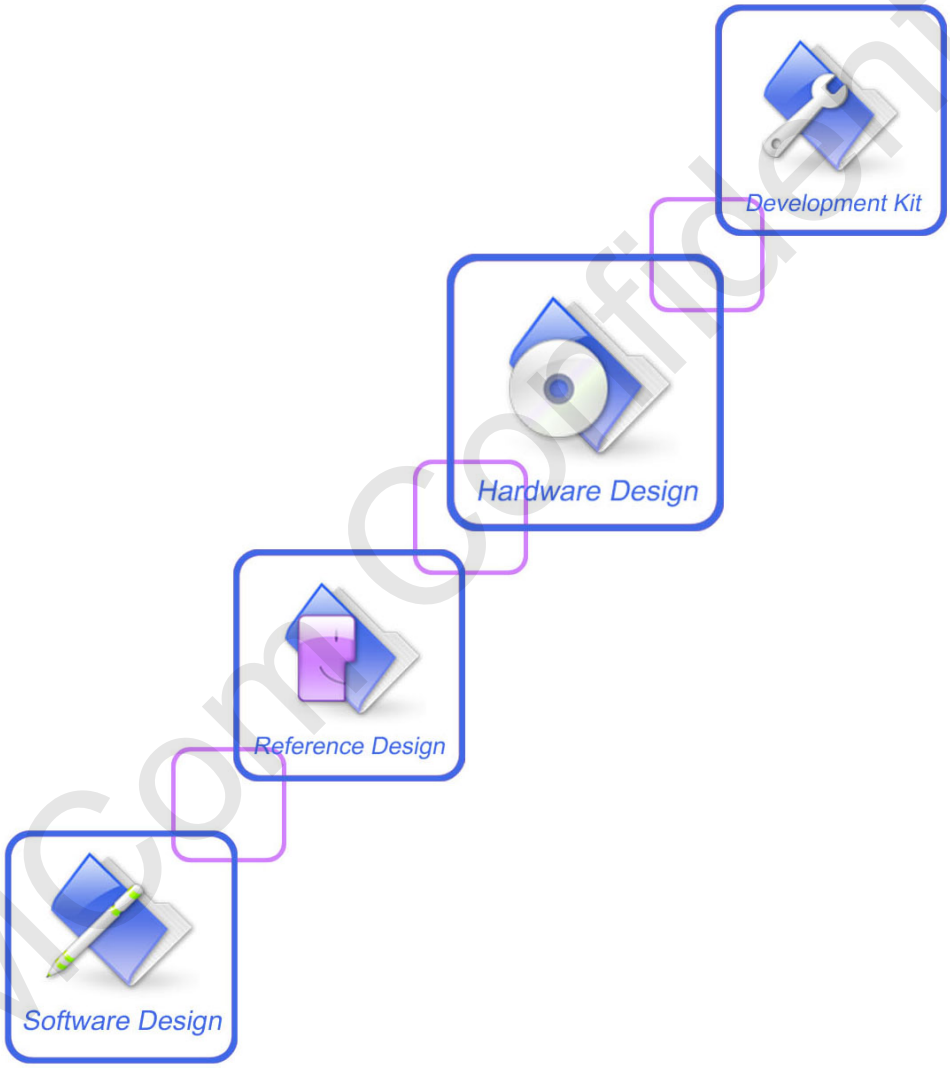
SIM8200EA-M2 _ Hardware Design_V1.01



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Revision History

Data	Version	Description of change	Author
2019-06-27	1.00	original version	Olivier.wu Xutao.jiang Cunbao.feng
2019-09-25	1.01	Modify the error	Olivier.wu

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1 Introduction

This document describes the electronic specifications, RF specifications, interfaces, mechanical characteristics and testing results of the SIMCom M.2 card. With the help of this document and other software application notes/user guides, users can understand and use SIM8200EA-M2 to design and develop laptop applications quickly.

1.1 Product Outline

Aimed at the EMEA/APAC/Brazil market, SIM8200EA-M2 supports Multi-Band 5G NR LTE-FDD/LTE-TDD/WCDMA, support R15 5G NSA/SA up to 4.0 Gbps data transfer. The supported radio frequency bands are described in the following table.

Table 1: SIM8200EA-M2 frequency bands

Standard	SIM8200EA-M2
5G NR	n1,n2,n3,n5,n7,n8,n12,n20,n25,n28,n40,n41,n66.n71.n77,n78,n79
LTE(FDD)	B1/B2/B3/B4/B5/B7/B8/B12/B13/B14/B17/B18/B19/B20/B25/B26/B28/B29/B30/ B32/B66/B71
LTE(TDD)	B34/B38/B39/B40/B41/B42/B43/B48
WCDMA	B1/B2/B3/B4/B5/B8
GNSS	GPS/GLONASS/ BeiDou/Galileo/QZSS

With a physical dimension of 30.0*52.0*2.3 mm, SIM8200EA-M2 can meet PCI Express key B M.2 Specification, and can meet almost any space requirement in users' applications. With M.2 Type 3052, SIM8200EA-M2 had almost all common interface integrated, such as USB2.0,USB3.1, PCIe Gen3.0, UIM(×2) card, Digital audio(I2S or PCM), I2C, GPIOs, Antenna × 6 etc.
With all the interfaces, SIM8200EA-M2 can also be utilized in the industrial handheld, machine-to-machine laptop application and especially the CPE/AR/VR/MR.

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1.2 Hardware Block Diagram

The Block Diagram of SIM8200EA-M2 is shown as below:

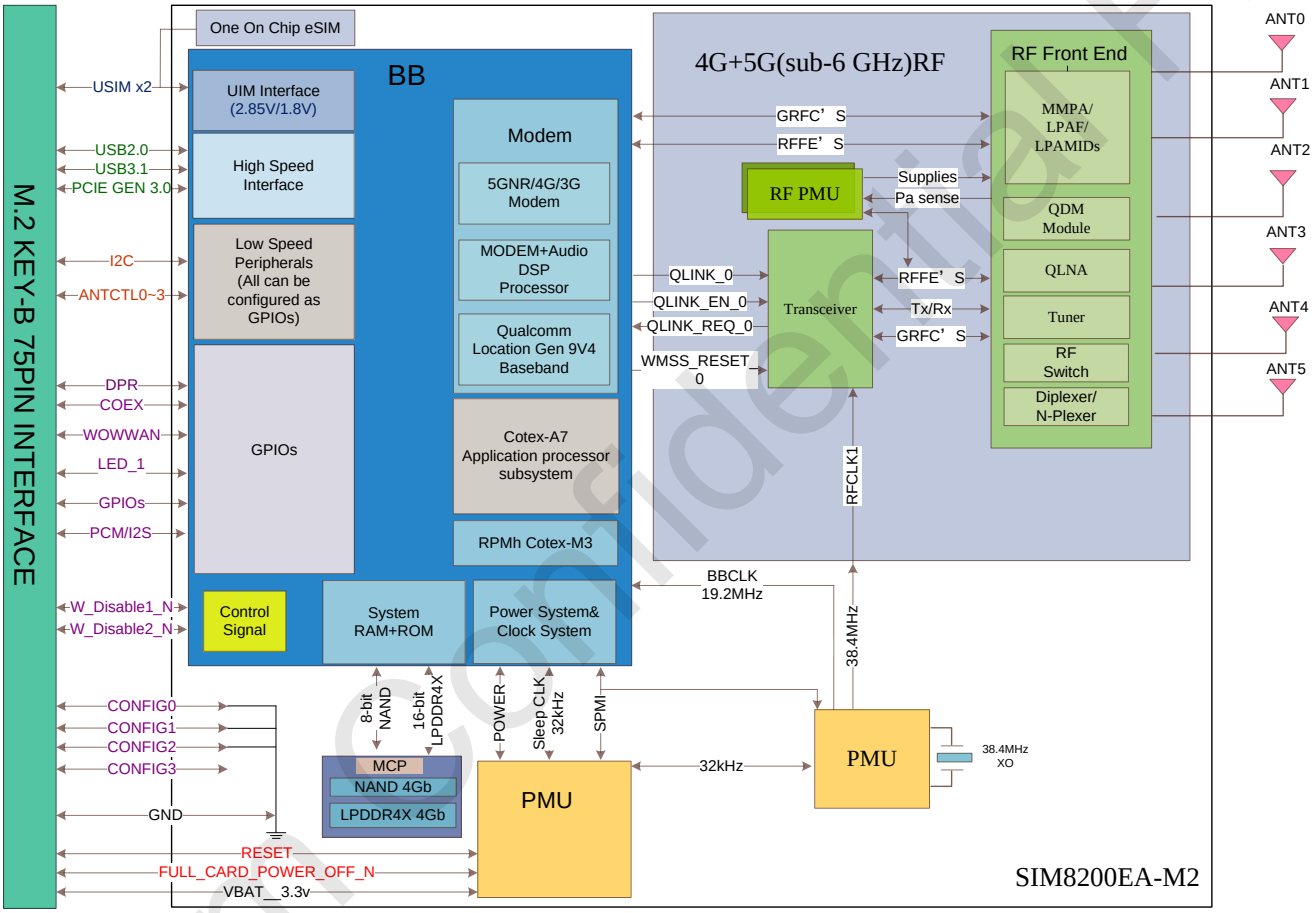

Figure 1: Standard Module block diagram

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1.3 Functional Overview

Table 2: General features

Feature	Implementation
Power supply	VBAT:3.3～4.4(TDB) Typical Power Rail: 3.3V
Power consumption	Current in sleep mode : TBD
Radio frequency bands	Please refer to the table 1
Transmitting power	5GNR power class: TBD LTE power class: 3 (0.25W) WCDMA power class: 3 (0.25W)
Data Transmission Throughput	5GNR: 1.5 Gbps (UL), 4 Gbps (DL) FDD-LTE CAT20+:Max 2.4Gbps (DL), 300Mbps (UL) TDD-LTE CAT20+:Max2.4Gbps (DL), 300Mbps (UL) HSPA+: 5.76 Mbps(UL), 42 Mbps(DL)
Antenna	5G main antenna. WCDMA/LTE diversity antenna GNSS antenna
GNSS	GNSS engine (GPS/GLONASS/ BeiDou/Galileo/QZSS) Protocol: NMEA
SMS	MT, MO, CB, Text and PDU mode SMS storage: USIM card or ME(default) Transmission of SMS alternatively over CS or PS.
USIM interface	Support identity card: 1.8V/ 2.85V
USIM application toolkit	Support SAT class 3, GSM 11.14 Release 98 Support USAT
Phonebook management	Support phonebook types: DC,MC,RC,SM,ME,FD,ON,LD,EN
Digital Audio feature	One I2S interface with dedicated main-clock for primary digital audio, the I2S also can be configured as PCM ● Half Rate (ETS 06.20) ● Full Rate (ETS 06.10) ● MCLK frequency: 12.288MHz (default) ● Enhanced Full Rate (ETS 06.50 / 06.60 / 06.80) ● WCDMA AMR-NB ● VoLTE AMR-WB ● Echo Cancellation ● Noise Suppression
PCIE interface	● One port PCIE interface, support PCIe Gen 3 (PCIe Gen 1/2 compatible) ● High communication data rate which is up to 8 Gbps per lane.

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USB	One USB 3.1 SuperSpeed and high-speed (for backward compatibility) USB3.1: super speed, with data rate which is up to 10 Gbps. USB2.0: high speed interface, support USB operations at low-speed and full-speed, which refer to USB1.0 and USB1.1.
Firmware upgrade	Firmware upgrade over USB interface or FOTA
Physical characteristics	Size: 30*52*2.3mm Weight: TBD
Temperature range	Normal operation temperature: -30°C to +75°C Extended operation temperature: -40°C to +85°C* Storage temperature -45°C to +90°C

Note: Module is able to make and receive voice calls, data calls, SMS and make GPRS/UMTS/HSPA+/LTE traffic in -40℃ ~ +85℃. The performance will be reduced slightly from the 3GPP specifications if the temperature is outside the normal operating temperature range and still within the extended operating temperature range.

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2 Package Information

2.1 Pin Assignment Overview

All functions of the M.2 card will be provided through 75 (including 8 notch pins) pads that will be connected to the customers' platform. The following figure is the high-level view of the pin assignment of the card.

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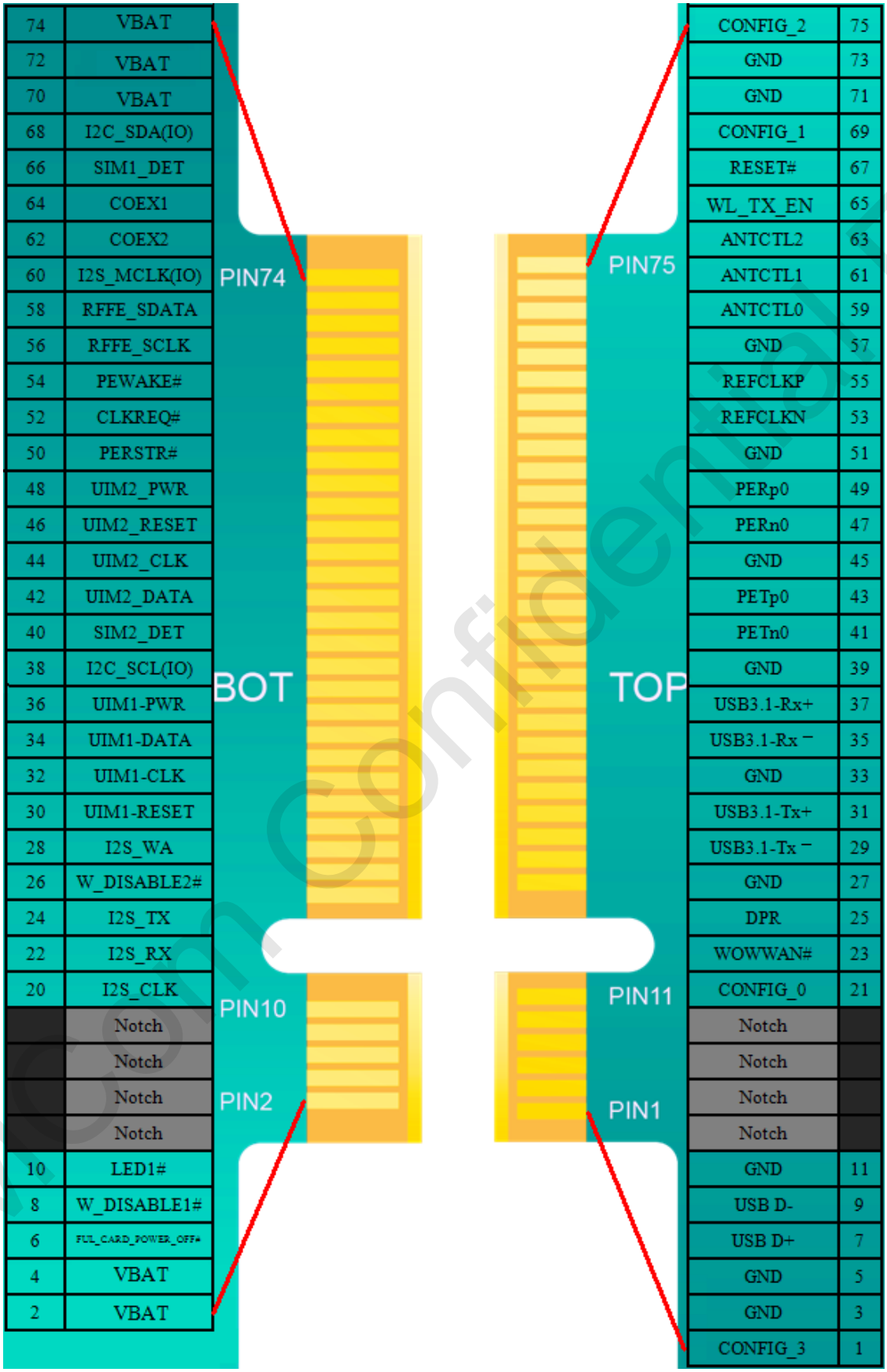

Figure 2: Pin map

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2.2 Pin Description

Table 3: IO parameters definition

Pin type	Description
PI	Power input
PO	Power output
AI	Analog input
AIO	Analog input/output
DIO	Bidirectional digital input /output
DI	Digital input
DO	Digital output
DOH	Digital output with high level
DOL	Digital output with low level
PU	Pull up
PD	Pull down
OD	Open Drain
OC	Open collector

Table 4: IO parameters definition

Voltage domain	Parameter		Min	Typ	Max
P3	VDD_P3=1.8V				
	VOH	High level output	1.35V	-	1.8V
	VOL	Low level output	0V	-	0.45V
	VIH	High level input	1.2V	1.8V	2.1V
	VIL	Low level input	-0.3V	-	0.6V
	Rp	Pull up/down resistor	80K ohm	-	240K ohm
P4	VDD_P4=1.8V				
	VOH	High level output	1.44V	-	1.8V
	VOL	Low level output	0V	-	0.4V
	VIH	High level input	1.26V	1.8V	2.1V
	VIL	Low level input	-0.3V	-	0.36V
	Rp	Pull up/down resistor	360K ohm	-	
	VDD_P4=2.85V				
	VOH	High level output	2.28V	-	2.85V
	VOL	Low level output	0V	-	0.4V
	VIH	High level input	2.0V	-	3.15V
	VIL	Low level input	-0.3V	-	0.57V

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	Rp	Pull up/down	285K ohm		

Table 5: Pin description

Pin name	Pin No.	Electrical Description		Description	Comment
Power supply					
VBAT	2,4,70,72,74		PI	M,2 card power supply, voltage range: 3.3～4.3V.	User should connect these pins together.
GND	3,5,11,27,33 ,39,45,51,57 ,71,73			Ground	
System Control					
FUL_CARD_POWER _OFF#	6		DI,PD	High level effective	It's 3.3V voltage domain but can be driven by either 1.8V or 3.3V GPIO.
RESET#	67	P3	DI,PU	System reset control input, active low.	RESET_N internally pulled to1.8V by 100k resistance
W_DISABLE1#	8	P3	DI	WWAN RF Disable, active low	It's 3.3V voltage domain but can be driven by either 1.8V or 3.3V GPIO.
W_DISABLE2#	26	P3	DI	GNSS Disable,active low	It's 3.3V voltage domain but can be driven by either 1.8V or 3.3V GPIO.
WOWWAN# （WAKE_ON_WWAN）	23	P3	OC	(WAKE_ON_WWAN) WWAN is used to wake up host, active low	If unused, please keep open.
WL_TX_EN	65	P3	DI	Adjustable WIFI coexists with N79/LAA	If unused, please keep open.
Configuration pins					
CONFIG_0	21		GND	Internally connected to the ground	SIM8200EA-M2 module is configured as WWAN USB3.1 interface type
CONFIG_1	69		GND	Internally connected to the ground	
CONFIG_2	75		GND	Internally connected to the ground	
CONFIG_3	1		NC	Not connected	
USB2.0/USB3.1					
USB D+	7		AIO	Positive line of the differential, bi-directional USB signal.	Main communication interface. USB3.1 up to 10Gbps data rate. USB2.0 up to
USB D-	9		AIO	Negative line of the differential, bi-directional USB signal.	
USB3.1-Tx-	29		AO	USB3.1 transmit data minus	

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USB3.1-Tx+	31		AO	USB3.1 transmit data plus	480Mbps data rate.
USB3.1-Rx-	35		AI	USB3.1 receive data minus	
USB3.1-Rx+	37		AI	USB3.1 receive data plus	
PCIe interface					
PETn0	41		AO	PCIe TX Differential signals Negative	Support PCIe GEN 3.0, up to 8Gbps data rate. If unused, please keep open.
PETp0	43		AO	PCIe TX Differential signals Positive	
PERn0	47		AI	PCIe RX Differential signals Negative	
PERp0	49		AI	PCIe RX Differential signals Positive	
REFCLKN	53		AIO	PCIe Reference Clock signal Negative	
REFCLKP	55		AIO	PCIe Reference Clock signal Positive	
PCIE assistant interface					
PERSTR#	50		DI	PCIe reset signal，active low	3.3V voltage domain，If unused, please keep open.
CLKREQ#	52		DIO	PCIe clock request signal，active low	
PEWAKE#	54		DO	PCIe walk up signal，active low	
USIM interface					
UIM1-PWR	36	P4	PO	Power output for USIM1 card, the voltage depends on the USIM1 card type. Its output current is up to 50mA.	1.8/3.0V voltage domain, All lines of USIM interface should be protected against ESD.
UIM1-DATA	34	P4	DIO	USIM1 Card data I/O, which has been pulled up via a 10KR resistor to USIM_VDD internally. Do not pull it up or down externally.	
UIM1-CLK	32	P4	DO	USIM1 clock output	
UIM1-RESET	30	P4	DO	USIM1 Reset output	
SIM1_DET	66	P3	DI	USIM1 card detecting input signal which has been pulled up via a 10KR resistor to VDD_P3 internally.	
UIM2_PWR	48	P4	PO	Power output for USIM2 card, the voltage depends on the USIM1 card type. Its output current is up to 50mA.	1.8/3.0V voltage domain, All lines of USIM interface should be protected against ESD.
UIM2_DATA	42	P4	DIO	USIM2 Card data I/O, which has been pulled up via a 10KR resistor to USIM_VDD internally. Do not pull it up or down externally.	

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UIM2_CLK	44	P4	DO	USIM2 clock output	
UIM2_RESET	46	P4	DO	USIM2 Reset output	
SIM2_DET	40	P3	DI	USIM2 card detecting input signal which has been pulled up via a 10KR resistor to VDD_P3 internally.	
ANTCTL interface					
ANTCTL0	59	P3	DO	Tunable ANT CTRL0	These signals are used for Antenna Control and should be routed to the appropriate
ANTCTL1	61	P3	DO	Tunable ANT CTRL1	
ANTCTL2	63	P3	DO	Tunable ANT CTRL2	
RFFE_SDATA	58	P3	DIO	Tunable ANT MIPI DATA	If unused, please keep them open.
RFFE_SCLK	56	P3	D0	Tunable ANT MIPI CLK	
I2S interface					
I2S_CLK	20	P3	DO	I2S clock output	1.8Vvoltage domain，Can be multiplexed into PCM signals，If unused, please keep them open.
I2S_RX	22	P3	DI	I2S data input	
I2S_TX	24	P3	DO	I2S data output	
I2S_WA	28	P3	DO	I2S word select (L/R)	
I2S_MCLK	60	P3	DO	I2S master clock	
I2C 接口					
I2C_SDA	68	P3	DIO	I2C data signal	1.8Vvoltage domain，If unused, please keep them open.
I2C_SCL	38	P3	D0	I2Cclock signal	
Coex interface					
COEX1 (COEX_RX*)	64	P3	DI	Wireless coexistence of WWAN and WiFi/BT, based on BT-sig coex is tence protocol	If unused, please keep them open.
COEX2 (COEX_TX*)	62	P3	DO	Wireless coexistence of WWAN and WiFi/BT, based on BT-sig coex is tence protocol	
Other pins					
LED1#	10	P3	OC	OC，active low，Status indicator driver LED	If unused, please keep them open.
DPR	25	P3	DI	The Pin is used to control SAR sensor on or off， active low, (default H) H: SAR SENSOR does not work, PA maximum power is not reduced L: SAR SENSOR work,	1.8Vvoltage domain
Notch					
Notch	12, 13, 14, 15, 16, 17, 18, 19			Notch	

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2.3 Mechanical Information

The following figure shows the package outline drawing of the M.2 card.

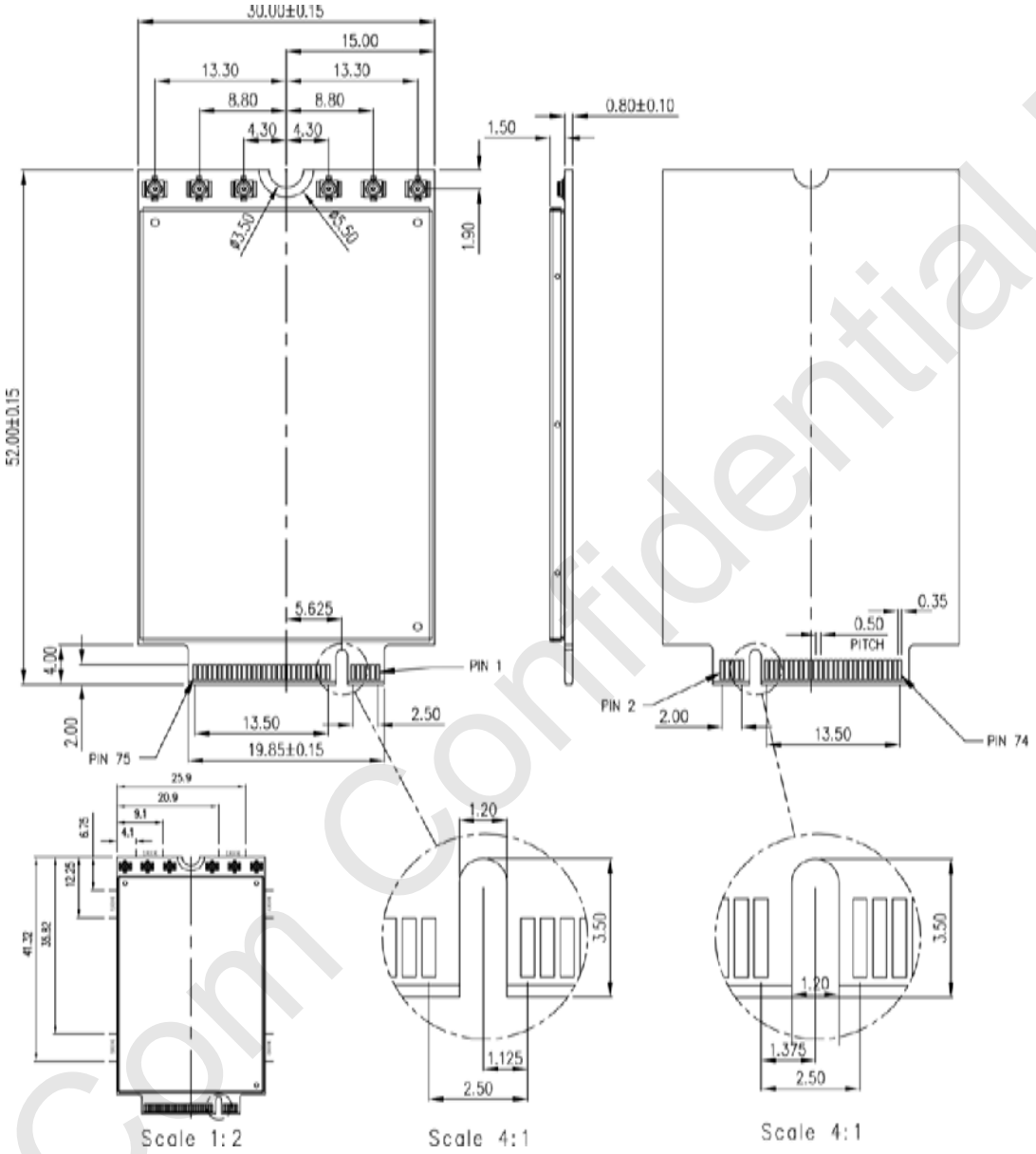

Figure 3: pin out diagram

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3 Interface Application

3.1 Power Supply

The recommended power supply of SIM8200EA-M2 is 3.8V and the voltage ranges from 3.3V to 4.3 V. The SIM8200EA-M2 has 5 power pins and 11 Ground pins, to ensure the SIM8200EA -M2 card works normally, all the pins must be connected. The M.2 connector pin is defined to support 500mA current per pin continuously.

Table 6: VBAT pins electronic characteristic

Symbol	Description	Min.	Typ.	Max.	Unit
VBAT	Module power voltage	3.135	3.8	4.3	V
$I_{VBAT(peak)}$	Module power peak current in normal mode.	-	TDB	-	A
$I_{VBAT(power-off)}$	Module power current in power off mode.	-	TDB	-	uA

3.1.1 Power Supply Design Guide

Make sure that the voltage on the 3.8V pins will never drop below 3.135V, even during a transmit burst, when current consumption may rise up to 1.0A. If the voltage drops below 3.135V, the module will be powered off automatically.

Note: Be sure the power supply for VBAT pins can support more than1.0A, using a total of more than 100uF capacitors is recommended, in order to avoid the voltage drop to lower than 3.135V. Some multi-layer ceramic chip (MLCC) capacitors (0.1/1uF) with low ESR in high frequency band can be used for EMC.

These capacitors should be put as close as possible to VBAT pads. Also, users should keep VBAT trace on circuit board wider than 2 mm to minimize PCB trace impedance. The following figure shows the recommended circuit.

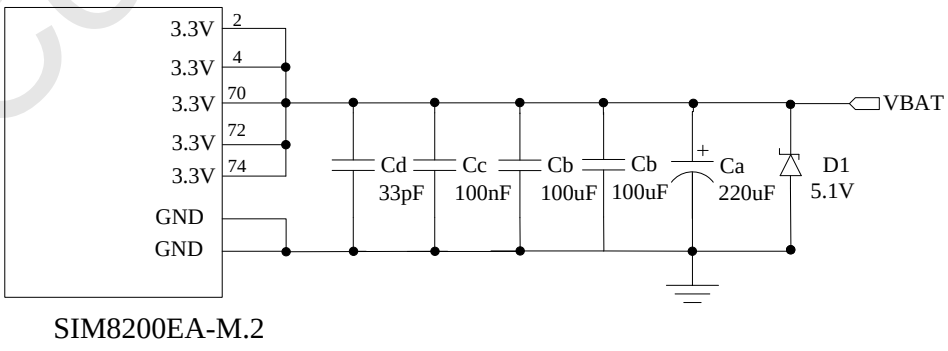

Figure 4: Power supply application circuit

Note: The test condition: The voltage of power supply for VBAT is 3.3V, Ca is 220 µF tantalum

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capacitor (ESR=0.7Ω).

In addition, in order to guard for over voltage protection, it is suggested to use a D1 diode to protect the M.2 card.

Table 7: Recommended TVS diode list

No.	Manufacturer	Part Number	V_{RWM}	Package
1	JCET	ESDBW5V0A1	5V	DFN1006-2L
2	Prisemi	PESDHC2FD4V5BH	4.5V	DFN1006-2L
3	WAYON	WS05DPF-B	5V	DFN1006-2L
4	WILL	ESD5611N	5V	DFN1006-2L
5	WILL	ESD56151W05	5V	SOD-323
6	WAYON	WS4.5DPV	4.5V	DFN1610-2L

3.1.2 Recommended Power Supply Circuit

It is recommended that a switching mode power supply or a linear regulator power supply is used. It is important to make sure that all the components used in the power supply circuit can resist the current which could be more than 4 A（TBD）.

The following figure shows the linear regulator reference circuit with 5V input and 3.3V output.

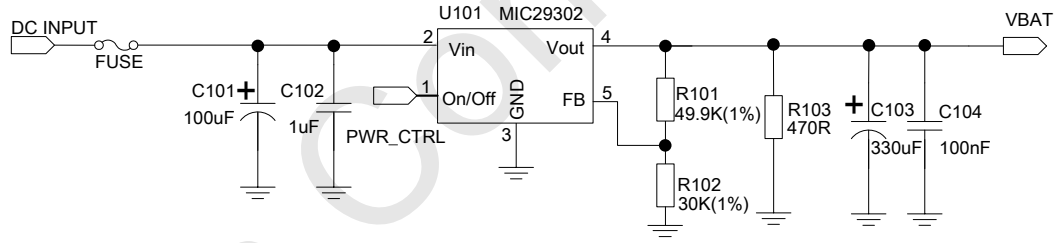

Figure 5: Linear regulator reference circuit

If there is a high dropout between input and VBAT, or the efficiency is extremely important, then a switching mode power supply will be preferable. The following figure shows the switching mode power supply reference circuit with 12V input and 3.3V output.

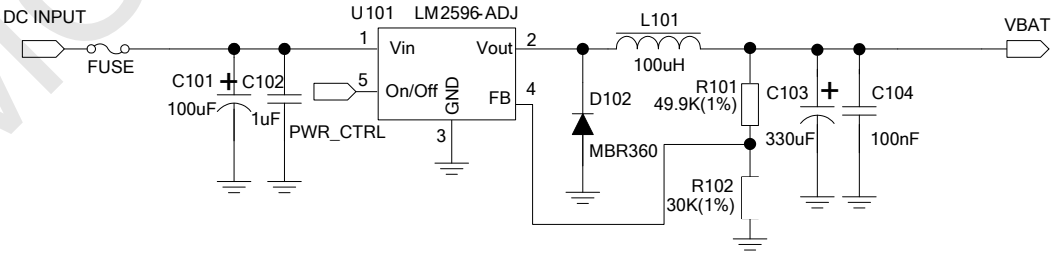

Figure 6: Switching mode power supply reference circuit

Note: The Switching Mode power supply solution for VBAT must be chosen carefully against

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Electro Magnetic Interference and ripple current from depraving RF performance.

3.2 Voltage Monitor

To monitor the VBAT voltage, the AT command “AT+CBC” can be used.

Note: For more details about voltage monitor commands, please refer to Document [1] in the appendix.

3.3 Turn on and off module

3.3.1 FUL_CARD_POWER_OFF#

Module can be powered on by pulling the FUL_CARD_POWER_OFF# pin, which is 3.3V tolerant，up to high level through GPIO.

FUL_CARD_POWER_OFF# signal is an active low input signal and will turn the module on when asserted high (≥1.7 V) and will force the module to shut down when asserted low (≤0.2 V). This pin is 3.3V tolerant and can be driven by either 1.8V or 3.3V GPIO and has been pulled down internal.

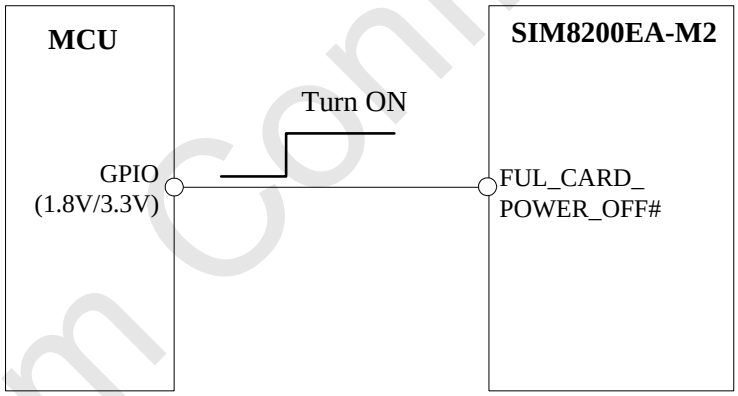

Figure 7: Reference power on/off circuit

Note: Module could be automatically power on by connecting FUL_CARD_POWER_OFF# pin to 3.3 V via 0R resistor directly.

The power-on scenarios are illustrated in the following figure.

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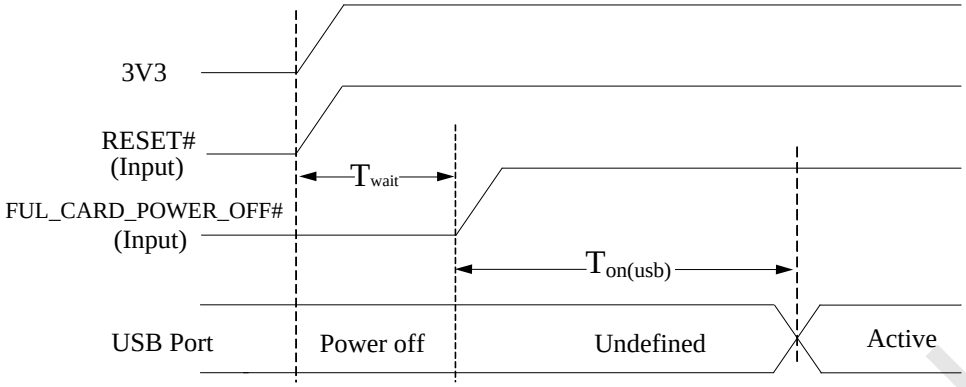

Figure 8: Power on timing sequence

Table 8: Power on timing and electronic characteristic

Symbol	Parameter	Min.	Typ.	Max.	Unit
T_{wait}	The time which is used to wait the 3.3v to be stable.	TBD	-	-	ms
$T_{on(usb)}$	The time from power-on issue to USB port ready	-	TBD	-	s
V_{IH}	Input high level voltage on FUL_CARD_POWER_OFF# pin	1.0	1.7	4.4	V
V_{IL}	Input low level voltage on FUL_CARD_POWER_OFF# pin	-0.3	0	0.2	V

3.3.2 Power off

The following methods can be used to power off the card.

- Method 1: Power off the card by holding the FUL_CARD_POWER_OFF# pin to a low level.
- Method 2: Power off Module by AT command "AT+CPOF".
- Method 3: over-voltage or under-voltage automatic power off.
- Method 4: over-temperature or under-temperature automatic power off.

Note: If the temperature is outside the range of -30~+75 ℃, some warning will be reported via AT port. If the temperature is outside the range of -40~+85 ℃, Module will be powered off automatically.

For details about "AT+CPOF", please refer to Document [1] in the appendix.

These procedures will make the M.2 card disconnect from the network and allow the software to enter a safe state, and save data before the card be powered off completely.
The power off scenario by pulling down the FUL_CARD_POWER_OFF# pin is illustrated in the following figure.

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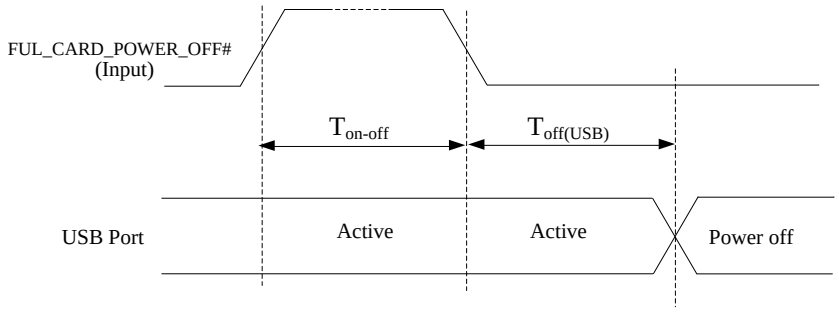

Figure 9: Power off timing sequence

Table 9: Power off timing and electronic characteristic

Symbol	Parameter	Time value			Unit
		Min.	Typ.	Max.	
$T_{off(usb)}$	The time from power-off issue to USB port off	-	TBD	-	s
T_{on-off}	The buffer time from power-off issue to power-on issue	TBD	-	-	s

3.4 Reset Function

Module can be reset by pulling the RESET# pin down to ground.

Note: This function is only used as an emergency reset, when both AT command "AT+CPOF" and the FUL_CARD_POWER_OFF# pin have lost efficacy.

The RESET# pin has been pulled up with a resistor to 1.8V internally, so it does not need to be pulled up externally. It is strongly recommended to put an ESD protection diode close to the Hardware circuit RESET# pin. Please refer to the following figure for the recommended reference circuit.

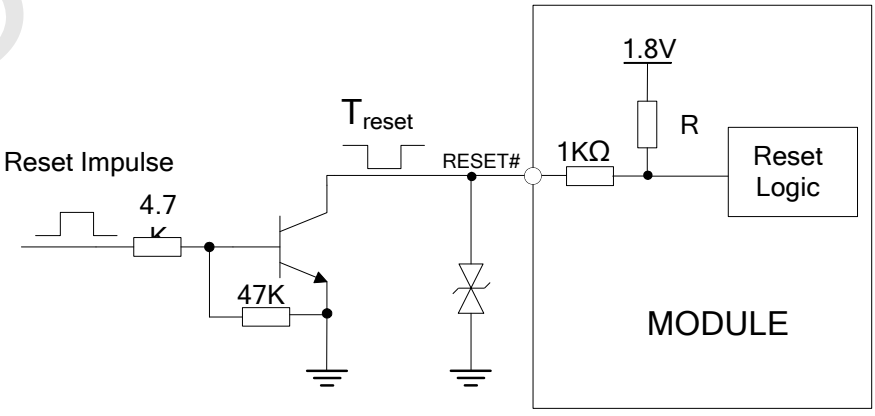

Figure 10: Reference reset circuit

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Table 10: RESET pin electronic characteristic

Symbol	Description	Min.	Typ.	Max.	Unit
T_{reset}	The active low level impulse time on RESET_N pin to reset Module	TBD	TBD	TBD	ms
V_{IH}	Input high level voltage	1.17	1.8	2.1	V
V_{IL}	Input low level voltage	-0.3	0	0.8	V

3.5 WoWWAN#

The WoWWAN# pin is an open collector signal which can be used as an interrupt signal to the host. Normally it will keep high logic level until certain conditions such as receiving SMS, voice call (CSD, video) or URC reporting, then WoWWAN# will change to low logic level to inform the host (client PC), the pulse time is 1 second.

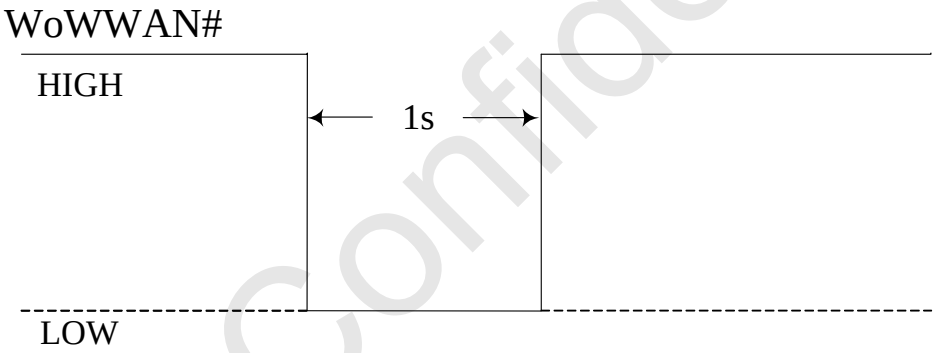

Figure 11: WOWWAN# behaviour（SMS and URC report）

WAKE_ON_WWAN Reference circuit is recommended in the following figure.

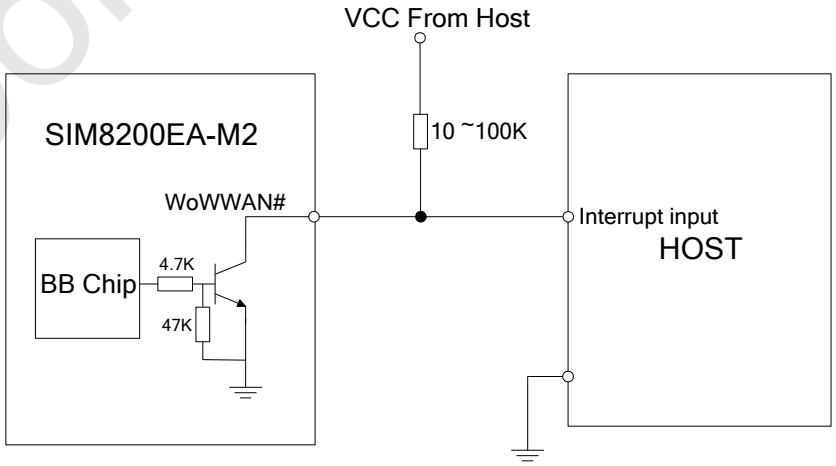

Figure 12: WOWWAN# behaviour（SMS and URC report）

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3.6 USB3.1 Interface

The module support one integrated USB interface which complies with the USB 3.1 specifications and supports super speed up to 10Gbps. The USB interface is used for AT command communication, data transmission, GNSS NMEA output, software debugging and voice over USB.

Note：The USB3.1-Tx+ and USB3.1-Tx- should be routed together and the nets must be traced by 90Ohm+/-10% differential impedance. The same treatment should be needed for the routing of USB3.1-RX+ and USB3.1-RX,Four times the width between TX and RX.

3.7 USB2.0 Interface

The Module implements a USB interface compliant with the USB2.0 specification. The module supports three USB speeds: low-speed (1.5Mbps), full-speed (12Mbps) and high-speed (480Mbps). But the OTG function and USB charging function are not supported.

Note：The USB_DN and USB_DP nets must be traced by 90Ohm+/-10% differential impedance.

Module is used as a USB device by default. Module supports the USB suspend and resume mechanism which can reduce power consumption. If there is no data transmission on the USB bus, Module will enter suspend mode automatically, and will be resumed by some events such as voice call, receiving SMS, etc.

3.8 PCIe Interface

Under development

3.9 UIM Interface

There is an eSIM card on the board that is connected to the inside of the SIM2 signal line. Users can use eSIM card on the board or an external SIM card. Module supports both 1.8V and 2.85V UIM Cards.

Table 11: UIM electronic characteristic in 1.8V mode (UIM-PWR=1.8V)

Symbol	Parameter	Min.	Typ.	Max.	Unit
UIM-PWR	LDO power output voltage	1.75	1.8	1.95	V
V_{IH}	High-level input voltage	0.65*UIM-PWR	-	UIM-PWR +0.3	V
V_{IL}	Low-level input voltage	-0.3	0	0.35*UIM-PWR	V
V_{OH}	High-level output voltage	UIM-PWR -0.45	-	UIM-PWR	V

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V_{OL}	Low-level output voltage	0	0	0.45	V

Table 12: UIM electronic characteristic 2.85V mode (UIM-PWR=2.85V)

Symbol	Parameter	Min.	Typ.	Max.	Unit
UIM-PWR	LDO power output voltage	2.75	2.85	3.05	V
V_{IH}	High-level input voltage	0.65*UIM-PWR	-	UIM-PWR +0.3	V
V_{IL}	Low-level input voltage	-0.3	0	0.25*UIM-PWR	V
V_{OH}	High-level output voltage	UIM-PWR -0.45	-	UIM-PWR	V
V_{OL}	Low-level output voltage	0	0	0.45	V

It is recommended to use an ESD protection component such as ESDA6V1-5W6 produced by ST (www.st.com) or SMF12C produced by ON SEMI (www.onsemi.com). Note that the USIM peripheral circuit should be close to the USIM card socket. The following figure shows the 6-pin SIM card holder reference circuit.

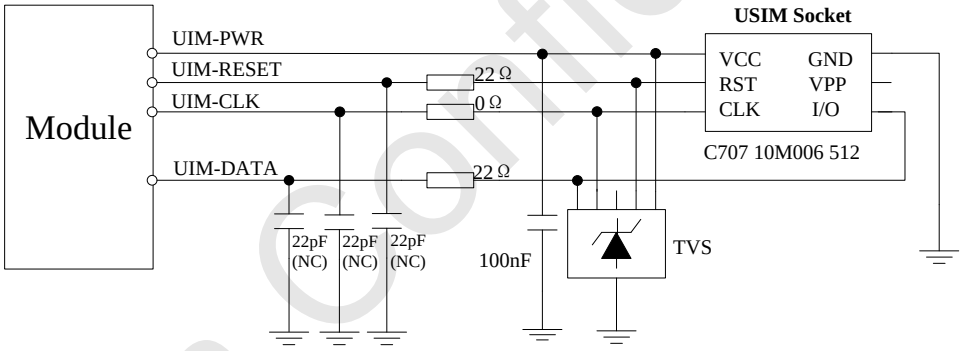

Figure 13: USIM interface reference circuit

The SIM Detect pin is used for detection of the UIM card hot plug in. User can select the 8-pin UIM card holder to implement UIM card detection function.
The following figure shows the 8-pin SIM card holder reference circuit.

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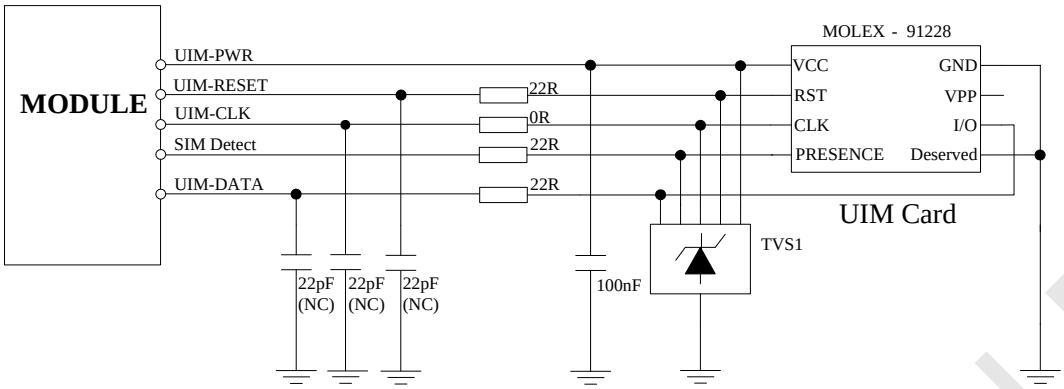

Figure 14: UIM interface reference circuit with UIM_DET

If the UIM card detection function is not used, user can keep the SIM Detect pin open.

SIM card circuit is susceptible, the interference may cause the SIM card failures or some other situations, so it is strongly recommended to follow these guidelines while designing:

- Make sure that the SIM card holder should be far away from the antenna while in PCB layout.
- SIM traces should keep away from RF lines, VBAT and high-speed signal lines.
- The traces should be as short as possible.
- Keep SIM holder's GND connect to main ground directly.
- Shielding the SIM card signal by ground.
- Recommended to place a 0.1～1uF capacitor on UIM-PWR line and keep close to the holder.
- The rise/fall time of UIM-CLK should not be more than 40ns.
- Add some TVS and the parasitic capacitance should not exceed 60pF.

3.10 I2S Interface

Module provides an I2S interface for external codec, which comply with the requirements in the Phillips I2S Bus Specifications

Table 13: I2S format

Characteristics	Specification
Line Interface Format	Linear(Fixed)
Data length	16bits(Fixed)
I2S Clock/Sync Source	Master Mode(Fixed)
I2S Clock Rate	1.536 MHz (Default)
I2S MCLK rate	12.288MHz (Default)
Data Ordering	MSB

Note: For more details about I2S AT commands, please refer to document [1]. in the appendix.

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3.10.1 I2S timing

Module supports 48 KHz I2S sampling rate and 32 bit coding signal (16 bit word length), the timing diagram is showed as following:

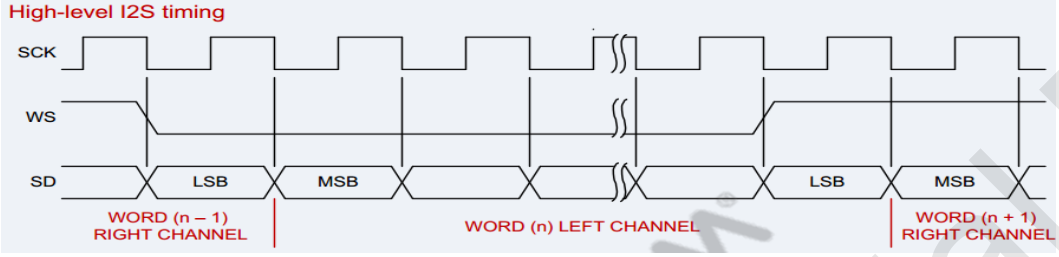

Figure 15: I2S timing

Table 14: I2S timing parameters

Signal	Parameter	Description	Min.	Typ.	Max.	Unit
I2S_MCLK	Frequency	Frequency	–	12.288	12.288	MHz
	T	Clock period	81.380	81.380	–	ns
	t(HC)	Clock high	0.45T	–	0.55T	ns
	t(LC)	Clock low	0.45T	–	0.55T	ns
I2S_CLK	Frequency	Frequency	8	48	48	KHz
	T	Clock period	20.83	20.83	125	us
	t(HC)	Clock high	0.45T	–	0.55T	ns
	t(LC)	Clock low	0.45T	–	0.55T	ns
I2S_WS	t(sr)	DIN/DOUT and WS input setup time	16.276	–	–	ns
	t(hr)	DIN/DOUT and WS input hold time	0	–	–	ns
	t(dtr)	DIN/DOUT and WS output delay	–	–	65.10	ns
	t(htr)	DIN/DOUT and WS output hold time	0	–	–	ns

3.10.2 I2S reference circuit

The following figure shows the external codec reference design.

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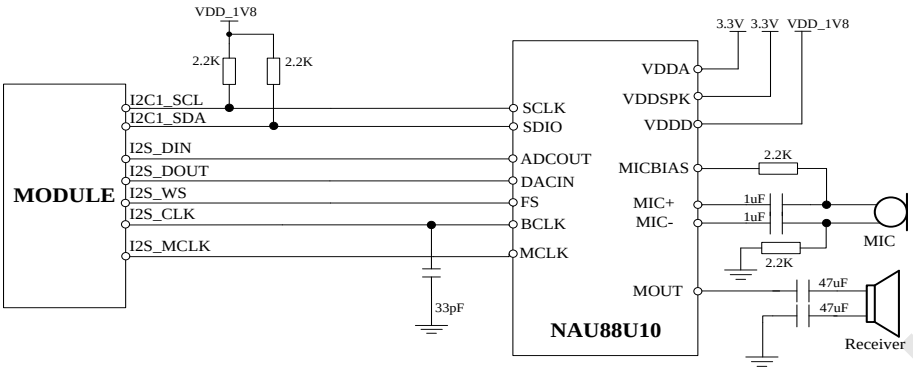

Figure 16: Audio codec reference circuit

3.11 DPR*

DPR (Dynamic Power Reduction) signal is used by SIM8200EA-M2 to assist in meeting regulatory SAR (Specific Absorption Rate) requirements for RF exposure. The signal is provided by a host system proximity sensor to the wireless device to provide an input trigger causing a reduction in the radio transmit output power.

User can use AT command to active this function, if do not need this function, this pin can be keep floating.

Table 15: DPR interface

Pin no	Pin Name	Pin status	Function
25	DPR	Low	Max transmitting power will be reduced
		High	Max transmitting power will not be reduced (default)
		Floating	Max transmitting power will not be reduced

Note:* means the DRP function is under developing.

3.12 I2C Interface

Module provides an I2C interface compatible with I2C specification, version 5.0, with clock rate up to 400 kbps. Its operation voltage is 1.8V.

The following figure shows the I2C bus reference design.

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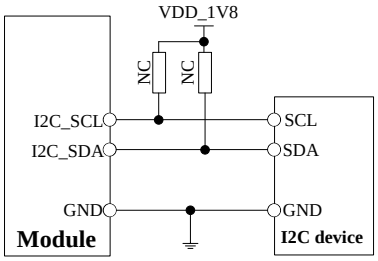

Figure 17: I2C reference circuit

Note：SDA and SCL have pull-up resistors in Module. So, 2 external pull up resistors are NO necessary in application circuit. For more details about AT commands please refer to document [1]. in the appendix.

3.13 CONFIG Pins

These signals provide the means to indicate the specific configuration of the module. SIM8200EA-M2 is configured as WWAN-USB3.0.

Table 16: CONFIG Pins

Pin no	Pin Name	Description
21	CONFIG_0	Connected to GND internally.
69	CONFIG_1	Connected to GND internally.
75	CONFIG_2	Connected to GND internally.
1	CONFIG_3	No Connect internally.

In the M.2 specification, the 4 pins are defined as below:

Table 17: Config interface

Config_0 (Pin 21)	Config_1 (Pin 69)	Config_2 (Pin 75)	Config_3 (Pin 1)	Module type and Main host interface	Port Configuration
GND	GND	GND	GND	SSD – SATA	N/A
GND	NC	GND	GND	SSD – PCIe	N/A
GND	GND	NC	GND	WWAN – PCIe	0

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GND	NC	NC	GND	WWAN – PCIe	1
GND	***GND***	***GND***	***NC***	***WWAN – USB 3.1***	***0***
GND	NC	GND	NC	WWAN – USB 3.1	1
GND	GND	NC	NC	WWAN – USB 3.1	2
GND	NC	NC	NC	WWAN – USB 3.1	3
NC	GND	GND	GND	WWAN – SSIC	0
NC	NC	GND	GND	WWAN – SSIC	1
NC	GND	NC	GND	WWAN – SSIC	2
NC	NC	NC	GND	WWAN – SSIC	3
NC	GND	GND	NC	WWAN – PCIe	2
NC	NC	GND	NC	WWAN – PCIe	3
NC	GND	NC	NC	RFU	N/A
NC	NC	NC	NC	No Module Present	N/A

3.14 LED1#

LED1# is open drain output and is used to allow SIM8200EA-M2 to provide network status via LED which will be provided by the host.

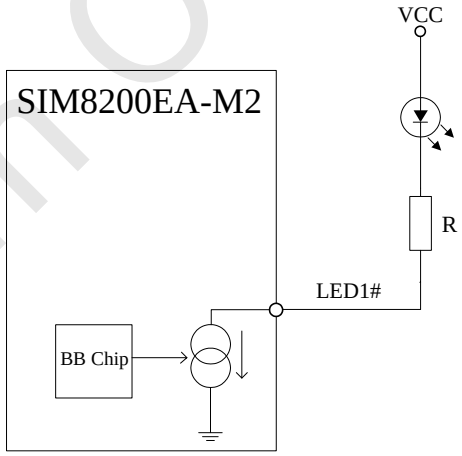

Figure 18: LED1# reference circuit

Note: The value of the resistor named "R" depends on the LED characteristic.

The timing sequence is as followed:

Table 18: LED1# pin status

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NETLIGHT pin status	Module status
Always On	Searching Network; Call Connect(include VOLTE,SRLTE)
200ms ON, 200ms OFF	Data Transmit; 4G registered;
800ms ON, 800ms OFF	3G registered network
OFF	Power off ;Sleep

3.15 W_DISABLE1#

The W_DISABLE1# pin controls SIM8200EA-M2 to enter or exit the flight mode, when the W_DISABLE1# signal is asserted to low level, all RF functions would be disabled. When the W_DISABLE1# signal is not asserted, the RF function will be active if it was not disabled by other means such as software.

Its reference circuit is shown in the following figure.

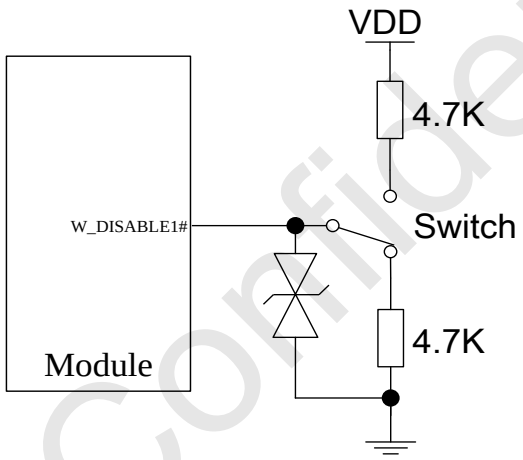

Figure 19: Flight mode switch reference circuit

Table 19: FLIGHTMODE pin status

FLIGHTMODE pin status	Module operation
Input Low Level	Flight Mode: RF is closed
Input High Level	AT+CFUN=4: RF is closed AT+CFUN=1: RF is working

3.16 W_DISABLE2#

The W_DISABLE2# pin controls SIM8200EA-M2 to enable or disable the GNSS function, when the W_DISABLE2# signal is asserted to low level, the GNSS function would be disabled.

Its reference circuit is shown in the following figure.

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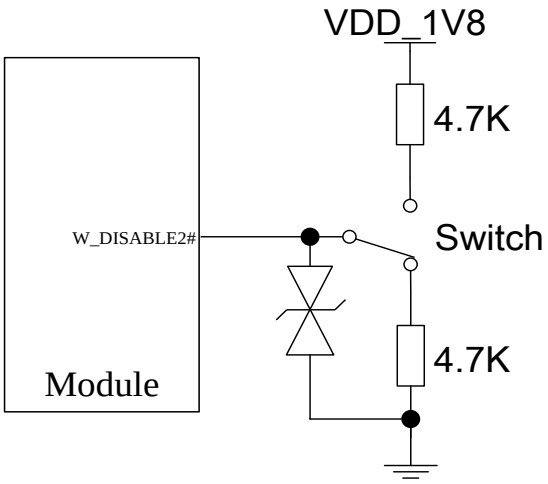

Figure 20: GNSS function switch reference circuit

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4 Antenna Interfaces

SIM8200EA-M2 provides a main antenna interface, a diversity antenna interface and a GNSS antenna interface. The antenna ports have an RF impedance of 50Ω.

4.1. Main/Diversity Antenna Interfaces

The Main/Diversity/GNSS antenna interfaces are shown as below.

Figure 21: Main/Diversity/GNSS antenna interfaces

Table 20: Antenna Port Definitions

ANT item	ANT name	Frequency Range	Functional description
ANT0	LTE_LB/MB/HB_TRX	617MHz~960MHz, 1710MHz~2690MHz	3G/4G/5G re-farming band signal send and receive
ANT1	5GN41_TRX; 5G_N77/N79_TRX	2496MHz~2690MHz; 3300MHz~5000MHz	5G N41 band signal send and receive; 5G NR band signal send and receive
ANT2	LTE_LB/MB/HB_DIV #1	617MHz~960MHz, 1710MHz~2690MHz	3G/4G/5G re-farming band signal receive
ANT3	LTE_MB/HB_DIV #2; 5G_N77/N79_DIV #1	1710MHz~2690MHz; 3300MHz~5000MHz	3G/4G/5G re-farming band signal receive; 5G NR band signal receive
ANT4	LTE_MB/HB_DIV #3; 5G_N77/N79_DIV #2	1710MHz~2690MHz; 3300MHz~5000MHz	3G/4G/5G re-farming band signal receive; 5G NR band signal receive
ANT5	5G_N77/N79_DIV #3; GNSS	3300MHz~5000MHz; 1166MHz~1610MHz	5G NR band signal receive; GNSS signal receive

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4.1.1. Operating Frequency

Table 21: SIM8200EA-M2 Operating frequencies

Frequency Band	Uplink (UL)	Downlink (DL)	Duplex Mode
WCDMA B1	1920 ~1980 MHz	2110 ~2170 MHz	FDD
WCDMA B2	1850~1910 MHz	1930~1990 MHz	FDD
WCDMA B3	1710 ~1785 MHz	1805 ~1880 MHz	FDD
WCDMA B4	1710 ~1755 MHz	2110~ 2155 MHz	FDD
WCDMA B5	824～849 MHz	869～894MHz	FDD
WCDMA B8	880 ~915 MHz	925 ~960 MHz	FDD
LTE B1	1920 ~1980 MHz	2110 ~2170 MHz	FDD
LTE B2	1850~1910MHz	1930~1990MHz	FDD
LTE B3	1710 ~1785 MHz	1805 ~1880 MHz	FDD
LTE B4	1710~1755MHz	2110~2155MHz	FDD
LTE B5	824～849 MHz	869～894MHz	FDD
LTE B7	2500~2570MHz	2620~2690MHz	FDD
LTE B8	880 ~915 MHz	925 ~960 MHz	FDD
LTE B12	699~716MHz	729~746MHz	FDD
LTE B13	777~787MHz	746~756MHz	FDD
LTE B14	788~798MHz	758~768MHz	FDD
LTE B17	704~716MHz	734~746MHz	FDD
LTE B18	815~830MHz	860~875MHz	FDD
LTE B19	830~845MHz	875~890MHz	FDD
LTE B20	832~862MHz	791~ 821MHz	FDD
LTE B25	1850~1915MHz	1930~1995MHz	FDD
LTE B26	814~849MHz	859~894MHz	FDD
LTE B28	703~748MHz	758~803MHz	FDD
LTE B29		717~728MHz	FDD
LTE B30	2305~2315MHz	2350~2360MHz	FDD
LTE B32		1452~1496MHz	FDD
LTE B34	2010~2025MHz	2010~2025MHz	TDD
LTE B38	2570 ~2620 MHz	2570 ~2620 MHz	TDD
LTE B39	1880~1920MHz	1880~1920MHz	TDD
LTE B40	2300 ~2400 MHz	2300 ~2400 MHz	TDD
LTE B41	2496 ~2690 MHz	2496 ~2690 MHz	TDD
LTE B42	3400~3600MHz	3400~3600MHz	TDD
LTE B48	3550~3700MHz	3550~3700MHz	TDD
LTE B66	1710~1780MHz	2110~2200MHz	FDD

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LTE B71	663~698MHz	617~652MHz	FDD
5G N77	3300~4200MHz	3300~4200MHz	TDD
5G N78	3300~3800MHz	3300~3800MHz	TDD
5G N79	4400~5000MHz	4400~5000MHz	TDD

Note: LTE-FDD B29 and B32 support Rx only and are only for secondary component carrier.

4.2. GNSS Antenna Interface

The following table shows frequency specification of GNSS antenna interface.

Table 22: GNSS frequencies

Type	Frequecy
GPS/Galileo/QZSS	1575.42±1.023MHz
GLONASS	1597.5~1605.8MHz
BeiDou/Compass	1561.098±2.046MHz

4.3. Antenna Installation

4.3.1 Antenna Requirements

The following table shows the requirements on main antenna, Diversity antenna and GNSS antenna.

Table 23: Recommended Antenna Characteristics

WCDMA/LTE antenna

Passive	Recommended standard
Direction	Omni directional
Gain	> -3dBi (Avg)
Input impedance	50 Ω
Efficiency	> 30 %
VSWR	< 2
Cable insertion Loss <1GHz	<1dB
Cable insertion Loss 1GHz~2.2GHz	<1.5dB
Cable insertion Loss 2.3GHz~2.7GHz	<2dB

GNSS antenna

Passive	Recommended standard
Frequency Range	1559~1609MHZ

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Direction	RHCP or liner, RHCP is the first choice
VSWR	< 2
Passive antenna gain	> 0 dBi
Active antenna NF	< 1.5
Active antenna gain	> 0 dBi
Active antenna Enbeded LNA gain	< 17 dB

Note: It is recommended to use a passive GNSS antenna when LTE B13 or B14 is supported, as the use of active antenna may generate harmonics which will affect the GNSS performance.

4.3.2. Recommended RF Connector for Antenna Installation

When choosing antennas, user should pay attentions to the connector on antenna which should match with the connector on the module. The standard 2x2 mm size RF receptacle connectors has been used on SIM7300x. The dimension of the connector on SIM8200EA is 2.0*2.0*0.6mm, which is from Murata, and the Part Number is MM4829-2702B/ RA4/ RB0.

Shows the RF connector dimension in the following figure:

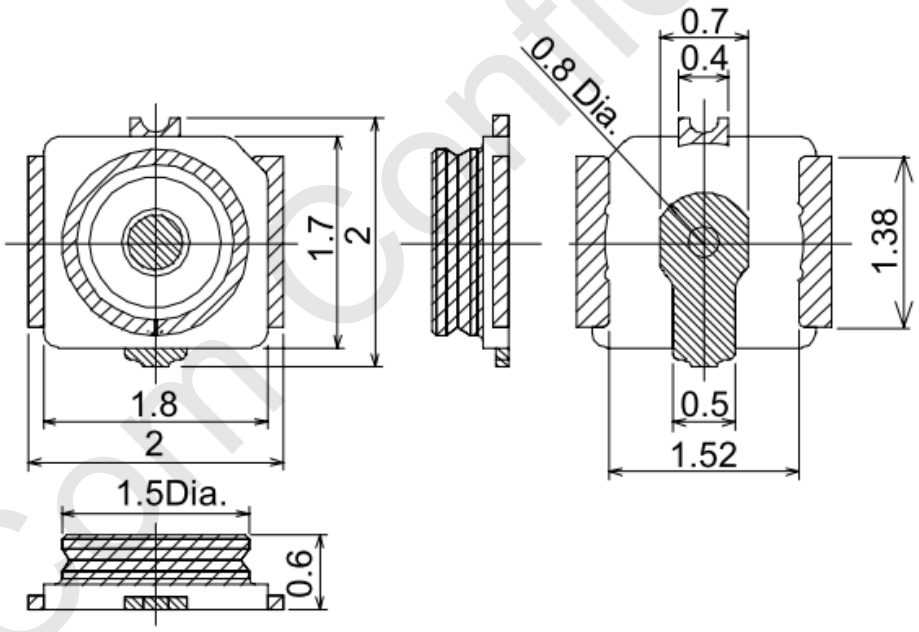

Figure 22: Antenna connector

Table 24: the major specifications of the RF connector

Item	Specification
Nominal Frequency Range	DC to 6 GHz

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Nominal Impedance	50Ω
Temperature Rating	-40℃ to + 85℃
Initial Contact Resistance (without conductor resistance)	Center contact 20.0mΩmax. Outer contact 20.0mΩmax.
Voltage Standing Wave Ratio (V.S.W.R.)	Meet the requirements of 1.3max.(DC～3GHz) 1.45max.(3GHz～6GHz)

There are two kinds of coaxial cables mating the RF connector in the SIM8200EA, SIMCom recommend use Murata and SUZHOU KELI, and the Part Number is MXFR32HP1000 of the Murata and KLC-2058 of the KELI.

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5 Electrical Specifications

5.1 Absolute maximum ratings

Absolute maximum rating for digital and analog pins of Module are listed in the following table:

Table 25: Absolute maximum ratings

Parameter	Min.	Typ.	Max.	Unit
Voltage at 3.3V pins	-0.3	-	TBD	V
Voltage at digital pins (GPIO,I2C,UART, I2S)	-0.3	-	2.1	V
Voltage at digital pins (UIM)	-0.3	-	3.05	V
Voltage at FUL_CARD_POWER_OFF#	-0.3	-	TBD	
Voltage at RESET#	-0.3	-	2.1	

5.2 Operating conditions

Table 26: Recommended operating ratings

Parameter	Min.	Typ.	Max.	Unit
Voltage at 3.3V	TBD	3.8	TBD	V

Table 27: 1.8V Digital I/O characteristics*

Parameter	Description	Min.	Typ.	Max.	Unit
V_{IH}	High-level input voltage	1.17	1.8	2.1	V
V_{IL}	Low-level input voltage	-0.3	0	0.63	V
V_{OH}	High-level output voltage	1.35	-	1.8	V
V_{OL}	Low-level output voltage	0	-	0.45	V
I_{OH}	High-level output current(no pull down resistor)	-	2	-	mA
I_{OL}	Low-level output current(no pull up resistor)	-	-2	-	mA
I_{IH}	Input high leakage current (no pull down resistor)	-	-	1	uA
I_{IL}	Input low leakage current(no pull up resistor)	-1	-	-	uA

Note: These parameters are for digital interface pins, such as UART, I2C, I2S, RESET#,

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ANTCTL, COEX and GPIOs (coex, DPR, SIM DETECT, SD_DET).

The operating temperature of Module is listed in the following table.

Table 28: Operating temperature

Parameter	Min.	Typ.	Max.	Unit
Normal operation temperature	-30	25	75	℃
Extended operation temperature*	-40	25	85	℃
Storage temperature	-45	25	+90	℃

Note: Module is able to make and receive voice calls, data calls, SMS and make UMTX/LTE traffic in -40℃ ~ +85℃. The performance will be reduced slightly from the 3GPP specifications if the temperature is outside the normal operating temperature range and still within the extreme operating temperature range.

5.3 Operating Mode

5.3.1 Operating Mode Definition

The table below summarizes the various operating modes of Module product.

Table 29: Operating mode Definition

Mode		Function
Normal operation	UMTS/LTE Sleep	AT command "AT+CSCLK=1" can be used to set the module to a sleep mode. In this case, the current consumption of module will be reduced to a very low level and the module can still receive paging message and SMS.
	UMTS/LTE Idle	Software is active. Module is registered to the network, and the Module is ready to communicate.
	UMTS/LTE Talk	Connection between two subscribers is in progress. In this case, the power consumption depends on network settings such as DTX off/on, FR/EFR/HR, hopping sequences, and antenna.
	UMTS/LTE Standby	Module is ready for data transmission, but no data is currently sent or received. In this case, power consumption depends on network settings.
	UMTS/LTE Data transmission	There is data transmission in progress. In this case, power consumption is related to network settings (e.g. power control level); uplink/downlink data rates, etc.
Minimum functionality mode		AT command "AT+CFUN=0" can be used to set the Module to a minimum functionality mode without removing the power supply. In this mode, the RF part of the Module will not work and the USIM card will not be accessible, but the serial port and USB port are still

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	accessible. The power consumption in this mode is lower than normal mode.
Flight mode	AT command “AT+CFUN=4” or pulling down the W_disable1# pin can be used to set the Module to flight mode without removing the power supply. In this mode, the RF part of the Module will not work, but the serial port and USB port are still accessible. The power consumption in this mode is lower than normal mode.
Power off	Module will go into power off mode by sending the AT command “AT+CPOF” or pull down the FUL_CARD_POWER_OFF# pin, normally. In this mode the power management unit shuts down the power supply, and software is not active. The serial port and USB are is not accessible.

5.3.2 Sleep mode

In sleep mode, the current consumption of Module will be reduced to a very low level, and Module can still receive paging message and SMS.
Several hardware and software conditions must be satisfied in order to let Module enter into sleep mode:
1. UART condition
2. USB condition
3. Software condition

Note: Before designing, pay attention to how to realize sleeping/waking function.

5.3.3 Minimum functionality mode and Flight mode

Minimum functionality mode ceases a majority function of Module, thus minimizing the power consumption. This mode is set by the AT command which provides a choice of the functionality levels.

- AT+CFUN=0: Minimum functionality
- AT+CFUN=1: Full functionality (Default)
- AT+CFUN=4: Flight mode

If Module has been set to minimum functionality mode, the RF function and UIM card function will be closed. In this case, the serial port and USB are still accessible, but RF function and UIM card will be unavailable.
If Module has been set to flight mode, the RF function will be closed. In this case, the serial port and USB are still accessible, but RF function will be unavailable.
When Module is in minimum functionality or flight mode, it can return to full functionality by the AT command “AT+CFUN=1”.

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5.4 Current Consumption

The current consumption is listed in the table below.

Table 30: Current consumption on VBAT Pins (VBAT=3.8V)

SIM8200EA-M2 TBD

GNSS	
GNSS supply current (AT+CFUN=0,with USB connection)	@ -140dBm，Tracking Typical:TBD
UMTS sleep/idle mode	
WCDMA supply current (GNSS off，without USB connection)	Sleep mode @DRX=9 Typical: TBD Idle mode @DRX=9 Typical: TBD
LTE sleep/idle mode	
LTE FDD supply current (GNSS off，without USB connection)	Sleep mode Typical: TBD Idle mode Typical: TBD
LTE TDD supply current (GNSS off，without USB connection)	Sleep mode Typical: TBD Idle mode Typical: TBD
UMTS Talk	
WCDMA B1	@Power TBD Typical: TBD
WCDMA B2	@Power TBD Typical: TBD
WCDMA B3	@Power TBD Typical: TBD
WCDMA B4	@Power TBD Typical: TBD
WCDMA B5	@Power TBD Typical: TBD
WCDMA B8	@Power TBD Typical: TBD
HSDPA data	
WCDMA B1	@Power TBD Typical: TBD
WCDMA B2	@Power TBD Typical: TBD
WCDMA B3	@Power TBD Typical: TBD
WCDMA B4	@Power TBD Typical: TBD
WCDMA B5	@Power TBD Typical: TBD
WCDMA B8	@Power TBD Typical: TBD
LTE data	
LTE-FDD B1	@5Mbps TBD Typical: TBD @10Mbps TBD Typical: TBD @20Mbps TBD Typical: TBD
LTE-FDD B2	@5Mbps TBD Typical: TBD @10Mbps TBD Typical: TBD @20Mbps TBD Typical: TBD
LTE-FDD B3	@5Mbps TBD Typical: TBD @10Mbps TBD Typical: TBD @20Mbps TBD Typical: TBD
LTE-FDD B4	@5Mbps TBD Typical: TBD @10Mbps TBD Typical: TBD

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	@20Mbps	TBD	Typical: TBD
LTE-FDD B5	@5Mbps	TBD	Typical: TBD
	@10Mbps	TBD	Typical: TBD
	@20Mbps	TBD	Typical: TBD
LTE-FDD B7	@5Mbps	TBD	Typical: TBD
	@10Mbps	TBD	Typical: TBD
	@20Mbps	TBD	Typical: TBD
LTE-FDD B8	@5Mbps	TBD	Typical: TBD
	@10Mbps	TBD	Typical: TBD
LTE-FDD B12	@5Mbps	TBD	Typical: TBD
	@10Mbps	TBD	Typical: TBD
	@20Mbps	TBD	Typical: TBD
LTE-FDD B13	@5Mbps	TBD	Typical: TBD
	@10Mbps	TBD	Typical: TBD
	@20Mbps	TBD	Typical: TBD
LTE-FDD B14	@5Mbps	TBD	Typical: TBD
	@10Mbps	TBD	Typical: TBD
	@20Mbps	TBD	Typical: TBD
LTE-FDD B17	@5Mbps	TBD	Typical: TBD
	@10Mbps	TBD	Typical: TBD
	@20Mbps	TBD	Typical: TBD
LTE-FDD B18	@5Mbps	TBD	Typical: TBD
	@10Mbps	TBD	Typical: TBD
	@20Mbps	TBD	Typical: TBD
LTE-FDD B19	@5Mbps	TBD	Typical: TBD
	@10Mbps	TBD	Typical: TBD
	@20Mbps	TBD	Typical: TBD
LTE-FDD B20	@5Mbps	TBD	Typical: TBD
	@10Mbps	TBD	Typical: TBD
	@20Mbps	TBD	Typical: TBD
LTE-FDD B25	@5Mbps	TBD	Typical: TBD
	@10Mbps	TBD	Typical: TBD
	@20Mbps	TBD	Typical: TBD
LTE-FDD B26	@5Mbps	TBD	Typical: TBD
	@10Mbps	TBD	Typical: TBD
	@20Mbps	TBD	Typical: TBD
LTE-FDD B28	@5Mbps	TBD	Typical: TBD
	@10Mbps	TBD	Typical: TBD
	@20Mbps	TBD	Typical: TBD
LTE-FDD B30	@5Mbps	TBD	Typical: TBD
	@10Mbps	TBD	Typical: TBD
	@20Mbps	TBD	Typical: TBD
LTE-TDD B34	@5Mbps	TBD	Typical: TBD
	@10Mbps	TBD	Typical: TBD
	@20Mbps	TBD	Typical: TBD
LTE-TDD B38	@5Mbps	TBD	Typical: TBD
	@10Mbps	TBD	Typical: TBD
	@20Mbps	TBD	Typical: TBD
LTE-TDD B39	@5Mbps	TBD	Typical: TBD
	@10Mbps	TBD	Typical: TBD
	@20Mbps	TBD	Typical: TBD

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LTE-TDD B40	@5Mbps @10Mbps @20Mbps	TBD TBD TBD	Typical: TBD Typical: TBD Typical: TBD
LTE-TDD B41	@5Mbps @10Mbps @20Mbps	TBD TBD TBD	Typical: TBD Typical: TBD Typical: TBD
LTE-TDD B42	@5Mbps @10Mbps @20Mbps	TBD TBD TBD	Typical: TBD Typical: TBD Typical: TBD
LTE-TDD B48	@5Mbps @10Mbps @20Mbps	TBD TBD TBD	Typical: TBD Typical: TBD Typical: TBD
LTE-FDD B66	@5Mbps @10Mbps @20Mbps	TBD TBD TBD	Typical: TBD Typical: TBD Typical: TBD
LTE-FDD B71	@5Mbps @10Mbps @20Mbps	TBD TBD TBD	Typical: TBD Typical: TBD Typical: TBD
5G data			
5G N1	@5Mbps @10Mbps @20Mbps	TBD TBD TBD	Typical: TBD Typical: TBD Typical: TBD
5G N2	@5Mbps @10Mbps @20Mbps	TBD TBD TBD	Typical: TBD Typical: TBD Typical: TBD
5G N3	@5Mbps @10Mbps @20Mbps	TBD TBD TBD	Typical: TBD Typical: TBD Typical: TBD
5G N5	@5Mbps @10Mbps @20Mbps	TBD TBD TBD	Typical: TBD Typical: TBD Typical: TBD
5G N7	@5Mbps @10Mbps @20Mbps	TBD TBD TBD	Typical: TBD Typical: TBD Typical: TBD
5G N8	@5Mbps @10Mbps	TBD TBD	Typical: TBD Typical: TBD
5G N12	@5Mbps @10Mbps @20Mbps	TBD TBD TBD	Typical: TBD Typical: TBD Typical: TBD
5G N20	@5Mbps @10Mbps @20Mbps	TBD TBD TBD	Typical: TBD Typical: TBD Typical: TBD
5G N25	@5Mbps @10Mbps @20Mbps	TBD TBD TBD	Typical: TBD Typical: TBD Typical: TBD
5G N28	@5Mbps @10Mbps @20Mbps	TBD TBD TBD	Typical: TBD Typical: TBD Typical: TBD
5G N40	@5Mbps @10Mbps @20Mbps	TBD TBD TBD	Typical: TBD Typical: TBD Typical: TBD

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5G N41	@5Mbps @10Mbps @20Mbps	TBD TBD TBD	Typical: TBD Typical: TBD Typical: TBD
5G N66	@5Mbps @10Mbps @20Mbps	TBD TBD TBD	Typical: TBD Typical: TBD Typical: TBD
5G N71	@5Mbps @10Mbps @20Mbps	TBD TBD TBD	Typical: TBD Typical: TBD Typical: TBD
5G N77	@5Mbps @10Mbps @20Mbps	TBD TBD TBD	Typical: TBD Typical: TBD Typical: TBD
5G N78	@5Mbps @10Mbps @20Mbps	TBD TBD TBD	Typical: TBD Typical: TBD Typical: TBD
5G N79	@5Mbps @10Mbps @20Mbps	TBD TBD TBD	Typical: TBD Typical: TBD Typical: TBD

5.5. RF Output Power

The following table shows the RF output power of SIM8200EA_M2 module.

Table 31: Conducted Output Power

Frequency	Max	Min
WCDMA Bands	24dBm + 1/-3dB	< -50dBm
LTE-FDD Bands	23dBm + 2/-2dB	< -40dBm
LTE-TDD Bands	23dBm + 2/-2dB	< -40dBm
5G Bands	23dBm + 2/-2dB	< -40dBm

5.6 Conducted Receive Sensitivity

The following tables show conducted RF receiving sensitivity of SIM8200EA_M2module.

Table 32:SIM8200EA-M2 Conducted RF Receiving Sensitivity

Frequency	Primary (Typ.)	Diversity (Typ.)	SIMO1(Typ.)	SIMO2(Worst Case)
WCDMA B1	TBD	TBD	TBD	TBD
WCDMA B2	TBD	TBD	TBD	TBD
WCDMA B3	TBD	TBD	TBD	TBD
WCDMA B4	TBD	TBD	TBD	TBD
WCDMA B5	TBD	TBD	TBD	TBD
WCDMA B8	TBD	TBD	TBD	TBD

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LTE-FDD B1(10M)	TBD	TBD	TBD	TBD
LTE-FDD B2(10M)	TBD	TBD	TBD	TBD
LTE-FDD B3(10M)	TBD	TBD	TBD	TBD
LTE-FDD B4(10M)	TBD	TBD	TBD	TBD
LTE-FDD B5(10M)	TBD	TBD	TBD	TBD
LTE-FDD B7(10M)	TBD	TBD	TBD	TBD
LTE-FDD B8(10M)	TBD	TBD	TBD	TBD
LTE-FDD B12(10M)	TBD	TBD	TBD	TBD
LTE-FDD B13(10M)	TBD	TBD	TBD	TBD
LTE-FDD B14(10M)	TBD	TBD	TBD	TBD
LTE-FDD B17(10M)	TBD	TBD	TBD	TBD
LTE-FDD B18(10M)	TBD	TBD	TBD	TBD
LTE-FDD B19(10M)	TBD	TBD	TBD	TBD
LTE-FDD B20(10M)	TBD	TBD	TBD	TBD
LTE-FDD B25(10M)	TBD	TBD	TBD	TBD
LTE-FDD B26(10M)	TBD	TBD	TBD	TBD
LTE-FDD B28(10M)	TBD	TBD	TBD	TBD
LTE-FDD B29(10M)	TBD	TBD	TBD	TBD
LTE-FDD B30(10M)	TBD	TBD	TBD	TBD
LTE-FDD B32(10M)	TBD	TBD	TBD	TBD
LTE-TDD B34(10M)	TBD	TBD	TBD	TBD
LTE-TDD B38(10M)	TBD	TBD	TBD	TBD
LTE-TDD B39(10M)	TBD	TBD	TBD	TBD
LTE-TDD B40(10M)	TBD	TBD	TBD	TBD
LTE-TDD B41(10M)	TBD	TBD	TBD	TBD
LTE-TDD B42(10M)	TBD	TBD	TBD	TBD
LTE-TDD B43(10M)	TBD	TBD	TBD	TBD
LTE-TDD B48(10M)	TBD	TBD	TBD	TBD
LTE-FDD B66(10M)	TBD	TBD	TBD	TBD
LTE-FDD B71(10M)	TBD	TBD	TBD	TBD
5G N1	TBD	TBD	TBD	TBD
5G N2	TBD	TBD	TBD	TBD
5G N3	TBD	TBD	TBD	TBD
5G N5	TBD	TBD	TBD	TBD
5G N7	TBD	TBD	TBD	TBD
5G N8	TBD	TBD	TBD	TBD
5G N12	TBD	TBD	TBD	TBD
5G N20	TBD	TBD	TBD	TBD
5G N25	TBD	TBD	TBD	TBD
5G N28	TBD	TBD	TBD	TBD
5G N40	TBD	TBD	TBD	TBD
5G N41	TBD	TBD	TBD	TBD
5G N66	TBD	TBD	TBD	TBD

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5G N71	TBD	TBD	TBD	TBD
5G N77	TBD	TBD	TBD	TBD
5G N78	TBD	TBD	TBD	TBD
5G N79	TBD	TBD	TBD	TBD

Note: The data in above table are gotten at static condition.

1. ***SIMO is a smart antenna technology that uses a single antenna at the transmitter side and multiple (two for SIM8200EA_M2) antennas at the receiver side, which can improve Rx performance.***
2. ***Per 3GPP specification.***

5.5 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 USIM card holder, SD card holder, audio jacks, switches, USB interface, etc. The following table shows the Module ESD measurement performance without any external ESD component.

Table 33: The ESD performance measurement table (Temperature: 25℃, Humidity: 45%)

Part	Contact discharge	Air discharge
VBAT,GND	+/-TBD	+/- TBD
Antenna port	+/- TBD	+/- TBD
FUL_CARD_POWER_OFF#	+/- TBD	+/- TBD
USB	+/- TBD	+/- TBD
RESET_N	+/- TBD	+/- TBD
UIM Card	+/- TBD	+/- TBD
Other PADs	+/- TBD	+/- TBD

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6 Top and Bottom View of Module

Figure 23: Top and bottom view of Module

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7 Label description Information

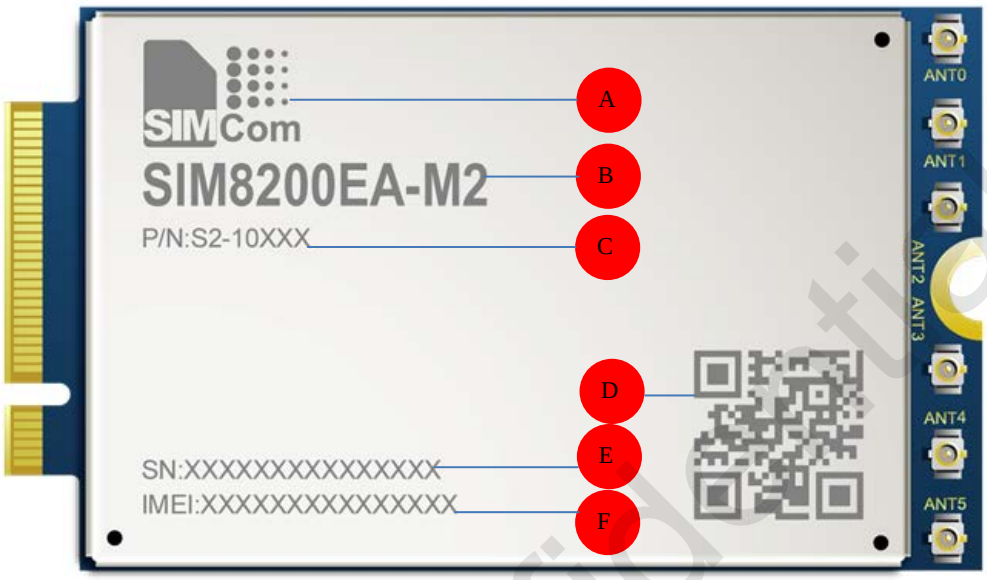

Figure 24: Label description of Module

Table 34: Label description of Module Information

No.	Description
A	LOGO
B	Project name
C	Product code
D	QR code
E	Serial number
F	International mobile equipment identity

7.1 Ordering Information

Table 35: SIM8200EA-M2 Information

Product name	P/N	Shipping package
SIM8200EA-M2	**S2-108R0**	**-TR**

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8 Packaging

Module support tray packaging.

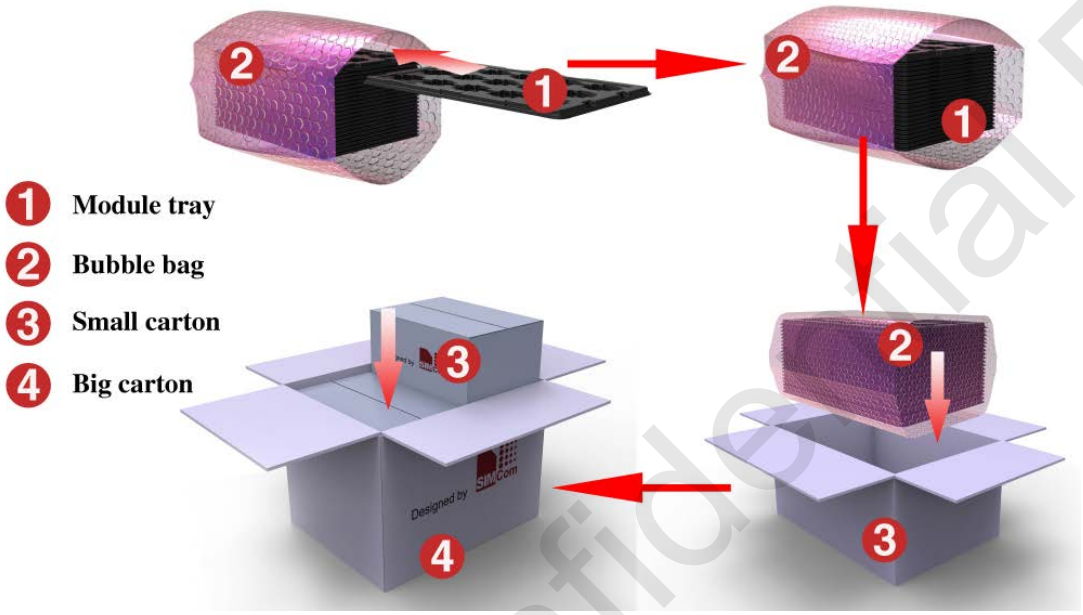

Figure 25: packaging diagram

Module tray drawing:

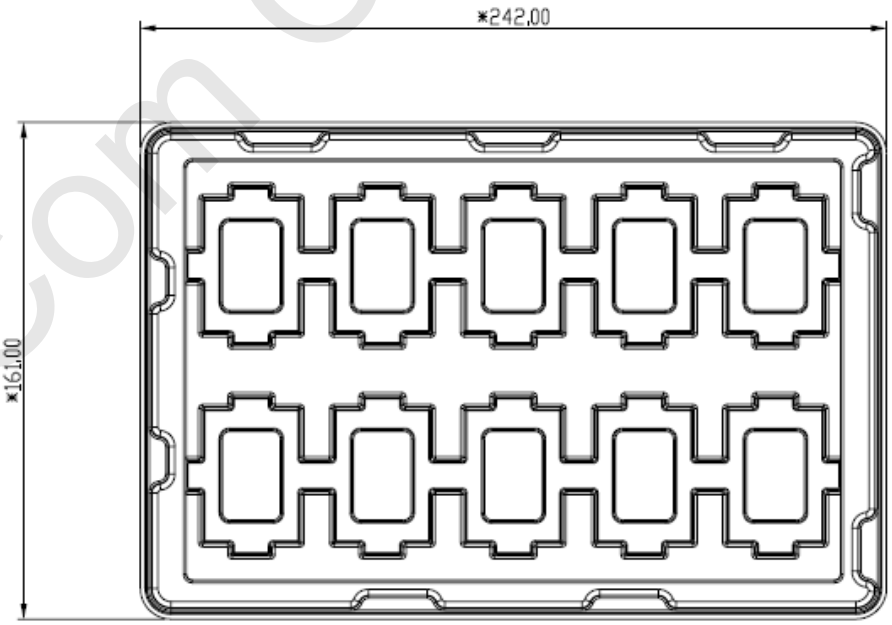

Figure 26: Tray drawing

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Table 36: Tray size

Length（±3mm）	Width（±3mm）	Number
245.0	165.0	10

Small carton drawing：

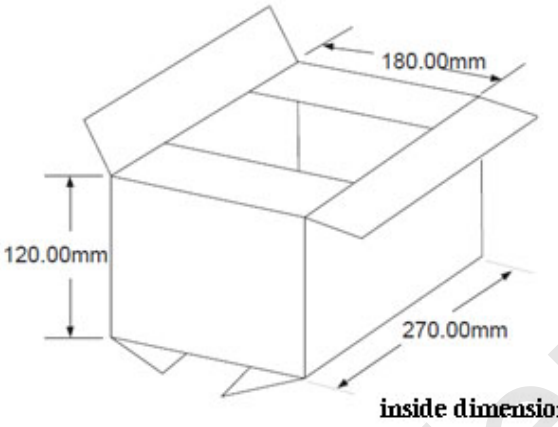

Figure 27: Small carton drawing

Table 37: Small Carton size

Length（±10mm）	Width（±10mm）	Height（±10mm）	Number
270	180	120	10*20=200

Big carton drawing：

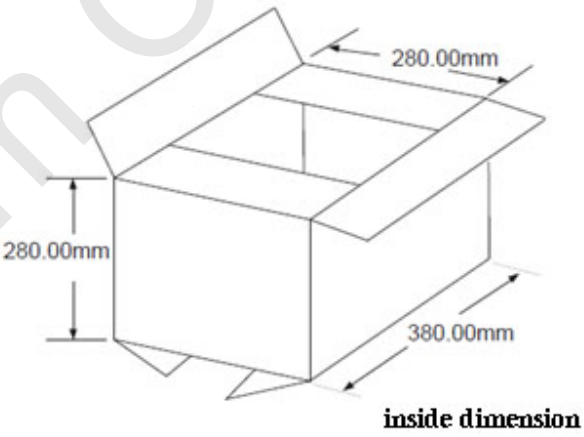

Figure 28: Big carton drawing

Table 38: Big Carton size

Length（±10mm）	Width（±10mm）	Height（±10mm）	Number
380	280	280	200*4=800

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Appendix

A. Coding Schemes and Maximum Net Data Rates over Air Interface

Table 39: Coding Schemes and Maximum Net Data Rates over Air Interface

HSDPA device category	Max data rate（peak）	Modulation type
Category 1	1.2Mbps	16QAM,QPSK
Category 2	1.2Mbps	16QAM,QPSK
Category 3	1.8Mbps	16QAM,QPSK
Category 4	1.8Mbps	16QAM,QPSK
Category 5	3.6Mbps	16QAM,QPSK
Category 6	3.6Mbps	16QAM,QPSK
Category 7	7.2Mbps	16QAM,QPSK
Category 8	7.2Mbps	16QAM,QPSK
Category 9	10.2Mbps	16QAM,QPSK
Category 10	14.4Mbps	16QAM,QPSK
Category 11	0.9Mbps	QPSK
Category 12	1.8Mbps	QPSK
Category 13	17.6Mbps	64QAM
Category 14	21.1Mbps	64QAM
Category 15	23.4Mbps	16QAM
Category 16	28Mbps	16QAM
Category 17	23.4Mbps	64QAM
Category 18	28Mbps	64QAM
Category 19	35.5Mbps	64QAM
Category 20	42Mbps	64QAM
Category 21	23.4Mbps	16QAM
Category 22	28Mbps	16QAM
Category 23	35.5Mbps	64QAM
Category 24	42.2Mbps	64QAM
HSUPA device category	**Max data rate（peak）**	**Modulation type**
Category 1	0.96Mbps	QPSK
Category 2	1.92Mbps	QPSK
Category 3	1.92Mbps	QPSK
Category 4	3.84Mbps	QPSK
Category 5	3.84Mbps	QPSK

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Category 6	5.76Mbps	QPSK
LTE-FDD device category (Downlink)	**Max data rate（peak）**	**Modulation type**
Category 1	10Mbps	QPSK/16QAM/64QAM
Category 2	50Mbps	QPSK/16QAM/64QAM
Category 3	100Mbps	QPSK/16QAM/64QAM
Category 4	150Mbps	QPSK/16QAM/64QAM
Category 5	300Mbps	QPSK/16QAM/64QAM
Category 6	300Mbps	QPSK/16QAM/64QAM
LTE-FDD device category (Uplink)	**Max data rate（peak）**	**Modulation type**
Category 1	5Mbps	QPSK/16QAM
Category 2	25Mbps	QPSK/16QAM
Category 3	50Mbps	QPSK/16QAM
Category 4	50Mbps	QPSK/16QAM
Category 5	75Mbps	QPSK/16QAM/64QAM
Category 6	50Mbps	QPSK/16QAM

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B. Related Documents

Table 40: Related Documents

NO.	Title	Description
[1]	SIM8200EA-M2 Series_AT Command Manual_V1.xx	AT Command Manual
[2]	ITU-T Draft new recommendationV.25ter	Serial asynchronous automatic dialing and control
[3]	GSM 07.10	Support GSM 07.10 multiplexing protocol
[4]	GSM 07.05	Digital cellular telecommunications (Phase 2+); Use of Data Terminal Equipment – Data Circuit terminating Equipment (DTE – DCE) interface for Short Message Service (SMS) and Cell Broadcast Service (CBS)
[5]	GSM 11.14	Digital cellular telecommunications system (Phase 2+); Specification of the SIM Application Toolkit for the Subscriber Identity Module – Mobile Equipment (SIM – ME) interface
[6]	GSM 11.11	Digital cellular telecommunications system (Phase 2+); Specification of the Subscriber Identity Module – Mobile Equipment (SIM – ME) interface
[7]	GSM 03.38	Digital cellular telecommunications system (Phase 2+); Alphabets and language-specific information
[8]	GSM 11.10	Digital cellular telecommunications system (Phase 2)； Mobile Station (MS) conformance specification； Part 1: Conformance specification
[9]	3GPP TS 51.010-1	Digital cellular telecommunications system (Release 5); Mobile Station (MS) conformance specification
[10]	3GPP TS 38.401	NG-RAN; Architecture description
[11]	3GPP TS 34.124	Electromagnetic Compatibility (EMC) for mobile terminals and ancillary equipment.
[12]	3GPP TS 34.121	Electromagnetic Compatibility (EMC) for mobile terminals and ancillary equipment.
[13]	3GPP TS 34.123-1	Technical Specification Group Radio Access Network; Terminal conformance specification; Radio transmission and reception (FDD)
[14]	3GPP TS 34.123-3	User Equipment (UE) conformance specification; Part 3: Abstract Test Suites.
[15]	EN 301 908-02 V2.2.1	Electromagnetic compatibility and Radio spectrum Matters (ERM); Base Stations (BS) and User Equipment (UE) for IMT-2000. Third Generation cellular networks; Part 2: Harmonized EN for IMT-2000, CDMA Direct Spread (UTRA FDD) (UE) covering essential requirements of article 3.2 of the R&TTE Directive
[16]	EN 301 489-24 V1.2.1	Electromagnetic compatibility and Radio Spectrum Matters (ERM); Electromagnetic Compatibility (EMC) standard for

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		radio equipment and services; Part 24: Specific conditions for IMT-2000 CDMA Direct Spread (UTRA) for Mobile and portable (UE) radio and ancillary equipment
[17]	IEC/EN60950-1(2001)	Safety of information technology equipment (2000)
[18]	3GPP TS 51.010-1	Digital cellular telecommunications system (Release 5); Mobile Station (MS) conformance specification
[19]	GCF-CC V3.23.1	Global Certification Forum - Certification Criteria
[20]	2002/95/EC	Directive of the European Parliament and of the Council of 27 January 2003 on the restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS)
[21]	SIM8200EA-M2 Series_UART_Application Note_V1.xx	This document describes how to use UART interface of SIMCom modules.
[22]	SIM8200EA-M2 Series_GPS_Application Note_V1.xx	GPS Application Note
[23]	SIM8200EA-M2 Antenna design guidelines for diversity receiver system	Antenna design guidelines for diversity receiver system

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C. Terms and Abbreviations

Table 41: Terms and Abbreviations

Abbreviation	Description
ADC	Analog-to-Digital Converter
ARP	Antenna Reference Point
BER	Bit Error Rate
BTS	Base Transceiver Station
CS	Coding Scheme
CSD	Circuit Switched Data
CTS	Clear to Send
DAC	Digital-to-Analog Converter
DRX	Discontinuous Reception
DSP	Digital Signal Processor
DTE	Data Terminal Equipment (typically computer, terminal, printer)
DTR	Data Terminal Ready
DTX	Discontinuous Transmission
EFR	Enhanced Full Rate
EGSM	Enhanced GSM
EMC	Electromagnetic Compatibility
ESD	Electrostatic Discharge
ETS	European Telecommunication Standard
EVDO	Evolution Data Only
FCC	Federal Communications Commission (U.S.)
FD	SIM fix dialing phonebook
FDMA	Frequency Division Multiple Access
FR	Full Rate
GMSK	Gaussian Minimum Shift Keying
GNSS	Global Navigation Satellite System
GPRS	General Packet Radio Service
GPS	Global Positioning System
GSM	Global Standard for Mobile Communications
HR	Half Rate
HSPA	High Speed Packet Access
HSIC	High-speed Inter-chip
I2C	Inter-Integrated Circuit
IMEI	International Mobile Equipment Identity
LTE	Long Term Evolution
MDIO	Management Data Input/Output
MMD	MDIO manageable device
MO	Mobile Originated
MS	Mobile Station (GSM engine), also referred to as TE
MT	Mobile Terminated
NMEA	National Marine Electronics Association

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PAP	Password Authentication Protocol
PBCCH	Packet Switched Broadcast Control Channel
PCB	Printed Circuit Board
PCS	Personal Communication System, also referred to as GSM 1900
RF	Radio Frequency
RMS	Root Mean Square (value)
RTC	Real Time Clock
SIM	Subscriber Identification Module
SMS	Short Message Service
SPI	serial peripheral interface
SMPS	Switched-mode power supply
TDMA	Time Division Multiple Access
TE	Terminal Equipment, also referred to as DTE
TX	Transmit Direction
UART	Universal Asynchronous Receiver & Transmitter
VSWR	Voltage Standing Wave Ratio
SM	SIM phonebook
SGMII	Serial gigabit media independent interface
NC	Not connect
EDGE	Enhanced data rates for GSM evolution
HSDPA	High Speed Downlink Packet Access
HSUPA	High Speed Uplink Packet Access
ZIF	Zero intermediate frequency
WCDMA	Wideband Code Division Multiple Access
VCTCXO	Voltage control temperature-compensated crystal oscillator
USIM	Universal subscriber identity module
UMTS	Universal mobile telecommunications system
UART	Universal asynchronous receiver transmitter

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D. Safety Caution

Table 42: 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.

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