Telit EVB 2.0

User Guide

1VV0301774 Rev. 3 – 2022-11-16

Telit Technical Documentation

APPLICABILITY TABLE

PRODUCTS
3990150703, Telit EVB 2.0

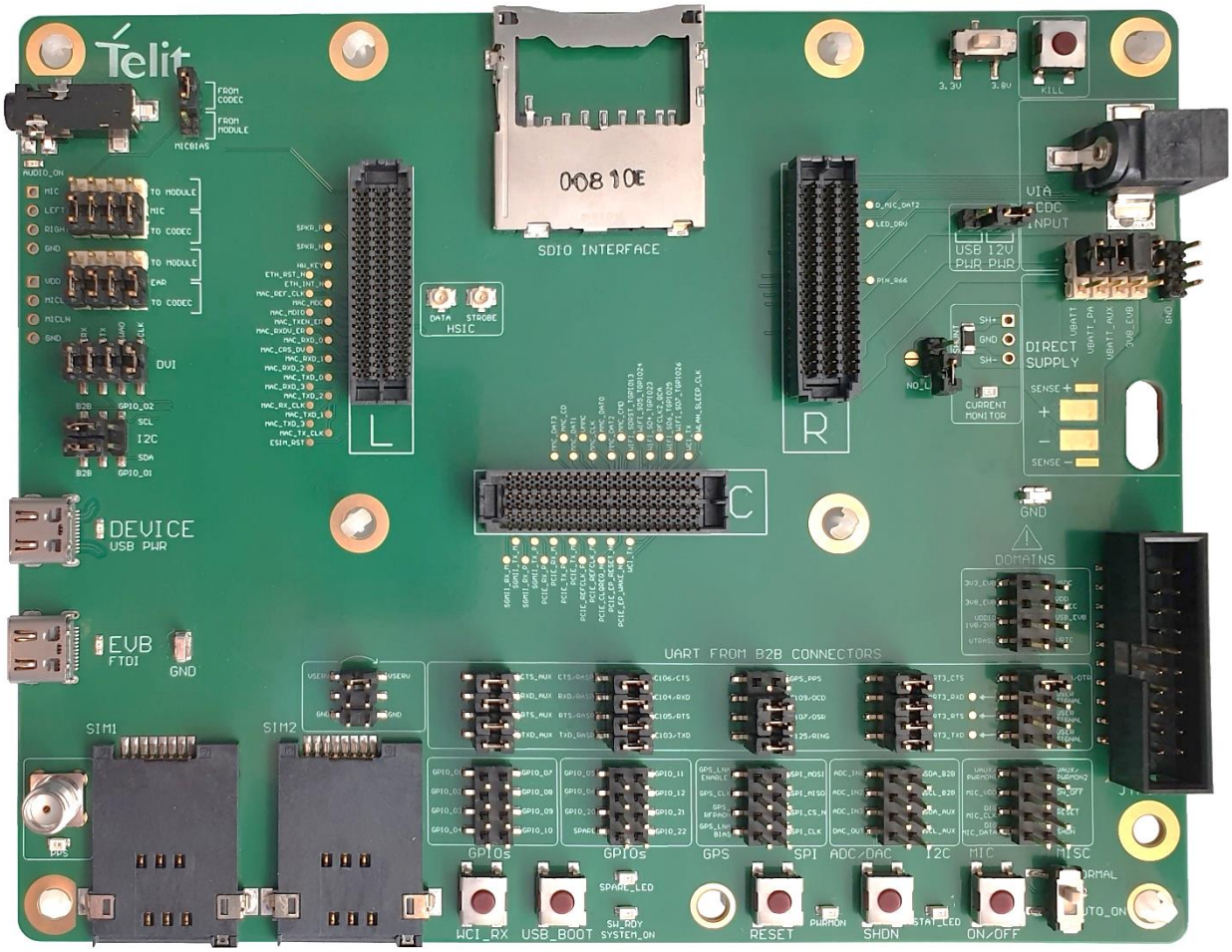


Figure 1: Telit EVB 2.0

SUPPORTED INTERFACES

PRODUCTS
All modules available on a legacy TLB
All modules available on a smart TLB

CONTENTS

1. INTRODUCTION

1.1. Scope

This document introduces the Telit EVB 2.0. The features and solutions described in this document are applicable to the variants listed in the applicability table.

1.2. Audience

This document is intended for system integrators that are using the Telit module in their products.

1.3. Contact Information, Support

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

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

Alternatively, use:

https://www.telit.com/contact-us

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

https://www.telit.com

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

Telit appreciates the user feedback on our information.

1.4. Symbol Conventions

	**Danger:** This information MUST be followed, or catastrophic equipment failure or personal injury may occur.
	**Warning:** Alerts the user on important steps about the module integration.
	**Note/Tip:** Provides advice and suggestions that may be useful when integrating the module.
	**Electro-static Discharge:** Notifies the user to take proper grounding precautions before handling the product.

Table 1: Symbol Conventions

All dates are in ISO 8601 format, that is YYYY-MM-DD.

2. GENERAL PRODUCT DESCRIPTION

2.1. Overview

Telit EVB 2.0 system consists of a main board, as well as connectors, cables, accessories, and software. It is designed to host Telit modules allowing users to easily test the main module functions and features.

2.2. Block Diagram

The block diagram below depicts the main Telit EVB 2.0 building blocks in their approximate positions on the board.

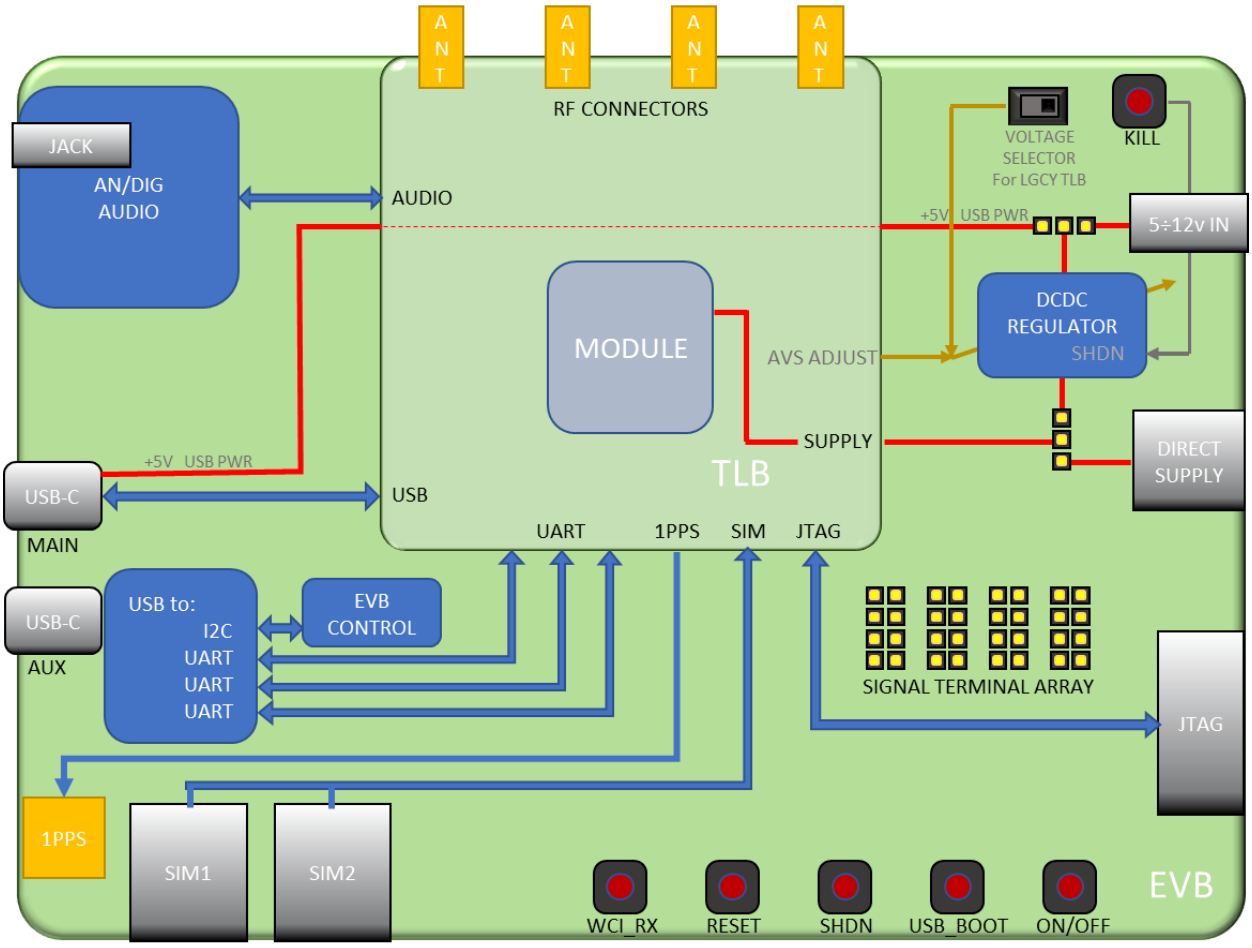


Figure 2: Telit EVB 2.0 Block Diagram

The Telit EVB 2.0 hosts a daughter board known as the TLB which serves as a mechanical adapter from various Telit modules form factors to the three board-to-board connectors.

This approach strikes a balance between the need for a small-closed-shielded hardware layout (best practice in electronics) and making it available in an open and user-friendly

package. Thus, the Telit EVB 2.0 and TLBs are intentionally not optimized as a "finished" product.

Of course, some circuit parts can be used as examples or inspirations, but in some cases, end product design solutions should be tailored to specific applications.

The modem communicates with the host PC via two USB-C cables: one for the module USB communication port and the other for serial lines, through a USB to serial converter.

The onboard power supply on the Telit EVB 2.0 is versatile and configurable: ancillary circuits and Telit module can be powered independently by USB PWR (DEVICE) and USB FTDI (EVB) through a regulator, via a 12V Wall Adapter through a regulator and, for specific in-depth tests, providing DC power directly from an external power supply (caution: the voltage must be regulated and needs to be within the modem voltage range).

The Telit EVB 2.0 includes two SIM card holders, thus supporting dual-SIM modems. For modules supporting only one SIM interface, SIM1 holder is the default SIM socket.

Push buttons and LEDs are used as interface towards the human operator.

A large number of standard 2.54 mm pin headers, clearly identified by silk screen on the PCB, helps the user in testing connections between ports or from an interface port to test equipment.

The audio section is minimal and allows testing with a standard hands-free headset, as well as connection to test equipment or to external amplifiers and transducers provided by the customer.

Telit modules require either 3.8, 3.3 or 1.8 V: this board is meant to be universal, thus it supports all three voltage levels; however, the user must carefully set up the board according to the instructions.

Warning: In case of incorrect power supply voltage configuration, the module can be irreversibly damaged.

2.1. Telit EVB 2.0 Target

Telit EVB 2.0 design aims at full compatibility with all existing Telit products and to be future proof.

2.2. TLB Types

TLBs are classified into two types: "old" (referred to as "LEGACY TLBs") and "new" (referred to as "SMART TLBs"). They differ in whether they were designed before or after Telit EVB 2.0 introduction.

TLB TAG	Description
LGCY38 TLB	The TLBs developed before this Telit EVB 2.0, for modules with V_{batt}=3.8V. The voltage selector must be set at 3.8V.
LGCY33 TLB	The TLBs developed before this Telit EVB 2.0, for modules with V_{batt}=3.3v. The voltage selector must be set to 3.3V.
SMRT38 TLB	TLBs that (in spite of the voltage selector position) automatically set the MAIN regulator's voltage to the required 3.8V.
SMRT33 TLB	TLB's that (in spite of the voltage selector position) automatically set the MAIN regulator's voltage to the required 3.3V.
SMRT18 TLB	TLB's that (in spite of the voltage selector position) automatically set the MAIN regulator's voltage to the required 1.8V.

Table 2: Product Variants and their Frequency Bands

Telit EVB 2.0 is backwards compatible with legacy TLBs that were developed and released prior to its introduction.

Telit EVB 2.0 offers some special features on the smart TLB:

- Power When Needed (PWN): The Main regulator is enabled when the TLB is properly inserted.
- Automatic Voltage Selection (AVS) for main supply: the range is approximately 1-4.5V.
- Automatic Voltage Selection (AVS) for VDDIO, typically 1.8 or 2.8V.
- Automatic Voltage Selection (AVS) for VSERV. The range is roughly 0.5-3.3V.

Please refer to "AVS Section" for detailed information about voltages on the SMART TLB's.

2.3. Main Features

Function	Features
Connection with PC or external host	The USB of the device is connected to the PC via an USB-C port (DEVICE PWR) The UART ports of the device are conveyed as VCP on an USB-C port (EVB FTDI) The main UART is converted by an FTDI chip An AUX UART is converted by an FTDI chip An UART3 is converted by an FTDI chip
Versatile power supply	DIRECT SUPPLY is for advanced users (typically, hardware designers) who need to provide supply voltage directly to the module

Function	Features
	VIA REGULATOR • 12V wall adapter or USB (DEVICE PWR or EVB FDTI) source selection Every device gets the proper voltage (1.8V, 3.3V, 3.8V) The voltage is automatic or even PROGRAMMABLE Power Supply can be opened for testing Power Supply is activated automatically or on demand When VIA DCDC mode is used, an external PC can control the regulator: it can be switched ON or OFF and the voltage can be set as desired
2 SIM holder	There are 2 SIM holders, for module supporting 2 SIM interfaces SIM1 is the default SIM holder for the module that manages a single SIM.
SDIO interface	The SDIO interface goes to dedicated connector powered by a 3.3v regulator
Digital audio	A codec provided with all ancillary parts is producing the digital audio
Analog audio	Buffer amplifier, click & pop-less design without tantalum capacitors and microphone bias circuitry to manage analog audio, both connected to the jack and test points
Push buttons and switches	All the basic HW activations (On/Off, Reset, ...) can be operated manually via push buttons
LED's	LEDs provide indication of board and module status and so on.
Current consumption measurements	Multiple ways available to measure module current consumption. Easy disconnect of ancillary circuits (needed during normal operation) to avoid leaking currents that impact current measurements
GPIO facilitation	Module signals are tied to pin headers, to ease test and debugging. Some signals are bridged with jumpers to make them available to high-level interfaces/connectors All headers can be connected by means of wired jumpers
Voltage & current monitorable by PC	A current and voltage monitor connected via I2C can be read by an external PC, allowing to monitor the status of the device under test
Control extension port	The I2C controlling bus and some supply rails are available on a connector to manage a daughter board for future use
JTAG header	2 x 10 shrouded JTAG header

Table 3: Functional Features

2.4. Main Electrical Specifications

Connector	Specification
Direct Supply	Refer to the module specifications
5.5/2.5mm power jack	5V or 12V (36 V tolerant)
SIM holders	Refer to the specifications of the module mounted
USB EVB FTDI	USB2 interface
USB DEVICE PWR	USB3, V_{USB} = 5v
Audio Jack Microphone	J-fet Electret Microphone: -38-45dBv/Pa

Connector	Specification
Audio Jack earpieces	>=16 Ohm, 32Ohm best

Table 4: Electrical Specification at Connections

2.5. Mechanical Specifications

2.5.1. Dimensions

The overall dimensions of Telit EVB 2.0 are:

- Size: 156x125 [mm]
- PCB Thickness: 1.6 [mm]

2.5.2. Temperature Range

Mode	Temperature	Note
Operating Temperature Range	-20°C - +55°C	SIM CARDs might not withstand extreme temperatures
	-40°C - +100°C	The board (except SIM cards) is fully functional (*) across the whole temperature range.
Storage and non-operating Temperature Range	-40°C - +85°C	

Table 5: Temperature Range

Note: (*) Functional: if applicable, the board is capable to supply and enable serial/USB communications to the TLB and its module.

3. 120-Pin Male B2B Connectors

3.1. B2B Connectors Layout (Top View)

The connection between Telit EVB 2.0 and TLB is implemented via three 120-poles (20 poles x 6 rows) SAMTEC SEARAY 1.27mm High Speed/High Density B2B connectors (10mm stack height SEAM/SEAF).

The drawing below shows the B2B connectors layout on the board.

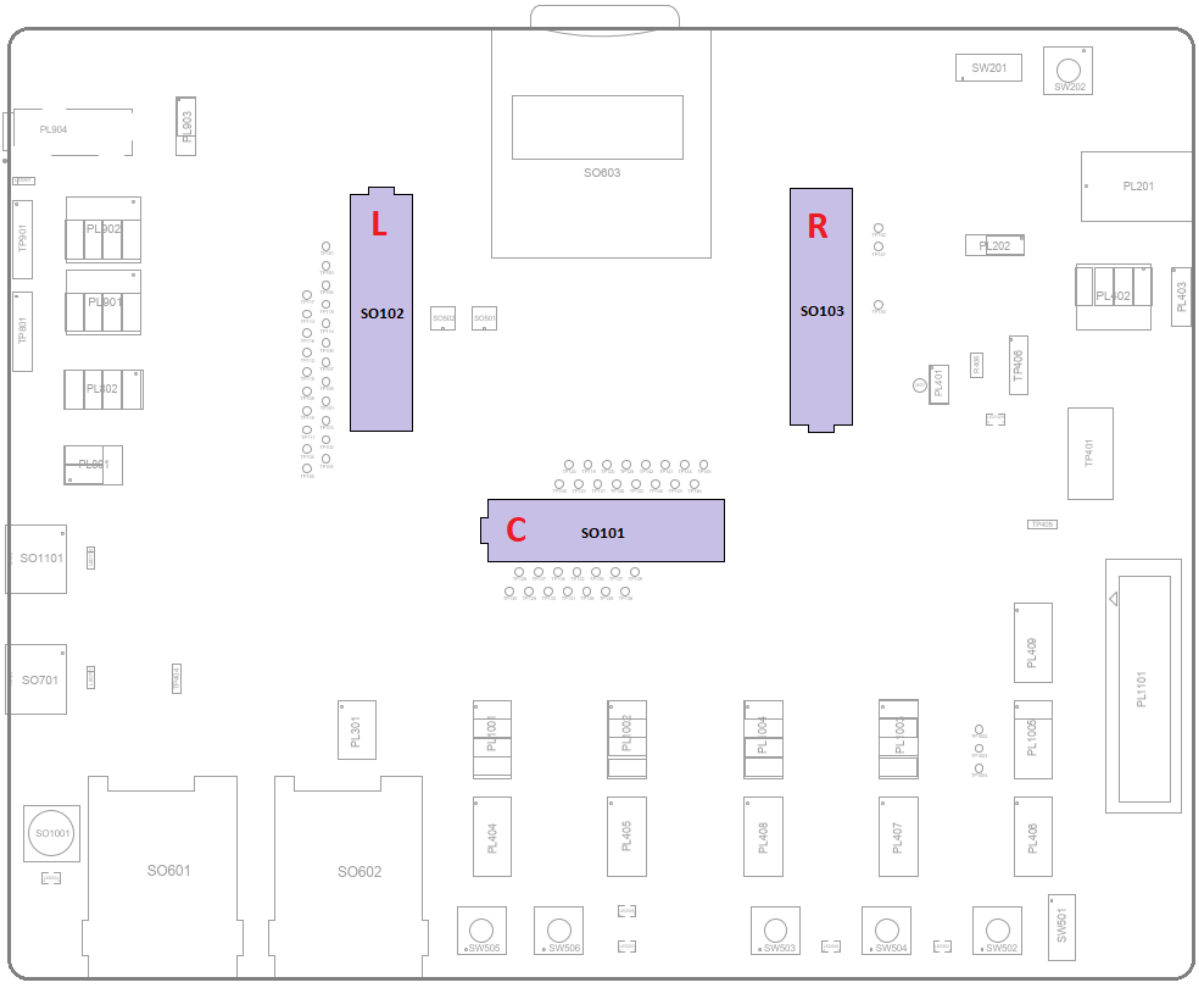


Figure 3: B2B Connectors Layout (top view)

Three tables in the following chapter provide detailed pin mapping.

Please refer to the User Guide of the specific TLB in use for the actual pin mapping and pin description.

Warning: Reserved pins must not be connected.

3.2. B2B Connectors Pinout

The tables below show the signal present on each B2B connector pin.

B2B L (LEFT)					
1 GPS_LNA_BIAS	2 GND	3 GPS_LNA_EN	4 MICBIAS_MODULE	5 GND	6 NC / JACK_DET
7 GND	8 GND	9 GND	10 GND	11 GND	12 NC
13 MIC2_MT+	14 MIC2_MT-	15 GND	16 EAR2_MT-	17 EAR2_MT+	18 NC
19 GND	20 GND	21 GND	22 GND	23 GND	24 GND
25 MIC1_MT+	26 MIC1_MT-	27 GND	28 EAR1_MT-	29 EAR1_MT+	30 GND
31 SPKR_N	32 SPKR_P	33 NC	34 NC	35 RESERVED (DON'T USE)	36 MIC_VDD
37 GND	38 GND	39 D_MIC_CLK	40 D_MIC_DATA_1	41 GND	42 GND
43 NC	44 GND	45 GND	46 GND	47 GND	48 GND
49 NC	50 GND	51 GND	52 ADC_IN3	53 ADC_IN2	54 ADC_IN1
55 NC	56 NC	57 NC	58 NC	59 DAC_OUT	60 NC
61 DVI_RX	62 DVI_TX	63 DVI_CLK	64 DVI_WAO	65 REF_CLK_FF	66 GND
67 GND	68 GND	69 GND	70 GND	71 GND	72 ESIM_RST
73 GND	74 GND	75 GND	76 GND	77 SIMVCC1	78 SIMVCC1
79 HSIC_STB	80 HSIC_DAT A	81 SIMCLK1	82 SIMIN1	83 SIMIO1	84 SIMRST1
85 HW_KEY	86 VRTC	87 ETH_RST_N	88 ETH_INT_N	89 SIMVCC2	90 SIMVCC2
91 USB_VBUS	92 USB_ID	93 SIMIN2	94 SIMIO2	95 SIMRST2	96 SIMCLK2
97 GND	98 GND	99 MAC_REF_CL K	100 MAC_TXEN_ER	101 MAC_MDIO	102 MAC_RXDV_ER
103 USB_D+	104 GND	105 MAC_TXD_0	106 MAC_MDC	107 MAC_RXD_0	108 MAC_CRS_DV
109 USB_D-	110 GND	111 MAC_TXD_1	112 MAC_TXD_2	113 MAC_RXD_1	114 MAC_RXD_2
115 GND	116 GND	117 MAC_TX_CLK	118 MAC_TXD_3	119 MAC_RX_CLK	120 MAC_RXD_3

Table 6: B2B L Pin-out Information

B2B C (CENTRAL)					
1 GND	2 GND	3 I2C_SCL_AUX	4 I2C_SDA_AUX	5 GND	6 SGMII_RX_M
7 USB_SS_RX_P	8 GND	9 I2C_SDA_B2B	10 TGPIO_06	11 SGMII_TX_M	12 SGMII_RX_P
13 USB_SS_RX_M	14 GND	15 TGPIO_05	16 I2C_SCL_B2B	17 SGMII_TX_P	18 GND
19 GND	20 GND	21 VAUX/PWRMON2	22 VAUX/PWRMON2	23 GND	24 PCIE_RX_P
25 USB_SS_TX_P	26 GND	27 NC	28 FORDCED_USB_BOOT	29 PCIE_TX_P	30 PCIE_RX_M
31 NetSO101_45	32 GND	33 TGPIO_12	34 SPI_MOSI	35 PCIE_TX_M	36 GND
37 GND	38 NC	39 TGPIO_11	40 TGPIO_04	41 GND	42 PCIE_REFCLK_P
43 #SPI_CS	44 TGPIO_02	45 TGPIO_03	46 SPI_MISO	47 NC	48 PCIE_REFCLK_M
49 VAUX/PWRMON1	50 VAUX/PWRMON1	51 LED_DRV_EN	52 SPI_CLK	53 NC	54 NC
55 TGPIO_08	56 TGPIO_07	57 TGPIO_01	58 TGPIO_09	59 NC	60 NC
61 TGPIO_21	62 TGPIO_10	63 TGPIO_22	64 TGPIO_20	65 NC	66 NC
67 VMMC	68 VMMC	69 MMC_CD	70 MMC_DAT3	71 NC	72 NC
73 MMC_DAT0	74 MMC_DAT2	75 MMC_CLK	76 MMC_DAT1	77 PCIE_EP_RESET_N	78 NC
79 TLB_CONN	80 GND	81 C107/DSR	82 MMC_CMD	83 PCIE_CLKREQ_N	84 NC
85 WIFI_SD0_TGPIO15	86 WIFI_SD1_TGPIO16	87 WIFI_SDCMD_TGPIO14	88 WIFI_SDRST_TGPIO13	89 TXD_AUX	90 RTS_AUX
91 WIFI_SD5_TGPIO24	92 WIFI_SD2_TGPIO17	93 WIFI_SD3_TGPIO18	94 WIFI_SD4_TGPIO23	95 RXD_AUX	96 CTS_AUX
97 WIFI_SD6_TGPIO25	98 WIFI_SD7_TGPIO26	99 WIFI_SDCLK_TGPIO19	100 WCI_TX	101 WCI_RX	102 NC
103 C125/RING	104 RFCLK2_QCA	105 WLAN_SLEEP_CLK	106 C105/RTS	107 PCIE_EP_WAKE_N	108 NC
109 C104/RXD	110 C109/DCD	111 C103/TXD	112 C106/CTS	113 C108/DTR	114 NC
115 NC	116 NC	117 NC	118 NC	119 NC	120 NC

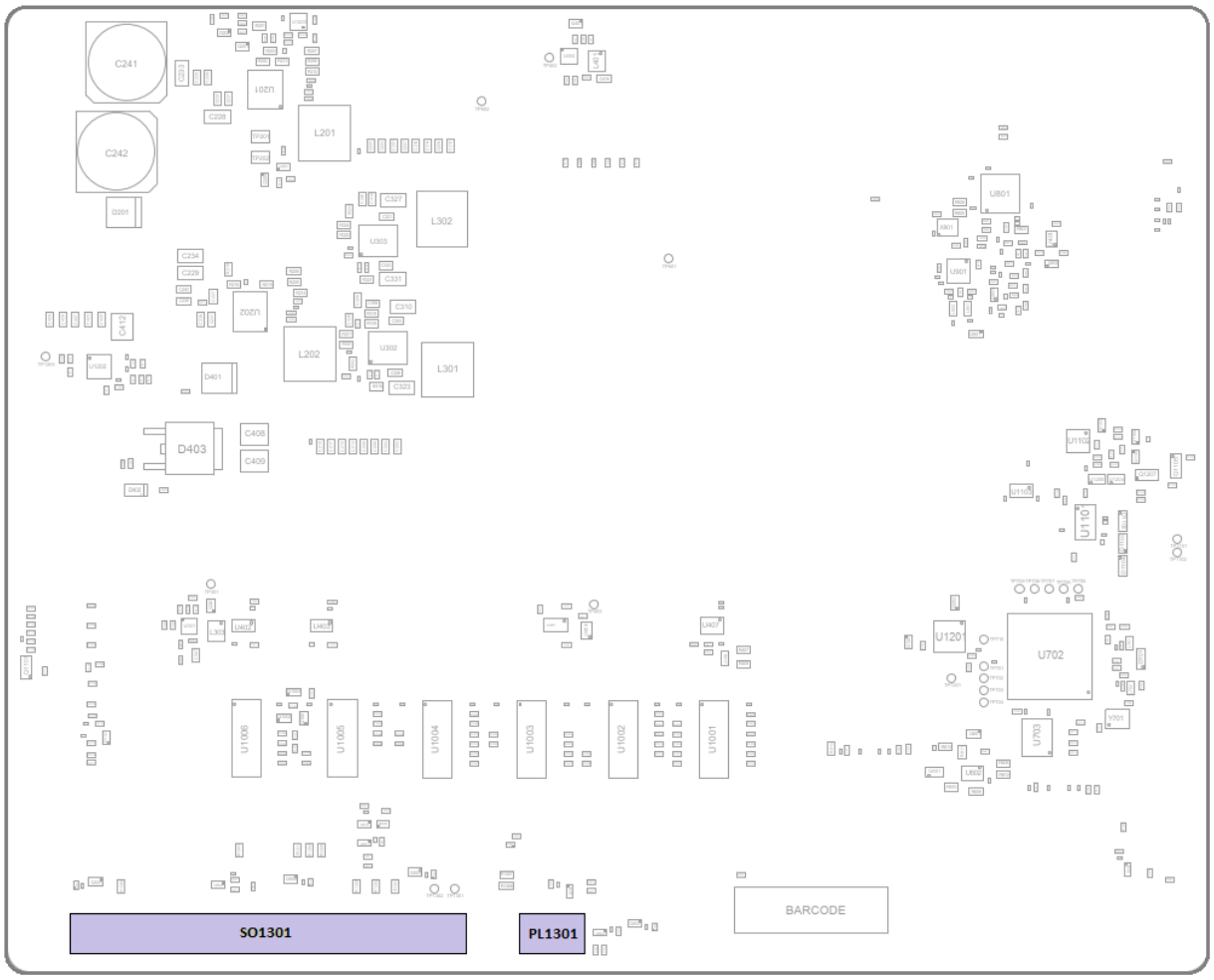
Table 7: B2B C Pin-out Information

B2B R (RIGHT)					
1 VBATT	2 VBATT	3 VBATT	4 VBATT_PA	5 VBATT_PA	6 VBATT_PA
7 VBATT	8 VBATT	9 VBATT	10 VBATT_PA	11 VBATT_PA	12 VBATT_PA
13 VBATT	14 VBATT	15 VBATT	16 VBATT_PA	17 VBATT_PA	18 VBATT_PA
19 VBATT_AUX	20 VBATT_AUX	21 VBATT_AUX	22 VBATT_PA	23 VBATT_PA	24 VBATT_PA
25 GND	26 GND	27 GND	28 GND	29 GND	30 DCDC_ADJ
31 GND	32 LDO_ADJ	33 GND	34 DCDC_OUTPUT	35 3V8_EVB	36 VSERV_FB
37 NC	38 NC	39 GND	40 GND	41 GND	42 GND
43 NC	44 NC	45 NC	46 VSERV	47 VSERV	48 VSERV
49 NC	50 NC	51 NC	52 NC	53 NC	54 NC
55 NC	56 NC	57 UART3_TXD	58 UART3_RXD	59 UART3_RTS	60 UART3_CTS
61 NC	62 NC	63 NC	64 NC	65 NC	66 TP153
67 NC	68 NC	69 NC	70 NC	71 NC	72 NC
73 NC	74 NC	75 NC	76 NC	77 NC	78 JTAG_DETECT
79 OLD_TLB_GND	80 GND	81 GND	82 TLB_DETECT	83 GND	84 GND
85 GND	86 GND	87 GND	88 GND	89 GND	90 GND
91 #RESET	92 #ON_OFF	93 STAT_LED	94 LED_DRV	95 SW_RDY/SYSTEM_ON	96 #SHDN
97 GND	98 GND	99 GND	100 GND	101 JTAG_TRIGOUT	102 JTAG_TRIGIN
103 GPS_PPS	104 GPS_RFPAON	105 GPS_CLK	106 GND	107 JTAG_SUPPLY	108 JTAG_PS_HOLD
109 GND	110 GND	111 GND	112 GND	113 JTAG_TDI	114 TP152
115 JTAG_TMS	116 JTAG_TDO	117 #JTAG_TRST	118 JTAG_TCK	119 JTAG_RTCK	120 #JTAG_RESOUT

Table 8: B2B R Pin-out Information

4. Extra Connectors on Bottom Side

4.1. Extra Connectors Layout (Bottom View)



4.1.1. SO1301 2x20 Female

Reserved for future use.

4.1.2. PL1301 2x3 Female

Reserved for future use.

5. POWER SUPPLY

During final product development phases, it might be necessary to supply the module with low-level voltages (either 1.8V, 3.3V, or 3.8V) from an external DC source located close to the board and through a wire of adequate section. This case is defined as "DIRECT SUPPLY".

Other users will just need to start working with the target module quickly and with reduced external devices. In this use-case, a wall adapter connected to the board through the on-board regulator will be the optimal solution. This case is defined "VIA DCDC".

Both approaches are supported with Telit EVB 2.0, hybrid solution is also possible.

Quite often, a user must source the target in DIRECT SUPPLY mode (i.e., to be closer to a "real application" situation, or to observe the module current consumption) while also powering up the remaining EVB circuitry with a separate power supply (that is, via DCDC).

For each of the four rails, the following options are available:

1. V_{batt}, feeding the baseband part of the target module
2. V_{batt}_PA, feeding the RF part of the target module
3. V_{batt}_AUX, feeding the auxiliary circuits NOT belonging to the module
4. 3V8_EVB, feeding auxiliary Telit EVB 2.0 circuits, fixed at 3.8V

These voltages are displayed on the selector from left to right, as shown below.

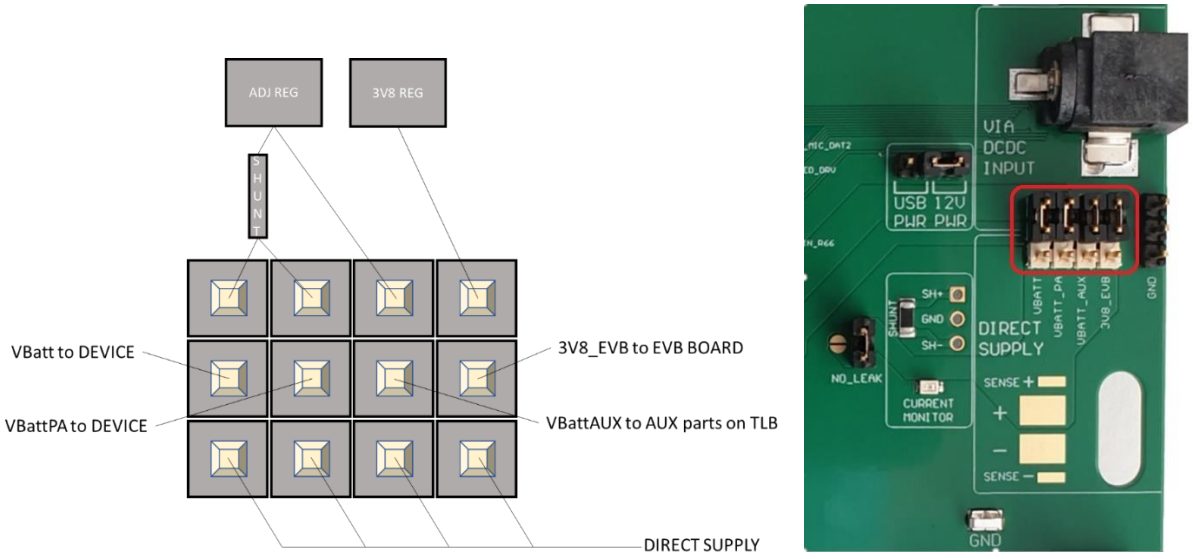


Figure 4: 4 Ways Power Selector

Please note that VIA DCDC can in turn be sourced by the wall adapter or, using the 3x1 male header selector, by the 5v of the USB DEVICE PWR.

5.1. Example Use Cases

Use Case 1:

The TLB is powered externally by DIRECT SUPPLY, while the Telit EVB 2.0 is powered by VIA DCDC. The Telit EVB 2.0 must always receive 3.8 V, so it is most frequently connected to the internal fixed regulator.

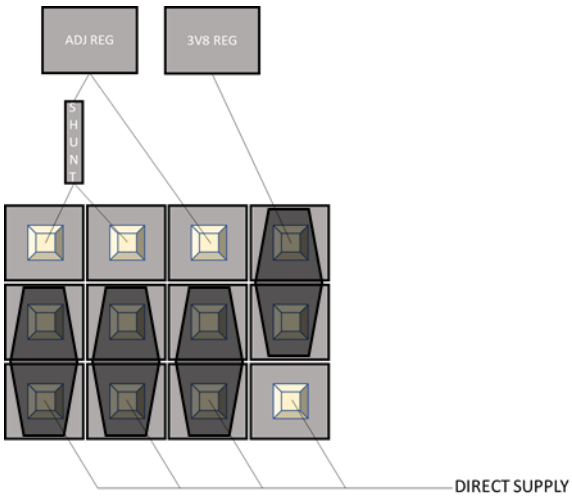


Figure 5: Use Case 1: 4 Ways Selector

Warning: This rail can only be connected to DIRECT SUPPLY when the external power supply is set to 3.8V.

Use Case 2:

The two most central headers on the left are the device's supply terminals, so if a separate DC source is required, connect to these two headers.

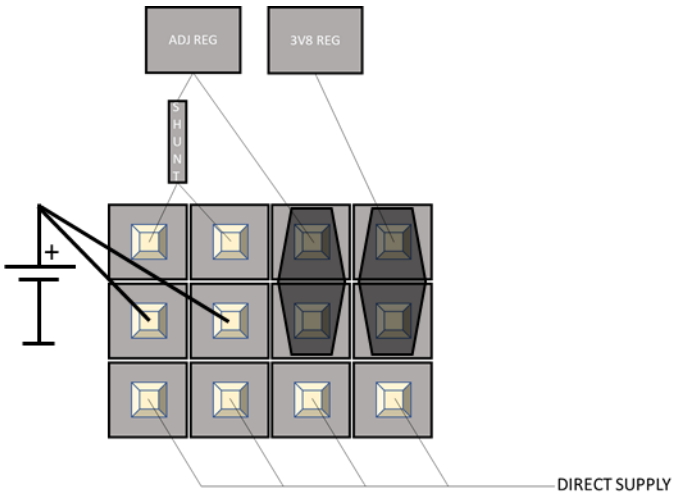


Figure 6: Use Case 2: 4 Ways Selector

Note: Please see section 5.6 Power Consumption Measurement for more information and use cases.

5.2. V_{batt} Voltage Level

Telit modules typically require either 3.8V, data cards require 3.3V, and 1.8V is the standard voltage for positioning modules. Please follow the guidelines below to provide the correct voltage to each Telit module:

- When in DIRECT SUPPLY mode,

  The user is responsible to set the correct voltage on the external power supply.

- When in VIA DCDC mode,
  - For LEGACY TLB's

    The voltage for LEGACY TLBs is selected using the EVB's 3.3v/3.8V voltage selector (please remember no LEGACY TLB supports positioning modules, thus there is no need for 1.8V selection)

  - For SMART TLB's

    The voltage is automatically set (that is AVS, Automatic Voltage Selection is implemented). A resistor mounted on the TLB properly biases the voltage regulator network and triggers V_{batt} voltage to be set according to the module mounted on the TLB.

5.3. Power Supply Configuration

5.3.1. No-Leak Jumper

NO_LEAK is a jumper that disconnects reverse polarity protection diodes, over-voltage protection, and stabilization capacitors. These components introduce current leakage thus this jumper must be removed during current consumption tests.

The adjacent "coffee bean" is a solder bridge that can be easily bridged with a solder ball and is placed parallel to the no-leak jumper.

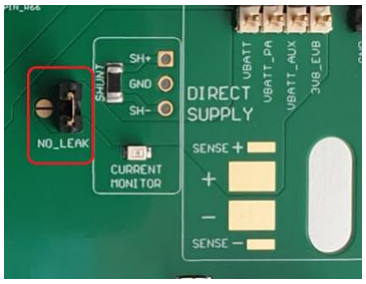


Figure 7: No-leak Jumper

5.3.2. Source Selector

When the VIA DCDC mode for some supply rail is used, it is possible to select the power source that can be supplied.

- Power source from the wall adapter (5V-12V, connected to the 5.5x2.5 mm jack): when the jumper is moved on the right position.

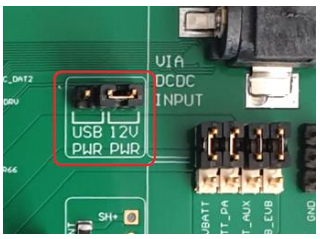


Figure 8: Source Selector in 12V position

- Power source from the 5V USB-PWR (USB DEVICE PWR): when the jumper is moved on the left position.

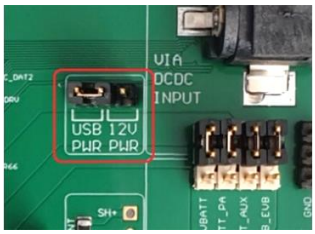


Figure 9: Source Selector in USB-PWR position

- Power source from the 5V USB-FTDI (USB EVB FTDI): when the central pin is directly connected via a wired jumper to the pin "USB_EVB" of the "DOMAINS" connector (look the chapter "*Voltage Domains*" for further details about this connector)

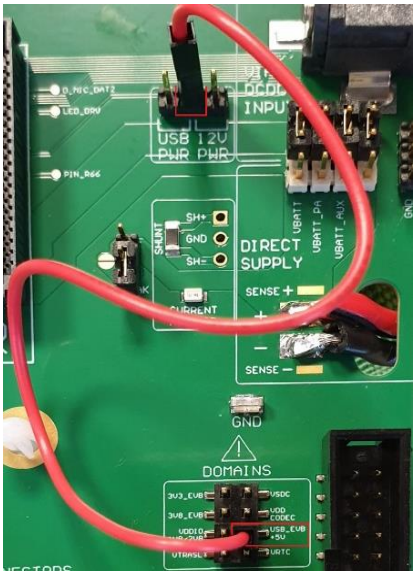


Figure 10: Source from USB-FTDI

5.3.3. Voltage Selector

On the legacy TLB board (developed before Telit EVB 2.0 introduction), no AVS (Automatic Voltage Selector) is available, thus the DCDC regulator must be set to the voltage needed by the device using the voltage selector switch.

With the selector set on the left position, the voltage is set to 3.3V.

With the selector set on the right position, the voltage is set to 3.8V.

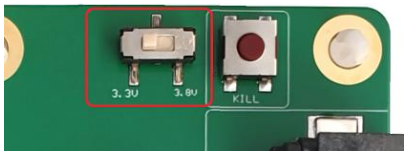


Figure 11: Voltage Selector

Note: On the "SMART TLBs" this selector has no effect on voltage selection.

5.3.4. Kill Push Button

The KILL button, located in the top right-hand corner of the Telit EVB 2.0, is designed to choke the device by disabling the DCDC regulator.

It is not recommended to use this button to power down the Telit module because the device must be turned off properly. This feature is only available to allow the user to simulate a sudden power supply interruption.

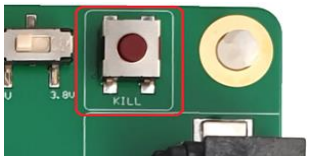


Figure 12: Kill Push Button

5.4. Power Supply Requirements

In DIRECT SUPPLY mode, the wirings impedance should be kept under control and must be less than 150mΩ, with an inductance not greater than 1µH. In general, a 0.5m long 18AWG wire is suitable.

In VIA DCDC mode, the wall adapter connected to the jack can supply a voltage in the 5V-12V range. The regulator can accept up to 36V (42V absolute maximum) but, in this case, the output voltage (V_{batt}) will not be properly regulated. Please note that a minimum current of 1.25A is required.

The cylindric jack is a 5,5x2,5 mm type with the inner terminal positive.

The WALL ADAPTER must fulfill the following requirements:

Wall Adapter	Value
Nominal Supply Voltage	8 V ÷ 12 V
Operating Voltage Range	4.8 V - 13 V (TBC)
Extended Voltange Range	4.8 V - 24 V (TBC)
Current sourced	>=1.25A

Table 9: WALL ADAPTER Requirements

Warning: When the power supply wire voltage drops at 4.8-5V (especially with thin wires), the 3.8V module may experience undervoltage.

5.5. 4-Wires Connection for Direct Supply

Any voltage drop due to connections or high impedance wires is a potential issue for the target and, in some cases, can lead to unexpected device switch-off (when V_{batt} falls below the minimum threshold). Thus, to prevent issues, it is recommended to use short and thick wires to supply power to the Telit EVB 2.0.

If possible, use the 4-wire connection (2 source cables and 2 sense cables), connecting all wires at the end point on the four dedicated pads on the Telit EVB 2.0. Termination" capacitors - requested by the external Power Supply to be stable – are already mounted on the Telit EVB 2.0.

A long cable without detection could be affected not only by voltage drops, but could also lead to power wupply instability (that is voltage overshoot, thus permanent device failure).

5.5.1. Direct Supply

Soldering is the best connection method to prevent voltage drops. To ensure good mechanical retention as well, it is recommended to pass the wires through the cable lock slot.

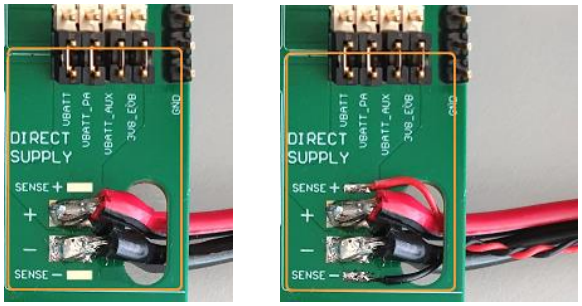


Figure 13: Direct Supply and Direct Supply with Sense

5.6. Power Consumption Measurement

The Telit EVB 2.0 not only allows different power supply configurations (as explained in the previous chapter), but at the same time supports different methods to measure current consumption of the Telit module connected to the Telit EVB 2.0 :

1. Current measurements through a current meter (EVB powered VIA "4 Ways Selector")
2. Current measurements current through an external power supply (Telit EVB 2.0 powered via "Direct Supply")
3. Current measurements through a shunt resistor.

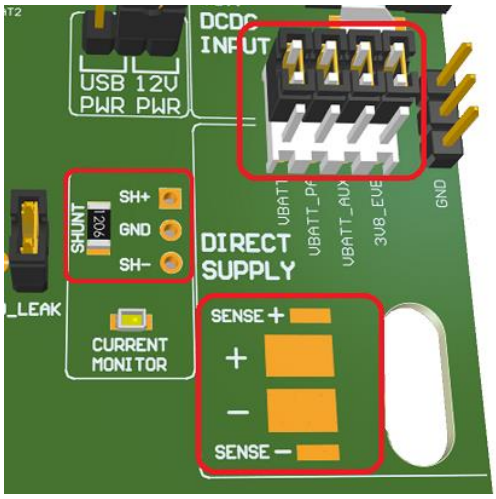


Figure 14: Current measurement points: 4 Ways Selector, Direct Supply, and shunt resistor

With the first two methods, it is possible to measure the current separately for **VBATT**, **VBATT_PA**, **VBATT_AUX** and **3V8_EVB** rails.

Note: Each current component can be measured separately only if allowed by the TLB geometry. Please check the TLB schematic to verify if these paths are available separately.

5.6.1. Measuring the Current by a Current Meter

The board is fully powered VIA DCDC. The current consumption of the device can be measured by placing an Ammeter in series to the desired rail.

The image below shows the VBATT measurement configuration.

Please ensure that the ammeter wires are properly sized. Avoid using thin or long wires because their high impedance could lead to voltage drop and the device could malfunction (disconnection, switch off).

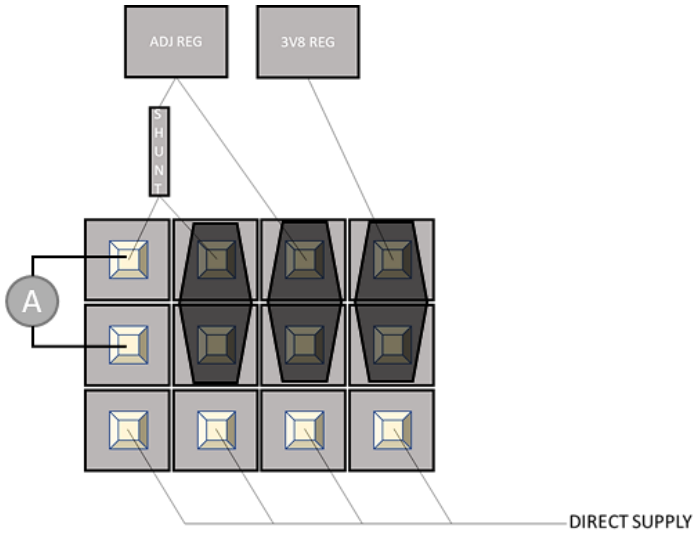


Figure 15: Ammeter Insertion

Measurement setup example:

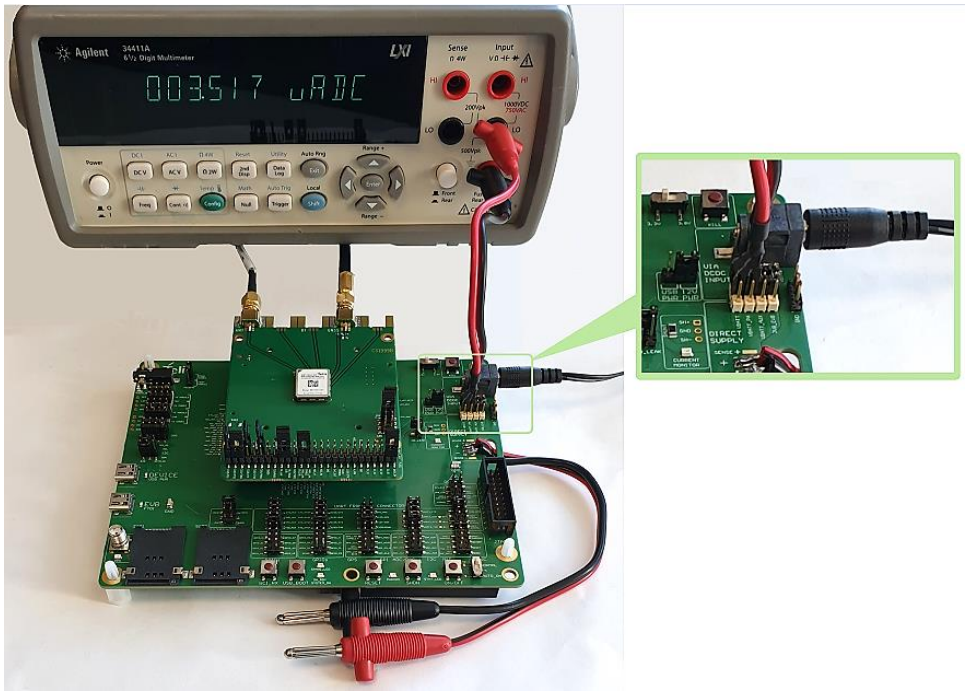


Figure 16: Measurement Setup with Ammeter

5.6.2. Measuring the Current by a Power Supply

In this case, only the device is powered by an external source via DIRECT SUPPLY, while the TLB's auxiliary parts and the Telit EVB 2.0 board are powered via DCDC. Obviously, a key requirement is that the external power supply must be able to perform current measurements.

The image below shows how to measure the consumption of the device.

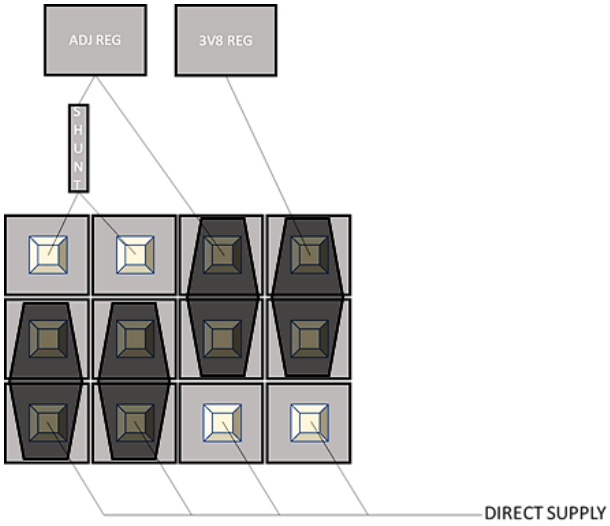


Figure 17: Measure the Current by a Power Supply

Example of measurement setup:

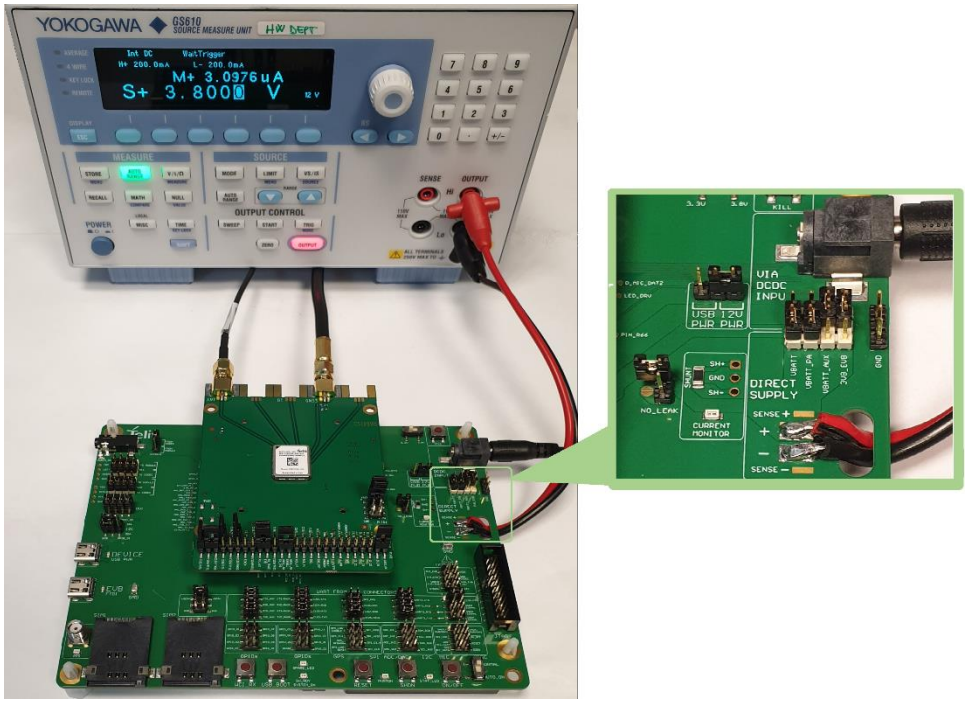


Figure 18: Measurement Setup with Ammeter

Note: Remove the NO-LEAK jumper to avoid leakage currents due to the protection network and the stabilization capacitors.

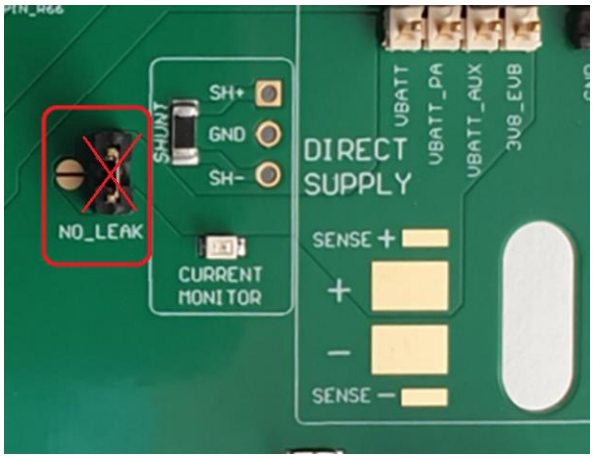


Figure 19: Avoiding Leakage Current

5.6.3. Measuring the Current through the Shunt Resistor

The device is exclusively powered VIA DCDC.

The device current consumption (total current consumption on VBATT and VBATT_PA) is indirectly measured by measuring the voltage across the 50 mΩ shunt resistor.

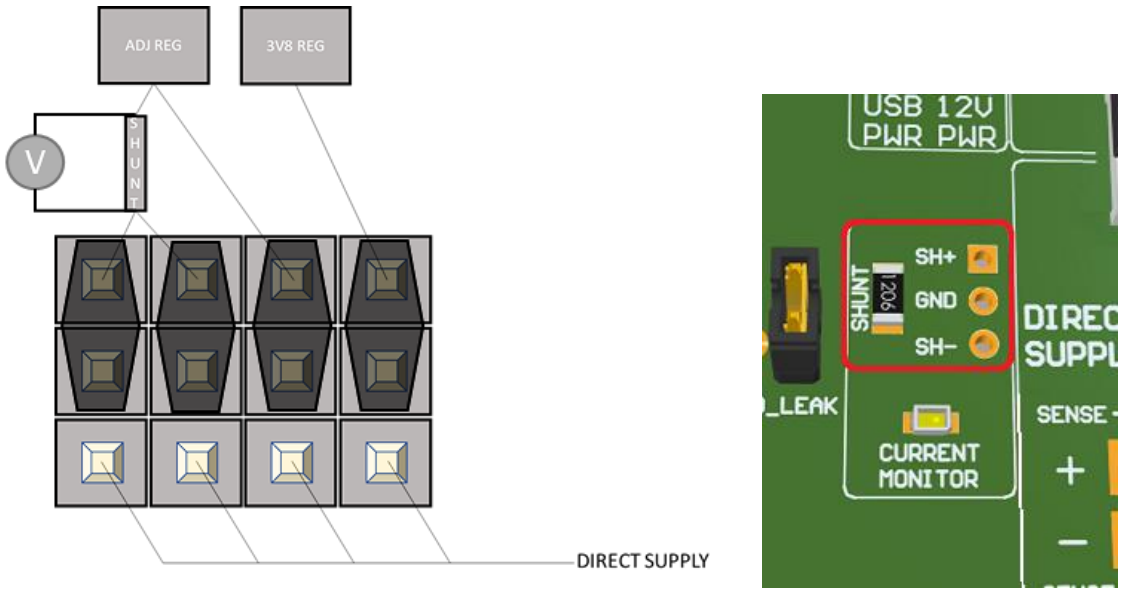


Figure 20: Measure the Current through the Shunt Resistor

5.7. VAUX/PWRMON Power Output

Most Telit modules include a regulated power supply output to supply small devices from the module itself, such as level translators, audio codecs, sensors, and so on.

Due to the different architectures, devices provide different voltages (usually 1.8V, rarely 2.8V) and current values, some as high as 50mA, some as low as 1mA. Obviously, the current flowing through this port adds up to the Vbatt current consumption. This is fine when the module is mounted on the final application, but is not acceptable when it is on top of the Telit EVB 2.0 , because in this way the consumption measured on the Telit EVB 2.0 is not in line with the specs (recall that the specs can not know in advance the currents drained from the ports of the module). So, on the Telit EVB 2.0, this Vaux/powermon port is buffered.

On the final application the buffer is needed only if the load current exceeds the Vaux/powermon current budget.

At the same time, if desidered, VAUX/PWRMON1/2 pins are available for supplying the translators through a 0-Ohm jumper. They are available as well on their pin header to allow the user to connect external application hardware and test the system.

Note: When connecting a load on this net, the related current will bias positively the current drawn by the device. Please take this into account when evaluating device power consumption.

6. VOLTAGE DOMAINS

All voltage domains are grouped in the frontal area of the board and are available on a dedicated male connector (2x4 pins, 2.54 mm): on this connector each pin represents a specific voltage domain. Each voltage name is silk-screened on the board to allow quick identification.

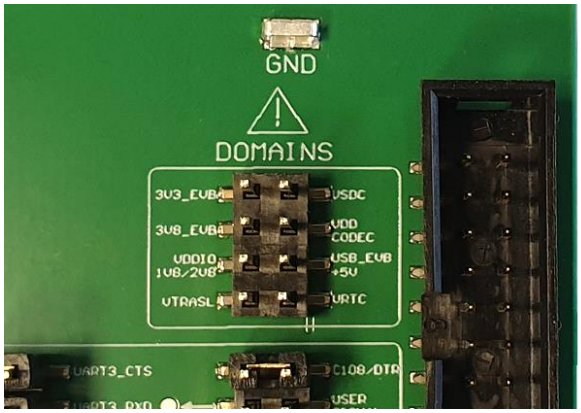


Figure 21: Voltage Domains

This connector makes testing and debugging operations easy because it allows internal or external connections using wire jumpers.

Warning:

Use this connector only for voltage monitoring or to power light loads: except for "USB_EVB +5V" do not exceed 5mA.

In case of overload, short circuit to ground or shorts between different voltage domains, the equipment will be irreversibly damaged

Don't connect an external power supply to these pins or catastrophic equipment failure may occur.

Note: since the +5v VBUS of the "EVB FTDI" USB connector are brought to the Pin "USB_EVB +5V" of DOMAINS connector, using a wired jumper to connect it to the central pin of "*Source Selector*", is it possible to take the +5v supply to the input of the DCDC regulators. This allows to supply the Telit EVB 2.0 using the USB connected to the FTDI chip. This connection is useful but could be not so ideal (because of the voltage drops on the wired jumper) and has to be tested in case of high current consumption (i.e. module in GPRS connection with 4 active TX-slots).

7. VSERV HEADER

Close to the Sim2 holder, there is the "VSERV" connector:

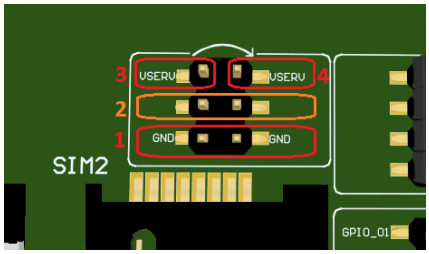


Figure 22: Vserv header

Pinout:

1. Two pins on the bottom are GND
2. Two central pins are spare pins for future use
3. Pin on the top left is the output of a DCDC converter that is enabled only when a TLB is plugged in. Voltage level:
    - If the TLB not require the VSERV at the B2B connector, VSERV=0.5V
    - If the TLB require a specific VSERV at the Right B2B connector (pins R46, R47, R48), the voltage level is automatically selected by a specific resistor placed in the TLB between pin R36 (Right B2B connector on the TLB) and GND
4. Pin on the top right: it is directly connected to the Right B2B connector (pins R46, R47, R48) to make the Vserv available on the TLB.

Typical use cases:

- Place a jumper between "3" and "4" to provide the Vserv from the DCDC converter to the TLB
- Place an ammeter between "3" and "4" to perform a current measurement absorbed by the TLB on the Vserv line
- Ignore the Vserv generated by the DCDC converter (leave pin "3" floating) and connect an external power supply on to the pin "4": a properly voltage level must be selected to avoid damage on the TLB (see TLB documentation)

8. DIGITAL SECTION

Most of the device pins available on the to Telit EVB 2.0 are digital.

Its supply domain is VDDIO_1V8/2V8 and is set to 1.8V or 2.8V depending on the device (legacy TLB's are satisfied with 1.8V, smart TLB's set the voltage by its own).

These signals mostly terminate on a male connector, allowing the user to connect to other boards using wire jumpers.

Some of these lines are not terminated on a header and are connected directly to a peripheral (that is the serial or the DVI lines). In such cases, there are a couple of headers with jumpers: this allows the signals to function normally, but also to be interrupted to facilitate testing, debugging and measuring.

Where possible, the name of the signal is silk-screened on the board to allow quick identification.

Digital pins are grouped in the frontal area of the board and are available on 2x4 pins, 2.54 mm connectors.

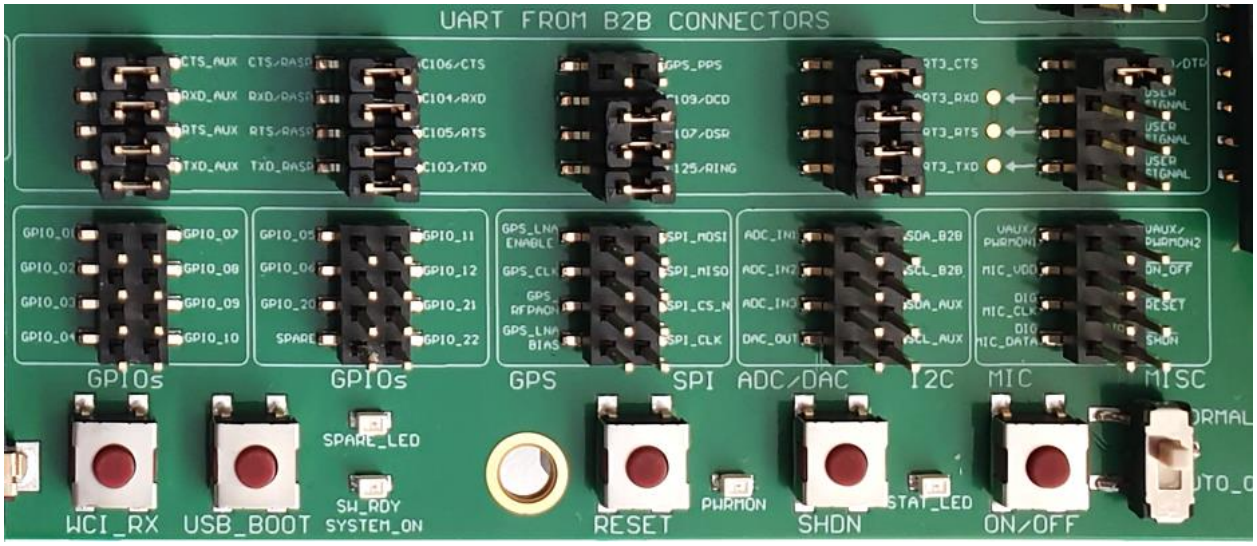


Figure 23: Digital Section: Pinout

8.1. Power On

In most cases a button connecting a pin to ground is the proper way to turn on Telit devices.

In the other cases, there will be an adapter circuitry on the TLB that translates the open collector interface with the appropriate one, depending on the specific device.

Note: In this document, all inverted lines (that is, active low signals), are labeled with a name ending with '#','*' or with a bar above the name.

Warning:

To check if the device has powered on, the hardware line PWRMON should be monitored.

No pull-up resistor should ever be used on the ON_OFF* line since it is internally pulled up. Using a pull-up resistor may cause problems with improper latching and power on/off of the module. The ON_OFF* line must be connected only in open collector or open drain configuration.

8.2. Communication Ports

8.2.1. USB DEVICE (USB PWR) and USB EVB (FTDI)

The Telit EVB 2.0 mounts two USB-C connectors labeled "DEVICE" and "EVB".

Normally, communication between the TLB-mounted device and the host PC takes place either through USB DEVICE port or UART lines (translated by the FTDI chip).

Figure 24: USB DEVICE (USB PWR) and USB EVB (FTDI)

The USB DEVICE is the upper one and is connected to the Telit module USB port. Through this port it is possible to power the Telit EVB 2.0, provided that the source selector is set on the left position (refer to 5.3.2 Source Selector).

Note: Some TLBs provide a on-board USB connector instead of relying on the USB port mounted on the EVB. Please refer to the TLB hardware documentation for further information.

The USB EVB (FTDI) is connected to a FTDI 4-channel port translator splitting the USB bus into one I2C interface and three UART lines.

The 3 UART lines are connected to the device serial lines and are mapped as Virtual Com Ports on the host PC.

Note: When the USB DEVICE (USB PWR) is used as a power source, make sure the USB cable is as short and thick as possible, in order to avoid voltage drops on the cable that can cause issues.

Please note that a regulator must have some voltage headroom to produce a reliable output voltage and the voltage drops reduce this margin.

8.2.2. UARTs Pins Naming Convention

On the Telit EVB 2.0 schematic, there is an apparent misalignment between the pins direction and their naming.

Note: Pins direction is inverted because on the main UART the host is considered the DTE (as per V.24 standards). On the other hand, for the other 2 UART lines, the Telit device is rated as DTE so the host becomes a DCE.

8.2.3. Serial Ports

The three serial ports are listed below:

- MODEM SERIAL (Main) is the port dedicated to the AT-commands
- AUX SERIAL is a second port for modules supporting two serial ports
- UART3 SERIAL is a spare serial port, often used by the GNSS receiver integrated in cellular devices

Each serial line must be configured as 115200 8-N-1, unless otherwise specified.

Serial port lines can be monitored (for example with a scope or logic state analyzer) or disconnected, thanks to dedicated jumpers placed on the front of the board. Each line

jumper is silk-screened to allow easy identification. These lines operate at same voltage of the module under test, as they are actually the device communication ports.

This allows to interface the Telit device with the customer hardware prototype.

Note: For minimal implementation, only TXD and RXD lines can be connected, with the other lines left floating as long as software flow control is implemented.

To avoid back powering effect, it is recommended to prevent HIGH logic level signals from being applied to the digital pins when the device is powered off or during an ON/OFF transition.

8.3. SIM Card Holders

Since some cellular modules support two SIM interfaces, the Telit EVB 2.0 mounts two SIM card holders.

The default SIM holder is the one labeled"SIM1" on the left.

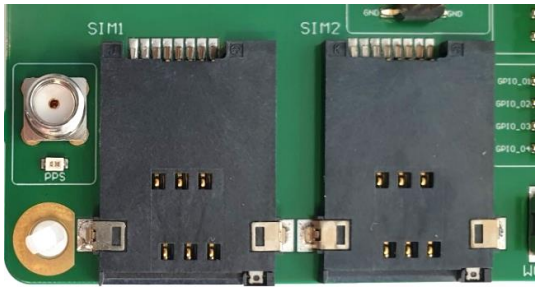


Figure 25: Sim Holders

Troubleshooting in SIMIN detection: for EMC reasons, a capacitor has been placed on the SIMN1 and SIMIN2 switching lines, which, for some modules, may be excessive and indicate "SIM present" when using the AT command "CPIN?" for SIM detection even though it is not there: in this case, the solution is to remove, from the EVB 2.0, these capacitors (see the image below).

On your application: leave these capacitors not populated or, if necessary, mount capacitors on SIMN1 and SIMIN2 lines if suggested in the hardware user guide for the specific module.

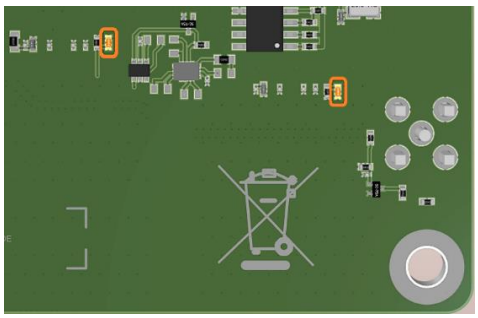


Figure 26: Bottom side view: highlighted the capacitors that must be removed in case of SIM detection error

8.4. SDIO Interface

At the top center of the Telit EVB 2.0, a SDIO card connector is mounted.

SDIO cards are supplied with 3.3V: this rail (derived from the 3V8_EVB line) is always on when the board powered on.

Figure 27: SDIO Interface

8.5. LEDs

8.5.1. CURRENT MONITOR

When exceeding about 100mA current draw, the LED switches on.

Figure 28: Current Monitor LED

8.5.2. STAT_ LED

Indication of Network Service Availability

Figure 29: STAT LED

The STAT_LED pin status displays network service availability and call status. The function is available as an alternative function of GPIO_01 (to be enabled by means of the AT#GPIO=1,0,2 AT command). Please refer to each module documentation for information on network service LED status.

STAT_LED status is defined accordingly to the table below:

Device Status	Led Status
Device off	Permanently off
Not Registered	Permanently on
Registered in idle	Blinking (1s on + 2 s off)
Registered in idle + power saving	Depends on the event that triggers the wakeup (In sync with network paging)
Connecting	Blinking 1s on + 2s off

Table 10: LED Status

8.5.3. PWRMON

This LED switches on when the module is operative.

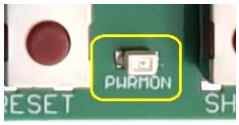


Figure 30: PWRMON LED

8.5.4. SW_RDY/SYSTEM_RDY

This LED switches on when the module is ready to operate. Please note that only some Telit devices support this function.

Figure 31: SW_RDY/SYSTEM_RDY LED

8.5.5. SPARE_LED

This LED is a visual test probe that switches on when the test point (a pin labeled "SPARE" located in the header connector placed near the led) connected by the user reaches the high logic level.

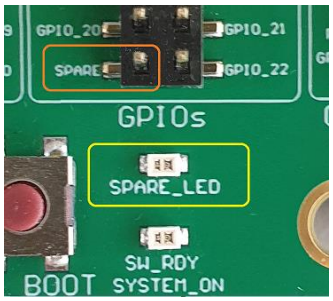


Figure 32: SPARE LED and

8.5.6. GPS PPS

This LED switches on when the device enables 1PPS output and the level is high: it's the 1PPS display, typical for positioning devices.

To make this signal (level 3.3V) available for external use, a SMA connector has been placed near to the homonymous led

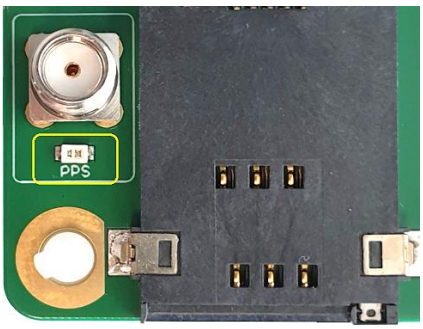


Figure 33: PPS LED

8.5.7. USB DEVICE ON

This LED switches on when the USB DEVICE is powered, and the USB controller is enabled.

Figure 34: USB DEVICE LED

8.5.8. USB EVB FTDI ON

This LED switches on when the host PC operating system enumerates the USB instance of the FTDI level converter.

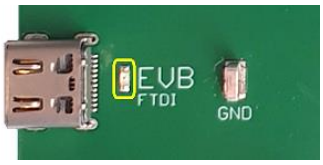


Figure 35: FDTI LED

8.5.9. AUDIO ON

This LED switches on when the "carrier" signal is present on the audio jack. It detects when the balanced output lines reach ½ VDD stage and is ready to produce sound.

The indication is supported for both digital and analog audio chains.

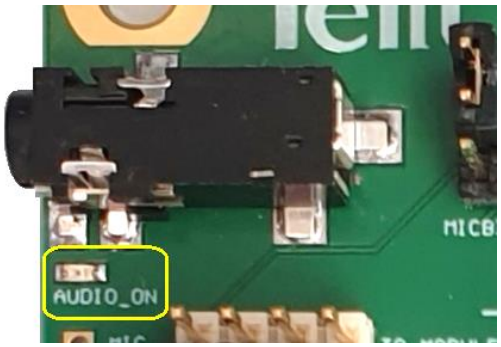


Figure 36: AUDIO_ON LED

8.6. Push Buttons

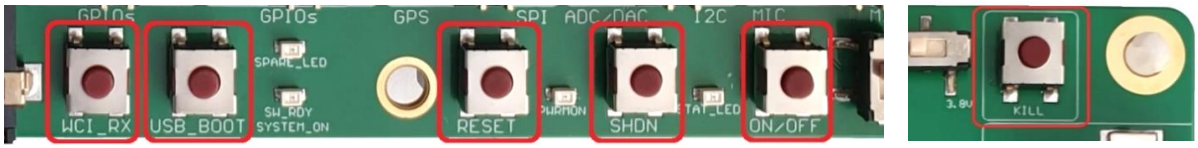
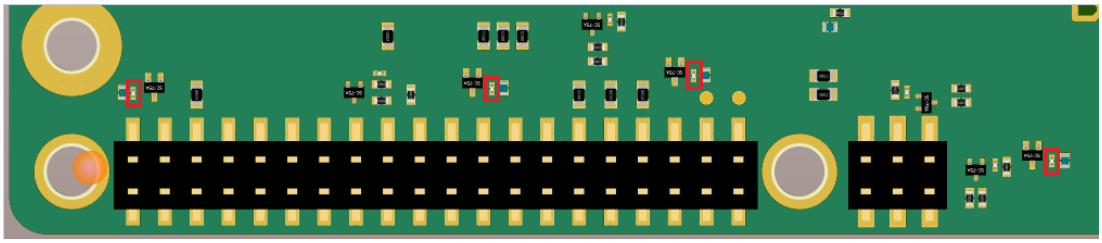


Figure 37: Push buttons

Troubleshooting in push buttons functions: for EMC reasons, capacitors has been placed on the USB_BOOT, RESET, SHDN and ON/OFF lines, which, for some modules, may be excessive and could be the cause of unwanted behavior. For example, it may happen that the module goes in BOOT-Loader mode as USB_BOOT would been pressed.

To avoid unwanted behavior, it is strongly recommended to remove from the bottom side of the EVB 2.0, the following four capacitors:



8.6.1. WCI_RX

This push button is available for compliance with some existent Telit devices requiring this line.

8.6.2. USB_BOOT

FORCED_USB_BOOT pin must be activated only during the firmware upgrade operation. Normally it must be left idle.

8.6.3. RESET

Some devices require a low level on this line as a RESET command.

8.6.4. SHDN

Some devices require a low level on this line as a SHUTDOWN request.

8.6.5. ON/OFF

This is the ON/OFF push button: keeping it pressed for a few seconds switches the device ON or OFF.

The adjacent "AUTO_ON" switch, is a "comfort gadget" for users who want to emulate ON/OFF button always pressed. When activated, it "holds down" the ON/OFF push button permanently.

8.6.6. KILL

This push button abruptly stops the main DCDC regulator, causing a power disruption if a device is powered through DCDC. It is the forced power-cycle function.

Warning: Use of KILL is not recommended.

Make sure to follow the switch-off procedures for the specific device in the application. It is provided on the Telit EVB 2.0 for testing purpose only.

9. AUDIO SECTION

The Telit EVB 2.0 AUDIO interface includes an headphone amplifier, typically not present on Telit evaluation boards: this solution was chosen since loudspeakers are referenced to ground, thus avoiding tantalum DC block capacitors causing audio clicks and pops.

The user interface is a CTIA standard handfree TRRS 3.5mm jack or a 4 test points array in 2.54mm pitch.

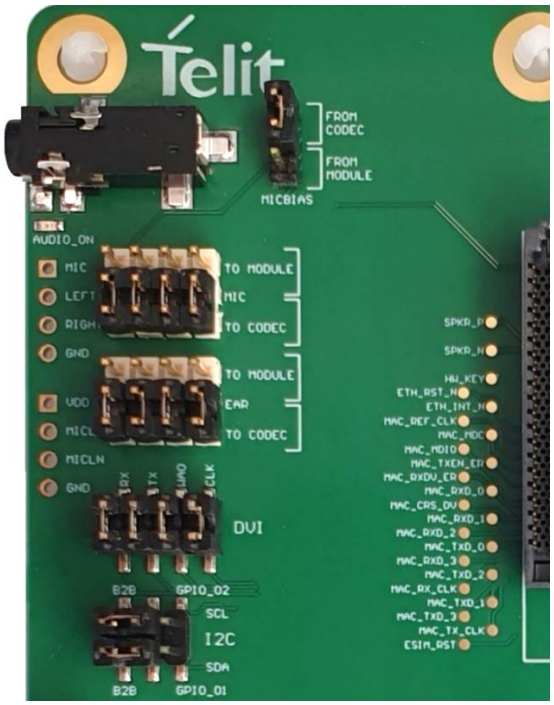


Figure 38: Digital Audio Jumpers Configuration

Since a CODEC (provided with local clock and I2C pull-up) handles the conversion, the other end, towards the device under test, can be easily operated as an analogue or digital interface.

This I2C interface (necessary to configure and activate the codec) is different from that of the FTDI chip: it belongs to the I2C port of the module under test.

Some Telit modules have dedicated I2C pins, known as "native I2C", while others share lines between GPIO and I2C.

The I2C selector allows to choose between native I2C and GPIO1/2: if different GPIO lines must be used, it is suggested to connect them using the supplied wired jumpers.

To provide the user with maximum flexibility, all audio and codec signals are routed through a pair of jumpered headers. In example, a handsfree can be connected directly and jumpers can be removed to connect external circuitry.

To initialize the audio codec using GPIO1 as SDA and GPIO2 as SCL, the following commands from the AT interface must be sent:

- AT#I2CWR=1,2,30,4,19
- 00109000100A330000330C0C09092424400060 <CTRL-Z>
- AT#I2CWR=1,2,30,17,1
- 8A <CTRL-Z>

Note: These setup commands via I2C have to be re-issued after the Module get back from sleep.

Troubleshooting at modules startup: if a module gets stuck at startup, please check the jumpers setting for the audio codec: if connected to GPIO1/2, remove the jumpers or keep them in the left "B2B" position on the I2C selector (see Figure 38) until the module boots up.

To use the audio in ANALOG MODE, the jumpers must be set as shown in the image below:

Figure 39: Jumpers Configuration for Audio in Analog Mode

Telit modules digital audio interface (DVI) is based on the I2S serial bus interface standard. The audio port can be connected to the end device using the digital interface, or via one of the several compliant codecs (in case an analog audio is needed).

9.1. Electrical Characteristics

The product is providing the DVI on the following pins:

Signal	I/O for the device	Function	Type
DVI_WA0	Output for Device (MASTER) Input for Device (SLAVE)	Digital Audio Interface (Word Alignment / LRCLK)	CMOS 1.8V/2.8V

DVI_RX	Input for Device Output for Codec	Digital Audio Interface (RX)	CMOS 1.8V/2.8V
DVI_TX	Output for Device Input for Codec	Digital Audio Interface (TX)	CMOS 1.8V/2.8V
DVI_CLK	Output for Device (MASTER) Input for Device (SLAVE)	Digital Audio Interface (BCLK)	CMOS 1.8V/2.8V

Table 11: DVI Pins

10. MECHANICAL SPECIFICATIONS

10.1. Drawing

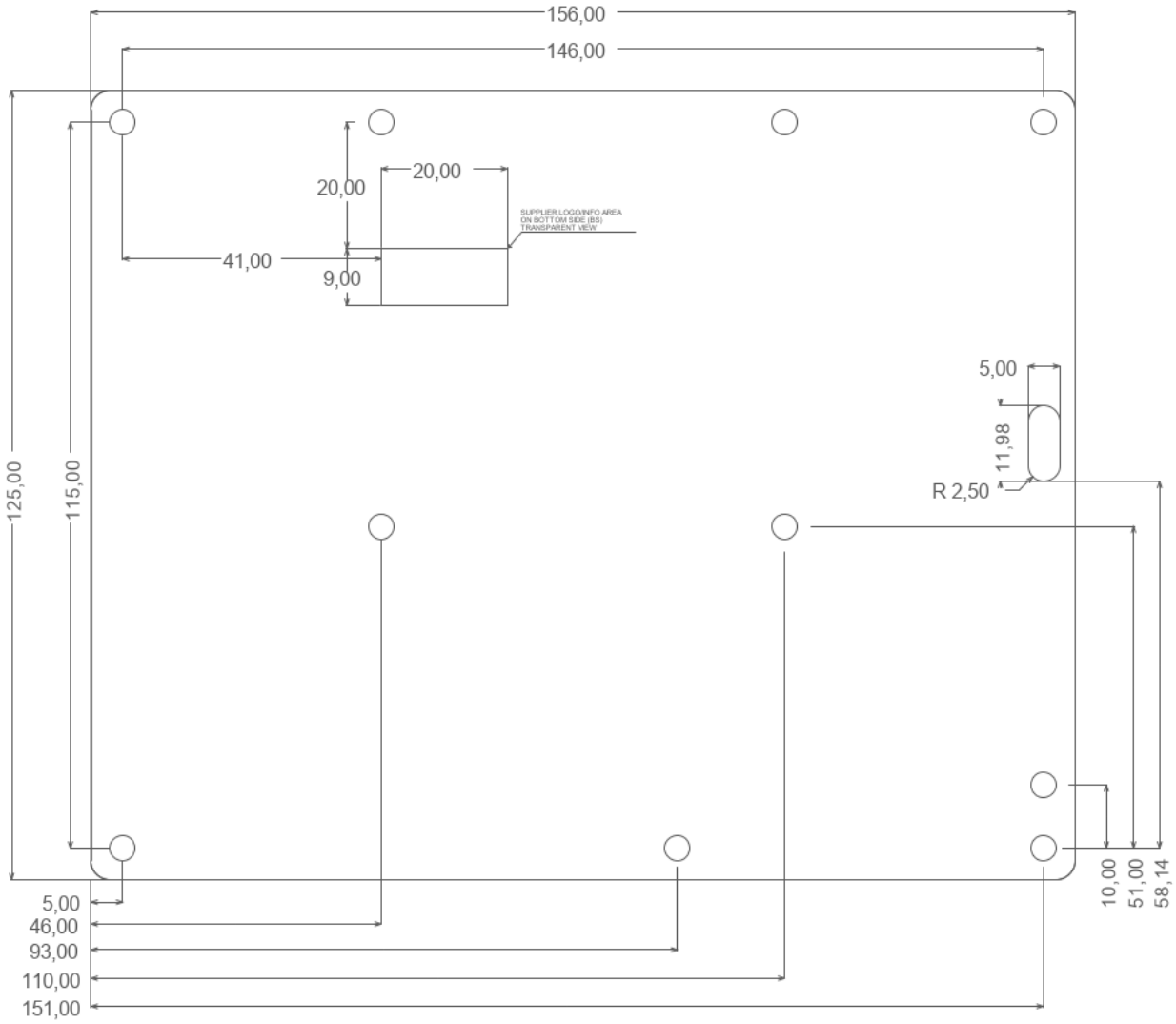


Figure 40: Board Mechanical Drawing (dimensions are in millimeters)

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Make sure the use of this product is allowed in your country and in the environment required. The use of this product may be dangerous and must be avoided in areas where:

- it can interfere with other electronic devices, particularly in environments such as hospitals, airports, aircrafts, etc.
- there is a 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 must be supplied with a stabilized voltage source and the wiring must be conformed to the security and fire prevention regulations. The product must be handled with care, avoiding any contact with the pins because electrostatic discharges may damage the product itself. Same cautions must be taken for the SIM, carefully checking 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, the external components of the module, as well as any project or installation issue, must be handled with care. Any interference may cause the risk of disturbing the GSM network or external devices or having an impact on the security system. Should there be any doubt, please refer to the technical documentation and the regulations in force. Every module must be equipped with a proper antenna with specific characteristics. The antenna must be installed carefully 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 must assess the final product against the SAR regulation.

The equipment is intended to be installed in a restricted area location.

The equipment must be supplied by an external specific limited power source in compliance with the standard EN 62368-1:2014.

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

https://ec.europa.eu/growth/sectors/electrical-engineering_en

12. GLOSSARY

EVB	Evaluation Board
FTDI	Future Technology Devices International
I/O	Input Output
SIM	Subscriber Identification Module
TLB	Translation Board
UART	Universal Asynchronous Receiver Transmitter
USB	Universal Serial Bus

13. DOCUMENT HISTORY

Revision	Date	Changes
0	2022-03-16	First document revision
1	2022-06-23	Added a note related to the SIM detection
2	2022-10-04	Added a note related to the use of GPIO1/2 for audio codec Added a note related to the effect, at the module startup, of the capacitor connected to the push buttons
3	2022-11-16	Note added on B2B connector pinout table and USB connector on TLB

From Mod.0818 rev.4

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