

IN-14 Nixie clock v1.0

ASSEMBLY GUIDE

What you will need:

- Soldering iron with standard and precise tip
- Side cutters
- Solder
- Solder pump or solder wick (for correcting mistakes)

Optional:

- Pliers / small tongs / twisters
- Crocodile clip
- Multimeter

Estimated assembly time: 7-9h

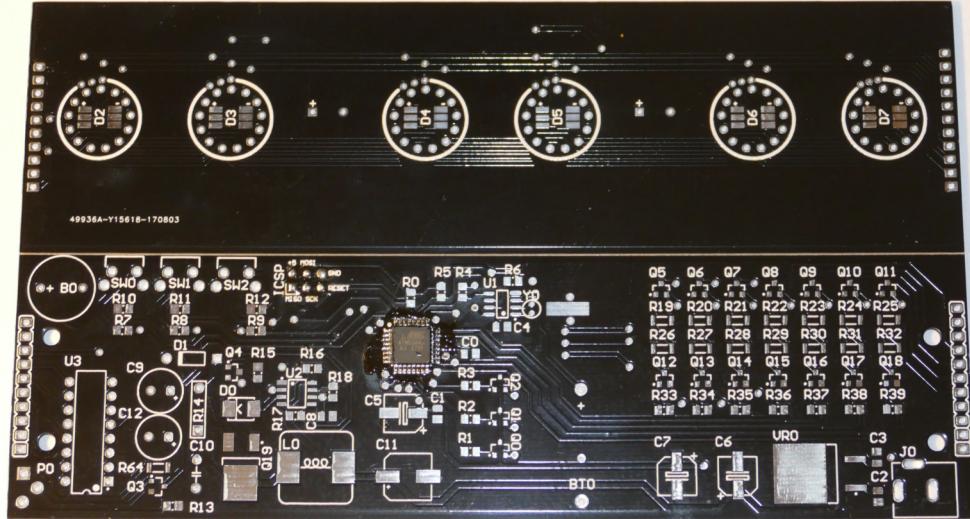
Great soldering tutorials: <https://www.youtube.com/playlist?list=PL2862BF3631A5C1AA>



Table of elements

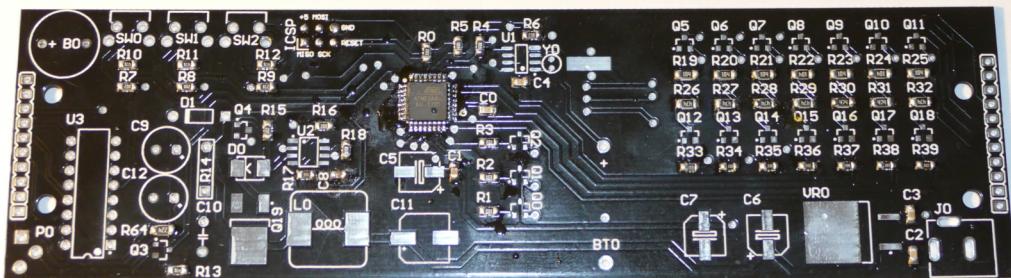
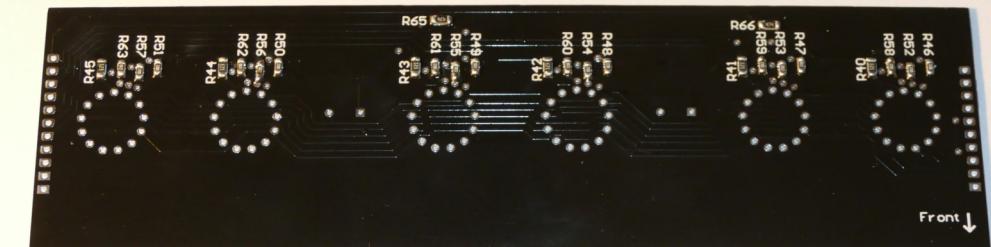
| Designator | Value | Package | Quantity | Comment |
|-------------------|------------------------|---------|----------|----------------------------------|
| Y0 | 32.768kHz | THT | 1 | |
| X6, X7 | IN-3 | Nixie | 2 | or similar, can be modern neon |
| X0-X5 | IN-14 | Nixie | 6 | |
| VR0 | (78M05)L7805ACD2T | D2PAK | 1 | or other 5V 1A linear stabilizer |
| U3 | SN74141N / K155ID1 | THT | 1 | can be found on eBay |
| U2 | NE555P | S08 | 1 | |
| U1 | DS1307Z+ | S08 | 1 | |
| U0 | ATmega8A-AU | TQFP32 | 1 | pre-soldered |
| SW0-SW2 | 6mm switch | THT | 3 | angular |
| R7-R9, R15, R16 | 1k | 0805 | 5 | |
| R64 | 220k | 1206 | 1 | |
| R46-R63 | 220 | 0805 | 18 | |
| R40-R45 | 12k | 1206 | 6 | can be 10-20k |
| R26-R32, R65, R66 | 470k | 1206 | 11 | |
| R19-R25 | 100k | 1206 | 7 | |
| R17, R33-R39 | 33k | 0805 | 8 | |
| R14 | 1k | THT | 1 | |
| R10-R13 | 470 | 0805 | 4 | |
| R0-R6, R18 | 10k | 0805 | 8 | |
| Q5-Q11 | MMBTA92 | SOT23 | 7 | or other PNP -300V -0.5A |
| Q4 | MMBT2907 | SOT23 | 1 | or other PNP -600mA |
| Q19 | IRFR310TRPBF | DPAK | 1 | or other N-channel mosfet 2A |
| Q12-Q18 | MMBTA42 | SOT23 | 7 | or other NPN 300V 0.5A |
| Q0-Q3 | MMBT2222A | SOT23 | 4 | or other NPN 600mA |
| P0 | 1k potentiometer | THT | 1 | angular |
| L0 | 100uH | SMD | 1 | THT equivalent fits as well |
| J0 | 2.1/5.5mm 9v DC | THT | 1 | |
| D2-D7 | LED RGB common cathode | 5050 | 6 | recommended min 3000mcd |
| D1 | UF4007 | THT | 1 | super-fast <75ns 400V 1A |
| D0 | M7 | DO214AC | 1 | Rectifier diode 400V 1A |
| C9, C12 | 2.2uF 400V | THT | 1 | max h=10mm |
| C8 | 2.2nF 50V | 0805 | 1 | |
| C5-C7 | 100uF 16V | type D | 3 | |
| C11 | 470uF 16V | type E | 1 | |
| C10 | 47pF | THT | 1 | |
| C0-C4 | 100nF 50V 0805 | 0805 | 5 | |
| BT0 | coincell CR2032 holder | THT | 1 | |
| B0 | Buzzer piezo 5v | THT | 1 | with generator |
| Connector | M20 female | THT | 21 | normal 2.54mm raster |
| Connector | M20 male | THT | 21 | normal 2.54mm raster |

1. Programmed IC



Microcontroller is already soldered to the pcb. You can separate PCBs before starting the assembly, or during later steps.

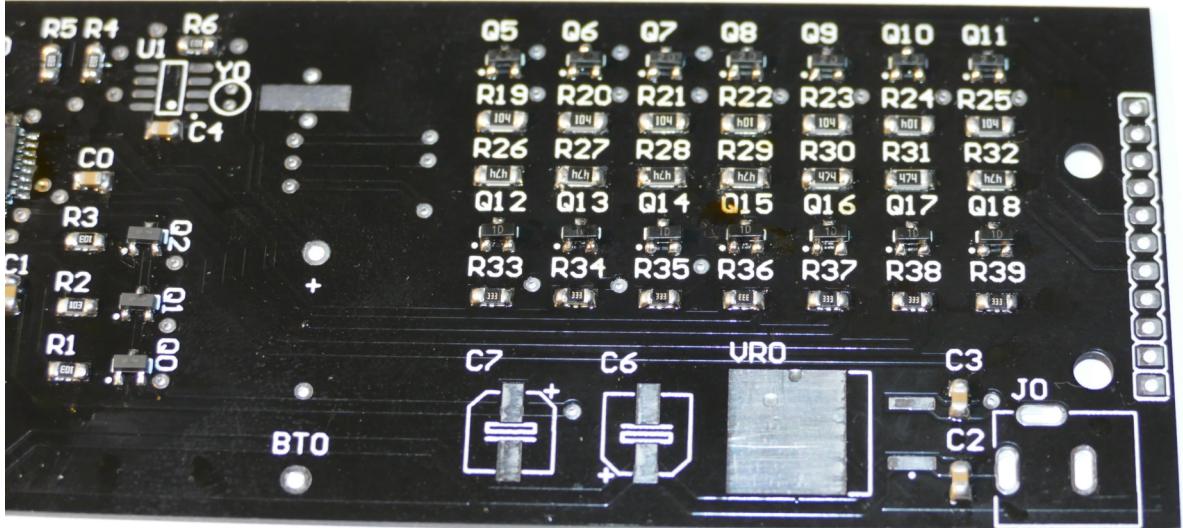
2. SMD resistors and ceramic capacitors



Start soldering with the smallest SMD elements such as resistors and ceramic capacitors.

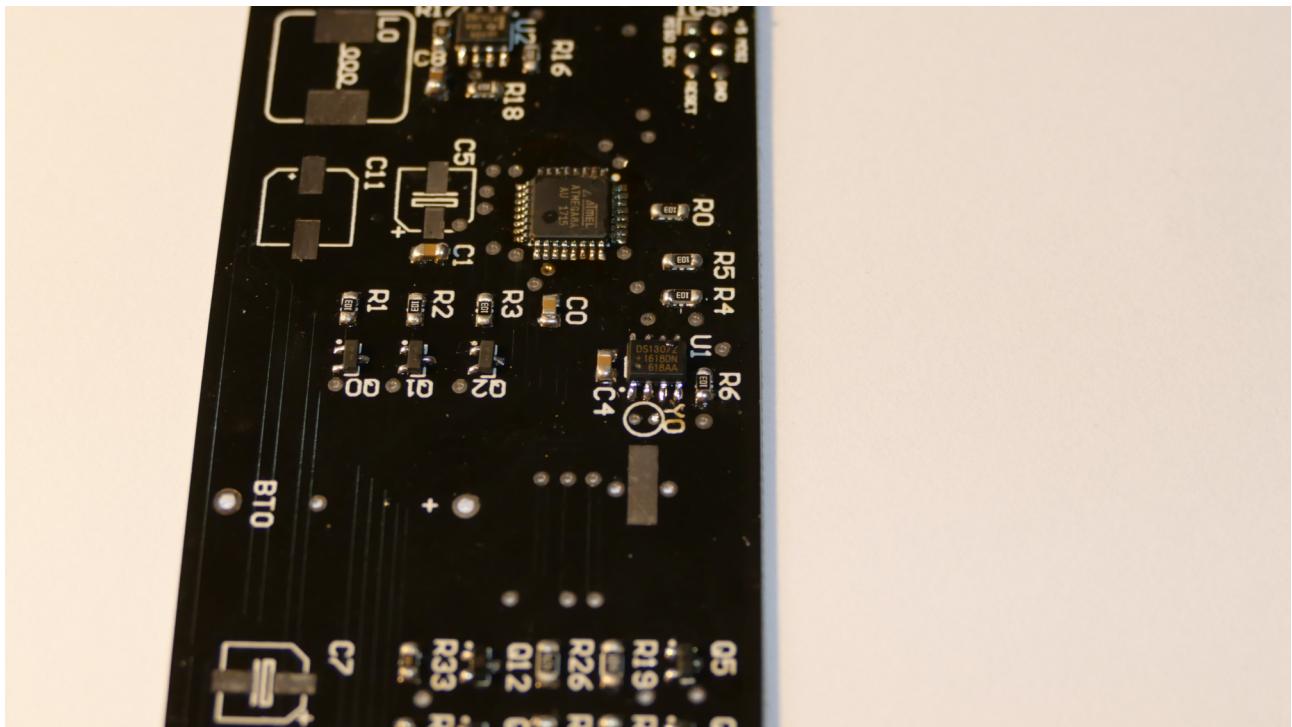
(I recommend soldering resistors on top/display board after step 6)

3. Transistors



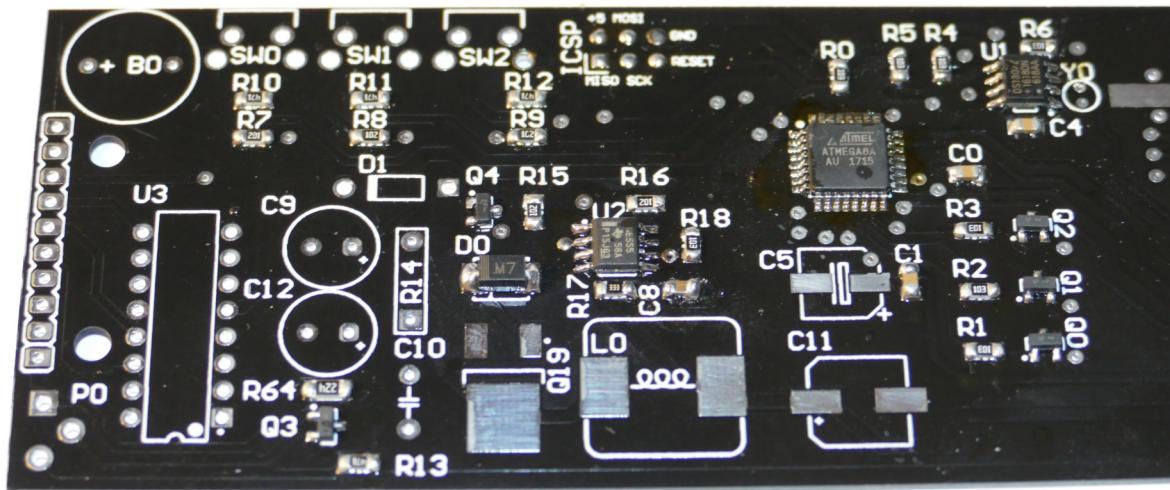
Mount SMD transistors in the next step.

4. Other ICs



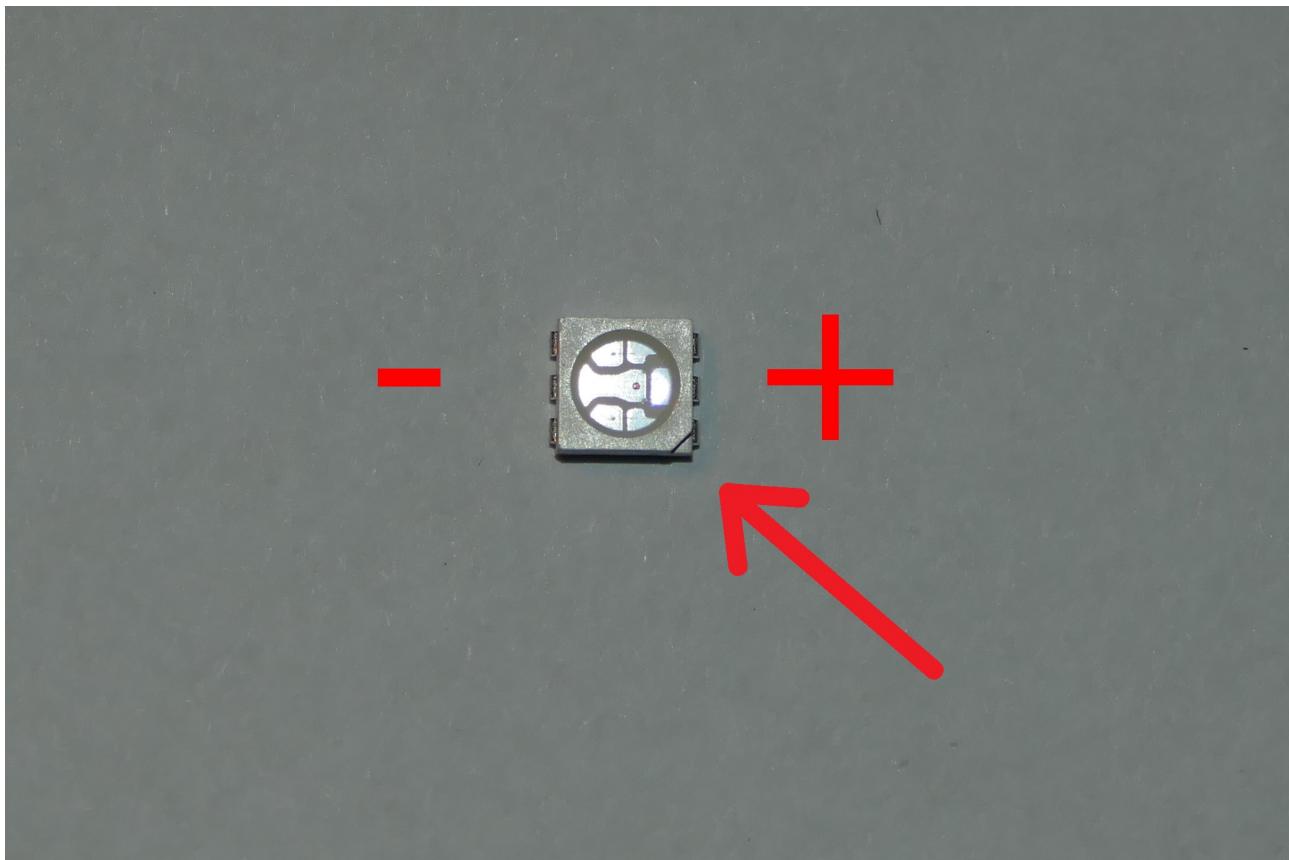
Solder two 8-pins ICs. I recommend soldering ICs with excessive amount of solder first, and then clearing bridges between pins with solder wick.

5. SMD rectifier diode

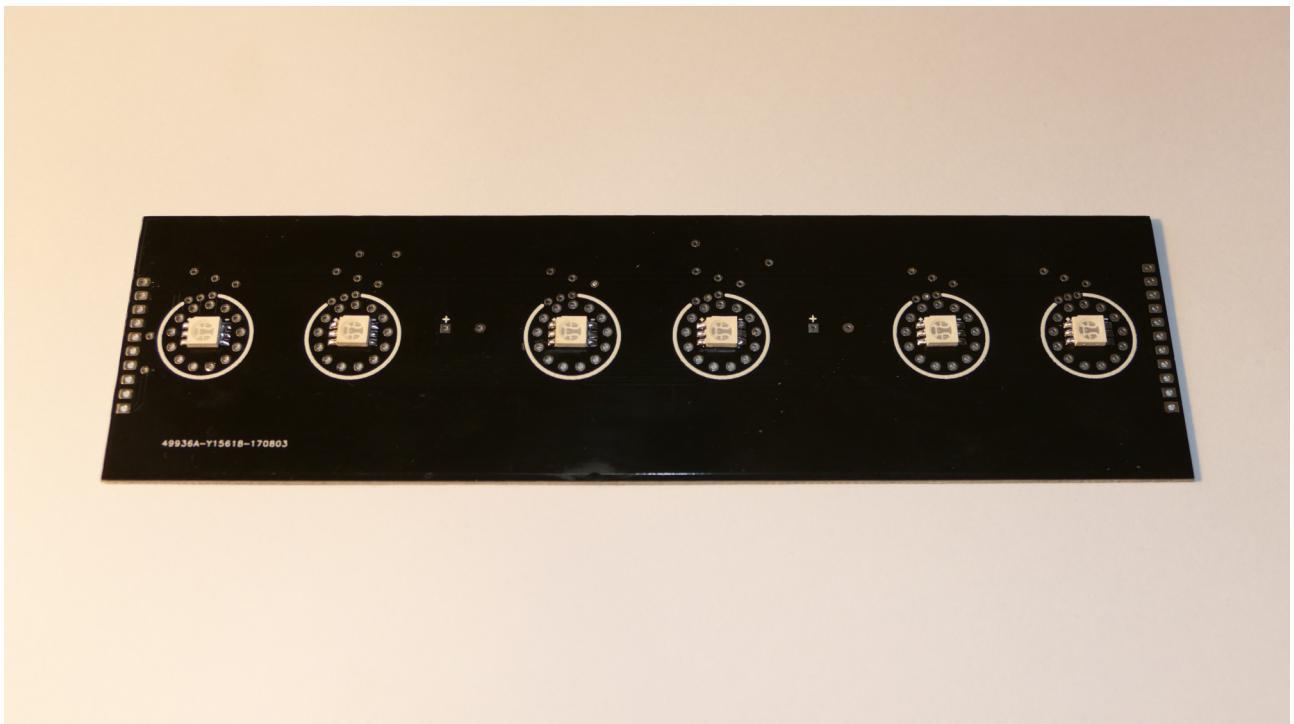


Solder rectifier diode.

6. LEDs



Solder backlight LEDs with correct polarity, as shown on the picture.



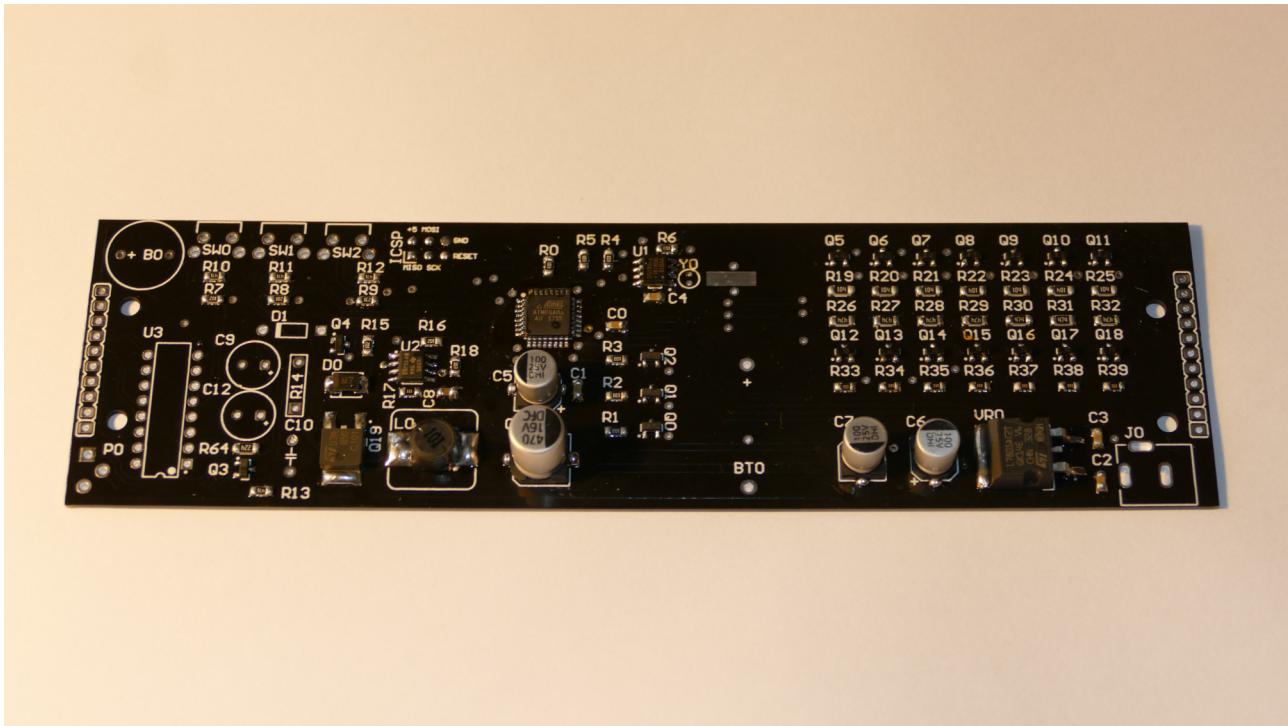
LEDs soldered to the display board.

(Now you can mount resistors to the top/display board)

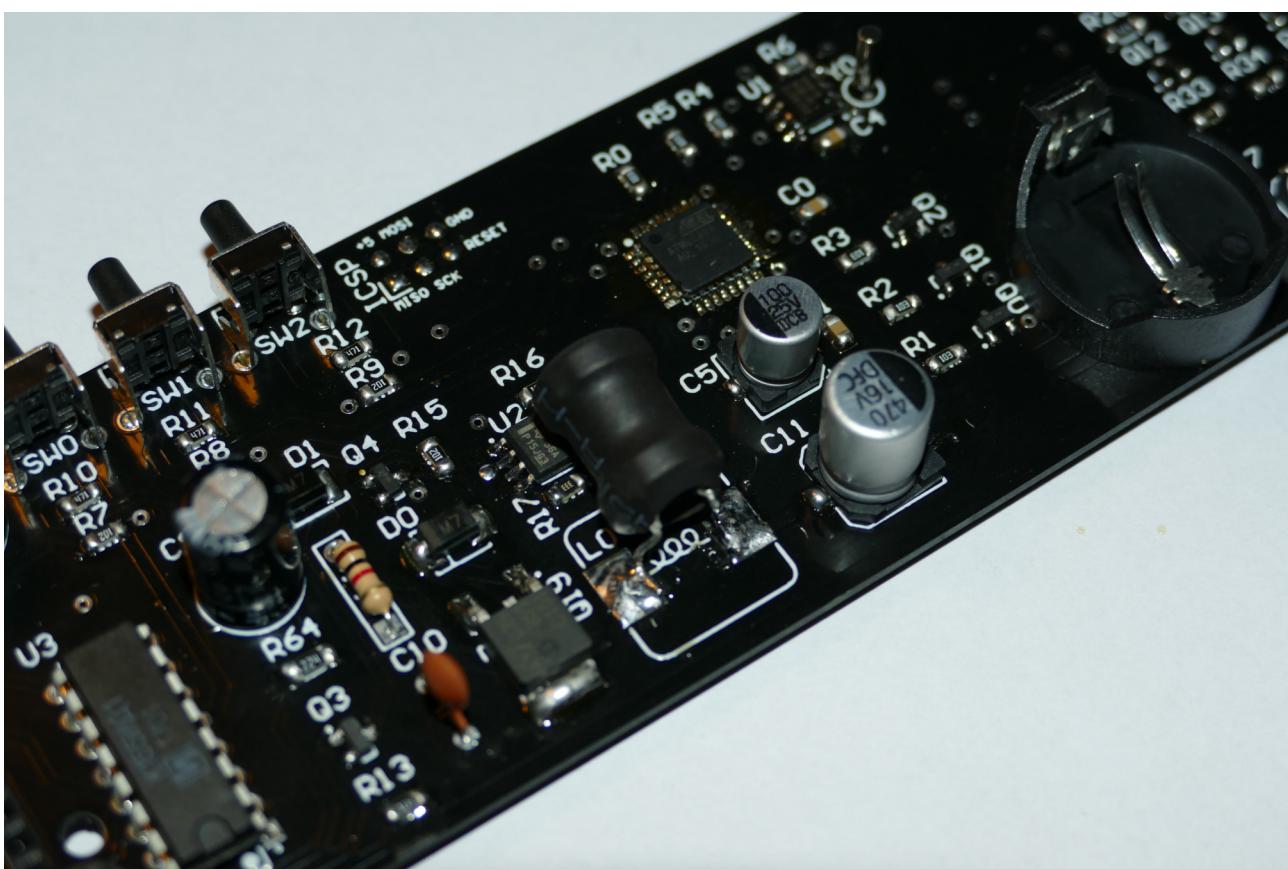


You can check for solder bridges with multimeter diode test mode or other 5v power supply. Plug GND to right bottom hole and probe vias above sockets with positive voltage; as shown on the picture.

7. Large SMD components

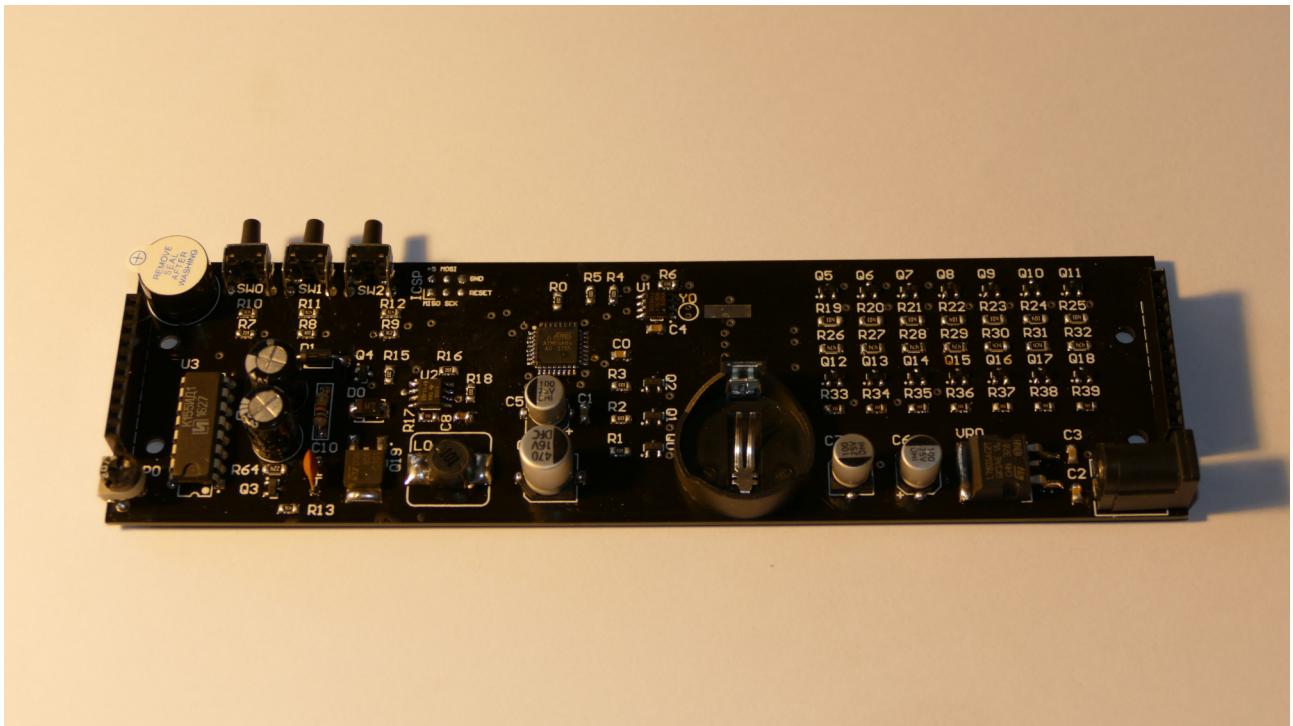


Solder large SMD elements to the main board. Notice that its possible to use THT equivalents instead of SMD with some of the components.



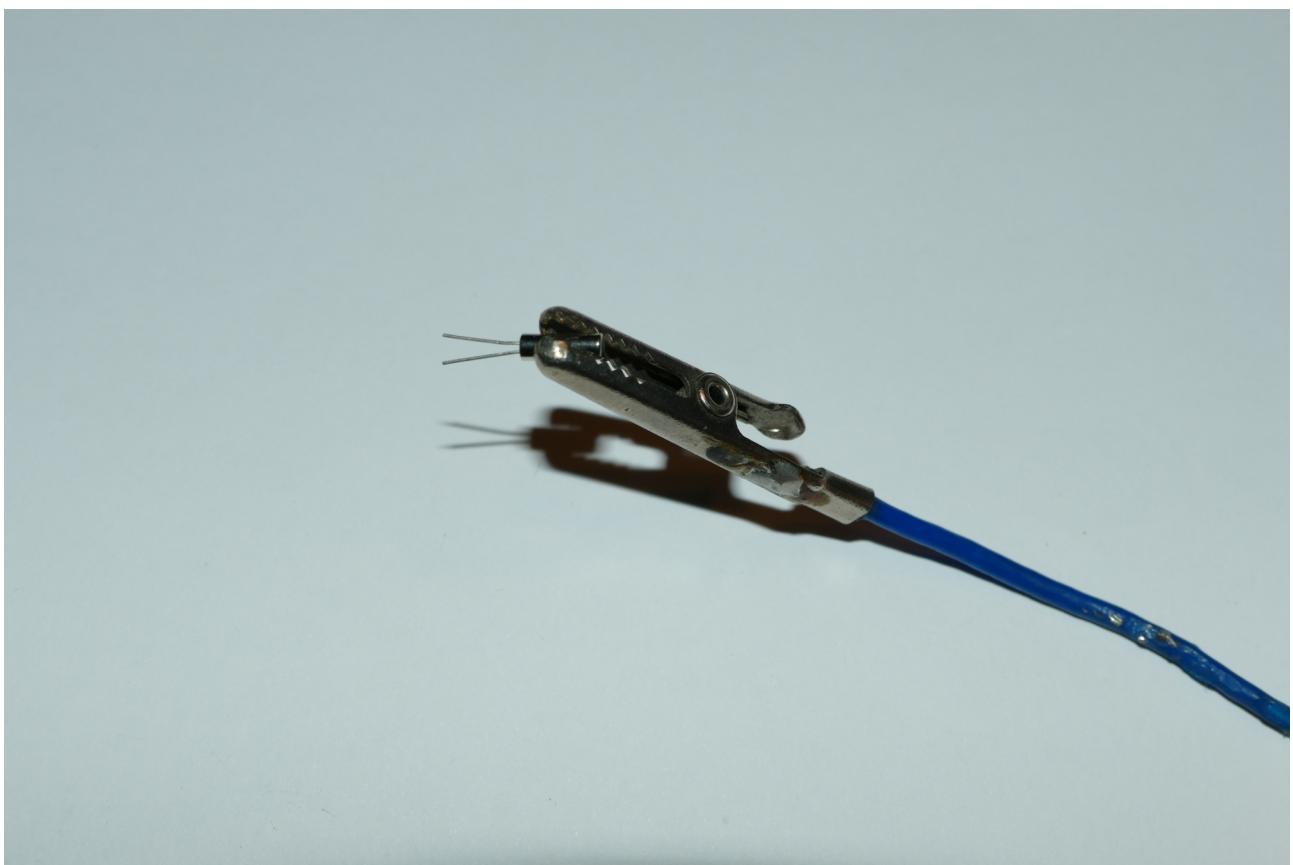
If you decide to do so, you will have to ensure that part will fit in- between the boards, by for instance bending it to the side.

8. THT parts on main board

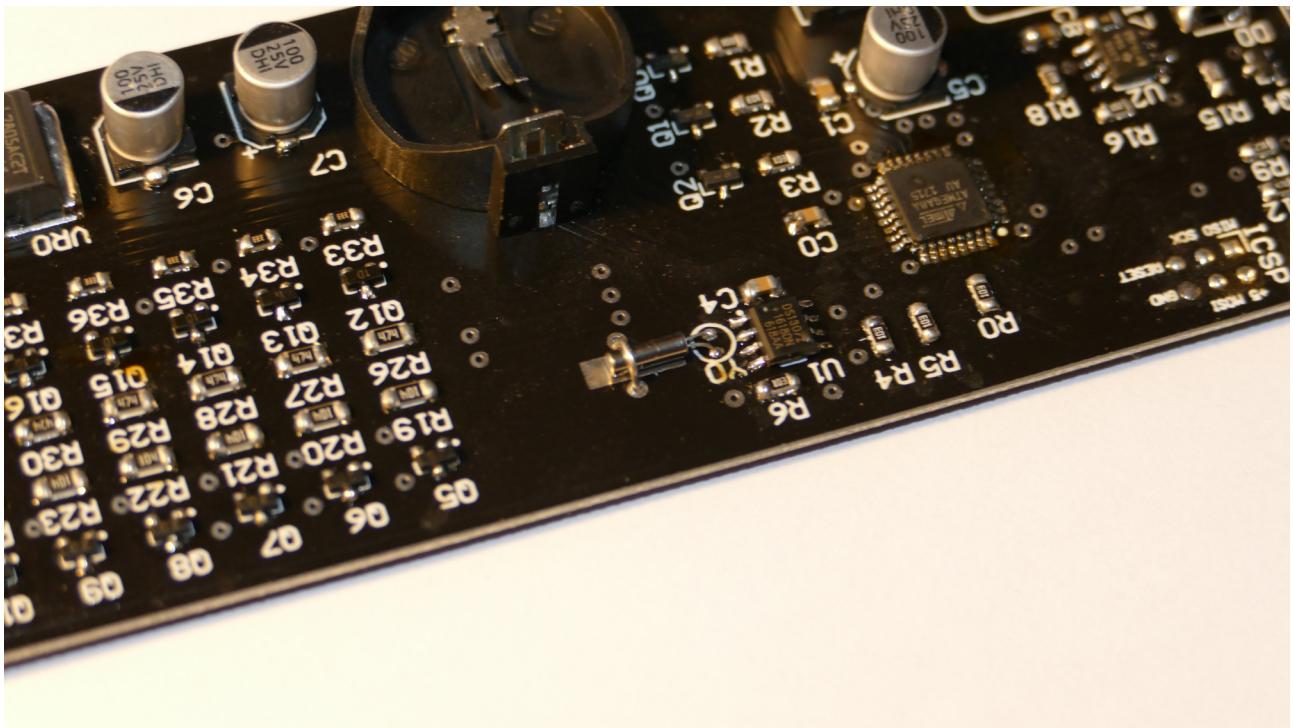


Mount THT components to the main board, you will have to separate the PCBs before this step if you havent done it before.

9. Mount clock crystal



While soldering small crystal, it is advisable to use crocodile clip in order to protect it from overheat. (it may have impact on clock accuracy over time)

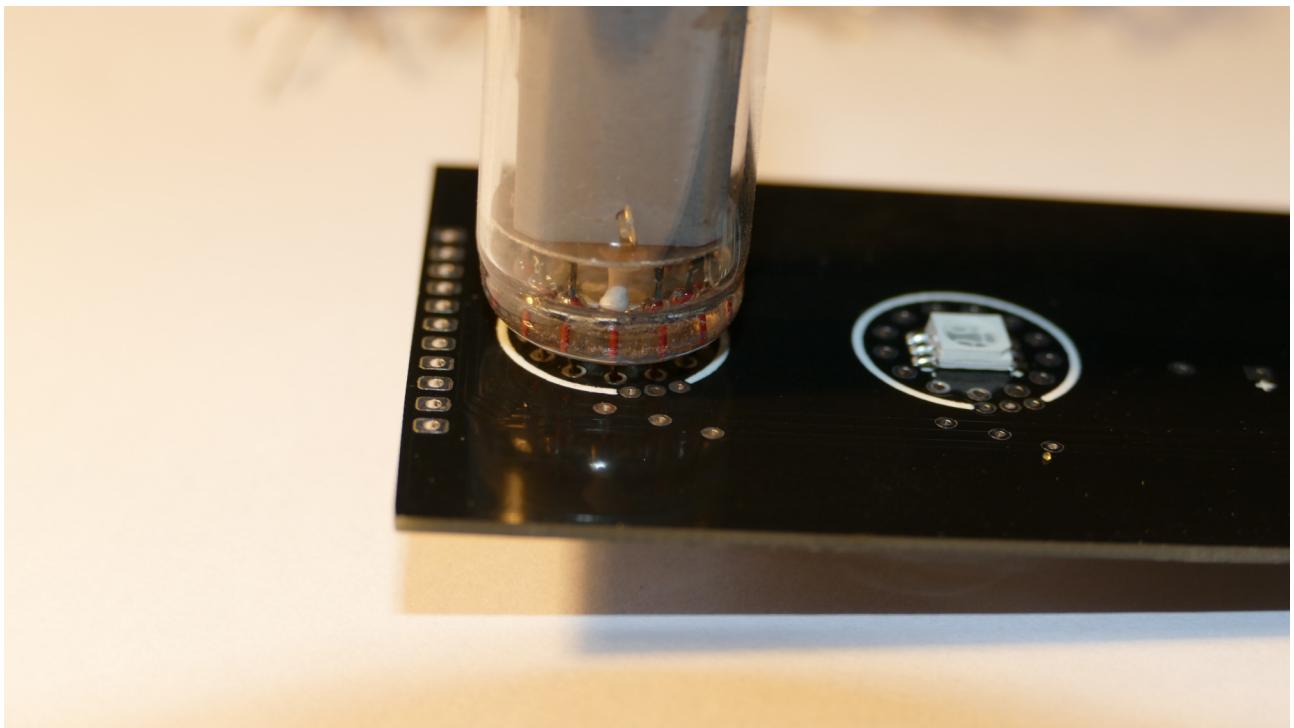


Bend the cristal over to touch exposed copper (DO NOT SOLDER CRISTAL TO PCB!) tight it down with wire from cut THT element pin; as shown on the picture.

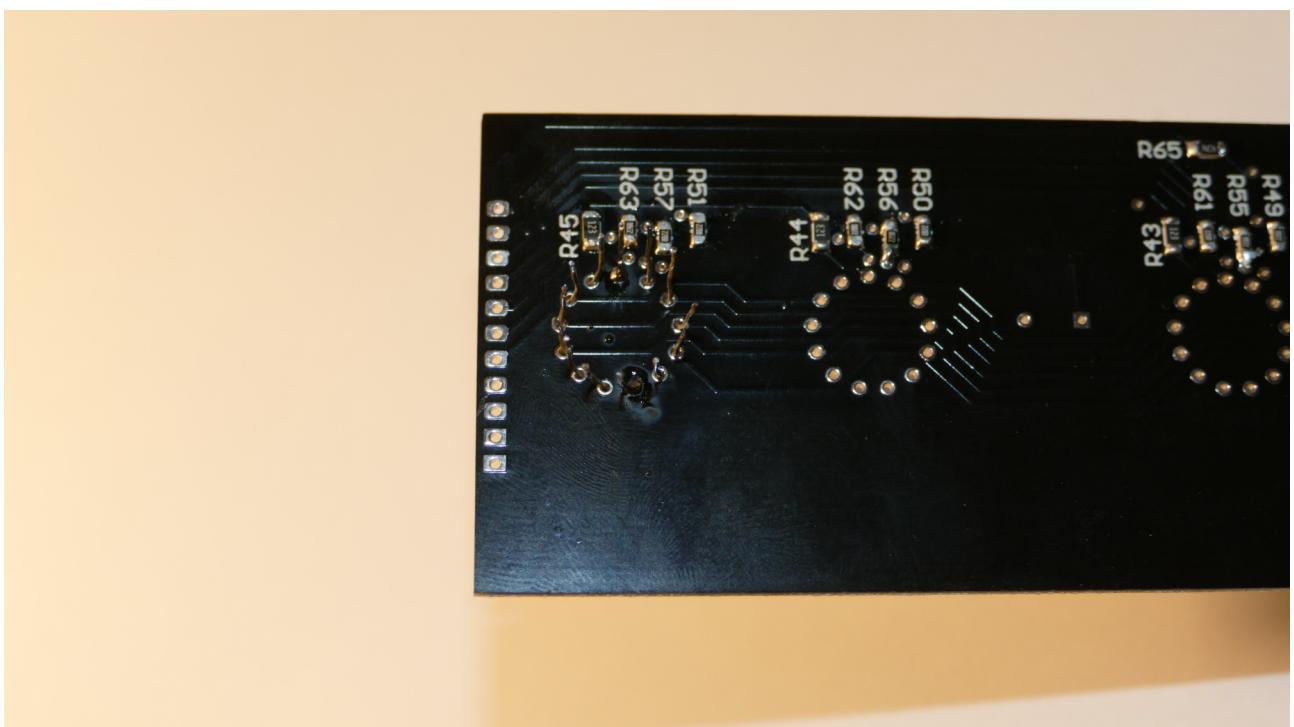
10. Position nixie tube



Place and adjust nixie tubes in the display boards sockets. Handle nixies with care, small cracks in glass near pins can cause vacuum to escape, and tube wont light up!



Mind the PCB orientation, there is a "Front" pointer on the bottom of the display board. While placing the nixie tubes ensure that pin with white cap inside / arrow marking on the bottom of the tube is correctly inserted in socket hole farthest from the front of the PCB.



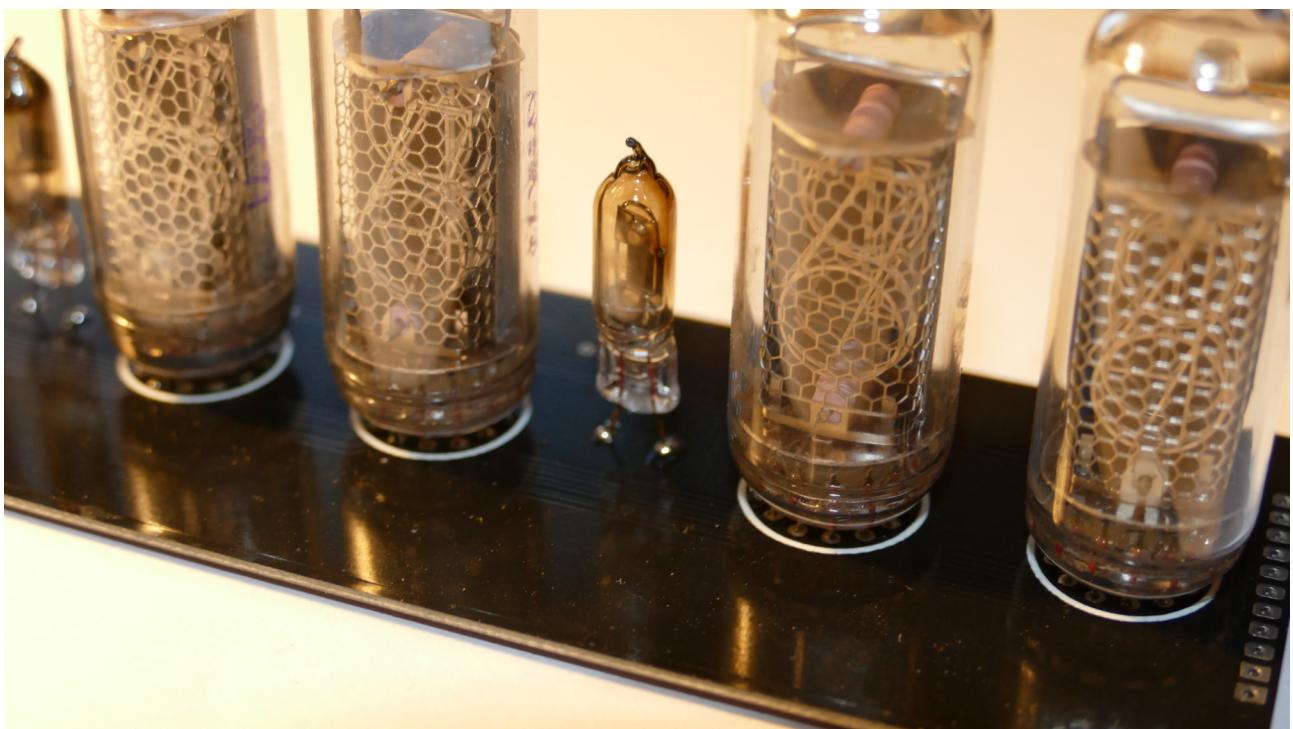
Solder two diagonal pins first from each tube and check on the alignment. With this method, its very easy to correct mistakes before final soldering.

11. Solder nixies

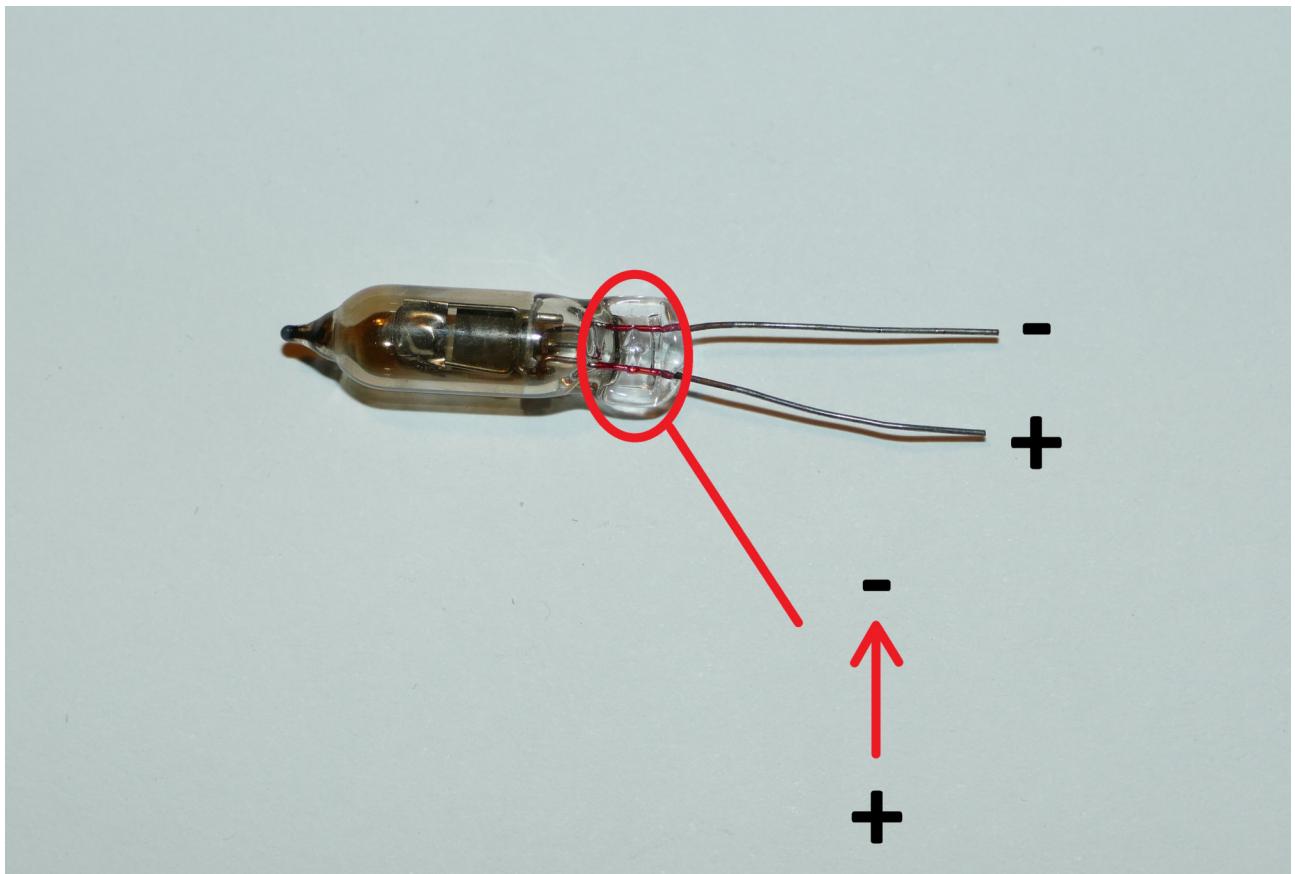


Once you are satisfied with the tubes alignment solder rest of the pins.

12. Separators

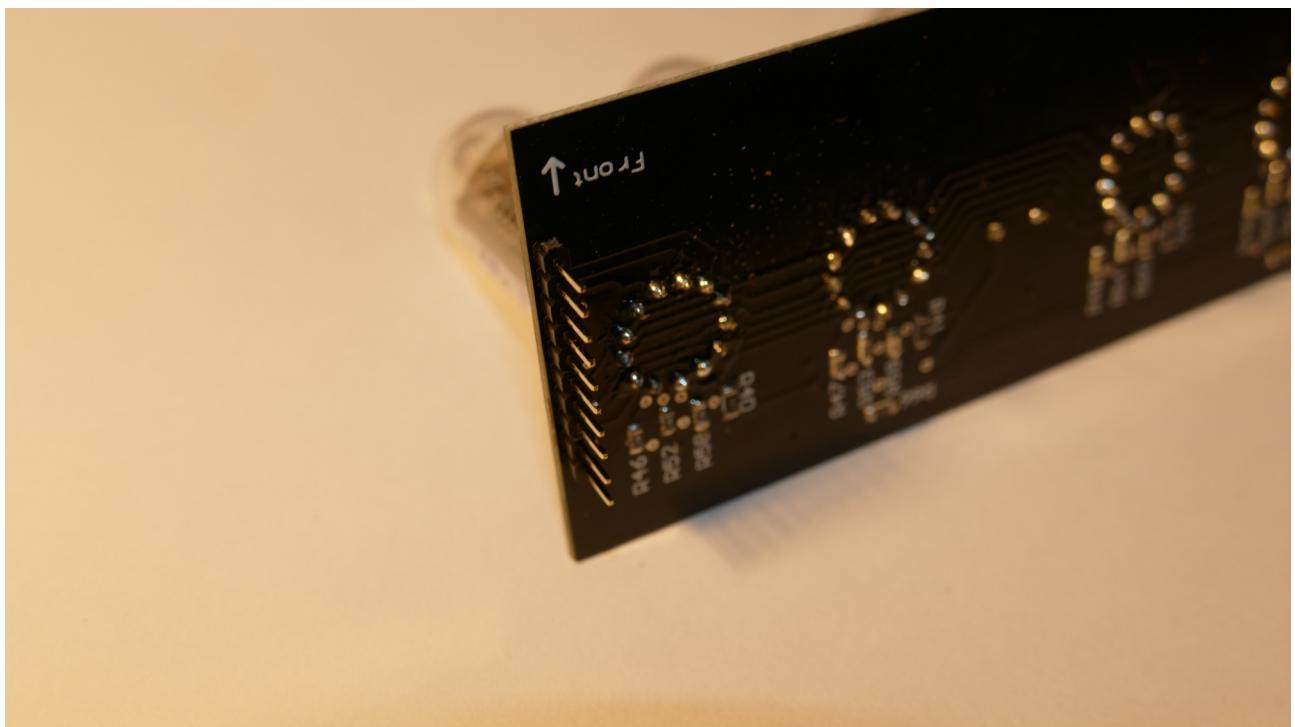


Solder separators at desirable pins height, be careful pins might be fragile! You can use support to hold PCB from two ends to make this step easier.



The arrow on tube indicates polarity; as shown on the picture.

13. Mount boards connectors



14. Double check all solder joints!



15. Elements clearance

Ensure that none of the parts on the main board touches nixie pins on the display board.

16. Turn on

After last step, the clock should be completed. Just insert battery (clock will not boot up without it!), stack boards on top of each other and then plug the power supply and you are ready to go!

Dont forget to set up time first and adjust brightness. I recommend setting brightness to half of the range on first turn on. You will find instruction how to do that in the User Manual

I hope everything went as planned, and your nixie clock is working flawlessly and it will serve you for many years to come!

Sincerely, Jakub Dorda