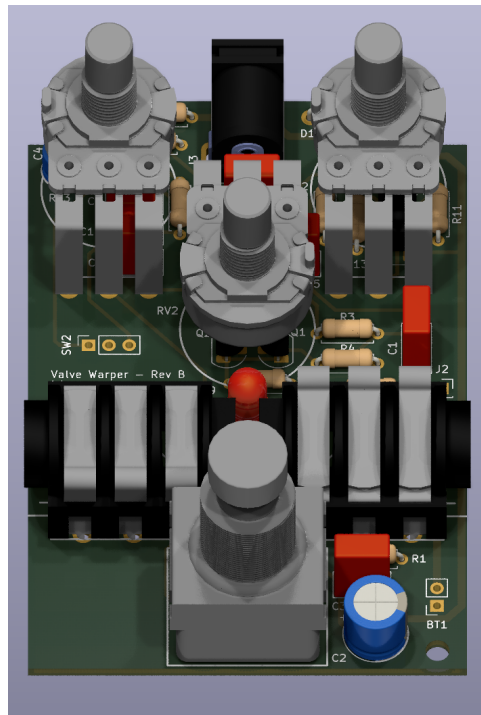




# Valve Warper Assembly Instructions

Flexible Overdrive



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## Introduction

The Audiofab Valve Warper is a discrete overdrive and is our version of the rare (only 152 of the original were made) and revered Dinosuaral Tube Bender.

Originally published in Guitar Magazine (UK) as a DIY project in 2003 (and clearly inspired by the Differential Distortion from August 1995 Popular Electronics). The commercial version of the pedal was optimized and tweaked compared to the magazine version to improve the tone and responsiveness. The resulting pedal is a tonal hybrid of the Tone Bender and Tube Screamer.

Our version incorporates a cut switch that enables two levels of treble cut, providing optional settings for a more “scooped” sound.

A huge thanks to Aion FX for providing the schematic trace of this pedal.

## Features

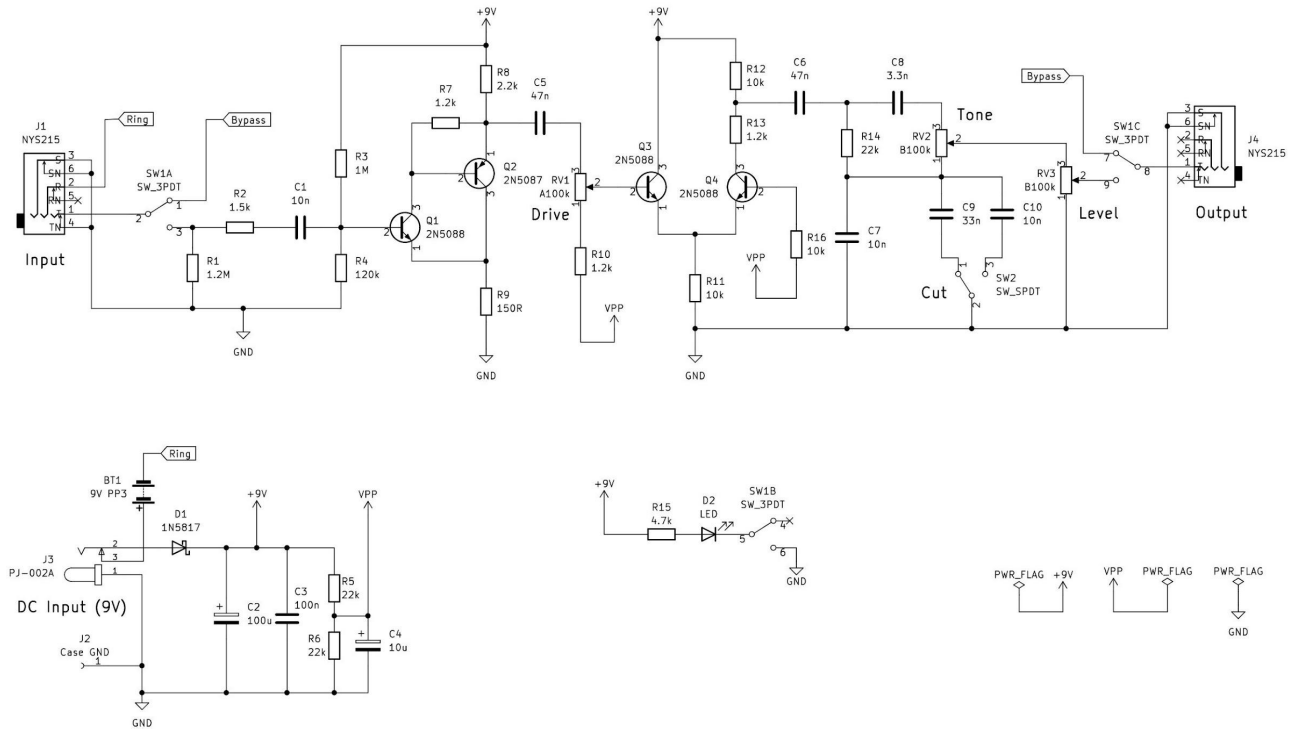
- All discrete circuitry
- Rugged design -- everything except the battery clip is PCB mounted
- True bypass switching
- Internal 9V battery and external 9V PSU input
- LED indicator
- Flexible controls offering a wide range of sounds

## Controls

- **Level:** Adjusts the output level (and can provide a massive boost)
- **Drive:** Adjusts the amount of overdrive -- from mild tube overdrive to full-on distortion
- **Tone:** Adjusts the treble (high-end content) of the output signal
- **Cut:** A three-position switch offering no treble cut or two levels of treble cut



# Schematic



# Parts List

| Ref         | Value           | Qty | Comments   | Alternate |
|-------------|-----------------|-----|--|-----------|
| PCB         | PCB1            | 1   | Valve Warper printed circuit board from Audiofab         |           |
| BT1         | 9V battery clip | 1   | <a href="#">232 Keystone Electronics   Mouser Canada</a> |           |
| C1, C7, C10 | 10n             | 3   | WIMA 5mm lead spacing; 16V or more                       |           |
| C2          | 100u / 16V      | 1   | D8 mm / 2.5mm lead spacing                               |           |
| C3          | 100n            | 1   | WIMA 5mm lead spacing; 16V or more                       |           |
| C4          | 10u / 16V       | 1   | D5 mm / 2mm lead spacing                                 |           |



|               |           |   |   |  |
|---------------|-----------|---|---|--|
| C5, C6        | 47n       | 2 | WIMA 5mm lead spacing; 16V or more                                      |  |
| C8            | 3.3n      | 1 | WIMA 5mm lead spacing; 16V or more                                      |  |
| C9            | 33n       | 1 | WIMA 5mm lead spacing; 16V or more                                      |  |
| D1            | 1N5817    | 1 | <a href="#">1N5817 STMicroelectronics   Mouser Canada</a>               |  |
| D2            | 5 mm LED  | 1 | <a href="#">LTL2P3KGKNN Lite-On   Mouser Canada</a>                     |  |
| J1, J4        | NYS215    | 2 | <a href="#">NYS215 REAN   Mouser Canada</a>                             | <a href="#">1/4" TRS Jack - PCB Mount - NMJ6HCD2</a>     |
| J2            | Bare wire | 1 | See assembly notes  |  |
| J3            | PJ-002A   | 1 | <a href="#">PJ-002A CUI Devices   Mouser Canada</a>                     | <a href="#">DC Power Jack 2.1mm Switched - PCB Mount</a> |
| Q1, Q3, Q4    | 2N5088    | 3 | <a href="#">2N5088 TRA PBFREE Central Semiconductor   Mouser Canada</a> |  |
| Q2            | 2N5087    | 1 | <a href="#">2N5087 PBFREE Central Semiconductor   Mouser Canada</a>     |  |
| R1            | 1.2M      | 1 | 1/4w resistor   |  |
| R2            | 1.5k      | 1 | 1/4w resistor   |  |
| R3            | 1M        | 1 | 1/4w resistor   |  |
| R4            | 120k      | 1 | 1/4w resistor   |  |
| R5, R6, R14   | 22k       | 3 | 1/4w resistor   |  |
| R7, R10, R13  | 1.2k      | 3 | 1/4w resistor   |  |
| R8            | 2.2k      | 1 | 1/4w resistor   |  |
| R9            | 150R      | 1 | 1/4w resistor   |  |
| R11, R12, R16 | 10k       | 3 | 1/4w resistor   |  |
| R15           | 4.7k      | 1 | 1/4w resistor   |  |
| RV1           | A100k     | 1 | <a href="#">16mm Potentiometer - Tall PCB Leg</a>                       | Also available from Tayda                                |



|           |               |   |   |                           |
|-----------|---------------|---|---|---------------------------|
| RV2, RV3  | B100k         | 2 | <a href="#">16mm Potentiometer - Tall PCB Leg</a>                     | Also available from Tayda |
| SW1       | SW_3PDT       | 1 | <a href="#">3PDT Footswitch - Solder Lug - Alpha</a>                  | Also available from Tayda |
| SW2       | SW_SPDT       | 1 | <a href="#">SPDT Toggle Switch ON/OFF/ON - Solder Lug - Short Bat</a> | Also available from Tayda |
|           |               |   |   |                           |
| LED bezel |               | 1 | <a href="#">5mm LED Bezel - Low Profile</a>                           |                           |
| Case      | Hammond 1590B | 1 |   | Also available from Tayda |
| Knobs     |               | 3 | <a href="#">Davies 1900 Clone Knob</a>                                | Also available from Tayda |

You can use 1/4w carbon film or metal film resistors. 5% tolerance is fine. 1% tolerance is better but likely won't make a huge difference in the sound.

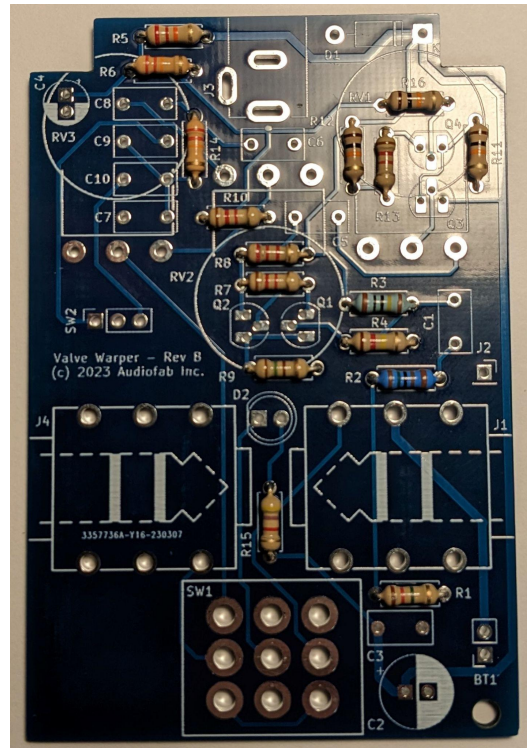
## Build Steps

Set aside the potentiometers, input / output jacks, footswitch, SPDT toggle switch, LED and the DC power jack. They will be installed after all of the other components

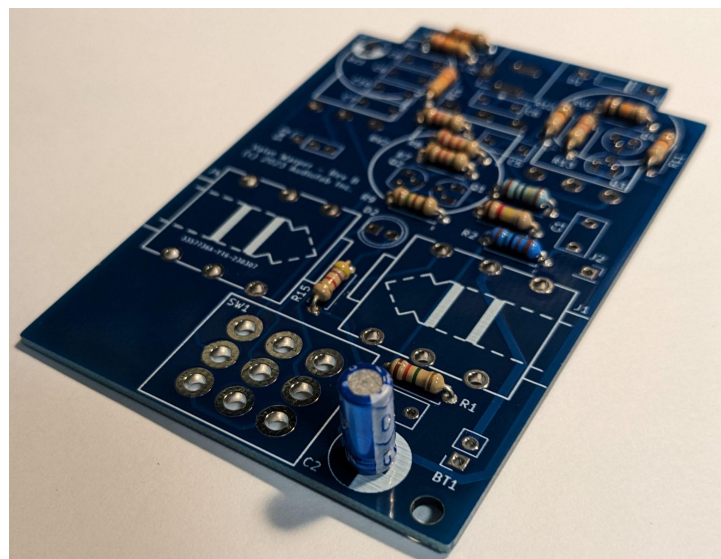
To simplify assembly, we recommend downloading and using the Interactive BOM (available from the [Downloads](#) page on [audiofab.com](#)). You can download and open the file in any standard web browser.

### Initial PCB assembly

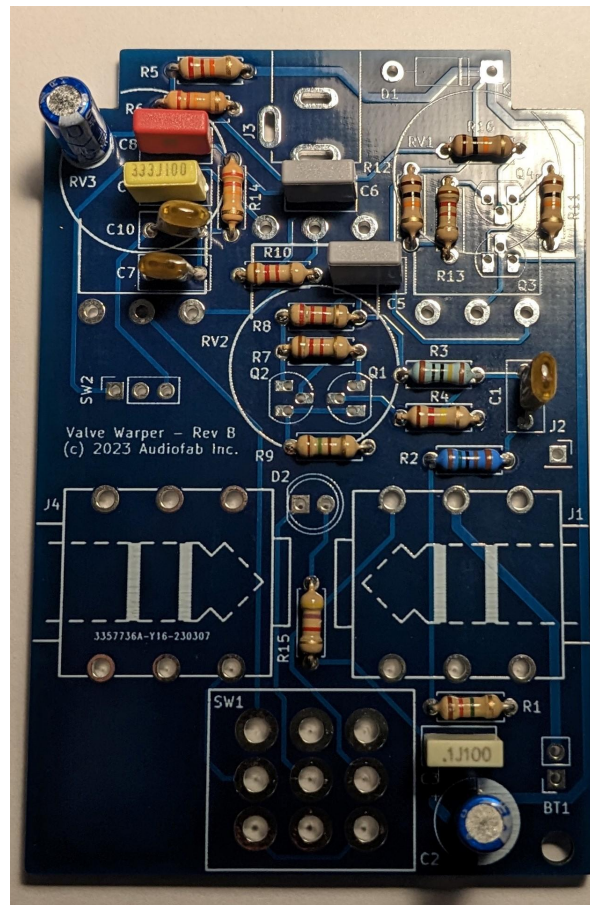
Using the Interactive BOM (or the Schematic -- see above), carefully check the value of and install each resistor. Insert them so they are flush with the PCB and carefully solder each lead. Trim the leads on the solder side of the PCB after soldering.



Install each of the capacitors. Carefully check the value of each capacitor before installation. Pay close attention to orientation of the polarized electrolytic capacitors.



Insert capacitors so they are flush with the PCB and carefully solder each lead. Trim the leads on the solder side of the PCB for each one after soldering.



Install the transistors and the Schottky diode. Pay close attention to the orientation. When soldering, be careful not to overheat them. We recommend soldering one lead and allowing it to cool before soldering another lead on the same transistor (or the Schottky diode). The transistor pads are small so be careful not to make any solder bridges. Trim the leads on the solder side of the PCB after soldering.

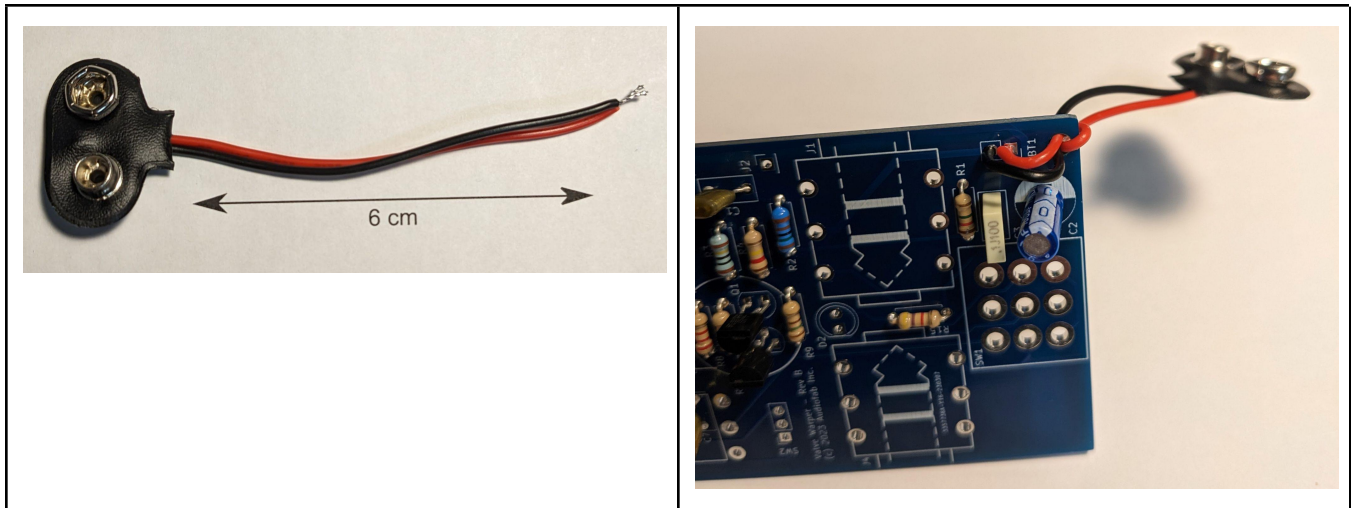
Inspect all of your soldering work and double check all components are installed in the correct locations and with the correct orientation (note: resistors and non-polarized capacitors can be installed either way).



## Mechanical components

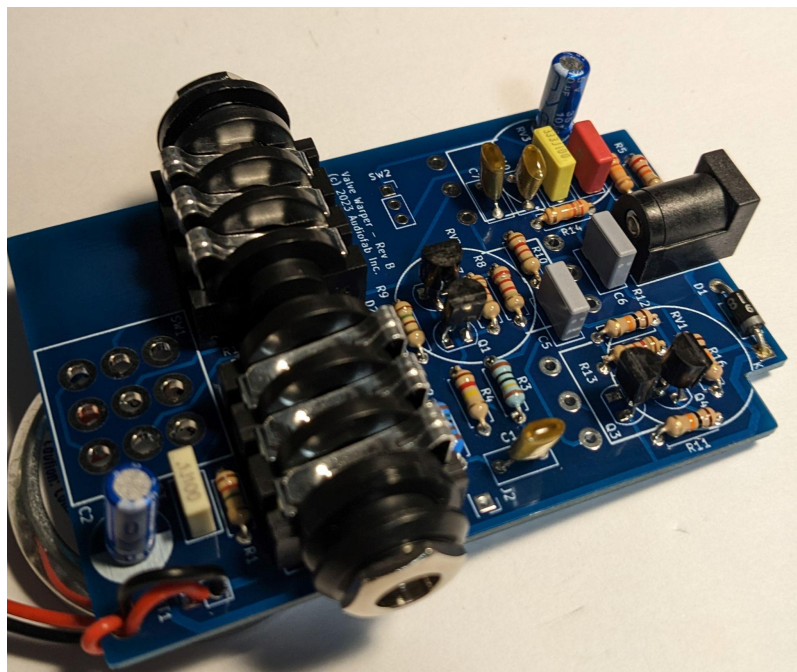
Trim the battery snap leads so they are 6 cm (2.4 in) long (see below). Then, wire strip and tin the ends of the wires on the battery snap. Install the battery snap by looping the positive (red) lead through the hole in PCB to provide strain relief. Pull the negative (black) lead through the hole (no loop required). Note that the positive (red) lead connects to pin 1 of BT1, the square pad and the negative (black) lead connects to pin 2 of BT1, the round pad.





Install the input and output jacks. Ensure they are flush with the PCB before soldering them.

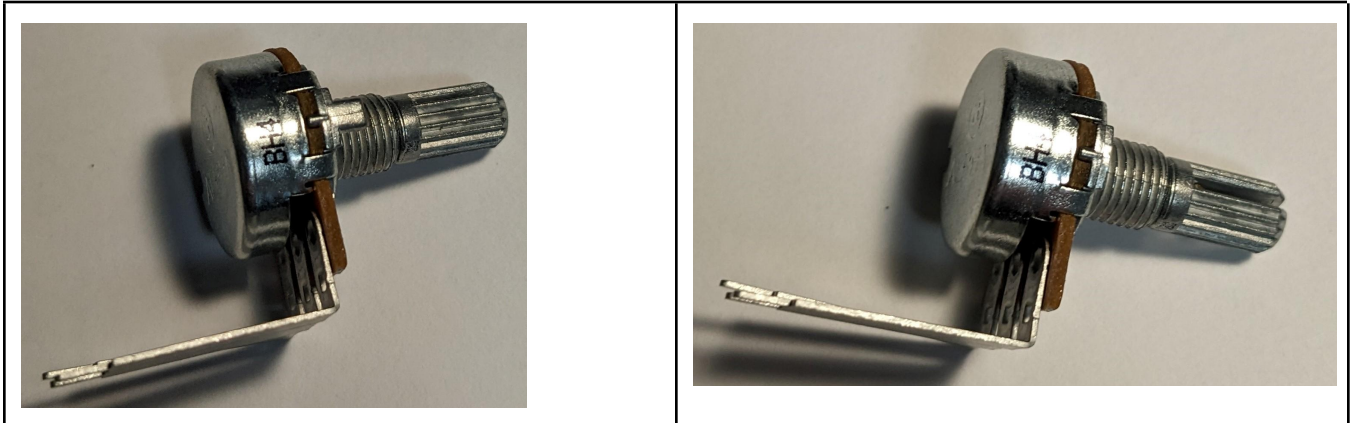
Install the DC jack and solder it. Ensure that it is flush and properly aligned with the PCB before soldering.



Before installing the potentiometers, snap off the small metal nib that is on the face of the potentiometer using needle nose pliers. Then, install the potentiometers to the PCB ensuring that the PCB legs are



flush with the surface of the PCB. Solder one pin of the potentiometer to hold it in place. Next, reflow the pin while aligning the potentiometer pins so they are flush with the PCB. Then, carefully solder each pin.

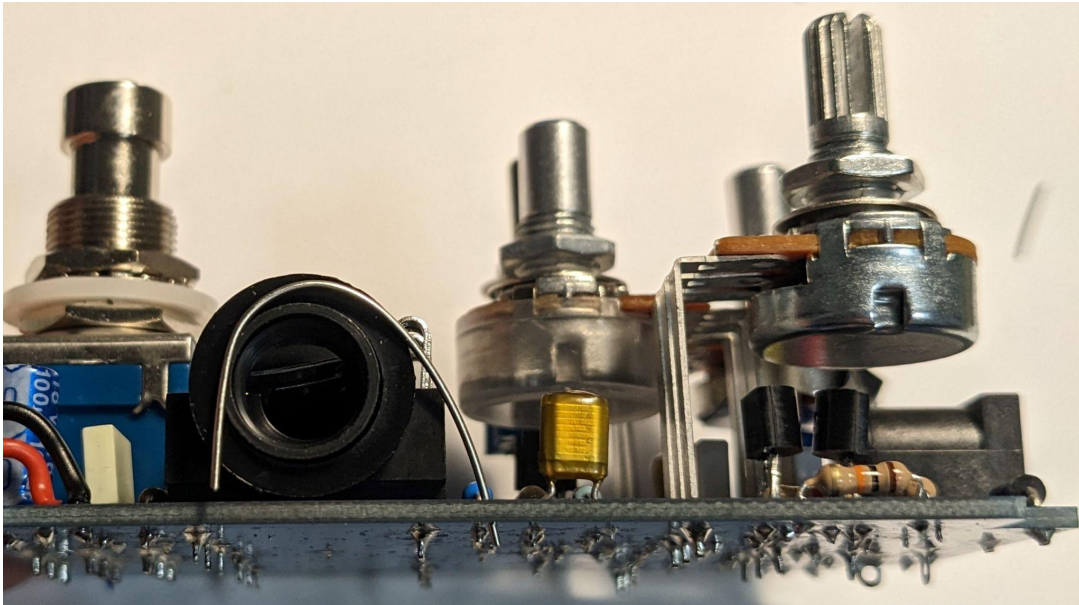


Install the 3PDT switch and solder it. Ensure that the base of the switch is flush with the PCB and that the switch is perpendicular (at a 90 degree angle) to the PCB.

Trim the leads on the input / output jacks, DC jack and 3PDT switch.

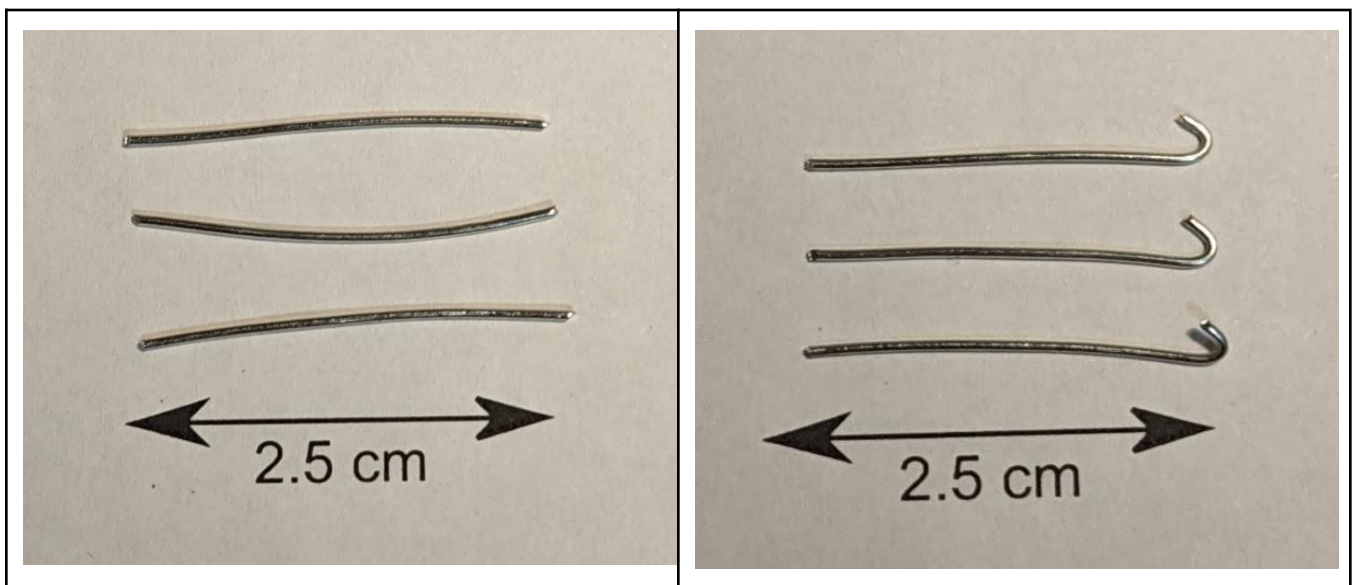
## Finishing up

J2 is used to ground the PCB to the case. You will need a piece of solid (not stranded) wire 5 cm (2 in) long that has been stripped. Bend the lead around the ferrule of J1 and insert one end into the J2 pad and solder it. Trim off any excess wire on the solder side of the PCB.



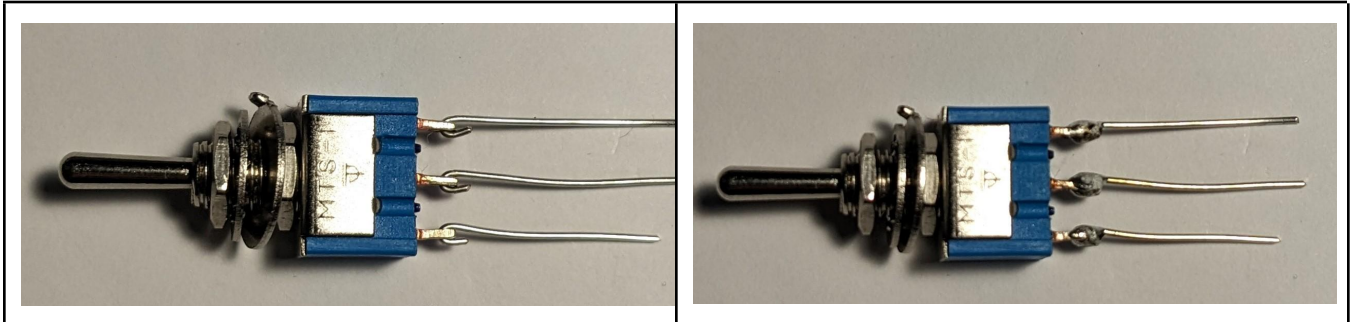
To ensure a successful final assembly, the tone cut switch and LED must be installed so their top surfaces are flush with the potentiometers and 3PDT switch.

The tone cut switch needs leads added so it will be at the correct height when installed. Prepare three solid (not stranded wires) that are 2.5 cm (1 in) long and connect them to the switch as shown.

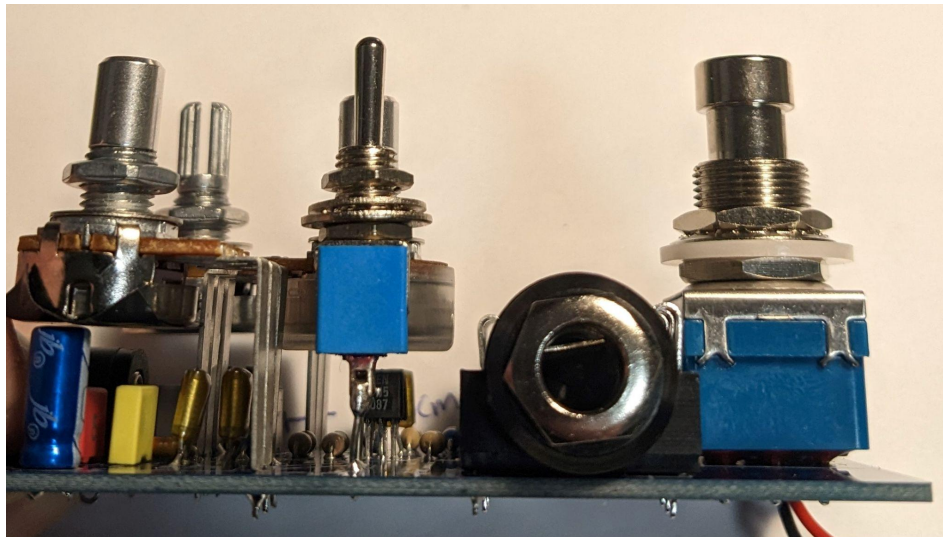




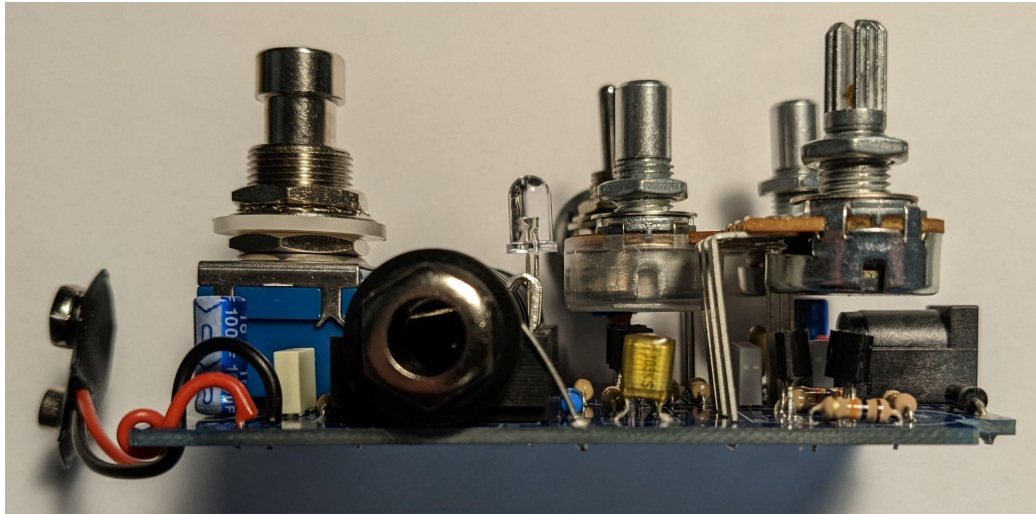
Carefully solder each lead ensuring that each lead is perpendicular to the switch. Avoid using excessive heat for soldering -- some switches are not robust and may not withstand too much heat without pins being damaged.



Mount the switch to the board and adjust the height so that the top of the switch body is level with the top of the potentiometer bodies. Solder the switch leads to the PCB.

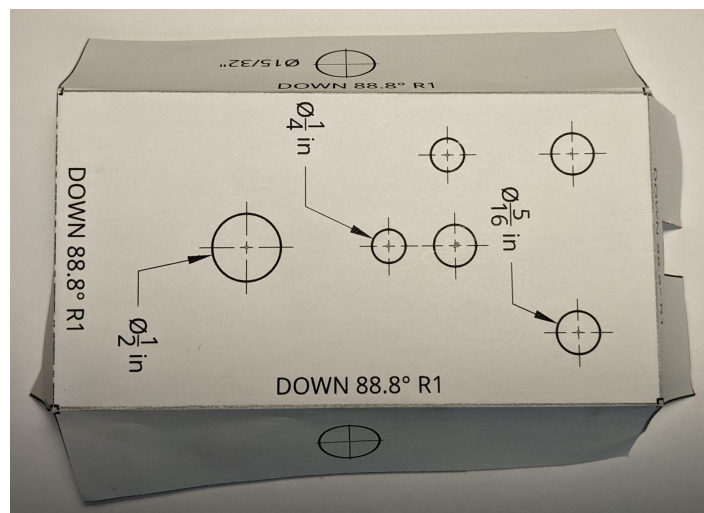


The LED is polarized and must be installed in the correct orientation. Align the flat side of the silk screen symbol with the flat side of the LED to ensure correct orientation. The LED must also be installed at the correct height (so it will protrude through the case). Align the flange at the bottom of the LED as shown in the photo below and then carefully solder each lead. Trim the LED leads on the solder side of the PCB.



## Case Machining

The provided drilling template must be printed out 1:1 on paper (check this by measuring the provided dimension) and trimmed to make a “wrapper” for the 1590B case. Once you have trimmed out the case using scissors or an Exacto knife (including the slot for the DC jack), carefully fold along the dotted lines to make your “wrapper”.



We recommend using a drill press along with proper safety equipment and procedures for machining the enclosure. It can be done with a hand drill, but is more challenging.



To begin, wrap the case with the drilling template and secure it to the edge using masking tape (or similar). Then, carefully center punch each hole (put an indentation in the metal at the center of the hole).

Mark the DC jack using a permanent marker or by carefully scratching into the enclosure finish. Remove the drilling template and tape from the case.

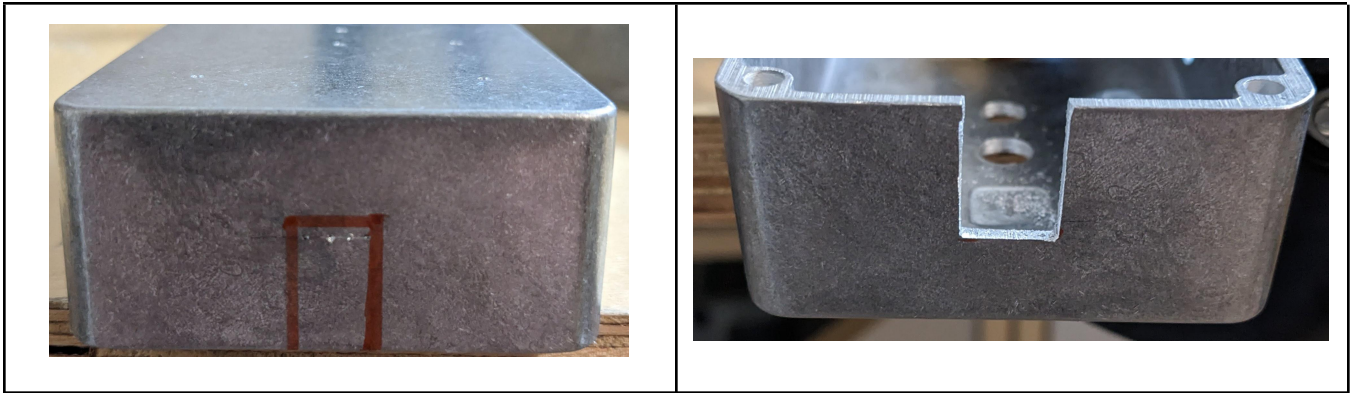
Begin by drilling each center punched hole with a small drill bit (recommended size 1/16"), ensuring that the bit aligns on the center punched hole. Next, drill the entire enclosure (all holes) with a 1/4" size drill bit. Be sure to protect the case from scratches and nicks while you are drilling it.

Then drill all holes at the specified sizes. We recommend using a stepped drill bit as it simplifies things. With the exception of the LED, all holes are slightly oversized to ease final assembly.

| <b>Component</b>       | <b>Hole size</b> |
|------------------------|------------------|
| Potentiometers         | 5/16"            |
| Cut switch             | 1/4"             |
| LED                    | 1/4"             |
| Footswitch             | 1/2"             |
| Input and output jacks | 1/2"             |

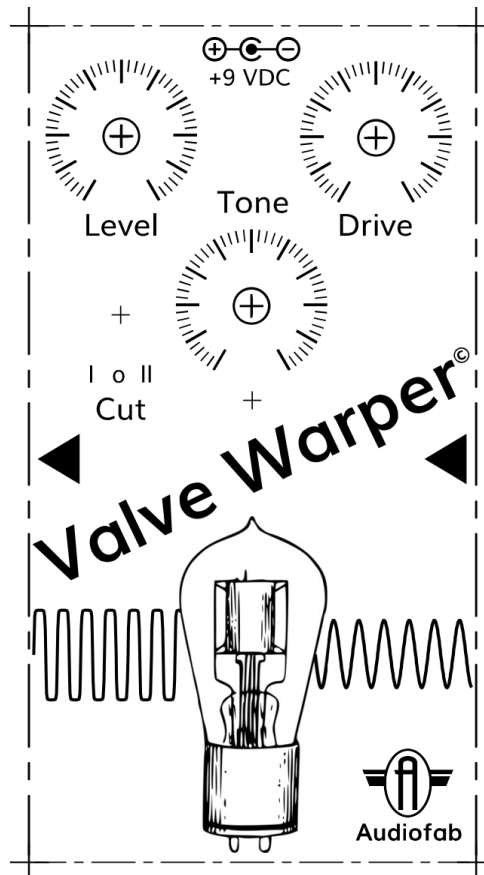
For the DC jack, center punch a series of holes along the top edge and begin by drilling a series of small holes (recommended size 5/64") along the horizontal dimension of the DC jack -- ideally with one in each corner. Then, using a hacksaw carefully cut down the centerline of the vertical dimension and stop when you hit the hole in the corner.

Snap the tab of metal out using a pliers and finish the hole with a file to make it neat and rectangular.



## Labeling

We provide 1:1 artwork that you can use to label your pedal. We've had good luck with a number of methods. For one-off home use, water slide decals work well and can be clear-coated with Krylon (or similar) to protect them.





## Final Assembly

Assuming everything was done as described above, final assembly is easy!

The wire that was installed at J2 must be able to make a good electrical connection to the case. Inspect the inside of the case where the input jack will be. If there is paint or powder coat around the input jack hole on the inside of the case, you will need to remove it to expose bare metal. If you need to remove and paint or powder coat, use sandpaper or something similar to expose bare metal around the jack to ensure that the wire makes good electrical contact with the case.

Remove nuts and washers from potentiometers and switches. Remove the ferrules and plastic outer rings from the input and output jacks. Make sure that the fiber washers (two per jack) stay on the input and output jacks.

Install the LED bezel into the case (it just snaps in).

Put one nut on the 3PDT footswitch and tighten it down as far as it will go. Put the lock washer on top of the nut. (This will ensure the proper height for the footswitch)

Insert the assembled board into the case, aligning everything and ensuring that the J2 wire contacts the case and doesn't block the input jack. It can sometimes take a few minor adjustments to get everything aligned and the board installed. Be patient!

Once the board is in place (with the potentiometers and switches protruding through the case), install the washers and nut and hand tighten everything down. Next, install the plastic outer rings and ferrules on the input and output jacks and hand tighten them.

Alternately tighten the input and output jack ferrules using a nut driver or wrench until they are snug (don't over torque them). Then, tighten down the remaining nuts using a nut driver or wrench (again, don't over torque them).





Check the clearance between the back edge of the case and the solder side of the PCB. It should be uniform all around the enclosure and roughly 3 mm (0.04 in). If it is not, you will need to disassemble the pedal and determine what went wrong. Once the assembled PCB is properly spaced and installed, you can install the knobs, install a 9V battery and close up the case using the four screws that came with the case.

Next, rock and roll!

## Terms

Other than this documentation, Audiofab does not provide any direct support for our projects. You will need some pedal building experience before building one of our pedals.

No refunds or replacements are offered unless it can be shown that our documentation or the circuit contain a reproducible error.



You are free to use our projects for any purpose, provided you retain our copyright notices and give appropriate attribution to Audiofab.

## Revision History

| <b>Version</b> | <b>Date</b>     | <b>Comments</b>              |
|----------------|-----------------|------------------------------|
| 1.0            | June 16, 2023   | Initial release              |
| 1.1            | June 19, 2023   | Added link to Downloads page |
| 1.2            | August 19, 2023 | Corrections to BOM           |