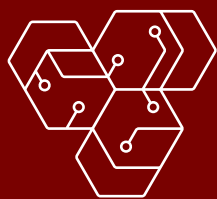
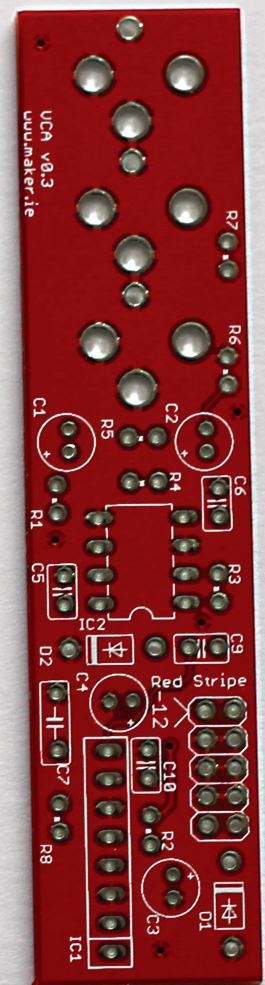


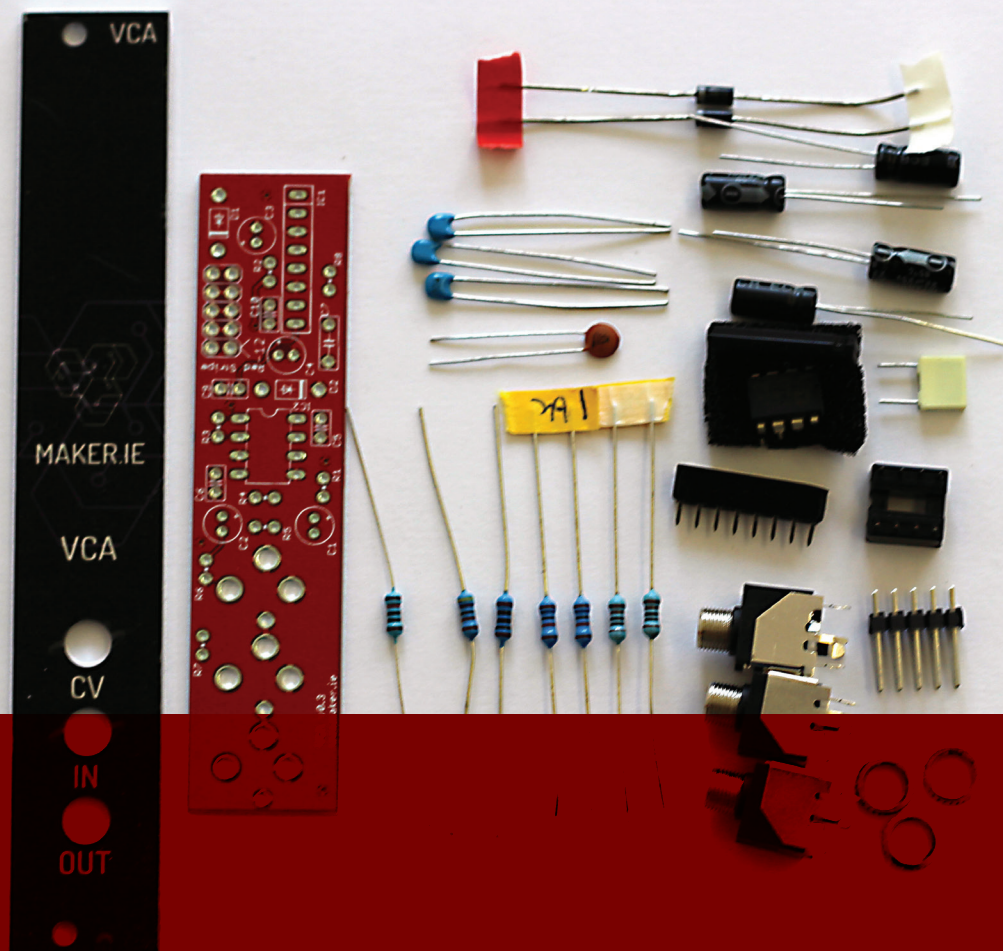
MAKER VCA

Assembly Guide



MAKER.IE





Technical Specifications

- Single VCA in a compact 4HP size, skiff friendly 30 mm depth
- AC coupled
- Exponential CV response, 0-5v input voltage
- Current Consumption +12v 20mA, -12v 20mA

Tools

Here is an overview of the tools we will need:

- Soldering iron (15 w will do fine, any hotter may start to burn the PCB)
- Solder
- Wire cutters
- Multi-meter
- De-soldering pump
- Helping hands/ soldering stand

Components

Here is a brief overview of the components we'll be using:

- Printed Circuit Board-Mechanically supports and electrically connects the components in the circuit
- THAT2180-Voltage Controlled Amplifier IC- The heart of the circuit, performs the voltage amplification
- OP275- Dual Operational Amplifier- This is used to convert the output current from the VCA to a voltage, and also to scale or attenuate the control voltage input
- Resistors- resist the flow of current
- Ceramic capacitors - power supply bypass capacitors
- Polyester Film capacitor - provides filtering at the control voltage input

-Electrolytic capacitors- used for power supply bypassing and also to block DC voltages / only pass AC voltages at the input and outputs of the VCA

- Diodes- Provide reverse power supply protection

- Pin header - This connects the power from the Eurorack system power bus to the module

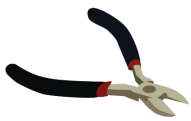
- Aluminium panel- Mounts to the circuit board after the components are on, so the module will fit in a rack unit or enclosure

- Jack sockets - for plugging cables in and out of the module

This is a beginner level kit. Some previous experience of completing electronic kit is recommended but not essential. This is the assembly guide for PCB version 0.3. Okay let's begin...

SOLDERING IS EASY; HERE'S HOW TO DO IT

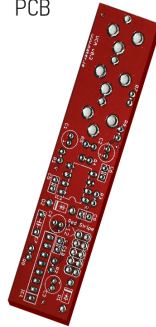
Wire cutter



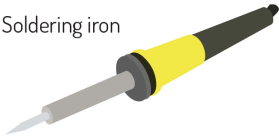
Solder



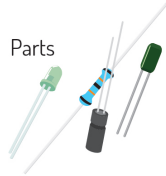
PCB



Soldering iron



Parts

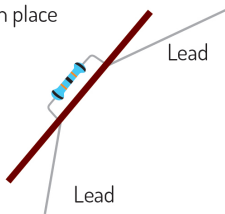


The iron is hot, be careful !

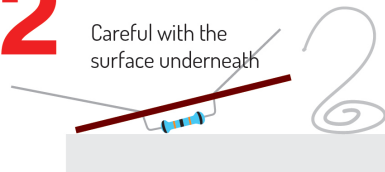
Your kit should come with instructions for what parts go where and what way !

Clean the tip of your iron before each solder connection !

1 Put your part in place. Bend out the leads so it stays in place



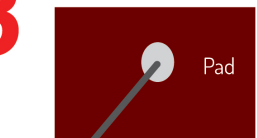
2 Put the PCB down so you can solder. Careful with the surface underneath



Find some good way to keep it steady

If you need a third hand, you can make a standing coil of the solder instead of holding it in your hands

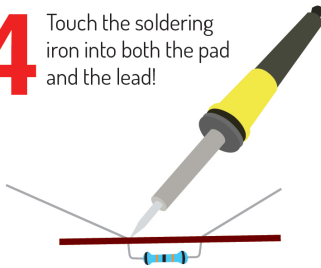
3 O.K, Lets solder!



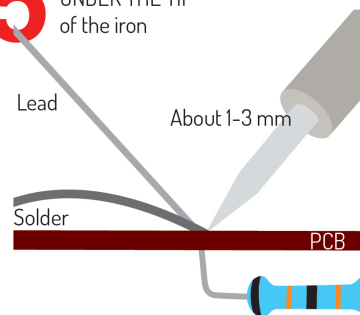
Psst! Clean the tip first!

First, you want to heat both the pad and the lead for about 1 second

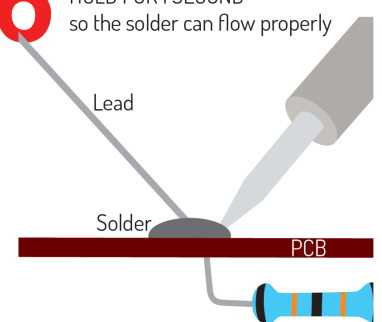
4 Touch the soldering iron into both the pad and the lead!



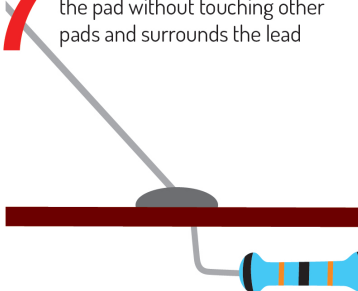
5 Now feed the solder UNDER THE TIP of the iron



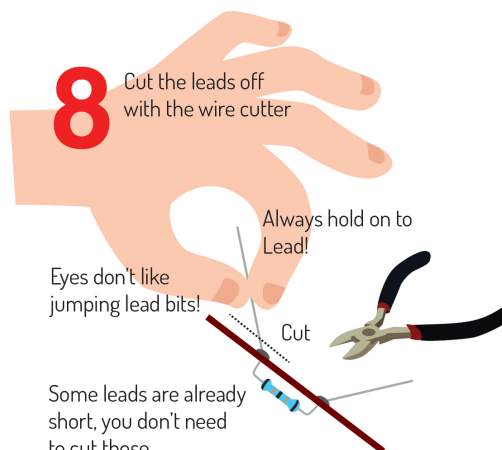
6 Stop feeding the solder then HOLD FOR 1 SECOND so the solder can flow properly



7 A good connection covers the pad without touching other pads and surrounds the lead



8 Cut the leads off with the wire cutter

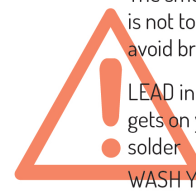


Always hold on to Lead!

Eyes don't like jumping lead bits!

Cut

Some leads are already short, you don't need to cut those



The smoke from the melting solder is not toxic, but blow gently on it to avoid breathing it.

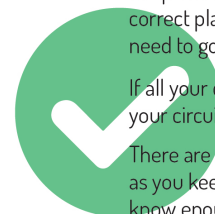
LEAD in the other hand is TOXIC, and gets on your skin when holding the solder

WASH YOUR HANDS WHEN YOU'RE DONE

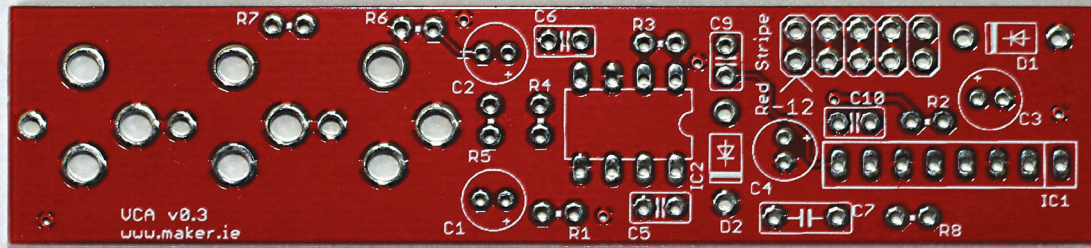
Keep soldering each part in its correct place. Remember some parts need to go in a certain way!

If all your connections are good, your circuit will just work!

There are more tricks you will learn as you keep soldering, but now you know enough to make many cool things.



Soldering



We are now going to begin soldering the circuit board. You will notice that the circuit board has numbers (R5, C11, etc.) beside the component outlines (known as the silkscreen layer of the board). The outlines and the components numbers help us to identify which components to solder where on the PCB.

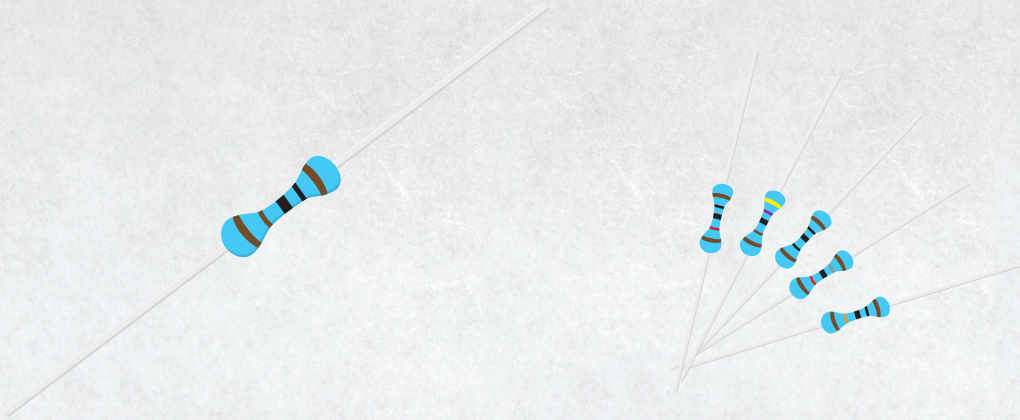
The circuit board is double sided. We will be soldering some components on the top side of the board, and some on the bottom side. We will go through the com-

ponents step by step. The most important things to keep in mind are:

- Take your time and check the silkscreen and the orientation of the components; some components are polarised and must be orientated in certain directions.
- You want to make sure the solder joints are good and solid and they should fill in the pad on the board that the component leg is coming through.

- Do not let solder cross between the solder pads on the board. This will cause a short circuit and mean your circuit will not work. A de-solder pump can easily fix this problem.
- Components, which must be orientated correctly, include the diodes, electrolytic capacitors, IC sockets and ICs, mono jacks and the variable potentiometer.
- Empty all contents into a small bowl/plate.

Step 1 – Resistors

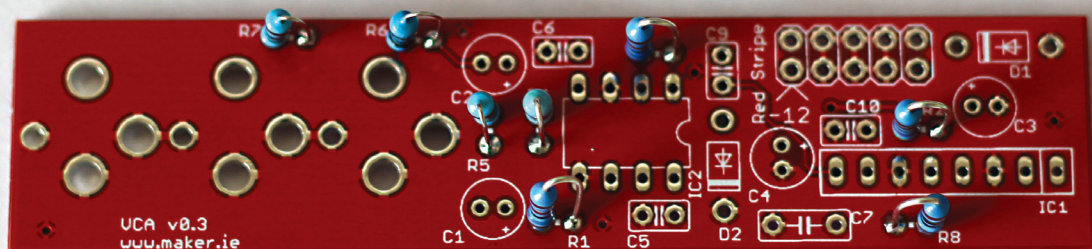


Solder the resistors following the numbers on the PCB and the guide below. Check the resistor colour codes and measure the values first with a multi-meter before soldering in place. All resistors in the kit are 1% tolerance. Insert the resistors vertically through the top side of the board where the numbers are marked, and the solder to the pads on the bottom side.

Clip the lead off each resistor with the wire cutter after soldering each joint. Cut the leads above the solder joint, also be careful not to cut the joint as this can break the solder joint.

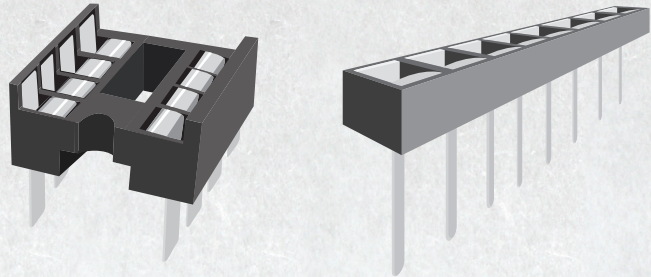
From the top left corner of the board (top side) and moving clockwise:

R7 - 1k (Brown, Black, Black, Brown, Brown)
R6 - 100k (Brown, Black, Black, Orange, Brown)
R5 - 10k (Brown, Black, Black, Red, Brown)
R4 - 1k (Brown, Black, Black, Brown, Brown)
R3 - 20k (Red, Black, Black, Red, Brown)
R2 - 4.7k (Yellow, Purple, Black, Brown, Brown)
R8 - 100 (Brown, Black, Black, Black, Brown)
R1 - 20k (Red, Black, Black, Red, Brown)



Step 2 – IC Sockets

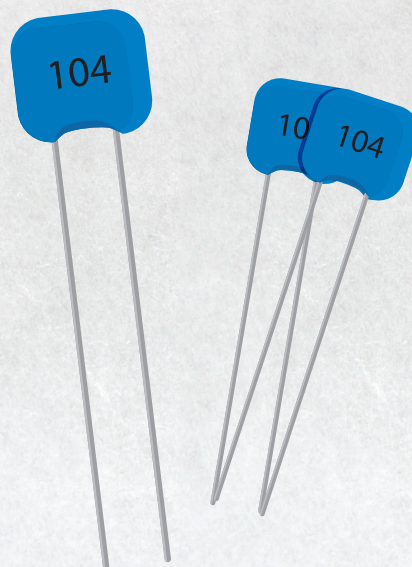
Solder the IC sockets in the IC positions on the top side of the PCB. Check the orientation, the little notch on the socket should match up with the notch on the PCB. Solder the tails on the sockets to the solder pads on the bottom side of the board. Use a small piece of cello tape to hold the socket in place while soldering. Note: the 8pin THAT2180 socket does not contain a notch- solder in any orientation.



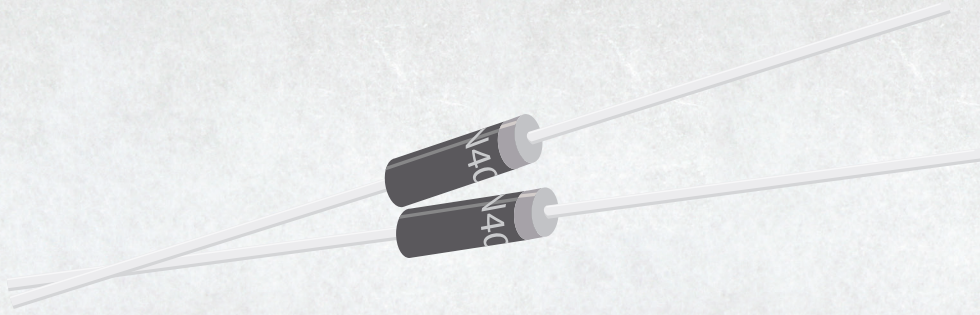
.....Step 3 – Ceramic Capacitors

Insert the ceramic capacitors through the top side of the board and solder to the pads on the bottom side of the board. These capacitors are not polarised. Follow the below guide (from the top left of the board and moving clockwise):

C5, C6 and C10- these are 100n value and they are marked 104 on the capacitors, C9 is 22pF value.



Step 4 – Diodes



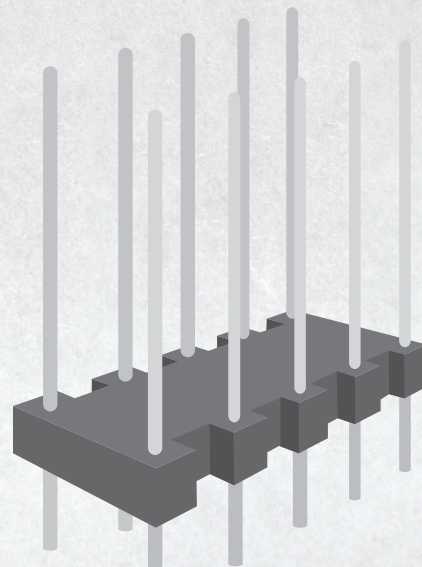
Next, we will solder the diodes. Diodes are polarised, meaning there is a positive and a negative pin, and must be soldered in the correct orientation for the circuit to work. Insert the diodes through the top side of the board and solder to the pads on the bottom side of the board. Again moving clockwise from the top left of the board:

D1-1N4001- Inserted horizontally, match the marking on the diode with the marking on the circuit board.

D2- 1N4001- Inserted horizontally, match the marking on the diode with the marking on the circuit board.

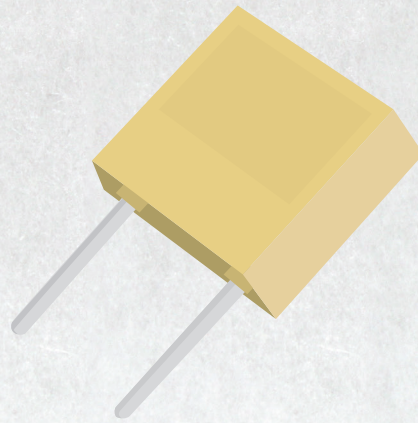
.....Step 5 – Power Pin Header

Insert the power pin header through the top side of the board and solder the tails on the header to the solder pads on the bottom side of the board. The header is not polarised. Use a small piece of cello tape to hold the header in place before soldering.



Step 6 – Polyester Capacitor

Insert the polyester film box capacitor, C7, value 1.5n, through the top side of the board and solder to the bottom side of the board. This capacitor is not polarised.



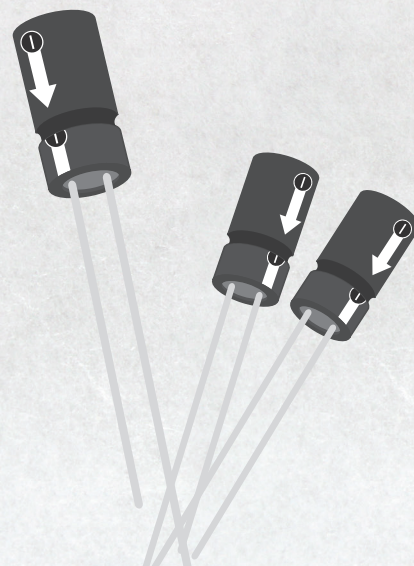
.....Step 7 – Electrolytic Capacitor

Insert the electrolytic capacitors through the top side of the board and solder to the pads on the bottom side of the board. These capacitors are polarised; the positive (+) pin must go through the pad marked (+) on the PCB. Clockwise from the top left of the board the values are:

-C1, C2- 10uF

-C3, C4- 22uF

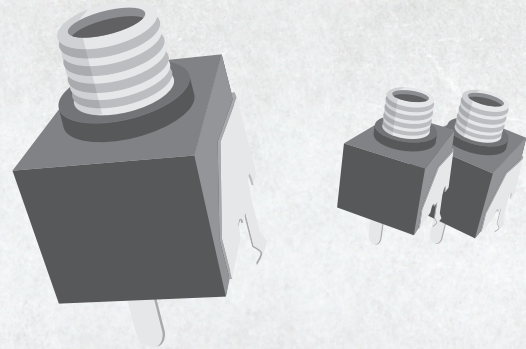
Now we are finished soldering the bottom side of the board. The rest of the components are placed on the top side of the board.



Step 8 - Jacks and Panels

Now insert the three jacks through the bottom side on the board. There is only one orientation that will fit.

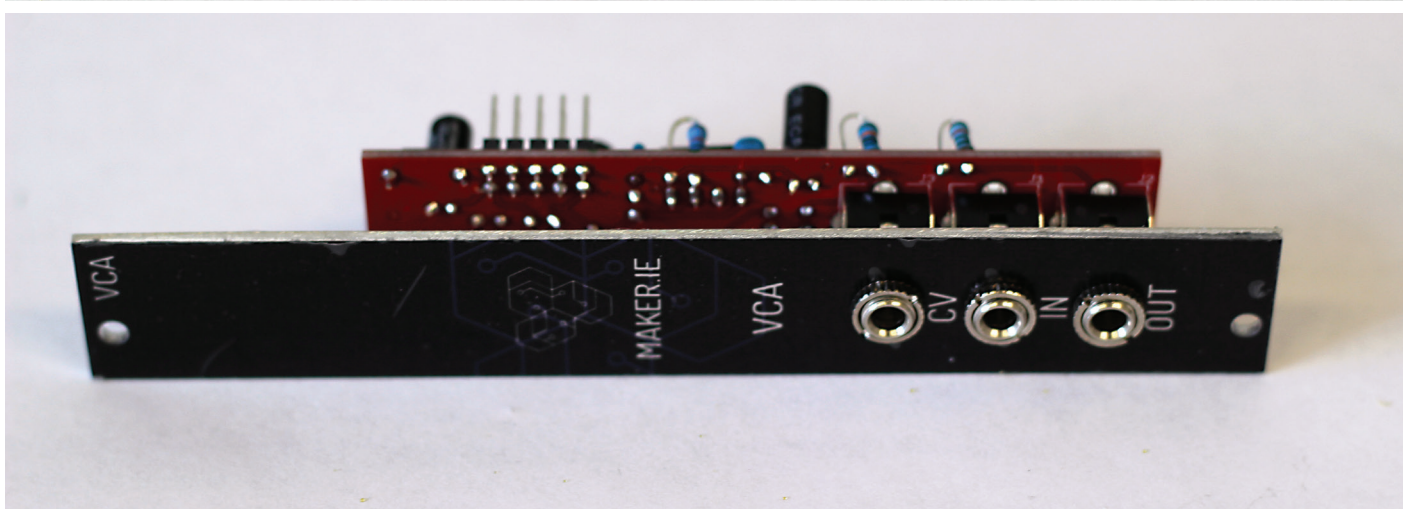
DON'T SOLDER THESE YET



Next, place the panels over the bottom of the board with the jack shafts matching the panel cut-outs. Screw the knurled nuts over the jack shafts, taking care just to use your fingers and not to scrape the panel. Screw these tight by hand, and the panel should be held firmly in place. Finally solder the jacks to the solder pads on the top side of the board.

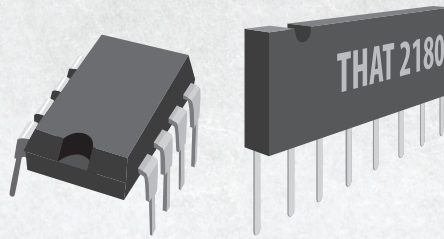


Don't forget to peel the protective coating off the panel



Step 9 – Insert the ICs.....

Carefully insert the THAT2180 and OP275 into the IC sockets. Two things to watch out for here. The IC pins can be quite fragile and easily broken. Usually the pins will require some gentle bending to fit them into the socket. Some people use an IC insertion tool for this job. If you are taking an IC out of the socket, you could use



a small flat-headed screwdriver or tweezer blade and slide it under the IC, which works as well as an insertion tool. Also, make sure to check the orientation of the IC, the little notch on the IC should match up the notch on the IC socket.

Step 10 – Testing and Troubleshooting

Before you power on the circuit, double check your soldering work and check for any bad/colder solder joints or any points where there may be bridging (where two pads close together are connected by small pieces of solder). You can use a multi-meter on the continuity range to check if any two pads or points you're not sure about are connected or not. De-fluxing is recommended also. Be thorough, even a very tiny piece of solder is enough to create a short in the circuit.

Connecting the power pin header- (important!) match the red stripe on the power cable with the red stripe /-12V marking on the PCB. This is assuming your eurorack power bus is following the convention that Red stripe is equal to -12V! The circuit has reverse polarity protection included, so in the case that you do plug your power cable in the wrong

way, plug it out quickly and insert it the correct way round.

Send a signal to the audio input, and send a control voltage signal (0-5v) to the CV input. Adjusting the CV signal should change the amplitude of the input signal.

If the circuit is not working, the most likely causes are:

- IC CHIPS MIS-SOCKETED

Check the orientation of the chips. The notches on the chips should match up with the notches on the PCB. If your socket has been soldered in with the wrong orientation, it will not matter as long as the IC is the right way round.

- EXPOSED METAL CAUSING A SHORT CIRCUIT

Are solder lugs or bits of wire from the component touching another? This may be causing a short circuit. Adjust the component's

position or de-solder/ re-solder the component to the pad.

- COMPONENTS INSERTED IN WRONG ORIENTATION

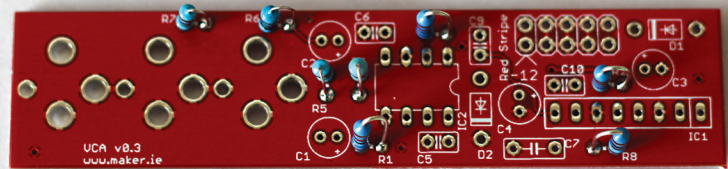
Double check the orientation of all the polarised components (diodes, capacitors, ICs) with the markings on the PCB and the schematic.

- BAD SOLDER JOINT

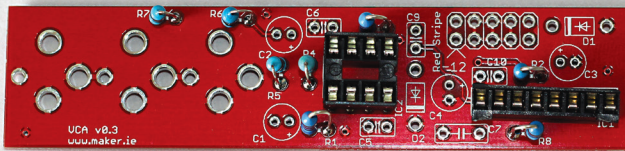
A number of reasons can cause a bad solder joint. Often dirt can get in and create a weak bond between the solder pad and the component. Re-heating the joint or applying a small piece of extra solder can help in these situations. Be careful re-soldering on certain components as extended periods of heat can damage them. If you think the component may be damaged by excess heat, it might be best to replace the component.

Maker VCA- Step by Step

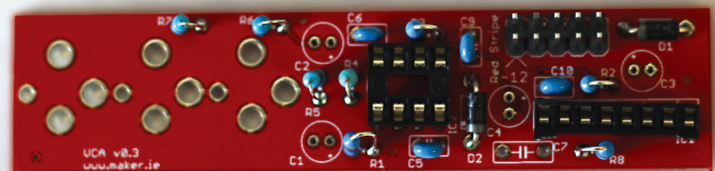
Resistors



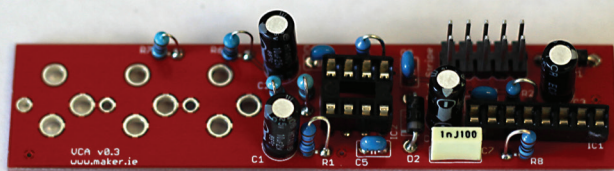
IC Sockets



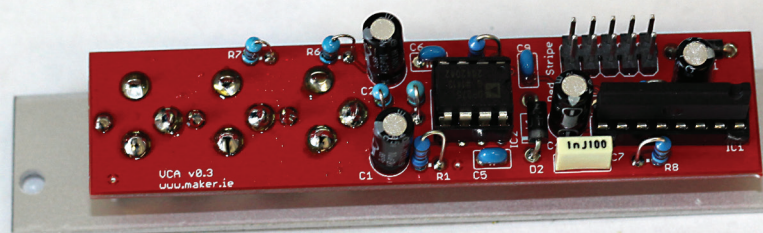
Ceramic Capacitors
Diodes
Power Pin Header

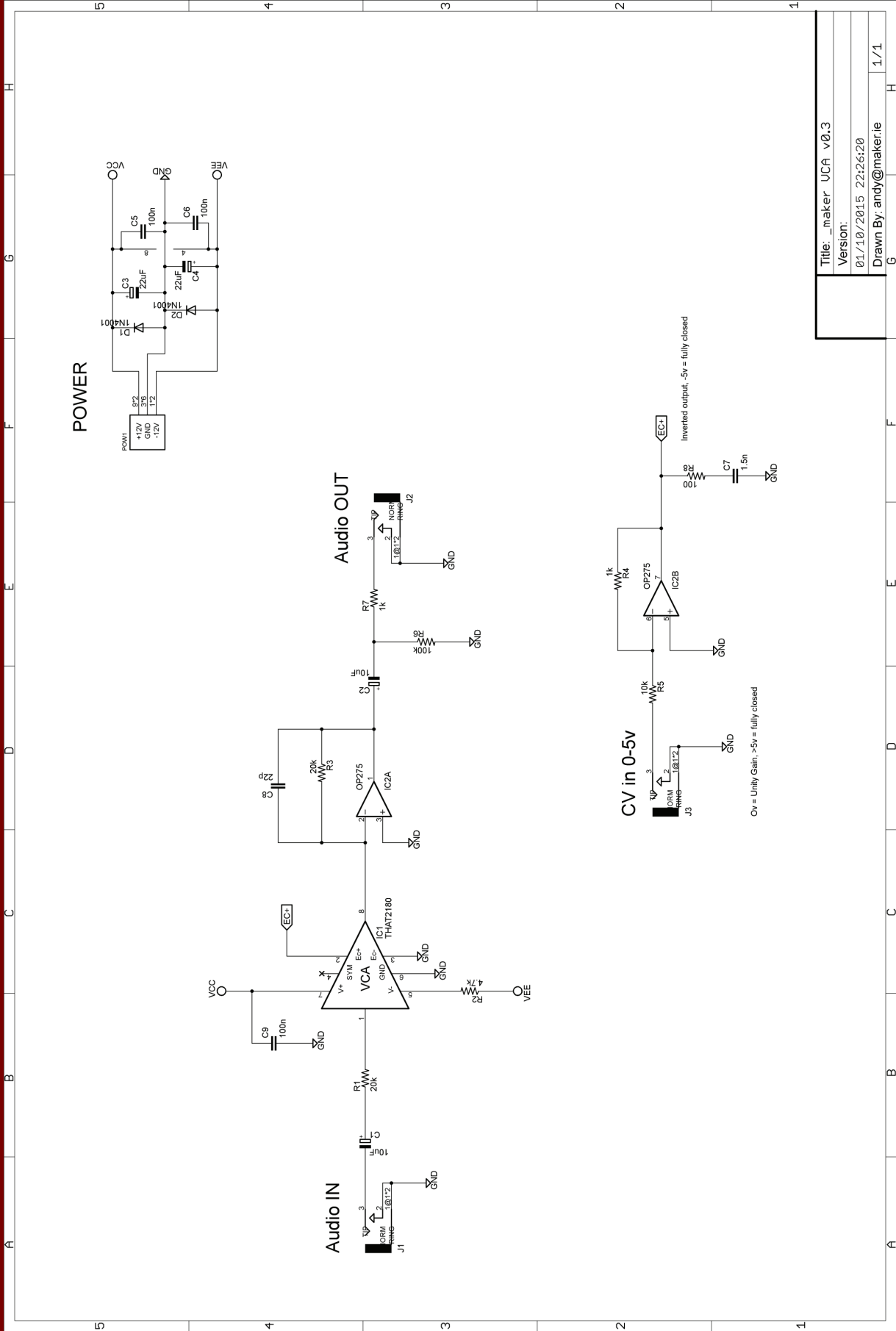


Polyester Capacitor
Electrolytic Capacitor



Jacks
Panel
ICs





Title: _maker UCA v0.3	
Version:	
01/10/2015 22:26:20	
Drawn By: andy@maker.ie	
1/1	

Circuit Description

What's happening in the circuit?

Power is provided to the circuit using the eurorack power bus, which supplies +12v, -12v and ground (0v). Diodes D1 and D2 provide reverse polarity protection; in the event that the input power polarity is reversed, the current travels through the diodes (path of least resistance) to ground. Capacitors C1 and C4 smooth out ripples in the power supply voltages. The op-amps IC1 and IC2 are powered by the +12v and -12v voltages.

The input signal is AC coupled by capacitor C1, which blocks DC from passing. R1 converts the input voltage to a current, which is input to pin 1 of IC1, a dedicated VCA integrated circuit manufactured by THAT Corporation. The IC controls gain internally by converting an input current signal to a bipolar logged voltage, adding a dc control voltage, and re-converting the summed voltage back to a current through a bipolar antilog circuit.

The output current is converted to a voltage by op-amp IC2A. Capacitor C8 is required to cancel the output capacitance of the VCA, which could otherwise potentially destabilise the current to voltage converter op-amp

Op-amp IC2CB takes the control voltage signal and inverts and attenuates this to approximately 0-500mV, which is sent to the positive sense control input (pic 2) of the VCA. Negative control voltages here cause loss, and positive voltages gain. At control voltages of 0v the VCA is fully open (0dB), and at 5v fully closed (-90dB).

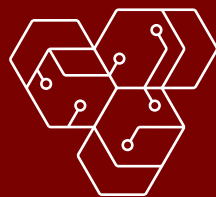
A typical op-amp's output impedance is inductive at high frequencies. Excessive inductance in the control port source impedance can cause the VCA chip to oscillate internally, so resistor R8 and capacitor C7 are included to prevent unwanted oscillations.

The output signal is AC coupled by capacitor C2. Resistor R7 in series with the output jack protects the op-amp output from external signals, and also prevents the op-amp output from directly "seeing" the capacitance of the output cable, so the signal can travel over a reasonably long stretch of cable. Resistor R8 prevents "pops" when an audio cable is unplugged from the circuit

Capacitors C5, C6, and C9 are bypass capacitors, which are located close to the IC pins to provide a local reservoir of power and provide a low impedance path to ground for power supply current returns.



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