

EC200U Series

Hardware Design

LTE Standard Module Series

Version: 1.3

Date: 2025-03-26

Status: Released



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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
-	2021-10-08	King MA/ Nathan LIU	Creation of the document
1.0	2021-11-05	King MA/ Nathan LIU	First official release
1.1	2022-07-11	Denny QIN/ Nathan LIU	- Added EC200U-AU and related contents. - Updated the information about USB serial drivers (Chapter 2.2). - Updated the comments of VDD_EXT (Chapter 3.3). - Updated the comments of ADC pins (Chapter 3.3 & 3.19). - Added the status of (U)SIM card in the description of AT+CFUN=0 (Table 8 & Chapter 3.5.2). - Added the design principle of bypass capacitor between USIM_VDD and GND in the (U)SIM circuit design (Chapter 3.8). - Changed the names of pins 38 and 39 (Chapter 3.2 & 3.3 & 3.11). - Modified the external clock scheme of codec chip and added note 2 (Chapter 3.13). - Deleted the 1.8 V power domain of SD card (Chapter 3.3 & 3.17). - Updated the max. slope of reflow zone (Figure 42 & Table 53).
1.2	2023-05-19	Chris LIANG/ Denny QIN/ Ryan YI	- Updated MMS as an optional protocol (Table 5). - Added a footnote that the support for DSDS requires a customized software (Table 5 & Chapter 3.8). - Updated the functional diagram (Figure 1). - Updated the reference circuit of power supply (Figure 9).

			5. Updated the recommended value of the pull-down resistor required in the automatic turn-on scenario and added the note 3 on power-on scenarios (Chapter 3.7.1). 6. Added the note 4 on VBAT voltage requirement when VBAT power supply is disconnected and then restored (Chapter 3.7.2.2). 7. Updated the recommended resistance and capacitance on RC circuits (Chapter 3.13). 8. Updated the recommended value of the pull-up resistor on the SDIO1_CMD signal trace (Chapter 3.17). 9. Added the GNSS antenna isolation requirement (Table 39). 10. Updated the recommended thickness of stencil for the module; Updated the recommended ramp-to-soak, ramp-up, and cool-down slopes and added a related note (Chapter 7.2). 11. Added module mounting direction (Chapter 7.3.3).
1.3	2025-03-26	Denny QIN/ Chris LIANG/ Kevin WANG	1. Deleted the related information about LCM, matrix keypad, SPI and WLAN application interfaces. 2. Specified that voice and audio of EC200U-EU are optional functions. 3. Updated the information about Bluetooth and Wi-Fi Scan (Table 2). 4. Added LTE uplink and downlink modulations (Table 3). 5. Added AGNSS feature description and GNSS performance (Tables 3 & 35). 6. Updated the functional diagram (Figure 1). 7. Added the note on pins 73–84 (Chapters 3.1 & 6.2). 8. Added the notification on USB_VBUS (Tables 5 & 12). 9. Updated the pull-up resistance value of USIM_DATA in reference circuit of (U)SIM interface (Figures 18 & 19). 10. Added a note on UART hardware flow control design (Chapter 3.9). 11. Updated notes on audio interface design (Chapter 3.12.1). 12. Updated reference circuit for RF antenna interfaces and added relevant notes (Chapters 4.1.3 & 4.2). 13. Updated antenna requirements (Table 34). 14. Updated the maximum values of peak current of VBAT_RF and voltage at digital pins (Table 35). 15. Updated EC200U-EU power consumption value under GPRS/LTE data transmission (Table 39). 16. Updated RF receiver sensitivity (Chapter 5.6).

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- 17. Updated the module's coplanarity standard (Chapter 6.1).
 - 18. Updated the pre-baking time to 24 h (Chapter 7.1).
 - 19. Updated the reference document for recommended module stencil thickness;
Added a note specifying that mercury-containing materials should be avoided for module processing;
Added a note prohibiting storage or use of unprotected modules in environments containing corrosive gases (Chapter 7.2).
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1 Introduction

This document defines the EC200U series module and describes its air interface and hardware interfaces which are connected with your applications.

This document can help you quickly understand module interface specifications, electrical and mechanical details, as well as other related information of EC200U series module. To facilitate its application in different fields, relevant reference design is also provided for customers' reference. Associated with application note and user guide, you can use EC200U series module to design and set up wireless applications easily.

This document is applicable to the following variants:

- EC200U-CN
- EC200U-EU
- EC200U-AU

1.1. Special Marks

Table 1: Special Marks

Mark	Definition
*	Unless otherwise specified, an asterisk (*) after a function, feature, interface, pin name, command, argument, and so on indicates that it is under development and currently not supported; and the asterisk (*) after a model indicates that the model sample is currently unavailable.
[...]	Brackets ([...]) used after a pin enclosing a range of numbers indicate all pins of the same type. For example, SDIO_DATA[0:3] refers to all four SDIO pins: SDIO_DATA0, SDIO_DATA1, SDIO_DATA2, and SDIO_DATA3.

2 Product Overview

2.1. General Description

EC200U series is a wireless communication module, which supports LTE-FDD, LTE-TDD, GSM/GPRS network data connection. It provides voice function for your special applications and also supports GNSS. The following table shows the frequency bands of the module.

Table 2: Frequency Bands and Functions

Technology	EC200U-CN	EC200U-EU	EC200U-AU
LTE-FDD	B1/B3/B5/B8	B1/B3/B5/B7/B8/B20/B28	B1/B2/B3/B4/B5/B7/B8/B28/B66
LTE-TDD	B34/B38/B39/B40/B41	B38/B40/B41	B38/B40/B41
GSM	Optional: EGSM900/DCS1800	GSM850/EGSM900/ DCS1800/PCS1900	GSM850/EGSM900/ DCS1800/PCS1900
GNSS (optional)	GPS, GLONASS, BDS, Galileo, QZSS	GPS, GLONASS, BDS, Galileo, QZSS	GPS, GLONASS, BDS, Galileo, QZSS
Bluetooth (optional) ¹	Bluetooth 4.2 (BR/ EDR + BLE)	Bluetooth 4.2 (BR/ EDR + BLE)	Bluetooth 4.2 (BR/ EDR + BLE)
Wi-Fi Scan (optional) ¹	2.4 GHz 11b (Rx)	2.4 GHz 11b (Rx)	2.4 GHz 11b (Rx)
Voice	Supported	Optional	Supported

EC200U series is an SMD type module which can be embedded into applications through 144 pins, including 80 LCC pins and 64 LGA pins.

¹ The module supports Bluetooth and Wi-Fi Scan functions. Due to the shared antenna interface, the two functions cannot be used at the same time. Bluetooth and Wi-Fi Scan functions are optional. Please contact Quectel Technical Support for details.

2.2. Key Features

Table 3: Key Features

Feature	Details
Power Supply	- Supply voltage: 3.3–4.3 V - Typical supply voltage: 3.8 V
Transmitting Power	- GSM850: Class 4 (33 dBm $\pm$2 dB) - EGSM900: Class 4 (33 dBm $\pm$2 dB) - DCS1800: Class 1 (30 dBm $\pm$2 dB) - PCS1900: Class 1 (30 dBm $\pm$2 dB) - LTE-FDD band: Class 3 (23 dBm $\pm$2 dB) - LTE-TDD band: Class 3 (23 dBm $\pm$2 dB)
LTE Features	- Supports up to 3GPP Rel-13 Cat1 bis FDD/TDD - Supports 1.4/3/5/10/15/20 MHz RF bandwidth - Modulations: - DL: QPSK, 16QAM and 64QAM - UL: QPSK and 16QAM - FDD: Max. 10 Mbps (DL), Max. 5 Mbps (UL) - TDD: Max. 8.96 Mbps (DL), Max. 3.1 Mbps (UL)
GSM Features ²	GPRS: - Supports GPRS multi-slot class 12 - Coding scheme: CS 1–4 - Max. 85.6 kbps (DL)/Max. 85.6 kbps (UL)
Internet Protocol Features	- Supports TCP/UDP/PPP/NTP/NITZ/FTP/HTTP/PING/CMUX/HTTPS/FTPS/SSL/FILE/MQTT/MMS ³ protocols - Supports PAP and CHAP for PPP connections
SMS	- Text and PDU mode - Point to point MO and MT - SMS cell broadcast - SMS storage: Stored in (U) SIM card and ME, ME by default
(U)SIM Interfaces	- Supports USIM/SIM card: 1.8/3.0 V - Supports Single SIM Single Standby (SSSS) by default ⁴
Audio Features	- Supports one analog audio input and one analog audio output - HR/FR/EFR/AMR/AMR-WB (optional) - Supports echo cancellation and noise suppression (optional)
USB Interface	Compliant with USB 2.0 specification (slave mode only); the data

² GSM on EC200U-CN is optional. Please contact Quectel Technical Support for details.

³ MMS is optional.

⁴ (U)SIM2 interface is optional. For the module supporting two (U)SIM interfaces, contact Quectel Technical Support to obtain the software version supporting DSSS or DSDS. See **document [1]** for details.

	transmission rate can reach up to 480 Mbps ● Used for AT command communication, data transmission, software debugging, firmware upgrade ● Supports USB serial drivers for Windows 10/11, Linux 2.6–6.7, Android 4.x–14.x, etc.
UART Interfaces	Main UART: ● Used for AT command communication and data transmission ● Baud rates reach up to 921600 bps; 115200 bps by default ● Support RTS and CTS hardware flow control Debug UART: ● Used for AP log output ● 921600 bps baud rates ● Can only be used as a debugging UART, not a general UART Auxiliary UART
I2C Interfaces	Two I2C interfaces
SD Card Interface	SD 2.0 protocol compliant
ADC Interfaces	Three ADC interfaces
USB_BOOT Interface	Forced download interface
AT Commands	● Compliant with <i>3GPP TS 27.007</i>, <i>3GPP TS 27.005</i> ● Quectel enhanced AT commands
Network Indication	NET_MODE and NET_STATUS to indicate network status
Antenna Interfaces	● Main antenna interface (ANT_MAIN) ● Wi-Fi Scan/Bluetooth antenna interface (ANT_BT/WIFI_SCAN) (optional) ¹ ● GNSS antenna interface (ANT_GNSS) (optional) ● 50 Ω characteristic impedance
Location	Supports Wi-Fi Scan/GNSS
GNSS (Optional)	● Supports GPS/GLONASS/Galileo/BDS/QZSS constellation types ● Supports AGNSS. For more details, see document [2].
Physical Characteristics	● Size: (28.0 ±0.15) mm × (31.0 ±0.15) mm × (2.4 ±0.2) mm ● Weight: approx. 4.1 g
Temperature Ranges	● Operating temperature range: -35 °C to +75 °C ⁵ ● Extended temperature range: -40 °C to +85 °C ⁶ ● Storage temperature range: -40 °C to +90 °C

⁵ Within the operating temperature range, the module meets 3GPP specification.

⁶ Within the extended temperature range, the module remains the ability to establish and maintain functions such as voice (optional), SMS and data transmission, without any unrecoverable malfunction. Radio spectrum and radio network are not influenced, while one or more specifications, such as P_{out}, may exceed the specified tolerances of 3GPP. When the temperature returns to the operating temperature range, the module meets 3GPP specifications again.

Firmware Upgrade	USB interface or FOTA
RoHS	All hardware components are fully compliant with EU RoHS directive

3 Application Interfaces

3.1. Pin Assignment

The following figure shows the pin assignment of the module.



Figure 1: Pin Assignment (Top View)

NOTE

1. If the forced download function is not used, do not pull USB_BOOT up before the module's successful startup.
2. KEYIN1 cannot be pulled up before the module's successful startup.
3. Keep all RESERVED and unused pins unconnected, and all GND pins are connected to the ground.

4. If pins 73–84 are unused, the corresponding stencil design can be omitted.

3.2. Pin Description

Table 4: Parameter Definition

Parameter	Description
AI	Analog Input
AO	Analog Output
AIO	Analog Input/Output
DI	Digital Input
DO	Digital Output
DIO	Digital Input/Output
OD	Open Drain
PI	Power Input
PO	Power Output

DC characteristics include power domain and rated current.

Table 5: Pin Description

Power Supply						
Pin Name	Pin No.	I/O	Description	DC Characteristics	Comment	
VBAT_BB	59, 60	PI	Power supply for module's baseband part and RF part	Vmax = 4.3 V Vmin = 3.3 V Vnom = 3.8 V	It must be provided with sufficient current of at least 1.5 A. A test point is recommended to be reserved.	
VBAT_RF	57, 58	PI	Power supply for module's RF part	Vmax = 4.3 V Vmin = 3.3 V Vnom = 3.8 V	It must be provided with sufficient current of at least 2 A.	

A test point is recommended to be reserved.

GND 8, 9, 19, 22, 36, 46, 48, 50–54, 56, 72, 76, 85–112

Module Output Power

Pin Name	Pin No.	I/O	Description	DC Characteristics	Comment
VDD_EXT	7	PO	Provide 1.8 V for external circuit	Vnom = 1.8 V I _{Omax} = 50 mA	Power supply for external GPIO's pull-up circuits. Add 2.2 μ F capacitor and TVS components if used. A test point is recommended to be reserved.

Turn-on/off

Pin Name	Pin No.	I/O	Description	DC Characteristics	Comment
PWRKEY	21	DI	Turn on/off the module	V _{ILmax} = 0.5 V	VBAT power domain. A test point is recommended to be reserved.
RESET_N	20	DI	Reset the module	V _{ILmax} = 0.5 V	VBAT power domain. A test point is recommended to be reserved if unused. Active low.

Status Indication

Pin Name	Pin No.	I/O	Description	DC Characteristics	Comment
STATUS	61	DO	Indicate module's operation status		
NET_MODE	5	DO	Indicate the module's network activity status	V _{OHmin} = 1.35 V V _{OLmax} = 0.45 V	1.8 V power domain. If unused, keep them open.
NET_STATUS	6	DO	Indicate the module's network registration mode	V _{OHmin} = 1.35 V V _{OLmax} = 0.45 V	

USB Interface

Pin Name	Pin No.	I/O	Description	DC Characteristics	Comment
USB_VBUS	71	AI	USB connection detect	V _{max} = 5.25 V V _{min} = 3.5 V V _{nom} = 5.0 V	A test point must be reserved. The USB_VBUS pin needs to be connected with a 1 kΩ resistor in series if USB_VBUS is connected to power supply and VBAT is powered down.
USB_DP	69	AIO	USB differential data bus (+)		Require differential impedance of 90 Ω. USB 2.0 compliant. Test points must be reserved.
USB_DM	70	AIO	USB differential data bus (-)		

(U)SIM Interface

Pin Name	Pin No.	I/O	Description	DC Characteristics	Comment
USIM_GND	10	-	(U)SIM1 card GND		Connect to the GND of (U)SIM card connector.
				I _o max = 50 mA	
USIM_VDD	14	PO	(U)SIM1 card power supply	For 1.8 V (U)SIM: V _{max} = 1.9 V V _{min} = 1.7 V For 3.0 V (U)SIM: V _{max} = 3.05 V V _{min} = 2.7 V	Either 1.8 V or 3.0 V can be recognized by the module automatically.
USIM_DATA	15	DIO	(U)SIM1 card data	For 1.8 V (U)SIM: V _{IL} max = 0.6 V V _{IH} min = 1.2 V V _{OL} max = 0.45 V V _{OH} min = 1.35 V For 3.0 V (U)SIM: V _{IL} max = 1.0 V V _{IH} min = 1.95 V V _{OL} max = 0.45 V	

				$V_{OHmin} = 2.55\text{ V}$	
USIM_CLK	16	DO	(U)SIM1 card clock	For 1.8 V (U)SIM: $V_{OLmax} = 0.45\text{ V}$ $V_{OHmin} = 1.35\text{ V}$	
				For 3.0 V (U)SIM: $V_{OLmax} = 0.45\text{ V}$ $V_{OHmin} = 2.55\text{ V}$	
USIM_RST	17	DO	(U)SIM1 card reset	For 1.8 V (U)SIM: $V_{OLmax} = 0.45\text{ V}$ $V_{OHmin} = 1.35\text{ V}$	
				For 3.0 V (U)SIM: $V_{OLmax} = 0.45\text{ V}$ $V_{OHmin} = 2.55\text{ V}$	
USIM_DET	13	DI	(U)SIM1 card hot-plug detect	$V_{ILmin} = -0.3\text{ V}$ $V_{ILmax} = 0.6\text{ V}$ $V_{IHmin} = 1.26\text{ V}$ $V_{IHmax} = 2.0\text{ V}$	1.8 V power domain. If unused, keep it open.
				$I_{Omax} = 50\text{ mA}$	
USIM2_VDD	128	PO	(U)SIM2 card power supply	For 1.8 V (U)SIM: $V_{max} = 1.9\text{ V}$ $V_{min} = 1.7\text{ V}$	Either 1.8 V or 3.0 V can be recognized by the module automatically.
				For 3.0 V (U)SIM: $V_{max} = 3.05\text{ V}$ $V_{min} = 2.7\text{ V}$	
AP_READY	2	DIO	(U)SIM2 card data	For 1.8 V (U)SIM: $V_{ILmax} = 0.6\text{ V}$ $V_{IHmin} = 1.26\text{ V}$ $V_{OLmax} = 0.45\text{ V}$ $V_{OHmin} = 1.35\text{ V}$	The (U)SIM2 function is optional. If the firmware version of the module supports the function of the (U)SIM2 card, the relevant functions of the (U)SIM2 card can be realized by configuring AP_READY, WAKEUP_IN, SLEEP_IND, and W_DISABLE#. For details, please
				For 3.0 V (U)SIM: $V_{ILmax} = 1.0\text{ V}$ $V_{IHmin} = 1.95\text{ V}$ $V_{OLmax} = 0.45\text{ V}$ $V_{OHmin} = 2.55\text{ V}$	
WAKEUP_IN	1	DO	(U)SIM2 card clock	For 1.8 V (U)SIM: $V_{OLmax} = 0.45\text{ V}$ $V_{OHmin} = 1.35\text{ V}$	

				For 3.0 V (U)SIM: $V_{OLmax} = 0.45\text{ V}$ $V_{OHmin} = 2.55\text{ V}$	consult Quectel Technical Support.
SLEEP_IND	3	DI	(U)SIM2 card hot-plug detect	$V_{ILmin} = -0.3\text{ V}$	
				For 1.8 V (U)SIM: $V_{OLmax} = 0.45\text{ V}$ $V_{OHmin} = 1.35\text{ V}$	
W_DISABLE#	4	DO	(U)SIM2 card reset	For 3.0 V (U)SIM: $V_{OLmax} = 0.45\text{ V}$ $V_{OHmin} = 2.55\text{ V}$	

Main UART Interface

Pin Name	Pin No.	I/O	Description	DC Characteristics	Comment
MAIN_RI	62	DO	Main UART ring indication	$V_{OLmax} = 0.45\text{ V}$ $V_{OHmin} = 1.35\text{ V}$	1.8 V power domain. If unused, keep them open.
MAIN_DCD	63	DO	Main UART data carrier detect	$V_{OLmax} = 0.45\text{ V}$ $V_{OHmin} = 1.35\text{ V}$	
MAIN_CTS	64	DO	Clear to send signal from the module	$V_{OLmax} = 0.45\text{ V}$ $V_{OHmin} = 1.35\text{ V}$	Connect to the MCU's CTS. 1.8 V power domain. If unused, keep it open.
MAIN_RTS	65	DI	Request to send signal to the module	$V_{ILmin} = -0.3\text{ V}$ $V_{ILmax} = 0.6\text{ V}$ $V_{IHmin} = 1.26\text{ V}$ $V_{IHmax} = 2.0\text{ V}$	Connect to the MCU's RTS. 1.8 V power domain. If unused, keep it open.
MAIN_DTR	66	DI	Main UART data terminal ready	$V_{ILmin} = -0.3\text{ V}$ $V_{ILmax} = 0.6\text{ V}$ $V_{IHmin} = 1.26\text{ V}$ $V_{IHmax} = 2.0\text{ V}$	1.8 V power domain. Pull-up by default. Low level wakes up the module. If unused, keep it open.
MAIN_TXD	67	DO	Main UART transmit	$V_{OLmax} = 0.45\text{ V}$ $V_{OHmin} = 1.35\text{ V}$	1.8 V power domain. If unused, keep them open.
MAIN_RXD	68	DI	Main UART receive	$V_{ILmin} = -0.3\text{ V}$ $V_{ILmax} = 0.6\text{ V}$ $V_{IHmin} = 1.26\text{ V}$ $V_{IHmax} = 2.0\text{ V}$	

Debug UART Interface

Pin Name	Pin No.	I/O	Description	DC Characteristics	Comment
DBG_TXD	12	DO	Debug UART transmit	$V_{OLmax} = 0.45\text{ V}$ $V_{OHmin} = 1.35\text{ V}$	1.8 V power domain. Test points must be reserved.
DBG_RXD	11	DI	Debug UART receive	$V_{ILmin} = -0.3\text{ V}$ $V_{ILmax} = 0.6\text{ V}$ $V_{IHmin} = 1.26\text{ V}$ $V_{IHmax} = 2.0\text{ V}$	

Auxiliary UART Interface

Pin Name	Pin No.	I/O	Description	DC Characteristics	Comment
AUX_RXD	137	DI	Auxiliary UART receive	$V_{ILmin} = -0.3\text{ V}$ $V_{ILmax} = 0.6\text{ V}$ $V_{IHmin} = 1.26\text{ V}$ $V_{IHmax} = 2.0\text{ V}$	1.8 V power domain. If unused, keep them open.
AUX_TXD	138	DO	Auxiliary UART transmit	$V_{OLmax} = 0.45\text{ V}$ $V_{OHmin} = 1.35\text{ V}$	

ADC Interfaces

Pin Name	Pin No.	I/O	Description	DC Characteristics	Comment
ADC2	43	AI	General-purpose ADC interface	Input voltage range: 0 V–VBAT_BB	It is recommended to reserve a voltage divider circuit. If unused, keep them open.
ADC1	44	AI	General-purpose ADC interface		
ADC0	45	AI	General-purpose ADC interface		

Analog Audio Interface

Pin Name	Pin No.	I/O	Description	DC Characteristics	Comment
LOUDSPK_P	73	AO	Loudspeaker differential output (+)		If unused, keep them open.
LOUDSPK_N	74	AO	Loudspeaker differential output (-)		
MIC_P	75	AI	Microphone analog input (+)		
MIC_N	77	AI	Microphone analog input (-)		

I2C Interface

Pin Name	Pin No.	I/O	Description	DC Characteristics	Comment
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I2C_SCL	41	OD	I2C serial clock	Require external pull-up to 1.8 V if used. If unused, keep them open.
I2C_SDA	42	OD	I2C serial data	
I2C2_SCL	141	OD	I2C serial clock	
I2C2_SDA	142	OD	I2C serial data	

PCM Interface

Pin Name	Pin No.	I/O	Description	DC Characteristics	Comment
PCM_DIN	24	DI	PCM data input	$V_{ILmin} = -0.3\text{ V}$ $V_{ILmax} = 0.6\text{ V}$ $V_{IHmin} = 1.26\text{ V}$ $V_{IHmax} = 2.0\text{ V}$	1.8 V power domain. If unused, keep them open.
PCM_DOUT	25	DO	PCM data output	$V_{OLmax} = 0.45\text{ V}$ $V_{OHmin} = 1.35\text{ V}$	
PCM_SYNC	26	DI	PCM data frame sync	$V_{ILmin} = -0.3\text{ V}$ $V_{ILmax} = 0.6\text{ V}$ $V_{IHmin} = 1.26\text{ V}$ $V_{IHmax} = 2.0\text{ V}$	1.8 V power domain. If unused, keep them open. The PCM function only supports slave mode.
PCM_CLK	27	DI	PCM clock	$V_{ILmin} = -0.3\text{ V}$ $V_{ILmax} = 0.6\text{ V}$ $V_{IHmin} = 1.26\text{ V}$ $V_{IHmax} = 2.0\text{ V}$	

SD Card Interface

Pin Name	Pin No.	I/O	Description	DC Characteristics	Comment
SD_DET	23	DI	SD card detect		1.8 V power domain. If unused, keep it open.
SDIO1_DATA3	28	DIO	SDIO data bit 3		3.2 V power domain. If unused, keep them open.
SDIO1_DATA2	29	DIO	SDIO data bit 2		
SDIO1_DATA1	30	DIO	SDIO data bit 1		
SDIO1_DATA0	31	DIO	SDIO data bit 0		
SDIO1_CLK	32	DO	SDIO clock		
SDIO1_CMD	33	DIO	SDIO command		
SDIO1_VDD	34	PO	SDIO power supply		

Antenna Interfaces

Pin Name	Pin No.	I/O	Description	DC Characteristics	Comment
ANT_BT/ WIFI_SCAN ⁷	35	AIO/ AI	The shared antenna interface of Bluetooth and Wi-Fi Scan		Wi-Fi Scan antenna can only receive but not transmit. 50 Ω characteristic impedance. If unused, keep it open.
ANT_GNSS	47	AI	GNSS antenna interface		50 Ω characteristic impedance. If unused, keep it open. GNSS function is optional.
ANT_MAIN	49	AIO	Main antenna interface		50 Ω characteristic impedance.

USB_BOOT

Pin Name	Pin No.	I/O	Description	DC Characteristics	Comment
USB_BOOT	115	DI	Force the module into download mode	$V_{ILmin} = -0.3\text{ V}$ $V_{ILmax} = 0.6\text{ V}$ $V_{IHmin} = 1.26\text{ V}$ $V_{IHmax} = 2.0\text{ V}$	1.8 V power domain. Active high. A circuit design for entering forced download mode should be reserved. A test point is recommended to be reserved.

Other Interfaces

Pin Name	Pin No.	I/O	Description	DC Characteristics	Comment
WAKEUP_IN	1	DI	Wake up the module	$V_{ILmin} = -0.3\text{ V}$ $V_{ILmax} = 0.6\text{ V}$ $V_{IHmin} = 1.26\text{ V}$ $V_{IHmax} = 2.0\text{ V}$	1.8 V power domain. Pull-up by default. If unused, keep it open.
AP_READY	2	DI	Application processor ready	$V_{ILmin} = -0.3\text{ V}$ $V_{ILmax} = 0.6\text{ V}$ $V_{IHmin} = 1.26\text{ V}$	1.8 V power domain. If unused, keep it open.

⁷ The module supports Bluetooth and Wi-Fi Scan functions. Due to the shared antenna interface, the two functions cannot be used at the same time. Bluetooth and Wi-Fi Scan functions are optional. Please contact Quectel Technical Support for details.

				$V_{IHmax} = 2.0\text{ V}$	
SLEEP_IND	3	DO	Sleep indicator	$V_{OLmax} = 0.45\text{ V}$ $V_{OHmin} = 1.35\text{ V}$	1.8 V power domain. If unused, keep it open.
W_DISABLE#	4	DI	Airplane mode control	$V_{ILmin} = -0.3\text{ V}$ $V_{ILmax} = 0.6\text{ V}$ $V_{IHmin} = 1.26\text{ V}$ $V_{IHmax} = 2.0\text{ V}$	1.8 V power domain. Pull-up by default. Driving the pin low can make the module enter the airplane mode. If unused, keep it open.
GPIO1	126	DO	CP log		It can output CP log, and only 8 Mbps baud rate is supported. A test point must be reserved.
GRFC1	143	DIO	Generic RF controller		
GRFC2	144	DIO	Generic RF controller		

Reserved Pins

Pin Name	Pin No.	Comment
RESERVED	18, 55, 81, 82, 116, 117	Keep these pins open.
BT_EN	139	
LCD_FMARK	119	
LCD_RSTB	120	
LCD_SEL	121	These pins are not defined with functions corresponding to the pin names. Please keep them reserved.
LCD_CS	122	
LCD_CLK	123	
LCD_SDC	124	
LCD_SI/O	125	
ISINK	140	

KEYIN1	78
KEYIN2	79
KEYIN3	80
KEYOUT0	83
KEYOUT1	84
KEYOUT2	113
KEYOUT3	114
SPI_CS	37
SPI_DOUT	38
SPI_DIN	39
SPI_CLK	40
WLAN_SLP_ CLK	118
WLAN_PWR_ EN	127
SDIO2_DATA3	129
SDIO2_DATA2	130
SDIO2_DATA1	131
SDIO2_DATA0	132
SDIO2_CLK	133
SDIO2_CMD	134
WLAN_WAKE	135
WLAN_EN	136

3.3. Operating Modes

Table 6: Overview of Operating Modes

Mode	Details	
Full Functionality Mode	Idle	Software is active. The module has registered on the network, and it is ready to send and receive data.
	Voice ⁸ /Data	Network connection is ongoing. In this mode, the power consumption is decided by network setting and data transmission rate.
Minimum Functionality Mode	AT+CFUN=0 can set the module to a minimum functionality mode without removing the power supply. In this case, both RF function and (U)SIM will be invalid.	
Airplane Mode	AT+CFUN=4 or pulling down W_DISABLE# can set the module to airplane mode. In this case, RF function will be invalid.	
Sleep Mode	In this mode, the power consumption of the module will be reduced to an ultra-low level. The module can still receive paging message, SMS, voice call and TCP/UDP data from the network normally.	
Power Down Mode	In this mode, the PMIC shuts down the power supply. Software is not active and the UART interface is not accessible, while operating voltage (connected to VBAT_RF and VBAT_BB) remains applied.	

NOTE

For more details about the AT command, see **document [4]**.

3.4. Power Saving

3.4.1. Sleep Mode

The module is able to reduce its power consumption to an ultra-low level in sleep mode. The following section describes power saving procedures of the module.

⁸ Voice function is supported on EC200U-CN/-AU, and is optional on EC200U-EU. For more details, contact Quectel Technical Support.

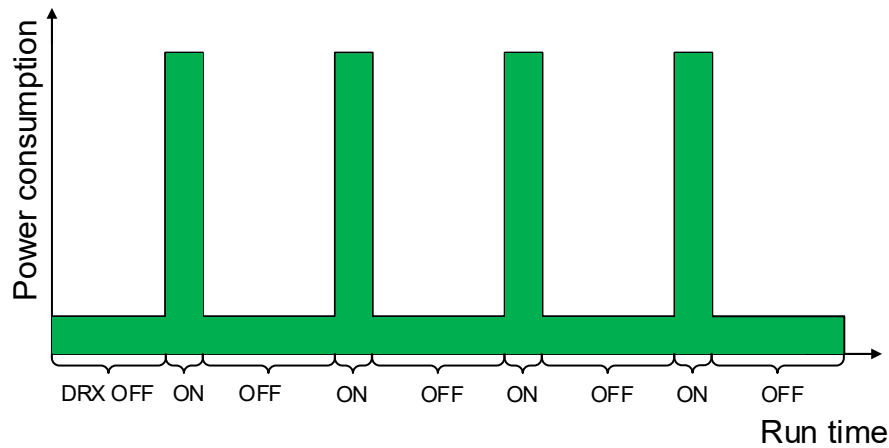


Figure 2: Module Power Consumption in Sleep Mode

NOTE

DRX cycle values are transmitted over the wireless network.

3.4.1.1. UART Application

If the MCU communicates with module via UART interface, the following preconditions should be met to let the module enter sleep mode.

- Execute **AT+QSCCLK=1** to enable sleep mode. For more details about the AT command, see **document [5]**.
- Drive MAIN_DTR to high level.

The following figure shows the connection between the module and the MCU.

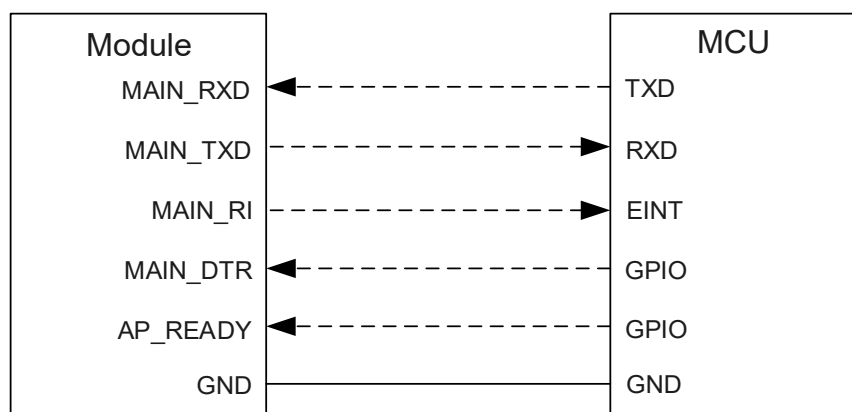


Figure 3: Sleep Mode Application via UART

- Driving MAIN_DTR to low level by the MCU can wake up the module.
- When the module has a URC to report, the URC will trigger the behavior of MAIN_RI pin. See **Chapter 3.17** for details about MAIN_RI behavior.

NOTE

Pay attention to the level match shown in dotted line between the module and the MCU.

3.4.1.2. USB Application with USB Remote Wakeup Function

If the host supports USB Suspend/Resume and remote wakeup functions, the following three preconditions must be met to make the module enter sleep mode.

- Execute **AT+QSCLK=1** to enable sleep mode.
- Ensure the MAIN_DTR is held at high level, or keep it open.
- The host's USB bus, which is connected with the module's USB interface, enters suspended state.

The following figure shows the connection between the module and the host.

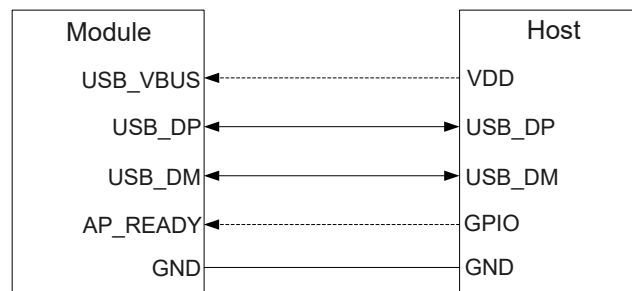


Figure 4: Sleep Mode Application with USB Remote Wakeup

- Sending data to the module through USB can wake up the module.
- When the module has a URC to report, the module will send remote wakeup signals via USB bus so as to wake up the host.

NOTE

1. USB Suspend is supported on Linux system but not supported on Windows system.
2. Pay attention to the level match shown in dotted line between the module and the host.

3.4.1.3. USB Application with USB Suspend/Resume and MAIN_RI Function

If the host supports USB Suspend/Resume but does not support remote wakeup function, the MAIN_RI signal is needed to wake up the host.

In this case, three preconditions can make the module enter the sleep mode.

- Execute **AT+QSClk=1** to enable sleep mode.
- Ensure the MAIN_DTR is held at high level, or keep it open.
- Ensure the host's USB bus, which is connected with the module's USB interface, enters suspended state.

The following figure shows the connection between the module and the host.

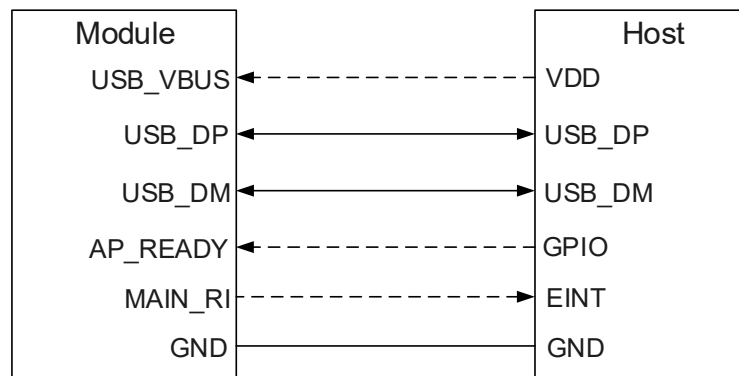


Figure 5: Sleep Mode Application with MAIN_RI

- Sending data to the module through USB can wake up the module.
- When the module has a URC to report, the URC will trigger the behaviors of MAIN_RI pin.

NOTE

1. USB Suspend is supported on Linux system but not supported on Windows system.
2. Pay attention to the level match shown in dotted line between the module and the host.

3.4.1.4. USB Application Without USB Suspend Function

If the host does not support USB Suspend function, USB_VBUS should be disconnected via an external control circuit of USB_VBUS to let the module enter sleep mode.

- Execute **AT+QSClk=1** to enable sleep mode.
- Ensure the MAIN_DTR is held at high level, or keep it open.

- Disconnect USB_VBUS.

The following figure shows the connection between the module and the host.

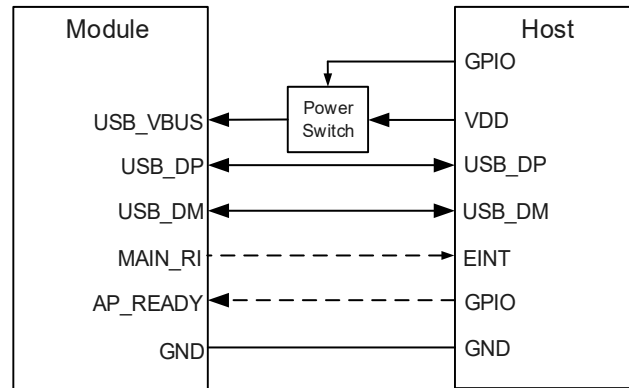


Figure 6: Sleep Mode Application Without Suspended Function

The module will be wakened up when USB_VBUS is restored to be powered.

NOTE

Please pay attention to the level match shown in dotted line between the module and the host.

3.4.2. Airplane Mode

When the module enters airplane mode, the RF function does not work, and all AT commands related to RF function will be not accessible. This mode can be set via the following ways.

Hardware:

The W_DISABLE# is pulled up by default. Its control function for airplane mode, which is disabled by default in software, can be enabled through **AT+QCFG="airplanecontrol",1**. When such a control function is enabled, you can drive W_DISABLE# to low level to make the module enter airplane mode.

Software:

AT+CFUN = <fun> provides the choice of the functionality level through setting <fun> into 0, 1 or 4.

- **AT+CFUN=0**: Minimum functionality mode (Both RF and (U)SIM functions are disabled).
- **AT+CFUN=1**: Full functionality mode (by default).
- **AT+CFUN=4**: Airplane mode (RF function is disabled).

NOTE

For more details about the AT command, see *document [4]*.

3.5. Power Supply

3.5.1. Power Supply Pins

The module provides four VBAT pins for connection with the external power supply. There are two separate voltage domains for VBAT.

- Two VBAT_RF pins for module's RF part.
- Two VBAT_BB pins for module's baseband part and RF part.

Table 7: VBAT and GND Pins

Pin Name	Pin No.	Description	Min.	Typ.	Max.	Unit
VBAT_RF	57, 58	Power supply for module's RF part	3.3	3.8	4.3	V
VBAT_BB	59, 60	Power supply for module's baseband part and RF part	3.3	3.8	4.3	V
GND	8, 9, 19, 22, 36, 46, 48, 50–54, 56, 72, 76, 85–112					

3.5.2. Voltage Stability Requirements

The power supply range of the module is from 3.3 V to 4.3 V. Please make sure that the input voltage will never drop below 3.3 V. The following figure shows the voltage drop during burst transmission in 2G network. The voltage drop will be less in 4G networks.

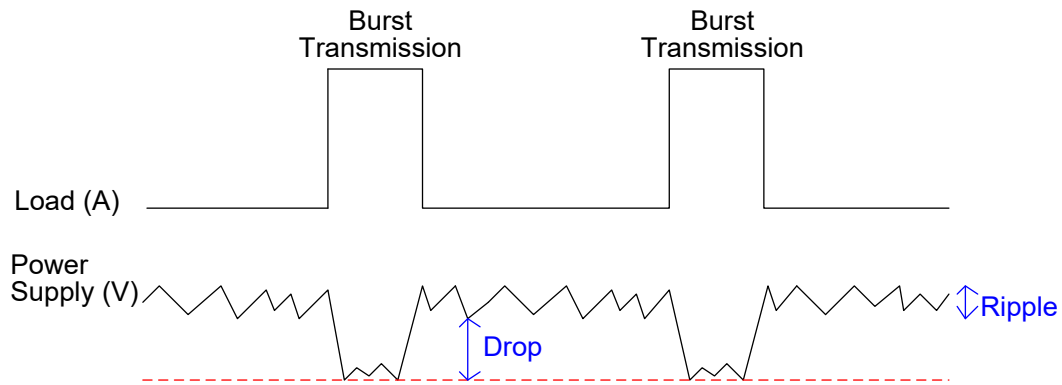


Figure 7: Power Supply Limits during Burst Transmission

To decrease voltage drop, a filter capacitor of about 100 μF with low ESR ($\text{ESR} \leq 0.7 \Omega$) should be used, and a multi-layer ceramic chip (MLCC) capacitor array should also be reserved due to its ultra-low ESR. It is recommended to use three ceramic capacitors (100 nF, 33 pF, 10 pF) for composing the MLCC array, and place these capacitors close to VBAT_BB and VBAT_RF. The main power supply from an external application has to be a single voltage source and can be expanded to two sub paths with star configuration routing. The width of VBAT_BB trace should be at least 2 mm; and the width of VBAT_RF trace should be at least 2.5 mm. In principle, the longer the VBAT trace is, the wider it will be.

In order to avoid the ripple and surge and ensure the stability of the power supply to the module, add a high-power TVS near the power supply.

The following figure shows the star configuration routing of the power supply.

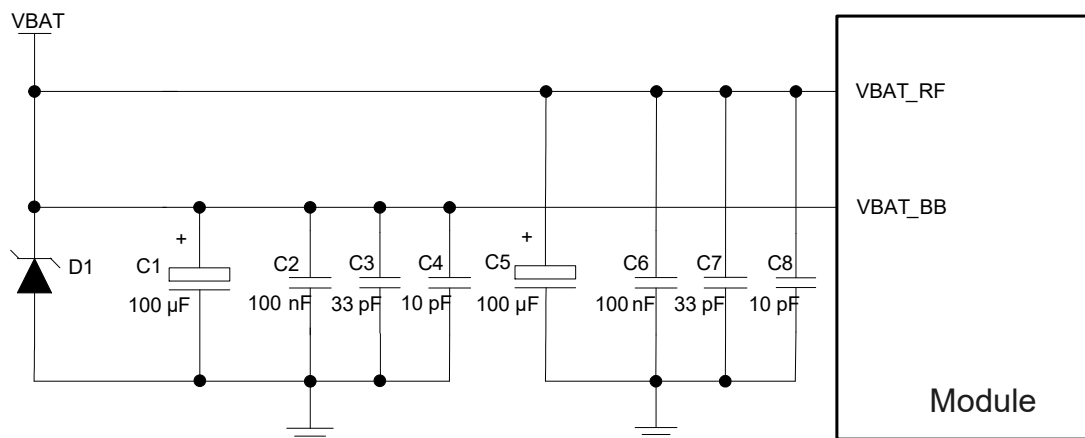


Figure 8: Star Configuration Routing of Power Supply

3.5.3. Reference Design for Power Supply

Power design for the module is very important, as the performance of the module largely depends on the power source. The power supply should be able to provide sufficient current of at least 2.0 A to the module when only LTE is available, and should be able to provide sufficient current of at least 3.0 A to the module when the GSM or both GSM and LTE are available. If the voltage drop between the input and output is not too high, it is suggested that an LDO should be selected for the module. If there is a big voltage difference between the input source and the desired output (VBAT), use a buck converter.

The following figure shows a reference design for +5 V input power source.

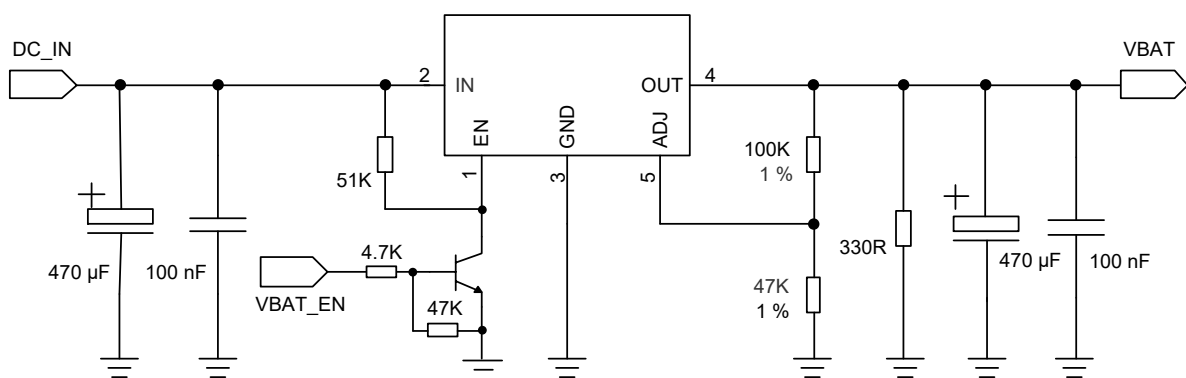


Figure 9: Reference Circuit of Power Supply

3.5.4. Power Supply Voltage Monitoring

You can use **AT+CBC** to monitor the VBAT_BB voltage value. For more details, see [document \[4\]](#).

3.6. Turn-on/Turn-off/Reset

3.6.1. Turn-on with PWRKEY

Table 8: Pin Definition of PWRKEY

Pin Name	Pin No.	I/O	Description	Comment
PWRKEY	21	DI	Turn on/off the module	VBAT power domain.

When the module is in power-off mode, it can be turned on to normal mode by driving PWRKEY to a low level for at least 2 s. It is recommended to use an open drain/collector driver to control the PWRKEY. A simple reference circuit is illustrated in the following figure.

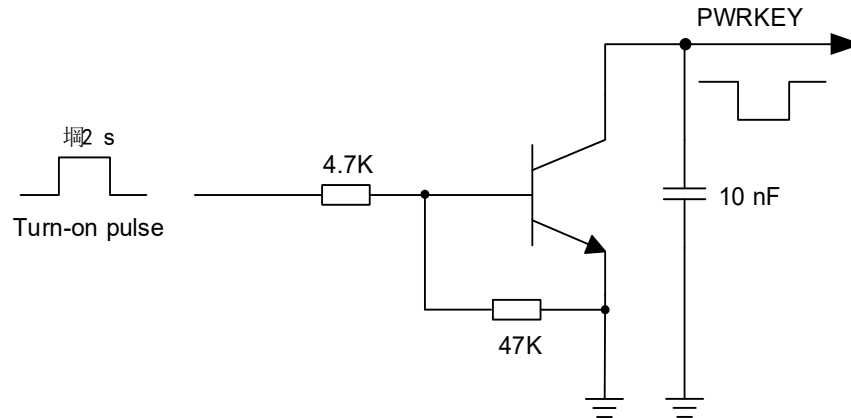


Figure 10: Turn-on by Using Driving Circuit

Another way to control the PWRKEY is to use a button directly. When pressing the button, electrostatic strike may generate from finger. Therefore, a TVS component is indispensable to be placed nearby the button for ESD protection.

A reference circuit is shown in the following figure.

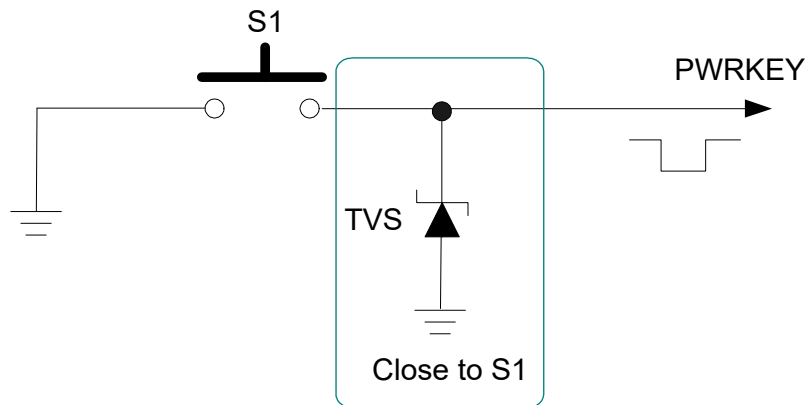


Figure 11: Turn-on by Using Button

The turn-on timing is illustrated in the following figure.

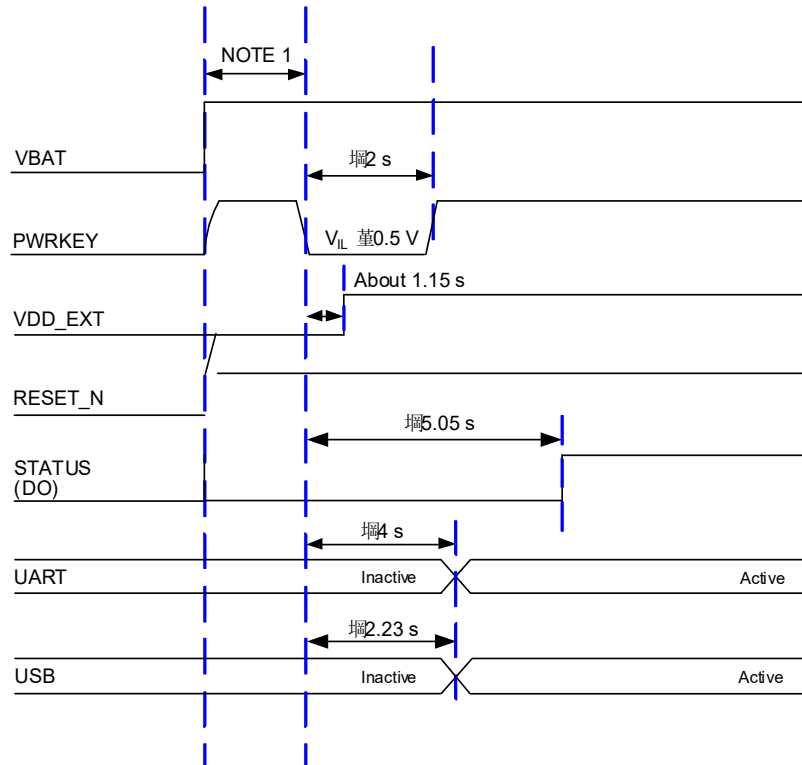


Figure 12: Turn-on Timing

NOTE

- Before pulling down the PWRKEY, ensure that the VBAT voltage is stable with the recommended range of 3.3–4.3 V. Ensure the voltage of VBAT is stable for at least 30 ms before driving the PWRKEY low.
- If the module needs to be turned on automatically when powered up, PWRKEY can be driven low to GND with a resistor of less than 1 k Ω . Ensure that the VBAT voltage is lower than 0.5 V before power-up.
- Pay special attention to the following two turn-on scenarios:
 - In the scenario where USB_VBUS is connected first (or has always been connected), VBAT is powered up later, and then PWRKEY is pulled down to turn on the module, it is necessary to ensure that VBAT is powered up stably for at least 2 s before PWRKEY is pulled down;
 - In the scenario where VBAT is powered up first (or has always been powered up), USB_VBUS is connected later, and then PWRKEY is pulled down to turn on the module, it is necessary to ensure that USB_VBUS is connected for at least 2 s before PWRKEY is pulled down.

3.6.2. Turn-off

The following ways can be used to turn off the module normally:

- Turn off the module with PWRKEY.
- Turn off the module by using **AT+QPOWD**. For more details about the AT command, see **document [4]**.

3.6.2.1. Turn-off with PWRKEY

Driving PWRKEY low for at least 3 s and releasing it, the module executes power-down procedure.

The turn-off timing is illustrated in the following figure.

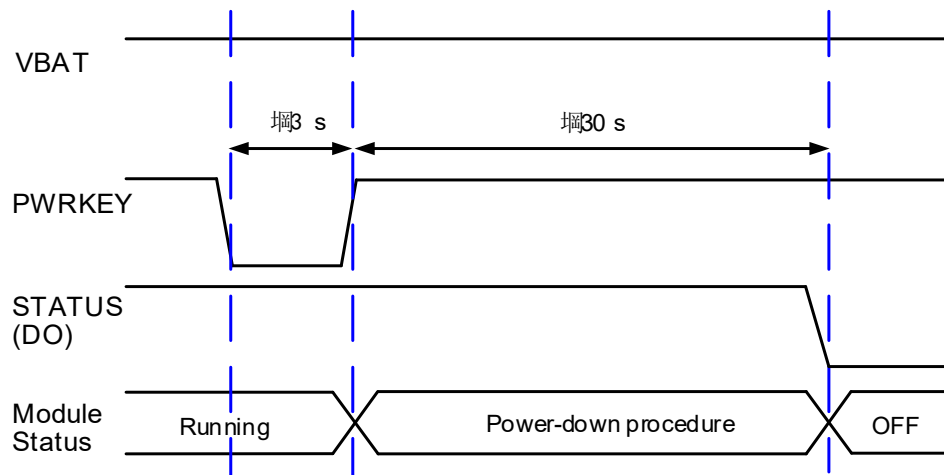


Figure 13: Turn-off Timing

3.6.2.2. Turn off Module with AT Command

It is also a safe way to use **AT+QPOWD** to turn off the module, which is similar to the procedure of turning off the module via PWRKEY.

See **document [4]** for details about **AT+QPOWD**.

NOTE

1. In order to avoid corrupting the data in internal flash, do not switch off the power supply when the module works normally. Only after the module is shut down by PWRKEY or AT command can the power supply be cut off.
2. When PWRKEY is connected to the ground with a pull-down resistor, the module will not boot

automatically after being turned off with the AT command. In this case, it is necessary to forcibly disconnect the VBAT power supply and turn on the module again. Therefore, it is recommended to use a control circuit to control the PWRKEY to turn on/off the module.

3. When being turned off, the module will log out of the network. The time for logging out relates to its network status. Thus, please pay attention to the shutdown time in your design because the actual shutdown time varies with the network status.
4. If you disconnect the VBAT power supply, ensure that the VBAT pins' voltage is less than 0.5 V before turning it on again.

3.6.3. Reset

The RESET_N can be used to reset the module. The module can be reset by driving RESET_N low for at least 100 ms and then releasing it. The RESET_N signal is sensitive to interference, so it is recommended to route the trace as short as possible and surround it with ground.

Table 9: Pin Definition of RESET_N

Pin Name	Pin No.	I/O	Description	Comment
RESET_N	20	DI	Reset the module	VBAT power domain. Active low. A test point is recommended to be reserved if unused.

The recommended circuit is similar to the PWRKEY control circuit. An open drain/collector driver or button can be used to control the RESET_N.

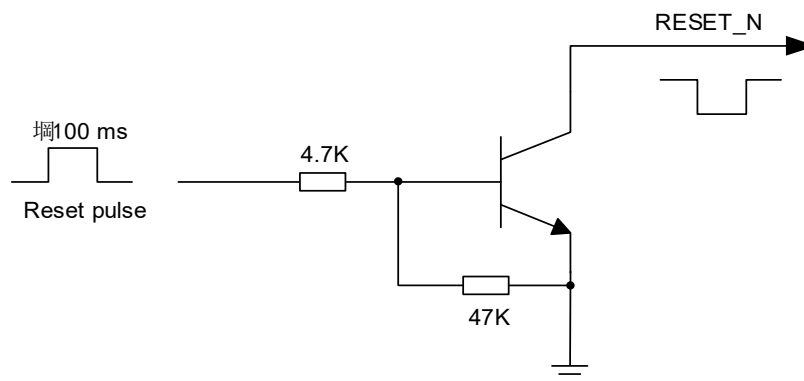


Figure 14: Reference Circuit of RESET_N by Using Driving Circuit

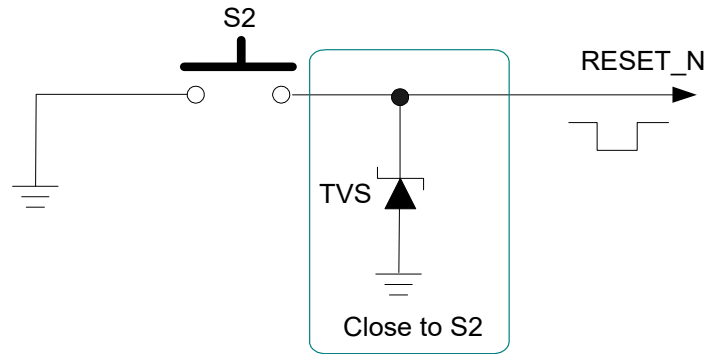


Figure 15: Reference Circuit of RESET_N by Using Button

The timing of resetting module is illustrated in the following figure.

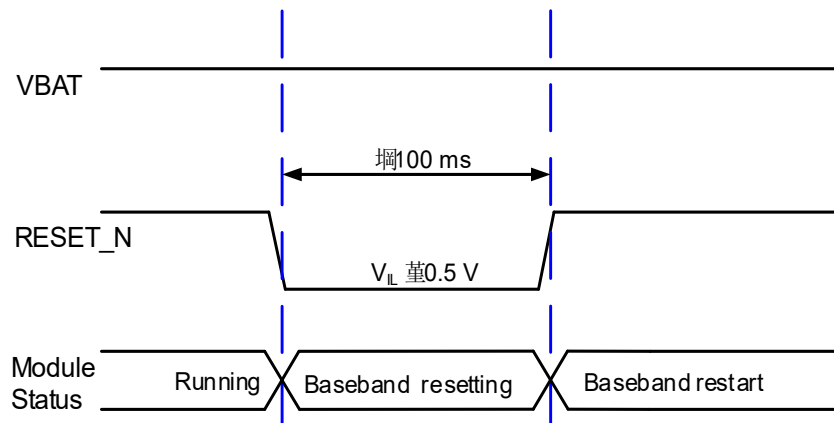


Figure 16: Timing of Resetting

NOTE

1. Ensure that there is no large capacitance exceeding 10 nF on PWRKEY and RESET_N.
2. It is recommended to use RESET_N only when the module cannot be turned off by **AT+QPOWD** or PWRKEY.
3. The RESET_N pin performs a soft reset which only resets the baseband, not the PMU.

3.7. (U)SIM Interfaces

The module provides two (U)SIM interfaces, which meet ETSI and IMT-2000 requirements. Both 1.8 V and 3.0 V (U)SIM cards are supported.

Table 10: Pin Definition of (U)SIM1 Interface

Pin Name	Pin No.	I/O	Description	Comment
USIM_VDD	14	PO	(U)SIM card power supply	Either 1.8 V or 3.0 V (U)SIM card is supported and can be identified automatically by the module.
USIM_DATA	15	DIO	(U)SIM card data	
USIM_CLK	16	DO	(U)SIM card clock	
USIM_RST	17	DO	(U)SIM card reset	
USIM_DET	13	DI	(U)SIM card hot-plug detect	1.8 V power domain. If unused, keep it open.
USIM_GND	10	-	(U)SIM card GND	

Table 11: Pin Definition of (U)SIM2 Interface

Pin Name	Pin No.	I/O	Description	Comment
USIM2_VDD	128	PO	(U)SIM2 card power supply	Either 1.8 V or 3.0 V can be recognized by the module automatically.
AP_READY	2	DIO	(U)SIM2 card data	The (U)SIM2 function is optional. If the firmware version of the module supports the function of the (U)SIM2 card, the relevant functions of the (U)SIM2 card can be realized by configuring AP_READY, WAKEUP_IN, SLEEP_IND, and W_DISABLE# pins. For details, please consult Quectel Technical Support.
WAKEUP_IN	1	DO	(U)SIM2 card clock	
W_DISABLE#	4	DO	(U)SIM2 card reset	
SLEEP_IND	3	DI	(U)SIM2 card hot-plug detect	

The module supports (U)SIM card hot-plug via the USIM_DET, and both high and low level detections are supported. By default, the function is disabled, and it can be enabled by **AT+QSIMDET**. See **document [4]** for more details about **AT+QSIMDET**.

The following figure shows a reference design for (U)SIM interface with an 8-pin (U)SIM card connector.

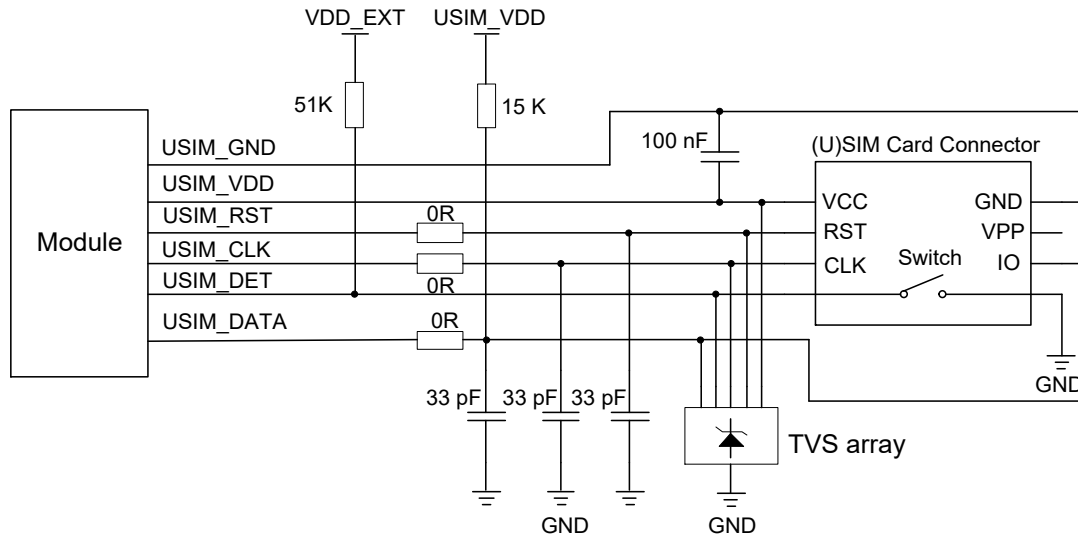


Figure 17: Reference Circuit of (U)SIM Interface with an 8-pin (U)SIM Card Connector

If (U)SIM card detection function is not needed, keep USIM_DET unconnected. A reference circuit for (U)SIM interface with a 6-pin (U)SIM card connector is illustrated in the following figure.

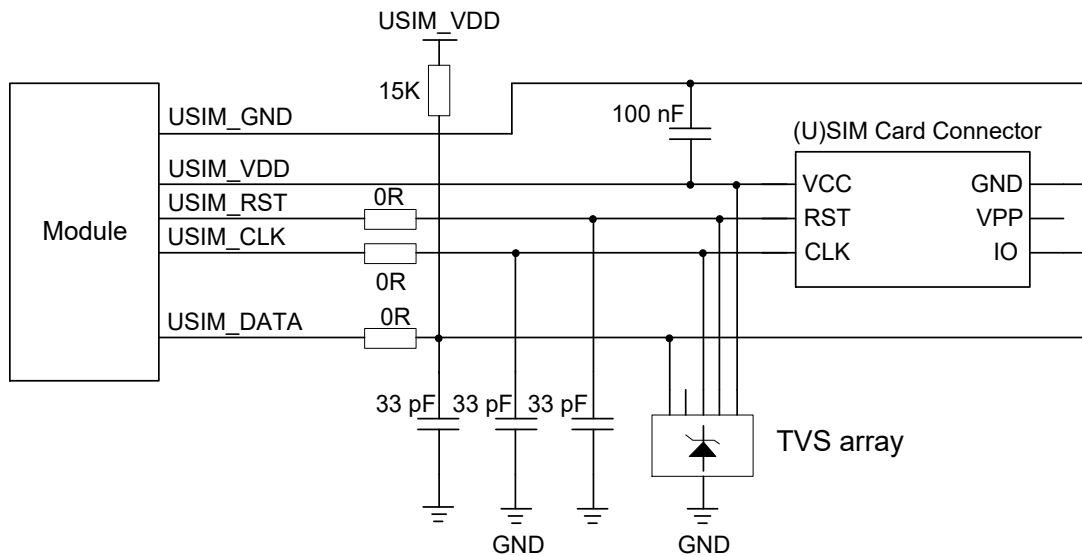


Figure 18: Reference Circuit of (U)SIM Interface with a 6-pin (U)SIM Card Connector

In order to enhance the reliability and availability of the (U)SIM card in your applications, please follow the criteria below in (U)SIM circuit design:

- Place (U)SIM card connector as close to the module as possible. Keep the trace length less than 200 mm as far as possible.
- Keep (U)SIM card signals away from RF and VBAT traces.
- Keep the trace between the ground of (U)SIM card connector and USIM_GND short and wide. Keep

the trace width of USIM_GND and USIM_VDD not less than 0.5 mm to maintain the same electric potential. If the ground is complete on your PCB, USIM_GND can be connected to PCB ground directly.

- Ensure that the bypass capacitor between USIM_VDD and GND does not exceed 1 μ F, and the capacitor should be close to the (U)SIM card connector.
- To avoid cross-talk between USIM_DATA and USIM_CLK, keep them away from each other and shield them with surrounded ground.
- In order to offer good ESD protection, it is recommended to add a TVS diode array whose parasitic capacitance should not exceed 15 pF. The 0 Ω resistors should be added in series between the module and the (U)SIM card to facilitate debugging. The 33 pF capacitors on USIM_DATA, USIM_CLK and USIM_RST are used for filtering out RF interference. Please note that the (U)SIM peripheral circuit should be close to the (U)SIM card connector.
- The pull-up resistor on USIM_DATA can improve anti-jamming capability of the (U)SIM card. If the (U)SIM card traces are too long, or the interference source is relatively close, it is recommended to add a pull-up resistor near the (U)SIM card connector.

NOTE

(U)SIM2 interface is optional. For the module supporting two (U)SIM interfaces, contact Quectel Technical Support to obtain the software version supporting DSSS or DSDS.

3.8. USB Interface

The module provides one integrated Universal Serial Bus (USB) interface which complies with the USB 2.0 specification and supports high-speed (480 Mbps) and full-speed (12 Mbps) modes. The USB interface only supports USB slave mode and it can be used for AT command communication, data transmission, software debugging and firmware upgrade.

Table 12: Pin Definition of USB Interface

Pin Name	Pin No.	I/O	Description	Comment
USB_DP	69	AIO	USB differential data bus (+)	Require differential impedance of 90 Ω .
USB_DM	70	AIO	USB differential data bus (-)	Test points must be reserved.
USB_VBUS	71	AI	USB connection detect	Typical 5.0 V, Minimum 3.5 V. A test point must be reserved. The USB_VBUS pin needs to be connected with a 1 k Ω resistor in series if USB_VBUS is connected

to power supply and VBAT is powered down.

GND	72	-	Ground
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For more details about the USB 2.0 specifications, please visit <http://www.usb.org/home>.

Reserve test points for debugging and firmware upgrade in your design. The following figure shows a reference circuit of USB interface.

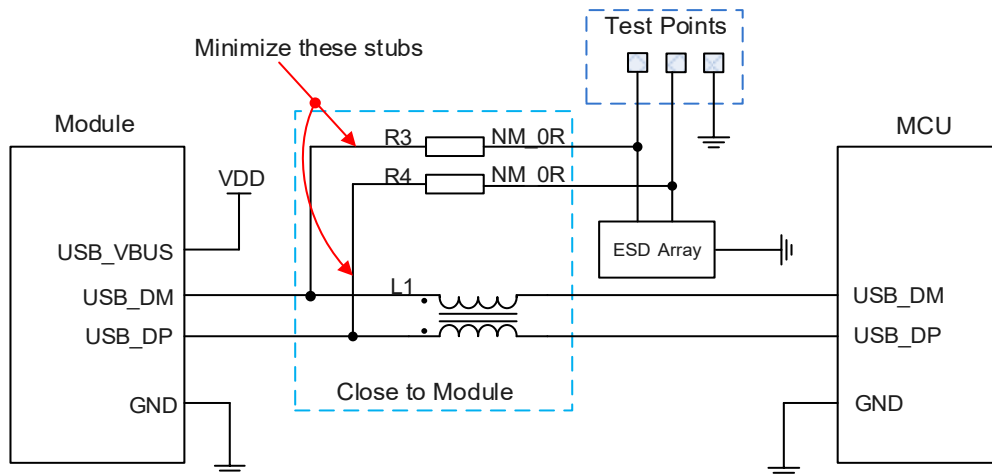


Figure 19: Reference Circuit of USB Application

A common mode choke L1 is recommended to be added in series between the module and your MCU in order to suppress EMI. Meanwhile, the 0 Ω resistors (R3 and R4) should be added in series between the module and the test points so as to facilitate debugging, and the resistors are not mounted by default. In order to ensure the integrity of USB data line signals, L1, R3 and R4 components must be placed close to the module, and also these resistors should be placed close to each other. The extra stubs of trace must be as short as possible.

The following principles should be complied with when designing the USB interface, so as to meet USB 2.0 specification.

- Route the USB signal traces as differential pairs with ground surrounded. The impedance of USB differential trace is 90 Ω.
- Do not route signal traces under crystals, oscillators, magnetic device and RF signal traces. It is recommended to route the USB differential traces in inner-layer of the PCB and to surround the traces with ground on that layer and with ground planes above and below.
- Pay attention to the influence of junction capacitance of ESD protection components on USB data lines. Typically, the capacitance value should be less than 2 pF, and keep the ESD protection components to the USB connector as close as possible.

3.9. UART Interfaces

The module provides three UART interfaces: the main UART interface, the debug UART interface and auxiliary UART Interface. The following shows their features.

- Main UART interface: Supports 4800 bps, 9600 bps, 19200 bps, 38400 bps, 57600 bps, 115200 bps, 230400 bps, 460800 bps and 921600 bps baud rates, and the default is 115200 bps. This interface is used for data transmission and AT command communication and supports RTS and CTS hardware flow control.
- Debug UART interface: Only supports 921600 bps baud rate, used for AP log output.
- Auxiliary UART Interface

Table 13: Pin Definition of Main UART Interface

Pin Name	Pin No.	I/O	Description	Comment
MAIN_RI	62	DO	Ring indication	
MAIN_DCD	63	DO	Main UART data carrier detect	
MAIN_CTS	64	DO	Clear to send signal from the module (Connect to the MCU's CTS)	
MAIN_RTS	65	DI	Request to send signal to the module (Connect to the MCU's RTS)	1.8 V power domain. If unused, keep them open.
MAIN_DTR	66	DI	Main UART data terminal ready	
MAIN_TXD	67	DO	Main UART transmit	
MAIN_RXD	68	DI	Main UART receive	

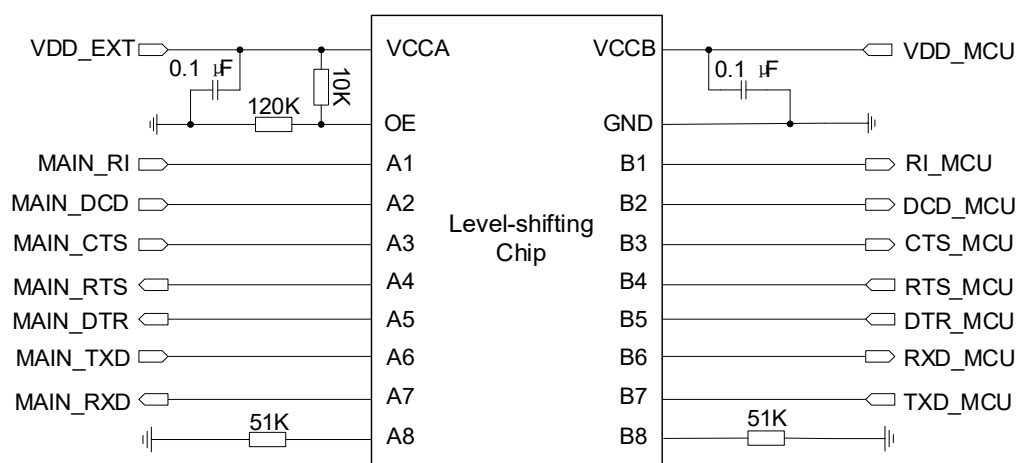
Table 14: Pin Definition of Debug UART Interface

Pin Name	Pin No.	I/O	Description	Comment
DBG_TXD	12	DO	Debug UART transmit	1.8 V power domain.
DBG_RXD	11	DI	Debug UART receive	Test points must be reserved.

Table 15: Pin Definition of Auxiliary UART Interface

Pin Name	Pin No.	I/O	Description	Comment
AUX_TXD	138	DO	Auxiliary UART transmit	1.8 V power domain. If unused, keep them open.
AUX_RXD	137	DI	Auxiliary UART receive	

The module provides 1.8 V UART interface. Use a level-shifting circuit if the application is equipped with a 3.3 V UART interface. A level-shifting chip TXS0108EPWR provided by Texas Instruments is recommended. The following figure shows a reference design.


Figure 20: Reference Circuit with Level-shifting Chip (Main UART)

Please visit <http://www.ti.com> for more information.

Another example with transistor circuit is shown as below. For the design of circuits shown in dotted lines, see that shown in solid lines, but pay attention to the direction of connection.

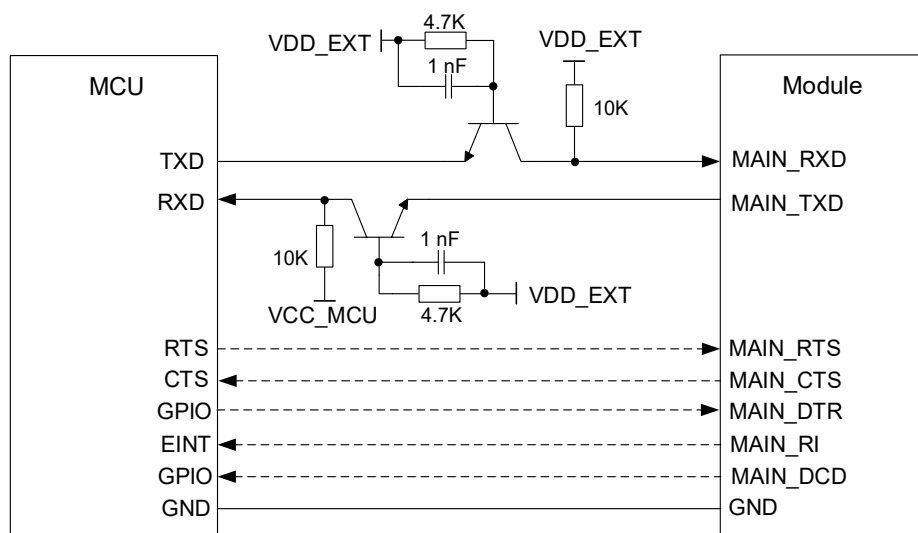


Figure 21: Reference Circuit with Transistor Circuit (Main UART)

NOTE

1. Transistor circuit solution is not suitable for applications with baud rates exceeding 460 kbps.
2. Please note that the module's CTS is connected to the MCU's CTS, and the module's RTS is connected to the MCU's RTS.
3. The level-shifting circuits (**Figure 20** and **Figure 21**) take the main UART as an example. The circuits of the auxiliary UART are connected in the same way as the main UART.
4. To increase the stability of UART communication, it is recommended to add UART hardware flow control design.

3.10. I2C Interfaces

The module provides two I2C interfaces.

Table 16: Pin Definition of I2C Interfaces

Pin Name	Pin No.	I/O	Description	Comment
I2C_SCL	41	OD	I2C serial clock	Require external pull-up to 1.8 V if used. If unused, keep them open.
I2C_SDA	42	OD	I2C serial data	
I2C2_SCL	141	OD	I2C serial clock	

I2C2_SDA	142	OD	I2C serial data
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NOTE

The I2C bus supports simultaneous connection of multiple peripherals except for codec IC. In other words, if a codec IC has been mounted on the I2C bus, no other peripherals can be mounted. If there is no codec IC on the bus, multiple peripherals can be mounted.

3.11. PCM Interface

The module provides one PCM interface for connecting to the external audio codec chip. Only the slave mode is supported. Therefore, the clock signal of the audio codec chip must be provided externally. It is recommended to use MAIN_DCD pin to provide the clock signal.

Table 17: Pin Definition of PCM Interface

Pin Name	Pin No.	I/O	Description	Comment
PCM_DIN	24	DI	PCM data input	1.8 V power domain. If unused, keep them open.
PCM_DOUT	25	DO	PCM data output	
PCM_SYNC	26	DI	PCM data frame sync	
PCM_CLK	27	DI	PCM clock	

The following figure shows the reference design of PCM and I2C interfaces with external codec chip:

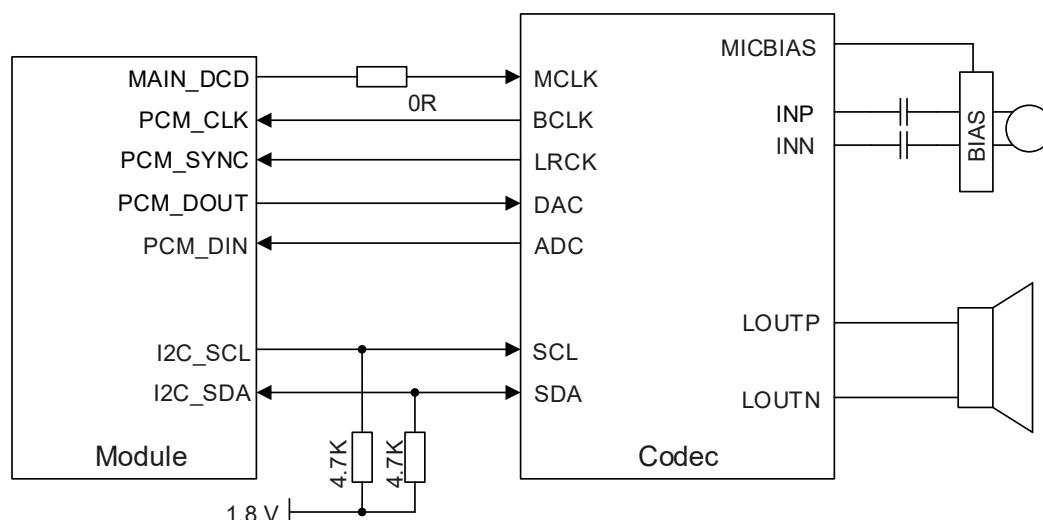


Figure 22: Reference Circuit of I2C and PCM Application with External Codec Chip

NOTE

1. It is recommended to reserve an RC ($R = 0 \Omega$, $C = 33 \text{ pF}$) circuit on the PCM traces, especially for PCM_CLK.
2. If MAIN_DCD provides the clock signal of audio codec chip, the pin cannot be for other functions.

3.12. Analog Audio Interfaces

The module provides one analog audio input channel and one analog audio output channel. The pin definition is shown in the table below.

Table 18: Pin Definition of Analog Audio Interfaces

Interface	Pin Name	Pin No.	I/O	Description
AOUT	LOUDSPK_P	73	AO	Loudspeaker differential output (+)
	LOUDSPK_N	74	AO	Loudspeaker differential output (-)
AIN	MIC_P	75	AI	Microphone analog input (+)
	MIC_N	77	AI	Microphone analog input (-)

- AIN channel is a differential input channel, which can be applied for input of microphone (usually an electret microphone).
- The AOUT channel is a differential output with a built-in power amplifier. The default configuration of power amplifier is Class AB and the maximum driving power is 500 mW for 8 Ω load. When PA is configured as Class D, the maximum driving power is 800 mW for 8 Ω load.

3.12.1. Notes on Audio Interface Design

It is recommended to use the electret microphone with dual built-in capacitors (e.g., 10 pF and 33 pF) to filter out RF interference, thus reducing TDD noise. Without these capacitors, TDD noise could be heard during the call. Note that the resonant frequency point of a capacitor largely depends on the material and production technique. Therefore, you need to discuss with your capacitor vendors to choose the most suitable capacitor to filter out high-frequency noises.

For model(s) that support(s) GSM, the severity degree of the RF interference in the voice channel during GSM transmitting largely depends on the application design. Therefore, a suitable capacitor can be selected based on the test results. Sometimes, even no RF filtering capacitor is required. The filter capacitors on the PCB should be placed near the audio device or audio interface as close as possible, and the trace should be as short as possible. The filter capacitors should be passed before reaching other connection points.

To decrease signal interferences, RF antennas should be placed away from audio interfaces and audio traces. Power traces and audio traces should not be parallel, and they should be far away from each other.

The differential audio traces must be routed according to the differential signal layout rule.

3.12.2. Microphone Interface Circuit

The reference circuit of the microphone interface is shown in the figure below:

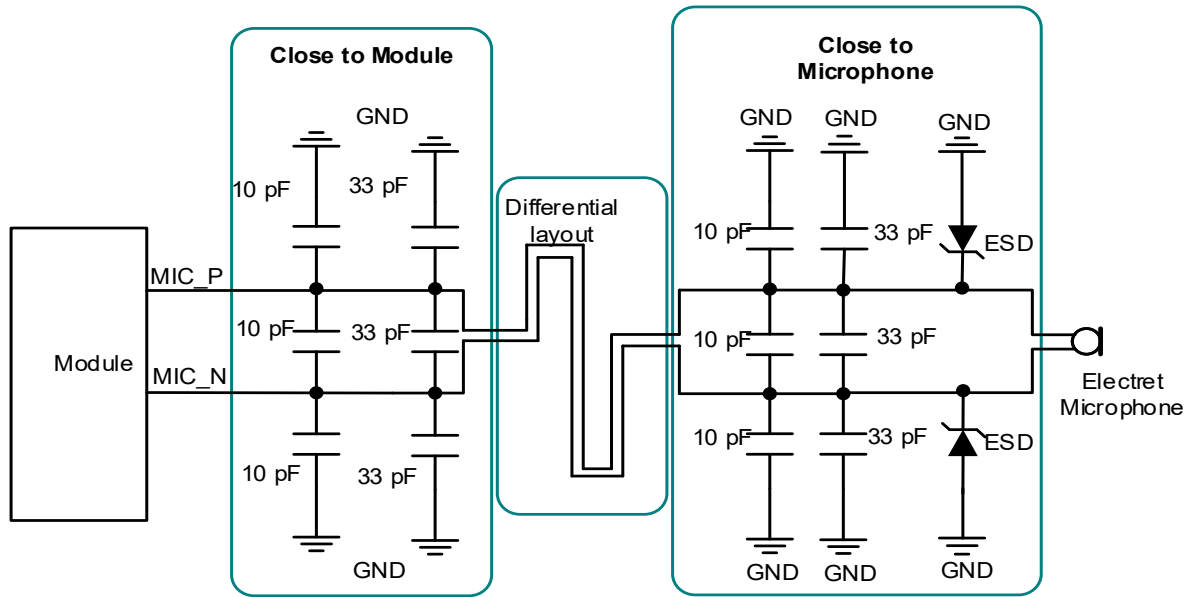


Figure 23: Reference Circuit of Microphone Interface

NOTE

MIC channel is sensitive to ESD, so it is not recommended to remove the ESD components used for protecting the MIC.

3.12.3. Loudspeaker Interface Circuit

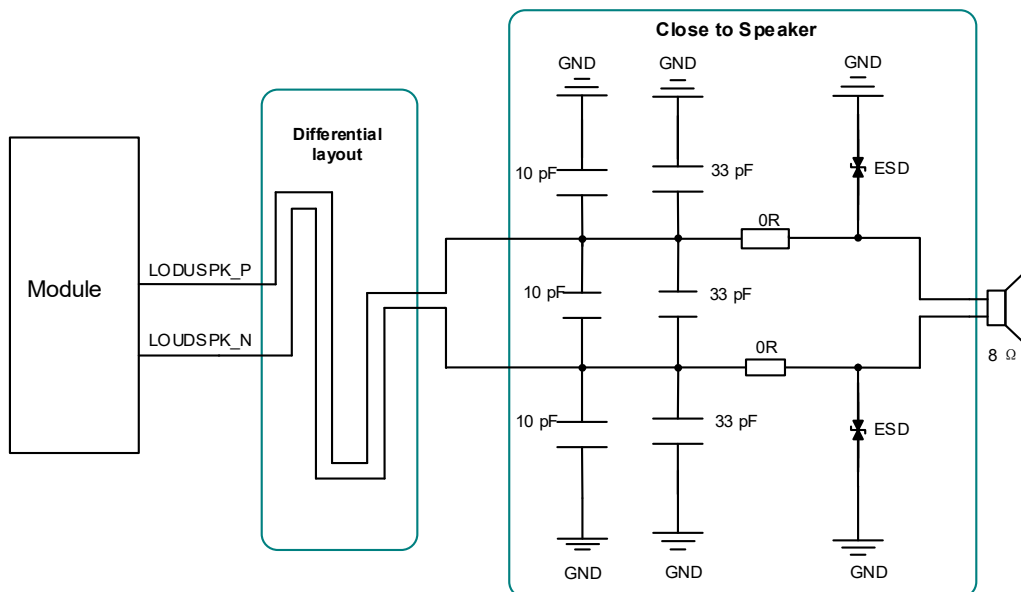


Figure 24: Reference Circuit of Loudspeaker Interface

3.13. SD Card Interface

The module supports SD 2.0 interface for SD card.

Table 19: Pin Definition of SD Card Interface

Pin Name	Pin No.	I/O	Description	Comment
SD_DET	23	DI	SD card detect	1.8 V power domain. If unused, keep it open.
SDIO1_DATA3	28	DIO	SDIO data bit 3	3.2 V power domain. If unused, keep them open.
SDIO1_DATA2	29	DIO	SDIO data bit 2	
SDIO1_DATA1	30	DIO	SDIO data bit 1	
SDIO1_DATA0	31	DIO	SDIO data bit 0	
SDIO1_CLK	32	DO	SDIO clock	
SDIO1_CMD	33	DIO	SDIO command	
SDIO1_VDD	34	PO	SDIO power supply	

The following figure shows a reference design of SD card interface.

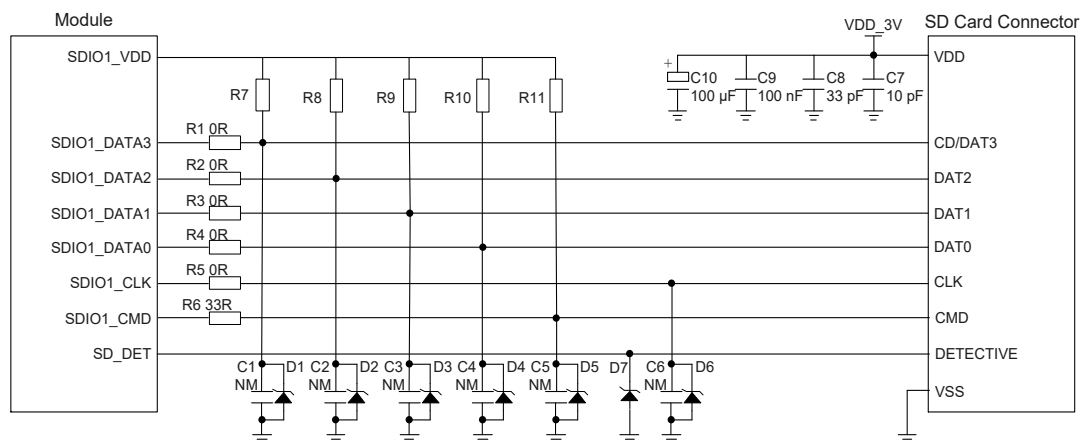


Figure 25: Reference Circuit of SD Card Interface

In SD card interface design, in order to ensure good communication performance with SD card, the following design principles should be complied with:

- The voltage range of SD card power supply VDD_3 V is 2.7–3.6 V and a sufficient current of at least 0.8 A should be provided. As the maximum output current of SDIO1_VDD is 150 mA which can only be used for SDIO pull-up resistors. An externally power supply is needed for SD card.
- To avoid jitter of bus, resistors R7–R11 are needed to pull up the SDIO to SDIO1_VDD. The recommended value is 4.7 kΩ. SDIO1_VDD should be used as the pull-up power.
- In order to adjust signal quality, it is recommended to add 0 Ω resistors R1–R5, and 33 Ω resistor R6 in series between the module and the SD card. The bypass capacitors C1–C6 are reserved and not mounted by default. All resistors and bypass capacitors should be placed close to the module.
- In order to offer good ESD protection, it is recommended to add a TVS array on SD card pins near the SD card connector with junction capacitance less than 15 pF.
- Keep SDIO signals far away from other sensitive circuits/signals such as RF circuits and analog signals, as well as noisy signals such as clock signals and DC-DC signals.
- It is important to route the SDIO signal surrounded with ground on the layer and ground planes above and below. The impedance of SDIO data trace is 50 Ω ±10 %.
- Make sure the adjacent trace spacing is more than twice the trace width and the load capacitance of SDIO bus should be less than 15 pF.
- It is recommended to keep the trace length difference between SDIO1_CLK and SDIO1_DATA[0:3]/SDIO1_CMD less than 1 mm and the total routing length less than 50 mm.

3.14. ADC Interfaces

The module provides three ADC interfaces. **AT+QADC=0** can be used to read the voltage value on ADC0 pin. **AT+QADC=1** can be used to read the voltage value on ADC1 pin. **AT+QADC=2** can be used to read the voltage value on ADC2 pin. For more details about **AT+QADC**, see **document [4]**.

In order to improve the accuracy of ADC, the traces of ADC should be surrounded with ground.

Table 20: Pin Definition of ADC Interfaces

Pin Name	Pin No.	Description	Comment
ADC0	45	General-purpose ADC interface	It is recommended to reserve a voltage divider circuit. If unused, keep them open.
ADC1	44	General-purpose ADC interface	
ADC2	43	General-purpose ADC interface	

Table 21: Characteristic of ADC Interfaces

Parameter	Min.	Typ.	Max.	Unit
ADC0 Input Voltage Range	0	-	VBAT_BB	V
ADC1 Input Voltage Range	0	-	VBAT_BB	V
ADC2 Input Voltage Range	0	-	VBAT_BB	V
ADC Resolution	-	12	-	bits

NOTE

Due to the difference in the ADC input voltage range between different modules of Quectel, in order to be more compatible with other modules, when using the ADC pins, it is strongly recommended to reserve a voltage divider circuit, and the resistance value of the voltage divider resistor must be less than 100 k Ω , otherwise the measurement accuracy of the ADC will be significantly reduced. When the voltage divider circuit is not used, the 1 k Ω resistor should be connected in series with the ADC pins.

3.15. Network Status Indication

The network indication pins can be used to drive network status indication LEDs. The module has NET_MODE and NET_STATUS for network status indication. The following tables describe pin definition and logic level changes in different network status.

Table 22: Pin Definition of Network Connection Status/Activity Indicator

Pin Name	Pin No.	I/O	Description	Comment
NET_MODE	5	DO	Indicate the module's network activity status	1.8 V power domain.
NET_STATUS	6	DO	Indicate the module's network registration mode	If unused, keep them open.

Table 23: Working State of Network Connection Status/Activity Indicator

Pin Name	Logic Level Changes	Network Status
NET_STATUS	Always high	Registered on LTE network

	Always low	Others
NET_MODE	Blink slowly (200 ms high/1800 ms low)	Network searching
	Blink quickly (234 ms high/266 ms low)	Idle
	Blink rapidly (62 ms high/63 ms low)	Data transmission is ongoing
	Always high	Voice calling

A reference circuit is shown in the following figure.

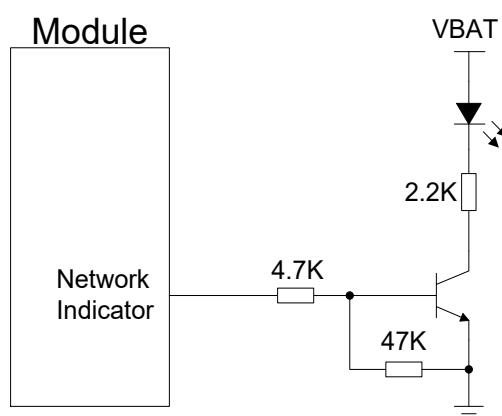


Figure 26: Reference Circuit of Network Indicator

3.16. STATUS

The STATUS pin indicates module's operation status. When the module is turned on normally, the STATUS outputs high level.

Table 24: Pin Definition of STATUS

Pin Name	Pin No.	I/O	Description	Comment
STATUS	61	DO	Indicate the module's operation status	1.8 V power domain. If unused, keep it open.

A reference circuit is shown in the following figure.

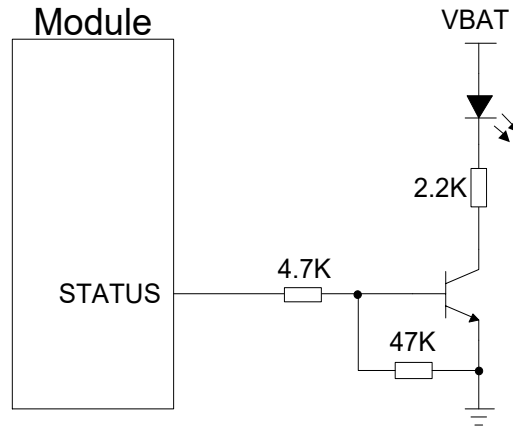


Figure 27: Reference Circuit of STATUS

NOTE

The STATUS cannot be used as the indication of power-down state when VBAT does not supply power to the module.

3.17. Behaviors of MAIN_RI

AT+QCFG="risignaltpe","physical" can be used to configure MAIN_RI behaviors.

No matter on which port a URC is presented, the URC will trigger the behavior of MAIN_RI pin.

NOTE

The **AT+QURCCFG** allows you to set the main UART, USB AT port or USB modem port as the URC output port. The default port is USB AT port.

In addition, MAIN_RI behaviors can be configured flexibly. The default behaviors of the MAIN_RI are shown as below.

Table 25: Behaviors of the MAIN_RI

State	Response
Idle	MAIN_RI keeps at high level
URC	MAIN_RI outputs 120 ms low pulse when a new URC returns

The MAIN_RI behavior can be configured by **AT+QCFG="urc/ri/ring"** and see **document [4]** for details.

3.18. USB_BOOT Interface

The module provides a USB_BOOT pin. You can pull up USB_BOOT to 1.8 V before VDD_EXT is powered up, and the module will enter forced download mode when it is turned on. In this mode, the module can upgrade firmware over USB interface.

If your application has a scan key, you can also press the "USB_BOOT + KEYOUT0" scan key before powered up the module, and the module will enter the forced download mode when it is turned on.

Table 26: Pin Definition of USB_BOOT Interface

Pin Name	Pin No.	I/O	Description	Comment
USB_BOOT	115	DI	Force the module into download mode	1.8 V power domain. Active high. A circuit design for entering forced download mode should be reserved. A test point is recommended to be reserved.

The following figure shows a reference circuit of USB_BOOT interface.

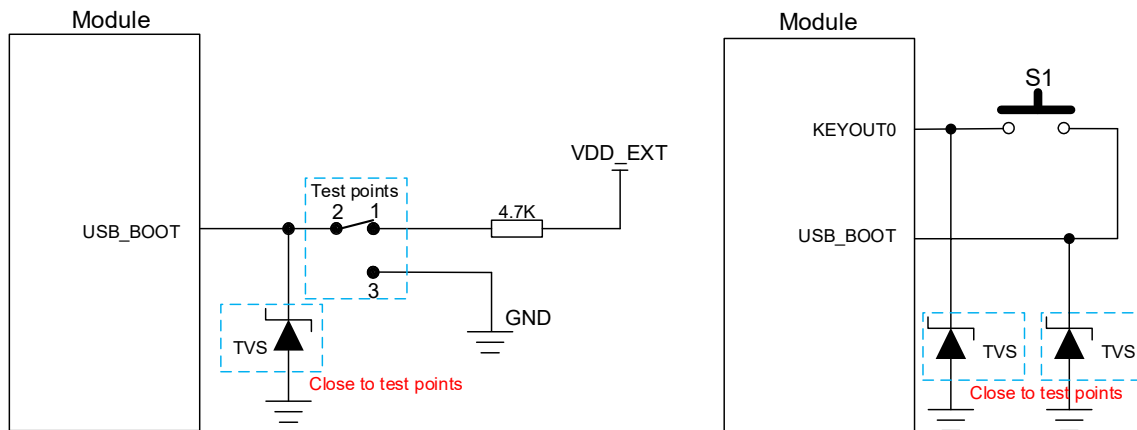


Figure 28: Reference Circuit of USB_BOOT Interface

4 Antenna Interfaces

The module provides a main antenna interface, a Wi-Fi Scan/Bluetooth antenna interface (optional) and a GNSS antenna interface (optional). The antenna ports have an impedance of 50 Ω .

Appropriate antenna type and design should be used with matched antenna parameters according to specific application. It is required to perform a comprehensive functional test for the RF design before mass production of terminal products. The entire content of this chapter is provided for illustration only. Analysis, evaluation and determination are still necessary when designing target products.

4.1. Main Antenna and Wi-Fi Scan/Bluetooth Antenna Interfaces

4.1.1. Pin Definition

The pin definition of main antenna and Wi-Fi Scan/Bluetooth antenna interfaces is shown below.

Table 27: Pin Definition of Antenna Interfaces

Pin Name	Pin No.	I/O	Description	Comment
ANT_MAIN	49	AIO	Main antenna interface	50 Ω characteristic impedance.
ANT_BT/ WIFI_SCAN	35	AIO/ AI	The shared antenna interface of Bluetooth and Wi-Fi Scan	Wi-Fi Scan antenna can only receive but not transmit. 50 Ω characteristic impedance. If unused, keep it open.

NOTE

The module supports Bluetooth and Wi-Fi Scan functions. Due to the shared antenna interface, the two functions cannot be used at the same time; Bluetooth and Wi-Fi Scan functions are optional. Please contact Quectel Technical Support for details.

4.1.2. Operating Frequency

Table 28: EC200U-CN Operating Frequencies

3GPP Band	Transmit	Receive	Unit
EGSM900	880–915	925–960	MHz
DCS1800	1710–1785	1805–1880	MHz
LTE-FDD B1	1920–1980	2110–2170	MHz
LTE-FDD B3	1710–1785	1805–1880	MHz
LTE-FDD B5	824–849	869–894	MHz
LTE-FDD B8	880–915	925–960	MHz
LTE-TDD B34	2010–2025	2010–2025	MHz
LTE-TDD B38	2570–2620	2570–2620	MHz
LTE-TDD B39	1880–1920	1880–1920	MHz
LTE-TDD B40	2300–2400	2300–2400	MHz
LTE-TDD B41	2535–2675	2535–2675	MHz

NOTE

The GSM network access technology of EC200U-CN is optional. If the module that you select doesn't support GSM network access technology, there is no corresponding frequency band.

Table 29: EC200U-EU Operating Frequencies

3GPP Band	Transmit	Receive	Unit
GSM850	824–849	869–894	MHz
EGSM900	880–915	925–960	MHz
DCS1800	1710–1785	1805–1880	MHz
PCS1900	1850–1910	1930–1990	MHz
LTE-FDD B1	1920–1980	2110–2170	MHz
LTE-FDD B3	1710–1785	1805–1880	MHz

LTE-FDD B5	824–849	869–894	MHz
LTE-FDD B7	2500–2570	2620–2690	MHz
LTE-FDD B8	880–915	925–960	MHz
LTE-FDD B20	832–862	791–821	MHz
LTE-FDD B28	703–748	758–803	MHz
LTE-TDD B38	2570–2620	2570–2620	MHz
LTE-TDD B40	2300–2400	2300–2400	MHz
LTE-TDD B41	2496–2690	2496–2690	MHz

Table 30: EC200U-AU Operating Frequencies

3GPP Band	Transmit	Receive	Unit
GSM850	824–849	869–894	MHz
EGSM900	880–915	925–960	MHz
DCS1800	1710–1785	1805–1880	MHz
PCS1900	1850–1910	1930–1990	MHz
LTE-FDD B1	1920–1980	2110–2170	MHz
LTE-FDD B2	1850–1910	1930–1990	MHz
LTE-FDD B3	1710–1785	1805–1880	MHz
LTE-FDD B4	1710–1755	2110–2155	MHz
LTE-FDD B5	824–849	869–894	MHz
LTE-FDD B7	2500–2570	2620–2690	MHz
LTE-FDD B8	880–915	925–960	MHz
LTE-FDD B28	703–748	758–803	MHz
LTE-FDD B66	1710–1780	2110–2180	MHz
LTE-TDD B38	2570–2620	2570–2620	MHz
LTE-TDD B40	2300–2400	2300–2400	MHz
LTE-TDD B41	2496–2690	2496–2690	MHz

4.1.3. Reference Design of RF Antenna Interfaces

A reference design of ANT_MAIN and ANT_BT/WIFI_SCAN is shown as below.

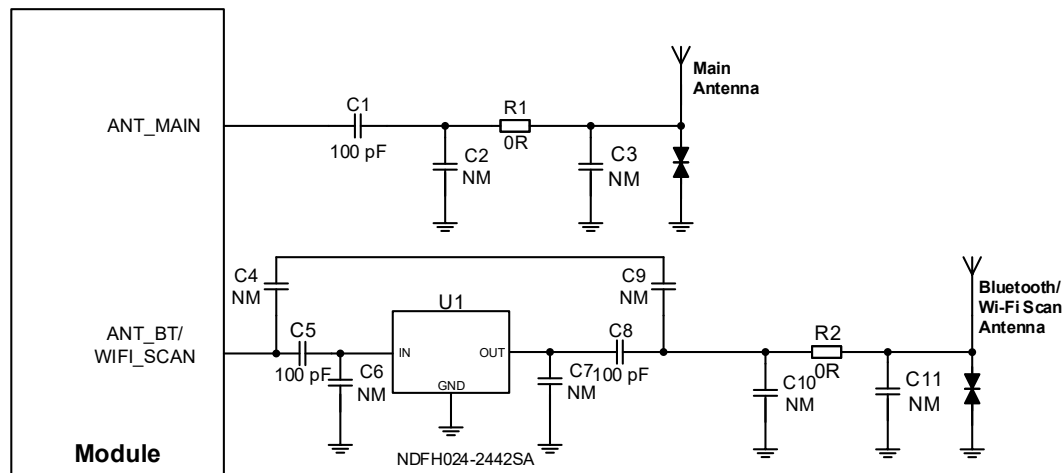


Figure 29: Reference Circuit of RF Antenna Interfaces

NOTE

- 1 To improve receiver sensitivity, ensure that the clearance among antennas is appropriate.
- 2 Place the DC-blocking capacitors (C1 and C8 (or C9)) and π -type matching components (C2, R1, C3 and C10, R2, C11) to antennas as close as possible.
- 3 The module supports Bluetooth and Wi-Fi Scan functions. Due to the shared antenna interface, the two functions cannot be used at the same time; Bluetooth and Wi-Fi Scan functions are optional. Please contact Quectel Technical Support for details.
- 4 Notes on C1 and C8 (or C9):
 - 1) If there is DC power at the antenna ports, place capacitors on C1 and C8 (or C9) to prevent short circuit to ground. The capacitance value is recommended to be 100 pF, which can be adjusted according to the debugging results.
 - 2) If there is no DC power in the peripheral design:
 - a) Do not reserve C1 and C8 (or C9).
 - b) If C1 and C8 (or C9) have already been reserved, they should be mounted with components, and it is recommended to use 0 Ω resistors. You can also match the components according to the debugging results.
5. It is recommended to reserve a filter at Wi-Fi Scan/Bluetooth antenna port. When the isolation between main antenna and Wi-Fi Scan/Bluetooth antenna is greater than 20 dB, the compatible design (C4 and C9) can be applied first.

4.2. GNSS Antenna Interface (Optional)

The following tables list the pin definition and frequency characteristics of the GNSS antenna interface respectively.

Table 31: Pin Definition of GNSS Antenna Interface

Pin Name	Pin No.	I/O	Description	Comment
ANT_GNSS	47	AI	GNSS antenna interface	50 Ω impedance. If unused, keep it open.

Table 32: GNSS Frequency

GNSS Constellation Type	Frequency	Unit
GPS	1575.42 $\pm$ 1.023	MHz
GLONASS	1601.7 $\pm$ 4.2	MHz
Galileo	1575.42 $\pm$ 2.046	MHz
BDS	1561.098 $\pm$ 2.046	MHz
QZSS	1575.42 $\pm$ 1.023	MHz

Table 33: GNSS Performance

Parameter	Description	Condition	Typ.	Unit
Sensitivity	Acquisition	Autonomous	-146	dBm
	Reacquisition	Autonomous	-160	dBm
	Tracking	Autonomous	-160	dBm
TTFF	Cold start @ open sky	Autonomous	28.0	s
		AGNSS start	5.0	s
	Warm start @ open sky	Autonomous	27.0	s
		AGNSS start	1.8	s

	Hot start @ open sky	Autonomous	3.2	s
		AGNSS start	1.7	s
Accuracy	CEP-50	Autonomous @ open sky	1.7	m

NOTE

1. Tracking sensitivity: the minimum GNSS signal power at which the module can maintain lock (keep positioning for at least 3 minutes continuously).
2. Reacquisition sensitivity: the minimum GNSS signal power required for the module to maintain lock within 3 minutes after loss of lock.
3. Acquisition sensitivity: the minimum GNSS signal power at which the module can fix position successfully within 3 minutes after executing cold start command.

In any case, it is recommended to use a passive antenna. However, if an active antenna is needed in your application, it is recommended to reserve a π -type attenuation circuit and use a high-performance LDO in the power system design.

A reference design of GNSS antenna is shown as below:

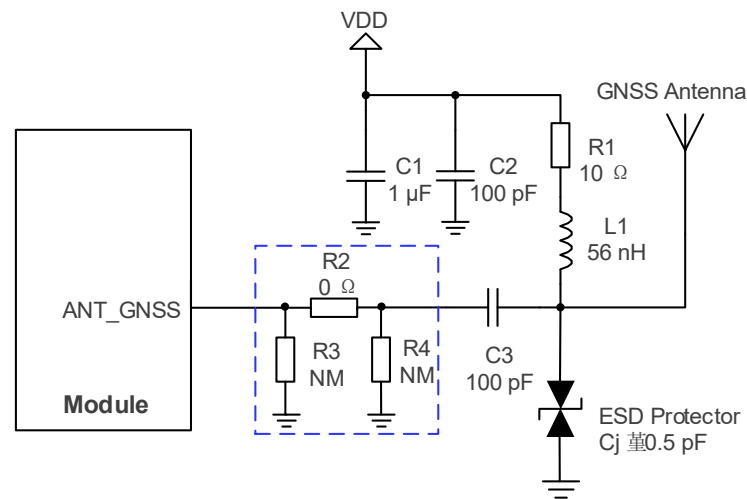


Figure 30: Reference Circuit of GNSS Antenna

NOTE

1. The active antenna requires an external power supply. GNSS_VDD is recommended to be 3.3 V @ 30 mA.
2. The VDD circuit (C1, C2, R1 and L1) is not needed if you use the passive antenna.

3. For passive antenna, notes on C3:

- 1) If there is DC power at the antenna port, place capacitor on C3 to prevent short circuit to ground. The capacitance value is recommended to be 100 pF, which can be adjusted according to the debugging results.
- 2) If there is no DC power in the peripheral design:
 - a) Do not reserve C3.
 - b) If C3 has already been reserved, it should be mounted with components, and it is recommended to use a 0 Ω resistor. You can also match the component according to the debugging results.

4.3. RF Routing Guidelines

For user's PCB, the characteristic impedance of all RF traces should be controlled to 50 Ω . The impedance of the RF traces is usually determined by the trace width (W), the materials' dielectric constant, the height from the reference ground to the signal layer (H), and the spacing between RF traces and grounds (S). Microstrip or coplanar waveguide is typically used in RF layout to control characteristic impedance. The following are reference designs of microstrip or coplanar waveguide with different PCB structures.

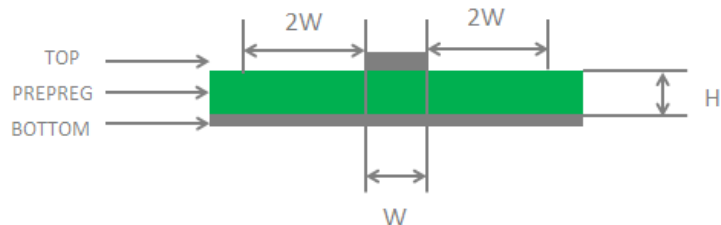


Figure 31: Microstrip Design on a 2-layer PCB

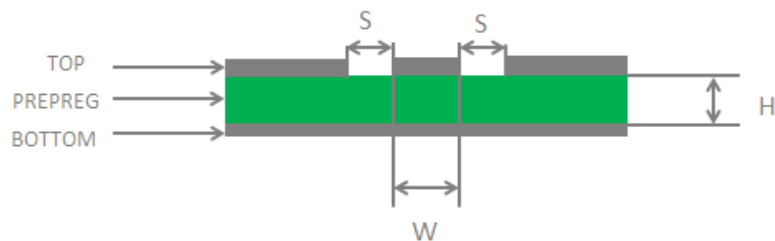


Figure 32: Coplanar Waveguide Design on a 2-layer PCB

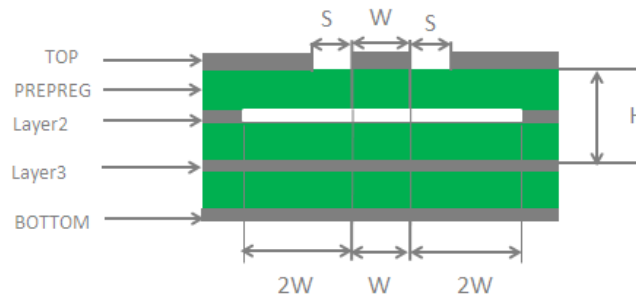


Figure 33: Coplanar Waveguide Design on a 4-layer PCB (Layer 3 as Reference Ground)

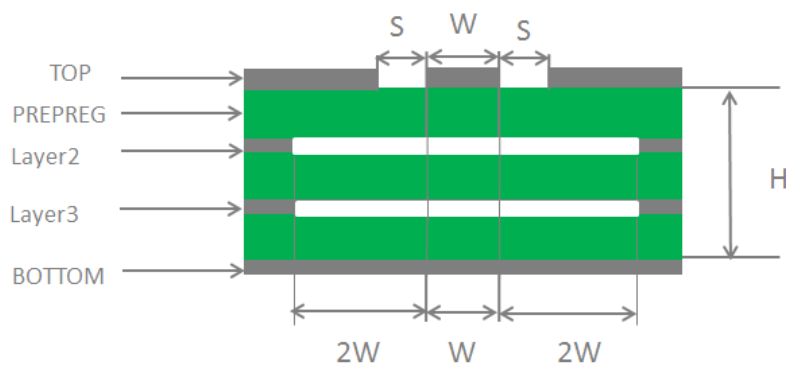


Figure 34: Coplanar Waveguide Design on a 4-layer PCB (Layer 4 as Reference Ground)

To ensure RF performance and reliability, follow the principles below in RF layout design:

- Use an impedance simulation tool to accurately control the characteristic impedance of RF traces to $50\ \Omega$.
- The GND pins adjacent to RF pins should not be designed as thermal relief pads, and should be fully connected to ground.
- The distance between the RF pins and the RF connector should be as short as possible and all the right-angle traces should be changed to curved ones. The recommended trace angle is 135° .
- There should be clearance under the signal pin of the antenna connector or solder joint.
- The reference ground of RF traces should be complete. Meanwhile, adding some ground vias around RF traces and the reference ground could help to improve RF performance. The distance between the ground vias and RF traces should be at least twice the width of RF signal traces ($2 \times W$).
- Keep RF traces away from interference sources (such as DC-DC, (U)SIM/USB/SDIO high frequency digital signals, display signals, and clock signals), and avoid intersection and paralleling between traces on adjacent layers.

See **document [6]** for more details about RF layout.

4.4. Antenna Installation

4.4.1. Antenna Requirements

The following table shows the requirements of the antennas.

Table 34: Antenna Requirements

Type	Requirements
GNSS (optional)	● Frequency range: 1559–1609 MHz ● Polarization: RHCP or linear ● VSWR: < 2 (typ.)
	For passive antenna usage: ● Passive antenna gain: > 0 dBi
	For active antenna usage: ● Active antenna noise factor: < 1.5 dB ● Active antenna internal LNA gain: < 24 dB
Cellular	● VSWR: ≤ 2 ● Efficiency: > 30 % ● Max. input power: 50 W ● Input impedance: 50 Ω ● Cable insertion loss: < 1 dB: LB (< 1 GHz) < 1.5 dB: MB (1–2.3 GHz) < 2 dB: HB (> 2.3 GHz)
Bluetooth/Wi-Fi Scan (optional)	● VSWR: ≤ 3 ● Gain: 1 dBi ● Max input power: 50 W ● Input impedance: 50 Ω ● Cable insertion loss: < 1 dB ● Isolation from the main antenna: > 20 dB

4.4.2. Recommended RF Connector for Antenna Installation

If RF connector is used for antenna connection, it is recommended to use U.FL-R-SMT receptacle provided by Hirose.

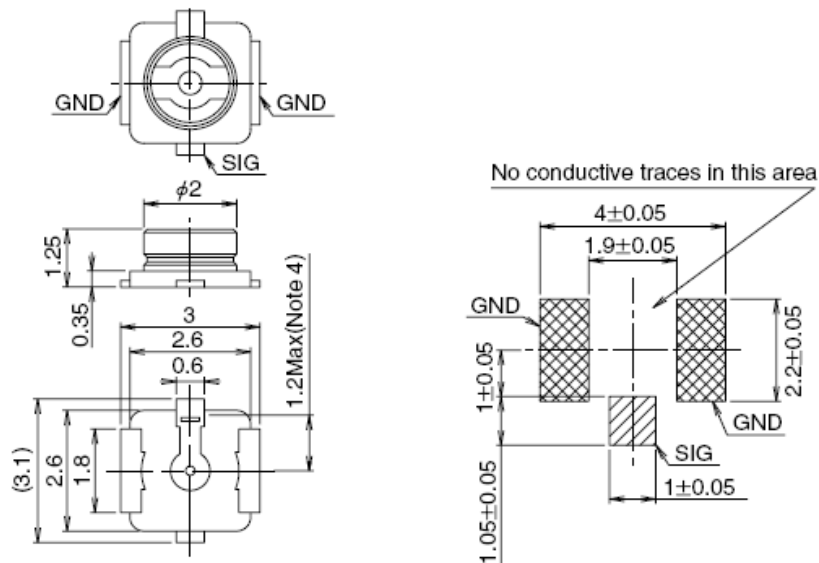


Figure 35: Dimensions of the Receptacle (Unit: mm)

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

	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 36: Specifications of Mated Plugs

The following figure describes the space factor of mated connector.

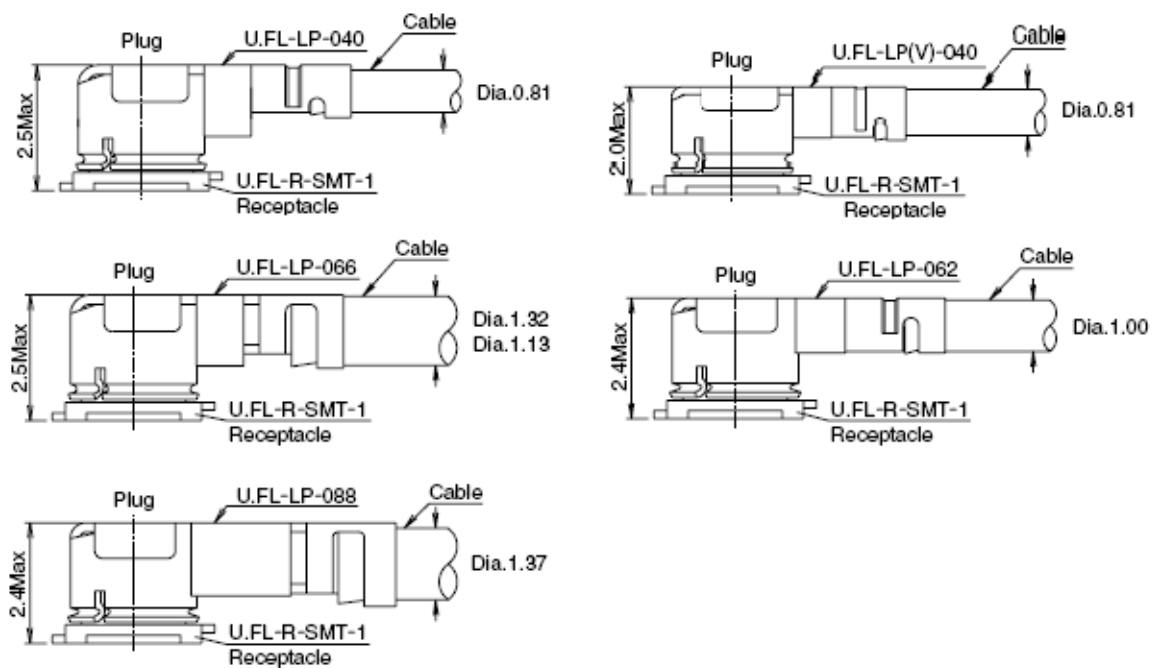


Figure 37: Space Factor of Mated Connector (Unit: mm)

For more details, please visit <http://hirose.com>.

5 Electrical Characteristics, Radio and Reliability

5.1. Absolute Maximum Ratings

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

Table 35: Absolute Maximum Ratings

Parameter	Min.	Max.	Unit
VBAT_RF/VBAT_BB	-0.3	6.0	V
USB_VBUS	-0.3	5.5	V
Peak Current of VBAT_BB	-	1.5	A
Peak Current of VBAT_RF	-	2.5	A
Voltage at Digital Pins	-0.3	2.1	V
Input Voltage at ADC0	0	VBAT_BB	V
Input Voltage at ADC1	0	VBAT_BB	V
Input Voltage at ADC2	0	VBAT_BB	V

5.2. Power Supply Ratings

Table 36: Power Supply Ratings

Parameter	Description	Conditions	Min.	Typ.	Max.	Unit
VBAT	VBAT_BB and VBAT_RF	The actual input voltages must be kept between the minimum and maximum value.	3.3	3.8	4.3	V
	Voltage drop during burst transmission	Maximum power control level	-	-	400	mV
I _{VBAT}	Peak supply current	Maximum power control level	-	1.8	2.0/3.0	A
USB_VBUS	USB detection	-	3.5	5.0	5.25	V

NOTE

The power supply should be able to provide sufficient current of at least 2.0 A to the module when only LTE is available, and should be able to provide sufficient current of at least 3.0 A to the module when the GSM or both GSM and LTE are available.

5.3. Operating and Storage Temperatures

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

Table 37: Operating and Storage Temperatures

Parameter	Min.	Typ.	Max.	Unit
Operating Temperature Range ⁹	-35	+25	+75	°C
Extended Temperature Range ¹⁰	-40	-	+85	°C
Storage Temperature Range	-40	-	+90	°C

⁹ Within the operating temperature range, the module meets 3GPP specifications.

¹⁰ Within the extended temperature range, the module remains the ability to establish and maintain functions such as voice (optional), SMS and data transmission, without any unrecoverable malfunction. Radio spectrum and radio network are not influenced, while one or more specifications, such as P_{out}, may exceed the specified tolerances of 3GPP. When the temperature returns to the operating temperature range, the module meets 3GPP specifications again.

5.4. Power Consumption

Table 38: EC200U-CN Power Consumption

Description	Conditions	Typ.	Unit
OFF state	Power down	32	μA
	AT+CFUN=0 (USB disconnected)	0.972	mA
	EGSM900 @ DRX = 2 (USB disconnected)	2.02	mA
	EGSM900 @ DRX = 5 (USB disconnected)	1.46	mA
	EGSM900 @ DRX = 5 (USB suspended)	2.90	mA
	EGSM900 @ DRX = 9 (USB disconnected)	1.30	mA
	DCS1800 @ DRX = 2 (USB disconnected)	2.00	mA
	DCS1800 @ DRX = 5 (USB disconnected)	1.46	mA
	DCS1800 @ DRX = 5 (USB suspended)	2.89	mA
	DCS1800 @ DRX = 9 (USB disconnected)	1.30	mA
	Sleep state	LTE-FDD @ PF = 32 (USB disconnected)	2.64
LTE-FDD @ PF = 64 (USB disconnected)		1.85	mA
LTE-FDD @ PF = 64 (USB suspended)		3.41	mA
LTE-FDD @ PF = 128 (USB disconnected)		1.46	mA
LTE-FDD @ PF = 256 (USB disconnected)		1.26	mA
LTE-TDD @ PF = 32 (USB disconnected)		2.70	mA
LTE-TDD @ PF = 64 (USB disconnected)		1.97	mA
LTE-TDD @ PF = 64 (USB suspended)		3.47	mA
LTE-TDD @ PF = 128 (USB disconnected)		1.56	mA
LTE-TDD @ PF = 256 (USB disconnected)		1.24	mA
Idle state	EGSM900 @ DRX = 5 (USB disconnected)	13.26	mA

	EGSM900 @ DRX = 5 (USB connected)	28.41	mA
	LTE-FDD @ PF = 64 (USB disconnected)	13.20	mA
	LTE-FDD @ PF = 64 (USB connected)	28.42	mA
	LTE-TDD @ PF = 64 (USB disconnected)	13.38	mA
	LTE-TDD @ PF = 64 (USB connected)	28.58	mA
GPRS data transmission (GNSS off)	EGSM900 4DL/1UL @ 32.49 dBm	217	mA
	EGSM900 3DL/2UL @ 30.87 dBm	339	mA
	EGSM900 2DL/3UL @ 28.8 dBm	391	mA
	EGSM900 1DL/4UL @ 26.74 dBm	411	mA
	DCS1800 4DL/1UL @ 29.44 dBm	146	mA
	DCS1800 3DL/2UL @ 27.91 dBm	220	mA
	DCS1800 2DL/3UL @ 25.93 dBm	249	mA
	DCS1800 1DL/4UL @ 23.89 dBm	260	mA
LTE data transmission (GNSS off)	LTE-FDD B1 @ 22.63 dBm	652	mA
	LTE-FDD B3 @ 22.73 dBm	630	mA
	LTE-FDD B5 @ 22.61 dBm	547	mA
	LTE-FDD B8 @ 22.21 dBm	545	mA
	LTE-TDD B34 @ 22.68 dBm	272	mA
	LTE-TDD B38 @ 22.94 dBm	352	mA
	LTE-TDD B39 @ 22.79 dBm	285	mA
	LTE-TDD B40 @ 23.37 dBm	461	mA
	LTE-TDD B41 @ 22.88 dBm	357	mA
GSM voice call	EGSM900 PCL = 5 @ 32.41 dBm	237	mA
	EGSM900 PCL = 12 @ 19.04 dBm	91	mA
	EGSM900 PCL = 19 @ 5.73 dBm	62	mA

DCS1800 PCL = 0 @ 29.45 dBm	161	mA
DCS1800 PCL = 7 @ 15.87 dBm	75	mA
DCS1800 PCL = 15 @ 0.51 dBm	58	mA

NOTE

The GSM network access technology of EC200U-CN is optional. If the module that you select does not support GSM network access technology, there is no corresponding power consumption.

Table 39: EC200U-EU Power Consumption

Description	Conditions	Typ.	Unit
OFF state	Power down	40	μA
	AT+CFUN=0 (USB disconnected)	1.68	mA
	GSM850 @ DRX = 2 (USB disconnected)	2.70	mA
	GSM850 @ DRX = 5 (USB disconnected)	2.15	mA
	GSM850 @ DRX = 5 (USB suspended)	3.56	mA
	GSM850 @ DRX = 9 (USB disconnected)	2.02	mA
	DCS1800 @ DRX = 2 (USB disconnected)	2.66	mA
	DCS1800 @ DRX = 5 (USB disconnected)	2.16	mA
	DCS1800 @ DRX = 5 (USB suspended)	3.55	mA
	DCS1800 @ DRX = 9 (USB disconnected)	1.90	mA
Sleep state	LTE-FDD @ PF = 32 (USB disconnected)	2.49	mA
	LTE-FDD @ PF = 64 (USB disconnected)	1.85	mA
	LTE-FDD @ PF = 64 (USB suspended)	3.24	mA
	LTE-FDD @ PF = 128 (USB disconnected)	1.52	mA
	LTE-FDD @ PF = 256 (USB disconnected)	1.35	mA
	LTE-TDD @ PF = 32 (USB disconnected)	2.55	mA

	LTE-TDD @ PF = 64 (USB disconnected)	1.87	mA
	LTE-TDD @ PF = 64 (USB suspended)	3.29	mA
	LTE-TDD @ PF = 128 (USB disconnected)	1.54	mA
	LTE-TDD @ PF = 256 (USB disconnected)	1.37	mA
Idle state	EGSM900 @ DRX = 5 (USB disconnected)	13.01	mA
	EGSM900 @ DRX = 5 (USB connected)	28.94	mA
	LTE-FDD @ PF = 64 (USB disconnected)	12.68	mA
	LTE-FDD @ PF = 64 (USB connected)	27.92	mA
	LTE-TDD @ PF = 64 (USB disconnected)	12.70	mA
	LTE-TDD @ PF = 64 (USB connected)	27.95	mA
GPRS data transmission (GNSS off)	GSM850 4DL/1UL @ 32.43 dBm	251	mA
	GSM850 3DL/2UL @ 31.04 dBm	391	mA
	GSM850 2DL/3UL @ 29.70 dBm	493	mA
	GSM850 1DL/4UL @ 28.62 dBm	580	mA
	EGSM900 4DL/1UL @ 32.62 dBm	234	mA
	EGSM900 3DL/2UL @ 31.57 dBm	373	mA
	EGSM900 2DL/3UL @ 30.34 dBm	475	mA
	EGSM900 1DL/4UL @ 29.45 dBm	571	mA
	DCS1800 4DL/1UL @ 29.99 dBm	162	mA
	DCS1800 3DL/2UL @ 29.19 dBm	254	mA
	DCS1800 2DL/3UL @ 27.79 dBm	315	mA
	DCS1800 1DL/4UL @ 26.58 dBm	372	mA
	PCS1900 4DL/1UL @ 28.57 dBm	179	mA
	PCS1900 3DL/2UL @ 27.90 dBm	287	mA
	PCS1900 2DL/3UL @ 26.51 dBm	363	mA

LTE data transmission (GNSS off)	PCS1900 1DL/4UL @ 25.66 dBm	440	mA
	LTE-FDD B1 @ 22.89 dBm	699	mA
	LTE-FDD B3 @ 23.33 dBm	726	mA
	LTE-FDD B5 @ 22.22 dBm	581	mA
	LTE-FDD B7 @ 23.31 dBm	881	mA
	LTE-FDD B8 @ 22.11 dBm	611	mA
	LTE-FDD B20 @ 22.32 dBm	647	mA
	LTE-FDD B28 @ 23.33 dBm	732	mA
	LTE-TDD B38 @ 23.20 dBm	335	mA
	LTE-TDD B40 @ 23.12 dBm	320	mA
	LTE-TDD B41 @ 22.91 dBm	361	mA
GSM voice call	GSM850 PCL = 5 @ 32.21 dBm	259	mA
	GSM850 PCL = 12 @ 19.21 dBm	97	mA
	GSM850 PCL = 19 @ 5.74 dBm	62	mA
	EGSM900 PCL = 5 @ 32.26 dBm	231	mA
	EGSM900 PCL = 12 @ 18.90 dBm	89	mA
	EGSM900 PCL = 19 @ 5.97 dBm	61	mA
	DCS1800 PCL = 0 @ 29.36 dBm	153	mA
	DCS1800 PCL = 7 @ 15.89 dBm	72	mA
	DCS1800 PCL = 15 @ 0.35 dBm	55	mA
	PCS1900 PCL = 0 @ 28.78 dBm	152	mA
	PCS1900 PCL = 7 @ 16.01 dBm	75	mA
	PCS1900 PCL = 15 @ 0.48 dBm	56	mA

NOTE

The voice function of EC200U-EU is optional. If the module that you select does not support voice, there is no corresponding power consumption.

Table 40: EC200U-AU Power Consumption

Description	Conditions	Typ.	Unit
OFF state	Power down	31	μA
	AT+CFUN=0 (USB disconnected)	1.034	mA
	EGSM900 @ DRX = 2 (USB disconnected)	2.06	mA
	EGSM900 @ DRX = 5 (USB disconnected)	1.52	mA
	EGSM900 @ DRX = 5 (USB suspended)	2.97	mA
	EGSM900 @ DRX = 9 (USB disconnected)	1.36	mA
	DCS1800 @ DRX = 2 (USB disconnected)	2.04	mA
	DCS1800 @ DRX = 5 (USB disconnected)	1.51	mA
	DCS1800 @ DRX = 5 (USB suspended)	2.93	mA
	DCS1800 @ DRX = 9 (USB disconnected)	1.36	mA
Sleep state	LTE-FDD @ PF = 32 (USB disconnected)	2.63	mA
	LTE-FDD @ PF = 64 (USB disconnected)	1.87	mA
	LTE-FDD @ PF = 64 (USB suspended)	3.41	mA
	LTE-FDD @ PF = 128 (USB disconnected)	1.50	mA
	LTE-FDD @ PF = 256 (USB disconnected)	1.31	mA
	LTE-TDD @ PF = 32 (USB disconnected)	2.69	mA
	LTE-TDD @ PF = 64 (USB disconnected)	1.91	mA
	LTE-TDD @ PF = 64 (USB suspended)	3.37	mA
	LTE-TDD @ PF = 128 (USB disconnected)	1.52	mA
	LTE-TDD @ PF = 256 (USB disconnected)	1.32	mA

Idle state	EGSM900 @ DRX = 5 (USB disconnected)	12.71	mA
	EGSM900 @ DRX = 5 (USB connected)	27.90	mA
	LTE-FDD @ PF = 64 (USB disconnected)	13.05	mA
	LTE-FDD @ PF = 64 (USB connected)	28.33	mA
	LTE-TDD @ PF = 64 (USB disconnected)	13.10	mA
	LTE-TDD @ PF = 64 (USB connected)	28.34	mA
GPRS data transmission (GNSS off)	GSM850 4DL/1UL @ 32.43 dBm	242	mA
	GSM850 3DL/2UL @ 31.00 dBm	385	mA
	GSM850 2DL/3UL @ 28.74 dBm	435	mA
	GSM850 1DL/4UL @ 26.50 dBm	447	mA
	EGSM900 4DL/1UL @ 32.39 dBm	208	mA
	EGSM900 3DL/2UL @ 30.81 dBm	325	mA
	EGSM900 2DL/3UL @ 28.76 dBm	376	mA
	EGSM900 1DL/4UL @ 26.68 dBm	392	mA
	DCS1800 4DL/1UL @ 29.97 dBm	153	mA
	DCS1800 3DL/2UL @ 28.47 dBm	220	mA
	DCS1800 2DL/3UL @ 26.28 dBm	245	mA
	DCS1800 1DL/4UL @ 24.29 dBm	256	mA
	PCS1900 4DL/1UL @ 29.78 dBm	152	mA
	PCS1900 3DL/2UL @ 28.26 dBm	228	mA
	PCS1900 2DL/3UL @ 26.26 dBm	261	mA
	PCS1900 1DL/4UL @ 24.08 dBm	270	mA
LTE data transmission (GNSS off)	LTE-FDD B1 @ 23.84 dBm	730	mA
	LTE-FDD B2 @ 23.31 dBm	606	mA
	LTE-FDD B3 @ 23.10 dBm	603	mA

	LTE-FDD B4 @ 23.53 dBm	606	mA
	LTE-FDD B5 @ 22.90 dBm	533	mA
	LTE-FDD B7 @ 23.40 dBm	692	mA
	LTE-FDD B8 @ 23.81 dBm	650	mA
	LTE-FDD B28 @ 23.47 dBm	632	mA
	LTE-FDD B66 @ 23.60 dBm	506	mA
	LTE-TDD B38 @ 23.85 dBm	346	mA
	LTE-TDD B40 @ 23.05 dBm	405	mA
	LTE-TDD B41 @ 23.61 dBm	347	mA
	GSM850 PCL = 5 @ 32.40 dBm	260	mA
	GSM850 PCL = 12 @ 19.46 dBm	96	mA
	GSM850 PCL = 19 @ 6.59 dBm	63	mA
	EGSM900 PCL = 5 @ 32.40 dBm	227	mA
GSM voice call	EGSM900 PCL = 12 @ 19.05 dBm	88	mA
	EGSM900 PCL = 19 @ 6.05 dBm	61	mA
	DCS1800 PCL = 0 @ 29.95 dBm	168	mA
	DCS1800 PCL = 7 @ 16.50 dBm	75	mA
	DCS1800 PCL = 15 @ 1.25 dBm	57	mA
	PCS1900 PCL = 0 @ 29.76 dBm	168	mA
	PCS1900 PCL = 7 @ 16.42 dBm	77	mA
	PCS1900 PCL = 15 @ 1.66 dBm	58	mA

5.5. Tx Power

The following table shows the RF output power of the module.

Table 41: RF Output Power

Frequency Bands	Max. RF Output Power	Min. RF Output Power
GSM850	33 dBm $\pm$ 2 dB	5 dBm $\pm$ 5 dB
EGSM900	33 dBm $\pm$ 2 dB	5 dBm $\pm$ 5 dB
DCS1800	30 dBm $\pm$ 2 dB	0 dBm $\pm$ 5 dB
PCS1900	30 dBm $\pm$ 2 dB	0 dBm $\pm$ 5 dB
LTE-FDD	23 dBm $\pm$ 2 dB	< -39 dBm
LTE-TDD	23 dBm $\pm$ 2 dB	< -39 dBm

NOTE

- For GPRS transmission on 4 uplink timeslots, the maximum output power reduction is 6.0 dB at most. The design conforms to 3GPP TS 51.010-1 **subclause 13.16**.
- The GSM network access technology of EC200U-CN is optional. If the module that you select doesn't support GSM network access technology, there is no corresponding RF output power.

5.6. Rx Sensitivity

The following tables show conducted RF receiver sensitivity of the module.

Table 42: EC200U-CN Conducted RF Receiver Sensitivity

Frequency	Receiver Sensitivity (Typ.)	
	Primary	3GPP
EGSM900	-109.5 dBm	-102.0 dBm
DCS1800	-108.2 dBm	-102.0 dBm
LTE-FDD B1 (10 MHz)	-97.4 dBm	-93.3 dBm
LTE-FDD B3 (10 MHz)	-98.0 dBm	-90.3 dBm
LTE-FDD B5 (10 MHz)	-98.4 dBm	-91.8 dBm
LTE-FDD B8 (10 MHz)	-98.4 dBm	-90.8dBm

LTE-TDD B34 (10 MHz)	-98.2 dBm	-93.8 dBm
LTE-TDD B38 (10 MHz)	-97.6 dBm	-93.3 dBm
LTE-TDD B39 (10 MHz)	-98.4 dBm	-93.8 dBm
LTE-TDD B40 (10 MHz)	-98.2 dBm	-93.8 dBm
LTE-TDD B41 (10 MHz)	-97.6 dBm	-91.8dBm

NOTE

The GSM network access technology of EC200U-CN is optional. If the module that you select doesn't support GSM network access technology, there is no corresponding RF receiver sensitivity data.

Table 43: EC200U-EU Conducted RF Receiver Sensitivity

Frequency	Receiver Sensitivity (Typ.)	
	Primary	3GPP
GSM850	-109.5 dBm	-102.0 dBm
EGSM900	-109.5 dBm	-102.0 dBm
DCS1800	-109 dBm	-102.0 dBm
PCS1900	-109 dBm	-102.0 dBm
LTE-FDD B1 (10 MHz)	-97.1 dBm	-93.3 dBm
LTE-FDD B3 (10 MHz)	-97.2 dBm	-90.3 dBm
LTE-FDD B5 (10 MHz)	-98.1 dBm	-91.8 dBm
LTE-FDD B7 (10 MHz)	-95.5 dBm	-91.3 dBm
LTE-FDD B8 (10 MHz)	-98.2 dBm	-90.8 dBm
LTE-FDD B20 (10 MHz)	-98.4 dBm	-90.8 dBm
LTE-FDD B28 (10 MHz)	-96.7 dBm	-92.3 dBm
LTE-TDD B38 (10 MHz)	-97.6 dBm	-93.3 dBm
LTE-TDD B40 (10 MHz)	-97.4 dBm	-93.8 dBm

LTE-TDD B41 (10 MHz)	-97.2 dBm	-91.8 dBm
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Table 44: EC200U-AU Conducted RF Receiver Sensitivity

Frequency	Receiver Sensitivity (Typ.)	
	Primary	3GPP
GSM850	-109.9 dBm	-102.0 dBm
EGSM900	-110 dBm	-102.0 dBm
DCS1800	-109.6 dBm	-102.0 dBm
PCS1900	-109.6 dBm	-102.0 dBm
LTE-FDD B1 (10 MHz)	-98.1 dBm	-93.3 dBm
LTE-FDD B2 (10 MHz)	-97.8 dBm	-91.3 dBm
LTE-FDD B3 (10 MHz)	-97.7 dBm	-90.3 dBm
LTE-FDD B4 (10 MHz)	-97.9 dBm	-93.3 dBm
LTE-FDD B5 (10 MHz)	-98.5 dBm	-91.8 dBm
LTE-FDD B7 (10 MHz)	-97.3 dBm	-91.3 dBm
LTE-FDD B8 (10 MHz)	-99.1 dBm	-90.8 dBm
LTE-FDD B28 (10 MHz)	-99.1 dBm	-92.3 dBm
LTE-FDD B66 (10 MHz)	-97.8 dBm	-92.8 dBm
LTE-TDD B38 (10 MHz)	-98.7 dBm	-93.3 dBm
LTE-TDD B40 (10 MHz)	-99.1 dBm	-93.8 dBm
LTE-TDD B41 (10 MHz)	-98.4 dBm	-91.8 dBm

5.7. ESD Protection

Static electricity occurs naturally and it may damage the module. Therefore, applying proper ESD countermeasures and handling methods is imperative. For example, wear anti-static gloves during the development, production, assembly and testing of the module; add ESD protection components to the

ESD sensitive interfaces and points in the product design.

Table 45: Electrostatics Discharge Characteristics (Temperature: 25–30 °C, Humidity: 40 ±5 %)

Tested Interfaces	Contact Discharge	Air Discharge	Unit
VBAT, GND	±5	±10	kV
Antenna Interfaces	±4	±8	kV
Other Interfaces	±0.5	±1	kV

6 Mechanical Information

This chapter describes the mechanical dimensions of the module. All dimensions are measured in millimeter. The tolerances for dimensions without tolerance values are ± 0.2 mm.

6.1. Mechanical Dimensions

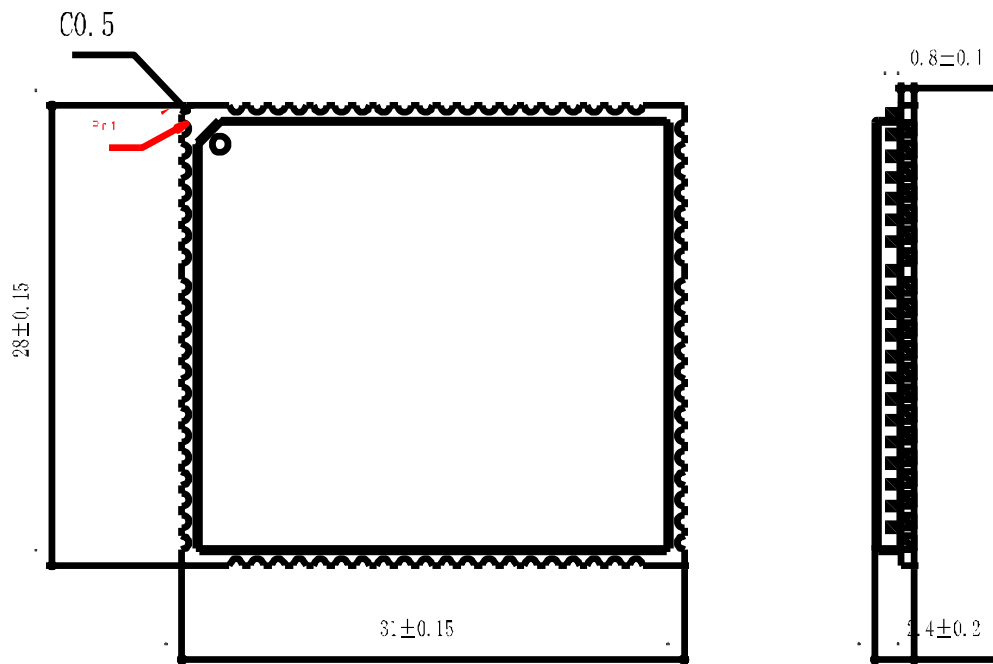


Figure 38: Module Top and Side Dimensions

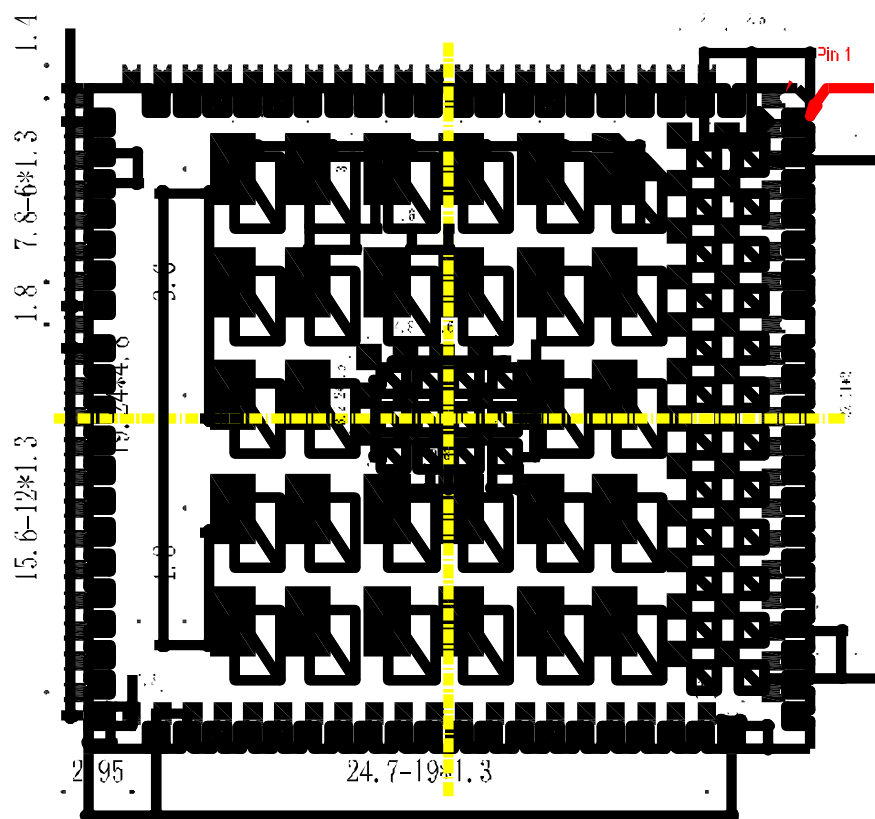


Figure 39: Module Bottom Dimensions

NOTE

The module's coplanarity standard: ≤ 0.13 mm.

6.2. Recommended Footprint

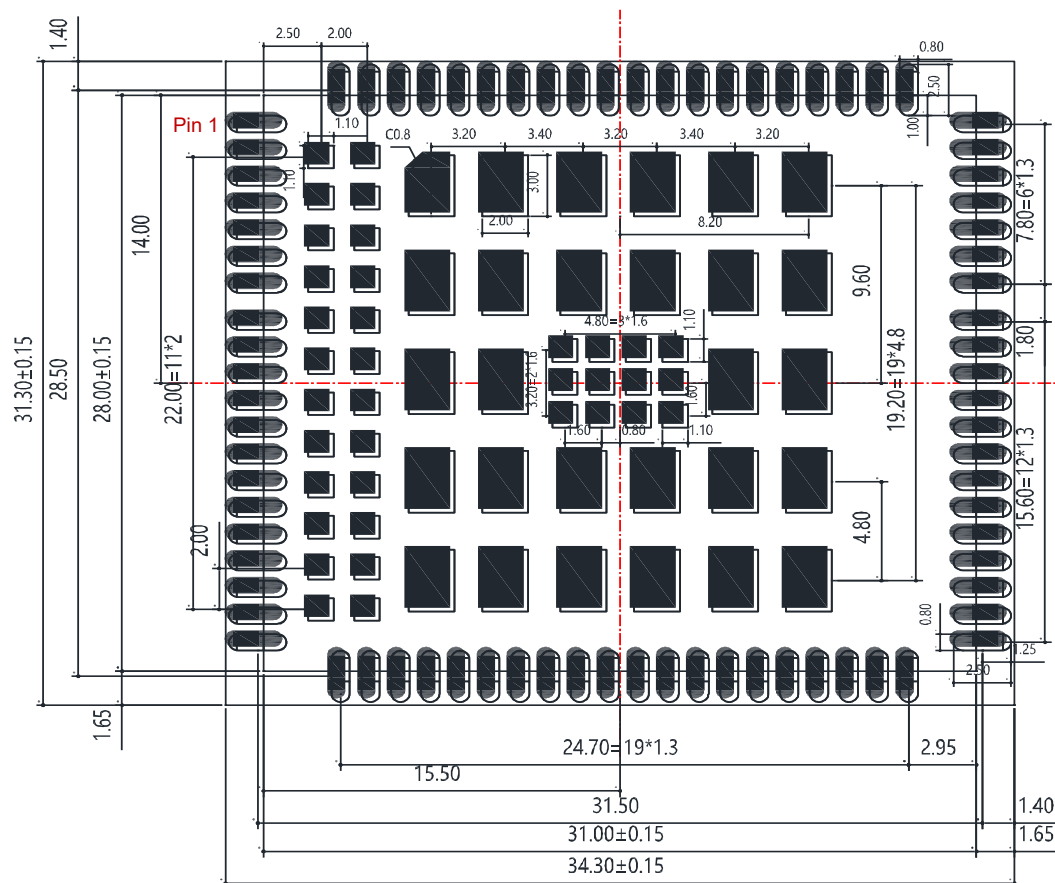


Figure 40: Recommended Footprint

NOTE

1. Keep at least 3 mm between the module and other components on the motherboard to improve soldering quality and maintenance convenience.
2. If pins 73–84 are unused, the corresponding stencil design can be omitted.

6.3. Top and Bottom Views



Figure 41: Top & Bottom View of the Module

NOTE

Images above are for illustration purpose only and may differ from the actual module. For authentic appearance and label, please refer to the module received from Quectel.

7 Storage, Manufacturing & Packaging

7.1. Storage Conditions

The module is provided with vacuum-sealed packaging. MSL of the module is rated as 3. The storage requirements are shown below.

1. Recommended Storage Condition: the temperature should be 23 ± 5 °C and the relative humidity should be 35–60 %.
2. Shelf life (in a vacuum-sealed packaging): 12 months in Recommended Storage Condition.
3. Floor life: 168 hours ¹¹ in a factory where the temperature is 23 ± 5 °C and relative humidity is below 60 %. After the vacuum-sealed packaging is removed, the module must be processed in reflow soldering or other high-temperature operations within 168 hours. Otherwise, the module should be stored in an environment where the relative humidity is less than 10 % (e.g., a dry cabinet).
4. The module should be pre-baked to avoid blistering, cracks and inner-layer separation in PCB under the following circumstances:
 - The module is not stored in Recommended Storage Condition;
 - Violation of the third requirement mentioned above;
 - Vacuum-sealed packaging is broken, or the packaging has been removed for over 24 hours;
 - Before module repairing.
5. If needed, the pre-baking should follow the requirements below:
 - The module should be baked for 24 hours at 120 ± 5 °C;
 - The module must be soldered to PCB within 24 hours after the baking, otherwise it should be put in a dry environment such as in a dry cabinet.

¹¹ This floor life is only applicable when the environment conforms to *IPC/JEDEC J-STD-033*. It is recommended to start the solder reflow process within 24 hours after the package is removed if the temperature and moisture do not conform to, or are not sure to conform to *IPC/JEDEC J-STD-033*. And do not unpack the modules in large quantities until they are ready for soldering.

NOTE

1. To avoid blistering, layer separation and other soldering issues, extended exposure of the module to the air is forbidden.
2. Take out the module from the package and put it on high-temperature-resistant fixtures before baking. If shorter baking time is desired, see *IPC/JEDEC J-STD-033* for the baking procedure.
3. Pay attention to ESD protection, such as wearing anti-static gloves, when touching the modules.

7.2. Manufacturing and Soldering

Push the squeegee to apply the solder paste on the surface of stencil, thus making the paste fill the stencil openings and then penetrate to the PCB. Apply proper force on the squeegee to produce a clean stencil surface on a single pass. To guarantee module soldering quality, the thickness of stencil for the module is recommended to be 0.15–0.20 mm. For more details, see **document [7]**.

The recommended peak reflow temperature should be 235–246 °C, with 246 °C as the absolute maximum reflow temperature. To avoid damage to the module caused by repeated heating, it is recommended that the module should be mounted only after reflow soldering for the other side of PCB has been completed. The recommended reflow soldering thermal profile (lead-free reflow soldering) and related parameters are shown below.

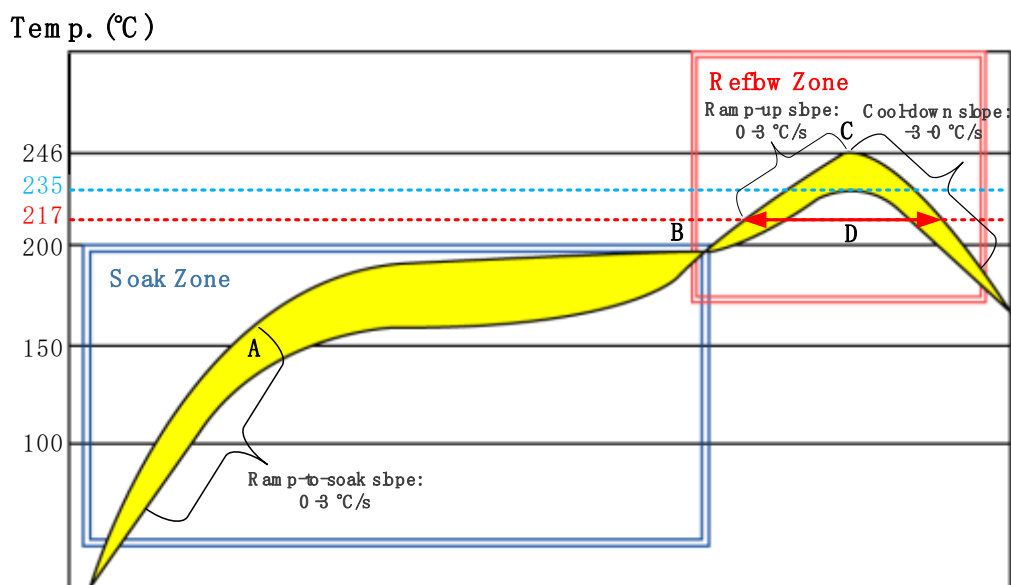


Figure 42: Recommended Reflow Soldering Thermal Profile

Table 46: Recommended Thermal Profile Parameters

Factor	Recommended Value
Soak Zone	
Ramp-to-soak Slope	0–3 °C/s
Soak Time (between A and B: 150 °C and 200 °C)	70–120 s
Reflow Zone	
Ramp-up Slope	0–3 °C/s
Reflow Time (D: over 217 °C)	40–70 s
Max Temperature	235–246 °C
Cool-down Slope	-3–0 °C/s
Reflow Cycle	
Max Reflow Cycle	1

NOTE

1. The above profile parameter requirements are for the measured temperature of the solder joints. Both the hottest and coldest spots of solder joints on the PCB should meet the above requirements.
2. During manufacturing and soldering, or any other processes that may contact the module directly, NEVER wipe the module's shielding can with organic solvents, such as acetone, ethyl alcohol, isopropyl alcohol, trichloroethylene. Otherwise, the shielding can may become rusted.
3. The shielding can for the module is made of Cupro-Nickel base material. It is tested that after 12 hours' Neutral Salt Spray test, the laser engraved label information on the shielding can is still clearly identifiable and the QR code is still readable, although white rust may be found.
4. If a conformal coating is necessary for the module, do NOT use any coating material that may chemically react with the PCB or shielding cover, and prevent the coating material from flowing into the module.
5. Avoid using ultrasonic technology for module cleaning since it can damage crystals inside the module.
6. Avoid using materials that contain mercury (Hg), such as adhesives, for module processing, even if the materials are RoHS compliant and their mercury content is below 1000 ppm (0.1 %).
7. Corrosive gases may corrode the electronic components inside the module, affecting their reliability and performance, and potentially leading to a shortened service life that fails to meet the designed lifespan. Therefore, do not store or use unprotected modules in environments containing corrosive gases such as hydrogen sulfide, sulfur dioxide, chlorine, and ammonia.
8. Due to the complexity of the SMT process, please contact Quectel Technical Support in advance

for any situation that you are not sure about, or any process (e.g., selective soldering, ultrasonic soldering) that is not mentioned in **document [8]**.

7.3. Packaging Specification

This chapter outlines the key packaging parameters and processes. All figures below are for reference purposes only, as the actual appearance and structure of packaging materials may vary in delivery.

The modules are packed in a tape and reel packaging as specified in the sub-chapters below.

7.3.1. Carrier Tape

Carrier tape dimensions are illustrated in the following figure and table:

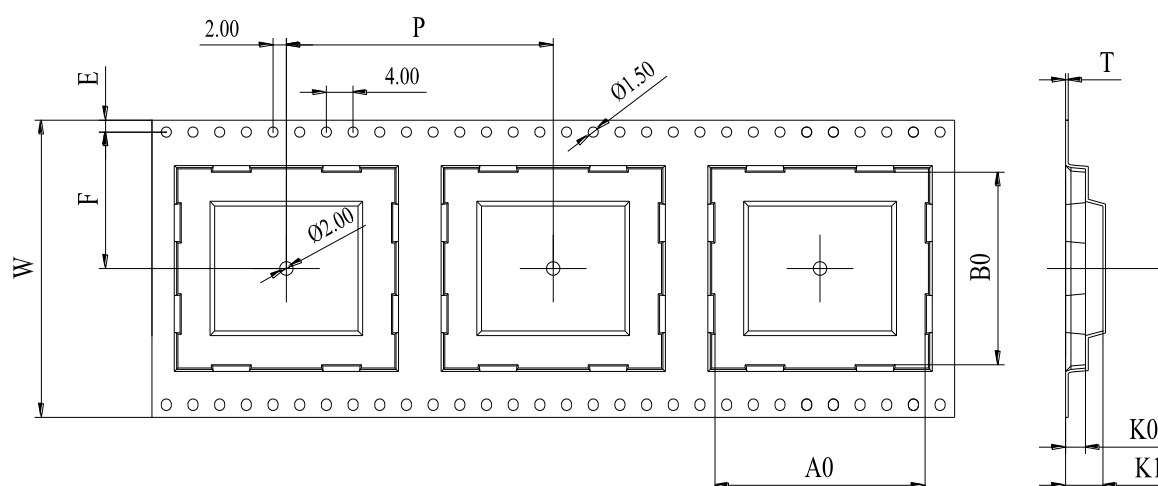


Figure 43: Carrier Tape Dimension Drawing (Unit: mm)

Table 47: Carrier Tape Dimension Table (Unit: mm)

W	P	T	A0	B0	K0	K1	F	E
44	40	0.4	31.5	28.5	3	5.6	20.2	1.75

7.3.2. Plastic Reel

Plastic reel dimensions are illustrated in the following figure and table:

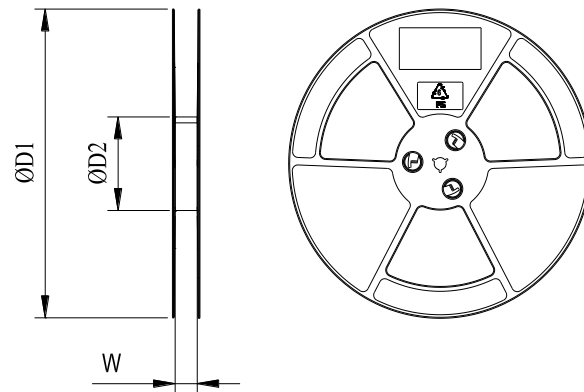


Figure 44: Plastic Reel Dimension Drawing

Table 48: Plastic Reel Dimension Table (Unit: mm)

ØD1	ØD2	W
330	100	44.5

7.3.3. Mounting Direction

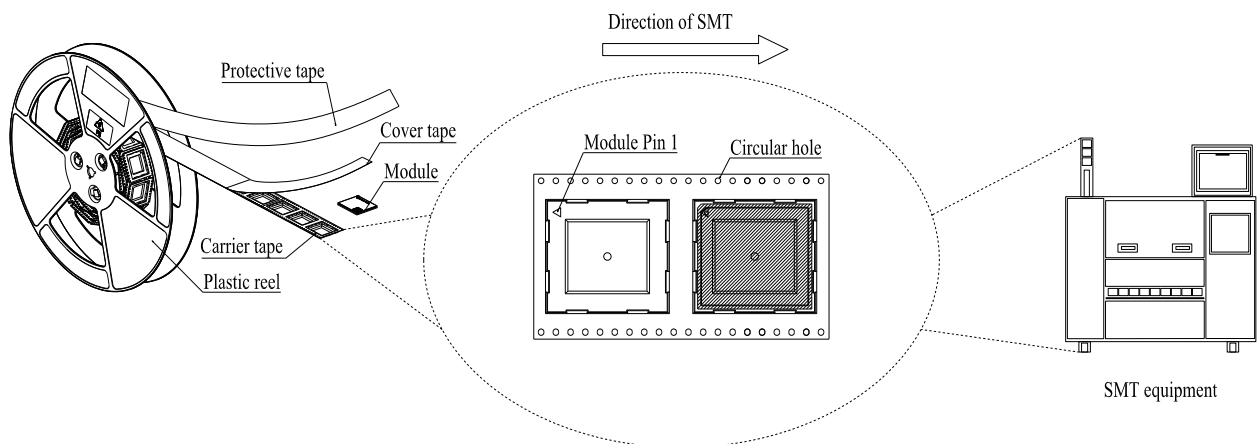
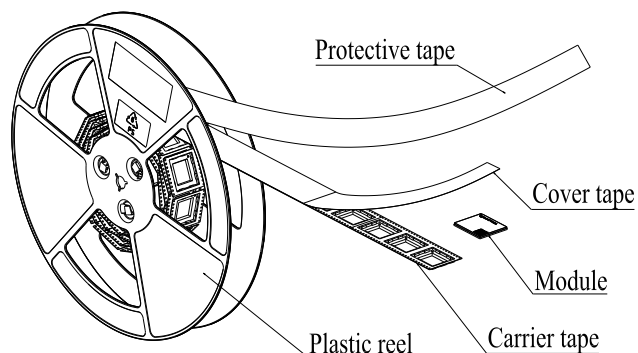


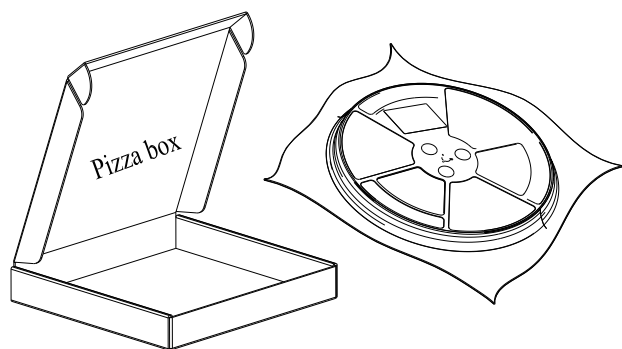
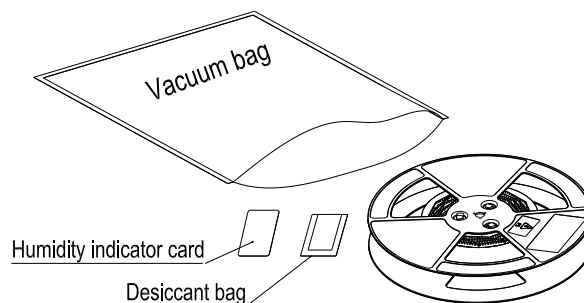
Figure 45: Mounting Direction

7.3.4. Packaging Process



Place the modules onto the carrier tape cavity and cover them securely with cover tape. Wind the heat-sealed carrier tape onto a plastic reel and apply a protective tape for additional protection. 1 plastic reel can pack 250 modules.

Place the packaged plastic reel, humidity indicator card and desiccant bag into a vacuum bag, and vacuumize it.



Place the vacuum-packed plastic reel into a pizza box.

Place the 4 packaged pizza boxes into 1 carton and seal it. 1 carton can pack 1000 modules.

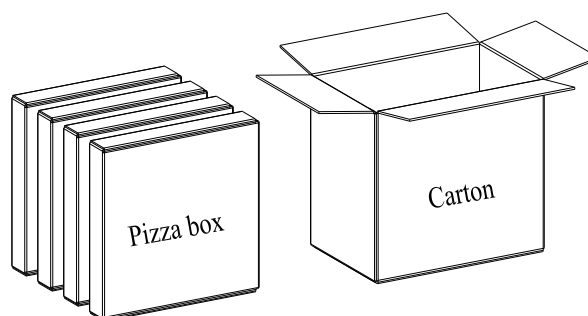


Figure 46: Packaging Process

8 Appendix References

Table 49: Related Documents

Document Name
[1] Quectel_EC200U&EG800G&EG91xU&EG915G_Series_Dual_SIM_Application_Note
[2] Quectel_EC200U_Series&EG912U-GL_GNSS_Application_Note
[3] Quectel_UMTS<E_EVB_User_Guide
[4] Quectel_EC200U&EG800G&EG91xU&EG915G_Series_AT_Commands_Manual
[5] Quectel_EC200U&EG800G&EG91xU&EG915G_Series_Low_Power_Mode_Application_Note
[6] Quectel_RF_Layout_Application_Note
[7] Quectel_Module_Stencil_Design_Requirements
[8] Quectel_Module_SMT_User_Guide

Table 50: Terms and Abbreviations

Abbreviation	Description
ADC	Analog-to-Digital Converter
AMR	Adaptive Multi-Rate
bps	Bits Per Second
CHAP	Challenge Handshake Authentication Protocol
C _j	Junction Capacitance
CMUX	Connection Multiplexing
CS	Coding Scheme
CTS	Clear to Send

DFOTA	Delta Firmware Upgrade Over-The-Air
DL	Downlink
DMA	Direct Memory Access
DSSS	Dual SIM Single Standby
DSDS	Dual SIM Dual Standby
DTR	Data Terminal Ready
EFR	Enhanced Full Rate
EGSM	Enhanced GSM
EMI	Electromagnetic Interference
ESD	Electrostatic Discharge
ESR	Equivalent Series Resistance
EVB	Evaluation Board
FDD	Frequency Division Duplex
FR	Full Rate
FTP	File Transfer Protocol
FTPS	FTP-over-SSL
GND	Ground
GSM	Global System for Mobile Communications
HR	Half Rate
HTTP	Hypertext Transfer Protocol
HTTPS	Hypertext Transfer Protocol Secure
LED	Light Emitting Diode
LTE	Long Term Evolution
MCU	Microcontroller Unit/Microprogrammed Control Unit
ME	Mobile Equipment

MMS	Multimedia Messaging Service
MQTT	Message Queuing Telemetry Transport
MSL	Moisture Sensitivity Level
NITZ	Network Identity and Time Zone
NTP	Network Time Protocol
PAP	Password Authentication Protocol
PCB	Printed Circuit Board
PDU	Protocol Data Unit
PF	Paging Frame
PMIC	Power Management Integrated Circuit
PPP	Point-to-Point Protocol
RF	Radio Frequency
RGB	Red, Green, Blue
SM	Smart Media
SMS	Short Message Service
SMTP	Simple Mail Transfer Protocol
SSL	Secure Sockets Layer
TCP	Transmission Control Protocol
TDD	Time Division Duplexing
UART	Universal Asynchronous Receiver & Transmitter
UDP	User Datagram Protocol
UL	Uplink
UMTS	Universal Mobile Telecommunications System
URC	Unsolicited Result Code
(U)SIM	(Universal) Subscriber Identity Module

V _{max}	Maximum Voltage Value
V _{nom}	Nominal Voltage Value
V _{min}	Minimum Voltage Value
V _{IHmax}	Maximum High-level Input Voltage
V _{IHmin}	Minimum High-level Input Voltage
V _{ILmax}	Maximum Low-level Input Voltage
V _{ILmin}	Minimum Low-level Input Voltage
V _{OHmax}	Maximum High-level Output Voltage
V _{OHmin}	Minimum High-level Output Voltage
V _{OLmax}	Maximum Low-level Output Voltage
V _{OLmin}	Minimum Low-level Output Voltage
VSWR	Voltage Standing Wave Ratio
WCDMA	Wideband Code Division Multiple Access
WLAN	Wireless Local Area Network

9 Waring

9.1. Important Notice to OEM integrators

1. This module is limited to OEM installation ONLY.
2. This module is limited to installation in fixed applications, according to Part 2.1091(b).
3. The separate approval is required for all other operating configurations, including portable configurations with respect to Part 2.1093 and different antenna configurations
4. For FCC Part 15.31 (h) and (k): The host manufacturer is responsible for additional testing to verify compliance as a composite system. When testing the host device for compliance with Part 15 Subpart B, the host manufacturer is required to show compliance with Part 15 Subpart B while the transmitter module(s) are installed and operating. The modules should be transmitting and the evaluation should confirm that the module's intentional emissions are compliant (i.e. fundamental and out of band emissions).

The host manufacturer must verify that there are no additional unintentional emissions other than what is permitted in Part 15 Subpart B or emissions are complaint with the transmitter(s) rule(s).

The Grantee will provide guidance to the host manufacturer for Part 15 B requirements if needed.

Important Note

notice that any deviation(s) from the defined parameters of the antenna trace, as described by the

instructions, require that the host product manufacturer must notify to Manufacturer of the product. that they wish to change the antenna trace design. In this case, a Class II permissive change application is required to be filed by the USI, or the host manufacturer can take responsibility through the change in FCC ID (new application) procedure followed by a Class II permissive change application.

End Product Labeling

When the module is installed in the host device, the FCC ID label must be visible through a window on the final device or it must be visible when an access panel, door or cover is easily re-moved. If not, a second label must be placed on the outside of the final device that contains the following text:

XMR202205EC200UAU

The FCC ID can be used only when all FCC compliance requirements are met.

Antenna Installation

- (1) The antenna must be installed such that 20 cm is maintained between the antenna and users,
- (2) The transmitter module may not be co-located with any other transmitter or antenna.
- (3) Only antennas of the same type and with equal or less gains as shown below may be used with this module. Other types of antennas and/or higher gain antennas may require additional authorization for operation.
- (4) The antenna type is an external dipole antenna, The antenna gain is as follows:

Band	Ant (dBi)
GSM 850	2.53
PCS 1900	1.59
LTE Band 2	1.59
LTE Band 4	2.00
LTE Band 5	2.53
LTE Band 7	3.00
LTE Band 38	2.30
LTE Band 41	3.00
LTE Band 66	2.00
Bluetooth	0.5

In the event that these conditions cannot be met (for example certain laptop configurations or co-location with another transmitter), then the FCC authorization is no longer considered valid and the FCC ID cannot be used on the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC authorization.

Manual Information to the End User

The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user's manual of the end product which integrates this module. The end user manual shall include all required regulatory information/warning as show in this manual.

9.2. FCC Statement

Federal Communication Commission Interference Statement

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide

reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur

in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

This device is intended only for OEM integrators under the following conditions: (For module device use)

- 1) The antenna must be installed such that 20 cm is maintained between the antenna and users, and
 - 2) The transmitter module may not be co-located with any other transmitter or antenna.
- As long as 2 conditions above are met, further transmitter test will not be required. However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed.

Radiation Exposure Statement

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20 cm between the radiator & your body.