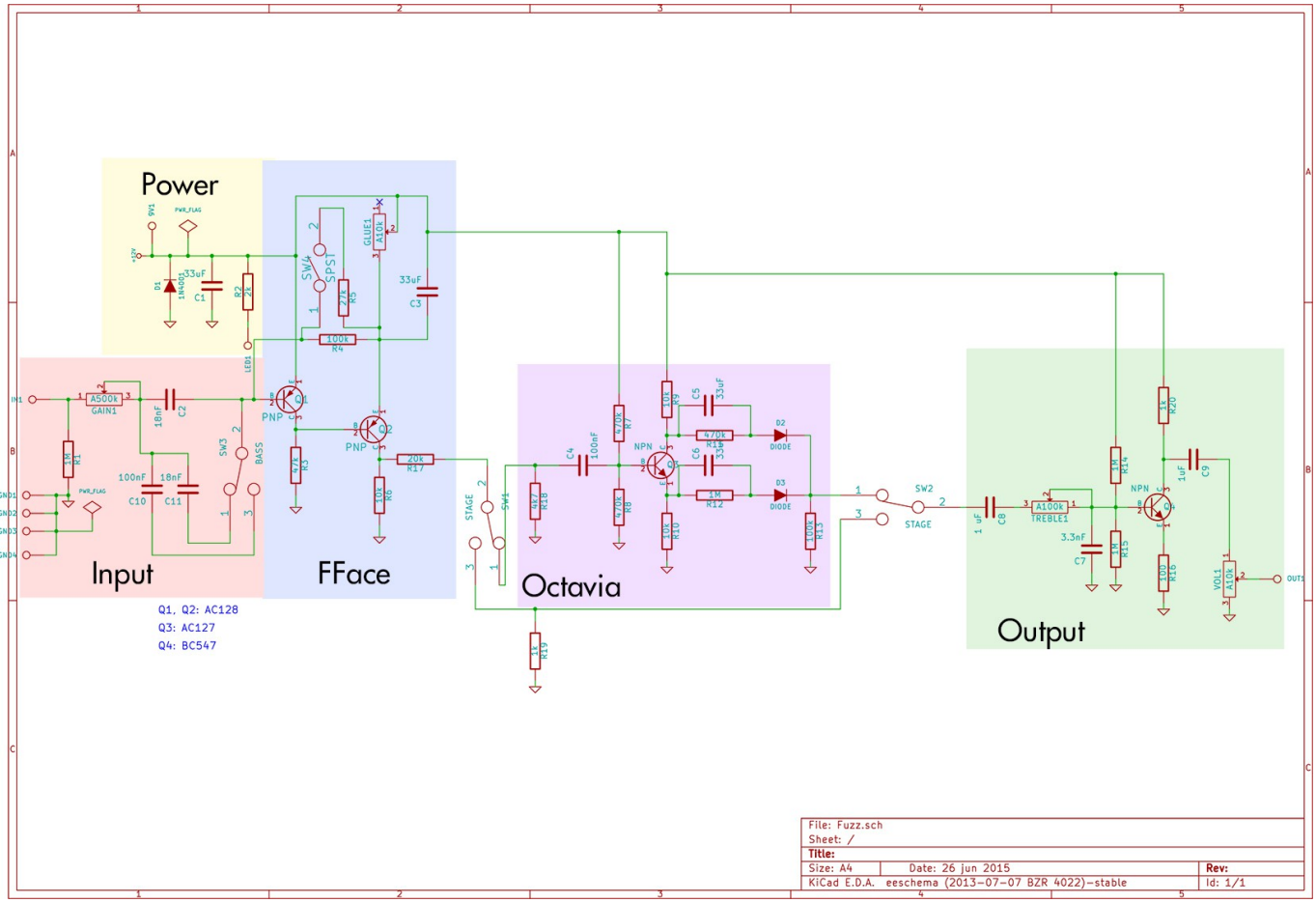
Glue Fuzz
Technical data

Power:
Input voltage: 9v.
Curent consomption: 10mA maximum.

Dimensions:
H/W/L: 50mm/70mm/115mm
Weight: 300g

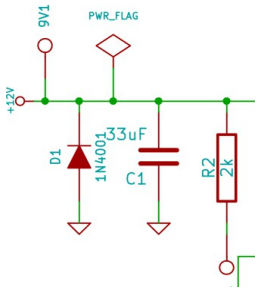
Schematic analysis:
The schematic can be divided in 5 parts:
1- The power section
2- The input section
3- Fuzz Face like module
4- Octavia module
5- Output section.



In short from left to right:
The signal first enters the input sections which allows to select the gain with Gain1 pot. A switch with three different caps will allow to choose different bass voicings.
Then there's a classic fuzz face/tonebender circuit. But I removed the gain pot from the original to allow a bias change control (glue pot).
The sw1 and sw2 are the same DPDT switch who allows to select or bypass the octavia mode.
Then the output section has a low pass filter with pot Treble1 and a gain stage with volume control.

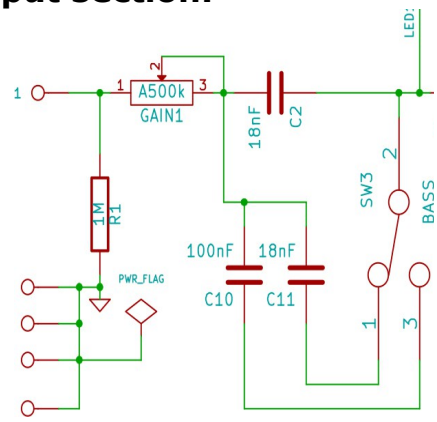
Good to know:
The Fface output on the collector of Q2 is very high. I found it too high to attack the octavia module correctly. So R17 and R18 will divide the input of the octavia by Vin=4,7/(20+4,7)xVout = 0,19xVout. Or if you prefer, the tension at the input of the octavia is 5 times less that the one out of the fface.
But the octavia mode will squash even more the volume. So, in order to have about the same levels when adding or bypassing the octavia, resistances R17 and R19 also divide the Fface output when octavia is bypassed by Vin=1/(20+1) Vout = 0,047xVout. Or if you prefer, the tension at the input of the treble filter when octavia is bypassed is 21 times less the output of the fface.
The drawback of doing that is that with extreme positions of glue settings or low gains, the output level will be too low. So, that's why there's an output gain stage with a gain of about 10 to get back some power!

The power section



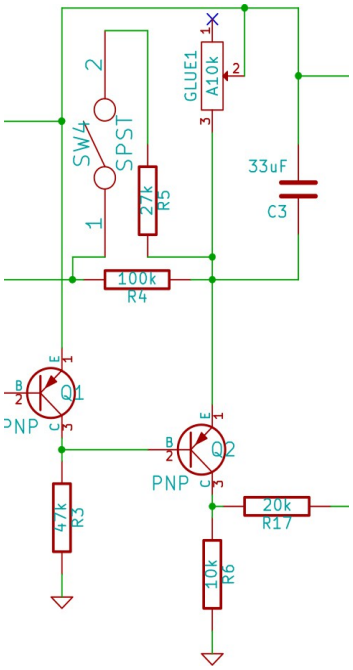
I kept it very simple:
D1 is a protection diode against reverse voltage.
C1 is a voltage filtering cap, it's a 33µF but 100µF will do.
R2 is the bypass led resistance.

Input section:



R1 fixes the input impedance pretty high to 1M.
Changing the Gain1 pot value will change the amount of current arriving at the base of Q1 thus acting at an input gain pot.
C2, C10 and C11 can be selected via an on-off-on 3 position switch. They are decoupling caps to prevent Q1's base tension to go up in the previous pedals or the guitar.
But together with Gain1 pot and the whole FFace module, these caps also makes a high pass filter. I don't how to precisely calculate the cut off frequency of the whole module. So I chose them by ear, and my spectrum analyzer tells me that.
If C2 only and Gain1=0, the cut off frequency is around 550Hz
If C2 and C11 and Gain1=0, the cut off frequency is around 380Hz
If C2 and C12 and Gain1=0, the cut off frequency is around 180Hz
If you plan to use the fuzz with a bass, or just for fun, you may want to change C11 or C12 to values between 200nF and 1µF to get even more bass.
So now lets enter the...

Fface module:



I won't go down very deep into explanations of this circuit, others did it before me. Please check this pages before going further:
http://www.electrosmash.com/fuzz-face
http://www.geofex.com/Article_Folders/fuzzface/fftech.htm

There are slight changes in my layout:

- Take care of the fact of the fuzz face is made out of PNPs, and the alim voltage can be represented by a -9V. This could be strange, but you just invert the ground and alimentation with a positive voltage and it works.

- I put a big input pot (GAIN1), this has been taken out of the "fuller mod", as said, "As a result, the variable resistor (gain1) allow you to radically clean up the distortion that the FF produces, producing subtle shades of softer distortion". The value of 500k is big enough to get almost clean tones when at maximum.

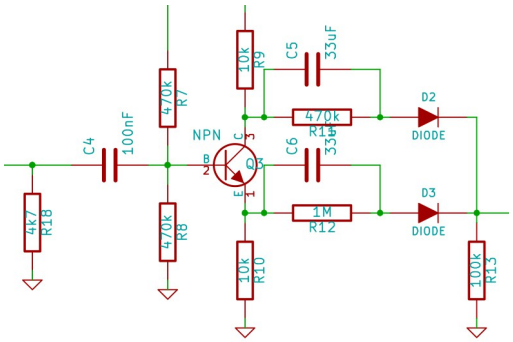
- The Glue pot is not wired the same. On the original Fface the C3 cap would be on the pin 2 of the GLUE pot and pin 1 of the pot is connected to the alim rail. This would have made the glue pot an actual gain pot. I didn't care about that because Gain1 pot already does the job and I wanted to be able to change the bias of the Fuzz face and get fun tones, and thus needed to change the resistance value between the voltage rail and Q2's emitter. Then I put C3 in between the voltage rail and Q2's emitter to get the maximum gain out of this stage.

Drawback: as you lower the gain, you'll have to raise the volume, but if you raise the volume, as the Fface always keeps the same gain, you'll get more noise...

- I added the possibility to change the value of the feedback resistance R4 with R5 and a dip switch. Putting R5 in parallel to R4 will increase the current fed back to Q1 and thus lowering the total gain of the module. With the 100k only the gain a bit too much, but some might enjoy it!

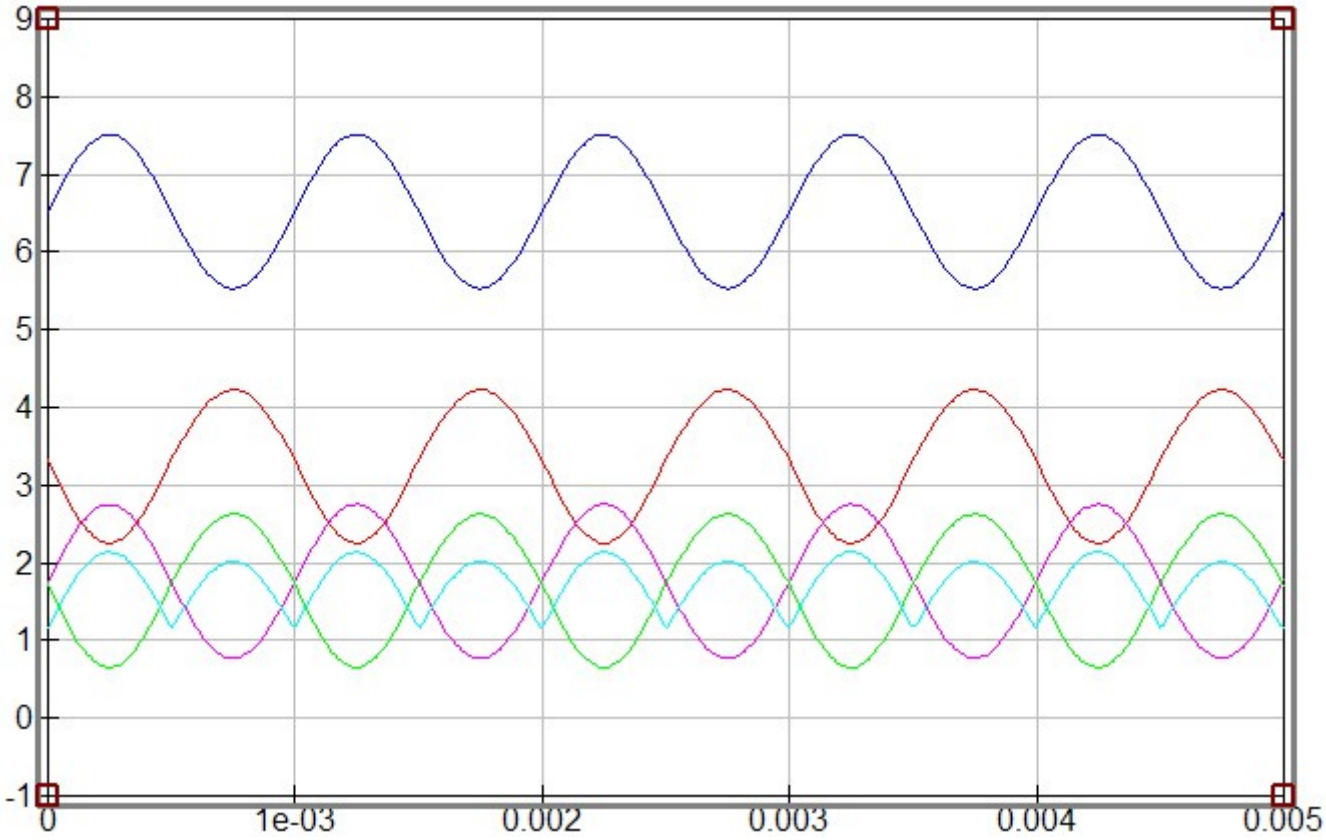
– R6 has a standard value, but R3 is a bit larger than the original. This was an attempt to lower the overall noise of the module by lower the gain of the first stage.

Octavia Module:



To produce the octavia fuzz sound you can use an audio transformer and a pair of diodes, or the schematic above.
It works like that:
C4 is a decoupling cap.
R7 and R8 setup the bias of the NPN transistor. Note that C4 and R7 makes a high pass filer cutting at F = 1/(2xPixC4xR7) = 3,38Hz.
Q3, R9 and R10 is an amp with a gain of 1.

Now comes the fun part.
First, we'll need this curves to show what happens:



Signals are taken from the emitter and collector of Q3. As it has a gain of 1, these

two signals are just in phase opposition of 180°. And Signal out of the emitter has an offset of about 3V (red curve) and signal out of the collector has an offset of around 6,5V (Blue curve).

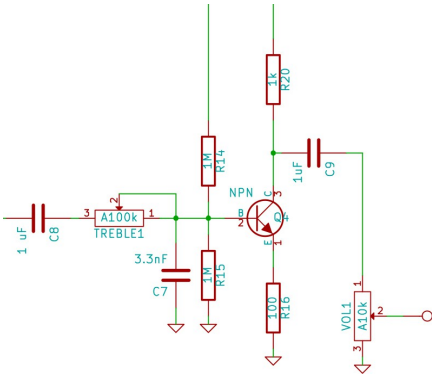
Now the couples C5/R13 and C6/R12 will reduce both these offsets to 1,7V and 1,5V (magenta and green curve). Then both theses signal will be cut by the diodes threshold at about 1V. That means all that's under 1v will be removed. And then both signals are summed to get the light blue curve.

As you can see this gives a new signal, which is twice the frequency of the input one, and has a bit of funny distortion in his lower part. Also there's still an offset of 1,5v but it'll be removed later by the C8 cap of the output section.

Now, that's the theory. I real life, a guitar signal is much more complex with tons of harmonics. And also it has an envelope. As you can see caps C6 and C5 are big. So as you play they will load and unload according to the signal envelope. Depending on the fface gain they will also load and unload more rapidly, but at the end all these parameters will change dynamically the ability of the module to produce an octave up effect. This why at the end you don't really ear that octave up effect but more of a “Groar” sound. But still, select your neck pickup, lower down your tone knob to muffle your sound and remove harmonics, lower the gain, and you get that strange octave tone...

If you absolutely want the octave up effect, then you should use an audio transformer.

Output section:



C8 is a decoupling cap, together with R15 it makes a high pass filter, cutting at F=1/(2xPixC8xR15)=15Hz.
Treble1 pot and C7 (And R15 but we'll neglect it) is a low pass filter, cutting down to 482Hz.
R14 and R15 set the bias to 4,5V on Q4's base.
R20 and R16 makes Q4 an amp with a gain of 10.
C9 is a decoupling cap to avoid sending an offset in pedals after the fuzz.
Vol1 sets the overall volume.

