

PROJECT NAME

BINARY

BASED ON

Darkglass® Duality

EFFECT TYPE

Bass fuzz

BUILD DIFFICULTY

■■■■■ Intermediate

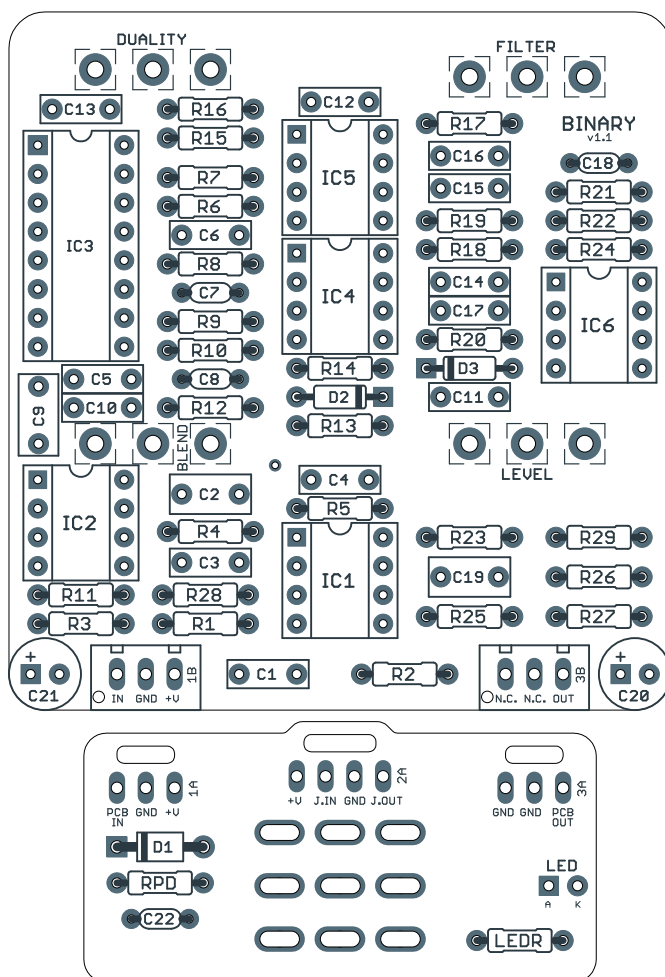
DOCUMENT VERSION

1.1.0 (2022-01-19)

aion
DIY GUITAR EFFECTS

PROJECT SUMMARY

A bass fuzz with two distinct voicings that can be blended together in any ratio, from vintage warmth to searing, gated chaos.



Actual size is 2.3" x 2.42" (main board) and 1.78" x 0.86" (bypass board).

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INTRODUCTION

The Binary Dual Fuzz is based on the Darkglass® Duality Dual Fuzz Engine, a bass pedal first released in 2013 that features two parallel fuzz paths that can be blended together in any ratio for a variety of textures. It was traced by Aion FX in 2021.

The first path is similar to the Microtubes B3K, a series of CMOS hex inverters that provides a warm, vintage-flavored drive.

The second path is devilishly simple, though extremely rare in guitar circuits. It uses a single op-amp stage configured as a comparator: signal to inverting input, non-inverting input tied to reference voltage, and no feedback path. As the input signal swings above and below the threshold set by the reference voltage, the op-amp converts this to the maximum and minimum voltage (a process called *hysteresis*), resulting in a heavily distorted and nearly synthesized square wave. The comparator is followed by a primitive two-diode noise gate to keep it quiet when no signal is coming through. These diodes also add crossover distortion.

In addition to the blended fuzz paths, there is also a tone control and volume control that are applied to the fuzz after the two paths have been blended. This is followed by a clean blend that balances the fuzz (after the tone and volume) with the unadulterated clean signal. It's more complicated than the average drive pedal, but it doesn't take long to get the hang of it.

The Binary is a direct clone of the Duality based on our own trace, which is documented at length in our tracing journal. Some extra power filtering has been added, but otherwise everything is true to the original.

USAGE

The Binary has four controls:

- **Duality** blends between the vintage-flavored fuzz and the aggressive, gated sawtooth fuzz.
- **Filter** is a 5kHz shelving treble filter after the two fuzzes have been blended.
- **Level** sets the overall output of the blended fuzz signal.
- **Blend** pans between the buffered clean signal and the blended fuzz signal.

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	10k	Metal film resistor, 1/4W	
R2	1M	Metal film resistor, 1/4W	
R3	1M	Metal film resistor, 1/4W	
R4	330k	Metal film resistor, 1/4W	
R5	15k	Metal film resistor, 1/4W	
R6	330k	Metal film resistor, 1/4W	
R7	10k	Metal film resistor, 1/4W	
R8	470k	Metal film resistor, 1/4W	
R9	10k	Metal film resistor, 1/4W	
R10	10k	Metal film resistor, 1/4W	
R11	1M	Metal film resistor, 1/4W	Not present in earlier Duality units.
R12	470k	Metal film resistor, 1/4W	
R13	15k	Metal film resistor, 1/4W	
R14	470k	Metal film resistor, 1/4W	
R15	330k	Metal film resistor, 1/4W	
R16	33k	Metal film resistor, 1/4W	
R17	10k	Metal film resistor, 1/4W	
R18	33k	Metal film resistor, 1/4W	
R19	10k	Metal film resistor, 1/4W	
R20	33k	Metal film resistor, 1/4W	
R21	2k2	Metal film resistor, 1/4W	
R22	220k	Metal film resistor, 1/4W	
R23	220k	Metal film resistor, 1/4W	
R24	1k	Metal film resistor, 1/4W	
R25	1M	Metal film resistor, 1/4W	
R26	100k	Metal film resistor, 1/4W	
R27	1k	Metal film resistor, 1/4W	
R28	10k	Metal film resistor, 1/4W	
R29	10k	Metal film resistor, 1/4W	
RPD	1M	Metal film resistor, 1/4W	Input pulldown resistor.
LEDR	4k7	Metal film resistor, 1/4W	LED current-limiting resistor. Adjust value to change LED brightness.

PARTS LIST, CONT.

PART	VALUE	TYPE	NOTES
C1	100n	Film capacitor, 7.2 x 2.5mm	
C2	1uF	Film capacitor, 7.2 x 3.5mm	
C3	1n	Film capacitor, 7.2 x 2.5mm	
C4	100n	Film capacitor, 7.2 x 2.5mm	
C5	22n	Film capacitor, 7.2 x 2.5mm	
C6	47n	Film capacitor, 7.2 x 2.5mm	
C7	680pF	MLCC capacitor, NP0/C0G	
C8	220pF	MLCC capacitor, NP0/C0G	
C9	1uF	Film capacitor, 7.2 x 3.5mm	
C10	10n	Film capacitor, 7.2 x 2.5mm	
C11	1n	Film capacitor, 7.2 x 2.5mm	
C12	2n2	Film capacitor, 7.2 x 2.5mm	
C13	1n	Film capacitor, 7.2 x 2.5mm	
C14	1n	Film capacitor, 7.2 x 2.5mm	
C15	1n	Film capacitor, 7.2 x 2.5mm	
C16	1n	Film capacitor, 7.2 x 2.5mm	
C17	1n	Film capacitor, 7.2 x 2.5mm	
C18	680pF	MLCC capacitor, NP0/C0G	
C19	1uF	Film capacitor, 7.2 x 3.5mm	
C20	100uF	Electrolytic capacitor, 6.3mm	Reference voltage filter capacitor.
C21	220uF	Electrolytic capacitor, 6.3mm	Power supply filter capacitor.
C22	100n	MLCC capacitor, X7R	Power supply filter capacitor.
D1	1N5817	Schottky diode, DO-41	
D2	1N914	Fast-switching diode, DO-35	
D3	1N914	Fast-switching diode, DO-35	
IC1	TL072	Operational amplifier, DIP8	
IC1-S	DIP-8 socket	IC socket, DIP-8	
IC2	TL072	Operational amplifier, DIP8	
IC2-S	DIP-8 socket	IC socket, DIP-8	
IC3	CD4049UBE	CMOS hex inverting buffer, DIP16	
IC3-S	DIP-16 socket	IC socket, DIP-16	
IC4	TL072	Operational amplifier, DIP8	
IC4-S	DIP-8 socket	IC socket, DIP-8	
IC5	TL072	Operational amplifier, DIP8	
IC5-S	DIP-8 socket	IC socket, DIP-8	
IC6	TL072	Operational amplifier, DIP8	
IC6-S	DIP-8 socket	IC socket, DIP-8	

PARTS LIST, CONT.

PART	VALUE	TYPE	NOTES
DUALITY	100kB	16mm right-angle PCB mount pot	
FILTER	100kB	16mm right-angle PCB mount pot	Reversed from original unit in v1.0. See build notes.
LEVEL	100kA	16mm right-angle PCB mount pot	
BLEND	100kB	16mm right-angle PCB mount pot	Reversed from original unit in v1.0. See build notes.
LED	5mm	LED, 5mm, red diffused	
IN	1/4" mono	1/4" phone jack, closed frame	Switchcraft 111X 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	Lumberg NEB/J 21 C or equivalent.
FSW	3PDT	Stomp switch, 3PDT	Available from Aion FX .
ENC	125B	Enclosure, die-cast aluminum	Can also use a Hammond 1590N1.

BUILD NOTES

Filter and Blend knob rotation

The Filter and Blend controls were inadvertently reversed in the original run of the Binary. This was fixed in version 1.1 which began shipping in January 2022.

If your PCB does not say “v1.1” in the upper right then you have the earlier reversed version. In this version the blend knob goes from full effect at CCW to full clean at CW, and the filter control will act as a treble cut as you turn it up rather than adding treble as in a normal tone control.

This has no impact on the sound of the unit, so it's fine to leave it as-is, but if you do want to correct the rotations then it's a simple fix. All you have to do is reverse lugs 1 and 3 of both potentiometers—in other words, connect lug 3 to pad 1 and lug 1 to pad 3. The middle lug is left as-is.

If you're using the recommended PCB-mount potentiometers, it's easiest to clip the two outer lugs at the bend of the “L” shape and then solder wires that cross over the center pin. Keep the center pin in place as an anchor so the pot has a rigid connection to the PCB.

R11 resistor

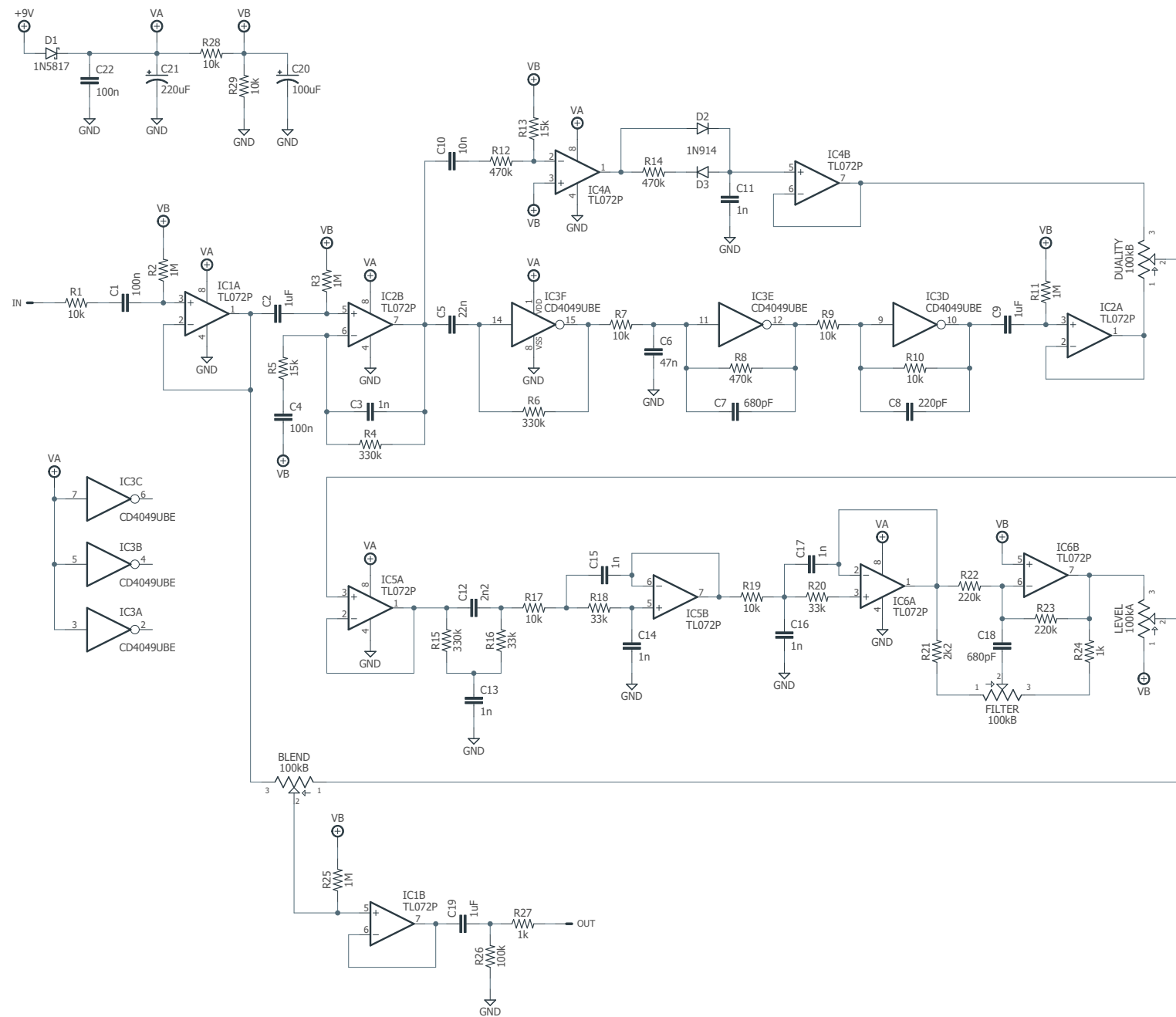
R11 is a 1M resistor from the input of IC2A to the bias voltage. Of the two Duality units that have been traced, Revision 4-K does not have this resistor and Revision 7 does.

It's good design practice to include it, and will have no impact on the tone other than improving the stability of IC2A if it's used, so it's recommended to use it in all cases.

Filter control midrange mod

Douglas from Darkglass shared a modification that can change the character of the Filter knob. By default, it's a 5kHz shelving filter, but it can be turned into a 1kHz midrange boost/cut control by using **2.2n** for C18 and soldering a **22n** capacitor across lugs 1 and 3 of the filter control.

SCHEMATIC



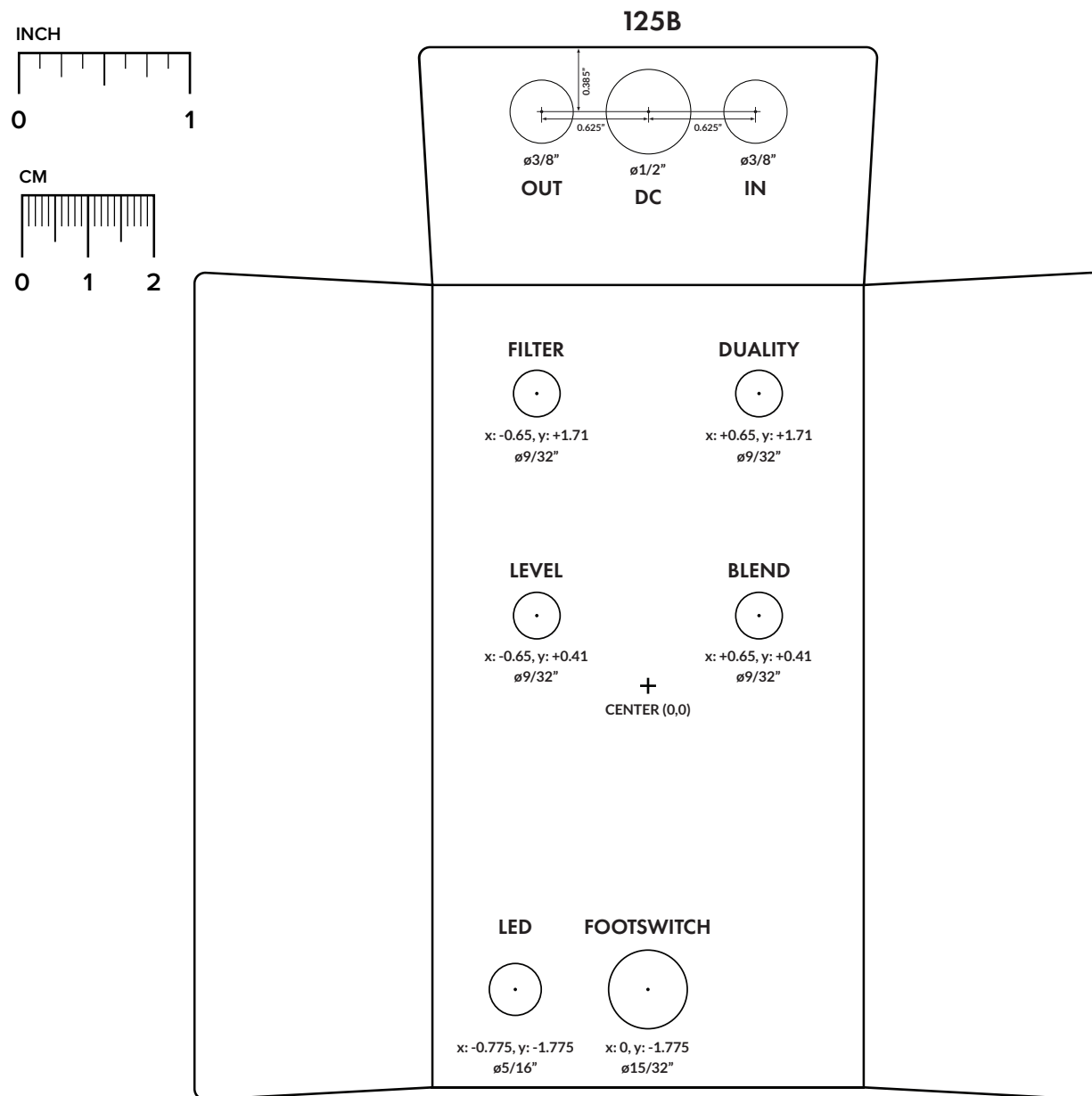
DRILL TEMPLATE

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.

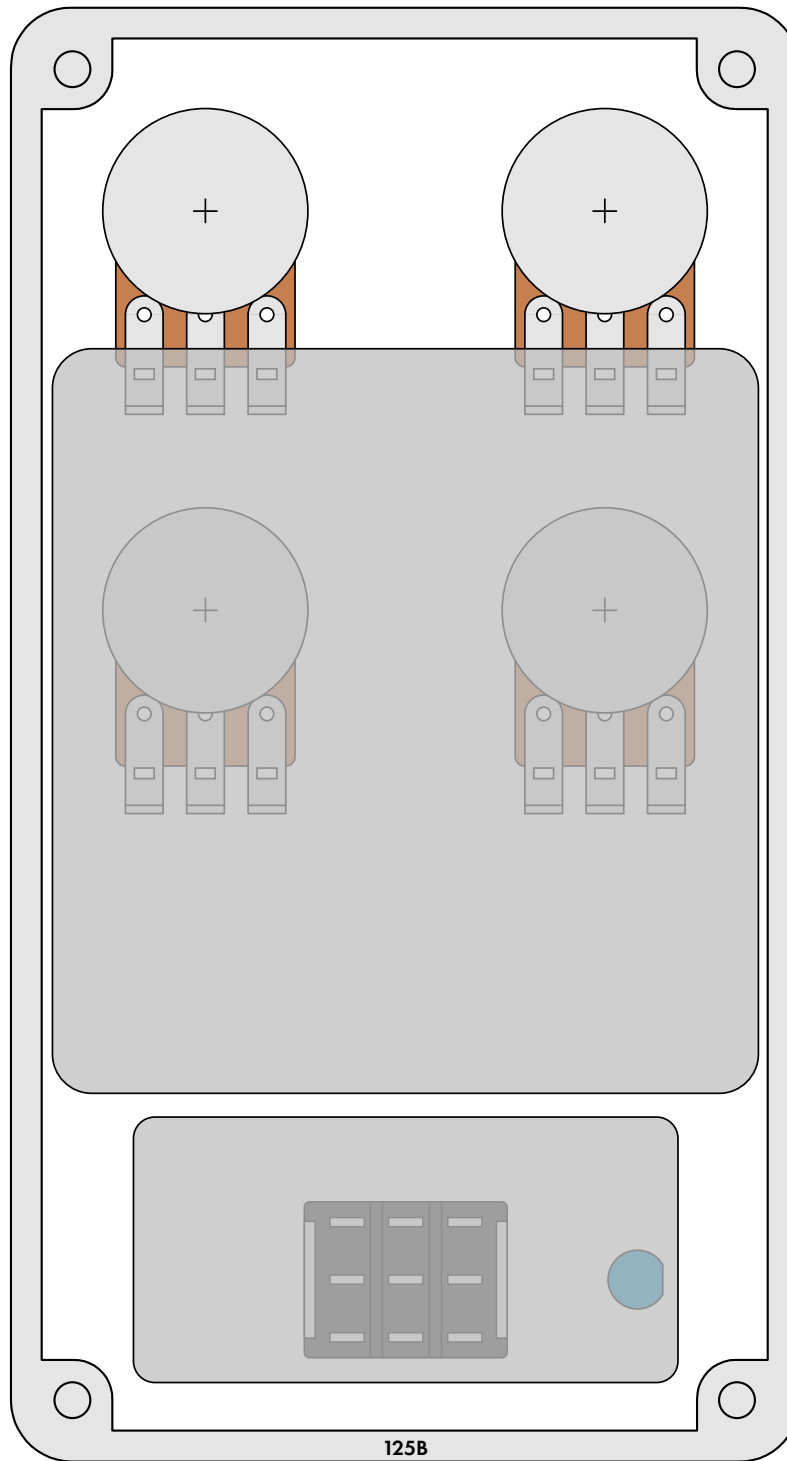
Top jack layout assumes the use of closed-frame jacks like the [Switchcraft 111X](#). If you'd rather use open-frame jacks, please refer to the Open-Frame Jack Drill Template for the top side.

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.

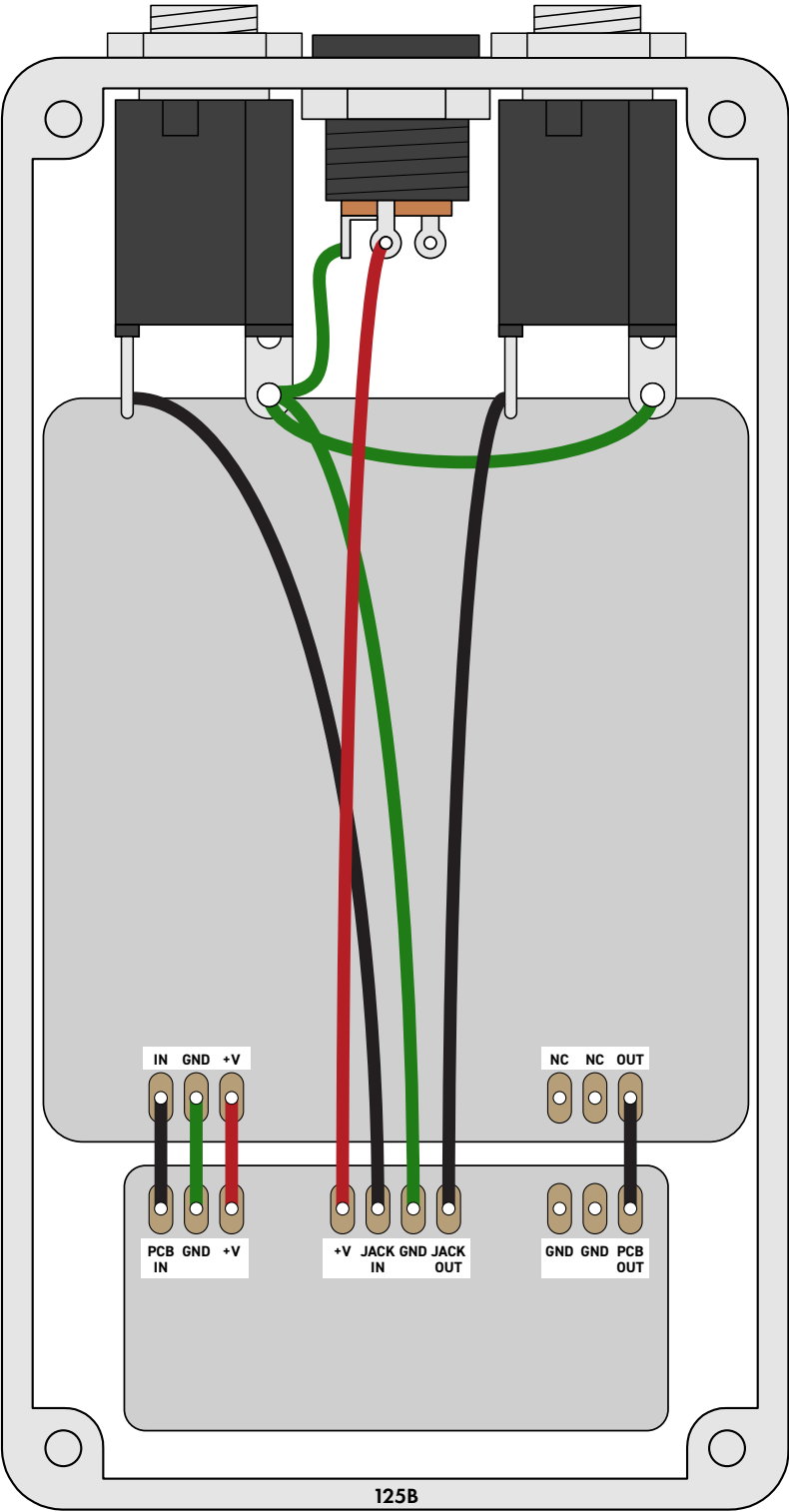


ENCLOSURE LAYOUT

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



WIRING DIAGRAM



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

1.1.0 (2022-01-19)

Corrected Blend and Filter controls working backwards compared to the original unit.

1.0.2 (2021-11-28)

Added build note about Blend and Filter controls being reversed from the original unit and how to change it. This will be corrected in version 1.1 of the PCB.

1.0.1 (2021-11-15)

Corrected value of C18 (was listed as 68pF) and added build notes on midrange mod.

1.0.0 (2021-11-12)

Initial release.