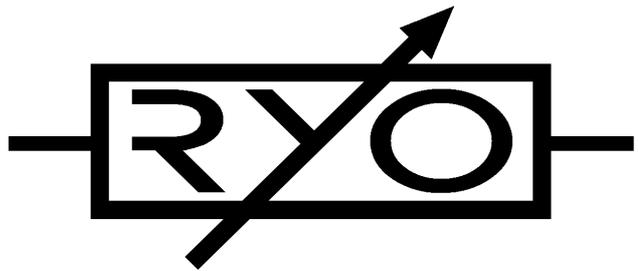


Ljunggren Audio Roll Your Own 3xVCA



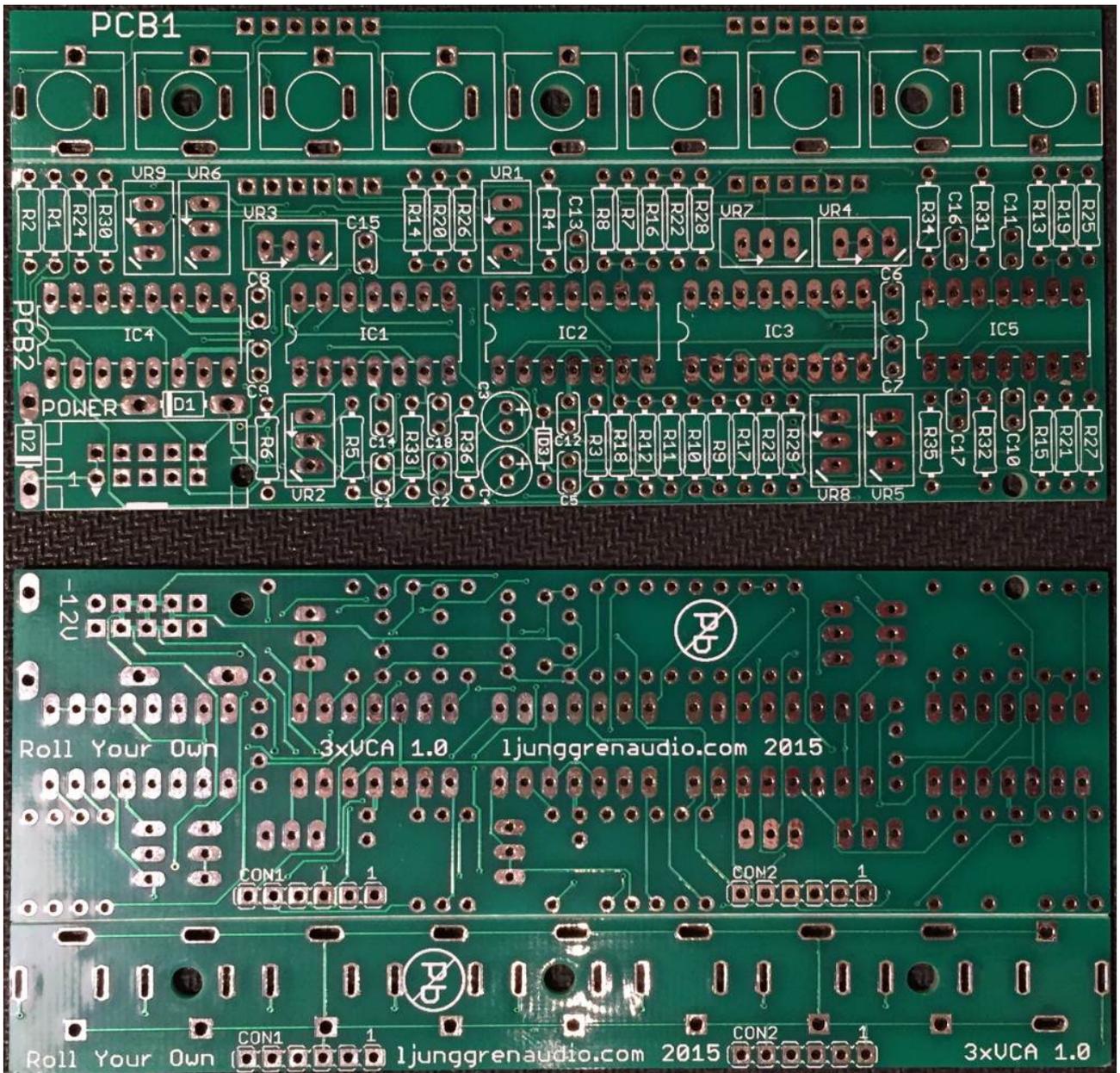
PCB Version: 3xVCA 1.0

Bills Of Material

Type	Qty	Value	Parts	Comment
Power header	1	5x2 pin	POWER	
Pin strip	2	6 pin	CON1, CON2	90 degree angled
Resistor	1	3.3k	R3	1/4W
Resistor	2	10R	R1, R2	1/4W
Resistor	3	330R	R34, R35, R36	
Resistor	6	22k	R22, R23, R24, R25, R26, R27	
Resistor	9	10k	R7, R8, R9, R10, R11, R12, R28, R29, R30	
Resistor	15	100k	R4, R5, R6, R13, R14, R15, R16, R17, R18, R19, R20, R21, R31, R32, R33	R13 to R15, R19 to R21 = 1%
Zener Diode	1	1N750	D3	Or 1N4732 or 1N5230 Zener 4.7V
Diode	2	1N5818	D1, D2	Or SB130, power polarity protection.
Trimmer	3	1k	VR7, VR8, VR9	3296W compatible
Trimmer	6	50k	VR1, VR2, VR3, VR4, VR5, VR6	3296W compatible
Capacitor	3	15pF	C16, C17, C18	Ceramic C0G/NP0 2.5mm
Capacitor	13	100nF	C1, C2, C5, C6, C7, C8, C9, C10, C11, C12, C13, C14, C15	Ceramic X7R 2.5mm
Electrolytic	2	10uF	C3, C4	2mm pin pitch, 5mm dia, 5mm height
IC socket	2	DIP16 socket	IC3, IC4	
OTA	2	LM13700	IC3, IC4	
IC socket	3	DIP14 socket	IC1, IC2, IC5	
OpAmp	2	TL084 or TL074	IC1, IC5	
OpAmp	1	LM324	IC2	
Jack	9	PJ301B(M)	J1, J2, J3, J4, J5, J6, J7, J8, J9	

Power Cable	IDC 16pin – 10pin
Faceplate	PCB material, black, 2mm.
PCB	One PCB split into two with v-cut.
Mounting Screws	Black pozi M3x6.

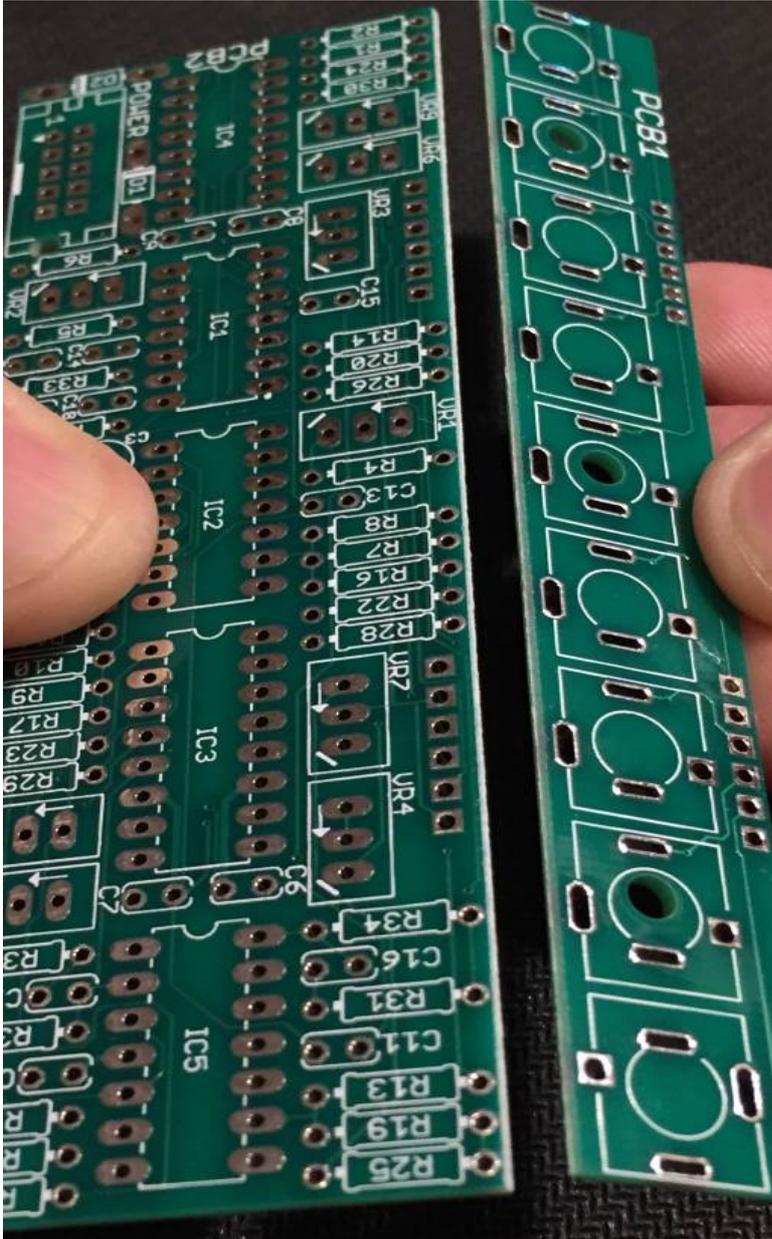
[Schematics can be found here.](#)



Empty PCB.

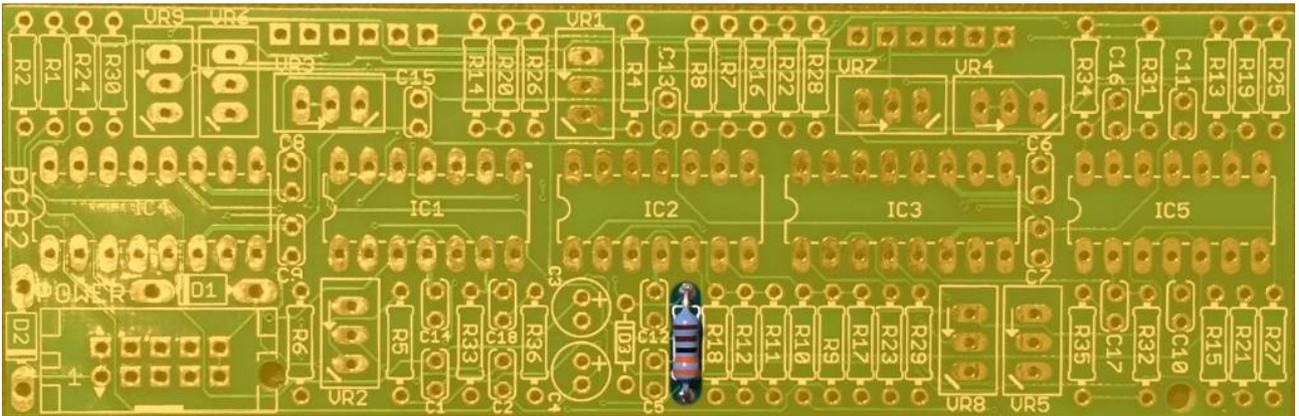
Assembly instructions

Start with breaking the PCB into two parts with your hands along the V-Cut.

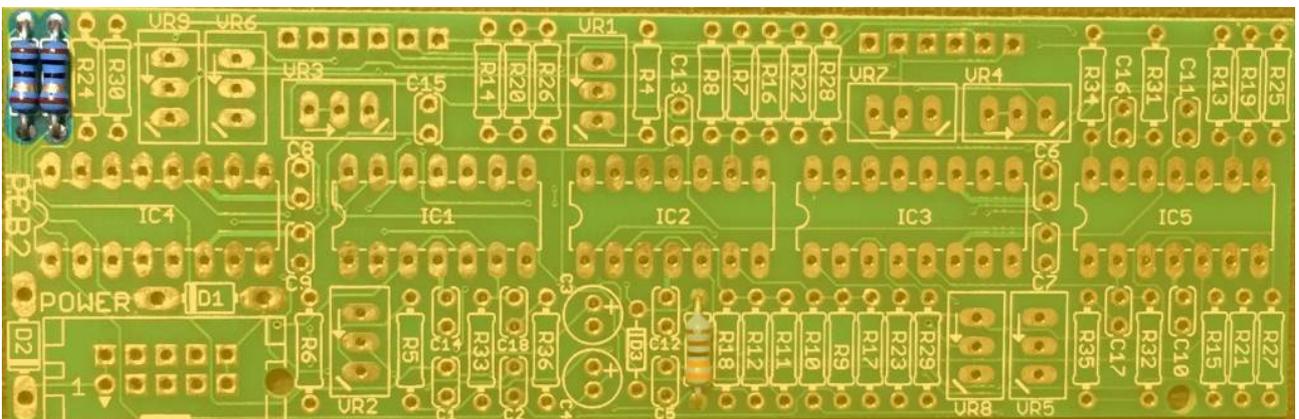


Step 1

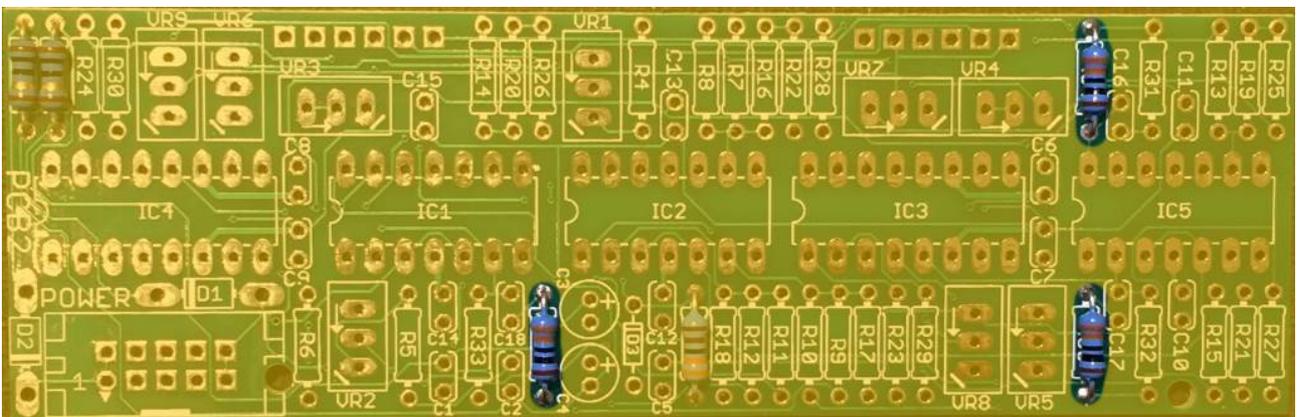
Solder resistors. Resistors are not sensitive to mounting direction.



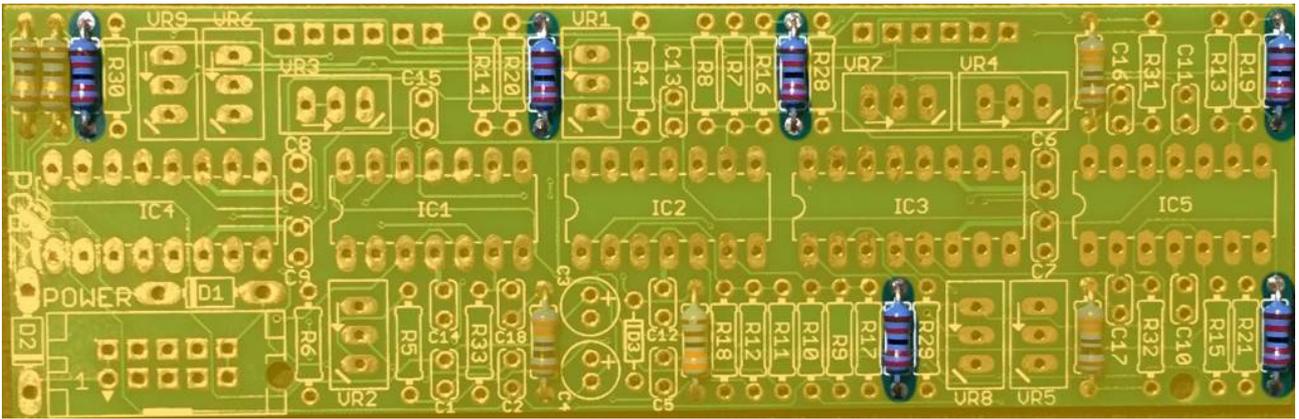
R3 3.3k



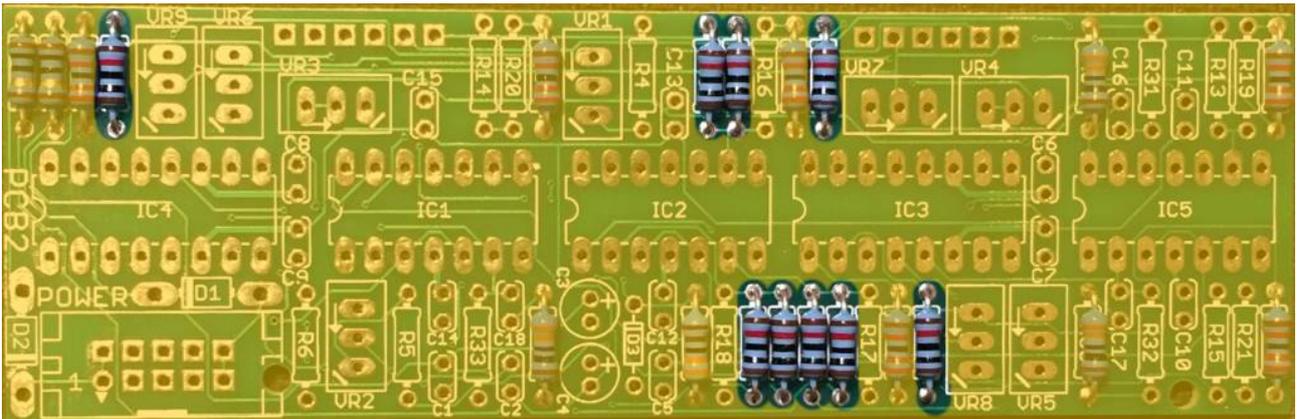
R1, R2 10R



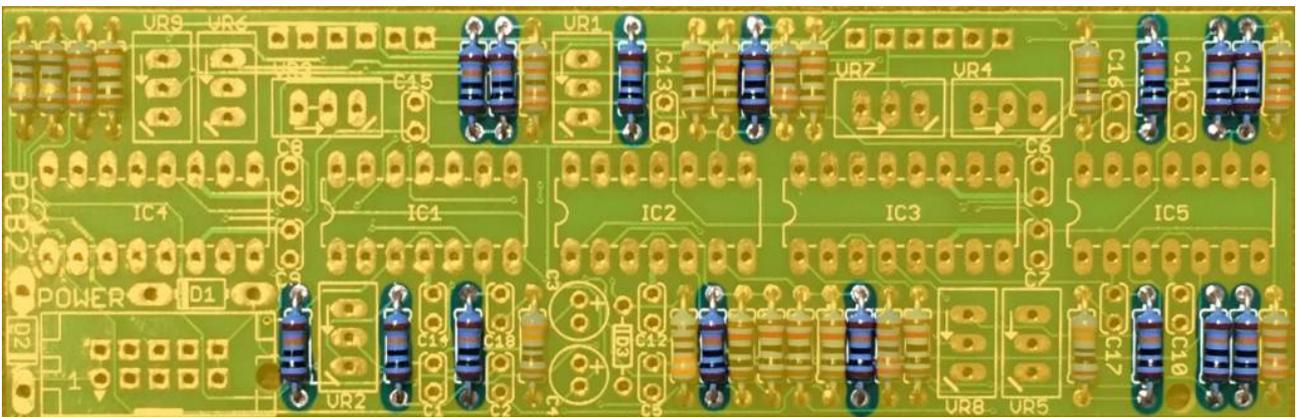
R34, R35, R36 330R



R22, R23, R24, R25, R26, R27 22k



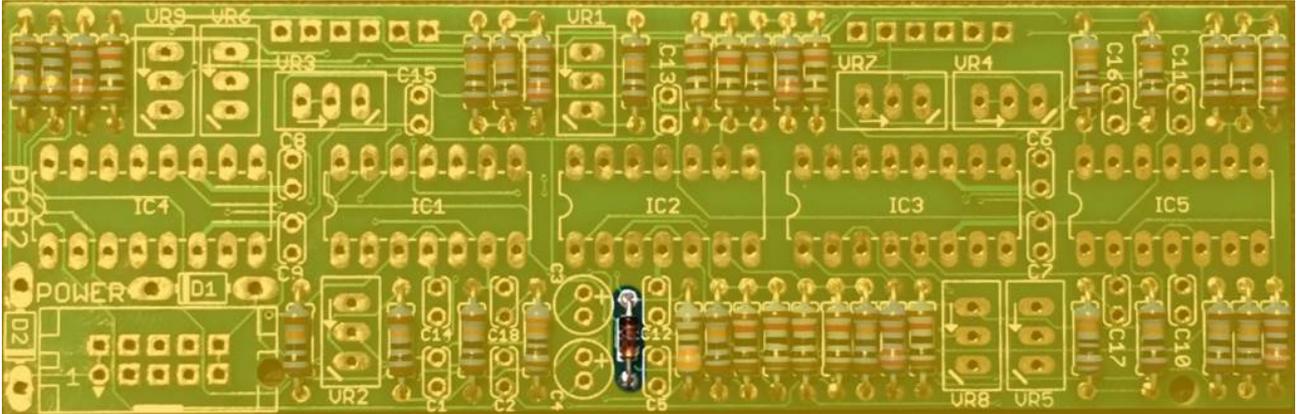
R7, R8, R9, R10, R11, R12, R28, R29, R30 10k



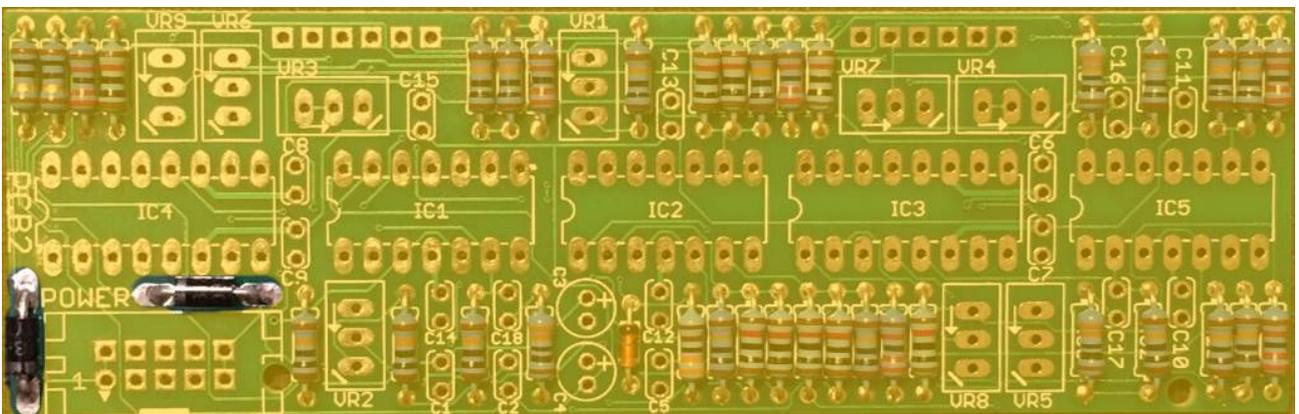
R4, R5, R6, R13, R14, R15, R16, R17, R18, R19, R20, R21, R31, R32, R33 100k

Step 2

Solder diodes. Diodes are sensitive to mounting direction, the stripe on the diode must be on the same side as indicated in the silk screen.



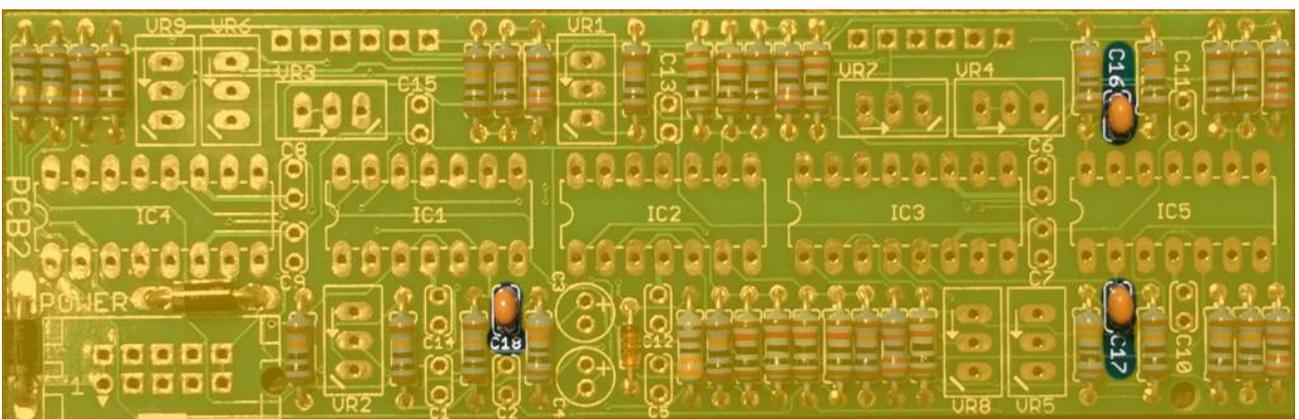
D3 1N750 4.7V Zener



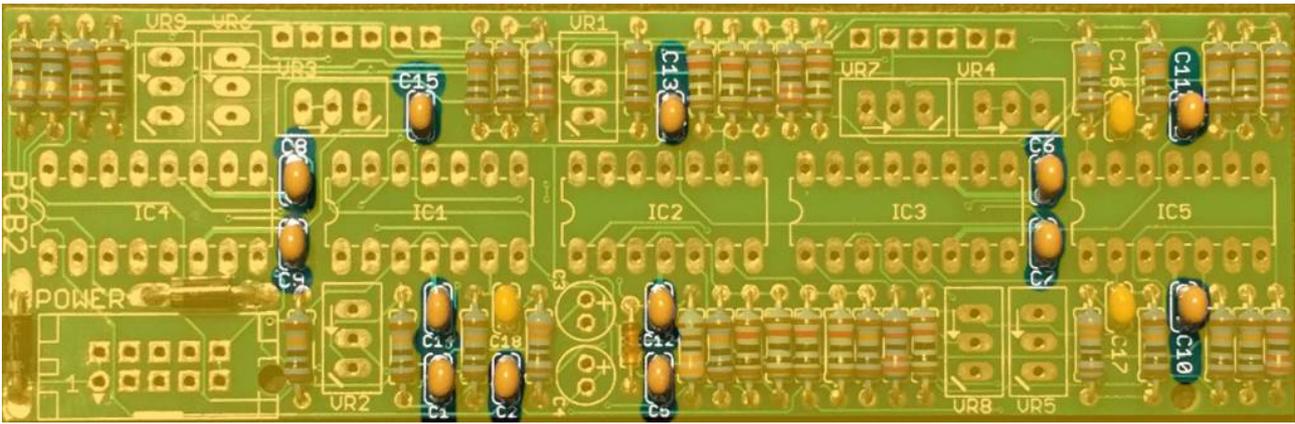
D1, D2 1N5818 Schottky rectifier

Step 3

Solder ceramic capacitors. Ceramic capacitors are not sensitive to mounting direction.



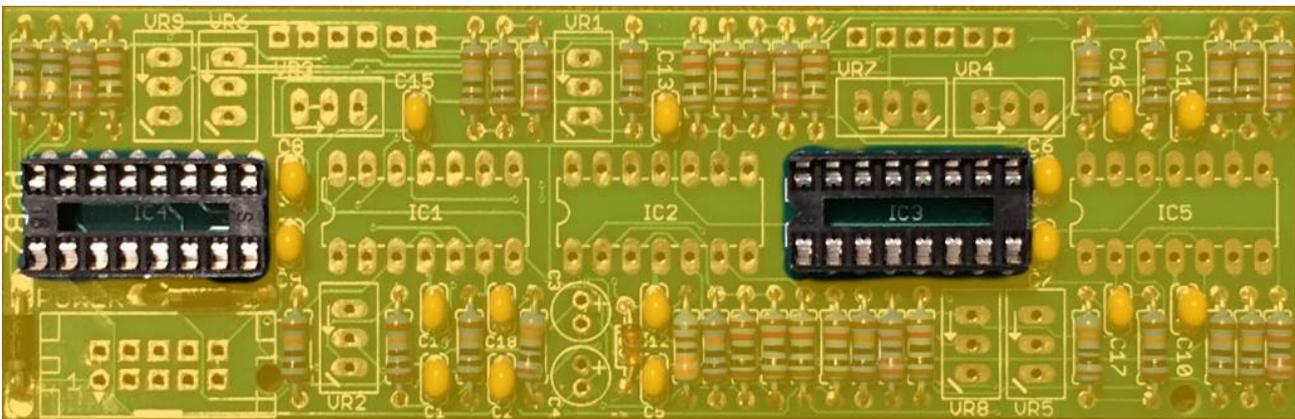
C16, C17, C18 15pF



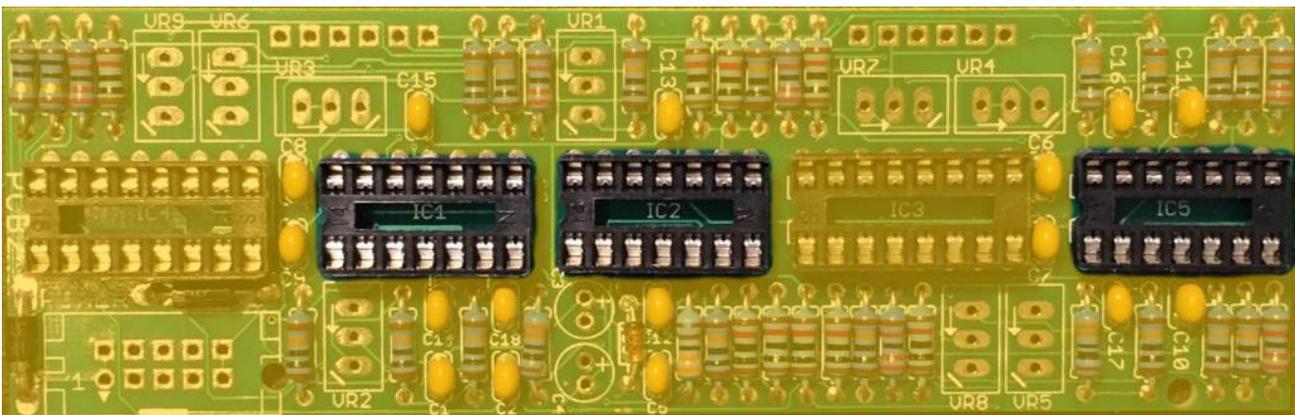
C1, C2, C5, C6, C7, C8, C9, C10, C11, C12, C13, C14, C15 100nF

Step 4

Solder IC sockets. Match the sockets indent with the indent on the silk screen. The indent marks the side that pin 1 is located on the IC. The ICs will be mounted later.



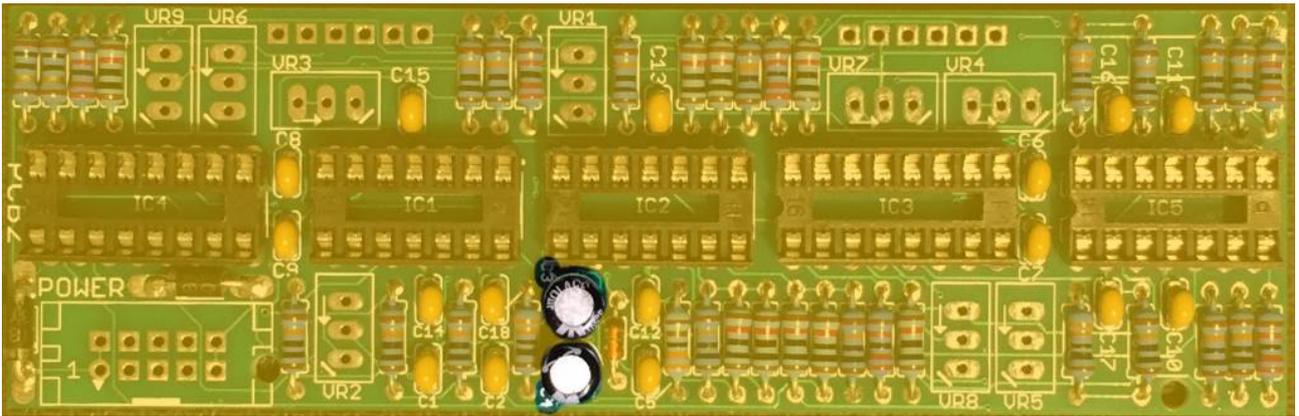
IC3, IC4 16 pin DIP socket



IC1, IC2, IC5 14 pin DIP socket

Step 5

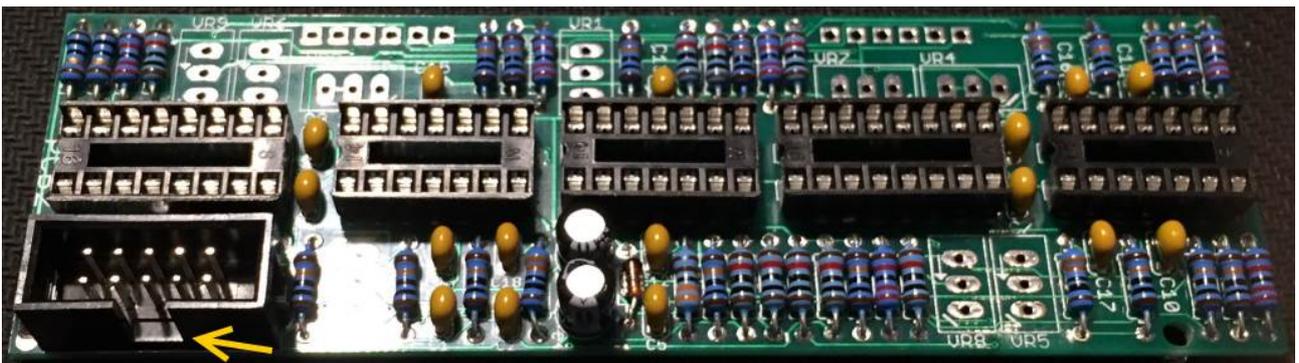
Solder Electrolytics. Sensitive to mounting direction. Long leg is + (anode).



C2 10 μ F

Step 6

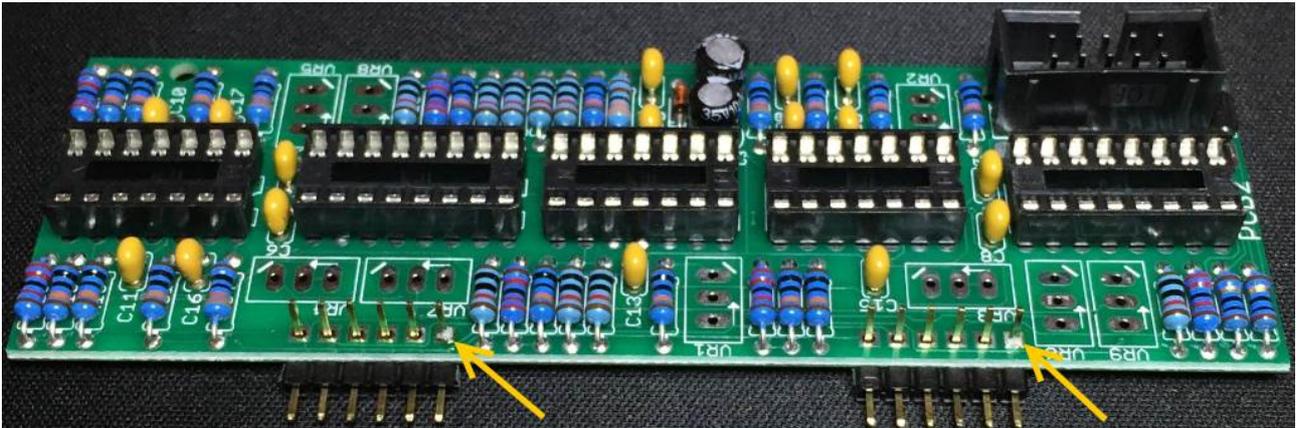
Solder the keyed boxed power header. Pay extra attention to the direction. The triangle (pin 1) must be at the -12V side. In the picture below the slot opening (key) is marked with a yellow arrow.



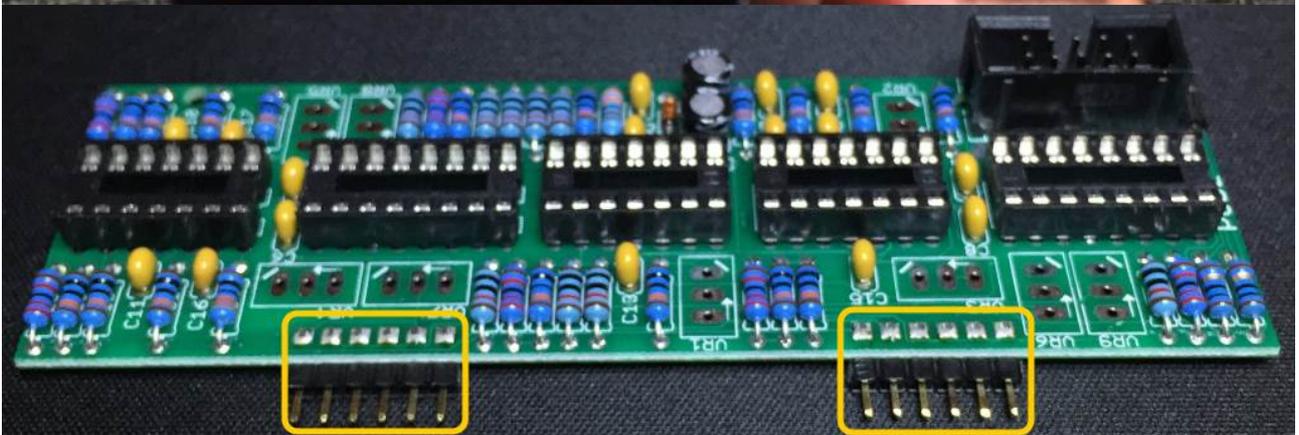
POWER

Step 7

Solder the two angled 6 pin strips in place on PCB2 like in the picture below. Only solder one pin on each pin strip.



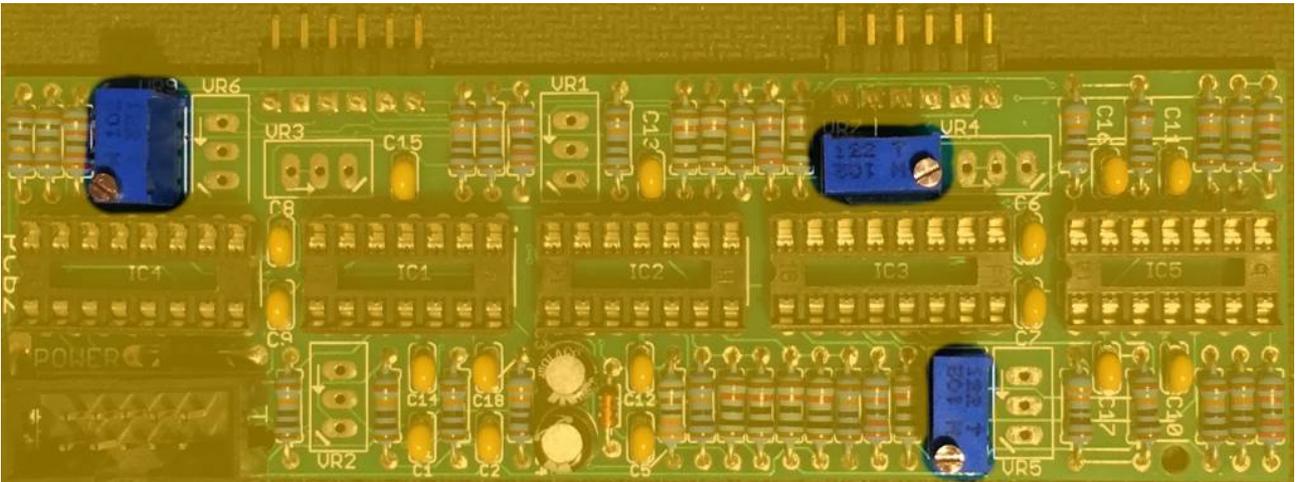
Check the angle of the pin strips. It should be a 90 degree angle. Adjust them if needed and solder the rest of the pins.



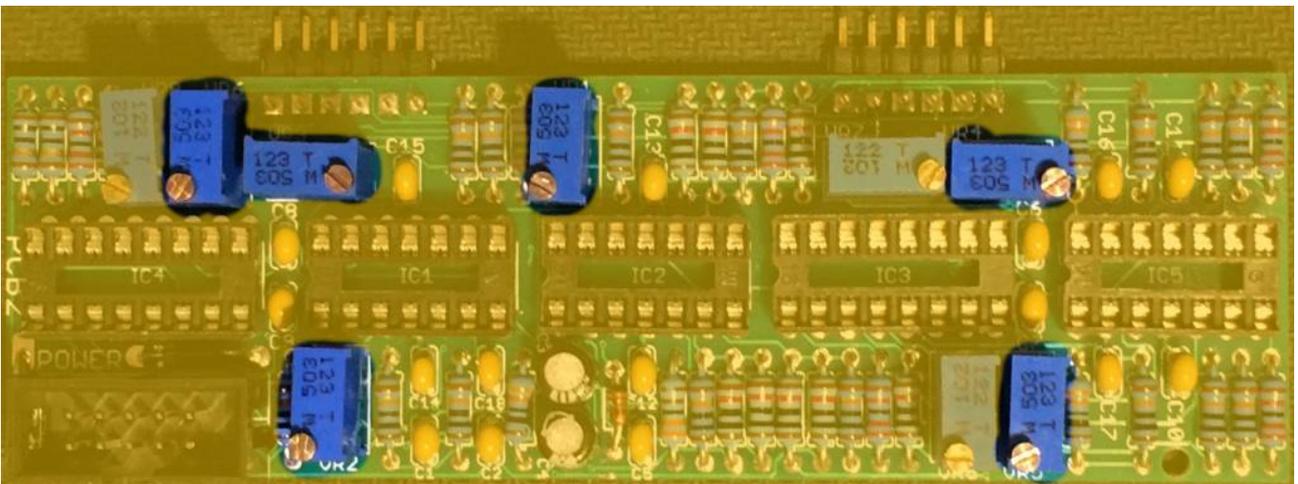
If there is a gap between PCB2 and the plastic part of the pin strip, push the plastic part in toward PCB2 until there isn't a gap any more. You can push it with the broad side of PCB1.

Step 8

Solder Trimmers. The screw should be in the same corner as the 45deg angled short stripe on the silk screen. That way a clockwise turn will increase the value and a counter clockwise turn will decrease the value.



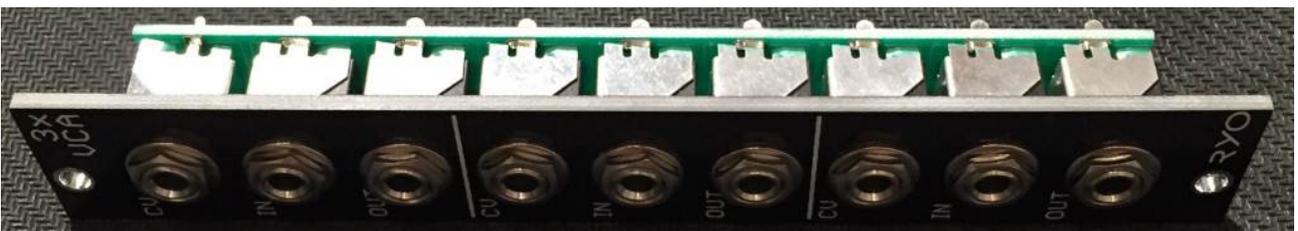
VR7, VR8, VR9 1k multi turn trimmer



VR1, VR2, VR3, VR4, VR5, VR6 50k multi turn trimmer

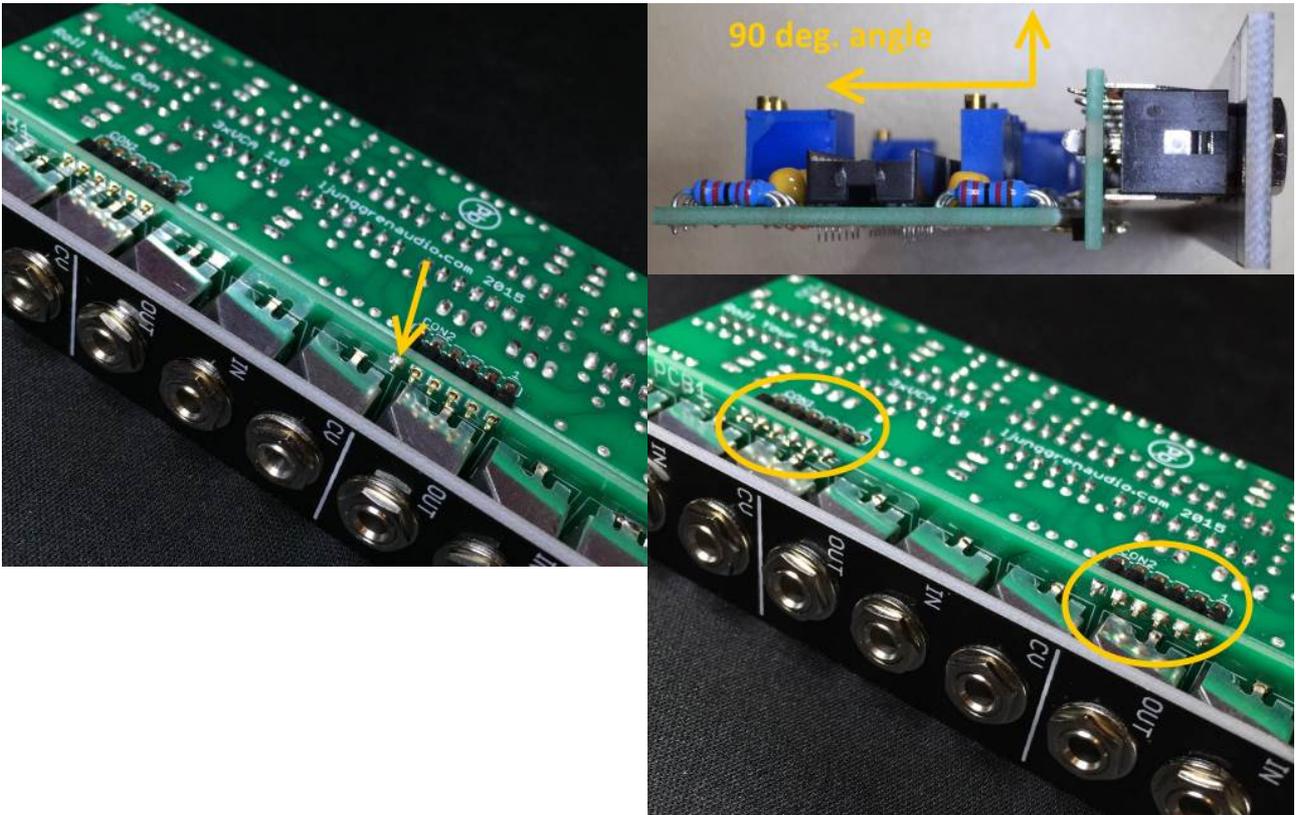
Step 9

Place the jacks in their places without soldering them and mount the panel over the jacks with the help of a washer and a nut on each jack. Don't worry if the jacks twist a tiny bit in their socket while tightening the nut, this is normal, as long as it's not soldered yet it won't be stressed. Use a socket wrench to keep the risk of scratching the panel to a minimum. Try not to make any corner of the top and bottom jack reach outside the PCB. Now you can solder the jacks in place.



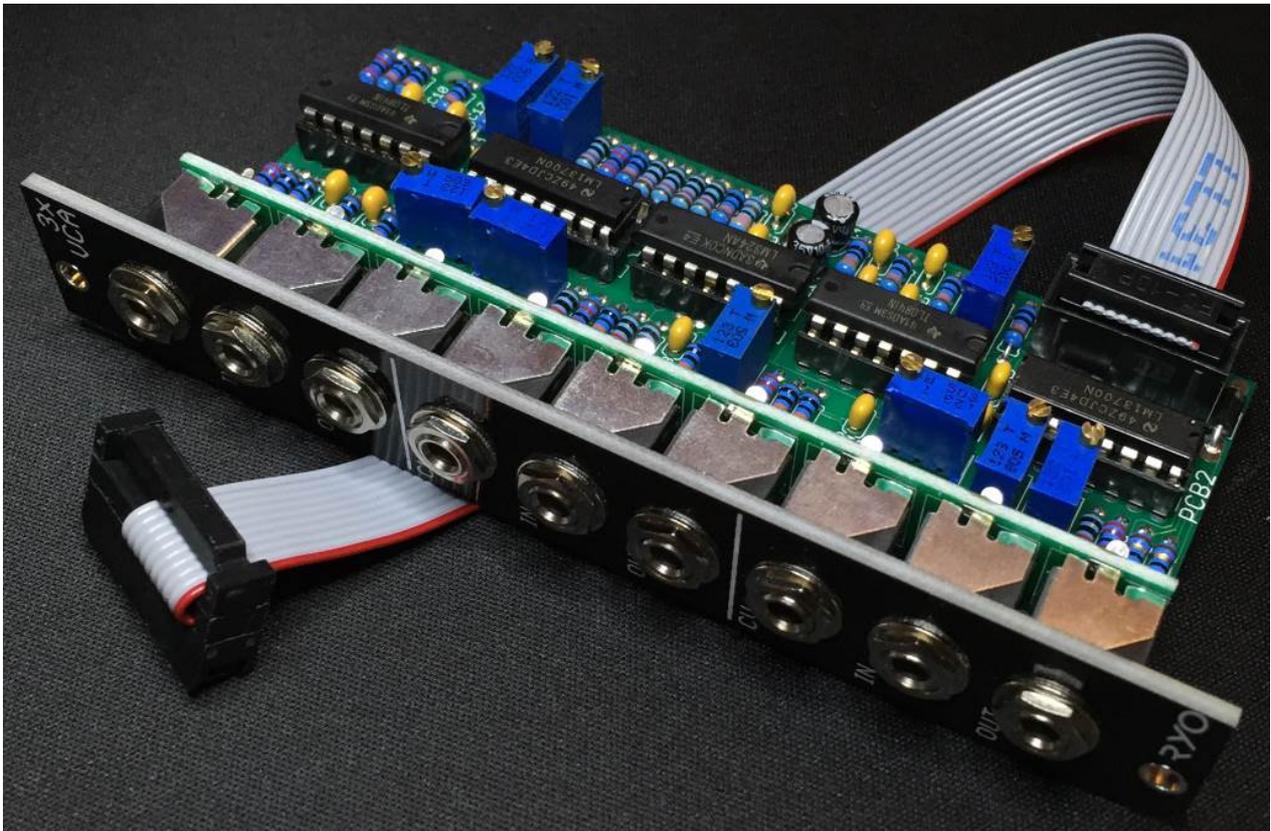
Step 10

Solder the two angled 6 pin strips in place on PCB1 like in the picture below. One pin first, then check the angle and adjust if needed before soldering the rest of the pins.



Step 11

Time to attach the power cable and the module is fully assembled.



Calibration

Now you need to calibrate. You only need to measure voltage with a multimeter but the precision you can achieve is dependant on the precision of your multimeter. With a good multimeter you should be able to get it calibrated within a couple of millivolts from the target value.

This guide describes how to set unity gain at 5V, this is the popular choice and gives ca 1.65x gain at 8V. Change the voltage to 8V on the CV in to set it by A-100 standard.

Let the 3xVCA be powered for 30 minutes before calibration to let it warm up.

Top VCA

Step 1

Feed 5.00V to CV in.

Feed 5.00V to signal IN.

Measure OUT.

Trim VR1 until OUT is roughly 2.5V.

Step 2

Feed 5.00V to CV in.

Feed 0.00V to signal IN.

Measure OUT.

Trim VR7 until OUT is 0.00V.

Step 3

Feed 0.00V to CV in.

Feed 5.00V to signal IN.

Measure OUT.

Trim VR4 until OUT is 0.00V.

Step 4

Feed 5.00V to CV in.

Feed 5.00V to signal IN.

Measure OUT.

Trim VR1 until OUT is 5.00V.

For more precision repeat step 2-4 until the values don't change any more.

Middle VCA

Step 1

Feed 5.00V to CV in.
Feed 5.00V to signal IN.
Measure OUT.
Trim VR2 until OUT is roughly 2.5V.

Step 2

Feed 5.00V to CV in.
Feed 0.00V to signal IN.
Measure OUT.
Trim VR8 until OUT is 0.00V.

Step 3

Feed 0.00V to CV in.
Feed 5.00V to signal IN.
Measure OUT.
Trim VR5 until OUT is 0.00V.

Step 4

Feed 5.00V to CV in.
Feed 5.00V to signal IN.
Measure OUT.
Trim VR2 until OUT is 5.00V.

For more precision repeat step 2-4 until the values don't change any more.

Bottom VCA

Step 1

Feed 5.00V to CV in.
Feed 5.00V to signal IN.
Measure OUT.
Trim VR3 until OUT is roughly 2.5V.

Step 2

Feed 5.00V to CV in.
Feed 0.00V to signal IN.
Measure OUT.
Trim VR9 until OUT is 0.00V.

Step 3

Feed 0.00V to CV in.
Feed 5.00V to signal IN.
Measure OUT.
Trim VR6 until OUT is 0.00V.

Step 4

Feed 5.00V to CV in.
Feed 5.00V to signal IN.
Measure OUT.
Trim VR3 until OUT is 5.00V.

For more precision repeat step 2-4 until the values don't change any more.