

BC660K-GL-TE-B

User Guide

NB-IoT Module Series

Version: 1.0

Date: 2021-01-08

Status: Released



Our aim is to provide customers with timely and comprehensive service. For any assistance, please contact our company headquarters:

Quectel Wireless Solutions Co., Ltd.

Building 5, Shanghai Business Park Phase III (Area B), No.1016 Tianlin Road, Minhang District, Shanghai 200233, China

Tel: +86 21 5108 6236

Email: info@quectel.com

Or our local office. For more information, please visit:

<http://www.quectel.com/support/sales.htm>.

For technical support, or to report documentation errors, please visit:

<http://www.quectel.com/support/technical.htm>

Or email to support@quectel.com.

General Notes

Quectel offers the information as a service to its customers. The information provided is based upon customers' requirements. Quectel makes every effort to ensure the quality of the information it makes available. Quectel does not make any warranty as to the information contained herein, and does not accept any liability for any injury, loss or damage of any kind incurred by use of or reliance upon the information. All information supplied herein is subject to change without prior notice.

Disclaimer

While Quectel has made efforts to ensure that the functions and features under development are free from errors, it is possible that these functions and features could contain errors, inaccuracies and omissions. Unless otherwise provided by valid agreement, Quectel makes no warranties of any kind, implied or express, with respect to the use of features and functions under development. To the maximum extent permitted by law, Quectel excludes all liability for any loss or damage suffered in connection with the use of the functions and features under development, regardless of whether such loss or damage may have been foreseeable.

Duty of Confidentiality

The Receiving Party shall keep confidential all documentation and information provided by Quectel, except when the specific permission has been granted by Quectel. The Receiving Party shall not access or use Quectel's documentation and information for any purpose except as expressly provided herein. Furthermore, the Receiving Party shall not disclose any of the Quectel's documentation and information to any third party without the prior written consent by Quectel. For any noncompliance to the above requirements, unauthorized use, or other illegal or malicious use of the documentation and information, Quectel will reserve the right to take legal action.

Copyright

The information contained here is proprietary technical information of Quectel. Transmitting, reproducing, disseminating and editing this document as well as using the content without permission are forbidden. Offenders will be held liable for payment of damages. All rights are reserved in the event of a patent grant or registration of a utility model or design.

Copyright © Quectel Wireless Solutions Co., Ltd. 2021. All rights reserved.

Safety Information

The following safety precautions must be observed during all phases of operation, such as usage, service or repair of any cellular terminal or mobile incorporating the module. Manufacturers of the cellular 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 cellular 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.



Cellular 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 cellular 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 cellular 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 cellular terminals. Areas with explosive or potentially explosive atmospheres include fuelling 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
-	2021-01-04	Winks WANG	Creation of the document
1.0	2021-01-08	Winks WANG	First official release

Contents

Safety Information	3
About the Document	4
Contents	5
Table Index	6
Figure Index	7
1 Introduction	8
2 Product Concept	9
2.1. Specifications.....	9
2.2. Block Diagram.....	10
2.3. Interface Distribution Diagram.....	11
2.4. Arduino Interface Definition.....	13
3 Operation Procedures	14
3.1. Operation Procedure with a Single Board.....	14
3.1.1. Interface Diagram of BC660K-GL-TE-B Used Alone.....	15
3.1.2. Operation Procedures for Using a Single Board.....	15
3.2. Operation Procedure with Multiple Boards.....	17
3.2.1. Interface Diagram of BC660K-GL-TE-B Used with STM32 Nucleo-64.....	17
3.2.2. Operation Procedure for Using Multi-Boards.....	19
3.2.3. Description of Pin Connection.....	20
3.3. Operation Procedure of Power Consumption Test.....	22
3.3.1. Prepare Test Tools.....	22
3.3.2. Modify BC660K-GL-TE-B.....	22
3.3.3. Test Power Consumption.....	23
4 Reliability and Electrical Characteristics	24
4.1. Absolute Maximum Ratings.....	24
4.2. Operating and Storage Temperatures.....	24
5 Mechanical Dimensions	26
5.1. Mechanical Dimensions of BC660K-GL-TE-B.....	26
5.2. Top and Bottom Views of BC660K-GL-TE-B.....	27
6 BC660K-GL-TE-B Kit and Accessories	28
6.1. BC660K-GL-TE-B Kit.....	28
6.2. BC660K-GL-TE-B Kit Accessories.....	29
7 Appendix A References	30

Table Index

Table 1: Specifications of BC660K-GL-TE-B	9
Table 2: Interfaces of BC660K-GL-TE-B.....	11
Table 3: Pin Connection between BC660K-GL-TE-B and STM32-L476RG MCU	20
Table 4: Absolute Maximum Ratings.....	24
Table 5: Operating and Storage Temperatures of BC660K-GL Module	24
Table 6: Accessories List.....	29
Table 7: Related Documents	30
Table 8: Terms and Abbreviations	30

Figure Index

Figure 1: Block Diagram of BC660K-GL-TE-B	10
Figure 2: Interface Distribution Diagram of BC660K-GL-TE-B	11
Figure 3: Arduino Interface Definition.....	13
Figure 4: Interface Diagram of BC660K-GL-TE-B Used Alone.....	15
Figure 5: UART Ports Displayed on PC	16
Figure 6: Interface Diagram of BC660K-GL-TE-B Used with STM32 Nucleo-64.....	17
Figure 7: Interface Diagram of STM32 Nucleo-64 Used with BC660K-GL-TE-B (Top View).....	18
Figure 8: Interface Diagram of STM32 Nucleo-64 Used with BC660K-GL-TE-B (Bottom View).....	19
Figure 9: ST-LINK Interface Displayed on PC	20
Figure 10: Pin Connection between BC660K-GL-TE-B and STM32-L476RG MCU.....	21
Figure 11: Schematic Diagram of BC660K-GL-CN-TE-B Before Modification	22
Figure 12: BC660K-GL-TE-B Wiring Diagram	23
Figure 13: Dimensions of BC660K-GL-TE-B (Top View).....	26
Figure 14: Top View of BC660K-GL-TE-B	27
Figure 15: Bottom View of BC660K-GL-TE-B.....	27
Figure 16: BC660K-GL-TE-B Kit Assembly	28
Figure 17: BC660K-GL-TE-B and Accessories.....	29

1 Introduction

Quectel supplies the development board BC660K-GL-TE-B to help you develop applications with the BC660K-GL module conveniently. Consult this document to learn about the interface specifications and electrical and mechanical details of the board as well as how to use it.

2 Product Concept

BC660K-GL-TE-B is a NB-IoT development board which supports Arduino interface. Designed in the form factor of 70.0 mm × 74.0 mm × 1.6 mm, BC660K-GL-TE-B can be used alone or in conjunction with an STM32 Nucleo-64 development board to develop and debug applications which communicate with the infrastructure of mobile network operators through NB-IoT radio protocols in 3GPP Rel-13 and Rel-14.

2.1. Specifications

Table 1: Specifications of BC660K-GL-TE-B

Features	Details
Power Supply	<p>USB interface: Supply voltage range: 4.75–5.25 V Typical supply voltage: 5.0 V</p> <p>Arduino interface: Supply voltage range: 4.75–5.25 V Typical supply voltage: 5.0 V</p> <p>Power adapter interface: Supply voltage range: 4.75–5.25 V Typical supply voltage: 5.0 V</p>
Transmitting Power	23 dBm ±2 dB
Temperature Range	<p>Operating temperature range: -35 °C to +75 °C ¹⁾</p> <p>Extended temperature range: -40 °C to +85 °C ²⁾</p> <p>Storage temperature range: -40 °C to +90 °C</p>
USIM Interface	Support 1.8/3.0 V external USIM card
UART Switch	Used to switch the communication object of BC660K-GL's main UART port between USB and MCU
USB Interface	<p>Support two UART ports</p> <p>Main UART (USB Serial Converter A):</p> <ul style="list-style-type: none"> ● Used for AT command communication and data transmission, where the baud rate is 115200 bps by default. For more details, see document [1]. ● Used for firmware upgrade, where the baud rate is 921600 bps by default.

	Debug UART (USB Serial Converter C):
	<ul style="list-style-type: none"> Used for debugging, where the baud rate is 6 Mbps by default.
Arduino Interface	Used for connection with the STM32 Nucleo-64 development board
RESET Button	Used to reset the BC660K-GL module
BOOT Button	Make the module enter download mode
PSM_EINT Button	Wake up the module from Deep Sleep/Light Sleep mode
Physical Characteristics	Size: (70.0 ±0.15) mm × (74.0 ±0.15) mm × (1.6 ±0.2) mm
Firmware Upgrade	<ul style="list-style-type: none"> Upgrade firmware via the main UART port Upgrade firmware via DFOTA
Antenna Interface	50 Ω characteristic impedance
SMS*	Text and PDU mode

NOTES

- ¹⁾ Within operating temperature range, the module is 3GPP compliant.
- ²⁾ Within extended temperature range, the module maintains functions such as SMS and data transmission, without any unrecoverable malfunction. Radio spectrum and radio network will not be influenced, while one or more specifications, such as P_{out}, may exceed the specified tolerances of 3GPP. When the temperature returns to the normal operating levels, the module will meet 3GPP specifications again.
- “*” means under development.

2.2. Block Diagram

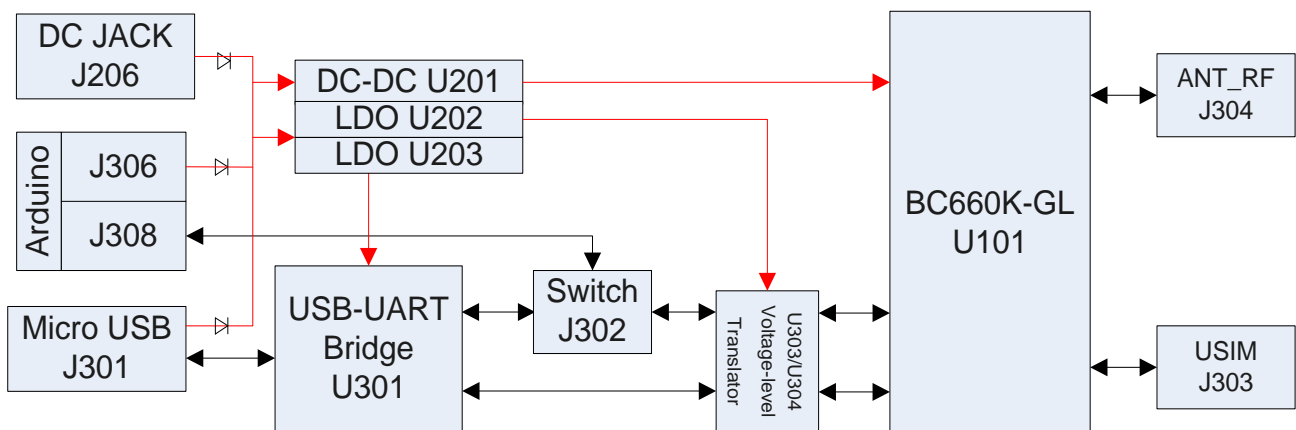


Figure 1: Block Diagram of BC660K-GL-TE-B

2.3. Interface Distribution Diagram

The following figure shows the interface distribution of BC660K-GL-TE-B.

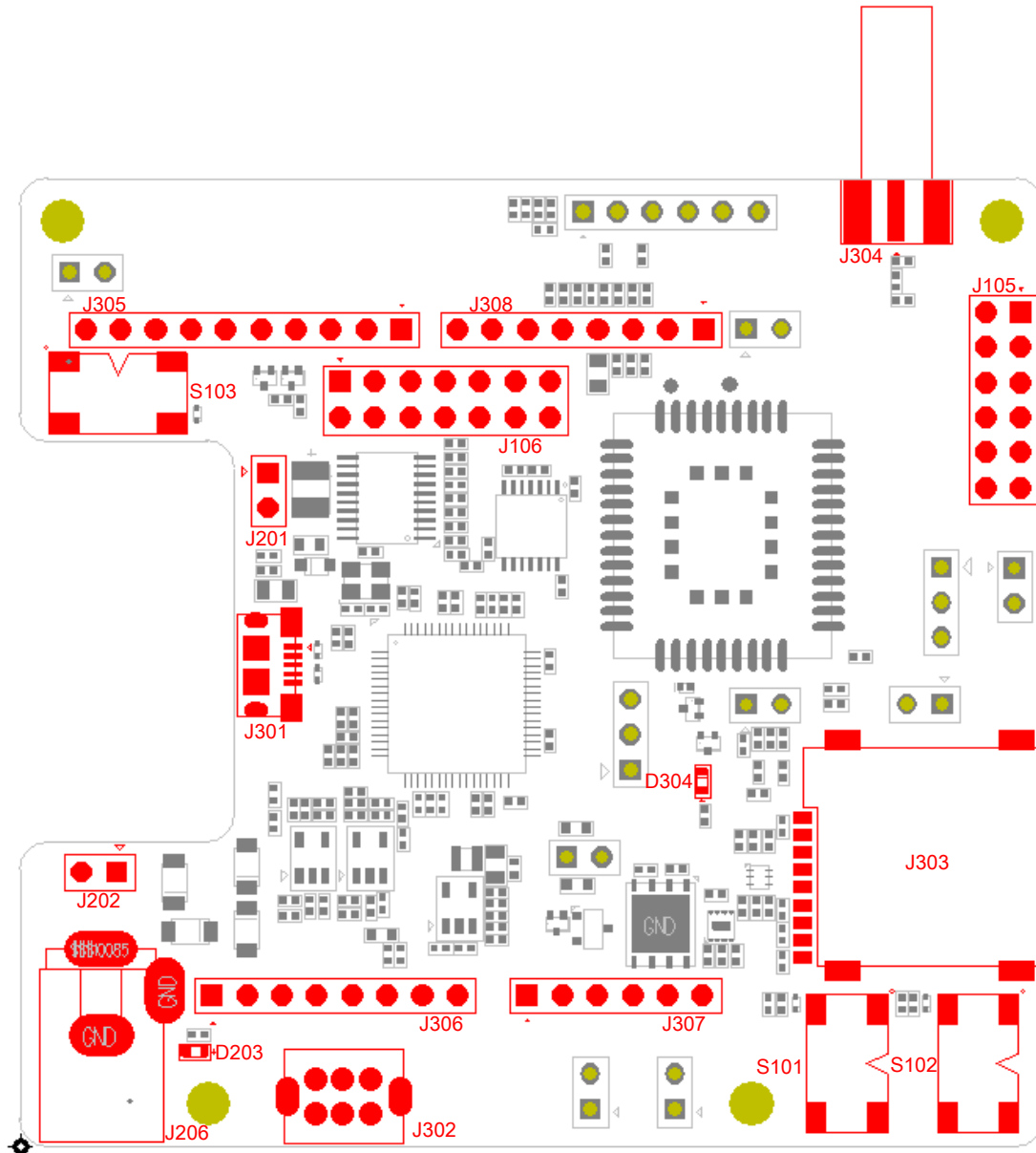


Figure 2: Interface Distribution Diagram of BC660K-GL-TE-B

Table 2: Interfaces of BC660K-GL-TE-B

Interface	Designator	Description
Power Supply Interfaces	J301	USB power supply interface
	J202	External power supply interface
	J206	Power adapter power supply interface
	J306	Arduino power supply interface
USB-UART Interface	J301	Support 2 UART ports
USIM Interface	J303	Micro-SIM card connector
Arduino Interfaces	J305, J306, J307, J308	Standard Arduino interfaces
RF Antenna Interface	J304	RF SMA connector
UART Switch	J302	Used to select the communication object of BC660K-GL's main UART: "MAIN UART TO USB" or "MAIN UART TO MCU"
BOOT Button	S101	Make the module enter download mode
RESET_N Button	S102	Reset the BC660K-GL module
PSM_EINT Button	S103	Wake up BC660K-GL from Deep Sleep/Light Sleep mode
Power Indicator	D203	Indicate the power on/off status
NETLIGHT	D304	Indicate the status of network connection
Test Points	J105、J106、 J201、J202	Basic function to test the module

2.4. Arduino Interface Definition

The following figure shows the Arduino interface definition of BC660K-GL-TE-B.

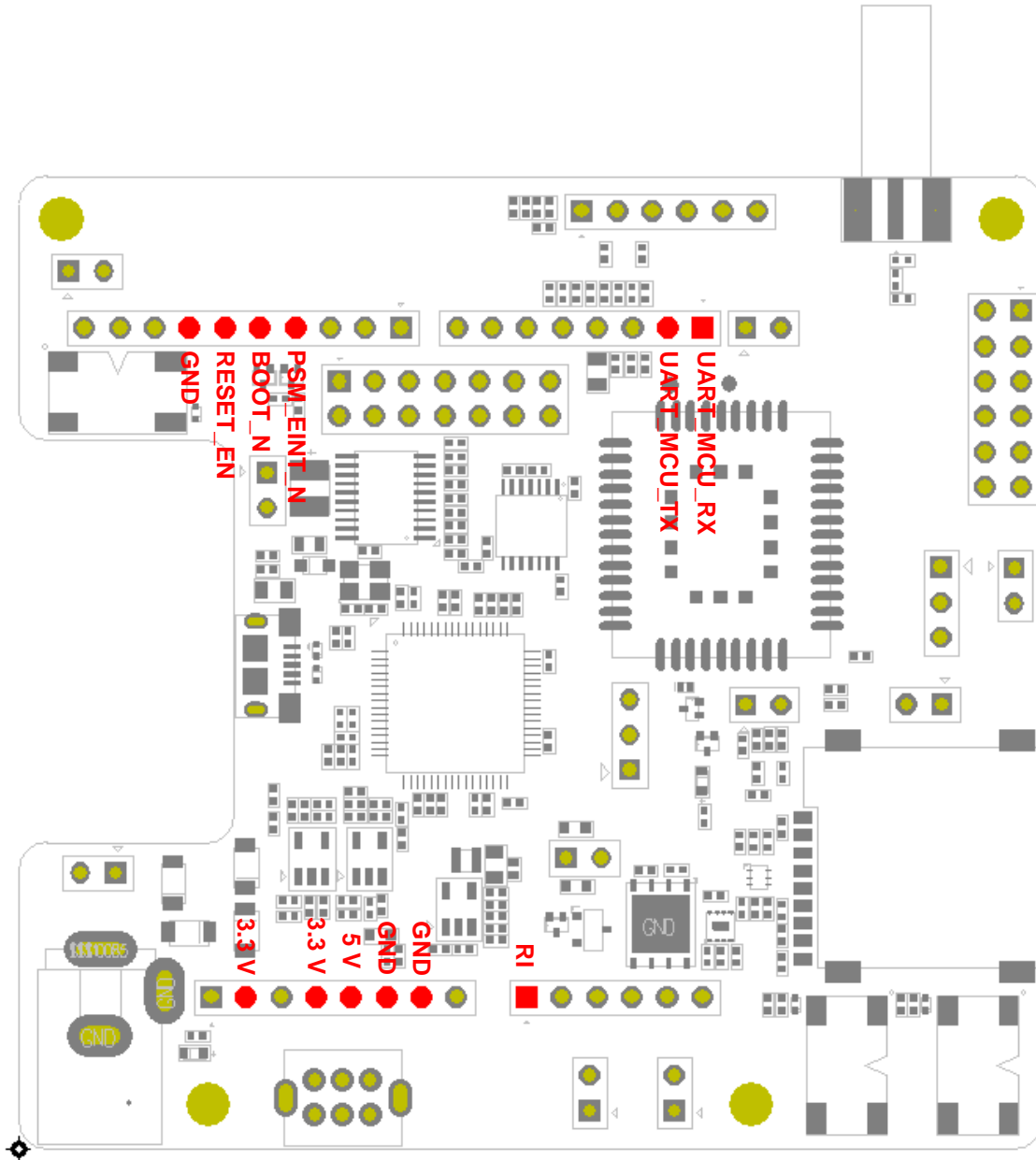


Figure 3: Arduino Interface Definition

3 Operation Procedures

The BC660K-GL-TE-B development board can be used alone to upgrade firmware and debug applications developed based on the BC660K-GL module. It can also be used in conjunction with an STM32 Nucleo-64 development board via the Arduino interface to develop NB-IoT applications based on STM32. In such two cases, the assembly procedures are different.

Besides, when you use the board to test the power consumption of the BC660K-GL module, the operation procedure is different from that in other cases as certain modifications need to be made.

This chapter illustrates in turn how to operate or modify BC660K-GL-TE-B for its being used alone, in conjunction with a STM32 Nucleo-64 board, or to test the power consumption of the BC660K-GL module.

3.1. Operation Procedure with a Single Board

This section elaborates the operation procedure for using BC660K-GL-TE-B alone.

3.1.1. Interface Diagram of BC660K-GL-TE-B Used Alone

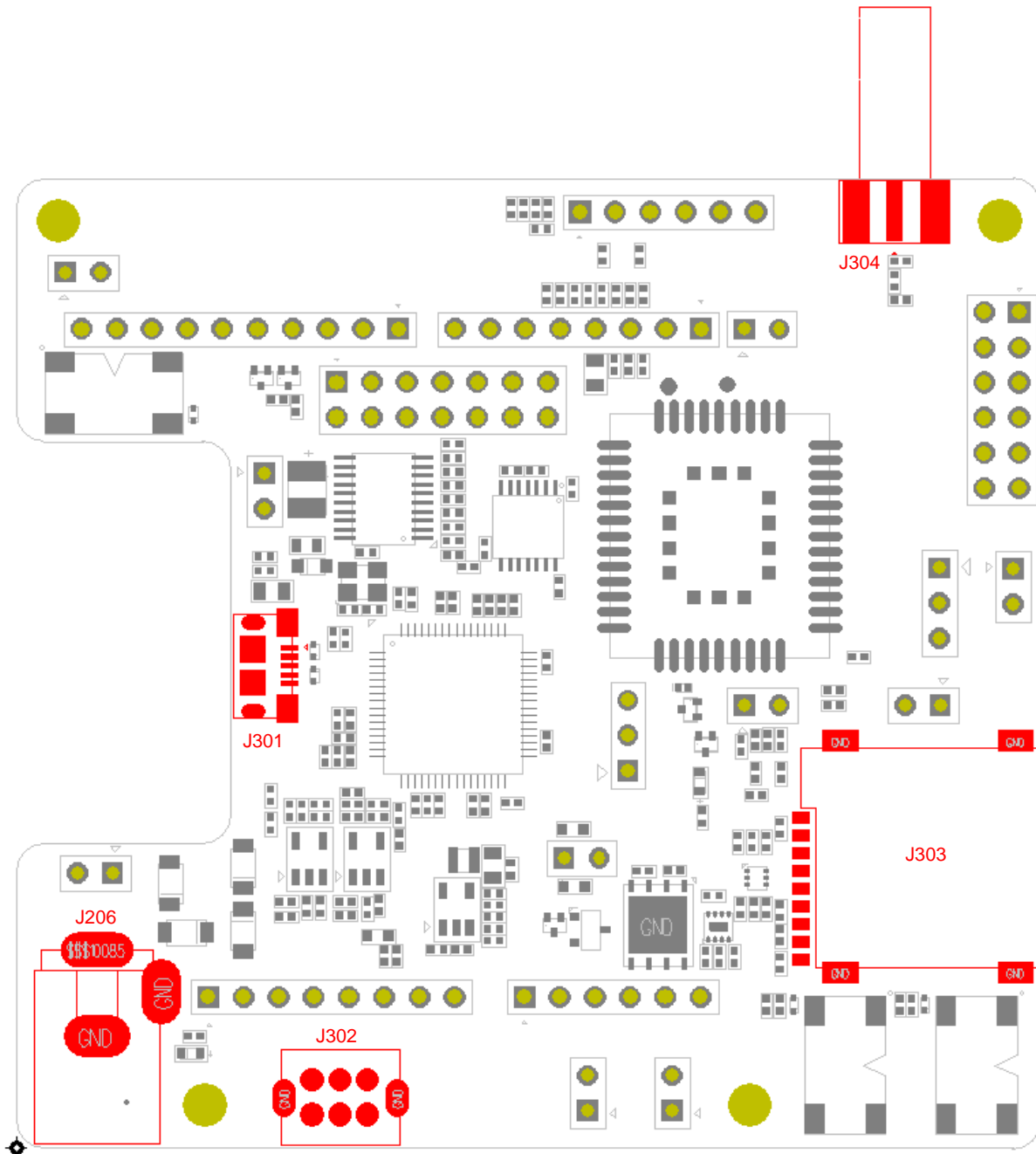


Figure 4: Interface Diagram of BC660K-GL-TE-B Used Alone

3.1.2. Operation Procedures for Using a Single Board

1. Install a USB-UART driver, which can be downloaded from the following link:
<https://www.ftdichip.com/Drivers/VCP.htm>

2. Insert a Micro-SIM card into J303; a NB-IoT USIM card should be selected.
3. Connect the rod antenna with the SMA connector on J304 (RF antenna connector).
4. Switch J302 (UART Switch) to the "MAIN UART TO USB" state.
5. Connect the J301 (USB power supply interface) with your PC via a Micro USB cable. After turning on BC660K-GL-TE-B, UART port information will be displayed on the "Device Manager" of the PC (as shown in the following figure).

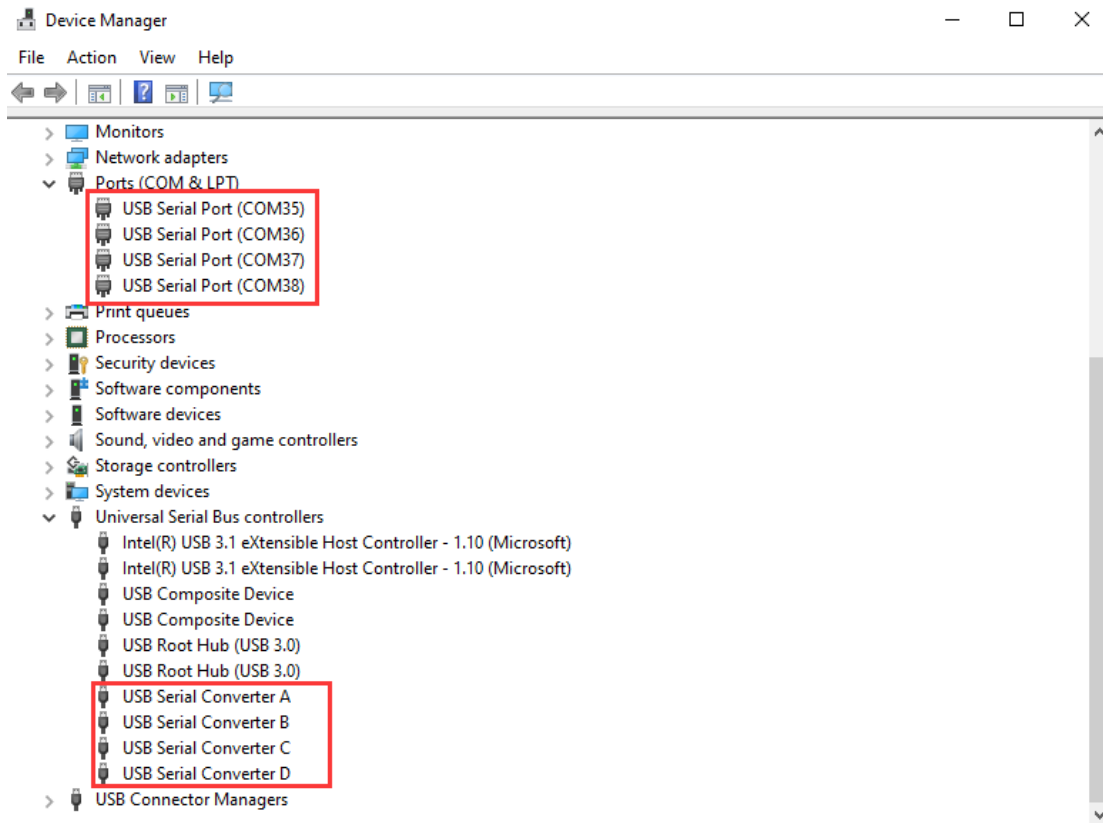


Figure 5: UART Ports Displayed on PC

Among the ports displayed, "USB Serial Port (COM35)" (corresponding to USB Serial Converter A) is connected with the main serial port of BC660K-GL and can be used for AT command transmission, data transmission and firmware upgrade; "USB Serial Port (COM37)" (corresponding to USB Serial Converter C) is connected with the debug serial port of BC660K-GL to output debug log information. For details of UART configurations, see **document [1]**.

NOTE

S102 can be used to reset the module, and S103 can be used to wake up the module from Deep Sleep or Light Sleep.

3.2. Operation Procedure with Multiple Boards

This chapter elaborates the assembly procedure for using BC660K-GL-TE-B in conjunction with an STM32 Nucleo-64 development board.

3.2.1. Interface Diagram of BC660K-GL-TE-B Used with STM32 Nucleo-64

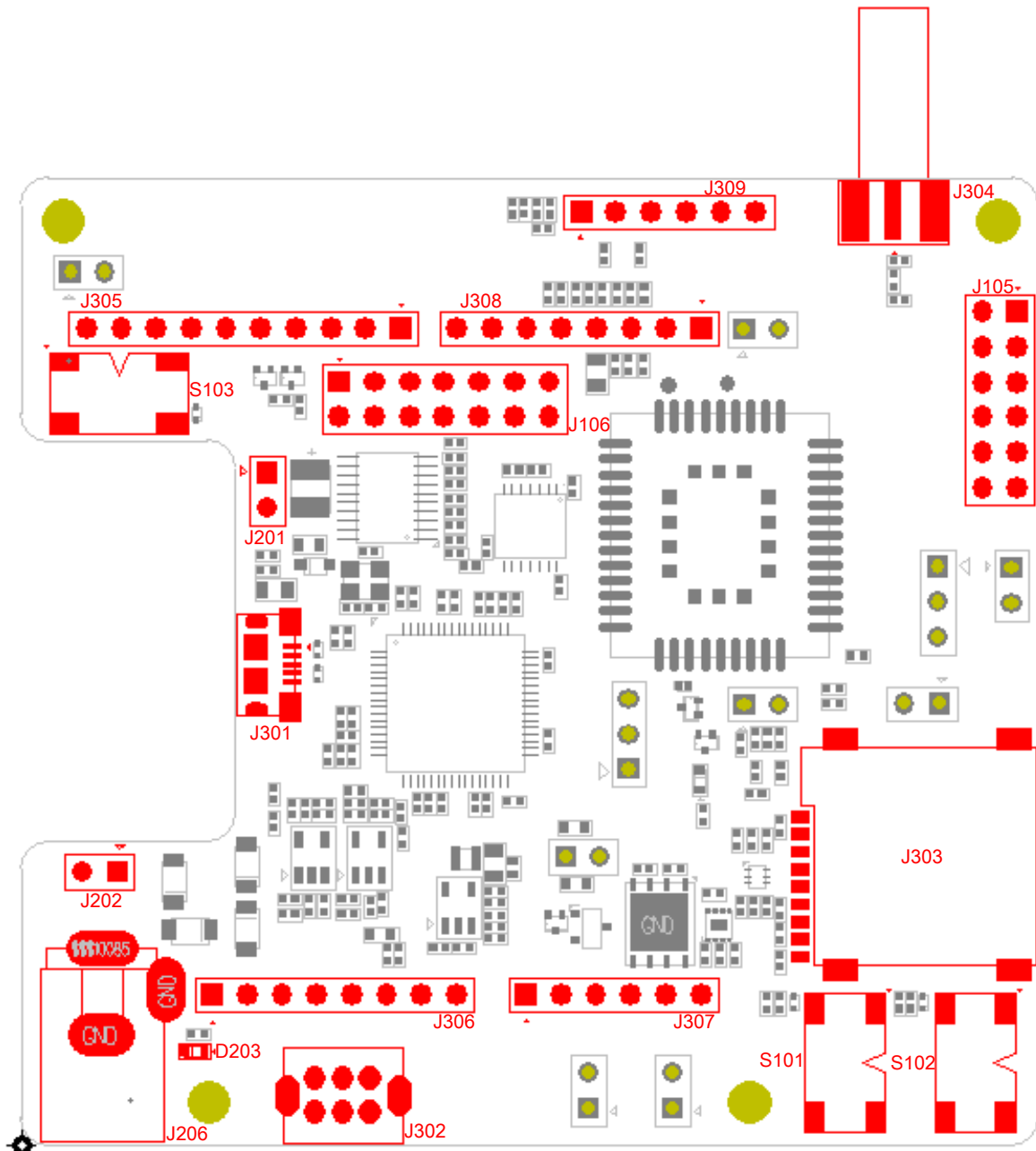


Figure 6: Interface Diagram of BC660K-GL-TE-B Used with STM32 Nucleo-64

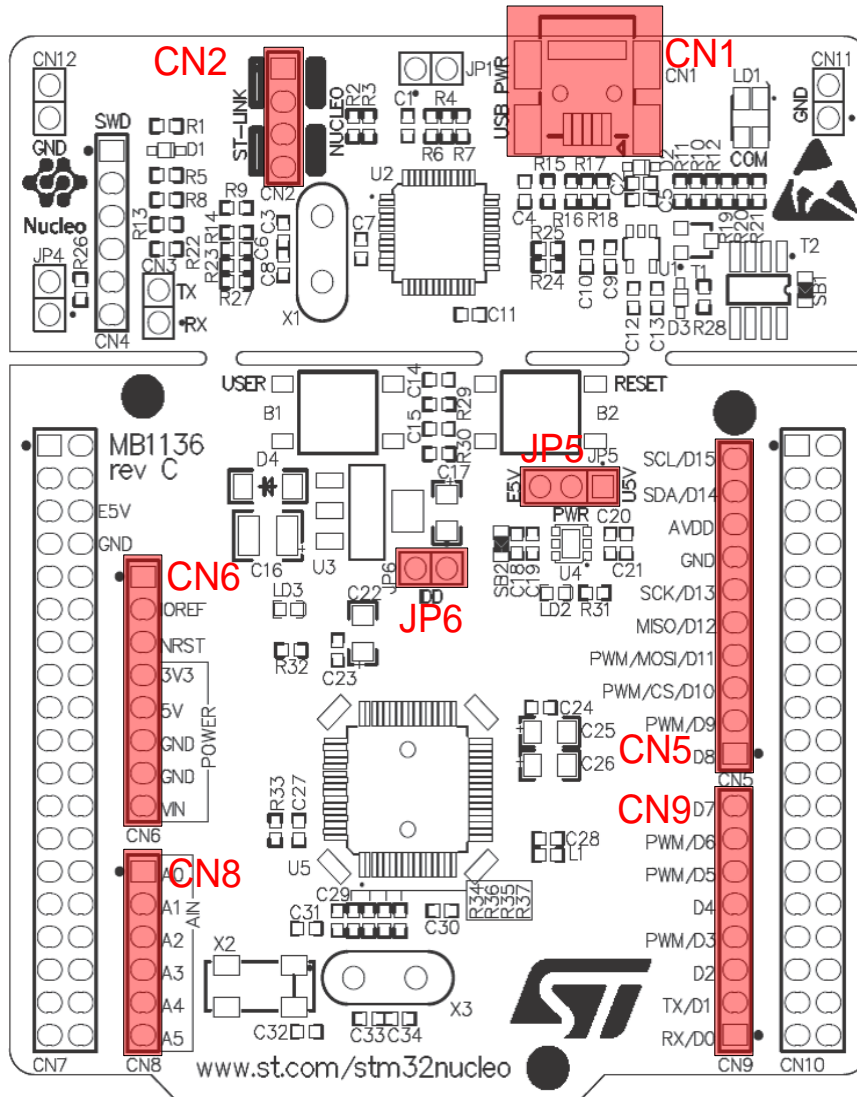


Figure 7: Interface Diagram of STM32 Nucleo-64 Used with BC660K-GL-TE-B (Top View)

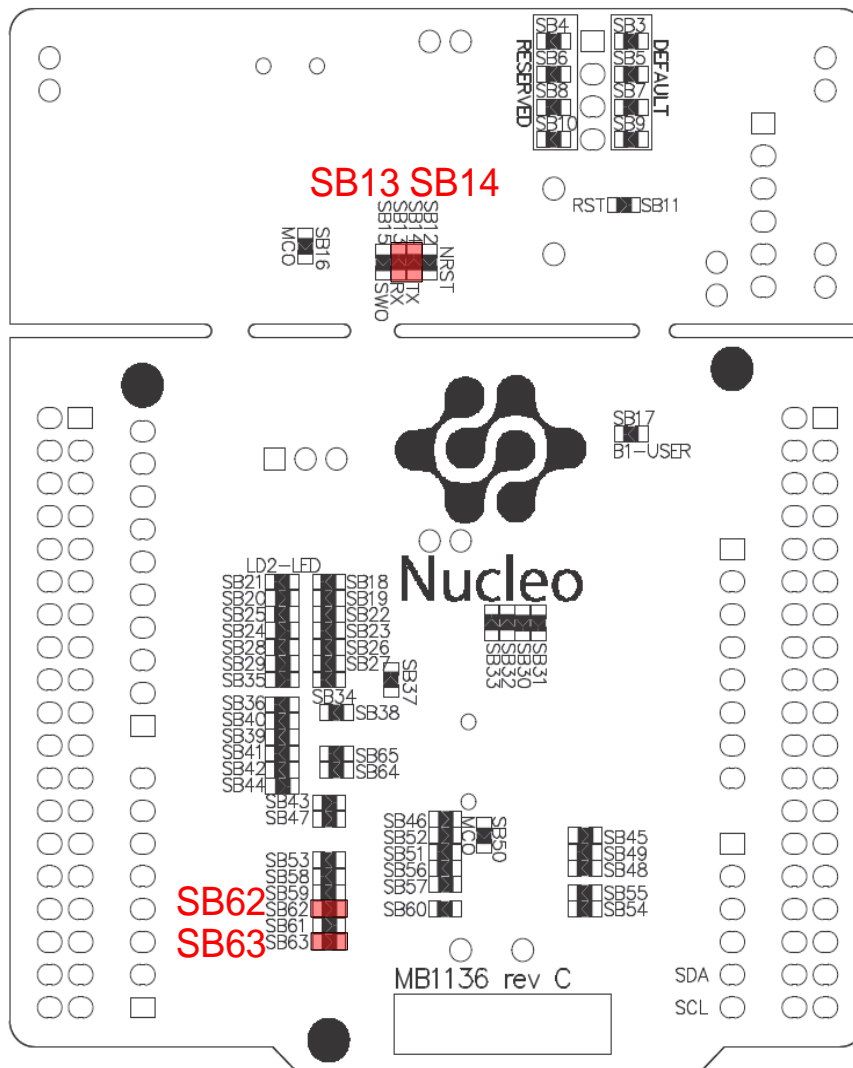


Figure 8: Interface Diagram of STM32 Nucleo-64 Used with BC660K-GL-TE-B (Bottom View)

3.2.2. Operation Procedure for Using Multi-Boards

1. Install a driver for STM32 Nucleo-64 board; the driver can be downloaded from the following link:
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 a USB-UART driver, which can be downloaded from the following link:
<https://www.ftdichip.com/Drivers/VCP.htm>
3. Remove the two 0 Ω resistors (SB13 and SB14) with a 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 a Micro-SIM card into J303; a NB-IoT USIM card should be selected;
6. Connect the rod antenna with the SMA connector on J304 (RF antenna connector);
7. Switch J302 (UART Switch) to the “MAIN UART TO MCU” state;
8. Connect BC660K-GL-TE-B with STM32 Nucleo-64 board via the Arduino interface. Specifically, connect J305, J306, J307 and J308 of BC660K-GL-TE-B with CN5, CN6, CN8 and CN9 respectively.
9. Connect CN1 of STM32 Nucleo-64 board with your PC via a Mini USB cable. After powering on the BC660K-GL module, the device information will be displayed on the “Device Manager” of the PC (as shown in the following figure).

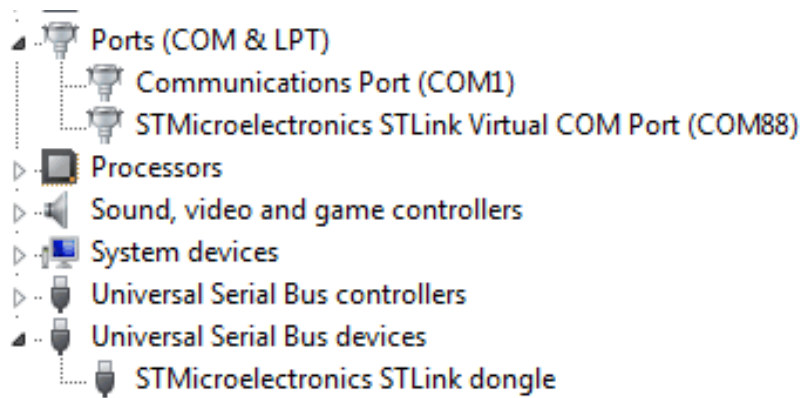


Figure 9: ST-LINK Interface Displayed on PC

3.2.3. Description of Pin Connection

The table below shows the pin connection between BC660K-GL-TE-B and STM32-L476RG MCU, one kind of STM32 Nucleo-64 board.

Table 3: Pin Connection between BC660K-GL-TE-B and STM32-L476RG MCU

No.	MCU (Morpho)	Arduino		BC660K-GL-TE-B	Remark
1	PA2	D1	CN9-2	UART_MCU_TX	Main UART port Rx
2	PA3	D0	CN9-1	UART_MCU_RX	Main UART port Tx
4	PA7	D11	CN5-4	PSM_EINT_N	External interrupt to Deep Sleep/Light Sleep

5	PA6	D12	CN5-5	BOOT_N	Active high
6	PA5	D13	CN5-6	RESET_EN	Active high
7	PA0	A0	CN8-1	RI	Ring indicator
8	+5 V	+5 V	CN6-5	+5 V	5.0 V power supply
9	GND	GND	CN5-7, CN6-6, 7	GND	GND
10	+3.3 V	+3.3 V	CN6-4	+3.3 V	3.3 V power supply
11	+3.3 V	IOREF	CN6-2	+3.3 V	3.3 V power supply

The following figure shows the pin connection between BC660K-GL-TE-B and STM32-L476RG MCU.

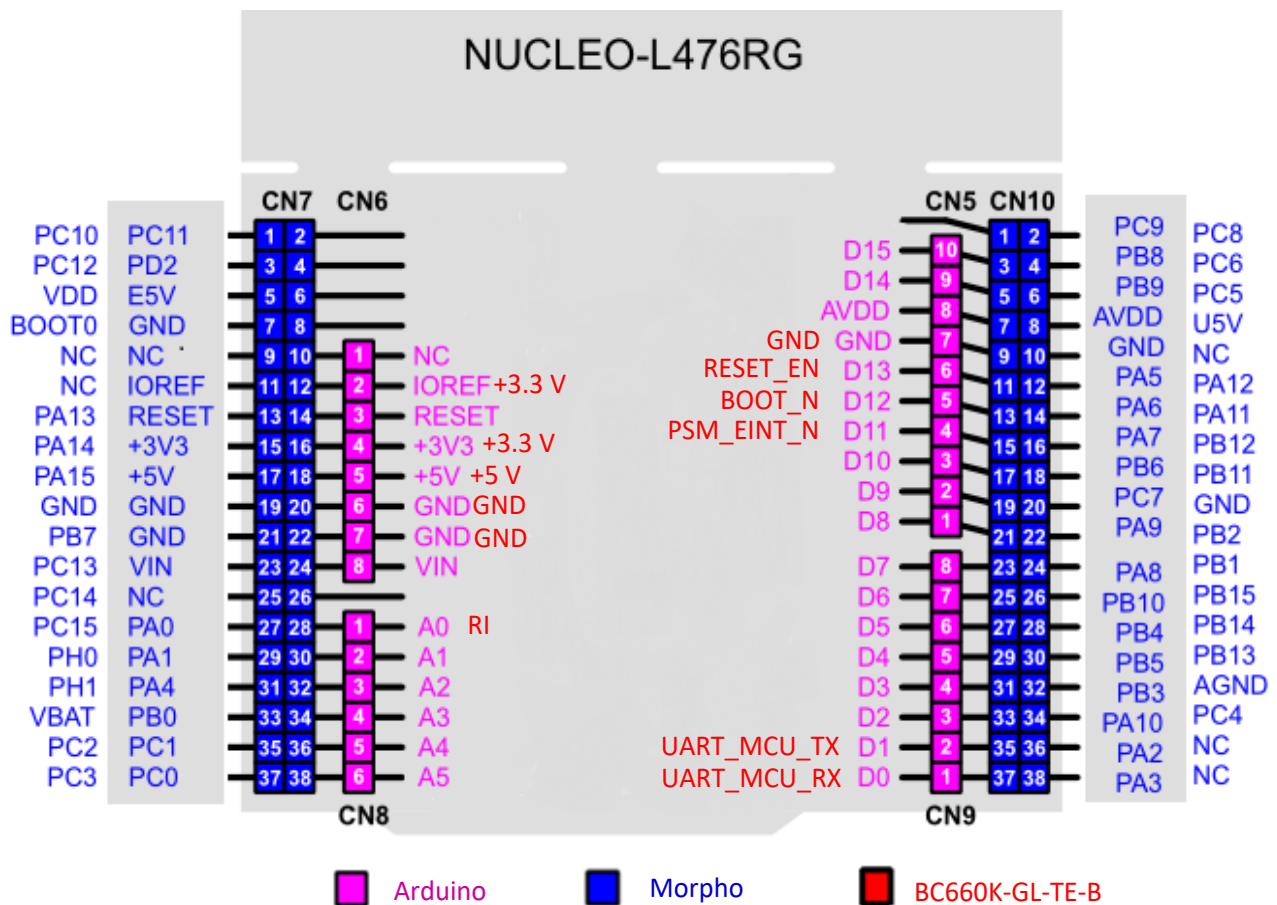


Figure 10: Pin Connection between BC660K-GL-TE-B and STM32-L476RG MCU

3.3. Operation Procedure of Power Consumption Test

3.3.1. Prepare Test Tools

The following equipment and tools are needed for the power consumption test:

- A BC660K-GL-TE-B development board;
- A DC power analyzer (a Keysight N6705C DC Power Analyzer is used in this case);
- Wires, a soldering iron, tin wires and wire stripping pliers, etc. to weld the power supply cord onto the board.

3.3.2. Modify BC660K-GL-TE-B

If you use the BC660K-GL-TE-B to test the power consumption of the BC660K-GL module, you need to modify the BC660K-GL-TE-B as follows:

1. Remove the jumper cap on J203 to disconnect the module from other parts.
2. Solder two wires respectively to the two pins (VBAT, GND) of J201 so that the external power supply can supply power to the module.

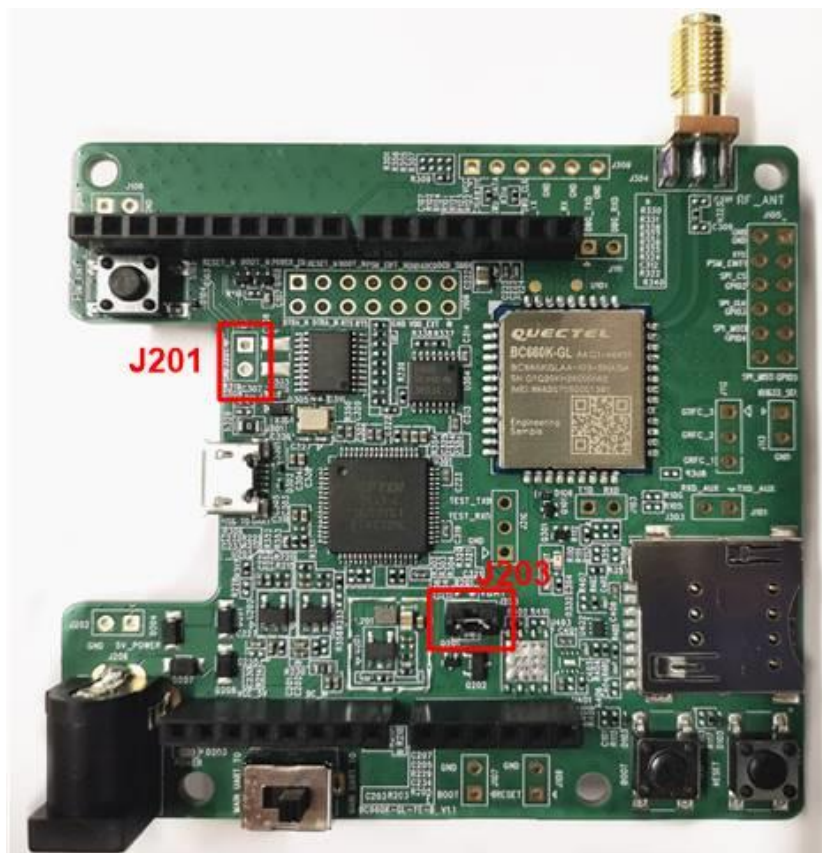


Figure 11: Schematic Diagram of BC660K-GL-CN-TE-B Before Modification

3.3.3. Test Power Consumption

Please do as follows to test the current consumption of the module on the modified BC660K-GL-TE-B:

1. Insert the USIM card;
2. Insert the USB cable into BC660K-GL-TE-B;
3. When J203 has been removed, set the output voltage of N6705C to 3.3 V, and connect the positive and negative wires of N6705C respectively to the two wires (VBAT, GND) welded on J201 to supply power to the module;
4. Turn on the preset voltage output of N6705C, and the module will automatically boot up after being powered on;
5. Conduct current consumption tests in different modes.

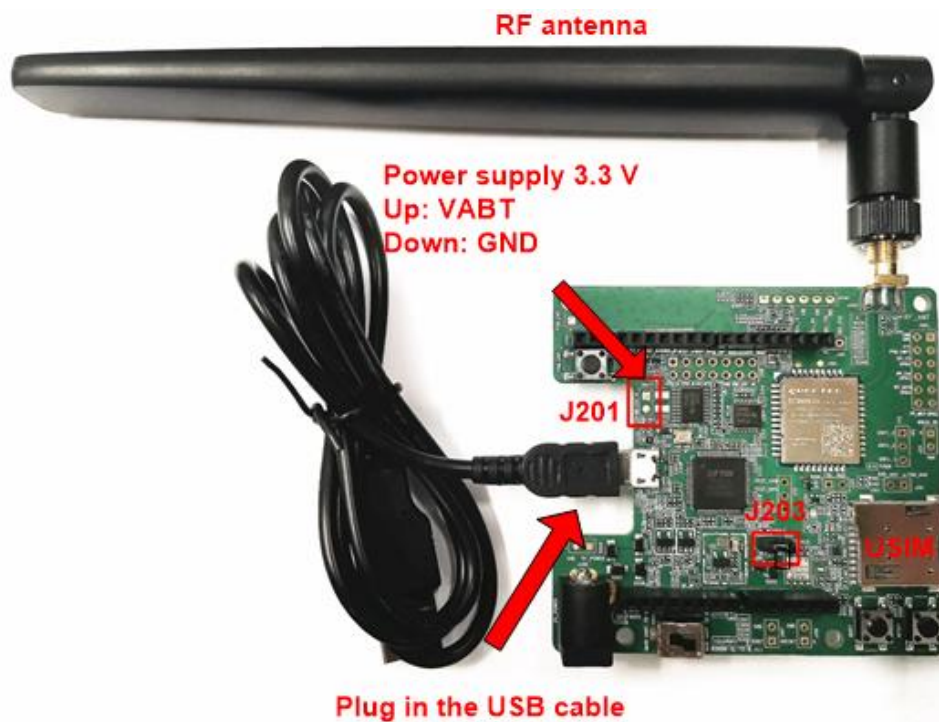


Figure 12: BC660K-GL-TE-B Wiring Diagram

4 Reliability and Electrical Characteristics

4.1. Absolute Maximum Ratings

The following table shows the power supply voltage of BC660K-GL:

Table 4: Absolute Maximum Ratings

Parameter	Min.	Max.	Unit
+5 V Adapter Supply Voltage	-	+6	V
VBAT	-	+4.3	V

4.2. Operating and Storage Temperatures

The operating and storage temperatures of BC660K-GL module are listed in the following table.

Table 5: Operating and Storage Temperatures of BC660K-GL Module

Parameter	Min.	Typ.	Max.	Unit
Operating Temperature Range ¹⁾	-35	+25	+75	°C
Extended Temperature Range ²⁾	-40	-	+85	°C
Storage Temperature Range	-40	-	+90	°C

NOTES

- ¹⁾ Within operating temperature range, the module is 3GPP compliant.
- ²⁾ Within extended temperature range, the module maintains functions such as SMS and data

transmission, without any unrecoverable malfunction. Radio spectrum and radio network will not be influenced, while one or more specifications, such as P_{out} , may exceed the specified tolerances of 3GPP. 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 BC660K-GL-TE-B. All dimensions are measured in mm. The tolerances for dimensions are ± 0.15 mm.

5.1. Mechanical Dimensions of BC660K-GL-TE-B

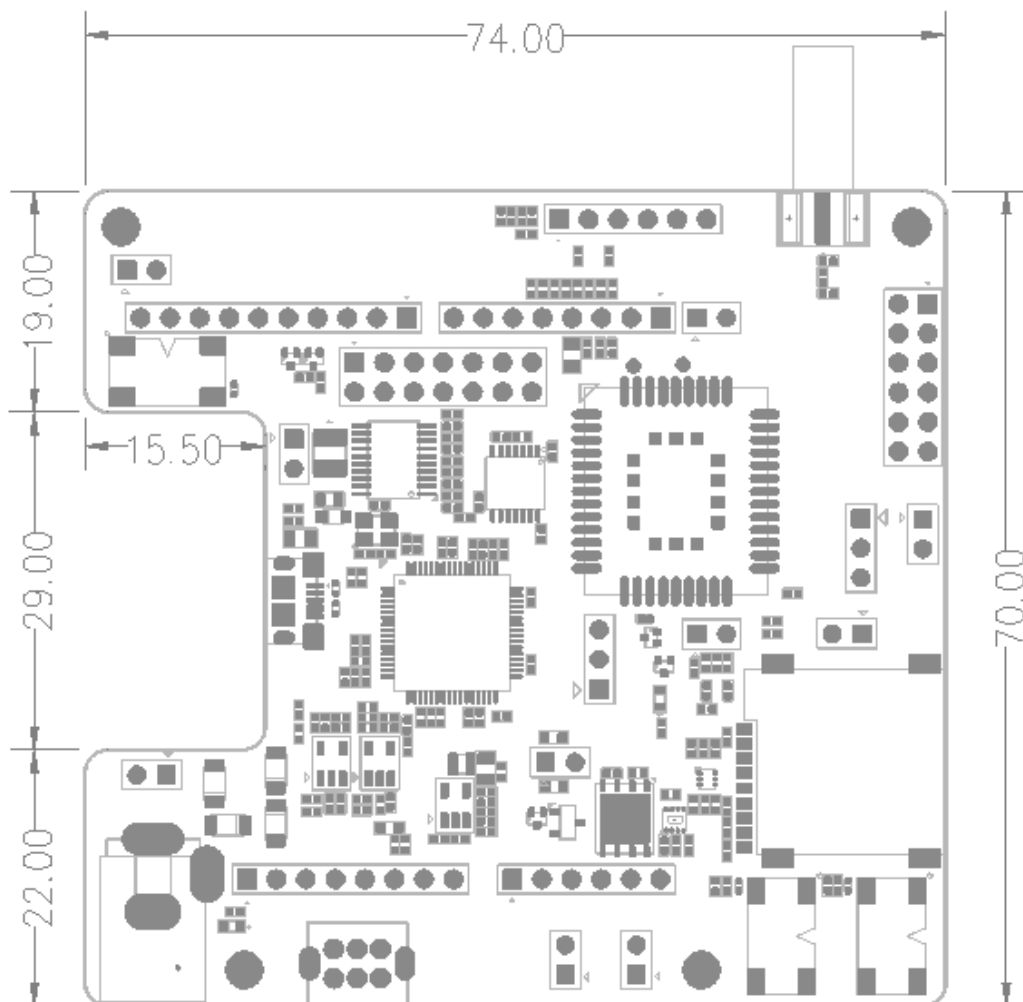


Figure 13: Dimensions of BC660K-GL-TE-B (Top View)

5.2. Top and Bottom Views of BC660K-GL-TE-B



Figure 14: Top View of BC660K-GL-TE-B



Figure 15: Bottom View of BC660K-GL-TE-B

6 BC660K-GL-TE-B Kit and Accessories

6.1. BC660K-GL-TE-B Kit



Figure 16: BC660K-GL-TE-B Kit Assembly

6.2. BC660K-GL-TE-B Kit Accessories



Figure 17: BC660K-GL-TE-B and Accessories

Table 6: Accessories List

Item	Description	Quantity (pcs)
Antenna	NB-IoT antenna with SMA connector	1
Cable	Micro USB cable	1
Instruction Sheet	A sheet of paper giving instructions for BC660K-GL-TE-B connection, details of accessories, etc.	1

7 Appendix A References

Table 7: Related Documents

No.	Document Name	Remark
[1]	Quectel_BC660K-GL_Hardware_Design	BC660K-GL Hardware Design

Table 8: Terms and Abbreviations

Abbreviation	Description
3GPP	3GPP 3rd Generation Partnership Project
3GPP Rel-13	3GPP Release 13
3GPP Rel-14	3GPP Release 14
bps	Bit(s) Per Second
dBm	Decibel Relative to One Milliwatt
DFOTA	Delta Firmware Upgrade Over-the-air
MCU	Microcontroller Unit
NB-IoT	Narrow Band Internet of Things
RF	Radio Frequency
SMA	Sub Miniature Version A
SMS	Short Message Service
UART	Universal Asynchronous Receiver & Transmitter
USB	Universal Serial Bus
USIM	Universal Subscriber Identification Module