

Build a Clock Doubler Board

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Version 1

S. Adolph

[Bitchin100 5MHz Upgrade](#)

Change record

Version	Comment
1	Initial document based on V4.4 PCB

Note: current design is V4.6, so this document is a little out of date.
I will be updating this document asap.

Overview

If you are here, you probably are thinking that a “Turbo” mode on a model T would be fun! The clock doubler board, once assembled, is soldered on to the top of the 80C85 CPU, and feeds the desired clock to the processor under user control.

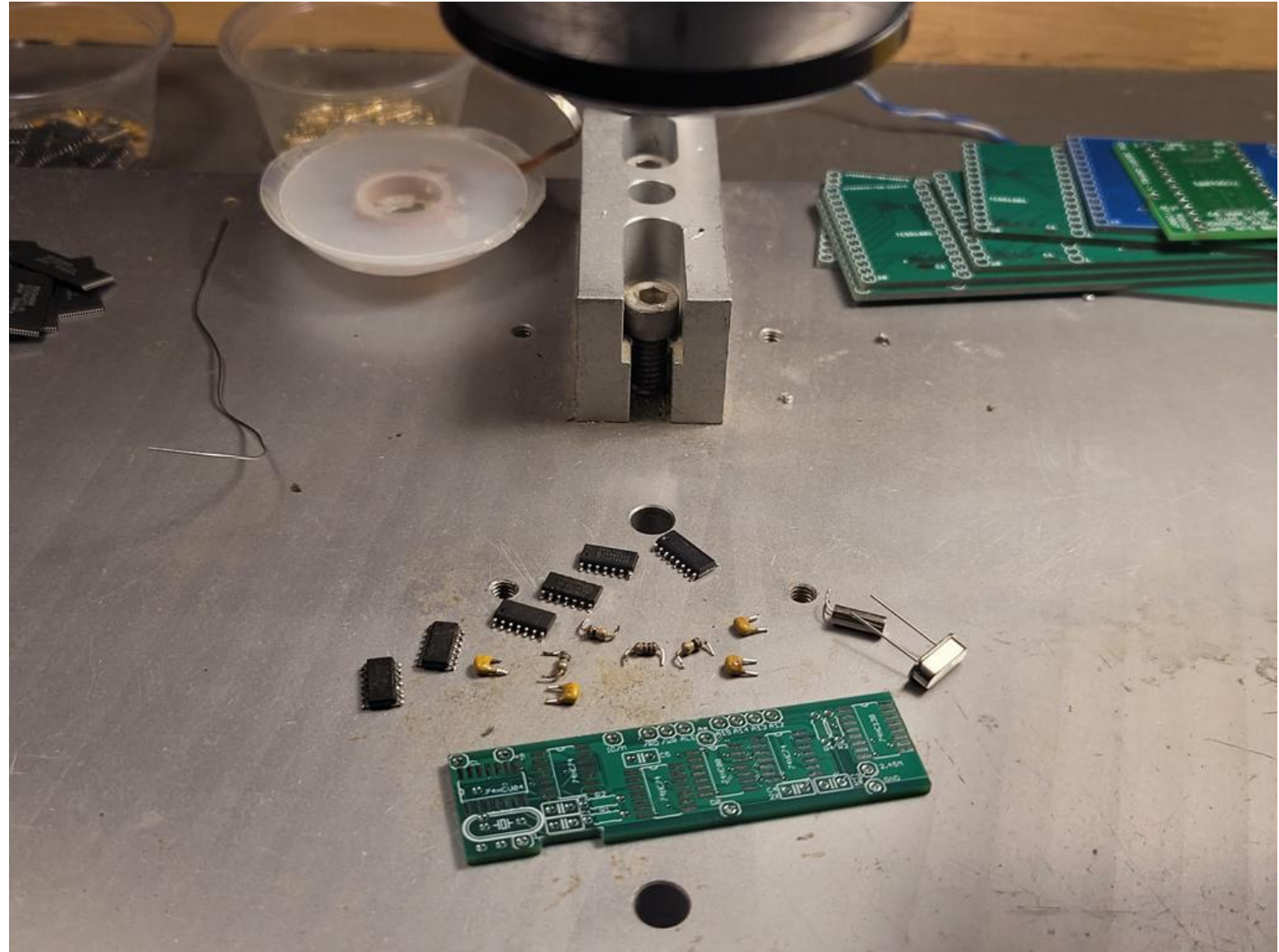
You need:

- PCB – make sure you get the PCB that fits your machine!
- all the parts on the BOM → recommend Digikey
- some fine soldering skills, equipment and supplies
- probably some form of visual magnification so you can check the work

Note: The Model T was never intended to run at 5MHz. While it appears to tolerate 5MHz operation, this is **OVERCLOCKING** beyond datasheet support.

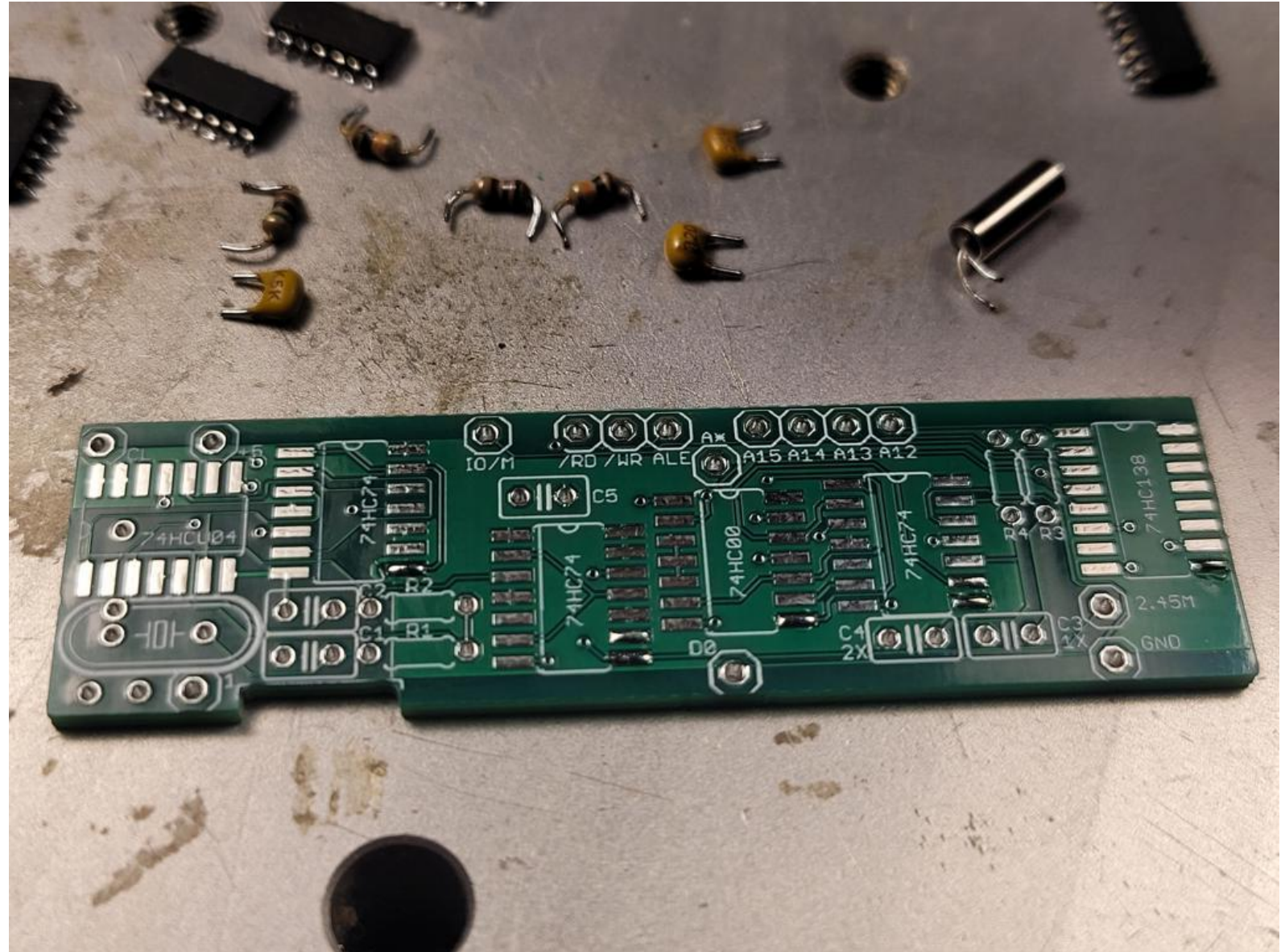
Getting started

- Here are all the parts under my microscope, which I use to help me see what I am doing.
- There are 2 different types of crystals.
 - Cylindrical (more expensive)
 - Low profile HC49 (cheaper)
- Only the T200 installation can make use of a cylindrical OR an HC49.
- All other boards use the low profile HC49.



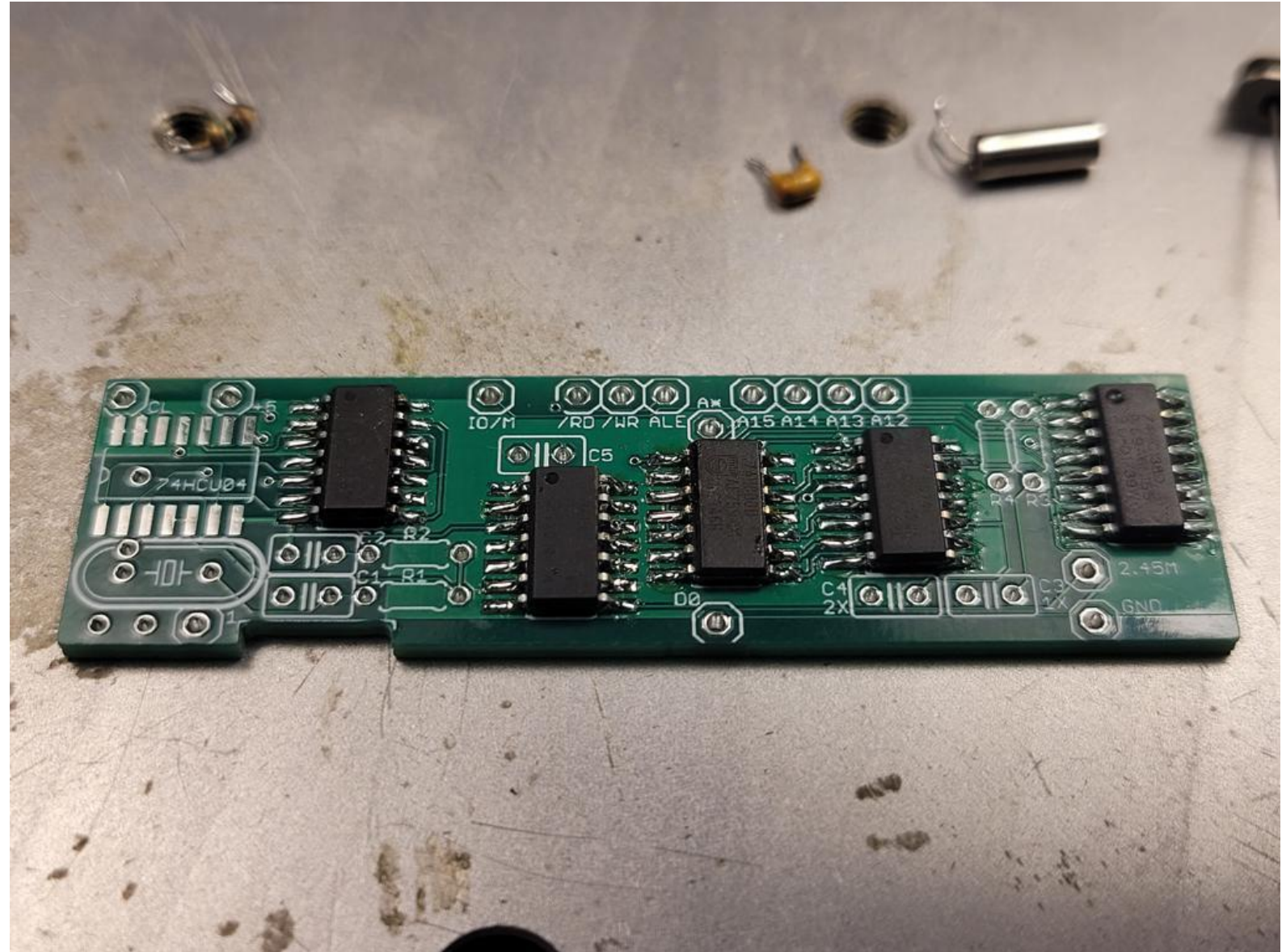
Getting started

- First step for me is to put a bit of solder on one pad for each of the 6 ICs.
- Note. For T200, the 74HCU04 is installed last! (because the crystal solders to the back side in T200).
- Then I hold each chip in place while I reflow the solder on the pad, securing the chip.
- Adjust the placement so the pads and chip leads all look aligned well.



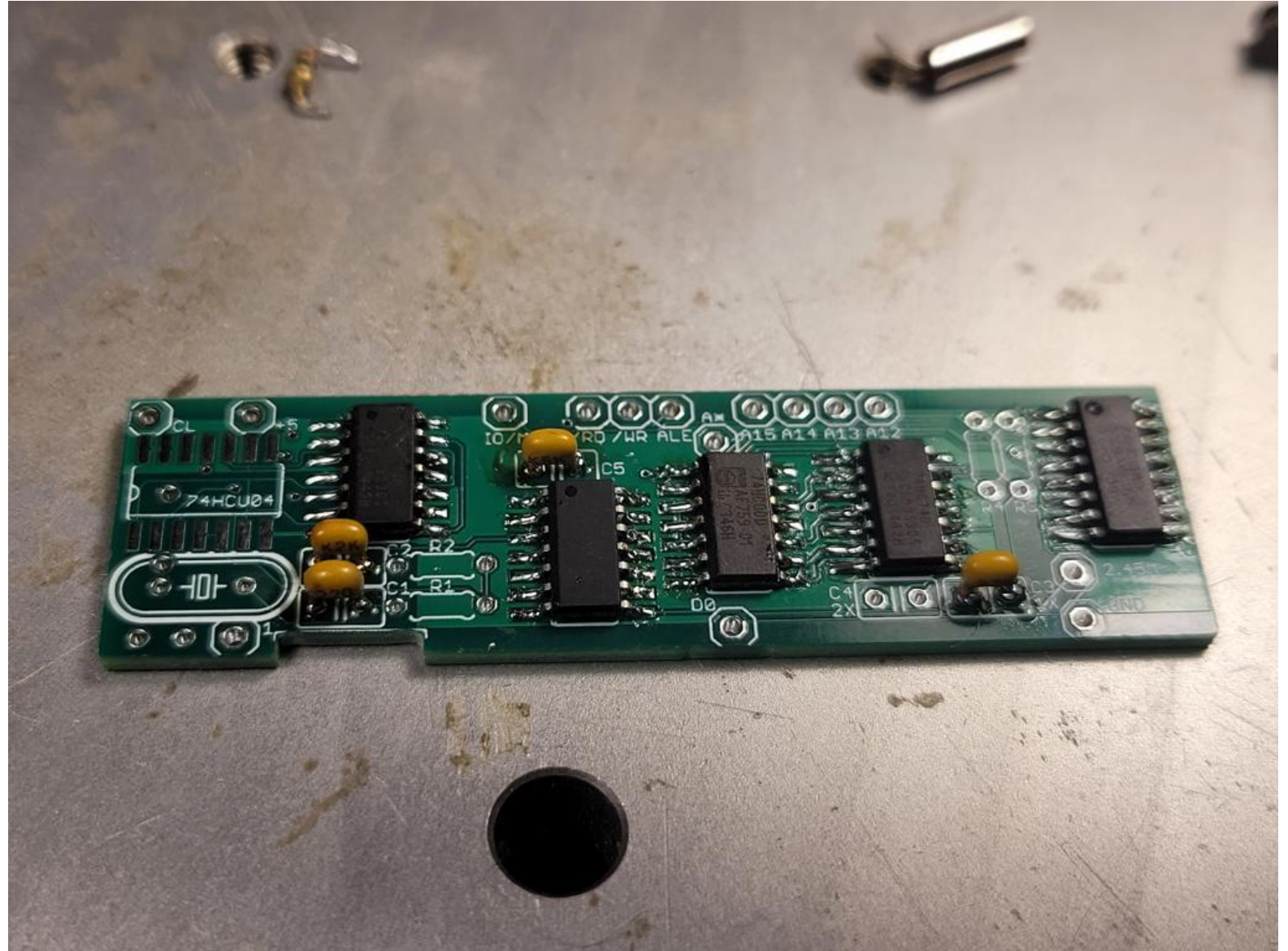
Solder down the chips

- Once all the chips are in place, you can solder all the pins down.
- Check over your work, look for solder bridges or pins you may have missed.
- Remember in T200 save the 74HCU04 till the end.



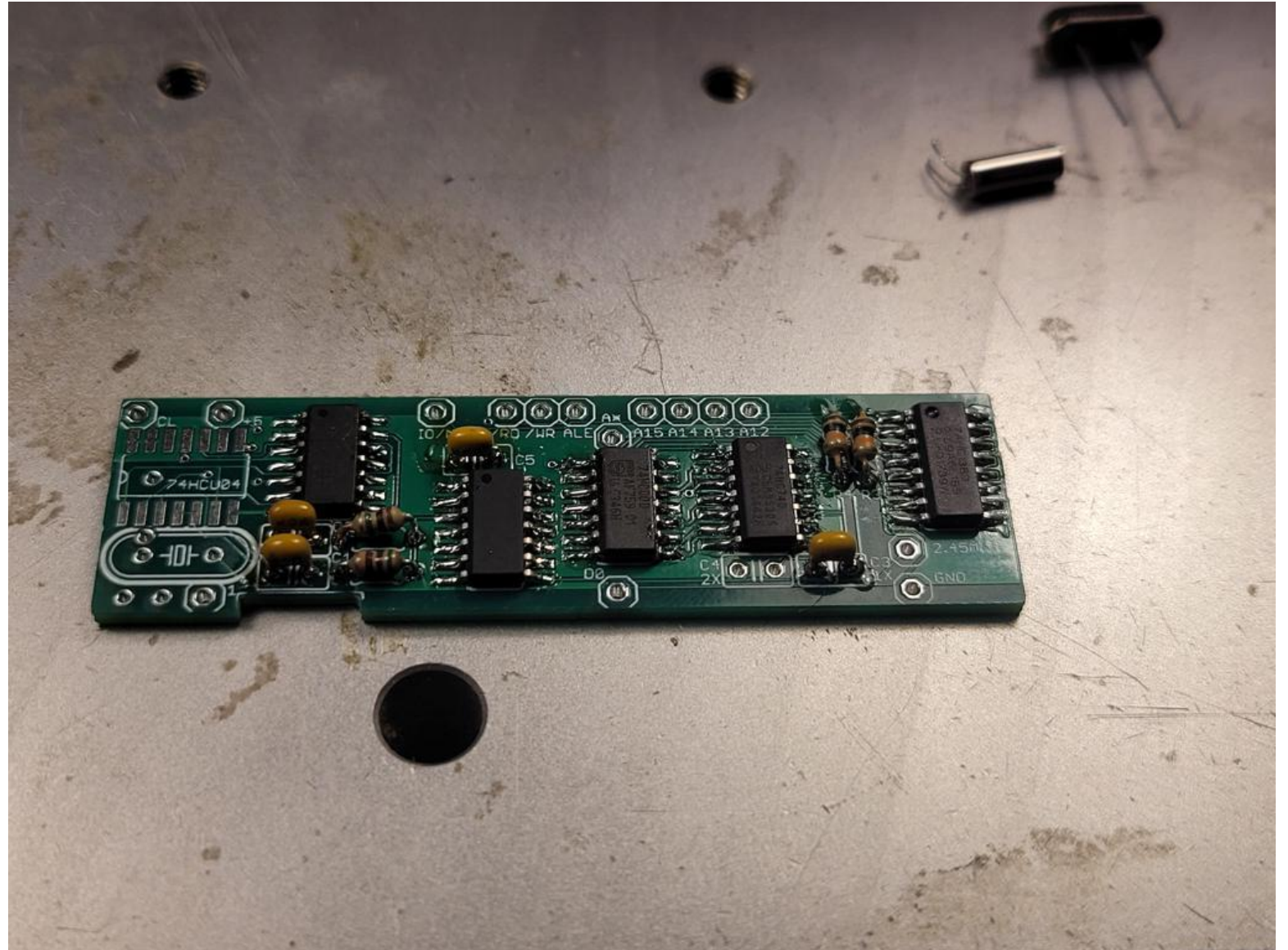
Install the caps

- Clip the leads of the capacitors so that they are as low profile as you can make them
- Leave a bit of lead exposed so that you can solder from the top side. This is important because you want the back of the PCB to be smooth with no solder lumps.
- Solder each leg of the caps to secure them in place.
- 22pF caps for C1, C2.
- 0.47uF caps for C5, and one of C3 or C4.
- Place C3 if you want default power up condition to be normal clock rate.
- Place C4 if you want default power up condition to be 2x clock rate.



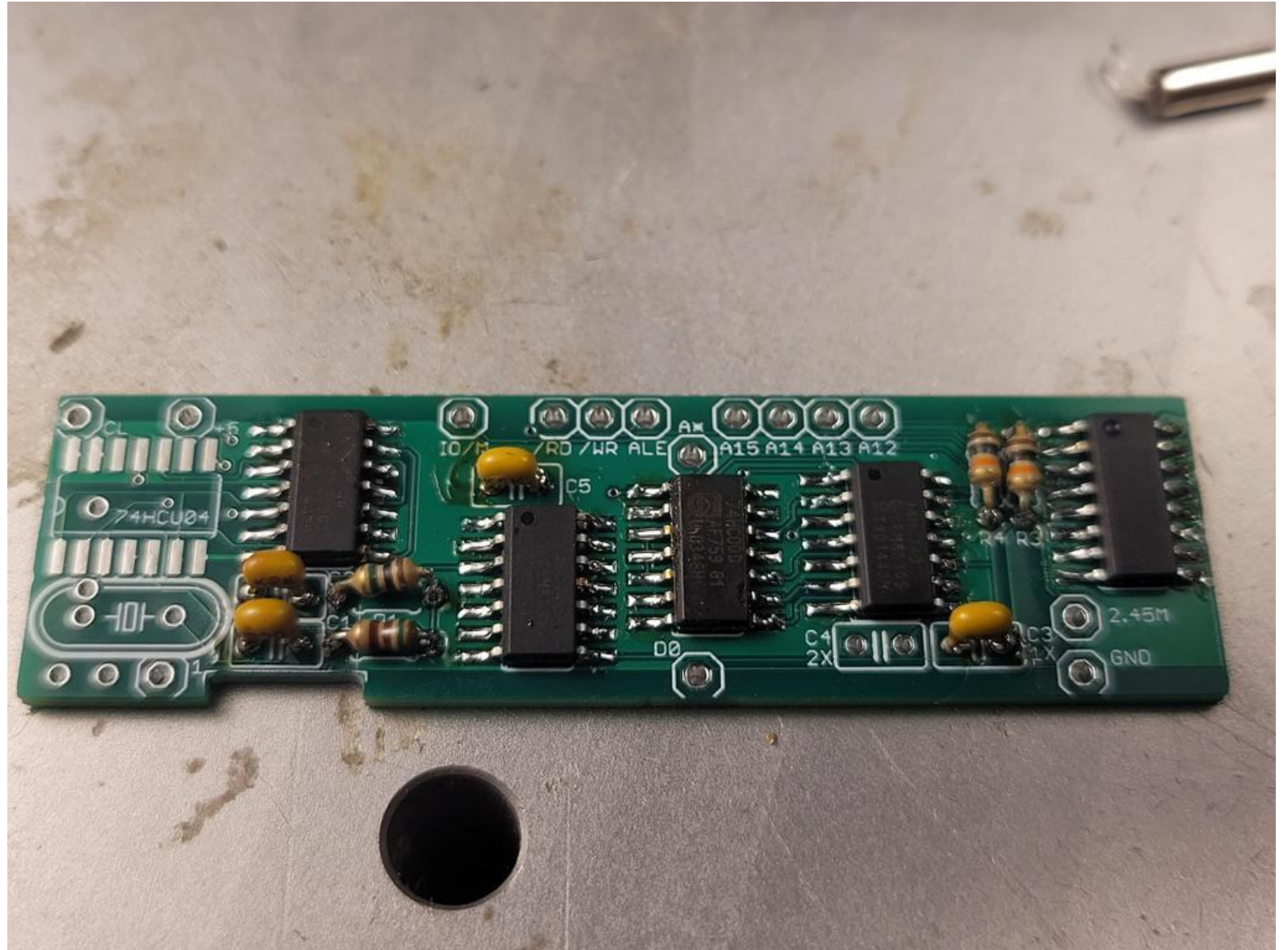
Install the resistors

- Similarly clip the leads of the resistors and form them so that the resistors sit flush to the board.
- Leave a bit of lead exposed so that you can solder from the top side. This is important because you want the back of the PCB to be smooth with no solder lumps.
- Solder each leg of the resistors to secure them in place.
- 10kohm for R3, R4.
- 499ohm for R1. 1Mohm for R2



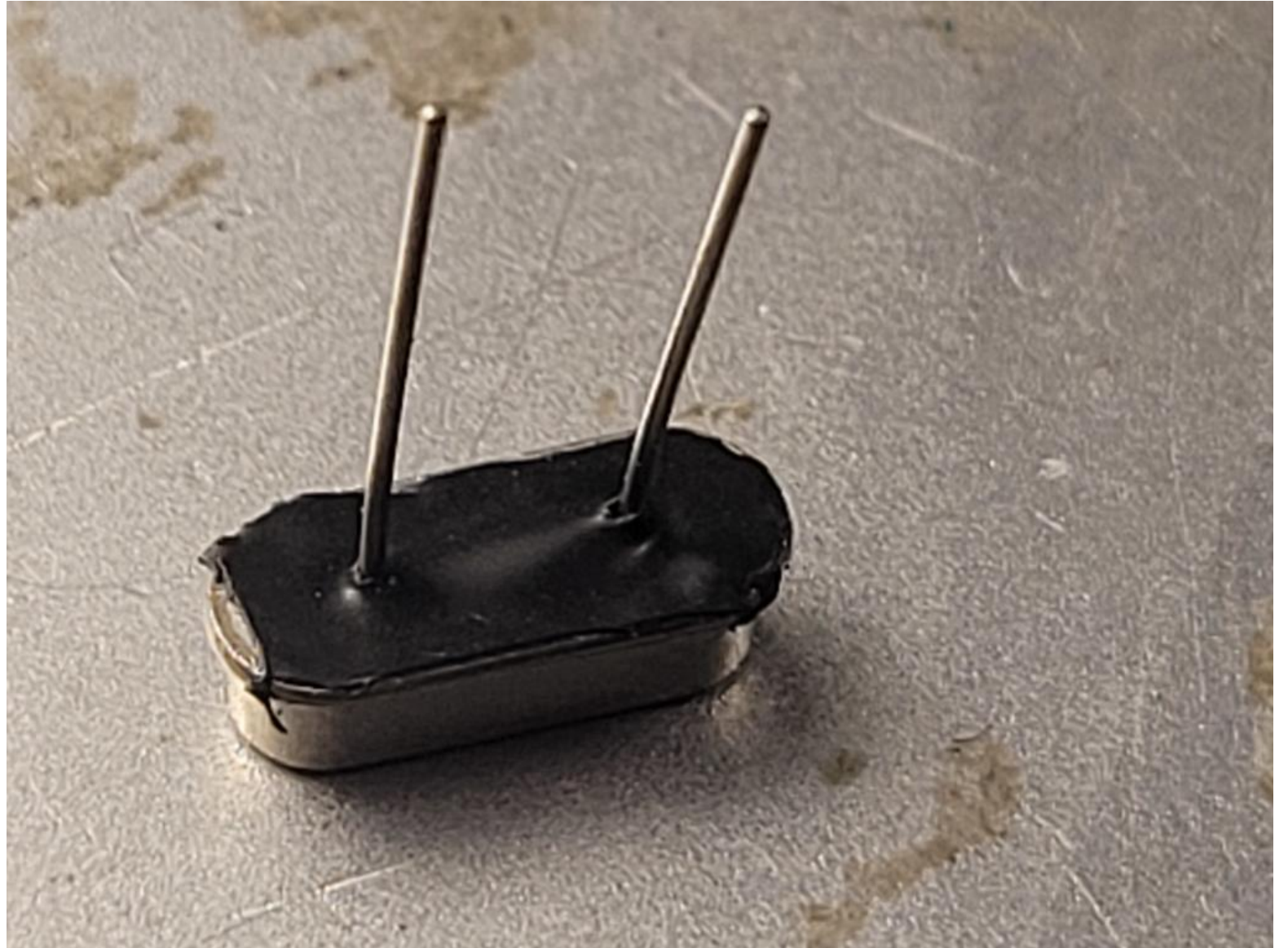
Ready for crystal

- Next step is to install the crystal.
- In this case I am building a T200 board, so the crystal needs to go on the back side.
- You can use either a cylindrical or low profile HC49.



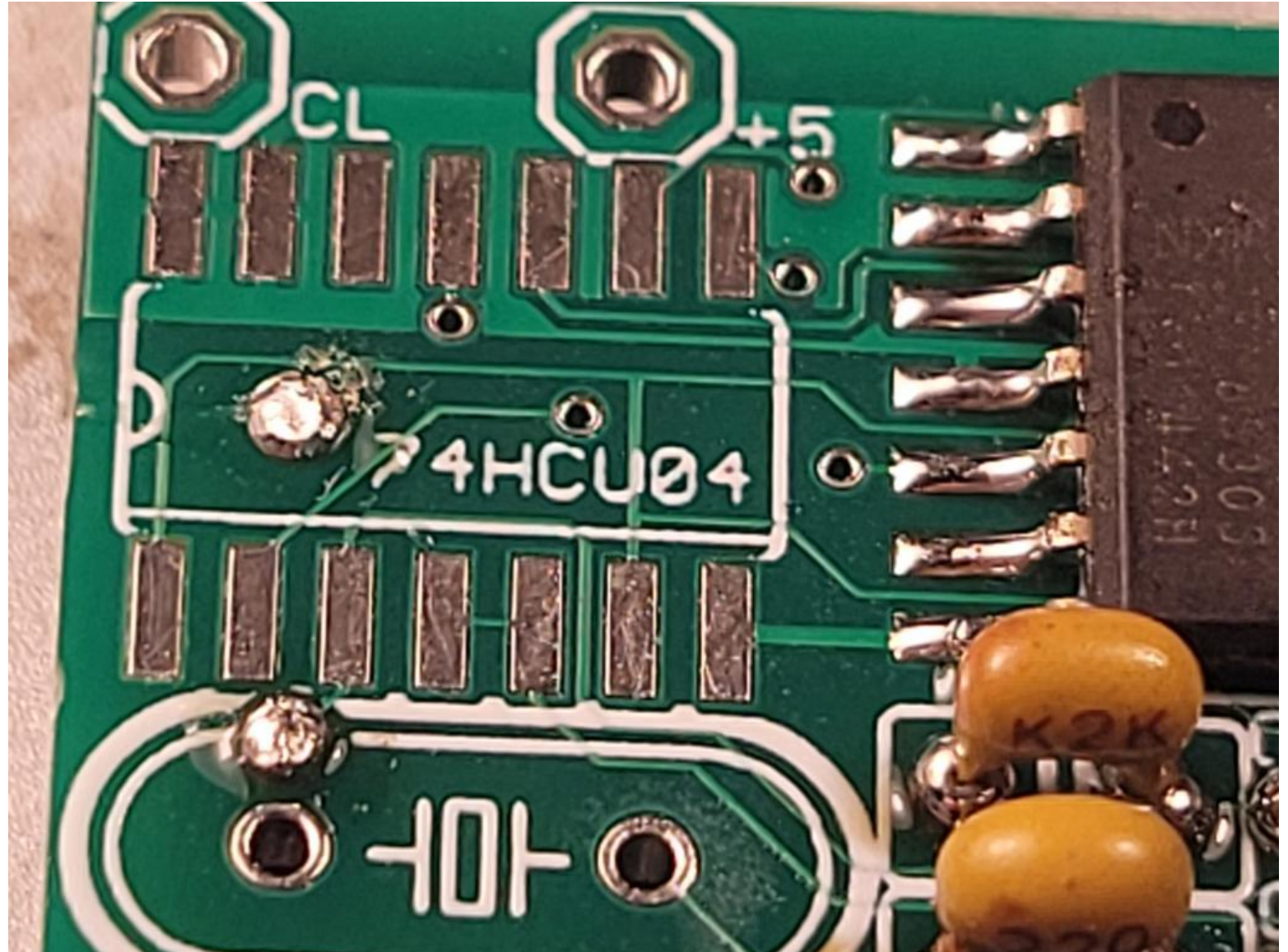
Isolate the crystal

- It is important that the metal case of the crystal does not make contact with any vias under the footprint.
- I use black electrical tape to do that.



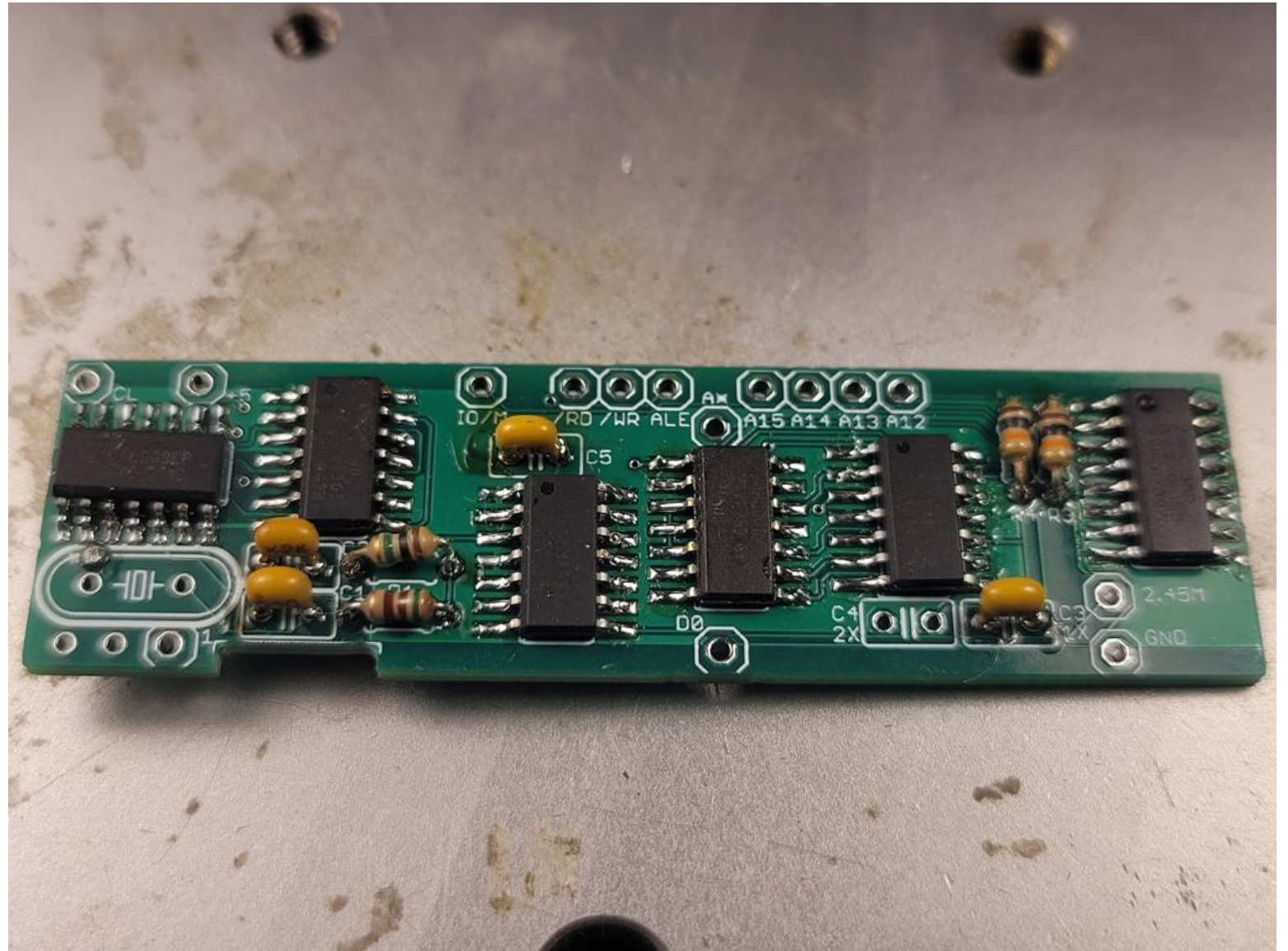
Install the crystal

- Insert the crystal on the underside in the vias indicated here (again this is for T200 – other models have the crystal inserted on the top side)
- Clip the leads flush
- Solder from the top side, minimizing the solder “bump”

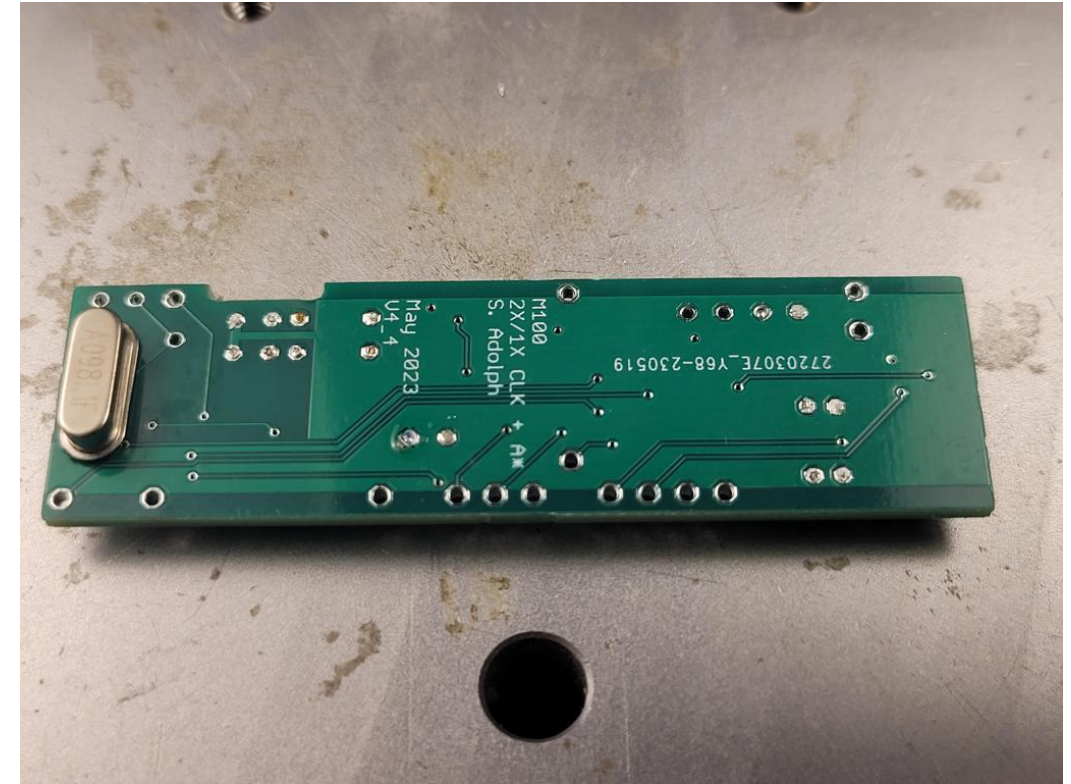
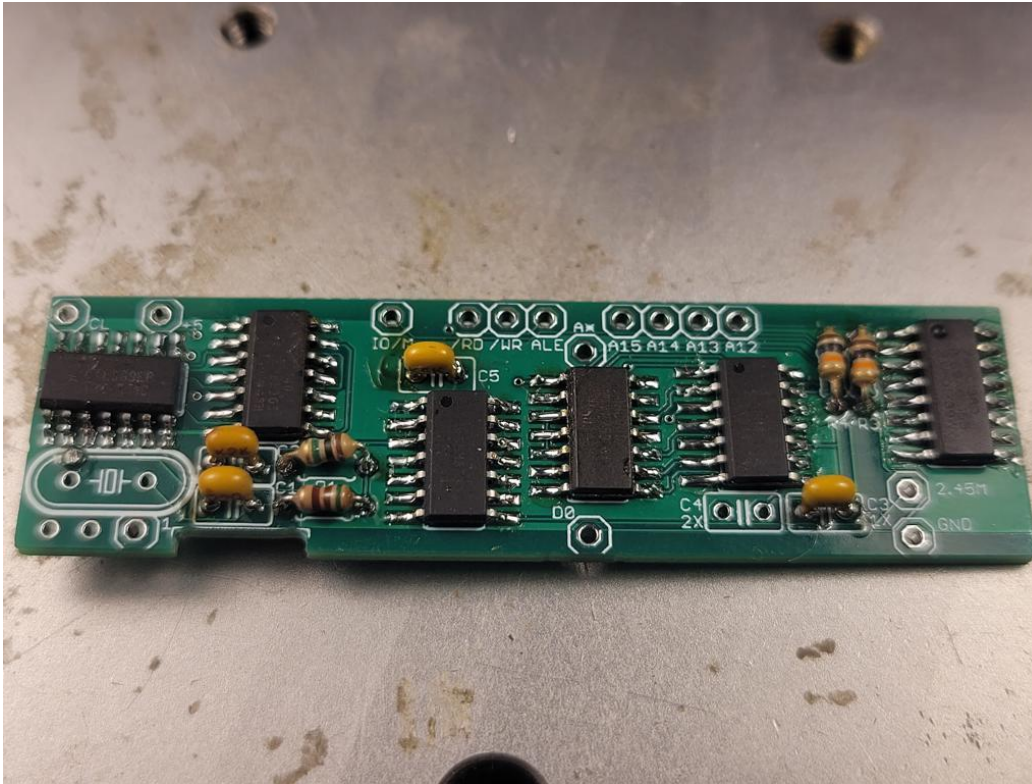


Install the 74HCU04 buffer

- Now, install the 74HCU04
- Now would be a good time to inspect all the work, checking for bad joints, bridges, etc.



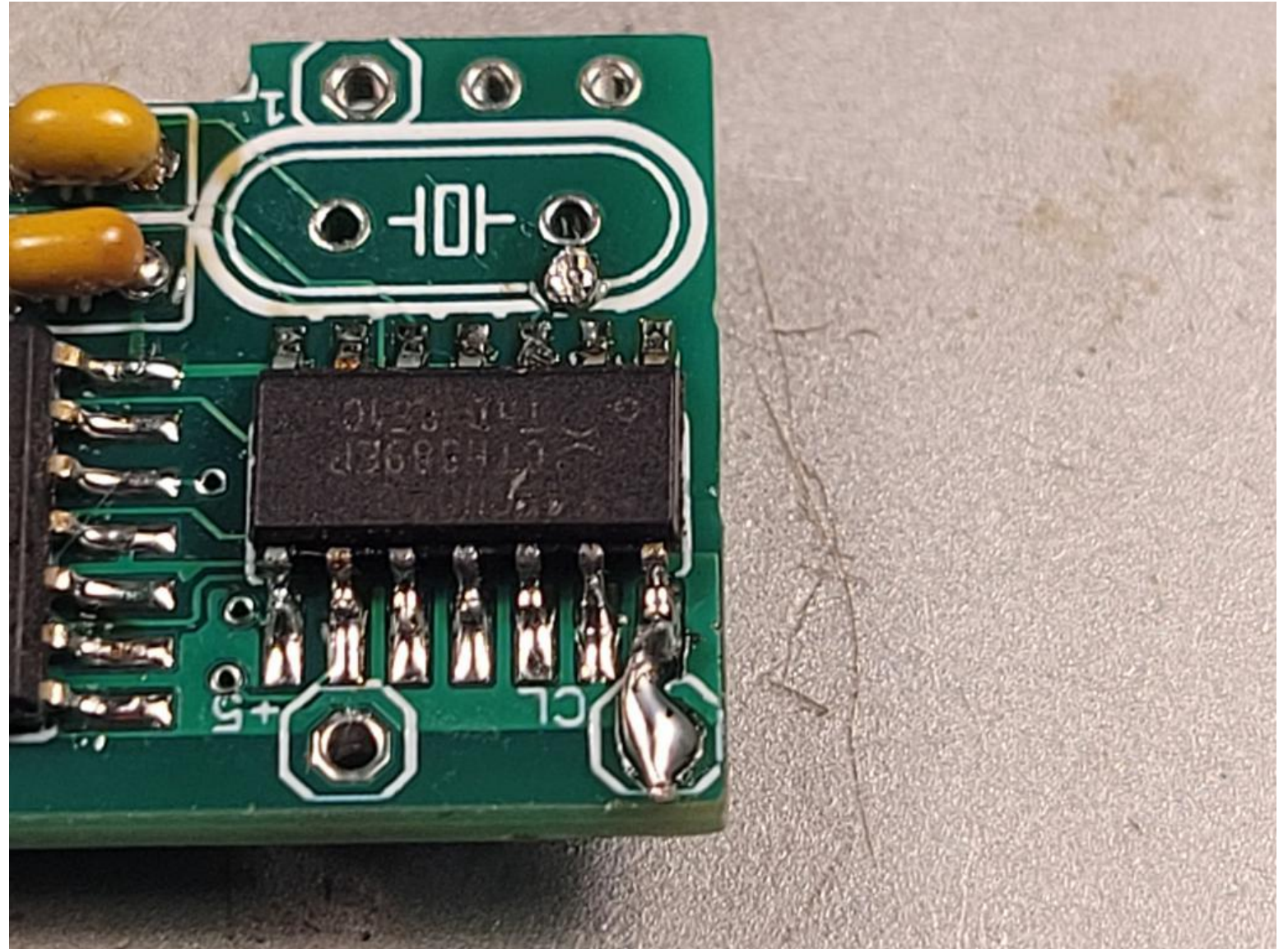
Almost finished! Here's what it should look like



- Now, install the 74HCU04
- In general, almost done! One more step for M100, T102, M10, PC-8201, KC-85
- (This one is ready to install in T200)

Configure the hardware slowdown function

- In Tandy 200, when in 2X mode, it is necessary to switch automatically to 1x mode when the CPU is accessing the real time clock RP5C01.
- That is accomplished by wiring in the “CL” signal to the input location on the board.
- In other platforms, this input should be tied to plus 5V. This is illustrated here.
- 5V is located at pin 14 on the 74HCU04, right next to the CL input.
- This configuration is shown here. (non T200 installation)



Finishing comments

- the backside of the PCB should be pretty smooth and flush, so that it sits well on the CPU.
- ready to move on to installation in the laptop
- laptop installation involves some direct soldering on the CPU, careful cutting of some specific tracks on the laptop, and installation of some wires to connect clock and ram control signals to the laptop PCB
- check out the [Bitchin100 5MHz Upgrade](#) page for model specific installation documents