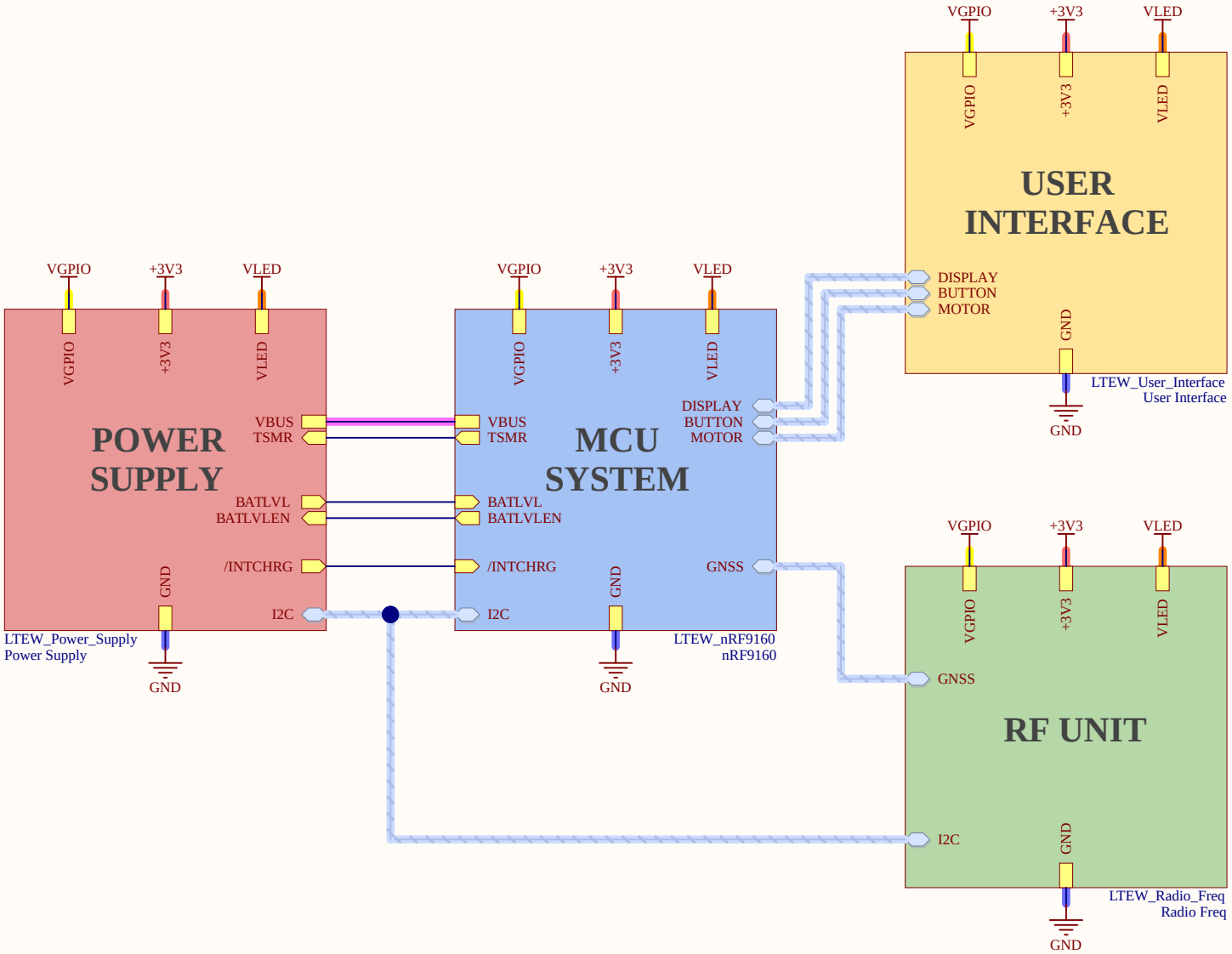
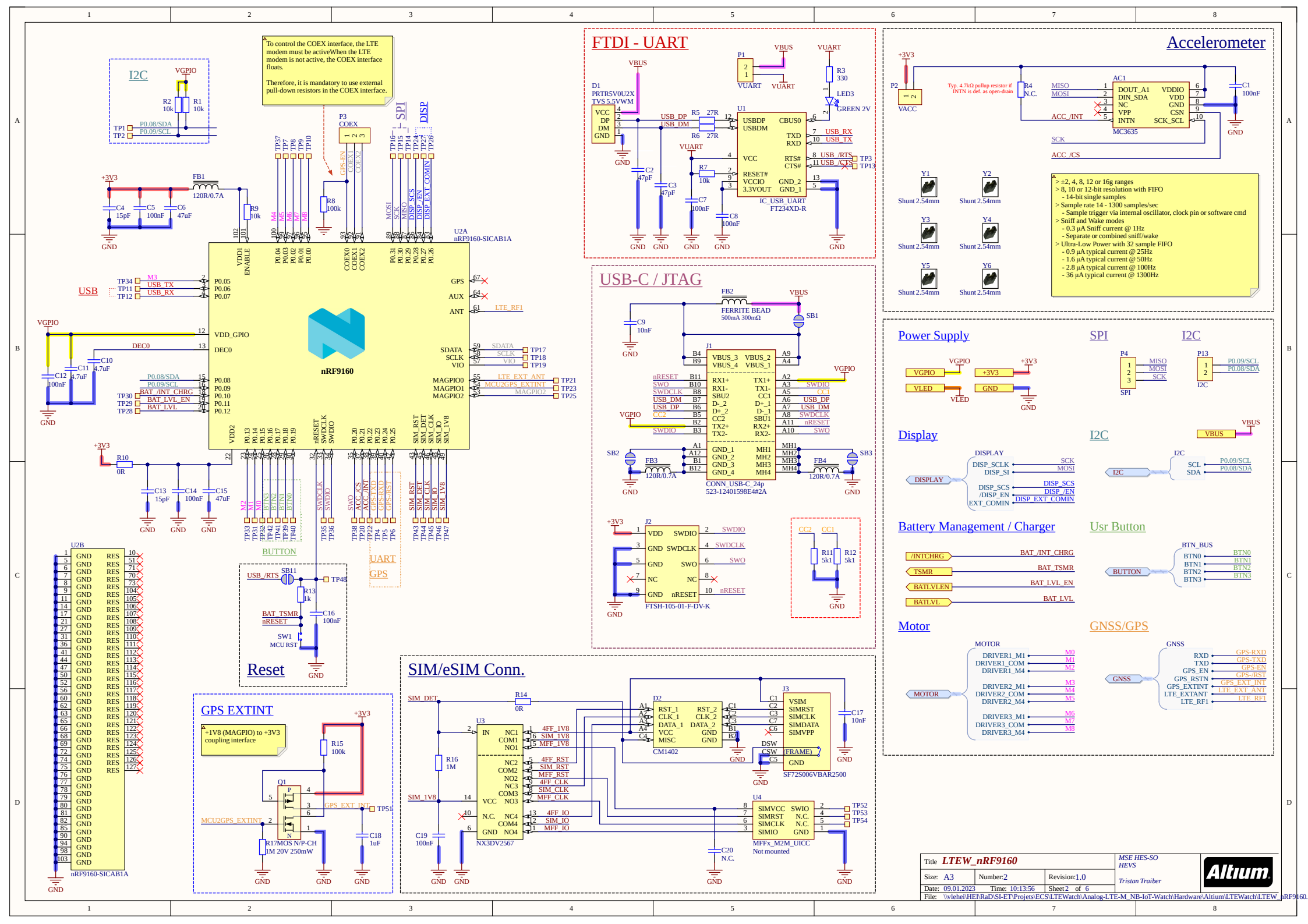
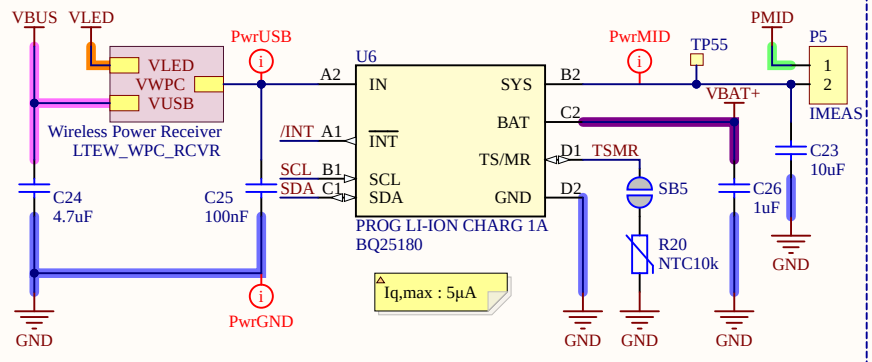


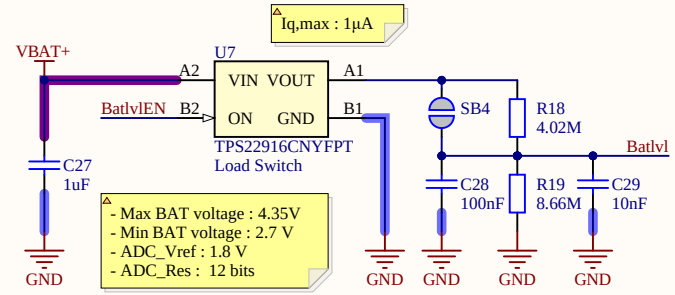
Title	***LTEWatch***		*MSE HES-SO HEVS*
Size: A4	Number:1	Revision:1.0	*Tristan Traiber*
Date: 09.01.2023	Time: 10:13:56	Sheet 1 of 6	
File:	\\vlehei\HEI\RaD\SI-ET\Projets\ECS\LTEWatch\Analog-LTE-M_NB-IoT-Watch\Hardware\Altium\LTEWatch\LTEWatch.SchD		


I2C
VGPIO
R2 10k
R1 10k
TP1 P0.08/SDA
TP2 P0.09/SCL
To control the COEX interface, the LTE modem must be activeWhen the LTE modem is not active, the COEX interface floats.
Therefore, it is mandatory to use external pull-down resistors in the COEX interface.
P3 COEX
SPI
DISP
+3V3
FB1 120R/0.7A
C4 15pF
C5 100nF
C6 47uF
R9 10k
R8 100k
U2A nRF9160-SICAB1A
USB
TP34 USB_TX
TP11 USB_RX
TP12
nRF9160
GPS
AUX
ANT
LTE_RF1
SDATA
SCLK
VIO
MAGPIO0
MAGPIO1
MAGPIO2
LTE_EXT_ANT
MCU2GPS_EXTINT
C10 4.7uF
C11 4.7uF
C12 100nF
DEC0
VDD_GPIO
P0.08/SDA
P0.09/SCL
BAT_/INT_CHRG
BAT_LVL_EN
BAT_LVL
R10 0R
C13 15pF
C14 100nF
C15 47uF
BUTTON
UART
GPS
U2B
nRF9160-SICAB1A
Reset
USB_/RTS
SB11
TP48
R13 1k
BAT_TSMR
nRESET
C16 100nF
SW1
MCU RST
GPS EXTINT
+1V8 (MAGPIO) to +3V3 coupling interface
R15 100k
Q1
R17MOS N/P-CH 1M 20V 250mW
C18 1uF
TP51
FTDI - UART
D1 PRTR5V0U2X TVS 5.5VWM
P1
VUART
R3 330
LED3 GREEN 2V
U1
USBDP
USBDM
CBUS0
TXD
RXD
RTS#
CTS#
GND_2
GND_1
VCC
RESET#
VCCIO
3.3VOUT
IC_USB_UART FT234XD-R
USB_DP
USB_DM
USB_RX
USB_TX
USB_/RTS
USB_/CTS
TP3
TP13
R5 27R
R6 27R
R7 10k
C2 47pF
C3 47pF
C7 100nF
C8 100nF
USB-C / JTAG
FB2 FERRITE BEAD 500mA 300mΩ
SB1
C9 10nF
J1
VBUS_3
VBUS_4
VBUS_2
VBUS_1
RX1+
RX1-
SBU2
D-_2
D+_2
CC2
TX2+
TX2-
TX1+
TX1-
CC1
D+_1
D-_1
SBU1
RX2+
RX2-
GND_1
GND_2
GND_3
GND_4
MH1
MH2
MH3
MH4
SWDIO
SWDCLK
USB_DM
USB_DP
nRESET
CONN_USB-C_24p 523-12401598E4#2A
SB2
SB3
FB3 120R/0.7A
FB4 120R/0.7A
J2
FTSH-105-01-F-DV-K
R11 5k1
R12 5k1
SIM/eSIM Conn.
SIM_DET
R14 0R
U3
NX3DV2567
4FF_1V8
SIM_1V8
MFF_1V8
4FF_RST
SIM_RST
MFF_RST
4FF_CLK
SIM_CLK
MFF_CLK
4FF_IO
SIM_IO
MFF_IO
R16 1M
C19 100nF
D2
CM1402
J3
SF72S006VBAR2500
C17 10nF
C20 N.C.
U4
MFFx_M2M_UICC
Not mounted
TP52
TP53
TP54
Accelerometer
P2
VACC
Typ. 4.7kΩ pullup resistor if INTN is def. as open-drain
R4 N.C.
AC1
MC3635
MISO
MOSI
SCK
ACC_/INT
ACC_/CS
C1 100nF
Y1 Shunt 2.54mm
Y2 Shunt 2.54mm
Y3 Shunt 2.54mm
Y4 Shunt 2.54mm
Y5 Shunt 2.54mm
Y6 Shunt 2.54mm
> ±2, 4, 8, 12 or 16g ranges
> 8, 10 or 12-bit resolution with FIFO
- 14-bit single samples
> Sample rate 14 - 1300 samples/sec
- Sample trigger via internal oscillator, clock pin or software cmd
> Sniff and Wake modes
- 0.3 µA Sniff current @ 1Hz
- Separate or combined sniff/wake
> Ultra-Low Power with 32 sample FIFO
- 0.9 µA typical current @ 25Hz
- 1.6 µA typical current @ 50Hz
- 2.8 µA typical current @ 100Hz
- 36 µA typical current @ 1300Hz
Power Supply
SPI
I2C
Display
Battery Management / Charger
/INTCHRG
TSMR
BATLVLEN
BATLVL
Usr Button
BTN_BUS
Motor
MOTOR
GNSS/GPS
GNSS
Title LTEW_nRF9160
MSE HES-SO HEVS
Tristan Traiber
Size: A3
Number:2
Revision:1.0
Date: 09.01.2023
Time: 10:13:56
Sheet 2 of 6
File: \\vlehei\HER\RaD\SI-ET\Projets\ECS\LTEWatch\Analog-LTE-M_NB-IoT-Watch\Hardware\Altium\LTEWatch\LTEW_nRF9160.

Li-Ion Battery Charger and Protection Unit



Battery Level Monitoring

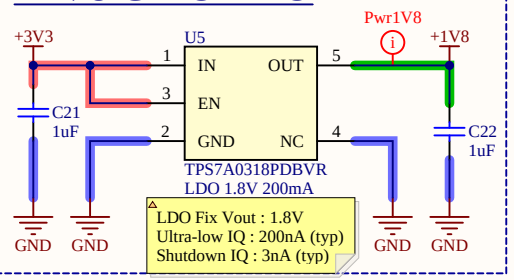


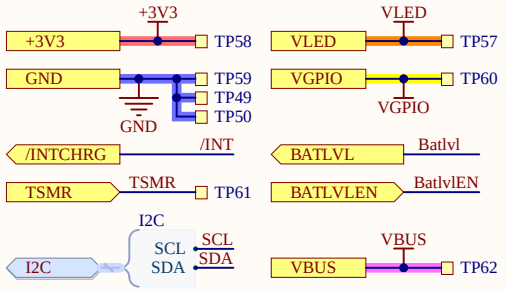
Fsample = 100e3
Rinput = 1 / (Fsample * 2.5e-12) = 4 MΩ
Rout = Rin * ainMax/(VBatMax-ainMax) = 8.89 MΩ (8.66 MΩ)

VADCMax = 2.98 [V], VADCMin = 1.85 [V]
Iout = 343.60n [A]

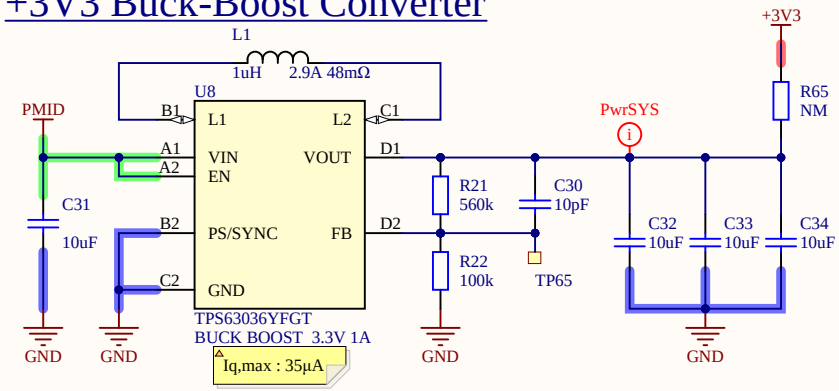
Battery Full ADCval = 4061 [bits]
Battery Empty ADCval = 2521 [bits]
Battery Level Range = 1540 [bits]

+1V8 GPIO LDO





+3V3 Buck-Boost Converter



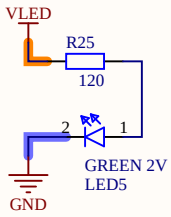
Inductor : L = 1uH
> D = (Vout - Vin)/Vout = (3.3-3)/3.3 = 1/11 = 9.09%
> Ipeak = Isw,max + (Vin*D)/(2*f*L) = 0.5 + (3*0.0909)/(2*2MHz*1uF) = 0.568A

FB :
> R1 = R2 * (Vout/VFB - 1) = 100k * (3.3/0.5 - 1) = 560k Ohms

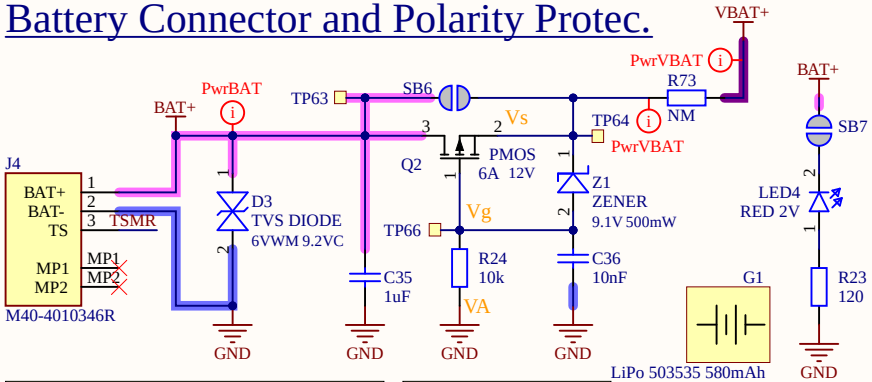
Iout Boost :
>Iout,max = n*Isw*(1 - D) = 0.8*1*(1-0.09) = 728mA

Iout Buck :
>D = Vout/Vin = 3.3/4.5=73.3%
>Iout,max = n*Isw/D = 0.8*1/0.73 = 1.09A

PWR ON



Battery Connector and Polarity Protec.



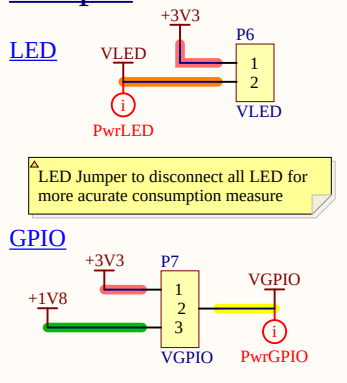
> Battery reverse polarity protection ; PMOSFET connect load to BAT+ if :
- Vgs = Vgth < -1.0V
> The Zener diode limits Vgs max range to protect MOSFET against over voltage (OVP) :
- 10 V < Vgs < 10 V

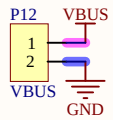
Revers BAT (4.2V) :
Vs = 0 V
Vg = VFZ
Vgs = Vg - Vs = VFZ
VFZ > Vgth (-1.0 V)

> PMOS = OPEN

Correct BAT :
Vs = +VBAT
Vg = VA = 0 V
Vgs = Vg-Vs = -VBAT
-VBAT < Vgth (-1.0 V)
> PMOS = CLOSE

Jumper

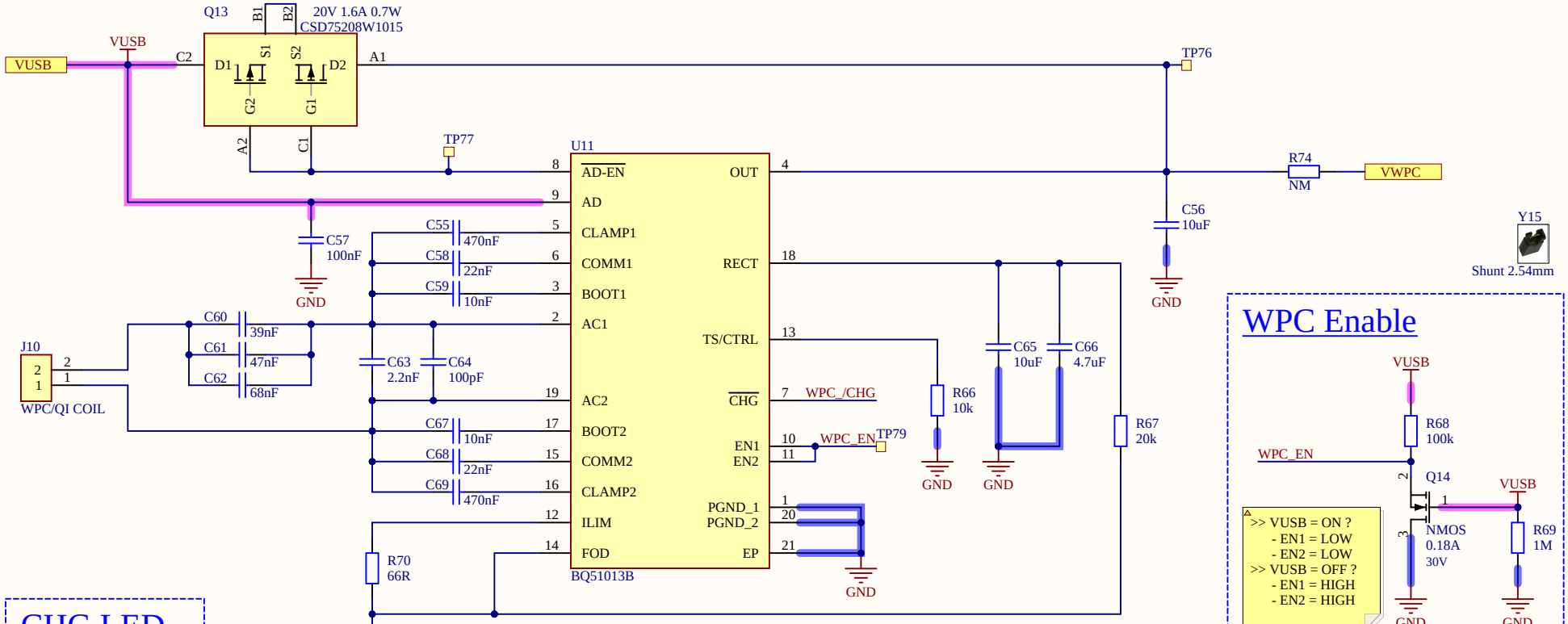




Y7 Shunt 2.54mm
Y8 Shunt 2.54mm
Y9 Shunt 2.54mm
Y13 Shunt 2.54mm
Y14 Shunt 2.54mm

Title	*LTEW_Power_Supply*		*MSE HES-SO HEVS*
Size: A4	Number:3	Revision:1.0	*
Date: 09.01.2023	Time: 10:13:57	Sheet 3 of 6	*Tristan Traiber*
File: \\vlehei\HEI\RaD\SI-ET\Projets\ECS\LTEWatch\Analog-LTE-M_NB-IoT-Watch\Hardware\Altium\LTEWatch\LTEW_Power_S			*

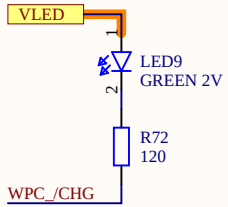
Altium



WPC Enable

>> <EN1 EN2> : Inputs that allow user to enable/disable wireless and wired charging :
> 00 Wireless charging is enabled
> 01 Dynamic communication current limit disabled
> 10 Wireless charging disabled
> 11 Wireless charging disabled.

CHG LED



R_ILim = R70 + R71 =
K_ILim/I_Max = 262/1 = 262 Ohm
R70 = 262 - R_FOD = 262 - 196 = 66 Ohm

11.2 Layout Example

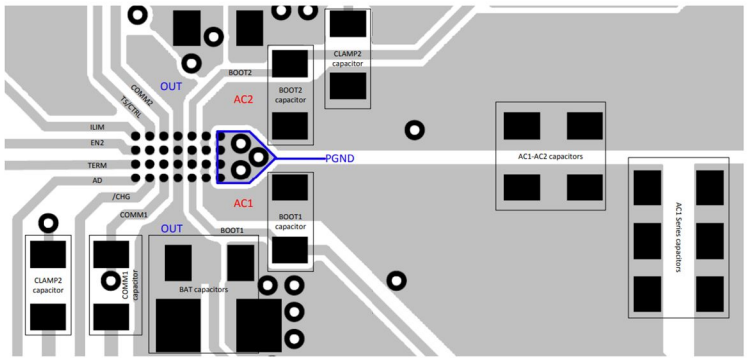
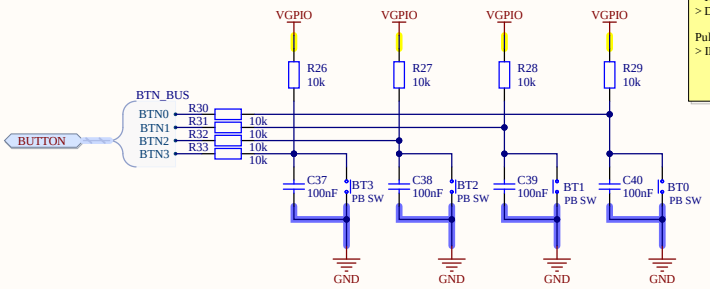


Figure 41. bq51003 Layout Schematic

Title	*LTEW_WPC_RCVR*		*MSE HES-SO HEVS* * *Tristan Traiber* *
Size: A4	Number:4	Revision:1.0	
Date: 09.01.2023	Time: 10:13:57	Sheet 4 of 6	
File:	\\vlehei\HEI\RaD\SI-ET\Projets\ECS\LTEWatch\Analog-LTE-M_NB-IoT-Watch\Hardware\Altium\LTEWatch\LTEW_WPC_R		

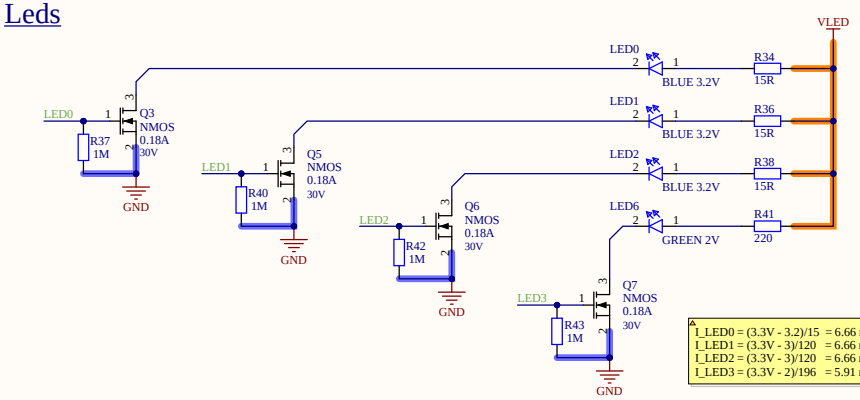
Buttons & Switches



Button user interface :
- Hardware debounce circuit : RC filter (F = 31Hz)
- If not wanted :
> Replace serial 10KR with 0R
> Disconnect C100nF

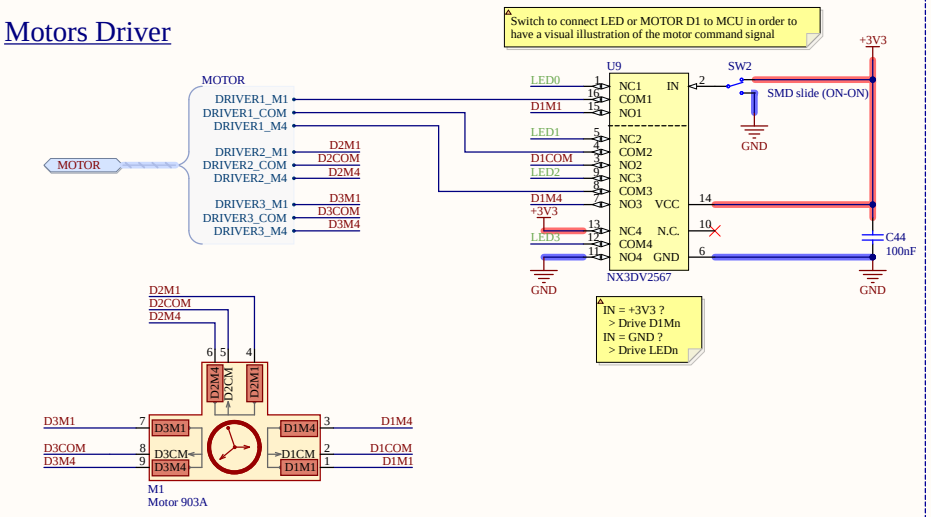
Pull-Up :
> IBtn = 3.3V/10kOhm = 330uA

Leds



I_LED0 = (3.3V - 3.2)/15 = 6.66 mA
I_LED1 = (3.3V - 3)/120 = 6.66 mA
I_LED2 = (3.3V - 3)/120 = 6.66 mA
I_LED3 = (3.3V - 2)/196 = 5.91 mA

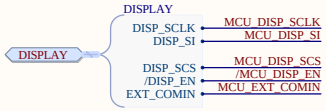
Motors Driver



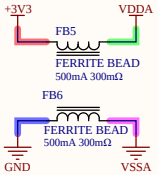
Switch to connect LED or MOTOR D1 to MCU in order to have a visual illustration of the motor command signal

IN = +3V3 ?
> Drive D1Mn
IN = GND ?
> Drive LEDn

Display Interface



Filter Power Supply and GND



4. Input Terminal names and function

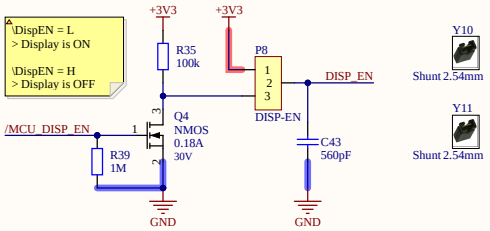
4-1) Input Terminal

Table 4

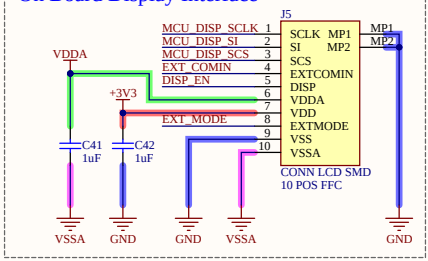
No.	Code	I/O	Voltage	Signal name	Remark
1	SCLK	I	0/3.0 (V)	Serial clock signal	
2	SI	I	0/3.0 (V)	Serial input signal	
3	SCS	I	0/3.0 (V)	Chip select signal	
4	EXTCOMIN	I	0/3.0 (V)	COM inversion polarity input pin	
5	DISP	I	0/3.0 (V)	Display ON/OFF switching signal	4-2
6	VDDA	I	3.0(V)	Power source for Analog	
7	VDD	I	3.0(V)	Power source for Logic	
8	EXTMODE	I	0/3.0 (V)	COM inversion mode switch terminal	4-1
9	VSS	I	0(V)	Logic ground	
10	VSSA	I	0(V)	Analogue ground	

【Remark 4-1】"H"=EXTCOMIN singal enabled, "L"=Serial input flag enabled.
When "H", connect EXTMODE to VDD and when "L" to VSS.
【Remark 4-2】ON/OFF for LCD display only. Memory data is maintained.
When "H", displays with memory data, and when "L", displays all white with memory data maintained.

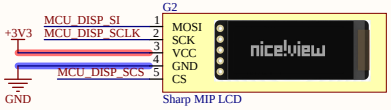
Display Enable Ctrl



On Board Display Interface



Nice!View Connector

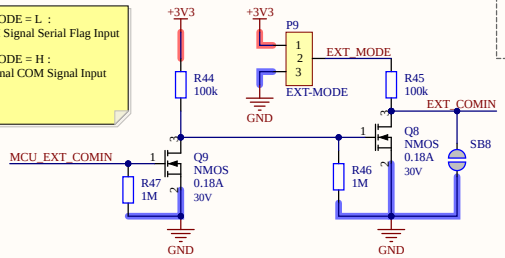


EXTMODE Option Ctrl & EXTCOMIN Interrupt

"EXT_COM_IN = "EXT_MODE" AND "MCU_EXT_COM_IN"

EXTMODE = L :
> COM Signal Serial Flag Input

EXTMODE = H :
> External COM Signal Input



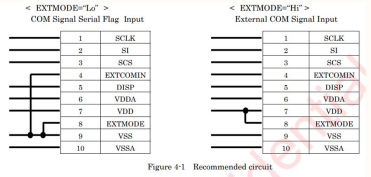
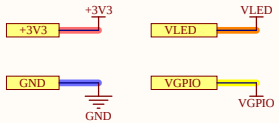


Figure 4-1 Recommended circuit

Power Supply



Title: LTEW_User_Interface		MSE HES-SO HEVS * Tristan Traiber *
Size: A3	Number: 5	Revision: 1.0
Date: 09.01.2023 Time: 10:13:57	Sheet 5 of 6	
File: \\vlehei\HEI\RaD\SI-ET\Projets\ECS\LTEWatch\Analog-LTE-M_NB-IoT-Watch\Hardware\Altium\LTEWatch\LTEW_User_Inte		

Ext. Antenna Enable

> GPS_EN = H:
- VGPS = ON

> GPS_EN = L:
- GPS = OFF

Ext. Antenna LED Indicator

I_LED = (3.3-2)/120 = 11mA

LNA_EN = H > LED = OFF
LNA_EN = L > LED = ON

External GNSS Antenna

External active antenna power supply supervisor

LNA_EN = H > Ext. Antenna
LNA_EN = L > On-board Ant.

GNSS Receiver

>IV_BCKP : 32 µA
> I_VCC: - Acquisition : 6.5...10.5mA
- Tracking : 6.0...8.0mA

> I_Peak: - Acquisition : 25mA
> I_VIO: - Acquisition : 2.2...2.3mA
- Tracking : 2.2...2.3mA

BeiDou, Galileo, GLONASS, GPS, GNSS
1.561GHz, 1.575GHz, 1.602GHz
-167dBm
< 25mW (tracking)
Ps =

u-blox MAX-M10S

SAW Filter

- Consumption : Ps = 10dBm (10mW)
- Center Freq : 1.588GHz
- 56MHz Bandwidth
- 2dB

- Supply Current : Idd = 80...350 µA
- Control Current : Ictrl = 1...10 µA

On-Board GNSS Antenna

Cellular LTE Antenna Interface

- Supply Current : Idd = 80...350 µA
- Control Current : Ictrl = 1...10 µA

=> MAGPIO (1V8) Compatible
VCtrl_L = -0.3...0.3 V
VCtrl_H = 1.4...VD V

On Board SMD Chip Antenna

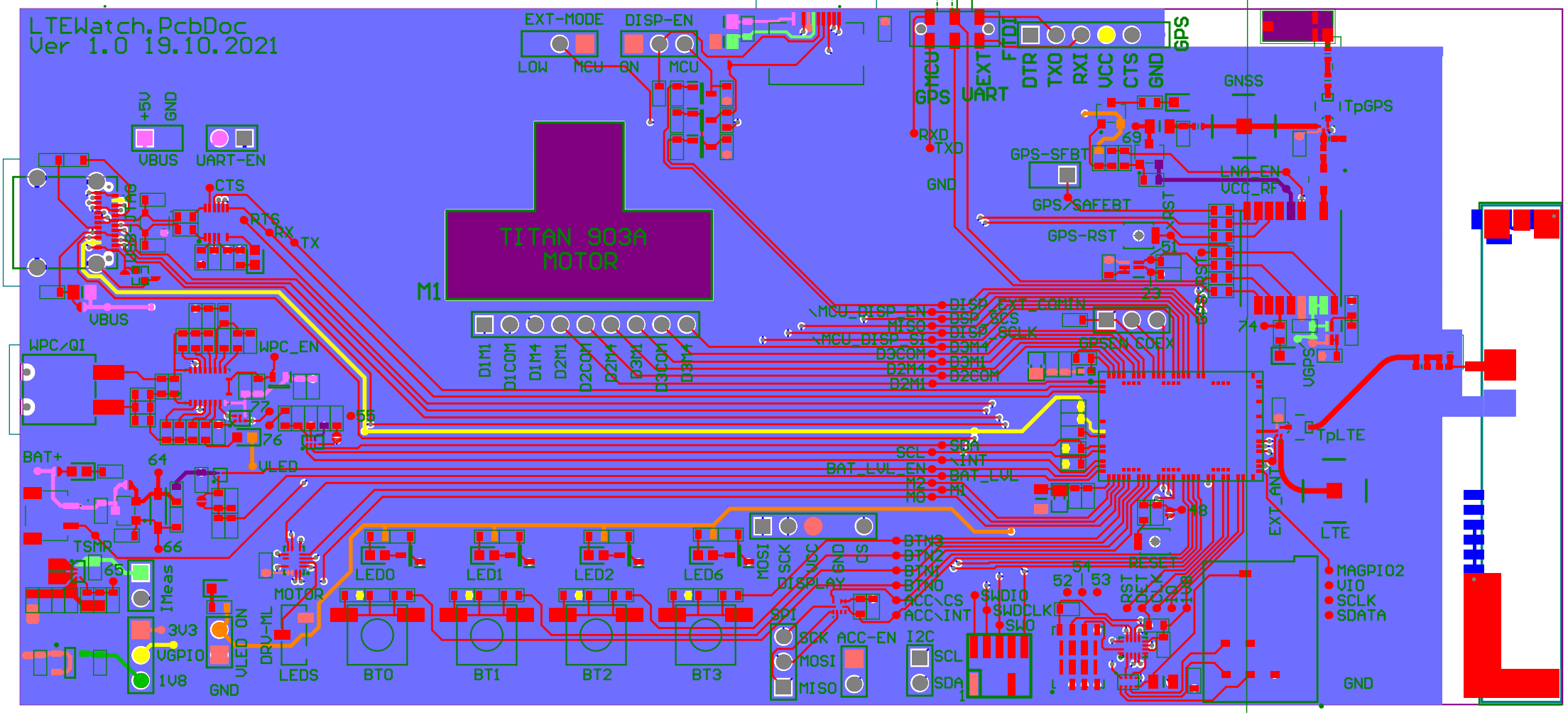
nRF9160_DK LTE-M Chip-Antenna

GPS Ctrl MCU/Ext

Title	*LTEW_Radio_Freq*		
Size: A3	Number:6	Revision:1.0	
Date: 09.01.2023	Time: 10:13:57	Sheet 6 of 6	
File: \\vlehei\HEI\RaD\SI-ET\Projets\ECS\LTEWatch\Analog-LTE-M_NB-IoT-Watch\Hardware\Altium\LTEWatch\LTEW_Radio_Fre			

MSE HES-SO
HEVS
*
Tristan Traiber
*

Altium


LTEWatch.PcbDoc
Ver 1.0 19.10.2021
EXT-MODE
DISP-EN
LOW
MCU
ON
MCU
GPS
UART
MCU
UEXT
FTDI
DTR
TXD
RXI
VCC
CTS
GND
GPS
GNSS
ITpGPS
RXD
TXD
GND
GPS-SFBT
GPS/SAFEBT
GPS-RST
LNA_EN
VCC_RF
TITAN 903A
MOTOR
M1
+5V
GND
VBUS
UART-EN
CTS
RTS
RX
TX
VBUS
WPC/QI
WPC_EN
BAT+
VLED
TSMR
IMeas
3V3
VGPIO
1V8
VLED ON
GND
DRV-ML
LEDS
MOTOR
LED0
LED1
LED2
LED6
BT0
BT1
BT2
BT3
D1M1
D1COM
D1M4
D2M1
D2COM
D2M4
D3M1
D3COM
D3M4
MCU_DISP_EN
MISO
MCU_DISP_SI
DISP_EXT_COMIN
DISP_SCS
DISP_SCLK
D3COM
D2M4
D2M1
D3M4
D2COM
GPSCXN
COEX
SCL
SDA
INT
BAT_LVL_EN
BAT_LVL
M2
M1
M0
MOSI
SCK
VCC
GND
CS
DISPLAY
SPI
SCK
MOSI
MISO
ACC-EN
I2C
SCL
SDA
BTN3
BTN2
BTN1
BTN0
ACC_CS
ACC_INT
SWDIO
SWDCLK
SWO
RESET
RST
SCL
SDA
EXT_ANT
LTE
TpLTE
MAGPIO2
VIO
SCLK
SDATA
GND

Line #	ECassembly	Name	Tolerance	Voltage	TempCoef	Description	Designator	Footprint	Quantity	Manufacturer 1	Manufacturer Part Number 1	Manufacturer Lifecycle 1	Supplier 1	Supplier Part Number 1	Supplier Unit Price 1	Supplier Subtotal 1
		P822601				ANTENNA PRESTTA OCTABAND LTE	A1	P822601	1				Digi-Key	939-1057-1-ND		
		MC3635				Accéléromètres X, Y, Z Axis ±2g, 4g, 8g, 12g, 16g 10-LGA (1,6x1,6)	AC1	MC3635	1				Mouser	498-MC3635		
		SKHUALE010				Tactile Switch, SPNO, SMD, 160gf, 6.2x6.3x2.5mm	BT0, BT1, BT2, BT3	Switch-PB-SMD-BT0, Switch-PB-SMD-BT1, Switch-PB-SMD-BT2, Switch-PB-SMD-BT3	4				Mouser	688-SKHUALE010		
		100nF				0.1 µF ±10% 25V Condensateurs céramique X7R 0603 (1608 métrique)	C1, C5, C7, C8, C12, C14, C16, C19, C25, C28, C37, C38, C39, C40, C44, C51, C57	C0603	17				Digi-Key	1276-1006-1-ND		
		47pF				47 pF ±5% 25V Ceramic Capacitor C0G, NP0 0603 (1608 Metric)	C2, C3	C0603	2				Digi-Key	399-C0603C470J3GAC7867CT-ND		
		15pF				15 pF ±5% 25V Ceramic Capacitor C0G, NP0 0603 (1608 Metric)	C4, C13	C0603	2				Digi-Key	478-10804-1-ND		
		47uF				47 µF ±20% 10V Ceramic Capacitor X5R 0805 (2012 Metric)	C6, C15	CAPC2012X11L	2				Digi-Key	490-9961-1-ND		
		10nF				10000 pF ±5% 25V Condensateurs céramique C0G, NP0 0603 (1608 métrique)	C9, C17, C29, C36, C46, C59, C67	C0603	7				Digi-Key	445-2664-1-ND		
		4.7uF				4.7 µF ±10% 25V Condensateurs céramique X6S 0603 (1608 métrique)	C10, C11, C24, C66	C0603	4				Digi-Key	490-7199-1-ND		
		1uF				1 µF ±10% 25V Ceramic Capacitor X7R 0603 (1608 Metric)	C18, C21, C22, C26, C27, C35, C41, C42, C45	C0603	9				Mouser	187-CL10B105KA8NNNC		
		N.C.				NC	C20	C0603	1							
		10uF				10 µF ±10% 25V Ceramic Capacitor X5R 0805 (2012 Metric)	C23, C31, C32, C33, C34, C56, C65	C0603	7				Mouser	81-GRM188R61E106KA3J		
		10pF				10 pF ±5% 50V Ceramic Capacitor C0G, NP0 0603 (1608 Metric)	C30	C0603	1				Digi-Key	478-1163-1-ND		
		560pF				560 pF ±5% 25V Ceramic Capacitor C0G, NP0 0603 (1608 Metric)	C43	C0603	1				Digi-Key	311-3957-1-ND		
		100nF				0.1 µF ±10% 25V Ceramic Capacitor X7R 0402 (1005 Metric)	C47	C0603	1				Digi-Key	1276-6720-1-ND		
		47pF				47 pF ±5% 25V Ceramic Capacitor C0G, NP0 0402 (1005 Metric)	C48	CAPC1005X55N	1				Digi-Key	1292-1324-1-ND		
		N.C.				NC	C49, C52, C53, C54	CAPC1005X55N	4							
		3.5pF				3.5 pF ±0,1pF 50V Condensateurs céramique C0G, NP0 0402 (1005 métrique)	C50	CAPC1005X55N	1				Mouser	81-GJM1555C1H3R5BB1D		
		470nF				0.47 µF ±10% 25V Ceramic Capacitor X7R 0603 (1608 Metric)	C55, C69	C0603	2				Digi-Key	490-3291-1-ND		
		22nF				0.022 µF ±10% 25V Ceramic Capacitor X7R 0603 (1608 Metric)	C58, C68	C0603	2				Digi-Key	399-C0603C223K3RAC7867CT-ND		
		39nF				0.039 µF ±10% 50V Ceramic Capacitor X7R 0603 (1608 Metric)	C60	C0603	1				Digi-Key	1292-1436-1-ND		
		47nF				0.047 µF ±10% 25V Ceramic Capacitor X7R 0603 (1608 Metric)	C61	C0603	1				Digi-Key	478-1235-6-ND		
		68nF				0.068 µF ±10% 25V Ceramic Capacitor X7R 0603 (1608 Metric)	C62	C0603	1				Digi-Key	1292-1462-1-ND		
		2.2nF				2200 pF ±5% 25V Ceramic Capacitor X7R 0603 (1608 Metric)	C63	C0603	1				Digi-Key	478-12683-1-ND		
		100pF				100 pF ±5% 25V Ceramic Capacitor C0G, NP0 0603 (1608 Metric)	C64	C0603	1				Digi-Key	478-06033A101JAT2ACT-ND		
		TVS 5.5VWM				Clamp Ipp Tvs Diode Surface Mount SOT-143B	D1	PRTR5V0U2X	1				Digi-Key	1727-3884-1-ND		
		CM1402				EMI Network Filter Arrays SIM CARD EMI FILTER WITH ESD PROTECTION	D2	CM1402	1				Digi-Key	CM1402-03CPOSTR-ND		
		TVS DIODE				9.2V Clamp 5A (8/20µs) Ipp Tvs Diode Surface Mount SOD-882	D3	SP100701ETG	1				Digi-Key	F6187CT-ND		
		NN03-320				Dual port antenna booster for GNSS, Bluetooth, 5G and UWB (1561 - 1606MHz, 2400 - 2500MHz, 3400 - 3800MHz, 3100 - 4800MHz and 6000 - 10600 MHz).	E1	XCVR_NN03-320	1				Digi-Key	2115-NN03-320CT-ND		
		120R/0.7A				Ferrite Bead, 120 Ohm @ 100MHz, 700mA, 130 mOhm Max	FB1, FB3, FB4	INDC1005X04L	3				Digi-Key	490-5439-1-ND		
		FERRITE BEAD				600 Ohms @ 100 MHz 1 Power, Signal Line Ferrite Bead 0805 (2012 Metric) 500mA 300mOhm	FB2, FB5, FB6	BEADC2012X110N	3				Digi-Key	240-2399-1-ND		
		TPS7A0318PDBVR				1.588GHz Frequency GPS RF SAW Filter (Surface Acoustic Wave) 2dB 56MHz Bandwidth 6-SMD, No Lead	FL1	B39162B3913U410	1				Digi-Key	B39162B3913U410CT-ND		
		LiPo 503535 580mAh				503535 3.8v 580mAh round lipo battery cells (Order : shorturl.at/tEFMZ)	G1	Battery_Lipo_503535	1					https://batteryzone.de/products/503535-580mah-hochspannung-3-8v-runde-polymer-smart-watch-moxibustion-instrument-auto-smart-box-batterie?_pos=1&_sid=59cfd2d74&_ss=r		
		Sharp MIP LCD				503535 3.8v 580mAh round lipo battery cells (Order : shorturl.at/tEFMZ)	G2	SHARP_MIP_LCD	1					https://keycapsss.com/keyboard-parts/parts/219/nice-view-1.08-e-paper-display		
		CONN_USB-C_24p				USB-C (USB TYPE-C) USB 3.2 Gen 2 (USB 3.1 Gen 2, Superspeed + (USB 3.1)) Receptacle Connector 24 Position Surface Mount, Right Angle; Through Hole	J1	12401598E42A - JTAG	1				Mouser	523-12401598E4#2A		
		FTSH-105-01-F-DV-K				Connector Header Surface Mount 10 position 0.050" (1.27mm)	J2	HDR_2x5-SMD-1.27mm-K	1				Digi-Key	SAM8796-ND		
		SF72S006VBAR2500				n 8 (6 + 2) Position Card Connector NANO SIM Surface Mount, Right Angle Gold	J3	SF72S006VBAR2500	1				Digi-Key	670-2967-6-ND		
		M40-4010346R				Connector Header Surface Mount, Right Angle 3 position 0.039" (1.00mm)	J4	M404010346R	1				Digi-Key	M40-4010346R-ND		
		CONN LCD SMD				10 Position FFC, FPC Connector Contacts, Top 0.020" (0.50mm) Surface Mount, Right Angle	J5	FH12A10S05SH55	1				Digi-Key	HFK110CT-ND		
		SMA				SMA Connector Jack, Female Socket 50Ohm Surface Mount Solder	J6, J9	73251-1350 - GNSS, 73251-1350 - LTE	2				Digi-Key	WM9357-ND		
		MM8130-2600				Coaxial Connector with Switch	J7, J8	COAXIAL-SWF - GNSS, COAXIAL-SWF - LTE	2				Digi-Key	490-4981-1-ND		
		WPC/QI COIL				2 Position Wire to Board Terminal Block Horizontal with Board 0.138" (3.50mm) Surface Mount	J10	23839422	1				Digi-Key	17-2383942-2CT-ND		
		2.9A 48mΩ				1 µH Shielded Drum Core, Wirewound Inductor 2.9 A 48mOhm Max 0806 (2016 Metric)	L1	1286ASH1R0MP2	1				Digi-Key	490-16593-1-ND		
		350mA 460mΩ				27 nH Unshielded Multilayer Inductor 350 mA 460mOhm Max 0402 (1005 Metric)	L2	LQG15WH0N7B02D	1				Digi-Key	490-2628-1-ND		
		N.C.				N.C.	L3	INDC1005X37N	1							
		9.7nH				9.7 nH Non blindé Bobiné Inducteur 1.4 A 81mOhms maxi 0402 (1005 métrique)	L4	LQW15AN10NG80D	1				Mouser	81-LQW15AN9N7G80D		
		11nH				11 nH Unshielded Drum Core, Wirewound Inductor 1.4 A 65mOhm 0402 (1005 Metric)	L5	LQW15AN10NG80D	1				Digi-Key	2035-1078-1-ND		
		13nH				13 nH Unshielded Drum Core, Wirewound Inductor 870 mA 140mOhm 0402 (1005 Metric)	L6	LQW15AN10NG80D	1				Digi-Key	2035-1525-1-ND		
		1.5nH				1.5 nH Non blindé Couche mince Inducteur 700 mA 250mOhms maxi 0402 (1005 métrique)	L7	INDC1005X37N	1				Digi-Key	535-10356-1-ND		
		22nH				22 nH Non blindé Bobiné Inducteur 780 mA 202mOhms maxi 0402 (1005 métrique)	L8	LQW15AN10NG80D	1				Digi-Key	490-7628-1-ND		
		BLUE 3.2V				Blue 470nm LED Indication - Discrete 3.2V 0603 (1608 Metric)	LED0, LED1, LED2	LEDC1608X80N	3				Digi-Key	732-4966-1-ND		
		GREEN 2V				Green 570nm LED Indication - Discrete 2V 0603 (1608 Metric)	LED3, LED5, LED6, LED8, LED9	LEDC1608X80N	5				Digi-Key	732-4980-1-ND		
		RED 2V				Red 625nm LED Indication - Discrete 2V 0603 (1608 Metric)	LED4, LED7	LEDC1608X80N	2				Digi-Key	732-4978-1-ND		
		Motor 903A				Titan 903A : 3 Hands Bidirectional, independent motor	M1	MOTOR	1							
		VUART				Header, 2-Pin	P1	HDR1X2 - UART	1				Mouser	649-1012937890201BLF		
		VACC				Header, 2-Pin	P2	HDR1X2 - ACCEL	1				Mouser	649-1012937890201BLF		
		COEX				Header, 3-Pin	P3	HDR1X3 - COEX	1				Digi-key	952-2263-ND		
		SPI				Header, 3-Pin	P4	HDR1X3 - SPI	1				Digi-key	952-2263-ND		
		IMEAS				Header, 2-Pin	P5	HDR1X2 - IMEAS	1				Mouser	649-1012937890201BLF		
		VLED				Header, 2-Pin	P6	HDR1X2 - VLED	1				Mouser	649-1012937890201BLF		
		VGPIO				Header, 3-Pin	P7	HDR1X3 - VGPIO	1				Digi-key	952-2263-ND		
		DISP-EN				Header, 3-Pin	P8	HDR1X3 - DISP_EN	1				Digi-key	952-2263-ND		
		EXT-MODE				Header, 3-Pin	P9	HDR1X3 - EXT_MODE	1				Digi-key	952-2263-ND		
		GPSUSB				Header, 6-Pin	P10	HDR1X6 - GPS	1				Digi-Key	732-5319-ND		
		GPS-SFBT				Header, 2-Pin	P11	HDR1X2 - GPSSAFEBOOT	1				Mouser	649-1012937890201BLF		
		VBUS				Header, 2-Pin	P12	HDR1X2 - VIN	1				Mouser	649-1012937890201BLF		
		I2C				Header, 2-Pin	P13	HDR1X2 - I2C	1				Mouser	649-1012937890201BLF		
		MOS N/P-CH				Mosfet Array N and P-Channel 20V 485mA, 370mA 250mW Surface Mount SC-89 (SOT-563F)	Q1, Q12	SOT50P160X60-6N	2				Digi-Key	SI1016X-T1-GE3CT-ND		
		PMOS				P-Channel 12 V 6A (Ta) 1W (Ta) Surface Mount SOT-23F	Q2, Q10, Q11	SSM3J332RLFT	3				Digi-Key	SSM3J338RLFCT-ND		
		NMOS				N-Channel 30 V 180mA (Ta) 260mW (Ta), 1.1W (Tc) Surface Mount SOT-323	Q3, Q4, Q5, Q6, Q7, Q8, Q9, Q14	SOT65P210X110-3N	8				Digi-Key	1727-1288-1-ND		
		20V 1.6A 0.7W				Mosfet Array 2 P-Channel (Dual) Common Source 20V 1.6A 750mW Surface Mount 6-DSBGA (1x1.5)	Q13	BGA6C50P2X3_95X145X62	1				Digi-Key	296-38339-1-ND		
		10k				10 kOhms ±1% 0.1W, 1/10W Chip Resistor 0603 (1608 Metric) Moisture Resistant Thick Film	R1, R2, R7, R9, R24, R26, R27, R28, R29, R30, R31, R32, R33, R48, R49, R50, R66	RES0603	17				Digi-Key	311-10.0KHRCT-ND		
		330				330 Ohms ±1% 0.1W, 1/10W Chip Resistor 0603 (1608 Metric) Automotive AEC-Q200 Thick Film	R3	RES0603	1				Digi-Key	CR0603-FX-3300ELFCT-ND		
		N.C.				N.C.	R4	RES0603	1							
		27R				27 Ohms ±1% 0.1W, 1/10W Chip Resistor 0603 (1608 Metric) Automotive AEC-Q200 Thick Film	R5, R6	RES0603	2				Digi-Key	P27.0HCT-ND		
		100k				RES SMD 100K OHM 1% 1/8W 0603	R8, R15, R22, R35, R44, R45, R68	RES0603	7				Digi-Key	311-100KCRCT-ND		
		0R				0 Ohms Jumper 0.1W, 1/10W Chip Resistor 0603 (1608 Metric) Moisture Resistant Thick Film	R10, R14	RESC2012X60N	2				Digi-Key	311-0.0GRCT-ND		
		5k1				5.1 kOhms ±1% 0.1W, 1/10W Chip Resistor 0603 (1608 Metric) Moisture Resistant Thick Film	R11, R12	RES0603	2				Digi-Key	311-5.10KHRDKR-ND		
		1k				1 kOhms ±1% 0.1W, 1/10W Chip Resistor 0603 (1608 Metric) Moisture Resistant Thick Film	R13, R53, R54, R55, R58	RES0603	5				Digi-Key	311-1.00KHRCT-ND		
		1M				1 MOhms ±1% 0.1W, 1/10W Chip Resistor 0603 (1608 Metric) Automotive AEC-Q200 Thick Film	R16, R17, R37, R39, R40, R42, R43, R46, R47, R56, R69	RES0603	11				Digi-Key	P1.00MHCT-ND		
		4.02M				4.02 MOhms ±1% 0,1W, 1/10W Pavé résistif 0603 (1608 métrique) Résistant à l'humidité Couche épaisse	R18	RES0603	1				Digi-Key	YAG5698CT-ND		
		8.66M				8.66 MOhms ±1% 0,1W, 1/10W Pavé résistif 0603 (1608 métrique) AutomobileAEC-Q200 Couche épaisse	R19	RES0603	1				Digi-Key	541-8.66MHCT-ND		
		NTC10k				NTC Thermistor 10k 0603 (1608 Metric)	R20	C0603	1				Digi-Key	P10547CT-ND		
		560k				560 kOhms ±1% 0.1W, 1/10W Chip Resistor 0603 (1608 Metric) Automotive AEC-Q200, Moisture Resistant Thick Film	R21	RES0603	1				Digi-Key	311-560KLDCT-ND		
		120				1 MOhms ±1% 0.1W, 1/10W Chip Resistor 0603 (1608 Metric) Automotive AEC-Q200 Thick Film	R23, R25, R51, R64, R72	RES0603	5				Digi-Key	A129677CT-ND		
		15R				15 Ohms ±1% 0.1W, 1/10W Chip Resistor 0603 (1608 Metric) Moisture Resistant Thick Film	R34, R36, R38	RES0603	3				Digi-Key	311-15.0HRTR-ND		
		220				220 Ohms ±1% 0.1W, 1/10W Chip Resistor 0603 (1608 Metric) Moisture Resistant Thick Film	R41	RES0603	1				Digi-Key	311-220HRTR-ND		
		10R				10 Ohms ±5% 0.25W, 1/4W Chip Resistor 0805 (2012 Metric) Automotive AEC-Q200 Thick Film	R52	RESC2012X60N	1				Digi-Key	2019-RK73B2ATTD100JCT-ND		
		33R				33 Ohms ±1% 0.1W, 1/10W Chip Resistor 0603 (1608 Metric) Thin Film	R57, R59, R60, R61, R62, R63	RES0603	6				Digi-Key	13-RT0603FRE0733RLCT-ND		
		NM				8.66 MOhms ±1% 0,1W, 1/10W Pavé résistif 0603 (1608 métrique) AutomobileAEC-Q200 Couche épaisse	R65, R73, R74	RES0603	3				Digi-Key	541-8.66MHCT-ND		
		20k				20 kOhms ±1% 0.1W, 1/10W Chip Resistor 0603 (1608 Metric) Moisture Resistant Thick Film	R67	RES0603	1				Digi-Key	311-20.0KHRCT-ND		
		66R				66.5 Ohms ±1% 0.1W, 1/10W Chip Resistor 0603 (1608 Metric) Moisture Resistant Thick Film	R70	RES0603	1				Digi-Key	311-66.5HRCT-ND		
		196				196 Ohms ±1% 0.1W, 1/10W Chip Resistor 0603 (1608 Metric) Moisture Resistant Thick Film	R71	RES0603	1				Digi-Key	311-196HRDKR-ND		
		BGS12PL6E6327XTSA1				RF Switch IC WLAN SPDT 50Ohm PG-TSNP-6-10	S1, S2	BGS12WN6E6327XTSA1	2				Digi-Key	BGS12PL6E6327XTSA1CT-ND		
		SKHUALE010				Tactile Switch, SPNO, SMD, 160gf, 6.2x6.3x2.5mm	SW1	Push Button C2.5X3.0 OMRON B3U-1000P(M)-B - MCU RST	1				Mouser	688-SKHUALE010		
		SMD slide (ON-ON)				SMD slide Switch (ON-ON)	SW2	CJS-120xA - M/L	1				Mouser	229-CJS-1200TA		
		Switch				SMD slide Switch (ON-ON)	SW3	JS102011JAQN - GPS	1				Digi-Key	CKN10722CT-ND		
		SKHUALE010				Tactile Switch, SPNO, SMD, 160gf, 6.2x6.3x2.5mm	SW4	Push Button C2.5X3.0 OMRON B3U-1000P(M)-B - GPS RST	1				Mouser	688-SKHUALE010		
		IC_USB_UART				USB Bridge, USB to UART USB 2.0 UART Interface 12-DFN (3x3)	U1	SON45P300X300X75-13N-D	1				Digi-Key	768-1178-1-ND		
		nRF9160-SICAB1A				Low power System-in-Package with integrated LTE-M/NB-IoT modem and GPS	U2	LGA50P1600X1050X104-161N	1				Digi-Key	1490-NRF9160-SICA-B1A-R7CT-ND		
		NX3DV2567				Low-ohmic four-pole double-throw analog switch	U3, U9	XQFN40P180X260X50-16N	2				Mouser	771-NX3DV2567GU115		
		MFFx_M2M_UICC				M2M UICC SIM Card	U4	SON127P600X90_HS-8N	1				N.A.	N.A.		
		TPS7A0318PDBVR				Linear Voltage Regulator IC Positive Fixed 1 Output 200mA SOT-23-5	U5	SOT95P280X145-5N	1				Digi-Key	296-TPS7A0318PDBVRCT-ND		
		BQ25180				Charger IC Lithium Ion/Polymer, Lithium Iron Phosphate 8-DSBGA	U6	BGA8C40P2X4_100X155X50	1				Mouser	595-BQ25180YBGR		
		TPS22916CNYFPT				Power Switch/Driver 1:1 P-Channel 2A 4-DSBGA	U7	BGA4C40P2X2_78X78X50	1				Mouser	595-TPS22916CNYFPT		
		TPS63036YFGT				Buck-Boost Switching Regulator IC Positive Adjustable 1.2V 1 Output 1A (Switch) 8-UFBGA, DSBGA	U8	BGA8C40P2X4_108X181X62	1				Mouser	595-TPS63036YFGT		
		MAX-M10S-00B				MAX-M10 RF Receiver BeiDou, Galileo, GLONASS, GPS, GNSS 1.561GHz, 1.575GHz, 1.602GHz -167dBm 921.6kbps	U10	MAXM10S00B	1				Mouser	377-MAX-M10S-00B		
		BQ51013B				Wireless Power Receiver PMIC 20-VQFN (3.5x4.5)	U11	BQ51050BRHLR	1				Mouser	595-BQ51013BRHLR		
		Shunt 2.54mm				Shunt Jumper 2.54mm Black	Y1, Y2, Y3, Y4, Y5, Y6, Y7, Y8, Y9, Y10, Y11, Y12, Y13, Y14, Y15	Shunt_2.54mm_Horizontal	15				Digi-Key	S9001-ND		
		ZENER				Zener Diode 9.1 V 500 mW ±6% Surface Mount SOD-123	Z1	SOD3716X145N	1				Digi-Key	BZT52C9V1-FDICT-ND		