PROJECT NAME
ONYX

BASED ON
BOSS® SG-1 Slow Gear
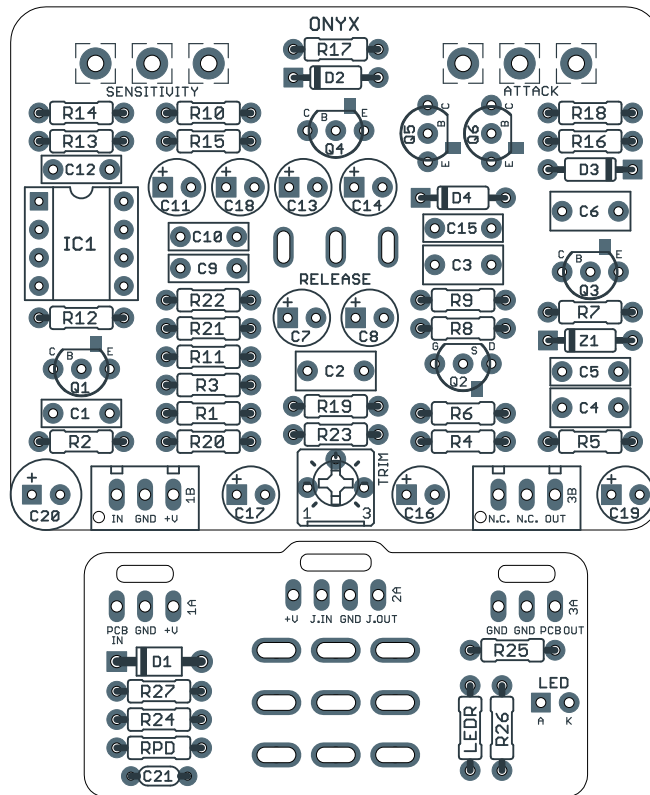
EFFECT TYPE
Automatic volume swell

BUILD DIFFICULTY
▮▮▯▯▯ Easy

DOCUMENT VERSION
1.0.0 (2023-09-08)

PROJECT SUMMARY
One of the rarest BOSS effects, it acts as a sort of slow noise gate by gradually fading in the signal when it detects pick attack.

Actual size is 2.3" x 1.86" (main board) and 1.78" x 0.86" (bypass board).

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INTRODUCTION

The Onyx Volume Swell is an adaptation of the BOSS SG-1 Slow Gear, first released in 1979. It's one of the very first BOSS effects pedals and still among the rarest. It has notably been used by Adam Granduciel (The War on Drugs) and Billy Corgan among others.

The Slow Gear can be described as an attack delay, automatic volume swell, or reverse compressor. It mutes the signal normally, and once the signal level crosses a certain threshold it fades it in at a set rate.

The resulting effect is similar to using a volume pedal, providing a violin-like "attackless" onset of the notes. Internally, it's more or less a tweaked noise gate—and in fact, the BOSS NS-1 Noise Suppressor is a nearly identical circuit, just tuned for more sensitivity and faster attack.

It's a simple circuit, far from perfect in execution, but once you adapt your playing to its quirks, it's a very unique effect that can add a new type of sound to your toolbox.

The Onyx is a direct adaptation of the SG-1 with one modification: we've added a Release switch that selects between two additional time constants that determine how quickly the trigger resets after it falls below the signal threshold. This offers a little extra flexibility to help accommodate different playing styles and speeds. It seems to impact the swell speed as well, which extends the usefulness. More on this in the build notes if you're curious.

USAGE

The Onyx has the following controls:

- **Attack** sets the speed of the volume swells. It's highly interactive with the Release toggle.
- **Sensitivity** sets the signal level going into the envelope detector.
- **Release** (toggle switch) sets the time constant of the "hold" on the signal, which also impacts the onset speed of the swell. The stock position is in the middle, which is the fastest setting, while the other two positions increase the swell time.

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	470k	Metal film resistor, 1/4W	
R2	10k	Metal film resistor, 1/4W	
R3	22k	Metal film resistor, 1/4W	
R4	470k	Metal film resistor, 1/4W	
R5	1M	Metal film resistor, 1/4W	
R6	10k	Metal film resistor, 1/4W	
R7	1M	Metal film resistor, 1/4W	
R8	1M	Metal film resistor, 1/4W	
R9	47k	Metal film resistor, 1/4W	
R10	470R	Metal film resistor, 1/4W	
R11	220k	Metal film resistor, 1/4W	
R12	1M	Metal film resistor, 1/4W	
R13	390R	Metal film resistor, 1/4W	
R14	390k	Metal film resistor, 1/4W	
R15	4k7	Metal film resistor, 1/4W	
R16	4k7	Metal film resistor, 1/4W	
R17	100k	Metal film resistor, 1/4W	
R18	100k	Metal film resistor, 1/4W	
R19	10k	Metal film resistor, 1/4W	
R20	22k	Metal film resistor, 1/4W	
R21	22k	Metal film resistor, 1/4W	
R22	1k	Metal film resistor, 1/4W	
R23	3k3	Metal film resistor, 1/4W	
R24	1k	Metal film resistor, 1/4W	
R25	1k	Metal film resistor, 1/4W	
R26	100k	Metal film resistor, 1/4W	
R27	47R	Metal film resistor, 1/4W	Power supply filter resistor.
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	47n	Film capacitor, 7.2 x 2.5mm	
C2	1uF	Film capacitor, 7.2 x 3.5mm	
C3	1uF	Film capacitor, 7.2 x 3.5mm	

PARTS LIST, CONT.

PART	VALUE	TYPE	NOTES
C4	1uF	Film capacitor, 7.2 x 3.5mm	
C5	33n	Film capacitor, 7.2 x 2.5mm	
C6	680n	Film capacitor, 7.2 x 4.5mm	
C7	2.2uF	Electrolytic capacitor, 5mm	Part of the Release switch mod. Increase for more range.
C8	10uF	Electrolytic capacitor, 4mm	Part of the Release switch mod. Increase for more range.
C9	22n	Film capacitor, 7.2 x 2.5mm	
C10	22n	Film capacitor, 7.2 x 2.5mm	
C11	1uF	Electrolytic capacitor, 4mm	
C12	1n	Film capacitor, 7.2 x 2.5mm	
C13	1uF	Electrolytic capacitor, 4mm	
C14	1uF	Electrolytic capacitor, 4mm	
C15	47n	Film capacitor, 7.2 x 2.5mm	
C16	10uF	Electrolytic capacitor, 5mm	
C17	47uF	Electrolytic capacitor, 5mm	Reference voltage filter capacitor.
C18	47uF	Electrolytic capacitor, 5mm	Power supply filter capacitor.
C19	47uF	Electrolytic capacitor, 5mm	Power supply filter capacitor.
C20	100uF	Electrolytic capacitor, 6.3mm	Power supply filter capacitor.
C21	100n	MLCC capacitor, X7R	Power supply filter capacitor.
Z1	1N5232B	Zener diode, 5.6V, DO-35	
D1	1N5817	Schottky diode, DO-41	
D2	1N914	Fast-switching diode, DO-35	
D3	1N914	Fast-switching diode, DO-35	
D4	1N914	Fast-switching diode, DO-35	
IC1	LM741	Operational amplifier, single, DIP8	
IC1-S	DIP-8 socket	IC socket, DIP-8	
Q1	2N5088	BJT transistor, NPN, TO-92	Substitute. Original uses 2SC732TM-GR.
Q2	2SK208-GR	JFET, N-channel, SOT-23	Available from Aion FX. Original uses 2SK30A-GR.
Q3	2N5088	BJT transistor, NPN, TO-92	Substitute. Original uses 2SC732TM-GR.
Q4	2N5088	BJT transistor, NPN, TO-92	Substitute. Original uses 2SC945.
Q5	2N5088	BJT transistor, NPN, TO-92	Substitute. Original uses 2SC945.
Q6	2N5088	BJT transistor, NPN, TO-92	Substitute. Original uses 2SC945.
TRIM	10k trimmer	Trimmer, 10%, 1/4"	Bourns 3362P or similar.

PARTS LIST, CONT.

PART	VALUE	TYPE	NOTES
ATTACK	20kB	Film capacitor, 7.2 x 3.5mm	
SENS.	100kA	Film capacitor, 7.2 x 2.5mm	
RELEASE	SPDT on-off-on	Film capacitor, 7.2 x 4.5mm	
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

Setting the trimmer

The trimmer sets the output volume of the effect when the gate is open (i.e. no signal attentuation). This can easily be set by ear, but here is the factory calibration procedure.

Use a signal generator to input a -20dBm 1kHz sine wave. Set Sensitivity to 12:00 and Attack to full. Adjust the trimmer for -25dBm +/-0.1dBm at the output. This will change based on the supply voltage, so ideally the unit should be calibrated at the normal operating voltage.

Release switch

We added a switch to select between three different capacitor values in the position that sets the speed of release. However, in testing this, we found that this capacitor also has a significant impact on the attack time, with larger capacitors giving a slower swell effect. This is fortunate, because at the stock setting, even at maximum Attack it's almost unusably fast! But it also means that the "release" label is not quite accurate. We will probably rename this to something like "Range" in a future version of the PCB, so you may want to follow suit on your own build.

We chose 2.2uF and 10uF for the default values, but if you want even longer, you might try 10uF and 47uF. Keep in mind you can always dial it back with the Attack knob.
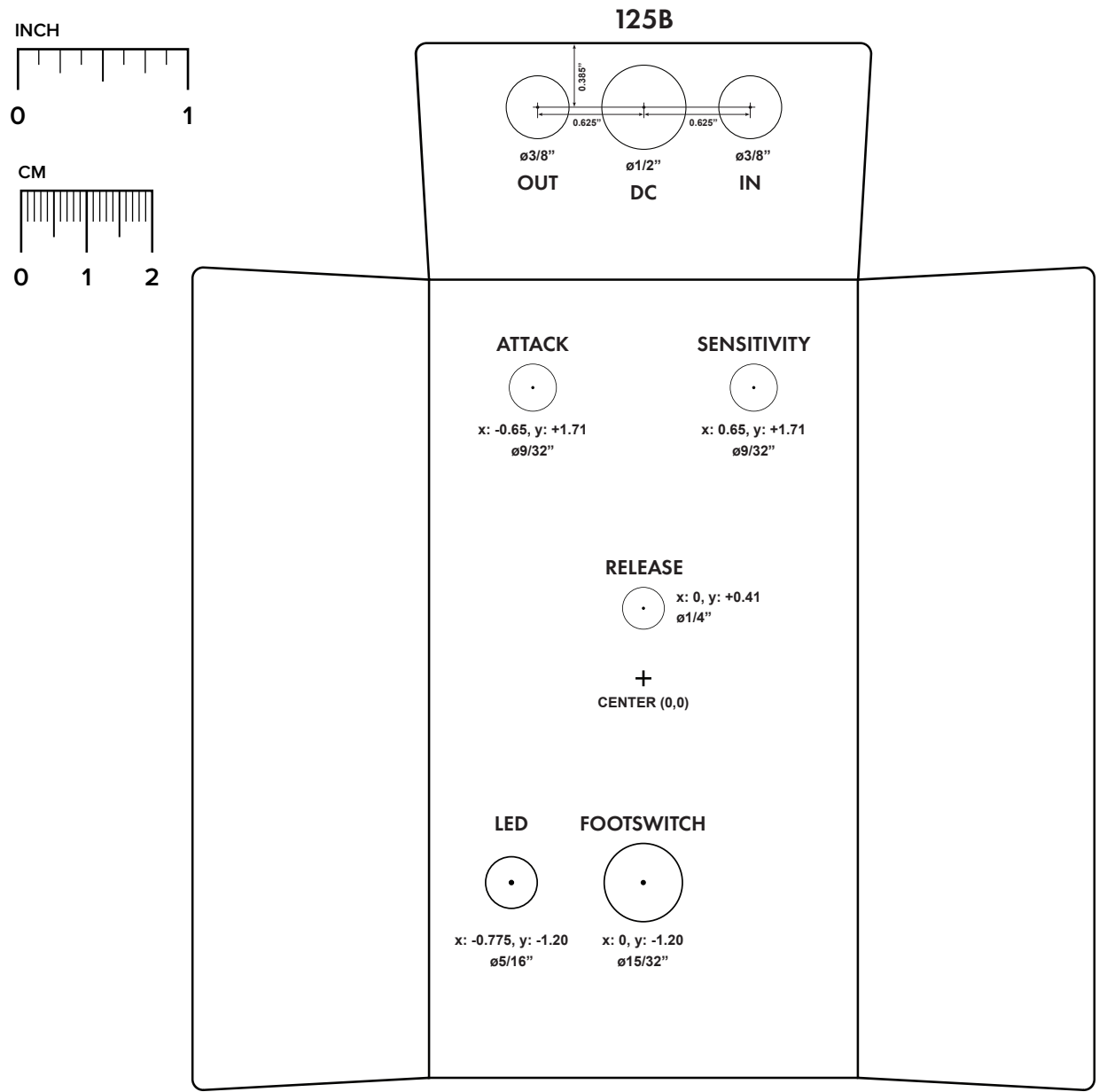
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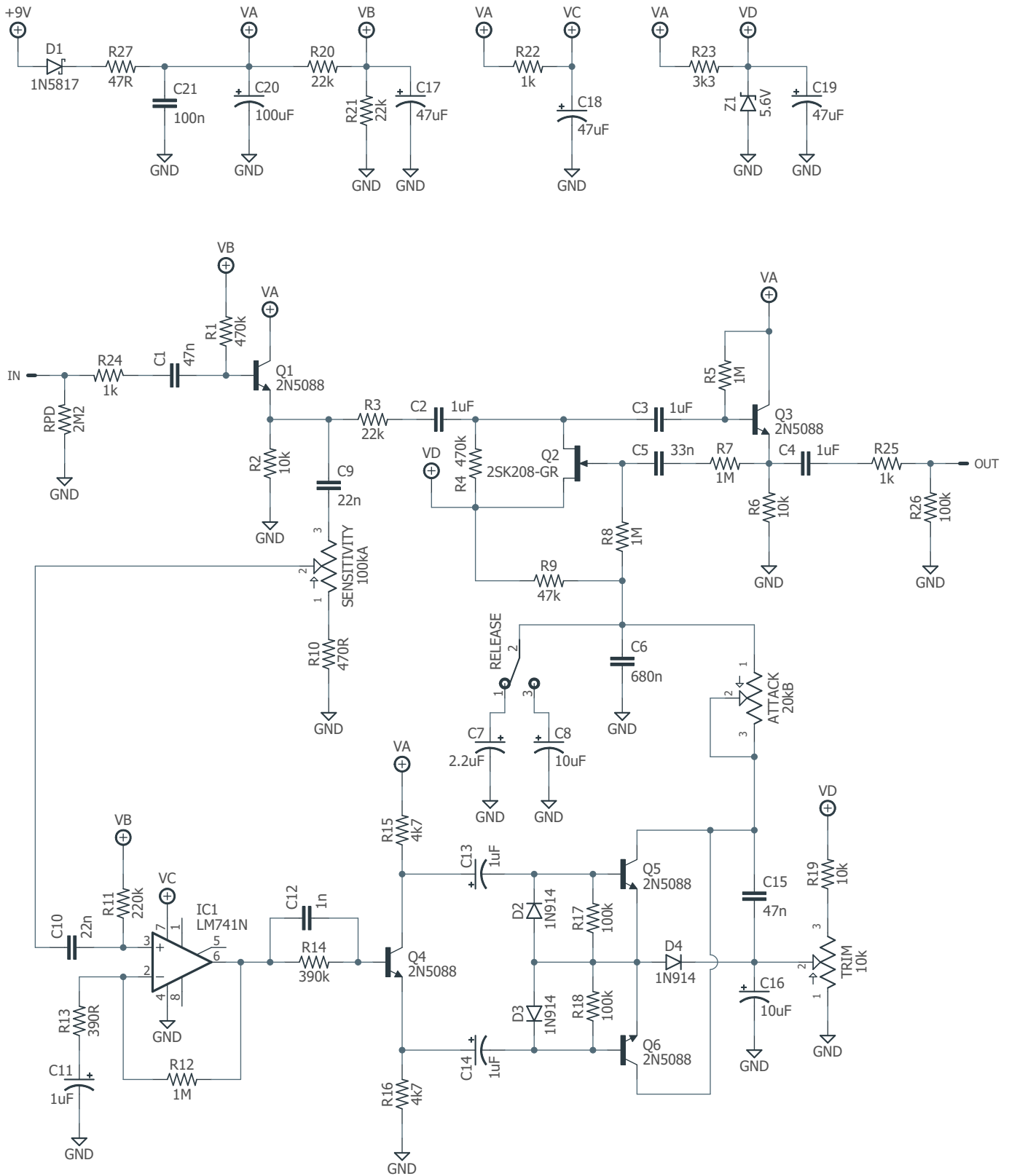
DRILL TEMPLATE

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.

INCH

0   1

CM

0   1   2

125B

0.385"

0.625"   0.625"

ø3/8"   ø1/2"   ø3/8"

OUT   **DC**   **IN**

ATTACK   **SENSITIVITY**

x: -0.65, y: +1.71   x: 0.65, y: +1.71
ø9/32"   ø9/32"

RELEASE
x: 0, y: +0.41
ø1/4"

\+
CENTER (0,0)

LED   **FOOTSWITCH**

x: -0.775, y: -1.20   x: 0, y: -1.20
ø5/16"   ø15/32"

ENCLOSURE LAYOUT

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

125B

WIRING DIAGRAM

IN GND +V

N.C. N.C. OUT

PCB IN GND +V

+V JACK IN GND JACK OUT

GND GND PCB OUT

125B

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.
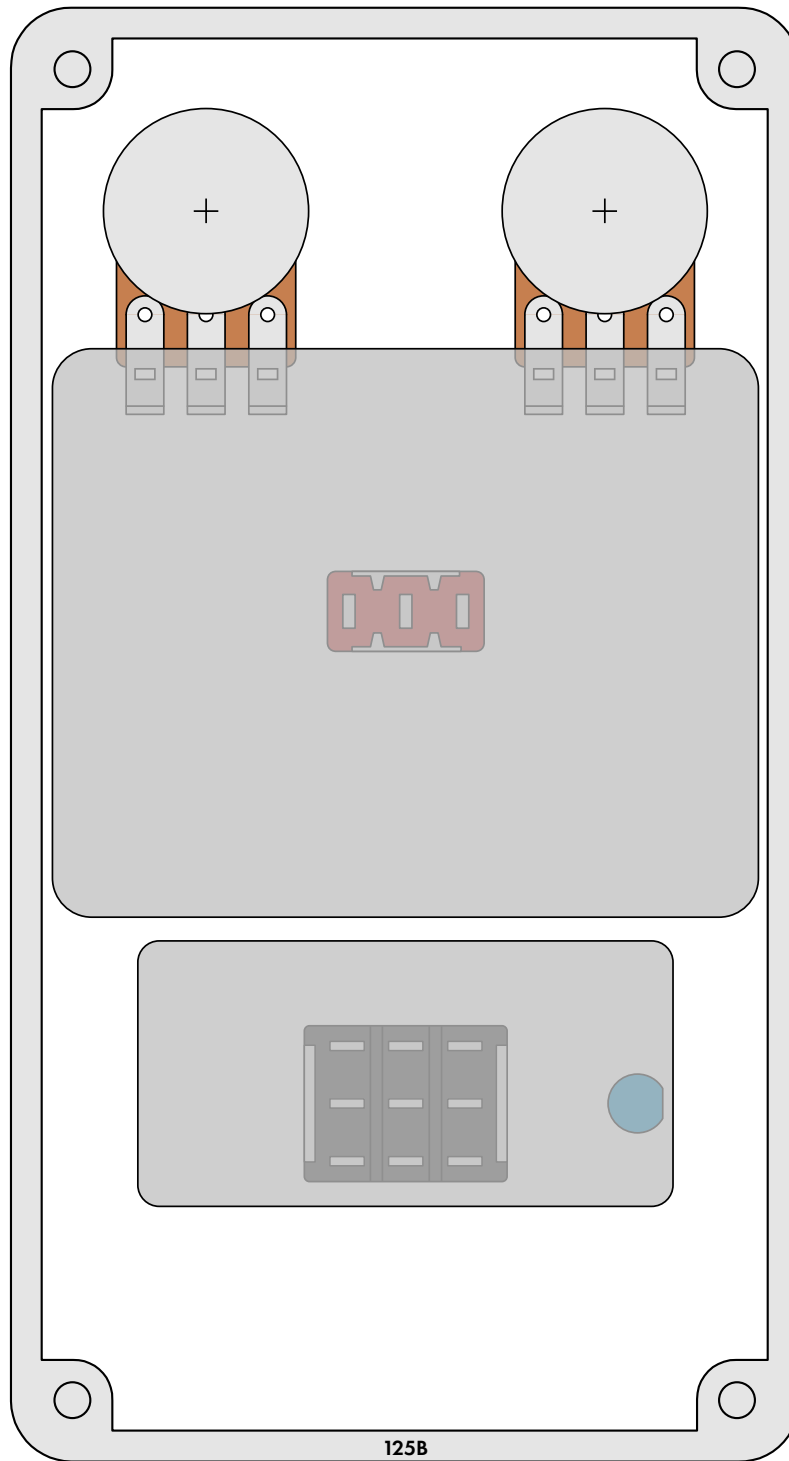
LICENSE & USAGE

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

1.0.0 (2023-09-08)
Initial release.