W80
Hardware Design

WIFI Module

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Version History

Date	Version	Description of change	Author
2020-5-22	V1.00	Initial release	Zhiqiang Liu Xiaobo Bai

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1. Introduction

This document describes the electronic specifications, RF specifications, interfaces, mechanical characteristics and testing results of the W80 module. With the help of this document, in combination with our application manual and user guide, customers can quickly apply W80 module into wireless applications.

1.1 Product Outline

The W80 is a small, low-power, low-cost Wi-Fi 6 and Bluetooth v5.1 module based on Qualcomm QCA-6391 chipset. The module can be used in car networking, wireless routing, and other wireless terminals. The module is designed to be used together with SIMCom SIM8200-LGA series modules to establish WLAN and Bluetooth connections. W80 supports 2X2+2X2 MU-MIMO and provides a maximum data rate up to 1774.5Mbps.

1.2 Hardware Interface Overview

W80 support the following interfaces:

- Power supply
- One I2S interface
- One PCIe *1 lane interface
- One COEX_UART interface
- One 32KHz clock input interface
- One BT_UART interface
- Two WLAN antenna interfaces
- LAA control interfaces
- GPIOs

1.3 Hardware Block Diagram

The following figure shows the hardware block diagram of W80:

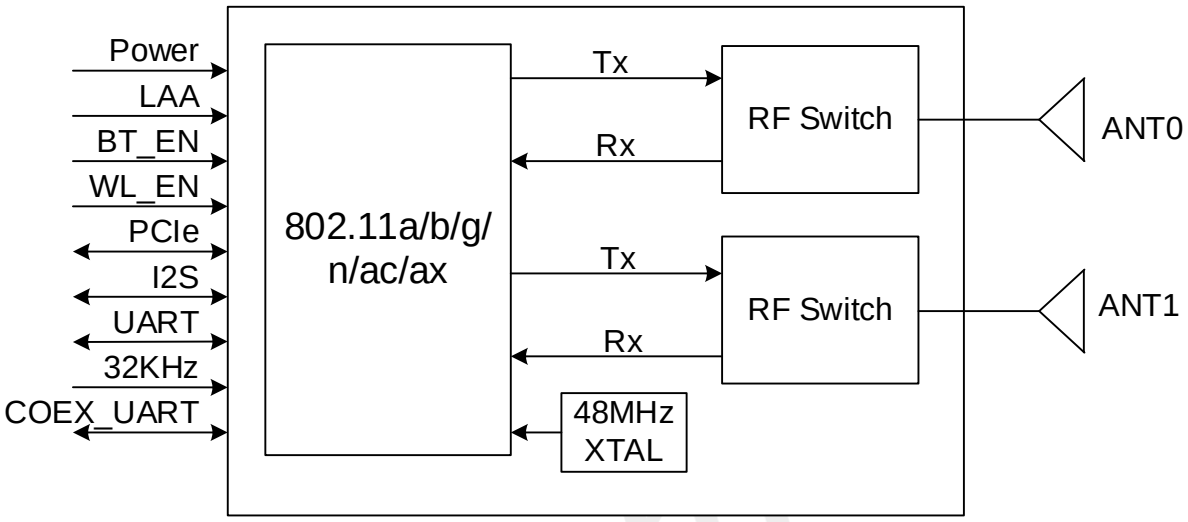

Figure 1：W80 hardware block diagram

1.4 Feature Overview

Table 1：Key features

Feature	Implementation
Power Supply	VPH : 3.3~4.4 V S2E_1P224 : 1.22~1.3 V S3E_0P824 : 0.82~0.95 V S4E_1P904 : 1.8~2.0 V VDD_IO : 1.8~2.0 V
Date Rate	802.11b：1，2，5.5，11Mbps 802.11g\a：6，9，12，18，24，36，48，54Mbps 802.11n_HT20：MCS0~MCS7 802.11n_HT40：MCS0~MCS7 802.11n_HT80：MCS0~MCS7 802.11ac_HT20: MCS0~MCS9 802.11ac_HT40: MCS0~MCS9 802.11ac_HT80: MCS0~MCS9 802.11ax_HT20: MCS0~MCS11 802.11ax_HT40: MCS0~MCS11 802.11ax_HT80: MCS0~MCS11
Transmitting power	802.11b/11Mbps：20dBm 802.11a/g/54Mbps：15dBm 802.11n_HT20/MCS7：15dBm 802.11n_HT40/MCS7：15dBm 802.11n_HT80/MCS7：15dBm

	802.11ac_HT20/MCS9：14dBm 802.11ac_HT40/MCS9：14dBm 802.11ac_HT80/MCS9：14dBm 802.11ax_HT20/MCS11：12dBm 802.11ax_HT40/MCS11：12dBm 802.11ax_HT80/MCS11：12dBm
WLAN Standard	IEEE 802.11a/b/g/n/ac/ax
Modulation Method	DSSS (1/2Mbps)，CCK(1/2/5.5/11Mbps)，OFDM（6/9/12/18/24/36/48/54Mbps）,OFDM technology combined with BPSK, QPSK, 16-qam , 64-qam, 256-qam, 1024-qam; 820.11b adopts CCK and DSSS modulation technology
PCIe Interface	One lane PCIe interface, support PCIe Gen 2.0
UART Interface	● One UART interface ● Data rate up to 3.2 Mbps
I2S Interface	One I2S interface, the I2S also can be configured as PCM
Antenna Interface	2X2+2X2
Physical characteristics	Size：24.0mm*17.0mm*2.6mm Weight：TBD
Temperature range	Normal operation：-30°C ~ +70°C Storage temperature：-40°C ~ +90°C

1.5 W80 and SIM8200G Connect Diagram

The following figure shows the connect diagram of W80 and SIM8200G, the details please refer the SIM8200G reference design.

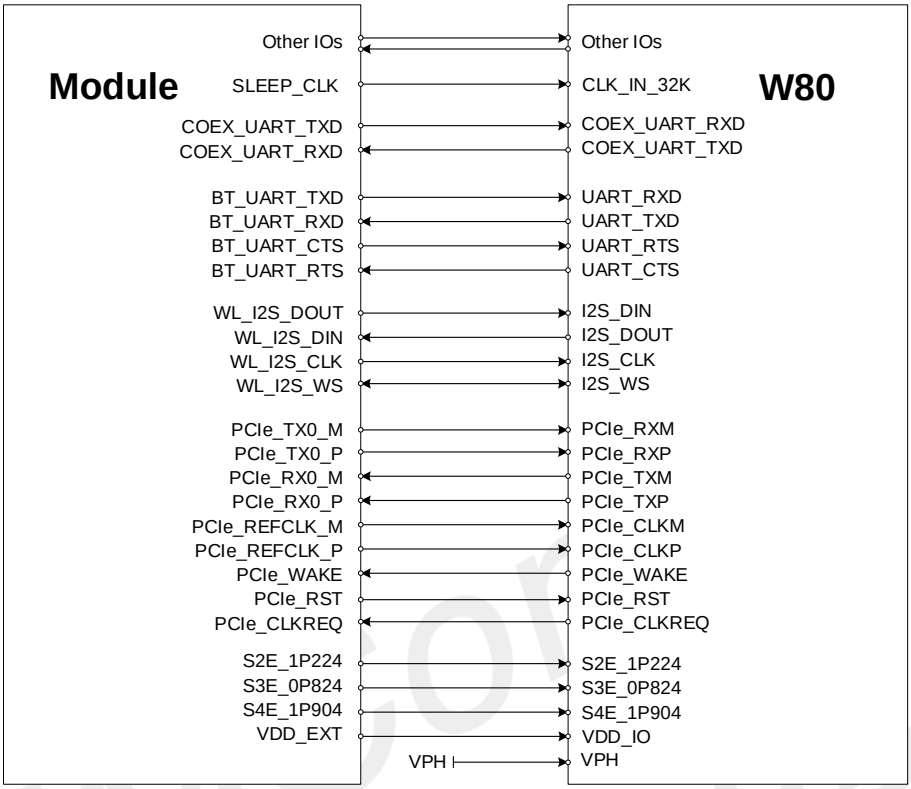

Figure 2：W80 and SIM8200G connect diagram

2. Package Information

2.1 Pin Assignment Overview

All functions of the W80 will be provided through 90 pins that will be connected to the customers' platform. The following figure is a high-level view of the pin assignment of the W80.

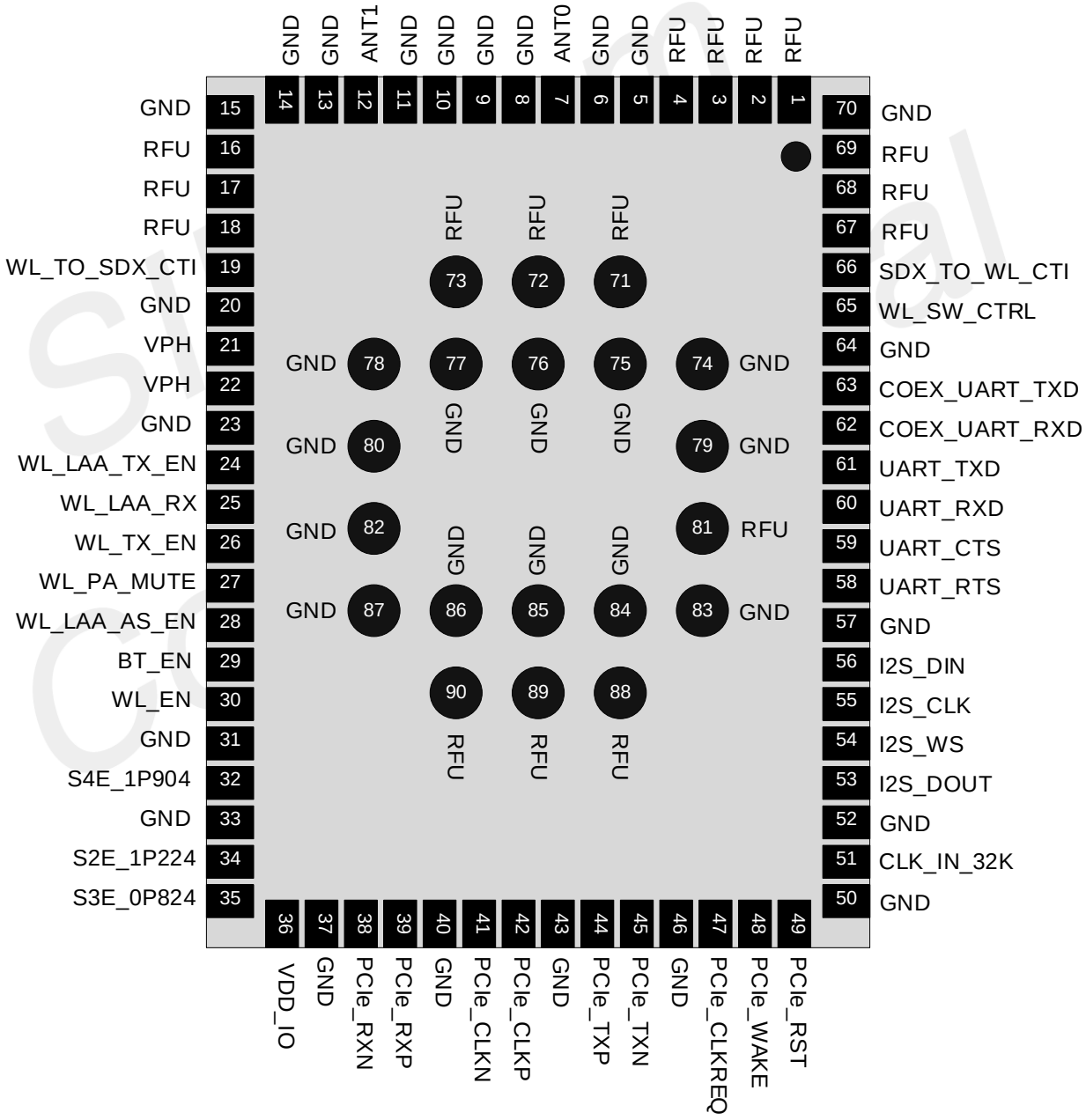

Figure 3：Pin assignment

2.2 Pin Description

Table 2：Pin description

Pin name	Pin number	I/O	Description	Comment
Power supply				
VPH	21,22	PI	Power for PA	
S2E_1P224	34	PI	Power for PCIe and RFA	
S3E_0P824	35	PI	Power for RFA and others	
S4E_1P904	32	PI	Power for PCIe and RFA	
VDD_IO	36	PI	Power for IO	
GND	5,6,8,9,10,11,13,14,15,20,23,31,33,37,40,43,46,50,52,57,64,70,74,75,76,77,78,79,80,82,83,84,85,86,87		Ground	
LAA control				
WL_LAA_TX_EN	24	DI	WLAN XFEM control LAA enable	
WL_LAA_RX	25	DO	WLAN XFEM control for LAA receiver	
WL_LAA_AS_EN	28	DI	WLAN LAA AS enable	
Moudle control				
WL_TX_EN	26	DI	WLAN XFEM control for WLAN TX enable	
WL_PA_MUTE	27	DI	WLAN XFEM control for PA mute	
BT_EN	29	DI	BT enable	
WL_EN	30	DI	EN for WLAN	
WL_SW_CTRL	65	DI	Switch control	
SDX_TO_WL_CTI	66	DI	GPIO	
WL_TO_SDX_CTI	19	DO	GPIO	
PCIe interface				
PCIe_RXM	38	AI	PCIe receive minus	Required 90Ω differential impedance
PCIe_RXP	39	AI	PCIe receive plus	
PCIe_CLKM	41	AI	PCIe reference clock minus	
PCIe_CLKP	42	AI	PCIe reference clock plus	
PCIe_TXM	44	AO	PCIe transmit minus	
PCIe_TXP	45	AO	PCIe transmit plus	

PCIe_RST	49	DO	PCIe reset.	
PCIe_CLKREQ	47	DIO	PCIe clock request.	These pins have been pulled up to 1.8V internally
PCIe_WAKE	48	DI	PCIe wake-up	
I2S interface				
I2S_DIN	56	DI	BT I2S serial data Input 0 for audio	
I2S_CLK	55	DI	BT I2S continuous serial clock 0 foraudio	
I2S_WS	54	DIO	BT I2S word select 0 for audio	
I2S_DOUT	53	DO	BT I2S serial data output 0 for audio	
UART interface				
COEX_UART_TXD	63	DO	LTE coexistence UART TXD	
COEX_UART_RXD	62	DI	LTE coexistence UART RXD	
UART_TXD	61	DO	BT UART transmit data for HCI messaging	
UART_RXD	60	DI	BT UART receive data for HCI messaging	
UART_CTS	59	DO	BT UART clear to send for HCI messaging	
UART_RTS	58	DI	BT UART request to send for HCI messaging	
Clock interface				
CLK_IN_32K	51	DI	Sleep clock input	
Antenna interface				
ANT0	7	AIO	WLAN/BT antenna0 interface	
ANT1	12	AIO	WLAN antenna1 interface	
RFU interface				
RFU	1,2,3,4,16,17,18, 67,68,69,71,72, 73,81,88,89,90		Reserved for future use	Keep open

NOTE

1. Unused and RFU pins should keep open.
2. All Power and GND pins should be connected to the customer's main PCB.

2.3 Mechanical Dimensions

The following figure shows the mechanical dimensions of W80.

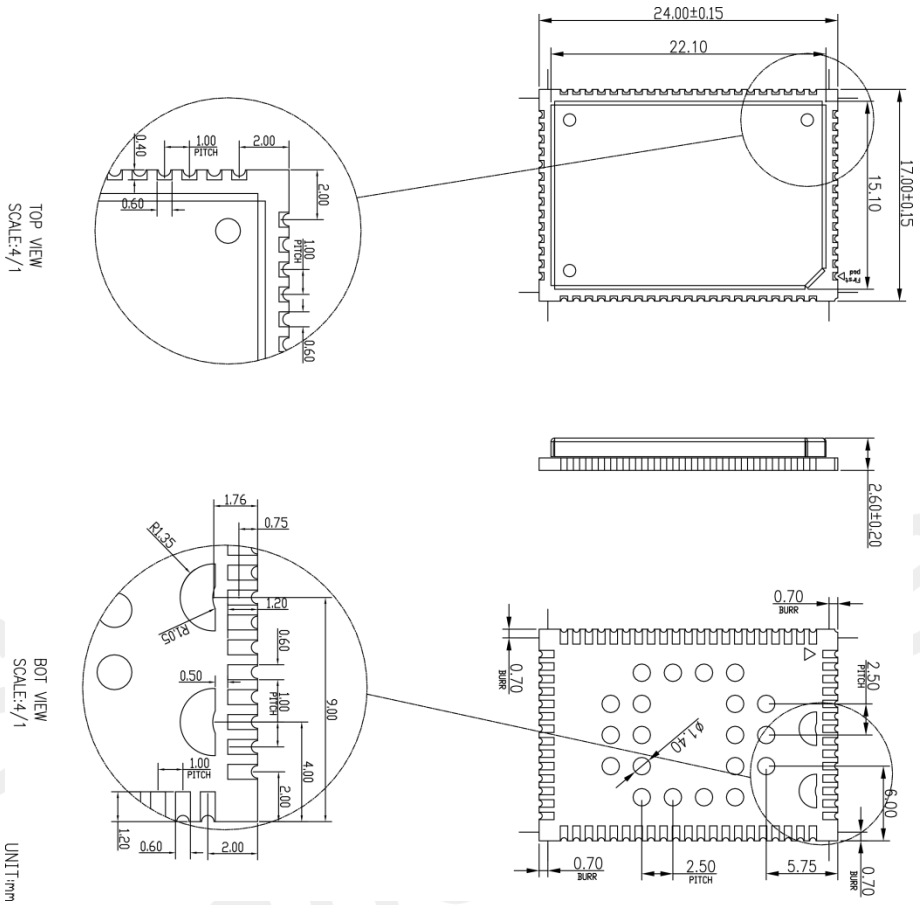

Figure 4：Dimensions of W80 (Unit: mm)

3. Interface Application

3.1 Power Supply

Ensure the module works properly, all power and GND pins should be connected; when all powers are supplied W80 will work well together with SIM8200-LGA series modules.

Timing of power on/off ：

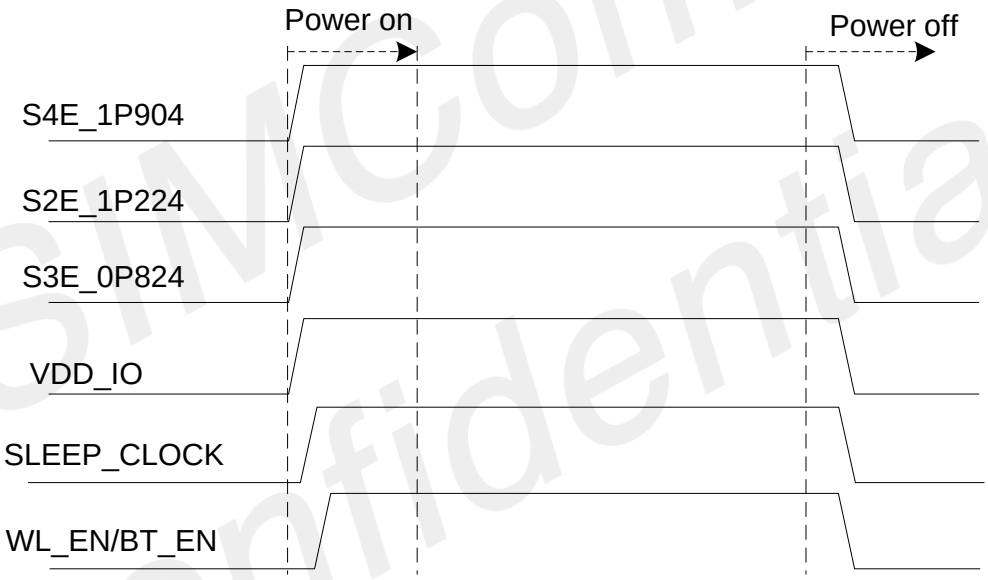

Figure 5：Timing of power on/off

NOTE

1. The trace of VPH needs to meet the width of 1000mA current at least.
2. The trace of S4E_1P904 needs to meet the width of 500mA current at least.
3. The trace of S2E_1P224 needs to meet the width of 500mA current at least.
4. The trace of S3E_0P824 needs to meet the width of 1500mA current at least.
5. The trace of VDD_IO needs to meet the width of 100mA current at least.

Table 3：Definition of Power and GND pins

Pin name	Pin number	I/O	Description	Comment
VPH	21,22	PI	Power for PA	
S2E_1P224	34	PI	Power for PCIe and RFA	
S3E_0P824	35	PI	Power for RFA and others	
S4E_1P904	32	PI	Power for PCIe and RFA	
VDD_IO	36	PI	Power for IO	
GND	5,6,8,9,10,11,13,14,15,20, 23,31,33,37,40,43,46,50, 52,57,64,70,74,75,76,77, 78,79,80,82,83,84,85,86, 87		Ground	

S4E_1P904, S2E_1P224, S3E_0P824 and VDD_IO should be connected to SIM8200-LGA series modules.

3.2 I2S Interface*

I2S is for audio feature with BT function, under developing now.

NOTE

"*" means under development.

3.3 Clock Interface

The 32KHz clock is for sleep mode of Bluetooth, the routing line of it should be as short as possible and also need GND protection.

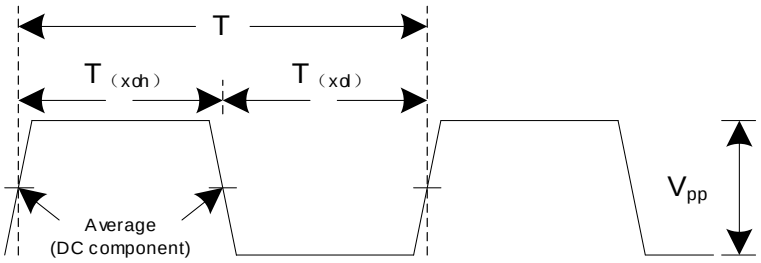

Figure 6：Timing of 32KHz

Table 4：Sleep clock

Symbol	Parameter	Min.	Typ.	Max.	Unit
T(xoh)	Sleep clock logic high	4.58	-	25.94	us
T(xol)	Sleep clock logic low	4.58	-	25.94	us
T	Sleep clock period	-	30.5208	-	us
F	Sleep clock frequency	-	32.7645	-	KHz
Vpp	Peak-to-peak voltage	-	1.8	-	V

3.4 LAA and Module Control Interface

3.4.1 LAA Control

Table 5：LAA control

Pin name	Pin number	I/O	Description	Comment
WL_LAA_TX_EN	24	DI	WLAN XFEM control LAA enable	
WL_LAA_RX	25	DO	WLAN XFEM control for LAA receiver	
WL_LAA_AS_EN	28	DI	WLAN LAA AS enable	

3.4.2 Module Control

Table 6：Module control

Pin name	Pin number	I/O	Description	Comment
WL_TX_EN	26	DI	WLAN XFEM control for WLAN TX enable	
WL_PA_MUTE	27	DI	WLAN XFEM control for PA mute	
BT_EN	29	DI	BT enable	
WL_EN	30	DI	EN for WLAN	
WL_SW_CTRL	65	DI	Switch control	
SDX_TO_WL_CTI	66	DI	GPIO	
WL_TO_SDX_CTI	19	DO	GPIO	

3.5 UART Interface

3.5.1 COEX UART

To reduce the mutual interference between LTE and WIFI, please connect COEX_UART to SIM8200-LGA series modules.

3.5.2 BT UART*

BT_UART is for communication with SIM8200-LGA series modules, under developing now.

NOTE

"*" means under development.

3.6 PCIe Interface

PCIe is for communication with SIM8200 series modules, which required differential trace impedance is 90±10%Ω, and the following figure is the PCIe reference circuit:

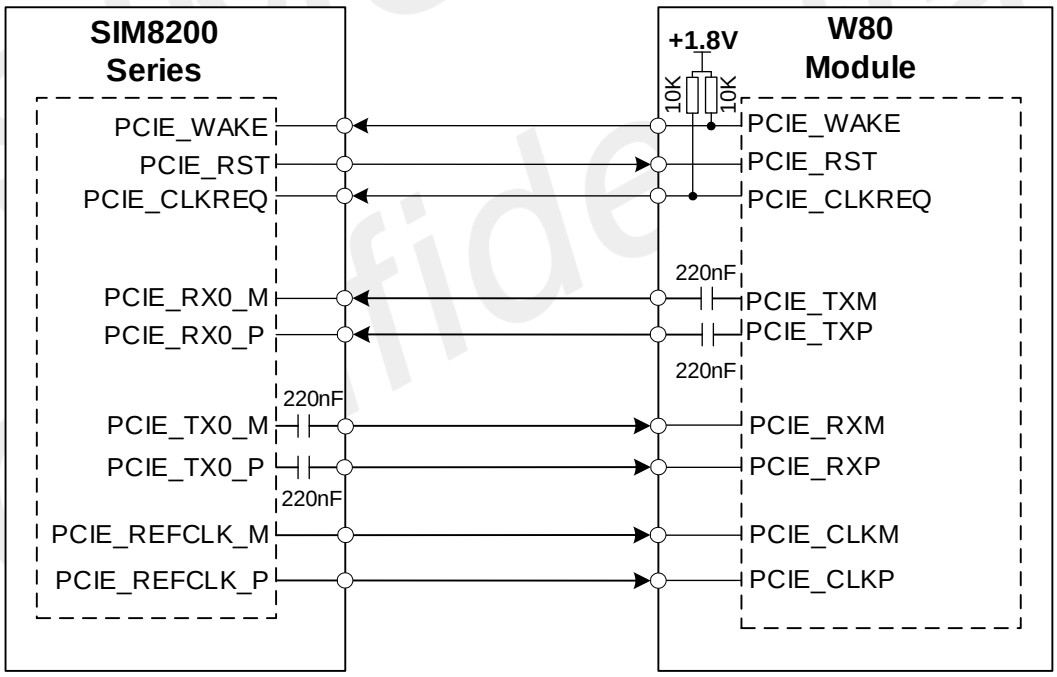

Figure 7：PCIe interface reference circuit

3.7 Antenna Interface

Pin7 and pin12 are for antenna, the characteristic impedance is 50Ω.

3.7.1 Frequency band

Table 7：Frequency band

Parameter	Value	Unit
Frequency range	2412~2484	MHz
	5180~5825	MHz

3.7.2 Reference design for RF

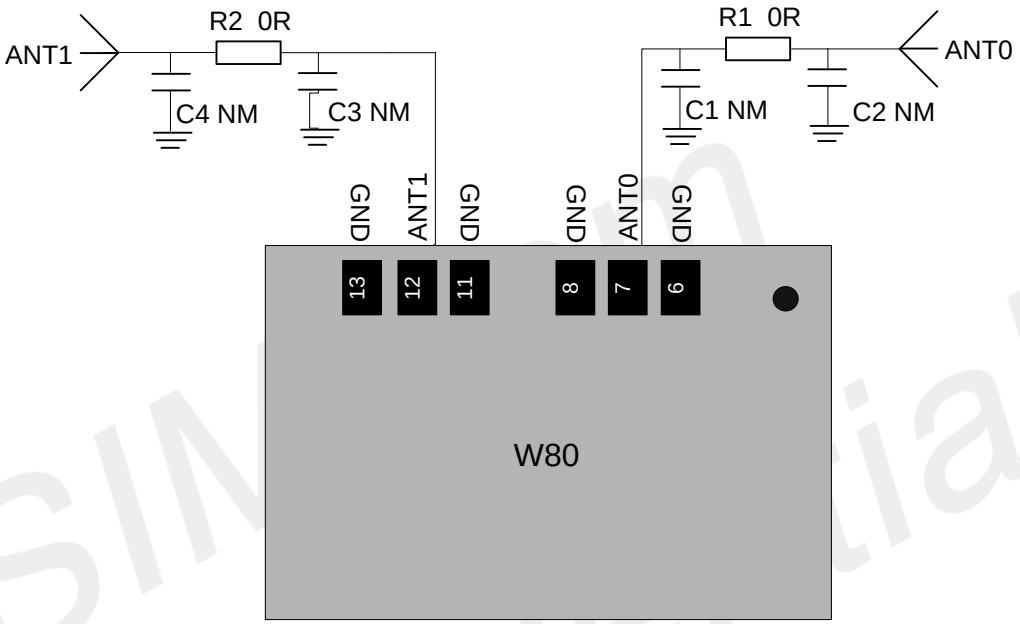

Figure 8：Reference design of RF

W80 provides two RF welding disc interfaces for connecting external antennas. The RF wiring connected to the module RF antenna welding disc is made with a micro-strip line or other type impedance line. The impedance must be controlled at about 50 ohms, and the routing line is as short as possible. In order to obtain better RF performance, two GND pads on each side of the RF interface are needed.

3.7.3 Requirement for antenna installation

Table 8：Requirement for antenna installation

Parameter	Requirement
Frequency range	2412~2484MHz
	5180~5825MHz
SWR	≤2:1
Line loss	<1dB
Gain（dBi）	>1
Input impedance（Ω）	50
Direction	Vertical

4. Electrical Specifications

4.1 Absolute Maximum Ratings

Table 9：Absolute maximum ratings

Parameter	Description	Min	Type	Max	Unit
VPH	Power for PA	-	-	4.8	V
S2E_1P224	Power for PCIe and RFA	-	-	1.4	V
S3E_0P824	Power for RFA and others	-	-	1.0	V
S4E_1P904	Power for PCIe and RFA	-	-	2.0	V
VDD_IO	Power for IO	-	-	2.0	V

4.2 Operating Conditions

Table 10：Power recommended operating ratings

Parameter	Description	Min	Type	Max	Unit
VPH	Power for PA	3.3	3.8	4.4	V
S2E_1P224	Power for PCIe and RFA	1.22	1.28	1.3	V
S3E_0P824	Power for RFA and others	0.82	0.88	0.95	V
S4E_1P904	Power for PCIe and RFA	1.8	1.88	2.0	V
VDD_IO	Power for IO	1.8	1.8	2.0	V

Table 11：1.8V digital I/O characteristics

Parameter	Description	Min	Type	Max	Unit
VIH	Input high level	1.26	-	2.1	V
VIL	Input low level	0	-	0.54	V
VOH	Output high level	1.35	-	1.8	V
VOL	Output low level	0	-	0.45	V

4.3 RF Characteristics

Table 12：Transmit power per chain

Data	Type	Unit
2.4G 802.11b @11Mbps	20.0	dBm
2.4G 802.11g @6Mbps	18.0	dBm
2.4G 802.11g @54Mbps	15.0	dBm
2.4G 802.11n，HT20 @MCS0	18.0	dBm
2.4G 802.11n，HT40 @MCS0	18.0	dBm
2.4G 802.11n，HT20 @MCS7	15.0	dBm
2.4G 802.11n，HT40 @MCS7	15.0	dBm
2.4G 802.11ac，VHT20 @MCS9	14.0	dBm
2.4G 802.11ac，VHT40 @MCS9	14.0	dBm
2.4G 802.11ax，HE20 @MCS11	12.0	dBm
2.4G 802.11ax，HE40 @MCS11	12.0	dBm
5G 802.11a @6Mbps	18.0	dBm
5G 802.11a @54Mbps	15.0	dBm
5G 802.11n，HT20 @MCS0	18.0	dBm
5G 802.11n，HT40 @MCS0	18.0	dBm
5G 802.11n，HT80 @MCS0	18.0	dBm
5G 802.11n，HT20 @MCS7	15.0	dBm
5G 802.11n，HT40 @MCS7	15.0	dBm
5G 802.11n，HT80 @MCS7	15.0	dBm
5G 802.11ac，VHT20 @MCS9	14.0	dBm
5G 802.11ac，VHT40 @MCS9	14.0	dBm
5G 802.11ac，VHT80 @MCS9	14.0	dBm
5G 802.11ax，HE20 @MCS11	12.0	dBm
5G 802.11ax，HE40 @MCS11	12.0	dBm
5G 802.11ax，HE80 @MCS11	12.0	dBm

Table 13：Receive Sensitivity at 2.4G for 1X1 configuration

Band	Type	Unit
2.4G11b@1Mbps	TBD	dBm
2.4G 11b@11 Mbps	TBD	dBm
2.4G 11g@6Mbps	TBD	dBm
2.4G 11g@54Mbps	TBD	dBm
2.4G 11n/ac@HT20-MCS0	TBD	dBm
2.4G 11n/ac@HT20-MCS7	TBD	dBm
2.4G 11n/ac@HT40-MCS0	TBD	dBm
2.4G 11n/ac@HT40-MCS7	TBD	dBm
2.4G 11ac@VHT20-MCS9	TBD	dBm
2.4G 11ac@VHT40-MCS9	TBD	dBm

2.4G 11ax@HE20-MCS0	TBD	dBm
2.4G 11ax@HE20-MCS11	-63	dBm
2.4G 11ax@HE40-MCS0	TBD	dBm
2.4G 11ax@HE40-MCS11	TBD	dBm

Table 14：Receive Sensitivity at 5G for 1X1 configuration

Band	Type	Unit
5G 11a@6Mbps	TBD	dBm
5G 11a@54Mbps	TBD	dBm
5G 11n/ac@HT20-MCS0	TBD	dBm
5G 11n/ac@HT20-MCS7	TBD	dBm
5G 11n/ac@HT40-MCS0	TBD	dBm
5G 11n/ac@HT40-MCS7	TBD	dBm
5G 11n/ac@HT80-MCS0	TBD	dBm
5G 11n/ac@HT80-MCS7	TBD	dBm
5G 11ac@VHT20-MCS9	TBD	dBm
5G 11ac@VHT40-MCS9	TBD	dBm
5G 11ac@VHT80-MCS9	TBD	dBm
5G 11ax@HE20-MCS0	TBD	dBm
5G 11ax@HE20-MCS11	-62	dBm
5G 11ax@HE40-MCS0	TBD	dBm
5G 11ax@HE40-MCS11	TBD	dBm
5G 11ax@HE80-MCS0	TBD	dBm
5G 11ax@HE80-MCS11	TBD	dBm

4.4 ESD

Module is sensitive to ESD in the process of storage, transporting, and assembling. When Module is mounted on the users' mother board, the ESD components should be placed beside the connectors which human body may touch, such as switches, USB interface, etc. The following table shows the Module ESD measurement performance.

Table 15：The ESD performance measurement table (Temperature：25℃，humidity：45%)

Parameter	Connect（±kv）	Air（±kv）
GND	TBD	TBD
Power	TBD	TBD
Antenna	TBD	TBD
PCIe	TBD	TBD
I2S	TBD	TBD
UART	TBD	TBD
Other PADs	TBD	TBD

NOTE

Test conditions: the external of the module has surge protection diodes and ESD protection diodes

5. Manufacturing

5.1 TOP and Bottom View of W80

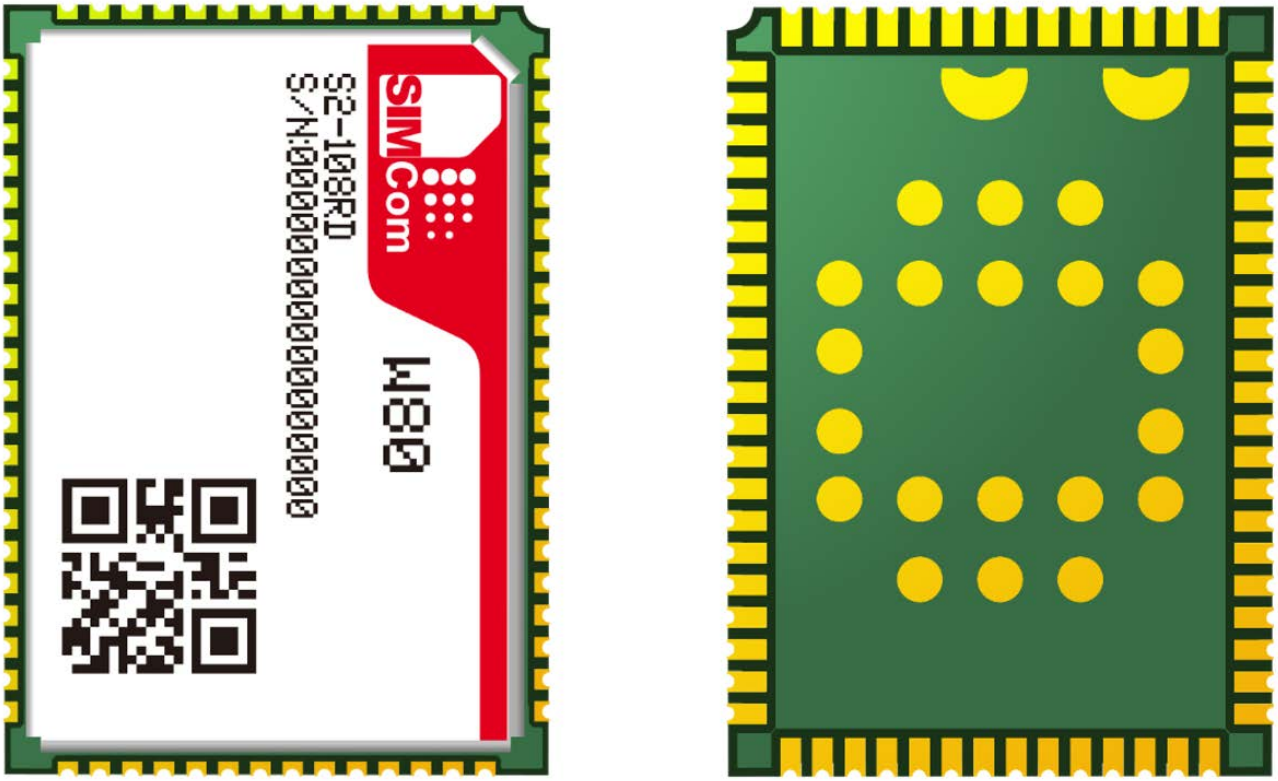

Figure 9：Top and bottom view of W80

5.2 Label Description Information

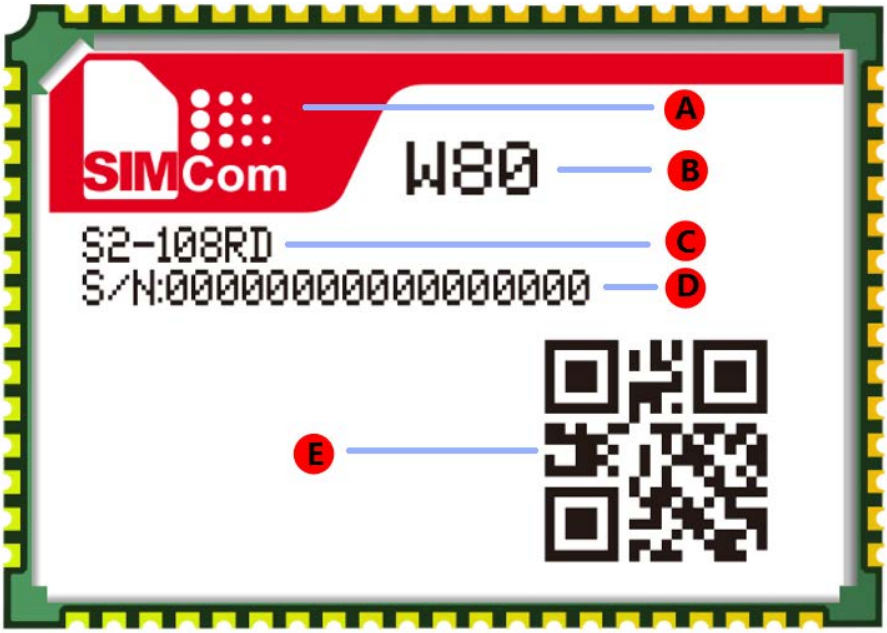

Figure 10：Label description of module

Table 16：Label description of module information

No.	Description
A	LOGO
B	Project name
C	Product code
D	Serial number
E	QR code

5.3 Recommended PCB Footprint

The following figure shows the PCB footprint of W80.

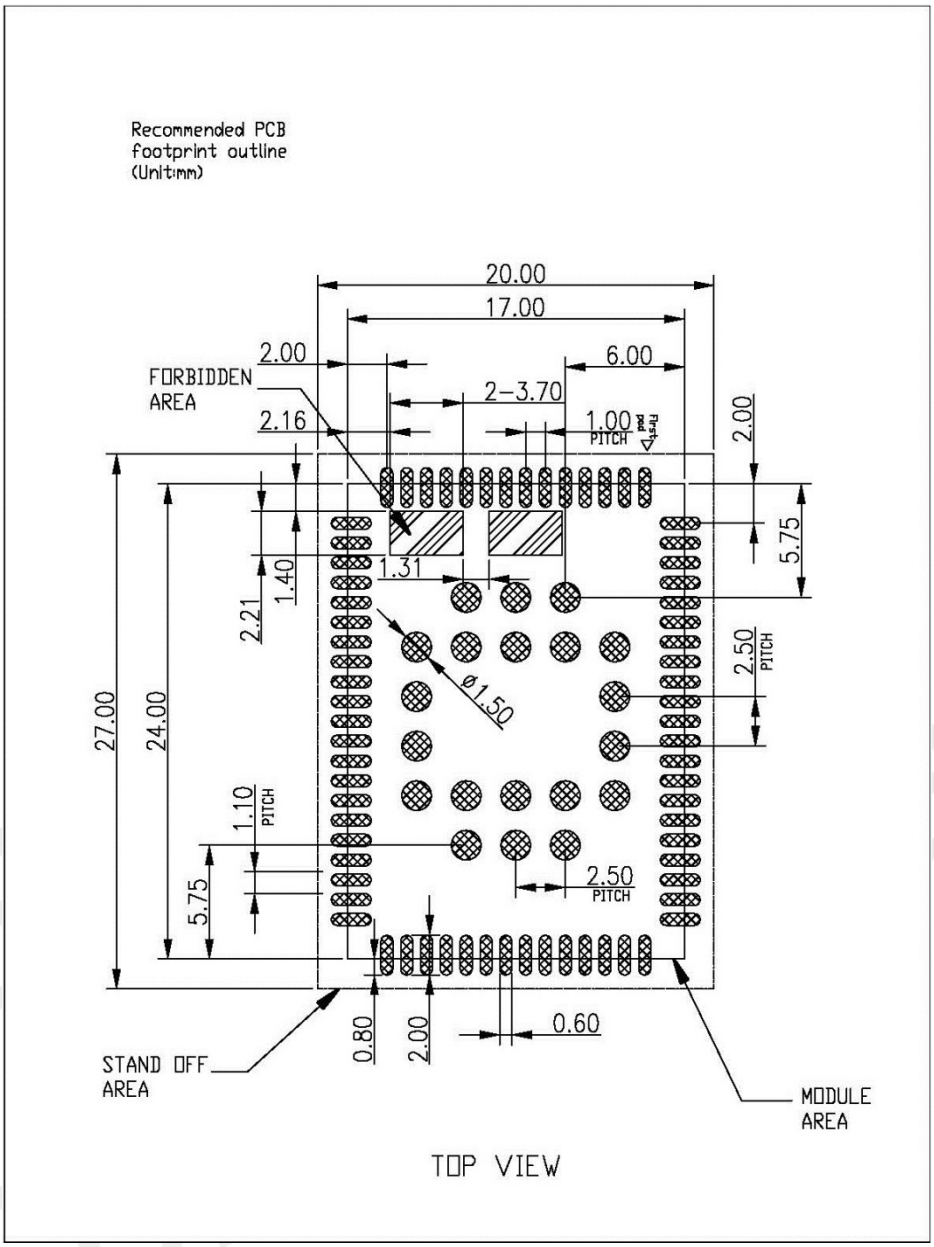

Figure 11：Recommended PCB footprint

5.4 Recommended SMT Stencil

The following figure shows the SMT stencil of W80.

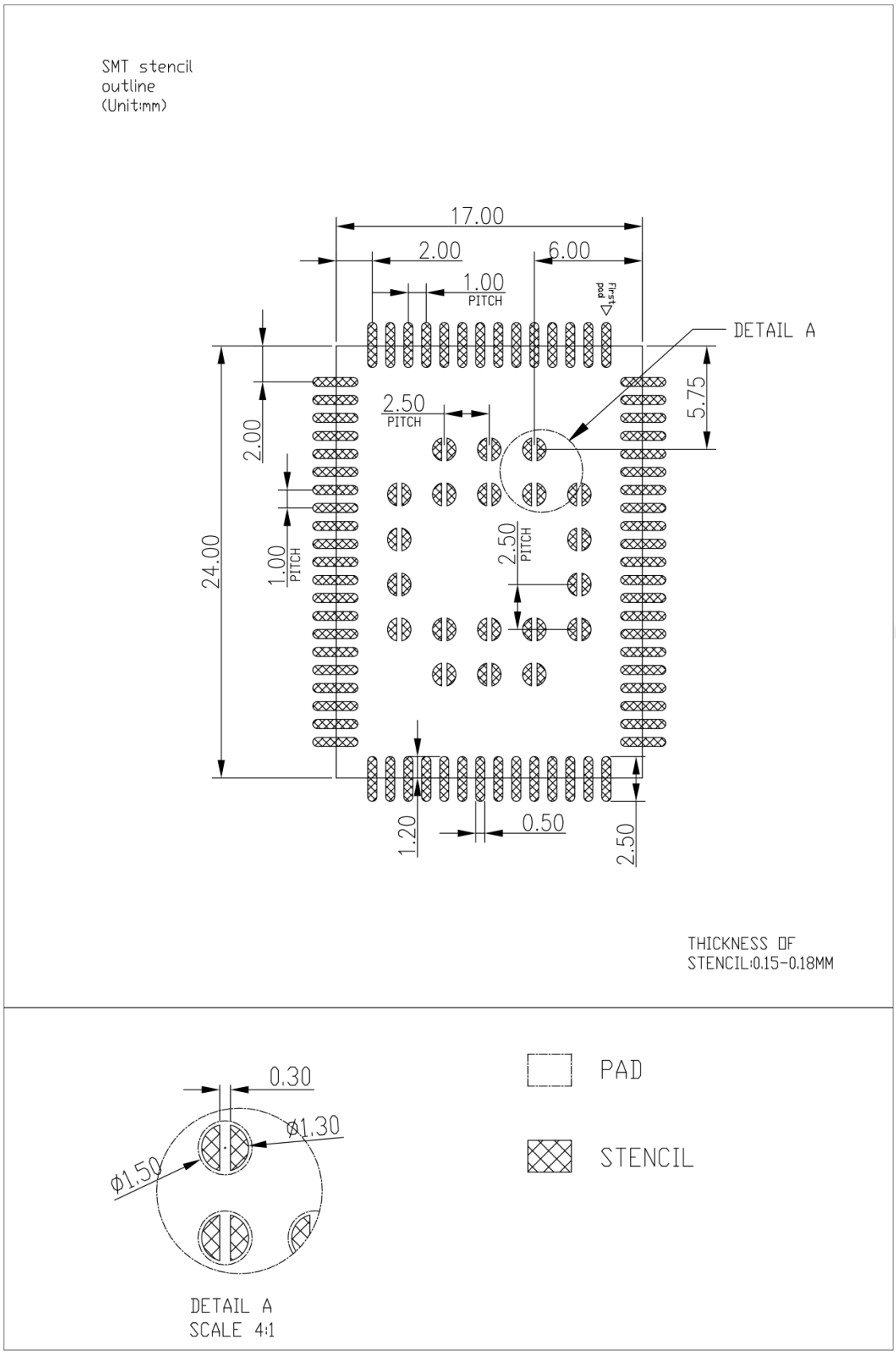

Figure 12：Recommended SMT stencil

5.5 Recommended SMT Reflow Profile

SIMCom provides a typical soldering profile. Therefore, the soldering profile shown below is only a generic recommendation and should be adjusted to the specific application and manufacturing constraints.

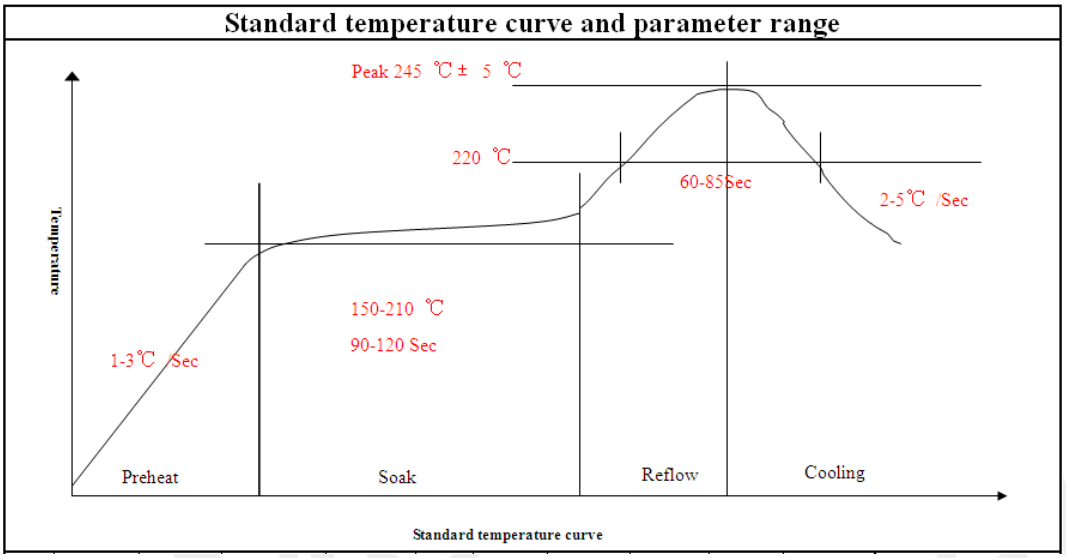

Figure 13：The ramp-soak-spike reflow profile of module

5.6 Moisture Sensitivity Level (MSL)

Module is qualified to Moisture Sensitivity Level (MSL) 3 in accordance with JEDEC J-STD-033. If the prescribed time limit is exceeded, users should bake module for 192 hours in drying equipment (<5% RH) at 40+5/-0°C, or 72 hours at 85+5/-5°C. Note that plastic tray is not heat-resistant, and only can be baked at 45° C.

Table 17：MSL ratings summary

MSL	Out-of-bag floor life	Comments
1	Unlimited	≤+30℃/85% RH
2	1 year	≤+30℃/60% RH
2a	4 weeks	≤+30℃/60% RH
3	168 hours	≤+30℃/60% RH
4	72 hours	≤+30℃/60% RH
5	48 hours	≤+30℃/60% RH
5a	24 hours	≤+30℃/60% RH
6	Mandatory bake before use. After bake, it must be reflowed within the time limit specified on the label.	≤+30℃/60% RH

NOTE

IPC / JEDEC J-STD-033 standard must be followed for production and storage.

5.7 Baking Requirements

It is necessary to bake modules if the prescribed time limit has been exceeded. The baking conditions are specified in Table 18. Note that if baking is required, the devices must be transferred into trays that can be baked to at least 125°C.

Table 18：Baking requirements

Baking conditions options	Duration
40°C±5°C, <5% RH	192 hours
120°C±5°C, <5% RH	4 hours

6. Packaging

Module support tray packaging.

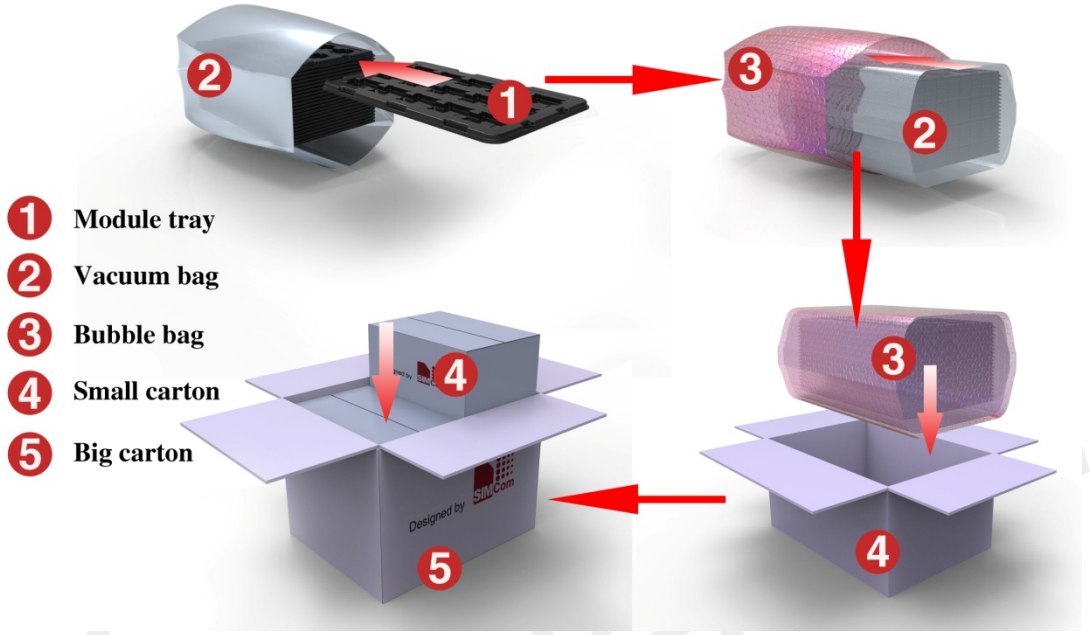

Figure 14：Packaging diagram

Module tray drawing：

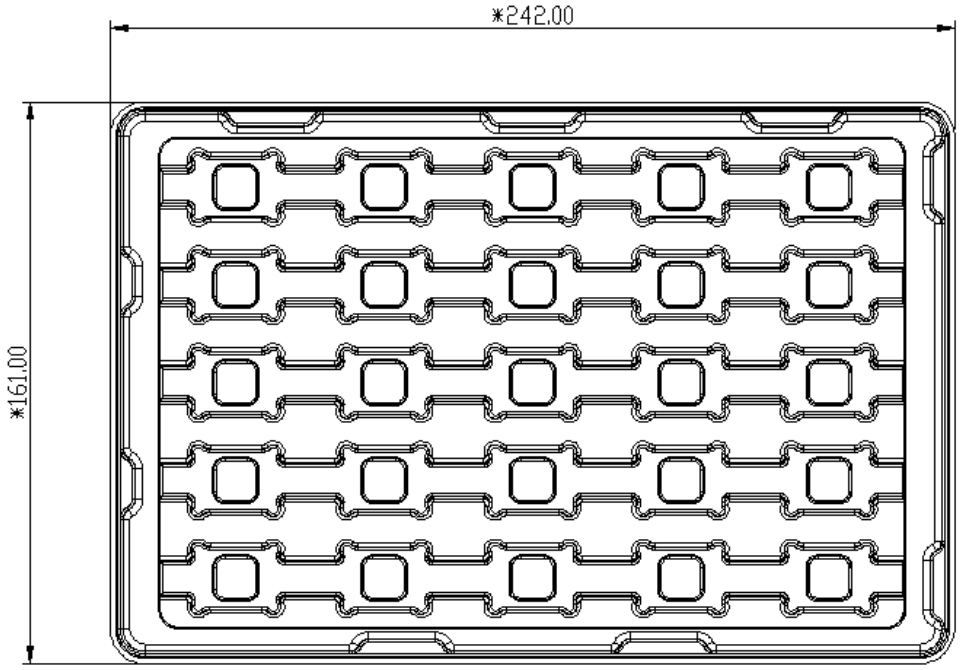

Figure 15：Tray drawing

Table 19：Tray size

Length（±3mm）	Width（±3mm）	Number
242.0	161.0	25

Small carton drawing：

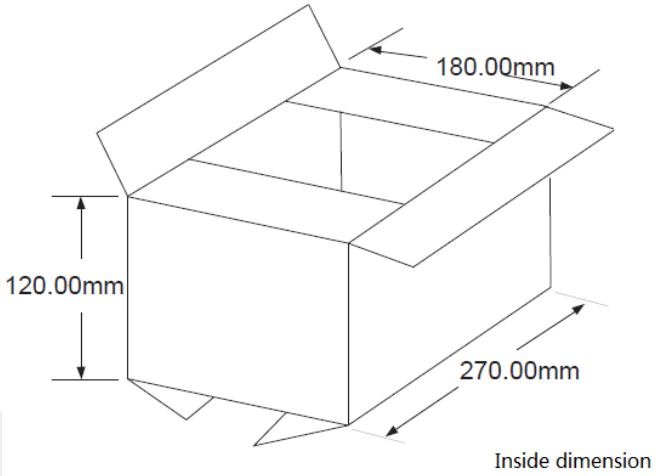

Figure 16：Small carton drawing

Table 20：Small carton size

Length（±10mm）	Width（±10mm）	Height（±10mm）	Number
270	180	120	25*20=500

Big carton drawing：

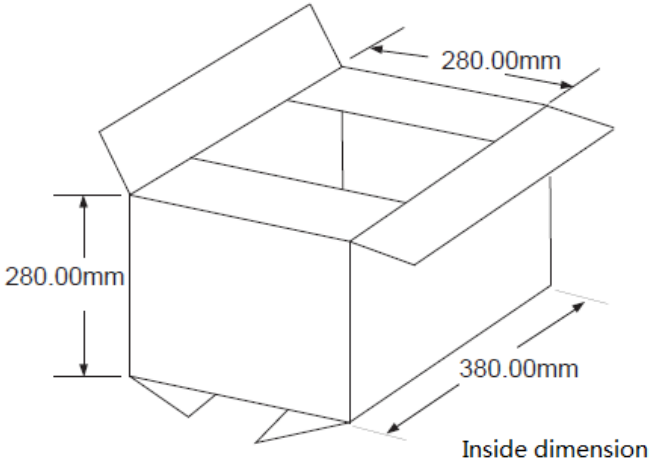

Figure 17：Big carton drawing

Table 21：Big carton size

Length（±10mm）	Width（±10mm）	Height（±10mm）	Number
380	280	280	500*4=2000

7. Appendix

7.1 Related Documents

Table 22：Related documents

NO	Title	Description
[1]	SIM8200G-LGA_KDL	W80 and SIM8200G reference design

7.2 Terms and Abbreviations

Table 23：Terms and abbreviations

Abbreviation	Description
BPSK	Binary Phase Shift Keying
B	Bidirectional digital input
CCK	Complementary Code Keying
DSSS	Direct Sequence Spread Spectrum
NC	Not connect
ESD	Electrostatic Discharge
I/O	Input/Output
LTE	Long Term Evolution
Mbps	Million Bits Per Second
MCS	Modulation and Coding Scheme
OFDM	Orthogonal Frequency Division Multiplexing
QAM	Quadrature Amplitude Modulation
QPSK	Quadrature Phase Shift Keying
RF	Radio Frequency
RX	Receive Direction
TX	Transmitting Direction
VSWR	Voltage Standing Wave Ratio
WLAN	Wireless Local Area Networks
LAA	Limited Access Authorization
MIMO	Multiple Input Multiple Output
I2S	Inter-IC Sound
LTE	Long Term Evolution
PCIe	Peripheral Component Interface Express
UART	Universal Asynchronous Receiver Transmitter

7.3 Safety Caution

Table 24：Safety caution

Marks	Requirements
	When in a hospital or other health care facility, observe the restrictions about the use of mobiles. Switch the cellular terminal or mobile off, medical equipment may be sensitive and not operate normally due to RF energy interference.
	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 to prevent interference with communication systems. Forgetting to think much of these instructions may impact the flight safety, or offend local legal action, or both.
	Do not operate the cellular terminal or mobile in the presence of flammable gases or fumes. Switch off the cellular terminal when you are near petrol stations, fuel depots, chemical plants or where blasting operations are in progress. Operation of any electrical equipment in potentially explosive atmospheres can constitute a safety hazard.
	Your cellular terminal or mobile receives and transmits radio frequency energy while switched on. RF interference can occur if it is used close to TV sets, radios, computers or other electric equipment.
	Road safety comes first! Do not use a hand-held cellular terminal or mobile when driving a vehicle, unless it is securely mounted in a holder for hands free operation. Before making a call with a hand-held terminal or mobile, park the vehicle.
	GSM cellular terminals or mobiles operate over radio frequency signals and cellular networks and cannot be guaranteed to connect in all conditions, especially with a mobile fee or an invalid SIM card. While you are in this condition and need emergent help, please remember to use emergency calls. In order to make or receive calls, the cellular terminal or mobile must be switched on and in a service area with adequate cellular signal strength. Some networks do not allow for emergency call if certain network services or phone features are in use (e.g. lock functions, fixed dialing etc.). You may have to deactivate those features before you can make an emergency call. Also, some networks require that a valid SIM card be properly inserted in the cellular terminal or mobile.