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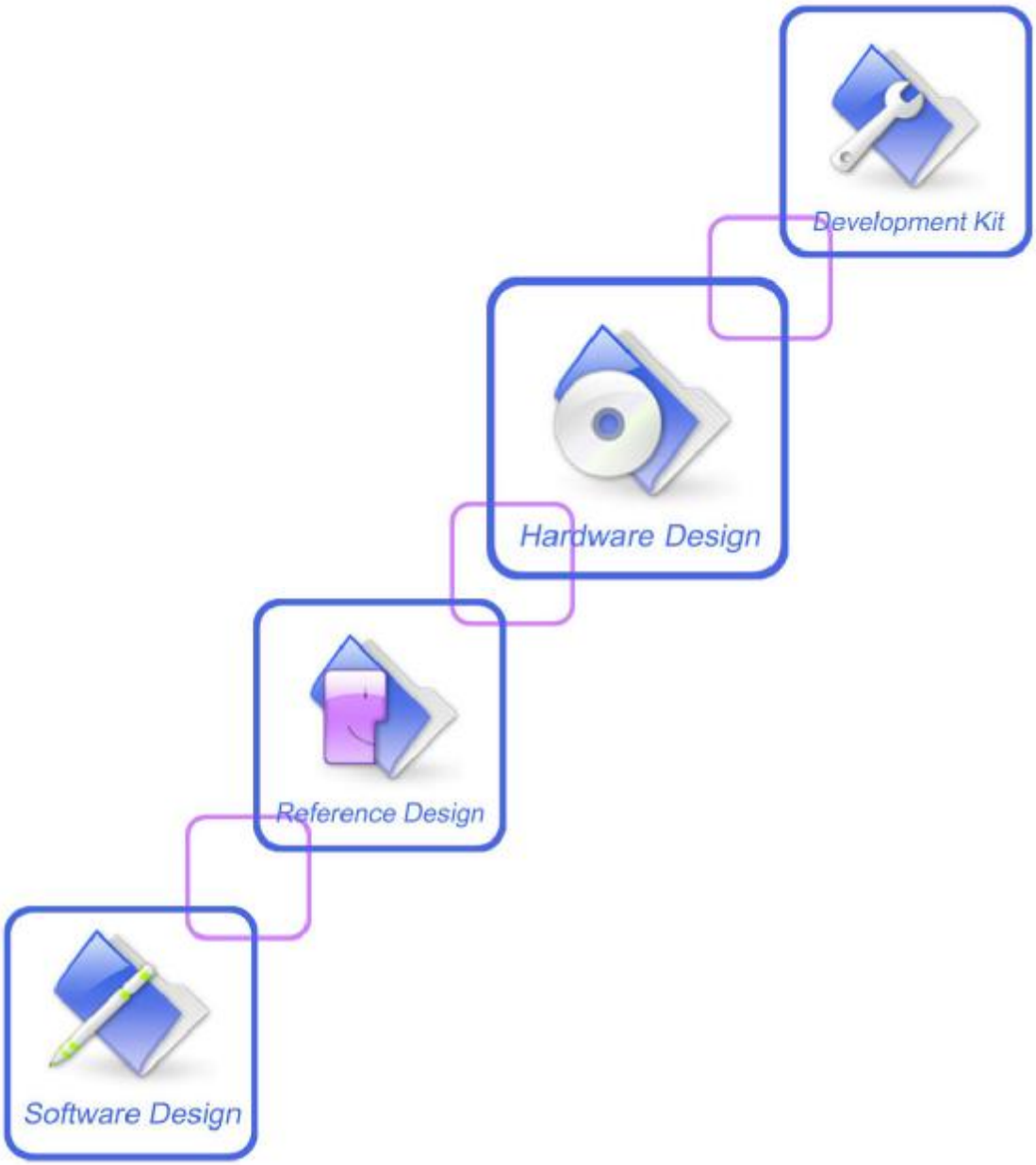
SIM7100 Series Hardware Design V1.02



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Revision History

Data	Version	Description of change	Author
2015-01-20	1.01	Original	Yang Hongliang Li Ya
2015-06-16	1.02	Add the description of SIM7100CT. Add the label description.	Yang Hongliang Li Ya

1 Introduction

This document describes the electronic specifications, RF specifications, interfaces, mechanical characteristics and testing results of the SIMCom SIM7100 series modules. With the help of this document and other SIM7100 software application notes/user guides, users can understand and use SIM7100 series modules to design and develop applications quickly.

1.1 Product Outline

Aimed at global market, the SIM7100 series modules support 5 air-interface standards including GSM, TD-SCDMA, CDMA, WCDMA and LTE. Users can choose the module according to the wireless network configuration. The supported radio frequency bands are described in the following table.

Table 1: SIM7100 series frequency bands

Standard	Frequency	SIM7100x							
		x="C"	x="CE"	x="CT"	x="E"	x="JE"	x="JC"	x="V"	x="A"
GSM	GSM 850MHz								
	EGSM 900MHz	P		P	P	P	P		
	DCS1800MHz	P		P	P	P	P		
	PCS1900MHz								
CDMA2000 /EVDO	BC0		P						
WCDMA	BAND5								P
	BAND6						P		
	BAND8	P			P	P	P		
	BAND2								P
	BAND1	P	P		P	P	P		
TD-SCDMA	TD-SCDMA 1.9G	P		P					
	TD- SCDMA 2G	P		P					
LTE-FDD	LTE-FDD B1	P	P		P	P	P		
	LTE-FDD B2								P
	LTE-FDD B3	P	P		P		P		
	LTE-FDD B4							P	P
	LTE-FDD B5								P
	LTE-FDD B7	P	P		P				
	LTE-FDD B8	P			P	P	P		
	LTE-FDD B13							P	
	LTE-FDD B17								P

	LTE-FDD B18						**P**		
	LTE-FDD B19						**P**		
	LTE-FDD B20				**P**				
LTE-TDD	LTE TDD B38	**P**	**P**	**P**	**P**				
	LTE TDD B39	**P**	**P**	**P**					
	LTE TDD B40	**P**	**P**	**P**	**P**				
	LTE TDD B41	**P**	**P**	**P**			**P**		
GNSS	GPS	**P**	**P**	**P**	**P**		**P**	**P**	**P**
	GLONASS	**P**	**P**	**P**	**P**		**P**	**P**	**P**

With a tiny physical dimension of 30*30*2.9 mm and the functions integrated, the SIM7100 series modules can meet almost any space requirement in users' applications, such as smart phone, PDA, industrial handheld, machine-to-machine and vehicle application, etc.

Note: For convenience of description, in the next content, the "SIM7100" means the "SIM7100 series module"

1.2 Hardware Interface Overview

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

- **Power Supply**
- **USB Interface**
- **UART Interface**
- **MMC/SD and SDIO Interfaces**
- **USIM Interface**
- **GPIO**
- **ADC**
- **LDO Power Output**
- **Current Sink Source**
- **PCM Interface**
- **Keypad Interface**
- **SPI Interface**
- **I2C Interface**

1.3 Hardware Block Diagram

The block diagram of the SIM7100 is shown in the figure below.

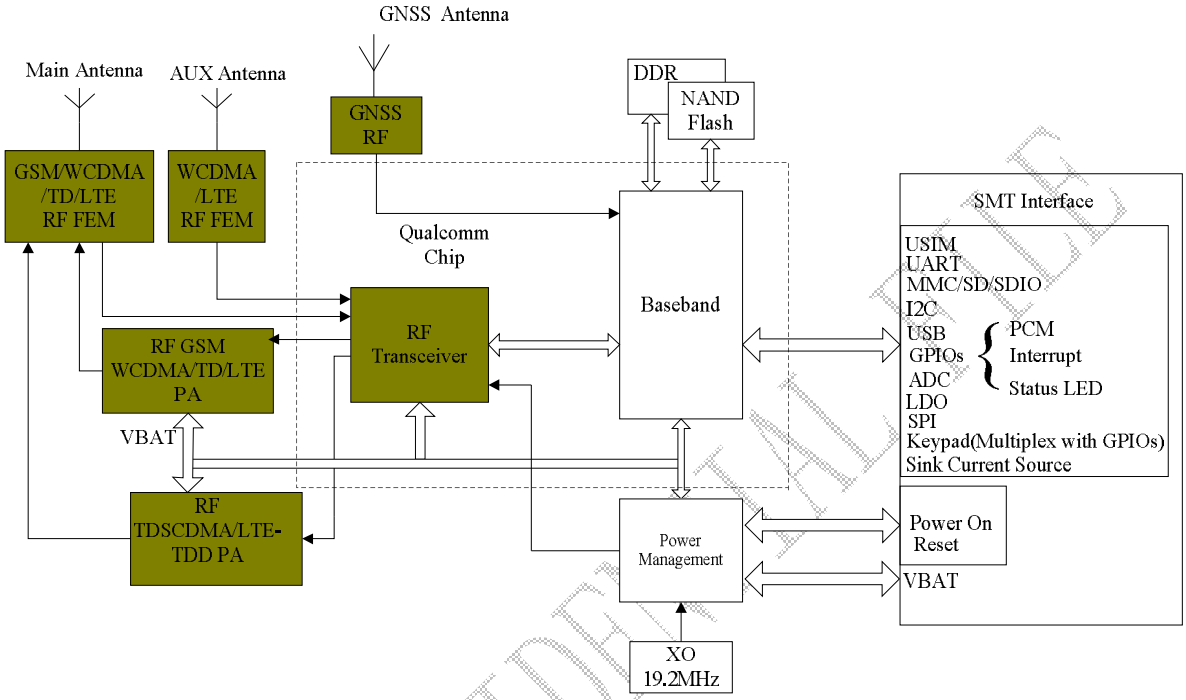

Figure 1: SIM7100 Block Diagram

1.4 Functional Overview

Table 2: General Features

Feature	Implementation
Power supply	Single supply voltage 3.4～4.2V
Power saving	▌ Current in sleep mode : <5mA
Radio frequency bands	Please refer to the table 1
Transmitting power	GSM/GPRS: ▌ Class 4 (2W): GSM850、EGSM900 ▌ Class 1 (1W): DCS1800、PCS1900 EDGE: ▌ Class E2 (0.5W): GSM850、EGSM900 ▌ Class E1 (0.4W): DCS1800、PCS1900 UMTS: ▌ Class 3 (0.25W): WCDMA ▌ Class 3 (0.25W): CDMA2000 ▌ Class 2 (0.25W): TD-SCDMA LTE: ▌ Class 3 (0.25W): LTE
Data Transmission Throughput	▌ GPRS multi-slot class 12 ▌ EDGE multi-slot class 12 ▌ UMTS R99 speed: 384 kbps DL/UL ▌ HSPA+: 5.76 Mbps(UL), 42 Mbps(DL) ▌ TD-HSDPA/HSUPA: 2.2 Mbps(UL), 2.8 Mbps(DL) ▌ CDMA EVDO:Rev-0,Rev-A, Rev-B ▌ LTE Category 3 - 100 Mbps (DL) ▌ LTE Category 3 - 50 Mbps (UL)
Antenna	▌ GSM/UMTS/LTE main antenna. ▌ UMTS/LTE auxiliary antenna. ▌ GPS/GLONASS antenna.
GNSS	▌ GNSS engine (GPS and GLONASS) ▌ Protocol: NMEA
SMS	▌ MT, MO, CB, Text and PDU mode ▌ SMS storage: USIM card or ME(default) ▌ Transmission of SMS alternatively over CS or PS.
USIM interface	Support identity card: 1.8V/ 3V
USIM application toolkit	▌ Support SAT class 3, GSM 11.14 Release 98 ▌ Support USAT
Phonebook management	Support phonebook types: DC,MC,RC,SM,ME,FD,ON,LD,EN

Audio feature	❙ Support PCM interface ❙ Only support PCM master mode and short frame sync, 16-bit linear data formats
UART interface	❙ A full modem serial port by default ❙ Baud rate: 300bps to 4Mbps(default:115200bps) ❙ Autobauding baud rate: 1200 bps to 115200bps ❙ Can be used as the AT commands or data stream channel. ❙ Support RTS/CTS hardware handshake and software ON/OFF flow control ❙ Multiplex ability according to GSM 07.10 Multiplexer Protocol.
MMC/SD/SDIO	❙ support MMC and SD cards with 2.95 V on SD port ❙ support SDIO with 1.8 V only on SD2 port
USB	USB 2.0 specification-compliant as a peripheral
Firmware upgrade	❙ Firmware upgrade over USB interface ❙ FOTA
Physical characteristics	Size:30*30*2.9mm Weight:5.7 g
Temperature range	❙ Normal operation temperature: -30°C to +80°C ❙ Extended operation temperature: -40°C to +85°C* ❙ Storage temperature -45°C to +90°C

Note: Module is able to make and receive voice calls, data calls, SMS and make GPRS/WCDMA/HSPA+/LTE traffic in -40℃ ~ +85℃. The performance will 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

All functions of the SIM7100 will be provided through 87 pads that will be connected to the customers' platform. The following Figure is a high-level view of the pin assignment of the SIM7100.

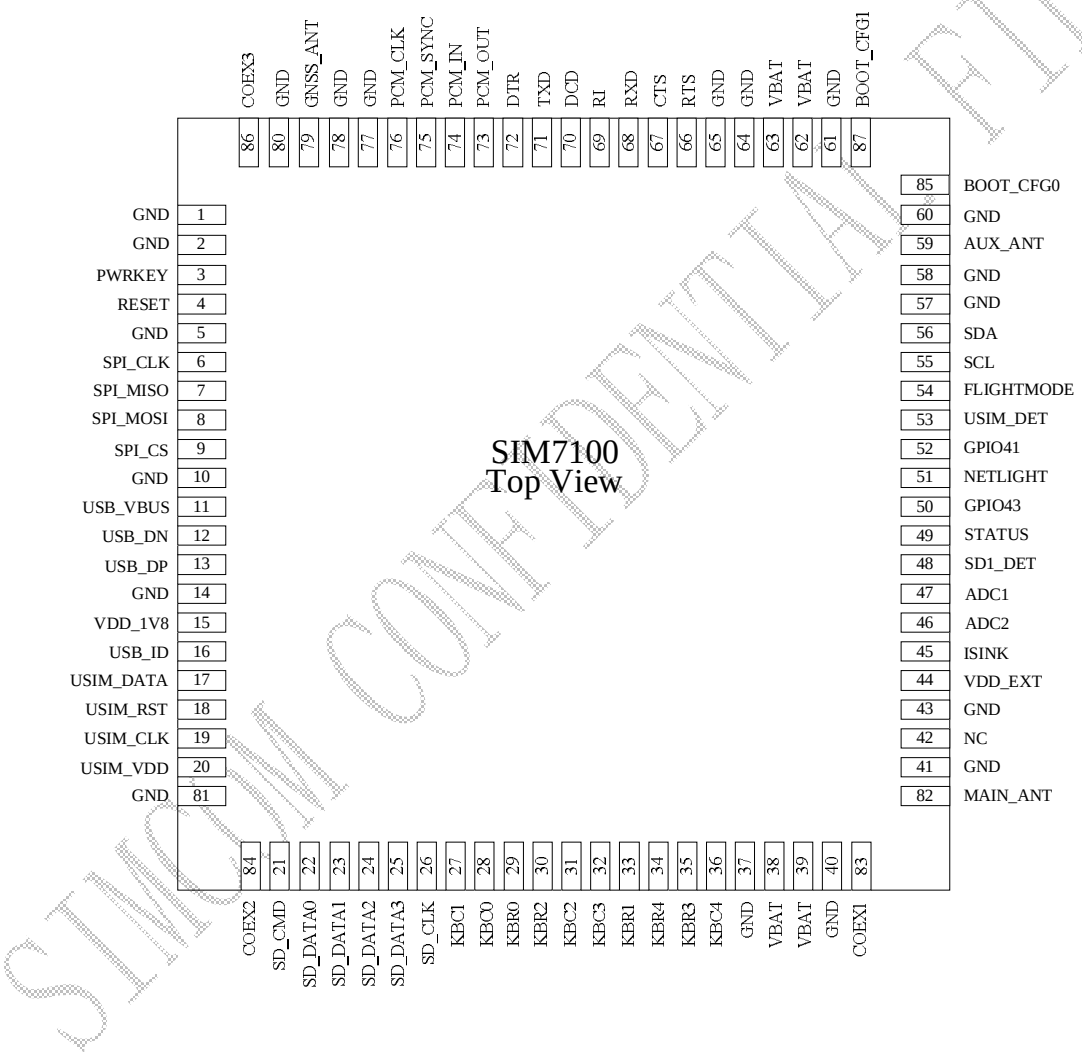

Figure 2: Pin Assignment Overview

Table 3: Pin Definition

Pad No.	Pad Name	Pad No.	Pad Name
1	GND	2	GND
3	PWRKEY	4	RESET
5	GND	6	SPI_CLK
7	SPI_MISO	8	SPI_MOSI
9	SPI_CS	10	GND
11	USB_VBUS	12	USB_DN
13	USB_DP	14	GND
15	VDD_1V8	16	USB_ID
17	USIM_DATA	18	USIM_RST
19	USIM_CLK	20	USIM_VDD
21	SD_CMD	22	SD_DATA0
23	SD_DATA1	24	SD_DATA2
25	SD_DATA3	26	SD_CLK
27	KBC1	28	KBC0
29	KBR0	30	KBR2
31	KBC2	32	KBC3
33	KBR1	34	KBR4
35	KBR3	36	KBC4
37	GND	38	VBAT
39	VBAT	40	GND
41	GND	42	NC
43	GND	44	VDD_EXT
45	ISINK	46	ADC2
47	ADC1	48	SD1_DET
49	STATUS	50	GPIO43
51	NETLIGHT	52	GPIO41
53	USIM_DET	54	FLIGHTMODE
55	SCL	56	SDA
57	GND	58	GND
59	AUX_ANT	60	GND
61	GND	62	VBAT
63	VBAT	64	GND
65	GND	66	RTS
67	CTS	68	RXD

69	RI	70	DCD
71	TXD	72	DTR
73	PCM_OUT	74	PCM_IN
75	PCM_SYNC	76	PCM_CLK
77	GND	78	GND
79	GNSS_ANT	80	GND
81	GND	82	MAIN_ANT
83	COEX1	84	COEX2
85	BOOT_CFG0	86	COEX3
87	BOOT_CFG1		

2.2 Pin description

Table 4: IO Parameters Definition

Pad 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.	Default Status	Description	Comment
Power Supply				
VBAT	38, 39, 62, 63	PI	Power supply, voltage range: 3.4～4.2V.	
NC	42		No connection.	Keep it open, or connect it to ground via a 100nF capacitor to be compatible with SIM5360*.

VDD_EXT	44	PO	LDO power output for SD card circuit or other external circuit with Max. 150mA current output. Its output voltage is Configurable（The default voltage is 0V）.	If unused, keep it open.
VDD_1V8	15	PO	1.8V SMPS output with Max. 50mA current output for external circuit, such as level shift circuit.	If unused, keep it open.
GND	1,2, 5, 10, 14, 37, 40, 41, 43, 57, 58, 60, 61, 64, 65, 77, 78, 80, 81		Ground	
System Control				
PWRKEY	3	DI,PU	System power on/off control input, active low.	PWRKEY has been pulled up to 1.8V via a 200KΩ resistor internally.
RESET	4	DI, PU	System reset control input, active low.	RESET has been pulled up to 1.8V via a 40KΩ resistor internally.
SD interface				
SD_CMD	21	DO	SDIO command	No need to pull them up externally. If unused, keep them open.
SD_DATA0	22	I/O	SDIO data	
SD_DATA1	23	I/O		
SD_DATA2	24	I/O		
SD_DATA3	25	I/O		
SD_CLK	26	DO	SDIO clock	
USIM interface				

USIM_DATA	17	I/O,PU	USIM Card data I/O, which has been pulled up via a 20KR resistor to USIM_VDD internally. Do not pull it up or down externally.	All lines of USIM interface should be protected against ESD.
USIM_RST	18	DO	USIM Reset	
USIM_CLK	19	DO	USIM clock	
USIM_VDD	20	PO	Power output for USIM card, its output Voltage depends on USIM card type automatically. Its output current is up to 50mA.	
SPI interface				
SPI_CLK	6	DO	SPI clock output	Only support SPI master mode. If unused, please keep them open.
SPI_MISO	7	DI	SPI master in/slave out data	
SPI_MOSI	8	DO	SPI master out/slave in data	
SPI_CS	9	DO	SPI chip-select output	
USB				
USB_VBUS	11	DI,PD	Valid USB detection input with 2.0～5.25V detection voltage	It has been pulled down to ground via a 10KΩ resistor internally.
USB_DN	12	I/O	Negative line of the differential, bi-directional USB signal.	
USB_DP	13	I/O	Positive line of the differential, bi-directional USB signal.	
USB_ID	16	DI	High-speed USB ID input	Keep it open.
UART interface				
RTS	66	DOH	Request to send	If unused, keep them open.
CTS	67	DI,PU	Clear to Send	
RXD	68	DI,PU	Receive Data	
RI	69	DOH	Ring Indicator	
DCD	70	DOH	Carrier detects	
TXD	71	DOH	Transmit Data	
DTR	72	DI,PU	DTE get ready	
I2C interface				
SCL	55	DO	I2C clock output	If unused, keep open, or else pull them up via 4.7KΩ resistors to 1.8V.
SDA	56	I/O	I2C data input/output	

Keypad interface				
KBR0	29	DOH	Bit 0 drive to the pad matrix	KBC0, KBC1, KBC2, KBC3, KBR0 and KBR2 pins can be configured as SD2 interface. If unused, please keep them open.
KBR1	33	DOH	Bit 1 drive to the pad matrix	
KBR2	30	DOH	Bit 2 drive to the pad matrix	
KBR3	35	DOH	Bit 3 drive to the pad matrix	
KBR4	34	DOH	Bit 4 drive to the pad matrix	
KBC0	28	DI,PD	Bit 0 for sensing key press on pad matrix	
KBC1	27	DI,PD	Bit 1 for sensing key press on pad matrix	
KBC2	31	DI,PD	Bit 2 for sensing key press on pad matrix	
KBC3	32	DI,PD	Bit 3 for sensing key press on pad matrix	
KBC4	36	DI,PD	Bit 4 for sensing key press on pad matrix	
PCM interface				
PCM_OUT	73	DO	PCM data output.	If unused, please keep them open.
PCM_IN	74	DI	PCM data input.	
PCM_SYNC	75	DO	PCM data frame sync signal.	
PCM_CLK	76	DO	PCM data bit clock.	
GPIO				
NETLIGHT	51	DO	LED control output as network status indication.	If unused, keep them open.
FLIGHTMODE	54	DI,PU	Flight Mode control input. High level(or open): Normal Mode Low level: Flight Mode	
STATUS	49	DO	Operating status output. High level: Power on and firmware ready Low level: Power off	
GPIO41	52	IO	GPIO	
GPIO43	50	IO	GPIO	
SD1_DET	48	IO	Default: GPIO Optional: SD card detecting input. H: SD card is removed L: SD card is inserted	
USIM_DET	53	IO	Default: GPIO Optional: USIM card detecting input. H: USIM is removed L: USIM is inserted	
RF interface				
MAIN _ANT	82	AIO	MAIN antenna soldering pad	
GNSS_ANT	79	AI	GNSS antenna soldering pad	

AUX_ANT	59	AI	Auxiliary antenna soldering pad	
Other interface				
ISINK	45	PO	Ground-referenced current sink.	If unused, please keep them open.
ADC1	47	AI	Analog-digital converter input 1	
ADC2	46	AI	Analog-digital converter input 2	
COEX1	83	I/O	RF synchronizing between Wi-Fi and LTE.	If unused, keep them open.
COEX2	84	I/O		
COEX3	86	I/O		
BOOT_CFG0	85	DI,PD	Boot configuration input. Module will be forced into USB download mode by connect 85 and 87 pins to VDD_1V8 during power up.	Do place 2 test points for debug.
BOOT_CFG1	87	DI,PD		

Note: For more details about compatibility between SIM7100 and SIM5360, please refer to document [25].

2.3 Mechanical Information

The following figure shows the package outline drawing of SIM7100.

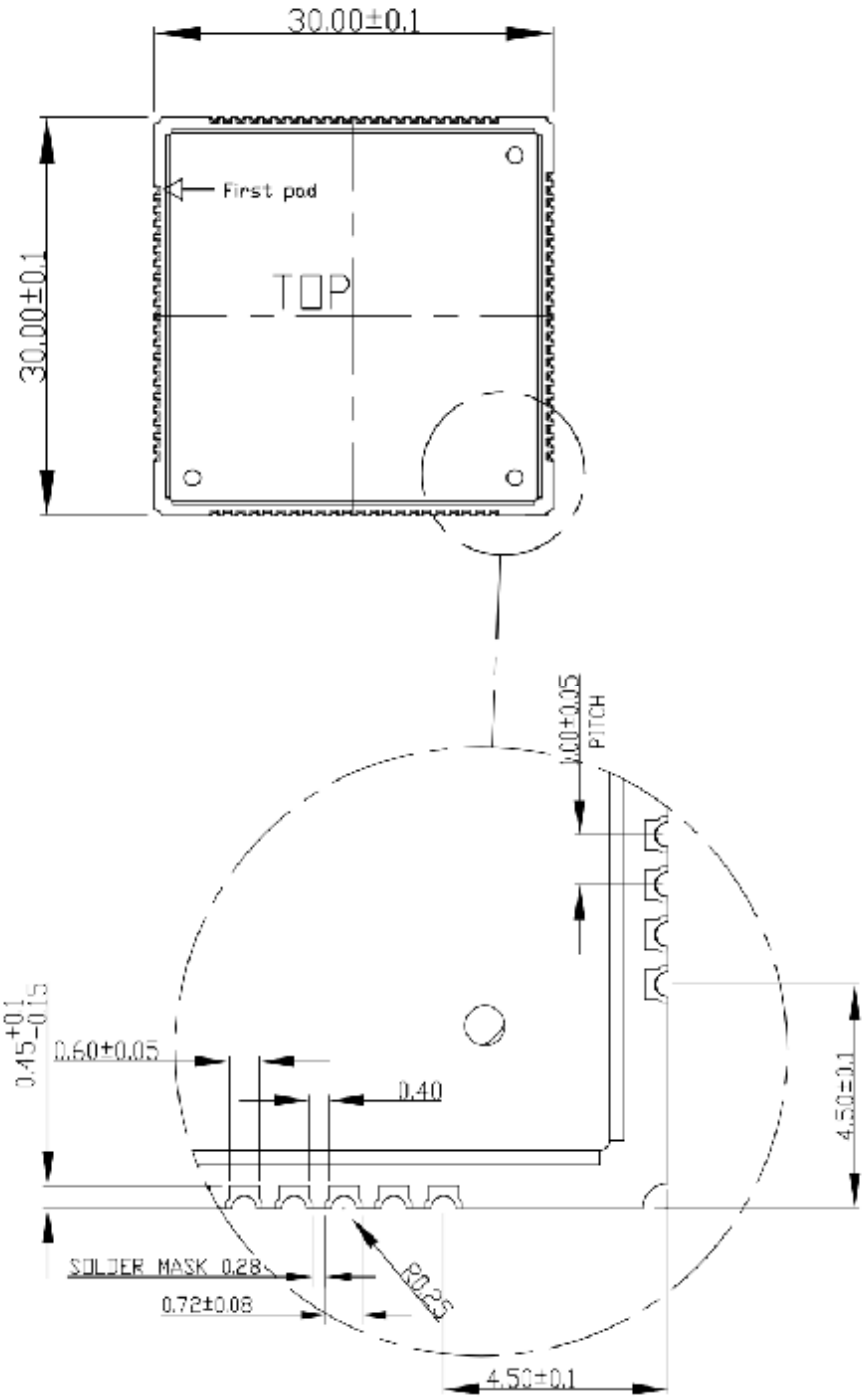

Figure 3: Top dimensions (Unit: mm)

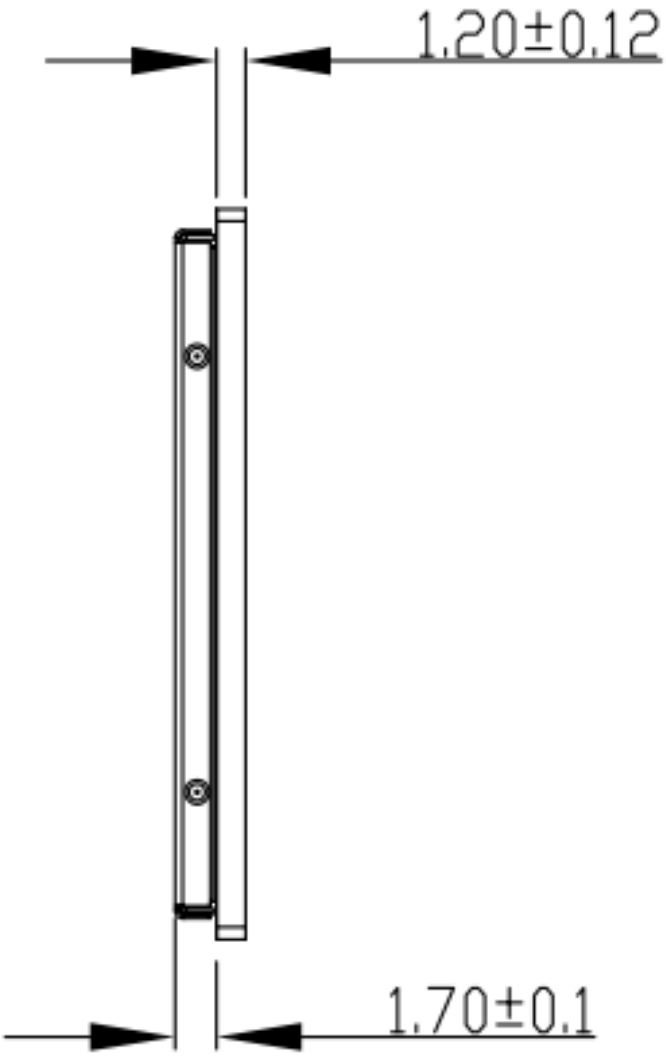

Figure 4: Side dimensions (Unit: mm)

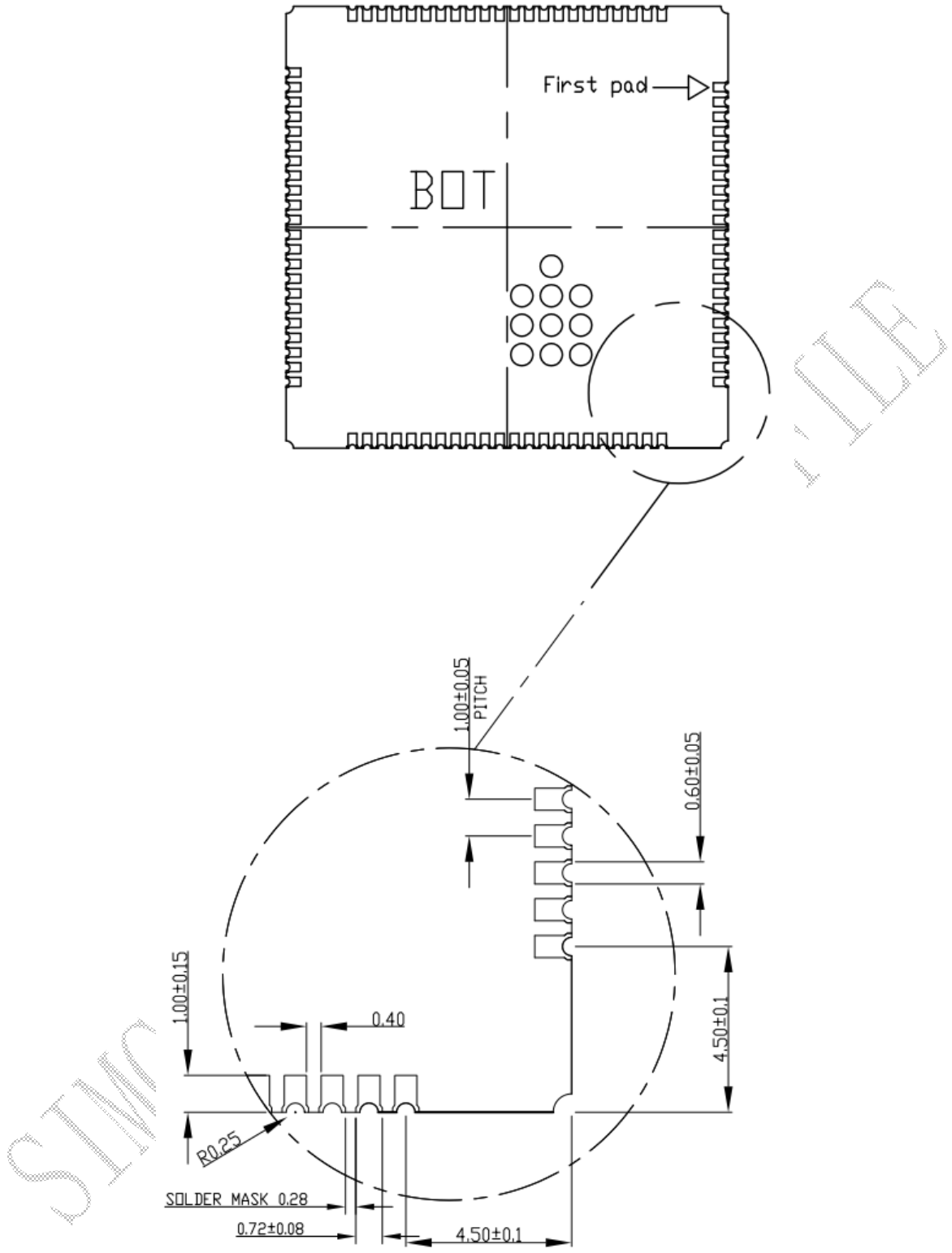

Figure 5: Bottom dimensions (Unit: mm)

2.4 Footprint Recommendation

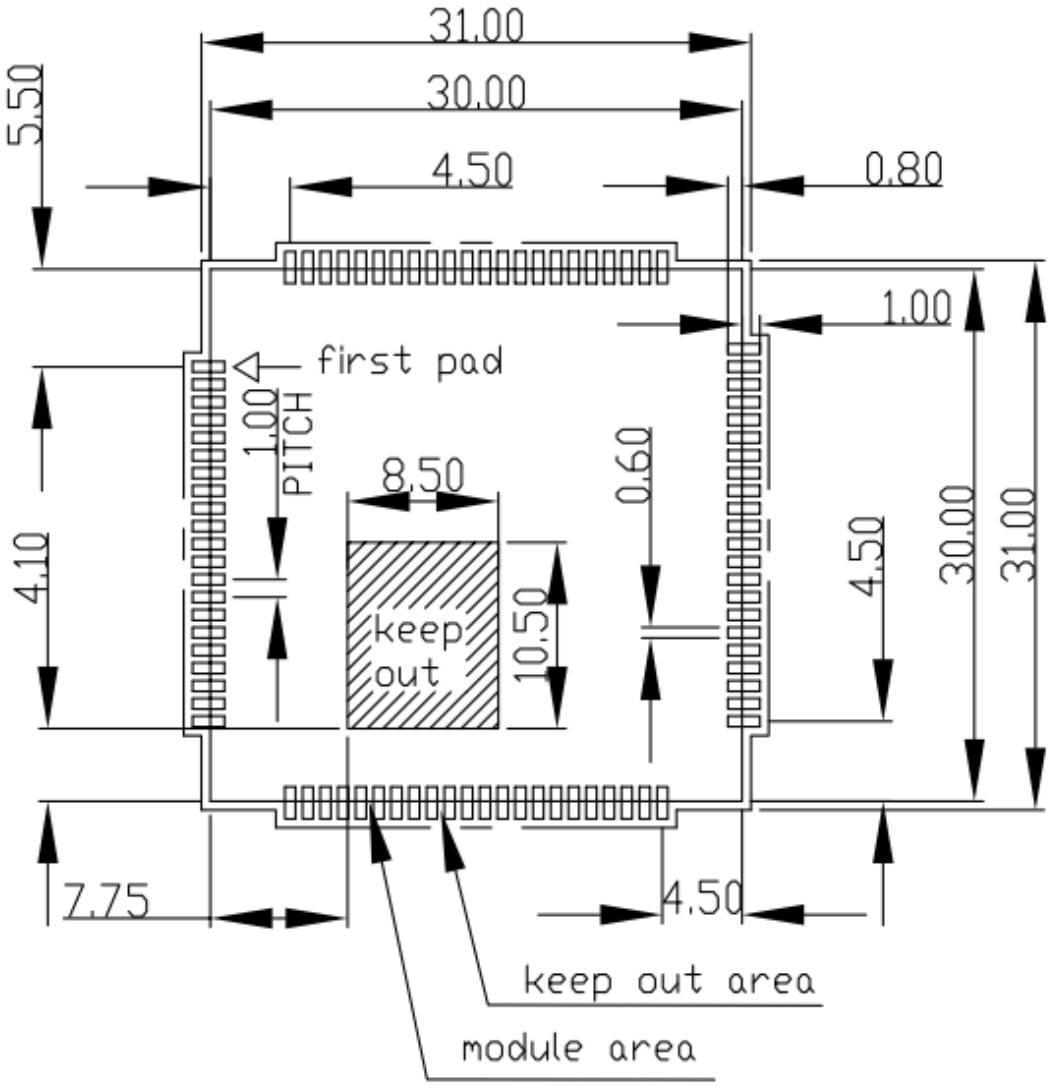

Figure 6: Footprint Recommendation (Unit: mm)

3 Interface Application

3.1 Power Supply

The power supply pins of SIM7100 include 4 pins (pin 62&63, pin 38&39) named VBAT.
The 4 VBAT pads supplies the power to RF and baseband circuits directly. On VBAT pads, the ripple current up to 2A typically, due to GSM/GPRS emission burst (every 4.615ms), may cause voltage drop. So the power supply for these pads must be able to provide sufficient current up to more than 2A in order to avoid the voltage drop is more than 300mV.
The following figure shows the VBAT voltage ripple wave at the maximum power transmit phase.

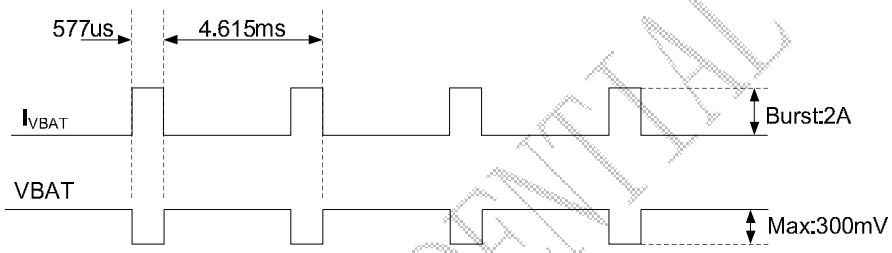

Figure 7: VBAT voltage drop during burst emission (GSM/GPRS)

Note: The test condition: The voltage of power supply for VBAT is 3.8V, Cd=100 μF tantalum capacitor (ESR=0.7Ω) and Cf=100nF (Please refer to Figure 8—Application circuit).

Table 6: VBAT Pins Electronic Characteristic

Symbol	Description	Min.	Typ.	Max.	Unit
VBAT	Module power voltage	3.4	3.8	4.3	V
$I_{VBAT(peak)}$	Module power peak current in normal mode.	-	2	-	A
$I_{VBAT(average)}$	Module power average current in normal mode	Please refer to the table 34.			
$I_{VBAT(sleep)}$	Power supply current in sleep mode				
$I_{VBAT(power-off)}$	Module power current in power off mode.	-	-	20	uA

3.1.1 Power supply Design Guide

Make sure that the voltage on the VBAT pins will never drop below 3.4V even during a transmit burst, when current consumption may rise up to 2A. If the voltage drops below 3.4V, the RF performance may be affected.

Note: If the power supply for BAT pins can support up to 2A, using a total of more than 300uF capacitors is recommended, or else users must using a total of 1000uF capacitors typically, in order to avoid the voltage drop is more than 300mV..

Some multi-layer ceramic chip (MLCC) capacitors (0.1/1uF) with low ESR in high frequency band can be used for EMC.

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

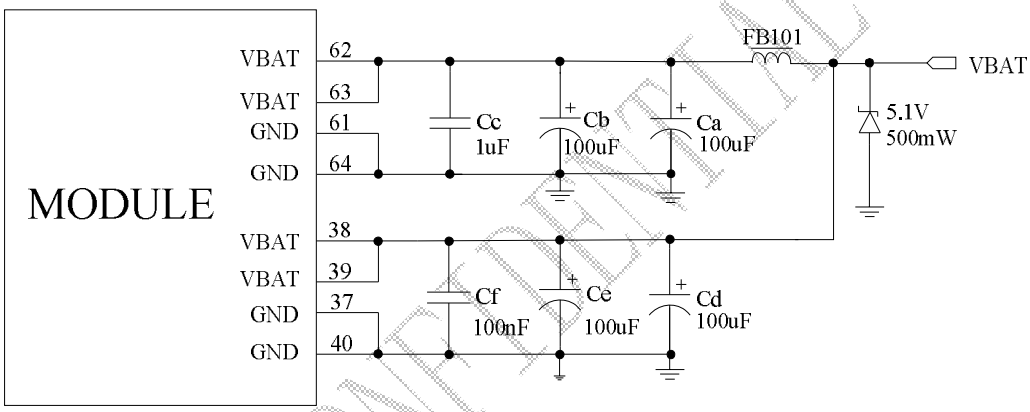

Figure 8: Power Supply Application Circuit

Note: The Cd, Ce, Cb, Cc and Cf are recommended to be mounted for SIM7100, or the Ca, Cb, Ce, Cc and Cf for SIM5360. For more details about compatibility between SIM7100 and SIM5360, please refer to document [25].

In addition, in order to guarding for over voltage protection, it is suggested to use a zener diode with 5.1V reverse zener voltage and more than 500mW power dissipation.

Table 7: Recommended Zener Diode List

No.	Manufacturer	Part Number	power dissipation	Package
1	On semi	MMSZ5231BT1G	500mW	SOD123
2	Prisemi	PZ3D4V2H	500mW	SOD323
3	Vishay	MMSZ4689-V	500mW	SOD123
4	Crownpo	CDZ55C5V1SM	500mW	0805

3.1.2 Recommended Power supply circuit

It is recommended that a switching mode power supply or linear regulator power supply is used. It is important to make sure that all the components used in the power supply circuit can resist a peak current up to 2A.

The following figure shows the linear regulator reference circuit with 5V input and 3.8V output.

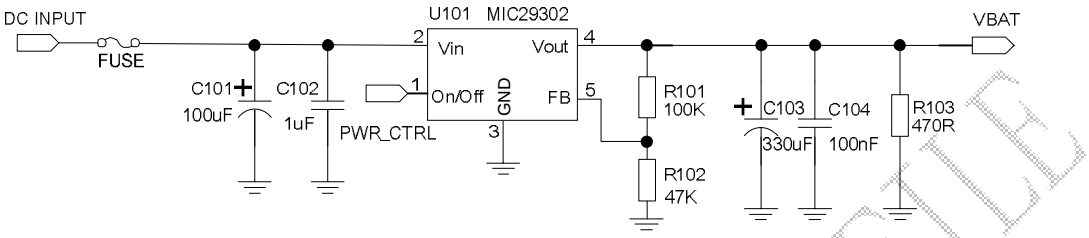

Figure 9: Linear Regulator Reference Circuit

If there is a big voltage difference between input and output for VBAT power supply, or the efficiency is extremely important, then a switching mode power supply will be preferable. The following figure shows the switching mode power supply reference circuit.

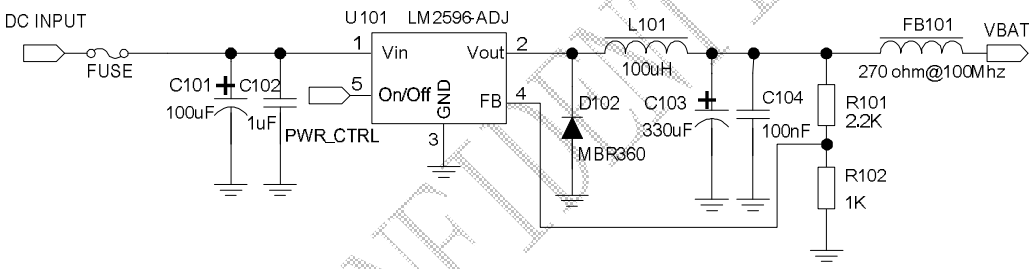

Figure 10: Switching Mode power supply Reference Circuit

Note: The Switching Mode power supply solution for VBAT must be chosen carefully against Electro Magnetic Interference and ripple current from depraving RF performance.

3.1.3 Voltage Monitor

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

For monitoring the VBAT voltage outside or within a special range, the AT command "AT+CVALARM" can be used to enable the under-voltage warning function.

If users need to power off SIM7100, when the VBAT voltage is out of a range, the AT command "AT+CPMVT" can be used to enable 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].

3.2 Power on/Power off/Reset Function

3.2.1 Power on

SIM7100 can be powered on by pulling the PWRKEY pin down to ground.
The PWRKEY pin has been pulled up with a 200KΩ resistor to 1.8V internally, so it does not need to pull it up externally. It is strongly recommended to put a100nF capacitor and an ESD protection diode close to the PWRKEY pin. Please refer to the following figure for the recommended reference circuit.

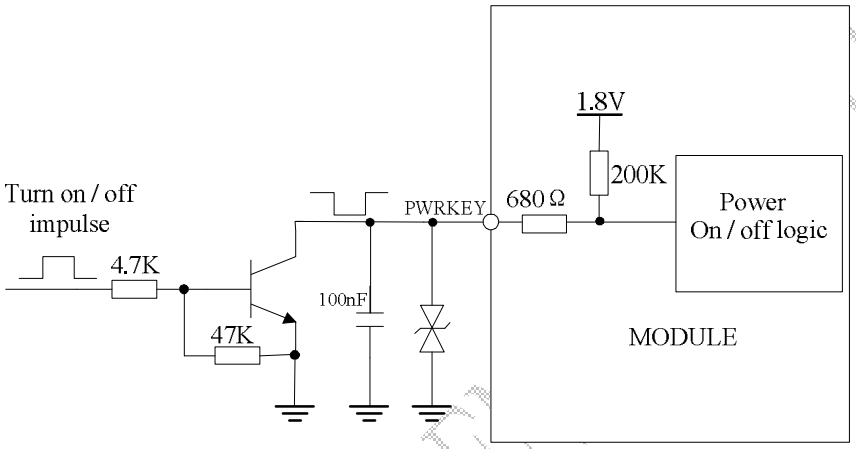

Figure 11: Reference power on/off circuit

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

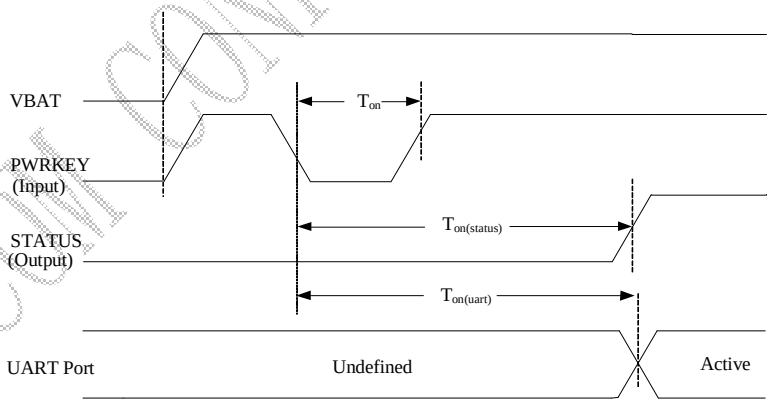

Figure 12: Power on Timing Sequence

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	100	500	-	ms
$T_{on(status)}$	The time from power-on issue to STATUS pin output high level(indicating power up ready)	15	-	25	s
$T_{on(uart)}$	The time from power-on issue to UART port ready	10	-	20	s
V_{IH}	Input high level voltage on PWRKEY pin	1.17	1.8	2.1	V
V_{IL}	Input low level voltage on PWRKEY pin	-0.3	0	0.3	V

3.2.2 Power off

The following methods can be used to power off SIM7100.

- Method 1: Power off SIM7100 by pulling the PWRKEY pin down to ground.
- Method 2: Power off SIM7100 by AT command "AT+CPOF".
- Method 3: over-voltage or under-voltage automatic power off. The voltage range can be set by AT command "AT+CPMVT".
- Method 4: over-temperature or under-temperature automatic power off.

Note: If the temperature is outside the range of -30~+80℃, some warning will be reported via AT port. If the temperature is outside the range of -40~+85℃, SIM7100 will be powered off automatically.

For details about "AT+CPOF" and "AT+CPMVT", please refer to Document [1].

These procedures will make module disconnect from the network and allow the software to enter a safe state, and save data before module be powered off completely.

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

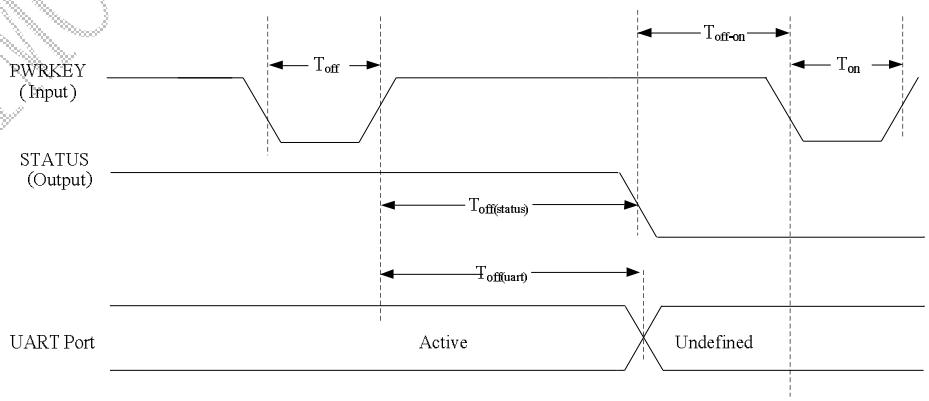

Figure 13: Power off timing sequence

Table 9: Power off timing and Electronic Characteristic

Symbol	Parameter	Time value			
		Min.	Typ.	Max.	Unit
T_{off}	The active low level time pulse on PWRKEY pin to power off module	2.5	--	--	s
$T_{off(status)}$	The time from power-off issue to STATUS pin output low level(indicating power off)*	10	-	-	s
$T_{off(uart)}$	The time from power-off issue to UART port off	10	-	-	s
T_{off-on}	The buffer time from power-off issue to power-on issue	0	-	-	s
V_{IH}	Input high level voltage on PWRKEY pin	1.17	1.8	2.1	V
V_{IL}	Input low level voltage on PWRKEY pin	-0.3	0	0.3	V

Note: The STATUS pin can be used to detect whether module is powered on or not. When module has been powered on and firmware goes ready, STATUS will be high level, or else STATUS will still low level.

3.2.3 Reset Function

SIM7100 can be reset by pulling the RESET pin down to ground.

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

The RESET pin has been pulled up with a 40KΩ resistor to 1.8V 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.

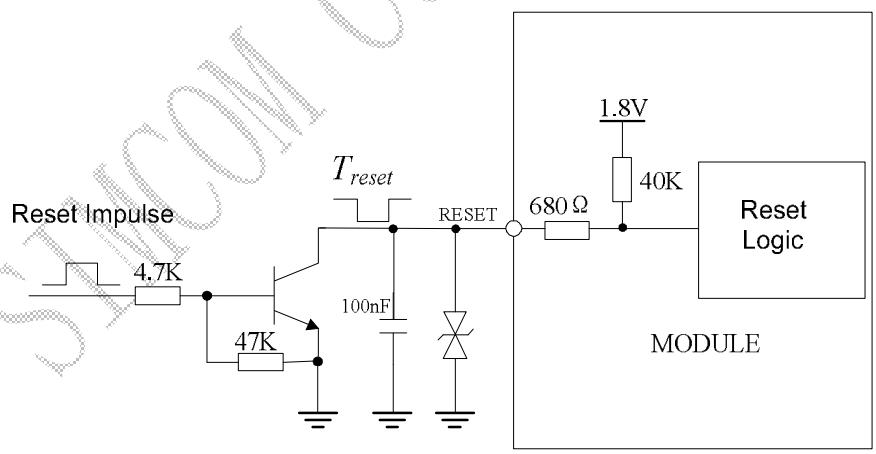

Figure 14: Reference Reset Circuit

Table 10: RESET Pin Electronic Characteristic

Symbol	Description	Min.	Typ.	Max.	Unit
T_{reset}	The active low level time impulse on RESET pin to reset module	50	100	500	ms
V_{IH}	Input high level voltage	1.17	1.8	2.1	V
V_{IL}	Input low level voltage	-0.3	0	0.3	V

3.3 UART Interface

SIM7100 provides a 7-wire UART (universal asynchronous serial transmission) interface as DCE (Data Communication Equipment). AT commands and data transmission can be performed through UART interface.

3.3.1 UART Design Guide

The following figures show the reference design.

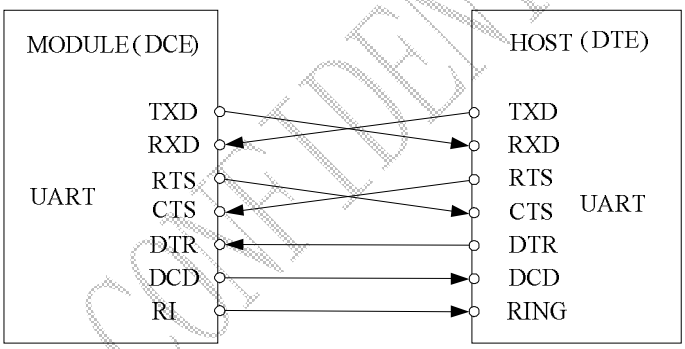

Figure 15: UART Full modem

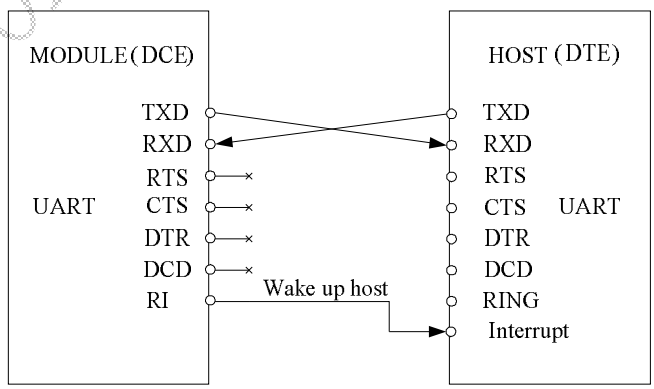

Figure 16: UART Null Modem

The SIM7100 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.

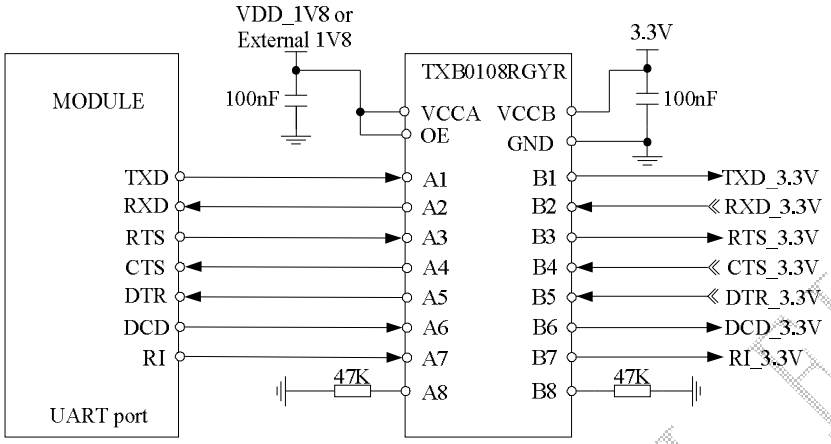

Figure 17: Reference circuit of level shift

To comply with RS-232-C protocol, the RS-232-C level shifter chip should be used to connect SIM7100 to the RS-232-C interface, for example SP3238ECA, etc.

Note: SIM7100 supports the following baud rates: 300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200, 230400, 460800, 921600, 3200000, 3686400, 4000000bps. The default band rate is 115200bps.

3.3.2 RI and DTR Behavior

The RI pin can be used as an interrupt output signal to inform the host controller such as application CPU.

Normally RI will keep high level until certain conditions such as receiving SMS, or a URC report coming, and then it will change to low level. It will stay low until the host controller clears the interrupt event with "AT+CRIRS" AT command.

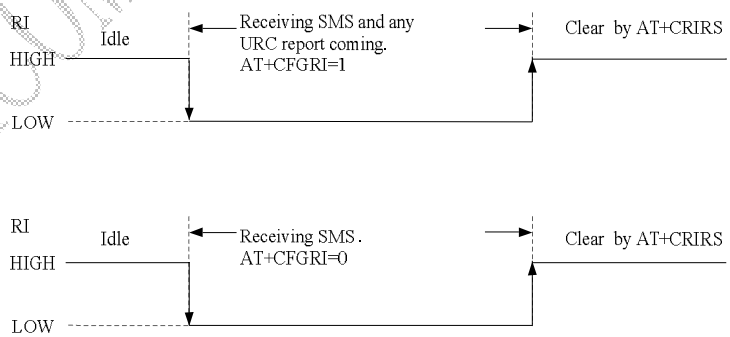

Figure 18: RI behaviour（SMS and URC report）

Normally RI will be kept high level until a voice call, then it will output periodic rectangular wave with 5900ms low level and 100ms high level. It will output this kind of periodic rectangular wave

until the call is answered or hung up.

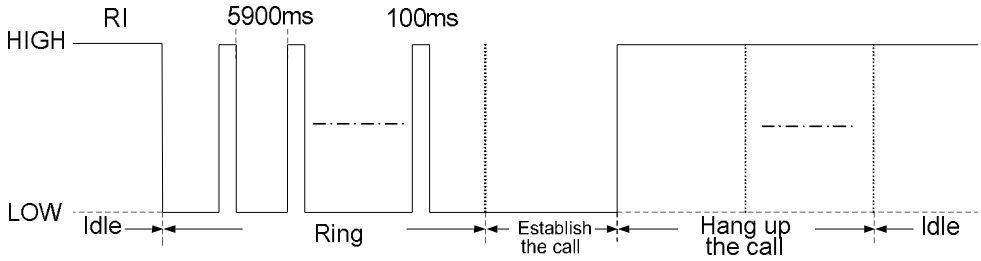

Figure 19: RI behaviour（voice call）

Note: For more details of AT commands about UART, please refer to document [1] and [22].

DTR pin can be used to wake SIM7100 from sleep. When SIM7100 enters sleep mode, pulling down DTR can wake SIM7100.

3.4 USB Interface

The SIM7100 contains a USB interface compliant with the USB2.0 specification as a peripheral, but the USB charging function is not supported.

3.4.1 USB Application Guide

SIM7100 can be used as a USB device. SIM7100 supports the USB suspend and resume mechanism which can reduce power consumption. If there is no data transmission on the USB bus, SIM7100 will enter suspend mode automatically, and will be resumed by some events such as voice call or receiving SMS, etc.

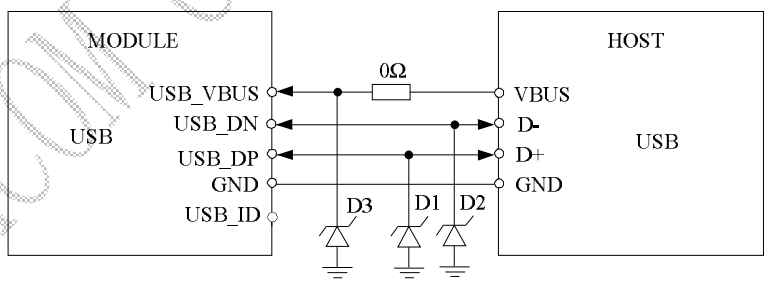

Figure 20: USB Reference Circuit

Because of the high bit rate 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 should be less than 1pF. It is recommended to use an ESD protection component such as ESD9L5.0ST5G provided by On Semiconductor (www.onsemi.com).

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

3.5 USIM Interface

SIM7100 supports both 1.8V and 3.0V USIM Cards.

Table 11: USIM Electronic characteristic in 1.8V mode (USIM_VDD =1.8V)

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

Table 12: USIM Electronic characteristic 3.0V mode (USIM_VDD =2.95V)

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

3.5.1 USIM 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 USIM peripheral circuit should be close to the USIM card socket. The following figure shows the 6-pin SIM card holder reference circuit.

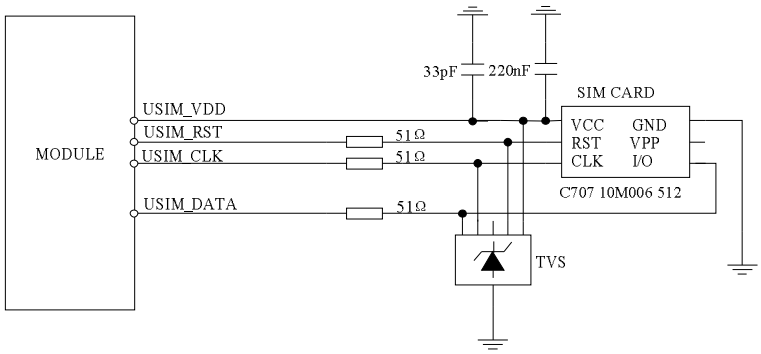

Figure 21: USIM interface reference circuit

Note: USIM_DATA has been pulled up with a 20KΩ resistor to USIM_VDD in module. A 220nF capacitor on USIM_VDD is used to reduce interference. For more details of AT commands about USIM, please refer to document [1].

3.5.2 Recommended USIM Card Holder

It is recommended to use the 6-pin USIM socket such as C707 10M006 512 produced by Amphenol. User can visit http://www.amphenol.com for more information about the holder.

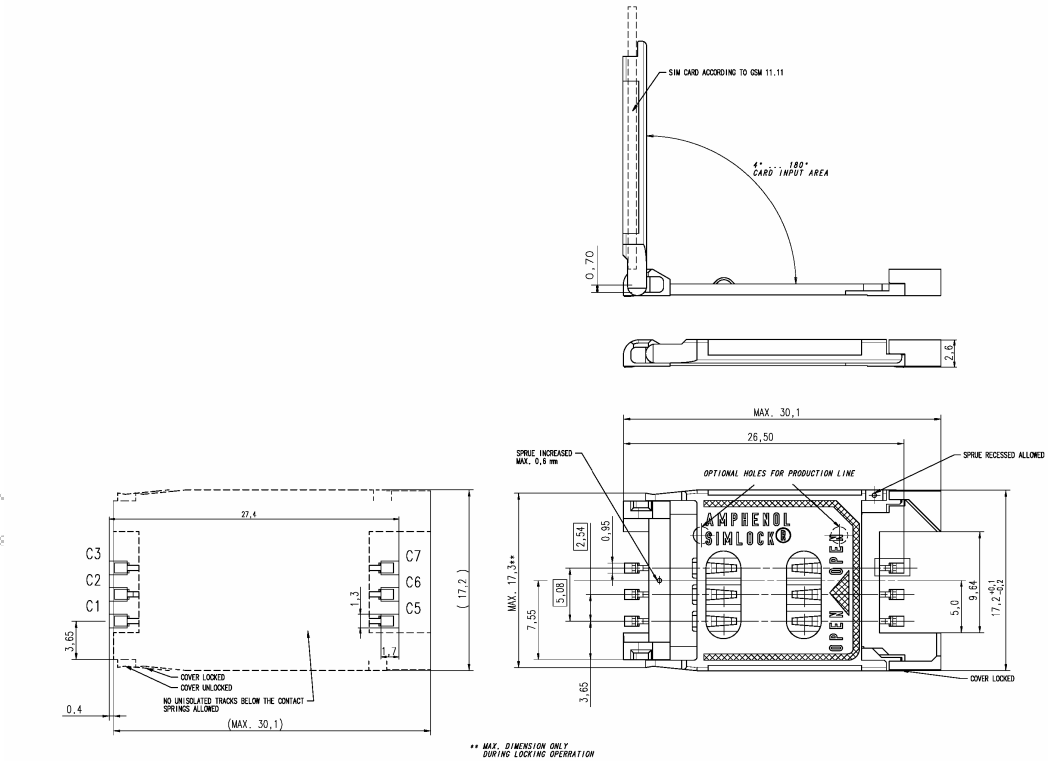

Figure 22: Amphenol SIM card socket

Table 13: Amphenol USIM Socket Pin Description

Pin	Signal	Description
C1	USIM_VDD	USIM Card Power supply.
C2	USIM_RST	USIM Card Reset.
C3	USIM_CLK	USIM Card Clock.
C5	GND	Connect to GND.
C6	VPP	
C7	USIM_DATA	USIM Card data I/O.

3.6 PCM Interface

SIM7100 provides a PCM interface for external codec, which can be used in master mode with short sync and 16 bits linear format.

Table 14: PCM Format

Characteristics	Specification
Line Interface Format	Linear(Fixed)
Data length	16bits(Fixed)
PCM Clock/Sync Source	Master Mode(Fixed)
PCM Clock Rate	2048 KHz (Fixed)
PCM Sync Format	Short sync(Fixed)
Data Ordering	MSB

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

3.6.1 PCM timing

SIM7100 supports 2.048 MHz PCM data and sync timing for 16 bits linear format codec.

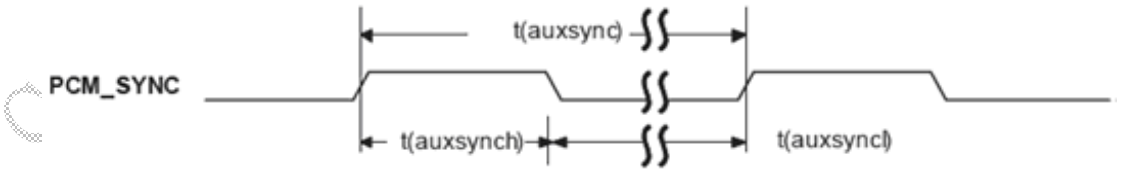

Figure 23: PCM_SYNC timing

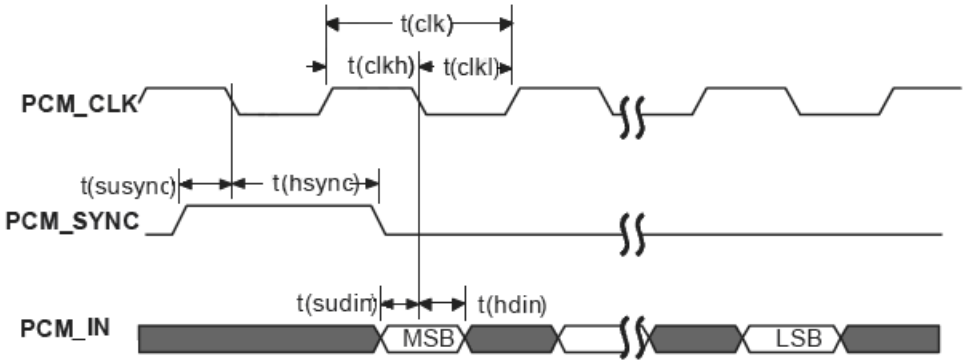

Figure 24: EXT CODEC to MODULE timing

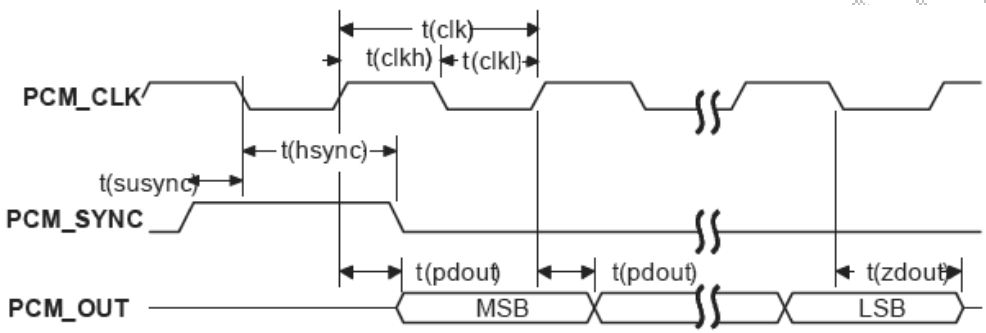

Figure 25: MODULE to EXT CODEC timing

Table 15: PCM Timing parameters

Parameter	Description	Min.	Typ.	Max.	Unit
T(sync)	PCM_SYNC cycle time	–	125	–	µs
T(synch)	PCM_SYNC high level time	–	488	–	ns
T(syncl)	PCM_SYNC low level time	–	124.5	–	µs
T(clk)	PCM_CLK cycle time	–	488	–	ns
T(clkh)	PCM_CLK high level time	–	244	–	ns
T(clkl)	PCM_CLK low level time	–	244	–	ns
T(susync)	PCM_SYNC setup time high before falling edge of PCM_CLK	–	122	–	ns
T(hsync)	PCM_SYNC hold time after falling edge of PCM_CLK	–	366	–	ns
T(sudin)	PCM_IN setup time before falling edge of PCM_CLK	60	–	–	ns
T(hdin)	PCM_IN hold time after falling edge of PCM_CLK	60	–	–	ns
T(pdout)	Delay from PCM_CLK rising to PCM_OUT valid	–	–	60	ns
T(zdout)	Delay from PCM_CLK falling to PCM_OUT HIGH-Z	–	–	60	ns

3.6.2 PCM Application Guide

The following figure shows the external codec reference design.

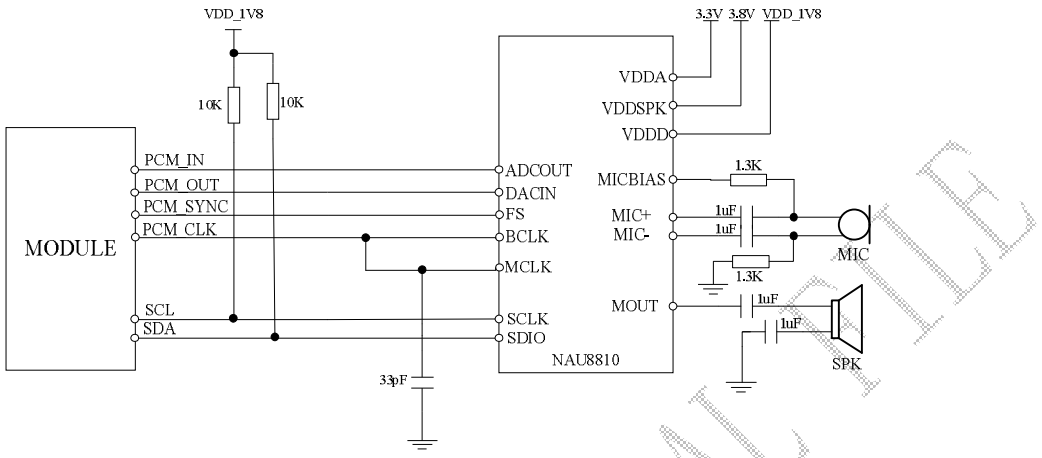

Figure 26: Audio Codec Reference Circuit

Note: SIM7100 can transmit PCM data by the USB port besides the PCM interface. For more details please refer to documents [1] and [23].

3.7 SD Interface

SIM7100 provides a 4-bit SD/MMC interface with clock rate up to 52 MHz. The voltage of MMC/SD interface is 2.95V with SD/MMC memory cards up to 2 TB, which is compatible with SDIO Card Specification (version 3.0), Secure Digital (Physical Layer Specification, version 3.0) and Multimedia Card Host Specification MMC (version 4.4).

Table 16: MMC/SD Electronic characteristic (SD_DATA0-SD_DATA3， SD_CLK and SD_CMD) *

Symbol	Parameter	Min.	Typ.	Max.	Unit
VDD_EXT	LDO power output voltage**	2.75	2.95	3.05	V
V_{IH}	High-level input voltage	0.65·VDD_EXT	-	VDD_EXT+0.3	V
V_{IL}	Low-level input voltage	-0.3	0	0.25·VDD_EXT	V
V_{OH}	High-level output voltage	VDD_EXT-0.4	2.95	VDD_EXT	V
V_{OL}	Low-level output voltage	0	0	0.45	V

Note:

****Be different from SD_DATA0-SD_DATA3，SD_CLK and SD_CMD，SD1_DET is 1.8V operation voltage.***

VDD_EXT must be set with 2.95V output by AT command.

3.7.1 SD Design guide

VDD_EXT can provide power for SD card. ESD/EMI components should be arranged beside SD card socket. Refer to the following application circuit.

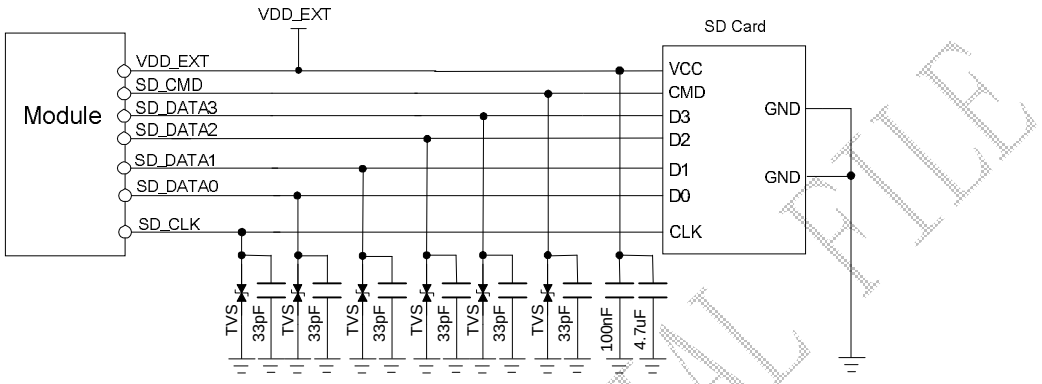

Figure 27: SD Reference Circuit

Note: The SD signal lines have internal pull-up resistors for BOM saving.

3.8 I2C Interface

SIM7100 provides a I2C interface compatible with I2C specification, version 2.1, with clock rate up to 400 kbps. Its operation voltage is 1.8V.

3.8.1 I2C Design Guide

The following figure shows the I2C bus reference design.

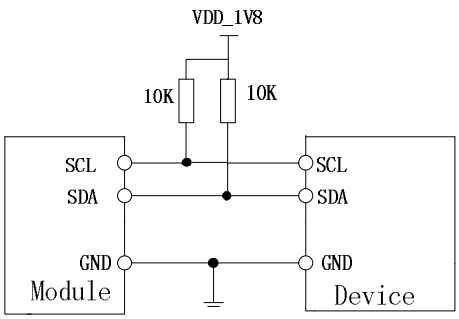

Figure 28: I2C Reference Circuit

Note:

SDA and SCL do not have pull-up resistors in module. So, 2 external pull up resistors are

needed in application circuit.

"AT+CRIIC and AT+CWIIC" AT commands could be used to read/write register values of the I2C peripheral devices. For more details about AT commands please refer to document [1].

3.9 Keypad Interface

SIM7100 provides a keypad interface, which supports five sense columns, and five keypad rows. The interface will generate a interrupt when any key is pressed. Its operation voltage is 1.8V.

3.9.1 Keypad Application Guide

A typical circuit about the keypad (5*5 keypad matrix) is shown in the following figure.

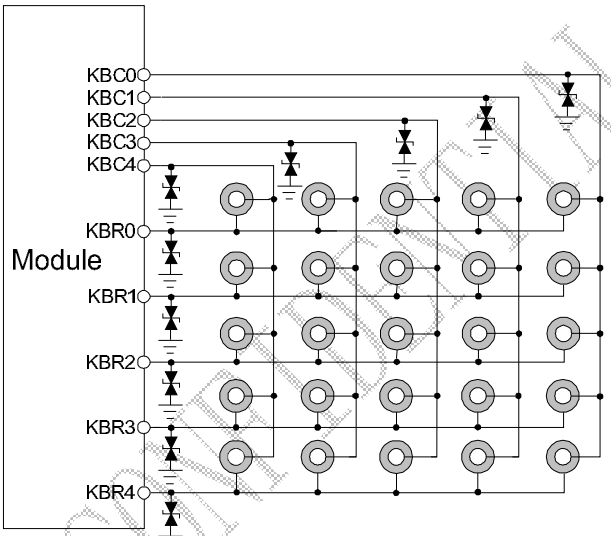

Figure 29: Keypad Reference Circuit

3.10 SPI Interface

SIM7100 provides a SPI interface as a master only. Its operation voltage is 1.8V, and its clock rate is up to 26 MHz.

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

3.11 Network status

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

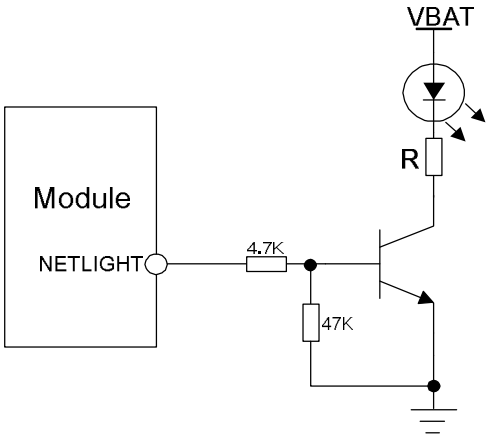

Figure 30: NETLIGHT Reference Circuit

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

Table 17: NETLIGHT Pin Status

NETLIGHT Pin Status	Module Status
Always On	Searching Network/Call Connect
200ms ON, 200ms OFF	Data Transmit
800ms ON, 800ms OFF	Registered network
OFF	Power off / Sleep

Note: NETLIGHT output low level as "OFF", and high level as "ON".

3.12 Flight Mode Control

The FLIGHTMODE pin can be used to control SIM7100 to enter or exit the Flight mode. In Flight mode, the RF circuit is closed to prevent interference with other equipments and minimize current consumption. Bidirectional ESD protection component is suggested to add on FLIGHTMODE pin, its reference circuit is shown in the following figure.

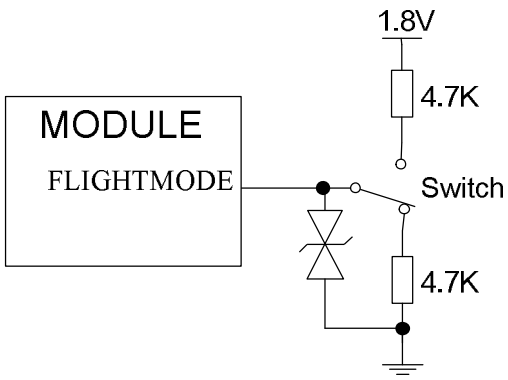

Figure 31: Flight Mode Switch Reference Circuit

Table 18: FLIGHTMODE Pin Status

FLIGHTMODE Pin Status	Module operation
Input Low Level	Flight Mode: RF is closed.
Input High Level	Normal Mode: RF is working.

3.13 Pin multiplex Function

Some pins of SIM7100 could be used for alternate function besides default function.

Table 19: Pin multiplex Function List

Pin Number	Pin Name	Default Function	Alternate Function
51	NETLIGHT	NETLIGHT	
54	FLIGHTMODE	FLIGHTMODE	
49	STATUS	STATUS	
52	GPIO41	GPIO41	
53	USIM_DET	GPIO42	USIM_DET
50	GPIO43	GPIO43	
48	SD1_DET	GPIO44	SD1_DET
34	KBR4	Keypads	-
35	KBR3		-
30	KBR2		SD2_DATA0
33	KBR1		-
29	KBR0		SD2_CMD
36	KBC4		-
32	KBC3		SD2_CLK
31	KBC2		SD2_DATA3
27	KBC1		SD2_DATA1
28	KBC0		SD2_DATA2

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

3.13.1 SD2 Interface

The Keypad pins can be multiplexed with SD2 pins. The SD2 is a SDIO 2.0 interface compatible with WLAN (802.11), its operation voltage is 1.8V.

Table 20: SD2 Pin description

Pin name	Pin No.	Function
KBR2	30	SD2_DATA0
KBC1	27	SD2_DATA1
KBC0	28	SD2_DATA2
KBC2	31	SD2_DATA3
KBR0	29	SD2_CMD
KBC3	32	SD2_CLK

Note: SD2 function is only used in Wi-Fi solution. For more details, please contact SIMCom.

3.14 Other interface

3.14.1 Sink Current Source

The ISINK pin is VBAT tolerant and intended to drive some passive devices, such as LCD backlight and white LED, etc. Its output current can be up to 40 mA and be set by the AT command "AT+ CLEDITST".

Table 21: Sink Current Electronic characteristic

Symbol	Description	Min.	Typ.	Max.	Unit
V_{ISINK}	Voltage tolerant	0.5	-	VBAT	V
I_{ISINK}	Current tolerant	0	-	40	mA

ISINK is a ground-referenced current sink. The following figure shows its reference circuit.

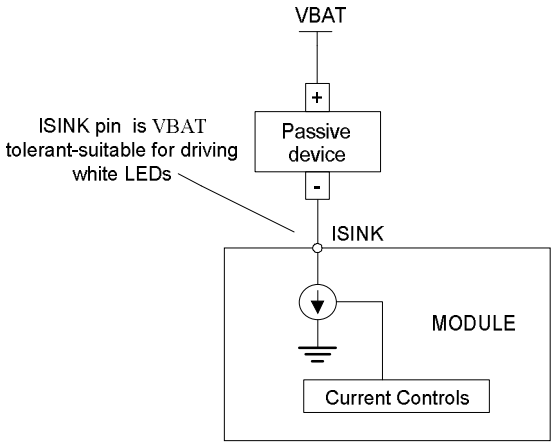

Figure 32: ISINK Reference Circuit

Note: The sinking current can be adjusted to meet the design requirement through the AT command "AT+ CLEDITST =<0>, <value>".The "value" ranges from 0 to 8, on behalf of the current from 0mA to 40mA by 5mA step.

3.14.2 ADC

SIM7100 has 2 dedicated ADC pins named ADC1 and ADC2.They are available for digitizing analog signals such as battery voltage and so on. These electronic specifications are shown in the following table.

Table 22: ADC1 and ADC2 Electronic Characteristics

Characteristics	Min.	Typ.	Max.	Unit
Resolution	–	15	–	Bits
Conversion time	–	442	–	ms
Input Range	0.3		VBAT	V
Input serial resistance	1	–	–	MΩ

Note: "AT+CADC" and "AT+CADC2" can be used to read the voltage of the ADC1 and ADC2 pins, for more details, please refer to document [1].

3.14.3 LDO

SIM7100 has a LDO power output, named VDD_EXT. its output voltage is 0V by default, Users can switch the LDO on or off by the AT command "AT+CVAUXS" and configure its output voltage by the AT command "AT+CVAUXV".

Table 23: Electronic characteristic

Symbol	Description	Min.	Typ.	Max.	Unit
V_{VDD_EXT}	Output voltage	1.7	2.95	3.05	V
I_O	Output current	-	-	150	mA

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

4 RF Specifications

4.1 GSM/UMTS/LTE RF Specifications

Table 24: Conducted transmission power

Frequency	Power	Min.
E-GSM900	33dBm ±2dB	5dBm ± 5dB
DCS1800	30dBm ±2dB	0dBm ± 5dB
E-GSM900 (8-PSK)	27dBm ±3dB	5dBm ± 5dB
DCS1800 (8-PSK)	26dBm +3/-4dB	0dBm ±5dB
WCDMA B1	24dBm +1/-3dB	<-50dBm
WCDMA B2	24dBm +1/-3dB	<-50dBm
WCDMA B5	24dBm +1/-3dB	<-50dBm
WCDMA B6	24dBm +1/-3dB	<-50dBm
WCDMA B8	24dBm + 1/-3dB	<-50dBm
CDMA BC0	24dBm + 1/-3dB	<-50dBm
TDSCDMA 1900	24dBm + 1/-3dB	<-50dBm
TDSCDMA 2000	24dBm + 1/-3dB	<-50dBm
LTE-FDD B1	23dBm +/-2.7dB	<-40dBm
LTE-FDD B2	23dBm +/-2.7dB	<-40dBm
LTE-FDD B3	23dBm +/-2.7dB	<-40dBm
LTE-FDD B4	23dBm +/-2.7dB	<-40dBm
LTE-FDD B5	23dBm +/-2.7dB	<-40dBm
LTE-FDD B7	23dBm +/-2.7dB	<-40dBm
LTE-FDD B8	23dBm +/-2.7dB	<-40dBm
LTE-FDD B13	23dBm +/-2.7dB	<-40dBm
LTE-FDD B17	23dBm +/-2.7dB	<-40dBm
LTE-FDD B18	23dBm +/-2.7dB	<-40dBm
LTE-FDD B20	23dBm +/-2.7dB	<-40dBm
LTE-TDD B38	23dBm +/-2.7dB	<-40dBm
LTE-TDD B39	23dBm +/-2.7dB	<-40dBm
LTE-TDD B40	23dBm +/-2.7dB	<-40dBm
LTE-TDD B41	23dBm +/-2.7dB	<-40dBm

Table 25: Operating frequencies

Frequency	Receiving	Transmission
E-GSM900	925～960 MHz	880～915 MHz
DCS1800	1805～1880 MHz	1710～1785 MHz
WCDMA B1	2110～2170 MHz	1920～1980 MHz
WCDMA B2	1930～1990 MHz	1850～1910 MHz
WCDMA B5	869～894 MHz	824～849 MHz

WCDMA B6	875～885	MHz	830～840	MHz
WCDMA B8	925～960	MHz	880～915	MHz
TDSCDMA 1.9G	1880～1920	MHz	1880～1920	MHz
TDSCDMA 2G	2010～2025	MHz	2010～2025	MHz
CDMA BC0	869～894	MHz	824～849	MHz
The LTE Operating frequencies are shown in the following table 26. Note: Operating frequencies of LTE TDD B41 for the SIM7100C is 100MHz BW, 2555～2655 MHz				
GPS L1 BAND	1574.4 ～1576.44 MHz		-	
GLONASS	1598 ～1606 MHz		-	

Table 26: E-UTRA operating bands

E-UTRA Operating Band	Uplink (UL) operating band	Downlink (DL) operating band	Duplex Mode
1	1920 MHz~1980 MHz	2110 MHz~2170 MHz	FDD
2	1850 MHz~1910 MHz	1930 MHz~1990 MHz	FDD
3	1710 MHz~1785 MHz	1805 MHz~1880 MHz	FDD
4	1710 MHz~1755 MHz	2110 MHz~2155 MHz	FDD
5	824 MHz~849 MHz	869 MHz~894MHz	FDD
6[1]	830 MHz~840 MHz	875 MHz~885 MHz	FDD
7	2500 MHz~2570 MHz	2620 MHz~2690 MHz	FDD
8	880 MHz~915 MHz	925 MHz~960 MHz	FDD
9	1749.9 MHz~1784.9 MHz	1844.9 MHz~1879.9 MHz	FDD
10	1710 MHz~1770 MHz	2110 MHz~2170 MHz	FDD
11	1427.9 MHz~1447.9 MHz	1475.9 MHz~1495.9 MHz	FDD
12	699 MHz~716 MHz	729 MHz~746 MHz	FDD
13	777 MHz~787 MHz	746 MHz~756 MHz	FDD
14	788 MHz~798 MHz	758 MHz~768 MHz	FDD
17	704 MHz~716 MHz	734 MHz~746 MHz	FDD
18	815 MHz~830 MHz	860 MHz~875 MHz	FDD
19	830 MHz~845 MHz	875 MHz~890 MHz	FDD
20	832 MHz~862 MHz	791 MHz~821 MHz	FDD
21	1447.9 MHz~1462.9 MHz	1495.9 MHz~1510.9 MHz	FDD
22	3410 MHz~3490 MHz	3510 MHz~3590 MHz	FDD
23	2000 MHz~2020 MHz	2180 MHz~2200 MHz	FDD
24	1626.5 MHz~1660.5 MHz	1525 MHz~1559 MHz	FDD
25	1850 MHz~1915 MHz	1930 MHz~1995 MHz	FDD
26	814 MHz~849 MHz	859 MHz~894 MHz	FDD
27	807 MHz~824 MHz	852 MHz~869 MHz	FDD
28	703 MHz~748 MHz	758 MHz~803 MHz	FDD

31	452.5 MHz~457.5 MHz	462.5 MHz~467.5 MHz	FDD
33	1900 MHz~1920 MHz	1900 MHz~1920 MHz	TDD
34	2010 MHz~2025 MHz	2010 MHz~2025 MHz	TDD
35	1850 MHz~1910 MHz	1850 MHz~1910 MHz	TDD
36	1930 MHz~1990 MHz	1930 MHz~1990 MHz	TDD
37	1910 MHz~1930 MHz	1910 MHz~1930 MHz	TDD
38	2570 MHz~2620 MHz	2570 MHz~2620 MHz	TDD
39	1880 MHz~1920 MHz	1880 MHz~1920 MHz	TDD
40	2300 MHz~2400 MHz	2300 MHz~2400 MHz	TDD
41	2496 MHz~2690 MHz	2496 MHz~2690 MHz	TDD
42	3400 MHz~3600 MHz	3400 MHz~3600 MHz	TDD
43	3600 MHz~3800 MHz	3600 MHz~3800 MHz	TDD
44	703 MHz~803 MHz	703 MHz~803 MHz	TDD

Table 27: Conducted receive sensitivity

Frequency	Receive sensitivity(Typical)	Receive sensitivity(MAX)
E-GSM900	< -109dBm	3GPP
DCS1800	< -109dBm	3GPP
WCDMA 2100	< -110dBm	3GPP
WCDMA 1900	< -110dBm	3GPP
WCDMA 850	< -110dBm	3GPP
WCDMA 900	< -110dBm	3GPP
TDSCDMA 1900	< -110dBm	3GPP
TDSCDMA 2000	< -110dBm	3GPP
CDMA BC0	< -110dBm	3GPP
LTE FDD/TDD	See table 28.	3GPP

Table 28: Reference sensitivity (QPSK)

E-UTRA band	1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz	Duplex Mode
1	-	-	-100	-97	-95.2	-94	FDD
2	-102.7	-99.7	-98	-95	-93.2	-92	FDD
3	-101.7	-98.7	-97	-94	-92.2	-91	FDD
4	-104.7	-101.7	-100	-97	-95.2	-94	FDD
5	-103.2	-100.2	-98	-95			FDD
6	-	-	-100	-97			FDD
7	-	-	-98	-95	-93.2	-92	FDD
8	-102.2	-99.2	-97	-94			FDD

9	-	-	-99	-96	-94.2	-93	FDD
10	-	-	-100	-97	-95.2	-94	FDD
11	-	-	-100	-97			FDD
12	-101.7	-98.7	-97	-94			FDD
13			-97	-94			FDD
14		-	-97	-94			FDD
17	-	-	-97	-94			FDD
18	-	-	-100	-97	-95.2	-	FDD
19	-	-	-100	-97	-95.2	-	FDD
20			-97	-94	-91.2	-90	FDD
21			-100	-97	-95.2		FDD
22			-97	-94	-92.2	-91	FDD
23	-104.7	-101.7	-100	-97			FDD
24			-100	-97			FDD
25	-101.2	-98.2	-96.5	-93.5	-91.7	-90.5	FDD
33	-	-	-100	-97	-95.2	-94	TDD
34	-	-	-100	-97	-95.2	-	TDD
35	-106.2	-102.2	-100	-97	-95.2	-94	TDD
36	-106.2	-102.2	-100	-97	-95.2	-94	TDD
37	-	-	-100	-97	-95.2	-94	TDD
38	-	-	-100	-97	-95.2	-94	TDD
39	-	-	-100	-97	-95.2	-94	TDD
40	-	-	-100	-97	-95.2	-94	TDD
41	-	-	-99	-96	-94.2	-93	TDD
42	-	-	-99	-96	-94.2	-93	TDD
43	-	-	-99	-96	-94.2	-93	TDD

4.2 GSM/UMTS/LTE Antenna Design Guide

Users should connect antennas to SIM7100'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:

- GSM900/GSM850<0.5dB
- DCS1800/PCS1900 <0.9dB
- WCDMA 2100/1900<0.9dB
- WCDMA 900/850<0.5 dB
- TDSCDMA 1900/2100<0.5dB
- CDMA BC0<0.5dB
- LTE (F<1GHz) <0.5dB
- LTE (1GHz<F<2GHz) <0.9dB
- LTE (2GHz<F) <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.

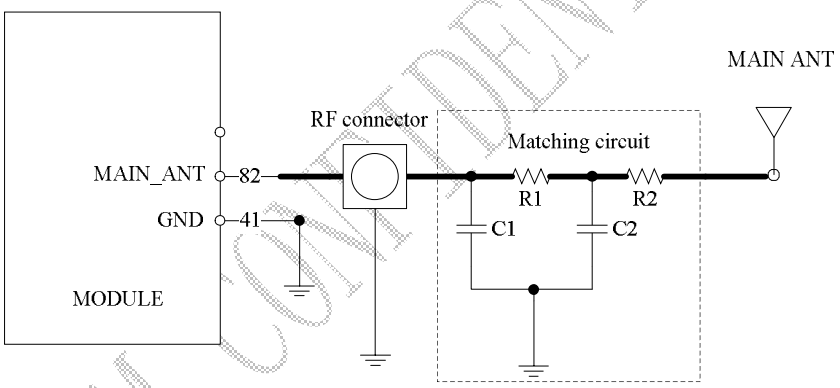

Figure 33: Antenna matching circuit (MAIN_ANT)

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

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

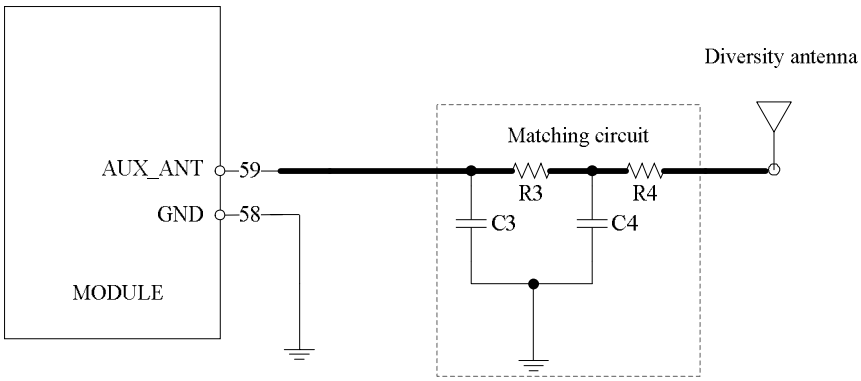

Figure 34: Antenna matching circuit (AUX_ANT)

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

Note：SIMCom suggests the LTE auxiliary antenna to be kept on, since there are many high bands in the designing of TDD-LTE, such as band38, band40 and band41. Because of the high insert loss of the RF cable and layout lines, the receiver sensitivity of these bands above will have risk to meet the authentication without the diversity antenna. For more details about auxiliary antenna design notice, please refer to document [26].

4.3 GNSS (GPS and GLONASS)

SIM7100 merges GNSS (GPS/GLONASS) satellite and network information to provide a high-availability solution that offers industry-leading accuracy and performance. This solution performs well, even in very challenging environmental conditions where conventional GNSS receivers fail, and provides a platform to enable wireless operators to address both location-based services and emergency mandates.

4.3.1 GNSS Technical specification

- Tracking sensitivity: -159 dBm（GPS）/-158 dBm（GLONASS）
- Cold-start sensitivity: -148 dBm
- Accuracy (Open Sky): 2.5m (CEP50)
- TTFF (Open Sky) : Hot start <1s, Cold start<35s
- Receiver Type: 16-channel, C/A Code
- GPS L1 Frequency: 1575.42±1.023MHz
- GLONASS: 1597.5~1605.8 MHz
- Update rate: Default 1 Hz
- GNSS data format: NMEA-0183
- GNSS Current consumption : 100mA ((WCDMA/GSM Sleep ,in total on VBAT pins)
- GNSS antenna: Passive/Active antenna

Note: If the antenna is active type, the power should be given by main board, because there is no power supply on GPS antenna pad. If the antenna is passive, it is suggested that the external LNA should be used.

4.3.2 GNSS Application Guide

Users can adopt an active antenna or a passive antenna as GNSS signal transceiver. In this document, all GNSS specification mentioned is from passive antenna. The following is the reference circuit.

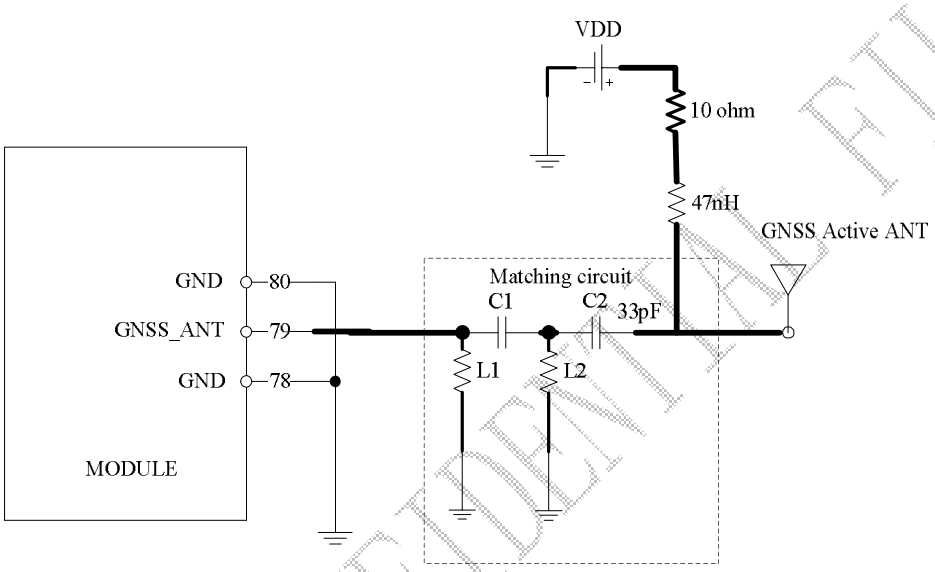

Figure 35: Active antenna circuit

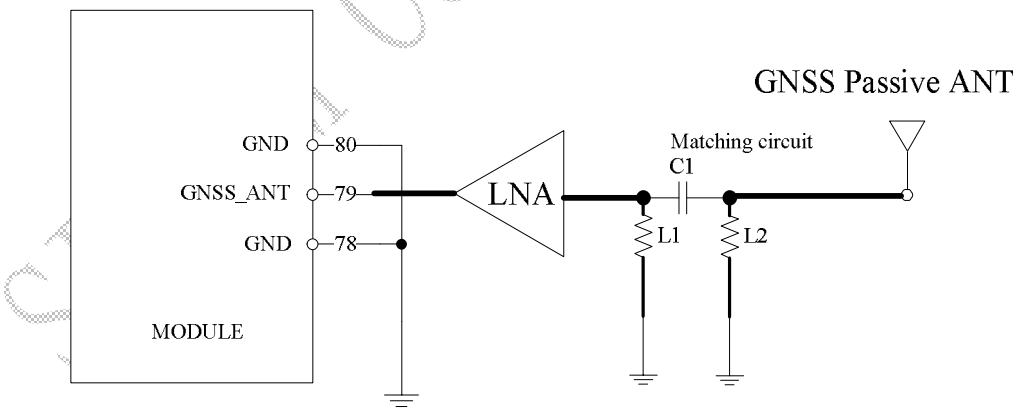

Figure 36: Passive antenna circuit (Default)

In above figures, the components C1 and L1, L2 are used for antenna matching, the values of the components can only be obtained after the antenna tuning usually, and they are provided by antenna vendor.C2 in Figure 35 is used for DC isolation. In active antenna circuit, users must use an external LDO/DCDC to provide VDD voltage whose value should be taken according active

antenna characteristic, and VDD can be shut down to avoid consuming additional current when not being used.

GNSS can be used by NMEA port. User can select NMEA as output through UART or USB. NMEA sentences are automatic and no command is provided. NMEA sentences include GSV, GGA, RMC, GSA, and VTG. Before using GNSS, user should configure SIM7100 in proper operating mode by AT command. Please refer to related document for details. SIM7100 can also get position location information through AT directly.

Note: GNSS is closed by default, it could be started by AT+CGPS. The AT command has two parameters, the first is on/off, and the second is GNSS mode. Default mode is standalone mode. AGPS mode needs more support from the mobile telecommunication network. Please refer to document [24] for more details.

5 Electrical Specifications

5.1 Absolute maximum ratings

Absolute maximum rating for digital and analog pins of SIM7100 are listed in the following table:

Table 29: Absolute maximum ratings

Parameter	Min.	Max.	Unit
Voltage at VBAT	-0.5	6.0	V
Voltage at USB_VBUS	-0.5	5.25	V
Voltage at digital pins (PWRKEY,RESET,SPI,Keypad,GPIO,I2C,UART,PCM)	-0.3	2.1	V
Voltage at digital pins (SD,USIM)	-0.3	3.05	V

5.2 Operating conditions

Table 30: Recommended operating ratings

Parameter	Min.	Typ.	Max.	Unit
Voltage at VBAT	3.4	3.8	4.2	V
Voltage at USB_VBUS	2.0	5	5.25	V

Table 31: 1.8V Digital I/O characteristics*

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

Note: These parameters are for digital interface pins, such as SPI, Keypad, GPIOs (NETLIGHT,

FLIGHTMODE, STATUS, USIM_DET, SD1_DET), I2C, UART, PCM, COEXn, and BOOT_CFGn.

The operating temperature of SIM7100 is listed in the following table.

Table 32: Operating temperature

Parameter	Min.	Typ.	Max.	Unit
Normal operation temperature	-30	25	80	℃
Extended operation temperature*	-40	25	85	℃
Storage temperature	-45	25	+90	℃

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

5.3 Operating Mode

5.3.1 Operating Mode Definition

The table below summarizes the various operating modes of SIM7100 series products.

Table 33: Operating mode Definition

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

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

5.3.2 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 SIM7100 enter into sleep mode:
1. UART condition
2. USB condition
3. Software condition

Note: Before designing, pay attention to how to realize sleeping/waking function and refer to Document [27] for more details.

5.3.3 Minimum functionality mode and Flight mode

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

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

If SIM7100 has been set to minimum functionality mode, the RF function and USIM card function will be closed. In this case, the serial port and USB are still accessible, but RF function and USIM card will be unavailable.
If SIM7100 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 SIM7100 is in minimum functionality or flight mode, it can return to full functionality by the AT command "AT+CFUN=1".

5.4 Current Consumption

The current consumption is listed in the table below.

Table 34: Current consumption on VBAT Pins (VBAT=3.8V)

GNSS	
GNSS supply current (AT+CFUN=0,with USB connection)	@ -140dBm，Tracking Typical:72mA
GSM Sleep mode/Idle Mode	
GSM/GPRS supply current (GNSS off，without USB connection)	Sleep mode@ BS_PA_MFRMS=2 Typical: 4.3mA Idle mode@ BS_PA_MFRMS=2 Typical: 20mA
UMTS Sleep/Idle Mode	
WCDMA supply current (GNSS off，without USB connection)	Sleep mode @DRX=9 Typical: 3.3mA Idle mode @DRX=9 Typical: 19mA
TD-SCDMA supply current (GNSS off，without USB connection)	Sleep mode TBD Idle mode TBD
EVDO supply current (GNSS off，without USB connection)	Sleep mode TBD Idle mode TBD
LTE Sleep/Idle mode	
LTE supply current (GNSS off，without USB connection)	Sleep mode Typical: 4.6mA Idle mode Typical: 26mA
GSM Talk	
GSM 900	@power level #5 Typical: 211mA
DCS1800	@power level #5 Typical: 191mA
UMTS Talk	
WCDMA B1	@Power 24dBm Typical: 665mA
WCDMA B2	@Power 24dBm Typical: 433mA
WCDMA B5	@Power 24dBm Typical: 375mA
WCDMA B6	@Power 24dBm Typical: TBD
WCDMA B8	@Power 24dBm Typical: 598mA
TD-SCDMA 1900	@Power 24dBm Typical: TBD
TD-SCDMA 2000	@Power 24dBm Typical: TBD
CDMA BC0	@Power 24dBm Typical: TBD
GPRS	
GSM 900 (1 Rx,4 Tx)	@power level #5 Typical: 227mA
DCS1800 (1 Rx,4 Tx)	@power level #0 Typical: 179mA
GSM 900 (3Rx, 2 Tx)	@power level #5 Typical: 360mA
DCS1800 (3Rx, 2 Tx)	@power level #0 Typical: 267mA
EDGE	
GSM 900	@power level #8 Typical: 210mA

(1 Rx,4 Tx)	
DCS1800 (1 Rx,4 Tx)	@power level #2 Typical: 171mA
GSM 900 (3Rx, 2 Tx)	@power level #8 Typical: 317mA
DCS1800 (3Rx, 2 Tx)	@power level #2 Typical: 244mA
HSDPA Data	
WCDMA B1	@Power 24dBm Typical: 487mA
WCDMA B2	@Power 24dBm Typical: 401mA
WCDMA B5	@Power 24dBm Typical: 356mA
WCDMA B6	@Power 24dBm Typical: 423mA
WCDMA B8	@Power 24dBm Typical: 430mA
TD-SCDMA Data	
TDSCDMA 1900	@Power 24dBm Typical: 141mA
TDSCDMA 2000	@Power 24dBm Typical: 149mA
EVDO Data	
BC0	@Power 24dBm Typical: 497mA
LTE Data	
LTE-FDD B1	@5Mbps Typical: 716mA @10Mbps Typical: 722mA @20Mbps Typical: 750mA
LTE-FDD B2	@5Mbps Typical: 578mA @10Mbps Typical: 610mA @20Mbps Typical: 637mA
LTE-FDD B3	@5Mbps Typical: 656mA @10Mbps Typical: 687mA @20Mbps Typical: 721mA
LTE-FDD B4	@5Mbps Typical: 519mA @10Mbps Typical: 556mA @20Mbps Typical: 583mA
LTE-FDD B5	@5Mbps Typical: 470mA @10Mbps Typical: 502mA
LTE-FDD B7	@5Mbps Typical: 733mA @10Mbps Typical: 766mA @20Mbps Typical: 831mA
LTE-FDD B8	@5Mbps Typical: 591mA @10Mbps Typical: 597mA
LTE-FDD B13	@10Mbps Typical: 521mA
LTE-FDD B17	@5Mbps Typical: 526mA @10Mbps Typical: 540mA
LTE-FDD B18	@5Mbps Typical: 551mA @10Mbps Typical: 569mA @15Mbps Typical: 602mA
LTE-FDD B20	TBD
LTE-TDD B38	@5Mbps Typical: 511mA @10Mbps Typical: 520mA @15Mbps Typical: 549mA
LTE-TDD B39	@5Mbps Typical: 321mA @10Mbps Typical: 336mA @15Mbps Typical: 365mA
LTE-TDD B40	@5Mbps Typical: 401mA

	@10Mbps Typical: 416mA @15Mbps Typical: 445mA
LTE-TDD B41	@5Mbps Typical: 417mA @10Mbps Typical: 428mA @15Mbps Typical: 448mA

5.5 ESD Notes

SIM7100 is sensitive to ESD in the process of storage, transporting and assembling. Especially, SIM7100 is mounted on the users' mother board, The ESD components should be placed beside the connectors which human body might touch, such as USIM card holder, audio jacks, switches and keys, etc. The following table shows the SIM7100 ESD measurement performance without any external ESD component.

Table 35: The ESD performance measurement table (Temperature: 25℃, Humidity: 45%)

Part	Contact discharge	Air discharge
VBAT,GND	+/-5K	+/-10K
Antenna port	+/-4K	+/-8K
USB	+/-3K	+/-6K
UART	+/-2K	+/-4K
Other PADs	+/-2K	+/-4K

6 SMT Production Guide

6.1 Top and Bottom View of SIM7100

Figure 37: Top and bottom view of SIM7100

Note: The 10 circular test points on bottom are only used for testing. They cannot be used for users' application circuit.

6.2 Label Information

Figure 38: Label Information

Table 36: The Description of Label Information

No.	Description
A	LOGO
B	No.1 Pin
C	Project Name
D	Product Code
E	Serial Number
F	International Mobile Equipment Identity
G	QR code

6.3 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.

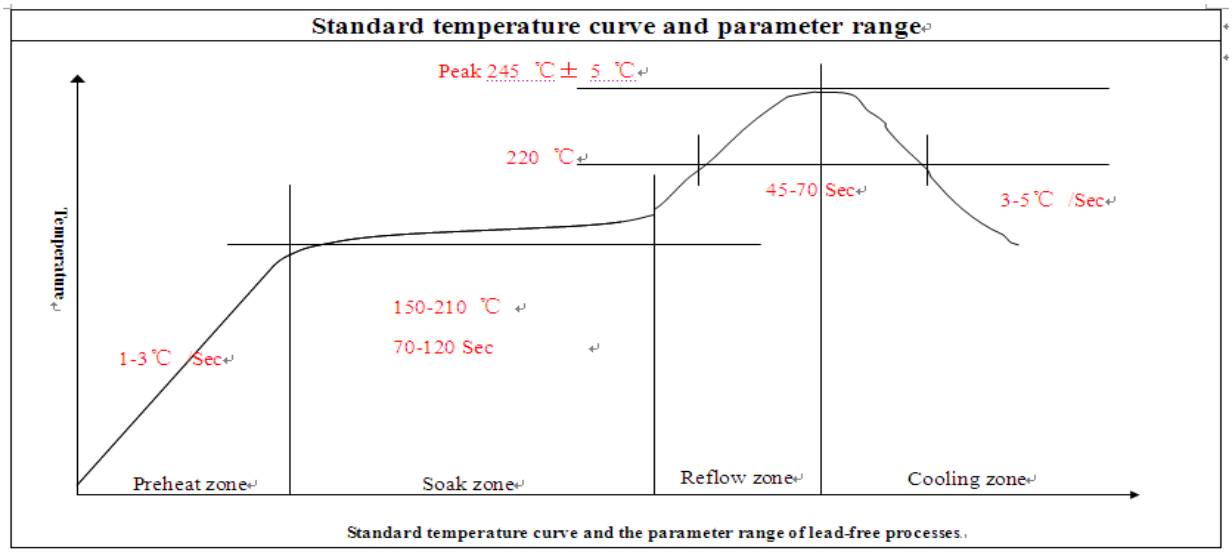

Figure 39: The ramp-soak-spike Reflow Profile of SIM7100

Note: For more details about secondary SMT, please refer to the document [21].

6.4 Moisture Sensitivity Level (MSL)

SIM7100 is qualified to Moisture Sensitivity Level (MSL) 5 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 37: 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.

NOTE: IPC / JEDEC J-STD-033 standard must be followed for production and storage.

6.5 Stencil Foil Design Recommendation

The recommended thickness of stencil foil is more than 0.15mm.

Appendix

A. Reference Design

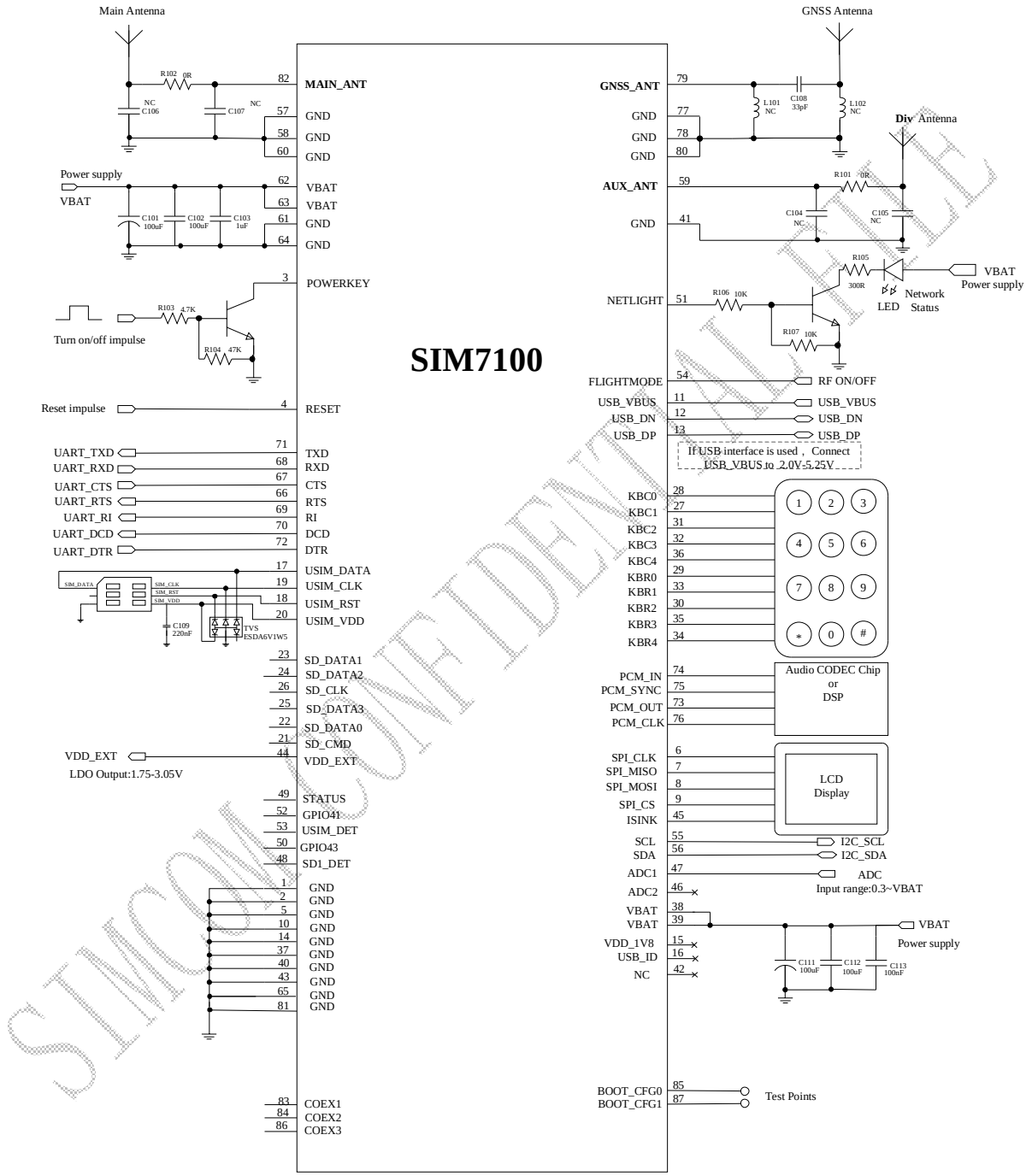

Figure 40: Reference Design

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

Table 38: Coding Schemes and Maximum Net Data Rates over Air Interface

Multislot definition(GPRS/EDGE)			
Slot class	**DL slot number**	**UL slot number**	**Active slot number**
1	1	1	2
2	2	1	3
3	2	2	3
4	3	1	4
5	2	2	4
6	3	2	4
7	3	3	4
8	4	1	5
9	3	2	5
10	4	2	5
11	4	3	5
12	4	4	5
GPRS coding scheme	**Max data rata（4 slots）**		**Modulation type**
CS 1 = 9.05 kb/s / time slot	36.2 kb/s		GMSK
CS 2 = 13.4 kb/s / time slot	53.6 kb/s		GMSK
CS 3 = 15.6 kb/s / time slot	62.4 kb/s		GMSK
CS 4 = 21.4 kb/s / time slot	85.6 kb/s		GMSK
EDGE coding scheme	**Max data rata（4 slots）**		**Modulation type**
MCS 1 = 8.8 kb/s/ time slot	35.2 kb/s		GMSK
MCS 2 = 11.2 kb/s/ time slot	44.8 kb/s		GMSK
MCS 3 = 14.8 kb/s/ time slot	59.2 kb/s		GMSK
MCS 4 = 17.6 kb/s/ time slot	70.4 kb/s		GMSK
MCS 5 = 22.4 kb/s/ time slot	89.6 kb/s		8PSK
MCS 6 = 29.6 kb/s/ time slot	118.4 kb/s		8PSK
MCS 7 = 44.8 kb/s/ time slot	179.2 kb/s		8PSK
MCS 8 = 54.4 kb/s/ time slot	217.6 kb/s		8PSK
MCS 9 = 59.2 kb/s/ time slot	236.8 kb/s		8PSK
HSDPA device category	**Max data rate（peak）**		**Modulation type**
Category 1	1.2Mbps		16QAM,QPSK
Category 2	1.2Mbps		16QAM,QPSK
Category 3	1.8Mbps		16QAM,QPSK
Category 4	1.8Mbps		16QAM,QPSK
Category 5	3.6Mbps		16QAM,QPSK
Category 6	3.6Mbps		16QAM,QPSK
Category 7	7.2Mbps		16QAM,QPSK

Category 8	7.2Mbps	16QAM,QPSK
Category 9	10.2Mbps	16QAM,QPSK
Category 10	14.4Mbps	16QAM,QPSK
Category 11	0.9Mbps	QPSK
Category 12	1.8Mbps	QPSK
Category 13	17.6Mbps	64QAM
Category 14	21.1Mbps	64QAM
Category 15	23.4Mbps	16QAM
Category 16	28Mbps	16QAM
Category 17	23.4Mbps	64QAM
Category 18	28Mbps	64QAM
Category 19	35.5Mbps	64QAM
Category 20	42Mbps	64QAM
Category 21	23.4Mbps	16QAM
Category 22	28Mbps	16QAM
Category 23	35.5Mbps	64QAM
Category 24	42.2Mbps	64QAM
HSUPA device category	**Max data rate（peak）**	**Modulation type**
Category 1	0.96Mbps	QPSK
Category 2	1.92Mbps	QPSK
Category 3	1.92Mbps	QPSK
Category 4	3.84Mbps	QPSK
Category 5	3.84Mbps	QPSK
Category 6	5.76Mbps	QPSK
LTE-FDD device category (Downlink)	**Max data rate（peak）**	**Modulation type**
Category 1	10Mbps	QPSK/16QAM/64QAM
Category 2	50Mbps	QPSK/16QAM/64QAM
Category 3	100Mbps	QPSK/16QAM/64QAM
Category 4	150Mbps	QPSK/16QAM/64QAM
LTE-FDD device category (Uplink)	**Max data rate（peak）**	**Modulation type**
Category 1	5Mbps	QPSK/16QAM
Category 2	25Mbps	QPSK/16QAM
Category 3	50Mbps	QPSK/16QAM
Category 4	50Mbps	QPSK/16QAM

C. Related Documents

Table 39: Related documents

SN	Title	Description
[1]	SIM7100_ATC_V0.xx	SIM7100_ATC_V0.xx
[2]	ITU-T Draft new recommendationV.25ter	Serial asynchronous automatic dialing and control
[3]	GSM 07.07	Digital cellular telecommunications (Phase 2+); AT command set for GSM Mobile Equipment (ME)
[4]	GSM 07.10	Support GSM 07.10 multiplexing protocol
[5]	GSM 07.05	Digital cellular telecommunications (Phase 2+); Use of Data Terminal Equipment – Data Circuit terminating Equipment (DTE – DCE) interface for Short Message Service (SMS) and Cell Broadcast Service (CBS)
[6]	GSM 11.14	Digital cellular telecommunications system (Phase 2+); Specification of the SIM Application Toolkit for the Subscriber Identity Module – Mobile Equipment (SIM – ME) interface
[7]	GSM 11.11	Digital cellular telecommunications system (Phase 2+); Specification of the Subscriber Identity Module – Mobile Equipment (SIM – ME) interface
[8]	GSM 03.38	Digital cellular telecommunications system (Phase 2+); Alphabets and language-specific information
[9]	GSM 11.10	Digital cellular telecommunications system (Phase 2)； Mobile Station (MS) conformance specification； Part 1: Conformance specification
[10]	3GPP TS 51.010-1	Digital cellular telecommunications system (Release 5); Mobile Station (MS) conformance specification
[11]	3GPP TS 34.124	Electromagnetic Compatibility (EMC) for mobile terminals and ancillary equipment.
[12]	3GPP TS 34.121	Electromagnetic Compatibility (EMC) for mobile terminals and ancillary equipment.
[13]	3GPP TS 34.123-1	Technical Specification Group Radio Access Network; Terminal conformance specification; Radio transmission and reception (FDD)
[14]	3GPP TS 34.123-3	User Equipment (UE) conformance specification; Part 3: Abstract Test Suites.
[15]	EN 301 908-02 V2.2.1	Electromagnetic compatibility and Radio spectrum Matters (ERM); Base Stations (BS) and User Equipment (UE) for IMT-2000. Third Generation cellular networks; Part 2: Harmonized EN for IMT-2000, CDMA Direct Spread (UTRA FDD) (UE) covering essential requirements of article 3.2 of the R&TTE Directive
[16]	EN 301 489-24 V1.2.1	Electromagnetic compatibility and Radio Spectrum Matters (ERM); Electromagnetic Compatibility (EMC) standard for radio equipment and services; Part 24: Specific conditions for IMT-2000 CDMA Direct Spread (UTRA) for Mobile and portable (UE) radio and ancillary equipment

[17]	IEC/EN60950-1(2001)	Safety of information technology equipment (2000)
[18]	3GPP TS 51.010-1	Digital cellular telecommunications system (Release 5); Mobile Station (MS) conformance specification
[19]	GCF-CC V3.23.1	Global Certification Forum - Certification Criteria
[20]	2002/95/EC	Directive of the European Parliament and of the Council of 27 January 2003 on the restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS)
[21]	Module secondary-SMT-UGD-V1.xx	Module secondary SMT Guidelines
[22]	SIM7100_UART_Application_Note_V0.xx	This document describes how to use UART interface of SIMCom SIM7100 modules.
[23]	SIM7100_USB_AUDIO_Application_Note_V0.xx	USB AUDIO Application Note
[24]	SIM7100_GPS_Application_Note_V0.xx	SIM7100 GPS Application Note
[25]	SIM5360_TO_SIM7100 MIGRATION GUIDE_Application Note_V1.xx	SIM5360 toSIM7100 MIGRATION GUIDE Application Note
[26]	ANTENNA DESIGN GUIDELINES FOR DIVERSITY RECEIVER SYSTEM	ANTENNA DESIGN GUIDELINES FOR DIVERSITY RECEIVER SYSTEM
[27]	SIM7100 Sleep Mode Application Note	SIM7100_Sleep_Mode_Application_Note_V0.01.pdf

D. Terms and Abbreviations

Table 40: Terms and Abbreviations

Abbreviation	Description
ADC	Analog-to-Digital Converter
ARP	Antenna Reference Point
BER	Bit Error Rate
BTS	Base Transceiver Station
CS	Coding Scheme
CSD	Circuit Switched Data
CTS	Clear to Send
DAC	Digital-to-Analog Converter
DRX	Discontinuous Reception
DSP	Digital Signal Processor
DTE	Data Terminal Equipment (typically computer, terminal, printer)
DTR	Data Terminal Ready
DTX	Discontinuous Transmission
EFR	Enhanced Full Rate
EGSM	Enhanced GSM
EMC	Electromagnetic Compatibility
ESD	Electrostatic Discharge
ETS	European Telecommunication Standard
EVDO	Evolution Data Only
FCC	Federal Communications Commission (U.S.)
FD	SIM fix dialing phonebook
FDMA	Frequency Division Multiple Access
FR	Full Rate
GMSK	Gaussian Minimum Shift Keying
GPRS	General Packet Radio Service
GSM	Global Standard for Mobile Communications
HR	Half Rate
HSPA	High Speed Packet Access
I2C	Inter-Integrated Circuit
IMEI	International Mobile Equipment Identity
LTE	Long Term Evolution
MO	Mobile Originated
MS	Mobile Station (GSM engine), also referred to as TE
MT	Mobile Terminated
PAP	Password Authentication Protocol
PBCCH	Packet Switched Broadcast Control Channel
PCB	Printed Circuit Board
PCS	Personal Communication System, also referred to as GSM 1900
RF	Radio Frequency
RMS	Root Mean Square (value)
RTC	Real Time Clock

SIM	Subscriber Identification Module
SMS	Short Message Service
SPI	serial peripheral interface
SMPS	Switched-mode power supply
TDMA	Time Division Multiple Access
TE	Terminal Equipment, also referred to as DTE
TX	Transmit Direction
UART	Universal Asynchronous Receiver & Transmitter
VSWR	Voltage Standing Wave Ratio
SM	SIM phonebook
NC	Not connect
EDGE	Enhanced data rates for GSM evolution
HSDPA	High Speed Downlink Packet Access
HSUPA	High Speed Uplink Packet Access
ZIF	Zero intermediate frequency
WCDMA	Wideband Code Division Multiple Access
VCTCXO	Voltage control temperature-compensated crystal oscillator
USIM	Universal subscriber identity module
UMTS	Universal mobile telecommunications system
UART	Universal asynchronous receiver transmitter

E. Safety Caution

Table 41: Safety caution

Marks	Requirements
	When in a hospital or other health care facility, observe the restrictions about the use of mobiles. Switch the cellular terminal or mobile off, medical equipment may be sensitive to not operate normally for RF energy interference.
	Switch off the cellular terminal or mobile before boarding an aircraft. Make sure it is switched off. The operation of wireless appliances in an aircraft is forbidden to prevent interference with communication systems. Forget to think much of these instructions may lead to the flight safety or offend against local legal action, or both.
	Do not operate the cellular terminal or mobile in the presence of flammable gases or fumes. Switch off the cellular terminal when you are near petrol stations, fuel depots, chemical plants or where blasting operations are in progress. Operation of any electrical equipment in potentially explosive atmospheres can constitute a safety hazard.
	Your cellular terminal or mobile receives and transmits radio frequency energy while switched on. RF interference can occur if it is used close to TV sets, radios, computers or other electric equipment.
	Road safety comes first! Do not use a hand-held cellular terminal or mobile when driving a vehicle, unless it is securely mounted in a holder for hands free operation. Before making a call with a hand-held terminal or mobile, park the vehicle.
	GSM cellular terminals or mobiles operate over radio frequency signals and cellular networks and cannot be guaranteed to connect in all conditions, for example no mobile fee or a invalid SIM card. While you are in this condition and need emergent help, please remember using emergency calls. In order to make or receive calls, the cellular terminal or mobile must be switched on and in a service area with adequate cellular signal strength. Some networks do not allow for emergency call if certain network services or phone features are in use (e.g. lock functions, fixed dialing etc.). You may have to deactivate those features before you can make an emergency call. Also, some networks require that a valid SIM card be properly inserted in the cellular terminal or mobile.

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