Tone Splendor

The Tone Splendor MK1S is a silicon fuzz pedal based on the original Tone Bender MK1. The Tone Bender MK1 was itself based on the design of the Maestro Fuzz-Tone FZ-1, the first commercially available guitar pedal. It has a raw, primitive fuzz sound fitting for its era.

The original design depended on undesirable electrical characteristics found in germanium transistors (leakage current) to function properly. Leakage current has a high degree of temperature sensitivity, which gave the original MK1 (and the FZ-1) the potential to have large shifts in operation depending on ambient temperature.

The Tone Splendor MK1S is a redesigned MK1 built around common silicon transistors - no leakage current required, no transistor selection or manual bias concerns, and negligible temperature sensitivity. The flaws and shortcomings of the original MK1's primitive design have been minimized or eliminated, but the raw fuzz sound remains.

The MK1S generates dense harmonics with its high degree of asymmetrical clipping, which is perfect for raw, cutting lead sounds. On lower notes, the sound is aggressive and harmonically rich in a way that can dominate the frequency spectrum.

The MK1S is capable of long sustain and modern fuzz sounds, but its overall sound belies its early design roots with slight gating on the decay and an old-school sizzle on the top end.

The Tone Splendor MK1S is a relatively low current device, and will have a long life if operated by battery power like the original MK1. Because the positive ground design of the original has been replaced with a modern negative ground design, this pedal can also be powered by a standard center-negative 9V adapter.

Table of Contents

Required Tools

1.5mm Hex Key

Needlenose Pliers

Philips Head Screwdriver

Ruler

Solder

Soldering Iron

Wire Cutter / Snipper

Wire Stripper

Optional Recommended Tools

Adjustable Wrench

Ant-Static Wrist Strap

Desoldering Braid

Desoldering Pump

Helping Hands

Multimeter

PCB Vise

Rocket Sockets

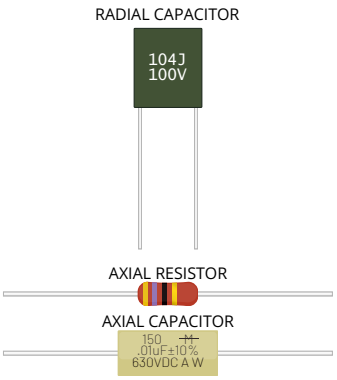
Tweezers

For a full-color digital copy of these instructions please visit https://www.modelectronics.com/

Notes on PCB Construction

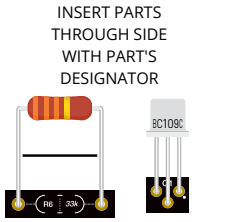
This section is intended for those unfamiliar with or new to constructing circuit boards.

Lead Spacing



Components are made in two common mounting types, radial and axial. Radial components feature leads that are parallel and oriented in the same direction whereas the leads of axial components protrude from each end of the component oriented in opposite directions.

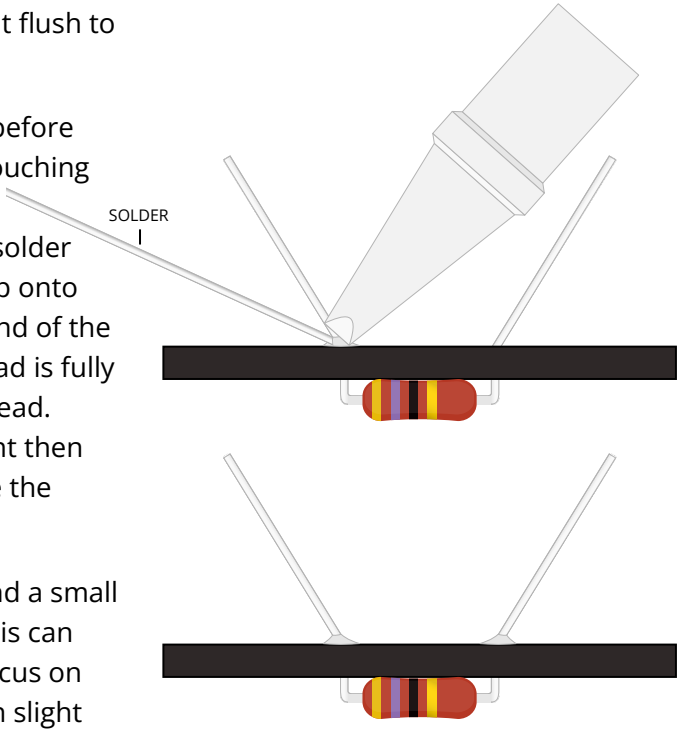
These parts will have corresponding footprints on the PCB marked with text. C_ designates a capacitor, R_ designates a resistor, and Q_ designates a transistor. The BOM (bill of materials) will cover all of the designators. Each footprint has a specific spacing. Footprints for the radial parts will match the spacing of that part, but axial parts require preparation to fit. With the exception of the transistors, all parts in this build use axial leads. For the axial components, you can simply use your finger to gently bend the lead until it is perpendicular where the lead meets the part.



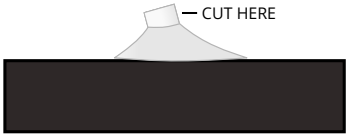
Soldering

After inserting the PCB into its footprint, make sure that the component is sitting flush against the PCB. Hold it in place and bend the leads on the opposite side of the PCB away from the component. This will keep the component flush to the PCB when soldering.

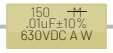
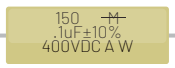
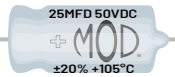
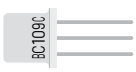
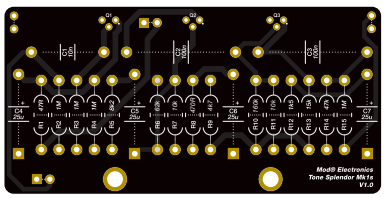
Make sure your soldering iron is fully warmed up before soldering. Position the tip of the iron so that it is touching both the solder pad of the PCB and the lead of the component. Slowly feed solder onto the pad. The solder should flow evenly across the pad and will slope up onto the component lead. You may need to move the end of the solder strand around the pad to ensure that the pad is fully coated in solder and that it is also bonding to the lead. Repeat this process for each lead of the component then use a pair of cutters to snip the lead directly above the peak of the solder.



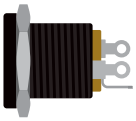
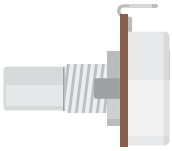
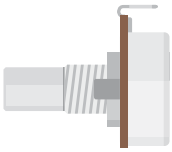
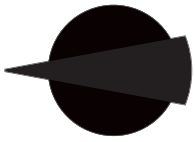
Ideally the solder will flow through the pad hole and a small amount will reach the opposite side of the PCB. This can take some practice to master and is not critical. Focus on consistently achieving full coverage of the pad with slight slopes surrounding the lead first.



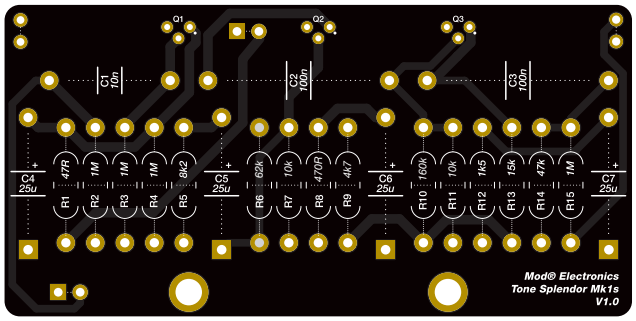
PCB Parts List

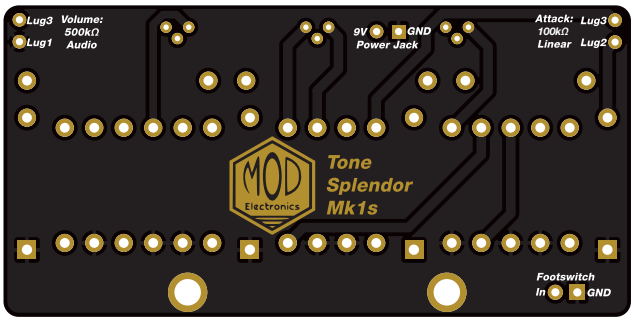
	R-CZERO	Qty 1	0Ω (Zero Ohm) Resistor
	R-PR02-47	Qty 1	47Ω 2W PR02 Metal Film Resistor
	R-PR02-470	Qty 1	470Ω 2W PR02 Metal Film Resistor
	R-PR02-1D5K	Qty 1	1.5KΩ 2W PR02 Metal Film Resistor
	R-PR02-4D7K	Qty 1	4.7KΩ 2W PR02 Metal Film Resistor
	R-PR02-8D2K	Qty 1	8.2KΩ 2W PR02 Metal Film Resistor
	R-PR02-10K	Qty 2	10KΩ 2W PR02 Metal Film Resistor
	R-PR02-15K	Qty 1	15KΩ 2W PR02 Metal Film Resistor
	R-PR02-47K	Qty 1	47KΩ 2W PR02 Metal Film Resistor
	R-PR02-62K	Qty 1	62KΩ 2W PR02 Metal Film Resistor
	R-PR02-160K	Qty 1	160KΩ 2W PR02 Metal Film Resistor
	R-PR02-1M	Qty 4	1MΩ 2W PR02 Metal Film Resistor
	C-MD01-630	Qty 1	10nF 630V Mallory Film Capacitor
	C-MD1-400	Qty 2	100nF 400V Mallory Film Capacitor
	C-ET25-50-MOD	Qty 4	25uF 50V Mod® Electrolytic Capacitor
	P-QBC109C	Qty 3	BC109C TO-18 Silicon Transistor
	P-PC-FUZZ-MOD3-B	Qty 1	Mod® Tone Splendor MK1S Main PCB

Offboard Parts List

	S-H750	Qty 1	Switched DC Barrel Jack
	S-H672	Qty 1	Stereo ¼" Jack
	S-H671	Qty 1	Mono switched ¼" jack
	R-VAM500KA-SS	Qty 1	500KΩ Log 16mm Potentiometer
	R-VAM100KL-SS	Qty 1	100KΩ Linear 16mm Potentiometer
	P-H501-L-BLK	Qty 1	Soft Click Black 3PDT Footswitch
	S-H165	Qty 1	Adhesive-backed Battery Cushion
	P-BATC-SN-1S	Qty 1	9V Battery Connector
	P-LPW-FLATBK-W	Qty 1	Prewired White LED with Black Bezel
	P-H1590BBCE-BK	Qty 1	Pre-drilled Black 1590BB Enclosure
	S-W3024TC-V-50	4 feet	24AWG Violet Top Coat Wire
	S-HS-SKT-B	Qty 2	M3 Black Socket Head Screw
	S-HSO-M3-10	Qty 2	M3 Male-Female 10mm Standoff
	S-HHN-M3	Qty 2	M3 Stainless Steel Hex Nut
	P-K495	Qty 2	Set Screw Black Zonk-Style Knob
	K-903-FACEPLATE	Qty 1	Tone Splenor MK1S Faceplate

PCB Bill-Of-Materials





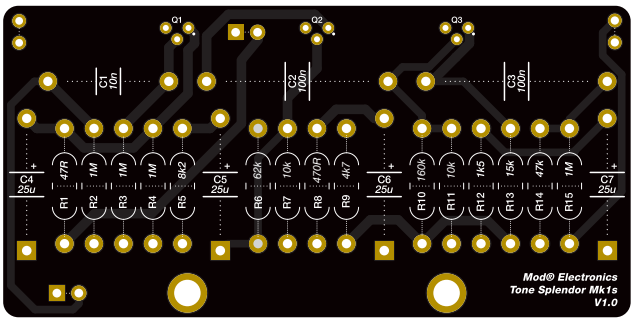
Note: Throughout these instructions and on the board, resistance and capacitance values are written in a shorthand form. The ohm (Ω) and Farad (F) symbols are left out, so a resistance value like 10kΩ will be written 10k, and a capacitance value like 100nF will be written as 100n. For resistance values <1kΩ, the letter R is used to explicitly show there is no multiplier (e.g. 470R = 470Ω).

When there is a decimal point, the multiplier is written in its place. For example: 2M2 = 2.2MΩ, 4k7 = 4.7kΩ, 8R2 = 8.2Ω. This is a commonly-used shorthand style you will see often.

Part	Value	Type
R1	47R	2W PR02 Metal Film Resistor
R2	1M	2W PR02 Metal Film Resistor
R3	1M	2W PR02 Metal Film Resistor
R4	1M	2W PR02 Metal Film Resistor
R5	8k2	2W PR02 Metal Film Resistor
R6	62k	2W PR02 Metal Film Resistor
R7	10k	2W PR02 Metal Film Resistor
R8	470R	2W PR02 Metal Film Resistor
R9	4k7	2W PR02 Metal Film Resistor
R10	160k	2W PR02 Metal Film Resistor
R11	10k	2W PR02 Metal Film Resistor
R12	1k5	2W PR02 Metal Film Resistor
R13	15k	2W PR02 Metal Film Resistor
R14	47k	2W PR02 Metal Film Resistor
R15	1M	2W PR02 Metal Film Resistor
C1	10n	630V Mallory Film Capacitor
C2	100n	400V Mallory Film Capacitor
C3	100n	400V Mallory Film Capacitor
C4	25u	Mod® Electrolytic Capacitor
C5	25u	Mod® Electrolytic Capacitor
C6	25u	Mod® Electrolytic Capacitor
C7	25u	Mod® Electrolytic Capacitor
Q1	BC109C	TO-18 Silicon Transistor
Q2	BC109C	TO-18 Silicon Transistor
Q3	BC109C	TO-18 Silicon Transistor

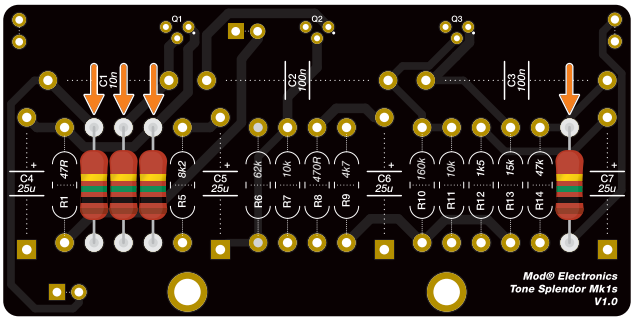
Main PCB Construction

Locate the included circuit board. The following steps will cover the placement and soldering of all parts that are mounted on this PCB. Use the BOM and Parts List as references. Note that reference designators like R1, R2, R3, etc. are in numerical order on the board to make locating them easier.

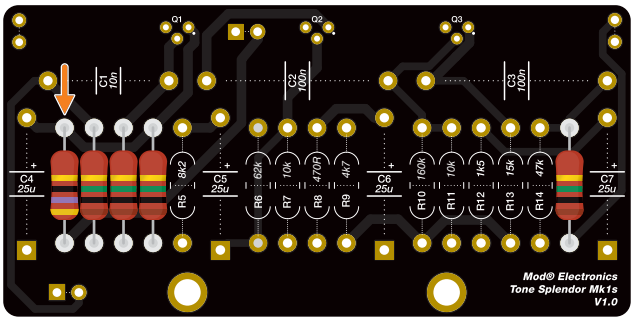


Part 1: Resistors

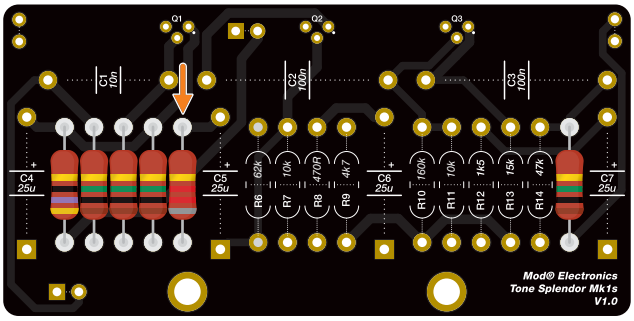
1.1: Locate four 1MΩ resistors. Their color bands are brown, black, green, gold. Insert these resistors at R2, R3, R4, and then solder each of them in place.



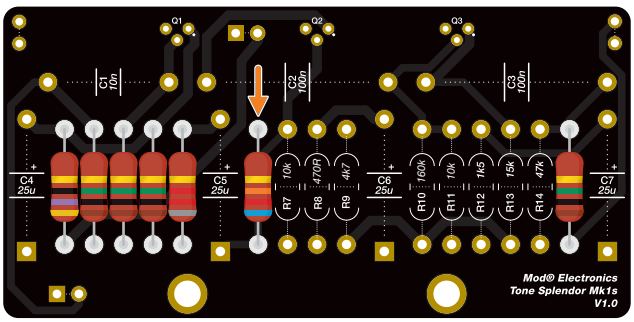
1.2: Locate the 47R resistor. Its color bands are yellow, violet, black, gold. Insert and solder this resistor at R1.



1.3: Locate the 8k2 resistor. Its color bands are gray, red, red, gold. Insert and solder this resistor at R5.



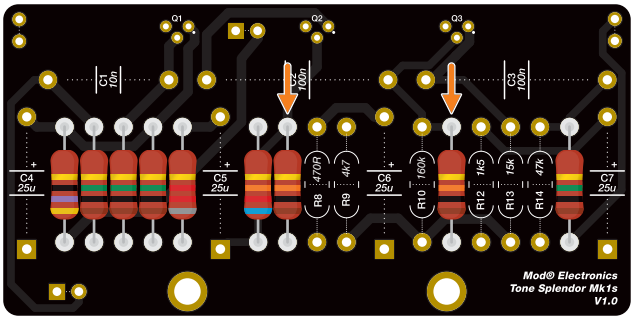
1.4: Locate the 62k resistor. Its color bands are blue, red, orange, gold. Insert and solder this resistor at R6.



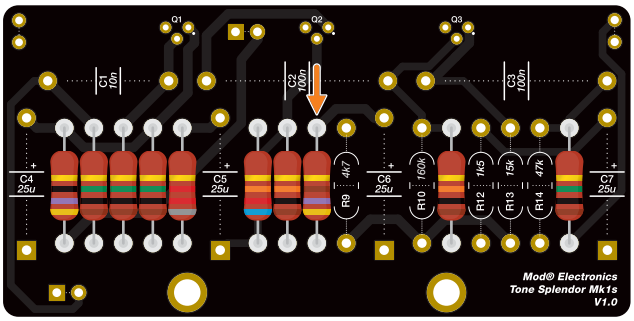
Main PCB Construction

Part 1: Resistors (cont.)

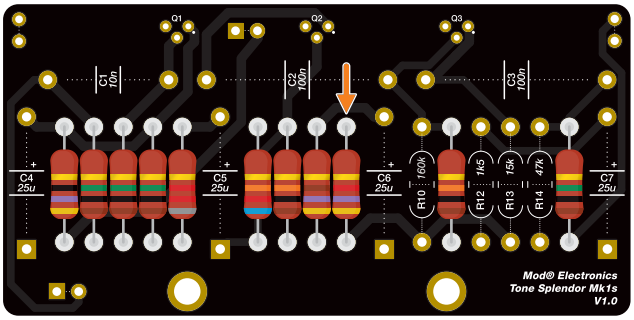
1.5: Locate two 10k resistors. Their color bands are brown, black, orange, gold. Insert these resistors at R7 and R11, and then solder each of them in place.



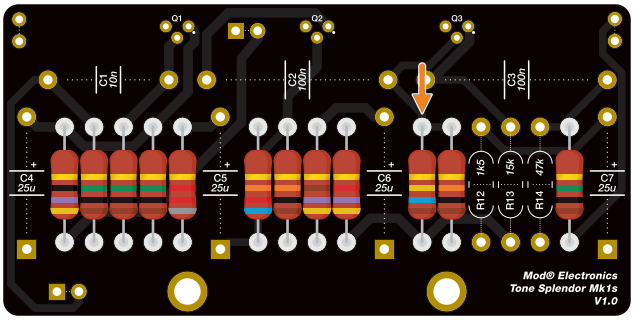
1.6: Locate the 470R resistor. Its color bands are yellow, violet, brown, gold. Insert and solder this resistor at R8.



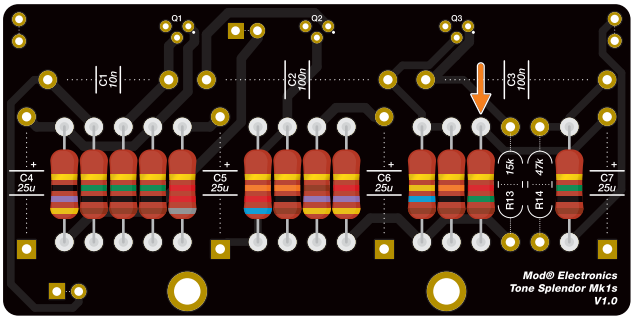
1.7: Locate the 4k7 resistor. Its color bands are yellow, violet, red, gold. Insert and solder this resistor at R9.



1.8: Locate the 160k resistor. Its color bands are brown, blue, yellow, gold. Insert and solder this resistor at R10.



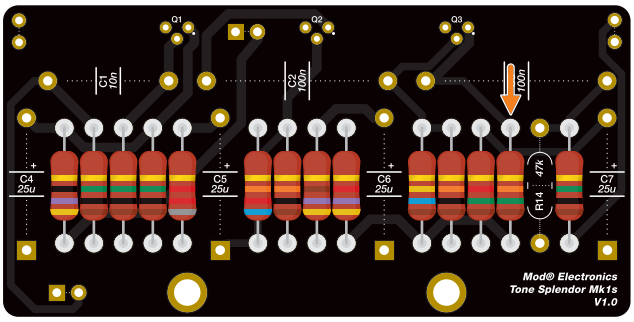
1.9: Locate the 1k5 resistor. Its color bands are brown, green, red, gold. Insert and solder this resistor at R12.



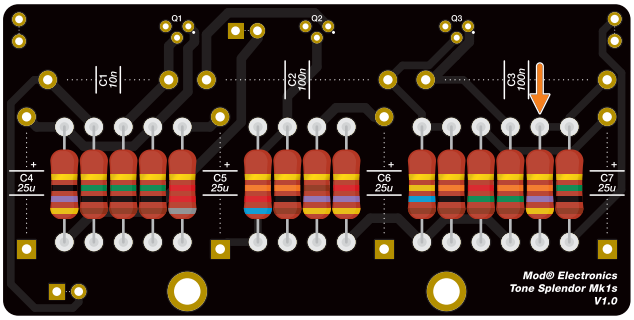
Main PCB Construction

Part 1: Resistors (cont.)

1.10: Locate the 15k resistor. Its color bands are brown, green, orange, gold. Insert and solder this resistor at R13.

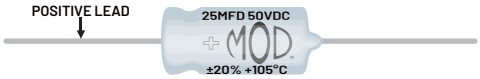


1.11: Locate the 47k resistor. Its color bands are yellow, violet, orange, gold. Insert and solder this resistor at R14.

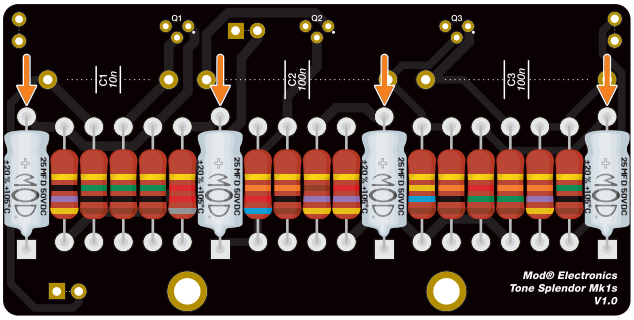


Part 2: Capacitors

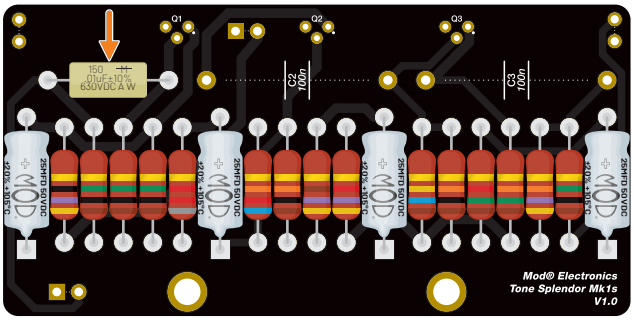
2.1: Locate the four silver Mod® 25u capacitors. When inserting the capacitors, note the orientation of the positive lead. This should match the orientation on the silkscreen (positive side marked "+").



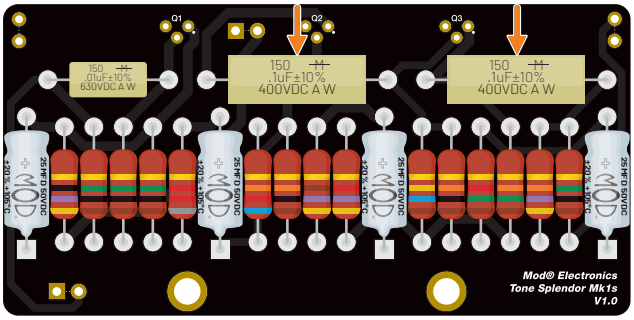
Insert these capacitors with the proper orientation at C4, C5, C6, and C7. Once inserted, solder all 4 capacitors in place.



2.2: Locate the (smaller) yellow 10n (0.01u) capacitor. Insert this capacitor at C1 and solder it in place. This capacitor is not polarized and can be inserted in either orientation.



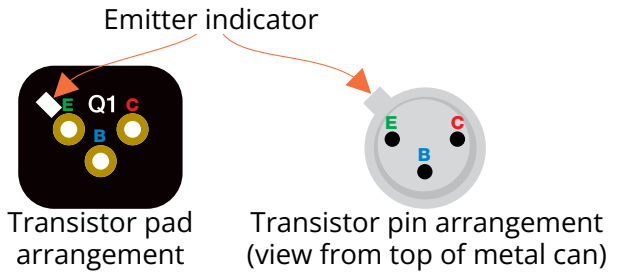
2.3: Locate the two (larger) yellow 100n (0.1u) capacitors. Insert these capacitors at C2 and C3 and solder both in place. These capacitors are not polarized and can be inserted in either orientation.



Main PCB Construction & Offboard Parts

Part 3: Transistors

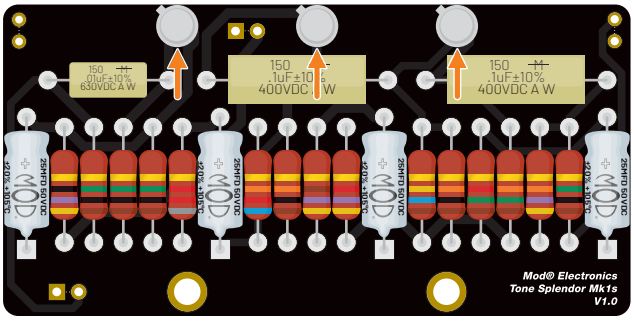
3.1: Locate the three BC109C transistors. These will be installed in Q1, Q2, and Q3. It is important that the pins are inserted correctly. Note in the diagram on the right that the pin orientation of the transistor matches the orientation of the mounting pads. The emitter is also indicated on the transistor with a metal tab, and should line up with the matching emitter indicator on the board.

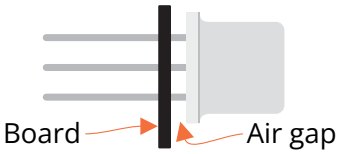


Transistor pad arrangement

Transistor pin arrangement (view from top of metal can)

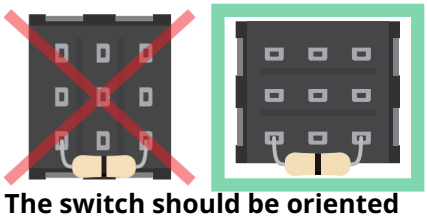
3.2: Minding the pin orientation, insert the three BC109C transistors into Q1, Q2, and Q3, The transistors do not need to be flush with the board - a small air gap is OK. Solder all 3 transistors into place.



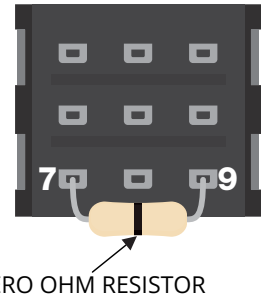


Part 4: Footswitch

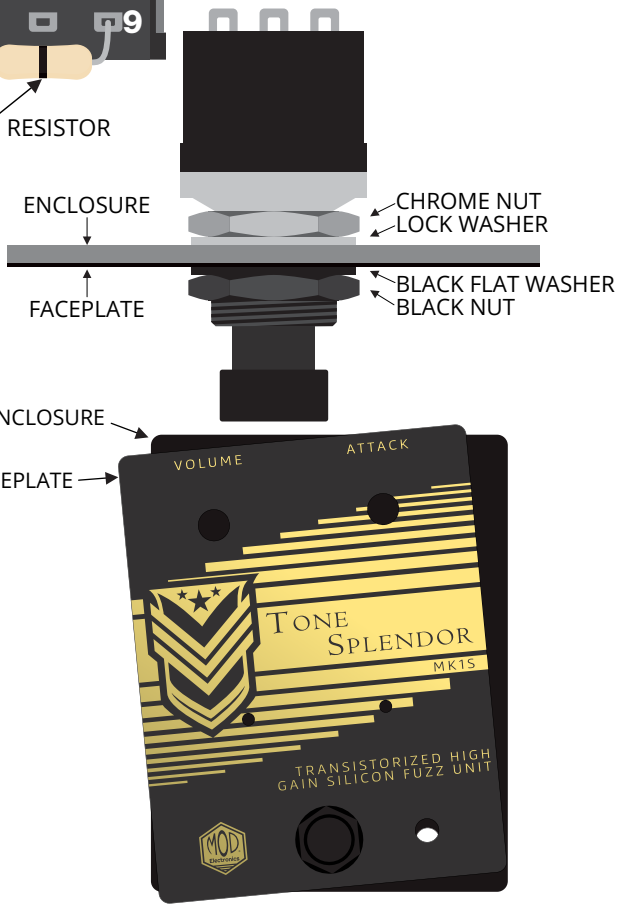
4.1: Locate the black 3PDT footswitch and the zero ohm resistor. Connect the zero ohm resistor between lug 7 and lug 9. Solder both lugs now.

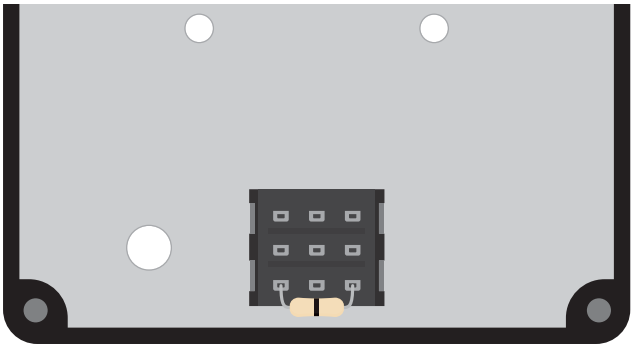


The switch should be oriented so it is wider than it is tall.



4.2: Once the bare wire is soldered, install the footswitch into the largest hole on the face of the enclosure. When doing so, line up the included faceplate with the holes on the enclosure first. Insert the footswitch through both the enclosure and the faceplate. Make sure the chrome nut and lock washer are on the inside of the enclosure, with the black washer and nut on the outside.

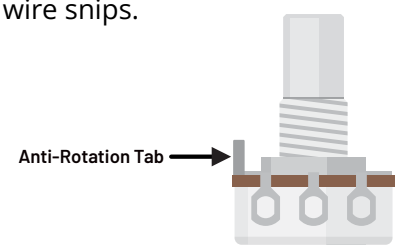




Offboard Parts

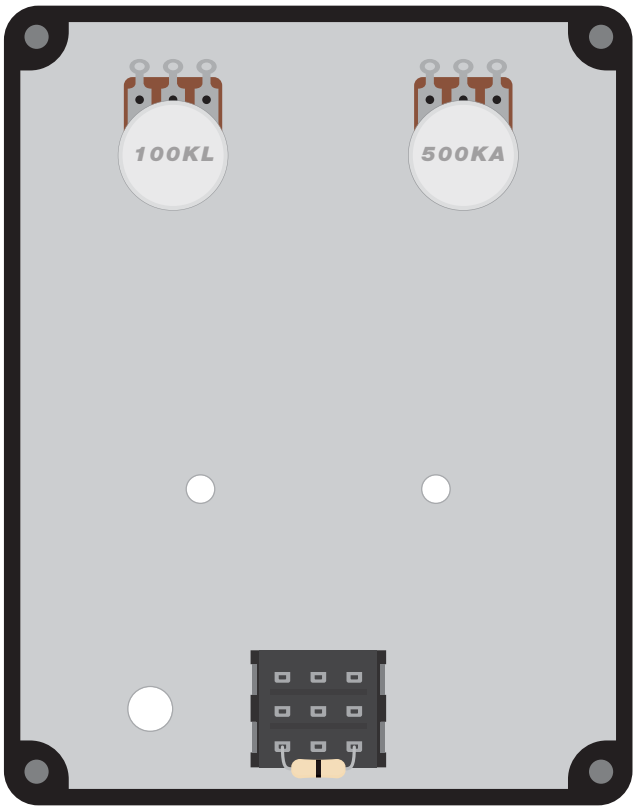
Part 5: Potentiometers

5.1: Locate the two potentiometers. Remove and set their mounting hardware aside. The anti-rotation tab should be removed from both. This can be done by bending it outward using a pair of pliers until it snaps, or by snipping it with a pair of wire snips.



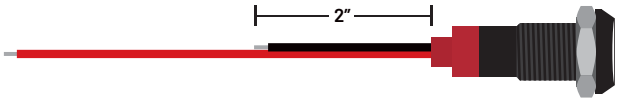
5.2: Install the two potentiometers in their respective mounting holes, noting which value goes where. Looking inside the open enclosure, the 100k linear taper potentiometer should be on the left as seen in the drawing to the right. Note that the 100k linear potentiometer may be marked "100KB" (B = linear taper).

The potentiometer hardware should be installed on the outside of the enclosure, with the washers going on first followed by the nuts.

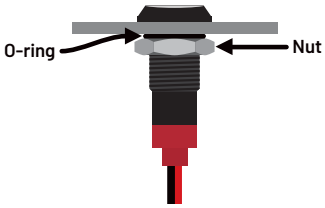


Part 6: Prewired LED & Standoffs

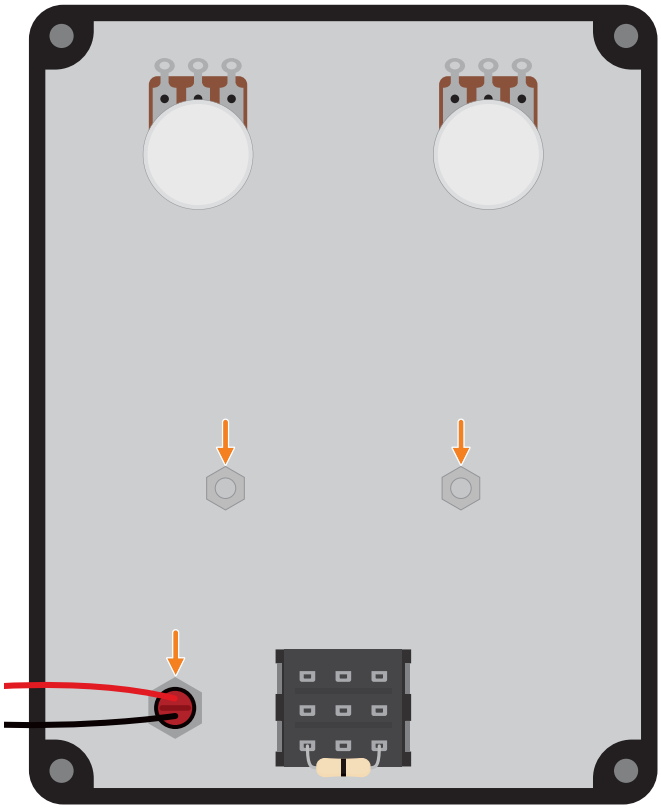
6.1: Locate the prewired LED. Trim the black wire down to 2", leaving the red wire at its full length. Re-strip the black wire.



6.2: Remove the mounting hardware and set it aside. Insert the prewired LED wires-first from the outside of the enclosure. Install it using the mounting hardware by first sliding the rubber O-ring onto the bushing, then installing the nut.

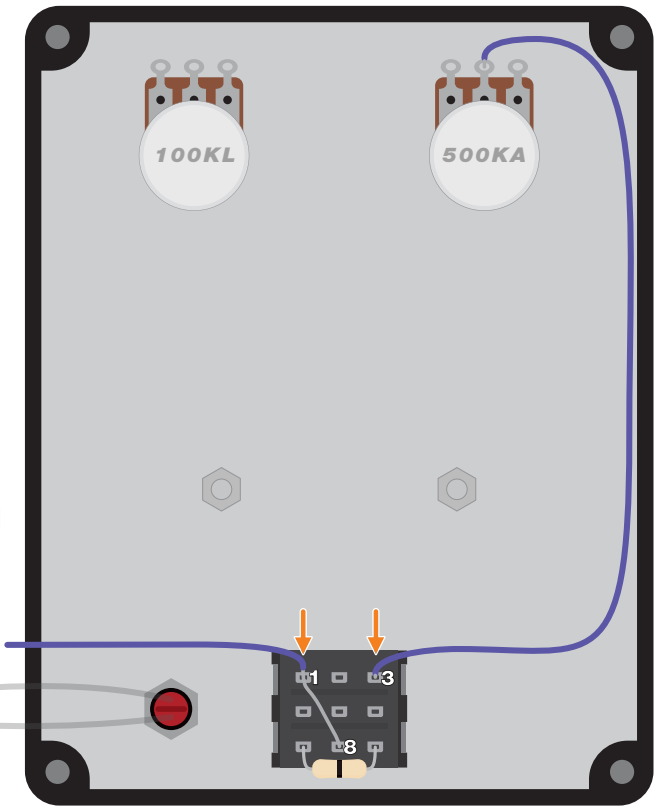


6.3: Locate the two male-female standoffs and the two black M3 screws. Insert the screws into the two smallest holes from the outside of the enclosure. Install the standoffs on the screws from the inside of the enclosure.

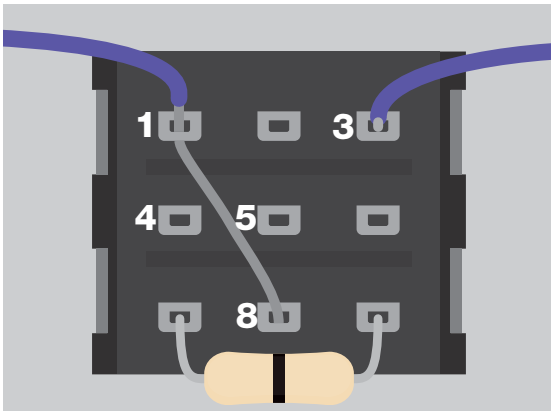


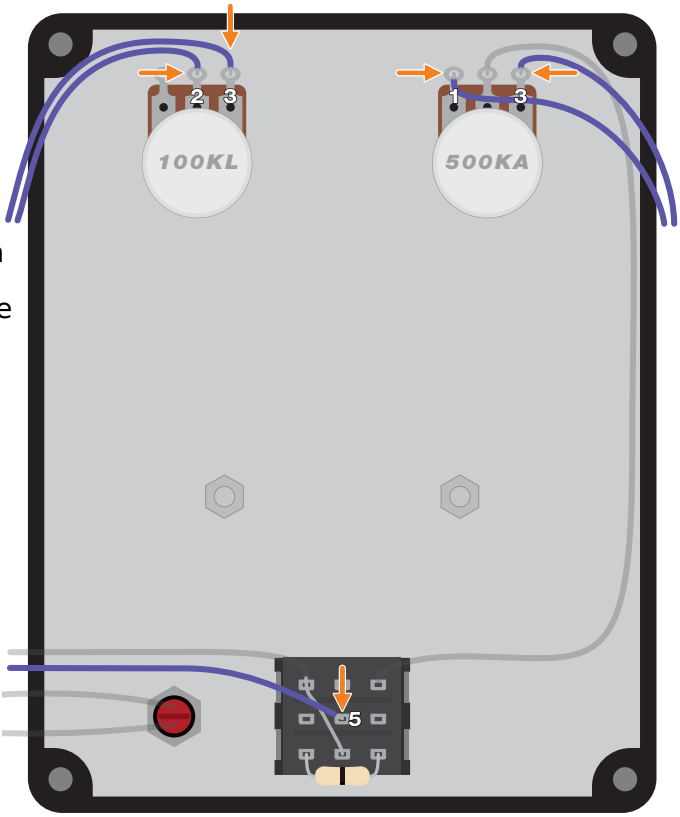
Part 7: Pot/Footswitch Wiring

7.1: Cut a 6” piece of wire and strip both ends. Connect it between lug 2 of the 500kA pot and lug 3 of the footswitch. Solder both ends now.



7.2: Cut a 3” piece of wire. Strip one end normally, and strip 0.75” of insulation off the other end. The longer bare end should be inserted through lug 1 of the footswitch and woven between the footswitch lugs to connect to lug 8 as well, as seen in the below diagram. Make sure that the bare wire does not touch lugs 4 and 5. Solder footswitch lugs 1 and 8 now, leaving the other end of the wire unconnected.



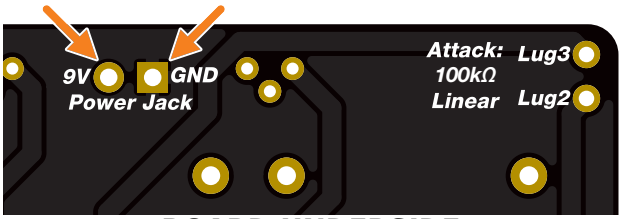


7.3: Cut four 2.5” pieces of wire, and strip both ends of each. Insert one end of each to lugs 2 and 3 of the 100kL pot, and lugs 1 and 3 of the 500kA pot. Solder each potentiometer lug now, leaving the other ends of each wire unconnected.

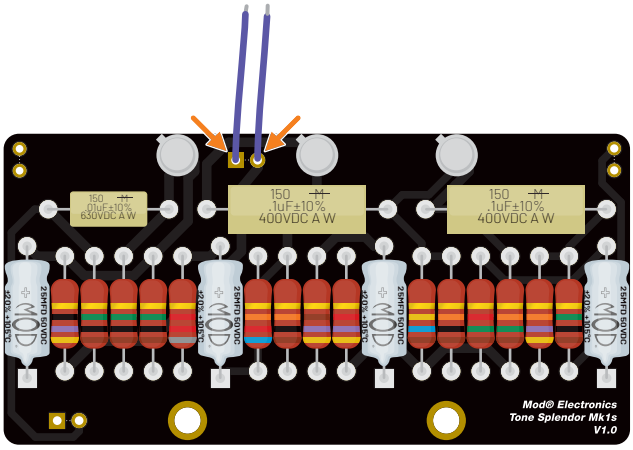
7.4: Cut one 2.75” piece of wire and strip both ends. Insert one end into lug 5 of the footswitch. Solder lug 5 now, leaving the other end of the wire unconnected.

Part 8: Offboard Connections

8.1: Cut two 2” pieces of wire and strip both ends of each wire. Locate the board again, and connect these wires to the GND (square) and 9V (round) pads of the offboard power jack connection as indicated in the diagram on the right. Solder both pads now, leaving the other ends unconnected. Note that the offboard connections are indicated on the bottom of the board, as seen below.

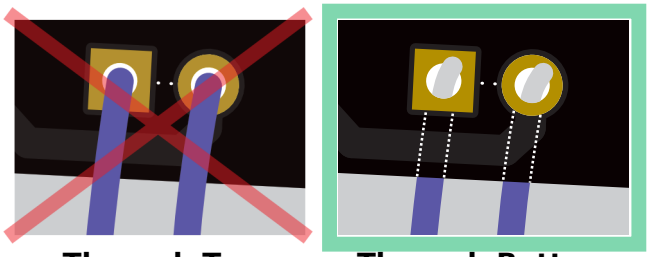


BOARD UNDERSIDE

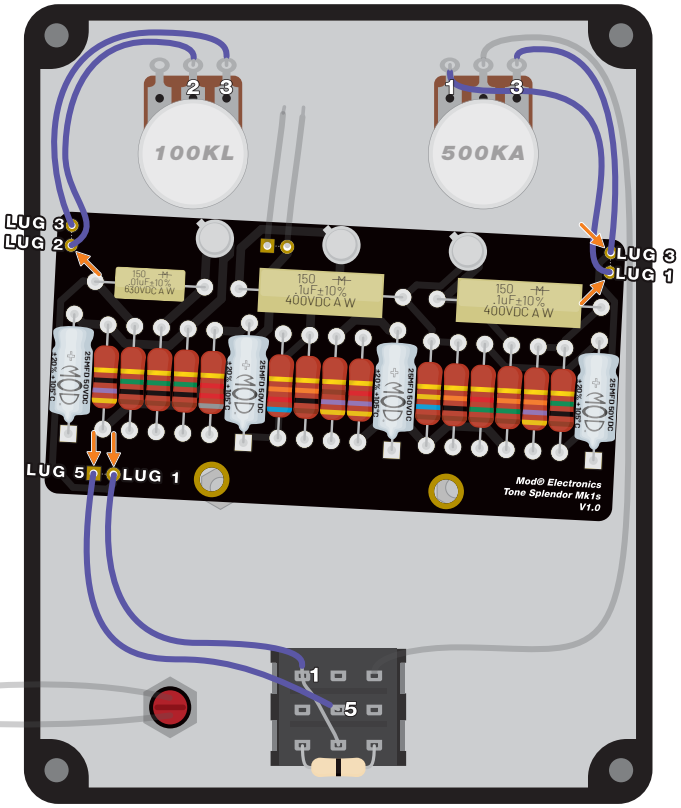


8.2: Place the board inside the enclosure, but do not install it yet. There are currently 6 wires that are connected only on one end: 2 on each potentiometer and 2 on the footswitch. The other ends of these wires should now be connected to the 6 open solder pads on the board as shown in the diagram to the right. The pads are grouped according to which offboard component they connect to. Remember that the connections are marked on the underside of the board and can be referenced that way as well.

Note: In the diagram on the right, the wires are inserted through the top of the board for clarity. That will work, but it will be easier to solder the contacts if the wires are inserted through the bottom of the board (see below).

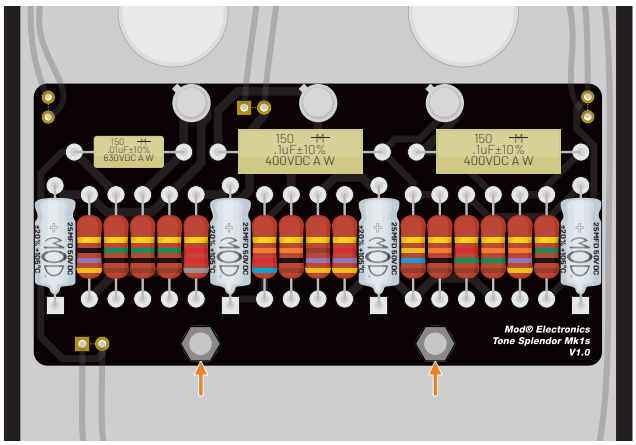


Through Top **Through Bottom**



Solder each of these 6 wire connections now.

8.3: Once the pots and footswitch are wired to the board, the board can be installed. Locate 2 M3 nuts. Slide the board mounting holes over the male end of the standoffs, then fasten the board by installing M3 nuts on each standoff.



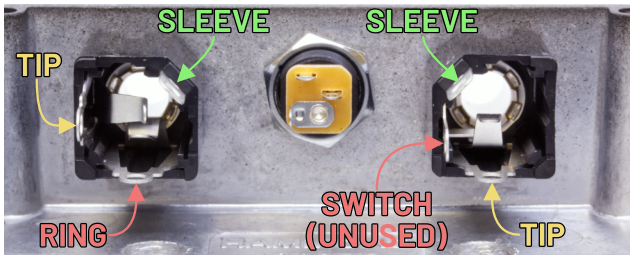
Offboard Parts

Part 9: Jacks

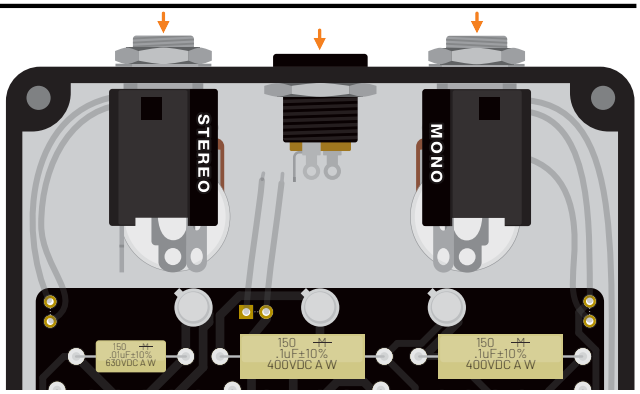
9.1: Locate the three included jacks:

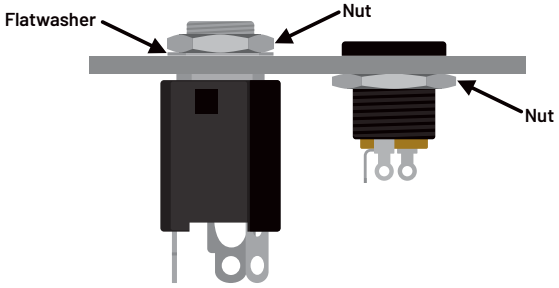
- Mono ¼” jack
- Stereo ¼” jack
- 5.5/2.1mm switched barrel jack

Install these jacks in the top of the enclosure with the barrel jack in the center. Note the location and orientation of the stereo and mono jacks. Looking into the enclosure, the stereo jack should be on the left (input jack).

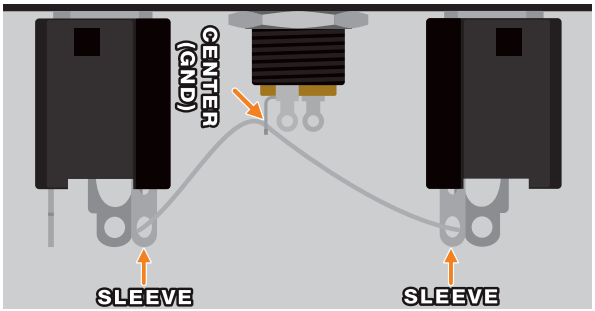


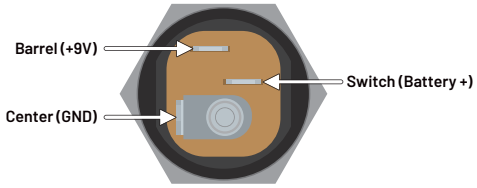
JACK ORIENTATION



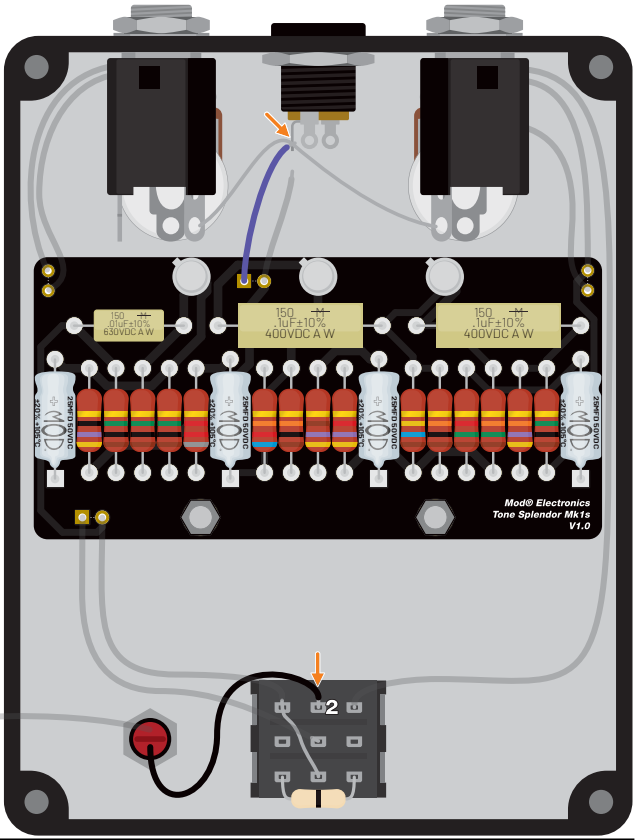


9.2: Locate the spool of stranded wire. Strip 2.5” of insulation off the end of the spool. Snip only this stripped portion off the spool for a 2.5” piece of bare wire. Run this bare wire through the sleeve lug of one ¼” jack, through the center (GND) lug of the barrel jack, and then through the sleeve lug of the other ¼” jack, as seen in the below diagram. Solder the sleeve contact of each ¼” jack now, but leave the barrel jack connection unsoldered.





9.3: There are two wires soldered near the top of the board which are still unconnected at the other end. Locate the wire connected to the square pad and connect the other end to the center (GND) lug of the barrel jack which has the bare wire going through it. Solder that contact now.

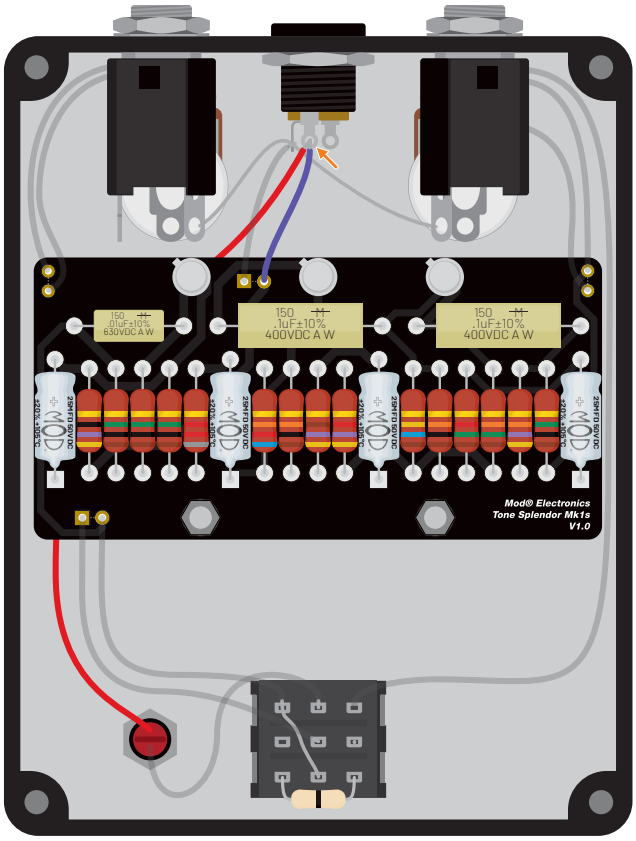


9.4: Locate the shorter black wire coming off the prewired LED. Connect it to lug 2 of the footswitch and solder that contact now.

Part 9: Jacks (Continued)

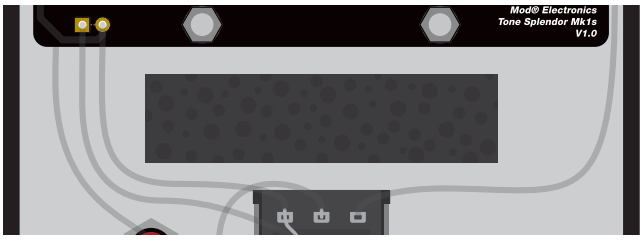
9.5: Locate the one remaining wire at the top of the board which is unconnected on the other end. Connect it to the sleeve (+) contact of the barrel jack, but do not solder it.

9.6: Locate the longer red wire coming off the prewired LED. Connect it to the same sleeve contact of the barrel jack. Solder the sleeve contact now.

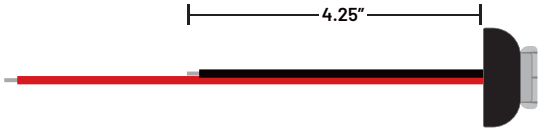


Part 10: Battery

10.1: Locate the adhesive-backed foam pad/ cushion. Make sure the enclosure surface between the footswitch and board is clear of any debris/particles. Remove the adhesive backing from the foam pad. Place the pad adhesive-side-down, centered directly between the footswitch and the board. Apply pressure for a few seconds to ensure the pad adheres to the enclosure.

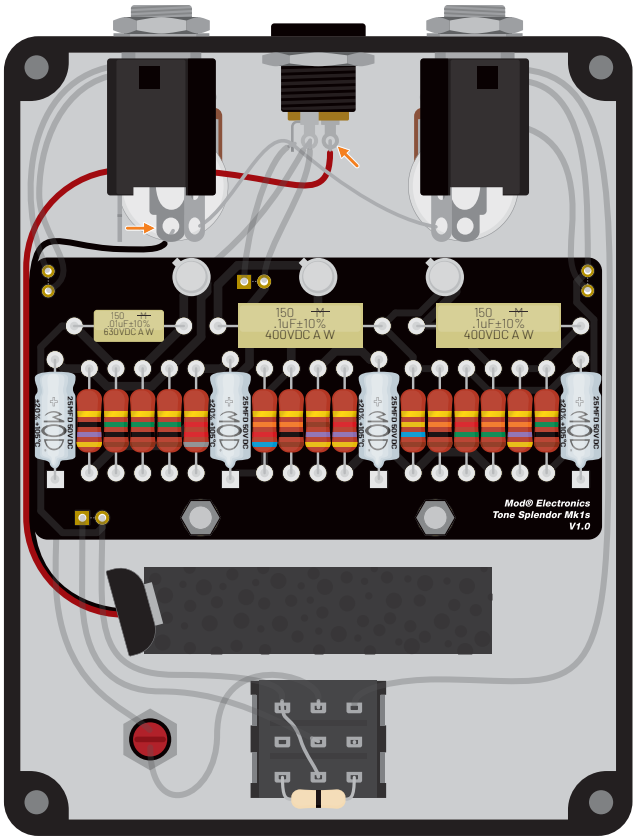


10.2: Locate the 9V battery connector. Cut the black wire down to 4.25” and re-strip it.



10.3: With the plastic end of the connector near the battery cushion, connect the black wire to the ring lug of the input stereo jack. Connect the red wire to the switch lug of the barrel jack. Solder both lugs now.

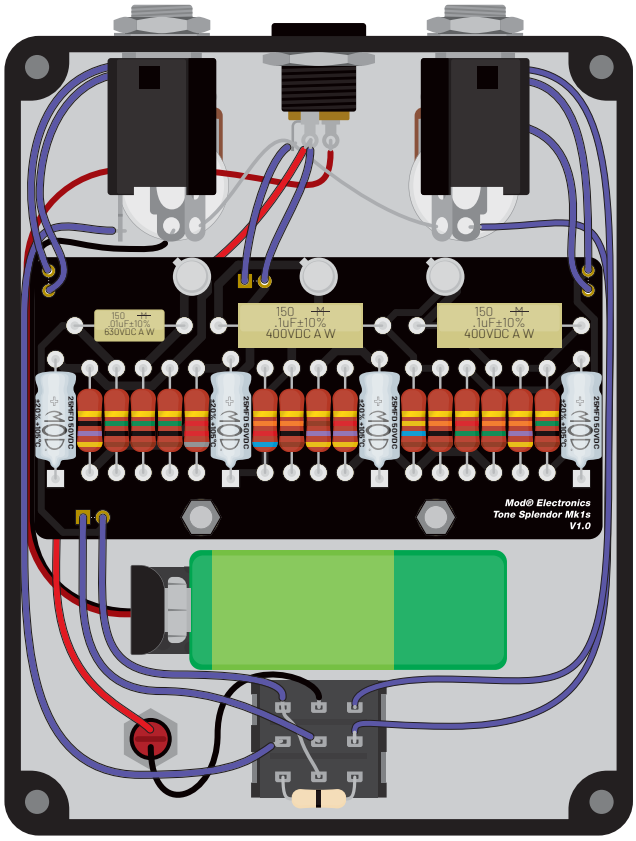
10.4: If you have a 9V battery on-hand you can install it now. It should rest on the cushion, which will hold it in place with friction when the enclosure lid is installed.



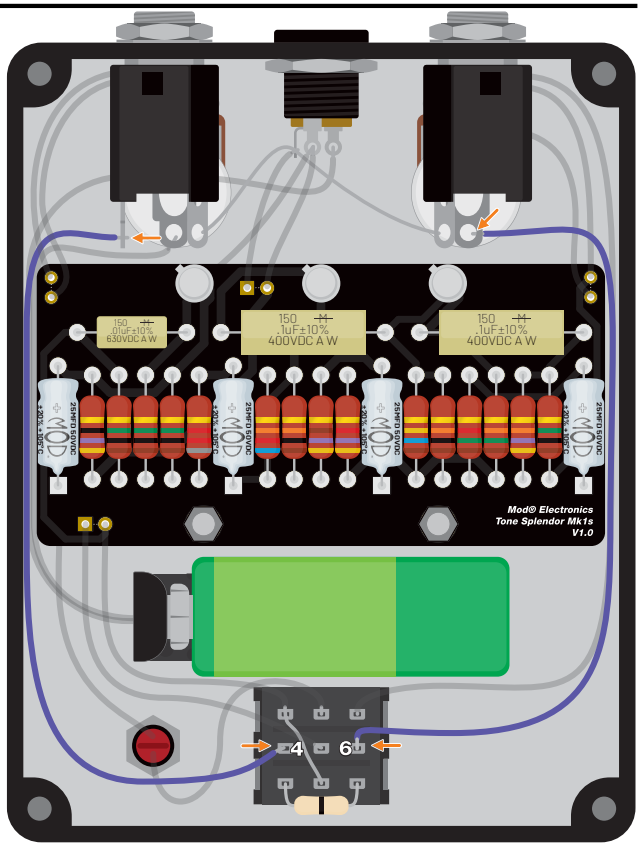
Offboard Parts

Part 11: Input/Output Wiring

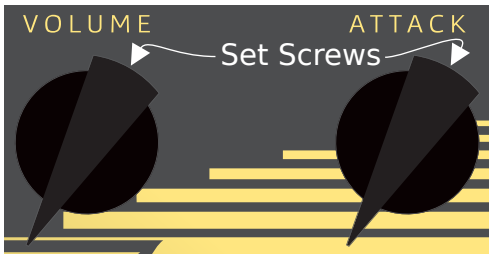
11.1: Cut two pieces of 4.75” wire and strip the ends of each. Connect one wire from lug 4 of the footswitch to the tip lug of the input (stereo) jack. Connect the other wire from lug 6 of the footswitch to the tip lug of the output (mono) jack. Solder both tip lugs and lugs 4 and 6 of the footswitch now.



FINAL LAYOUT

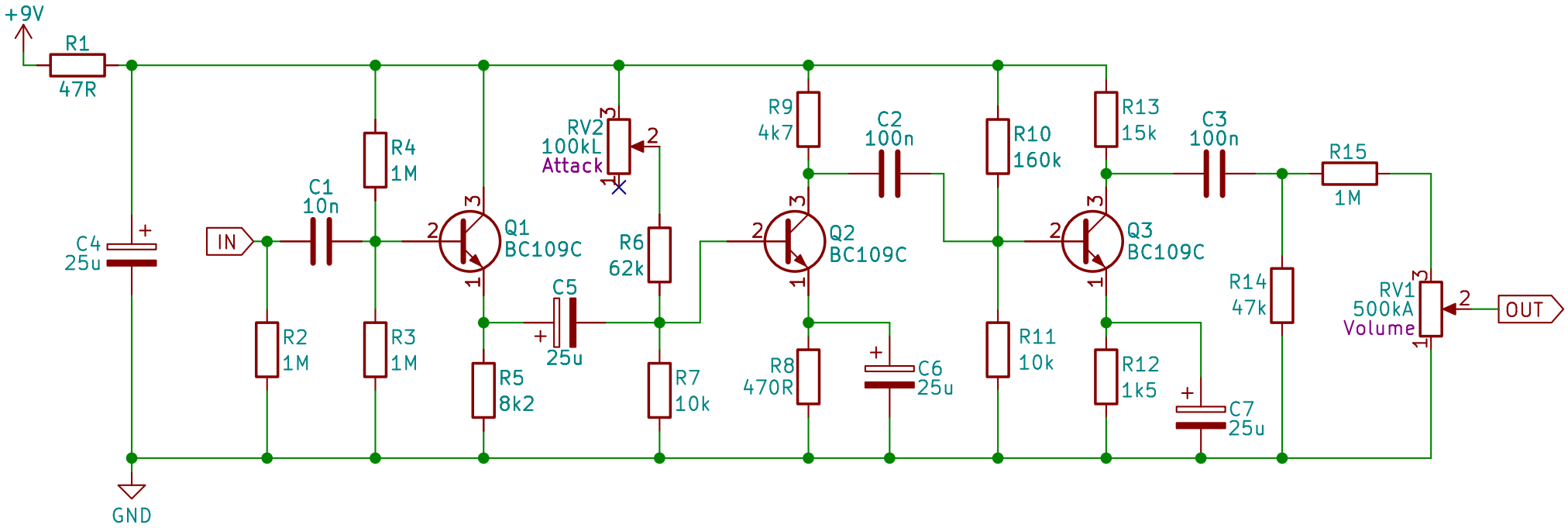


11.2: The knobs can now be installed. Rotate the potentiometer shafts fully counter-clockwise, then slide the knobs over the shafts. If they do not slide fully down, the set screws may need to be loosened. Once the knobs have been slid over the shafts, orient the knobs like the diagram below and tighten the set screws with a 1.5mm hex key.



11.3: The build is now complete! Re-install the lid/backplate with the four phillips head screws. The pedal can be powered with a standard center-negative pedal power supply, or if a 9V battery was installed, it can operate on a single battery for a long time due to the low current draw.

Schematic


+9V
R1
47R
C4
25u
GND
IN
C1
10n
R2
1M
R4
1M
R3
1M
Q1
BC109C
R5
8k2
C5
25u
RV2
100kL
Attack
R6
62k
R7
10k
R9
4k7
Q2
BC109C
R8
470R
C6
25u
C2
100n
R10
160k
R11
10k
R13
15k
Q3
BC109C
R12
1k5
C7
25u
C3
100n
R14
47k
R15
1M
RV1
500kA
Volume
OUT