

BC95-TE-B User Guide

NB-IoT Module Series

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History

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1 Introduction

In order to help customers to develop applications with Quectel BC95 module, Quectel supplies corresponding TE-B evaluation board to test the module. This document can help customers quickly understand BC95-TE-B interface specifications, electrical and mechanical details and know how to use it.

1.1. Safety Information

The following safety precautions must be observed during all phases of the operation, such as usage, service or repair of any cellular terminal or mobile incorporating BC95 module. Manufacturers of the cellular terminal should send the following safety information to users and operating personnel, and incorporate these guidelines into all manuals supplied with the product. If not so, Quectel assumes no liability for the customers' failure to comply with these precautions.



Full attention must be given 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. You must comply with laws and regulations restricting the use of wireless devices while driving.



Switch off the cellular terminal or mobile before boarding an aircraft. Make sure it is switched off. The operation of wireless appliances in an aircraft is forbidden, so as to prevent interference with communication systems. Consult the airline staff about the use of wireless devices on boarding the aircraft, if your device offers an Airplane Mode which must be enabled prior to boarding an aircraft.



Switch off your wireless device when in hospitals, clinics or other health care facilities. These requests are designed to prevent possible interference with sensitive medical equipment.



Cellular terminals or mobiles operating over radio frequency signal and cellular network cannot be guaranteed to connect in all conditions, for example no mobile fee or with an invalid (U)SIM card. While you are in this condition and need emergent help, please remember using emergency call. In order to make or receive a call, the cellular terminal or mobile must be switched on and in a service area with adequate cellular signal strength.



Your cellular terminal or mobile contains a transmitter and receiver. When it is ON, it receives and transmits radio frequency energy. RF interference can occur if it is used close to TV set, radio, computer or other electric equipment.



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

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2 Product Concept

BC95-TE-B is a NB-IoT evaluation board which supports Arduino interface. Designed in 74.0mm × 70.0mm × 1.6mm form factor, BC95-TE-B can be used either alone or in conjunction with STM32 Nucleo-64 development board, in order to develop and debug applications for communication with mobile network operators' infrastructure equipment through the NB-IoT radio protocol (3GPP Rel-13).

2.1. Key Features

The following table describes the detailed features of BC95-TE-B.

Table 1: Key Features of BC95-TE-B

Feature	Details
Power Supply	<p>USB interface: Supply voltage: 4.75V ~ 5.25V, typical supply voltage: 5.0V</p> <p>Arduino interface: Supply voltage: 4.75V ~ 5.25V, typical supply voltage: 5.0V</p>
Transmitting Power	23dBm±2dB
Temperature Range	<p>Operation temperature range: -30°C ~ +75°C¹⁾</p> <p>Extended temperature range: -40°C ~ +85°C²⁾</p>
USIM Interface	Only support 3.0V external USIM card
USB Interfaces	<p>Support two UART ports</p> <p>Main port (Ch A):</p> <ul style="list-style-type: none"> ● Used for AT command communication and data transmission, and the baud rate is 9600bps ● Main port can also be used for firmware upgrading, and the baud rate is 115200bps ● When the module is communicating with MCU, please keep Ch A unconnected. <p>Debug port (Ch B):</p> <ul style="list-style-type: none"> ● Debug port is used for debugging ● Only support 921600bps baud rate

Arduino Interface	Used to connect with STM32 Nucleo-64 development board
RESET Button	Used to reset BC95 module
Physical Characteristics	Size: (74.0±0.15)mm × (70.0±0.15)mm × (1.6±0.2mm)
Firmware Upgrade	Firmware upgrade via main port or DFOTA ³⁾
Antenna Interface	Connected to antenna pad with 50 ohm impedance control

NOTES

- ¹⁾ Within operation temperature range, the module is 3GPP compliant.
- ²⁾ Within extended temperature range, the module remains the ability to establish and maintain an SMS, data transmission, etc. There is no unrecoverable malfunction. There are also no effects on radio spectrum and no harm to radio network. Only one or more parameters like P_{out} might reduce in their value and exceed the specified tolerances. When the temperature returns to the normal operating temperature levels, the module will meet 3GPP specifications again.
- ³⁾ DFOTA function is only supported on B657 version or later.

2.2. Functional Diagram

The following figure shows a block diagram of BC95-TE-B.

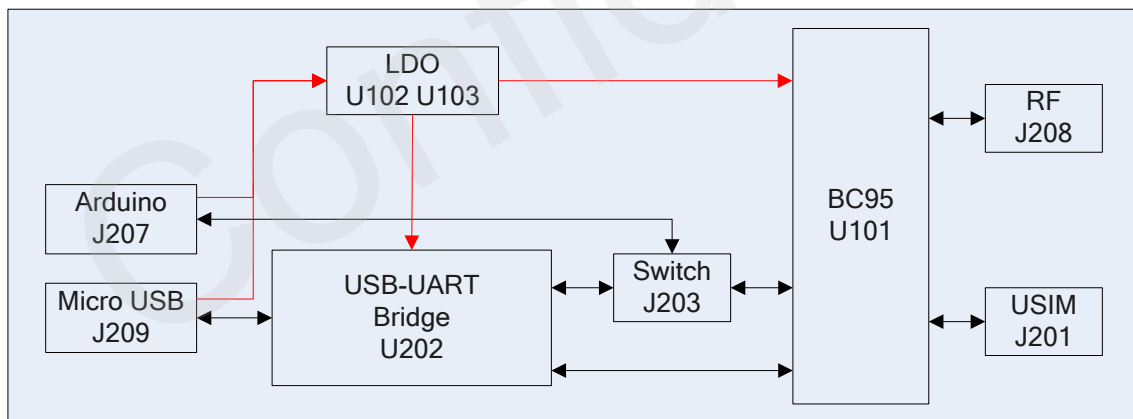


Figure 1: Functional Diagram of BC95-TE-B

2.3. Interface Distribution Diagram

The following figure shows an interface distribution diagram of BC95-TE-B.

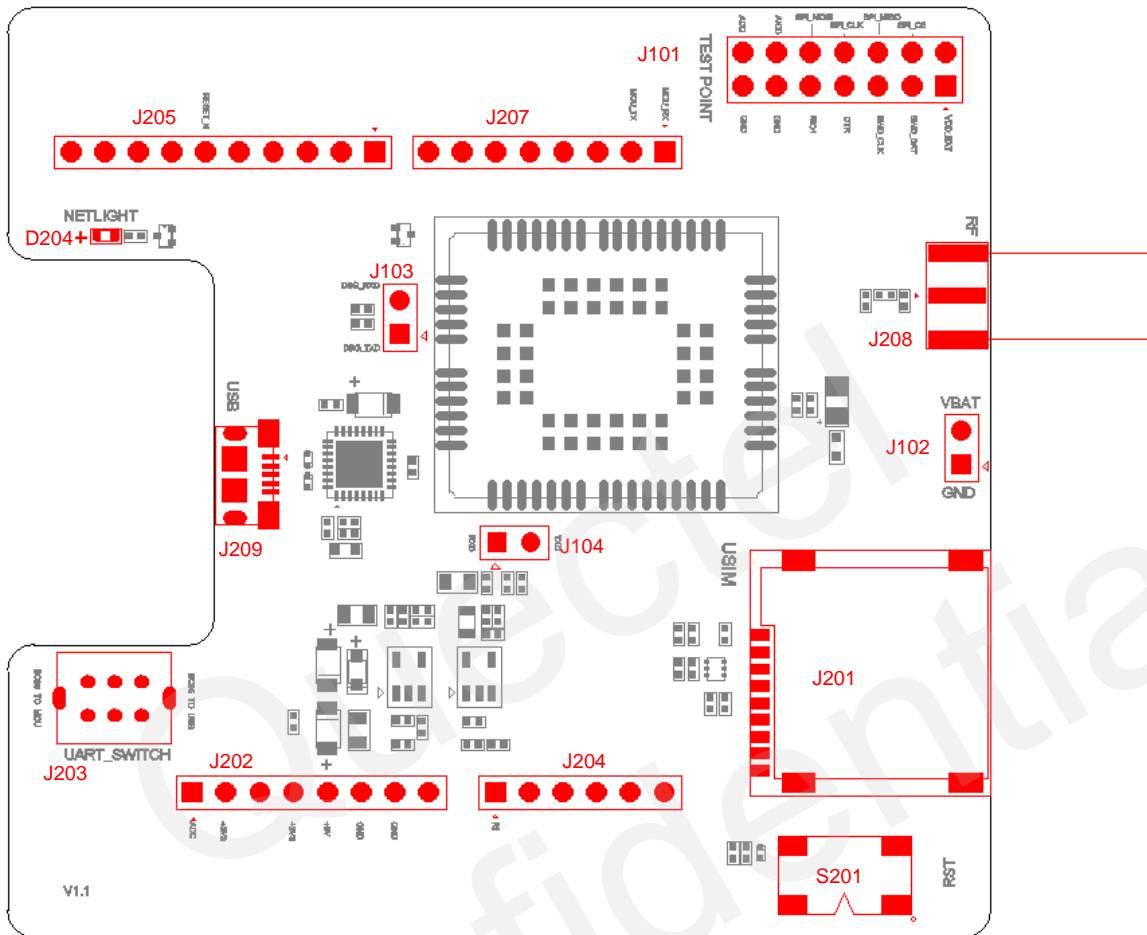


Figure 2: Interface Distribution Diagram of BC95-TE-B

The table below shows the description of BC95-TE-B interfaces.

Table 2: Interfaces of BC95-TE-B

Interface	Designator	Description
Power Supply	J209	Power supply for USB interface
	J202	Power supply for Arduino interface
USB Interface	J209	Support two UART ports
USIM Card Interface	J201	Micro USIM card connector

Arduino Interface	J202, J204, J205, J207	Standard Arduino interface
RF Antenna Interface	J208	RF SMA connector
UART Switch	J203	Used to switch communication objects of BC95 main port: “BC95 TO USB” or “BC95 TO MCU”
RESET Button	S201	Used to reset BC95 module
LED Indicator	D204	Used to indicate network status
Test Points	J101, J102, J103, J104	Used to test the basic functionalities of BC95 module

2.4. Arduino Interface Definition

The following figure shows the Arduino interface definition of BC95-TE-B.

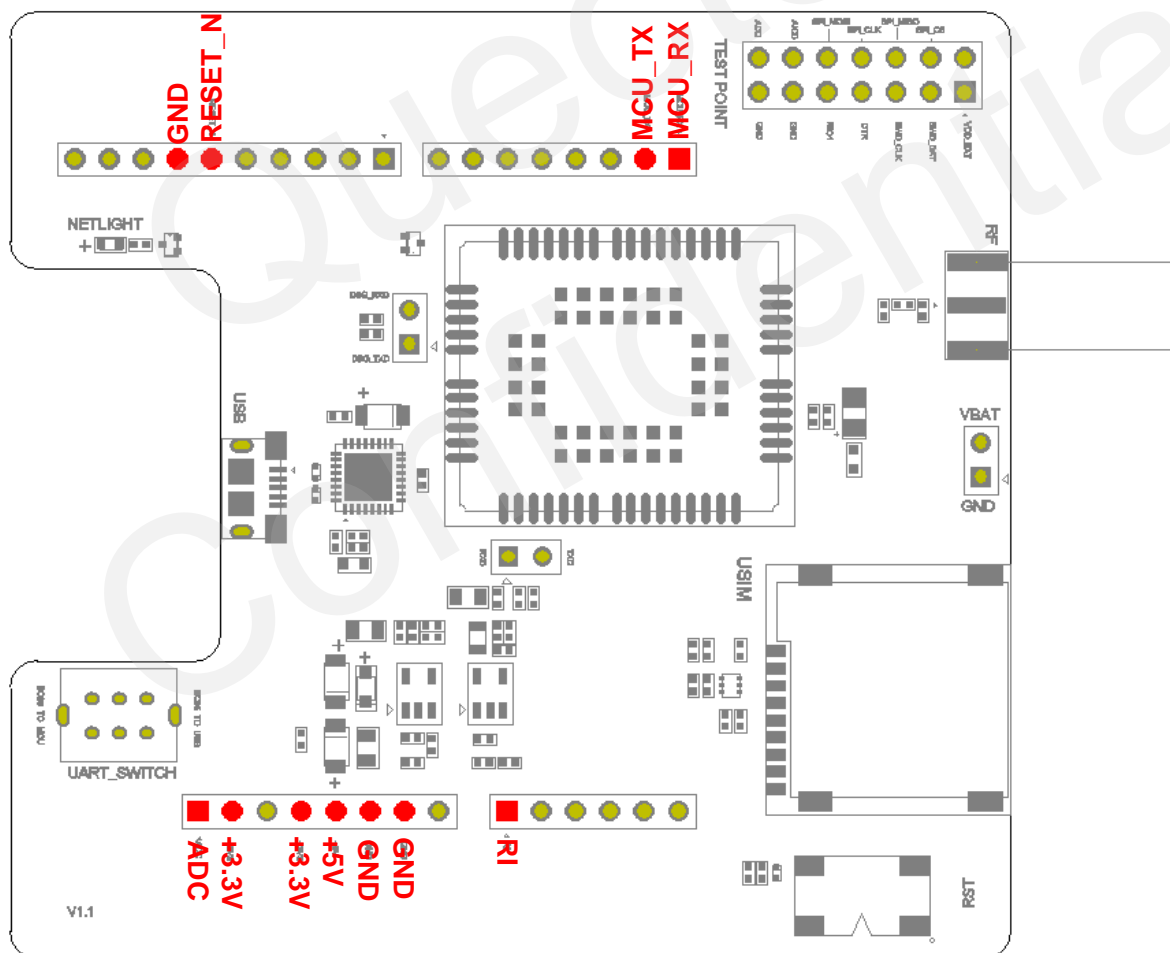


Figure 3: Arduino Interface Definition

3 Operation Procedures

This chapter mainly illustrates the operation procedures of BC95-TE-B. BC95-TE-B can be used alone to upgrade and debug NB-IoT applications based on BC95-TE-B. Meanwhile, it can also be used in conjunction with an STM32 Nucleo-64 development board via Arduino interface to develop NB-IoT applications based on STM32. The following part describes the two ways of using BC95-TE-B in detail.

3.1. Operation Procedures with Single Board

This section elaborates the operation procedures of using the BC95-TE-B alone.

3.1.1. Interface Diagram of Using BC95-TE-B Alone

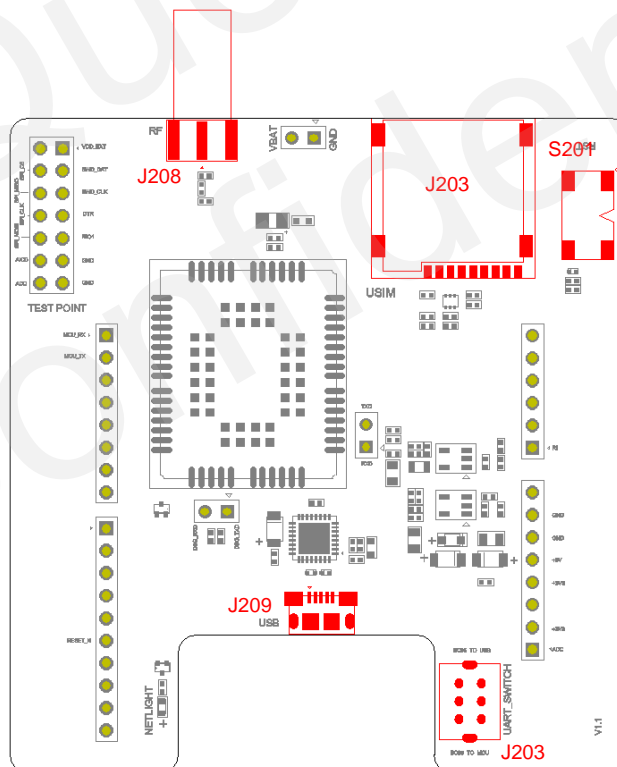


Figure 4: Interface Diagram of Using BC95-TE-B Alone

3.1.2. Operation Procedures of Using BC95-TE-B Alone

1. Install USB-UART driver, which can be downloaded from the following address:
<https://www.exar.com/product/interface/uarts/usb-uarts/xr21v1412>;
2. Insert Micro USIM card into J203, please choose an appropriate USIM card according to hardware versions of BC95 module.
3. Connect a rod antenna with SMA connector on J208;
4. Switch “**UART_SWITCH**” to “BC95 TO USB” state;
5. Connect the J209 with PC via Micro USB cable. After turning on BC95-TE-B, UART port information will be shown on device manager of PC. CH A is the main port and can be used for AT command communication and firmware upgrading. CH B is the debug port and can be used to view log. For details of port configuration, please refer to **document [1]**.



Figure 5: UART Ports Displayed on PC

NOTE

In this process, S201 can be used to reset the BC95 module.

3.2. Operation Procedures with Multi Boards

This section elaborates the operation procedures of using the BC95-TE-B in conjunction with an STM32 Nucleo-64 development board.

3.2.1. Interface Diagram of Using Multi Boards

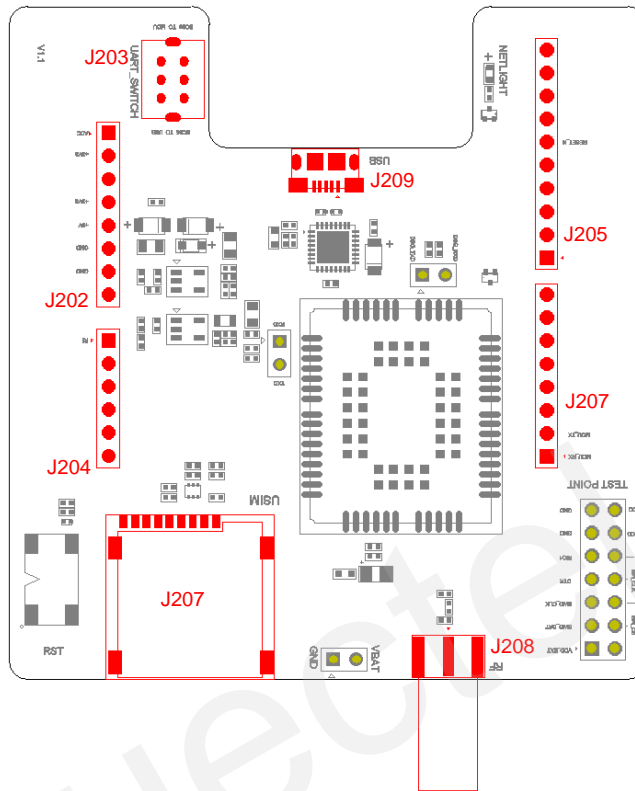


Figure 6: Interface Diagram of Using Multi Boards

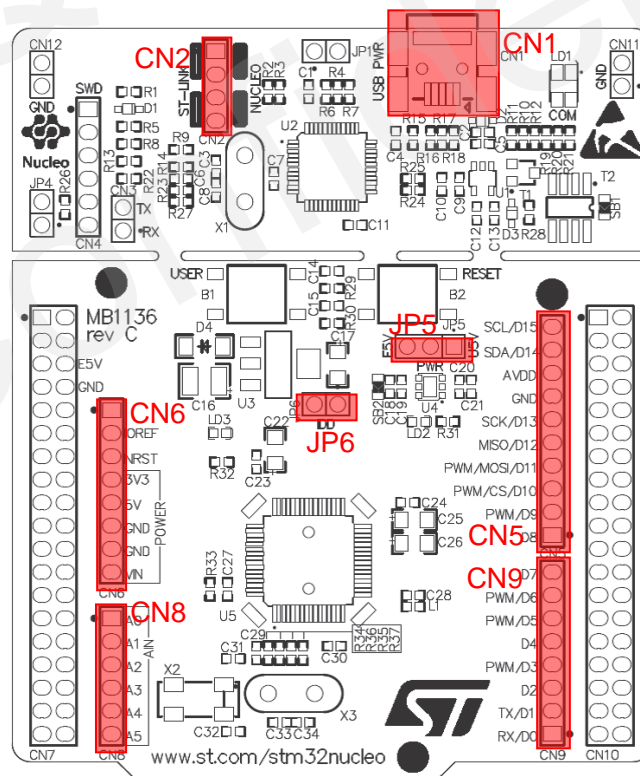


Figure 7: STM32-Nucleo Interface Diagram (Top View)

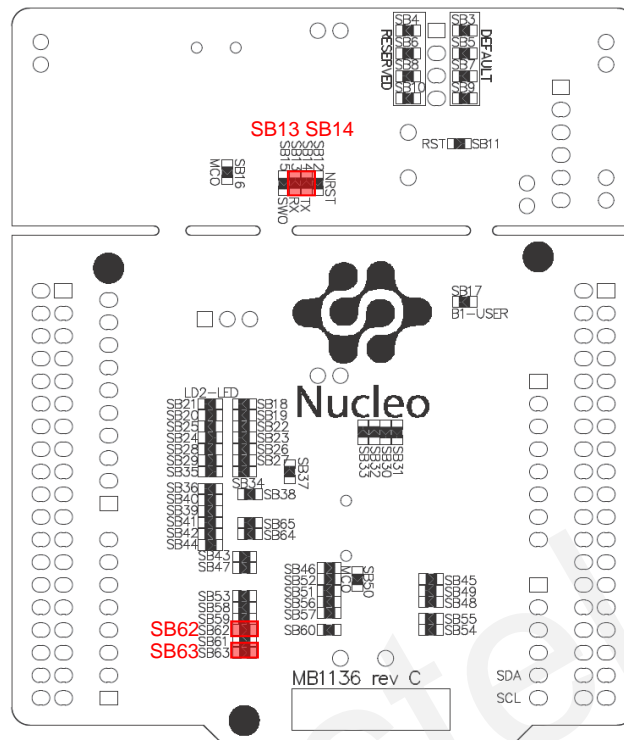


Figure 8: STM32-Nucleo Modification Diagram (Bottom View)

3.2.2. Operation Procedures of Using Multi Boards

1. Install driver for STM32-Nucleo board, which can be downloaded from the following address:
http://www.st.com/content/st_com/en/products/evaluation-tools/product-evaluation-tools/mcu-eval-tools/stm32-mcu-eval-tools/stm32-mcu-nucleo/nucleo-l476rg.html;
2. Install USB-UART driver, which can be downloaded from the following address:
<https://www.exar.com/product/interface/uarts/usb-uarts/xr21v1412>;
3. Remove 0 ohm resistors of SB13 and SB14 by soldering iron, and then solder them onto SB62 and SB63 respectively;
4. Short-circuit pin 1 & 2 of CN2, pin 3 & 4 of CN2, pin 1 & 2 of JP5 and pin 1 & 2 of JP6;
5. Insert Micro USIM card into J203, please choose an appropriate USIM card according to hardware versions of BC95 module.
6. Connect rod antenna with SMA connector on J208;
7. Switch "UART_SWITCH" to "BC95 TO MCU" state;
8. Connect Arduino interface to STM32-Nucleo board, and connect J202, J204, J205 and J207 of BC95-TE-B to CN6, CN8, CN5 and CN9 respectively.
9. Connect CN1 of STM32-Nucleo board with PC via Mini USB cable. After powering on BC95 module, device information will be shown on the device manager of PC.

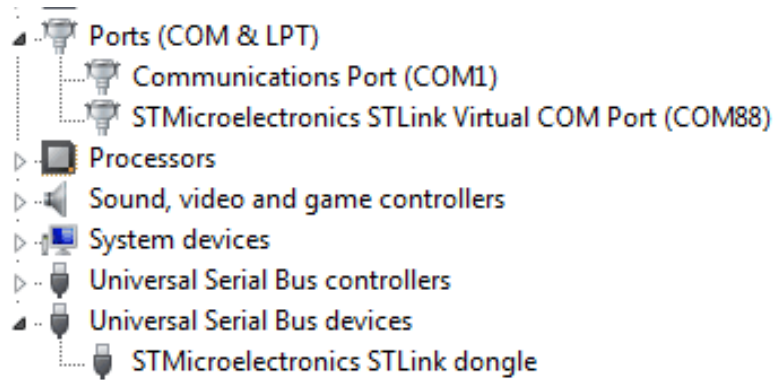


Figure 9: ST-LINK Interface Displayed on PC

3.2.3. Description of Pin Connection

The table below shows the pin connection between BC95-TE-B and STM32-L476RG MCU.

Table 3: Pin Connection between BC95-TE-B and STM32-L476RG MCU

No.	MCU (Morpho)	Arduino	BC95-TE-B	Remark
1	PA2	D1	CN9-2	MCU_RX Main port RX
2	PA3	D0	CN9-1	MCU_TX Main port TX
3	PA0	A0	CN8-1	RI
4	PA5	D13	CN5-6	RESET_N Active high
5	NC	NC	CN6-1	ADC
6	+3V3	+3V3	CN6-2, 4	+3.3V 3.3V power supply
7	+5V	+5V	CN6-5	+5V 5.0V power supply
8	GND	GND	CN5-7, CN6-6, 7	GND Ground

The following figure shows the pin connection between BC95-TE-B and STM32-L476RG MCU.

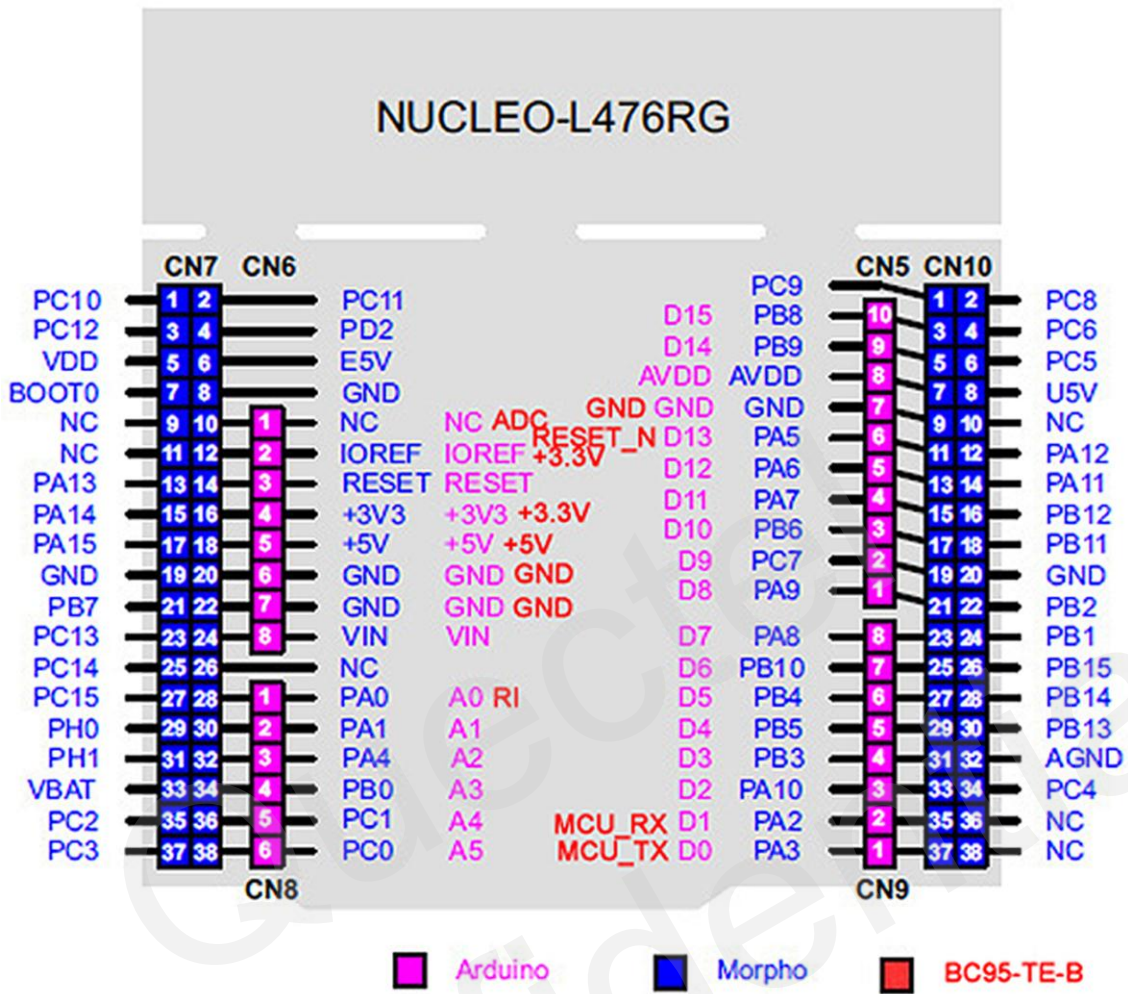


Figure 10: Pin Connection between BC95-TE-B and STM32-L476RG MCU

4 Electrical and Reliability

4.1. Absolute Maximum Ratings

Absolute maximum ratings for power supply and voltage on digital and analog pins of the BC95 module are listed in the following table.

Table 4: Absolute Maximum Ratings

Parameter	Min.	Max.	Unit
+5V	-0.3	6	V
VBAT	-0.3	+4.25	V
Current of Power Supply	0	0.3	A
Voltage at Digital Pins	-0.3	+3.3	V
Voltage at Analog Pins	-0.3	+4.25	V
Voltage at Digital/Analog Pins in Power Down Mode	-0.25	+0.25	V

4.2. Operating Temperature

The operating temperature is listed in the following table.

Table 5: Operating Temperature

Parameter	Min.	Typ.	Max.	Unit
Operation Temperature Range ¹⁾	-30	+25	+75	°C
Extended Temperature Range ²⁾	-40		+85	°C

NOTES

- 1) Within operation temperature range, the module is 3GPP compliant.
- 2) Within extended temperature range, the module remains the ability to establish and maintain an SMS, data transmission, etc. There is no unrecoverable malfunction. There are also no effects on radio spectrum and no harm to radio network. Only one or more parameters like P_{out} might reduce in their value and exceed the specified tolerances. When the temperature returns to the normal operating temperature levels, the module will meet 3GPP specifications again.

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5 Mechanical Dimensions

This chapter describes the mechanical dimensions of BC95-TE-B. All dimensions are measured in mm. The tolerances for dimensions are $\pm 0.15\text{mm}$.

5.1. Mechanical Dimensions of BC95-TE-B

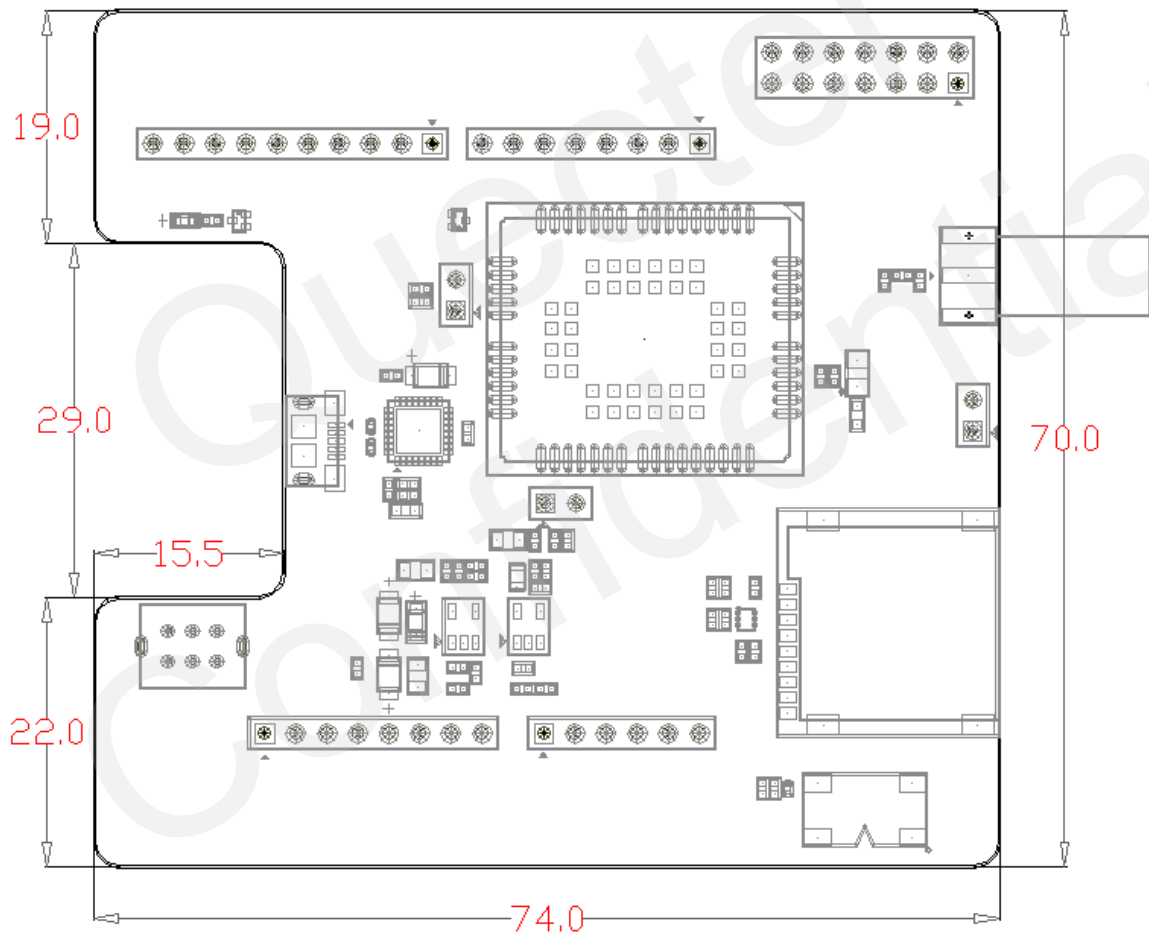


Figure 11: Dimensions of BC95-TE-B (Top View)

5.2. Design Effect Drawings of BC95-TE-B

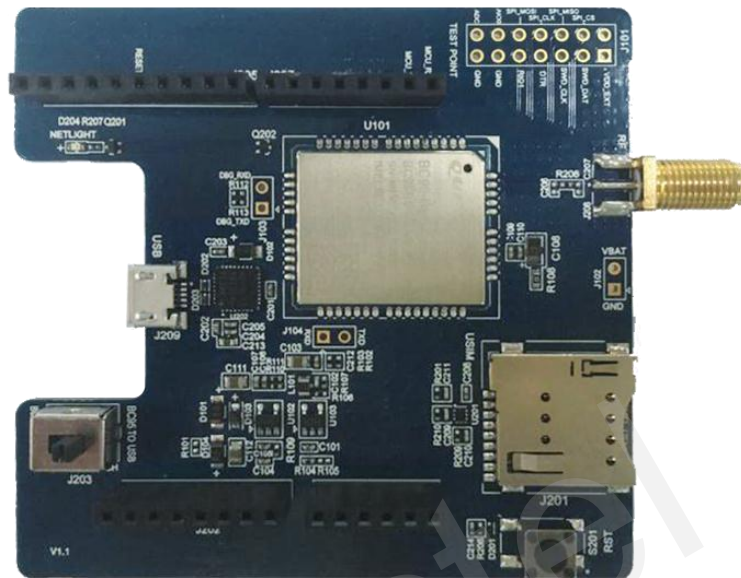


Figure 12: Top View of the BC95-TE-B



Figure 13: Bottom View of the BC95-TE-B

NOTE

These are design effect drawings of BC95-TE-B. For more accurate pictures, please refer to the BC95-TE-B that you get from Quectel.

6 Appendix A References

Table 6: Related Documents

No.	Document Name	Remark
[1]	Quectel_BC95_Hardware_Design	BC95 hardware design specifications

Table 7: Terms and Abbreviations

Abbreviation	Description
IC	Integrated Circuit
MCU	Microcontroller Unit
NB-IoT	Narrow Band Internet of Things
UART	Universal Asynchronous Receiver & Transmitter
USB	Universal Serial Bus
USIM	Universal Subscriber Identification Module