PROJECT NAME

ZIRCON

aion DIY GUITAR EFFECTS

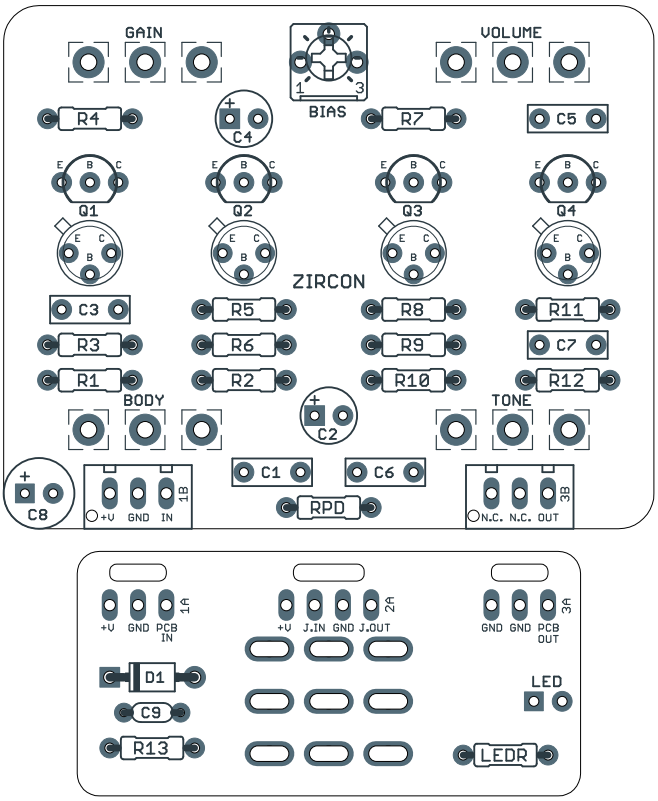
BASED ON
“Hot Silicon” Tone Bender

BUILD DIFFICULTY
Easy

EFFECT TYPE
Fuzz / Distortion

DOCUMENT VERSION
1.0.0 (2021-02-19)

PROJECT SUMMARY
An adaptation of the classic Tone Bender Mk. II circuit using silicon transistors and a Big Muff-style tone control.



Actual size is 2.3” x 1.86” (main board) and 1.78” x 0.87” (bypass board).

TABLE OF CONTENTS

INTRODUCTION

The Zircon Silicon Fuzz is a version of the "Hot Silicon" community project, itself an adaptation of the Sola Sound Tone Bender for silicon transistors.

The history of this circuit is a bit suspect, with two people claiming originality. It dates to 2003 at the very latest when Doug Hammond posted a schematic for a circuit he called the Hot Silicon, which was a hybrid of two earlier circuits from Gus Smalley and Aron Nelson.

However, an almost identical circuit was posted by Mictester in 2009 on freestompboxes.org, and he claimed he first developed it in the 1970s when he was trying to make a friend's silicon Tone Bender from Macari's (Sola Sound) sound good, and then tweaked the circuit over the following decades until arriving at the finalized version in 1994. (Sola Sound did make a very small number of Tone Bender Mk III's with silicon transistors—these are different than the Jumbo Tone Bender which was basically a Big Muff clone.)

Maybe it was just parallel development that arrived at the same outcome. Regardless of true origin, though, the Hot Silicon (or Silicon Tone Bender) is a fantastic circuit that has endured as a classic in the DIY scene for many years.

The Zircon is a near-direct adaptation of the Hot Silicon circuit, with one change: the input capacitor switch (called "Fat" in the original schematic) has been changed to a potentiometer so it can be gradually blended in or out rather than being either full-on or full-off.

USAGE

The Zircon has the following controls:

- **Body** blends between two input capacitors. Note that this may be seen as working backwards, with more bass on the low end that is gradually removed for a treble emphasis on the high end.
- **Gain** controls the amount of gain in the transistor fuzz stage.
- **Tone** is a Big Muff-style balance control that pans between a low-pass filter (bass emphasis) and a high-pass filter (treble emphasis).
- **Volume** is the overall output level.

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	150k	Metal film resistor, 1/4W	
R2	22k	Metal film resistor, 1/4W	
R3	10k	Metal film resistor, 1/4W	
R4	1k	Metal film resistor, 1/4W	
R5	10k	Metal film resistor, 1/4W	
R6	100R	Metal film resistor, 1/4W	
R7	47k	Metal film resistor, 1/4W	
R8	10k	Metal film resistor, 1/4W	
R9	10k	Metal film resistor, 1/4W	
R10	10k	Metal film resistor, 1/4W	
R11	10k	Metal film resistor, 1/4W	
R12	2k2	Metal film resistor, 1/4W	
R13	100R	Metal film resistor, 1/4W	
RPD	2M2	Metal film resistor, 1/4W	
LEDR	4k7	Metal film resistor, 1/4W	
C1	10n	Film capacitor, 7.2 x 2.5mm	
C2	10uF	Electrolytic capacitor, 5mm	
C3	100n	Film capacitor, 7.2 x 2.5mm	
C4	4.7uF	Electrolytic capacitor, 4mm	
C5	100n	Film capacitor, 7.2 x 2.5mm	
C6	8n2	Film capacitor, 7.2 x 2.5mm	
C7	100n	Film capacitor, 7.2 x 2.5mm	
C8	100uF	Electrolytic capacitor, 6.3mm	
C9	100n	MLCC capacitor, X7R	
D1	1N5817	Schottky diode, DO-41	
Q1	2N5088	BJT transistor, NPN, TO-92	
Q2	2N5088	BJT transistor, NPN, TO-92	
Q3	2N5088	BJT transistor, NPN, TO-92	
Q4	2N5088	BJT transistor, NPN, TO-92	
BIAS	5k trimmer	Trimmer, 10%, 1/4"	See build notes for bias info.

PARTS LIST, CONT.

PART	VALUE	TYPE	NOTES
BODY	100kA	16mm right-angle PCB mount pot	
GAIN	1kB	16mm right-angle PCB mount pot	
TONE	50kB	16mm right-angle PCB mount pot	
VOL.	100kA	16mm right-angle PCB mount pot	
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.
FSW	3PDT	Stomp switch, 3PDT	
ENC	125B	Enclosure, die-cast aluminum	Can also use a Hammond 1590N1.

BUILD NOTES

Setting the bias trimmer

The bias trimmer sets the gain and saturation of Q3, and is interactive with the external gain control.

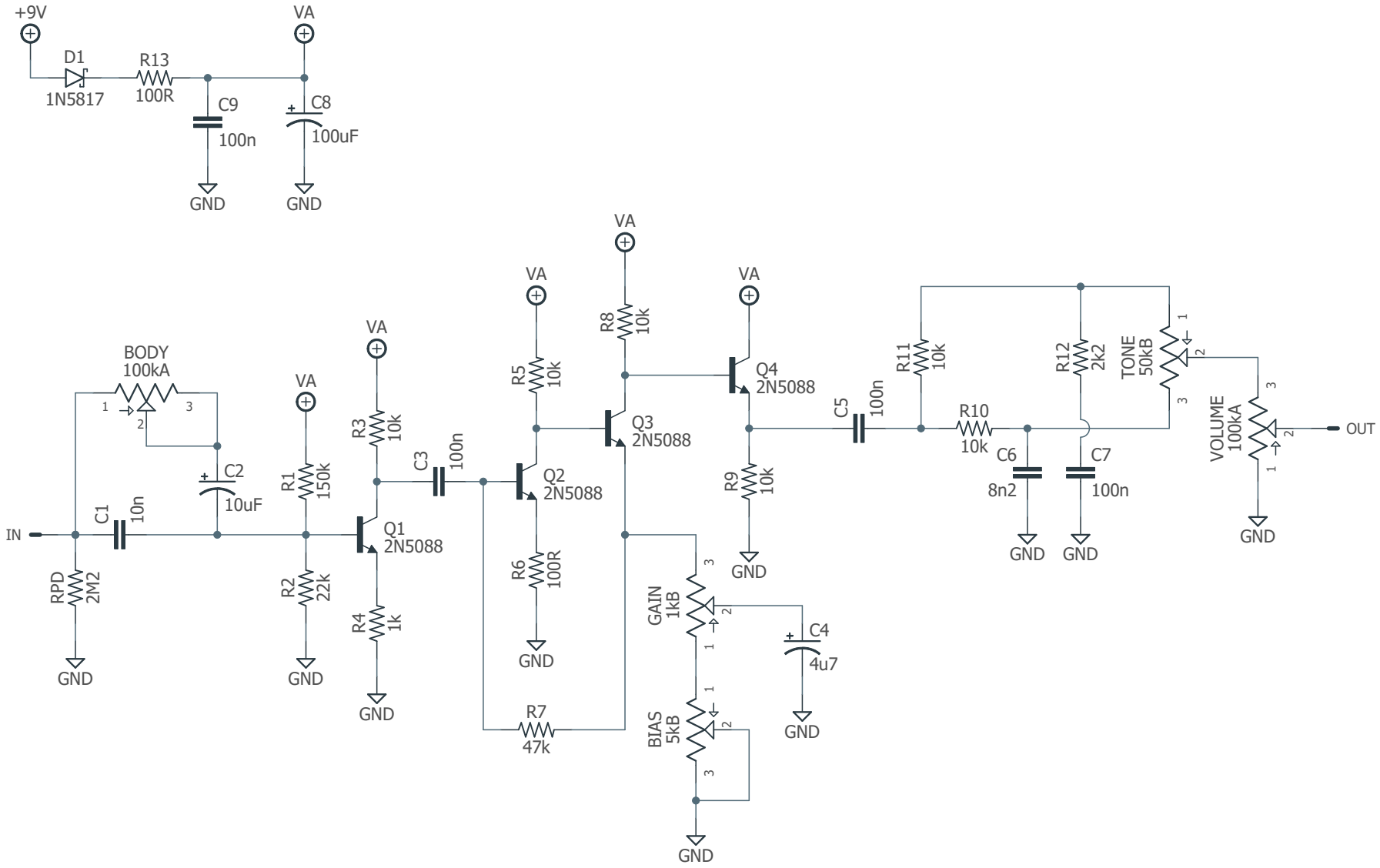
It's recommended to set the external Gain control to halfway, and then adjust the Bias trimmer until the gating (i.e. the complete cutoff of signal, including background noise, when not playing) goes away. In other words, you won't hear this gating effect once it's biased.

However, this is just a starting point and you may be able to get some interesting sounds by playing with the bias!

Transistor outlines

Two different sets of footprints have been provided for each of the transistors, either standard TO-92 or vintage TO-18 metal can (e.g. 2N2222A). Each outline is connected together on the PCB, so you can use either the top or bottom one in each pair, but not both.

SCHEMATIC


+9V
D1
1N5817
R13
100R
C9
100n
C8
100uF
VA
GND
BODY
100kA
C2
10uF
C1
10n
IN
RPD
2M2
R1
150k
R2
22k
R3
10k
R4
1k
C3
100n
Q1
2N5088
R5
10k
R6
100R
Q2
2N5088
R7
47k
R8
10k
Q3
2N5088
R9
10k
Q4
2N5088
C5
100n
GAIN
1kB
C4
4u7
BIAS
5kB
R11
10k
R10
10k
C6
8n2
R12
2k2
C7
100n
TONE
50kB
VOLUME
100kA
OUT

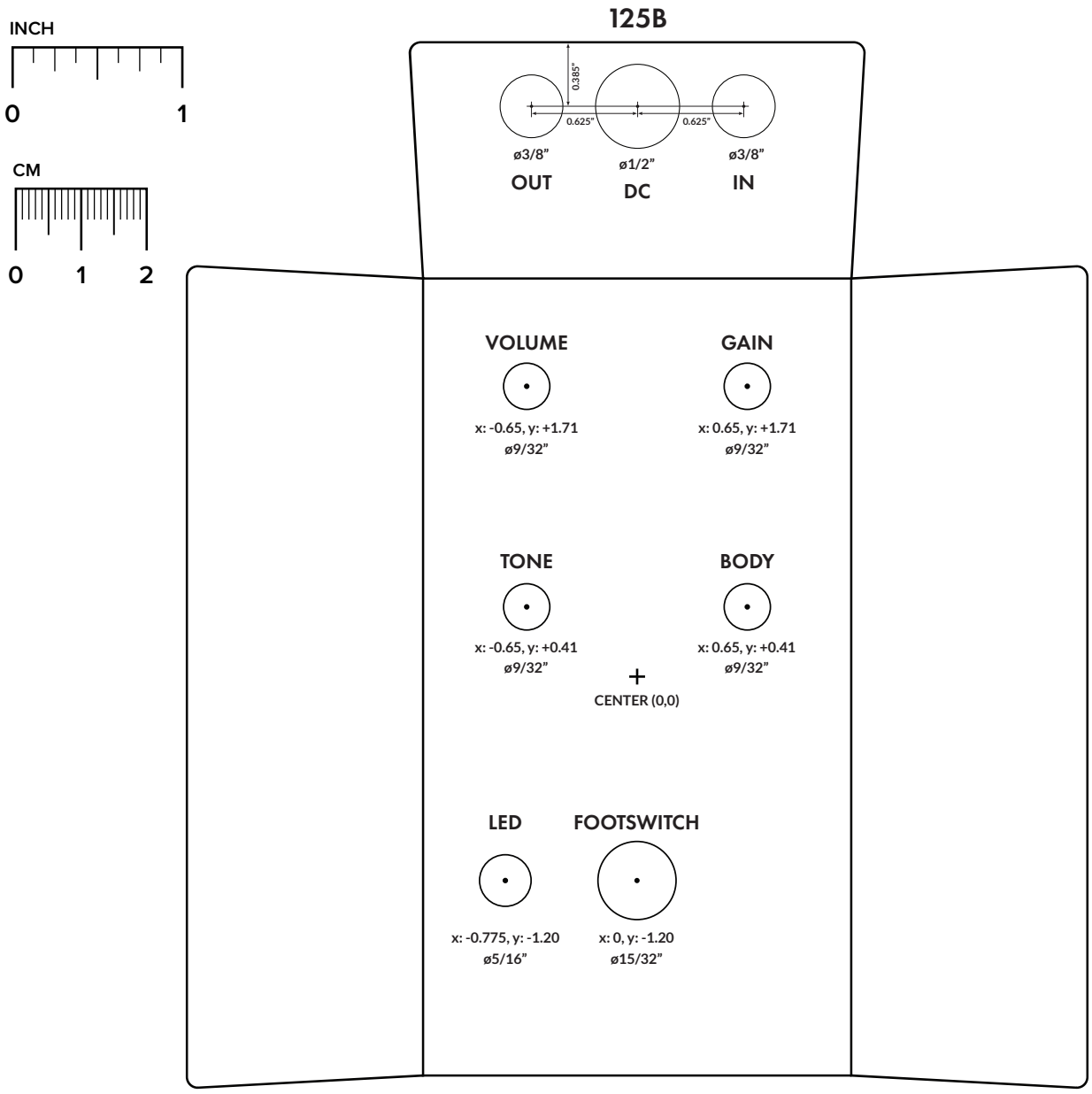
DRILL TEMPLATE

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.

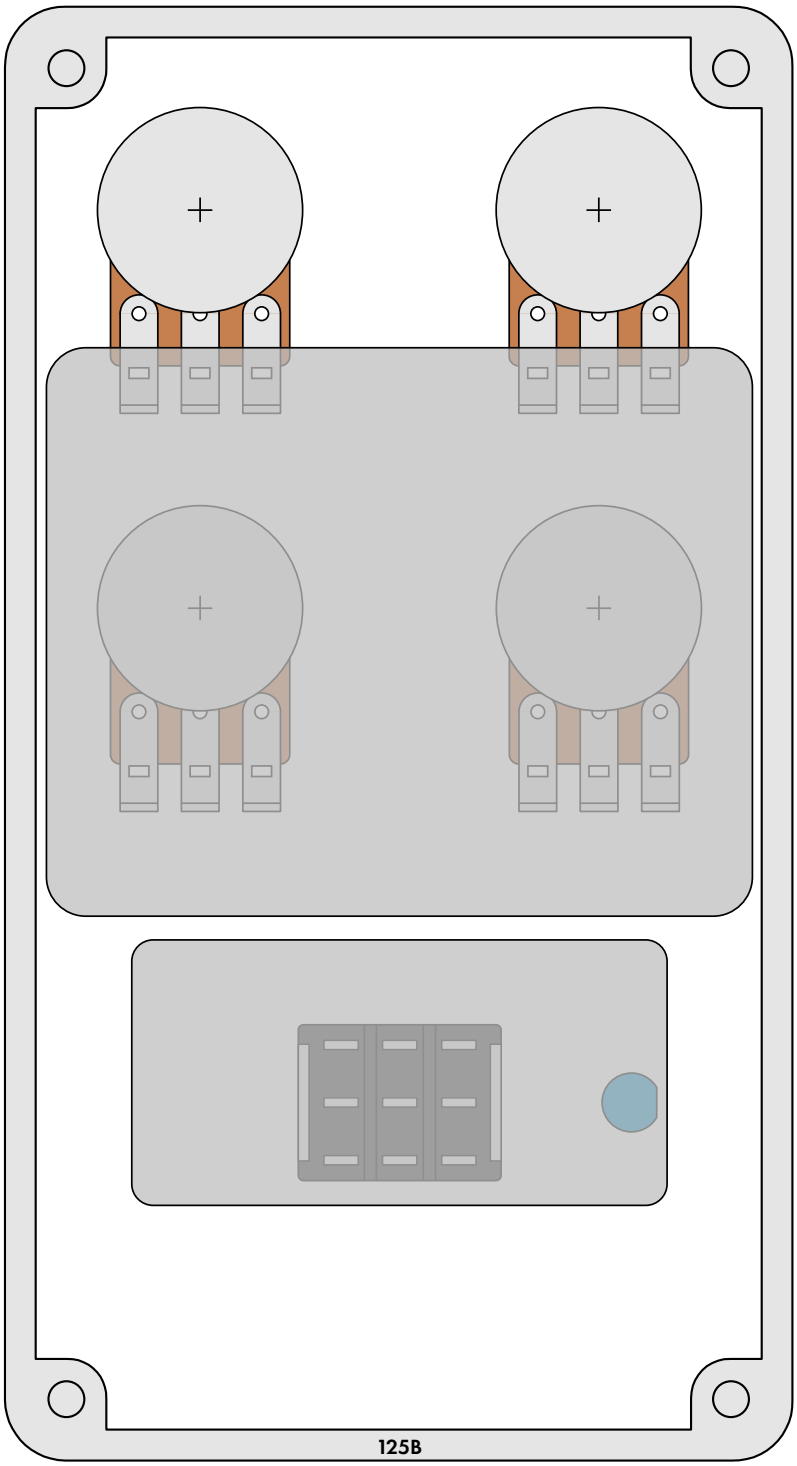
Top jack layout assumes the use of closed-frame jacks like the Switchcraft 111X. If you'd rather use open-frame jacks, please refer to the Open-Frame Jack Drill Template for the top side.

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.

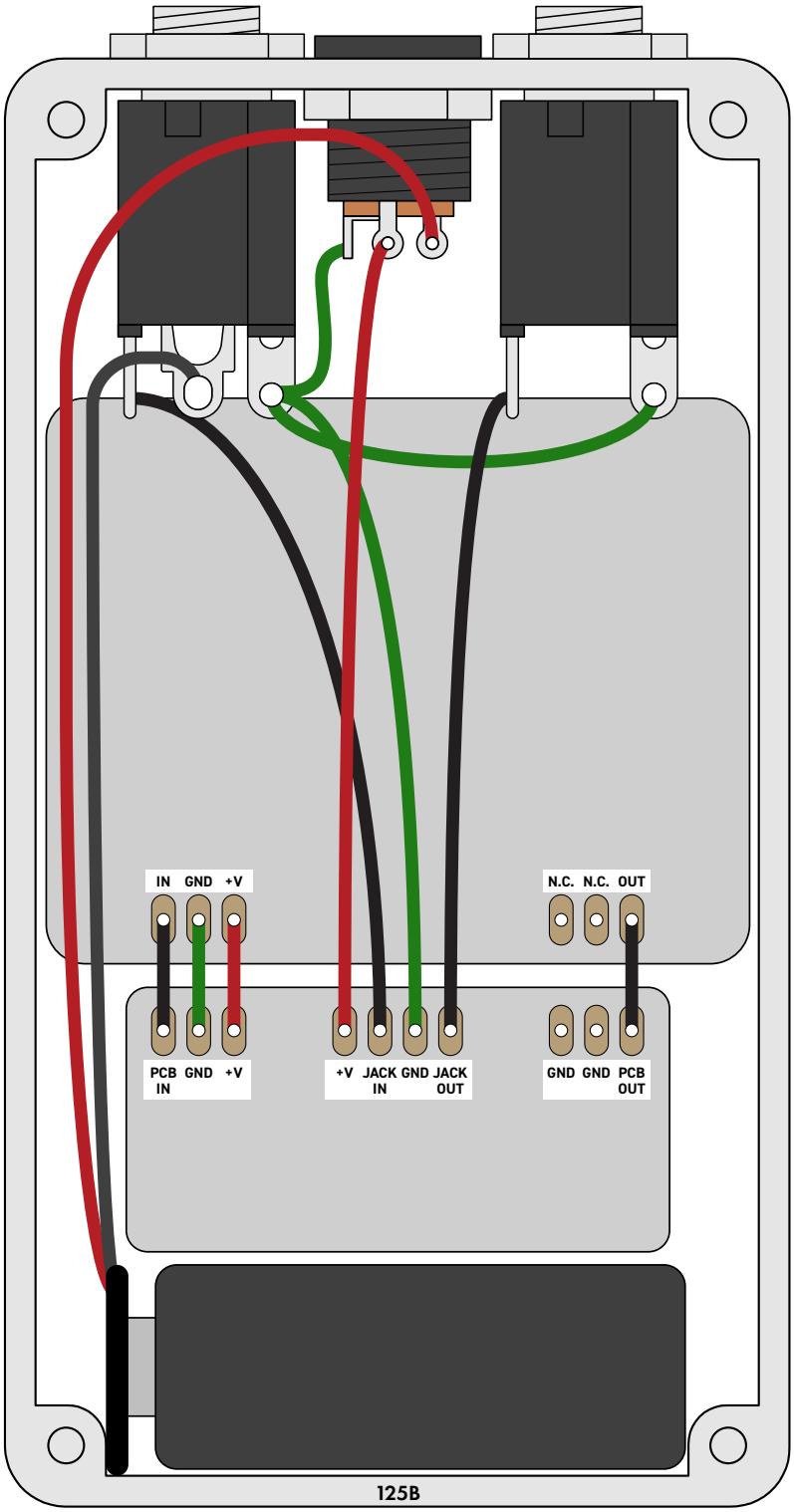


ENCLOSURE LAYOUT

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



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

1.0.0 (2021-02-19)
Initial release.