PROJECT NAME

MURAMASA

aion
DIY GUITAR EFFECTS

BASED ON
Keeley Katana Boost

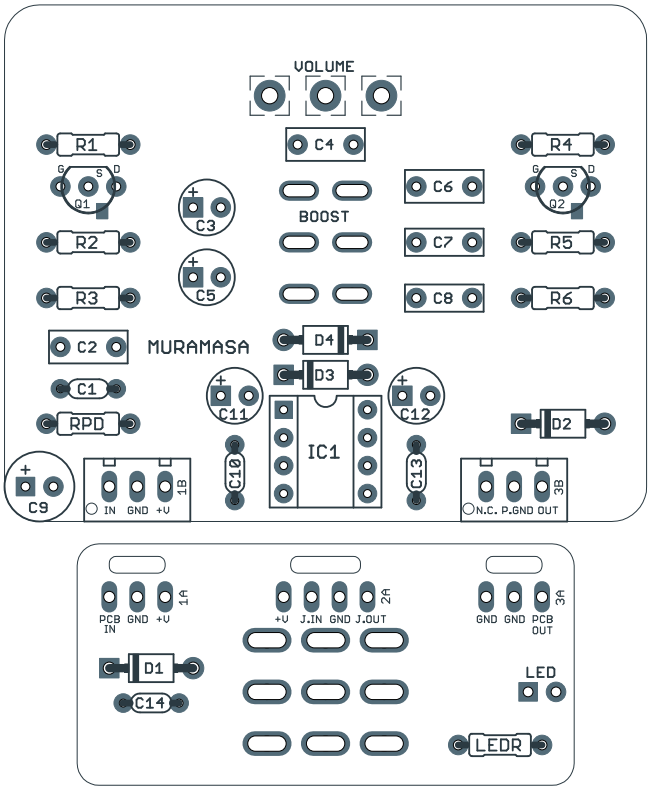
BUILD DIFFICULTY
Easy

EFFECT TYPE
JFET Boost

DOCUMENT VERSION
1.0.0 (2020-11-27)

PROJECT SUMMARY

An adaptation of Robert Keeley's classic Class A boost, using cascaded JFETs that can keep it clean or lend a little bit of grit. Notably used by John Mayer.



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

TABLE OF CONTENTS

INTRODUCTION

The Muramasa JFET Boost is an adaptation of the Keeley Katana, a two-stage JFET boost that was originally released in 2005, the second commercial product from Keeley Electronics after the Keeley Compressor. However, the circuit itself dates a little earlier to 2000, when Robert Keeley collaborated with Legendary Tones to create a pedal called the Time Machine Boost. The "modern" side of the TMB is nearly identical to the Katana, but without the Boost switch.

The pedal itself is fairly simple, using two cascaded JFETs powered by an 18V charge pump. The first JFET is capable of pushing the second into clipping, particularly when Boost mode is engaged.

There have been two major versions of the Katana. Version 1 used the 2N5484 or 2N5458 JFETs, while version 2 uses J201s. While the basic schematic is the same, nearly all of the component values are different in V2. The parts list shows the values for V1, while the V2 values are shown in the "Notes" column where applicable.

The JFETs used in the original Katana Boost are not currently manufactured in through-hole format. Extra pads have been provided if you want to use surface-mount JFETs (part number MMBFJ201 or MMBF5484 are still in production; the 2N5458 has no current SMD substitute). Aion FX also offers pre-soldered MMBFJ201s on adapter boards if you find surface-mount parts intimidating. See build notes for more details.

The Muramasa is a direct adaptation of both versions of the Katana, including the ability to configure the boost switch to boost the first stage (V1 Katana) or the second stage (V2).

USAGE

The Muramasa has the following controls:

- **Volume** is the output master volume of the effect.
- **Boost** increases the gain of one of the JFETs and cuts more treble for a rounder and grittier tone.

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	1M	Metal film resistor, 1/4W	
R2	680R	Metal film resistor, 1/4W	
R3	4k7	Metal film resistor, 1/4W	
R4	1M	Metal film resistor, 1/4W	
R5	680R	Metal film resistor, 1/4W	
R6	4k7	Metal film resistor, 1/4W	
RPD	2M2	Metal film resistor, 1/4W	
LEDR	4k7	Metal film resistor, 1/4W	LED current-limiting resistor. Adjust value to change LED brightness.
C1	220pF	MLCC capacitor, NP0/C0G	V2: 100pF (also some V1 units)
C2	220n	Film capacitor, 7.2 x 2.5mm	V2: 100n
C3	OMIT		V2: 10uF
C4	220n	Film capacitor, 7.2 x 2.5mm	V2: 100n
C5	10uF	Electrolytic capacitor, 5mm	V2: omit (leave empty)
C6	220n	Film capacitor, 7.2 x 2.5mm	
C7	15n	Film capacitor, 7.2 x 2.5mm	V2: 2n2
C8	1n	Film capacitor, 7.2 x 2.5mm	V2: omit (leave empty)
C9	100uF	Electrolytic capacitor, 6.3mm	Power supply filter capacitor.
C10	470n	MLCC capacitor, X7R	Charge pump filter capacitor.
C11	10uF	Electrolytic capacitor, 5mm	Charge pump filter capacitor.
C12	10uF	Electrolytic capacitor, 5mm	Charge pump filter capacitor.
C13	470n	MLCC capacitor, X7R	Charge pump filter capacitor.
C14	100n	MLCC capacitor, X7R	Power supply filter capacitor.
D1	1N5817	Schottky diode, DO-41	
D1	1N5817	Schottky diode, DO-41	
D2	1N4742A	Zener diode, 12V, DO-41	
D3	1N5817	Schottky diode, DO-41	
D4	1N5817	Schottky diode, DO-41	
Q1	MMBF5484	JFET, N-channel, SOT-23	V2: J201 (MMBFJ201)
Q2	MMBF5484	JFET, N-channel, SOT-23	V2: J201 (MMBFJ201)

PARTS LIST, CONT.

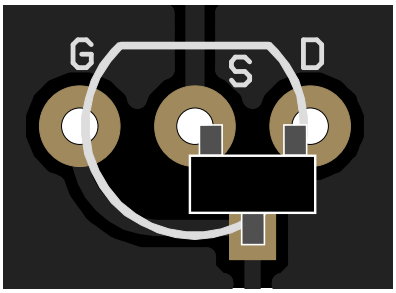
PART	VALUE	TYPE	NOTES
IC1	LT1054CP	Charge pump, DIP-8	Can also use TC1044SCPA.
IC1-S	DIP-8 socket	IC socket, DIP-8	
VOL.	250kA	16mm right-angle PCB mount pot	
BOOST	DPDT on-on	Toggle switch, DPDT on-on	
IN	1/4" stereo	1/4" phone jack, closed frame	Switchcraft 112BX or equivalent.
OUT	1/4" mono	1/4" phone 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

Using SMD JFETs

None of the JFETs used in the different versions of the Katana are currently available in through-hole format. This PCB uses a hybrid through-hole/SMD outline for each JFET. An extra “G” (gate) pad is included to accommodate surface-mount devices without the need for adapters.

SMD JFETs should be oriented as follows:



All surface-mount JFETs use the same pinout, so this configuration will fit any type that we’re aware of. However, always check the datasheet if you’re uncertain—they’re difficult to desolder if you make a mistake.

Using through-hole adapters

If you’re not confident in your ability to work with surface-mount parts, Aion FX offers two types of JFETs that come pre-soldered to adapters for use in through-hole designs.

The 2N5457 (MMBF5457) is similar to the types used in V1, although with a lower $V_{GS(off)}$ specification, it will be very slightly ‘hotter’ or grittier.

The J201 (MMBFJ201) is the same as the type used in the V2 Katana and will perform identically.

We also have bare surface-mount adapters if you’d prefer to use the MMBF5484. You’ll still need to solder a surface-mount component to the adapter, but it reduces the risk of ruining the main PCB since you can test it first.

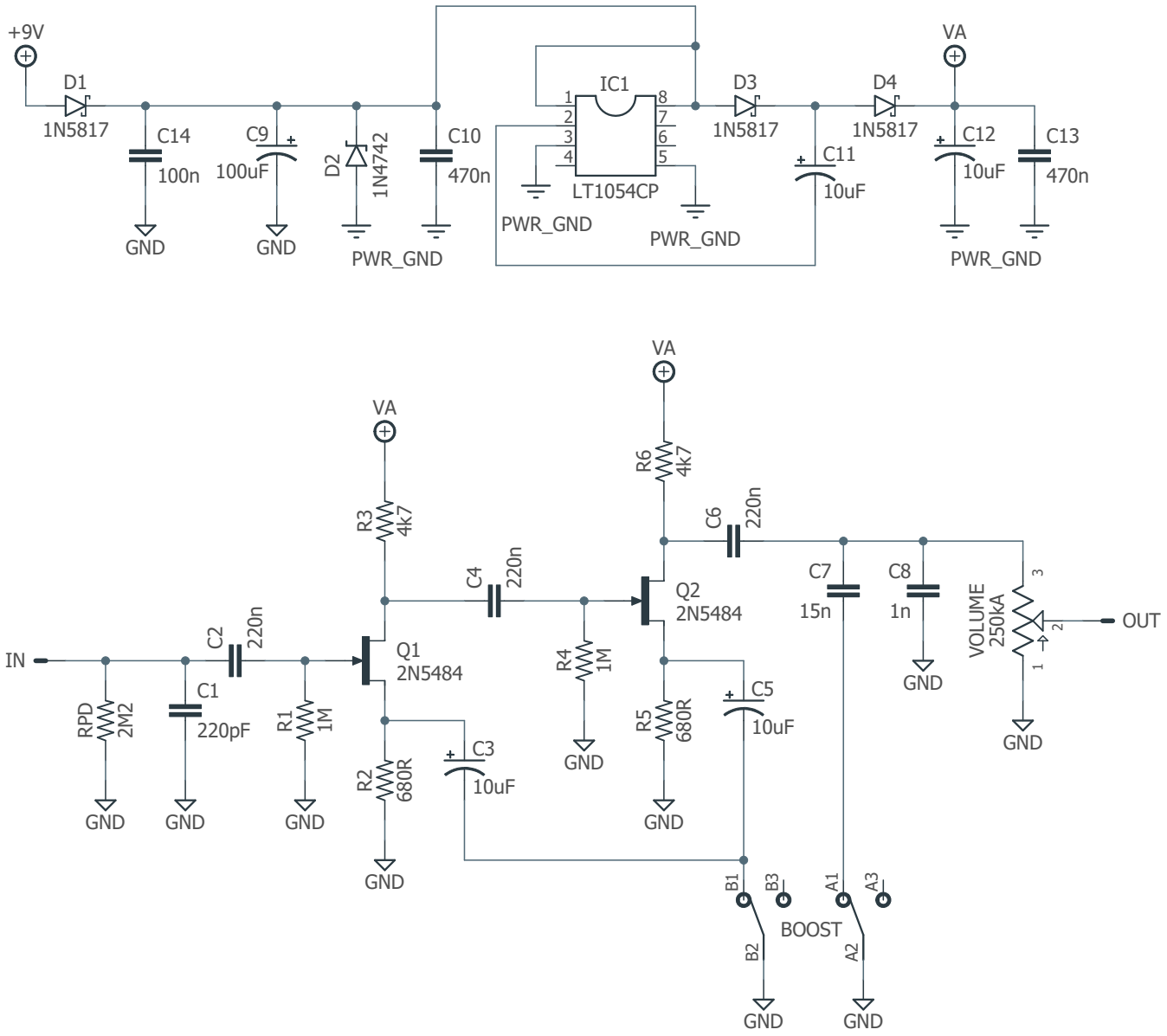
Boost switch

C3 and C5 are 10uF capacitors coming off the source of Q1 and Q2 respectively. **Only one of these capacitors should be populated, not both.**

The Boost switch on the first version of the Katana added a 10uF capacitor to Q2’s source pin. To build this version, include C5 and leave C3 empty.

The second version of the Katana moved the boost to the first stage by putting the 10uF capacitor on Q1’s source pin. To build this version, include C3 and leave C5 empty. (However, note that in version 2, the PCB was designed similarly to ours, allowing either mode to be chosen during the manufacturing process. It’s possible some V2’s were made with the Boost switch affecting the second stage instead of the first, though we haven’t seen any of these.)

SCHEMATIC


+9V
D1
1N5817
C14
100n
GND
C9
100uF
GND
D2
1N4742
PWR_GND
C10
470n
IC1
LT1054CP
PWR_GND
PWR_GND
D3
1N5817
C11
10uF
D4
1N5817
VA
C12
10uF
C13
470n
PWR_GND
VA
R6
4k7
C6
220n
VA
R3
4k7
C4
220n
Q2
2N5484
C7
15n
C8
1n
VOLUME
250kA
OUT
GND
GND
IN
C2
220n
Q1
2N5484
RPD
2M2
C1
220pF
R1
1M
R2
680R
C3
10uF
R4
1M
R5
680R
C5
10uF
GND
GND
GND
GND
GND
GND
B1
B3
A1
A3
BOOST
B2
A2
GND
GND

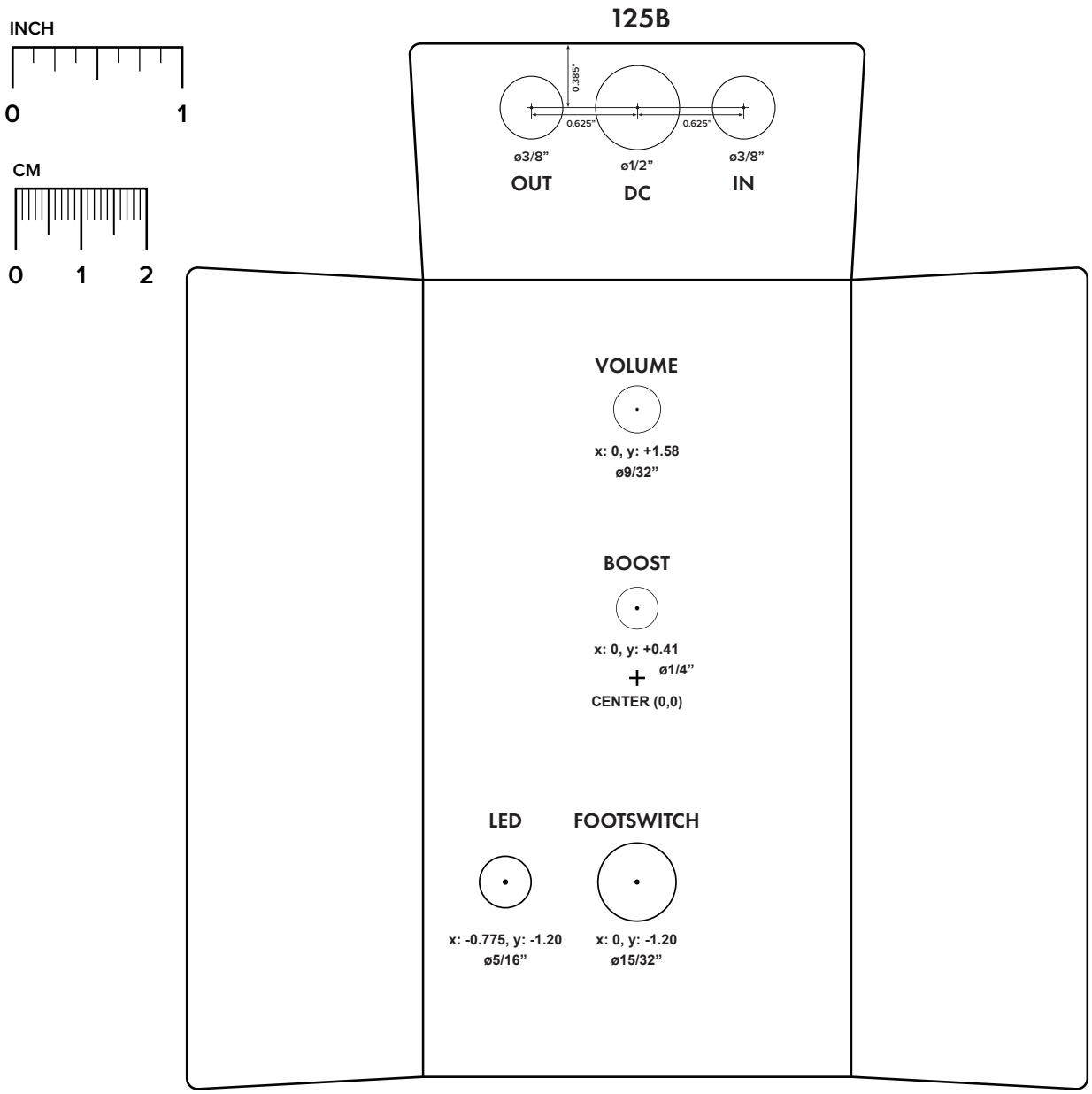
DRILL TEMPLATE

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.

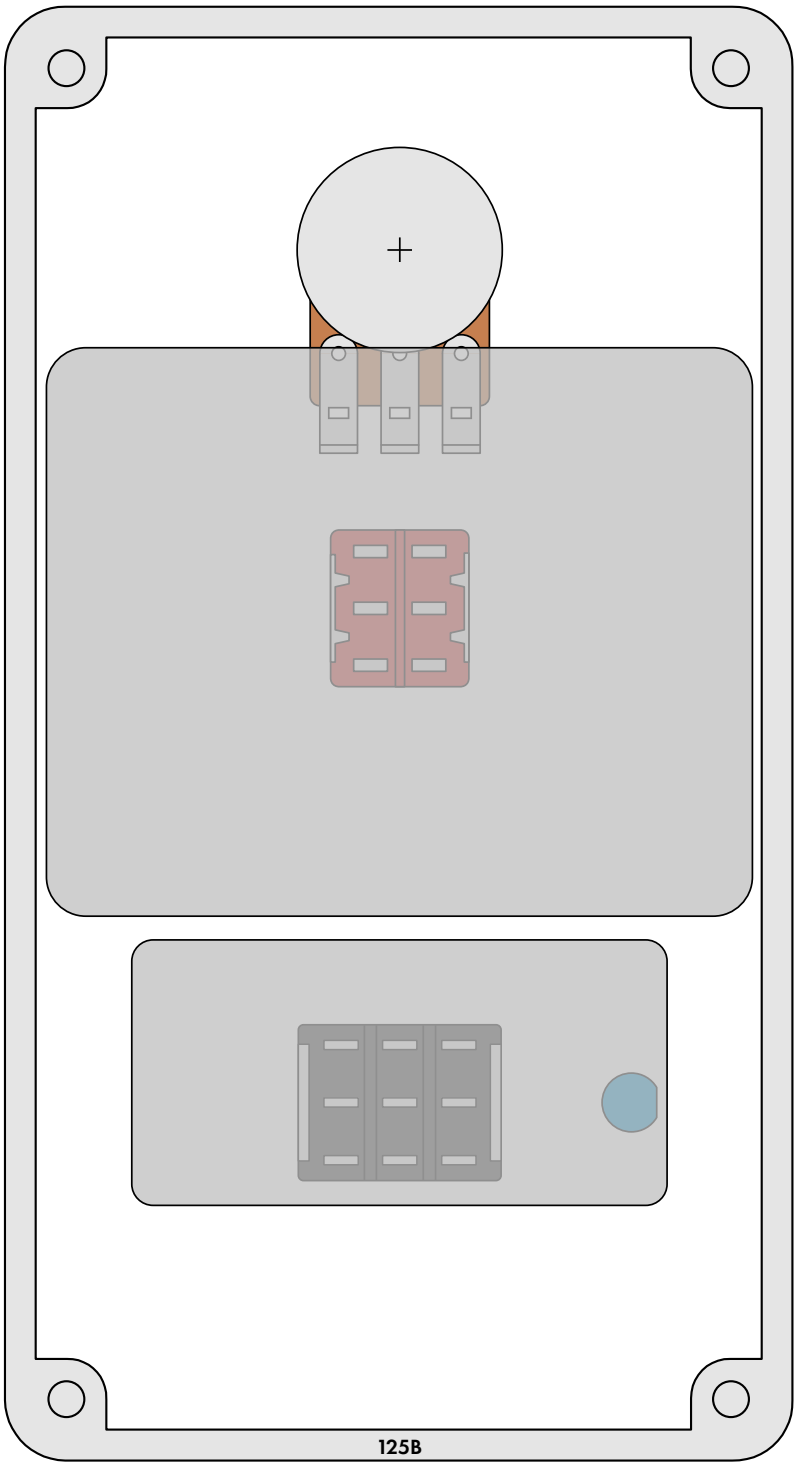
Top jack layout assumes the use of closed-frame jacks like the Switchcraft 111X. If you'd rather use open-frame jacks, please refer to the Open-Frame Jack Drill Template for the top side.

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.

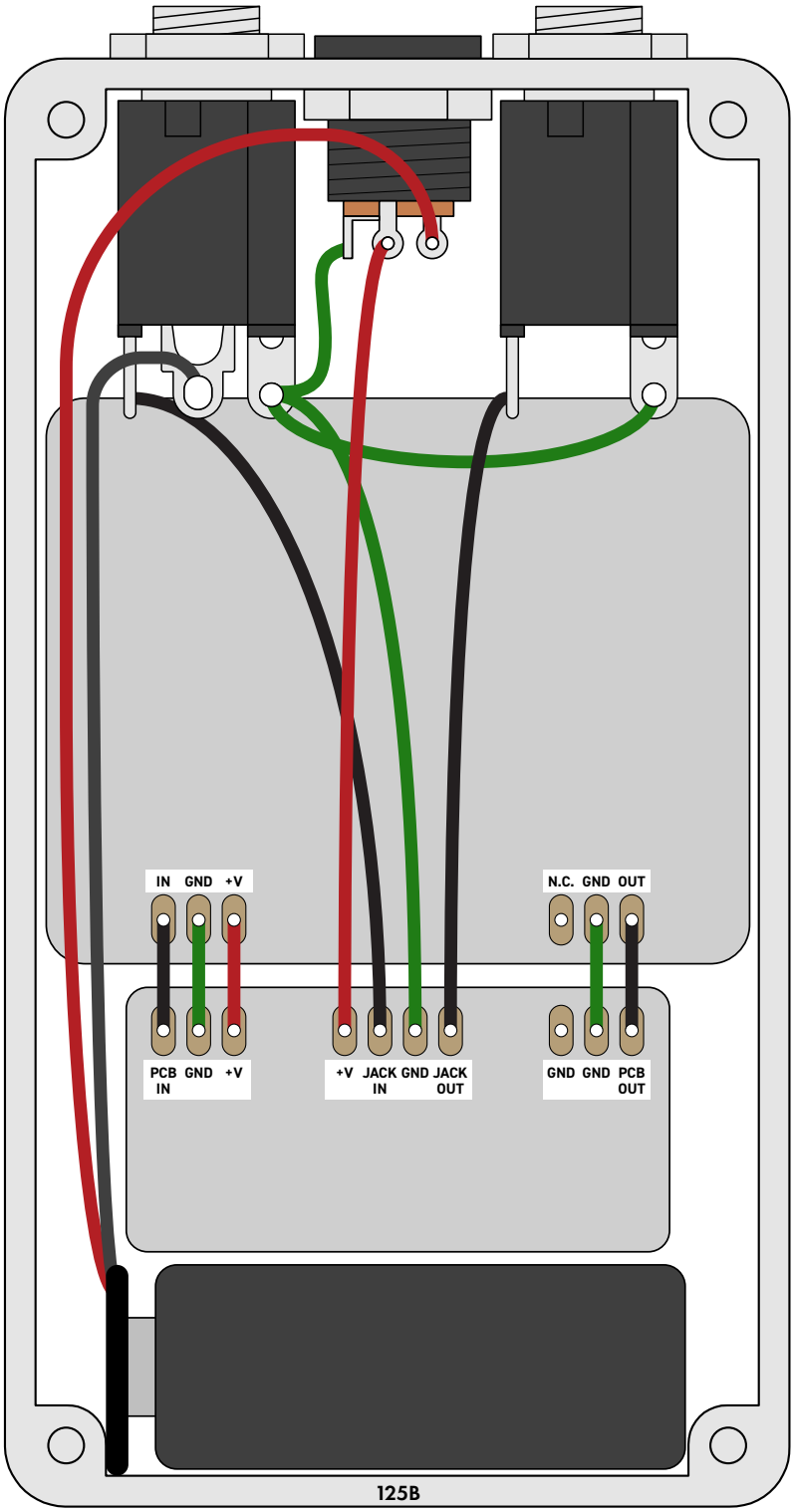


ENCLOSURE LAYOUT

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 (2020-11-27)
Initial release.