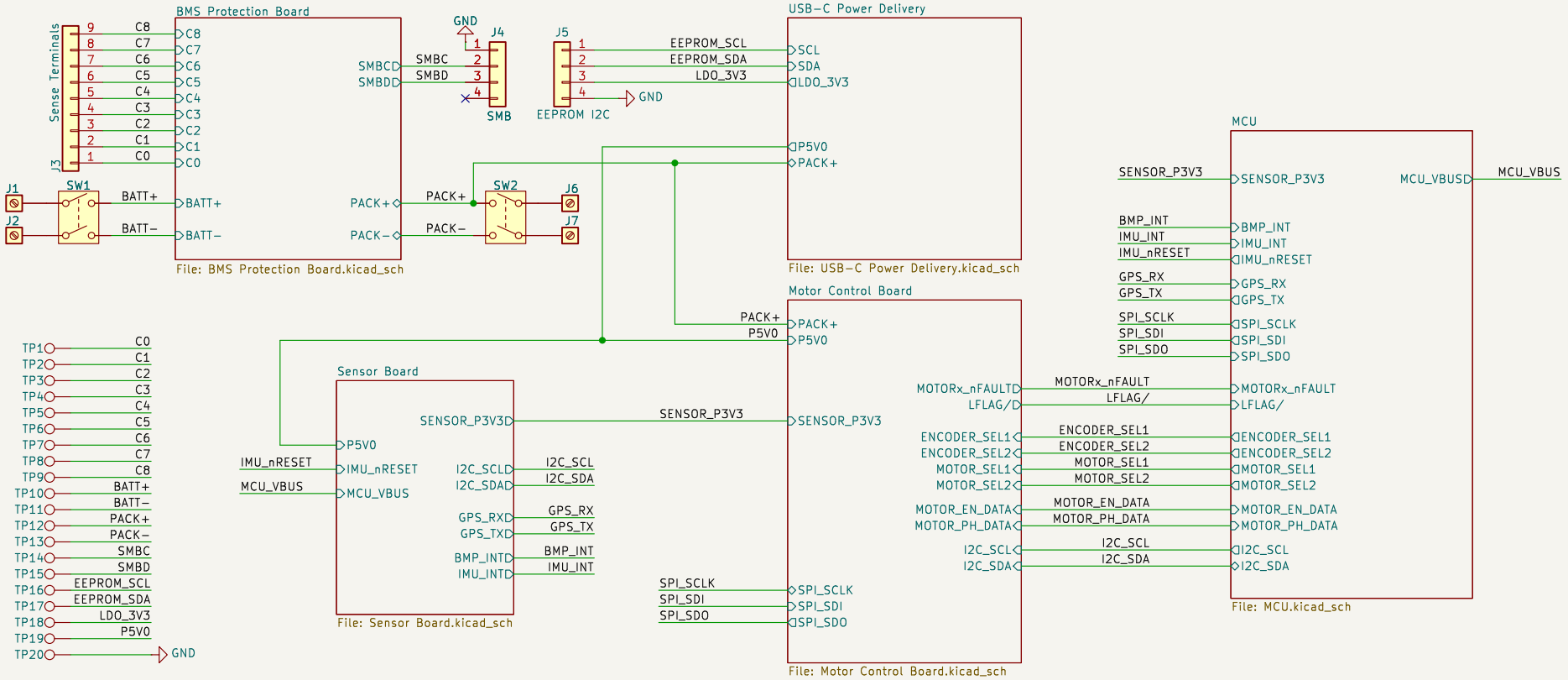
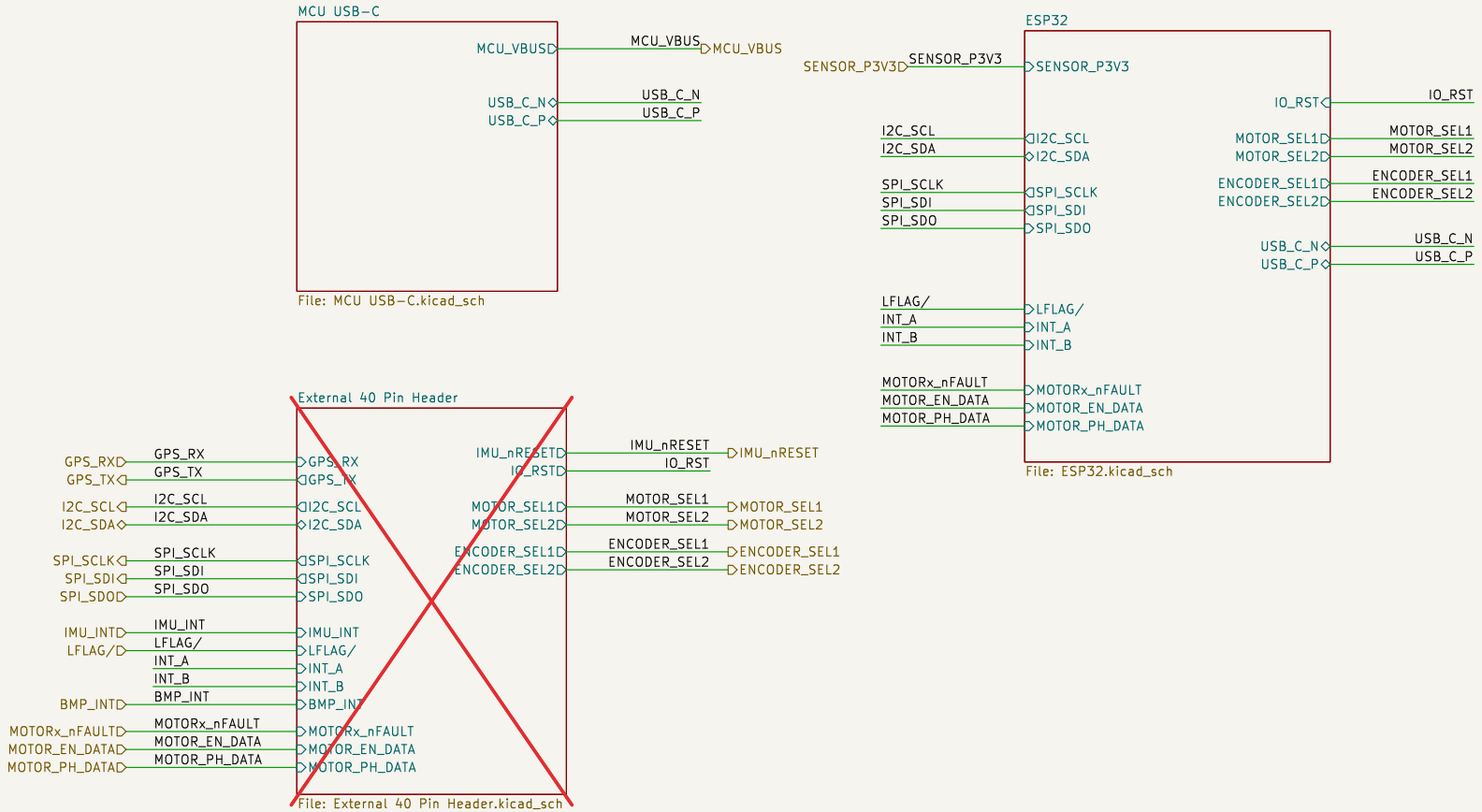


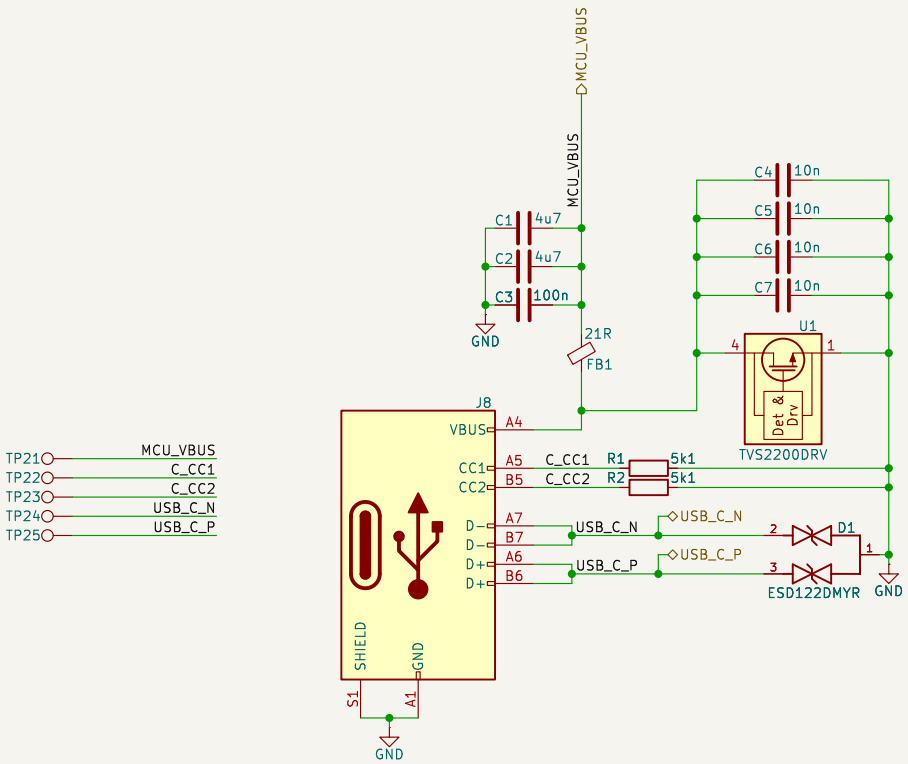
Sheet: /		
File: STAR.kicad_sch		
Title:		
Size: A4	Date:	**Rev:**
KiCad E.D.A. 9.0.4		Id: 1/38



Sheet: /MCU/
File: MCU.kicad_sch

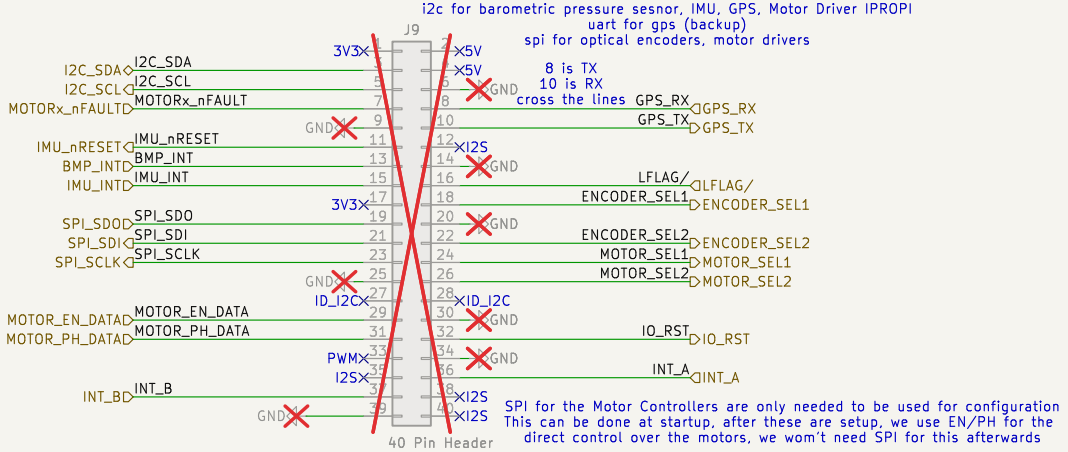
Title:

Size: A4	Date:	**Rev:**
KiCad E.D.A. 9.0.4		Id: 2/38

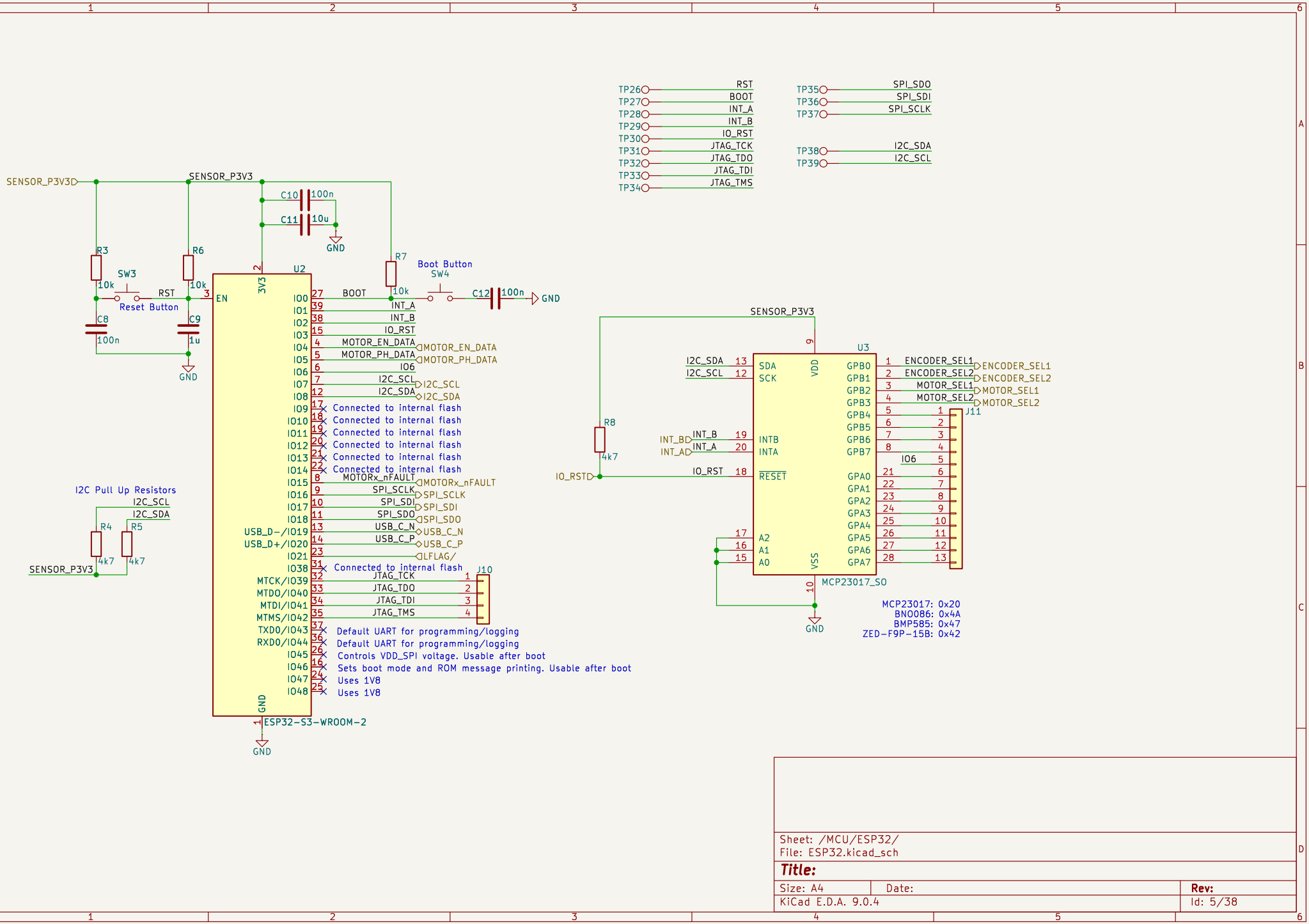


Sheet: /MCU/MCU USB−C/		
File: MCU USB−C.kicad_sch		
Title:		
Size: A4	Date:	**Rev:**
KiCad E.D.A. 9.0.4		Id: 3/38

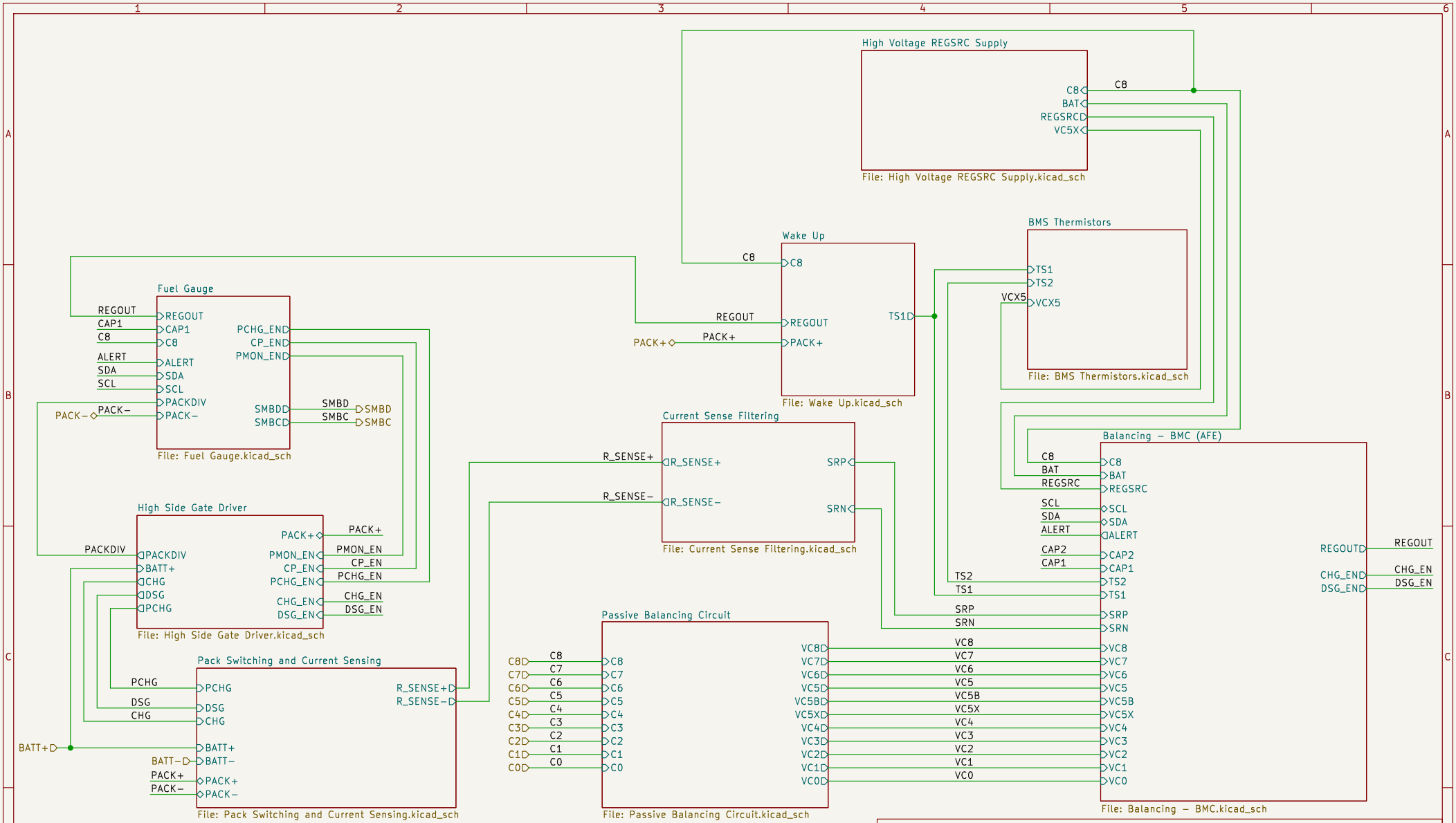
If we are using an external board (TDAA4VM J721EXSKG01EVM) 40 pin header



Sheet: /MCU/External 40 Pin Header/		
File: External 40 Pin Header.kicad_sch		
Title:		
Size: A4	Date:	**Rev:**
KiCad E.D.A. 9.0.4		Id: 4/38



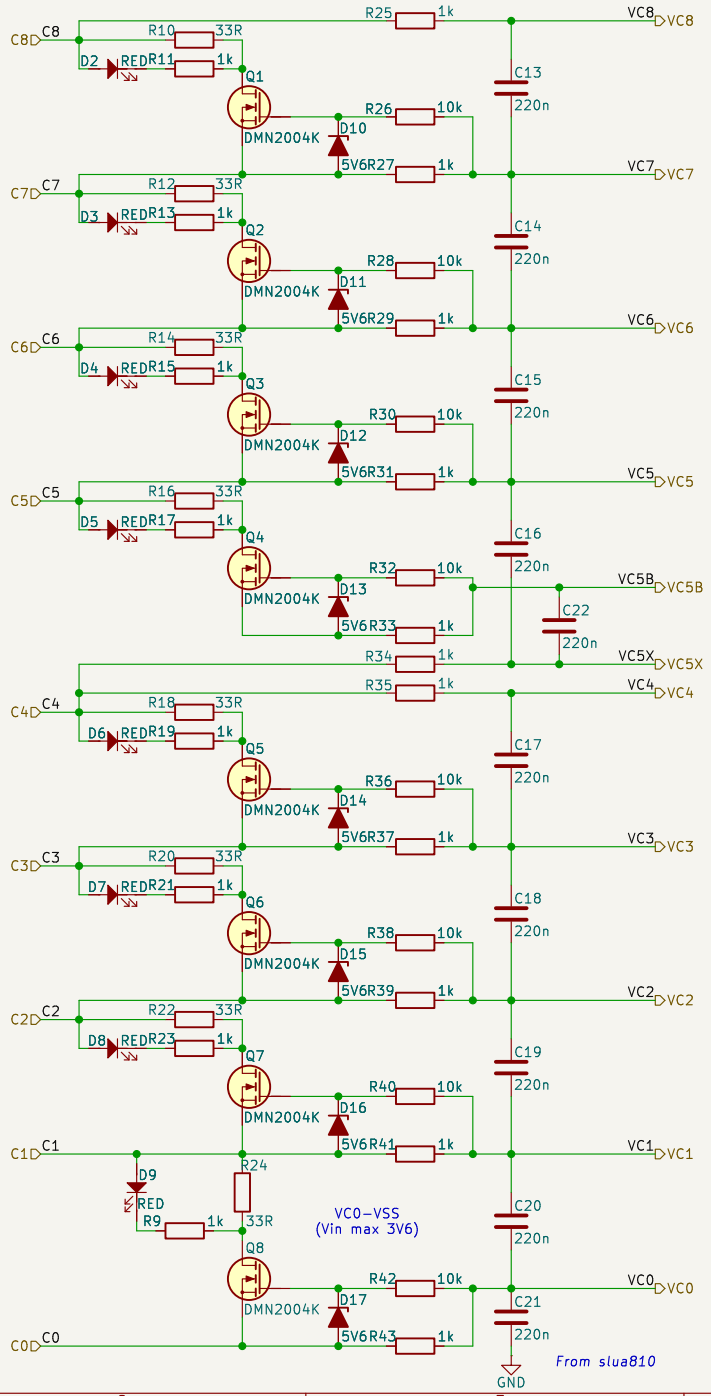
Sheet: /MCU/ESP32/		
File: ESP32.kicad_sch		
Title:		
Size: A4	Date:	**Rev:**
KiCad E.D.A. 9.0.4		Id: 5/38

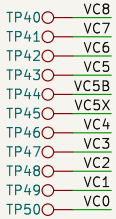


BMS Protection Board for 8S Battery Pack
In/Out: min voltage: 25.6V, nominal voltage: 29.6V, max voltage: 33.6V
Output: 50A continuous discharge current
Min Each Cell set to 3.2V, Max Each Cell set to 4.2V

Sheet: /BMS Protection Board/		
File: BMS Protection Board.kicad_sch		
Title:		
Size: A4	Date:	**Rev:**
KiCad E.D.A. 9.0.4		Id: 7/38

Passive Balancing Circuit

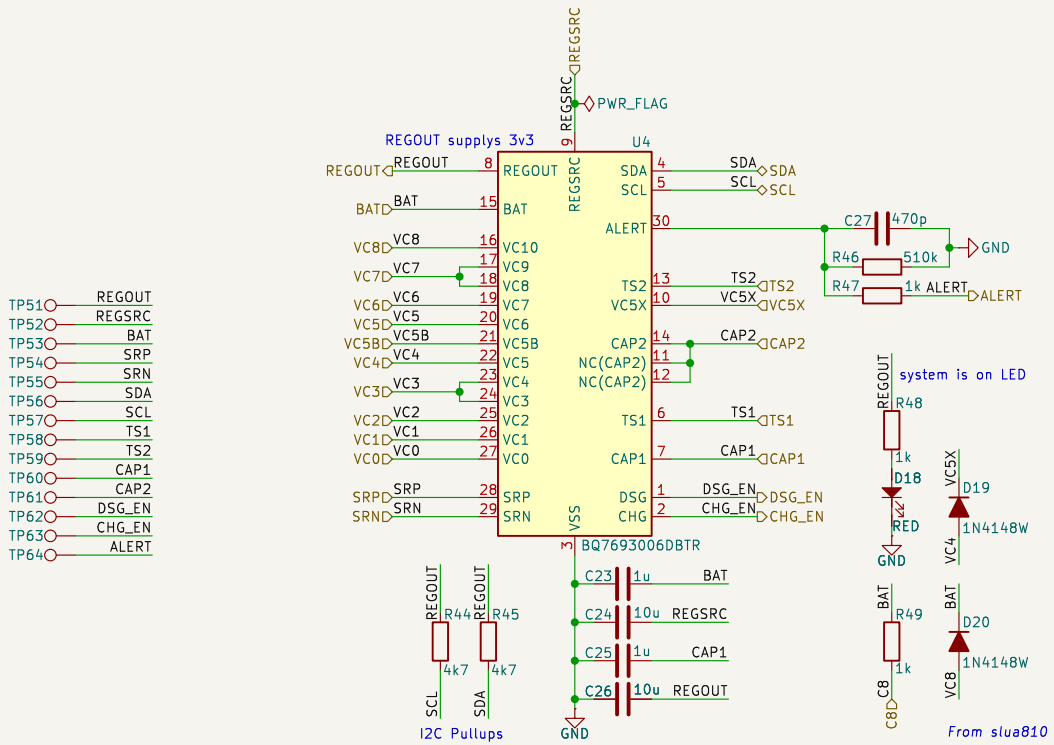




Sheet: /BMS Protection Board/Passive Balancing Circuit/
File: Passive Balancing Circuit.kicad_sch

Title:

Size: A4	Date:	**Rev:**
KiCad E.D.A. 9.0.4		Id: 8/38



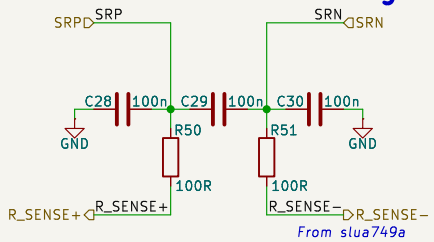
Balancing & BMC (AFE)

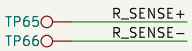
Sheet: /BMS Protection Board/Balancing – BMC (AFE)/
File: Balancing – BMC.kicad_sch

Title:

Size: A4	Date:	**Rev:**
KiCad E.D.A. 9.0.4		Id: 9/38

Current Sense Filtering

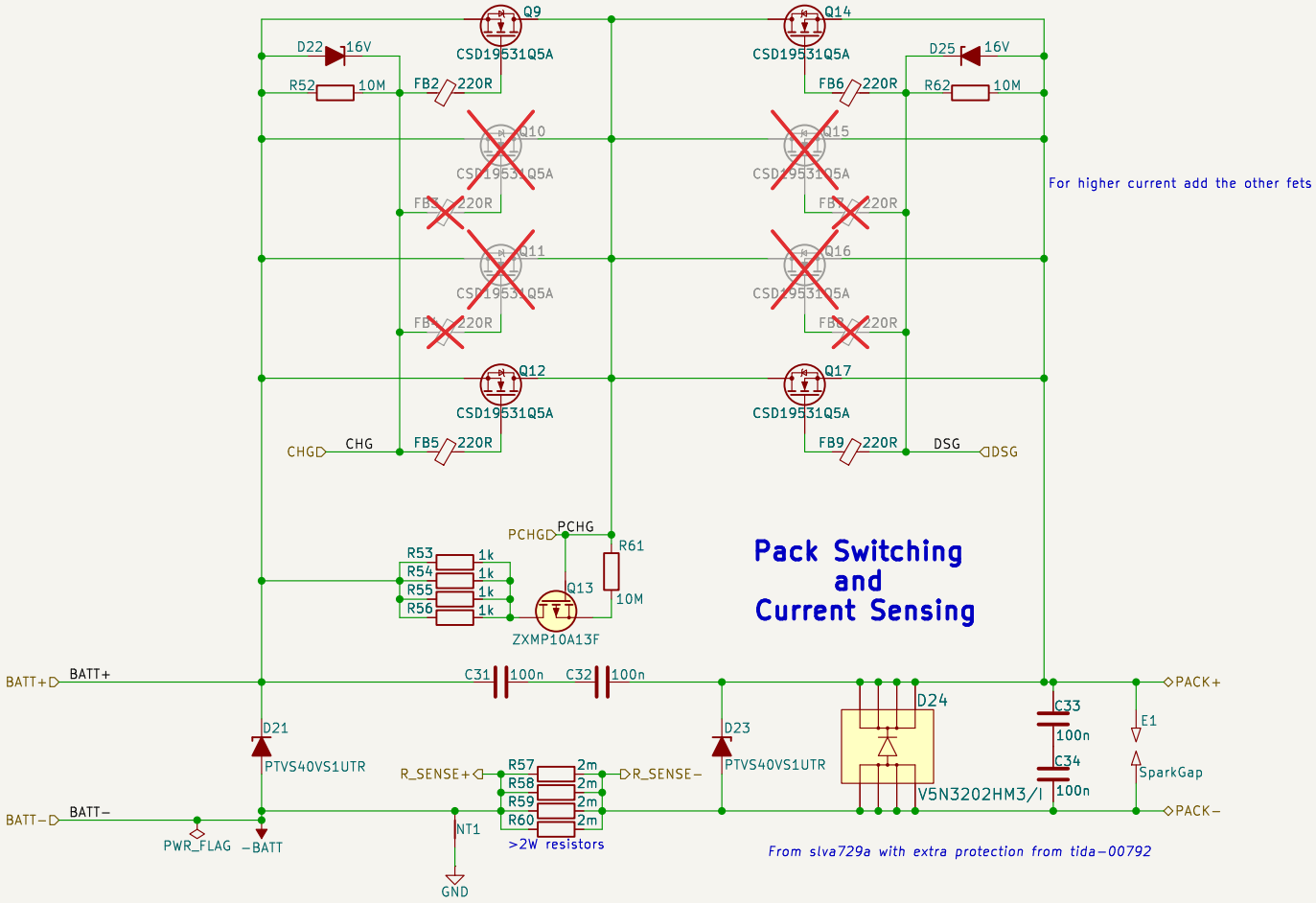




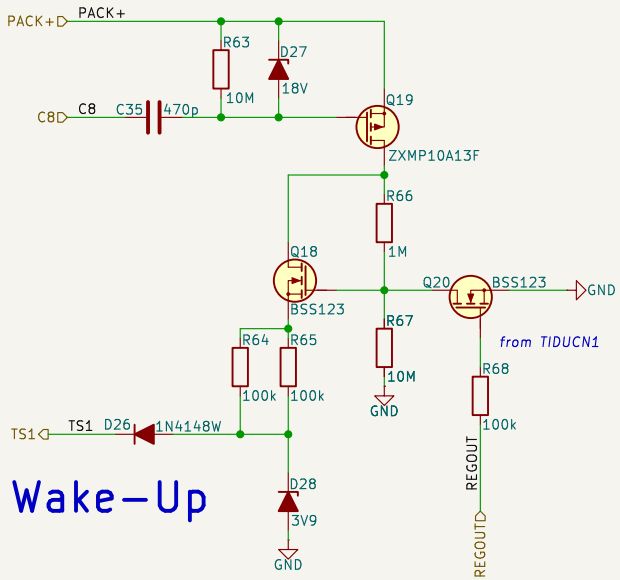
Sheet: /BMS Protection Board/Current Sense Filtering/
File: Current Sense Filtering.kicad_sch

Title:

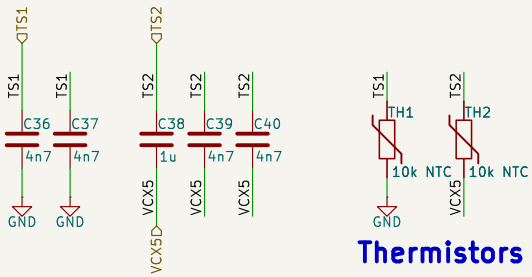
Size: A4	Date:	**Rev:**
KiCad E.D.A. 9.0.4		Id: 10/38



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: 11/38

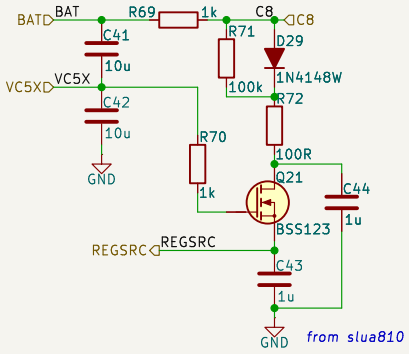


Sheet: /BMS Protection Board/Wake Up/		
File: Wake Up.kicad_sch		
Title:		
Size: A4	Date:	**Rev:**
KiCad E.D.A. 9.0.4		Id: 12/38



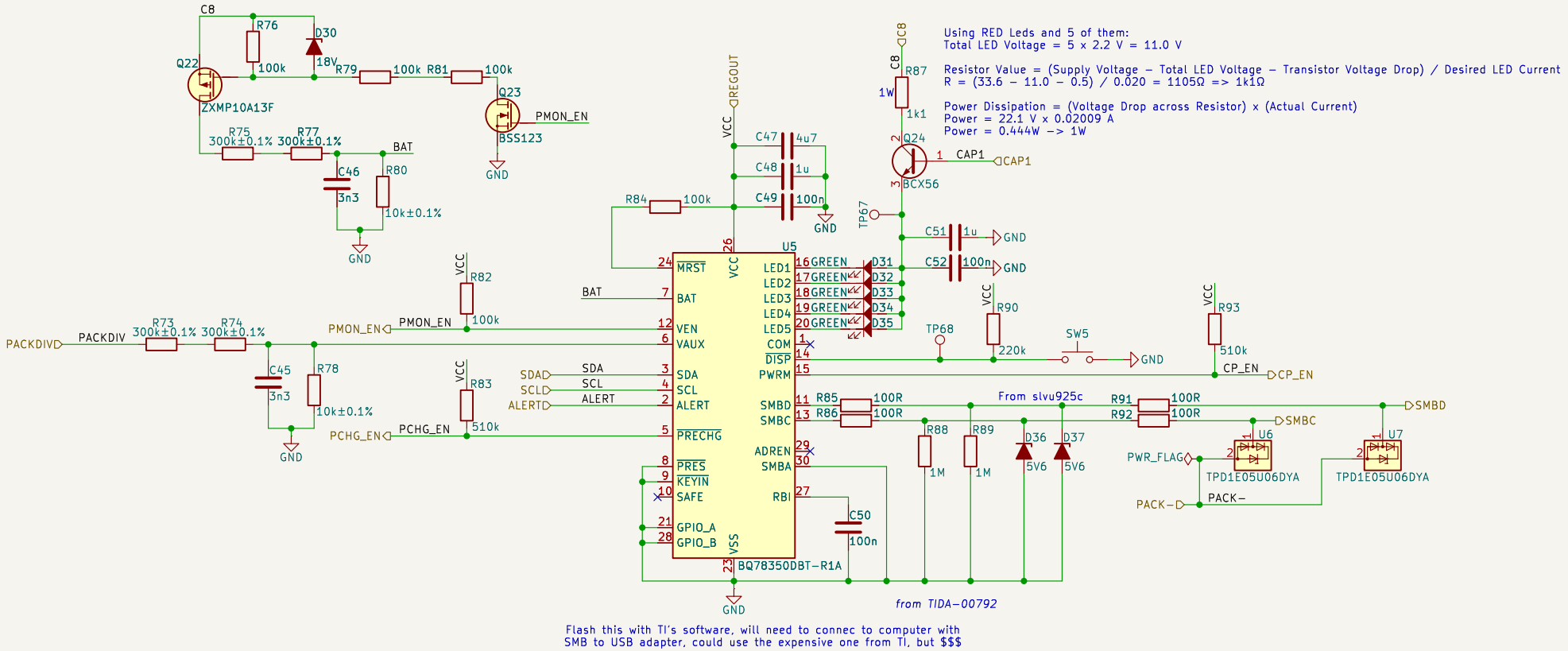
Sheet: /BMS Protection Board/BMS Thermistors/		
File: BMS Thermistors.kicad_sch		
Title:		
Size: A4	Date:	**Rev:**
KiCad E.D.A. 9.0.4		Id: 13/38

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: 14/38

Fuel Gauge

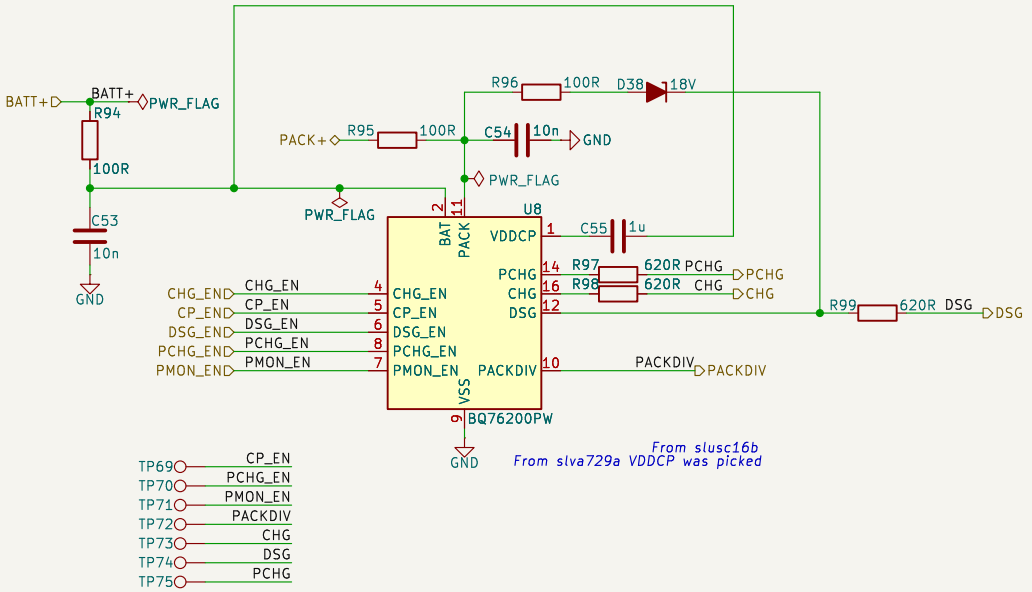


Sheet: /BMS Protection Board/Fuel Gauge/
File: Fuel Gauge.kicad_sch

Title:

Size: A4	Date:	**Rev:**
KiCad E.D.A. 9.0.4		Id: 15/38

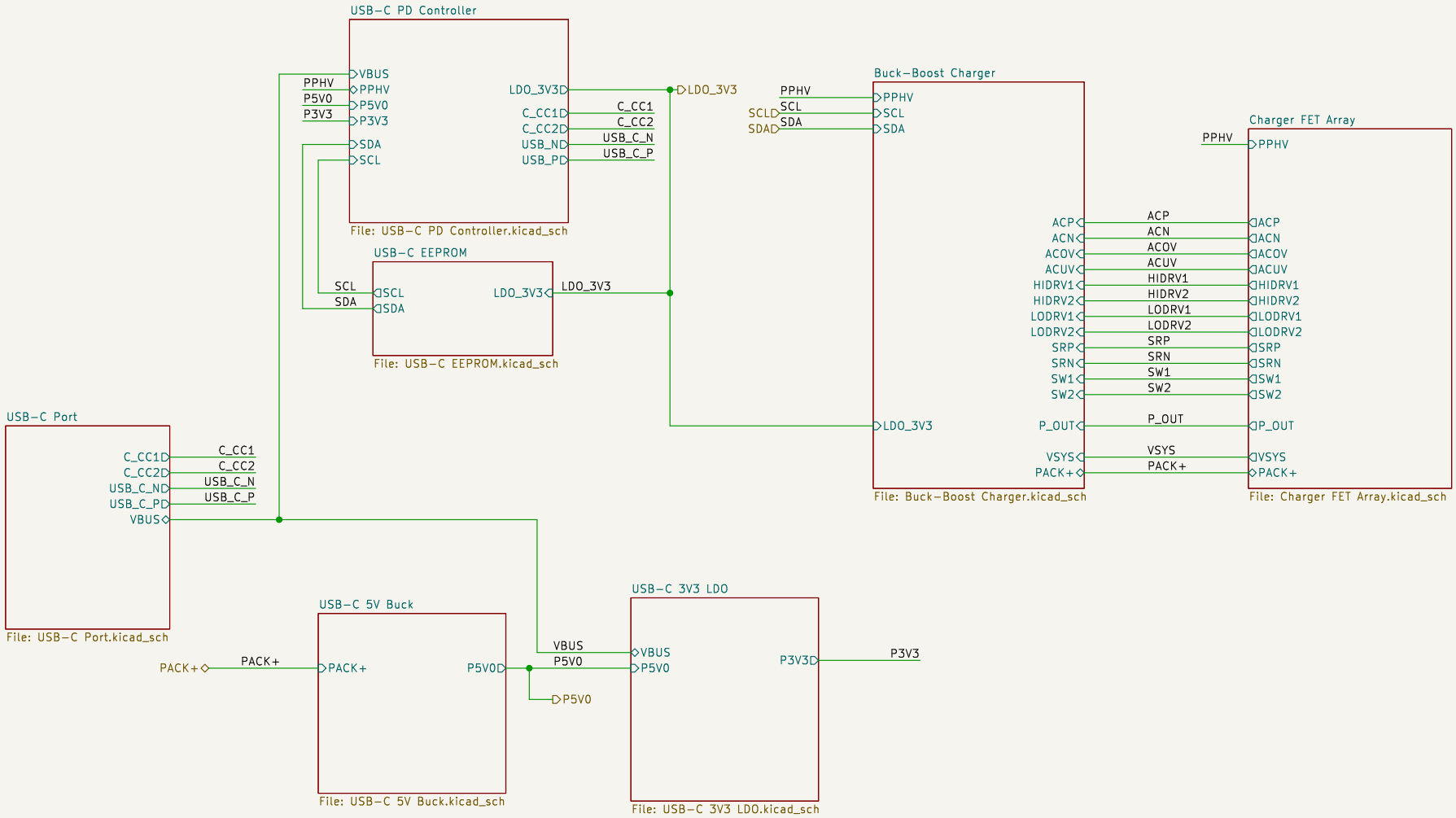
High-Side Gate Driver



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: 16/38



Design is based off of PMP41062

The Correct Flashing Process

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.

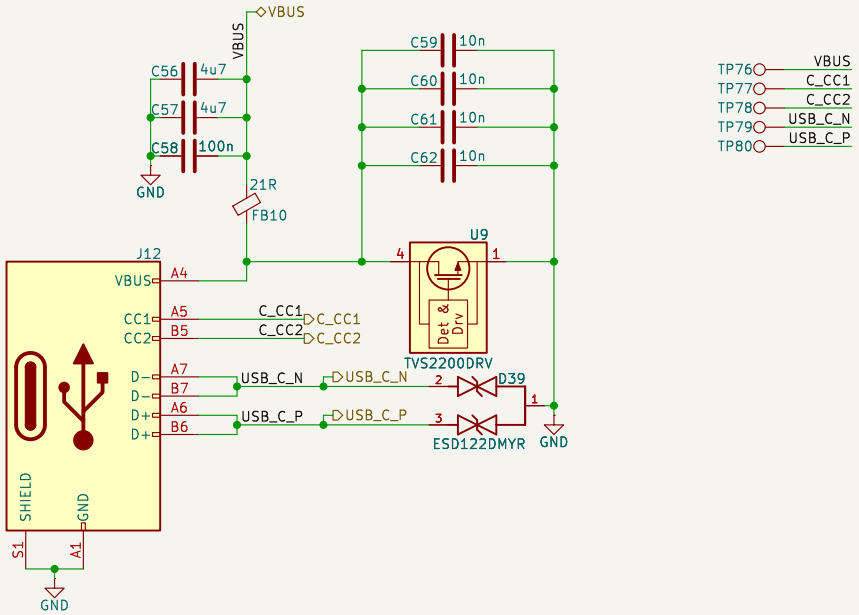
Assemble the Final Circuit: Once the EEPROM is successfully flashed, connect it to the I2Cc (the controller port) of the TPS25751.

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:

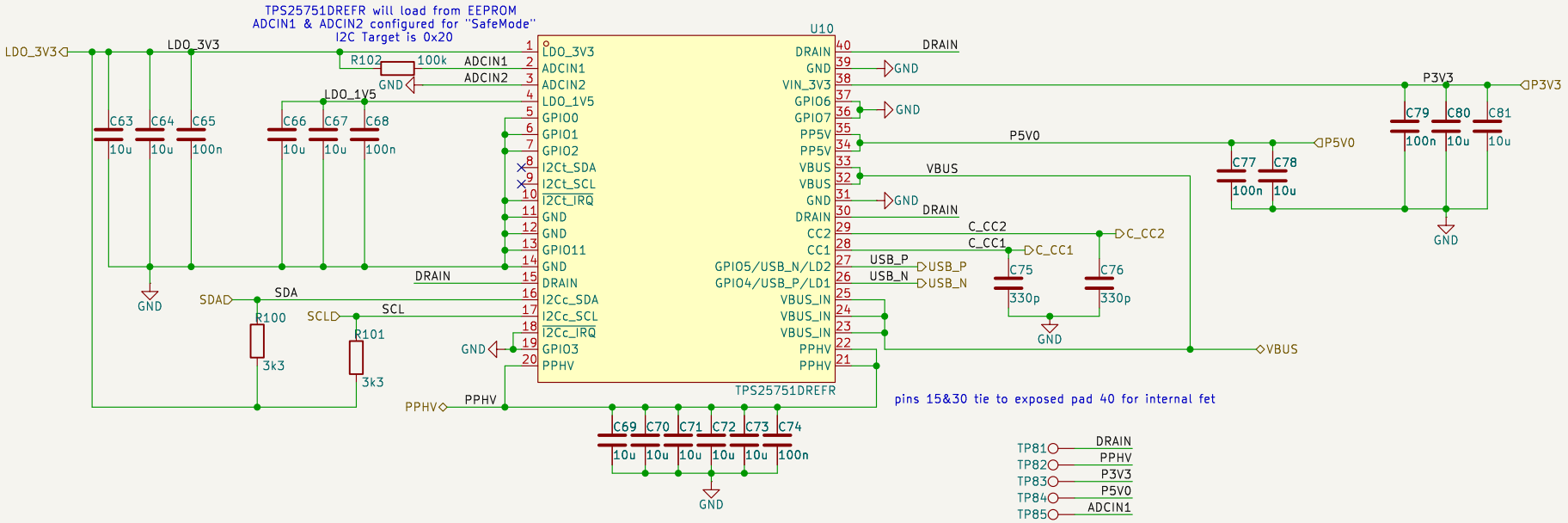
Size: A4	Date:	**Rev:**
KiCad E.D.A. 9.0.4		Id: 17/38



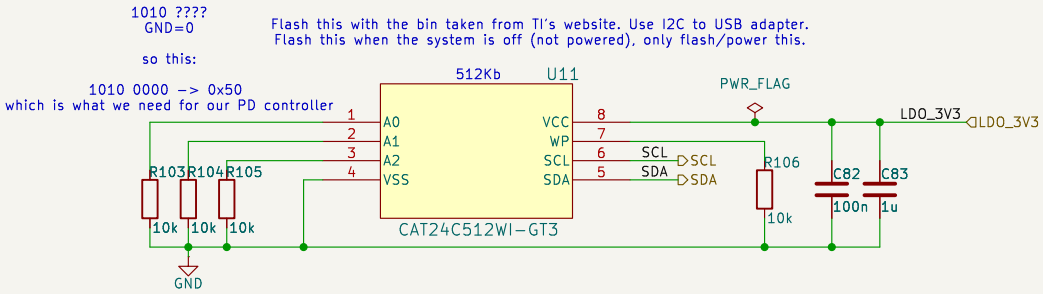
Sheet: /USB-C Power Delivery/USB-C Port/
File: USB-C Port.kicad_sch

Title:

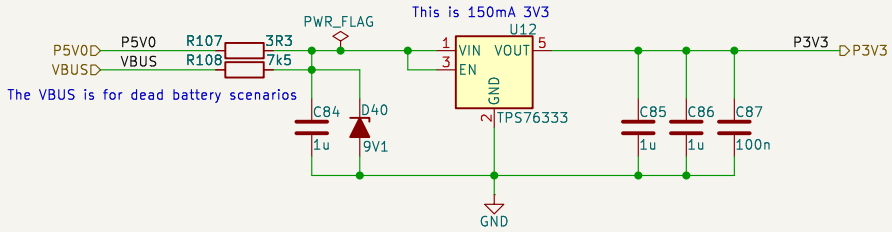
Size: A4	Date:	**Rev:**
KiCad E.D.A. 9.0.4		Id: 18/38



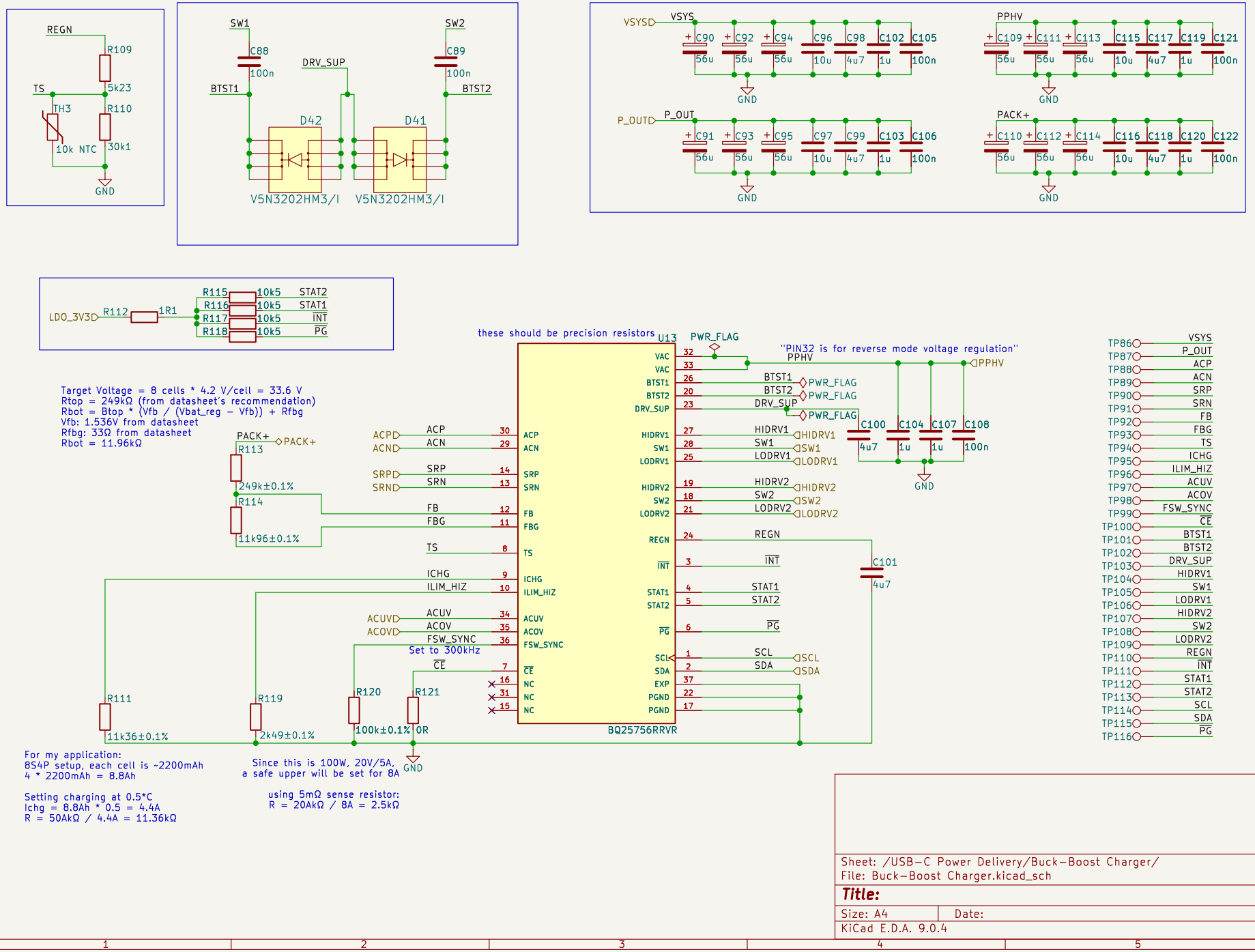
Sheet: /USB-C Power Delivery/USB-C PD Controller/		
File: USB-C PD Controller.kicad_sch		
Title:		
Size: A4	Date:	**Rev:**
KiCad E.D.A. 9.0.4		Id: 19/38

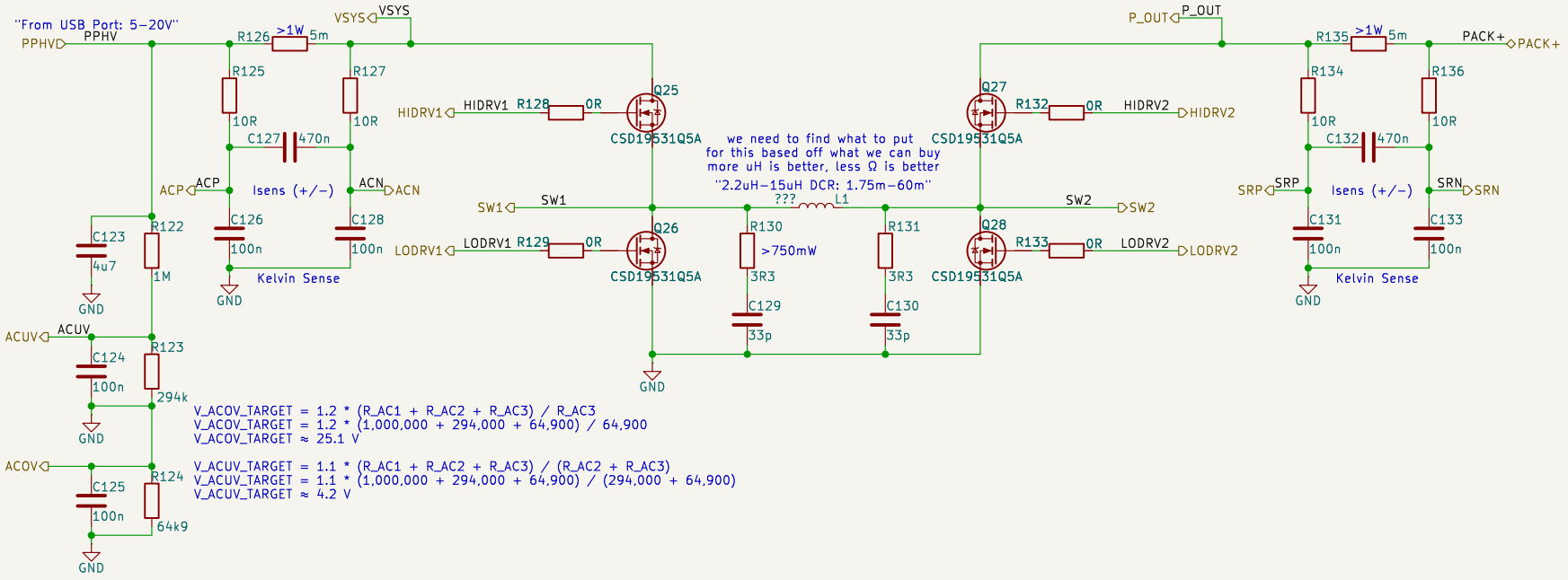


Sheet: /USB-C Power Delivery/USB-C EEPROM/		
File: USB-C EEPROM.kicad_sch		
Title:		
Size: A4	Date:	**Rev:**
KiCad E.D.A. 9.0.4		Id: 20/38



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: 21/38


REGN
R109
5k23
TS
TH3
R110
10k NTC
30k1
GND
SW1
C88
100n
DRV_SUP
BTST1
SW2
C89
100n
BTST2
D42
D41
V5N3202HM3/I
V5N3202HM3/I
VSYS
C90 C92 C94 C96 C98 C102 C105
56u 56u 56u 10u 4u7 1u 100n
GND
PPHV
C109 C111 C113 C115 C117 C119 C121
56u 56u 56u 10u 4u7 1u 100n
GND
P_OUT
C91 C93 C95 C97 C99 C103 C106
56u 56u 56u 10u 4u7 1u 100n
GND
PACK+
C110 C112 C114 C116 C118 C120 C122
56u 56u 56u 10u 4u7 1u 100n
GND
LDO_3V3
R112
1R1
R115 10k5 STAT2
R116 10k5 STAT1
R117 10k5 INT
R118 10k5 PG
these should be precision resistors
U13
PWR_FLAG
"PIN32 is for reverse mode voltage regulation"
PPHV
VAC 32
VAC 33
BTST1 26
BTST2 20
DRV_SUP 23
HIDRV1 27
SW1 28
LODRV1 25
HIDRV2 19
SW2 18
LODRV2 21
REGN 24
INT 3
STAT1 4
STAT2 5
PG 6
SCL 1
SDA 2
EXP 37
PGND 22
PGND 17
ACP 30
ACN 29
SRP 14
SRN 13
FB 12
FBG 11
TS 8
ICHG 9
ILIM_HIZ 10
ACUV 34
ACOV 35
FSW_SYNC 36
CE 7
NC 16
NC 31
NC 15
BQ25756RRVR
C100 C104 C107 C108
4u7 1u 1u 100n
GND
C101
4u7
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
PACK+
R113
249k±0.1%
R114
11k96±0.1%
ACP
ACN
SRP
SRN
FB
FBG
TS
ICHG
ILIM_HIZ
ACUV
ACOV
FSW_SYNC
Set to 300kHz
CE
R111
11k36±0.1%
R119
2k49±0.1%
R120
100k±0.1%
R121
0R
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 = 50Akꭥ / 4.4A = 11.36kΩ
Since this is 100W, 20V/5A,
a safe upper will be set for 8A
using 5mΩ sense resistor:
R = 20Akꭥ / 8A = 2.5kΩ
TP86 VSYS
TP87 P_OUT
TP88 ACP
TP89 ACN
TP90 SRP
TP91 SRN
TP92 FB
TP93 FBG
TP94 TS
TP95 ICHG
TP96 ILIM_HIZ
TP97 ACUV
TP98 ACOV
TP99 FSW_SYNC
TP100 CE
TP101 BTST1
TP102 BTST2
TP103 DRV_SUP
TP104 HIDRV1
TP105 SW1
TP106 LODRV1
TP107 HIDRV2
TP108 SW2
TP109 LODRV2
TP110 REGN
TP111 INT
TP112 STAT1
TP113 STAT2
TP114 SCL
TP115 SDA
TP116 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: 22/38



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: 23/38

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

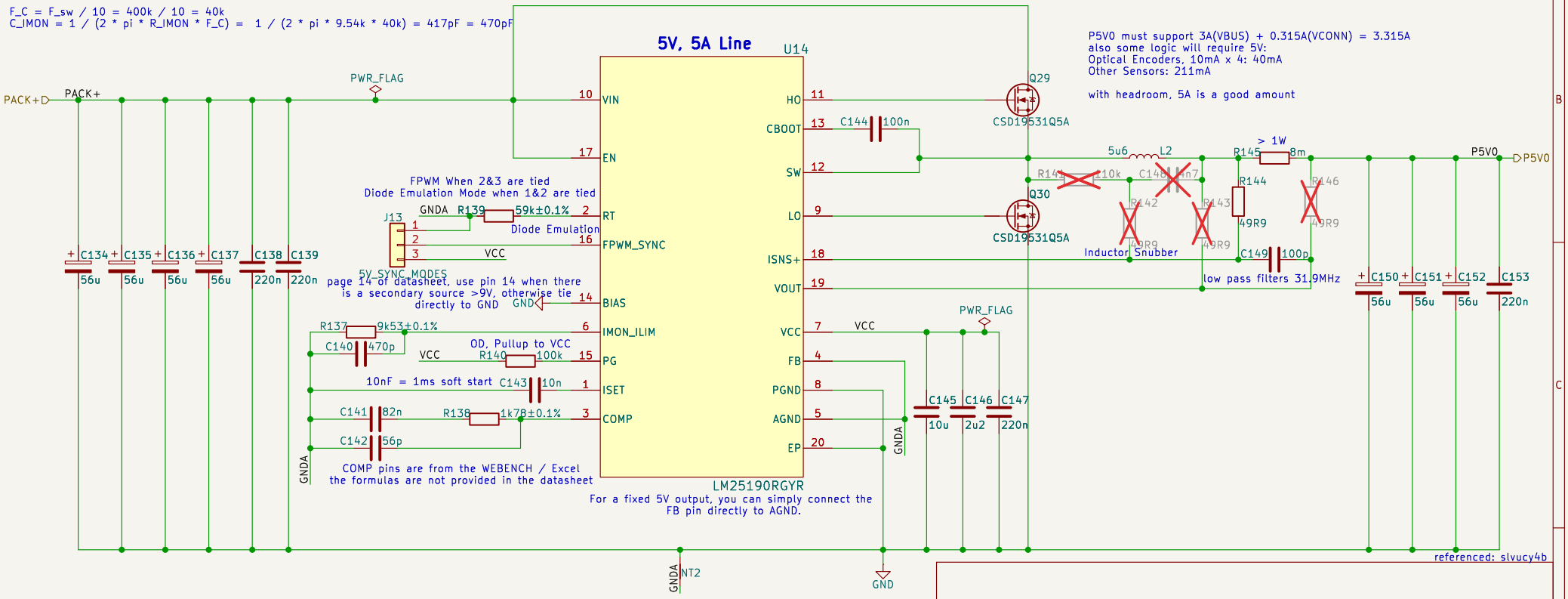
I_CO(RMS) = Delta_I_L / 12^(1/2) = 0.55A
*** The Capacitor Bank must be rated for > 0.55A for its ripple current

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

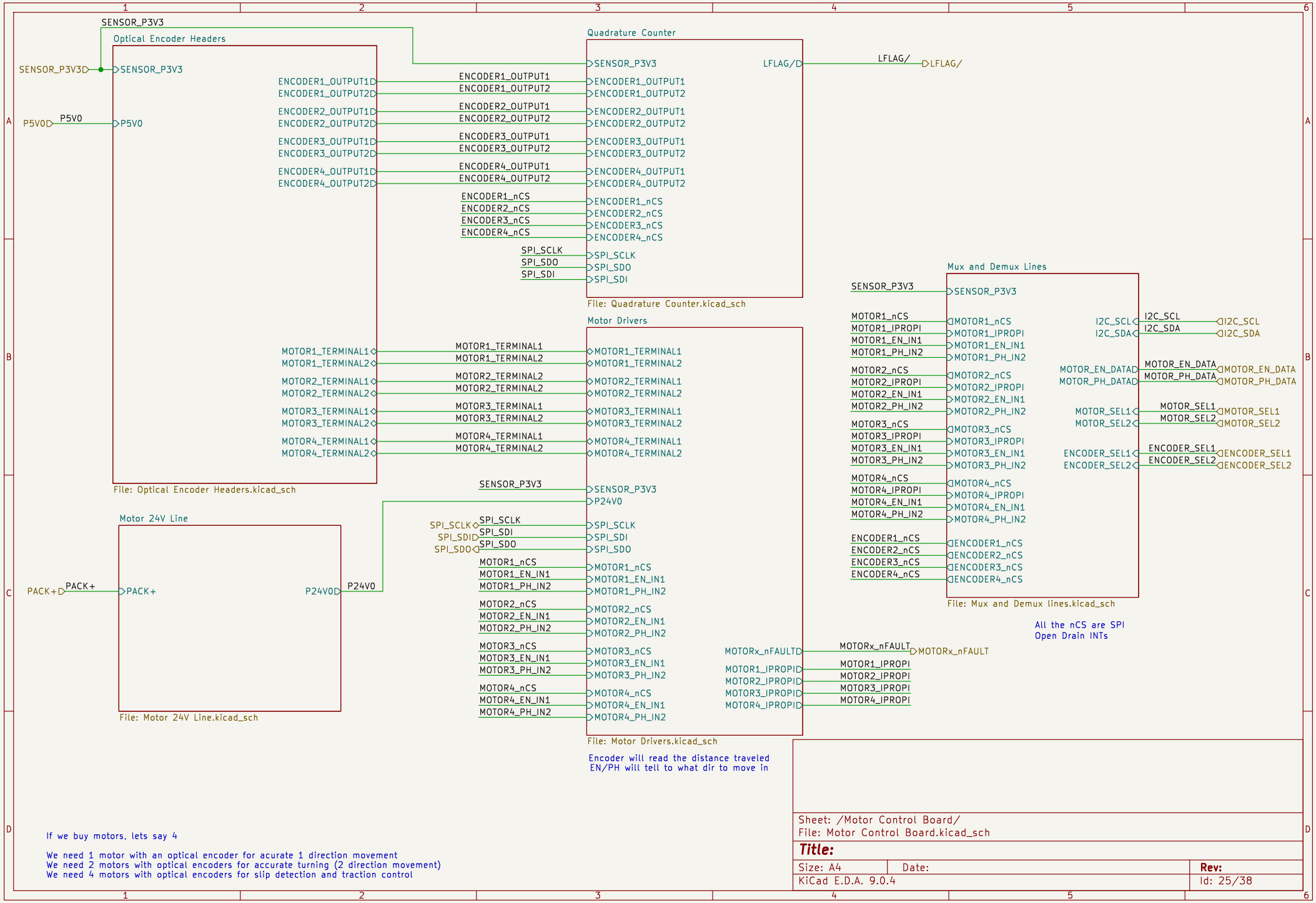
Soft Start:
* From datasheet: I_ISET (internal) is 10uA
* Delta_V = 1V (voltage ramp from 0 to 1)
I = Delta_Q / Delta_T , C = Delta_Q / Delta_V , Delta_T = (C * Delta_V) / I
T_SSCC = (C_ISET * Delta_V) / I_ISET = (10n * 1) / 10u = 1ms

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



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: 24/38


SENSOR_P3V3
Optical Encoder Headers
SENSOR_P3V3
P5V0
ENCODER1_OUTPUT1
ENCODER1_OUTPUT2
ENCODER2_OUTPUT1
ENCODER2_OUTPUT2
ENCODER3_OUTPUT1
ENCODER3_OUTPUT2
ENCODER4_OUTPUT1
ENCODER4_OUTPUT2
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/
ENCODER1_nCS
ENCODER2_nCS
ENCODER3_nCS
ENCODER4_nCS
SPI_SCLK
SPI_SDO
SPI_SDI
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
Encoder will read the distance traveled
EN/PH will tell to what dir to move in
Motor 24V Line
PACK+
File: Motor 24V Line.kicad_sch
Mux and Demux Lines
I2C_SCL
I2C_SDA
MOTOR_EN_DATA
MOTOR_PH_DATA
MOTOR_SEL1
MOTOR_SEL2
ENCODER_SEL1
ENCODER_SEL2
File: Mux and Demux lines.kicad_sch
All the nCS are SPI
Open Drain INTs
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
Sheet: /Motor Control Board/
File: Motor Control Board.kicad_sch
Title:
Size: A4
Date:
Rev:
KiCad E.D.A. 9.0.4
Id: 25/38

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)

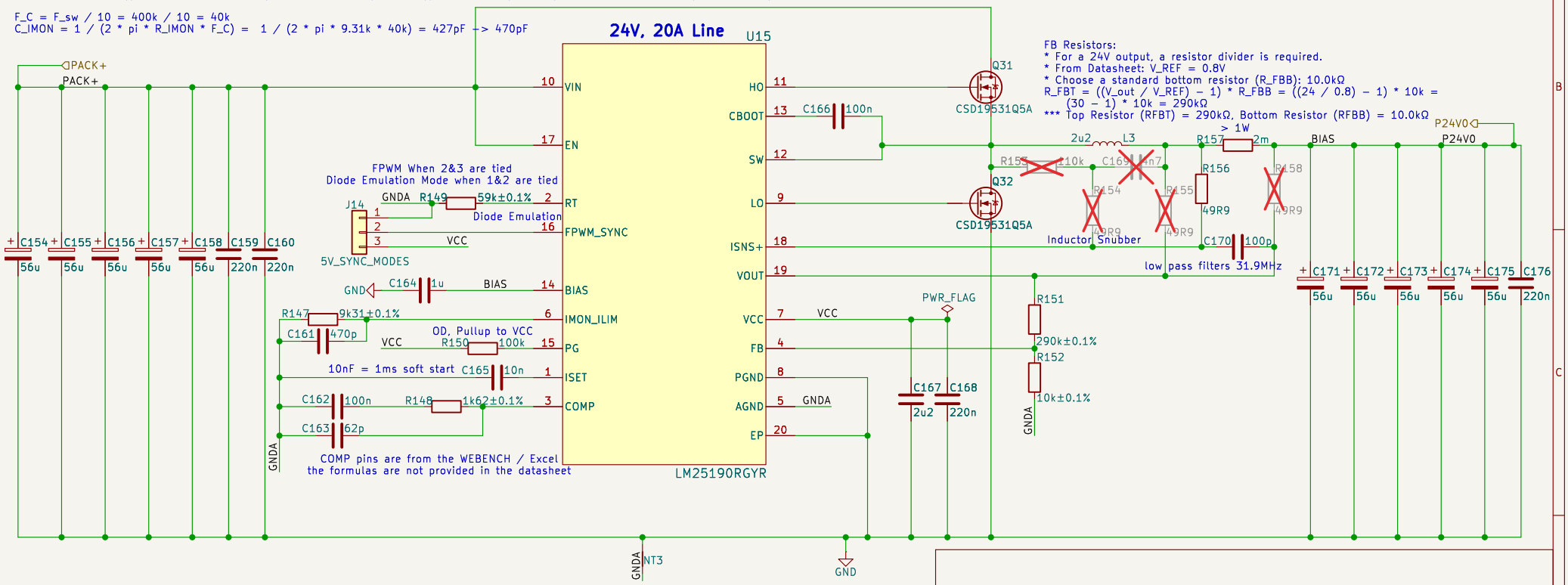
F_C = F_sw / 10 = 400k / 10 = 40k
C_IMON = 1 / (2 * pi * R_IMON * F_C) = 1 / (2 * pi * 9.31k * 40k) = 427pF -> 470pF

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



Sheet: /Motor Control Board/Motor 24V Line/		
File: Motor 24V Line.kicad_sch		
Title:		
Size: A4	Date:	**Rev:**
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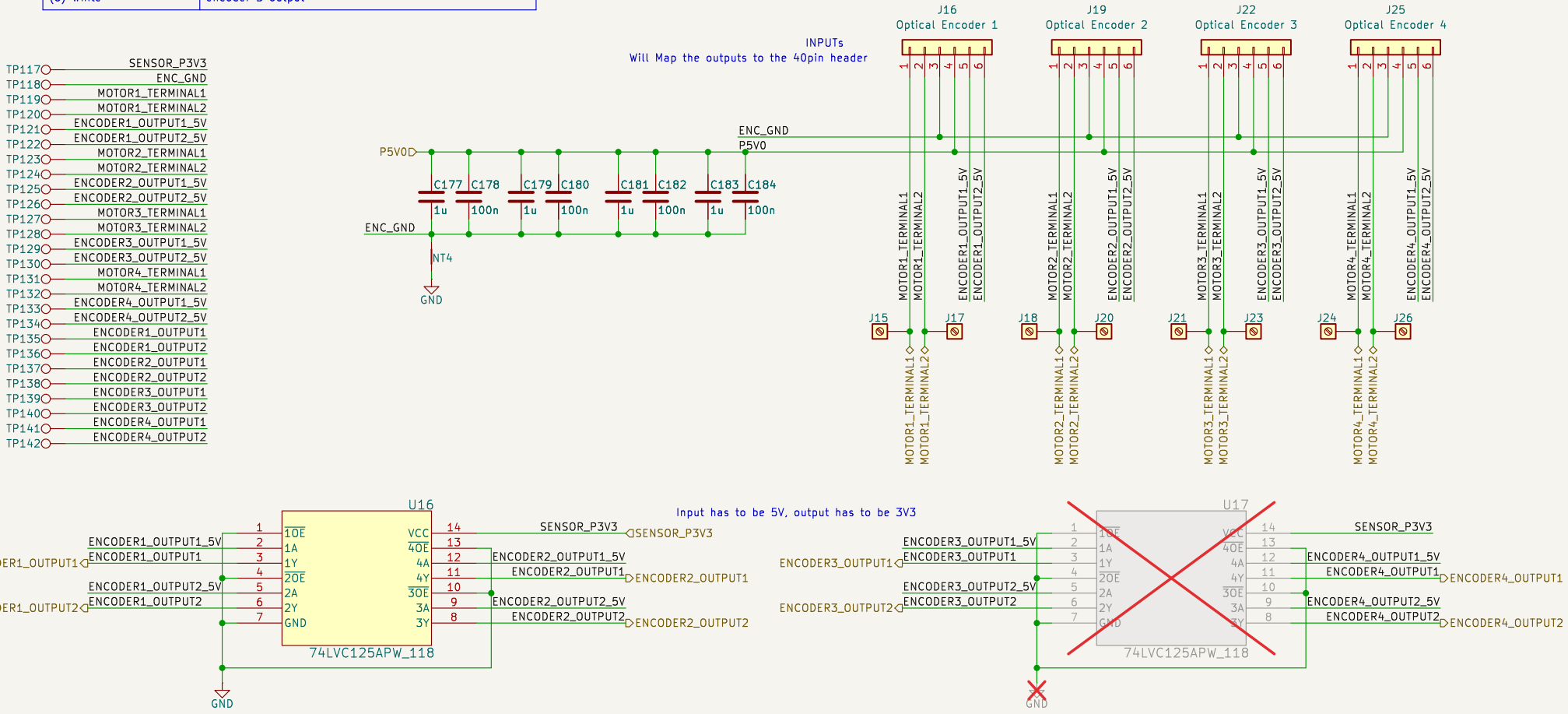
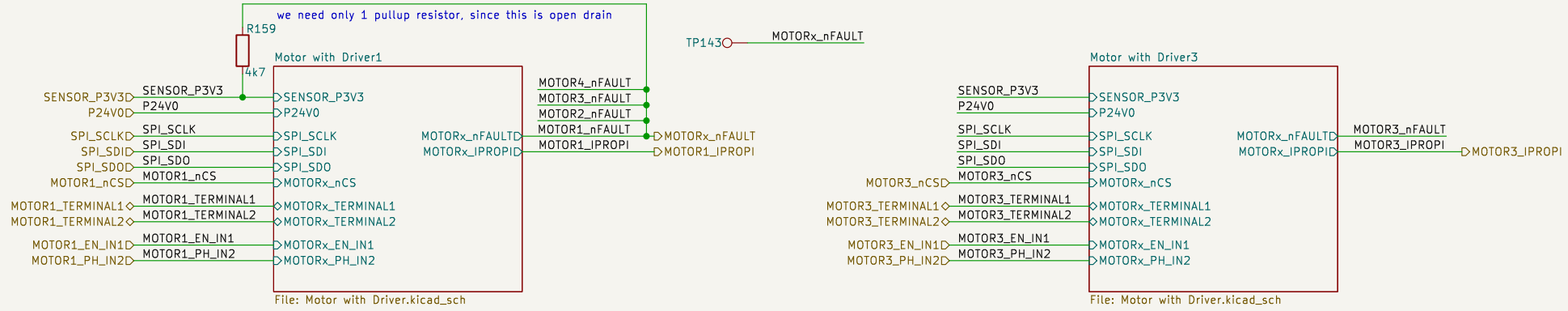
(1) Red	motor power (connects to one motor terminal)
(2) Black	motor power (connects to the other motor terminal)
(3) Green	encoder GND
(4) Blue	encoder Vcc (3.5 – 20 V)
(5) Yellow	encoder A output
(6) White	encoder B output



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: 27/38



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

Title:

Size: A4	Date:	**Rev:**
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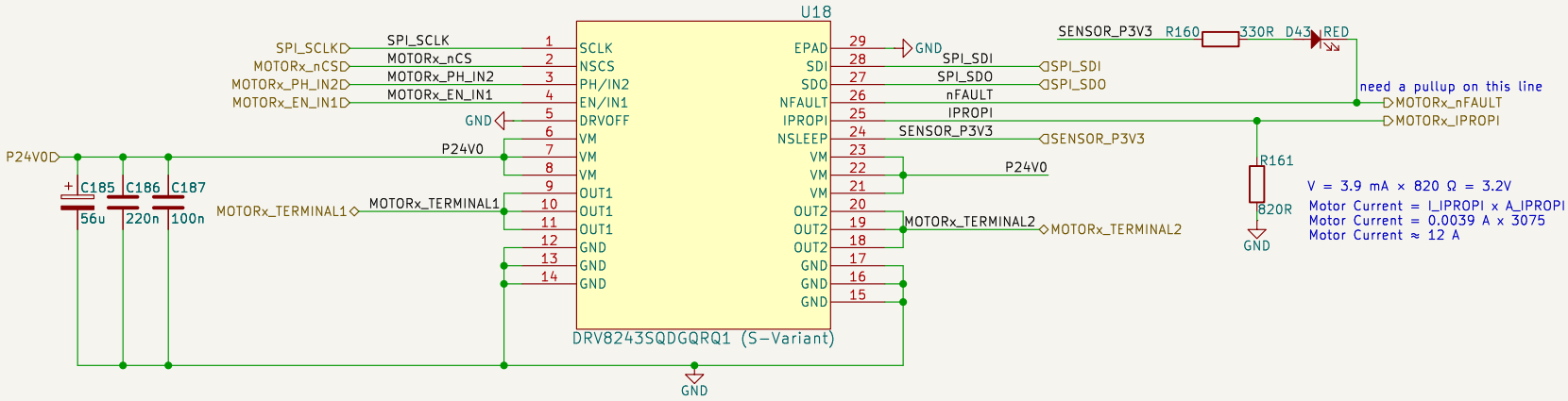
For the SPI (P) variant, you can set the SCLK frequency up to 10 MHz.

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.



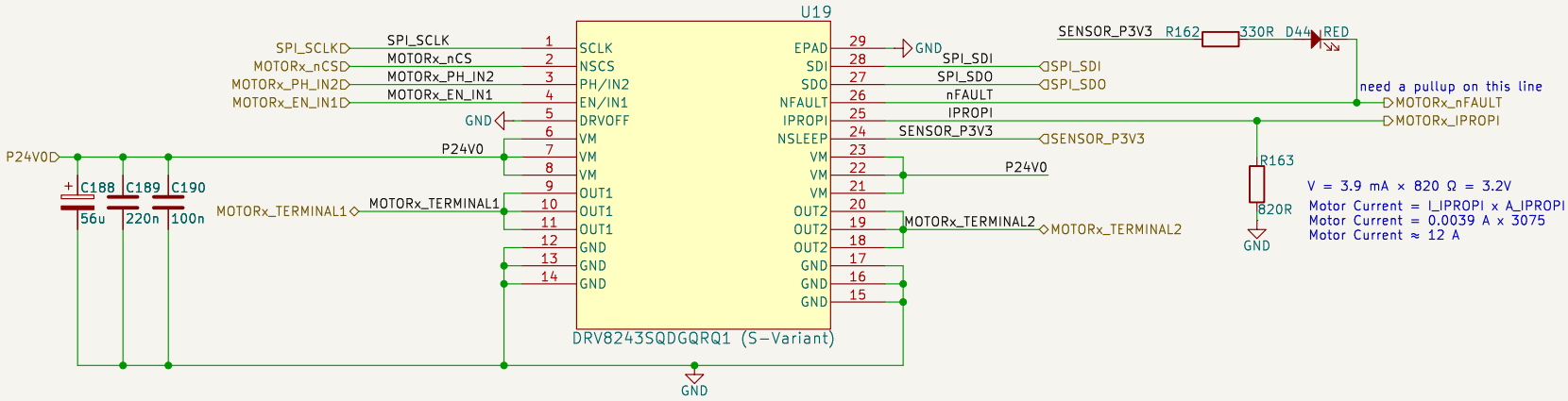
Sheet: /Motor Control Board/Motor Drivers/Motor with Driver1/
File: Motor with Driver.kicad_sch

Title:

Size: A4	Date:	**Rev:**
KiCad E.D.A. 9.0.4		Id: 29/38

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.



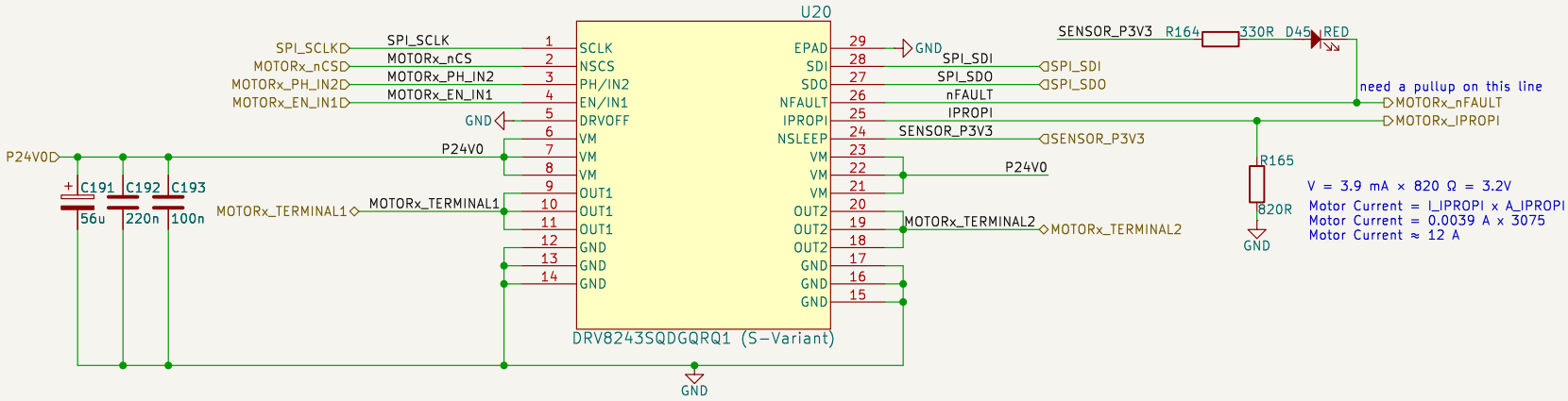
Sheet: /Motor Control Board/Motor Drivers/Motor with Driver2/
File: Motor with Driver.kicad_sch

Title:

Size: A4	Date:	**Rev:**
KiCad E.D.A. 9.0.4		Id: 30/38

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.



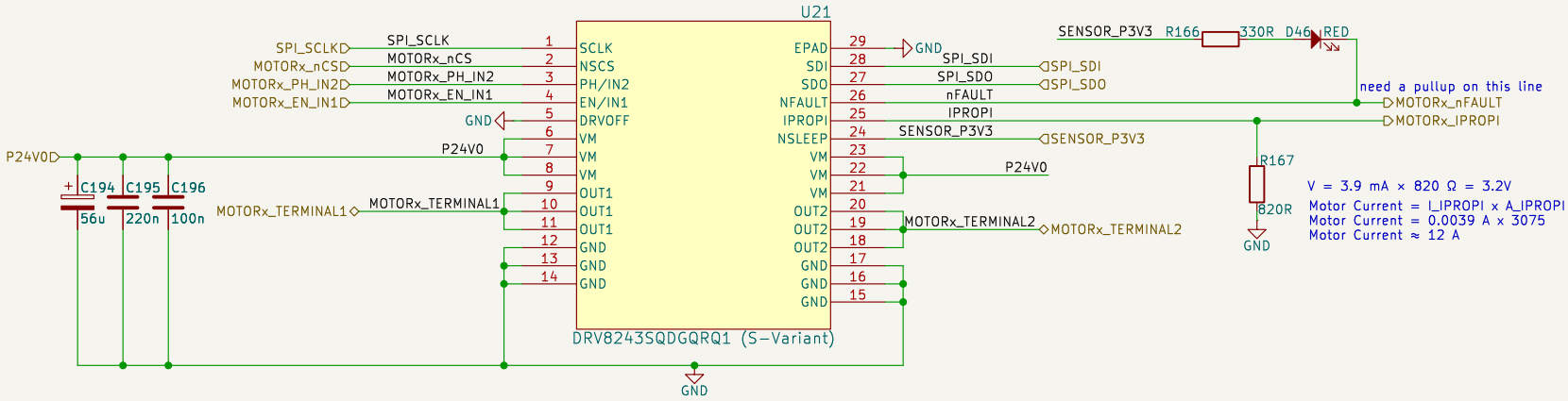
Sheet: /Motor Control Board/Motor Drivers/Motor with Driver3/
File: Motor with Driver.kicad_sch

Title:

Size: A4	Date:	**Rev:**
KiCad E.D.A. 9.0.4		Id: 31/38

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

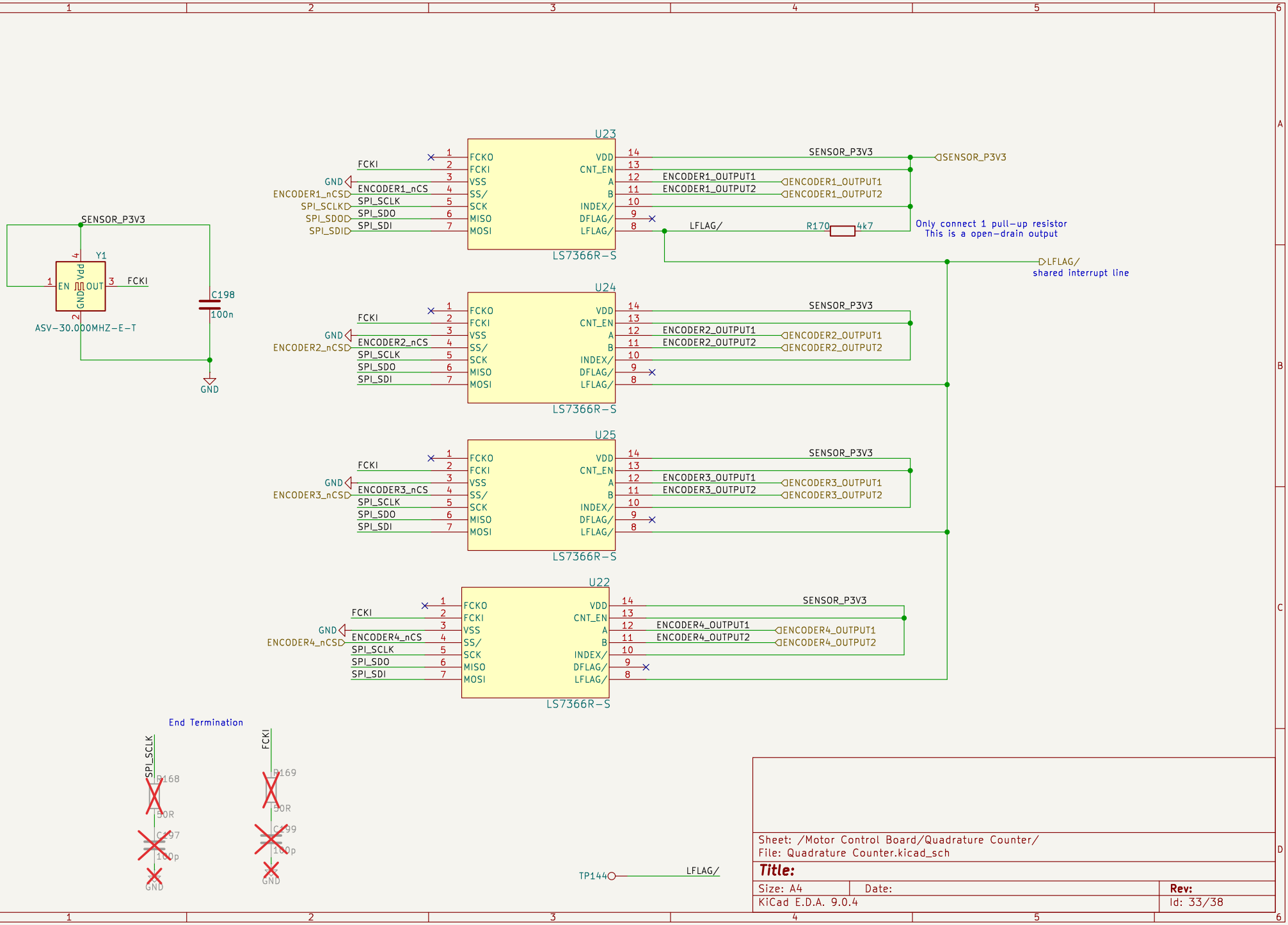
For the SPI (S) variant, the maximum is 10 MHz, but you should reduce it to 8 MHz if you have a 20 pF load on the SDO line.



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: 32/38


SENSOR_P3V3
Y1
EN
GND
Vdd
OUT
FCKI
ASV-30.000MHZ-E-T
C198
100n
GND
U23
FCKO
FCKI
VSS
SS/
SCK
MISO
MOSI
VDD
CNT_EN
A
B
INDEX/
DFLAG/
LFLAG/
FCKI
GND
ENCODER1_nCS
SPI_SCLK
SPI_SDO
SPI_SDI
ENCODER1_OUTPUT1
ENCODER1_OUTPUT2
SENSOR_P3V3
LFLAG/
R170
4k7
Only connect 1 pull-up resistor
This is a open-drain output
LFLAG/
shared interrupt line
LS7366R-S
U24
ENCODER2_nCS
ENCODER2_OUTPUT1
ENCODER2_OUTPUT2
U25
ENCODER3_nCS
ENCODER3_OUTPUT1
ENCODER3_OUTPUT2
U22
ENCODER4_nCS
ENCODER4_OUTPUT1
ENCODER4_OUTPUT2
End Termination
SPI_SCLK
FCKI
R168
R169
50R
C197
C199
100p
GND
TP144
LFLAG/
Sheet: /Motor Control Board/Quadrature Counter/
File: Quadrature Counter.kicad_sch
Title:
Size: A4
Date:
Rev:
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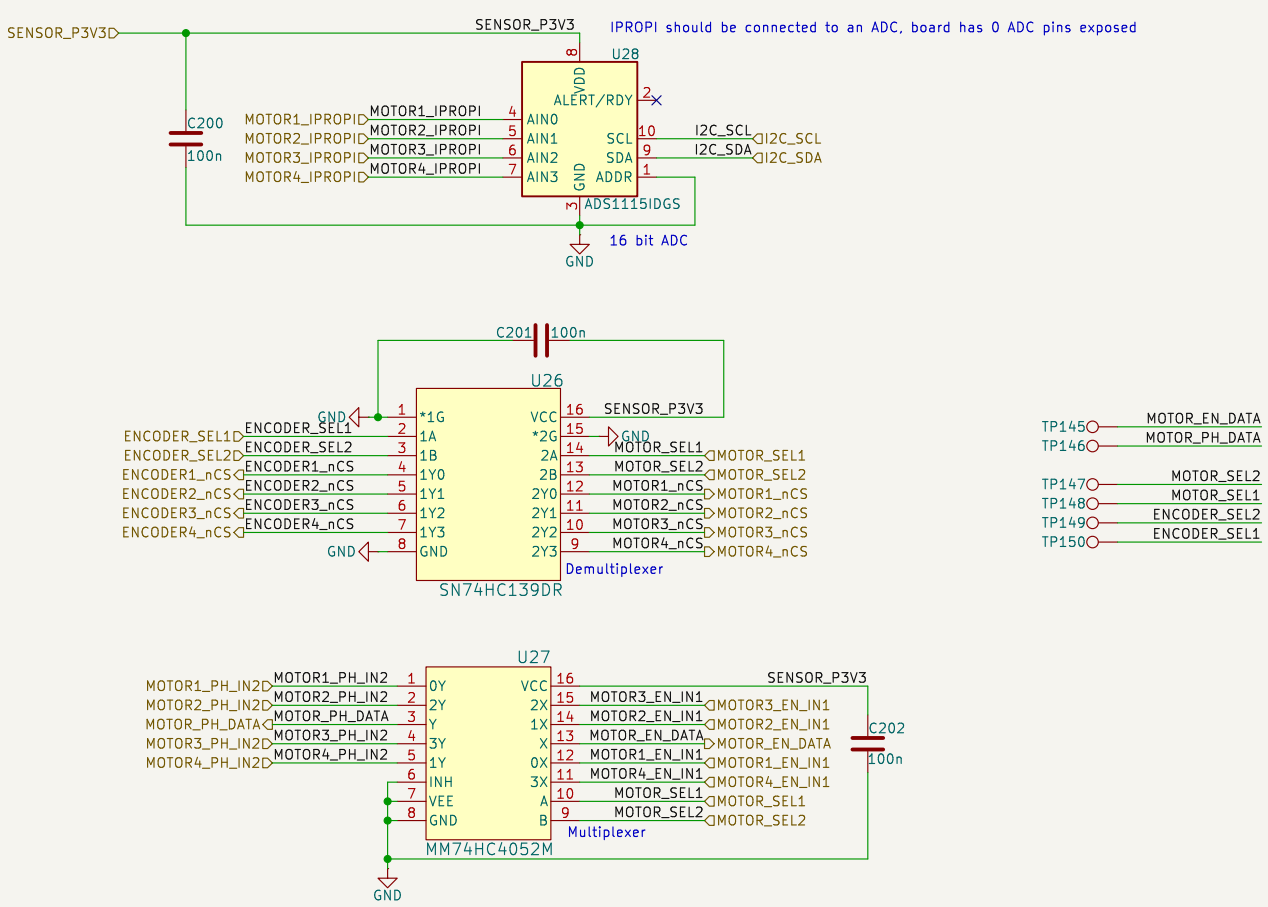
SENSOR_P3V3
SENSOR_P3V3
IPROPI should be connected to an ADC, board has 0 ADC pins exposed
U28
VDD
ALERT/RDY
C200
100n
MOTOR1_IPROPI
MOTOR2_IPROPI
MOTOR3_IPROPI
MOTOR4_IPROPI
MOTOR1_IPROPI
MOTOR2_IPROPI
MOTOR3_IPROPI
MOTOR4_IPROPI
AIN0
AIN1
AIN2
AIN3
SCL
SDA
ADDR
GND
I2C_SCL
I2C_SDA
I2C_SCL
I2C_SDA
ADS1115IDGS
16 bit ADC
GND
C201
100n
U26
GND
*1G
ENCODER_SEL1
ENCODER_SEL1
1A
ENCODER_SEL2
ENCODER_SEL2
1B
ENCODER1_nCS
ENCODER1_nCS
1Y0
ENCODER2_nCS
ENCODER2_nCS
1Y1
ENCODER3_nCS
ENCODER3_nCS
1Y2
ENCODER4_nCS
ENCODER4_nCS
1Y3
GND
GND
VCC
SENSOR_P3V3
*2G
GND
2A
MOTOR_SEL1
MOTOR_SEL1
2B
MOTOR_SEL2
MOTOR_SEL2
2Y0
MOTOR1_nCS
MOTOR1_nCS
2Y1
MOTOR2_nCS
MOTOR2_nCS
2Y2
MOTOR3_nCS
MOTOR3_nCS
2Y3
MOTOR4_nCS
MOTOR4_nCS
Demultiplexer
SN74HC139DR
TP145
TP146
TP147
TP148
TP149
TP150
MOTOR_EN_DATA
MOTOR_PH_DATA
MOTOR_SEL2
MOTOR_SEL1
ENCODER_SEL2
ENCODER_SEL1
U27
MOTOR1_PH_IN2
MOTOR2_PH_IN2
MOTOR_PH_DATA
MOTOR3_PH_IN2
MOTOR4_PH_IN2
MOTOR1_PH_IN2
MOTOR2_PH_IN2
MOTOR_PH_DATA
MOTOR3_PH_IN2
MOTOR4_PH_IN2
0Y
2Y
Y
3Y
1Y
INH
VEE
GND
VCC
SENSOR_P3V3
2X
MOTOR3_EN_IN1
MOTOR3_EN_IN1
1X
MOTOR2_EN_IN1
MOTOR2_EN_IN1
X
MOTOR_EN_DATA
MOTOR_EN_DATA
0X
MOTOR1_EN_IN1
MOTOR1_EN_IN1
3X
MOTOR4_EN_IN1
MOTOR4_EN_IN1
A
MOTOR_SEL1
MOTOR_SEL1
B
MOTOR_SEL2
MOTOR_SEL2
Multiplexer
MM74HC4052M
C202
100n
GND
Sheet: /Motor Control Board/Mux and Demux Lines/
File: Mux and Demux lines.kicad_sch
Title:
Size: A4
Date:
Rev:
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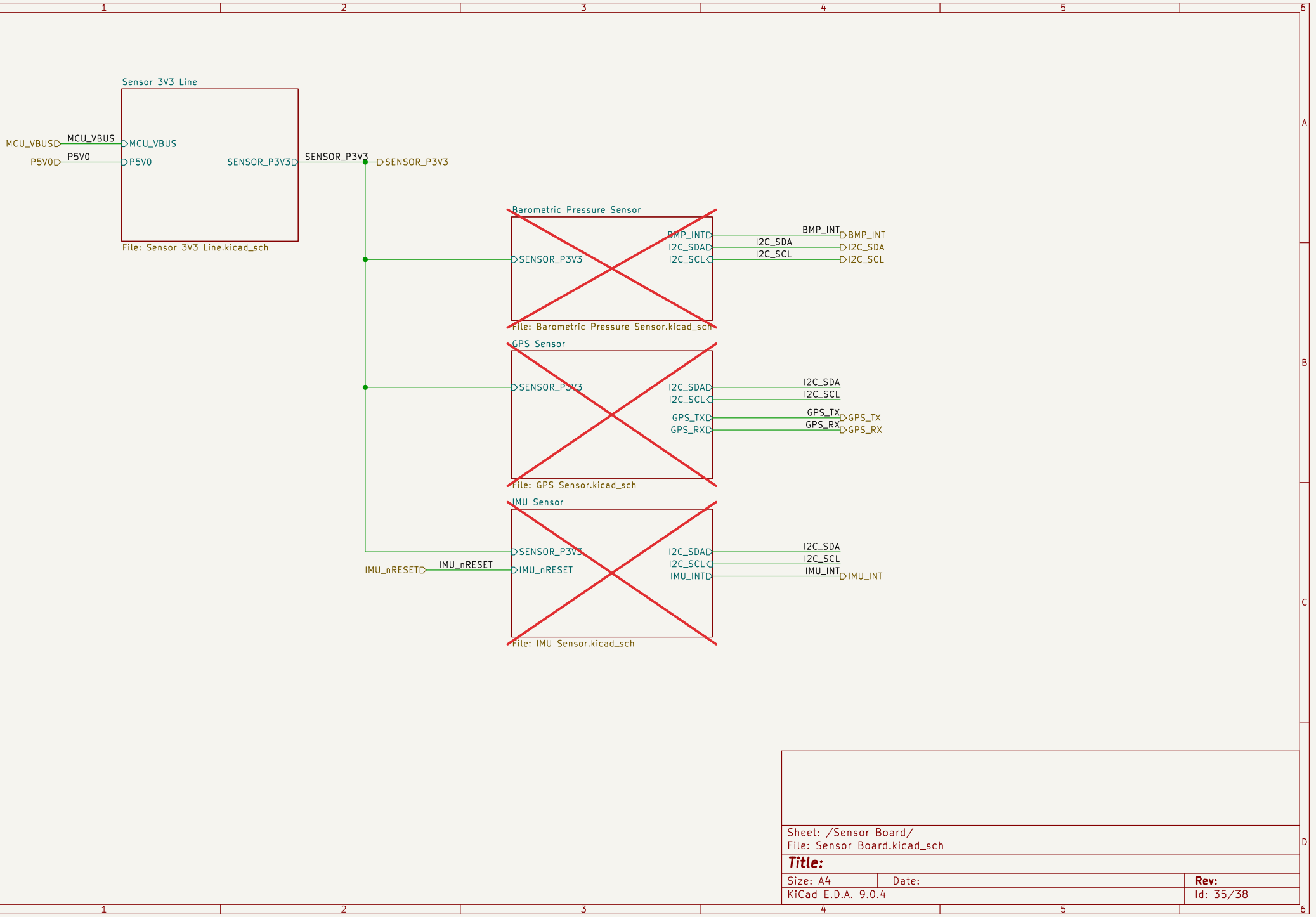
Id: 34/38


Sensor 3V3 Line
MCU_VBUS
P5V0
MCU_VBUS
P5V0
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
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
File: GPS Sensor.kicad_sch
IMU Sensor
SENSOR_P3V3
IMU_nRESET
IMU_nRESET
I2C_SDA
I2C_SCL
IMU_INT
I2C_SDA
I2C_SCL
IMU_INT
File: IMU Sensor.kicad_sch
Sheet: /Sensor Board/
File: Sensor Board.kicad_sch
Title:
Size: A4
Date:
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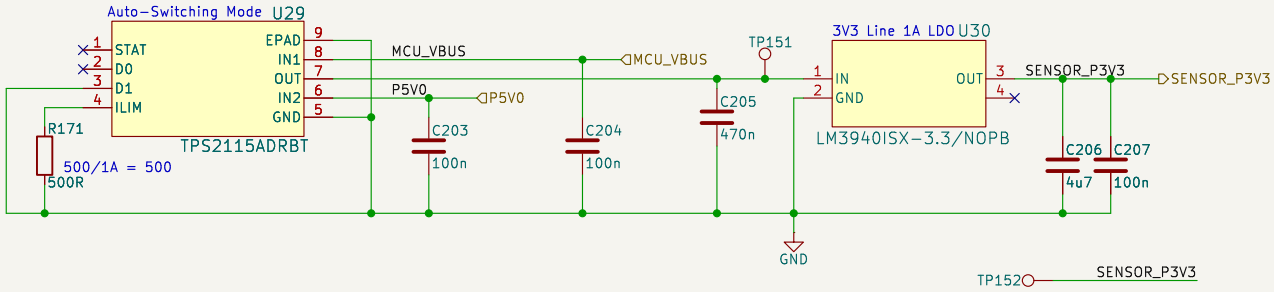
Id: 35/38



Sheet: /Sensor Board/Sensor 3V3 Line/		
File: Sensor 3V3 Line.kicad_sch		
Title:		
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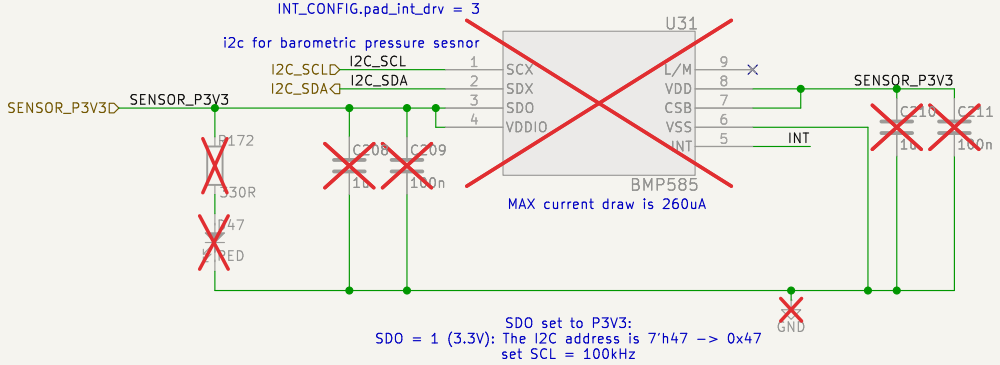
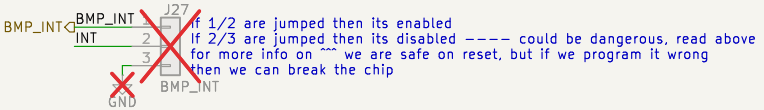
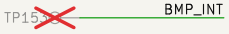
Per the datasheet, the unused INT pin is tied to GND to prevent a floating input.
CRITICAL: The interrupt pin must be disabled in software to prevent a short circuit.
Ensure the 'int_en' bit in the INT_CONFIG register (0x14) remains disabled (set to 0).

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:**
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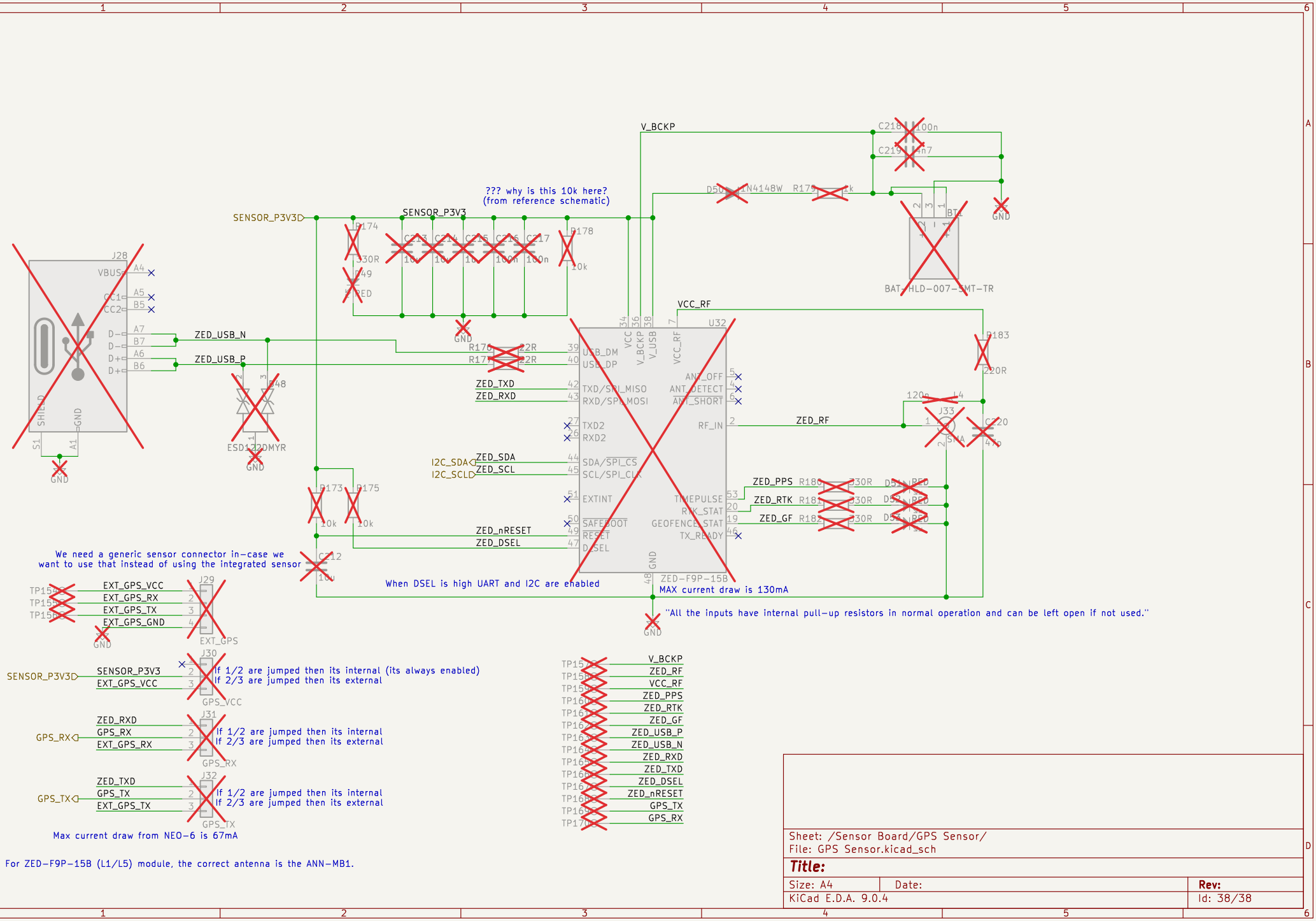
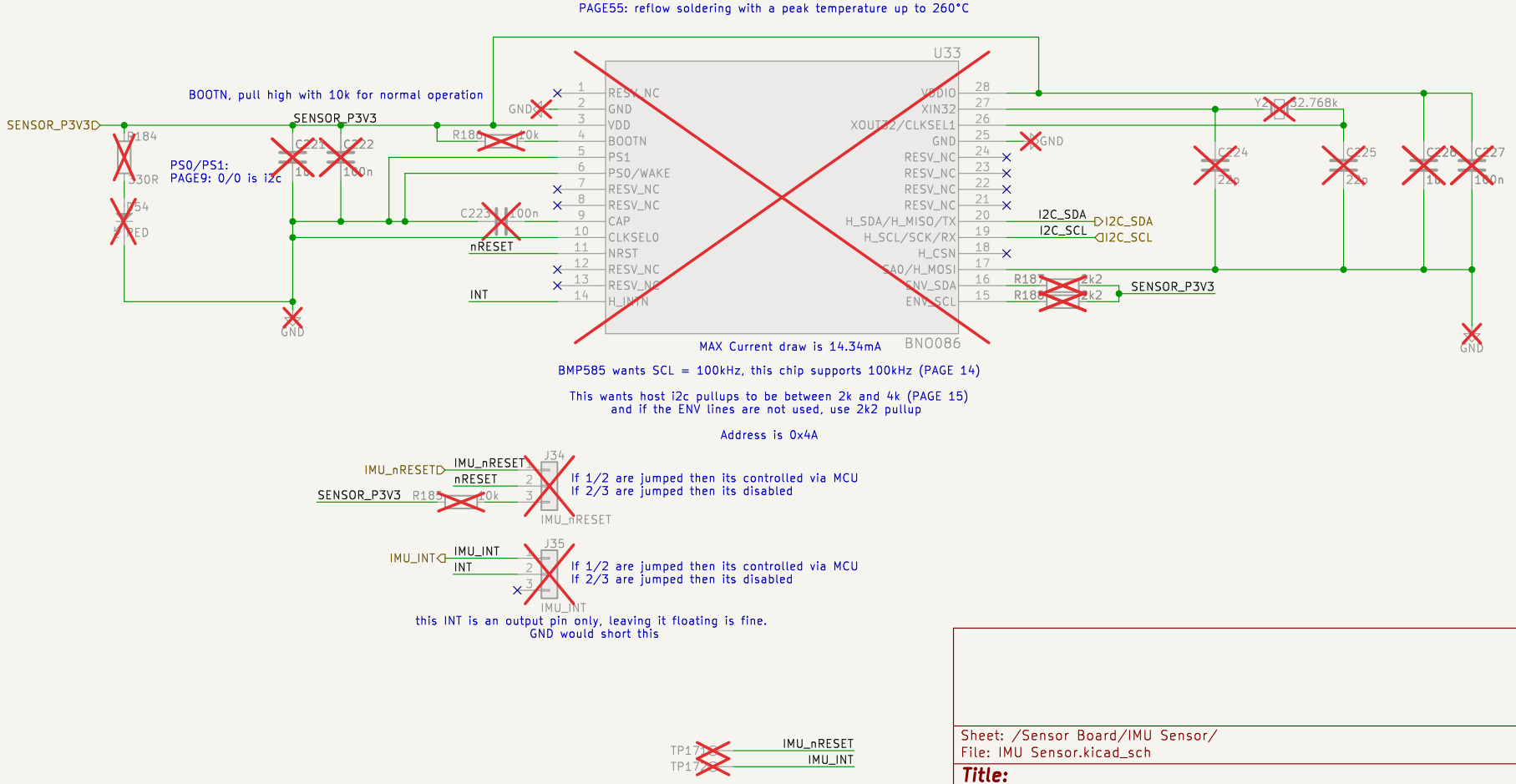

V_BCKP
??? why is this 10k here?
(from reference schematic)
SENSOR_P3V3
VCC_RF
ZED_USB_N
ZED_USB_P
ZED_TXD
ZED_RXD
ZED_SDA
ZED_SCL
ZED_nRESET
ZED_DSEL
ZED_RF
ZED_PPS
ZED_RTK
ZED_GF
I2C_SDA
I2C_SCL
ZED-F9P-15B
MAX current draw is 130mA
When DSEL is high UART and I2C are enabled
"All the inputs have internal 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
EXT_GPS_VCC
EXT_GPS_RX
EXT_GPS_TX
EXT_GPS_GND
If 1/2 are jumped then its internal (its always enabled)
If 2/3 are jumped then its external
If 1/2 are jumped then its internal
If 2/3 are jumped then its external
Max current draw from NEO-6 is 67mA
For ZED-F9P-15B (L1/L5) module, the correct antenna is the ANN-MB1.
BAT-HLD-007-SMT-TR
Sheet: /Sensor Board/GPS Sensor/
File: GPS Sensor.kicad_sch
Title:
Size: A4
Date:
Rev:
KiCad E.D.A. 9.0.4
Id: 38/38



Sheet: /Sensor Board/IMU Sensor/		
File: IMU Sensor.kicad_sch		
Title:		
Size: A4	Date:	**Rev:**
KiCad E.D.A. 9.0.4		Id: 39/38