

DUAL DRUM MODULE BUILD GUIDE VERS. 2

NONLINEARCIRCUITS

Circuit Description:

This PCB contains two identical circuits which are very tweak-able drum hits; you can easily get sounds ranging from thumping bass up to snappy toms and cheesy 80s synth drums. The core design was originally in a Japanese DIY magazine from the late 70s and was intended as a standalone, self-contained device to be used with a drum kit. This version has been trimmed down a lot from the original design and modified to suit use in a modular synth.

The main input obtains a trigger from whatever input signal you give it. This trigger is converted to an envelope where you can adjust the height of the envelope with the sensitivity pot (= how hard the drum is hit) and adjust the decay rate from very short to ridiculously long.

The envelope has a primary function to control the VCA, giving the classic drum-hit shaped sound, sharp rise and longer decay.

The sound source is a crude VCO. To control the VCO, there is a tune pot, a CV input with an attenuator and a pot to send the envelope to the VCO as well. A touch of the envelope on the VCO gives a very realistic drum sound.

The output of the VCO can be a triangle wave or a rough, raspy trapezoid shape; there is a pot to vary between the two waveforms or set the output somewhere in between.

Mods for PCBs sold before 20 August 2013:

Version 1 of the PCB requires a number of changes in resistor values and a few resistors mounted point-to-point to get it working properly. My apologies, it was a proto-type, but none of the mods are very difficult and are clearly described below. If you have any trouble just ask on the appropriate thread on Muffs or by email to nonlinearcircuits at hotmail.com. The mods are numbered and can be ticked off on the table as each is completed.

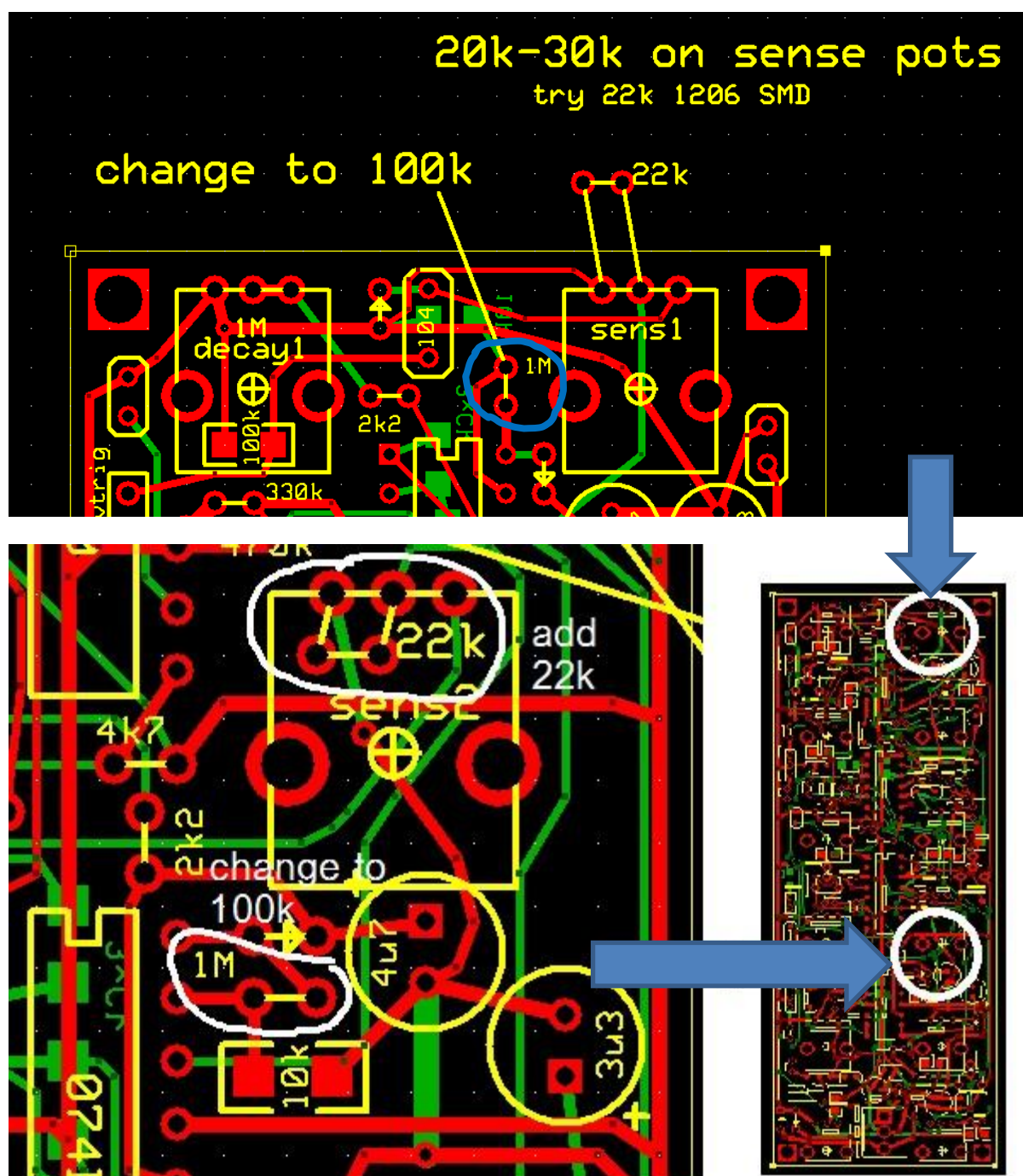
Mod		done?
1	convert Sense pots to Log (no need if you already have Log pots)	
2	change input gain resistors to from 1M to 100k	
3	do not install two 470k and two smd 100k resistors	
4	change two 10k resistors to 47k	
5	change two 47k resistors to 200k	
6	change two 220R* resistors to 1k	
7	change 102 capacitor to 332	
8a	install 3k9	
8b	install 3k9	
8c	install 200k	
8d	install 200k	

1. Sense pots

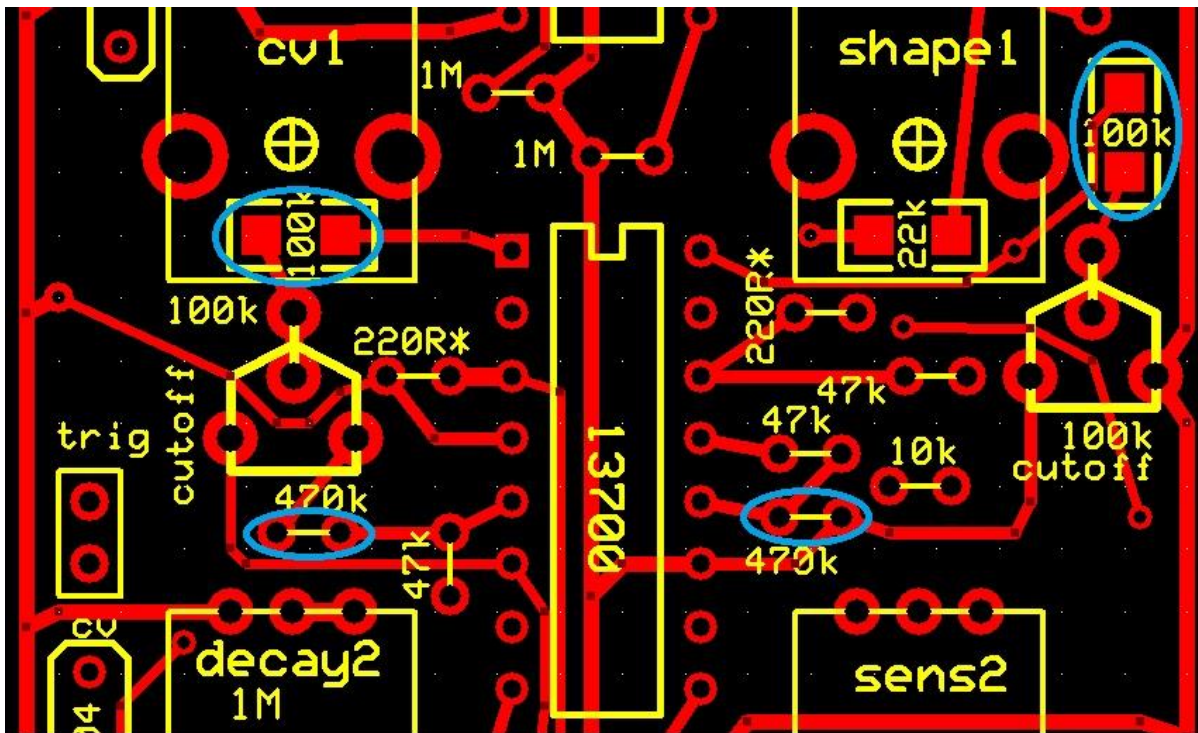
The two Sense pots are supposed to be 100kA, as in log pots. I used 100kB (linear) pots and soldered 22k SMD resistors between the centre pin and the one on the left (ground) when looking the component side of the PCB. *If you have 100kA pots do not do this mod.*

2. Adjust input gain

Input adjust gain is set by a 1M resistor for each circuit. This gives 100x gain of the input signal. Change these to 100k to get 10x gain when the Sense pot is at maximum. You could go lower and get greater control of sensitivity, 47k would still be fine.

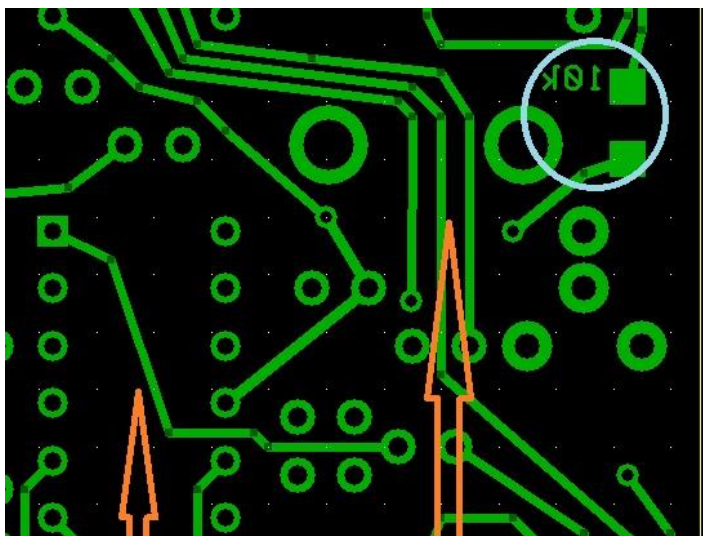


3. There are four resistors you do not install, two 470k and two SMD 100k. These are indicated in the image below and are all close to the LM13700.



Do not install

4. On the solder side of the PCB, there is a 10k 1206 resistor between the “shape1” pot and the edge of the board. Replace this with a 47k 1206 resistor. See image below:

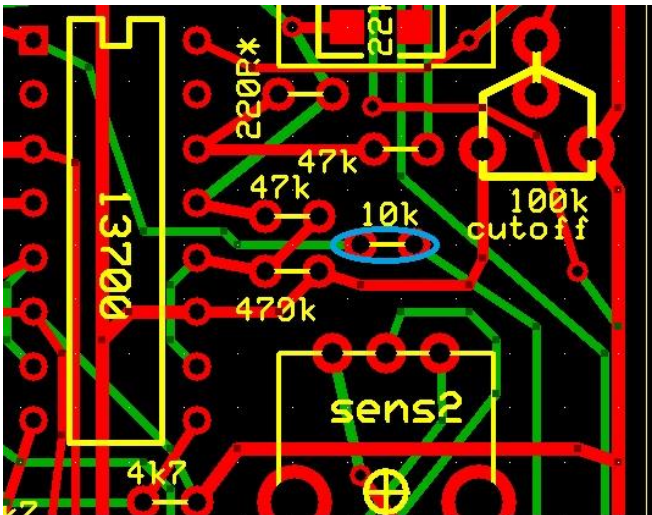


replace with 47k
1206 smd

Shape1 pot

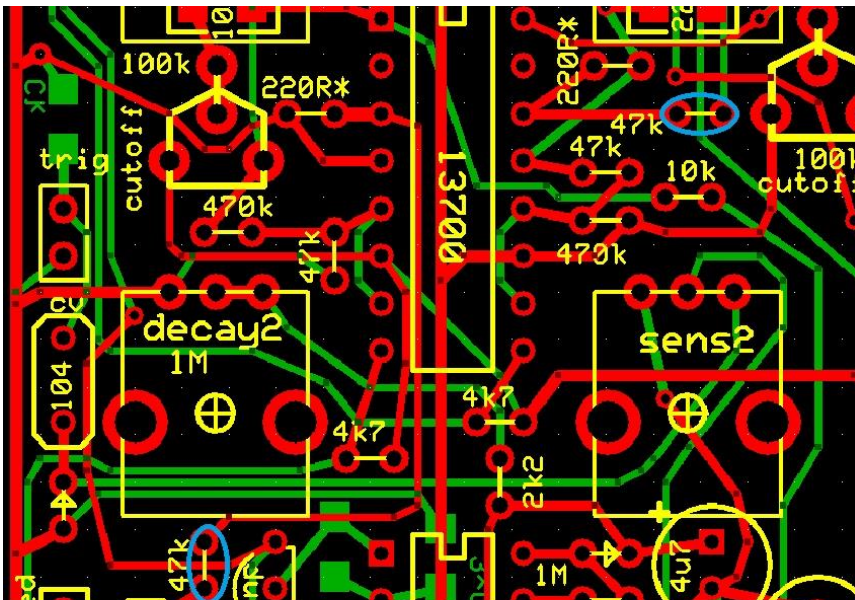
LM13700

You also need to replace another 10k resistor with a 47k, see image below:



○ replace with 47k

5. Change two 47k resistors to 200k. See image below.



○ Change to 200k

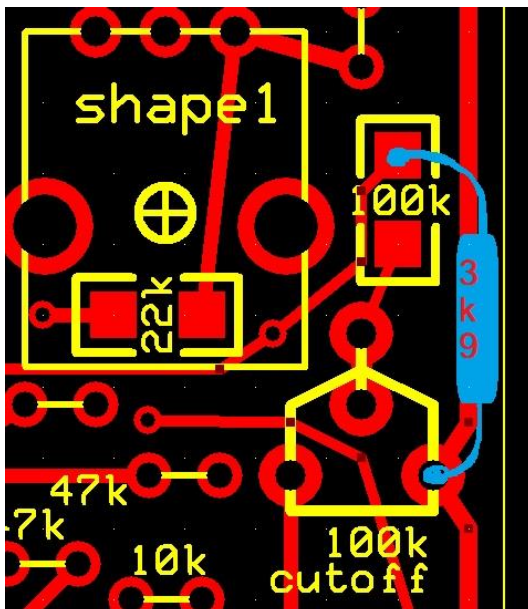
6. There are two resistors marked 220R*. One is next to pin 3 of the LM13700 and the other next to pin 15 of the LM13700.

Install 1k for both of these, instead of 220R.

7. There is a capacitor near pin 10 of the LM3900, marked 102, replace this with a 332 (3.3nF)

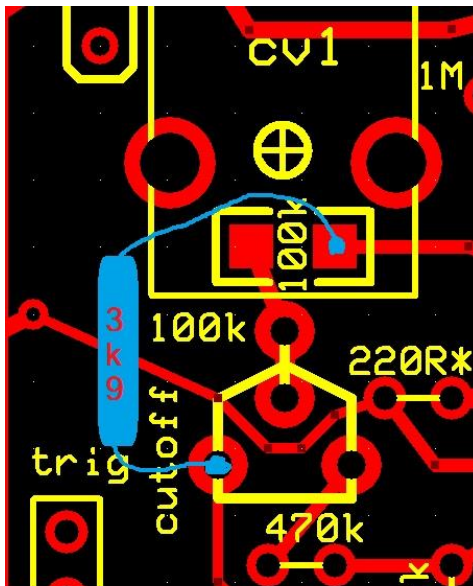
This capacitor and the 222 on the other side of the LM3900 are the caps for the VCO.

That was the easy stuff; the following four resistors need to be installed point-to-point. Be careful they are not shorting out on other pads or components.



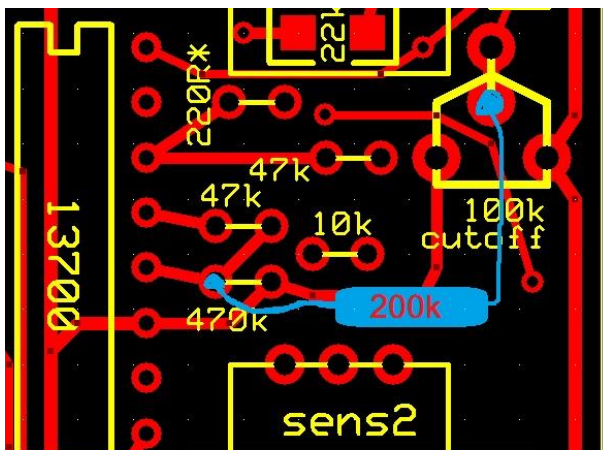
install a 3k9 resistor between the upper pad of the smd 100k (which is not installed) and the leg of the trimpot closest to the edge of the PCB

8b



install 3k9 between the pad of the 100k smd (not installed) closest to the LM13700 and the leg of the trimpot. Be careful the lead of the 3k9 does not touch the other pad of the 100k smd.

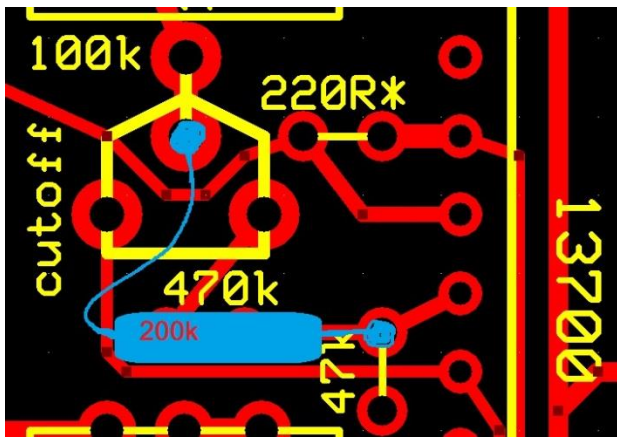
8c



Install 200k from the slider (centre-pin) of the cutoff trimpot to the pad of the 470k (not installed) closest to pin 12 of the LM13700.

This is easiest to install on the solder side of the PCB

8d



Install 200k from the slider of the other cutoff trimpot to the pad of the 47k close to pin 5 of the LM13700. Install on the solder side of the PCB, the 470k under the 200k is not installed. If you have space the 200k can be soldered to the unused 470k pad, which connects to the 47k.

Mods Done!



Mods for PCBs sold after 20 August 2013:

PCBs from the second batch only need a few mods.

1. If you use linear pots for Sense, add 22k smd resistors to convert them to Log pots, *see mod #1 in the previous section.*
2. Change the 102 capacitor near pins 10 & 11 of the LM3900 to a 332 (3.3nF). Actually a 2.2nF will be fine here too. *This is the same as mod #7 in the previous section.*
3. Change two 47k resistors to 82k. These resistors determine the maximum amplitude of the output signal. If using 47k, the max is 3V p-p. If replaced with 82k, the max amplitude is 4V p-p. You could experiment with higher values (say 100k) to increase the signal amplitude.

Mods Done!



SETUP

The process is the same for both circuits.

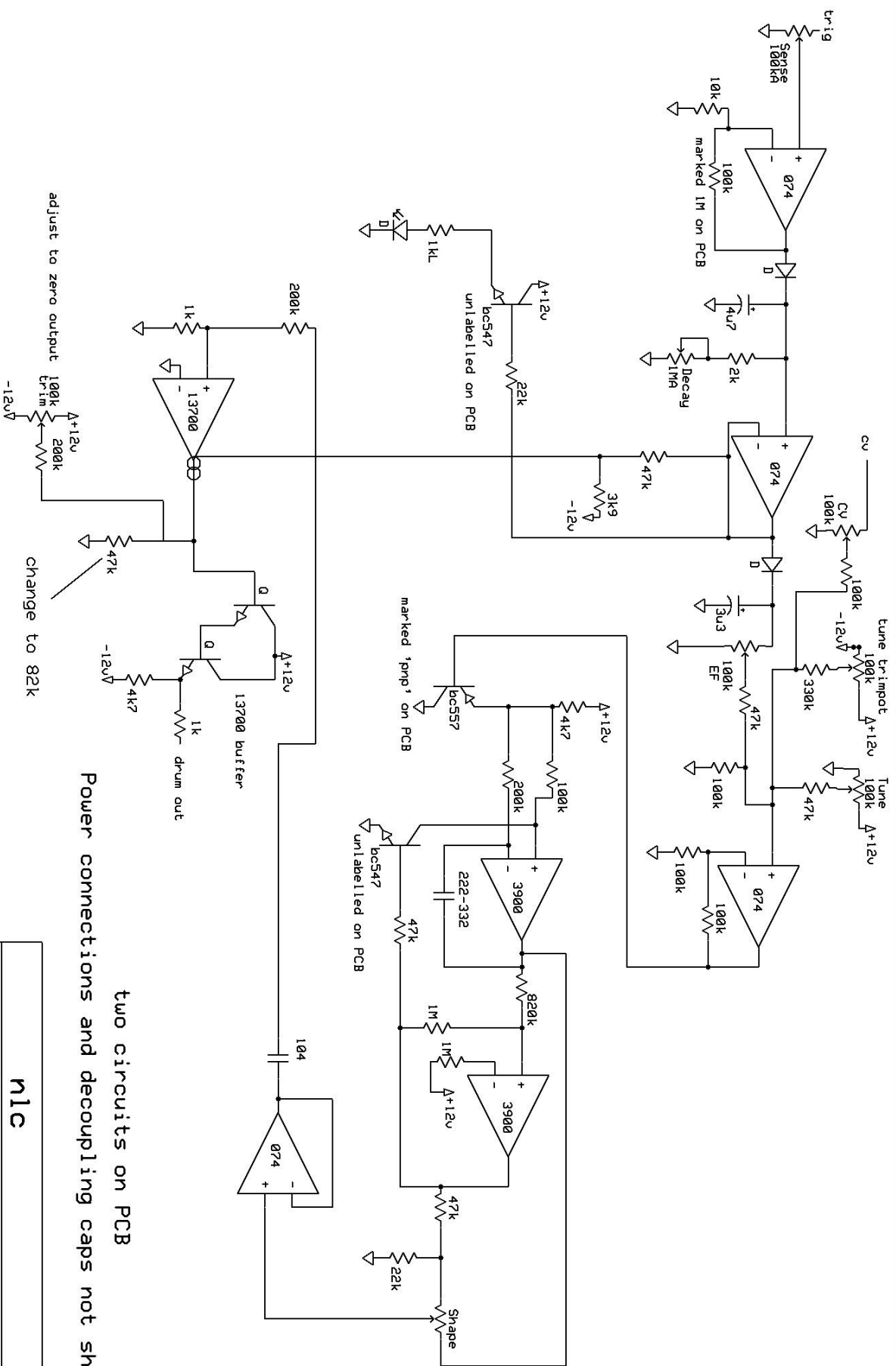
Monitor the outputs, turn the Tune and Envelope (EF) pots to 0, turn Sense and Decay to 10 and give the circuit a trigger or gate. Once you hear a sound, adjust the tune trimpot just enough so that the VCO stops oscillating. You want the VCO to not oscillate when the Tune pot is at 0, as the envelope can then be used to control the VCO, it will be clear when you use the module.

With no audio output (VCO not oscillating), monitor the output jack with an oscilloscope or multimeter and adjust the cutoff trimpot so the output is 0V (This trimpot is to remove DC offset on the output signal)

BOM – get spares, I cannot count

component	total number	thru-hole	1206 smd
13700	1		
TL074	2		
LM3900	1		
3k9	2	2	
47k	12	11	1
1k	6	6	
200k	4	4	
10R	2	2	
82k	2	2	
4k7	4	4	
10k	2	0	2
22k	6	0	6
100k (marked "Ck" on solder side)	14	2	12
200k	2	2	
1M	4	4	
330k	2	2	
820k	2	2	
1kL (adjust to suit LED)	2	2	
2k2	2	2	
222 cap	1	1	
332 cap (in place of 102 on PCB)	1	1	
104 cap	4	4	
4u7 electro	2		

3u3 electro	2		
47n-100n decoupling cap	5	5	
10u electro	2		
22n (decoupling)	1		1
1MA pot 9mm vertical	2		
100kB pot 9mm vertical	8		
100kA pot 9mm vertical	2		
100k trimpot	4		
bc557	2	2	
bc547	4	4	
diodes	6	6	
LEDs	2		
1N4004 (optional)	2		



two circuits on PCB
Power connections and decoupling caps not shown

n1c
dual drum module

Rev 1.2
25/8/2013