For Guitar Pedal Builders

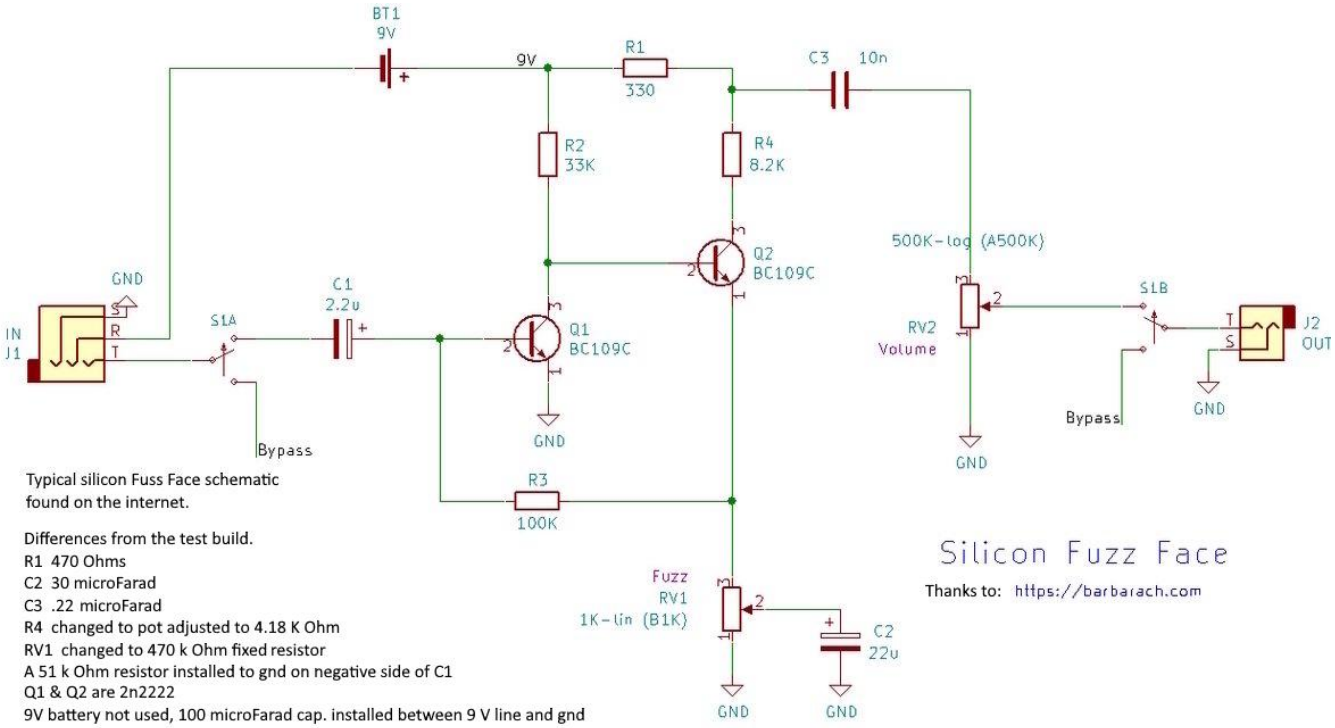
Original 1960's
vintage Fuzz Face

There are a lot of people who build their own guitar effects pedals. There are parts suppliers on Amazon that cater to these builders. The people that do build their own pedals will be familiar with the 1960's vintage Fuss Face pedal. It is also a popular one to reproduce. The original Fuss Face used germanium PNP transistors, however, a silicon NPN transistor version is popular and simple to build.

The breadboard below is the silicon transistor version and what was used to do some tests. I was interested in documenting some performance results and get a better understanding on how the circuit performs. The notes below cover measured gain, frequency response, a different way of doing the "bias" adjustment which is in reality a symmetry adjustment and other things. There is lots of information on this guitar pedal on YouTube.

The Fuss Face is just an audio amplifier driven into distortion and that's about it although the design is unusual. No intentional signal clipping is provided or any means of producing distortion other than the intrinsic circuit limitations. The circuit was never designed to be a guitar distortion pedal.

Below is a typical Fuzz Face schematic that was found on the internet.



General Information

Power supply voltage of the Fuzz Face bread boarded below is +9 Volts after polarity protection diode. Protection diode not used on above schematic.

Transistor Q1 2n2222 hFE 124

Transistor Q2 2n2222 hFE 115

Transistors were selected for a gain of around 120. Very high gain transistors may lead into oscillation issues.

For this pedal it has been recommended by others that the Q2 collector resistor (R4) be selected for half the supply voltage at the collector, typically 4.5 Volts. This is for waveform symmetry. It's referred to as the "bias" adjustment. In the breadboard R4 was replaced with a 10 K pot.

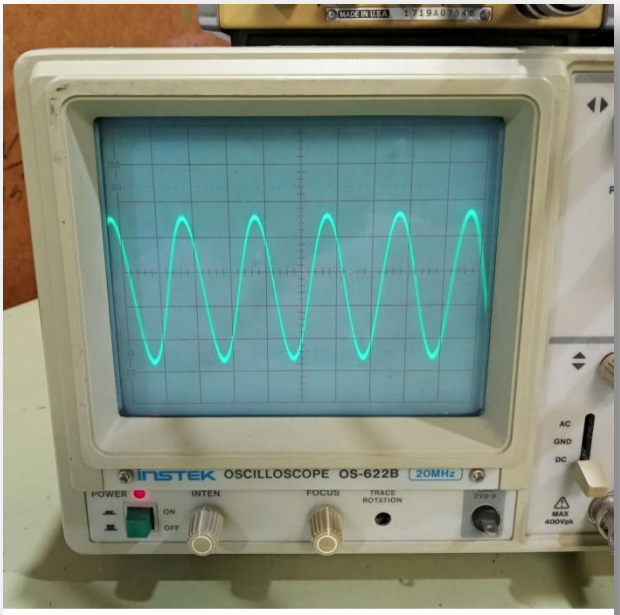
Here the "bias" (symmetry) was adjusted using an oscilloscope on the output and not by measuring the voltage at the collector of Q2.

Symmetry was adjusted with a scope at 1000 Hz. "Bias" pot adjusted resistance 4.18K (Q2 collector resistor). Measured Q2 collector voltage after adjustment is 5.35 VDC. This adjustment affects the sound. Maladjustment can lead to a raspy or Velcro sound according to some.

I see no issue in setting the "bias" voltage at 4.5 VDC at the collector of Q2, I just did it differently. The results are similar but not identical. Using an oscilloscope confirms the results.

Overall measured gain needs more work and is a bit tricky to do as the pedal feedback circuit can affect the input level. It seems to depend on the output impedance of the signal source (guitar). Anyway, with the gain turned all the way up (fuzz pot.) and an input of 0.0005 Volt RMS the gain was measured at 52 dB. The gain measurement was done in the linear region and at 1000 Hz.

Frequency response sweep was done in the linear region. Response is virtually flat from 500 Hz to 5 kHz. Reference frequency is 1000 Hz. At 100 Hz it was down 1 dB, at 200 Hz -0.3 dB and at 300 Hz -0.1 dB. All waveforms shown below were taken at the output. All measurements are high impedance.



Clean output, low distortion

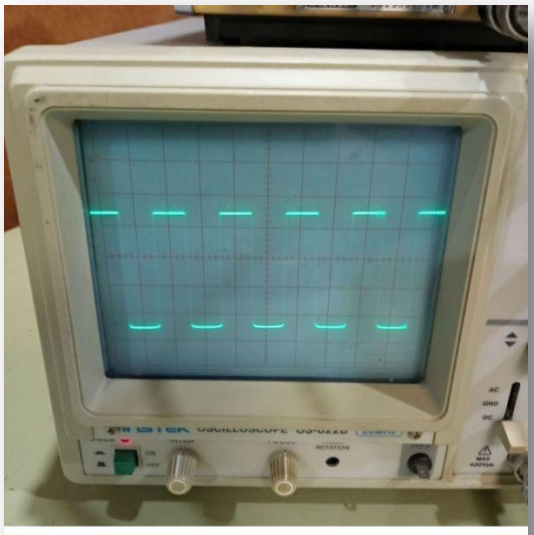
Main test equipment used:

HP 204D Oscillator

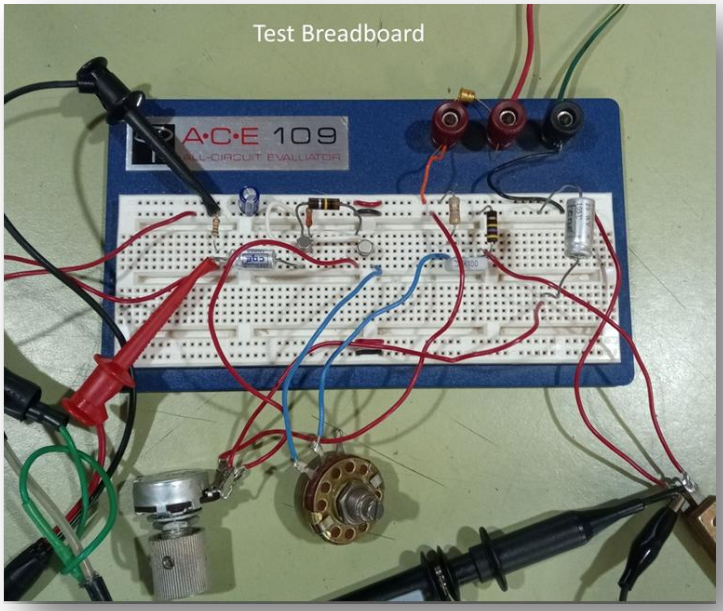
HP 400 EL AC Voltmeter

INSTEK Oscilloscope OS-622B

HP 331A Distortion Analyzer



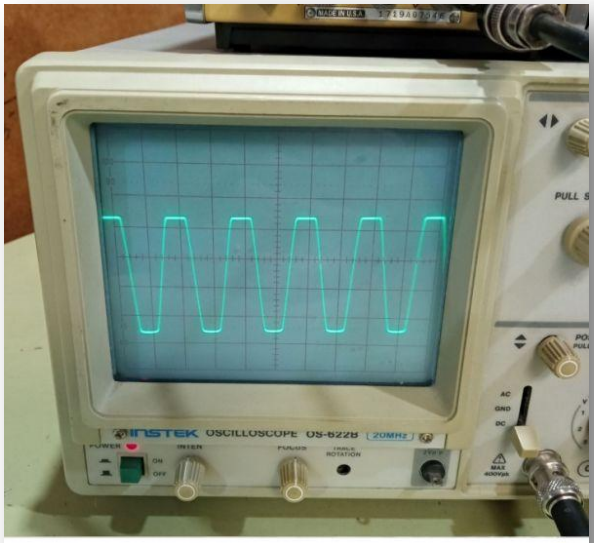
Full Distortion - 1000 Hz Sine Wave Input



I did a distortion test in the pedal's linear region. It was measured at a 1000 Hz and was 2.3 %. It may have been lower if the circuit was packaged properly. At full gain the pedal will start to show noticeable distortion when the input level exceed about 0.001 Volts rms. I presume you can use the Fuzz Face as a boost pedal if you turned down the volume on the guitar.

Every effort was made to make these measurements as accurate as possible but I could have missed something.

The above information is interesting to me and maybe of interest to a few others and it gives a sense of what is going on with the Fuss Face pedal but what really counts is how it sounds. In my opinion it sounds great and it also cleans up very nicely.



Some Distortion - 1000 Hz Sine Wave Input

I have completed 3 pedals and not just breadboard copies. They are the Fuzz Face, Tone Bender MK II and a clean boost pedal LPB-1. The Tone Bender was built using period (1966) germanium transistors.

Clean Boost Pedal

I did a few tests on the LPB-1 clean boost pedal I built. It was virtually flat to 0.1 dB from 300 Hz to over 10 kHz. Gain was measured at 24.7 dB. It only uses 1 transistor. I think I used a 2n4401.

Frequency response (input voltage 0.045 RMS linear region)

Hz	Gain	Hz	Gain
50	22.9	2000	24.7
100	24.1	4000	24.7
200	24.6	6000	24.7
300	24.7	10000	24.7
500	24.7		
800	24.7		
1000	24.7		

I don't have any distortion measurement results but it looked quite clean on the oscilloscope. Except for the transistor I don't remember if I used the identical components that were on the schematic but they are very common and I probably did. I noted the current draw as 5 ma. Most of that was probably the LED.

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