FRAUDHACKER

FX TYPE: Fuzz Octave

Based on the Boss® BF-2™

Enclosure Size: 1590BB

“Softie” compatibility: none

Overview

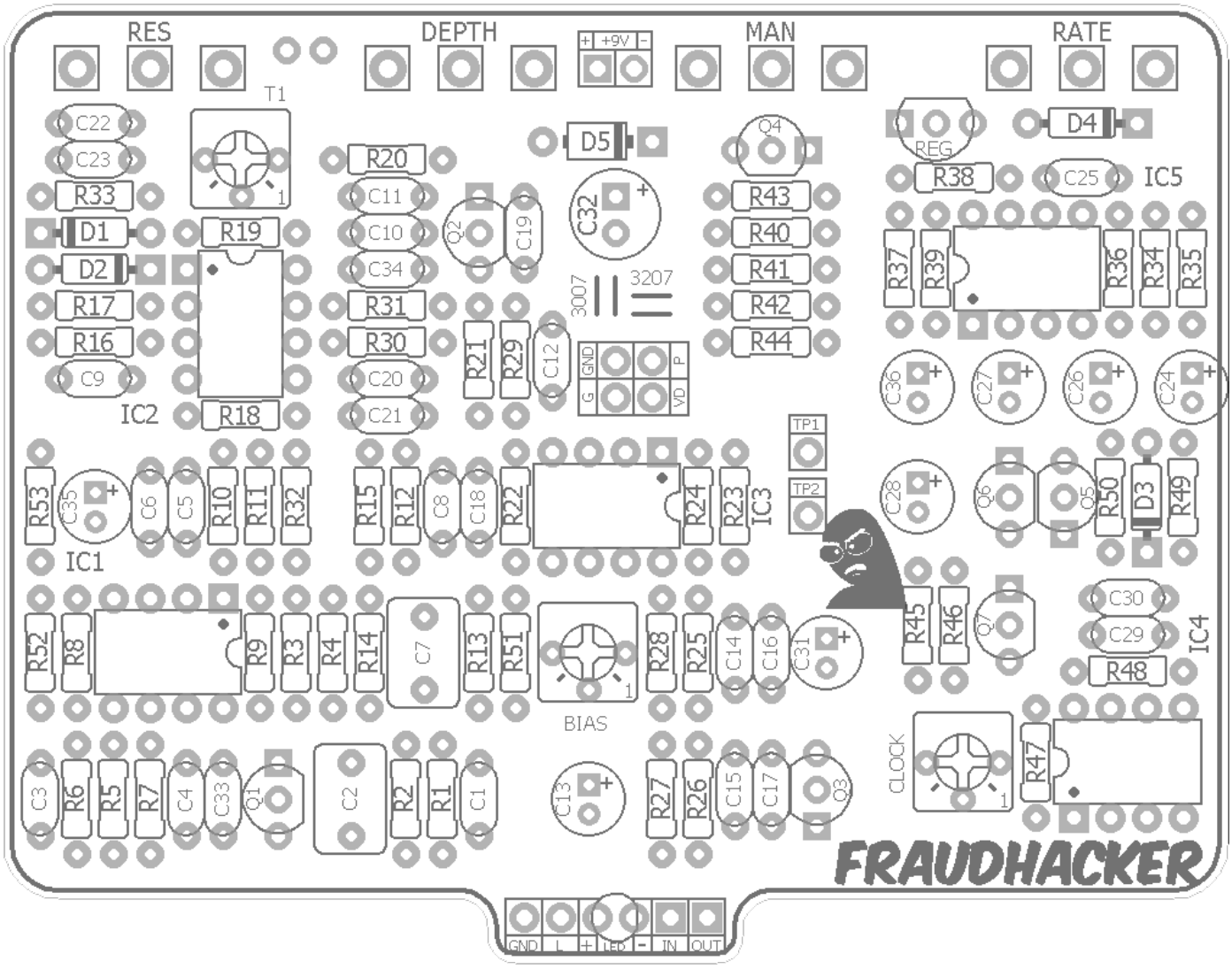
Having built a number of flangers over the years from the exceptional to adequate (I’m not naming names) I can say with reasonable confidence that the BF-2™ falls into the top half of the flanger bell curve. Perhaps not quite as beloved as the MXR 117 or EHX Electric Mistress, the BF-2 holds its own and is likely to satisfy many builders who need a high quality, straight-forward flanger pedal that is easy to build and relatively low cost.

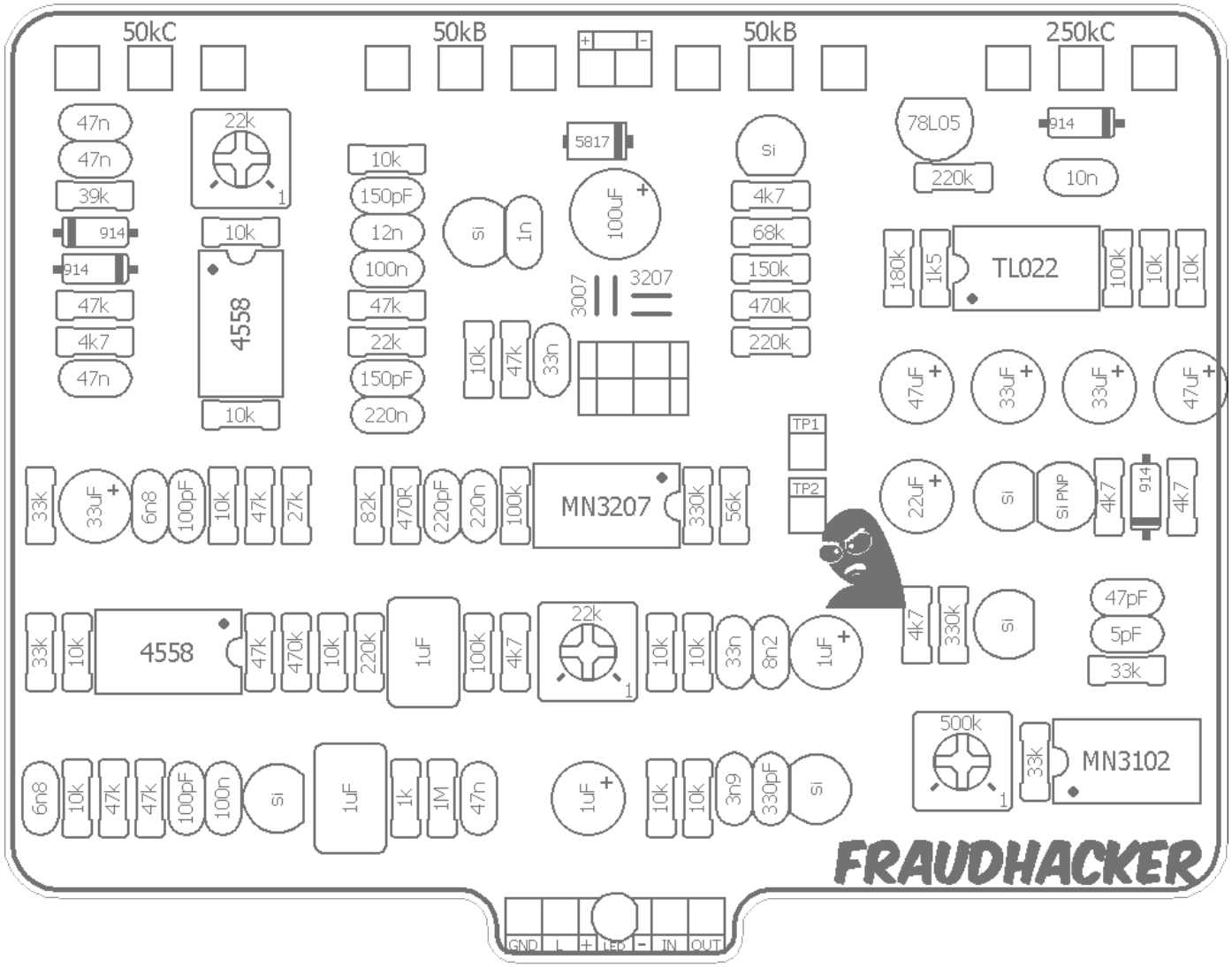
The Fraudhacker is a faithful adaption of the BF-2™. The only modifications made were the removal of the Boss flip-flop bypass (in favor of true bypass), and the option of using different BBD technology depending on part availability. This flanger circuit should be accessible to most experience levels and I can recommend it as a worthy addition to your arsenal.

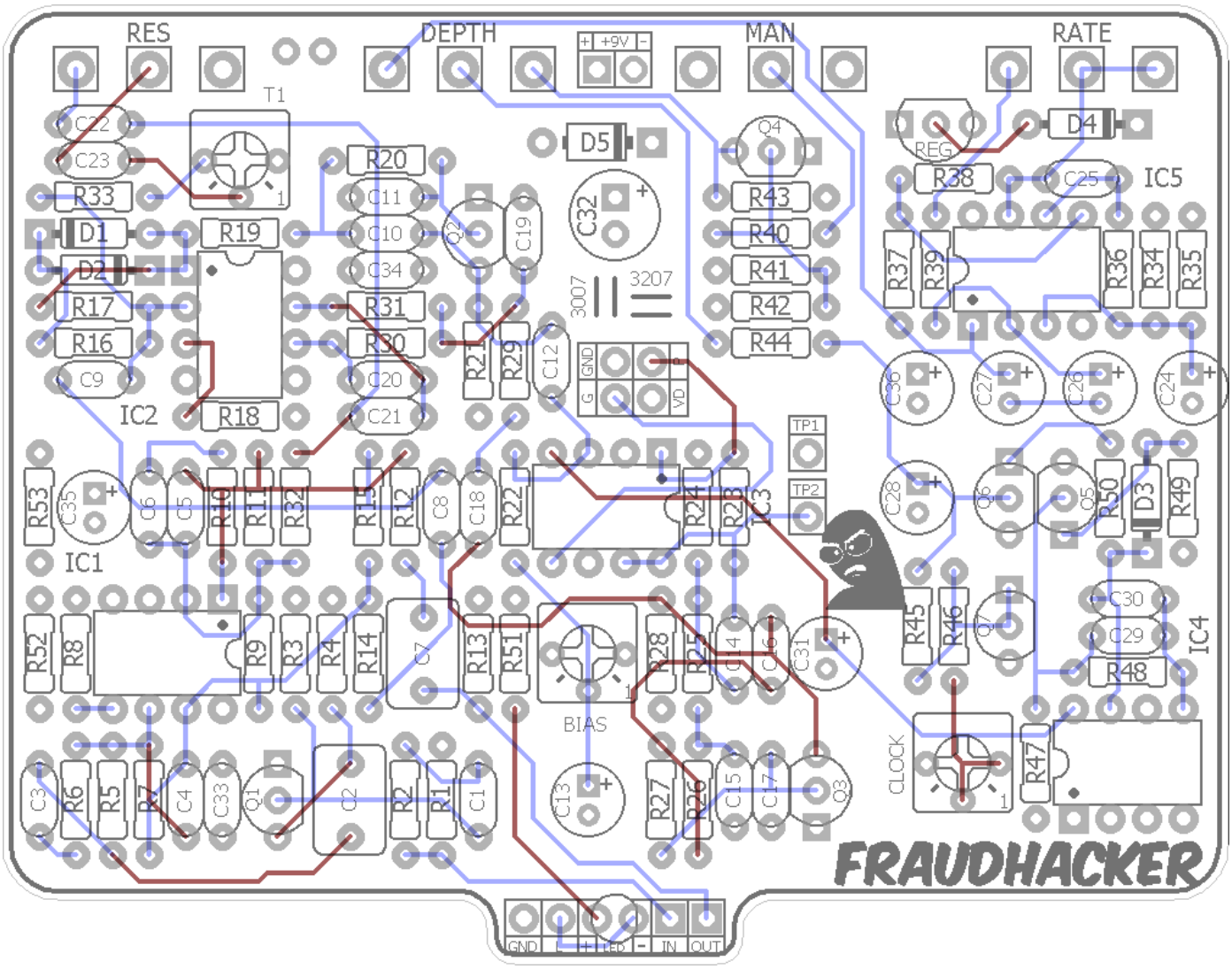
Controls

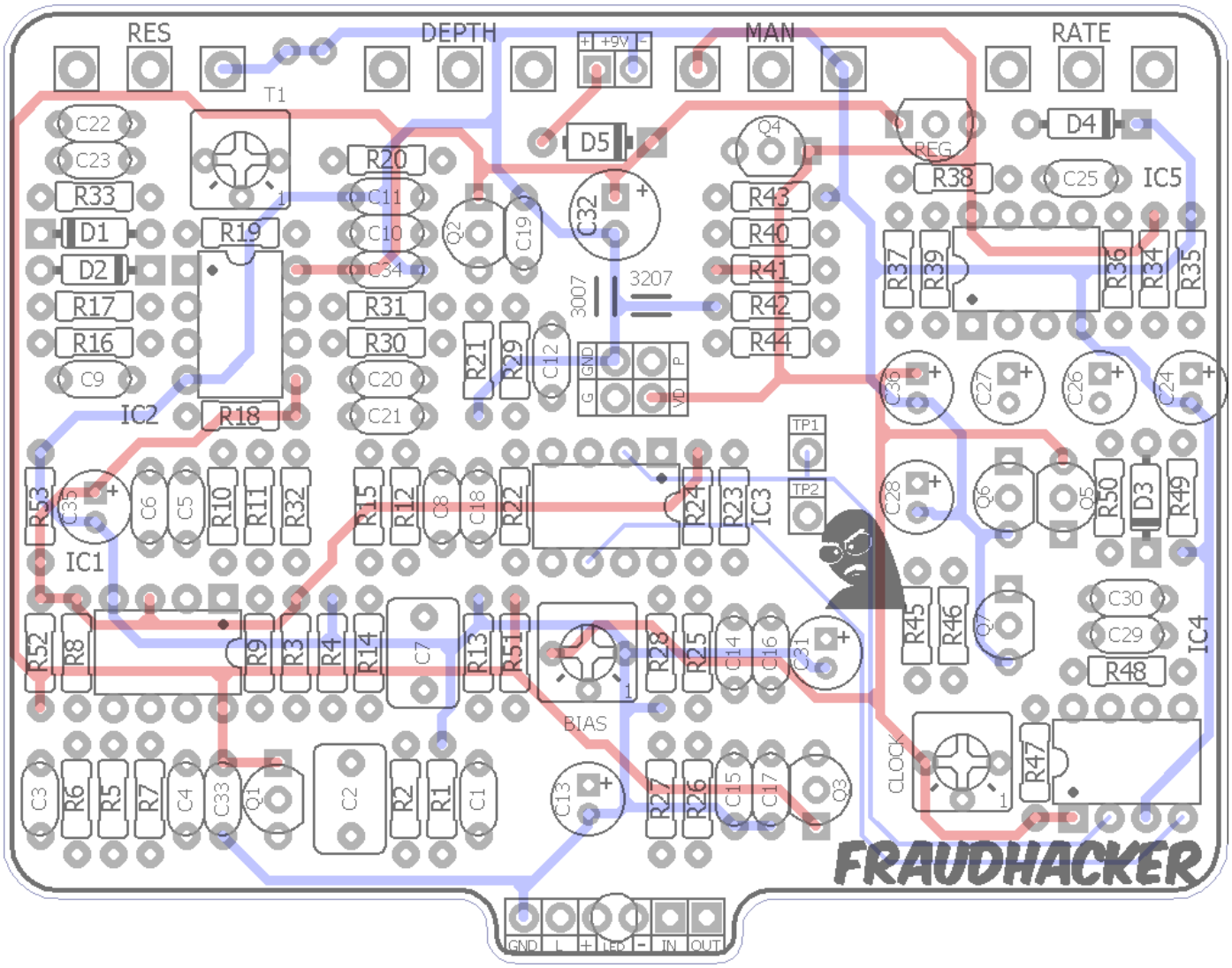
- **RATE -** Modulation speed.
- **MAN -** Used for manual control of the flanger in place of the LFO to set a notched frequency center. MAN is somewhat interactive with the RATE and DEPTH controls and works best when the latter are set at 50% and below.
- **DEPTH -** Modulation intensity.
- **RES -** Modulation feedback.
- **BIAS -** This trimmer sets the voltage input bias of the BBD.
- **CLOCK -** This trimmer sets the maximum operational frequency of the clock chip (it should be 50kHz for the Fraudhacker).
- **T1 -** This trimmer is used to limit the amount of feedack introduced with the Res control to prevent the flanger from going into self-oscillation.

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.


RES
DEPTH
+9V
MAN
RATE
T1
C22
C23
R33
D1
D2
R17
R16
C9
IC2
R19
R18
R20
C11
C10
C34
R31
R30
C20
C21
D5
C32
3007
3207
Q2
C19
R21
R29
C12
GND
G
VD
P
Q4
R43
R40
R41
R42
R44
REG
R38
C25
IC5
D4
R37
R39
R36
R34
R35
C36
C27
C26
C24
TP1
TP2
R53
C35
C6
C5
R10
R11
R32
IC1
R15
R12
C8
C18
R22
R24
R23
IC3
C28
Q6
Q5
R50
D3
R49
R52
R8
R9
R3
R4
R14
C7
R13
R51
BIAS
R28
R25
C14
C16
C31
R45
R46
Q7
C30
C29
R48
IC4
C3
R6
R5
R7
C4
C33
Q1
C2
R2
R1
C1
C13
R27
R26
C15
C17
Q3
CLOCK
R47
FRAUDHACKER
GND
IN
OUT


50kC
50kB
50kB
250kC
47n
47n
39k
914
914
47k
4k7
47n
22k
10k
4558
10k
10k
150pF
12n
100n
47k
22k
150pF
220n
5817
si
1n
100uF
3007
3207
10k
47k
33n
si
4k7
68k
150k
470k
220k
78L05
220k
914
10n
180k
1K5
TL022
100k
10k
10k
47uF
33uF
33uF
47uF
TP1
TP2
33k
33uF
6n8
100pF
10k
47k
27k
82k
470R
220pF
220n
100k
MN3207
330k
56k
22uF
si
si PNP
4k7
914
4k7
33k
10k
4558
47k
470k
10k
220k
1uF
100k
4k7
22k
10k
10k
33n
8n2
1uF
4k7
330k
si
47pF
5pF
33k
500k
33k
MN3102
6n8
10k
47k
47k
100pF
100n
si
1uF
1k
1M
47n
1uF
10k
10k
3n9
330pF
si
FRAUDHACKER
GND
L
+
LED
-
IN
OUT


RES
DEPTH
MAN
RATE
+9V
T1
D5
Q4
D4
REG
IC5
IC2
IC1
IC3
IC4
BIAS
CLOCK
TP1
TP2
FRAUDHACKER
GND
+
LED
-
IN
OUT


RES
DEPTH
MAN
RATE
+9V
T1
D5
Q4
REG
D4
IC5
IC2
IC1
IC3
IC4
BIAS
CLOCK
TP1
TP2
3007
3207
FRAUDHACKER
GND
IN
OUT

Resistors		Resistors		Caps		Caps	
R1	1M	R31	47k	C1	47n	C31	1uF
R2	1k	R32	27k	C2	1uF	C32	100uF
R3	470k	R33	39k	C3	6n8	C33	100n
R4	10k	R34	10k	C4	100pF	C34	100n
R5	47k	R35	10k	C5	100pF	C35	33uF
R6	10k	R36	100k	C6	6n8	C36	47uF
R7	47k	R37	180k	C7	1uF	Diodes	
R8	10k	R38	220k	C8	220pF	D1 - D4	1n914
R9	47k	R39	1k5	C9	47n	D5	1n5817
R10	10k	R40	68k	C10	12n	Transistors	
R11	47k	R41	150k	C11	150pF	Q1	2n5088
R12	470R	R42	470k	C12	33n	Q2	2n5088
R13	100k	R43	4k7	C13	1uF	Q3	2n5088
R14	220k	R44	220k	C14	33n	Q4	2n5088
R15	82k	R45	4k7	C15	3n9	Q5	2n5087
R16	4k7	R46	330k	C16	8n2	Q6	2n5088
R17	47k	R47	33k	C17	330pF	Q7	2n5088
R18	10k	R48	33k	C18	220n	ICs	
R19	10k	R49	4k7	C19	1n	IC1	4558
R20	10k	R50	4k7	C20	150pF	IC2	4558
R21	10k	R51	4k7	C21	220n	IC3	MN3207
R22	100k	R52	33k	C22	47n	IC4	MN3102
R23	56k	R53	33k	C23	47n	IC5	TL022
R24	330k			C24	47uF	Regulator	
R25	10k			C25	10n	REG	78L05
R26	10k			C26	33uF	Trimmers	
R27	10k			C27	33uF	BIAS	22k
R28	10k			C28	22uF	T1	22k
R29	47k			C29	5pF	CLOCK	500k
R30	22k			C30	47pF	Pots	
						DEPTH	50kB
						MAN	50kB
						RES	50kC
						RATE	250kC

Value	QTY	Type	Rating	Value	QTY	Type	Rating
470R	1	Carbon / Metal Film	1/4W	8n2	1	Film	16v min.
1k	1	Carbon / Metal Film	1/4W	10n	1	Film	16v min.
1k5	1	Carbon / Metal Film	1/4W	12n	1	Film	16v min.
4k7	6	Carbon / Metal Film	1/4W	33n	2	Film	16v min.
10k	14	Carbon / Metal Film	1/4W	47n	4	Film	16v min.
22k	1	Carbon / Metal Film	1/4W	100n	2	Film	16v min.
27k	1	Carbon / Metal Film	1/4W	220n	2	Film	16v min.
33k	4	Carbon / Metal Film	1/4W	1uF	1	Film	16v min.
39k	1	Carbon / Metal Film	1/4W	1uF	3	Electrolytic	16v min.
47k	7	Carbon / Metal Film	1/4W	22uF	1	Electrolytic	16v min.
56k	1	Carbon / Metal Film	1/4W	33uF	3	Electrolytic	16v min.
68k	1	Carbon / Metal Film	1/4W	47uF	2	Electrolytic	16v min.
82k	1	Carbon / Metal Film	1/4W	100uF	1	Electrolytic	16v min.
100k	3	Carbon / Metal Film	1/4W	1n914	4		
150k	1	Carbon / Metal Film	1/4W	1n5817	1		
180k	1	Carbon / Metal Film	1/4W	2n5088	6		
220k	3	Carbon / Metal Film	1/4W	2n5087	1		
330k	2	Carbon / Metal Film	1/4W	4558	2		
470k	2	Carbon / Metal Film	1/4W	MN3207	1		
1M	1	Carbon / Metal Film	1/4W	MN3102	1		
5pF	1	Ceramic / MLCC	16v min.	TL022	1		
47pF	1	Ceramic / MLCC	16v min.	78L05	1		
100pF	2	Ceramic / MLCC	16v min.	22k	2	Bourns 3362p	
150pF	2	Ceramic / MLCC	16v min.	500k	1	Bourns 3362p	
220pF	1	Ceramic / MLCC	16v min.	50kB	2	PCB Right Angle	16mm
330pF	1	Ceramic / MLCC	16v min.	50kC	1	PCB Right Angle	16mm
1n	1	Film	16v min.	250kC	1	PCB Right Angle	16mm
3n9	1	Film	16v min.				
6n8	2	Film	16v min.				

MN3207/MN3102:
https://cabintechglobal.com/mn3207
https://cabintechglobal.com/mn3102

Some people have had good luck with the Cabintech MN32xx supply and some have not. I bought two sets. Both worked. YMMV.

v3207/v3102:
These seem out of stock in most places. They may be available directly from CoolAudio but they do not appear to sell in quantities less than 10.

MN3007:
https://cabintechglobal.com/mn3007
https://smallbear-electronics.mybigcommerce.com/ic-mn3007-xvive-audio-re-makes/

Using an MN3007 requires an MN3101. The MN3102 cannot be used.

TL022:
https://stompboxparts.com/semiconductors/tl022cp-dual-op-amp-ic/
https://www.taydaelectronics.com/tl022cp-tl022-operational-amplifier-ic.html

Bourns 500k trimmer:
https://stompboxparts.com/pots/trim-pot-3362p/
https://www.taydaelectronics.com/potentiometer-variable-resistors/cermet-potentiometers/3362p/500k-ohm-trimmer-potentiometer-cermet-1-turn-3362-3362p.html

Bourns 22k Trimmer
https://stompboxparts.com/pots/trim-pot-3362p/
https://www.taydaelectronics.com/potentiometer-variable-resistors/cermet-potentiometers/3362p/20k-ohm-trimmer-potentiometer-cermet-1-turn-3362p.html

- 20k and 25k can be subbed for 22k without issue.

16mm Right Angle Pots:
http://smallbear-electronics.mybigcommerce.com/alpha-single-gang-16mm-right-angle-pc-mount/

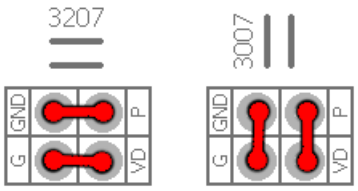
DC Jacks:
https://smallbear-electronics.mybigcommerce.com/2-1-mm-all-plastic-round/
https://stompboxparts.com/power-connections/dc-power-jack-2-1mm-low-profile/
https://lovemyswitches.com/thinline-lumberg-dc-power-jack-2-1mm/

1/4” jacks:
https://smallbear-electronics.mybigcommerce.com/1-4-in-mono-nys229/
https://smallbear-electronics.mybigcommerce.com/1-4-in-mono-switchcraft-11/
https://lovemyswitches.com/1-4-mono-jack-lumberg-klbm-3/
https://lovemyswitches.com/1-4-mono-jack-neutrik-rean-nys229/

My preferred 3PDT switch:
https://lovemyswitches.com/pro-3pdt-latched-foot-switch-solder-lugs-feather-soft-click/

Due to a manufacturing error, the bypass LED needs a small workaround in order to function properly. At issue is when the cathode of the LED is soldered directly to the PCB (as normal) the LED remains dimly lit when "off". In order to make the LED go fully dark in bypass, you'll need to omit the hookup spot on the PCB and wire the cathode directly to the 3PDT switch. This eliminates the problem. This should only be an issue for this first batch of boards. I will be switching to another manufacturer for subsequent runs. See the wiring diagram for more.

I've included the option to use either MN/v3207, MN/v3102 **or** MN3007/MN3101 for the BBD and clock chips. Since this effect only runs at 9v, there really is no reason to use the MN3007/MN3101. However, we continue to be in a supply chain vacuum so the 3207 and 3102 may not be easily available. There are two jumper wires you need to solder in on the PCB according to which technology you use.



You can mix and match the MN and "v" (Cool Audio) brands of the 3207 and 3102 but if you use an MN3007 BBD you *must* also use an MN3101 clocking chip. The MN3102 will not work properly with an MN3007.

Calibration

Luckily, calibrating the Fraudhacker is very easy. Here's what you need to do:

1. Set all controls full CCW and all trimmers halfway up.

2. If you have an audio probe, connect the probe to the "TP2" pad on the PCB (TP2 is connected to pins 7&8 of IC3). Using some audio input to the circuit adjust the Bias trimmer until you achieve the cleanest sounding output possible at TP2. If you do not have an audio probe, just listen to the effect output instead of using TP2 and adjust the Bias trimmer for a similar result.

3. If you have a frequency measurement setting on your multimeter, connect the black lead to ground and the red lead to the "TP1" pad on the PCB (TP1 is connected to pin2 of IC3). Adjust the clock trimmer until you get a reading of 50kHz. If you do not have a frequency measurement tool, leave the Clock trimmer at about half up. BTW: you do not need any audio input for this step.

4. Now you can start to adjust all the controls to verify that they are working correctly. Check slow and fast Rates, different Depth, Manual and Res settings for function.

5. The final step is to set T1. This limits the amount of feedback created by the Res control. In the absence of T1, the circuit will go into self-oscillation when the Res control is at max. We will use T1 to prevent that.

6. Use the following settings: Rate 1/3 up, Depth and Res full up, Man full CCW.

7. Using audio input to the circuit adjust T1 so that the max Res setting cuts off just before self-oscillation. If you are adventurous, you can set T1 so that there is *just a hint* of oscillation when the Res control is maxed. This can sound cool. You just have to be careful since it can get really loud really quick if you don't control it.

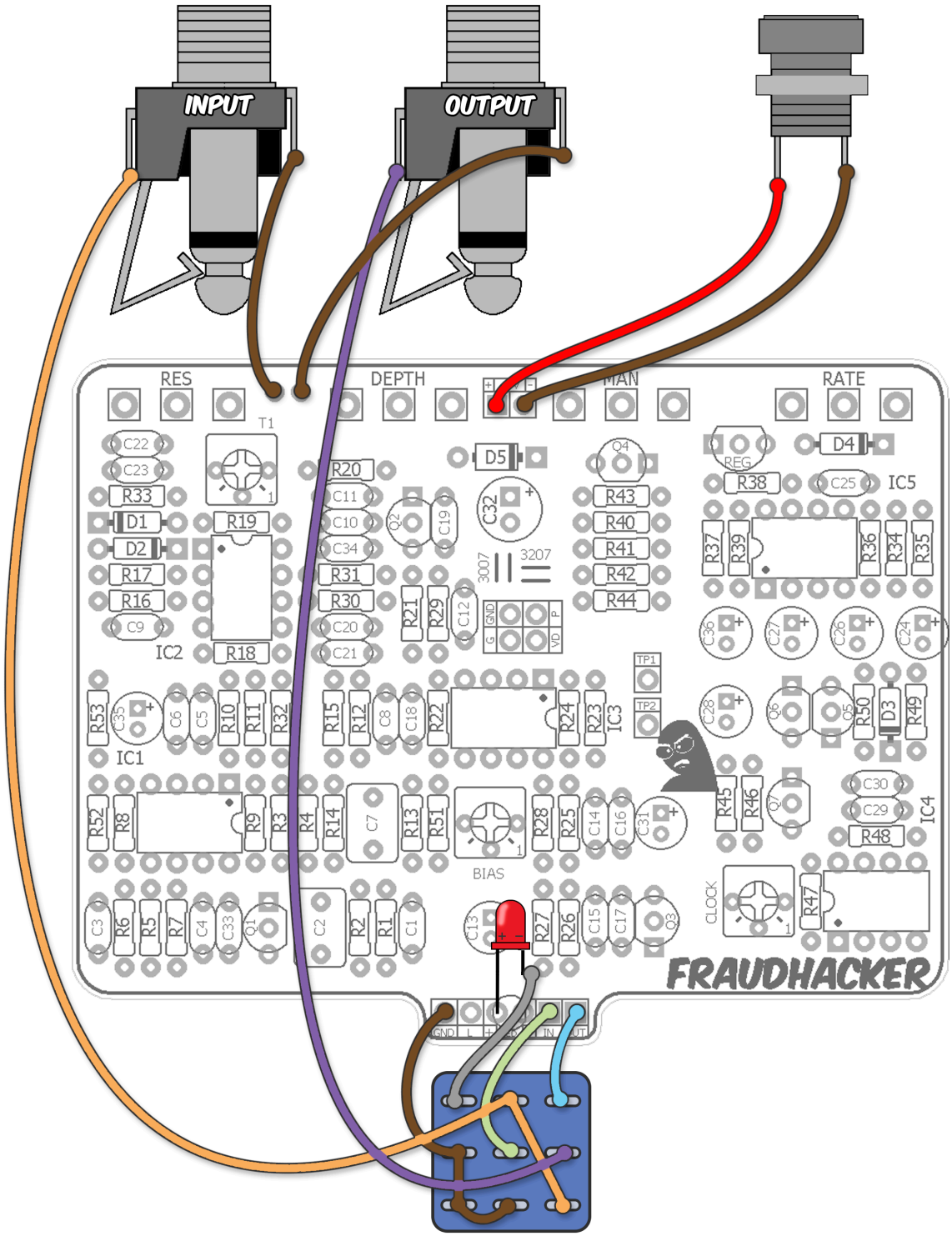
Mods

You may wonder if one uses the MN3007/MN3101 chipsets then can the Fraudhacker run at higher voltages? And the answer is yes but with a caveat. I have tested the circuit with 12v power and it works fine. However, you'll notice that in this circuit the BBD supply voltage is *limited to the regulator output* which is about 5.6v stock. So, running it at 12v does nothing for the BBD itself. However, you can try substituting a higher voltage regulator in place of the 5v one (socketing REG is a good idea here). I tested it using a 6v regulator with the circuit running at 12v and it worked fine. You may even be able to go up to a 9v regulator but I did not test that. Most likely you'll need to re-adjust the clock trimmer if you make any of these changes.

Your next question might be: can I just ditch the regulator altogether with the MN3007 and make everything run at 12v? The answer is no, you cannot. It turns out that the regulator prevents LFO ticking in this circuit. So, it's necessary. And, honestly: this circuit sounds just fine stock. I don't see any big advantage in pushing the supply a couple extra volts. But, someone will end up asking these questions so luckily I've already done the work to try to answer them!

Lastly, and because you may not already be confused enough, I did test running the circuit @ 9v with MN3207/MN3102 but using a 6v regulator instead of 5v and that also worked just fine.

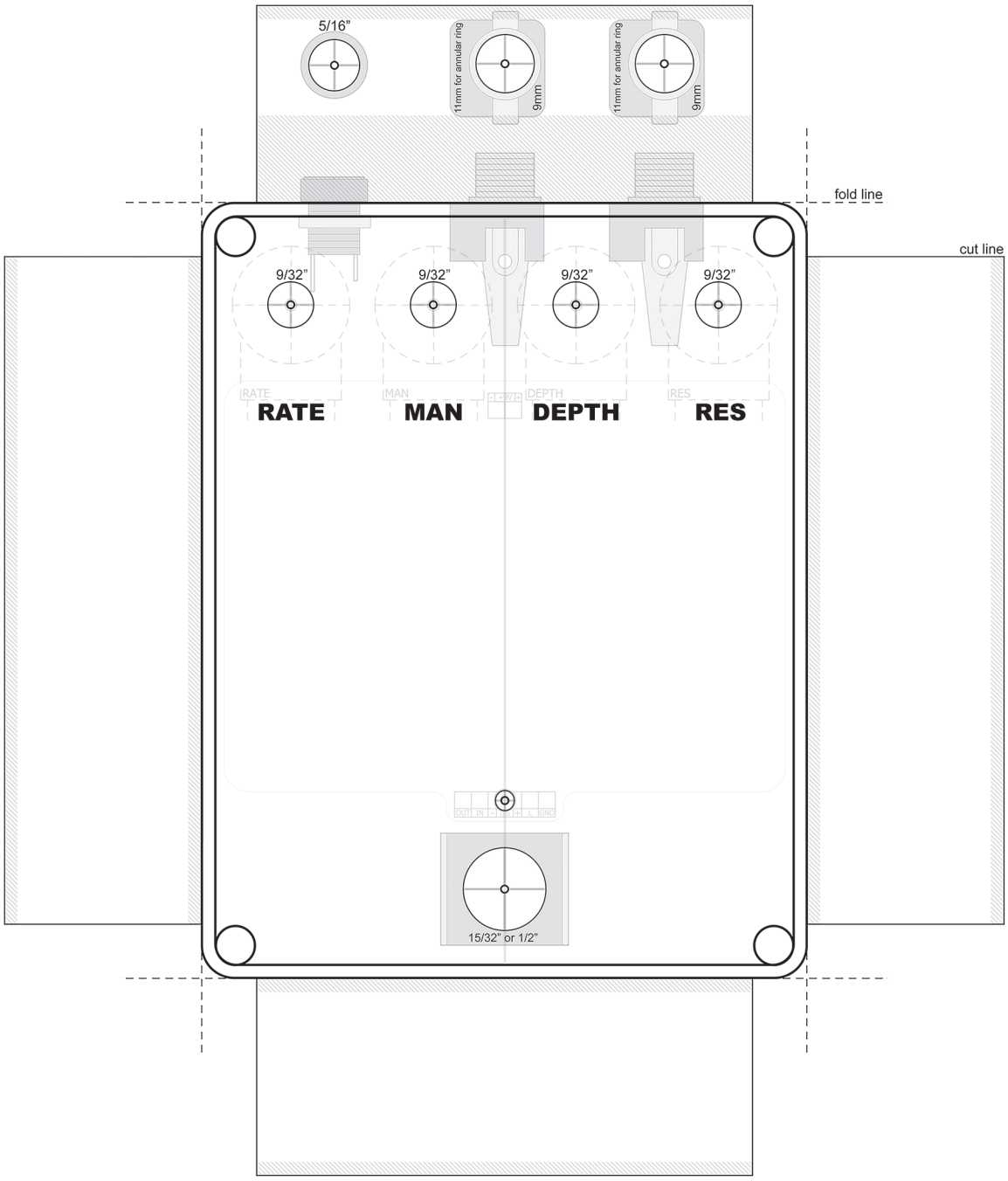
FINAL NOTE:
On the schematic I listed the transistors as "Si" without a specific designation. I used both 2n5088 and 2n5087 for the NPN and PNP parts, resp. Other pin compatible transistors might work depending on what you have available. I believe 2n3904 and 2n3906 would work well as subs if needed but I did not test any transistor types other than the 5088/5087.



The long lead (anode) of the LED can be soldered directly to the PCB. Solder a wire (shown in gray) to the negative lead (cathode) of the LED and connect it to the 3PDT as shown. Do not use the “L” pad on the PCB.

I suggest using ample wire for the input and output jack. This will allow you to route them far away from the Rate pot/LFO.

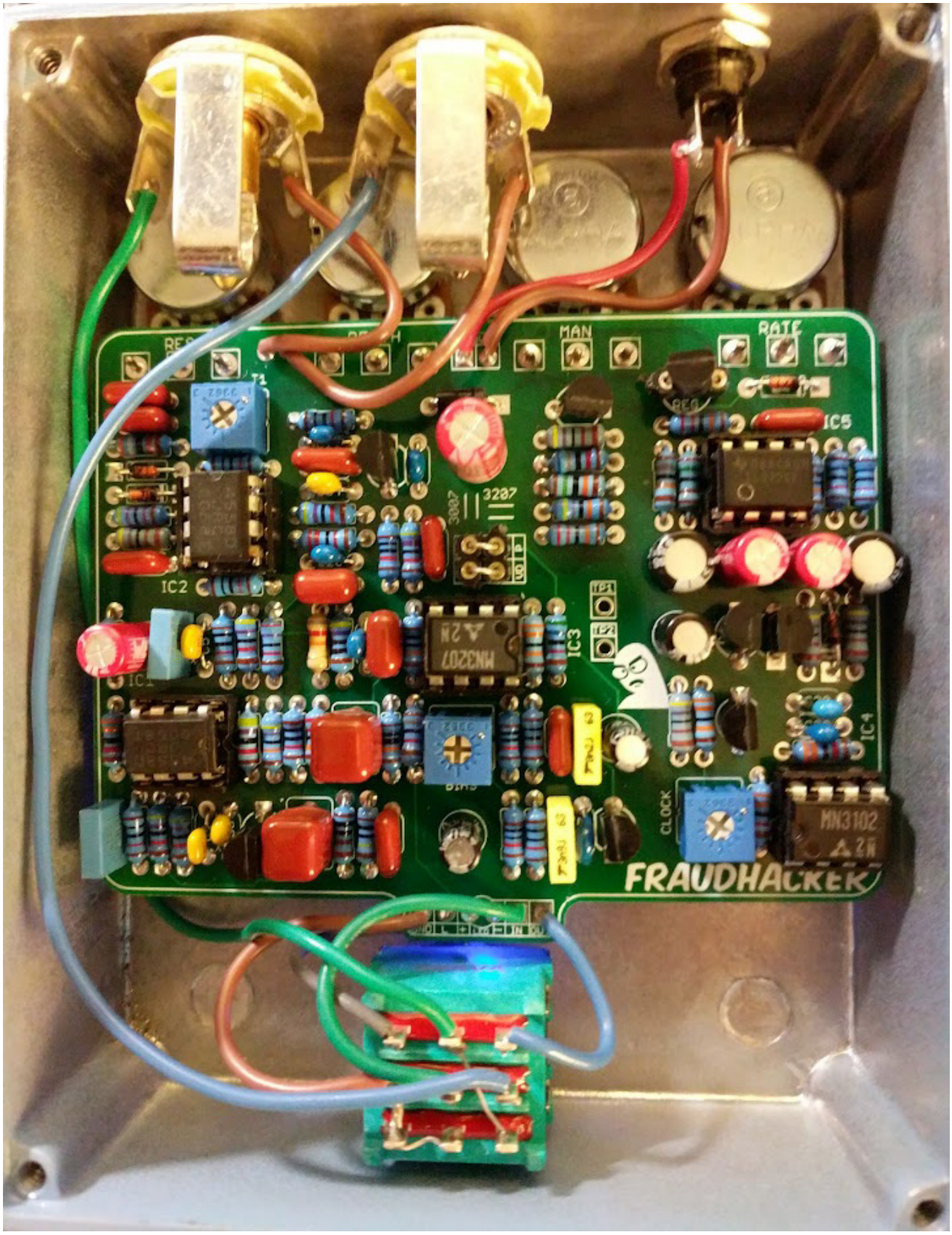
Note: *Drill Guides are approximate and may require tweaking depending on the types of jacks, switches and pots you use.*

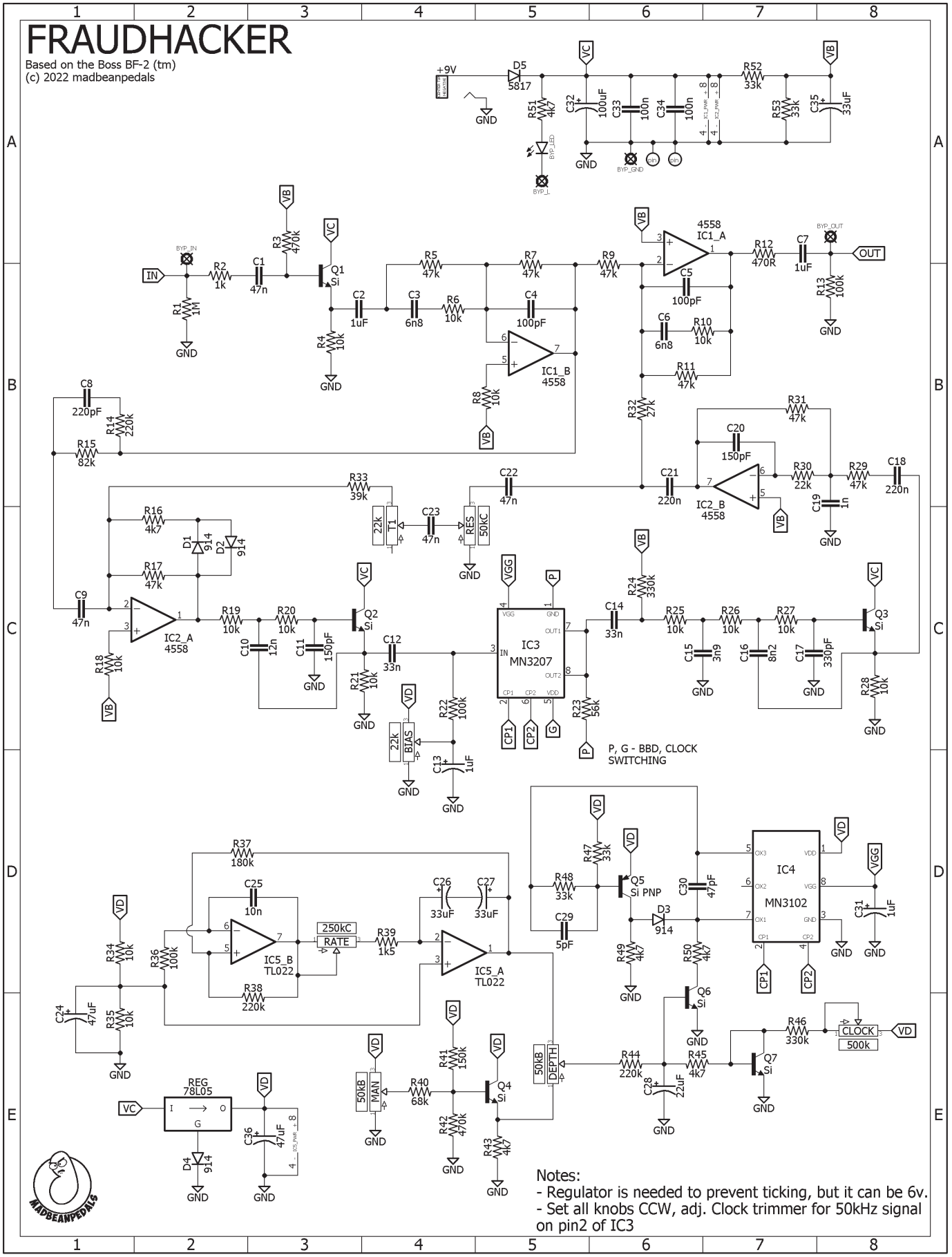


IC1	4558
1	4.54
2	4.53
3	4.53
4	0
5	4.53
6	4.54
7	4.55
8	9.24
IC2	**4558**
1	4.54
2	4.52
3	4.49
4	0
5	4.53
6	4.53
7	4.59
8	9.24
IC3	**MN3207**
1	0
2	2.75
3	2.87
4	5.29
5	5.97
6	2.77
7	3.18
8	3.18
IC4	**MN3102**
1	5.67
2	2.75
3	0
4	2.77
5	5.52
6	155mV
7	4.56
8	5.29

IC5	TL022
1	varies
2	2.83
3	2.83
4	0
5	varies
6	varies
7	varies
8	5.67
Q1	**2n5088**
C	9.24
B	3.96
E	3.51
Q2	**2n5088**
C	9.24
B	4.52
E	3.94
Q3	**2n5088**
C	9.24
B	3.95
E	3.46
Q4	**2n5088**
C	5.67
B	1.59
E	1.03
Q5	**2n5087**
C	208mV
B	5.55
E	5.67
Q6	**2n5088**
C	4.2
B	517mV
E	0
Q7	**2n5088**
C	498mV
B	498mV
E	0
REG	**78L05**
I	9.24
G	0.63
O	5.67

- 9.42vDC One Spot
- Current Draw: ~15mA
- All knobs set CCW


MAN
RATE
IC5
IC2
IC3
IC4
IC1
CLOCK
MN3102
FRAUDHACKER


FRAUDHACKER
Based on the Boss BF-2 (tm)
(c) 2022 madbeanpedals
+9V
D5
5817
VC
VB
R51 4k7
C32 100uF
C33 100n
C34 100n
R52 33k
R53 33k
C35 33uF
GND
BYP_LED
BYP_L
BYP_GND
BYP_IN
IN
R1 1M
R2 1k
C1 47n
R3 470k
Q1 Si
C2 1uF
R4 10k
R5 47k
C3 6n8
R6 10k
R7 47k
C4 100pF
IC1_B 4558
R8 10k
R9 47k
IC1_A 4558
C5 100pF
C6 6n8
R10 10k
R11 47k
R12 470R
C7 1uF
BYP_OUT
OUT
R13 100k
C8 220pF
R14 220k
R15 82k
R31 47k
C20 150pF
R32 27k
C21 220n
IC2_B 4558
R30 22k
R29 47k
C18 220n
C19 1n
R33 39k
C22 47n
C23 47n
22k T1
RES 50kC
R16 4k7
D1 914
D2 914
R17 47k
C9 47n
IC2_A 4558
R18 10k
R19 10k
R20 10k
C10 12n
C11 150pF
Q2 Si
C12 33n
R21 10k
R22 100k
22k BIAS
C13 1uF
VGG
P
IC3 MN3207
CP1
CP2
G
R23 56k
R24 330k
C14 33n
R25 10k
R26 10k
R27 10k
Q3 Si
C15 3n9
C16 8n2
C17 330pF
R28 10k
P, G - BBD, CLOCK SWITCHING
R37 180k
C25 10n
IC5_B TL022
250kC RATE
R39 1k5
C26 33uF
C27 33uF
IC5_A TL022
R38 220k
R34 10k
R36 100k
C24 47uF
R35 10k
R47 33k
R48 33k
Q5 Si PNP
C29 5pF
D3 914
C30 47pF
IC4 MN3102
C31 1uF
R49 4k7
R50 4k7
Q6 Si
REG 78L05
D4 914
C36 47uF
50kB MAN
R40 68k
R41 150k
Q4 Si
R42 470k
R43 4k7
50kB DEPTH
R44 220k
R45 4k7
C28 22uF
Q7 Si
R46 330k
CLOCK 500k
Notes:
- Regulator is needed to prevent ticking, but it can be 6v.
- Set all knobs CCW, adj. Clock trimmer for 50kHz signal on pin2 of IC3
MADBEANPEDALS