AH20C

Hardware Design

Automotive 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 cellular terminal or mobile incorporating the module. Manufacturers of the cellular terminal shall 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 given to driving at all times in order to reduce the risk of an accident. Using a mobile while driving (even with a handsfree kit) causes distraction and can lead to an accident. Please comply with laws and regulations restricting the use of wireless devices while driving.

Switch off the cellular terminal or mobile before boarding an aircraft. The operation of wireless appliances in an aircraft is forbidden to prevent interference with communication systems. If there is an Airplane Mode, it shall be enabled prior to boarding an aircraft. Please consult the airline staff for more restrictions on the use of wireless devices on an aircraft.

Wireless devices may cause interference on sensitive medical equipment, so please be aware of the restrictions on the use of wireless devices when in hospitals, clinics or other healthcare facilities.

Cellular terminals or mobiles operating over radio signal and cellular network cannot be guaranteed to connect in certain conditions, such as when the mobile bill is unpaid or the (U)SIM card is invalid. When emergency help is needed in such conditions, use emergency call if the device supports it. In order to make or receive a call, the cellular terminal or mobile must be switched on in a service area with adequate cellular signal strength. In an emergency, the device with emergency call function cannot be used as the only contact method considering network connection cannot be guaranteed under all circumstances.

The cellular terminal or mobile contains a transceiver. When it is ON, it receives and transmits radio frequency signals. RF interference can occur if it is used close to TV sets, radios, computers or other electric equipment.

In locations with explosive or potentially explosive atmospheres, obey all posted signs and turn off wireless devices such as mobile phone or other cellular terminals. Areas with explosive or potentially explosive atmospheres include fuelling areas, below decks on boats, fuel or chemical transfer or storage facilities, and areas where the air contains chemicals or particles such as grain, dust or metal powders.

About the Document

Revision History

Version	Date	Author	Description
-	2022-01-21	Julian XIA	Creation of the document
1.0.0	2022-01-21	Julian XIA	Preliminary
1.0.1	2022-06-10	Julian XIA	Preliminary: 1. Updated Bluetooth 5.0 to Bluetooth 5.2. 2. Updated module's weight information (Table 2) 3. Updated pin 2, 3, 5, 6 descriptions (Table 4, Table 5). 4. Updated pin 12 description (Table 4, Table 11). 5. Updated power consumption data (Table 17). 6. Updated RF performances (Table 18). 7. Updated ESD parameters (Table 20). (Table 22).
1.0.2	2022-12-30	Julian XIA/ Shinnie XU	Preliminary: 1. Updated the power-up and power-down timing (Figure 4). 2. Updated block diagram of Bluetooth application interface connection (Figure 5). 3. Added the description of I2C interface (Chapter 3.5.3). 4. Updated the absolute maximum ratings (Table 15). 5. Updated recommended footprint and top and bottom views of the module (Figure 18, Figure 19). 6. Updated the ramp-up slope and cool-down slope (Figure 20, Table 22). 7. Updated the packing specifications (Chapter 6.3).

Contents

Table Index

Figure Index

1 Introduction

This document defines the AH20C and describes its air interface and hardware interfaces which are connected to your applications.

With this document, you can quickly understand module interface specifications, electrical and mechanical details, as well as other related information of the module. The document, coupled with application notes and user guides, makes it easy to design and set up mobile applications with the module. It is designed to be used in conjunction with Quectel Automotive modules (like AG52xR series, AG55xQ series, etc.) or other application processors (like IMX6, IMX8, etc.) to provide you with Automotive + Bluetooth applications.

Table 1: Module Information

Module	Bluetooth
AH20C	Bluetooth Low Energy (BLE 5.2)

2 Product Overview

2.1. General Description

AH20C is a cost-effective Bluetooth 5.2 module with low power consumption. It provides a UART and a PCM interface for Bluetooth function. It is an SMD type module which can be embedded in applications through its 24 LGA pins. The size is only 13 mm × 13 × 2.45 mm.

2.2. Key Features

Table 2: Key Features

Parameter	Description
Power Supply	● **VDD_BT_3V3:** Supply voltage range: 3.14–3.46 V Typical supply voltage: 3.3 V ● **VDD_PADS:** Supply voltage range: 1.7–1.9 V Typical supply voltage: 1.8 V
Bluetooth Protocol	● GATT ● SPP
Bluetooth Operation Modes	● Classic Bluetooth (BR + EDR) ● Bluetooth Low Energy (BLE)
Bluetooth Modulations	GFSK, 8-DPSK, π/4-DQPSK
Bluetooth Application Interfaces	● UART ● PCM
Antenna Interface	● ANT_BT ● 50 Ω impedance
Physical Characteristics	● Size: (13 ±0.2) mm × (13.0 ±0.2) mm × (2.45 ±0.2) mm ● Package: LGA ● Weight: approx. 0.71 g

Temperature Ranges	● Operating temperature range: -40 °C to +85 °C [1] ● Storage temperature range: -40 °C to +95 °C
RoHS	All hardware components are fully compliant with EU RoHS directive

2.3. Functional Diagram

The following figure shows a block diagram of the module and illustrates the major functional parts.

- Power management
- Bluetooth application interface
- RF antenna interface
- Other interfaces

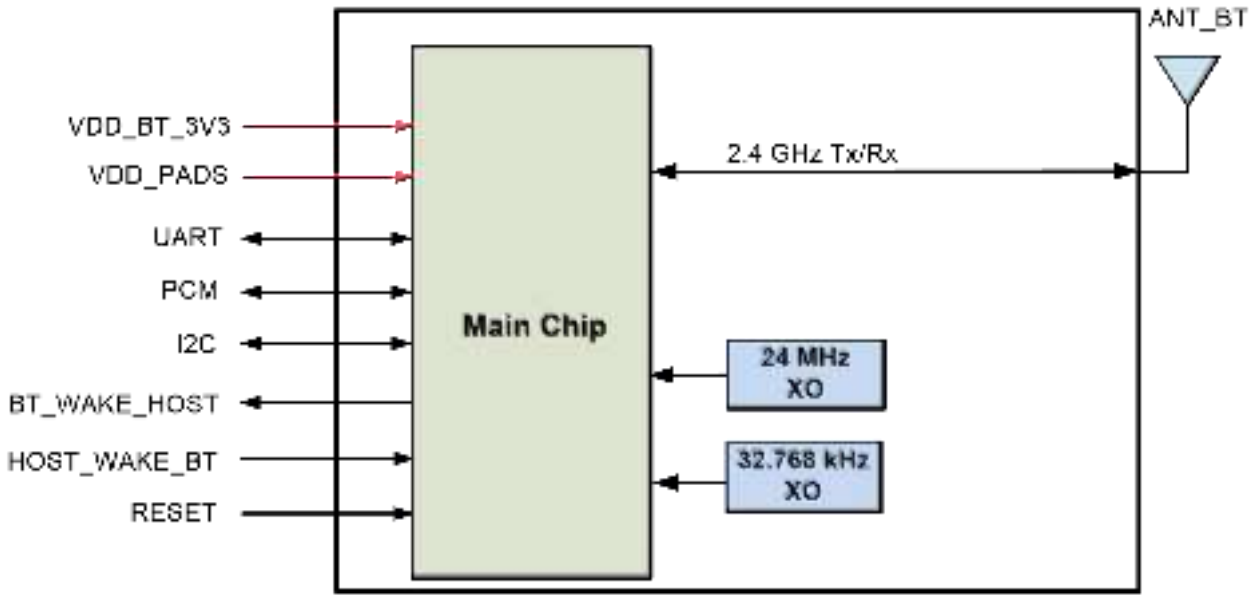


Figure 1: Functional Diagram

2.4. EVB Kit

To help you develop applications with the module, Quectel supplies an evaluation board (V2X&5G EVB) with accessories to control or test the module. For more details, see ***document [1]***.

[1] Within the operating temperature range, the module's related performance meets Bluetooth specification.

3 Application Interfaces

3.1. Pin Assignment

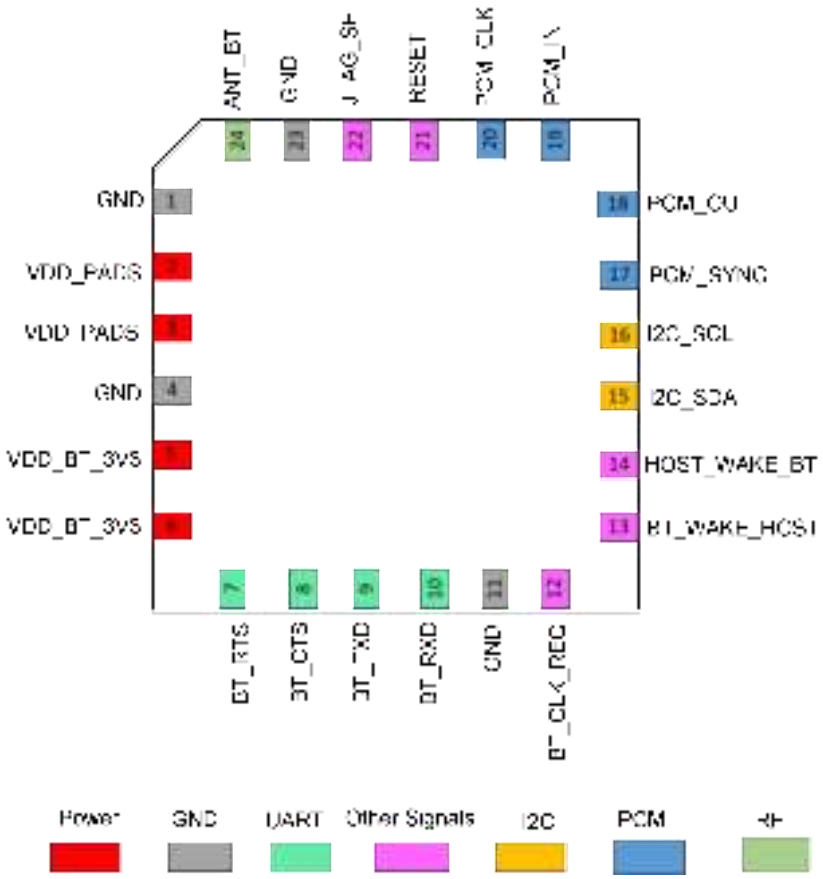


Figure 2: Pin Assignment (Top View)

NOTE

1. Keep all unused pins unconnected.
2. All GND pins should be connected to ground.

3.2. Pin Description

Table 3: I/O Parameters Definition

Type	Description
AIO	Analog Input Output
DI	Digital Input
DO	Digital Output
PI	Power Input

Table 4: Pin Description

Power Supply					
Pin Name	**Pin No.**	**I/O**	**Description**	**DC Characteristics**	**Comment**
VDD_BT_3V3	5, 6	PI	Power supply for the module	Vmin = 3.14 V Vnom = 3.3 V Vmax = 3.46 V	It should be provided with sufficient current up to 100 mA.
VDD_PADS	2, 3	PI	Power supply for the module's I/O pins	Vmin = 1.7 V Vnom = 1.8 V Vmax = 1.9 V	1.8 power domain. It should be provided with sufficient current up to 80 mA.
GND	1, 4, 11, 23				
Reset					
Pin Name	**Pin No.**	**I/O**	**Description**	**DC Characteristics**	**Comment**
RESET	21	DI	Resets the module	1.8 V power domain	Internally pulled up to 1.8 V. Active low.
Bluetooth Application Interfaces					
Pin Name	**Pin No.**	**I/O**	**Description**	**DC Characteristics**	**Comment**
BT_WAKE_HOST	13	DO	Bluetooth wakes up the host	1.8 V power domain	If unused, keep them open.
HOST_WAKE_BT	14	DI	Host wakes up Bluetooth		

PCM_IN	19	DI	PCM data input		
PCM_SYNC	17	DI	PCM data frame sync		
PCM_CLK	20	DI	PCM clock		
PCM_OUT	18	DO	PCM data output		
BT_RTS	7	DO	DCE request to send signal to DTE		
BT_CTS	8	DI	DCE clear to send signal from DTE		
BT_TXD	9	DO	Bluetooth UART transmit		
BT_RXD	10	DI	Bluetooth UART receive		
I2C_SCL	16	DI	I2C serial clock		
I2C_SDA	15	DI	I2C serial data		
BT_CLK_REQ	12	DO	Shared-clock application		
RF Antenna Interface					
Pin Name	**Pin No.**	**I/O**	**Description**	**DC Characteristics**	**Comment**
ANT_BT	24	AIO	Bluetooth antenna interface		50 Ω impedance.
Other Interfaces					
Pin Name	**Pin No.**	**I/O**	**Description**	**DC Characteristics**	**Comment**
JTAG_SEL	22	DI	ARM JTAG debugging mode control	1.8 V power domain	If unused, connect it to ground.

3.3. Power Supply

Table 5: Definition of Power Supply and GND Pins

Pin Name	Pin No.	I/O	Description	Min.	Typ.	Max.	Unit
VDD_BT_3V3	5, 6	PI	Power supply for the module	3.14	3.3	3.46	V
VDD_PADS	2, 3	PI	Power supply for the module's I/O pins	1.71	1.8	1.9	V
GND	1, 4, 11, 23						

3.3.1. Reference Design for Power Supply

The module is powered by VDD_BT_3V3, and it is recommended to use a power supply chip which is able to output a current of at least 100 mA. The following figure shows a reference design for VDD_BT_3V3 which is controlled by EN_CTRL:

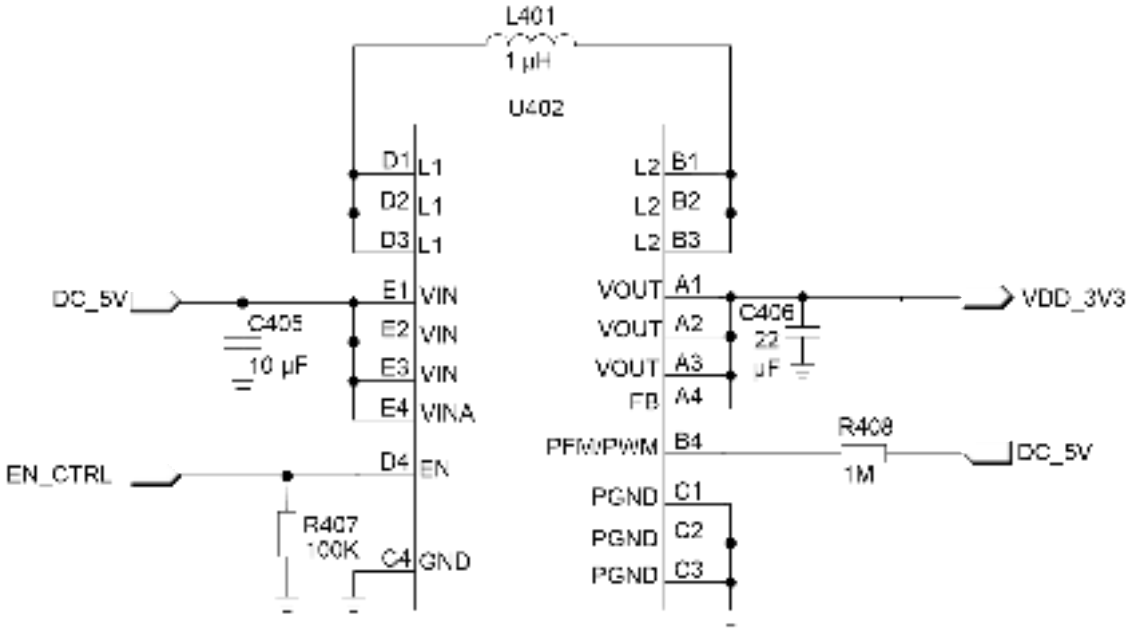


Figure 3: Reference Circuit of Power Supply

The power-up and power-down timing is illustrated in the following figure:

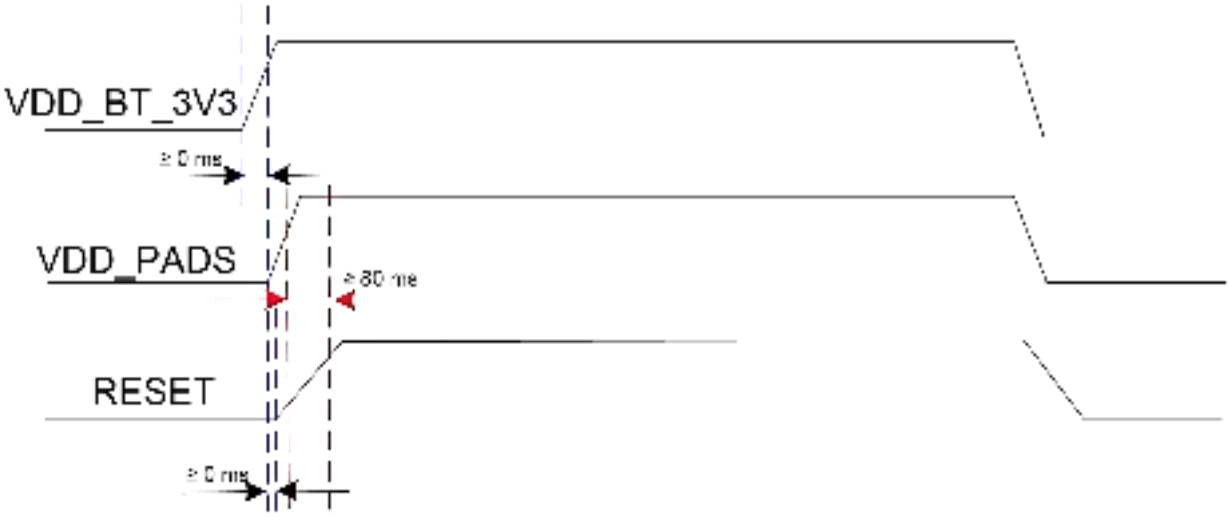


Figure 4: Power-up and Power-down Timing

3.3.2. Reset

RESET is used to reset the module.

Table 6: Pin Definition of RESET

Pin Name	Pin No.	I/O	Description	Comment
RESET	21	DI	Resets the module	1.8 V power domain. Internally pulled up to 1.8 V. Active low.

3.4. Bluetooth Application Interfaces

The module provides a UART and a PCM interface for Bluetooth functions. The following figure shows the Bluetooth application interface connection between the module and the host:

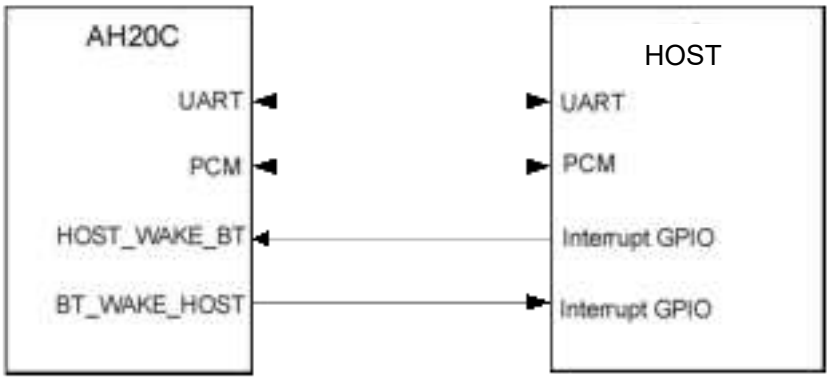


Figure 5: Bluetooth Application Interface Connection

3.4.1. BT_WAKE_HOST and HOST_WAKE_BT

Table 7: Pin Definition of BT_WAKEUP_HOST and HOST_WAKEUP_BT

Pin Name	Pin No.	I/O	Description	Comment
HOST_WAKE_BT	14	DI	Host wakes up Bluetooth	1.8 V power domain. If unused, keep them open.
BT_WAKE_HOST	13	DO	Bluetooth wakes up the host	

3.4.2. PCM Interface

The module provides a PCM interface for Bluetooth audio functions. The following table shows the pin definition of PCM interface.

Table 8: Pin Definition of PCM Interface

Pin Name	Pin No.	I/O	Description	Comment
PCM_IN	19	DI	PCM data input	1.8 V power domain. If unused, keep them open.
PCM_SYNC	17	DI	PCM data frame sync	

PCM_CLK	20	DI	PCM clock
PCM_OUT	18	DO	PCM data output

The following figure shows the PCM interface connection between the module and the host:

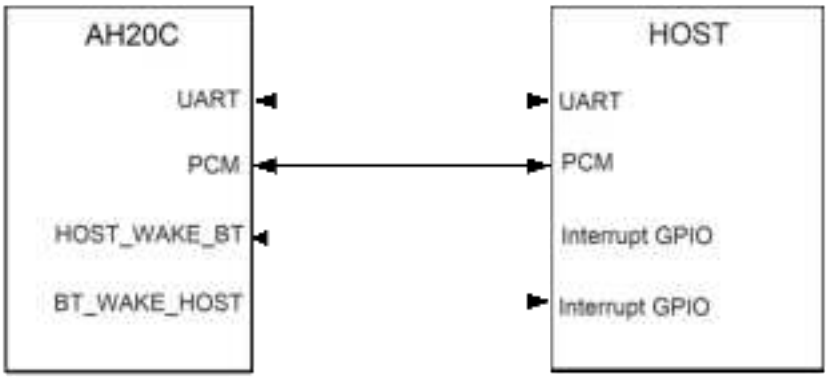


Figure 6: PCM Interface Connection

3.4.3. UART Interface

The module serves as DCE (Data Communication Equipment), which is connected in the traditional DCE-DTE (Data Terminal Equipment) mode.

The following table shows the pin definition of UART interface:

Table 9: Pin Definition of UART Interface

Pin Name	Pin No.	I/O	Description	Comment
BT_RTS	7	DO	DCE request to send signal to DTE	1.8 V power domain. If unused, keep them open.
BT_CTS	8	DI	DCE clear to send signal from DTE	
BT_TXD	9	DO	Bluetooth UART transmit	
BT_RXD	10	DI	Bluetooth UART receive	

The following figure shows the UART interface connection between the module and the host:

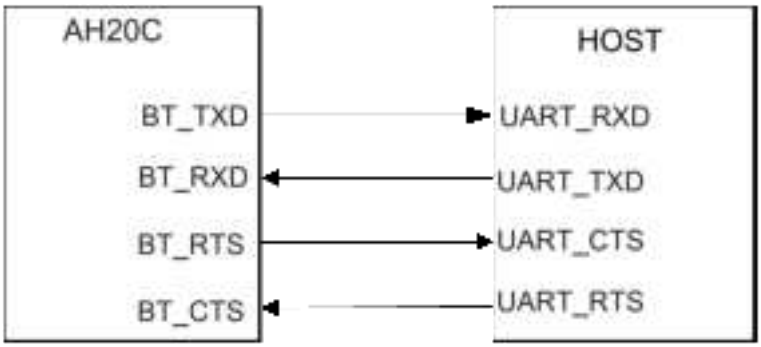


Figure 7: UART Interface Connection

3.5. Other Interfaces

3.5.1. JTAG_SEL

JTAG_SEL can be used to control ARM JTAG debugging mode.

Table 10: Pin Definition of JTAG_SEL

Pin Name	Pin No.	I/O	Description	Comment
JTAG_SEL	22	DI	ARM JTAG debugging mode control	1.8 V power domain. If unused, connect it to ground.

3.5.2. BT_CLK_REQ

BT_CLK_REQ is used for shared-clock application with the host.

Table 11: Pin Definition of BT_CLK_REQ

Pin Name	Pin No.	I/O	Description	Comment
BT_CLK_REQ	12	DO	Shared-clock application	1.8 V power domain, If unused, keep it open.

3.5.3. I2C Interface

The I2C interface of the module cannot be used as general I2C port. It is connected with external I2C EEPROM for data exchange.

The following table shows the pin definition of I2C interface:

Pin Name	Pin No.	I/O	Description	Comment
I2C_SCL	16	DI	I2C serial clock	1.8 V power domain. If unused, keep them open.
I2C_SDA	15	DI	I2C serial data	

3.6. RF Antenna Interface

ANT_BT is the RF antenna pin, and the RF port requires 50 Ω characteristic impedance.

3.6.1. Pin Definition of RF Antenna Interface

The following table shows the pin definition of RF antenna interface:

Table 12: Pin Definition of RF Antenna Interface

Pin Name	Pin No.	I/O	Description	Comment
ANT_BT	24	AIO	Bluetooth antenna interface	50 Ω impedance

3.6.2. Operating Frequency

Table 13: Operating Frequency

Feature	Frequency	Unit
Bluetooth	2.400–2.4835	GHz

3.6.3. Reference Design of RF Antenna Interface

The module comes with ground pins which are next to the antenna pin for better grounding.

It is recommended to reserve a π-type and two notch filter circuits for better RF performance. C2, L1 and L3, C3 form two notch filter circuits for filtering out interference caused by specific frequencies. When L3, C2, L1 and C3 are not mounted, C1, R1 and C4 form a π-type matching circuit. Capacitors (C1, C2, C3, and C4) and inductors (L1 and L3) are not mounted by default, and R1 is only mounted with 0 Ω resistor.

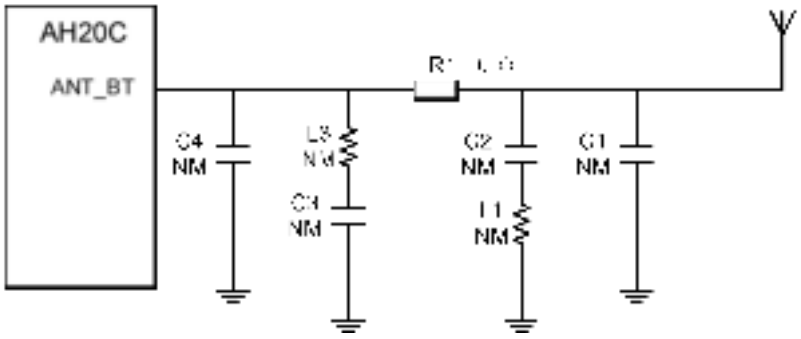


Figure 8: Reference Circuit for RF Antenna Interface

3.6.4. 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.

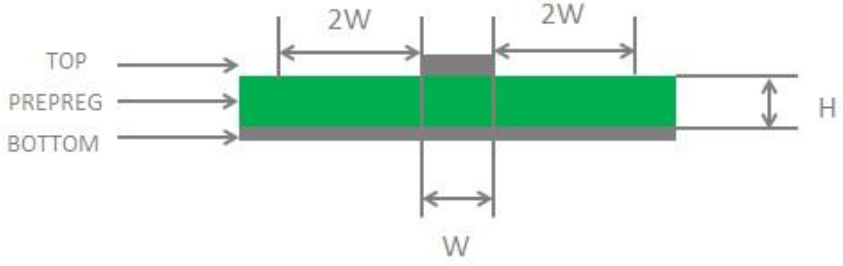


Figure 9: Microstrip Design on a 2-layer PCB

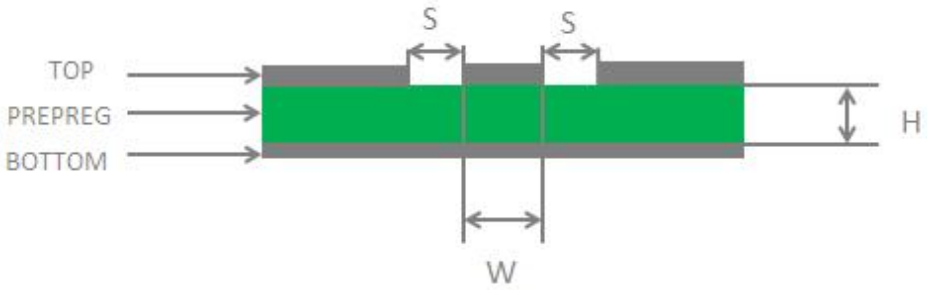


Figure 10: Coplanar Waveguide Design on a 2-layer PCB

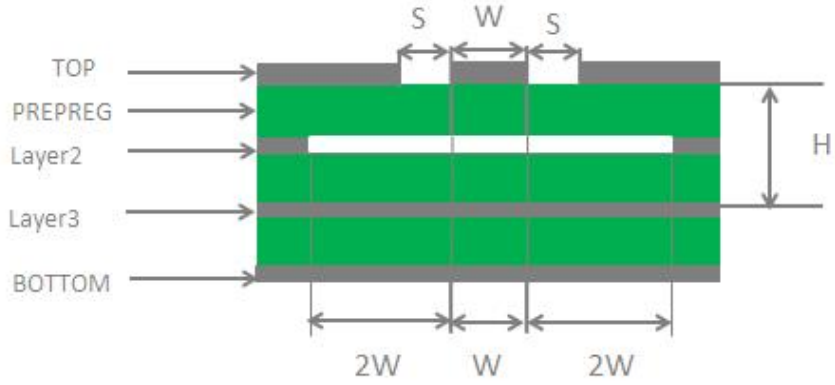


Figure 11: Coplanar Waveguide Design on a 4-layer PCB (Layer 3 as Reference Ground)

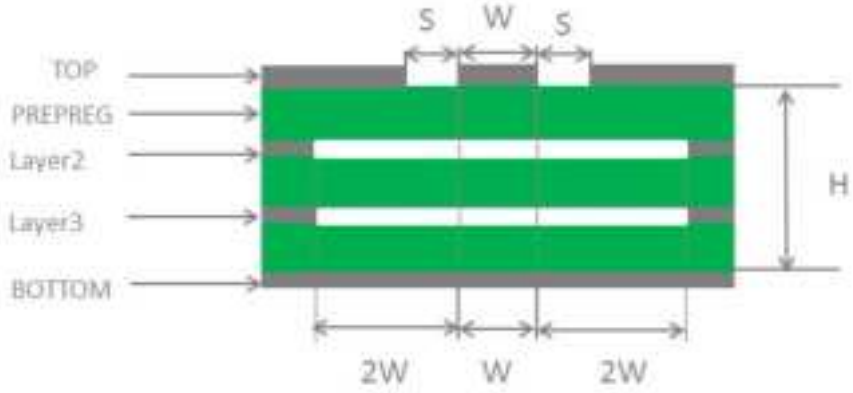


Figure 12: Coplanar Waveguide Design on a 4-layer PCB (Layer 4 as Reference Ground)

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 Ω.
- 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 not less than twice the width of RF signal traces (2 × W).
- Keep RF traces away from interference sources, and avoid intersection and paralleling between traces on adjacent layers.

For more details about RF layout, see ***document [2].***

3.6.5. Antenna Design Requirements

Table 14: Antenna Design Requirements

Parameter	Requirement
Frequency Range (GHz)	2.400–2.4835 (Cable insertion loss <1 dB)
VSWR	≤ 2
Gain (dBi)	1 (Typ.)
Max Input Power (W)	50
Input Impedance (Ω)	50
Polarization Type	Vertical

3.6.6. RF Connector Recommendation

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

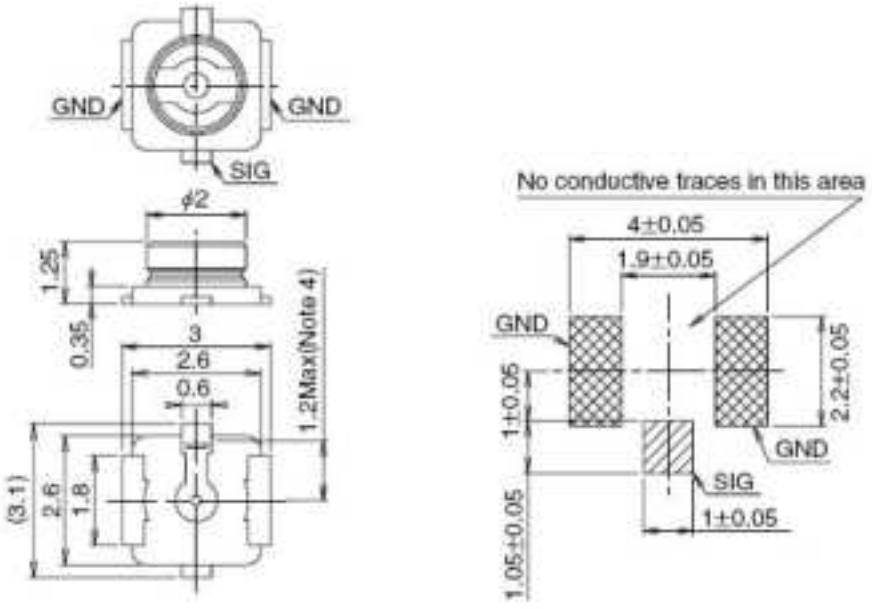


Figure 13: Dimensions of the Receptacle (Unit: mm)

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

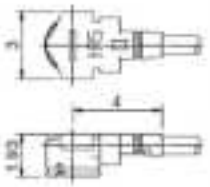
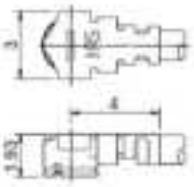
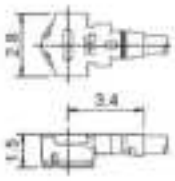
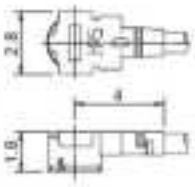
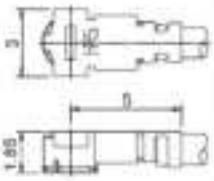
Part No.	U.FL-LP-040	U.FL-LP-066	U.FL-LP(V)-040	U.FL-LP-062	U.FL-LP-088
					
Mated Height	2.5mm Max. (2.4mm Nom.)	2.5mm Max. (2.4mm Nom.)	2.0mm Max. (1.9mm Nom.)	2.4mm Max. (2.3mm Nom.)	2.4mm Max. (2.3mm Nom.)
Applicable cable	Dia. 0.81mm Coaxial cable	Dia. 1.13mm and Dia. 1.32mm Coaxial cable	Dia. 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 14: Specifications of Mated Plugs

The following figure describes the space factor of mated connectors.

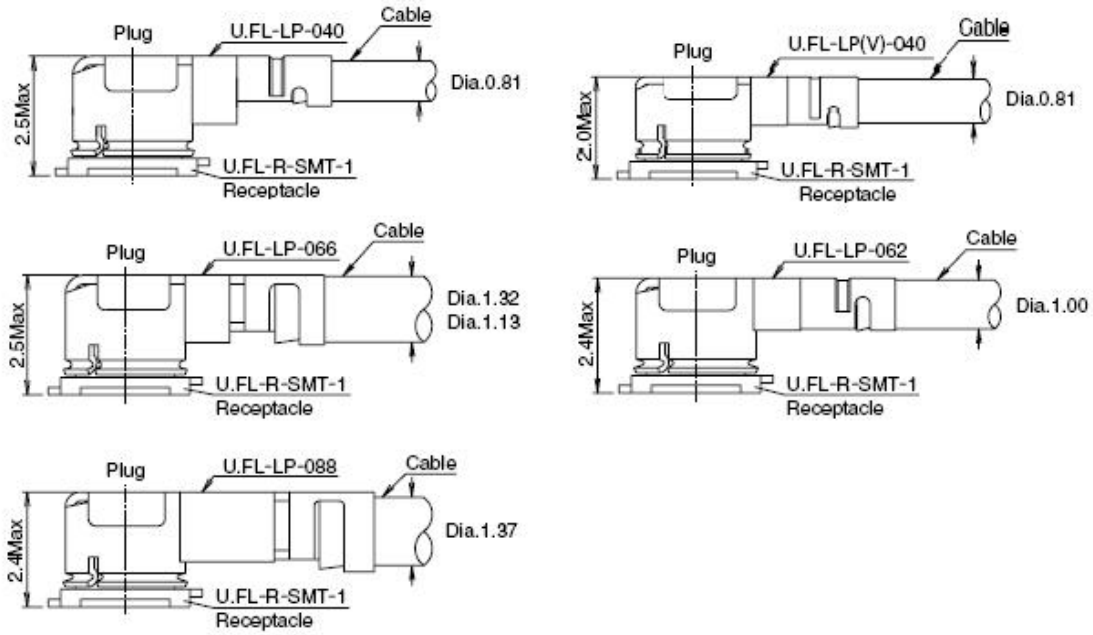


Figure 15: Space Factor of Mated Connectors (Unit: mm)

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

4 Electrical Characteristics & Reliability

4.1. Absolute Maximum Ratings

Table 15: Absolute Maximum Ratings (Unit: V)

Parameter	Min.	Max.
VDD_BT_3V3	-0.5	3.7
VDD_PADS	-0.5	2.2
Digital I/O Input Voltage	-0.5	VDD_PADS + 0.2

4.2. Power Supply Ratings

Table 16: Module Power Supply Ratings (Unit: V)

Parameter	Min.	Typ.	Max.
VDD_BT_3V3	3.14	3.3	3.46
VDD_PADS	1.7	1.8	1.9

4.3. Power Consumption

Table 17: Power Consumption

Mode	Channel	Tx power	$I_{VDD\_BT\_3V3}$	I_{VDD_PADS}
BR	CH0	7.27 dBm	11.51 mA	27.13 mA
	CH39	7.79 dBm	12.13 mA	27.28 mA
	CH78	7.37 dBm	11.68 mA	27.35 mA
EDR	CH0	6.56 dBm	10.49 mA	27.41 mA
	CH39	7.57 dBm	11.27 mA	27.45 mA
	CH78	7.13 dBm	10.72 mA	27.51 mA
BLE	CH0	8.13 dBm	17.37 mA	23.79 mA
	CH19	9.39 dBm	19.63 mA	23.97 mA
	CH39	8.76 dBm	17.07 mA	24.97 mA

4.4. RF Performances

The following tables summarize the transmitting and receiving performances of the module:

Table 18: Tx power and Rx Sensitivity

Mode	Channel	Tx Power	Rx Sensitivity
BR	CH0	7.66 dBm	-90.0 dBm
	CH39	8.10 dBm	-90.5 dBm
	CH78	7.48 dBm	-91.0 dBm
EDR	CH0	6.85 dBm	-93.0 dBm
	CH39	7.95 dBm	-93.5 dBm
	CH78	7.56 dBm	-92.0 dBm
BLE	CH0	8.56 dBm	-92.0 dBm
	CH19	9.87 dBm	-93.5 dBm

	CH39	9.34 dBm	-93.0 dBm

4.5. Digital I/O Characteristics

Table 19: 1.8 V I/O Characteristics (Unit: V)

Parameter	Description	Min.	Max.
V_{IH}	High-level Input Voltage	1.1	-
V_{IL}	Low-level Input Voltage	-	0.6
V_{OH}	High-level Output Voltage	1.4	-
V_{OL}	Low-level Output Voltage	-	0.4

4.6. 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 20: Electrostatic Discharge Characteristics (Temperature: 25–30 °C, Humidity: 40 ±5 %)

Tested Interfaces	Contact Discharge	Air Discharge	Unit
VDD_BT_3V3	±8	±12	kV
VDD_PADS	±8	±12	kV
ANT_BT	±8	±12	kV
GND	8	12	kV

4.7. Operating and Storage Temperatures

Table 21: Operating and Storage Temperatures (Unit: °C)

Parameter	Min.	Typ.	Max.
Operating temperature range [2]	-40	-	+85
Storage temperature range	-40	-	+95

[2] Within the operating temperature range, the module's related performance meets Bluetooth specification.

5 Mechanical Information

This chapter describes the mechanical dimensions of AH20C. All dimensions are measured in millimeter (mm), and the dimensional tolerances are ±0.2 mm unless otherwise specified.

5.1. Mechanical Dimensions

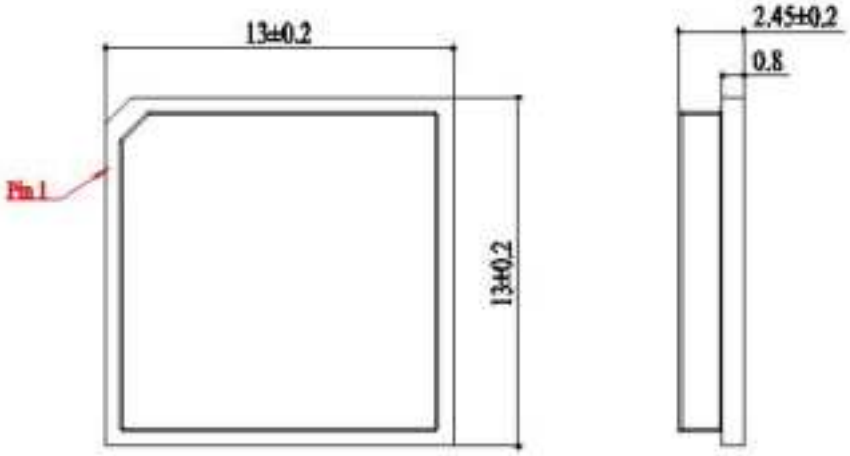


Figure 16: Top and Side Dimensions

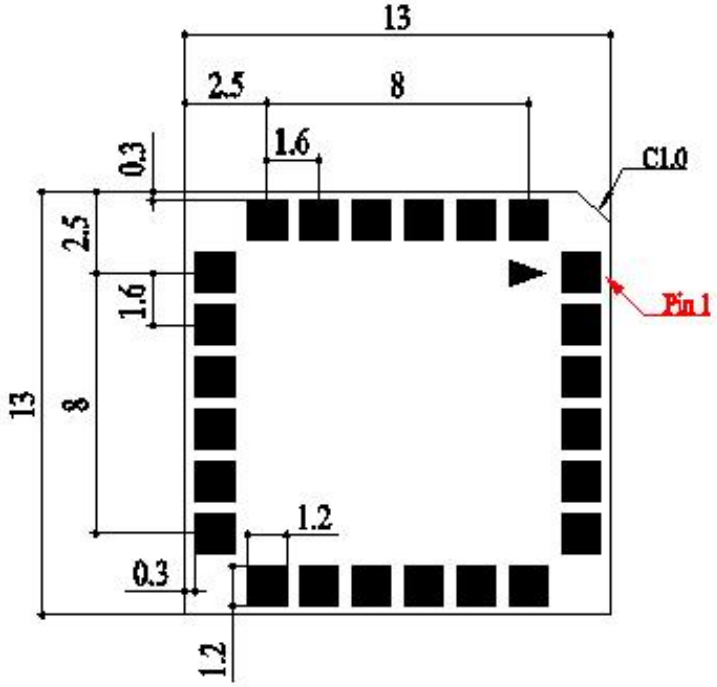


Figure 17: Bottom Dimension (Bottom View)

NOTE

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

5.2. Recommended Footprint

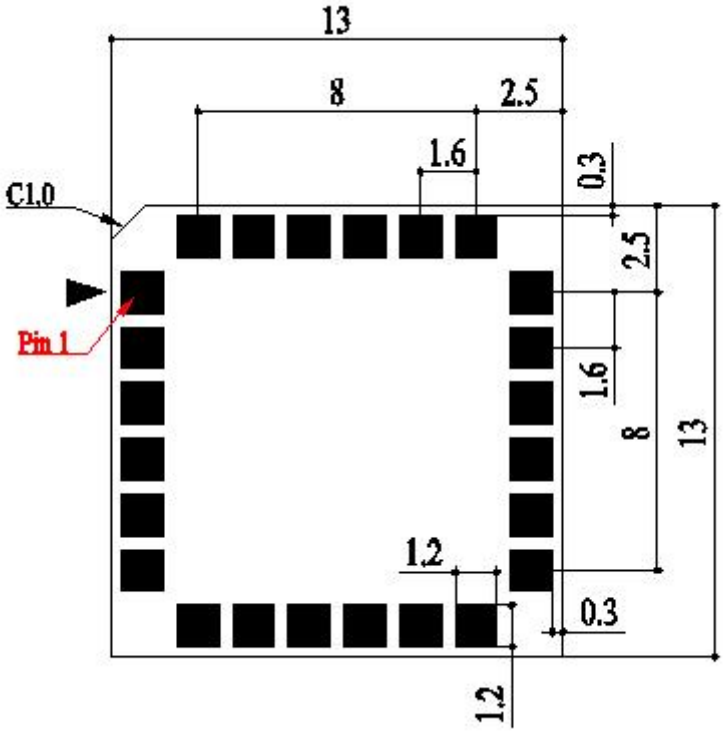


Figure 18: Recommended Footprint (Top View)

NOTE

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

5.3. Top and Bottom Views

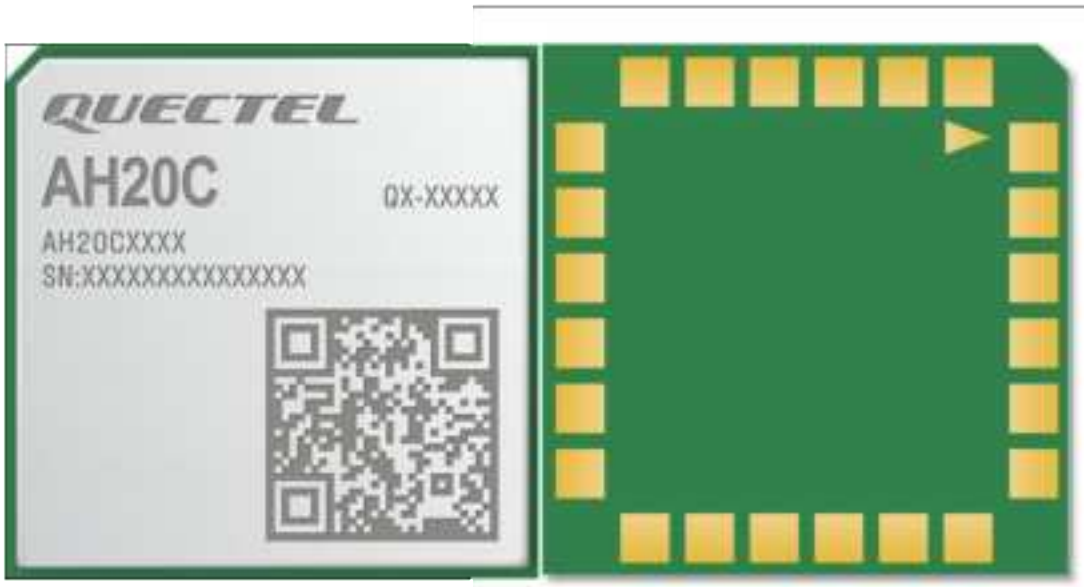


Figure 19: Top and Bottom Views of the Module

NOTE

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

6 Storage, Manufacturing & Packaging

6.1. 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 [3] 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

[3] 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 remove the packages of tremendous modules if they are not 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.

6.2. 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 0.15–0.18 mm. For more details, see ***document [3]***.

The recommended reflow soldering thermal profile (lead-free reflow soldering) and related parameters are shown below. The recommended peak reflow temperature should be 235–246 ºC, with 246 ºC 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.

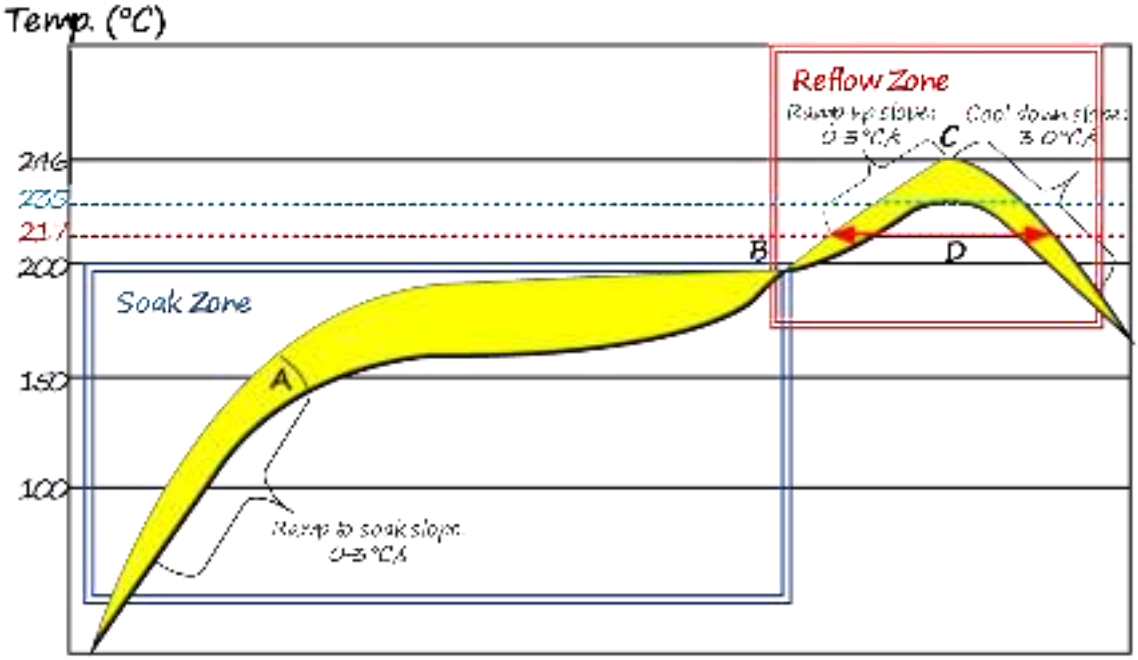


Figure 20: Recommended Reflow Soldering Thermal Profile

Table 22: 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, 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 [3]***.

6.3. 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.

The module adopts carrier tape packaging and details are as follow:

6.3.1. Carrier Tape

Dimension details are as follow:

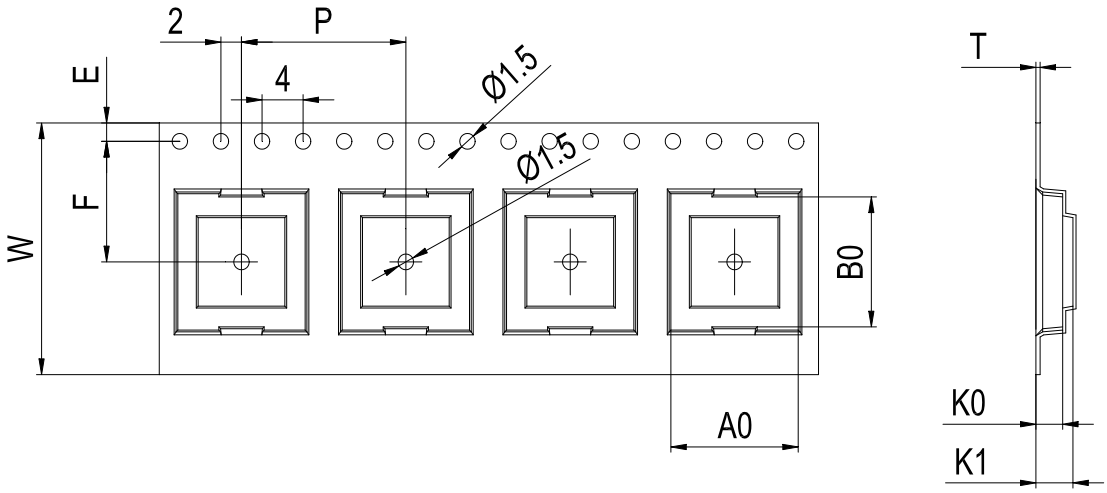


Figure 21: Carrier Tape Dimensions Drawing

Table 23: Carrier Tape Dimension Table (Unit: mm)

W	P	T	A0	B0	K0	K1	F	E
24	20	0.4	13.4	13.4	2.95	5.6	11.5	1.75

6.3.2. Plastic Reel

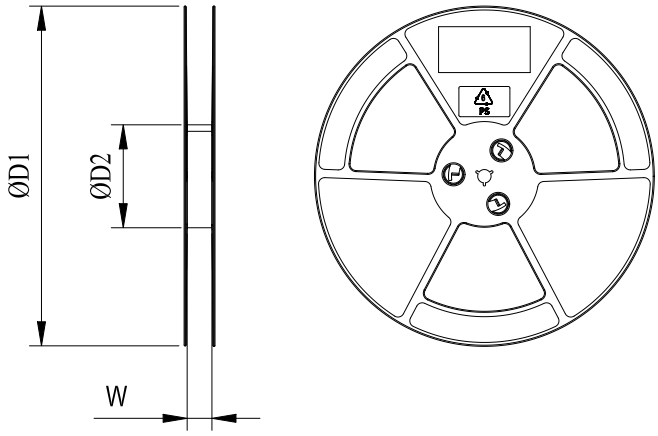


Figure 22: Plastic Reel Dimension Drawing

Table 24: Plastic Reel Dimension Table (Unit: mm)

øD1	øD2	W
330	100	24.5

6.3.3. Mounting Direction

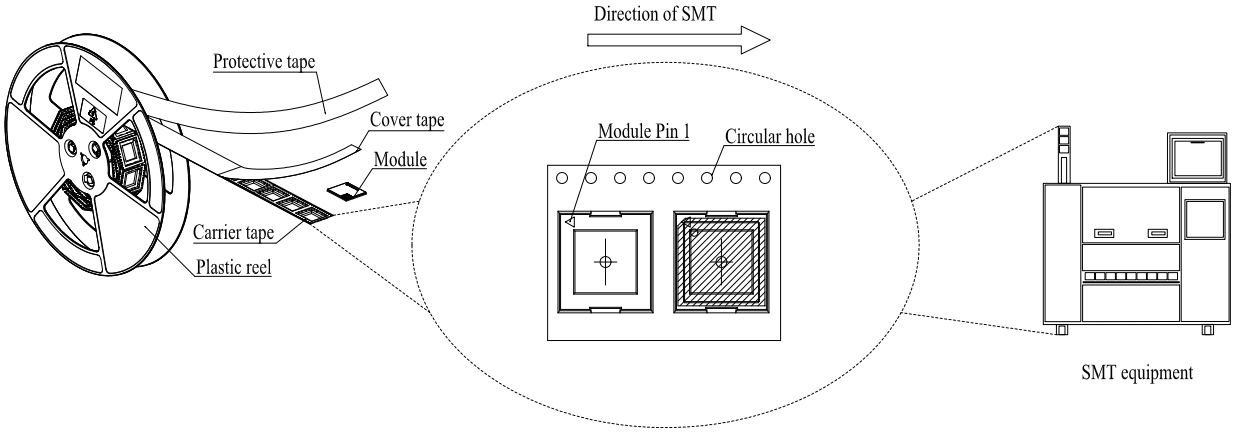
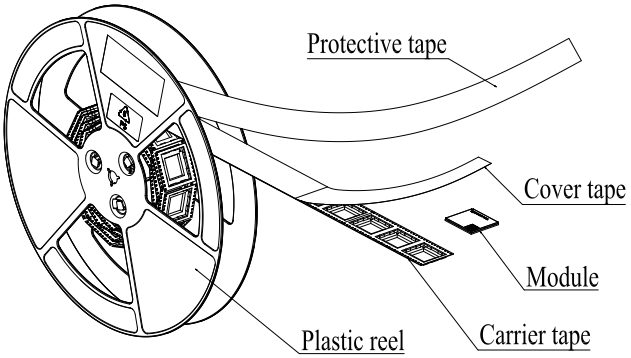


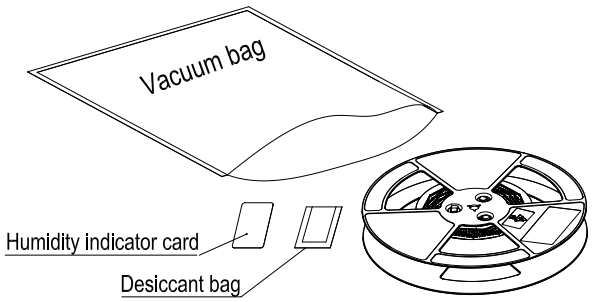
Figure 23: Mounting Direction

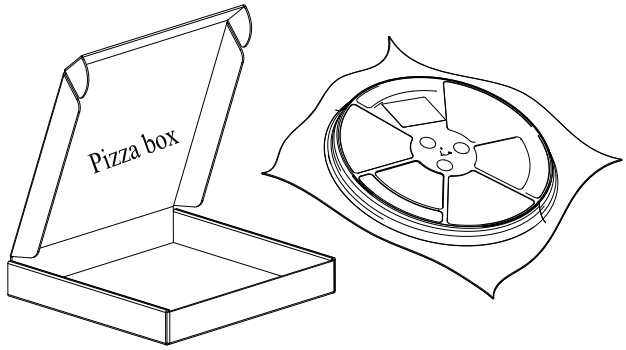
6.3.4. Packaging Process



Place the module into the carrier tape and use the cover tape to cover it; then wind the heat-sealed carrier tape to 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, vacuumize it.





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

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

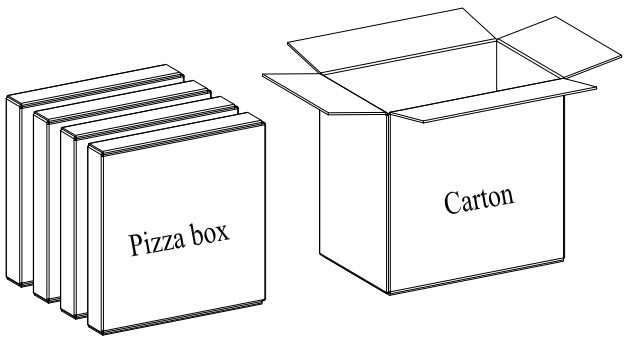


Figure 24: Packaging Process

7 Appendix References

Table 25: Related Documents

Document Name
[1] Quectel_V2X&5G_EVB_User_Guide
[2] Quectel_RF_Layout_Application_Note
[3] Quectel_Module_SMT_Application_Note

Table 26: Terms and Abbreviations

Abbreviation	Description
ARM	Advanced RISC Machine
BLE	Bluetooth Low Energy
BT	Bluetooth
DPSK	Differential Phase Shift Keying
DQPSK	Differential Quadrature Phase Shift Keying
BR	Basic Rate
EDR	Enhanced Data Rate
CTS	Clear To Send
DCE	Data Communication Equipment
DTE	Data Terminal Equipment
EEPROM	Electrically Erasable Programmable Read-Only Memory
ESD	Electrostatic Discharge
GATT	Generic Attribute Profile

GFSK	Gauss Frequency Shift Keying
GND	Ground
I/O	Input/Output
I2C	Inter-Integrated Circuit
JTAG	Joint Test Action Group
LGA	Land Grid Array
PCB	Printed Circuit Board
PCM	Pulse Code Modulation
RF	Radio Frequency
RoHS	Restriction of Hazardous Substances
RTS	Request to Send
Rx	Receive
RXD	Receive Data
SMT	Surface Mount Technology
SPP	Serial Port Profile
Tx	Transmit
TXD	Transmit Data
UART	Universal Asynchronous Receiver/Transmitter
V_{IH}max	Maximum High-level Input Voltage
V_{IH}min	Minimum High-level Input Voltage
V_{IL}max	Maximum Low-level Input Voltage
V_{IL}min	Minimum Low-level Input Voltage
Vmax	Maximum Voltage
Vmin	Minimum Voltage
Vnom	Nominal Voltage

$V_{OH}max$	Maximum High-level Output Voltage
$V_{OH}min$	Minimum High-level Output Voltage
$V_{OL}max$	Maximum Low-level Output Voltage
$V_{OL}min$	Minimum Low-level Output Voltage
VSWR	Voltage Standing Wave Ratio

CE Statement

The minimum distance between the user and/or any bystander and the radiating structure of the transmitter is 20cm.

Hereby, We, Quectel Wireless Solutions Co., Ltd. declares that the radio equipment type **AH20C** is in compliance with the Directive 2014/53/EU.

The full text of the EU declaration of conformity is available at the following internet address:

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

https://www.quectel.com.

The device operates with the following frequency bands and transmitting power:

Band	Tx (MHz)	Rx (MHz)	The Maximum (EIRP) Transmitted Power (dBm)
Bluetooth	2402 ~ 2480	2402 ~ 2480	8.62 dBm
Bluetooth LE	2402 ~ 2480	2402 ~ 2480	7.70 dBm

FCC Certification Requirements.

According to the definition of mobile and fixed device is described in Part 2.1091(b), this device is a mobile device.

And the following conditions must be met:

1. This Modular Approval is limited to OEM installation for mobile and fixed applications only. The antenna installation and operating configurations of this transmitter, including any applicable source-based time-averaging duty factor, antenna gain and cable loss must satisfy MPE categorical Exclusion Requirements of 2.1091.

2. The EUT is a mobile device; maintain at least a 20 cm separation between the EUT and the user's body and must not transmit simultaneously with any other antenna or transmitter.

3.A label with the following statements must be attached to the host end product: This device contains **FCC ID: XMR2023AH20C.**

4.To comply with FCC regulations limiting both maximum RF output power and human exposure to RF radiation, maximum antenna gain (including cable loss) must not exceed:

❒ Bluetooth LE:≤ 0.73 dBi

5. This module must not transmit simultaneously with any other antenna or transmitter

6. The host end product must include a user manual that clearly defines operating requirements and conditions that must be observed to ensure compliance with current FCC RF exposure guidelines.

For portable devices, in addition to the conditions 3 through 6 described above, a separate approval is required to satisfy the SAR requirements of FCC Part 2.1093

If the device is used for other equipment that separate approval is required for all other operating configurations, including portable configurations with respect to 2.1093 and different antenna configurations.

For this device, OEM integrators must be provided with labeling instructions of finished products. Please refer to KDB784748 D01 v07, section 8. Page 6/7 last two paragraphs:

A certified modular has the option to use a permanently affixed label, or an electronic label. For a permanently affixed label, the module must be labeled with an FCC ID - Section 2.926 (see 2.2 Certification (labeling requirements) above). The OEM manual must provide clear instructions explaining to the OEM the labeling requirements, options and OEM user manual instructions that are required (see next paragraph).

For a host using a certified modular with a standard fixed label, if (1) the module's FCC ID is not visible when installed in the host, or (2) if the host is marketed so that end users do not have straightforward commonly used methods for access to remove the module so that the FCC ID of the module is visible; then an additional permanent label referring to the enclosed module:"Contains Transmitter Module **FCC ID: XMR2023AH20C**" or "Contains **FCC ID: XMR2023AH20C**" must be used. The host OEM user manual must also contain clear instructions on how end users can find and/or access the module and the FCC ID.

The final host / module combination may also need to be evaluated against the FCC Part 15B criteria for unintentional radiators in order to be properly authorized for operation as a Part 15 digital device.

The user's manual or instruction manual for an intentional or unintentional radiator shall caution the user that changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment. In cases where the manual is provided only in a form other than paper, such as on a computer disk or over the Internet, the information required by this section may be included in the manual in that alternative form, provided the user can reasonably be expected to have the capability to access information in that form.

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.

Changes or modifications not expressly approved by the manufacturer could void the user's authority to operate the equipment.

IC Statement

IRSS-GEN

"This device complies with Industry Canada’s licence-exempt RSSs. 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." or "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; 2) l’utilisateur de l’appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d’en compromettre le fonctionnement."

Déclaration sur l'exposition aux rayonnements RF

The EUT is a mobile device; maintain at least a 20 cm separation between the EUT and the user’s body and must not transmit simultaneously with any other antenna or transmitter.

L'autre utilisé pour l'émetteur doit être installé pour fournir une distance de séparation d'au moins 20 cm de toutes les personnes et ne doit pas être colocalisé ou fonctionner conjointement avec une autre antenne ou un autre émetteur.

To comply with IC regulations limiting both maximum RF output power and human exposure to RF radiation, maximum antenna gain (including cable loss) must not exceed:

- ❒ Bluetooth LE:≤ 0.73 dBi

The host product shall be properly labelled to identify the modules within the host product.

The Innovation, Science and Economic Development Canada certification label of a module shall be clearly visible at all times when installed in the host product; otherwise, the host product must be labeled to display the Innovation, Science and Economic Development Canada certification number for the module, preceded by the word “Contains” or similar wording expressing the same meaning, as follows:

“Contains IC: **10224A-2023AH20C**” or “where: **10224A-2023AH20C** is the module’s certification number”.

Le produit hôte doit être correctement étiqueté pour identifier les modules dans le produit hôte.

L'étiquette de certification d'Innovation, Sciences et Développement économique Canada d'un module doit être clairement visible en tout temps lorsqu'il est installédans le produit hôte; sinon, le produit hôte doit porter une étiquette indiquant le numéro de certification d'Innovation, Sciences et Développement économique Canada pour le module, précédé du mot «Contient» ou d'un libellé semblable exprimant la même signification, comme suit:"Contient IC: **10224A-2023AH20C** " ou "où: **10224A-2023AH20C** est le numéro de certification du module.