Oil Tanker Fuzz

Design By Erik Vincent

Sometimes, bass players want something to pull them out of the mix and do something different. Sometimes the guitar player wants to play clean or solos and there isn't a rhythm guitarist to back him up, leaving the bass player to fend for himself. The Oil Tanker Fuzz fits the bill!

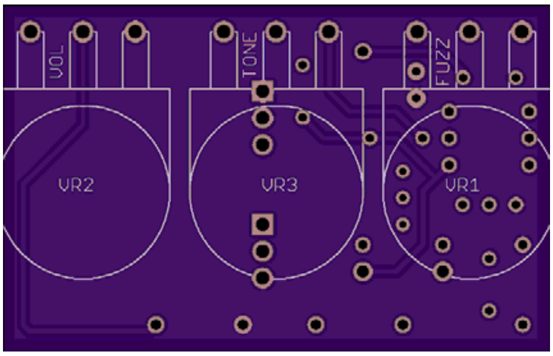
If you want nice beefy explosive fuzz that makes your bass sound like an oil tanker scraping up on concrete, give this pedal a shot. This pedal is based around several fuzz pedal ideas and focuses on bass delivery for stage and recording-mix scenarios.

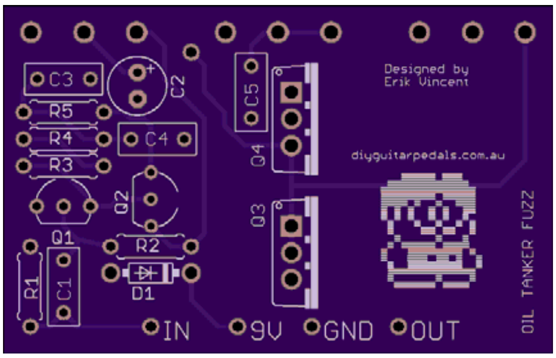
The pedal uses 3 pot controls: Volume, Tone, and Fuzz. Beginner friendly; be sure to watch the build video for the Oil Tanker to get an idea of how simple this build can be.

The PCB itself will fit snug into a 1590B enclosure.

Bill of Materials, Stock Oil Tanker Fuzz

Capacitor		Resistor	
C1	22nF (film)	**R1**	1M
C2	22µF (Electrolytic)	**R2**	100K
C3	100nF (film)	**R3**	100K
C4	33nF (film)	**R4**	1K
C5	220nF (film)	**R5**	5.6K
Diode		**Potentiometer**	
D1	1N4001	**Fuzz**	1kb (16mm)
		Volume	500ka (16mm)
Transistor/MOSFET		**Tone**	10kb (16mm)
Q1	2N5088		
Q2	BS170		
Q3	IRF520 (TO-220)		
Q4	IRF520 (TO-220)		





PCB Spacing
The Oil Tanker Fuzz PCB is spaced for 1590B sized enclosures or larger

Pot Spacing
The Oil Tanker Fuzz PCB mounted potentiometers are spaced for Alpha 16mm potentiometers.

How it works & modifications

Following is a couple of worthwhile modifications that can be applied to the Oil Tanker Fuzz.

Transistors and MOSFETs
Currently this pedal uses a 2N5088 NPN Transistor for its input-stage, which has a rather high gain. Changing out to different transistors with higher or lower gain, may be desired. For lower gain, a 2N3904 would be an alternative, whereas a 2N5089 would give it a bit higher gain. For a wide swinging transistor, a SS9014 would also be an alternative. Q1 is just an emitter follower transistor for the input boost of the circuit.

Q2 is a simple N-Channel MOSFET with a low gate threshold voltage (0.8V to 3.0V). Experimenting with different N-Channel MOSFETs for Q2, such as a 2N7000, with different gate threshold voltage ranges will change the gain responses.

Q3 and Q4 are N-Channel MOSFETs that are being used as clipping diodes that have a very “soft knee” when looked under an oscilloscope. The gate shorted to drain means that the "diode" doesn't start to conduct until the gate/drain is more than the threshold voltage more positive than the source (positive for N-channels, negative for P channels). So the forward voltage of these diodes is usually 1.5 to 3V. The knee of conduction is quite soft, and so diodes using this don't go from full off to full on, they gradually turn on. This happens to be quite good for soft distortion. Much like switching clipping diode types on fuzz, distortion, dirt, and gain pedals, changing out the IRF520 MOSFETs for a different MOSFET model will affect the clipping sound on the end of the circuit. Just make sure your MOSFETs have a Vgs threshold/th of at least 6 volts which effects how quickly it will gradually turn on (lower Vgs thresholds turn on faster and clip harsher) and that the Vgs (Max) doesn’t fall under 9V if intending to drive the circuit with regular power, or doesn’t fall under 20V if intending to drive the circuit with 18V.

Capacitors

Any impedance between C2 emitter and ground via the Fuzz pot will reduce the gain of the output stage, as this is a form of local negative feedback. Increasing this impedance will reduce the gain. If we are looking for high gain it is a common practice to have some, or all, of the entire emitter resistor grounded with a bypass capacitor. The bypass capacitor C2 should have a reactance, at the lowest frequency you are interested to amplify, less than the value of Fuzz Pot.

$fc = 1/(2\pi RC)$

$fc = 1/(2\pi \cdot R_{pot1} \cdot C2)$

$fc = 1/(2\pi \cdot 1K \cdot 22uF)$

$fc = 1/(2\pi \cdot 1000 \cdot 0.000022)$

$fc = 7.2Hz$

All the frequencies over 7.2Hz get full amplification. The 22uF is so big that almost all the frequencies get full amplification. Making C2 smaller will amplify less of the lower frequencies

The output capacitor C3 blocks the DC level from saturating any device following the Oil Tanker Fuzz. It creates a high pass filter together with Volume Pot Resistance that will determine the lowest frequency that gets out of the pedal. Making this cap bigger will let more low frequencies out. The cut frequency of this High Pass Filter is:

$fc = 1/(2\pi RC)$

$fc = 1/(2\pi \cdot R_{vol} \cdot C3)$

$fc = 1/(2\pi \cdot 500K \cdot 0.1uF)$

$fc = 1/(2\pi \cdot 500000 \cdot 0.0000001)$

$fc = 3.1Hz$

The minimum cut frequency is 3.1Hz, it goes higher when RVOL goes down. It means that with low volume levels, the amount of bass frequencies of the signal are slightly reduced, making C3 bigger will let more low harmonics out. Making C3 smaller will let less low harmonics out. Typical values are between 10nF and 100nF.

Potentiometers

In regards to the output capacitor of C3, changing the volume pot from a 500K resistance pot to a 100K resistance pot changes the high pass filter response. For example, changing C3 from 100nF to 10nF and changing the pot to 100K will give a much higher cut-off, making the sound brighter.

$fc = 1/(2\pi RC)$

$fc = 1/(2\pi \cdot R_{vol} \cdot C3)$

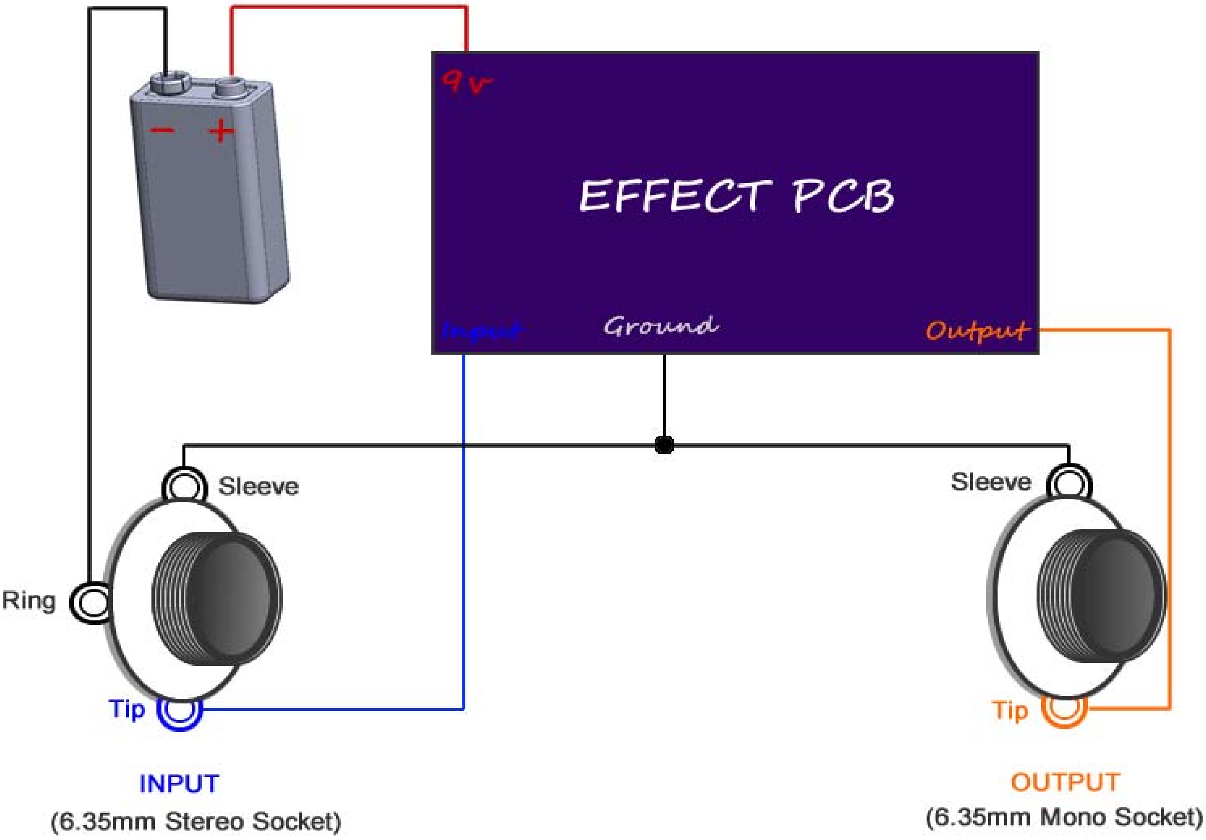
$fc = 1/(2\pi \cdot 100K \cdot 0.01uF)$

$fc = 1/(2\pi \cdot 100000 \cdot 0.00000001)$

$fc = 160Hz$

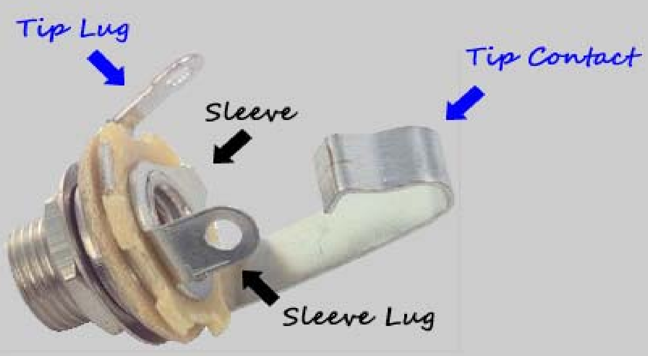
Testing Your Effect

Using aligator clips or soldering directly, wire your effect as in the following...



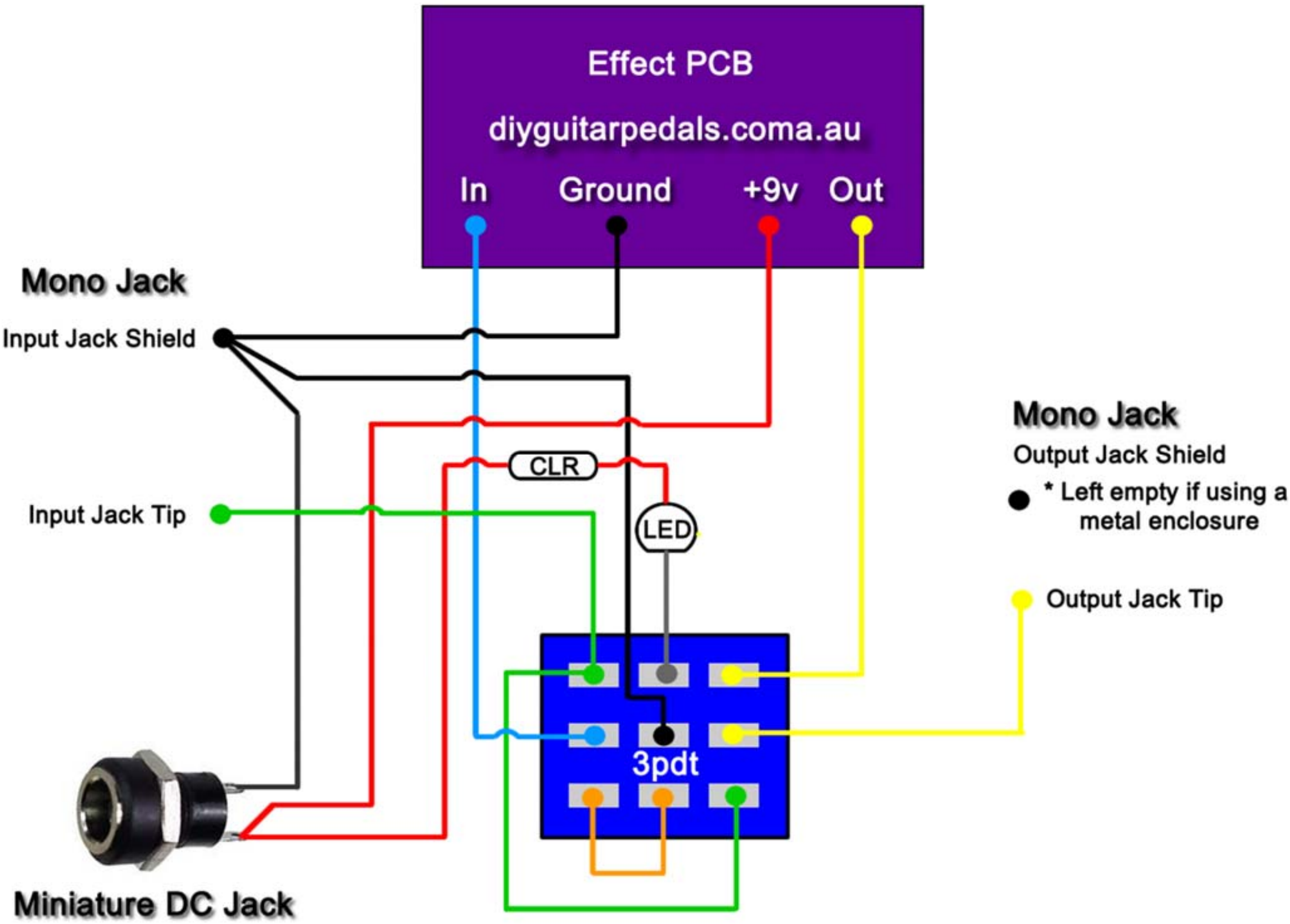
Input and Output Sockets

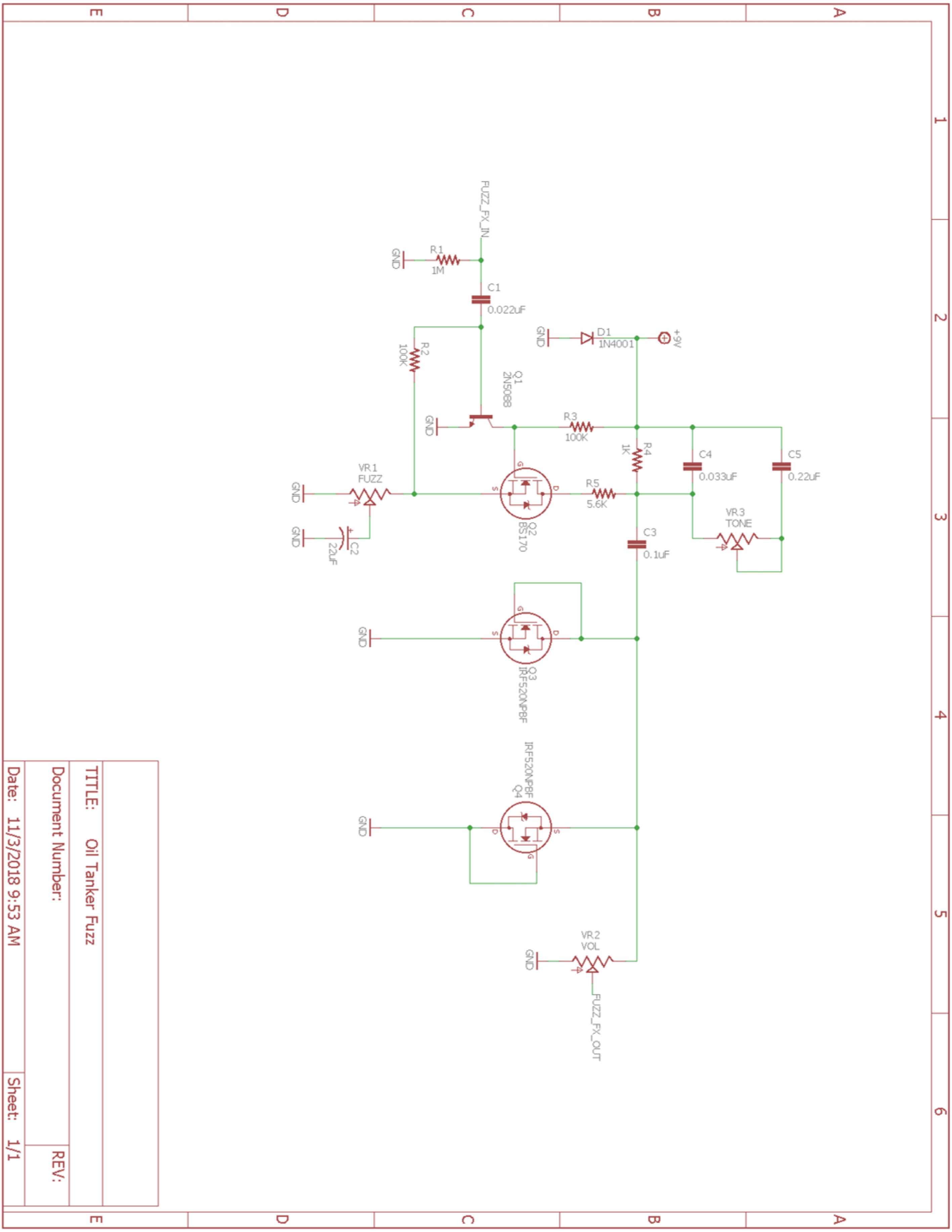
Pay close attention to the lugs of your sockets. Look at them side on so that you can distinguish the sockets individual layers. For instance the tip lug is connected to tip contact. The stereo jack looks the same as the socket below except it has an extra lug and contact for "Ring".



Offboard Wiring Diagram

Using a non-switched Miniature DC Jacks and 2 Mono Jacks





FUZZ_FX_IN
R1
1M
GND
C1
0.022uF
R2
100K
Q1
2N5088
D1
1N4001
+9V
R3
100K
R4
1K
C4
0.033uF
C5
0.22uF
VR1
FUZZ
C2
22uF
Q2
BS170
R5
5.6K
C3
0.1uF
VR3
TONE
Q3
IRF520NPBF
Q4
IRF520NPBF
VR2
VOL
FUZZ_FX_OUT
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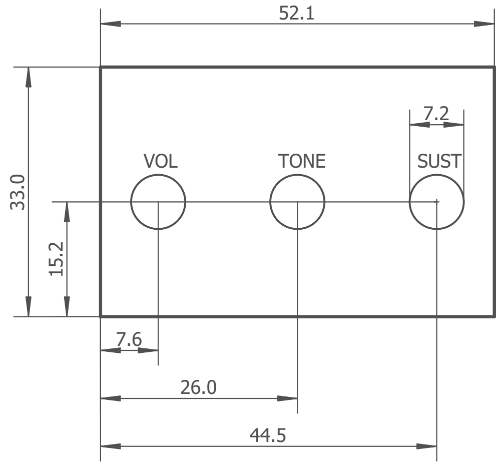
52.1
7.2
VOL
TONE
SUST
33.0
15.2
7.6
26.0
44.5