VFE_BUMBLEBEE

FX TYPE: Compressor / Swell

Enclosure Size: 1590B

Overview

From the VFE website:

Create ambient textures and unique effects with the BUMBLEBEE, a combination swell & compressor pedal. A wide attack ranges yields bowed guitar, reverse delay, and slow, synth pad-style effects. Blend it with the optical compressor for a unique “blooming” effect, or isolate the compressor & use it to tighten up your tone. Combine with the Blueprint or a reverb pedal for a taste of sonic heaven. The BUMBLEBEE loves bass too!

HOW THE BUMBLEBEE CAME TO BE

The very first pedal I built was a clone of the Boss SG-1 Slow Gear. It barely worked. After countless hours of finding my mistakes and modifying the circuit to swell longer, I was hooked. I went on a pedal building and modifying rampage, which eventually led to designing my own circuits - and the Bumblebee was one of the very first VFE designs.

The Bumblebee is a result of a long-evolution of design, always pushing the envelope to see how slow I could get a guitar or bass to swell. This quest led to the addition of the compressor to the front end of the circuit, which allows for long swells to ring out without dying off too quickly.

Controls

LEVEL: Sets the amount of gain in the output section. As a swell pedal, a master volume/boost is critical to creating the perfect swell and avoiding volume drops.

SUSTAIN: Sets the gain/sustain of the optical compressor. The compressor section is tuned to work with the swell, so settings above 12:00 will result in a LOT of squish. For use as an “always on”, natural compressor, set this control at 12:00 or below.

ATTACK: Sets the speed of the swell effect. The range of this control is set by the S-F-M switch above it.

MIX: Blends between the swell and compressor output sections. Use this to isolate either section, or blend them for a unique “blooming” effect.

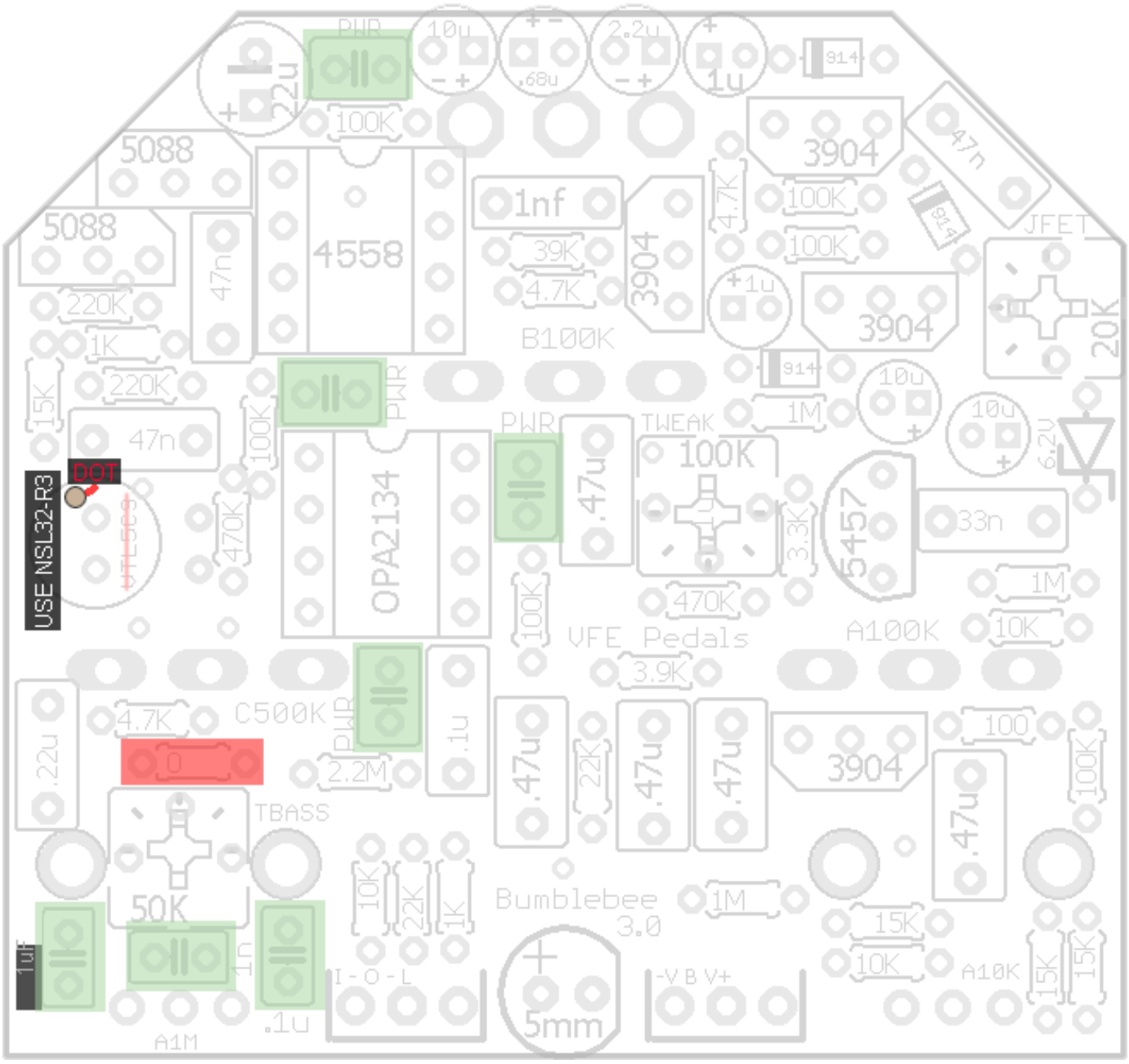
TRIGGER: Adjust the sensitivity of the swell effect. This control is the key to getting the best, most natural swell sounds. Set it so that the signal cuts out when you mute the strings, and swells in full when you pluck them (even a single string played on the 20th fret).

S-F-M: Sets the range of swells that the ATTACK control can achieve. S = slow, F = fast, M = medium. This control also affects the release, or how long it takes for the effect to “reset” between notes.

TBASS: This trimmer balances the sensitivity of the swell from low to high notes.

TWEAK, JFET: These trimmer are used to set the 2n5457 JFET for the optimal swell effect (see notes).

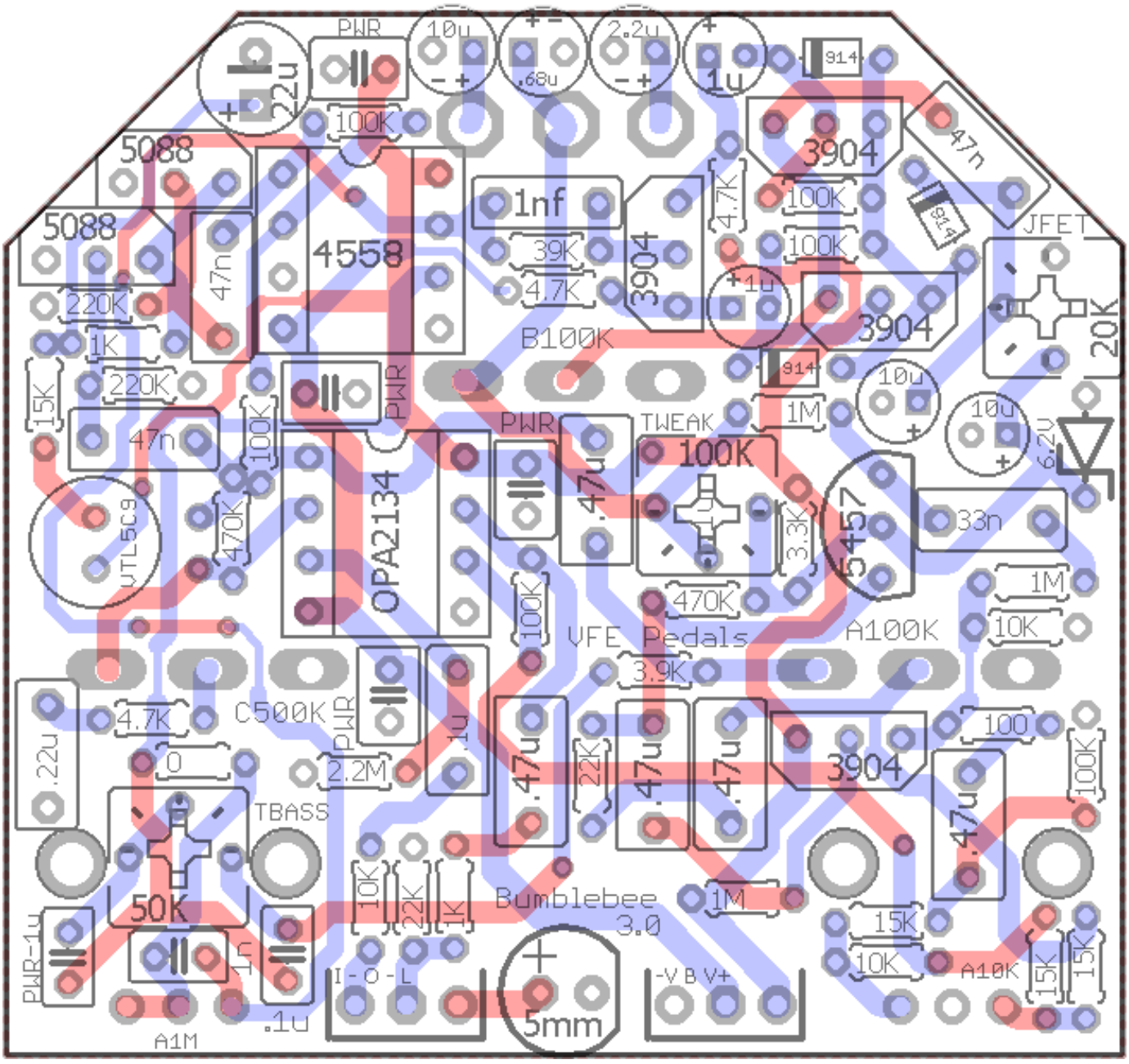
Technical assistance for your build(s) is available via the madbeanpedals forum. Please go there rather than emailing me for assistance on builds. This is because (1) I’m not always available to respond via email in a timely and continuous manner, and (2) posting technical problems and solutions in the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



The 2.5mm MLCC caps are highlighted in green. The bottom left is 1uF. Next to it is 1n. All other ones are 100n.

Red highlight - solder a jumper there.

Use NSL32-R3, not the VTL5C9. The cream dot on the part denotes the cathode of the internal LED on the optocoupler and should be placed as shown above.


PWR
10u
.68u
2.2u
1u
914
47n
3904
100K
5088
5088
4558
1nf
39K
4.7K
3904
4.7K
100K
JFET
20K
220K
1K
220K
47n
B100K
1u
914
3904
1M
10u
10u
6.2V
15K
47n
100K
PWR
PWR
TWEAK
100K
.47u
5457
33n
470K
OPA2134
VTL5C9
3.3K
1M
10K
100K
470K
VFE Pedals
A100K
3.9K
4.7K
C500K
PWR
2.2M
.1u
.47u
22K
.47u
.47u
3904
100
100K
.22u
0
TBASS
.47u
50K
10K
22K
1K
Bumblebee
3.0
1M
15K
10K
A10K
15K
15K
PWR-1u
1n
.1u
I - O - L
5mm
-V B V+
A1M

Resistors		Caps		Diodes	
R1	470K	C1	1n	D2	6.2v Zener
R2	22K	C2	1uF	D3	1n914
R3	1K	C3	100n	D4	1n914
R4	1K	C4	680n	D5	1n914
R5	jumper	C5	10uF	Transistors	
R6	10K	C6	100n	Q1	2n5088
R7	2M2	C7	100n	Q2	2N5457
R8	3k9	C8	220n	Q3	2n5088
R9	4k7	C9	22uF	Q4	2n3904
R10	100K	C10	47n	Q5	2n3904
R11	100K	C11	47n	Q6	2n3904
R12	220K	C12	100n	Q7	2n3904
R13	220K	C13	470n	Opto	
R14	15K	C14	2u2	LDR1	NSL32-R3
R15	470K	C15	100n	IC	
R17	4k7	C16	10uF	IC1	OPA2134a
R20	39K	C17	470n	IC2	4558
R22	1M	C18	33n	Switch	
R25	3k3	C19	470n	MODE	On/Off/On
R26	1M	C20	1uF	Trimmers	
R27	1M	C21	1uF	TRIM	20K
R28	100R	C22	47n	BASS	50K
R29	10K	C23	10uF	TWEAK	100K
R30	100K	C24	470n	Pots	
R31	15K	C25	1n	MIX	10kA
R32	4k7	C26	100n	TRIGGER	1MA
R33	100K	C27	470n	LEVEL	100kA
R34	100K			ATTACK	100kB
R35	15K			SUSTAIN	500kC
R36	10K				
R37	15K				
R38	100K				
R39	22K				

Value	QTY	Type	Rating
100R	1	Carbon / Metal Film	1/8W
1K	2	Carbon / Metal Film	1/8W
3k3	1	Carbon / Metal Film	1/8W
3k9	1	Carbon / Metal Film	1/8W
4k7	3	Carbon / Metal Film	1/8W
10K	3	Carbon / Metal Film	1/8W
15K	4	Carbon / Metal Film	1/8W
22K	2	Carbon / Metal Film	1/8W
39K	1	Carbon / Metal Film	1/8W
100K	6	Carbon / Metal Film	1/8W
220K	2	Carbon / Metal Film	1/8W
470K	2	Carbon / Metal Film	1/8W
1M	3	Carbon / Metal Film	1/8W
2M2	1	Carbon / Metal Film	1/8W
1n	1	MLCC - 2.5mm	25v min.
100n	5	MLCC - 2.5mm	25v min.
1uF	1	MLCC - 2.5mm	25v min.
1n	1	Film	25v min.
33n	1	Film	25v min.
47n	3	Film	25v min.
100n	1	Film	25v min.
220n	1	Film	25v min.
470n	5	Film	25v min.

Value	QTY	Type	Rating
0.68uF	1	Electrolytic	25v min.
1uF	2	Electrolytic	25v min.
2u2	1	Electrolytic	25v min.
10uF	3	Electrolytic	25v min.
22uF	1	Electrolytic	25v min.
Zener	1	6.2v	
1n914	3		
2n5088	2		
2N5457	1	*see notes	
2n3904	4		
NSL32-R3	1		
OPA2134a	1		
4558	1		
On/Off/On	1	SPDT / PCB Pin Mount	
20K	1	Bourns 3362p	
50K	1	Bourns 3362p	
100K	1	Bourns 3362p	
10kA	1	Right Angle Plastic Shaft	9mm
1MA	1	Right Angle Plastic Shaft	9mm
100kA	1	PC Mount Right Angle	16mm
100kB	1	PC Mount Right Angle	16mm
500kC	1	PC Mount Right Angle	16mm

Resistors	https://www.mouser.com/Xicon/Passive-Components/Resistors/Film-Resistors/Metal-Film-Resistors-Through-Hole/_/N-7gz41?P=1yzaok0Z1z0zls8Z1z1414h http://smallbear-electronics.mybigcommerce.com/resistors-1-8-w-1-metal-film/
1n	http://www.mouser.com/ProductDetail/KEMET/C320C102J5G5TA/?qs=sGAEpiMZZMt3KoXD5rJ2NyCoF5j9nbtORIOIgJ9L0hY%3d
100n	http://www.mouser.com/Search/ProductDetail.aspx?R=C320C104K5R5TAvirtualkey64600000virtualkey80-C320C104K5R
1uF	https://www.mouser.com/ProductDetail/TDK/FG18X7R1E105KRT00?qs=sGAEpiMZZMvsSlwiRhF8qqG20SskRxtTWmu5pRd0MWR2hMB%252B0SwsFA%3D%3D
Film	http://smallbear-electronics.mybigcommerce.com/tmc07-box-1/
Electrolytic	http://smallbear-electronics.mybigcommerce.com/aluminum-radial-1/
0.68uF	https://www.mouser.com/ProductDetail/Nichicon/UKL2AR68KDD?qs=sGAEpiMZZMtZ1n0r9vR22SMYX67SZ2TePdfDG45dRrM%3D
6.2v Zener	https://www.mouser.com/ProductDetail/Vishay-Semiconductors/1N4735A-TR?qs=sGAEpiMZZMtQ8nqTKtFS%2FJrR9ou1I1aD2lX4jQGgky0%3D
1n914	http://smallbear-electronics.mybigcommerce.com/diode-1n914/
2n5088	http://smallbear-electronics.mybigcommerce.com/transistor-2n5088/
2n5457	http://smallbear-electronics.mybigcommerce.com/transistor-fet-2n5457/
2n3904	http://smallbear-electronics.mybigcommerce.com/transistor-2n3904/
NSL32R3	http://www.smallbear-electronics.mybigcommerce.com/photocoupler-silonex-nsl-32sr3/
OPA2134	http://www.mouser.com/Search/ProductDetail.aspx?R=OPA2134PAvirtualkey59500000virtualkey595-OPA2134PA http://smallbear-electronics.mybigcommerce.com/ic-opa2134pa/
4558	http://smallbear-electronics.mybigcommerce.com/ic-jrc4558d/
On/Off/On	http://smallbear-electronics.mybigcommerce.com/spdt-center-off/
20k	https://www.mouser.com/ProductDetail/Bourns/3362P-1-203LF/?qs=sGAEpiMZZMvygUB3GLcD7iDNlz%2fNDKomhkYgCqD12rc%3d
50k	https://www.mouser.com/ProductDetail/Bourns/3362P-1-503LF?qs=sGAEpiMZZMvygUB3GLcD7vRbQqL9uMLMZgtO2Ks3Q%2f4%3d
100k	http://www.mouser.com/ProductDetail/Bourns/3362P-1-104LF/?qs=sGAEpiMZZMvygUB3GLcD7l39JMs%2f%2f%2fLOs09gVZSzi2c%3d
9mm	http://smallbear-electronics.mybigcommerce.com/alpha-single-gang-9mm-right-angle-pc-mount-w-knurled-plastic-shaft/
16mm	http://smallbear-electronics.mybigcommerce.com/alpha-single-gang-16mm-right-angle-pc-mount/

Like most VFE projects, the Bumblebee is pretty challenging due to the compactness of the PCB. You will find the switch and some pots difficult to get to when soldering. Just be careful not to burn any components!

There are a few deviations I made from the build and Peter's recommendations. I suggest you do the same.

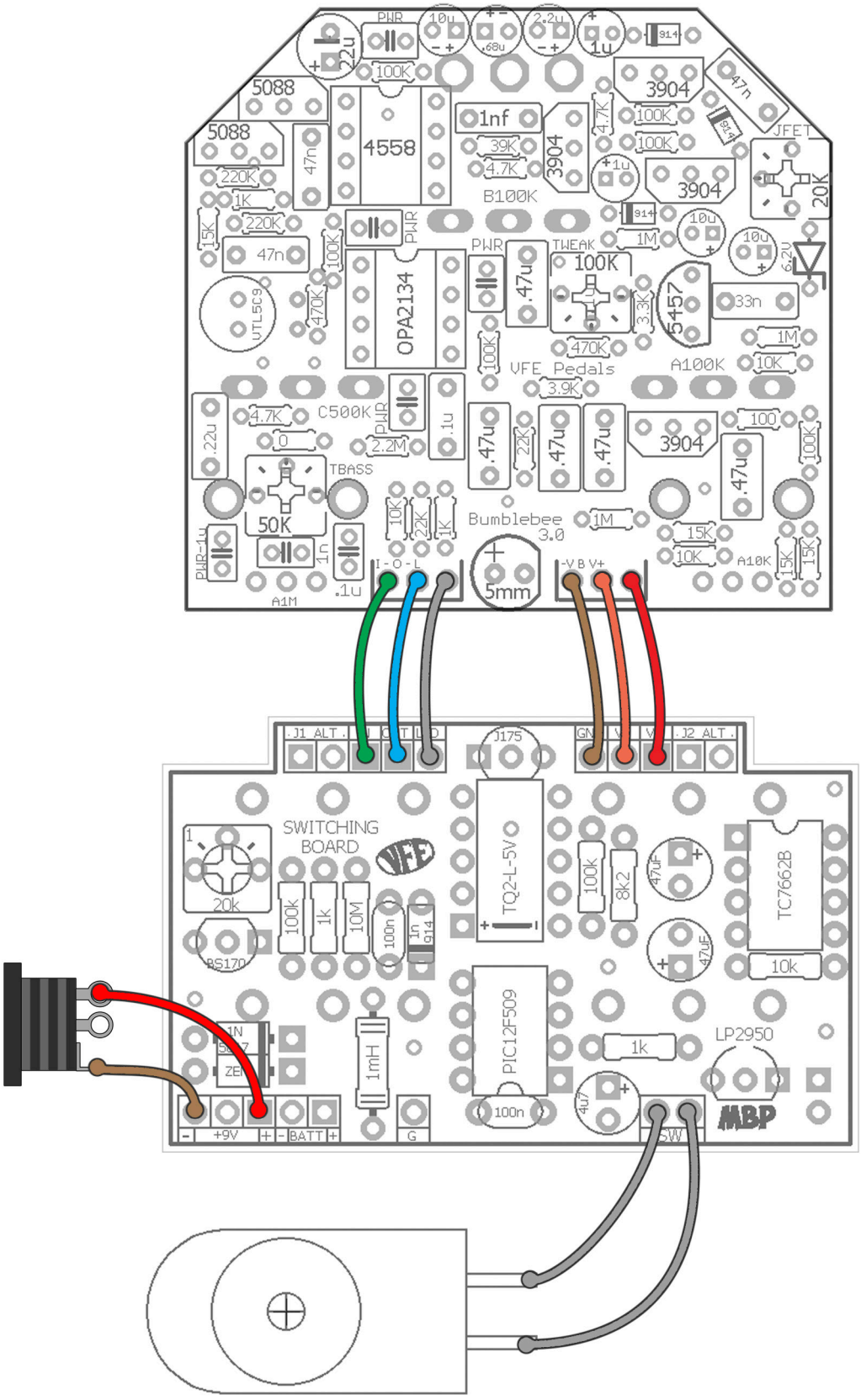
1. Use an NSL32-R3 instead of the VTL5C9 opto-coupler. I confirmed the NSL as the part he used later in the production life of the Bumblebee. The NSL is a better choice because it is less than half the cost and fits much easier in the space. I tested both, and while the VTL is perhaps a little more intense on the compression, the NSL still offers all you need. And, the VTL was not as smooth causing the compression to noticeably flutter on release.

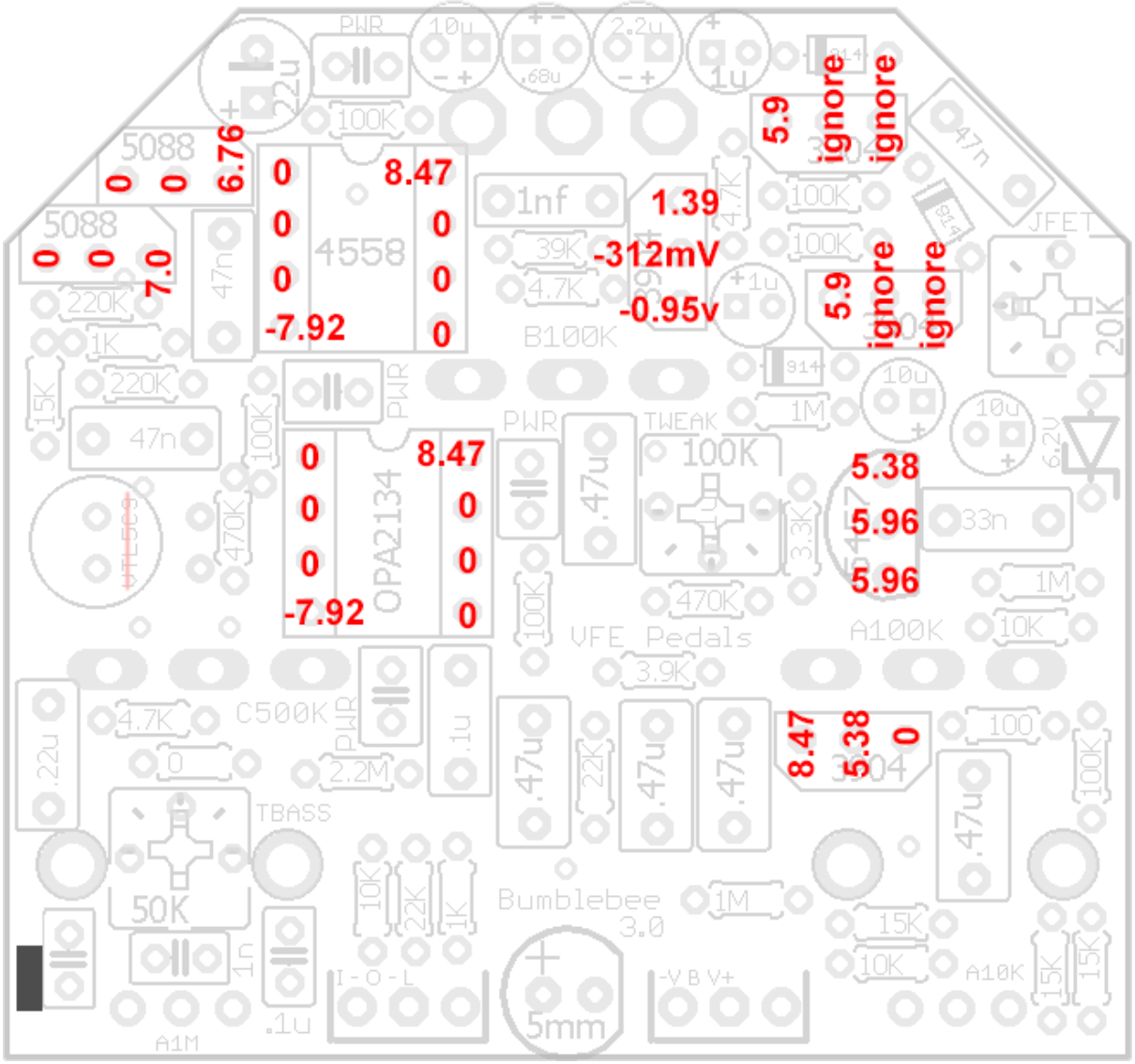
2. IIRC, Peter mentioned that he found the best swell effect is achieved by using a 2n5457 with a Vgs (cutoff voltage) of between 1.25 and 1.5v. Unfortunately, we are long past the time of acquiring dozens of through-hole JFETs cheaply to find specific Vgs measurements. If you have a lot of them, by all means, test them out and find one in that range. If not, don't worry because the next step will make this process unnecessary. I do recommend using a socket for the 2n5457 in case you want to try different devices.

3. Peter recommended not installing the 20k trim and using a fixed 22k resistor in its place. Don't do this. Use the trimmer! I built two Bumblebees, one with the resistor and one with the trimmer. I could not get the swell to work using the fixed resistor method (and that was with a pre-tested 2n5457). IMO, the 20k trimmer is essential to getting this to work optimally. It may be he used JFETs with a very narrow cut-off range and was able to get away with the fixed resistor. But, my experience was different.

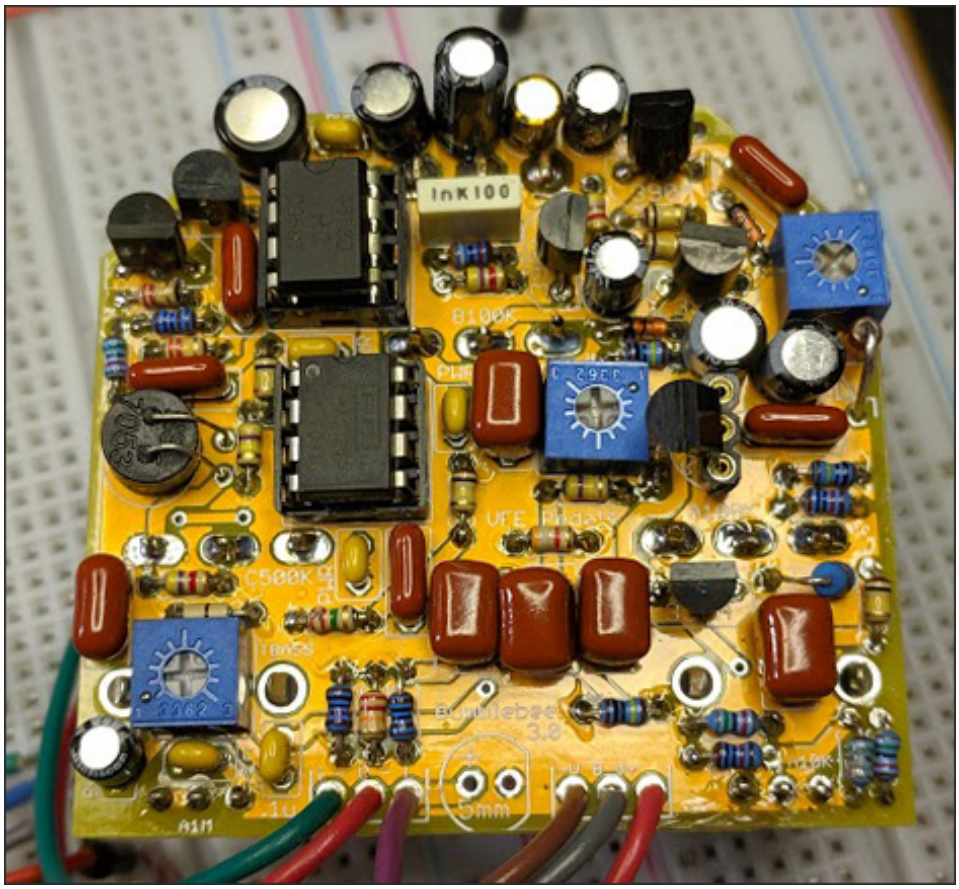
4. To set up the swell effect do the following: set the switch in its middle position, the MIX knob all the way counter-clockwise and all other pots to their middle position. Leave TWEAK in the center and the 20k trimmer all the way down. Now, adjust the 20k trimmer clockwise until you hear notes start to swell up in volume. Continue adjusting it until the volume of the swell matches your input. From there, you can adjust the TWEAK trimmer to fine-tune. In my build, the 20k is set at about 11 o'clock and the TWEAK trimmer pretty much in the middle.

5. Lastly, Peter recommends putting an additional 1n cap between pins 6 and 7 of IC2B to prevent bleed-through from the envelope into the signal path. I'm not sure why. There is already a 1n cap there and that creates an LP filter @ about 160Hz at the max setting which is a lot. Adding another 1n cap reduces that by half but I did not have any bleed-through using just one cap. And, it would make more sense to use a 2n2 rather than two 1n caps. You could socket this cap and try both if you like.

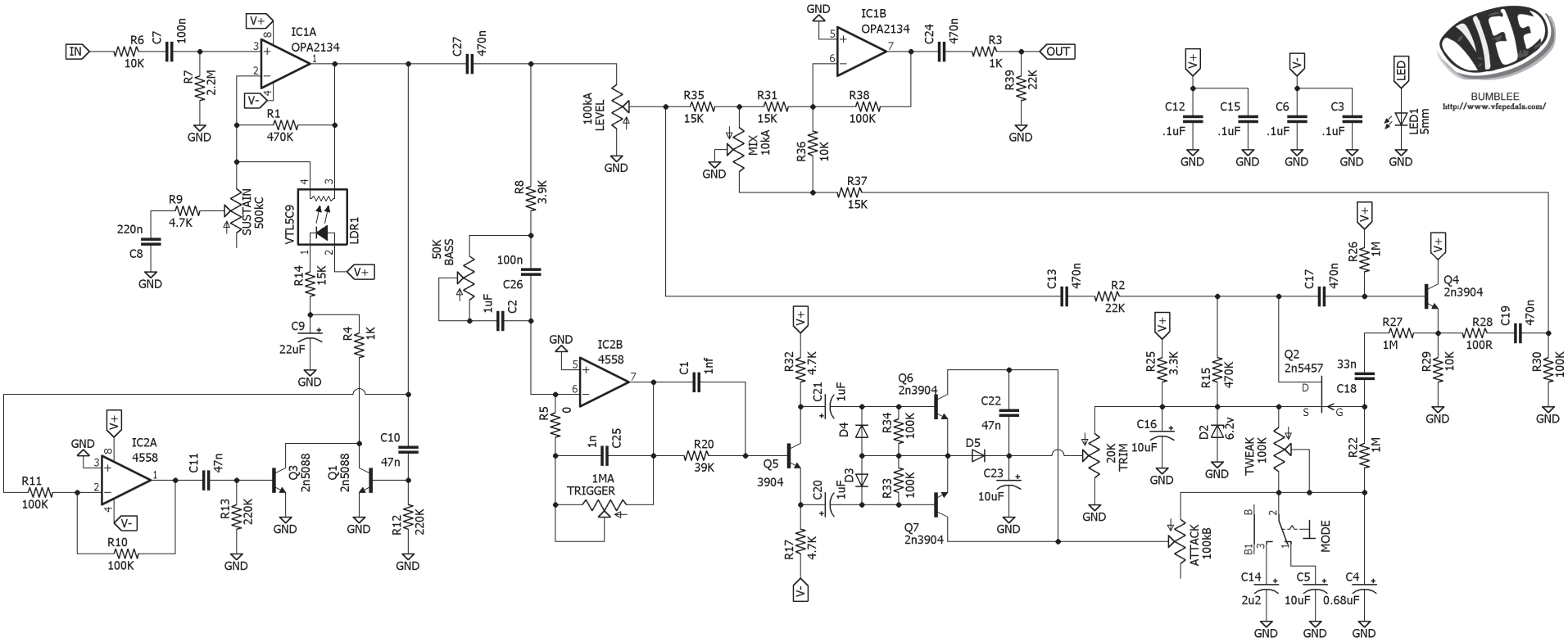

PWR
5088
4558
OPA2134
VFE Pedals
Bumblebee
3.0
5mm
SWITCHING
BOARD
TQ2-L-5V
PIC12F509
TC7662B
LP2950
1mH
BS170
J1 ALT.
J2 ALT.
J175
+9V
BATT
SW



Current Draw: 36mA
DC Supply: 9.42v One Spot



- I did not have a 1uF MLCC for the TBASS adjustment so I used an electrolytic. You can too, if you like. Just use the same orientation (negative side goes north).
- I also did not have a 0.68uF electrolytic for the switch so I used a 0.47uF instead. This is actually the default value used in the Slow Gear and it worked out fine.


IN
R6 10K
C7 100n
R7 2.2M
IC1A OPA2134
V+
V-
GND
R1 470K
C27 470n
100kA LEVEL
R35 15K
R31 15K
IC1B OPA2134
C24 470n
R3 1K
OUT
R39 22K
R38 100K
R36 10K
MIX 10kA
R37 15K
C12 .1uF
C15 .1uF
C6 .1uF
C3 .1uF
LED
LED1 5mm
BUMBLEE
http://www.vfepedals.com/
R9 4.7K
SUSTAIN 500kC
VTL5C9
LDR1
220n C8
R14 15K
C9 22uF
R4 1K
R8 3.9K
50K BASS
100n C26
1uF C2
C13 470n
R2 22K
C17 470n
R26 1M
Q4 2n3904
R27 1M
R28 100R
C19 470n
R29 10K
R30 100K
Q2 2n5457
33n C18
IC2B 4558
C1 1nf
R5 0
1n C25
1MA TRIGGER
R20 39K
R32 4.7K
C21 1uF
D4
R34 100K
Q6 2n3904
C22 47n
D5
C23 10uF
Q7 2n3904
C20 1uF
D3
R33 100K
R17 4.7K
Q5 3904
R25 3.3K
R15 470K
C16 10uF
D2 6.2v
20K TRIM
TWEAK 100K
R22 1M
ATTACK 100kB
MODE
B1
C14 2u2
C5 10uF
C4 0.68uF
IC2A 4558
R11 100K
C11 47n
R10 100K
R13 220K
Q3 2n5088
Q1 2n5088
C10 47n
R12 220K