PROJECT NAME

CYGNUS

aion DIY GUITAR EFFECTS

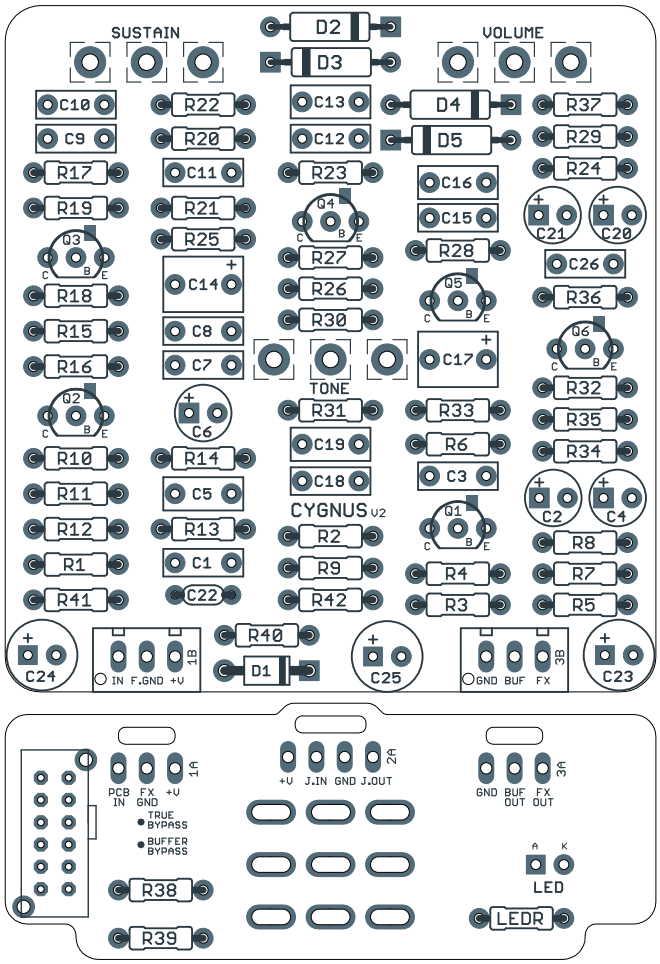
BASED ON
Cornish P-2 / G-2

BUILD DIFFICULTY
Intermediate

EFFECT TYPE
Distortion / sustainer, fuzz

DOCUMENT VERSION
2.0.0 (2023-10-06)

PROJECT SUMMARY
Based on the classic Big Muff circuit, this pedal adds a meticulously-designed buffered bypass along with an additional transistor-based buffer stage on the effect input.



Actual size is 2.3” x 2.43” (main board) and 2.3” x 0.87” (bypass board).

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INTRODUCTION

The Cygnus Distortion/Sustainer is adapted from the Pete Cornish P-2 and G-2, two Big Muff-based pedals that share a PCB but with several part differences to distinguish them.

Cornish pedals are probably best known for being extremely expensive. There are two reasons for this. First, the build quality and reliability is unmatched. Second, the mysterious nature of them, partially due to the fact that the circuit is obscured and partially because of the A-list of clients. (The P-2 was originally designed for David Gilmour, while the G-2 was developed with Lou Reed.)

Inside, the circuit is a basic Big Muff with a few changes such as a simplified hi-cut tone control and the famous class-A transistor buffer design. The P-2 is similar to a Ram's Head Muff, while the G-2 was designed to be much lower gain with a drastically different EQ as well as germanium clipping diodes. In fact, until the G-2 it was traced in 2009, people had no idea it was a Muff derivative. The P-2 was traced by Aion FX in 2023.

The Cygnus is a faithful reproduction of the G-2 and P-2 circuits, and the parts list includes both variants. The default is the P-2 circuit, while each G-2 change is listed in the "Notes" column.

We've made one major addition in our project: an internal switch allowing the pedal to be used in true-bypass mode instead of buffered bypass. As with the Klon KTR, the buffer mode is "almost always better", but you can be the judge of that.

USAGE

The Cygnus has the following controls:

- **Sustain** controls the signal level going into the first clipping stage, which affects the amount of drive or sustain.
- **Tone** is a basic high-cut filter.
- **Volume** is the overall output.

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	10M	Metal film resistor, 1/4W	
R2	1k	Metal film resistor, 1/4W	
R3	120k	Metal film resistor, 1/4W	
R4	120k	Metal film resistor, 1/4W	
R5	200k	Metal film resistor, 1/4W	
R6	7k5	Metal film resistor, 1/4W	
R7	10k	Metal film resistor, 1/4W	
R8	51R	Metal film resistor, 1/4W	
R9	1M	Metal film resistor, 1/4W	
R10	1k	Metal film resistor, 1/4W	
R11	120k	Metal film resistor, 1/4W	
R12	68k	Metal film resistor, 1/4W	
R13	150k	Metal film resistor, 1/4W	
R14	10k	Metal film resistor, 1/4W	G-2 uses 8k2.
R15	39k	Metal film resistor, 1/4W	
R16	100k	Metal film resistor, 1/4W	
R17	470k	Metal film resistor, 1/4W	
R18	15k	Metal film resistor, 1/4W	G-2 value is likely 15k, but 18k is recommended. See build notes.
R19	100R	Metal film resistor, 1/4W	G-2 value is likely 680R, but 100R is recommended. See build notes.
R20	100R	Metal film resistor, 1/4W	G-2 uses 1k.
R21	8k2	Metal film resistor, 1/4W	
R22	100k	Metal film resistor, 1/4W	
R23	470k	Metal film resistor, 1/4W	
R24	15k	Metal film resistor, 1/4W	
R25	100R	Metal film resistor, 1/4W	G-2 uses 680R.
R26	8k2	Metal film resistor, 1/4W	
R27	100k	Metal film resistor, 1/4W	
R28	470k	Metal film resistor, 1/4W	
R29	15k	Metal film resistor, 1/4W	
R30	100R	Metal film resistor, 1/4W	
R31	100k	Metal film resistor, 1/4W	
R32	390k	Metal film resistor, 1/4W	

PARTS LIST, CONT.

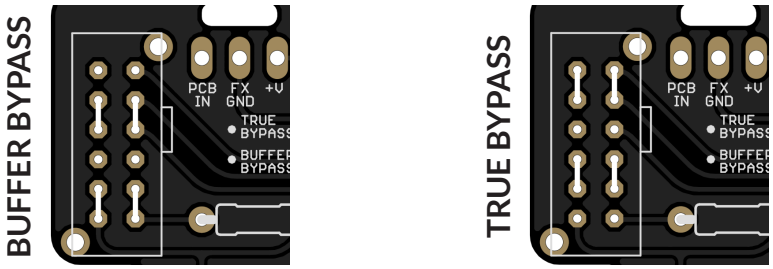
PART	VALUE	TYPE	NOTES
R33	100k	Metal film resistor, 1/4W	
R34	10k	Metal film resistor, 1/4W	G-2 uses 8k2.
R35	2k2	Metal film resistor, 1/4W	
R36	1k2	Metal film resistor, 1/4W	G-2 uses 620R.
R37	39k	Metal film resistor, 1/4W	
R38	91R	Metal film resistor, 1/4W	
R39	51k	Metal film resistor, 1/4W	
R40	100R	Metal film resistor, 1/4W	
R41	120R	Metal film resistor, 1/4W	
R42	100R	Metal film resistor, 1/4W	
LEDR	10k	Metal film resistor, 1/4W	LED current-limiting resistor. Adjust value to change LED brightness.
C1	100n	Film capacitor, 7.2 x 2.5mm	
C2	4.7uF	Electrolytic capacitor, 4mm	
C3	1n	Film capacitor, 7.2 x 2.5mm	
C4	22uF	Electrolytic capacitor, 5mm	
C5	220n	Film capacitor, 7.2 x 2.5mm	
C6	4.7uF	Electrolytic capacitor, 4mm	
C7	10n	Film capacitor, 7.2 x 2.5mm	
C8	47n	Film capacitor, 7.2 x 2.5mm	
C9	470pF	MLCC capacitor, NP0/C0G	G-2 uses 1n film.
C10	47n	Film capacitor, 7.2 x 2.5mm	
C11	47n	Film capacitor, 7.2 x 2.5mm	
C12	470pF	MLCC capacitor, NP0/C0G	G-2 uses 1n film.
C13	220n	Film capacitor, 7.2 x 2.5mm	
C14	2.2uF	Film capacitor, 7.2 x 5mm	
C15	470pF	MLCC capacitor, NP0/C0G	G-2 uses 1n film.
C16	220n	Film capacitor, 7.2 x 2.5mm	
C17	2.2uF	Film capacitor, 7.2 x 5mm	
C18	10n	Film capacitor, 7.2 x 2.5mm	
C19	220n	Film capacitor, 7.2 x 2.5mm	
C20	OMIT	Electrolytic capacitor, 5mm	G-2 uses 22uF. Omit (leave empty) for P-2.
C21	22uF	Electrolytic capacitor, 5mm	
C22	100n	MLCC capacitor, X7R	Power supply filter capacitor.
C23	220uF	Electrolytic capacitor, 6.3mm	Power supply filter capacitor.
C24	100uF	Electrolytic capacitor, 6.3mm	Power supply filter capacitor.
C25	220uF	Electrolytic capacitor, 6.3mm	Power supply filter capacitor.
C26	10n	Film capacitor, 7.2 x 2.5mm	P-2 only. Omit (leave empty) for G-2.

PARTS LIST, CONT.

PART	VALUE	TYPE	NOTES
D1	1N5817	Schottky diode, DO-41	
D2	1N914	Fast-switching diode, DO-35	G-2 uses germanium (e.g. 1N34A).
D3	1N914	Fast-switching diode, DO-35	G-2 uses germanium (e.g. 1N34A).
D4	1N914	Fast-switching diode, DO-35	G-2 uses germanium (e.g. 1N34A).
D5	1N914	Fast-switching diode, DO-35	G-2 uses germanium (e.g. 1N34A).
Q1	BC550C	BJT transistor, NPN, TO-92	G-2 uses BC549C.
Q2	BC550C	BJT transistor, NPN, TO-92	G-2 uses BC549C.
Q3	BC550C	BJT transistor, NPN, TO-92	G-2 uses BC549C.
Q4	BC550C	BJT transistor, NPN, TO-92	G-2 uses BC549C.
Q5	BC550C	BJT transistor, NPN, TO-92	G-2 uses BC549C.
Q6	BC550C	BJT transistor, NPN, TO-92	G-2 uses BC549C.
SUSTAIN	100kA	16mm right-angle PCB mount pot	G-2 uses 50kA.
TONE	25kB	16mm right-angle PCB mount pot	
VOLUME	10kA	16mm right-angle PCB mount pot	
TB-BUF	4PDT slide	Slide switch, 4PDT	E-Switch EG4208 (4mm lever) or EG4208A (6mm lever)
IN	1/4" mono	1/4" phone jack, closed frame	Switchcraft 111X 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.

Bypassing the true bypass / buffer switch

The E-Switch EG4208 slide switch used for the true bypass/buffer selector is available from Mouser Electronics but may not be accessible to everyone. If you are unable to obtain it, you can hard-wire the switch to either true bypass mode or buffered mode by soldering jumpers to the switch pads.



C14 and C17 capacitors

In both the P-2 and G-2, the coupling capacitors immediately after Q4 and Q5 (C14 and C17) are 4.7uF electrolytics. Since film capacitors are generally viewed as superior to electrolytic within the audio path, we used a film capacitor footprint. However, 4.7uF film capacitors are unnecessarily expensive and large, so we reduced the recommended value to 2.2uF.

There will be no audible difference between 4.7uF and 2.2uF since the output impedance coming off the transistors is low. Most likely you could go down to 1uF or even further with no change.

If you do want to use electrolytics in these two positions instead, the polarity has been marked on the PCB. (Film caps have no polarity, so this marking can be ignored if using the recommended caps.)

R7 and R39 resistor values (G-2 only)

The original G-2 trace from 2009 showed a 50k resistor for the output pulldown resistor (R39 in this project, R40 in the original trace schematic).

This may have been correct for the unit that was traced, but 50k is a non-standard resistor value, and each of the seven Cornish pedals we've traced has used 51k here. So whether or not it's an error, we're pretty confident that current-production G-2 units would use 51k.

This makes no practical difference to the finished pedal, only changing the output impedance by around 2%, but we're meticulous!

In addition, R7 (R10 in trace) was shown as a 20k resistor in the original trace. It's possible this was correct in that particular G-2 unit, but once again, each of the seven that we've traced has used 10k here. Since the buffer is a separate PCB module shared between all of the pedals, we're confident that the current-production G-2 uses 10k as well.

Resistors & diodes in the first clipping stage (G-2 only)

The G-2 was first traced in 2009 by Dirk Hendrik for freestompboxes.org. The trace was thorough, and other than the resistors mentioned above, there is no reason to doubt its accuracy.

However, with thousands of people building clones based on the schematic in the years since, it's become apparent that the choice of diodes in the first gain stage is very important. The G-2 uses germanium diodes, which are notoriously inexact and have a wide variance in forward voltage even among the same part number. Germanium diodes usually have forward voltages from 0.2V to 0.4V, with some types going even higher or lower.

If the diodes have too low of a forward voltage, the transistor's gain is not high enough to keep up and as a result it will not distort the signal like it should. There are three solutions to this potential issue:

1. Use germanium diodes with a forward voltage above ~0.3V. (No testing has been done to see where the cutoff is, so you might be able to go slightly lower or you may need to go even higher.)
2. Use BAT41 diodes (silicon Schottky) instead of germanium. These have a forward voltage of around 0.4V which is more than enough.
3. Increase the gain of the previous stage by using an **18k** resistor for R18 and **100R** for R19.

Since #3 is the simplest and most universal solution, the parts list for the G-2 variant has been updated to use these values by default. If you'd like to try #1 or #2, though, you should use the original Cornish values of **15k** for R18 and **680R** for R19.

The P-2 does not have this issue since it uses silicon clipping diodes and has higher gain throughout.

Tone modifications (G-2 only)

The G-2 is known for having significantly more low-end than a standard Big Muff circuit, and this can sometimes be too much in a live setting depending on the mix.

If you want to keep most of the G-2's character but cut the bass, try omitting C20 (the G-2's 22uF capacitor in the last stage) and instead using C26 (the P-2's 10n capacitor). This is responsible for a lot of the bass-heaviness, and that single change will go a long way. It's also recommended to reduce the input capacitor (C1) to 100n.

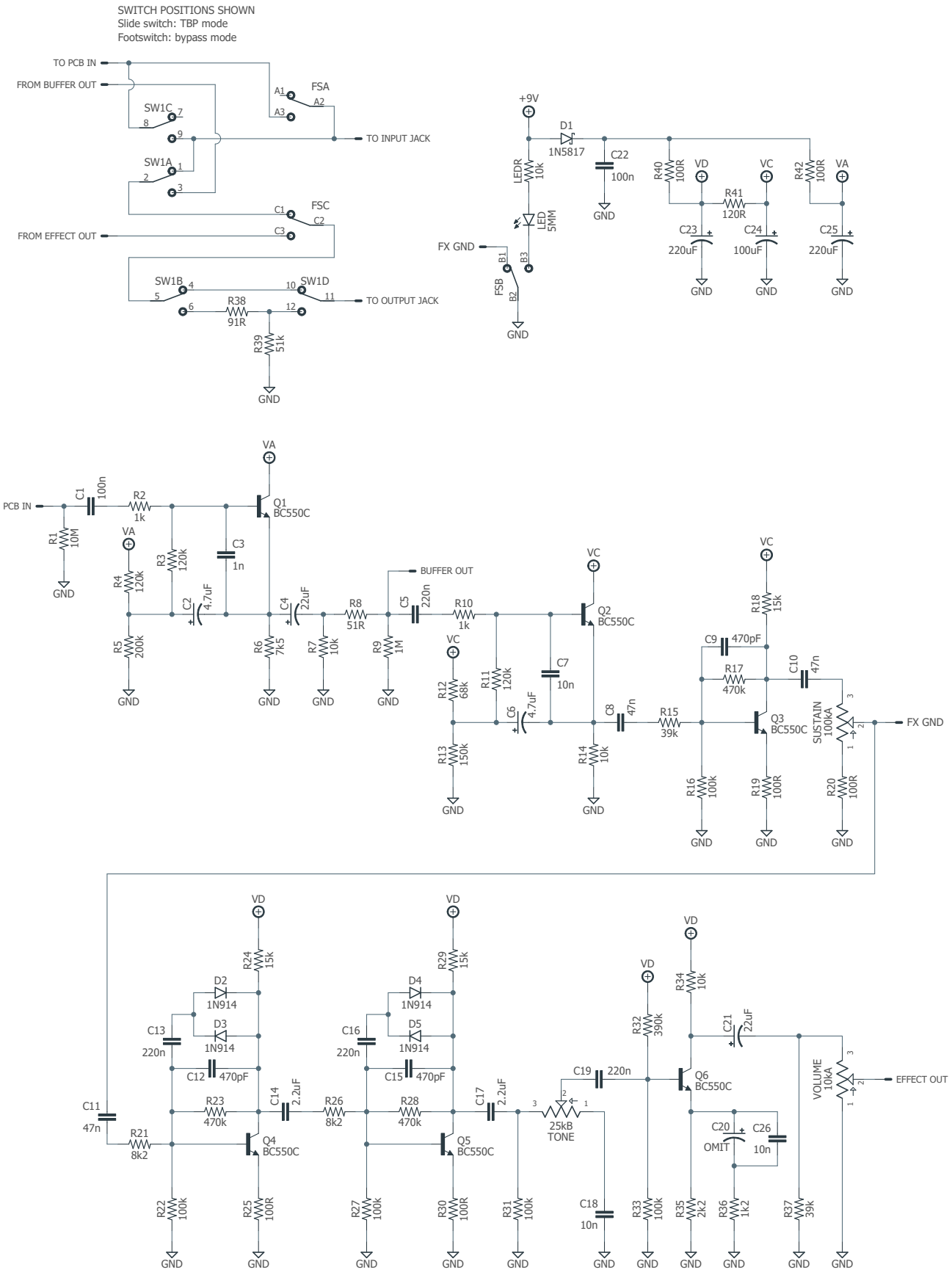
Transistor substitutions

The BC549C (G-2) and BC550C (P-2) are interchangeable with no difference in sound, so either can be used. If you want to substitute a different transistor, you'll want one with very high hFE, in the 600s.

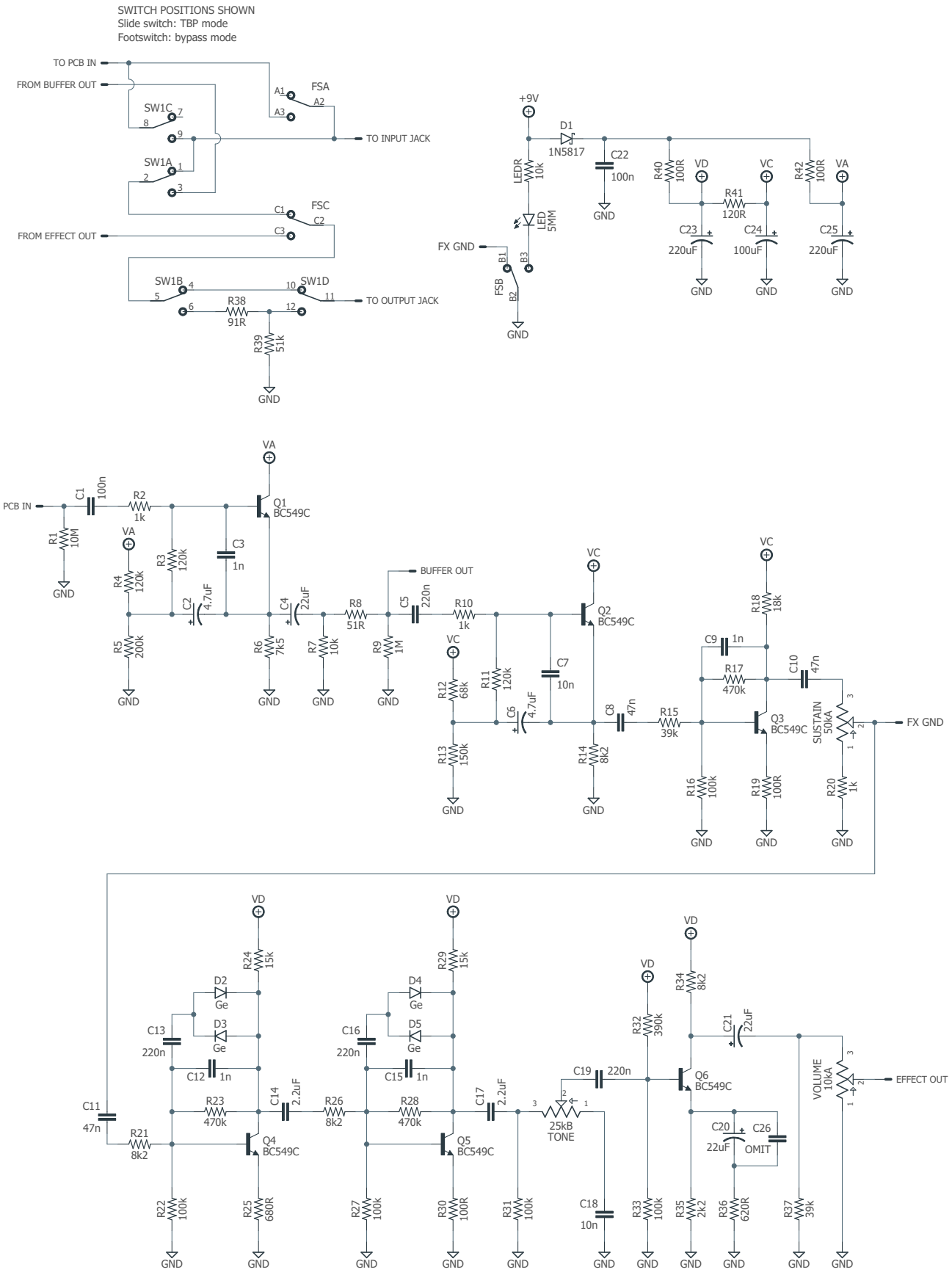
The PCB layout uses the C-B-E transistor pinout, which is the opposite of the E-B-C convention used by transistors with a "2N" prefix such as the 2N3904. The closest substitute in this series is the 2N5089. If using these, rotate them 180 degrees. Use a multimeter to check the pinout if you're not sure.

The transistor outlines also include a rectangular collector pad above the "B" and "E" pins so that a SMD transistor such as the BC849C can be used.

SCHEMATIC (P-2)



SCHEMATIC (G-2)



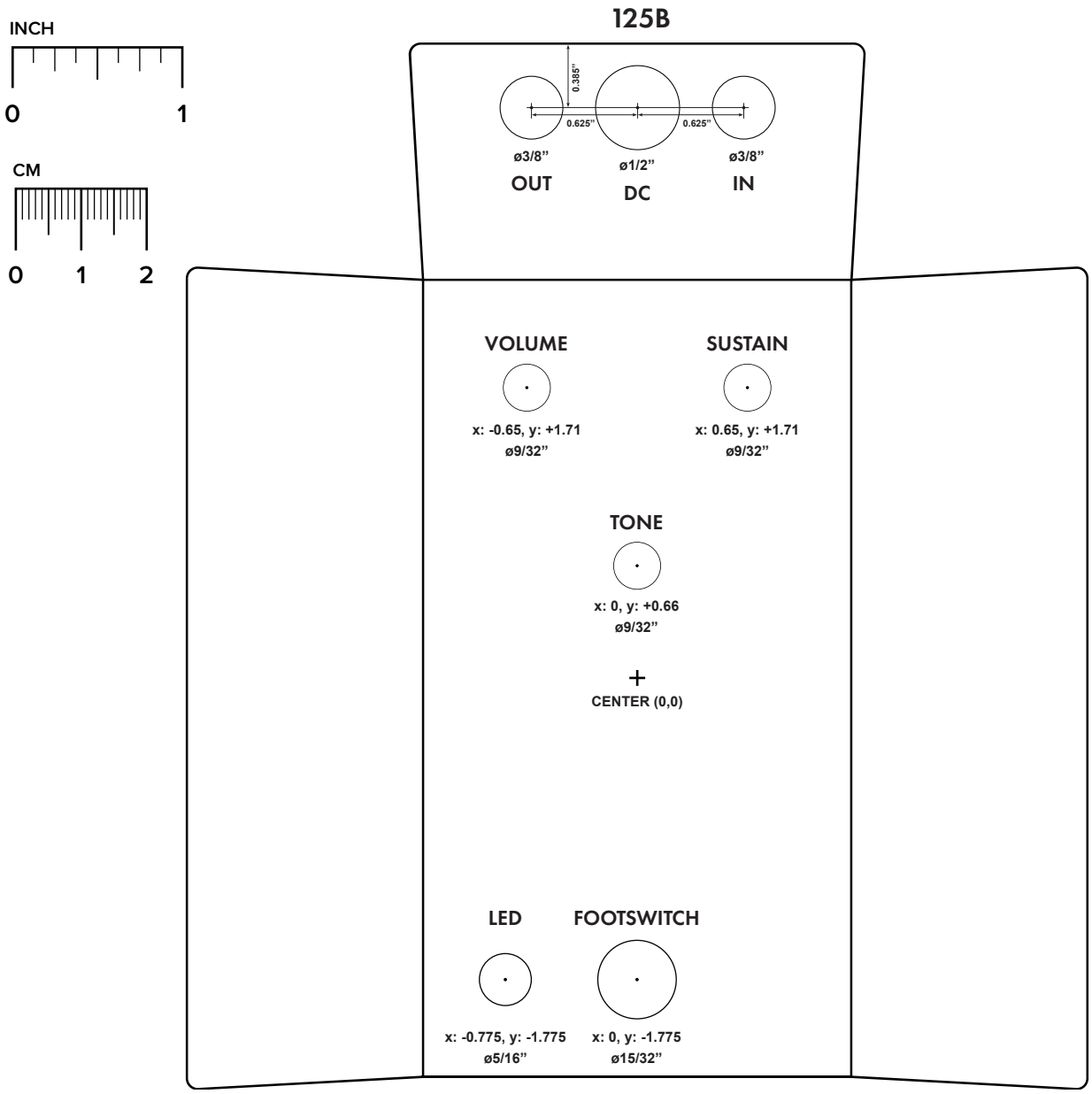
DRILL TEMPLATE

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.

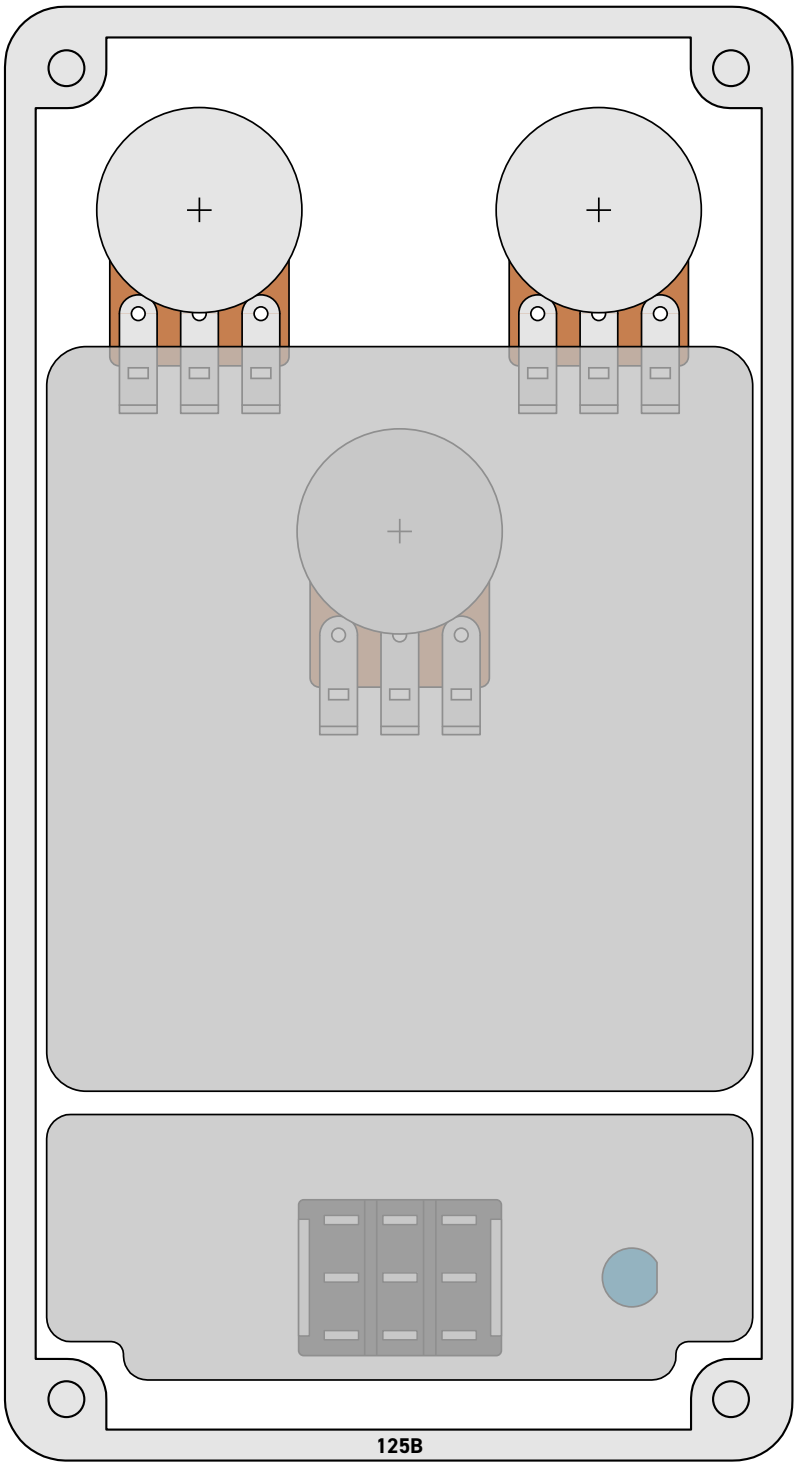
Top jack layout assumes the use of closed-frame jacks like the Switchcraft 111X. If you'd rather use open-frame jacks, please refer to the Open-Frame Jack Drill Template for the top side.

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.

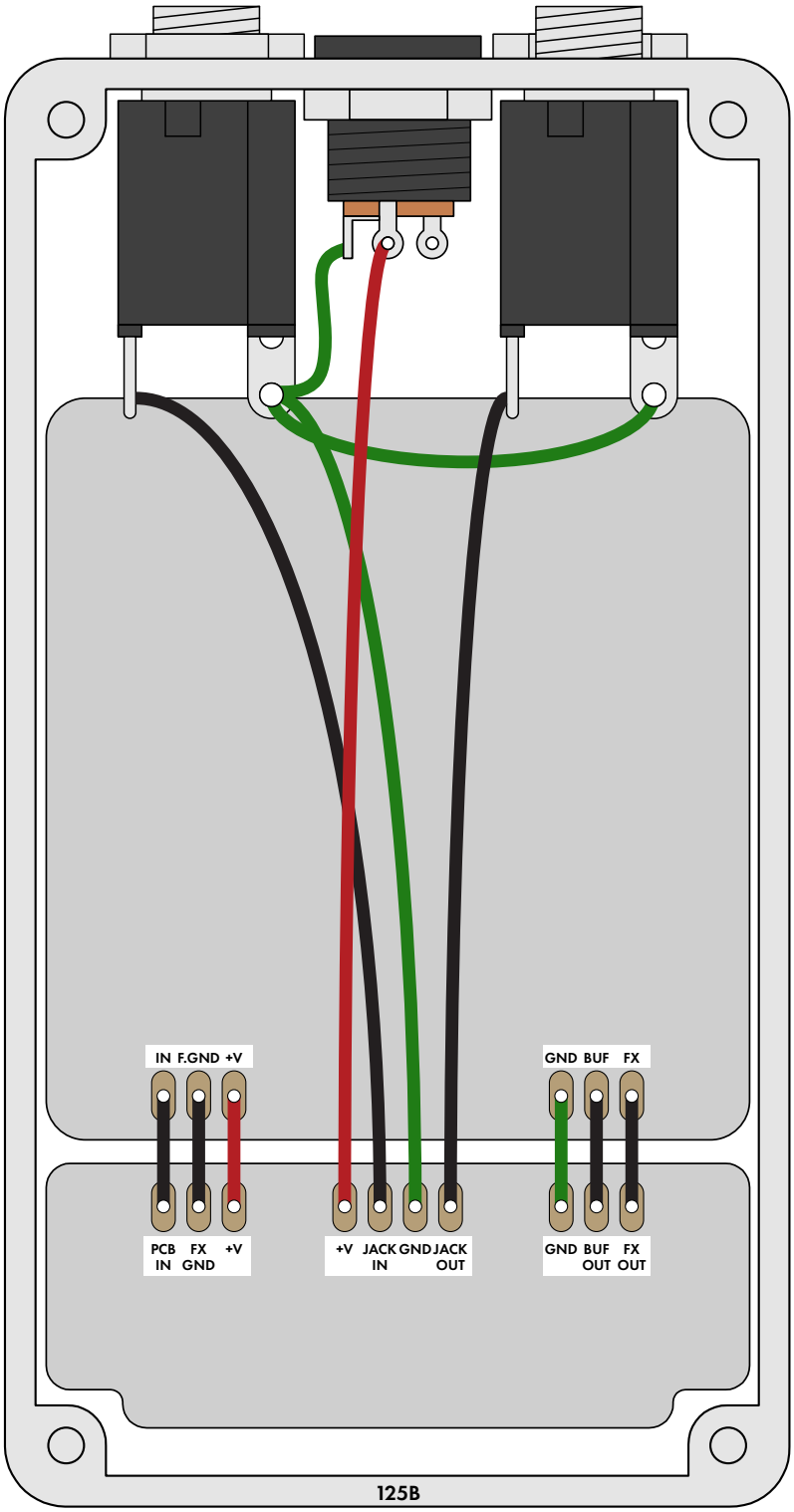


ENCLOSURE LAYOUT

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

2.0.0 (2023-10-06)

- New PCB layout to add P-2 compatibility based on our trace.
- Changed transistor outlines to BC549/550 convention.
- Changed R7 from 20k to 10k and added information on this change to the build notes section.

1.0.2 (2023-08-04)
Changed R39 from 50k to 51k and added information on this change to the build notes section.

1.0.1 (2020-04-06)
Added notes about resistors in first transistor stage (R18 and R19).

1.0.0 (2019-03-14)
Initial release.