Power

File: power.kicad_sch

MCU

File: mcu.kicad_sch

Motors

File: motors.kicad_sch

Sensors_IO

File: sensors.kicad_sch

Sheet: /
File: orbibot-controller.kicad_sch

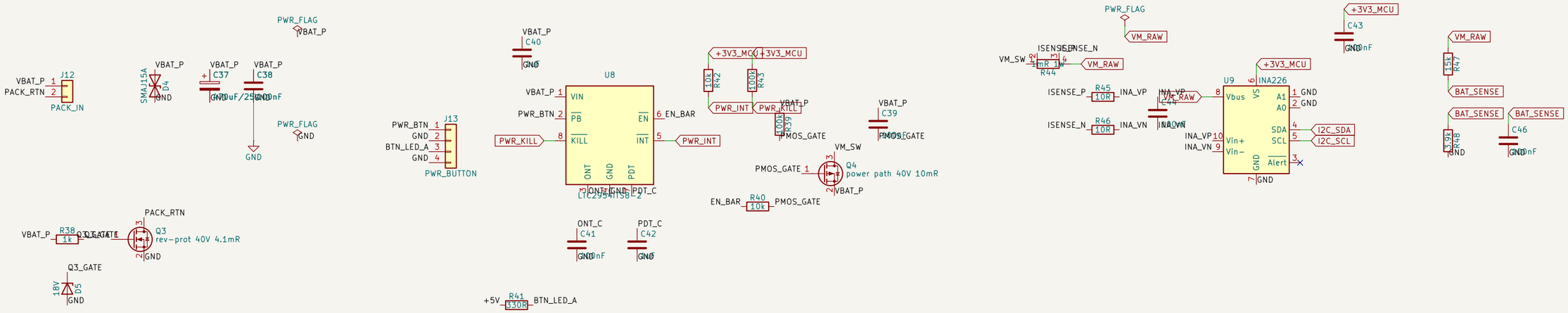
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PACK INPUT + REVERSE PROTECTION — 4S LiFePO4, 10.0–14.6 V
Q3 is a LOW-SIDE NMOS: drain to the pack's negative terminal, source to
board GND, gate to VBAT_P. A backwards pack turns the gate negative, the
FET off, and its body diode blocks — the ground path opens instead of the
board dying. D5 clamps Vgs, which the pack alone would drive to 14.6 V.

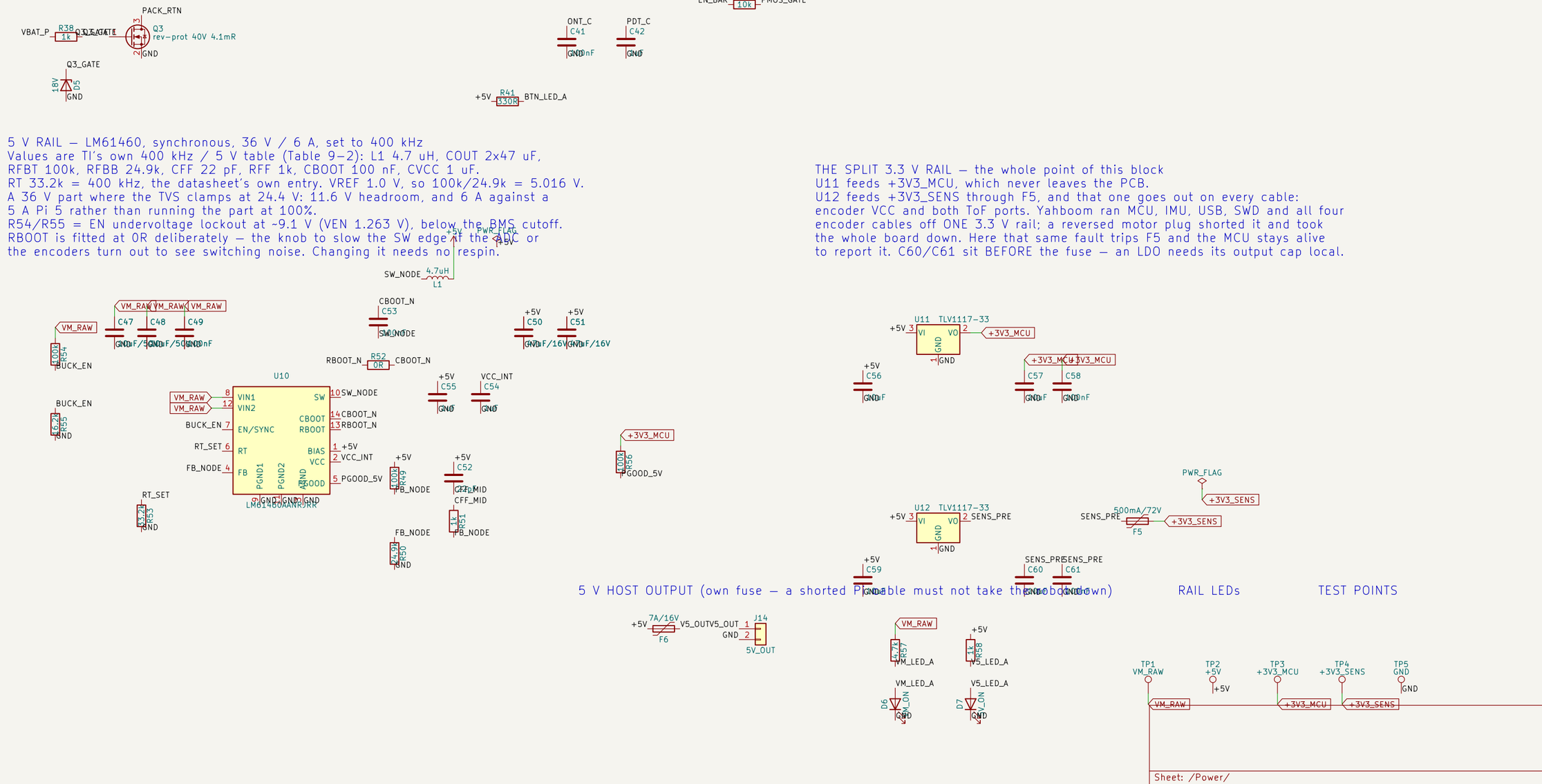
SOFT POWER SWITCH — LTC2954-2 + PMOS power path
The -2 variant: open-drain HIGH-VOLTAGE EN, made to pull a PMOS gate down.
C39 + R40 slew the gate over ~1 ms so the PMOS soft-starts into the load.
C41 = 0.64 s hold-to-start. C42 = 6.4 s hold-to-force-off.
FIRMWARE: KILL must be HIGH within 512 ms of turn-on. R43 pulls it up so this
does not depend on boot time; the MCU drives PWR_KILL LOW to power down.

CURRENT / VOLTAGE MONITOR — INA226, I2C 0x40 (A0,A1 to GND)
R44 is a 4-terminal Kelvin shunt: 1/4 carry current, 2/3 sense it. 2 mOhm gives
24 mV at 12 A and 40 mV at the 20 A peak, inside the +/-81.92 mV input range.
R45/R46 + C44 filter motor switching noise out of the sense pair.
BATTERY DIVIDER: 15k/3.9k puts 14.6 V at 3.01 V, just under the 3.3 V ADC top.



5 V RAIL — LM61460, synchronous, 36 V / 6 A, set to 400 kHz
Values are TI's own 400 kHz / 5 V table (Table 9-2): L1 4.7 uH, COUT 2x47 uF,
RFBT 100k, RFBB 24.9k, CFF 22 pF, RFF 1k, CBOOT 100 nF, CVCC 1 uF.
RT 33.2k = 400 kHz, the datasheet's own entry. VREF 1.0 V, so 100k/24.9k = 5.016 V.
A 36 V part where the TVS clamps at 24.4 V: 11.6 V headroom, and 6 A against a
5 A Pi 5 rather than running the part at 100%.
R54/R55 = EN undervoltage lockout at ~9.1 V (VEN 1.263 V), below the BMS cutoff.
RBOOT is fitted at 0R deliberately — the knob to slow the SW edge if the ADC or
the encoders turn out to see switching noise. Changing it needs no respin.

THE SPLIT 3.3 V RAIL — the whole point of this block
U11 feeds +3V3_MCU, which never leaves the PCB.
U12 feeds +3V3_SENS through F5, and that one goes out on every cable:
encoder VCC and both ToF ports. Yahboom ran MCU, IMU, USB, SWD and all four
encoder cables off ONE 3.3 V rail; a reversed motor plug shorted it and took
the whole board down. Here that same fault trips F5 and the MCU stays alive
to report it. C60/C61 sit BEFORE the fuse — an LDO needs its output cap local.



5 V HOST OUTPUT (own fuse — a shorted Pi cable must not take the whole board down)

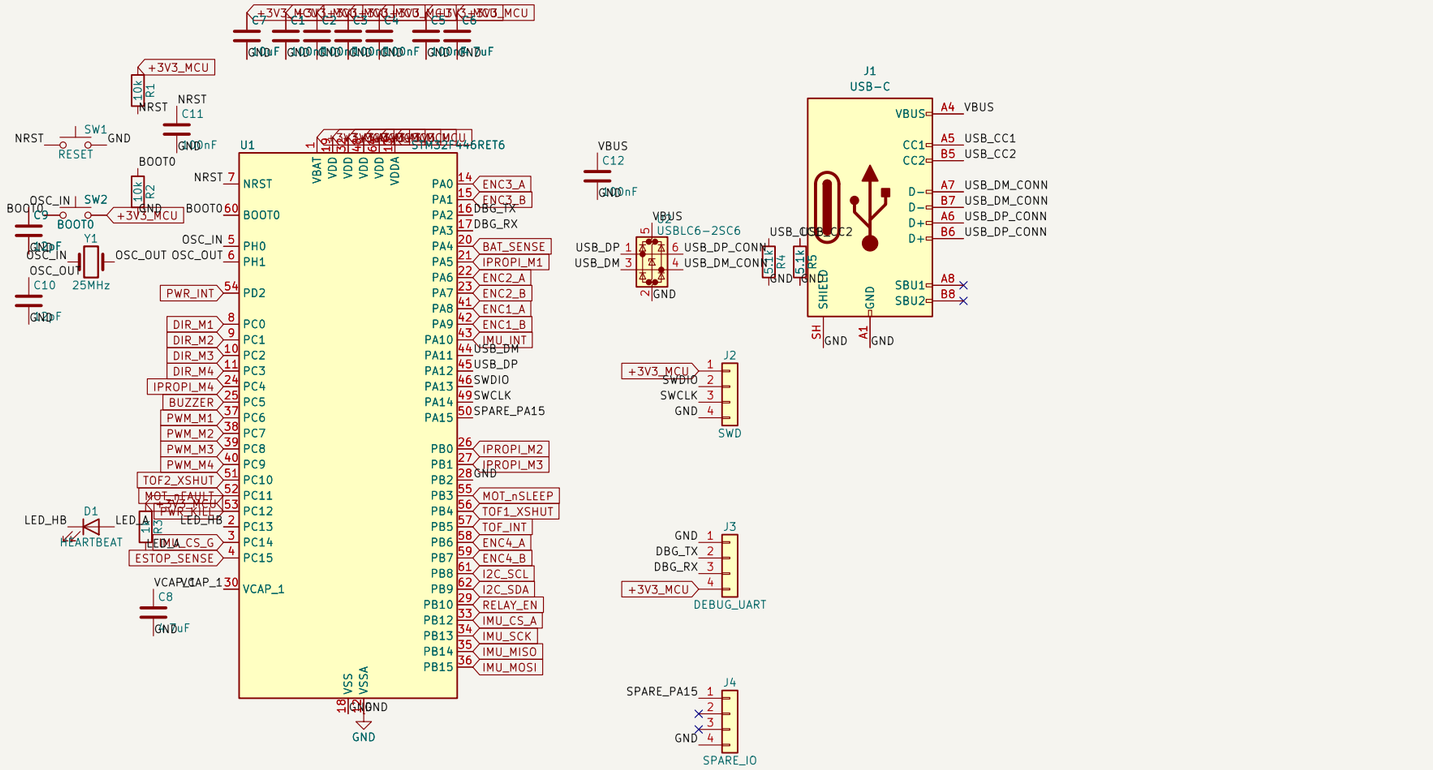
RAIL LEDs

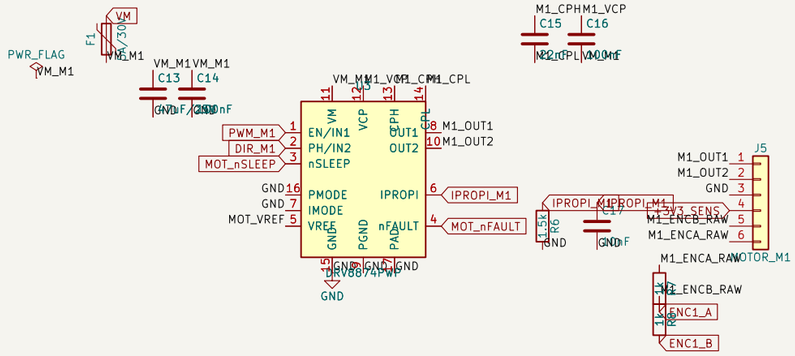
TEST POINTS

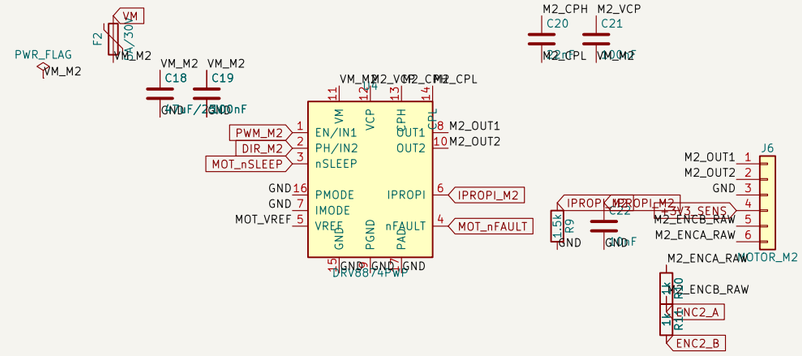
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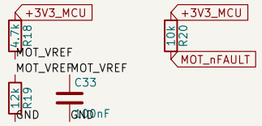
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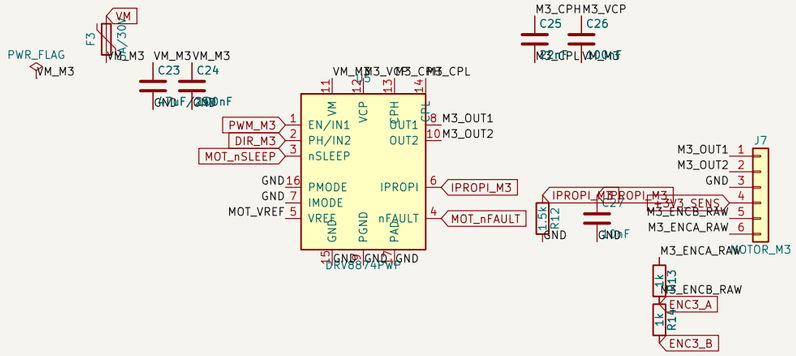
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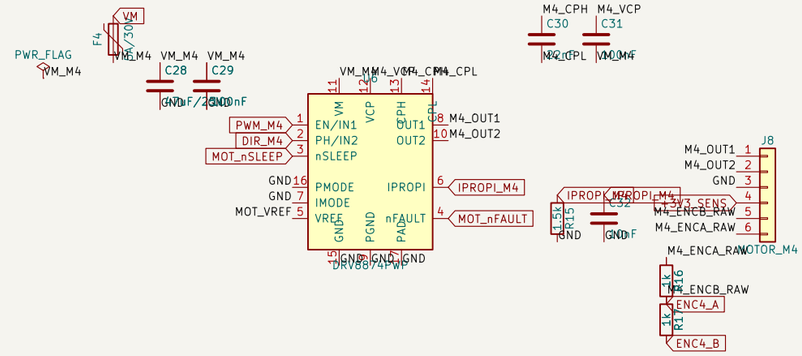

+3V3_MCU
C7 100nF
C1 100nF
C2 100nF
C3 100nF
C4 100nF
C5 100nF
C6 2.2uF
U1
STM32G431RET6
NRST
BOOT0
OSC_IN
OSC_OUT
25MHz
C10 10pF
C9 10pF
PWR_INT
DIR_M1
DIR_M2
DIR_M3
DIR_M4
IPROPI_M4
BUZZER
PWM_M1
PWM_M2
PWM_M3
PWM_M4
TOF2_XSHUT
MOT_nFAULT
FW_ADC
LED_HB
LED_A
HEARTBEAT
LED_A_CS_G
ESTOP_SENSE
VCAP_1
C8 2.2uF
ENC3_A
ENC3_B
DBG_TX
DBG_RX
BAT_SENSE
IPROPI_M1
ENC2_A
ENC2_B
ENC1_A
ENC1_B
IMU_INT
USB_DM
USB_DP
SWDIO
SWCLK
SPARE_PA15
IPROPI_M2
IPROPI_M3
MOT_nSLEEP
TOF1_XSHUT
TOF_INT
ENC4_A
ENC4_B
I2C_SCL
I2C_SDA
RELAY_EN
IMU_CS_A
IMU_SCK
IMU_MISO
IMU_MOSI
SW1
RESET
SW2
J1
USB-C
VBUS
CC1
CC2
D-
D+
SBU1
SBU2
SHIELD
USBLC6-2SC6
USB_DP
USB_DM
USB_DP_CONN
USB_DM_CONN
USB_CC1
USB_CC2
5.1k
J2
SWD
J3
DEBUG_UART
J4
SPARE_IO





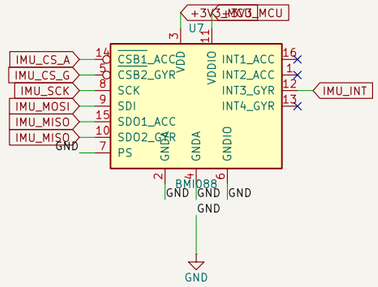




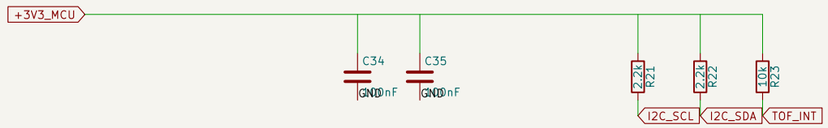


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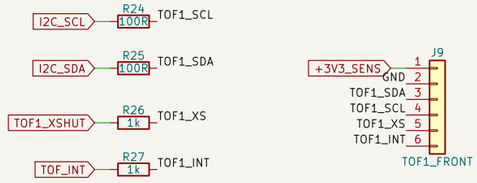
IMU — ICM20948 on SPI2 (+3V3_MCU, on-board)



I2C bus pull-ups + TOF_INT pull-up (to +3V3_MCU, so the bus survives a +3V3_SENS fuse trip)

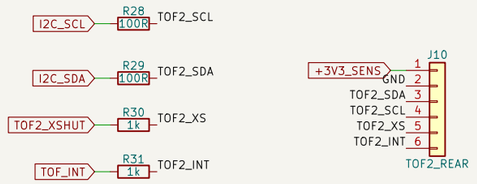


ToF 1 — FRONT centre. 6-pin JST: 1 +3V3_SENS, 2 GND, 3 SDA, 4 SCL, 5 XSHUT, 6 INT

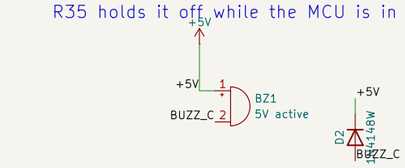


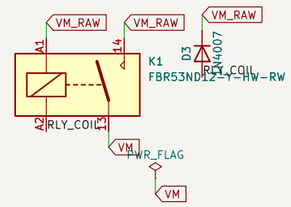
E-stop relay, stage 2 (hard) — VM_RAW in, VM out.
Coil runs off VM_RAW, not +5V: a relay big enough to break
12 A DC is an automotive part with a 12 V coil.
Fail-safe — R37 holds the FET off, so a reset or
unprogrammed MCU leaves the motors unpowered.

ToF 2 — REAR centre. Same pinout. Both INTs wired-OR onto TOF_INT



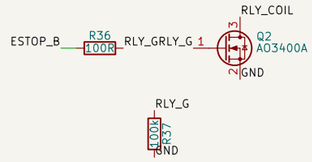
Buzzer — 5V active, low-side NPN.
R35 holds it off while the MCU is in reset.

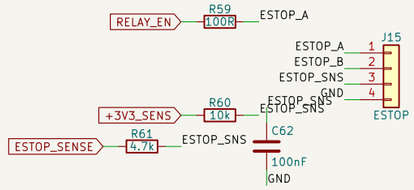




OLED 0.96" — 4-pin JST: 1 +3V3_SENS, 2 GND, 3 SDA, 4 SCL. Same I2C bus, address 0x3C







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