

**CIR-KIT**  
BREADBOARD BUNDLE

# HARD CLIP DISTORTION

## BUILD GUIDE

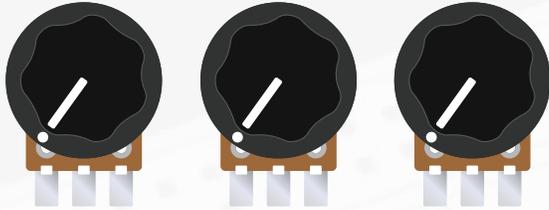


**DIY**

BY COPPERSOUND PEDALS

# INCLUDED COMPONENTS

## POTENTIOMETERS



B100K  
x1

B250K  
x1

C1K  
x1

## PRECUT WIRE



1.5" Red, Black, Green, Blue  
x40

## OP-AMP



TL071  
x1

## RESISTORS & DIODES



Resistors  
(various)  
x9



Diodes  
1n4148  
x2



Diode  
1n4001  
x1

## TRANSISTORS & CAPACITORS



Electrolytics  
(various)  
x5



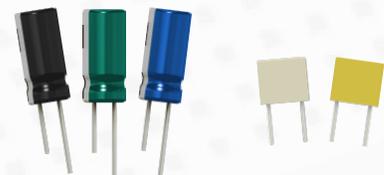
Ceramics  
(various)  
x2



Film Caps  
(various)  
x5

### COMPONENT COLOR AND VALUE VARIATIONS

Some components in your kit may be a slightly different in color from the breadboard step shown. This is normal.



### REFERENCE

**Resistors** limit/control electrical current.

**Diodes** direct current flow in one direction, often used for clipping (distortion).

**Transistors** used to amplify signals.

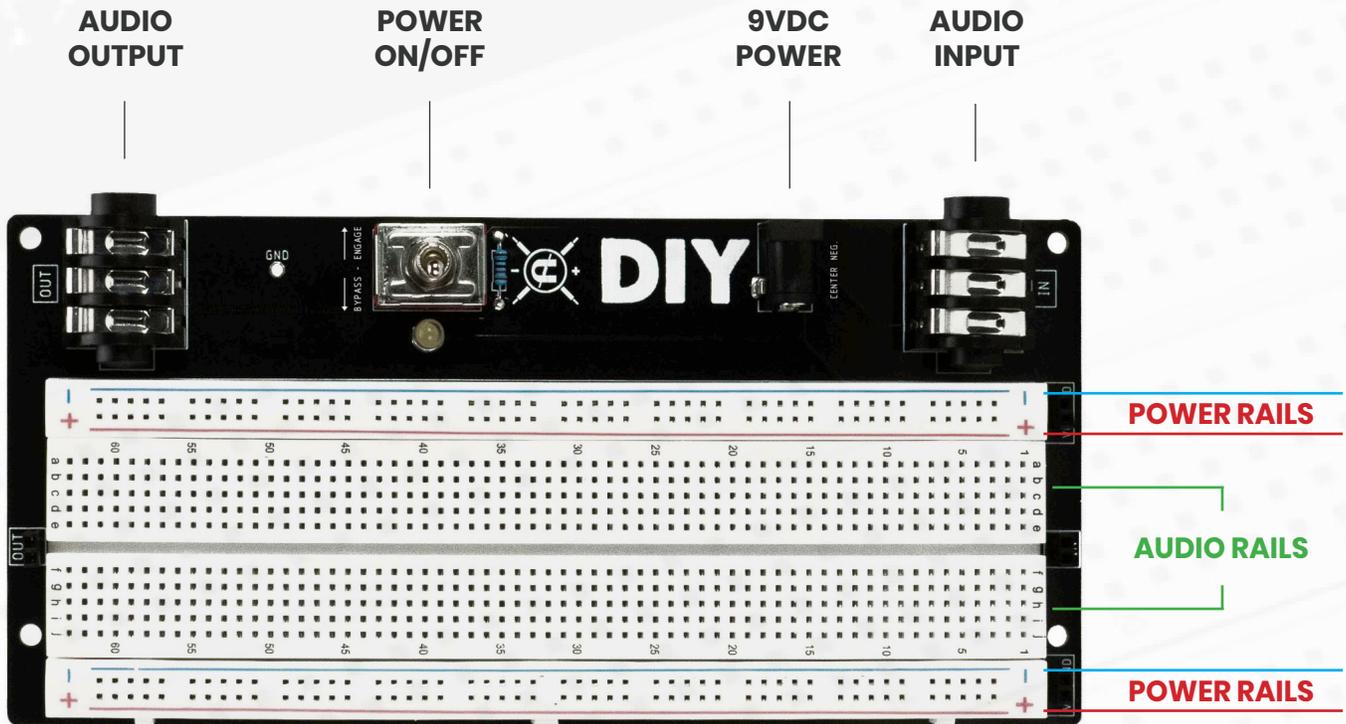
**Film Caps** used to shape EQ and tone.

**Potentiometers** (Pots) Control parameters by changing electrical resistance.

**Electrolytic Caps** polarized (- +), used for power filtering and coupling signals.

**Op-Amp** (Operational Amplifier) used as an amplifier, buffer, or a summing stage.

# BREADBOARD SIGNAL FLOW

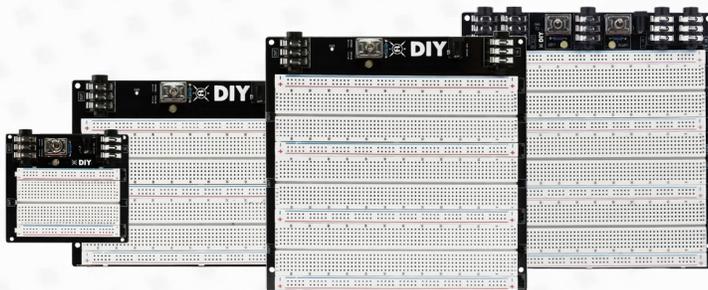


## POWER RAILS FLOW HORIZONTAL

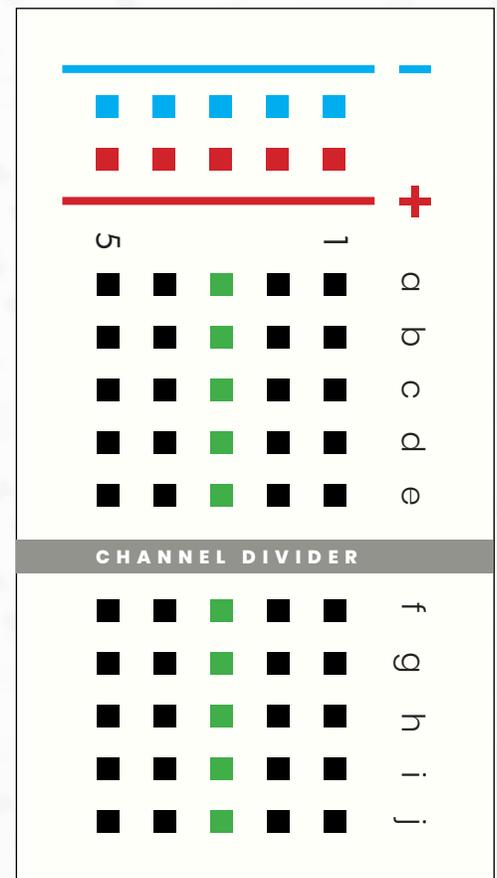
The **negative** rail will connect to the pin header marked GND, and the **positive** rail will connect to the pin header marked VCC.

## AUDIO RAILS FLOW VERTICAL

Channels a-e are connected, and channels f-j are connected.

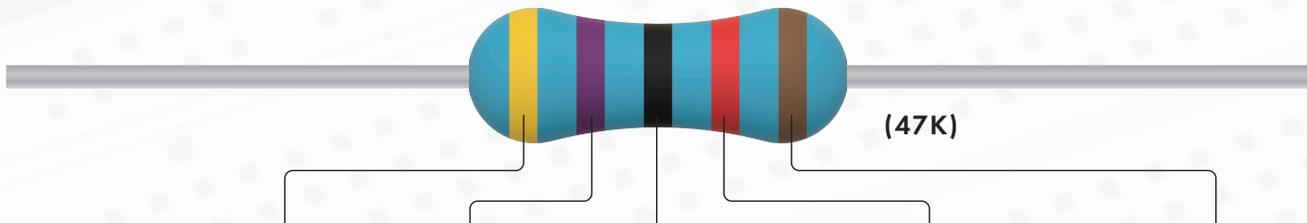


Check out our other [DIY Breadboards](#)



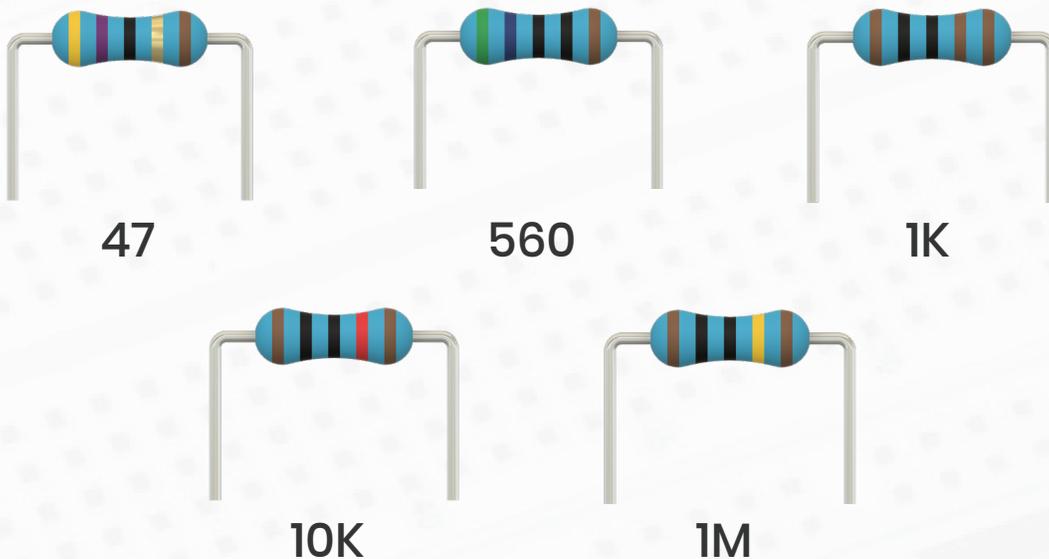
# READING RESISTORS

Reading resistors may seem intimidating, but it's a crucial part of breadboarding and is actually very easy! To determine the resistor value, follow the table and colors below. To ensure you are reading the correct value, keep in mind that the tolerance band is always found on the far right.



COLOR	1ST BAND	2ND BAND	3RD BAND	DECIMAL MULTIPLIER		TOLERANCE	
BLACK	0	0	0	1	1		
BROWN	1	1	1	10	10	±	1%
RED	2	2	2	100	100	±	2%
ORANGE	3	3	3	1K	1,000		
YELLOW	4	4	4	10K	10,000		
GREEN	5	5	5	100K	100,000		
BLUE	6	6	6	1M	1,000,000		
VIOLET	7	7	7	10M	10,000,000		
GRAY	8	8	8		100,000,000		
WHITE	9	9	9		1,000,000,000		
GOLD					0.1	±	5%

Shown below are the resistors and values used in this build.



47

560

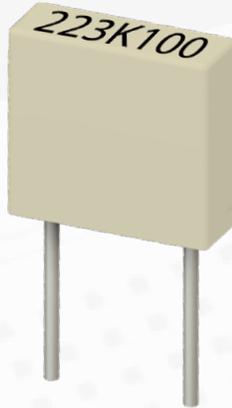
1K

10K

1M

# UNDERSTANDING BOX CAPS CAPACITANCE VALUE

## NUMERALS ONLY



223K100

FACE VALUE

FACE VALUE

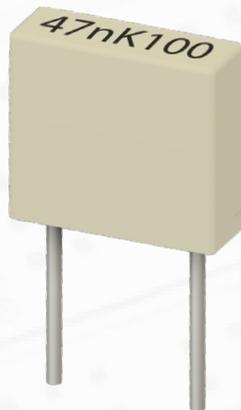
0's MULTIPLIER

223 = 22000pico (p)

OR 22nano (nF)

OR .022micro ( $\mu$ F)

## ALPHA-NUMERICAL



47n K 100

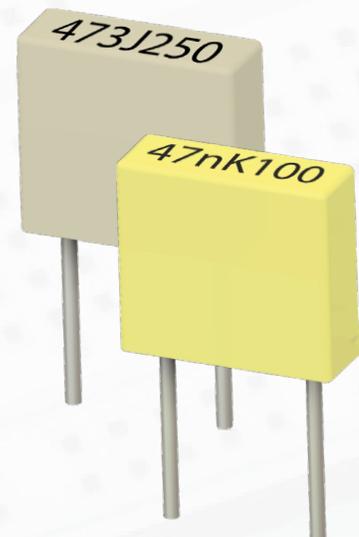
CAPACITANCE

TOLERANCE %

VOLTAGE MAX

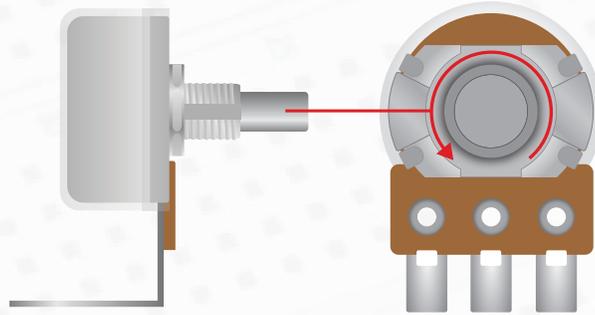
## HOW YOUR CAP MAY LOOK

Some caps may vary slightly in color and reading. For example, a cap that reads **47nK100** is the same as **473J250**. Both variations will work and sound the same in the breadboard. Experiment with different cap values using our [Film Cap Substitution Box](#).

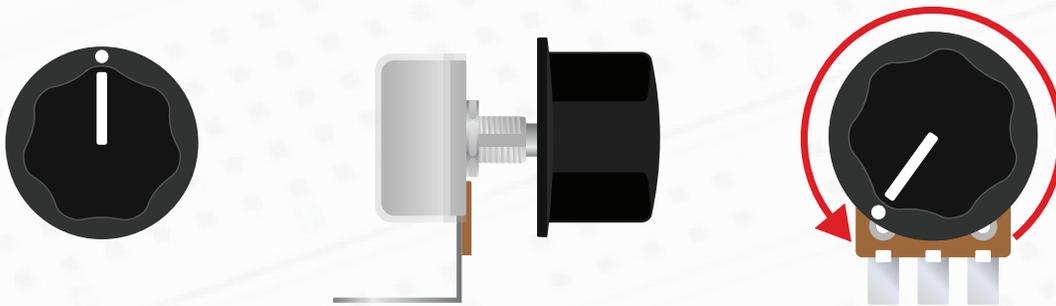


## POTENTIOMETER ASSEMBLY

Take the [potentiometer](#) and turn the shaft all the way to the left counter clock-wise. Then, place the knob on on the shaft and rotate until the pointer on the indicator is in the OFF position.



Turn the shaft all the way counter clock-wise.



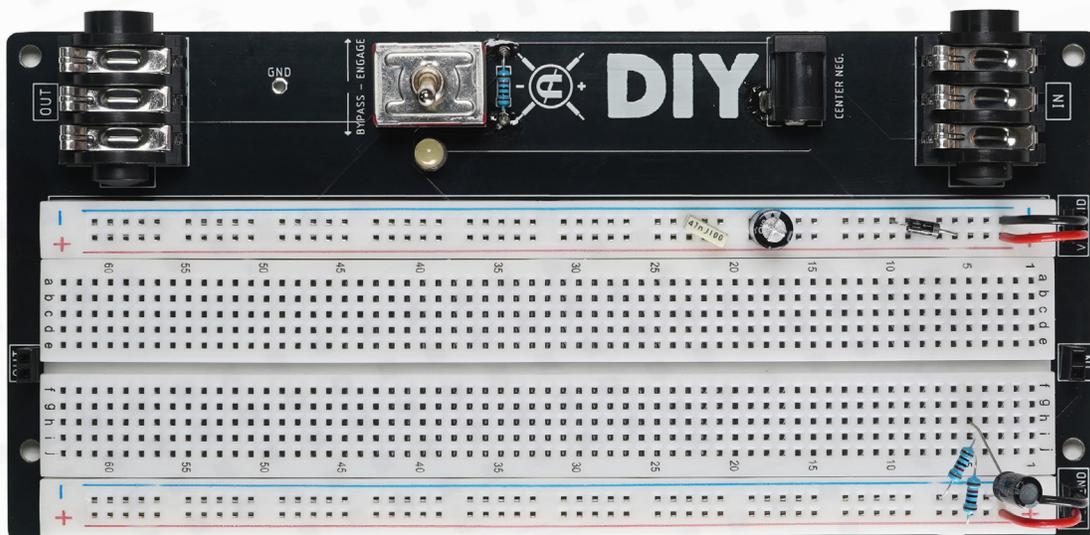
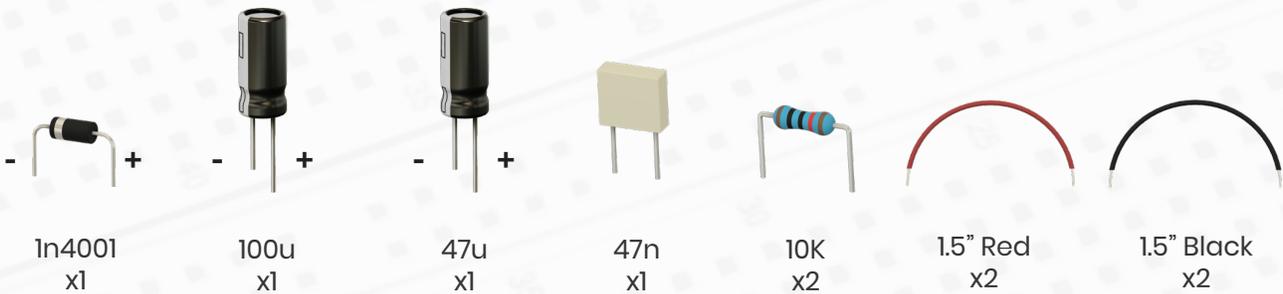
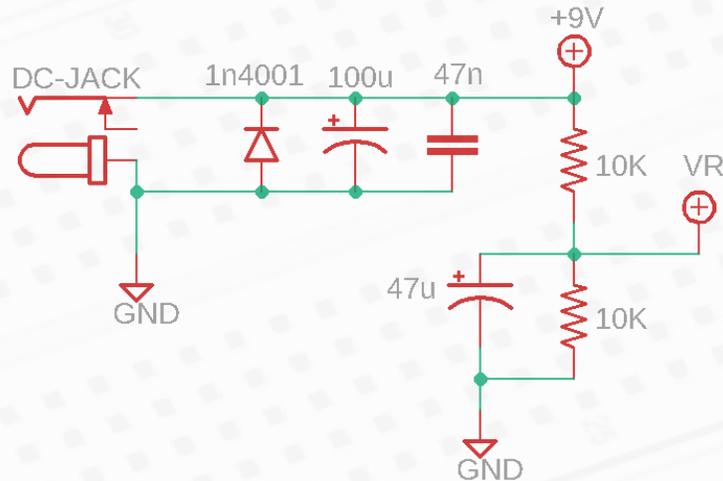
Insert the knob onto the shaft and turn until the indicator reaches the OFF position.  
Note: If you're having trouble, ensure the set screw inside is backed out all the way.



Tighten the setscrew inside the knob with the HEX key until tight. Now, good to go!

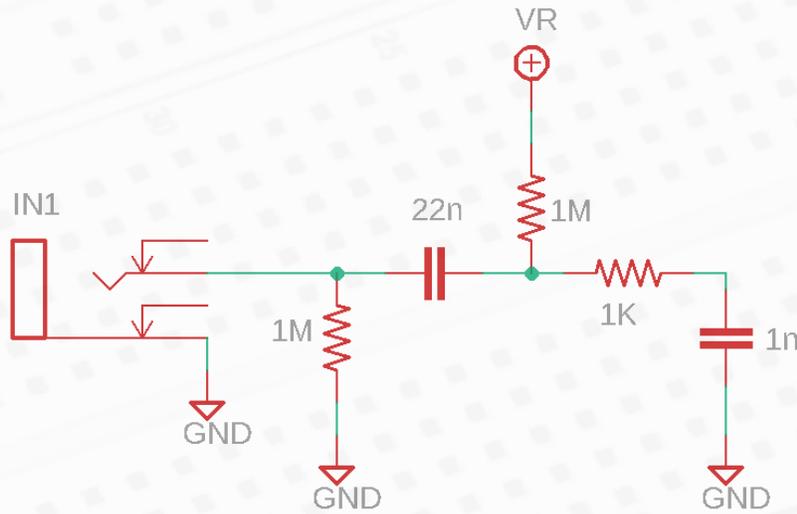
# STEP 1 // POWER FILTERING + REFERENCE VOLTAGE

Power filtering helps to filter unwanted noise from power supplies, while preventing incorrect polarity from damaging the circuit. Ensure that polarized components (diode + electrolytic capacitor) are inserted correctly. In the schematic below, power is shown as 9V, whereas the breadboard shows VCC. Please note that for the majority of pedal circuits, these terms are interchangeable. The two 10K resistors form a divider network, forming reference voltage, or “VR” at 4.5 volts.



## STEP 2 // INPUT

The input capacitor blocks DC signal, while setting the amount of low frequency audio allowed into the circuit. The pull down resistor prevents popping from the switch, and the 1M resistor to VR establishes reference voltage for the circuit.



22n  
x1



1n  
x1



1.5" Green  
x3



1.5" Black  
x1



1M  
x2

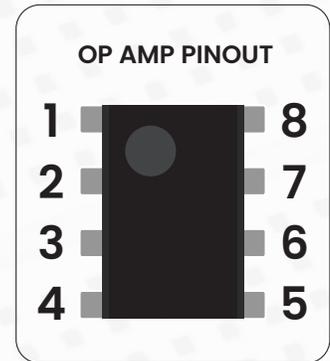
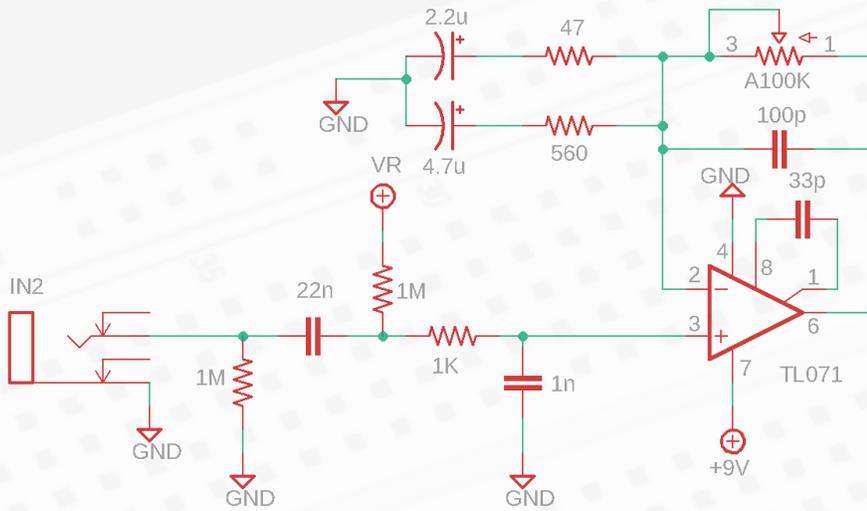


1K  
x1



## STEP 3 // GAIN STAGE

Signal enters the op amp, and is amplified based on the position of the potentiometer. Some EQing is applied at this stage through the resistors and electrolytic caps to ground.



A100K  
x1



560  
x1



47  
x1



TL071  
x1



100pF  
x1



33pF  
x1



2.2µ  
x1



4.7µ  
x1



1.5" Green  
x5



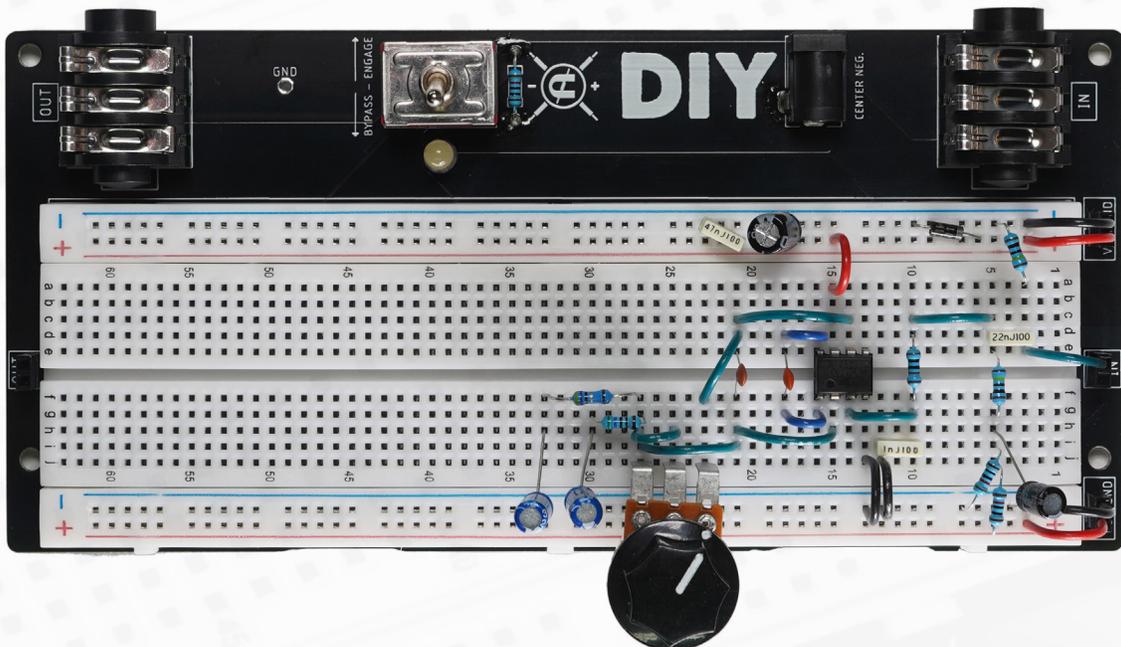
1.5" Blue  
x5



1.5" Red  
x1

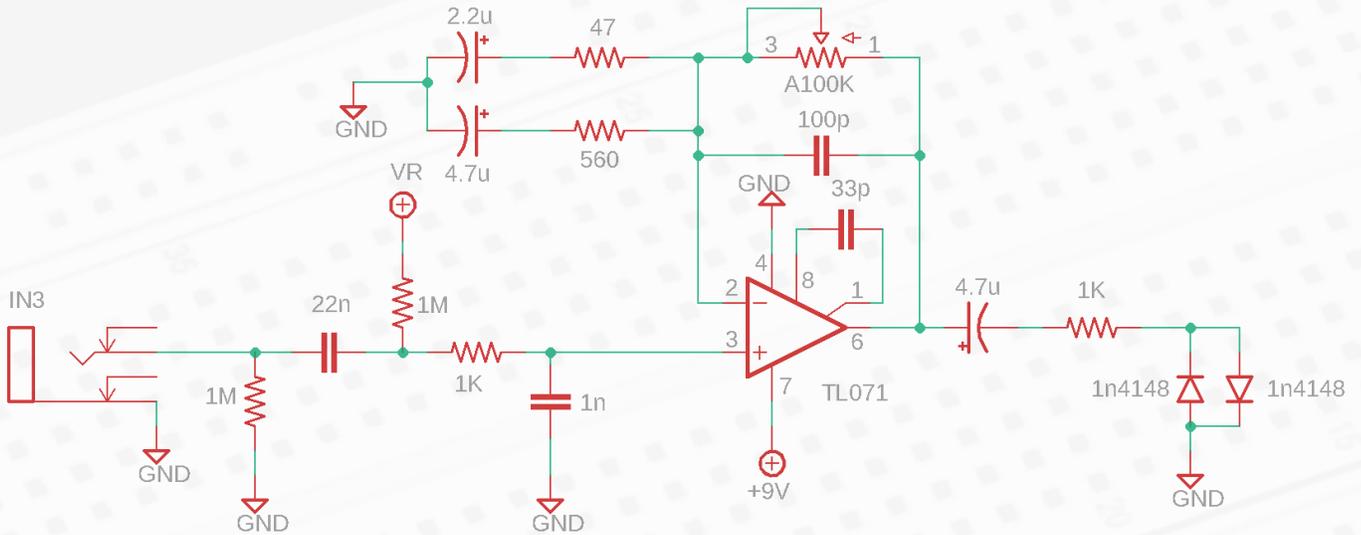


1.5" Black  
x1



# STEP 4 // CLIPPING SECTION

The symmetrical placement of the two diodes to ground clip both sides of the waveform equally, creating the distorted effect.



4.7u  
x1



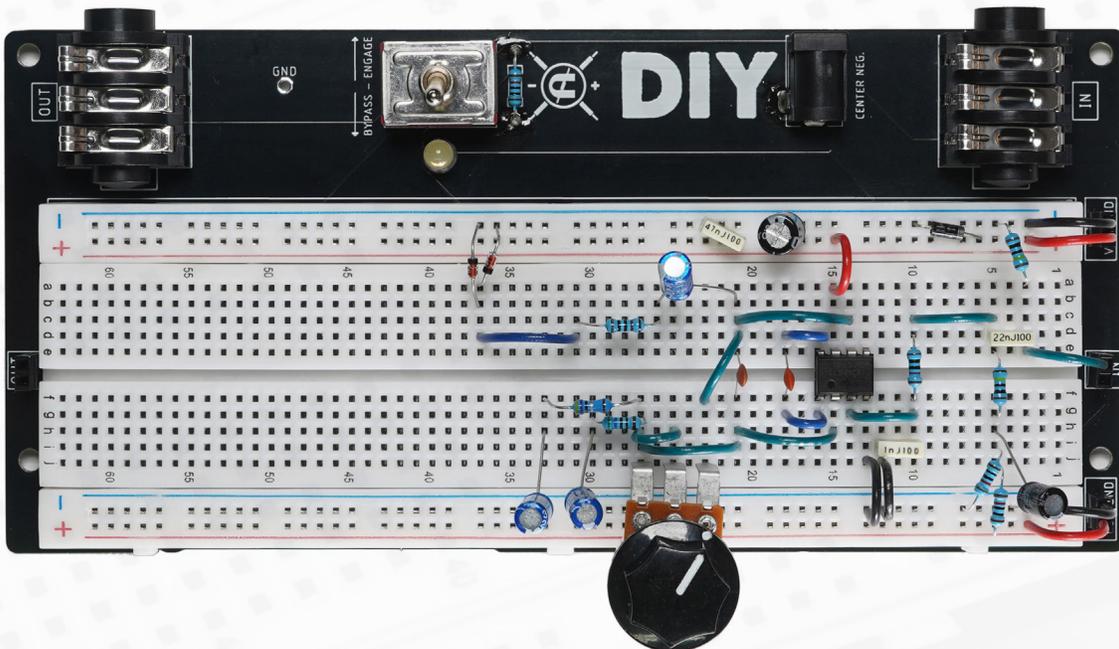
1N4148  
x2



1K  
x1

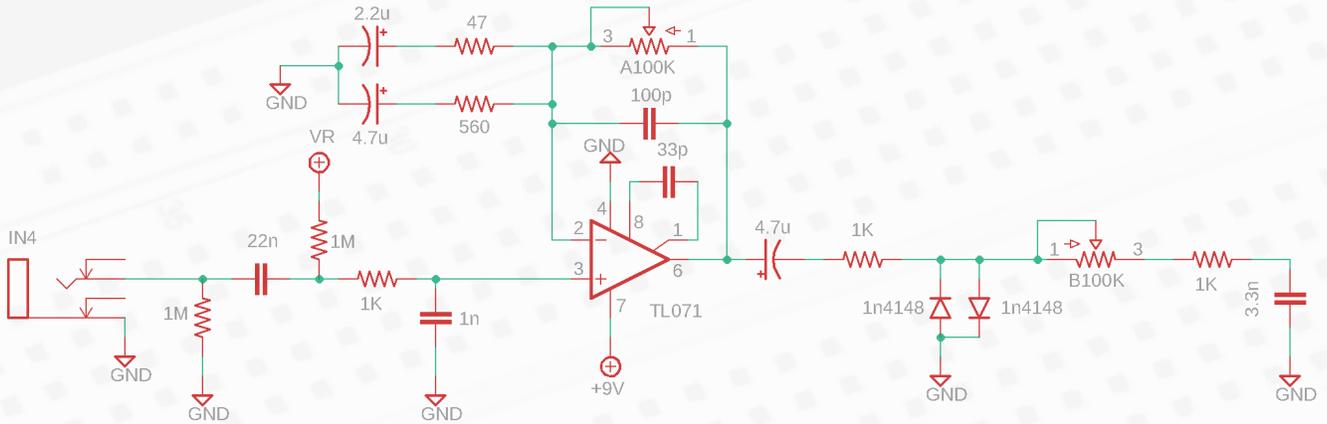


1.5" Blue  
x1



## STEP 5 // TONE NETWORK

In this section, the potentiometer, 1K resistor, and film capacitor create a low pass filter. Rotating the potentiometer counter-clockwise reduces high end content.



B100K  
x1



1K  
x1



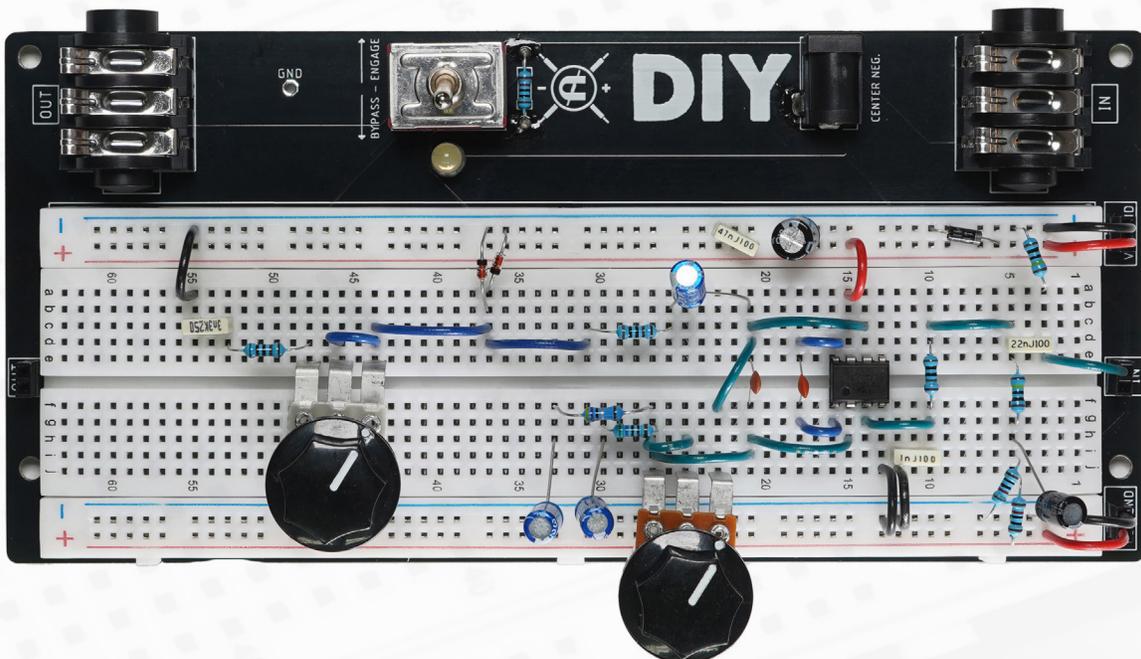
3.3n  
x1



1.5" Black  
x1

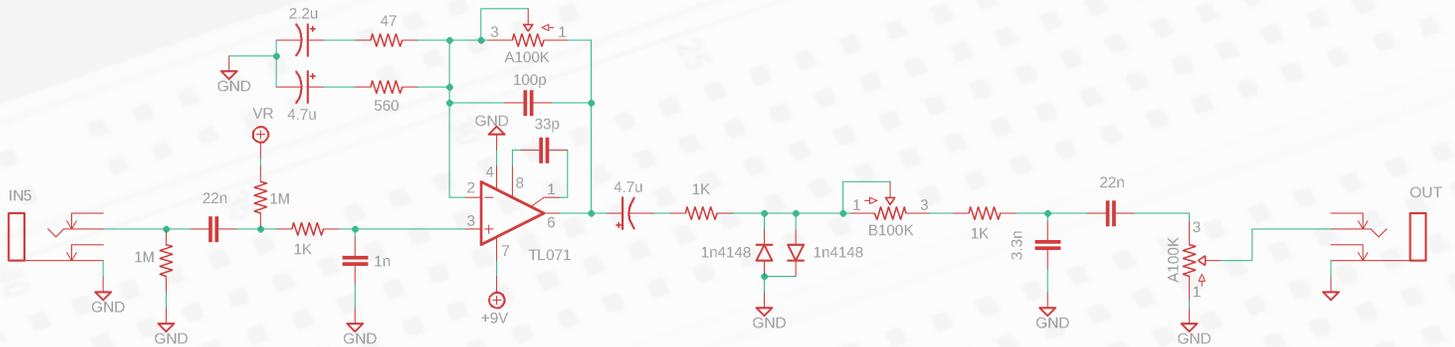


1.5" Blue  
x2



## STEP 6 // OUTPUT

The volume knob acts as an attenuator, setting the output volume of the circuit.



A100K  
x1



22n  
x1



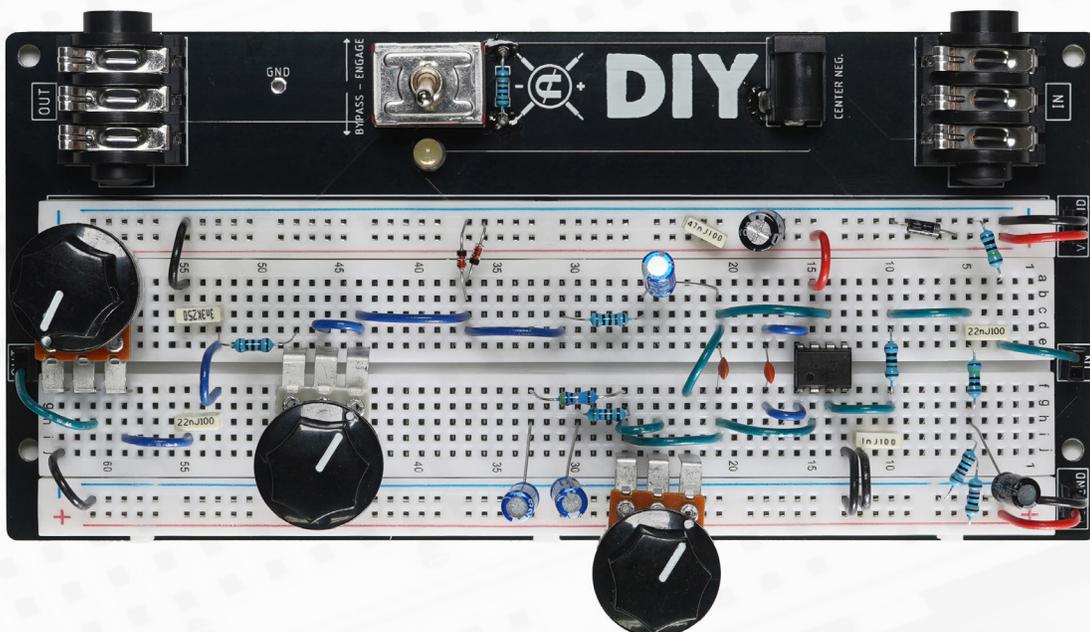
1.5" Green  
x1



1.5" Black  
x1



1.5" Blue  
x2



## TROUBLESHOOTING

**Not getting power to the Power Rails/LED is not turning on when the toggle switch is set to the 'Engage' position.**

Check that the proper connections are being made from the "VCC" & "GND" pin headers to the Power Rails. Pay attention to the orientation of Polarized components (Diodes and Electrolytic Capacitors).

Check the polarity of your power supply. Breadboards require "Center negative" polarity (as is with the power supply shipped with the bundle).

**Not getting any effect when the toggle switch is set to the Engage position.**

Most common issues will pertain to the proper connections being made. This could be as simple as a component being 1 slot away from the correct Audio Rail.

Check that transistors are in the correct orientation, and not flipped around 180 degrees.

**Getting effect when toggle switch is set to Engage, but it doesn't sound as expected.**

Check that the transistor is in the correct orientation and not flipped around 180 degrees. Check that the resistors are in the correct place and didn't get swapped with a different value. Pay attention to the orientation of Polarized components (Diodes and Electrolytic Capacitors).

Still stuck? Please reach out to us with any questions you have! We're here to help. Email us at: [diy@coppersoundpedals.com](mailto:diy@coppersoundpedals.com)