PROJECT NAME

# GALE

aion DIY GUITAR EFFECTS

**BASED ON**
Schaffer-Vega Diversity System

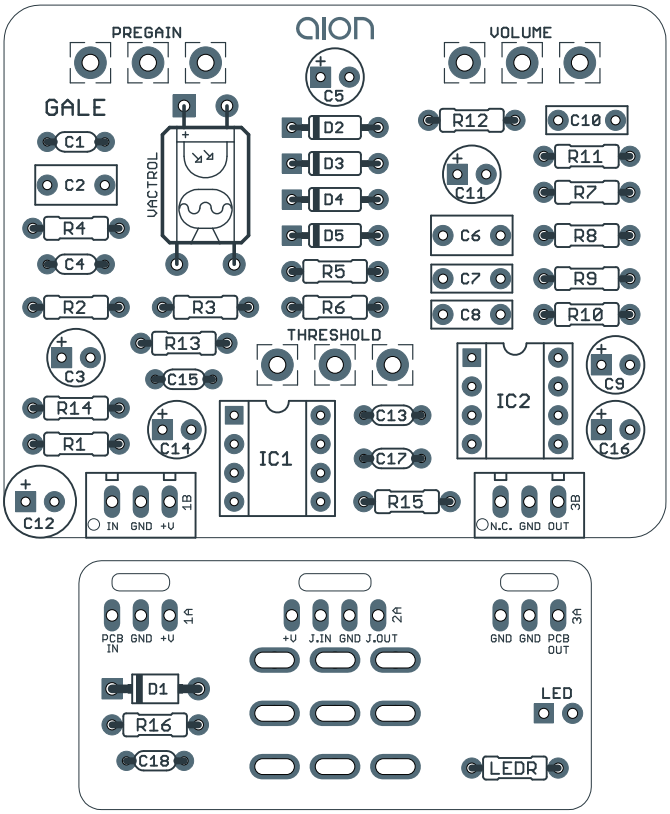
**BUILD DIFFICULTY**
▮▮▯▯▯ Easy

**EFFECT TYPE**
Booster & optical limiter

**DOCUMENT VERSION**
1.0.1 (2019-11-26)

## PROJECT SUMMARY

A pedal adaptation of the Schaffer-Vega Diversity System (SVDS), the first widely-used wireless system for guitar, famously used by AC/DC, Van Halen, Kiss, and Pink Floyd.




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

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## INTRODUCTION

The Gale Booster / Limiter is a pedal adaptation of the Schaffer-Vega Diversity System, and more directly based on the SoloDallas Storm (version 2, 2019, traced by Aion FX). The SVDS was designed by Ken Schaffer and released in 1976 by the Vega Corporation. It was the first wireless system that was reliable enough to be used by major touring acts.

While it was used by several famous guitarists including Ace Frehley, David Gilmour and Eddie Van Halen, it's Angus Young of AC/DC whose tone was most impacted by it. He found that when he was in the studio, he couldn't get quite the same tone as he got on stage, so he ended up running his guitar through the wireless unit even when recording.

Because of this, the SVDS joins the ranks of the SDD-3000 and Echoplex EP-3 as an effect unit whose coloration was desirable even when the main part of the effect wasn't used.

In the pedal adaptation, the actual wireless portions of the SVDS have been removed, leaving only the pregain, limiter, and output amplifier, which form the core analog signal path of the original unit.

The Gale is a direct adaptation of the Storm with no changes except for some added power filtering.

## USAGE

The Gale has the following controls:

- **Pregain** sets the signal level at the input. At higher settings, it can drive the limiter harder for more compression.
- **Threshold** sets the threshold of the optical limiter.
- **Volume** is the output volume control.

# 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 | 2k | Metal film resistor, 1/4W | |
| R2 | 1M | Metal film resistor, 1/4W | |
| R3 | 2k | Metal film resistor, 1/4W | |
| R4 | 15k | Metal film resistor, 1/4W | |
| R5 | 1k | Metal film resistor, 1/4W | |
| R6 | 10k | Metal film resistor, 1/4W | |
| R7 | 10k | Metal film resistor, 1/4W | |
| R8 | 2k | Metal film resistor, 1/4W | |
| R9 | 8k2 | Metal film resistor, 1/4W | |
| R10 | 2k | Metal film resistor, 1/4W | |
| R11 | 10R | Metal film resistor, 1/4W | |
| R12 | 10R | Metal film resistor, 1/4W | |
| R13 | 10k | Metal film resistor, 1/4W | |
| R14 | 10k | Metal film resistor, 1/4W | |
| R15 | 10R | Metal film resistor, 1/4W | |
| R16 | 10R | Metal film resistor, 1/4W | |
| LEDR | 4k7 | Metal film resistor, 1/4W | LED current-limiting resistor. Adjust value to change LED brightness. |
| C1 | OMIT | MLCC capacitor, NP0/C0G | 120pF capacitor disconnected in original. See build notes. |
| C2 | 1uF | Film capacitor, 7.2 x 3.5mm | |
| C3 | 10uF | Electrolytic capacitor, 5mm | |
| C4 | 120pF | MLCC capacitor, NP0/C0G | Measured value 130pF in original. |
| C5 | OMIT | Electrolytic capacitor, 5mm | 10uF capacitor disconnected in original. See build notes. |
| C6 | 1uF | Film capacitor, 7.2 x 3.5mm | |
| C7 | 1n | Film capacitor, 7.2 x 2.5mm | |
| C8 | 100n | Film capacitor, 7.2 x 2.5mm | |
| C9 | 10uF | Electrolytic capacitor, 5mm | |
| C10 | 100n | Film capacitor, 7.2 x 2.5mm | |
| C11 | 10uF | Electrolytic capacitor, 5mm | |
| C12 | 100uF | Electrolytic capacitor, 6.3mm | Power supply filter capacitor. |
| C13 | 100n | MLCC capacitor, X7R | Power supply filter capacitor. |

# PARTS LIST, CONT.

| PART | VALUE | TYPE | NOTES |
|---|---|---|---|
| C14 | 10uF | Electrolytic capacitor, 5mm | |
| C15 | 100n | MLCC capacitor, X7R | |
| C16 | 10uF | Electrolytic capacitor, 5mm | |
| C17 | 100n | MLCC capacitor, X7R | |
| C18 | 100n | MLCC capacitor, X7R | |
| D1 | 1N5817 | Schottky diode, DO-41 | |
| D2 | BAT42 | Schottky diode, DO-35 | |
| D3 | BAT42 | Schottky diode, DO-35 | |
| D4 | BAT42 | Schottky diode, DO-35 | |
| D5 | BAT42 | Schottky diode, DO-35 | |
| IC1 | RC4558P | Operational amplifier, DIP8 | |
| IC1-S | DIP-8 socket | IC socket, DIP-8 | |
| IC2 | LM386N-1 | Audio amplifier, DIP8 | |
| IC2-S | DIP-8 socket | IC socket, DIP-8 | |
| PRE. | 100kB | 16mm right-angle PCB mount pot | |
| THR. | 100kA | 16mm right-angle PCB mount pot | |
| VOL. | 1kB | 16mm right-angle PCB mount pot | |
| VACT | NSL-32 | Vactrol/opto-isolator, NSL-32 | |
| 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

## Wiring note

In order to maintain good grounding practices, the LM386 output stage has been given its own ground instead of sharing a ground plane with the input stage and limiter circuit. Because of this, there is another ground wire that needs to be connected on the right side, adjacent to the “Out” wire.

The wiring diagram shows this added wire, but since it’s otherwise identical to most other Aion projects, it could easily be overlooked.

## Omitted parts

The SoloDallas Storm has two capacitors on the PCB that are populated, but linked by jumpers on the bottom side so that they are disconnected unless the jumpers are in place. This is a common manufacturing trick in SMT assembly that lets them decide on the fly whether to use either of the capacitors, even on a per-unit basis.

The first is a 120pF capacitor on the input, which is commonly used to tame radio frequencies, and is marked “input RF filter” on the PCB.

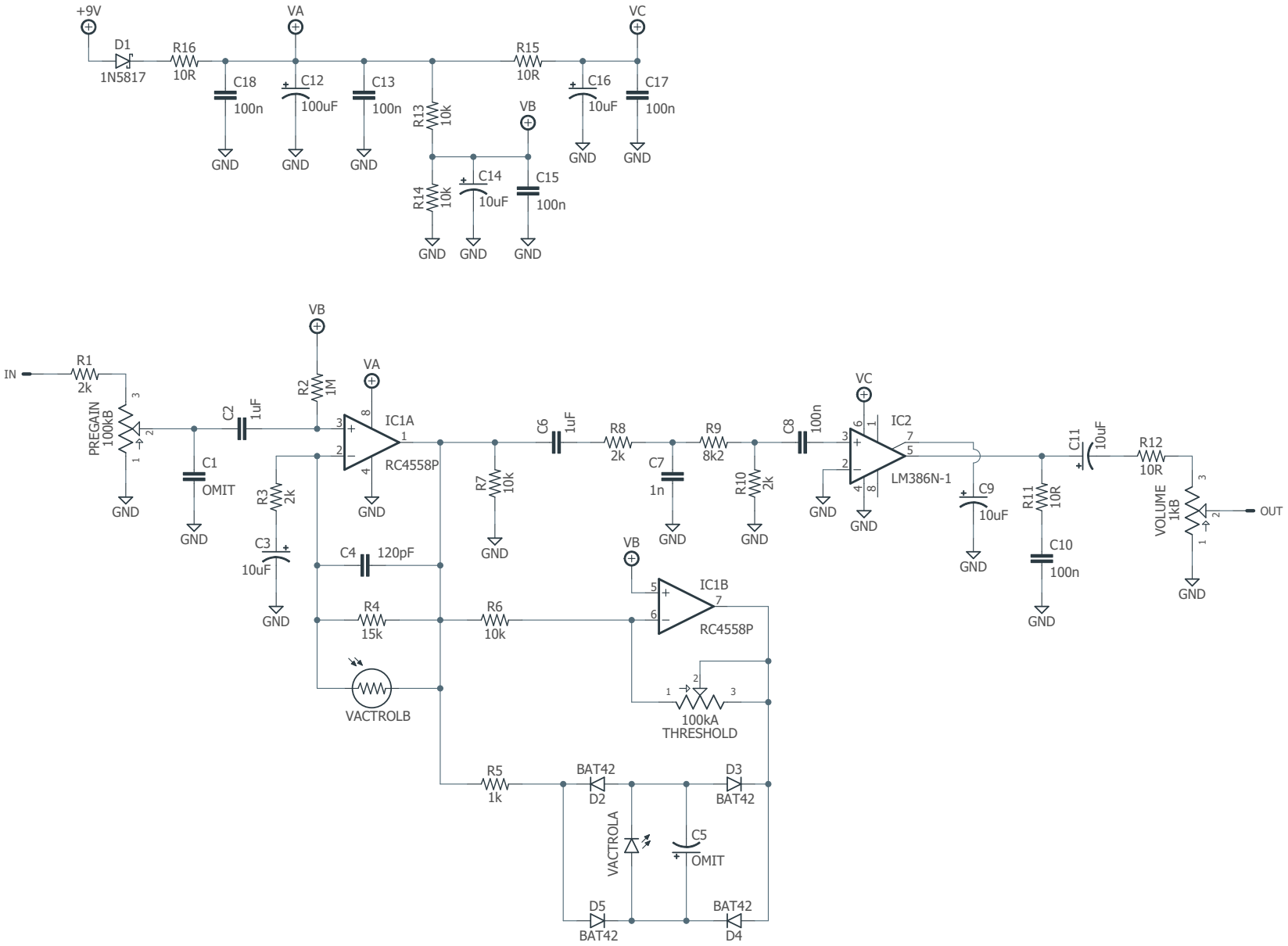
The second is a 10uF capacitor in parallel with the vactrol LED which helps control the attack time, marked “isolator threshold” on the PCB. This capacitor is very commonly used in similar optical compressor/limiter circuits.

In the Gale project, the jumpers have been omitted, so you can just decide whether to include the capacitors or leave them off. On the unit that was traced, both jumpers were unpopulated, so both capacitors were disconnected.

## Vactrol selection

The original Storm unit uses an NSL-32 vactrol. A VTL5C3 was found to work just as well, so there are probably a few different types you can use here if you don’t have access to the NSL-32.

# SCHEMATIC


+9V
VA
VC
D1
1N5817
R16
10R
C18
100n
C12
100uF
C13
100n
R15
10R
C16
10uF
C17
100n
R13
10k
VB
R14
10k
C14
10uF
C15
100n
GND
IN
R1
2k
PREGAIN
100kB
C1
OMIT
C2
1uF
R2
1M
IC1A
RC4558P
R3
2k
C3
10uF
C4
120pF
R7
10k
C6
1uF
R8
2k
C7
1n
R9
8k2
R10
2k
C8
100n
IC2
LM386N-1
C9
10uF
R11
10R
C10
100n
C11
10uF
R12
10R
VOLUME
1kB
OUT
IC1B
RC4558P
R4
15k
R6
10k
VACTROLB
100kA
THRESHOLD
R5
1k
BAT42
D2
D3
BAT42
VACTROLA
C5
OMIT
D5
BAT42
BAT42
D4

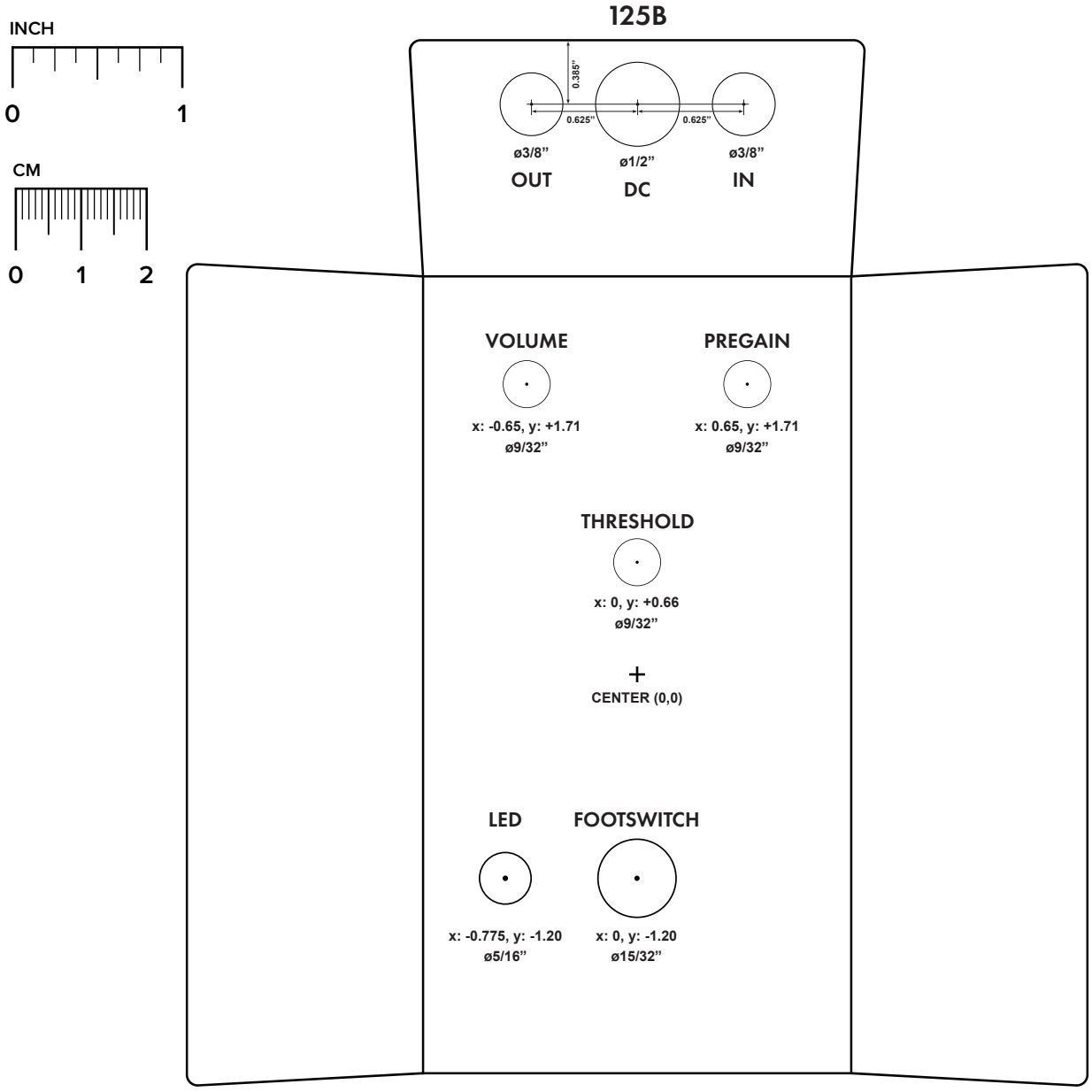
# DRILL TEMPLATE

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.

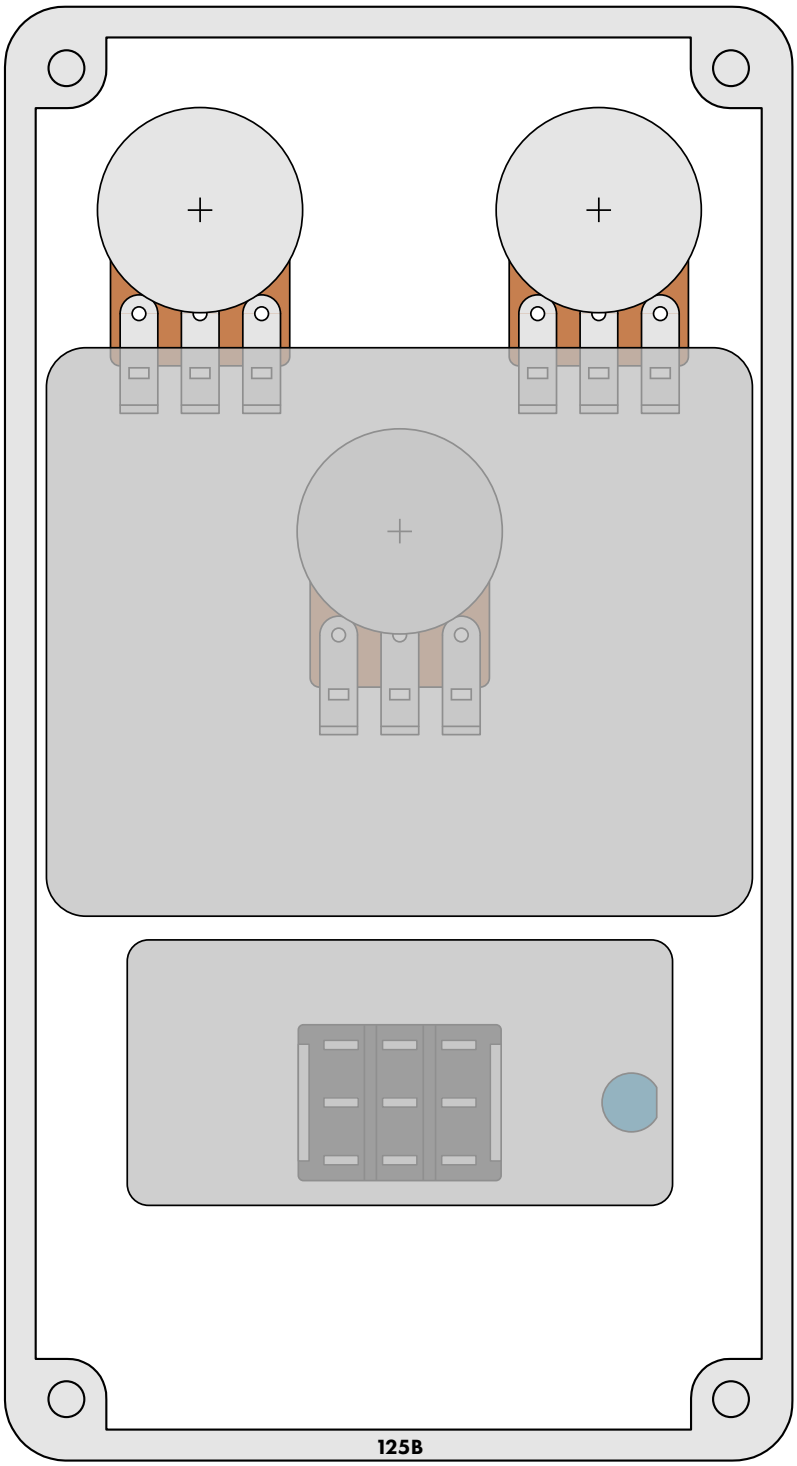
**Top jack layout** assumes the use of closed-frame jacks like the Switchcraft 111X. If you'd rather use open-frame jacks, please refer to the Open-Frame Jack Drill Template for the top side.

**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.

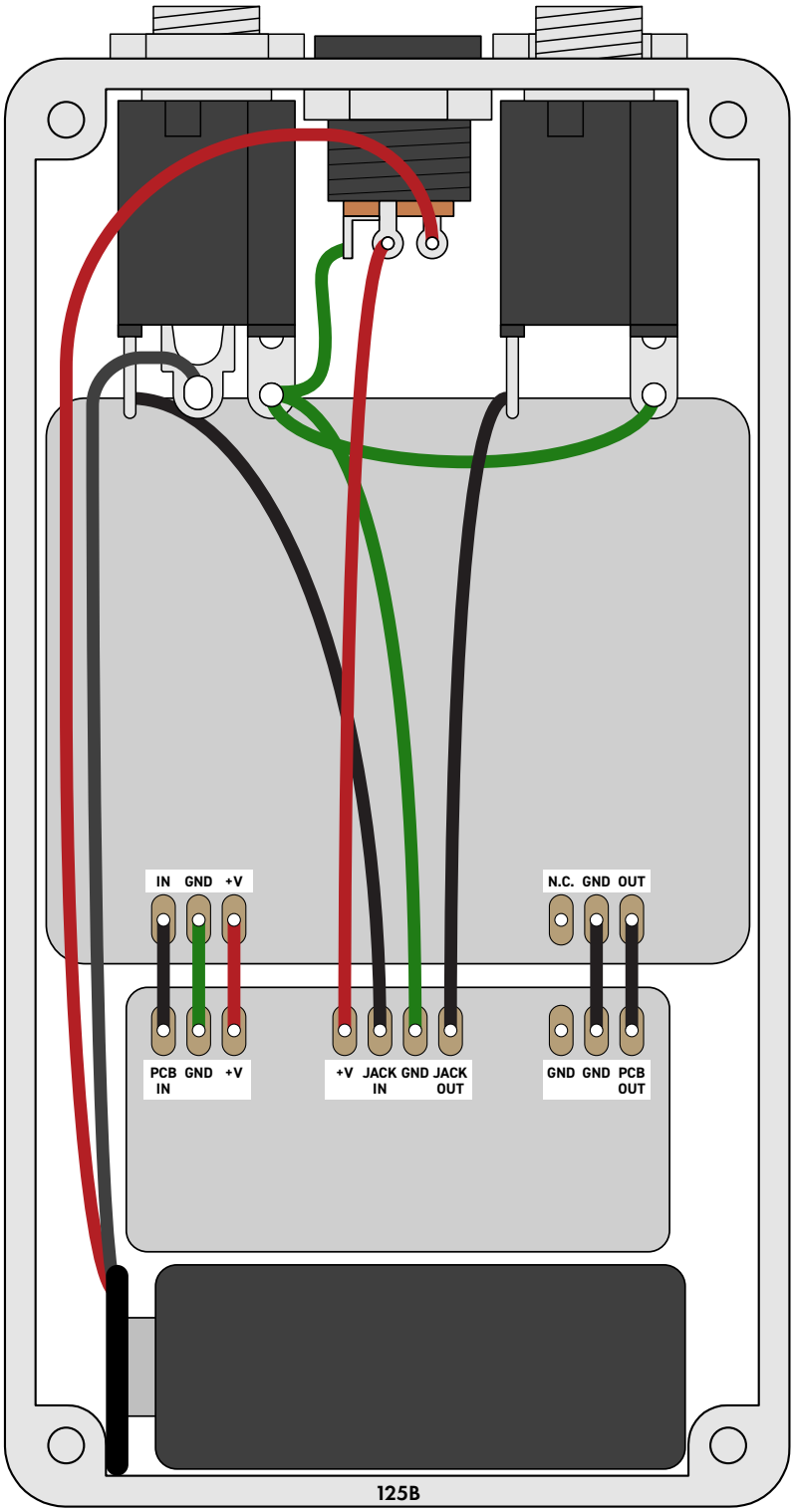


# ENCLOSURE LAYOUT

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

**1.0.1 (2019-11-26)**
Values of R5 and R6 were reversed in the parts list. R5 should be 1k and R6 should be 10k. The schematic and Google spreadsheet were correct.

**1.0.0 (2019-10-18)**
Initial release.