PROJECT NAME

RIFT

DIY GUITAR EFFECTS

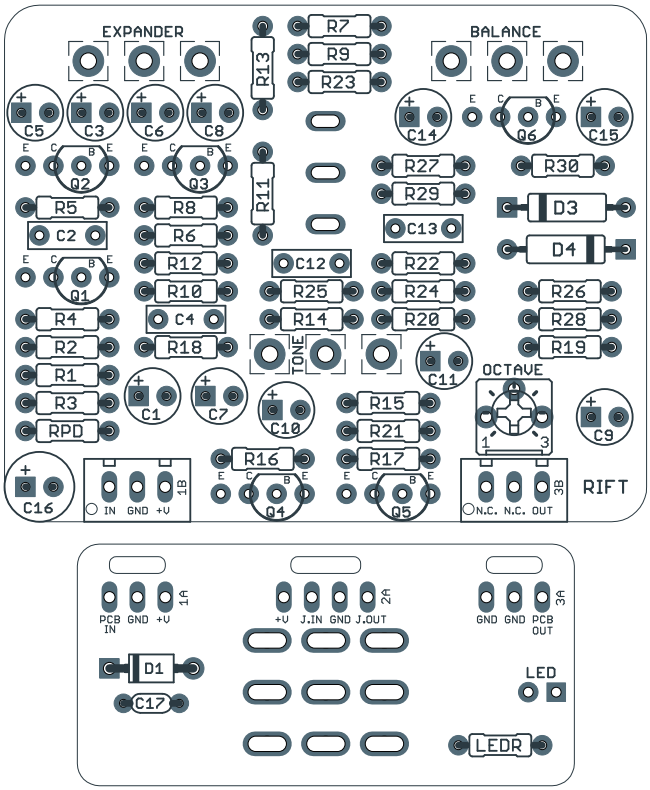
BASED ON
Univox Superfuzz

BUILD DIFFICULTY
Intermediate

EFFECT TYPE
Octave Fuzz

DOCUMENT VERSION
1.0.2 (2024-08-08)

PROJECT SUMMARY
A classic untamed fuzz from the 1970s that adds an octave-up overtone, famous for its use by Pete Townshend of The Who.



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 Rift Octave Fuzz is a recreation of the Univox Superfuzz, originally developed by the Shin-ei company in Japan in the late 1960s and called the FY-6. Shin-ei rebadged the circuit for over a dozen other brands such as Apollo, Electra and Hohner. However, the Univox Superfuzz was the most well-known of the brands and today is considered the definitive version of the circuit.

The Superfuzz uses a phase splitter followed by a differential pair to emphasize the upper octave. It's very similar in concept to something like the fOXX Tone Machine, but with the major difference of using active transistors instead of diodes to rectify the signal.

The Rift includes one modification to lend more flexibility to the circuit. While the original unit only had a tone switch to go between two presets, this project provides the option of using a potentiometer to blend between them so it's not just full-on one way or the other.

The new 125B version of the Rift is identical to the previous one, except that the diode clipping switch has been removed in favor of a simpler layout that is easier to build. The previous version of the Rift is still available if you want that option.

USAGE

The Rift has the following controls:

- **Expander** is the overall distortion or fuzz level of the effect.
- **Volume** controls the overall output of the effect.
- **Tone** switches between a mid-scooped filter and a flat EQ. Optionally, a pot can be used here instead of a switch to allow for blending between the two settings.

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 (most 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	22k	Metal film resistor, 1/4W	FY-6 uses 100k here.
R2	100k	Metal film resistor, 1/4W	
R3	100k	Metal film resistor, 1/4W	
R4	1k8	Metal film resistor, 1/4W	
R5	47k	Metal film resistor, 1/4W	
R6	470k	Metal film resistor, 1/4W	
R7	10k	Metal film resistor, 1/4W	
R8	47k	Metal film resistor, 1/4W	
R9	3k3	Metal film resistor, 1/4W	FY-6 uses a jumper here.
R10	220k	Metal film resistor, 1/4W	
R11	150k	Metal film resistor, 1/4W	
R12	10k	Metal film resistor, 1/4W	
R13	10k	Metal film resistor, 1/4W	
R14	470R	Metal film resistor, 1/4W	
R15	470R	Metal film resistor, 1/4W	
R16	100k	Metal film resistor, 1/4W	
R17	22k	Metal film resistor, 1/4W	
R18	10k	Metal film resistor, 1/4W	
R19	1k8	Metal film resistor, 1/4W	FY-6 uses 2k here.
R20	22k	Metal film resistor, 1/4W	
R21	100k	Metal film resistor, 1/4W	
R22	47k	Metal film resistor, 1/4W	
R23	10k	Metal film resistor, 1/4W	
R24	22k	Metal film resistor, 1/4W	
R25	10k	Metal film resistor, 1/4W	
R26	100k	Metal film resistor, 1/4W	
R27	15k	Metal film resistor, 1/4W	
R28	10k	Metal film resistor, 1/4W	
R29	1k	Metal film resistor, 1/4W	
R30	100k	Metal film resistor, 1/4W	

PARTS LIST, CONT.

PART	VALUE	TYPE	NOTES
RPD	2M2	Metal film resistor, 1/4W	Input pulldown resistor. Can be as low as 1M.
LEDR	10k	Metal film resistor, 1/4W	LED current-limiting resistor. Adjust value to change LED brightness.
C1	10uF	Electrolytic capacitor, 5mm	
C2	2n2	Film capacitor, 7.2 x 2.5mm	FY-6 uses 1n here.
C3	10uF	Electrolytic capacitor, 5mm	
C4	100n	Film capacitor, 7.2 x 2.5mm	
C5	10uF	Electrolytic capacitor, 5mm	
C6	10uF	Electrolytic capacitor, 5mm	
C7	10uF	Electrolytic capacitor, 5mm	
C8	10uF	Electrolytic capacitor, 5mm	
C9	10uF	Electrolytic capacitor, 5mm	
C10	10uF	Electrolytic capacitor, 5mm	
C11	10uF	Electrolytic capacitor, 5mm	
C12	1n	Film capacitor, 7.2 x 2.5mm	
C13	100n	Film capacitor, 7.2 x 2.5mm	
C14	10uF	Electrolytic capacitor, 5mm	
C15	10uF	Electrolytic capacitor, 5mm	
C16	100uF	Electrolytic capacitor, 6.3mm	Power supply filter capacitor.
C17	100n	MLCC capacitor, X7R	Power supply filter capacitor.
D1	1N5817	Schottky diode, DO-41	
D3	1N34A	Diode, germanium, NOS	Can also use BAT41.
D4	1N34A	Diode, germanium, NOS	Can also use BAT41.
Q1	2N3904	BJT transistor, NPN, TO-92	Substitute. Original uses 2SC828, 2SC537, or 2SC539. Recommended to use 2N3904 (higher gain) for Q1-3 and 2N3903 (lower gain) for Q4-6. Also recommended to match Q4 and Q5 as closely as possible.
Q2	2N3904	BJT transistor, NPN, TO-92	
Q3	2N3904	BJT transistor, NPN, TO-92	
Q4	2N3903	BJT transistor, NPN, TO-92	
Q5	2N3903	BJT transistor, NPN, TO-92	
Q6	2N3903	BJT transistor, NPN, TO-92	
EXPND	50kB	16mm right-angle PCB mount pot	
BAL	50kB	16mm right-angle PCB mount pot	
TONE	50kB	16mm right-angle PCB mount pot	Optional modification - can use a potentiometer instead of a switch to blend between tone settings.
TONE	SPDT	Toggle switch, SPDT on-on	Omit if using tone pot.
OCTAVE	10k trimmer	Trimmer, 10%, 1/4”	Adjust for strongest octave.

PARTS LIST, CONT.

PART	VALUE	TYPE	NOTES
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

Transistor selection

The original Superfuzz usually used 2SC828 transistors, sometimes 2SC537 or 539. There is nothing special about these transistors, but being early silicons, they were much lower gain than modern silicons. This makes a big difference in the circuit.

AionFX took measurements of an original Superfuzz as part of the development process for the updated version of the Rift. The transistors (2SC537G) tested as follows using a Peak Atlas DCA55, which uses a 2.5mA collector test current:

Q1: 124 hFE
Q2: 95 hFE
Q3: 143 hFE
Q4: 62 hFE
Q5: 50 hFE
Q6: 52 hFE

In general, most people agree that the Superfuzz sounds best with higher-gain transistors at the beginning and lower-gain transistors at the end. If you have only six transistors, it's recommended to assign them using the following process:

1. The transistor with the lowest gain is used for Q6.
2. The two transistors closest in gain are used for Q4 and Q5.
3. Of the remaining transistors, the highest gain should go in Q1, second-highest in Q2, and third-highest in Q3.

It's recommended to use the 2N3904 for Q1-3. There aren't very many transistors available today that get down to the 50-60 gain range, but the 2N3903 is often under 100 and is a great choice for Q4-6.

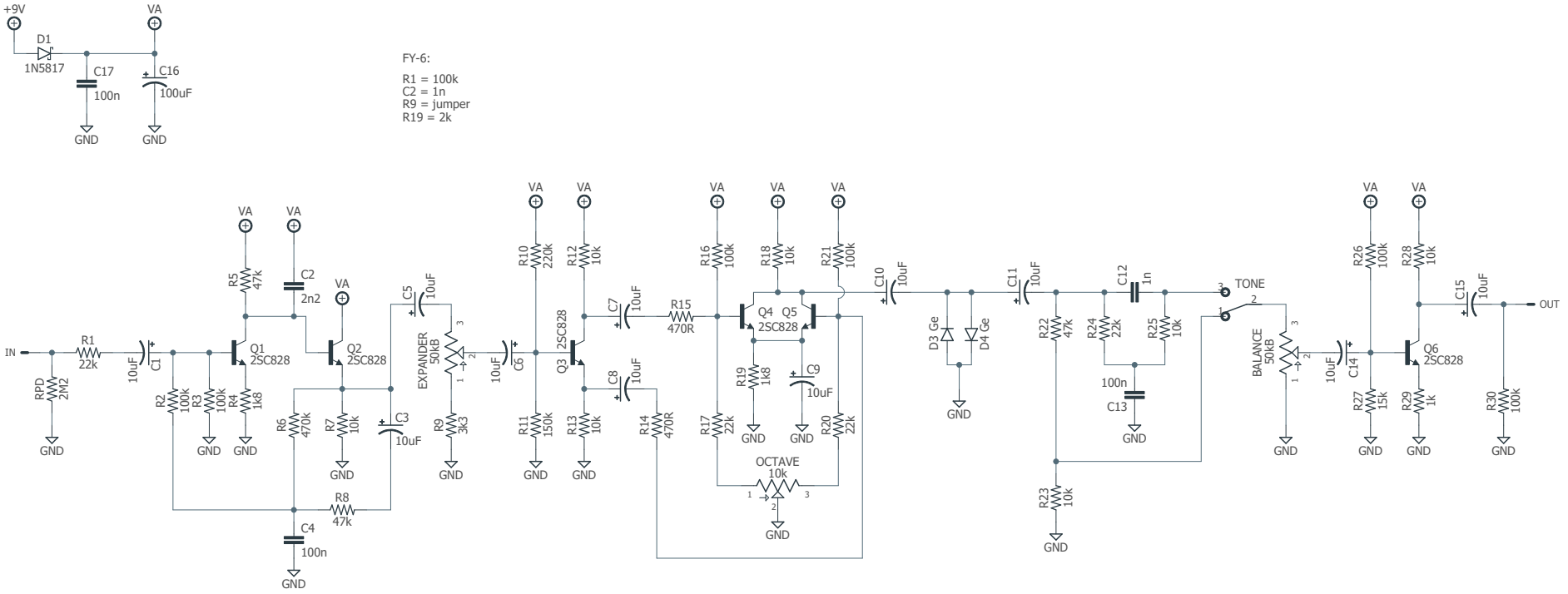
The Rift PCB layout uses the USA-standard E-B-C pinout (2N3904, 2N5088, etc.) for the transistors, but an extra pad has been provided on each transistor footprint to support the Japanese E-C-B convention. If you do use a vintage transistor like the 2SC828 or 2SC945, make sure to adjust accordingly.

Fine-tuning the octave

For the most pronounced octave effect, you want to make sure the Q4 and Q5 transistors are matched as closely as possible for gain (hFE). Most multimeters have an hFE function to test them. As you can see from the original measurements above, though, it can still sound great with transistors that are pretty far off from each other, so don't get too hung up on this aspect of the build.

The octave trimmer is there to compensate for unmatched transistors, and in fact Shin-ei implemented this trimmer because it was easier and cheaper than sorting for matched transistors. You will get the best effect if you use the two transistors that are closest in hFE for Q4 and Q5 and then use the octave trimmer to fine-tune the effect.

SCHEMATIC


+9V
VA
D1
1N5817
C17
100n
C16
100uF
GND
FY-6:
R1 = 100k
C2 = 1n
R9 = jumper
R19 = 2k
IN
R1
22k
10uF
C1
RPD
2M2
R2
100k
R3
100k
R4
1k8
Q1
2SC828
Q2
2SC828
R5
47k
C2
2n2
R6
470k
R7
10k
C3
10uF
R8
47k
C4
100n
C5
10uF
EXPANDER
50kB
R9
3k3
10uF
C6
R10
220k
R11
150k
Q3
2SC828
R12
10k
R13
10k
C7
10uF
C8
10uF
R14
470R
R15
470R
R16
100k
R17
22k
Q4
Q5
2SC828
R18
10k
R19
1k8
C9
10uF
R20
22k
R21
100k
OCTAVE
10k
C10
10uF
D3 Ge
D4 Ge
C11
10uF
R22
47k
R23
10k
C12
1n
R24
22k
R25
10k
100n
C13
TONE
BALANCE
50kB
10uF
C14
R26
100k
R27
15k
R28
10k
Q6
2SC828
R29
1k
C15
10uF
R30
100k
OUT

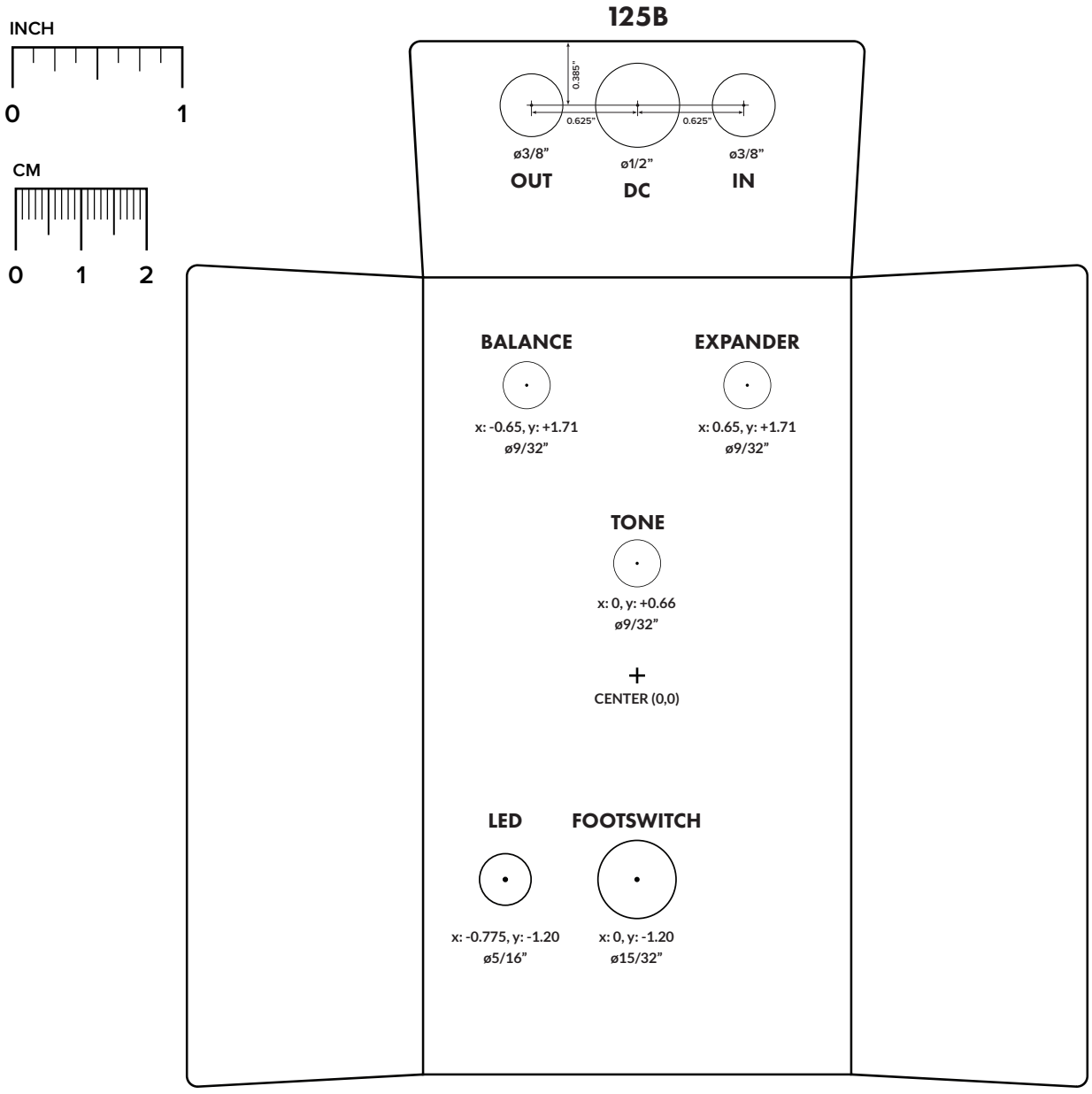
DRILL TEMPLATE

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.

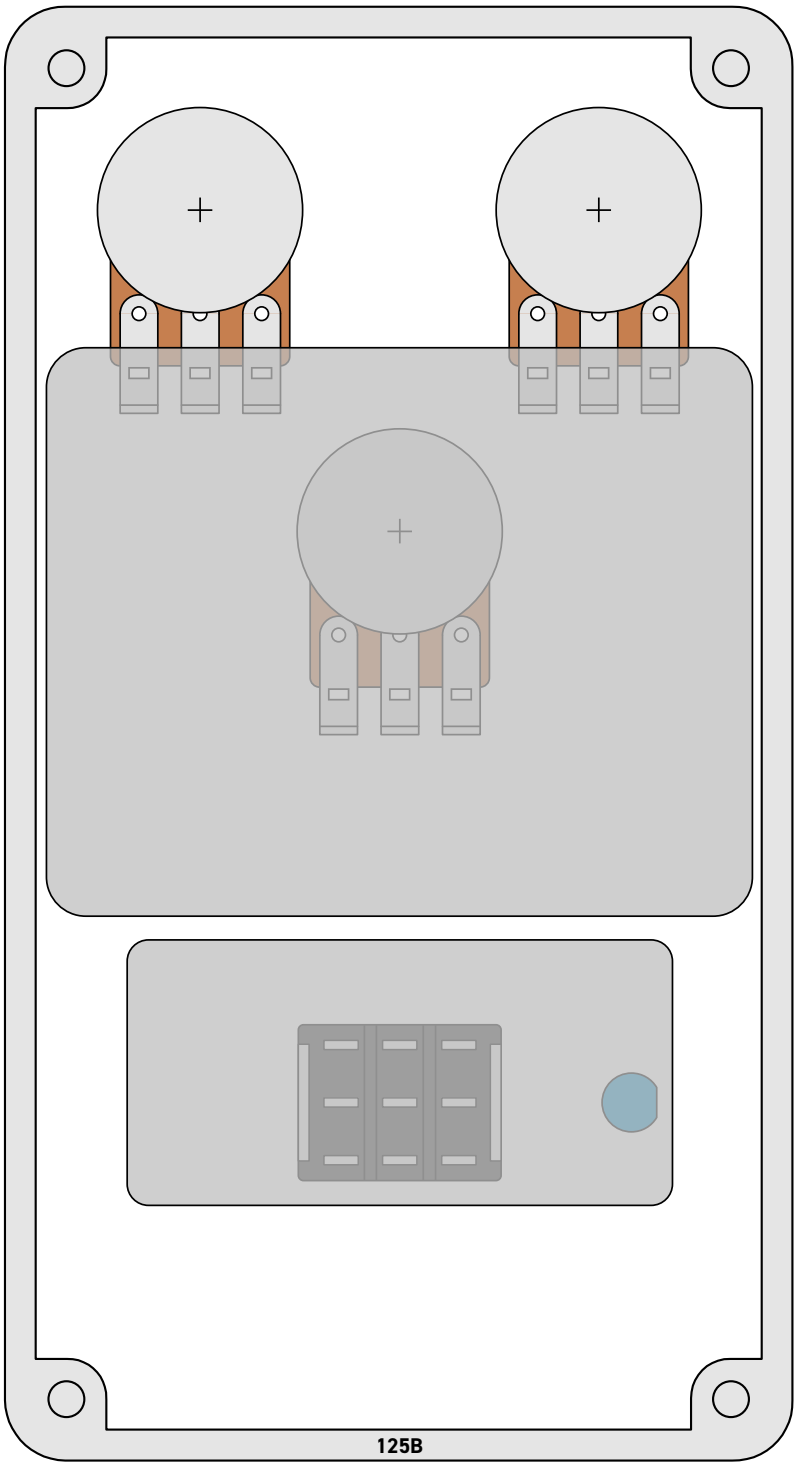
Top jack layout assumes the use of closed-frame jacks like the Switchcraft 111X. If you'd rather use open-frame jacks, please refer to the Open-Frame Jack Drill Template for the top side.

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.

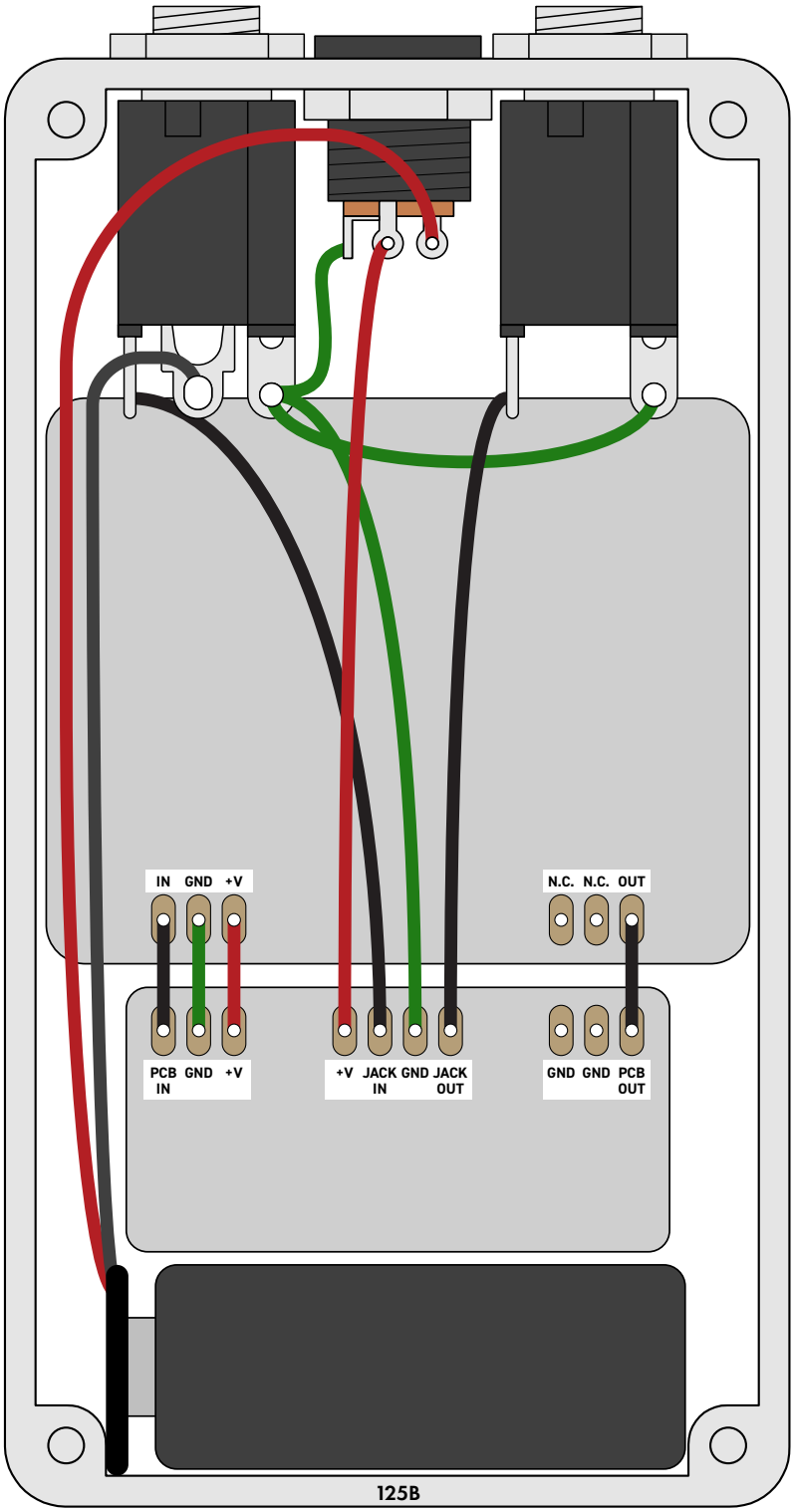


ENCLOSURE LAYOUT

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

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

1.0.2 (2024-08-08)
Changed LEDR to 10k to work with a wider variety of LEDs.

1.0.1 (2021-04-08)
Corrected typo in transistor assignment on page 6.

1.0.0 (2019-02-01)
Initial release.