AH20C

Hardware Design

Bluetooth Module Series

Version: 1.0.0

Date: 2022-01-21

Status: Preliminary

At Quectel, our aim is to provide timely and comprehensive services to our customers. If you require any assistance, please contact our headquarters:

Quectel Wireless Solutions Co., Ltd.
Building 5, Shanghai Business Park Phase III (Area B), No.1016 Tianlin Road, Minhang District, Shanghai 200233, China
Tel: +86 21 5108 6236
Email: info@quectel.com

Or our local offices. For more information, please visit:
http://www.quectel.com/support/sales.htm.

For technical support, or to report documentation errors, please visit:
http://www.quectel.com/support/technical.htm.
Or email us at: support@quectel.com.

Legal Notices

We offer information as a service to you. The provided information is based on your requirements and we make every effort to ensure its quality. You agree that you are responsible for using independent analysis and evaluation in designing intended products, and we provide reference designs for illustrative purposes only. Before using any hardware, software or service guided by this document, please read this notice carefully. Even though we employ commercially reasonable efforts to provide the best possible experience, you hereby acknowledge and agree that this document and related services hereunder are provided to you on an “as available” basis. We may revise or restate this document from time to time at our sole discretion without any prior notice to you.

Use and Disclosure Restrictions

License Agreements

Documents and information provided by us shall be kept confidential, unless specific permission is granted. They shall not be accessed or used for any purpose except as expressly provided herein.

Copyright

Our and third-party products hereunder may contain copyrighted material. Such copyrighted material shall not be copied, reproduced, distributed, merged, published, translated, or modified without prior written consent. We and the third party have exclusive rights over copyrighted material. No license shall be granted or conveyed under any patents, copyrights, trademarks, or service mark rights. To avoid ambiguities, purchasing in any form cannot be deemed as granting a license other than the normal non-exclusive, royalty-free license to use the material. We reserve the right to take legal action for noncompliance with abovementioned requirements, unauthorized use, or other illegal or malicious use of the material.

Trademarks

Except as otherwise set forth herein, nothing in this document shall be construed as conferring any rights to use any trademark, trade name or name, abbreviation, or counterfeit product thereof owned by Quectel or any third party in advertising, publicity, or other aspects.

Third-Party Rights

This document may refer to hardware, software and/or documentation owned by one or more third parties ("third-party materials"). Use of such third-party materials shall be governed by all restrictions and obligations applicable thereto.

We make no warranty or representation, either express or implied, regarding the third-party materials, including but not limited to any implied or statutory, warranties of merchantability or fitness for a particular purpose, quiet enjoyment, system integration, information accuracy, and non-infringement of any third-party intellectual property rights with regard to the licensed technology or use thereof. Nothing herein constitutes a representation or warranty by us to either develop, enhance, modify, distribute, market, sell, offer for sale, or otherwise maintain production of any our products or any other hardware, software, device, tool, information, or product. We moreover disclaim any and all warranties arising from the course of dealing or usage of trade.

Privacy Policy

To implement module functionality, certain device data are uploaded to Quectel's or third-party's servers, including carriers, chipset suppliers or customer-designated servers. Quectel, strictly abiding by the relevant laws and regulations, shall retain, use, disclose or otherwise process relevant data for the purpose of performing the service only or as permitted by applicable laws. Before data interaction with third parties, please be informed of their privacy and data security policy.

Disclaimer

a) We acknowledge no liability for any injury or damage arising from the reliance upon the information.
b) We shall bear no liability resulting from any inaccuracies or omissions, or from the use of the information contained herein.
c) While we have made every effort to ensure that the functions and features under development are free from errors, it is possible that they could contain errors, inaccuracies, and omissions. Unless otherwise provided by valid agreement, we make no warranties of any kind, either implied or express, and exclude all liability for any loss or damage suffered in connection with the use of features and functions under development, to the maximum extent permitted by law, regardless of whether such loss or damage may have been foreseeable.
d) We are not responsible for the accessibility, safety, accuracy, availability, legality, or completeness of information, advertising, commercial offers, products, services, and materials on third-party websites and third-party resources.

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

Contents

Table Index

Figure Index

1 Introduction

This document defines the AH20C and describes its air interface and hardware interfaces which relate to customers' applications.

It can help customers quickly understand interface specifications, electrical and mechanical details, as well as other related information of the module. Associated with application notes and user guides, customers can use AH20C to design and set up mobile applications easily. It is designed to be used in conjunction with Quectel LTE Standard modules (like AG520 series) or other application processor (like IMX6, IMX8, etc.) to provide customers with LTE + Bluetooth applications.

Table 1: Module Information

Module	Bluetooth
AH20C	Bluetooth Low Energy (BLE 5.0)

2 Product Overview

2.1. General Description

AH20C is a low power consumption and cost-effective Bluetooth module. It supports Bluetooth 5.0 standard and a UART & PCM interface for Bluetooth. The module is an SMD type module with 24 LGA pins. The size is only 13 mm × 13 mm × 2.45 mm.

2.2. Key Features

Table 2: Key Features

Features	Details
Power Supply	● **VDD_BT_3V3:** Typical supply voltage: 3.3 V ● **VDD_PADS:** Typical supply voltage: 1.8 V
Bluetooth Protocol Features	● GATT ● SPP
Bluetooth Operation Mode	● Classic Bluetooth (BR + EDR) ● Bluetooth Low Energy (BLE)
Bluetooth Modulation	GFSK, 8-DPSK, π/4-DQPSK
Bluetooth Application Interface	UART and PCM (for Bluetooth)
Antenna Interface	● Bluetooth antenna interface ● 50 Ω impedance
Physical Characteristics	● Size: (13 ±0.2) mm × (13.0 ±0.2) mm × (2.45 ±0.2) mm ● Package: LGA ● Weight: TBD
Temperature Range	● Operating temperature range: -40 °C to +85 °C ● 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
- Baseband
- Radio frequency
- Peripheral interface

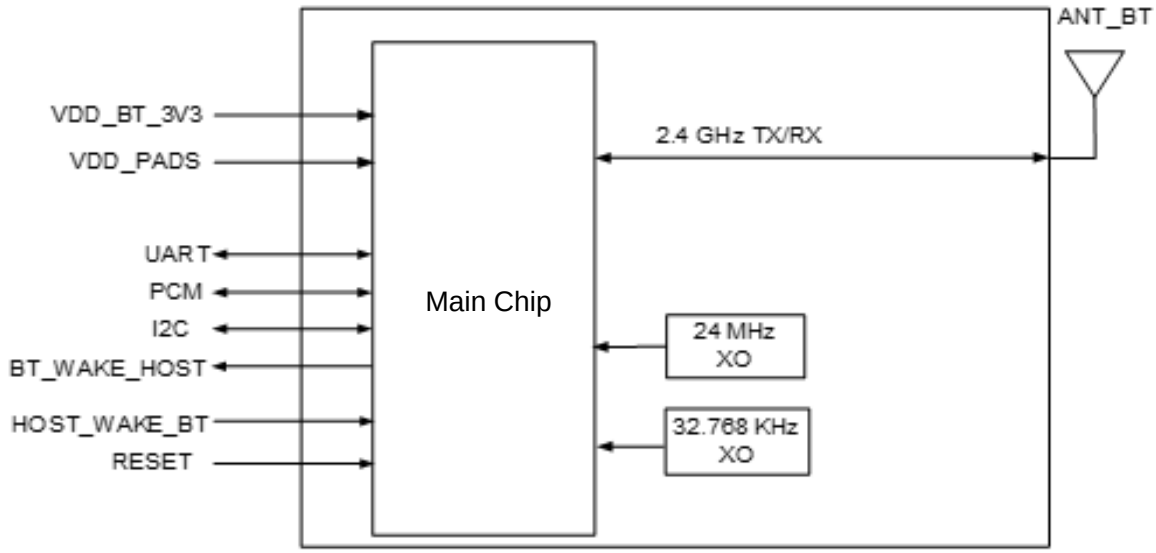


Figure 1: Functional Diagram of AH20C

2.4. EVB

To help customers develop applications with AH20C conveniently, Quectel supplies the evaluation board (UMTS & LTE EVB), USB to RS-232 converter cable, USB data cable, power adapter, 4 antennas, and other peripherals to control or test the module. For more details, see ***document [1]***.

3 Application Interfaces

3.1. General Description

AH20C is equipped with 24 LGA pins. The subsequent chapters will provide a detailed introduction to the following interfaces and pins of the module:

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

3.2. Pin Assignment

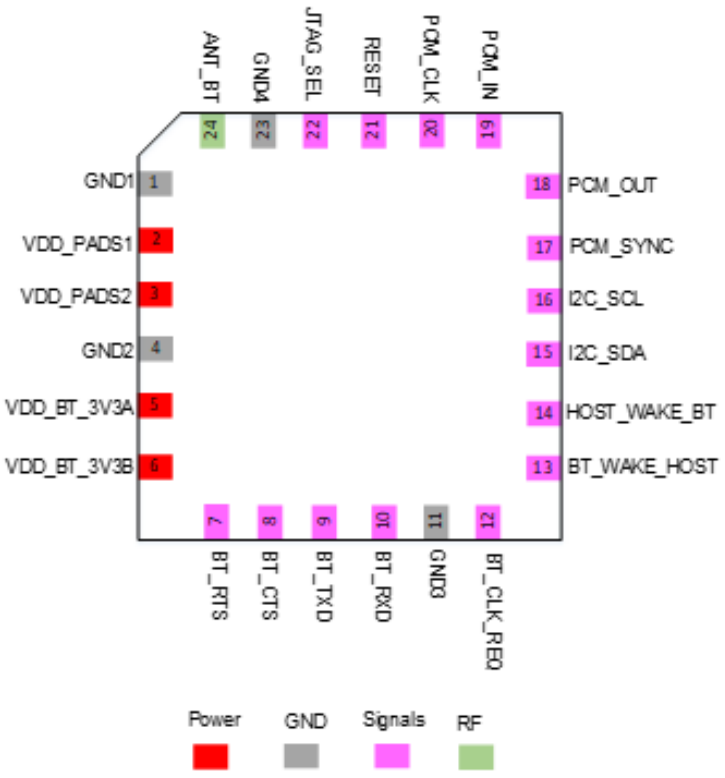


Figure 2: Pin Assignment (Top View)

NOTE

Please keep all RESERVED pins open.

3.3. Pin Description

Table 3: I/O Parameters Definition

Type	Description
AIO	Analog Input Output
DI	Digital Input
DO	Digital Output
DIO	Digital Input Output
OD	Open Drain
PI	Power Input

Table 4: Pin Description

Power Supply				
Pin Name	**Pin No.**	**I/O**	**Description**	**Comment**
VDD_BT_3V3	5, 6	PI	Power supply for the module	It must be provided with sufficient current up to TBD A.
VDD_PADS	2, 3	PI	Power supply for the module's I/O pins	1.8 power domain. It must be provided with sufficient current up to TBD mA.
GND	1, 4, 11, 23			
Bluetooth Application Interfaces				
Pin Name	**Pin No.**	**I/O**	**Description**	**Comment**

BT_WAKE_HOST	13	OD	Bluetooth wakes up the host	1.8 V power domain.
HOST_WAKE_BT	14	OD	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	Bluetooth UART request to send	
BT_CTS	8	DI	Bluetooth UART clear to send	
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	
RF Antenna Interface				
Pin Name	**Pin No.**	**I/O**	**Description**	**Comment**
ANT_BT	24	AIO	Reserved dedicated Bluetooth antenna interface	50 Ω impedance.
Other Interfaces				
Pin Name	**Pin No.**	**I/O**	**Description**	**Comment**
JTAG_SEL	22	DI	ARM JTAG debugging mode control	If unused, keep this pin open.
RESET	21	DI	Module reset	1.8 V power domain.
BT_CLK_REQ	12	DO	Mutual clock application	

3.4. Power Supply

The following table shows the power supply pins and ground pins of AH20C:

Table 5: Definition of Power Supply and GND Pins

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

AH20C is powered by VDD_BT_3V3, and it is recommended to use a power supply chip, which is able to output a current of TBD A at least. The following figure shows a reference design for VDD_BT_3V3 which is controlled by EN_CTRL:

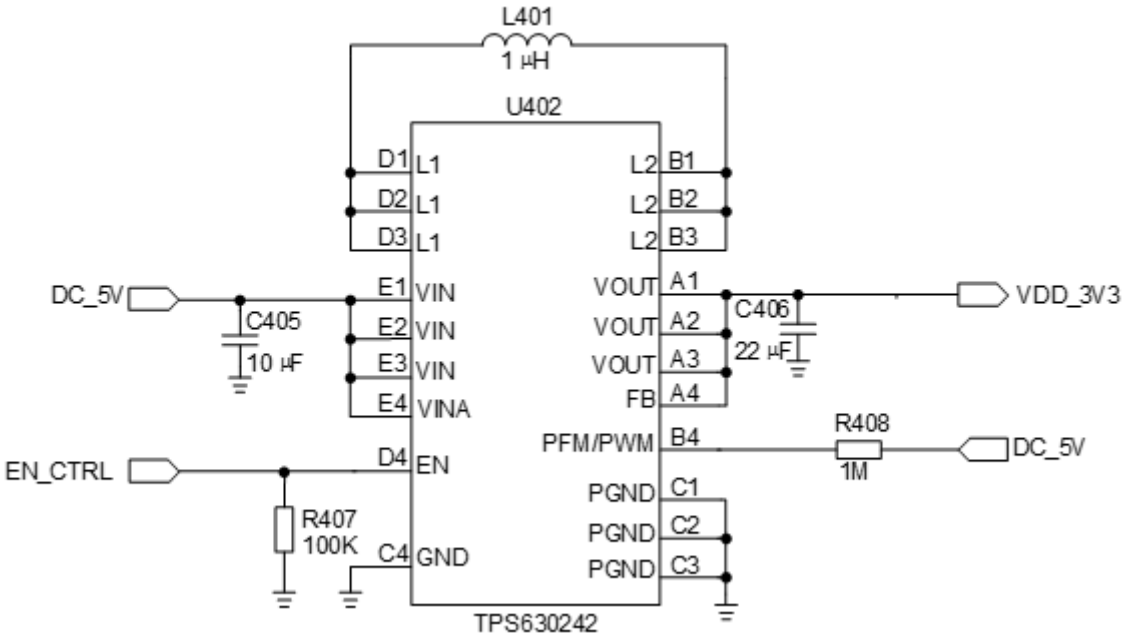


Figure 3: Reference Circuit for VDD_BT_3V3

The power on and off scenario is illustrated in the following figure:

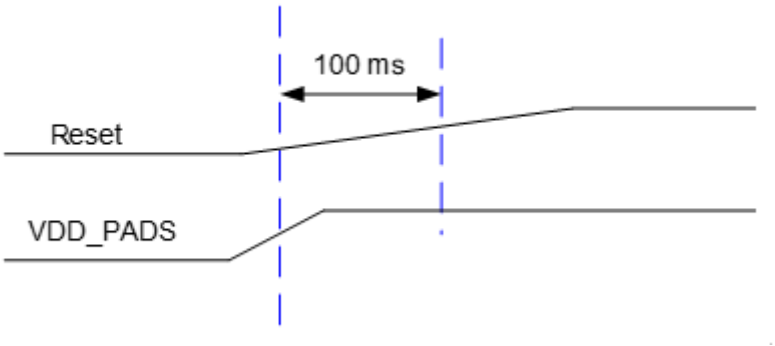


Figure 4: Time Sequence

3.5. Bluetooth Application Interface

For Bluetooth applications, a UART & PCM interface is arranged on AH20C.

The following figure shows the block diagram of Bluetooth application interface connection between AH20C and the host:

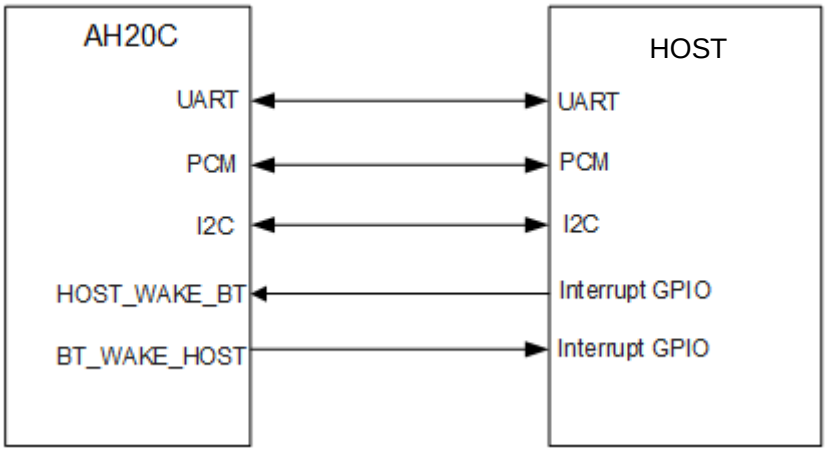


Figure 5: Block Diagram of Bluetooth Interface Connection

3.5.1. BT_WAKE_HOST and HOST_WAKE_BT

Table 6: Pin Definition of BT_WAKEUP_HOST and HOST_WAKEUP_BT

Pin Name	Pin No.	I/O	Description	Comment
HOST_WAKE_BT	14	OD	Host wakes up Bluetooth function	1.8 V power domain.
BT_WAKE_HOST	13	OD	Bluetooth function wakes up host	

3.5.2. PCM Interface

PCM interface is used for audio over Bluetooth. This interface is not suitable for lower power consumption Bluetooth functions. The following table shows the pin definition of PCM interface.

Table 7: 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
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 AH20C and the host:

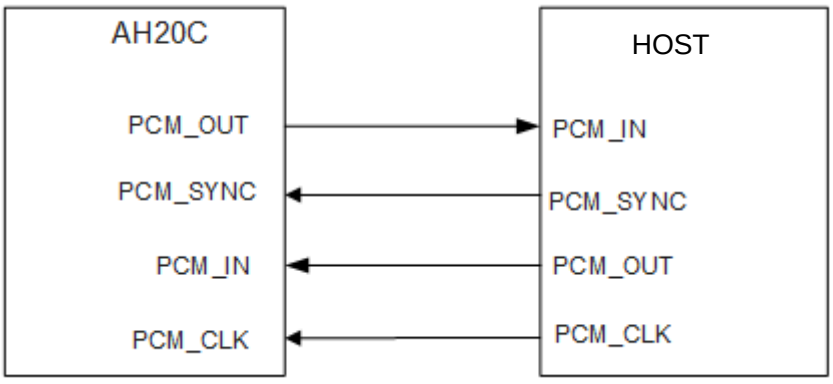


Figure 6: PCM Interface Connection

3.5.3. BT_UART

The following table shows the pin definition of BT_UART:

Table 8: Pin Definition of BT_UART

Pin Name	Pin No.	I/O	Description	Comment
BT_RTS	7	DO	Bluetooth UART request to send	1.8 V power domain.
BT_CTS	8	DI	Bluetooth UART clear to send	
BT_TXD	9	DO	Bluetooth UART transmit	
BT_RXD	10	DI	Bluetooth UART receive	

The following figure shows the reference design for BT_UART connection between AH20C and the host:

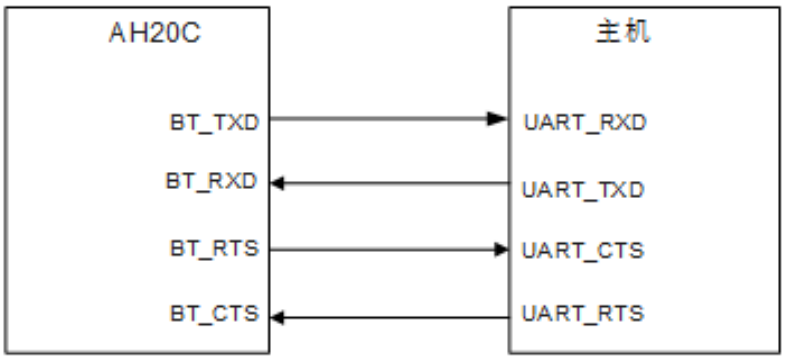


Figure 7: BT_UART Connection

3.6. Other Interfaces

3.6.1. JTAG_SEL

JTAG_SEL can be used to control ARM JTAG debugging mode.

Table 9: Pin Definition of JTAG_SEL

Pin Name	Pin No.	I/O	Description	Comment
JTAG_SEL	22	DI	ARM JTAG debugging mode control	If unused, keep this pin open.

3.6.2. RESET

RESET is used to reset the module.

Table 10: Pin Definition of RESET

Pin Name	Pin No.	I/O	Description	Comment
RESET	21	DI	Module reset	1.8 V power domain.

3.6.3. BT_CLK_REQ

BT_CLK_REQ is used for mutual clock application with the host.

Table 11: Pin Definition of RESET

Pin Name	Pin No.	I/O	Description	Comment
BT_CLK_REQ	12	DO	Mutual clock application	1.8 V power domain.

3.7. RF Antenna Interfaces

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

3.7.1. Pin Definition of RF Antenna Interface

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

Table 12: Pin Definition of RF Antenna Interfaces

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

3.7.2. Operating Frequency

Table 13: Operating Frequency of the Module

Feature	Frequency	Unit
BLE	2.402–2.480	GHz

3.7.3. Reference Design of RF Antenna Interfaces

The RF trace in host PCB connected to the module's RF antenna pin shall be microstrip line or other types of RF trace, with characteristic impendence close to 50 Ω. AH20C comes with grounding pins which are next to the antenna pin in order to give a better grounding.

It is recommended to reserve a π-type and two LCs matching circuit for better RF performance. C2/L1 and L3/C3 include two notch filter circuits for filtering out interference caused by specific frequencies. When L3/C2/L1/C3 is not attached, C1/R1/C4 forms a π-type matching circuit. Capacitor (C1/C2/C3/C4) and inductor (L1/L3) are not mounted by default. By default, R1 is the 0 Ω resistor.

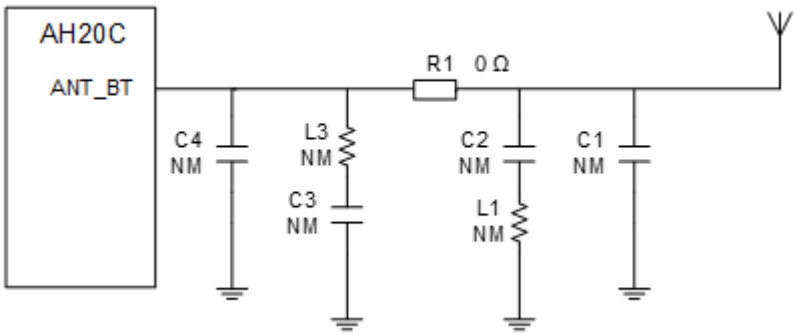


Figure 8: Reference Circuit for RF Antenna Interfaces

3.7.4. Reference Design of RF Layout

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.

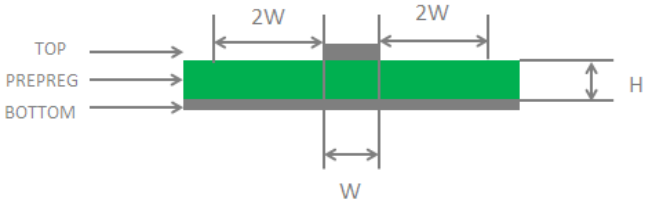


Figure 9: Microstrip Design on a 2-layer PCB

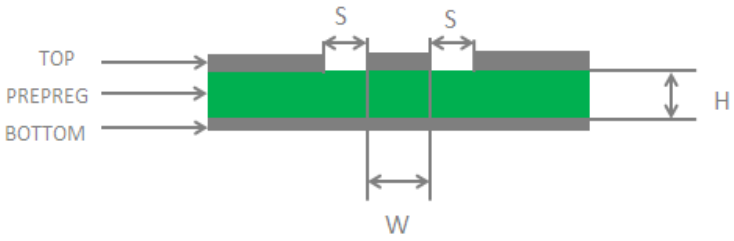


Figure 10: Coplanar Waveguide Design on a 2-layer PCB

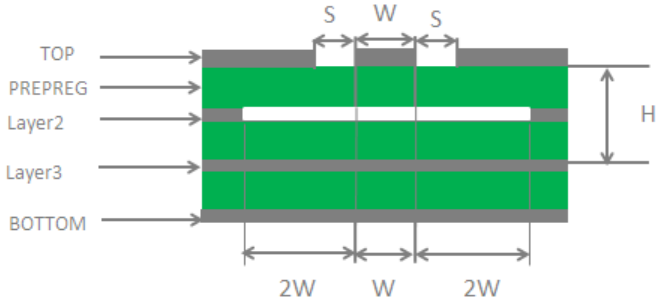


Figure 11: Coplanar Waveguide Design on a 4-layer PCB (Layer 3 as Reference Ground)

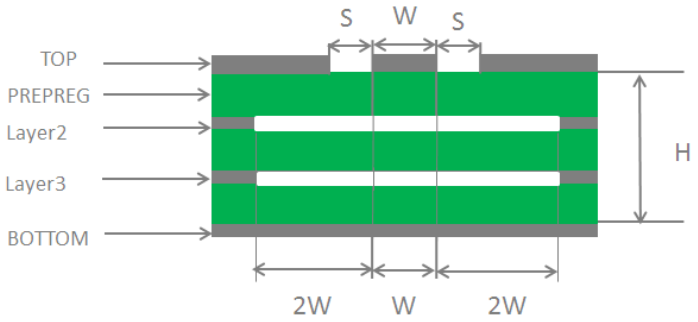


Figure 12: Coplanar Waveguide Design on a 4-layer PCB (Layer 4 as Reference Ground)

To ensure RF performance and reliability, the following principles should be complied with 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 no less than two times 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].***

3.7.5. Requirements for Antenna Design

The following tables show the requirements on antenna cables and antennas:

Table 14: Antenna Cable Requirements

Type	Requirements
2.402–2.480 GHz	Cable insertion loss <1 dB

Table 15: Antenna Requirements

Type	Requirements
Frequency Range	2.402–2.480 GHz
VSWR	< 2:1
Gain (dBi)	1 (typical)
Max Input Power (W)	50
Input Impedance (Ω)	50
Polarization Type	Vertical

3.7.6. RF Connector Recommendation

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

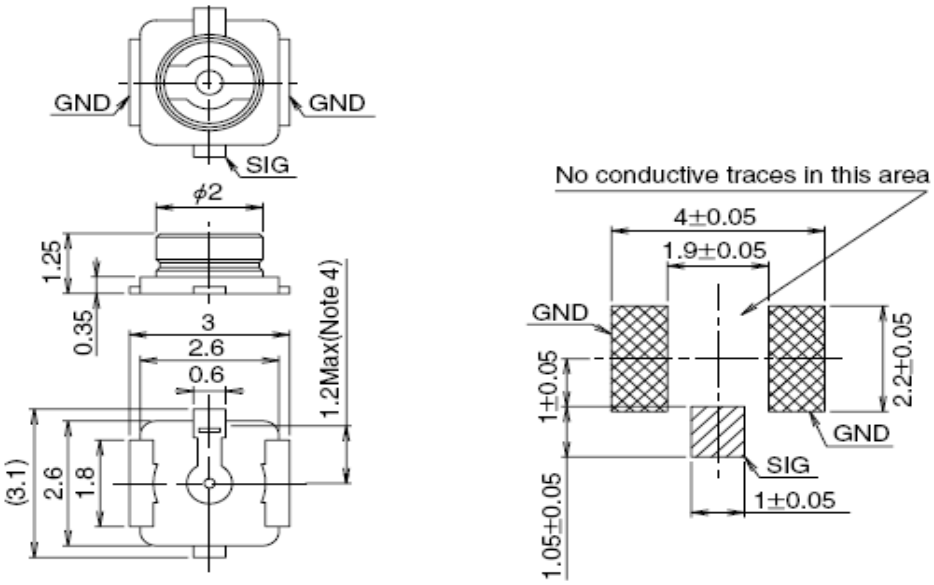


Figure 13: Dimensions of the U.FL-R-SMT Connector (Unit: mm)

U.FL-LP serial connectors listed in the following figure can be used to match the U.FL-R-SMT.

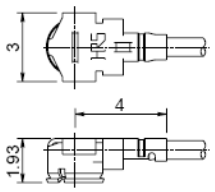
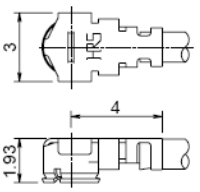
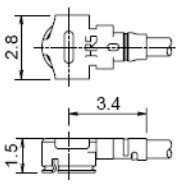
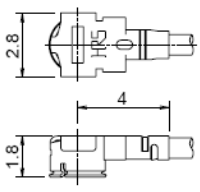
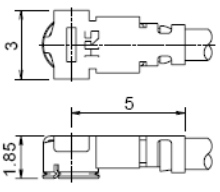
Part No.	U.FL-LP-040	U.FL-LP-066	U.FL-LP(V)-040	U.FL-LP-062	U.FL-LP-088
					
Mated Height	2.5mm Max. (2.4mm Nom.)	2.5mm Max. (2.4mm Nom.)	2.0mm Max. (1.9mm Nom.)	2.4mm Max. (2.3mm Nom.)	2.4mm Max. (2.3mm Nom.)
Applicable cable	Dia. 0.81mm Coaxial cable	Dia. 1.13mm and Dia. 1.32mm Coaxial cable	Dia.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

The following figure describes the space factor of mated connector

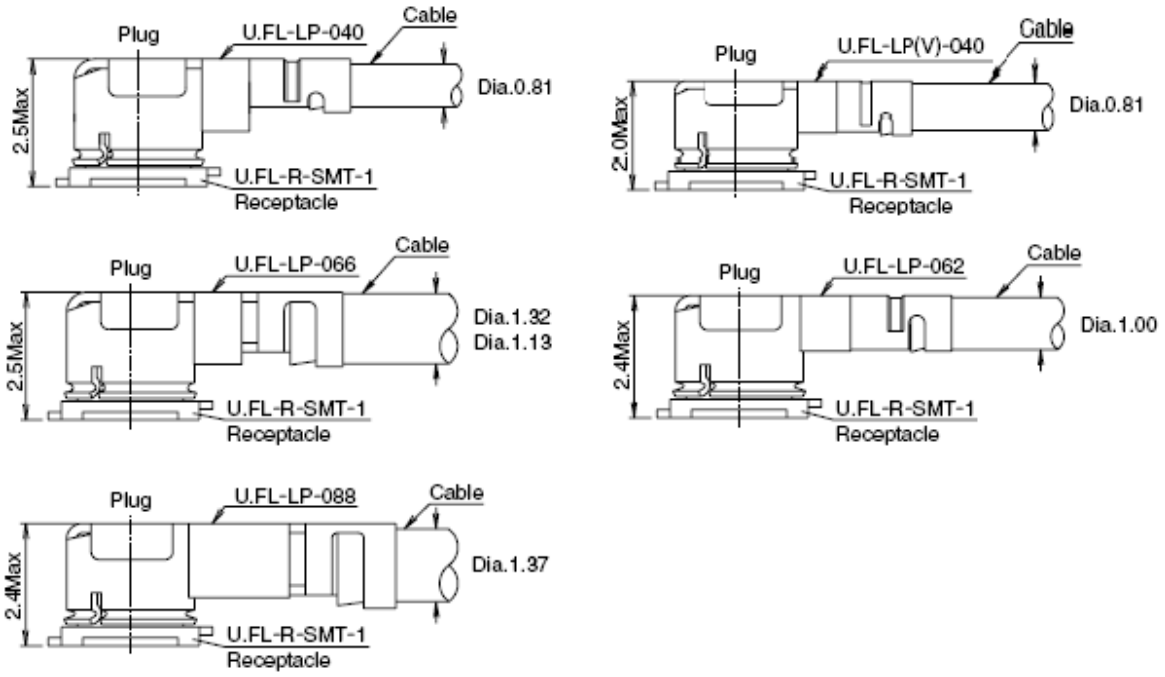


Figure 15: Space Factor of Mated Connector (Unit: mm)

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

4 Electrical Characteristics & Reliability

4.1. 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 16: Absolute Maximum Ratings

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

The following table shows the recommended operating conditions of AH20C.

Table 17: Recommended Operating Conditions

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

4.2. I/O Interface Characteristics

The following table shows the general DC electrical characteristics over recommended operating conditions (unless otherwise specified).

Table 18: General DC Electrical Characteristics

Symbol	Parameter	Min.	Max.	Unit
V_{IH}	High Level Input Voltage	1.1	-	V
V_{IL}	Low Level Input Voltage	-	0.6	V
V_{OH}	High Level Output Voltage	1.4	-	V
V_{OL}	Low Level Output Voltage	-	0.4	V

4.3. Power Consumption

The values of power consumption for AH20C in non-signaling low power mode is shown as below:

Table 19: Power Consumption of the Module (Non-signaling Low Power Mode)

Conditions	Frequency	$I_{VDD\_BT\_3V3}$	I_{VDD_PADS}	Unit
TX	CH0	TBD	TBD	mA
	CH19	TBD	TBD	mA
	CH39	TBD	TBD	mA
RX	CH0	TBD	TBD	mA
	CH19	TBD	TBD	mA
	CH39	TBD	TBD	mA

4.4. RF Performances

The following tables summarize the transmitting and receiving performances of AH20C:

Table 20: Conducted RF Performance of BLE

Frequency	Transmitting Power (Typ.)	Receiving Sensitivity (Typ.)	Unit
0	TBD	TBD	dBm
19	TBD	TBD	dBm
39	TBD	TBD	dBm

4.5. ESD

If the static electricity generated by various ways discharges to the module, the module maybe damaged to a certain extent. Thus, please take proper ESD countermeasures and handling methods. For example, wearing anti-static gloves during the development, production, assembly and testing of the module; adding ESD protective components to the ESD sensitive interfaces and points in the product design.

Table 21: Electrostatic Discharge Characteristics

Tested Interfaces	Contact Discharge	Air Discharge	Unit
VDD_BT_3V3	TBD	TBD	kV
GND	TBD	TBD	kV
RF	TBD	TBD	kV

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

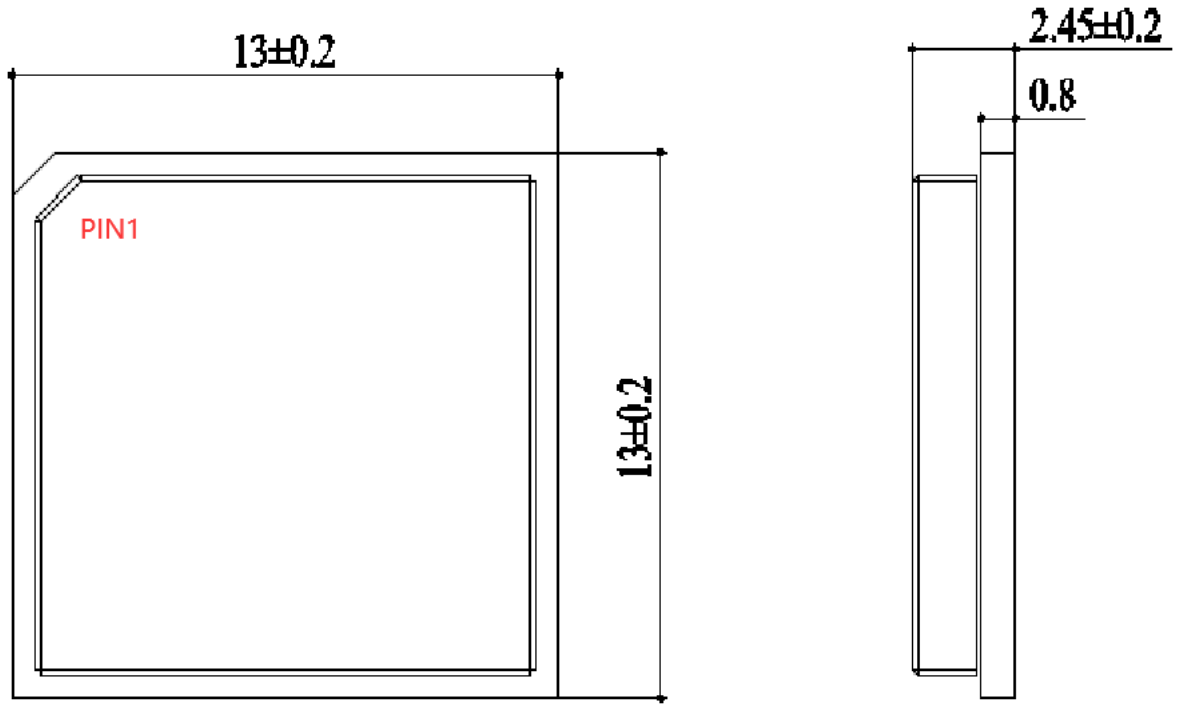


Figure 16: Top and Side Dimensions

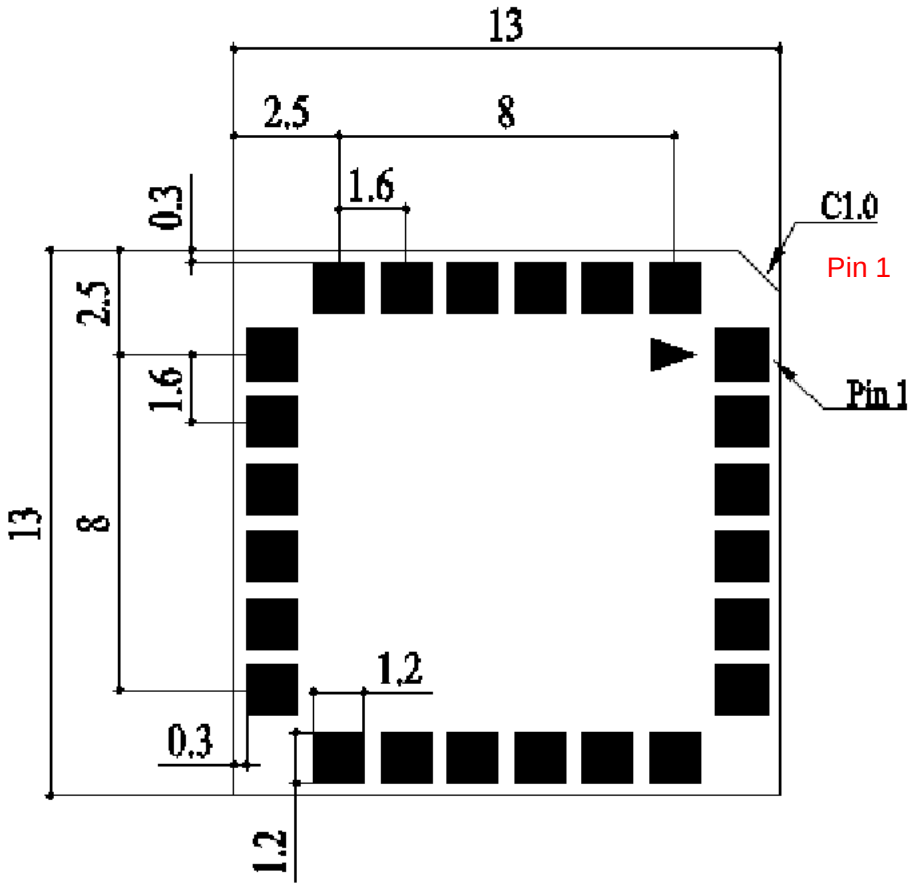


Figure 17: Bottom Dimension (Top View)

NOTE

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

5.2. Recommended Footprint

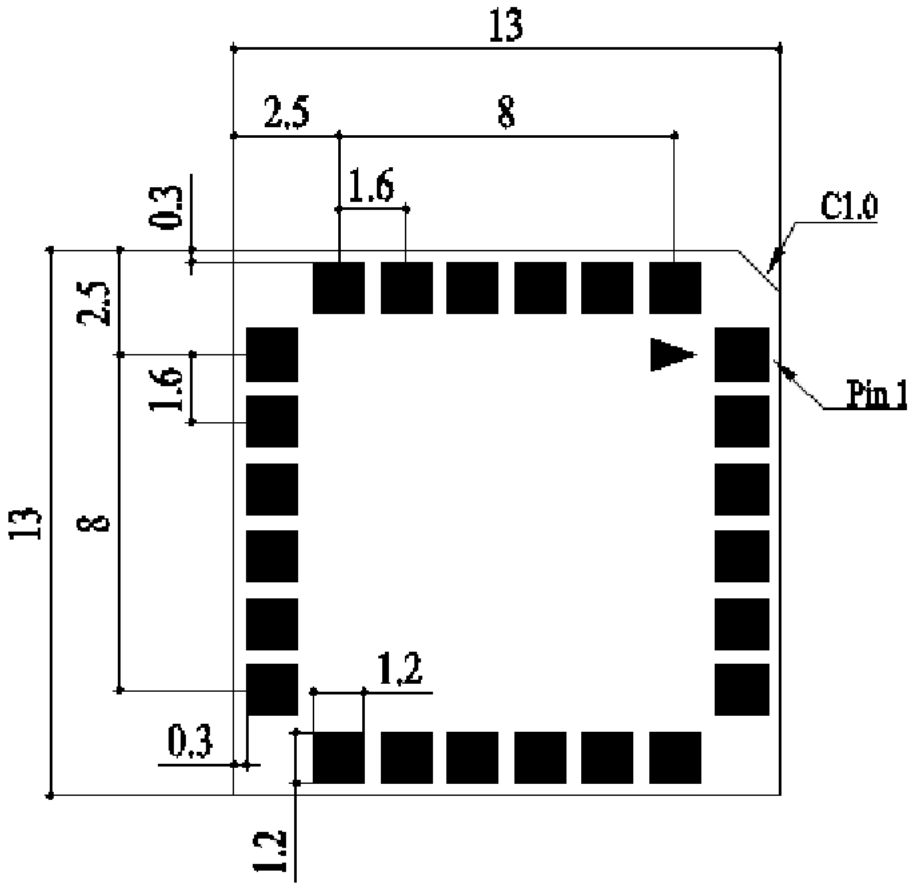


Figure 18: Recommended Footprint (Top View)

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

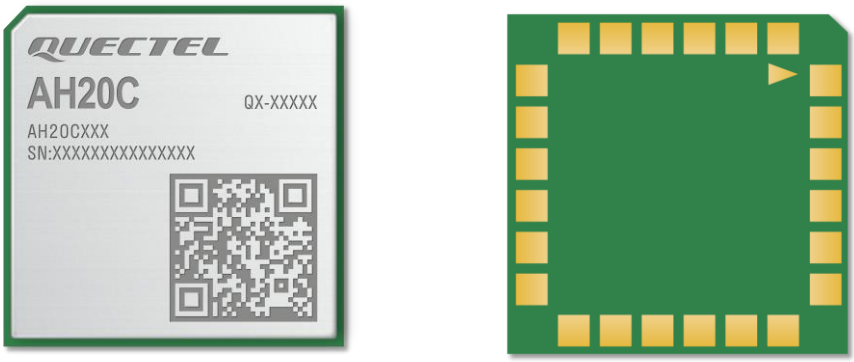


Figure 19: Top and Bottom Views of the Module

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. The storage life (in vacuum-sealed packaging) is 12 months in Recommended Storage Condition.

3. The floor life of the module is 168 hours [1] in a plant 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 drying 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 above occurs;
   - 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;
   - All modules must be soldered to PCB within 24 hours after the baking, otherwise they should be put in a dry environment such as in a drying oven.

[1] 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. All modules must be soldered to PCB within 24 hours after the baking, otherwise put them in the drying oven. 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. The force on the squeegee should be adjusted properly to produce a clean stencil surface on a single pass. To ensure the 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]***.

It is suggested that the peak reflow temperature is 235 °C to 246 ºC, and the absolute maximum reflow temperature is 246 ºC. To avoid damage to the module caused by repeated heating, it is strongly recommended that the module should be mounted 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.

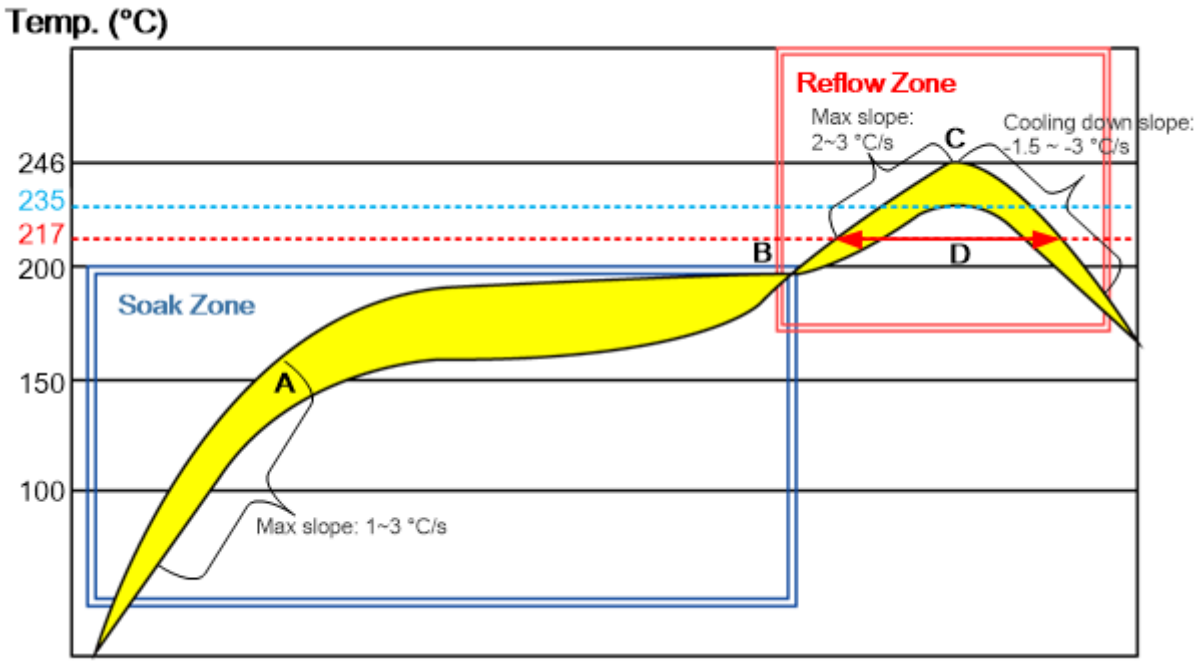


Figure 20: Recommended Reflow Soldering Thermal Profile

Table 22: Recommended Thermal Profile Parameters

Factor	Recommendation
Soak Zone	
Max slope	1–3 °C/s
Soak time (between A and B: 150 °C and 200 °C)	70–120 s
Reflow Zone	
Max slope	2–3 °C/s
Reflow time (D: over 220 °C)	45–70 s
Max temperature	235 °C to 246 °C
Cooling down slope	-1.5 to -3 °C/s
Reflow Cycle	
Max reflow cycle	1

NOTE

1. 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.
2. 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.
3. 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.

6.3. Packaging

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

6.3.1. Carrier Tape

Dimension details are as follow:

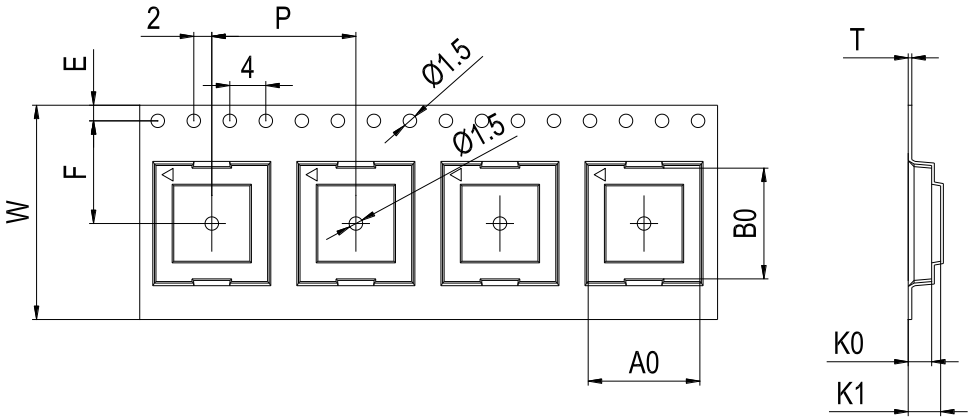


Figure 21: Carrier Tape Dimension Drawing

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

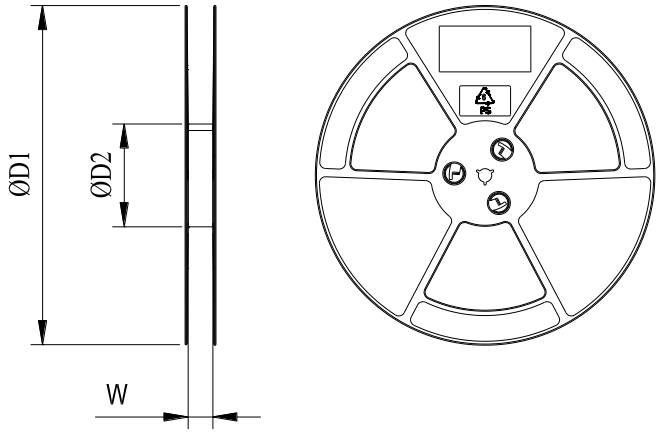
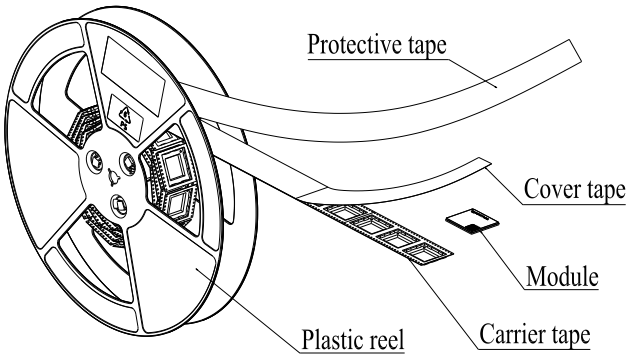


Figure 22: Plastic Reel Dimension Drawing

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

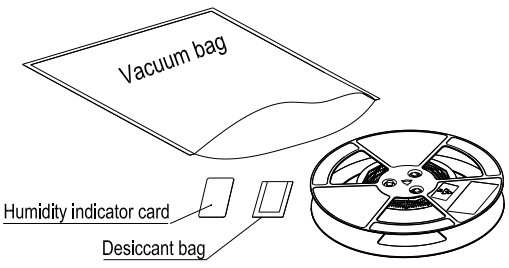
øD1	øD2	W
330	100	24.5

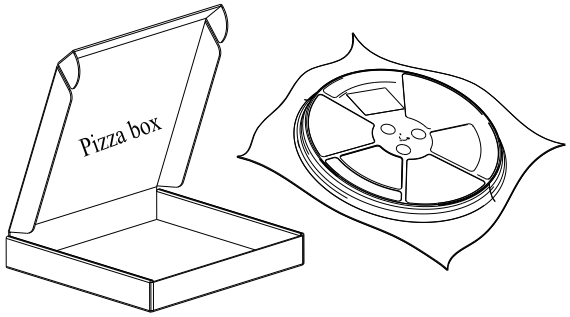
6.3.3. Packaging Process



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

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





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

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

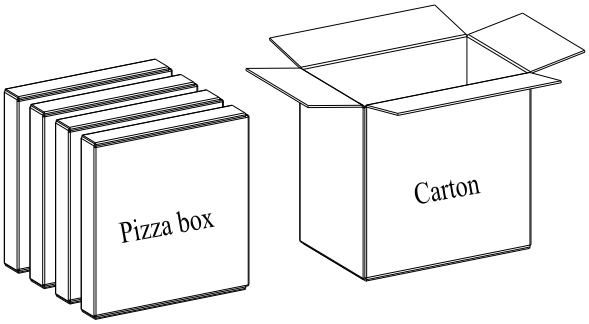


Figure 23: Packaging Process

7 Appendix References

Table 25: Related Documents

Document Name
[1] Quectel_UMTS&LTE_EVB_User_Guide
[2] Quectel_RF_Layout_Application_Note
[3] Quectel_Module_Secondary_SMT_User_Guide

Table 26: Terms and Abbreviations

Abbreviation	Description
GFSK	Gauss Frequency Shift Keying
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
ESD	Electrostatic Discharge
GND	Ground
IEEE	Institute of Electrical and Electronics Engineers
I/O	Input/Output
LTE	Long Term Evolution

Mbps	Million Bits Per Second
PCB	Printed Circuit Board
PCM	Pulse Code Modulation
RF	Radio Frequency
RH	Relative Humidity
RoHS	Restriction of Hazardous Substances
RTS	Request to Send
RXD	Receive Data
SMT	Surface Mount Technology
STA	Station
TXD	Transmit Data
UART	Universal Asynchronous Receiver/Transmitter
VDD	Voltage Power for Digital Device
USB	Universal Serial Bus
V_{IH}max	Maximum Input High Level Voltage Value
V_{IH}min	Minimum Input High Level Voltage Value
V_{IL}max	Maximum Input Low Level Voltage Value
V_{IL}min	Minimum Input Low Level Voltage Value
VIO	Voltage for Input/Output Port
V_{OL}max	Maximum Output Low Level Voltage Value
V_{OH}min	Minimum Output High Level Voltage Value
VSWR	Voltage Standing Wave Ratio