Battery & protection

File: BMS.kicad_sch

- 3V3
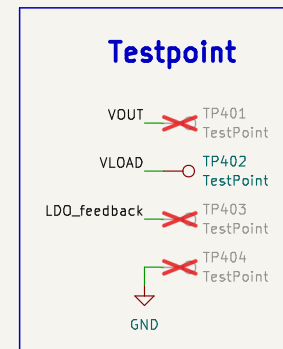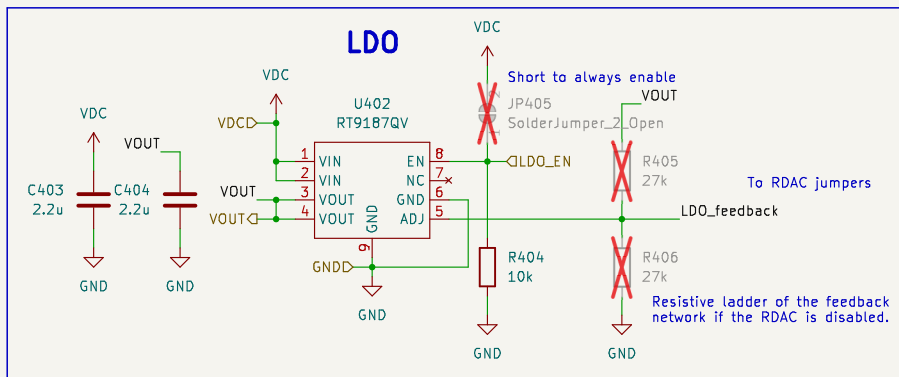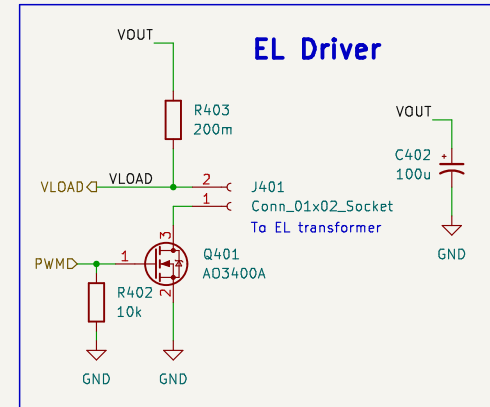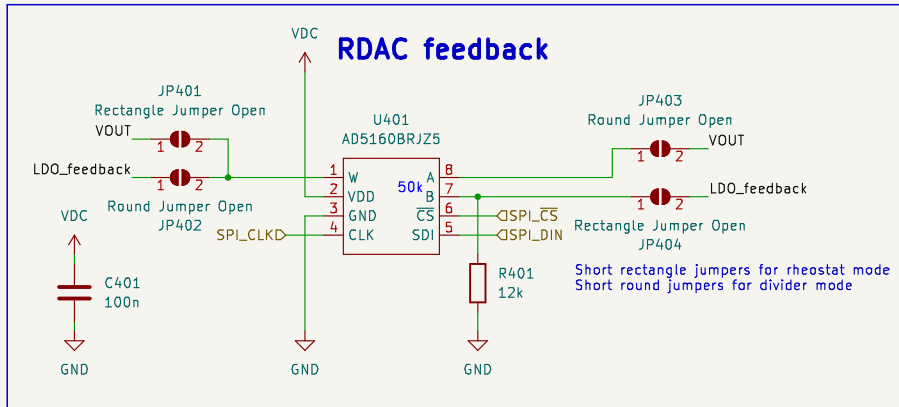- VDC
- eFUSE_EN — eFUSE_FAULT
- eFUSE_FAULTD
- VBAT_senseD — VBAT_sense
- GNDD

+3V3 VDC

GND

EL driver 0

File: ELDM.kicad_sch

- VDC
- LDO_EN — LDO_EN0
- SPI_CS — SPI_CS0
- SPI_CLK — SPI_CLK
- SPI_DIN — SPI_TX
- VOUTD — VO0
- VLOADD — VL0
- PWM — PWM0
- GND

VDC

GND

EL driver 1

File: ELDM.kicad_sch

- VDC
- LDO_EN — LDO_EN1
- SPI_CS — SPI_CS1
- SPI_CLK — SPI_CLK
- SPI_DIN — SPI_TX
- VOUTD — VO1
- VLOADD — VL1
- PWM — PWM1
- GND

VDC

GND
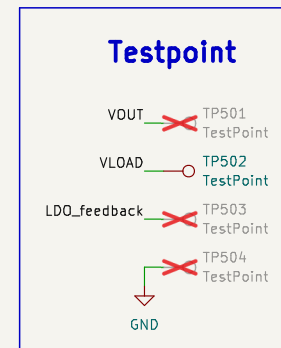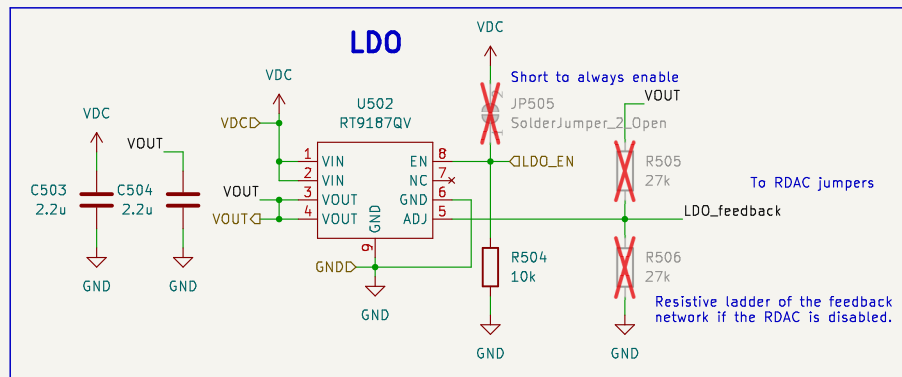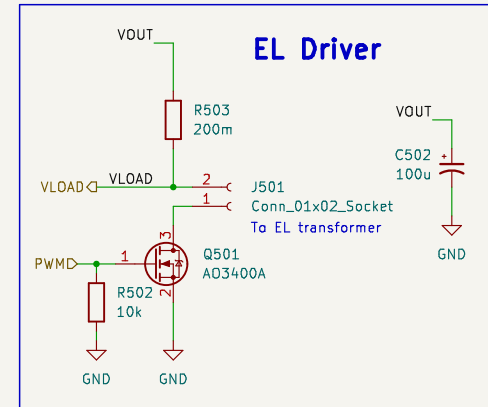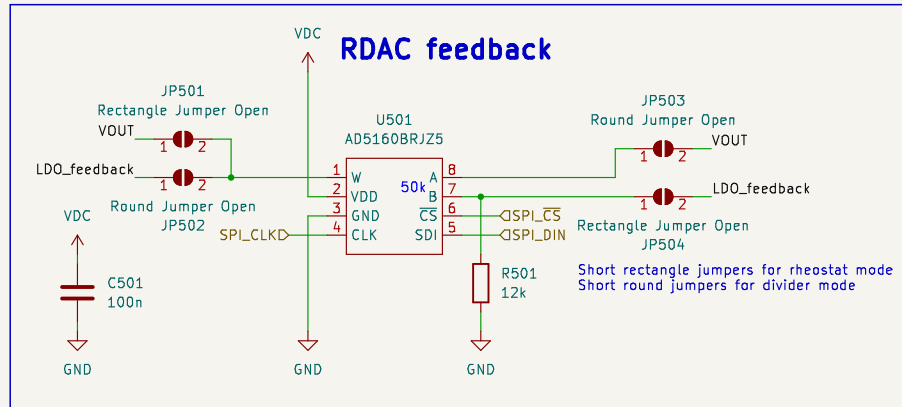
EL driver 2

File: ELDM.kicad_sch

- VDC
- LDO_EN — LDO_EN2
- SPI_CS — SPI_CS2
- SPI_CLK — SPI_CLK
- SPI_DIN — SPI_TX
- VOUTD — VO2
- VLOADD — VL2
- PWM — PWM2
- GND

VDC

GND

EL driver 3

File: ELDM.kicad_sch

- VDC
- LDO_EN — LDO_EN3
- SPI_CS — SPI_CS3
- SPI_CLK — SPI_CLK
- SPI_DIN — SPI_TX
- VOUTD — VO3
- VLOADD — VL3
- PWM — PWM3
- GND

VDC

GND
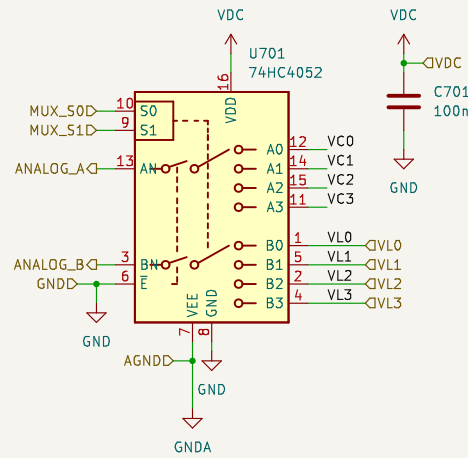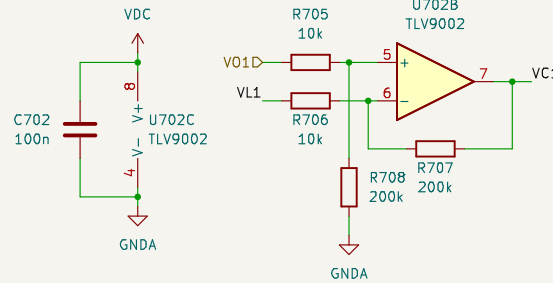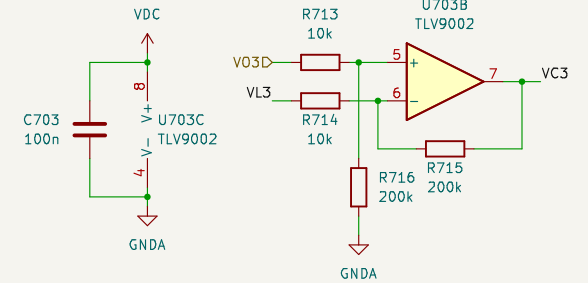
Analogue signal processing

File: ASP.kicad_sch

- VO0 — DVO0
- VO1 — DVO1
- VO2 — DVO2
- VO3 — DVO3
- VL0 — DVL0
- VL1 — DVL1
- VL2 — DVL2
- VL3 — DVL3
- VDC
- ANALOG_AD — ANALOG_A
- ANALOG_BD — ANALOG_B
- MUX_S0 — MUX_S0
- MUX_S1 — MUX_S1
- AGND
- GND

VDC

GND

GNDA

BRAIN

U101
Pico
Raspberry Pi Pico

VDC +3V3

SSD_CLK R110 1k D103 red GND

SSD_DATA R109 1k D102 green GND

Pin	Signal		Signal	Pin
PWM0	1	GPIO0	VBUS	40
LDO_EN0	2	GPIO1	VSYS	39
	3	GND	3V3_EN	38
PWM1	4	GPIO2	3V3	37
LDO_EN1	5	GPIO3	ADC_VREF	36
PWM2	6	GPIO4	GPIO28_ADC2	35
LDO_EN2	7	GPIO5	GPIO28_ADC2	34 → VBAT_sense
	8	GND	AGND	33
PWM3	9	GPIO6	GPIO27_ADC1	32 → ANALOG_B
LDO_EN3	10	GPIO7	GPIO26_ADC0	31 → ANALOG_A
SSD_CLK	11	GPIO8	RUN	30 → eFUSE_FAULT
SSD_DATA	12	GPIO9	GPIO22	29
	13	GND	GND	28
SPI_CS0	14	GPIO10	GPIO21	27 → MUX_S1
SPI_CS1	15	GPIO11	GPIO20	26 → MUX_S0
SPI_CS2	16	GPIO12	GPIO19	25 → SPI_TX
SPI_CS3	17	GPIO13	GPIO18	24 → SPI_CLK
	18	GPIO13	GND	23
T_SYNC	19	GPIO14	GPIO17	22 → UART0_RX
	20	GPIO15	GPIO16	21 → UART0_TX

SWCLK 41 GND 42 SWDIO 43

SWCLK SWDIO

+3V3 SW_SPDT SW102 GND GND GND GND GNDA GND

SW101 SW_Push
Reset button

Debug header

J101
Conn_01x06_Pin

+3V3

1	
2	
3	SWCLK
4	SWDIO
5	UART0_RX
6	UART0_TX

GND

Time sync cable

J102
Conn_01x02_Pin

| 1 | |
| 2 | T_SYNC |

GND

7-segment display

VDC

U102
74HC595

SSD_DATA — SER
SSD_CLK — SRCLK
SRCLR
RCLK
OE

R101
RN101

D101
D198K

QA QB QC QD QE QF QG QH

VCC GND

SW_SPDT SW103

VDC C101 100n GND

VDC C102 10u GND

Switch to VDC to disable 7-segment display

GND

7-segment display is remove due to insufficient space on the PCB.

Li-ion battery

Alternative DC input

SW201
SW_SPDT

+BATT

Conn_01x02_Socket
J201

BT201
Li-ion Battery

GND

GND   GND

C201
100u

GND

R201
47k

VBAT_sense

R202
47k

GND

eFUSE

+BATT

VDC   +3V3

VDC◁   ◁3V3

U201
TPS25200DRVR

R204
300k

7 EPAD
6 IN
5 GND
4 EN

OUT   1
ILIM 2
*FAULT 3

Ilim=1.92A

C202 300k
100n R203

eFUSE_EN

◁eFUSE_EN

GND   GND

SolderJumper_2_Open
JP201

Connect EN to FAULT to turn off internal MOSFET
automatically when there is a power fault.

eFUSE_FAULT

C203
100u

GND

R205
47k

R206
47k

GND

GND

Power BAD buzzer

+3V3

eFUSE_FAULT 1

Q201
AO3401A

eFUSE_FAULT ◁

R207
10k

BZ201
Buzzer

Use internal pull-down

GND   GND

Power LED

VDC

R208
1k

D201
Yellow

GND

Power testpoint

VDC

TP201
TestPoint

TP202
TestPoint

GND

RDAC feedback

JP301
Rectangle Jumper Open

VOUT

LDO_feedback

Round Jumper Open
JP302

VDC

C301
100n

GND

U301
AD5160BRJZ5

1	W	A	8
2	VDD	B	7
3	GND	CS	6
4	CLK	SDI	5

50k

SPI_CLK

GND

JP303
Round Jumper Open

VOUT

LDO_feedback

SPI_CS
SPI_DIN

Rectangle Jumper Open
JP304

R301
12k

GND

Short rectangle jumpers for rheostat mode
Short round jumpers for divider mode

Divider mode calculation.
https://www.geogebra.org/calculator/vzmcez3b

EL Driver

VOUT

R303
200m

VLOAD

VLOAD

J301
Conn_01x02_Socket
To EL transformer

VOUT

C302
100u

GND

PWM

Q301
AO3400A

R302
10k

GND   GND

LDO

VDC

VDC

VDC

VOUT

C303
2.2u

C304
2.2u

VDC

VOUT

VOUT

GND   GND

U302
RT9187QV

1	VIN	EN	8
2	VIN	NC	7
3	VOUT	GND	6
4	VOUT	ADJ	5

GND

9

Short to always enable
JP305
SolderJumper_2_Open

LDO_EN

R304
10k

GND

VOUT

R305
27k

LDO_feedback

R306
27k

GND

To RDAC jumpers

Resistive ladder of the feedback
network if the RDAC is disabled.

Testpoint

VOUT   TP301
            TestPoint

VLOAD   TP302
            TestPoint

LDO_feedback   TP303
                TestPoint

            TP304
            TestPoint

GND

RDAC feedback

VDC

JP401
Rectangle Jumper Open
VOUT
1 2

LDO_feedback
1 2

VDC
Round Jumper Open
JP402

C401
100n

GND

U401
AD5160BRJZ5

1 W
2 VDD
3 GND
4 CLK

A 8
50k B 7
CS 6
SDI 5

SPI_CLK

SPI_CS
SPI_DIN

JP403
Round Jumper Open
1 2 VOUT

1 2 LDO_feedback

Rectangle Jumper Open
JP404

R401
12k

GND

GND

Short rectangle jumpers for rheostat mode
Short round jumpers for divider mode

Divider mode calculation.
https://www.geogebra.org/calculator/vzmcez3b

EL Driver

VOUT

R403
200m

VLOAD   VLOAD
2
1

J401
Conn_01x02_Socket
To EL transformer

VOUT

C402
100u

GND

PWM
1
R402
10k

Q401
AO3400A

GND   GND

LDO

VDC

VDC

VOUT

C403
2.2u

C404
2.2u

GND   GND

VDCD   VDD

VOUT   VOUT

U402
RT9187QV

1 VIN
2 VIN
3 VOUT
4 VOUT

EN 8
NC 7
GND 6
ADJ 5

GND 9

GNDD

GND

R404
10k

GND

Short to always enable
JP405
SolderJumper_2_Open

LDO_EN

VOUT

R405
27k

LDO_feedback

R406
27k

GND

To RDAC jumpers

Resistive ladder of the feedback
network if the RDAC is disabled.

Testpoint

VOUT   TP401
TestPoint

VLOAD   TP402
TestPoint

LDO_feedback   TP403
TestPoint

TP404
TestPoint

GND

RDAC feedback

VDC

JP501
Rectangle Jumper Open
VOUT
1 2

LDO_feedback
1 2

Round Jumper Open
JP502

VDC

C501
100n

GND

U501
AD5160BRJZ5

1 W
2 VDD
3 GND
4 CLK

A 8
50k B 7
CS 6
SDI 5

SPI_CS
SPI_DIN

GND

R501
12k

GND

JP503
Round Jumper Open
1 2 VOUT

1 2 LDO_feedback

Rectangle Jumper Open
JP504

Short rectangle jumpers for rheostat mode
Short round jumpers for divider mode

Divider mode calculation.
https://www.geogebra.org/calculator/vzmcez3b

EL Driver

VOUT

R503
200m

VLOAD
VLOAD
2
1

J501
Conn_01x02_Socket
To EL transformer

PWM
1

Q501
AO3400A

R502
10k

GND   GND

VOUT

C502
100u

GND

LDO

VDC

VDC

VOUT

C503
2.2u

C504
2.2u

GND   GND

VDCD
VOUT
VOUT

U502
RT9187QV

1 VIN
2 VIN
3 VOUT
4 VOUT

EN 8
NC 7
GND 6
ADJ 5

GND 9

GNDD

GND

R504
10k

GND

Short to always enable
JP505
SolderJumper_2_Open

VDC

VOUT

LDO_EN

R505
27k

LDO_feedback

R506
27k

GND

To RDAC jumpers

Resistive ladder of the feedback
network if the RDAC is disabled.

Testpoint

VOUT

TP501
TestPoint

VLOAD

TP502
TestPoint

LDO_feedback

TP503
TestPoint

TP504
TestPoint

GND

RDAC feedback

VDC

JP601
Rectangle Jumper Open
VOUT
1 2
LDO_feedback
1 2
Round Jumper Open
JP602

VDC

C601
100n

GND

GND

U601
AD5160BRJZ5
1 W   A 8
2 VDD   50k B 7
3 GND   CS 6
4 CLK   SDI 5

SPI_CLK

SPI_CS
SPI_DIN

GND

JP603
Round Jumper Open
1 2   VOUT

1 2   LDO_feedback
Rectangle Jumper Open
JP604

R601
12k

GND

Short rectangle jumpers for rheostat mode
Short round jumpers for divider mode

Divider mode calculation.
https://www.geogebra.org/calculator/vzmcez3b

EL Driver

VOUT

R603
200m

VLOAD   VLOAD
2
1
J601
Conn_01x02_Socket
To EL transformer

VOUT

C602
100u

GND

PWM
1
Q601
AO3400A
R602
10k

GND   GND

LDO

VDC

VDC

VOUT

C603
2.2u

C604
2.2u

VDC

GND   GND

U602
RT9187QV
1 VIN   EN 8
2 VIN   NC 7
3 VOUT   GND 6
4 VOUT   ADJ 5
9 GND

VOUT

VOUT

GND

VDC

Short to always enable
JP605
SolderJumper_2_Open

VOUT

LDO_EN

R605
27k

To RDAC jumpers

LDO_feedback

R604
10k

R606
27k

Resistive ladder of the feedback
network if the RDAC is disabled.

GND   GND

Testpoint

VOUT   TP601
TestPoint

VLOAD   TP602
TestPoint

LDO_feedback   TP603
TestPoint

TP604
TestPoint

GND

ADC input MUX

VDC

VDC

U701
74HC4052

C701
100n

GND

MUX_S0 — 10 S0
MUX_S1 — 9 S1
16 VDD

ANALOG_A — 13 AN

A0 — 12 VC0
A1 — 14 VC1
A2 — 15 VC2
A3 — 11 VC3

ANALOG_B — 3 BN
GND — 6 E

B0 — 1 VL0
B1 — 5 VL1
B2 — 2 VL2
B3 — 4 VL3

VEE 7
GND 8

GND

AGND

GND

GNDA

Testpoint

VC0 — TP701 TestPoint
VC1 — TP702 TestPoint
VC2 — TP703 TestPoint
VC3 — TP704 TestPoint

Current sense amplifier
channels 0 & 1

R701 10k
U702A TLV9002

VO0 — R701
VL0 — R702 10k

3 +
2 −
1 VC0

R704 200k
R703 200k

GNDA

VDC

C702 100n
U702C TLV9002
V+ 8
V− 4

GNDA

R705 10k
U702B TLV9002

VO1 — R705
VL1 — R706 10k

5 +
6 −
7 VC1

R708 200k
R707 200k

GNDA

Current sense amplifier
channels 2 & 3

R709 10k
U703A TLV9002

VO2 — R709
VL2 — R710 10k

3 +
2 −
1 VC2

R712 200k
R711 200k

GNDA

VDC

C703 100n
U703C TLV9002
V+ 8
V− 4

GNDA

R713 10k
U703B TLV9002

VO3 — R713
VL3 — R714 10k

5 +
6 −
7 VC3

R716 200k
R715 200k

GNDA