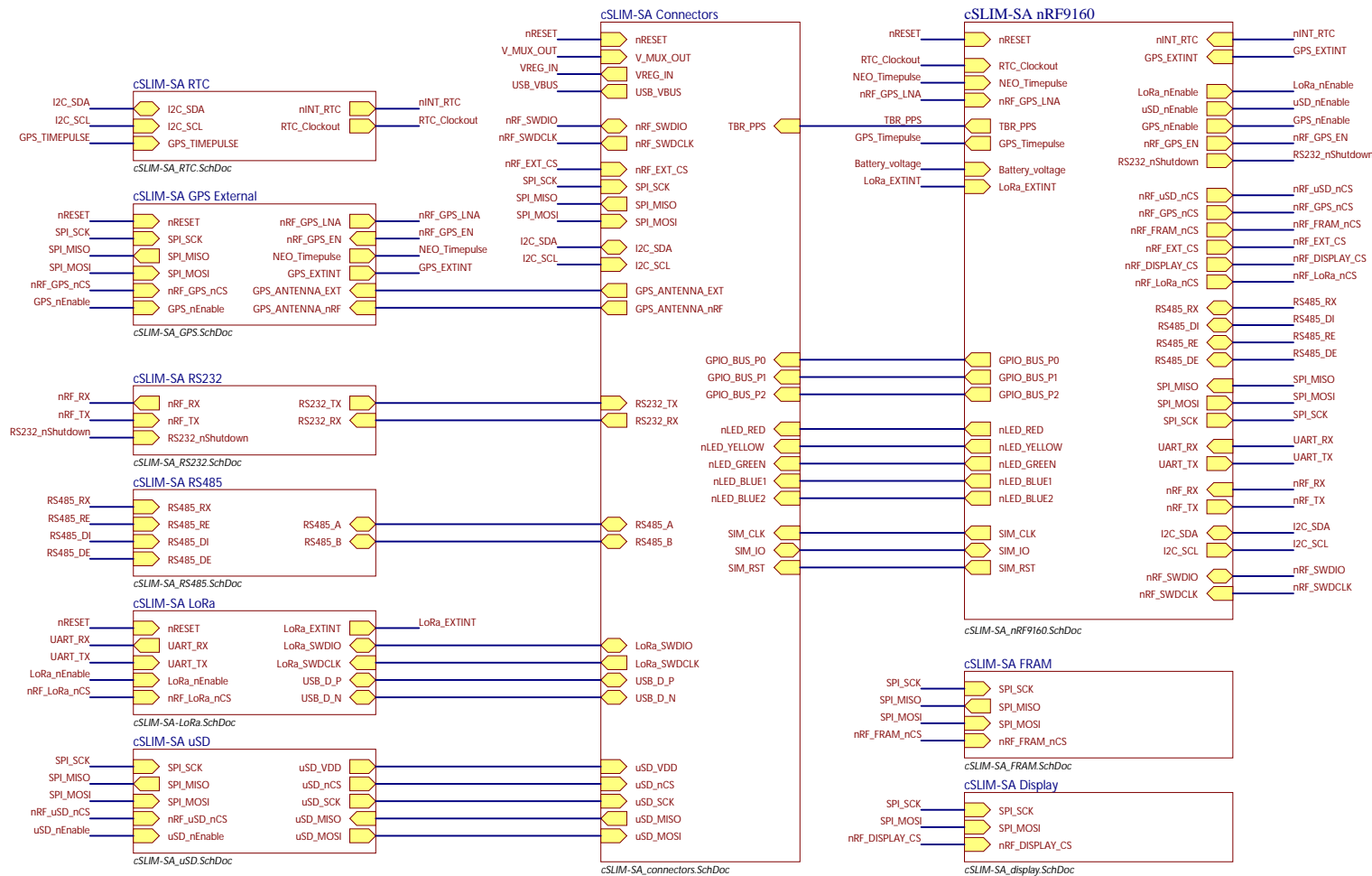
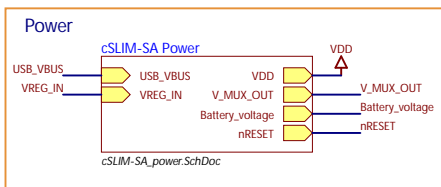


cSLIM v1 (Stand Alone buoy-controller)

Project 2021 NTNU

Vetle Berg Abrahamsen

Sheet 1: Overview
Sheet 2: nRF9160
Sheet 3: LoRa Module
Sheet 4: RS485
Sheet 5: RS232
Sheet 6: Connectors
Sheet 7: Power
Sheet 8: uSD
Sheet 9: Display
Sheet 10: GNSS
Sheet 11: FRAM
Sheet 12: RTC



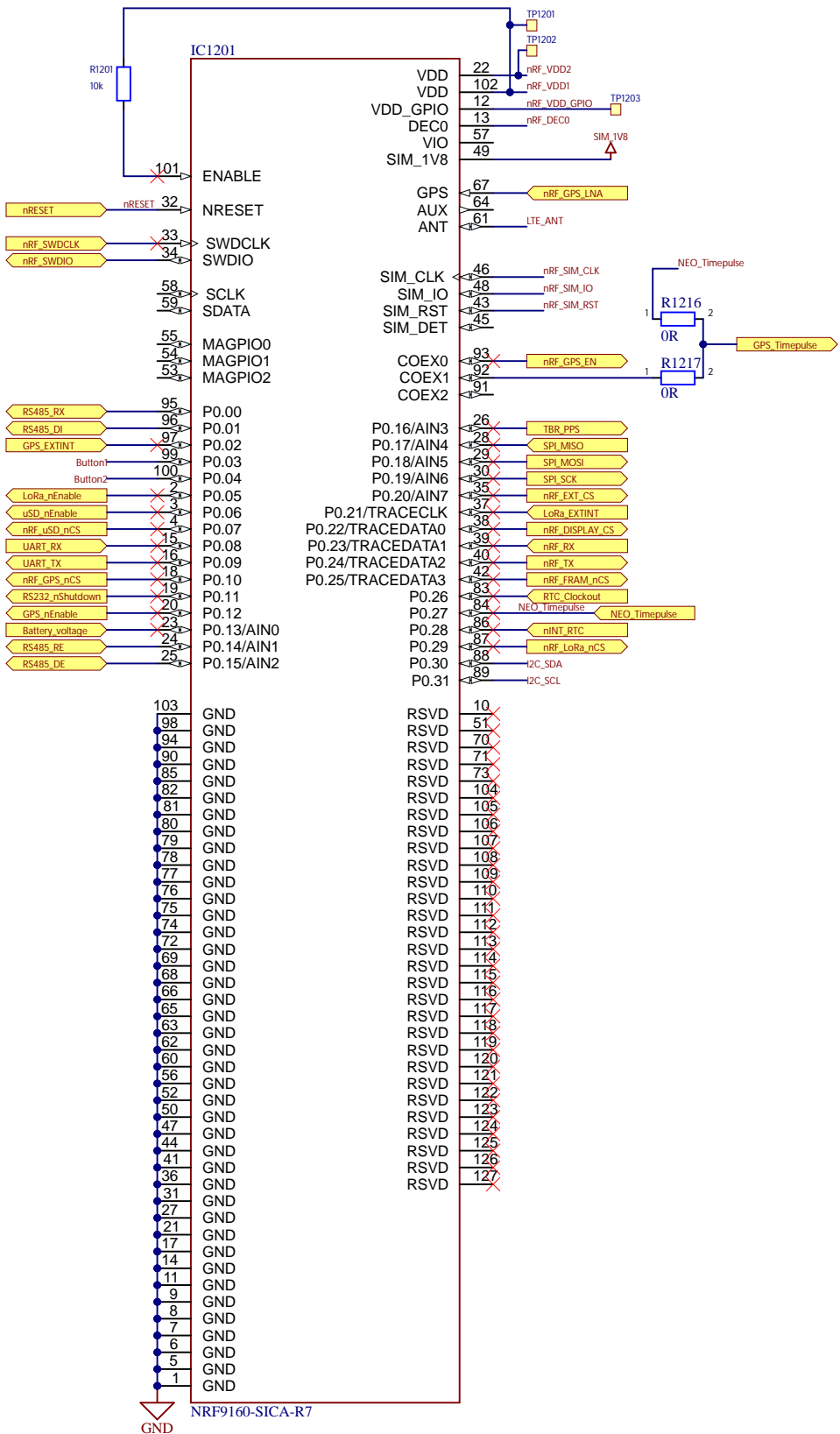
	Title cSLIM v1 - Overview		
	Size A4	Number	Revision v1
Date: 17.01.2022	Sheet 1 of 12		
File: cSLIM-SA.SchDoc	Drawn by: Vetle Berg Abrahamsen		

✗ The No ERC object is a design directive. This directive is placed on a node in the circuit to suppress harmless warnings and/or error violation conditions that are detected when the schematic project is compiled.

Based on framework for the cSLIM-shield done by Eivind Holen Jølgard

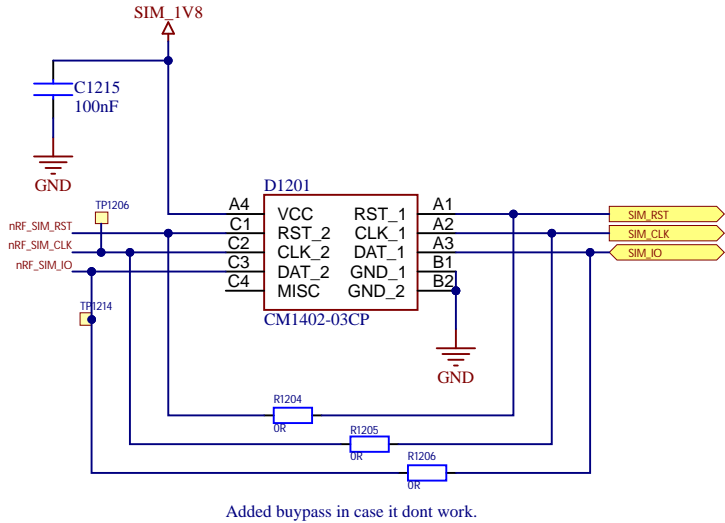
[See Eyvinds Github for schematics and PCB on this link.](#)

nRF9160 SiP



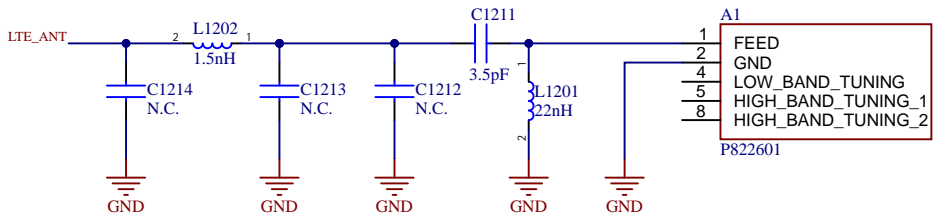
NOTE:
pin 45 (SIM_DET) not used and needs to be left floating.
External pull-up resistor on nRESET not allowed
When internal GPS is used, COEX1 provides 1PPS, only use either R1216 or R1217

EMI-protection for SIM

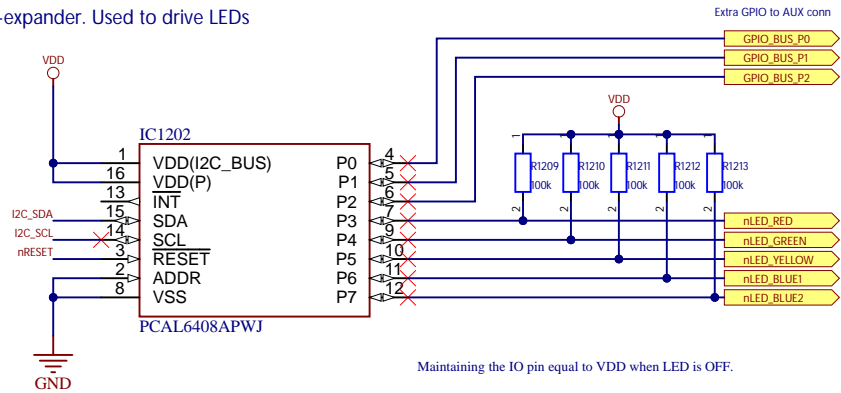


Added bypass in case it doesn't work.

LTE Antenna matching

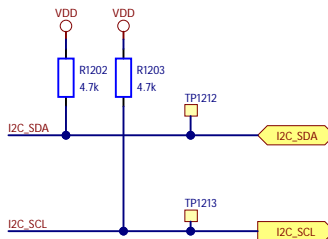


8-bit I2C-bus IO-expander. Used to drive LEDs



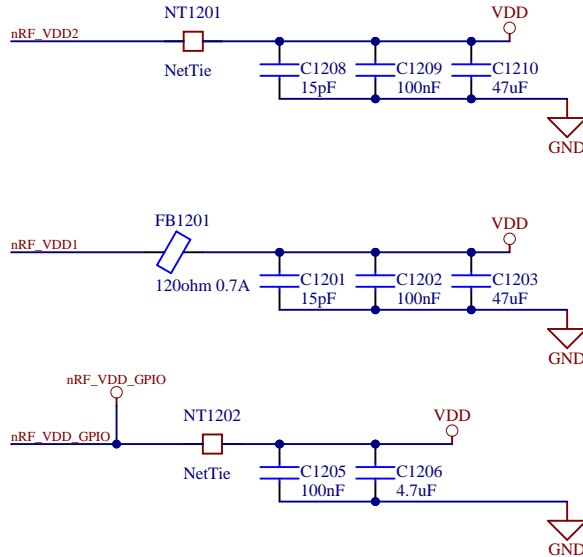
Maintaining the IO pin equal to VDD when LED is OFF.

I2C pullup resistors

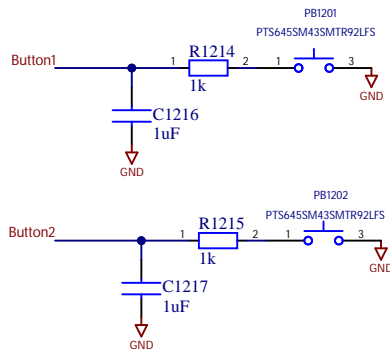


Power to nRF

Using net-tie to connect two different nets without warnings.
Tie VDD_GPIO and VDD together, as long as they power up at the same time, it is okay



Pushbuttons



 NTNU cSLIM v1	Title cSLIM v1 - nRF9160		
	Size A3	Number	Revision v1
Date: 17.01.2022		Sheet 2 of 12	
File: cSLIM-SA_nRF9160.SchDoc		Drawn by: Vetle Berg Abrahamsen	

A

A

B

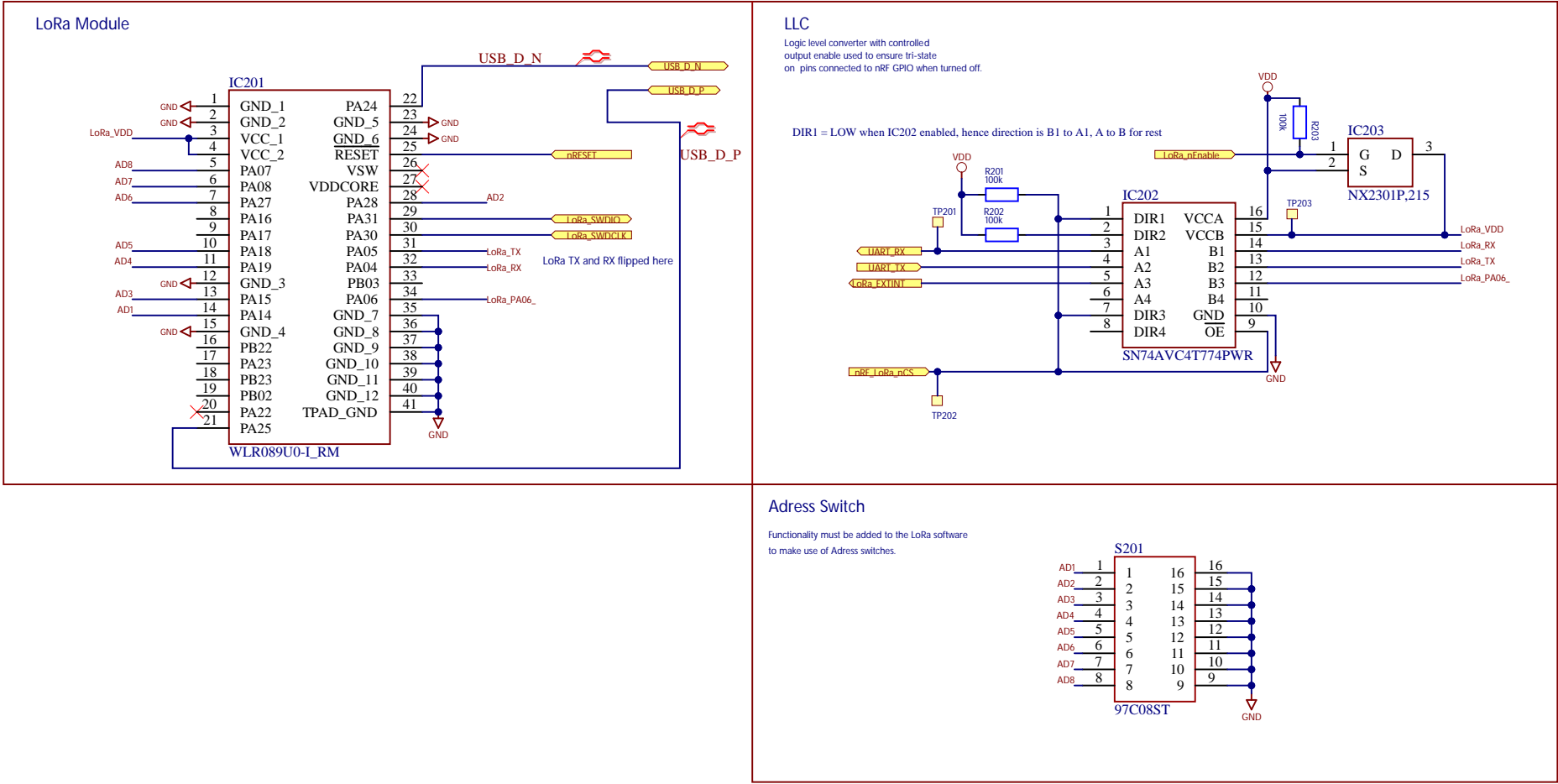
B

C

C

D

D




REMOVED interface for LoRa:

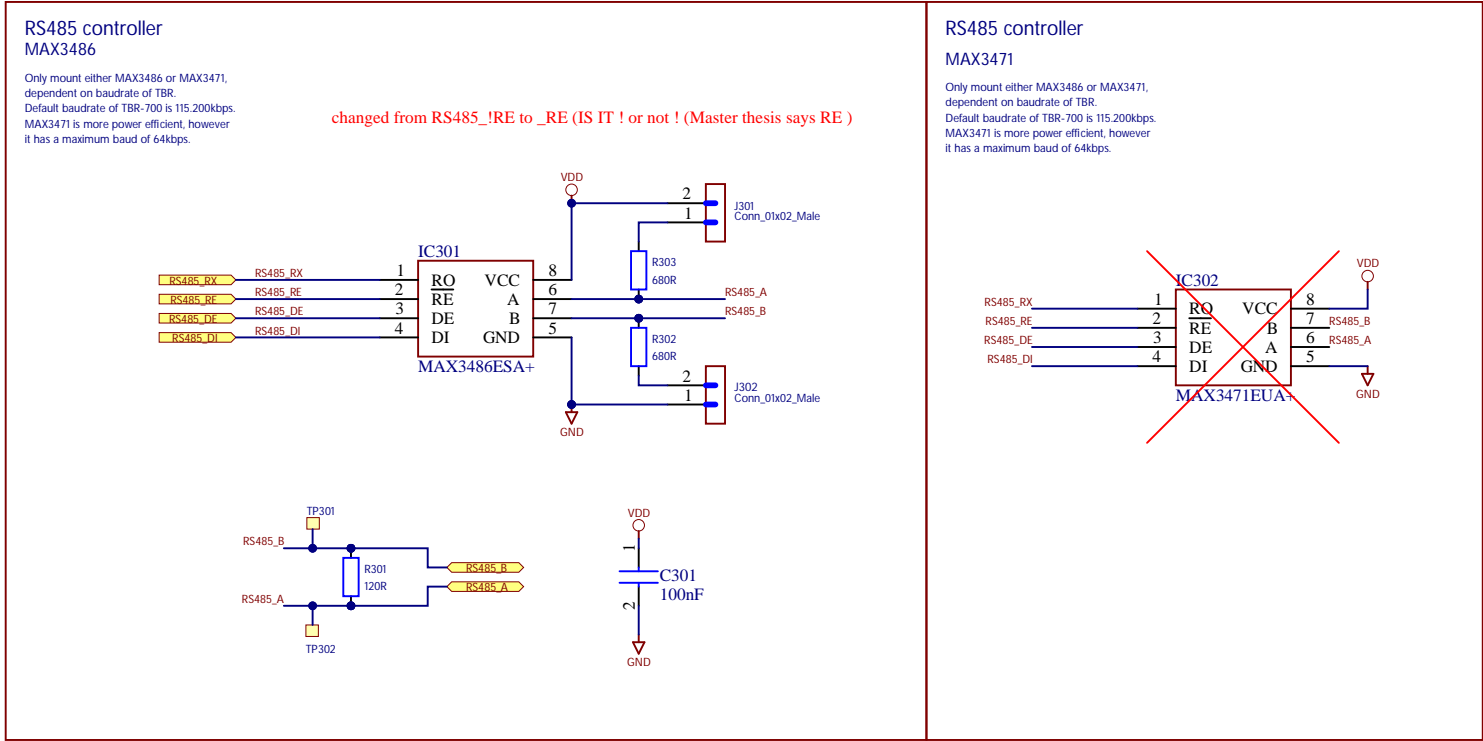
I2C_SDA - PA16
I2C_SCL - PA17


LoRa MOSI - PB22
LoRa MISO - PB02
LoRa SCK - PB23
LoRa nCS - PA23

PB03 output removed, insert if LED-blue2 is wanted to be controlled by it

MARK: LoRa module pins will draw power from nRF GPIO if it is not powered on. This lead to problems with I2C, SPI and UART communication with other devices. Remove unneeded connections and/or insert LLC to ensure tri-state-inputs if LoRa module should be powered down completely.

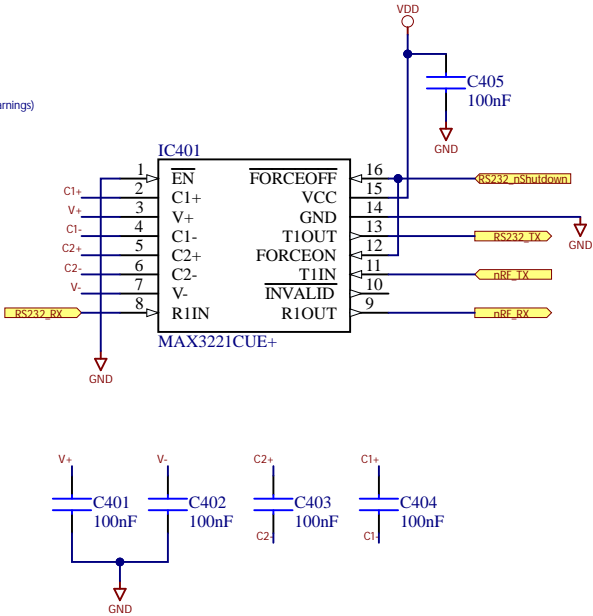
 NTNU cSLIM v1	Title cSLIM v1 - LoRa Module		
	Size A4	Number	Revision v1
Date: 17.01.2022		Sheet 3 of 12	
File: cSLIM-SA-LoRa.SchDoc		Drawn by: Vette Berg Abrahamsen	



 <div>NTNU cSLIM v1</div>	Title cSLIM v1 - RS485		
	Size A4	Number	Revision v1
Date: 17.01.2022			Sheet 4 of 12
File: cSLIM-SA_RS485.SchDoc			Drawn by: Vette Berg Abrahamsen

RS232 controller

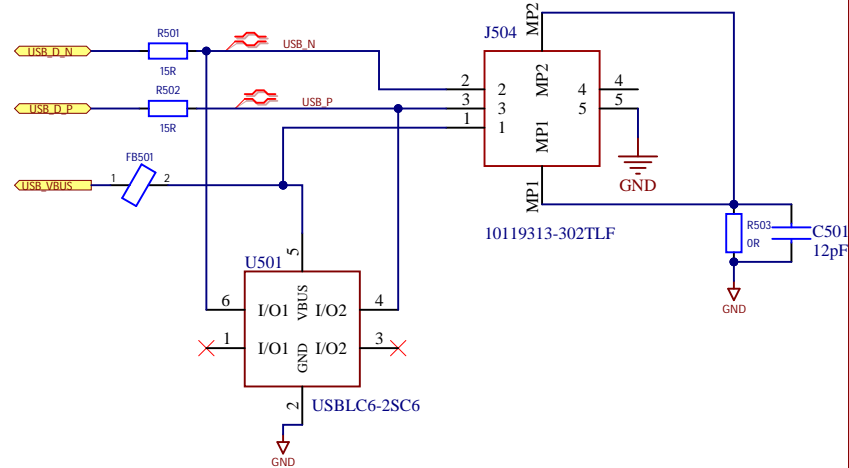
Powered from MAX3221
(remove electrical rule warnings)



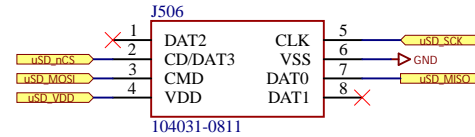
NTNU
cSLIM v1

Title			cSLIM v1 - RS232
Size	Number	Revision	
A4		v1	
Date: 17.01.2022		Sheet 5 of 12	
File: cSLIM-SA_RS232.SchDoc		Drawn by: Vette Berg Abrahamsen	

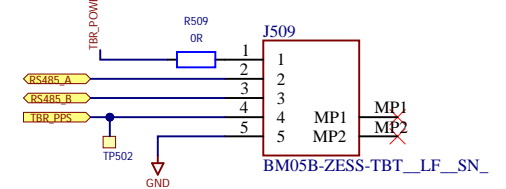
USB Connector



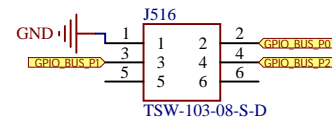
uSD Card reader



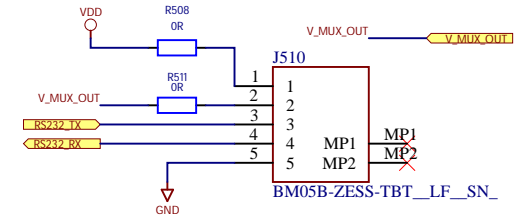
RS485 Connector



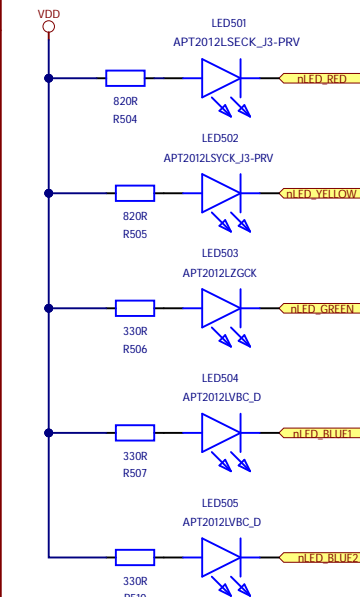
Auxiliary connector



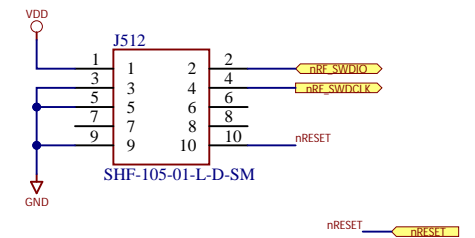
RS232 Connector



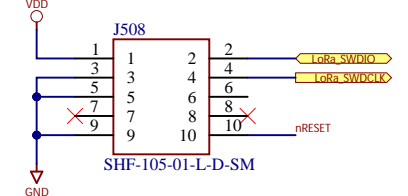
LEDs



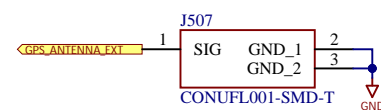
nRF9160 SWD Connector



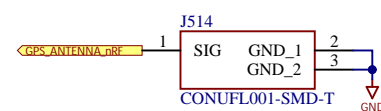
LoRa_module SWD Connector



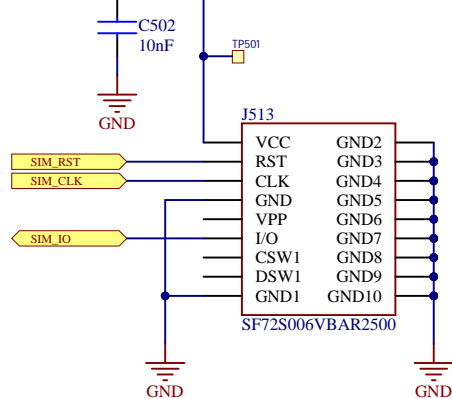
GPS Antenna Connector uBlox



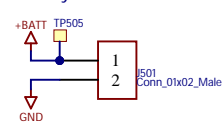
GPS Antenna Connector nRF



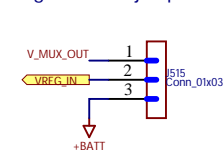
SIM Connector



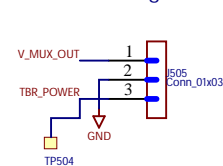
Battery Connector



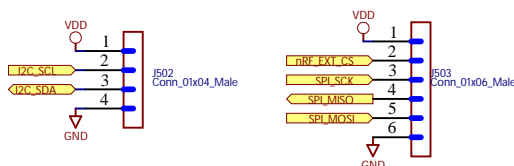
Regulator VIN jumper



External regulator



2.54mm headers for external I2C and SPI devices

NTNU
cSLIM v1Title
cSLIM v1 - ConnectorsSize
A4

Number

Revision
v1

Date: 17.01.2022

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File: cSLIM-SA_connectors.SchDoc

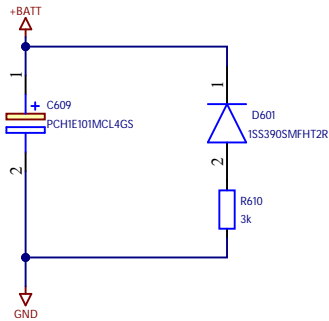
Drawn by: Vette Berg Abrahamsen

A

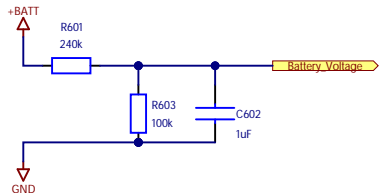
A

Polarization protection

Capacitor for battery supply and diode to protect circuitry of wrong polarization

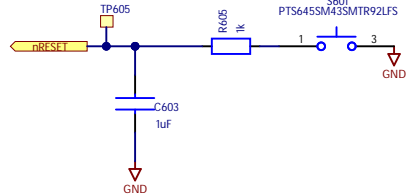


Battery measurement



nRESET signal

RESET button
The nRESET pin of the nRF9160 has a 13kOhm internal pull up

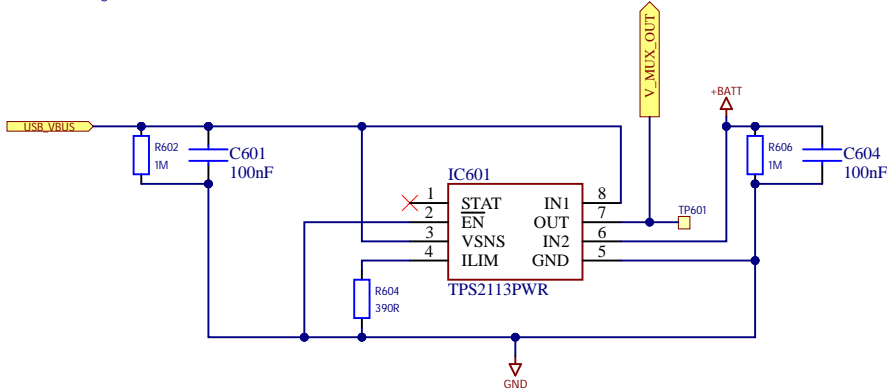


B

B

Power multiplexer

Selecting USB when connected



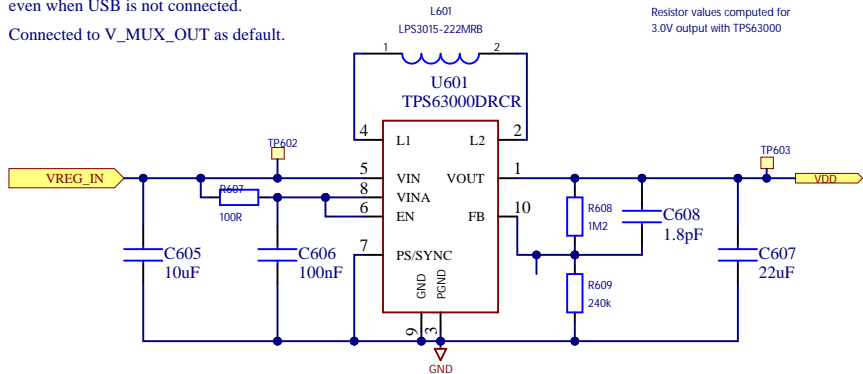
3.3V Buck-Boost regulator

VREG_IN selects either V_MUX_OUT or +BAT as VIN on Buck-boost regulator
Physical jumper J515. This is due to battery related problems where the battery do not get selected byt voltage multiplexer, even when USB is not connected.

Connected to V_MUX_OUT as default.

R608 and R609 is not necessary when using TPS63001 as the output voltage is fixed to 3.3V. If another voltage is required use TPS63000 with appropriate resistor values

Resistor values computed for 3.0V output with TPS63000



C

C

D

D



NTNU
cSLIM v1

Title
cSLIM v1 - Power

Size
A4

Number

Revision

v1

Date: 17.01.2022

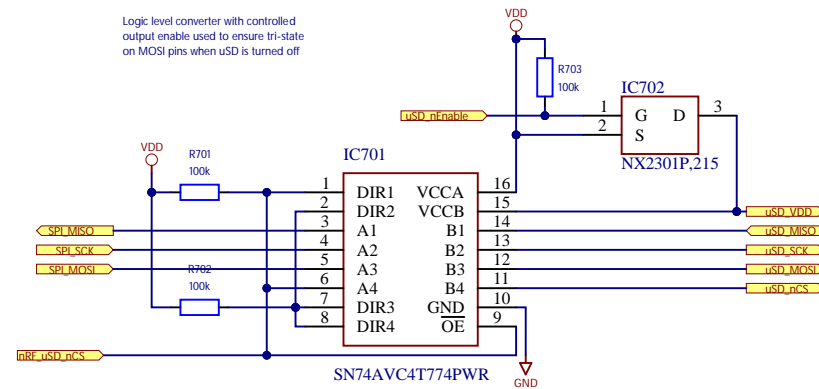
Sheet 7 of 12

File: cSLIM-SA_power.SchDoc

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uSD LLC

Logic level converter with controlled output enable used to ensure tri-state on MOSI pins when uSD is turned off

NTNU
cSLIM v1

Title

cSLIM v1 - uSD

Size

Number

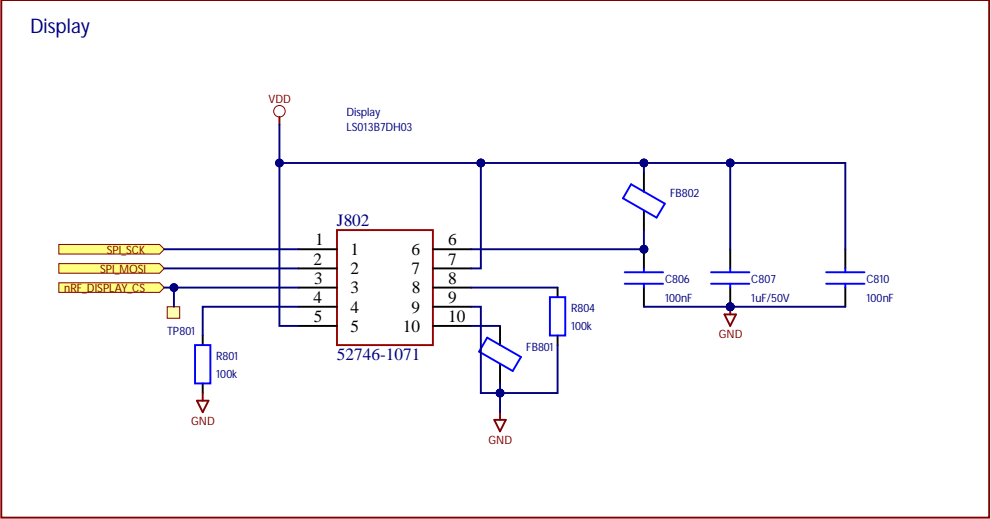
Revision


Date: 17.01.2022

Sheet 8 of 12

File: cSLIM-SA_uSD.SchDoc

Drawn by: Vetle Berg Abrahamsen

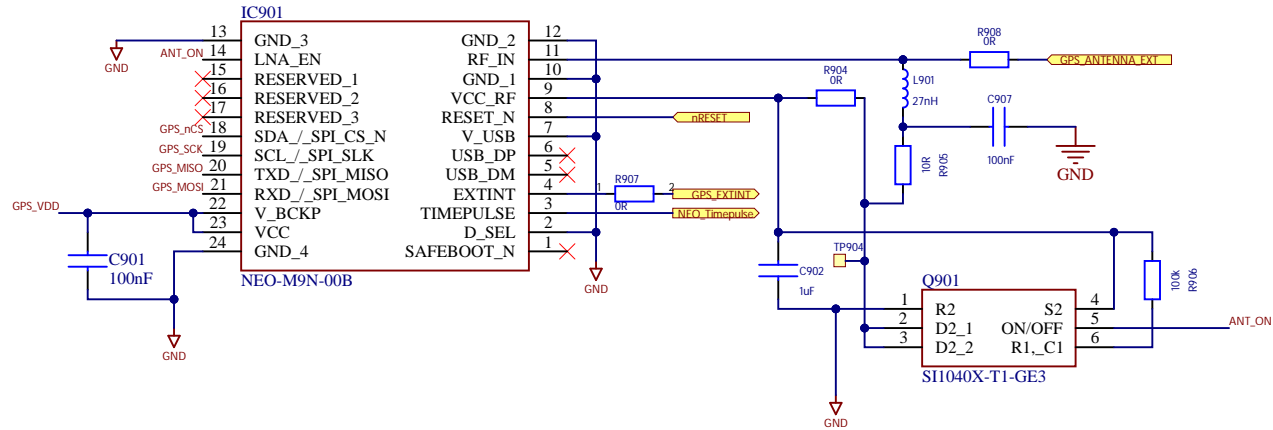


 NTNU cSLIM v1	Title cSLIM v1 - Display		
	Size A4	Number	Revision v1
Date: 17.01.2022			Sheet 9 of 12
File: cSLIM-SA_display.SchDoc			Drawn by: Vette Berg Abrahamsen

Ublox GNSS receiver and LLC

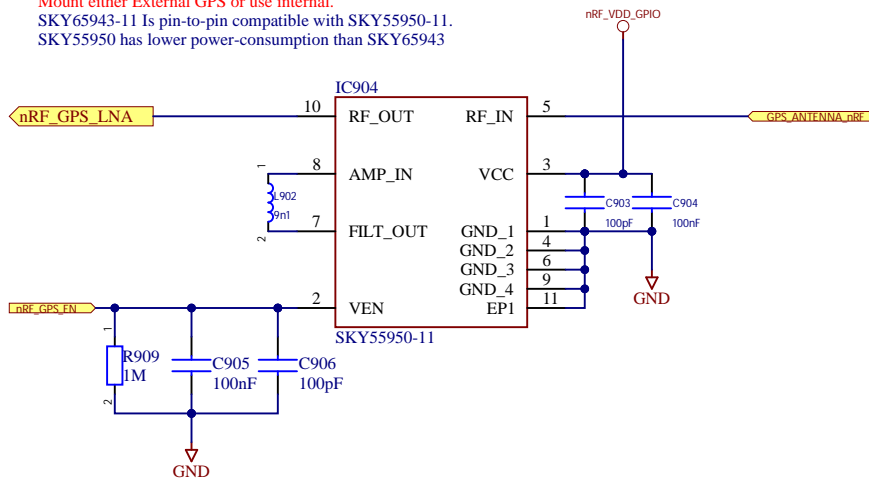
C901, L901, R905, and C902 is only needed with active antenna (Taoglass FXP.611 is passive).R904 can be used instead of C901, C902 and R906 for antenna always on.

Mount either External GPS or use internal.

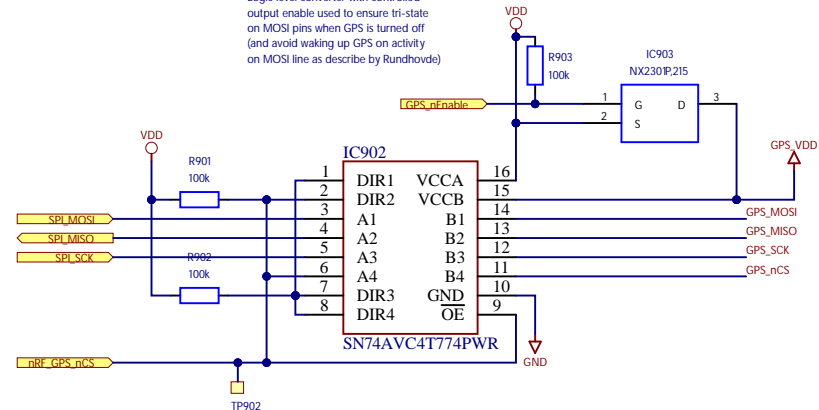


External LNA for internal GNSS receiver

Mount either External GPS or use internal.
SKY65943-11 Is pin-to-pin compatible with SKY55950-11.
SKY55950 has lower power-consumption than SKY65943



Logic level converter with controlled output enable used to ensure tri-state on MOSI pins when GPS is turned off (and avoid waking up GPS on activity on MOSI line as describe by Rundhovde)



cSLIM v1

cSLIM v1 - GNSS

Size A4

Number

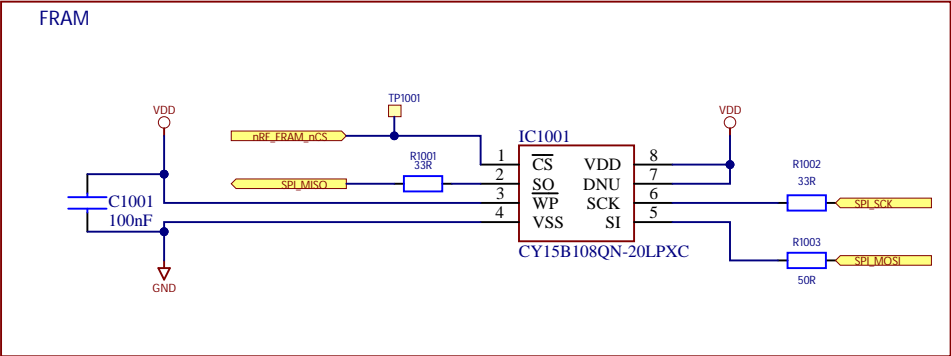
Revision v1


Date: 17.01.2022

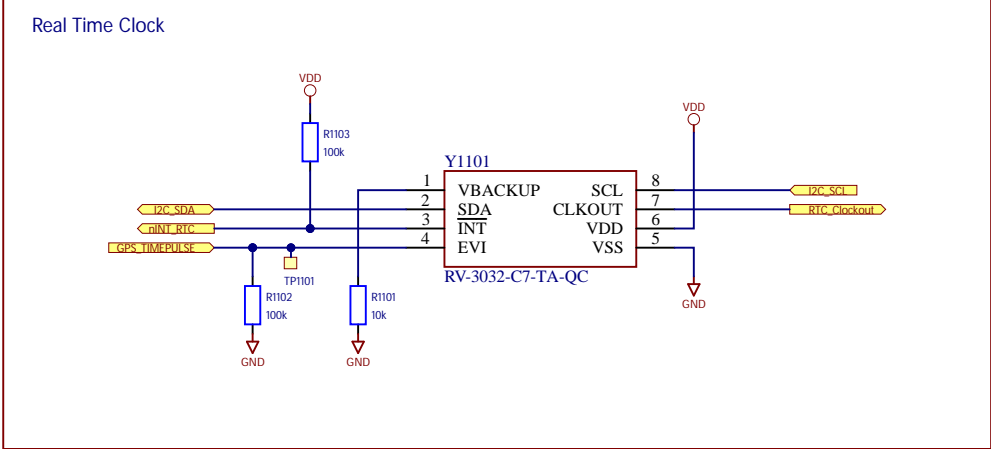
Sheet 10 of 12


File: cSLIM-SA_GPS.SchDoc

Drawn by: Vette Berg Abrahamsen



 NTNU cSLIM v1	Title cSLIM v1 - FRAM		
	Size A4	Number	Revision v1
Date: 17.01.2022			Sheet 11 of 12
File: cSLIM-SA_FRAM.SchDoc			Drawn by: Vette Berg Abrahamsen



 NTNU cSLIM v1	Title cSLIM v1 - RTC		
	Size A4	Number	Revision v1
Date: 17.01.2022			Sheet 12 of 12
File: cSLIM-SA_RTC.SchDoc			Drawn by: Vette Berg Abrahamsen