WOODSTORK21

FX TYPE: Fuzz

Based on the Fulltone® '69™

Enclosure Size: 1590B

Softie compatibility: Softie3

Overview

The **Woodstork** was first offered in the mbp 1590G series of projects. These were circuits designed specifically for the Hammond 1590G enclosure (being about 2/3 the size of a 1590B). Since not everyone likes that small form factor the Woodstork'21 has been added to fit the more widely used 1590B. It's the same circuit with the additional option of using axial caps (which was not possible in the 1590G).

With the impending closure of smallbear we have arrived at the inevitable dwindling supply of pre-tested PNP germanium transistors suitable for fuzzes. So, if you are a novice builder you might consider that as an entry barrier to this project. If you already have working and reliable PNP germaniums, or know where to acquire them then this is a great project to build!

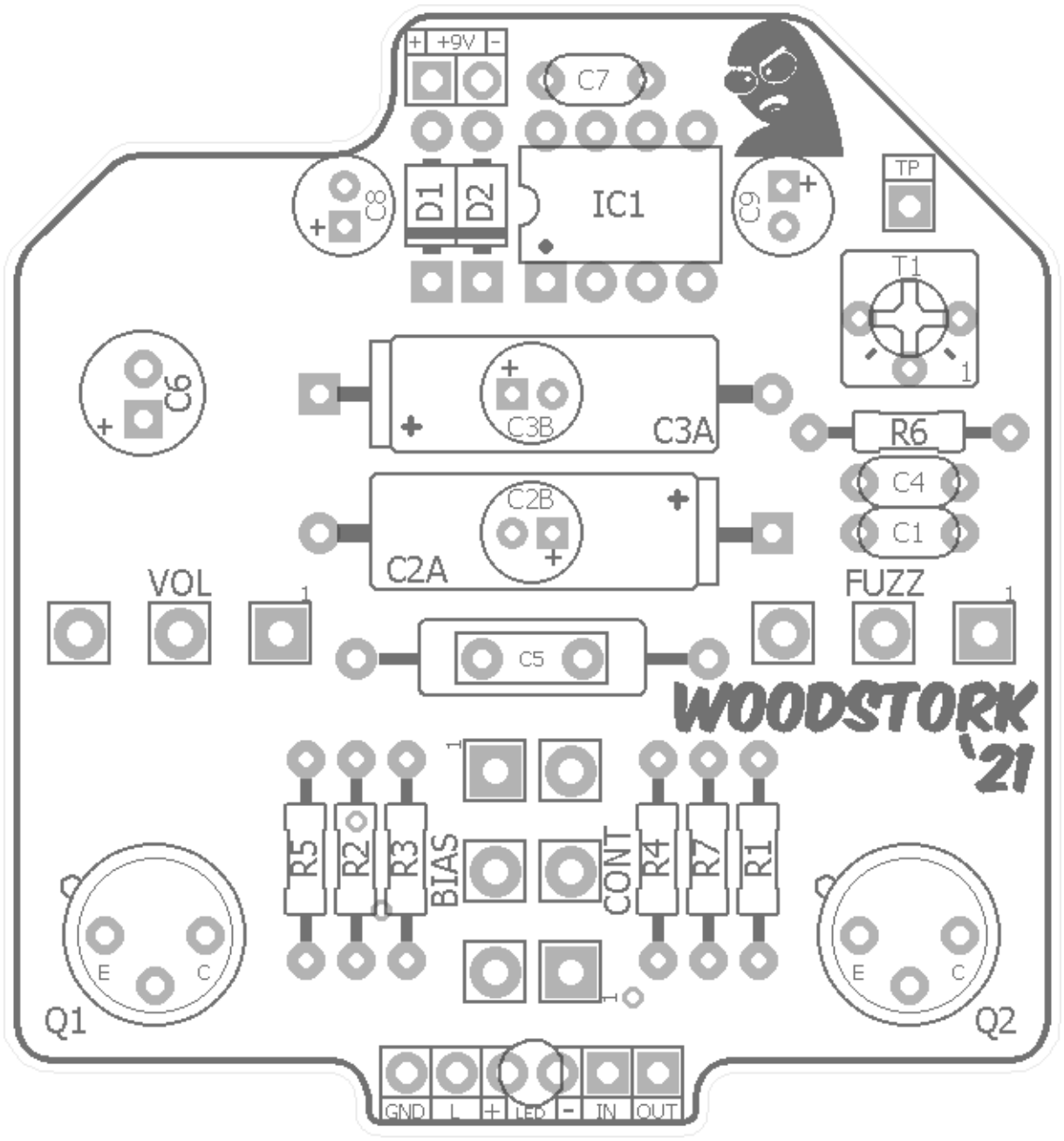
Controls

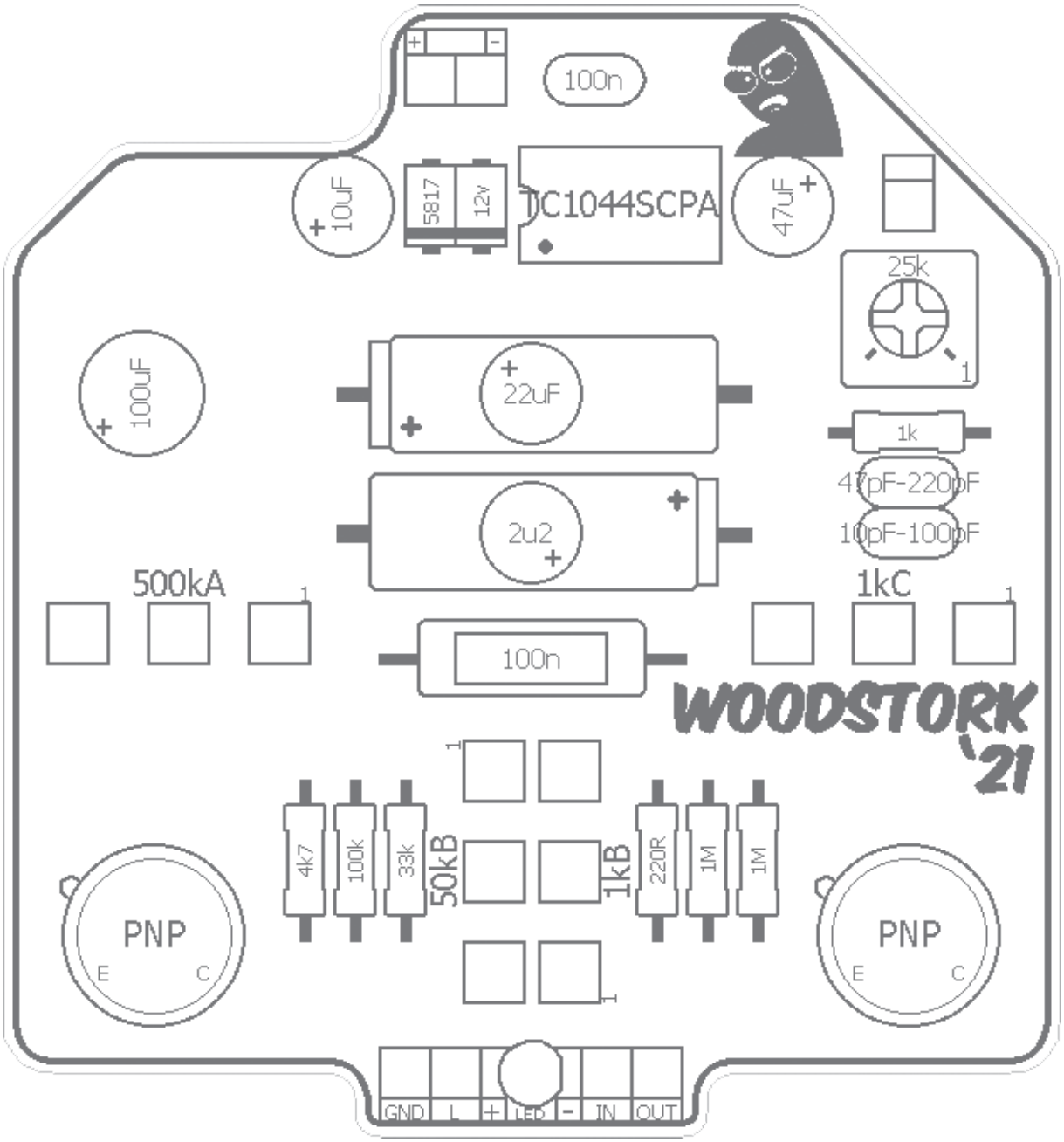
- **VOL -** Effect output level.
- **FUZZ -** Tends to sound best fully CW for maximum fuzz. The use of a 1kC (reverse audio) instead of 1kB does make the control have a bit more range.
- **BIAS -** CCW, adds series resistance to the input. CW, stock Fuzz Face. The Bias and Fuzz control are somewhat interactive. Use lower settings on both controls to achieve a lower gain fuzz without the inherent mudiness.
- **CONT -** The countour control adds volume to the output. One of the main complaints about the original FF was that the volume knob had to be dimed just to achieve unity with bypass. Increasing the stock resistor value (470R) gets you a bit more volume and slightly more aggressive fuzz tone.
- **T1 -** This trimmer is used to bias the Q2 collector.

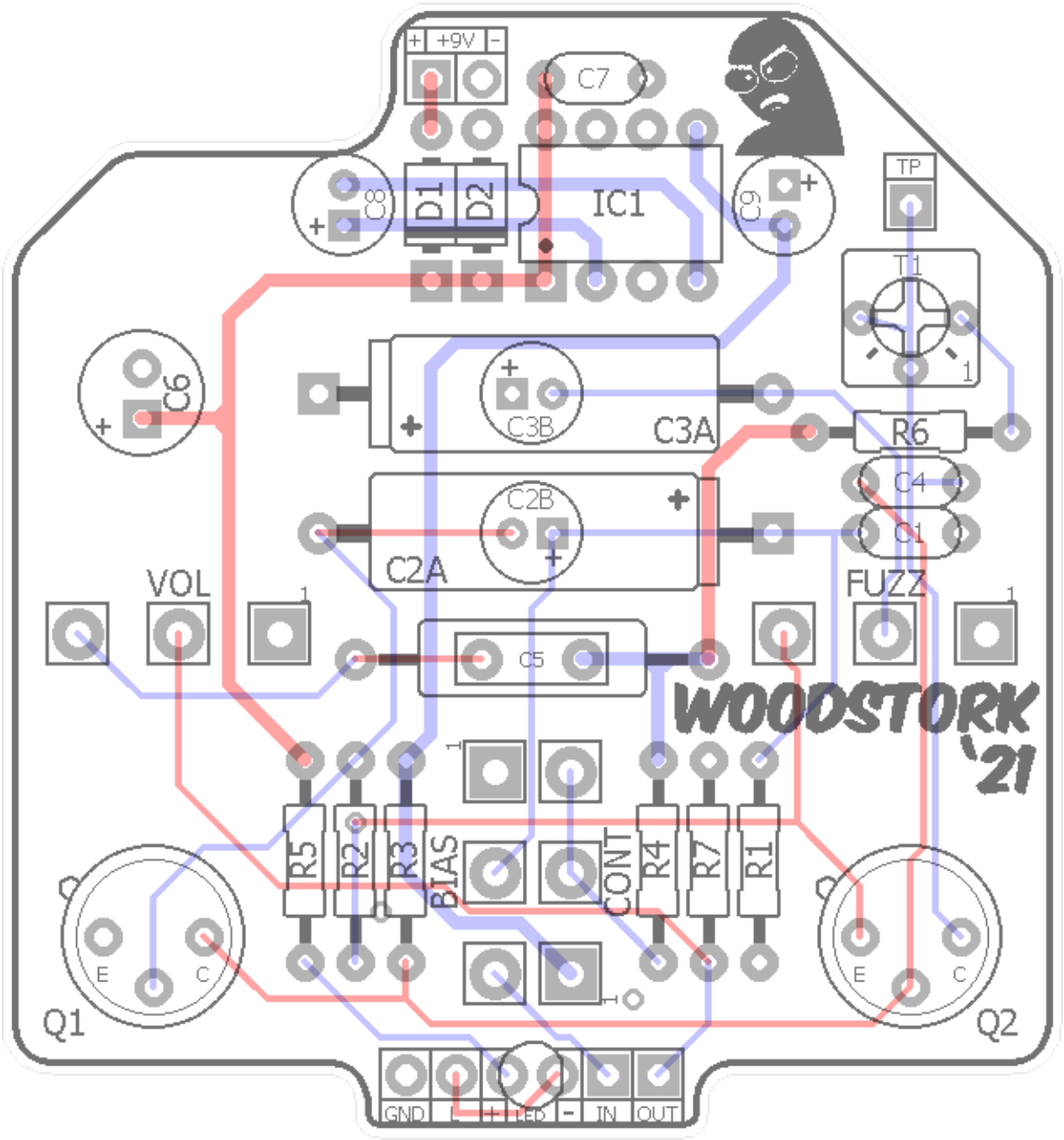
Important Note

The Woodstork'21 is a negative ground effect that creates a positive ground supply. IOW, you can still use your 9v center tip negative power supplies with it, but within the circuit the charge pump (IC1) inverts the supply voltage to its negative counterpart. This is one method of achieving a stable circuit suitable for PNP germaniums. The wiring is done exactly the same way as any negative ground effect.

Technical assistance for your build(s) is available via the madbeanpedals forum. Please go there rather than emailing me for assistance on builds. This is because (1) I'm not always available to respond via email in a timely and continuous manner, and (2) posting technical problems and solutions in the forum creates a record from which other members may benefit.


+9V
C7
IC1
D1
D2
C8
C9
TP
T1
C6
C3B
C3A
R6
C4
C1
C2B
C2A
VOL
FUZZ
C5
WOODSTORK
'21
R5
R2
R3
BIAS
CONT
R4
R7
R1
E
C
Q1
E
C
Q2
GND
L
+
LED
-
IN
OUT


100n
10uF
5817
12v
TC1044SCPA
47uF
25k
100uF
22uF
1k
47pF-220pF
10pF-100pF
2u2
500kA
1kC
100n
WOODSTORK '21
4k7
100k
33k
50kB
1kB
220R
1M
1M
PNP
E
C
PNP
E
C
GND
L
+
LED
-
IN
OUT


+9V
C7
IC1
D1
D2
C8
C9
TP
T1
C6
C3B
C3A
R6
C4
C2B
C1
C2A
VOL
FUZZ
C5
WOODSTORK
'21
R5
R2
R3
BIAS
CONT
R4
R7
R1
E
C
Q1
Q2
GND
LED
IN
OUT

Resistors		Caps		Diodes	
R1	1M (opt)	C1	10pF-100pF (opt)	D1	1N5817
R2	100k	C2	2u2	D2	12v Zener
R3	33k	C3	22uF	Transistors	
R4	220R	C4	47pF-220pF (opt)	Q1	PNP-GE
R5	4k7	C5	100n	Q2	PNP-GE
R6	1k	C6	100uF	ICs	
R7	1M (opt)	C7	100n	IC1	TC1044**SCPA**
		C8	10uF	Trimmers	
		C9	47uF	T1	25k
				Pots	
				CONT	1kB
				FUZZ	1kC
				BIAS	50kB
				VOL	500kA

There are four optional parts (opt). See Notes for an explanation.

Value	QTY	Type	Rating
220R	1	Carbon/Metal Film or Carbon Comp	1/4W
1k	1	Carbon/Metal Film or Carbon Comp	1/4W
4k7	1	Carbon/Metal Film or Carbon Comp	1/4W
33k	1	Carbon/Metal Film or Carbon Comp	1/4W
100k	1	Carbon/Metal Film or Carbon Comp	1/4W
1M	2	Carbon/Metal Film or Carbon Comp	1/4W
10pF-100pF	1	Ceramic / MLCC	16v. Min
47pF-220pF	1	Ceramic / MLCC	16v. Min
100n	2	Film	16v. Min
2u2	1	Electrolytic	16v. Min
10uF	1	Electrolytic	16v. Min
22uF	1	Electrolytic	16v. Min
47uF	1	Electrolytic	16v. Min
100uF	1	Electrolytic	16v. Min
1N5817	1		
Zener	1	12v, 1W	
PNP-GE	2	*your choice	
TC1044**SCPA**	1	or, MAX1044**CPA**	
25k	1	Bourns 3362p	
1kB	1	PCB Right Angle	16mm
1kC	1	PCB Right Angle	16mm
50kB	1	PCB Right Angle	16mm
500kA	1	PCB Right Angle	16mm

The 2u2, 22uF and one of the 100n film caps can be either radial or axial (for extra mojo). This is explained further in the Notes section.

TO-5 sockets for the transistors can be used (not listed).

PNP germanium transistors:
You'll need to source these yourself.

Sprague ATOM (for fun): I used 2uF and 25uF ATOM caps for my build.
https://www.tubesandmore.com/products/capacitor-sprague-atom-aluminum-electrolytic

All kinds of 100n axial caps: Note, some might be too large!
https://www.tubesandmore.com/products/capacitors?filters=3109a3115c112a3109

TC1044SCPA:
https://www.mouser.com/ProductDetail/579-TC1044SCPA

MAX1044CPA:
https://www.mouser.com/ProductDetail/700-MAX1044CPA
https://smallbear-electronics.mybigcommerce.com/ic-max1044cpa/

TO-5 socket:
https://www.mouser.com/ProductDetail/575-91743103
https://smallbear-electronics.mybigcommerce.com/to-5-transistor-socket-mill-max/

Bourns 3362p 25k:
https://www.mouser.com/ProductDetail/652-3362P-1-253LF

Sub (20k): https://www.taydaelectronics.com/potentiometer-variable-resistors/cermet-potentiometers/3362p/20k-ohm-trimmer-potentiometer-cermet-1-turn-3362p.html

1kB: https://www.taydaelectronics.com/p1-b1k-ohm-linear-taper-potentiometer-round-shaft-pc-mount-5409.html
1kC: https://www.taydaelectronics.com/c-1k-ohm-anti-log-taper-potentiometer-round-shaft-pc-mount-l.html
50kB: https://www.taydaelectronics.com/tayda-b50k-ohm-linear-taper-potentiometer-round-shaft-pc-mount.html
500kA: https://www.taydaelectronics.com/tayda-500k-ohm-logarithmic-taper-potentiometer-round-shaft-pc-mount.html

Thinline DC Jack:
http://smallbear-electronics.mybigcommerce.com/dc-power-jack-all-plastic-unswitched-2-1-mm/

Mono Jacks:
http://smallbear-electronics.mybigcommerce.com/lumberg-1-4-compact-shrouded-mono-jack/

http://smallbear-electronics.mybigcommerce.com/1-4-in-mono-nys229/

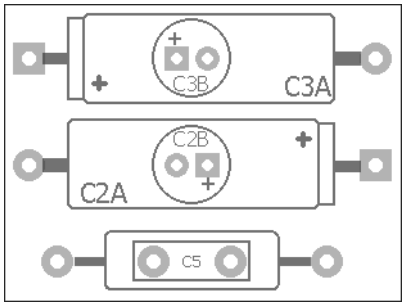
https://smallbear-electronics.mybigcommerce.com/1-4-in-mono-enclosed-switchcraft-111x/

Optional Parts

- R1 and R7 are pulldown resistors on the input and output, resp. These were not used in the original Fuzz Faces and are present to minimize any popping from the footswitch. If you are using any soft touch relay based switching you probably don't need them. For 3PDT mechanical you might need one or both if you get a bad pop.
- C1 is used on the FT'69 and is a10pF ceramic capacitor. Its purpose is to filter out any RF interference. Higher values can be used for more attenuation but 100pF is probably the highest you want to go before you start bleeding off treble frequencies.
- C4 is not used in the FT69. Its purpose it to further filter out noise on Q2, should there be any. Typical values are 47pF - 220pF. 47pF or 100pF tends be most suitable. Again, too high a value will start to bleed off treble response (but if you are building a fuzz for bass you could even go up to 1n).

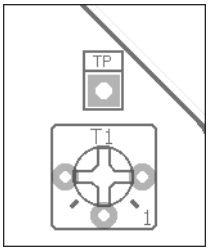
Capacitors

- C2, C3 and C5 can be either radial (IOW the typical footprint we use in sotmpboxes these days) or axial (what you see most often in amps). It's entirely up to you which you prefer. I like axial for fuzzes like this purely for the mojo.
- For the electrolytics, the axial lead spacing is about 21mm. For the film cap, it's about 18mm. For their raidal counterparts, spacing is 2mm and 5mm, resp.

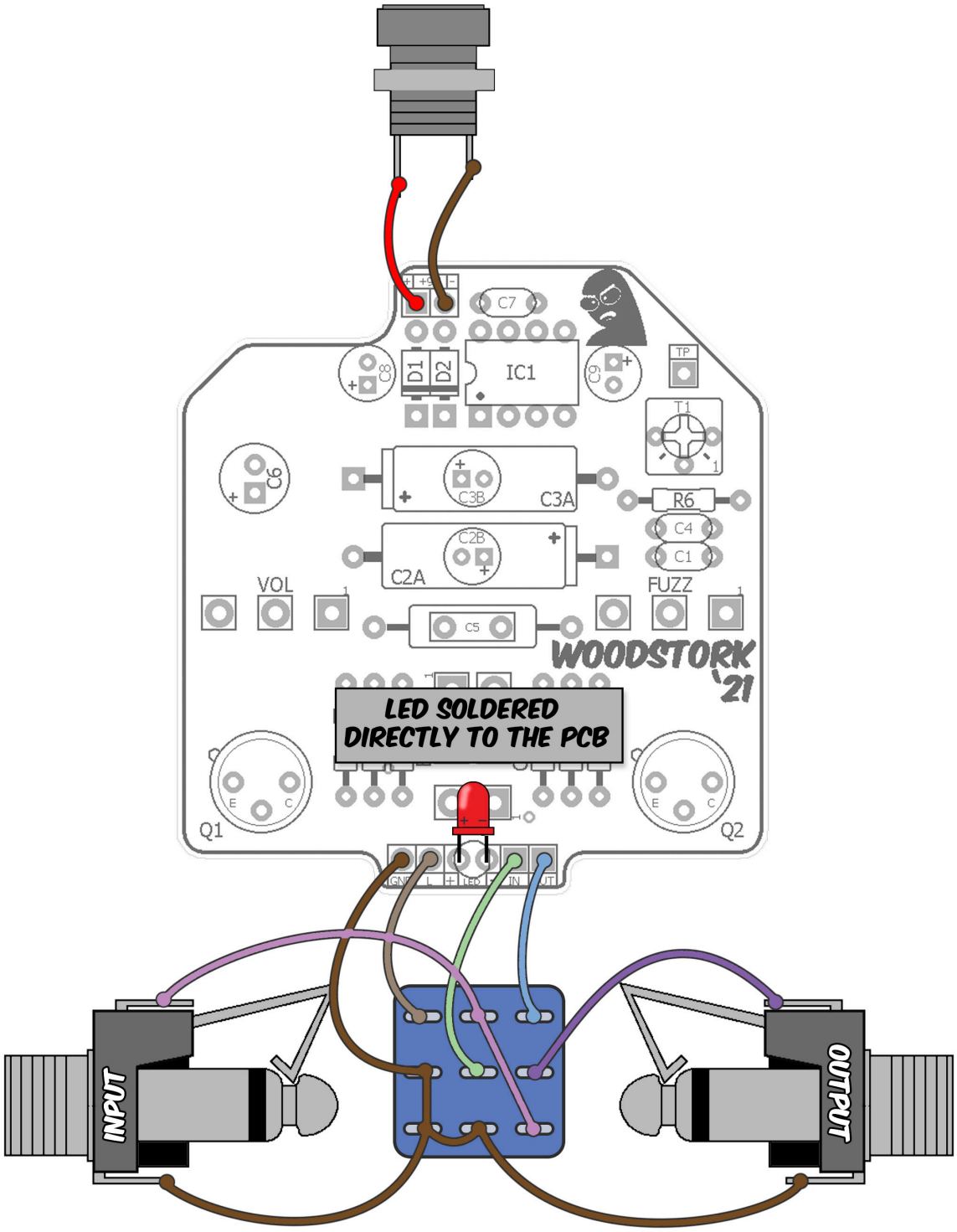


Biasing

- The Q2 collector must be biased for proper operation. In a positive ground effect like this one the Q2 collector is typically set to half the supply voltage. So, -4.5 on a -9v supply. You can sometimes achieve a more pronounced compression (note squash eg Eric Johnson) by going a bit further down to -3v. Some transistors respond better than others to this so it's sort of a crapshoot.
- To set the Q2 bias, use your multimeter with the black lead attached to ground and the red lead touching the "TP" pad on the Woodstork'21 PCB. Now adjust T1 until you get approximately -4.5v.

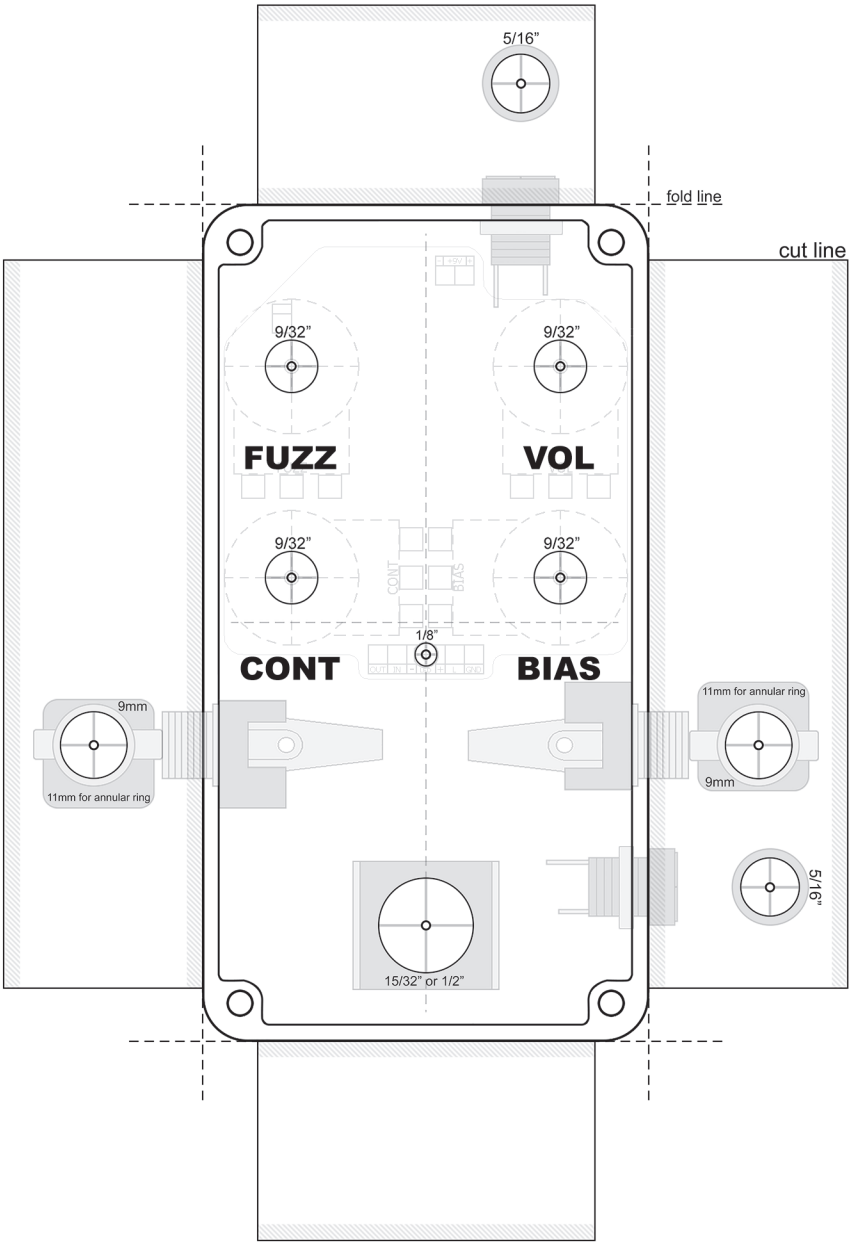


- With some transistor pairs, you may run into a situation where even with the full range of T1 you still cannot get down to -4.5v. If that happens, just increase the value of R6. Go from 1k up to 4k7 or maybe even 8k2. I ran into this with the pair I chose for this project so I modified the R6 value to make up the difference.



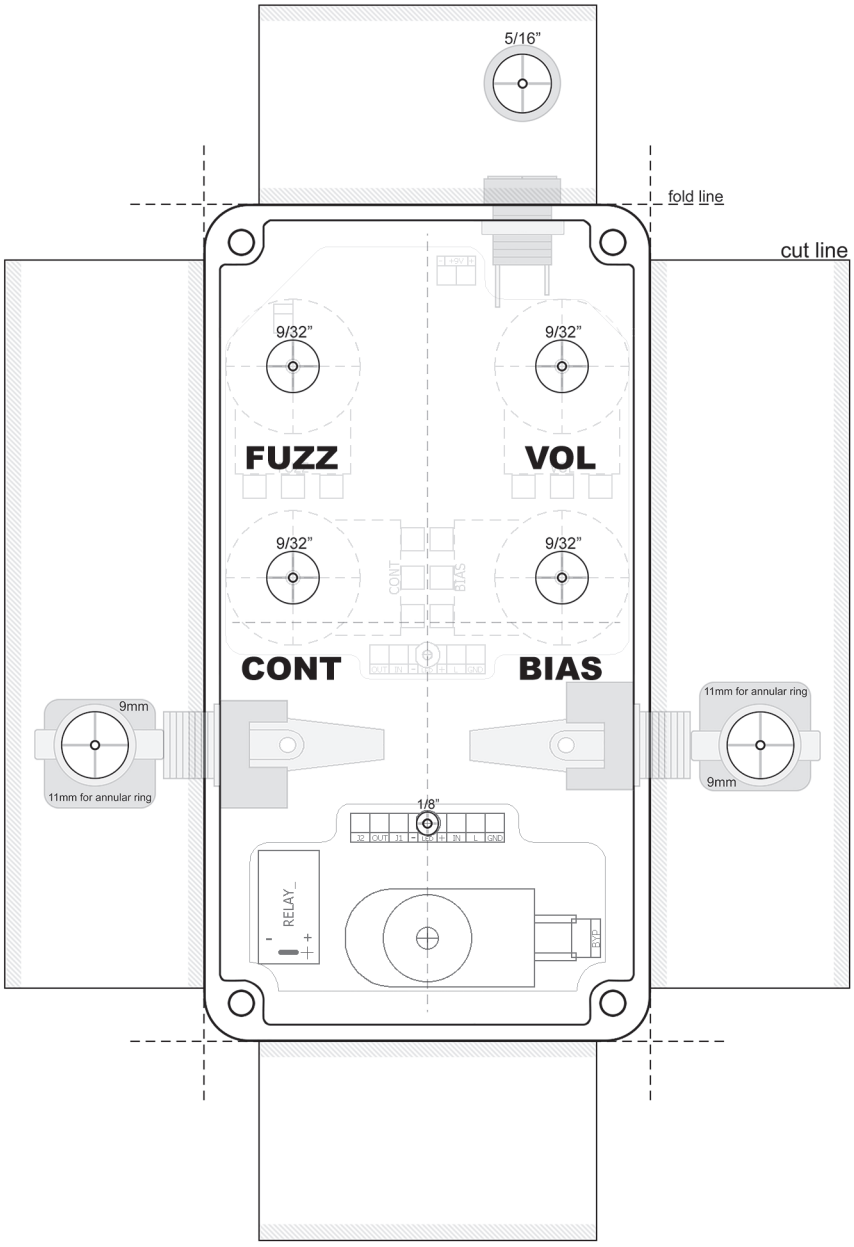
3PDT bypass wiring. If you want to use the Softie3 relay bypass instead (sold separately) please refer to that project documentation for wiring instructions.

Note: *Drill Guides are approximate and may require tweaking depending on the types of jacks, switches and pots you use.*



Use this drill template for regular 3PDT bypass. There are two locations for the DC jack depending on your preference. Be sure to only drill for one!

Note: *Drill Guides are approximate and may require tweaking depending on the types of jacks, switches and pots you use.*



Use this drill template for Softie3 relay bypass (sold separately). When using the Softie3, the DC jack needs to at the top. Note the different LED location, too.

- 9.42vDC One Spot
- Current Draw: ~2mA

Measurement Conditions
- Contour about 1/3rd up and all other knobs set to their middle positions.

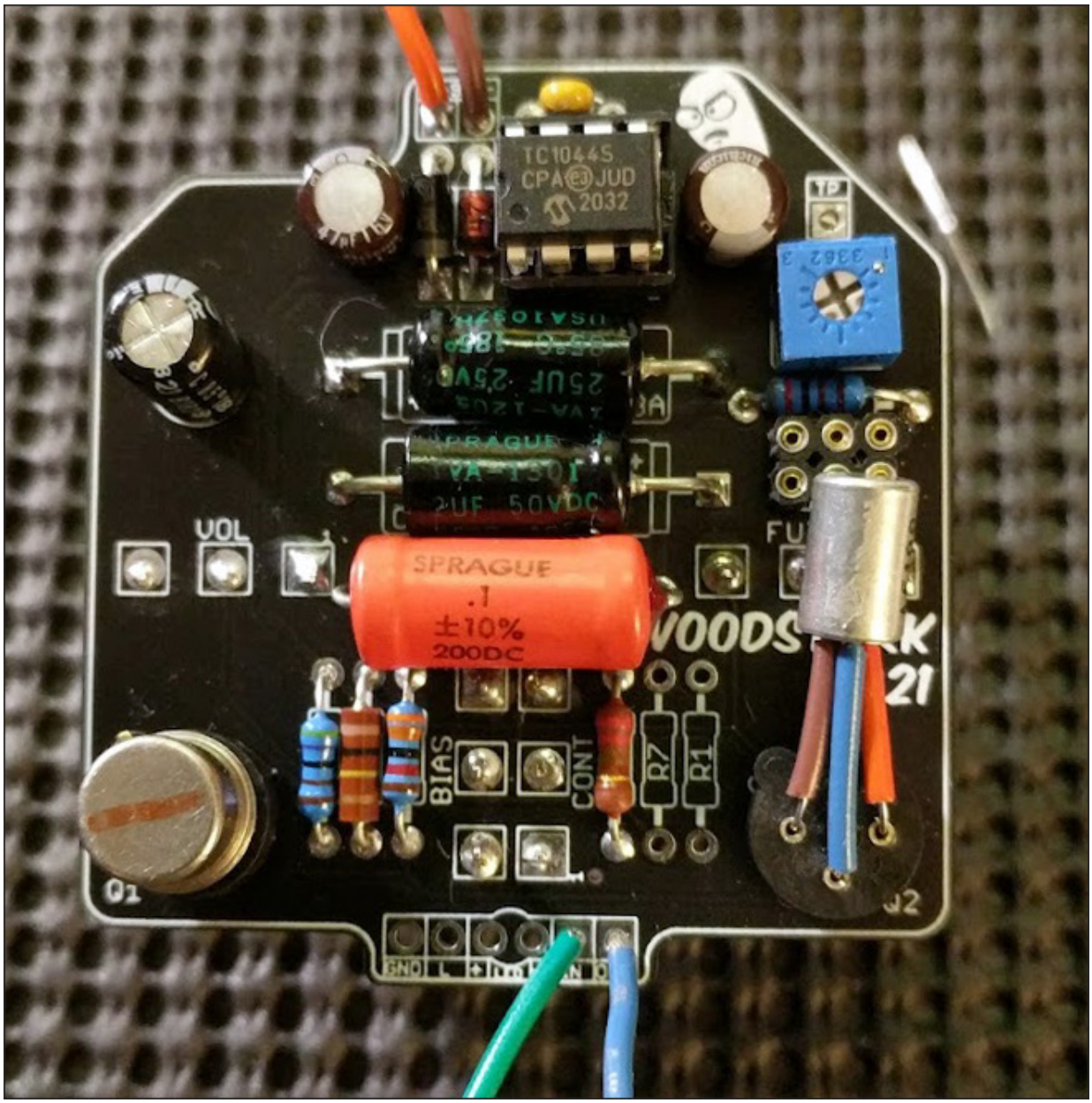
IC1	TC1044SCPA
1	9.32
2	5.43
3	0
4	-3.87
5	-9.28
6	4.4
7	5.47
8	9.32

Q1	PNP
C	-422mv
B	-113mV
E	0

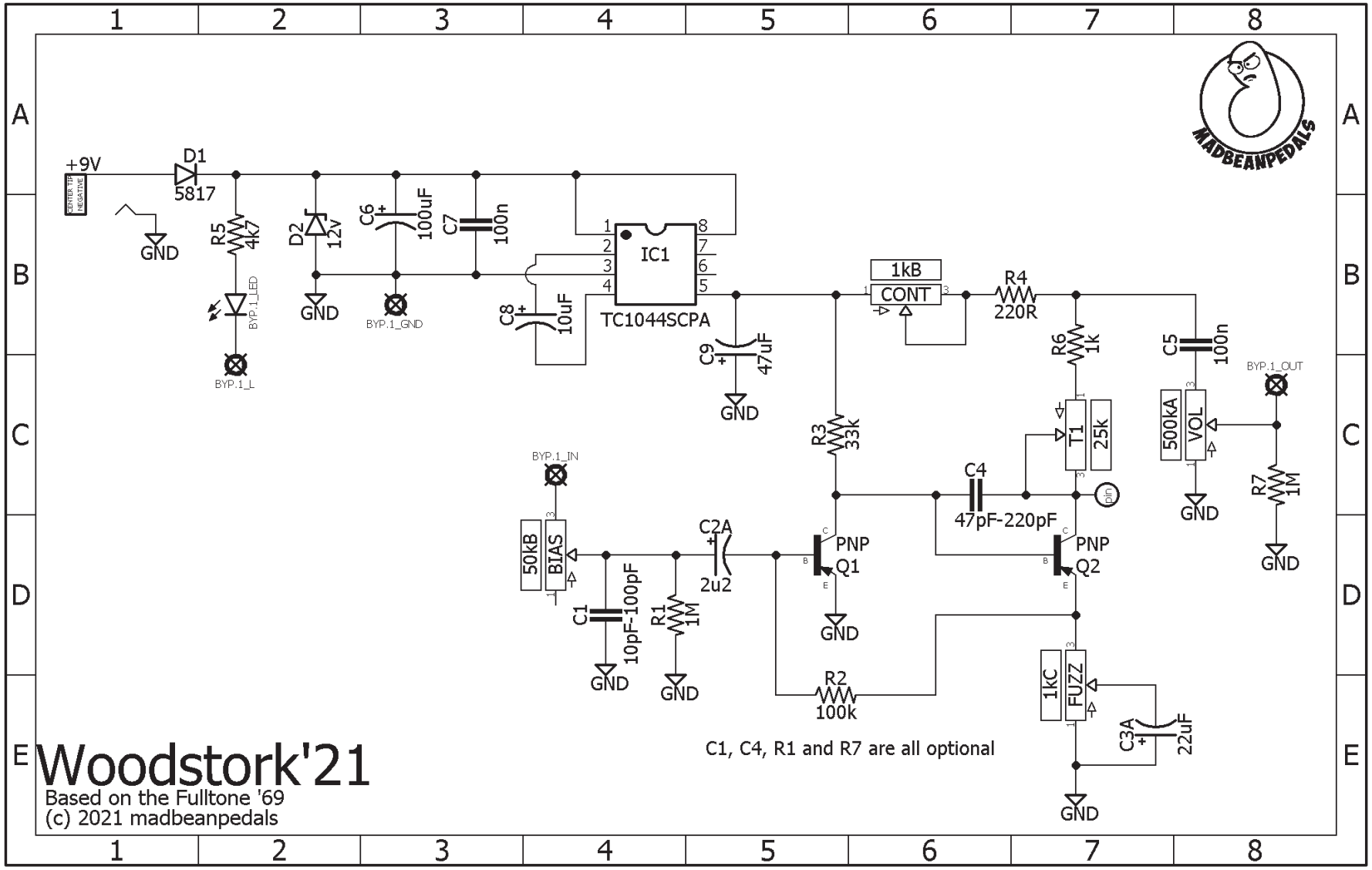
Q2	PNP
C	-4.58
B	-365mV
E	-284mV

My Q1 collector is a little low on this pair. Typically you want to see something closer to -700mV. So, I might end up lowering R3 a bit or trying a different pair. For Q1 I used an ancient 2N1305 and Q2 is an AC188.

Keep in mind that it best to let the transistors warm up for a few minutes before taking measurement or adjust the Q2 bias. Voltages float a lot on germaniums as they respond to ambient temperature.



On this build I decided to leave off the pulldown resistors and socket the two optional capacitors. If I end up needing them I'll just socket them and solder one lead in on each.


+9V
D1
5817
GND
R5
4k7
BYP.1_LED
BYP.1_L
D2
12V
GND
C6
100uF
BYP.1_GND
C7
100n
C8
10uF
IC1
TC1044SCPA
C9
47uF
GND
1kB
CONT
R4
220R
R6
1k
C5
100n
BYP.1_OUT
500kA
VOL
GND
R7
1M
GND
R3
33k
T1
25k
C4
47pF-220pF
BYP.1_IN
50kB
BIAS
C2A
2u2
PNP
Q1
PNP
Q2
C1
10pF-100pF
GND
R1
1M
GND
GND
R2
100k
1kC
FUZZ
C3A
22uF
GND
C1, C4, R1 and R7 are all optional
Woodstork'21
Based on the Fulltone '69
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