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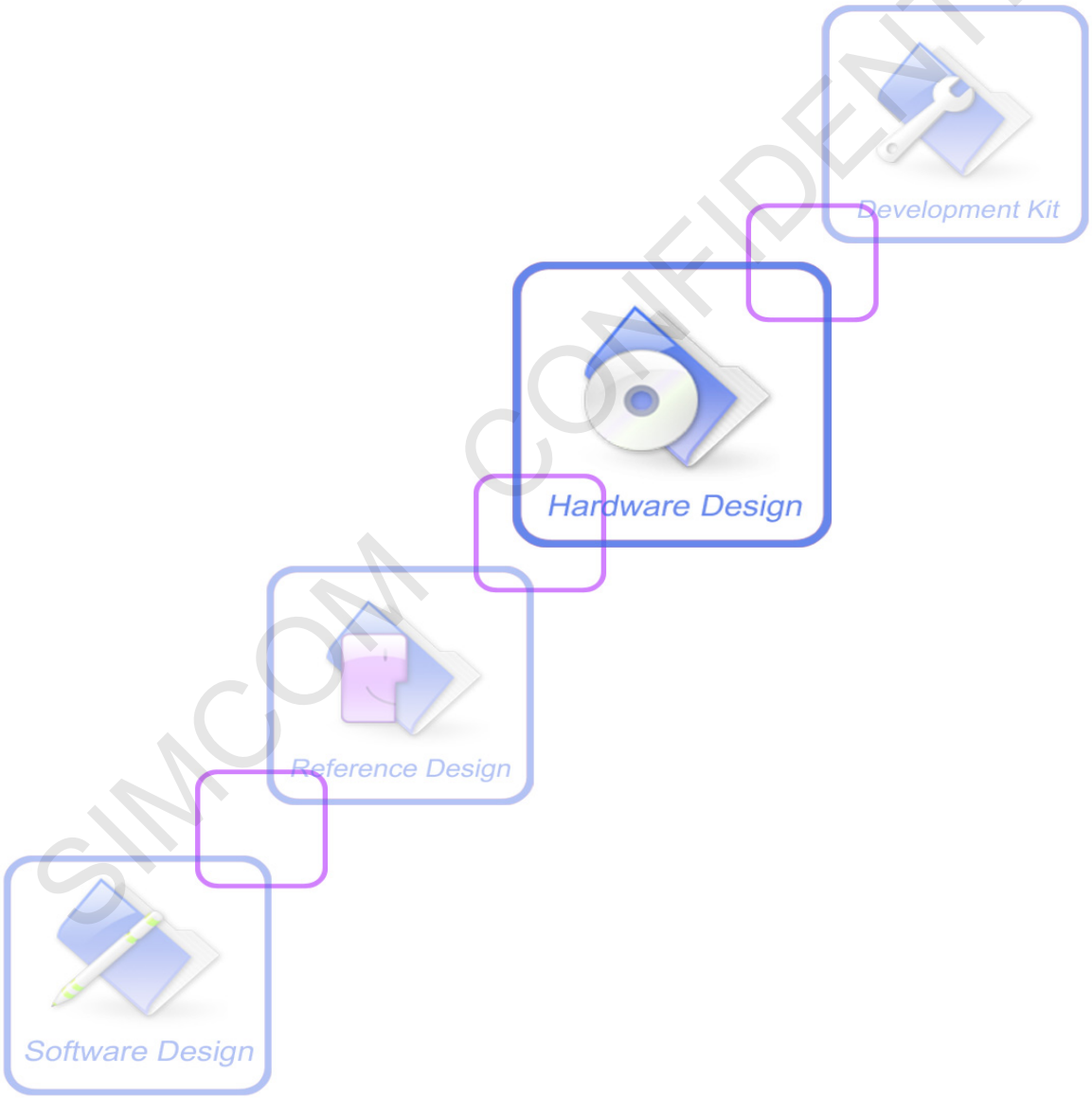
SIM7600CE-PCIE_Hardware Design_V1.02



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Version History

Date	Version	Description of change	Author
2016-08-05	1.00	Origin	Ma Honggang Lili.Teng
2016-12-22	1.01	Update figure 1; Delete SIM7600C-PCIE information; Change the VCC range to 3.4~4.2V; Update table 27 about “Power Off” description; Delete PCM interface; Update current consumption;	Ma Honggang
2017-02-08	1.02	Add packaging chapter； Add antenna matching circuit; Update table17&table 19；	Ma Honggang Gao Fan

1. Introduction

This document describes the electronic specifications, RF specifications, interfaces, mechanical characteristics and testing results of the SIMCom SIM7600CE-PCIE modules. With the help of this document and other related software application notes/user guides, users can understand and use SIM7600CE-PCIE modules to design and develop applications quickly.

1.1 Product Outline

Aimed at global market, the SIM7600CE-PCIE modules support 6 air-interface standards including GSM, TD-SCDMA, CDMA, WCDMA, TDD-LTE and FDD-LTE. Users can choose the module according to the wireless network configuration. The supported radio frequency bands are described in the following table.

Table 1: SIM7600CE-PCIE Series Frequency Bands

Standard	Frequency	SIM7600CE-PCIE(A)*
GSM	EGSM 900MHz	✓
	DCS1800MHz	✓
CDMA2000/ EVDO	BC0	✓
WCDMA	BAND1	✓
	BAND8	✓
TD-SCDMA	TD-SCDMA 1.9G	✓
	TD- SCDMA 2G	✓
LTE-FDD	LTE-FDD B1	✓
	LTE-FDD B3	✓
	LTE-FDD B8	✓
LTE-TDD	LTE TDD B38	✓
	LTE TDD B39	✓
	LTE TDD B40	✓
	LTE TDD B41	✓
Category		CAT4
GNSS		✓

Note: SIM7600CE-PCIE do not support audio feature, SIM7600CE-PCIEA provides Analog audio interface.

1.2 Hardware Interface Overview

SIM7600CE-PCIE provides various hardware interfaces via Mini PCI Express card connector.

- **Power Supply**
- **PERST#**
- **W_DISABLE#**
- **LED_WWAN#**
- **WAKE#**
- **USB Interface**
- **USIM Interface**
- **UART Interface**
- **I2C Interface**
- **Analog Audio Interface* (Only provided on PCIEA products)**

1.3 Hardware Block Diagram

The following figure is SIM7600CE-PCIE hardware block diagram.

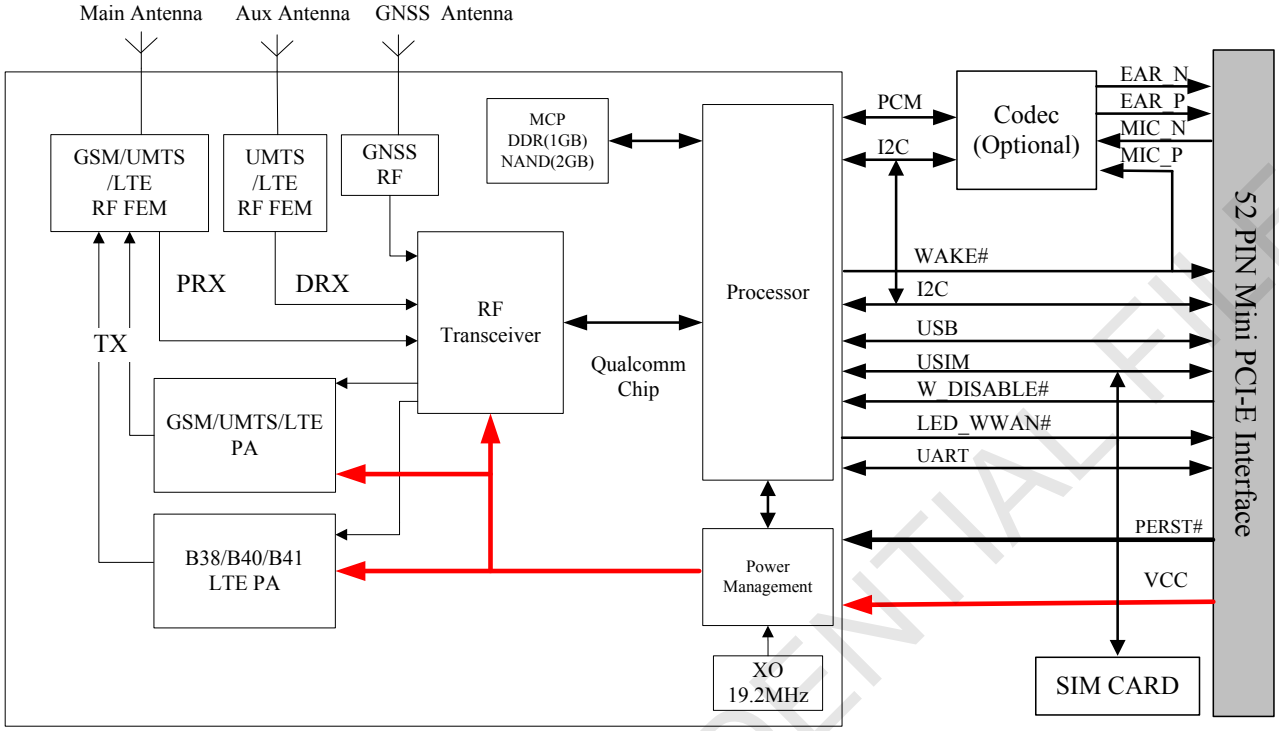

Figure 1: SIM7600CE-PCIE Block Diagram

1.4 Functional Overview

Table 2: SIM7600CE-PCIE Key Features

Feature	Implementation
Power supply	Single supply voltage 3.4V~4.2V
Radio frequency bands	Please refer to the table 1
Transmitting power	GSM/GPRS power class: --EGSM900: 4 (2W) --DCS1800: 1 (1W) EDGE power class: --EGSM900: E2 (0.5W) --DCS1800: E1 (0.4W) CDMA 1X power class: 3 (0.25W) UMTS power class: --WCDMA :3 (0.25W) --EVDO: 3 (0.25W): --TD-SCDMA: 2 (0.25W) LTE power class: 3 (0.25W)
Data Transmission	GPRS multi-slot class 12

Throughput	EDGE multi-slot class 12 UMTS R99 speed: 384 kbps DL/UL HSPA+: 5.76 Mbps(UL), 42 Mbps(DL) TD-HSDPA/HSUPA: 2.2 Mbps(UL), 2.8 Mbps(DL) CDMA EVDO:Rev-0,Rev-A, Rev-B LTE CAT 4 ： 150 Mbps (DL) LTE CAT 4 ： 50 Mbps (UL)
Antenna	GSM/UMTS/LTE main antenna. UMTS/LTE auxiliary antenna GNSS antenna
GNSS	GNSS engine (GPS,GLONASS and BD) 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/ 3V
USIM application toolkit	Support SAT class 3, GSM 11.14 Release 98 Support USAT
Phonebook management	Support phonebook types: SM, FD, LD, RC, ON, MC
Audio feature	***SIM7600CE-PCIE do not support audio interface.*** ***SIM7600CE-PCIEA product support analog audio interface.*** One analog signal output with 32Ω load resistance,50mW output power, and one analog input.
UART interface	A full modem serial port by default Baud rate: 300bps to 4Mbps(default:115200bps) Autobauding baud rate: 9600,19200,38400,57600,115200bps Can be used as the AT commands or data stream channel. Support RTS/CTS hardware handshake and software ON/OFF flow control Multiplex ability according to GSM 07.10 Multiplexer Protocol.
USB	USB 2.0 high speed interface
Firmware upgrade	Firmware upgrade over USB interface
Physical characteristics	Size: 50.80*31*5.35mm Weight: less than 12g
Temperature range	Normal operation temperature: -30°C to +80°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/WCDMA/HSPA+/LTE traffic in -40℃~+85℃. The performance will reduce slightly from the 3GPP specifications if the temperature is outside of the normal operating temperature and still within the extreme operating temperature.

2. Package Information

2.1 Pin Out Diagram

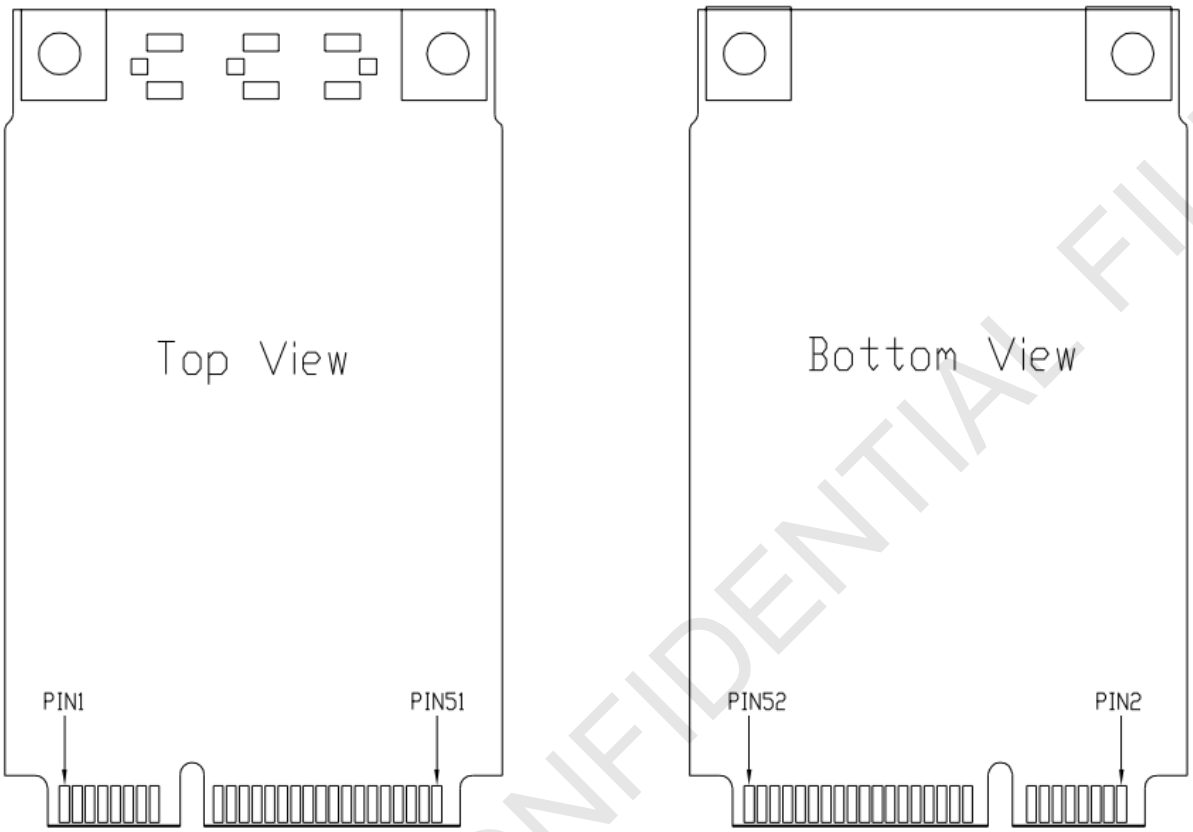

Figure 2: SIM7600CE-PCIE Pin out Diagram

2.2 PCI Express Mini Card Connector Pin Description

Table 3: PCI Express Mini Card Connector Pin Description

Pin name	Pin number	I/O	Description	Comment
Power supply				
VCC	2,24,39,41,52	I	Power supply for module	3.8V typical
GND	4,9,15,18,21, 26,27,29,34,3 5,37,40,43,50		Ground	-
Reset				
PERST#	22	I	Reset input (Active low)	If unused, keep open.
USB 2.0				
USB_DP	38	I/O	USB 2.0 high speed port for data transfer, voice call, debug and FW download, etc.	If unused, keep open.
USB_DN	36			
USIM card interface				
USIM_VDD	8	O	Power output for USIM card, its output Voltage depends on USIM card type automatically. Its output current is up to 50mA.	-
USIM_DATA	10	I/O	USIM Card data I/O, which has been pulled up via a 100KR resistor to USIM_VDD internally. Do not pull it up or down externally.	-
USIM_CLK	12	O	USIM clock.	Make sure the rise time and fall time of USIM_CLK less than 40ns;
USIM_RST	14	O	USIM Reset.	-
USIM_DET	16	I	USIM card detect.	-
UART interface				
UART_CTS	11	I	Clear to Send	If unused, keep open
UART_RTS	13	O	Request to send	
UART_RXD	17	I	Receive Data	
UART_TXD	19	O	Transmit Data	
UART_RI	44	O	Ring Indicator	
UART_DTR	46	I	DTE get ready	
I2C interface				
SCL	30	O	I2C clock output	Pulled up inside the

SDA	32	I/O	I2C data input/output	module; If unused, keep open
Others				
WAKE#/MICP	1	I/O	SIM7600CE-PCIE: Wake up host SIM7600CE-PCIEA: MIC positive input	If unused, keep open. If Analog audio is available, wake up function is invalid. If Analog audio is needed,please consult our sales staff, for more information .
MICN	3	I	SIM7600CE-PCIE: NC SIM7600CE-PCIEA: MIC negative input	
EARP	5	O	SIM7600CE-PCIE: NC SIM7600CE-PCIEA: Receiver positive output	
EARN	7	O	SIM7600CE-PCIE: NC SIM7600CE-PCIEA: Receiver negative output	
W_DISABLE#	20	I	RF Control Input	If unused, keep open.
LED_WWAN#	42	O	Network Status Indication output	If unused, keep open.
NC	6,23,25,28,31,33,45,47,48,49,51	--	No connection	Keep open

2.3 Package Dimensions

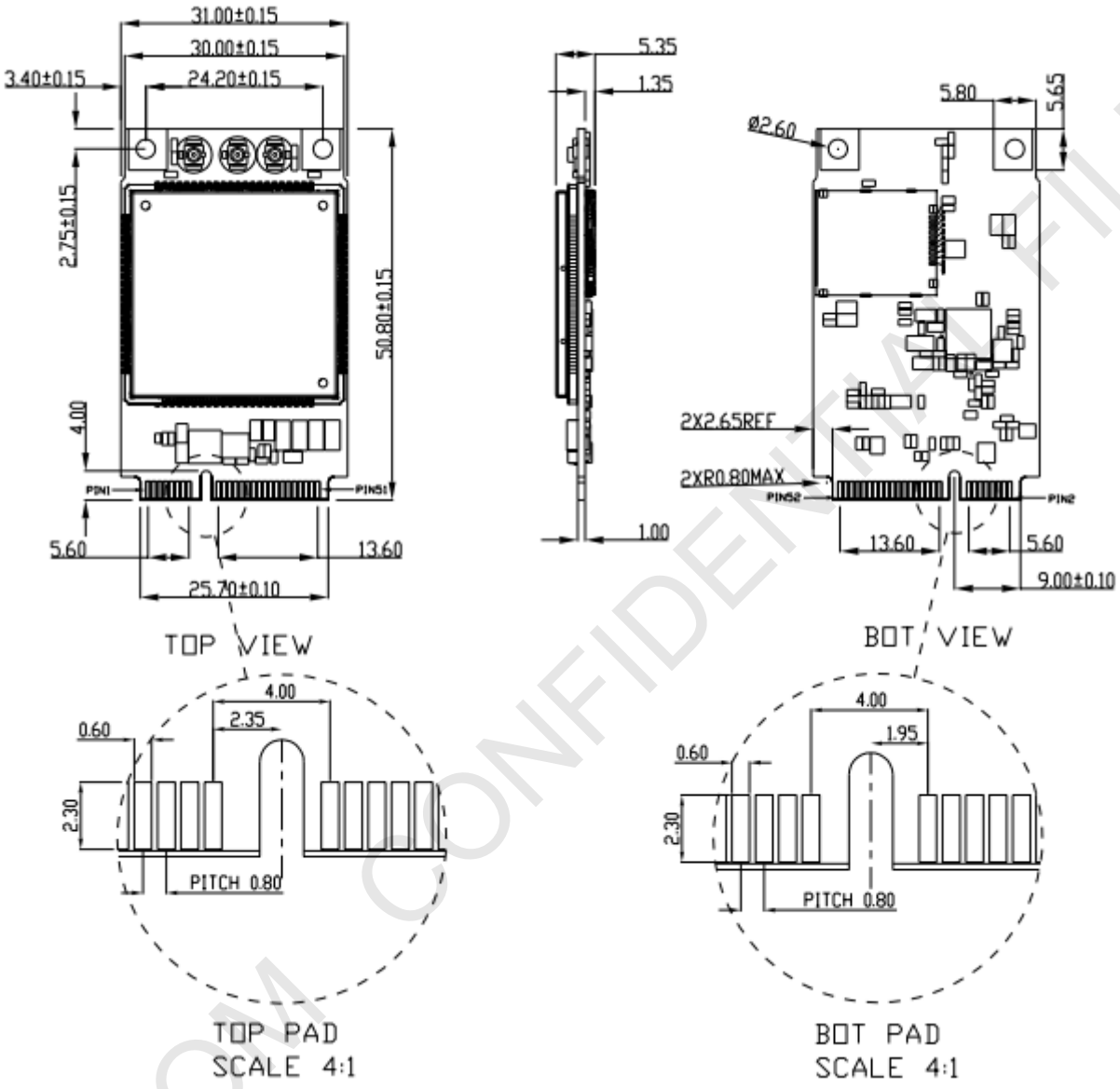

Figure 3: Dimensions of SIM7600CE-PCIE (Unit: mm)

3. Interface Application

3.1 Power Supply

The recommended power supply voltage of SIM7600CE-PCIE is 3.8V.

Table 4: Recommended 3.3V Power Supply Characteristics

Symbol	Parameter	Min	Type	Max	Unit
Vo	Power supply voltage	3.4	3.8	4.2	V
Io	Supply current capability	-	2000	-	mA

3.2 PERST#

SIM7600CE-PCIE can be reset by pulling the PERST# pin down to ground.

The PERST# pin has been pulled up with a 47KΩ resistor to 1.8V internally, so there is no need to pull it up externally. It is strongly recommended to put a 100nF capacitor and an ESD protection diode close to the PERST# pin. Please refer to the following figure for the recommended reference circuit.

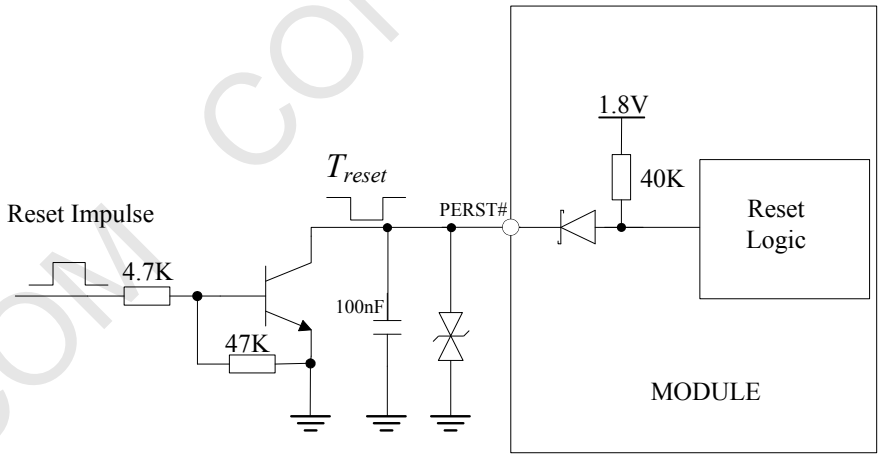

Figure 4: PERST# Reference Circuit

Table 5: PERST# Pin Electronic Characteristic

Symbol	Description	Min.	Typ.	Max.	Unit
T_{reset}	The active low level time impulse on PERST# pin to reset module	50	100	500	ms
V_{IH}	Input high level voltage	1.17	1.8	3.6	V
V_{IL}	Input low level voltage	-0.3	0	0.2	V

3.3 W_DISABLE#

The W_DISABLE# pin can be used to control SIM7600CE-PCIE to enter or exit the Flight mode. In Flight mode, the RF circuit is closed to prevent interference with other equipments and minimize current consumption.

Table 6: W_DISABLE# Pin Status

W_DISABLE# status	Module operation
Input Low Level	Flight Mode: RF is closed.
Input High Level	The module mode depends on AT+CFUN command: AT+CFUN=1: RF is working. AT+CFUN=0: RF is closed.

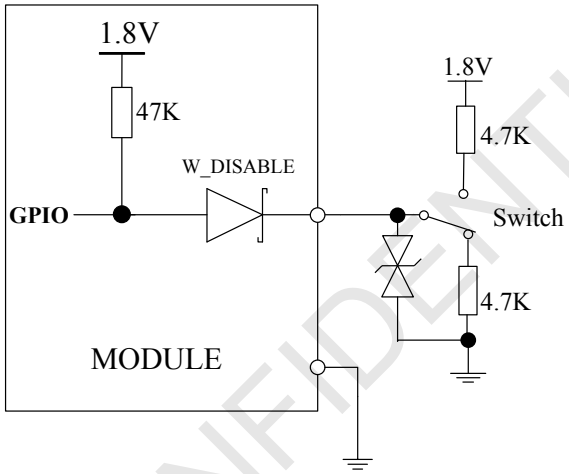

Figure 5: W_DISABLE# Reference Circuit

Table 7: W_DISABLE# Pin Electrical Characteristic

Symbol	Parameter	Min	Type	Max	Unit
V_{IH}	High-level input voltage	1.17	1.8	3.6	V
V_{IL}	Low-level input voltage	-0.3	0	0.3	V

3.4 LED_WWAN#

The LED_WWAN# pin can be used to drive a network status indication LED by default. Its status is listed in the following table.

Table 8: Network Status Indication LED Status

LED Status	Module Status
On	Searching Network/Call Connect
200ms On, 200ms Off	Data Transmit
800ms On, 800ms Off	Registered network
Off	Power off / Sleep

Reference circuit is recommended in the following figure:

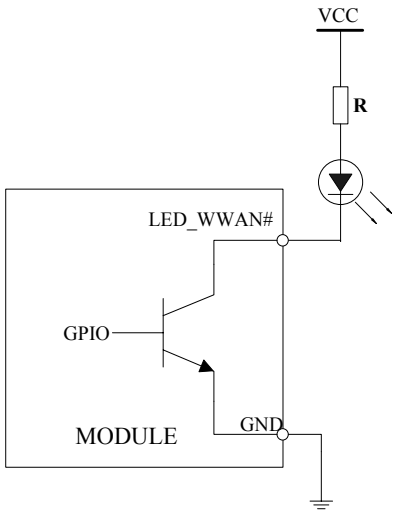

Figure 6: LED_WWAN# Reference Circuit

3.5 WAKE#

The WAKE# pin can be used as an interrupt signal to host. Normally it will keep high logic level until certain condition such as receiving SMS, voice call (CSD, video) or URC reporting, then WAKE# will change to low logic level to inform the master (client PC). It will stay low until the master clears the interrupt event with AT command.

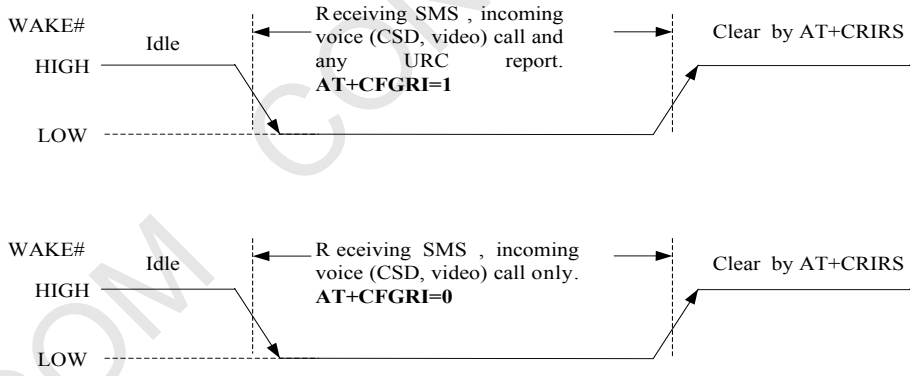

Figure 7: WAKE# behaviour

However, if the module is used as caller, the WAKE# will remain high. Please refer to the following figure.

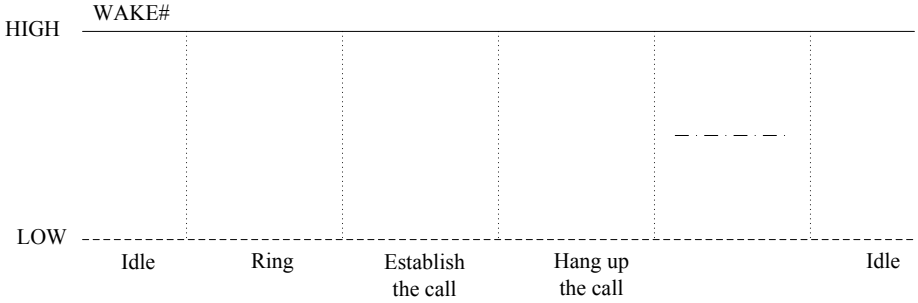

Figure 8: WAKE# behaviour as a caller

WAKE# Reference circuit is recommended in the following figure:

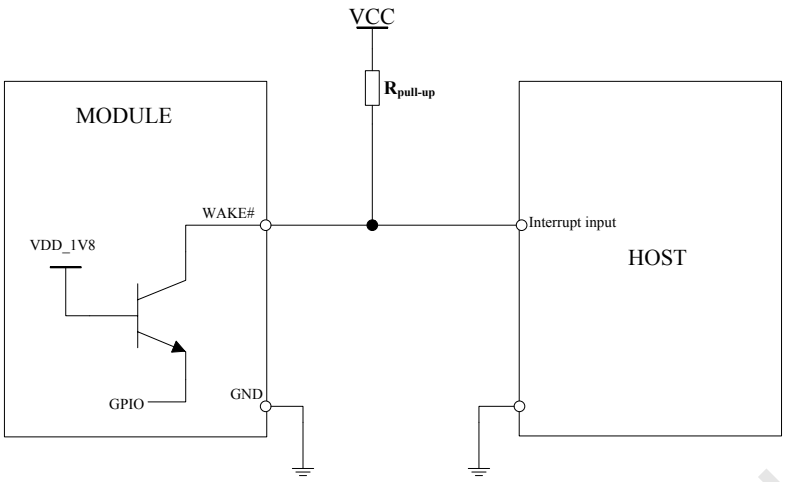

Figure 9: WAKE# Reference Circuit

Note: If Analog audio is available, WAKE# function is invalid.

3.6 USB 2.0

SIM7600CE-PCIE is compliant with USB 2.0 specification. It supports full-speed and high- speed when acting as a peripheral device.

SIM7600CE-PCIE can be used as a USB device. SIM7600CE-PCIE supports the USB suspend and resume mechanism which can reduce power consumption. If there is no data transmission on the USB bus, SIM7600CE-PCIE will enter suspend mode automatically, and will be resumed by some events such as voice call or receiving SMS, etc.

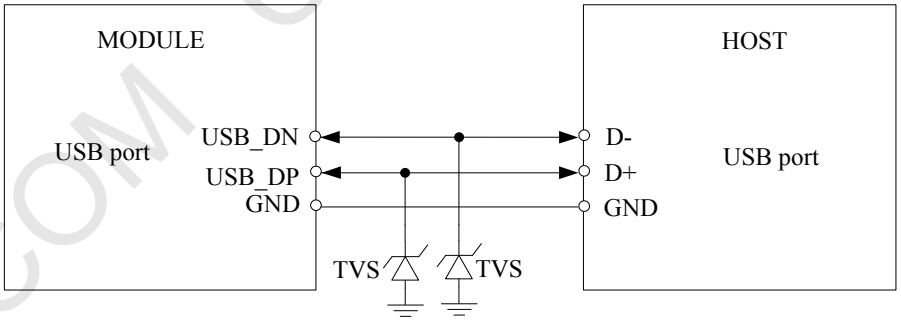

Figure 10: USB Reference Circuit

Because of the high bit rate on USB bus, please pay more attention to the influence of the junction capacitance of the ESD component on USB data lines. Typically, the capacitance should be less than 1pF. It is recommended to use an ESD protection component such as ESD9L5.0ST5G provided by On Semiconductor (www.onsemi.com).

Note;

1. ***The USB_DN and USB_DP nets must be traced by 90Ohm+/-10% differential impedance.***
2. ***The USB VBUS of the module is connected to VBAT internally, so there is no need to connect externally.***
3. ***The SIM7600CE-PCIE has two kinds of interface (UART and USB) to connect to host CPU. For example, on windows XP operating system, USB interface is mapped to 4virtual ports: "SimTech***

HS-USB Audio 9001", "SimTech HS-USB AT port 9001", "SimTech HS-USB Diagnostics 9001", "SimTech HS-USB NMEA 9001".

3.7 USIM Interface

USIM interface complies with the GSM Phase 1 specification and the new GSM Phase 2+ specification for FAST 64 kbps USIM card. Both 1.8V and 3.0V USIM card are supported. USIM interface is powered from an internal regulator in the module.

Table 9: USIM Electronic characteristic in 1.8V mode (USIM_VDD =1.8V)

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

Table 10: USIM Electronic characteristic 3.0V mode (USIM_VDD =2.95V)

Symbol	Parameter	Min.	Typ.	Max.	Unit
USIM_VDD	LDO power output voltage	2.75	2.95	3.05	V
V_{IH}	High-level input voltage	0.65*USIM_VDD	-	USIM_VDD +0.3	V
V_{IL}	Low-level input voltage	-0.3	0	0.25·USIM_VDD	V
V_{OH}	High-level output voltage	USIM_VDD -0.45	-	USIM_VDD	V
V_{OL}	Low-level output voltage	0	0	0.45	V

The USIM_DET pin is used for detection of the USIM card hot plug. User can select the 8-pin USIM card holder to implement USIM card detection function.
USIM_DET has been pulled up to 1.8V inside module;

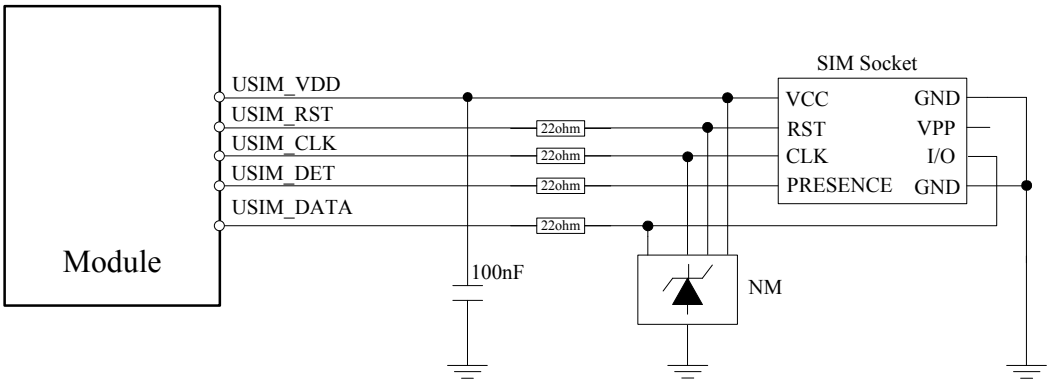

Figure 11: USIM interface reference circuit with detection function

If the USIM card detection function is not used, user can keep the USIM_DET pin open. The reference circuit of 6-pin USIM card holder is illustrated in the following figure.

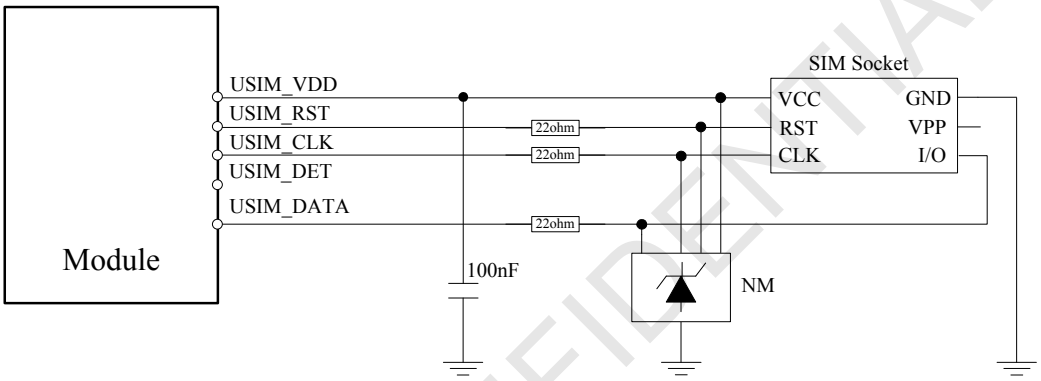

Figure 12: USIM interface reference circuit

Note: USIM_DATA has been pulled up with a 10KΩ resistor to USIM_VDD in module. A 100nF capacitor on USIM_VDD is used to reduce interference.

Note: USIM_CLK is very important signal; customer must make sure the rise time and fall time of USIM_CLK less than 40ns!

3.8 UART Interface

SIM7600CE-PCIE provides one UART (universal asynchronous serial transmission) port. The module is as the DCE (Data Communication Equipment) and the client PC is as the DTE (Data Terminal Equipment). AT commands are entered and serial communication is performed through UART interface.

The application circuit is in the following figures.

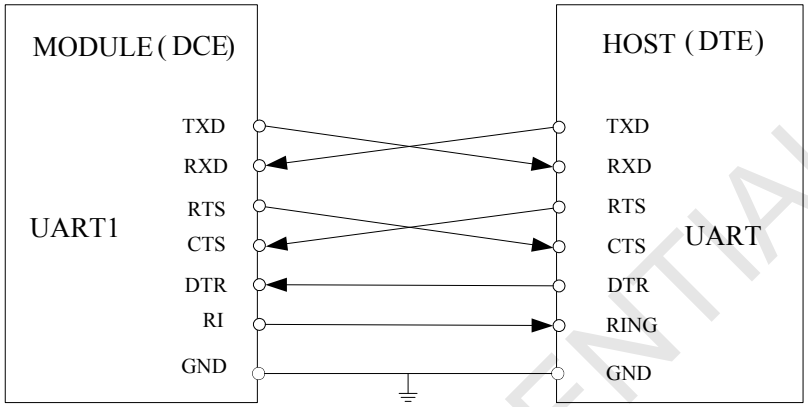

Figure 13: UART Full modem

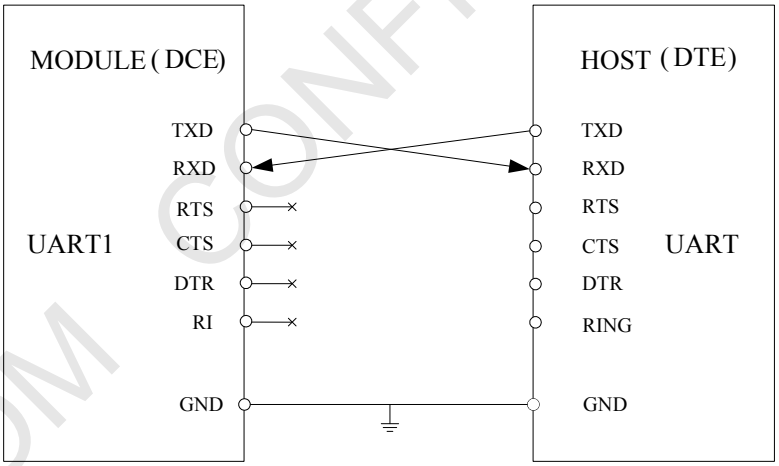

Figure 14: UART Null modem

Table 11: UART Electrical Characteristic

Symbol	Parameter	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	1.8	V
V_{OL}	Low-level output voltage	0	0	0.45	V

The SIM7600CE-PCIE UART is 1.8V interface. A level shifter should be used if user's application is equipped with a 3.3V UART interface. The level shifter TXB0108RGYR provided by Texas Instruments is recommended. The reference design of the TXB0108RGYR is in the following figures.

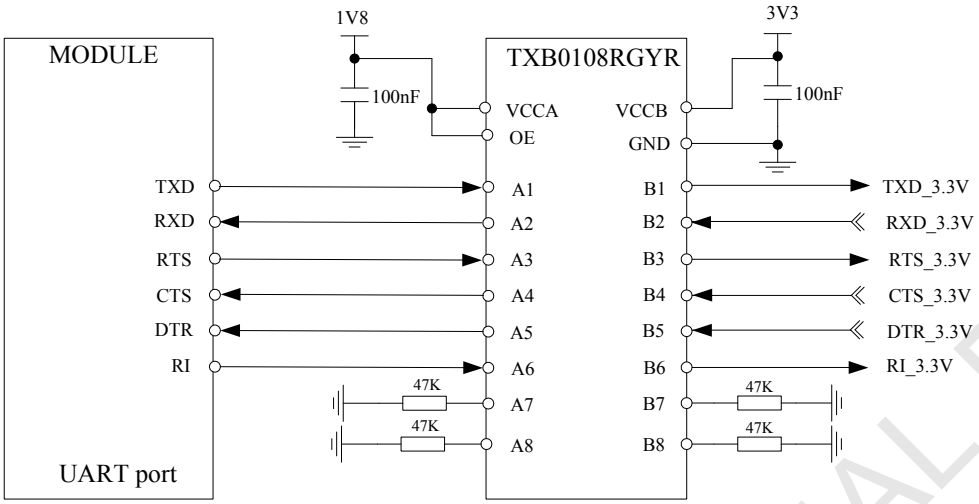

Figure 15: Reference circuit of level shift

To comply with RS-232-C protocol, the RS-232-C level shifter chip should be used to connect SIM7600CE-PCIE to the RS-232-C interface. In this connection, the TTL level and RS-232-C level are converted mutually. SIMCom recommends that user uses the SP3238ECA chip with a full modem. For more information please refers to the RS-232-C chip datasheet.

Note: SIM7600CE-PCIE supports the following baud rate: 300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200, 230400, 460800, 921600, 3200000, 3686400, 4000000bps. Default baud rate is 115200bps.

3.9 I2C Interface

SIM7600CE-PCIE provides I2C interface compatible with I2C specification, version 5.0, with clock rate up to 400 kbps. Its operation voltage is 1.8V.

Note: Since the I2C is connected to the audio codec chip on board, the users should choose the I2C device whose address is not the same with the audio codec (0x34). If the the audio codec chip is not mounted on board, users could ignore this.

The following figure shows the I2C bus reference design.

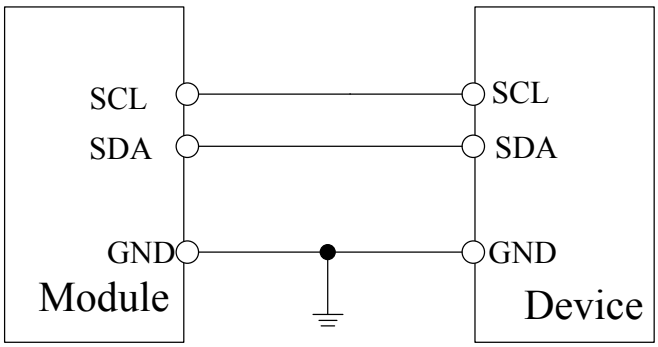

Figure 16: I2C Reference Circuit

Note: SDA and SCL are pulled up to 1.8V via 2.2K resistors in module. So external pull up resistors are not needed in application circuit. For more details about I2C AT commands please refer to document [1].

Table 12: I2C Electrical Characteristic

Symbol	Parameter	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	1.8	V
V_{OL}	Low-level output voltage	0	0	0.45	V

3.10 Analog Audio Interface

SIM7600CE-PCIEA provides one analog signal output and one analog input. MICP/N is used as microphone input; EARP/N is used as audio output. Regarding audio parameters configuration, please refer to the ATC manual.

Table 13: MIC input characteristics

Parameter	Min	Typ	Max	Unit
Mic biasing voltage		1.80		V
Working Current			3	mA
External Microphone Load Resistance	1.2	2.2		K Ω

Table 14: Audio output characteristics

Parameter	Min	Typ	Max	Unit
Load resistance	27	32	-	Ω
Output power	-	50	-	mW

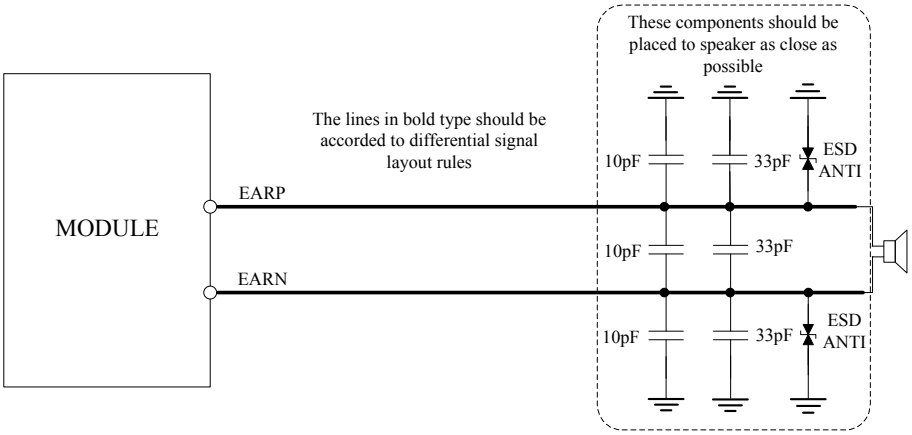

Figure 17: Receiver interface configuration

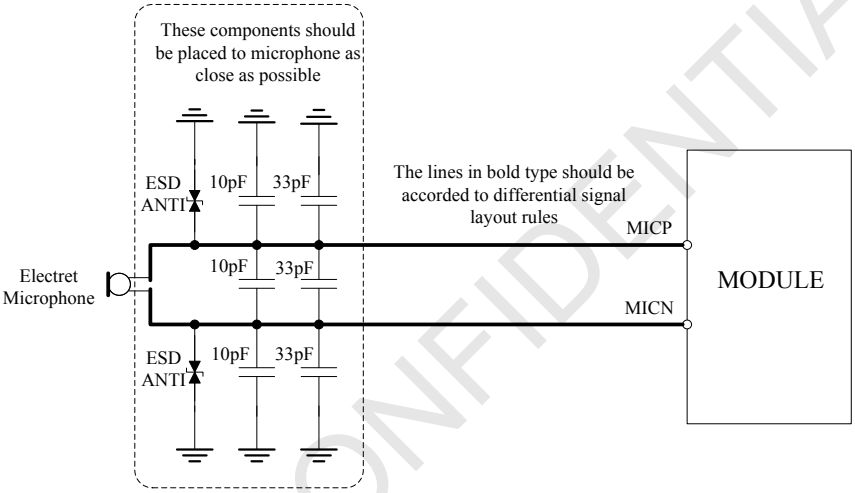

Figure 18: Microphone interface configuration

Note: SIM7600CE-PCIEA has integrated MIC bias circuit. There is no need to pull the MICP and MICN up to the external power, just connect it to microphone. MICP and MICN must be differential lines.

Main audio parameters can be changed to satisfy users' requirement. User can adjust them through AT command according to their own electronic and mechanical design. For more details please refers to audio application document.

4. RF Specifications

4.1 GSM/WCDMA/TD-SCDMA/EVDO/LTE RF Specifications

Table 15: Conducted transmission power

Frequency	Power	Min.
E-GSM900	33dBm ±2dB	5dBm ± 5dB
DCS1800	30dBm ±2dB	0dBm ± 5dB
E-GSM900 (8-PSK)	27dBm ±3dB	5dBm ± 5dB
DCS1800 (8-PSK)	26dBm +3/-4dB	0dBm ±5dB
WCDMA B1	24dBm +1/-3dB	<-50dBm
WCDMA B8	24dBm + 1/-3dB	<-50dBm
CDMA BC0	24dBm + 1/-3dB	<-50dBm
TDSCDMA 1900	24dBm + 1/-3dB	<-50dBm
TDSCDMA 2000	24dBm + 1/-3dB	<-50dBm
LTE-FDD B1	23dBm +/-2.7dB	<-40dBm
LTE-FDD B3	23dBm +/-2.7dB	<-40dBm
LTE-FDD B8	23dBm +/-2.7dB	<-40dBm
LTE-TDD B38	23dBm +/-2.7dB	<-40dBm
LTE-TDD B39	23dBm +/-2.7dB	<-40dBm
LTE-TDD B40	23dBm +/-2.7dB	<-40dBm
LTE-TDD B41	23dBm +/-2.7dB	<-40dBm

Table 16: Operating frequencies

Frequency	Receiving	Transmission
E-GSM900	925～960 MHz	880～915 MHz
DCS1800	1805～1880 MHz	1710～1785 MHz
WCDMA B1	2110～2170 MHz	1920～1980 MHz
WCDMA B8	925～960 MHz	880～915 MHz
TDSCDMA 1.9G	1880～1920 MHz	1880～1920 MHz
TDSCDMA 2G	2010～2025 MHz	2010～2025 MHz
CDMA BC0	869～894 MHz	824～849 MHz
The LTE Operating frequencies are shown in the following table 17.		
GPS	1574.4 ～1576.44 MHz	-
GLONASS	1598 ～1606 MHz	-
BD	1559 ～1563 MHz	

Table 17: E-UTRA operating bands

E-UTRA Operating Band	Uplink (UL) operating band	Downlink (DL) operating band	Duplex Mode
1	1920 MHz~1980 MHz	2110 MHz~2170 MHz	FDD
3	1710 MHz~1785 MHz	1805 MHz~1880 MHz	FDD
8	880 MHz~915 MHz	925 MHz~960 MHz	FDD
38	2570 MHz~2620 MHz	2570 MHz~2620 MHz	TDD
39	1880 MHz~1920 MHz	1880 MHz~1920 MHz	TDD
40	2300 MHz~2400 MHz	2300 MHz~2400 MHz	TDD
41	2496 MHz~2690 MHz	2496 MHz~2690 MHz	TDD
Note: Operating frequencies of LTE TDD B41 for the SIM7600CE-PCIE is 100MHz BW, 2555～2655 MHz			

Table 18: Conducted receive sensitivity

Frequency	Receive sensitivity(Typical)	Receive sensitivity(MAX)
E-GSM900	< -109dBm	3GPP
DCS1800	< -109dBm	3GPP
WCDMA 2100	< -110dBm	3GPP
WCDMA 900	< -110dBm	3GPP
TDSCDMA 1900	< -110dBm	3GPP
TDSCDMA 2000	< -110dBm	3GPP
CDMA BC0	< -110dBm	3GPP
LTE FDD/TDD	See table 19	3GPP

Table 19: Reference sensitivity (QPSK)

E-UTRA band	1.4 MHz Standard	3 MHz Standard	5 MHz Standard	10 MHz Standard	5 MHz Test Resort	15 MHz Standard	20 MHz Standard	Duplex Mode
1	-	-	-100	-97	-101	-95.2	-94	FDD
3	-101.7	-98.7	-97	-94	-99	-92.2	-91	FDD
8	-102.2	-99.2	-97	-94	-102			FDD
38	-	-	-100	-97	-101	-95.2	-94	TDD
39	-	-	-100	-97	-101.5	-95.2	-94	TDD
40	-	-	-100	-97	-101	-95.2	-94	TDD
41	-	-	-98	-95	-101	-93.2	-92	TDD

4.2 RF Antenna Connector

SIM7600CE-PCIE have 3 antenna connectors, one of which is the GSM/UMTS/LTE main antenna connector, the others are UMTS/LTE auxiliary antenna connector and GPS/GLONASS antenna connector. Recommended antenna characteristics of SIM7600CE-PCIE are described by 2 following tables.

Table 20: Recommended Passive Antenna Characteristics

Passive	Recommended standard
Direction	omnidirectional
Gain	> -3dBi (Avg)
Input impedance	50 ohm
Efficiency	> 50 %
VSWR	< 2

Table 21: Recommended Active Antenna Characteristics

Band	Performance	
	TRP	TIS
EGSM900	≧ 29dBm	≦ -104dBm
DCS1800	≧ 26dBm	≦ -104dBm
WCDMA B1	≧ 19dBm	≦ -104dBm
WCDMA B2	≧ 19dBm	≦ -104dBm
LTE B1	≧ 18dBm	≦ -92dBm(10MHz)
LTE B3	≧ 18dBm	≦ -89dBm(10MHz)
LTE B8	≧ 18dBm	≦ -89dBm(10MHz)
LTE B38	≧ 18dBm	≦ -92dBm(10MHz)
LTE B39	≧ 18dBm	≦ -92dBm(10MHz)
LTE B40	≧ 18dBm	≦ -92dBm(10MHz)
LTE B41	≧ 18dBm	≦ -91dBm(10MHz)

NOTE: The above LTE only test 10MHZ bandwidth

The RF connector in the module side is an ultra small surface mount coaxial connector (Part Number: U.FL-R-SMT, vended by HRS). It has high performance with wide frequency range, surface mountable and reflows solderable. Following are parameters (Figure 19). Certainly user can visit http://www.hirose-connectors.com/ for more information.

To get good RF performance in user's design, SIMCom suggests user to use the matching RF adapter cable which is also supplied by HRS (Part Number: U.FL-LP（V）-040), the following figure (Figure 20) is the dimensions of U.FL series RF adapter cable. User can contact SIMCom for more information.

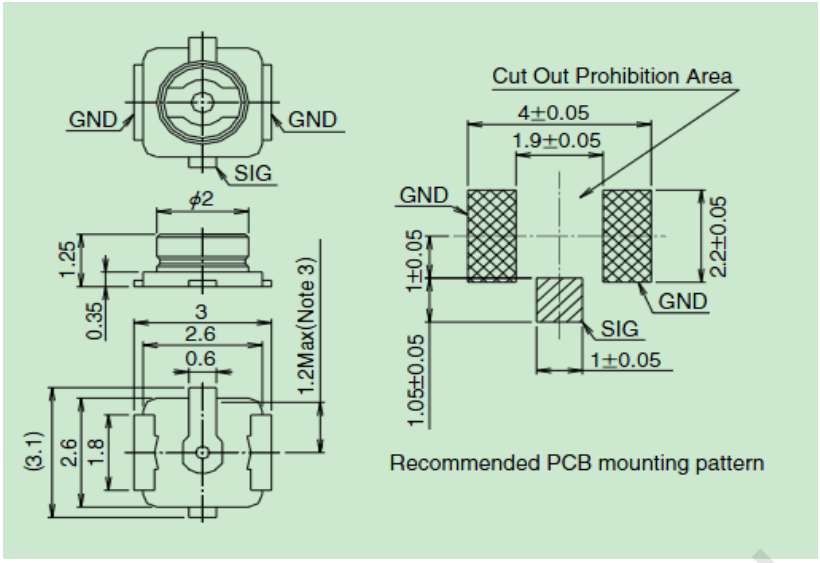

Figure 19: U.FL-R-SMT (Unit: mm)

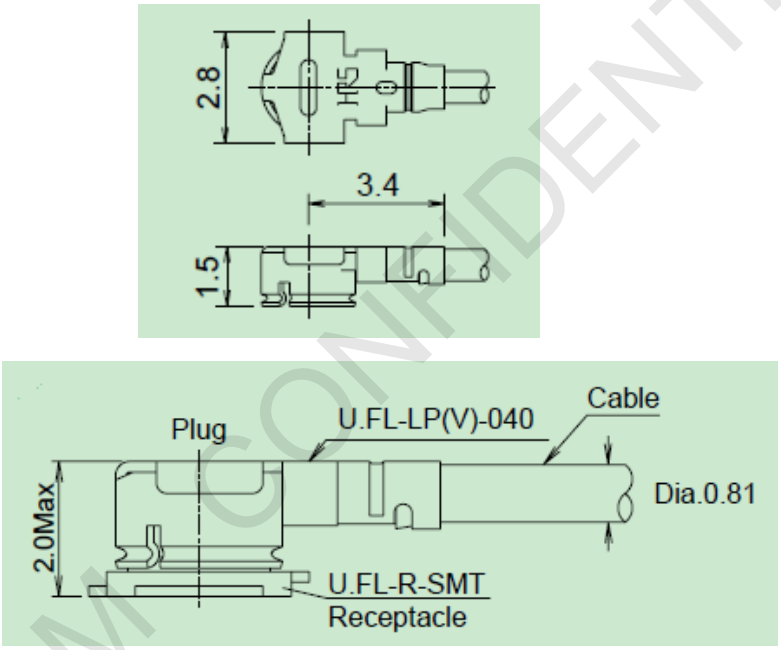

Figure 20: U.FL series RF adapter cable (Unit: mm)

To facilitate the antenna tuning and certification test, a RF connector and an antenna matching circuit should be added. The following figure is the recommended circuit.

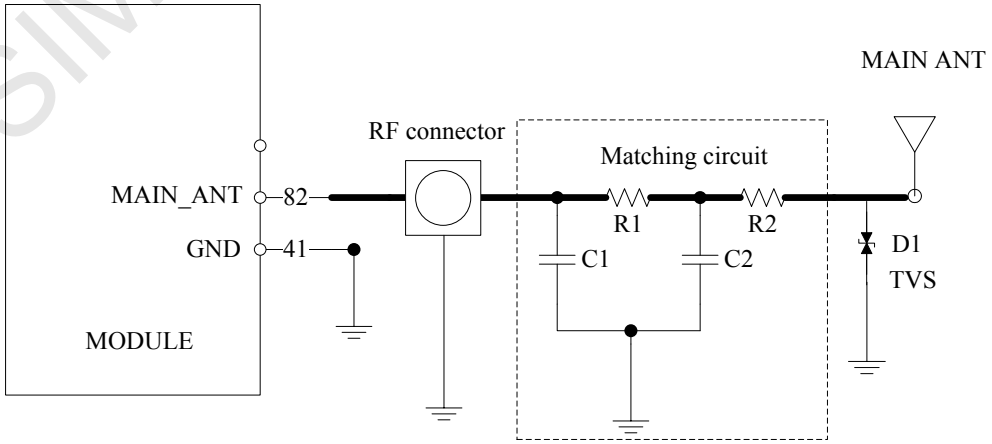

Figure 21: Antenna matching circuit (MAIN_ANT)

In above figure, the components R1,C1,C2 and R2 are used for antenna matching, the value of components can only be got after the antenna tuning, usually, they are provided by antenna vendor. By default, the R1, R2 are 0Ω resistors, and the C1, C2 are reserved for tuning.

The RF test connector in the figure is used for the conducted RF performance test, and should be placed as close as to the module's antenna pin. The traces impedance between components must be controlled in 50Ω. The component D1 is a Bidirectional ESD Protection device, which is suggested to add to protection circuit, the recommended Part Numbers of the TVS are listed in the following table:

Table 22: TVS part number list

Package	Type	Supplier
0201	LXES03AAA1-154	Murata
0402	LXES15AAA1-153	Murata

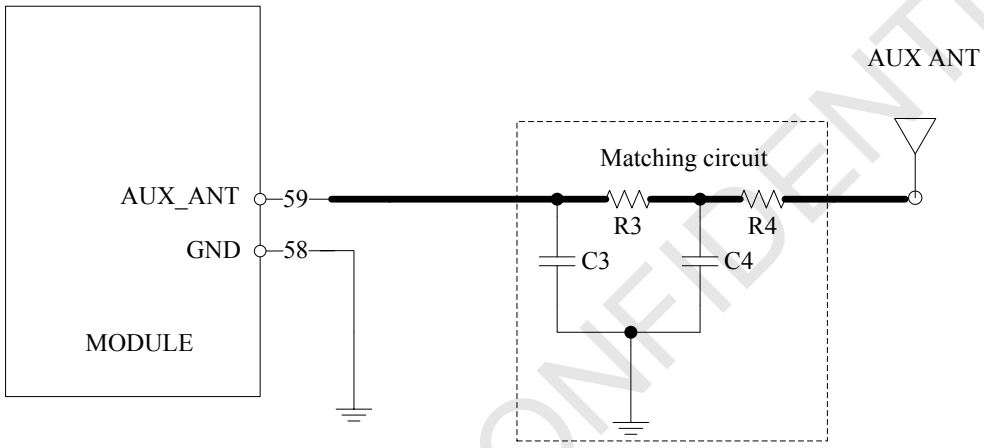

Figure 22: Antenna matching circuit (AUX_ANT)

In above figure, R3, C3, C4 and R4 are used for auxiliary antenna matching. By default, the R3, R4 are 0Ω resistors, and the C3, C4 are reserved for tuning.

Note：SIMCom suggests the LTE auxiliary antenna to be kept on, since there are many high bands in the designing of TDD-LTE, such as band38, band40 and band41.

4.3 GNSS

SIM7600CE-PCIE merges GNSS (GPS/GLONASS/BD) satellite and network information to provide a high-availability solution that offers industry-leading accuracy and performance. This solution performs well, even in very challenging environmental conditions where conventional GNSS receivers fail, and provides a platform to enable wireless operators to address both location-based services and emergency mandates.

4.3.1 GNSS Technical specification

Tracking sensitivity: -159 dBm（GPS）/-158 dBm（GLONASS）/TBD (BD)

Cold-start sensitivity: -148 dBm

Accuracy (Open Sky): 2.5m (CEP50)

TTFF (Open Sky) : Hot start <1s, Cold start<35s

Receiver Type: 16-channel, C/A Code
GPS L1 Frequency: 1575.42±1.023MHz
GLONASS: 1597.5~1605.8 MHz
BD: 1559.05~1563.14 MHz
Update rate: Default 1 Hz
GNSS data format: NMEA-0183
GNSS Current consumption : 100mA (GSM/CDMA 1X/UMTS/LTE Sleep ,in total on VBAT pins)
GNSS antenna: Passive/Active antenna

It is suggested either the external LNA or active antenna used. It is not needed for both of them at the same time.

Note: Performance will vary depending on the environment, antenna type and signal conditions and so on.

4.3.2 GNSS Operate Mode

SIM7600CE-PCIE supports both A-GPS and S-GPS, and then provides three operating modes: mobile-assisted mode, mobile-based mode and standalone mode. A-GPS includes mobile-assisted and mobile-based mode.

In mobile-assisted mode, when a request for position location is issued, available network information is provided to the location server (e.g. Cell-ID) and assistance is requested from the location server. The location server sends the assistance information to the handset. The handset/mobile unit measures the GNSS observables and provides the GNSS measurements along with available network data (that is appropriate for the given air interface technology) to the location server. The location server then calculates the position location and returns results to the requesting entity.

In mobile-based mode, the assistant data provided by the location server encompasses not only the information required to assist the handset in measuring the satellite signals, but also the information required to calculate the handset's position. Therefore, rather than provide the GNSS measurements and available network data back to the location server, the mobile calculates the location on the handset and passes the result to the requesting entity.

In standalone (autonomous) mode, the handset demodulates the data directly from the GNSS satellites. This mode has some reduced cold-start sensitivity, and a longer time to first fix as compared to the assisted modes. However, it requires no server interaction and works out of network coverage.

This combination of GNSS measurements and available network information provides:

- High-sensitivity solution that works in all terrains: Indoor, outdoor, urban, and rural
- High availability that is enabled by using both satellite and network information

Therefore, while network solutions typically perform poorly in rural areas and areas of poor cell geometry/density, and while unassisted, GNSS-only solutions typically perform poorly indoors. The SIM7600CE-PCIE GNSS solution provides optimal time to fix, accuracy, sensitivity, availability, and reduced network utilization in both of these environments, depending on the given condition.

GNSS can be used by NMEA port. User can select NMEA as output through UART or USB. NMEA sentences are automatic and no command is provided. NMEA sentences include GSV, GGA, RMC, GSA, and VTG. Before using GNSS, user should configure SIM7600CE-PCIE in proper operating mode by AT command. Please refer to related document for details. SIM7600CE-PCIE can also get position location information through AT directly.

4.3.3 Application Guide

Users can adopt an active antenna or a passive antenna as GNSS signal receiver. In this document, all GNSS

specification mentioned is from passive antenna. The following is the reference circuit.

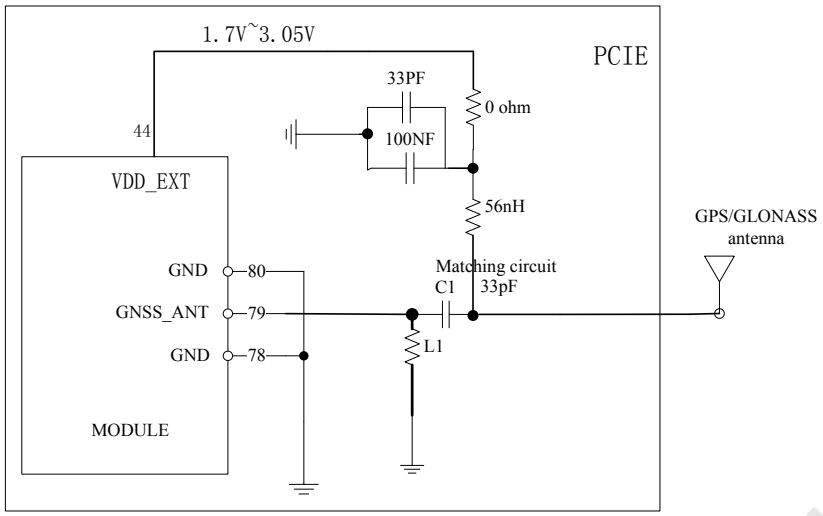

Figure 23: Active antenna circuit

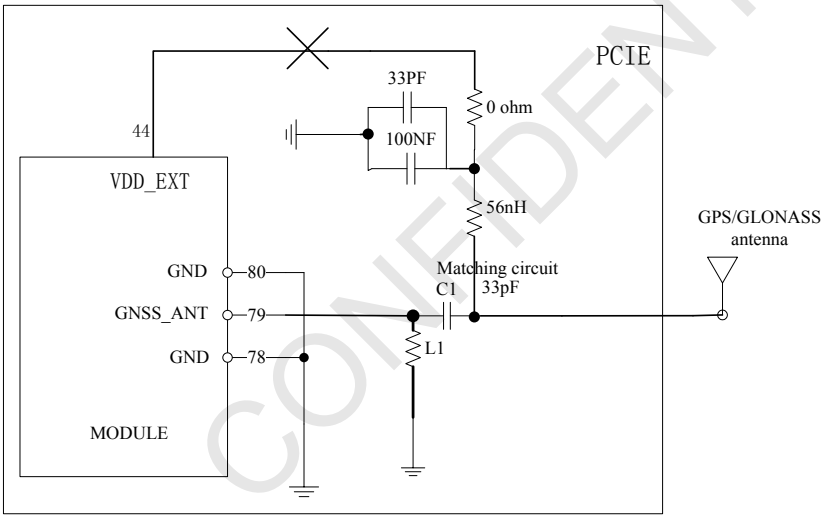

Figure 24: Passive antenna circuit (Default)

In above Figure 24 by default, the passive antenna is used and the VDD_EXT do not output voltage. In above Figure 23 the active antenna is used, and users need to open the VDD_EXT by AT+CVAUXS=1 to output 2.95V. If users want to change the voltage of VDD_EXT, use this AT command; "AT+CVAUXV". For example, if customer needs the output voltage value to be 1.8V, the AT command should be "AT+CVAUXV=1800000". The output voltage range of VDD_EXT is from 1.7V to 3.05V.

Note; For more details of AT commands about VDD_EXT, please refer to document [1].

Note: GNSS is closed by default, it could be started by AT+CGPS. The AT command has two parameters, the first is on/off, and the second is GNSS mode. Default mode is standalone mode.

AGPS mode needs more support from the mobile telecommunication network. Please refer to document [22] for more details.

5. Electrical Specifications

5.1 Absolute Maximum Ratings

The absolute maximum ratings are described by the following table. Module may be damaged beyond these ratings.

Table 23: Absolute maximum ratings

Symbol	Parameter	Min	Type	Max	Unit
V_{CC}	VCC input voltage	-0.3	-	4.5	V
V_{IO}	Voltage at digital pins (1.8V digital I/O) *	-0.3	-	2.1	V

Note: These parameters are for digital interface pins, such as I2C,UART,GPIO.

5.2 Recommended Operating Conditions

Please refer to the follow table for recommended operating conditions.

Table 24: Operating Conditions

Symbol	Parameter	Min	Type	Max	Unit
V_{CC}	3.8V Input voltage	3.4	3.8	4.2	V
V_{IO}	Voltage at digital pins (1.8V digital I/O)	0	1.8	1.95	V
T_{OPER}	Operating temperature	-40	+25	+85	℃
T_{STG}	Storage temperature	-45	+25	+90	℃

5.3 Operating Mode

5.3.1 Operating Mode

The table below summarizes the various operating modes of SIM7600CE-PCIE.

Table 25: Operating Mode

Mode		Function
Normal operation	GSM/CDMA2000/UMTS/LTE Sleep	In this case, the current consumption of module will be reduced to the minimal level and the module can still receive paging message and SMS.
	GSM/CDMA2000/UMTS/LTE Idle	Software is active. Module is registered to the network, and the module is ready to communicate.

	GSM/CDMA2000/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, antenna.
	GPRS/EDGE/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.
	GPRS/EDGE/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" 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 or the USIM card will not be accessible, or both RF part and USIM card will be closed, and the serial port and USB port are still accessible. The power consumption in this mode is lower than normal mode.
Power off		Customer could cut off the VBAT to power off module.

5.3.2 Power saving mode

SIM7600CE-PCIE has two power saving modes: minimum functionality mode and sleep mode. In which module will achieve lower power consumption for power saving.

5.3.3 Sleep mode

In sleep mode, the current consumption of module will be reduced to the minimal level, and module can still receive paging message and SMS.

Several hardware and software conditions must be satisfied together in order to let SIM7600CE-PCIE 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 and refer to Document [22] for more details.

5.3.4 Minimum functionality 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: Disable RF function of the module (Flight mode)

If SIM7600CE-PCIE has been set to minimum functionality mode, the module will firstly enter sleep mode, then the RF function and USIM card function will be closed. In this case, the serial port is still accessible, but RF function or USIM card will be unavailable. When SIM7600CE-PCIE is in minimum functionality or flight mode, it can return to full functionality by the AT command "AT+CFUN=1".

5.4 Current Consumption

The current consumption is listed in the table below.

Table 26: Current Consumption (VCC=3.8V)

GNSS	
GNSS supply current (AT+CFUN=0,with USB connection)	@ -140dBm，Tracking Typical:72mA
GSM sleep/idle mode	
GSM/GPRS supply current (GNSS off，without USB connection)	Sleep mode@ BS_PA_MFRMS=2 Typical: 2.8mA Idle mode@ BS_PA_MFRMS=2 Typical: 18mA
UMTS sleep/idle mode	
WCDMA supply current (GNSS off，without USB connection)	Sleep mode @DRX=9 Typical: 3.3mA Idle mode @DRX=9 Typical: 17.5mA
TD-SCDMA supply current (GNSS off，without USB connection)	Sleep mode Typical: 2.3mA Idle mode Typical: 17.5mA
EVDO supply current (GNSS off，without USB connection)	Sleep mode Typical: 2.0mA Idle mode : 17.8mA
LTE sleep/idle mode	
LTE supply current (GNSS off，without USB connection)	Sleep mode Typical: 4.6mA Idle mode Typical: 17.5mA
GSM Talk	
EGSM900	@power level #5 Typical: 220mA
DCS1800	@power level #5 Typical: 162mA
UMTS Talk	
WCDMA B1	@Power 24dBm Typical: 540mA
WCDMA B8	@Power 24dBm Typical: 385mA
TD-SCDMA 1900	@Power 24dBm Typical: 118mA
TD-SCDMA 2000	@Power 24dBm Typical: 117mA
CDMA BC0	@Power 24dBm Typical: 400mA
GPRS	
EGSM900(1 Rx,4 Tx)	@power level #5 Typical: 230mA
DCS1800(1 Rx,4 Tx)	@power level #0 Typical: 195mA
EGSM900(3Rx, 2 Tx)	@power level #5 Typical: 370mA
DCS1800(3Rx, 2 Tx)	@power level #0 Typical: 275mA
EDGE	
EGSM900(1 Rx,4 Tx)	@power level #8 Typical: 400mA
DCS1800(1 Rx,4 Tx)	@power level #2 Typical: 300mA
EGSM900(3Rx, 2 Tx)	@power level #8 Typical: 320mA
DCS1800(3Rx, 2 Tx)	@power level #2 Typical: 230mA
HSDPA data	
WCDMA B1	@Power 24dBm Typical: 478mA
WCDMA B8	@Power 24dBm Typical: 430mA
TD-SCDMA data	
TDSCDMA 1900	@Power 24dBm Typical: 141mA
TDSCDMA 2000	@Power 24dBm Typical: 150mA
EVDO data	
BC0	@Power 24dBm Typical: 490mA

LTE data			
LTE-FDD B1	@5Mbps @10Mbps @20Mbps	22.3dBm 22.4dBm 22.4dBm	Typical: 577mA Typical: 590mA Typical: 630mA
LTE-FDD B3	@5Mbps @10Mbps @20Mbps	22.2dBm 22.1dBm 22.1dBm	Typical: 479mA Typical: 498mA Typical: 530mA
LTE-FDD B8	@5Mbps @10Mbps	22.8dBm 22.8dBm	Typical: 644mA Typical: 646mA
LTE-TDD B38	@5Mbps @10Mbps @20Mbps	21.8dBm 21.8dBm 21.8dBm	Typical: 370mA Typical: 380mA Typical: 403mA
LTE-TDD B39	@5Mbps @10Mbps @20Mbps	21.8dBm 21.8dBm 21.8dBm	Typical: 270mA Typical: 280mA Typical: 305mA
LTE-TDD B40	@5Mbps @10Mbps @20Mbps	21.5dBm 21.7dBm 21.7dBm	Typical: 407mA Typical: 416mA Typical: 444mA
LTE-TDD B41	@5Mbps @10Mbps @20Mbps	21.6dBm 21.7dBm 21.7dBm	Typical: 390mA Typical: 396mA Typical: 420mA

Note: In the table above the current consumption value is the typical one of the module tested in the laboratory. In the mass production stage, there may be some difference.

5.5 Electro-Static Discharge

SIM7600CE-PCIE is an ESD sensitive component, so more attention should be paid to the procedure of handling and packaging. The ESD test results are shown in the following table.

Table 27: ESD characteristics (Temperature: 25℃, Humidity: 45 %)

Part	Contact discharge	Air discharge
VBAT,GND	+/-6K	+/-12K
Antenna port	+/-5K	+/-10K
USB	+/-4K	+/-8K
UART	+/-3K	+/-6K
Other PADs	+/-3K	+/-6K

6. Packaging

SIM7600CE-PCIE module support tray packaging.

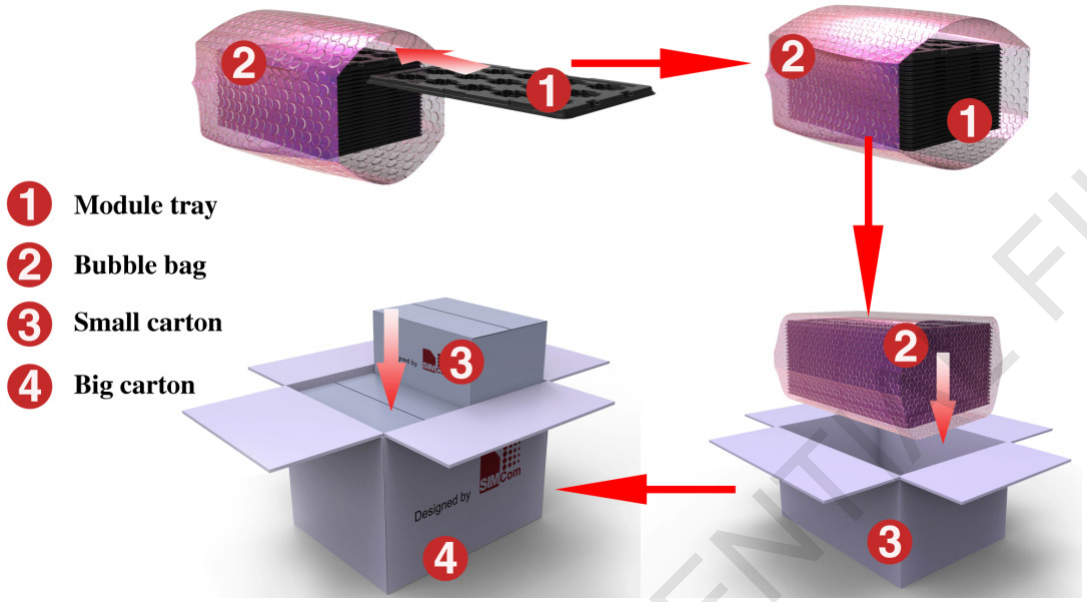

Figure 25: Tray packaging

Module tray drawing:

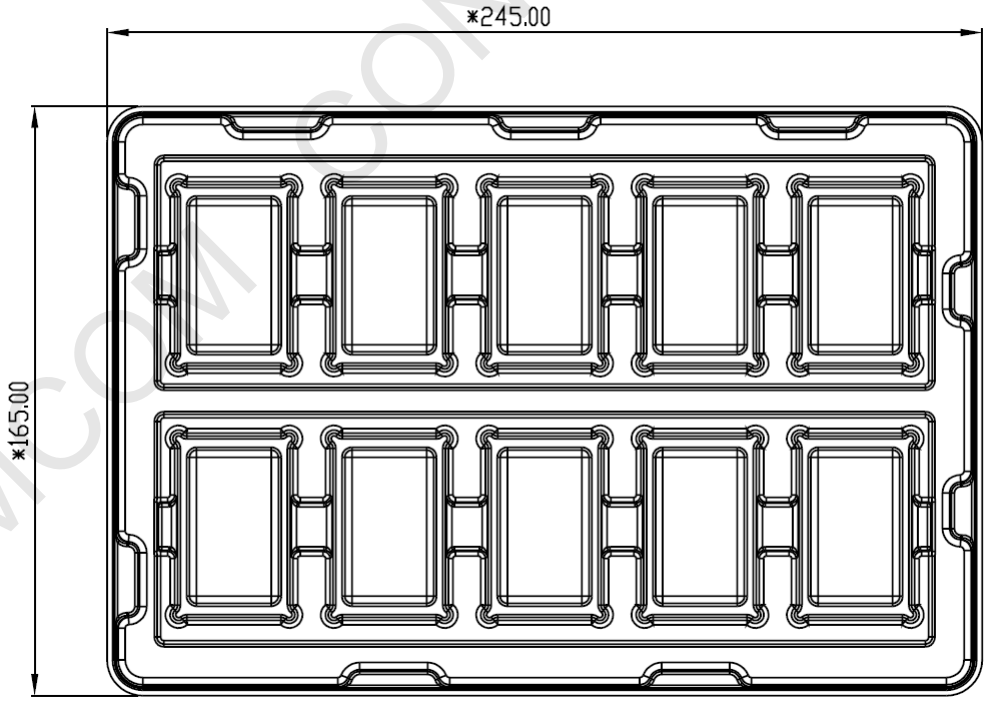

Figure 26: Tray drawing

Table 28: Tray size

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

Small carton drawing:

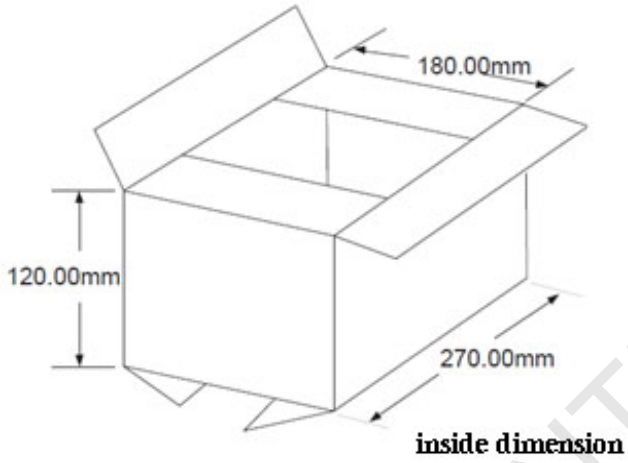

Figure 27: Small carton drawing

Table 29: Small Carton size

Length（±10mm）	Width（±10mm）	Height（±10mm）	Number
270	180	120	10*10=100

Big carton drawing:

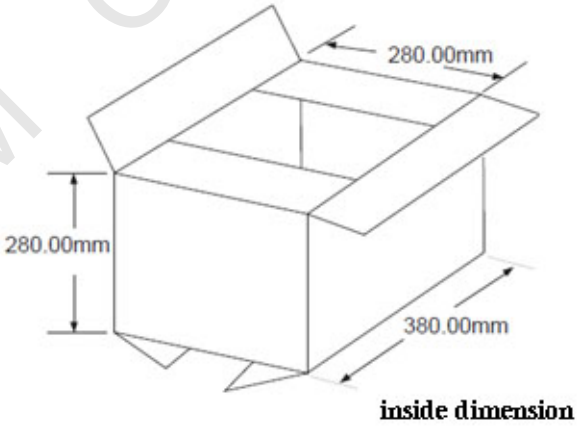

Figure 28: Big carton drawing

Table 30: Big Carton size

Length（±10mm）	Width（±10mm）	Height（±10mm）	Number
380	280	280	100*4=400

Appendix

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

Table 31: Coding Schemes and Maximum Net Data Rates over Air Interface

Multislot definition(GPRS/EDGE)			
Slot class	**DL slot number**	**UL slot number**	**Active slot number**
1	1	1	2
2	2	1	3
3	2	2	3
4	3	1	4
5	2	2	4
6	3	2	4
7	3	3	4
8	4	1	5
9	3	2	5
10	4	2	5
11	4	3	5
12	4	4	5
GPRS coding scheme	**Max data rata（4 slots）**		**Modulation type**
CS 1 = 9.05 kb/s / time slot	36.2 kb/s		GMSK
CS 2 = 13.4 kb/s / time slot	53.6 kb/s		GMSK
CS 3 = 15.6 kb/s / time slot	62.4 kb/s		GMSK
CS 4 = 21.4 kb/s / time slot	85.6 kb/s		GMSK
EDGE coding scheme	**Max data rata（4 slots）**		**Modulation type**
MCS 1 = 8.8 kb/s/ time slot	35.2 kb/s		GMSK
MCS 2 = 11.2 kb/s/ time slot	44.8 kb/s		GMSK
MCS 3 = 14.8 kb/s/ time slot	59.2 kb/s		GMSK
MCS 4 = 17.6 kb/s/ time slot	70.4 kb/s		GMSK
MCS 5 = 22.4 kb/s/ time slot	89.6 kb/s		8PSK
MCS 6 = 29.6 kb/s/ time slot	118.4 kb/s		8PSK
MCS 7 = 44.8 kb/s/ time slot	179.2 kb/s		8PSK
MCS 8 = 54.4 kb/s/ time slot	217.6 kb/s		8PSK
MCS 9 = 59.2 kb/s/ time slot	236.8 kb/s		8PSK
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
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
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

II. Related Documents

Table 32: Related Documents

SN	Title	Description
[1]	SIM7500_SIM7600 Series_AT Command Manual_V1.xx.pdf	SIM7600 AT command document
[2]	ITU-T Draft new recommendationV.25ter	Serial asynchronous automatic dialing and control
[3]	GSM 07.07	Digital cellular telecommunications (Phase 2+); AT command set for GSM Mobile Equipment (ME)
[4]	GSM 07.10	Support GSM 07.10 multiplexing protocol
[5]	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)
[6]	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
[7]	GSM 11.11	Digital cellular telecommunications system (Phase 2+); Specification of the Subscriber Identity Module – Mobile Equipment (SIM – ME) interface
[8]	GSM 03.38	Digital cellular telecommunications system (Phase 2+); Alphabets and language-specific information
[9]	GSM 11.10	Digital cellular telecommunications system (Phase 2); Mobile Station (MS) conformance specification; Part 1: Conformance specification
[10]	3GPP TS 51.010-1	Digital cellular telecommunications system (Release 5); Mobile Station (MS) conformance specification
[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 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]	Module secondary-SMT-UGD-V1.xx	Module secondary SMT Guidelines
[22]	SIM7100_GPS_Application _Note_V0.xx	SIM7100 GPS Application Note
[23]	ANTENNA DESIGN GUIDELINES FOR DIVERSITY RECEIVER SYSTEM	ANTENNA DESIGN GUIDELINES FOR DIVERSITY RECEIVER SYSTEM

III. Terms and Abbreviations

Table 33: 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
GPRS	General Packet Radio Service
GSM	Global Standard for Mobile Communications
HR	Half Rate
HSPA	High Speed Packet Access
I2C	Inter-Integrated Circuit
IMEI	International Mobile Equipment Identity
LTE	Long Term Evolution
MO	Mobile Originated
MS	Mobile Station (GSM engine), also referred to as TE
MT	Mobile Terminated
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
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

IV. Safety Caution

Table 34: 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 to not operate normally for 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. Forget to think much of these instructions may lead to the flight safety or offend against 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, for example no mobile fee or a invalid SIM card. While you are in this condition and need emergent help, please remember using 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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