

FCM740D Hardware Design

Wi-Fi&Bluetooth Module Series

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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 to reduce the risk of an accident. Using a mobile phone 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 phones 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
-	2023-10-09	Lisa LI	Creation of the document

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1 Introduction

QuecOpen® is a solution where the module acts as the main processor. Constant transition and evolution of both the communication technology and the market highlight its merits. It can help you to:

- Realize embedded applications' quick development and shorten product R&D cycle
- Simplify circuit and hardware structure design to reduce engineering costs
- Miniaturize products
- Reduce product power consumption
- Apply OTA technology
- Enhance product competitiveness and price-performance ratio

This document defines FCM740D in QuecOpen® solution and describes its air interfaces and hardware interfaces, which are connected with your applications. The document provides a quickly insight into interface specifications, RF performance, electrical and mechanical details, as well as other related information of the module.

Hereby, Quectel Wireless Solutions Co., Ltd. declares that the radio equipment type FCM740D is in compliance with Directive 2014/53/EU.

The full text of the EU declaration of conformity is available at the following internet address:
<http://www.quectel.com/support/technical.htm>

Disposal of old electrical appliances



The European directive 2012/19/EU on Waste Electrical and Electronic Equipment (WEEE), requires that old household electrical appliances must not be disposed of in the normal unsorted municipal waste stream. Old appliances must be collected separately in order to optimize the recovery and recycling of the materials they contain, and reduce the impact on human health and the environment.

The crossed out “wheeled bin” symbol on the product reminds you of your obligation, that when you dispose of the appliance, it must be separately collected.

Consumers should contact their local authority or retailer for information concerning the correct disposal of their old appliance.

2 Product Overview

FCM740D is a high-performance MCU Wi-Fi 4 and Bluetooth module supporting IEEE 802.11b/g/n and Bluetooth 5.2 standards. The module provides PWM and multiple ADC interfaces for various applications.

FCM740D supports either SMT or wave-soldering technology with compact packaging. The general features of the module are as follow:

- 120 MHz and 32-bit MCU processor
- Built-in 256 KB RAM and 4 MB Flash
- Support for secondary development

Table 1: Basic Information

FLM240D	
Packaging type	DIP
Pin counts	21
Dimensions	(15.8 ±0.2) mm × (20.3 ±0.2) mm × (2.7 ±0.2) mm
Weight	About 0.85 g

2.1. Key Features

Table 2: Key Features

Basic Information	
Protocols and Standards	● Wi-Fi Protocols: IEEE 802.11b/g/n ● Bluetooth protocol: BLE 5.2 ● All hardware components are fully compliant with EU RoHS directive
Power Supply	VBAT Power Supply: ● 3.0–3.6 V ● Typ.: 3.3 V
Temperature Ranges	Operating temperature ¹ : -40 to +105 °C Storage temperature: -45 to +115 °C
EVB Kit	FLM240D-TE-B ²
Antenna/Antenna Interface	
Antenna/ Antenna Interface ³	● PCB antenna ● RF coaxial connector ● 50 Ω characteristic impedance
Application Interfaces ⁴	
Application Interfaces	UART、PWM、ADC、I2C、SPI

¹ Within the operating temperature range, the module's related performance meets IEEE and Bluetooth specifications.

² For more details about the EVB.

³ The module is provided with one of the two antenna/antenna interface designs. For more details, please contact Quectel Technical Support.

⁴ For more details about the interfaces, see *Chapter 3.3* and *Chapter 3.4*.

3 Application Interfaces

3.1. Pin Assignment

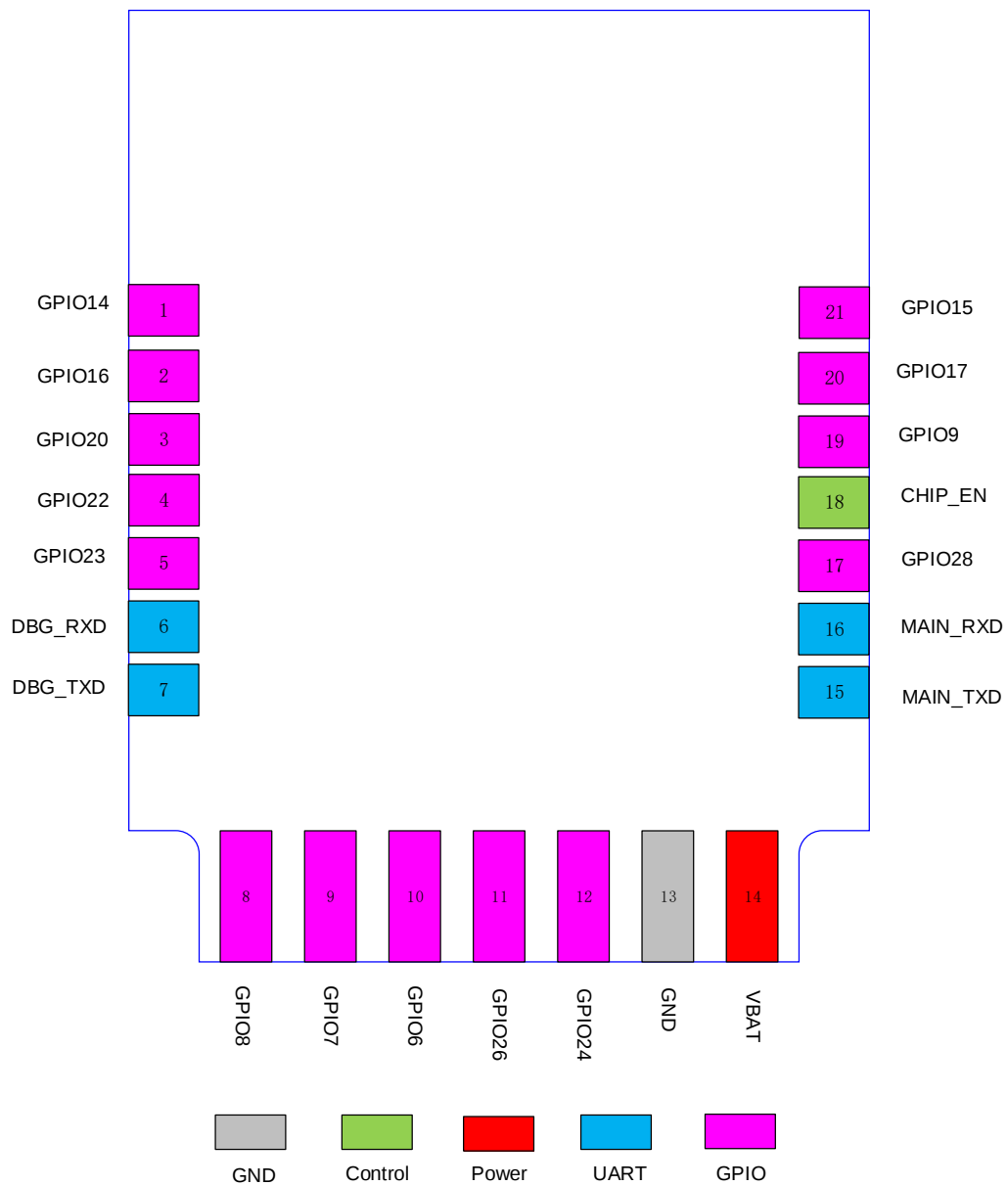


Figure 1: Pin Assignment (Top View)

NOTE

1. The module provides 14 GPIO interfaces by default. In the case of multiplexing, it can support PWM、UART、I2C and ADC interfaces.
2. The GND pin should be connected to ground.

3.2. Pin Description

Table 3: Parameter Description

Parameter	Description
DI	Digital Input
DO	Digital Output
DIO	Digital Input/Output
PI	Power Input

DC characteristics include power domain and rated current.

Table 4: Pin Description

Power Supply					
Pin Name	Pin No.	I/O	Description	DC Characteristics	Comment
VBAT	14	PI	Power supply for the module	Vmax = 3.6 V Vmin = 3.0 V Vnom = 3.3 V	It must be provided with sufficient current of at least 0.3 A.
GND	13				

Control Signals					
Pin Name	Pin No.	I/O	Description	DC Characteristics	Comment
CEN	18	DI	Reset the module	VBAT	Hardware reset; Internally pulled up to 3.3 V; Active low.

Main UART					
-----------	--	--	--	--	--

Pin Name	Pin No.	I/O	Description	DC Characteristics	Comment
MAIN_TXD	15	DO	Main UART transmit	VBAT	
MAIN_RXD	16	DI	Main UART receive		
Debug UART					
Pin Name	Pin No.	I/O	Description	DC Characteristics	Comment
DBG_TXD	7	DO	Debug UART transmit	VBAT	Test points must be reserved.
DBG_RXD	6	DI	Debug UART receive		
GPIO Interfaces					
Pin Name	Pin No.	I/O	Description	DC Characteristics	Comment
GPIO14	1	DIO	General-purpose input/output	VBAT	Interrupt wakeup.
GPIO16	2	DIO			
GPIO20	3	DIO			
GPIO22	4	DIO			
GPIO23	5	DIO			
GPIO8	8	DIO			
GPIO7	9	DIO			
GPIO6	10	DIO			
GPIO26	11	DIO			
GPIO24	12	DIO			
GPIO28	17	DIO			
GPIO9	19	DIO			
GPIO17	20	DIO			
GPIO15	21	DIO			

3.3. GPIO Multiplexing

The module provides 10 GPIO interfaces by default, and can support up to 14 GPIO interfaces in the case of multiplexing. Pins are defined as follows:

Table 5: GPIO Multiplexing

Pin Name (Default Function)	Pin No.	Alternate Function 0 (GPIO No.)	Alternate Function 1	Alternate Function 2	Alternate Function 3	Alternate Function 4	Description
GPIO23	4	GPIO23	ADC3	TDO	SPI_MISO	-	TDO: JTAG test data output.
GPIO14	6	GPIO14	SDIO_CLK	SPI_CLK	ANT0	-	
GPIO26	7	GPIO26	ADC1	IRDA	PWM5	-	IRDA: IrDA input.
GPIO24	8	GPIO24	ADC2	LPO_CLK	PWM4	-	LPO_CLK: low-power 32.768 kHz clock output.
GPIO6	9	GPIO6	13M_CLK_OUT	PWM0	-	-	13M_CLK_OUT: 13 MHz clock output.
GPIO22	12	GPIO22	ADC5	26M_CLK_OUT	TDI	TXEN	26M_CLK_OUT: 26 MHz clock output. TDI: JTAG test data input.
GPIO20	14	GPIO20	I2C1_SCL	TCK			TCK: JTAG test clock.
GPIO16	15	GPIO16	SDIO_CMD	SPI_MOSI	ANT2	-	
GPIO9	18	GPIO9	BT_PRIORITY	PWM3	-	-	BT_PRIORITY: Prioritize the use of Bluetooth function

							when Bluetooth and Wi-Fi functions coexist.
GPIO21	20	GPIO21	ADC6	I2C1_SDA	TMS	SPI_CS	TMS: JTAG test mode select.
GPIO8	21	GPIO8	BT_ACTIVE	PWM2	-	-	BT_ACTIVE: Enable Bluetooth function when Bluetooth and Wi-Fi functions coexist.
GPIO7	22	GPIO7	WIFI_ACTIVE	PWM1	-	-	WIFI_ACTIVE: Enable Wi-Fi function when Bluetooth and Wi-Fi functions coexist.
DBG_RXD	16	GPIO1	I2C2_SDA	-	-	-	
DBG_TXD	19	GPIO0	I2C2_SCL	-	-	-	
MAIN_RXD	23	GPIO10	DL_RX	-	-	-	DL_RX: receive when flash is in download mode.
MAIN_TXD	24	GPIO11	DL_TX	-	-	-	DL_TX: transmit when flash is in download mode.

NOTE

All the GPIO pins of the modules support interrupting wakeup.

3.4. Application Interfaces

3.4.1. UART Interfaces

The module supports two UART interfaces by default: the main UART and the debug UART.

Table 6: Pin Definition of UART Interfaces

Pin Name	Pin No.	I/O	Description	Comment
MAIN_TXD	15	DO	Main UART transmit	
MAIN_RXD	16	DI	Main UART receive	
DBG_TXD	7	DO	Debug UART transmit	Test points must be reserved.
DBG_RXD	6	DI	Debug UART receive	

The main UART can be used for data transmission. The default baud rate is 115200 bps, and the maximum baud rate can reach 6 Mbps. The main UART is also available for firmware upgrade, in which case it supports a default baud rate of 921600 bps.

The main UART connection between the module and the MCU is illustrated below.

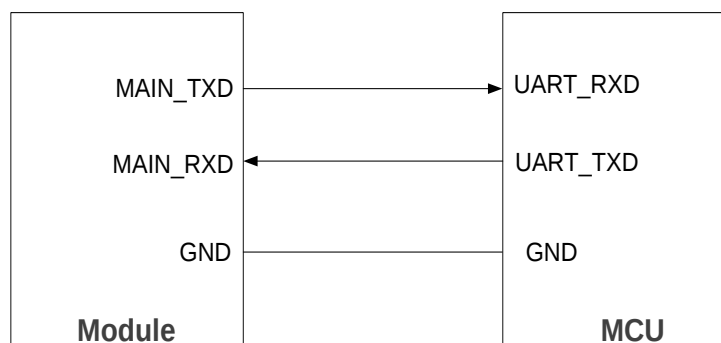


Figure 2: Main UART Connection

The debug UART supports 921600 bps baud rate by default, and is used for outputting partial logs with debugging tools. DBG_TXD and DBG_RXD are not recommended to be used as download ports.

The following is a reference design of debug UART.

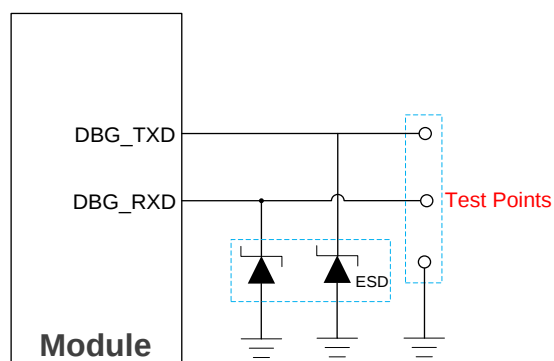


Figure 3: Debug UART Reference Design

3.4.2. PWM Interfaces

In the case of multiplexing, the module supports maximum 6 PWM channels. Pin description of PWM interfaces are as follows.

Table 7: Pin Definition of PWM Interfaces

Pin Name	Pin No.	Multiplexing Function	I/O	Description
GPIO6	10	PWM0	DO	PWM0 out
GPIO7	9	PWM1	DO	PWM1 out
GPIO8	8	PWM2	DO	PWM2 out
GPIO9	19	PWM3	DO	PWM3 out
GPIO24	12	PWM4	DO	PWM4 out
GPIO26	11	PWM5	DO	PWM5 out

3.4.3.ADC Interfaces

In the case of multiplexing, the module supports maximum 5 ADC interfaces, and the voltage range is 0–2.4 V. To improve ADC accuracy, surround ADC trace with ground.

Table 8: Pin Definition of ADC Interfaces

Pin Name	Pin No.	Multiplexing Function	I/O	Description
GPIO26	11	ADC1	AI	General-purpose ADC interface
GPIO24	12	ADC2	AI	General-purpose ADC interface
GPIO23	5	ADC3	AI	General-purpose ADC interface
GPIO28	17	ADC4	AI	General-purpose ADC interface
GPIO22	4	ADC5	AI	General-purpose ADC interface

Table 9: ADC Features

Parameter	Min.	Typ.	Max.	Unit
ADC Voltage Range	0	-	2.4	V
ADC Resolution Rate	-	13	-	bit

3.4.4.I2C Interface

In the case of multiplexing, the module provides one I2C interfaces that support master mode and slave mode. The interface supports up to 400 kHz clock with 7-bit and 10-bit addressing. If the low level on SCL or bus idle duration is greater than a programmable threshold, the module will generate an interrupt to the MCU.

Table 10: Pin Definition of I2C Interface

Pin name	Pin NO.	Alternate Function	I/O	Description
DBG_RXD	6	I2C2_SDA	OD	I2C2 Serial data
DBG_TXD	7	I2C2_SCL	OD	I2C2 Serial clock

3.4.5. SPI

In the case of multiplexing, the module provides an SPI that supports both master and slave modes. The maximum clock frequency of the interface can reach 25 MHz, and the received data can be latched on either rising edge or falling edge of clock signal. The transmitting data can be set by MSB or LSB first.

Table 11: Pin Definition of SPI

Pin name	Pin NO.	Alternate Function	I/O	Description	Comment
GPIO17	20	SPI_MISO	DIO	SPI master-in slave-out	
GPIO14	1	SPI_CLK	DIO	SPI clock	In master mode, it is an output signal; in slave mode, it is an input signal.
GPIO16	2	SPI_MOSI	DIO	SPI master-out slave-in	
GPIO15	21	SPI_CSN	DIO	SPI chip select	In master mode, it is an input signal; in slave mode, it is an output signal.

The following figure shows the connection between the host and the slave:

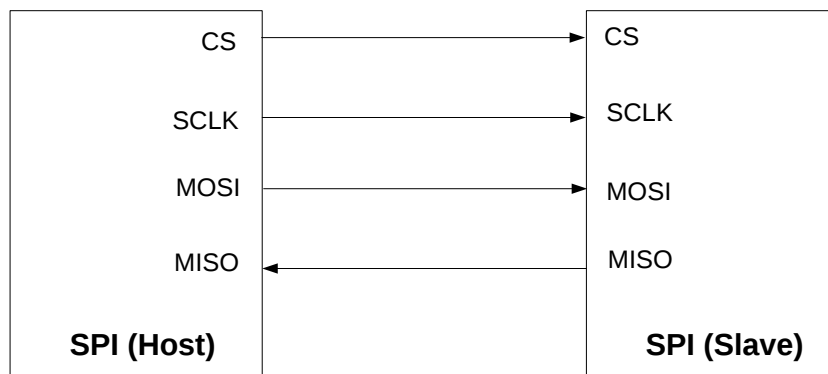


Figure 4: SPI Connection

4 Operating Characteristics

4.1. Power Supply

Power supply and ground pins of the module are defined in the following table.

Table 12: Pin Definition of Power Supply and GND Pins

Pin Name	Pin No.	I/O	Description	Min.	Typ.	Max.	Unit
VBAT	14	PI	Power supply for the module	3.0	3.3	3.6	V
GND	13						

4.1.1. Reference Design for Power Supply

The module is powered by VBAT, and it is recommended to use a power supply chip that can provide sufficient current of at least 0.3 A. For better power supply performance, it is recommended to parallel a 22 μ F decoupling capacitor, and two filter capacitors (1 μ F and 100 nF) near the module's VBAT pin. C4 is reserved for debugging and not mounted by default. In addition, it is recommended to add a TVS near the VBAT to improve the surge voltage bearing capacity of the module. In principle, the longer the VBAT trace is, the wider it should be.

VBAT reference circuit is shown below:

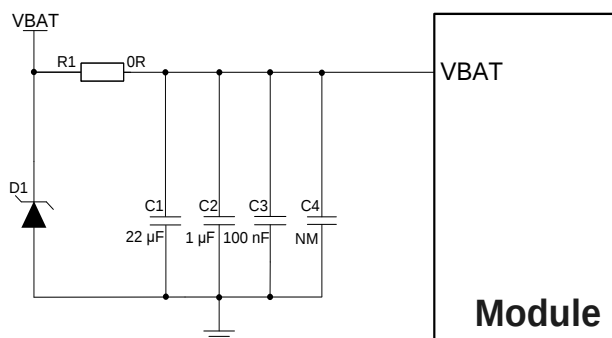


Figure 5: VBAT Reference Circuit

4.2. Turn On

After the module VBAT is powered on, keep the CHIP_EN at high level to realize the automatic startup of the module.

Table 13: Test Point Definition of CHIP_EN

Pin Name	Pin No.	I/O	Description	Comment
CHIP_EN	18	DI	Enable the module	Hardware enable. Internally pulled up to VBAT. Active high.

The turn-on timing is shown below:

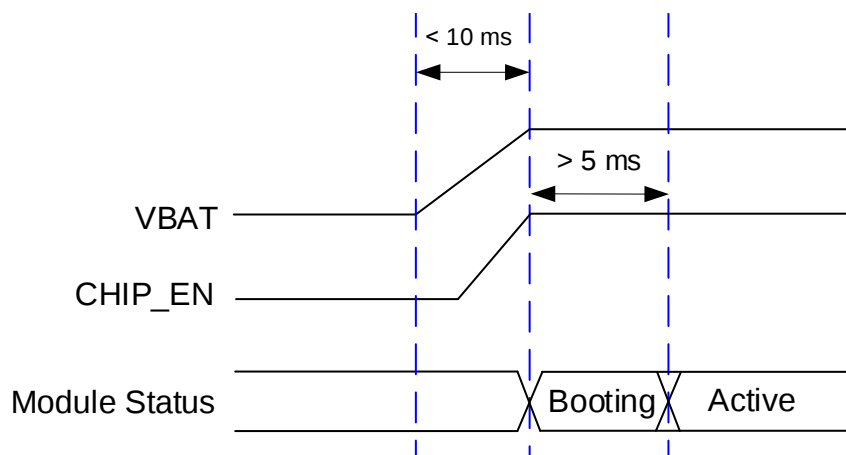


Figure 6: Turn-on Timing

4.3. Reset

Drive CHIP_EN low for at least 100 ms and then release it to reset the module.

Table 14: Pin Definition of CHIP_EN

Pin Name	Pin No.	I/O	Description	Comment
CHIP_EN	10	DI	Reset the module	Hardware reset. Internally pulled up to 3.3 V. Active low.

The reference design for resetting the module is shown below. An open collector driving circuit can be used to control the CHIP_EN pin.

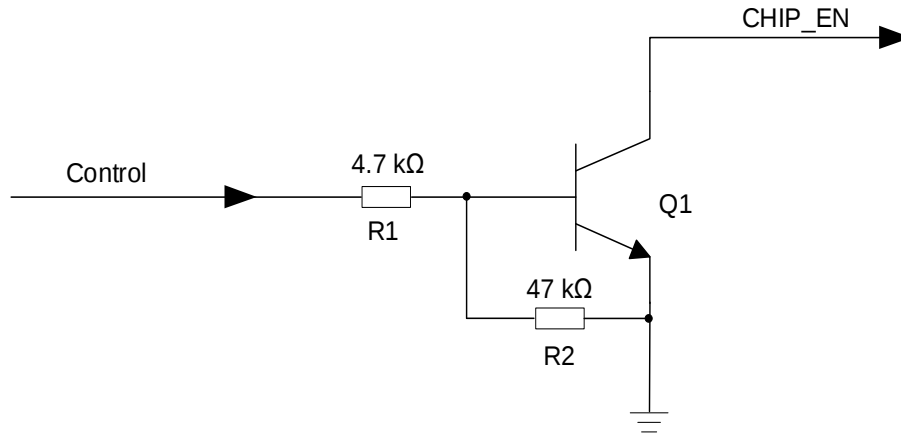


Figure 7: Reference Circuit of CHIP_EN by A Using Driving Circuit

Another way to control the CHIP_EN is by using a button directly. When pressing the button, an electrostatic strike may generate from finger. Therefore, a TVS component shall be placed near the button for ESD protection.

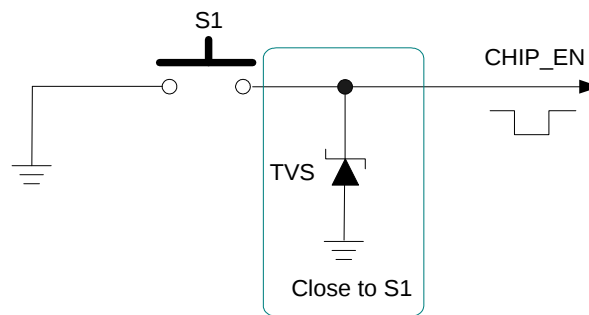


Figure 8: Reference Circuit of CHIP_EN with A Button

The module reset timing is illustrated in the following figure.

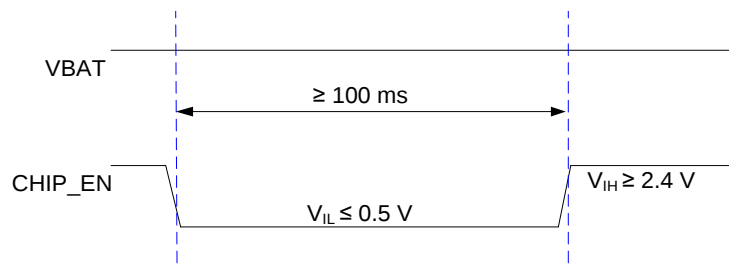


Figure 9: Reset Timing

4.4. Download Mode

Keep the input signal of CHIP_EN at low level during resetting or power-up and the module will enter download mode. In the download mode, the firmware can be download through the main UART. During the hardware design, the CHIP_EN pin of the module is connected to the RTS of the serial port chip, or the CHIP_EN is controlled according to the following waveform, otherwise the download will fail.

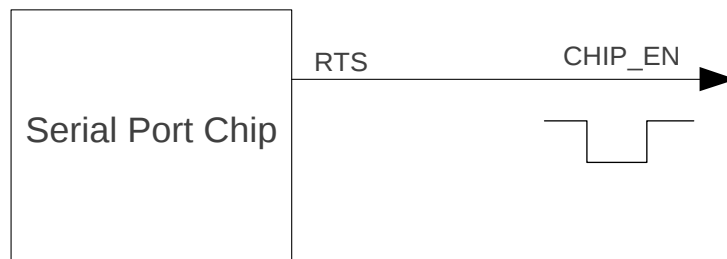


Figure 10: Reference Design for Download Mode

5 RF Performances

5.1. Wi-Fi Performances

Table 15: Wi-Fi Performances

Operating Frequency			
2.4 GHz: 2.400–2.4835 GHz			
Modulation			
BPSK, QPSK, CCK, 16QAM, 64QAM			
Operating Mode			
- AP - STA - AP + STA			
Encryption Mode			
WPA-PSK, WPA2-PSK, WPA3-SAE			
Transmission Data Rate			
802.11b: 1 Mbps, 2 Mbps, 5.5 Mbps, 11 Mbps 802.11g: 6 Mbps, 9 Mbps, 12 Mbps, 18 Mbps, 24 Mbps, 36 Mbps, 48 Mbps, 54 Mbps 802.11n: HT20 (MCS 0–MCS 7)			
Condition (VBAT = 3.3 V; Temp.: 25 °C)		Typ.; Unit: dBm; Tolerance: ±2 dB	
		Transmitting Power	Receiver Sensitivity
2.4 GHz	802.11b @ 1 Mbps	16	TBD
	802.11b @ 11 Mbps	16	TBD
	802.11g @ 6 Mbps	15	TBD
	802.11g @ 54 Mbps	14	TBD

802.11n, HT20 @ MCS 0	≤ -5 dB	14	TBD
802.11n, HT20 @ MCS 7	≤ -27 dB	13	TBD

5.2. Bluetooth Performances

Table 16: Bluetooth Performances

Operating Frequency		
2.400–2.4835 GHz		
Modulation		
GFSK		
Operating Mode		
BLE		
Condition (VBAT = 3.3 V; Temp.: 25 °C)	Typ.; Unit: dBm; Tolerance: ± 2 dB	
	Transmitting Power	Receiver Sensitivity
BLE (1 Mbps)	6	TBD

5.3. Antenna/Antenna Interface

The module is provided with one of the two antenna/antenna interface designs: PCB antenna or RF coaxial connector. The RF coaxial connector is not available when the module is designed with a PCB antenna.

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.

5.3.1. PCB Antenna ⁵

Table 17: PCB Antenna Specifications

Parameter	Requirement
Frequency Range (GHz)	2.400–2.500
Input Impedance (Ω)	50
VSWR	≤ 3
Gain (dBi)	0 (最大值)
Efficiency	38 %

When designed with PCB antenna, the module should be placed on the edge of the motherboard. The PCB antenna should be at least 16 mm away from the metal components, connectors, vias, traces, and copper pour area on the motherboard. On the motherboard, all PCB layers under the PCB antenna should be designed as a keep-out area.

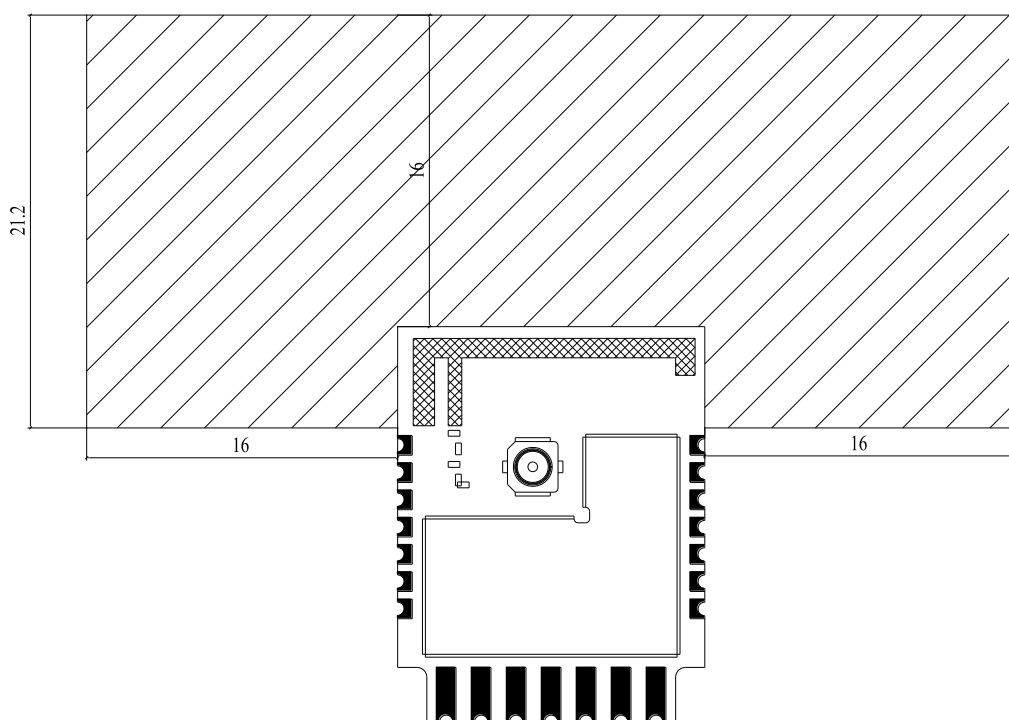


Figure 11: Keep-out Area on Motherboard

During PCB design, do not route traces across the RF test point at the bottom of the module to ensure the module

⁵ The module is provided with one of the two antenna/antenna interface designs. For more details, please contact Quectel Technical Support.

performance.

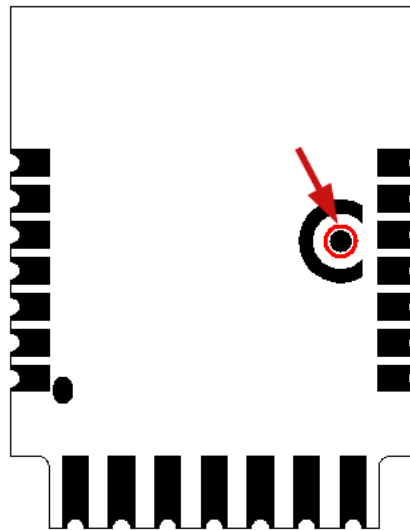


Figure 12: Prohibited Area for Routing

5.3.2. RF Coaxial Connector ⁶

5.3.2.1. Receptacle Specifications

The mechanical dimensions of the receptacle mounted on the module are as follows.

⁶ The module is provided with one of the two antenna/antenna interface designs. For more details, please contact Quectel Technical Support.

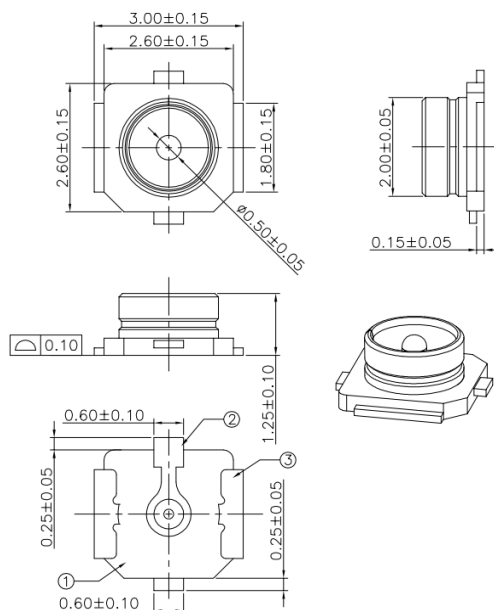


Figure 13: Dimensions of the Receptacle (Unit: mm)

Table 18: Major Specifications of the RF Connector (Receptacle)

Item	Specification
Nominal Frequency Range	DC to 6 GHz
Nominal Impedance	50 Ω
Temperature Rating	-40 °C to +105 °C
Voltage Standing Wave Ratio (VSWR)	Meet the requirements of: Max. 1.3 (DC–3 GHz) Max. 1.45 (3–6 GHz)

5.3.2.2. Antenna Connector Installation

The receptacle mounted on the module accepts two types of mated plugs that will meet a maximum height of 1.2 mm using a Ø 0.81 mm coaxial cable or a maximum height of 1.45 mm utilizing a Ø 1.13 mm coaxial cable.

The following figure shows the dimensions of mated plugs using Ø 0.81 mm coaxial cables.

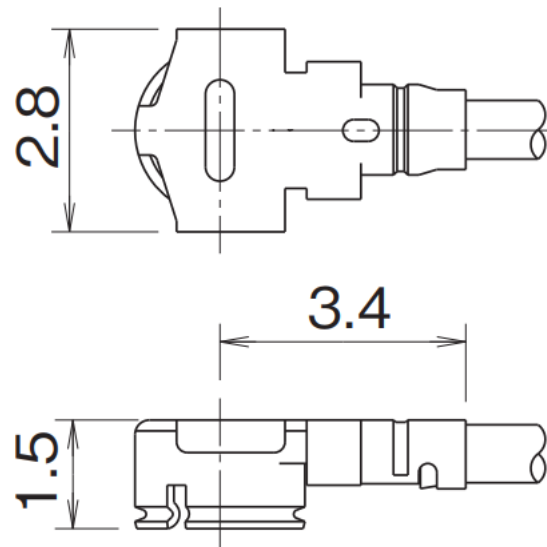


Figure 14: Dimensions of Mated Plugs (Ø 0.81 Coaxial Cables) (Unit: mm)

The following figure illustrates the connection between the receptacle on the module and the mated plug using a Ø 0.81 mm coaxial cable.

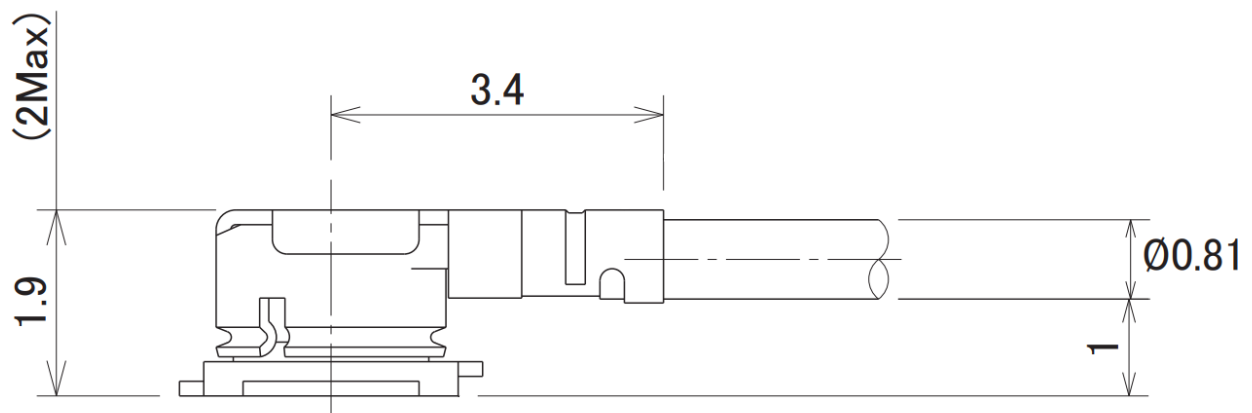


Figure 15: Space Factor of Mated Connectors (Ø 0.81 mm Coaxial Cables) (Unit: mm)

The following figure illustrates the connection between the receptacle mounted on the module and the mated plug using a Ø 1.13 mm coaxial cable.

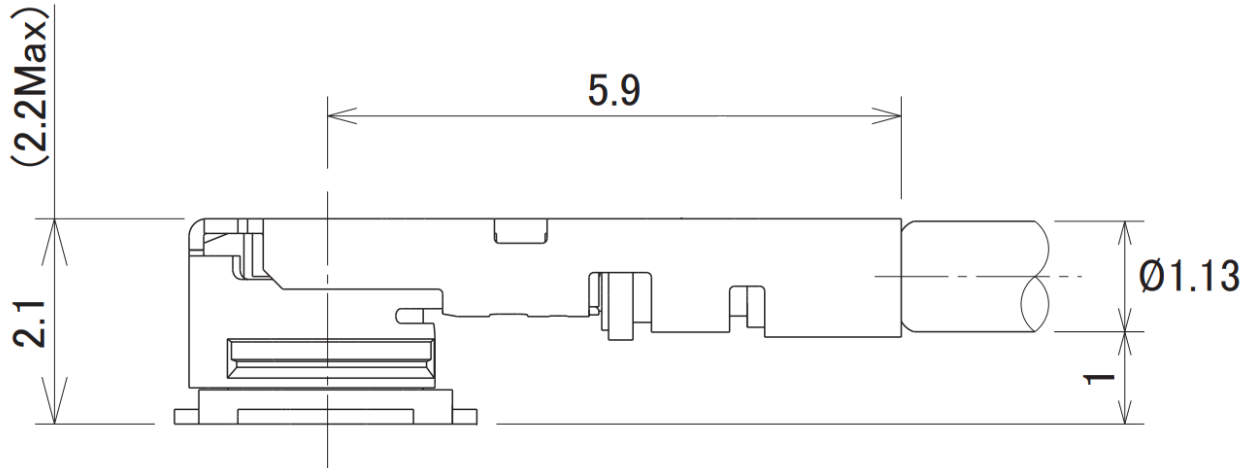


Figure 16: Space Factor of Mated Connectors (Ø 1.13 mm Coaxial Cables) (Unit: mm)

5.3.2.3. Assemble Coaxial Cable Plug Manually

The pictures for plugging in a coaxial cable plug is shown below, $\theta = 90^\circ$ is acceptable, while $\theta \neq 90^\circ$ is not.

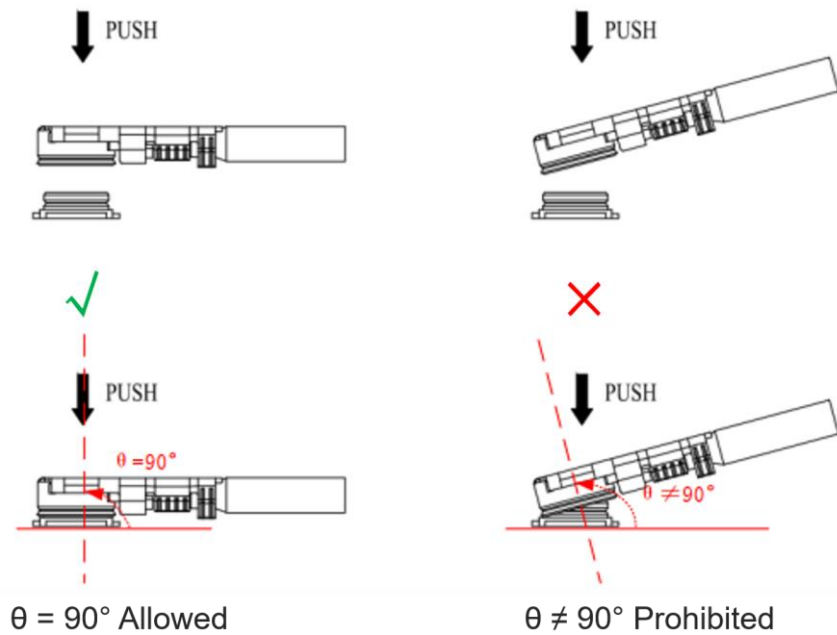


Figure 17: Plug in a Coaxial Cable Plug

The pictures of pulling out the coaxial cable plug is shown below, $\theta = 90^\circ$ is acceptable, while $\theta \neq 90^\circ$ is not.

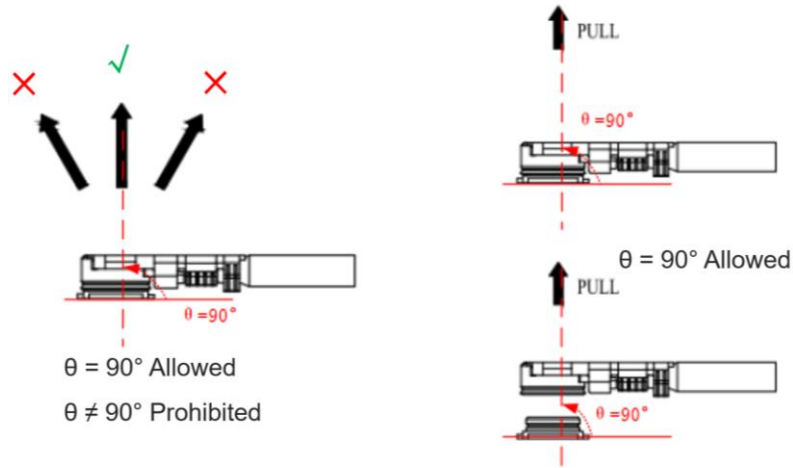


Figure 18: Pull out a Coaxial Cable Plug

5.3.2.4. Assemble Coaxial Cable Plug with Jig

The pictures of installing the coaxial cable plug with a jig is shown below, $\theta = 90^\circ$ is acceptable, while $\theta \neq 90^\circ$ is not.

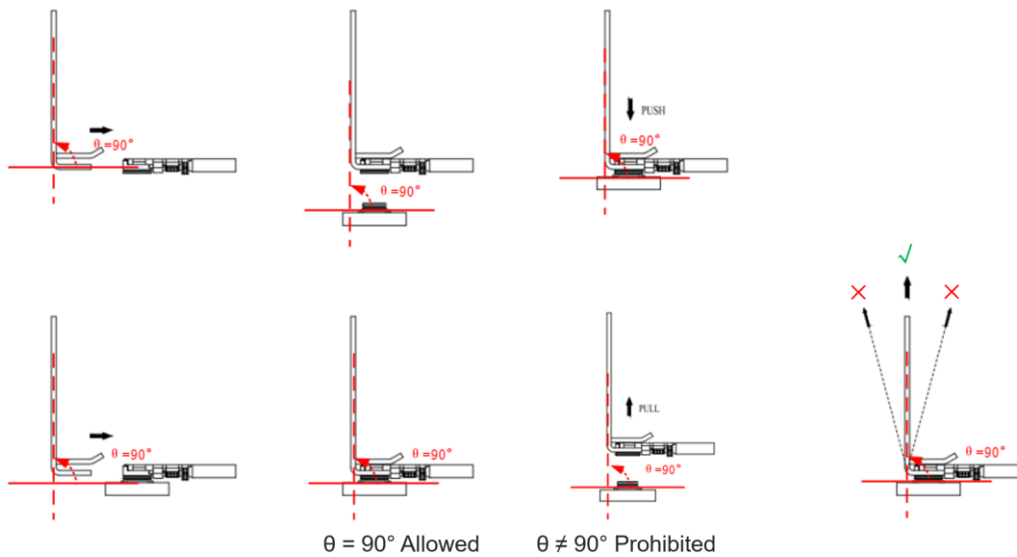


Figure 19: Install the Coaxial Cable Plug with Jig

5.3.2.5. Recommended Mated Plug and Cable Manufacturer

Mated plugs and cables by I-PEX are recommended. For more details, visit <https://www.i-pex.com>.

6 Electrical Characteristics & Reliability

6.1. Absolute Maximum Ratings

Table 19: Absolute Maximum Ratings (Unit: V)

Parameter	Min.	Max.
VBAT	-0.3	3.9
Voltage at Digital Pins	-0.3	3.9
Voltage at ADC1	0	2.4
Voltage at ADC2	0	2.4
Voltage at ADC3	0	2.4
Voltage at ADC4	0	2.4
Voltage at ADC5	0	2.4

6.2. Power Supply Ratings

Table 20: Module Power Supply Ratings (Unit: V)

Parameter	Description	Condition	Min.	Typ.	Max.
VBAT	Power supply for the module	The actual input voltages must be kept between the minimum and maximum values.	3.0	3.3	3.6

6.3. Wi-Fi Power Consumption

Table 21: Power Consumption in RF Non-signaling Mode (Unit: mA)

Condition (VBAT = 3.3 V; Temp.: 25 °C; Duty Cycle: 99 %)			I _{VBAT} (Typ.)
2.4 GHz	802.11b	Tx 1 Mbps @ 16 dBm	TBD
		Tx 11 Mbps @ 16 dBm	TBD
	802.11g	Tx 6 Mbps @ 15 dBm	TBD
		Tx 54 Mbps @ 14 dBm	TBD
	802.11n	Tx HT20 MCS 0 @ 14 dBm	TBD
		Tx HT20 MCS 7 @ 13 dBm	TBD

6.4. Digital I/O Characteristics

Table 22: VBAT I/O Characteristics (Unit: V)

Parameter	Description	Min.	Max.
V _{IH}	High-level input voltage	0.7 × VBAT	VBAT + 0.2
V _{IL}	Low-level input voltage	-0.3	0.3 × VBAT
V _{OH}	High-level output voltage	0.9 × VBAT	VBAT
V _{OL}	Low-level output voltage	0	0.1 × VBAT

6.5. ESD Protection

Static electricity occurs naturally and 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 23: ESD Characteristics (Unit: kV)

Model	Test Result	Standard
Human Body Model (HBM)	± 4	<i>ANSI/ESDA/JEDEC JS-001-2017</i>
Charged Device Model (CDM)	± 0.25	<i>ANSI/ESDA/JEDEC JS-002-2018</i>

7 Mechanical Information

This chapter describes the mechanical dimensions of the module. All dimensions are measured in millimeters (mm), and the dimensional tolerances are ± 0.2 mm unless otherwise specified.

7.1. Mechanical Dimensions

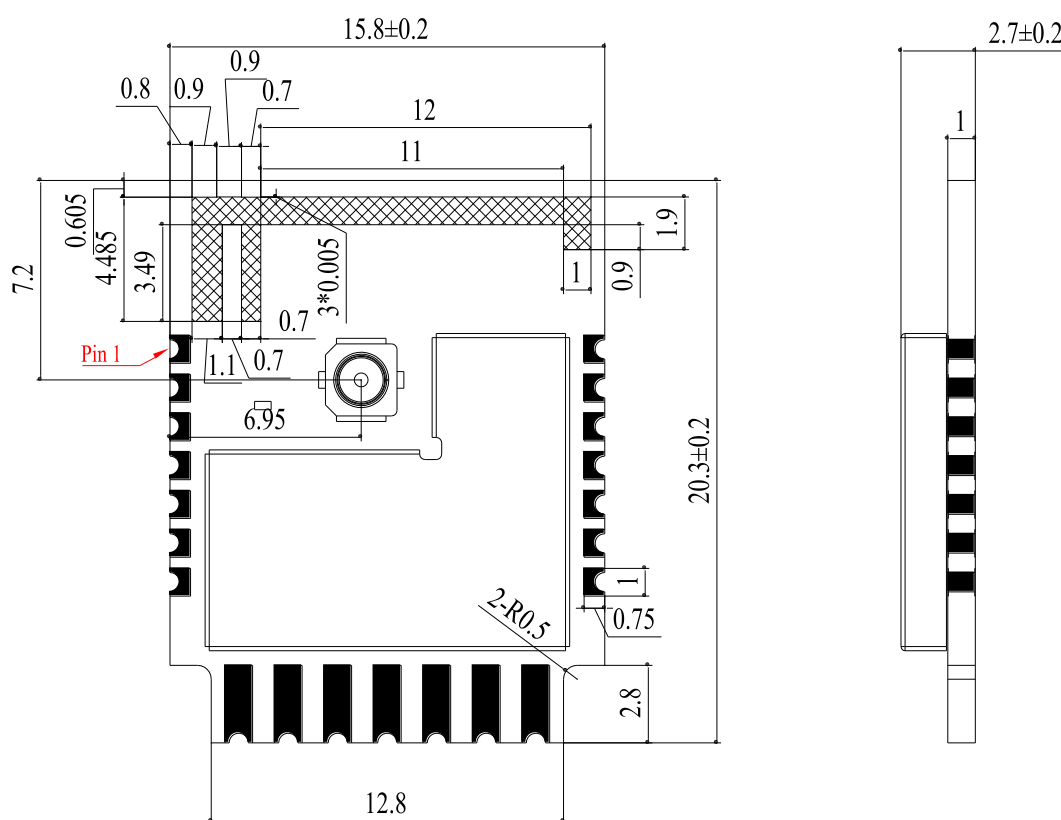


Figure 20: Top and Side Dimensions

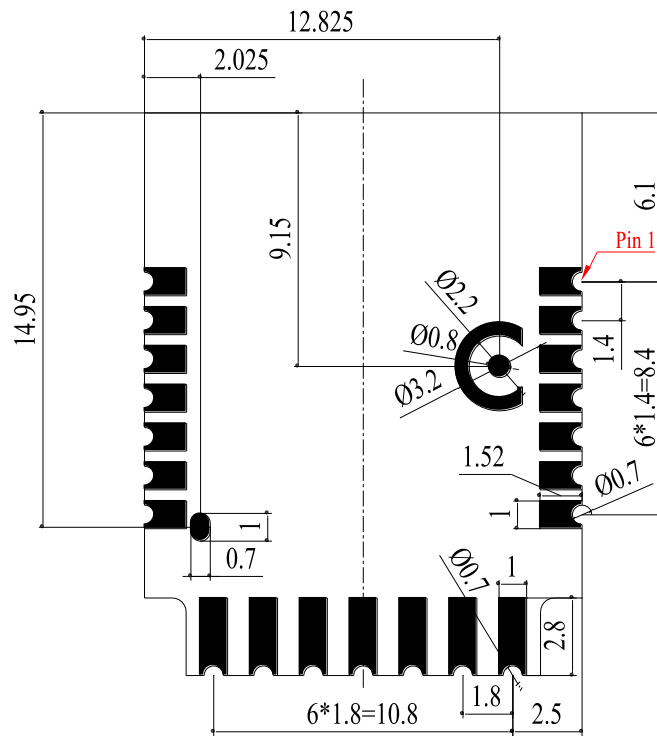
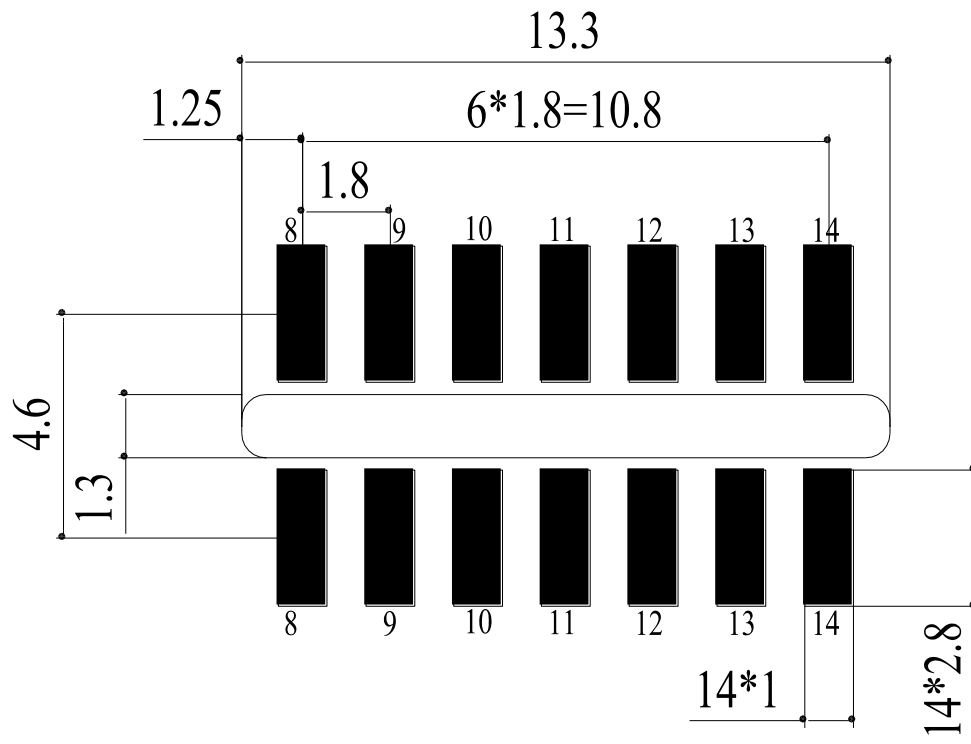


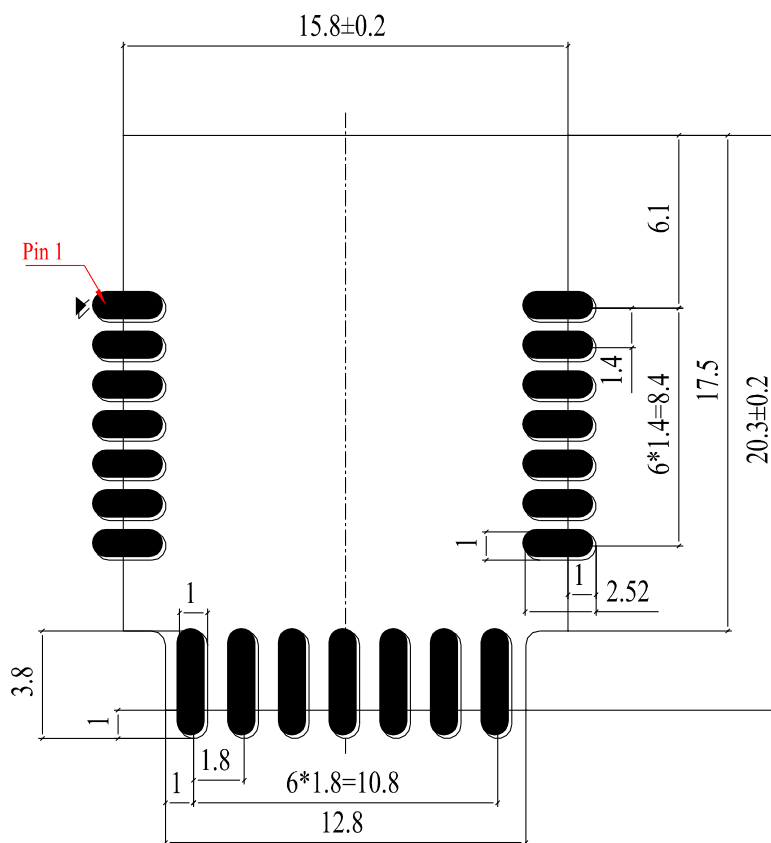
Figure 21: Bottom Dimensions (Bottom View)

NOTE

The package warpage level of the module refers to the JEITA ED-7306 standard.

7.2. Recommended Footprint





Unlabeled tolerance: +/-0.2mm

Figure 22: Recommended Footprint

NOTE

Keep at least 3 mm between the module and other components on the motherboard to improve soldering quality and maintenance convenience.

7.3. Top and Bottom Views



Figure 23: Top and Bottom Views (PCB Antenna)



Figure 24: Top and Bottom Views (RF Coaxial Connector)

NOTE

1. Images above are for illustrative purposes only and may differ from the actual module. For authentic appearance and label, please refer to the module received from Quectel.
2. The RF coaxial connector is not available when the module is designed with a PCB antenna.

8 Storage, Manufacturing & Packaging

8.1. 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 ⁷ 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 8 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.

NOTE

⁷ 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*. Do not unpack the modules in large quantities until they are ready for soldering.

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.

8.2. Manufacturing and Soldering

8.2.1. Reflow 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 0.15–0.18 mm. For more details, see **document** 错误! 未找到引用源。。

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.

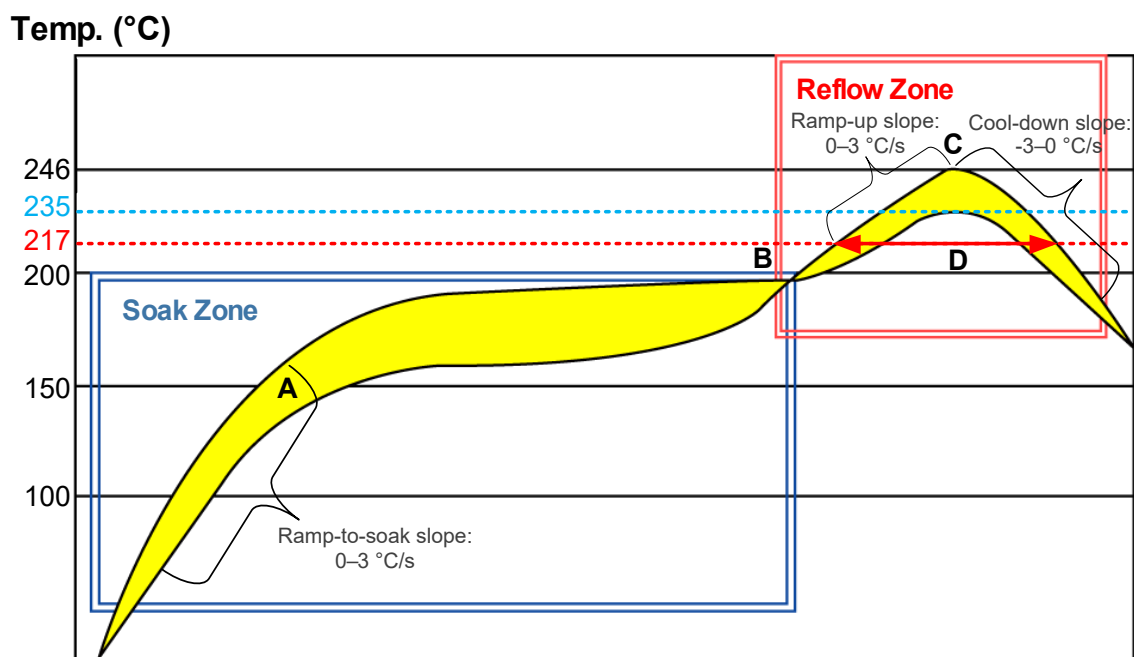


Figure 25: Recommended Reflow Soldering Thermal Profile

Table 24: 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

8.2.2. Wave Soldering

The recommended peak wave-soldering temperature should be 265 ± 5 °C, with 270 °C as the absolute maximum wave-soldering temperature. The recommended wave-soldering thermal profile (lead-free wave-soldering) and related parameters are shown below.

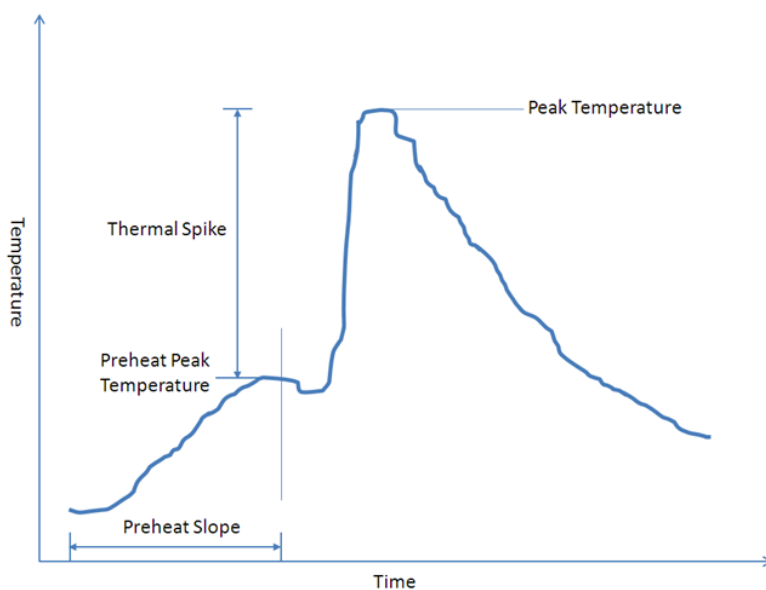


Figure 26: Recommended Lead-free Wave-soldering Thermal Profile

Table 25: Recommended Thermal Profile Parameters

Factor	Recommended Value (Typ.)
Preheat ramp-up slope	1–3 °C/s
Preheat peak temperature (Bottom)	95–145 s
Peak temperature (Bottom)	240–270 °C
Tin immersion time	2–6 s
Tin tab setting temperature	265 ±5 °C
Cool-down slope	< 8 °C/s
Tapping temperature	< 150 °C (T _g)
Chain speed	0.8–1.2 m/min
Orbital elevation	4–6 °

8.2.3.Manual Soldering

Table 26: Recommended Manual-soldering Parameters

Factor	Recommended Value
Soldering temperature	360 ±20 °C
Soldering time	< 3 s/solder joint

NOTE

1. The above profile parameter requirements are for the measured temperature of 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, etc. 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. 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*.
7. If use wave flowing, for better quality, keep the thermal profile, the amount of flux spraying and the tin slag and copper left over in tin tab in rational levels, and mind the rationality of the opening and the thickness of jigs during production.

8.3. Packaging Specifications

This chapter describes only the key parameters and process of packaging. All figures below are for reference only. The appearance and structure of the packaging materials are subject to the actual delivery.

8.3.1. Carrier Tape

Carrier tape dimensions are detailed below:

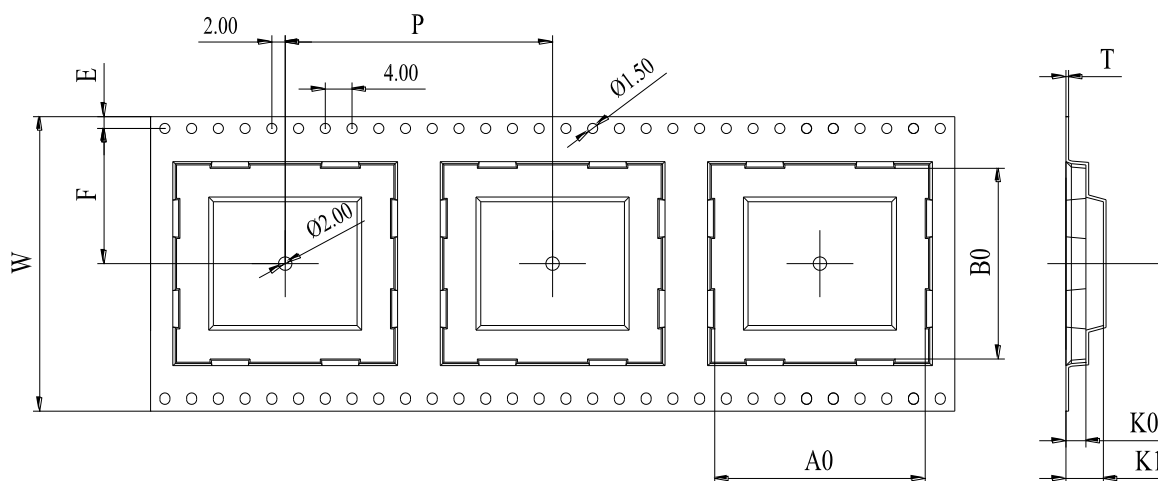


Figure 27: Carrier Tape Dimension Drawing

Table 27: Carrier Tape Dimension Table (Unit: mm)

W	P	T	A0	B0	K0	K1	F	E
---	---	---	----	----	----	----	---	---

32	24	0.4	17.7	15.4	3.3	4.6	14.2	1.75
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8.3.2. Plastic Reel

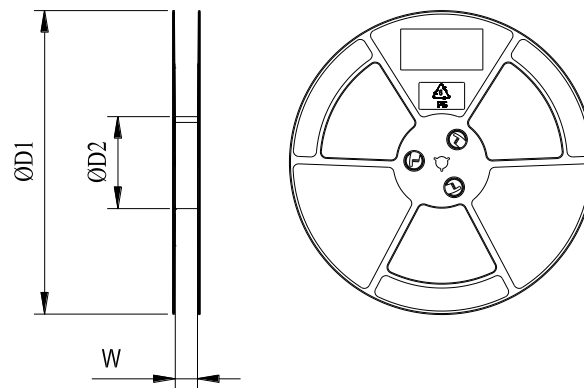


Figure 28: Plastic Reel Dimension Drawing

Table 28: Plastic Reel Dimension Table (Unit: mm)

ØD1	ØD2	W
330	100	32.5

8.3.3. Mounting Direction

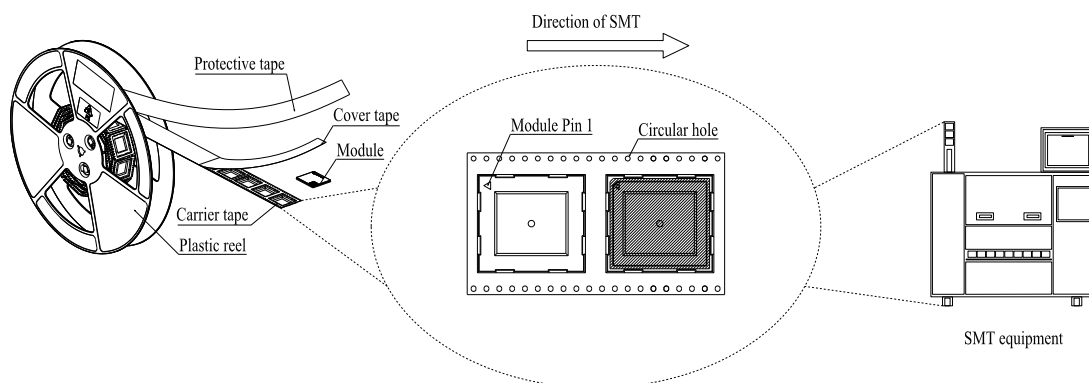
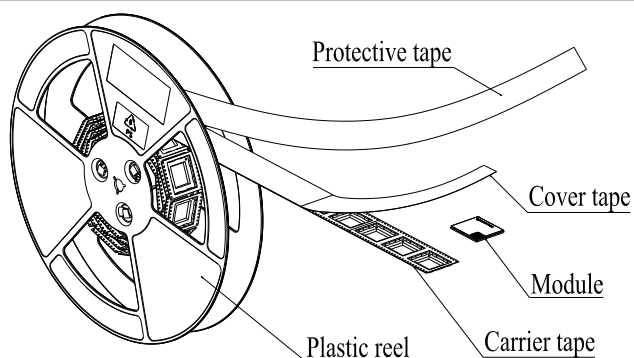


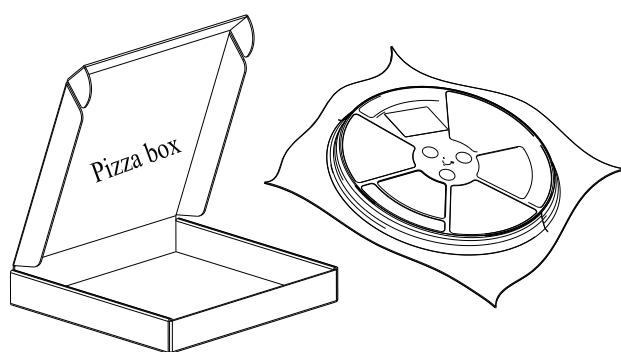
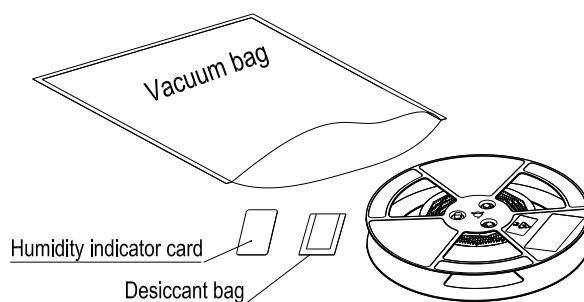
Figure 29: Mounting Direction

8.3.4. Packaging Process



Place the modules into the carrier tape and use the cover tape to cover them; then wind the heat-sealed carrier tape on the plastic reel and use the protective tape for protection. 1 plastic reel can load 500 modules.

Place the packaged plastic reel, 1 humidity indicator card and 1 desiccant bag into a vacuum bag, then vacuumize it.



Place the vacuum-packed plastic reel inside the pizza box.

Put 4 packaged pizza boxes into 1 carton box and seal it. 1 carton box can pack 2000 modules.

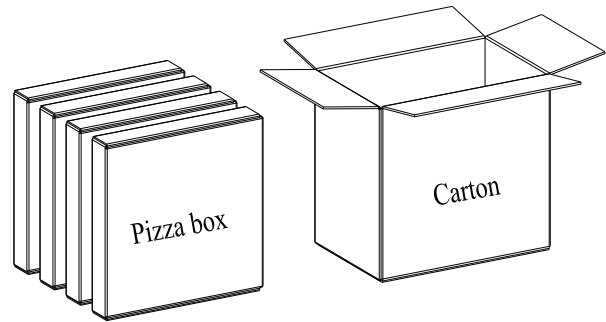


Figure 30: Packaging Process

9 Appendix References

Table 29: Reference Documents

Document Name
[1] Quectel_FCM740D_TE-B_User_Guide
[2] Quectel_Module_SMT_Application_Note

Table 30: Terms and Abbreviations

Abbreviation	Description
ADC	Analog-to-Digital Converter
AP	Access Point
BLE	Bluetooth Low Energy
BPSK	Binary Phase Shift Keying
CCK	Complementary Code Keying
CDM	Charged Device Model
DIP	Dual In-line Package
ESD	Electrostatic Discharge
EVM	Error Vector Magnitude
GFSK	Gauss Frequency Shift Keying
GND	Ground
GPIO	General-Purpose Input/Output
HBM	Human Body Model

HT	High Throughput
IEEE	Institute of Electrical and Electronics Engineers
I/O	Input / Output
Mbps	Megabits per second
MCS	Modulation and Coding Scheme
MCU	Microcontroller Unit
MSL	Moisture Sensitivity Level
OTA	Over-The-Air
PCB	Printed Circuit Board
PSK	Pre-Shared Key
PWM	Pulse Width Modulation
QAM	Quadrature Amplitude Modulation
QPSK	Quadrature Phase Shift Keying
RAM	Random Access Memory
RF	Radio Frequency
RoHS	Restriction of Hazardous Substances
SAE	Simultaneous Authentication of Equals
SMT	Surface Mount Technology
STA	Station
TVS	Transient Voltage Suppressor
Tx	Transmit
UART	Universal Asynchronous Receiver/Transmitter
(U)SIM	(Universal) Subscriber Identity Module
V _{IH}	High-level Input Voltage
V _{IL}	Low-level Input Voltage

V _{max}	Maximum Voltage
V _{min}	Minimum Voltage
V _{nom}	Nominal Voltage Value
V _{OH}	High-level Output Voltage
V _{OL}	Low-level Output Voltage
VSWR	Voltage Standing Wave Ratio
WPA	Wi-Fi Protected Access

FCC Statement

Warning: Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

NOTE: 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 or more 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

The device must not be co-located or operating in conjunction with any other antenna or transmitter. 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.

FCC Radiation Exposure Statement

This equipment should be installed and operated with minimum distance 20cm between the radiator and your body.

Does not comply with the use restrictions of the product:

Portable devices used close with human's body (within 20cm), Like Cell phone, Notebook etc.

Integration instructions for host product manufacturers according to KDB 996369 D03 OEM Manual v01

2.2 List of applicable FCC rules

FCC Part 15 Subpart C 15.247 & 15.209.

2.3 Specific operational use conditions

The module can be used for mobile applications with a maximum 0dBi antenna. The host manufacturer installing this module into their product must ensure that the final product complies with the FCC requirements by a technical assessment or evaluation to the FCC rules,

including the transmitter operation. The host manufacturer 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 shown in this manual.

2.4 Limited module procedures

Not applicable. The module is a Single module and complies with the requirement of FCC Part 15 212.

2.5 Trace antenna designs

Not applicable. The module has its own antenna, and doesn't need a host's printed board micro strip trace antenna etc.

2.6 RF exposure considerations

The module must be installed in the host equipment such that at least 20cm is maintained between the antenna and user's body; and if RF exposure statement or module layout is changed, then the host product manufacturer is required to take responsibility of the module through a change in FCC ID or new application. The FCC ID of the module cannot be used on the final product. In these circumstances, the host manufacturer will be responsible for reevaluating the end product (including the transmitter) and obtaining a separate FCC authorization.

2.7 Antennas

Antenna Specification are as follows:

Type: PCB Antenna

Gain: 0 dBi Max

This device is intended only for host manufacturers under the following conditions: The transmitter module may not be co-located with any other transmitter or antenna; The module shall be only used with the internal antenna(s) that has been originally tested and certified with this module. The antenna must be either permanently attached or employ a "unique" antenna coupler.

As long as the conditions above are met, further transmitter test will not be required. However, the host manufacturer is still responsible for testing their end-product for any additional compliance requirements required with this module installed (for example, digital device emissions, PC peripheral requirements, etc).

2.8 Label and compliance information

Host product manufacturers need to provide a physical or e-label stating "Contains FCC ID: XMR2023FCM740D" with their finished product.

2.9 Information on test modes and additional testing requirements

Host manufacturer must perform test of radiated & conducted emission and spurious emission, etc. according to the actual test modes for a stand-alone modular transmitter in a host, as well as for multiple simultaneously transmitting modules or other transmitters in a host product. Only when all the test results of test modes comply with FCC requirements, then the end product can be sold legally.

2.10 Additional testing, Part 15 Subpart B disclaimer

The modular transmitter is only FCC authorized for FCC Part 15 Subpart C 15.247 & 15.209 and that the host product manufacturer is responsible for compliance to any other FCC rules that apply to the host not covered by the modular transmitter grant of certification. If the grantee markets their product as being Part 15 Subpart B compliant (when it also contains unintentional-radiator digital circuitry), then the grantee shall provide a notice stating that the final host product still requires Part 15 Subpart B compliance testing with the modular transmitter installed.

Federal Communication Commission Statement (FCC, U S)

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

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.

FCC Caution:

Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

IMPORTANT NOTES**Co-location warning:**

This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

OEM integration instructions:

This device is intended only for OEM integrators under the following conditions:

The transmitter module may not be co-located with any other transmitter or antenna. The module shall be only used with the external antenna(s) that has been originally tested and certified with this module.

As long as the 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 (for example, digital device emissions, PC peripheral requirements, etc.).

Validity of using the module certification:

In the event that these conditions cannot be met (for example certain laptop configurations or co-location with another transmitter), then the FCC authorization for this module in combination with the host equipment is no longer considered valid and the FCC ID of the module 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.

End product labeling:

The final end product must be labeled in a visible area with the following: "Contains Transmitter Module **FCC ID: XMR2023FCM740D**"

Information that must be placed in the end user manual:

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 shown in this manual.

IC Statement

This device complies with Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

The device is compliance with RF field strength limits, users can obtain Canadian information on RF exposure and compliance.

IC Radiation Exposure Statement

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

Déclaration d' exposition aux radiations:

Cet équipement est conforme aux limites d' exposition aux rayonnements IC établies pour un environnement non contrôlé. Cet équipement doit être installé et utilisé avec un minimum de 20 cm de distance entre la source de rayonnement et votre corps.