Avionics

File: Avionics.kicad_sch

Connectors

File: Connectors.kicad_sch

Power

File: Power.kicad_sch

Motors

File: motor_driver.kicad_sch

Watchdog

File: watchdog.kicad_sch

MRAM — Nonvolatile Memory
(4Mbit storage)

3.3V   Using QSPI   3.3V

R21
10k

U3
MR25H40MDF

FLASH_CS   1 CS   VDD 8
FLASH_MISO   2 SO   HOLD 7   FLASH_IO3
FLASH_IO2   3 WP   SCK 6   FLASH_SCK
                4 SI   SI   5   FLASH_MOSI
                   VSS   EP   9

C7
0.1uF

GND   GND   GND

+1V1

C13   C14   C15
0.1uF   0.1uF   4.7uF

GND

3.3V   capacitor for every power pin

C16   C28   C40   C45   C46   C47   C48   C49   C50
0.1uF 0.1uF 0.1uF 0.1uF 0.1uF 0.1uF 0.1uF 0.1uF 0.1uF

GND

Status LED

C5   D1
0.1uF   1655

DOUT DIN
VSS

3.3V

NEOPIXEL

GND

PRIMARY PROCESSOR

+1V1   3.3V

3.3V

R20
33

+1V1   C12
            4.7uF

PWR_FLAG   GND

C10   C11   3.3uH
4.7uF   4.7uF   L1

GND

U2

DVDD DVDD DVDD DVDD   QSPI_IOVDD IOVDD IOVDD IOVDD IOVDD IOVDD IOVDD IOVDD IOVDD   USB_OTP_VDD ADC_AVDD

61 VREG_AVDD   USB_DP 67 USB_IC_D+   R41   R42
64 VREG_VIN   USB_DM 66 USB_IC_D-   27   27   R55   USB_D+
65 VREG_FB   10k   USB_D-
63 VREG_LX
62 VREG_PGND   3.3V

FLASH_CS   75 QSPI_SS   GPIO0   77   FGOUT_1   3.3V
FLASH_MOSI 72 QSPI_SD0   GPIO1   78 nSCS_1
FLASH_MISO 74 QSPI_SD1   GPIO2   79 BRAKE_1   R52   R51
FLASH_IO2 73 QSPI_SD2   GPIO3   80 PWM_1   10k   10k
FLASH_IO3 70 QSPI_SD3   GPIO4   1   nSLEEP_1
                                    GPIO5   3   nSCS_1   nFAULT_1
FLASH_SCK 71 QSPI_SCLK   GPIO6   4   DRVOFF_1   FGOUT_2   3.3V
Y1   GPIO7   6
ABM8-272-T3   GPIO8   7   PWM_2
                                    GPIO9   8   BRAKE_2   R48   R49
C1   R38   GPIO10   10k   10k
15pF   1k   XTAL1 30 XIN   GPIO11 11 nSLEEP_2
                     XTAL2 31 XOUT GPIO12   nFAULT_2
C2   GPIO13 12 DRVOFF_2   FGOUT_3   3.3V
15pF   GPIO14 13
GND   GND   GPIO15 14 PWM_3
                                    GPIO16 16 BRAKE_3   R47   R46
                     RUN 35 RUN   GPIO17 17 nSCS_3   10k   10k
                                    GPIO18 18 nSLEEP_3
                                    GPIO19   nFAULT_3
                     SWCLK 33 SWCLK GPIO20 20 DRVOFF_3   FGOUT_4   3.3V
                     SWDIO 34 SWD   GPIO21 21 nSCS_4
                                    GPIO22 22 PWM_4
Raspberry Pi   GPIO23 23 BRAKE_4   R45
RP2350B QFN-80   GPIO24   10k
                                    GPIO25 26 nSLEEP_4
RESET   GPIO26 27   nFAULT_4
R3   GPIO27 28 DRVOFF_4
1k   RUN   GPIO28 36
SW1   R23   GPIO29 37   3.3V
KMR231NG LFS 1k RUN   GPIO30 38
                                    GPIO31 39
GND   RESET RUN   GPIO32 40 SDO0
SWD RESET   GPIO33 42 MOTOR_PGOOD R44   R43
                                    GPIO34 43 MOTOR_EN   10k   10k
BOOT SEL   GPIO35 44 SDIO
R4   GPIO36 45
1k   FLASH_CS   GPIO37 46   SDA_PWR
SW2   GPIO38 47 SCLK0   SCL_PWR
KMR231NG LFS   GPIO39 48 NEOPIXEL

GND   GPIO40_ADC0 49 MOTOR_Tx
                                    GPIO41_ADC1 52 MOTOR_Rx
To enter USB boot: GPIO42_ADC2 53 WATCHDOG_FEED
1. Press and hold BOOT_SEL button   GPIO43_ADC3 54
2. Press release RESET button   GPIO44_ADC4 56
3. Release BOOT_SEL button   GPIO45_ADC5 57
                                    GPIO46_ADC6 57
                                    GPIO47_ADC7 58

                     81 GND

GND   RP2350_80QFN

NOTE: Components labeled "do not install" (DNI) are not populated by default
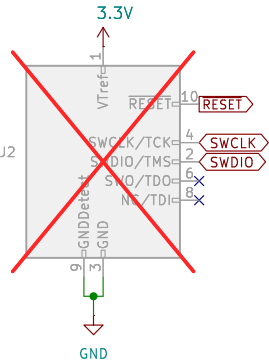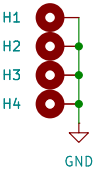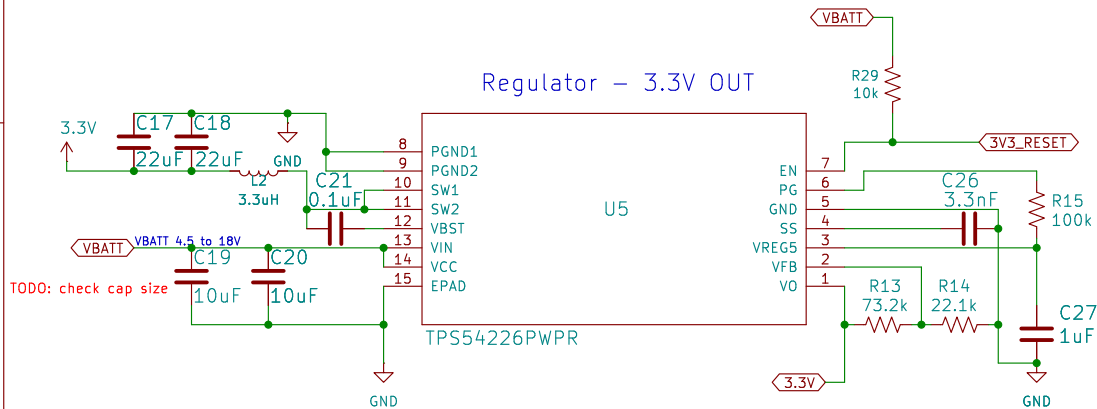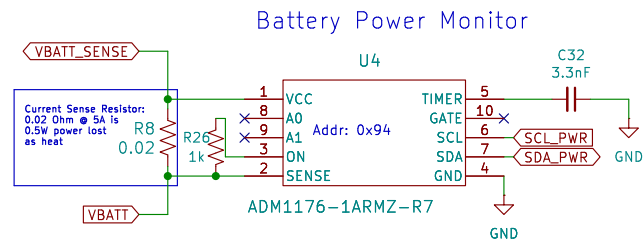
Carson Lauer
Stanford Student Space Initiative

Avionics

Power Connectors: USB-C Power Delivery to 2S Li-ion Battery

J13

Pin	Signal
A12	GND
A9	VBUS
A4	VBUS
A5	CC1
B5	CC2
A7	D−
B7	D−
A6	D+
B6	D+
A8	SBU1
B8	SBU2
S1	SHIELD
A1	GND

USB_CC1
USB_CC2
R40 5.1k
R39 5.1k
GND

USB_D−
USB_D+
GND

C29 4.7uF

PWR_FLAG
GND

ADCS

J5

Pin	Signal
1	MOTOR_EN
2	MOTOR_PGOOD
3	MOTOR_Tx
4	MOTOR_Rx
5	PWR_FLAG
6	
7	VBATT_SENSE
8	
9	
10	

GND

SWD

3.3V

J2

Pin	Signal
1	VTref
10	RESET
4	SWCLK/TCK
2	SWDIO/TMS
6	SWO/TDO
8	NC/TDI
9	GNDDetect
3	GND

RESET
SWCLK
SWDIO

GND

Mounting Holes

H1
H2
H3
H4

GND

Connectors

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Sheet: /Connectors/
File: Connectors.kicad_sch
Title: Reaction Wheel Motor Board
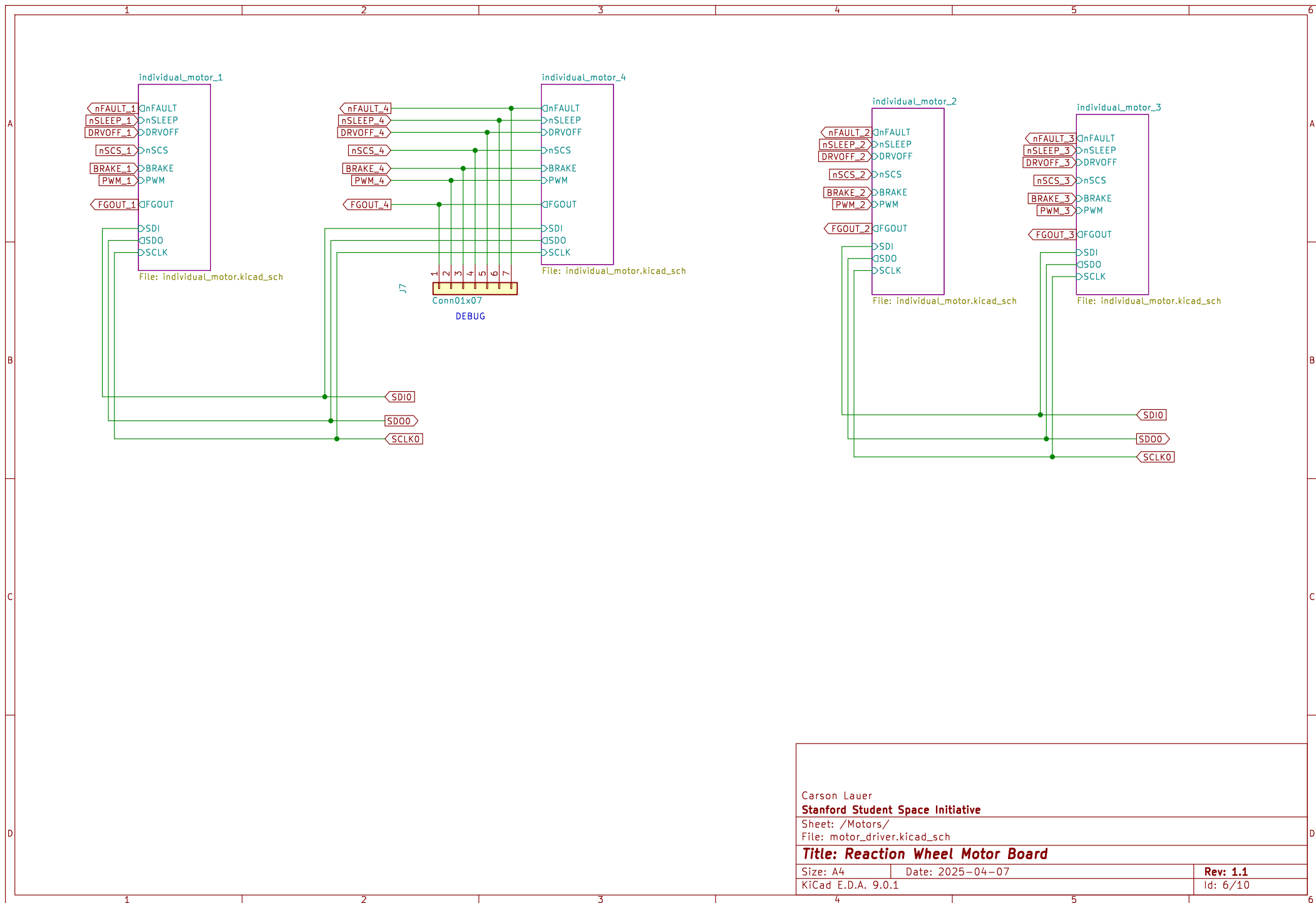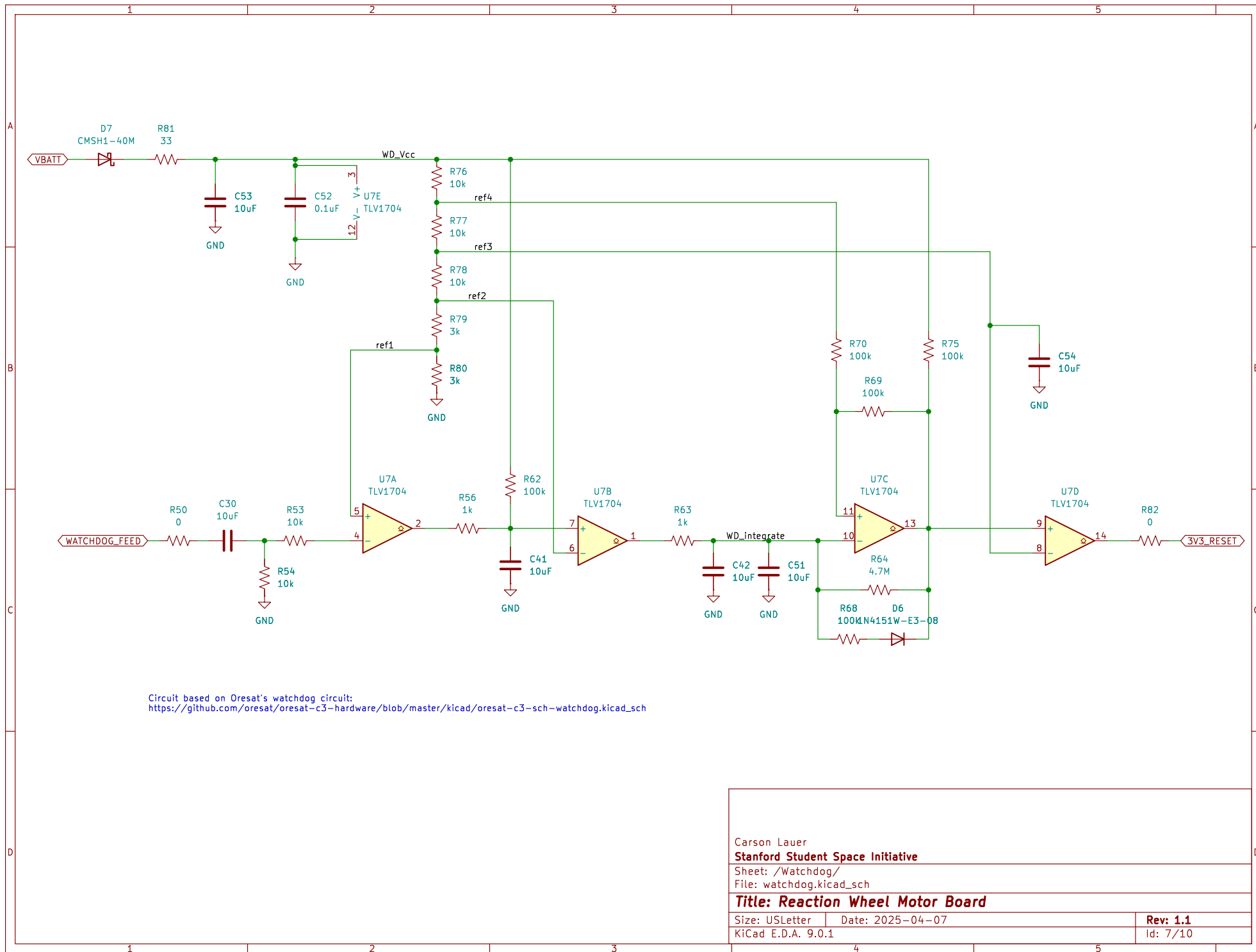Size: A4 | Date: 2025-04-07 | **Rev: 1.1**
KiCad E.D.A. 9.0.1 | Id: 4/10

Battery Power Monitor

VBATT_SENSE

U4

C32
3.3nF

Current Sense Resistor:
0.02 Ohm @ 5A is
0.5W power lost
as heat

R8
0.02

R26
1k

Pin	Label
1	VCC
8	A0
9	A1
3	ON
2	SENSE

Addr: 0x94

TIMER	5
GATE	10
SCL	6
SDA	7
GND	4

SCL_PWR
SDA_PWR

GND

VBATT

ADM1176-1ARMZ-R7

GND

Regulator — 3.3V OUT

VBATT

R29
10k

3V3_RESET

3.3V

C17 C18
22uF 22uF

GND

L2
3.3uH

C21
0.1uF

VBATT   VBATT 4.5 to 18V

C19   C20
10uF   10uF

TODO: check cap size

U5

8	PGND1
9	PGND2
10	SW1
11	SW2
12	VBST
13	VIN
14	VCC
15	EPAD

EN	7
PG	6
GND	5
SS	4
VREG5	3
VFB	2
VO	1

C26
3.3nF

R15
100k

R13   R14
73.2k   22.1k
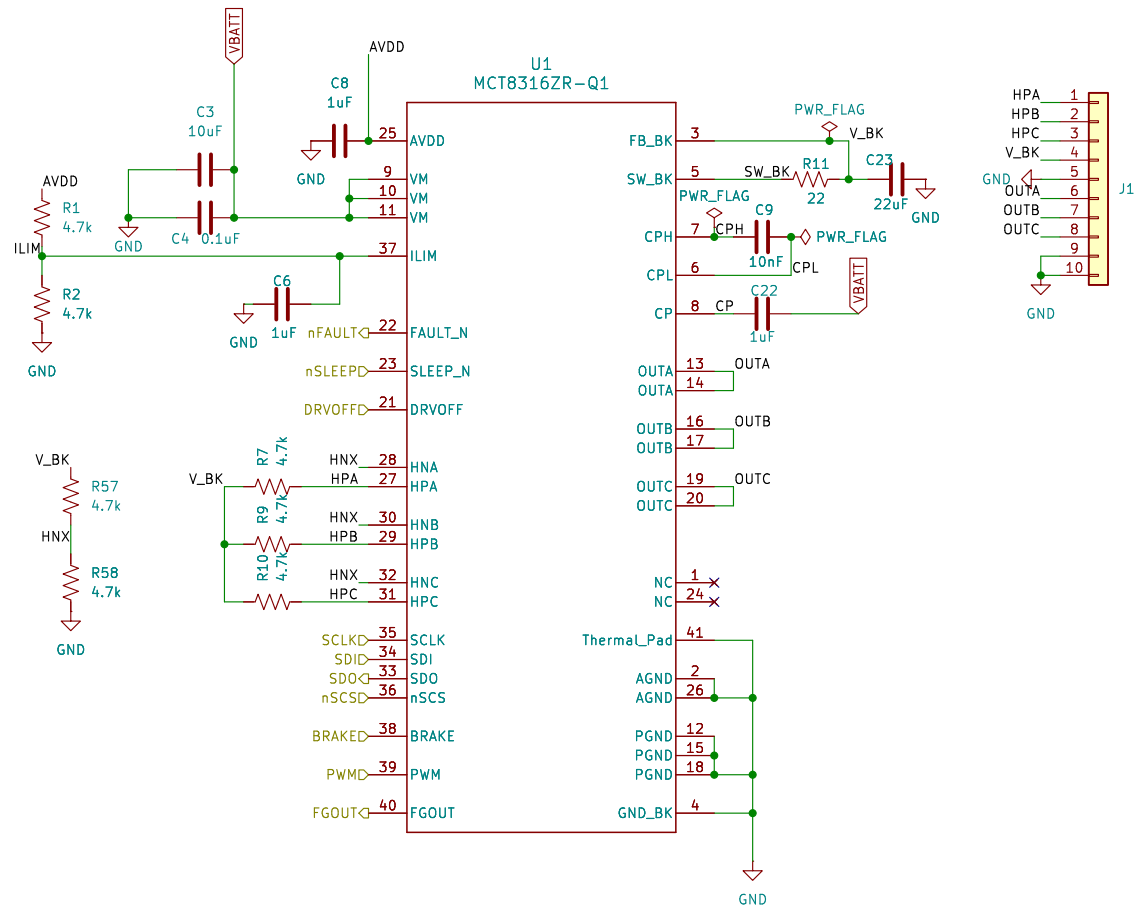
C27
1uF

3.3V

GND

TPS54226PWPR

GND

Power

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Sheet: /Power/
File: Power.kicad_sch

Title: Reaction Wheel Motor Board

Size: A4	Date: 2025-04-07	Rev: 1.1
KiCad E.D.A. 9.0.1		Id: 5/10

individual_motor_1

nFAULT_1 — nFAULT
nSLEEP_1 — nSLEEP
DRVOFF_1 — DRVOFF
nSCS_1 — nSCS
BRAKE_1 — BRAKE
PWM_1 — PWM
FGOUT_1 — FGOUT
SDI
SDO
SCLK

File: individual_motor.kicad_sch

individual_motor_4

nFAULT_4 — nFAULT
nSLEEP_4 — nSLEEP
DRVOFF_4 — DRVOFF
nSCS_4 — nSCS
BRAKE_4 — BRAKE
PWM_4 — PWM
FGOUT_4 — FGOUT
SDI
SDO
SCLK

File: individual_motor.kicad_sch

J7
1 2 3 4 5 6 7
Conn01x07
DEBUG

individual_motor_2

nFAULT_2 — nFAULT
nSLEEP_2 — nSLEEP
DRVOFF_2 — DRVOFF
nSCS_2 — nSCS
BRAKE_2 — BRAKE
PWM_2 — PWM
FGOUT_2 — FGOUT
SDI
SDO
SCLK

File: individual_motor.kicad_sch

individual_motor_3

nFAULT_3 — nFAULT
nSLEEP_3 — nSLEEP
DRVOFF_3 — DRVOFF
nSCS_3 — nSCS
BRAKE_3 — BRAKE
PWM_3 — PWM
FGOUT_3 — FGOUT
SDI
SDO
SCLK

File: individual_motor.kicad_sch

SDI0
SDO0
SCLK0

SDI0
SDO0
SCLK0

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Sheet: /Motors/
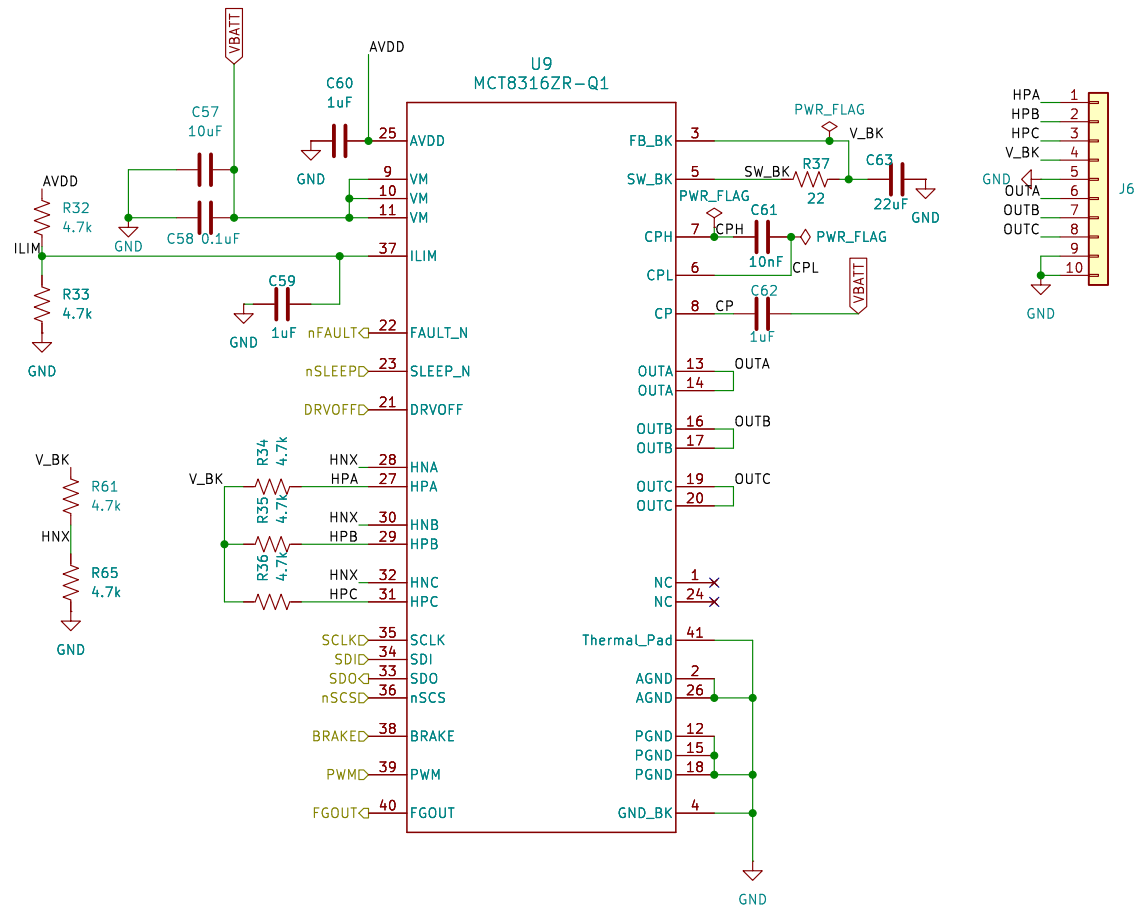File: motor_driver.kicad_sch
Title: Reaction Wheel Motor Board
Size: A4   Date: 2025-04-07   Rev: 1.1
KiCad E.D.A. 9.0.1   Id: 6/10

Circuit based on Oresat's watchdog circuit:
https://github.com/oresat/oresat-c3-hardware/blob/master/kicad/oresat-c3-sch-watchdog.kicad_sch

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Sheet: /Watchdog/
File: watchdog.kicad_sch
Title: Reaction Wheel Motor Board

| Size: USLetter | Date: 2025-04-07 | **Rev: 1.1** |
| KiCad E.D.A. 9.0.1 | | Id: 7/10 |

U6
MCT8316ZR-Q1

VBATT

AVDD

U1
MCT8316ZR-Q1

C8
1uF

C3
10uF

AVDD

R1
4.7k

ILIM

R2
4.7k

GND

C4   0.1uF

GND

C6
1uF

GND

GND

25 AVDD
9   VM
10 VM
11 VM
37 ILIM

nFAULT   22 FAULT_N
nSLEEP   23 SLEEP_N
DRVOFF   21 DRVOFF

V_BK
R57
4.7k

HNX
R58
4.7k

GND

V_BK   R7 4.7k
HNX
HPA

R9 4.7k
HNX
HPB

R10 4.7k
HNX
HPC

28 HNA
27 HPA
30 HNB
29 HPB
32 HNC
31 HPC

SCLK   35 SCLK
SDI   34 SDI
SDO   33 SDO
nSCS   36 nSCS

BRAKE 38 BRAKE
PWM   39 PWM
FGOUT 40 FGOUT

PWR_FLAG

FB_BK   3
SW_BK   5

PWR_FLAG
CPH   7 CPH
CPL   6 CPL
CP   8 CP

V_BK

R11
22

SW_BK

C23
22uF

GND

C9
10nF
CPL

PWR_FLAG

C22
1uF

VBATT

OUTA 13 OUTA
OUTA 14
OUTB 16 OUTB
OUTB 17
OUTC 19 OUTC
OUTC 20

NC   1
NC   24

Thermal_Pad 41

AGND 2
AGND 26
PGND 12
PGND 15
PGND 18
GND_BK 4

GND

HPA   1
HPB   2
HPC   3
V_BK 4
GND   5
OUTA 6
OUTB 7
OUTC 8
      9
      10

J1

GND

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Sheet: /Motors/individual_motor_1/
File: individual_motor.kicad_sch
Title: Reaction Wheel Motor Board
Size: A4   Date: 2025-04-07   Rev: 1.1
KiCad E.D.A. 9.0.1   Id: 7/10

U8
MCT8316ZR-Q1

U9
MCT8316ZR-Q1

Title: Reaction Wheel Motor Board

Size: A4 | Date: 2025-04-07 | **Rev: 1.1**
KiCad E.D.A. 9.0.1 | | Id: 9/10