Power

File: power.kicad_sch

User Input

File: user_input.kicad_sch

MCU

File: microcontroller.kicad_sch

Motor Driver

File: motor_driver.kicad_sch

Indicators

File: indicators.kicad_sch

Mounting points

4 x M3 for threaded inserts
1 x M2 for board support

M3 holes	M2 holes
H1 MountingHole	H5 MountingHole
H2 MountingHole	H6 MountingHole
H3 MountingHole	
H4 MountingHole	

Fiducials

- FID1 Fiducial
- FID2 Fiducial
- FID3 Fiducial

SJFOM

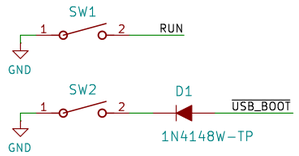
Sheet: /
File: StepUp.kicad_sch

Title: System diagram

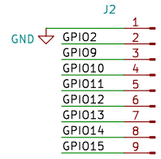
Size: A4	Date: 2025-02-22	**Rev: v0.3**
KiCad E.D.A. 9.0.0		Id: 1/6

MCU reset/prog buttons

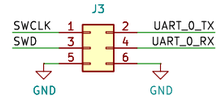
Run – resets MCU
USB_BOOT – hold this and toggle Run to enumerate as USB device for UF2 firmware upload
NOTE: Buttons are SMD and usually hidden from user



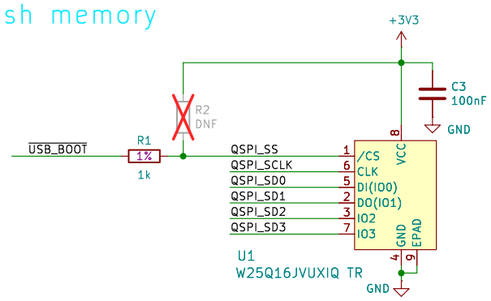
Spare I/O



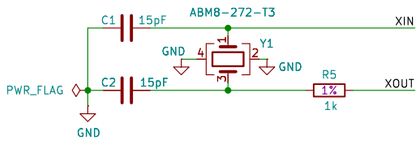
Debug header



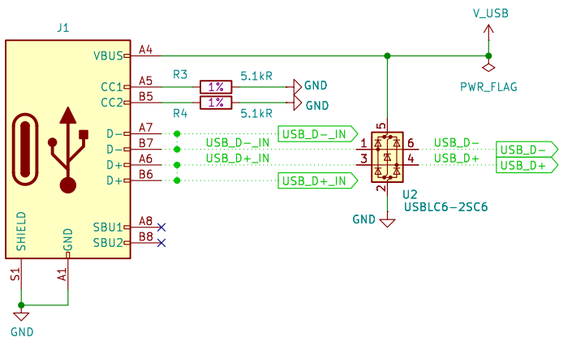
Flash memory

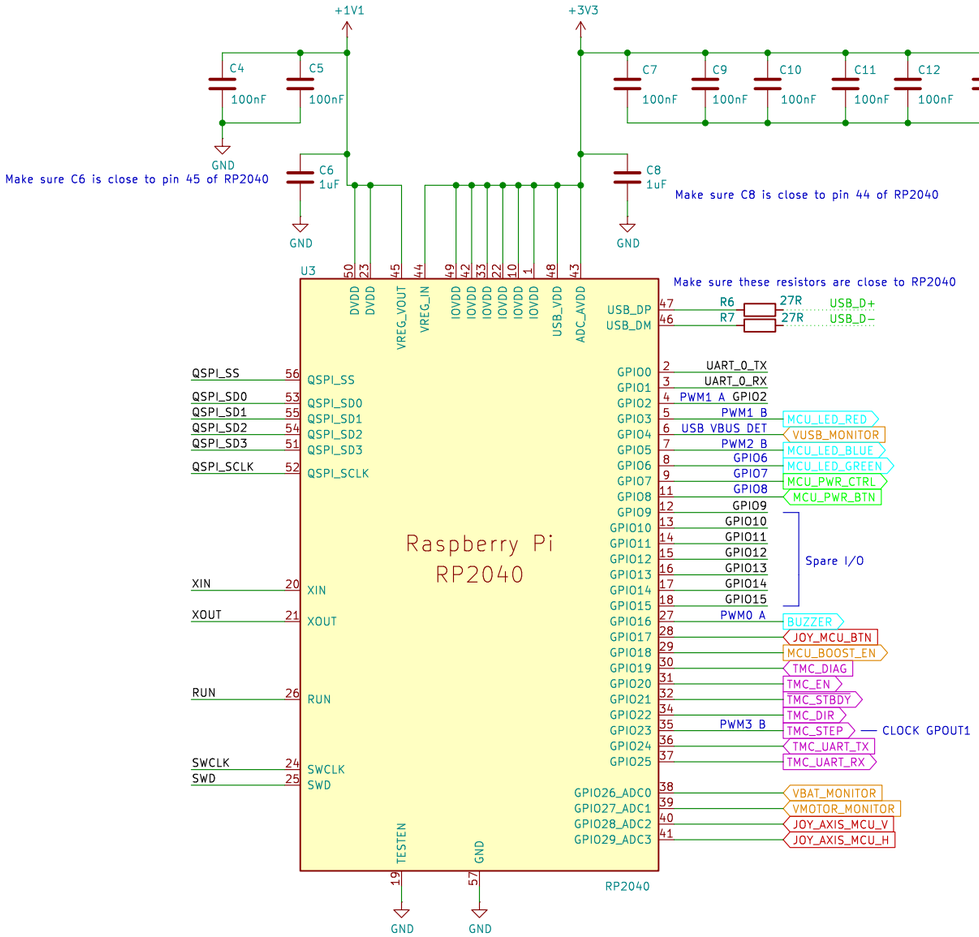


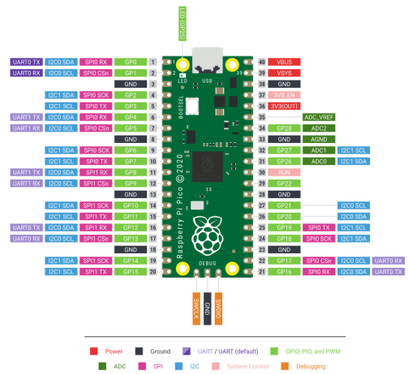
Crystal



USB input







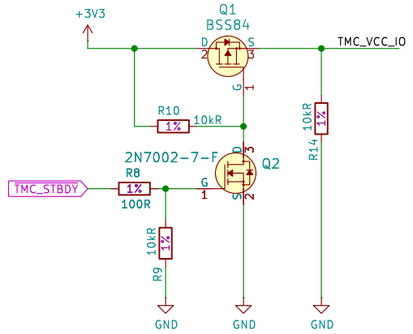
SJFOM
Sheet: /MCU/
File: microcontroller.kicad_sch

Title: Microcontroller

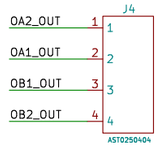
Size: A3	Date: 2025-02-22	**Rev: v0.3**
KiCad E.D.A. 9.0.0		Id: 2/6

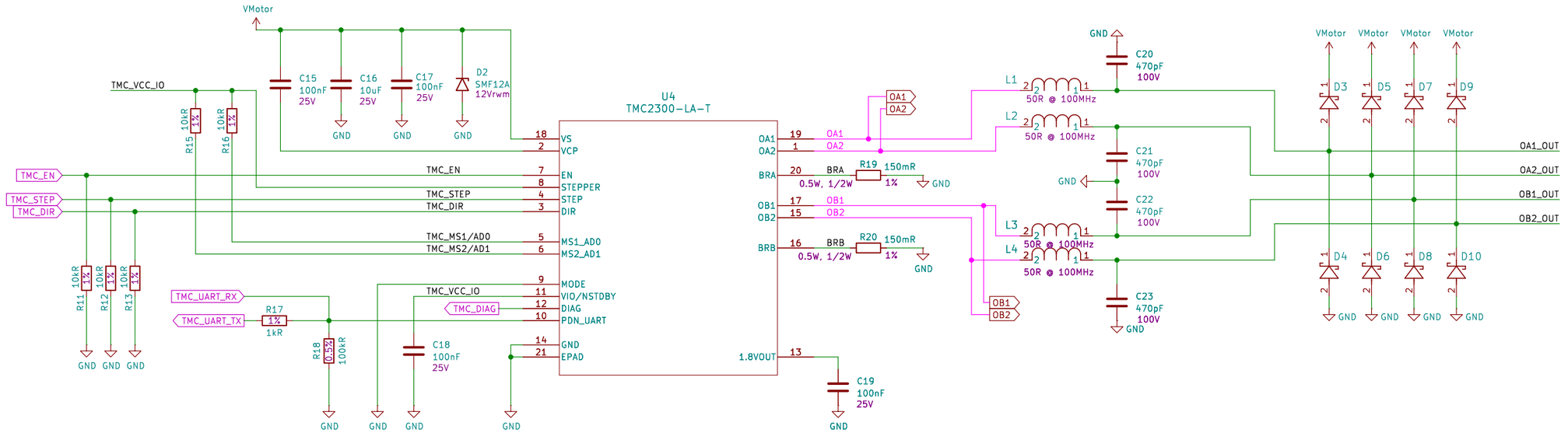
TMC power control

TMC_STDY controls VCC_IO power state



Motor connector

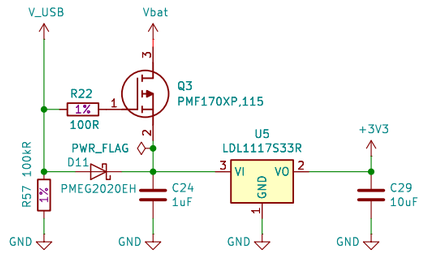




SJFOM		
Sheet: /Motor Driver/		
File: motor_driver.kicad_sch		
Title: Motor Driver		
Size: A3	Date: 2025-02-22	**Rev: v0.3**
KiCad E.D.A. 9.0.0		Id: 3/6

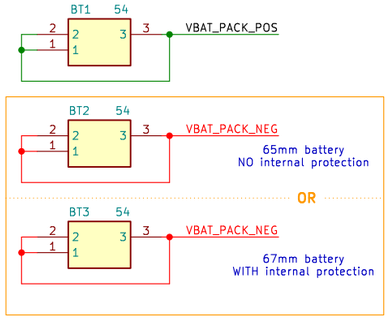
3v3 LDO

Default: 3v3 powered by Vbat
USB inserted: 3v3 powered by Vusb



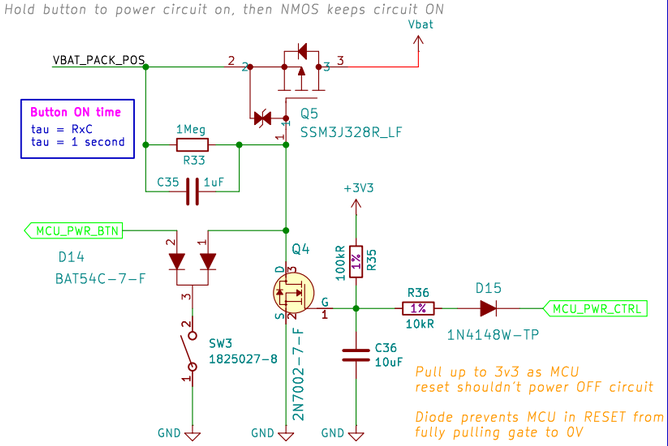
Battery connector

2 battery clip connectors
Option:
BT2 – battery of length ~65mm, no internal protection
OR
BT3 – battery of length ~67mm, with internal protection

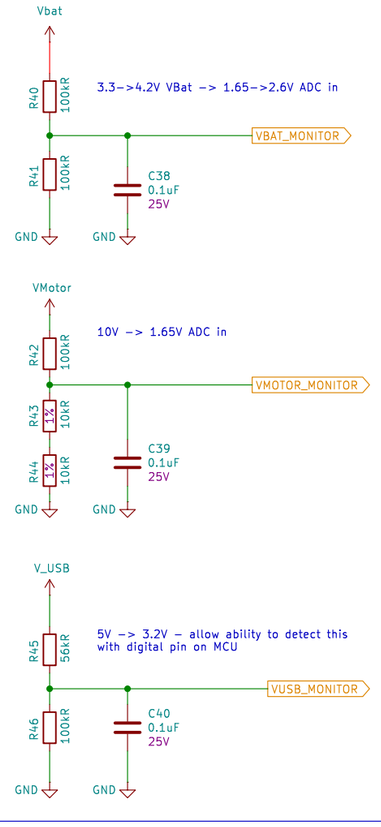


Power switch

Hold button to power circuit on, then NMOS keeps circuit ON

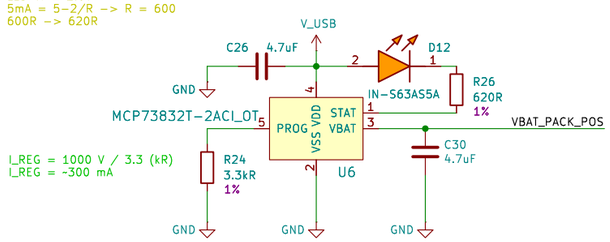


Voltage monitoring



Battery charge IC

LED Vf = 2.0V
5mA = 5-2/R -> R = 600
600R -> 620R



$$I_{REG} = \frac{1000V}{R_{PROG}}$$

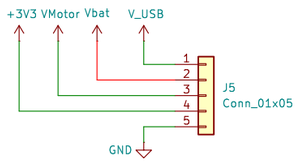
Where:

R_{PROG} = kOhms

I_{REG} = milliampere

Voltage test pads

Common voltages



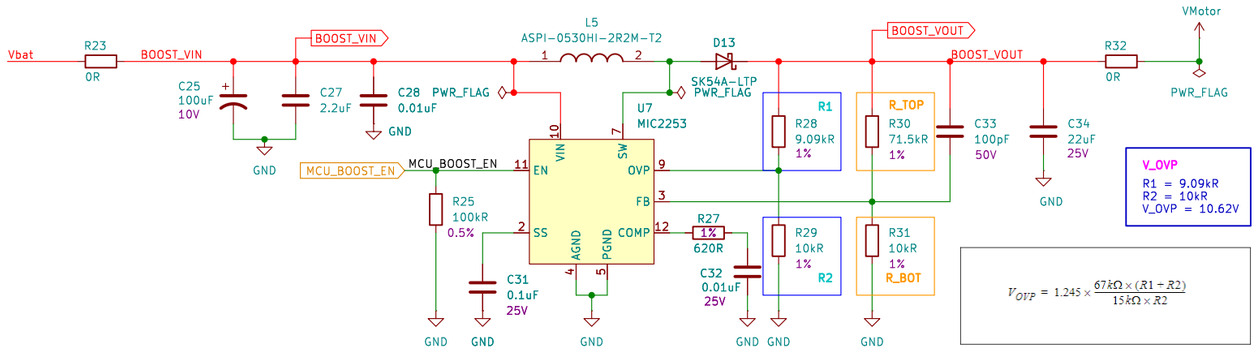
Step up boost converter

Boost from VBat -> 10V
OR jumper resistors can be removed for testing power consumption

V_OUT
R_TOP = 71.5kR
R_BOT = 10kR
V_OUT = 10.15V

$$V_{OUT} = V_{REF} \times \left(\frac{R_{TOP}}{R_{BOT}} + 1\right)$$

Where:
V_{REF} = 1.245V

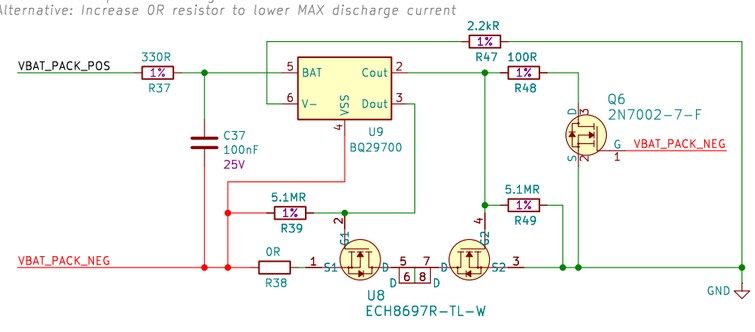


V_OVP
R1 = 9.09kR
R2 = 10kR
V_OVP = 10.62V

$$V_{OVP} = 1.245 \times \frac{67k\Omega \times (R1 + R2)}{15k\Omega \times R2}$$

Battery Protection circuit

Default: ~4.3Amp MAX discharge current
Alternative: Increase OR resistor to lower MAX discharge current



SJFOM

Sheet: /Power/		
File: power.kicad_sch		
Title: Power		
Size: A3	Date: 2025-02-22	**Rev: v0.3**
KiCad E.D.A. 9.0.0		Id: 4/6

Status LED's

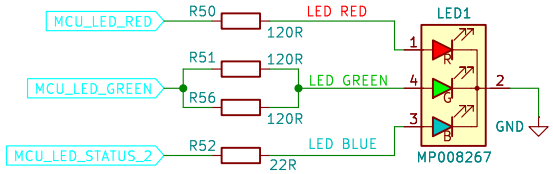
Status LEDs, RGB 3-in-1, through-hole, clear dome

LED resistor calculations (matching mcd values)

RED – 20mA = 600 mcd → 1mA = 30mcd
- 300mcd = 10mA
- Vf=2V (typ), 3.3-2V = 1.3V/10mA = 130R → 120R

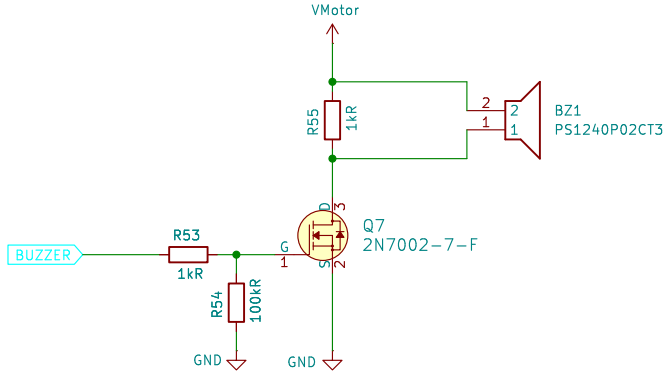
BLUE – 20mA = 300 mcd → 1mA = 15 mcd
- 300mcd = 20mA
- Vf=3V (typ), 3.3-3V = 0.3V/20mA = 15R → 22R

GREEN – 20mA = 1300 mcd → 1mA = 65 mcd
- 300mcd = 4.6mA
- Vf=3V (typ), 3.3-3V = 0.3V/4.6mA = 65R → 60R



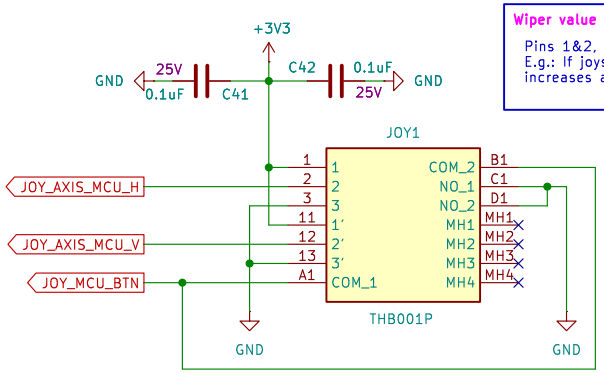
Buzzer

To indicate device states, f = 4kHz
~10V from the boost converter also used for the buzzer



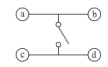
SJFOM	
Sheet: /Indicators/	
File: indicators.kicad_sch	
Title: User Input	
Size: A4	Date: 2025-02-22
KiCad E.D.A. 9.0.0	Id: 5/6
	Rev: v0.3

Joystick

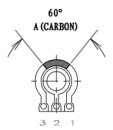


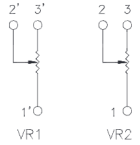
Wiper value

Pins 1&2, resistance goes down as wiper moved in that direction
E.g.: If joystick has pin 1 = 3v3 and pin 3 = GND, pin 2 voltage increases as josytick moved to pin 1, decreases as moved to pin 3



Circuit diagram





SJFOM	
Sheet: /User Input/	
File: user_input.kicad_sch	
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KiCad E.D.A. 9.0.0	Id: 6/6
	Rev: v0.3