nonlinearcircuits

QUO/LPF

build notes version 2

11 April 2014

This circuit is based on the 4 pole LPF in Electronotes 41, tho has been subject to a number of tweaks and prods to bring it to where it is now. This manual is mainly intended for the Version 2 PCB, how do you know which version is which? Version 2 has V2.0 printed just near the Q pot and power connector.

BOM – components in bold indicate the value printed on PCB, but other values can be installed as noted

component	quantity	
4 pole ON-ON toggle switch	1	select high or low range
100k pots	7	*see notes*
Connector - Molex, .156 in KK, up, 3 pin	1	
TL074	2	SMT SOIC - 0.050 pitch
NJM13700M	2	DMP16 package *see notes*
J108 or J112 FET	4	marked "gsd" on PCB
BC547	5	no mark, just transistor outline
BC557	2	*matched!* marked "p" on PCB
150pF	4	4.5mm pin spacing, polys or something nice
1nF	4	5.0mm pin spacing, polys or something nice
10uF BP (25v or higher rating)	3	2.0mm pin spacing, must be bipolar
10uF (35v or higher rating)	2	2.5mm pin spacing, for decoupling
sockets	8	nanas or whatever you choose
20k multi-turn trimpot	1	
100k regular trimpot	1	
1N4007	2	optional, reverse voltage protection
LEDs	4	
3V zener diodes	2	up to 5V is probably okay
1N4148	4	any regular signal diodes ok
47nF-100nF caps	11	2.5mm pin spacing, for decoupling, unmarked on PCB
20-30pF	1	2.5mm pin spacing,
22-100nF	2	1206smd for decoupling
thru-hole resistors		
10R	2	
220R	8	
470R	4	for LED brightness, *adjust to suit LED types*
1k	4	
2k2	1	
10k	1	
33k	7	
51k	1	*see notes, 100k - 120k is better*
56k	1	

91k	1	
180k	1	
220k	2	
300k	1	
3M	1	
1k tempco	1	optional, only if using as VCO or care about 1V/oct, otherwise regular 1k okay
1206 smd resistors		
10k	10	marked “d” on PCB, except for one marked “10”
30k	4	
100k	20	marked “C” on PCB
200k	1	*see notes*

pots

These ones from Tayda will do, though be careful none of the metal flaps are sitting on PCB traces, trim them back if so. You can find many brands of this type of pot, Alpha make nice ones too.

http://www.taydaelectronics.com/potentiometer-variable-resistors/rotary-potentiometer/linear/100k-ohm-linear-taper-potentiometer-round-shaft-pcb-9mm.html

51k thru-hole and 200k 1206 smd resistors

These two control the amplitude of the output signals.

51k sets the level for the 180^0 and 0^0 outputs and

200k sets the level for the 90^0 and 270^0 outputs.

The 200k is probably fine, but the 51k should be increased as the corresponding levels are lower. Try 120k.

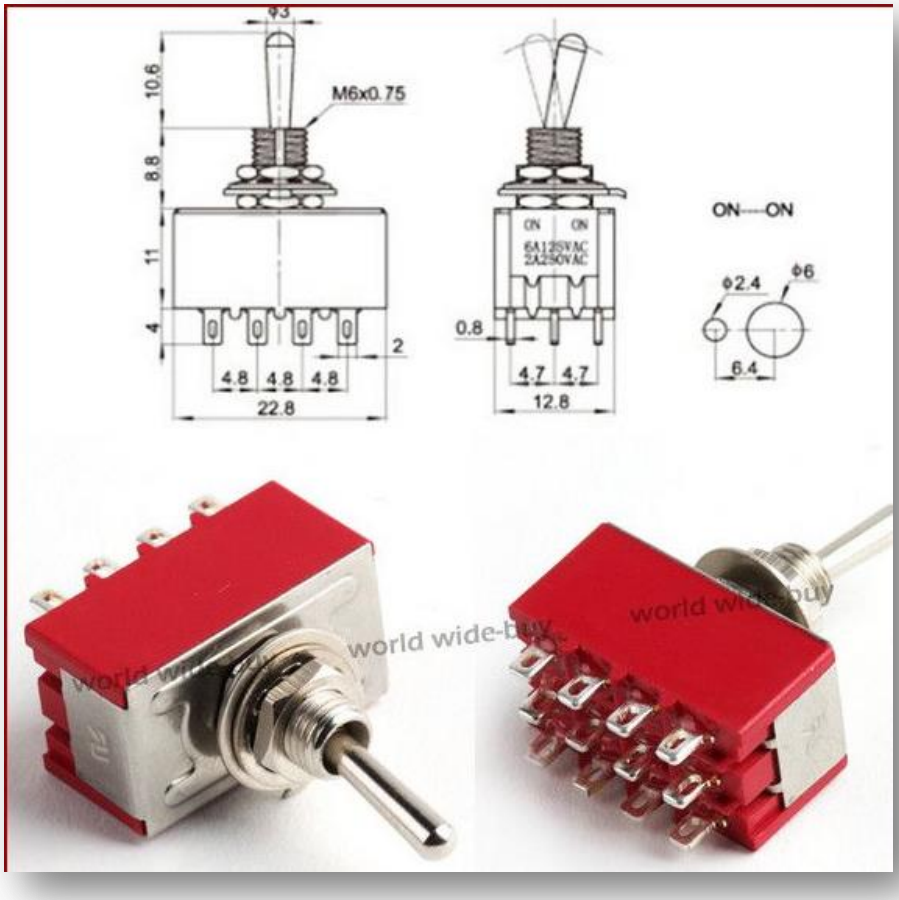
This type of circuit is firstly a VCF; the QUO function is a bonus. It means the signals get smaller when the QUO is run very slowly, down to 2V p-p, at higher frequencies the QUO will be 10V p-p……..or depending on what resistor values you choose to set the output signal levels.

NJM13700M

This is a wide-body package, not the standard SOIC. It is in production and available from Mouser, Digikey and RS components, about $1.20 each.

4 pole switch

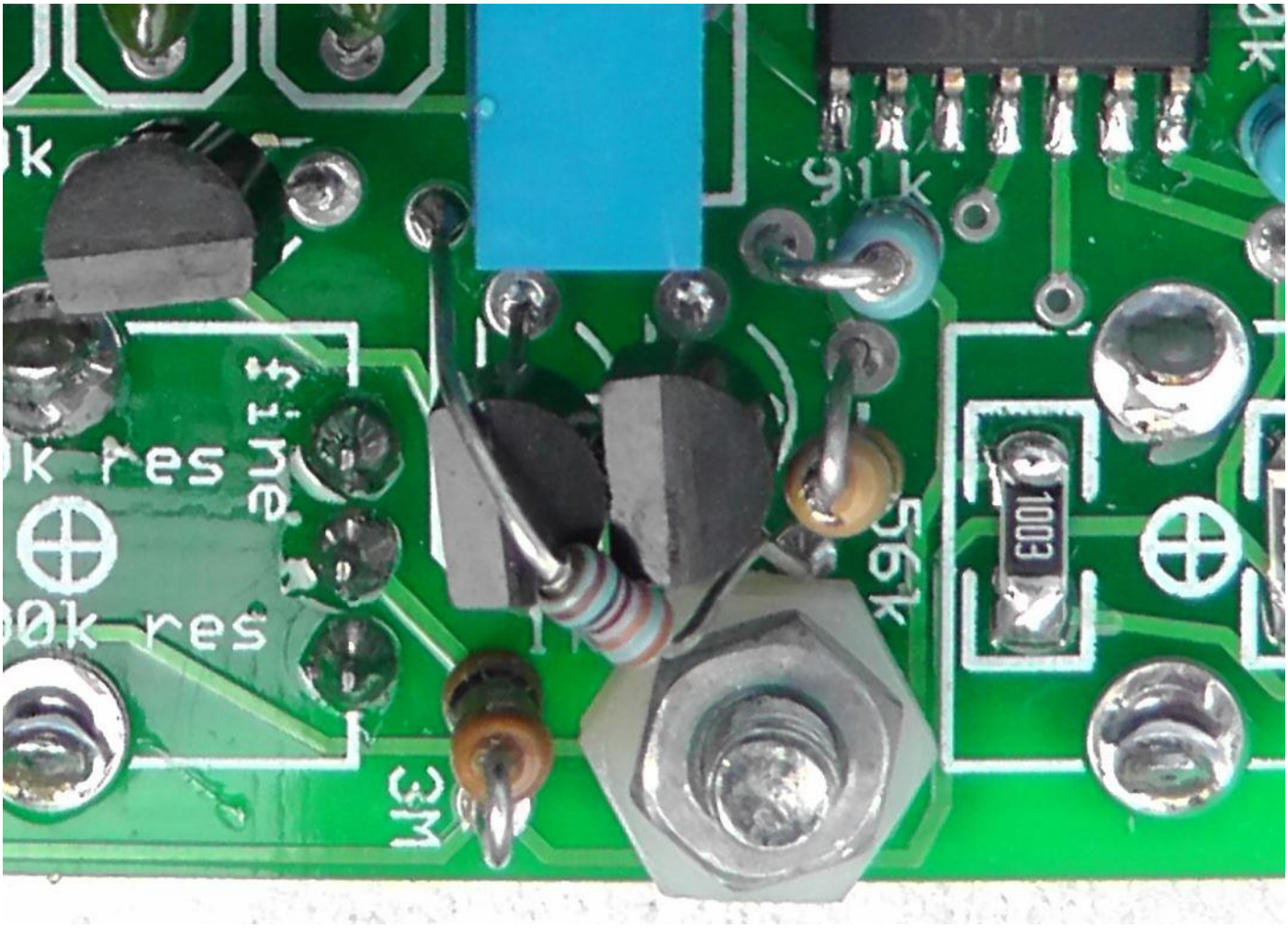
I used this



Tempco resistor and standoff

The 1k tempco is place in contact with the matched PNP transistors. If you don't care about 1V/oct scaling, don't bother matching the transistors and use a regular 1k resistor. The module will still work perfectly well. One solder point for the 1k tempco is close to the stand-off mount and the leg of the resistor may touch the nut or screw of the standoff. I got around this by placing a plastic nut (a plastic washer will do too) to ensure the tempco is not in contact with the stand-off. If you use pots that bolt to the panel, you will not need stand-offs, so this section is not important ☺

See picture below:



Building

I assume if you bought the PCB, you know what you are doing. If not, start with the surface mount parts first, then the chips. It will be very difficult to install the chips last, which is the usual procedure, so install them before getting the thru-hole parts on board.

Once the SMD is done, carry on as usual, resistors, caps, trannies as you like.

Setup

The 20k multi trimpot is to get 1V/Oct scaling. Adjust the Coarse & Fine pots so your multi-meter reads 0V at the base of the PNP transistor connected to the 1k tempco. Now insert a 1V CV signal and adjust the 20k trimpot until you see 18mV at the base of the trannie.

The 100k trimpot serves to remove DC offset on the signal. It is a bit redundant as the 10uF bipolar caps do that as well. Nevertheless, monitor the signal going into the Q pot (pin 1) and adjust the 100k trimpot until this is centred on 0V, you need an oscilloscope for this. If you do not have one, no drama, make sure it is about in the middle setting and relax.

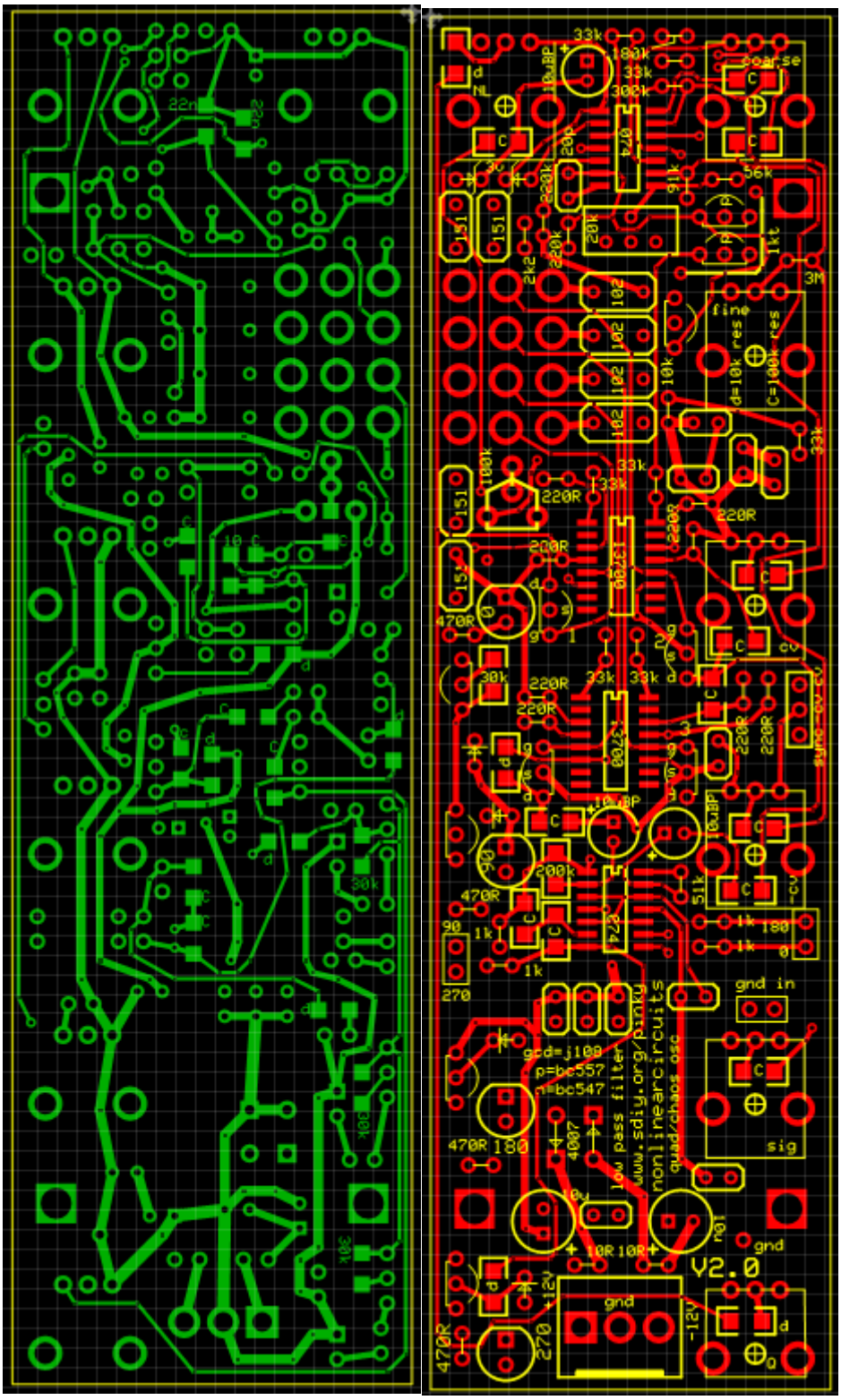
Use

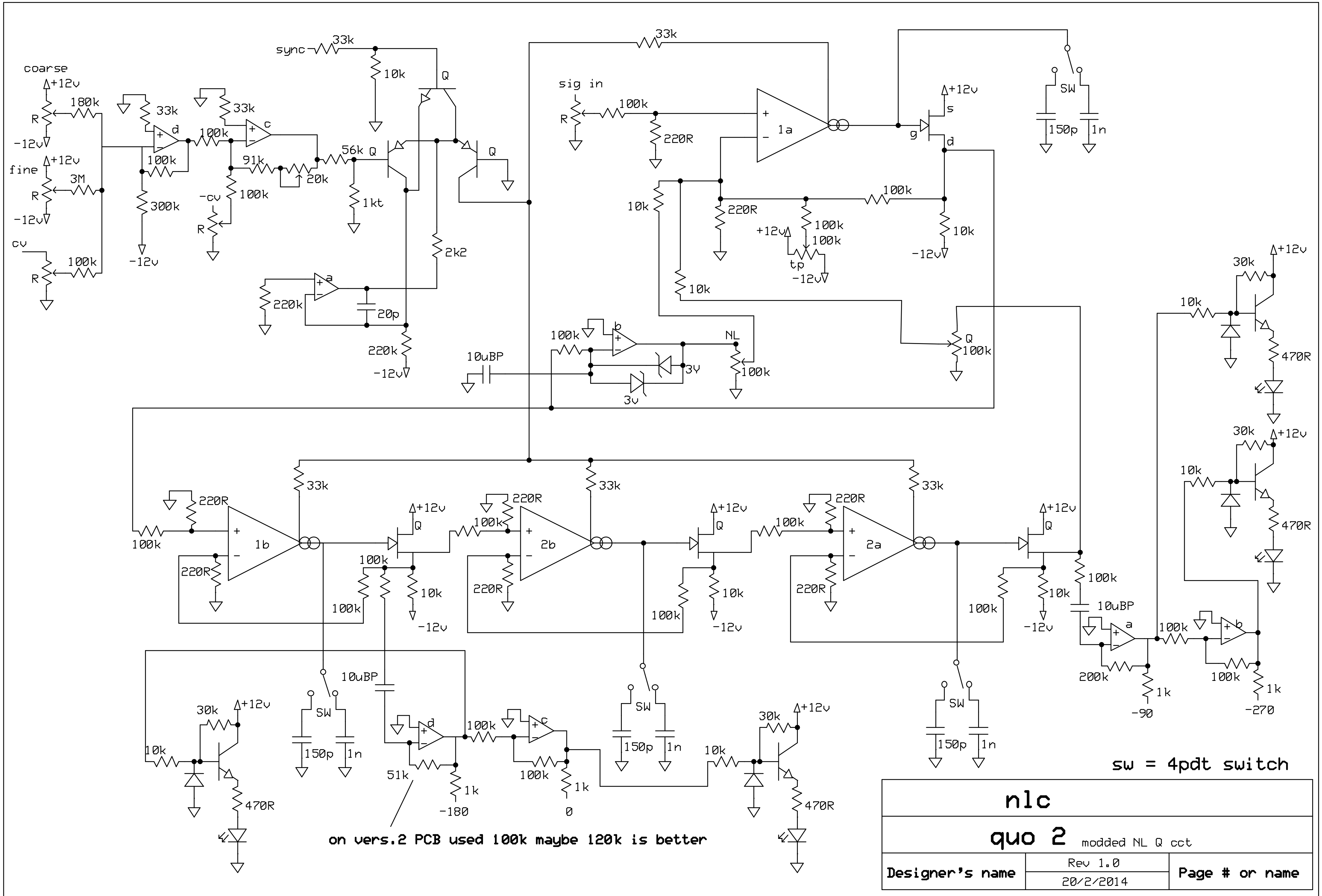
The NL (nonlinear) pot is best kept at 0 for normal use. It is most effective when using the module as a filter. Get a nice filter patch running and try adjusting the NL pot to see what happens.

To use the module as a QUO, turn up the Q pot to at least 7. If it is turned to 10, it will still oscillate but the waveforms will not be nice sine-waves. Actually it takes a bit of tweaking to get the sines spot on, usually somewhere around 7.5-8.5 will do it. For most purposes, it is even preferable not to have perfect sine-waves; distorted wave-shapes have harmonics.

The sync input is a hard sync, *very hard*, feeding it gates turns off the oscillator which allows a burst function. It can of course be fed audio rate signals to modulate the filter.

This vid is a good demo of this module in action - http://youtu.be/pFWKrey0U_4



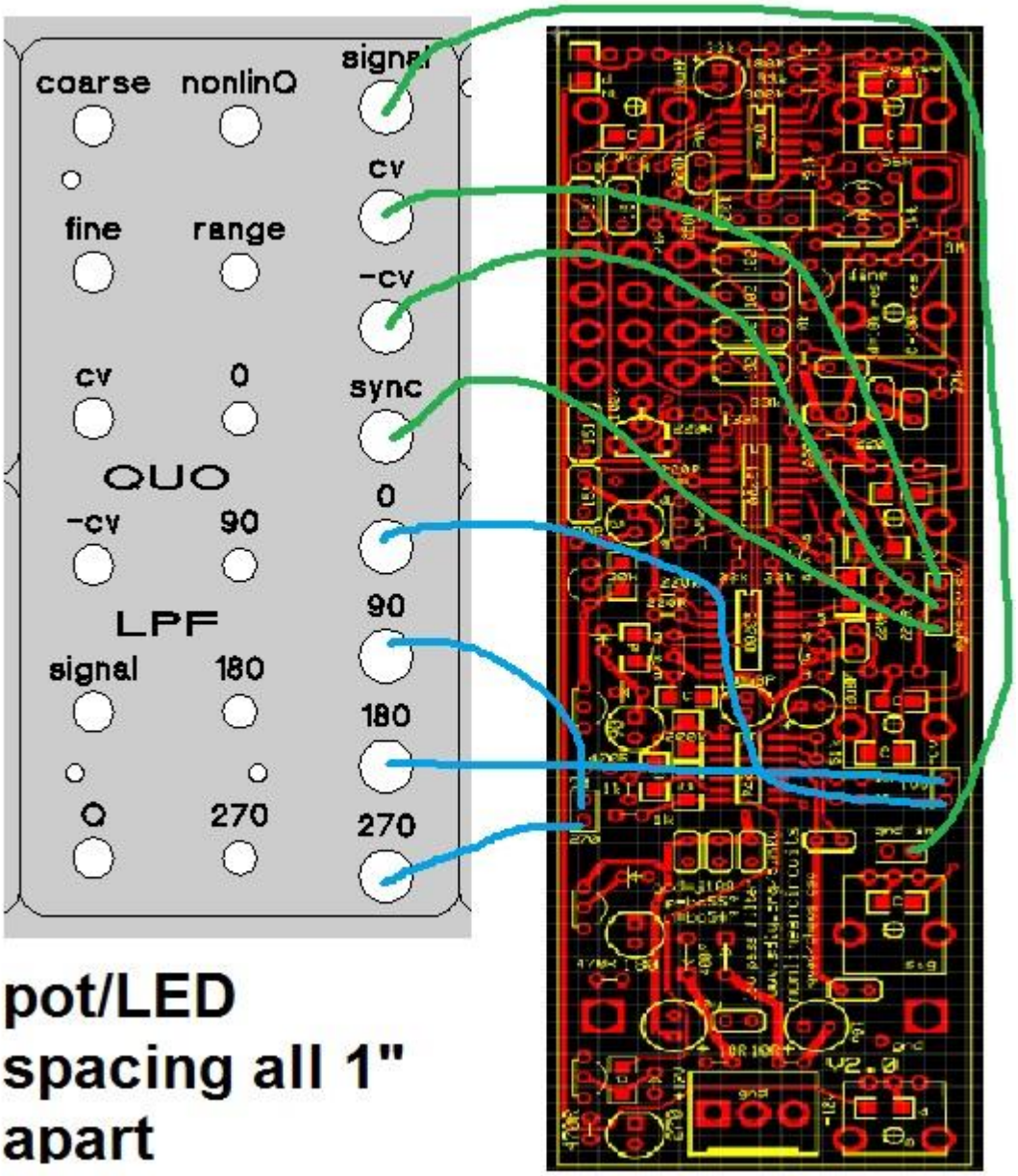


sw = 4pdt switch

nlc

quo 2 modded NL Q cct

Designer's name	Rev 1.0 / 20/2/2014	Page # or name



pot/LED spacing all 1" apart