

# Coffee Bean Roaster

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# Project Overview and Name ~1 min

- Our project aims for implementing a functional precision temperature control for equipment like a Coffee Bean Roaster, by recycling simple popcorn maker with built in heater, fan, and AC power distribution.
- The project will dive into recreating thermocouple module, AC or DC heat fan dimmer/control board, wall plug AC/DC converter, additional app/GUI control on screen display.
- Major challenges would be precise feedback control of temperature in the chamber, additional serial peripheral interface bus may be required if multiple thermocouple is desired.
- ESP32, K-Type Thermocouple, 16x4 LCD
- Overall circuit designs (filter types, power regulator type, power source, microcontroller used, important sensors, actuators or ICs, data buses used)

# BOM ~30 sec

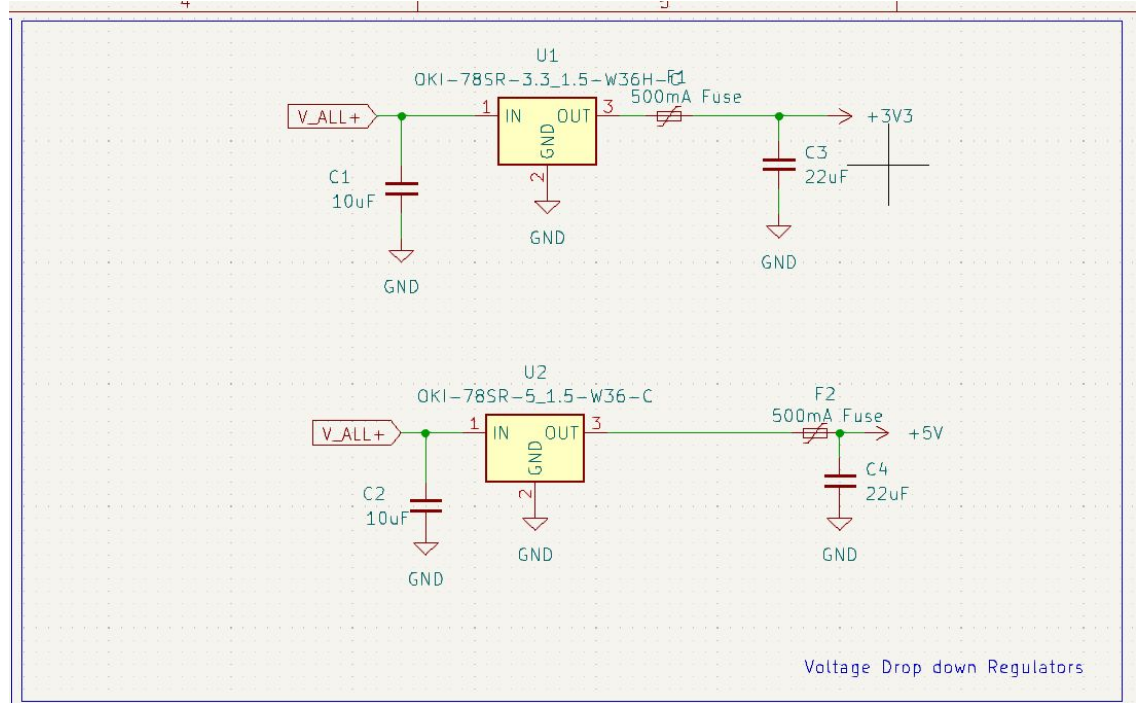
Coffee Bean Roaster BOM												
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L4	fx =sum(L6:L1014)											
	A	B	C	D	E	F	G	H	I	J	K	L
1	Partner 1 Name: Mirwais Lodin	Partner 1 Email: mloclin@berkeley.edu	Partner 2 Name: Carlon jansen	Partner 2 Email: carlson@berkeley.edu	Partner 3 Name: Liam McHugh	Partner 3 Email: liam.mchugh@berkeley.edu	Partner 4 Name: Andrew Liu	Partner 4 Email: liandrew8168@berkeley.edu				
2	Instructions											
3	Fill in the cells with the YELLOW highlight. Do not edit red cells. WE WILL ADJUST THE MULTIPLIER TO ACCOUNT FOR MULTIPLE BOARDS, YOU SHOULD NOT. Fill out the Digi-key part # OR the Mouser Part #, DO NOT fill out both. Choose the cheapest distributor that has the part in stock. If the part is not in stock by the time we order parts, there is a risk that we will not purchase it. For any approved Amazon or Adafruit parts, leave Digi-key and Mouser Part# columns blank like the example. For approved Amazon parts, put the ASIN (under the Product Information Section) for Manufacturer Part # in the format "Amazon - #####". For approved Adafruit parts, put the Product ID for Manufacturer Part # in the format "Adafruit - #####".											
4	Total Price for Project											
	\$99.12											
5	Qty (for 1 board)	Manufacturer Part #	Digi-key Part#/SKU	Mouser Part#/SKU	Price/unit (\$)	Purchase URL	Reference Designator	Description (include component value if applicable)	Datasheet Link	Multiple	Total Qty	Total Price/part (\$)
6	5	CL121A106K00NNE	1276-1096-2-ND		\$0.10	https://mm.digikey.com/Volume0/opasdata/d2200/C1,C2,C13,C14,C17	C1, C2, C13, C14, C17	CAP CER 100UF 16V XSR 0805	https://mm.digikey.com/Volume0/opasdata/d2200/C1,C2,C13,C14,C17	2	10	\$1.00
7	2	GRM188R60J226MEAD0	490-7611-2-ND		\$0.15	https://www.digikey.com/en/products/detail/murata-c3/c4	C3,C4	CAP CER 22UF 6.3V XSR 0603	https://search.murata.co.jp/Ceramy/imag	2	4	\$0.60
8	1	C0805KRX7698B103	311-1136-2-ND		\$0.10	https://www.digikey.com/en/products/detail/vagc/c5	C5	CAP CER 10000PF 50V X7R 0805 (0.01uF)	https://www.vagco.com/upload/media/pr	2	2	\$0.20
9	1	CL1218105KAFNNE	1276-1066-2-ND		\$0.10	https://www.digikey.com/en/products/detail/sams/c19	C19	CAP CER 1UF 25V X7R 0805	https://mm.digikey.com/Volume0/opasdata/d2200/C1,C2,C13,C14,C17	2	2	\$0.20
10	1	CL1218104KCFNNE	1276-6840-2-ND		\$0.10	https://www.digikey.com/en/products/detail/sams/c10,c16,c18,c20,c21	C10,C16,C18,C20,C21	CAP CER 0.1UF 100V X7R 0805	https://mm.digikey.com/Volume0/opasdata/d2200/C1,C2,C13,C14,C17	2	2	\$0.20
11	1	150080R575000	732-4984-2-ND		\$0.19	https://www.digikey.com/en/products/detail/vagc/d1	D1	LED RED CLEAR 0805 SMD	https://www.we-online.com/components/	2	2	\$0.38
12	2	1N4148	1N4148F5-ND		\$0.20	https://www.onsemi.com/download/data-sheet	D7,D8	SMALL SGNL DIODE D035 100V 175C	https://www.onsemi.com/download/data-sheet	2	4	\$0.80
13	1	WYTP26-2004YG			\$9.99	https://www.amazon.com/Wayin-Top-Display-Inter	D51	20x4 LCD Display		1	1	\$9.99
14	2	CQ2 500	507-1089-2-ND		\$0.49	https://www.digikey.com/en/products/detail/bel-d/f1,f2	F1,F2	FUSE BRD MT 500MA 32VAC 63VDC	https://www.belfuse.com/resources/datas	2	4	\$1.96
15	2	BLM18KG121TN10	490-2524-2-ND		\$0.10	https://www.digikey.com/en/products/detail/murata-fb1/fb2	FB1,FB2	120 Ohms @ 100 MHz 1 Power Line Ferrite	https://www.murata.com/products/produ	2	4	\$0.40
16	2	61300311121	732-5316-ND		\$0.13	https://www.digikey.com/en/products/detail/vagc/j1,j3	J1,J3	CONN HEADER VERT 3POS 2.54MM	https://www.we-online.com/components/	2	4	\$0.52
17	1	61300611121	732-5319-ND		\$0.35	https://www.digikey.com/en/products/detail/vagc/j2	J2	CONN HEADER VERT 6POS 2.54MM	https://www.we-online.com/components/	2	2	\$0.70
18	3	691137710002	732-10955-ND		\$0.41	https://www.digikey.com/en/products/detail/vagc/j4	J4	TERM BLK 2POS SIDE ENTRY 5MM PCB	https://www.we-online.com/components/	2	6	\$2.46
19	1	1US84125-6F-A	609-5379-2-ND		\$0.81	https://www.digikey.com/en/products/detail/act/j5	J5	CONN RCP USB2.0 TYP C 24P SMD RA	https://mm.digikey.com/Volume0/opasdata/d2200/C1,C2,C13,C14,C17	2	2	\$1.62
20	1	CP-102A	CP-102A-ND		\$0.65	https://www.digikey.com/en/products/detail/act/j6	J6	CONN PWR JACK 2X5 5MM SOLDER	https://www.digikey.com/en/products/detail/act/j6	2	2	\$1.30
21	1	B04B-PASK	455-1819-ND		\$0.37	https://www.digikey.com/en/products/detail/act/j7	J7	CONN HEADER VERT 4POS 2MM	https://www.int-mfg.com/product/pdf/enr	2	2	\$0.74
22	1	BC580B01T1G	BC580B01TGOSTR-ND		\$0.11	https://www.digikey.com/en/products/detail/onse/q1	Q1	TRANS NPN 45V 0.1A SOT23-3	https://www.onsemi.com/pdf/datasheet	2	2	\$0.22
23	3	RMCF06031T10K0	RMCF06031T10K0TR-ND		\$0.10	https://www.digikey.com/en/products/detail/stack/r1-r8,r10	R1-R8,R10	RES 10K OHM 5% 1/10W 0805	https://www.select.com/catalog/sei-rmc	2	6	\$0.60
24	2	R08050R-075K1L	311-5-1KARTR-ND		\$0.10	https://www.digikey.com/en/products/detail/vagc/r11,r12	R11,R12	RES 5.1K OHM 5% 1/8W 0805	https://www.vagco.com/upload/media/pr	2	4	\$0.40
25	3	RK73H2ATTD4701F	2019-RK73H2ATTD4701FTF		\$0.10	https://www.digikey.com/en/products/detail/vagc/r6,r7,r9	R6,R7,R9	RES 4.7K OHM 1% 1/4W 0805	https://www.koa-speer.com/pdfs/RK73H	2	6	\$0.60
26	1	RR1220P-102-D	RR1220P-102-D		\$0.10	https://www.digikey.com/en/products/detail/susm/r8	R8	RES SMD 1K OHM 0.5% 1/10W 0805	https://www.susumu.co.jp/common/pdf/r	2	2	\$0.20
27	1	TC33K-2-103E	TC33K-103ETR-ND		\$0.28	https://www.digikey.com/en/products/detail/bour/rv1	RV1	TRIMMER 10K OHM 0.15W J LEAD TOP	https://www.bourns.com/docs/Product-D	2	2	\$0.56
28	2	TL3305AF2600G	EG5353TR-ND		\$0.21	https://www.digikey.com/en/products/detail/e-sw/sw5,sw6	SW5,SW6	SWITCH TACTILE SPST-NO 0.05A 12V	https://sten-eswitch-13110800-production	2	4	\$0.84
29	1	OKI-785R-3-3/1.5-W36H-C	811-2014-ND		\$4.97	https://www.digikey.com/en/products/detail/mura/u1	U1	DC DC CONVERTER 3.3V 5W	https://www.murata.com/products/produ	2	2	\$9.94
30	1	OKI-785R-5/1.5-W36-C	811-2196-5-ND		\$4.97	https://www.digikey.com/en/products/detail/mura/u2	U2	DC DC CONVERTER 5V 8W	https://www.murata.com/products/produ	2	2	\$9.94
31	1	PCF8574ADWR	296-13105-2-ND		\$1.33	https://www.digikey.com/en/products/detail/telex/u4	U4	IC XPNDR 100KHZ 12C 16SOIC	https://www.ti.com/general/docs/suppor	2	2	\$2.66
32	1	MAX31855KASA+T	MAX31855KASA+TTR-ND		\$8.39	https://www.digikey.com/en/products/detail/analog/u5	U5	IC CONV THERMOCOUPLE-DGTL SOIC	https://www.analog.com/media/en/techni	2	2	\$16.78
33	1	LD1117333CTR	497-1241-2-ND		\$0.41	https://www.digikey.com/en/products/detail/ati/u7	U7	IC REG LINEAR 3.3V 800MA SOT23	https://www.st.com/content/ccc/resource	2	2	\$0.82
34	1	ESP32-S2-SOLO-N4R2	1965-ESP32-S2-SOLO-N4R2		\$2.30	https://www.digikey.com/en/products/detail/espr/u8	U8	RF TXRX MOD WIFI PCB TRACE SMD	https://www.espressif.com/sites/default/fi	2	2	\$4.60
35	1	Amazon - B09281KTS8			\$7.99	https://www.amazon.com/100-240V-Converter-Tra		24V 1A AC Adapter Power Supply 100-240V		1	1	\$7.99
36	1	Adafruit-270			\$9.95	https://www.adafruit.com/product/270		Thermocouple Type-K Glass Braid Insulate		2	2	\$19.90
37	2	Amazon-B09X1P3YHL			0	https://www.amazon.com/Channel-Driver-Optocou		6PCS 1 Channel DC 3V Relay High Level Di		2	4	0

# Schematic ~2 min

Voltage drop down module:  
DC-DC Converters

24V to 3.3V

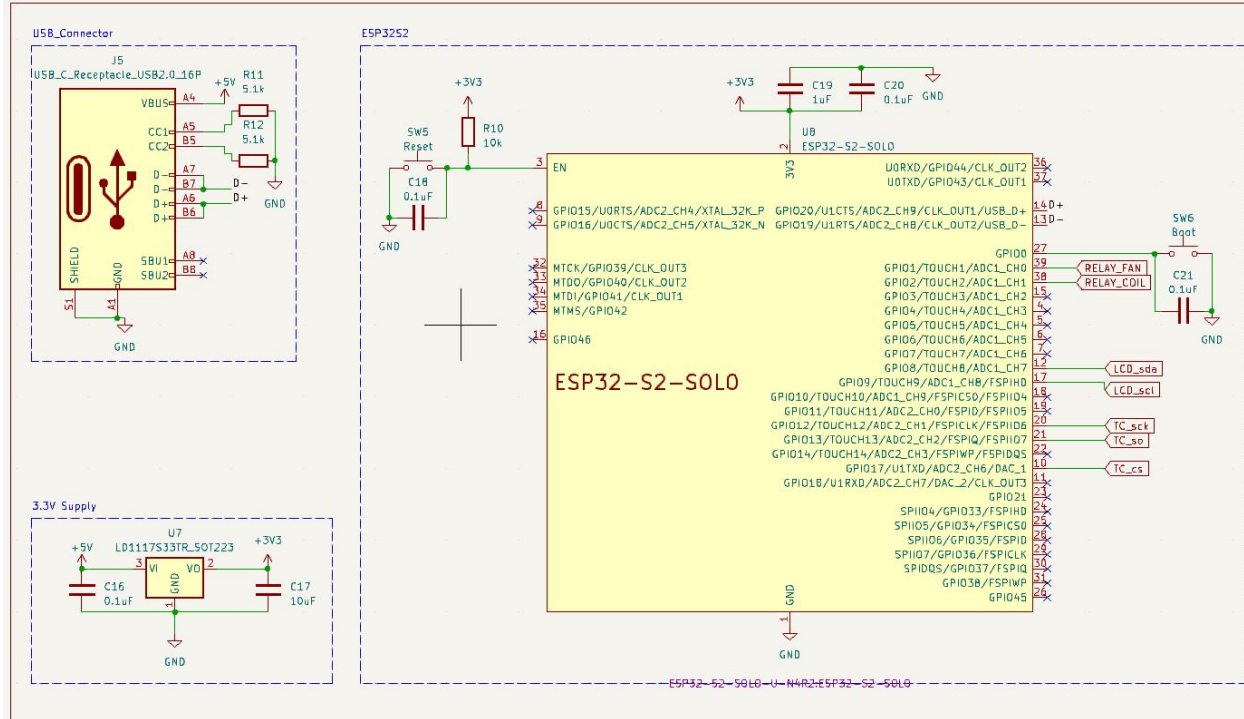
24V to 5V



## USB Voltage drop down: -LDO linear Regulator

## ESP32-S2-SOLO: assigned GPIO:

- thermocouple: SO, SCK,CS
- LCD I2C: sda,scl
- Fan relay
- Heater relay
- Boot button
- Reset button



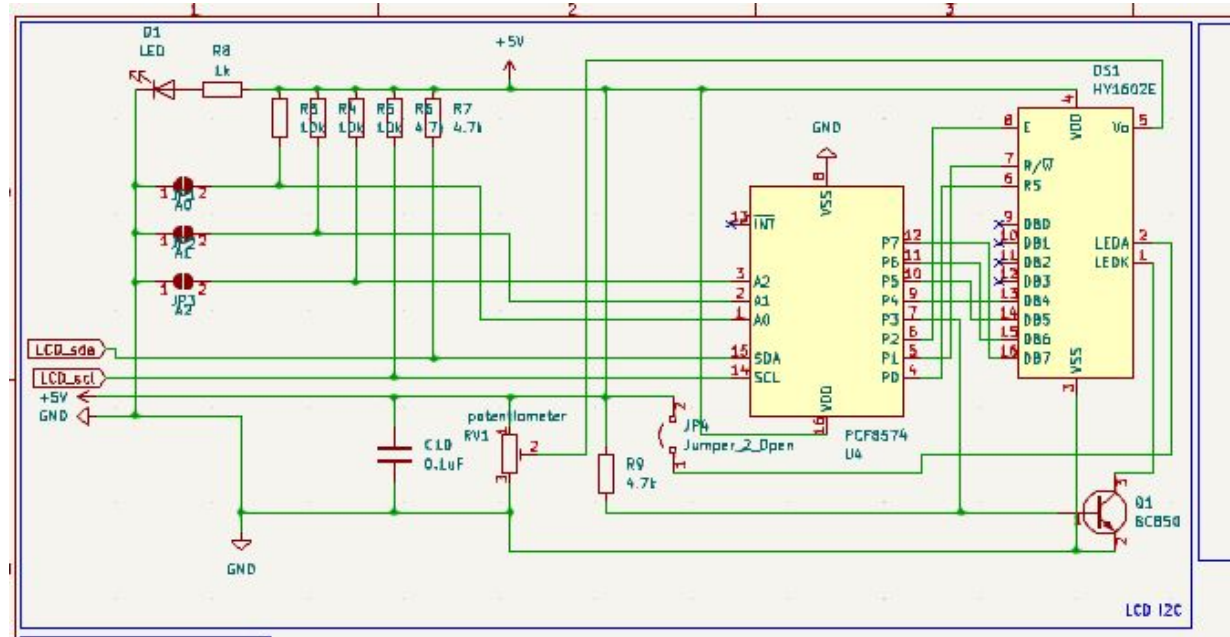
# Schematic ~2 min

LCD I2C:

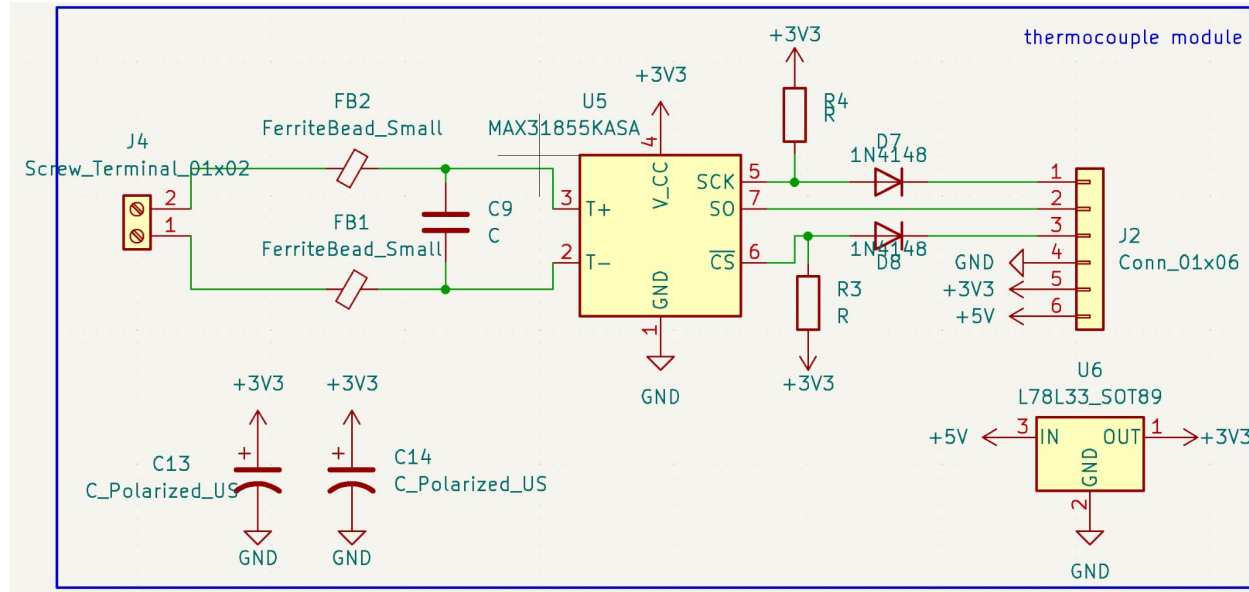
Generic 20x4 LCD display, replicate I2C board with IO expander



Roll over image to zoom in



## MAX31855 IC, screw terminal connected to k-type thermocouple





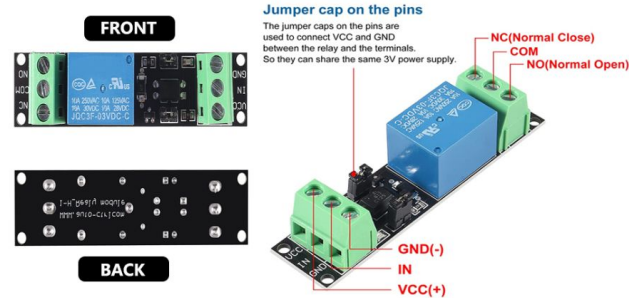
# Schematic ~2 min

Additional COTS components not included in schematics:

-3V AC relays for Heater and Fan

-AC/DC converter → Output 24V 85 ~ 305 VAC, 100 ~ 430 VDC Input

## 1 Channel 3V/3.3V Power Relay Module



### Power interface:

VCC: Connect to the positive pole of the power supply (3.3V)

GND: Connect to the negative pole of the power supply

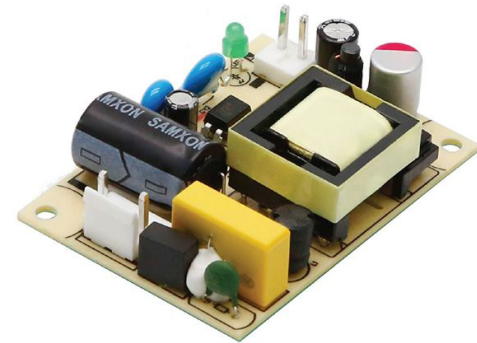
IN: high level control relay pull-in

Load interface:

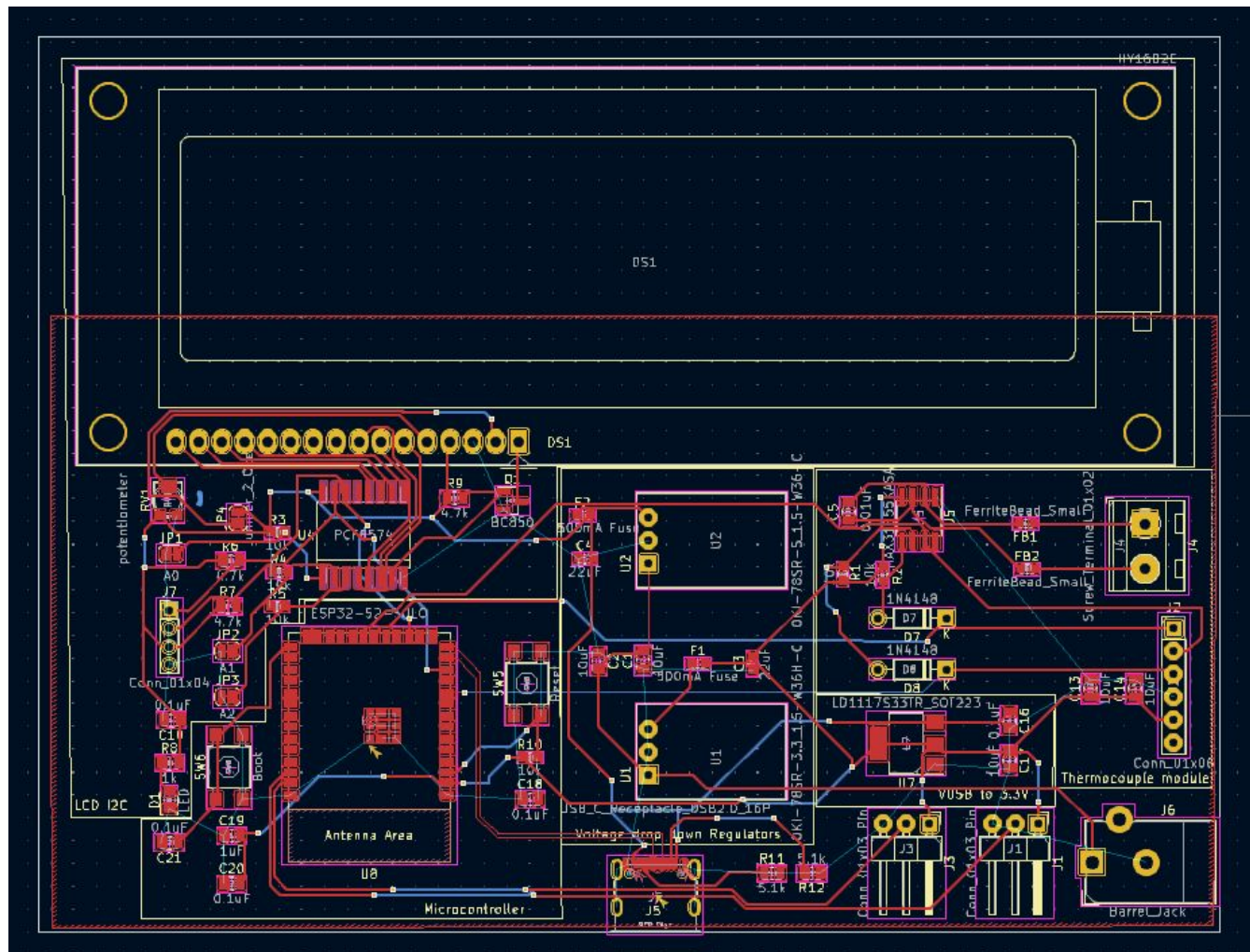
NO: Normally open interface of the relay, the relay is suspended before pull-in, and shorted to COM after pull-in

COM: Relay common interface

NC: Normally closed interface of the relay, the relay is short-circuited with COM before pull-in, and hangs up after pull-in





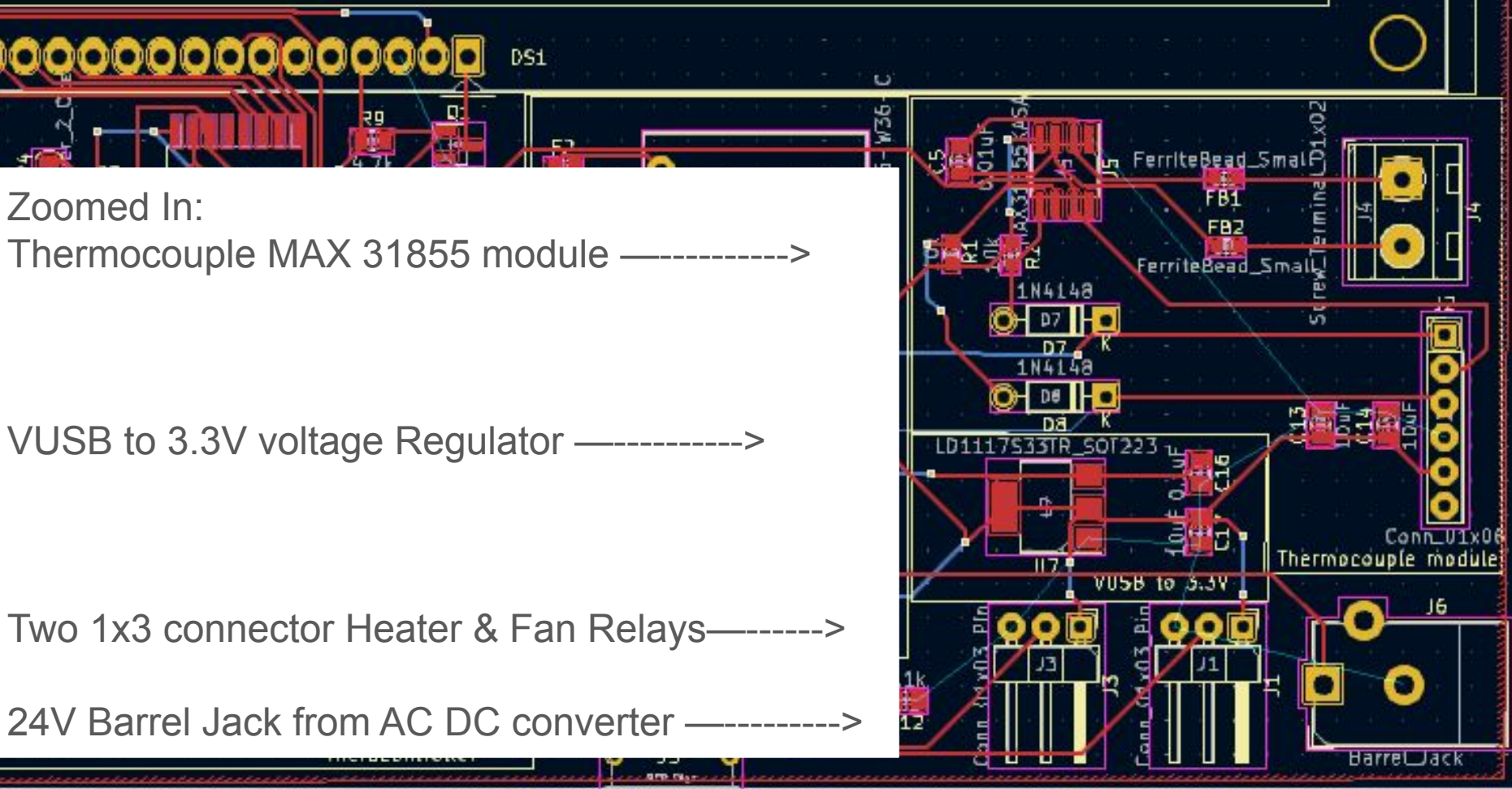


Zoomed In:  
Thermocouple MAX 31855 module ----->

VUSB to 3.3V voltage Regulator ----->

Two 1x3 connector Heater & Fan Relays ----->

24V Barrel Jack from AC DC converter ----->



Zoomed In:  
24V DC to 5V DC DC converter —>

24V DC to 3.3V DC DC converter —>

