PROJECT NAME

ORPHEUS GE

aion DIY GUITAR EFFECTS

BASED ON
Mosrite® Fuzzrite (germanium)

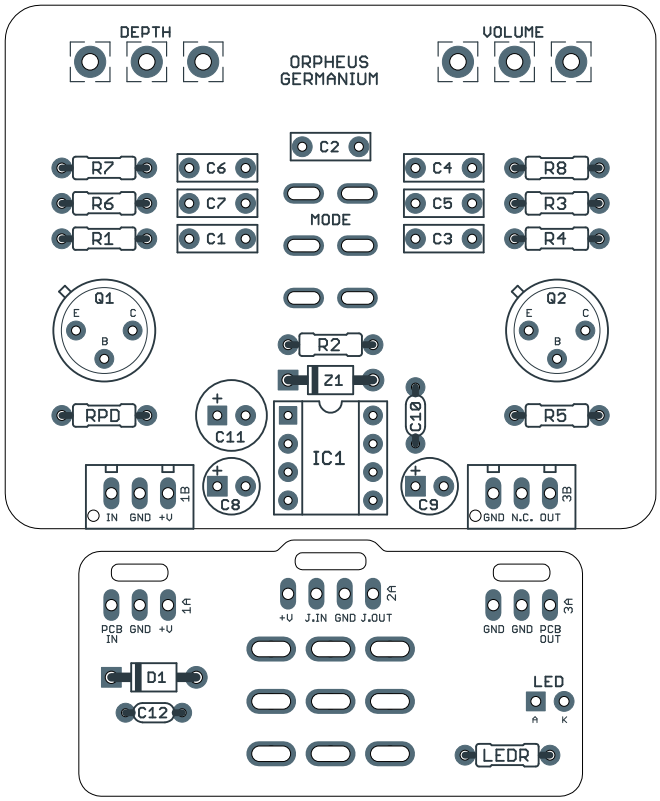
BUILD DIFFICULTY
▮▮▯▯▯ Easy

EFFECT TYPE
Germanium fuzz

DOCUMENT VERSION
1.0.0 (2024-07-04)

PROJECT SUMMARY

The definitive American response to the fuzz effects coming out of the UK in the mid-1960s, featuring two germanium transistors in a unique blending arrangement.



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 **germanium** version of the project. There is also a silicon version, based on the later Fuzzrite circuit. While the names are similar, the schematic and part numbering are different. Confirm your PCB looks like the one above and is labeled “Orpheus Germanium” or just “Orpheus” before proceeding.

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INTRODUCTION

The Orpheum Germanium Fuzz is based on the original version of the Mosrite Fuzzrite, designed by Ed Sanner in Bakersfield, CA and originally released in 1966. It's considered to be the definitive American response to the British fuzzes of the mid-1960s, a fully original circuit that stands alongside such legends as the Tone Bender and Fuzz Face. It was responsible for the classic fuzz tones on "In-A-Gadda-Da-Vida" by Iron Butterfly.

In 2022, Catalinbread released an adaptation of the germanium Fuzzrite in collaboration with the original inventor. The most notable change is the addition of a Vintage/Modern toggle switch that adds back the fullness that is taken away by the low-valued coupling capacitors, which was the major shortcoming of the original Fuzzrite. This switch makes the circuit far more versatile, and so we have incorporated it into our version.

The germanium Fuzzrite was the basis for the fuzz sub-circuit of the Acoustic 360 bass amp and 260 guitar amp. We have released projects for the full preamp as well as the standalone fuzz circuit from the amp. It's similar to the germanium version, but uses NPN transistors (one silicon and one germanium) and has input and output buffers.

In 1968, the Fuzzrite was redesigned to use NPN silicon transistors, a change that was also taking place with the classic Fuzz Face and Tone Bender on the other side of the Atlantic. This version of the circuit was also either cloned or whitelabeled as the Orpheum Fuzz, Clark Fuzz, Guild Foxey Lady and Electro-Harmonix Axis. We have an alternate version of this project called the Orpheus Silicon if you want to build one of these circuits.

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USAGE

The Orpheus Germanium has two knobs and one toggle switch:

- **Depth** blends between the output of the first transistor and the second transistor. Since the second transistor is where most of the distortion takes place, it acts as a drive control.
- **Volume** is the output volume of the effect.
- **Mode** (toggle switch) selects between vintage and modern. Modern mode adds significantly more midrange and bass to round out the EQ.

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	2M2	Metal film resistor, 1/4W	10M in Catalinbread and Orpheum.
R2	22k	Metal film resistor, 1/4W	
R3	1M	Metal film resistor, 1/4W	
R4	47k	Metal film resistor, 1/4W	
R5	100k	Metal film resistor, 1/4W	68k in Catalinbread. 47k in Orpheum.
R6	22k	Metal film resistor, 1/4W	
R7	1M2	Metal film resistor, 1/4W	1M in Catalinbread.
R8	100k	Metal film resistor, 1/4W	Omit (leave empty) in Catalinbread.
RPD	2M2	Metal film resistor, 1/4W	Input pulldown resistor.
LEDR	10k	Metal film resistor, 1/4W	LED current-limiting resistor.
C1	47n	Film capacitor, 7.2 x 2.5mm	100n in Orpheum.
C2	47n	Film capacitor, 7.2 x 2.5mm	100n in Orpheum.
C3	47n	Film capacitor, 7.2 x 2.5mm	100n in Orpheum.
C4	2n2	Film capacitor, 7.2 x 2.5mm	5n in Orpheum (4n7 is closest standard equivalent).
C5	8n2	Film capacitor, 7.2 x 2.5mm	Part of the Mode switch mod. Can reduce to 4n7 for less bass.
C6	2n2	Film capacitor, 7.2 x 2.5mm	5n in Orpheum (4n7 is closest standard equivalent).
C7	8n2	Film capacitor, 7.2 x 2.5mm	Part of the Mode switch mod. Can reduce to 4n7 for less bass.
C8	10uF	Electrolytic capacitor, 5mm	
C9	47uF	Electrolytic capacitor, 5mm	Power supply filter capacitor.
C10	100n	MLCC capacitor, X7R	Power supply filter capacitor.
C11	100uF	Electrolytic capacitor, 6.3mm	Power supply filter capacitor.
C12	100n	MLCC capacitor, X7R	Power supply filter capacitor.
D1	1N5817	Schottky diode, DO-41	
Z1	1N4742A	Zener diode, 12V, DO-41	
IC1	LT1054CP	Voltage converter, DIP-8	
IC1-S	DIP-8 socket	IC socket, DIP-8	
Q1	Ge PNP	Germanium transistor, PNP	See build notes for transistor selection.
Q2	Ge PNP	Germanium transistor, PNP	See build notes for transistor selection.

PARTS LIST, CONT.

PART	VALUE	TYPE	NOTES
DEPTH	500kC	16mm right-angle PCB mount pot	See build notes for other potentiometer values.
VOLUME	50kA	16mm right-angle PCB mount pot	See build notes for other potentiometer values.
MODE	DPDT on-on	Toggle switch, DPDT on-on	
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

Potentiometer values

The original Fuzzrite used a 350k potentiometer for Depth and 33k for Volume. These are non-standard values, so R7 and R8 have been added in parallel with these pots to allow standard types to be used.

- For **Depth**, use a 500kC potentiometer with a 1M2 resistor for R13.
- For **Volume**, use a 50kA potentiometer with a 100k resistor for R14.

The 500kC value for Depth is taken from the Catalinbread version. The original used 500kB. Reverse-audio (C) taper provides a smoother transition from low to high gain, but with the same minimum and maximum settings as the original, so we've used it for the default parts list in this circuit. They used a 1M parallel resistor for R7, but this is likely because their version used mostly carbon-comp resistors and 1M2 was more difficult to source.

Volume was originally "B" (linear) taper, but "A" (audio or log) provides a better range of control.

Volume was also sometimes 500kB. If using this value, R8 should be omitted.

Transistor selection

The original Fuzzrite used 2N2613 for Q1 and 2N408 for Q2, both germanium PNP transistors. We've never seen detailed measurements of these, but since they're germanium, it's safe to say they were all over the place in h_{FE} and leakage.

Based on the datasheet, the 2N2613 is much higher gain, with a minimum h_{FE} of 120 as compared to only 65 for the 2N408. Although the minimum gain spec is very different than average gain, this gives us some guidance, telling us that Q1 should be significantly higher than Q2, at least a 2:1 gain ratio.

In the Catalinbread unit that we took apart for this project, Q1 was a 2N404 with a gain of 182, and Q2 was a GT308A Russian transistor with a gain of 53. So their Q1/Q2 ratio was around 3.5:1.

This is just some baseline information to be used as a starting point. Many people have tried drastically different combinations, either higher gain or lower, and found that it was more to their liking. If you only have two transistors, just use them without a second thought and don't focus too much on the formula.

Mode switch modifications

When engaged, the Mode switch increases the size of the coupling capacitors of both sides of the blend, which allows more midrange and low-end.

It's recommended to use 8n2 for C5 and C7, which adds up to 10n4 when put in parallel with the existing 2n2 capacitors (C4 and C6). If you find that modern mode is too bassy, you can reduce C5 and C7 to 4n7.

C5 and C7 also do not both have to be the same value, for instance if you find that it needs more bass on the higher end of the Depth control but not on the lower end.

Variants

The germanium Fuzzrite did not have the widespread clones and variants of the silicon version, but it did have one in particular, the Orpheum Fuzz (which also had a better-known silicon version).

Orpheum Fuzz

To build an Orpheum Fuzz, make the following substitutions:

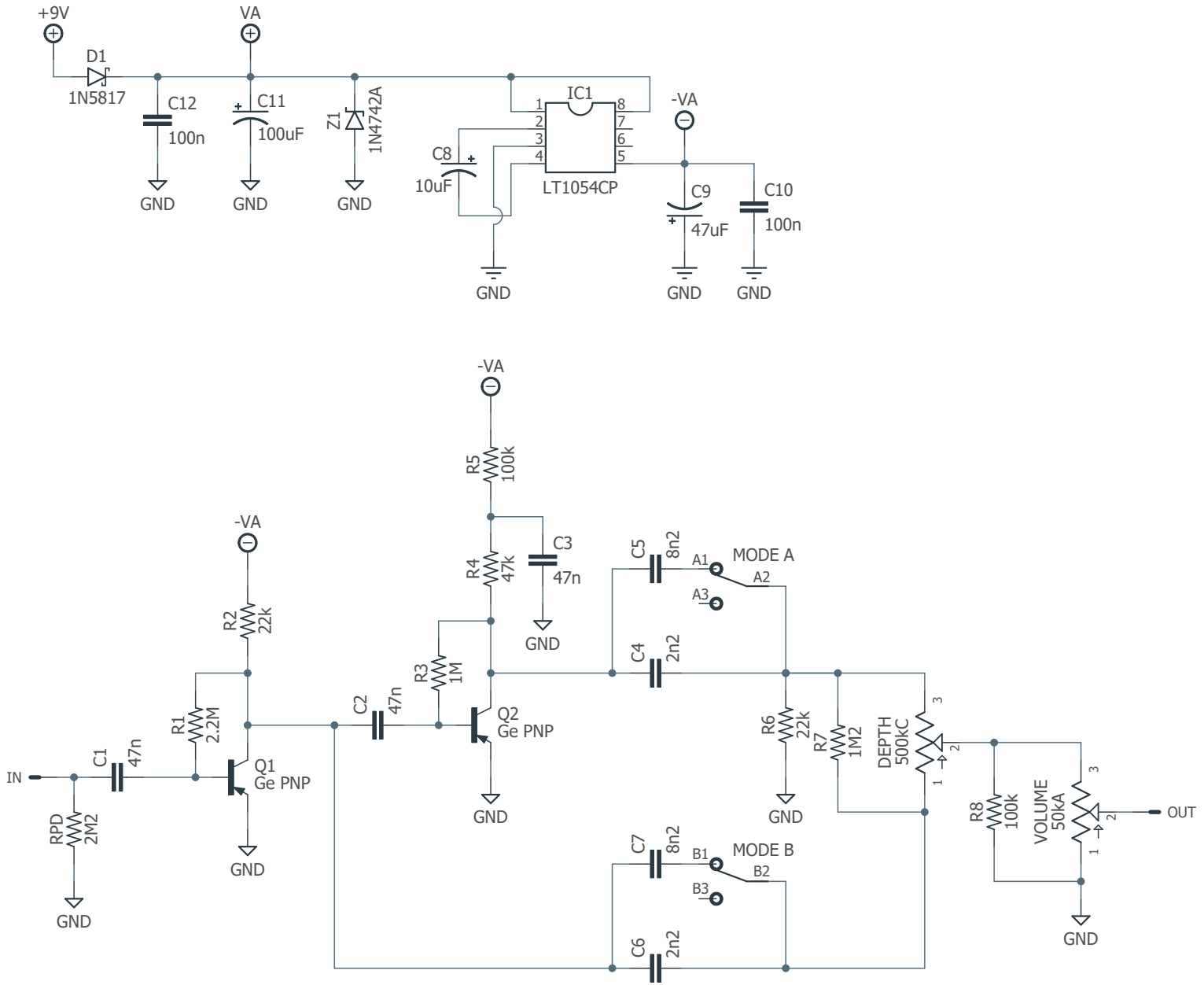
- **R1:** 2.2M → 10M
- **R5:** 100k → 47k
- **C1:** 47n → 100n
- **C2:** 47n → 100n
- **C3:** 47n → 100n
- **C4:** 2n2 → 5n (nearest standard value is 4n7)
- **C6:** 2n2 → 5n (nearest standard value is 4n7)
- **Depth:** 500kB → 200kA (nearest standard value is 250kA; can use 1M for R7 to get 200k)
- **Volume:** 50kB → 250kB

Catalinbread Fuzzrite

The Catalinbread Fuzzrite also changed a couple of values. These may have been from an original Fuzzrite that they used as reference, or they could have been changed so the circuit worked better with the type of transistors they used.

- **R1:** 2.2M → 10M
- **R5:** 100k → 68k
- **R7:** 1M2 → 1M
- **Depth:** 500kB → 500kC
- **Volume:** 50kB → 500kB

SCHEMATIC


+9V
D1
1N5817
C12
100n
GND
VA
C11
100uF
GND
Z1
1N4742A
GND
IC1
LT1054CP
C8
10uF
GND
-VA
C9
47uF
GND
C10
100n
GND
-VA
R5
100k
C3
47n
GND
R4
47k
C5
8n2
A1
MODE A
A2
A3
C4
2n2
-VA
R2
22k
R3
1M
C2
47n
Q2
Ge PNP
GND
R6
22k
R7
1M2
DEPTH
500kC
R1
2.2M
C1
47n
IN
Q1
Ge PNP
GND
RPD
2M2
GND
C7
8n2
B1
MODE B
B2
B3
C6
2n2
R8
100k
VOLUME
50kA
OUT
GND

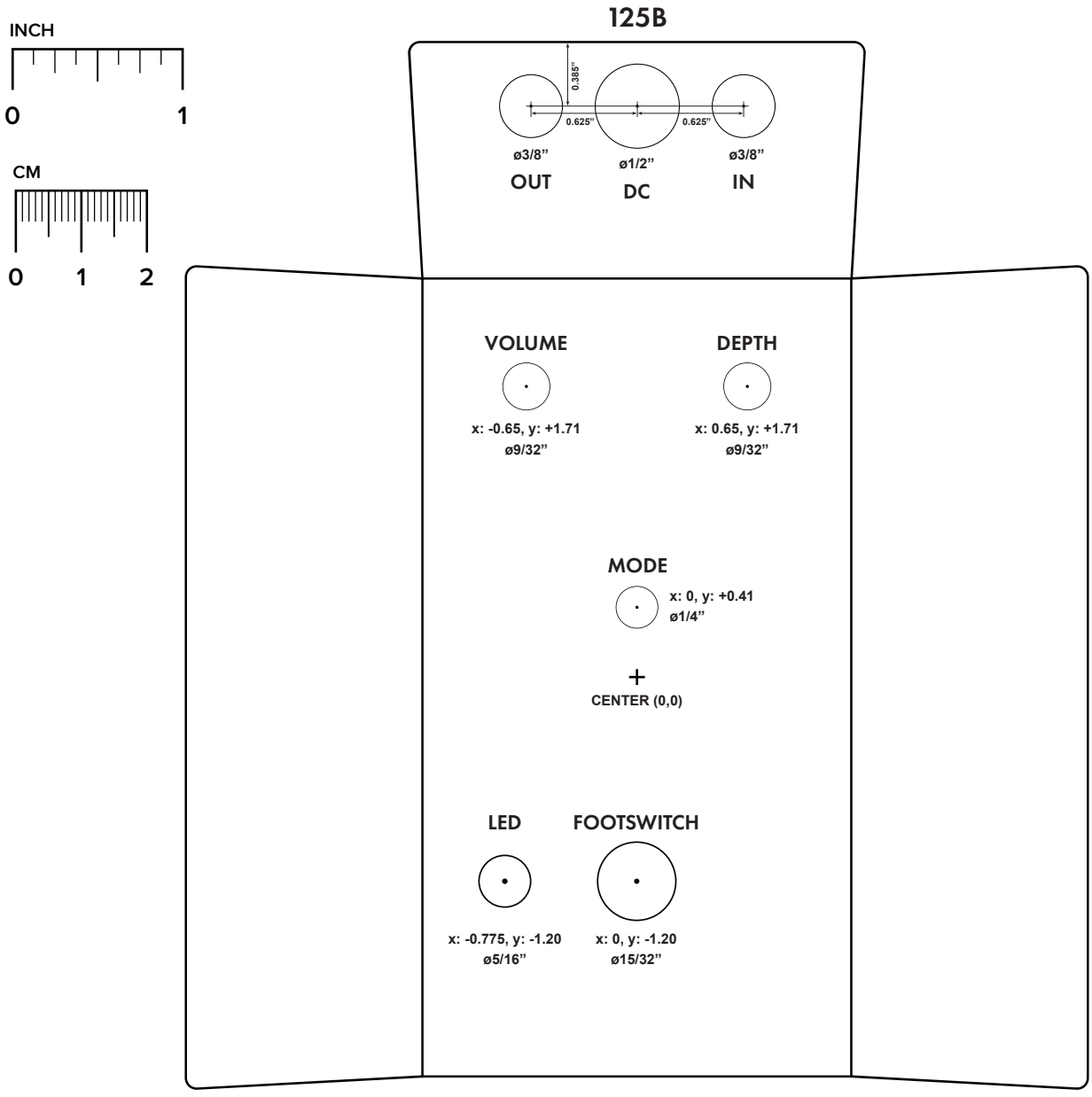
DRILL TEMPLATE

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.

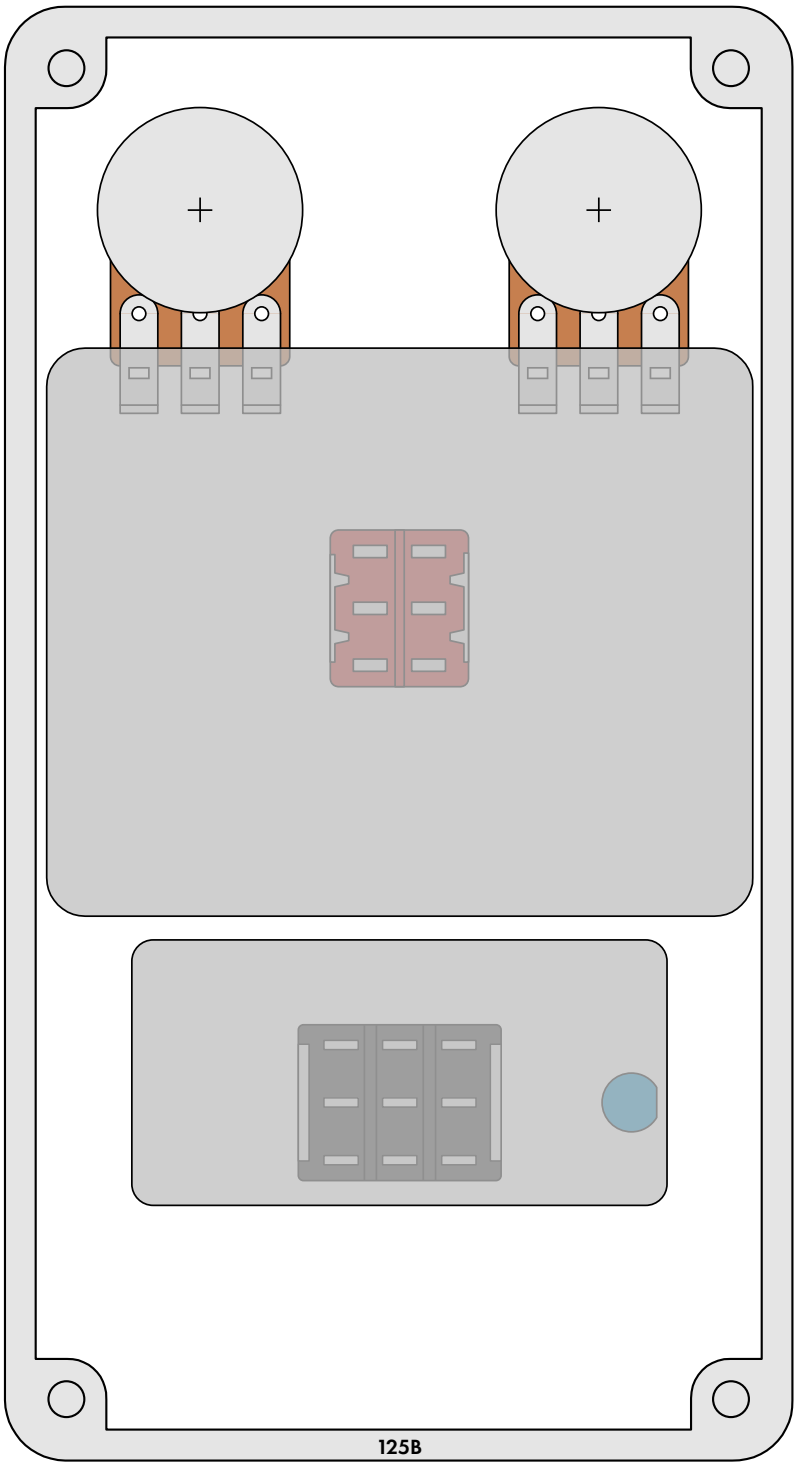
Top jack layout assumes the use of closed-frame jacks like the Switchcraft 111X. If you'd rather use open-frame jacks, please refer to the Open-Frame Jack Drill Template for the top side.

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.

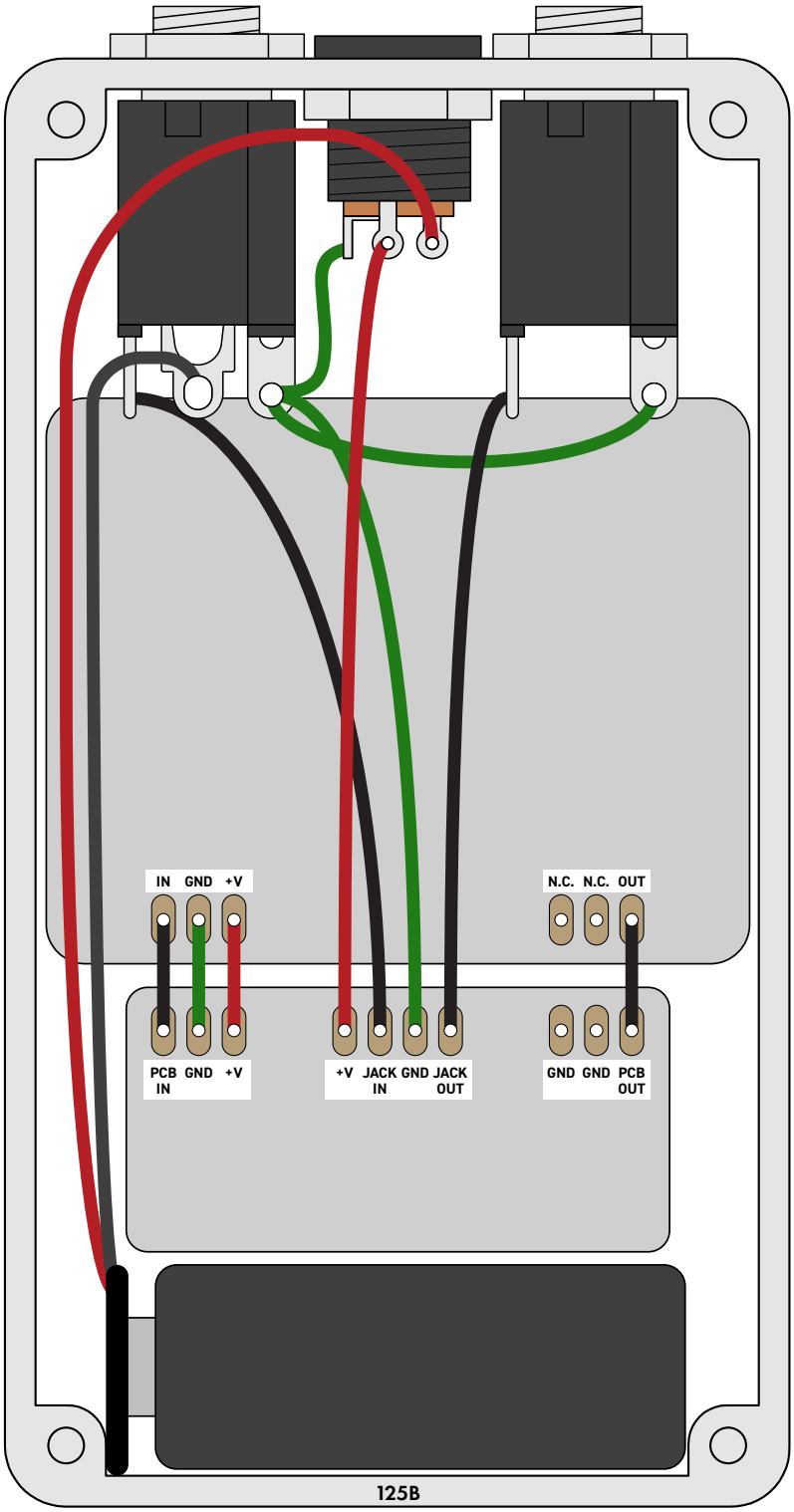


ENCLOSURE LAYOUT

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

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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 cannotbe 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.

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DOCUMENT REVISIONS

1.0.0 (2024-07-04)

Initial release.