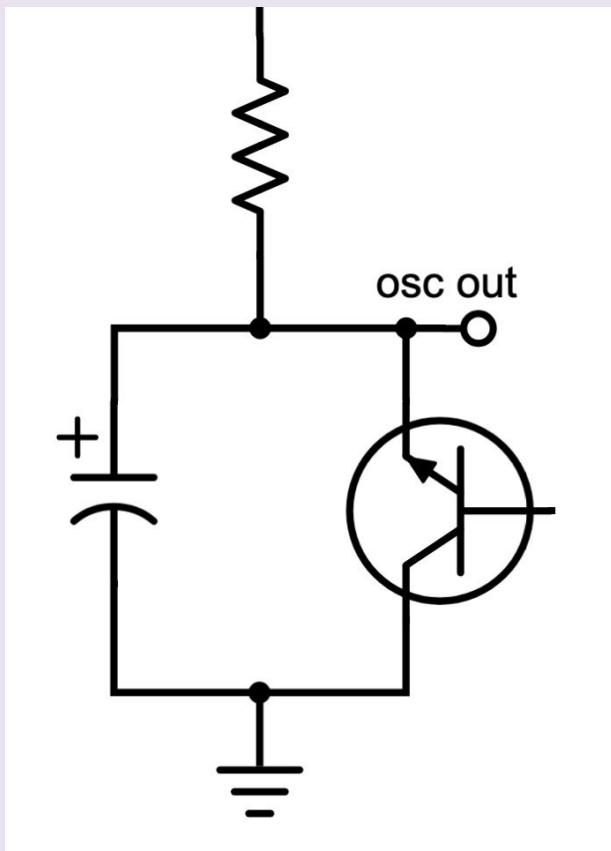


Reverse avalanche circuit

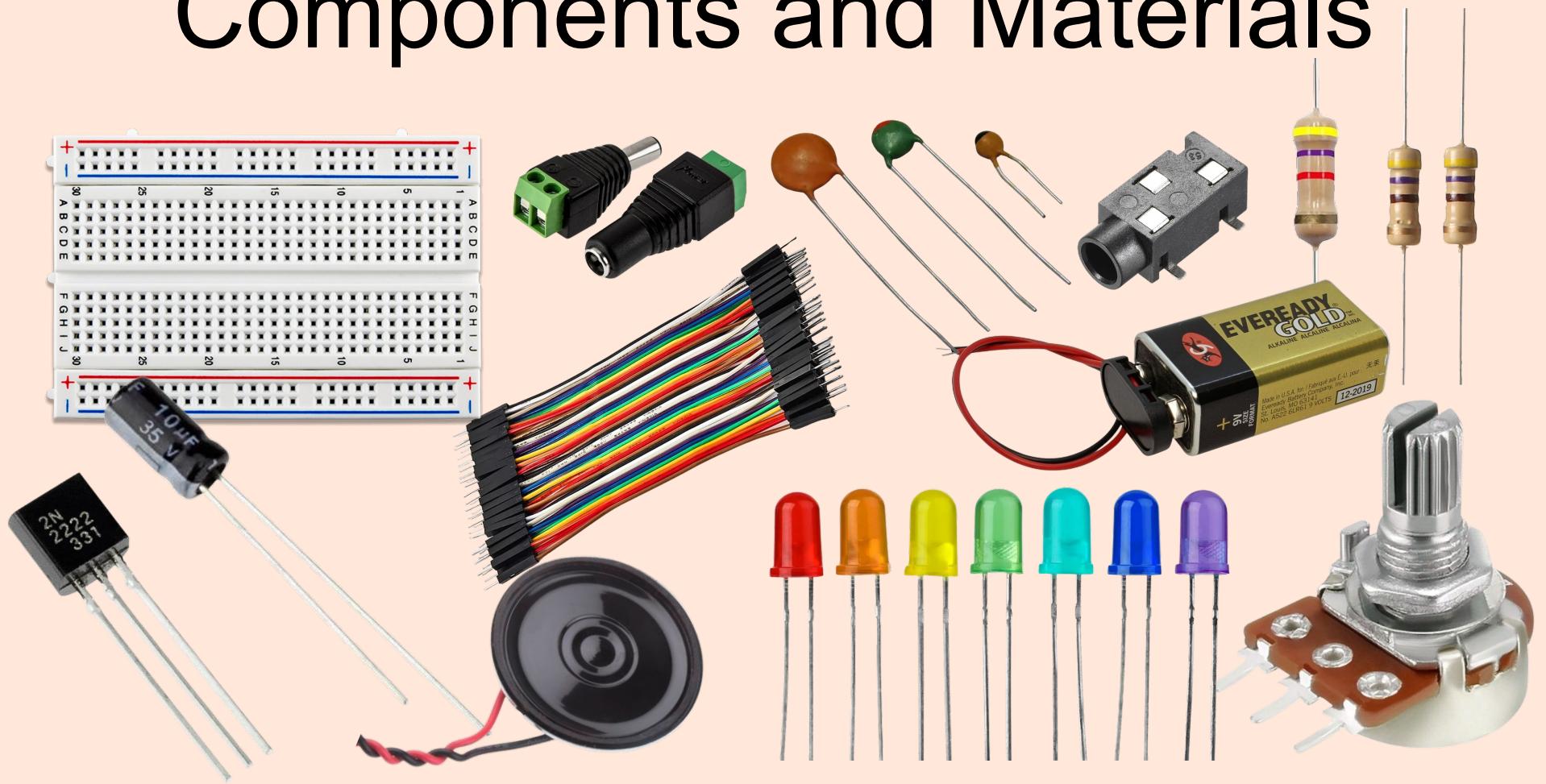
# Reverse avalanche detail



## Reverse avalanche detail



# Components and Materials

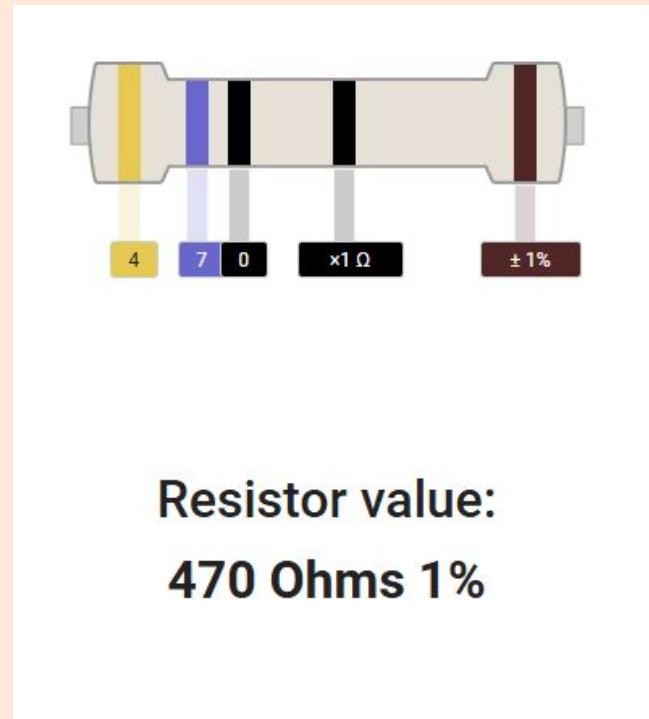
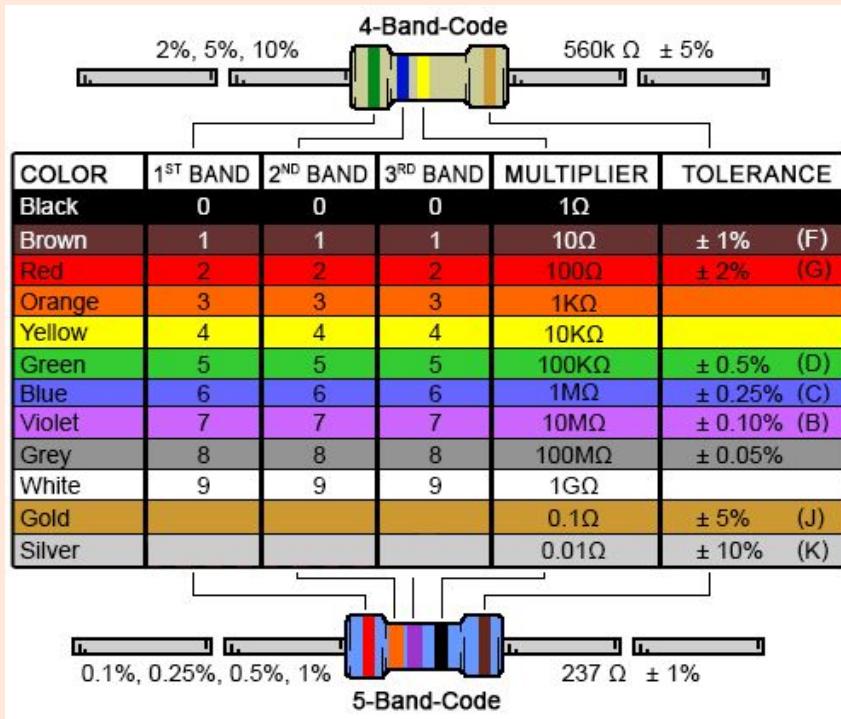


# Resistor

- Resistors reduce the flow of current
- They are used to control current, divide voltages, time control, and many more!
- They are measured in Ohms
- Not polarized

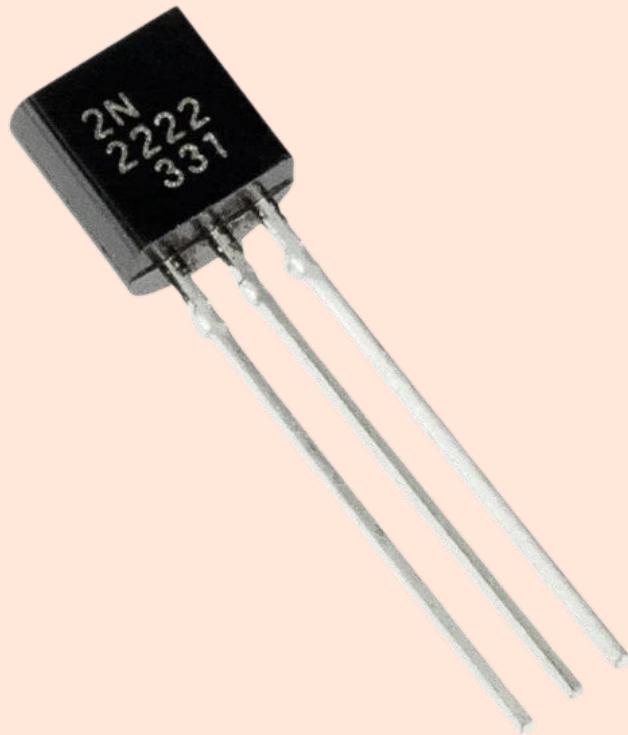


# Resistor Bands



# Transistor

- Transistors amplify electrical signals
- They typically have a Collector, Base, Emitter
  - Emitter is the negative lead
  - Base activates the transistor
  - Collector is the positive lead



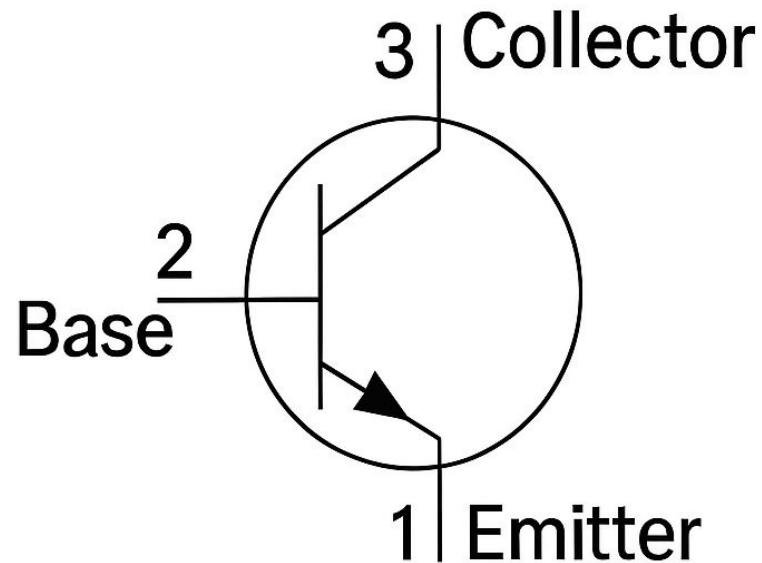


NPN

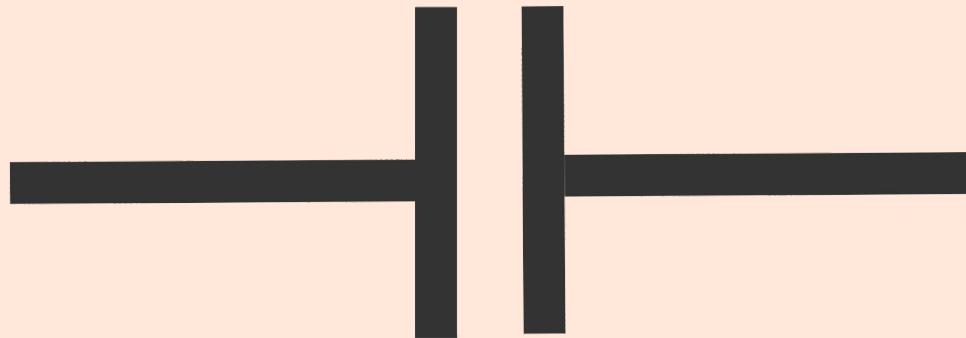
1 Emitter

2 Base

2 Collector

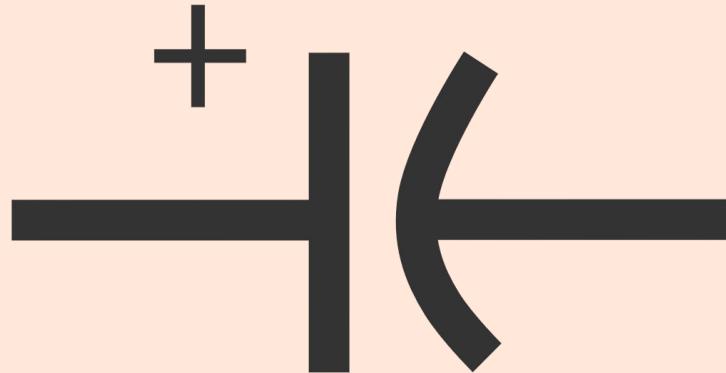


# Ceramic Capacitors

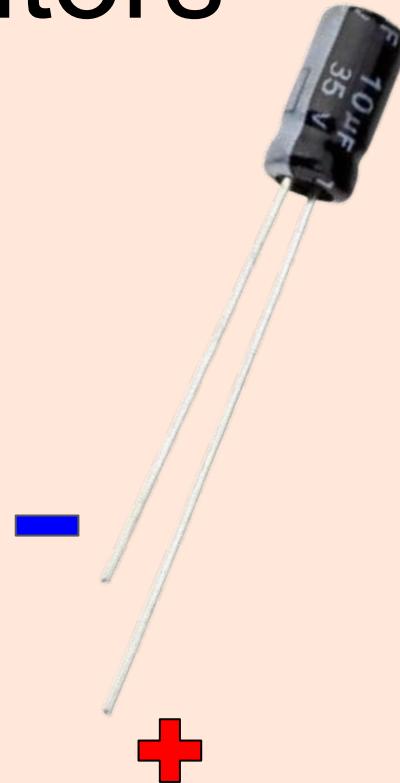


**Symbol for non-polarized capacitor**

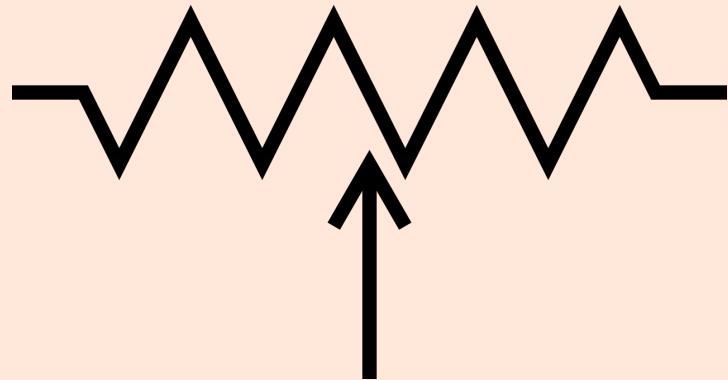
# Electrolytic Capacitors



**Symbol for a polarized capacitor**

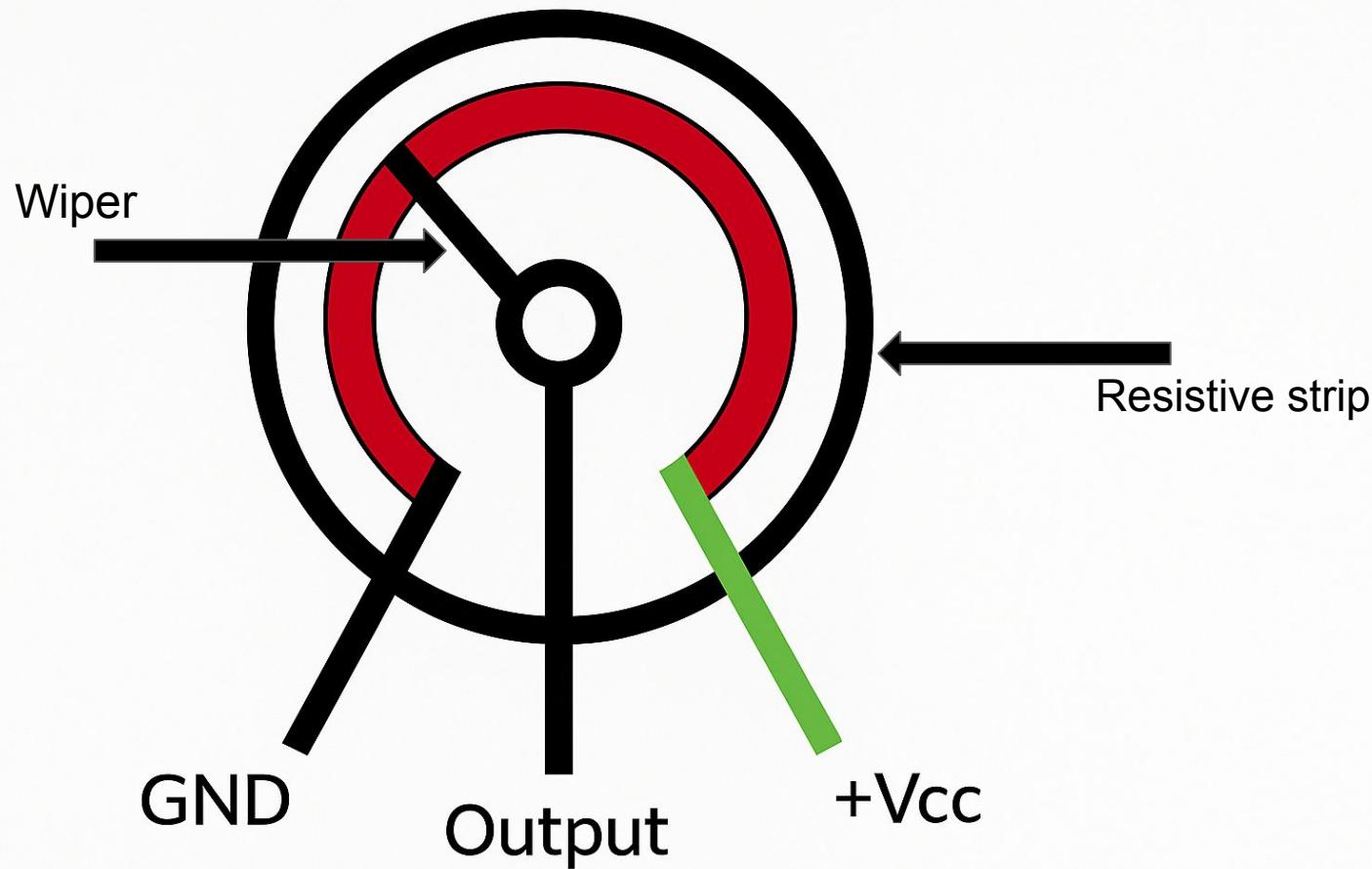


# Variable Resistor aka Potentiometer



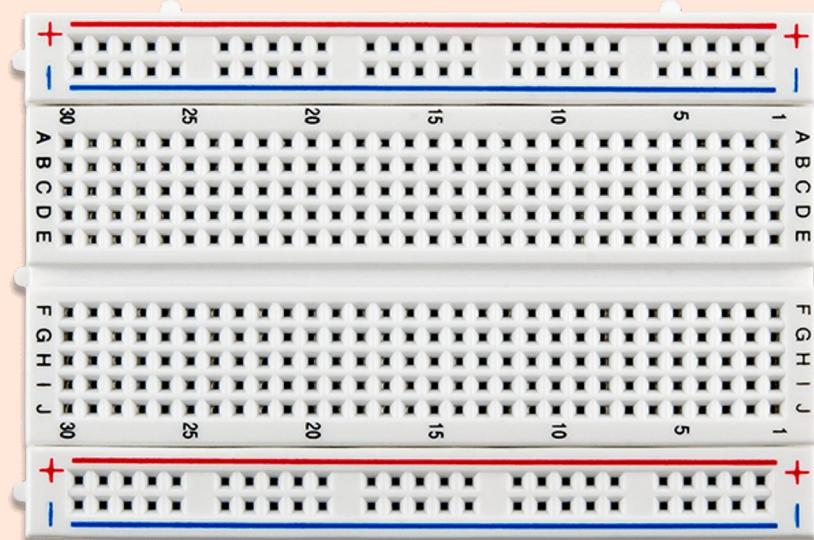
**Symbol for a variable  
resistor**



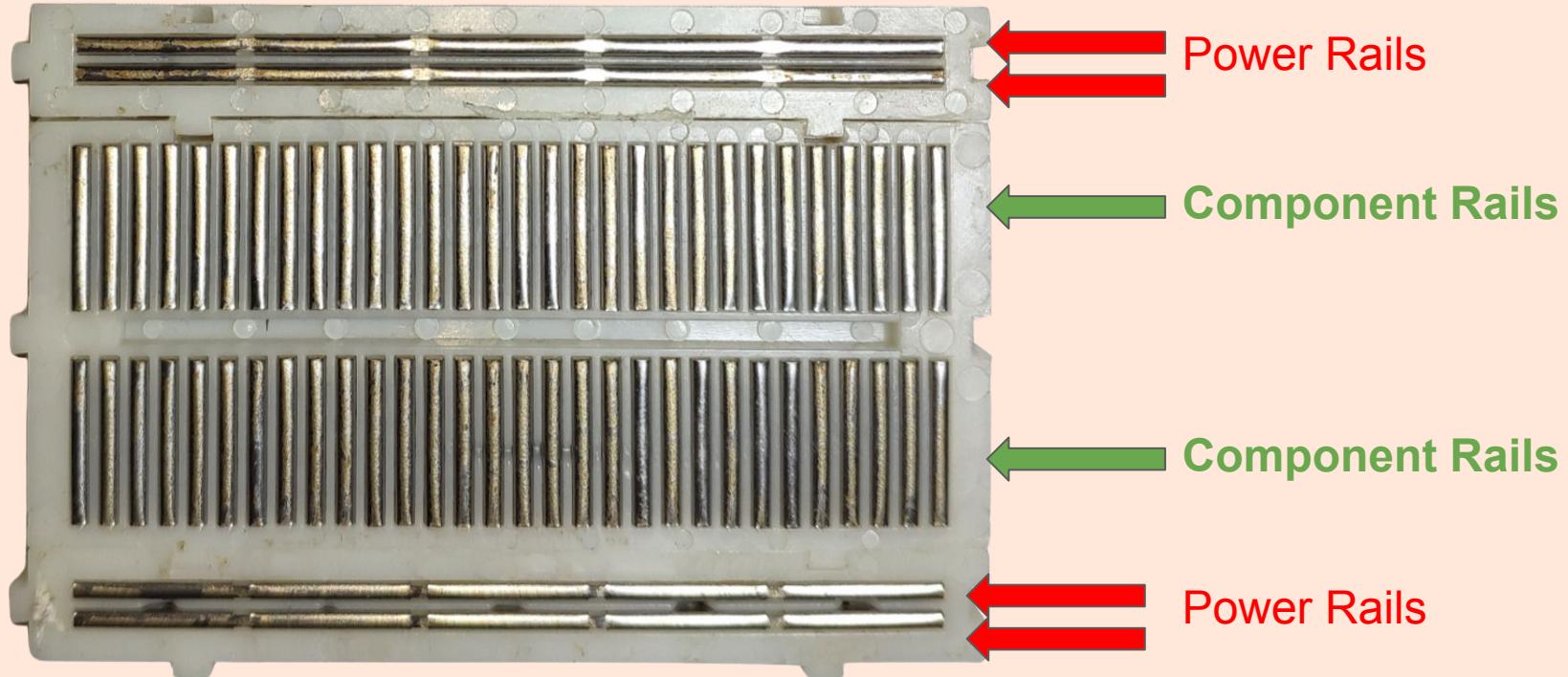


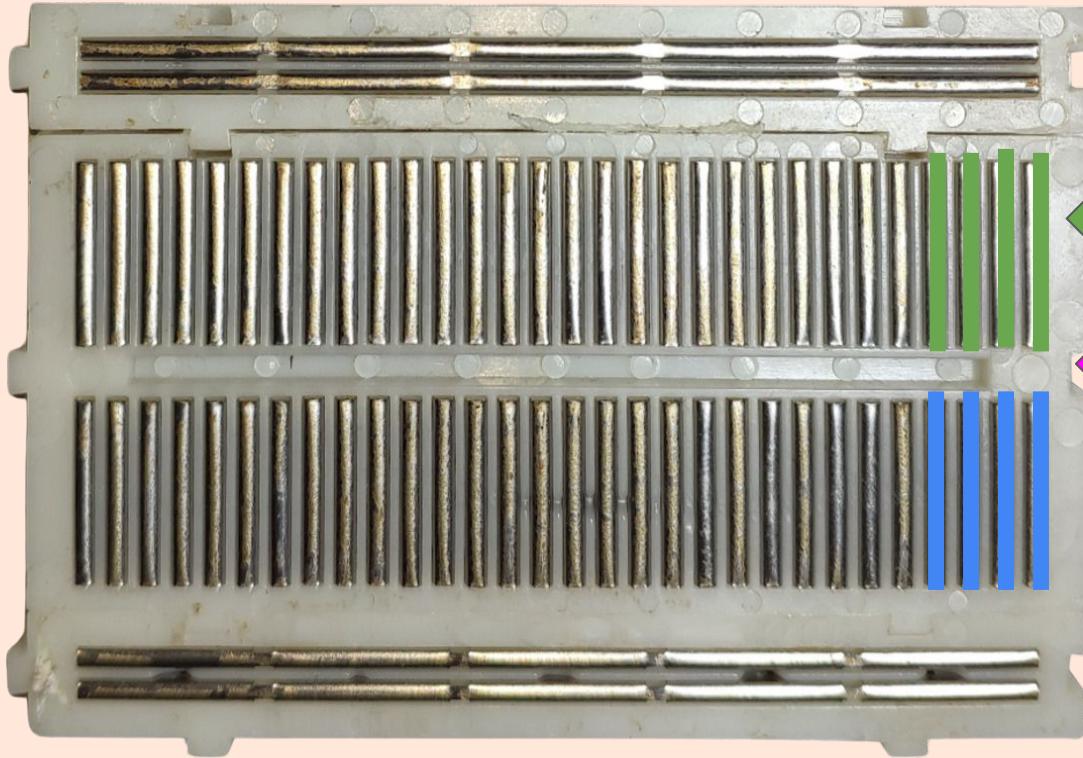
# Breadboard

- A breadboard is a plastic board with conductive metal channels.
  - It allows us to build and test circuits without soldering components.
- **Red** rails represents Power
- **Blue** rails represents Ground



# Inside a Breadboard



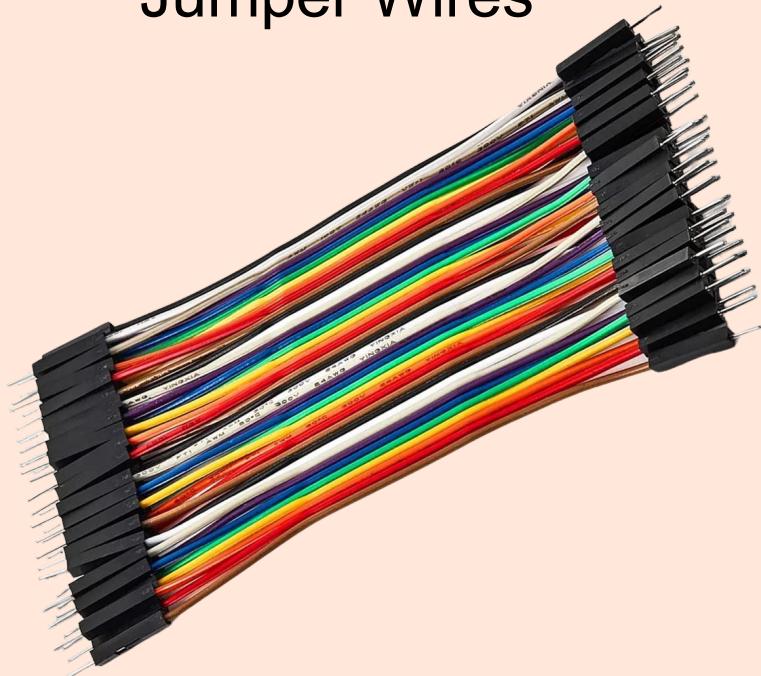


Vertical holes are linked together

But they are NOT linked across the divider

# Connectors

Jumper Wires



DC Plug Terminals



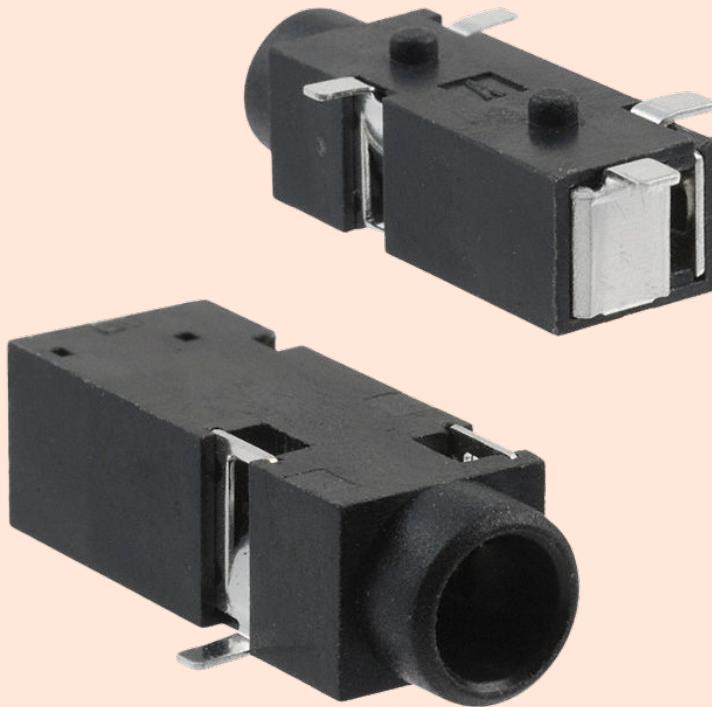
# Light-Emitting-Diode (LED)

LEDs are polarized

- They have + and - legs
- LEDs have one leg that will be longer to indicate the positive leg
- Often used to help indicate power is on in circuits



# 3.5mm Headphone Jack



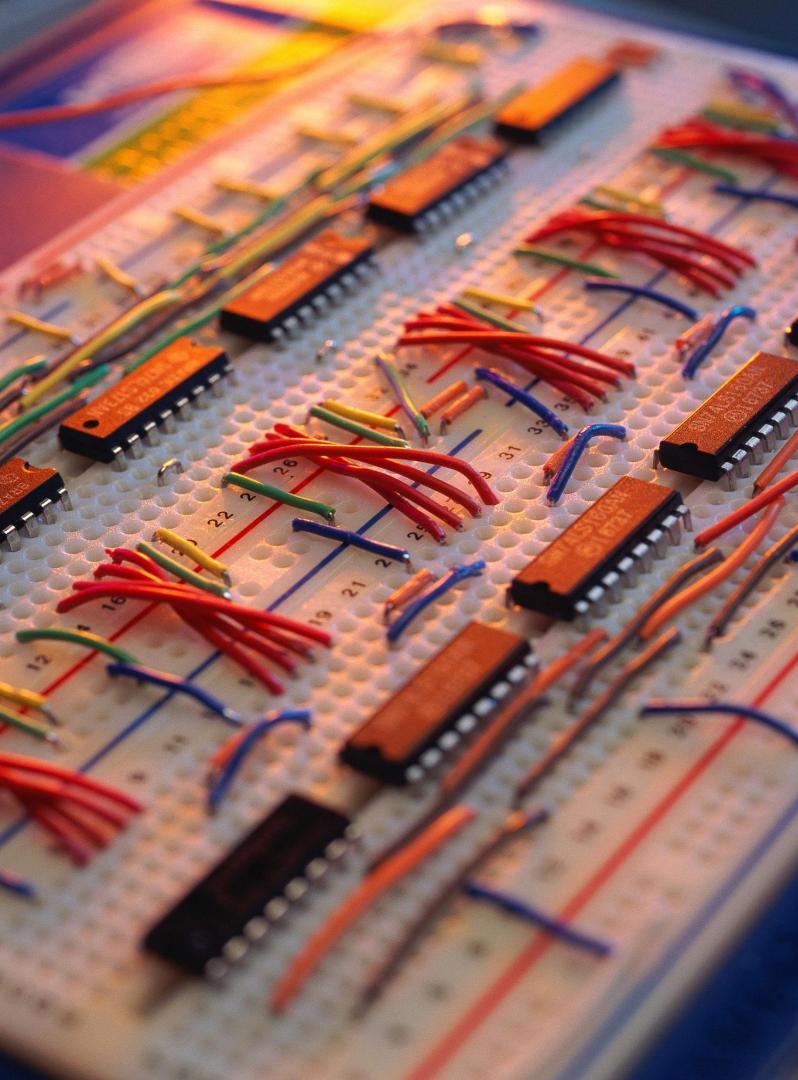
# Power

12V Power Supply



9V Battery





# Let's Build!

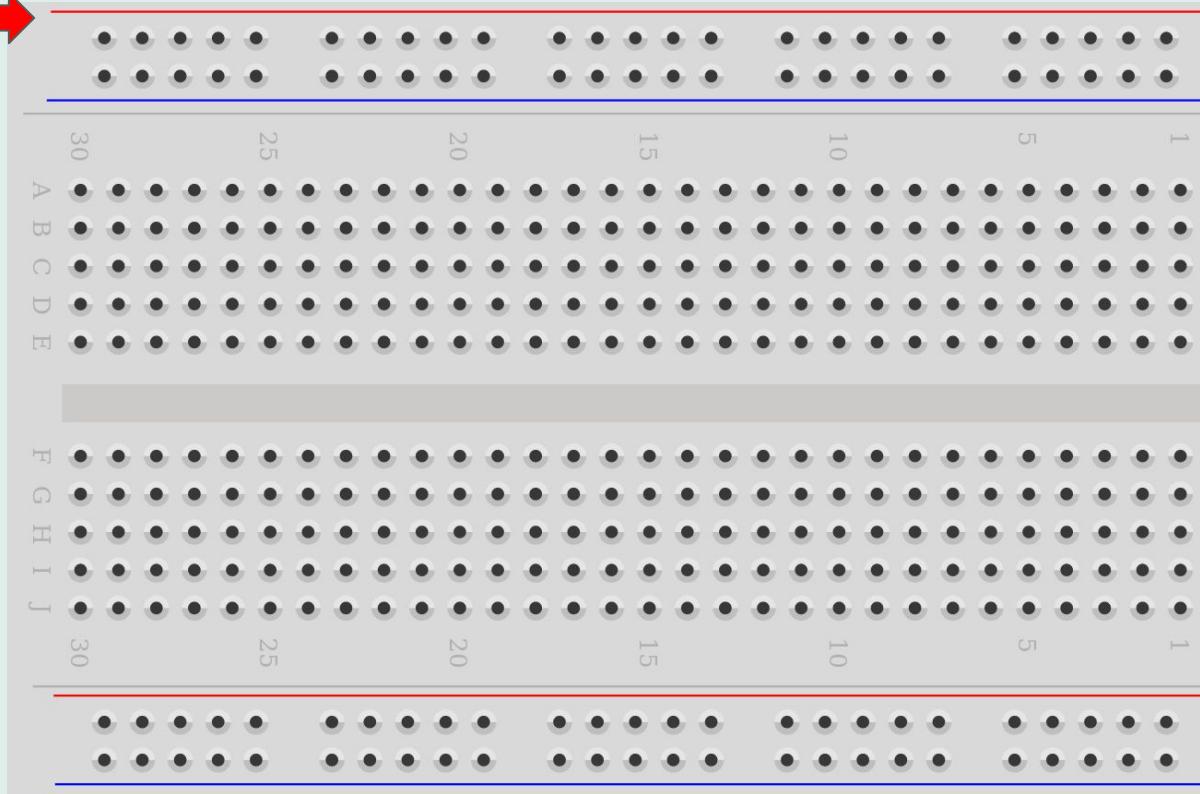
## **Safety Rule!**

Make sure to unplug your power when adjusting components.

Plug in your power when you are ready to test your circuit.

# Start with the Breadboard

Power is  
the red rail



Ground is  
the blue rail

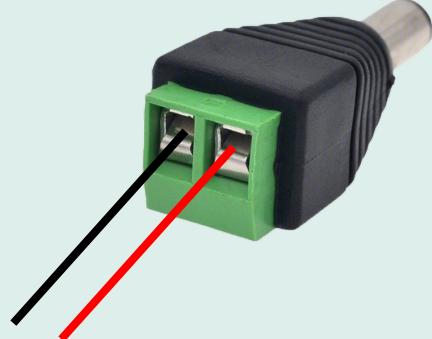
# Connect your DC Plugs



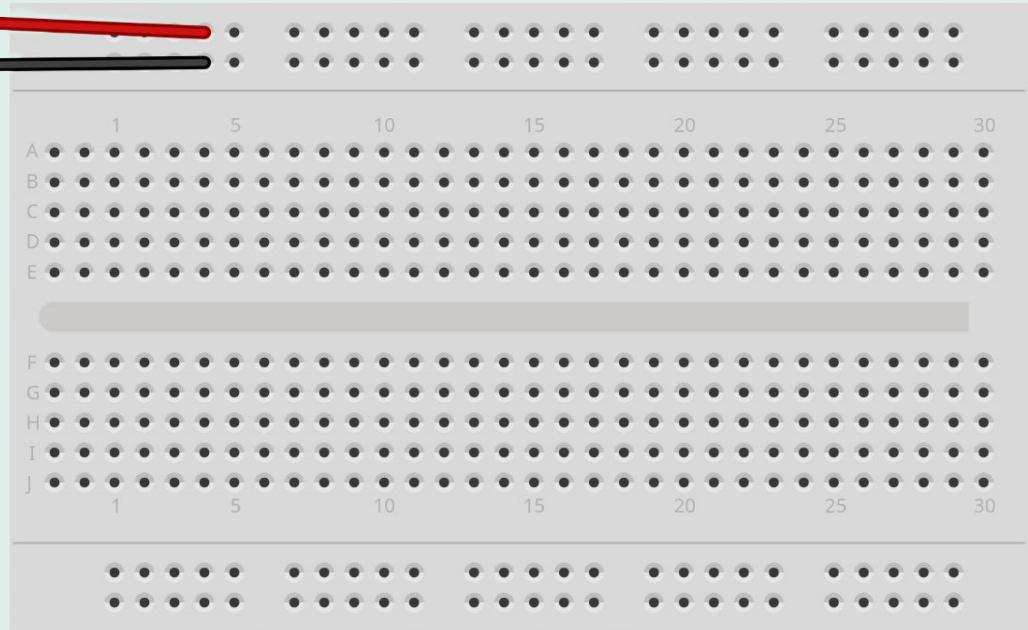
Black

or **Blue** = Ground, – sign

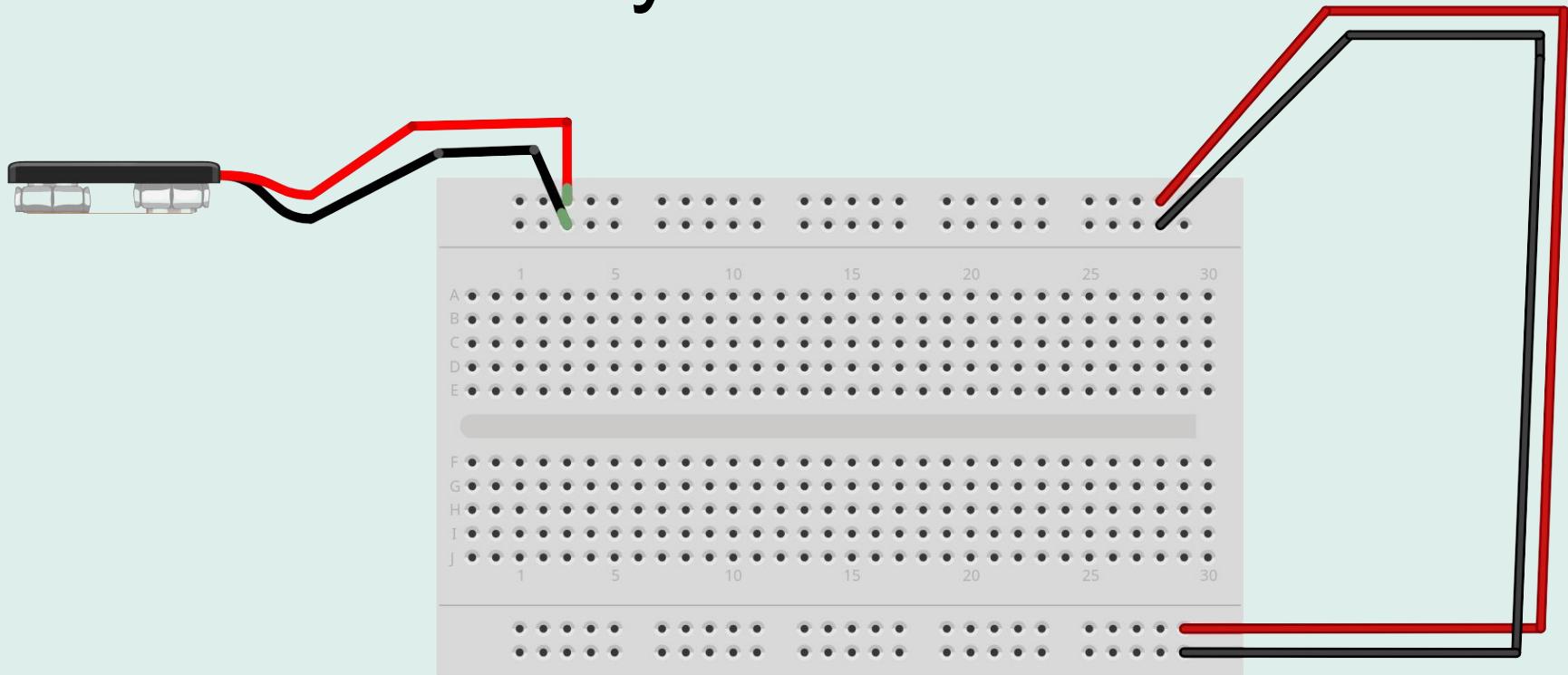
**Red** = Power, + sign



Insert the  
wires into the  
terminals and  
tighten the  
screws with a  
screwdriver



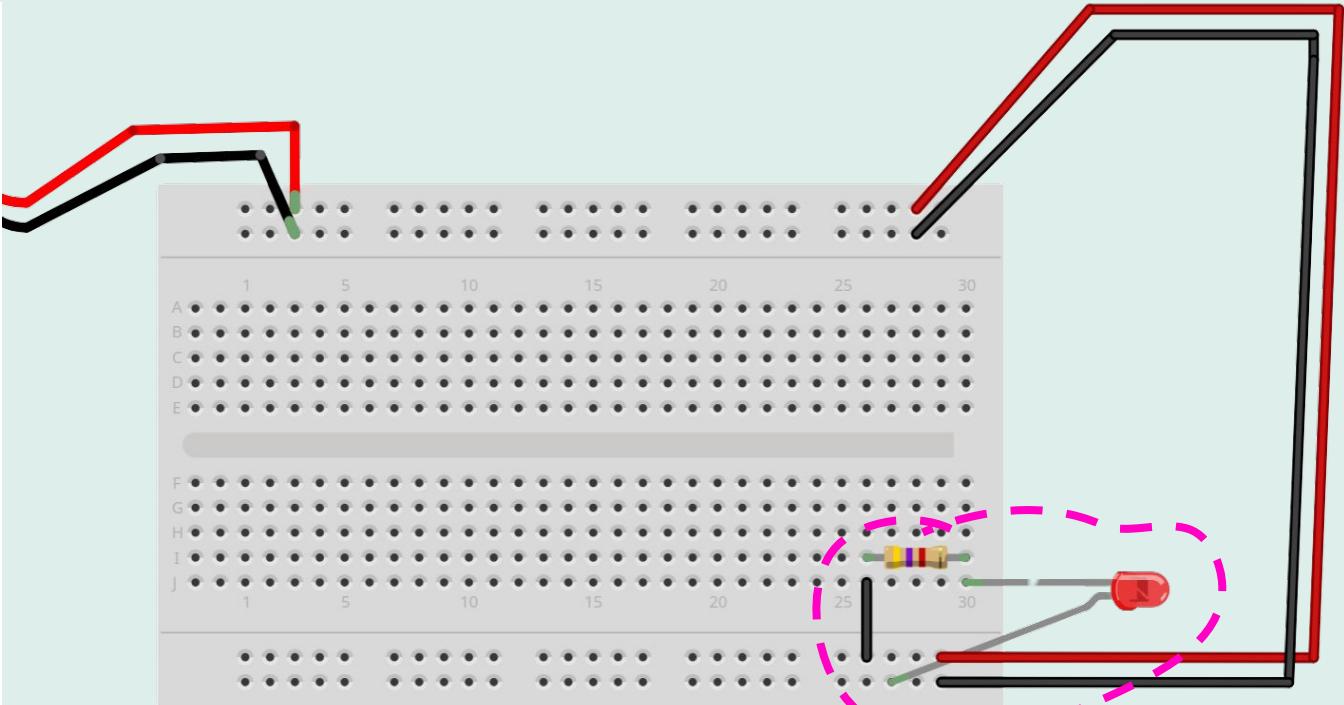
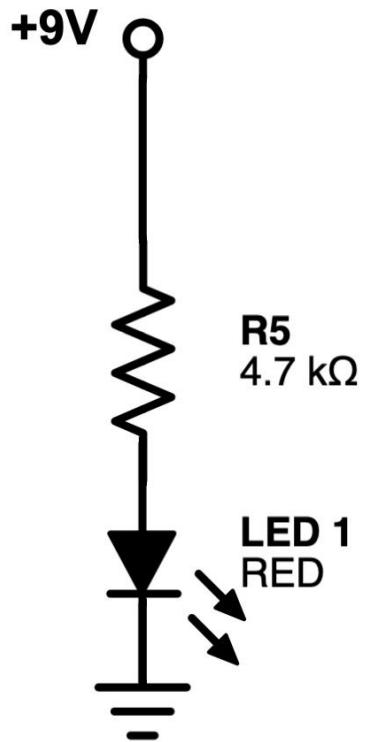
# Connect your Power Lines



Red is power = +

Black is ground = -

# Connect your LED



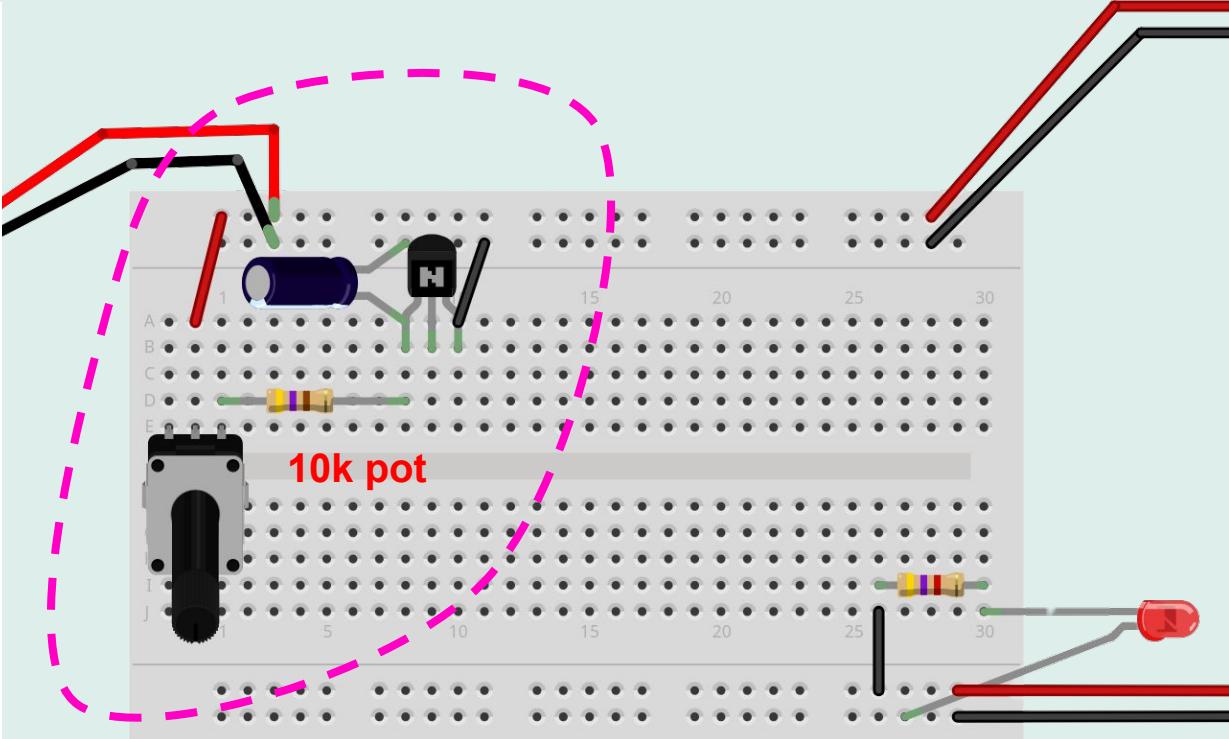
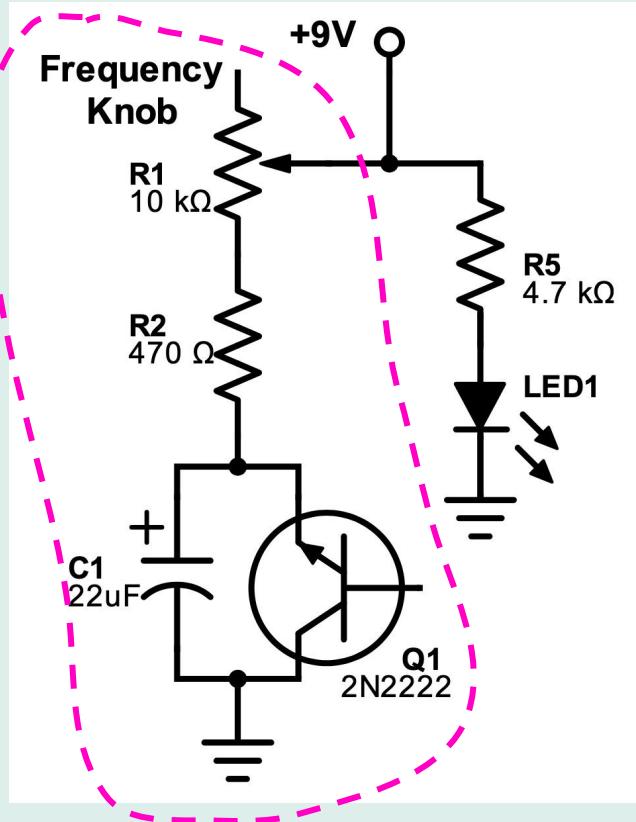
Longest leg of the LED goes to the bottom rail

# Connect your power

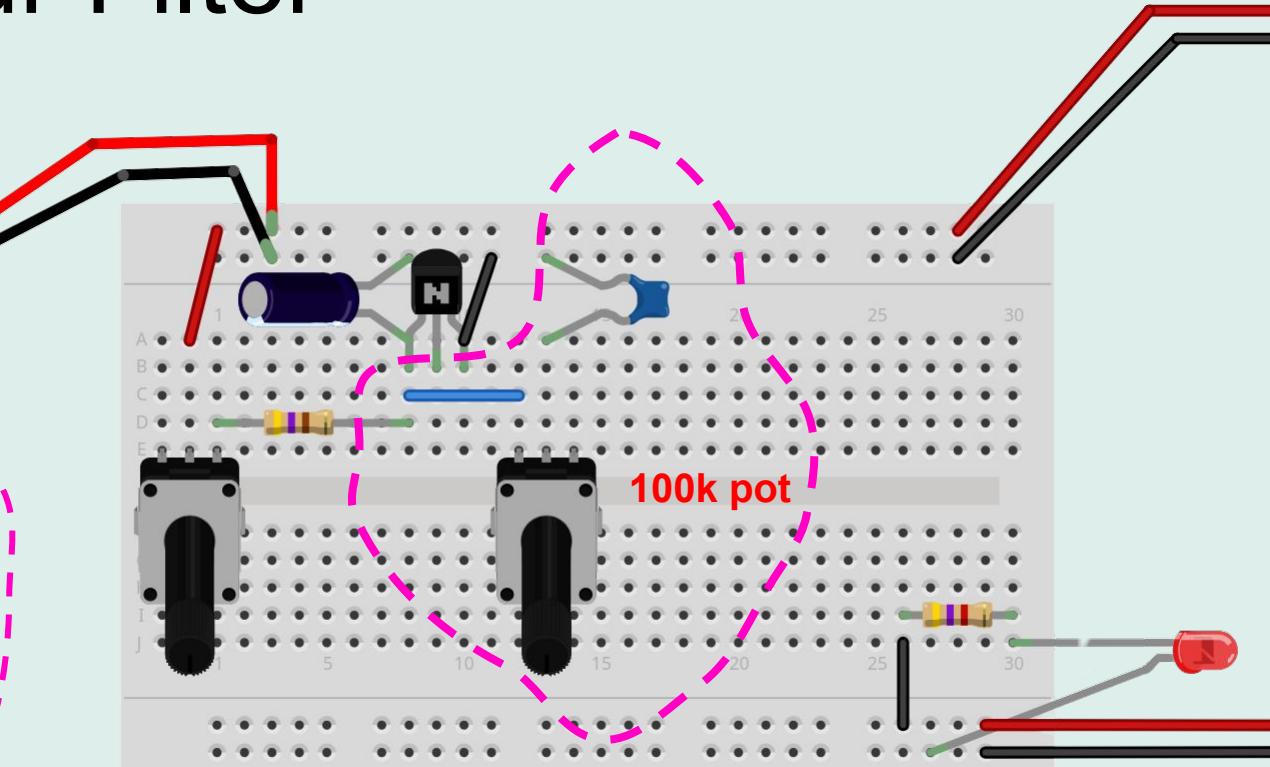
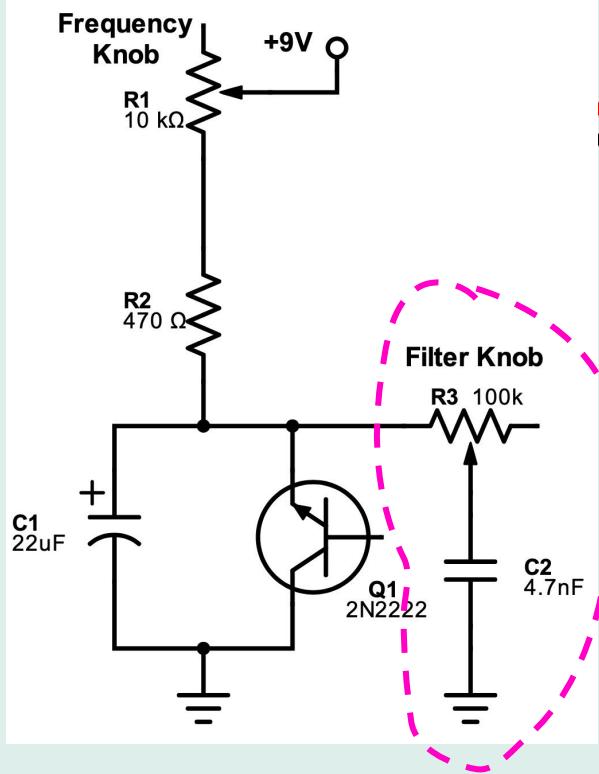
Check if your LED turns on!



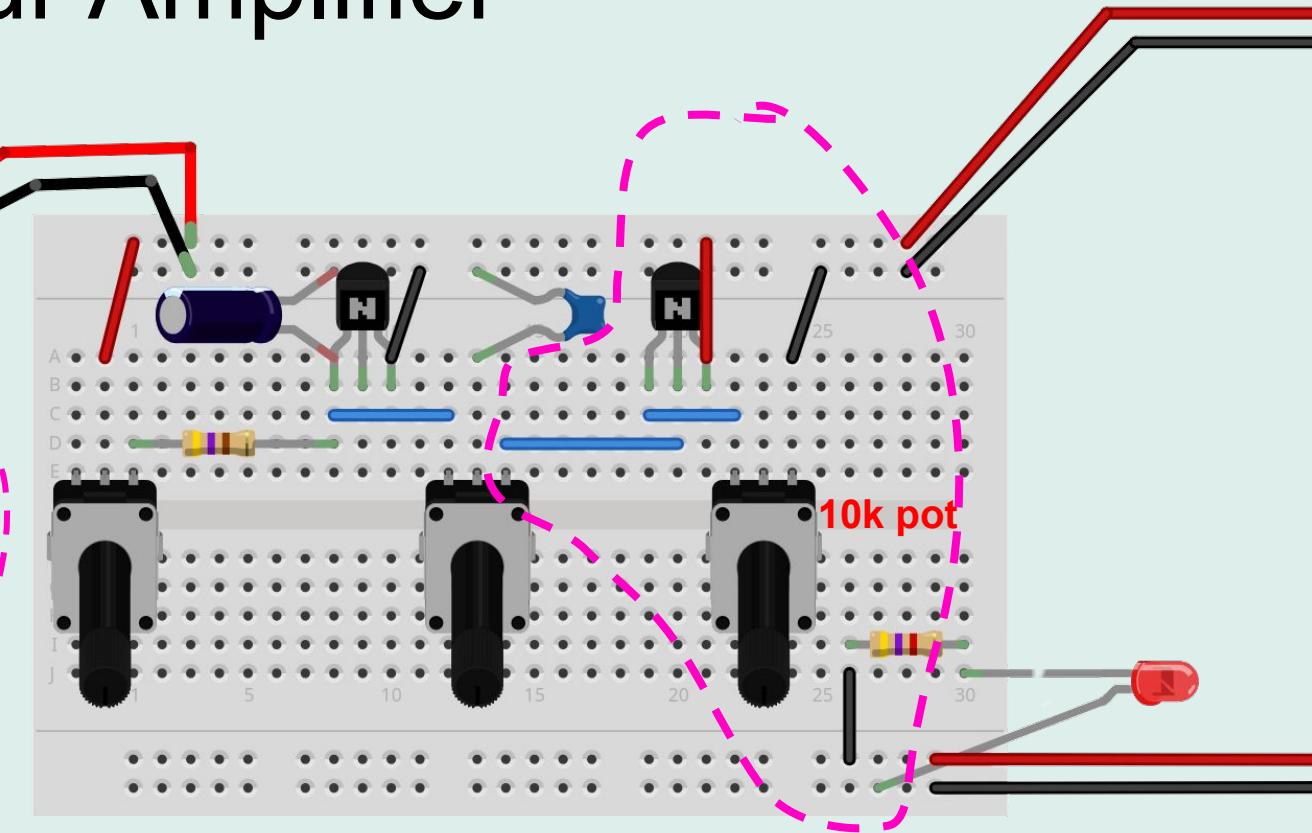
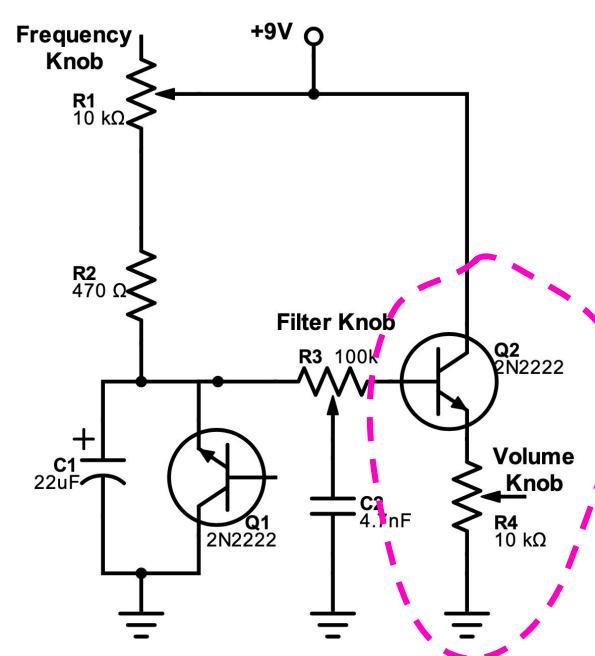
# Connect your Oscillator



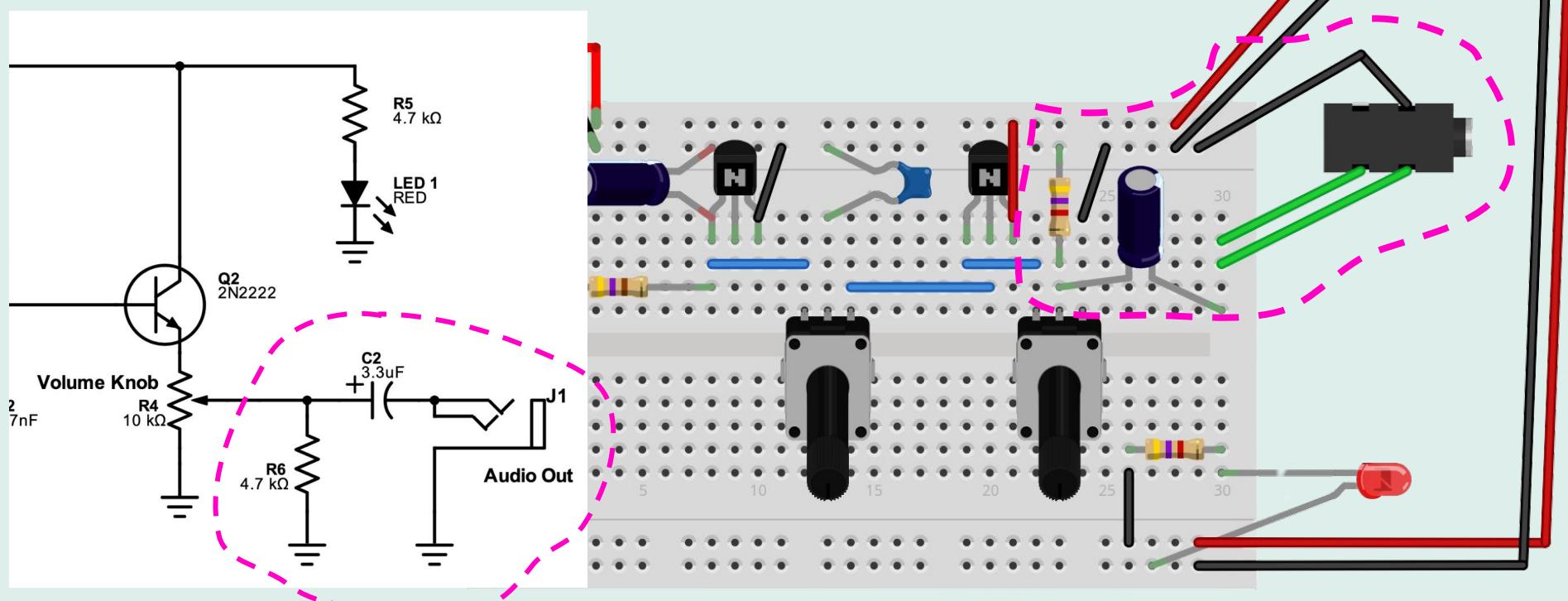
# Connect your Filter



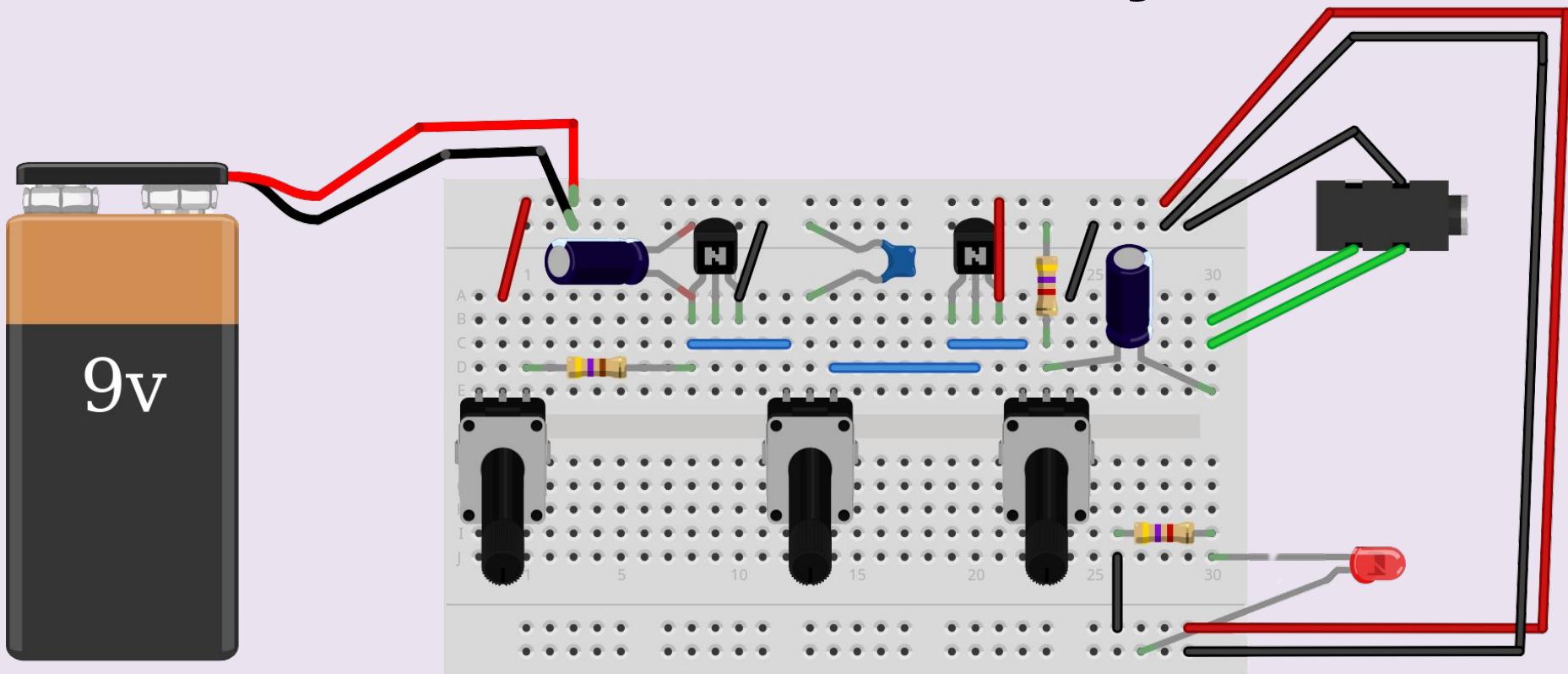
# Connect your Amplifier



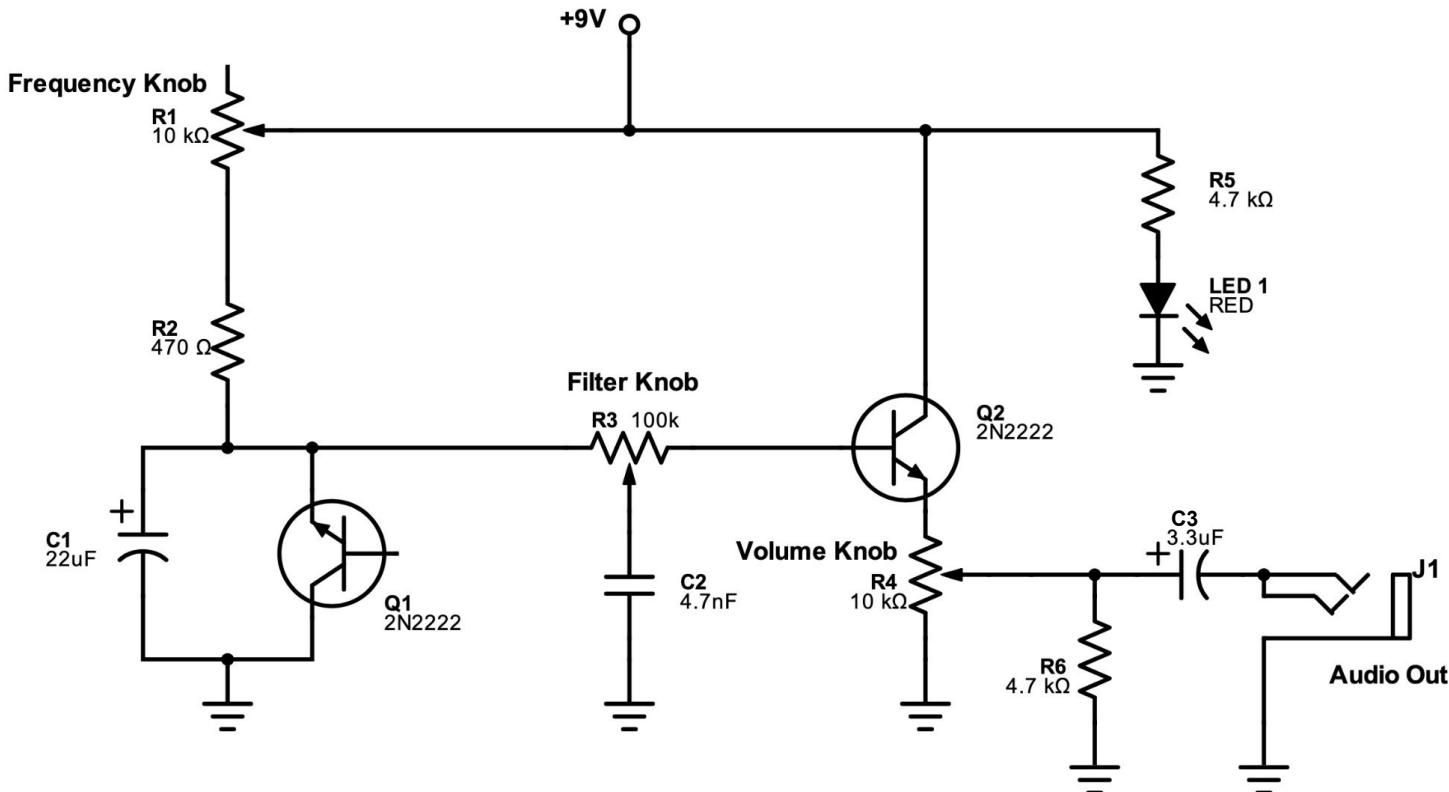
# Connect your Output filter & Headphone Jack



# Voila! Your finished synth!



# Schematic



# **Sound Test Time!**

Connect your auxiliary jack of your headphones or speaker to your headphone jack

Raise your hand if you need help!

# What to do next?

Solder it to a perf board

Insert photo of soldered breadboard

Give ideas on how to package the synth

Provide ideas on how to elongate leads

Performance ideas!

**Visit our Github for the workshop  
reference guide**



# Connect with us!



Mir Jeffres



Christine Hoang