SIM5360A_User_Manual_V1.03

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Document Title	SIM5360A User Manual
Version	1.03
Date	2014-07-03
Status	Release
Document Control ID	SIM5360A_User_Manual_V1.03

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FCC Compliance Statement: This device complies with Part 15 of the FCC Rules . Operation is subject to the following two conditions: 1. This device may not cause harmful interference, and 2. This device must accept any interference received, including interference that may cause undesired operation. This device must accept any interference received, including interference that may cause undesired operation. Product that is a radio transmitter is labeled with FCC ID.

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(2) Any changes or modifications not expressly approved by the grantee of this device could void the user's authority to operate the equipment.

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(5) the modules FCC ID is not visible when installed in the host, or

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This Class B digital apparatus complies with Canadian ICES-003.

Cet appareil numérique de la classe B est conforme à la norme NMB-003 du Canada.

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Contents

Revision History **10**

1 Introduction **11**

1.1 Product Outline 11
1.2 Hardware Interface Overview 11
1.3 Hardware Diagram 12
1.4 Functional Overview 12

2 Package Information **13**

2.1 Pin Configuration 13
2.2 Pin description 16
2.3 Package Dimensions 19
2.4 Footprint Recommendation 21

3 Application Interface Specification **21**

3.1 Power Supply 21
3.1.1 Power Supply Pin 22
3.1.2 Design Guide 22
3.1.3 RTC Backup 24
3.2 Power on/off Time Sequence 26
3.2.1 Power on Sequence 26
3.2.2 Power off Sequence 27
3.3 UART Interface 28
3.3.1 Pin Description 30
3.3.2 Application Guide 30
3.4 SD/MMC Interface 32
3.4.1 Pin Description 32
3.4.2 Design guide 33
3.5 USIM Interface 33
3.5.1 Pin description 33
3.5.2 Application Guide 34
3.5.3 Recommend Components 35
3.6 I2C Interface 36
3.6.1 Pin Description 37
3.6.2 Signal Description 37
3.6.3 Design Guide 37
3.7 Keypad Interface 37
3.7.1 Pin Description 37
3.7.2 Application Guide 38
3.8 USB Interface 39
3.8.1 Application Guide 39
3.9 SPI Interface 40
3.9.1 Pin Description 40
3.10 GPIO Interface 40

SIMCOM CONFIDENTIAL FILE

3.10.1 Pin Description 41
3.10.2 Application Guide 42
3.11 PCM Interface 43
3.11.1 Pin Description 44
3.11.2 Signal Description 44
3.11.3 Application Guide 47
3.12 GNSS (GPS and GLONASS) 48
3.12.1 Technical specification 48
3.12.2 Operate Mode 49
3.12.3 Application Guide 49
3.13 Multi-functional interface 51
3.13.1 Sink Current Source 51
3.13.2 Reset Function 52
3.13.3 ADC 52
3.13.4 LDO 53

4 RF Specification 54
4.1 RF Specification 54
4.2 Operating Specification 54
4.3 Antenna Design Guide 55

Contact us: 57

SIMCOM CONFIDENTIAL FILE

Table Index

Table 2 : General Feature 12
Figure 2: Pin viewTable 3 : Pin definition 15
Table 4 : Pin description 16
Table 5 : Pin description 22
Table 6 : Recommended zener diode models....................23
Table 7 : Power on timing 27
Table 8 : Power off timing....................28
Table 9 : Pin description 30
Table 10 : Logic level 30
Table 11 : Pin description....................32
Table 12 : Electronic characteristic....................33
Table 16 : Pin description 33
Table 17 : Electronic characteristic....................34
Table 18 : Pin description 37
Table 19 : Pin description 37
Table 20 : GPIO configuration 38
Table 21 : Electronic characteristic....................39
Table 22 : Pin description 40
Table 23 : Electronic characteristic 40
Table 24 : Pin description 41
Table 25 : Electronic characteristic 41
Table 26 : LED status 42
Table 27 : Control status 43
Table 28 : Pin description 44
Table 29 : Electronic characteristic 44
Table 30 : Timing parameters....................45
Table 31 : Timing parameters....................47
Table 32 : Electronic characteristic....................51
Table 33 : Electronic Characteristics 52
Table 34 : Electronic characteristic....................53

SIMCOM CONFIDENTIAL FILE

Table 35 : Conducted transmission power......54
Table 36 : Operating frequencies......54
Table 37 : Conducted receive sensitivity......54
Table 38 : GPRS/EDGE data throughout......54
Table 39 : HSDPA throughout......55

SIMCOM CONFIDENTIAL FILE

Figure Index

Figure 1 : SIM5360A functional architecture 12
Figure 2 : Pin viewTable 3: Pin definition 14
Figure 3 : Top dimensions (Unit: mm) 19
Figure 4 : Side dimensions (Unit: mm) 20
Figure 5 : Bottom dimensions (Unit: mm) 20
Figure 6 : Footprint recommendation (Unit: mm) 21
Figure 7 : VBAT voltage drop during burst emission (GSM/GPRS) 22
Figure 8 : VBAT input application circuit 23
Figure 9 : Reference circuit of the LDO power supply 23
Figure 10 : Reference circuit of the DCDC power supply 24
Figure 11 : RTC supply from capacitor 25
Figure 12 : RTC supply from non-chargeable battery 25
Figure 13 : RTC supply from rechargeable battery 25
Figure 15 : Power on Timing Sequence 26
Figure 16 : Power off timing sequence 28
Figure 17 : UART1 Full modem 29
Figure 18 : Null modem (UART1 and UART2) 29
Figure 19 : RI behaviour in NULL Modem 31
Figure 20 : RI behaviour in FULL Modem 31
Figure 21 : Reference circuit of level shift 32
Figure 22 : SD interface circuit 33
Figure 23 : USIM interface reference circuit 35
Figure 24 : Amphenol SIM card socket 36
Figure 25 : Reference circuit 38
Figure 26 : USB interface 39
Figure 27 : Application circuit 42
Figure 28 : Flight mode switch 43
Figure 29 : Synchrony timing 44
Figure 30 : EXT CODEC to MODULE timing 45
Figure 31 : MODULE to EXT CODEC timing 45

SIMCOM CONFIDENTIAL FILE

Figure 32 : Synchrony timing 46

Figure 33 : EXT CODEC to MODULE timing..46

Figure 34 : MODULE to EXT CODEC timing..47

Figure 35 : Reference Circuit of PCM Application with Audio Codec 48

Figure 36 : Active antenna circuit 50

Figure 37 : Passive antenna circuit (Default) 50

Figure 38 : Current drive...51

Figure 39 : Reset circuit 52

Figure 40 : Antenna matching circuit (MAIN_ANT) 56

Figure 41 : Antenna matching circuit (DIV_ANT)..56

SIMCOM CONFIDENTIAL FILE

Revision History

Data	Version	Description of change	Author
2014-02-28	1.01	Original	Libing
2014-04-18	1.02	Add UART2 description	Libing
2014-07-03	1.03	Modify pin names of SIM5360A	Libing

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1 Introduction

This document describes electronic specifications, RF specifications, function interface, mechanical characteristic and testing conclusions of the SIMCom SIM5360A module. With the help of this document and other SIM5360A software application notes, user guides, users can quickly understand and use SIM5360A module to design and develop applications quickly.

1.1 Product Outline

Designed for global market, SIM5360A is a quad-band GSM/GPRS/EDGE and dual-band UMTS /HSPA+ that works on frequencies of GSM 850MHz, EGSM 900 MHz, DCS 1800 MHz, PCS 1900MHz and WCDMA 1900/850 MHz.
With a tiny configuration of 30*30*2.9 mm and integrated functions, SIM5360A can meet almost any space requirement in users' application, such as Smart phone, PDA phone, industrial handhelds, machine-to-machine, vehicle applications, etc..

There are 82 pins on SIM5360, which provide most application interfaces for customers' board.

1.2 Hardware Interface Overview

Sub-interfaces are described in detail in the next chapter, which includes:

- **Power Supply**
- **USB Interface**
- **UART Interface**
- **SD card Interfaces**
- **SIM Interface**
- **GPIO**
- **ADC**
- **LDO Power Output**
- **Current Sink Source**
- **PCM Interface**
- **Keypad Interface**
- **SPI Interface**
- **RTC**

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- **I2C Interface**

1.3 Hardware Diagram

The global architecture of the SIM5360A Embedded module is described in the figure below.

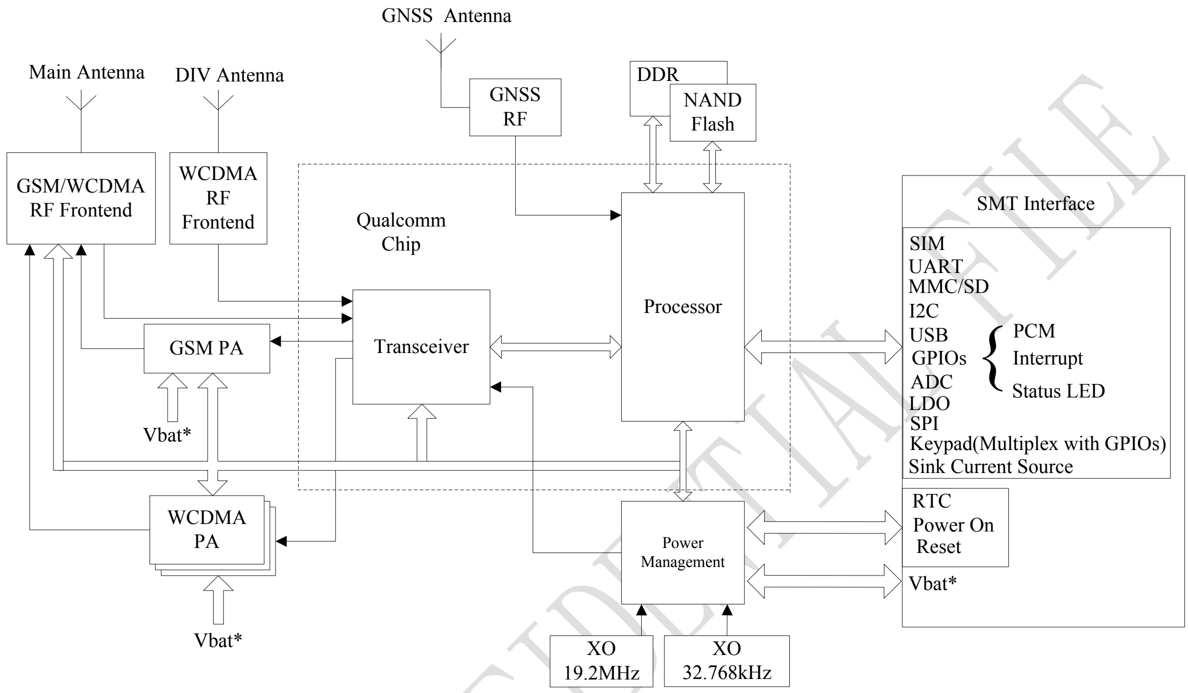

Figure 1: SIM5360A functional architecture

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1.4 Functional Overview

Table 1: General Feature

Feature	Implementation
Power supply	Single supply voltage 3.4～4.2V
Transmission data	● Dual-mode UMTS/HSPA+/EDGE/GPRS operation ● GPRS Class B, multislot class 12 operation, Supports coding scheme: CS1-4 ● EDGE multislot class 12 operation, Supports coding schemes MSC1-9 ● UMTS R99 data rates-384 kbps DL/UL ● Category 6 HSDPA -14.4 Mbps HSUPA-5.76 Mbps ● CSD feature: 9.6, 14.4, 64 kbps UL/DL
GNSS	● GNSS engine (GPS and GLONASS) ● Protocol: NMEA ● Mobile-assisted mode ● Mobile-based mode ● Standalone mode

SMS	● MT, MO, CB, Text and PDU mode ● SMS storage: SIM card or ME(default) ● Support transmission of SMS alternatively over CSD or GPRS. User can choose preferred mode.
SIM interface	Support identity card: 1.8V, 3V.
Audio features(optional)	Speech codec modes: ● Half Rate (ETS 06.20) ● Full Rate (ETS 06.10) ● Enhanced Full Rate (ETS 06.50 / 06.60 / 06.80) ● AMR (WCDMA) ● AMR+QCP (GSM) ● A5/1, A5/2, and A5/3 ciphering
UART interface	● Support full mode or null mode ● Support AT command
USB	Support USB2.0 Slave mode
Rx-diversity	Support UMTS Rx-diversity.
Phonebook management	Support phonebook types: SM, FD, LD, RC, ON, MC.
SIM application toolkit	Support SAT class 3, GSM 11.14 Release 98 Support USAT
Real Time Clock	Support RTC
Physical characteristics	Size:30*30*2.9mm Weight:5.7 g
Firmware upgrade	Firmware upgrade over USB interface
PCM	Multiplex on GPIOs. Used for analog audio function with external codec. Support long frame sync and short frame sync. Support 8-bit A-law, μ-law and 16-bit linear data formats. Support master and slave mode, but must be the master in long frame sync.
Temperature range	● Normal operation temperature: -10°C to +60°C ● Storage temperature -45°C to +90°C

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2 Package Information

2.1 Pin Configuration

All hardware interfaces which connect SIM5360A to customers' application platform are through 82 pins pads (Metal half hole). Figure 2 is SIM5360A outline diagram.

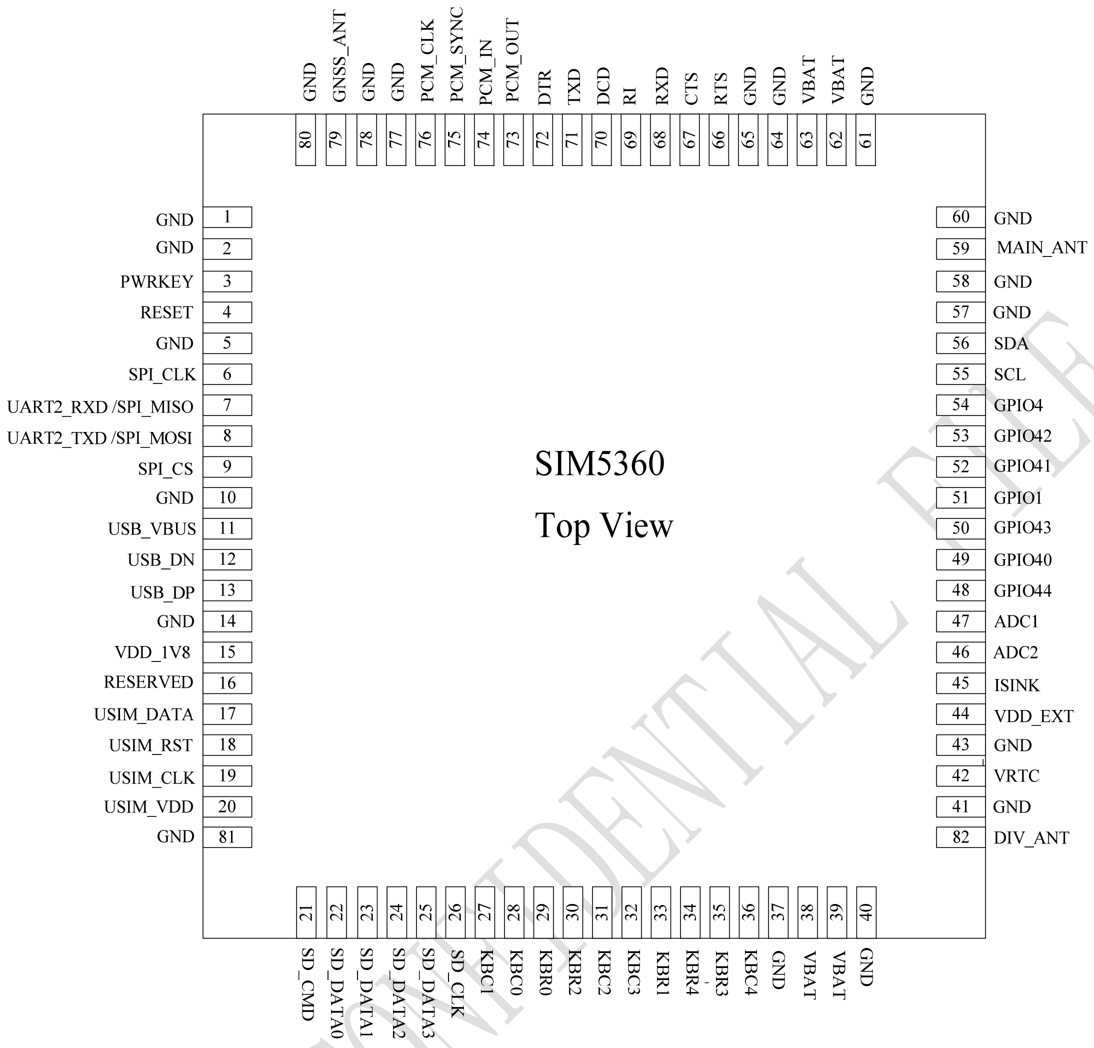

Figure 2: Pin view

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Table 2: Pin definition

Pin No.	Define	Pin No.	Define
1	GND	2	GND
3	POWERKEY	4	RESET
5	GND	6	SPI_CLK
7	UART2_RXD / SPI_MISO	8	UART2_TXD / SPI_MOSI
9	SPI_CS	10	GND
11	USB_VBUS	12	USB_DN
13	USB_DP	14	GND
15	VDD_1V8	16	RESERVED
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	VRTC
43	GND	44	VDD_EXT
45	ISINK	46	ADC2
47	ADC1	48	GPIO44
49	GPIO40	50	GPIO43
51	NETLIGHT/GPIO1	52	GPIO41
53	GPIO42	54	GPIO4
55	SCL	56	SDA
57	GND	58	GND
59	MAIN_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	DIV_ANT

2.2 Pin description

IO Parameters Definition

Pin Type	Description
PI	Power input
PO	Power output
IO	Bidirectional input / output
DI	Digital input
DO	Digital output
AI	Analog input

Table 3: Pin description

Pin name	Pin No.	I/O	Description	Comment
Power Supply				
VBAT	38,39, 62,63	PI	Power supply voltage	
VRTC	42	I/O	Power supply for RTC	If it is unused, keep open.
VDD_EXT	44	PO	LDO power output for SD card circuit or other external circuit. This LDO output voltage can be changed by the AT command “AT+CVAUXV”.	
VDD_1V8	15	PO	The 1.8V SMPS output for external circuit, such as level shift circuit.	
GND	1,2,5,10,14,37,40,41,43,57,58,60,61,64,65,77,78,80,81		Ground	
Power on/off				

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POWERKEY	3	DI	POWERKEY should be pulled low at least 180ms to power on or 500ms to power off the module.	
SD interface				
SD_CMD	21	I/O	SDIO command	If it is unused, keep open.
SD_DATA0	22	I/O	SDIO data	
SD_DATA1	23	I/O	SDIO data	
SD_DATA2	24	I/O	SDIO data	
SD_DATA3	25	I/O	SDIO data	
SD_CLK	26	DO	SDIO clock	
USIM interface				
USIM_DATA	17	I/O	SIM Data Output/Input	All signals of SIM interface should be protected against ESD/EMC.
USIM_RST	18	DO	SIM Reset	
USIM_CLK	19	DO	SIM Clock	
USIM_VDD	20	PO	Voltage Supply for SIM card Support 1.8V or 3V SIM card	
SPI/UART2 interface				
SPI_CLK	6	DO	SPI clock	If it is unused, keep open.
UART2_RXD /SPI_MISO	7	DI	Receive data of UART2 / SPI (master only) master in/slave out data	
UART2_TXD / SPI_MOSI	8	DO	Transmit data of UART2 / SPI (master only) master out/slave in data	
SPI_CS	9	DO	SPI chip-select	
USB				
USB_VBUS	11	PI	USB power supply input	They are compliant with the USB 2.0 specification. If it is unused, keep open.
USB_DN	12	I/O	Minus (-) line of the differential, bi-directional USB signal to/from the	
USB_DP	13	I/O	Plus (+) line of the differential, bi-directional USB signal to/from the	
UART1 **interface**				
RTS	66	DO	Request to send	RXD has been pulled down with a 12kR resistor to ground in the module. If it is unused, keep open.
CTS	67	DI	Clear to Send	
RXD	68	DI	Receive Data	
RI	69	DO	Ring Indicator	
DCD	70	DO	Carrier detects	
TXD	71	DO	Transmit Data	
DTR	72	DI	DTE get ready	

I2C interface				
SCL	55	DO	I2C clock output	None pulled up resistors in the module. Pulled up with a 2.2kR resistor to 1.8V externally. . If it is unused, keep open.
SDA	56	I/O	I2C data	
Keypad interface				
KBR0	29	DO	Bit 0 drive to the pad matrix	All Keypad pins can be configured as GPIOs. If it is unused, keep open.
KBR1	33	DO	Bit 1 drive to the pad matrix	
KBR2	30	DO	Bit 2 drive to the pad matrix	
KBR3	35	DO	Bit 3 drive to the pad matrix	
KBR4	34	DO	Bit 4 drive to the pad matrix	
KBC0	28	DI	Bit 0 for sensing key press on pad matrix	
KBC1	27	DI	Bit 1 for sensing key press on pad matrix	
KBC2	31	DI	Bit 2 for sensing key press on pad matrix	
KBC3	32	DI	Bit 3 for sensing key press on pad matrix	
KBC4	36	DI	Bit 4 for sensing key press on pad matrix	
PCM interface				
PCM_OUT/GPIO5	73	DO	PCM data output. It also can be multiplexed as GPIO5.	If it is unused, keep open.
PCM_IN/GPIO0	74	DI	PCM data input. It also can be multiplexed as GPIO0 with module wake/interrupt.	
PCM_SYNC/GPIO2	75	DO	PCM data frame sync signal. It also can be multiplexed as GPIO2.	
PCM_CLK/GPIO3	76	DO	PCM data bit clock. It also can be multiplexed as GPIO3.	
GPIOs				
NETLIGHT/GPIO1	51	DO	Output PIN as LED control for network status.	If it is unused, keep open.
GPIO4	54	DI	Input PIN as RF operating control.	
GPIO40	49	DO	Output PIN as operating status indicating of module.	
GPIO41	52	DO	General input/output PIN. It can be used as wake/interrupt signal to host from module	
GPIO43	50	DI	General input/output PIN. It can be used as wake/interrupt signal to module from host.	

GPIO44	48	I/O	General input/output PIN.	
GPIO42	53	I/O	General input/output PIN.	
RF interface				
MAIN _ANT	59		MAIN ANT soldering pad	
GNSS_ANT	79	AI	GNSS ANT soldering pad	
DIV_ANT	82	AI	Diversity ANT soldering pad	
Other interface				
RESET	4	DI	System reset in, active low.	
ISINK	45	DI	Current source of ground-referenced current sink	Refer to 3.13.1
ADC1	47	AI	Analog Digital Converter Input	Refer to 3.13.3
ADC2	46	AI	Analog Digital Converter Input	
RESERVED	16		Reserved	

2.3 Package Dimensions

The following figure shows mechanical dimensions of SIM5360.

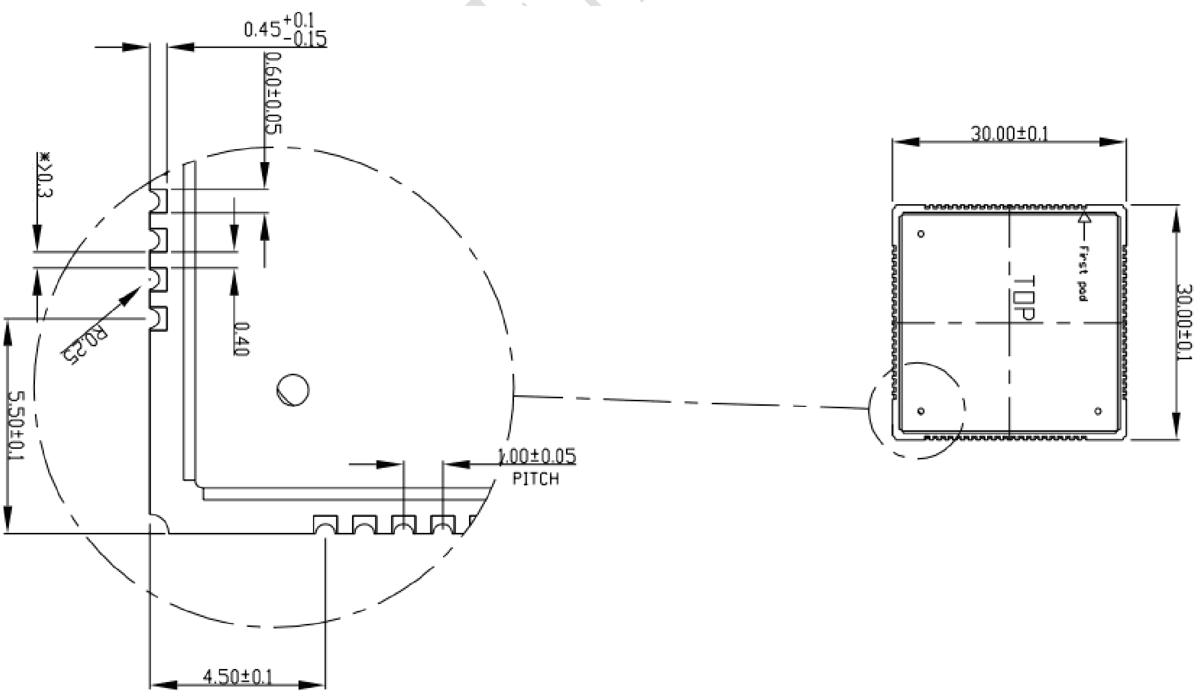

Figure 3: Top dimensions (Unit: mm)

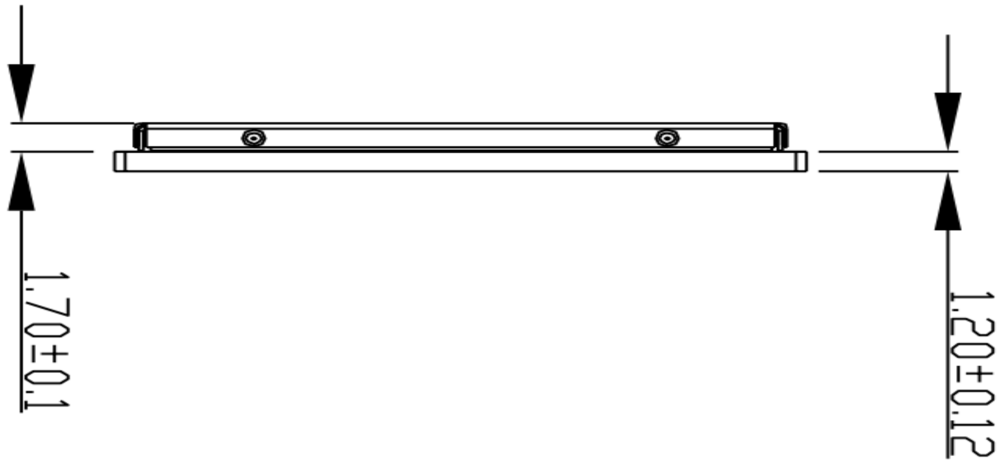

Figure 4: Side dimensions (Unit: mm)

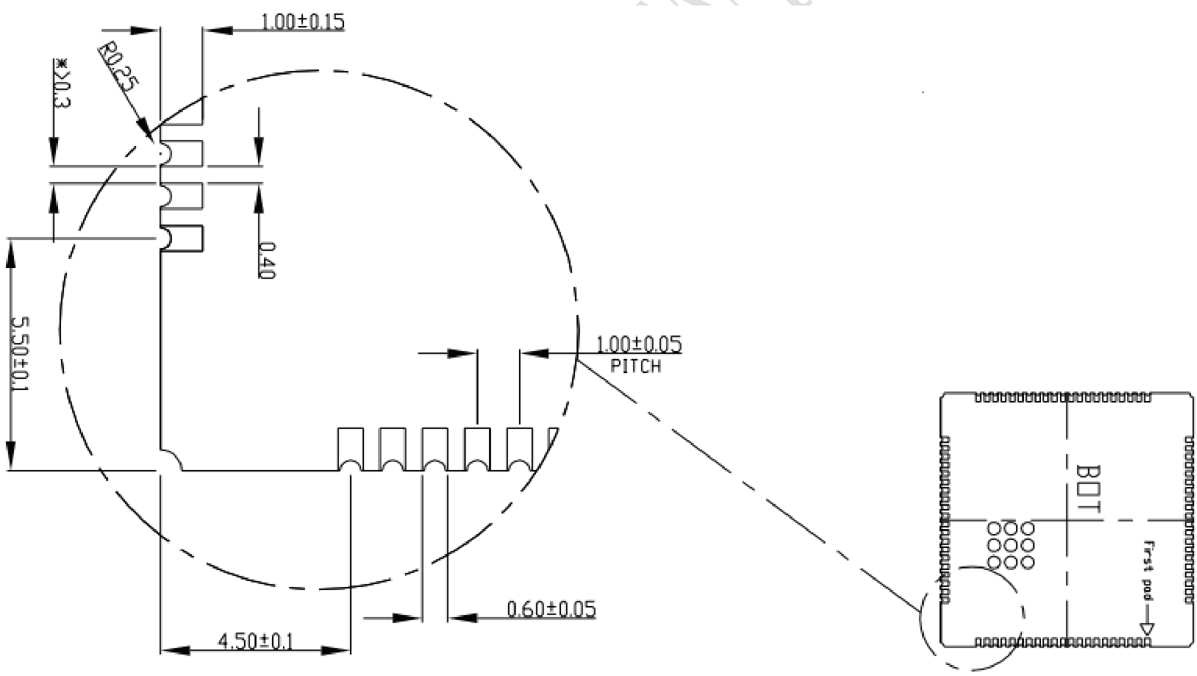

Figure 5: Bottom dimensions (Unit: mm)

2.4 Footprint Recommendation

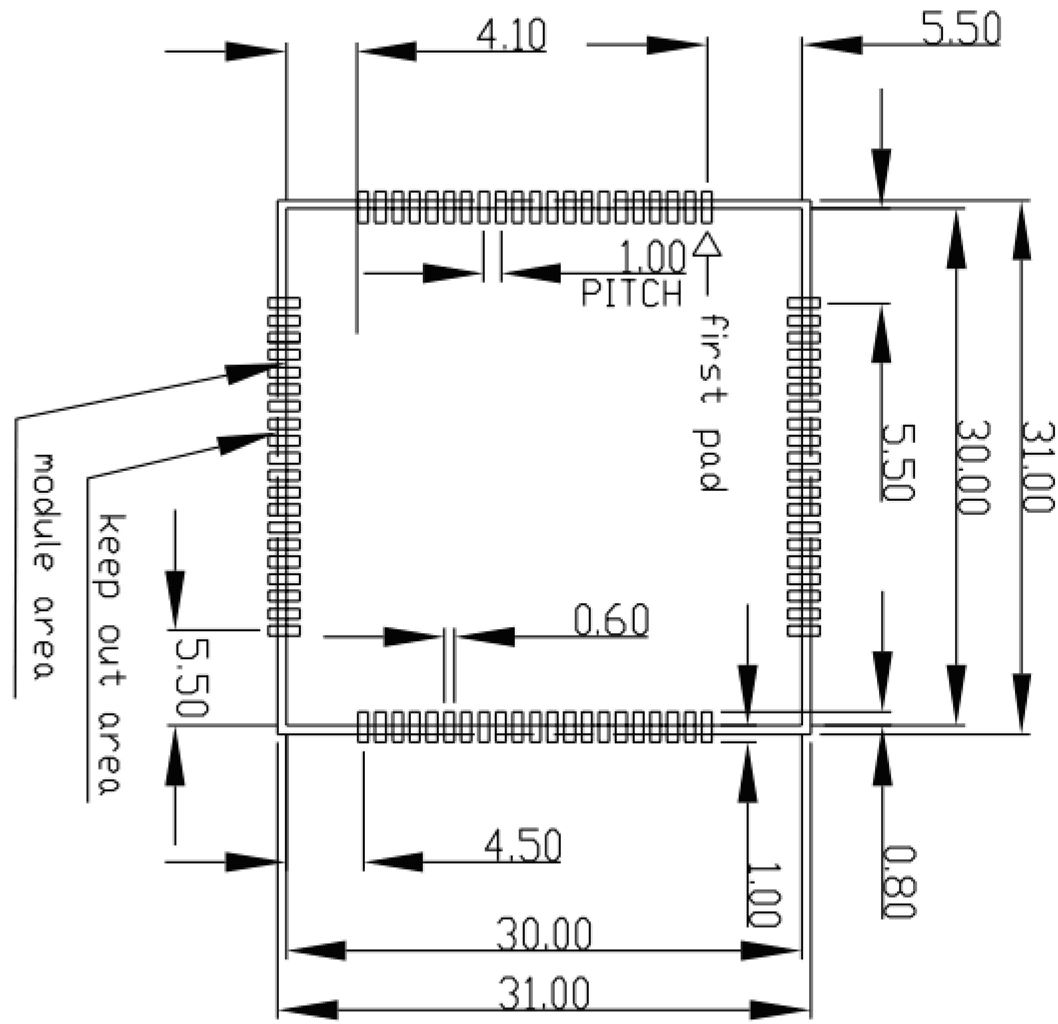

Figure 6: Footprint recommendation (Unit: mm)

3 Application Interface Specification

3.1 Power Supply

The power supply pins of SIM5360A include four VBAT pins (pin 62&63, pin 38&39). VBAT directly supplies the power to RF circuit and baseband circuit. All four VBAT pins of SIM5360A must be used together. VBAT directly supplies the power to RF PA and baseband system. For the VBAT, the ripple due to GSM/GPRS emission burst (every 4.615ms) may cause voltage drop, and the current consumption rises typically to peak of 2A. So the power supply must be able to provide sufficient current up to more than 2A. The following figure is the VBAT voltage ripple wave at the maximum power transmit phase.

The test condition: VBAT =4.0V, VBAT maximum output current =2A, C_A=100 µF tantalum capacitor

(ESR=0.7Ω) and C_B=1μF(Please refer to Figure 8—Application circuit).

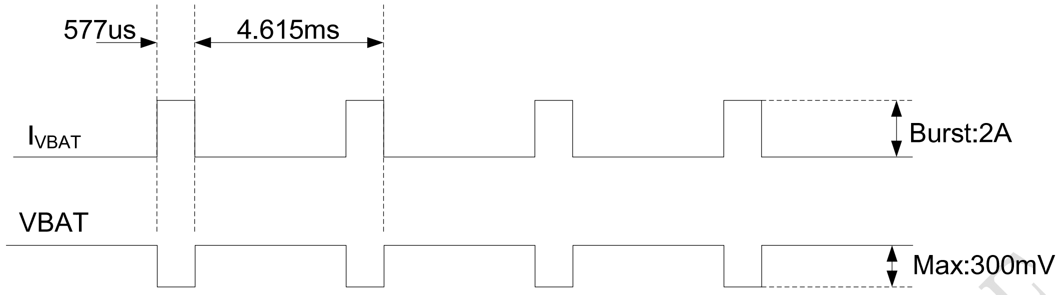

Figure 7: VBAT voltage drop during burst emission (GSM/GPRS)

3.1.1 Power Supply Pin

Two VBAT pins are dedicated to connect the supply voltage.

Table 4: Pin description

Pin type	Pin name	Min	Typ	Max	Unit
POWER	VBAT	3.4	3.8	4.2	V

Note:

1. When the module is power off, users must pay attention to the issue about current leakage. Refer to Chapter 3.10.2.

3.1.2 Design Guide

Make sure that the input voltage at the VBAT pin will never drop below 3.3V even during a transmit burst when the current consumption rises up to more than 2A. If the power voltage drops below 3.3V, the module may be shut down automatically. Using large tantalum capacitors (above 100uF) will be the best way to reduce the voltage drops. If the power current cannot support up to 2A, users must introduce larger capacitor (typical 1000uF) to storage electric power, especially GPRS multiple time slots emission.

For the consideration of RF performance and system stability, some multi-layer ceramic chip (MLCC) capacitors (0.1/1uF) need to be used for EMC because of their low ESR in high frequencies. Note that capacitors should be put beside VBAT pins as close as possible. Also User should minimize the PCB trace impedance from the power supply to the VBAT pins through widening the trace to 80 mil or more on the board. The following figure is the recommended circuit.

In addition, in order to get a stable power source, it is suggested to use a zener diode of which reverse zener voltage is 5.1V and dissipation power is more than 500mW.

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Table 5: Recommended zener diode models

No.	Manufacturer	Part Number	Power	Package
1	On semi	MMSZ5231BT1G	500mW	SOD123
2	Prisemi	PZ3D4V2H	500mW	SOD323
3	Prisemi	PZ5D4V2H	500mW	SOD523
4	Vishay	MMSZ4689-V	500mW	SOD123
5	Crownpo	CDZ55C5V1SM	500mW	0805

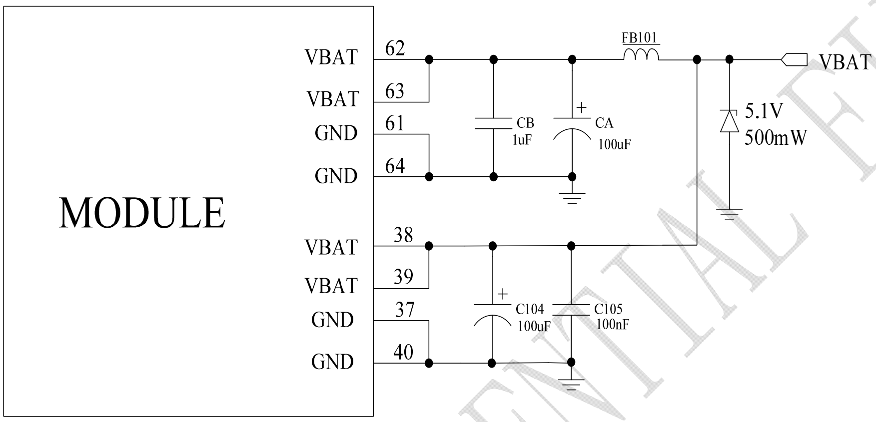

Figure 8: VBAT input application circuit

There are three sections about how to design and optimize users' power systems.

Power supply circuit

We recommend DCDC or LDO is used for the power supply of the module, make sure that the peak current of power components can rise up to more than 2A. The following figure is the reference design of +5V input power supply. The designed output for the power supply is 4.1V, here a linear regulator can be used.

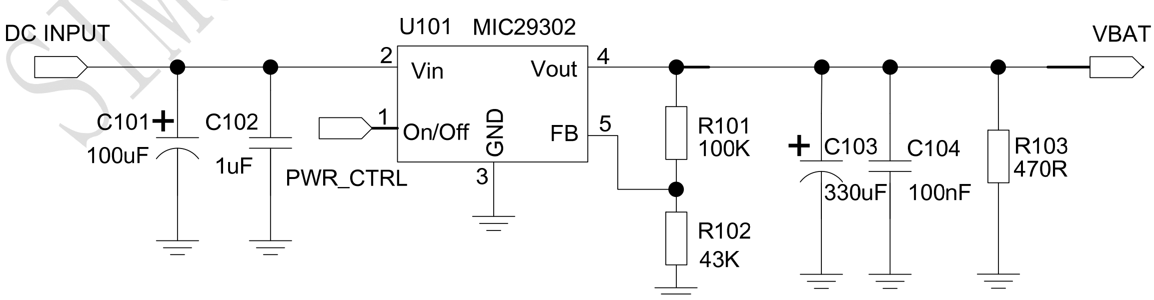

Figure 9: Reference circuit of the LDO power supply

If there is a big difference between the input voltage and the desired output (VBAT), a switching converter

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power will be preferable because of its better efficiency, especially at the high current situation. The following figure is the reference circuit. Note that DCDC may deprave RF performance because of ripple current intrinsically.

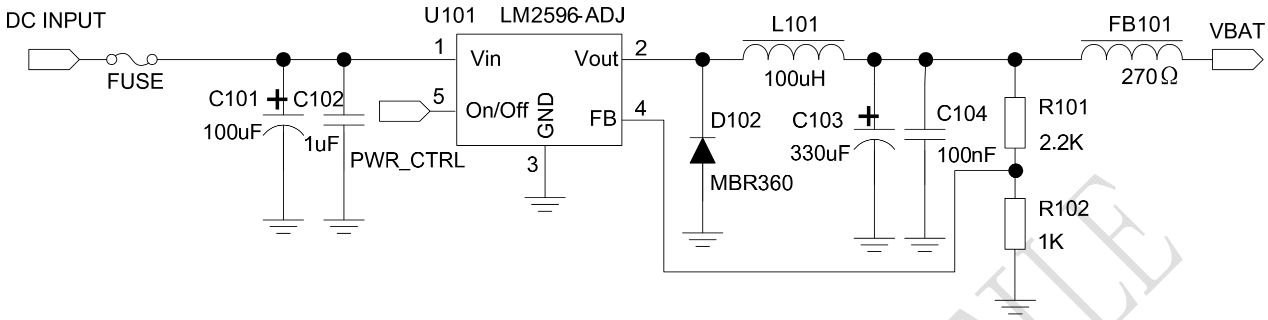

Figure 10: Reference circuit of the DCDC power supply

Voltage monitor

To monitor the power supply voltage, user can use the AT command “AT+CBC”, this command has two parameters: the battery status and the voltage value (mV). It will return the capacity percentage and actual value of battery (at the VBAT pin). The voltage is continuously measured at intervals, whenever the measured battery voltage is lower than a specific value set by the AT command “AT+CVALARM”. For example, if the voltage value is set to be 3.4V, the following URC will be presented: “warning! voltage is low: 3.3v”.

If the voltage is lower than a specific value which is set by the AT command “AT+CPMVT”, the module will be powered off automatically and AT commands cannot be executed any more.

Note: Under-voltage warning function is disabled by default, user can enable it by the AT command “AT+CVALARM”. Please refer to Document [1].

3.1.3 RTC Backup

The module uses RTC (Real Time Clock) to update and maintain inherent time and keeps system alive at no power supply status. The RTC power supply of module can be provided by an external capacitor or a battery (non-chargeable or rechargeable) through the VRTC. The following figures show various reference circuits for RTC back up. The discharge current is less than 10uA.

- **External capacitor backup**

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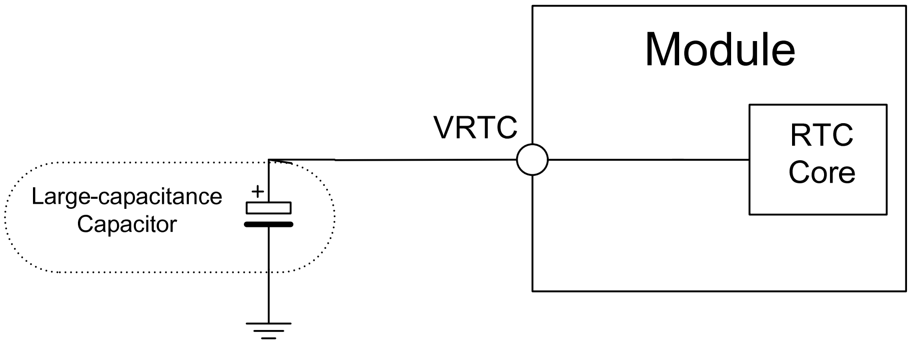

Figure 11: RTC supply from capacitor

- **Non-chargeable battery backup**

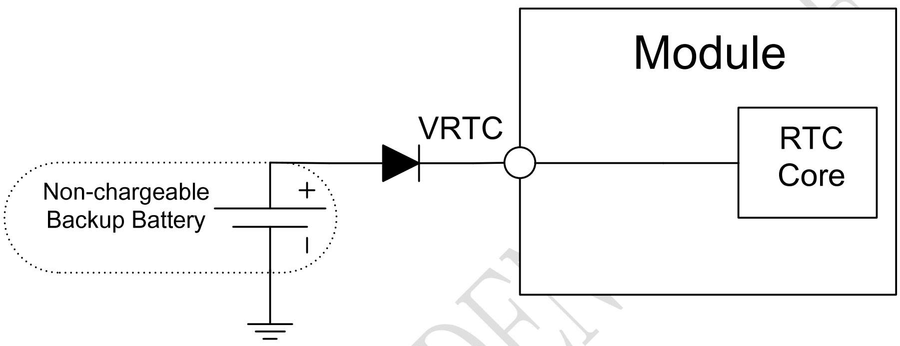

Figure 12: RTC supply from non-chargeable battery

- **Rechargeable battery backup**

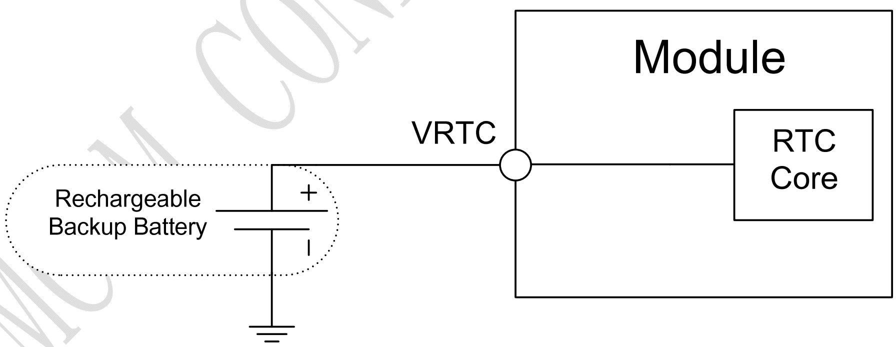

Figure 13: RTC supply from rechargeable battery

Coin-type rechargeable battery is recommended, such as ML414H-IV01E form Seiko can be used.

Note: The VRTC can be disabled, jus disconnect it in application circuit.

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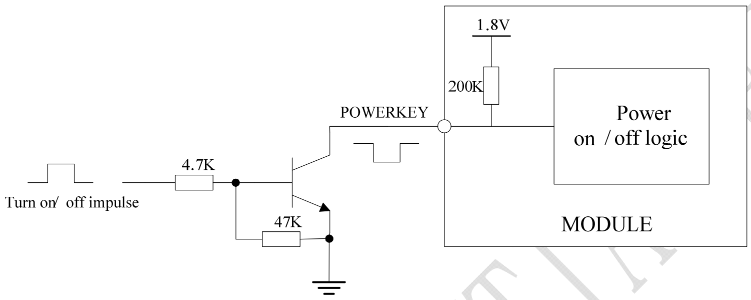
3.2 Power on/off Time Sequence

3.2.1 Power on Sequence

SIM5360A can be powered on by POWERKEY pin, which starts normal operating mode.
POWERKEY pin is pulled up with a 200k ohm resistor to 1.8V in module. User can power on the SIM5360A by pulling the POWERKEY pin down for a short time. The power-on scenarios are illustrated in the following figures.



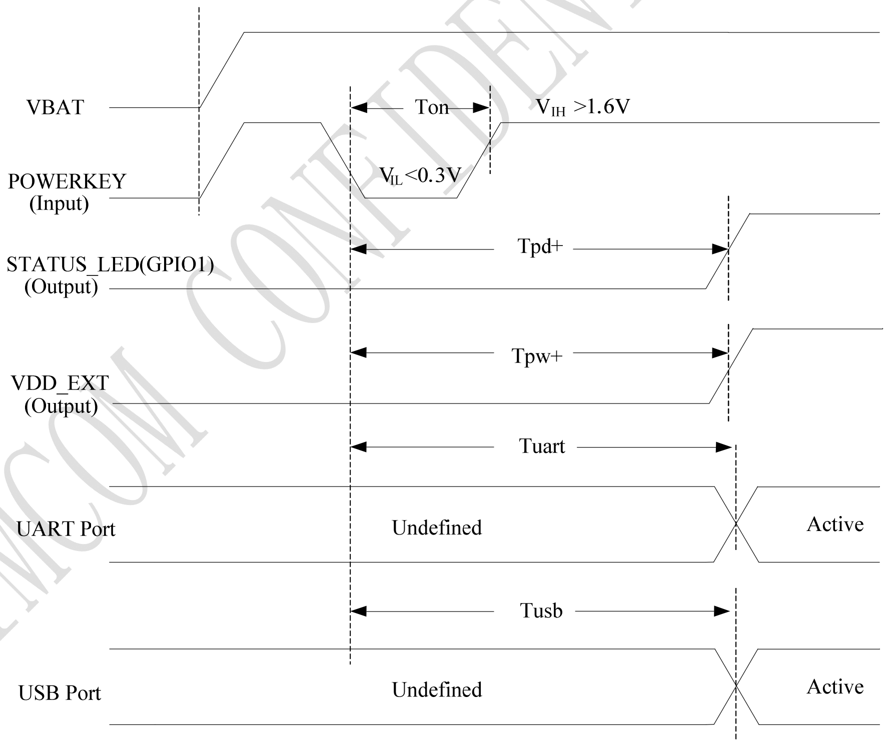


Figure 14: Power on Timing Sequence

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Table 6: Power on timing

Symbol	Parameter	Time value			Unit
		Min.	Typ.	Max.	
Ton	The time to pull POWERKEY down to power on	180	500	-	ms
TpD+	The time to indicate connecting with the network	-	-	5	s
Tpw+	The time to indicate the module is powered on completely	-	-	0.5	s
Tuart	The time to enable UART	-	-	8	s
Tusb	The time to enable USB	-	-	10	s

Note: Module could be automatically power on by connecting Power ON pin to Low level directly. Before designing, please refer to Document [27] for more detail.

3.2.2 Power off Sequence

The following methods can be used to power down SIM5360. These procedures will make module disconnect from the network and allow the software to enter a safe state, and then save data before completely powering the module off.

- Method 1: Power off SIM5360A by pulling the POWERKEY pin down
- Method 2: Power off SIM5360A by AT command

User can power off the SIM5360A by pulling POWERKEY down for a specific time. The power off scenario is illustrated in the following figure.

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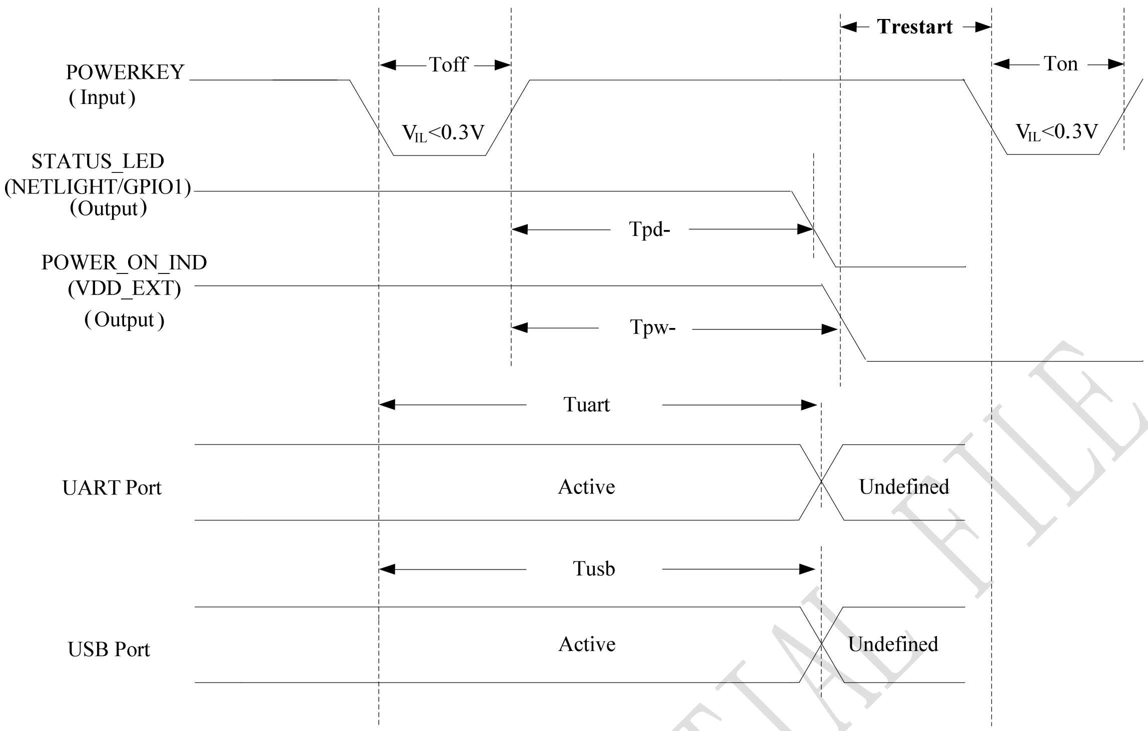

Figure 15: Power off timing sequence

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Table 7: Power off timing

Symbol	Parameter	Time value			Unit
		Min.	Typ.	Max.	
Toff	The time pulling POWERKEY down to power off	0.5	-	5	s
TpD-	The time to indicate disconnecting from the network	-	-	2	s
Tpw-	The time to indicate the module power off completely	-	-	2	s
Tuart	The time to disable UART	-	-	3	s
Tusb	The time to disable USB	-	-	2	s
Trestart	The time to power on again after Tpw-	0	-	-	s

User can also use the AT command “AT+CPOF” to power down the module. After that, the AT commands cannot be executed any longer. The module enters the POWER DOWN mode, only the RTC is still active. For details, refer to *Document [1]*.

3.3 UART Interface

SIM5360A provides two UARTs (universal asynchronous serial transmission) port. UART1 consists of a flexible 7-wire serial interface. UART2 consists of 2-wire serial interface. The module is as the DCE (Data

Communication Equipment) and the client PC is as the DTE (Data Terminal Equipment). AT commands are entered and serial communication is performed through UART interface.
In order to prevent the UART signals of the module damaged due to voltage spikes or ESD, series resistors can be used on UART signals.

The application circuit is in the following figures.

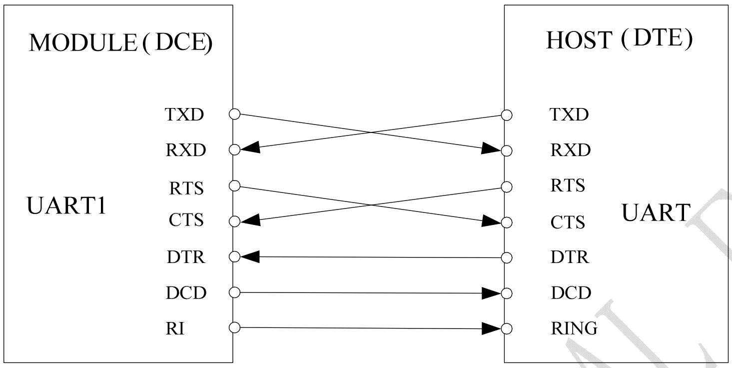

Figure 16: UART1 Full modem

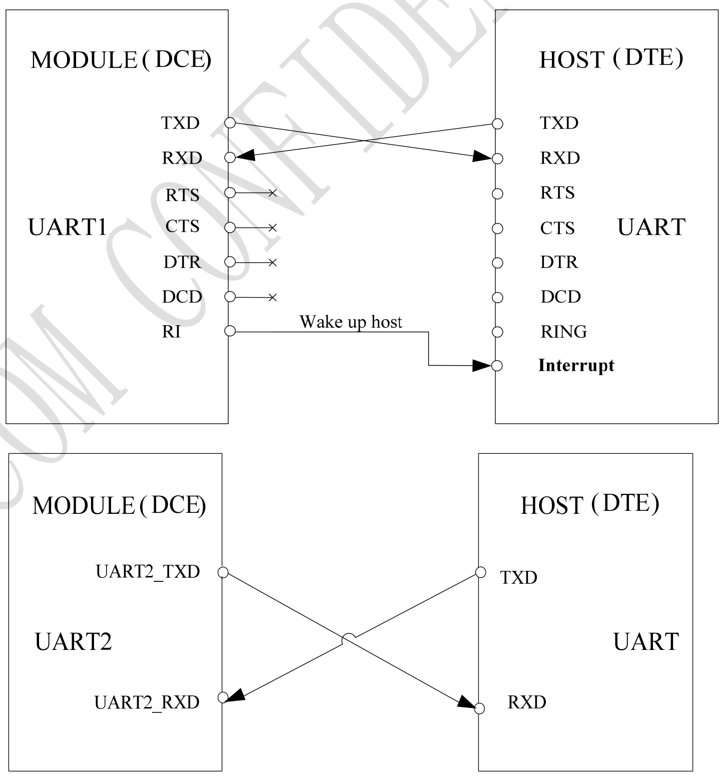

Figure 17: Null modem (UART1 and UART2)

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3.3.1 Pin Description

Table 8: Pin description

Pin type	Pin name	Pin No.	I/O	Default Status
UART1	RXD	68	I	Pull-Down
	TXD	71	O	Pull-Up
	RTS	66	O	
	CTS	67	I	Pull-Up
	DTR	72	I	Pull-Up
	DCD	70	O	
	RI	69	O	
UART2	UART2_RXD	7	I	Pull-Down
	UART2_TXD	8	O	Pull-Up

More pin information refers to chapter 2.2.

Table 9: Logic level

Symbol	Parameter	Min	Typ	Max	Unit
V_{IH}	High-level input voltage	1.26	1.8	2.1	V
V_{IL}	Low-level input voltage	-0.3	0	0.63	V
V_{OH}	High-level output voltage	1.35	1.8	1.8	V
V_{OL}	Low-level output voltage	0	0	0.45	V

3.3.2 Application Guide

If UART port is used in Null Modem, the pin “RI” can be used as an interrupt signal to HOST. Normally it will keep high logic level until certain condition such as receiving SMS, voice call (CSD, video) or URC reporting, then “RI” will change to low logic level to inform the master (client PC). It will stay low until the master clears the interrupt event with AT command.

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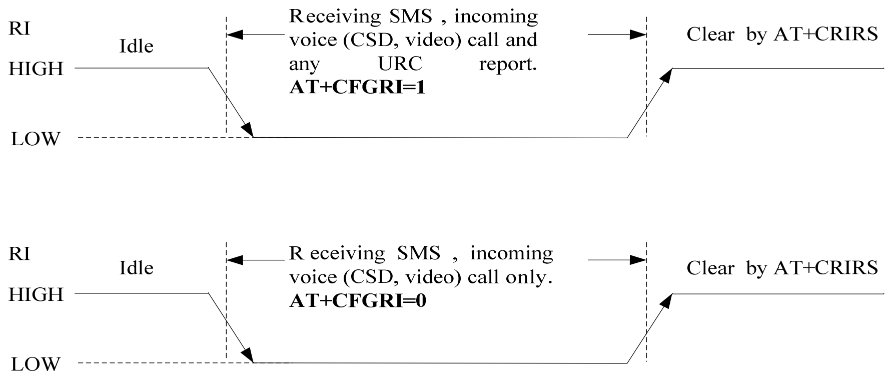

Figure 18: RI behaviour in NULL Modem

If Full Modem is used to establish communication between devices, the pin "RI" is another operation status. Initially it keeps high, when a voice call or CSD call comes, the pin "RI" will change to low for about 5900ms, then it will return to high level for 100ms. It will repeat this procedure until this call is answered or hung up.

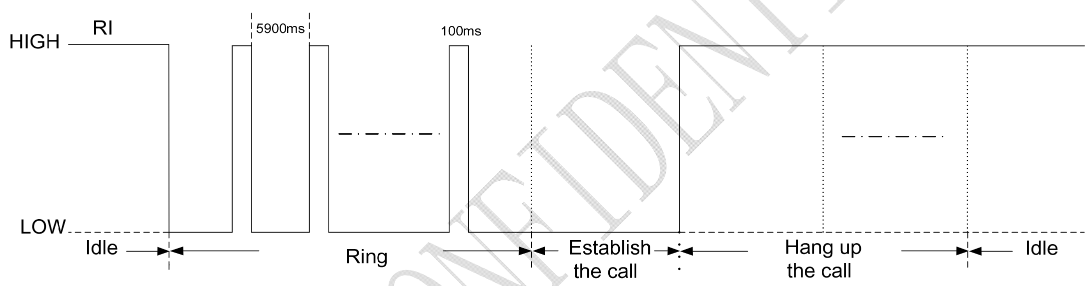

Figure 19: RI behaviour in FULL Modem

The SIM5360A UART is 1.8V interface. A level shifter should be used if user's application is equipped with a 3.3V UART interface. The level shifter TXB0108RGYR provided by Texas Instruments is recommended. The reference design of the TXB0108RGYR is in the following figures.

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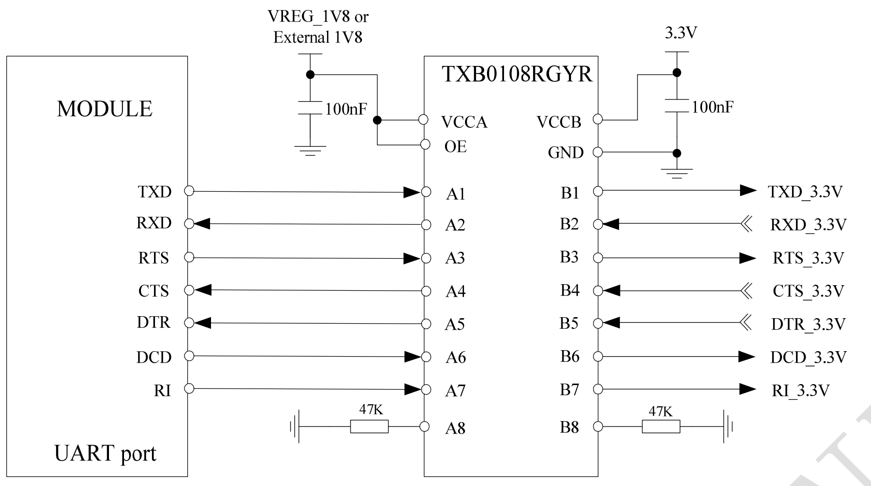

Figure 20: Reference circuit of level shift

To comply with RS-232-C protocol, the RS-232-C level shifter chip should be used to connect SIM5360A to the RS-232-C interface. In this connection, the TTL level and RS-232-C level are converted mutually. SIMCom recommends that user uses the SP3238ECA chip with a full modem. For more information please refers to the RS-232-C chip datasheet.

Note: SIM5360A supports the baud rate: 300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200, 230400, 460800, 921600, 3200000, 3686400, 4000000bps. Default rate is 115200bps.

3.4 SD/MMC Interface

SIM5360A provides one 4-bit SD/MMC interface. Its operation voltage is 2.85V, with clock rates up to 52 MHz. It supports 1-bit SD/MMC or 4-bit SD data transmission mode. Though the same hardware controller is used, the initialization procession for SD or MMC cards is different. SIM5360A will detect which card is inserted automatically.

Note: Interface with SD/MMC memory cards up to 32GB.

3.4.1 Pin Description

Table 10: Pin description

Pin name	Pin No.	Function
SD_DATA0	22	SD/MMC card data0
SD_DATA1	23	SD card data1
SD_DATA2	24	SD card data2
SD_DATA3	25	SD card data3
SD_CLK	26	SD card clock
SD_CMD	21	SD card command

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VDD_EXT	44	SD card power

Table 11: Electronic characteristic

Symbol	Parameter	Min	Typ	Max	Unit
VDD_EXT	LDO power output	2.71	2.85	2.99	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	0.3·VDD_EXT	V
V_{OH}	High-level output voltage	2.71	2.85	2.99	V
V_{OL}	Low-level output voltage	0	0	0.45	V

3.4.2 Design guide

The module provides a LDO named VDD_EXT for SD card power supply. The LDO is 2.85V by default, capable of 300mA. Data lines should be pulled up to VDD_EXT by 10K resistors. ESD/EMI components should be arranged beside SD card socket. Refer to the following application circuit.

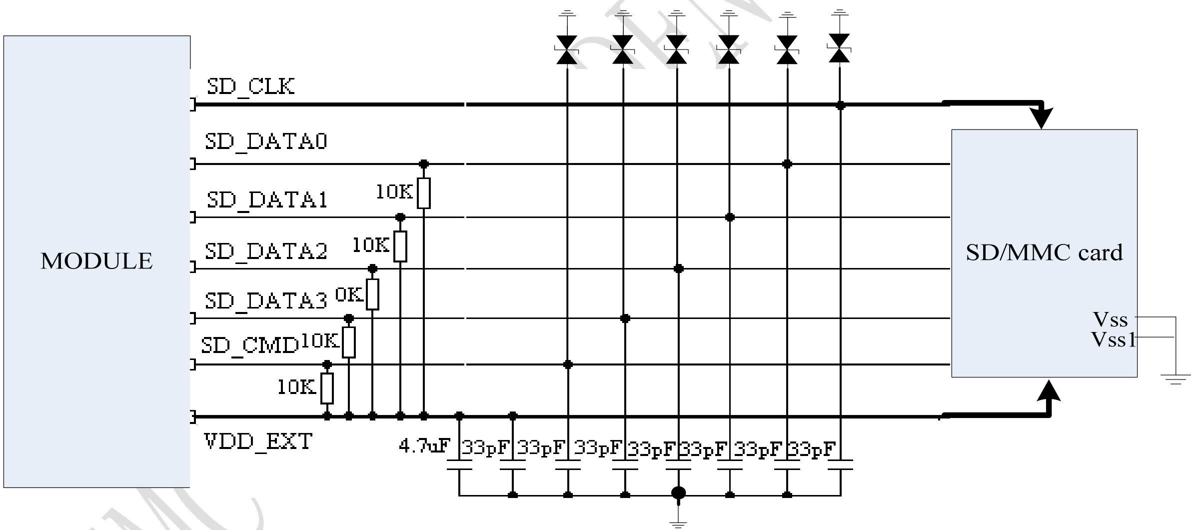

Figure 21: SD interface circuit

3.5 USIM Interface

The USIM provides the required subscription verification information to allow the mobile equipment to attach to a GSM or UMTS network. Both 1.8V and 3.0V SIM Cards are supported.

3.5.1 Pin description

Table 12: Pin description

Pin name	Pin	Description
USIM_CLK	19	USIM Card Clock
USIM_RST	18	USIM Card Reset
USIM_DATA	17	USIM Card data I/O, which has been pulled up with a 22kR resistor to USIM_VDD in module. Do not pull up or pull down in users' application circuit.
USIM_VDD	20	USIM Card Power output depends automatically on USIM mode，one is 3.0V±10%, another is 1.8V±10%. Current is less than 50mA.

Table 13: Electronic characteristic

Symbol	Parameter	3.0V mode			1.8V mode			Unit
		Min	Typ	Max	Min	Typ	Max	
USIM_VDD	LDO power output	2.71	2.85	3.05	1.7	1.8	1.9	V
V_{IH}	High-level input voltage	0.65·USIM_VDD	-	USIM_VDD +0.3	0.65·USIM_VDD	-	USIM_VDD +0.3	V
V_{IL}	Low-level input voltage	-0.3	0	0.3·USIM_VDD	-0.3	0	0.3·USIM_VDD	V
V_{OH}	High-level output voltage	2.71	2.85	3.05	1.7	1.8	1.9	V
V_{OL}	Low-level output voltage	0	0	0.45	0	0	0.45	V

3.5.2 Application Guide

It is recommended to use an ESD protection component such as ST (www.st.com) ESDA6V1W5 or ON SEMI (www.onsemi.com) SMF05C. Note that the SIM peripheral circuit should be close to the SIM card socket. The reference circuit of the 6-pin SIM card holder is illustrated in the following figure.

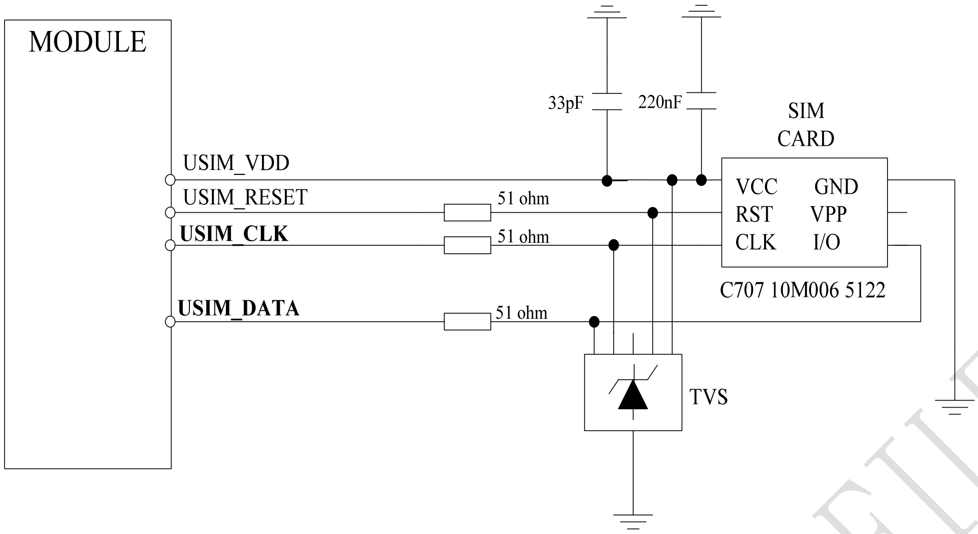

Figure 22: USIM interface reference circuit

Note: USIM_DATA has been pulled up with a 15kohm resistor to USIM_VDD in module. A 220nF shut capacitor on USIM_VDD is used to reduce interference. Use AT Commands to get information in USIM card. For more detail, please refer to document [1].

3.5.3 Recommend Components

For 6 pins USIM socket, SIMCom recommend to use Amphenol **C707 10M006 512 2**. User can visit http://www.amphenol.com for more information about the holder.

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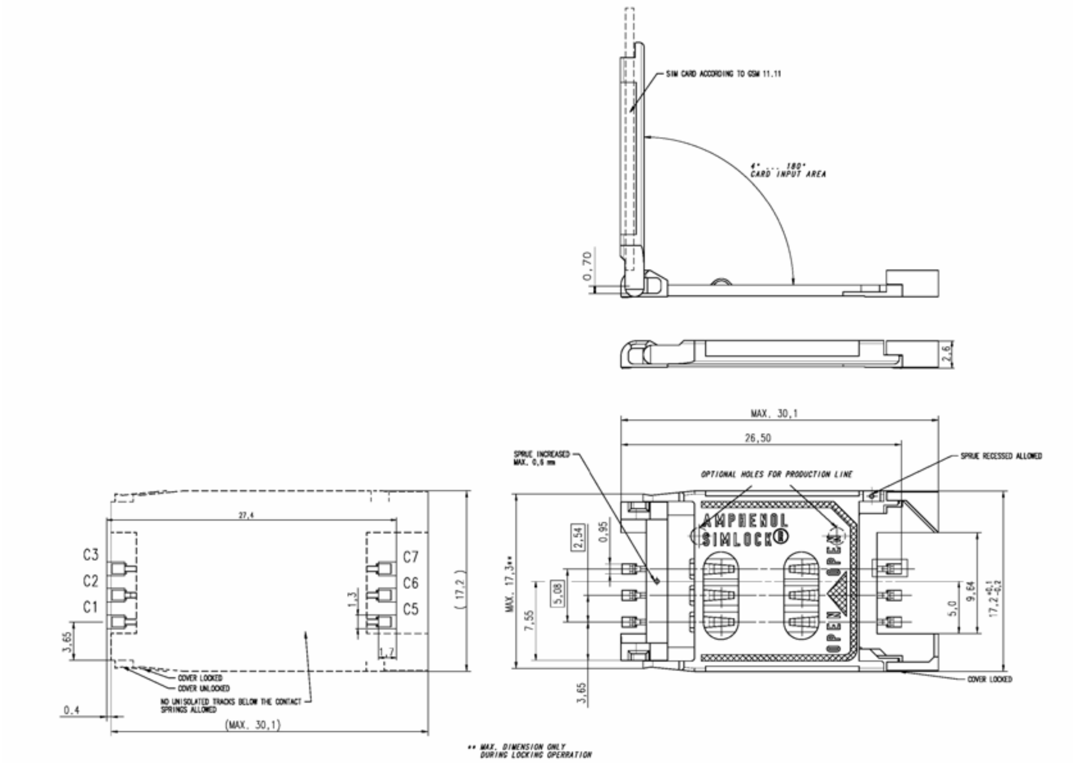

Figure 23: Amphenol SIM card socket

Table 19: Amphenol USIM socket pin description

Pin	Signal	Description
C1	USIM_VDD	SIM Card Power supply, it can identify automatically the SIM Card power mode，one is 3.0V±10%, another is 1.8V±10%.
C2	USIM_RST	SIM Card Reset.
C3	USIM_CLK	SIM Card Clock.
C5	GND	Connect to GND.
C6	VPP	
C7	USIM_DATA	SIM Card data I/O.

3.6 I2C Interface

I2C is used to communicate with peripheral equipments and can be operated as either a transmitter or receiver, depending on the device function. Use AT Commands “AT+CRIIC and AT+CWIIC” to read/write register values of related peripheral equipments connected with I2C interface. Its operation voltage is 1.8V.

3.6.1 Pin Description

Table 14: Pin description

Pin name	Pin No.	Function
SDA	56	Serial interface data input and output
SCL	55	Serial interface clock input

3.6.2 Signal Description

Both SDA and SCL are bidirectional lines, connected to a positive supply via a pull-up resistor respectively. When the bus is free, both lines are high.

3.6.3 Design Guide

For SIM5360, the data on the I2C bus can be transferred at rates up to 400kbps. The number of peripheral devices connected to the bus is solely dependent on the bus capacitance limit of 400pF. Note that PCB traces length and bending are in users' control to minimize load capacitance.

Note：SDA and SCL have none pulled up resistors in module. So there is need to pull them up in users' application circuit.

3.7 Keypad Interface

SIM5360A module provides a keypad interface that supports five sense lines, or columns, and five keypad rows. The interface generates an interrupt when any key is pressed. Its operation voltage is 1.8V.

3.7.1 Pin Description

Table 15: Pin description

Pin name	Pin No.	Function
KBC0	28	Sensing keys
KBC1	27	
KBC2	31	
KBC3	32	

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KBC4	36	
KBR0	30	Driving pads
KBR1	29	
KBR2	30	
KBR3	35	
KBR4	34	

3.7.2 Application Guide

All keypad pins can be configured for GPIOs. These GPIOs also support interruption operation if used as input pins. A typical circuit about the keypad (5*5 keypad matrix) is shown in the following figure.

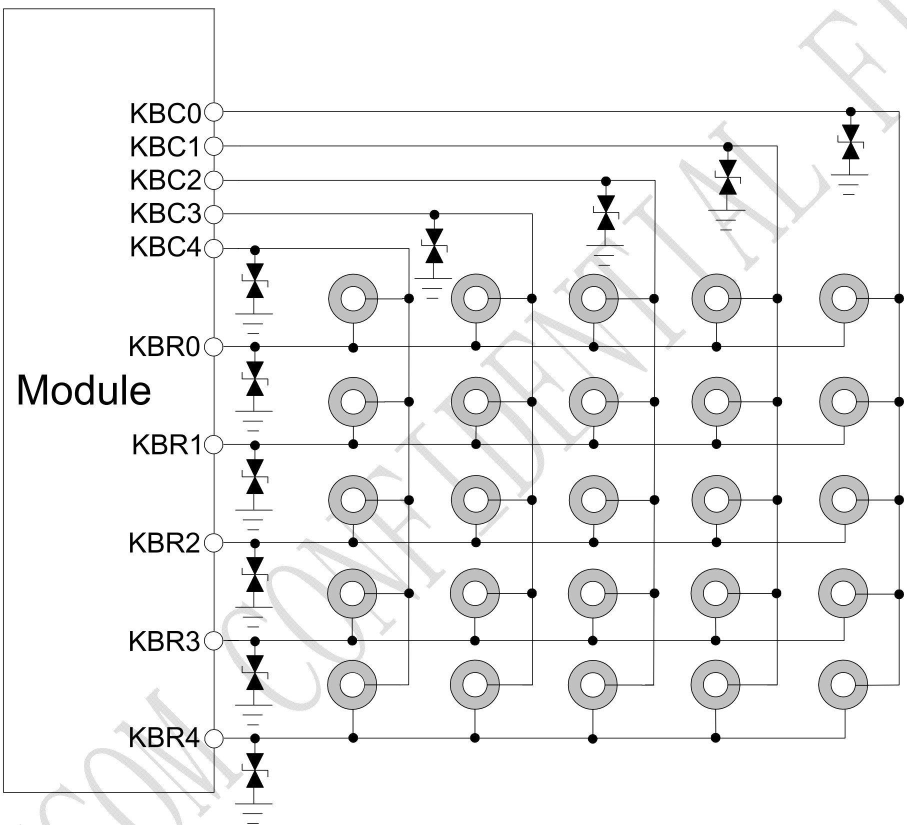

Figure 24: Reference circuit

If these pins are configured for GPIOs, the sequence is listed in the following table.

Table 16: GPIO configuration

Keypad interface	GPIO No.
KBR4	GPIO6
KBR3	GPIO7
KBR2	GPIO8
KBR1	GPIO9
KBR0	GPIO10

KBC4	GPIO11
KBC3	GPIO12
KBC2	GPIO13
KBC1	GPIO14
KBC0	GPIO15

Note: Refer to document [23] for detailed information of Keypad Application Note.

3.8 USB Interface

SIM5360A module contains a USB interface. This interface is compliant with the USB2.0 specification. The USB2.0 specification requires hosts such as the computer to support all three USB speeds, namely low-speed (1.5Mbps), full-speed (12Mbps) and high-speed (480Mbps). USB charging and USB-OTG is not supported.

Table 17: Electronic characteristic

Pin name	Pin No.	Input voltage scope(V)		
		Min	Typ	Max
USB_VBUS	11	3	5.0	5.25
USB_DP	13	They are compliant with the USB 2.0 specification.		
USB_DN	12			

3.8.1 Application Guide

Currently SIM5360A supports the USB suspend and resume mechanism which can help to save power. If no transaction is on USB bus, SIM5360A will enter suspend mode. When some events such as voice call or receiving SMS happen, SIM5360A will resume normal mode automatically.

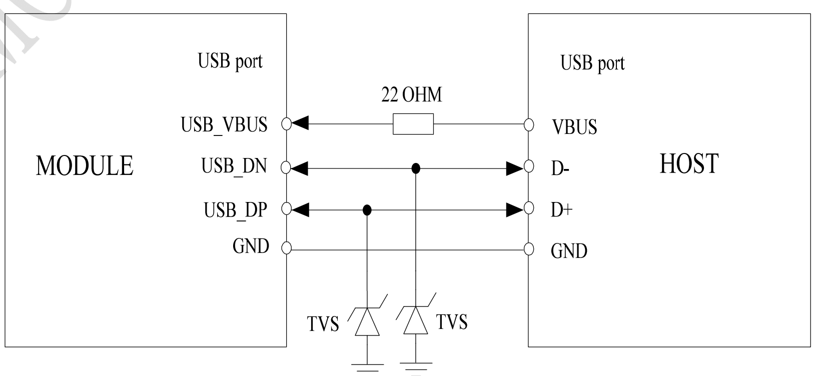

Figure 25: USB interface

Because of high bit rate on USB bus, pay attention to influence of junction capacitance of ESD component on USB data lines. Typically, the capacitance should be less than 4pF @1MHz.
It is recommended to use an ESD protection component such as ON SEMI (www.onsemi.com) ESD9M5.0ST5G or ESD9L5.0ST5G.

Note：The SIM5360A has two kinds of interface (UART and USB) to connect to host CPU. USB interface is mapped to five virtual ports: "SIMTECH HS-USB Modem 9000", "SIMTECH HS-USB NMEA 9000", "SIMTECH HS-USB AT port 9000", "SIMTECH HS-USB Diagnostics 9000" and "SIMTECH Wireless HS-USB Ethernet Adapter 9000".

3.9 SPI Interface

SPI interface of SIM5360A is master only. It provides a duplex, synchronous, serial communication link with peripheral devices. Its operation voltage is 1.8V, with clock rates up to 26 MHz.

3.9.1 Pin Description

Table 18: Pin description

Pin name	Pin No.	Function
SPI_CS	9	SPI chip-select; not mandatory in a point-to-point connection
SPI_MISO	7	SPI master in/slave out data
SPI_CLK	6	SPI clock
SPI_MOSI	8	SPI master out/slave in data

Table 19: Electronic characteristic

Symbol	Parameter	Min	Typ	Max	Unit
V_{IH}	High-level input voltage	1.26	1.8	2.1	V
V_{IL}	Low-level input voltage	-0.3	0	0.63	V
V_{OH}	High-level output voltage	1.35	1.8	1.8	V
V_{OL}	Low-level output voltage	0	0	0.45	V

3.10 GPIO Interface

SIM5360A provides a limited number of GPIO pins. All GPIOs can be configured as inputs or outputs. User can use AT Commands to read or write GPIOs status. Refer to ATC document for details.

3.10.1 Pin Description

Table 20: Pin description

Pin name	Pin No.	I/O	Function
NETLIGHT/GPIO1	51	O	Output PIN as LED control for network status. If it is unused, left open.
GPIO4	54	I	Input PIN as RF operating control. H: Normal Mode L:Flight Mode If it is unused, left open.
GPIO40	49	O	Output PIN as operating status indicating of module. H: Power on L: Power off If it is unused, left open.
GPIO41	52	I/O	General input/output PIN. It can be used as wake/interrupt signal to host from module If it is unused, left open.
GPIO42	53	I/O	General Purpose Input/Output Port.
GPIO43	50	I/O	General Purpose Input/Output Port. It can be used as wake/interrupt signal to module from host. If it is unused, left open.
GPIO44	48	I/O	General Purpose Input/Output Port

Note: If more GPIOs need to be used, users can configure GPIO on other multiple function interfaces, such as PCM. Please refer to GPIO list.

Table 21: Electronic characteristic

Symbol	Parameter	Min	Typ	Max	Unit
V_{IH}	High-level input voltage	1.26	1.8	2.1	V
V_{IL}	Low-level input voltage	-0.3	0	0.63	V
V_{OH}	High-level output voltage	1.35	1.8	1.8	V
V_{OL}	Low-level output voltage	0	0	0.45	V

Note: The output driver current of GPIOs is 2mA.

3.10.2 Application Guide

Network status

GPIO1 is used to control Network Status LED; application circuit is shown below.

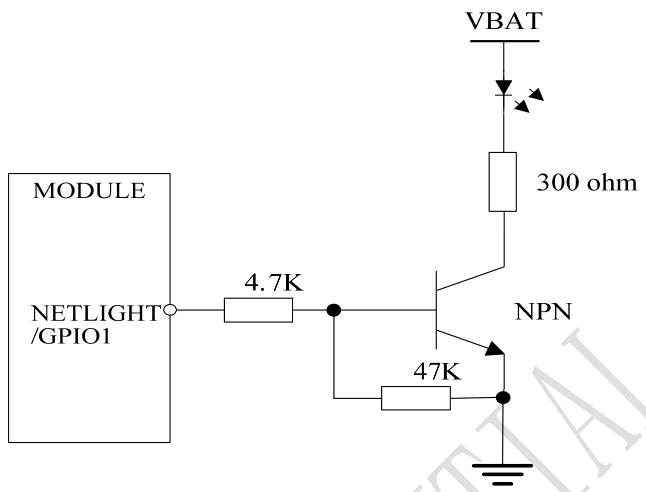

Figure 26: Application circuit

Note: The value of resistor Rx depends on LED characteristic.

Table 22: LED status

LED 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

Flight mode control

GPIO4 controls SIM5360A module to enter or exit the Flight mode. In Flight mode, SIM5360A closes RF function to prevent interference with other equipments or minimize current consumption. Bidirectional ESD protection component is suggested to add on GPIO4.

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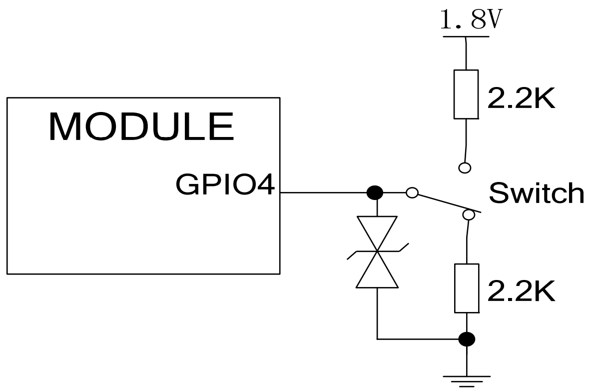

Figure 27: Flight mode switch

Table 23: Control status

GPIO4 Status	Module operation
Low Level	Flight Mode: RF is closed.
High Level	Normal Mode: RF is working.

Note：1. For SIM5360, GPIO0, GPIO2, GPIO3 and GPIO5 have multiplex function, user can use them as PCM interface to connect extend codec. Refer to section 3.11 and document [1] for details.
2. When the module is powered off, make sure all digital interfaces (PCM UART, etc) connected with peripheral devices have no voltage higher than 0.3V. If users' design cannot meet above conditions, high level voltages maybe occur in GPIO pins because current leakage from above digital interfaces may occur.

3.11 PCM Interface

SIM5360A provides hardware PCM interface for external codec. The PCM interface enables communication with an external codec to support hands-free applications. SIM5360A PCM interface can be used in two modes: the default mode is auxiliary PCM (8 KHz long sync mode at 128 KHz PCM CLK); the other mode is primary PCM (8 KHz short sync mode at 2048 KHz PCM CLK). In short-sync (primary PCM) mode, SIM5360A can be a master or a slave. In long-sync (auxiliary PCM) mode, SIM5360A is always a master. SIM5360A also supports 3 kinds of coding formats: 8 bits (υ-law or A-law) and 16 bits (linear).

Note: PCM interface is multiplexed from GPIO (default setting). The AT command "AT+CPCM" is used to switch between PCM and GPIO functions. Please refer to document [21] and document [1] for details.

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3.11.1 Pin Description

Table 24: Pin description

Pins	Pin No.	Description
PCM_OUT	73	PCM data output
PCM_IN	74	PCM data input
PCM_SYNC	75	PCM data synchrony
PCM_CLK	76	PCM data clock

Table 25: Electronic characteristic

Symbol	Parameter	Min	Typ	Max	Unit
V_{IH}	High-level input voltage	1.26	1.8	2.1	V
V_{IL}	Low-level input voltage	-0.3	0	0.63	V
V_{OH}	High-level output voltage	1.35	1.8	1.8	V
V_{OL}	Low-level output voltage	0	0	0.45	V

3.11.2 Signal Description

The default PCM interface in SIM5360A is the auxiliary PCM interface. The data changes on the high level of PCM_CLK and is sampled at the falling edge of PCM_CLK in one period. Primary PCM is disabled after every power-on or every reset event. So user must use AT command to enable the primary PCM mode after powering on or resetting the module every time if user wants to use Primary PCM.SIM5360A PCM Interface can be operated in Master or Slave mode if it is configured to primary PCM. In Master Mode, the Module drives the clock and sync signals that are sent to the external codec. When it is in Slave Mode, the external codec drives the clock and sync signals which are sent to the module. Both PCM modes are discussed in this section followed by additional PCM topics.

Auxiliary PCM (128 KHz PCM clock)

υ-law coding is supported by the auxiliary PCM. The auxiliary codec port operates with standard long-sync timing and a 128 KHz clock. The AUX_PCM_SYNC runs at 8 KHz with 50% duty cycle. Most υ-law codec support the 128 KHz clock.

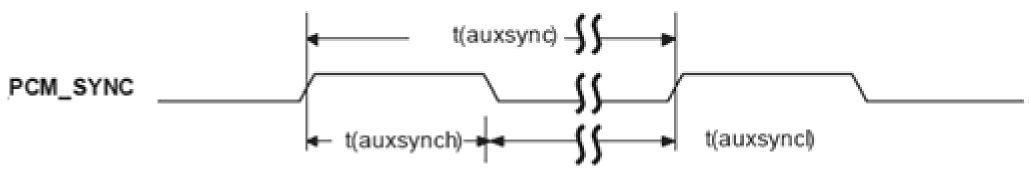

Figure 28: Synchrony timing

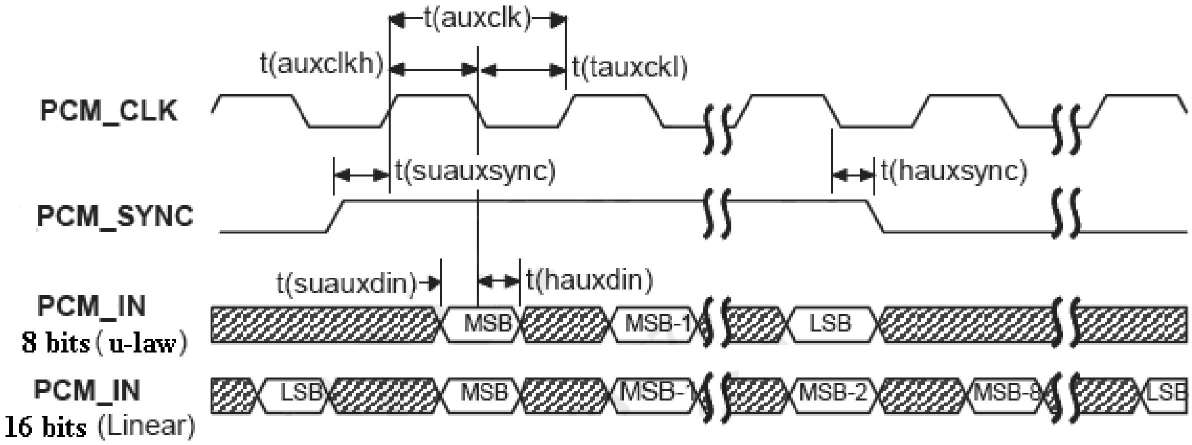

Figure 29: EXT CODEC to MODULE timing

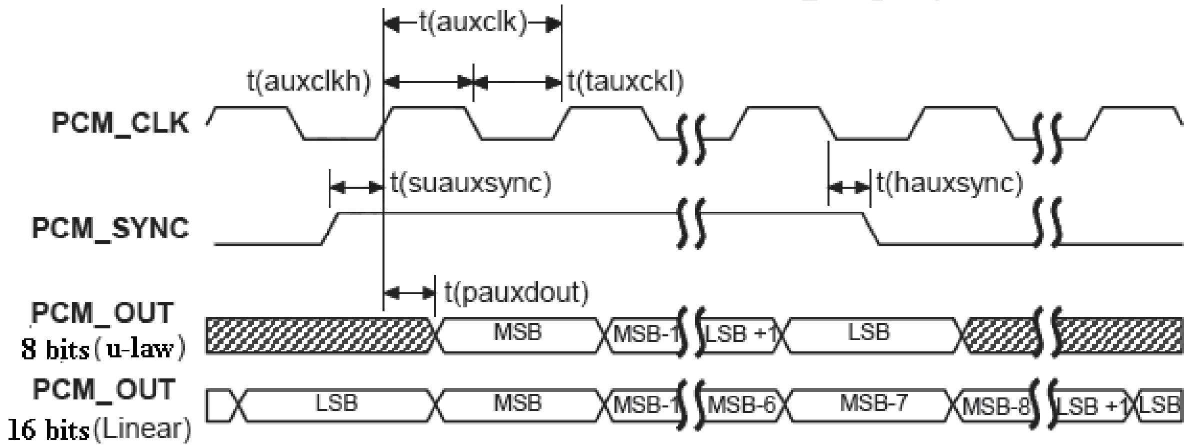

Figure 30: MODULE to EXT CODEC timing

Table 26: Timing parameters

Parameter	Description	Min	Typ	Max	Unit
T(auxsync)	AUX_PCM_SYNC cycle time	–	125	-	μs
T(auxsynch)	AUX_PCM_SYNC high time	62.4	62.5	-	μs
T(auxsyncl)	AUX_PCM_SYNC low time	62.4	62.5	-	μs
T(auxclk)*	AUX_PCM_CLK cycle time	-	7.8	–	μs
T(auxclkh)	AUX_PCM_CLK high time	3.8	3.9	–	μs
T(auxclkl)	AUX_PCM_CLK low time	3.8	3.9	–	μs
T(suauxsync)	AUX_PCM_SYNC setup time high before falling edge of PCM_CLK	1.95	–	–	μs
T(hauxsync)	AUX_PCM SYNC hold time after falling edge	1.95	–	–	μs

	of PCM_CLK				
T(suauxdin)	AUX_PCM_IN setup time before falling edge of AUX_PCM_CLK	70	–	–	ns
T(hauxdin)	AUX_PCM_IN hold time after falling edge of AUX_PCM_CLK	20	–	–	ns
T(pauxdout)	Delay from AUX_PCM_CLK rising to AUX_PCM_OUT valid	–	–	50	ns

***Note: T(auxclk) = 1/(128 KHz).**

Primary PCM (2048 KHz PCM clock)

SIM5360A also supports 2.048 MHz PCM data and sync timing for υ-law codec. This is called the primary PCM interface. User can use AT command to take the mode you want as discussed above.

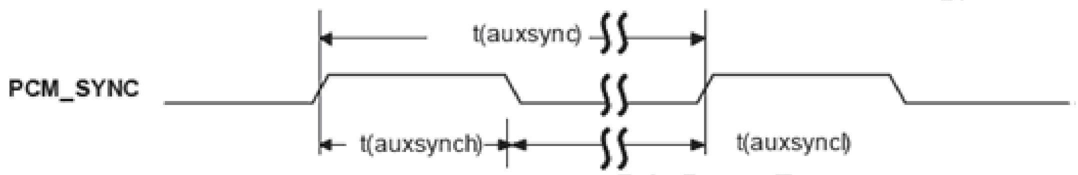

Figure 31: Synchrony timing

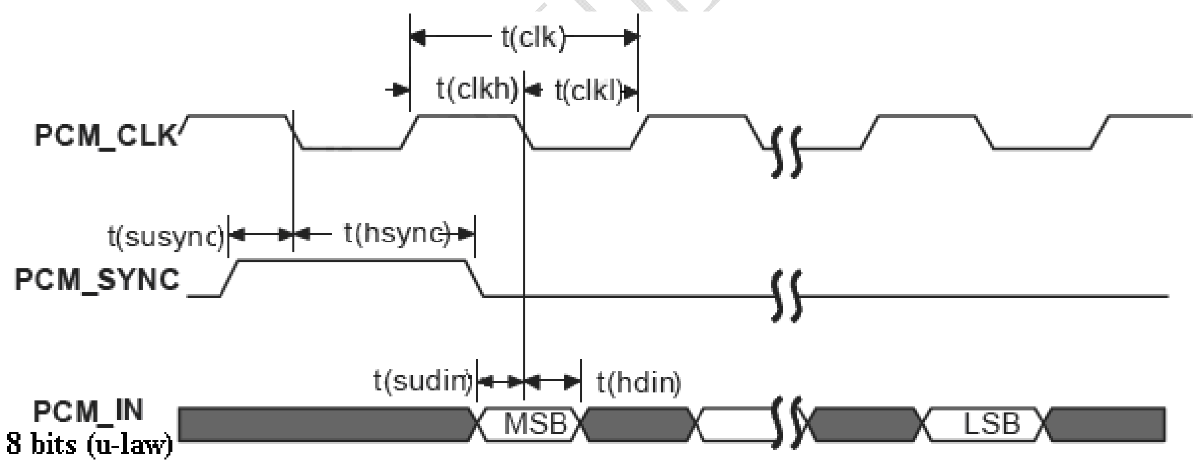

Figure 32: EXT CODEC to MODULE timing

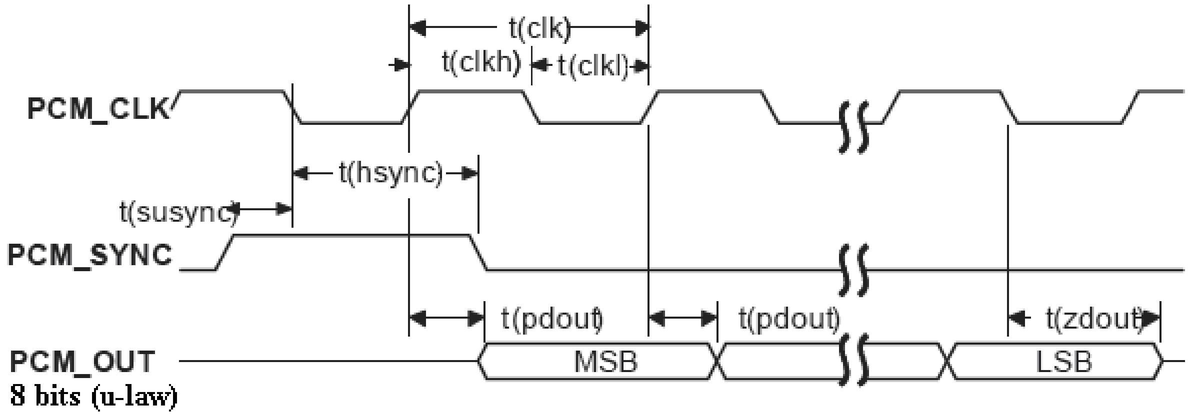

Figure 33: MODULE to EXT CODEC timing

Table 27: Timing parameters

Parameter	Description	Min	Typ	Max	Unit
T(sync)	PCM_SYNC cycle time	–	125	–	µs
T(synch)	PCM_SYNC high time	400	500	–	ns
T(syncl)	PCM_SYNC low time	–	124.5	–	µs
T(clk)	PCM_CLK cycle time	–	488	–	ns
T(clkh)	PCM_CLK high time	–	244	–	ns
T(clkl)	PCM_CLK low time	–	244	–	ns
T(susync)	PCM_SYNC setup time high before falling edge of PCM_CLK	60	–	–	ns
T(hsync)	PCM_SYNC hold time after falling edge of PCM_CLK	60	–	–	ns
T(sudin)	PCM_IN setup time before falling edge of PCM_CLK	50	–	–	ns
T(hdin)	PCM_IN hold time after falling edge of PCM_CLK	10	–	–	ns
T(pdout)	Delay from PCM_CLK rising to PCM_OUT valid	–	–	350	ns
T(zdout)	Delay from PCM_CLK falling to PCM_OUT HIGH-Z	–	160	–	ns

*Note: **SIM5360A can transmit PCM data by USB except for PCM interface.***

3.11.3 Application Guide

The mode of SIM5360A PCM can be configured by AT command “AT+CPCM and AT+CPCMFMT”, and the default configuration is master mode using short sync data format with 2.048MHz PCM_CLK and 8 kHz PCM_SYNC. Please refer to document [21] and document [1] for details.

In addition, the firmware of SIM5360A has integrated the configuration on WM8960GEFL/RV codec provided by WOLFSON MICROELECTRONICS with I2C interface.
The reference circuit of the reference design of PCM interfaces with external codec IC in the following figure. It is recommended to use a 26MHz CXO component such as TXC CORPORATION (www.txccorp.com) 8W26000011.

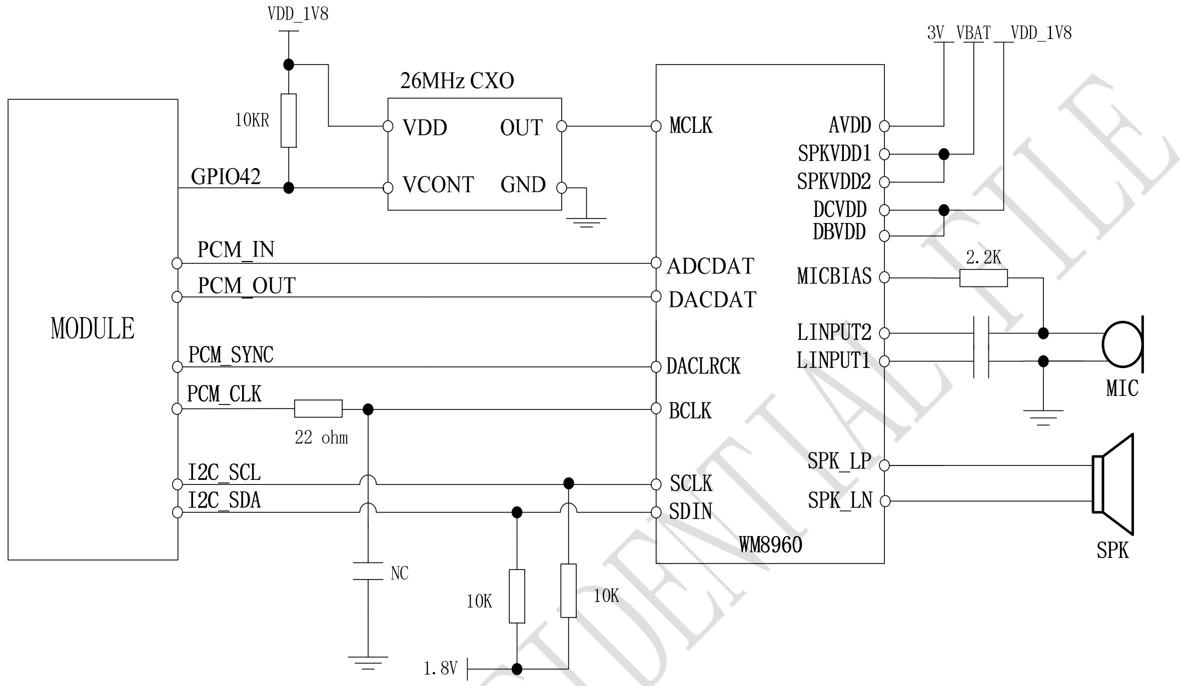

Figure 34: Reference Circuit of PCM Application with Audio Codec

3.12 GNSS (GPS and GLONASS)

SIM5360A 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.

3.12.1 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

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GNSS data format NMEA-0183
GNSS Current consumption (WCDMA/GSM Sleep mode) **100mA** (Total supply current)
GNSS antenna Passive/Active antenna

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

3.12.2 Operate Mode

SIM5360A supports both A-GPS and S-GPS, and then provides three operating modes: mobile-assisted mode, mobile-based mode and standalone mode. A-GPS includes mobile-assisted and mobile-based mode.

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

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

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

This combination of GNSS measurements and available network information provides:

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

Therefore, while network solutions typically perform poorly in rural areas and areas of poor cell geometry/density, and while unassisted, GNSS-only solutions typically perform poorly indoors. The SIM5360A GNSS solution provides optimal time to fix, accuracy, sensitivity, availability, and reduced network utilization in both of these environments, depending on the given condition.

3.12.3 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.

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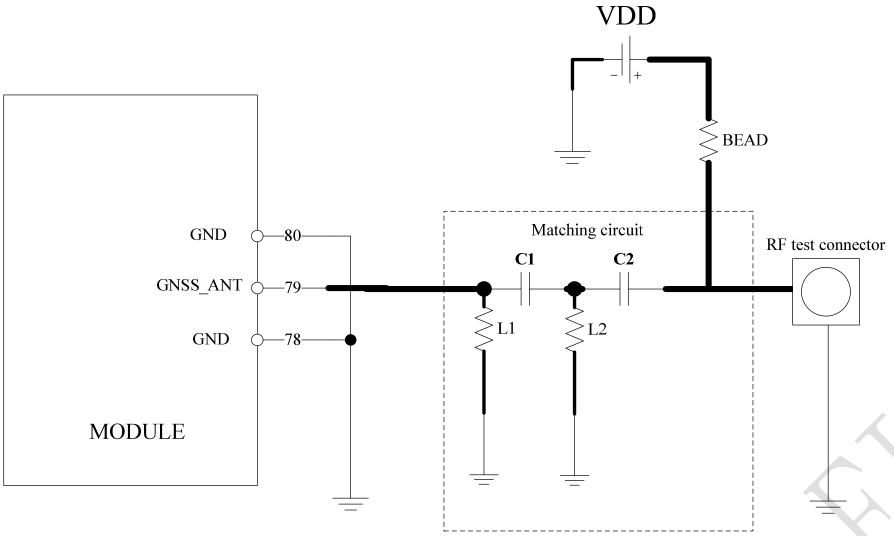

Figure 35: Active antenna circuit

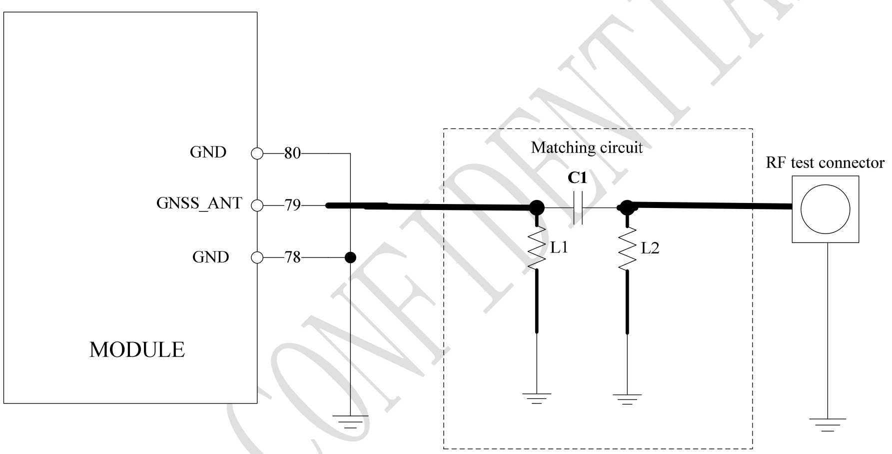

Figure 36: Passive antenna circuit (Default)

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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 36 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 SIM5360A in proper operating mode by AT command. Please refer to related document for details. SIM5360A 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. Refer to AGPS application document for details.

3.13 Multi-functional interface

SIM5360A merges functions for various applications. It can enrich users' design and lower the cost of users' hardware.

3.13.1 Sink Current Source

The dedicated pin (ISINK) is intended for driving passive devices, such as LCD backlight, this implementation is VBAT tolerant and suitable for driving white LEDs. The high-current driver can maintain a constant current which is set by *the AT command "AT+ CLEDITST"*, capable of up to 40 mA.

Table 28: Electronic characteristic

Symbol	Description	Min	Typ	Max	Unit
ISINK	Input voltage	0.5	VDD	VBAT	V
I_O	Input current	5	-	40	mA

Since the driver is ground-referenced current sink, the operating device it drives must form a current path between the VDD pin and the ISINK pin. The following figure is for users reference.

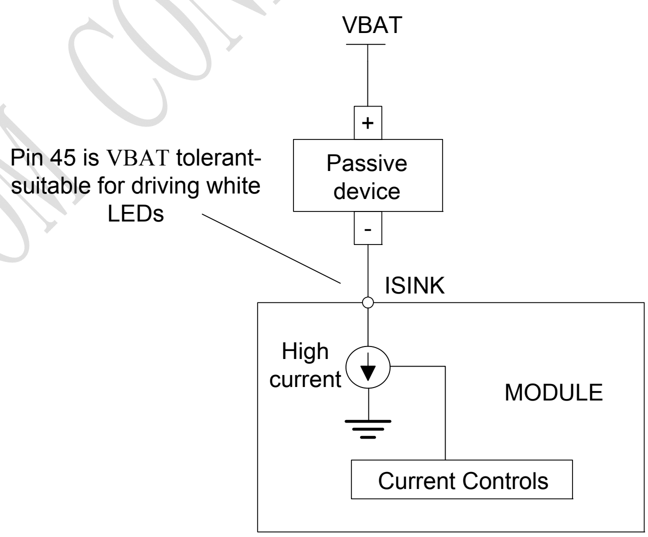

Figure 37: Current drive

Note: The sinking current can be adjusted to meet design requirement through the AT command "AT+ CLEDITST =<0>, <value>".The "value" ranges from 0 to 15,on behalf of the current changes from 0mA to 150mA in steps of 10mA.

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3.13.2 Reset Function

SIM5360A also have a RESET pin (PIN4) to reset the module. This function is used as an emergency reset only when AT command "AT+CPOF" and the POWERKEY pin has no effect. User can pull the RESET pin to ground, then the module will reset.

This pin is already pulled up in module, so the external pull-up resistor is not necessary. A 100nF capacitor close to the RESET pin is strongly recommended. A reference circuit is recommended in the following figure.

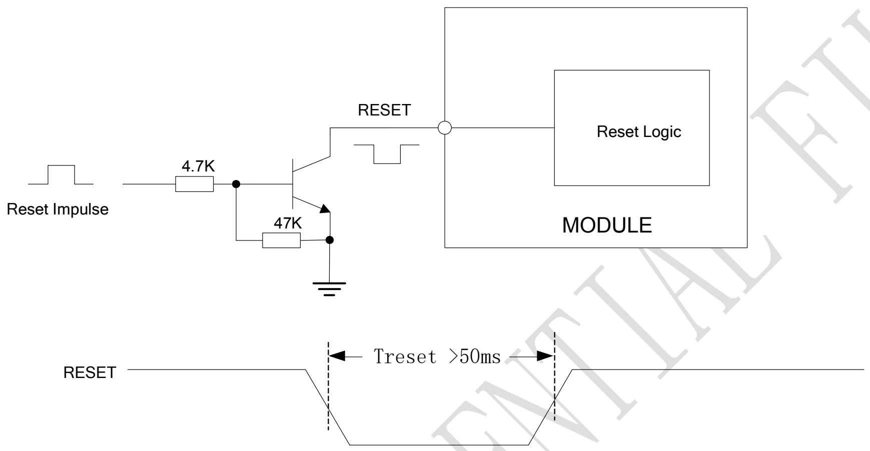

Figure 38: Reset circuit

Note：50ms<Treset<200ms. ESD components are suggested to be used on Reset pin.

3.13.3 ADC

SIM5360A has a dedicated ADC that is available for digitizing analog signals such as battery voltage and so on; it is on PIN 47 and PIN 46 , namely ADC1 and ADC2 . This ADC is 15 bit successive-approximation circuit, and electronic specification is shown in the following table.

Table 29: Electronic Characteristics

Specification	Min	Typ	Max	Unit	Comments/Conditions
Resolution		15		Bits	
Analog input bandwidth	–	100	–	kHz	Analog Vdd = ADC reference 2.4MHz sample rate
Gain Error	-2.5		+2.5	%	
Offset Error	-3.5		+3.5	LSB	
Input Range	GND		2.2V	V	
Input serial resistance		2		kΩ	Sample and hold switch resistance
Power supply current Normal operation		1.5		mA	
Power supply current Off		50	200	nA	

User can introduce a signal in the ADC pin directly and use the AT command "AT+CADC" to get the raw

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data which is between 0 and 32768. The data can be transformed to any type such as voltage, temperature etc. Please refer to *document [1]*.

Note: The input signal voltage value in ADC must not be higher than 2.2V.

3.13.4 LDO

SIM5360A has a LDO power output, namely VDD_EXT. The LDO is available and output voltage is 2.85v by default, rated for 300mA. User 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 30: Electronic characteristic

Symbol	Description	Min	Typ	Max	Unit
VDD_EXT	Output voltage	1.5	2.85	3.05	V
I_O	Output current	-	-	300	mA

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4 RF Specification

4.1 RF Specification

Table 31: Conducted transmission power

Frequency	Max	Min
GSM850	33dBm ±2dB	5dBm ± 5dB
PCS1900	30dBm ±2dB	0dBm ± 5dB
GSM850 (8-PSK)	27dBm ±3dB	5dBm ± 5dB
PCS1900(8-PSK)	26dBm +3/-4dB	0dBm ±5dB
WCDMA 1900	24dBm +1/-3dB	-56dBm ±5dB
WCDMA 850	24dBm +1/-3dB	-56dBm ±5dB

Table 32: Operating frequencies

Frequency	Receiving	Transmission
GSM850	869 ～894 MHz	824 ～849 MHz
PCS1900	1930～1990 MHz	1850～1910 MHz
WCDMA1900	1930～1990 MHz	1850～1910 MHz
WCDMA 850	869 ～894 MHz	824 ～849 MHz

Table 33: Conducted receive sensitivity

Frequency	Receive sensitivity
GSM850	< -109dBm
PCS1900	< -109dBm
WCDMA 1900	< -110dBm
WCDMA 850	< -110dBm

4.2 Operating Specification

SIM5360A can support high rate data by GSM/WCDMA wireless network. In the different network environment, data transmission rate shifts depending on modulation and encoding.

Table 34: GPRS/EDGE data throughout

Function	Coding schemes	1 Timeslot	2 Timeslot	4 Timeslot
GPRS	CS-1	9.05kbps	18.1kbps	36.2kbps
	CS-2	13.4kbps	26.8kbps	53.6kbps

	CS-3	15.6kbps	31.2kbps	62.4kbps
	CS-4	21.4kbps	42.8kbps	85.6kbps
EDGE	MCS-1	8.80kbps	17.6kbps	35.20kbps
	MCS-2	11.2kbps	22.4kbps	44.8kbps
	MCS-3	14.8kbps	29.6kbps	59.2kbps
	MCS-4	17.6kbps	35.2kbps	70.4kbps
	MCS-5	22.4kbps	44.8kbps	89.6kbps
	MCS-6	29.6kbps	59.2kbps	118.4kbps
	MCS-7	44.8kbps	89.6kbps	179.2kbps
	MCS-8	54.4kbps	108.8kbps	217.6kbps
	MCS-9	59.2kbps	118.4kbps	236.8kbps

Table 35: HSDPA throughout

Category	Supported	Max supported HS-DSCH codes	Theoretical max peak rate(Mbps)	Modulation
Category1		5	1.2	16QAM,QPSK
Category2		5	1.2	16QAM,QPSK
Category3		5	1.8	16QAM,QPSK
Category4		5	1.8	16QAM,QPSK
Category5	✓	5	3.6	16QAM,QPSK
Category6	✓	5	3.6	16QAM,QPSK
Category7	✓	10	7.2	16QAM,QPSK
Category8	✓	10	7.2	16QAM,QPSK
Category9		15	10.0	16QAM,QPSK
Category10	✓	15	14.0	16QAM,QPSK
Category11		5	0.9	QPSK
Category12	✓	5	1.8	QPSK

Note: Actual throughout rates depend on network configuration, network loading, signal condition and so on.

4.3 Antenna Design Guide

There are three antenna ports for SIM5360A, Main antenna port named MAIN_ANT, Diversity antenna port named DIV_ANT and GPS/GLONASS antenna port named GNSS_ANT, The RF interface of the three antenna ports has an impedance of 50Ω.The maximum gain of the Main antenna gain should not exceed 1dBi considering the SAR radio. No antenna gain may be used that would exceed the 2W EIRP power limit in 1900MHz band.The input impendence of the antenna should be 50Ω, and the VSWR should be less than 2.

SIMCom recommends that the total insertion loss between the antenna pad and antenna should meet the following requirements:

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- GSM850<0.5dB
- PCS1900 <0.9dB
- WCDMA 1900<0.9dB
- WCDMA 850<0.5dB

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.

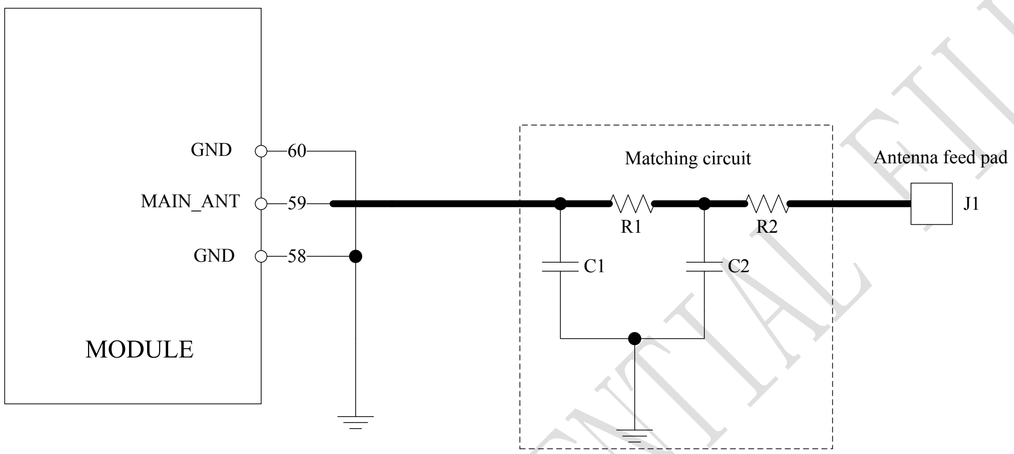

Figure 39: Antenna matching circuit (MAIN_ANT)

In this figure, the components R1,C1,C2 and R2 is 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 0 ohm 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 50ohm.

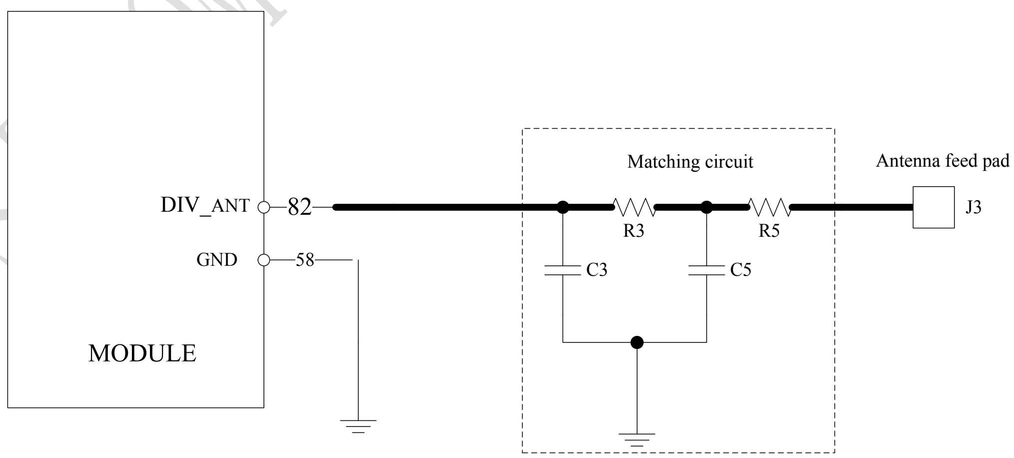

Figure 40: Antenna matching circuit (DIV_ANT)

In above figure, the components R3,C3,C5 and R5 is used for diversity antenna matching. The method of antenna tuning is same as MAIN_ANT.

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