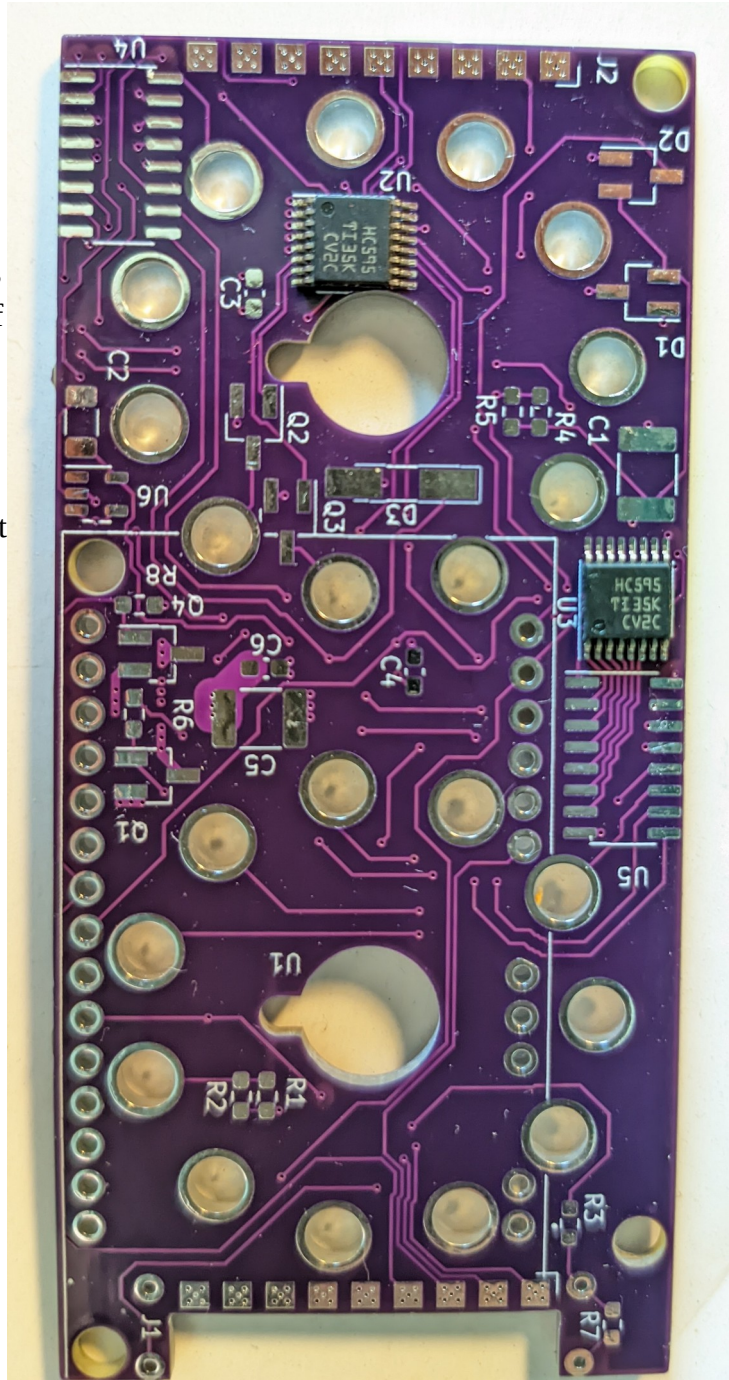


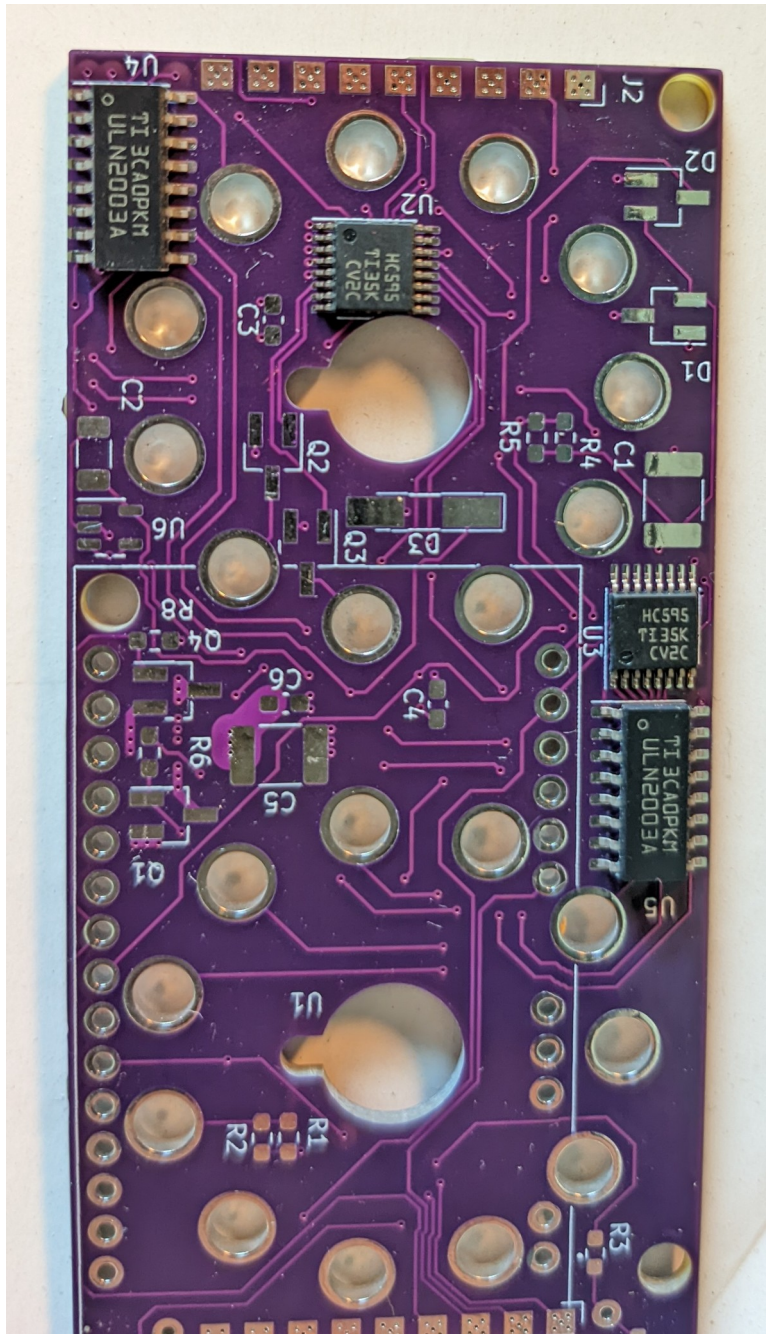
Nixie clock soldering manual

This manual describes the order and procedures which we found the easiest to assemble the kit, you can always deviate from this ofcourse, as long as you make sure to first solder all the SMD components, then the Nixie tubes, and lastly the ESP32. **This order is very important, since otherwise you will probably not be able to complete the kit without a lot of unnecessary de-soldering (and maybe even needing a new PCB).** This manual describes the procedure for a single kit, as they are all almost the same (the differences between the first, second and potentially third are described when applicable), and you can test your first kit without soldering the second or third already.

- 1) Start by soldering U2 and U3, their orientation can be seen in the picture on the right. (The dot has to be on the corner where the silkscreen line continues alongside the pad.)
 - a) The easiest way to solder these ICs is to solder each of the two sides of the IC as a whole blob and then afterwards using solder wick to remove the excess. You can also remove the excess by slamming the PCB on a table on its edge right after heating one of the two blobs on the sides of the IC.
 - b) It is possible to solder these ICs pin by pin, but for that you need a steady hand and quite a fine soldering tip.



- 2) Next you can solder U4 and U5.
These can be soldered more easily pin by pin. The dot has to be on the corner where the silkscreen extends alongside the pad again.

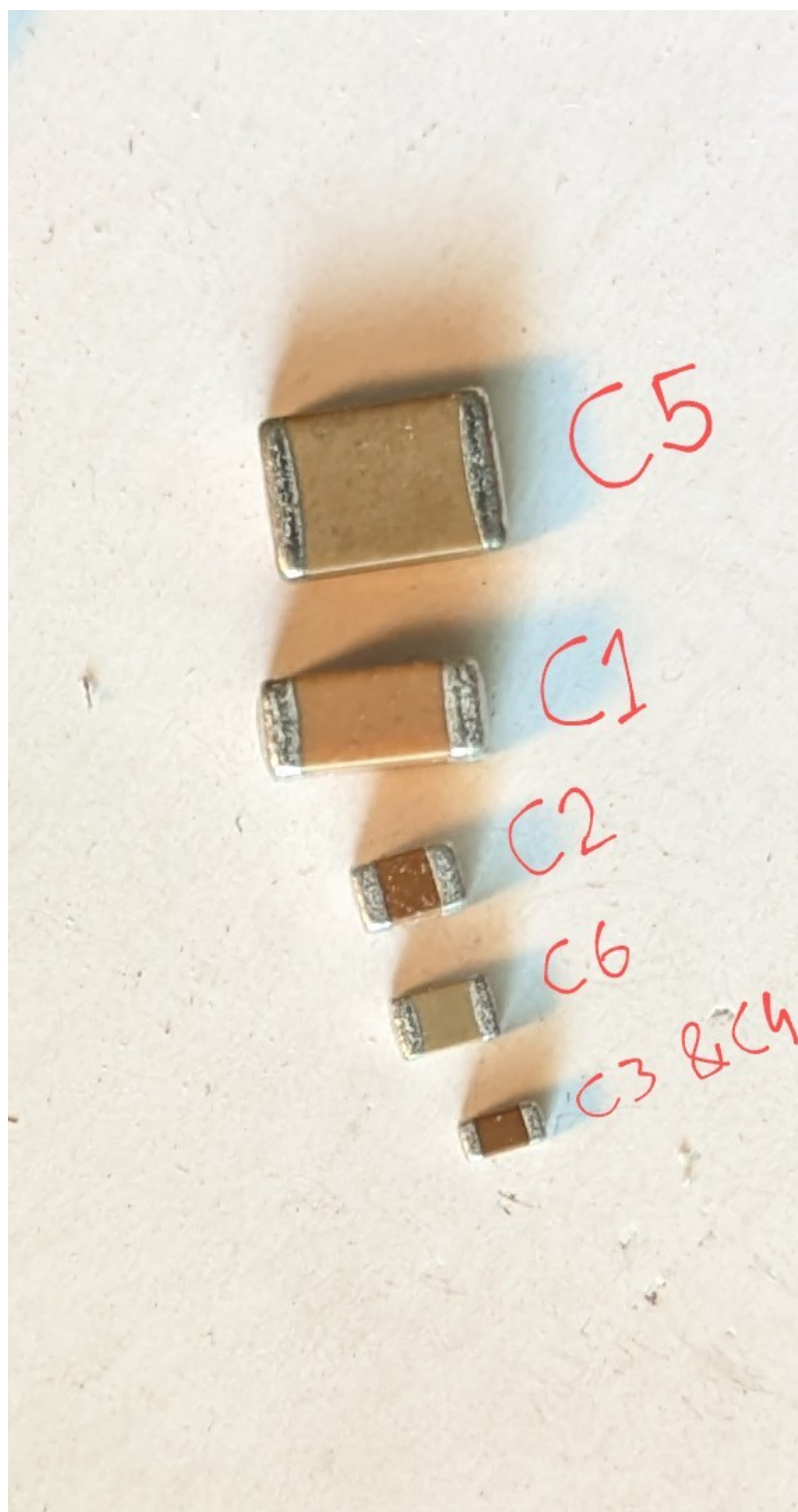


- 3) Solder the resistors next, R1 through R5 are black with white text, and R6 and R8 are green with white text. For the black resistors make sure to use the resistors with the correct marking, as seen below (“18D” for R3 and “433” for R1, R2, R4 and R5):

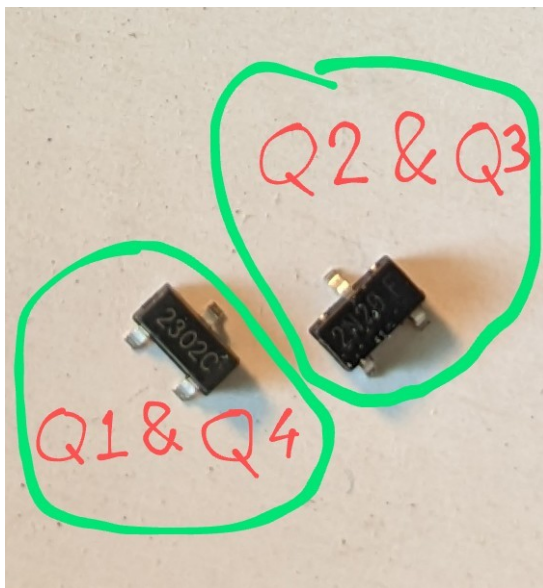


- a) R6 and R8 are quite distinguishable from the rest already because they are green, but they should have the marking “4701”, also R7 can be left empty.

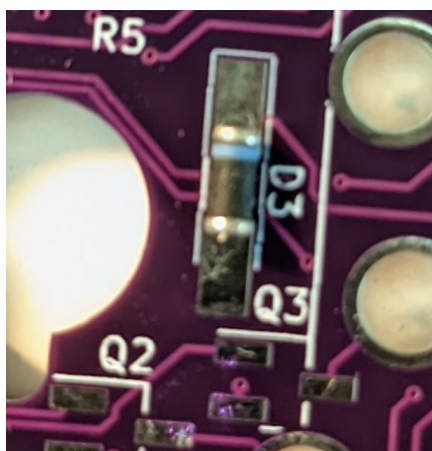
- 4) Next you can solder the ceramic capacitors. They all have slightly different colours and sizes. You can distinguish them from the following picture:



- 5) Next you can solder all the transistors and diodes. Q1 and Q4 should have the marking “2302C”, D1 and D2 should have the marking “D86” and Q2 and Q3 should have the marking “2N20F”. Q2 and Q3 can also be recognized since this is the slightly chunkier package, which also has the pins run entirely through the package, so you can see two small metal points left and right of the single pin. This can be seen in the picture on the top right:



- 6) Solder the zener diode next (D3).
a) The blue stripe has to be on the side where the silkscreen runs entirely around the pad:



- 7) The last SMD component that you have to solder on the bottom side of the PCB is the voltage regulator (U6). **This step only has to be done on the second and third kit (or only second if you have a 2 kit clock, or none if you have a 1 kit clock).**
- 8) Next solder the transformer (T1).
- 9) Now you can start soldering the Nixie tubes, make sure to solder them on the side where the silkscreen is printed (top side). Also crank up the heat of your soldering iron if this is possible, since the pins can have some dirt on them that is easier to burn off if you use a higher temperature. **It is important to not protrude the center plastic pin through the PCB more than about 1cm, since otherwise your ESP32 pins will not reach the pads.**
- 10) Lastly solder the ESP32.
 - a) It only has to be soldered on the first kit (the one that doesn't have the voltage regulator U6).
 - b) First cut off pins D15, D2, D5 and D18, do this as close to the plastic of the header as possible.
 - c) Then you should be able to fit the ESP32 on the back side and rest it against the center plastic pin of Nixie tube N1. Solder the pins from the bottom side of the PCB (so the side the ESP32 is on).

Now you can test it by asking a SHOCK member to program the ESP32 for you.

When you have soldered all kits that you have, you can connect them together with a header.

- This can be done in two different ways:
 - With only a male header, this makes the kit more prone to lifting pads if you drop the kit for example, but the digits will be closer together, so if you put the clock in a wooden case immediately, this is probably the best way, since the wooden case provides a lot of structural support.
 - With a male and female header, this way you can disconnect the kits while transporting them. This is especially recommended with 3 kit clocks, since without this it will most definitely break if you drop it.

You can also put in the neon indicators used for the double dot* now. If you plan on using the wooden case for the 2 kit clock, it is best if you leave the leads sticking out of the PCB front as much as possible so the neon indicators can protrude through the front.

* It is also possible to only use a dot instead of a double dot between the kits if you prefer that. In this case you need to leave out N3 and solder R7 with the same resistor as you soldered R3.