

BC68-TE-B User Guide

NB-IoT Module Series

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About the Document

History

Revision	Date	Author	Description
1.0	2017-11-24	Brooke WANG	Initial
1.1	2018-03-17	Power JIN	<ol style="list-style-type: none">1. Added external power supply interface.2. Updated pin definition of Arduino interface in Chapter 2.4.3. Updated pin connection of PA0 and PA1 in Chapter 3.2.3.

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1 Introduction

In order to help customers to develop applications with Quectel BC68 module, Quectel supplies corresponding TE-B evaluation board to test the module. This document can help customers quickly understand BC68-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 BC68 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.

2 Product Concept

BC68-TE-B is a NB-IoT evaluation board which supports Arduino interface. Designed in 70.0mm × 74.0mm × 1.6mm form factor, BC68-TE-B can be used either alone or in conjunction with STM32 Nucleo-64 development board, to develop and debug applications for communication with mobile network operators' infrastructure equipment through the NB-IoT radio protocol (3GPP Rel-14).

2.1. Key Features

The following table describes the detailed features of BC68-TE-B.

Table 1: Key Features of BC68-TE-B

Feature	Details
Power Supply	<p>USB interface: Supply voltage: 4.75V~5.25V, typical supply voltage: 5.0V</p> <p>Arduino interfaces: Supply voltage: 4.75V~5.25V, typical supply voltage: 5.0V</p> <p>External Power supply interface: Supply voltage: 5.0V</p>
Transmitting Power	23dBm±2dB
Temperature Range	<p>Operation temperature range: -35°C ~ +75°C¹⁾</p> <p>Extended temperature range: -40°C ~ +85°C²⁾</p> <p>Storage temperature range: -40°C ~ +90°C</p>
USIM Interface	Support 1.8V/3.0V external Class B USIM card
USB Interface	<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 supports 4800bps, 9600bps (default) and 115200bps baud rate ● Main port can also be used for firmware upgrading, and the baud rate is 921600bps ● 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 supports 921600bps baud rate
Arduino Interfaces	Used to connect with STM32 Nucleo-64 development board
RESET Button	Used to reset BC68 module
Physical Characteristics	Size: (70.0±0.15)mm × (74.0±0.15)mm × (1.6±0.15mm)
Firmware Upgrade	Firmware upgrade via main port or DFOTA
Antenna Interface	Connected to antenna pad with 50Ω 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.

2.2. Functional Diagram

The following figure shows a block diagram of BC68-TE-B.

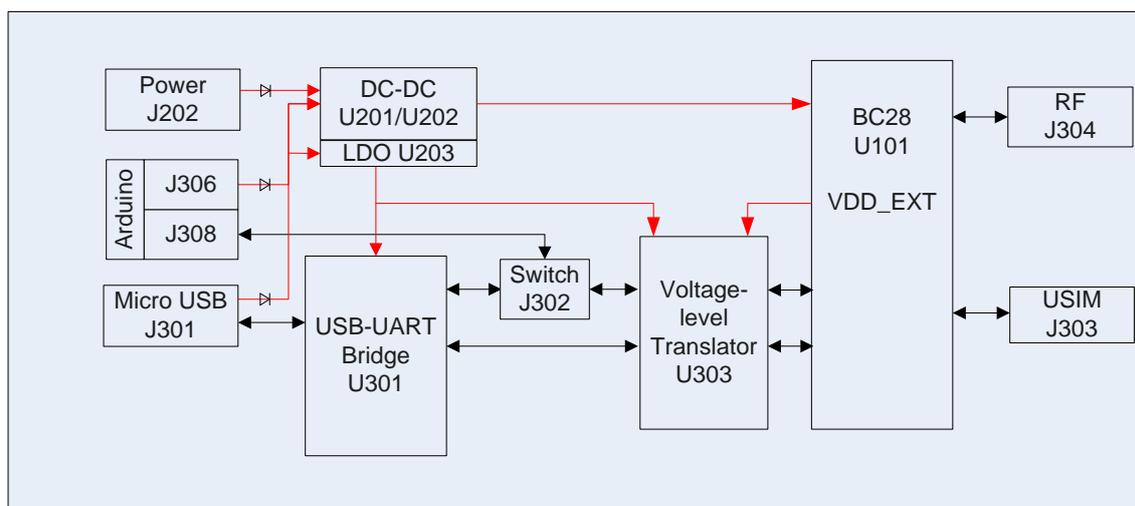


Figure 1: Functional Diagram of BC68-TE-B

2.3. Interface Distribution Diagram

The following figure shows an interface distribution diagram of BC68-TE-B.

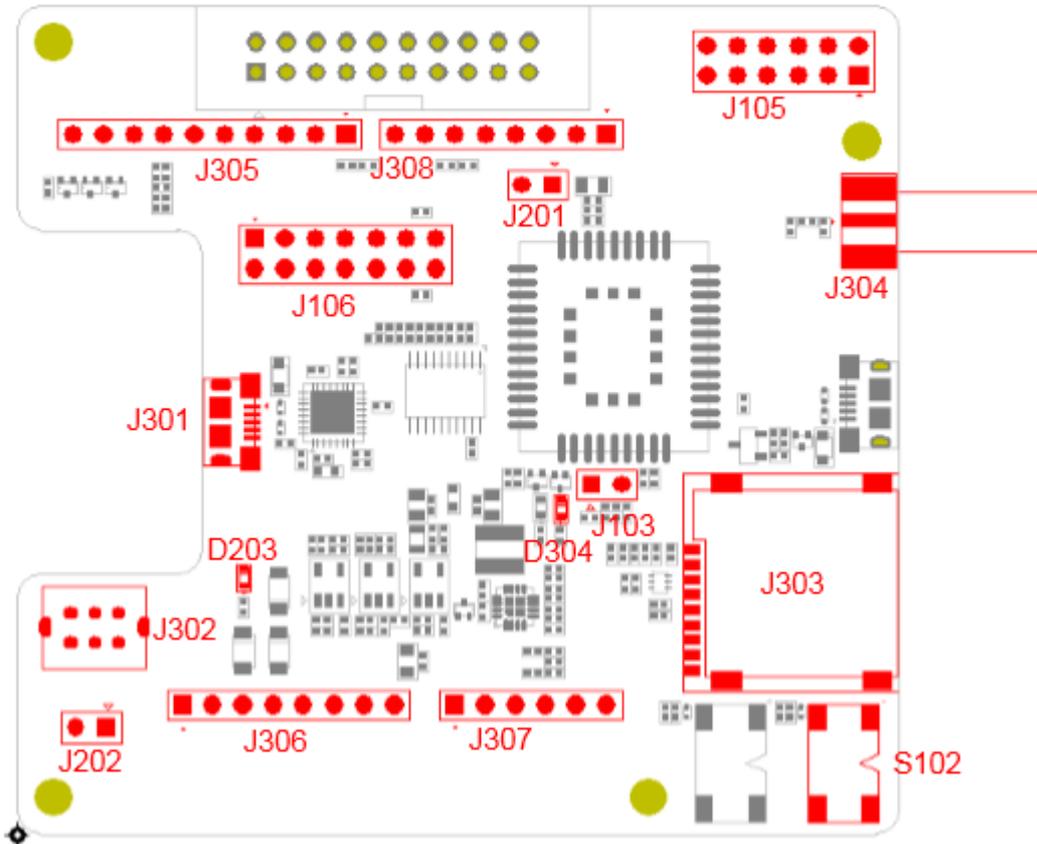


Figure 2: Interface Distribution Diagram of BC68-TE-B

The table below shows the description of BC68-TE-B interfaces.

Table 2: Interfaces of BC68-TE-B

Interface	Designator	Description
Power Supply	J301	Power supply for USB interface
	J306	Power supply for Arduino interfaces
	J202	External power supply interface
USB Interface	J301	Support two UART ports

USIM Interface	J303	Micro USIM card connector
Arduino Interfaces	J305, J306, J307, J308	Standard Arduino interfaces
RF Antenna Interface	J304	RF SMA connector
UART Switch	J302	Used to switch communication objects of BC68 main port [MCU←→USB (Ch A)]
RESET Button	S102	Used to reset BC68 module
LED Indicator	D203	Used to indicate power ON/OFF status
	D304	Used to indicate network connectivity status
Test Points	J103, J105, J106, J201	Used to test the basic functionalities of BC68 module

2.4. Pin Definition of Arduino

The following figure shows the pin definition of Arduino interface.

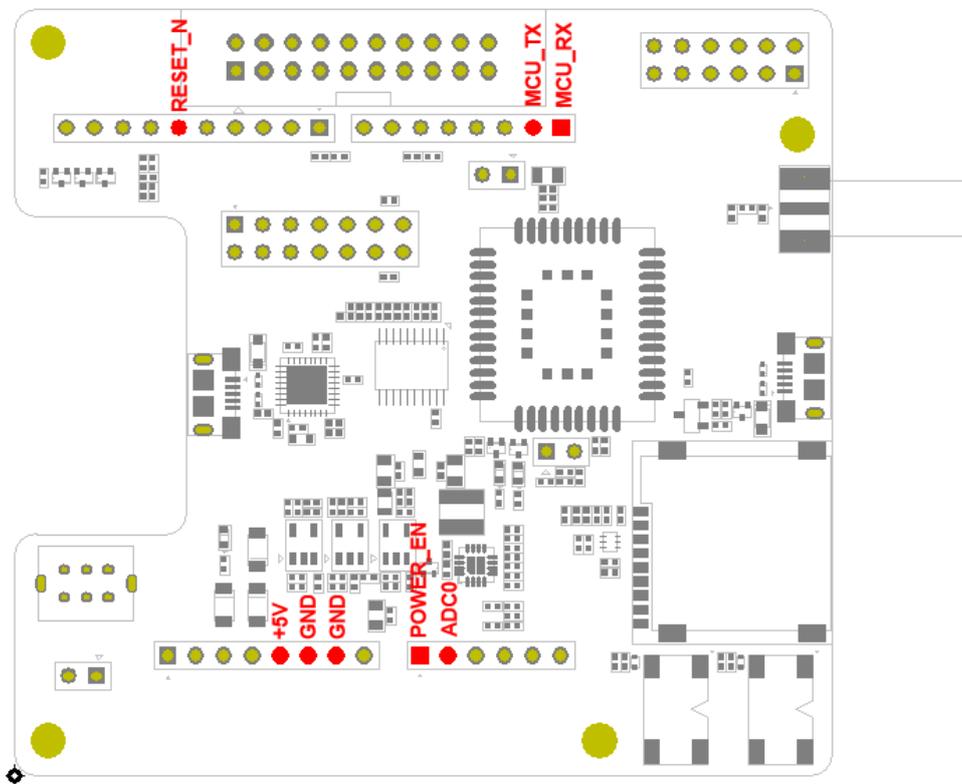


Figure 3: Pin Definition of Arduino Interface

3 Operation Procedures

This chapter mainly illustrates the operation procedures of BC68-TE-B. BC68-TE-B can be used alone to upgrade and debug NB-IoT applications based on BC68-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 BC68-TE-B in detail.

3.1. Operation Procedures with Single Board

This section elaborates the operation procedures of using the BC68-TE-B alone.

3.1.1. Interface Diagram of Using BC68-TE-B Alone

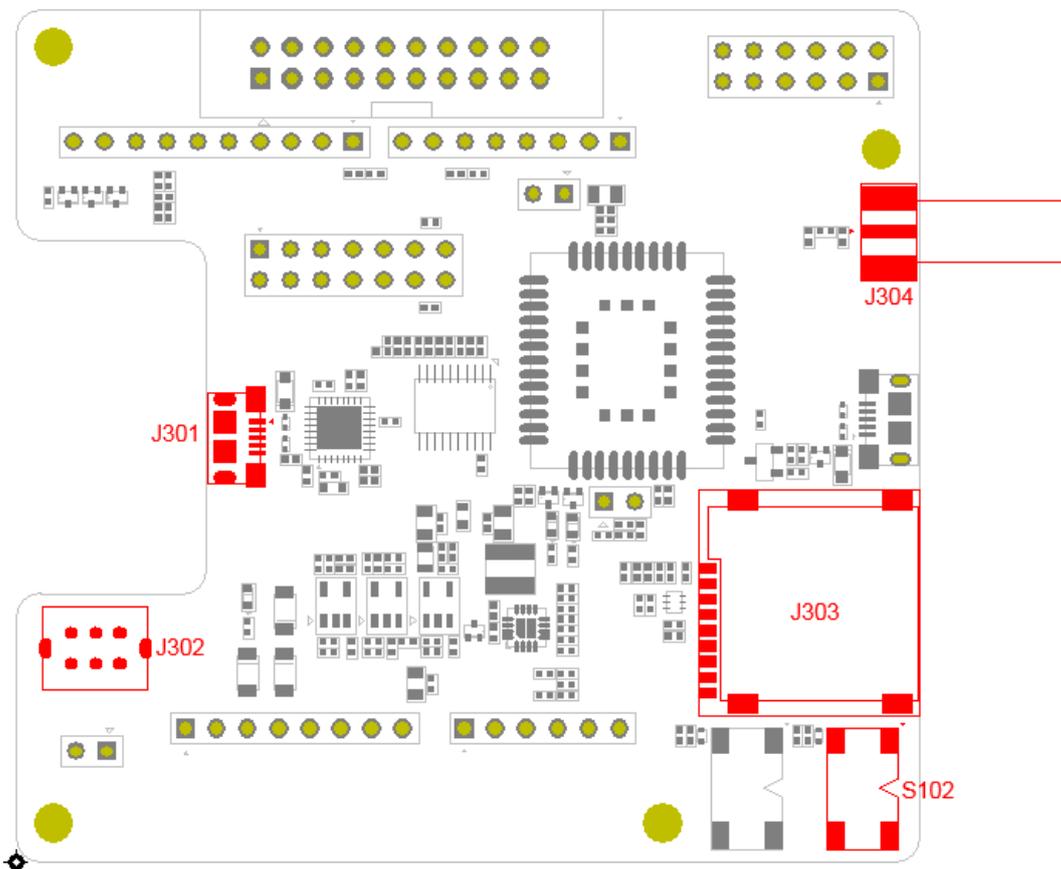


Figure 4: Interface Diagram of Using BC68-TE-B Alone

3.1.2. Operation Procedures of Using BC68-TE-B Alone

1. Install USB-UART driver, which can be downloaded from the following address:
<https://www.exar.com/product/interface/uarts/usb-uart/xr21v1412>;
2. Insert Micro USIM card into J303, please choose an appropriate USIM card according to hardware versions of BC68 module;
3. Connect a rod antenna with SMA connector on J304;
4. Switch J302 (UART Switch) to “**MAIN UART TO USB**” state;
5. Connect the J301 with PC via Micro USB cable. After turning on BC68-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, S102 can be used to reset the BC68 module.

3.2. Operation Procedures with Multi Boards

This section elaborates the operation procedures of using the BC68-TE-B in conjunction with an STM32 Nucleo-64 development board.

3.2.1. Interface Diagram of Using Multi Boards

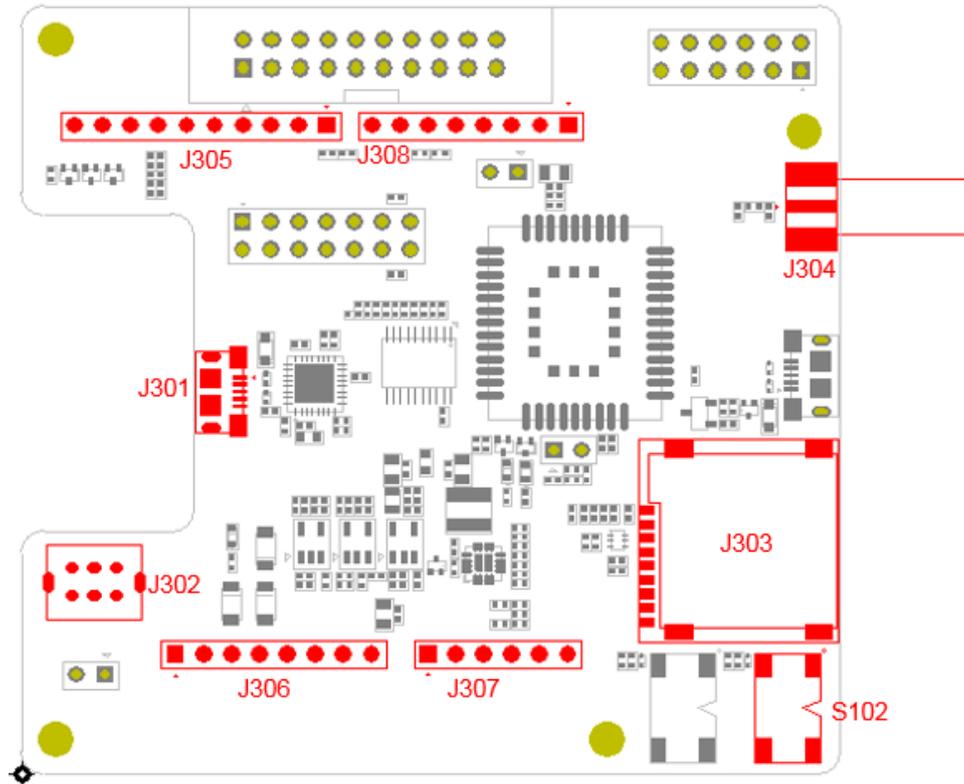


Figure 6: Interface Diagram of Using Multi Boards

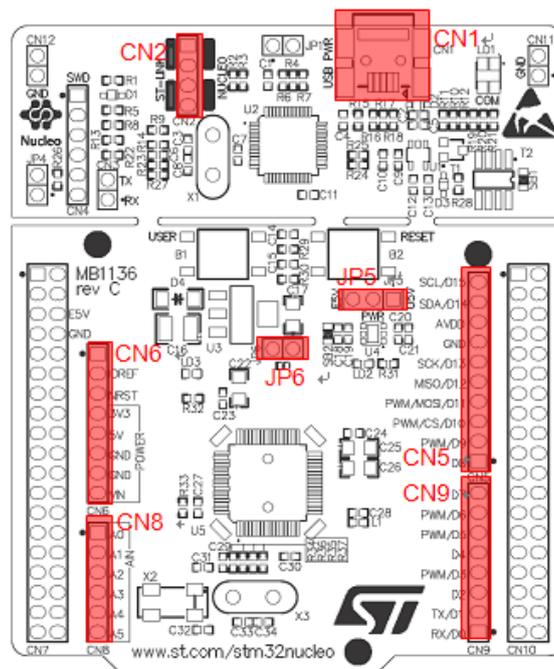


Figure 7: STM32-Nucleo Interface Diagram (Top View)

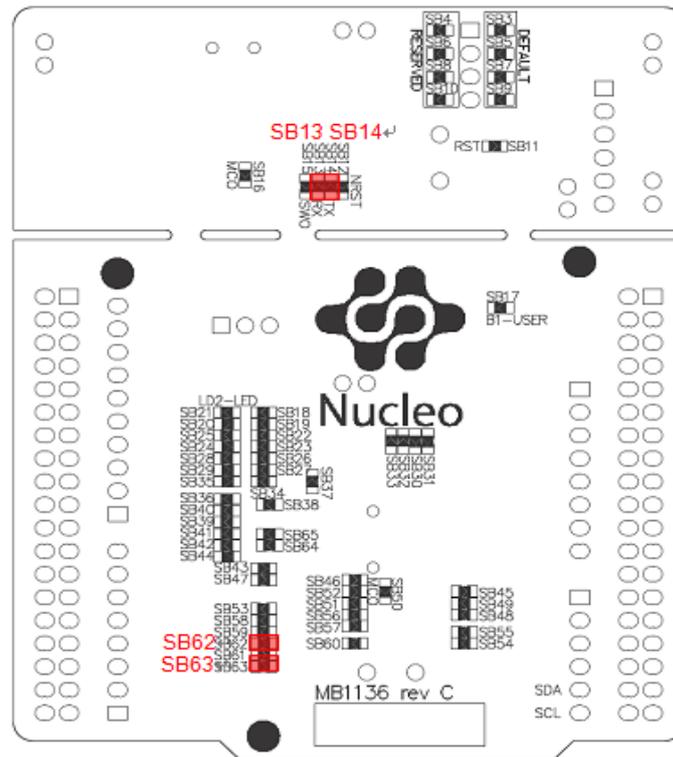


Figure 8: STM32-Nucleo Modification Diagram (Bottom View)

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 J303, and please choose an appropriate USIM card according to hardware versions of BC68 module;
6. Connect rod antenna with SMA connector on J304;
7. Switch J302 (UART Switch) to “MAIN UART TO MCU” state;
8. Connect Arduino interface to STM32-Nucleo board, and connect J305, J306, J307 and J308 of BC68-TE-B to CN5, CN6, CN8 and CN9 respectively;
9. Connect CN1 of STM32-Nucleo board with PC via Mini USB cable. After powering on BC68 module, device information will be shown on the device manager of PC.

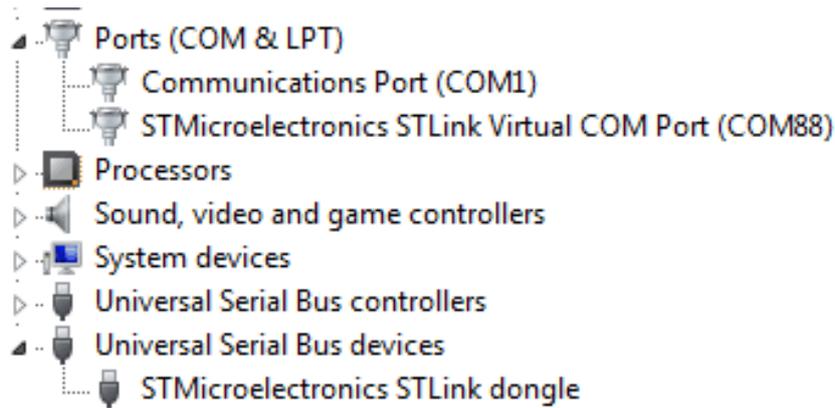


Figure 9: ST-LINK Interface Displayed on PC

3.2.3. Description of Pin Connection

The table below shows the pin connection between BC68-TE-B and STM32-L476RG MCU.

Table 3: Pin Connection between BC68-TE-B and STM32-L476RG MCU

No.	MCU (Morpho)	Arduino	BC68-TE-B	Remark
1	PA2	D1	CN9-2	MCU_TX Main port RX
2	PA3	D0	CN9-1	MCU_RX Main port TX
3	PA1	A1	CN8-2	ADC0 Analog to Digital
4	PA5	D13	CN5-6	RESET_N Active high
5	PA0	A0	CN8-1	POWER_EN DC-DC enable
6	+5V	+5V	CN6-5	+5V 5.0V power supply
7	GND	GND	CN6-6, 7	GND Ground

The following figure shows the pin connection between BC68-TE-B and STM32-L476RG MCU.

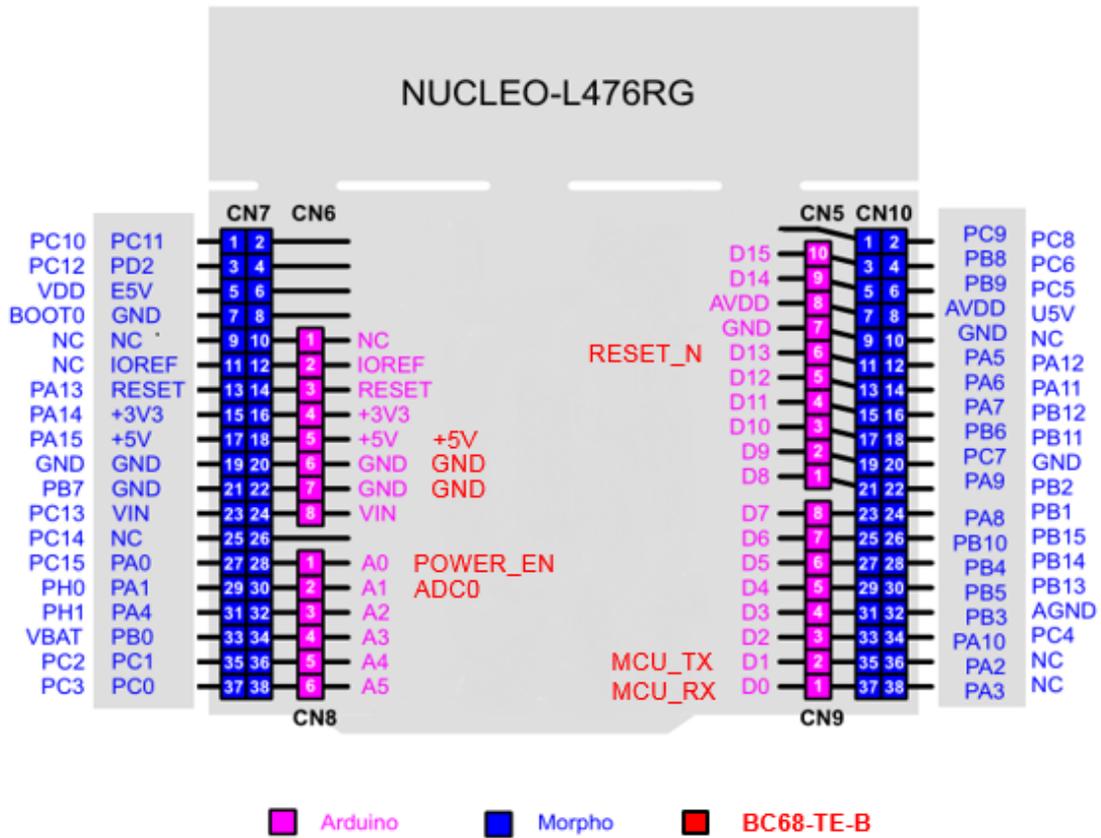


Figure 10: Pin Connection between BC68-TE-B and STM32-L476RG MCU

4 Electrical and Reliability

4.1. Absolute Maximum Ratings

Absolute maximum ratings for power supply and voltage on digital and analog pins of the BC68 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	0.8	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 and Storage Temperatures

The operating and storage temperatures are listed in the following table.

Table 5: Operating and Storage Temperatures

Parameter	Min.	Typ.	Max.	Unit
Operation Temperature Range ¹⁾	-35	+25	+75	°C
Extended Temperature Range ²⁾	-40		+85	°C

Storage Temperature Range	-40	+90	°C
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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.

5 Mechanical Dimensions

This chapter describes the mechanical dimensions of BC68-TE-B. All dimensions are measured in mm. The tolerances for dimensions are $\pm 0.15\text{mm}$.

5.1. Mechanical Dimensions of BC68-TE-B

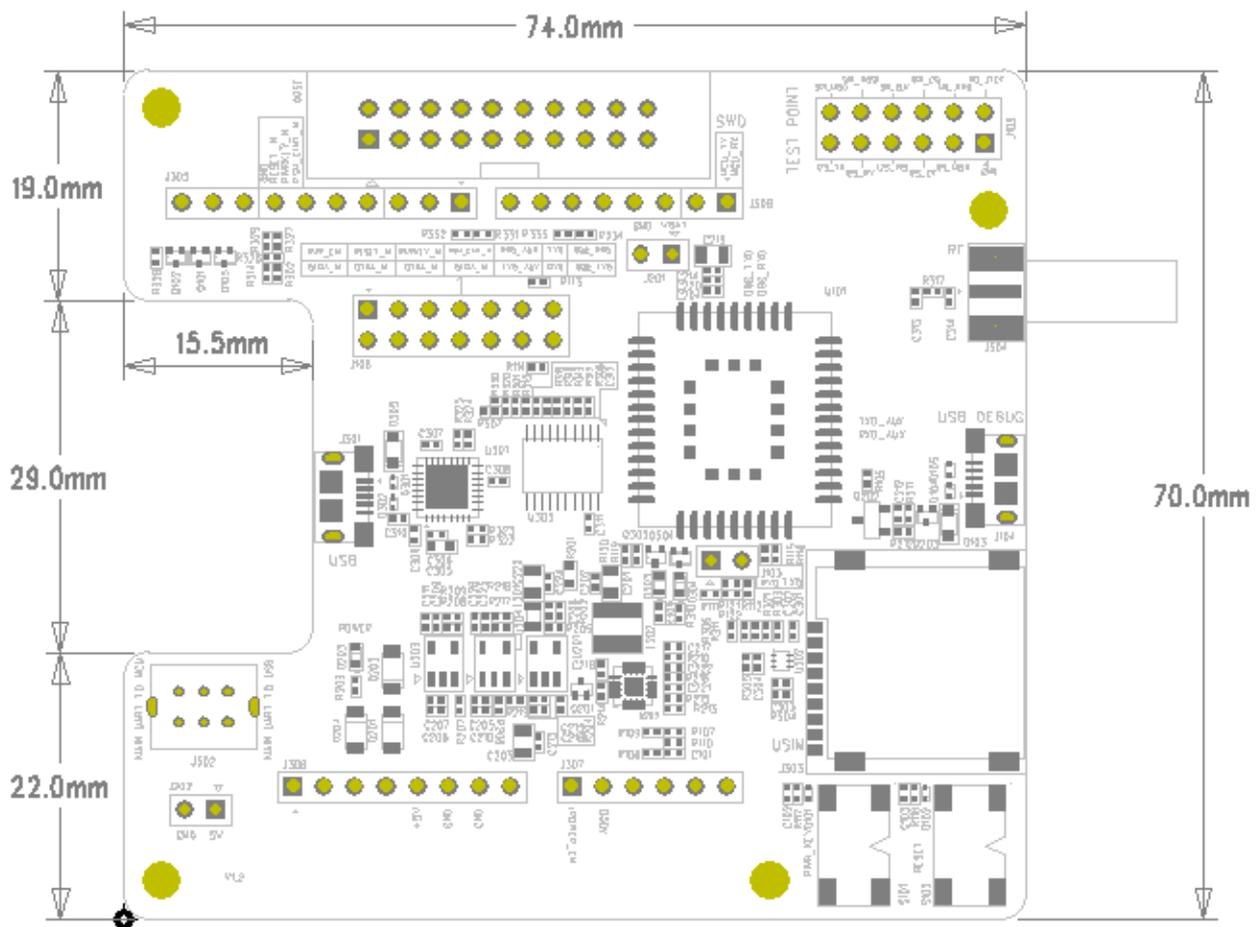


Figure 11: Dimensions of BC68-TE-B (Top View)

5.2. Design Effect Drawings of BC68-TE-B

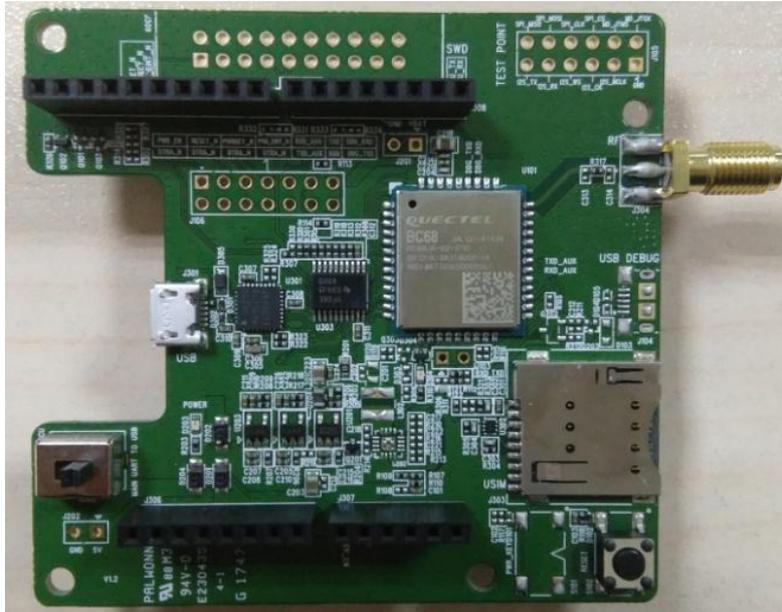


Figure 12: Top View of the BC68-TE-B



Figure 13: Bottom View of the BC68-TE-B

NOTE

These are design effect drawings of BC68-TE-B. For more accurate pictures, please refer to the BC68-TE-B that you get from Quectel.

6 Appendix A References

Table 6: Related Documents

No.	Document Name	Remark
[1]	Quectel_BC68_Hardware_Design	BC68 hardware design

Table 7: Terms and Abbreviations

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