CHARLIE EVK
HW User Guide

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TELIT
TECHNICAL
DOCUMENTATION

[01.2017]

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APPLICABILITY TABLE

PRODUCTS

- CHARLIE EVALUATION KIT

Contents

1. INTRODUCTION

1.1. Scope

Scope of this document is to describe the hardware components of the CHARLIE EVK board based on Telit ME310G1-WW module and ATSAMD21G18 MCU from Microchip.

1.2. Audience

This document is intended for Telit customers, who are integrators, about to implement their applications using our CHARLIE EVK board.

1.3. Contact Information, Support

For general contact, technical support services, technical questions and report documentation errors contact Telit Technical Support at:

- TS-EMEA@telit.com
- TS-AMERICAS@telit.com
- TS-APAC@telit.com
- TS-SRD@telit.com

Alternatively, use:

http://www.telit.com/support

For detailed information about where you can buy the Telit modules or for recommendations on accessories and components visit:

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Our aim is to make this guide as helpful as possible. Keep us informed of your comments and suggestions for improvements.

Telit appreciates feedback from the users of our information.

1.4. Text Conventions

Danger – This information MUST be followed or catastrophic equipment failure or bodily injury may occur.

Caution or Warning – Alerts the user to important points about integrating the module, if these points are not followed, the module and end user equipment may fail or malfunction.

Tip or Information – Provides advice and suggestions that may be useful when integrating the module.

All dates are in ISO 8601 format, i.e. YYYY-MM-DD.

1.5. Related Documents

- ME310G1 HW User Guide, 1VV0301351

2. OVERVIEW

The aim of this document is to describe the “CHARLIE” EVK board based on Telit ME310G1-WW modem module and ATSAMD21G18 MCU from Microchip.

The CHARLIE board is an Arduino MKR form factor evaluation board that can be programmed with Arduino IDE or with native tools for ATSAMD21 from Microchip.

The CHARLIE EVK board is powered either by

- onboard USB connectors
- VIN pin on connector

Using either the onboard 3.8V DC power supply or by a 3.7 V LIPO battery.

All GPIO pins of Telit ME310G1-WW levels are set to 1.8 V, while all GPIO from ATSAMD21 MCU are set at 3.3 V.

This document lists and describes circuit building blocks and connectors

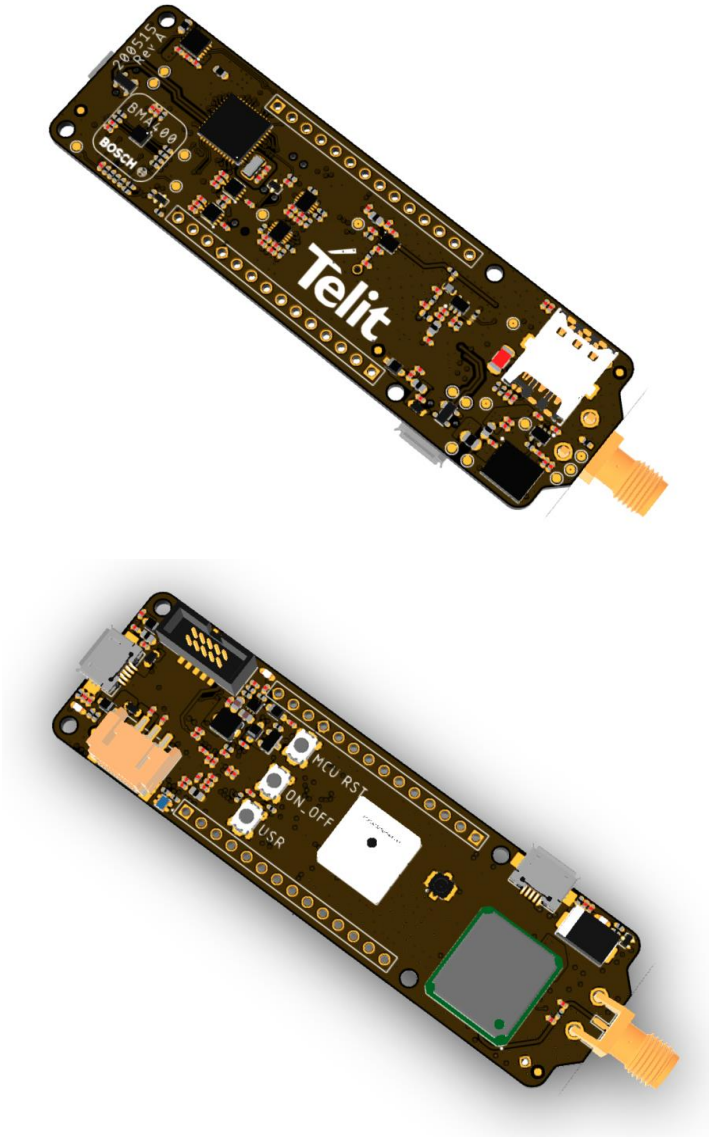

Figure 1 - CHARLIE EVK Board

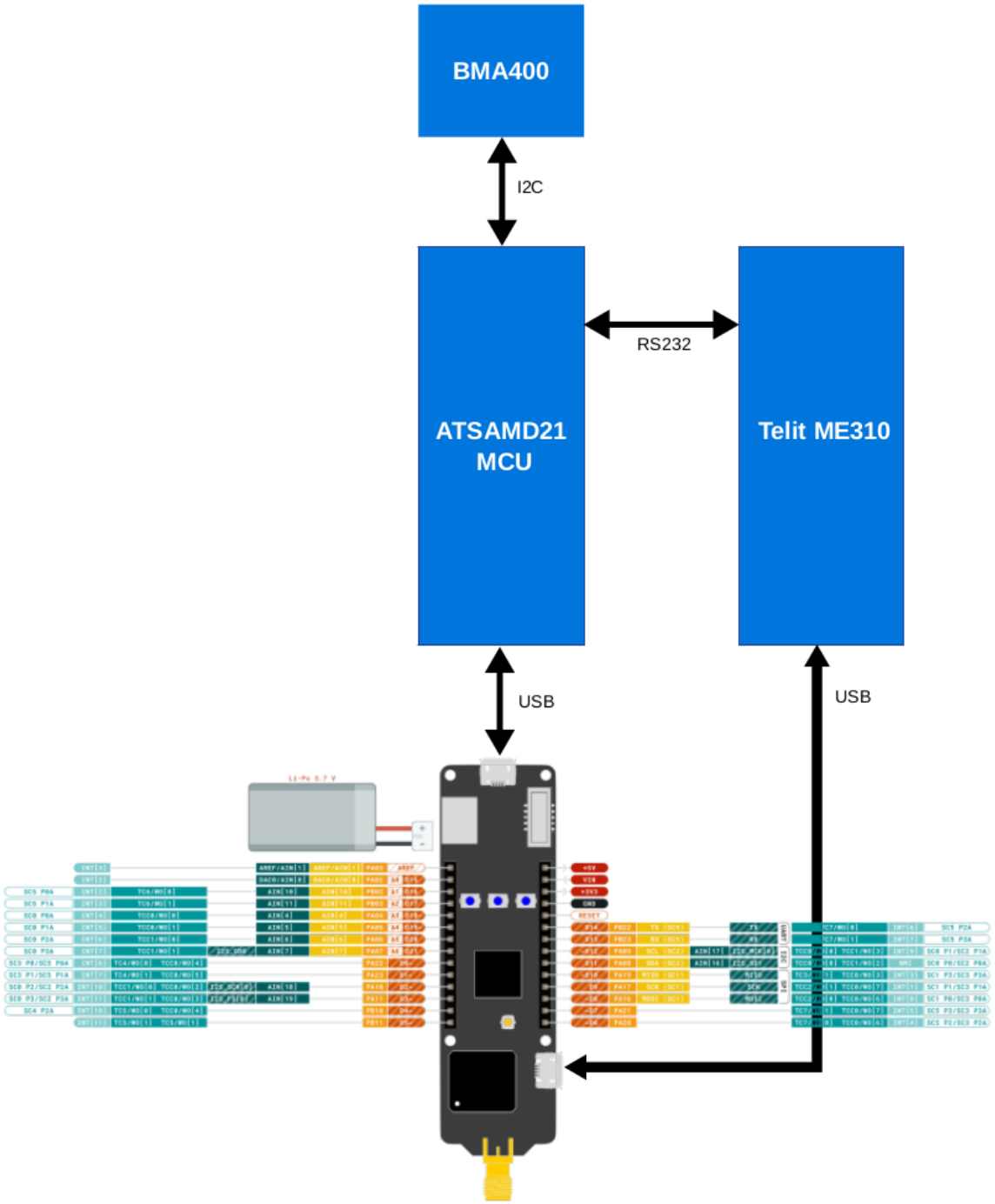

Figure 2 - CHARLIE Block Diagram

The CHARLIE EVK has 2 USB connectors:

- The first USB connector is located at opposite site of ME310 module and SMA connector is connected to the ATSAMD21 microcontroller
- The second USB connector is located near to the ME310 module and SMA connector is connected to the ME310 module

ATSAMD21 MCU communicates with Telit ME310 module using an asynchronous serial connection.

The ATSAMD21 MCU is connected to the onboard BMA400 accelerometer from Bosh Sensortec.

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3. CONNECTORS

3.1. Arduino MKR format Pin-out

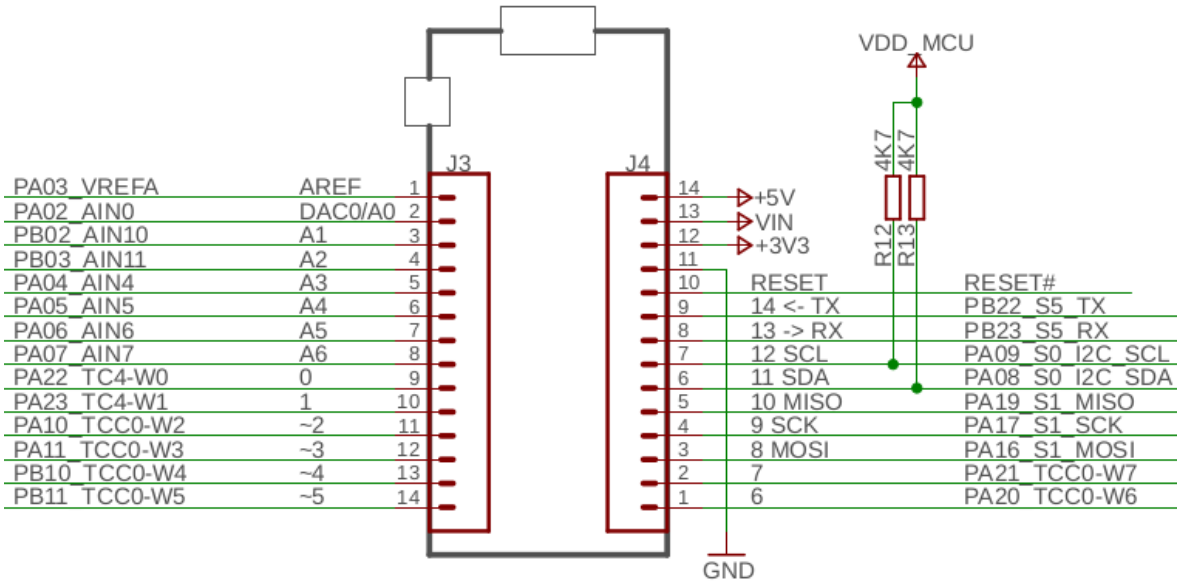

Figure 3 - Arduino MKR Pinout

Pin	Signal	I/O	Function	Type	MCU I/O
POWER SUPPLY					
J4,14	+5V	O	5.0 V I/O Level		
J4,13	VIN	I	External Power Input		
J4,12	+3V3	O	3.3 V I/O Level		
J4,11	GND	-			
GPIO INTERFACE @ 3V3					
J4,10	RESET	I	MCU Reset		
J4,9	D14	I/O	GPIO/USART TX		PB22
J4,8	D13	I/O	GPIO/USART RX		PB23
J4,7	D12	I/O	GPIO/I2C SCL		PA09

J4,6	D11	I/O	GPIO/I2C SDA	PA08
J4,5	D10	I/O	GPIO/SPI MISO	PA19
J4,4	D9	I/O	GPIO/SPI SCK	PA17
J4,3	D8	I/O	GPIO/SPI MOSI	PA16
J4,2	D7	I/O	GPIO/PWM	PA21
J4,1	D6	I/O	GPIO/PWM	PA20
J3,14	D5	I/O	GPIO/PWM	PB11
J3,13	D4	I/O	GPIO/PWM	PB10
J3,12	D3	I/O	GPIO/PWM	PA11
J3,11	D2	I/O	GPIO/PWM	PA10
J3,10	D1	I/O	GPIO	PA23
J3,9	D0	I/O	GPIO	PA22
J3,8	D21/A6	I/O	GPIO/AIN[7]	PA07
J3,7	D20/A5	I/O	GPIO/AIN[6]	PA06
J3,6	D19/A4	I/O	GPIO/AIN[5]	PA05
J3,5	D18/A3	I/O	GPIO/AIN[4]	PB04
J3,4	D17/A2	I/O	GPIO/AIN[11]	PB03
J3,3	D16/A1	I/O	GPIO/AIN[10]	PB02
J3,2	D15/A0	I/O	GPIO/AIN[0]	PA02
J3,1	AREF	I	AREF/AIN[1]	PA03

3.2. MCU Native USB Connector

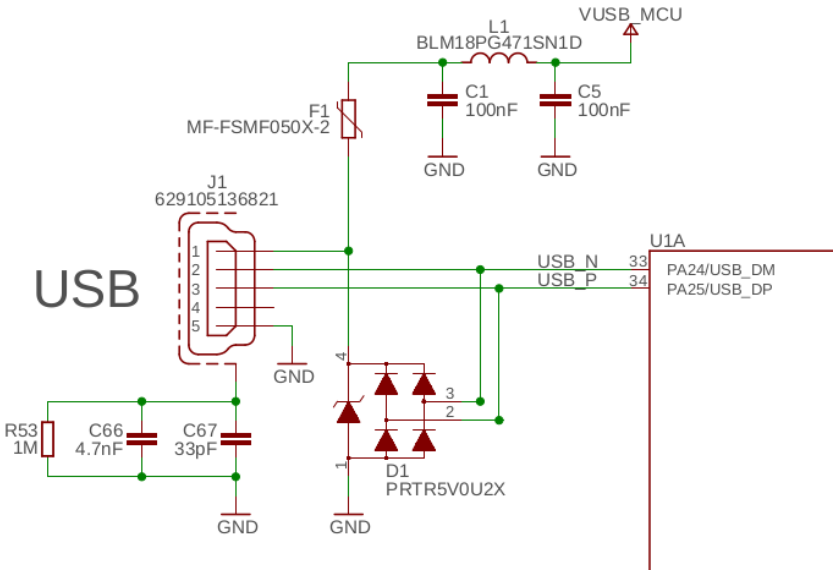

Figure 4 – ATSAMD21 Native USB

Pin	Signal	I/O	Function	Type	Comment
POWER SUPPLY					
J1,1	5V	I			
J1,5	GND	-			
USB HS 2.0 COMMUNICATION PORT (FW upgrade and Data)					
J1,2	USB_DM	I/O	USB differential Data (-)		PA24
J1,3	USB_DP	I/O	USB differential Data (+)		PA25
J1,4	USB OTG ID	N.C.			

The J1 USB plug is connected to the ATSAMD21 MCU native USB port. The board is protected by resettable fuse and ESD discharge.

3.3. ME310 Native USB Connector

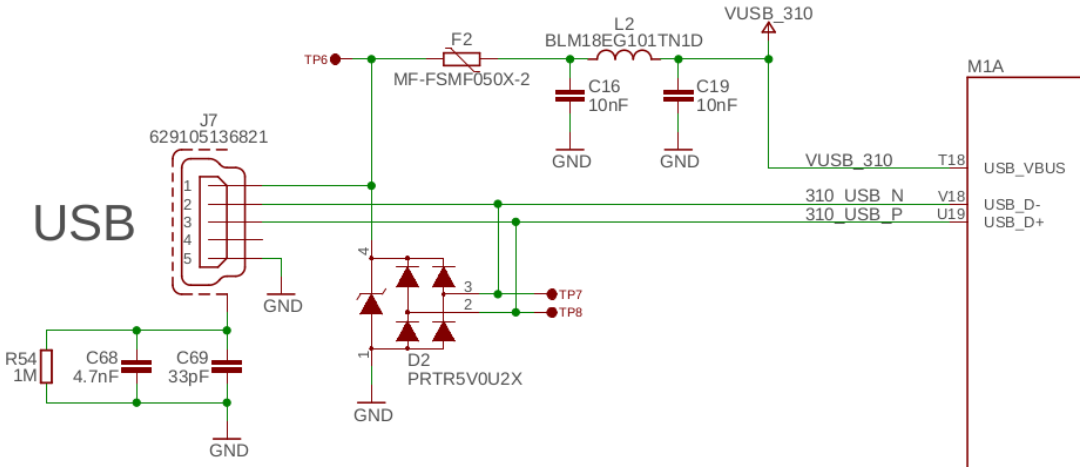

Figure 5 – ME310 Native USB

Pin	Signal	I/O	Function	Type	ME310
POWER SUPPLY					
J7,1	5V	I	USB_VBUS		T18
J7,5	GND	-			
USB HS 2.0 COMMUNICATION PORT (FW upgrade and Data)					
J7,2	USB_DM	I/O	USB differential Data (-)		V18
J7,3	USB_DP	I/O	USB differential Data (+)		U19
J7,4	USB OTG ID	N.C.			

The J7 USB plug is connected to the ME310 native USB port. The board is protected by resettable fuse and ESD discharge.

3.4. MCU DEBUG connector

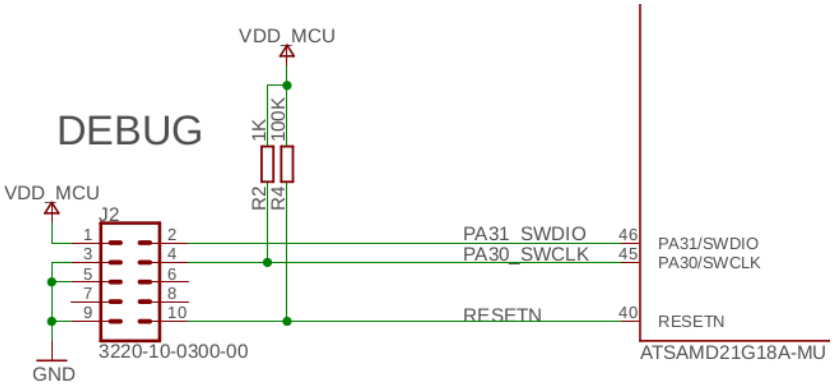

Figure 6 - DEBUG connector

Pin	Signal	I/O	Function	Type	Comment
POWER SUPPLY					
J2,1	3V3	I			
J2,3	GND	-			
J2,5	GND	-			
J2,9	GND	-			
DEBUG Interface					
J2,2	SWDIO	I/O	DEBUG DATA		PA31
J2,4	SWCLK	I	DEBUG CLOCK		PA30
J2,10	RESETN	I	RESET		RESETN

3.5. SIM Connectors

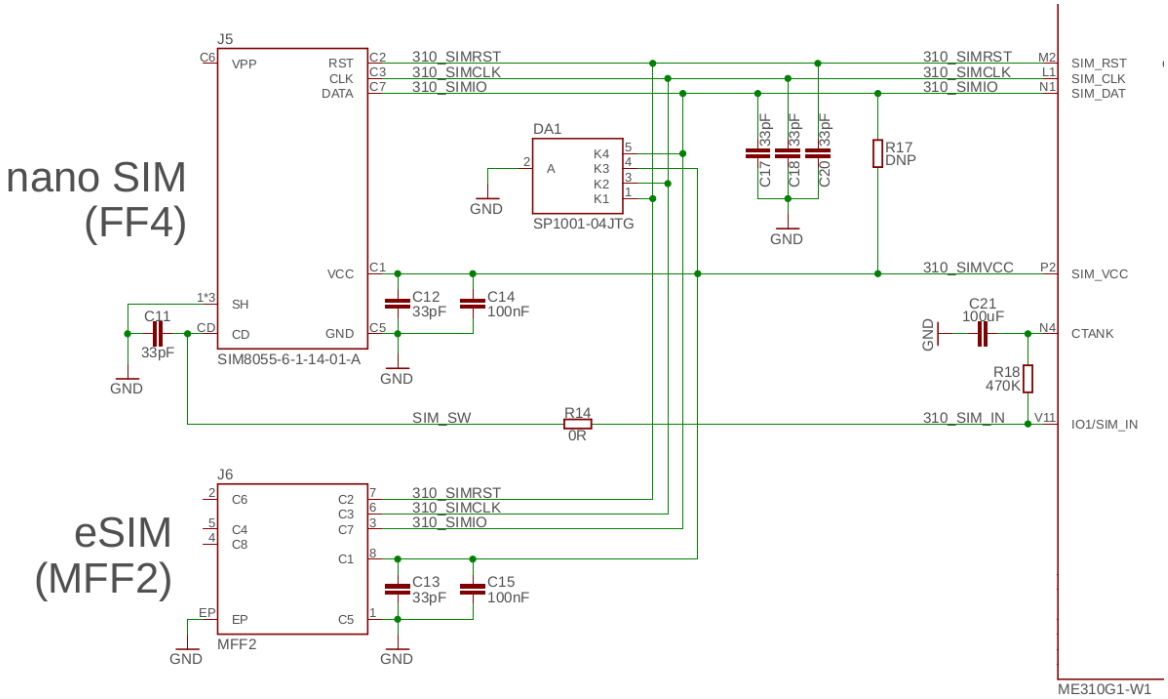

Figure 7 - SIM Sockets

The board supports a micro SIM socket and includes pads to solder an eSIM: both inputs are ESD protected.

3.6. ANTENNA Connectors

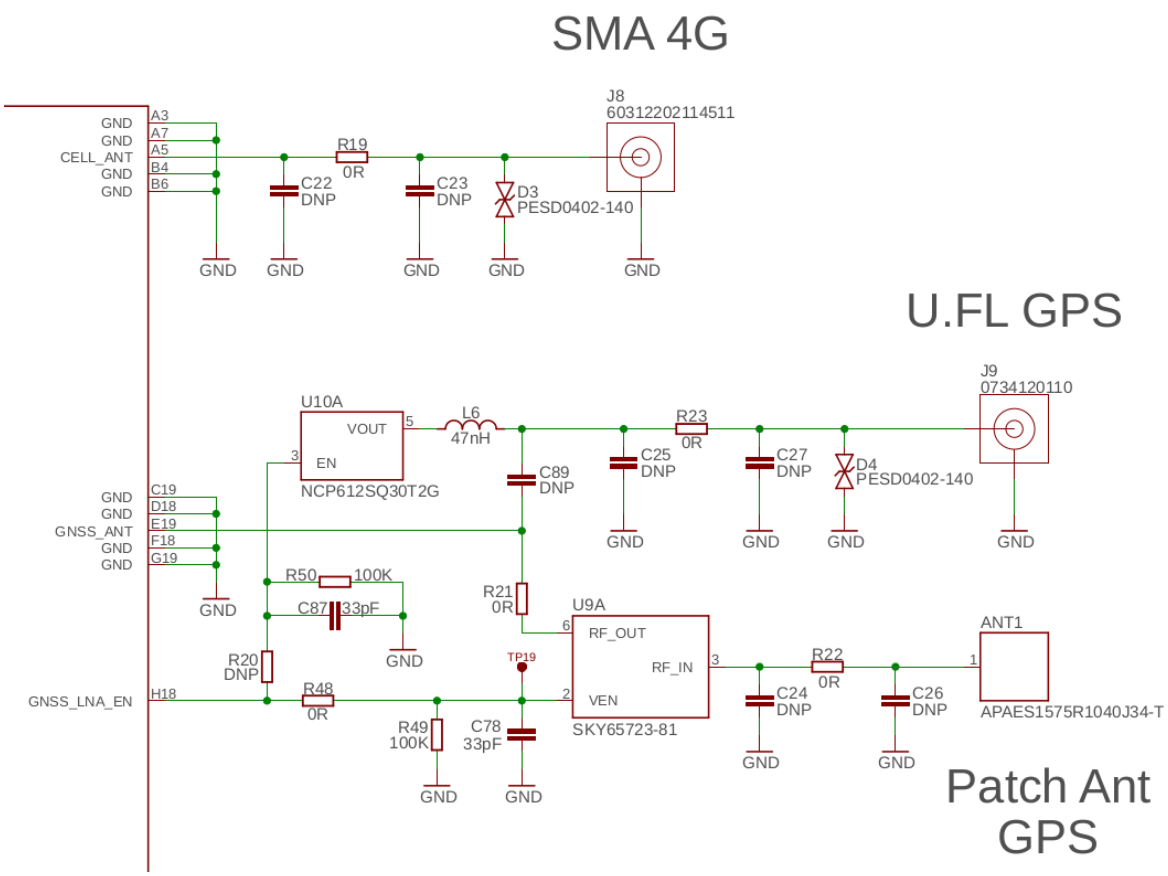

Figure 8 – Antennas

The 4G Cellular antenna signal is connected to the J8 SMA connector.

The GNSS Signal can be connected either to the uFL connector J9 or the GPS Patch Antenna, which is enabled by default.

In order to disable the Patch Antenna and connect an external GPS antenna to J9, remove R48 and R21 resistors and solder a 0-ohm resistor on R20 pads and a 100 pF capacitor on C89 pads.

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4. CIRCUIT BLOCKS

4.1. MCU to ME310 serial connection

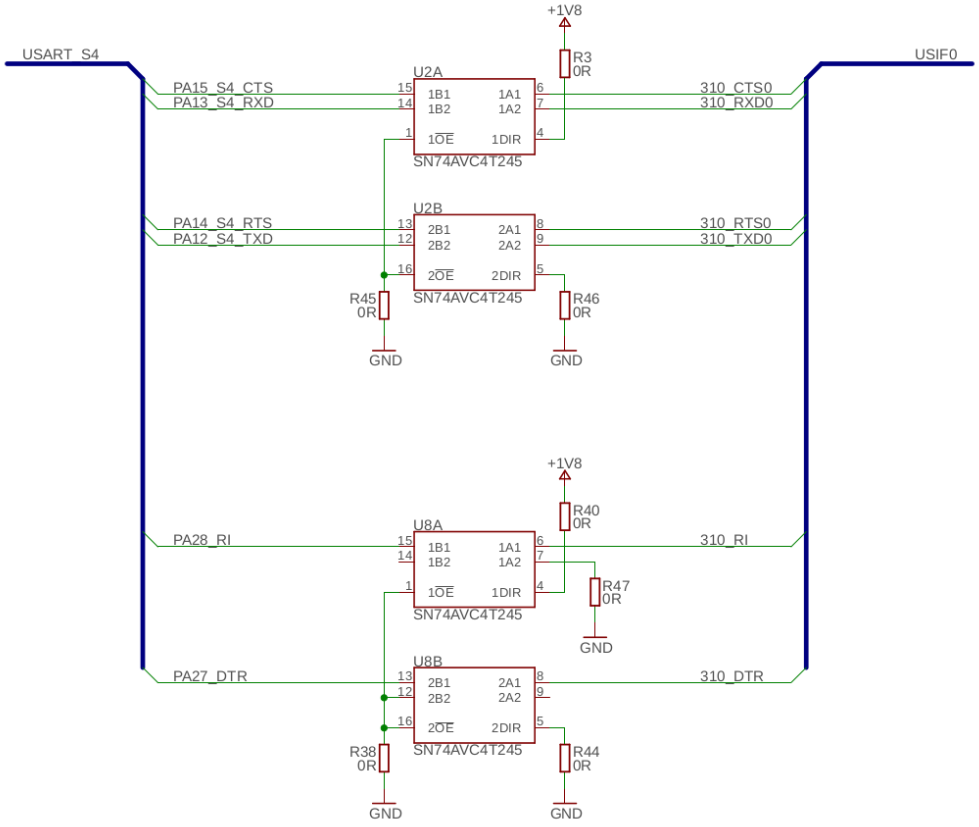


Figure 9 –MCU to ME310 Serial Connection

The ATSAMD21 MCU GPIO works at 3.3 V while the ME310 GPIO levels are 1.8 V. To connect the two devices using a serial connection with hardware handshake, level shifters are used.

MCU Pin	MCU Direction	Function	ME310 Direction	ME310 Pin
PA15	I	CTS	O	AA17
PA13	I	RXD	O	AA15
PA14	O	RTS	I	Y18
PA12	O	TXD	I	Y16
PA28	I	RI	O	D13
PA27	O	DTR	I	D11

4.2. BMA400 Accelerometer

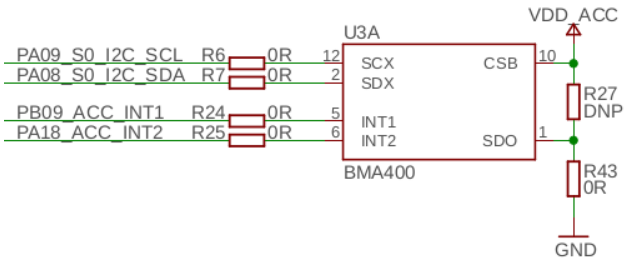


Figure 10 – BMA400 Accelerometer

The CHARLIE board mounts a Bosch Sensortech BMA400 ultra low power acceleration sensor, connected to the ATSAMD21 MCU through I2C communication.

Pin	Direction	Function
PA09	O	I2C Clock
PA08	I/O	I2C Data
PB09	I	INT1 from BMA400
PA18	I	INT2 from BMA400

4.3. MCU Buttons and LEDs

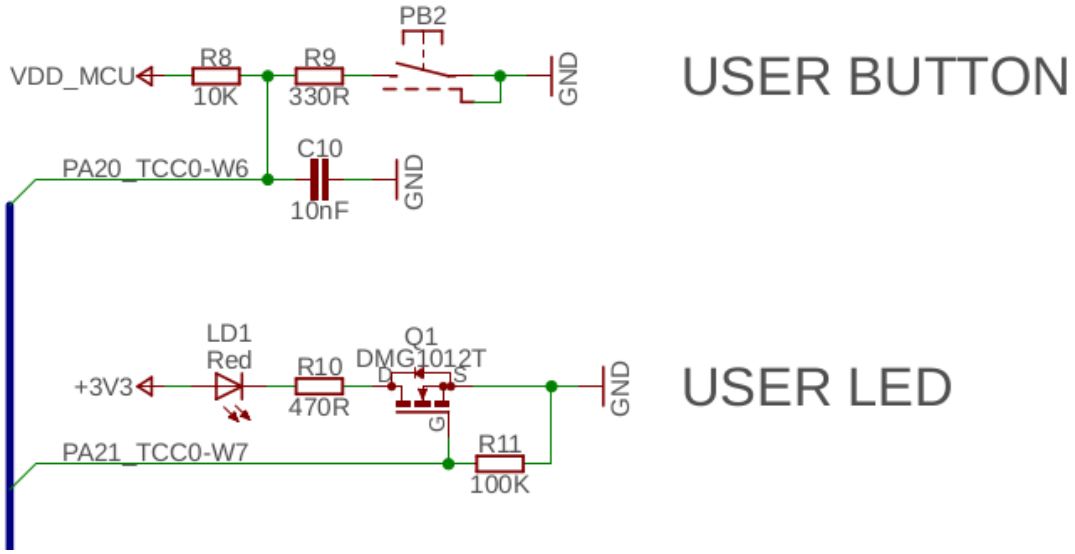


Figure 11 – ATSAMD21 Pushbuttons and Leds

The CHARLIE board has a user-available LED, LD1 and a button, PB2 connected to ATSAMD21 MCU. The led is ON when the MCU pin is high, while the button is active LOW.

Pin	Direction	Function
PA20	O	User RED LED
PA21	I	User Button

4.4. ME310 SLED

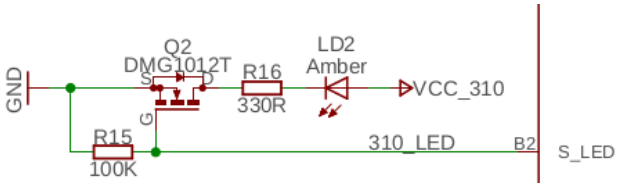


Figure 12 – ME310 SLed

The CHARLIE board has a LED, LD2 connected to ME310 S_LED pin. The led is ON when the MCU pin is high.

Pin	Direction	Function
B2	O	Amber LD2/S_LED

4.5. MCU Reset Button

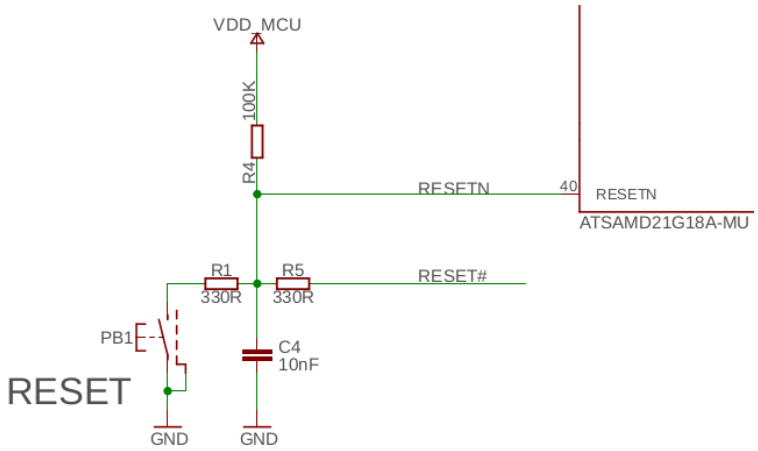


Figure 13 – RESET button

The CHARLIE board has one RESET button PB1 connected to ATSAMD21 MCU.

4.6. Battery Charger

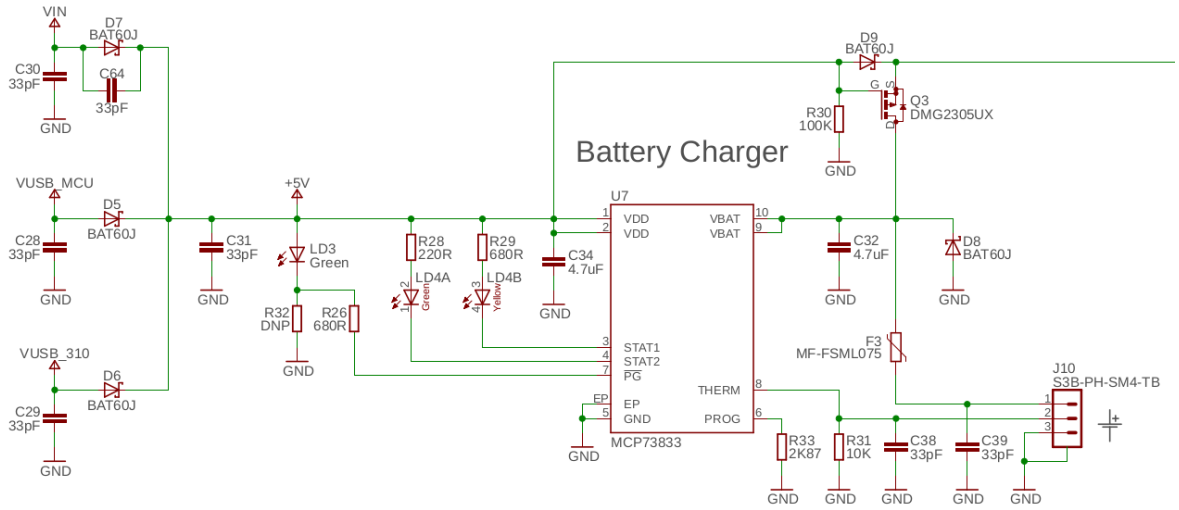


Figure 14 - Battery Charger

A +3.7 V Lipo battery (not included) connected to J10 can power the CHARLIE board.

The battery can be charged by the onboard charger, which receives receives +5V from the VIN connector, MCU USB Native Connector or ME310 Native USB connector.

When an external power source is present and the battery is connected, the battery is charged. The Board voltage is supplied by the external power source.

When the external power source is disconnected, the CHARLIE board is battery powered

The battery charger notifies its status through the 3 LEDs:

Pin	Direction	LED	Function
PG	O	LD3 green	Power Good
STAT1	O	LD4A yellow	Charging
STAT2	O	LD4B green	Charge Complete

Powering the board through the native USB port is not recommended on long term, since it relies on the host device capability to supply the required current. Telit suggests using an external 5V DC power supply through VIN power connector or using an external battery pack

Battery connector J17 is S3B-PH-SM4-TB.

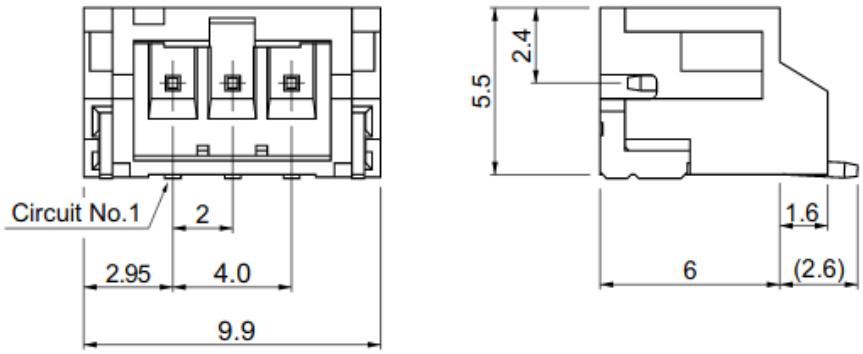


Figure 15 - Battery Connector

PIN	Function	Comment
Battery		
1	+	
2	Temperature sensor	
3	-	

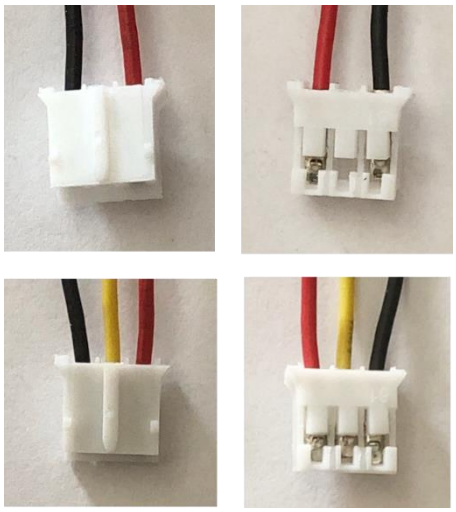


Figure 16 Connector without temperature sensor (top) and with temperature sensor (bottom)

By default, the Charlie board is configured for batteries without NTC temperature sensor.

To disable battery temperature monitoring, the 10 Kohm resistor R31 is mounted.

If a battery with NTC temperature sensor is connected to the board WITHOUT removing R31 resistor, the battery charger will not function.

In order to charge a battery equipped with NTC (3 wire connections), R31 must be removed.

WARNING

Use Li-Ion battery V_{nom} = 3.7V, V_{chrg} = 4.2V Capacity >= 700 mAh

Li-Po batteries are charged at 4.2V with a current that is usually half the nominal capacity (C/2). This board has a dedicated IC that has a preset charging current of 350mAh: this means that the MINIMUM capacity of the Li-Po battery shall be 700 mAh.

It is strongly recommended that a Li-Po battery of **at least 700mAh** capacity is selected. Smaller cells will be damaged by this current and may overheat, release gasses, catch fire and explode.

A larger cell will take more time to charge but won't overheat or cause any harm.

4.7. 3V3 Power Supply

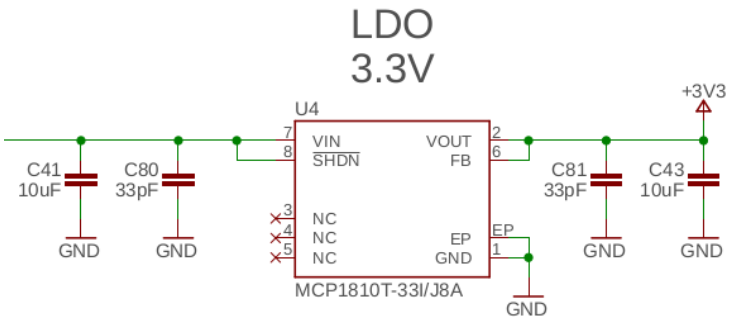


Figure 17 - 3V3 Power Supply

The CHARLIE board provides a +3.3 V power source to power:

- ATSAMD21 MCU and LEDs
- BMA400 Accelerometer
- Level Shifters

4.8. 1V8 Power Supply

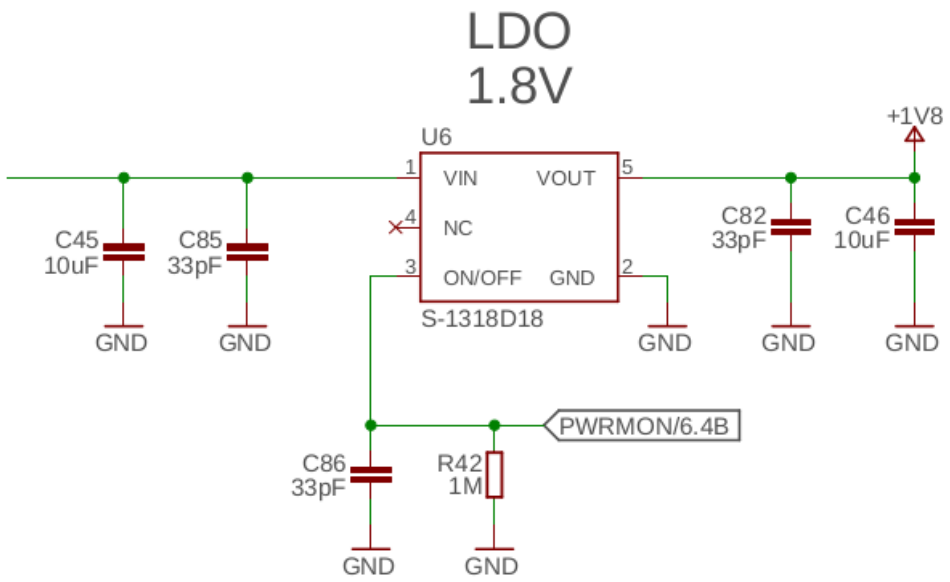


Figure 18 – ME310 internal power supply

The ME310 module is powered at 3.8 V, but all I/O pins operate at 1.8 V: the LDO provides 1.8 V level to:

- level translators
- SKY65723-81 Low-Noise Amplifier Front-End Module.

PWRMON pin on ME310 module enables the 1.8 V LDO output.

4.9. 3V8 Power Supply

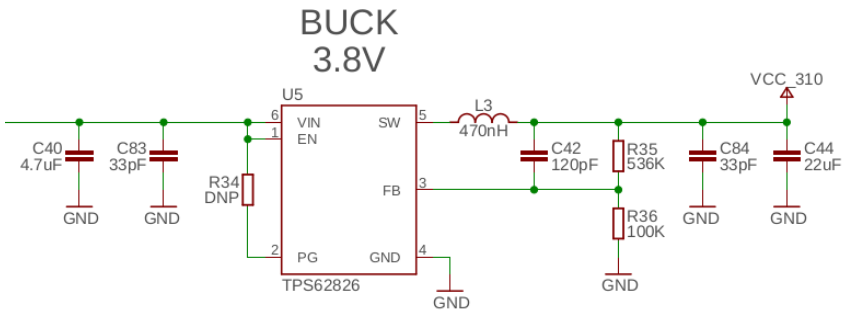


Figure 19 – ME310 3.8 V power supply

The ME310 module is powered at 3.8V, the Buck converter provides 3.8V power supply for:

- ME310 Module
- NCP612S LDO regulator for uFL GPS antenna

4.10. ME310 ON/OFF Switch

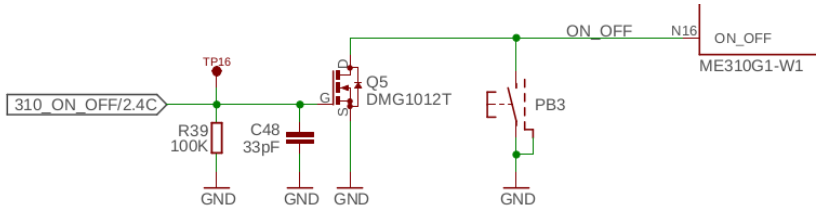


Figure 20 - ON/OFF Switch Circuit

The ON_OFF pin can be controlled by the PB3 bush-button or by the 310_ON_OFF signal that is connected to PB08 output pin of ATSAMD21 MCU.

4.11. MCU RTC Clock

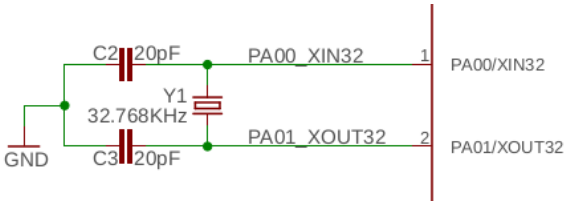
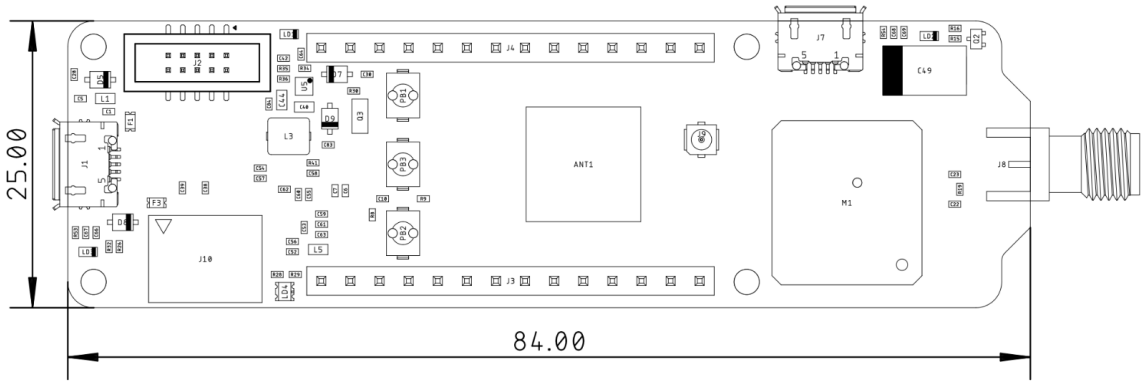


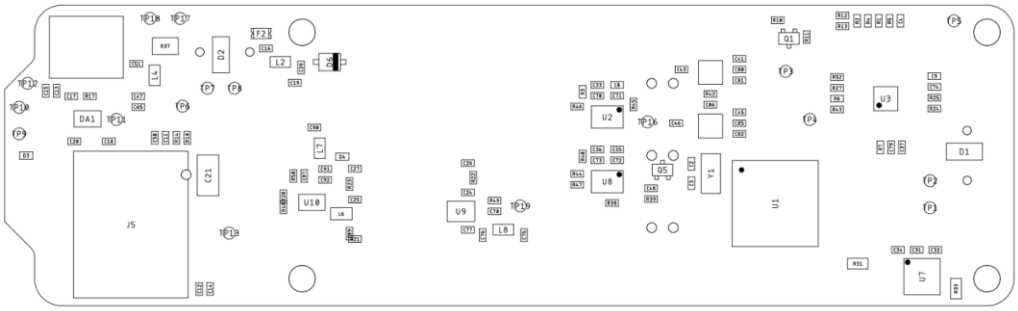
Figure 21 - RTC Clock Circuit

A 32.768 kHz quartz oscillator is connected to PA00 and PA01 of ATSAMD21 MCU to provide an accurate time base for the internal RTC.

5. MECHANICAL DESIGN

5.1. Drawing





6. SAFETY RECOMMENDATIONS

6.1. READ CAREFULLY

Be sure the use of this product is allowed in the country and in the environment required. The use of this product may be dangerous and has to be avoided in the following areas:

- Where it can interfere with other electronic devices in environments such as hospitals, airports, aircrafts, etc.
- Where there is risk of explosion such as gasoline stations, oil refineries, etc. It is the responsibility of the user to enforce the country regulation and the specific environment regulation.

Do not disassemble the product; any mark of tampering will compromise the warranty validity. We recommend following the instructions of the hardware user guides for correct wiring of the product. The product has to be supplied with a stabilized voltage source and the wiring has to be conformed to the security and fire prevention regulations. The product has to be handled with care, avoiding any contact with the pins because electrostatic discharges may damage the product itself. Same cautions have to be taken for the SIM, checking carefully the instruction for its use. Do not insert or remove the SIM when the product is in power saving mode.

The system integrator is responsible for the functioning of the final product; therefore, care has to be taken to the external components of the module, as well as any project or installation issue, because the risk of disturbing the GSM network or external devices or having impact on the security. Should there be any doubt, please refer to the technical documentation and the regulations in force. Every module has to be equipped with a proper antenna with specific characteristics. The antenna has to be installed with care in order to avoid any interference with other electronic devices and has to guarantee a minimum distance from the body (20 cm). In case this requirement cannot be satisfied, the system integrator has to assess the final product against the SAR regulation.

The European Community provides some Directives for the electronic equipment introduced on the market. All of the relevant information is available on the European Community website:

http://ec.europa.eu/enterprise/sectors/rtte/documents/

The text of the Directive 99/05 regarding telecommunication equipment is available,

while the applicable Directives (Low Voltage and EMC) are available at:

http://ec.europa.eu/enterprise/sectors/electrical/

7. ACRONYMS

TTSC	Telit Technical Support Centre
USB	Universal Serial Bus
HS	High Speed
DTE	Data Terminal Equipment
UMTS	Universal Mobile Telecommunication System
WCDMA	Wideband Code Division Multiple Access
HSDPA	High Speed Downlink Packet Access
HSUPA	High Speed Uplink Packet Access
UART	Universal Asynchronous Receiver Transmitter
HSIC	High Speed Inter Chip
SIM	Subscriber Identification Module
SPI	Serial Peripheral Interface
ADC	Analog – Digital Converter
DAC	Digital – Analog Converter
I/O	Input Output
GPIO	General Purpose Input Output
CMOS	Complementary Metal – Oxide Semiconductor
MOSI	Master Output – Slave Input
MISO	Master Input – Slave Output
CLK	Clock
MRDY	Master Ready
SRDY	Slave Ready

CS	Chip Select
RTC	Real Time Clock
PCB	Printed Circuit Board
ESR	Equivalent Series Resistance
VSWR	Voltage Standing Wave Radio
VNA	Vector Network Analyzer

8. DOCUMENT HISTORY

Revision	Date	Changes
0	2020-07-20	Initial revision
1	2020-09-02	Battery information added
2	2020-10-29	ME310 variant updated to ME310G1-WW

SUPPORT INQUIRIES

Link to **www.telit.com** and contact our technical support team for any questions related to technical issues.

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