



SIM7672X Series Hardware Design

LTE Module

SIMCom Wireless Solutions Limited

SIMCom Headquarters Building, Building 3, No. 289 Linhong
Road, Changning District, Shanghai P.R. China

Tel: 86-21-31575100

support@simcom.com

www.simcom.com

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SIMCom Wireless Solutions Limited

SIMCom Headquarters Building, Building 3, No. 289 Linhong Road, Changning District, Shanghai P.R. China

Tel: +86 21 31575100

Email: simcom@simcom.com

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2023-07-27	1.02	Add the information about the PINs which supported wakeup function.(Chapter 2.1, Chapter 2.2) Add the information about always on GPIO interface.(Chapter 2.1, Chapter 2.2) Add PSM information. (Chapter 5.3.4) Update GNSS standalone mode reference design. (Chapter 3.10)	Boru.Zhou

Federal Communication Commission Interference Statement

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:
(1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

FCC Caution:

- Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

- This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

Radiation Exposure Statement:

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator & your body.

This device is intended only for OEM integrators under the following conditions:

- 1) The antenna must be installed such that 20 cm is maintained between the antenna and users, and the maximum antenna gain allowed for use with this device is 2.23 dBi.
- 2) The transmitter module may not be co-located with any other transmitter or antenna.

As long as 2 conditions above are met, further transmitter test will not be required. However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed

IMPORTANT NOTE: In the event that these conditions can not be met (for example certain laptop configurations or co-location with another transmitter), then the FCC authorization is no longer considered valid and the FCC ID can not be used on the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC authorization.

End Product Labeling

This transmitter module is authorized only for use in device where the antenna may be installed such that 20 cm may be maintained between the antenna and users. The final end product must be labeled in a visible area with the following: "Contains FCC ID: 2AJYU-8XS0001". The grantee's FCC ID can be used only when all FCC compliance requirements are met.

Manual Information To the End User

The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user's manual of the end product which integrates this module. The end user manual shall include all required regulatory information/warning as show in this manual.

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1. Introduction

This document describes the electronic specifications, RF specifications, interfaces, mechanical characteristics, and test results of the SIM7672X Series module. With the help of this document, customers can quickly understand SIM7672X Series module.

Associated with other software application notes and user guides, customers can use SIM7672X Series to design and develop applications easily. SIMCom provides a set of evaluation boards to facilitate test and development of SIM7672X module. The evaluation board tools include an EVB board, a USB cable, an antenna, a GNSS active antenna and other peripherals.

1.1. Documentation Overview

The documents listed in Table 1 primarily cover the module's technical information. To thoroughly understand the device and its application, it is necessary to study all relevant documents.

Table 1: SIM7672X Series Documents Overview

No.	Document	Description
1	SIM7672X_Series_Hardware_Design_V1.02 (This document)	Mainly introducing interface functions, recommend circuit, PCB layout guideline, packaging and other hardware components, as well as the use of AT commands
2	SIMCom_SIM767XX Series_Reference_Design_20230814	Reference circuit applications
3	8XS000-SIM767XX-TE_V1.02_DL&PCB	SIM767XX TE SCH&PCB PDF Document
4	SIMCOM_EVB_DL&PCB	SIMCOM_EVB SCH&PCB PDF Document
5	MOD_SIM767XX_124	Reference Package (Pads)
6	SIM7672X & SIM7652X _Series_ AT_Command _Manual_V1.00	AT Command Manual
7	Module Secondary SMT Process User Guide_V1.01	Module secondary SMT Guidelines
8	SIM767XX_TE kit_User Guide_V1.00	The use of TE board, forced download, startup, reset, and the location of other measurement points, as well as the use method in

		conjunction with EVB
9	SIM767XX&SIM7652X_Series_CAT1_Module_Schematic&Layout_Checklist_V1.00	SIM7672X peripheral circuit schematic and PCB checklist

NOTE

This current revision is an early release to support initial product developers. The content is subject to change without advance notice.

1.2. Product Outline

The module supports LTE-TDD and LTE-FDD. The supported radio frequency bands are described in the following table.

Table 2: Module frequency bands

Standard	Frequency	SIM7672E	SIM7672NA	SIM7672S	SIM7672G
LTE-FDD	LTE-FDD B1	✓		✓	✓
	LTE-FDD B2		✓		✓
	LTE-FDD B3	✓		✓	✓
	LTE-FDD B4		✓		✓
	LTE-FDD B5	✓	✓	✓	✓
	LTE-FDD B7	✓		✓	✓
	LTE-FDD B8	✓		✓	✓
	LTE-FDD B12		✓		✓
	LTE-FDD B13		✓		✓
	LTE-FDD B14		✓		
	LTE-FDD B18				✓
	LTE-FDD B19				✓
	LTE-FDD B20	✓			✓
	LTE-FDD B25				✓
	LTE-FDD B26				✓
	LTE-FDD B28	✓			✓
	LTE-FDD B66		✓		✓
	LTE-FDD B71		✓		✓
LTE-TDD	LTE TDD B34			✓	✓
	LTE TDD B38			✓	✓

	LTE TDD B39			✓	✓
	LTE TDD B40			✓	✓
	LTE TDD B41			✓	✓
Category		CAT1	CAT1	CAT1	CAT1
GNSS		Optional	Optional	Optional	Optional

With a small physical dimension of 24*24*2.4mm, the module can meet almost any space requirement in customers' applications, such as smart phone, PDA, industrial handheld, machine-to-machine and vehicle application, etc.

The module provides 124 pins, including 80 LCC pins in the outer ring and 44 LGA pins in the inner ring. This document will introduce all the functional pins.

1.3. Hardware Interface Overview

The interfaces are described in detail in the following chapters including:

- Power supply
- USB 2.0 interface
- Three UART interfaces, one full function serial port, one ordinary serial port and one debug serial port
- One USIM interface
- PCM interface
- I2C interface
- Two General ADC interfaces
- General input and output interfaces (GPIOs)
- Two ANT tuner control interfaces (GRFCs)
- USB_BOOT interface
- Module operation status indication interface
- Network status indication interface
- MAIN_UART_WAKEUP interface
- GNSS interfaces
- Antenna interfaces

1.4. Hardware Block Diagram

The block diagram of the SIM7672X module is shown in the figure below.

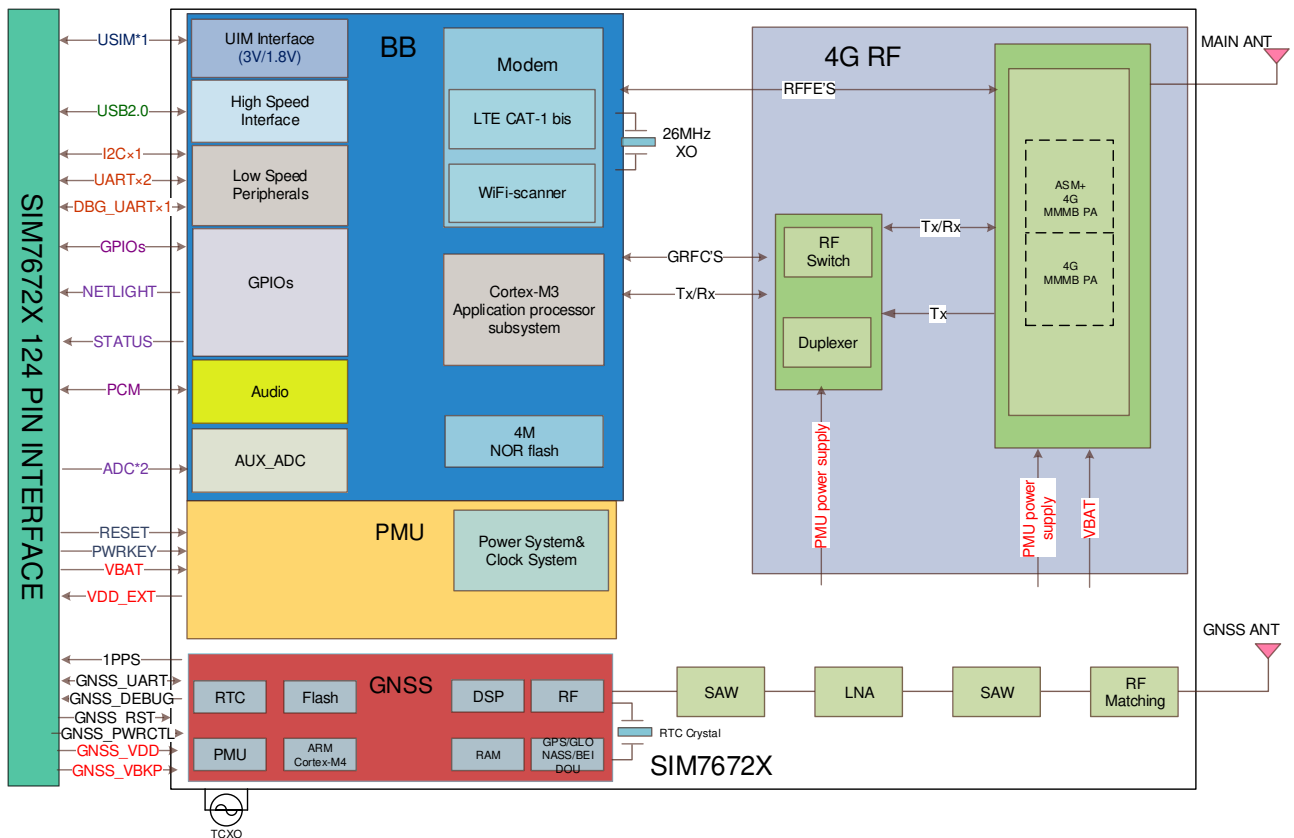


Figure 1: SIM7672X block diagram

1.5. Functional Overview

Table 3: General features

Feature	Implementation
Power supply	VBAT: 3.4V~4.2V, Recommended VBAT: 3.8V

Power saving	<p>Idle mode Typical: 4.13mA</p> <p>Current in Sleep mode@DRX=0.32S typical: 1.5mA (GNSS off)</p> <p>Current in Sleep mode@DRX=0.64S typical: 729uA (GNSS off)</p> <p>Current in Sleep mode@DRX=1.28S typical: 477uA (GNSS off)</p> <p>Current in PSM mode: 10uA</p> <p>Please refer to the table 55</p>
Radio frequency bands	Please refer to the table 2
Transmitting power	LTE power level: 3 (23dBm±2.7dB)
Data Transmission Throughput	TDD/FDD-LTE category 1 : 10 Mbps (DL), 5 Mbps (UL)
Antenna	<p>LTE antenna interface</p> <p>GNSS antenna interface</p>
SMS	<ul style="list-style-type: none"> • MT, MO, CB, Text, PDU mode • Short Message (SMS) storage device: USIM Card, CB does not support saving in SIM Card • Support CS domain SMS
USIM interface	Support identity card: 1.8V/ 3V
USIM application toolkit	<p>Support SAT class 3, GSM 11.14 Release 98</p> <p>Support USAT</p>
Phonebook management	Support phonebook types: SM/FD/ON/AP/SDN
Audio feature	Support PCM interface
UART interface	<ul style="list-style-type: none"> • Full function serial port <p>Baud rate support from 600bps to 921600bps</p> <p>AT command and data can be sent through serial port</p> <p>Support RTS/CTS hardware flow control</p> <p>Support serial port multiplexing function conforming to GSM 07.10 protocol</p> <ul style="list-style-type: none"> • Debug serial port <p>Support debug function</p> <ul style="list-style-type: none"> • AUX_UART serial port <p>Support GNSS communication function</p>
USB	<p>Compliant with USB 2.0 specification and supports slave mode but not master mode.</p> <p>This interface can be used for AT command sending, data transmission, GNSS NMEA output, software debugging and upgrading.</p>
Firmware upgrade	Firmware upgrade over USB interface or MAIN_UART interface
Physical characteristics	<p>Size: 24*24*2.4mm</p> <p>Weight: 2.83g (Typical)</p>
Temperature range	<p>Normal operation temperature: -30°C to +75°C</p> <p>Extended operation temperature: -40°C to +85°C*</p> <p>Storage temperature: -45°C to +90°C</p>

NOTE

When the module is within the extended operation temperature range, module is able to establish and maintain data transmission, SMS, etc. The performance may deviate slightly from the 3GPP specifications, but will meet 3GPP specifications again when the temperature returns to normal operating temperature levels. It is strongly recommended that customers take heat dissipation measures to ensure that the normal operating temperature of the module can't be exceeded.

2. Package Information

2.1. Pin Assignment Overview

The following figure is a top view of the pin assignment of the module for SIM7672X.

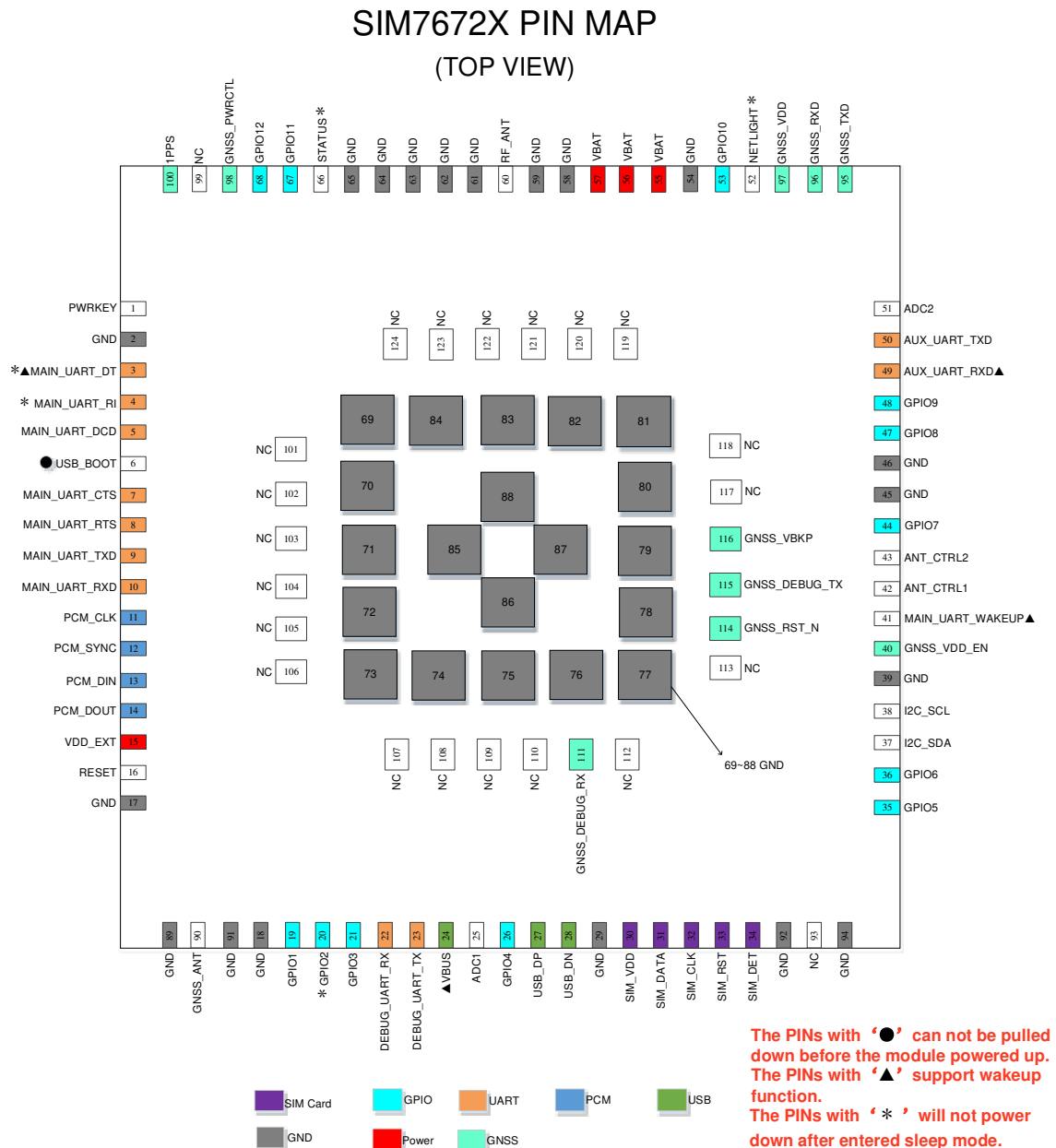


Figure 2: Pin assignment overview for SIM7672X

Table 4: Pin Description

PIN NO	PIN NAME	PIN NO	PIN NAME
1	PWRKEY	2	GND
3	MAIN_UART_DTR ▲*	4	MAIN_UART_RI *
5	MAIN_UART_DCD	6	USB_BOOT ●
7	MAIN_UART_CTS	8	MAIN_UART_RTS
9	MAIN_UART_TXD	10	RXD
11	PCM_CLK	12	PCM_SYNC
13	PCM_DIN	14	PCM_DOUT
15	VDD_EXT	16	RESET
17	GND	18	GND
19	GPIO1	20	GPIO2 *
21	GPIO3	22	DEBUG_UART_RX
23	DEBUG_UART_TX	24	VBUS▲
25	ADC1	26	GPIO4
27	USB_DP	28	USB_DN
29	GND	30	SIM_VDD
31	SIM_DATA	32	SIM_CLK
33	SIM_RST	34	SIM_DET
35	GPIO5	36	GPIO6
37	I2C_SDA	38	I2C_SCL
39	GND	40	GNSS_VDD_EN
41	MAIN_UART_WAKEUP▲	42	NC
43	NC	44	GPIO7
45	GND	46	GND
47	GPIO8	48	GPIO9
49	AUX_UART_RXD	50	AUX_UART_TXD
51	ADC2	52	NETLIGHT *
53	GPIO10	54	GND
55	VBAT	56	VBAT
57	VBAT	58	GND
59	GND	60	RF_ANT
61	GND	62	GND
63	GND	64	GND
65	GND	66	STATUS *
67	GPIO11	68	GPIO12
69	GND	70	GND
71	GND	72	GND
73	GND	74	GND

75	GND	76	GND
77	GND	78	GND
79	GND	80	GND
81	GND	82	GND
83	GND	84	GND
85	GND	86	GND
87	GND	88	GND
89	GND	90	GNSS_ANT
91	GND	92	GND
93	NC	94	GND
95	GNSS_TXD	96	GNSS_RXD
97	GNSS_VDD	98	GNSS_PWRCTL
99	NC	100	1PPS
101	NC	102	NC
103	NC	104	NC
105	NC	106	NC
107	NC	108	NC
109	NC	110	NC
111	GNSS_DEBUG_RX	112	NC
113	NC	114	GNSS_RST_N
115	GNSS_DEBUG_TX	116	GNSS_VBKP
117	NC	118	NC
119	NC	120	NC
121	NC	122	NC
123	NC	124	NC

NOTE

'●' indicates that the pin cannot be pulled down before the module powered up, otherwise it will affect the normal start-up of the module.

'▲' indicates that the pins support wakeup function.

'*' indicates that these interfaces are always on GPIO, they can remain the previous status when the module enters sleep mode.

GNSS_VDD_EN (PIN 40) only can be used at standalone mode!!!

NC: NOT CONNECT. Do not connect them to GND.

2.2. Pin Description

Table 5: Pin parameter abbreviation

Pin type	Description
PI	Power input
PO	Power output
AI	Analog input
AIO	Analog input/output
I/O	Bidirectional 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

Table 6: 1.8V IO parameters definition

Power Domain	Parameter	Description	Min	Typ.	Max
1.8V	V_{IH}	High level input	$VCC * 0.7$	1.8V	-
	V_{IL}	Low level input	-	0V	$VCC * 0.2$
	R_{pu}	Pull up resistor	117K Ω		331 K Ω
	R_{pd}	Pull down resistor	91 K Ω		291 K Ω
	I_{IL}	Input leakage current	-10uA	-	10uA
	V_{OH}	Output level range	$VCC * 0.8$	-	-
	V_{OL}	Output low range	-		$VCC * 0.15$
	I_{OL}	Maximum current driving capacity at low level output	-	-	-
	I_{OH}	Maximum current driving capacity at high level output $V_{pad}=VCC-0.2V$	-	-	-

Table 7: Pin description

Pin name	Pin No.	Pin parameter		Description	Note
		Power domain	Type		
Power supply					
VBAT	55,56, 57	-	PI	Module input voltage ranges from 3.4V to 4.2V, typical values is 3.8V.	
VDD_EXT	15	-	PO	1.8V power output, output current up to 50 mA.	Default on. It can provide 1V8 power supply for GNSS. If unused, keep it open.
GND	2,17,18, 29,39, 45,46, 54,58, 59,61, 62,63, 64,65, 69,70, 71,72, 73,74, 75,76, 77,78, 79,80, 81,82, 83,84, 85,86, 87,88, 89,91, 92,94	-	-	Ground	
System Control					
PWRKEY	1	-	DI,PU	Power ON/OFF input, active low.	
RESET	16	-	DI,PU	System reset control input, active low.	
USIM interface					
SIM_DATA	31	1.8/3.0V	I/O,PU	SIM data signal.	This pin has been pull-up with 4.7KΩ resistor to SIM_VDD internally.
SIM_RST	33	1.8/3.0V	I/O,PU	SIM RST signal reset	

				output.	
SIM_CLK	32	1.8/3.0V	I/O,PU	SIM CLK signal clock output.	
SIM_VDD	30	1.8/3.0V	PO	SIM card power supply output.	Supports 1.8V/3.0V output according to the card type, its output current is up to 30mA.
SIM_DET	34	1.8V	I/O,PU	SIM card insert detect.	It can be set to high/low active with the AT command, refer to Document [25]

USB interface

VBUS▲	24	-	PI	Valid USB detection input. Active high, $V_{min}=3.6V$, $V_{max}=5.2V$, $V_{norm}=5V$	
USB_DN	28	-	AIO	Negative electrode of the differential, bi-directional USB signal.	
USB_DP	27	-	AIO	Positive electrode of the differential, bi-directional USB signal.	

Full function UART interface

MAIN_UART_RTS	8	1.8V	DI	RTS input	If unused, keep it open.
MAIN_UART_CTS	7	1.8V	DO	CTS output	
MAIN_UART_RXD	10	1.8V	DI	Data input	
MAIN_UART_TXD	9	1.8V	DO	Data output	
MAIN_UART_RI *	4	1.8V	DO	Ringing indicator	
MAIN_UART_DCD	5	1.8V	DO	Carrier detection	
MAIN_UART_DTR *▲	3	1.8V	DI	DTE Ready	

Debug_UART

DEBUG_UART_TX	23	1.8V	DOH	Debug UART, the boot log will be output during boot up.	Default used as debug port.
DEBUG_UART_RX	22	1.8V	DI		

AUX_UART

AUX_UART_TXD	50	1.8V	DO	Data output	Two-wire serial port
AUX_UART_RXD▲	49	1.8V	DI	Data input	

I2C interface

I2C_SCL	38	1.8V	OD	I2C clock output	If unused, keep it
---------	----	------	----	------------------	--------------------

I2C_SDA	37	1.8V	OD	I2C data I/O	open. Need pull up to VDD_1V8 externally.
PCM interface					
PCM_CLK	11	1.8V	I/O,PD	PCM clock	If unused, keep it open.
PCM_SYNC	12	1.8V	I/O,PD	PCM frame synchronization	
PCM_DIN	13	1.8V	DI,PD	PCM data input	
PCM_DOUT	14	1.8V	DO,PD	PCM data output	
GPIO					
GPIO1	19	1.8V	IO,PU	General purpose I/O	If unused, keep it open.
GPIO2 *	20	1.8V	IO,PD	General purpose I/O	If unused, keep it open.
GPIO3	21	1.8V	IO,PU	General purpose I/O	If unused, keep it open.
GPIO4	26	1.8V	IO,PD	General purpose I/O	If unused, keep it open.
GPIO5	35	1.8V	IO,PU	General purpose I/O	If unused, keep it open.
GPIO6	36	1.8V	IO,PU	General purpose I/O	If unused, keep it open.
GPIO7	44	1.8V	IO,PU	General purpose I/O	If unused, keep it open.
GPIO8	47	1.8V	IO,PU	General purpose I/O	If unused, keep it open.
GPIO9	48	1.8V	IO,PD	General purpose I/O	If unused, keep it open.
GPIO10	53	1.8V	IO,PU	General purpose I/O	If unused, keep it open.
GPIO11	67	1.8V	IO,PU	General purpose I/O	If unused, keep it open.
GPIO12	68	1.8V	IO,PU	General purpose I/O	If unused, keep it open.
GNSS interface					
GNSS_PWRCTL	98	1.8V	DI	The enable control PIN of GNSS Vcore power supply.	Active high.
GNSS_VDD_EN	40	1.8V	DI	The enable control PIN of GNSS system power supply.	It only can be used at standalone mode.
GNSS_VDD	97	-	PI	The power input for GNSS.	Module VDD_EXT (PIN 15) can be used for this power supply
GNSS_VBKP	116	-	PI	GNSS VRTC power input, input voltage	If unused, keep it open.

				2.0V~3.6V, recommend 2.8V power supply.	
1PPS	100	1.8V	DO	1PPS signal output	If unused, keep it open.
GNSS_RXD	96	1.8V	DI	GNSS UART RX	Connect to MCU UART_TXD; Or use 1K resistor in series in module AUX_UART_TXD (PIN 50).
GNSS_TXD	95	1.8V	DO	GNSS UART TX	Connect to MCU UART_RXD; Or use 1K resistor in series in module AUX_UART_RXD (PIN 49).
GNSS_RST_N	114	-	AI	GNSS RST interface	
GNSS_DEBUG_TX	115	1.8V	DO	GNSS debug output	
GNSS_DEBUG_RX	111	1.8V	DI	GNSS debug input	
ANT interface					
RF_ANT	60	-	AIO	Main antenna	
GNSS_ANT	90	-	AIO	GNSS antenna	
Other pins					
ADC1	25	-	AI	General Purpose ADC1	If unused, keep it open.
ADC2	51	-	AI	General Purpose ADC2	If unused, keep it open.
NETLIGHT *	52	1.8V	DO	Network registration status indicator (LED).	
STATUS *	66	1.8V	DO	Module status indicator (LED).	
USB_BOOT●	6	1.8V	DI	Firmware download guide control input. When pull-down to GND and press PWRKEY, module will access in USB download mode.	Please reserve 2 test points for debug. Do not pull down USB_BOOT during normal power on!
ANT_CTRL1	42		DO	FEMIO for tuner switch	
ANT_CTRL2	43		DO	FEMIO for tuner switch	
MAIN_UART_WAK EUP▲	41	1.8V	DI	MAIN_UART_RXD wake-up pin.	Connect it to MAIN_UART_RXD externally if use this function.

NOTE

Please reserve test points for USB_BOOT, GND, DEBUG_UART_TX, GNSS_DEBUG_TX, GNSS_DEBUG_RX, GNSS_TXD and GNSS_RXD.

If there is no USB connector, please also reserve test points for VBUS, USB_DP, and USB_DN for firmware upgrading.

'●' Indicates that the pin cannot be pulled down before the module powered up, otherwise it will affect the normal start-up of the module.

'▲' Indicates that the pin support wakeup function.

'*' indicates that these interfaces are always on GPIO, they can remain the previous status when the module enters sleep mode.

2.3. Mechanical Information

The following figure shows the package outline drawing of SIM7672X.

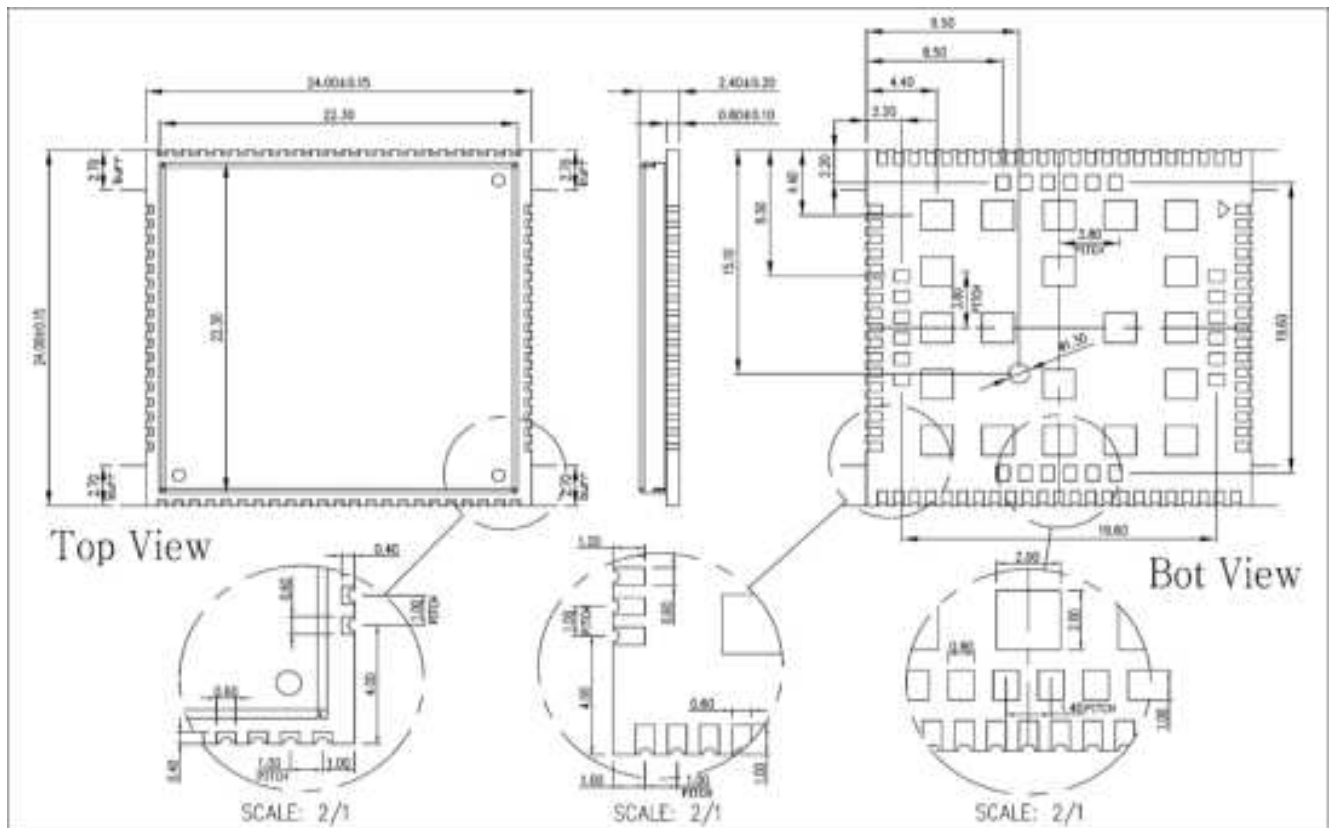


Figure 3: Dimensions (Unit: mm)

NOTE

The side length dimension is 24.00±0.15mm excluding the burr area.

2.5. Recommend Stencil Size

Recommend stencil thickness 0.15mm.

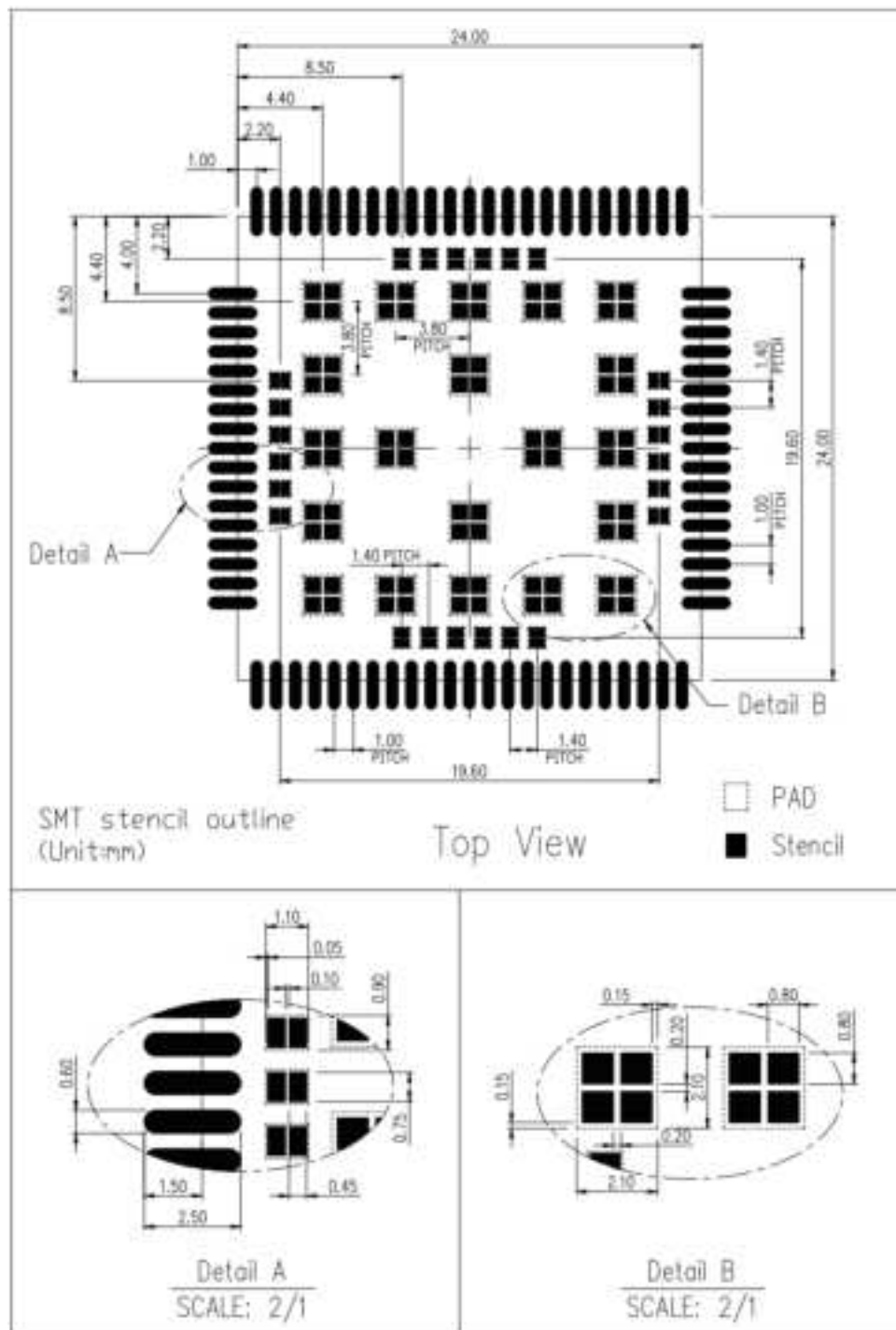


Figure 5: Recommend stencil dimension (Unit: mm)

3. Interface Application

3.1. Power Supply

The module offers 3 power supply pins (55, 56, 57) as VBAT power input pin. SIM7672X uses these three pins supply the internal RF and baseband circuit.

Table 8: Power interface pins definition

Pin name	Pin No.	I/O	Description	Note
VBAT	55,56,57	PI	Module input voltage ranges from 3.4V to 4.2V, typical values is 3.8V.	-
GND	2,17,18,29,39,45,46,54,58,59,61,62,63,64,65,69,70,71,72,73,74,75,76,77,78,79,80,81,82,83,84,85,86,87,88,89,91,92,94			

Table 9: VBAT pins electronic characteristic

Parameter	Description	Min.	Typ.	Max.	Unit
VBAT	Module supply voltage	3.4	3.8	4.2	V
I _{VBAT (peak)}	Module consumption peak current	-	-	746	mA
I _{VBAT (average)}	Module average consumption current (idle mode)	-	4.13	-	mA
I _{VBAT (sleep)}	Current in Sleep mode@DRX=0.32S (GNSS off)	-	1.5	-	mA
	Current in Sleep mode@DRX=0.64S (GNSS off)	-	729	-	uA
	Current in Sleep mode@DRX=1.28S (GNSS off)	-	477	-	uA
I _{VBAT(PSM)}	Current in PSM mode	-	10	-	uA
I _{VBAT (power-off)}	Module average consumption current (off leakage current)	-	8	-	uA

NOTE

Test condition: VBAT power supply 3.8V, the module is tested on EVB board, and the power input has a 100uF tantalum capacitor.

3.1.1. Power Supply Design Guide

In the customer's design, special attention must be paid to the design of the power supply. If the voltage drops below 3.4V, the RF performance of the module will be affected, the module will shut down if the voltage is too low. It is recommended to select an LDO or DC-DC chip with an enable pin, and the enable pin is controlled by the MCU.

NOTE

When the power supply can provide a peak current, the total capacity of the external power supply capacitance is recommended to be no less than 100uF.

It is recommended to place four 10pF/33pF/0.1uF/1uF ceramic capacitors near VBAT to improve RF performance and system stability. At the same time, it is recommended that the VBAT layout routing width from the power supply on the PCB to the module be at least 2mm. The recommended reference design is as follows:

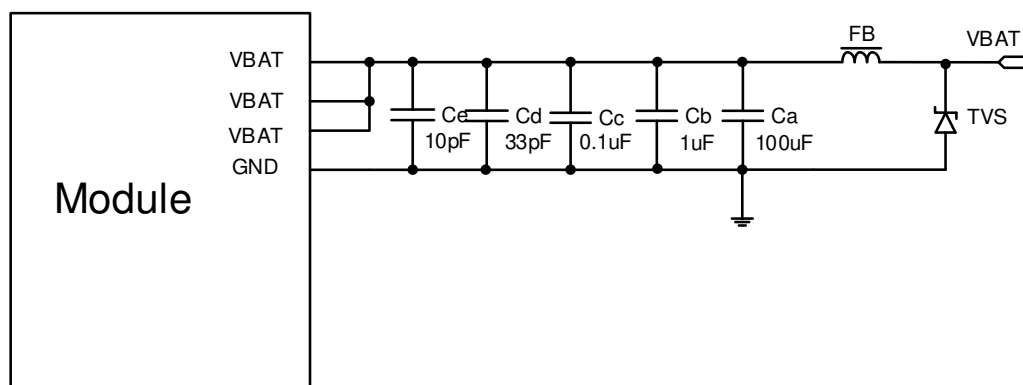


Figure 6: Power supply application circuit

If the VBAT input contains high-frequency interference, it is recommended to add magnetic beads for filtering. The recommended types of magnetic beads are BLM21PG300SN1D and MPZ2012S221A.

In addition, in order to prevent the damage of SIM7672X caused by surge and overvoltage, it is recommended to parallel one TVS on the VBAT pin of the module.

Table 10: TVS for VBAT part number list

Manufacturer	Part Number	V_{RWM}	V_{Cmax}	P_{PPmax}	C_{Jmax}	Package
WILL	ESD56301D05-2/TR	5V	9.5V	1500W	700pF	DFN1610-2L
WILL	ESD56301D04-2/TR	4.85V	11V	2000W	480pF	DFN1610-2L
WAYON	WS2057KP	5V	12V	2040W	700pF	DFN1610-2L
WAYON	WS4.5DPHXM	4.85V	11V	2255W	700pF	DFN1610-2L

NOTE

When selecting TVS by customer, it is necessary to pay attention to the clamping voltage in the case of surge protection. The clamping voltage should not be higher than 6V when 100V surge input.

3.1.2. Recommended Power Supply Circuit

In order to avoid damaging the module, please do not cut off the power supply when module works normally. Only after the module is shut down by PWRKEY or AT command, the power supply can be cut off.

It is suggested that customer's design should have the ability to cut off the power supply for module in abnormal state, and then switch on the power to restart the module.

The PWR_CTRL signal indicates that the module is connected to the host and can be controlled.

When the input power is greater than 9V, the DCDC chip is recommended. When the input is less than 9V, it is recommended to use LDO power supply. The following figure shows the DC-DC regulator reference circuit:

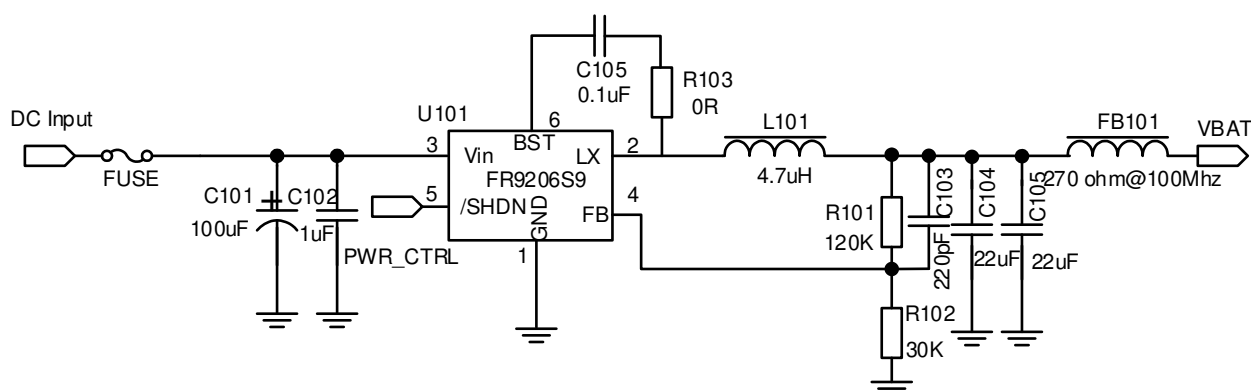


Figure 7: Power supply reference circuit

When the VBAT power is turned off, the voltage should decrease rapidly. To avoid voltage anomalies, when the VBAT is lower than the minimum value, it must be pulled below 100mV for at least 1 second before the system is powered up again.

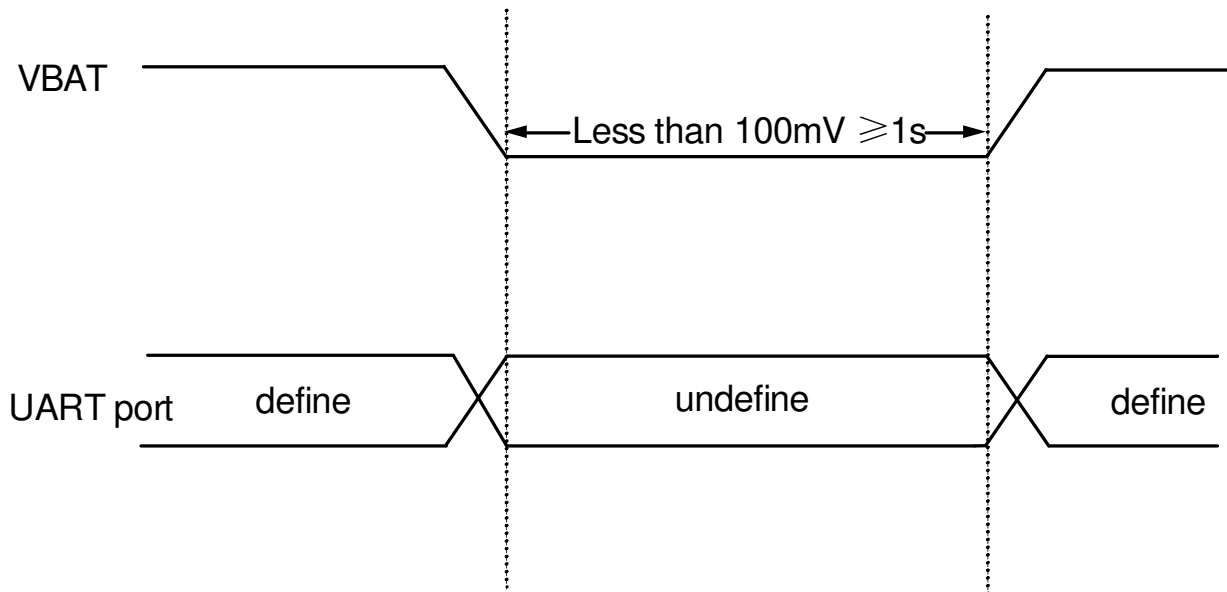


Figure 8: Power-off and power-on restart sequence

3.1.3. Voltage Monitor

AT command 'AT+CBC' can be used to monitor VBAT voltage.

AT command 'AT+CVALARM' can be used to set high/low voltage alarm, when the actual voltage exceeds the preset range, a warning message will be reported through the AT port.

AT command 'AT+CPMVT' can be used to set high/low voltage power off, when the actual voltage exceeds the preset range, the module will shut down automatically.

NOTE

Overvoltage alarm and overvoltage shutdown are off by default. For details of AT commands, please refer to document [1].

3.2. Power On/ Off and Reset

3.2.1. Power on

Table 11: PWRKEY interface pin definition

Pin name	Pin No.	I/O	Description	Note
PWRKEY	1	DI,PU	Power ON/OFF input, active low.	

Customer can power on the module by pulling down the PWRKEY pin. It is recommended to add TVS diode near the module pin for ESD performance. The recommended circuit is as follows:

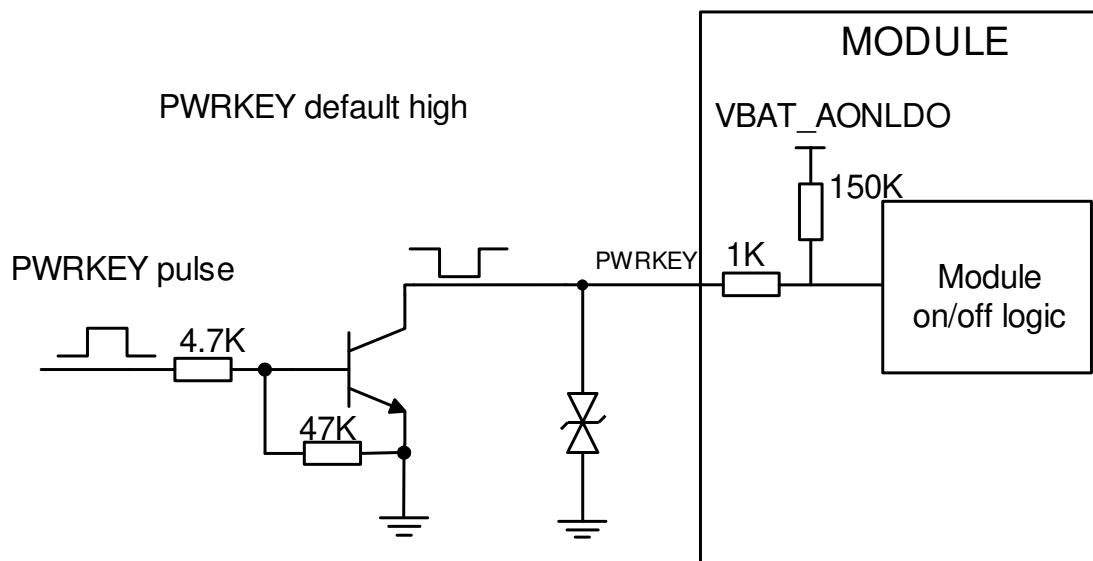


Figure 9: Reference power on/off circuit

NOTE

1. It is forbidden to pull down both RESET key and PWRKEY to power on the module at the same time.
2. If there is more than 1.3V remaining voltage before the module VBAT is powered on, the module automatically starts when it is powered on.

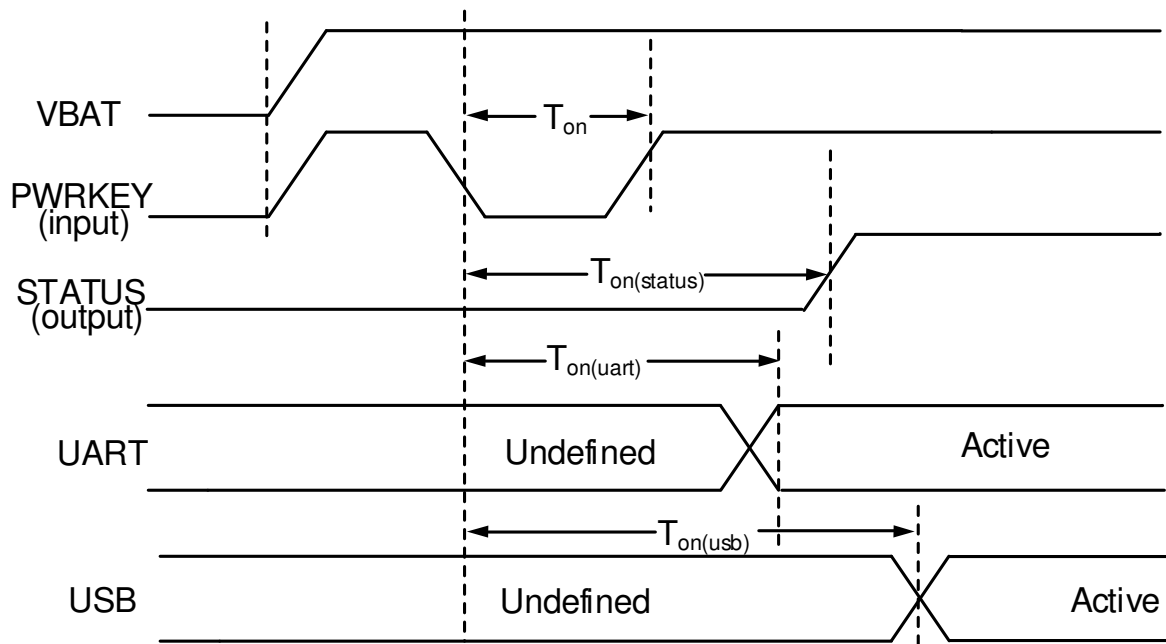


Figure 10: Power on sequence

Table 12: Power on timing and electronic characteristic

Symbol	Parameter	Min.	Typ.	Max.	Unit
T_{on}	The time of active low-level impulse of PWRKEY pin to power on module	-	50	-	ms
$T_{on(status)}$	The time from power-on issue to STATUS pin output high level (indicating power up ready)	-	320	-	ms
$T_{on(uart)}$	The time from power-on issue to UART port ready	-	55	-	ms
$T_{on(usb)}$	The time from power-on issue to USB port ready	-	470	-	ms
V_{IH}	Input high level voltage on PWRKEY pin	-	2.1	-	V
V_{IL}	Input low level voltage on PWRKEY pin	0	0	0.4	V

3.2.2. Power off

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

- Power off by pulling the PWRKEY pin down to a low level for 2.5s.
- Power off Module by AT command 'AT+CPOF'.
- Over-voltage or under-voltage automatic power off, the voltage range can be set by 'AT+CPMVT'.
- Over-temperature or under-temperature automatic power off.

It is strongly recommended that the customer use PWRKEY or 'AT+CPOF' to shut down, and then cut off VBAT (especially when the module does not need to work). In addition, the customer cannot shut down VBAT by disconnecting it, which may cause damage to flash.

NOTE

1. When the temperature exceeds the range of $-30 \sim +75^{\circ}\text{C}$, SIM7672X will report warning information through AT port. When the temperature exceeds the range of $-40 \sim +85^{\circ}\text{C}$, SIM7672X will shut down automatically. For a detailed description of 'AT+ CPOF' and 'AT+ CPMVT', please refer to document [1].
2. The VBAT voltage must fall below 1.3V before power on. Otherwise, the module will restarts automatically.

PWRKEY can be used to power off the module. For power off sequence, please see the following figure:

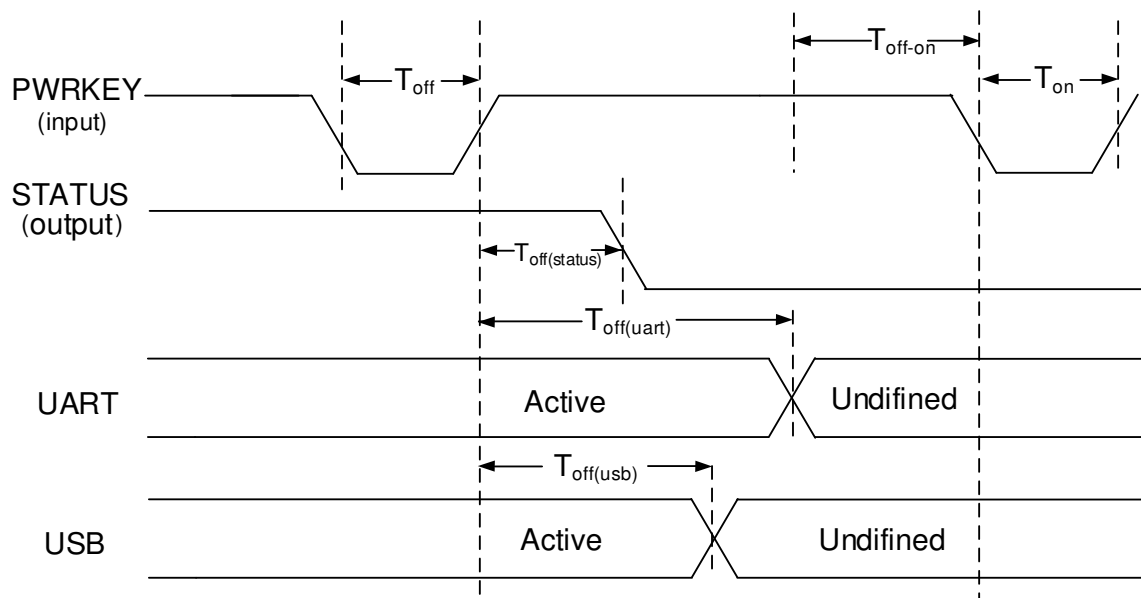


Figure 11: Power off timing sequence

Table 13: Power off sequence parameters

Symbol	Parameter	Min.	Typ.	Max.	Unit
T_{off}	Power off low level pulse width	2.5	-	-	s
$T_{off(status)}$	Power off time (according to status interface)	-	480	-	us
$T_{off(usb)}$	Power off time (according to UART interface)	-	2.4	-	ms
$T_{off(usb)}$	Power off time (according to USB interface)	-	690	-	us
T_{off-on}	Power off - power on buffer time	2	-	-	s

NOTE

The status pin can be used to judge whether the module is powered on or not. When the module is powered on and initialization is completed, the status outputs a high level, otherwise the low level will be maintained all the time.

3.2.3. Reset Function

Table 14: RESET interface pin definition

Pin name	Pin No.	I/O	Description	Note
RESET	16	DI,PU	System reset control input, active low.	

The module can be reset by pulling down the reset pin to a low level.

The recommended circuit is showed as follows:

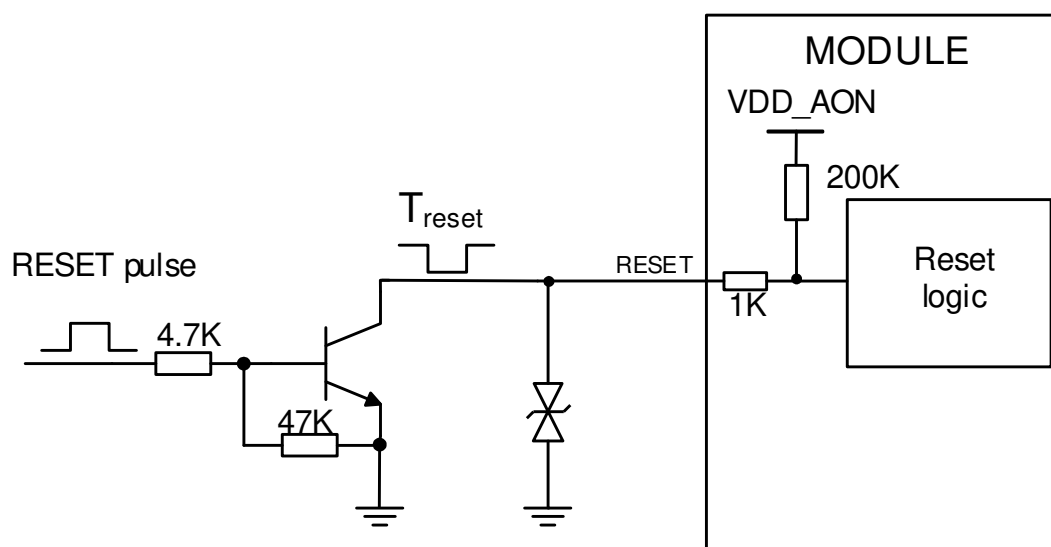


Figure 12: Reference reset circuit

Table 15: RESET pin electronic characteristic

Symbol	Description	Min.	Typ.	Max.	Unit
T_{reset}	The active low level time impulse on RESET pin to reset module	-	0.5	-	s
V_{IH}	Input high level voltage	-	1.2	-	V
V_{IL}	Input low level voltage	-0.3	0	0.4	V

NOTE

It is recommended to use the reset pin only in case of emergency, such as the module is not responding. The reset time is recommended to be 0.5s.

3.3. UART Interface

The module provides three serial ports, the main communication serial port is MAIN_UART, one ordinary serial port for GNSS communication, and the DEBUG_UART dedicate to print log.

Table 16: UART interface pins definition

Pin name	No.	Power domain	Type	Description	Note
Full function UART interface					
MAIN_UART_RTS	8	1.8V	DI	RTS input	If unused, keep it open.
MAIN_UART_CTS	7	1.8V	DO	CTS output	
MAIN_UART_RXD	10	1.8V	DI	Data input	
MAIN_UART_TXD	9	1.8V	DO	Data output	
MAIN_UART_RI	4	1.8V	DO	Ring indicator	
MAIN_UART_DCD	5	1.8V	DO	Carrier detection	
MAIN_UART_DTR	3	1.8V	DI	DTE Ready	
Debug UART					
DEBUG_UART_TX	23	1.8V	DO	Debug UART, the boot log will be output during boot up.	Default used as debug port.
DEBUG_UART_RX	22	1.8V	DI		
AUX_UART					
AUX_UART_TXD	50	1.8V	DO	Data output	Two-wire serial port
AUX_UART_RXD	49	1.8V	DI	Data input	

3.3.1. UART Design Guide

When customer uses full-function serial port, please refer to the following connection mode:

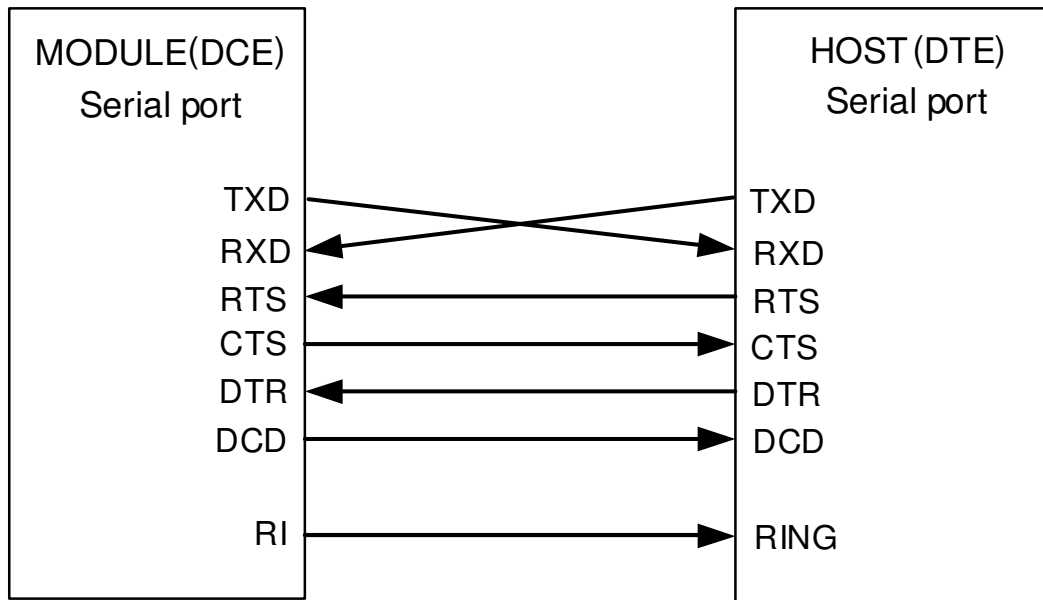


Figure 13: Serial port connection diagram (full-function mode)

When using 2-wire serial port, please refer to the following connection mode:

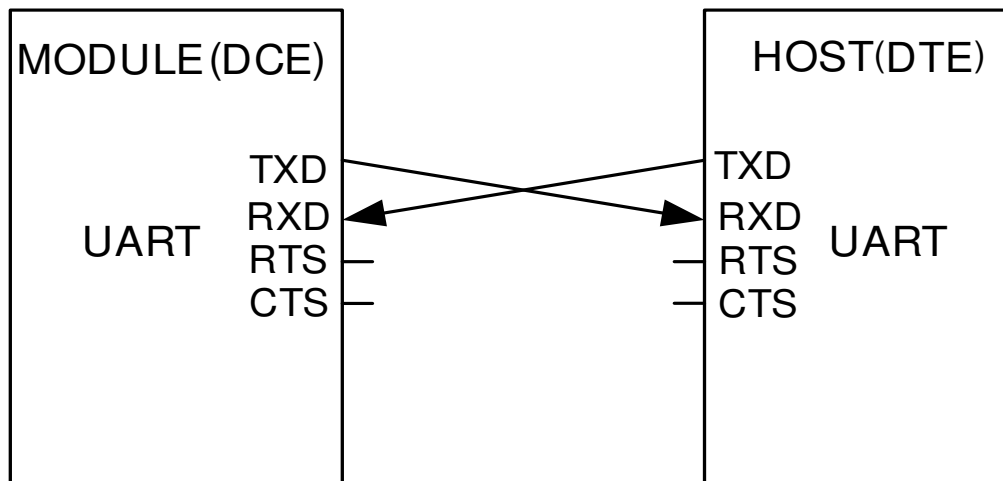


Figure 14: Serial port connection diagram (NULL mode)

The following figure shows the use of triode for level shifter circuits. Please pay special attention to the direction of signal.

The recommended triode model is MMBT3904.

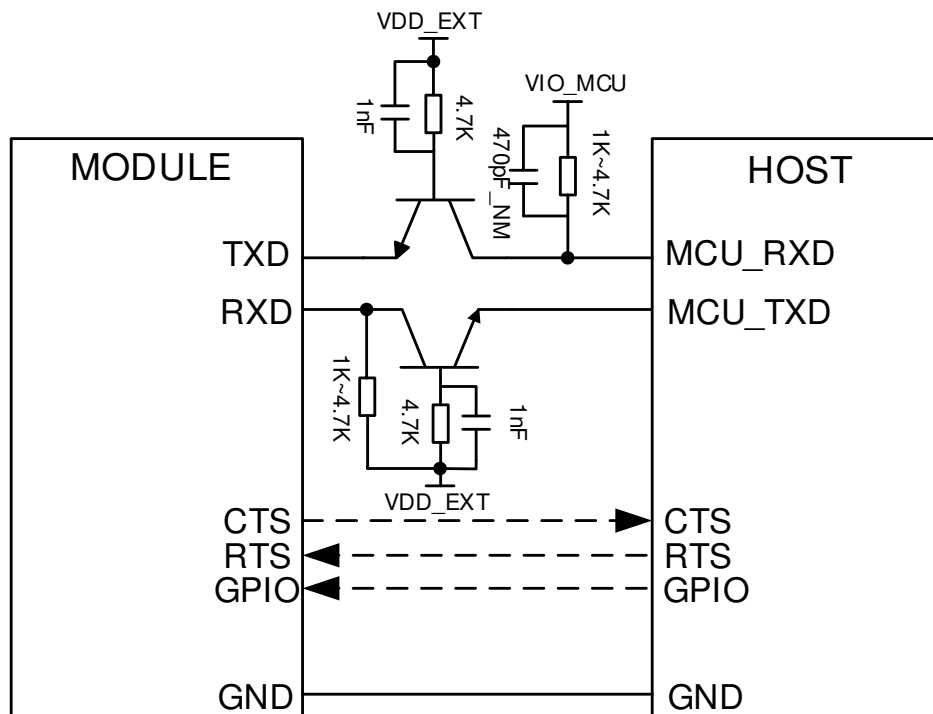


Figure 15: Triode level conversion circuit

NOTE

1. Main UART supports the following baud rates: 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200, 230400 and 921600. The default baud rate is 115200bps.
2. The maximum baud rate supported by SIM7672X ordinary serial port is 921600bps.
3. The parasitic capacitance of the transistor will affect the edge of the high-speed digital signal. It is not recommended to use this circuit when the signal speed is higher than 115200bps.

3.3.2. RI and DTR Behavior

RI usually keeps high level output. When receiving a short message or URC report, RI outputs a low level for 120ms (short message)/60ms (URC), and then returns to a high-level state.

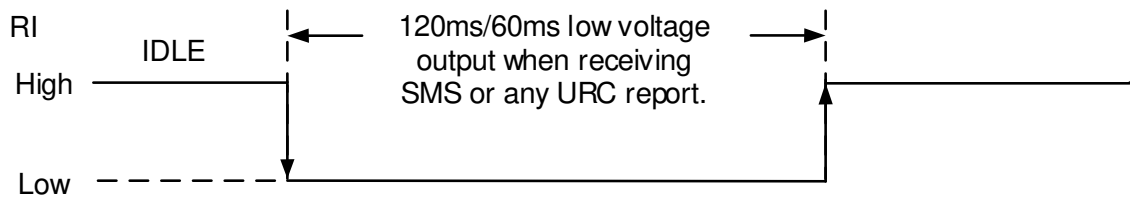


Figure 16: RI behaviour (SMS and URC report)

After setting the AT command “AT+CSCLK=1”, and then pulling up the DTR pin, module will enter into the sleep mode from the idle mode. In sleep mode, the UART is unavailable. When SIM7672X enters into the sleep mode, pulling down DTR can wake up the module.

After setting the AT command “AT+CSCLK=0”, SIM7672X Series remain still when the DTR pin is pulling up.

NOTE

After the module has entered into sleep mode, customers can pull DTR down to GND to wake up the module.

3.4. USB Interface

The module contains a USB interface, which complies with the USB2.0 specification as a peripheral, but does not support USB charging function and USB HOST mode.

USB supports high speed mode (480Mbps) and full speed mode (12Mbps), it is used for AT command communication, data transmission, GNSS NMEA output, firmware upgrade and software debugging.

It is recommended to reserve USB test points during design. If a main control chip is connected, 0R resistors must be reserved for switching external test points during design, as shown in the figure below.

Table 17: USB interface pins definition

Pin name	No.	Power domain	Type	Description	Note
VBUS	24	-	PI	Valid USB detection input. Active high, $V_{min}=3.6V$, $V_{max}=5.2V$, $V_{norm}=5V$	
USB_DN	28	-	AIO	Negative electrode of the differential, bi-directional USB signal.	
USB_DP	27	-	AIO	Positive electrode of the differential, bi-directional USB signal.	

3.4.1. USB Reference Design

The module can be used as a USB slave device. The recommended connection circuit diagram is as follows:

The branch wiring should not exceed 2mm

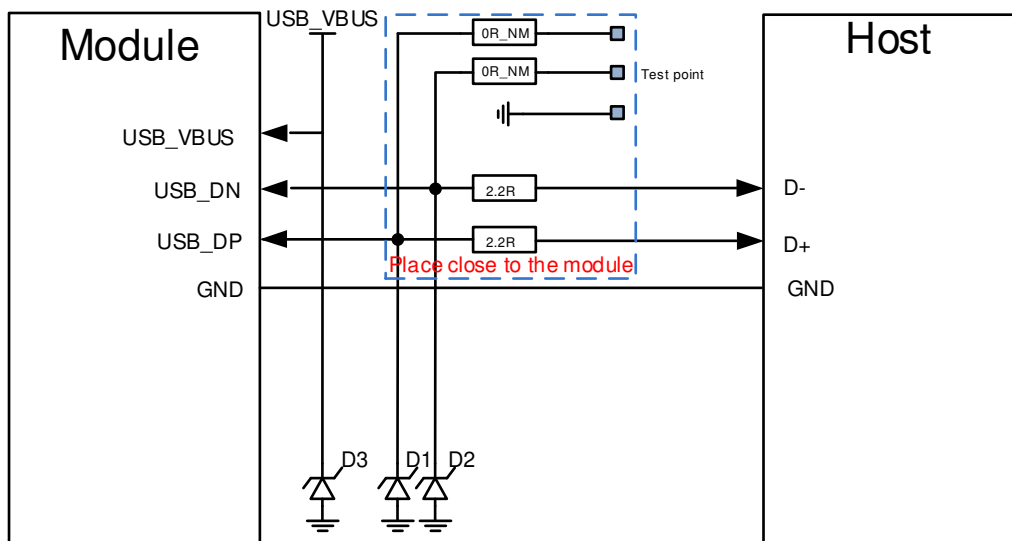


Figure 17: USB circuit diagram

Customers should pay attention to the selection of D3 devices. It is recommended to choose anti-static and anti-surge two-in-one devices, and one TVS tube can be placed, recommended model AZ9707-01F. D+/D- trace impedance is controlled according to 90Ω and covered with ground; D1/D2 select TVS tube with capacitance value <1pf, and they should be placed near the USB connector or test point, recommended models ESD73131CZ and ESD9L5.0ST5G.

Table 18: TVS for USB part number list

Manufacturer	Part Number	V _{RWM}	V _{Cmax}	C _{Jmax}	Package
WILL	ESD73131CZ-2/TR	5V	6.5V	0.45pF	DWN0603-2L
ON	ESD9L5.0ST5G	5V	9.8V	0.9pF	SOD-923
AMAZING	AZ9707-01F	7V	12.5V	950pF	DFN1610

NOTE

1. The gap from other signals should keep 3 times line width.
2. Trace routes should be away from other sensitive signals (RF, audio, and XO).
3. The detection of USB2.0 speed is determined automatically by the USB protocol.
4. There is no need to pull up the DP external, since it may affect the device USB enumeration.

3.4.2. USB_BOOT Interface

The module provides one forced download boot interface 'USB_BOOT'.

Table 19: USB_BOOT interface pin definition

Pin name	No.	Power domain	Type	Description	Note
USB_BOOT	6	1.8V	DI	Firmware download guide control input. When pull-down to GND and press PWRKEY, module will access in USB download mode.	Please reserve 2 test points for debug. Do not pull down USB_BOOT during normal power on!

If the module fails to boot, customers can force upgrade through the USB_BOOT port.

Before the module is powered on, pull down the USB_BOOT pin to GND, then apply VBAT power to the module, and press PWRKEY to enter the download mode. After entering the download mode, release USB_BOOT and remove the pull-down.

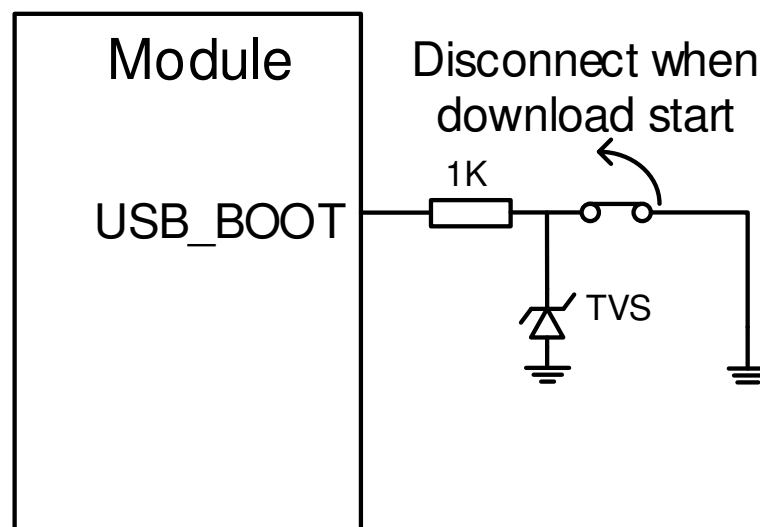


Figure 18: Reference USB_BOOT circuit

Customers will see the download port in the device manager port of the windows system.

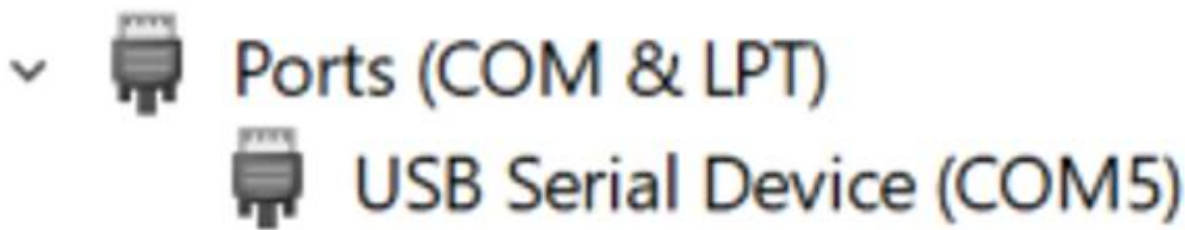


Figure 19: Force-download port

NOTE

1. USB_BOOT is the download control pin, this pin cannot be pulled down before the normal power on. Otherwise, it will enter the download mode.
2. It is recommended to reserve test point to facilitate debugging and upgrading.

3.5. USIM Interface

The module supports both 1.8V and 3.0V USIM cards. The interface power of the USIM card is provided by the voltage regulator inside the module.

Table 20: USIM interface pins definition

Pin name	No.	Power domain	Type	Description	Note
SIM_DATA	31	1.8/3.0V	I/O,PU	SIM data signal.	This pin has been pull-up with 4.7KΩ resistor to SIM_VDD internally.
SIM_RST	33	1.8/3.0V	I/O,PU	SIM RST signal reset output.	
SIM_CLK	32	1.8/3.0V	I/O,PU	SIM CLK signal clock output.	
SIM_VDD	30	1.8/3.0V	PO	SIM card power supply output.	Supports 1.8V/3.0V output according to the card type, its output current is up to 30mA.

SIM_DET	34	1.8V	I/O,PU	SIM card insert detect.	It can be set to high/low active with the AT command, refer to document [25]
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Table 21: USIM electronic characteristic in 1.8V mode (SIM_VDD=1.8V)

Symbol	Parameter	Min.	Typ.	Max.	Unit
SIM_VDD	LDO power output voltage	1.62	1.8	1.98	V
V _{IH}	High-level input voltage	0.7*SIM_VDD	-	-	V
V _{IL}	Low-level input voltage	-0.3	0	0.2*SIM_VDD	V
V _{OH}	High-level output voltage	0.8*SIM_VDD	-	-	V
V _{OL}	Low-level output voltage	-	0	0.15*SIM_VDD	V

Table 22: USIM electronic characteristic in 3.0V mode (SIM_VDD=3V)

Symbol	Parameter	Min.	Typ.	Max.	Unit
SIM_VDD	LDO power output voltage	2.7	3	3.3	V
V _{IH}	High-level input voltage	0.7*SIM_VDD	-	-	V
V _{IL}	Low-level input voltage	-0.3	0	0.2*SIM_VDD	V
V _{OH}	High-level output voltage	0.8*SIM_VDD	-	-	V
V _{OL}	Low-level output voltage	-	0	0.15*SIM_VDD	V

3.5.1. SIM Application Guide

It is recommended to use ESD protection component. 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.

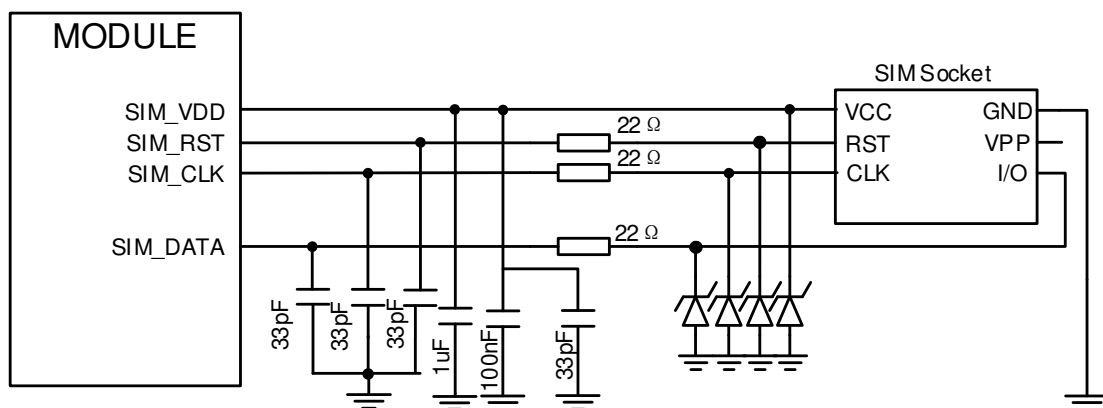


Figure 20: SIM interface reference circuit

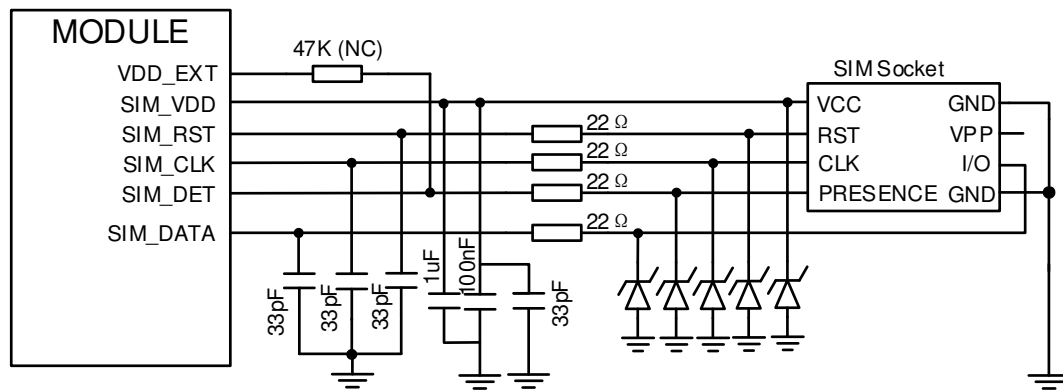


Figure 21: SIM interface reference circuit (8PIN)

NOTE

1. SIM_DATA has been pulled up with a 4.7KΩ resistor to SIM_VDD in module.
2. A 100nF capacitor on SIM_VDD is used to reduce interference.
3. Using "AT+UIMHOTSWAPON=0 or 1" to enable SIM card hot swap function. This function is disabled by default.
4. Using "AT+UIMHOTSWAPLEVEL=0 or 1"AT command to set the USIM card detection level to adapt to the signal logic.
5. For more details of AT commands about USIM, please refer to document [1].

The circuit of the USIM card is easy to be interfered with, resulting in the failure to recognize or drop the card, etc. so please follow the following principles during the design:

- Be sure to keep the USIM socket away from the main antenna during the PCB layout phase.
- USIM card traces should be away from RF, VBAT and high speed signals, at the same time the USIM card traces should be as short as possible.
- Keep the USIM socket's GND pin directly connected to the main ground.
- To prevent SIM_CLK from other signal interference, it is suggested to make separate package to protect SIM_CLK processing.
- Place TVS near the USIM socket, and the parasitic capacitance of TVS should not be greater than 15pF, such as WS03DTUMS-B.
- Connect 22 Ω resistors in series between USIM socket and module can enhance ESD protection performance.
- The rise/fall time of USIM_CLK should not exceed 40ns.

Table 23: TVS for USIM socket part number list

Manufacturer	Part Number	V _{RWM}	V _{Cmax}	P _{PPmax}	C _{Jmax}	Package
WAYON	WS03DTUMS-B	3.3V	8V	35W	0.7pF	DFN0603-2L

WILL	ESD9X5VU-2/TR	5V	8V	72W	0.9pF	DFN1006-2L
------	---------------	----	----	-----	-------	------------

3.6. I2C Interface

The module provides one I2C interface, which supports standard speed clock frequency 100Kbps and high speed clock frequency 400Kbps. Its operation voltage is 1.8V.

Table 24: I2C interface pins definition

Pin name	No.	Power domain	Type	Description	Note
I2C_SCL	38	1.8V	OD	I2C clock output	If unused, keep it open. Need pull up to VDD_EXT externally.
I2C_SDA	37	1.8V	OD	I2C data I/O	

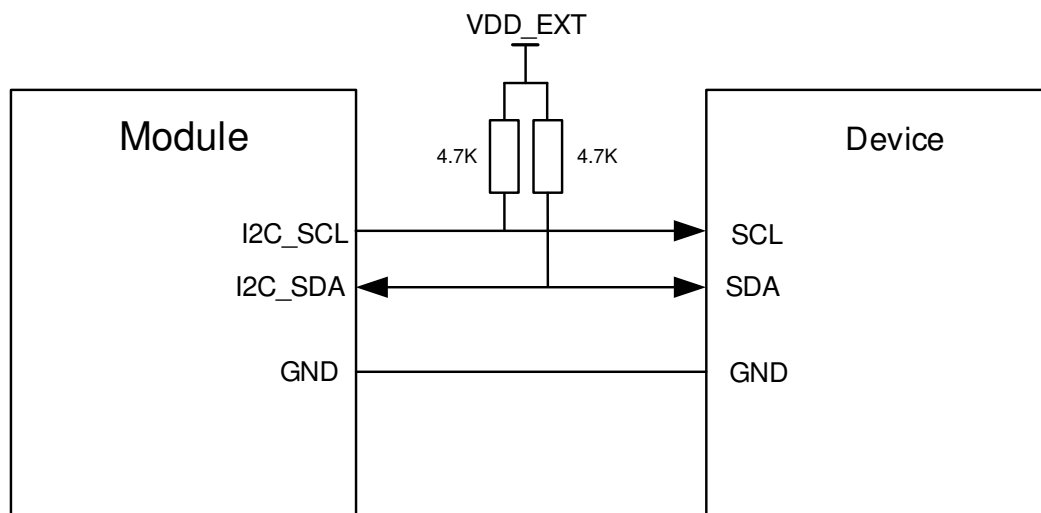


Figure 22: I2C reference circuit

NOTE

I2C_SCL and I2C_SDA have no pull-up resistor inside, external resistor is needed.

3.7. GPIO Interface

The module provides multiple GPIOs.

Table 25: Standard GPIO Resources of SIM7672X

Pin No.	Pin name	AT command operation GPIO number	Pin typ.	Power domain	Default function	Pad Edge wakeup
19	GPIO1	GPIO1	IO	1.8V	PU	NO
20	GPIO2	GPIO2	IO	1.8V	PD	NO
21	GPIO3	GPIO3	IO	1.8V	PU	NO
26	GPIO4	GPIO4	IO	1.8V	PD	NO
35	GPIO5	GPIO5	IO	1.8V	PU	NO
36	GPIO6	GPIO6	IO	1.8V	PU	NO
44	GPIO7	GPIO7	IO	1.8V	PU	NO
47	GPIO8	GPIO8	IO	1.8V	PU	NO
48	GPIO9	GPIO9	IO	1.8V	PD	NO
53	GPIO10	GPIO10	IO	1.8V	PU	NO
67	GPIO11	GPIO11	IO	1.8V	PU	NO
68	GPIO12	GPIO12	IO	1.8V	PU	NO

3.8. STATUS Interface

The STATUS pin can be used to determine whether the module is powered on or not. When the module is powered on and initialization is complete, the status output is high, otherwise it will remain low.

Table 26: STATUS interface pin definition

Pin name	No.	Power domain	Type	Description	Note
STATUS	42	1.8V	DO	Module operation status indication	If unused, keep it open.

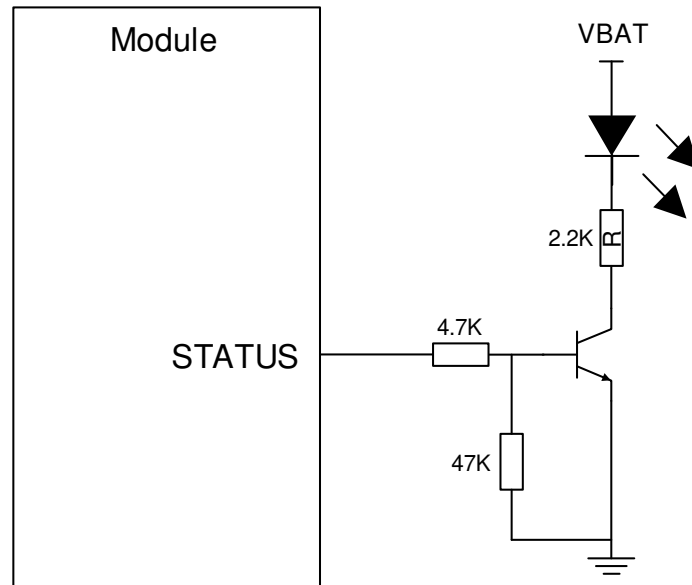


Figure 23: STATUS reference circuit

NOTE

The value of the resistor named “R” depends on the LED characteristic.

3.9. Network Status

Table 27: NETLIGHT interface pin definition

Pin name	No.	Power domain	Type	Description	Note
NETLIGHT	52	1.8V	DO	Network registration status indicator (LED).	

The NETLIGHT pin is used to control Network Status LED, its reference circuit is shown in the following figure.

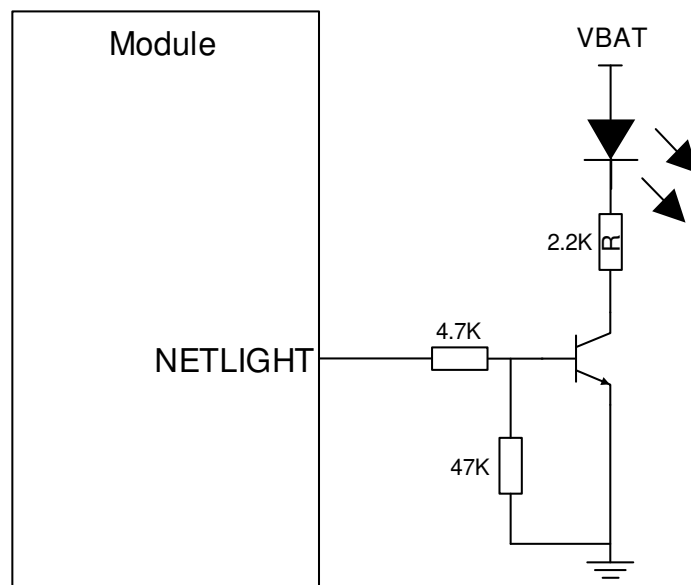


Figure 24: NETLIGHT reference circuit

NOTE

The value of the resistor named “R” depends on the LED characteristic.

The NETLIGHT signal is used to control the LED light that indicates the status of the network. The working status of this pin is shown in the table below.

Table 28: LTE mode NETLIGHT pin status

NETLIGHT pin status	Module status
Always On	Searching Network
200ms ON, 200ms OFF	Data Transmit/Registered
OFF	Power off / Sleep

3.10. GNSS Interface

The module supports GNSS function interface. GNSS provides 2 power supply input interfaces, 2 GNSS power enable control switch, 1 reset interface, 1 debug interface, 1 UART interface and 1 pulse synchronous clock signal interface, which are described in detail as follows.

Table 29: GNSS interface description

PIN Name	PIN NO	I/O	Description	Note
GNSS_VBKP	116	PI	GNSS backup power input	Power supply ranges from 2.0V to 3.6V, suggest 2.8V power supply.
GNSS_VDD	97	PI	GNSS VSYS input	The power supply voltage must be no less than 1.75V and no more than 1.9V, typically 1.8V. The cable must be as short as possible, with a cable width of more than 0.3mm.
GNSS_PWRCTL	98	DI	GNSS's internal Vcore power enable control	Active high. Solution 1: Use 10K resistor in series to connect to GPIO, recommend use GPIO2 (PIN20). Solution 2: Use 10K resistor in series to connect to MCU GPIO.
GNSS_VDD_EN	40	DI	GNSS's internal system power enable control	Only at standalone mode it can be used by connecting to MCU GPIO with 10K resistor in series. If unused, keep it open.
GNSS_RXD	96	DI	GNSS UART RXD	1.8V power domain. Solution 1: Use 1K resistor in series to connect AUX_UART_TXD (PIN50) of the module. Solution 2: Use 1K resistor in series to connect to MCU UART_TXD.
GNSS_TXD	95	DO	GNSS UART TXD	1.8V power domain. Solution 1: Use 1K resistor in series to connect AUX_UART_RXD (PIN49) of the module. Solution 2: Use 1K resistor in series to connect to MCU UART_RXD
1PPS	100	DO	GNSS pulse synchronous clock signal	If unused, keep it open.
GNSS_DEBUG_TX	115	DO	GNSS debug TXD	
GNSS_DEBUG_RX	111	DI	GNSS debug RXD	
GNSS_RST_N	114	AI	GNSS RST interface	Active low.

GNSS recommended reference design solution 1:

SIM7672X module itself provides power, power enable and UART transmission to GNSS, the recommended reference design is as follows:

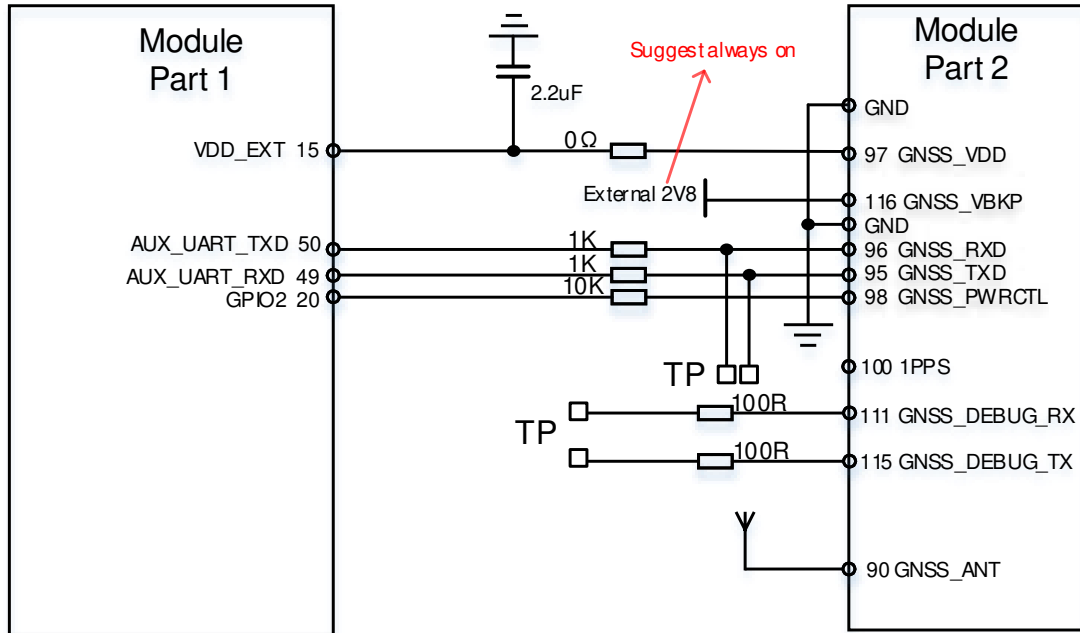


Figure 25: GNSS reference design (Non-standalone GNSS solution)

GNSS recommended reference design solution 2:

The external MCU provides power, power enable and UART transmission to GNSS, this solution is used for scenarios where GNSS can work standalone without the module powering up. The recommended reference design is as follows:

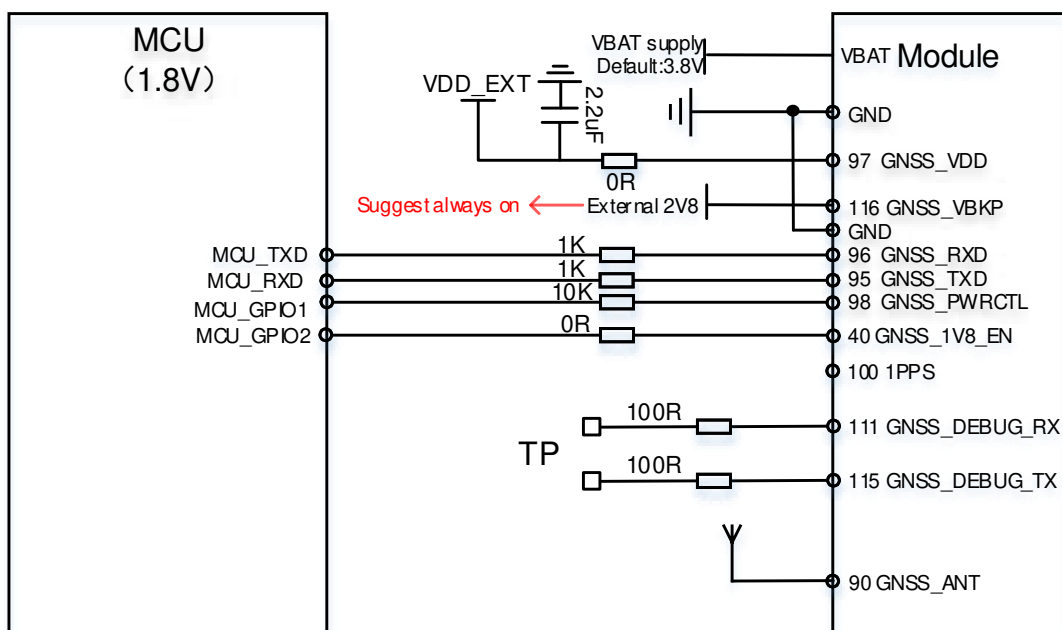


Figure 26: GNSS reference design (Standalone GNSS solution)

NOTE

1. Please place 1K resistors in series for serial communication lines with non-standalone GNSS solution to prevent leakage current to the serial ports of GNSS chip.
2. The standalone GNSS reference design is only applicable to 1.8V power domain MCU. If the MCU is not 1.8V power domain, a level shift circuit should be added.
3. The standalone GNSS design needs VBAT voltage input.
4. At standalone mode, MCU_GPIO1 and MCU_GPIO2 should be pulled up at the same time to meet the power on sequence.
5. The GNSS_VDD has higher requirements for power supply, PCB routing should be as short as possible, and the routing width is required to be at least 0.3mm.
6. GNSS_VBKP power supply input is a necessary condition for hot start, which can ensure the performance index of GNSS hot start to reach the optimal state. When 2.8V input, the typical current consumption value is 37uA.
7. Make sure to connect a 10K resistor to the GNSS_PWRCTL pin in series and then to the external enable signal.

AT commands about GNSS are as following table.

Table 30: AT commands about GNSS

AT Command	Description
AT+CGNSSPWR=<n>	GNSS power control <n>=1: Active GNSS <n>=0: Close GNSS
AT+CGNSSTST=<n>	Send data received from UART to NMEA port <n>=1: Start sending data to NMEA port <n>=0: Stop sending data to NMEA port
AT+CGPSCOLD	Cold start GNSS
AT+CGPSWARM	Warm start GNSS
AT+CGPSHOT	Hot start GNSS
AT+CGNSSSLEEP*	Set GNSS into sleep mode
AT+CGNSSWAKEUP*	Wake up GNSS
AT+CGNSSFLP=<n>*	<n>=1: Open periodic power saving mode <n>=0: Close periodic power saving mode

NOTE

The GPIO2 will be pulled up after sending “AT+CGNSSPWR=1”.

‘*’ Indicates that the functions is in development.

Please reserve test points of GNSS_RXD and GNSS_TXD for firmware upgrade.

Please refer to document [1] for more AT commands about GNSS.

3.11. PCM Interface*

The module provides a set of PCM interface, can be connected to an external audio codec chip, supports master mode, 16-bit linear short frame format.

The module supports audio function, does not support VoLTE function, customers can use audio function on PCM external codec. For specific parameters and matters, please refer to the relevant manuals of the software.

Table 31: PCM interface pins definition

Pin name	No.	Power domain	Type	Description	Note
PCM_CLK	11	1.8V	I/O,PD	PCM clock	If unused, keep it open.
PCM_SYNC	12	1.8V	I/O,PD	PCM frame synchronization	
PCM_DIN	13	1.8V	DI,PD	PCM data input	
PCM_DOUT	14	1.8V	DO,PD	PCM data output	

Table 32: PCM interface description

Characteristic	Description
Encoding-Format	Linear
Data bits	16bits/24bits
Master-slave mode	Master
PCM sample rate	8KHz/16KHz
PCM frame synchronization	Short frame
Data format	MSB

3.11.1. PCM Sequence

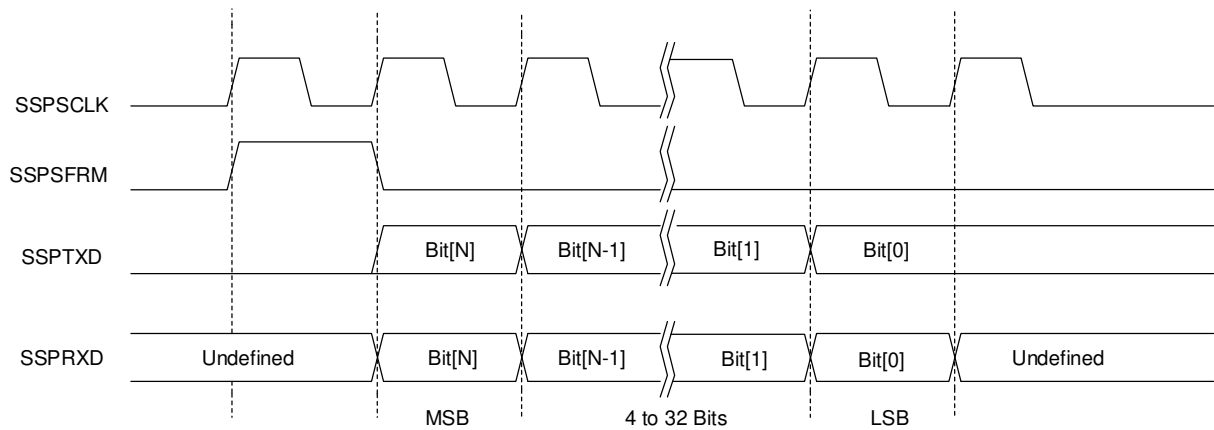


Figure 27: PCM sequence

3.11.2. PCM Reference Design

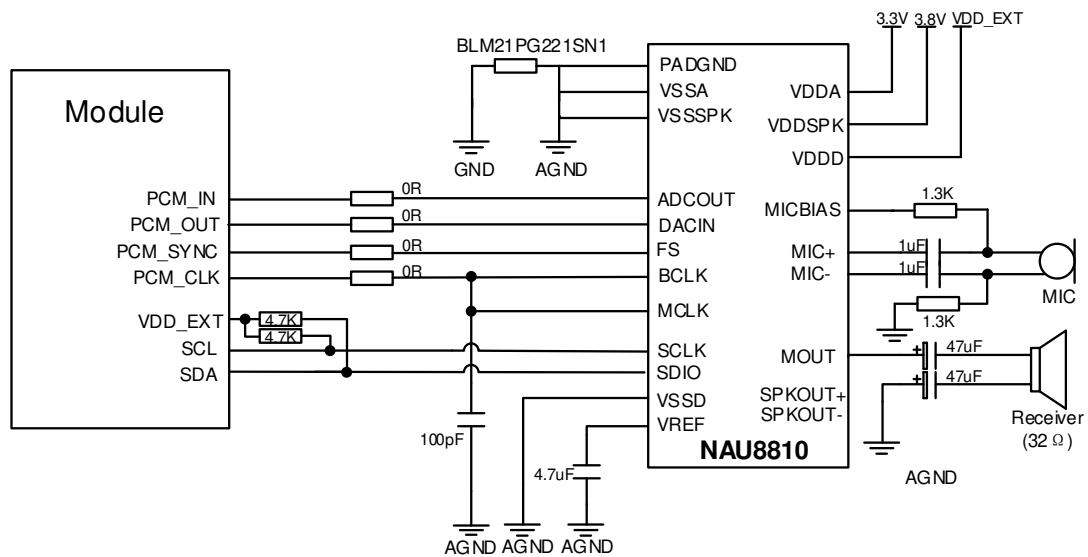


Figure 28: PCM reference design

NOTE

PCM function is in development.

3.12. Other Interface

3.12.1. ADC

The module has 2 general ADC pins, and support VBAT ADC.

Table 33: ADC interface pins definition

Pin name	No.	Power domain	Type	Description	Note
ADC1	25	0V-1.1V	AI	General Purpose ADC	If unused, keep it open.
ADC2	51	0V-1.1V	AI	General Purpose ADC	If unused, keep it open.

The electrical characteristics are as follows:

Table 34: General ADC electronic characteristics

Characteristics	Min.	Typ.	Max.	Unit
Resolution	-	12	-	Bits
Input Range	0	-	1.1	V
Input Resistance	0.26	-	0.75	MΩ

NOTE

“AT+CADC=2” can be used to read the voltage of the ADC1 pin.
 “AT+CADC2=2” can be used to read the voltage of the ADC2 pin.
 “AT+CBC” can be used to read the voltage value of the power supply (VBAT).
 For more details, please refer to document [1].

3.12.2. VDD_EXT

The module provides 1 LDO outputs: VDD_EXT.

VDD_EXT can only provide a current capacity of 50mA. It can be used as a power supply for module GNSS_VDD (PIN97).

Table 35: LDO output pin definition

Pin name	No.	Power domain	Type	Description	Note
VDD_EXT	15	-	PO	1.8V power output, output current up to 50 mA.	Default on. It can provide 1V8 power supply for GNSS. If unused, keep it open.

Table 36: VDD_EXT electrical characteristics

Symbol	Description	Min.	Typ.	Max.	Unit
V _{DD_EXT}	Output voltage	-	1.8	-	V
I _O	Output current	-	-	50	mA

NOTE

1. If the module enters PSM mode, the VDD_EXT will be powered off.
2. If the damage will affect the system startup, it is recommended that customers add TVS protection. The recommended model is ESD56051N.

Table 37: TVS for VDD_EXT part number list

Manufacturer	Part Number	V _{RWM}	V _{Cmax}	C _{Jmax}	Package
WILLSEMI	ESD56051N-2/TR	3.3V	10V	65F	DFN1006-2L

3.12.3. MAIN_UART_WAKEUP

The module provides a MAIN_UART_WAKEUP interface, which can connect to MAIN_UART_RXD externally to wake up the module.

Table 38: MAIN_UART_WAKEUP interface pin definition

Pin name	No.	Power domain	Type	Description	Note
MAIN_UART_WAKEUP	41	1.8V	DI	MAIN_UART_RXD wake-up pin.	Connect it to MAIN_UART_RXD externally if use this function.

3.12.4. ANT_CTRL

The module provides a set of antenna GRFC dedicated signals lines. It can be used to control the antenna tuner to improve antenna performance.

Table 39: ANT_CTRL interface pins definition

Pin name	No.	Power domain	Type	Description	Note
ANT_CTRL1	42		DO	FEMIO for tuner switch	
ANT_CTRL2	43		DO	FEMIO for tuner switch	

The reference circuit is shown in the following figure:

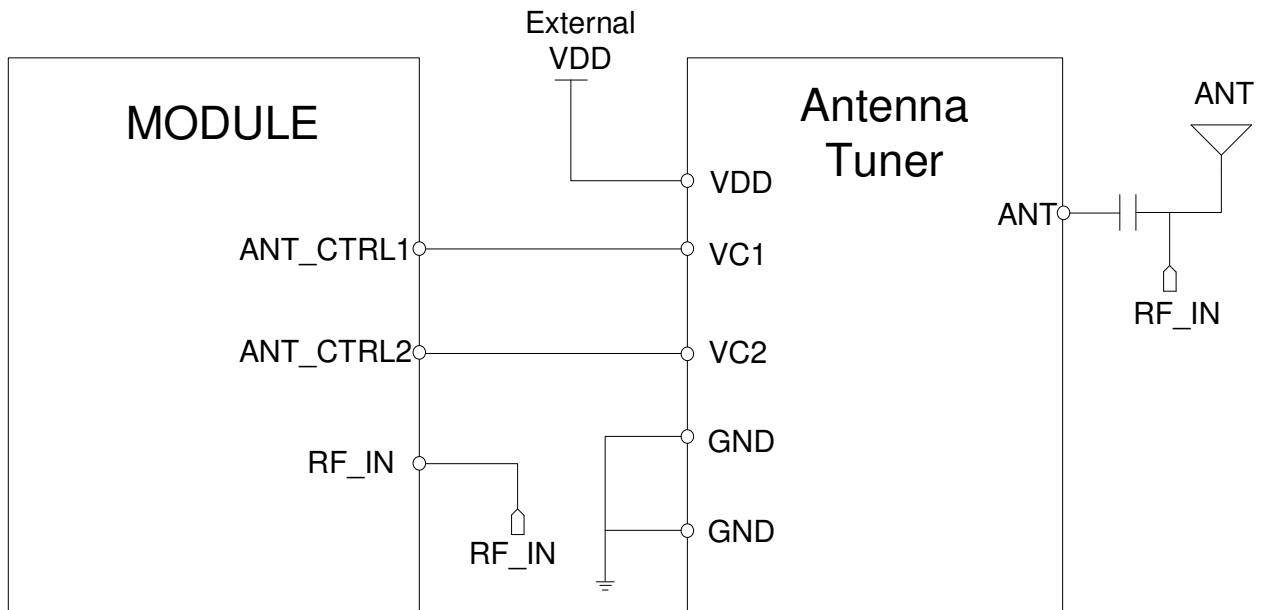


Figure 29: RF control interface reference circuit

4. RF Specifications

4.1. LTE Specifications

Table 40: Conducted transmission power

Frequency	Power	Min.
LTE-FDD B1	23dBm +/-2.7dB	<-40dBm
LTE-FDD B2	23dBm +/-2.7dB	<-40dBm
LTE-FDD B3	23dBm +/-2.7dB	<-40dBm
LTE-FDD B4	23dBm +/-2.7dB	<-40dBm
LTE-FDD B5	23dBm +/-2.7dB	<-40dBm
LTE-FDD B7	23dBm +/-2.7dB	<-40dBm
LTE-FDD B8	23dBm +/-2.7dB	<-40dBm
LTE-FDD B12	23dBm +/-2.7dB	<-40dBm
LTE-FDD B13	23dBm +/-2.7dB	<-40dBm
LTE-FDD B14	23dBm +/-2.7dB	<-40dBm
LTE-FDD B18	23dBm +/-2.7dB	<-40dBm
LTE-FDD B19	23dBm +/-2.7dB	<-40dBm
LTE-FDD B20	23dBm +/-2.7dB	<-40dBm
LTE-FDD B25	23dBm +/-2.7dB	<-40dBm
LTE-FDD B26	23dBm +/-2.7dB	<-40dBm
LTE-FDD B28	23dBm +/-2.7dB	<-40dBm
LTE-FDD B66	23dBm +/-2.7dB	<-40dBm
LTE-FDD B71	23dBm +/-2.7dB	<-40dBm
LTE-TDD B34	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 41: E-UTRA operating bands

E-UTRA	UL Freq.	DL Freq.	Duplex Mode
1	1920~1980 MHz	2110~2170 MHz	FDD
2	1850~1910MHz	1930~1990MHz	FDD
3	1710~1785 MHz	1805~1880 MHz	FDD
4	1710~1755MHz	2110~2155MHZ	FDD
5	824 ~ 849 MHz	869 ~ 894MHz	FDD
7	2500~2570MHz	2620~2690MHz	FDD
8	880~915 MHz	925~960 MHz	FDD
12	699~716MHz	729~746MHz	FDD
13	777~787MHz	746~756MHz	FDD
14	788~798MHz	758~768MHz	FDD
18	815~830MHz	860~875MHz	FDD
19	830~845MHz	875~890MHz	FDD
20	832~862MHz	791~821MHz	FDD
25	1850~1915MHz	1930~1995MHz	FDD
26	814~849MHz	859~894MHz	FDD
28	703~748MHz	758~803MHz	FDD
66	1710~1780MHz	2110~2200MHz	FDD
71	663~698MHz	617~652MHz	FDD
34	2010~2025MHz	2010~2025MHz	TDD
38	2570~2620 MHz	2570~2620 MHz	TDD
39	1880~1920 MHz	1880~1920 MHz	TDD
40	2300~2400 MHz	2300~2400 MHz	TDD
41	2535~2655 MHz	2535~2655 MHz	TDD

Table 42: Conducted receive sensitivity

Frequency	Receive sensitivity(Typical)	Receive sensitivity(MAX)
LTE FDD/TDD	Refer to the table 43	3GPP

Table 43: Reference sensitivity (QPSK)

E-UTRA Band	3GPP TS36.521-1						Actual 10 MHz	Duplex Mode
	1.4 MHz	3MHz	5MHz	10MHz	15 MHz	20 MHz		
1	-	-	-100	-97	-95.2	-94	TBD	FDD
2	-102.7	-99.7	-98	-95	-93.2	-92	TBD	FDD
3	-101.7	-98.7	-97	-94	-92.2	-91	TBD	FDD
4	-104.7	-101.7	-100	-97	-95.2	-94	TBD	FDD
5	-103.2	-100.2	-98	-95	-	-	TBD	FDD
7	-	-	-98	-95	-93.2	-92	TBD	FDD

8	-102.2	-99.2	-97	-94	-	-	TBD	FDD
12	-101.7	-98.7	-97	-94	-	-	TBD	FDD
13	-	-	-97	-94	-	-	TBD	FDD
14	-	-	-97	-94	-	-	TBD	FDD
18	-	-	-99.3	-96.3	-94.5	-	TBD	FDD
19	-	-	-99.3	-96.3	-94.5	-	TBD	FDD
20	-	-	-97	-94	-91.2	-90	TBD	FDD
25	-101.2	-98.2	-96.5	-93.5	-91.7	-90.5	TBD	FDD
26	-102.7	-99.7	-97.5	-94.5	-92.7	-	TBD	FDD
28	-	-100.2	-98.5	-95.5	-93.7	-91	TBD	FDD
66	-104.2	-101.2	-99.5	-96.5	-94.7	-93.5	TBD	FDD
71	-	-	-96.5	-93.5	-91.7	-90.5	TBD	FDD
34	-	-	-100	-97	-95.2	-	TBD	TDD
38	-	-	-100	-97	-95.2	-94	TBD	TDD
39	-	-	-100	-97	-95.2	-94	TBD	TDD
40	-	-	-100	-97	-95.2	-94	TBD	TDD
41	-	-	-98	-95	-93.2	-92	TBD	TDD

4.2. LTE Antenna Requirements

For better overall performance, it is recommended that the antenna design should refer to the index requirements in the following table.

Table 44: LTE antenna requirements

Passive	Recommended standard
Operating band	Please refer to the table 40 and table 41
Direction	Omnidirectional
Gain	> -3dBi (Avg)
Input impedance	50 ohm
Efficiency	> 50 %
Maximum input power	50W
VSWR	< 2
Isolation	>20dB
PCB insertion loss(<1GHz)	<0.5dB
PCB insertion loss(1GHz~2.2GHz)	<1dB
PCB insertion loss(2.3GHz~2.7GHz)	<1.5dB

4.3. GNSS Specifications

Table 45: GNSS operating bands

Type	Frequency
GPS L1	1575.42±1.023MHz
GLONASS G1	1601.7±6.75MHz
BeiDou B1I	1561.098±2.046MHz
GALILEO E1	1575.42±1.023MHz

Table 46: GNSS performance

GNSS	Description	Performance			
		Min	Type	Max	Unit
Horizontal Position Accuracy	Automatic position		0.18		m
Velocity Accuracy	Without Aid				m/s
	DFPS				m/s
Timing Accuracy					ns
Dynamic Performance	Maximum Altitude				m
	Maximum Velocity				m/s
	Maximum Acceleration				G
TTFF (A-GPS off)	Hot start		0.42		S
GPS(L1)+GLONASS+BEIDOU	Warm start		14		S
	Cold start		23.4		S
TTFF (A-GPS on) (EPO in flash mode)	Hot start				S
	Warm start				S
	Cold start				S
Sensitivity GPS (L1)	Autonomous acquisition (cold start)		-147		dBm
	Re-acquisition		-156.5		dBm
	Tracking		-164		dBm
Receiver	Channels				
	Update rate				Hz
	Tracking L1, CA code				
	Protocol support NMEA, PAIR				

Power consumption With GPS (L1) +GALILEO+BEIDOU	Acquisition				mA
	Continuous tracking				mA
	Sleep current				uA
	RTC current				uA

4.4. GNSS Antenna Requirements

Table 47: Recommended Antenna Characteristics (GNSS)

Passive	Recommended standard
Operating band	L1: 1559~1609MHZ
Direction	Hemisphere, face to sky
Input impedance	50 ohm
Maximum input power	50W
VSWR	<2
Plan category	RHCP or Linear
Passive antenna gain	0dBi
Active antenna gain	-2dBi
Active antenna noise figure	<1.5
Built-in antenna LNA gain	20dB(Typ.)
Total antenna gain	<18 dB
Coaxial insertion loss	<1.5dB

4.5. Antenna Reference Design

4.5.1. Passive Antenna for LTE/GNSS

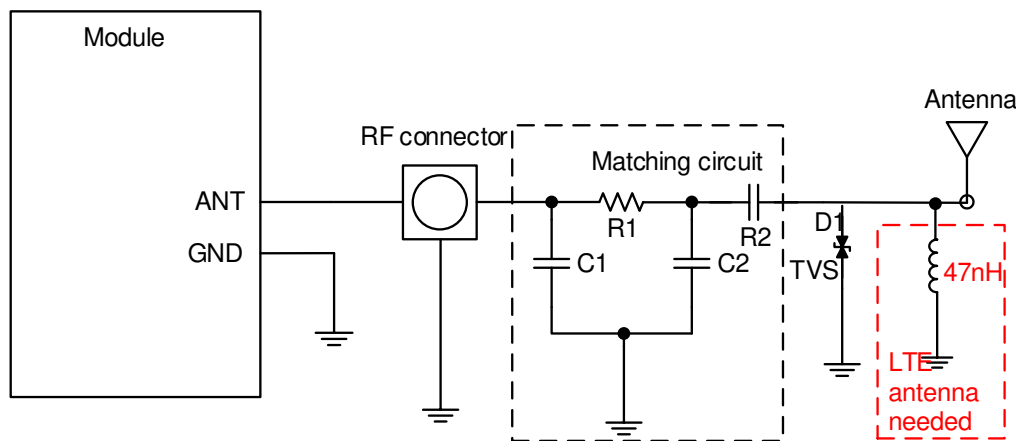


Figure 30: Passive antenna reference

In above figure, the component R1/C1/C2/C3 is reserved for antenna matching, the value of components can only be acquired after the antenna tuning, usually provided by the antenna factory. Among them, R1 paste 0Ω, C3 paste 100pF, C1 and C2 do not paste by default. The component D1 is a Bidirectional ESD Protection device, which is suggested to add to protection circuit, the recommended Part Numbers of the TVS for RF main antenna and GNSS antenna are listed in the following table:

Table 48: TVS for RF main antenna part number list

Manufacturer	Part Number	V_{RWM}	V_{Cmax}	C_{Jmax}	Package
Murata	LXES03AAA1-154	4V	28V	0.05pF	0603
INPAQ	CES10201V05B0	5V	30V	0.1pF	0201
BiLSEMI	BLE5V0CR05UB	5V	40V	0.05pF	DFN1006-2L

Table 49: TVS for GNSS antenna part number list

Manufacturer	Part Number	V_{RWM}	V_{Cmax}	C_{Jmax}	Package
WAYON	WE05DGCF-B	5V	23V	0.3pF	DFN1006-2L

4.5.2. Active Antenna for GNSS

If active antenna is used, there should be an external power supply. Reference design is shown as bellow:

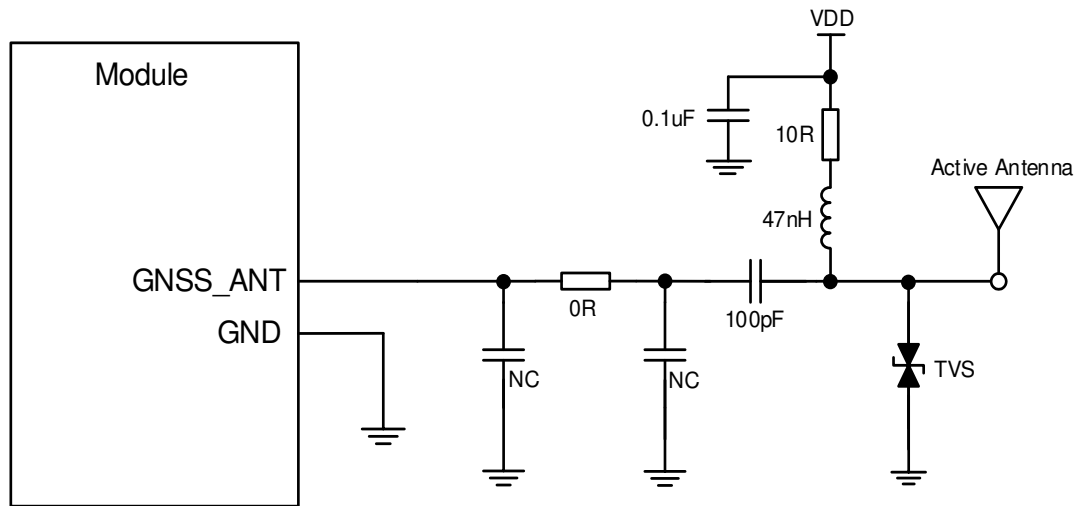


Figure 31: Active antenna reference

4.6. PCB layout

Customers should pay attention to the impedance design of PCB layout from the module ANT port to the antenna connector, and the length of the PCB trace should be within 20 mm, and far away from interference signals such as power & clock. It is recommended to reserve RF Switch Connector for conduction test.

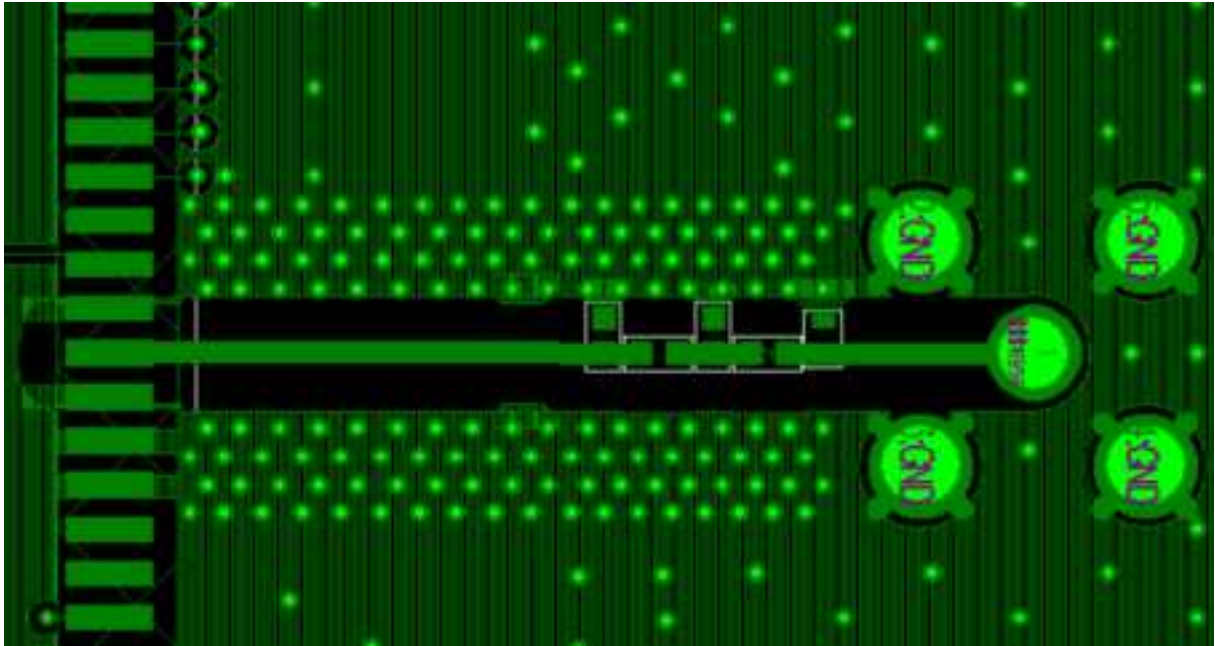


Figure 32: Reference PCB layout

5. Electrical Specifications

5.1. Absolute maximum ratings

Absolute maximum rating for digital and analog pins of SIM7672X are listed in the following table, exceeding these limits may cause permanent damage to the module.

Table 50: Absolute maximum ratings

Parameter	Min.	Typ.	Max.	Unit
Voltage on VBAT	-0.3	-	4.5	V
Voltage on VBUS	-0.3	-	5.4	V
Voltage at digital pins (GPIO, I2C, UART, PCM)	-0.3	-	2.0	V
Voltage at I/O pins (USIM)	-0.3	-	2.0	V
	-0.3	-	3.3	V
Voltage at PWRKEY	-0.3	-	4.5	V
Voltage at RESET	-0.3	-	3.6	V

5.2. Operating conditions

Table 51: Recommended operating ratings

Parameter	Min.	Typ.	Max.	Unit
Voltage at VBAT	3.4	3.8	4.2	V
Voltage at VBUS	3.6	5.0	5.2	V

Table 52: 1.8V Digital I/O characteristics*

Parameter	Description	Min.	Typ.	Max.	Unit
V _{IH}	High-level input voltage	VCC*0.7	1.8	VCC+0.2	V
V _{IL}	Low-level input voltage	-0.3	0	VCC*0.2	V
V _{OH}	High-level output voltage	VCC*0.8	-	-	V
V _{OL}	Low-level output voltage	0	-	VCC*0.15	V

I_{OH}	High-level output current (no pull down resistor)	-	-	-	mA
I_{OL}	Low-level output current (no pull up resistor)	-	-	-	mA
I_{IH}	Input high leakage current (no pull-down resistor)	-	-	10	μ A
I_{IL}	Input low leakage current (no pull up resistor)	-10	-	-	μ A

NOTE

These parameters are for digital interface pins, such as GPIO, I2C, UART and PCM.

The operating temperature of SIM7672X is listed in the following table.

Table 53: Operating temperature

Parameter	Min.	Typ.	Max.	Unit
Normal operation temperature	-30	25	75	$^{\circ}$ C
Extended operation temperature*	-40		85	$^{\circ}$ C
Storage temperature	-45		90	$^{\circ}$ C

NOTE

When Module is within the extended operation temperature range, Module is able to establish and maintain data transmission, SMS, etc. The performance may deviate slightly from the 3GPP specifications, but will meet 3GPP specifications again when the temperature returns to normal operating temperature levels. It is strongly recommended that customers take heat dissipation measures to ensure that the normal operating temperature of the module can't be exceeded.

5.3. Operating Mode

5.3.1. Operating Mode Definition

The table below summarizes the various operating modes of SIM7672X product.

Table 54: Operating mode Definition

Mode		Function
Normal operation	LTE Sleep	AT command “AT+CSCLK=1” can be used to set the module to sleep mode. 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.
	LTE Idle	Software is active. Module is registered to the network, and the module is ready to communicate.
	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 AT+CSCLK=1’ 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 accessible. The power consumption in this mode is lower than normal mode.
Flight mode		AT command ‘AT+CFUN=4’ 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.
PSM mode		AT command ‘AT+CPSMS’ can be used to set the module to PSM mode without removing the power supply. In this mode, the CPU is powered off, only the clock circuit inside the module works, the network is not connected, and the serial port and USB are unavailable. In this case, the power consumption of the module is reduced to the minimum.
Power off		Module will go into power off mode by sending the AT command ‘AT+CPOF’ or pull down the PWRKEY 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 not accessible.

5.3.2. Sleep mode

In sleep mode, the current consumption of module will be reduced to the minimal level.

Both hardware and software should meet several conditions simultaneously so that SIM7672X will enter into sleep mode:

- USB condition: Send ‘AT+CSCLK=1’ and unplug USB.
- Software condition: Software must support sleep mode configuration.
- UART condition: Send ‘AT+CSCLK=1’.

NOTE

Before designing, please pay attention to how to realize sleeping/waking function and refer to document [24] for more details.

5.3.3. Minimum functionality mode and Flight mode

Minimum power consumption mode ceases a majority function of Module, to enable the module enter the minimum power consumption mode, the following hardware and software conditions must be followed:

- (1) Module is in normal mode.
- (2) Send AT command "AT+CFUN=0".
- (3) Send AT command "AT+CSCLK=1".
- (4) DTR pin pulled to high level and VBUS pulled to low level.

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 SIM7672X has been set to minimum functionality mode, the RF function and SIM card function will be closed. In this case, the serial port and USB are still accessible, but RF function and SIM card will be unavailable.

If SIM7672X 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 SIM7672X is in minimum functionality or flight mode, it can return to full functionality by the AT command "AT+CFUN=1".

5.3.4. PSM mode

The PSM mode can be set by "AT+CPSMS", and it can minimize the current consumption.

The module is initially in the RRC connect state, and it will enter idle mode after disconnecting RRC Connect by "end call", while the timer T3324/T3412 starts timing. After the timer T3324 expires, the module enters the PSM mode. The module will wake up automatically after the timer T3412 expiring, and it will enter TAU mode.

The AT command for entering the PSM mode are as follows:

AT+QCPMUCFG=1,4 //Set PMU Deep sleep mode

AT+QCPMSMR=1 //Open PSM reporting URC

AT+CEREG?

AT+CPSMS=1,,,"01011111","00000001" //Enable PSM Mode, Set T3412_ext and T3324
AT+CEREG?//Query network status

After entering the PSM mode, the module will terminate the network connection, and unable to respond to requests. Customers can send AT command when the timer T3412 expiring or pull down the PWRKEY to wake up the module. The module will exit the PSM mode by "AT+CPSMS=0".

5.4. Current Consumption

The current consumption is listed in the table below.

Table 55: Current consumption on VBAT Pins (VBAT=3.8V)

LTE sleep/Idle mode			
LTE supply current (GNSS off, without USB connection)	Idle mode Typical: 4.13mA Sleep mode@DRX=0.32S Typical: 1.5mA Sleep mode@DRX=0.64S Typical: 729uA Sleep mode@DRX=1.28S Typical: 477uA		
PSM mode			
PSM supply current	PSM mode Typical: 10uA		
Minimum functionality mode			
AT+CFUN=0, AT+CSCLK=1	Typical: 139uA (with simcard) Typical: 148uA (without simcard)		
LTE Cat1			
LTE-FDD B1	@10MHz	23dBm	Typical :618mA
LTE-FDD B2	@10MHz	23dBm	Typical :656mA
LTE-FDD B3	@10MHz	23dBm	Typical :611mA
LTE-FDD B4	@10MHz	23dBm	Typical :613mA
LTE-FDD B5	@10MHz	23dBm	Typical :546mA
LTE-FDD B7	@10MHz	23dBm	Typical :668mA
LTE-FDD B8	@10MHz	23dBm	Typical :510mA
LTE-FDD B12	@10MHz	23dBm	Typical :580mA
LTE-FDD B13	@10MHz	23dBm	Typical :540mA
LTE-FDD B18	@10MHz	23dBm	Typical :600mA
LTE-FDD B19	@10MHz	23dBm	Typical :514mA
LTE-FDD B20	@10MHz	23dBm	Typical :536mA
LTE-FDD B25	@10MHz	23dBm	Typical :646mA
LTE-FDD B26	@10MHz	23dBm	Typical :569mA
LTE-FDD B28	@10MHz	23dBm	Typical :505mA
LTE-FDD B66	@10MHz	23dBm	Typical :658mA
LTE-FDD B71	@10MHz	23dBm	Typical :550mA

LTE-TDD B34	@10MHz	23dBm	Typical :475mA
LTE-TDD B38	@10MHz	23dBm	Typical :470mA
LTE-TDD B39	@10MHz	23dBm	Typical :497mA
LTE-TDD B40	@10MHz	23dBm	Typical :639mA
LTE-TDD B41	@10MHz	23dBm	Typical :463mA

Table 56: Standalone GNSS current consumption on VBAT Pins (VBAT=3.8V, CAT1 OFF)

Mode	Condition	Typical (mA)
GPS (L1)	-130dBm/Tracking	7.40
	-145dBm/Tracking	7.32
	-130dBm/Cold start	9.79
	-145dBm/Cold start	9.69
	Loss of lock	8.87
GPS (L1) +GLONASS	-130dBm/Tracking	8.73
	-145dBm/Tracking	8.71
	-130dBm/Cold start	11.09
	-145dBm/Cold start	9.88
	Loss of lock	9.70
GPS (L1) +BEIDOU	-130dBm/Tracking	10.31
	-145dBm/Tracking	10.14
	-130dBm/Cold start	10.60
	-145dBm/Cold start	10.89
	Loss of lock	9.96
Real network active antenna GPS (L1) +GALILEO+BEIDOU	Outdoor search	12.23
	Acquisition	11.86
	Loss of lock	12.41
Real network passive antenna GPS (L1) +GALILEO+BEIDOU	Outdoor search	10.32
	Acquisition	9.85
	Loss of lock	10.55

5.5. ESD Notes

SIM7672X is sensitive to ESD in the process of storage, transporting, and assembling. When SIM7672X is mounted on the customers' mother board, the ESD components should be placed beside the connectors which human body may touch, such as SIM card holder, audio jacks, switches, keys, etc. The following table shows the SIM7672X ESD measurement performance.

Table 57: The ESD performance measurement table (Temperature: 25℃, Humidity: 45%)

Part	Contact discharge	Air discharge
VBAT, GND	+/-4K	+/-8K
Antenna port	+/-4K	+/-8K
USB interface	+/-4K	+/-6K
UART interface	+/-3K	+/-6K
Other PADS	+/-1K	+/-2K

NOTE

Test conditions:

- The external of the module has surge protection diodes and ESD protection diodes.
- The data in table above were tested using SIMCom EVB.

6. SMT Production Guide

6.1. Top and Bottom View of SIM7672X

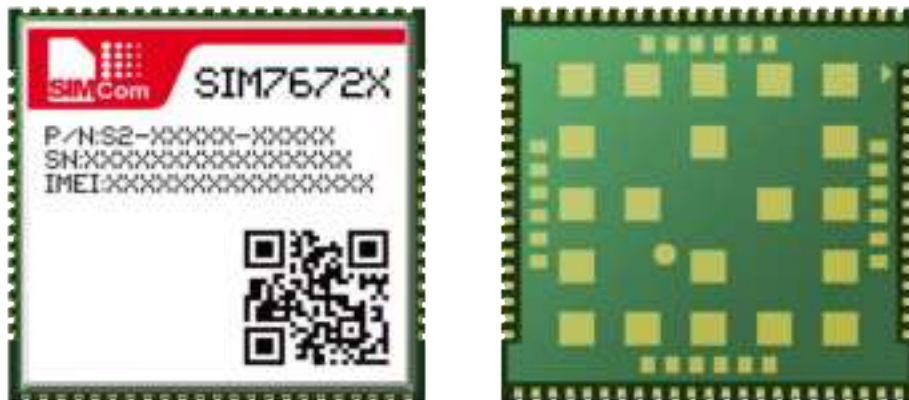


Figure 33: Top and bottom view of SIM7672X

NOTE

The above is the design effect diagram of the module for reference. The actual appearance is subject to the actual product.

6.2. Label Information



Figure 34: Label information for SIM7672X

Table 58: The description of label information

No.	Description
A	Project name
B	Part number
C	Serial number
D	IMEI number
E	QR code

6.3. Typical SMT Reflow Profile

It is recommended to lead free.

During the furnace temperature test, the thermocouple test point should be connected to the module position to ensure that the module position reaches the required temperature. Recommended furnace temperature profile (lead-free SMT reflow) is as follows:

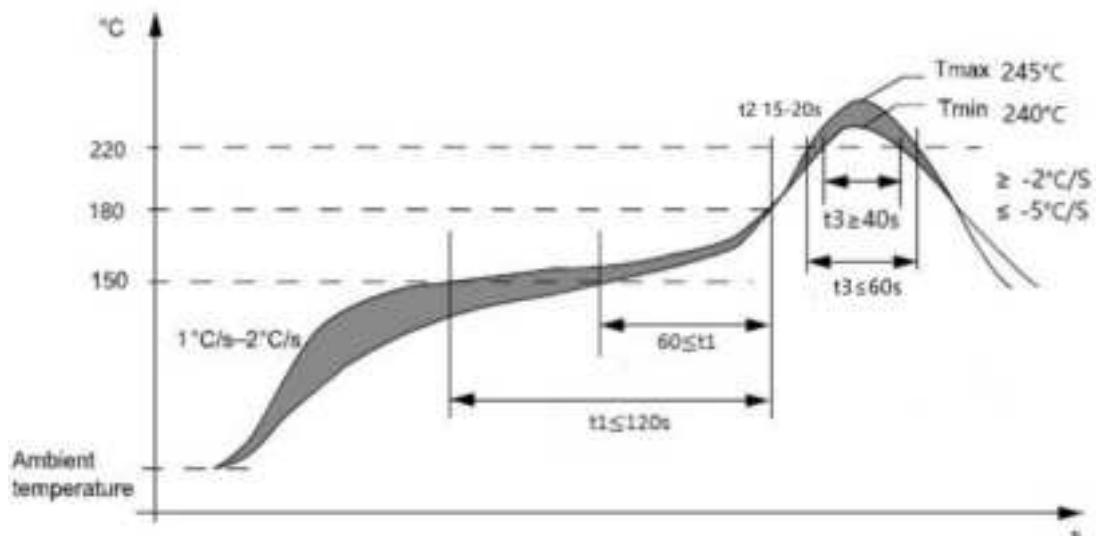


Figure 35: Recommended reflow furnace temperature curve (lead-free)

Table 59: The main board reflux temperature curve requirements (lead-free)

Temperature range	Time	Critical parameter
Preheating zone (room temperature~150 °C)	NA	Temperature rise slope 1~2°C/S
T1(150~180°C)	60-120S	/
T2(180-220°C)	15-20S	/
T3(≥220°C)	40-60S	Peak temperature 240~245°C
Cooling Zone	NA	Cooling slope -2~-5°C/S

NOTE

- The maximum times of refluxes for the module is once.
- Recommended lead-free process.
- In the table above, the temperature testing location includes the solder mask of the module MCU pins, bottom LGA pins, and external LCC pins.
- The actual welding temperature is affected by other external factors, such as the presence of furnace carriers, solder paste, size and thickness of the substrate, and component resistance. Thermal requirements and panel design, etc. Please confirm with our engineering and technical personnel in time if the recommended parameters cannot be reached. Otherwise, the module may be damaged.
- For boards with thickness less than 1.2mm, it is recommended to use board supported by furnace carrier or materials with high Tg to prevent warping and PCB when heated. Deformation, thus affecting module welding. For modules larger than 35.0 mm *35.0 mm and 5G products, it is recommended to use the furnace carrier to pass through the furnace to reduce the cause of the bottom plate and mold. Due to the difference of Tg value of block, the phenomenon of unbalanced thermal stress appears in the process of high temperature welding reflow, resulting in the defect rate of virtual welding and little tin.

- After the module is welded, X-ray and optical inspection methods shall be used to check the welding quality. For specific standards, please refer to relevant standards of IPC-A-610H.
- For more information about shipping and manufacturing, please refer to [Module Secondary SMT Process User Guide](#).
- Due to the complexity of the SMT process, in case of uncertainty or processes not mentioned in this document (such as selective wave soldering, ultrasonic welding), please contact SIMCom support team before SMT process starts.

6.4. Moisture Sensitivity Level (MSL)

The modules are shipped in vacuum-sealed aluminum foil bag bags, vacuum packaging according to IPC/JEDEC standard J-STD-020C specification.

- Recommended storage conditions: The temperature is $23^{\circ}\text{C} \pm 5^{\circ}\text{C}$, and the relative humidity is 35% to 60%.
- Storage period (sealed vacuum packaging): Under recommended storage conditions, the storage period is 12 months.

The module meets the humidity sensitivity level 3, and the storage period after unpacking is shown in table below.

The out-of-bag floor life of the module with MSL-3 is 168 hours. If the workshop temperature is $23^{\circ}\text{C} \pm 5^{\circ}\text{C}$ and the relative humidity is less than 60%, the module needs to be unpacked within 168 hours of reflux production or other high temperature operations. Otherwise, the module shall be stored in an environment with relative humidity less than 10% (for example, a moisture-proof cabinet) to keep the product dry.

Table 60: Moisture Sensitivity Level

MSL	Out-of-bag floor life	Comment
1	Unlimited	$\leq +30^{\circ}\text{C}/85\% \text{ RH}$
2	1 year	$\leq +30^{\circ}\text{C}/60\% \text{ RH}$
2a	4 weeks	
3	168 hours	
4	72 hours	
5	48 hours	
5a	24 hours	
6	Mandatory bake before use. After bake, it must be reflowed within the time limit specified on the label.	

Before using, it is necessary to confirm whether the package is in good condition. After unpacking, check the status of humidity indicator card in vacuum bag (Figure 36). The module needs to be baked before use if any of the following conditions occur.

- Explanation Humidity indicator card: 30%, 40%, and 50% of any indicator circle has discolouring

- The module has been un-packed and the module exceeds the humidity sensitivity level corresponding to the exposed workshop time. For example, MSL=3 is 168.
- Packed, but the Shelf Life exceeds 12 months;
- Exceeds the Floor Life;
- Unable to track and determine the status of the module;

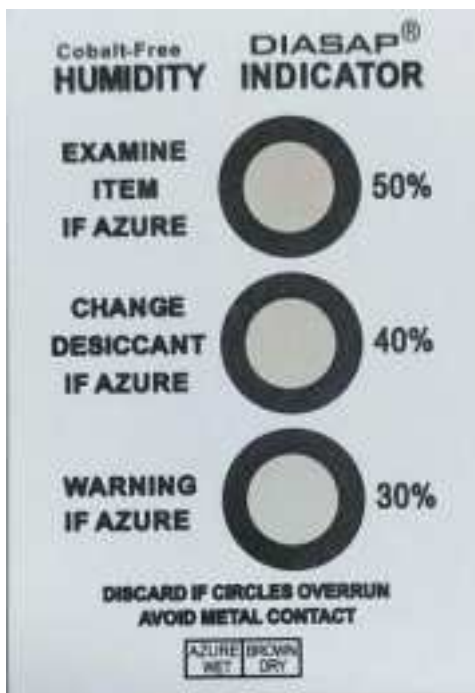


Figure 36: Humidity card

The following conditions also need to be pre-baked.

- The storage temperature and humidity do not meet the recommended storage conditions.
- Vacuum sealed bag leak, bulk materials
- Before repairing the module.
- After unpacking, the module failed to complete production or storage under the control of humidity sensitive level 3.

6.5. Baking Requirements

If baking is required, proceed according to the requirements in the table below. Preferentially choose a nitrogen-filled oven.

Table 61: Module baking requirements

Baking conditions	Baking time	Comment
120°C ± 5°C, <5% RH	8 hours	Not applicable to original packaging pallets

NOTE

- In order to prevent and reduce the occurrence of poor welding caused by moisture, such as foaming and delamination, the module should be strictly controlled. It is not recommended to expose the module to air for a long time after unpacking the vacuum package.
 - Before baking, it is necessary to remove the module from the package and place the bare module on the high temperature resistant device to avoid high temperature damage to the plastic tray or coil; The modules for secondary baking must be welded within 24 hours after baking, otherwise they need to be stored in vacuum packaging or in a drying oven.
 - Please pay attention to ESD protection when unpacking and placing modules, such as wearing anti-static gloves.
-

7. Packaging

SIM7672X module support tray packaging.

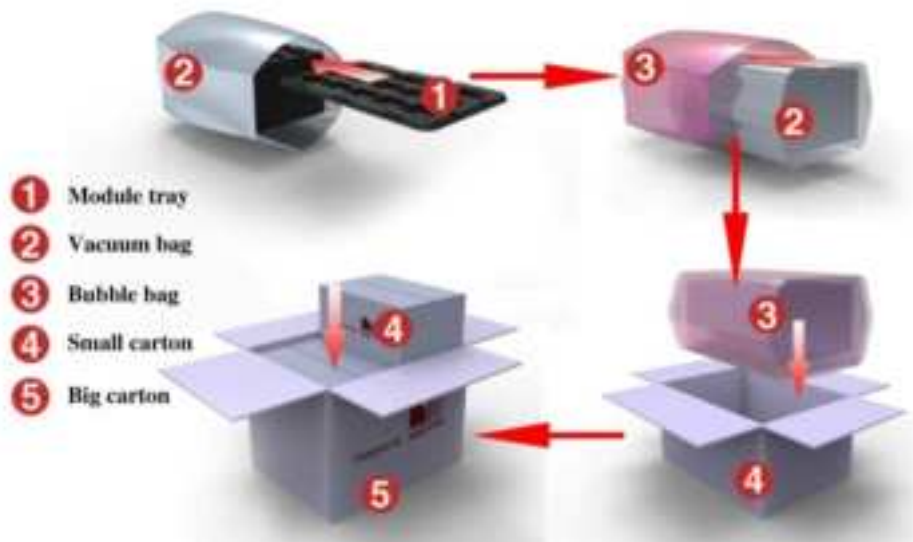


Figure 37: Packaging diagram

Module tray drawing:

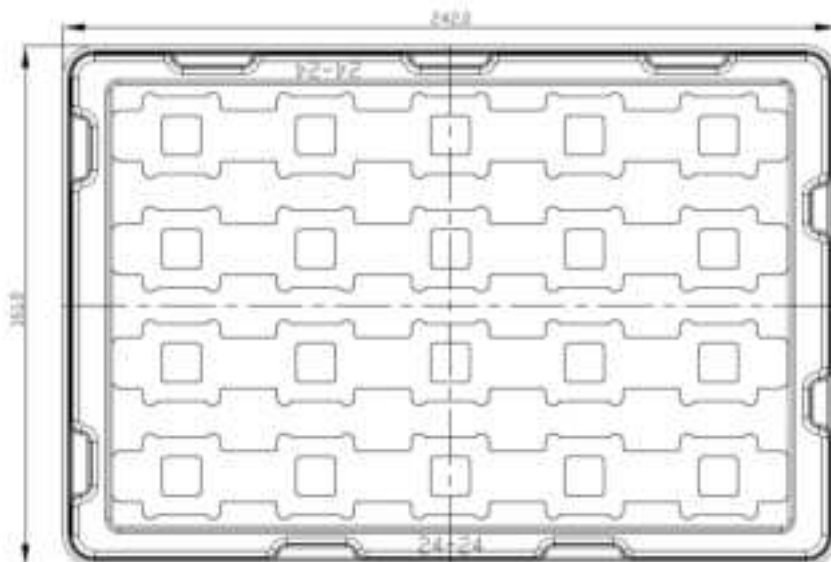


Figure 38: Tray drawing

Table 62: Tray size

Length ($\pm 3\text{mm}$)	Width ($\pm 3\text{mm}$)	Module number
242.0	161.0	20

Small carton drawing:

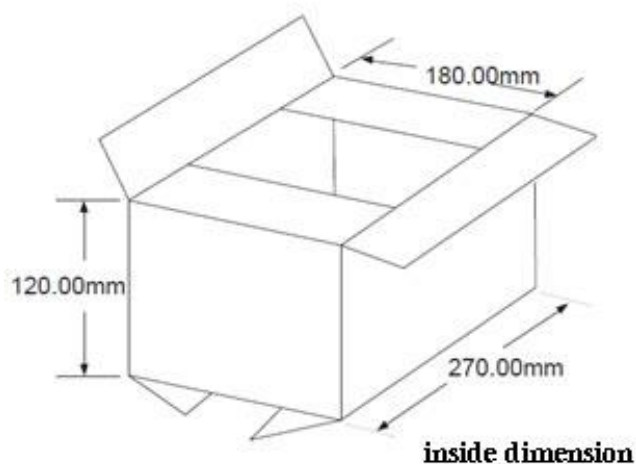


Figure 39: Small carton drawing

Table 63: Small Carton size

Length ($\pm 10\text{mm}$)	Width ($\pm 10\text{mm}$)	Height ($\pm 10\text{mm}$)	Module number
270	180	120	20*20=400

Big carton drawing:

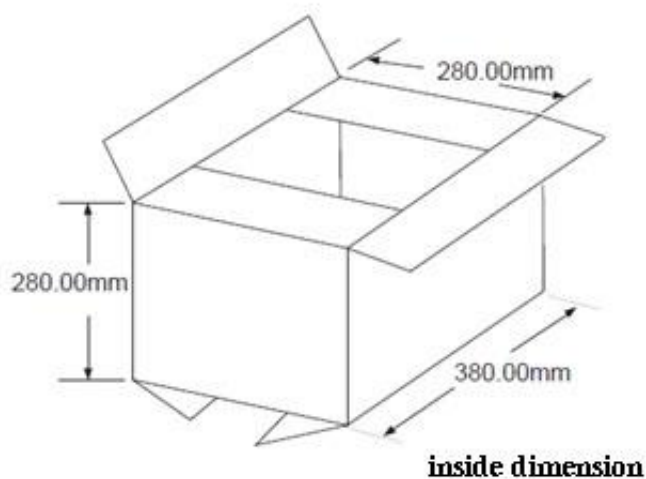


Figure 40: Big carton drawing

Table 64: Big Carton size

Length ($\pm 10\text{mm}$)	Width ($\pm 10\text{mm}$)	Height ($\pm 10\text{mm}$)	Module number
380	280	280	400*4=1600

8. Appendix

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

Table 65: Coding Schemes and Maximum Net Data Rates over Air Interface

LTE-FDD device category (Downlink)	Max data rate (peak)	Modulation type
Category M1	1Mbps	QPSK/16QAM
LTE-FDD device category (Uplink)	Max data rate (peak)	Modulation type
Category M1	375kbps	QPSK/16QAM

8.2. Related Documents

Table 66: Related Documents

NO.	Title	Description
[1]	SIM7672X & SIM7652X _Series_ AT_Command _Manual_ V1.00	AT Command Manual
[2]	ITU-T Draft new recommendation V.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 Process User Guide_V1.01	Module secondary SMT Guidelines
[22]	SIM7672X & SIM7652X Series_UART_Application Note_V1.00	This document describes how to use UART interface of SIMCom modules.
[23]	Antenna design guidelines for diversity receiver system	Antenna design guidelines for diversity receiver system
[24]	SIM7672X & SIM7652X Series_Sleep Mode_Application Note_V1.00	Sleep Mode Application Note
[25]	SIM7672X & SIM7652X Series_UIM HOT SWAP_Application Note_V1.00	This document introduces UIM card detection and UIM hot swap.

8.3. Terms and Abbreviations

Table 67: Terms and Abbreviations







Abbreviation	Description
ADC	Analog-to-Digital Converter
ARP	Antenna Reference Point
BER	Bit Error Rate
BD	BeiDou
BTS	Base Transceiver Station
CS	Coding Scheme
CSD	Circuit Switched Data
CTS	Clear to Send
DAC	Digital-to-Analog Converter
DSP	Digital Signal Processor
DTE	Data Terminal Equipment (typically computer, terminal, printer)
DTR	Data Terminal Ready
DTX	Discontinuous Transmission

DAM	Downloadable Application Module
DPO	Dynamic Power Optimization
EFR	Enhanced Full Rate
EGSM	Enhanced GSM
EMC	Electromagnetic Compatibility
ESD	Electrostatic Discharge
ETS	European Telecommunication Standard
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
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
NMEA	National Marine Electronics Association
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
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
EDGE	Enhanced data rates for GSM evolution
ZIF	Zero intermediate frequency

WCDMA	Wideband Code Division Multiple Access
VCTCXO	Voltage control temperature-compensated crystal oscillator
SIM	Universal subscriber identity module
UMTS	Universal mobile telecommunications system
UART	Universal asynchronous receiver transmitter
PSM	Power saving mode
FD	SIM fix dialing phonebook
LD	SIM last dialing phonebook (list of numbers most recently dialed)
MC	Mobile Equipment list of unanswered MT calls (missed calls)
ON	SIM (or ME) own numbers (MSISDNs) list
RC	Mobile Equipment list of received calls
SM	SIM phonebook
NC	Not connect

8.4. Safety Caution

Table 68: 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.
	<p>GSM cellular terminals or mobiles operating over radio frequency signals and cellular networks 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.</p> <p>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.</p> <p>Also, some networks require that a valid SIM card be properly inserted in the cellular terminal or mobile.</p>