

QUADTEC - 101 BUILD GUIDE

NEUZTEC 4 2019

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v1.0



Introduction

QUADTEC-101 is a dual-core quadrophonic oscillator in a desktop or Eurorack format. QUADTEC-101 is offered as a DIY kit, which requires soldering. The goal of this Build Guide is to make the assembly process as easy as possible and accessible to tinkerers of all skill and age levels.

Tools Required

- Soldering iron: Any will do, however a higher power (30W+) iron with a fine chisel or bevel tip will be easiest to use
- Side Cutters (also known as flush or diagonal cutters) to clip off excess leads
- Two Wrenches: 1 8mm, and one 7/16" to tighten pot and jack nuts

Consumables Required

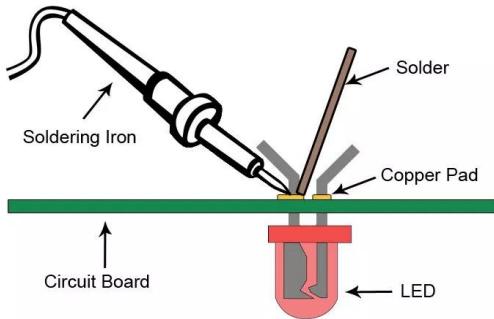
- Rosin Core Solder, preferable 63/37 Lead/Tin composition
- Solder wick in case of mistakes

What is Soldering and How Do I Get Really Good?

Soldering is the act of joining two metals using an intermediate metal to bridge the connection. We are soldering copper component legs to copper pads on a printed circuit board (PCB) using lead-based solder.

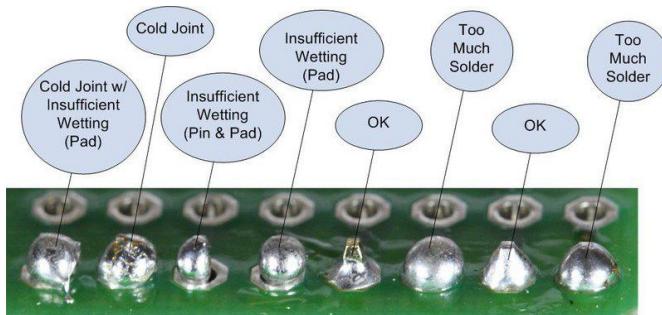
The most important tip to good solder joints is to first concentrate on heating up both pieces of metal first and then introduce the solder. You are not “painting” the molten solder onto the part, you are heating up the parts and then filling in the gaps with solder.

How To Solder



A good idea is to apply heat from the soldering iron first, count to 3 in your head, and then introduce a little bit of solder. Count to 3 again in your head and finally remove the soldering iron.

Once you complete your first solder joint, compare your results with this image and see where you stand.



If you are struggling, please ask for assistance! It's what we're here for.

Bill of Materials

A Bill of Materials (or BOM for short) is a table that matches each part number with its value or part type. BOMs are used in DIY builds, as

well as mass assembly as a means of describing what parts are placed on a PCB, and where to find them.

To save on space, part numbers are printed on the PCB rather than their values. For instance, a resistor will be labelled as 'R12' instead of '200 Ohms'. The BOM will tell you what value 'R12' is and what type of part it is. Resistors are conventionally referred to as 'R*', capacitors as 'C*', and integrated circuits as 'IC*' or 'U*'

The Bill of Materials is your best friend and is found on PAGE 18.

A good idea is to mark off the components you've already soldered on the BOM with a highlighter or pencil. This keeps you on track in the event you take a break or get distracted.

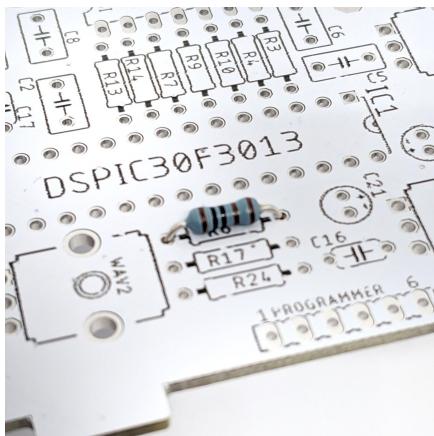
1. Resistors

Always start with resistors. They come in a strip and they look like this:

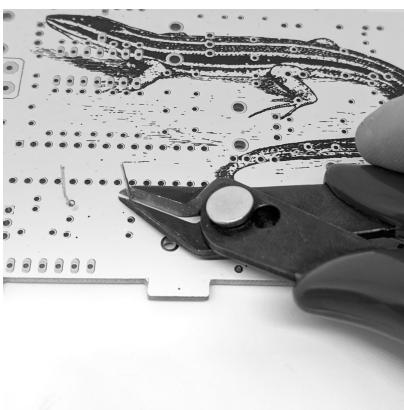


Resistors impede the flow of current and have a variety of uses in electrical circuits. In QUADTEC-101 they are used to set the cut-off frequency of the output filters, to set the output gain of the output amplifiers, and to limit current coming from the CV inputs.

Resistor leads need to be bent and inserted into the PCB. Resistors do not have a polarity, and can be installed either way around.



Now you may flip the PCB over and solder the leads in the way described in the earlier sections. Once you have both leads properly soldered, you can go ahead and trim the leads using the side cutters.

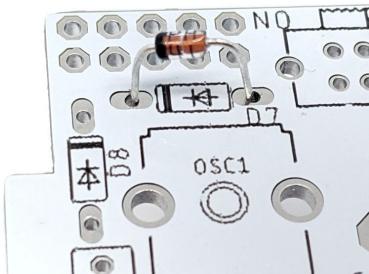


Congratulations! You've soldered one perfect resistor. Great job! Finish up the rest of the resistors using the BOM, before moving forward.

2. Diodes

Diodes are similarly shaped to resistors, however they have a much different purpose. Diodes are semiconductors, and they only conduct in one direction. In Quadtec-101 they are used to prevent power from being applied backwards and potentially destroying your beautiful instrument.

Diodes DO HAVE A POLARITY and you need to double or triple-check that you are installing them the right way around.

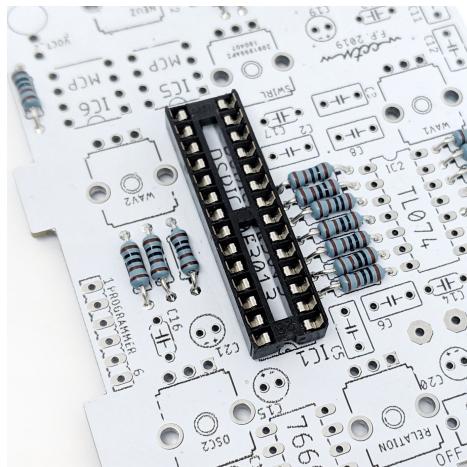


The diagram on the PCB shows one black end that needs to line up with the black end of the diode. Insert them flush and solder the same way you solder resistors.

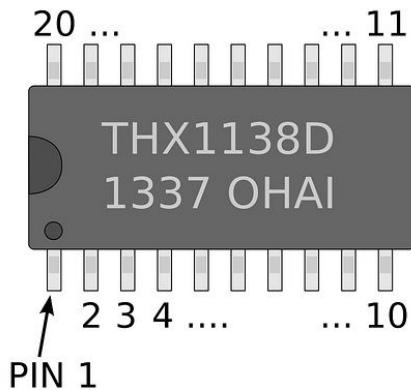
3. Sockets and ICs

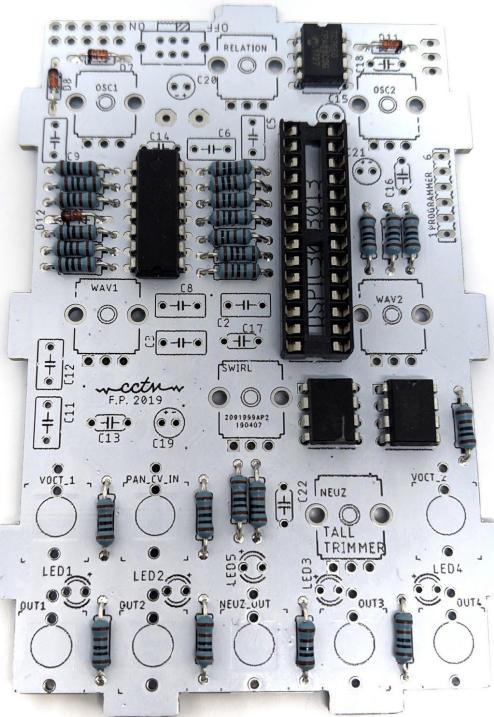
The order for soldering PCBs is always flattest to tallest - this is so it's easier to flip the board over and have the desk supporting the components. If you do taller ones first, then the shorter components will drop down when you flip the PCB over.

Let's solder the socket first. The socket is for the DSPIC chip. We use a socket for a few reasons, primarily because the DSPIC is the most sensitive component on this board, and we don't want to introduce too much heat to it. The other reason is that the DSPIC is the most costly component to replace in case of accidentally soldering it in backwards.



Next up are the ICs. There are 4 - TL074, TC7660, and 2 x MCP4802. Make sure you do not confuse the TC7660 with the MCP4802, even though they look very similar. Double check under a light source to tell them apart by the markings on top. The diagrams on the PCB show which direction the notch of the chips needs to go. If there is no notch, there are several ways to find which end is pin 1.

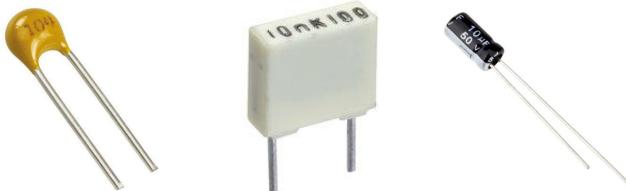




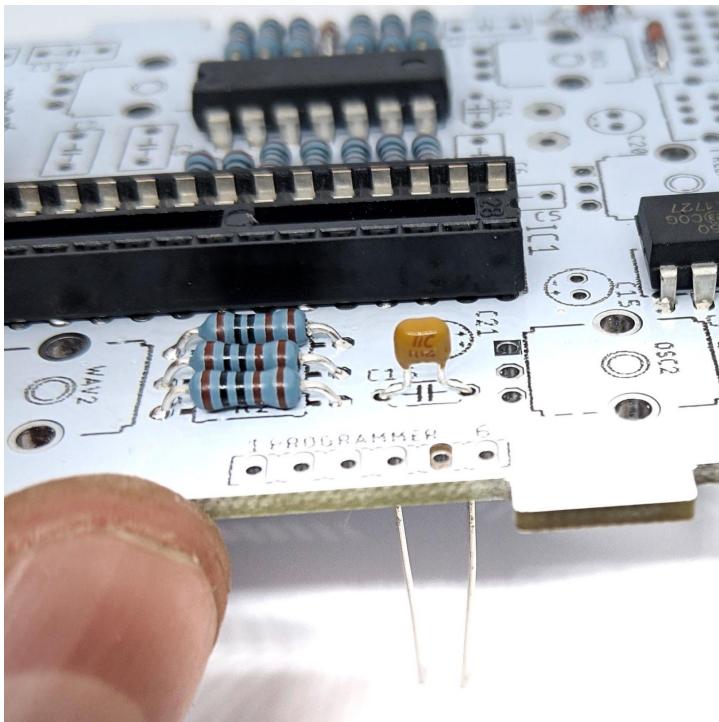
At this point, your board should look like this. Hooray!

4. Capacitors

Quadtec-101 Uses 3 different types of capacitors, but luckily they all have different shapes and colours, so it's easy to tell them apart.



The small yellow capacitors are called Ceramic Capacitors, and we should solder them first.

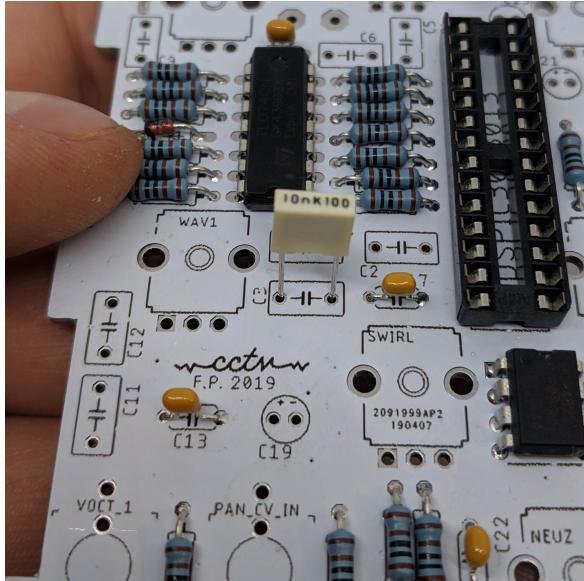


These caps DO NOT HAVE POLARITY, so you can solder them either way. These caps, like the others, match their footprint so it's easy to find where to install them.

Ceramic Capacitors are cheap, but behave non-linearly in audio paths. In QUADTEC-101 we are using ceramic capacitors to smooth out the DC voltage rails, and to provide localized storage of high-current energy for each of the ICs.

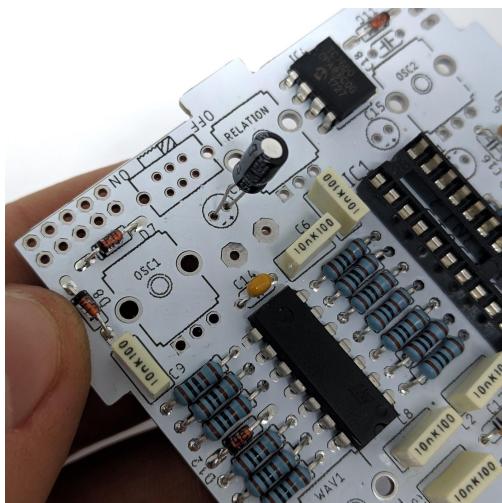
Next up are Film capacitors, these are best for audio and high-voltage applications, and we are using them in the output filter stages here.

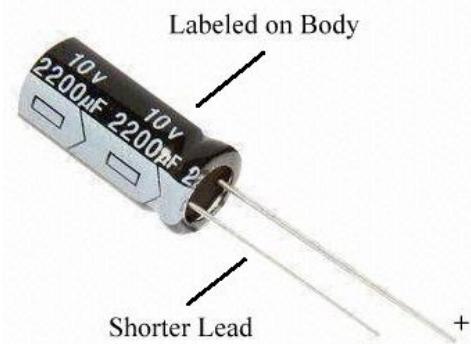
Film capacitors are non-polarized, so you can install them either way.



Finally, we have a few electrolytic capacitors to install. Electrolytics are very cheap in high capacities, and are excellent at storing large amounts of energy. These are used to smooth out ripple noise in the power supplies.

Electrolytics **DO HAVE POLARITY AND YOU MUST MAKE SURE TO INSTALL THEM CORRECTLY.**

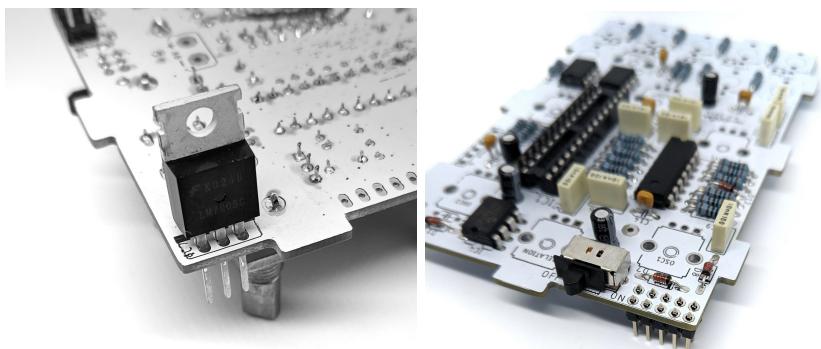




The PCB has a marking showing '+' and '−', and these correspond to the longer and shorter lead, respectively.

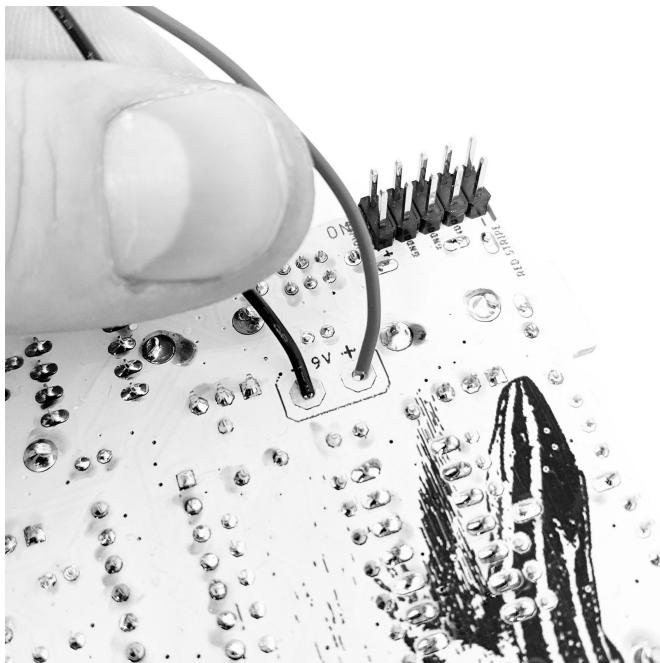
5. Odds and Ends

Next we'll solder the 10-pin power connector, the battery on-off switch, and the voltage regulator. Extra attention needs to be paid to the voltage regulator, since it has to go in the right way, but it also needs to be soldered on the bottom of the PCB (not the top!). The power header also needs to be soldered on the bottom of the PCB.



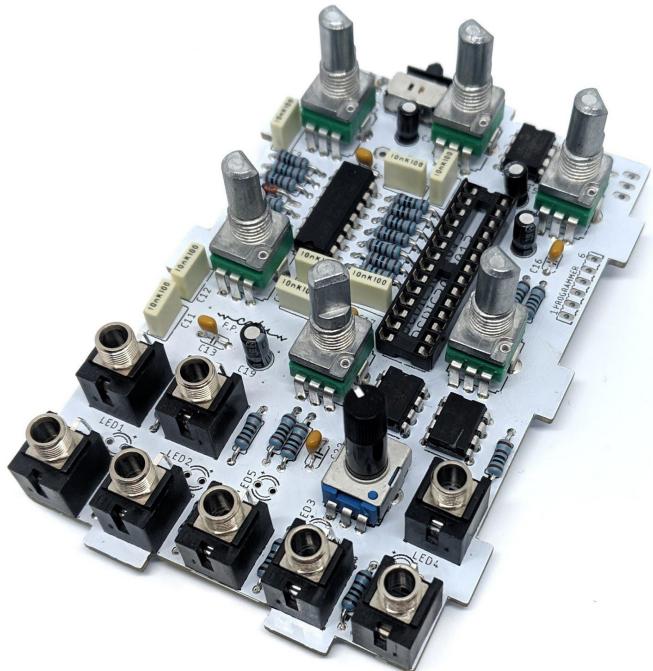
Note: There is a similar footprint labelled 'programmer'. No component is installed here. If you wish to hack your Quadtec-101 by writing your own firmware, this is a port for the common 'PicKit 3' programmer.

Before moving on, be sure to solder the 9V battery clip. The Red Lead goes to the '+' sign, the black lead goes to '-'.

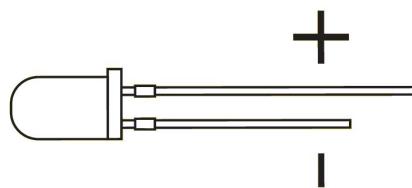


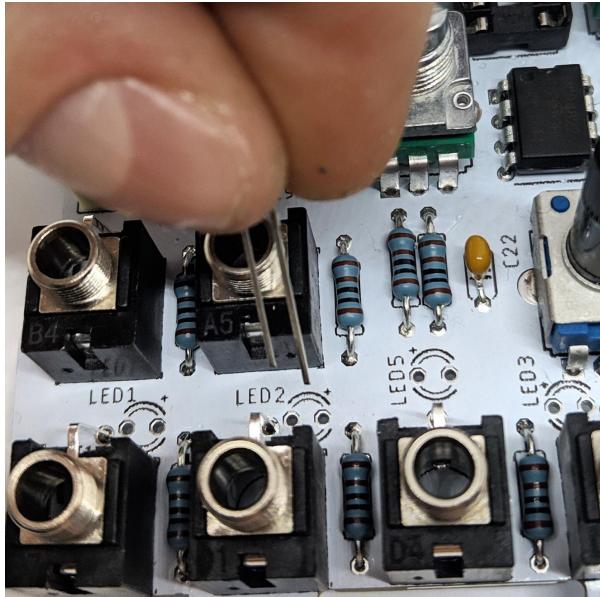
6. Jacks and Potentiometers and LEDs

All that's left is the easy part. These components should be assembled by doing a 'dry fit' with the panel - meaning you insert the components through their footprints, then attach the panel with one or two nuts, and then solder. This makes sure the components are lined up properly with the panel, and ensures the LEDs are at the right height, and all equal.



The LEDs (light emitting diodes) are diodes after all, and as such they also HAVE A POLARITY. Make sure you install them the right way around!

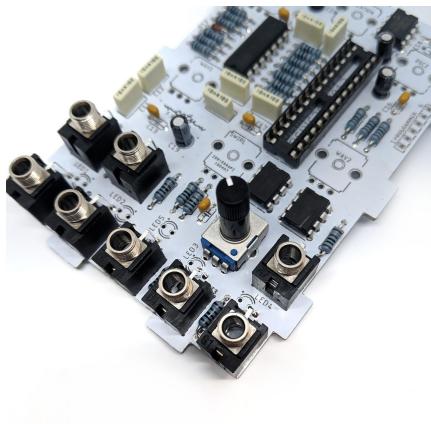




The PCB has a '+' sign marking the positive leg of the LED. The positive leg of the LED is the longer of the two.

A potentiometer (or pot for short) is a type of variable resistor that is used to control various parameters in synthesizer. This is the electrical component that is dressed up with the knob.

Quadtec-101 has one pot that is different than the others, and you should make sure it goes in the right place!



Once the pots, jacks, and leds are installed, power up the synth to see if all is well. You will have a current-indicating power supply available to see if the draw is correct on all the rails. If everything looks good, you can insert the DSPIC and install the panel by tightening down the pot and jack nuts.



At this point, it's time to do a test. Check if your LEDs are all working, and listen to each output to make sure you have signal. If something's not right, you'll need to troubleshoot. Ask for assistance in troubleshooting if you need it.

7. Enclosure

Quadtec-101 includes a simple enclosure to allow use in desktop mode. This enclosure consists of 3 laser cut pieces and one 3d-printed battery holder. The pieces friction fit together using the tabs cut into the PCB. If you find that a large amount of force is needed to get the pieces to snap together, flip the front piece and/or swap the left and right pieces around to find a combination that fits.

8. Usage

The digital oscillators are coded to provide synthesis at 40,000 samples per second. Using the waveshape knob, different waveshapes are blended together to create new, complex, and often unusual sounds. Some waveshapes are stored as wavetables, gathered from a variety of sources, and others are computed in real time. As you turn the knob from fully counter-clockwise to fully clockwise, you will experience a blending of the following 9 waveshapes:

Triangle

Evenangle

Eventooth

Cello

Saw

Square

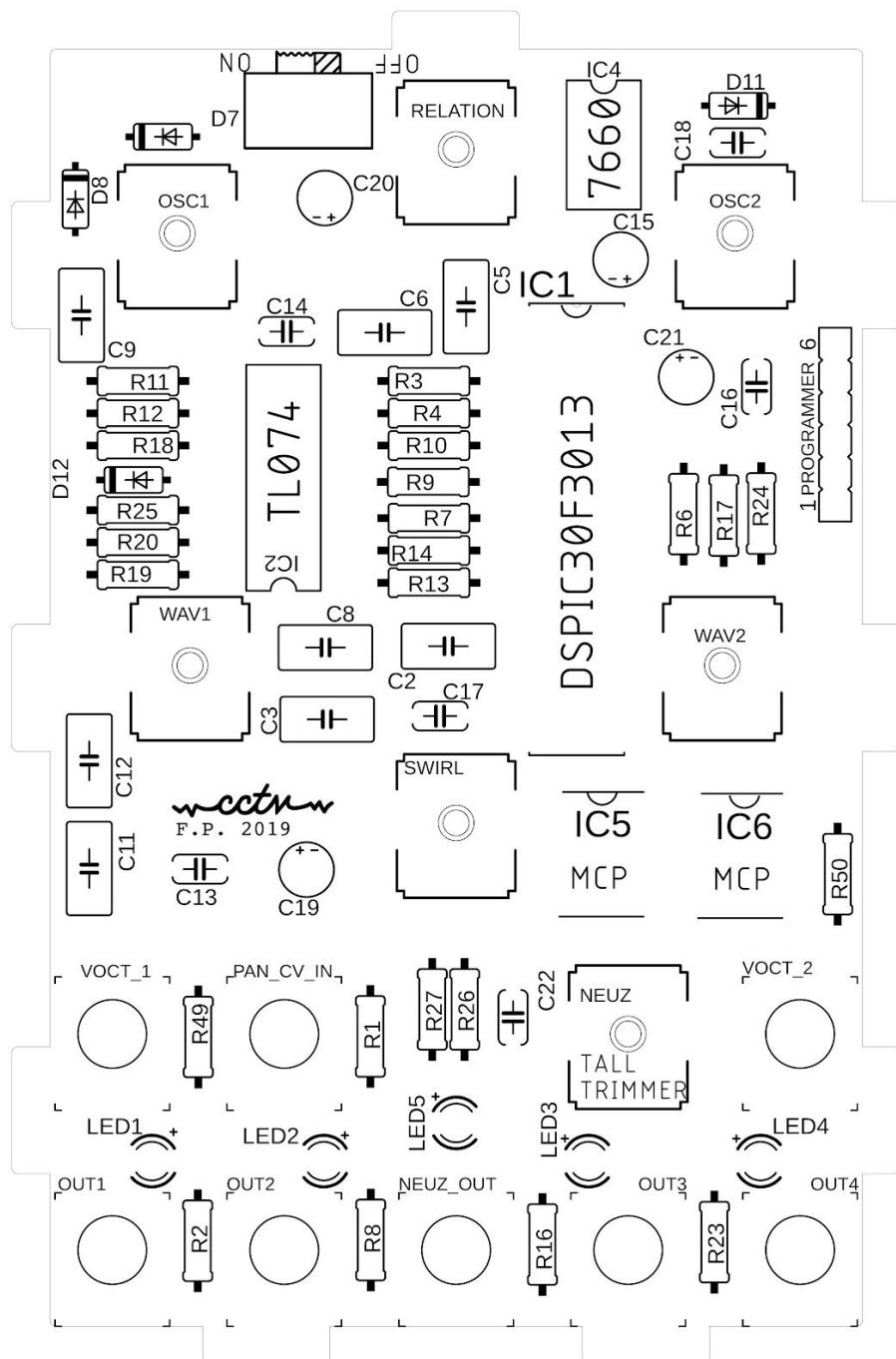
"Videogame" Pulse

Pluck

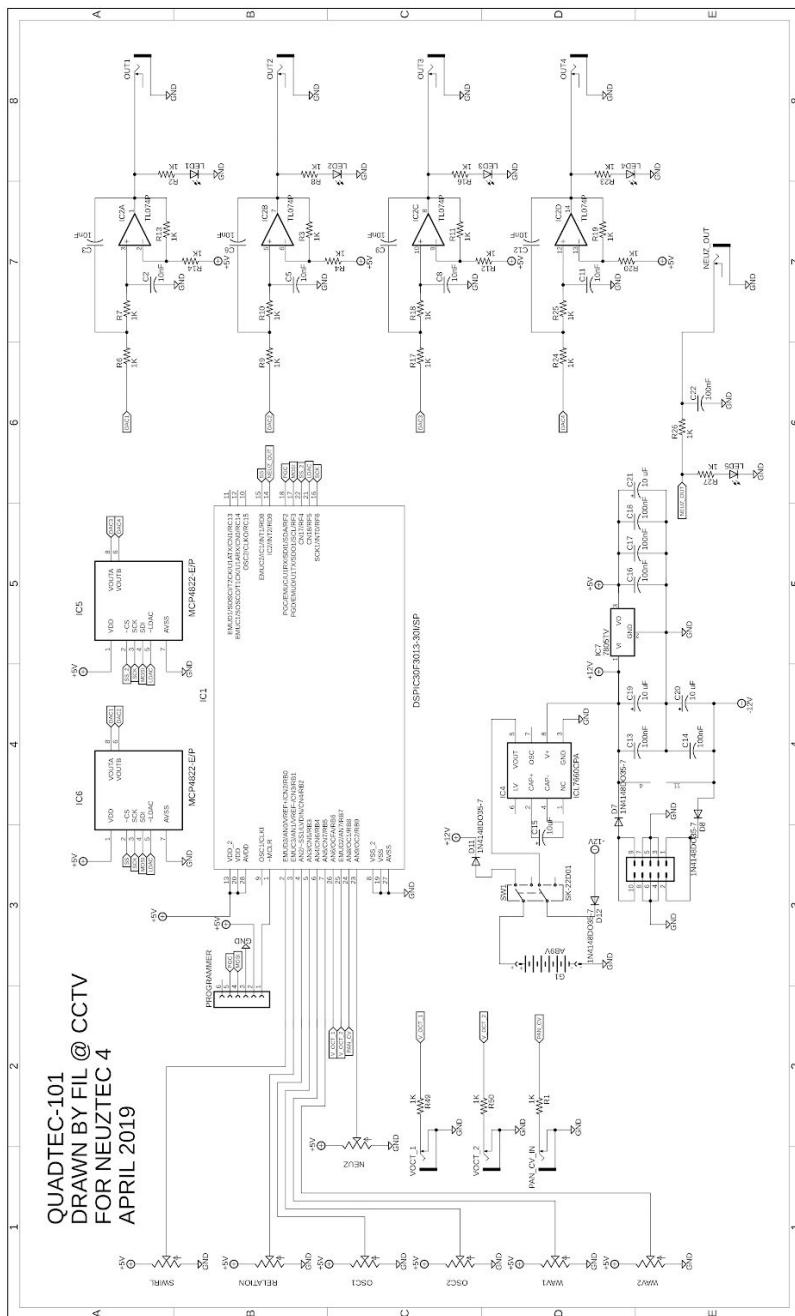
FM

Each oscillator has controls dedicated for each on the left and right half of the module. Each of the two oscillators has pitch control with the knob in the top left/right and CV inputs that tracks 1 V/OCT, as well as the waveshape blend knob.

Layout



Schematic



Qty	Value	Device	Package	Reference	Description
6	B10K	9MM Pot		OSC1, OSC2, RELATION, SWIRL, WAV1, WAV2	9mm vertical snap-in pot, Alpha / Panasonic style
1	B10K	9MM Trim Pot		NEUZ	9mm vertical snap-in trimmer pot, Song-Huei Style
25	1K	R-US_0207/10	0207/10	R1, R2, R3, R4, R6, R7, R8, R9, R10, R11, R12, R13, R14, R16, R17, R18, R19, R20, R23, R24, R25, R26, R27, R45, R50	Resistor, Through-hole
4	10 uF	CPOL-USE24-4	E2-4	C15 C19, C20, C21	Polarized Electrolytic Capacitor
6	100nF	C-US050-024X044	C050-024X044	C13, C14, C16, C17, C18, C22	Ceramic Capacitor
8	10nF	C-US050-035X075	C050-035X075	C2, C3, C5, C6, C8, C9, C11, C12	Film Capacitor
5	LED3MM	T3		LED1, LED2, LED3, LED4, LED5	3mm Red LED
4	1N4148	DO35-7		D7, D8, D11, D12	Small Signal Diode
1	7805TV	TO220V		IC7	Positive 5V Voltage Regulator
1	AB9V			G1	9-V Battery Clip
1	DSPIC30F3013	DIP28		IC1	16-bit Digital Signal Processor
1	Pin Header			SV2	Power Header
1	ICL7660	DIP8		IC4	Negative Voltage Converter
2	MCP4802	DIP8		IC5, IC6	Digital to Analog Converter
1	SK-22D01			SW1	DPDT Slide Switch
8	PJ301M			NEUZ_OUT, OUT1, OUT2, OUT3, OUT4, PAN_CV_IN, VOCT_1, VOCT_2	3.5mm jack for Eurorack modular synths
1	TL074P	DIL14		IC2	OP AMP

Design Files:

github.com/cctvfm/quadtec101

Usage Information:
cctv.fm/product-page/quadtec-101

Manual written in April 2019

