A7672X & SIM767XX Series Compatible Design

LTE Module

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Version History

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1 Introduction

This document is targeted for customers to understand the differences between A7672X and SIM767XX. Customers can use A7672X or SIM767XX series module to design and develop applications quickly.

1.1 Module Overview

The A7672X series module supports LTE-TDD/LTE-FDD/GSM. The SIM767XX series module supports LTE-FDD/LTE-TDD. Customers can choose different types of modules according to their needs to meet diversified market demands.

Table 1: Module basic information comparison

Modules	Rendering	Package	Size	Description
A7672X		80 LCC pins and 44 LGA pins	24*24*2.4 mm	LTE CAT-1
SIM767XX		80 LCC pins and 44 LGA pins	24*24*2.4 mm	LTE CAT-1

1.2 Features

This chapter lists the function parameters of A7672X and SIM767XX, the comparison is as follows:

Table 2: Module function comparison

Function	A7672X series	SIM767XX series
Power	Power supply range: 3.4V~4.2V	Power supply range: 3.4V~4.2V

	Typical value: 3.8V	Typical value: 3.8V
Peak current	2A	0.8A
Sleep current	<2mA	Sleep mode@DRX=0.64S Typical: 950uA
Frequency band	A7672S: GSM:EGSM900/DCS1800 LTE-FDD: 1/3/5/8 LTE-TDD: 34/38/39/40/41 A7672E: GSM:EGSM900/DCS1800 LTE-FDD: 1/3/5/7/8/20 A7672SA: GSM:GSM850/EGSM900/DCS1800/PCS1900 LTE-FDD: 1/2/3/4/5/7/8/28/66	SIM7672E: LTE-FDD: 1/3/5/7/8/20/28 SIM7672NA: LTE-FDD: 2/4/5/12/13/14/66/71 SIM7672G: LTE-FDD: 1/2/3/4/5/7/8/12/13/18/19/20/25/26/28/66/71 LTE-TDD: 34/38/39/40/41
GNSS	Support GNSS function interface	Support GNSS function interface
Temperature range	Normal working temperature: -30°C ~ +80°C Extended operating temperature: -40°C ~ +85°C * Storage temperature: -45°C ~ +90°C	Normal working temperature: -30°C ~ +75°C Extended operating temperature: -40°C ~ +85°C * Storage temperature: -45°C ~ +90°C
UART interface	Main serial port UART1: ● For AT command transmission and data transmission ● Baud rate supports from 300bps to 3686400bps, the default is 115200bps ● Support RTS and CTS hardware flow control ● Support serial port multiplexing function in accordance with GSM 07.10 protocol Debug serial port UART_LOG: ● Support debug usage UART3 serial port: ● Ordinary serial port	Main serial port UART: ● For AT command transmission and data transmission ● Baud rate supports from 600bps to 460800bps, the default is 115200bps ● Support RTS and CTS hardware flow control ● Support serial port multiplexing function in accordance with GSM 07.10 protocol Debug serial port DEBUG_UART: ● Support debug usage AUX serial port AUX_UART: ● Support GNSS communication function
(U)SIM interface	Support (U)SIM card: 1.8V/3.0V	Support (U)SIM card: 1.8V/3.0V
PCM interface	NA	● Supports a PCM digital audio interface ● Support 16bits linear encoding format ● Support short frame mode Only supports master mode. The function is in development.
USB interface	USB2.0, only supports slave mode, the maximum data transfer rate is 480Mbps	USB2.0, only supports slave mode, the maximum data transfer rate is 480Mbps
SD card interface	NA	NA

SGMII interface	NA	NA
WLAN/BT interface	Only supports Bluetooth data transmission	SIM7672G supports Wi-Fi scanner
ADC interface	● Provide a ADC and a VBAT_ADC interfaces ● Voltage range: 0~1.8V Resolution: 9 bits	● Provide two ADC interfaces ● Voltage range: 0~1.1V Resolution: 12 bits
Network indication	NETLIGHT: Network indication	NETLIGHT: Network indication
Diversity indication	No	No
Antenna interface	Main antenna interface GNSS antenna interface(optional) Bluetooth antenna interface(optional)	Main antenna interface GNSS antenna interface
Software upgrade	Upgrade software via USB	Upgrade software via USB or UART

NOTE

In the extended operating temperature range, the module can work normally, but does not guarantee full compliance with 3GPP test specifications.

2 Package Introduction

2.1 Pin Assignment Overview

The following figure shows the pin assignment of A7672X and SIM767XX.

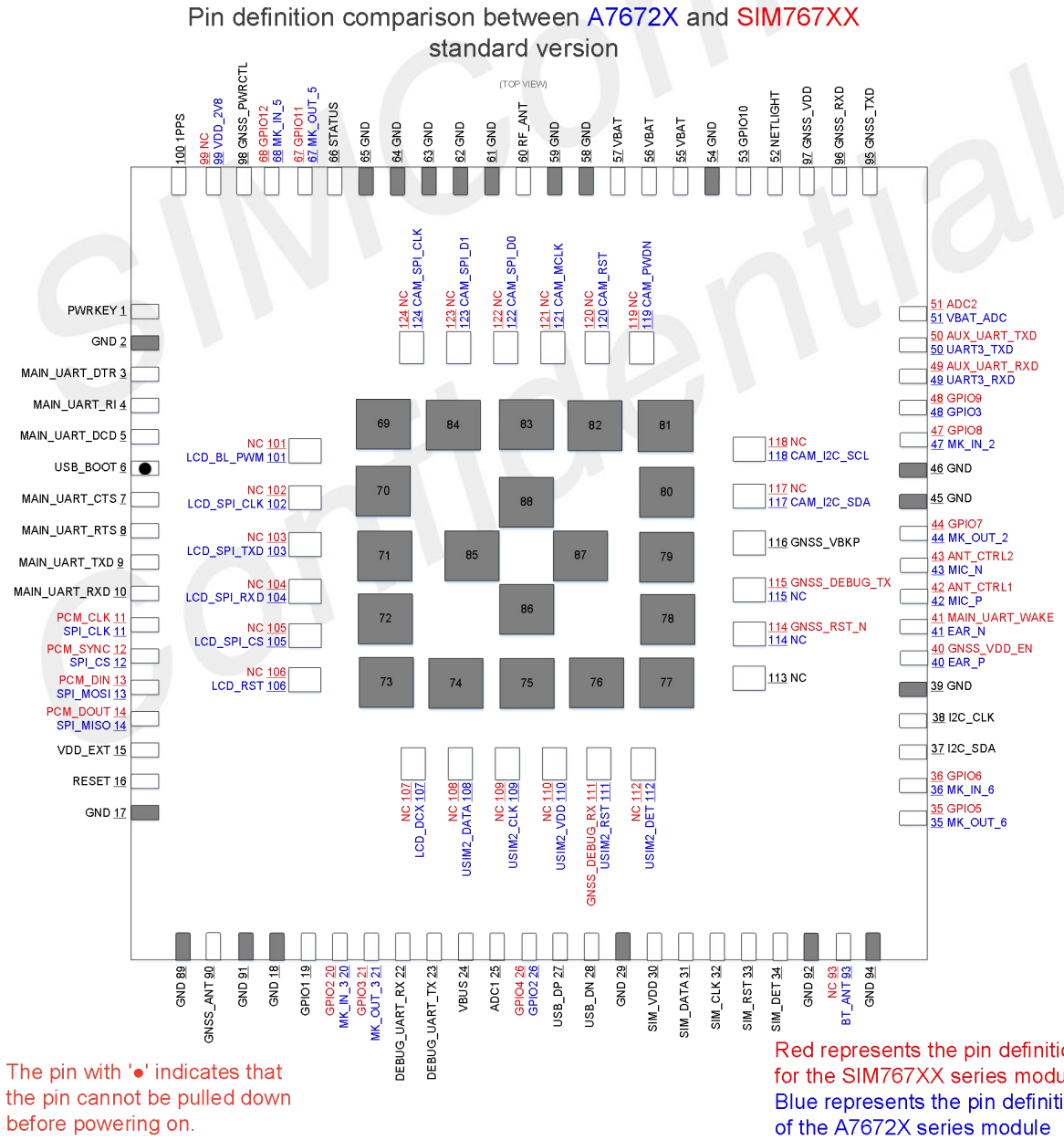

Figure 1: A7672X and SIM767XX pin assignment (Top view)

2.2 Pin definition

This chapter describes the pin definition and comparison of A7672X and SIM767XX series.

Table 3: Pin type definition

PIN type	Description
PI	Power input
PO	Power output
AI	Analog input
AO	Analog output
I/O	Input or 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

Table 4: Module pin definition comparison

A7672X				SIM767XX			
Pin No.	Pin Name	I/O	Power domain	Pin No.	Pin Name	I/O	Power domain
1	PWRKEY	DI	Power ON/OFF input, active low. V_{IH}: 0.7*VBAT V_{IL}: 0.3*VBAT	1	PWRKEY	DI	Power ON/OFF input, active low. V_{IH}: 2.1V V_{IL}: 0.4V
2	GND	-	GND	2	GND	-	GND
3	DTR	DI	1.8V	3	MAIN_UART_DTR	DI	1.8V
4	RI	DO	1.8V	4	MAIN_UART_RI	DO	1.8V
5	DCD	DO	1.8V	5	MAIN_UART_DCD	DO	1.8V
6	USB_BOOT●	DI	1.8V	6	USB_BOOT●	DI	1.8V
7	CTS	DO	1.8V	7	MAIN_UART_CTS	DO	1.8V
8	RTS	DI	1.8V	8	MAIN_UART_RTS	DI	1.8V
9	TXD	DOH	1.8V	9	MAIN_UART_TXD	DOH	1.8V
10	RXD	DI	1.8V	10	MAIN_UART_RXD	DI	1.8V

11	SPI_CLK	IO, PD	1.8V	11	PCM_CLK	IO, PD	1.8V
12	SPI_CS	IO, PD	1.8V	12	PCM_SYNC	IO, PD	1.8V
13	SPI_MOSI	DO ,PD	1.8V	13	PCM_DIN	DI, PD	1.8V
14	SPI_MISO	DI, PD	1.8V	14	PCM_DOUT	DO ,PD	1.8V
15	VDD_EXT	PO	1.8V	15	VDD_EXT	PO	1.8V
16	RESET	DI, PU	System reset control input, active low. V_{IH}: 0.7*VBAT V_{IL}: 0.3*VBAT	16	RESET	DI, PU	System reset control input, active low. V_{IH}: 1.5V V_{IL}: 0.4V
17	GND	-	GND	17	GND	-	GND
18	GND	-	GND	18	GND	-	GND
19	GPIO1	IO, PU	1.8V	19	GPIO1	IO, PU	1.8V
20	MK_IN_3	DI	1.8V	20	GPIO2	IO, PD	1.8V
21	MK_OUT_3	DO	1.8V	21	GPIO3	IO, PU	1.8V
22	UART_LOG_RX	DI	1.8V	22	DEBUG_UART_RX	DI	1.8V
23	UART_LOG_TX	DO H	1.8V	23	DEBUG_UART_TX	DO H	1.8V
24	VBUS	AI	Valid USB detection input. Active high, Vmax(valid)= 3.0V, Vmax(detection)=5.2V	24	VBUS	AI	Valid USB detection input. Active high, Vmax(valid)= 3.6V, Vmax(detection)=5.2V
25	ADC	AI	0V-1.8V	25	ADC1	AI	0V-1.1V
26	GPIO2	IO, PD	1.8V	26	GPIO4	IO, PD	1.8V
27	USB_DP	IO	-	27	USB_DP	IO	-
28	USB_DM	IO	-	28	USB_DN	IO	-
29	GND	-	GND	29	GND	-	GND
30	USIM1_VDD	PO	1.8V/3.0V	30	SIM_VDD	PO	1.8V/3.0V
31	USIM1_DATA	IO, PU	1.8V/3.0V	31	SIM_DATA	IO, PU	1.8V/3.0V
32	USIM1_CLK	IO, PU	1.8V/3.0V	32	SIM_CLK	IO, PU	1.8V/3.0V
33	USIM1_RST	IO,	1.8V/3.0V	33	SIM_RST	IO,	1.8V/3.0V

		PU				PU	
34	USIM1_DET	IO, PU	1.8V	34	SIM_DET	IO, PU	1.8V
35	MK_OUT_6/I2C3_SDA	IO	1.8V	35	GPIO5	IO, PU	1.8V
36	MK_IN_6/I2C3_SCL	IO	1.8V	36	GPIO6	IO, PU	1.8V
37	I2C_SDA	IO	1.8V	37	I2C_SDA	IO	1.8V
38	I2C_CLK	DO	1.8V	38	I2C_CLK	DO	1.8V
39	GND	-	GND	39	GND	-	GND
40	EAR_P	AIO	1.8V	40	GNSS_VDD_EN	DI	1.8V
41	EAR_N	AIO	1.8V	41	MAIN_UART_WAKE	DI	1.8V
42	MIC_P	AIO	1.8V	42	ANT_CTRL1	DO	1.8V
43	MIC_N	AIO	1.8V	43	ANT_CTRL2	DO	1.8V
44	MK_OUT_2	DO	1.8V	44	GPIO7	IO, PU	1.8V
45	GND	-	GND	45	GND	-	GND
46	GND	-	GND	46	GND	-	GND
47	MK_IN_2	DI	1.8V	47	GPIO8	IO, PU	1.8V
48	GPIO3	IO, PD	1.8V	48	GPIO9	IO, PD	1.8V
49	UART3_RXD	DI	1.8V	49	AUX_UART_RXD	DI	1.8V
50	UART3_TXD	DOH	1.8V	50	AUX_UART_TXD	DOH	1.8V
51	VBAT_ADC	AI	-	51	ADC2	AI	0V-1.1V
52	NETLIGHT	DO	1.8V	52	NETLIGHT	DO	1.8V
53	GPIO4	IO, PU	1.8V	53	GPIO10	IO, PU	1.8V
54	GND	-	GND	54	GND	-	GND
55	VBAT	PI	3.4V~4.2V	55	VBAT	PI	3.4V~4.2V
56	VBAT	PI	3.4V~4.2V	56	VBAT	PI	3.4V~4.2V
57	VBAT	PI	3.4V~4.2V	57	VBAT	PI	3.4V~4.2V
58	GND	-	GND	58	GND	-	GND
59	GND	-	GND	59	GND	-	GND
60	RF_ANT	AIO	-	60	RF_ANT	AIO	-
61	GND	-	GND	61	GND	-	GND
62	GND	-	GND	62	GND	-	GND
63	GND	-	GND	63	GND	-	GND
64	GND	-	GND	64	GND	-	GND

65	GND	-	GND	65	GND	-	GND
66	STATUS	DO	1.8V	66	STATUS	DO	1.8V
67	MK_OUT_5	DO	1.8V	67	GPIO11	IO, PU	1.8V
68	MK_IN_5	DI	1.8V	68	GPIO12	IO, PU	1.8V
69	GND	-	GND	69	GND	-	GND
70	GND	-	GND	70	GND	-	GND
71	GND	-	GND	71	GND	-	GND
72	GND	-	GND	72	GND	-	GND
73	GND	-	GND	73	GND	-	GND
74	GND	-	GND	74	GND	-	GND
75	GND	-	GND	75	GND	-	GND
76	GND	-	GND	76	GND	-	GND
77	GND	-	GND	77	GND	-	GND
78	GND	-	GND	78	GND	-	GND
79	GND	-	GND	79	GND	-	GND
80	GND	-	GND	80	GND	-	GND
81	GND	-	GND	81	GND	-	GND
82	GND	-	GND	82	GND	-	GND
83	GND	-	GND	83	GND	-	GND
84	GND	-	GND	84	GND	-	GND
85	GND	-	GND	85	GND	-	GND
86	GND	-	GND	86	GND	-	GND
87	GND	-	GND	87	GND	-	GND
88	GND	-	GND	88	GND	-	GND
89	GND	-	GND	89	GND	-	GND
90	GNSS_ANT	AIO	-	90	GNSS_ANT	AIO	-
91	GND	-	GND	91	GND	-	GND
92	GND	-	GND	92	GND	-	GND
93	BT_ANT	AIO	-	93	NC	-	-
94	GND	-	GND	94	GND	-	GND
95	GNSS_TXD	DO	1.8V	95	GNSS_TXD	DO	1.8V
96	GNSS_RXD	DI	1.8V	96	GNSS_RXD	DI	1.8V
97	1V8_GNSS	PI	-	97	GNSS_VDD	PI	-
98	GNSS_PWRCTL	DI	1.8V	98	GNSS_PWRCTL	DI	1.8V
99	VDD_2V8	PO	-	99	NC	-	-
100	1PPS	DO	1.8V	100	1PPS	DO	1.8V
101	LCD_BL_PWM	DO	1.8V	101	NC	-	-
102	LCD_SPI_CLK	DO	1.8V	102	NC	-	-
103	LCD_SPI_TXD	DI, DO	1.8V	103	NC	-	-
104	LCD_SPI_RXD	DI	1.8V	104	NC	-	-

105	LCD_SPI_CS	DO	1.8V	105	NC	-	-
106	LCD_RST	DO	1.8V	106	NC	-	-
107	LCD_DCX	DO	1.8V	107	NC	-	-
108	USIM2_DATA	I/O, PU	1.8/3.0V	108	NC	-	-
109	USIM2_CLK	I/O, PU	1.8/3.0V	109	NC	-	-
110	USIM2_VDD	PO	1.8/3.0V	110	NC	-	-
111	USIM2_RST	I/O, PU	1.8/3.0V	111	GNSS_DEBUG_RX	DI	1.8V
112	USIM2_DET	IO, PU	1.8V	112	NC	-	-
113	NC	-	-	113	NC	-	-
114	NC	-	-	114	GNSS_RST_N	AI	-
115	NC	-	-	115	GNSS_DEBUG_TX	DO	1.8V
116	GNSS_VBKP	PI	-	116	GNSS_VBKP	PI	-
117	CAM_I2C_SDA	DI, DO	1.8V	117	NC	-	-
118	CAM_I2C_SCL	DO	1.8V	118	NC	-	-
119	CAM_PWDN	DO	1.8V	119	NC	-	-
120	CAM_RST	DO	1.8V	120	NC	-	-
121	CAM_MCLK	DO	1.8V	121	NC	-	-
122	CAM_SPI_D0	DI	1.8V	122	NC	-	-
123	CAM_SPI_D1	DI	1.8V	123	NC	-	-
124	CAM_SPI_CLK	DO	1.8V	124	NC	-	-

NOTE

The PIN name highlighted in blue indicates A7672X.
The PIN name highlighted in red indicates SIM767XX.
The PIN Marked '●' is used to enter forced download mode, and it cannot be pulled down before the module powered up, otherwise it will affect the normal start-up of the module.

3 Physical Size

This chapter introduces the A7672X and SIM767XX series modules' external dimensions and the recommended PCB footprint outline.

3.1 Top and Bottom View

The following figures show top and bottom view of A7672X and SIM767XX.

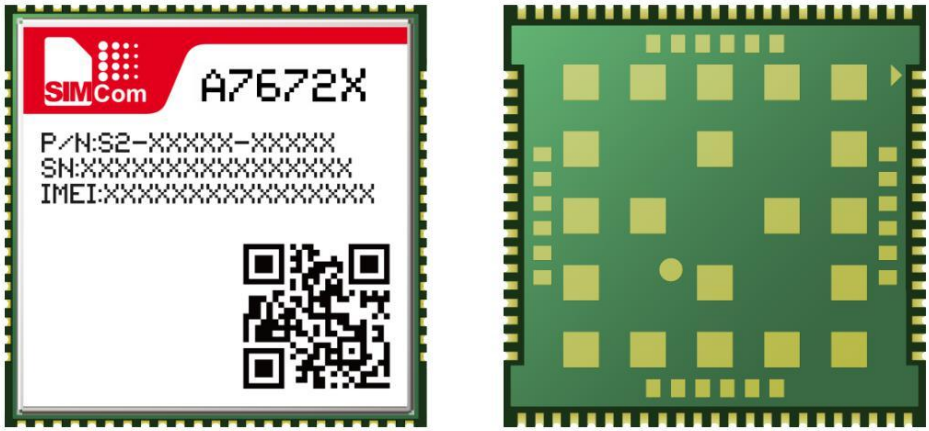

Figure 2: A7672X top and bottom view

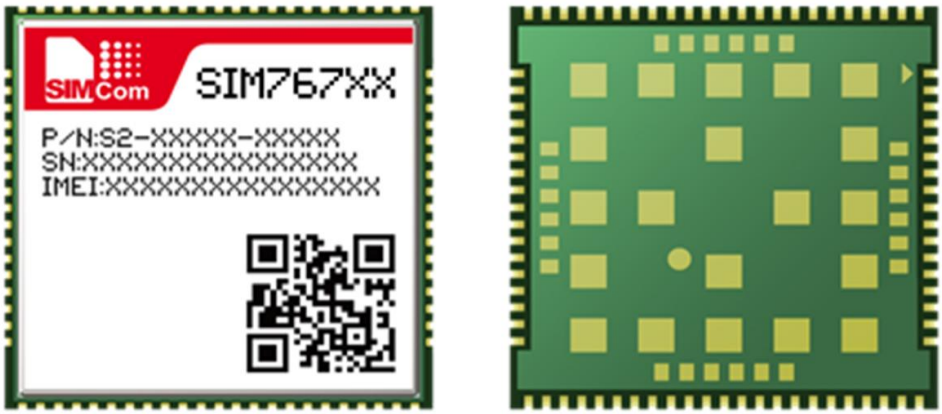

Figure 3: SIM767XX top and bottom view

NOTE

The above is the design effect drawing of the module for reference, and the actual appearance shall prevail in kind.

3.2 Recommended PCB footprint outline

A7672X and SIM767XX series have the same recommended PCB footprint outline.

The recommended PCB footprint outline for A7672X/SIM767XX series is shown as below.

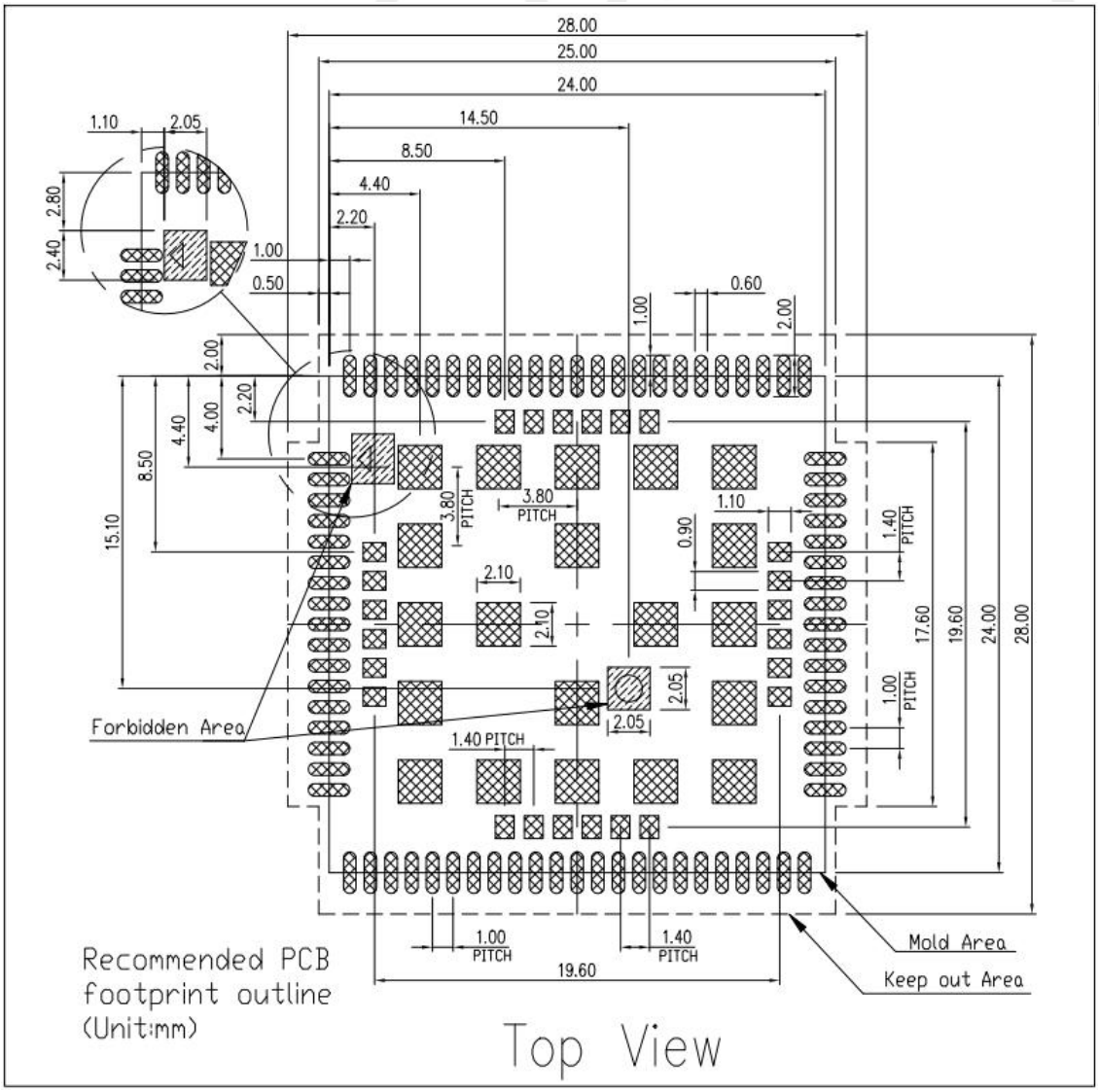

Figure 4: Recommended PCB footprint outline (Unit: mm)

NOTE

For details information, please refer to each HD guide.

4 Hardware Reference Design

Customers using A7672X and SIM767XX interfaces can refer to the design in this chapter.

4.1 Power Supply

4.1.1 Power requirements

The following table shows the supply voltage range of A7672X and SIM767XX series.

Table 5: Module recommended supply voltage comparison

Modules	Power Pin	Symbol description	Min	Typical	Max	Unit
A7672X series	VBAT	Power supply range	3.4	3.8	4.2	V
SIM767XX series	VBAT	Power supply range	3.4	3.8	4.2	V

When the A7672X is at the maximum power in GSM TX mode, the peak current can reach 2A (peak current), which results in a large voltage drop on VBAT. In order to ensure that the voltage drop is less than 300mV, the power supply capacity of external power supply must be no less than 2A. The sudden current and voltage drop model at the battery end are shown in the figure below:

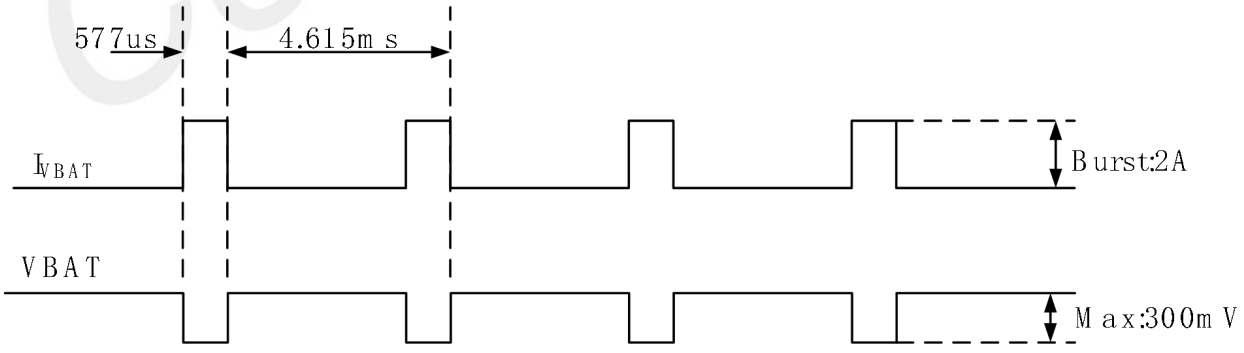

Figure 5: A7672X Burst transmission power requirements

In the customer's design, special attention must be paid to the design of the power supply section to ensure that even when the current consumption of the module reaches the peak current, the drop of VBAT does not fall below 3.4V. If the voltage drops below 3.4V, the RF performance of the module will be affected.

NOTE

- When the power supply of A7672X can provide a peak current of 2A, the total capacitance of the external power supply capacitor is recommended not to be less than 300uF; if it cannot provide a peak current of 2A, it is recommended that the total capacitance of the external capacitor is not less than 600uF to ensure that the voltage drop on the VBAT at any time does not exceed 300mV.
- When the power supply of SIM767XX can provide a peak current of 0.8A, the total capacity of the external power supply capacitance is recommended to be no less than 100uF.

It is recommended to place four ceramic capacitors of 10pF/33nF/0.1uF/1uF close to VBAT to improve RF performance and system stability. At the same time, it is recommended that the width of the VBAT trace between the power supply on the PCB and the module is at least 3mm. The reference design recommendations are as follows:
If the VBAT input contains high frequency interference, it is recommended to add magnetic beads for filtering. The recommended models of magnetic beads are BLM21PG300SN1D and MPZ2012S221A.

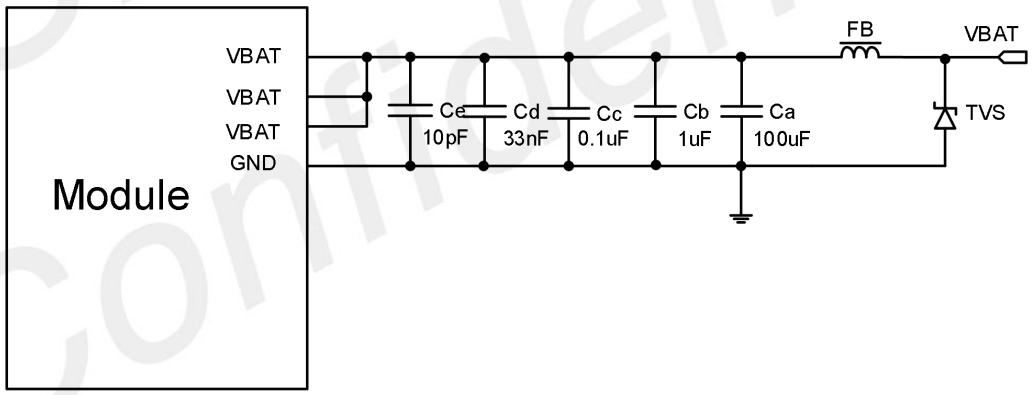

Figure 6: VBAT input reference circuit

Table 6: TVS for VBAT part number list

Manufacturer	Part Number	V_{RWM}	$V_{C}max$	$P_{PP}max$	$C_{J}max$	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

4.1.2 Recommended external power circuit

The module power supply design is the basis for the stable performance of the module. When choosing a power supply, it is necessary to ensure that it has a load capacity of at least 2A. 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:

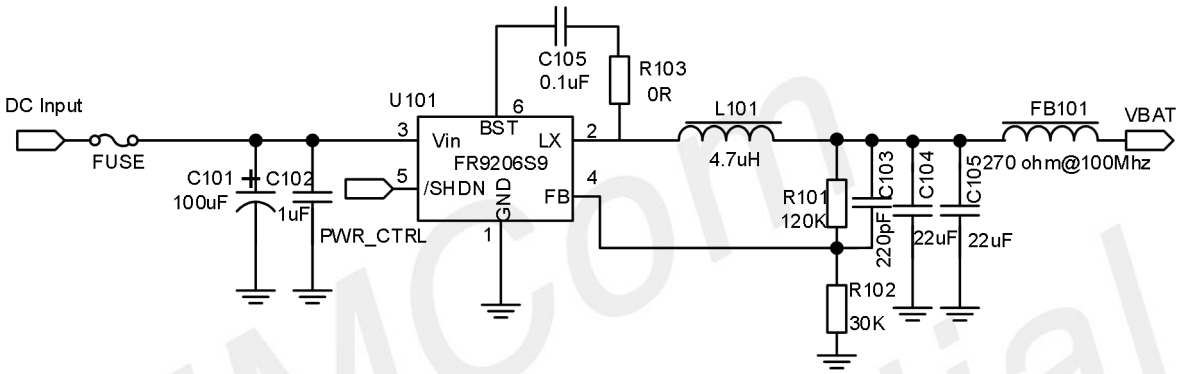

Figure 7: Recommended circuit for switching power supply

4.2 Power on/off Circuit

A7672X &SIM767XX series can be turned on by driving the PWRKEY pin to a low level for a certain time. . Using an open drain or collector driver is recommended to control the PWRKEY. The reference circuit is shown below.

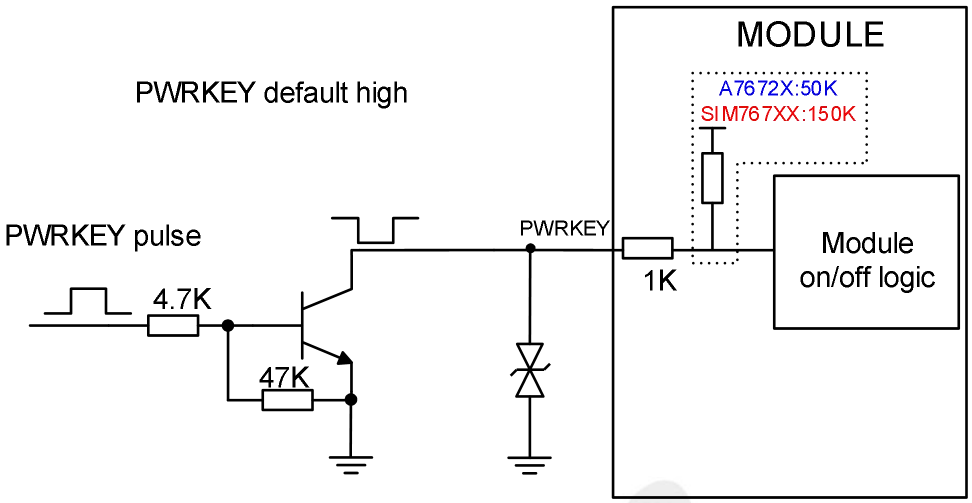

Figure 8: Power on/off reference circuit

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

- Power off by pulling the PWRKEY pin down to a low level.
- Power off Module by AT command 'AT+CPOF'.
- Over-voltage or under-voltage automatic power off, use "AT+CPMVT" to set the voltage range.
- 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 power 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.

Table 6: Power on timing and electronic characteristic

Symbol	A7672X				SIM767XX			
	Min	Typ	Max	Unit	Min	Typ	Max	Unit
T_{on}	-	30	-	ms	-	50	-	ms
V_{IH}	0.7* VABT	-	VBAT	V	-	2.1	-	V
V_{IL}	0	0	0.3* VBAT	V	0	0	0.4	V

4.3 Reset Circuit

The A7672X and SIM767XX series can be reset by pulling down the reset pin to a low level. The recommended circuit is as follows:

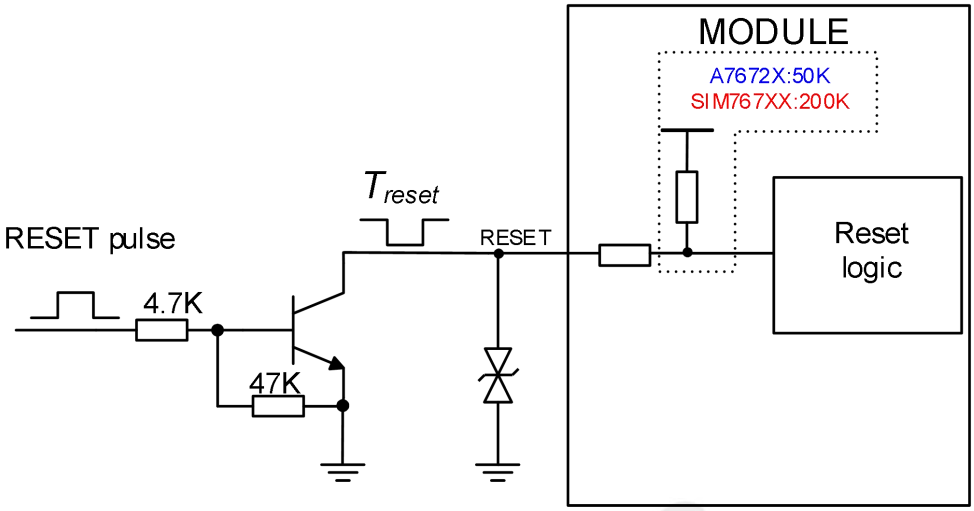

Figure 9: Reference reset circuit

Table 7: RESET pin electronic characteristic

Symbol	A7672X				SIM767XX			
	Min	Typ	Max	Unit	Min	Typ	Max	Unit
T_{on}	2	2.5	-	s		0.5	-	s
V_{IH}	0.7* VBAT	-	VBAT	V	1.5		3.3	V
V_{IL}	0	0	0.3* VBAT	V	-0.3	0	0.4	V

4.4 USB Interface

Both A7672X and SIM767XX series module provide a USB2.0 interface, supporting high-speed 480Mbps and full-speed mode 12Mbps, and do not support USB charging function and USB HOST mode.

USB is the main debugging port and software upgrade interface. It is recommended that customers reserve USB test points during design. If the main control chip is connected, 0R resistors should be reserved for switching external test points during design, as shown in the figure below.

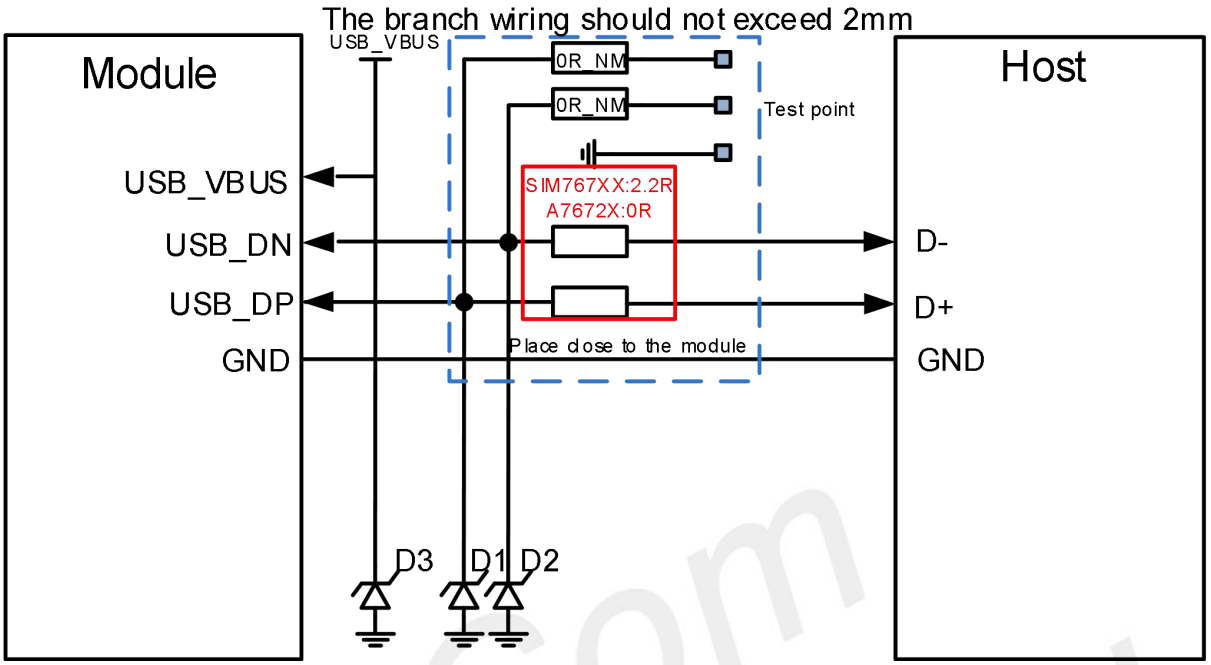

Figure 10: USB reference circuit

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 8: TVS for USB part number list

Manufacturer	Part Number	V_{RWM}	$V_C$max	$C_J$max	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

4.5 USB_BOOT Interface

A7672X and SIM767XX series support the USB forced download function.
Before the A7672X/SIM767XX is powered on, customer can pull the USB_BOOT pin to GND, then apply VBAT power to the module, and press PWRKEY to enter the download mode.

The reference circuit is as follows:

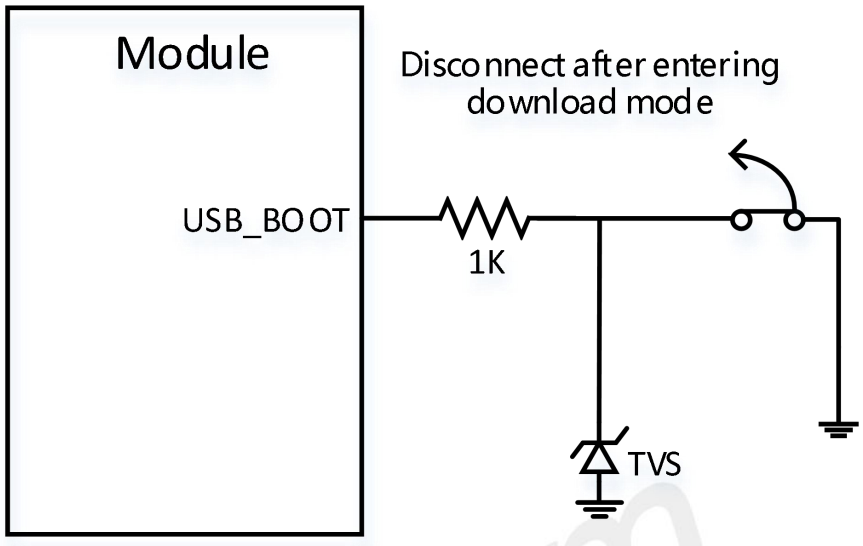

Figure 11: Forced download reference circuit

4.6 Network Indication

The NETLIGHT pins can be used to drive a network status indicator LED. The following circuit is the reference design.

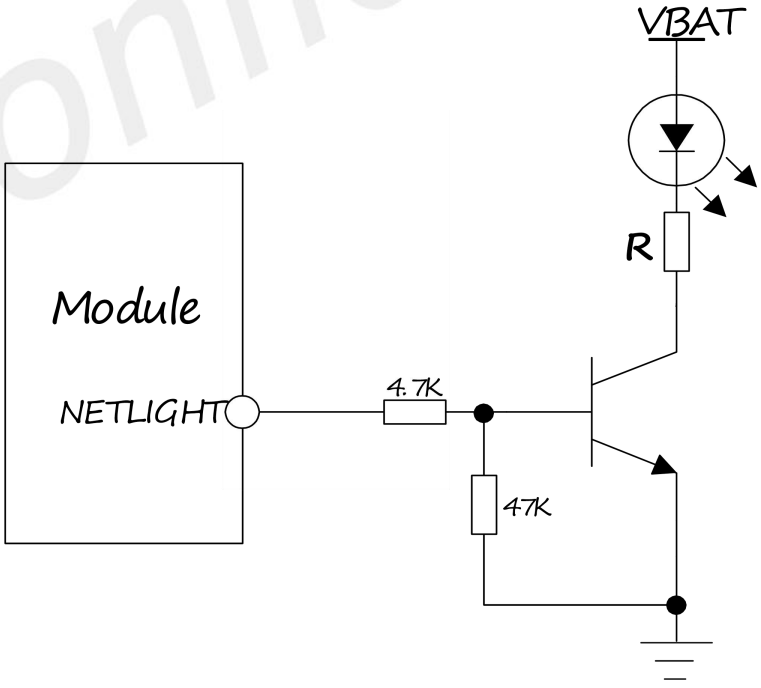

Figure 12: NETLIGHT/STATUS reference circuit

Table 9: NETLIGHT pin status

Module	NETLIGHT pin status	Module status
SIM767XX	Always On	Searching Network
	200ms ON, 200ms OFF	Data Transmit/Registered
	OFF	Power off / Sleep
A7672X	Always On	Searching Network
	200ms ON, 200ms OFF	Data Transmit
	800ms ON, 800ms OFF	Registered network
	OFF	Power off / Sleep

NOTE

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

4.7 USIM Interface

A7672X and SIM767XX series support 1.8V/3.0V (U)SIM card by default and support hot-swappable function. The USIM peripheral circuit should be close to the USIM card socket. The following figure shows the 6-pin SIM card holder reference circuit.

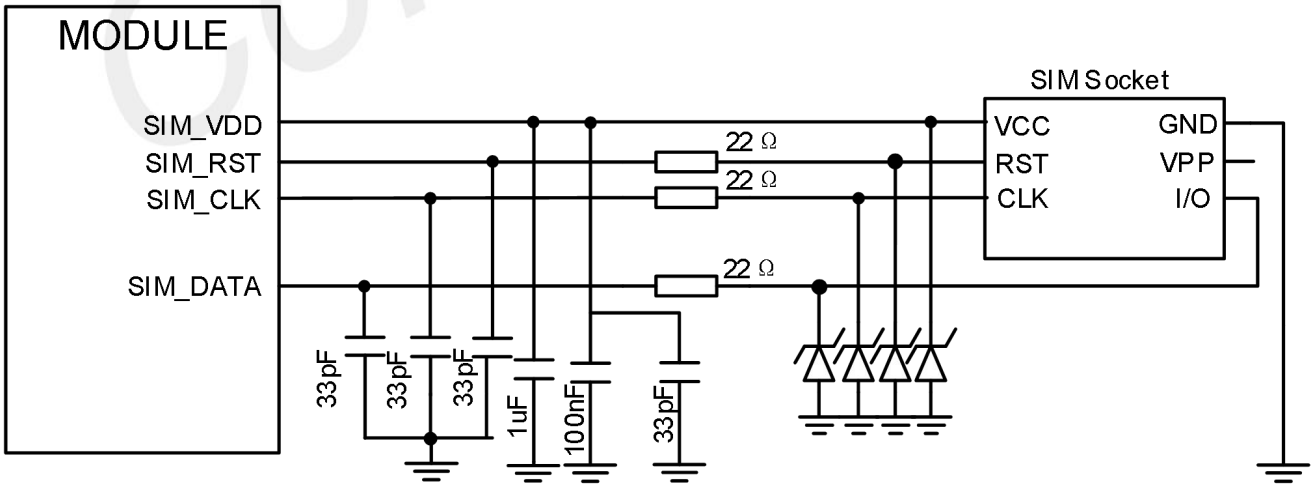

Figure 13: SIM interface reference circuit

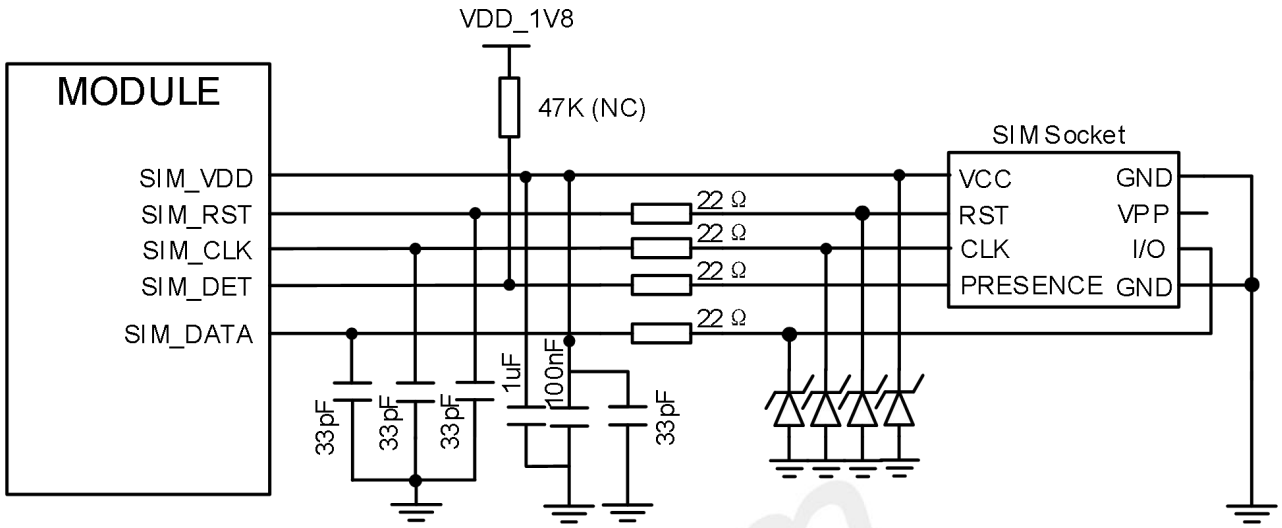

Figure 14: SIM interface reference circuit (8PIN)

Table 10: TVS for USIM part number list

Manufacturer	Part Number	V_{RWM}	V_Cmax	$P_{PP}max$	C_Jmax	Package
WAYON	WE05DUCF	5V	8.5V	56W	0.7pF	DFN1006-2L
WILL	ESD9X5VU-2/TR	5V	8V	72W	0.9pF	DFN1006-2L

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”AT command to set module SIM card hot swap function enable. This function is disabled by default.
4. Using “AT+UIMHOTSWAPLEVEL=0 or 1”AT command to set the SIM card detection level to adapt the signal logic.
5. Please refer to each AT Command Manual for more details of AT commands about USIM.

4.8 UART Interface

A7672X/SIM767XX series provide three serial ports, one main full-function communication serial port UART, one ordinary two-wire serial port, one print LOG serial port.

Below are the reference circuits.

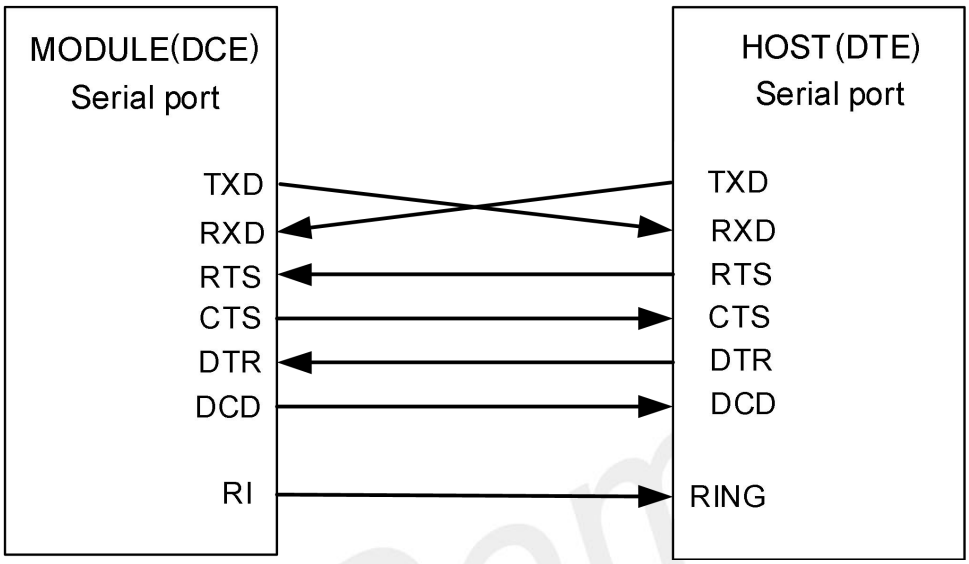

Figure 15: UART Full modem

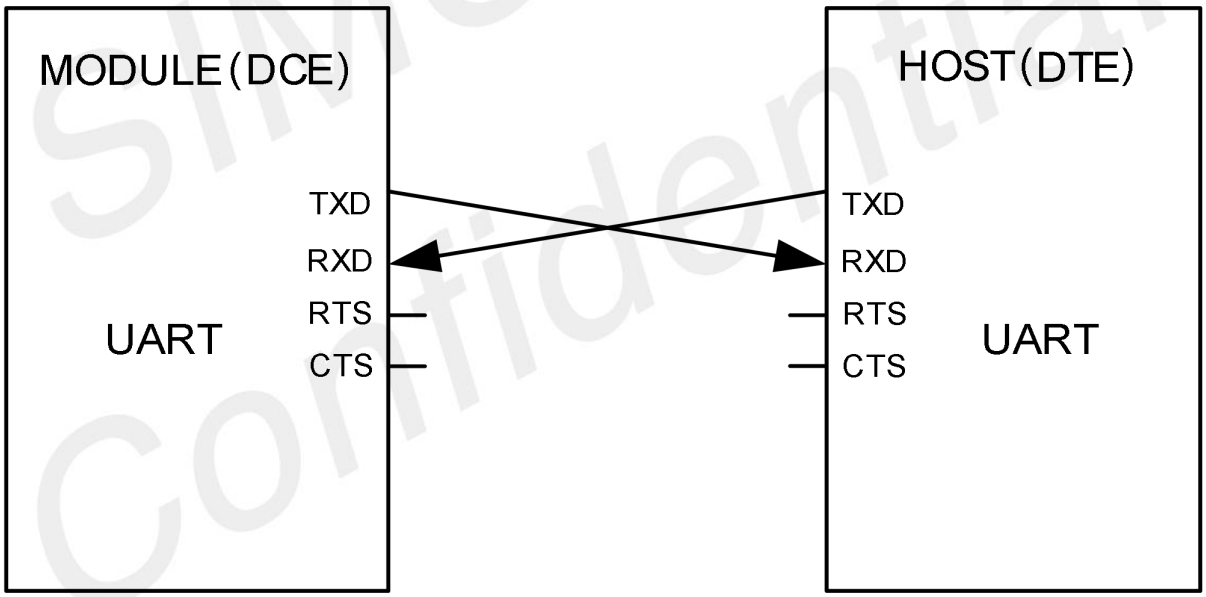

Figure 16: UART Null modem

The following figure shows the use of a transistor for circuit conversion. The circuit in the dotted line can refer to the circuit of the solid line TXD and RXD, and you need to pay attention to the direction of the signal. The recommended transistor model here is MMBT3904.

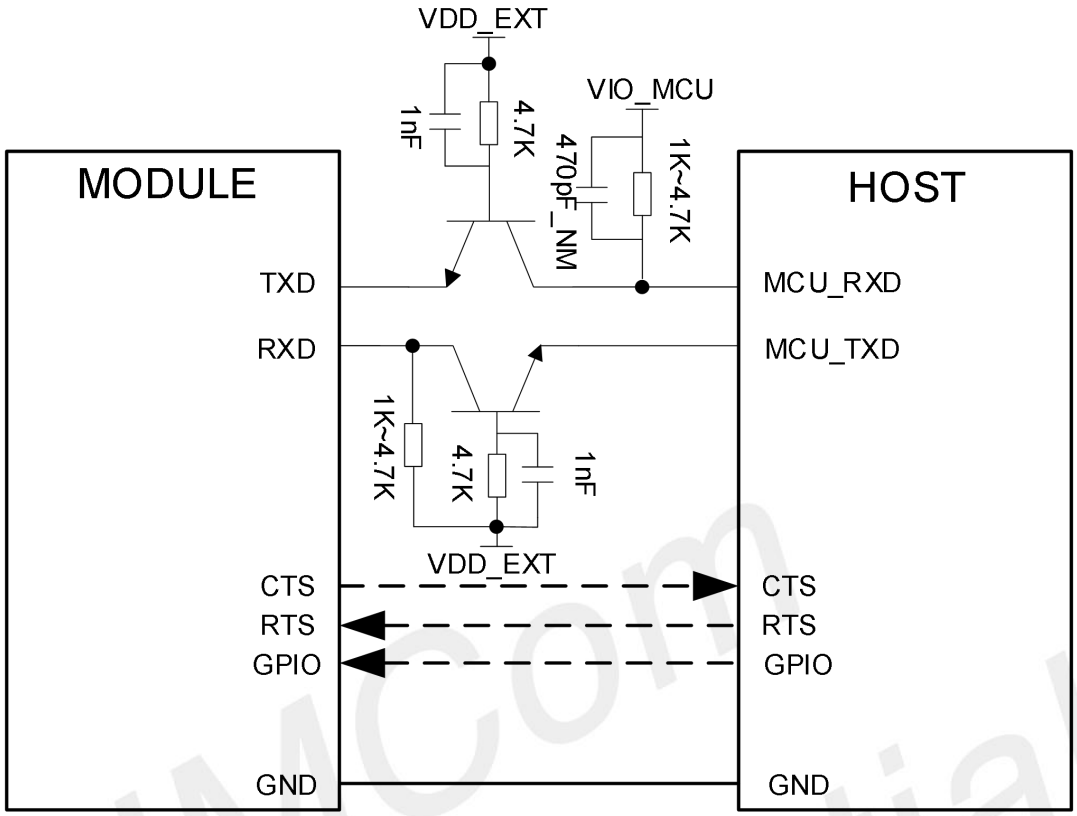

Figure 17: Triode level conversion circuit

NOTE

1. Main UART of A7672X supports the following baud rates: 300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200, 230400, 460800, 921600, 1842000 and 3686400. The default baud rate is 115200bps.
2. Main UART of SIM767XX supports the following baud rates: 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600,115200, 230400 and 460800. The default baud rate is 115200bps.
3. The maximum baud rate supported by A7672X ordinary serial port is 921600. The maximum baud rate supported by SIM767XX ordinary serial port is 460800.
4. 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.

4.9 PCM Interface*

SIM767XX 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.

SIM767XX supports voice function, does not support VoLTE function. Customers can use voice function on PCM external codec. For specific parameters and matters, please refer to the relevant manuals of the software.

The recommended circuit of PCM is as follows:

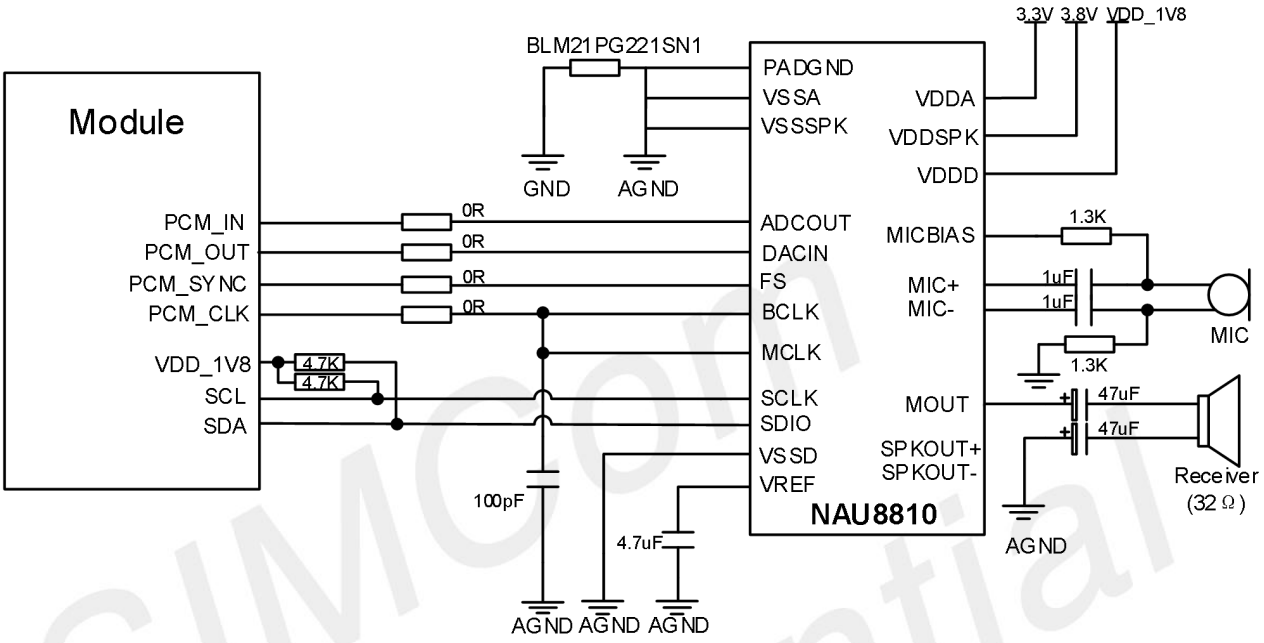

Figure 18: SIM767XX PCM recommended circuit

NOTE

PCM function of SIM767XX is in development. For details information, please refer to each HD guide.

4.10 SPI*

The A7672X provides a set of 4 wire (MISO, MOSI, CS and CLK) SPI interface with maximum clock rate of 52 MHz. It supports master mode and provides full-duplex format, synchronous and serial communication with peripheral devices.

The reference circuit for SPI is shown in the following figure:

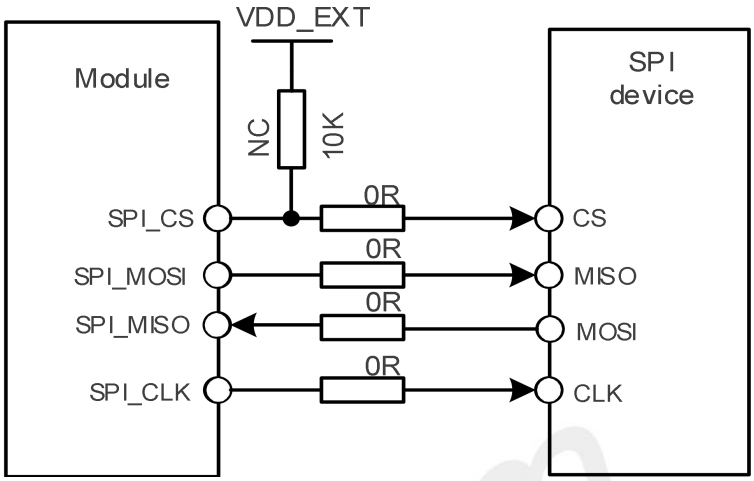

Figure 19: SPI reference design

NOTE

SPI function of SIM767XX is in development. For details information, please refer to each HD guide.

4.11 I2C

A7672X and SIM767XX series provide one set of I2C interface, and it supports standard speed clock frequency 100Kbps, supports high speed clock frequency 400Kbps, its operation voltage is 1.8V.

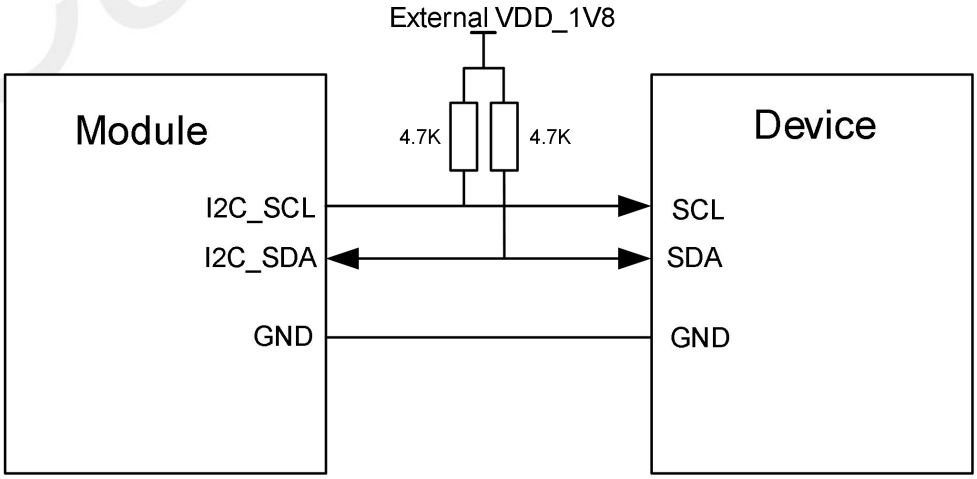

Figure 20: I2C reference design

4.12 ADC Interface

SIM767XX series provides 2 ADC interfaces. A7672X provides 1 ADC interface and 1 VBAT_ADC. The electrical characteristics are compared as follows:

Table 11: ADC interface parameters

Function	A7672X series	SIM767XX series
ADC Interface	Resolution: 9Bits Voltage range: 0~1.8V	Resolution: 12Bits Voltage range: 0~1.1V

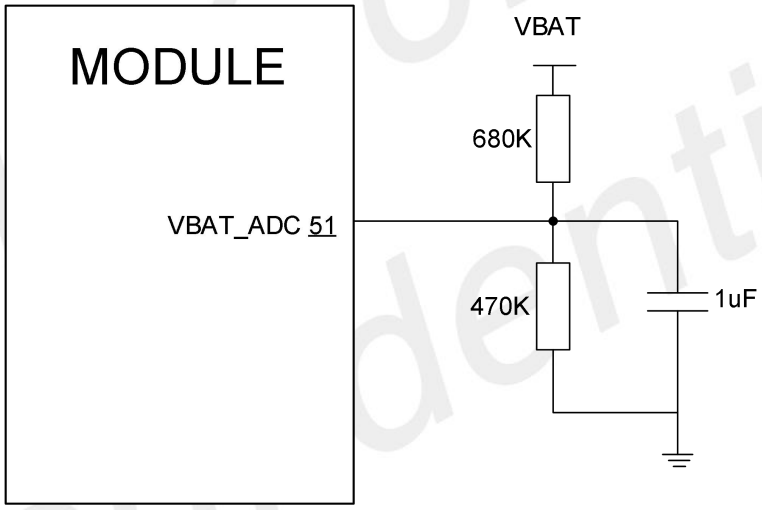

Figure 21: A7672X VBAT_ADC reference design

4.13 GNSS Interface

4.13.1 A7672X

A7672X supports GNSS function interface. GNSS provides 2 power supply input interfaces, 1 GNSS power enable control switch, 1 UART interface and 1 pulse synchronous clock signal interface, which are described in detail as follows.

Table 12: A7672 GNSS interface

PIN name	NO.	I/O	Description	Note
GNSS_VBKP	116	PI	GNSS backup power input	Power supply range 1.4V~3.6V, I_{VBKP}=1mA (Typical, GNSS_VBKP=1.8V).
1V8_GNSS	97	PI	GNSS Vcore and VDDIO input	The supply voltage shall be 1.8V~1.9V, and routing width should more than 0.5mm.
GNSS_PWRCTL	98	DI	GNSS Vcore and VDDIO power enable control	Active high. Solution 1: Connect to GPIO, recommend use MK_IN_3 (PIN20). Solution 2: Connect to MCU GPIO.
GNSS_RXD	96	DI	GNSS UART RX	1.8V power domain. Solution 1: Use 1K resistor to connect UART3_TXD (PIN50) of the module in series. Solution 2: Connect to MCU UART_TX.
GPS_TXD	95	DO	GNSS UART TX	1.8V power domain. Solution 1: Use 1K resistor to connect UART3_RXD (PIN49) of the module in series. Solution 2: Connect to MCU UART_RX.
1PPS	100	DO	GNSS pulse synchronous clock signal	If unused, keep it open.

GNSS recommended reference design solution 1:
A7672X module itself provides power, power enable and UART transmission to GNSS, the recommended reference design as follows:

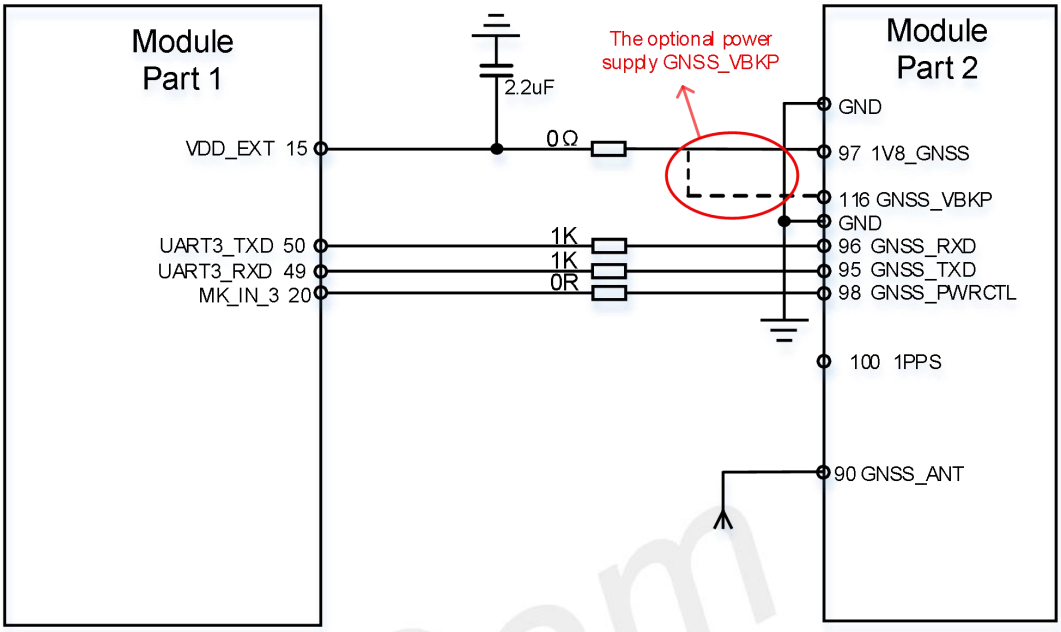

Figure 22: A7672X GNSS reference design (Non-standalone GNSS solution)

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 as follows:

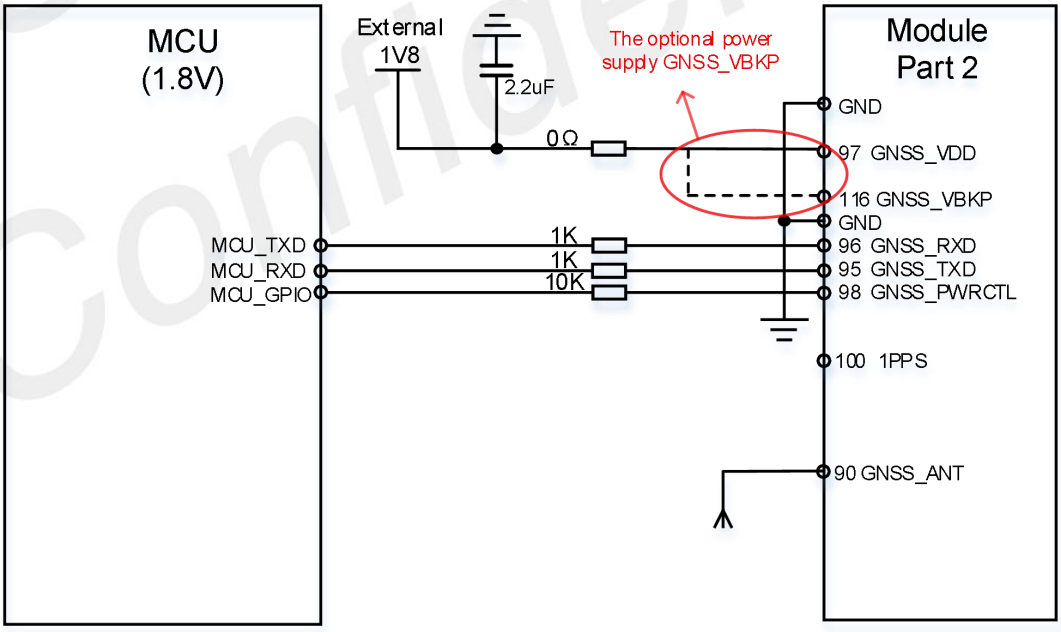

Figure 23: A7672X GNSS reference design (Standalone GNSS solution)

4.13.2 SIM767XX

SIM767XX 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 13: SIM767XX GNSS interface

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	If unused, keep it open.

			signal
GNSS_DEBUG_TX	115	DO	GNSS debug TXD
GNSS_DEBUG_RX	111	DI	GNSS debug RXD
GNSS_RST_N	114	AI	GNSS RST interface

GNSS recommended reference design solution 1:
SIM767XX module itself provides power, power enable and UART transmission to GNSS, the recommended reference design as follows:

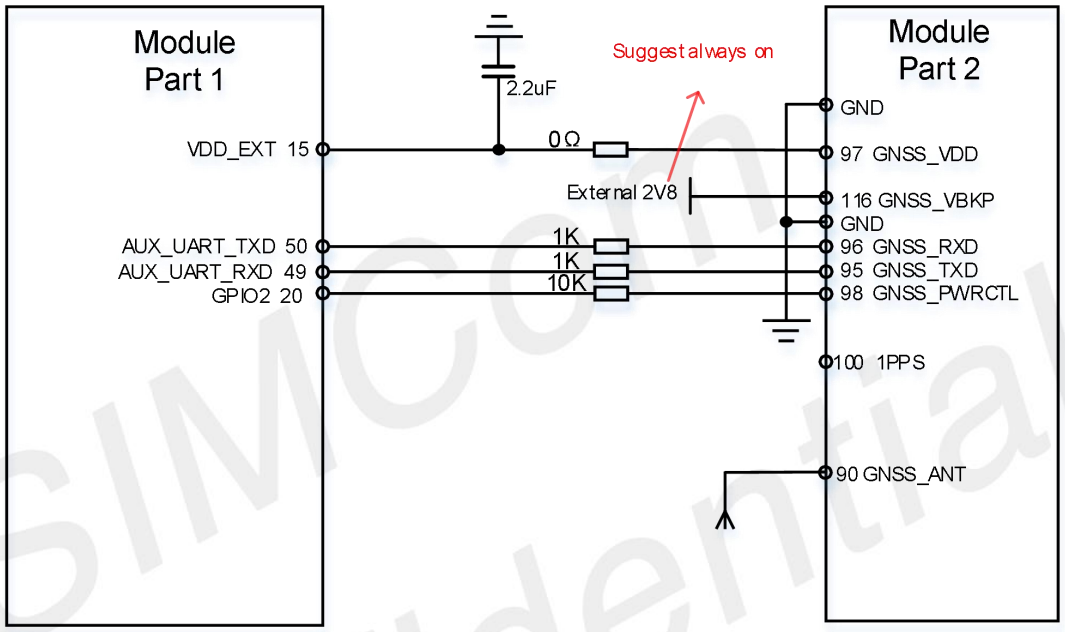

Figure 24: SIM767XX GNSS reference design (Non-standalone GNSS solution)

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 as follows:

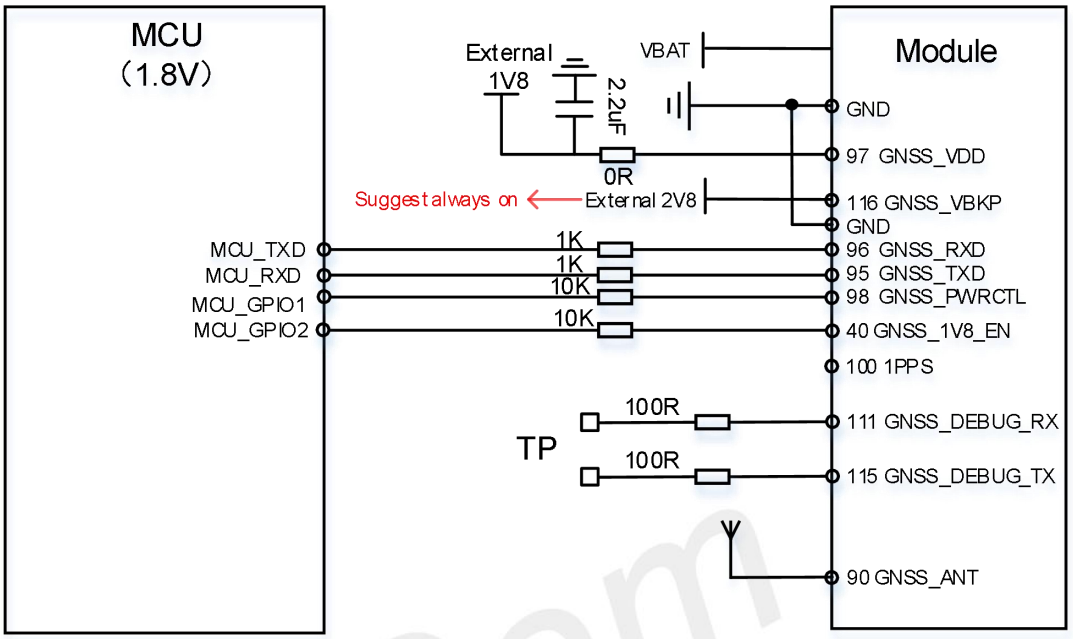

Figure 25: SIM767XX GNSS reference design (Standalone GNSS solution)

4.14 RF Interface

In order to ensure the best performance of the output radio frequency, it is recommended to reserve a π-type matching circuit, and the capacitor is not attached by default.

4.14.1 Passive Antenna for LTE/GNSS

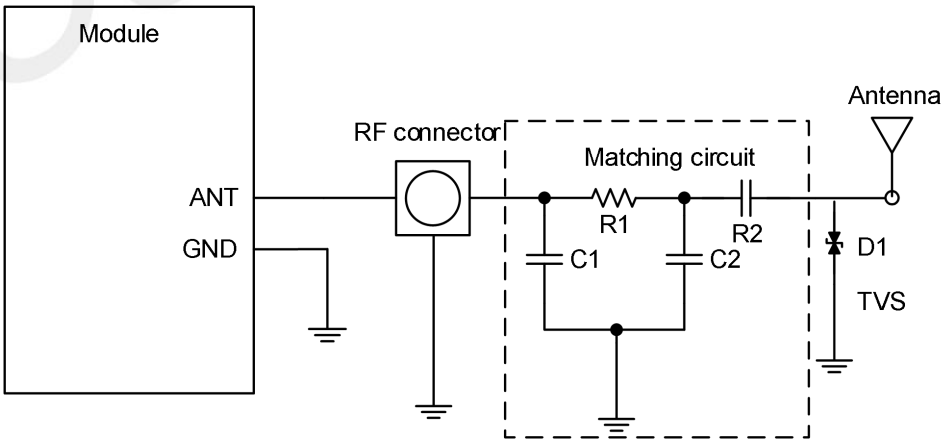

Figure 26: Passive antenna reference

In above figure, the component R1/R2/C1/C2 is reserved for antenna matching, the value of components can only be got after the antenna tuning, usually provided by the antenna factory. Among them, R1 paste 0Ω, R2 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 14: TVS for RF main antenna part number list

Manufacturer	Part Number	V_{RWM}	$V_{C}max$	$C_{J}max$	Package
Murata	LXES03AAA1-154	4V	28V	0.05pF	0603
INPAQ	CES10201V05B0	5V	30V	0.1pF	0201
BilLSEMI	BLE5V0CR05UB	5V	40V	0.05pF	DFN1006-2L

Table 15: TVS for GNSS antenna part number list

Manufacturer	Part Number	V_{RWM}	$V_{C}max$	$C_{J}max$	Package
WAYON	WE05DGCF-B	5V	23V	0.3pF	DFN1006-2L

4.14.2 Active Antenna for GNSS

If an active antenna is used, there should be an external power supply, while the VDD_2V8 of A7672X can provide power supply for the active antenna.

Default power supply value of A7672X is controlled by AT+CVAUXV, default is 3V, which should meet the antenna requirement. For example, “AT+CVAUXV=2800” sets power supply 2.8V.

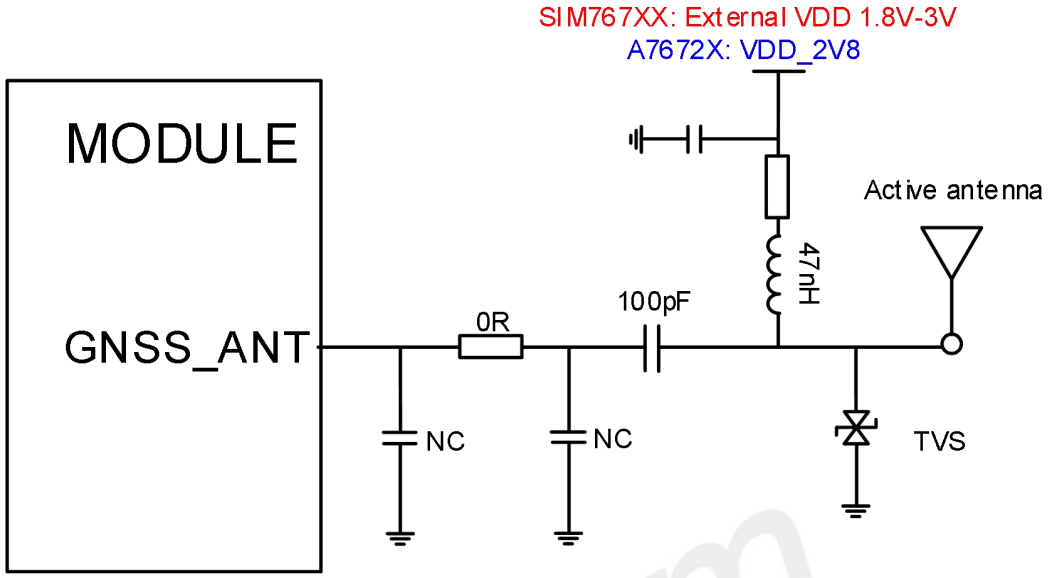

Figure 27: Active antenna reference

NOTE

For details information, please refer to each HD guide.

5 Appendix

5.1 Related documents

Table 16: Related documents

SN	Document name	Remark
[1]	A7672X Series Hardware Design	A7672X Hardware Design Document
[2]	SIM7672X Hardware Design	SIM7672X Hardware Design Document
[3]	SIM7672X & SIM7652X_Series_AT_Command_Manual_V1.xx	AT Command Manual
[4]	A76XX_Series_AT_Command_Manual_V1.xx	AT Command Manual

5.2 Terms and Abbreviation

Table 17: Terms and Abbreviation

Abbreviation	Description
ESD	Electrostatic Discharge
GSM	Global Standard for Mobile Communications
I2C	Inter-Integrated Circuit
PCB	Printed Circuit Board
PCS	Personal Communication System, also referred to as GSM 1900
RF	Radio Frequency
RX	Receive Direction
SIM	Subscriber Identification Module
UART	Universal Asynchronous Receiver & Transmitter
NC	Not connect
EDGE	Enhanced data rates for GSM evolution
HSDPA	High Speed Downlink Packet Access HSUPA

USIM	Universal subscriber identity module
UMTS	Universal mobile telecommunications system
SMPS	Switch Mode Power Supply