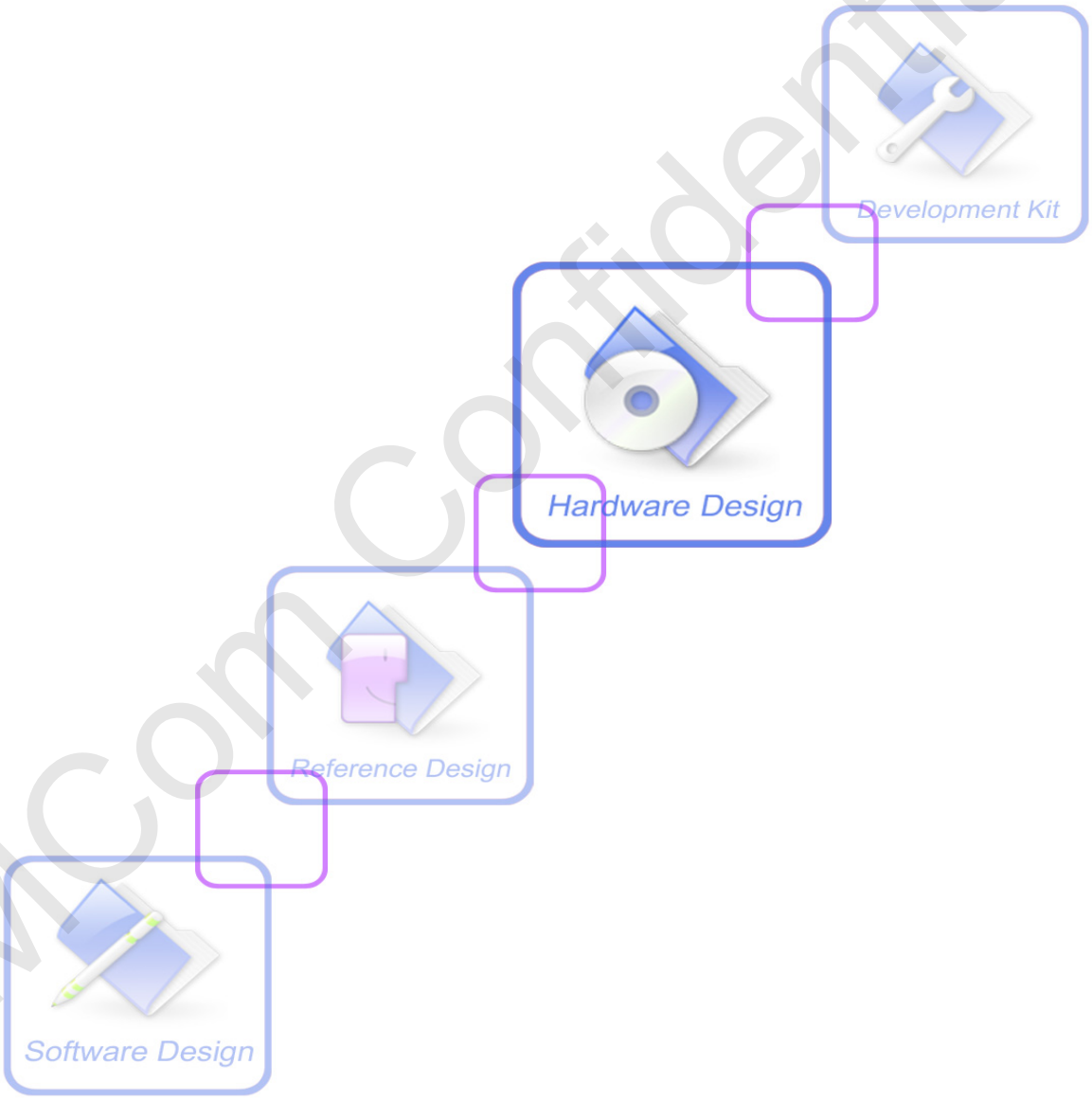
SIM7060G Hardware Design_V1.00



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Data	Version	Description of change	Author
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1 Introduction

This document describes SIM7060G hardware interface in great detail. The document can help customer to quickly understand SIM7060G interface specifications, electrical and mechanical details. With the help of this document and other SIM7060G application notes, customer guide, customers can use SIM7060G to design various applications quickly.

1.1 Product Outline

The SIM7060G module supports LTE CAT-NB1 and LTE CAT-NB2. The physical dimension of SIM7060G is 24x24x2.6 mm，compatible with SIM7000 package. For the detailed description of the frequency band, please refer to the following table:

Table 1：SIM7060G frequency bands

Standard	Frequency	Variants
		SIM7060G
HD-FDD	B1	✓
	B2	✓
	B3	✓
	B4	✓
	B5	✓
	B8	✓
	B11	✓
	B12	✓
	B13	✓
	B17	✓
	B18	✓
	B19	✓
	B20	✓
	B25	✓
	B26	✓
	B28	✓
	B66	✓
	B70	✓
	B71	✓

1.2 Hardware Interface Overview

The interfaces are described in detail in the next chapters include:

- Power Supply

- USB Interface
- UART Interface
- SIM Interface
- ADC Interface
- I2C Interface
- Power output
- GPIOs
- Antenna Interface: NB Antenna、GNSS Antenna

1.3 Hardware Block Diagram

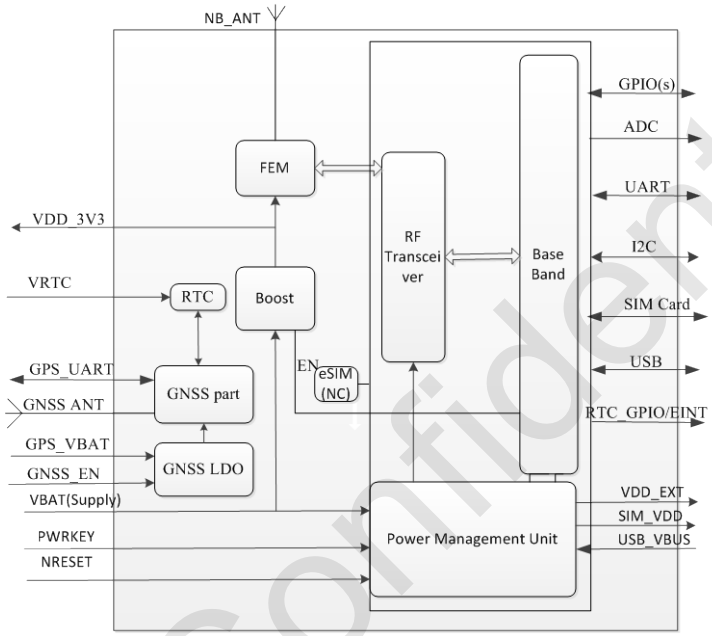

Figure 1：SIM7060G block diagram

1.4 Functional Overview

Table 2：NB-IOT general features

feature	Implementation
Power supply	Power supply voltage:2.1V ~3.6V，type:3.3V
Power saving	Current in PSM mode: 4uA
Radio frequency bands	Please refer to the table 1
Transmitting power	LTE 23dBm
Data Transmission Throughput	LTE CAT NB2: 126Kbps (DL) LTE CAT NB2: 150Kbps (UL)
Antenna	LTE antenna
SMS	MT，MO，Text and PDU mode
SIM interface	Support identity card: 1.8V/ 3V
UART1 interface	A full modem serial port by default Baud rate: default: auto baud rate

	Can be used as the AT commands or data stream channel Support RTS/CTS hardware handshake
UART0 interface	Baud rate: It is 921600bps when used download mode. Can be used for debugging and upgrading firmware
UART2 interface	Used to communicate with GNSS Baud rate: default:115200bps
USB	USB 1.1 interface for debugging (Log port can be selected by AT command.)
Firmware upgrade	Firmware upgrade over UART0 interface
Physical characteristics	Size:24x24x2.6 mm Weight: 3.2g
Temperature range	Normal operation temperature: -30°C to + 80°C Extended operation temperature: -40°C to + 85°C* Storage temperature: -45°C to + 90°C

Note: The performance will be reduced slightly from the 3GPP specifications if the temperature is outside the normal operating temperature range and still within the extreme operating temperature range.

2 Package Information

2.1 Pin Assignment Overview

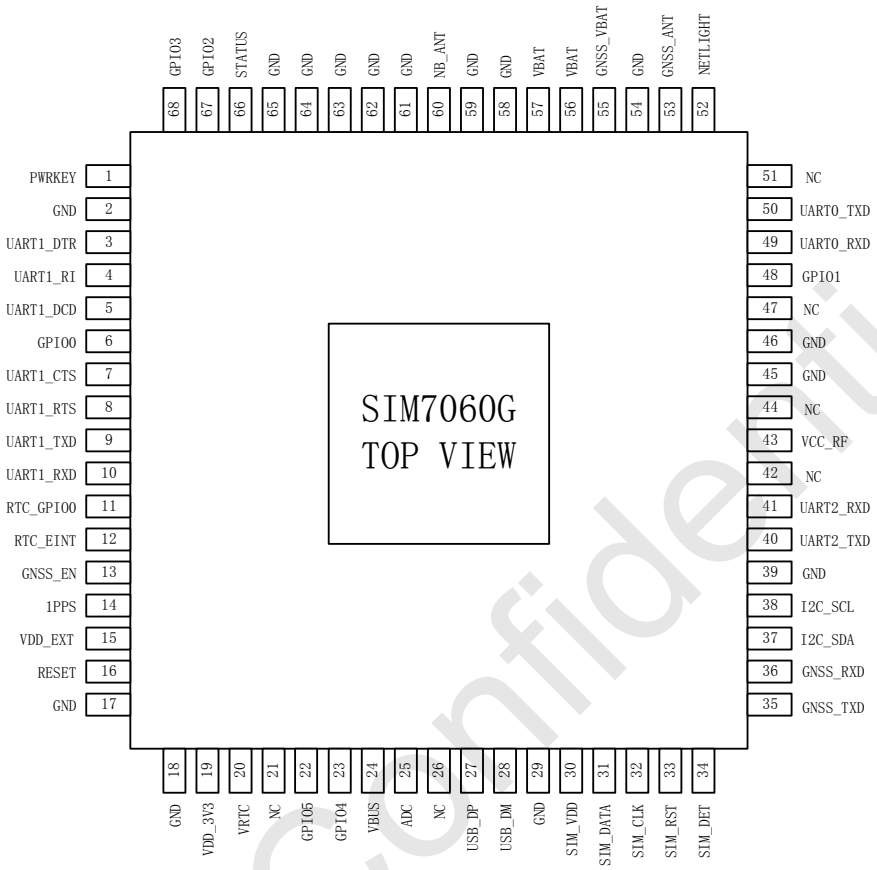

Figure 2: Pin assignment overview

Table 3：Pin definition

Pin No.	Pin Name	Pin No.	Pin Name
1	PWRKEY	2	GND
3	UART1_DTR	4	UART1_RI
5	UART1_DCD	6	GPIO0
7	UART1_CTS	8	UART1_RTS
9	UART1_TXD	10	UART1_RXD
11	RTC_GPIO0	12	RTC_EINT
13	GNSS_EN	14	1PPS
15	VDD_EXT	16	RESET
17	GND	18	GND
19	VDD_3V3	20	VRTC
21	NC	22	GPIO5
23	GPIO4	24	VBUS
25	ADC	26	NC
27	USB_DP	28	USB_DM
29	GND	30	SIM_VDD
31	SIM_DATA	32	SIM_CLK
33	SIM_RST	34	SIM_DET
35	GNSS_TXD	36	GNSS_RXD
37	I2C_SDA	38	I2C_SCL
39	GND	40	UART2_TXD
41	UART2_RXD	42	NC
43	VCC_RF	44	NC
45	GND	46	GND
47	NC	48	GPIO1
49	UART0_RXD	50	UART0_TXD
51	NC	52	NETLIGHT
53	GNSS_ANT	54	GND
55	GNSS_VBAT	56	VBAT
57	VBAT	58	GND
59	GND	60	NB_ANT
61	GND	62	GND
63	GND	64	GND
65	GND	66	STATUS
67	GPIO2	68	GPIO3

2.2 Pin Description

Table 4：IO parameters definition

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

Table 5：Pin description

Pin name	Pin No.	I/O	Description	Comment
Power supply				
VBAT	56、57	PI	NB-IOT power input	2.1V-3.6V
GNSS_VBAT	55	PI	GNSS power input	2.9V-4.3V
VDD_EXT	15	PO	Power output 1.8V for other external circuits with Max 50mA current output, such as level shift circuit. Not present in PSM mode.	If unused, keep it open.
VDD_3V3	19	PO	Power output 3.3V for other external circuits with Max 50mA current output. Not present in PSM mode.	If unused, keep it open.
GND	2、17、18、29、39、45、46、54、58、59、61、62、63、64、65		Ground	
System Control				
PWRKEY	1	DI，PU	System power on/off control input, active low. The efficient input level must be below 0.5V.	PWRKEY has been pulled up to VBAT via 40Kohm resistor internally.

RESET	16	DI，PU	System reset control input, active low.	RESET has been pulled up to VBAT via 40Kohm resistor internally.
SIM interface				
SIM_DATA	31	I/O，PU	SIM Card data I/O	
SIM_RST	33	DO	SIM Reset	
SIM_CLK	32	DO	SIM clock	
SIM_VDD	30	PO	Power output for SIM card, its output Voltage depends on SIM card type automatically.	
SIM_DET	34	DI	SIM card detecting input. (This function do not support yet in standard software.)	If used, keep a 10kΩ resistor pulling up to the VDD_EXT.
USB interface				
VBUS	24	DI,PD	Valid USB detection input with 3.6~5.25V detection voltage	USB interface for debugging
USB_DP	27	I/O	Positive line of the differential, bi-directional USB signal.	
USB_DM	28	I/O	Negative line of the differential, bi-directional USB signal.	
UART interface				
UART0_TXD	50	DOH	Transmit Data	If unused, keep them open.
UART0_RXD	49	DI，PU	Receive Data	
UART1_TXD	9	DOH	Transmit Data	
UART1_RXD	10	DI，PU	Receive Data	
UART1_RTS	8	DI，PU	Request to send	
UART1_CTS	7	DOH	Clear to Send	
UART1_DCD	5	DOH	Data carrier detect	
UART1_DTR	3	DI，PU	Transmit Data	
UART1_RI	4	DOH	Ring Indicator	
UART2_TXD	40	DOH	Transmit Data	
UART2_RXD	41	DI，PU	Receive Data	
I2C interface				
I2C_SDA	37	I/O	I2C data input/output	If used, keep a 4.7kΩ resistor pulling up to the VDD_EXT.
I2C_SCL	38	O	I2C clock output	
Indicate and Control in PSM Mode				
RTC_GPIO0	11	DO	In PSM, RTC_GPIO0 will change state from low to high if RTC_EINT receive interrupt event.	Voltage Domain: VBAT
RTC_EINT	12	DI、PU	RTC_EINT can be the wake up source for exiting PSM.	
GPIO				
NETLIGHT	52	DO	LED control output as network status indication.	

STATUS	66	DO	Operating status output. High level: Power on and firmware ready Low level: Power off	If unused, keep them open.
GPIO0	6	IO	Do not pull down before power on	
GPIO1	48	IO	Programmable general purpose input and output.	
GPIO2	67	IO		
GPIO3	68	IO		
GPIO4	23	IO		
GPIO5	22	IO		
RF interface				
NB_ANT	60	I	NB-IOT antenna	If unused, keep them open.
GNSS_ANT	53	I	GNSS antenna	
GNSS interface				
GNSS_RXD	36	I	Receive Data	If unused, keep them open.
GNSS_TXD	35	O	Transmit Data	
1PPS	14	O	Pulse signal output per second	
VRTC	20	I/O	Power supply for GNSS RTC	
GNSS_EN	13	I	GNSS power enable	
VCC_RF	43	PO	2.8V voltage output pin for powering the active antenna	If unused, keep them open.
Other interface				
ADC	25	AI	Analog-digital converter input. Voltage range: 0.1−1.4V.	If unused, keep them open.
NC	21、26、42、44、47、51		No connection.	Keep it open

2.3 Mechanical Information

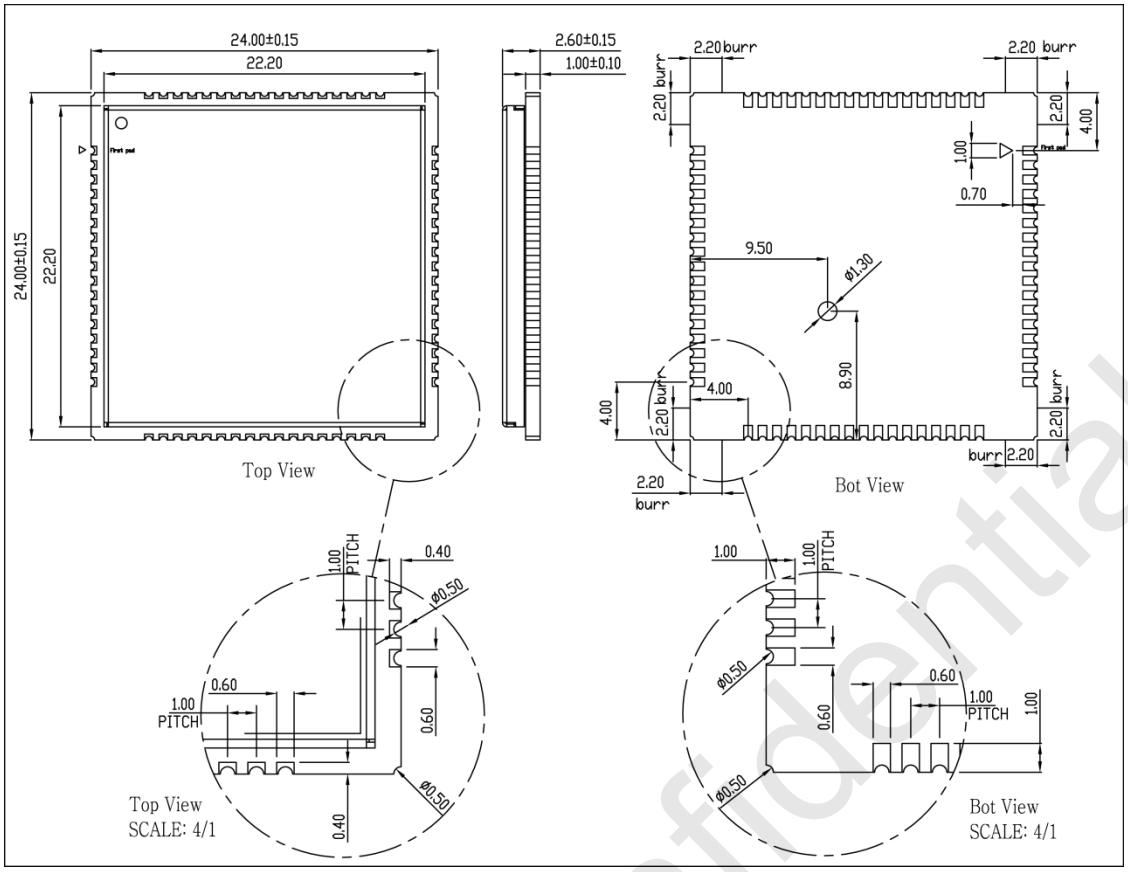

Figure 3：Dimensions (Unit: mm)

2.4 Footprint Recommendation

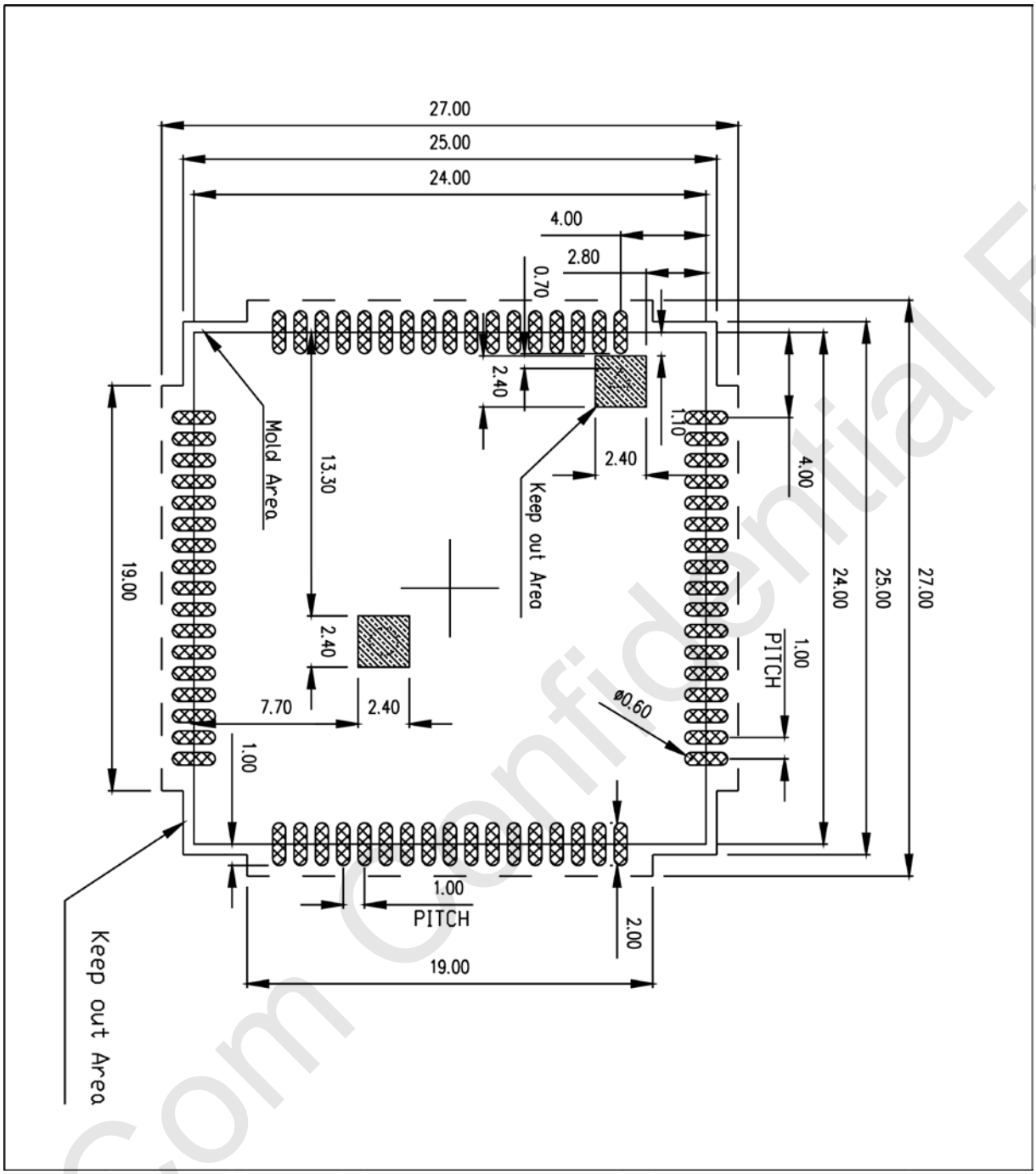

Figure4：Footprint recommendation (Unit: mm)

3 Application mode of SIM7060G

3.1 All-in-one mode

In all-in-one mode,UART2 of SIM7060G is connected to GNSS_UART . GPIO5 can be used to enable and disable the GNSS part.
In this mode, GNSS part can be enabled by AT command “AT+CGNSPWR=1” and disabled by AT command “AT+CGNSPWR=0”.

NOTE: Since the power supply range of NB-IOT and GNSS is different, please pay attention to the voltage range when using the same power supply.

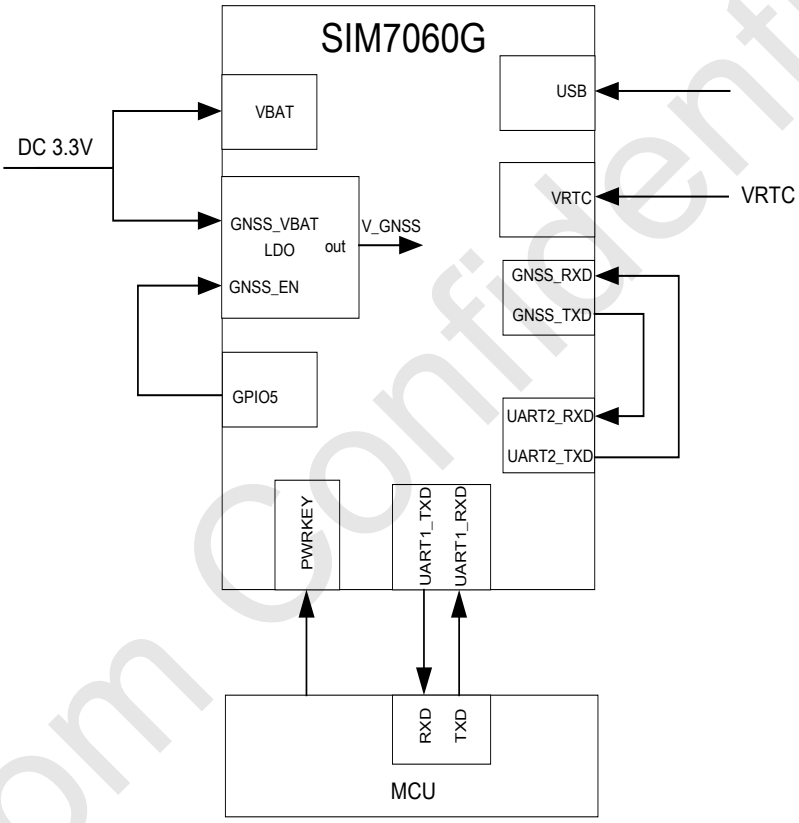

Figure5：All-in-one mode diagram

3.2 Stand-alone mode

In stand-alone mode，NB-IOT and GNSS can work independently. It’s convenient for customer to control them separately.Figure6 is the block diagram of this mode.

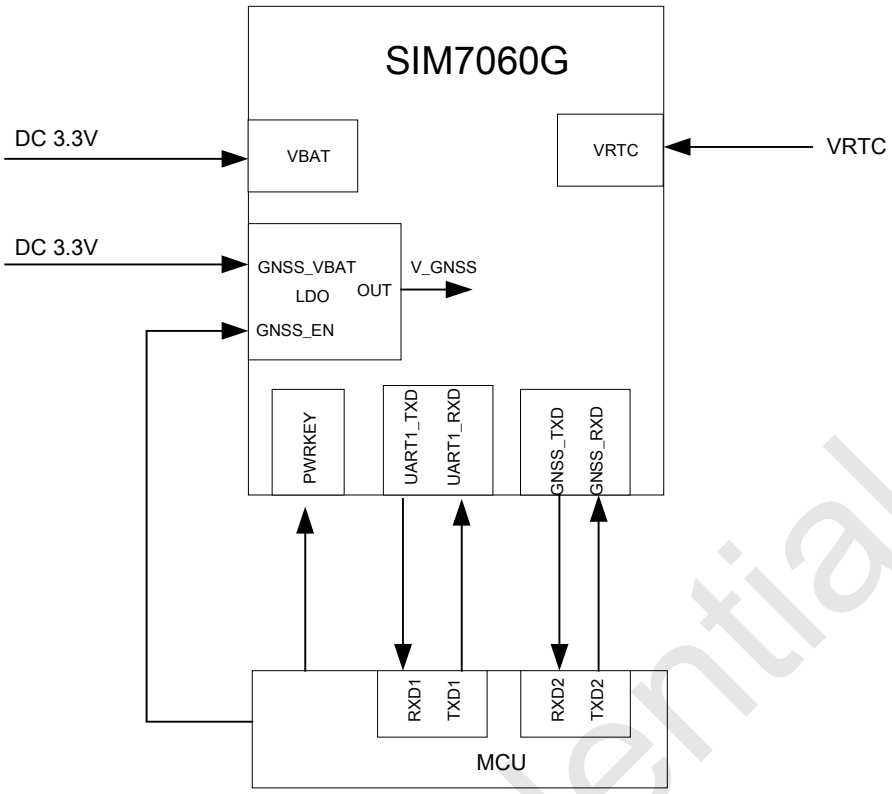

Figure6：Stand-alone mode diagram

4 NB-IOT interface application

4.1 Power supply of NB-IOT

The module VBAT power supply range is from 2.1v to 3.6V and the recommended voltage is 3.3V. When the module is transmitting at maximum power in the NB-IOT network, the peak current can reach to 800mA instantaneously.

Table 6：VBAT pins electronic characteristic

Symbol	Description	Min.	Typ.	Max.	Unit
VBAT	Module power voltage	2.1	3.3	3.6	V
$I_{VBAT(peak)}$	Module power peak current in NB emission	800	-	-	mA
$I_{VBAT(average)}$	Module power average current in normal mode	Please refer to the table 31			
$I_{VBAT(sleep)}$	Power supply current in sleep mode				
$I_{VBAT(PSM)}$	Power supply current in PSM mode	-	4	-	uA
$I_{VBAT(power-off)}$	Module leakage current	-	-	12	uA

4.2 Reference Circuit of NB-IOT Power Supply

Make sure that the voltage on the VBAT pins will never drop below 2.1V.If the voltage drops below 2.1V, the module may shut down due to low voltage.

Note: If the power supply for VBAT pins can support up to 800mA, using a total of more than 100uF capacitors is recommended, or else users must use a total of 300uF capacitors typically, in order to avoid the voltage drop. The module power peak current depends on the total capacitance.

The following figure shows the recommended circuit .These capacitors should be put as close as possible to VBAT pads. Also, users should keep VBAT trace on circuit board wider than 1 mm to minimize PCB trace impedance.

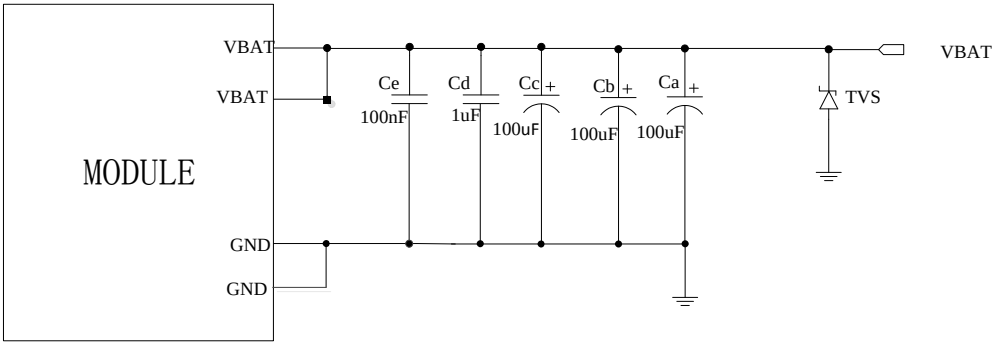

Figure 7：Power supply application circuit

Table 7：Recommended TVS diode list

No.	Manufacturer	Part Number	Package
1	Prisemi	PESDHC2FD4V5B	DFN1006
2	Prisemi	PESDHC3D3V3U	SOD323
3	WILLsemi	ESD5651N-2/TR	DFN1006

4.3 Voltage Monitor

To monitor the VBAT voltage, the AT command “AT+CBC” can be used.
When the VBAT voltage is out of the range, the NB-IOT part will be powered off when the overvoltage power-off function is enabled. The AT command “AT+CBATCHK=1” can be used to enable the overvoltage power-off function and the under-voltage power-off function.

Note: Under-voltage warning function and under-voltage power-off function are disabled by default. For more information about these AT commands, please refer to Document [1].

4.4 Power on/Power off/Reset Function

4.4.1 NB-IOT power on

The NB-IOT part of SIM7060G can be powered on by pulling the PWRKEY pin to ground.
The PWRKEY pin has been pulled up with a resistance to VBAT internally, so it does not need to be pulled up externally. It is strongly recommended to put a 100nF capacitor and an ESD protection diode close to the PWRKEY pin, as it would strongly enhance the ESD performance of PWRKEY pin. Please refer to the following figure for the recommended reference circuit.

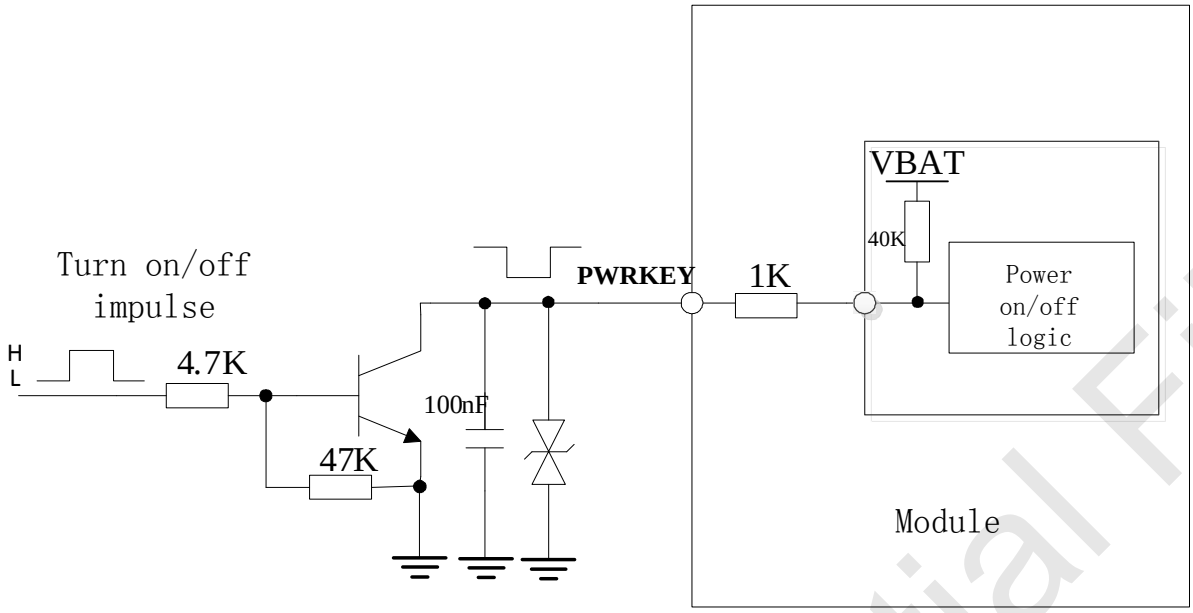

Figure 8：Reference power on/off circuit

Note: Do not pull GPIO0 (Pin6) to low before powering on SIM7060G.

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

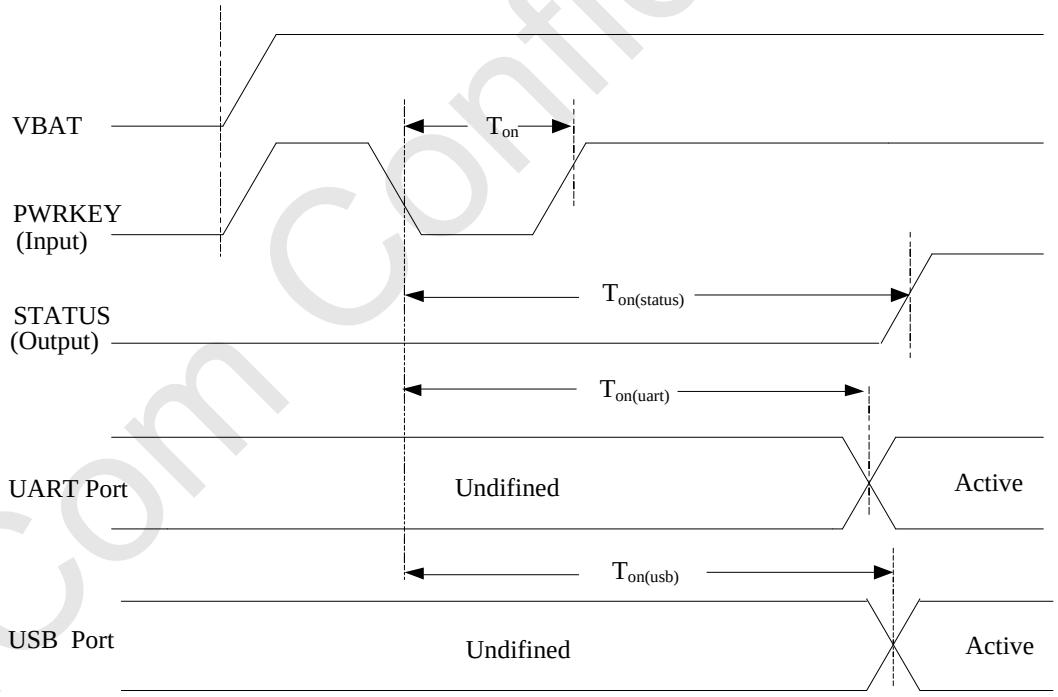

Figure 9：Power on timing sequence

Table 8：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	215	800	-	ms
$T_{on(status)}$	The time from power-on issue to				ms

	STATUS pin output high level(indicating power up ready)	-	440	-	
$T_{on(uart)}$	The time from power-on issue to UART port ready	TBD			s
V_{IH}	Input high level voltage on PWRKEY pin	0.7*VBAT			V
V_{IL}	Input low level voltage on PWRKEY pin			0.3*VBAT	V

4.4.2 NB-IOT power off

The following methods can be used to power off NB-IOT:

- Method 1: Power off the NB-IOT part of SIM7060G by pulling the PWRKEY pin to ground
- Method 2: Power off the NB-IOT part of SIM7060G by AT command “AT+CPOWD=1”.
- Method 3: Over-voltage or under-voltage automatic power off. The function can be enabled by AT command “AT+CBATCHK=1”.It is disabled by default.

The power off scenario by pulling down the PWRKEY pin is illustrated in the following figure.

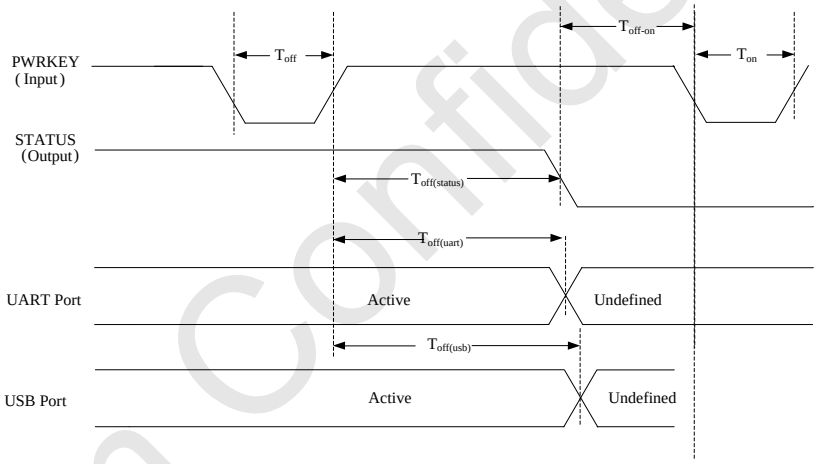

Figure 10：Power off timing sequence

Table 9：Power off timing and electronic characteristic

Symbol	Parameter	Min.	Typ.	Max.	Unit
T_{off}	The active low level time pulse on PWRKEY pin to power off module	-	1	-	s
$T_{off(status)}$	The time from power-off issue to STATUS pin output low level(indicating power off)*	-	-	TBD	s

Note: The STATUS pin can be used to detect whether the NB-IOT part is powered on or not. When the NB-IOT part has been powered on , STATUS will be high level, otherwise STATUS will still be with the low level.

4.4.3 NB-IOT reset function

SIM7060G can be reset by pulling the RESET pin to ground.

Note: This function is only used as an emergency reset. The RESET pin will be ineffectiveness in the power off mode.

The RESET pin has been pulled up to VBAT with a 40KΩ resistor internally. So it does not need to be pulled up externally. It is strongly recommended to put a100nF capacitor and an ESD protection diode close to the RESET pin. Please refer to the following figure for the recommended reference circuit.

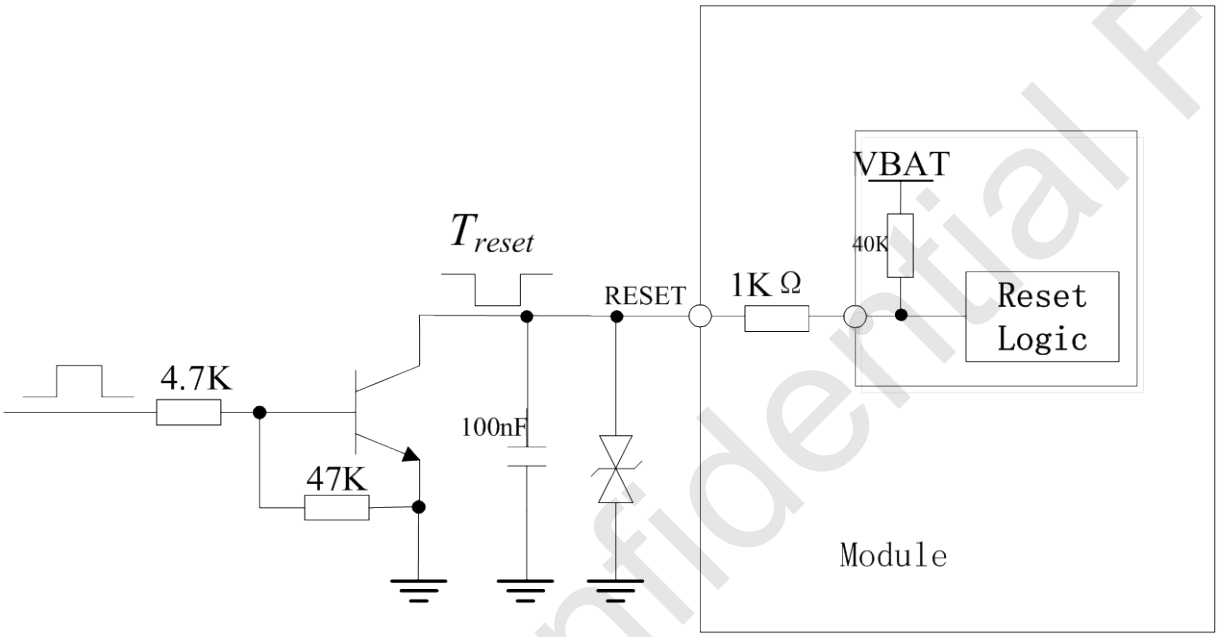

Figure 11：Reference reset circuit

Table 10：RESET pin electronic characteristic

Symbol	Parameter	Min.	Typ.	Max.	Unit
T_{reset}	The active low level time impulse on RESET pin to reset module	40	-	-	ms
V_{IH}	Input high level voltage	0.7*VBAT			V
V_{IL}	Input high level voltage			0.3*VBAT	V

4.5 UART Interface

SIM7060G provides a 7-wire UART1 (universal asynchronous serial transmission) interface as DCE (Data Communication Equipment). AT commands and data transmission can be performed through UART1 interface. UART0 can be used for debugging and firmware update.UART2 can be used to communicate with the GNSS part (Refer to All-in-one mode).

4.5.1 UART Design Guide

The following figures show the reference design.

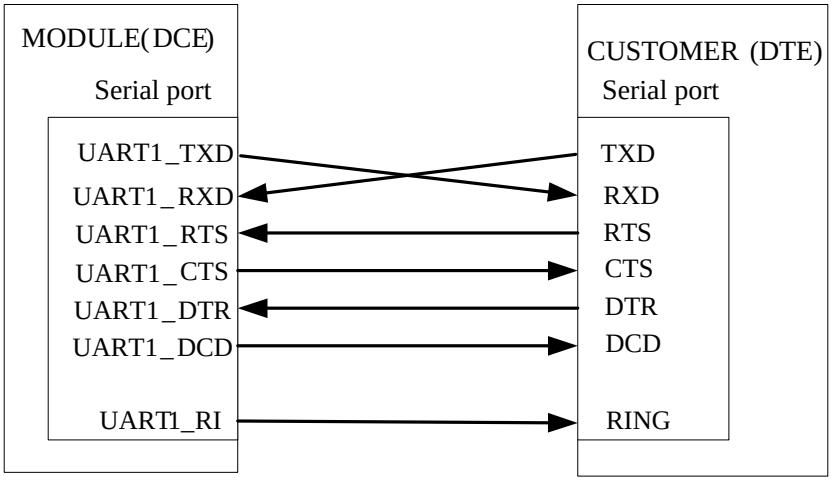

Figure 12：UART full modem

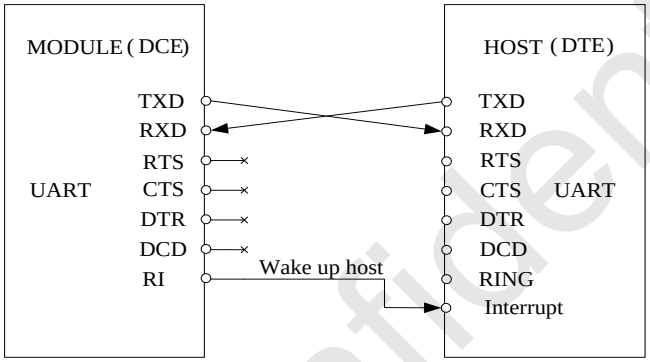

Figure 13：UART null modem

The SIM7060G UART is 1.8V voltage interface. If user's UART application circuit is 3.3V voltage interface, the level shifter circuits should be used for voltage matching. The TXB0108RGYR provided by Texas Instruments is recommended. The following figure shows the voltage matching reference design.

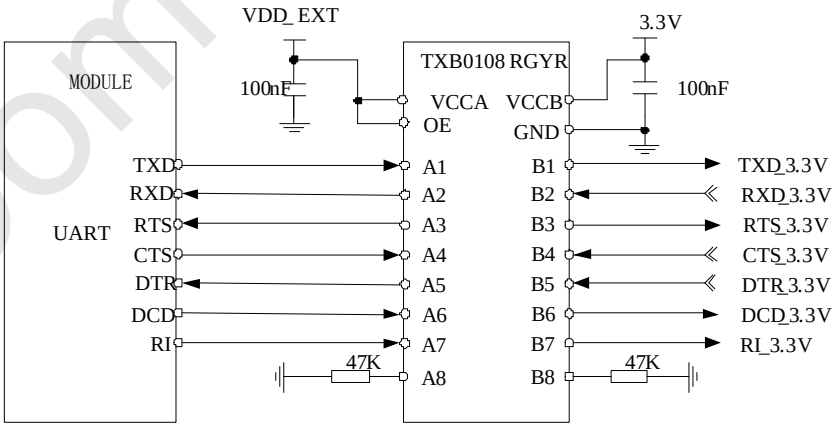

Figure 14：Reference circuit of level shift

Note: When use the level shifter IC, the pull up resistance on TXD_3.3V，RTS_3.3V，DCD_3.3V should not be less than 47KΩ.

Also the following reference circuit is recommended:

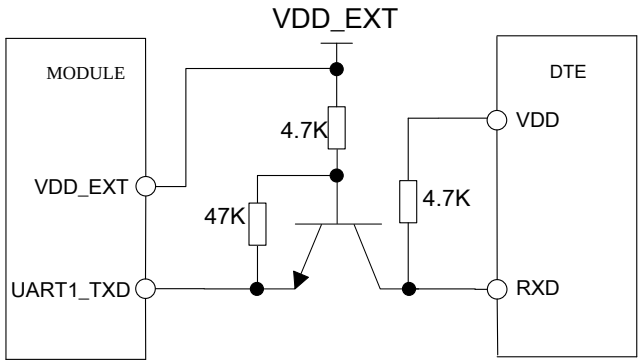

Figure 15：TX level matching circuit

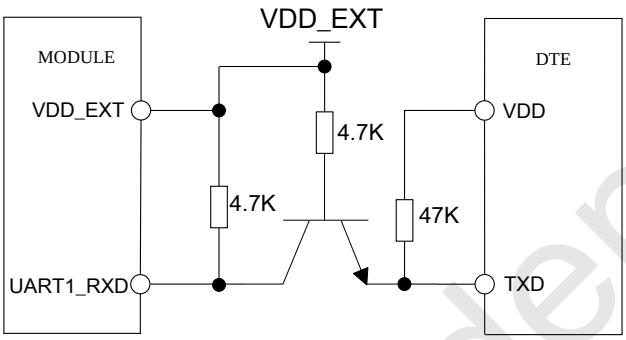

Figure 16：RX level matching circuit

Note: The triode conversion circuit is not suitable for high baud rate more than 460800bps. When using UART0 for downloading software, the baud rate is 921600bps, please pay attention to the device's speed support.

4.5.2 RI and DTR Behavior

The RI pin description:

The RI pin can be used to interrupt output signal to inform the host controller such as application CPU. Before that, users must use AT command "AT+CFGRI=1" to enable this function.

Normally RI will keep high level until certain conditions such as receiving SMS, or a URC report coming, then it will output a low level pulse 120ms, in the end, it will become high level.

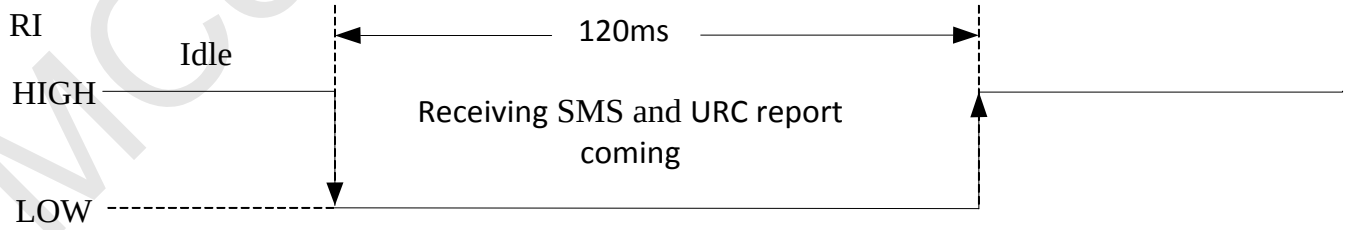

Figure 17：RI behaviour （SMS and URC report）

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

The DTR pin description:

After setting the AT command "AT+CSCLK=1", the NB-IOT part of SIM7060G will enter into sleep mode by

pulling up the DTR pin when module is in idle mode. In sleep mode, the UART is unavailable. Pulling down the DTR pin can be used to wake up the NB-IOT part of SIM7060G from the sleep mode.

AT command “AT+CSCLK=0” can bse used to disable the sleep mode.

4.6 USB Interface

The SIM7060G contains a USB interface compliant with the USB1.1 specification as a peripheral, but the USB charging function is not supported.

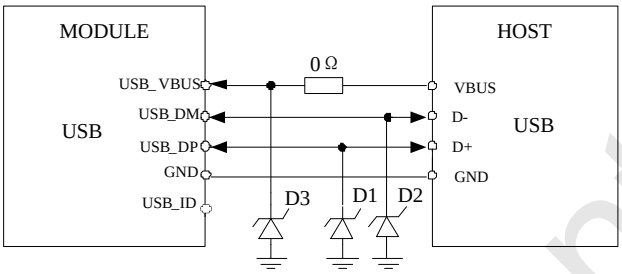

Figure 18：USB reference circuit

Because of the high speed on USB bus, more attention should be paid to the influence of the junction capacitance of the ESD component on USB data lines. Typically, the capacitance of the D1 and D2 should be less than 2pF.

Table 11：Recommended TVS list

No.	Manufacturer	Part Number	Description	Package
1	ON Semi	ESD9L5.0ST5G	TVS 5V 0.5PF 150mW RO	SOD-923
2	TOSHIBA	DF2S6.8UFS	TVS 5V 2PF 150mW RO	SOD-923
3	ON Semi	ESD9L5.0ST5G	TVS 5V 0.5PF 150mW RO	SOD-923
4	TOSHIBA	DF2S6.8UFS	TVS 5V 2PF 150mW RO	SOD-923

4.7 SIM Interface

SIM7060G supports both 1.8V and 3.0V SIM Cards.
A 2*2mm eSIM chip location is reserved inside the module. For internal SIM card chip, please contact SIMCOM.

Table 12：SIM electronic characteristic in 1.8V mode (SIM_VDD=1.8V)

Symbol	Parameter	Min.	Typ.	Max.	Unit
SIM_VDD	LDO power output voltage	1.75	1.8	1.95	V
V_{IH}	High-level input voltage	0.65*SIM_VDD	-	SIM_VDD +0.3	V
V_{IL}	Low-level input voltage	-0.3	0	0.25*SIM_VDD	V

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

Table 13：SIM electronic characteristic 3.0V mode (SIM_VDD=3V)

Symbol	Parameter	Min.	Typ.	Max.	Unit
SIM_VDD	LDO power output voltage	2.75	3	3.05	V
V_{IH}	High-level input voltage	0.65*SIM_VDD	-	SIM_VDD +0.3	V
V_{IL}	Low-level input voltage	-0.3	0	0.25*SIM_VDD	V
V_{OH}	High-level output voltage	SIM_VDD -0.45	-	SIM_VDD	V
V_{OL}	Low-level output voltage	0	0	0.45	V

4.7.1 SIM Application Guide

It is recommended to use an ESD protection component such as ESDA6V1W5 produced by ST (www.st.com) or SMF15C produced by ON SEMI (www.onsemi.com). Note that the SIM peripheral circuit should be close to the SIM card socket. The following figure shows the 6-pin SIM card holder reference circuit.

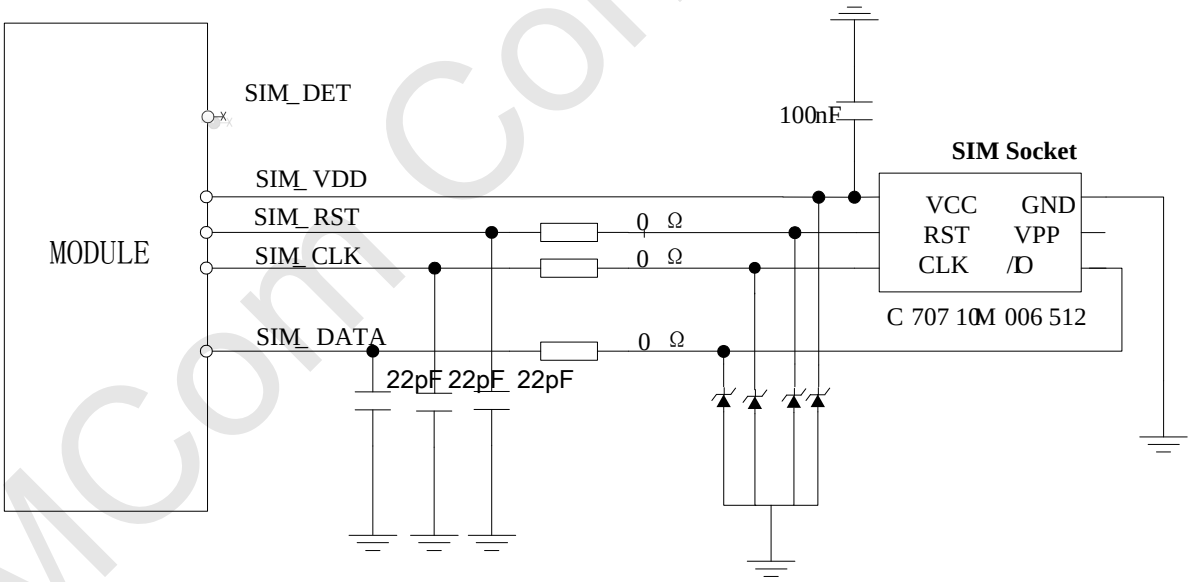

Table 19：SIM interface reference circuit

Note: A 100nF capacitor on SIM_VDD is used to reduce interference. For more details of AT commands about SIM, please refer to document [1].SIM_CLK is very important signal, the rise time and fall time of SIM_CLK should be less than 40ns, otherwise the SIM card might not be initialized correctly. If SIM_DET is used, a 10KΩ resistor is necessary to pulling up to the power VDD_EXT.

4.8 Network status

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

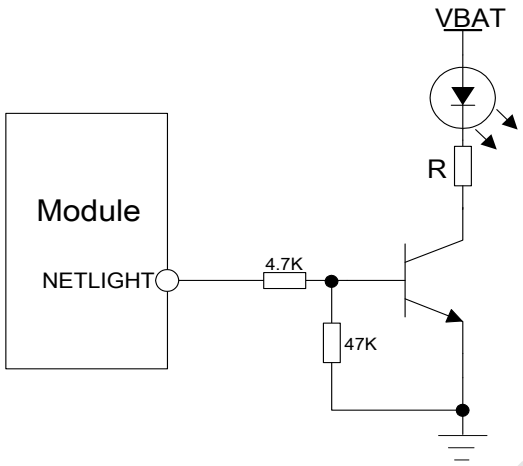

Figure 20：NETLIGHT reference circuit

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

Table 14：NETLIGHT pin status

NETLIGHT pin status	Module status
64ms ON, 800ms OFF	No registered network
64ms ON, 3000ms OFF	Registered network
64ms ON, 300ms OFF	Data transmit
OFF	Power off or PSM mode

4.9 ADC

SIM7060G has a dedicated ADC pin. It is available for digitizing analog signals such as battery voltage and so on. The electronic specifications are shown in the following table.

Table 15：ADC electronic characteristics

Characteristics	Min.	Typ.	Max.	Unit
Resolution	–	10	–	Bits
Input Range	0.1	–	1.4	V

4.10 Power Supply Output

SIM7060G has a LDO power output named VDD_EXT, the output voltage is 1.8V. Meanwhile it has a DCDC power output named VDD_3V3, the output voltage is 3.3V. Both of them are not present in PSM mode.

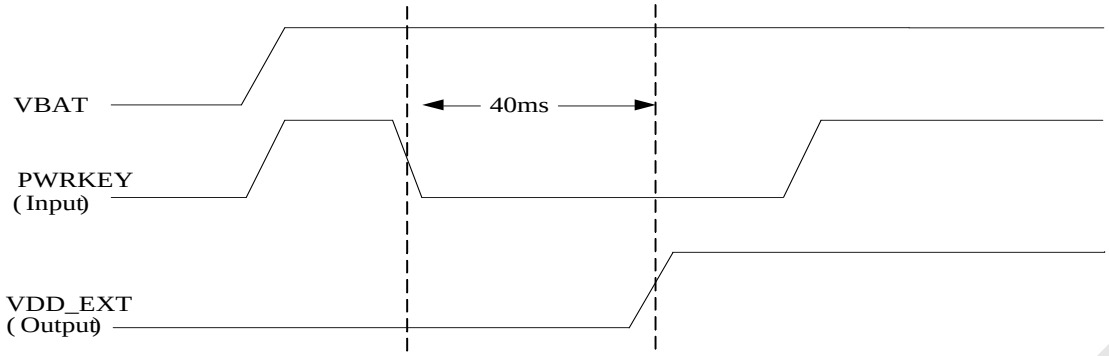

Figure 21：Power on sequence of the VDD_EXT

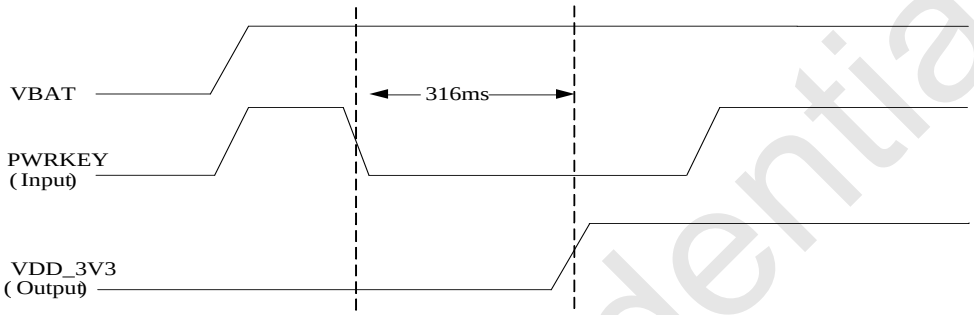

Figure 22：Power on sequence of the VDD_3V3

Table 16：Electronic characteristic

Pin name	Description	Min.	Typ.	Max.	Unit
VDD_EXT					
V_{VDD_EXT}	Output voltage	1.7	1.8	1.9	V
I_O	Output current	-	-	50	mA
VDD_3V3					
V_{VDD_3V3}	Output voltage	3.2	3.3	VBAT-0.1	V
I_O	Output current	-	-	50	mA

5 GNSS interface application

5.1 GNSS power input

The power supply range of GNSS is from 2.9V to 4.3V. The power supply should be able to provide sufficient current up to 200mA.

5.2 Power on/off GNSS

After the module is powered up, the GNSS part can be turned on/off via the GNSS_EN pin. Turn on the GNSS by pulling the GNSS_EN pin to high (1.5-4.3V) and pulling it down (0-0.3V) to turn off the GNSS. After the GNSS is turned on, the GNSS part automatically enters into the running mode and will run according to the set configuration.

5.3 Serial Port of GNSS

The serial port level of GNSS is 1.8V. For connection with other levels, please refer to 4.5.1. The GNSS serial port is used as the data output and command input for the NMEA. The default baud rate is 115200 bps, you can upgrade the GNSS firmware through this serial port.

Table 17：GNSS UART interface

	Nam.	Pin	Function
Serial port	GNSS_TXD	35	Transmit Data
	GNSS_RXD	36	Receive Data

5.4 1PPS output

The 1PPS pin outputs pulse-per-second signal for precise timing purposes after the position has been fixed. The 1PPS signal can be provided through designated output pin for many external applications. This pulse is not only limited to be active every second but also allowed to set the required duration, frequency, and active high/low by programming user-defined settings.
Figure 24 shows the 1PPS reference design circuit:

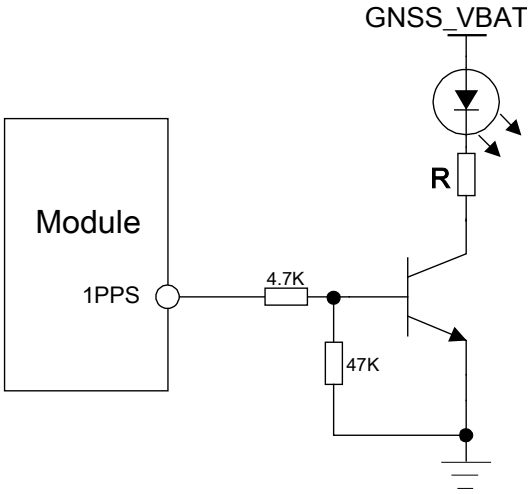

Figure 23: 1PPS reference design circuit

5.5 Backup Power of GNSS

GNSS part provides battery backup memory, which contains all the necessary information for quick start and a small number of user configuration variables. It needs to supply 3V power to the VRTC pin, so that the module can save the clock information when the power is off.

5.6 Software Upgrade of GNSS

GNSS firmware can be upgraded through UART interface.

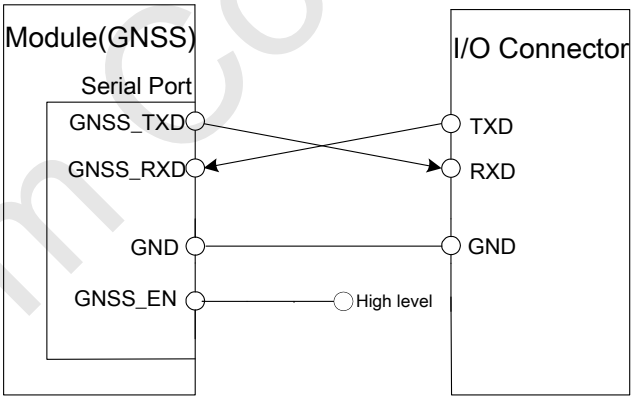

Figure 24: Connection for software upgrading and debugging for GNSS

If customer upgrades NB and GNSS part in all-in-one mode, the GNSS UART should be connected to NB UART2; GNSS_EN should be connected to GPIO5 of NB. Then the customer could upgrade the module NB and GNSS part at the same time through the UART0.

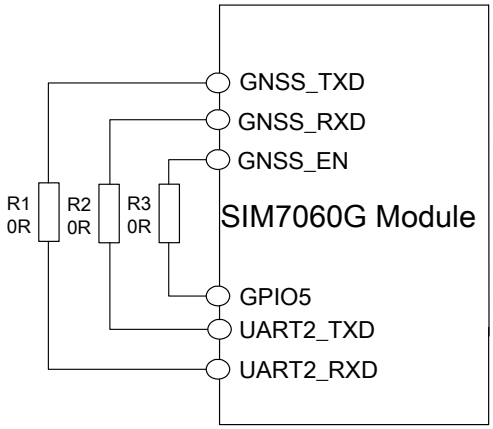

Figure 25: Connection for software upgrading in all-in-one Mode

5.7 A-GPS

A-GPS is the meaning of Assisted GPS, which is a system that can under certain conditions improve the startup performance, or time-to-first-fix (TTFF) of a GPS satellite-based positioning system. Module supports EPO file, EASY mode, SBAS and RTCM.

5.7.1 EPO

The module supports the EPO (Extended Prediction Orbit) data service. The EPO data service is supporting 7/14/30 days orbit predictions to customers. It needs occasional download from EPO server. Supply of aiding information like ephemeris, almanac, rough last position and time and satellite status and an optional time synchronization signal will reduce time to first fix significantly.

The user should update the EPO files from the EPO server in the period of validity of EPO file through the internet. Then the EPO data should send to the module by the HOST side. The module has the shorter cold TTFF and warm TTFF, when the A-GPS is used.

Note: For more information about EPO, please contact SIMCom.

5.7.2 EASY Mode

EASY is the abbreviation of Embedded Assist System, it works as embedded software which accelerates TTFF by predicting satellite navigation messages from received ephemeris.

No additional computing interval for EASY task. EASY is efficiently scheduled and computed in free time of every second after GPS navigation solution.

Easy function is conceptually designed to automatically engage for predicting after first receiving the broadcast ephemeris. After a while （generally tens of seconds）, 3-day extensions will be completely generated then all EASY functions will be maintained at a standby condition. EASY assistance is going to be engaged when the GPS requests in new TTFF condition or re-generates again with another new received ephemeris. Meanwhile, TTFF will be benefited by EASY assistance.

Note: The modes mentioned above can be set by PMTK commands; customer can refer to document [23] for more information.

5.8 SBAS

SBAS is the abbreviation of Satellite Based Augmentation System. The SBAS concept is based on the transmission of differential corrections and integrity messages for navigation satellites that are within sight of a network of reference stations deployed across an entire continent. SBAS messages are broadcast via geostationary satellites able to cover vast areas.

Several countries have implemented their own satellite-based augmentation system. Europe has the European Geostationary Navigation Overlay Service (EGNOS) which covers Western Europe and beyond. The USA has its Wide Area Augmentation System (WAAS). Japan is covered by its Multi-functional Satellite Augmentation System (MSAS). India has launched its own SBAS program named GPS and GEO Augmented Navigation (GAGAN) to cover the Indian subcontinent.

5.9 Multi-tone AIC

The module supports Multi-tone AIC (active interference canceller) to suppress the RF noise from Wi-Fi and so on.

With the help of AIC function, The GNSS signal could be demodulated from the jammed signal, which can ensure better navigation quality. AIC function is enabled by default. Enabling AIC function will increase extra current consumption

Note: Using the PMTK286 command to enable/disable AIC function:

Enable AIC function: $PMTK286,1*23

Disable AIC function: $PMTK286,0*22

6 RF Specifications

6.1 LTE RF Specifications

Table 18：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 B8	23dBm +/-2.7dB	<-40dBm
LTE-FDD B11	23dBm +/-2.7dB	<-40dBm
LTE-FDD B12	23dBm +/-2.7dB	<-40dBm
LTE-FDD B13	23dBm +/-2.7dB	<-40dBm
LTE-FDD B17	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 B70	23dBm +/-2.7dB	<-40dBm
LTE-FDD B71	23dBm +/-2.7dB	<-40dBm

** **Note：The max power is tested result single-tone in CAT-NB2. Multi-tone test results please refer to part 6.2.3F.3 for CAT-NB2.***

Table 21: Maximum Power Reduction (MPR) for UE category NB2 Power Class 3

Modulation	QPSK		
Tone positions for 3 Tones allocation	0-2	3-5 and 6-8	9-11
MPR	≤ 0.5 dB	0 dB	≤ 0.5 dB
Tone positions for 6 Tones allocation	0-5 and 6-11		
MPR	≤ 1 dB	≤ 1 dB	
Tone positions for 12 Tones allocation	0-11		
MPR	≤ 2 dB		

Table 19: E-UTRA operating bands

E-UTRA	UL Freq.	DL Freq.	Duplex Mode
1	1920~1980 MHz	2110~2170 MHz	HD-FDD

2	1850~1910 MHz	1930~1990 MHz	HD-FDD
3	1710~1785 MHz	1805~1880 MHz	HD-FDD
4	1710~1755 MHz	2110~2155 MHz	HD-FDD
5	824~849 MHz	869~894 MHz	HD-FDD
8	880~915 MHz	925~960 MHz	HD-FDD
11	1427.9~1447.9 MHz	1475.9~1495.9 MHz	HD-FDD
12	699~716 MHz	729~746 MHz	HD-FDD
13	777~787 MHz	746~756 MHz	HD-FDD
17	704~716 MHz	734~746 MHz	HD-FDD
18	815~830 MHz	860~875 MHz	HD-FDD
19	830~845 MHz	875~890 MHz	HD-FDD
20	832~862 MHz	791~821 MHz	HD-FDD
25	1850~1915 MHz	1930~1995 MHz	HD-FDD
26	814 ~849 MHz	859~894 MHz	HD-FDD
28	703~748 MHz	758~803 MHz	HD-FDD
66	1710~1780 MHz	2110~2200 MHz	HD-FDD
70	1695~1710 MHz	1995~2020 MHz	HD-FDD
71	663~698 MHz	617~652 MHz	HD-FDD

Table 20: CAT-NB2 Reference sensitivity (QPSK)

Operating band	REFSENS (dBm) 3GPP Request	REFSENS Typical(dBm)	REFSENS Typical(dBm repeated)
All band	-108.2	-114	-131

6.2 NB Antenna Design Guide

Users should connect antennas to SIM7060G's antenna pads through micro-strip line or other types of RF trace and the trace impedance must be controlled in 50Ω.SIMCom recommends that the total insertion loss between the antenna pads and antennas should meet the following requirements:

Table 21: Trace loss

Frequency	Loss
700MHz-960MHz	<0.5dB
1710MHz-2170MHz	<0.9dB
2300MHz-2650MHz	<1.2dB

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

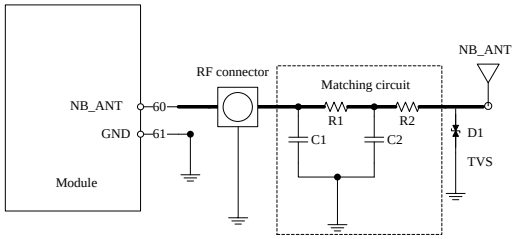

Figure 26: Antenna matching circuit

In above figure, the components R1,C1,C2 and R2 are used for antenna matching, the values of components can only be achieved after the antenna tuning and usually provided by antenna vendor. By default, the R1, R2 are 0Ω resistors, and the C1, C2 are reserved for tuning. The component D1 is a TVS for ESD protection, and it is optional for users according to application environment.

The RF test connector is used for the conducted RF performance test, and should be placed as close as to the module's NB_ANT pin. The traces impedance between SIM7060G and antenna must be controlled in 50Ω.

Two TVS are recommended in the table below.

Table 22: Recommended TVS

Package	Part Number	Vender
0201	LXES03AAA1-154	Murata
0402	LXES15AAA1-153	Murata

6.3 GNSS Antenna Design Guide

In order to achieve excellent positioning performance, especially in weak signals, the correct antenna design circuit should be observed.

6.3.1 Passive antenna

Passive antenna contains radiating elements such as ceramic antennas, spiral antennas, and sheet antennas. And it needs a passive matching network, to match the 50 Ω impedance.

The most commonly used antenna of GNSS antenna is patch antenna. Patch antenna is flat and usually has ceramic and metal body and is installed on the metal substrate.

SIM7060G's GNSS circuit for passive antenna:

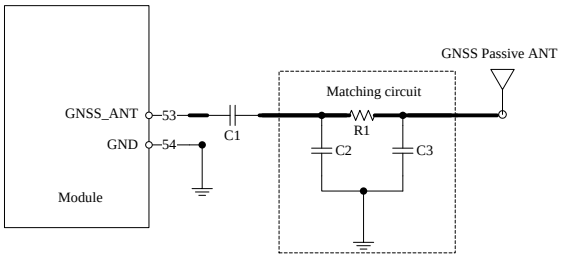

Figure 27: GNSS circuit for passive antenna

In above figure, the component C1 is used for DC blocking ,and the components R1,C1 and C2 are used for antenna matching, the values of the components can only be achieved after the antenna tuning and usually

provided by antenna vendor. By default, the R1 are 0Ω resistors, and the C1, C2 are reserved for tuning.

6.3.2 Active antenna

The active antenna is internally integrated with a low noise amplifier (LNA) and requires additional power supply to the active antenna. The SIM7060G module can supply power to the active antenna. The customer only needs to connect the active antenna.

SIM7060G's GNSS circuit for active antenna:

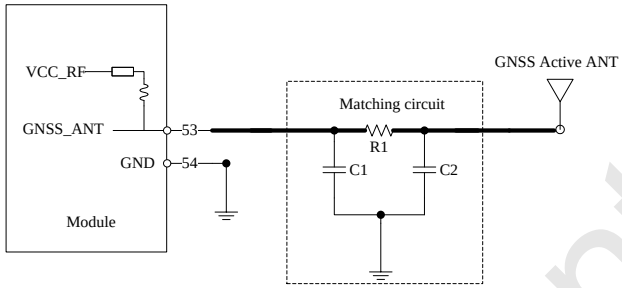

Figure 28: GNSS circuit for active antenna

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

6.4 RF traces note

6.4.1 RF traces layout

- Keep the RF trace from module ant pin to antenna as short as possible
- RF trace should be 50 Ω either on the top layer or in the inner layer
- RF trace should be avoided right angle and sharp angle.
- Put enough GND vias around RF traces.
- RF trace should be far away from other high speed signal lines.

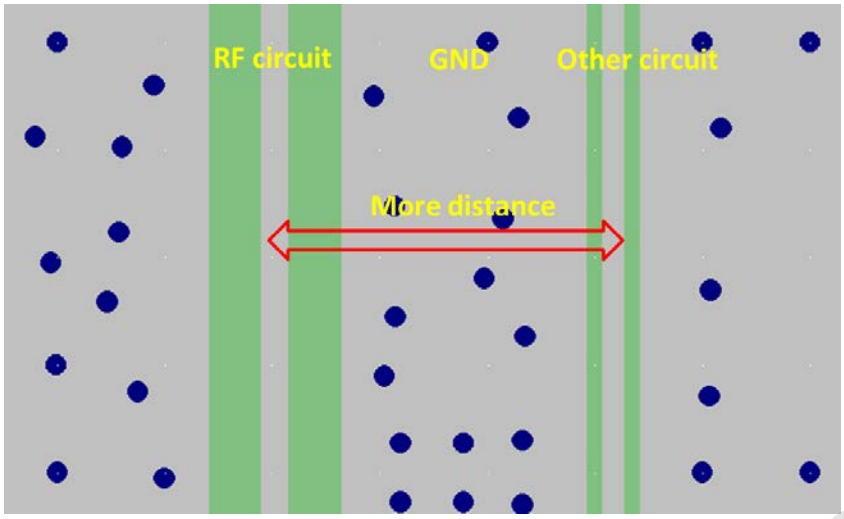

Figure 29: RF trace should be far away from other high speed signal lines

- Avoiding the paralleling layout of other system antennas nearly.
- There should be some distance from The GND to the inner conductor of the SMA connector. It is better to keep out all the layers from inner to the outer conductor.

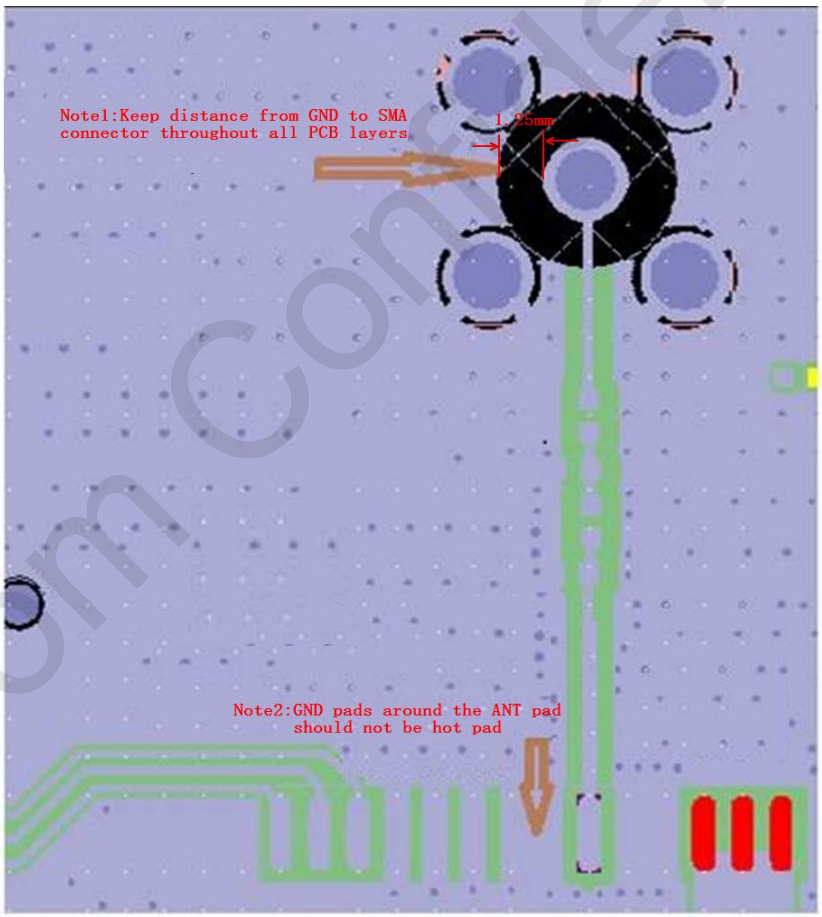

Figure 30: The distance between GND to the inner conductor of SMA

- GND pads around the ANT pad should not be hot pad to keep the GND complete, as shown in fig.31 Note2.

6.4.2 LTE ANT and other system ANT decoupling

- Make sure the efficiency of LTE main ANT more than 40%
- Keep the decoupling of LTE main ANT to WLAN ANT more than 15dB
- Keep the decoupling of LTE main ANT to GNSS ANT more than 30dB

Note: The decoupling value can be provided by ANT adventure. More details can refer to the document *ANTENNA DESIGN GUIDELINES FOR DIVERSITY RECEIVER SYSTEM V1.01.pdf*

7 Electrical Specifications

7.1 Absolute maximum ratings

Absolute maximum rating for digital and analog pins of SIM7060G are listed in the following table:

Table 23：Absolute maximum ratings

Parameter	Min.	Typ.	Max.	Unit
Voltage at VBAT	-0.3	-	3.63	V
Voltage at GNSS_VBAT	-	-	4.5	V
Voltage at VRTC	-	-	4.3	V
Voltage at GNSS_EN	-	-	4.5	V
Voltage at VBUS	-0.3	-	5.85	V
Voltage at digital pins (GPIO, UART etc)	-0.3	-	2.1	V
Voltage at digital pins (SIM)	-0.3	-	3.05	V
PWRKEY、RESET、RTC_EINT、RTC_GPIO0	-0.3	-	3.63	

7.2 Operating conditions

Table 24：Recommended operating ratings

Parameter	Min.	Typ.	Max.	Unit
Voltage at VBAT	2.1	3.3	3.6	V
Voltage at GNSS_VBAT	2.9	3.3	4.3	V
GNSS_EN(V_{OH})	1.5	-	4.3	V
GNSS_EN(V_{OL})	-	-	0.3	V
Voltage at VBUS	3.6	5.0	5.25	V
VRTC	2.5	-	4.3	V

Table 25：1.8V Digital I/O characteristics*

Parameter	Description	Min.	Typ.	Max.	Unit
V_{IH}	High-level input voltage	1.17	1.8	2.1	V
V_{IL}	Low-level input voltage	-0.3	0	0.63	V
V_{OH}	High-level output voltage	1.35	-	1.8	V
V_{OL}	Low-level output voltage	0	-	0.45	V
I_{OH}	High-level output current(no pull down resistor)			4	mA
I_{OL}	Low-level output current(no pull up resistor)			4	mA

I_{IH}	Input high leakage current (no pull down resistor)			5	uA
I_{IL}	Input low leakage current(no pull up resistor)			5	uA

Note: These parameters are for digital interface pins, such as GPIOs (including NETLIGHT, STATUS, SIM_DET), UART0, UART1, UART2

7.3 Operating Modes of NB-IOT

7.3.1 Operating Mode Definition

The table below summarizes the various operating modes of SIM7060G product.

Table 26：Operating mode Definition

Mode		Function
Normal operation	LTE Sleep	In this case, the current consumption of module will be reduced to the minimal level and the module can still receive paging message and SMS.
	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” 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 SIM 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		In this mode, the module will be the least current consumption. Meanwhile, all the output of the LDO and DCDC in the module will be closed except the RTC power. And also all of the functions will be unavailable except the RTC function. In PSM, RTC_GPIO0 will change state from high to low. RTC_EINT or PWRKEY can wake up the module.
Power off mode		Module will go into power off mode by sending the AT command “AT+CPOWD=1” or pull down the PWRKEY pin. 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.

7.3.2 Sleep mode

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

Several hardware and software conditions must be satisfied together in order to let SIM7060G enter sleep mode:

1. UART condition
2. Software condition
3. USB condition

7.3.3 Minimum functionality mode and Flight mode

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

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

If SIM7060G 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 SIM7060G 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 SIM7060G is in minimum functionality or flight mode, it can return to full functionality by the AT command “AT+CFUN=1”.

7.3.4 Power Saving Mode (PSM)

SIM7060G module can enter into PSM for reducing its power consumption. The mode is similar to power-off, but the module remains registered on the network and there is no need to re-attach or re-establish the network connections. So in PSM all the functions will be unavailable except the RTC function, module cannot immediately respond users’ requests.

In PSM, RTC_GPIO0 will change state from low to high if RTC_EINT receive interrupt event.

Either of the following methods will wake up the module from PSM:

- Pulling PWRKEY or RTC_EINT to low level will wake up the module.
- When the T3412 timer expires, the module will be automatically woken up.

Power domain of RTC_GPIO0 and RTC_EINT is VBAT, please consider the electrical characteristics when connecting to external IO (suggest to use trigger as low-active).

Table 27: RTC_GPIO0/RTC_EINT characteristics

IO	Vih(min).	Vih(max).	Vil(min).	Vil(max).	VBAT
RTC_EINT	1.575	2.1	0	0.525	2.1(min)
RTC_EINT	2.725	3.6	0	0.905	3.6(max)
IO	**Voh(min).**	**Voh(max).**	**Vol(min).**	**Vol(max).**	**VBAT**
RTC_GPIO0	1.785	-	-	0.315	2.1(min)
RTC_GPIO0	3.085	-	-	0.545	3.6(max)

7.3.5 Extended Mode DRX (e-DRX)

In idle or sleep mode, module and the network may negotiate over non-access stratum signaling the use of extended mode DRX for reducing power consumption.

7.4 Operation Modes of GNSS

GNSS supports operating modes like full on mode, stop mode, backup mode, periodic mode, AlwaysLocate™ mode and GLP mode.

- Full on mode: In this mode, the GNSS will enter full on mode after first power up. Power consumption will vary depending on the amount of satellite acquisitions and number of satellites in track.

Note: The GNSS modes mentioned above are set by PMTK commands. The PMTK commands for multiple position chosen are illustrated as below:

$PMTK353,1,0,0,0,0*2A (GPS only)
$PMTK353,0,0,0,0,1*2A (BEIDOU only)
$PMTK353,0,1,0,0,0*2A (GLONASS only)
$PMTK353,1,1,0,0,0*2B (GPS+GLONASS)
$PMTK353,1,0,0,0,1*2B (GPS+BEIDOU)
Customer can refer to document [23] for more information.

- Stop mode: Stop mode means a low quiescent power state and a PMTK command can be used to enter. Any character input will exit from stop mode.

Note: Using the PMTK161 command to enter stop mode: "$PMTK161,0*28"
Customer can refer to document [23] for more information.

- Backup mode: In this mode, the power source (such as battery) is connected to VRTC pin, which will help to keep its internal RTC running when the GNSS_VBAT is turned off. The VRTC power must be kept active all the time, the GNSS module will perform a quick start every power-on.
- Periodic mode**:** In this mode, periodic control power on/off of GNSS to reduce power consumption. "$PMTK225,(Type),(Run time),(Sleep time),(Second run time),(Second sleep time)*16"

Note: Using the PMTK225 command to set periodic mode:
Periodic backup mode:
"$PMTK225,0*2B"
"$PMTK223,1,25,180000,60000*38"

*"$PMTK225,1,3000,12000,18000,72000*16"*

Periodic standby mode:

*"$PMTK225,0*2B"*

*"$PMTK223,1,25,180000,60000*38"*

*"$PMTK225,2,3000,12000,18000,72000*16"*

Customer can refer to document [23] for more information.

- AlwaysLocate™ mode: AlwaysLocate™ is an intelligent controller of GNSS periodic mode. Depending on the environment and motion conditions, GNSS can adaptive adjust the on/off time to achieve balance of positioning accuracy and power consumption.

***Note: Using the PMTK225 command to set AlwaysLocateTM mode.**

AlwaysLocateTM standby mode:

*"$PMTK225,0*2B"*

*"$PMTK225,8*23"*

AlwaysLocateTM Backup mode:

*"$PMTK225,0*2B"*

*"$PMTK225,9*22"*

Customer can refer to document [23] for more information.

7.5 Current Consumption

Table 28：Current consumption on VBAT Pins (VBAT=3.3V)

Sleep/Idle Mode	
LTE supply current (without USB connection)	Sleep mode Typical:243uA （AT+CFUN=0） Idle mode Typical:6.45mA
Power Saving Mode	
PSM supply current	PSM mode Typical:4uA
eDRX	
eDRX mode supply current （Tested in sleep mode）	@PTW=40.96s, eDRX=81.92s, DRX=2.56s Typical：650uA

7.6 ESD Notes

SIM7060G is sensitive to ESD in the process of storage, transporting, and assembling. When SIM7060G is mounted on the users' mother board, the ESD components should be placed beside the connectors which human body may touch, such as SIM card holder, switches, keys, etc. The following table shows the SIM7060G ESD measurement performance without any external ESD component.

Table 29: The ESD performance measurement table

Part	Contact discharge(kV)	Air discharge(kV)
GND（Shield）	+/-6	+/-12
GND （RF）	+/-6	+/-12

VBAT	+/-5	+/-10
Antenna port	+/-5	+/-10

Note: Temperature: 25℃, Humidity: 45%, tested on SIMCOM-EVB.

8 SMT Production Guide

8.1 Top and Bottom View of SIM7060G

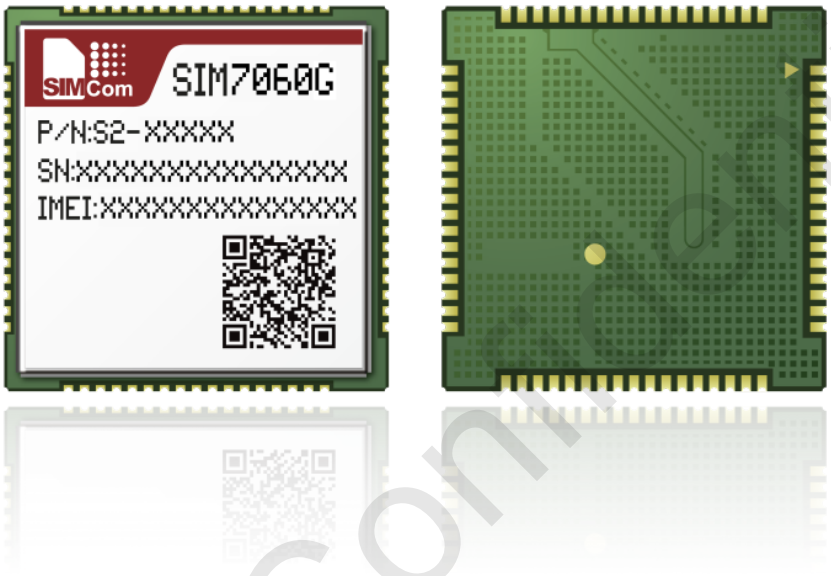

Figure 31：Top and bottom view of SIM7060G

8.2 Typical SMT Reflow Profile

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

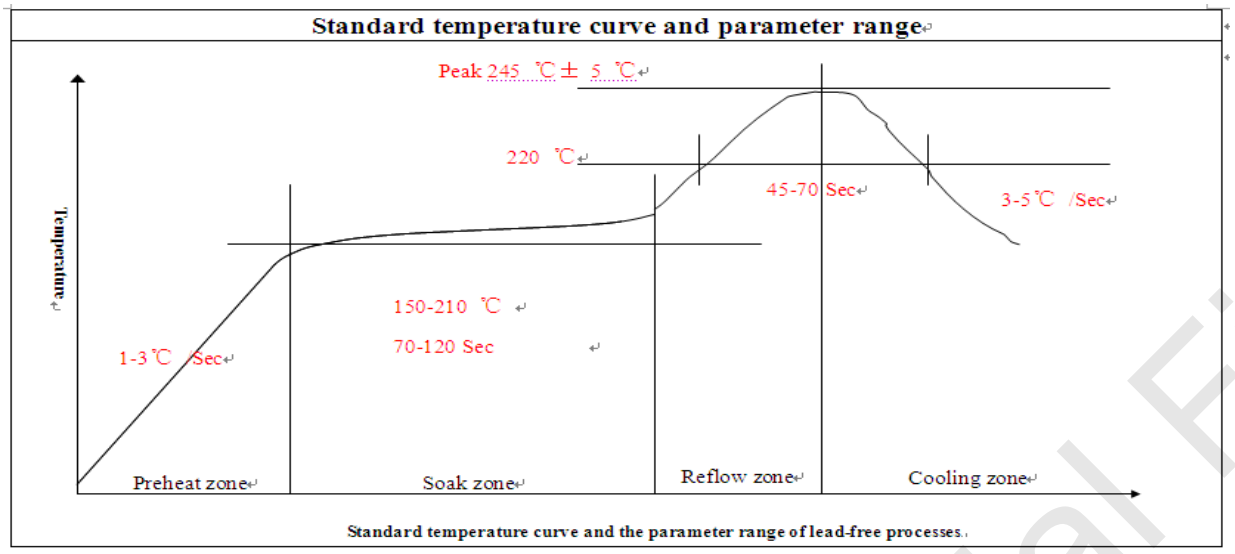

Figure 31：The ramp-soak-spike reflow profile of SIM7060G

8.3 Moisture Sensitivity Level (MSL)

SIM7060G is qualified to Moisture Sensitivity Level (MSL) **3** in accordance with JEDEC J-STD-033. If the prescribed time limit is exceeded, users should bake modules for 192 hours in drying equipment (<5% RH) at 40+5/-0°C, or 72 hours at 85+5/-5°C. Note that plastic tray is not heat-resistant, and only can be baked at 45° C.

Table 30：Moisture Sensitivity Level and Floor Life

Moisture Sensitivity Level (MSL)	Floor Life (out of bag) at factory ambient≤30°C/60% RH or as stated
1	Unlimited at ≦30℃/85% RH
2	1 year
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.

8.4 Baking Requirements

SIM7060G modules are vacuum packaged, and guaranteed for 6 months storage without opening or leakage under the following conditions: the environment temperature is lower than 40℃, and the air humidity is less than 90%.

If the condition meets one of the following ones shown below, the modules should be baked sufficiently before

re-flow soldering, and the baking condition is shown in table below; otherwise the module will be at the risk of permanent damage during re-flow soldering.

- If the vacuum package is broken or leakage;
- If the vacuum package is opened after 6 months since it's been packed;
- If the vacuum package is opened within 6 months but out of its Floor Life at factory ambient≦30℃ /60%RH or as stated.

Table 31：Baking requirements

Baking temperature	Moisture	Time
40℃±5℃	<5%	192 hours
120℃±5℃	<5%	4 hours

Note: Care should be taken if that plastic tray is not heat-resistant, the modules should be taken out for preheating, and otherwise the tray may be damaged by high-temperature heating.

8.5 Stencil Foil Design Recommendation

The recommended thickness of stencil foil is 0.15mm.

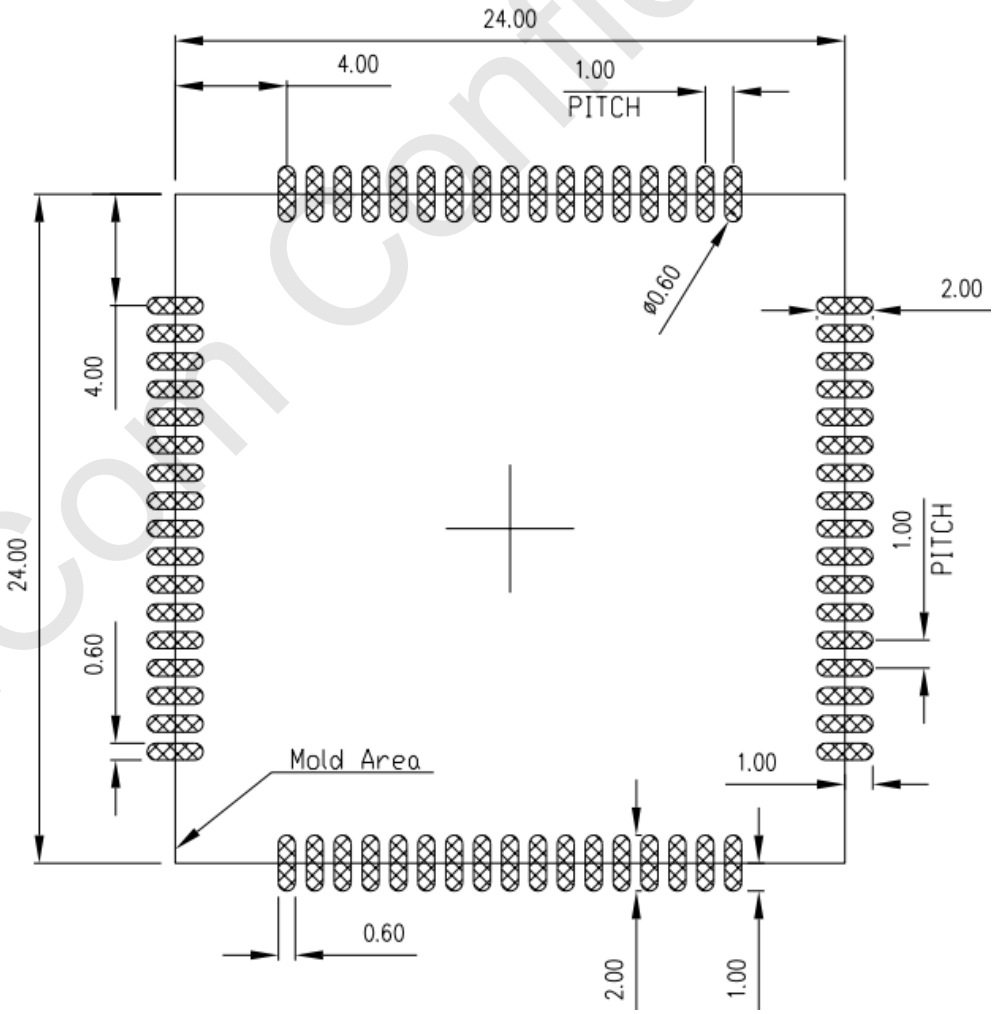

Figure 32：Recommended SMT stencil footprint outline

9 Packaging

SIM7060G module support tray packaging (default packaging).

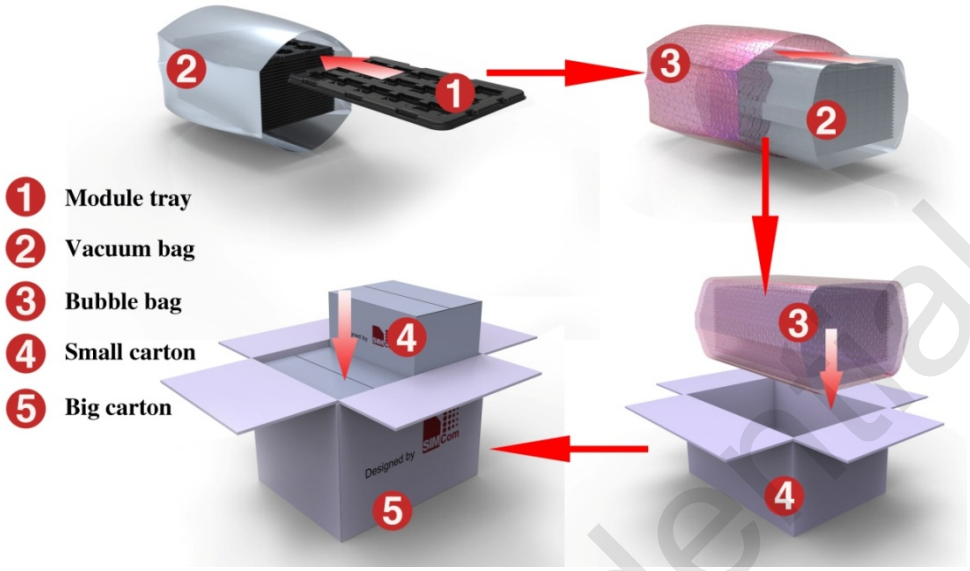

Figure 33：packaging diagram

Module tray drawing：

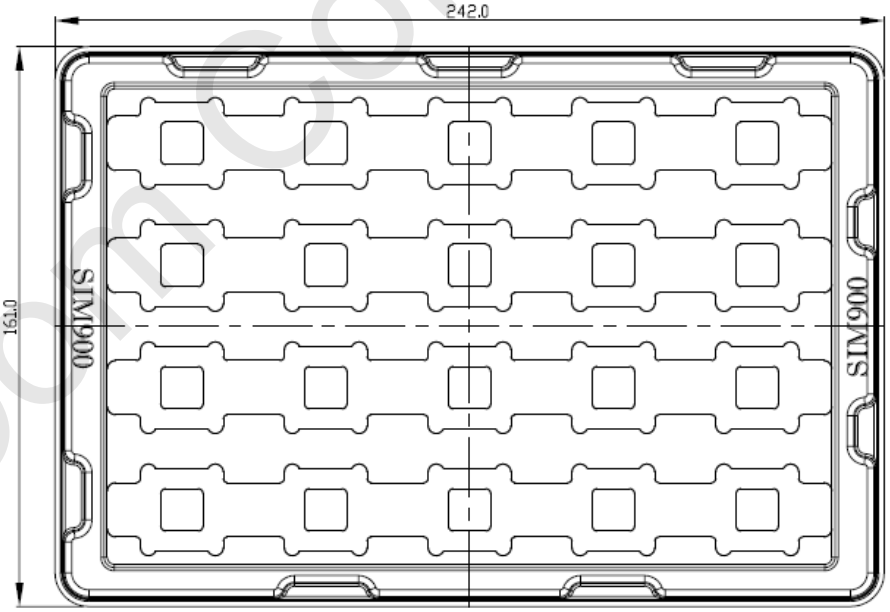

Figure 34：Tray drawing

Figure 32：Tray size

Length（±3mm）	Width（±3mm）	Module number
242.0	161.0	20

Small carton drawing：

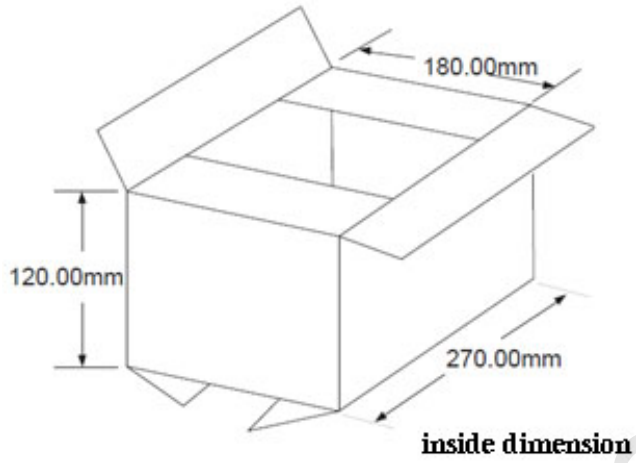

Figure 35：Small carton drawing

Table 33：Small Carton size

Length（±10mm）	Width（±10mm）	Height（±10mm）	Module number
270	180	120	20*20=400

Big carton drawing：

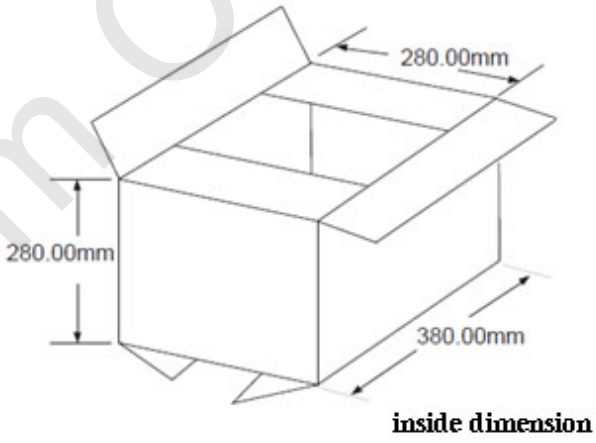

Figure 36：Big carton drawing

Table 34：Big Carton size

Length（±10mm）	Width（±10mm）	Height（±10mm）	Module number
380	280	280	400*4=1600

10 Appendix

I. Related Documents

Table 35：Related Documents

NO.	Title	Description
[1]	SIM7020 Series_AT Command Manual_V1.xx	AT Command Manual
[2]	ITU-T Draft new recommendationV.25ter	Serial asynchronous automatic dialing and control
[3]	3GPP TS 51.010-1	Digital cellular telecommunications system (Release 5); Mobile Station (MS) conformance specification
[4]	3GPP TS 34.124	Electromagnetic Compatibility (EMC) for mobile terminals and ancillary equipment.
[5]	3GPP TS 34.121	Electromagnetic Compatibility (EMC) for mobile terminals and ancillary equipment.
[6]	3GPP TS 34.123-1	Technical Specification Group Radio Access Network; Terminal conformance specification; Radio transmission and reception (FDD)
[7]	3GPP TS 34.123-3	User Equipment (UE) conformance specification; Part 3: Abstract Test Suites.
[8]	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
[9]	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
[10]	IEC/EN60950-1(2001)	Safety of information technology equipment (2000)
[11]	3GPP TS 51.010-1	Digital cellular telecommunications system (Release 5); Mobile Station (MS) conformance specification
[12]	GCF-CC V3.23.1	Global Certification Forum - Certification Criteria
[13]	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)
[14]	Module secondary-SMT-UGD-V1.xx	Module secondary SMT Guidelines
[15]	ETSI EN 301 908-13 (ETSI TS 136521-1 R13.4.0)	IMT cellular networks; Harmonized EN covering the essential requirements of article 3.2 of the R&TTE Directive; Part 13
[16]	SIM868_NMEA Message Specification_V1.xx	
[17]	SIM7060 Series_GNSS_Application Note_V1.02	

II. Terms and Abbreviations

Table 36: Terms and Abbreviations

Abbreviation	Description
ADC	Analog-to-Digital Converter
AMR	Adaptive Multi-Rate
CS	Coding Scheme
CSD	Circuit Switched Data
CTS	Clear to Send
DTE	Data Terminal Equipment (typically computer, terminal, printer)
DTR	Data Terminal Ready
DTX	Discontinuous Transmission
EFR	Enhanced Full Rate
EGSM	Enhanced GSM
ESD	Electrostatic Discharge
ETS	European Telecommunication Standard
FR	Full Rate
GPRS	General Packet Radio Service
GSM	Global Standard for Mobile Communications
HR	Half Rate
IMEI	International Mobile Equipment Identity
Li-ion	Lithium-Ion
MO	Mobile Originated
MS	Mobile Station (GSM engine), also referred to as TE
MT	Mobile Terminated
PAP	Password Authentication Protocol
PBCCH	Packet Broadcast Control Channel
PCB	Printed Circuit Board
PCL	Power Control Level
PCS	Personal Communication System, also referred to as GSM 1900
PDU	Protocol Data Unit
PPP	Point-to-point protocol
RF	Radio Frequency
RMS	Root Mean Square (value)
RTC	Real Time Clock
RX	Receive Direction
SIM	Subscriber Identification Module
SMS	Short Message Service
TE	Terminal Equipment, also referred to as DTE
TX	Transmit Direction
UART	Universal Asynchronous Receiver & Transmitter
URC	Unsolicited Result Code

USSD	Unstructured Supplementary Service Data
PSM	Power saving mode
BD	BeiDou

III. Safety Caution

Table 37: Safety Caution

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

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