RUSTBUCKET 2019 - REV.1

FX TYPE: Dynamic Filter

Based on the EHX® Attack Decay™

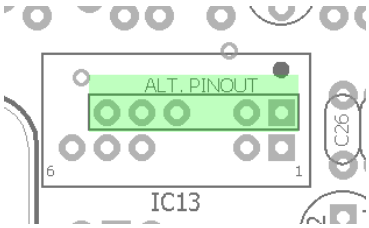
All rev.1 boards are marked as such on the PCB. They are blue instead of the original red. If you have the previous version, go to the Archives for the project doc.

The rev.1 version of the Rustbucket is the exact same circuit as the original 2019 version. There are a couple of layout changes.

1) The pots were converted to 9mm PCB mount from wired 9mm. I did this due to customer feedback. Originally I had intended the wired pots to allow one to build the Rustbucket in a 1590BB but in hindsight it's probably more trouble than it's worth. So, rev1 boards should be used with a 125BB enclosure only (a new drill template is included in this doc).

2) Since the pots were converted to PCB mount the SPDT switch was also made PCB mount. This requires using one of the small framed switches to fit.

I have updated the links for the pots and switch.



3) I included some alternate pins for a different power supply in case I need to change it in the future. However, the board still includes the same Murata supply for now. Just leave these pins alone.

Do you like violence? Sorry...I meant, do you like violins? You probably have heard some examples of guitars made to sound like bowed instruments; EVH and his rapid fire volume knob twisting, Eric Johnson and his insane control of pick attack, or Jimmy Page and his bowed Les Paul. The Rustbucket is a circuit that will get you that sound without having to use any of the aforementioned techniques. You turn it on, play some notes, and the effect more-or-less does the heavy lifting for you allowing you to bypass any constraints on your playing technique.

Well, not exactly, but we'll get back to that later. It's also important to mention that this is basically a monophonic effect. Most chords will not work very well with it as they cause multiple or inconsistent triggering (thanks to Scruffie for pointing this out to me). The Rustbucket shines with single note playing...even fast leads!

The EHX® Attack Decay™ is described as a "tape reverse simulator". It sort of is, and kinda is not. Tape reverse can be described as an inversion of dynamics and with a guitar it is characterized by reversing both the volume and attack envelope of a plucked note. The Rustbucket does not do this. Rather, it creates an enveloped gate which open and closes around a plucked note. The difference is while the volume envelope on the Rustbucket will swell and decay similar to a tape reverse, the attack envelope is removed (almost) completely rather than being moved to the end of the note. So, the effect is very similar but not exactly the same thing.

This effect does require some mechanical adjustment in your playing to get the most out of it. The controls are both very sensitive and interdependent and will react according to how you are playing. This means that you really need to spend some time dialing it in for both your guitar and your playing technique. Not every knob setting is a winner, but once you dial it in it works very well. I will do my best to describe how below.

Note: The Rustbucket 2019 is a bit of a current hog (because of the NKA0515 unit). It draws 170mA under load so make sure you use an appropriate power supply. Also, the NKA and 5v regulator will get a bit hot when powered so be careful when you are poking around the circuit.

Controls

Sense: Sets the sensitivity of the note envelope. Low settings have low sensitivity and vice-versa. This is also the most important knob adjustment to make to get the effect working well. You need to set it within the range that it responds to your guitar and your playing dynamics. Too low and it will not trigger the envelope. Too high and it will become so sensitive that minor pick or string scratches will trigger it into a sonic mess.

Harm: Sets the harmonics of the plucked note. Low settings are fairly clean. As it is turned up the note distorts. The Harm control will allow you to "smooth out" the subsequent envelope according to your playing dynamics.

Edge: This switch increases the distortion generated by the Harm setting into more fuzzy territory.

Attack: Determines whether he initial note envelope has a fast (full down) or slow (full up) attack. Think of it in terms of a bowed instrument where the speed of the bow across the strings determines how quickly the note volume swells to its maximum.

Decay: Similar to the Attack control but in reverse. The Decay knob determines how quickly the note dies out. Fast decay is full down and slow decay is full up.

Blend: Allows you to blend the dry vs. effected signal. Full down is dry only, full up is wet only.

Terms of Use: *You are free to use purchased **Rustbucket** circuit boards for both DIY and small commercial operations. You may not offer **Rustbucket** PCBs for resale or as part of a "kit" in a commercial fashion. Peer to peer re-sale is fine, though.*

Notes

Changes to the 2019 version

The biggest change between the 2019 and versions is that the Rustbucket no longer requires an 18v power supply. The 2019 version only requires a 9v supply capable of 200mA. This was made possible by using a Murata NKA0515SC bi-polar supply to power the circuit. This magic box takes a 5v input and spits out +/-15vDC rated at 33mA per rail. This turns out to be just enough to power the Rusbucket off a 9v supply with the extra step of using an LM7805 regulator. There is an additional benefit in that it seems to noticeably lower the noise floor of the Rustbucket from the previous version. The only downside is that using the Murata supply makes the overall cost of the build increase. However, I've taken the extra step of including the NKA0515SC with the PCB and at slightly lower than cost. Because that's the kind of guy I am!

Building the board

Obviously, this build is no joke. I do not advise taking this one on if you are a novice. Also, you should know how to audio probe not only for the trimpot biasing, but in case something goes wrong. With a circuit this complicated the chance of making an error in you build goes up exponentially. But, this design is well-vetted and if you take your time AND make sure you have good parts it should go smoothly.

Speaking of parts: make sure you get your MN3007 and CA3080 from a reliable source like smallbear or other trusted vendors. A fake (or unvetted) part here will sink your build faster than a fat man in a pool of mercury (see what I did there?) And, with this much invested in time and money to build the Rustbucket you might as well do it right!

Trimpots

There are two trimmers that need to be set, as well. The BIAS trimmer is for the MN3007 which controls the delay of the note. It does not set the delay amount, but rather biases the chip for the best output. To set this, use an audio probe on either of the output pins (7 or 8) of IC6. Play a note or use and audio source to feed the input of the circuit. Adjust the BIAS trimmer for the cleanest output you can get on the output pin you are probing. There will be a small range where this setting is optimal and your ear is fine for making the adjustment. Set the control knobs wherever you feel you can get the best result while adjusting the trim. I suggest leaving them all about halfway up with the Edge switch off.

The second trimmer sets the output GAIN of the effected signal. There is no optimal setting here other than the one that gets you a nice strong output signal that blends about 50/50 with your dry signal when the Blend knob is halfway up.

B.O.M.

Resistors		Resistors		Caps		Diodes	
R1	1M	R39	1M	C1	68n	D1 - D9	1n914
R2	100k	R40	27k	C2	220n	D10	1N5817
R3	150k	R41	470R	C3	330n	**Transistors**	
R4	150k	R42	220R	C4	2u2	Q1	2N5087
R5	39k	R43	24k	C5	6n8	Q2	2N5087
R6	470k	R44	100k	C6	18n	Q3	2N5088
R7	470k	R45	15k	C7	1uF	Q4	2N5088
R8	680R	R46	22R	C8	220pF	Q5	2N5087
R9	100k	R47	15k	C9	1uF	Q6	2N5087
R10	1k	R48	510R	C10	10n	Q7	2N5088
R11	1k	R49	10k	C11	47n	Q8	2N5088
R12	10k	R50	12k	C12	4u7	**Regulator**	
R13	10k	R51	10k	C13	100uF	REG	LM7805
R14	100k	R52	2k4	C14	33uF	**ICs**	
R15	100k	R53	120k	C15	2u2	IC1	4558
R16	100k	R54	47k	C16	4u7	IC2	CA3080
R17	100k	R55	1k	C17	27n	IC3	LM1458
R18	27k	R56	1k	C18	220pF	IC4	4558
R19	150k	R57	15k	C19	220n	IC5	CD4047
R20	51k	R58	560k	C20	220uF	IC6	MN3007
R21	470k	R59	15k	C21	100n	IC7	CD4013
R22	5k6	R60	18k	C22	220uF	IC8	CD4066
R23	56k	R61	18k	C23	220uF	IC9	LM1458
R24	47k	R62	1k5	C24	220uF	IC10	LM311
R25	68k	R63	4k7	C25	100n	IC11	CA3080
R26	27k	R64	150R	C26	100n	IC12	LM741
R27	6k8	R65	4k7			IC13	NKA0515SC
R28	91k					**Switch**	
R29	91k					EDGE	SPDT
R30	5k6					**Trimpots**	
R31	10k					GAIN	10k
R32	270k					BIAS	100k
R33	1k					**Pots**	
R34	12k					SENSE	10kA
R35	470k					BLEND	10kB
R36	1M					ATTACK	500kA
R37	1k					DECAY	500kA
R38	27k					HARM	1MB

Shopping List

Value	QTY	Type	Rating
22R	1	Carbon / Metal Film	1/4W
150R	1	Carbon / Metal Film	1/4W
220R	1	Carbon / Metal Film	1/4W
470R	1	Carbon / Metal Film	1/4W
510R	1	Carbon / Metal Film	1/4W
680R	1	Carbon / Metal Film	1/4W
1k	6	Carbon / Metal Film	1/4W
1k5	1	Carbon / Metal Film	1/4W
2k4	1	Carbon / Metal Film	1/4W
4k7	2	Carbon / Metal Film	1/4W
5k6	2	Carbon / Metal Film	1/4W
6k8	1	Carbon / Metal Film	1/4W
10k	5	Carbon / Metal Film	1/4W
12k	2	Carbon / Metal Film	1/4W
15k	4	Carbon / Metal Film	1/4W
18k	2	Carbon / Metal Film	1/4W
24k	1	Carbon / Metal Film	1/4W
27k	4	Carbon / Metal Film	1/4W
39k	1	Carbon / Metal Film	1/4W
47k	2	Carbon / Metal Film	1/4W
51k	1	Carbon / Metal Film	1/4W
56k	1	Carbon / Metal Film	1/4W
68k	1	Carbon / Metal Film	1/4W
91k	2	Carbon / Metal Film	1/4W
100k	7	Carbon / Metal Film	1/4W
120k	1	Carbon / Metal Film	1/4W
150k	3	Carbon / Metal Film	1/4W
270k	1	Carbon / Metal Film	1/4W
470k	4	Carbon / Metal Film	1/4W
560k	1	Carbon / Metal Film	1/4W
1M	3	Carbon / Metal Film	1/4W

Value	QTY	Type	Rating
220pF	2	Ceramic / MLCC	25v min.
6n8	1	Film	25v min.
10n	1	Film	25v min.
18n	1	Film	25v min.
27n	1	Film	25v min.
47n	1	Film	25v min.
68n	1	Film	25v min.
100n	3	Film	25v min.
220n	2	Film	25v min.
330n	1	Film	25v min.
1uF	1	Film	25v min.
1uF	1	Electrolytic	25v
2u2	2	Electrolytic	25v
4u7	2	Electrolytic	25v
33uF	1	Electrolytic	25v
100uF	1	Electrolytic	25v
220uF	4	Electrolytic	25v
1n914	9		
1N5817	1		
2N5087	4		
2N5088	4		
LM7805	1		
LM741	1		
LM1458	2		
4558	2		
CD4013	1		
CD4047	1		
CD4066	1		
CA3080	2		
LM311	1		
MN3007	1		
NKA0515SC	1	*included with PCB	
SPDT	1	On/On	
10k	1	Bourns 3362p	
100k	1	Bourns 3362p	
10kA	1	Right Angle	9mm
10kB	1	Right Angle	9mm
500kA	2	Right Angle	9mm
1MB	1	Right Angle	9mm

Parts Guide

2N5087: http://smallbear-electronics.mybigcommerce.com/transistor-2n5087/

2N5088: http://smallbear-electronics.mybigcommerce.com/transistor-2n5088/

LM7805: http://smallbear-electronics.mybigcommerce.com/lm7805ct/

LM741: http://smallbear-electronics.mybigcommerce.com/ic-741/

LM1458: http://smallbear-electronics.mybigcommerce.com/ic-mc1458p-ti/

4558: http://smallbear-electronics.mybigcommerce.com/ic-jrc4558d/

CD4013: http://smallbear-electronics.mybigcommerce.com/ic-cd4013/

CD4047: http://smallbear-electronics.mybigcommerce.com/ic-cd4047/

CD4066: http://smallbear-electronics.mybigcommerce.com/ic-cd4066/

CA3080: http://smallbear-electronics.mybigcommerce.com/ic-ca3080ae/

LM311: http://smallbear-electronics.mybigcommerce.com/ic-lm311/

MN3007: http://smallbear-electronics.mybigcommerce.com/ic-mn3007/

10k trimpot: https://www.taydaelectronics.com/potentiometer-variable-resistors/cermet-potentiometers/3362p/10k-ohm-trimmer-potentiometer-cermet-1-turn-3362p.html

or, https://www.mouser.com/ProductDetail/Bourns/3362P-1-103LF?qs=sGAEpiMZZMvygUB3GLcD-7k%252bod3ZqvEIQboRRPdOKB6M%3d

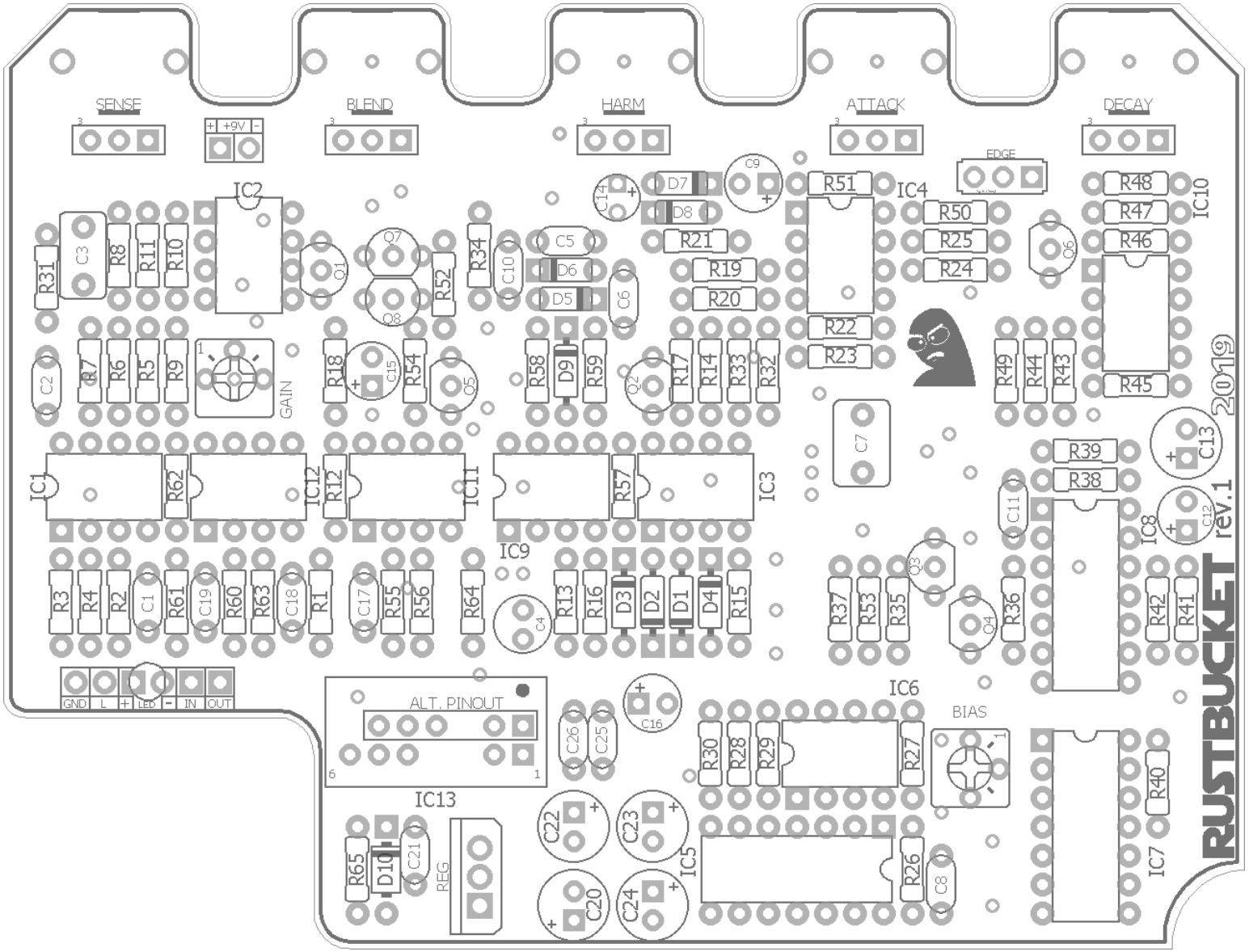
100k trimpot: https://www.taydaelectronics.com/potentiometer-variable-resistors/cermet-potentiometers/3362p/100k-ohm-trimmer-potentiometer-cermet-1-turn-3362p.html

or, https://www.mouser.com/ProductDetail/Bourns/3362P-1-104LF?qs=sGAEpiMZZMvygUB3GLcD7l39JMs%2f%2f%-2fLOs09gVZSzi2c%3d

Updated - 9mm pots (10kA, 10kB, 500kA, 1MB): http://smallbear-electronics.mybigcommerce.com/alpha-single-gang-9mm-right-angle-pc-mount/

Updated - SPDT switch: http://smallbear-electronics.mybigcommerce.com/spdt-on-on-mountain-10tc410/

Layout


SENSE
BLEND
HARM
ATTACK
DECAY
+9V
EDGE
GAIN
BIAS
ALT. PINOUT
REG
GND
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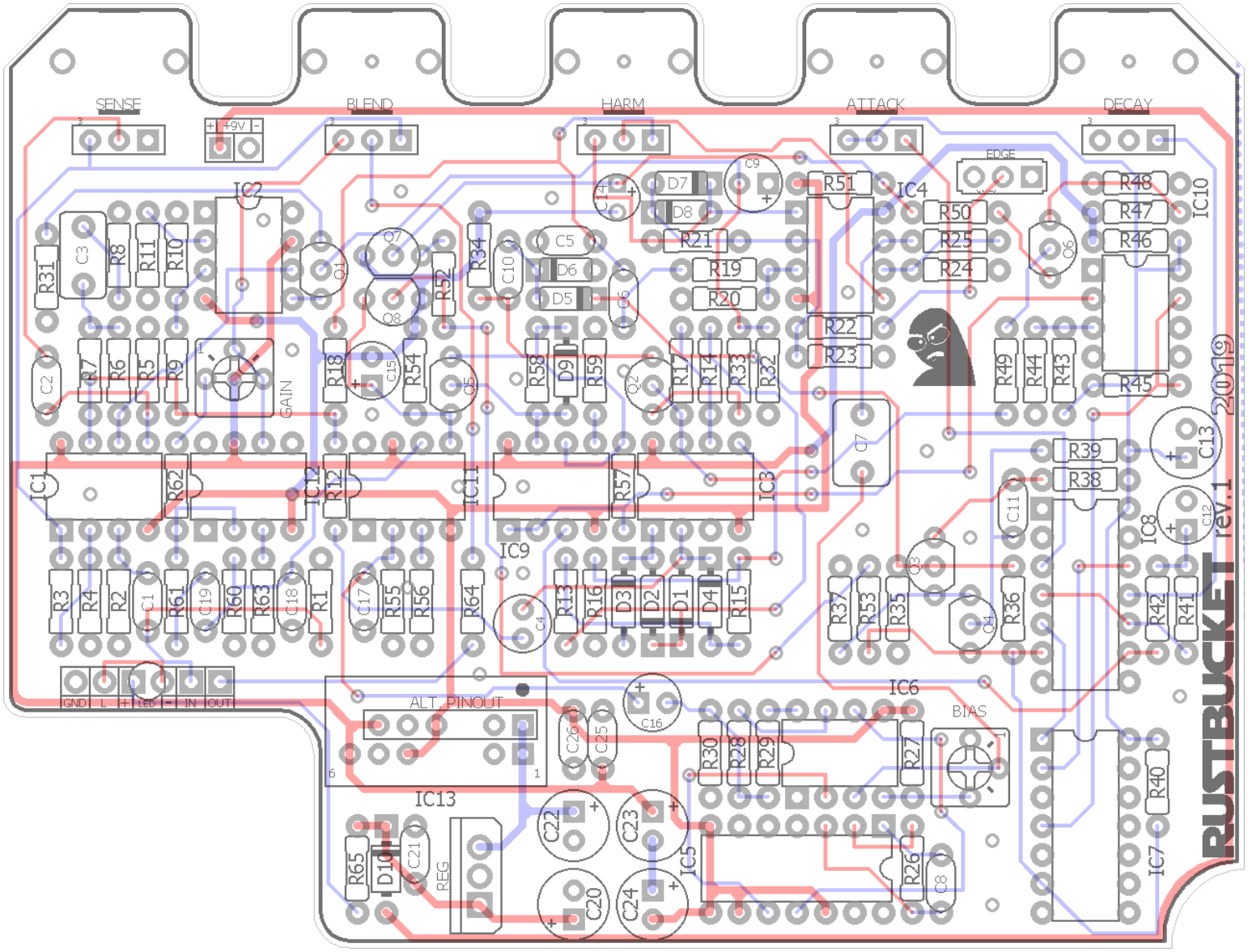
+
LED
-
IN
OUT
IC1
IC2
IC3
IC4
IC5
IC6
IC7
IC8
IC9
IC10
IC11
IC12
IC13
RUSTBUCKET
rev.1
2019

Traces


SENSE
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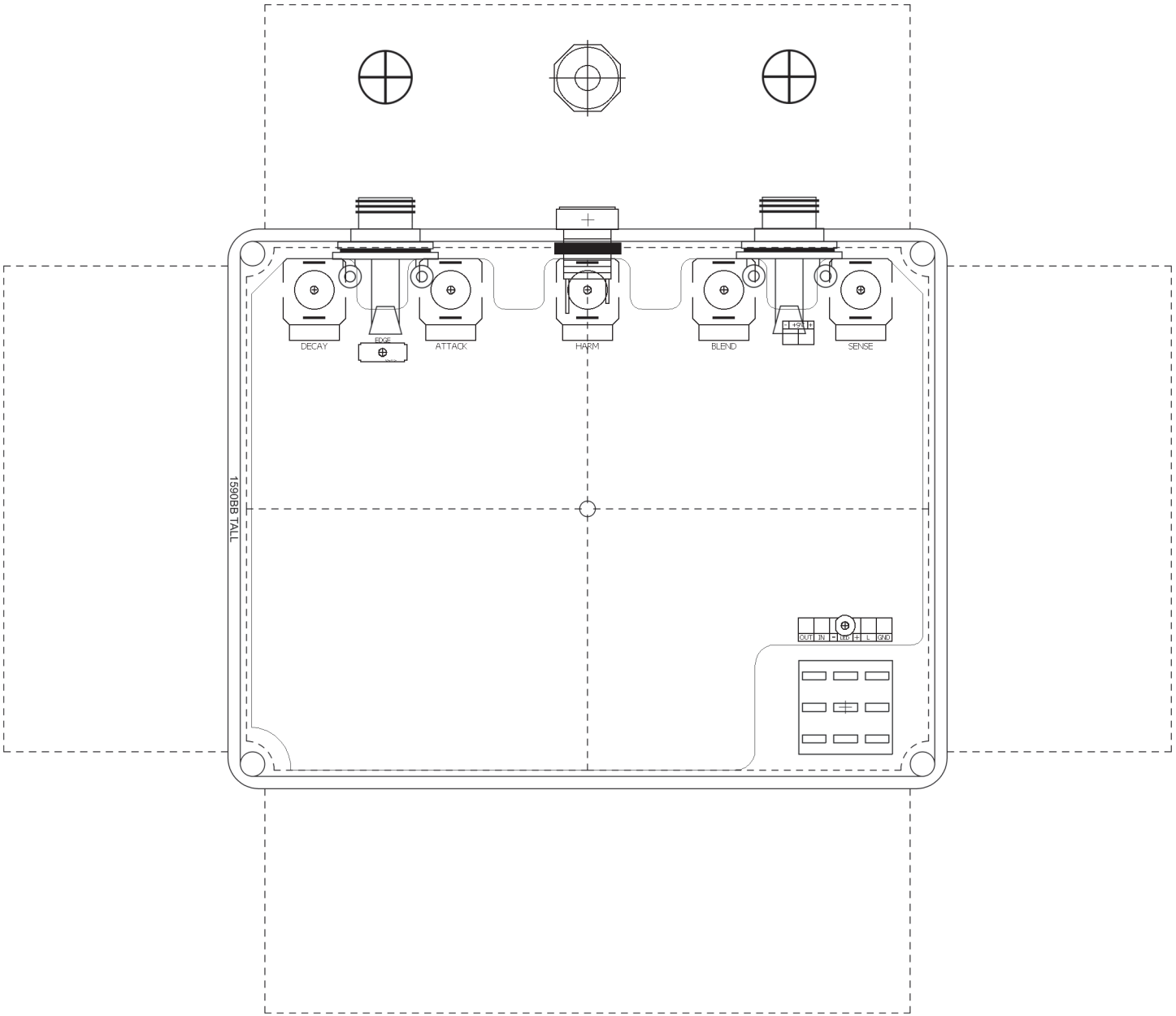
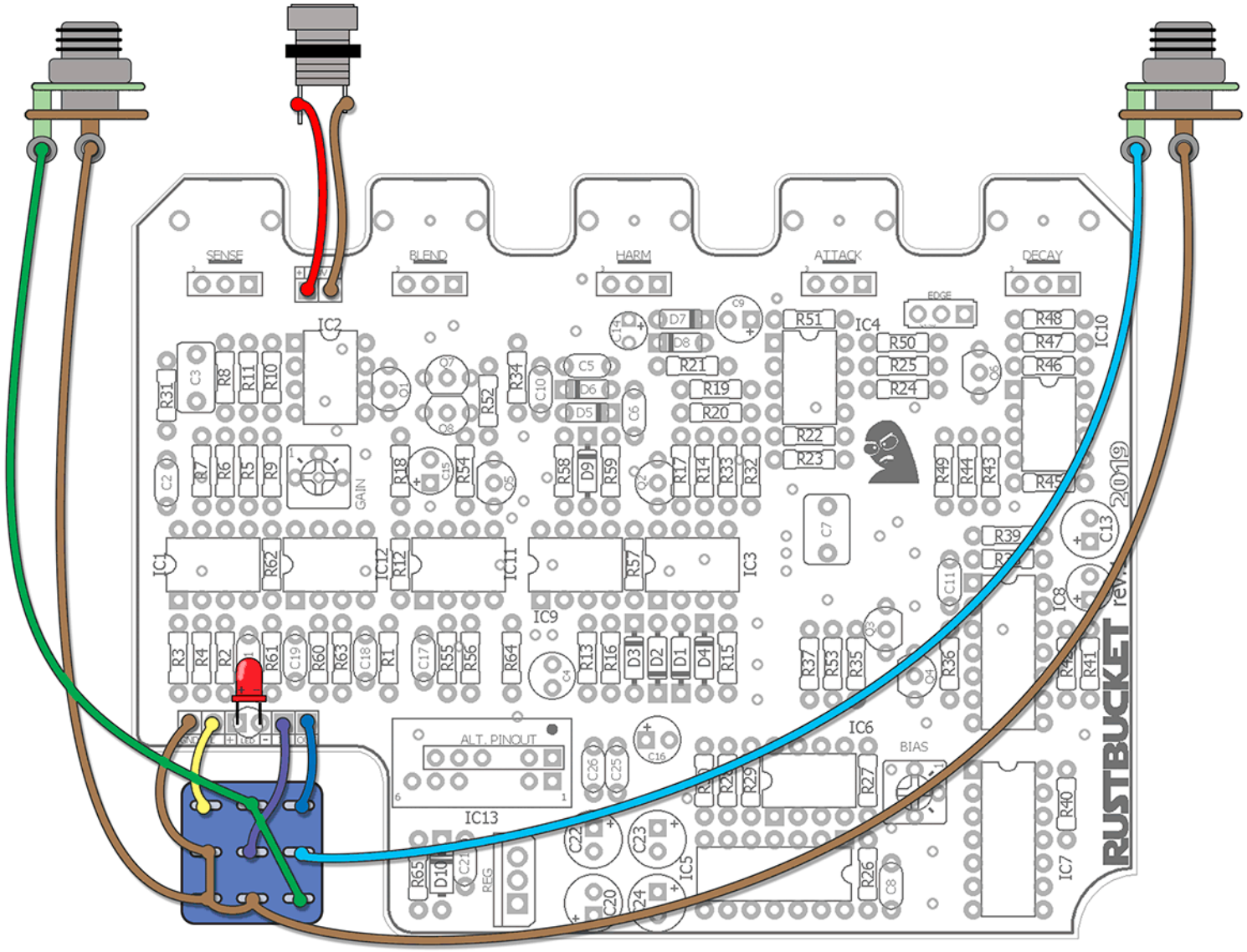
125BB Drill Guide



Wiring


SENSE
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IC1
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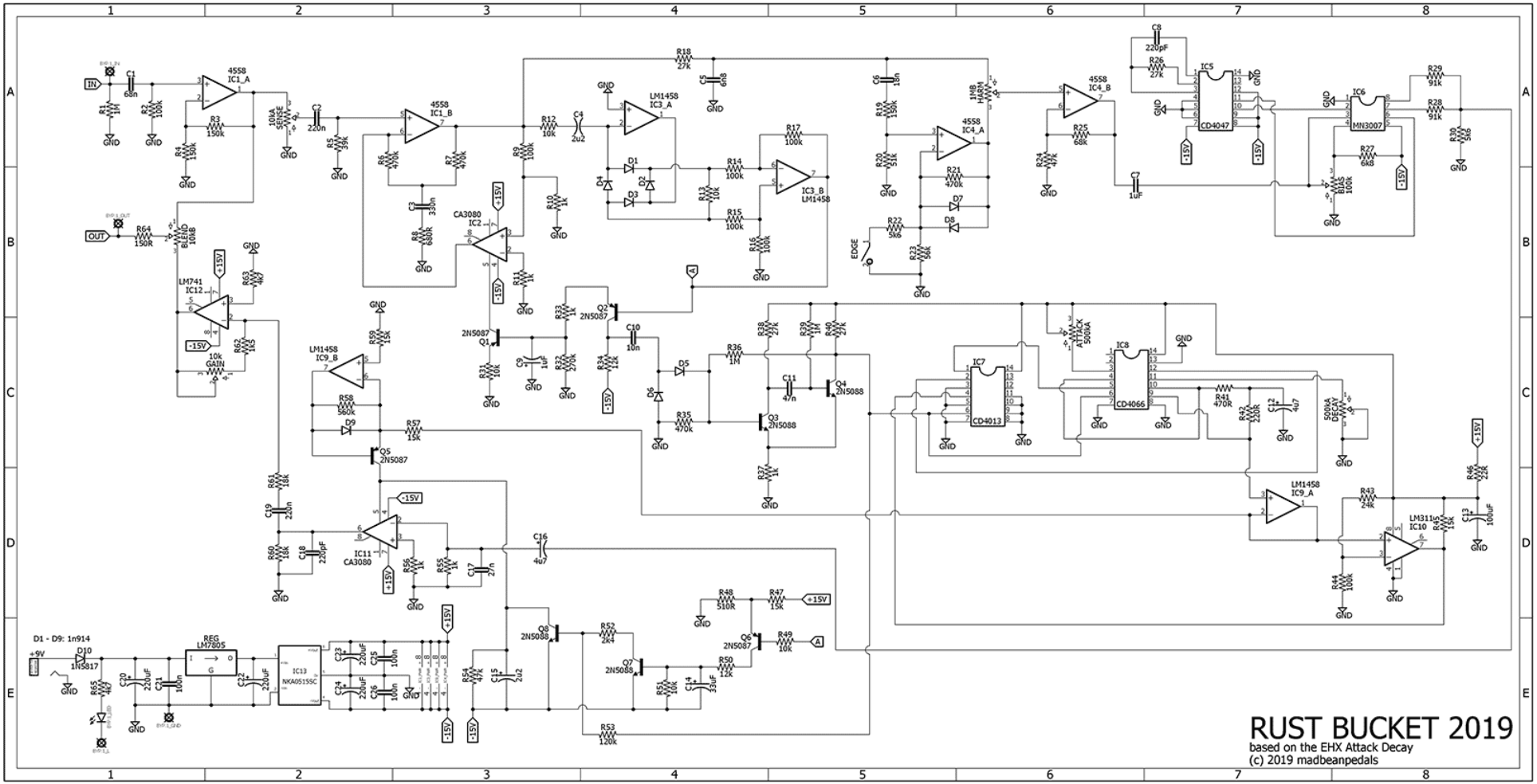
IC12
IC13
REG
RUSTBUCKET
2019

Schematic


RUST BUCKET 2019
based on the EHX Attack Decay
(c) 2019 madbeanpedals
D1 - D9: 1n914
IC1_A
IC1_B
IC2
IC3_A
IC3_B
IC4_A
IC4_B
IC5
IC6
IC7
IC8
IC9_A
IC9_B
IC10
IC11
IC12
IC13
CD4047
MN3007
CD4013
CD4066
LM1458
LM741
CA3080
LM311n
4558
REG
LM7805
NKA0515SC
2N5087
2N5088
1N5817
ATTACK
DECAY
EDGE
GAIN
+15V
GND
+9V

Voltages

IC1	4558
1	0
2	0
3	0
4	-14.52
5	0
6	0
7	0
8	14.53

IC2	CA3080
1	ignore
2	0
3	0
4	-14.52
5	-14.02
6	0
7	14.51
8	ignore

IC3	LM1458
1	ignore
2	0
3	0
4	-14.51
5	ignore
6	ignore
7	ignore
8	14.5

IC4	4558
1	0
2	0
3	0
4	-14.5
5	0
6	0
7	0
8	14.5

IC5	CD4047
1	-7.39
2	-7.2
3	-6.97
4	0
5	0
6	0
7	-14.5
8	-14.5
9	-14.5
10	-7.24
11	-7.24
12	-14.51
13	-7.37
14	0

IC6	MN3007
1	0
2	-7.24
3	-7.46
4	-13.6
5	-14.51
6	-7.24
7	-7.18
8	-7.26

IC7	CD4013
1	0
2	14.42
3	0
4	67.9mV
5	0
6	0.462
7	0
8	0
9	0
10	0
11	0
12	0
13	14.42
14	14.42

IC8	CD4066
1	ignore
2	ignore
3	14.32
4	12.7mV
5	0
6	0.463
7	0
8	0
9	12.7mV
10	12.7mV
11	12.7mV
12	14.42
13	0
14	14.42

IC9	LM1458
1	13.4mV
2	13.4mV
3	12.8mV
4	-14.52
5	0
6	0
7	-362.5mV
8	14.51

IC10	LM311
1	0
2	12.5mV
3	11.64
4	0
5	14.34
6	14.34
7	67.4mV
8	14.42

IC11	CA3080
1	ignore
2	0
3	0
4	-14.52
5	-14.52
6	0
7	14.52
8	ignore

IC12	LM741
1	-14.51
2	0
3	0
4	-14.52
5	-14.52
6	0
7	14.52
8	ignore

IC13	NKA0515
1	4.93
2	0
3	
4	-14.52
5	0
6	14.53

REG	LM7805
In	9.01
Gnd	0
Out	4.93

Q1	2N5087
C	-13.92
B	0
E	0

Q2	2N5087
C	-14.52
B	0
E	0

Q3	2N5088
C	14.39
B	154mV
E	0.415

Q4	2N5088
C	0.463
B	1
E	0.415

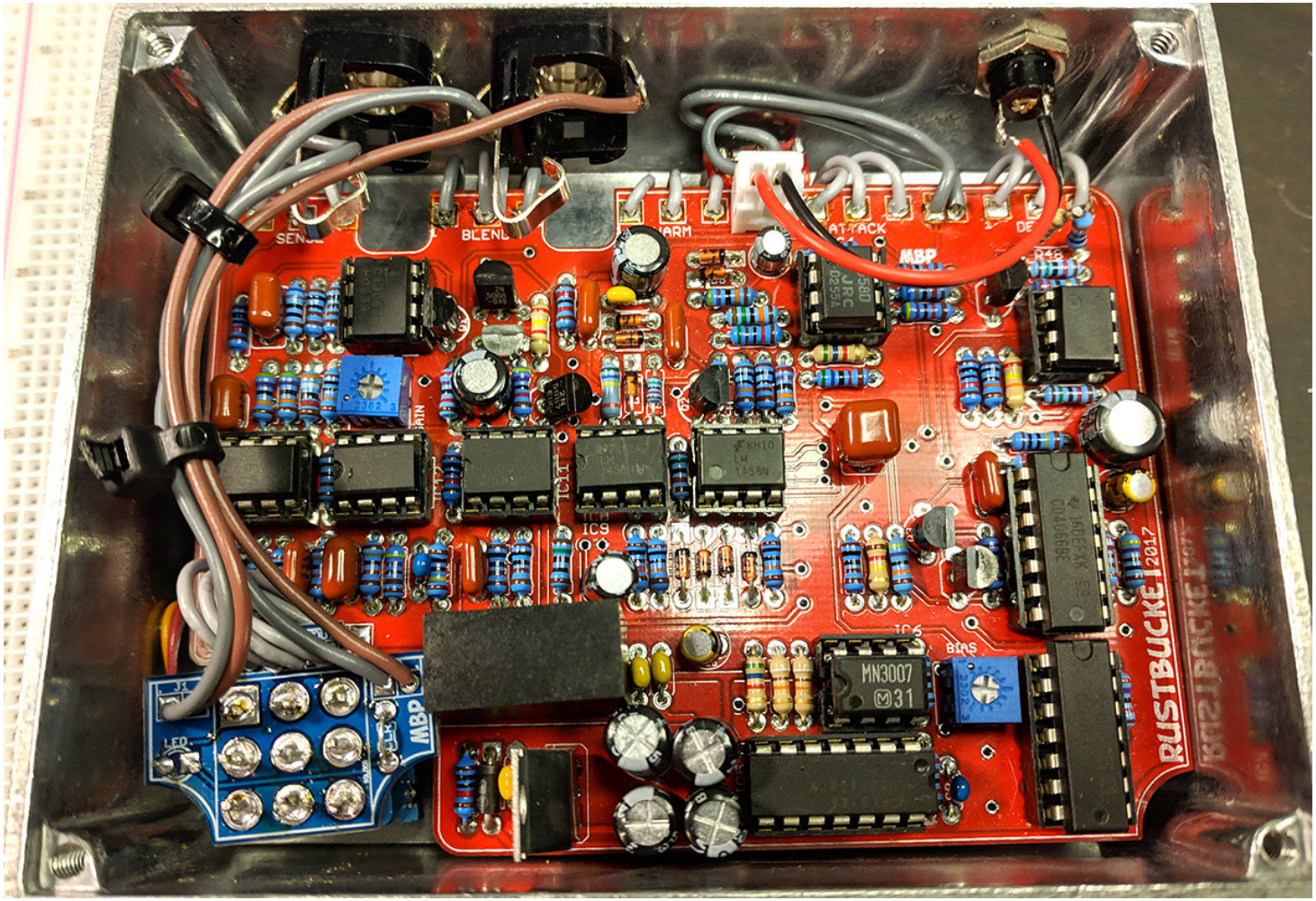
Q5	2N5087
C	-14.5
B	-132mV
E	0

Q6	2N5087
C	-14.32
B	0
E	0.478

Q7	2N5088
C	-13.88
B	-14.42
E	-14.5

Q8	2N5088
C	-14.5
B	-13.89
E	-14.5

Build Pic



Don’t be like me and use a 1590A bypass board for your 3PDT switch. Too close!

Also, this build is an intermittent prototype so it is slightly different than the final production board. Everything is basically in the same place except the top of the board still had PCB mounted pots.