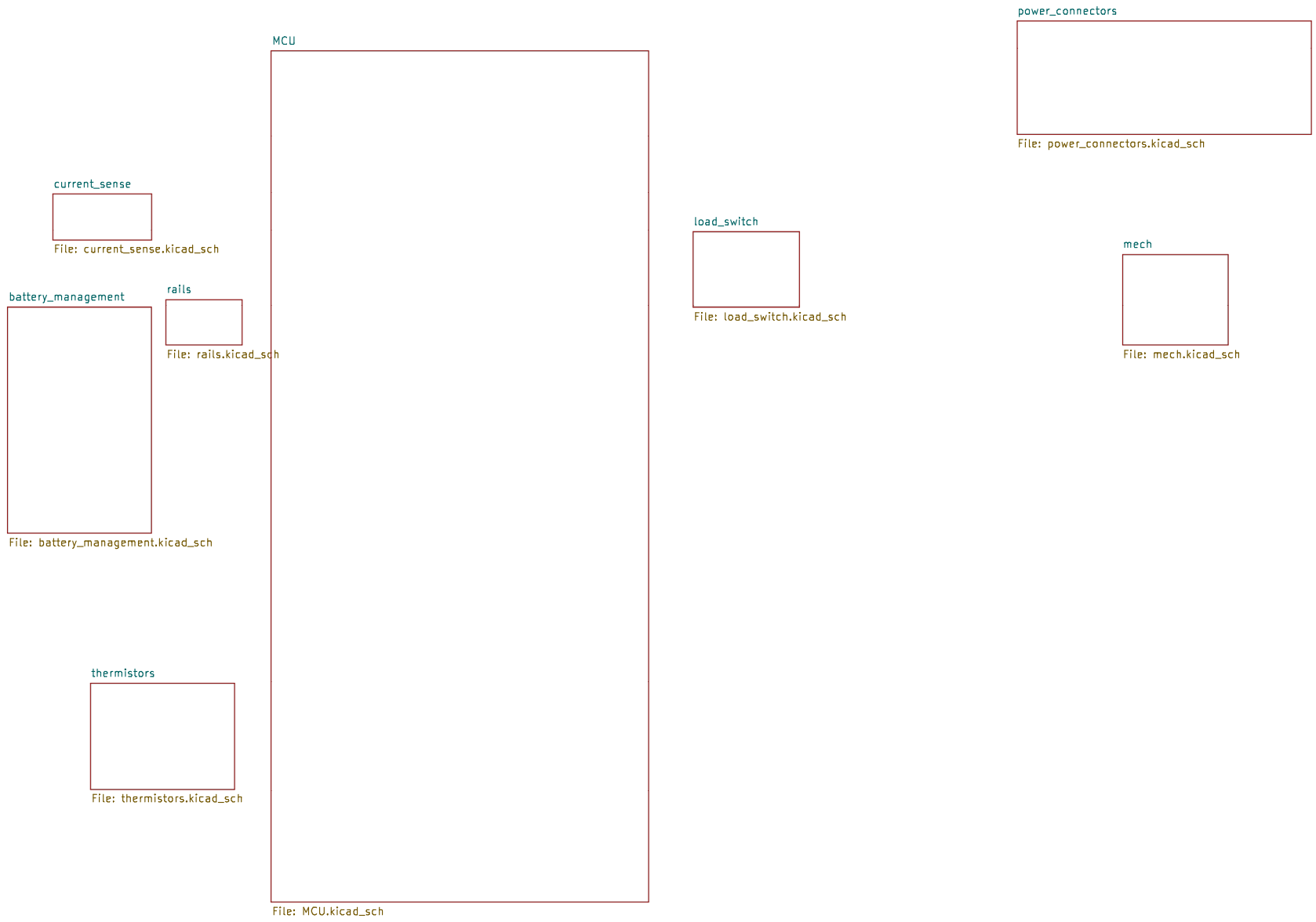
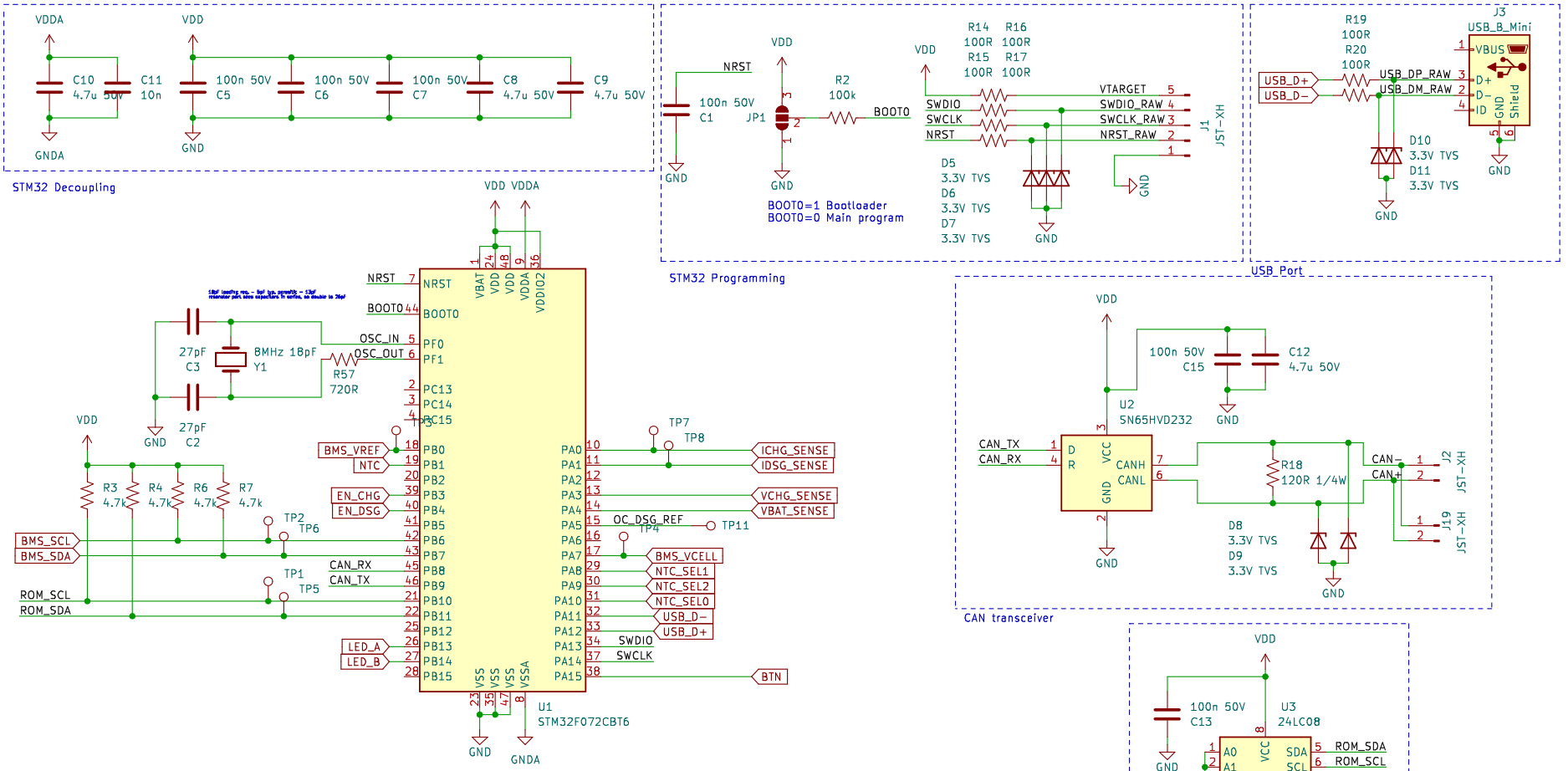
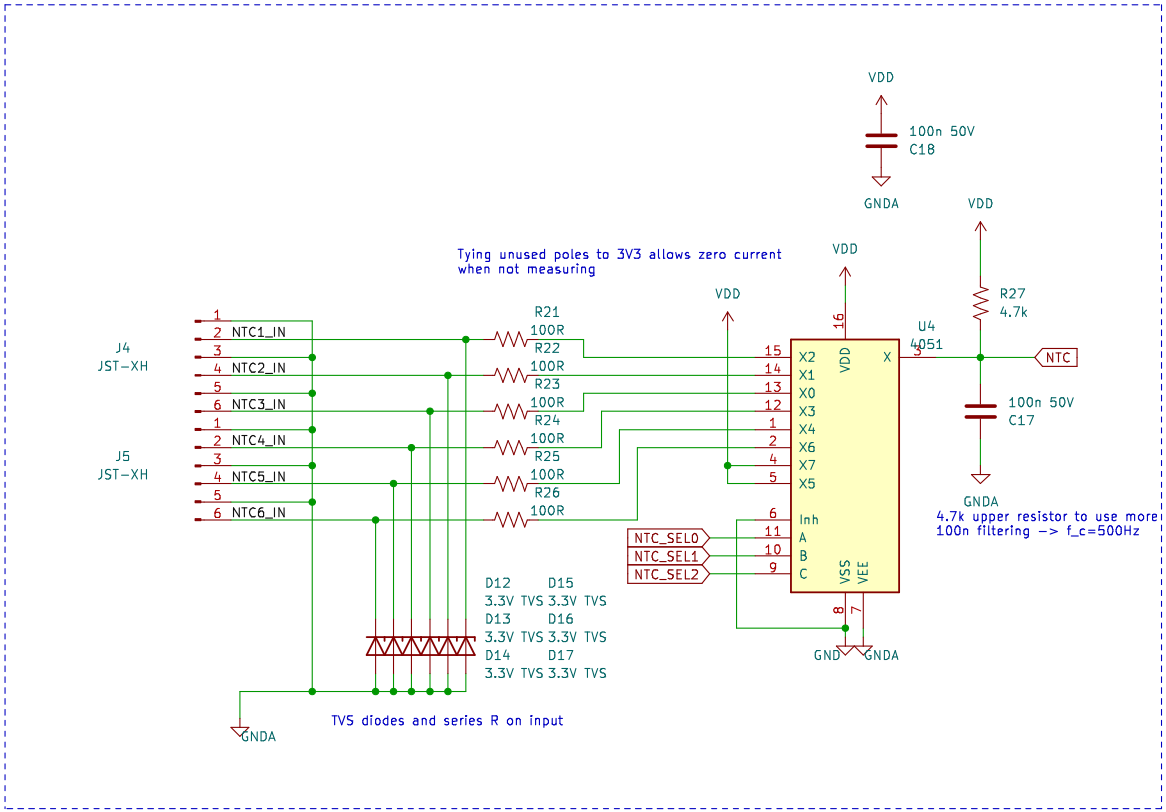
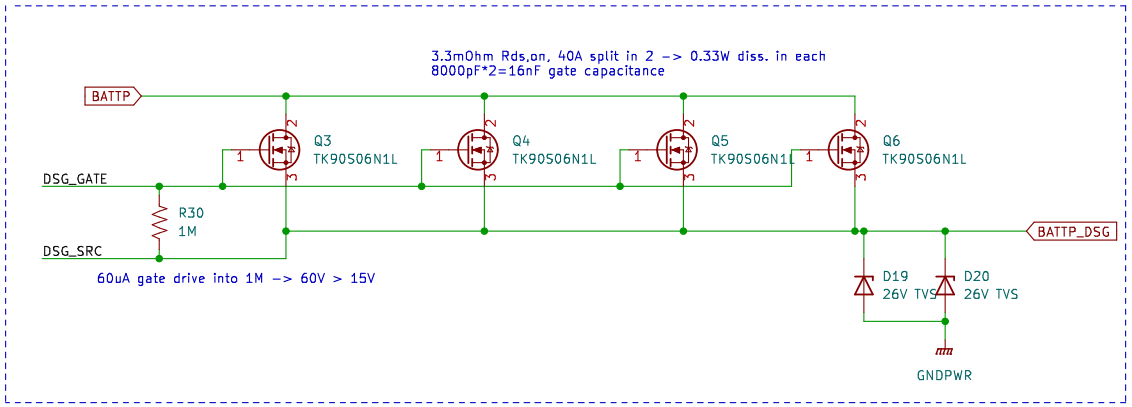

power_connectors
File: power_connectors.kicad_sch
MCU
current_sense
File: current_sense.kicad_sch
load_switch
File: load_switch.kicad_sch
mech
File: mech.kicad_sch
battery_management
rails
File: rails.kicad_sch
File: battery_management.kicad_sch
thermistors
File: thermistors.kicad_sch
File: MCU.kicad_sch


STM32 Decoupling
STM32 Programming
BOOT0=1 Bootloader
BOOT0=0 Main program
USB Port
CAN transceiver
Persistent data EEPROM
Indicator LEDs
U1
STM32F072CBT6
U2
SN65HVD232
U3
24LC08
J1
JST-XH
J2
J19
J3
USB_B_Mini
STM32 Microcontroller

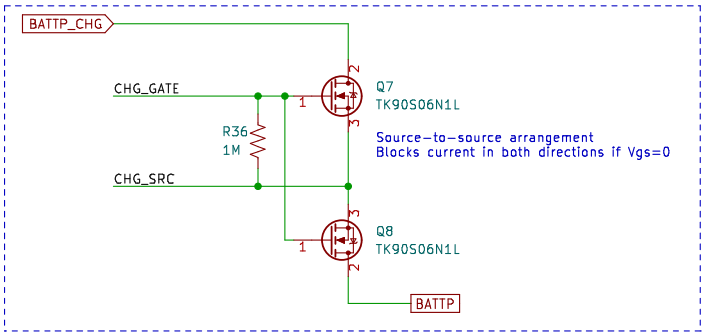


Thermistor analog MUX into ADC

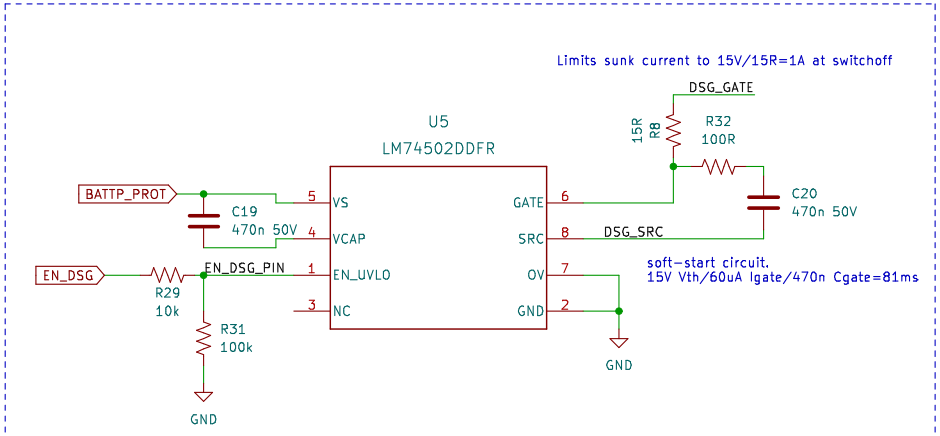
Thermistors



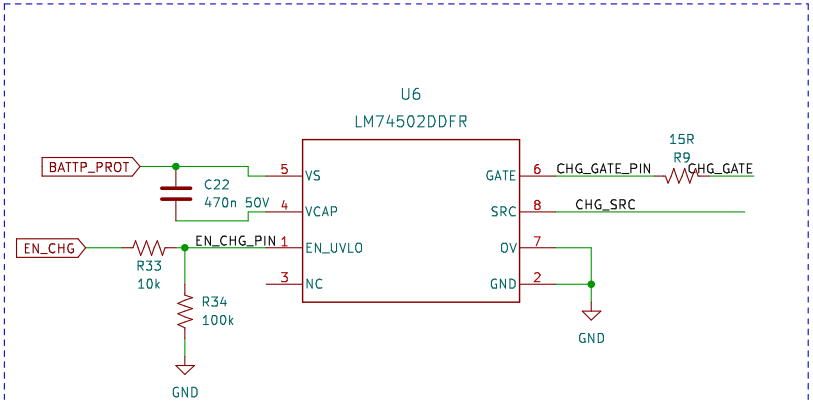
Discharging switch



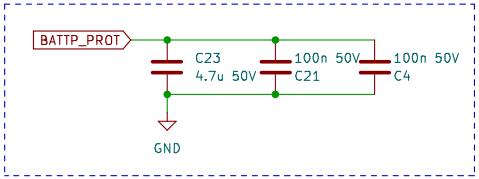
Charging switch



Discharge FET gate driver

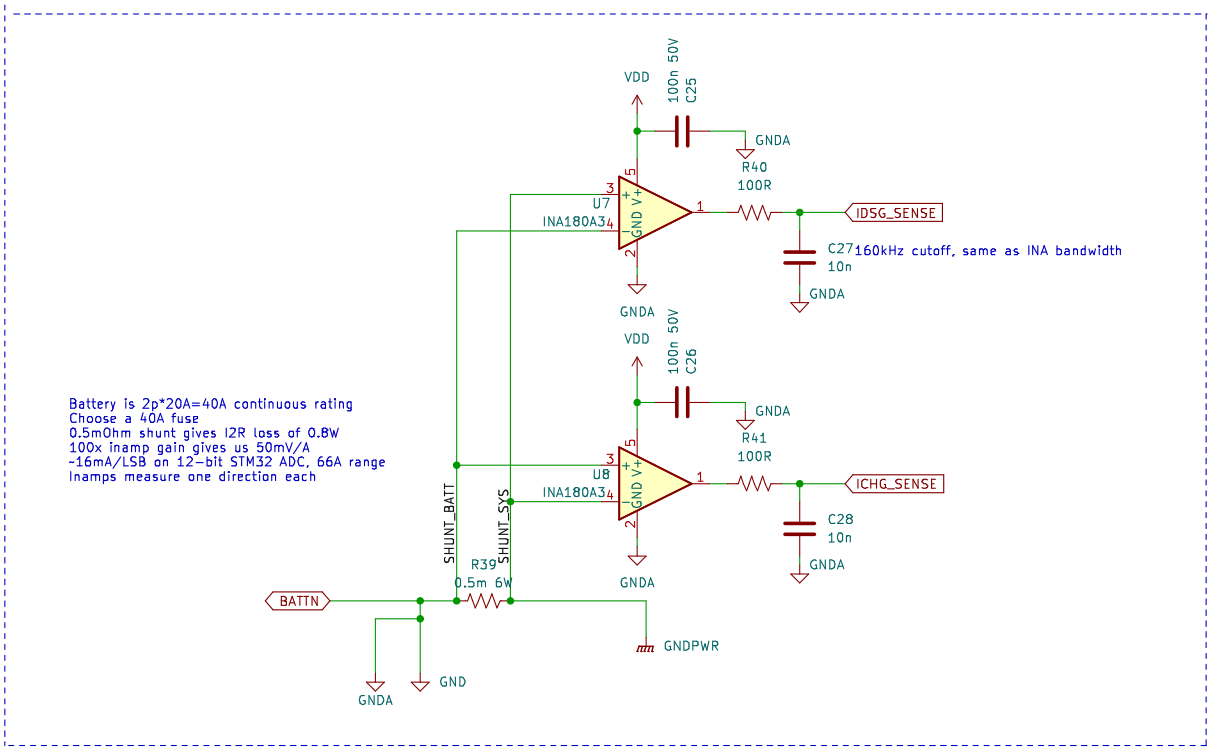


Charge FET gate driver



Decoupling for gate drivers

Charge/discharge switches

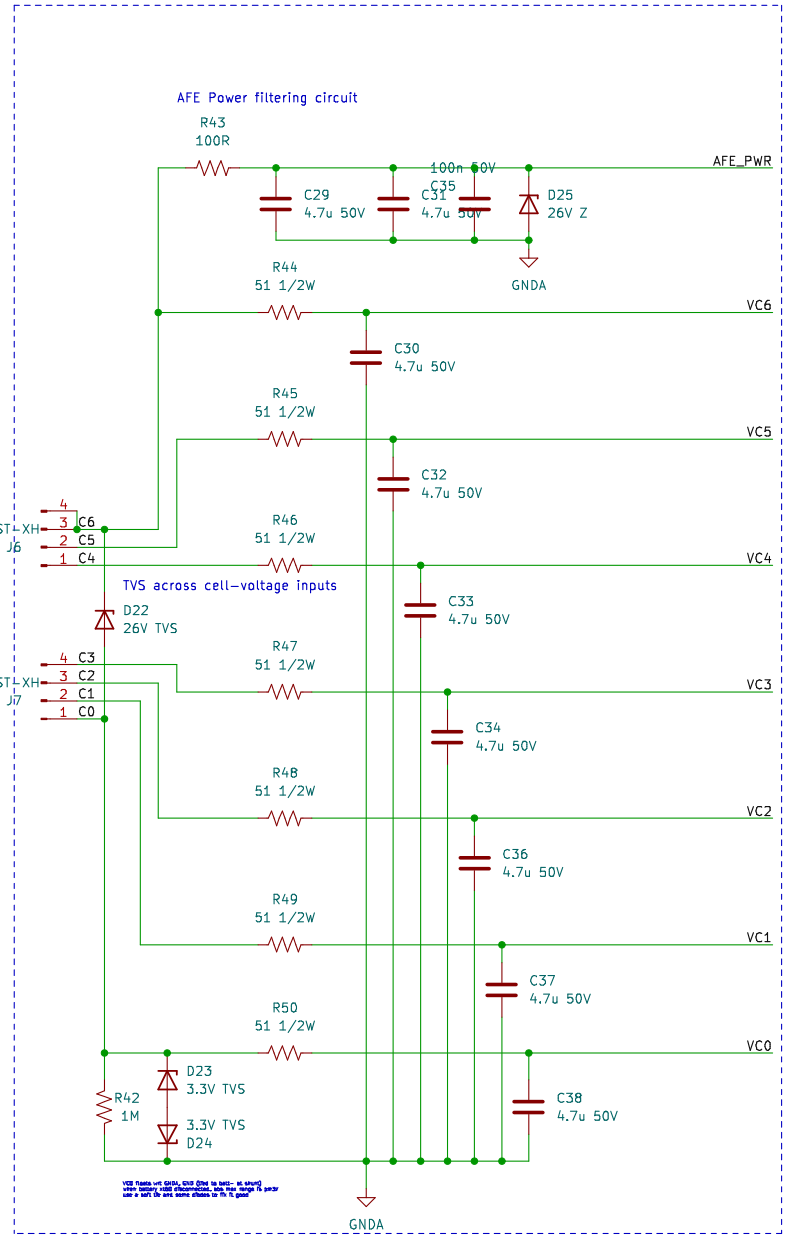


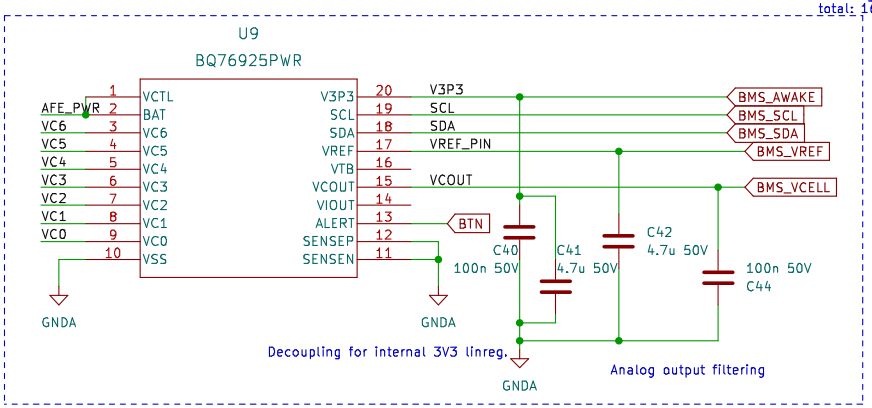
Bidirectional current sense shunt and amplifiers

Current sensing

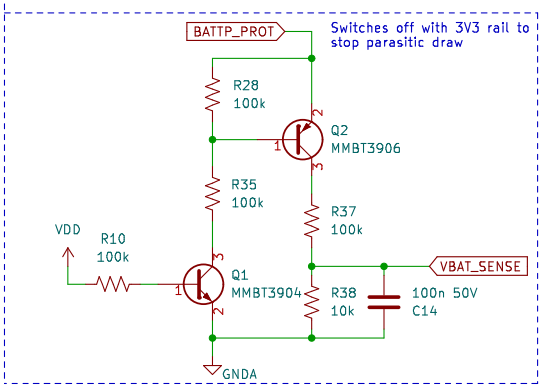
Battery management system

Quiescent current draw:
Load switches: 2x2.5uA
BMS AFE: 1uA
3V3 Reg: 10uA (3uA typ)
total: 16uA. A 6Ah battery lasts ~40yr

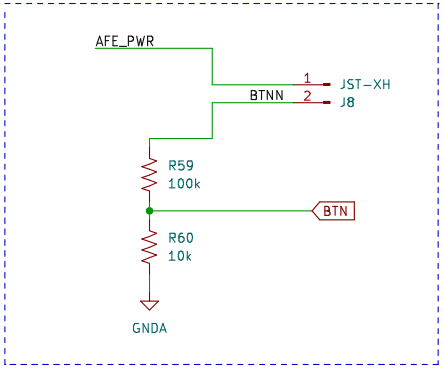




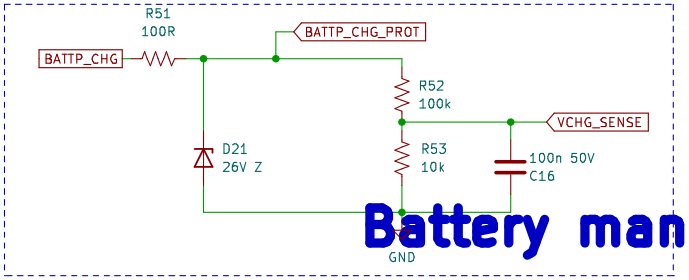
BMS analog front end IC



Battery voltage sense



Wake button circuit
Also used as STM32 input

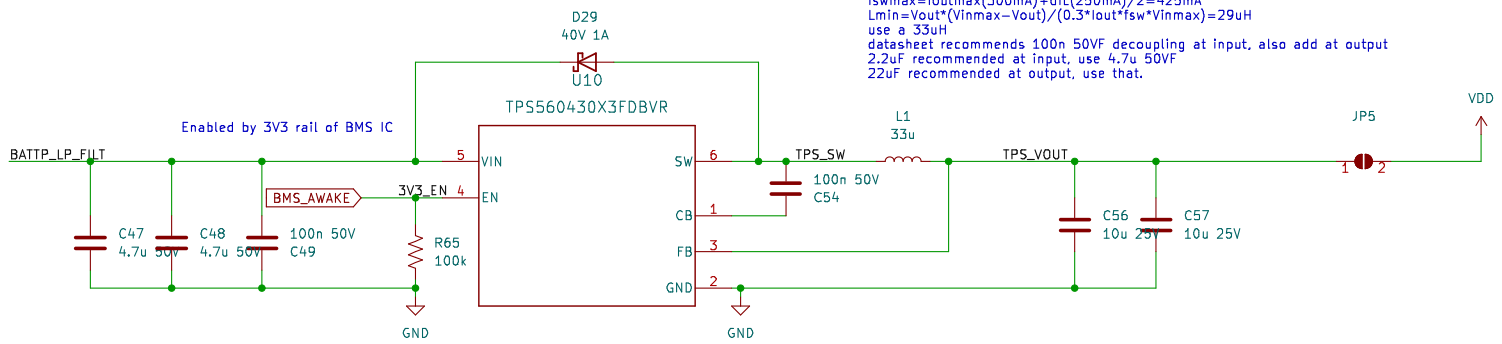


Charger input voltage sense

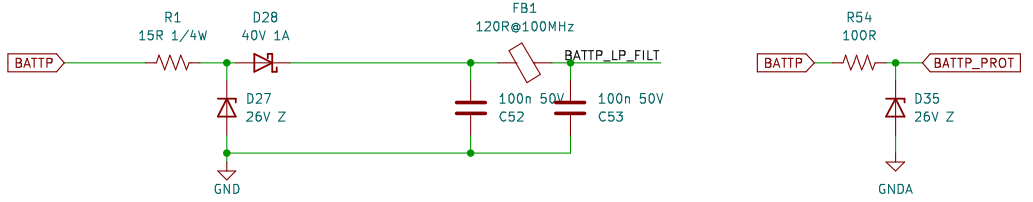
Switching reg design
output: 3.3V 300mA
input: 22.2-25.2V (6S)

part: TPS560430X3F
4-36V Vin, Vsw=1.1MHz, Vout=3.3V+/-1.5%
logic-level EN input active High, 3uA shutdown current

duty cycle = Vout/(eta*Vinmax)=15% - (eta=85% efficiency)
dIL=(Vinmax-Vout)*D/(fsw*Lavg)=250mA (use 12uH inductor recommended in datasheet)
IICmax=IIimmin(800mA)-(1/2)*dIL(250mA)=675mA>300mA load OK
Iswmax=Ioutmax(300mA)+dIL(250mA)/2=425mA
Lmin=Vout*(Vinmax-Vout)/(0.3*Iout*fsw*Vinmax)=29uH
use a 33uH
datasheet recommends 100n 50VF decoupling at input, also add at output
2.2uF recommended at input, use 4.7u 50VF
22uF recommended at output, use that.



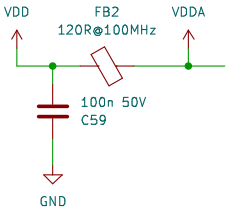
3V3 Step-down DC/DC converter



Zener clamp + holdup ckt feeds step-down

Zener clamp feeds bus voltage sense divider

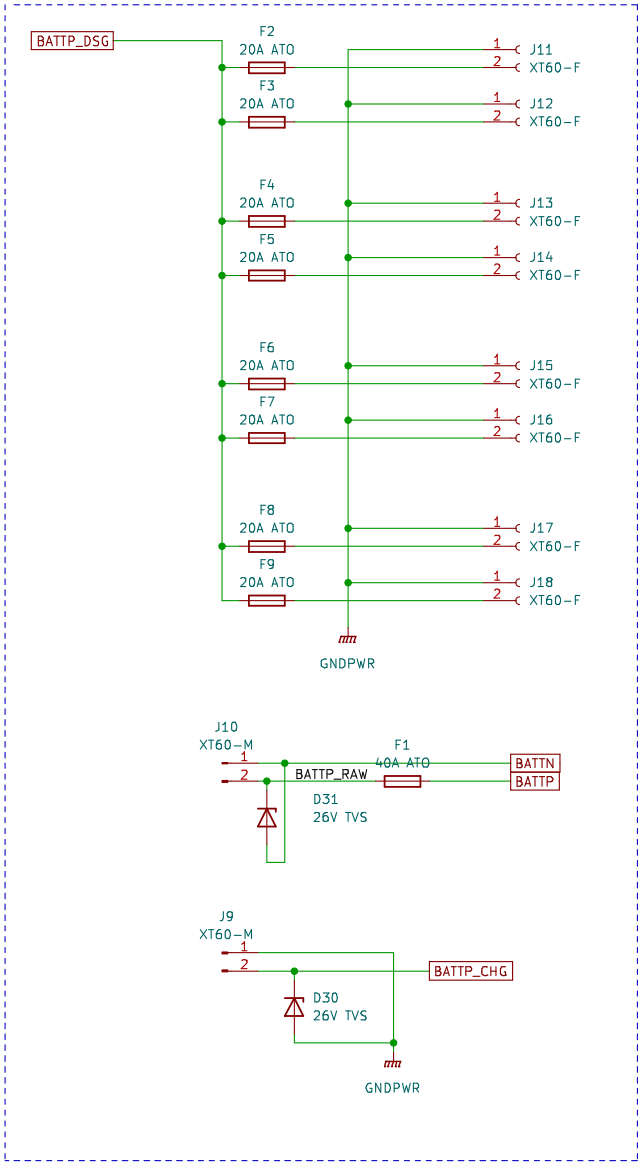
Filters for bus voltage



Analog domain filter

Power rail generation


H1
MountingHole
H2
MountingHole
H3
MountingHole
H4
MountingHole



Power connectors

TVS diodes are sprinkled near XT60 plugs to avoid ESD, transients breaking ckt

To avoid debris causing shorts:
Female XT60s are used for power out.
Male XT60s are used for power in.

Power connectors