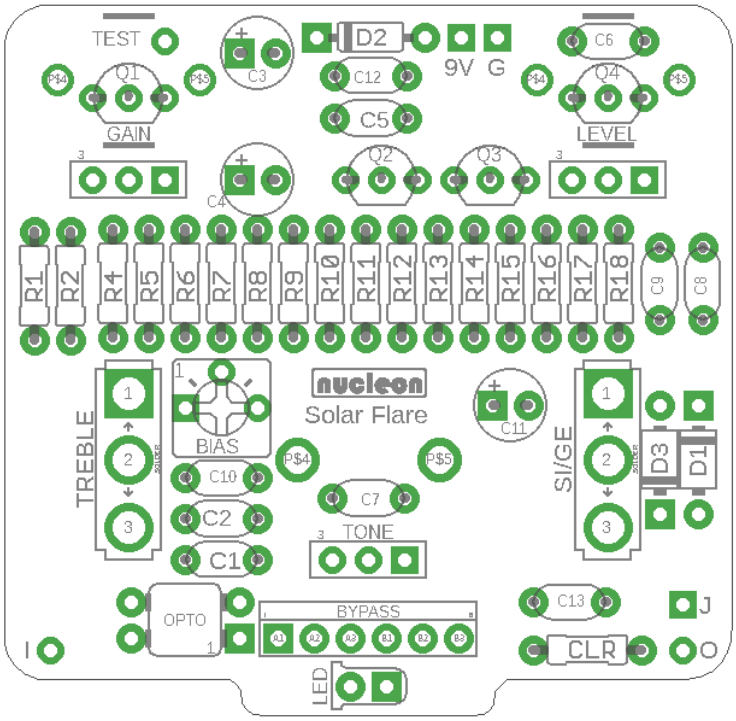
Solar Flare hybrid OD &Fuzz

Date Modified: August 29 2018

Years ago, Robert Keeley posted and discussed a circuit online that he eventually released as the Fuzz Head. At its heart it is a (NPN) germanium Rangemaster circuit followed by a silicon differential distortion stage. The Solar Flare uses the same idea but implements a 'flipped' PNP germanium Rangemaster as the first stage. PNP germanium transistors are more easily sourced than NPN ones. It makes no difference on the sound. This is a great little dirt box that can produce tones ranging from treble boost via overdrive to thick compressed fuzz.



This project is for personal (DIY) use only. Commercial (re)selling or distribution of the PCB, it's design layout, this build document is prohibited. These materials are not to be sold as part of a kit. PCBs may only be used as part of a commercial pedal after express permission from NucleonFX. NucleonFX can not be held accountable for any damage to yourself or equipment from the project here described.

BOM

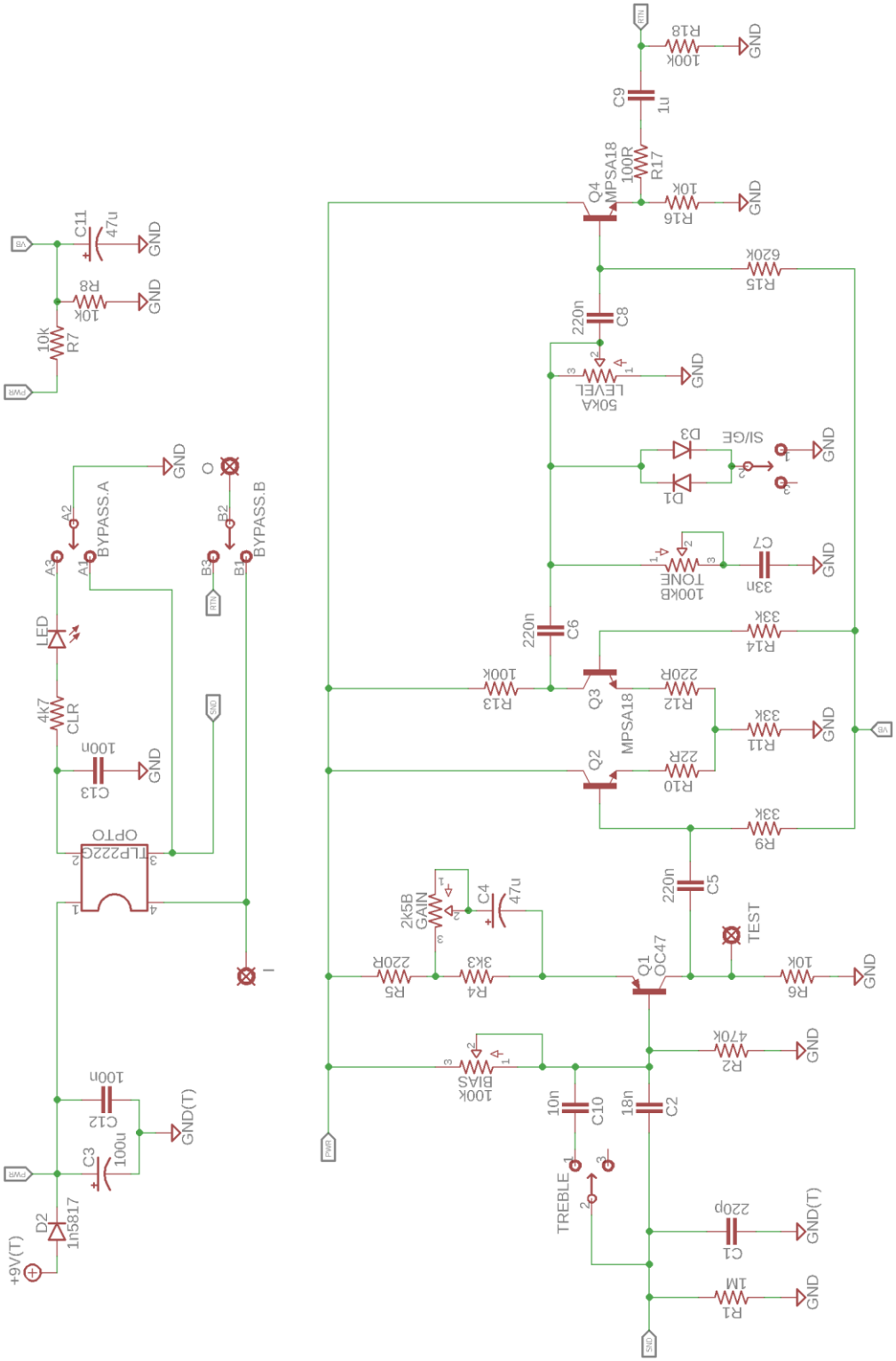
Resistors	
R1	1M
R2	470k
R3	Not there
R4	3k3
R5	220R
R6	10k
R7	10k
R8	10k
R9	33k
R10	22R
R11	33k
R12	220R
R13	100k
R14	33k
R15	620k
R16	10k
R17	100R
R18	100k
CLR	3k3

Capacitors	
C1	220p
C2	18n
C3	100u
C4	47u
C5	220n
C6	220n
C7	33n
C8	220n
C9	1u
C10	10n
C11	47u
C12	100n MLCC
C13	100n MLCC

Diodes and misc	
D1	1N4148
D2	1N5817
D3	1N60
Opto	TLP222G
Q1	OC47 or similar
Q2, Q3, Q4	MPSA18

Controls	
GAIN	5kB
LEVEL	50kB
TONE	100kB
TREBLE	SPST or SPDT
SI/GE	SPST or SPDT
Bypass	DPDT Stomp

Schematic


R18
100K
GND
C9
1u
Q4
MPSA18
100R
R17
10K
R16
GND
620K
R15
220n
C8
50KA
LEVEL
GND
D3
SI/GE
D1
GND
100KB
TONE
C7
33n
GND
220n
C6
33K
R14
100K
R13
Q3
MPSA18
220R
R12
33K
R11
GND
Q2
22R
R10
33K
R9
220n
C5
2k5B
GAIN
C4
47u
TEST
220R
R5
3K3
R4
Q1
OC47
10K
R6
GND
100K
BIAS
470K
R2
GND
10n
C10
18n
C2
TREBLE
220p
C1
GND(T)
1M
R1
GND
C11
47u
GND
R8
10K
GND
10k
R7
BYPASS.A
BYPASS.B
LED
4k7
CLR
100n
C13
GND
OPTO
TLP222G
100n
C12
GND(T)
C3
100u
D2
1n5817
+9V(T)

NOTES

See the General Build Doc on the website for general tips on building pedals and soldering germanium transistors.

Germanium Transistor

Most any germanium transistor with a (true) gain of 50 to 80 will produce nice results here. True gain means: compensated for leakage. You can read all about that on Geofex: http://www.geofex.com/Article_Folders/ffselect.htm
The Nucleon store offers the option of including a transistor with your board. Alternatively, you can buy one from another online vendor like Newtone or Small Bear. Be careful with eBay. Yes, transistors may seem a lot cheaper there, but most piles have already been cherry picked: the good ones have already been taken out. It's basically a crap shoot as transistors with the same type designation can have wildly varying gains.

Another thing to note is that the properties of germanium transistors are quite sensitive to changes in temperature. More on that below.

Setting the bias

There is a BIAS trimmer on the board that can be used to tune the Rangemaster part of the circuit. To do so requires a Digital MultiMeter (DMM). You've already got one of course, right? Power up the effect, select the DMM's voltage setting and clip the common (usually black) probe of the DMM to a ground point like pin 1 of the Level pot or the J-pad. Touch the pad labeled TEST on the PCB (top left) with the red probe of the DMM. Adjust the BIAS trimmer until the reading on the DMM is about 2.2 V. Test the circuit by rocking out with your guitar. See what varying the bias point does to the sound.

It is well known that germanium devices like Rangemasters and Fuzz Faces can sound different from day to day. To test your build for stability set up the bias at room temperature, put the pedal in the fridge for a while and check the bias (and the sound) when it's frosty. Alternatively, warm the transistor between your fingers while looking at the reading on the DMM.

Treble, Mid or Full Range?

You can adjust C2 and C10 to taste. Stock values give you the options of a tight mid or a more full range boost. Lowering C2 (between 4n7 and 18n) reduces bass content, producing a more treble boosted sound. Capacitor C10 is in parallel to C2. Closing the switch adds the value of C10 to C2, so the input capacitance increased, resulting in a beefier sound. So C2 sets up the treble and C10 determines the difference between the two switch positions.

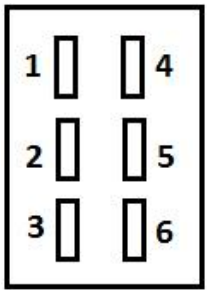
The Si/Ge switch
Closing this switch the overdrive goes into a more fuzzy territory. Volume will be lower. You can experiment with different diodes but at least have one of them be a germanium one.

Wiring

I - tip of input jack
O - tip of output jack
J - sleeve of output jack

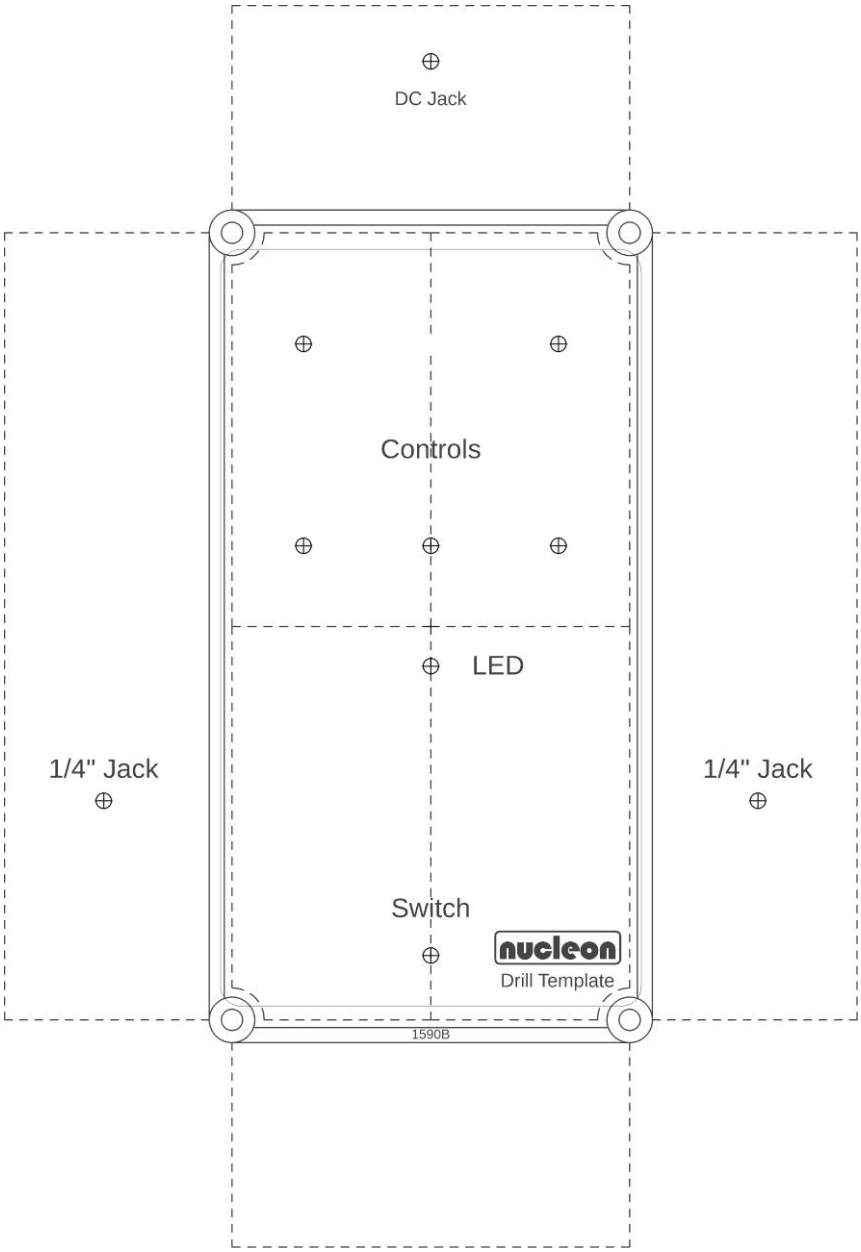
9V - sleeve of power jack
G - center of power jack

Bypass DPDT
Two sets of three (1 + 2 + 3 and 4 + 5 + 6) corresponding to columns on a DPDT switch.
1 and 4: top lug
2 and 5: center lug
3 and 6: bottom lug



For quick and easy wiring consider using the Nucleon Bypass board.

Drilling template (1590B)

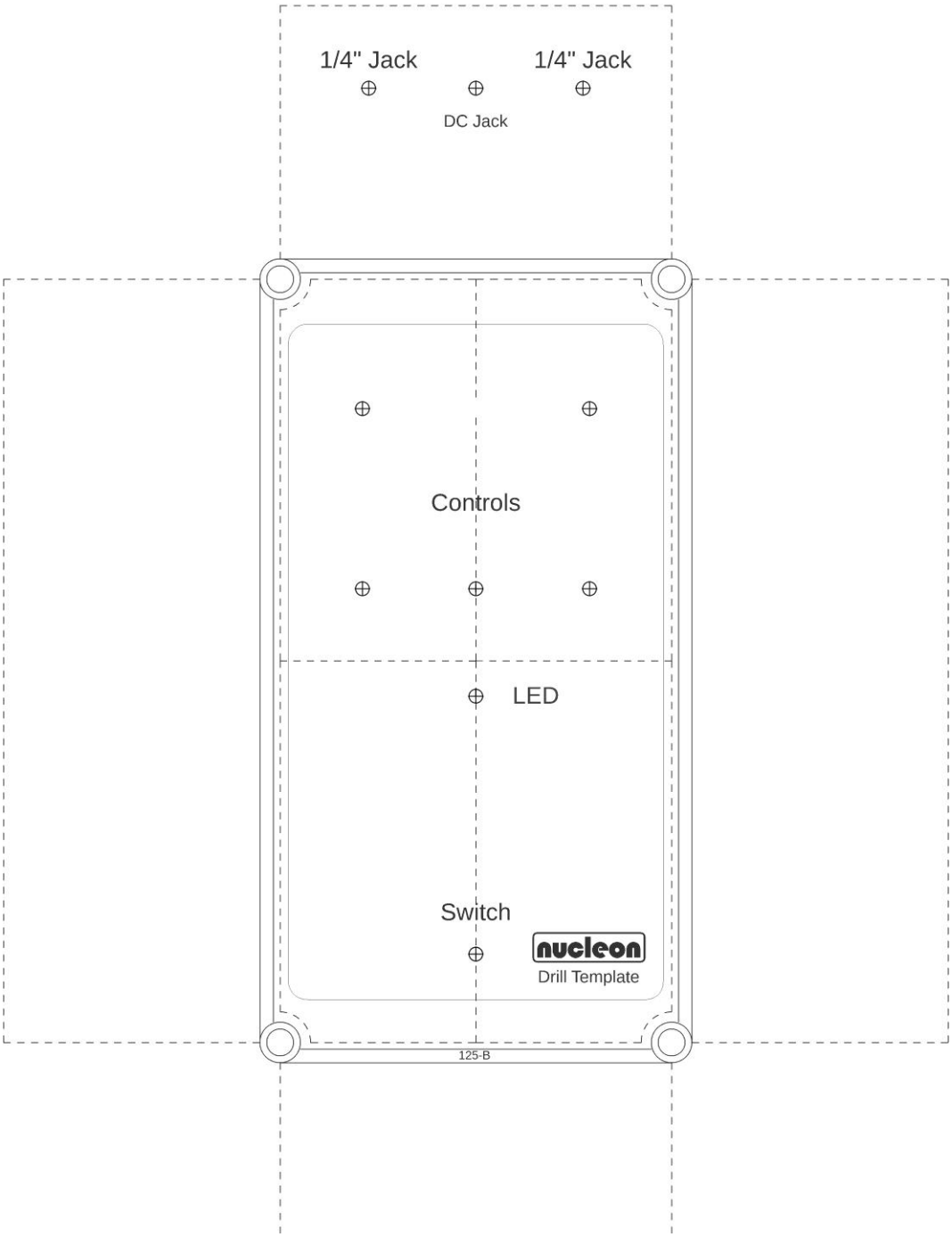


Drill Sizes

Pots: 7 mm minimum (use 8mm if you need some wiggle room)
Toggle switch: 6mm (7mm for extra wiggle room)
Jacks: 9 or 10 mm
Stomp: 12 or 13 mm (5 inches usually)
DC Jack: 7 mm (small barrel, no switch) to 13 mm (round 'Boss style' switched jacks)

Drilling template (125BB)

(unverified)



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