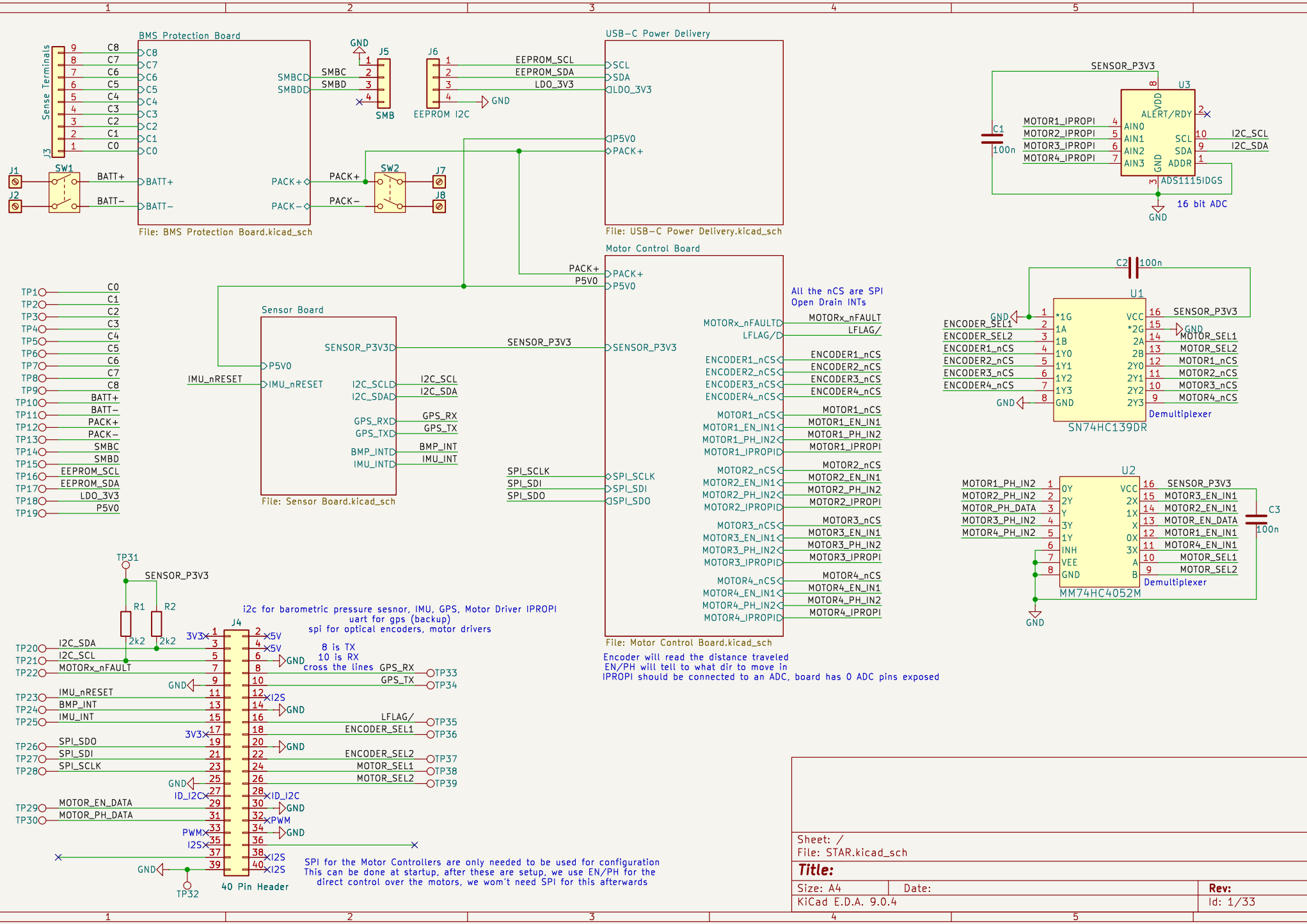
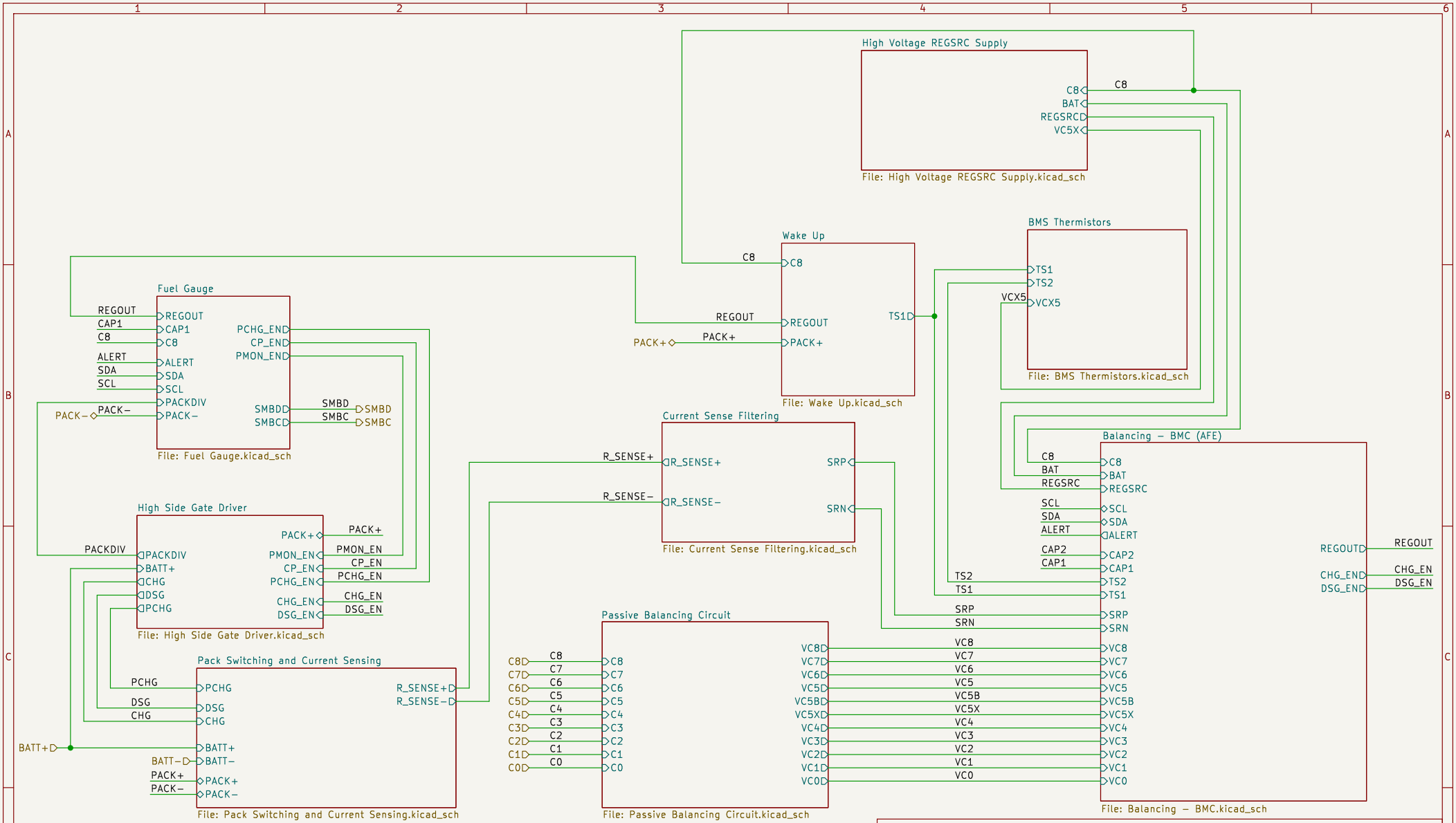

BMS Protection Board
Sense Terminals
J3
C8
C7
C6
C5
C4
C3
C2
C1
C0
SMBC
SMBD
GND
J5
SMB
J6
EEPROM I2C
EEPROM_SCL
EEPROM_SDA
LDO_3V3
GND
J1
J2
SW1
BATT+
BATT−
PACK+
PACK−
SW2
J7
J8
File: BMS Protection Board.kicad_sch
USB−C Power Delivery
SCL
SDA
LDO_3V3
P5V0
PACK+
File: USB−C Power Delivery.kicad_sch
SENSOR_P3V3
U3
VDD
ALERT/RDY
MOTOR1_IPROPI
MOTOR2_IPROPI
MOTOR3_IPROPI
MOTOR4_IPROPI
AIN0
AIN1
AIN2
AIN3
GND
SCL
SDA
ADDR
I2C_SCL
I2C_SDA
C1
100n
ADS1115IDGS
16 bit ADC
TP1
TP2
TP3
TP4
TP5
TP6
TP7
TP8
TP9
TP10
TP11
TP12
TP13
TP14
TP15
TP16
TP17
TP18
TP19
Sensor Board
SENSOR_P3V3
P5V0
IMU_nRESET
I2C_SCL
I2C_SDA
GPS_RX
GPS_TX
BMP_INT
IMU_INT
File: Sensor Board.kicad_sch
Motor Control Board
PACK+
P5V0
SENSOR_P3V3
SPI_SCLK
SPI_SDI
SPI_SDO
All the nCS are SPI
Open Drain INTs
MOTORx_nFAULT
LFLAG/
ENCODER1_nCS
ENCODER2_nCS
ENCODER3_nCS
ENCODER4_nCS
MOTOR1_nCS
MOTOR1_EN_IN1
MOTOR1_PH_IN2
MOTOR1_IPROPI
MOTOR2_nCS
MOTOR2_EN_IN1
MOTOR2_PH_IN2
MOTOR2_IPROPI
MOTOR3_nCS
MOTOR3_EN_IN1
MOTOR3_PH_IN2
MOTOR3_IPROPI
MOTOR4_nCS
MOTOR4_EN_IN1
MOTOR4_PH_IN2
MOTOR4_IPROPI
File: Motor Control Board.kicad_sch
Encoder will read the distance traveled
EN/PH will tell to what dir to move in
IPROPI should be connected to an ADC, board has 0 ADC pins exposed
C2
100n
U1
*1G
*2G
1A
1B
1Y0
1Y1
1Y2
1Y3
2A
2B
2Y0
2Y1
2Y2
2Y3
VCC
ENCODER_SEL1
ENCODER_SEL2
ENCODER1_nCS
ENCODER2_nCS
ENCODER3_nCS
ENCODER4_nCS
MOTOR_SEL1
MOTOR_SEL2
MOTOR1_nCS
MOTOR2_nCS
MOTOR3_nCS
MOTOR4_nCS
Demultiplexer
SN74HC139DR
U2
0Y
2Y
Y
3Y
1Y
INH
VEE
0X
3X
A
B
MOTOR1_PH_IN2
MOTOR2_PH_IN2
MOTOR_PH_DATA
MOTOR3_PH_IN2
MOTOR4_PH_IN2
MOTOR3_EN_IN1
MOTOR2_EN_IN1
MOTOR_EN_DATA
MOTOR1_EN_IN1
MOTOR4_EN_IN1
C3
100n
MM74HC4052M
TP31
R1
R2
2k2
2k2
i2c for barometric pressure sesnor, IMU, GPS, Motor Driver IPROPI
uart for gps (backup)
spi for optical encoders, motor drivers
J4
3V3
5V
I2S
ID_I2C
PWM
8 is TX
10 is RX
cross the lines GPS_RX
GPS_TX
LFLAG/
ENCODER_SEL1
ENCODER_SEL2
MOTOR_SEL1
MOTOR_SEL2
MOTOR_EN_DATA
MOTOR_PH_DATA
TP20
TP21
TP22
TP23
TP24
TP25
TP26
TP27
TP28
TP29
TP30
TP32
TP33
TP34
TP35
TP36
TP37
TP38
TP39
40 Pin Header
SPI for the Motor Controllers are only needed to be used for configuration
This can be done at startup, after these are setup, we use EN/PH for the
direct control over the motors, we wom't need SPI for this afterwards
Sheet: /
File: STAR.kicad_sch
Title:
Size: A4
Date:
Rev:
KiCad E.D.A. 9.0.4
Id: 1/33



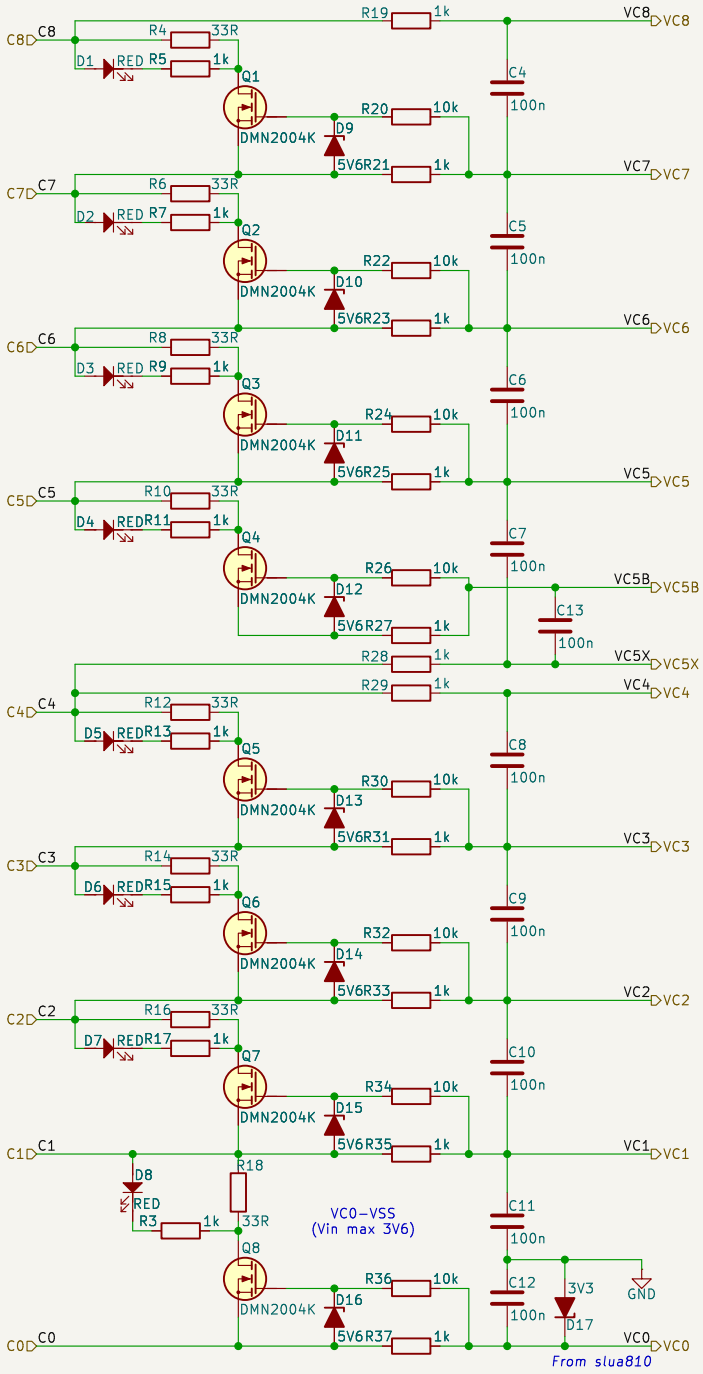
BMS Protection Board for 8S Battery Pack
In/Out: min voltage: 25.6V, nominal voltage: 29.6V, max voltage: 33.6V
Output: 50A continuous discharge current
Min Each Cell set to 3.2V, Max Each Cell set to 4.2V

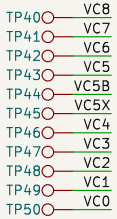
Sheet: /BMS Protection Board/
File: BMS Protection Board.kicad_sch

Title:

Size: A4	Date:	**Rev:**
KiCad E.D.A. 9.0.4		Id: 2/33

Passive Balancing Circuit

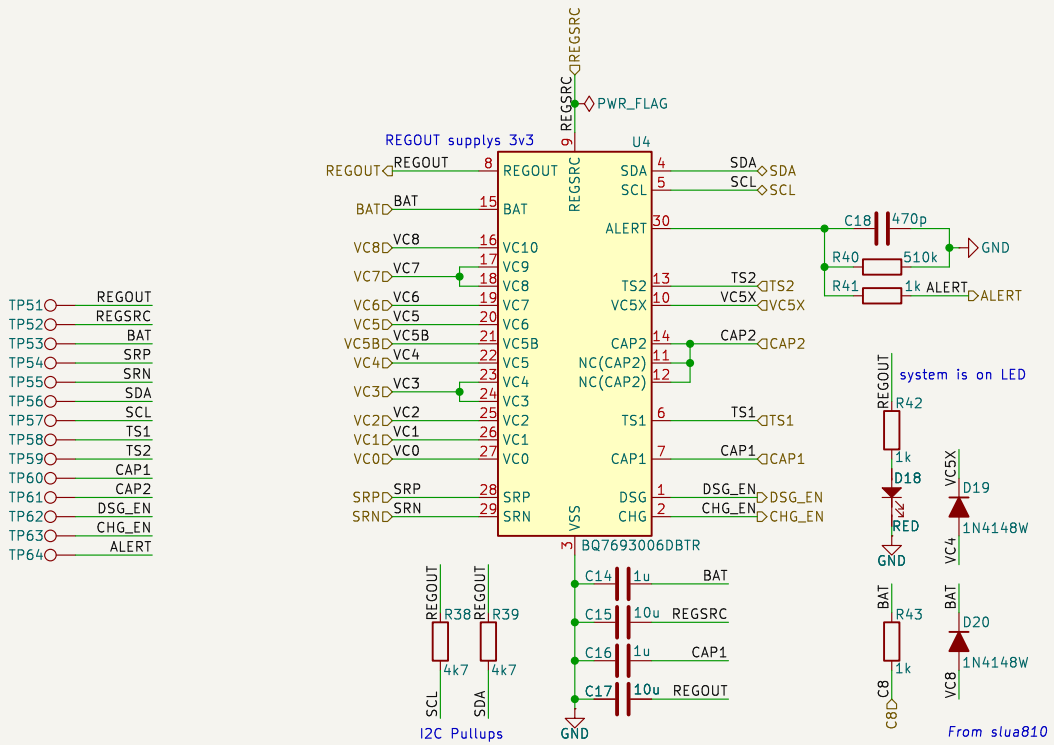




Sheet: /BMS Protection Board/Passive Balancing Circuit/
File: Passive Balancing Circuit.kicad_sch

Title:

Size: A4	Date:	**Rev:**
KiCad E.D.A. 9.0.4		Id: 3/33



Balancing & BMC (AFE)

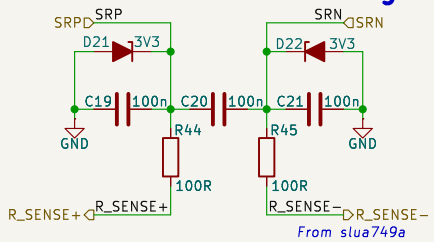
TP51	REGOUT
TP52	REGSRC
TP53	BAT
TP54	SRP
TP55	SRN
TP56	SDA
TP57	SCL
TP58	TS1
TP59	TS2
TP60	CAP1
TP61	CAP2
TP62	DSG_EN
TP63	CHG_EN
TP64	ALERT

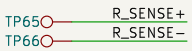
Sheet: /BMS Protection Board/Balancing – BMC (AFE)/
File: Balancing – BMC.kicad_sch

Title:

Size: A4 | Date: | **Rev:**
KiCad E.D.A. 9.0.4 | Id: 4/33

Current Sense Filtering

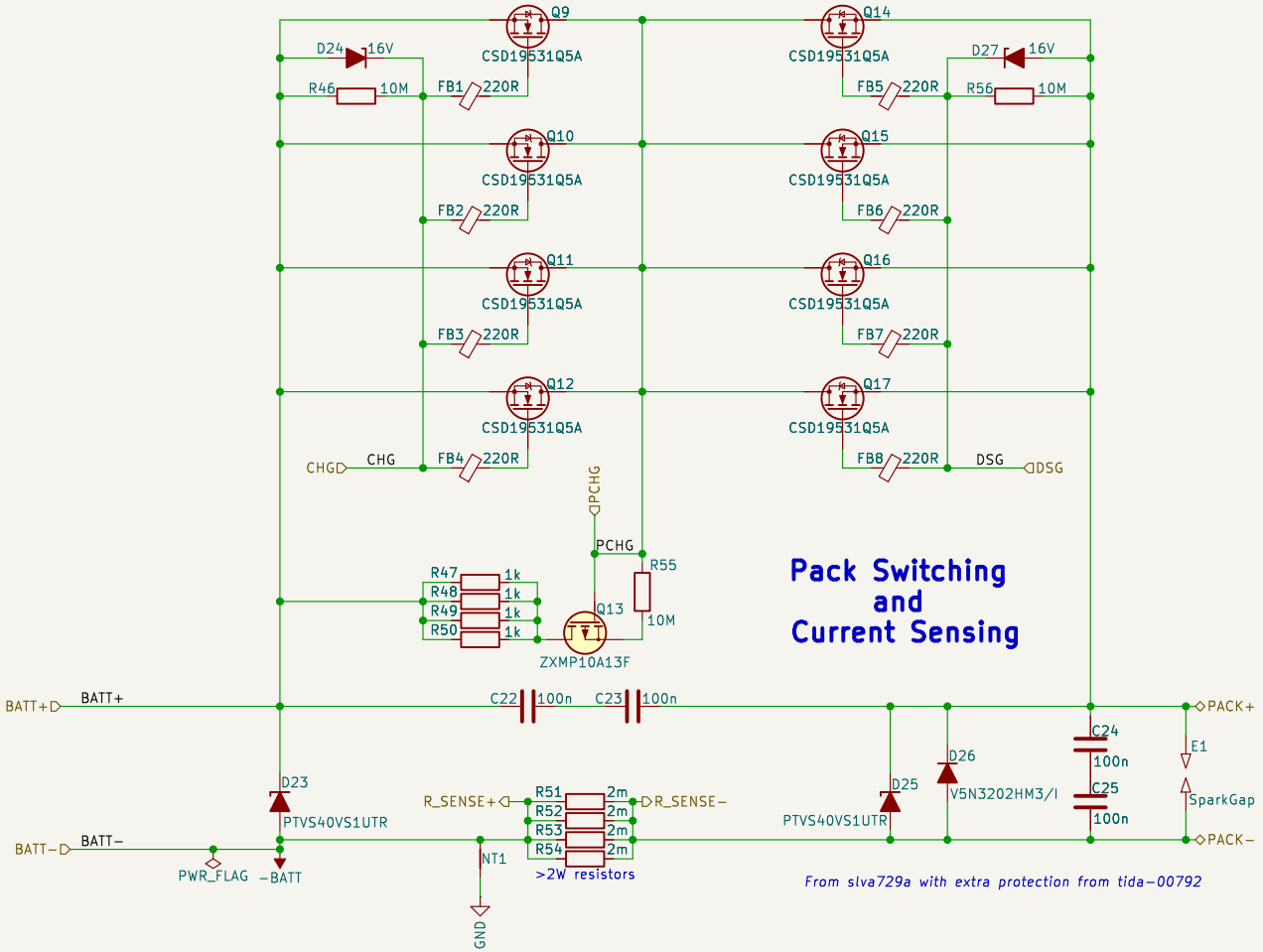




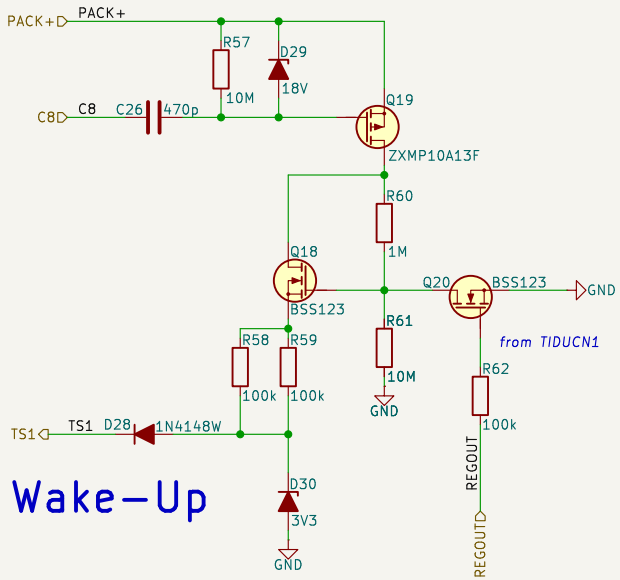
Sheet: /BMS Protection Board/Current Sense Filtering/
File: Current Sense Filtering.kicad_sch

Title:

Size: A4	Date:	**Rev:**
KiCad E.D.A. 9.0.4		Id: 5/33

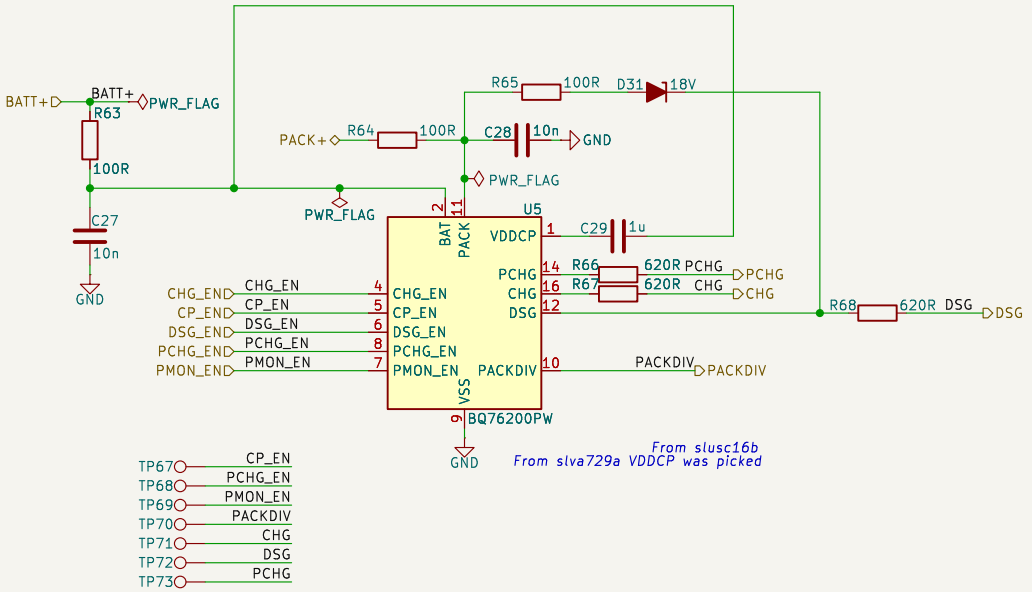


Sheet: /BMS Protection Board/Pack Switching and Current Sensing/		
File: Pack Switching and Current Sensing.kicad_sch		
Title:		
Size: A4	Date:	**Rev:**
KiCad E.D.A. 9.0.4		Id: 6/33



Sheet: /BMS Protection Board/Wake Up/		
File: Wake Up.kicad_sch		
Title:		
Size: A4	Date:	**Rev:**
KiCad E.D.A. 9.0.4		Id: 7/33

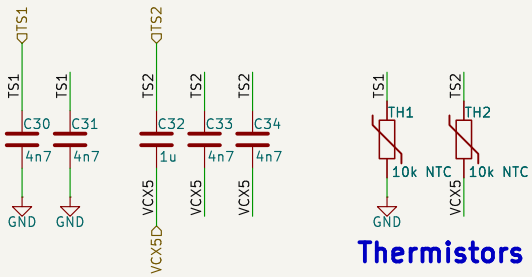
High-Side Gate Driver



Sheet: /BMS Protection Board/High Side Gate Driver/
File: High Side Gate Driver.kicad_sch

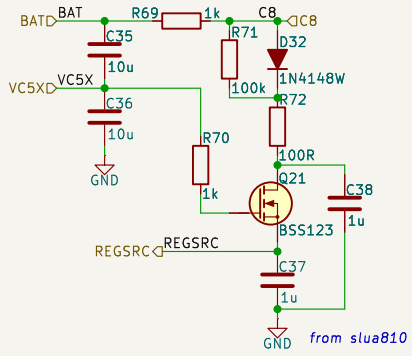
Title:

Size: A4	Date:	**Rev:**
KiCad E.D.A. 9.0.4		Id: 8/33



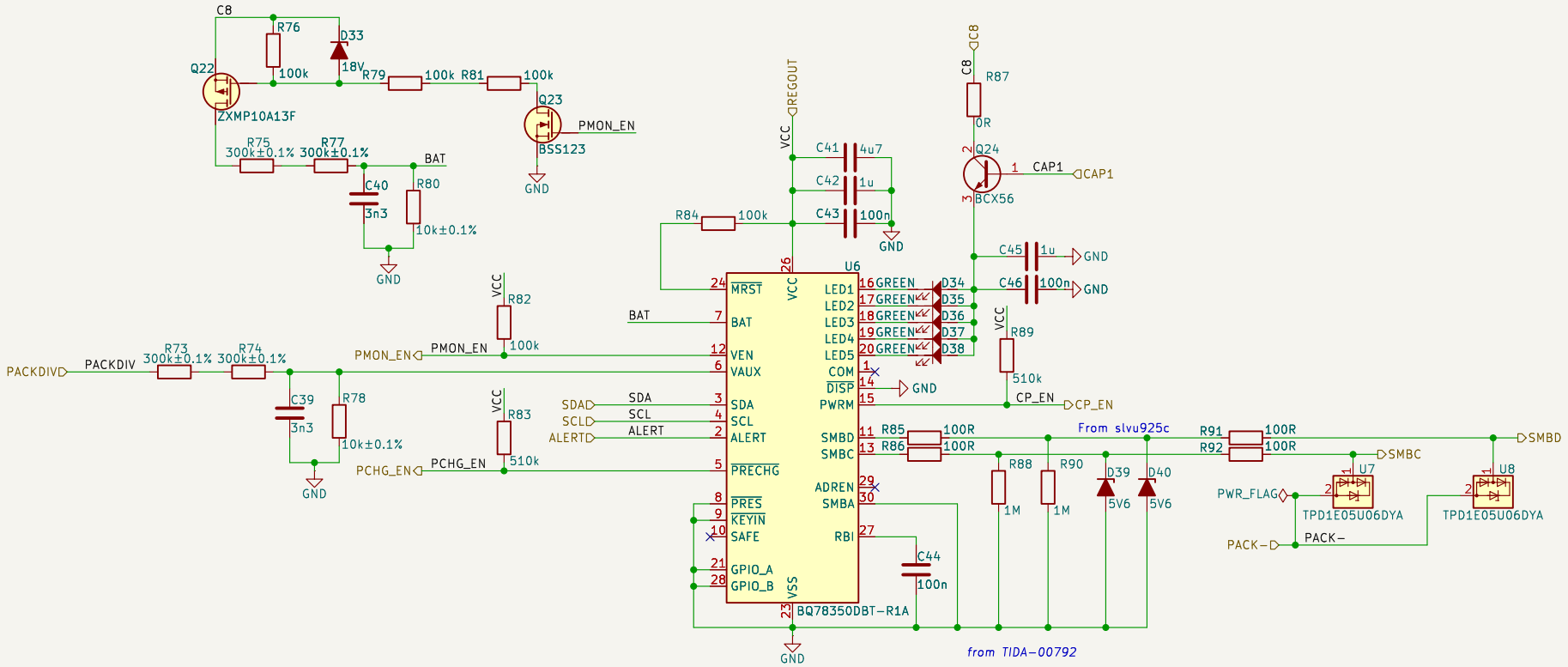
Sheet: /BMS Protection Board/BMS Thermistors/		
File: BMS Thermistors.kicad_sch		
Title:		
Size: A4	Date:	**Rev:**
KiCad E.D.A. 9.0.4		Id: 9/33

High Voltage REGSRC Supply



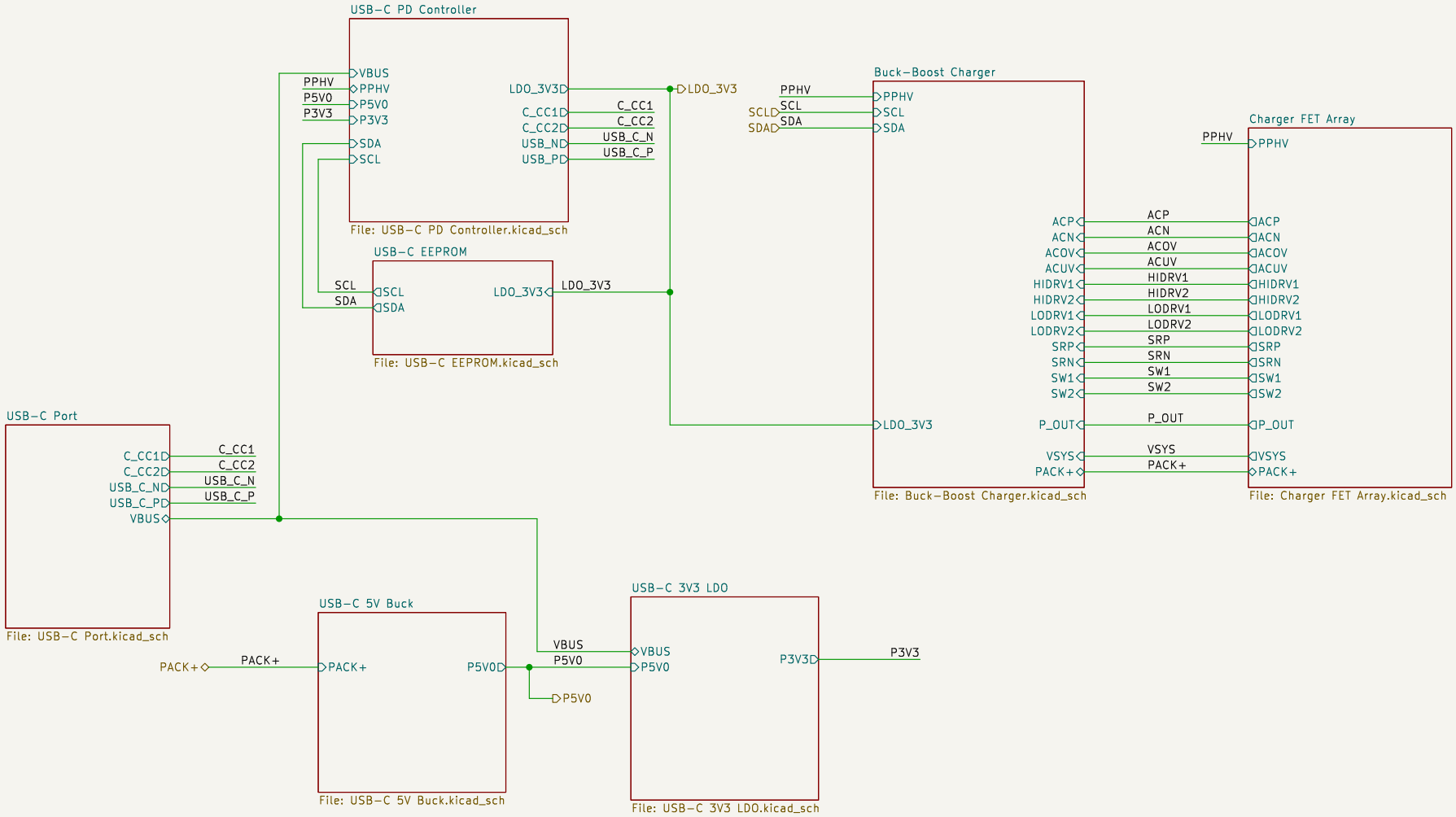
Sheet: /BMS Protection Board/High Voltage REGSRC Supply/		
File: High Voltage REGSRC Supply.kicad_sch		
Title:		
Size: A4	Date:	**Rev:**
KiCad E.D.A. 9.0.4		Id: 10/33

Fuel Gauge



Flash this with TI's software, will need to connec to computer with SMB to USB adapter, could use the expensive one from TI, but $$$

Sheet: /BMS Protection Board/Fuel Gauge/		
File: Fuel Gauge.kicad_sch		
Title:		
Size: A4	Date:	**Rev:**
KiCad E.D.A. 9.0.4		Id: 11/33



Design is based off of PMP41062

The Correct Flashing Process
Here is the correct workflow:

Generate Your Configuration: Use the TPS2575x Application Customization Tool from Texas Instruments to create the binary file (.bin) that contains all your desired settings.

Program the EEPROM Separately: Connect the CAT24C512 EEPROM to your dedicated flasher or an Arduino. Do this before connecting it to the TPS25751.

Connect power (VCC), ground (GND), SDA, and SCL.

Use the flasher's software to write the .bin file you generated onto the EEPROM.

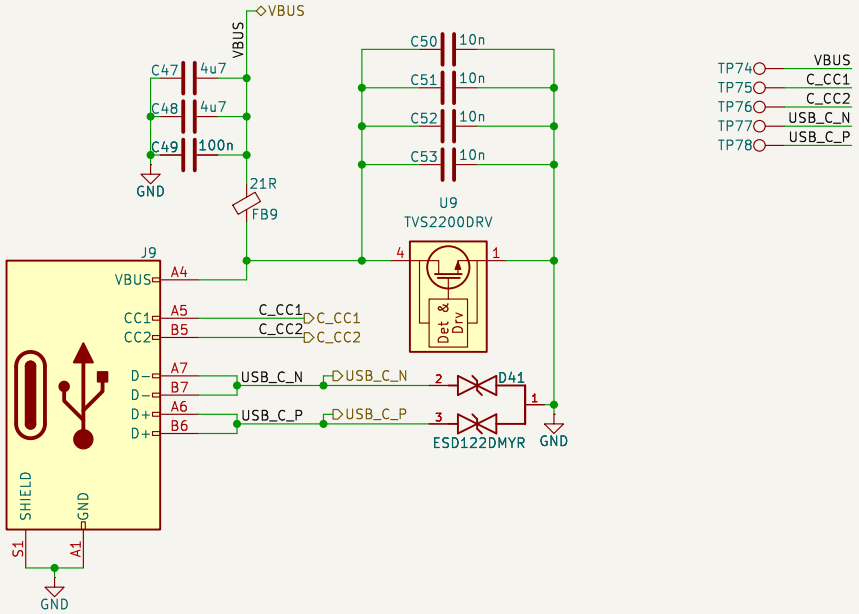
Assemble the Final Circuit: Once the EEPROM is successfully flashed, connect it to the I2Cc (the controller port) of the TPS25751.

Now, when you power on your circuit, the TPS25751 will use its I2Cc port to automatically read the settings you loaded onto the EEPROM and will configure itself correctly.

Sheet: /USB-C Power Delivery/
File: USB-C Power Delivery.kicad_sch

Title:

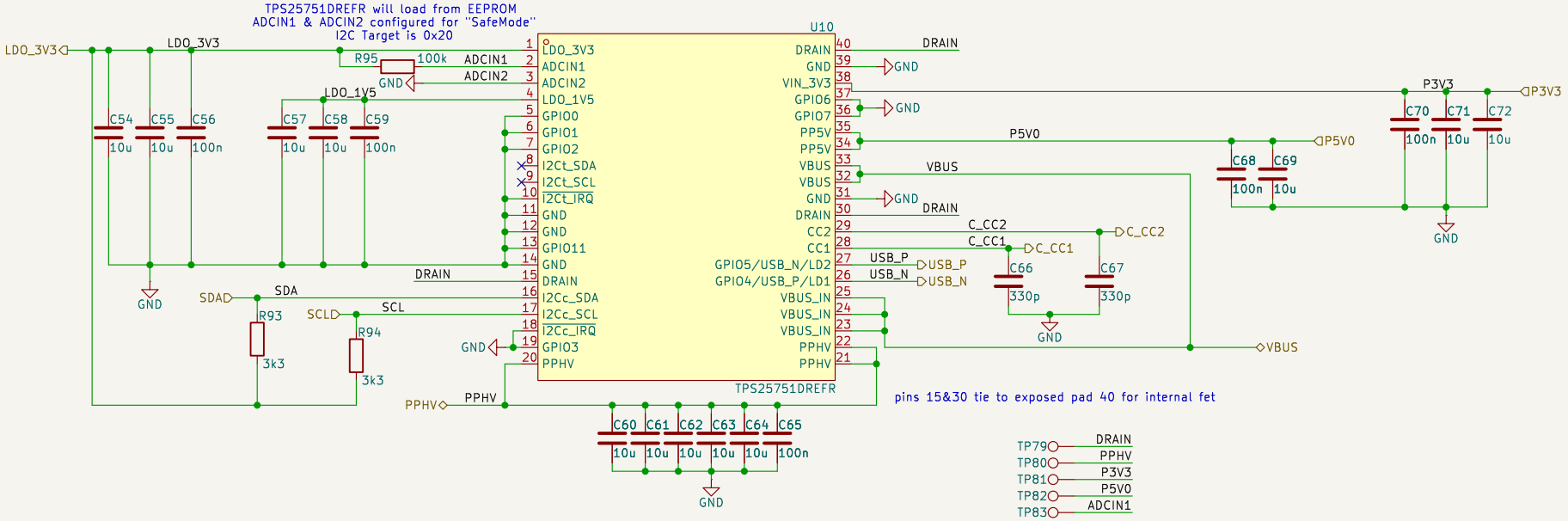
Size: A4	Date:	**Rev:**
KiCad E.D.A. 9.0.4		Id: 12/33



Sheet: /USB-C Power Delivery/USB-C Port/
File: USB-C Port.kicad_sch

Title:

Size: A4	Date:	**Rev:**
KiCad E.D.A. 9.0.4		Id: 13/33



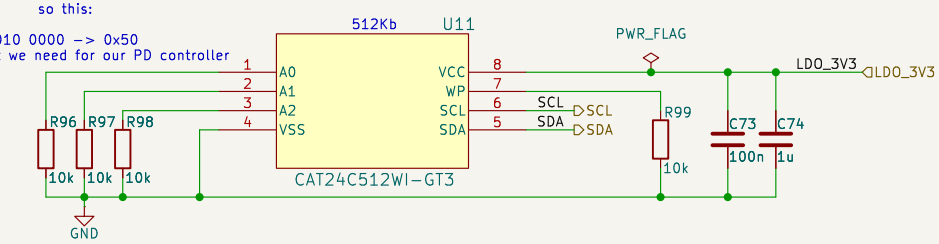
Sheet: /USB-C Power Delivery/USB-C PD Controller/		
File: USB-C PD Controller.kicad_sch		
Title:		
Size: A4	Date:	**Rev:**
KiCad E.D.A. 9.0.4		Id: 14/33

1010 ????
GND=0

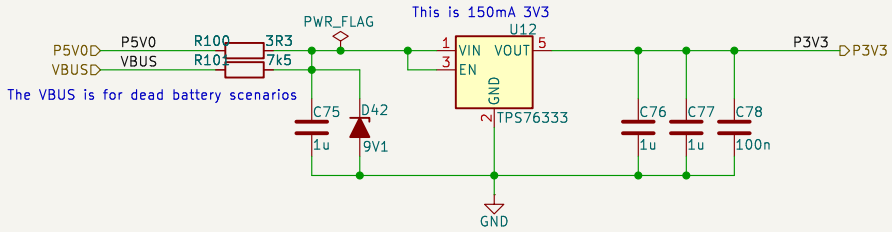
so this:

1010 0000 -> 0x50
which is what we need for our PD controller

Flash this with the bin taken from TI's website. Use I2C to USB adapter.
Flash this when the system is off (not powered), only flash/power this.



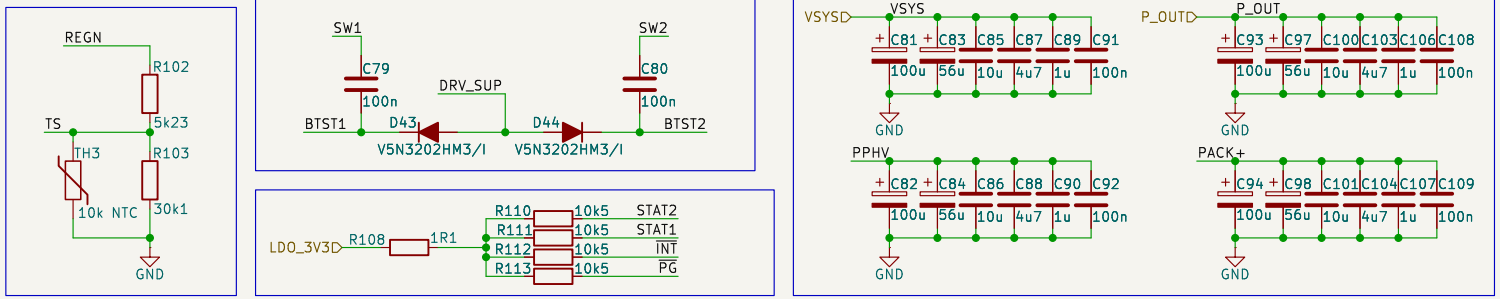
Sheet: /USB-C Power Delivery/USB-C EEPROM/		
File: USB-C EEPROM.kicad_sch		
Title:		
Size: A4	Date:	**Rev:**
KiCad E.D.A. 9.0.4		Id: 15/33



Sheet: /USB-C Power Delivery/USB-C 3V3 LDO/
File: USB-C 3V3 LDO.kicad_sch

Title:

Size: A4	Date:	**Rev:**
KiCad E.D.A. 9.0.4		Id: 16/33



these should be precision resistors

Target Voltage = 8 cells * 4.2 V/cell = 33.6 V
Rtop = 249kΩ (from datasheet's recommendation)
Rbot = Btop * (Vfb / (Vbat_reg − Vfb)) + Rfbg
Vfb: 1.536V from datasheet
Rfbg: 33Ω from datasheet
Rbot = 11.96kΩ

"PIN32 is for reverse mode voltage regulation"

U13 BQ25756RRVR

PACK+ R105 249k±0.1% R106 11k96±0.1%

R104 11k36±0.1% R107 2k49±0.1% R109 100k±0.1% R114 0R

Set to 300kHz

C95 4u7 C99 1u C102 1u C105 100n C96 4u7

GND

For my application:
8S4P setup, each cell is ~2200mAh
4 * 2200mAh = 8.8Ah

Setting charging at 0.5*C
Ichg = 8.8Ah * 0.5 = 4.4A
R = 50AkΩ / 4.4A = 11.36kΩ

Since this is 100W, 20V/5A,
a safe upper will be set for 8A

using 5mΩ sense resistor:
R = 20AkΩ / 8A = 2.5kΩ

TP84 VSYS
TP85 P_OUT
TP86 ACP
TP87 ACN
TP88 SRP
TP89 SRN
TP90 FB
TP91 FBG
TP92 TS
TP93 ICHG
TP94 ILIM_HIZ
TP95 ACUV
TP96 ACOV
TP97 FSW_SYNC
TP98 CE
TP99 BTST1
TP100 BTST2
TP101 DRV_SUP
TP102 HIDRV1
TP103 SW1
TP104 LODRV1
TP105 HIDRV2
TP106 SW2
TP107 LODRV2
TP108 REGN
TP109 INT
TP110 STAT1
TP111 STAT2
TP112 SCL
TP113 SDA
TP114 PG

Sheet: /USB-C Power Delivery/Buck-Boost Charger/
File: Buck-Boost Charger.kicad_sch

Title:

Size: A4 | Date: | **Rev:**
KiCad E.D.A. 9.0.4 | Id: 17/33

Switching Frequency = 400kHz
Vin = 25.6V -> 33.6V (29.6V nominal)
Vout = 5V
Iout = 5A
Ripple = 1% * 5V = 50 mV

* From Datasheet: Delta_I_L should be between 30% and 50%:
* If we do 40%, 40% * 5A = 2A
Lo = Vout / (Delta_I_L * F_sw) * (1 - Vout / Vin_nom) = 5 / (2 * 400k) * (1 - 5 / 29.6) = 5.19uH -> 5.6uH

* "The inductor's saturation current rating must be higher than the maximum peak current."
Deltaa_I_L = Vout / (L_o * F_sw) * (1 - Vout / Vin_MAX) = 5 / (5.6u * 400k) * (1 - 5 / 33.6) = 1.89A
* Verify with the peak current
I_LO(PK) = I_o + Delta_I_L / 2 = 5 + 1.89 / 2 = 5.945
*** The inductor selected must have a saturation current rating above 6A

A 20% Saftey margin: 5.95 * 1.2 = 7.14A
The switching frequency is programmed by a single resistor from the RT pin to AGND.
R_RT[kΩ] = ((10^6 / F_sw{kHz}) - 59) / 41 = ((10^6 / 400) - 59) / 41 = 59.54kΩ = 59k

(pin 6)
* From datasheet:
* Vrefl = 1V
* I_IMON_OFFSET = 25uA
* gm_IMON = 2uA/mV
R_IMON = V_refl / ((R_CS * G_mIMON * I_CC) + I_IMON_OFFSET) = 1 / ((8m * 2u * 5) + 25u) = 9.53kΩ

F_C = F_sw / 10 = 400k / 10 = 40k
C_IMON = 1 / (2 * pi * R_IMON * F_C) = 1 / (2 * pi * 9.54k * 40k) = 417pF = 470pF

Current Sense Resistor:
* From Datasheet V_CS-TH = 60mV
Rs = V_CS-TH / (1.2 * I_LO(PK)) = 60m / (1.2 * 5.95) = 8.4mΩ -> 8mΩ is a standard resistor

* Ripple Cout
Cout >= Delta_I_L / (8 * F_sw * Delta_Vout) = 1.9 / (8 * 400k * 50m) = 11.87uF = 11.9uF
* Transient Cout, assuming an acceptable voltage overshoot of 3% (150 mV)
Cout >= (L_o * (Delta_I_Load)^2) / ((Vout + Delta_V_overshoot)^2 - (Vout)^2) = (5.6u * 5^2) / ((5 + 0.15)^2 - 5^2) = 92uF = 100uF

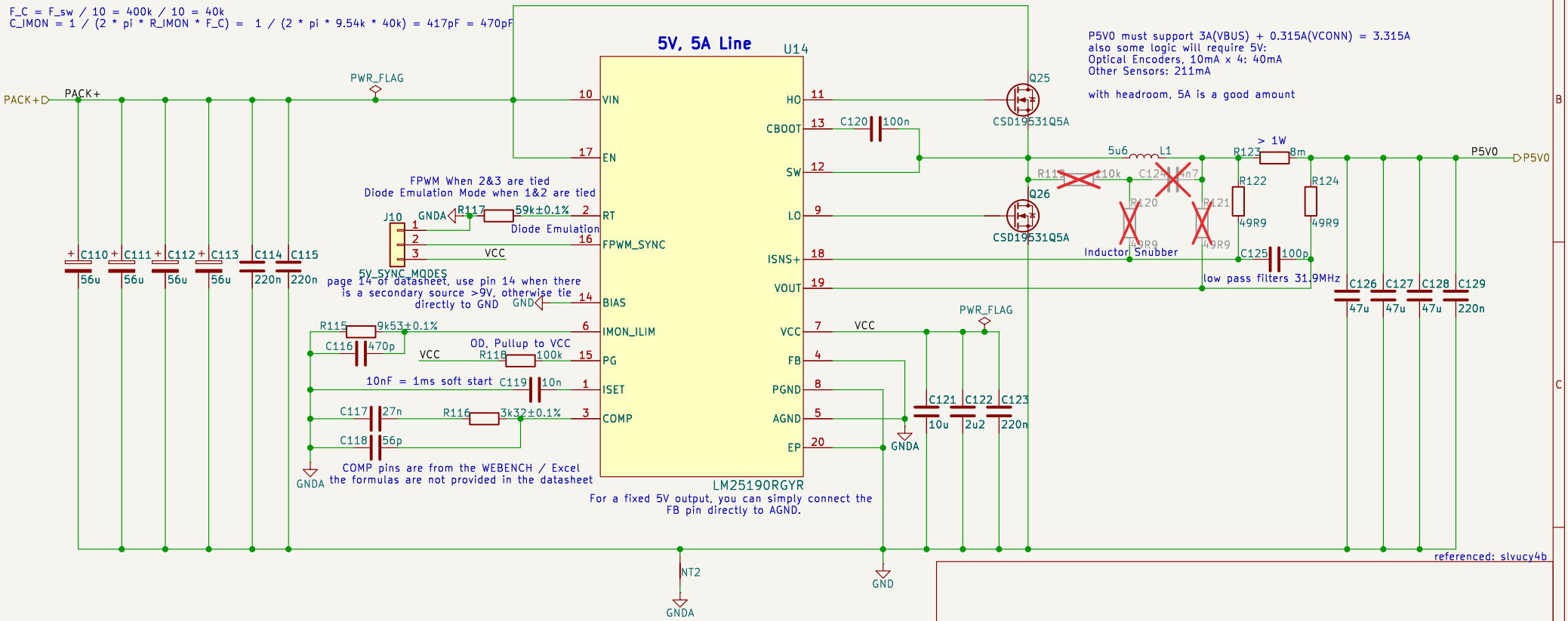
I_CO(RMS) = Delta_I_L / 12^(1/2) = 0.55A
*** The Capacitor Bank must be rated for > 0.55A for its ripple current

Cin:
Dmax = Vout / Vin(MIN) = 5 / 25.6 = 195m
I_CIN(RMS) = SQRT(D * ((1 - D) * (I_out)^2 + (Delta_I_L)^2 / 12) = SQRT(195m * ((1 - 195m) * 5^2 + 1.9^2 / 12) = 1.99 A(RMS)
Delta_V_Supply = 1% * 25.6V = 0.256 = 0.25V
C_in >= (I_out * D * (1 - D)) / (F_sw * Delta_V_Supply) = (5 * 195m * (1 - 195m)) / (400k * 0.25) = 7.85uF

Soft Start:
* From datasheet: I_ISET (internal) is 10uA
* Delta_V = 1V (voltage ramp from 0 to 1)
I = Delta_Q / Delta_T , C = Delta_Q / Delta_V , Delta_T = (C * Delta_V) / I
T_SSCC = (C_ISET * Delta_V) / I_ISET = (10n * 1) / 10u = 1ms

P5V0 must support 3A(VBUS) + 0.315A(VCONN) = 3.315A
also some logic will require 5V:
Optical Encoders, 10mA x 4: 40mA
Other Sensors: 211mA

with headroom, 5A is a good amount

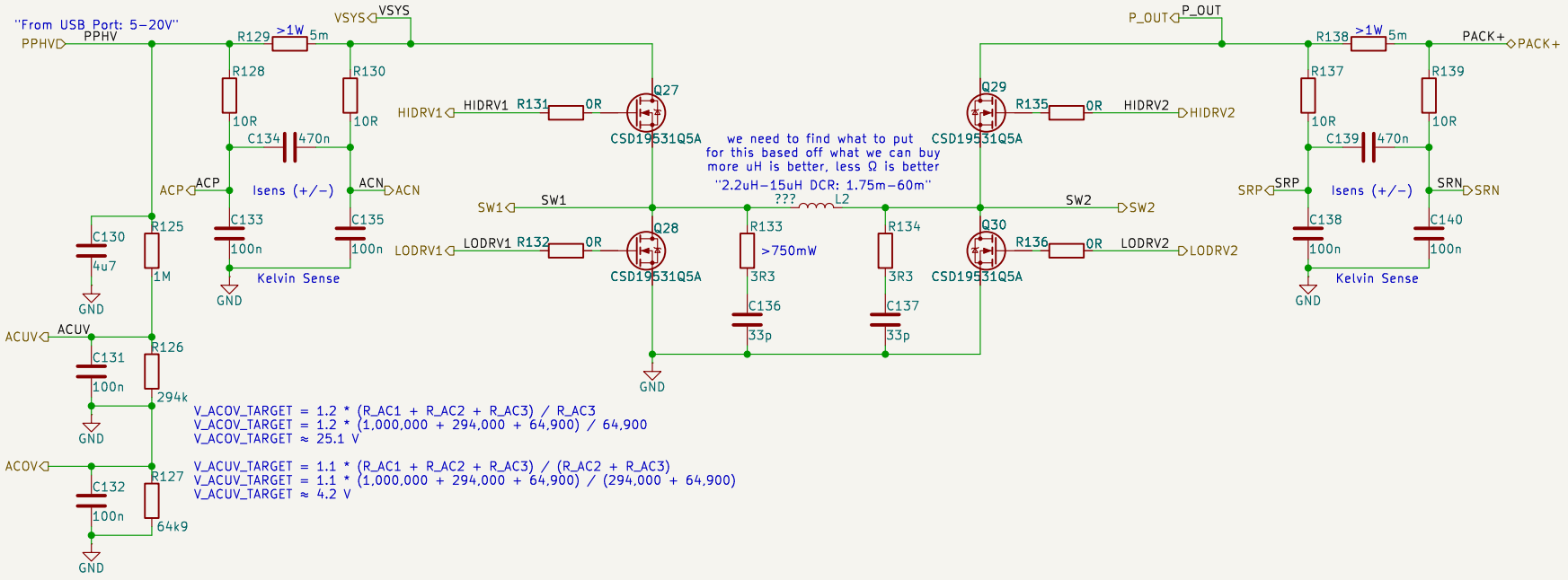


referenced: slvucy4b

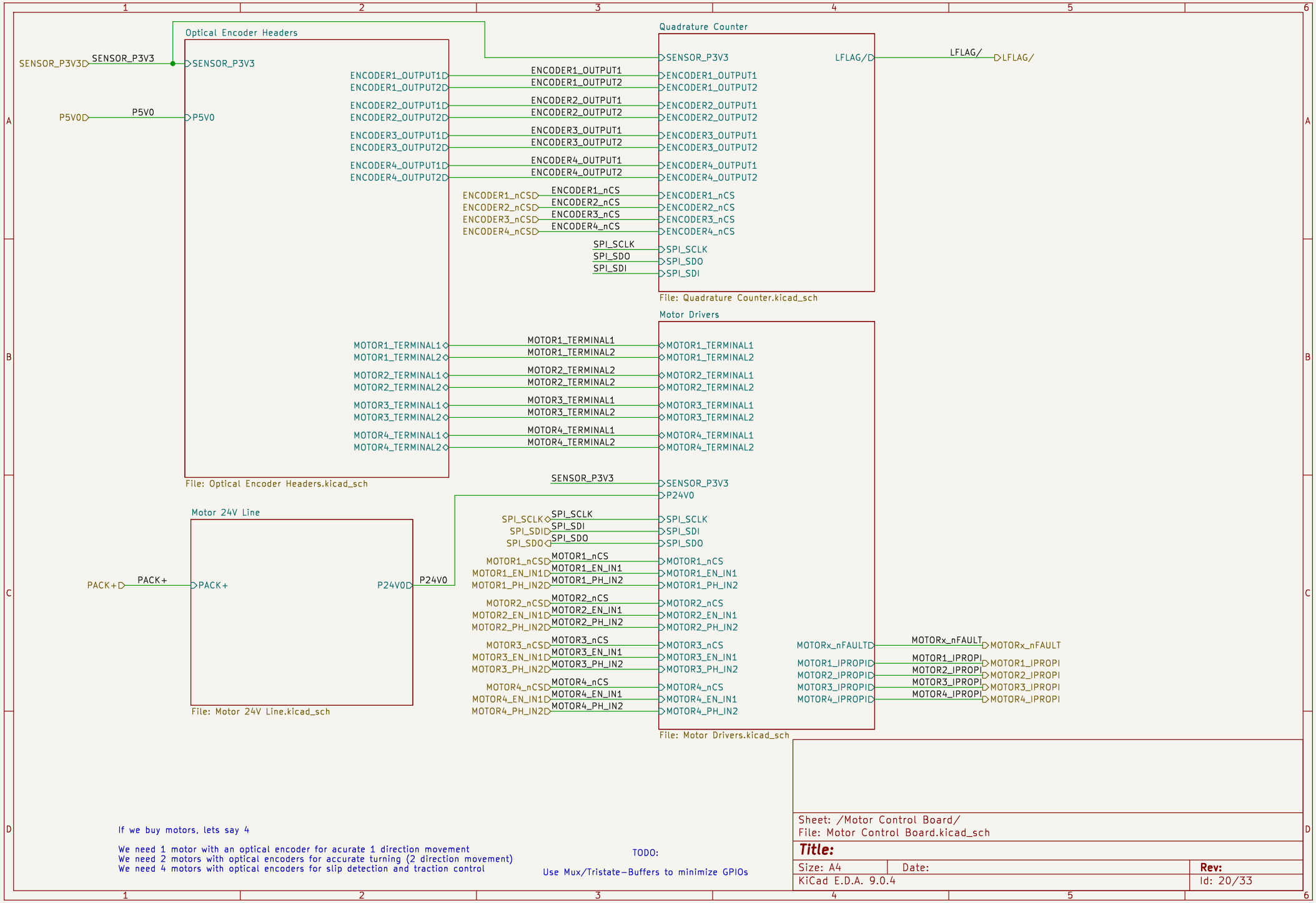
Sheet: /USB-C Power Delivery/USB-C 5V Buck/
File: USB-C 5V Buck.kicad_sch

Title:

Size: A4	Date:	Rev:
KiCad E.D.A. 9.0.4		Id: 18/33



Sheet: /USB-C Power Delivery/Charger FET Array/		
File: Charger FET Array.kicad_sch		
Title:		
Size: A4	Date:	**Rev:**
KiCad E.D.A. 9.0.4		Id: 19/33


Optical Encoder Headers
SENSOR_P3V3
P5V0
ENCODER1_OUTPUT1
ENCODER1_OUTPUT2
ENCODER2_OUTPUT1
ENCODER2_OUTPUT2
ENCODER3_OUTPUT1
ENCODER3_OUTPUT2
ENCODER4_OUTPUT1
ENCODER4_OUTPUT2
ENCODER1_nCS
ENCODER2_nCS
ENCODER3_nCS
ENCODER4_nCS
SPI_SCLK
SPI_SDO
SPI_SDI
MOTOR1_TERMINAL1
MOTOR1_TERMINAL2
MOTOR2_TERMINAL1
MOTOR2_TERMINAL2
MOTOR3_TERMINAL1
MOTOR3_TERMINAL2
MOTOR4_TERMINAL1
MOTOR4_TERMINAL2
File: Optical Encoder Headers.kicad_sch
Quadrature Counter
LFLAG/
File: Quadrature Counter.kicad_sch
Motor Drivers
P24V0
MOTOR1_nCS
MOTOR1_EN_IN1
MOTOR1_PH_IN2
MOTOR2_nCS
MOTOR2_EN_IN1
MOTOR2_PH_IN2
MOTOR3_nCS
MOTOR3_EN_IN1
MOTOR3_PH_IN2
MOTOR4_nCS
MOTOR4_EN_IN1
MOTOR4_PH_IN2
MOTORx_nFAULT
MOTOR1_IPROPI
MOTOR2_IPROPI
MOTOR3_IPROPI
MOTOR4_IPROPI
File: Motor Drivers.kicad_sch
Motor 24V Line
PACK+
File: Motor 24V Line.kicad_sch
If we buy motors, lets say 4
We need 1 motor with an optical encoder for acurate 1 direction movement
We need 2 motors with optical encoders for accurate turning (2 direction movement)
We need 4 motors with optical encoders for slip detection and traction control
TODO:
Use Mux/Tristate-Buffers to minimize GPIOs
Sheet: /Motor Control Board/
File: Motor Control Board.kicad_sch
Title:
Size: A4
Date:
Rev:
KiCad E.D.A. 9.0.4
Id: 20/33

Switching Frequency = 400kHz
Vin = 25.6V -> 33.6V (29.6V nominal)
Vout = 24V
Iout = 20A
Ripple = 1% * 24V = 240 mV

* From Datasheet: Delta_I_L should be between 30% and 50%:
* If we do 30%, 30% * 20A = 6A
Lo = Vout / (Delta_I_L * F_sw) * (1 - Vout / Vin_nom) = 24 / (6 * 400k) * (1 - 24 / 29.6) = 1.9uH -> 2.2uH

* "The inductor's saturation current rating must be higher than the maximum peak current."
Delta_I_L = Vout / (L_o * F_sw) * (1 - Vout / Vin_MAX) = 24 / (2.2u * 400k) * (1 - 24 / 33.6) = 7.8A
* Verify with the peak current
I_LO(PK) = I_o + Delta_I_L / 2 = 20 + 7.8 / 2 = 23.9A
*** The inductor selected must have a saturation current rating above 24A

A 20% Saftey margin: 23.9 * 1.2 = 28.7A

The switching frequency is programmed by a single resistor from the RT pin to AGND.
R_RT[kΩ] = ((10^6 / F_sw[kHz]) - 59) / 41 = ((10^6 / 400) - 59) / 41 = 59.54kΩ -> 59kΩ

(pin 6)
* From datasheet:
* Vrefl = 1V
* I_IMON_OFFSET = 25uA
* gm_IMON = 2uA/mV
R_IMON = V_refl / ((R_CS * G_mIMON * I_CC) + I_IMON_OFFSET) = 1 / ((2m * 2u * 20) + 25u) = 9.26kΩ -> 9.31kΩ (standard E96)

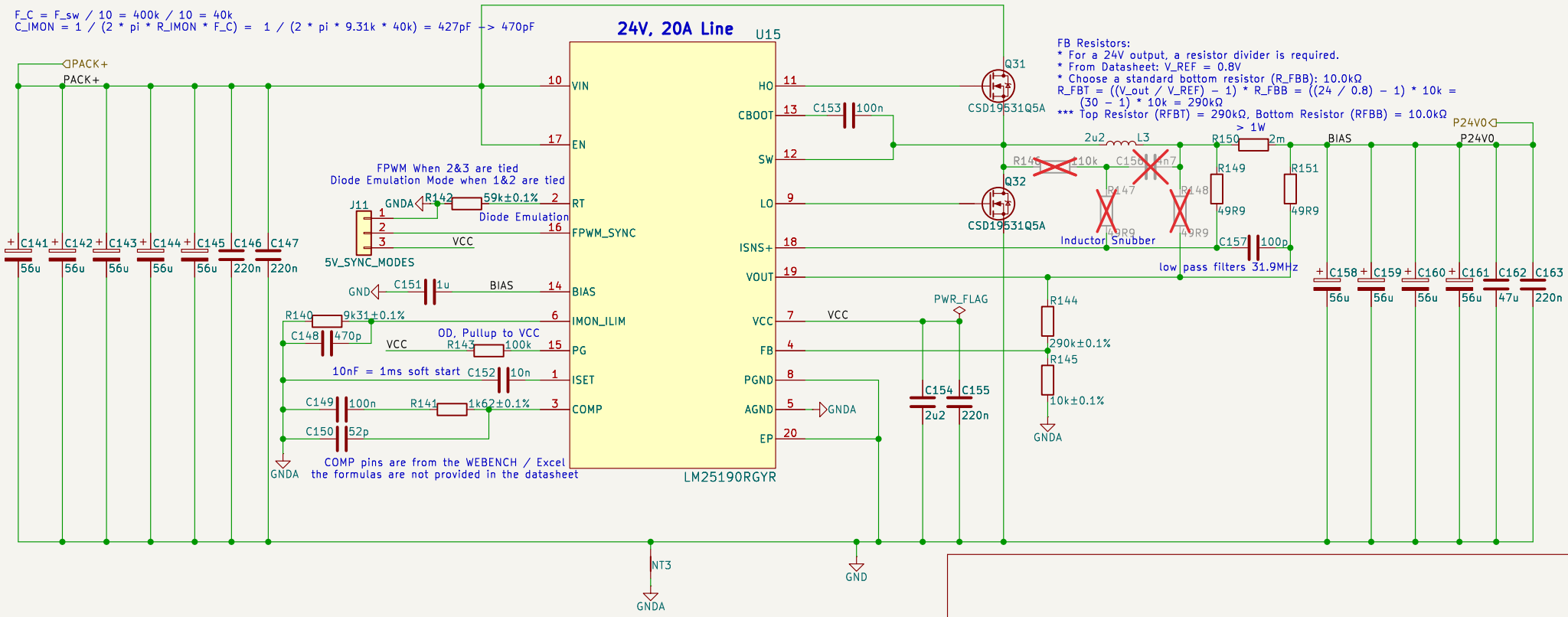
F_C = F_sw / 10 = 400k / 10 = 40k
C_IMON = 1 / (2 * pi * R_IMON * F_C) = 1 / (2 * pi * 9.31k * 40k) = 427pF -> 470pF

Current Sense Resistor:
* From Datasheet V_CS-TH = 60mV
Rs = V_CS-TH / I_PEAKCL = 60m / 28.7A = 2.09mΩ -> 2.0mΩ is a standard resistor

* Cout
Transient response will dominate capacitor selection for a high-current design.
A practical choice for a 20A output would be at least 220uF effective capacitance. -> 220uF
* I_CO(RMS) = Delta_I_L / 12^(1/2) = 7.8 / 3.46 = 2.25A(RMS)
*** The Capacitor Bank must be rated for > 2.25A for its ripple current

Cin:
Dmax = Vout / Vin(MIN) = 24 / 25.6 = 0.938
Delta_I_L(@Vin_MIN) = 24 / (2.2u * 400k) * (1 - 24 / 25.6) = 1.7A
I_CIN(RMS) = SQRT(D * ((1 - D) * I_out^2 + Delta_I_L^2 / 12)) = SQRT(0.938 * ((1 - 0.938) * 20^2 + 1.7^2 / 12)) = 4.88A(RMS)
Delta_V_Supply = 1% * 25.6V = 0.256V = 0.25V
C_in >= (I_out * D * (1 - D)) / (F_sw * Delta_V_Supply) = (20 * 0.938 * (1 - 0.938)) / (400k * 0.25) = 11.6uF -> 22uF effective

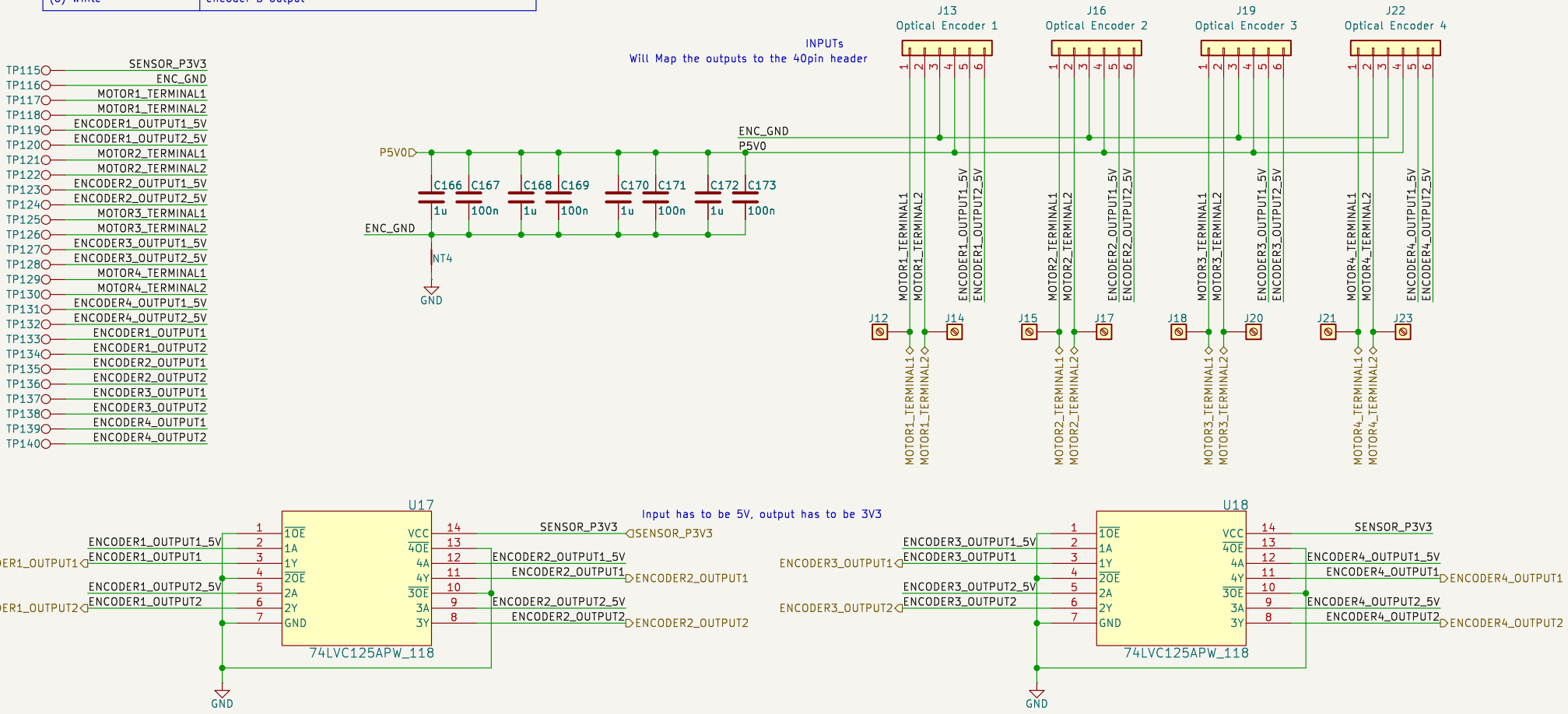
Soft Start:
* From datasheet: I_ISET (internal) is 10uA
* Delta_V = 1V (voltage ramp from 0 to 1)
For a slower start on this high-power line, let's select C_ISET = 22nF
T_SSCC = (C_ISET * Delta_V) / I_ISET = (22n * 1) / 10u = 2.2ms



using global GNDA, is this what we should be doing?

Sheet: /Motor Control Board/Motor 24V Line/		
File: Motor 24V Line.kicad_sch		
Title:		
Size: A4	Date:	**Rev:**
KiCad E.D.A. 9.0.4		Id: 22/33

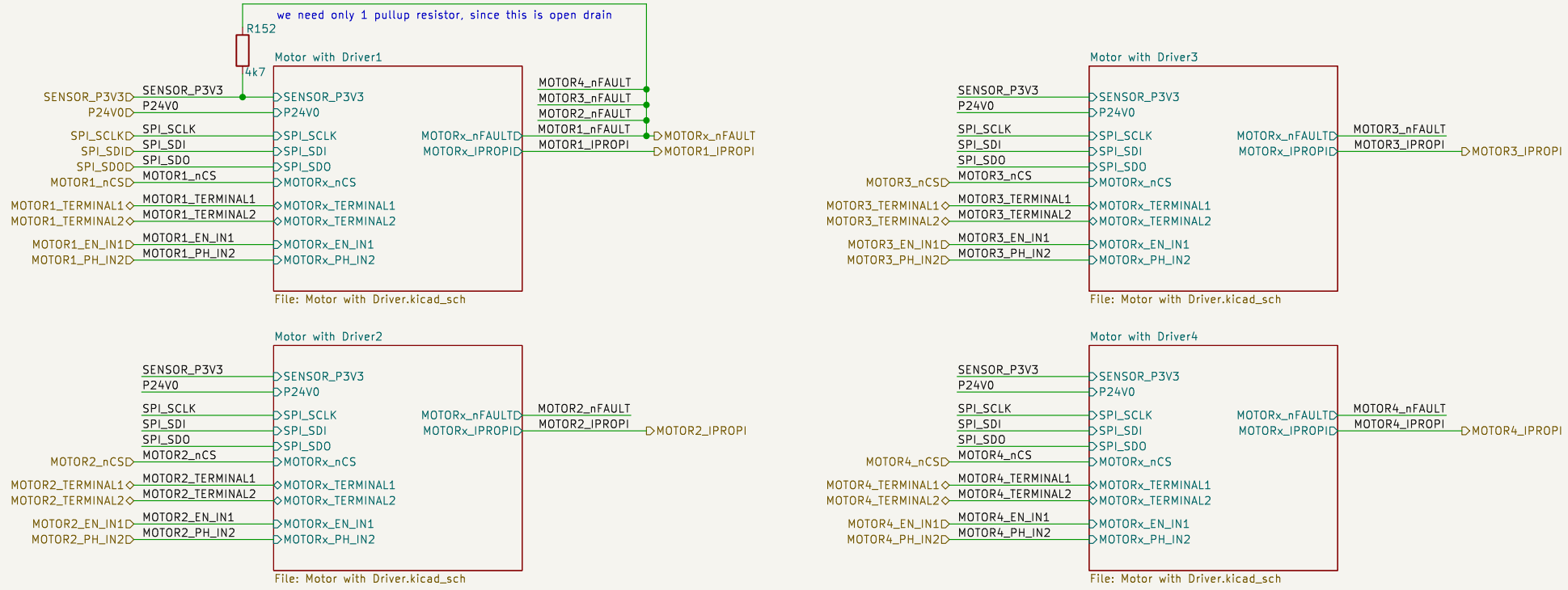
(1) Red	motor power (connects to one motor terminal)
(2) Black	motor power (connects to the other motor terminal)
(3) Green	encoder GND
(4) Blue	encoder Vcc (3.5 – 20 V)
(5) Yellow	encoder A output
(6) White	encoder B output



Sheet: /Motor Control Board/Optical Encoder Headers/
File: Optical Encoder Headers.kicad_sch

Title:

Size: A4	Date:	**Rev:**
KiCad E.D.A. 9.0.4		Id: 24/33



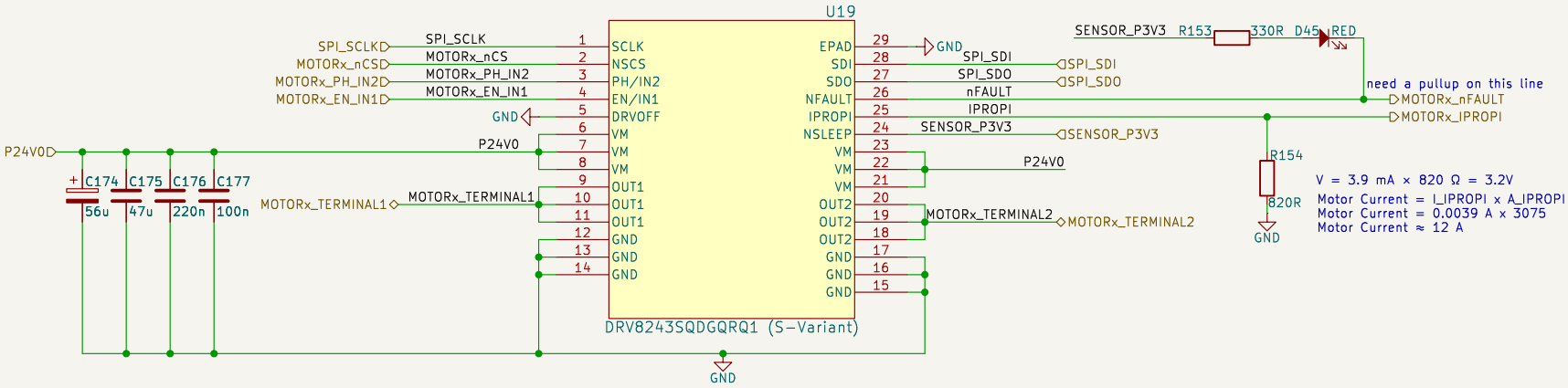
Sheet: /Motor Control Board/Motor Drivers/
File: Motor Drivers.kicad_sch

Title:

Size: A4	Date:	**Rev:**
KiCad E.D.A. 9.0.4		Id: 25/33

For the SPI (P) variant, you can set the SCLK frequency up to 10 MHz.

For the SPI (S) variant, the maximum is 10 MHz, but you should reduce it to 8 MHz if you have a 20 pF load on the SDO line.



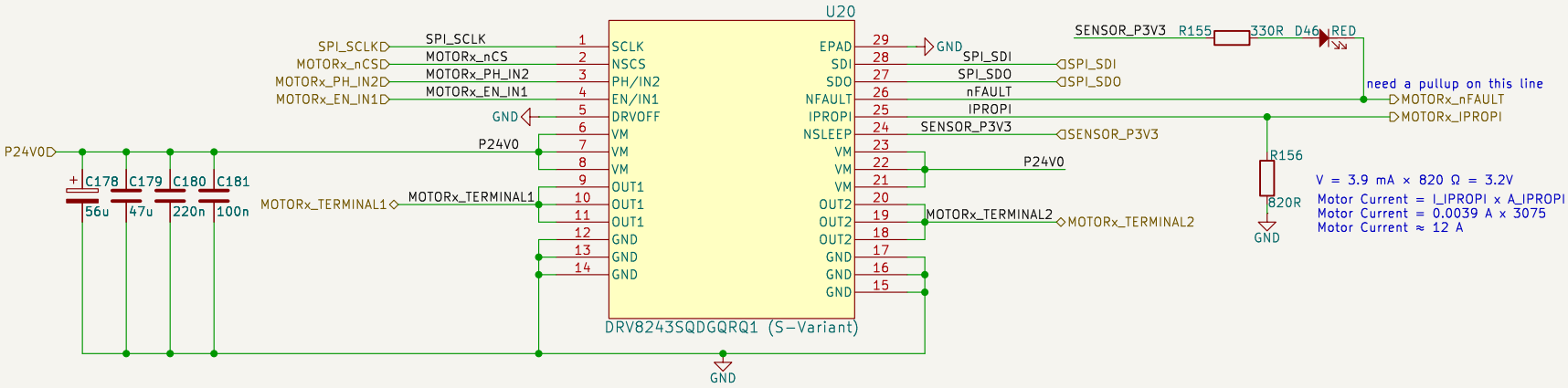
Sheet: /Motor Control Board/Motor Drivers/Motor with Driver1/
File: Motor with Driver.kicad_sch

Title:

Size: A4	Date:	**Rev:**
KiCad E.D.A. 9.0.4		Id: 26/33

For the SPI (P) variant, you can set the SCLK frequency up to 10 MHz.

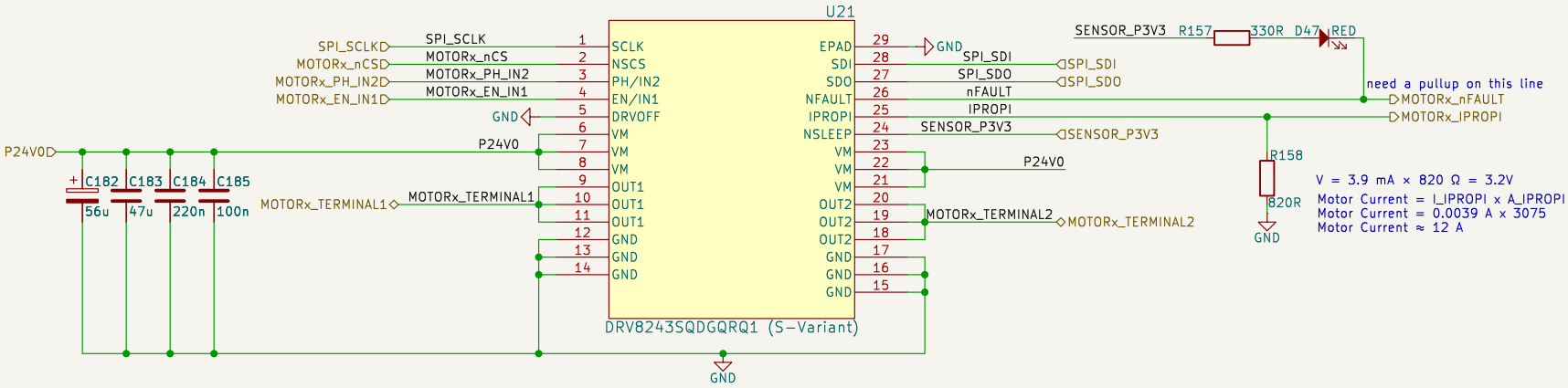
For the SPI (S) variant, the maximum is 10 MHz, but you should reduce it to 8 MHz if you have a 20 pF load on the SDO line.



Sheet: /Motor Control Board/Motor Drivers/Motor with Driver2/
File: Motor with Driver.kicad_sch

Title:

Size: A4	Date:	**Rev:**
KiCad E.D.A. 9.0.4		Id: 27/33



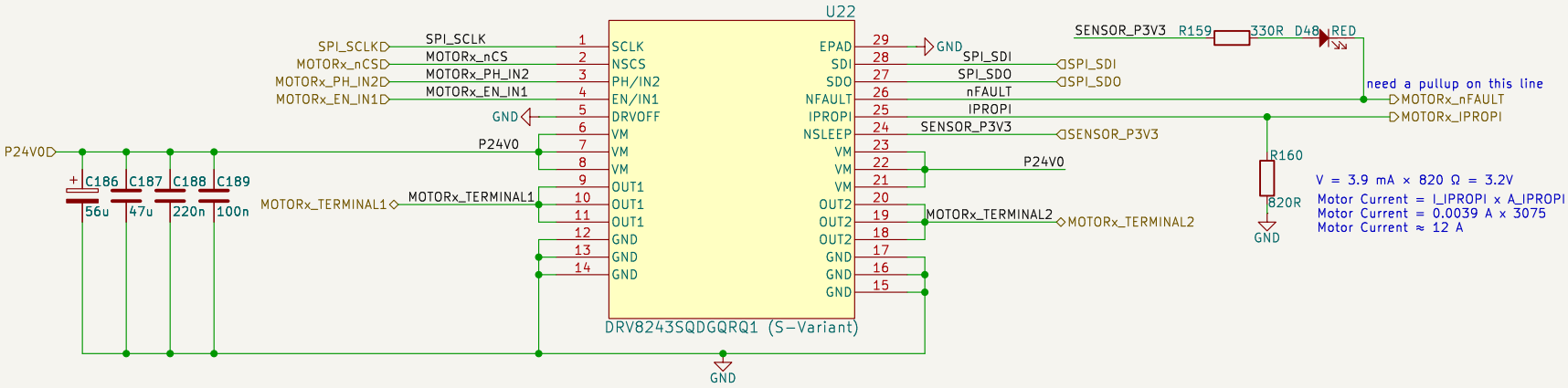
Sheet: /Motor Control Board/Motor Drivers/Motor with Driver3/
File: Motor with Driver.kicad_sch

Title:

Size: A4	Date:	**Rev:**
KiCad E.D.A. 9.0.4		Id: 28/33

For the SPI (P) variant, you can set the SCLK frequency up to 10 MHz.

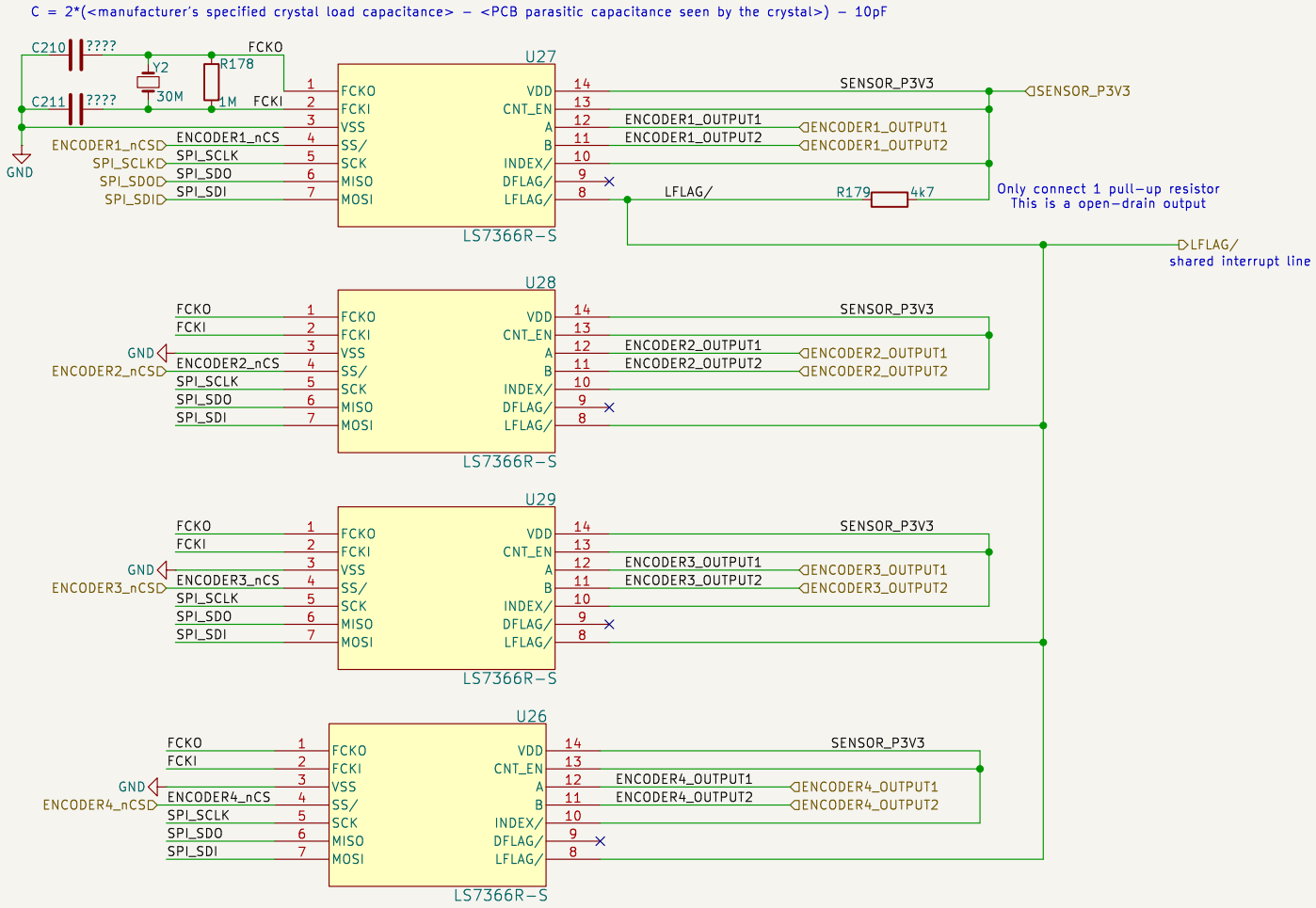
For the SPI (S) variant, the maximum is 10 MHz, but you should reduce it to 8 MHz if you have a 20 pF load on the SDO line.



Sheet: /Motor Control Board/Motor Drivers/Motor with Driver4/
File: Motor with Driver.kicad_sch

Title:

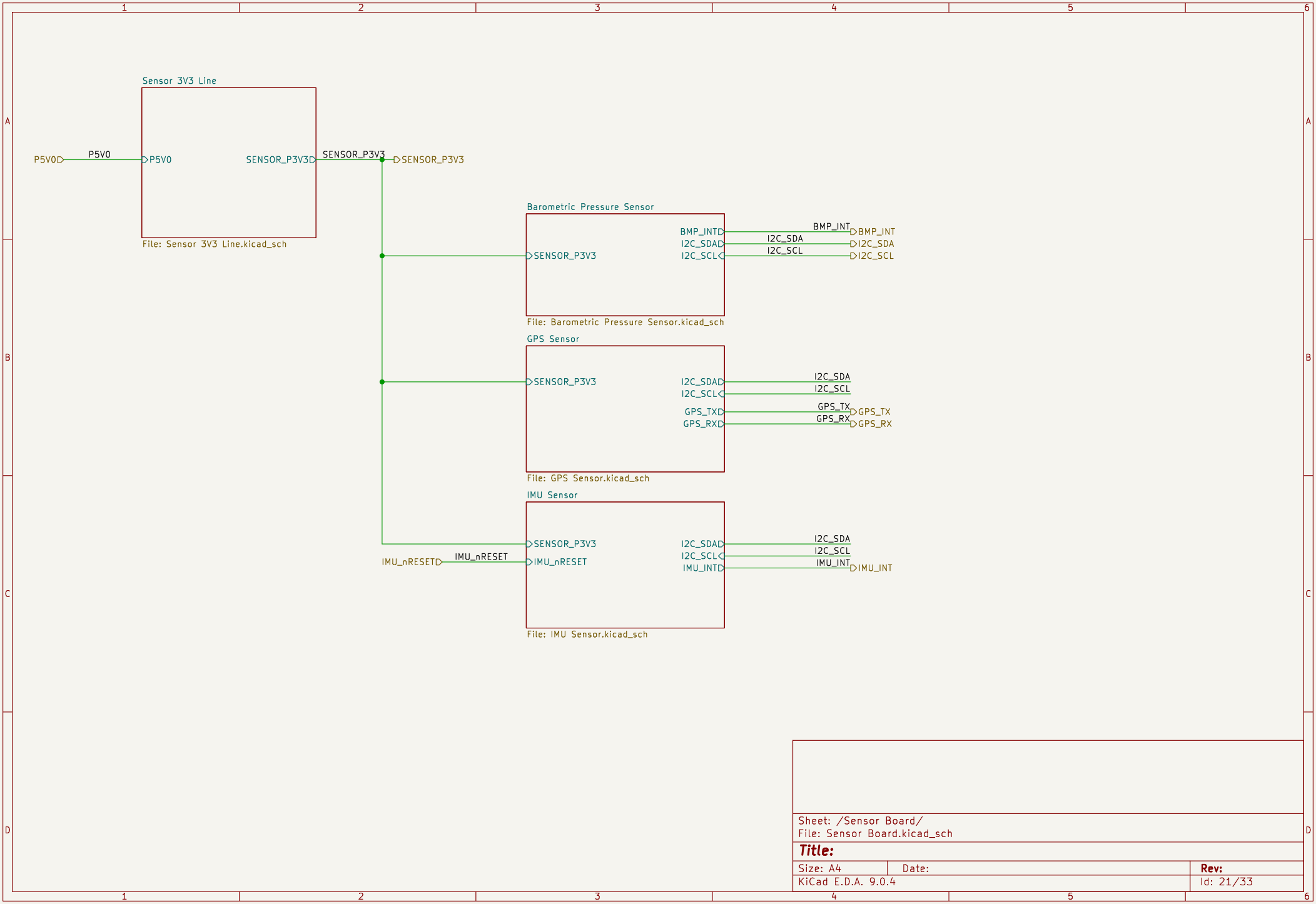
Size: A4	Date:	**Rev:**
KiCad E.D.A. 9.0.4		Id: 29/33

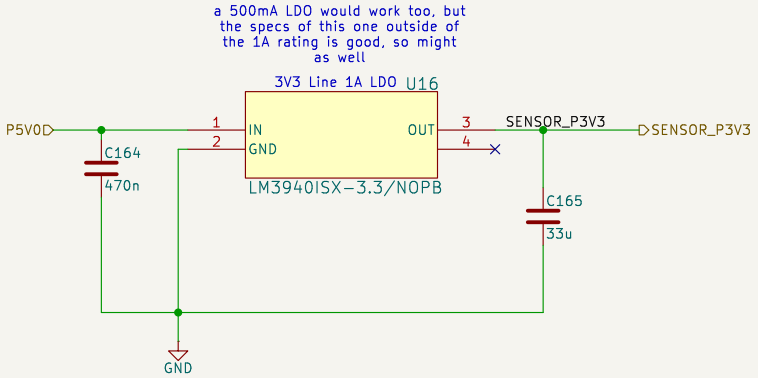


Sheet: /Motor Control Board/Quadrature Counter/
File: Quadrature Counter.kicad_sch

Title:

Size: A4	Date:	**Rev:**
KiCad E.D.A. 9.0.4		Id: 33/33

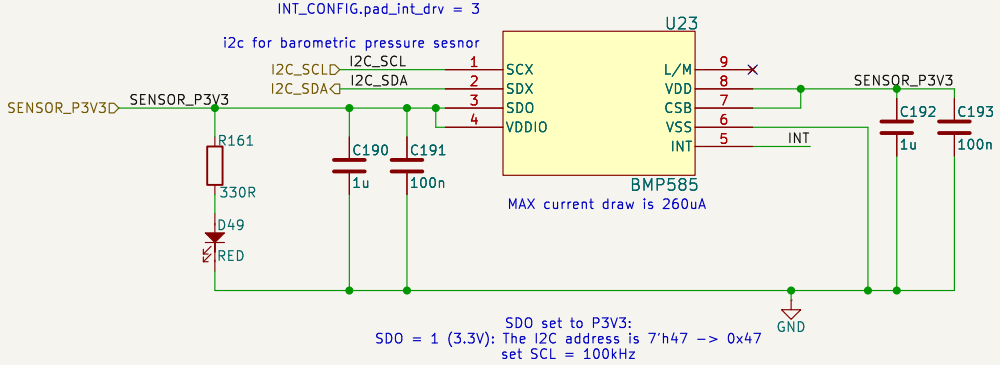

Sensor 3V3 Line
P5V0
P5V0
P5V0
SENSOR_P3V3
SENSOR_P3V3
SENSOR_P3V3
File: Sensor 3V3 Line.kicad_sch
Barometric Pressure Sensor
SENSOR_P3V3
BMP_INT
I2C_SDA
I2C_SCL
BMP_INT
I2C_SDA
I2C_SCL
BMP_INT
I2C_SDA
I2C_SCL
File: Barometric Pressure Sensor.kicad_sch
GPS Sensor
SENSOR_P3V3
I2C_SDA
I2C_SCL
GPS_TX
GPS_RX
I2C_SDA
I2C_SCL
GPS_TX
GPS_RX
GPS_TX
GPS_RX
File: GPS Sensor.kicad_sch
IMU Sensor
SENSOR_P3V3
IMU_nRESET
IMU_nRESET
IMU_nRESET
I2C_SDA
I2C_SCL
IMU_INT
I2C_SDA
I2C_SCL
IMU_INT
IMU_INT
File: IMU Sensor.kicad_sch
Sheet: /Sensor Board/
File: Sensor Board.kicad_sch
Title:
Size: A4
Date:
Rev:
KiCad E.D.A. 9.0.4
Id: 21/33

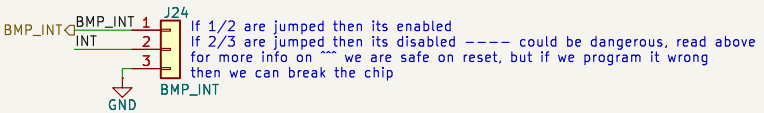


Sheet: /Sensor Board/Sensor 3V3 Line/		
File: Sensor 3V3 Line.kicad_sch		
Title:		
Size: A4	Date:	**Rev:**
KiCad E.D.A. 9.0.4		Id: 23/33

Per the datasheet, the unused INT pin is tied to GND to prevent a floating input.
CRITICAL: The interrupt pin must be disabled in software to prevent a short circuit.
Ensure the 'int_en' bit in the INT_CONFIG register (0x14) remains disabled (set to 0).

Datasheet sets the IRQ to 0 on start up, so never turn it on
PAGE49: 0x14 on reset is set to 0x35
PAGE49: <int_en 2bits> <int_od 2bits> <int_pol 2bits> <int_mode 2bits LSB>
PAGE51: 8.5, setup for 0x14, <0> <1> <0> <1>
this means: int_mode = latched, int_pol = active low, int_od = open_drain, int_en = disabled
INT_CONFIG.int_en = 0
INT_CONFIG.od = 1
INT_CONFIG.pol = 0
INT_CONFIG.mode = 1
INT_CONFIG.pad_int_drv = 3

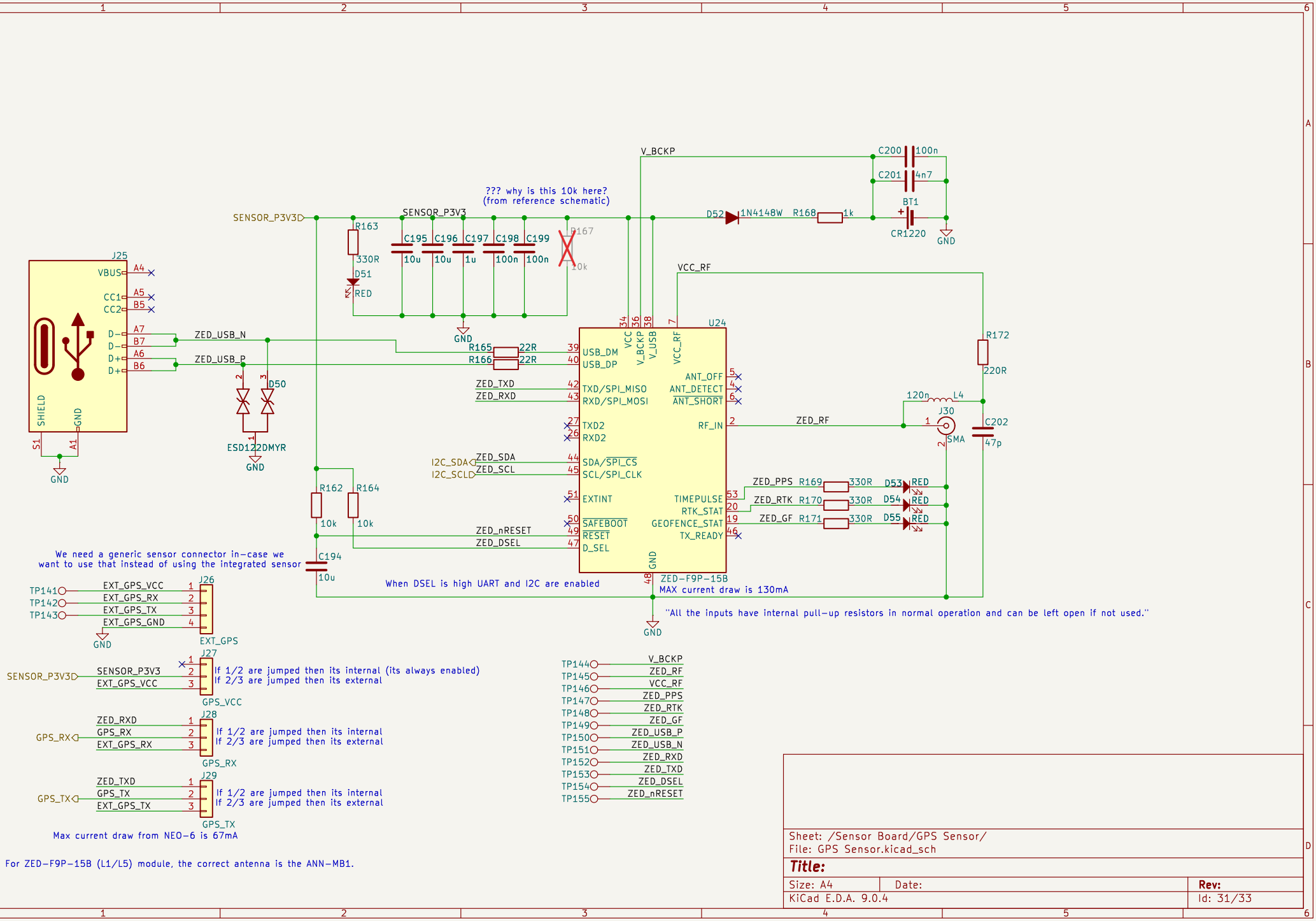


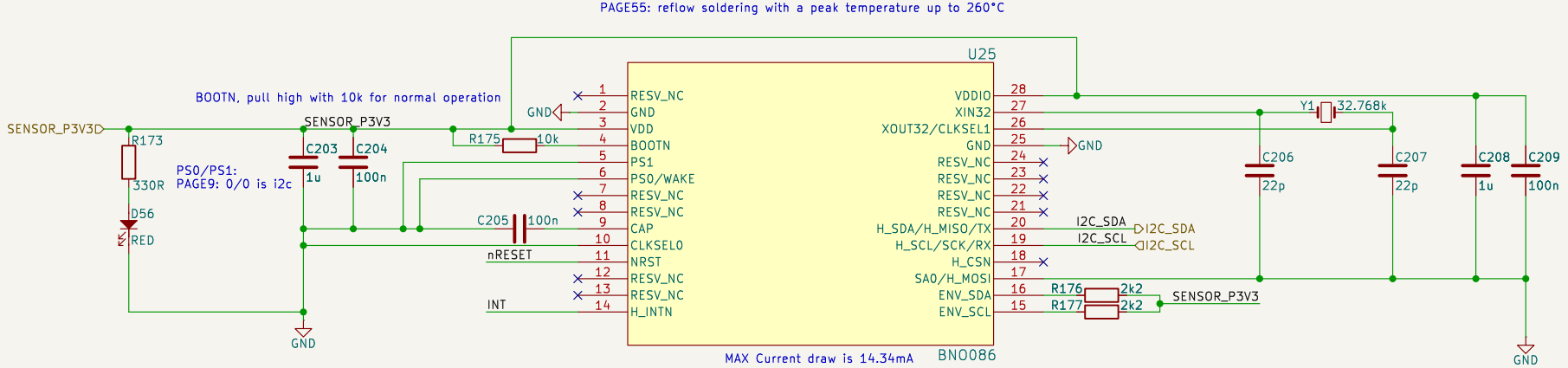


Sheet: /Sensor Board/Barometric Pressure Sensor/
File: Barometric Pressure Sensor.kicad_sch

Title:

Size: A4 | Date: | **Rev:**
KiCad E.D.A. 9.0.4 | Id: 30/33


V_BCKP
C200 100n
C201 4n7
BT1
CR1220
GND
??? why is this 10k here?
(from reference schematic)
SENSOR_P3V3
D52 1N4148W R168 1k
R163 330R
D51 RED
C195 10u
C196 10u
C197 1u
C198 100n
C199 100n
R167 10k
VCC_RF
J25
VBUS A4
CC1 A5
CC2 B5
D- A7
D- B7
D+ A6
D+ B6
SHIELD
GND
S1
A1
ZED_USB_N
ZED_USB_P
D50
ESD122DMYR
R165 22R
R166 22R
U24
USB_DM 39
USB_DP 40
VCC 34
V_BCKP 36
V_USB 38
VCC_RF 7
ANT_OFF 5
ANT_DETECT 4
ANT_SHORT 6
ZED_TXD 42
ZED_RXD 43
TXD/SPI_MISO
RXD/SPI_MOSI
TXD2 27
RXD2 26
RF_IN 2
ZED_RF
R172 220R
120n L4
J30 SMA
C202 47p
I2C_SDA ZED_SDA 44
I2C_SCL ZED_SCL 45
SDA/SPI_CS
SCL/SPI_CLK
R162 10k
R164 10k
EXTINT 51
SAFEBOOT 50
RESET 49
D_SEL 47
TIMEPULSE 53
RTK_STAT 20
GEOFENCE_STAT 19
TX_READY 46
ZED_PPS R169 330R D53 RED
ZED_RTK R170 330R D54 RED
ZED_GF R171 330R D55 RED
ZED_nRESET
ZED_DSEL
C194 10u
GND 48
ZED-F9P-15B
MAX current draw is 130mA
When DSEL is high UART and I2C are enabled
"All the inputs have internal pull-up resistors in normal operation and can be left open if not used."
We need a generic sensor connector in-case we want to use that instead of using the integrated sensor
J26
TP141 EXT_GPS_VCC 1
TP142 EXT_GPS_RX 2
TP143 EXT_GPS_TX 3
EXT_GPS_GND 4
EXT_GPS
J27
SENSOR_P3V3 SENSOR_P3V3 1
EXT_GPS_VCC 2
3
If 1/2 are jumped then its internal (its always enabled)
If 2/3 are jumped then its external
GPS_VCC
J28
GPS_RX ZED_RXD 1
GPS_RX 2
EXT_GPS_RX 3
If 1/2 are jumped then its internal
If 2/3 are jumped then its external
GPS_RX
J29
GPS_TX ZED_TXD 1
GPS_TX 2
EXT_GPS_TX 3
If 1/2 are jumped then its internal
If 2/3 are jumped then its external
GPS_TX
Max current draw from NEO-6 is 67mA
For ZED-F9P-15B (L1/L5) module, the correct antenna is the ANN-MB1.
TP144 V_BCKP
TP145 ZED_RF
TP146 VCC_RF
TP147 ZED_PPS
TP148 ZED_RTK
TP149 ZED_GF
TP150 ZED_USB_P
TP151 ZED_USB_N
TP152 ZED_RXD
TP153 ZED_TXD
TP154 ZED_DSEL
TP155 ZED_nRESET
Sheet: /Sensor Board/GPS Sensor/
File: GPS Sensor.kicad_sch
Title:
Size: A4
Date:
Rev:
KiCad E.D.A. 9.0.4
Id: 31/33



Sheet: /Sensor Board/IMU Sensor/	
File: IMU Sensor.kicad_sch	
Title:	
Size: A4	Date:
KiCad E.D.A. 9.0.4	Rev: Id: 32/33