BC95 Hardware Design

NB-IoT Module Series

Rev. BC95_Hardware_Design_V1.0

Date: 2016-10-12

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About the Document

History

Revision	Date	Author	Description
1.0	2016-10-12	Bryant CHEN/ Mark ZHANG	Initial

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1 Introduction

This document defines the BC95 module and describes its hardware interface which are connected with your application and the air interface.

This document can help you quickly understand module interface specifications, electrical and mechanical details. Associated with application note and user guide, you can use BC95 module to design and set up mobile applications easily.

1.1. Safety Information

The following safety precautions must be observed during all phases of the operation, such as usage, service or repair of any cellular terminal or mobile incorporating BC95 module. Manufacturers of the cellular terminal should send the following safety information to users and operating personnel, and incorporate these guidelines into all manuals supplied with the product. If not so, Quectel assumes no liability for the customer's failure to comply with these precautions.

	Full attention must be given to driving at all times in order to reduce the risk of an accident. Using a mobile while driving (even with a handsfree kit) causes distraction and can lead to an accident. You must comply with laws and regulations restricting the use of wireless devices while driving.
	Switch off the cellular terminal or mobile before boarding an aircraft. Make sure it is switched off. The operation of wireless appliances in an aircraft is forbidden, so as to prevent interference with communication systems. Consult the airline staff about the use of wireless devices on boarding the aircraft, if your device offers an Airplane Mode which must be enabled prior to boarding an aircraft.
	Switch off your wireless device when in hospitals, clinics or other health care facilities. These requests are desinged to prevent possible interference with sensitive medical equipment.
	Cellular terminals or mobiles operating over radio frequency signal and cellular network cannot be guaranteed to connect in all conditions, for example no mobile fee or with an invalid USIM card. While you are in this condition and need emergent help, please remember using emergency call. In order to make or receive a call, the cellular terminal or mobile must be switched on and in a service area with adequate cellular signal strength.
	Your cellular terminal or mobile contains a transmitter and receiver. When it is ON, it receives and transmits radio frequency energy. RF interference can occur if it is used close to TV set, radio, computer or other electric equipment.
	In locations with potentially explosive atmospheres, obey all posted signs to turn off wireless devices such as your phone or other cellular terminals. Areas with potentially explosive atmospheres include fuelling areas, below decks on boats, fuel or chemical transfer or storage facilities, areas where the air contains chemicals or particles such as grain, dust or metal powders, etc.

2 Product Concept

2.1. General Description

BC95 is a series of NB-IoT module which contains three variants: BC95-CM, BC95-SL and BC95-VF. It is designed to communicate with Mobile Network Operator infrastructure equipment using the NB-IoT radio protocol (3GPP Rel-13). The following table shows the frequency bands of BC95 series module.

Table 1: Frequency Bands of BC95 Series Module

Mode	BC95-CM	BC95-SL	BC95-VF
H-FDD	B8 (900MHz)	B5 (850MHz)	B20 (800MHz)

The BC95 is designed to support a very large number of connected terminal devices (up to 100,000 per cell), and it supports adaptive modulation coding and spreading schemes to enable a trade-off between coverage and bit rate.

With a tiny profile of 19.9mm × 23.6mm × 2.2mm, the module can meet almost all the requirements for IoT applications, including vehicles and personal tracking, security system, wireless POS, industrial PDA, smart metering, remote maintenance & control, etc.

BC95 is an SMD type module with LCC package, which can be easily embedded into applications. It provides abundant hardware interfaces such as ADC and UART interfaces.

Designed with power saving technique, the BC95 consumes an ultra-low current in SLEEP mode.

The module fully complies with the RoHS directive of the European Union.

2.2. Key Features

The following table describes the detailed features of BC95 module.

Table 2: BC95 Key Features

Feature	Implementation
Power Supply	Supply voltage: 3.1V ~ 4.2V Typical supply voltage: 3.8V
Power Saving	Ultra-low sleep current
Transmitting Power	23dBm±2dB
Temperature Range	● Operation temperature range[1]: -35°C ~ +75°C ● Extended temperature range[2]: -40°C ~ +85°C
USIM Interface	Support USIM card: 3.0V
SWD Interface	SWD port: ● Two lines on SWD port interface: SWD_CLK and SWD_DATA ● SWD port can be used for firmware upgrading
UART Interfaces	Main port: ● Three lines on main port interface ● Used for AT command communication and data transmission ● Only support 9600bps baud rate Debug port: ● Two lines on debug port interface: DBG_TXD and DBG_RXD ● Debug port is used for debugging ● Only support 921600bps baud rate
Physical Characteristics	Size: 19.9±0.15 × 23.6±0.15 × 2.2±0.2mm Weight: Approx 1.6g
Firmware Upgrade	Firmware upgrade via SWD port
Antenna Interface	Connected to antenna pad with 50 Ohm impedance control

NOTES

1. [1] Within operation temperature range, the module is 3GPP compliant.
2. [2] Within extended temperature range, the module remains the ability to establish and maintain SMS, data transmission, etc. There is no unrecoverable malfunction; there are also no effects on radio spectrum and no harm to radio network. Only one or more parameters like P_{out} might reduce in their value and exceed the specified tolerances. When the temperature returns to the normal operating temperature levels, the module will meet 3GPP compliant again.

2.3. Functional Diagram

The following figure shows a block diagram of BC95 and illustrates the major functional parts.

- Radio frequency
- Power management
- Peripheral interface

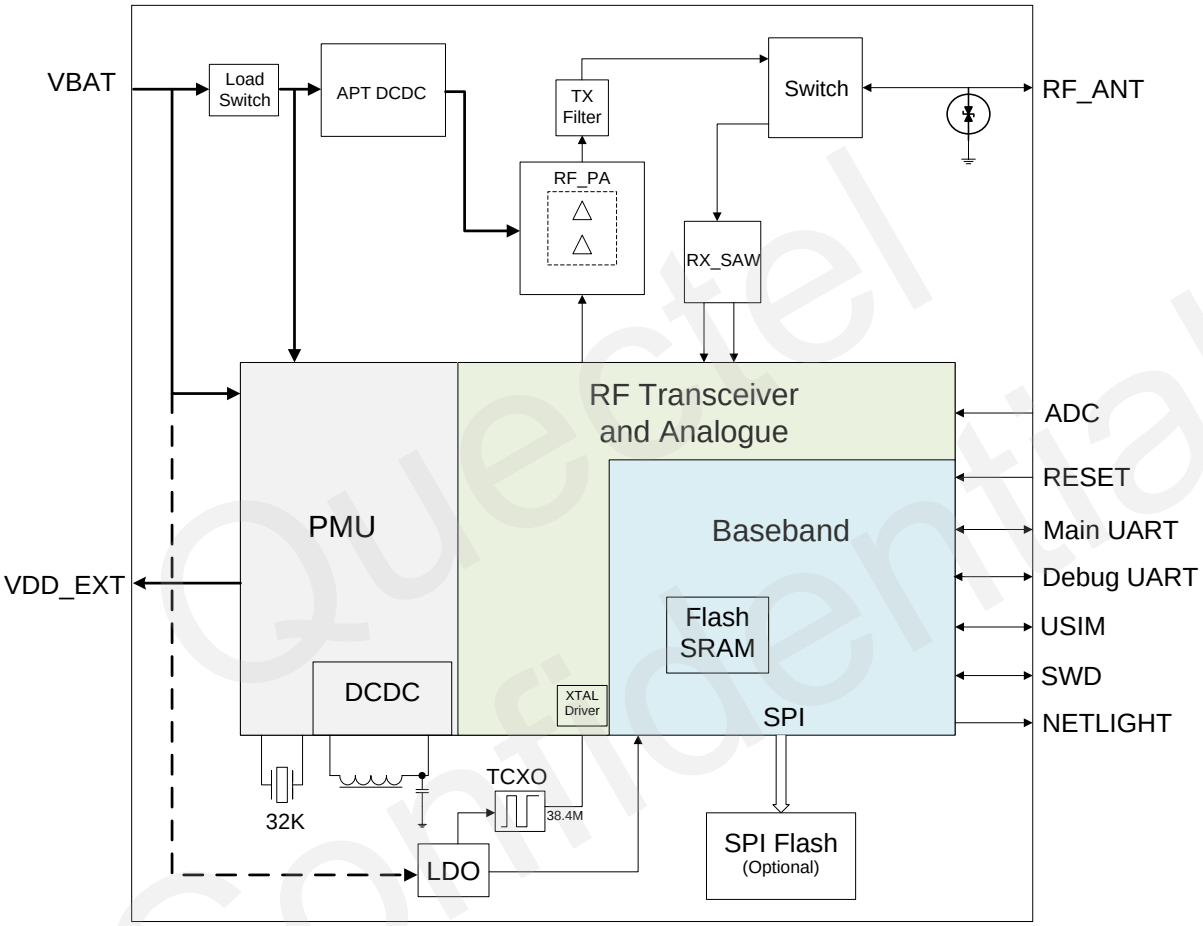

Figure 1: Functional Diagram

2.4. Evaluation Board

In order to help you to develop applications with BC95, Quectel supplies the evaluation board (EVB), RS-232 to USB cable, power adapter, antenna and other peripherals to control or test the module.

3 Application Functions

3.1. General Description

BC95 is equipped with 54-pin 1.1mm pitch SMT pads plus 40-pin ground pads and reserved pads. The following chapters provide detailed descriptions of these pins:

- Power supply
- SWD interface
- UART interfaces
- USIM interface
- ADC interface
- RF interface
- NETLIGHT

3.2. Pin Assignment

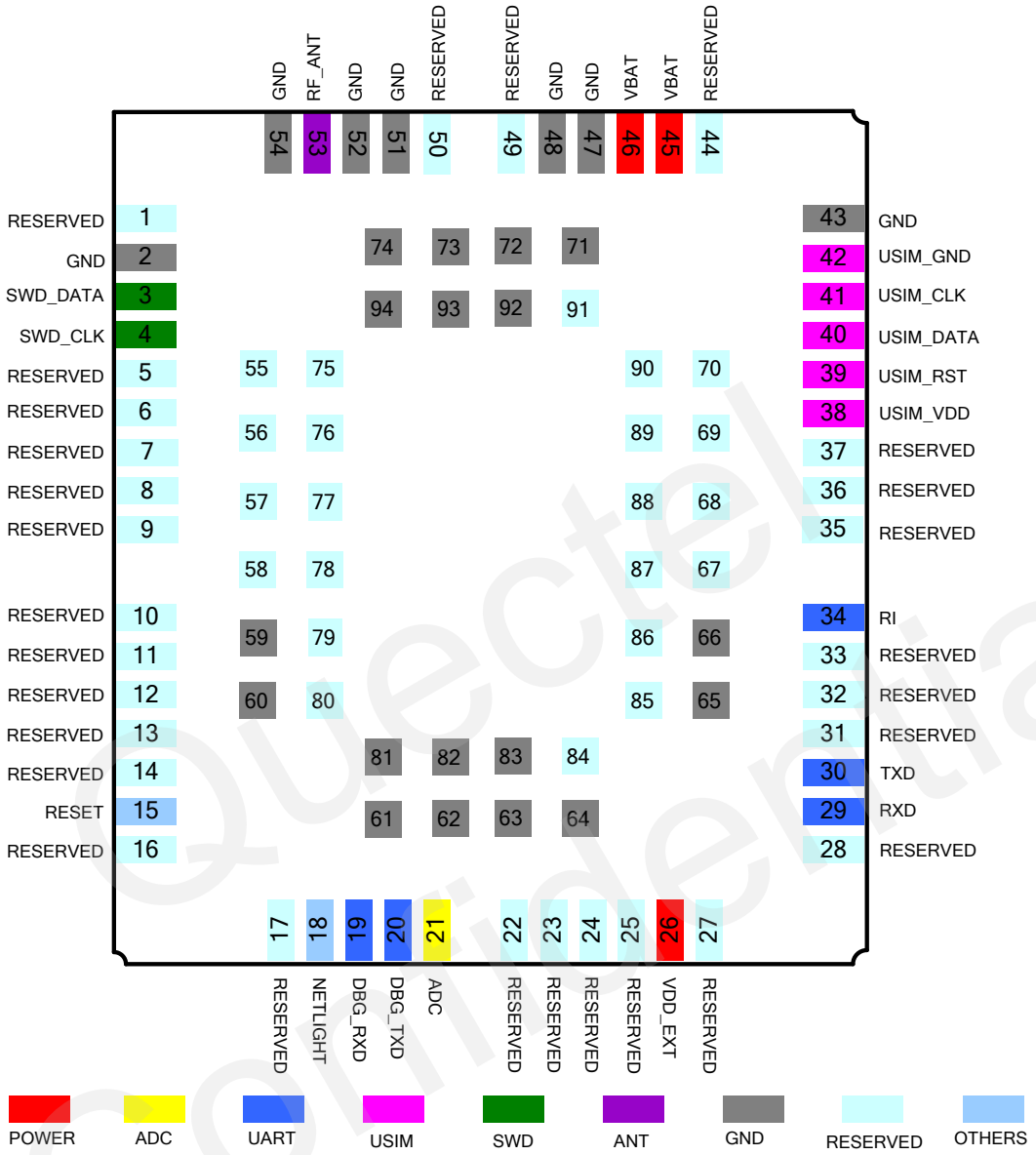

Figure 2: Pin Assignment

3.3. Pin Description

The following tables show the pin definition and description of BC95.

Table 3: I/O Parameters Definition

Type	Description
IO	Bidirectional input/output
DI	Digital input
DO	Digital output
PI	Power input
PO	Power output
AI	Analog input
AO	Analog output
OD	Open drain

Table 4: Pin Description

Power Supply					
Pin Name	**Pin No.**	**I/O**	**Description**	**DC Characteristics**	**Comment**
VBAT	45, 46	PI	Main power supply of the module: VBAT=3.1V~4.2V	Vmax=4.2V Vmin=3.1V Vnorm=3.8V	
VDD_EXT	26	PO	Supply 3.0V voltage for external circuit	Vnorm=3.0V $I_O$max=20mA	If unused, keep this pin open. Recommend to add a 2.2~4.7uF bypass capacitor when using this pin for power supply.
GND	2, 43, 47, 48, 51, 52, 54,		Ground		

	59~66, 71~74, 81~83, 92~94				
SWD Interface					
Pin Name	**Pin No.**	**I/O**	**Description**	**DC Characteristics**	**Comment**
SWD_DATA	3	IO	Serial wire data signal	V_{OL}max=0.4V V_{OH}min=2.4V V_{IL}min=-0.3V V_{IL}max=0.6V V_{IH}min=2.1V V_{IH}max=3.3V	Used for firmware upgrading.
SWD_CLK	4	DI	Serial wire clock signal	V_{OL}max=0.4V V_{OH}min=2.4V	
Reset Interface					
Pin Name	**Pin No.**	**I/O**	**Description**	**DC Characteristics**	**Comment**
RESET	15	DI	Reset the module	R_{PU}≈78kΩ V_{IH}max=3.3V V_{IH}min=2.1V V_{IL}max=0.6V	Pull up internally. Active low.
Network Status Indicator					
Pin Name	**Pin No.**	**I/O**	**Description**	**DC Characteristics**	**Comment**
NETLIGHT	18	DO	Network status indication	V_{OL}max=0.4V V_{OH}min=2.4V	If unused, keep this pin open.
ADC interface					
Pin Name	**Pin No.**	**I/O**	**Description**	**DC Characteristics**	**Comment**
ADC	21	AI	General purpose analog to digital converter	Input voltage range: -0.3V to 4.2V	If unused, keep this pin open.
UART Port					
Pin Name	**Pin No.**	**I/O**	**Description**	**DC Characteristics**	**Comment**
RXD	29	DI	Receive data	V_{IL}max=0.6V V_{IH}min=2.1V V_{IH}max=3.3V	3.0V power domain. If unused, keep this pin open.
TXD	30	DO	Transmit data	V_{OL}max=0.4V V_{OH}min=2.4V	3.0V power domain. If unused, keep this pin open.

RI	34	DO	Ring indicator	V_{OL}max=0.4V V_{OH}min=2.4V	3.0V power domain. If unused, keep this pin open.
Debug Port					
Pin Name	**Pin No.**	**I/O**	**Description**	**DC Characteristics**	**Comment**
DBG_RXD	19	DI	Receive data	V_{IL}max=0.6V V_{IH}min=2.1V V_{IH}max=3.3V	If unused, keep these pins open.
DBG_TXD	20	DO	Transmit data	V_{OL}max=0.4V V_{OH}min=2.4V	If unused, keep these pins open.
USIM Interfaces					
Pin Name	**Pin No.**	**I/O**	**Description**	**DC Characteristics**	**Comment**
USIM_VDD	38	DO	Power supply for USIM card	Vnorm=3.0V	All signals of USIM interfaces should be protected against ESD with a TVS diode array. Maximum trace length from the module pad to USIM card connector is 200mm.
USIM_RST	39	DO	USIM reset	V_{OL}max=0.4V V_{OH}min=2.4V	
USIM_DATA	40	IO	USIM data	V_{OL}max=0.4V V_{OH}min=2.4V V_{IL}min=-0.3V V_{IL}max=0.6V V_{IH}min=2.1V V_{IH}max=3.3V	
USIM_CLK	41	DO	USIM clock	V_{OL}max=0.4V V_{OH}min=2.4V	
USIM_GND	42		USIM ground		
RF Interface					
Pin Name	**Pin No.**	**I/O**	**Description**	**DC Characteristics**	**Comment**
RF_ANT	53	IO	RF antenna pad	Impedance of 50Ω	
RESERVED Pins					
Pin Name	**Pin No.**	**I/O**	**Description**	**DC Characteristics**	**Comment**
RESERVED	1, 5~14, 16, 17, 22, 23, 24, 25, 27, 28, 31~33,		Reserved		Keep these pins unconnected.

	35~37, 44, 49, 50, 55~58, 67~70, 75~80, 84~91

3.4. Operating Modes

BC95 module has three operating modes, which can determine availability of functions for different levels of power-saving.

Table 5: Overview of Operating Modes

Mode	Function	
Normal Operation	Active	In Active mode, all functions of the module are available and all processors are active. Radio transmission and reception can be performed. Transitions to Standby mode and Deep-sleep mode can only be initiated in Active mode.
	Standby	In Standby mode, all processors are inactive, but all peripherals can be active. The system clock is active and power consumption is reduced via clock gating and power gating. Standby mode is entered when all processors are executing a wait-for-interrupt (WFI) instruction.
	Deep-sleep	In Deep-sleep, only the 32kHz RTC is working, which means the module can be moved to active state by an RTC interrupt or by an external event through the peripherals that are using the RTC. This mode is entered by all processors setting the “sleep-deep” bit and then executing a WFI instruction.

3.5. Power Supply

3.5.1. Power Supply Pins

BC95 provides two VBAT pins dedicated to connect with the external power supply.

The following table shows the VBAT pins and ground pins.

Table 6: VBAT and GND Pins

Pin Name	Pin No.	Description	Min.	Typ.	Max.	Unit
VBAT	45, 46	Power supply for module	3.1	3.8	4.2	V
GND	2, 43, 47, 48, 51, 52, 54, 59~66, 71~74, 81~83, 92~94	Ground	-	0	-	V

3.5.2. Reference Design for Power Supply

The power supply range of the module is 3.1V to 4.2V. Make sure that the input voltage will never drop below 3.1V even in burst transmission. If the power voltage drops below 3.1V, the module will be abnormal. The power design for the module is very important, as the performance of power supply for the module largely depends on the power source. The power supply is capable of providing the sufficient current up to 0.5A at least.

For better power performance, it is recommended to place a 100uF tantalum capacitor with low ESR (ESR=0.7Ω) and three ceramic capacitors with 100nF, 100pF and 22pF near the VBAT pin. A reference circuit is illustrated in the following figure.

The width of trace should be designed as wider as possible and the principle of the VBAT route is the longer route, the wider trace.

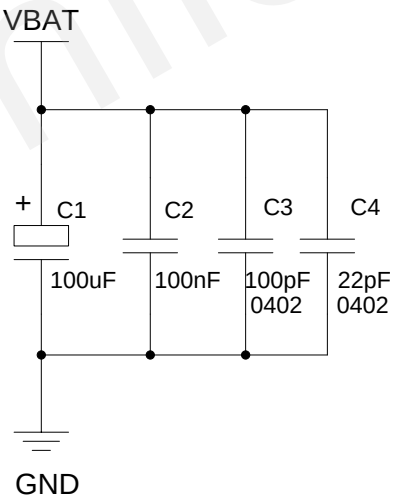

Figure 3: Reference Circuit for the VBAT Input

3.6. Power on and down Scenarios

3.6.1. Power on

The module can be automatically turned on by supplied power source to VBAT pins.

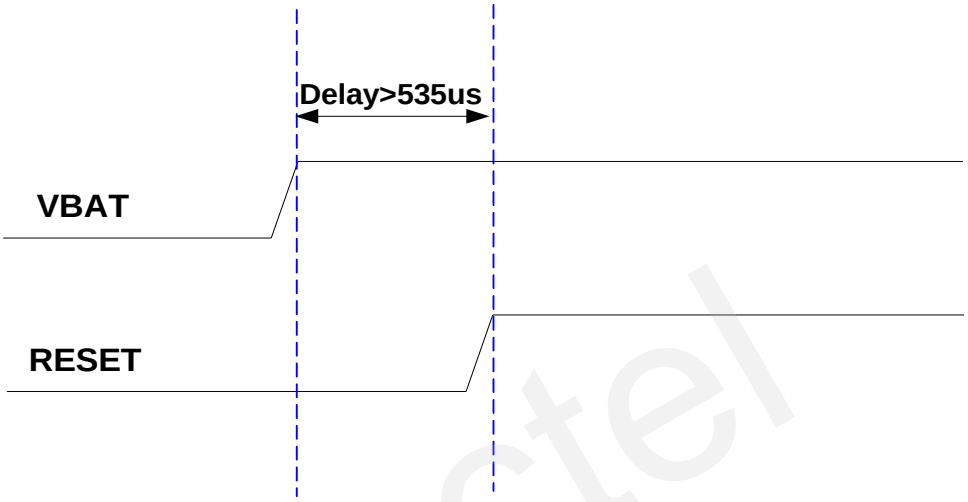

Figure 4: Turn-on Timing

3.6.2. Power down

The module can be turned off by shutting down the VBAT power supply.

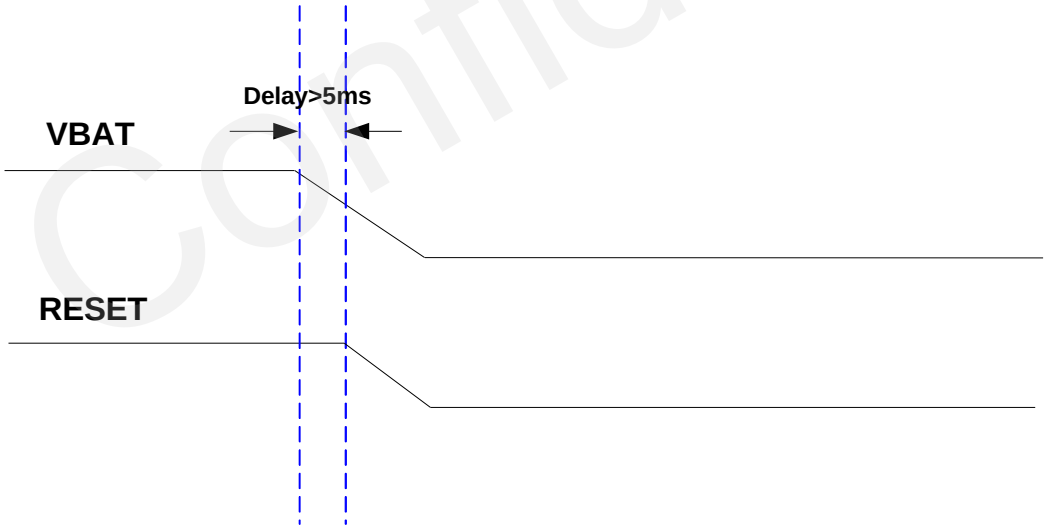

Figure 5: Turn-off Timing

3.6.3. Reset the Module

The module can be reset by driving the reset pin to a low level voltage for a certain time. The reset timing is illustrated as the following table.

Table 7: Reset Characteristics

Pin Name	Pin No.	Description	Reset Time
RESET	15	Reset the module, low active	>100ms

The recommended circuit is shown as below. You can use open drain/collector driver or button to control the RESET.

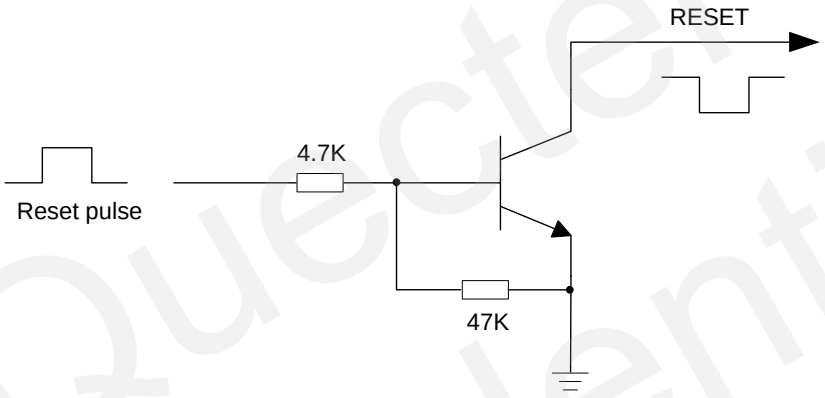

Figure 6: Reference Circuit of RESET by Using Driving Circuit

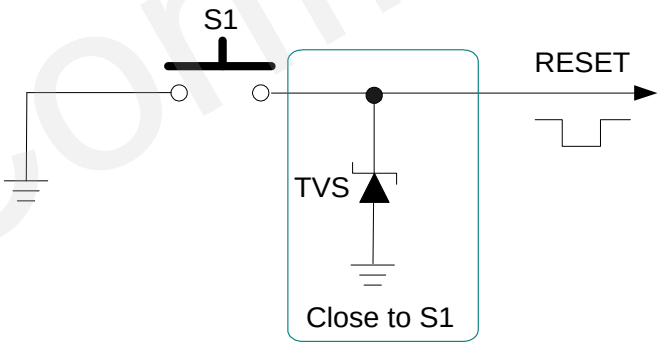

Figure 7: Reference Circuit of RESET by Using Button

3.7. SWD Interface

The module provides one Serial Wire Debug (SWD) interface for firmware upgrading. It is recommended to reserve SWD interface in order to upgrade firmware.

Table 8: Pin Definition of SWD Interfaces

Interfaces	Name	Pin NO.	Description
SWD	SWD_DATA	3	Serial wire data signal
SWD	SWD_CLK	4	Serial wire clock signal

The following figure is a reference design for SWD interface.

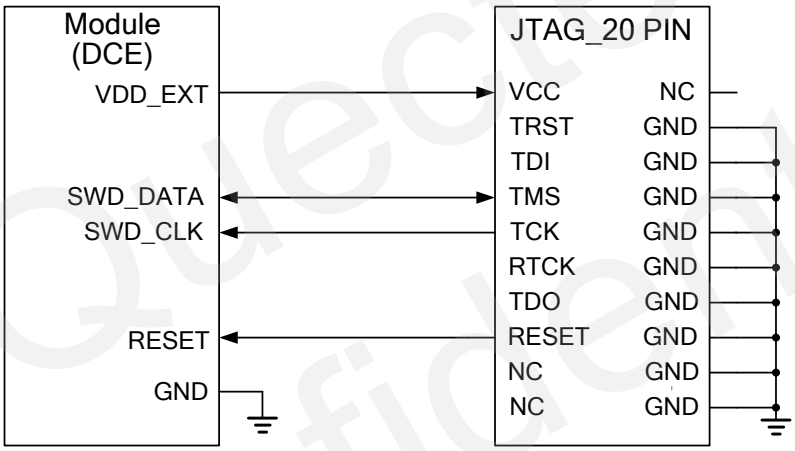

Figure 8: Reference Design for SWD Interface

3.8. UART Interfaces

The module provides two UART ports: main port and debug port. The module is designed as a DCE (Data Communication Equipment), following the traditional DCE-DTE (Data Terminal Equipment) connection.

The main port:

- TXD: Send data to RXD of DTE.
- RXD: Receive data from TXD of DTE.
- RI: Ring indicator (when the SMS, data of the module are coming, the module will output signal to inform DTE).

The debug port:

- DBG_TXD: Send data to the COM port of computer.
- DBG_RXD: Receive data from the COM port of computer.

The logic levels are described in the following table.

Table 9: Pin Definition of the UART Interfaces

Interfaces	Pin No.	Pin Name	Description	Comment
Debug Port	19	DBG_RXD	Receive data	3.0V power domain
	20	DBG_TXD	Transmit data	3.0V power domain
Main Port	29	RXD	Receive data	3.0V power domain
	30	TXD	Transmit data	3.0V power domain
	34	RI	Ring indicator	3.0V power domain

Table 10: Logic Levels of the UART Interfaces

Parameter	Min.	Max.	Unit
V_{IL}	-0.1 × VDD_EXT	0.2 × VDD_EXT	V
V_{IH}	0.7×VDD_EXT	1.1×VDD_EXT	V
V_{OL}		0.4	V
V_{OH}	2.4	VDD_EXT	V

3.8.1. Main Port

Main port can be used for AT command communication and data transmission. The baud rate is 9600bps.

When main port is applied in modulation-demodulation, a reference design for main port connection is shown as below.

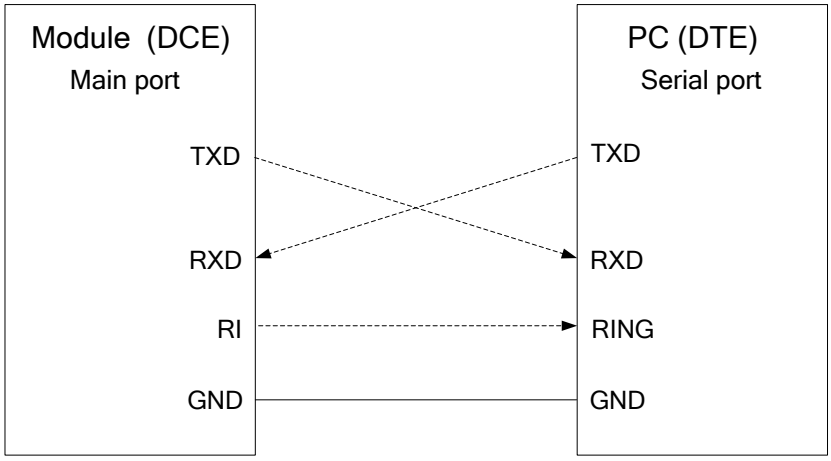

Figure 9: Reference Design for Main Port

3.8.2. Debug Port

Debug port can only be used to capture the system's log with UE Log View tool and output the log. The baud rate is 921600bps.

A reference design for debug port is shown as below.

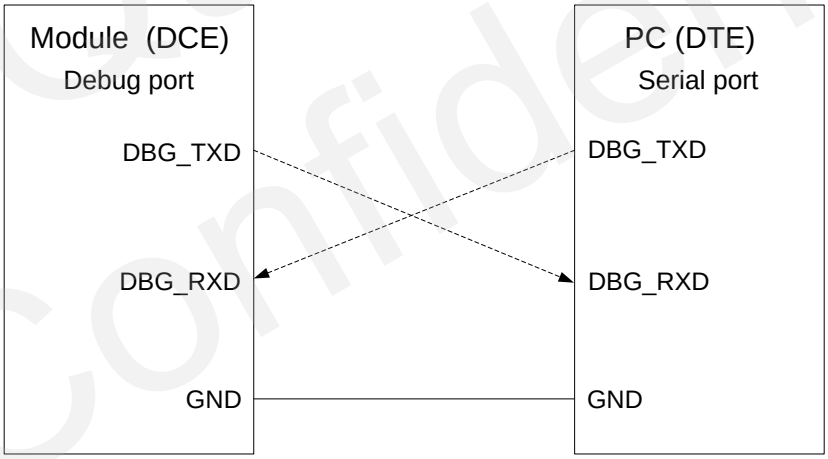

Figure 10: Reference Design for Debug Port

3.8.3. The UART Application

A reference design of 3.3V level match is shown as below.

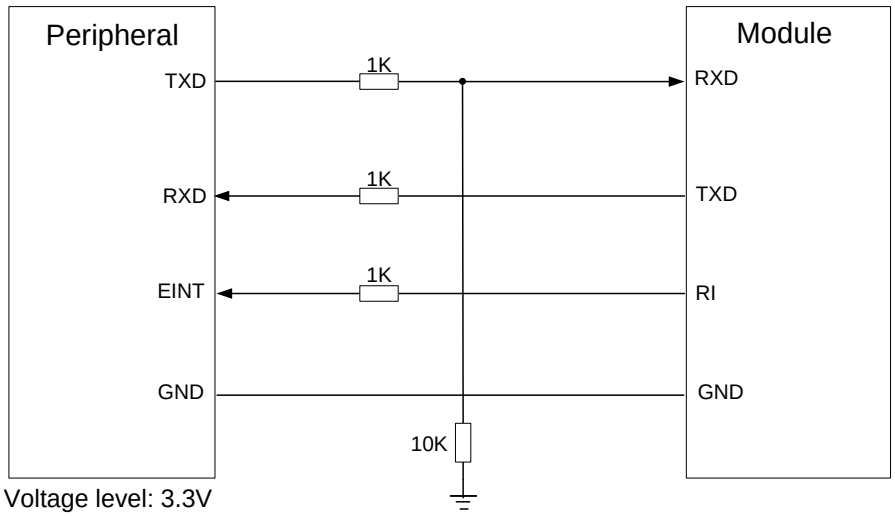

Figure 11: Level Match Design for 3.3V System

NOTE

It is highly recommended to add the resistor divider circuit on the UART port signal lines when the host's voltage level is 3.3V. For systems with a higher voltage level, a level shifter IC could be used between the host and the module.

The following circuit shows a reference design for the communication between module and PC. As the electrical level of module is 3.0V, so a RS-232 level shifter must be used. Please make sure the I/O voltage of level shifter which connects to module is 3.0V.

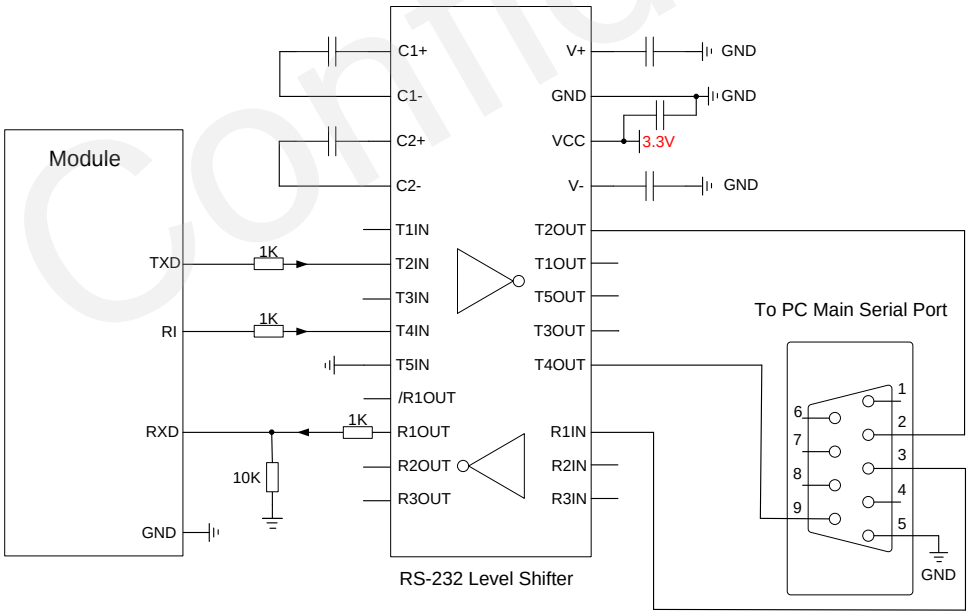

Figure 12: Sketch Map for RS-232 Interface Match

Please visit vendor web site to select the suitable RS-232 level shifter IC, such as: http://www.exar.com/ and http://www.maximintegrated.com.

3.9. ADC Interface*

The module provides a 10-bit ADC input channel to measure the value of voltage. This ADC is available in Active mode and Standby mode.

Table 11: Pin Definition of the ADC

Name	Pin No.	Description
ADC	21	Analog to digital converter

NOTE

"*" means this function is under development.

3.10. USIM Card Interface

The module contains one USIM interface to allow the module to access to the USIM cards.

3.10.1. USIM Card Application

The USIM interface supports the functionality of the 3GPP specification, which is intended for use with a USIM application Tool-kit.

The USIM interface is powered by an internal regulator in the module. Only 3.0V USIM cards are supported.

Table 12: Pin Definition of the USIM Interface

Pin No.	Name	Description	Comment
38	USIM_VDD	Supply power for USIM card. Automatic detection of USIM card voltage is 3.0V±5%.	

41	USIM_CLK	USIM card clock
40	USIM_DATA	USIM card data I/O
39	USIM_RST	USIM card reset
42	USIM_GND	USIM card ground

A reference circuit for 6-pin USIM card connector is illustrated as the following figure.

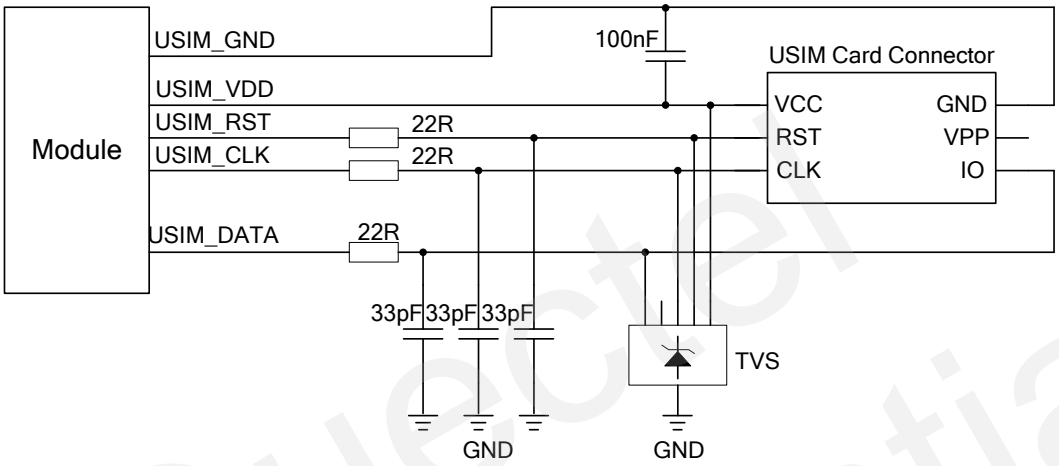

Figure 13: Reference Circuit for USIM Interface with 6-pin USIM Card Connector

For more information of USIM card connector, please visit http://www.amphenol.com and http://www.molex.com.

In order to enhance the reliability and availability of the USIM card in application. Please follow the below criteria in the USIM circuit design.

- Keep layout of USIM card to the module as close as possible. Keep the trace length as less than 200mm as possible.
- Keep USIM card signal away from RF and VBAT trace.
- Assure the ground between module and USIM card connector short and wide. Keep the trace width of ground no less than 0.5mm to maintain the same electric potential. The decouple capacitor of USIM_VDD is less than 1uF and must be near to USIM card connector.
- To avoid cross talk between USIM_DATA and USIM_CLK. Keep them away from each other and shield them with surrounded ground
- In order to offer good ESD protection, it is recommended to add a TVS diode array. For more information of TVS diode, you can visit http://www.onsemi.com/. The most important rule is to place the ESD protection device close to the USIM card connector and make sure the USIM card interface signal lines being protected will go through the ESD protection device first and then lead to module. The 22Ω resistors should be connected in series between the module and the USIM card so as to

suppress EMI spurious transmission and enhance ESD protection. Please note that the USIM peripheral circuit should be close to the USIM card connector.

- Place the RF bypass capacitors (33pF) close to the USIM card on all signals lines to improve EMI suppression.

3.11. Behaviors of the RI*

Table 13: Behaviors of the RI

State	RI Response
Standby	HIGH
SMS	When a new SMS comes, the RI changes to LOW and holds low level for about 120ms, then changes to HIGH.
URC	Certain URCs can trigger 120ms low level on RI.

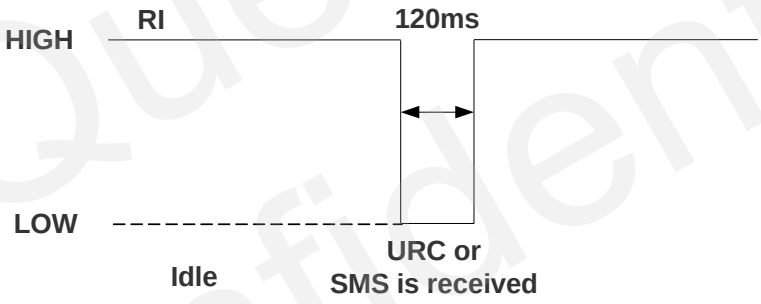

Figure 14: Behaviors of RI When the URC or SMS is Received

NOTE

"*" means this function is under development.

3.12. Network Status Indication*

The NETLIGHT signal can be used to drive a network status indicator LED. The working state of this pin is listed in the following table.

Table 14: Working State of the NETLIGHT

State	Module Function
Low	The module is not working or not synchronized with network.
High	The module is synchronized with network.

A reference circuit is shown as below.

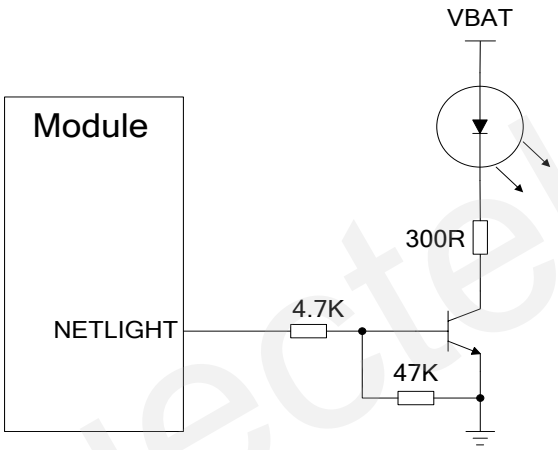

Figure 15: Reference Design for NETLIGHT

NOTE

"*" means this function is under development.

4 Antenna Interface

The pin 53 is the RF antenna pad. The RF interface has an impedance of 50Ω.

Table 15: Pin Definition of the RF_ANT

Name	Pin	Description
GND	51	Ground
GND	52	Ground
RF_ANT	53	RF antenna pad
GND	54	Ground

4.1. RF Reference Design

A reference design for RF is shown as below.

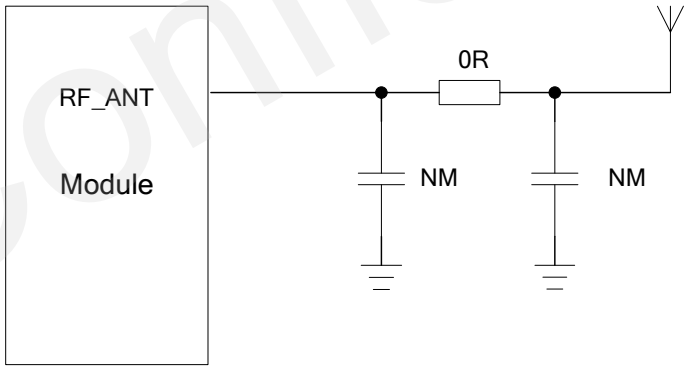

Figure 16: Reference Design for RF

BC95 provides an RF antenna pad for antenna connection. There is one grounding pad on the both sides of the antenna pad in order to give a better grounding. Besides, a π-type match circuit is suggested to be used to adjust the RF performance, and it is better to keep match circuit close to RF_ANT port of the module.

4.1.1. Impedance Control for RF Trace

The RF trace in host PCB connected to the module RF antenna pad should be coplanar waveguide line or microstrip line, whose characteristic impedance should be set to 50Ω. It is recommended to use coplanar waveguide line. The characteristic impedance of coplanar waveguide line could been affected by many factors, such as dielectric constant, distance between signal layer and reference ground(H), line width(W), clearance between line and ground(S), copper foil thicknesses(T). The relative relationship between those parameters could be obtained through software like CITS25, shown as follows.

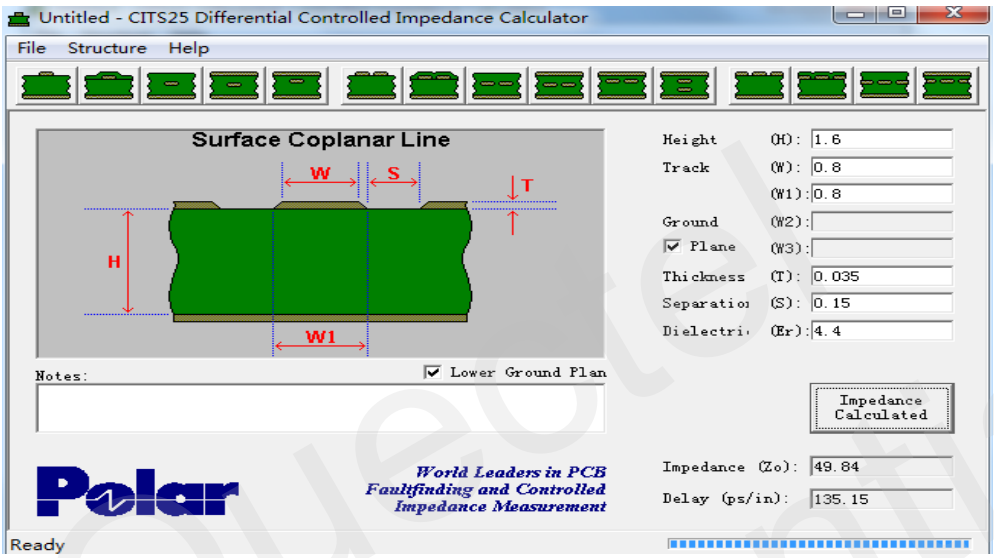

Figure 17: Coplanar Waveguide Line Structure (Software Calculation)

The reference ground would be different for different host PCB. It should set the top layer as RF trace and set bottom layer as reference ground for two-layer PCB, as shown in following figure.

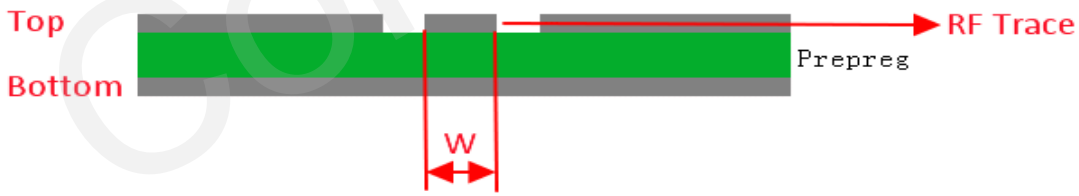

Figure 18: Layout for Two-layer PCB

For four-layer PCB, it should choose the second layer, third layer or bottom layer as reference ground. The area located in the layer between RF trace and reference ground should be kept out. And the width of that area should be five times wider than RF trace at least. Just as shown in figures below. It is the same with other multi-layer PCBs.

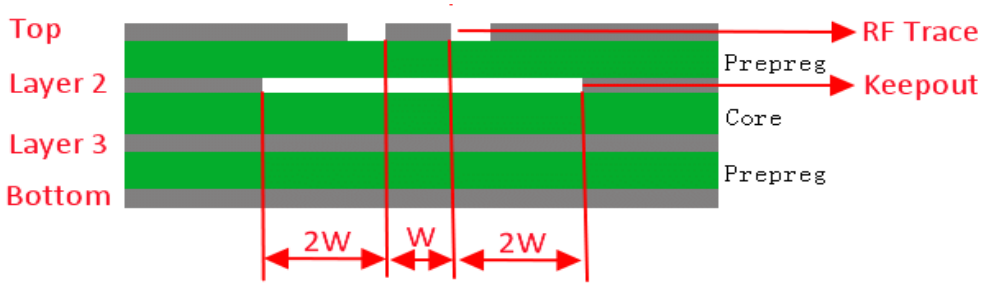

Figure 19: Layout for Four-layer PCB (Third Layer as Reference Ground)

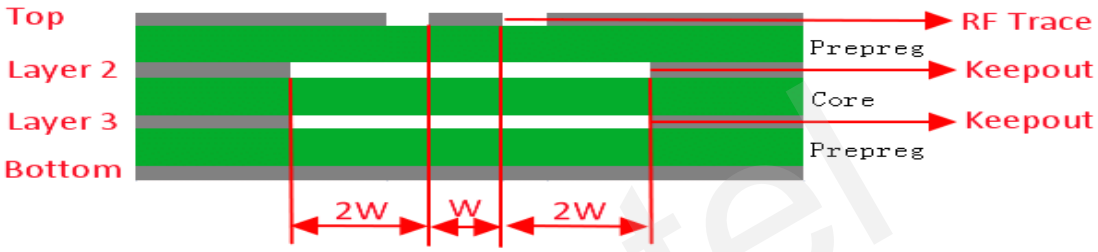

Figure 20: Layout for Four-layer PCB (Bottom Layer as Reference Ground)

4.2. RF Output Power

Table 16: RF Output Power (Uplink GMSK and BPSK Modulation)

Frequency	Max.	Min.
900MHz	23dBm±2dB	<-40dBm
850MHz	23dBm±2dB	<-40dBm
800MHz	23dBm±2dB	<-40dBm

NOTE

This design is compliant with the NB-IoT radio protocol *3GPP Rel-13*.

4.3. RF Receiving Sensitivity

Table 17: RF Receiving Sensitivity (MCS-1, BLER <10%)

Frequency	Receive Sensitivity
900MHz	-135dBm
850MHz	-135dBm
800MHz	-135dBm

4.4. Operating Frequencies

Table 18: Operating Frequencies

Frequency	Receive	Transmit
900MHz	925~960MHz	880~915MHz
850MHz	869~894MHz	824~849MHz
800MHz	791~821MHz	832~862MHz

4.5. Antenna Requirement

The following table shows the requirement on NB-IoT antenna.

Table 19: Antenna Cable Requirement

Frequency Range	Requirement
791-960MHz	Insertion Loss: <1dB

Table 20: Antenna Requirements

Type	Requirements
Frequency Range	791-960MHz
VSWR	≤2
Gain (dBi)	≥1
Max Input Power (W)	5
Input Impedance (Ω)	50
Polarization Type	linear

4.6. RF Cable Soldering

Soldering the RF cable to RF pad of module correctly will reduce the loss on the path of RF, please refer to the following example of RF cable soldering.

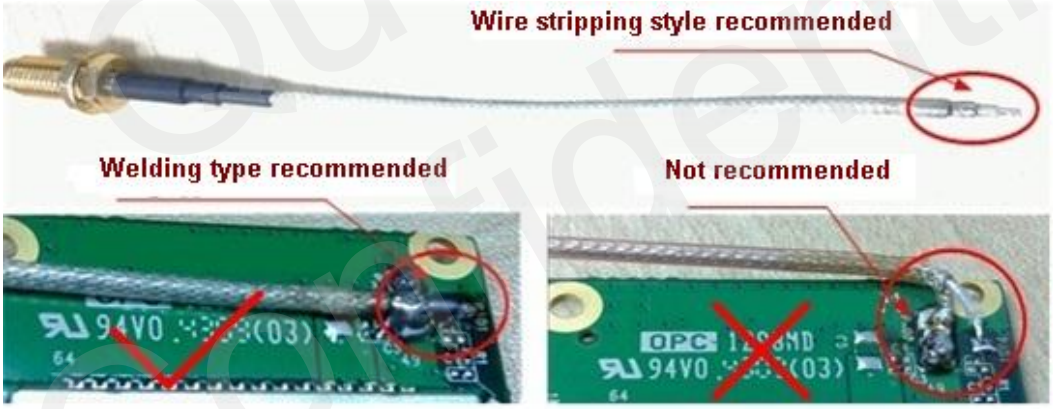

Figure 21: Recommended RF Cable Soldering

5 Electrical, Reliability and Radio Characteristics

5.1. Absolute Maximum Ratings

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

Table 21: Absolute Maximum Ratings

Parameter	Min.	Max.	Unit
VBAT	-0.3	+4.2	V
Peak Current of Power Supply	0	0.3	A
RMS Current of Power Supply	0	0.25	A
Voltage at Digital Pins	-0.3	+3.0	V
Voltage at Analog Pins	-0.3	+4.2	V
Voltage at Digital/Analog Pins in Power Down Mode	-0.25	+0.25	V

5.2. Operating Temperature

The operating temperature is listed in the following table:

Table 22: Operating Temperature

Parameter	Min.	Typ.	Max.	Unit
Operation Temperature Range [1)]	-35	+25	+75	ºC
Extended Operation Range [2)]	-40		+85	ºC

NOTES

1. [1)] Within operation temperature range, the module is 3GPP compliant.
2. [2)] Within extended temperature range, the module remains the ability to establish and maintain SMS, data transmission, etc. There is no unrecoverable malfunction; there are also no effects on radio spectrum and no harm to radio network. Only one or more parameters like Pout might reduce in their value and exceed the specified tolerances. When the temperature returns to the normal operating temperature levels, the module will meet 3GPP compliant again.

6 Mechanical Dimensions

This chapter describes the mechanical dimensions of the module.

6.1. Mechanical Dimensions of the Module

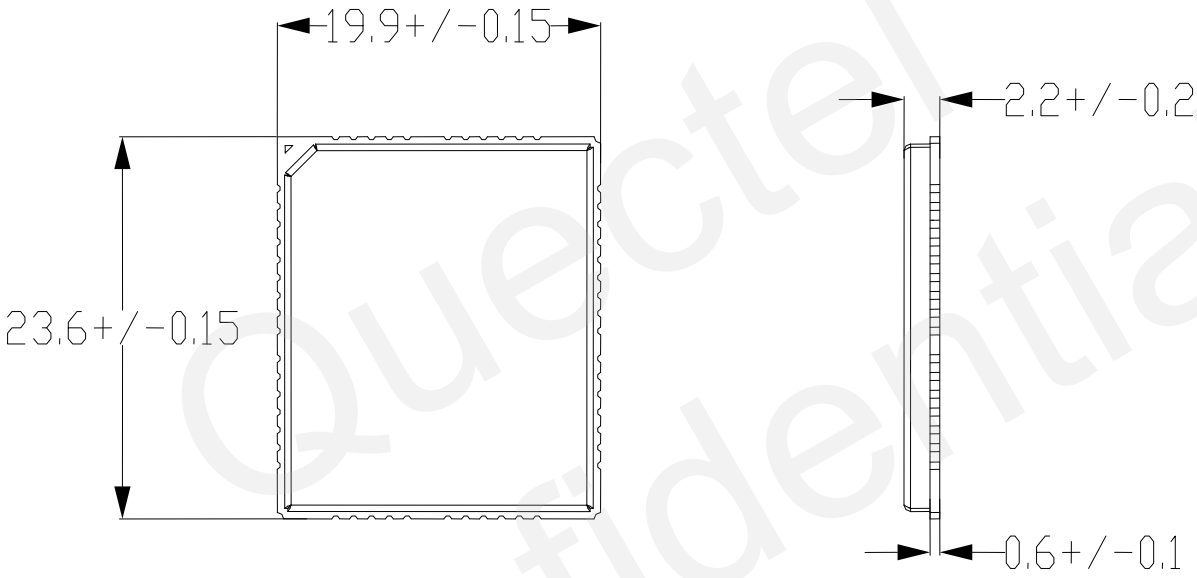

Figure 22: Top and Side Dimensions of BC95 Module (Unit: mm)

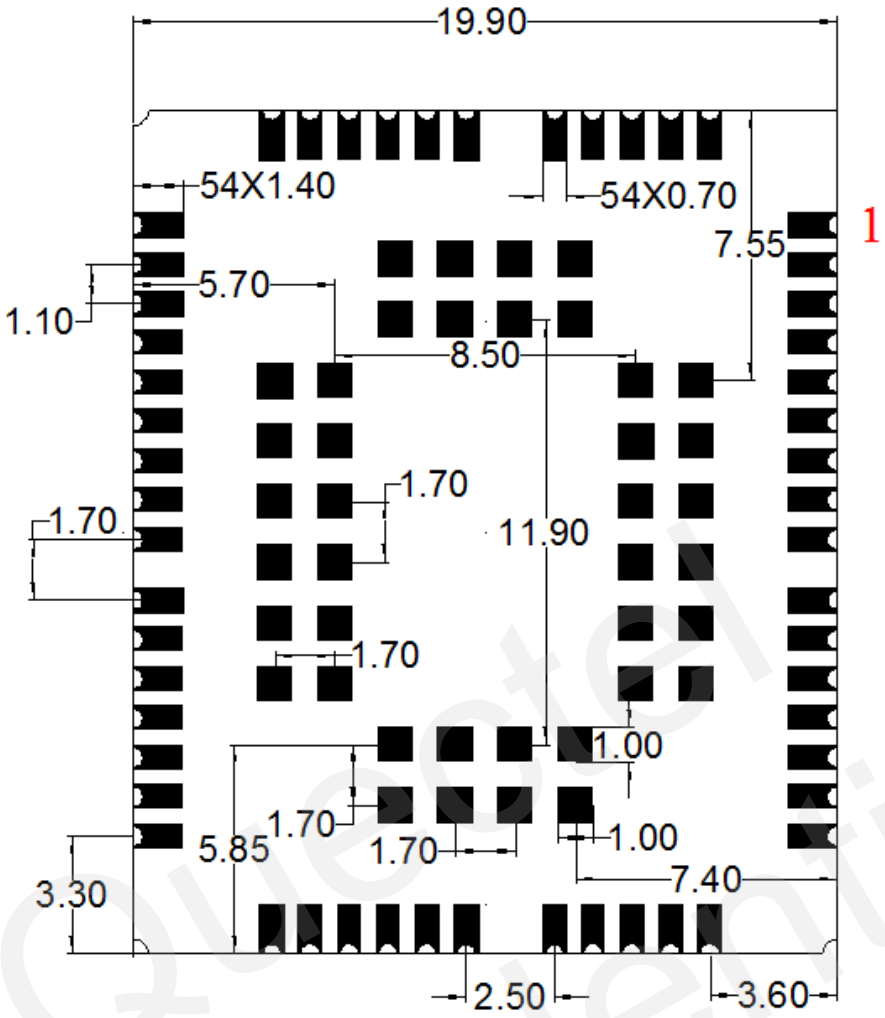

Figure 23: Bottom Dimensions of BC95 Module (Unit: mm)

6.2. Recommended Footprint

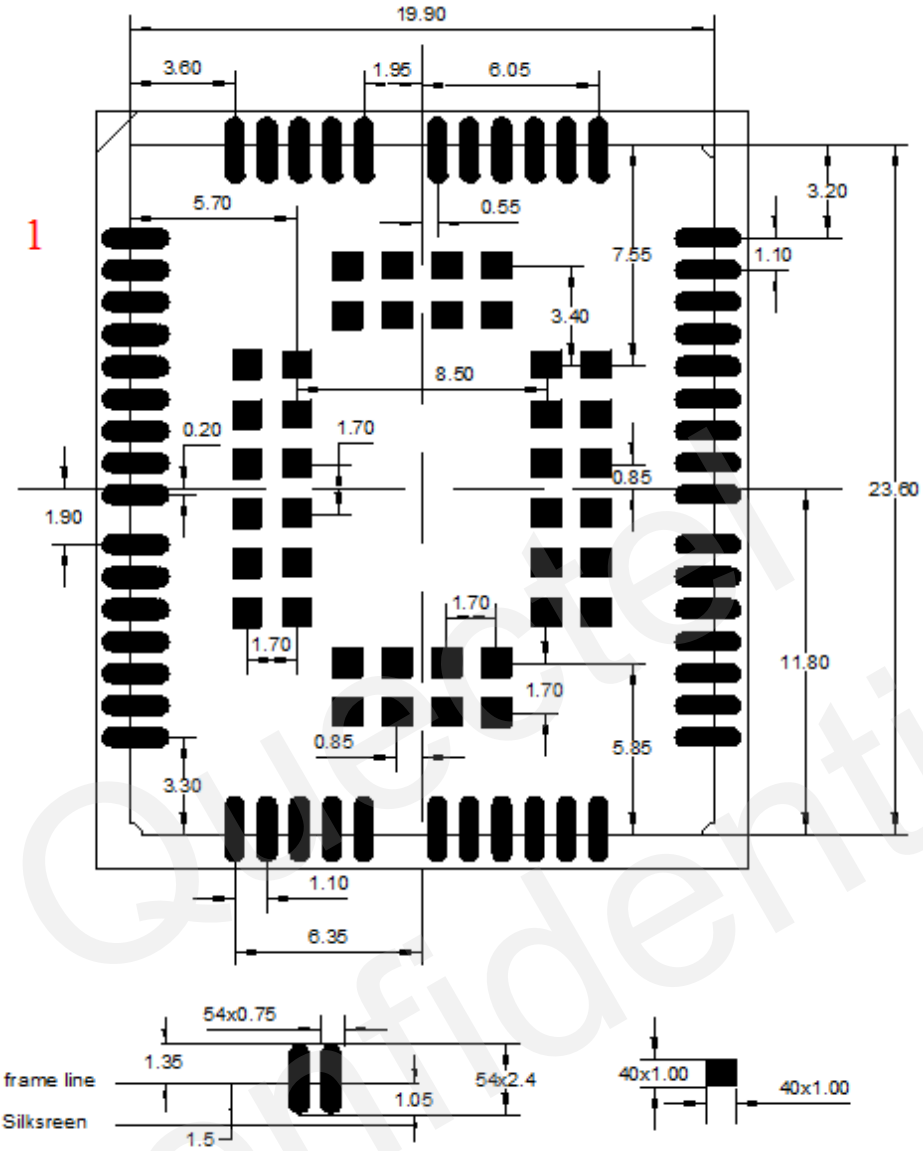

Figure 24: Recommended Footprint (Unit: mm)

NOTES

1. For easy maintenance of the module, please keep about 3mm between the module and other components in the host PCB.
2. All RESERVED pins must not be connected to GND.
3. All dimensions are in millimeters.

6.3. Design Effect Drawing of the Module

Figure 25: Top View of the Module

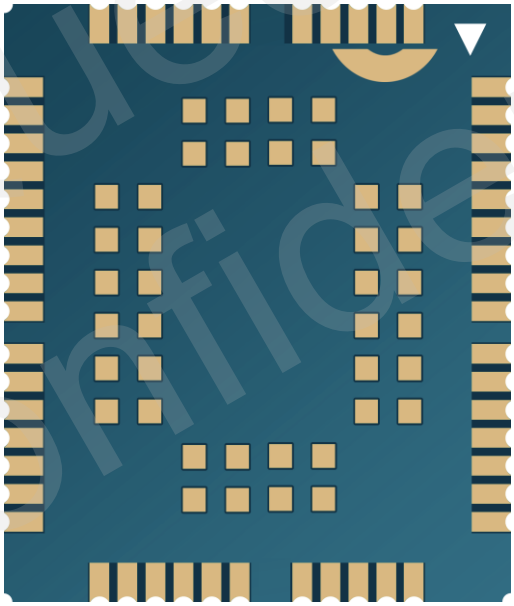

Figure 26: Bottom View of the Module

NOTE

These are design effect drawings of BC95 module. For more accurate pictures, please refer to the module that you get from Quectel.

7 Storage and Manufacturing

7.1. Storage

BC95 module is stored in a vacuum-sealed bag. The storage restrictions are shown as below.

1. Shelf life in the vacuum-sealed bag: 12 months at <40ºC/90%RH.

2. After the vacuum-sealed bag is opened, devices that will be subjected to reflow soldering or other high temperature processes must be:

- Mounted within 72 hours at the factory environment of ≤30ºC/60% RH.
- Stored at <10% RH.

3. Devices require baking before mounting, if any circumstance below occurs:

- When the ambient temperature is 23ºC±5ºC, humidity indication card shows the humidity is >10% before opening the vacuum-sealed bag.
- Device mounting cannot be finished within 72 hours at factory conditions of ≤30ºC/60%

4. If baking is required, devices may be baked for 48 hours at 125ºC±5ºC.

NOTE

As the plastic container cannot be subjected to high temperature, it should be removed from devices before high temperature (125ºC) baking. If shorter baking time is desired, please refer to the IPC/JEDECJ-STD-033 for baking procedure.

7.2. 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 so as to produce a clean stencil surface on a single pass. To ensure the module soldering quality, the thickness of stencil at the hole of the module pads should be 0.15mm. For more details, please refer to ***document [1]***.

It is suggested that the peak reflow temperature is 235 ~ 245ºC (for SnAg3.0Cu0.5 alloy). The absolute max reflow temperature is 260ºC. To avoid damage to the module when it is repeatedly heated, it is suggested that the module should be mounted after the first panel has been reflowed. The following picture is the actual diagram which we have operated.

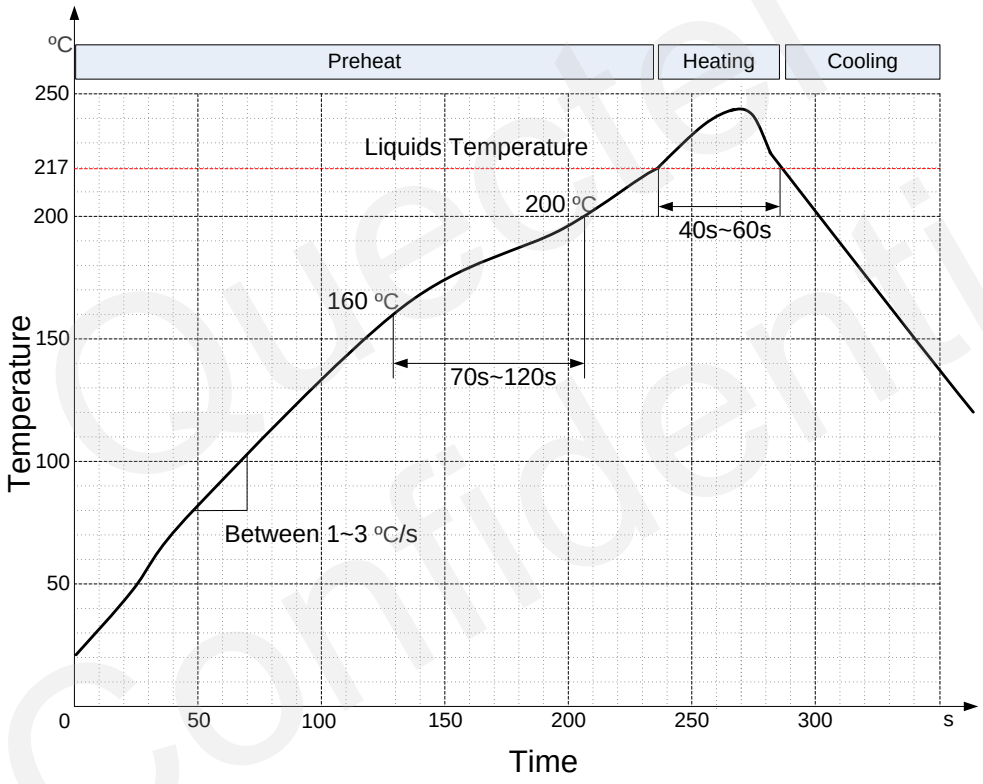

Figure 27: Ramp-Soak-Spike Reflow Profile

7.3. Packaging

The modules are stored inside a vacuum-sealed bag which is ESD protected. It should not be opened until the devices are ready to be soldered onto the application.

7.3.1. Tape and Reel Packaging

The reel is 330mm in diameter and each reel contains 250 modules.

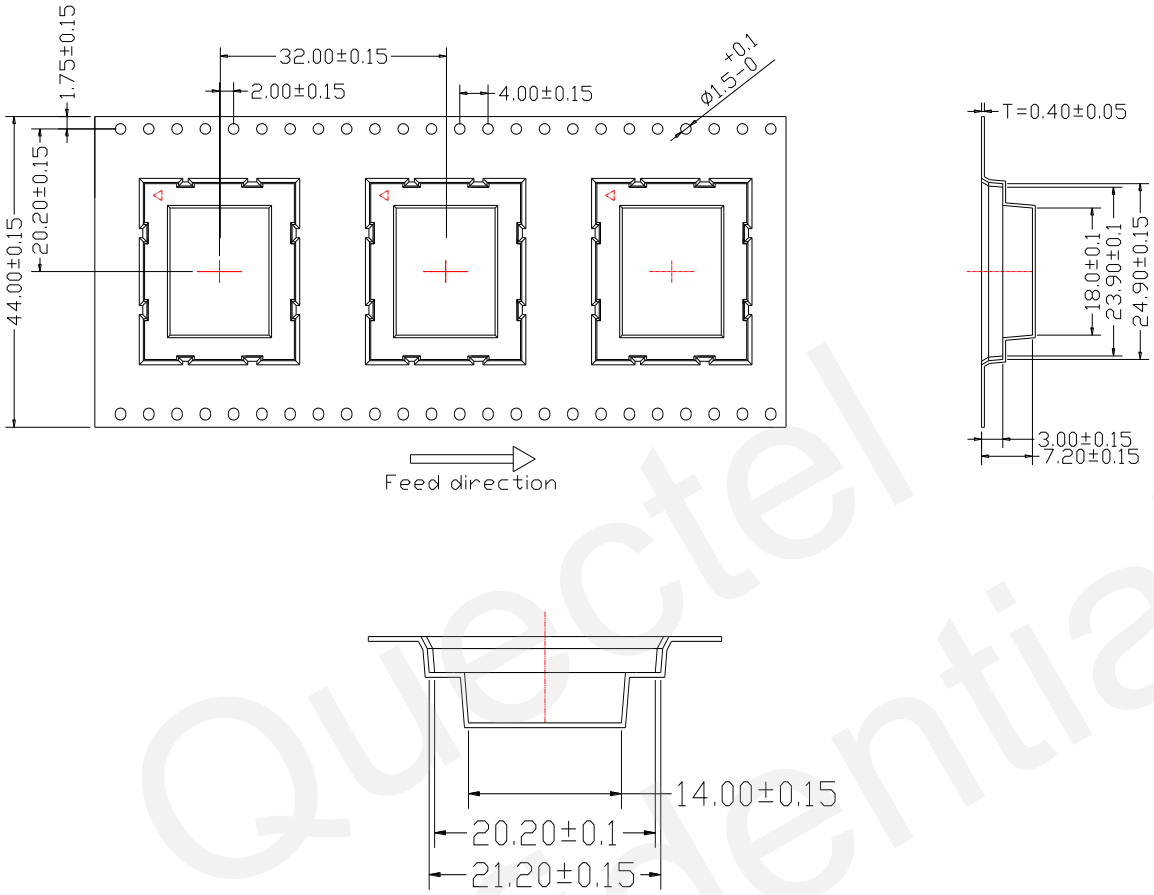

Figure 28: Tape Dimensions

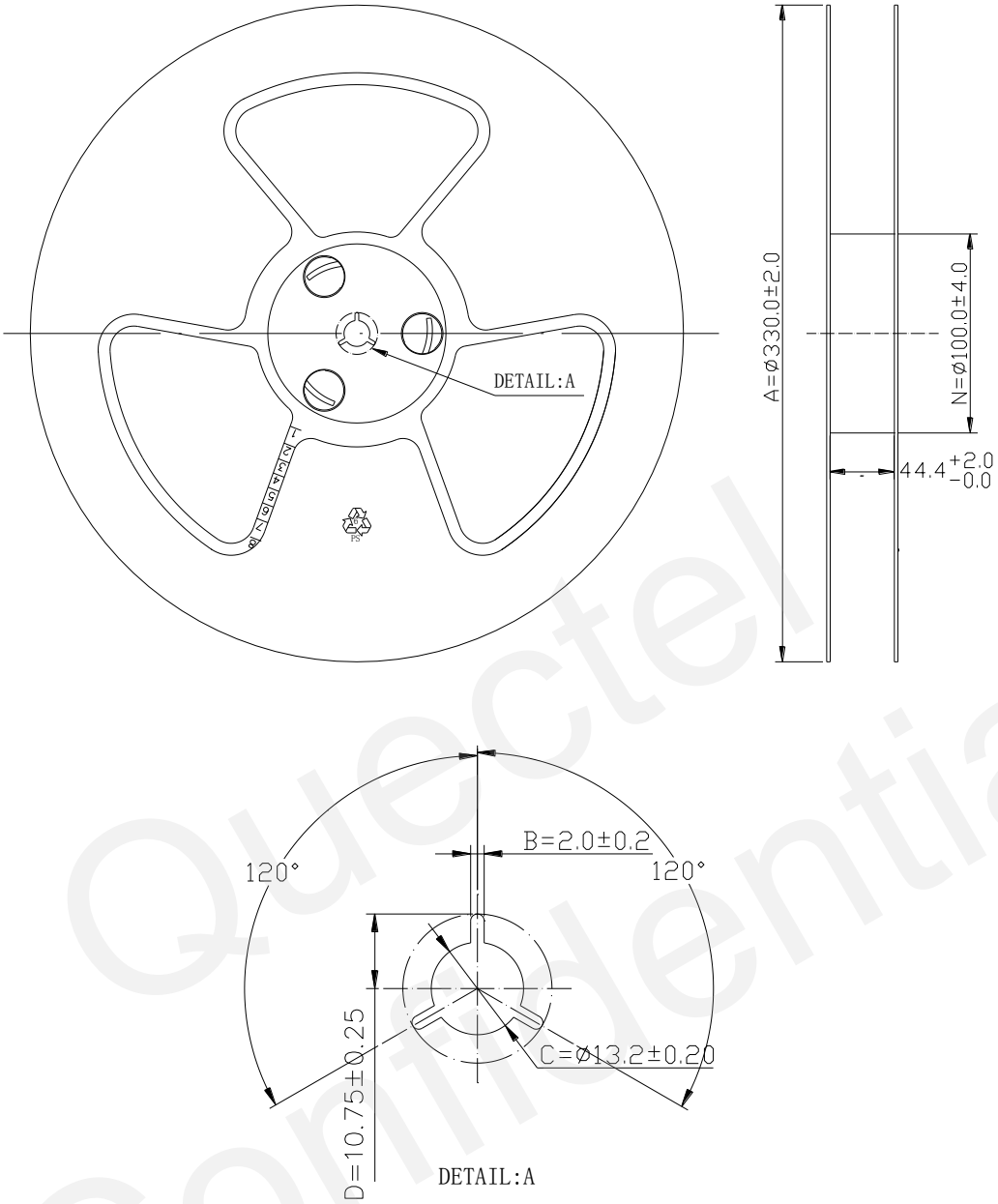

Figure 29: Reel Dimensions

8 Appendix A Reference

Table 23: Related Documents

SN	Document Name	Remark
[1]	Module_Secondary_SMT_User_Guide	Module Secondary SMT User Guide

Table 24: Terms and Abbreviations

Abbreviation	Description
ADC	Analog-to-Digital Converter
DCE	Data Communications Equipment (typically module)
DTE	Data Terminal Equipment (typically computer, external controller)
I/O	Input/Output
IC	Integrated Circuit
Imax	Maximum Load Current
Inorm	Normal Current
kbps	Kilo Bits Per Second
LED	Light Emitting Diode
PCB	Printed Circuit Board
RF	Radio Frequency
RMS	Root Mean Square (value)
RTC	Real Time Clock
RX	Receive Direction

USIM	Universal Subscriber Identification Module
SMS	Short Message Service
TE	Terminal Equipment
TX	Transmitting Direction
UART	Universal Asynchronous Receiver & Transmitter
URC	Unsolicited Result Code
VSWR	Voltage Standing Wave Ratio
Vmax	Maximum Voltage Value
Vnorm	Normal Voltage Value
Vmin	Minimum Voltage Value
VIHmax	Maximum Input High Level Voltage Value
VIHmin	Minimum Input High Level Voltage Value
VILmax	Maximum Input Low Level Voltage Value
VILmin	Minimum Input Low Level Voltage Value
VImax	Absolute Maximum Input Voltage Value
VImin	Absolute Minimum Input Voltage Value
VOHmax	Maximum Output High Level Voltage Value
VOHmin	Minimum Output High Level Voltage Value
VOLmax	Maximum Output Low Level Voltage Value
VOLmin	Minimum Output Low Level Voltage Value