Building Cyduino from the kit parts

Following are step-by-step instructions for soldering the components of the Cyduino project onto the PCB. A guide like this is probably overkill — most people can probably figure out how everything goes together using the schematic. But it can be nice to see what the board looks like at each step, especially for inexperienced builders. Hopefully, this guide lessens the chances of making mistakes.

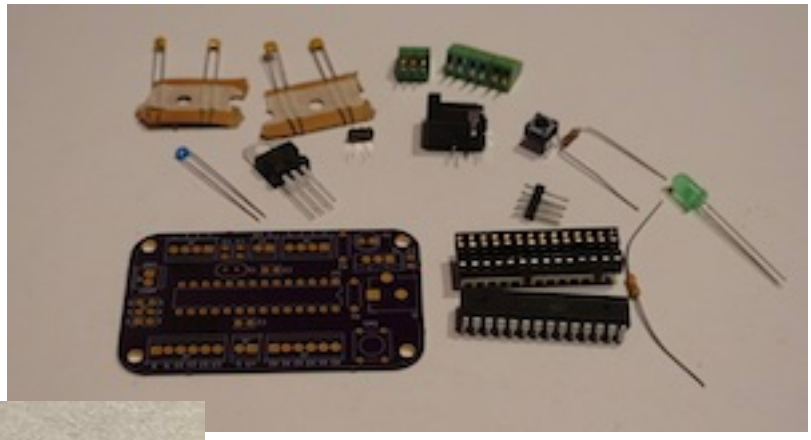
It is a good idea to read the Cyduino description document before starting to build the kit. The document has a BoM listing and descriptions of the various parts of the circuit.

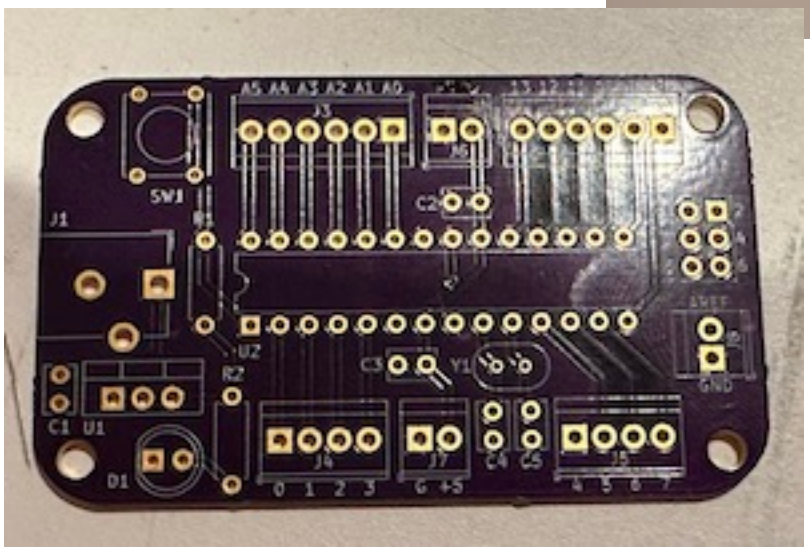
Most of the soldering is quite easy. As always, we start with the small components (ceramic capacitors and resistors) and work towards the biggest components (voltage regulators and connectors). Note that when soldering any ground connection, we are actually soldering to the ground plane on the PCB. These are harder to heat to the temperatures required to melt the solder. We need to make sure that the soldering-iron tip is well tinned and that we make good thermal contact. Be patient and allow enough time for everything to heat up. We may even want to increase the soldering-iron temperature[1].

It is always a good idea to check things as the build progresses. Use the continuity-test function of the multimeter to check the solder connections.

0. Gather the parts.

Consult the BoM to see the complete list. Below is a close-up view of the PCB.

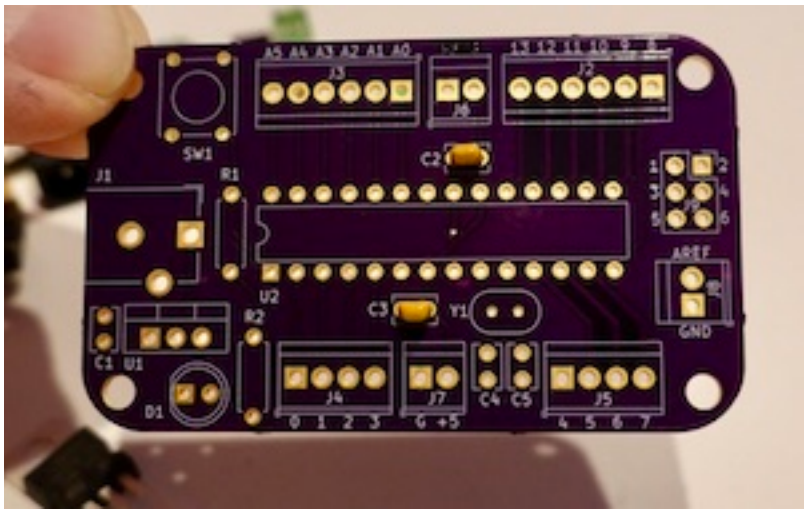




[1] Generally, I use a soldering tip temperature of around 650°C. If the ground connections are “being stubborn”, I may turn the temperature up to 700°C or 725°C to get a bit more thermal energy flowing.

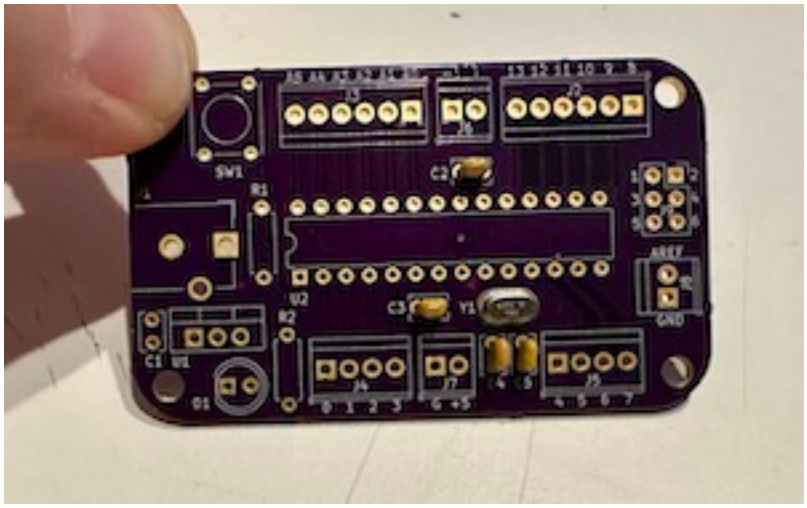
1. Bypass capacitors.

Solder in the two 0.1-μF bypass capacitors. They are labeled C2 and C3 on the board.



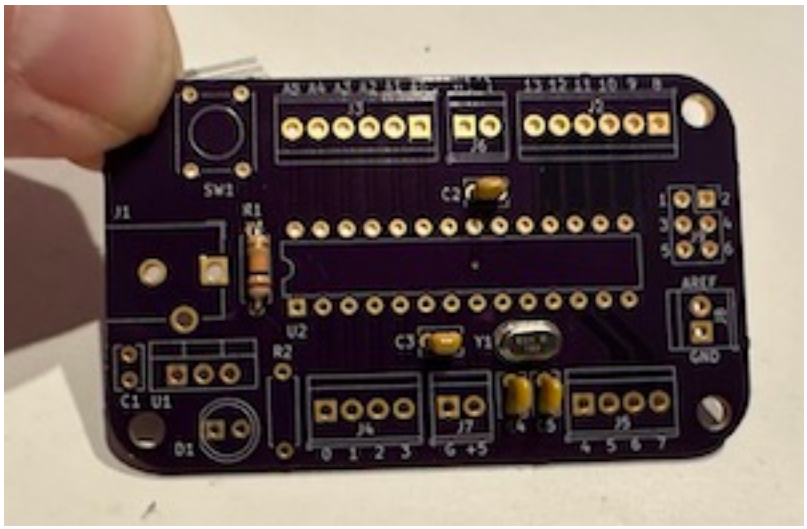
2. Oscillator crystal and capacitors

Solder in the crystal, labeled Y1, and the two capacitors, labeled C4 and C5, for the oscillator.



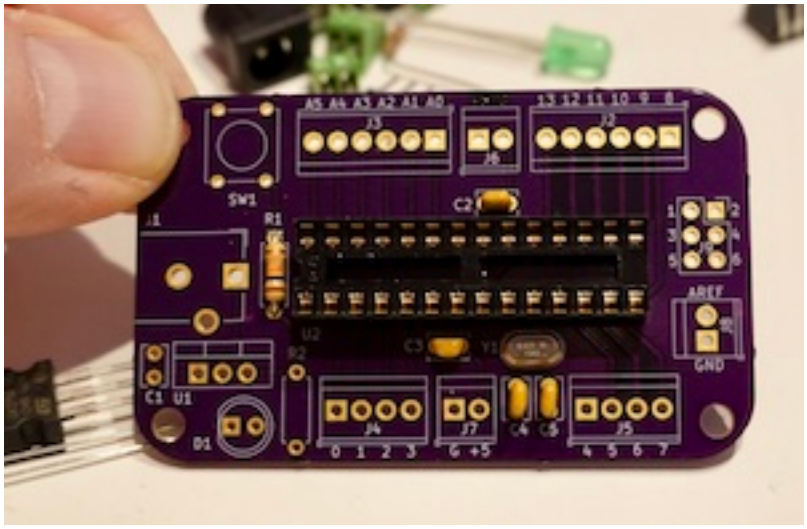
3. Reset pull-up resistor

Add the 10-kΩ pull-up resistor. It is labeled R1 on the board.



4. Microcontroller socket

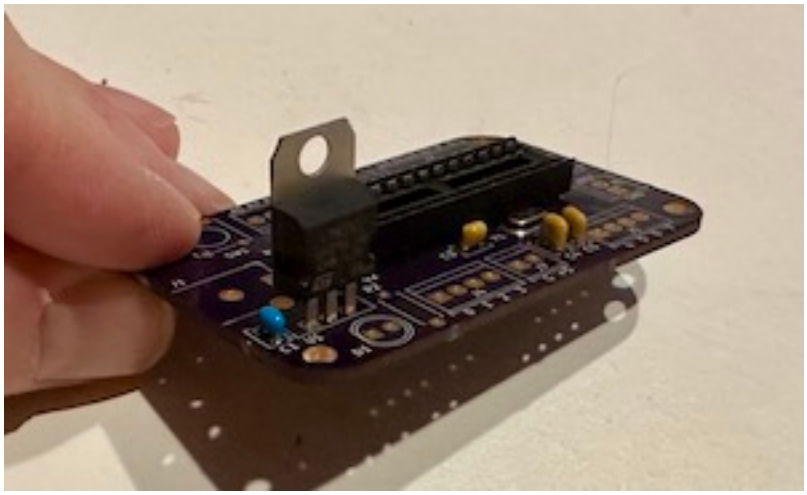
Solder in the 20-pin socket for the Atmega328 chip. This may look to be tedious, but it should only take a couple of minutes. Note that there are two ground connections — be sure that those are soldered well.



5. Voltage regulator and capacitor

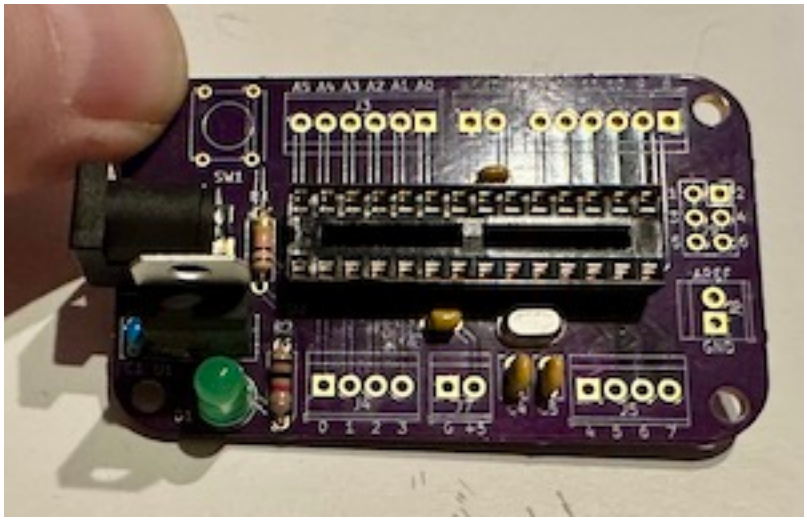
Solder in the 7805 voltage regulator (U1). and the 0.22-μF (or 0.33-μF) capacitor (C1). The regulator input is nearest the capacitor, the output is closest to the microcontroller.

That's it for the required parts. The rest are optional, depending on the application.



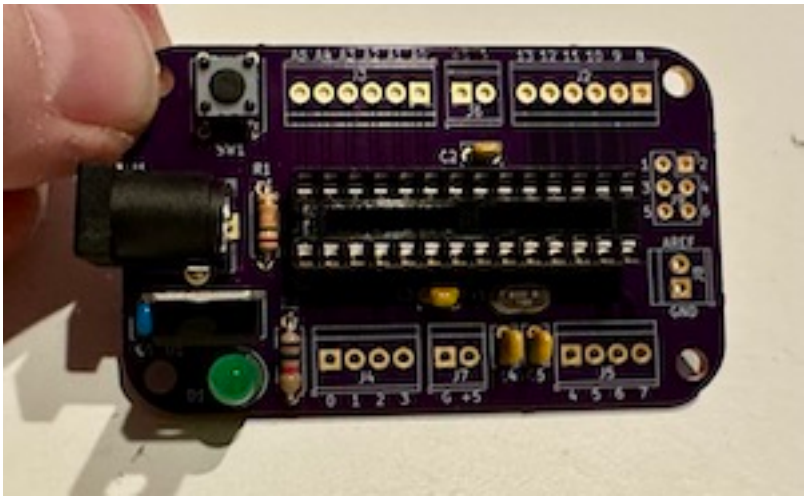
6. LED and resistor

Add the LED (D1) and the current-limiting resistor (R2). Be sure to connect the LED with correct polarity. As always, any color LED is fine — the kits prepared by IEEE may have red, green, or blue. Also the kit comes with a 3.3-kΩ resistor, but we used a 1-kΩ here. Again, the actual resistor value isn't too important, as long it is not too small.



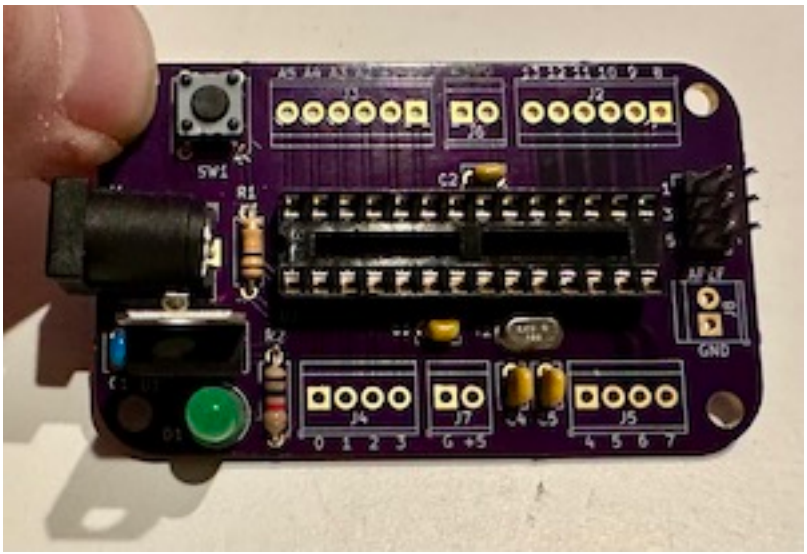
7. Reset switch

Solder in the reset switch. It may be necessary to bend the leads to fit them in. The switch will not fit in “sideways”, and it doesn’t matter if it is “up” or “down” since the switch is symmetric. We can’t really go wrong here



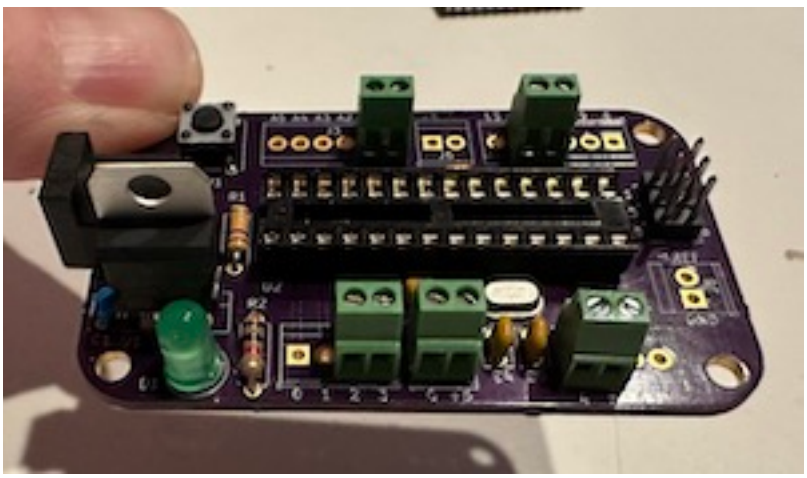
8. ICSP header

Solder in the ICSP header. This can be little tricky to hold in place while soldering since the pins can’t be bent. Try using a piece of tape to hold it in place. Or a friend. Solder one pin in place first, and then check the alignment. If the header is crooked, melt the solder on the one pin while pushing the header into proper position.



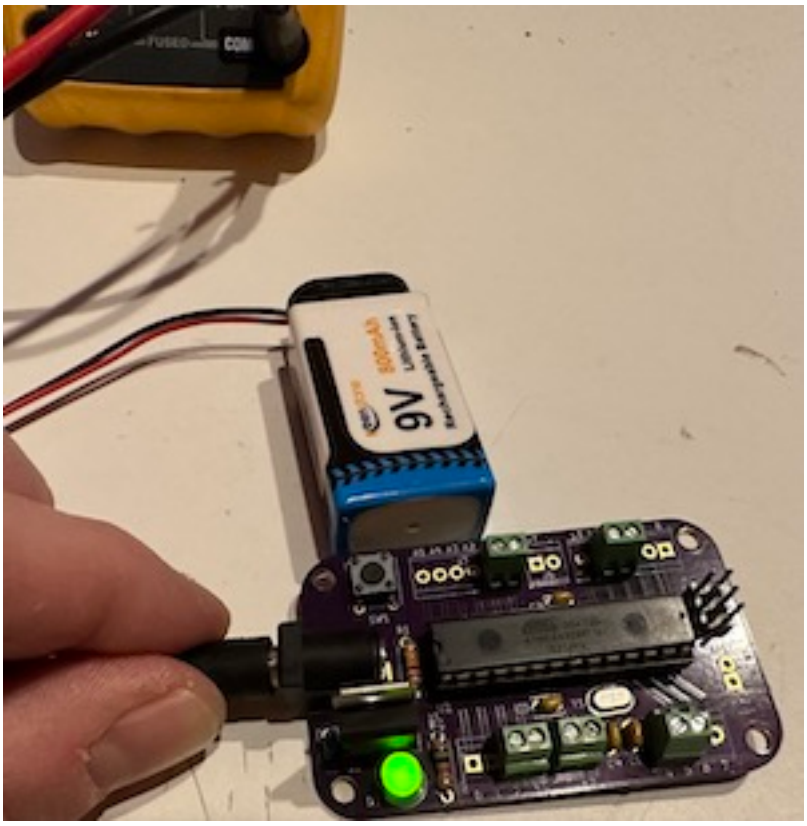
9. Connectors

Finally, solder in connectors for the pins that will be used. Typically, there will be at least one two-position connector for ground and +5 V. Then there can be any number of other connections depending on the application. In this case, we will be using a parallel-connected LCD display that requires six digital pins. We can use screw terminals, as in this case, or simple male header pins, or even female headers. A janky approach would be simply solder wires directly to the through holes. However, any wires soldered like that will probably break before long.

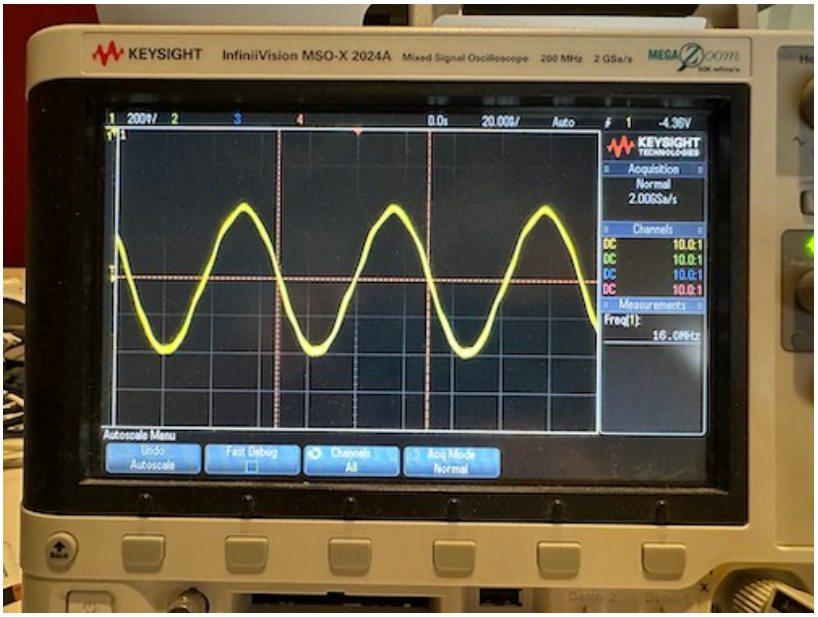


10. Insert the controller, connect power, and check.

Carefully insert the Atmega328 chip (presumably already programmed) into the socket. Mind the direction! Connect the power — the LED should light up. It is a good idea to use the multimeter to check the power and ground connection to the chip and at other points in the circuit.



Finally, if an oscilloscope is available, we can check the oscillator. Probing between pin 9 (or pin 10) and ground, we should see a 16-MHz sine wave. The controller has a “heart beat”, and it should be working.



If everything is working as expected, we can connect the Cyduino to make our system. Below is a photo of the finished Cyduino working in the thermometer set up that was description in the Cyduino document.