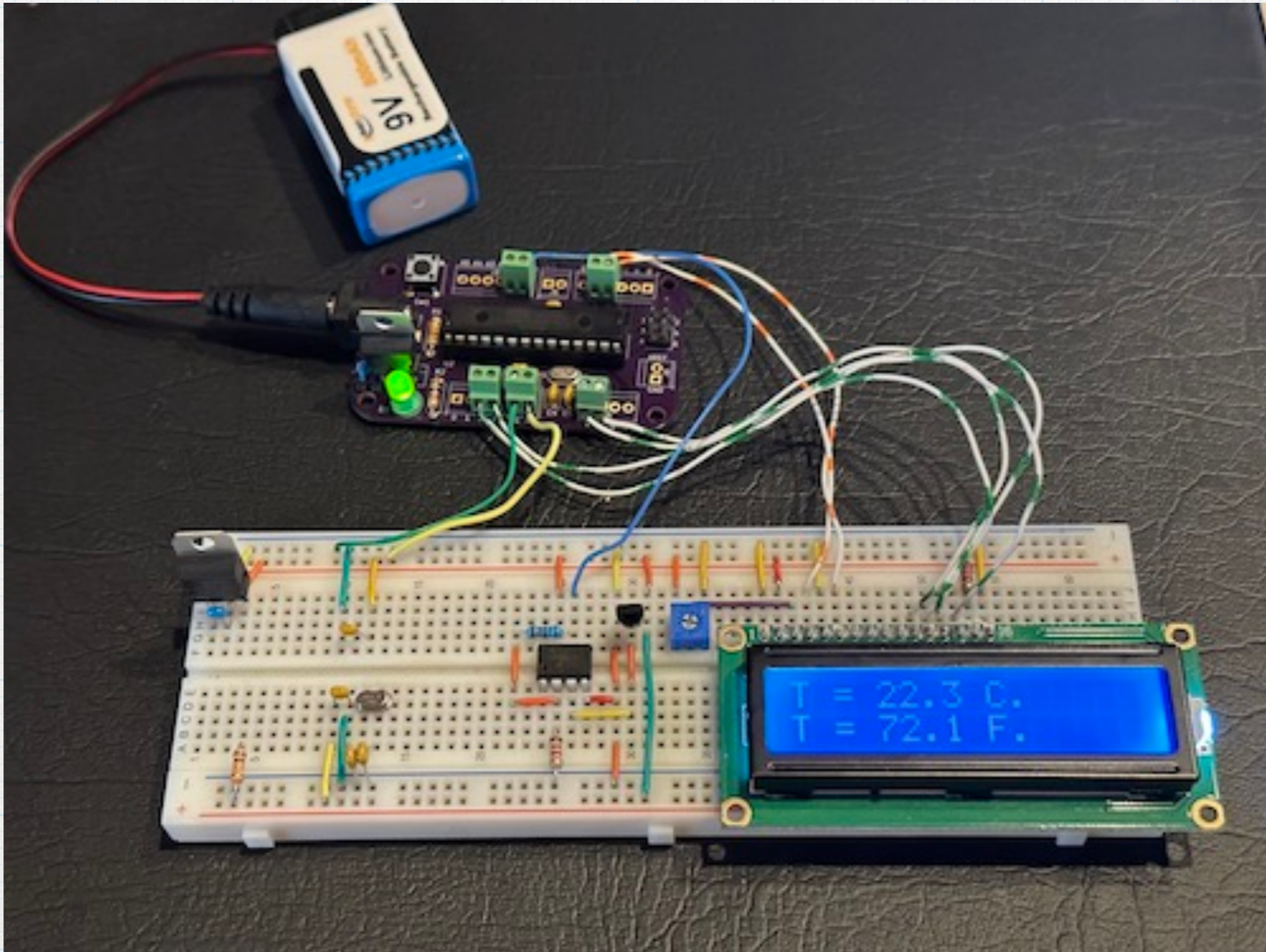
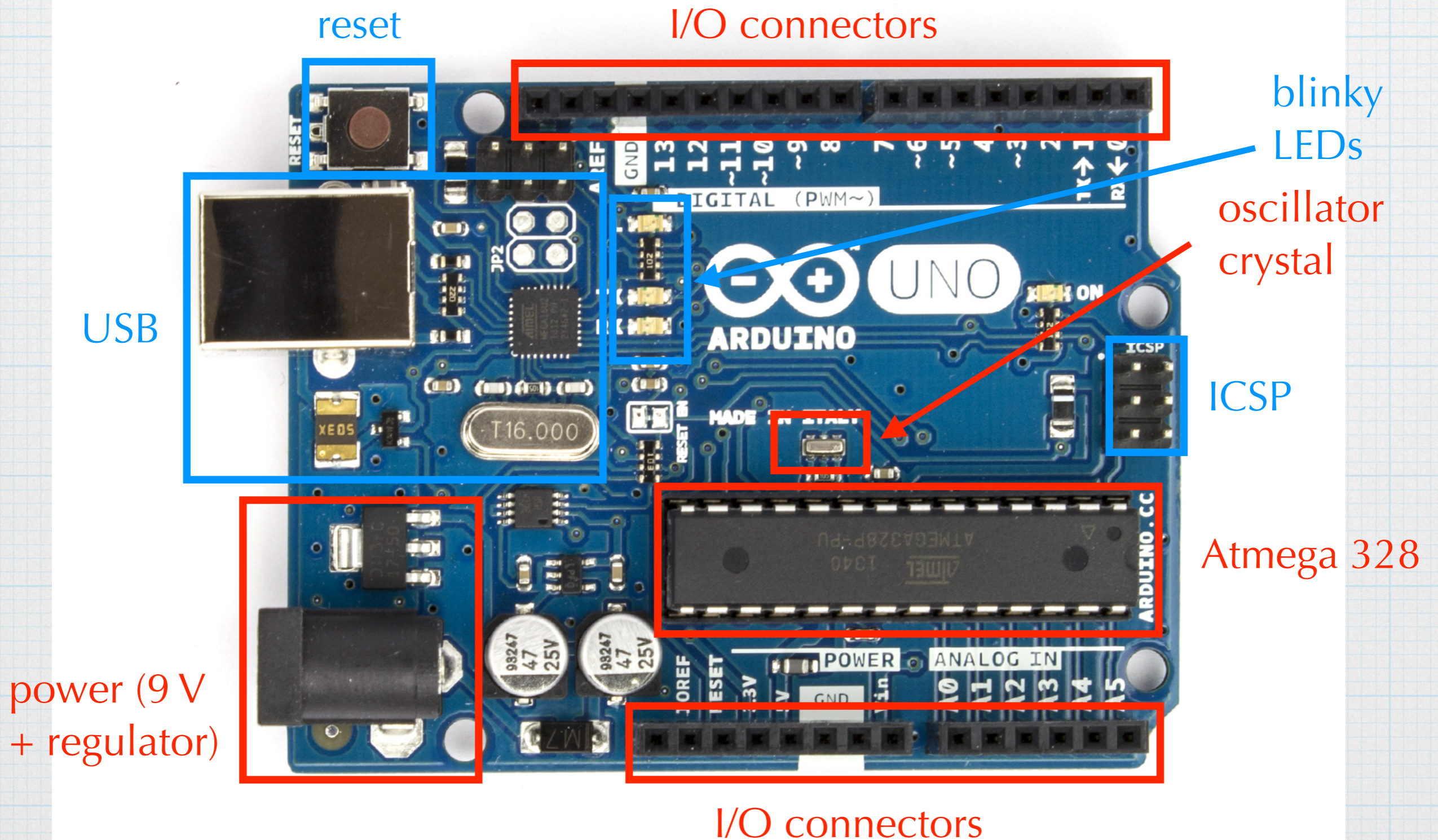


# Cyduino – a bare-bones Arduino



# Arduino Uno

Recall the basic layout of the hardware. The items with red outlines are essential. The items in blue are “optional”.



# Boil the Arduino down.

Definitely keep:

- Atmega 328
- voltage regulator.
- quartz crystal and capacitors for the clock
- pull-up resistor on the reset pin

Maybe keep:

- Momentary switch for reset.
- ICSP header for programming
- LED power indicator
- Header pins, terminal blocks, or other types of wiring connectors.

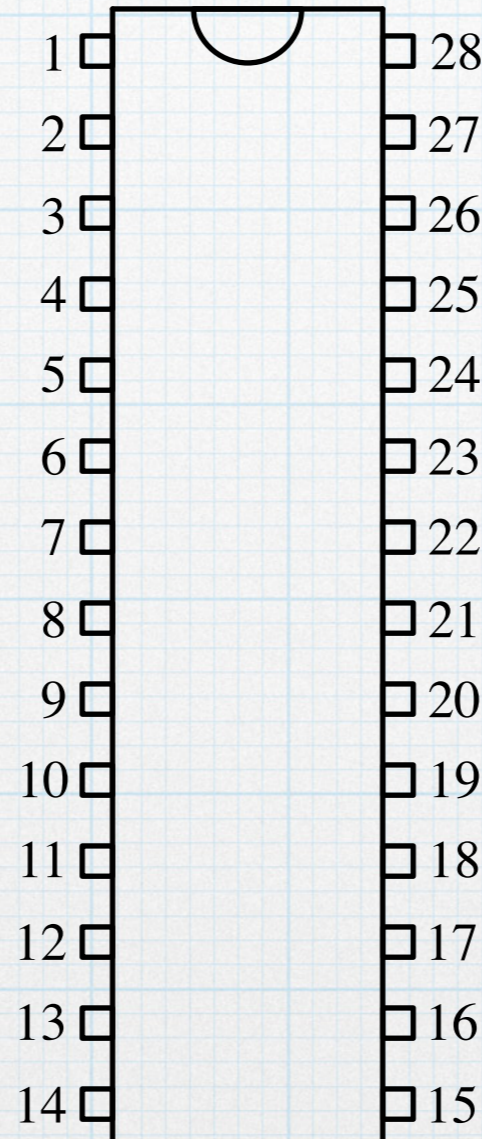
Lose:

- USB interface. Without it, we can't program the Atmega directly. Also, we must use alternative power input.
- Blinky LEDs. Not a big deal

# Pin assignment for Atmega328

Pin	data sheet	Arduino	function
1	PC6	Reset	Reset
2	PD0	digital 0	RX
3	PD1	digital 1	TX
4	PD2	digital 2	
5	PD3	digital 3	also PWM
6	PD4	digital 4	
7	VCC	VCC	power
8	GND	GND	ground
9	PB6	crystal	oscillator
10	PB7	crystal	oscillator
11	PD5	digital 5	also PWM
12	PD6	digital 6	also PWM
13	PD7	digital 7	
14	PB0	digital 8	

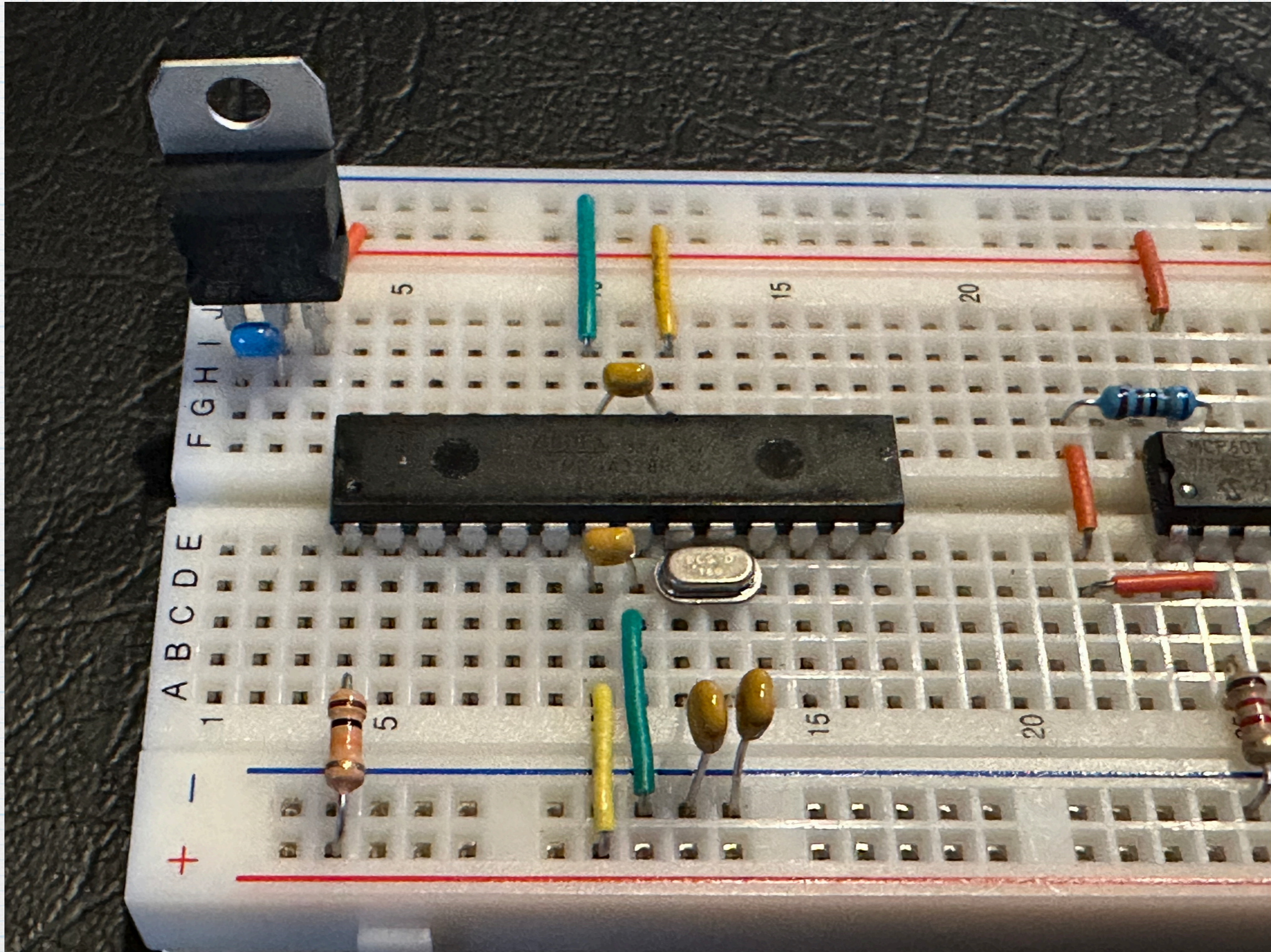
28-pin through-hole package



Pin	data sheet	Arduino	function
15	PB1	digital 9	also PWM
16	PB2	digital 10	also PWM
17	PB3	digital 11	MOSI, PWM
18	PB4	digital 12	MISO
19	PB5	digital 13	SCK
20	AVCC	VDD	power
21	AREF	analog ref	
22	GND	GND	ground
23	PC0	analog 0	ADC 0
24	PC1	analog 1	ADC 1
25	PC2	analog 2	ADC 2
26	PC3	analog 3	ADC 3
27	PC4	analog 4	ADC 4
28	PC5	analog 5	ADC 5

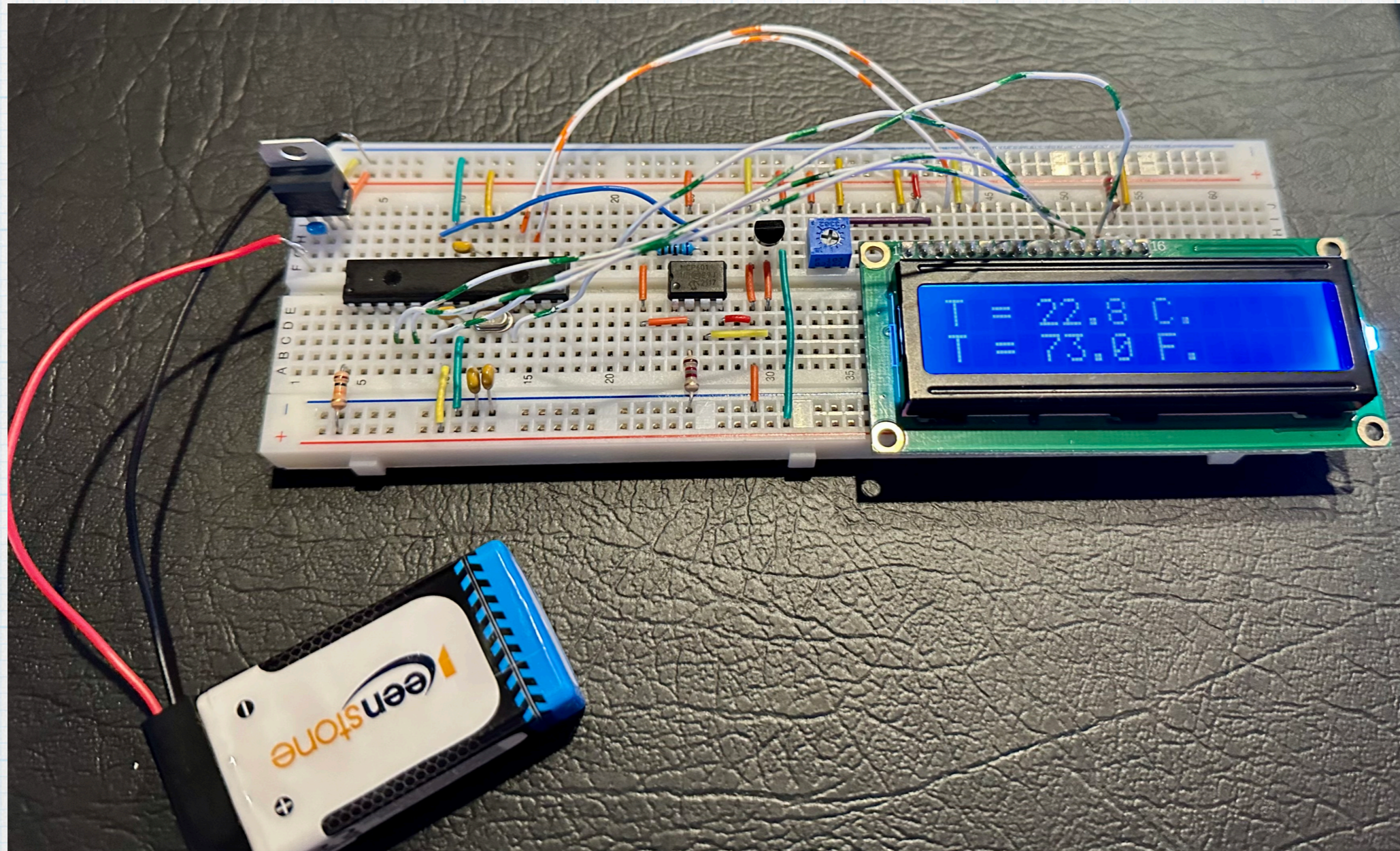


# Build a breadboard version first



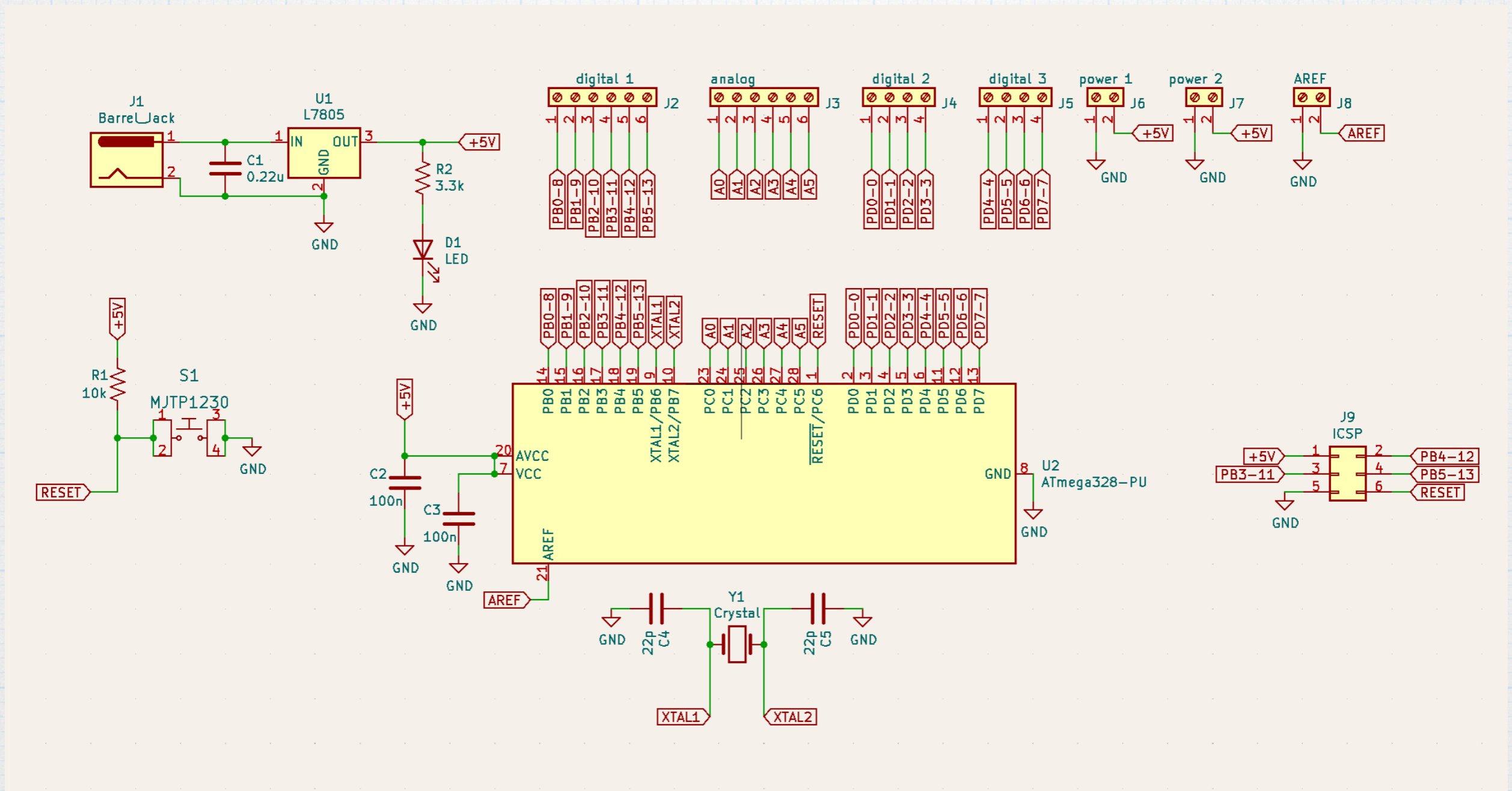
Atmega chip is taken from the Arduino. It still has the working thermometer program on it.

It works!



# Design a PCB

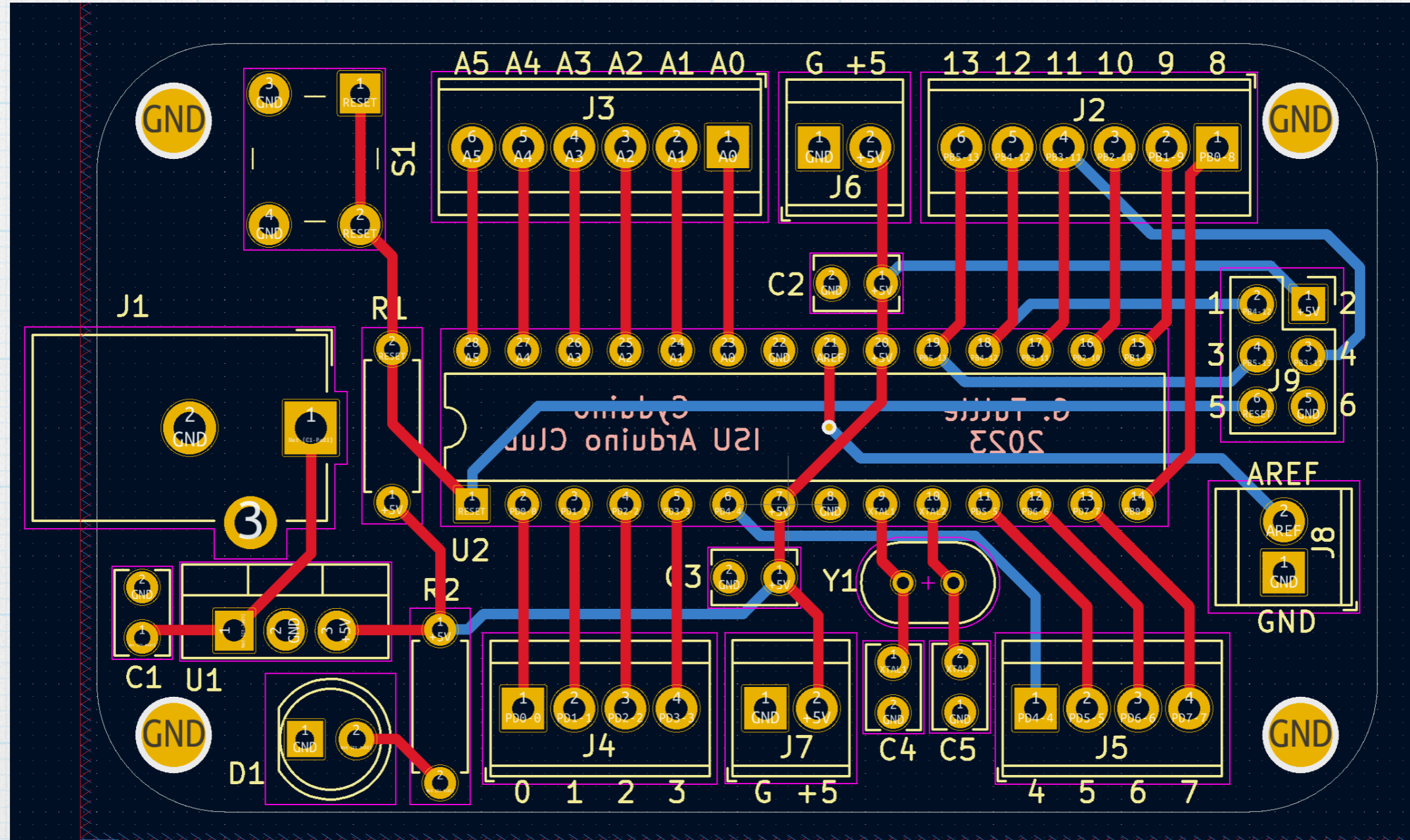
Below is the schematic, as laid out in Kicad. Note that we made extensive use of symbolic links, which should make it easier to reuse the design later.





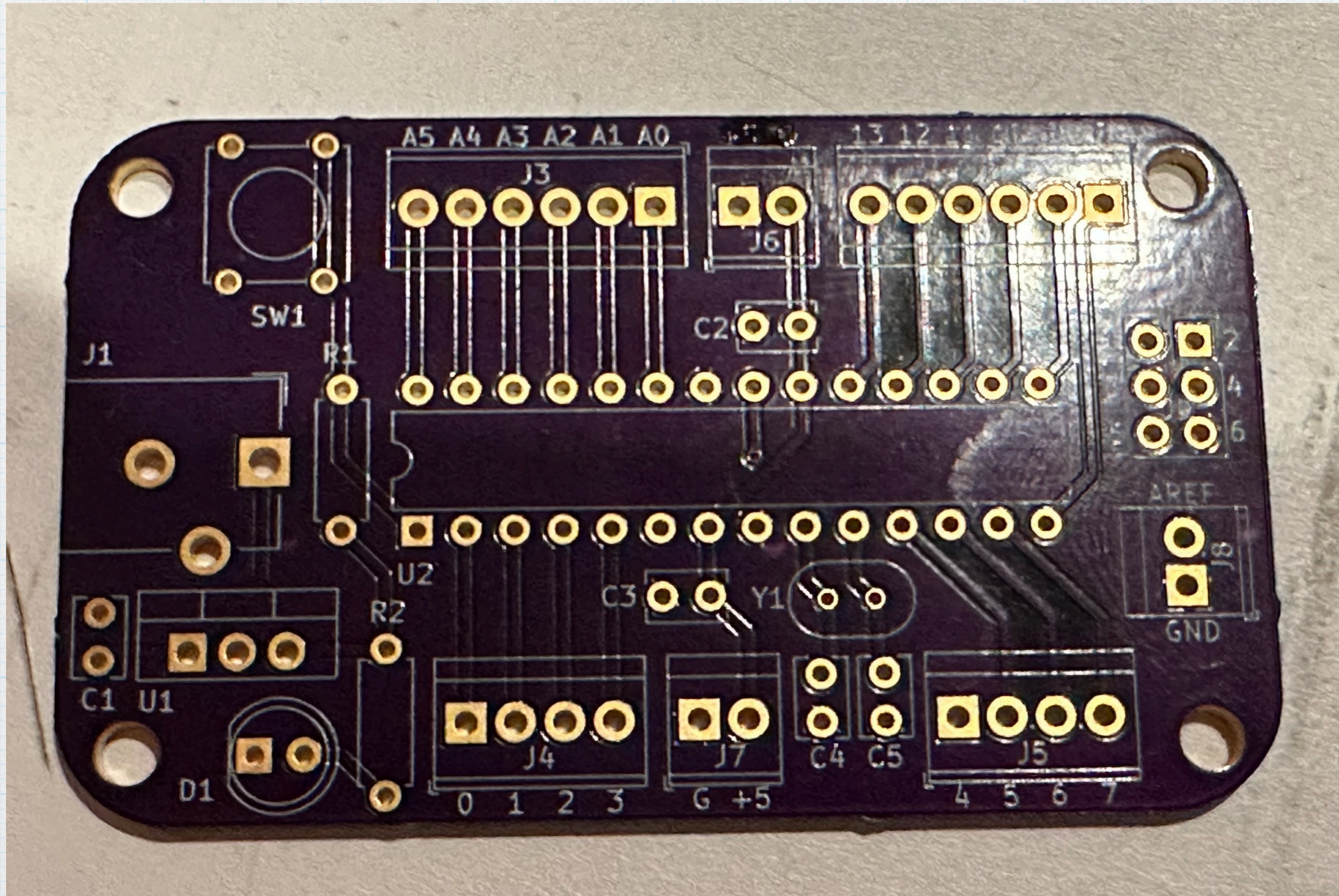
# The PCB

Below is the basic PCB layout.



# The PCB

The fabricated PCB, from Oshpark.



# Cyduino

It has:

- Atmega 328
- voltage regulator (to run off a 9-V battery)
- quartz crystal and capacitors for the clock
- pull-up resistor on the reset pin.

As options:

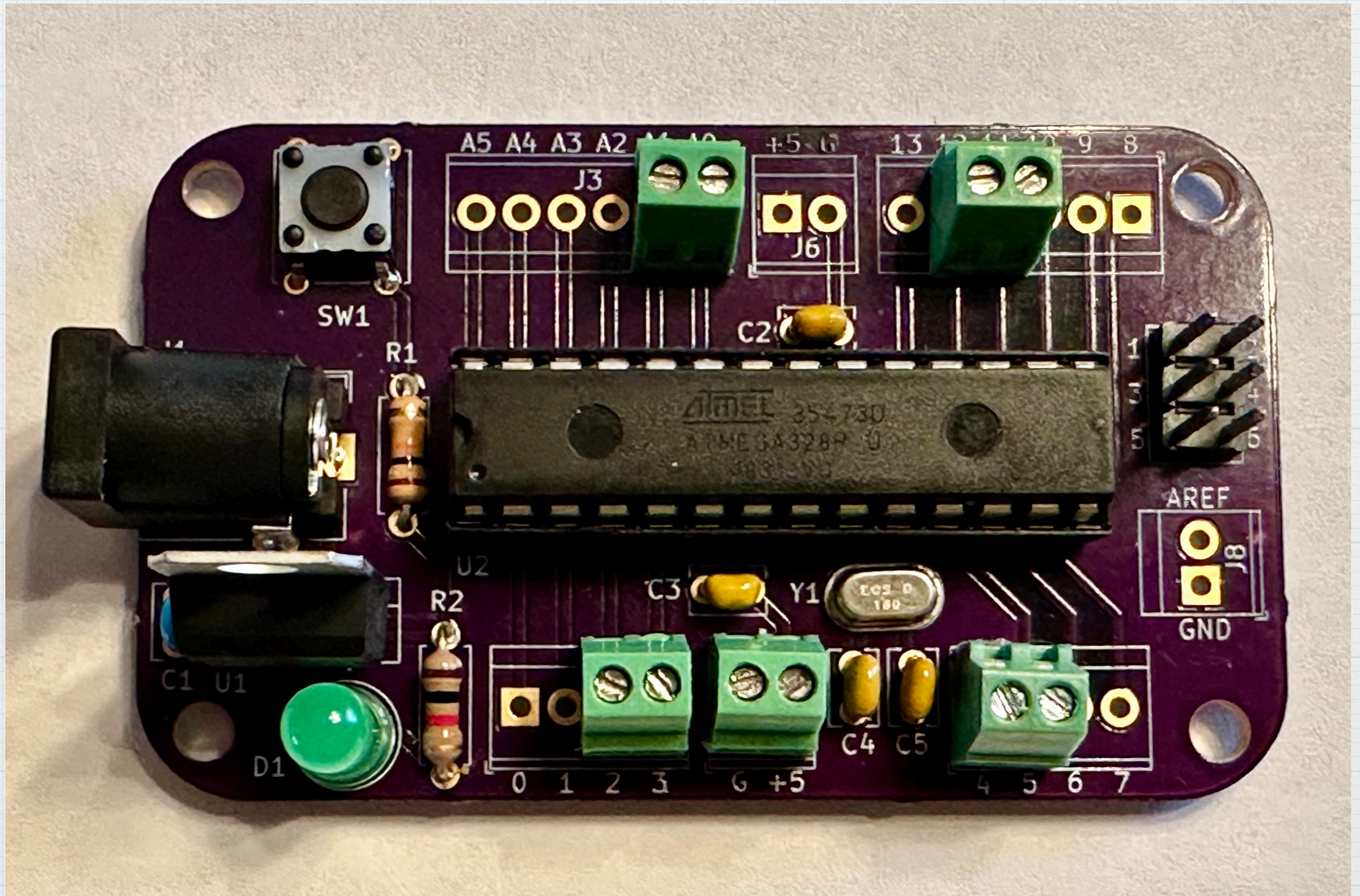
- Momentary switch for reset.
- ICSP header for programming
- LED power indicator
- Header pins, terminal blocks, or other types of wiring connectors.

Missing:

- USB interface.

# Completed version.

See the build document for the detailed step-by-step instructions.



# Bill of Materials (Prices as of Mar 2023)

part	part number	DigiKey number	quantity	price	total
<b>Atmega 328</b>	ATMEGA328P-PU	ATMEGA328P-PU-ND	1	3.32	3.32
<b>socket</b>	On Shore ED281DT	ED3050-5-ND	1	0.37	0.37
<b>5-V regulator</b>	STMicro L7805CV	497-1443-5-ND	1	0.69	0.69
<b>100-nF cap</b>	Vishay K104K15X7RF5TL2	BC1084CT-ND	2	0.23	0.46
<b>220-nF cap</b>	Vishay K224K20X7RF53L2	K224K20X7RF53L2-ND	1	0.43	0.43
<b>16-MHz crystal</b>	ECS-160-20-46X	XC1759-ND	1	0.39	0.39
<b>22-pF capacitor</b>	K220J15C0GF5TL2	<u>BC1005CT-ND</u>	2	0.27	0.54
<b>red LED</b>	Cree C5SMF-RJF-CT0W0BB1	C5SMF-RJF-CT0W0BB1-ND	1	0.17	0.17
<b>3.3-kΩ resistor</b>	Stackpole CF14JT3K30	CF14JT3K30CT-ND	1	0.10	0.10
<b>10-kΩ resistor</b>	Stackpole CF14JT10K0	CF14JT10K0CT-ND	1	0.10	0.10
<b>switch</b>	APEM MJTP1230	679-2428-ND	1	0.15	0.15
<b>barrel jack</b>	CUI PJ-102AH	CP-102AH-ND	1	0.82	0.82
<b>ICSP header</b>	Amphenol 67996-406HLF	609-3218-ND	1	0.29	0.29
<b>screw term - 2</b>	On Shore OSTVN02A150	ED10561-ND	3	0.92	2.76
<b>board</b>			1	2.50	2.50
					13.09

Move the programmed Atmega chip from the breadboard to the Cyduino PCB. Make all the connections. And it works!

