PROJECT NAME

MONOLITH

aion DIY GUITAR EFFECTS

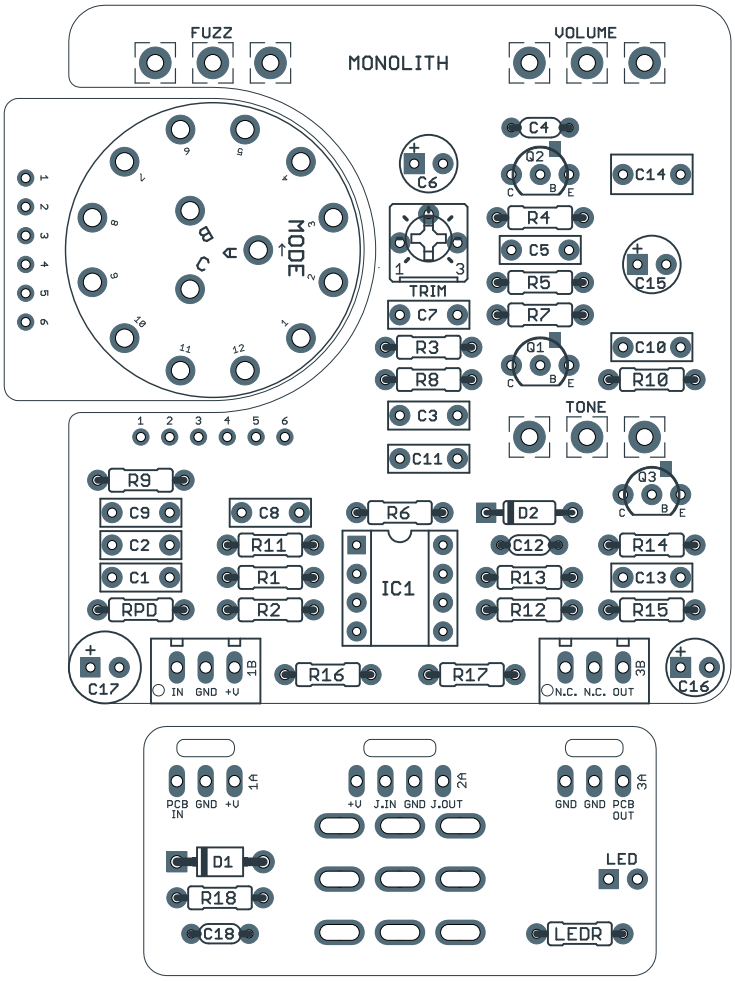
BASED ON
Lovetone® Big Cheese

BUILD DIFFICULTY
Intermediate

EFFECT TYPE
Distortion / fuzz

DOCUMENT VERSION
1.0.3 (2021-08-02)

PROJECT SUMMARY
A legendary silicon transistor fuzz that has been spotted in the rigs of many high-profile musicians such as The Edge, Jimmy Page, Colin Greenwood and Johnny Marr among many others.



Actual size is 2.3" x 2.42" (main board), 1.78" x 0.87" (bypass board), and 1.05" x 1.23" (rotary switch daughterboard).

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INTRODUCTION

The Monolith Silicon Fuzz is an adaptation of the Lovetone Big Cheese, a versatile fuzz pedal released in 1995. The Big Cheese is perhaps Lovetone's most famous pedal, with a jaw-dropping artist repertoire that includes The Edge, Jimmy Page, Colin Greenwood, Ed O'Brien, Johnny Marr, J Mascis, Stephen Malkmus, Jeff Tweedy and Kevin Shields.

The Big Cheese is a hybrid of several different circuit topologies. An op-amp provides input buffering and output gain recovery, and a silicon transistor fuzz resembling a Fuzz Face or Tone Bender is sandwiched in the middle. This is followed by diode hard clipping and a Big Muff-style tone control.

In traditional Lovetone fashion, the Big Cheese also has a rotary control, allowing three different tone stack modes: tone bypass, scooped mids, and flat mids. There is also a fourth mode called "Cheese" that changes the bias on the transistor fuzz, delivering gated "amp death" tones similar to other circuits that use intentional misbiasing such as the Zvex Fuzz Factory or Cornish NG-3.

The result is in a class of its own, an extremely versatile and unique drive machine that is deserving of the high praise it receives.

The Monolith is an exact adaptation of the Big Cheese except for the addition of an optional boost stage at the end to increase the maximum volume. The original can get well above unity gain at max volume, but by reconfiguring the output buffer as a gain boost, we can get a bit more out of it.

Special thanks to Ian (LaceSensor / Gigahearts FX), the DIY community's resident Lovetone expert, for help verifying the Monolith prototype against an original Big Cheese for accuracy.

USAGE

The Monolith has three controls and one rotary switch:

- **Fuzz** (called "Curds" in the original) controls the amount of gain in the first transistor stage.
- **Tone** is similar to a Big Muff tone control, panning between a bass emphasis (called "Hog") on one side and a treble emphasis (called "Bee") in the other direction.
- **Volume** (called "Whey") is the output volume of the effect.
- **Mode** is a rotary switch that selects between four different tone modes: Off (tone bypass), 1 (scooped mids), 2 (flat mids), and "Cheese" mode which biases the transistor into instability.

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	1k	Metal film resistor, 1/4W	
R2	330k	Metal film resistor, 1/4W	
R3	100k	Metal film resistor, 1/4W	
R4	470R	Metal film resistor, 1/4W	
R5	470k	Metal film resistor, 1/4W	
R6	10k	Metal film resistor, 1/4W	
R7	100k	Metal film resistor, 1/4W	
R8	1k	Metal film resistor, 1/4W	
R9	47k	Metal film resistor, 1/4W	
R10	47k	Metal film resistor, 1/4W	
R11	47k	Metal film resistor, 1/4W	
R12	330k	Metal film resistor, 1/4W	
R13	JUMPER		33k for boosted output stage mod. See build notes.
R14	OMIT		15k for boosted output stage mod. See build notes.
R15	470R	Metal film resistor, 1/4W	
R16	22k	Metal film resistor, 1/4W	
R17	22k	Metal film resistor, 1/4W	
R18	100R	Metal film resistor, 1/4W	Power supply filter resistor.
LEDR	4k7	Metal film resistor, 1/4W	LED current-limiting resistor. Adjust value to change LED brightness.
RPD	2M2	Metal film resistor, 1/4W	Input pulldown resistor.
C1	47n	Film capacitor, 7.2 x 2.5mm	
C2	1n5	Film capacitor, 7.2 x 2.5mm	
C3	47n	Film capacitor, 7.2 x 2.5mm	
C4	47pF	MLCC capacitor, NP0/C0G	
C5	47n	Film capacitor, 7.2 x 2.5mm	
C6	4.7uF	Electrolytic capacitor, 4mm	
C7	47n	Film capacitor, 7.2 x 2.5mm	
C8	2n2	Film capacitor, 7.2 x 2.5mm	
C9	6n8	Film capacitor, 7.2 x 2.5mm	
C10	10n	Film capacitor, 7.2 x 2.5mm	

PARTS LIST, CONT.

PART	VALUE	TYPE	NOTES
C11	47n	Film capacitor, 7.2 x 2.5mm	
C12	OMIT		100pF for boosted output stage mod. See build notes.
C13	OMIT		100n for boosted output stage mod. See build notes.
C14	4.7uF	Film capacitor, 7.2 x 7.2mm	
C15	OMIT		Electrolytic alternative to C14. See build notes.
C16	47uF	Electrolytic capacitor, 5mm	Reference voltage filter capacitor.
C17	100uF	Electrolytic capacitor, 6.3mm	Power supply filter capacitor.
C18	100n	MLCC capacitor, X7R	Power supply filter capacitor.
D1	1N5817	Schottky diode, DO-41	
D2	1N914	Fast-switching diode, DO-35	
Q1	BC549C	BJT transistor, NPN, TO-92	
Q2	BC549C	BJT transistor, NPN, TO-92	
Q3	BC549C	BJT transistor, NPN, TO-92	
IC1	TL072	Operational amplifier, DIP8	
IC1-S	DIP8 socket	IC socket, DIP-8	
FUZZ	1kB	16mm right-angle PCB mount pot	
TONE	100kB	16mm right-angle PCB mount pot	
VOL.	10kA	16mm right-angle PCB mount pot	
MODE	3P4T rotary	Rotary switch, 3 pole / 4 position	Must be Alpha SR2612F. See parts spreadsheet (2nd tab) for sources.
TRIM	1k trimmer	Trimmer, 10%, 1/4"	Bourns 3362P or similar.
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	Mouser 163-4302-E or equivalent.
FSW	3PDT	Stomp switch, 3PDT	
ENC	125B	Enclosure, die-cast aluminum	Can also use a Hammond 1590N1.

BUILD NOTES

Rotary switch selection

The rotary switch sub-PCB is designed for the Alpha SR2612F 3P4T PCB-mount rotary switch. We are not aware of any other brands with this form factor, so there are no substitutes. It's available from Mouser, Small Bear, Tayda and several more. See the parts list spreadsheet (2nd tab) for links.

Rotary switch orientation

The silkscreen of the initial release of the Monolith mistakenly shows the rotary switch oriented with the "A" pole pointing up. It should instead be rotated 120 degrees so the "B" pole is pointing up. Each of the three poles is identical, so it makes no electronic difference which way it's positioned, but this way it keeps the black standoffs from pressing against the side of the enclosure since it's already a tight fit.

If you follow the drill template including the anti-rotation pin, there's only one way to install it—but just be aware of the discrepancy that on the earliest PCBs the rotary won't line up with the "A-B-C" notation on the daughterboard. This will be corrected in the next restock.

Soldering the rotary switch

The drill template includes holes for the anti-rotation pins. Precise drilling is needed in order for the anti-rotation pins to work. If you need to drill the hole a size larger because it's slightly out of alignment, then it loses its anti-rotation function.

The rotary switch has a daughterboard that snaps off the main board. It's recommended to solder this in place once the main PCB has been installed into the enclosure. This way, everything will be at the correct height and will not cause any stress to the joints after everything is together. Think of it as a PCB-mounted pot that requires some assembly.

When soldered to the rotary switch, the pads on the daughterboard should line up perfectly with the pads on the main PCB if the drilling is precise. However, be aware that there is not a lot of clearance between the top PCB and bottom PCB.

The easiest method for connecting the sub-PCB to the main PCB is via 0.1" snap-apart wire headers. Solder the header to the main PCB first, then thread the daughterboard through the pins and down onto the rotary switch. Solder the daughterboard to the rotary pins, then solder the pins of the header.

Be careful—this will be extremely difficult to desolder if you make any mistakes!

Alternately, you can add another 3/8" hex nut (e.g. from 1/4" jack) on the inside of the rotary switch to mount it higher inside the enclosure. You will lose the use of the anti-rotation pin, so it's possible that the rotary switch can come loose over time due to the rotational force, but it gives enough space to run flexible wires between the main board and daughterboard in case they are slightly out of alignment.

Trimming the rotary shaft

You will likely need to cut the shaft of the rotary switch by around 0.4" to match the height of the potentiometer shaft so the knobs sit at the same level. A rotary tool cutoff wheel works great, but you can do it with normal snippers as well—it just won't be a clean cut this way so it may need some sanding or filing to level it off.

Transistor outlines

The original Big Cheese used European BC-series transistors, and since these are still widely available, the Monolith PCB uses this pinout. The 2N5088/5089 is essentially identical and can be used as a substitute with no changes to the circuit. However, if you use the 2N5088, you will need to install the transistors backwards (rotated 180 degrees from the outline). If you're not sure, check the datasheet. And if your unit makes no sound when first powered up, the transistor orientation is the most likely culprit, so look there first.

You can also use SMD transistors if you want. The extra SMD pad above the "B" and "E" pads is for the collector, which follows the pinout for all standard SMD transistors.

Setting the bias trimmer

The trimmer controls the operation of the "Cheese" mode, which pushes the transistor into instability for gated or amp-death sounds. This interacts with the Fuzz control and should be set so that the gating sounds occur toward the top end of the Fuzz control's rotation. Start with the trimmer set halfway, then adjust it up or down from there until the Cheese mode's operation is to your liking.

Gain boost

While the Big Cheese has plenty of volume, some people want more out of it. Fortunately, it's easy to convert the op-amp output buffer to a volume boost stage, so the Monolith PCB includes space for all the necessary components. Use the following parts to double the available volume:

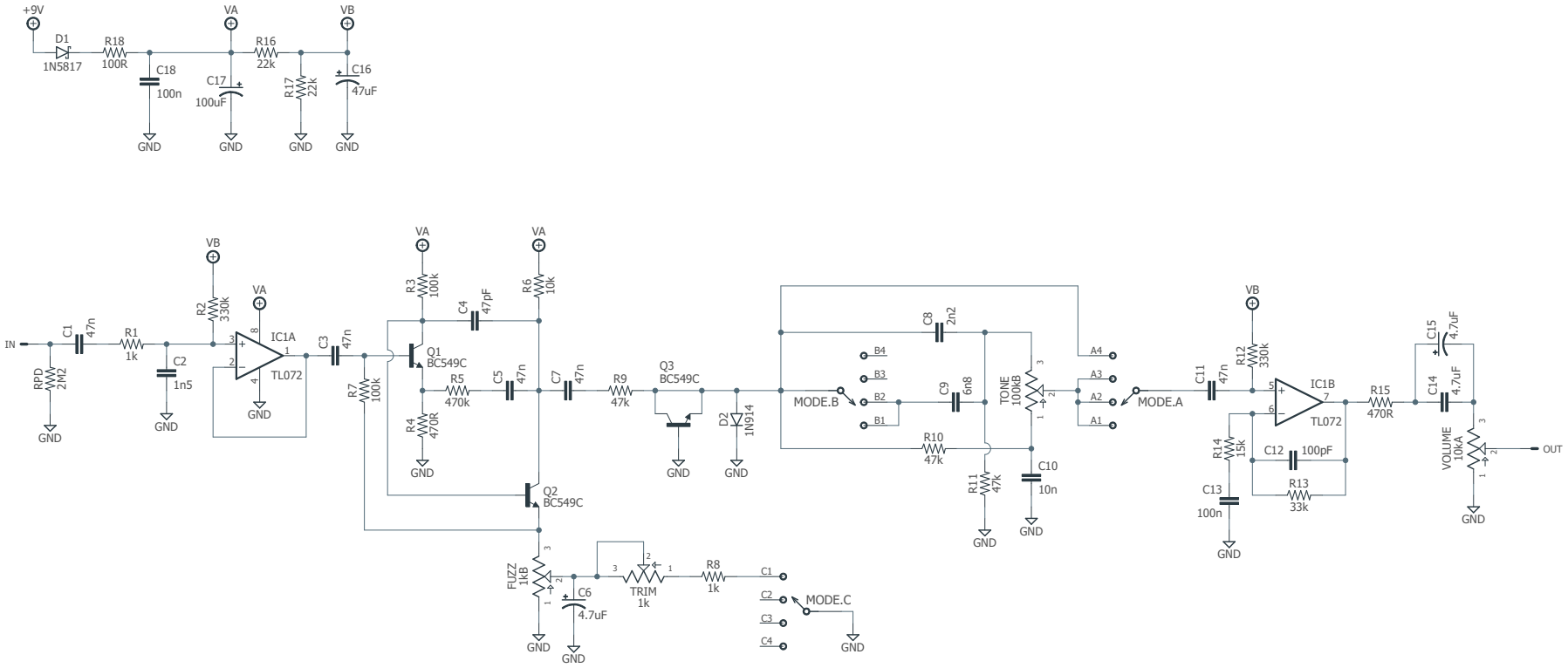
- **R13:** 33k
- **R14:** 15k (or reduce this for even more volume)
- **C12:** 100pF
- **C13:** 100n

To omit the gain boost stage and keep it 100% stock, **jumper R13** and omit R14, C12 and C13.

Electrolytic and film capacitors

The original Big Cheese uses a 4.7uF electrolytic capacitor in the audio path (C15). Since film is much better quality, we've added space for a film capacitor to be used instead (C14). While the parts list calls for 4.7uF to be used to keep the value the same as the original, you can use 2.2uF or 1uF instead with no perceptible change in tone.

SCHEMATIC


+9V
D1
1N5817
R18
100R
C18
100n
GND
VA
C17
100uF
GND
R16
22k
R17
22k
GND
VB
C16
47uF
GND
IN
C1
47n
R1
1k
C2
1n5
GND
RPD
2M2
GND
VB
R2
330k
VA
IC1A
TL072
GND
C3
47n
R7
100k
VA
R3
100k
C4
47pF
R6
10k
VA
Q1
BC549C
R5
470k
C5
47n
R4
470R
GND
C7
47n
R9
47k
Q3
BC549C
GND
D2
1N914
GND
Q2
BC549C
FUZZ
1kB
C6
4.7uF
GND
TRIM
1k
R8
1k
C1
C2
C3
C4
MODE.C
GND
MODE.B
B4
B3
B2
B1
C8
2n2
C9
6n8
TONE
100kB
R10
47k
R11
47k
GND
C10
10n
GND
A4
A3
A2
A1
MODE.A
C11
47n
VB
R12
330k
IC1B
TL072
C13
100n
GND
R14
15k
C12
100pF
R13
33k
R15
470R
C15
4.7uF
C14
4.7uF
VOLUME
10kA
GND
OUT

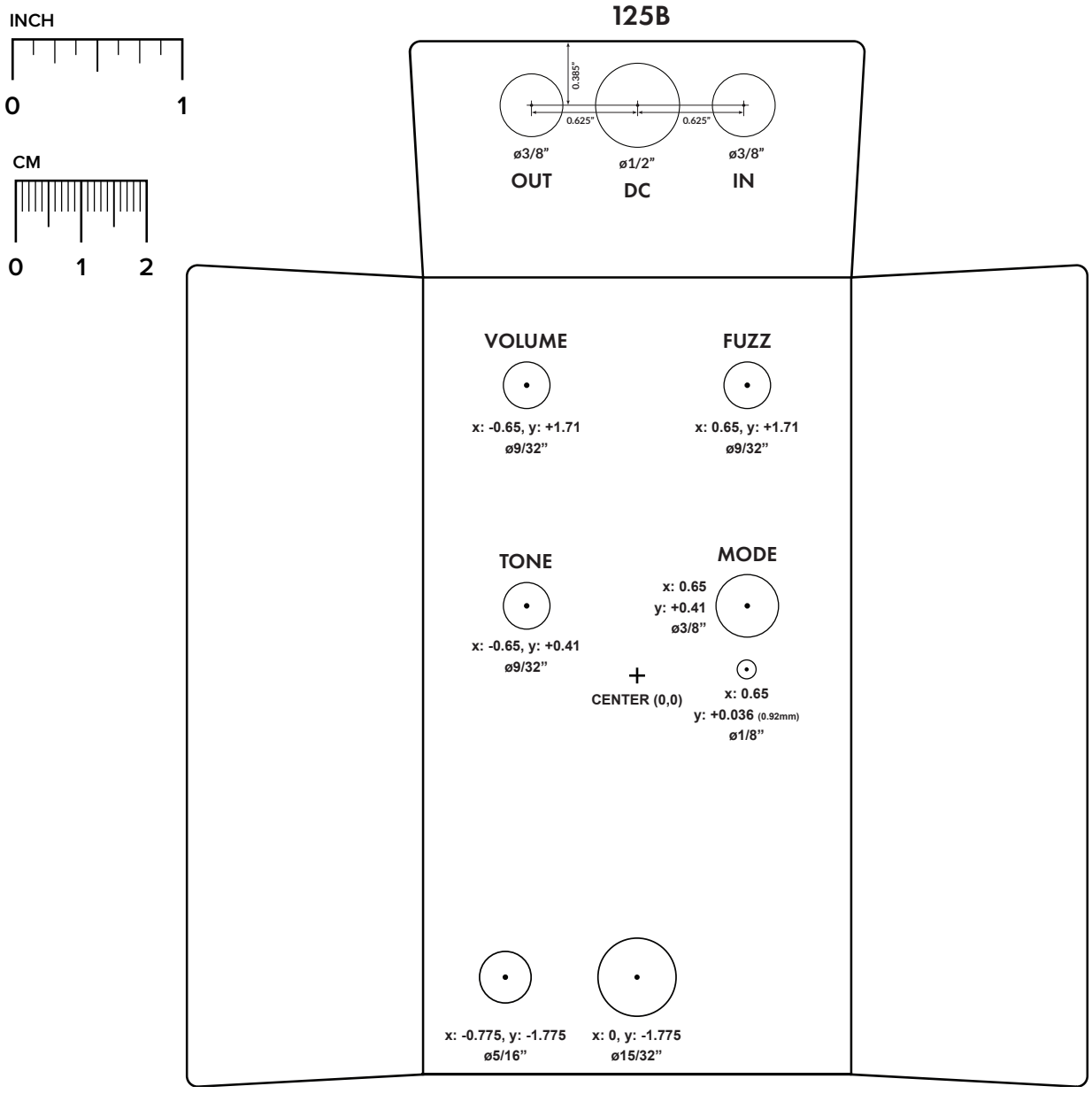
DRILL TEMPLATE

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.

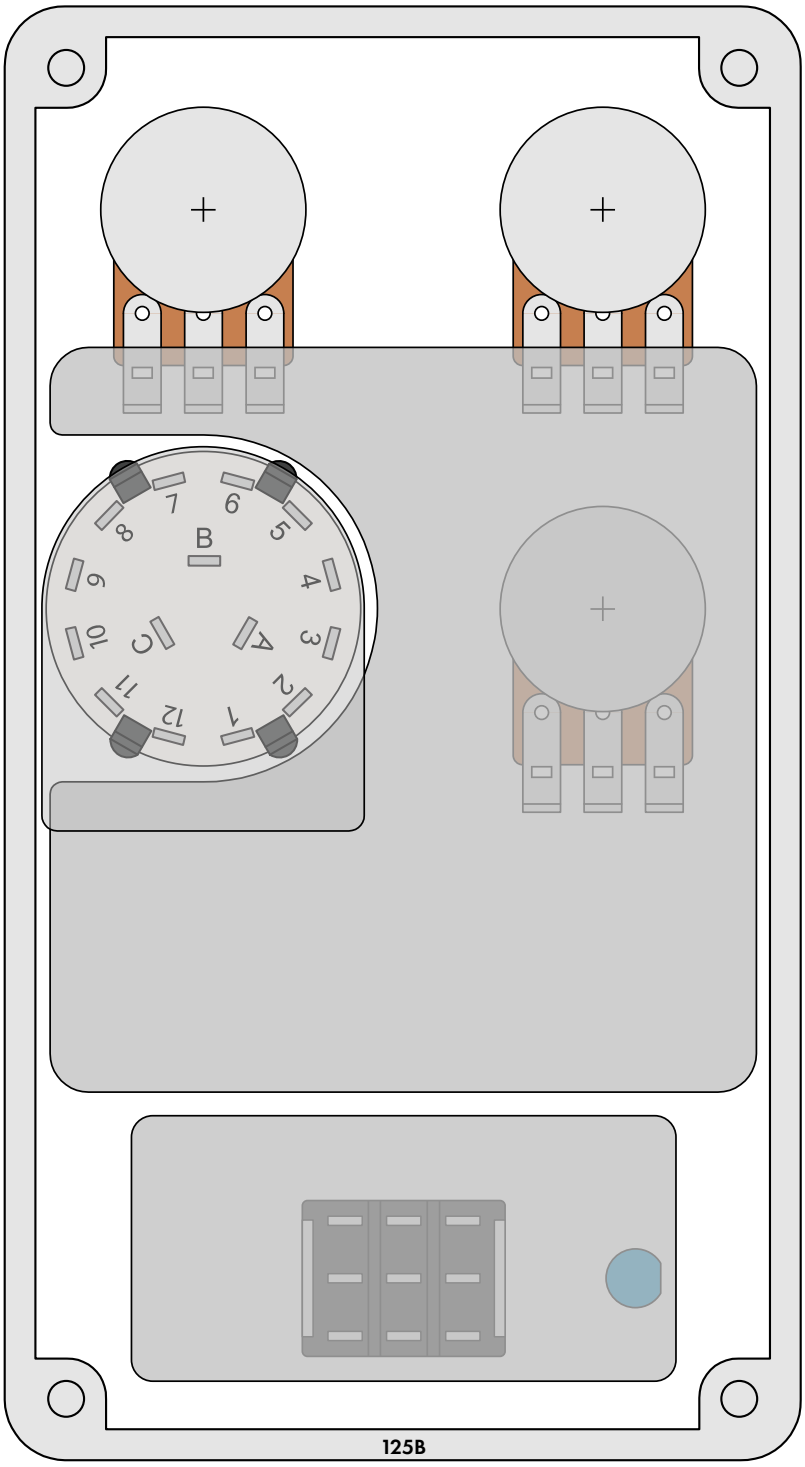
LED hole drill size assumes the use of a 5mm LED bezel, available from several parts suppliers. Adjust size accordingly if using something different, such as a 3mm bezel, a plastic bezel, or just a plain LED.



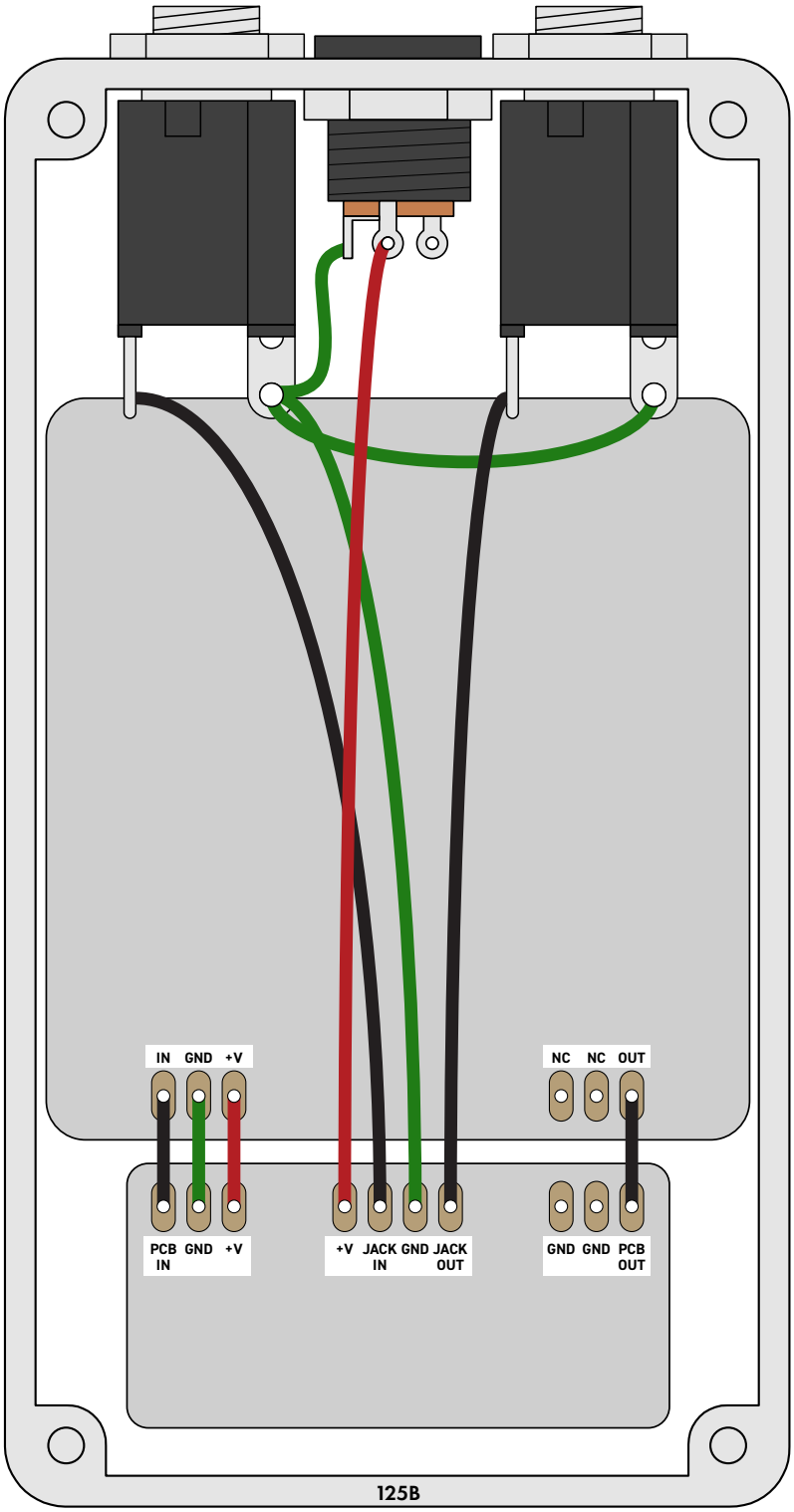
ENCLOSURE LAYOUT

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

Note that the rotary switch is rotated so the “B” pole is on the top. This keeps the black standoffs from touching the sides of the enclosure. In the initial release, the daughterboard PCB shows the “A” pole on top, but this should be ignored. It will be corrected in subsequent runs.



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 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.

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

1.0.3 (2021-08-02)
Corrected y-coordinate of the rotary anti-rotation pin in drill template (0.036", not 0.364"). The physical position was correct.

1.0.2 (2021-07-21)
Clarified the type of rotary switch required.

1.0.1 (2021-07-12)
Added missing resistor RPD (2M2) to parts list.

1.0.0 (2021-07-02)
Initial release.