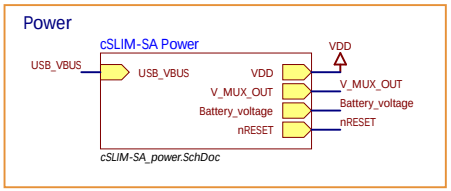
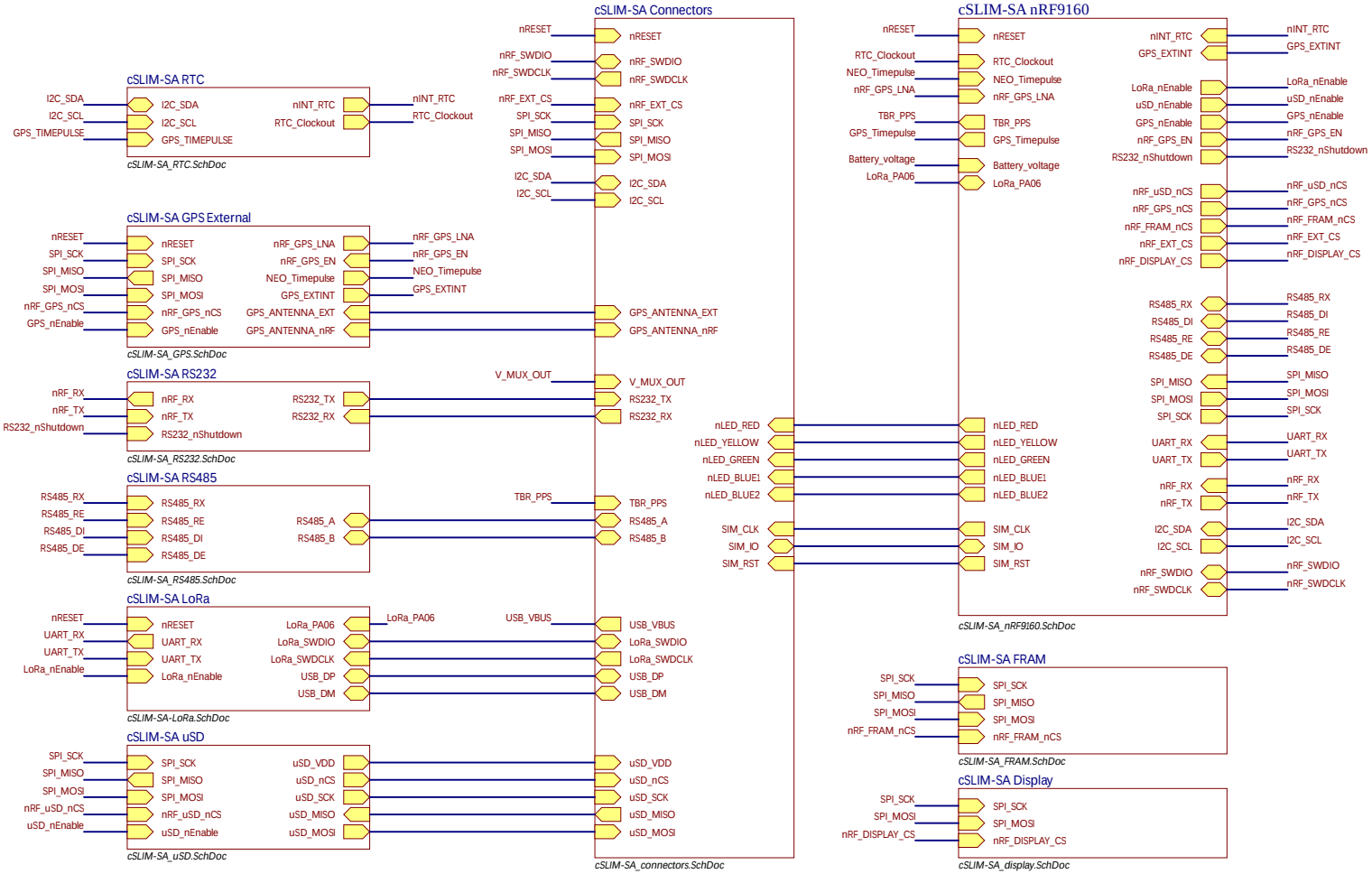
cSLIM-SA (Stand Alone buoy-controller)

Project 2021 NTNU

Vetle Berg Abrahamsen



Use LoRa PB03 or nRF to control Blue2 led?



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 Jølsgard

See Eyvinds Github for schematics and PCB on this link.

Eivind Jølsgard

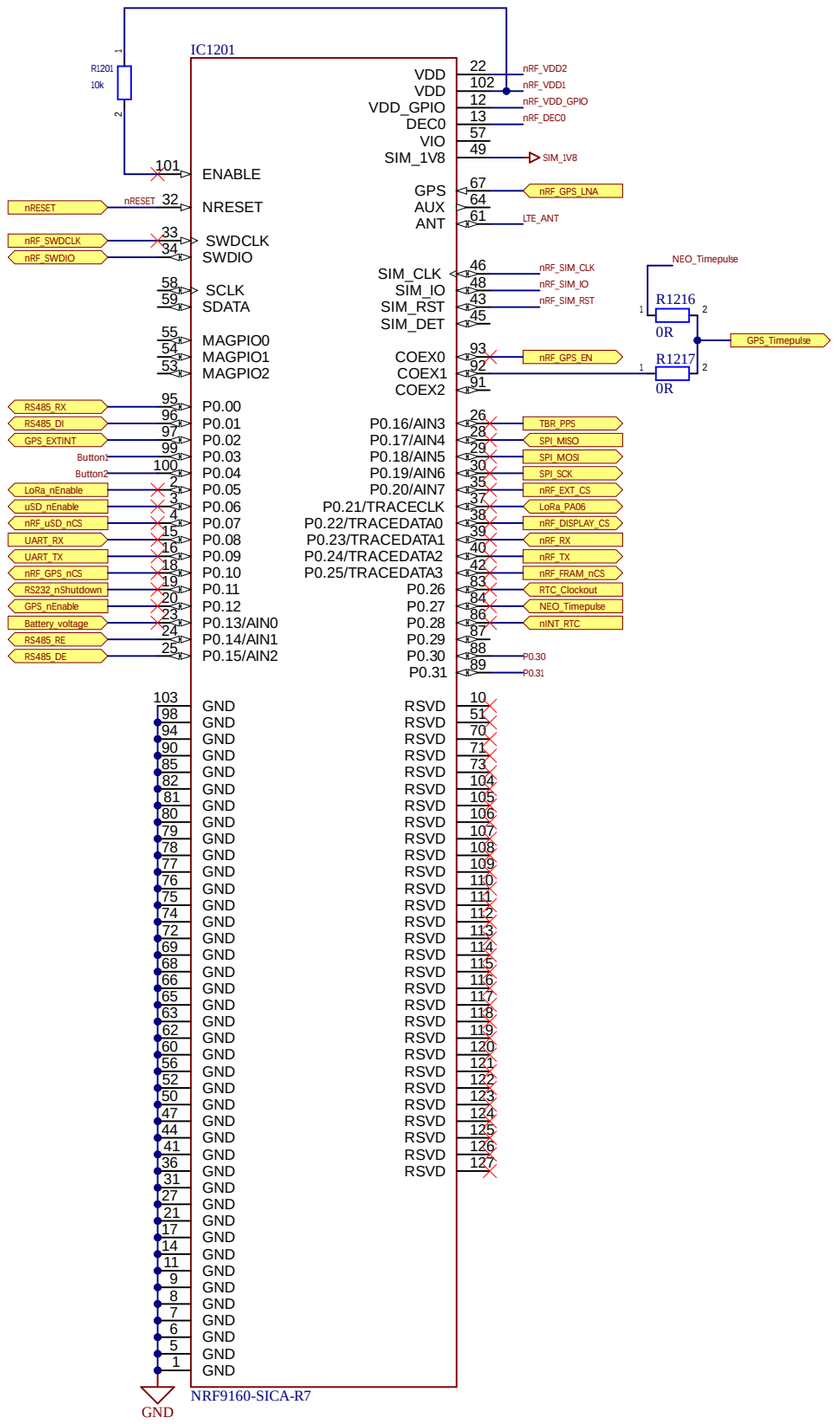
NTNU

Sheet: /
File: cSLIM-shield.sch

Title: cSLIM Overview

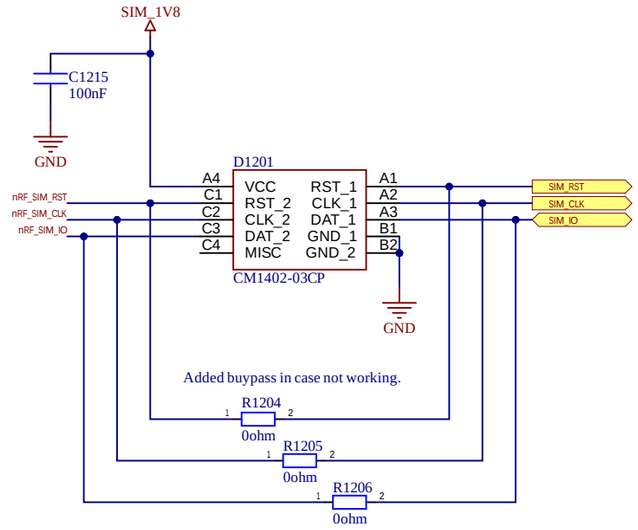
Size: A4	Date: 2021-03-31	Rev: v1
KiCad E.D.A. kicad (5.1.4)-1		Id: 1/11

nRF9160 SiP

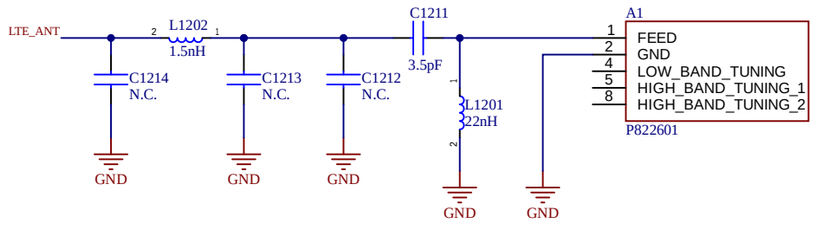


NOTE:
pin 45 (SIM_DET) not used and needs to ble left floating.
External pull-up resitor on nRESET not allowed
When internal GPS is used, COEX1 provides 1PPS, only use either R1216 or R1217

EMI-protection for SIM

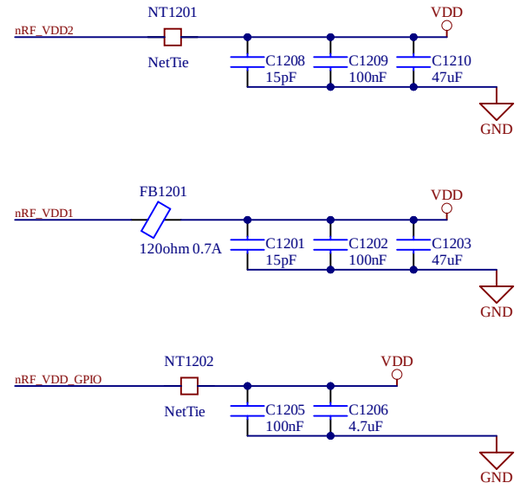


Antenna matching



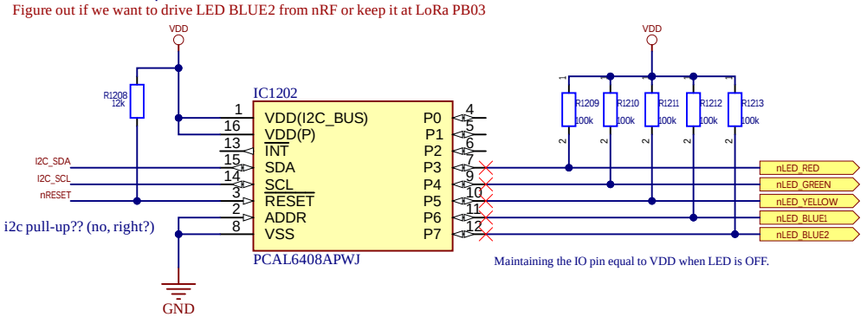
Power to nRF

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

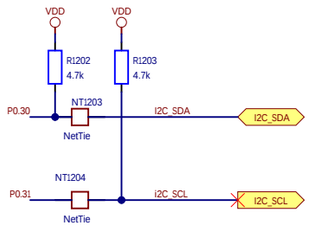


8-bit I2C-bus IO-expander. Used to drive LEDs

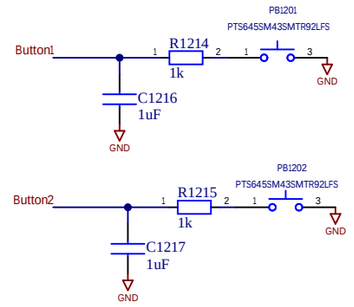
Figure out if we want to drive LED BLUE2 from nRF or keep it at LoRa PB03



I2C pullup resistors

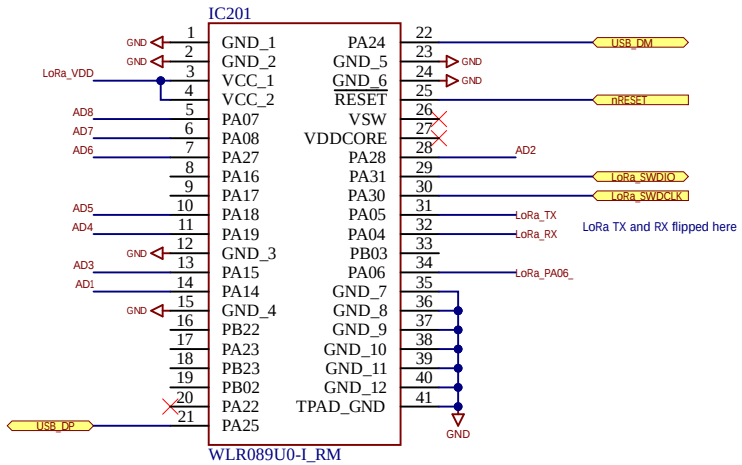


Pushbuttons



Title		
Size A3	Number	Revision
Date: 11.02.2021		Sheet of
File: C:\Users\..\cSLIM-SA_nRF9160.SchDoc		Drawn By:

LoRa Module

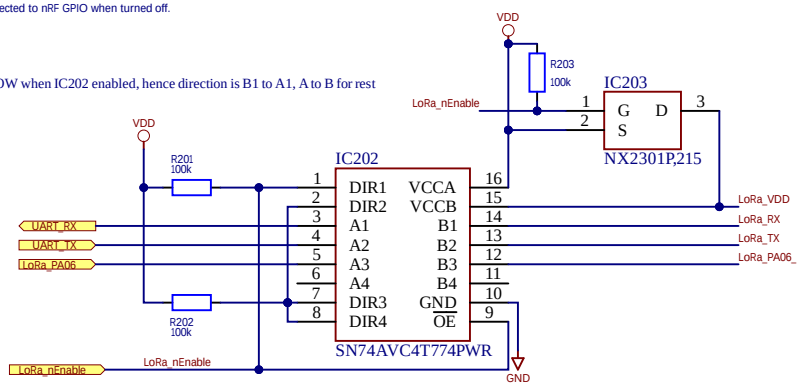


LoRa TX and RX flipped here

TTL

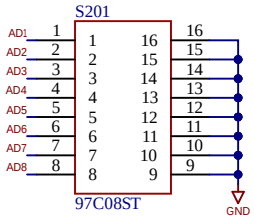
Logic level converter with controlled
output enable used to ensure tri-state
on pins connected to nRF GPIO when turned off.

DIR1 = LOW when IC202 enabled, hence direction is B1 to A1, A to B for rest



Adress Switch

Functionality must be added to the LoRa software
to make use of Adress 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, 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 comunication with other devices.
Remove unneeded connections and/or insert LLC to ensure tri-state-inputs if
LoRa module should be powered down completely.

Eivind Jølsgard

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Sheet: /
File: cSLIM-shield-LoRa.sch

Title: cSLIM LoRa Module

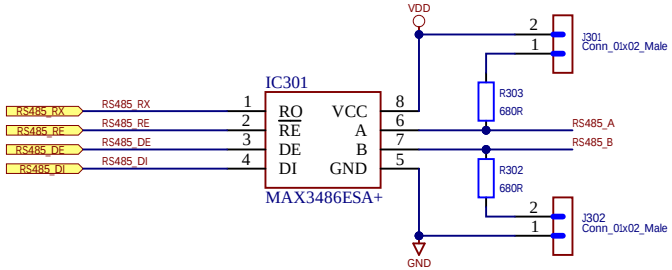
Size: A4	Date: 2021-03-31	Rev: v1
KiCad E.D.A. kicad (5.1.4)-1		Id: 2/11

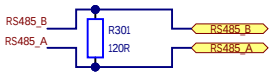
RS485 controller

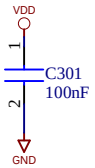
MAX3486

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.

changed from RS485_!RE to _RE (IS IT ! or not ! (Master thesis says RE)







RS485 controller

MAX3471

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dependent on baudrate of TBR.
Default baudrate of TBR-700 is 115.200kbps.
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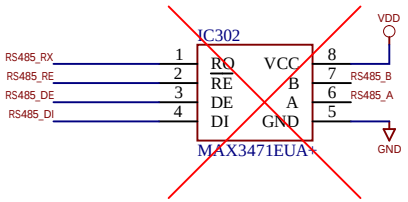
it has a maximum baud of 64kbps.



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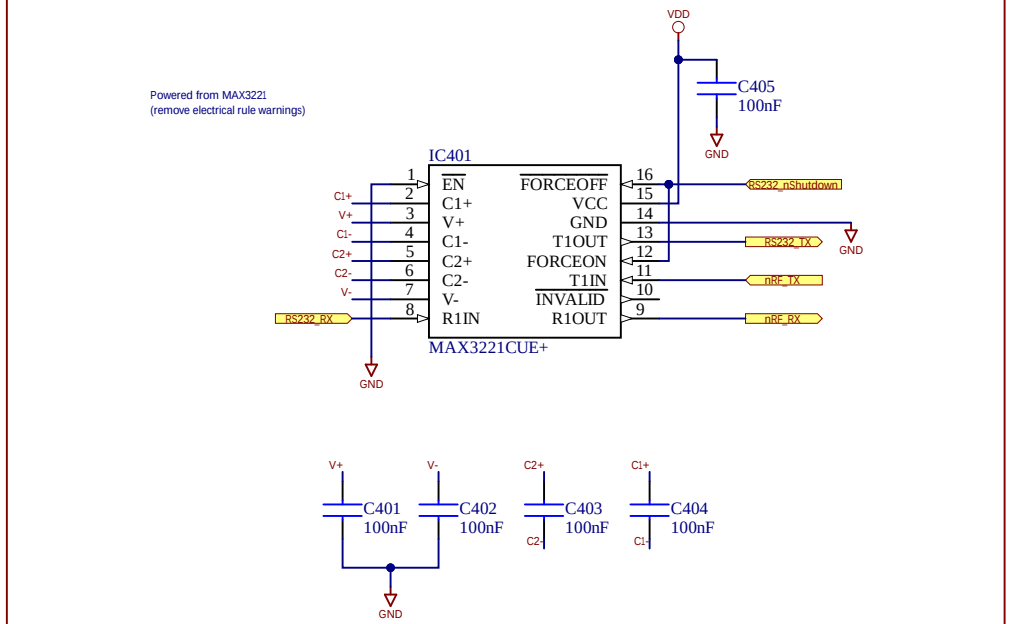
Sheet: /
File: cSLIM_RS485.sch

Title: cSLIM RS485

Size: A4	Date: 2021-06-30	Rev: v1.1
KiCad E.D.A. kicad (5.1.4)-1		Id: 3/11

RS232 controller



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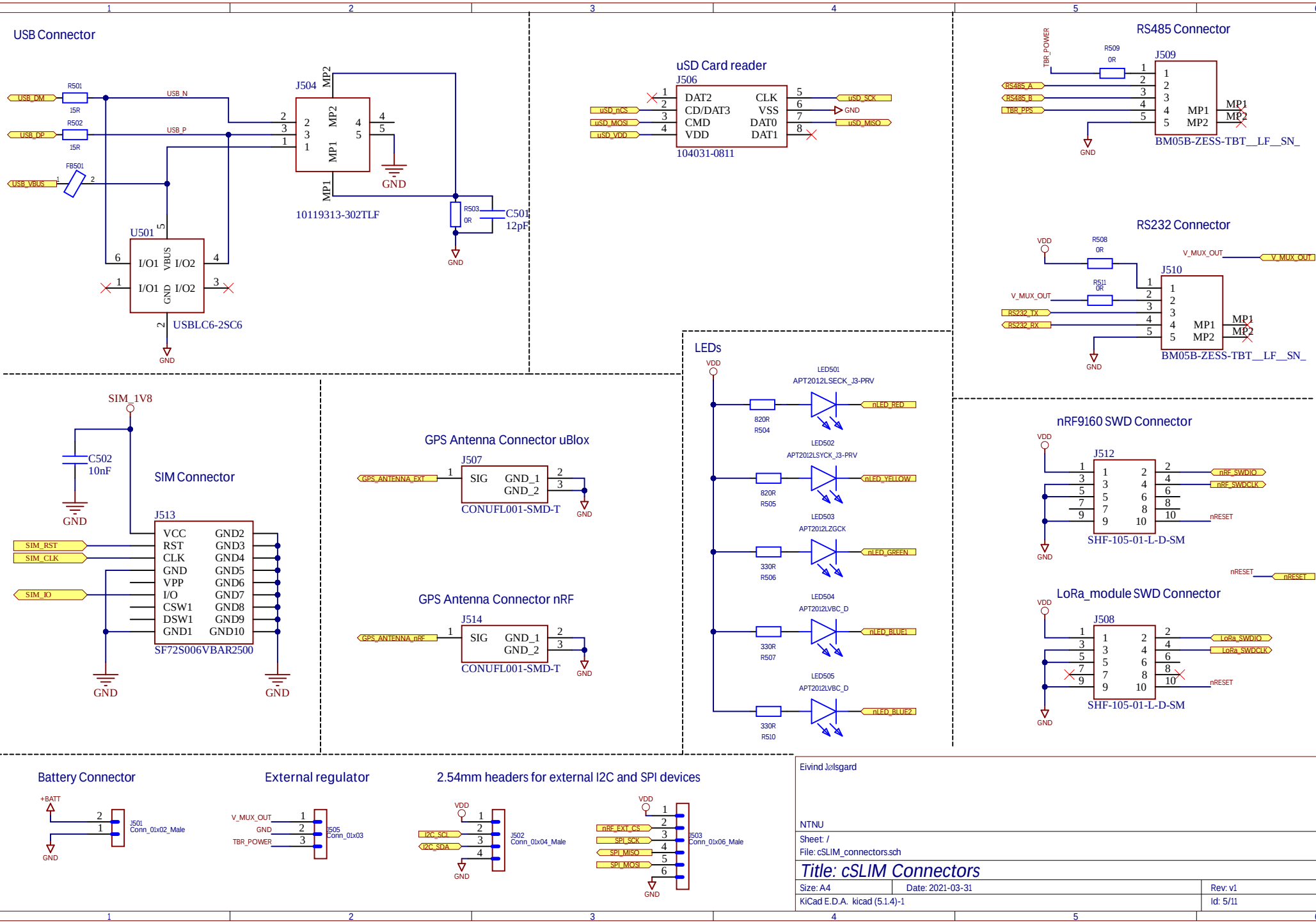
Sheet: /
File: cSLIM_RS232.sch

Title: cSLIM RS232

Size: A4	Date: 2021-03-31	Rev: v1
KiCad E.D.A. kicad (5.1.4)-1		Id: 4/11



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Sheet: /

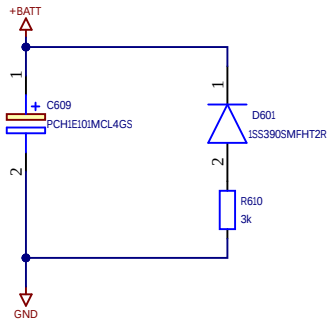
File: cSLIM_connectors.sch

Title: cSLIM Connectors

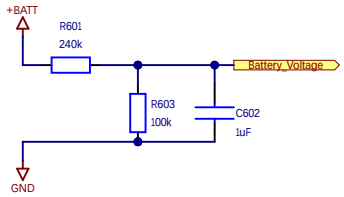
Size: A4	Date: 2021-03-31	Rev: v1
KiCad E.D.A. kicad (5.1.4)-1		Id: 5/11

Polarization protection

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

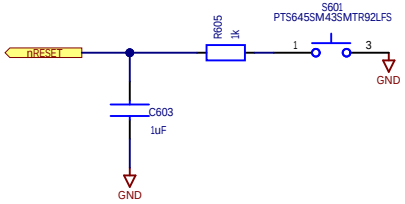


Battery measurement



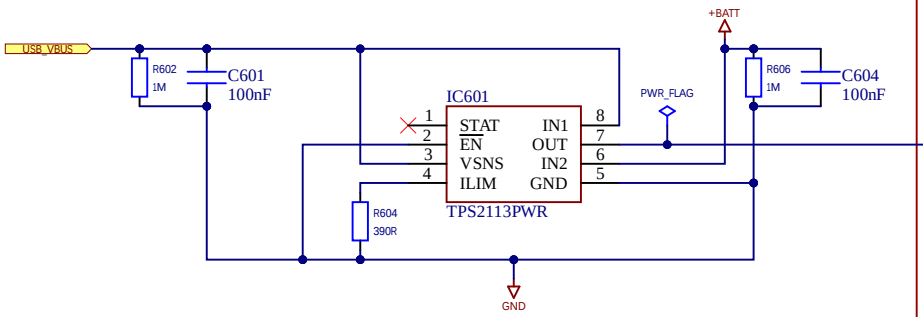
nRESET signal

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



Power multiplexer

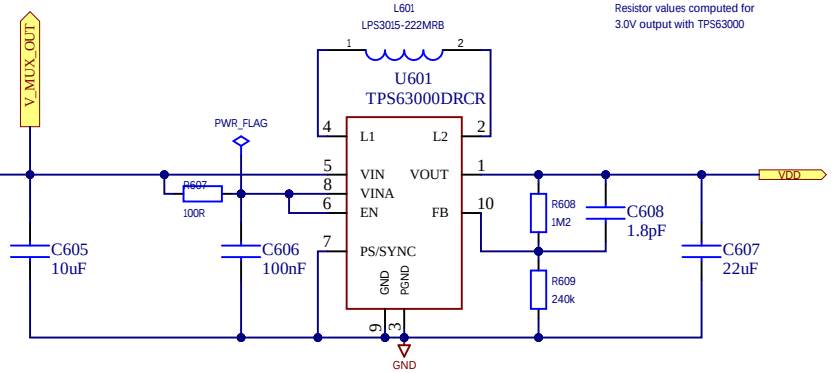
Selecting USB when connected



3.3V Buck-Boost regulator

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



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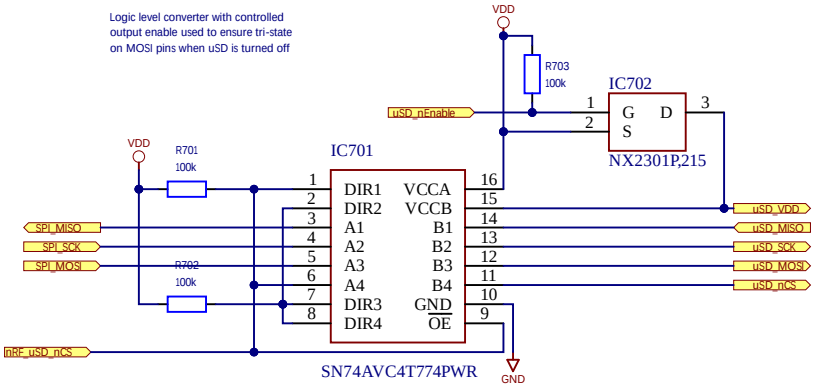
Sheet: /
File: cSLIM_power.sch

Title: cSLIM Power

Size: A4	Date: 2021-03-31	Rev: v1
KiCad E.D.A. kicad (5.1.4)-1		Id: 6/11

uSD LLC



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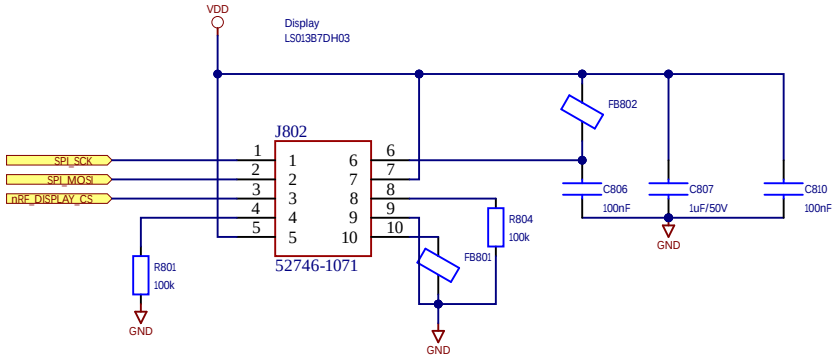
Sheet: /
File: cSLIM_uSD.sch

Title: cSLIM uSD

Size: A4	Date: 2021-03-31	Rev: v1
KiCad E.D.A. kicad (5.1.4)-1		Id: 7/11

Display



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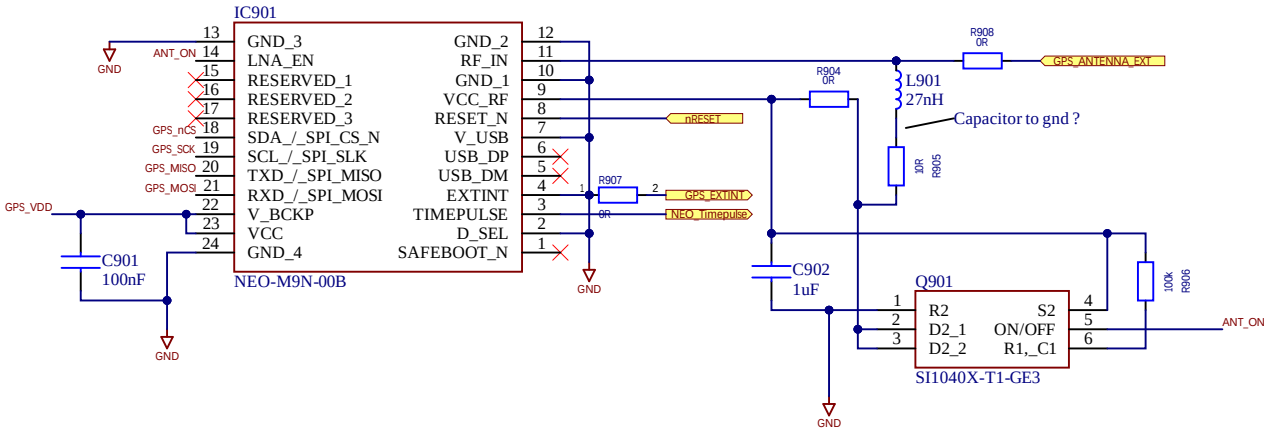
NTNU		
Sheet: /		
File: cSLIM_display.sch		
Title: cSLIM Display		
Size: A4	Date: 2021-06-30	Rev: v1.1
KiCad E.D.A. kicad (5.1.4)-1		Id: 8/11

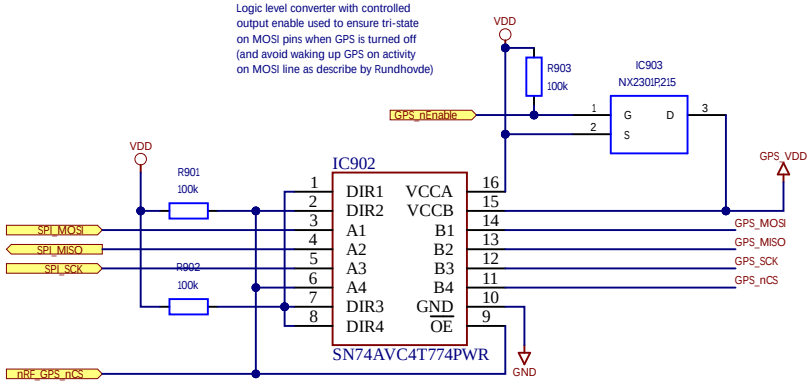
Ublox GNSS receiver and LLC

Q901, L901, R905, and C902 is only needed
with active antenna (Taoglass FXP.611 is passive).R904 can be used instead
of Q901, C902 and R906 for antenna always on.

Mount either External GPS or use internal.

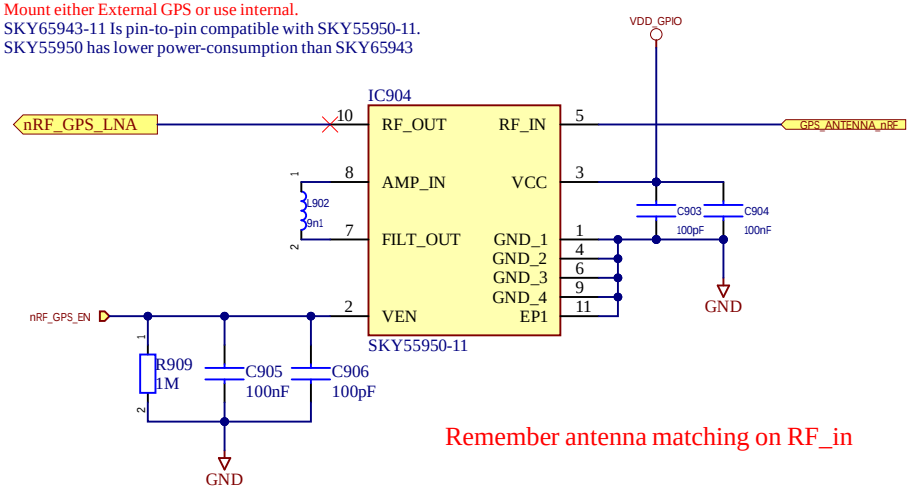


Logic level converter with controlled
output enable used to ensure tri-state
on MOSI pins when GPS is turned off
(and avoid waking up GPS on activity
on MOSI line as describe by Rundhovde)



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



Remember antenna matching on RF_in

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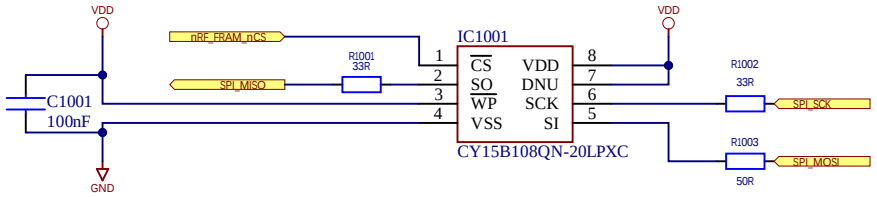
NTNU	
Sheet: /	
File: cSLIM_GPS.sch	
Title: cSLIM External GPS	
Size: A4	Date: 2021-03-31
KiCad E.D.A. kicad (5.1.4)-1	Rev: v1
	Id: 9/11

FRAM



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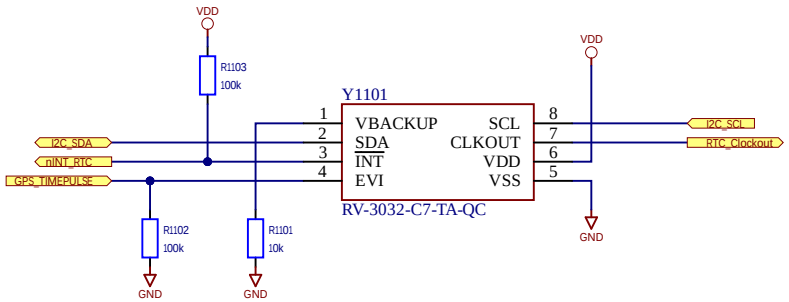
Sheet: /
File: cSLIM_FRAM.sch

Title: cSLIM FRAM

Size: A4	Date: 2021-03-31	Rev: v1
KiCad E.D.A. kicad (5.1.4)-1		Id: 10/11

Real Time Clock



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Sheet: /
File: cSLIM_RTC.sch

Title: cSLIM RTC

Size: A4	Date: 2021-03-31	Rev: v1
KiCad E.D.A. kicad (5.1.4)-1		Id: 11/11

Comment	Description	Designator	Footprint	LibRef	Quantity
P822601	Antenna	A1	P822601	P822601	1
100nF	Capacitor	C301, C401, C402, C403, C404, C405, C601, C604, C606, C806, C810, C901, C904, C905, C1001, C1202, C1205, C1209, C1215	CAPC1608X90N	C	19
12pF	Capacitor	C501	CAPC1608X90N	C	1
10nF	Capacitor	C502	CAPC1608X90N	C	1
1uF	Capacitor	C602, C603, C902, C1216, C1217	CAPC1608X90N	C	5
10uF	Capacitor	C605	CAPC1608X90N	C	1
22uF	Capacitor	C607	CAPC1608X90N	C	1
1.8pF	Capacitor	C608	CAPC1608X90N	C	1
PCH1E101MCL4GS	Capacitor Polarised	C609	CAPAE660X840N	PCH1E101MCL4GS	1
1uF/50V	Capacitor	C807	CAPC1608X90N	C	1
100pF	Capacitor	C903, C906	CAPC1608X90N	C	2
15pF	Capacitor	C1201, C1208	CAPC1608X90N	C	2
47uF	Capacitor	C1203, C1210	CAPC1608X90N	C	2
4.7uF	Capacitor	C1206, C1207	CAPC1608X90N	C	2
3.5pF	Capacitor	C1211	CAPC1608X90N	C	1
N.C.	Capacitor	C1212, C1213, C1214	CAPC1608X90N	C	3
1SS390SMFHT2R	Diode	D601	SODFL1608X70N	1SS390SMFHT2R	1
CM1402-03CP	Diode ESD (Uni-directional)	D1201	CM140203CP	CM1402-03CP	1
500mA		FB501	CAPC1608X90N	Ferrite_Bead	1
Ferrite_Bead		FB801, FB802	CAPC1608X90N	Ferrite_Bead	2
120ohm 0.7A		FB1201	CAPC1608X90N	Ferrite_Bead	1
WLR089U0-I_RM	Integrated Circuit	IC201	WLR089U0IRM	WLR089U0-I_RM	1
SN74AVC4T774PWR	Integrated Circuit	IC202, IC701, IC902	SOP65P640X120-16N	SN74AVC4T774PWR	3
NX2301P,215	Integrated Circuit, [NoValue]	IC203, IC702, IC903	SOT95P230X110-3N	NX2301P,215	3
MAX3486ESA+	Integrated Circuit	IC301	SOIC127P600X175-8N	MAX3486ESA+	1
MAX3471EUA+	Integrated Circuit	IC302	SOP65P490X110-8N	MAX3471EUA+	1
MAX3221CUE+	Integrated Circuit	IC401	SOP65P640X110-16N	MAX3221CUE+	1
TPS2113PWR	Integrated Circuit	IC601	SOP65P640X120-8N	TPS2113PWR	1
NEO-M9N-00B	Integrated Circuit	IC901	NEOM9N00B	NEO-M9N-00B	1
SKY55950-11	Integrated Circuit	IC904	SKY6594311	SKY65943-11	1
CY15B108QN-20LPXC	Integrated Circuit	IC1001	SON65P323X328X55-8N	CY15B108QN-20LPXC	1
NRF9160-SICA-R7	IC RF TxRx + MCU Cellular GPS 700MHz ~ 2.2GHz 161-TFLGA Module	IC1201	XCVR_NRF9160-SICA-R7	NRF9160-SICA-R7	1
PCAL6408APWJ	Integrated Circuit	IC1202	SOP65P640X110-16N	PCAL6408APWJ	1
Conn_01x02_Male	Connector	J301, J302, J501	HDRV2W110P0X254_1X2_508X254X854P	61300211121	3
Conn_01x04_Male	Connector	J502	HDRV4W64P0X254_1X4_1016X250X901P	PH1-04-UA	1
Conn_01x06_Male	Connector	J503	HDRV6W64P0X254_1X6_1524X254X869P	61300611121	1
10119313-302TLF	Connector	J504	10119313302TLF	10119313-302TLF	1
Conn_01x03	Connector	J505	HDRV3W64P0X254_1X3_762X254X869P	61300311121	1
104031-0811	Connector	J506	1040310811	104031-0811	1
CONUFL001-SMD-T	Connector	J507, J514	CONUFL001-SMD	CONUFL001-SMD-T	2
SHF-105-01-L-D-SM	Connector	J508, J512	SHF10501LDSMLCKTR	SHF-105-01-L-D-SM-LC-K-TR	2
BM05B-ZESS-TBT__LF__SN_	Connector	J509, J510	BM05BZESSTBTLFSN	BM05B-ZESS-TBT__LF__SN_	2
SF72S006VBAR2500	Connector	J513	SF72S006VBAR2500	SF72S006VBAR2500	1
52746-1071	Connector	J802	52746-1071	52746-1071	1
LPS3015-222MRB		L601	LPS3015	LPS3015-103MRB	1
27nH		L901	L-1608	L	1
9n1		L902	LQW18AS10NG0CD	L_1	1
22nH		L1201	L-1608	L	1
1.5nH		L1202	L-1608	L	1
APT2012LSECK_J3-PRV	LED	LED501	LEDC2012X75N	APT2012LSECK_J3-PRV	1
APT2012LSYCK_J3-PRV	LED	LED502	LEDC2012X85N	APT2012LSYCK_J3-PRV	1
APT2012LZGCK	LED	LED503	LEDC2012X85N	APT2012LZGCK	1
APT2012LVBC_D	LED	LED504, LED505	LEDC2012X85N	APT2012LVBC_D	2
NetTie		NT1201, NT1202, NT1203, NT1204	NETTIE_FP	NetTie	4
	Switch 4-pi. used 1-3 (2-4 not in use)	PB1201, PB1202, S601	PTS645(SMT)	PTS645SM43SMTR92LFS	3
SI1040X-T1-GE3	MOSFET (N-Channel)	Q901	SOTFL50P160X60-6N	SI1040X-T1-GE3	1
100k		R201, R202, R203, R603, R701, R702, R703, R801, R804, R901, R902, R903, R906, R1102, R1103, R1209, R1210, R1211, R1212, R1213	RESC1608X55N	R	20
120R		R301	RESC1608X55N	R	1
680R		R302, R303	RESC1608X55N	R	2
15R		R501, R502	RESC1608X55N	R	2
0R		R503, R508, R509, R511, R904, R907, R908, R1216, R1217	RESC1608X55N	R	9
820R		R504, R505	RESC1608X55N	R	2
330R		R506, R507, R510	RESC1608X55N	R	3
240k		R601, R609	RESC1608X55N	R	2
1M		R602, R606, R909	RESC1608X55N	R	3
390R		R604	RESC1608X55N	R	1
1k		R605, R1214, R1215	RESC1608X55N	R	3
100R		R607	RESC1608X55N	R	1
1M2		R608	RESC1608X55N	R	1
3k		R610	RESC1608X55N	R	1
10R		R905	RESC1608X55N	R	1
33R		R1001, R1002	RESC1608X55N	R	2
50R		R1003	RESC1608X55N	R	1
10k		R1101, R1201	RESC1608X55N	R	2
4.7k		R1202, R1203	RESC1608X55N	R	2
0ohm		R1204, R1205, R1206	RESC1608X55N	R	3
12k		R1208	RESC1608X55N	R	1
97C08ST	Switch	S201	SOIC127P671X170-16N	97C08ST	1
USBLC6-2SC6	Integrated Circuit	U501	SOT95P280X145-6N	USBLC6-2SC6	1
TPS63000DRCR	Integrated Circuit	U601	TPS63002DRCR	TPS63000DRCR	1
RV-3032-C7-TA-QC	Integrated Circuit	Y1101	RV3032C7TAQA	RV-3032-C7-TA-QC	1