QuecPython BG95-XX Zero EVB

Specification and User Guide

LPWA Module Series

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Safety Information

The following safety precautions must be observed during all phases of operation, such as usage, service or repair of any terminal or mobile incorporating the module. Manufacturers of the terminal should notify users and operating personnel of the following safety information by incorporating these guidelines into all manuals of the product. Otherwise, Quectel assumes no liability for customers' failure to comply with these precautions.

Full attention must be paid to driving at all times in order to reduce the risk of an accident. Using a mobile while driving (even with a handsfree kit) causes distraction and can lead to an accident. Please comply with laws and regulations restricting the use of wireless devices while driving.

Switch off the terminal or mobile before boarding an aircraft. The operation of wireless appliances in an aircraft is forbidden to prevent interference with communication systems. If there is an Airplane Mode, it should be enabled prior to boarding an aircraft. Please consult the airline staff for more restrictions on the use of wireless devices on an aircraft.

Wireless devices may cause interference on sensitive medical equipment, so please be aware of the restrictions on the use of wireless devices when in hospitals, clinics or other healthcare facilities.

Terminals or mobiles operating over radio signal and cellular network cannot be guaranteed to connect in certain conditions, such as when the mobile bill is unpaid or the (U)SIM card is invalid. When emergency help is needed in such conditions, use emergency call if the device supports it. In order to make or receive a call, the terminal or mobile must be switched on in a service area with adequate cellular signal strength. In an emergency, the device with emergency call function cannot be used as the only contact method considering network connection cannot be guaranteed under all circumstances.

The terminal or mobile contains a transceiver. When it is ON, it receives and transmits radio frequency signals. RF interference can occur if it is used close to TV sets, radios, computers or other electric equipment.

In locations with explosive or potentially explosive atmospheres, obey all posted signs and turn off wireless devices such as mobile phone or other terminals. Areas with explosive or potentially explosive atmospheres include fueling areas, below decks on boats, fuel or chemical transfer or storage facilities, and areas where the air contains chemicals or particles such as grain, dust or metal powders.

About the Document

Revision History

Version	Date	Author	Description
-	2024-01-30	Chavis CHEN	Creation of the document
1.0.0	2024-01-30	Chavis CHEN	Preliminary

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1 Introduction

This EVB is applicable to BG95 series module.

BG95 series is a multi-mode (LTE Cat M1/LTE Cat NB2/EGPRS) LPWA module that complies with 3GPP Rel-14 specifications. It supports the maximum uplink rate of 1119 kbps and the maximum downlink rate of 588 kbps in LTE Cat M1 network. The module has ultra-low power consumption with built-in MCP and ARM Cortex A7 processor supporting ThreadX system. Compared with similar products, its PSM leakage is reduced by 70 % and power consumption in eDRX mode is reduced by 85 %.

BG95 series module has a complete set of hardware-based security functions that allow trusted applications to run directly on Cortex A7 TrustZone engine. It can be compatible with Quectel LTE standard modules (EG91/EG95), NB-IoT modules (BC35-G/BC95 R2.0) and UMTS/HSPA module (UG96), which is convenient for you to design and upgrade products quickly.

The dimension of BG95 series module is 23.6 mm × 19.9 mm × 2.2 mm. The module also has the characteristics of low power consumption, high integration, and high mechanical strength. All of these can maximize the convenience of you for product development. Adopting LGA packaging type, it is particularly suitable for automated SMT of contemporary mass production, and provides easy SMT welding and after-sales maintenance. Meanwhile, rich Internet protocols, industrial-grade standard interfaces and various functions extend the scope of the module to a wider range of M2M applications.

2 Product Overview

2.1. Top and Bottom Views

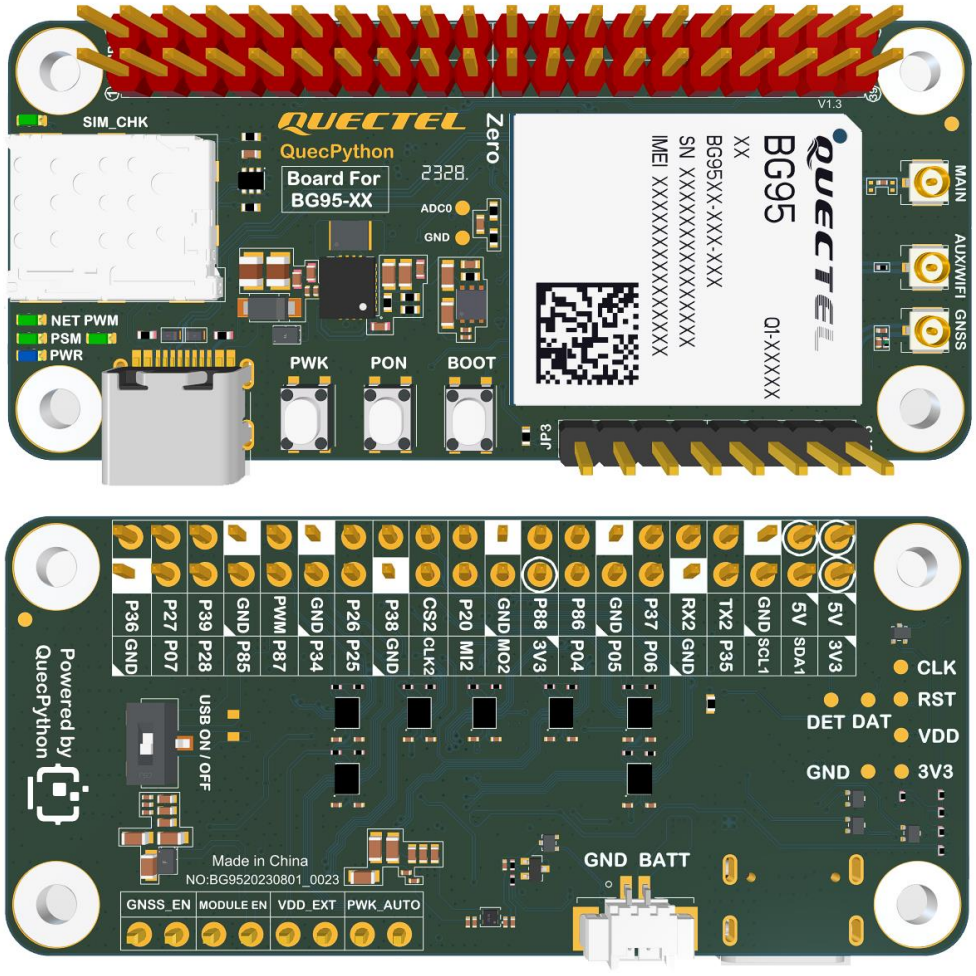


Figure 1: Top and Bottom Views

NOTE

Images above are for illustration purpose only. Refer to the actual appearance.

2.2. Component Placement

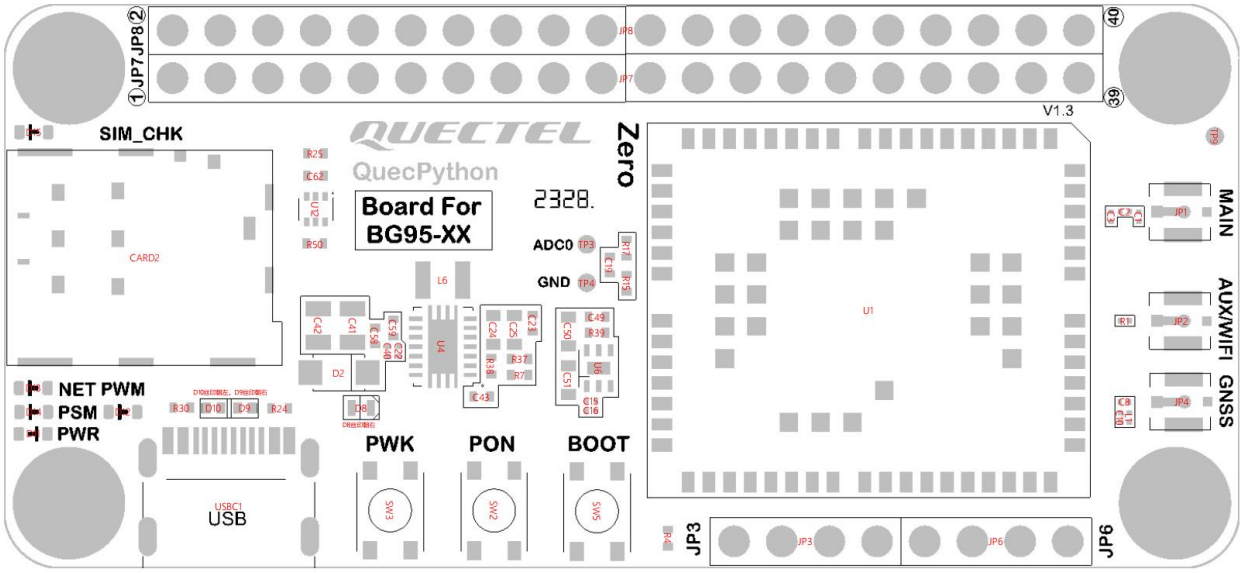


Figure 2: Top View for Component Placement

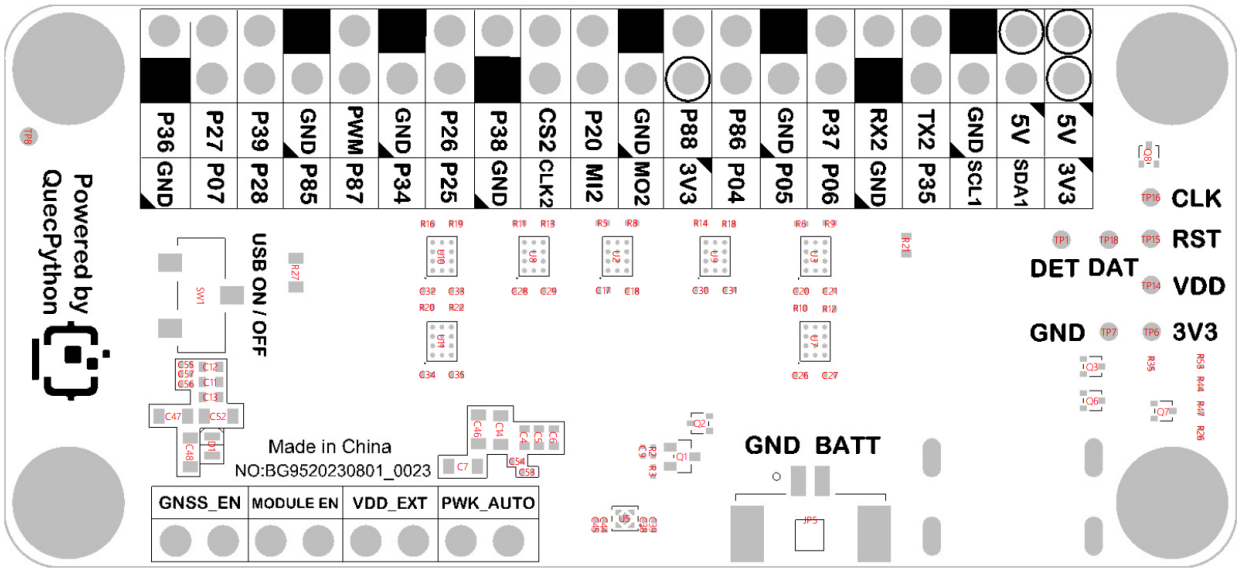


Figure 3: Bottom View for Component Placement

2.3. Major Components

Table 1: Major Components

Component	Module Type	RefDes.	Comment
Major module	BG95 series	U1	
DCDC	TPS63020DSJR	U4	
LDO1	TLV75533PDRVR	U6	
LDO2	NCP114AMX180TBG	U5	
Level shifting	TXS0104EYZTR	U2, U3, U7, U8, U9, U10, U11	
SIM card slot 1	SMN-315-ARP7	CARD2	Nano-SIM
LED indicators	-	PWR, PSM, NET_PWK, SIM_CHK	
ADC	-	ADC0, GND	
USB power consumption detection switch	-	USB ON/OFF	
Battery interface	-	BATT, GND	

2.4. Electrical Characteristics

- USB power supply range: 4.8–5.5 V.
- Pin header power supply range: 2.5–5.5 V.
- Battery power supply range: 2.5–5.5 V.

NOTE

1. When USB and pin header supply power simultaneously, the voltage of the two must be the same. If the difference is large, the related circuits may be burned out.
2. When pin header supplies power, the power supply pins are pin 2 and pin 4 of the forty pin headers.
3. When the voltage of battery is 2.5 V, the current cannot be less than 2 A.

2.5. Requirements of Power Supply

The EVB carries a buck-boost DCDC with an input voltage range of 2.5–5.5 V. When the input voltage is less than 3.6 V, the DCDC is in boost mode. While the input voltage is greater than 3.6 V, the DCDC is in buck mode.

2.5.1. Power Supply of USB

When powered by USB, the EVB does not allow any battery to be mounted.

2.5.2. Power Supply of Battery

When powered by battery, the EVB does not allow to be powered by USB, and the battery power supply range is only 2.5–5.5 V. Do not use a battery that exceeds the voltage range.

2.6. Test Points

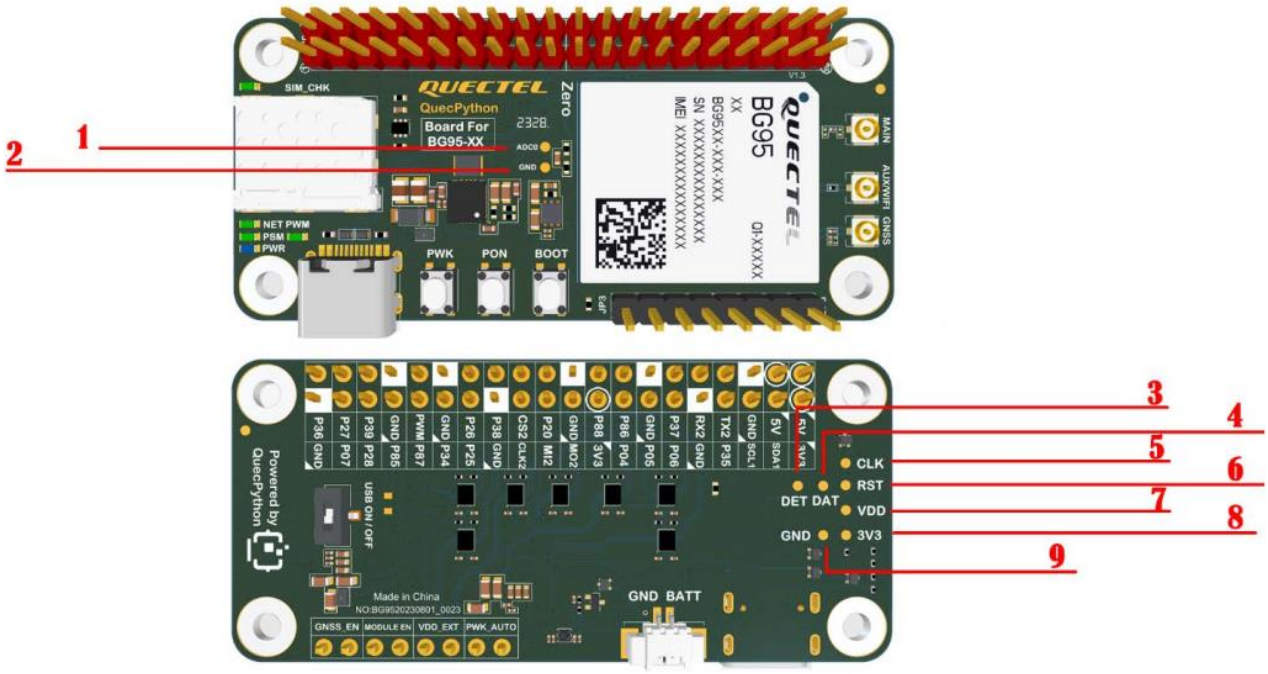


Figure 4: Distribution of Test Points

Table 2: Pin Definition of Test Points

No.	Silkscreen Name	Comment
1	ADC0	Voltage measurement value of ADC0 [1]
2	GND	Ground
3	DET	SIM_DET of module
4	DAT	USIM_DATA of module
5	CLK	USIM_CLK of module
6	RST	USIM_RST of module
7	VDD	USIM_VDD of module
8	3V3	LDO 3.3 V test point
9	GND	Ground

2.7. Indicators

- SIM_CHK: when the SIM card is inserted, the indicator lights up.
- NET: network status indicator.
- PSM: sleep status indicator.
- PWM: PWM function indicator.
- PWR: power supply indicator.

2.8. ADC

ADC0_IN is connected to VBAT of the module by default. The ADC0 input voltage is one-fourth of the VBAT input voltage.

[1] See ***Chapter 2.8*** for voltage measurement value of ADC0.

2.9. Power Consumption Measurement Control Switch

The EVB contains a single pole double throw switch (USB ON/OFF). When the switch is in the closed state, USB can be connected normally; When the USB switch is off, Type-C only supplies power to the EVB without USB interaction function, and it can be used to measure power consumption of the module.

3 Function Description of Pin Header

The BG95 series EVB provides forty compatible pin headers for peripherals, and eight-Pin function used for enabling and controlling pins. The definition of EVB pin headers is described as follows:

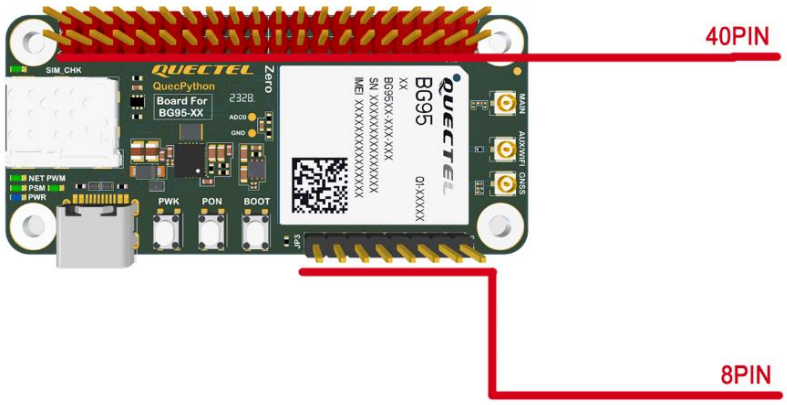


Figure 5: Layout Diagram of Pin Headers

3.1. Pin Definition of Forty Pin Headers

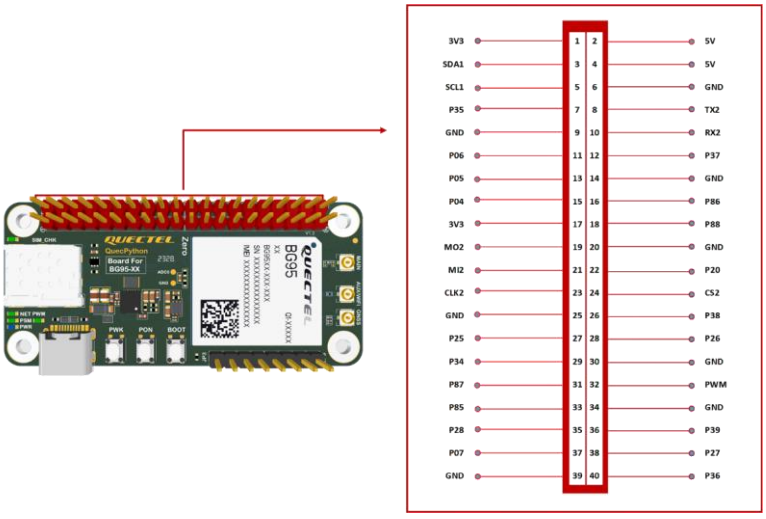


Figure 6: Pin Distribution of Forty Pin Headers

Table 3: Pin Definition of Forty Pin Headers

No.	Silk screen	Default Function	Multiplexing Function	Function Description	No.	Silk screen	Default Function	Multiplexing Function	Function Description
1	3V3	-	-	3.3 V output	2	5V	-	-	5 V output
3	SDA1	I2C1_SDA	GPIO14	I2C1 serial data/ General-purpose input/output	4	5V	-	-	5 V output
5	SCL1	I2C1_SCL	GPIO13	I2C1 serial clock/ General-purpose input/output	6	GND	-	-	Ground
7	P35	GPIOX	UART4_TXD	General-purpose input/output/ UART4 transmit	8	TX2	UART2_TXD	-	UART2 transmit
9	GND	-	-	Ground	10	RX2	UART2_RXD	-	UART2 receive
11	P06	GPIO3	PCM_DIN	General-purpose input/output/ Digital audio input	12	P37	GPIOX	I2C_SDA	General-purpose input/output/ I2C serial data
13	P05	GPIO2	PCM_SYNC	General-purpose input/output/ Digital audio synchronization	14	GND	-	-	Ground
15	P04	GPIO1	PCM_CLK	General-purpose input/output/ Digital audio clock	16	P86	GPIO19	-	General-purpose input/output

17	3V3	-	-	3.3 V output	18	P88	GPIO21	-	General-purpose input/output
19	MO2	SPI2_MOSI	GPIO8/ UART0_TXD	SPI2 master-output slave-input/ General-purpose input/output/ UART0 transmit	20	GND	-	-	Ground
21	MI2	SPI2_MISO	GPIO7/ UART0_RXD	SPI2 master-input slave-output/ General-purpose input/output/ UART0 receive	22	P20	GPIOX	-	General-purpose input/output
23	CLK2	SPI2_CLK	GPIO5/ I2C0_CLK	SPI2 clock/ General-purpose input/output/ I2C0 clock	24	CS2	SPI2_CS	GPIO6/ I2C0_SDA	SPI2 chip select/ General-purpose input/output/ I2C0 serial data
25	GND	-	-	Ground	26	P38	GPIOX	-	General-purpose input/output
27	P25	GPIO9	SPI0_CS	General-purpose input/output/ SPI0 chip select	28	P26	GPIO10	SPI0_CLK	General-purpose input/output/SPI0 clock
29	P34	GPIOX	UART4_RXD	General-purpose input/output/ UART4 receive	30	GND	-	-	Ground
31	P87	GPIO20	-	General-purpose input/output	32	PWM	PWM0	GPIO17	PWM0 transmit/ General-purpose

									input/output
33	P85	GPIO18	PWM1	General-purpose input/output/ PWM1 output	34	GND	-	-	Ground
35	P28	GPIO12	SPI0_MISO/ UART3_RXD	General-purpose input/output/ SPI0 master-input slave-output/ UART3 receive	36	P39	GPIOX	-	General-purpose input/output
37	P07	GPIO4	PCM_DOUT	General-purpose input/output/ Digital audio output	38	P27	GPIO11	SPI0_MOSI/ UART3_TXD	General-purpose input/output/SPI0 master-output slave-input/ UART3 transmit
39	GND	-	-	Ground	40	P36	GPIOX	I2C_SCL	General-purpose input/output/ I2C serial clock

3.2. Pin Definition of Eight Pin Headers

This chapter describes how to enable and control BG95 series EVB function.

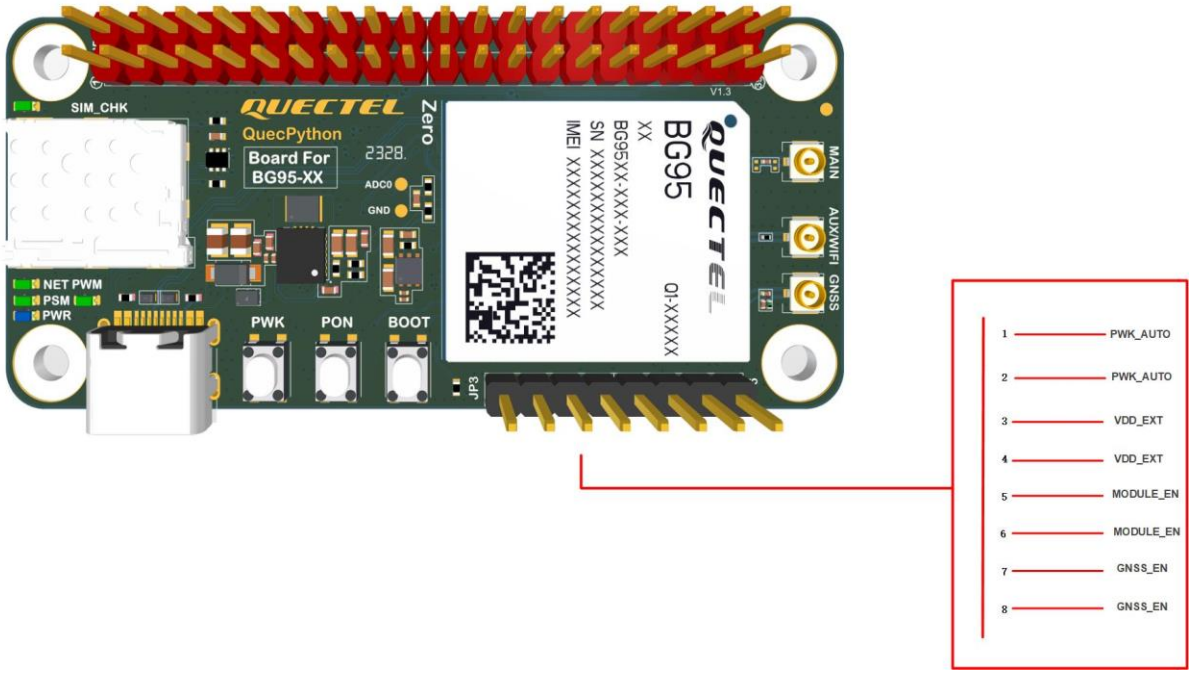


Figure 7: Pin Distribution of Eight Pin Headers

Table 4: Pin Definition of Eight Pin Headers

Pin No.	Function	Silkscreen
1	POWERKEY	PWK_AUTO
2	1.8 V	
3	1.8 V	VDD_EXT
4	VDD_EXT	
5	VBAT	MODULE_EN
6	3.6 V	
7	3.3 V	GNSS_EN
8	GNSS_EN	

- Pin 1 and pin 2: turn on automatically.
- Pin 3 and pin 4: after pin 3 and pin 4 are connected, they are used to supply power to the peripheral circuits; To measure the power consumption of the module, disconnect pin 3 and pin 4 [2].
- Pin 5 and pin 6: when pin 5 and pin 6 are connected, the USB power supply supplies power to the module through DCDC. Disconnect pin 5 and pin 6, and an external power supply can be connected to pin 5 to supply power to the module and measure power consumption.
- Pin 7 and pin 8: enable GNSS active power supply.

[2]Turn off the USB detection switch.

4 Mechanical Information

This chapter describes the mechanical dimensions of the BG95 series EVB.

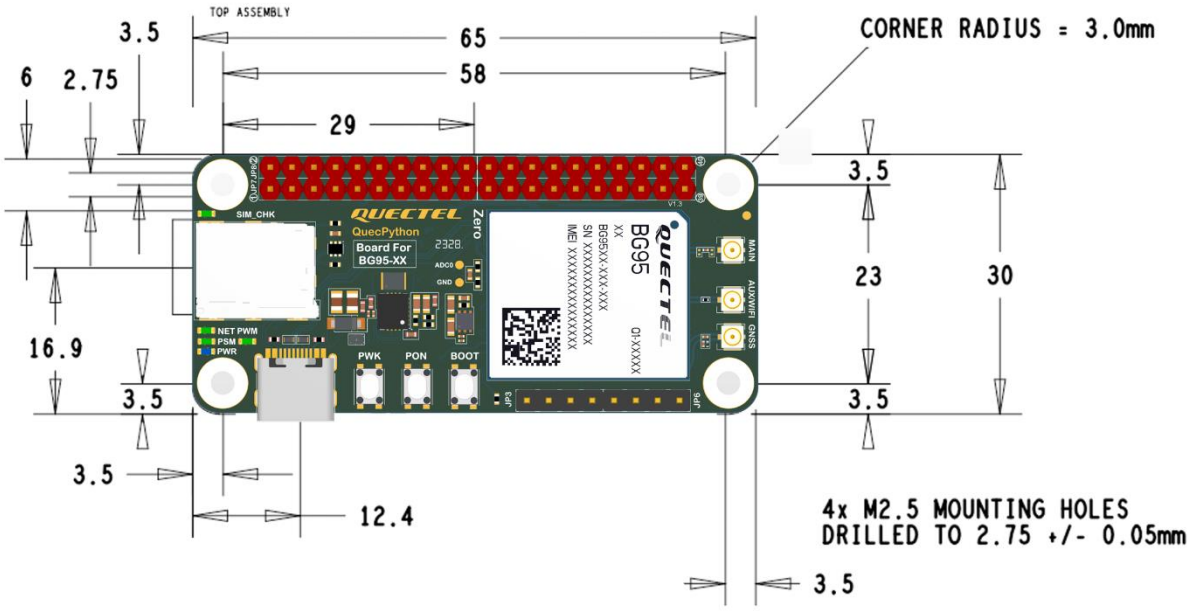


Figure 8: EVB Dimensions

5 RF Connector Recommendation

The EVB board is equipped with an RF connector (socket) for connecting antenna easily. Dimensions of antenna connectors are shown in the following figure.

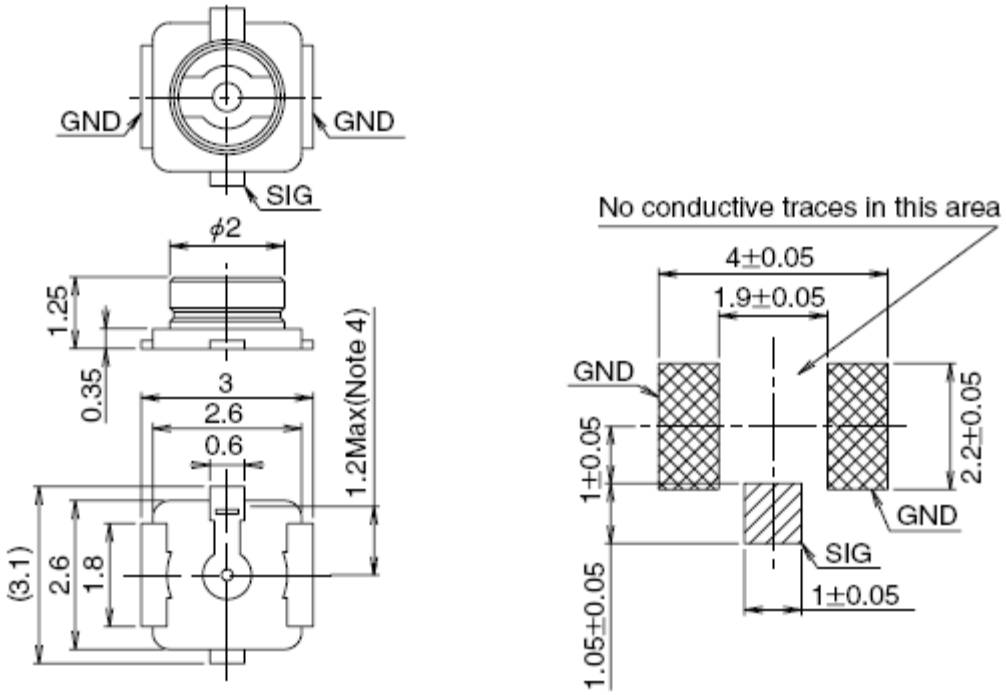


Figure 9: Dimensions of the Receptacle (Unit: mm)

U.FL-LP series mated plugs listed in the following figure can be used to match the U.FL-R-SMT connector.

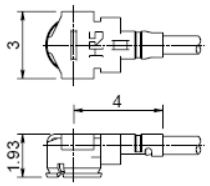
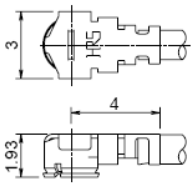
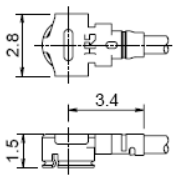
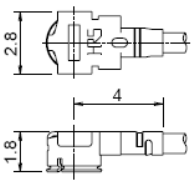
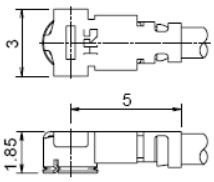
	U.FL-LP-040	U.FL-LP-066	U.FL-LP(V)-040	U.FL-LP-062	U.FL-LP-088
Part No.					
Mated Height	2.5mm Max. (2.4mm Nom.)	2.5mm Max. (2.4mm Nom.)	2.0mm Max. (1.9mm Nom.)	2.4mm Max. (2.3mm Nom.)	2.4mm Max. (2.3mm Nom.)
Applicable cable	Dia. 0.81mm Coaxial cable	Dia. 1.13mm and Dia. 1.32mm Coaxial cable	Dia. 0.81mm Coaxial cable	Dia. 1mm Coaxial cable	Dia. 1.37mm Coaxial cable
Weight (mg)	53.7	59.1	34.8	45.5	71.7
RoHS	YES				

Figure 10: Specifications of Mated Plugs (Unit: mm)

The following figure describes the space factor of mated connectors.

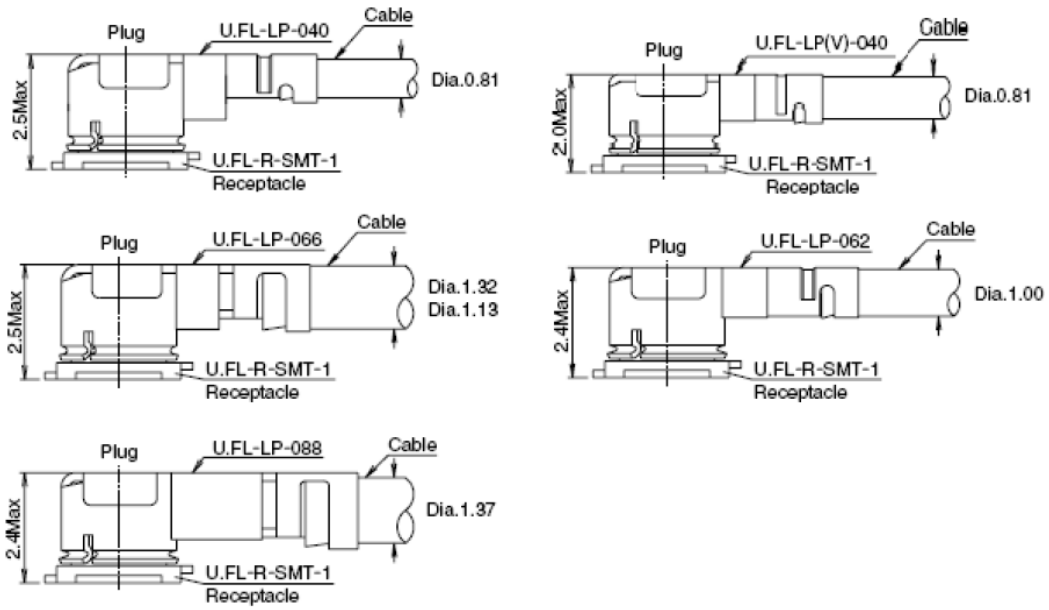


Figure 11: Space Factor of Mated Connectors (Unit: mm)

6 Reliability and Electrical Characteristics

This chapter mainly describes the power supply characteristics of EVB interfaces.

6.1. Power Supply Characteristics

The USB input voltage of the EVB is 4.8–5.5 V, and then it is converted by DCDC to 3.6 V power supply for the module. The power supply requirements are shown in the following tables:

Table 5: Input Power Supply Range

Parameters	Description	Min.	Typ.	Max.	Unit
V_I	USB power supply	4.8	5.0	5.5	V
V_I	Pin Header Power Supply	2.5	5.0	5.5	V
V_I	Battery Power Supply	2.5	4.2	5.5	V

Table 6: I/O Requirements

Parameters	Description	Min.	Max.	Unit
V_{IH}	High-level input voltage	0.7 × VCC	VCC + 0.3	V
V_{IL}	Low-level input voltage	-0.3	0.3 × VCC	V
V_{OH}	High-level output voltage	VCC - 0.5	VCC	V
V_{OL}	Low-level output voltage	0	0.4	V

NOTE

The typical value of VCC is 3.3 V.

7 Notification

7.1. Turn-on

The power-up scenario is illustrated in the following figure.

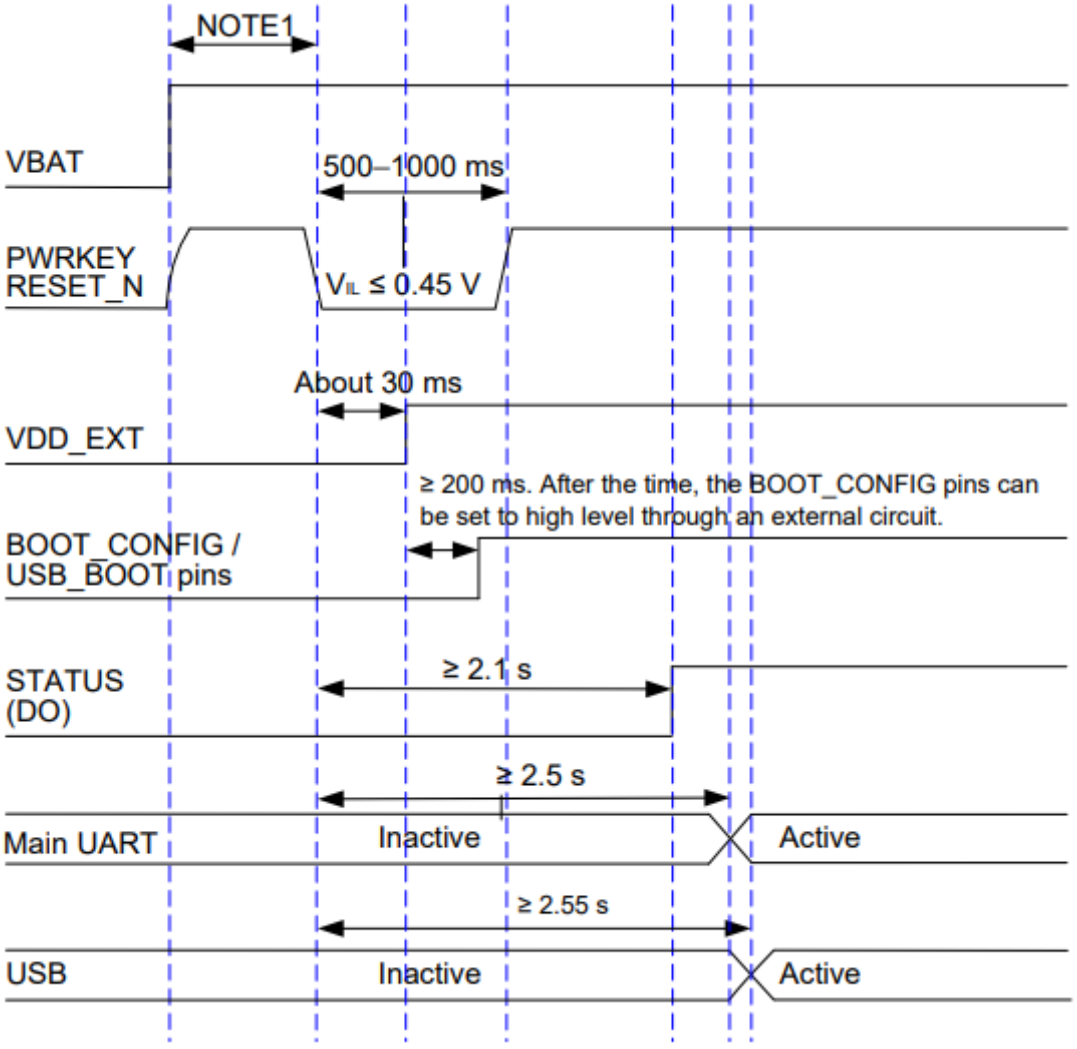


Figure 12: Timing of Turn-on with PWRKEY

NOTE

Make sure that VBAT is stable before pulling down PWRKEY pin. It is recommended that the time difference between powering up VBAT and pulling down PWRKEY pin is not less than 30 ms. If the module needs to turn on automatically but does not need turn-off function, short-circuit the two pins corresponding to the PWK_AUTO silkscreen among the pin headers.

8 Appendix

8.1. EVB Schematics

Click the link https://images.quectel.com/python/2023/12/BG95_Board_Sch_0829.pdf to download schematics of EVB.

8.2. EVB Silkscreen

Click the link https://images.quectel.com/python/sites/2/2024/01/BG95_Board_SILK_SCREEN.pdf to download the silkscreen figure of EVB.