PROJECT NAME

# VIRIDIAN

aion DIY GUITAR EFFECTS

**BASED ON**
Mad Professor Little Green Wonder

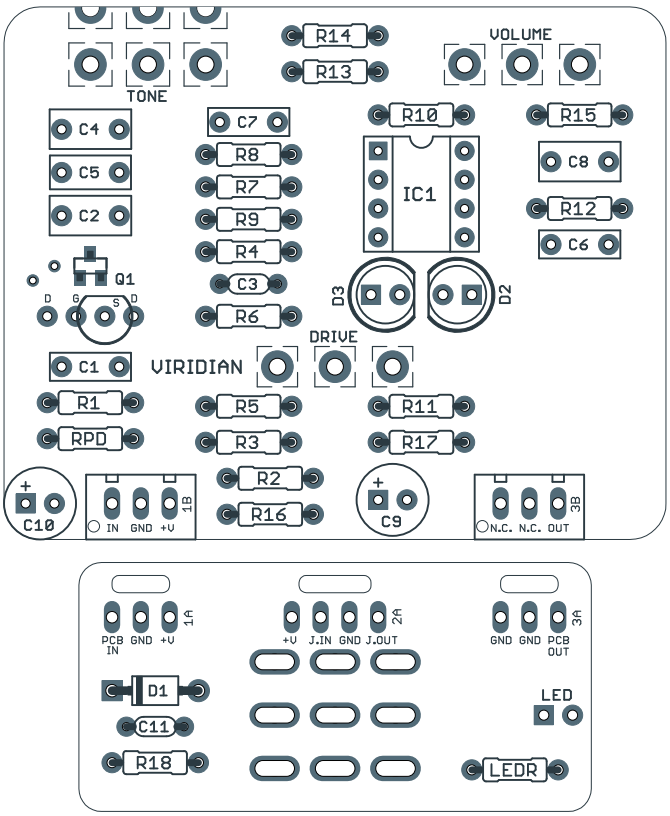
**BUILD DIFFICULTY**
▮▮▯▯▯ Easy

**EFFECT TYPE**
Overdrive

**DOCUMENT VERSION**
1.0.0 (2020-08-28)

## PROJECT SUMMARY

A very unique adaptation of the classic Tube Screamer circuit, this pedal is seen as a secret weapon for rhythm work by some guitarists such as Jeffrey Kunde.




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

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## INTRODUCTION

The Viridian Dynamic Overdrive is based on the BJFe / Mad Professor Little Green Wonder, an op-amp drive that can be viewed as BJFe's take on the Tube Screamer.

The BJFe Little Green Wonder was first released in 2003. Only 117 units were ever produced, so the original BJFe version is extremely rare. Later, in 2007, Mad Professor Amplification of Finland released the Little Green Wonder under license from BJFe, the first of many licensed designs that would follow. The BJFe version had undergone a few minor tweaks throughout the small run, and the Mad Professor version was based on the final version, which was the one that Bjorn was most happy with.

The Viridian is based on the Mad Professor version of the Little Green Wonder. The only modification is the inclusion of two optional tapering resistors so that a more common 100kA dual potentiometer can be used for the tone control.

## USAGE

The Viridian has three controls:

- **Gain** controls the amount of gain from the first transistor stage.
- **Tone** is a dual-function control that changes frequencies in two stages at once. See build notes for more information on how it works.
- **Volume** is the output volume of the effect.

# 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 | 5k6 | Metal film resistor, 1/4W | |
| R2 | 1M | Metal film resistor, 1/4W | |
| R3 | 10k | Metal film resistor, 1/4W | |
| R4 | 5k6 | Metal film resistor, 1/4W | |
| R5 | 27k | Metal film resistor, 1/4W | |
| R6 | 5k6 | Metal film resistor, 1/4W | |
| R7 | 1k | Metal film resistor, 1/4W | |
| R8 | OMIT | | Leave empty unless using a dual 100kA pot for the tone control, in which case use 27k here. |
| R9 | 2k | Metal film resistor, 1/4W | |
| R10 | 2k | Metal film resistor, 1/4W | |
| R11 | 27k | Metal film resistor, 1/4W | |
| R12 | 2k | Metal film resistor, 1/4W | |
| R13 | 470R | Metal film resistor, 1/4W | |
| R14 | OMIT | | Leave empty unless using a dual 100kA pot for the tone control, in which case use 27k here. |
| R15 | 5k6 | Metal film resistor, 1/4W | |
| R16 | 27k | Metal film resistor, 1/4W | |
| R17 | 27k | Metal film resistor, 1/4W | |
| R18 | 47R | Metal film resistor, 1/4W | |
| RPD | 2M2 | Metal film resistor, 1/4W | Input pulldown resistor. Can be as low as 1M. |
| LEDR | 4k7 | 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 | 100pF | MLCC capacitor, NP0/C0G | |
| C4 | 1uF | Film capacitor, 7.2 x 3.5mm | |
| C5 | 220n | Film capacitor, 7.2 x 2.5mm | |
| C6 | 100n | Film capacitor, 7.2 x 2.5mm | |
| C7 | 47n | Film capacitor, 7.2 x 2.5mm | |
| C8 | 1uF | Film capacitor, 7.2 x 3.5mm | |
| C9 | 100uF | Electrolytic capacitor, 6.3mm | Reference voltage filter capacitor. |

# PARTS LIST, CONT.

| PART | VALUE | TYPE | NOTES |
|---|---|---|---|
| C10 | 100uF | Electrolytic capacitor, 6.3mm | Power supply filter capacitor. |
| C11 | 100n | MLCC capacitor, X7R | Power supply filter capacitor. |
| D1 | 1N5817 | Schottky diode, DO-41 | |
| D2 | 3mm green | LED, 3mm, green diffused | |
| D3 | 3mm green | LED, 3mm, green diffused | |
| Q1 | J201 | BJT transistor, NPN, TO-92 | Substitute; original uses 2SK170(BL). Pads are provided for either through-hole or SMD. |
| IC1 | LF353N | Operational amplifier, DIP8 | Can also be TLC272. See build notes. |
| IC1-S | DIP-8 socket | IC socket, DIP-8 | |
| DRIVE | 500kA | 16mm right-angle PCB mount pot | |
| TONE | 20kA dual | 16mm right-angle PCB mount pot | Can also use 100kA dual. See build notes. |
| VOL. | 50kB | 16mm right-angle PCB mount pot | |
| 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. |

## Tone control

The tone control is very unique and requires some explanation. It uses a dual 20kA potentiometer to control the tone in two stages of the circuit at once. (The earliest of the BJFe-built versions used linear taper, but it was changed to log after around 40 units, long before the Mad Professor version.)

The first half is pretty standard: a control that affects the low-cut frequency of the first gain stage. At the low end, the bass content is highest, and as you turn it up the bass is gradually cut. This is similar to the bass control of a Zendrive or Timmy.

The second half is odd, and in fact we traced an original LGW to verify that the existing schematics available online were correct. (They were.) By connecting pins 1 and 3 together, both "halves" of the voltage divider are in parallel with each other. The net effect is similar to the first stage in that it affects the low frequencies, but the curious difference here is that knob positions 0 and 10 are identical. As you turn the knob up from zero, the low-cut frequency goes up (i.e. more bass is cut), but at around 2:00 on the control it hits a peak and then starts going back down before arriving back at the lowest setting again on the far side.

While DIYers commonly split this dual-gang tone control into two separate knobs, understand that the second-stage tone control is very strange on its own and is really designed to work in conjunction with the first stage. It works great as a dual control, but splitting them out is not nearly as useful as it sounds. Therefore, the Viridian's implementation of the LGW circuit stays true to the original by retaining the dual potentiometer.

### Using a 100kA dual potentiometer

The easiest way to handle the tone control is to use a 100kA dual pot, which is much easier to find than the stock circuit's 20kA (and is available in the correct form factor). If you use a 100kA pot, you'll want to include **27k** tapering resistors for **R8** and **R14**. This will reduce the effective value to 20k, and while the sweep will be slightly different, all the tones are there.

### Using a 20kA dual potentiometer

The stock circuit's 20kA value for the tone control is uncommon. Tayda Electronics is the only supplier that carries it, but the shaft and pin format are both wrong in theirs. It can be made to work, though.

You'll need to solder wires to the three pins in the row closest to the shaft and bend them upward toward the bottom set of PCB pads. (Clipped diode or resistor leads work great for this, and it helps to bend the straight pins into a small "eyelet" with needle-nose pliers to make a solder lug.)

The three pins on the row farthest from the shaft need to be bent straight up at as sharp an angle as possible, even backwards slightly. It will fit, but you may need to work at it a bit.

For the knurled shaft, one common trick is to use the anti-rotation tab (the one you snap off with pliers) to fill the gap in the shaft. It's the exact width for a snug fit, and it prevents the knob's set screw from squeezing the two halves of the shaft together and getting off-center.

## IC selection

The earliest BJFe Little Green Wonders used the LF353 IC. However, Bjorn wasn't satisfied with how it sounded on battery power once the battery dropped to around 8V, so he changed the IC to the TLC272 which sounded better across the life of the battery.

For awhile, he included both ICs so the user could change them out on their own, but eventually he stopped including the LF353, although the IC itself has always remained socketed (including in the Mad Professor version) for those who know what they're doing.

Bjorn maintains that he prefers the sound of the LF353 at 9V, so if you plan on running this pedal solely from adapter power and not a battery, you should consider using the LF353 instead of the TLC272.

## JFET selection

In the original LGW, the Q1 input buffer uses a 2SK170(BL) JFET. These are obsolete and hard to find. Due to their low Vgs(off) value, they'll clip at low input signals, so it's not functioning strictly as a clean input buffer like you'd normally see in this type of circuit.

Aion FX measured the JFET in an original Little Green Wonder using a Peak Atlas DCA75. Here are the characteristics:

| PART | TYPE | $V_{GS(off)}$ | $I_{DSS}$ | GFS | $R_{DS(on)}$ |
|---|---|---|---|---|---|
| Q1 | 2SK170(BL) | -0.47V | 6.85mA | 25.6mA/V | 19.8R |

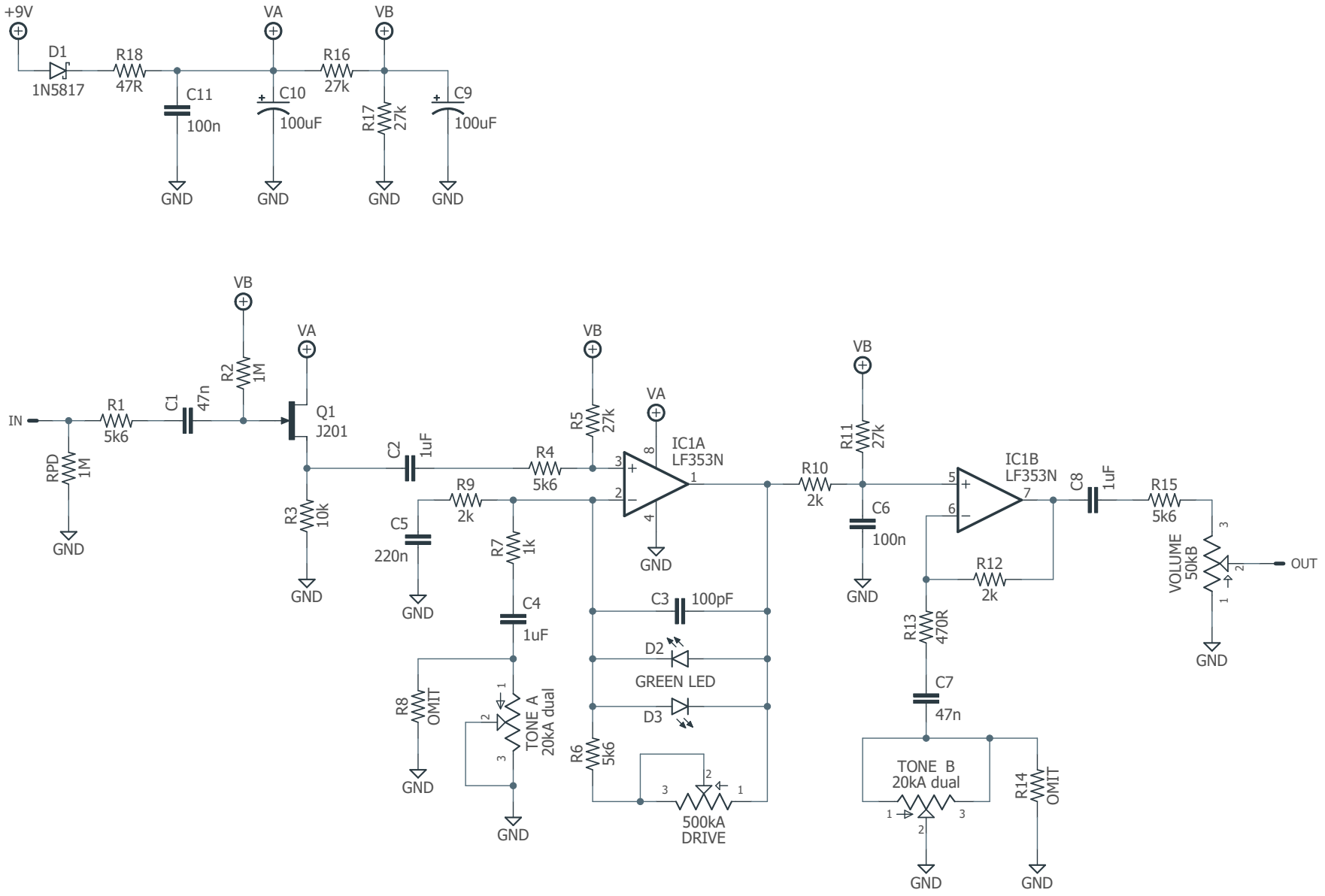
Don't obsess over the particulars, the exact specs really don't matter and this is just for posterity's sake. But it's enough to confirm that the **J201** is a near-exact replacement. The Vgs(off) value averages slightly higher, about -0.60 to -0.80V, but it's far closer than any other JFET.

J201s are also nearly extinct in through-hole format, but the MMBFJ201 is a SMD version that is still in production. On the PCB, two outlines have been included for the JFET, one for TO-92 and one for SMD (called SOT-23) right above it. Make sure you only use one or the other—don't put both a through-hole and surface mount part in the two Q1 spots.

## J201 adapters

Many DIY builders are intimidated by the small size of surface-mount parts. Aion FX offers pre-soldered J201s on adapters so they can easily be used as through-hole parts.

# SCHEMATIC


+9V
VA
VB
D1
1N5817
R18
47R
C11
100n
C10
100uF
R16
27k
R17
27k
C9
100uF
GND
IN
R1
5k6
C1
47n
R2
1M
RPD
1M
Q1
J201
R3
10k
C2
1uF
R4
5k6
R5
27k
IC1A
LF353N
R9
2k
C5
220n
R7
1k
C4
1uF
R8
OMIT
TONE A
20kA dual
C3
100pF
D2
GREEN LED
D3
R6
5k6
500kA
DRIVE
R10
2k
R11
27k
C6
100n
IC1B
LF353N
R12
2k
R13
470R
C7
47n
TONE B
20kA dual
R14
OMIT
C8
1uF
R15
5k6
VOLUME
50kB
OUT

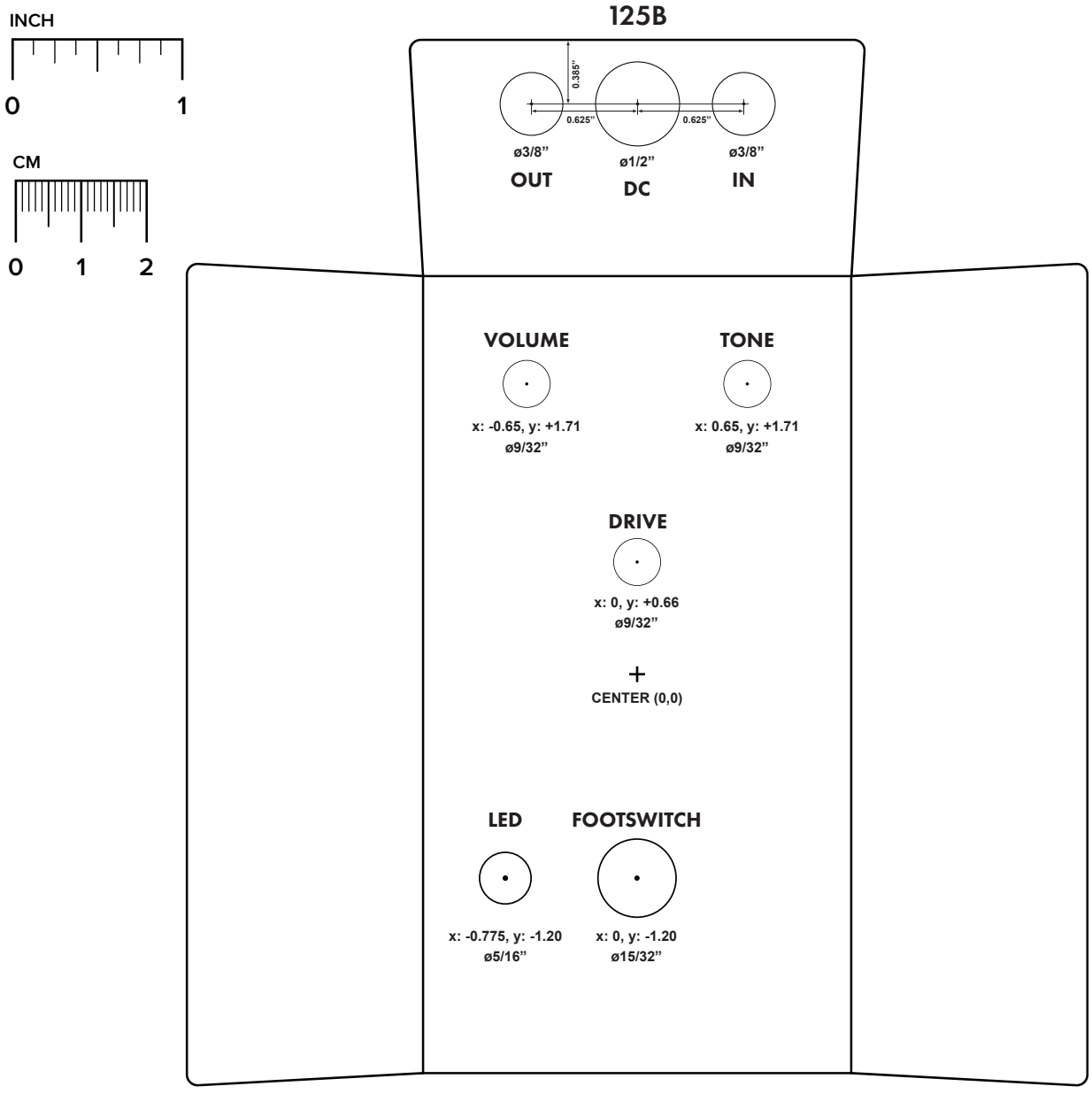
# DRILL TEMPLATE

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.

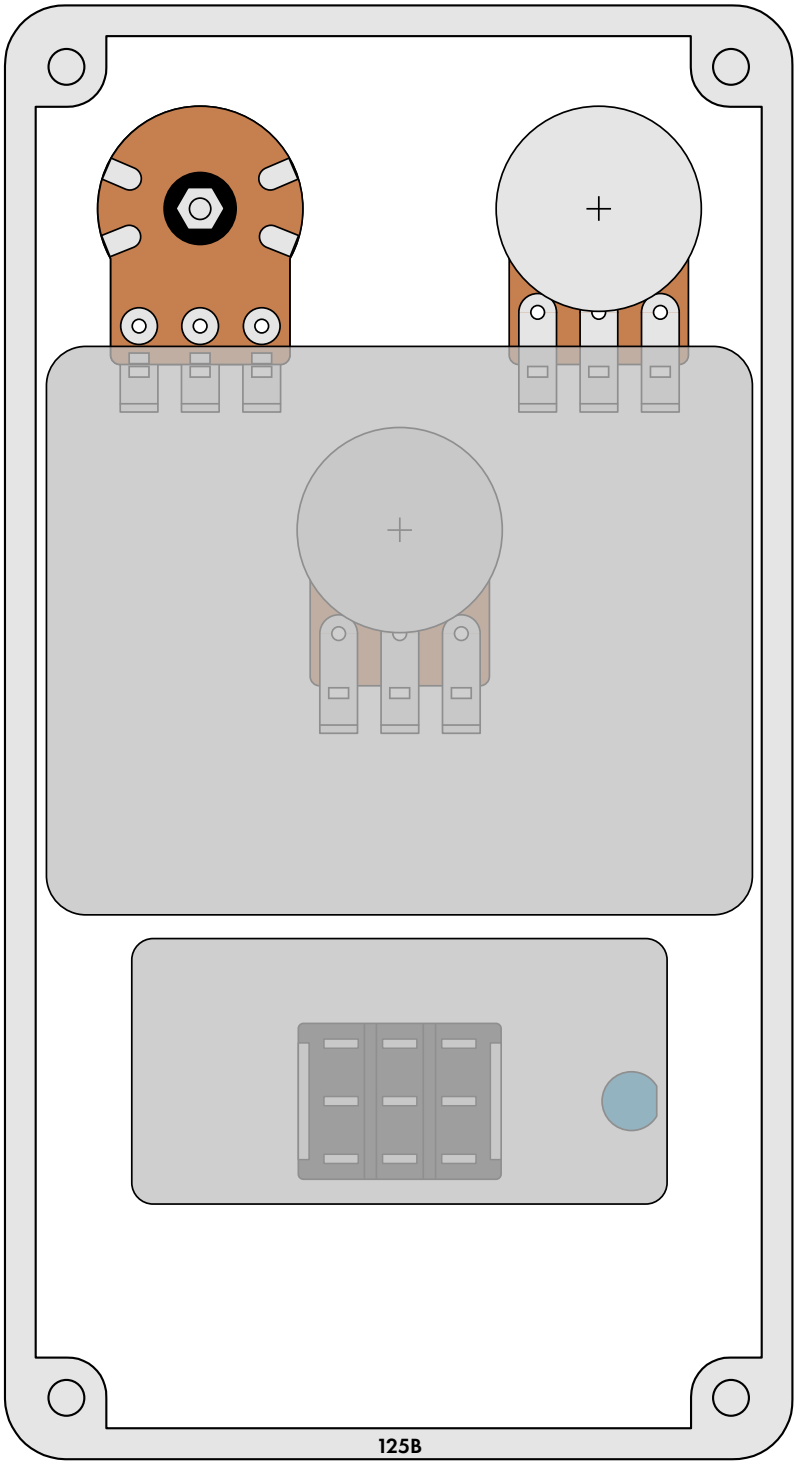
**LED hole drill size** assumes the use of a 5mm LED bezel, available from several parts suppliers. Adjust size accordingly if using something different, such as a 3mm bezel, a plastic bezel, or just a plain LED.



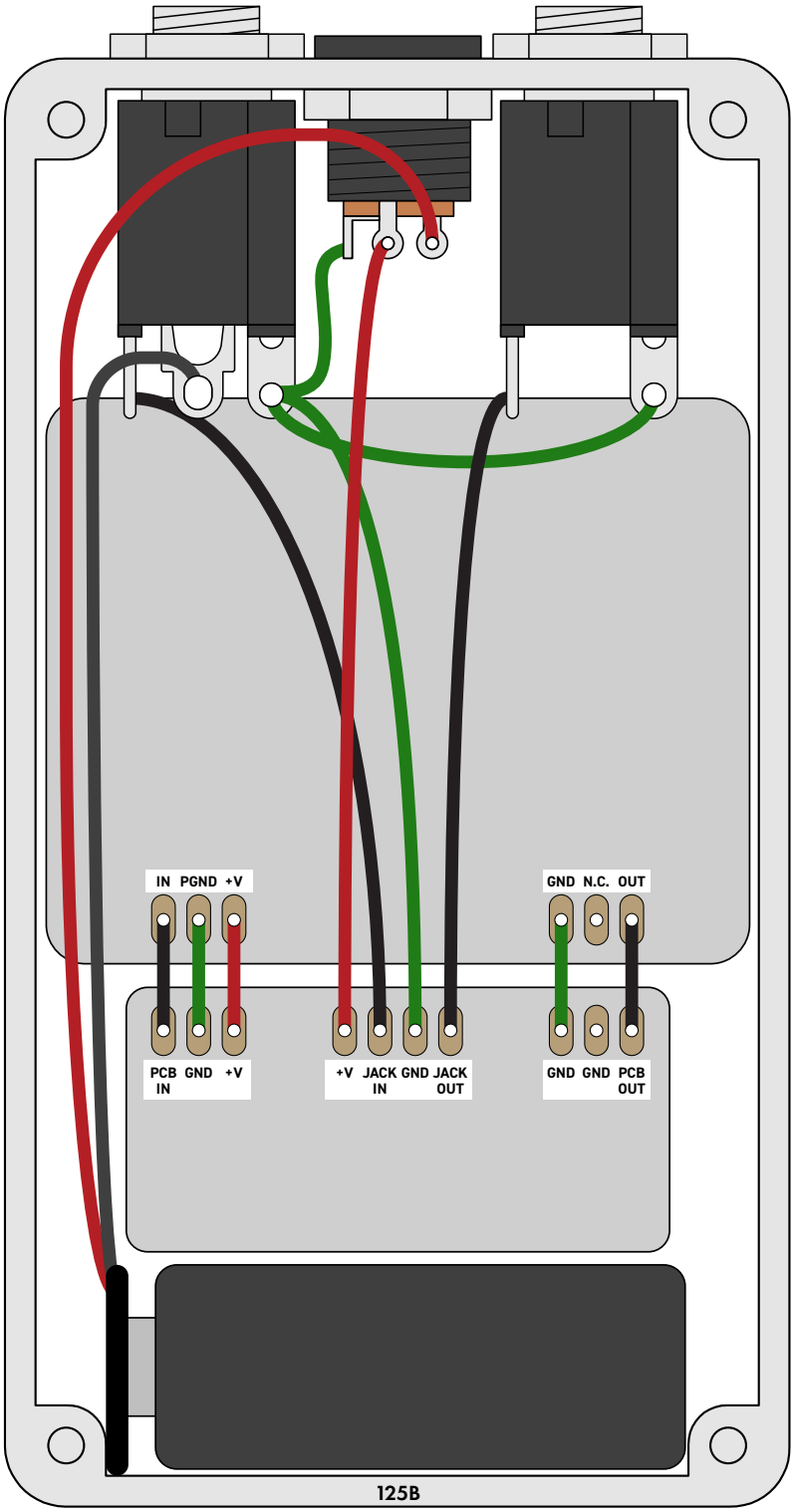
# ENCLOSURE LAYOUT

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

**Note:** The upper pads for the dual-gang gain potentiometer appear to be cut in half. **This is intentional!** It's called a *plated half-hole* or *castellated hole*, and it's used so that the PCB can lay flat across the pots instead of angling upward for the dual pot. Solder it like you would if they were normal pads, but bend the top pins forward slightly so they make contact with the edge of the pads.



# 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 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

**1.0.0 (2020-08-28)**
Initial release.