

# Quectel BC95

## Compact NB-IoT Module with Ultra-low Power Consumption



BC95 is a high-performance NB-IoT module with extremely low power consumption. The ultra-compact 23.6mm × 19.9mm × 2.2mm profile makes it a perfect choice for size sensitive applications. Designed to be compatible with Quectel GSM/GPRS M95 module in the compact and unified form factor, it provides a flexible and scalable platform for migrating from GSM/GPRS to NB-IoT networks.

BC95 adopts surface mounted technology, making it an ideal solution for durable and rugged designs. The low profile and small size of LCC package allow BC95 to be easily embedded into space-constrained applications and provide reliable connectivity with the applications. This kind of package is ideally suited for large-scale manufacturing which has strict requirements for cost and efficiency.

Due to compact form factor, ultra-low power consumption and extended temperature range, BC95 is the best choice for a wide range of IoT applications, such as smart metering, bike sharing, smart parking, smart city, security and asset tracking, home appliances, agricultural and environmental monitoring, etc. It is able to provide a complete range of SMS\* and data transmission services to meet client-side demands.



### Key Benefits

- ✓ Compact-sized NB-IoT module
- ✓ Ultra-low power consumption
- ✓ Super high sensitivity
- ✓ LCC package makes it easy for large volume manufacturing
- ✓ Compatible with Quectel GSM/GPRS module, easy for future upgrading
- ✓ Embedded with abundant Internet service protocols
- ✓ Fast time-to-market:  
Reference designs, evaluation tools and timely technical support minimize design-in time and development efforts



Compact Size



B8/B5/B20/B28 Extended Temperature Range: -40°C ~ +85°C



LCC Package



Multiple Serial Ports



Ultra-low Power Consumption



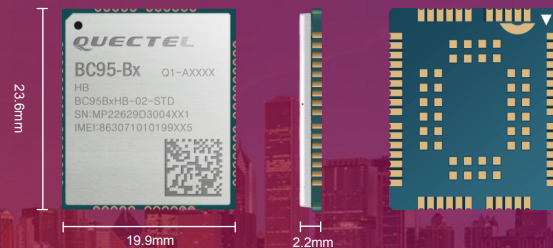
Quectel Enhanced AT Commands



Embedded Internet Services Protocols

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### Frequency Bands

BC95-B8: 900MHz

BC95-B5: 850MHz

BC95-B20: 800MHz

BC95-B28: 700MHz

### Data

Data Transmission:

Single Tone:

DL: 24Kbps

UL: 15.625kbps

Multi Tone\*:

UL: 62.5kbps

DL: 24kbps

Protocol Stacks:

IPv4

IPv6\*

UDP

CoAP

LwM2M

Non-IP

DTLS\*

Download Method:

UART

DFOTA\*

### SMS\*

Point-to-point MO and MT

Text/PDU Mode

### Electrical Characteristics

Maximum Output Power:

23dBm±2dB

Sensitivity:

-129dBm±1dB

Power Consumption (Typical):

PSM: 3.6uA

Idle: 2mA @DRX=1.28s

LTE Cat NB1 Connectivity:

220mA @23dBm (Band 8/5/20)

250mA @23dBm (Band 28)

80mA @12dBm (Band 8/5/20/28)

65mA @0dBm (Band 8/5/20/28)

### Interfaces

USIM × 1

UART × 2

ADC\* × 1

RESET × 1

Antenna × 1

### General Features

LCC Package

94 Pins

Supply Voltage Range:

3.1V~4.2V, 3.6V Typ.

Temperature Range:

Temperature Range: -40°C ~ +85°C

Dimension:

23.6mm × 19.9mm × 2.2mm

Weight:

1.8g±0.2g

AT Command:

3GPP TS 27.007 V14.3.0 (2017-03) and Quectel

Enhanced AT Commands

### Approvals

RoHS Compliant

CCC/NAL\*/SRRC (China)

CE/GCF (Europe)

RCM (Australia)

FCC\* (North America)

\* Under Development

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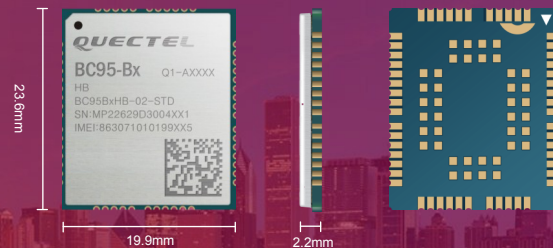
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# **GSM** EVB User Guide

**GSM/GPRS/UMTS/HSPA/NB-IoT Module Series**

Rev. GSM\_EVB\_User\_Guide\_V3.4

Date: 2017-03-03



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

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# About the Document

## History

Revision	Date	Author	Description
1.0	2009-06-17	Tracy ZHANG	Initial
1.1	2009-11-12	Yong AN	<ol style="list-style-type: none"><li>1. Modified Figure 5, 6, 7 and 10.</li><li>2. Added some contents on how to better operate module for customers when module is set to autobauding by default in Chapter 5.2.</li></ol>
2.0	2011-04-15	Roy CHEN	Added Introduction to UART in Section 5.6.
3.0	2013-05-03	Tony WU	Added SD card connector instead of LCD display connector.
3.1	2013-09-23	Tony WU	Optimized introduction description.
3.2	2014-01-14	Vivian WANG	Added introduction to SD interface.
3.3	2015-05-20	Tony WU	<ol style="list-style-type: none"><li>1. Changed module name from “M10” to “GSM”.</li><li>2. Added applicable modules.</li></ol>
3.4	2017-03-03	Bryant CHEN	<ol style="list-style-type: none"><li>1. Added information about BC95 module.</li><li>2. Updated EVB kit accessories in Figure 3.</li><li>3. Updated description of firmware upgrade in Chapter 5.3.</li></ol>

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# 1 Introduction

This document describes how to use the GSM Evaluation Board (EVB), which is an assistant tool for engineers to develop and test Quectel GSM, UMTS and NB-IoT modules.

This document is applicable to Quectel GSM modules, UC15 module and BC95 module.

## 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 GSM, UMTS and NB-IoT modules. 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 customer's 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 General Overview

Quectel supplies GSM EVB for designers to develop applications based on Quectel GSM, UMTS and NB-IoT modules. This EVB can test basic functionalities of these modules.

### 2.1. GSM EVB Top and Bottom View

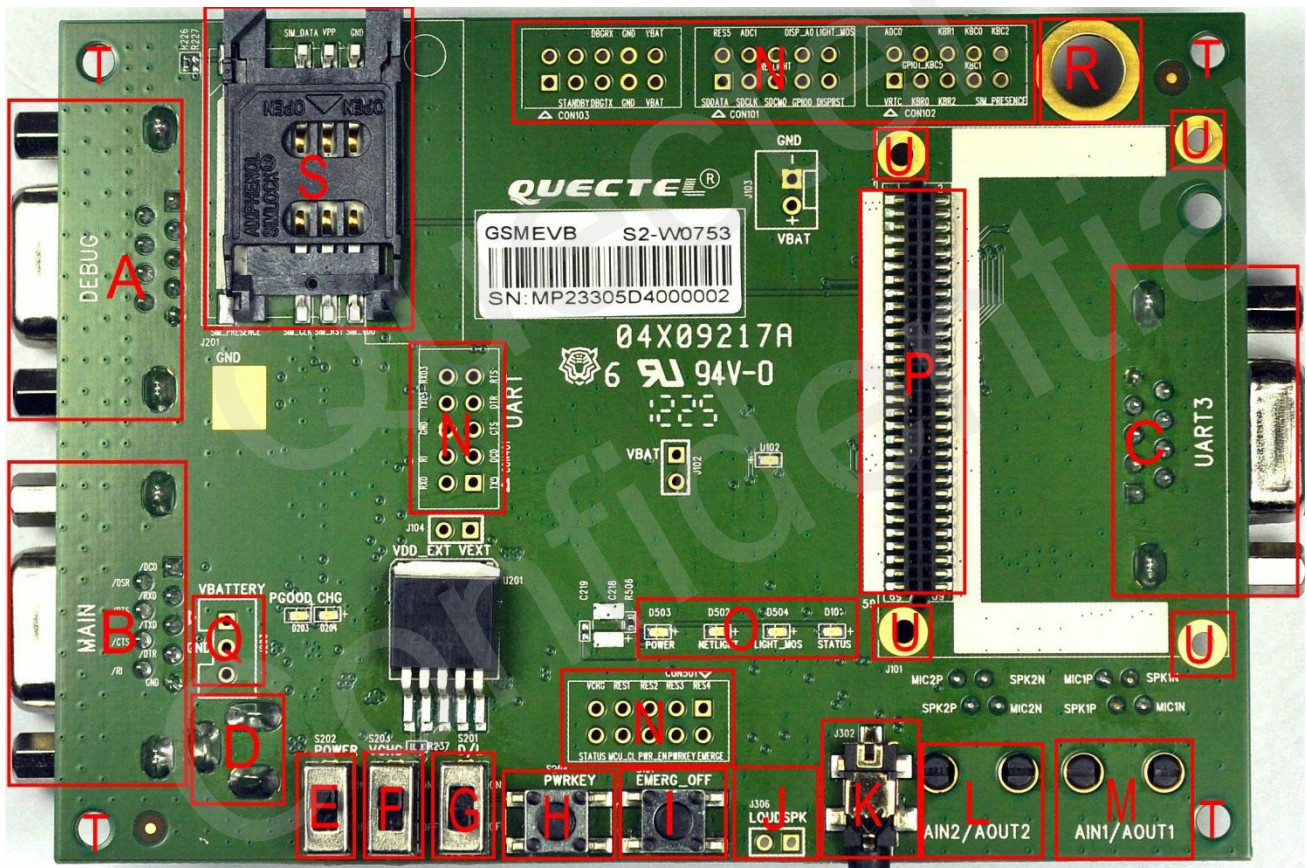


Figure 1: GSM EVB Top View

#### NOTES

1. Some interfaces and test pins are reserved only for engineers to debug some functions which are not used for customers.
2. Some functions are only supported in certain software versions.



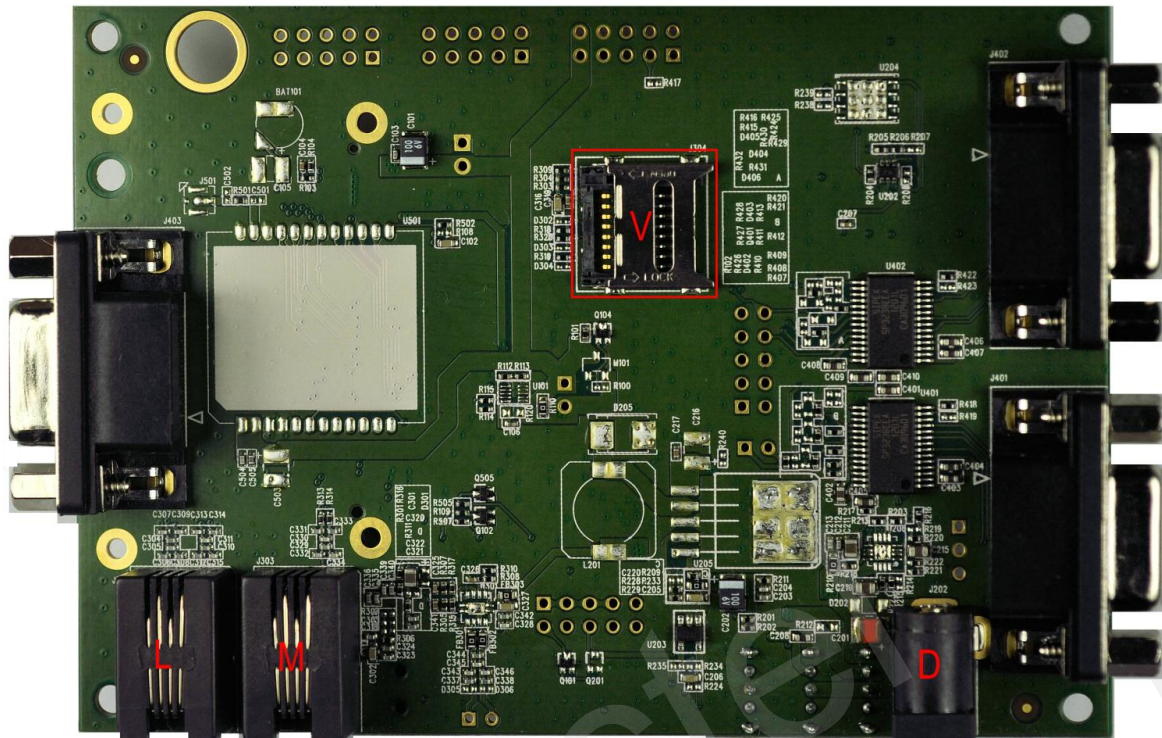


Figure 2: GSM EVB Bottom View

- A: Debug port
- B: Main port
- C: UART3 port
- D: Adapter interface
- E: POWER switch
- F: VCHG switch (*Not used*)
- G: D/L switch
- H: PWKEY button
- I: EMERG\_OFF button
- J: Loudspeaker interface (*Not used*)
- K: Earphone interface
- L: Handset interface of audio channel 2
- M: Handset interface of audio channel 1
- N: Test points
- O: Status indication LEDs (*D203&D204 Not used*)
- P: 60-pin TE-A interface
- Q: Battery interface (*Not used*)
- R: Fixture hole for RF cable connector
- S: (U)SIM card interface
- T: Fixture holes for EVB poles
- U: Screw holes for fixing the module
- V: SD card interface

## 2.2. EVB Kit Accessories

All accessories of the GSM EVB kit are listed as below.



Figure 3: EVB Kit Accessories

Table 1: Accessories List

Items	Description	Quantity
Cables	USB to UART converter cable	1
	USB cable	1
	RF cable	1
Antenna	Antenna	1
Adapter	5V DC adapter	1

Audio	Earphone	1
Disk	Disk involving related documents and drivers	1
Instruction Sheet	A sheet of paper giving instructions for EVB connection, details of EVB accessories, etc.	1
Other	Bolts and nuts for fixing EVB	1

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## 3 Interface Application

### 3.1. Power Interface

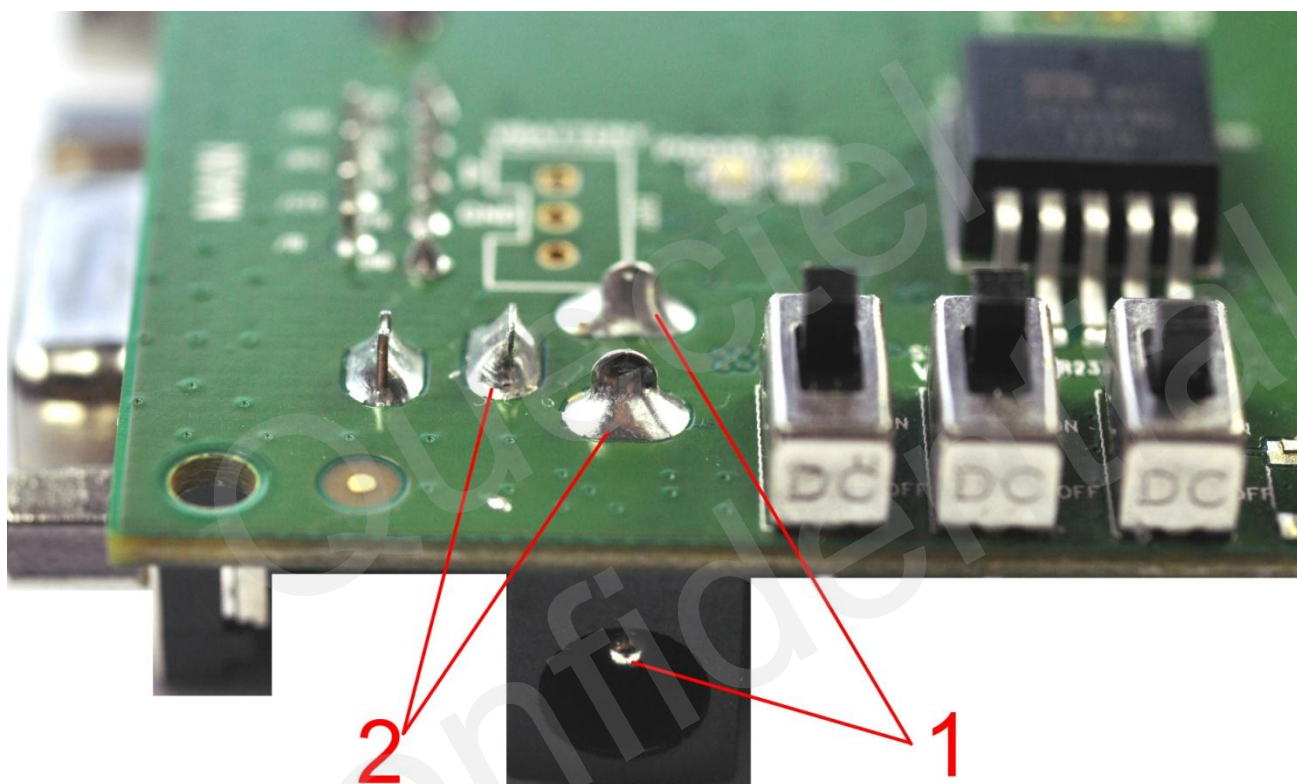


Figure 4: Power Interface

Table 2: Pin Description of Power Interface

Pin No.	Signal	I/O	Description
1	Adapter input	PI	5V/2A DC source input
2	GND		Ground

## 3.2. Audio Interfaces

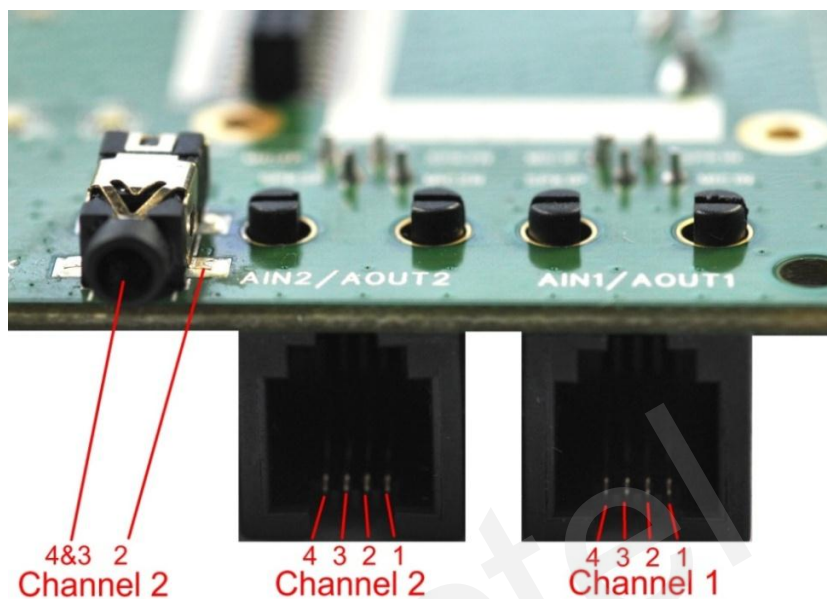


Figure 5: Audio Interfaces

Table 3: Pin Description of Audio Channel 1

Interface	Signal	Pin No.	Description
AIN1/AOUT1	MIC1N	1	Channel 1 for negative microphone input.
	SPK1N	2	Channel 1 for negative receiver output.
	SPK1P	3	Channel 1 positive receiver output.
	MIC1P	4	Channel 1 positive microphone input.

Table 4: Pin Description of Audio Channel 2

Interface	Signal	Pin No.	Description
AIN2/AOUT2	MIC2N	1	Channel 2 for negative microphone input.
	AGND	2	AGND of audio circuits.
	SPK2P	3	Channel 2 for positive receiver output.
	MIC2P	4	Channel 2 for positive microphone input.

### 3.3. (U)SIM Card Interface



Figure 6: (U)SIM Card Interface

Table 5: Pin Description of (U)SIM Card Interface

Pin No.	Signal	I/O	Description
1	GND		Ground
2	VPP		Not connected
3	SIM_DATA	IO	(U)SIM card data input and output
4	SIM_CLK	DO	(U)SIM card clock
5	SIM_RST	DO	(U)SIM card reset
6	SIM_VDD	PO	Power supply for (U)SIM card

#### NOTE

Only USIM card can be identified on BC95 module.

### 3.4. Antenna Interface

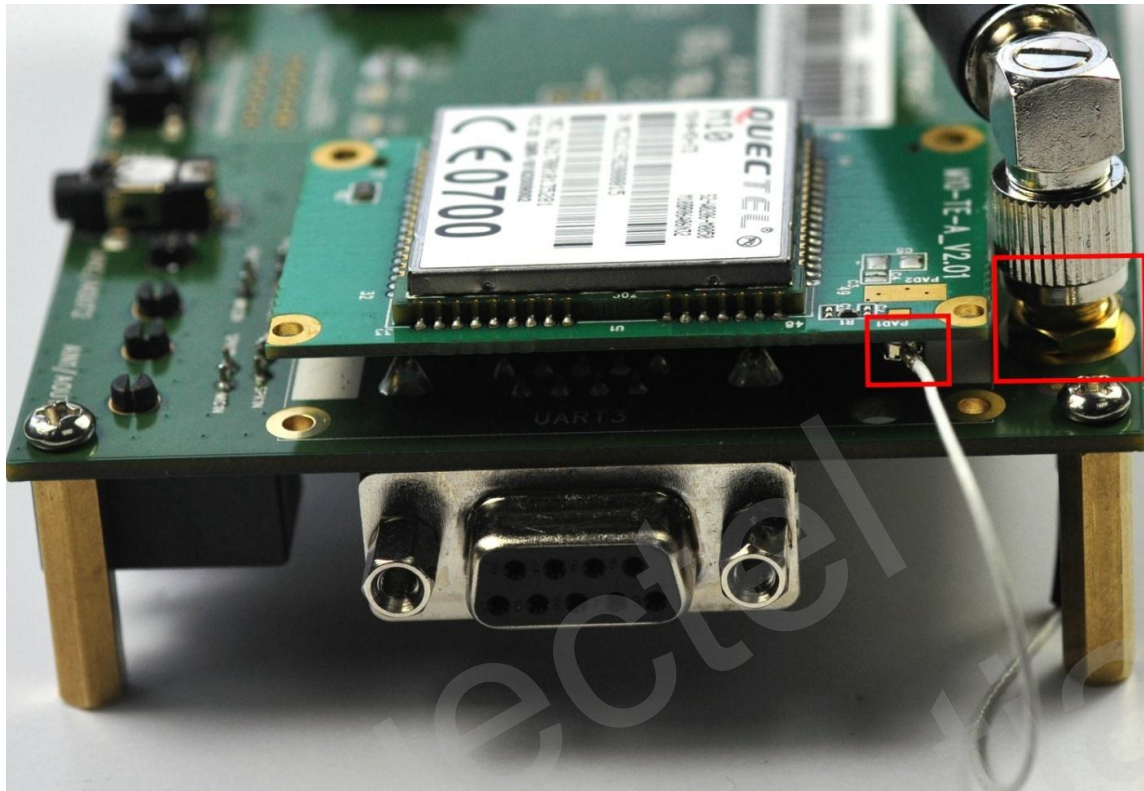


Figure 7: Antenna Interface



### 3.5. SD Card Interface

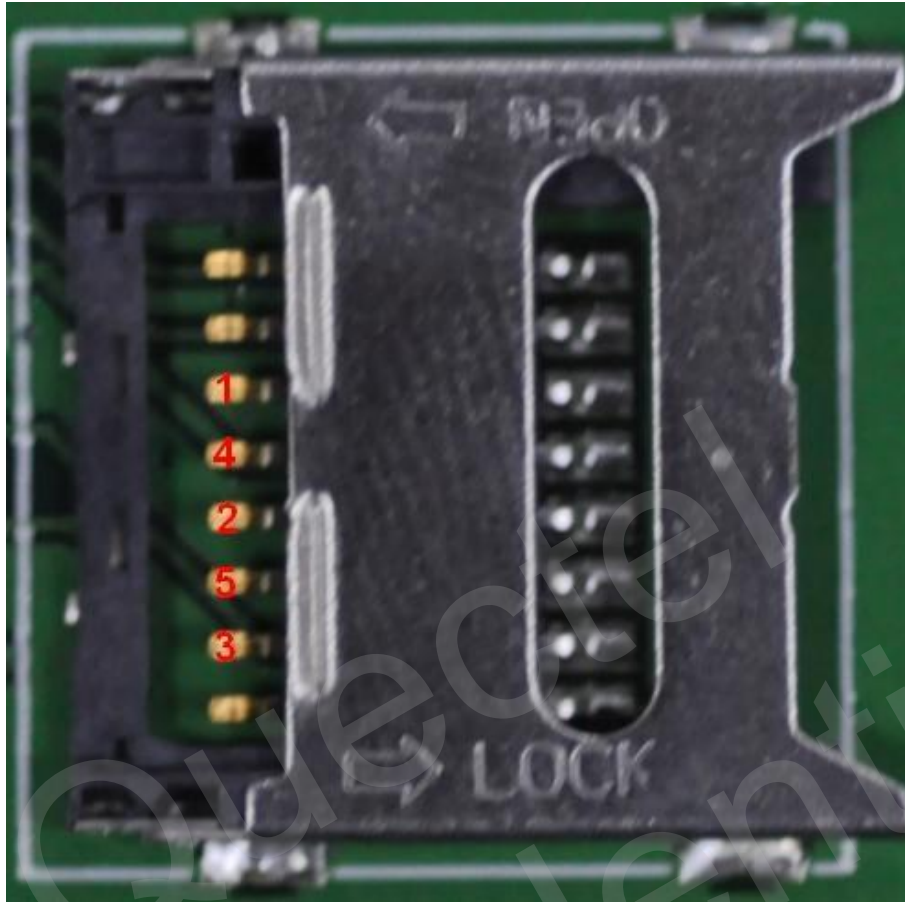


Figure 8: SD Card Interface

Table 6: Pin Description of SD Card Interface

Pin No.	Name	I/O	Description
1	SD_CMD	IO	SD card command signal
2	SD_CLK	DO	Clock signal of SD card output
3	SD_DATA	IO	Data output and input signal of SD card
4	SD_VDD	PO	Power supply for SD card
5	SD_VSS		Ground

The GSM EVB provides Micro SD card interface, but only supports 1-bit SD mode. For more details, please refer to corresponding hardware designs.

### 3.6. Main Port and Debug Port

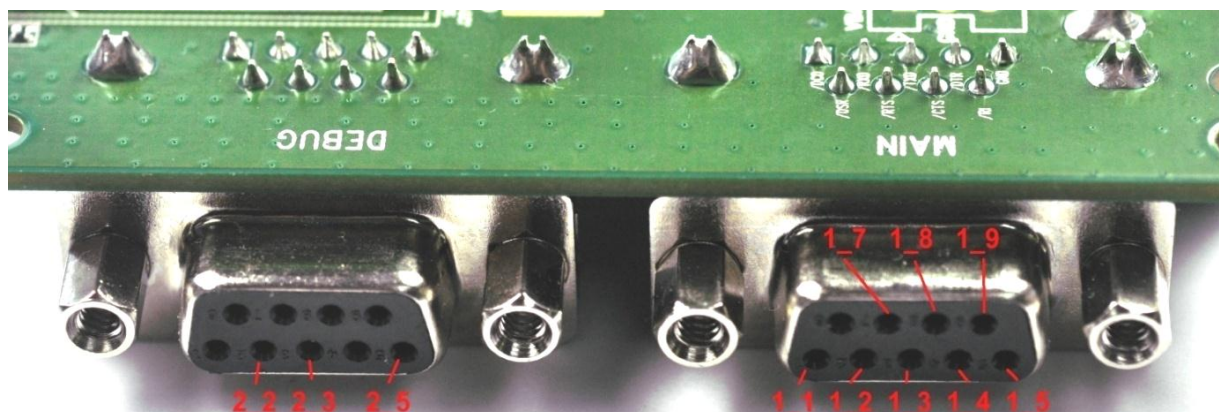


Figure 9: Main Port and Debug Port

Table 7: Pin Description of Main Port

Pin No.	Signal	I/O	Description
1_1	DCD	DO	Data carrier detection
1_2	TXD	DO	Transmit data
1_3	RXD	DI	Receive data
1_4	DTR	DI	Data terminal ready
1_5	GND		Ground
1_7	RTS	DI	Request to send
1_8	CTS	DO	Clear to send
1_9	RI	DO	Ring indicator

Table 8: Pin Description of Debug Port

Pin No.	Signal	I/O	Description
2_2	DBG_TXD	DO	Transmit data
2_3	DBG_RXD	DI	Receive data
2_5	GND		Ground

### 3.7. UART3 Port

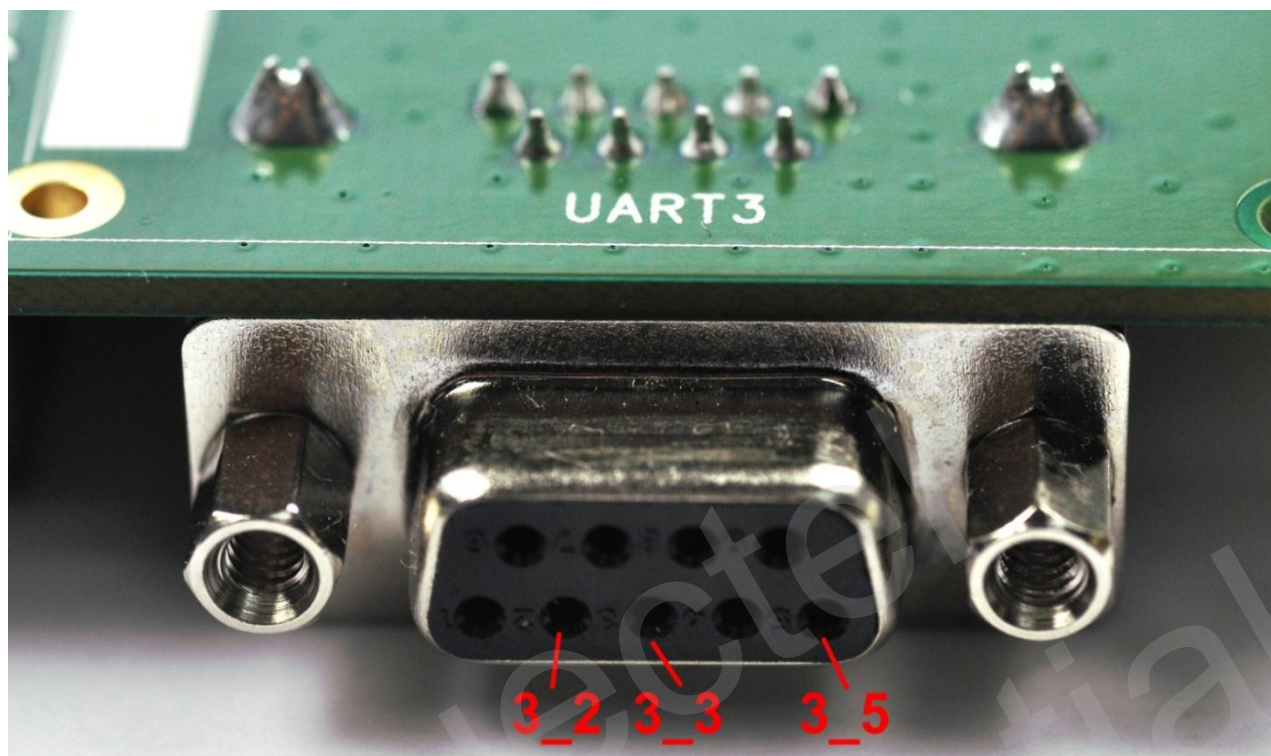


Figure 10: UART3 Port

Table 9: Pins of UART3 Port

Pin No.	Signal	I/O	Description
3_2	UART3_TXD	DO	Transmit data
3_3	UART3_RXD	DI	Receive data
3_5	GND		Ground

### 3.8. Switches and Buttons

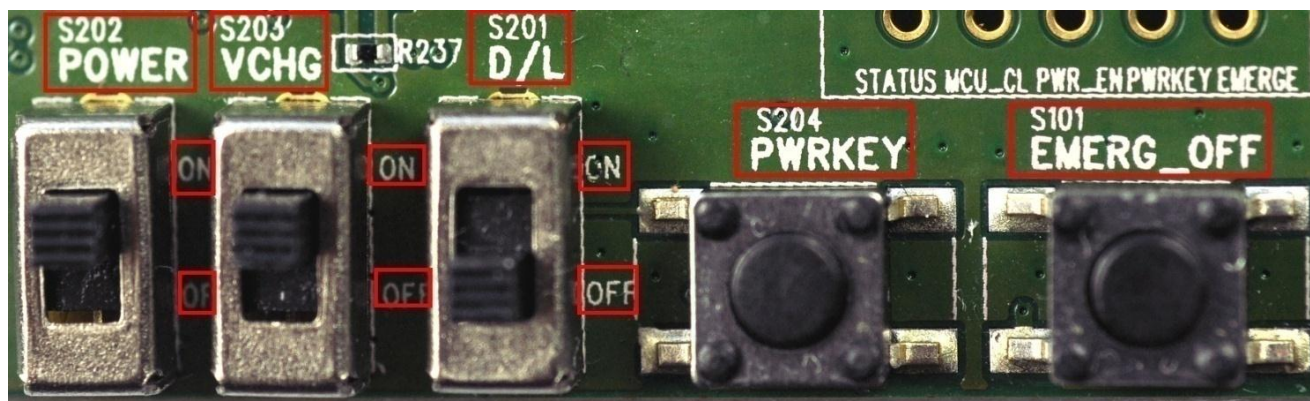


Figure 11: Switches and Buttons

Table 10: Description of Switches and Buttons

Part No.	Pin Name	I/O	Description
S202	POWER	DI	Control power supply via adaptor.
S203	VCHG	DI	Control charging if the module has charging function.
S201	D/L	DI	Switch to "ON" to download firmware for GSM and UC15 modules.
S204	PWRKEY	DI	Used to turn on/off GSM and UC15 modules. BC95 module does not have this function.
S101	EMERG_OFF	DI	Emergency button for shutting down the module. On BC95 module, it is used as RESET function to reset the module.



### 3.9. Status Indication LEDs

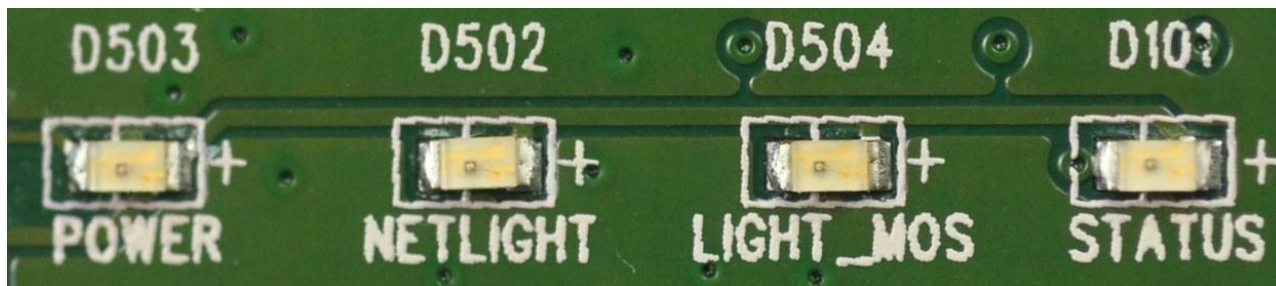


Figure 12: Status Indication LEDs

Table 11: Description of Status Indication LEDs

Part No.	Part Name	I/O	Description
D503	POWER	DO	Indicates the power supply for the module is ready. Bright: VBAT ON Extinct: VBAT OFF
D502	NETLIGHT	DO	Indicates the network status of the module. This function is under development for BC95 module.
D504	LIGHT_MOS	DO	Specially used for LIGHT_MOS demo.
D101	STATUS	DO	Indicates the operating status of the module.

## 3.10. Test Points

### 3.10.1. CON103



Figure 13: Test Points CON103

Table 12: Pin Description of CON103

Pin No.	Signal	I/O	Description
1	DBG_RXD	DI	Receive data
2	GND		Ground
3	VBAT	PI	Power supply for the module
4	STANDBY		Not used
5	DBG_TXD	DO	Transmit data
6	GND		Ground
7	VBAT	PI	Power supply for the module

### 3.10.2. CON101



Figure 14: CON101 Points

Table 13: Pins Description of CON101

Pin No.	Signal	I/O	Description
1	RES5		Not used
2	ADC1		Not used
3	NETLIGHT	DO	NETLIGHT driving output
4	DISP_A0		Reserved
5	LIGHT_MOS		Reserved
6	SDDATA	IO	SD card interface
7	SDCLK	DO	
8	SDCMD	IO	
9	GPIO0	IO	General purpose input/output port
10	DISPRST		Reserved

### 3.10.3. CON102



Figure 15: CON102 Points

Table 14: Pins Description of CON102

Pin No.	Signal	I/O	Description
1	ADC0	AI	Analog to digital converter
2	GPIO101_KBC5	IO	Keyboard interface
3	KBR1	DO	
4	KBC0	DI	
5	KBC2	DI	
7	KBR0	DO	
8	KBR2	DO	RTC supply
9	KBC1	DI	
6	VRTC	IO	
10	SIM_PRESENCE	DI	(U)SIM card detection

### 3.10.4. CON401

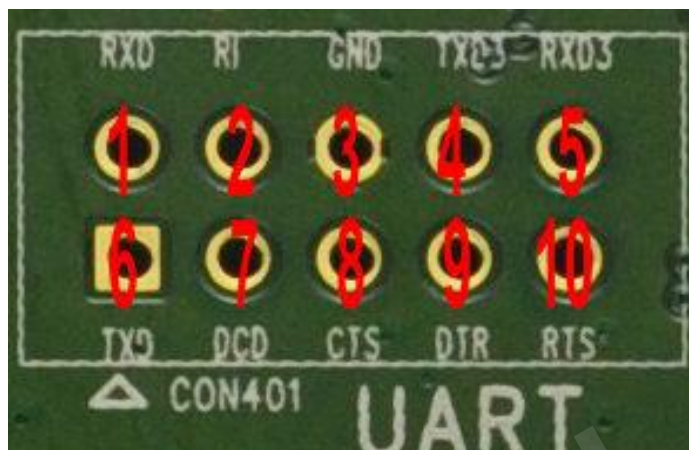


Figure 16: CON401 Points

Table 15: Pins Description of CON401

Pin No.	Signal	I/O	Description
1	RXD	DI	Receive data
2	RI	DO	Ring indicator
3	GND		Ground
4	TXD3	DO	UART3 transmit data
5	RXD3	DI	UART3 receive data
6	TXD	DO	Transmit data
7	DCD	DO	Data carrier detection
8	CTS	DO	Clear to send
9	DTR	DI	Data terminal ready
10	RTS	DI	Request to send

### 3.10.5. CON501

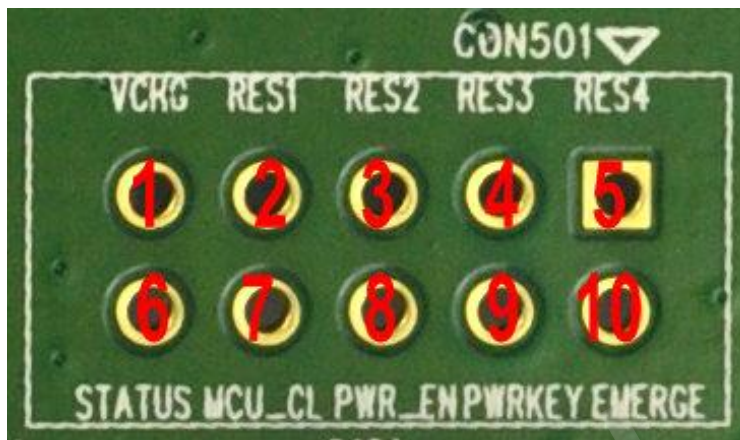


Figure 17: CON501 Points

Table 16: Pins Description of CON501

Pin No.	Signal	I/O	Description
1	VCHG	PI	Voltage input for the charging circuit
2	RES1	Reserved	Reserved
3	RES2		
4	RES3		
5	RES4		
6	STATUS	DO	Operating status of the module
7	MCU_CL		Reserved
8	PWR_EN	DO	Power enable control
9	PWRKEY	DI	Turn on/off the module The BC95 module does not have this function.
10	EMERGE	DI	Shut down the module in emergency. On BC95 module, it is used as RESET function to reset the module.



## 4 EVB Kit Accessories Assembly



Figure 18: GSM EVB Kit and Accessories

# 5 Operation Procedures Illustration

## 5.1. Power on the Module

- (1) Connect the TE-A to the 60-pin connector on EVB.
- (2) Connect EVB to the 5V power adapter.
- (3) Switch S202 to **ON** state, S203 to **OFF** state, and S201 to **OFF** state. The D503 LED on the EVB will be light. And BC95 module will be powered on (BC95 module does not have PWRKEY pin).
- (4) Press the PWRKEY for about 2 seconds, the GSM and UC15 modules will be powered on, D101 LED will be light.
- (5) The D502 LED will flicker at a certain frequency. The working status of the module can be judged by the LED status. Please refer to corresponding hardware designs for detailed network status indication.

## 5.2. Communication via UART Interface

- (1) Connect the main port of EVB to PC's USB port with the USB to UART converter cable.
- (2) Open the HyperTerminal (AT command window) on PC. The location of the HyperTerminal in Windows XP system is: Start→Program→Accessory→Communication→HyperTerminal. Set appropriate baud rate (such as 115200bps) and COM number which can be checked by the Device Manager on PC.
- (3) Connect an antenna to TE-A with an RF cable.
- (4) Insert (U)SIM card (only USIM card for BC95 module) into the (U)SIM card connector.
- (5) Insert earphone or handset into audio interface.
- (6) Power on the module according to the procedures mentioned in **Chapter 5.1**.
- (7) Wait for 2~3 seconds, and input "AT" or "at" string once or more until "OK" is received from the module in the HyperTerminal.

The module is set to autobauding mode in default configuration. This operation is to synchronize the baud rate between the computer and the module.



(8) Input AT command and the module will execute its corresponding function. For instance, when inputting “ATD112;”, an emergency call will be established.

### 5.3. Firmware Upgrade

For GSM and UC15 modules, start QFlash tool on PC to upgrade firmware, and then switch S201 and S202 on the EVB to **ON** state as shown in the figure below, the upgrading process will be started. For more details, please refer to **document [4]**.

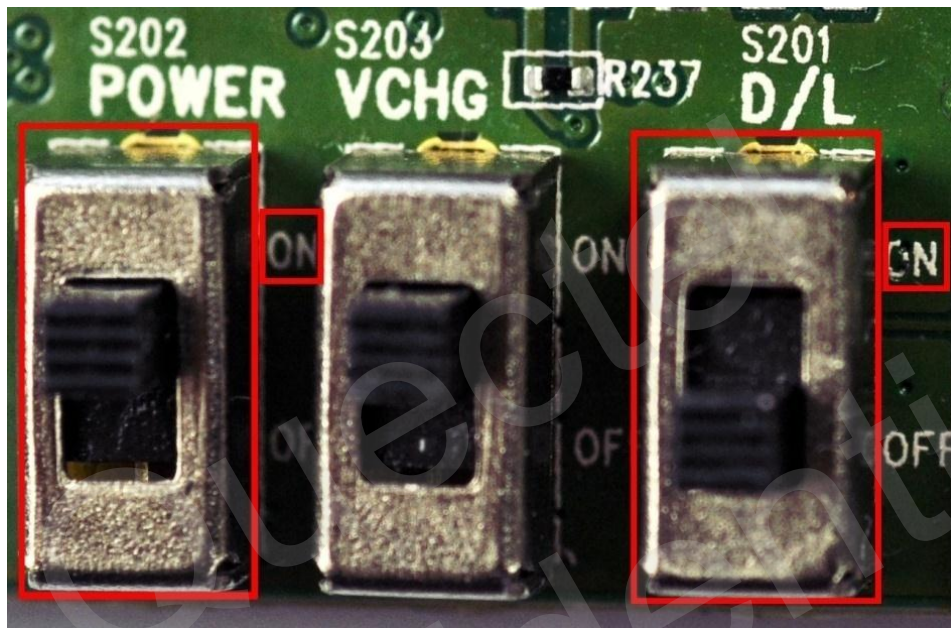


Figure 19: Switches State for Firmware Upgrade

For BC95 module, run Universal Code Loader or Code Loader tool to upgrade firmware, and then switch S202 on the EVB to **ON** state, the upgrading process will be started. For more details, please refer to **document [5] and [6]**.

### 5.4. Power off the Module

Press the **PWRKEY** button for less than 1 second, the GSM and UMTS modules will be powered off. And switch S202 to **OFF** state, the BC95 module will be turned off.

## 5.5. Emergency Off

Press the **EMERG\_OFF** button for more than 0.1 second, the module will be shut down immediately. And the module can be restarted by pressing the **PWRKEY** button.

### NOTE

This operation is harmful to the whole module system and should only be done in emergency, such as failing to turn off the module through the **PWRKEY** button.

## 5.6. UART3 Port

The module provides two UART ports for achieving dual UART. One is UART1 which is the main UART port; the other is UART 3 which is the assisted UART port. AT+QEAUART=1 command is used to enable UART3 port.

## 5.7. Supplementary Information

If the module has been welded on your PCB, you can follow the steps below to connect the module with the EVB. After that, UART communication is ready.

1. Remove R102 resistance to the place of the R224 resistance to change the power supply.

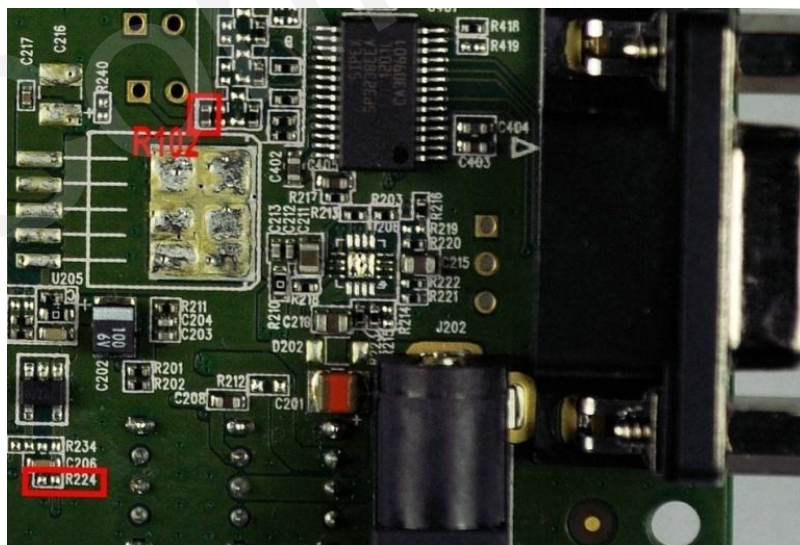
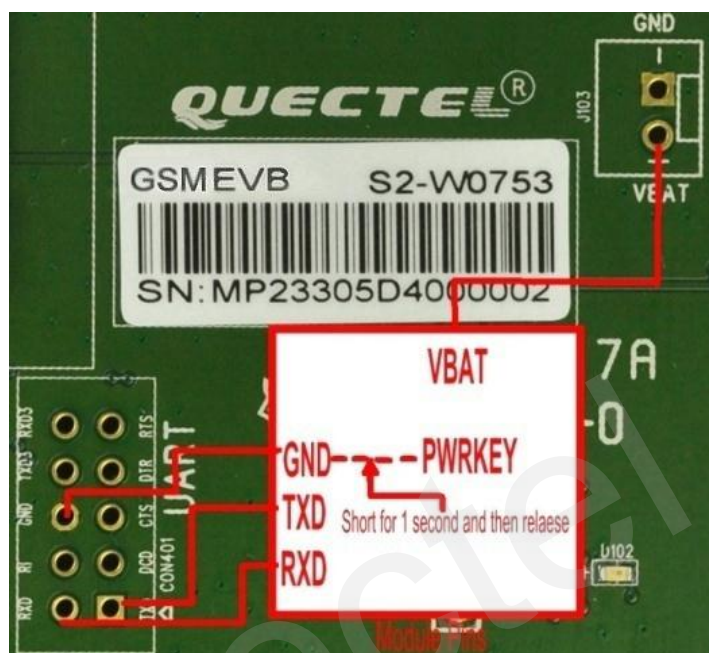


Figure 20: Change the Power Supply

Pull out the module pins of TXD, RXD, VBAT, and GND to the EVB pins of TXD, RXD, VBAT, and GND with 4 wires. Make the power key and GND to short-circuit for 1s and cut down the connection to run the module.



### Figure 21: Circuit for Pin Connections

## 6 60-pin Assignment

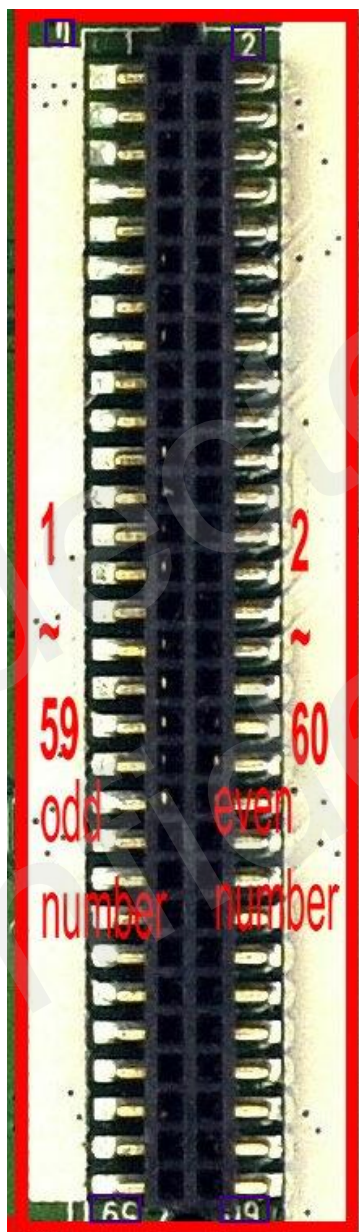


Figure 22: DIP Connector of GSM EVB

Table 17: Pin Definition of the 60-pin DIP Connector

Pin No.	Pin Name	I/O	Pin No.	Pin Name	I/O
1	VBAT	PI	2	GND	
3	VBAT	PI	4	GND	
5	VBAT	PI	6	GND	
7	VBAT	PI	8	GND	
9	VBAT	PI	10	GND	
11	VCHG	PI	12	ADC0	AI
13	ADC1	AI	14	VRTC	IO
15	VDD_EXT	PO	16	NETLIGHT	DO
17	PWRKEY	DI	18	KBR0	DO
19	STATUS	DO	20	KBR1	DO
21	GPIO0	IO	22	KBR2	DO
23	BUZZER	Reserved	24	TXD3	DO
25	SIM_VDD	PO	26	RXD3	DI
27	SIM_RST	DO	28	KBC0	DI
29	SIM_DATA	IO	30	KBC1	DI
31	SIM_CLK	DO	32	KBC2	DI
33	SIM_PRESENCE	DI	34	LIGHT_MOS	DO
35	GPIO1_KBC5	IO	36	EMERG_OFF	DI
37	DCD	DO	38	SD_CMD	IO
39	DTR	DI	40	SD_CLK	DO
41	RXD	DI	42	SD_DATA	IO
43	TXD	DO	44	DISP_A0	Reserved
45	RTS	DI	46	DISP_RST	Reserved
47	CTS	DO	48	DBG_RXD	DI
49	RI	DO	50	DBG_TXD	DO
51	AGND		52	AGND	

53	SPK1P	AO	54	MIC1P	AI
55	SPK1N	AO	56	MIC1N	AI
57	SPK2P	AO	58	MIC2P	AI
59	AGND		60	MIC2N	AI

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# 7 Appendix A Reference

**Table 18: Related Documents**

SN	Document Name	Remark
[1]	Quectel_xx_AT_Commands_Manual	AT commands manual for Quectel GSM, UC15 and BC95 modules
[2]	Quectel_GSM_UART_Application_Note	The document of serial port application note
[3]	Quectel_xx_Hardware_Design	Hardware designs for Quectel GSM, UC15 and BC95 modules
[4]	Quectel_QFlash_User_Guide	Firmware upgrade user guide for GSM and UC15 modules
[5]	Quectel_BC95_Firmware_Upgrade_via_Universal_Code Loader_User_Guide	BC95 firmware upgrade via Universal Code Loader user guide
[6]	Quectel_BC95_Firmware_Upgrade_via_Code Loader_User_Guide	BC95 firmware upgrade via Code Loader user guide