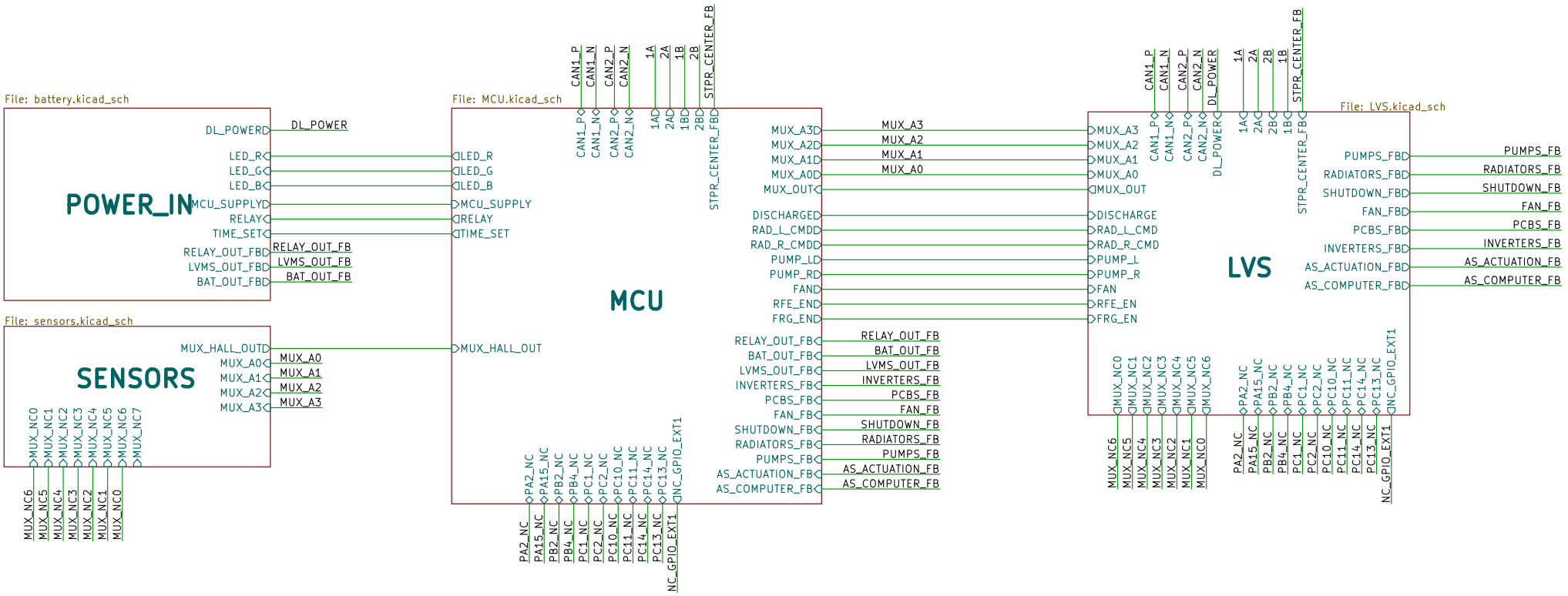


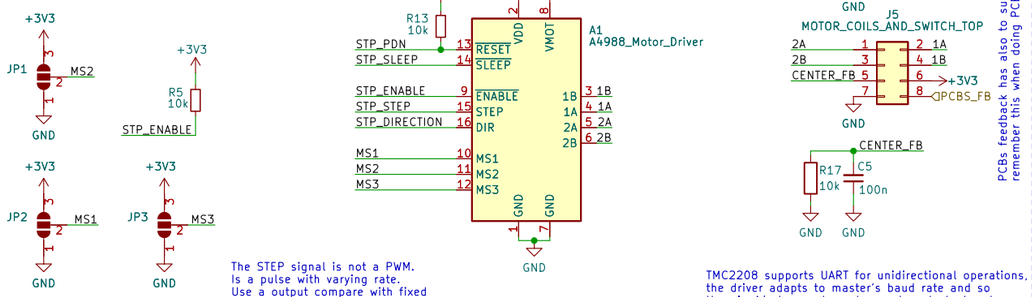
Mirco Tollardo
Nicolò Durisotto
E-Agle TRT

Sheet: /
File: fenice-bms-lv-hw.kicad_sch

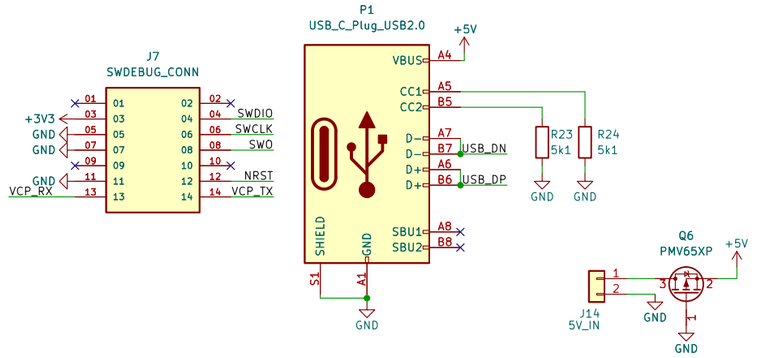
Title: Fenice BMS LV

Size: A4	Date: 2021-10-12	**Rev: 1.1**
KiCad E.D.A. kicad 6.0.11-2627ca5db0~126~ubuntu22.04.1		Id: 1/5

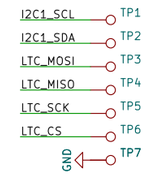
MOTOR DRIVER A4988



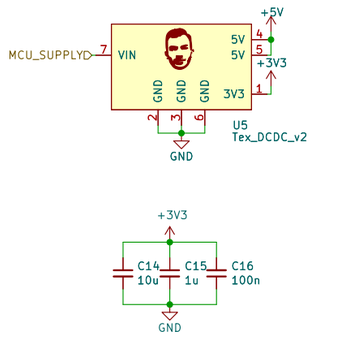
DEBUG CONNECTORS



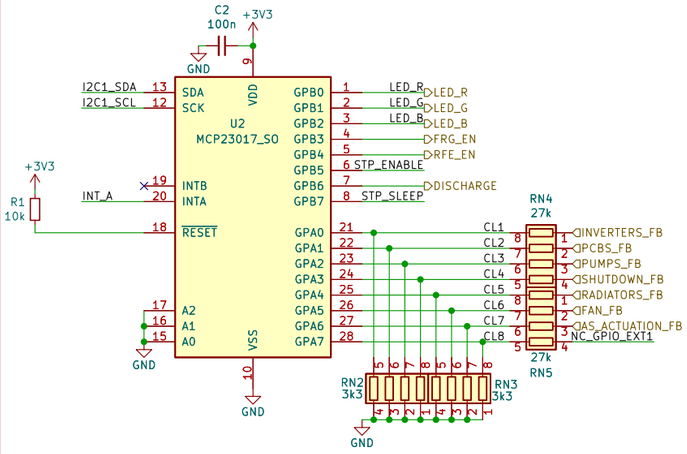
TESTPOINT

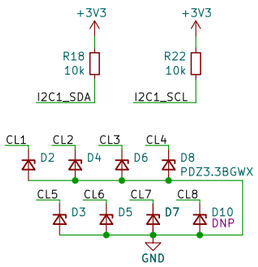


MCU POWER SUPPLY

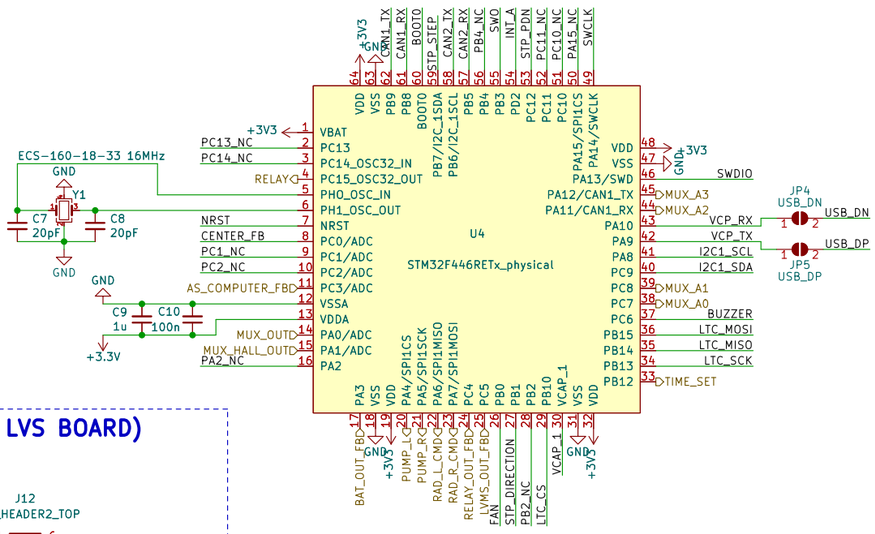


GPIO EXTENSION

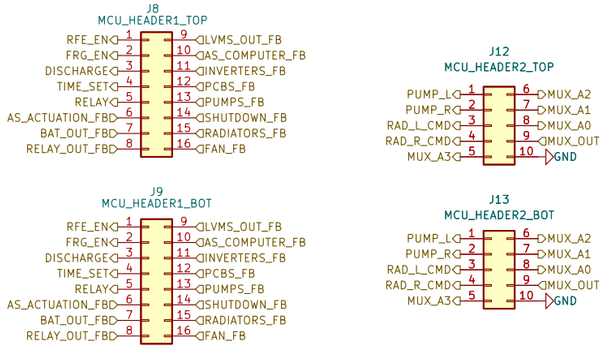




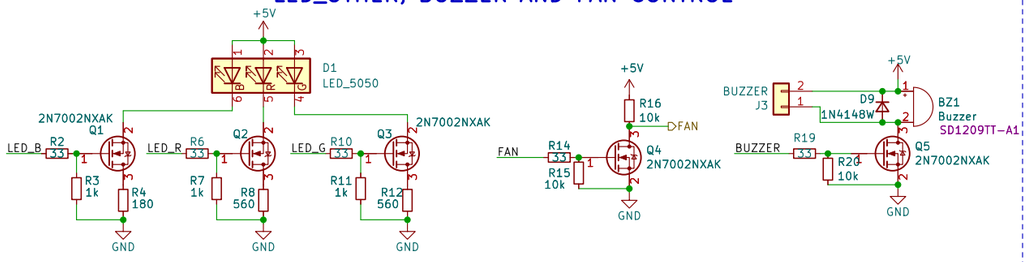
MCU



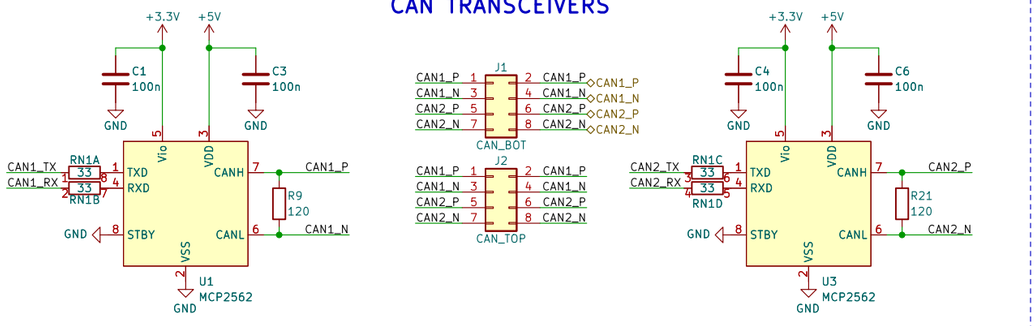
TOP TO BOTTOM HEADERS (MCU TO LVS BOARD)



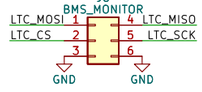
LED_OTHER, BUZZER AND FAN CONTROL



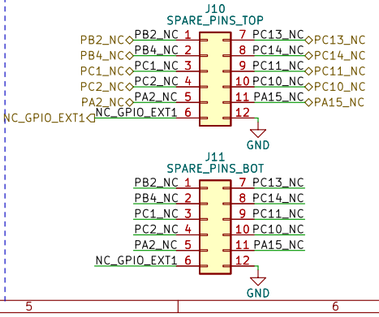
CAN TRANSCEIVERS

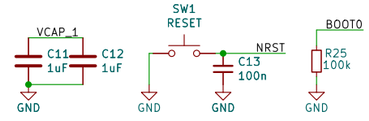


CELLBOARD



SPARE PINS





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Nicolò Durisotto

E-Agle TRT

Sheet: /MCU/
File: MCU.kicad_sch

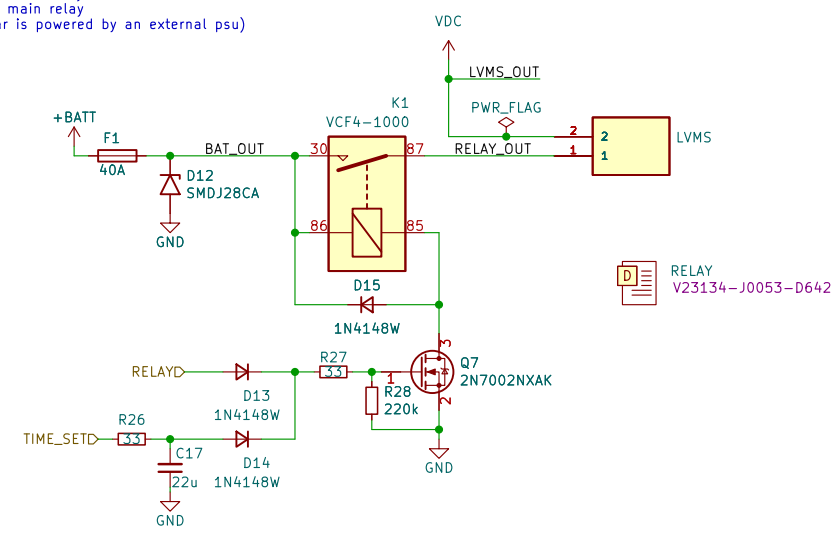
Title: Fenice BMS LV

Size: A3	Date: 2021-10-12	**Rev: 1.1**
KiCad E.D.A.	kicad 6.0.11-2627ca5db0-126-ubuntu22.04.1	Id: 3/5

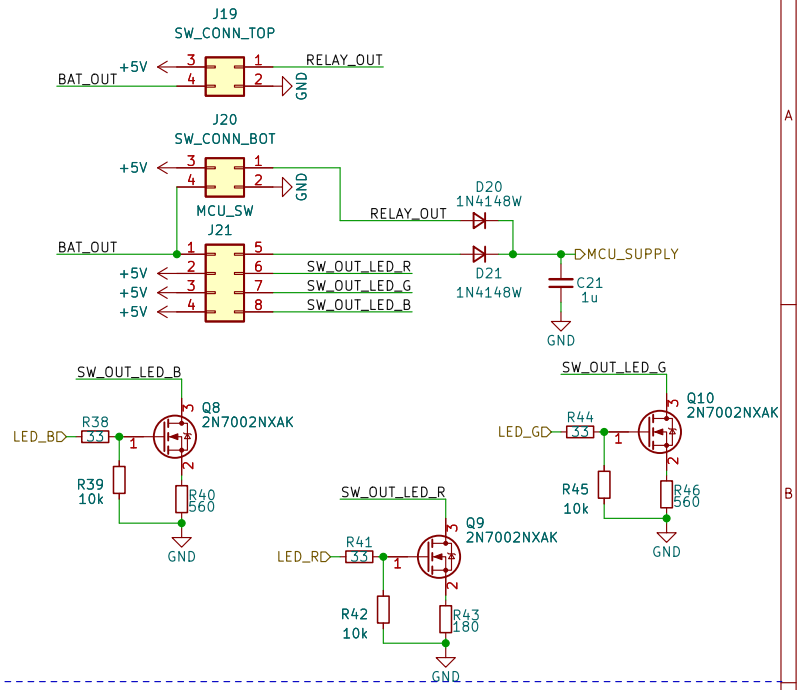
LVMS & BMS RELAY

A note for SW:
if voltage at RELAY_OUT outside battery's
rated voltage, DO NOT close main relay
(this might happen if the car is powered by an external psu)

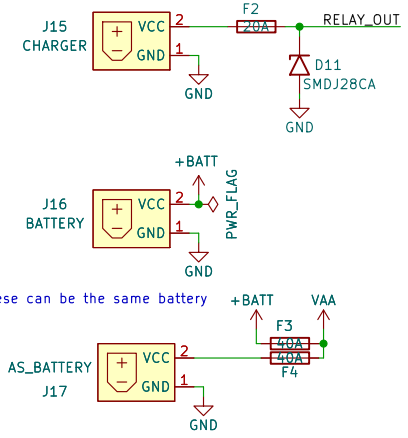
BAT_OUT_FB will also serve as feedback in order to add a self-kill switch for the MCU.
As stated in FSG rules, the LVMS must disable the whole LVS.



MCU SWITCH

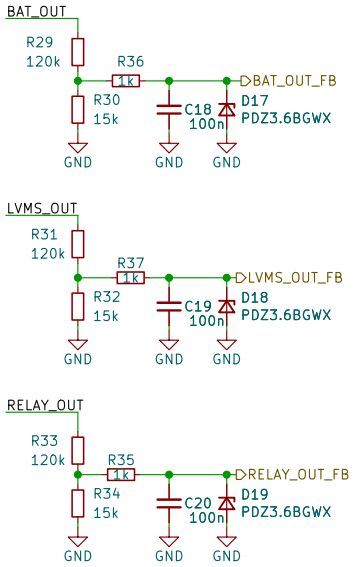


CHARGER & BATTERY CONNECTORS



A 40A fuse can be used as a jumper.
If a single battery pack is used it is
necessary to fit in the fuse to use the AS

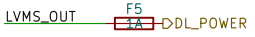
ANALOG VOLTAGES READING



For 28V the output voltage will be 3,11V

DATALOGGER

As stated in the 2022 FSG datalogger's datasheet:
The DL must be supplied by a voltage of 12 V DC to 60 V DC.
It draws a maximum power of 10 W.
It must be reasonably fused in the supply wiring.



EV 4.6.6
The datalogger must be directly supplied from the LVMS

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Nicolò Durisotto
E-Agle TRT

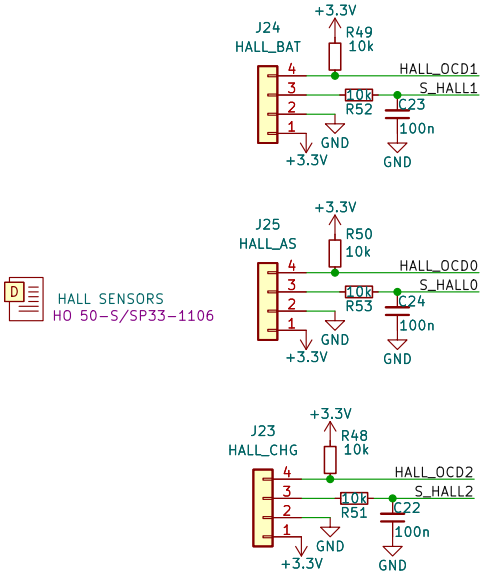
Sheet: /POWER_IN/
File: battery.kicad_sch

Title: Fenice BMS LV

Size: A4	Date: 2021-10-12	**Rev: 1.1**
KiCad E.D.A.	kicad 6.0.11-2627ca5db0~126~ubuntu22.04.1	Id: 5/5

One sensor will measure otput current from the batteries
One will be used to monitor the current from the charger

HALL CURRENT SENSORS



HALL SENSORS
HO 50-S/SP33-1106

For the current sensor:

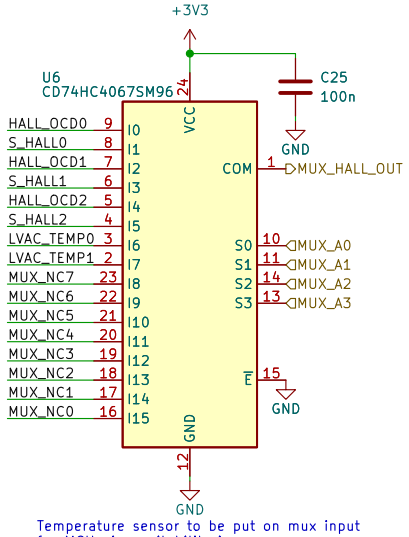
Vref = 1.65V
Theoretical Sensitivity = 1.84 mV/A

Vout = Vref+Current*Sensitivity

Current = (Vout − Vref)/Sensitivity

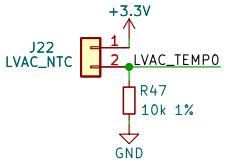
OCD is low when the current flowing
the current transducer is 2.92*Ipn
Ipn is the primary nominal current,
which in this case is 50A

This can just be used during tests to
determine average current going through the AS

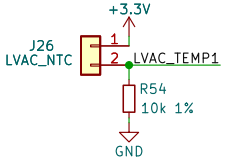


Temperature sensor to be put on mux input
for MCU pin availability issue

LVAC TEMPERATURE SENSORS

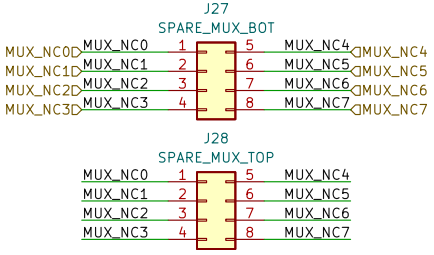


NTC Battery temperature sensor
10k



This can connector can be
attached to an NTC or alternatively
to another sensor that can be addded later.

MUX SPARE PINS



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Nicolò Durisotto
E-Agle TRT

Sheet: /SENSORS/
File: sensors.kicad_sch

Title: Fenice BMS LV

Size: A4	Date: 2021-10-12	**Rev: 1.1**
KiCad E.D.A.	kicad 6.0.11-2627ca5db0~126~ubuntu22.04.1	Id: 6/5

LVS CONNECTORS

RADIATOR FANS
VA68-B101-83A

PUMPS
INTG3-573
Maximum pump power 60W

FAN_HV
SAN_ACE 80
2 x SAN ACE 80 on TSAC, PWM signal is controlled by mainboard
Maximum current draw is 1.7A for the 24V model

current to the modem is 2A max at 9V

J31
1-776231-4

J32
1-776231-4

VDC
F10 7.5A
FAN_SUPPLY
FAN_FB
R64 1M
J33
FAN_LV
FAN
GND

PUMPS

+5V
U9C
NCS2333DR2G
GND

U9A
NCS2333DR2G
PUMP_RD
PUMP_L_5V
R68 5k1
R66 10k
GND

JP6
Pump Bridge
PUMP_R_5V

U9B
NCS2333DR2G
PUMP_LD
R69 5k1
R67 10k
GND

VDC
F12 7.5A
PUMP_SUPPLY
PUMPS_FB
R65 1M
GND

RADIATORS

VDC
2N7002NXAK
R76 3k9
RAD_L
Q16 PHB29N08T
R72 33
RAD_L_CMD
Q14
R74 100k
R78 10k
GND

VDC
2N7002NXAK
R77 3k9
RAD_R
Q17 PHB29N08T
R73 33
RAD_R_CMD
Q15
R75 100k
R79 10k
GND

VDC
F14 7.5A
RADIATOR_SUPPLY
RADIATORS_FB
RAD_L
D34
STTH1002CT
RAD_R
R80 1M
GND

AUTONOMOUS DRIVE ENABLE

This is simply a connector to bypass the RES on the SD

J30
RES

VDC
F6 5A
ASMS_FB
J29
ASMS

K4
VCF4-1000
VAA
AS_SUPPLY
AS_ACTUATION_FB
K2
PR16-24V-540-2C
D27
1N4148W
D24
1N4148W
GND

Datasheet
V23134-J0053-D642

JETSON DCDC

U7
DCDC2510
VAA
F11 10A
AS_COMPUTER_SUPPLY
GND

This voltage divider is thought for maximum 18V
AS_COMPUTER_SUPPLY
R61 15k
R62 3k3
R63 1k
C26 100n
D31
PDZ3.6BGWX
AS_COMPUTER_FB
GND

SHUTDOWN POWER SUPPLY

AIR
GV242BAC
J35
SD

VDC
F13 7.5A
5A would still be ok
SHUTDOWN_FB
U10
DCDC2510
VSD
F15 7.5A
SD_START
GND

RES can be supplied from this DCDC

RES characteristics (FSG handbook 2023):
12 to 24V supply voltage
0.26A at 12V

INVERTERS

inverter enable signals

VSD
SD_END
D23
1N4148W
K3
EX12U1S
FRG
FRG_END
R55 33
R56 10k
Q11
2N7002NXAK
GND

VSD
SD_END
D28
1N4148W
K5
EX12U1S
RFE
RFE_END
R57 33
R59 10k
Q12
2N7002NXAK
GND

VDC
F8 5A
INVERTERS_SUPPLY
INVERTERS_FB
R58 1M
GND

Inverter works with voltage rating 18-25.5V (tested)

SHUTDOWN FEEDBACKS

+3V3
U8
CD74HC4067SM96
C27 100n
GND
COM
MUX_OUT
S0 MUX_A0
S1 MUX_A1
S2 MUX_A2
S3 MUX_A3
E
SD_END
BSPD_FB
IMD_FB
LVMS_FB
RES_FB
TSMS_FB
LV_ENCL_1_FB
LV_ENCL_2_FB
HV_ENCL_1_FB
HV_ENCL_2_FB
BACK_PLATE_FB
HVD_FB
AMS_FB
ASMS_FB
INTERLOCK_FB
SD_START
RN8 RN9 RN10 RN11 RN12 RN13
3k3
27k

J34
Conn_02x03_Top_Bottom
LVMS_FB
TSMS_FB
GND
RES_FB
LV_ENCL_2_FB
LV_ENCL_1_FB

DISCHARGE MOSFET

D32
RGL34B
SD_END
D33
SMAJ40CA
DISCHARGE+
DISCHARGE-
DISCHARGED
R70 33
R71 10k
Q13
2N7002NXAK
GND

DISCHARGE RELAY
PNC113

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E-Agle TRT

Sheet: /LVS/
File: LVS.kicad_sch

Title: Fenice BMS LV

Size: A3	Date: 2021-10-12	**Rev: 1.1**
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