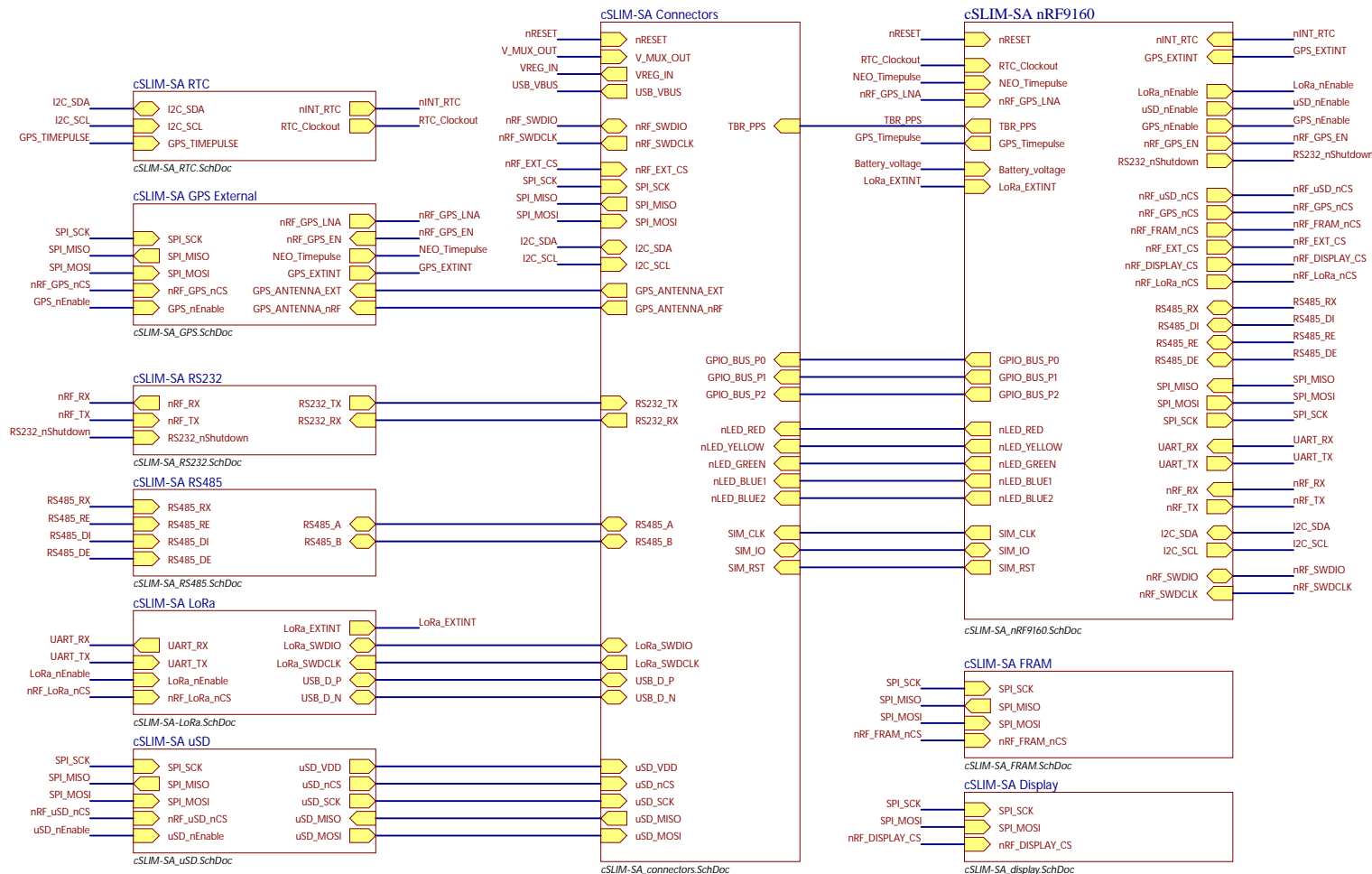
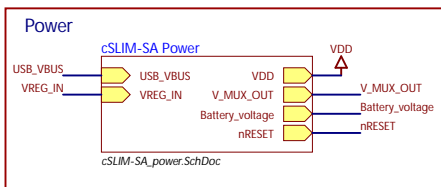


cSLIM-v1 (Stand Alone buoy-controller)

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



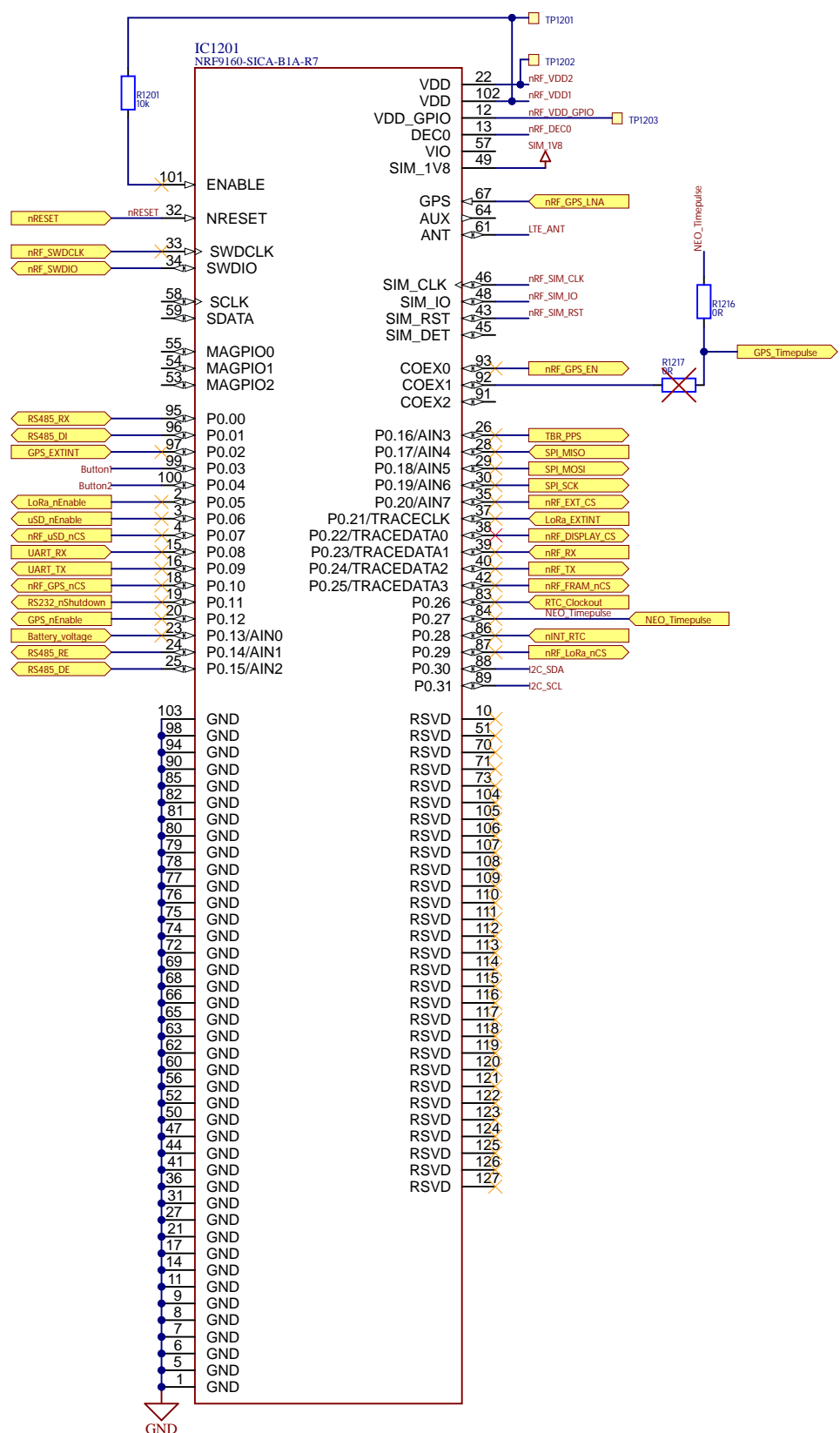
✗ This symbol is used on components that is normally not mounted on the PCB. However, the components will be found in the bill of materials. Hence, schematics should be used together with the bill of material when assembling the pcb.

✗ 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.

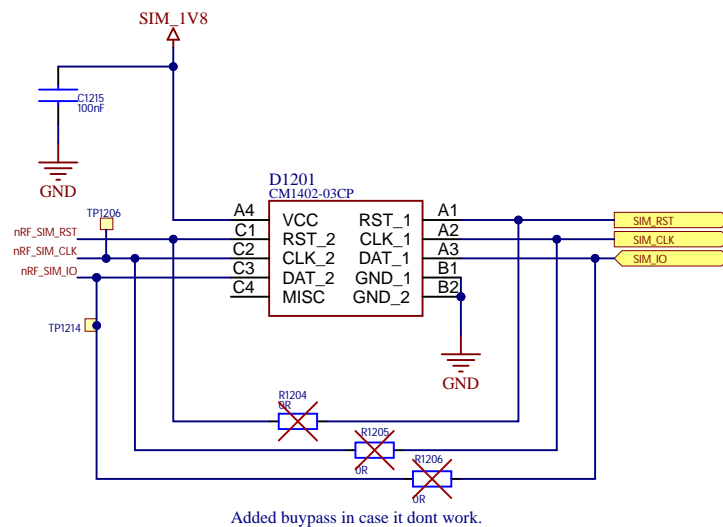
Based on framework for the cSLIM-shield by Eivind Holen Jølsøgard
See Eyvinds Github for schematics and PCB on this link.
https://github.com/eivinhj/cSLIM_nRF9160-DK_shield

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nRF9160 SiP

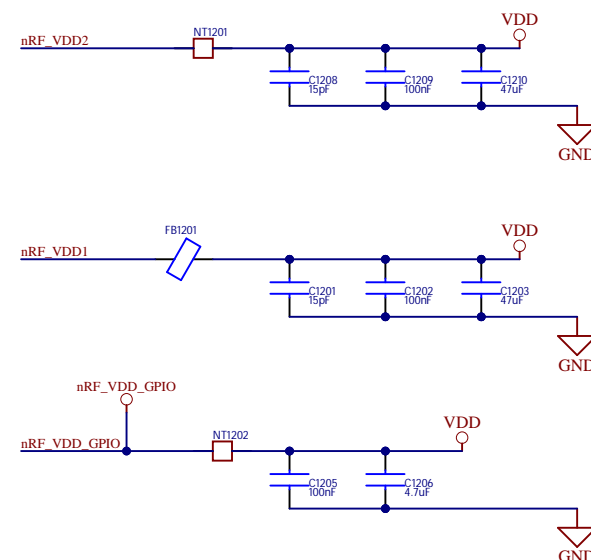


EMI-protection for SIM

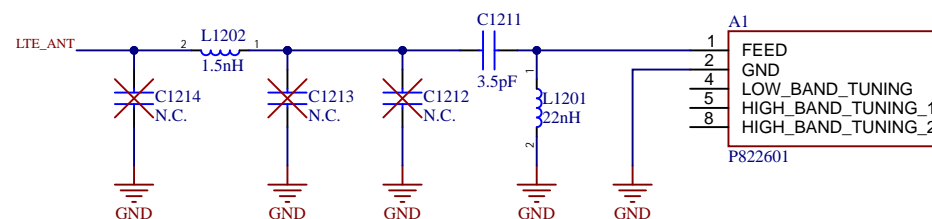


Power to nRF

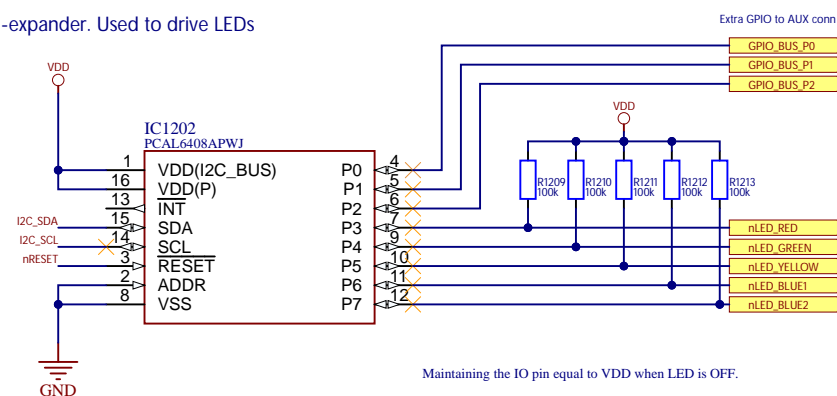
Using net-tie to connect two different nets without warnings.



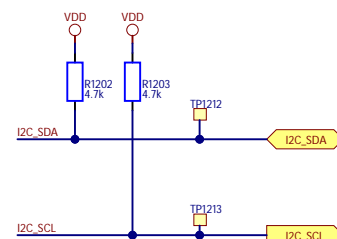
LTE Antenna matching



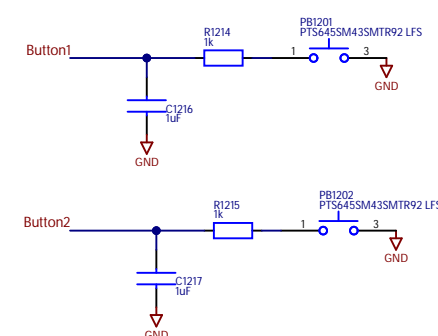
8-bit I2C-bus IO-expander. Used to drive LEDs



I2C pullup resistors



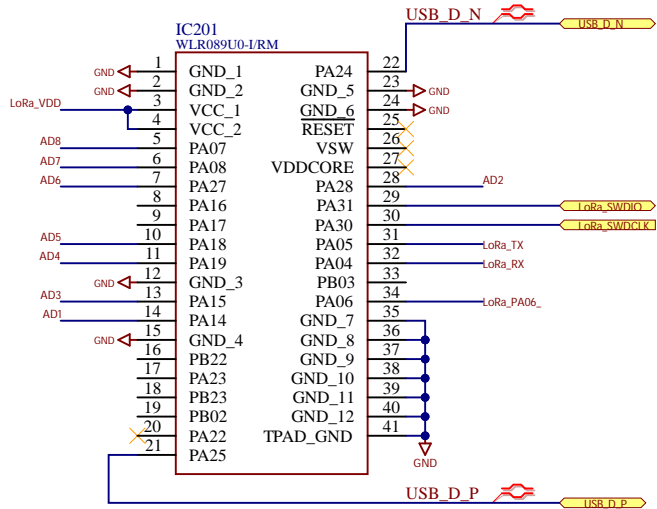
Pushbuttons



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

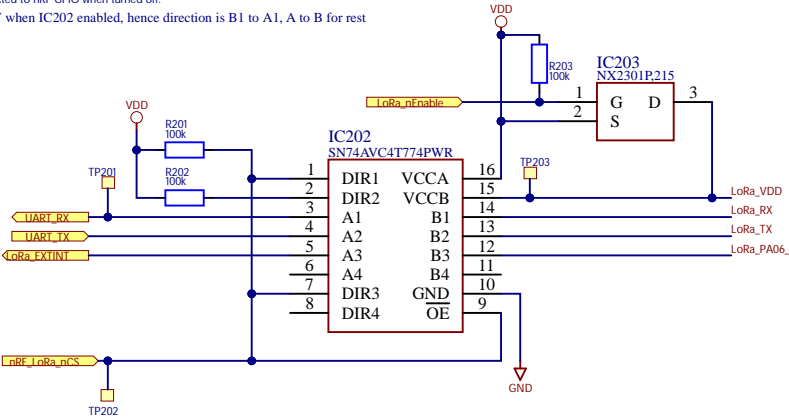
note: LoRa_VDD is left floating when mosfet (IC203) is off. include pulldown on LoRa_VDD

LoRa Module



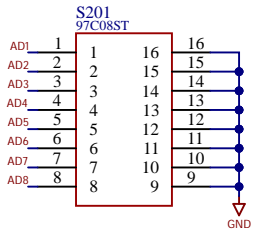
LLC

Logic level converter with controlled output enable used to ensure tri-state on pins connected to nRF GPIO when turned off.
DIR1 = LOW when IC202 enabled, hence direction is B1 to A1, A to B for rest



Address Switch


Functionality must be added to the LoRa software to make use of Address switches.



REMOVED interface for LoRa:

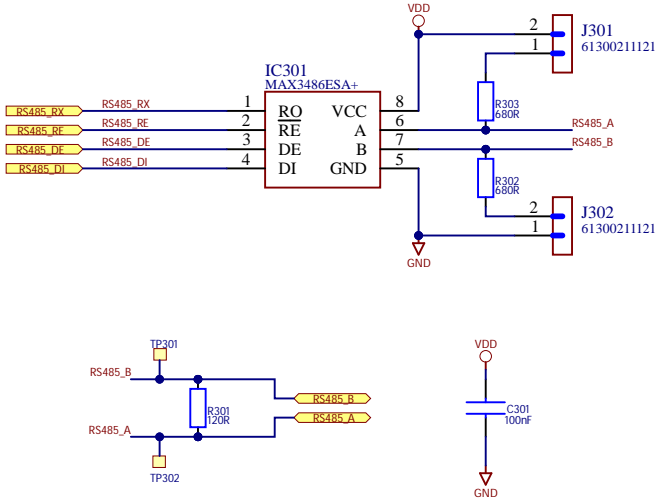
- I2C_SDA - PA16
- I2C_SCL - PA17
- LoRa MOSI - PB22
- LoRa MISO - PB02
- LoRa SCK - PB23
- LoRa nCS - PA23
- PB03 output removed (used for led)

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		
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Date: 20.06.2022		Sheet 3 of 12	
File: cSLIM-SA-LoRa.SchDoc		Drawn by: Vette Berg Abrahamsen	

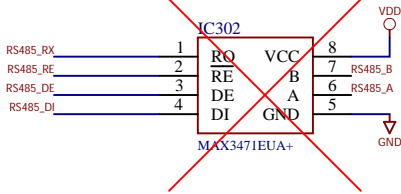
RS485 controller
MAX3486

Only mount either MAX3486 or MAX3471,
dependent on baudrate of TBR.
Default baudrate of TBR-700 is 115.200kbps.
MAX3471 is more power efficient, however
it has a maximum baud of 64kbps.



RS485 controller
MAX3471

Only mount either MAX3486 or MAX3471,
dependent on baudrate of TBR.
Default baudrate of TBR-700 is 115.200kbps.
MAX3471 is more power efficient, however
it has a maximum baud of 64kbps.



NTNU

cSLIM v1

Title

cSLIM v1 - RS485

Size

A4

Number

Revision

v1

Date: 20.06.2022

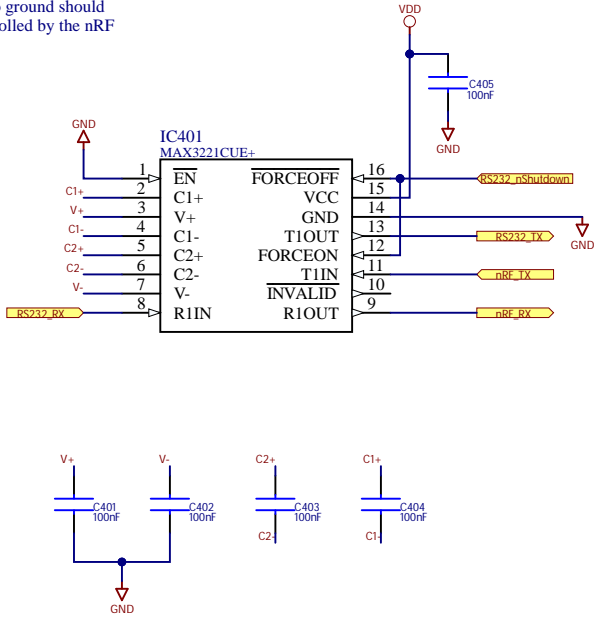
Sheet 4 of 12


File: cSLIM-SA_RS485.SchDoc

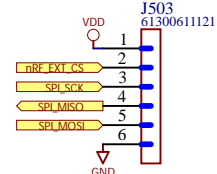
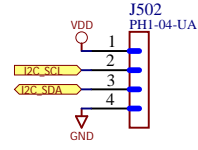
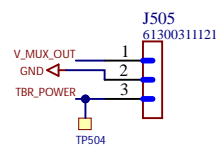
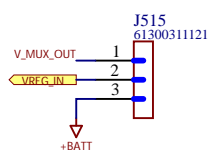
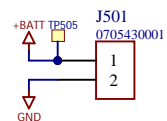
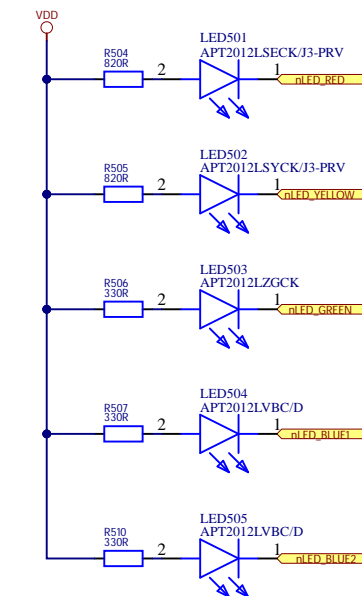
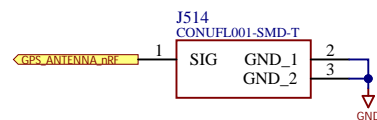
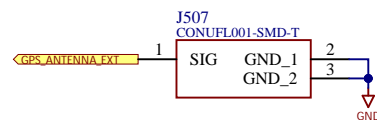
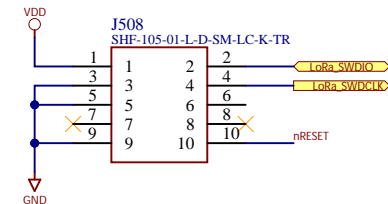
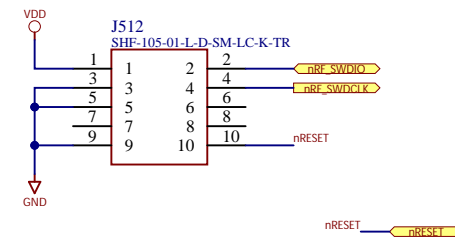
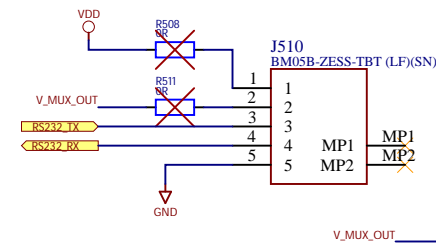
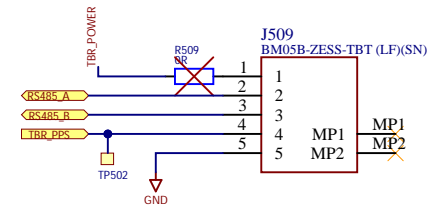
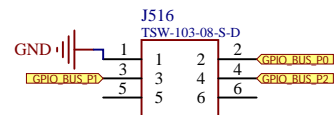
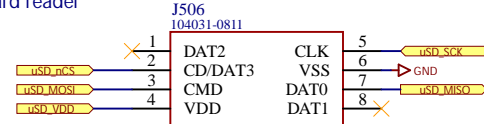
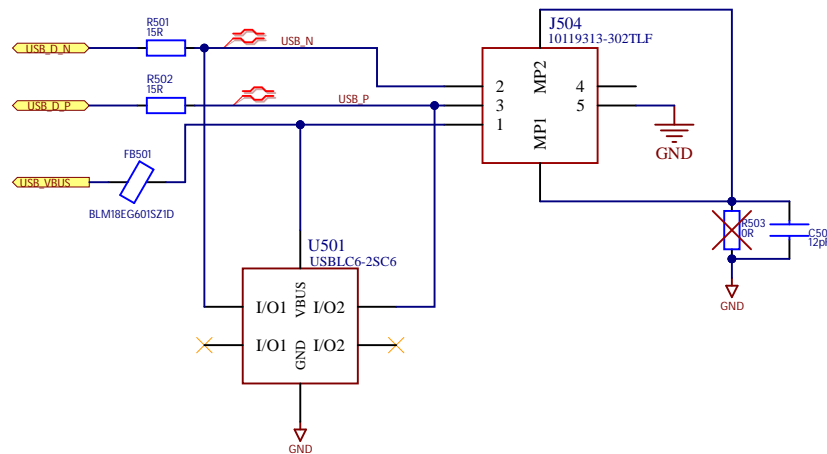
Drawn by: Vette Berg Abrahamsen

RS232 controller

Note: The nEN pin connected to ground should be considered to be controlled by the nRF for future designs



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File: cSLIM-SA_RS232.SchDoc		Drawn by: Vette Berg Abrahamsen	



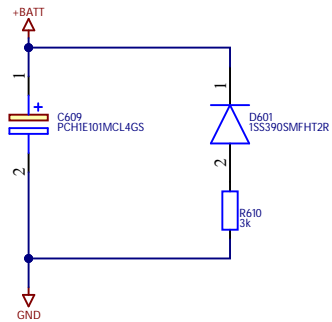
cSLIM v1 - Connectors

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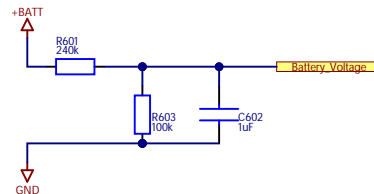
Drawn by: Vetle Berg Abrahamsen

Polarization protection

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

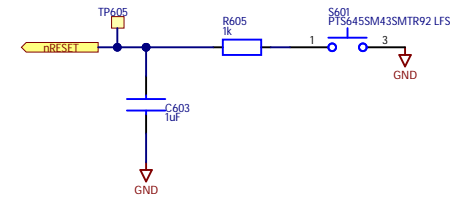


Battery measurement



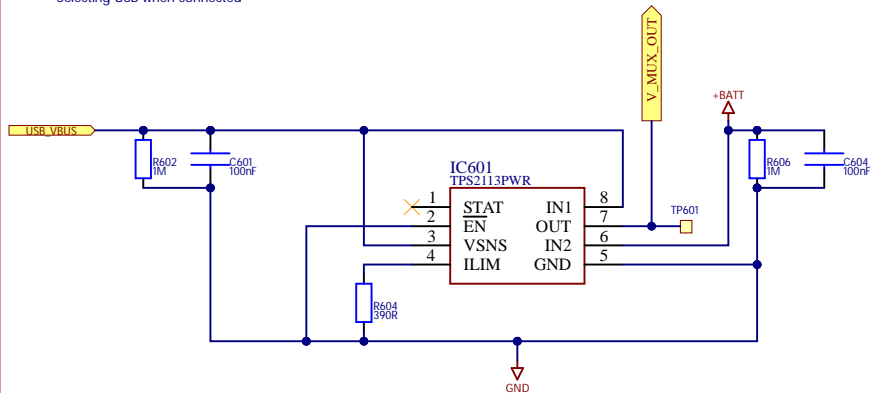
nRESET signal

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



Power multiplexer

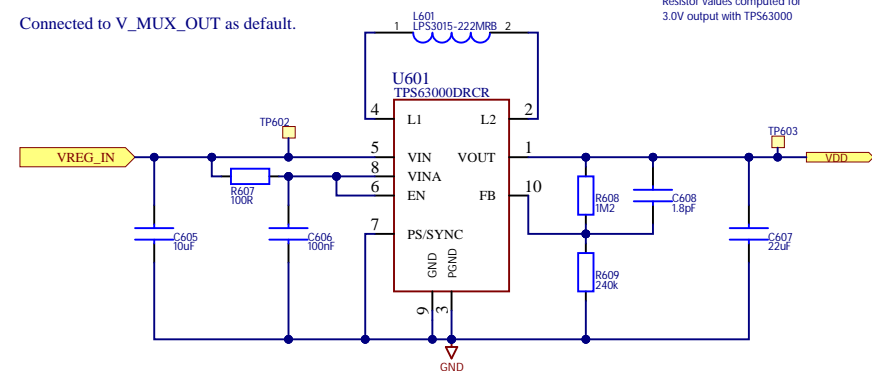
Selecting USB when connected



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 by 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



NTNU
cSLIM v1

Title

cSLIM v1 - Power

Size

A4

Number

Revision

v1

Date: 20.06.2022

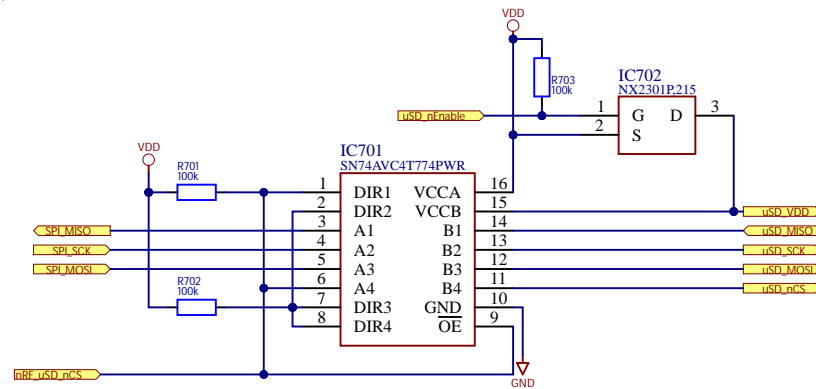
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File: cSLIM-SA_power.SchDoc

Drawn by: Vette Berg Abrahamsen

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

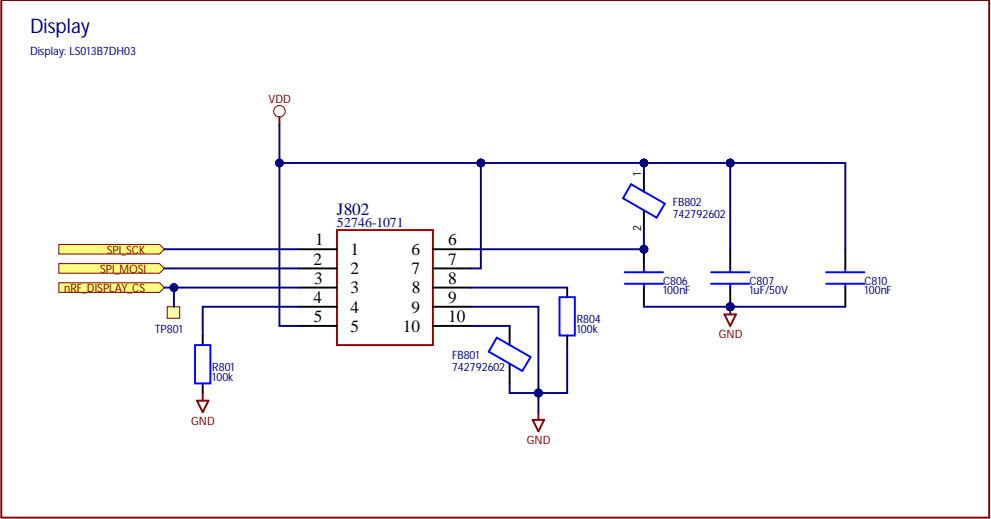
Revision


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File: cSLIM-SA_uSD.SchDoc

Drawn by: Vetle Berg Abrahamsen

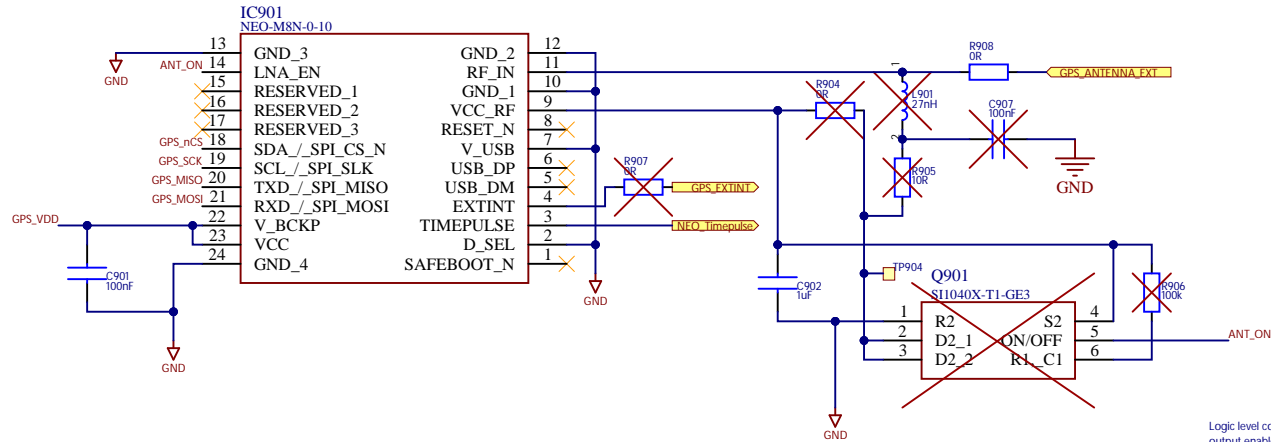


 NTNU cSLIM v1	Title cSLIM v1 - Display		
	Size A4	Number	Revision v1
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File: cSLIM-SA_display.SchDoc		Drawn by: Vette Berg Abrahamsen	

Ublox GNSS receiver and LLC

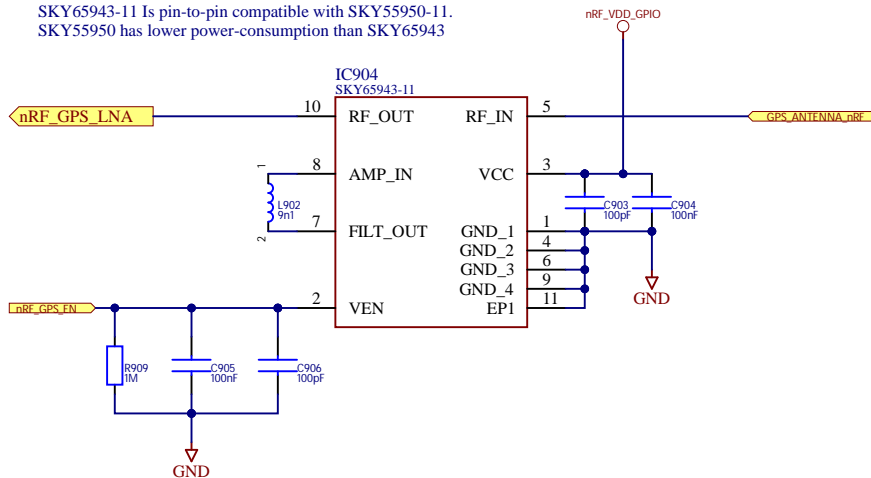
C901, L901, R905, and C902 is only needed with active antenna (Taoglass FXP.611 is passive).R904 can be used instead of C901, C902 and R906 for antenna always on.

Only mounting one of the two GNSS receivers is required. Both can be mounted.

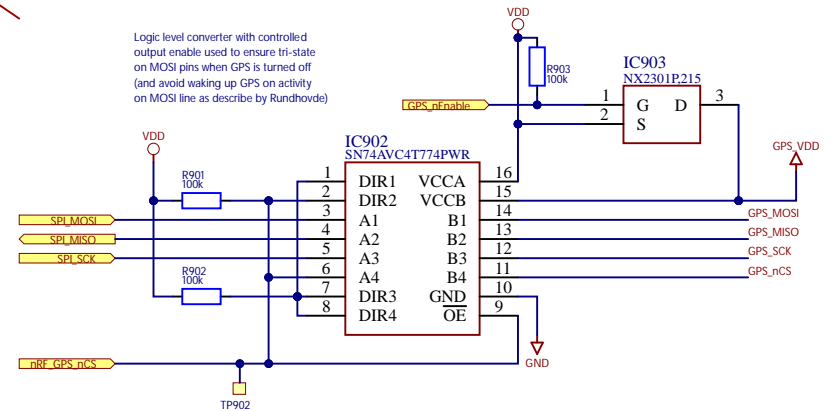


External LNA for internal GNSS receiver

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)



NTNU

cSLIM v1

cSLIM v1 - GNSS

Size A4

Number

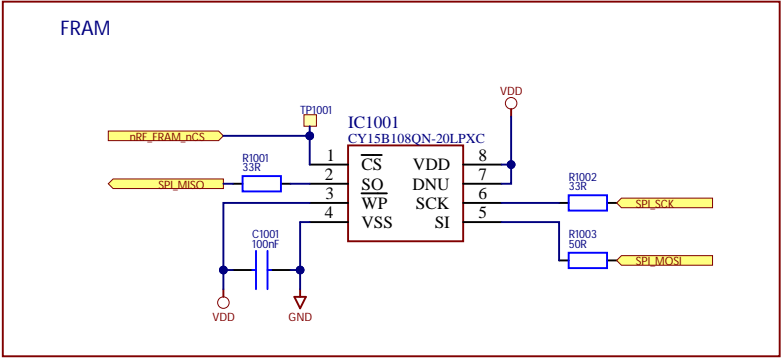
Revision v1


Date: 20.06.2022

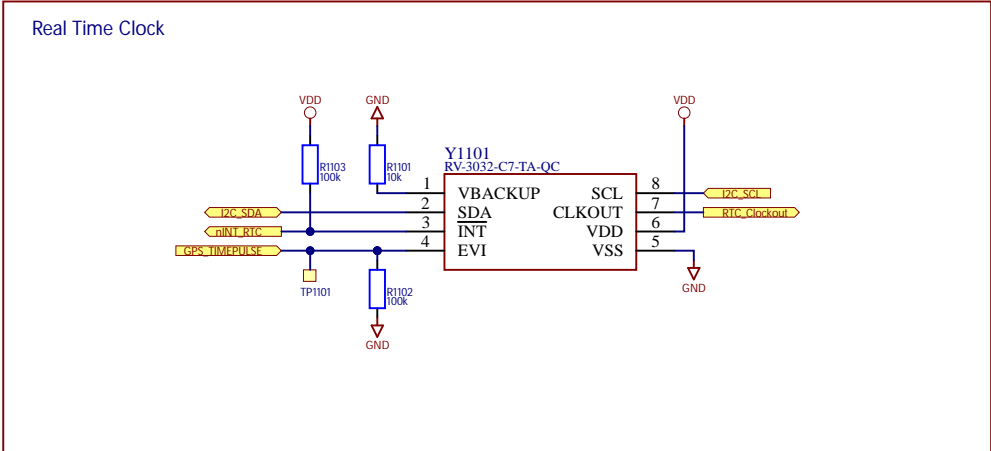
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File: cSLIM-SA_GPS.SchDoc

Drawn by: Vette Berg Abrahamsen



 NTNU cSLIM v1	Title cSLIM v1 - FRAM		
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File: cSLIM-SA_FRAM.SchDoc		Drawn by: Vette Berg Abrahamsen	



 NTNU cSLIM v1	Title cSLIM v1 - RTC		
	Size A4	Number	Revision v1
	Date: 20.06.2022		Sheet 12 of 12
File: cSLIM-SA_RTC.SchDoc		Drawn by: Vette Berg Abrahamsen	