PROJECT NAME

SOLARIS

DIY GUITAR EFFECTS

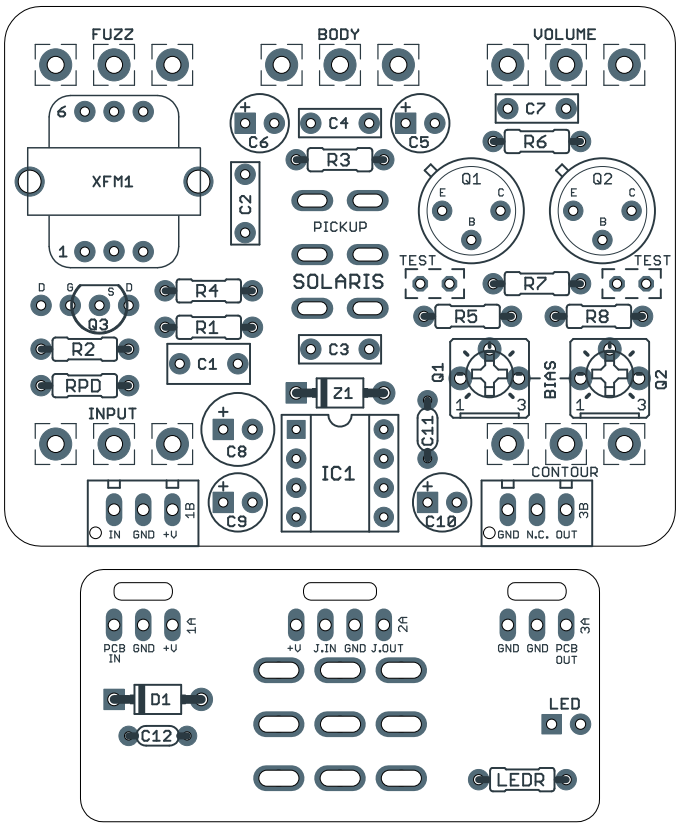
BASED ON
Dallas-Arbiter Fuzz Face

BUILD DIFFICULTY
Intermediate

EFFECT TYPE
Germanium fuzz

DOCUMENT VERSION
1.0.1 (2024-08-08)

PROJECT SUMMARY
A hot-rodded adaptation of the classic fuzz pedal made famous by Jimi Hendrix.



Actual size is 2.3" x 1.86" (main board) and 2.3" x 0.86" (bypass board).

IMPORTANT NOTE

This documentation is for the **PCB-only** version of the project. If you are building the full kit from Aion FX, please use the kit build documentation instead. The instructions are more detailed and may differ in some areas due to the specialized parts and assembly methods used in our kits.

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INTRODUCTION

The Solaris Germanium Fuzz is an adaptation of the classic Dallas-Arbiter Fuzz Face circuit from 1966.

The Solaris is a “deluxe” version of the Fuzz Face that adds 3 new knobs and a switch for extra flexibility. Added controls include an Input attenuation control (similar to using the volume control on a guitar to control the gain), a Body control to filter the amount of bass that is fed into the circuit, and a Contour control to tweak the midrange emphasis. (If you just want a no-frills Fuzz Face without the extra mods, the Proteus project is a stripped-down version of the Solaris.) There is also a charge pump allowing for -9V operation from a normal +9V supply.

New in the 125B version of the Solaris is a switchable pickup simulator at the input. The Fuzz Face was originally designed to connect directly to an electric guitar, and as a result it is notoriously picky about where it’s placed in the signal chain. If it’s fed a low-impedance signal (e.g. if there’s another pedal before it) then it loses much of its character.

The pickup simulator solves this problem by adding a transformer, resistor and capacitor to convert the source signal into the higher impedance that the circuit likes. It was invented by Jack Orman of AMZ and has been used in commercial versions of the Fuzz Face such as the Earthquaker Devices Erupter.

It won’t provide the same interactivity with the guitar’s tone & volume as if the pedal was connected directly to the guitar, but it will allow the circuit itself to retain the tonal character. You should only use it if you want to place the Solaris in a position other than first in your signal chain.

USAGE

The Solaris has five controls and one toggle:

- **Fuzz** controls the amount of gain from the second transistor where the clipping occurs.
- **Volume** is the output volume of the effect.
- **Contour** affects the midrange by varying the Q2 bias.
- **Input** allows you to attenuate the input signal, mimicking the effects of turning down your guitar volume. This way you can get similar volume-knob tones even if the fuzz is not the first effect in your chain. Joe Gagan, who came up with this control, recommends turning the Fuzz knob all the way up and using only this knob for the amount of distortion.
- **Body** is an input capacitor blend, which controls the amount of bass.
- **Pickup** enables or disables the pickup simulator.

PARTS LIST

This parts list is also available in a spreadsheet format which can be imported directly into Mouser for easy parts ordering. Mouser doesn't carry all the parts—notably potentiometers—so the second tab lists all the non-Mouser parts as well as sources for each.

View parts list spreadsheet →

PART	VALUE	TYPE	NOTES
R1	1M	Metal film resistor, 1/4W	
R2	1M	Metal film resistor, 1/4W	
R3	10k	Metal film resistor, 1/4W	
R4	1k	Metal film resistor, 1/4W	
R5	10k	Metal film resistor, 1/4W	
R6	100k	Metal film resistor, 1/4W	
R7	1k	Metal film resistor, 1/4W	
R8	220R	Metal film resistor, 1/4W	
RPD	2M2	Metal film resistor, 1/4W	Input pulldown resistor.
LEDR	10k	Metal film resistor, 1/4W	LED current-limiting resistor. Adjust value to change LED brightness.
C1	1uF	Film capacitor, 7.2 x 3.5mm	
C2	100n	Film capacitor, 7.2 x 2.5mm	
C3	1n	Film capacitor, 7.2 x 2.5mm	
C4	10n	Film capacitor, 7.2 x 2.5mm	
C5	10uF	Electrolytic capacitor, 5mm	
C6	22uF	Electrolytic capacitor, 5mm	
C7	10n	Film capacitor, 7.2 x 2.5mm	
C8	100uF	Electrolytic capacitor, 6.3mm	
C9	10uF	Electrolytic capacitor, 5mm	
C10	47uF	Electrolytic capacitor, 5mm	
C11	100n	MLCC capacitor, X7R	
C12	100n	MLCC capacitor, X7R	
Z1	1N4742A	Zener diode, 12V, DO-41	
D1	1N5817	Schottky diode, DO-41	
Q1	Germanium	Germanium transistor, PNP	Recommended to buy a selected Fuzz Face set. See build notes.
Q1-S	TO-5 socket	Transistor socket, TO-5	
Q2	Germanium	Germanium transistor, PNP	Recommended to buy a selected Fuzz Face set. See build notes.
Q2-S	TO-5 socket	Transistor socket, TO-5	
Q3	2N5457	JFET, N-channel, TO-92	Any equivalent general-purpose JFET will work here.
IC1	TC1044SCPA	Voltage inverter, DIP8	
IC1-S	DIP-8 socket	IC socket, DIP-8	

PARTS LIST, CONT.

PART	VALUE	TYPE	NOTES
XFM1	42TL019	Transformer, audio, 10KCT/600CT	
Q1BIAS	100k trimmer	Trimmer, 10%, 1/4"	
Q2BIAS	10k trimmer	Trimmer, 10%, 1/4"	
FUZZ	1kC	16mm right-angle PCB mount pot	Original uses linear (B) taper, but reverse (C) gives better control range.
VOL.	500kA	16mm right-angle PCB mount pot	
INPUT	250kB	16mm right-angle PCB mount pot	
BODY	100kB	16mm right-angle PCB mount pot	
CONT.	1kB	16mm right-angle PCB mount pot	
PICKUP	DPDT	Toggle switch, DPDT	
LED	5mm	LED, 5mm, red diffused	
IN	1/4" stereo	1/4" phone jack, closed frame	Switchcraft 112BX or equivalent.
OUT	1/4" mono	1/4" phone jack, closed frame	Switchcraft 111X or equivalent.
DC	2.1mm	DC jack, 2.1mm panel mount	Mouser 163-4302-E or equivalent.
BATT	Battery snap	9V battery snap	Optional. Use the soft plastic type—the hard-shell type will not fit.
FSW	3PDT	Stomp switch, 3PDT	
ENC	125B	Enclosure, die-cast aluminum	Can also use a Hammond 1590N1.

BUILD NOTES

Transistors

For this circuit, as with other vintage fuzzes, it's not so much the part number of the germanium transistor as it is the properties—specifically, gain (hFE) and leakage.

The Fuzz Face isn't as picky about its transistors as other germanium fuzzes like the Tone Bender, but you can save a lot of time by just buying a matched set from Small Bear Electronics or somewhere else. However, if you don't have access to pre-matched transistors or you just want to sort your own, here's what to look for.

Characteristics

This is just a general guideline. There are some transistors that meet these characteristics that won't sound right, and others that are outside this nominal range that will work just fine.

- **Q1:** hFE 70-90, low to high leakage (not more than 300µA)
- **Q2:** hFE 110-140, low to high leakage (not more than 300µA)

Biasing

The Solaris is set up to allow for easy biasing of the two transistors via trim pots without having to swap out resistors.

As a starting point, turn the Q1 bias trimmer to 9:00 and the Q2 trimmer to around 2:00. Set the Contour knob just above 9:00. Then, with a multimeter, touch the black and red leads to the two pads marked "TEST" below Q1. Turn the Q1 trimmer until the multimeter reads **-0.7V** (either positive or negative depending on which lead is touching which pad).

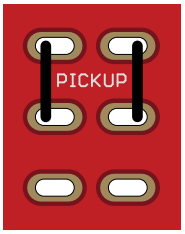
Next, moving to the test pads under Q2, turn the Q2 bias trimmer until the multimeter shows **-4.5V** (again, either positive or negative). Then, measure each leg on all three of the transistors. You're looking for something near these voltages.

- **Q1:** Collector -0.7V, Base -0.2V, Emitter 0V
- **Q2:** Collector -4.5V, Base -0.7V, Emitter -0.5V

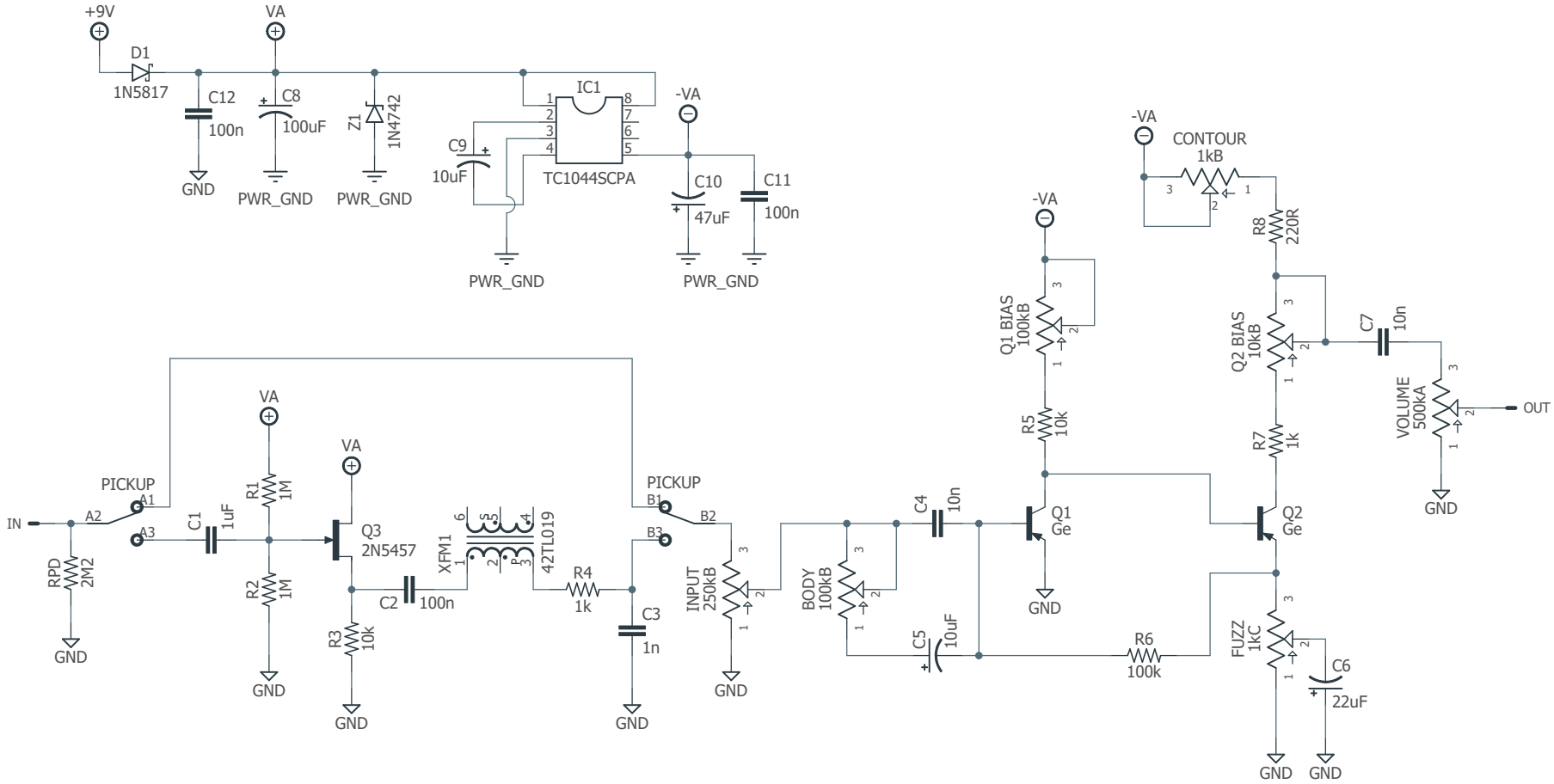
The voltages don't need to be anywhere near exact, this is just a benchmark. Let your ears be the judge. Some people prefer the Q2 voltage to be higher, around 5.5V.

Omitting the pickup simulator

The 42TL019 transformer is readily available from Mouser, but at times they may be out of stock. Or, you may just not want this option in your build. To omit the pickup simulator, leave off C1-3, R1-4, Q3, and the transformer. Then, solder jumpers across the toggle switch pads as shown in the diagram to the right.



SCHEMATIC


+9V
VA
D1
1N5817
C12
100n
C8
100uF
Z1
1N4742
GND
PWR_GND
PWR_GND
IC1
C9
10uF
TC1044SCPA
-VA
C10
47uF
C11
100n
PWR_GND
PWR_GND
IN
PICKUP
A1
A2
A3
C1
1uF
R1
1M
R2
1M
RPD
2M2
GND
GND
VA
Q3
2N5457
R3
10k
GND
C2
100n
XFM1
42TL019
R4
1k
C3
1n
GND
PICKUP
B1
B2
B3
INPUT
250kB
GND
BODY
100kB
C4
10n
C5
10uF
-VA
Q1 BIAS
100kB
R5
10k
Q1
Ge
GND
-VA
CONTOUR
1kB
R8
220R
Q2 BIAS
10kB
C7
10n
R7
1k
Q2
Ge
VOLUME
500kA
OUT
GND
R6
100k
FUZZ
1kC
C6
22uF
GND
GND

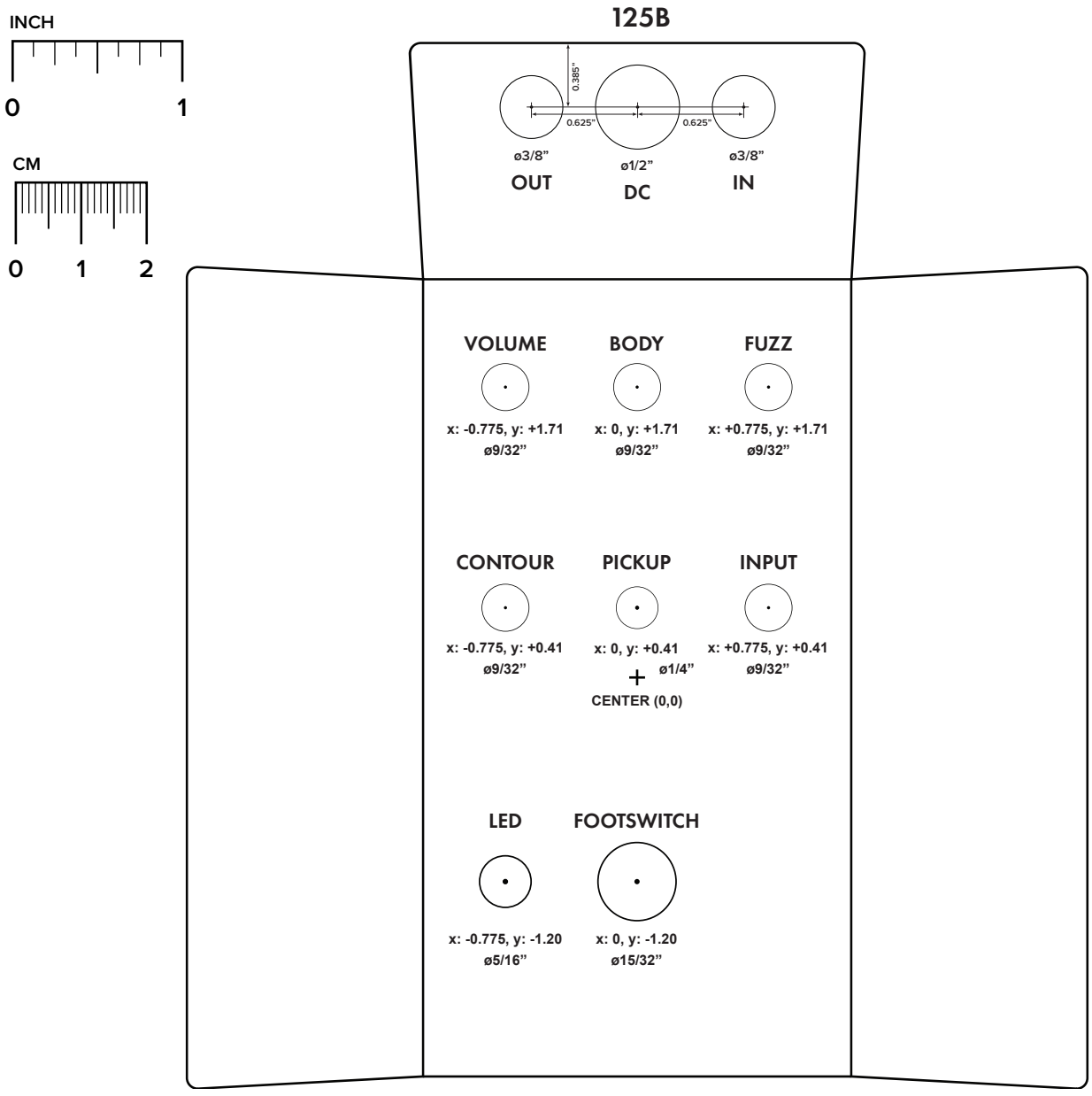
DRILL TEMPLATE

Cut out this drill template, fold the edges and tape it to the enclosure. Before drilling, it's recommended to first use a center punch for each of the holes to help guide the drill bit.

Ensure that this template is printed at 100% or "Actual Size". You can double-check this by measuring the scale on the printed page.

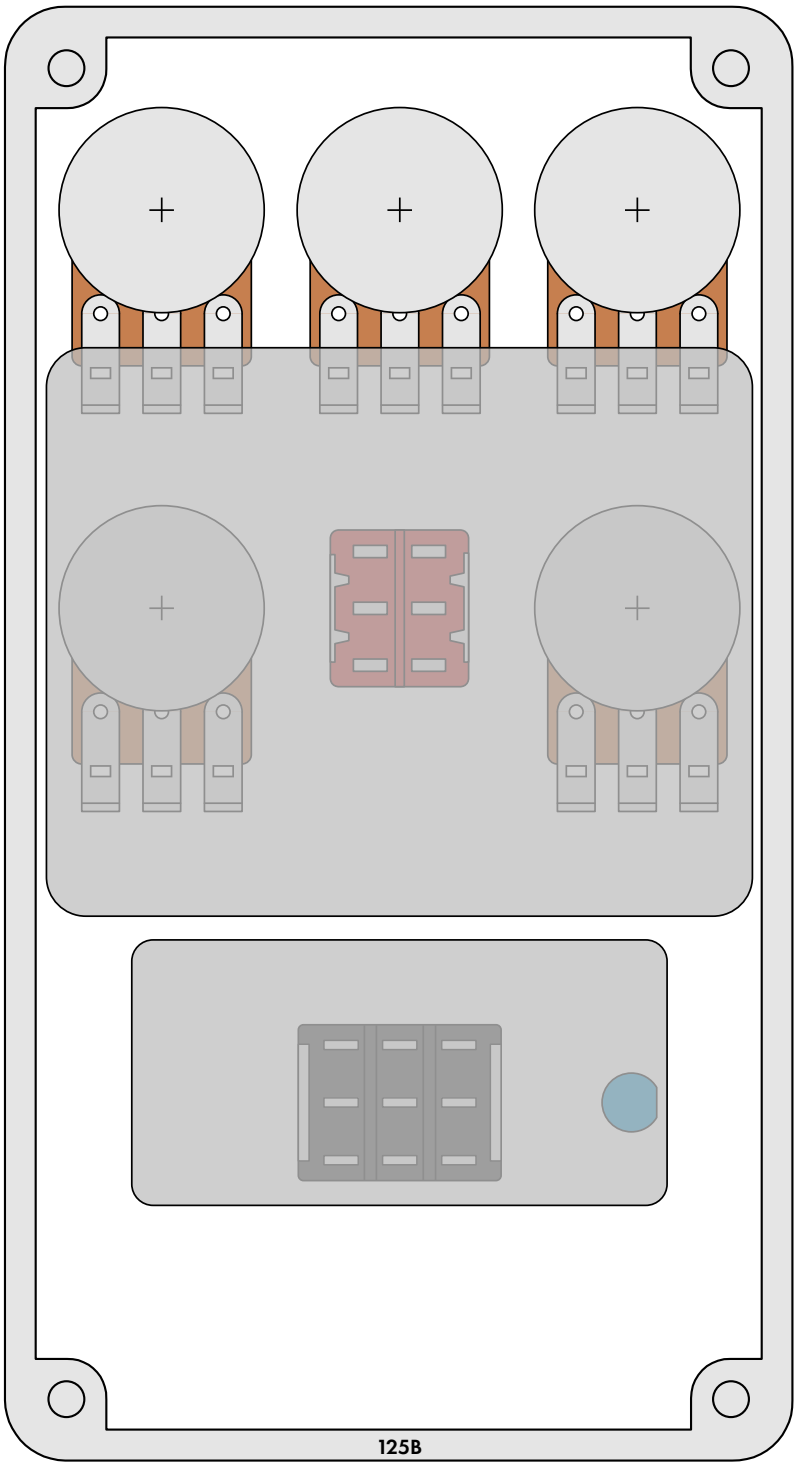
Top jack layout assumes the use of closed-frame jacks like the Switchcraft 111X. Open-frame jacks will not fit in layouts with 5 or more knobs due to the placement of the DC jack.

LED hole drill size assumes the use of a 5mm LED bezel, available from several parts suppliers. Adjust size accordingly if using something different, such as a 3mm bezel, a plastic bezel, or just a plain LED.

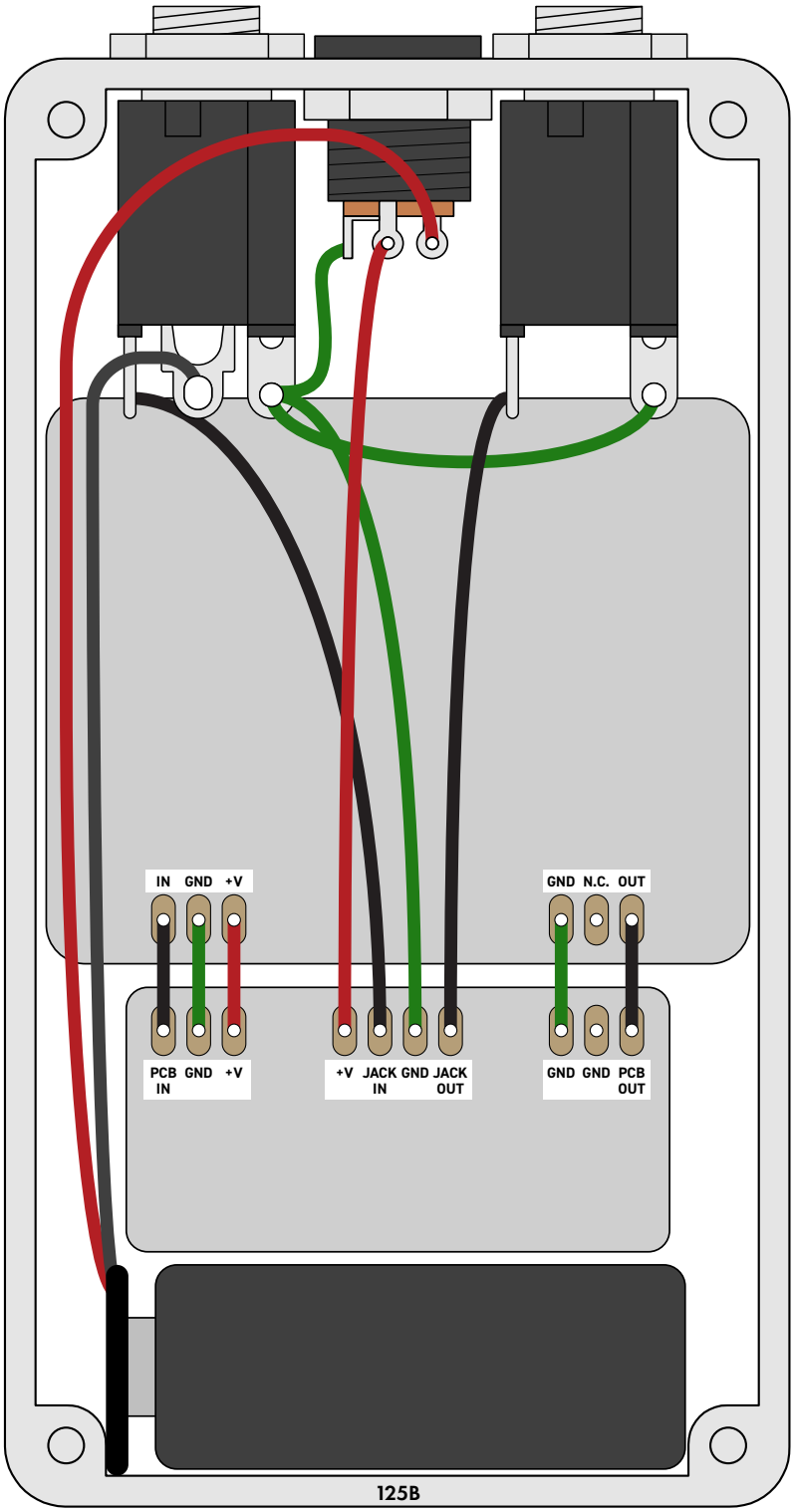


ENCLOSURE LAYOUT

Enclosure is shown without jacks. See next page for jack layout and wiring.



WIRING DIAGRAM



Shown with optional 9V battery. If battery is omitted, both jacks can be mono rather than one being stereo. Leave the far-right lug of the DC jack unconnected.

LICENSE & USAGE

No direct support is offered for these projects beyond the provided documentation. It's assumed that you have at least some experience building pedals before starting one of these. Replacements and refunds cannot be offered unless it can be shown that the circuit or documentation are in error.

All of these circuits have been tested in good faith in their base configurations. However, not all the modifications or variations have necessarily been tested. These are offered only as suggestions based on the experience and opinions of others.

Projects may be used for commercial endeavors in any quantity unless specifically noted. No attribution is necessary, though a link back is always greatly appreciated. The only usage restrictions are that **(1) you cannot resell the PCB as part of a kit without prior arrangement**, and **(2) you cannot "goop" the circuit, scratch off the screenprint, or otherwise obfuscate the circuit to disguise its source**. (In other words: you don't have to go out of your way to advertise the fact that you use these PCBs, but please don't go out of your way to hide it. The guitar effects industry needs more transparency, not less!)

DOCUMENT REVISIONS

1.0.1 (2024-08-08)
Changed LEDR to 10k to work with a wider variety of LEDs.

1.0.0 (2020-07-03)
Initial release.