GOSUNCN

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MG2608-G

Hardware Development Guide

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GSM Module

Website: www.gosuncwelink.com

E-mail: welink@gosuncn.com

Revision Records

REV. NO.	Revision Records	Date
V1.0	Preliminary Issue	2018-05-25
V1.1	The physical diagram is added and the serial port description is modified	2018-06-04
V1.2	Update the pin number and function	2018-06-27

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Introduction

This document defines the MG2608-G module and its hardware interface specification, electrical characteristics and mechanical details. With the help of this document and in combination of our application manual and user guide, the user can quickly apply the MG2608-G module to wireless applications.

Relevant Documents

Serial number	Document name	Note
1	GOSUNCN MG2608-G Module AT Command Manual	Opened
2	MG2608-G Reference Design	Opened

1 Introduction

The MG2608-G module is a four-frequency band GSM/GPRS module. Its working frequency bands are GSM 850 MHz, GSM 900 MHz, DCS 1800 MHz and PCS 1900 MHz. MG2608-G supports GPRS multi-slot level 10 and GPRS encoding formats CS-1, CS-2, CS-3 and CS-4.

MG2608-G has an ultra-small size of 18.0 mm x16.0 mm x2.3 mm, which almost can meet the requirements of all M2M, including automotive and personal tracking services, wireless POS machines, intelligent metering, industrial-grade PDA and other M2M applications.

32MbNorFlash + 32MbSRAM are built into MG2608-G, they support the open-source platform of open CPU held by GOSUNCN . They are convenient for user to do secondary development, and they will greatly reduce the development cycle and cost of user.

MG2608-G has abundant peripheral interfaces, which support UART, SPI, SDIO, I2C and other interfaces that can support up to 20 GPIOs, and supports ADC, audio input and output functions to meet the requirements of various application scenarios.

MG2608-G is a chip-type module, which is encapsulated by LCC. It can be embedded in customer's application through its pin soldering pad. It provides rich hardware interface between module and customer's motherboard.

The MG2608-G module adopts power-saving technology. The current power consumption is 1.34 mA in sleep mode DRX=5.

MG2608-G is embedded with TCP UDP PPP HTTPS SSL and other protocols, the embedded extended AT command can make users use these Internet protocols more easily.

The MG2608-G module fully conforms to RoHS standard.

Table 1-1 Main features of Module

Features	Notes
Frequency range	♦ Frequency: GSM850, GSM900, DCS1800, PCS1900 ♦ Automatic frequency band search ♦ Band selection can be set by AT command ♦ Compliance with GSM Phase 2/2 +
Transmitting power	♦ Class 4 (2W): GSM850 and GSM900 ♦ Class 1 (1W): DCS1800 and PCS1900
Power supply	♦ VBAT 3.4 V ~ 4.2 V, typical value 3.8 V
Power saving mode current consumption	♦ 1.60 mA @ DRX=2 ♦ 1.34 mA @ DRX=5 ♦ 1.23 mA @ DRX=9
GPRS connection characteristics	♦ GPRS multi-slot level 12 (default) ♦ GPRS mobile station level B

GPRS data characteristics	♦ GPRS Data Downlink Transmission: Maximum 85.6 kbps ♦ GPRS Data Uplink: Maximum 85.6 kbps ♦ Coding formats: CS-1, CS-2, CS-3 and CS-4 ♦ Supporting PAP (Cryptographic Authentication Protocol) Protocols Usually Used for PPP Connections ♦ Embedded protocols: TCP/UDP/FTP/PPP et al
Temperature Ranges	♦ Normal operating temperature:-40 ℃ ~ + 85 ℃ ♦ Storage temperature:-45 c ~ + 90 c
Short message (SMS)	Text and PDU mode
SIM card holder	Support SIM/USIM Card: 1.8 V, 3V
Antenna interface	50
Audio interface	Supports call, recording, and playback functions that drive 8 ohm horns directly
Serial port	♦ Full-function serial port ■ For AT commands and GPRS data ■ Adaptive baud rate: from 2400 bps to 921 600 bps ♦ Commissioning serial port ■ For software upgrading ■ For software debugging
SPI	Support
SDIO	Support
I2C	Support
Size	18.0 + 0.15 x16.0 + 0.15 x2.3 + 0.2 mm Weight: 3g

1.1. Functional Diagram

The following diagram illustrates the main functions of MG2608-G:

- Storage
- GSM radio frequency
- Power Management
- Interface part

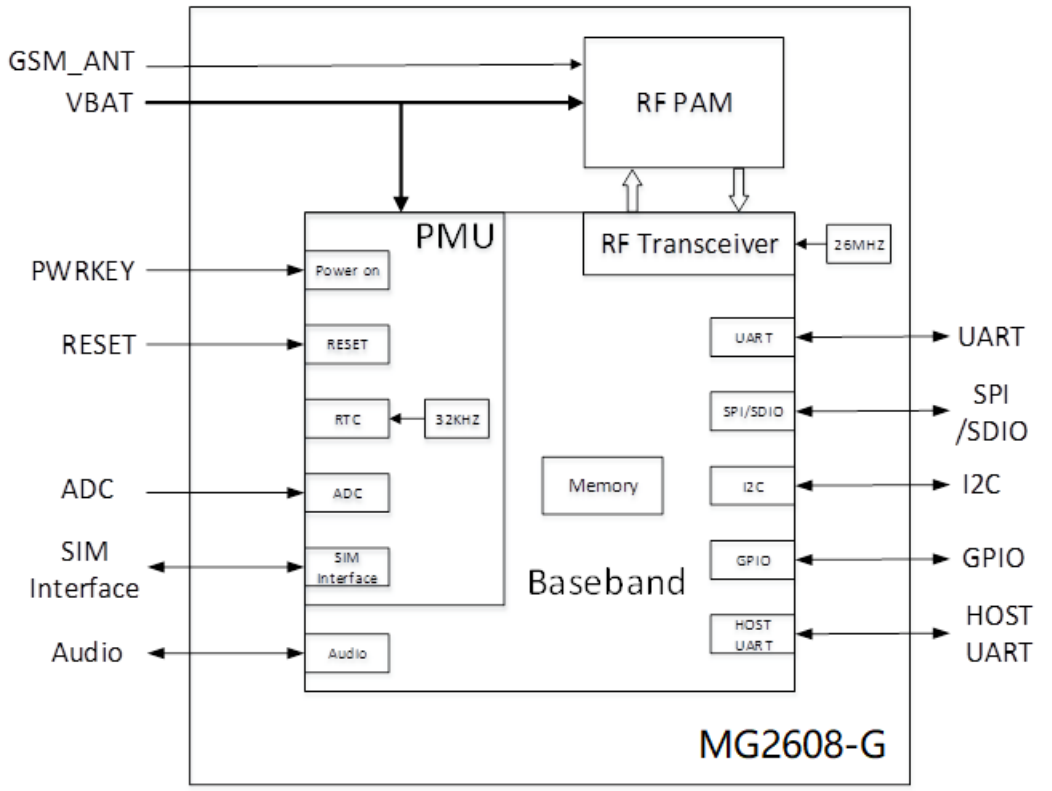

Chart1-1 Function block diagram

1.2. Evaluation board

In order to facilitate testing and use of MG2608-G, GOSUNCN provides a set of assessment boards. The assessment boards includes MG2608-G module, EVB_MG2608-G, UART to USB line and so on.

2 Application Interface

The module is LCC encapsulated, with 52 SMT coil pins. The functions of the following interfaces are described in detail in subsequent chapters:

- Power feed
- Turn on/off
- Power saving technology
- Serial port
- Audio interface
- SIM card holder

2.1 Pin description

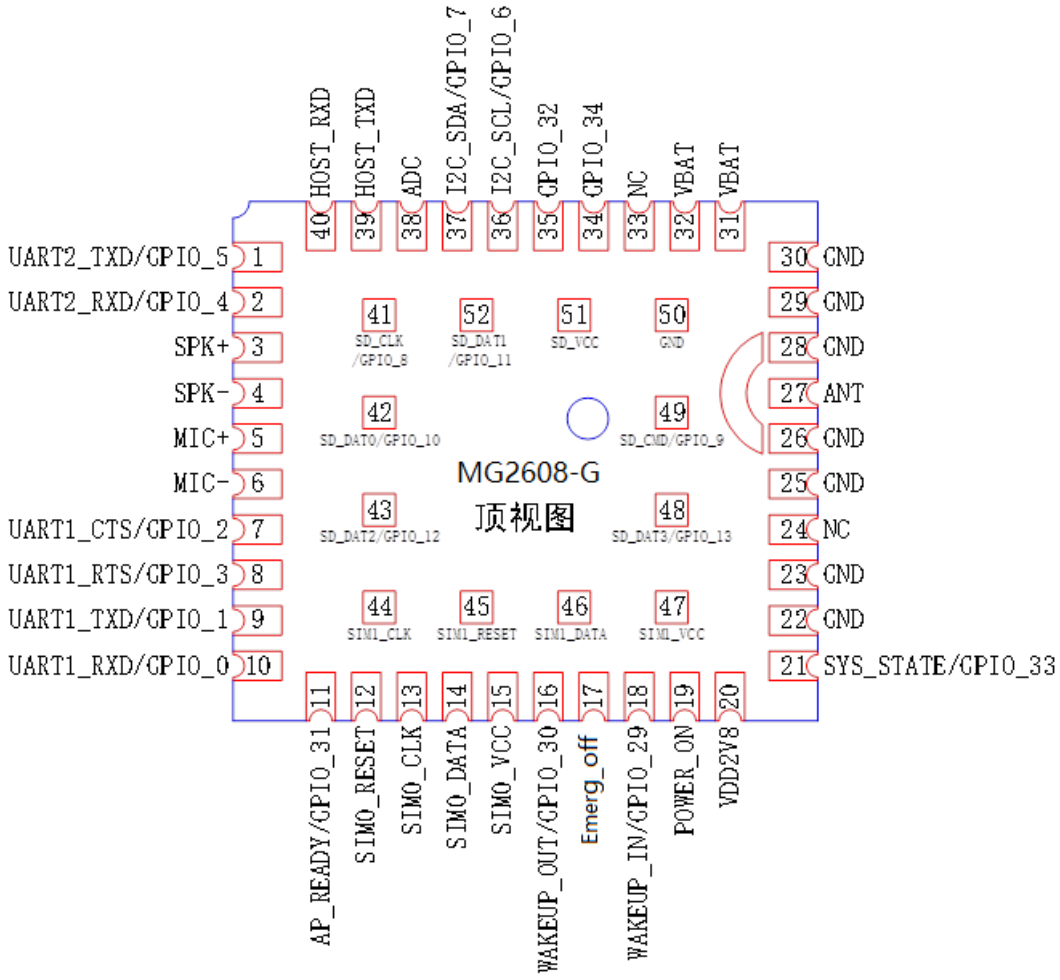

Chart 2-1Pin arrangement (front view)

Table 2-1Pin description

Power source					
Pin name	Pin No.	I/O	Pin description	Electrical characteristics	Remarks
VBAT	31 32	i	Module Main Power Supply VBAT=3. 4V ~ 4. 2V	Vmax = 4.2 V Vmin = 3.4 V Vnorm = 3.8 V	Maximum load current of module in burst mode is 1.6 A
VDD2V8	20	O	Output 2.8 V, 10 mA	Vmax = 2.95 V	1. Hovering if not used 2. If this pin is used for external power supply, it is recommended to parallel a 2 ~ 4.7 uF decoupling capacitor, and the load current should not exceed 10
SD_VCC	51	O	This pin is used for power supply to external SD card, and can be used as general LDO too. The output 2.8/3.0/3.2 V is adjustable, 150 mA	Vmax = 3.2 V	1. Hovering if not used 2. If this pin is used for external power supply, a 2 ~ 4.7 uF decoupling capacitor is recommended for parallel connection
GND	22 23 25 26 28 29 30 50		Modular		
Power key					
Pin name	Pin No.	I/O	Pin description	Electrical characteristics	Remarks
POWER_ON	19	i	Pull up inside, lower the pin for more than 1 second to start the module; Pull the pin down for more than 1.5 seconds to shut down the module	VIL max = 0.4 V	
Re-setting					
Pin name	Pin No.	I/O	Pin description	Electrical characteristics	Remarks
EMERG_OFF	17	i	Hardware shutdown pin, low level is effective. Lower the pin by for over 200ms, then the module is shut down	VIL max = 0.4 V	No external pull-up required
Audio interface					

Pin name	Pin No.	i /o	Pin description	Electrical characteristics	Remarks
MICP MICN	5 6	i	Differential audio input		Support for call, recording and playback functions
SPK1P SPK1N	3 4	O	Differential audio output, 8 ohm horn can be driven directly		
Module state indication					
Pin name	Pin No.	I/O	Pin description	Electrical characteristics	Remarks
SYS_STATE (GPIO_33)	21	O	Network status indication	VOHmin=0. 85 x VDDIO VOLmax=0. 15 x VDDIO	Not to be suspended
AP_READY (GPIO_31)	11	i	AP side ready	VILmin=-0. 3V VIL max=0. 25 x VDDIO VIHmin=0. 75 x VDDIO VIHmax=VDDIO+0. 3	
WAKEUP_OUT (GPIO_33)	16	O	Signal for module to wake up the host computer If an external awakening event is received, the pin outputs a default level pulse signal lower than 1s.	VOHmin=0. 85 x VDDIO VOLmax=0. 15 x VDDIO	Used for module to wake up other devices (if receiving downlink data/SMS/Call, the module send instruction the signal)
WAKEUP_IN (GPIO_33)	18	i	Used for the external device awakening module, while the module sleeps, the external can awaken the module through the pin	VILmin=-0. 3V VIL max=0. 25 x VDDIO VIHmin=0. 75 x VDDIO VIHmax=VDDIO+0. 3	To use, add a pull-up resistance to the external circuit. The edge triggers and the descending edge wakes up the module;
GPIO_34	34	I/O	Universal GPIO	VILmin=-0. 3V VIL max=0. 25 x VDDIO VIHmin=0. 75 x VDDIO VIHmax=VDDIO+0. 3 VOHmin=0. 85 x VDDIO VOLmax=0. 15 x VDDIO	
GPIO_32	35	I/O	Universal GPIO		
Main serial port					
Pin name	Pin No.	I/O	Pin description	Electrical characteristics	Remarks
UART1_TXD (GPIO_1) (SPI2_CS0)	9	O	Module send data	VILmin=-0. 3V VIL max=0. 25 x VDDIO VIHmin=0. 75 x VDDIO VIHmax=VDDIO+0. 3 VOHmin=0. 85 x VDDIO VOLmax=0. 15 x VDDIO	For AT version: Module will not enter the sleep state and power saving by default. If the module is required to go to sleep, AT+CSCLK=1 or 2. If it is
UART1_RXD (GPIO_0) (SPI2_CLK)	10	i	Module receiving data		

UART1_RTS (GPIO3) (SPI2_DO)	8	O	Clear to Send		required to issue AT instructions to the module during sleep, Other unused pins can be suspended;
UART1_CTS (GPIO2) (SPI2_CS1)	7	i	DTE requests that data be sent to the module		
UART2					
Pin name	Pin No.	I/O	Pin description	Electrical characteristics	Remarks
UART2_RXD (GPIO_4) (SPI2_DI) (LPG)	2	I	Hardware UART2	VILmin=-0. 3V VIL max=0. 25 x VDDIO VIHmin=0. 75 x VDDIO VIHmax=VDDIO+0. 3 VOHmin=0. 85 x VDDIO VOLmax=0. 15 x VDDIO	Not to be suspended
UART2_TXD (GPIO_5) (PWM)	1	O			
Commissioning serial port					
Pin name	Pin No.	I/O	Pin description	Electrical characteristics	Remarks
HOST_RXD	40	i	For software debugging and firmware downloads	VILmin=-0. 3V VIL max=0. 25 x VDDIO VIHmin=0. 75 x VDDIO VIHmax=VDDIO+0. 3 VOHmin=0. 85 x VDDIO VOLmax=0. 15 x VDDIO	Not to be suspended
HOST_TXD	39	O			
I2C interface					
Pin name	Pin No.	I/O	Pin description	Electrical characteristics	Remarks
I2C_SCL (GPIO_6)	36	O	I2C Interface, Master mode only	VILmin=-0. 3V VIL max=0. 25 x VDDIO VIHmin=0. 75 x VDDIO VIHmax=VDDIO+0. 3 VOHmin=0. 85 x VDDIO VOLmax=0. 15 x VDDIO	Not to be suspended
I2C_SDA (GPIO_7)	37	I/O			
SIM0 interface					
Pin name	Pin No.	I/O	Pin description	Electrical characteristics	Remarks
SIM0_VDD	15	O	SIM0 card supply voltage	Module Automatic Selection 1.8 V or 3.0 V	The SIM card interface recommends the use of TVS tube for ESD protection, SIM card block to the module longest line diameter

SIM0_RESET	12	O	SIM0 card reset	3V: VOLmax = 0.36 VOHmin=0. 9xSIM0_VDD 1.8 V: VOLmax=0. 2xSIM0_VDD VOHmin=0. 9xSIM0_VDD	should not exceed 20 cm
SIM0_DATA	14	I/O	SIM0 card data line	3V: VOLmax = 0.4 VOHmin=SIM0_VDD-0.4 1.8 V: VOLmax=0. 15 x SIM0_VDD VOHmin=SIM0_VDD-0. 4	
SIM0_CLK	13	O	SIM0 card clock line	3V: VOLmax = 0.4 VOHmin=0. 9xSIM0_VDD 1.8 V: VOLmax=0. 12 x SIM0_VDD VOHmin=0. 9xSIM0_VDD	
SIM1 interface					
Pin name	Pin No.	I/O	Pin description	Electrical characteristics	Remarks
SIM1_VCC	47	O	SIM1 card supply voltage	Module automatically selects 1.8 V or 3.0 V	It is recommeded that TVS tube shall used for ESD protection of SIM card interface , the longest line diameter from SIM card block to the module should not exceed 20 cm
SIM1_RESET	45 (33 ftlb.)	O	SIM1 card reset	3V: VOLmax = 0.36 VOHmin=0. 9xSIM1_VDD 1.8 V: VOLmax=0. 2xSIM1_VDD VOHmin=0. 9xSIM1_VDD	
SIM1_DATA	46	I/O	SIM1 card data line	3V: VOLmax = 0.4 VOHmin=SIM1_VDD-0.4 1.8 V: VOLmax=0. 15 x SIM1_VDD VOHmin=SIM1_VDD-0. 4	
SIM1_CLK	44	O	SIM1 card clock line	3V: VOLmax = 0.4 VOHmin=0. 9xSIM1_VDD 1.8 V: VOLmax=0. 12 x SIM1_VDD VOHmin=0. 9xSIM1_VDD	
SD cardinterface					

Pin name	Pin No.	I/O	Pin description	Electrical characteristics	Remarks
SD_CLK (GPIO_8) (SPI_CLK)	41	O	SD card clock signal SPI interface clock signal	VILmin=-0. 3V VIL max=0. 25 x SD_VCC VIHmin=0. 75 x SD_VCC VIHmax = SD_VCC + 0.3 VOHmin=0. 85 x SD_VCC VOLmax=0. 15 x SD_VCC	SD Card Interface Recommended to Use TVS Tube for ESD Protection
SD_DAT0 (GPIO_10) SPI_CS	42	I/O	SD card data signal line 0 SPI interface chip selection signal		
SD_DAT1 (GPIO_11) SPI_DO	52	I/O	SD card data signal line 1 SPI interface data output		
SD_DAT2 (GPIO_12) SPI_DI	43	I/O	SD card data signal line 2 SPI interface data input		
SD_DAT3 (GPIO_13)	48	I/O	SD card data signal line 3		
SD_CMD (GPIO_9)	49	O	SD card command line		
ADC					
Pin name	Pin No.	I/O	Pin description	Electrical characteristics	Remarks
ADC	38	I	Analogy- digital converter	Input range 0 ~ 1.85 V 10 bit Error range +—20mv	Not to be suspended
RF interface					
Pin name	Pin No.	I/O	Pin description	Electrical characteristics	Remarks
ANT	27	I/O	GPRS RF signal input and output	50 ohmic impedance	

Table 2-2 **GPIO Configuration**

MG2608-G PINNO.	GPIOs number	Name	Power Domain	Pull-Up	Pull-Up/Down Resistor	At Reset			After Reset			Function0				Function1				Function2				Function3			
						H/L/Hiz	pull	PinState	H/L/Hiz	pull	PinState	Function0	TYPE	pull	Address	Function1	TYPE	pull	Address	Function2	TYPE	pull	Address	Function3	TYPE	pull	Address
10	GPIO0	GPIO_0/UART1_RXD		2.8 V,	166K	H	UP	Input	H	UP	Input	GPIO_0	I/O	UP	0x01A2A090 (0x0)	UART1_RXD	i	UP	0x01A2A090 (0x1)	SPI2_CLK	I/O	UP	0x01A2A090 (0x2)				
9	GPIO1	GPIO_1/UART_TXD		2.8 V,	166K	l.	DN	Input	l.	DN	Input	GPIO_1	I/O	DN	0x01A2A094 (0x0)	UART1_TXD	O	OFF	0x01A2A094 (0x1)	SPI2_CS_0	I/O	UP	0x01A2A094 (0x2)				
7	GPIO 2	GPIO_2/UART_RTS		2.8 V,	166K	l.	DN	Input	l.	DN	Input	GPIO2	I/O	DN	0x01A2A098 (0x0)	UART1_RTS	i	UP	0x01A2A098 (0x1)	SPI2_CS_1	I/O	UP	0x01A2A098 (0x2)	PWL_1	O	OFF	0x01A2A098 (0x3)
8	GPIO3	GPIO_3/UART_CTS	VDDIO	2.8 V,	166K	L	DN	Input	L	DN	Input	GPIO3	I/O	DN	0x01A2A09C (0x0)	UART1_CTS	O	OFF	0x01A2A09C (0x1)	SPI2_DI_0	I/O	DN	0x01A2A09C (0x2)	LPSCO_1	O	OFF	0x01A2A09C (0x3)
2	GPIO_4	GPIO_4/UART_2_RXD	2.8 V	2.8 V,	166K	H	UP	Input	H	UP	Input	GPIO_4	I/O	UP	0x01A2A0A0 (0x0)	UART2_RXD	i	UP	0x01A2A0A0 (0x1)	SPI2_DI_1	i	UP	0x01A2A0A0 (0x2)	LPG	O	UP	0x01A2A0A0 (0x3)
1	GPIO_5	GPIO_5/UART_2_TXD		2.8 V,	166K	l.	DN	Input	l.	DN	Input	GPIO_5	I/O	DN	0x01A2A0A4 (0x0)	UART2_TXD	O	OFF	0x01A2A0A4 (0x1)	LCD_TE	i	DN	0x01A2A0A4 (0x2)	PWT	O	OFF	0x01A2A0A4 (0x3)
36	GPIO_6	GPIO_6/UART_2_RTS/I_2C_SCL		2.8 V,	33K	l.	DN	Input	l.	DN	Input	GPIO_6	I/O	DN	0x01A2A0A8 (0x0)	UART2_RTS	i	UP	0x01A2A0A8 (0x1)	I2C3_SCL	I/O	UP	0x01A2A0A8 (0x2)	TCO3	O	OFF	0x01A2A0A8 (0x3)
37	GPIO_7	GPIO_7/UART_2_CTS/I_2C_3_SDA		2.8 V,	33K	l.	DN	Input	l.	DN	Input	GPIO_7	I/O	DN	0x01A2A0AC (0x0)	UART2_CTS	O	OFF	0x01A2A0AC (0x1)	I2C3_SDA	I/O	UP	0x01A2A0AC (0x2)	TCO_4	O	OFF	0x01A2A0AC (0x3)
41	GPIO_8	SSD_CLK/SPI1_CLK		1.9 V,	166K	l.	OFF	OUTPUT	26 MHz	OFF	OUTPUT	SDMMC_CLK	O	OFF	0x01A2A04C (0x0)	GPIO_8	I/O	DN	0x01A2A04C (0x1)	SPI1_CLK	I/O	DN	0x01A2A04C (0x2)	I2C1_SCL	I/O	UP	0x01A2A04C (0x3)
49	GPIO_9	SSD_CMD/SPI_CS0		1.9 V,	50k	H	UP	Input	H	UP	Input	SDMMC_CMD	I/O	UP	0x01A2A050 (0x0)	GPIO_9	I/O	DN	0x01A2A050 (0x1)	SPI1_CS_0	I/O	UP	0x01A2A050 (0x2)	I2C1_SDA	I/O	UP	0x01A2A050 (0x3)
42	GPIO_10	SSD_DATA0/SPI1_CS1	VMMC	1.9 V,	50k	H	UP	Input	H	UP	Input	SDMMC_DATA_0	I/O	UP	0x01A2A054 (0x0)	GPIO_10	I/O	DN	0x01A2A054 (0x1)	SPI1_CS_1	I/O	UP	0x01A2A054 (0x2)				
52	GPIO_11	SSD_DATA1/SPI1_DI_O	1.8/1.9/2.0/2.6/2.8/3.0/3.3 V	1.9 V,	50k	H	UP	Input	H	UP	Input	SDMMC_DATA_1	I/O	UP	0x01A2A058 (0x0)	GPIO_11	I/O	DN	0x01A2A058 (0x1)	SPI1_DI_0	I/O	DN	0x01A2A058 (0x2)				
43	GPIO_12	SSD_DATA2/SPI1_DI_1		1.9 V,	50k	H	UP	Input	H	UP	Input	SDMMC_DATA_2	I/O	UP	0x01A2A05C (0x0)	GPIO_12	I/O	DN	0x01A2A05C (0x1)	SPI1_DI_1	i	DN	0x01A2A05C (0x2)				
48	GPIO_13	SSD_DATA3		1.9 V,	50k	H	UP	Input	H	UP	Input	SDMMC_DATA_3	I/O	UP	0x01A2A060 (0x0)	GPIO_13	I/O	DN	0x01A2A060 (0x1)								
\	GPIO_14	GPIO_14/I_2S_BCK		1.9 V,	166K	H	OFF	OUTPUT	H	OFF	OUTPUT	LCD_RSTB	O	OFF	0x01A2A064 (0x0)	GPIO_14	I/O	DN	0x01A2A064 (0x1)	DAI_RST	i	DN	0x01A2A064 (0x2)	I2S_BCK	I/O	DN	0x01A2A064 (0x3)
\	GPIO_15	GPIO_15/I_2S_LRCK	VLCD	1.9 V,	166K	H	OFF	OUTPUT	H	OFF	OUTPUT	SPI_LCD_CS	O	OFF	0x01A2A068 (0x0)	GPIO_15	I/O	DN	0x01A2A068 (0x1)	DAI_CLK	O	OFF	0x01A2A068 (0x2)	I2S_LRCK	I/O	DN	0x01A2A068 (0x3)
\	GPIO_16	GPIO_16/I_2S_DI	1.8/2.8 V	1.9 V,	166K	H	OFF	OUTPUT	H	OFF	OUTPUT	SPI_LCD_SCK	O	OFF	0x01A2A06C (0x0)	GPIO_16	I/O	DN	0x01A2A06C (0x1)	DAI_DI	i	DN	0x01A2A06C (0x2)	I2S_DI	i	DN	0x01A2A06C (0x3)
\	GPIO_17	GPIO_17/I_2S_DO		1.9 V,	166K	l.	DN	OUTPUT	l.	DN	OUTPUT	SPI_LCD_DIO	I/O	DN	0x01A2A070 (0x0)	GPIO_17	I/O	DN	0x01A2A070 (0x1)	DAI_DO	O	OFF	0x01A2A070 (0x2)	I2S_DO	O	OFF	0x01A2A070 (0x3)
	GPIO_18	GPIO_18		1.9 V,	166K	H	OFF	OUTPUT	H	OFF	OUTPUT	SPI_LCD_SDC	O	OFF	0x01A2A074 (0x0)	GPIO_18	I/O	DN	0x01A2A074 (0x1)								
\	GPIO_19	GPIO_19/I_2C_2_SCL		1.9 V,	33K	H	OFF	OUTPUT	H	OFF	OUTPUT	CAM_PWDN	O	OFF	0x01A2A078 (0x0)	GPIO_19	I/O	DN	0x01A2A078 (0x1)	I2C2_SCL	I/O	UP	0x01A2A078 (0x2)				
\	GPIO_20	GPIO_20/I_2C_2_SDA		1.9 V,	33K	l.	OFF	OUTPUT	l.	OFF	OUTPUT	CAM_RSTB	O	OFF	0x01A2A07C (0x0)	GPIO_20	I/O	DN	0x01A2A07C (0x1)	I2C2_SDA	I/O	UP	0x01A2A07C (0x2)				
\	GPIO_21	GPIO_21	VCAM	1.9 V,	166K	l.	OFF	OUTPUT	l.	OFF	OUTPUT	CAM_CLK	O	OFF	0x01A2A080 (0x0)	GPIO_21	I/O	DN	0x01A2A080 (0x1)								
\	GPIO_22	GPIO_22	1.8/2.8 V	1.9 V,	166K	H	DN	OUTPUT	H	DN	OUTPUT	SPI_CAM_SCK	I/O	DN	0x01A2A084 (0x0)	GPIO_22	I/O	DN	0x01A2A084 (0x1)								
\	GPIO_23	GPIO_23		1.9 V,	166K	l.	DN	Input	L	DN	Input	SPI_CAM_DI_0	I	DN	0x01A2A088 (0x0)	GPIO_23	I/O	DN	0x01A2A088 (0x1)	SPI_CAM_DI_1	I	DN	0x01A2A088 (0x2)				
\	GPIO_24	GPIO_24		1.9 V,	166K	L	DN	Input	L	DN	Input	SPI_CAM_DI_1	I	DN	0x01A2A08C (0x0)	GPIO_24	I/O	DN	0x01A2A08C (0x1)	SPI_CAM_DI_0	i	DN	0x01A2A08C (0x2)	SPI_CAM_SSN	I/O	DN	0x01A2A08C (0x3)
\	GPIO_25	GPIO_25		2.8 V,	166K	L	DN	Input	L	DN	Input	KEYIN_0	I	DN	0x01A2A0B0 (0x0)	GPIO_25	I/O	DN	0x01A2A0B0 (0x1)								
\	GPIO_26	GPIO_26		2.8 V,	166K	l.	DN	Input	L	DN	Input	KEYIN_1	I	DN	0x01A2A0B4 (0x0)	GPIO_26	I/O	DN	0x01A2A0B4 (0x1)								
\	GPIO_27	GPIO_27		2.8 V,	166K	l.	DN	Input	l.	DN	Input	KEYIN_2	I	DN	0x01A2A0B8 (0x0)	GPIO_27	I/O	DN	0x01A2A0B8 (0x1)								
\	GPIO_28	GPIO_28		2.8 V,	166K	l.	DN	Input	l.	DN	Input	KEYIN3	i	DN	0x01A2A0BC (0x0)	GPIO_28	I/O	DN	0x01A2A0BC (0x1)								
18	GPIO_29	GPIO_29	VDDIO	2.8 V,	166K	l.	DN	Input	l.	DN	Input	KEYIN_4	i	DN	0x01A2A0C0 (0x0)	GPIO_29	I/O	DN	0x01A2A0C0 (0x1)								
16	GPIO_30	GPIO_30	2.8 V	2.8 V,	166K	l.	DN	Input	l.	DN	Input	KEYOUT_0	I/O	DN	0x01A2A0C4 (0x0)	GPIO_30	I/O	DN	0x01A2A0C4 (0x1)								
11	GPIO_31	GPIO_31		2.8 V,	166K	l.	DN	Input	l.	DN	Input	KEYOUT_1	I/O	DN	0x01A2A0C8 (0x0)	GPIO_31	I/O	DN	0x01A2A0C8 (0x1)								
35	GPIO_32	GPIO_32		2.8 V,	166K	l.	DN	Input	l.	DN	Input	KEYOUT_2	I/O	DN	0x01A2A0CC (0x0)	GPIO_32	I/O	DN	0x01A2A0CC (0x1)								
21	GPIO_33	GPIO_33/32 K_OUT		2.8 V,	166K	l.	DN	Input	l.	DN	Input	KEYOUT3	I/O	DN	0x01A2A0D0 (0x0)	GPIO_33	I/O	DN	0x01A2A0D0 (0x1)					DBG_CLK (32K clockout)	O	OFF	0x01A2A0D0 (0x5)
34	GPIO_34	GPIO_34		2.8 V,	166K	l.	DN	Input	l.	DN	Input	KEYOUT_4	I/O	DN	0x01A2A0D4 (0x0)	GPIO_34	I/O	DN	0x01A2A0D4 (0x1)					HST_CLK	I	DN	0x01A2A0D4 (0x5)
40	GPIO_35	HST_RXD/GPIO_35	VDDIO	2.8 V,	166K	H	UP	Input	H	UP	Input	HST_RXD	I	UP	0x01A2A0D8 (0x0)	GPIO_35	I/O	DN	0x01A2A0D8 (0x1)								
39	GPIO_36	HST_TXD/GPIO_36	2.8 V	2.8 V	166K	H	UP	OUTPUT	H	UP	OUTPUT	HST_TXD	I/O	UP	0x01A2A0DC (0x0)	GPIO_36	I/O	DN	0x01A2A0DC (0x1)								

2.2 Operating Mode

The following table briefly describes the various working patterns mentioned in the following chapters.

Table 2-3 Operating mode

Mode	Function	
OF NORMAL WORKING	GSM/GPRS SLEEP	If the WAKEUP_IN pin is high and is not interrupted (e.g. GPIO interruption or serial data awakening interruption), the module automatically enters sleep mode. In sleep mode, the module is still able to receive data packets, short messages, and calls.
	GSM IDLE	The software works normally. Module is registered on the GSM network, there is no data, voice and SMS interaction.
	GSM TALK	The GSM connection is working properly. There are data or voice or text messages interacting. In this mode, module power consumption depends on the strength of the environmental signal, dynamic DTX control and RF frequency.
	GPRS IDLE	The module is not registered to the GPRS network. The module cannot be accessed through the GPRS channel.
	GPRS STANDBY	The module is registers on the GPRS network but does not activate the PDP context (the module has not obtained an IP address).
	GPRS READY	The PDP context is successfully activated (the module has obtained an IP address), but the data has been transfered, in this state, the module can send or receive data.
	GPRS DATA	Transfering of GPRS data In this mode, the power consumption of the module depends on the level of power control, the operating RF frequency band, and the GPRS multi-slot configuration.
Power Off mode	By sending the "AT + CPOWD=1" command, use the PWRKEY pin or the "emerg_off" 1 pin to achieve normal shutdown. The power management chip turns off the baseband part of the power supply, and only the RTC power supply is reserved. The software does not run and the serial port cannot be accessed. Maintain VBAT power supply.	
Minimum Function Mode (Maintain Supply Voltage)	Use the "AT + CFUN" command to set the module to the least functional mode without power down. In this mode, the radio frequency does not work, or the SIM card does not work, or both do not work, but the serial port can still be accessed. The power consumption in this mode is very low.	

2.3 Power feed

2.3.1 Module power supply performance

In the application design of GSM/GPRS module, the power supply design is a very important part. Because GSM transmits with a burst pulse of 577 us (1/8 TDMA cycle (4.615 ms)) every 4.615 ms. During the burst phase, the power supply must be able to provide a high peak current to ensure that the voltage does not fall to the lowest operating voltage of

the module.

For the MG2608-G module, the peak current of the module reaches 1.6 A at the maximum transmit power level, which will cause the voltage drop of the VBAT terminal. In order to ensure that the module can work steadily and normally, it is suggested that the maximum drop voltage at the VBAT end of the module should not exceed 400 mV.

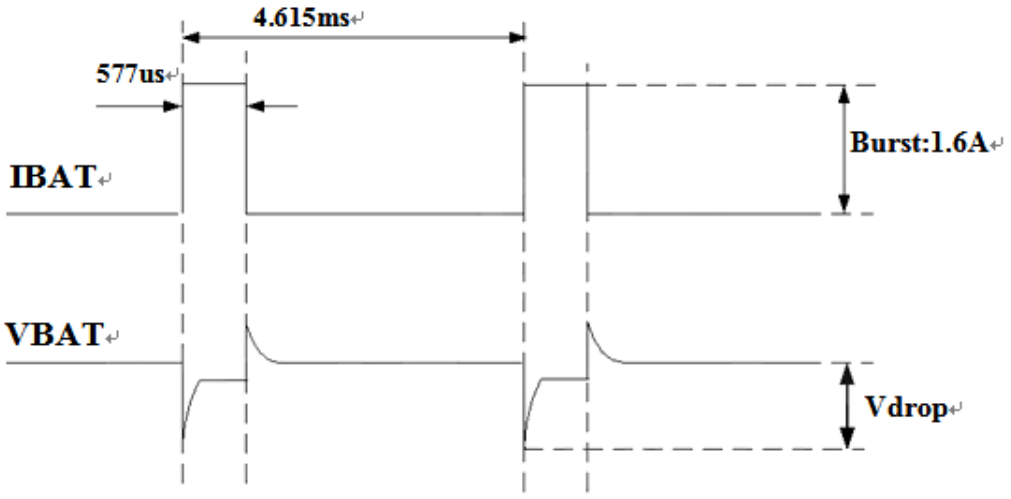

Chart 2-2 Voltage and Current Waveform Diagrams When Module is Emissioned

2.3. 2 Decrease in voltage sags

The voltage input range of module power supply VBAT is from 3.4 V to 4.2 V, but the module usually sags on the VBAT power supply when it is emitted by RF, which is caused by the impedance of the power supply and the route, so it is difficult to avoid. Therefore, special attention should be paid to the power supply design of the module to ensure that the VBAT voltage will not fall below 3.0 V, when the voltage falls below 3.0 V, it may lead to power shutdown or restart. At the VBAT input, a 100uF tantalum capacitor with low ESR (ESR = 0.7 omega) and 100nF, 33pF, 10pF filter capacitors (0603 encapsulation) are proposed to be connected in parallel. The reference circuit of the VBAT input is shown in Figure 4. and it is suggested that the PCB line of VBAT should be as short and wide as possible, in order to reduce the equivalent impedance of VBAT line, and ensure that the voltage drop will not be too large at the maximum transmit power, and the general voltage drop will be controlled within 400 mV. It is suggested that the width of VBAT roughting is not less than 2 mm, and the longer the length of the VBAT is, the wider the width of the VBAT is.

Note: The hardware shutdown voltage of the module is 3.0 V

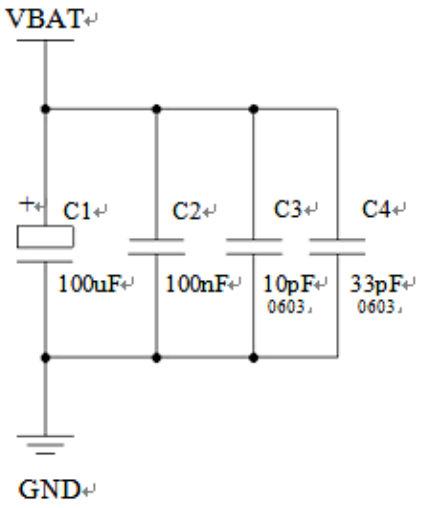

Chart 2-3 VBAT input reference circuit

2.3. 3 Power supply reference circuit

The design of the power supply is crucial to the power supply of the module and the power supply that can provide at least 2A current must be selected. If the voltage difference between the input voltage and the supply voltage of the module is not very large, it is recommended that LDO be used as the power supply. If there is a large voltage difference between the input and output, the switching power supply converter is used.

LDO power supply:

Below diagram is a reference design for + 5V power supply using Micrel's LDO of model MIC29302WU. Its output voltage is 4.16 V and the load current peaks reaches to 3A. In order to ensure the stability of the output power, it is suggested that a voltage regulator should be reserved at the output and placed near the module VBAT pin. It is suggested that the voltage stabilizer with reverse breakdown voltage of 5.1 V and dissipative power of more than 1 W should be selected.

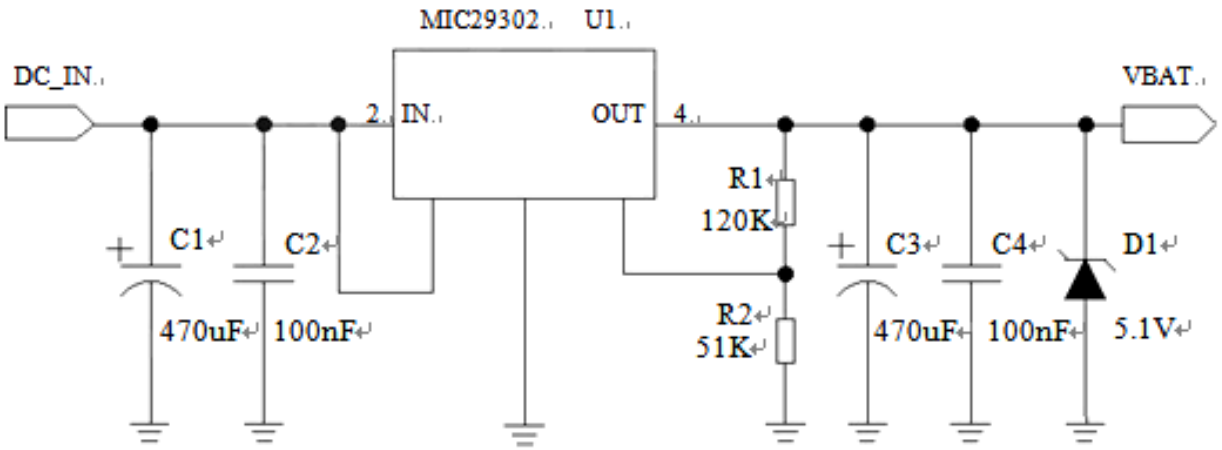

Chart 2-4Power Supply Input Reference Design

DCDC power supply:

The following diagram is a reference design for DCDC switching power supply, using JW5033H switching power supply chip of JW503H, which has a maximum output current of 2A and an input voltage of 4.7 V ~ 20V. Note that the type of C25 should be selected according to the input voltage in order to choose the withstand voltage value.

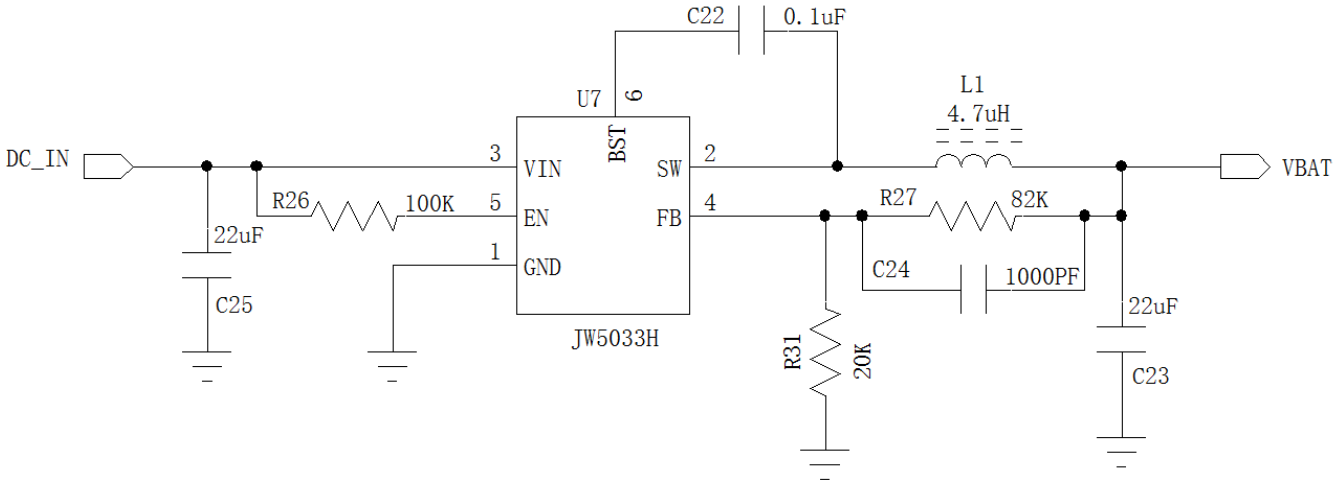

Chart 2-5 DCDC Power Supply Input Reference Design

2.4 Start-up and shut-down

2.4.1 Start up

The MG2608-G module can be booted through the PWRKEY pin. At the shutdown state, press the PWRKEY key for more than 2s, the module will enter the boot process. If the voltage of VBAT pin is greater than the boot voltage set by the software (default 3.55 V), the software will continue to boot until the system is booted completly. Otherwise, the boot action will stop and the system will shut down.

2.4.1.1 PWRKEY pin boot

After the VBAT is powered on, the PWRKEY pin can start the module, pull the PWRKEY pin down for 1 second, and the PWRKEY pin can be released after the boot is successful. It is possible to judge whether the module is on or not by detecting the level of the VDDIO pin. It is recommended to use the open set drive circuits to control PWRKEY pins. The following diagram shows the reference circuit:

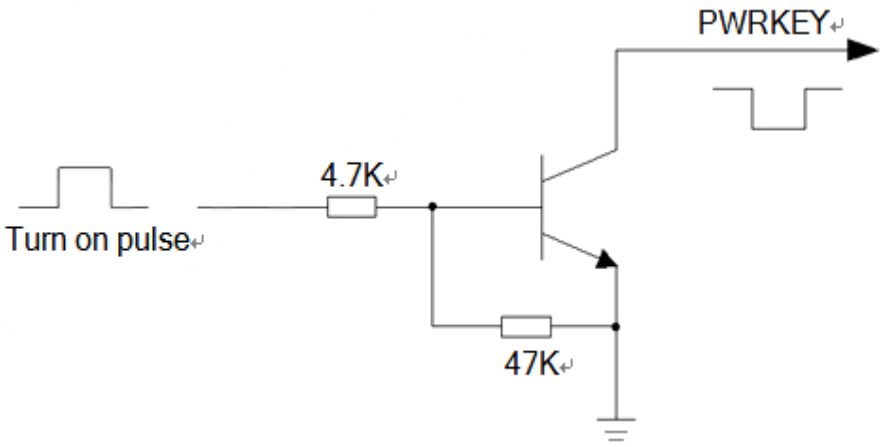

Chart 2-6 Open Set Drive Reference Boot Circuit

Another way to control a PWRKEY pin is to use a button switch directly. An TVS pipe is placed near the button for ESD protection. The following picture shows the reference circuit:

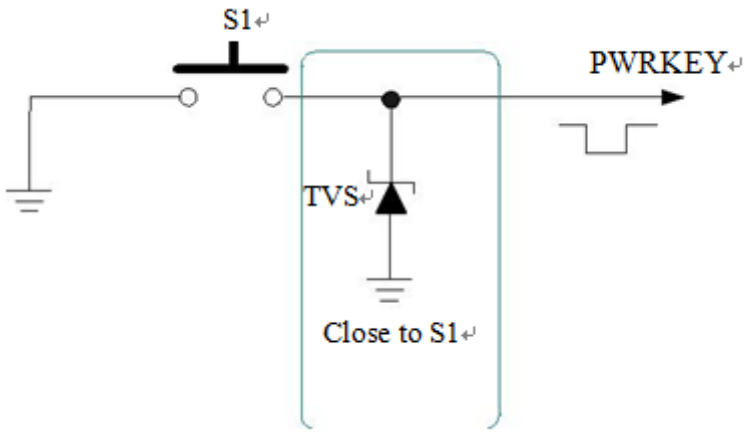

Chart 2-7 Button boot reference circuit

2.4.1.2 Power on boot

The PWRKEY pin can be grounded directly to realize the power-on automatic boot function. Note that in power-on mode, it will not be possible to shut down, as long as the voltage of the VBAT pin is greater than the boot voltage, even if the software calls the shutdown interface, the module will still start up again. In addition, in this mode, in order to successfully start up, the VBAT pin voltage shall be still greater than the set by the software start-up voltage, if it is not satisfied, the module will be closed, there will be repeated turn-on and shutdown.

2.4.2 Shutdown

The module can be turned off in the following way

- Normal shutdown: use PWRKEY pin to shutdown.
- Low-voltage automatic shutdown: the module detects low-voltage to shutdown.
- Emergency shutdown: shutdown via emerg_off pin.

2.4.2.1 PWRKEY pin shutdown

If PWRKEY pin is pulled down for more than 1.5 seconds, the module will perform shutdown action.

In the process of shutdown, the module needs to cancel the GSM network, and the time of cancellation is related to the current state of the network. By determination, it takes about 2s ~ 12s, therefore, it is suggested to extend the 12 seconds before the power is cut off or restarted to ensure that the software keeps the important data before the power is completely cut off.

Note: After the AT version is shut down, the module enters shutdown mode and cannot execute further AT commands. The shutdown mode can be indicated by the VDDIO pin and the low level indicates that the module has entered the shutdown mode.

2.4.2.2 Low voltage automatic shutdown

When the VBAT pin voltage is lower than the shutdown voltage set by the software (the default setting is 3.4 V), the software will close the module by the shutdown action to prevent all sorts of abnormalities from occurring in the low voltage state.

Note: For PWRKEY grounded power on mode, When the VBAT voltage is lower than the shutdown voltage, Module will still perform the shutdown action, but after shutdown, it will be booted up again because of the power-on of hardware. Because the VBAT voltage is below the boot voltage, the software will perform the shutdown action again, so it will appear the phenomenon of repeatedly starting and shutting down until the VBAT voltage is lower than the hardware boot voltage of 3.0 V, the hardware will not start up.

2.4.2.3 Emerg_off emergency shutdown

The 17th pin of MG2608-G module is emerg_off pin. Its function is hardware shutdown.

You can turn off the module by pulling down the emerg_off pin about 200 ms and then release it. It is recommended that OC drive circuits be used to control emerg_off pins. The following picture shows the reference circuit:

NOTE: The three-stage collector and emitter shall not be in series with a resistance greater than 1 ohm.

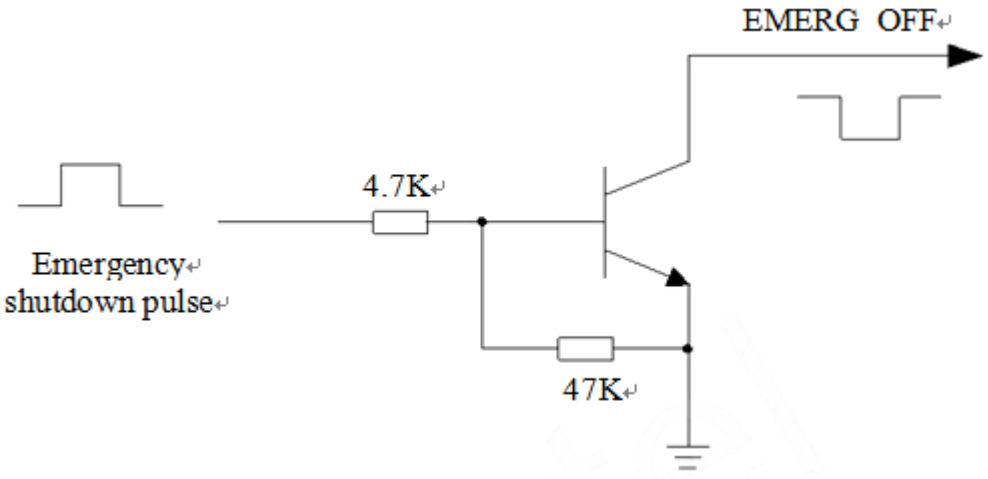

Chart2-8 Open Set Drive Reference Emergency Shutdown Circuit

Another way to control emerg_off pins for emergency shutdown is to use a button switch directly. An TVS pipe is placed near the button for ESD protection. The following picture shows the reference circuit:

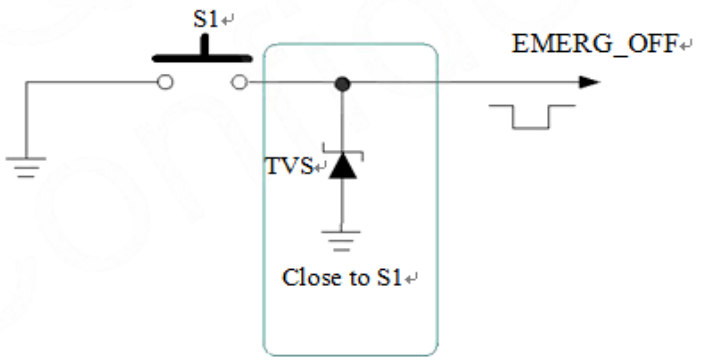

Chart2-9 button emergency shutdown reference circuit

Note: Under the power-on configuration, when the emerg_off pin is pulled down, the module will turn on again after shutdown, emerg_off pin will indirectly play the role of restarting.

2.5 Power saving technology

According to the system requirements, there are two ways to make the module into the low-power state. Use the "AT + CFUN" command for the AT version to get the module into the minium functional state.

2.5.1 Least functional mode

Minimum functional mode can minimize module functionality, which can be set by sending the "AT + CFUN =<fun>" command. The <fun>1parameter can be selected 0, 1, 4.

- 0: Minimum function (turn off RF and SIM cards);
- 1: Full function (default);
- 4: Turn off the RF transmitting and receiving function;

If you use "AT + CFUN = 0" to set the module to the least functional mode, the RF section and the SIM card section will be turned off. The serial port is still valid, but the AT commands associated with the RF part and the SIM card part are not available.

If you use "AT + CFUN = 4" to set up the module, some of the RF functionality will be turned off, while the serial port will remain in effect. All AT commands associated with the RF section are not available.

After the module is set with "AT + CFUN=0" or "AT + CFUN=4", it can be returned to full-function state with the "AT + CFUN=1" command setting.

2.5.2 Sleep mode (slow clock mode)

MG2608-G supports sleep mode. For AT version, WAKEUP_IN pins are used to control dormancy. WAKEUP_IN high voltage permits the module to dormancy. When WAKEUPIN is high, the module will enter dormancy mode in 30 seconds or so without action. WAKEUP_IN changes from a high level to a low level to wake up the module. At the same time, the main serial port continues to send AT instructions to wake up the module, but some of the previous AT instructions will be lost.

Note: The AT version default state does not enter dormancy, it is required to send instruction AT+CSCCLK=1 or AT+CSCCLK=2 to make the module into dormancy. Please refer to "GOSUNCN MG2608-G Module AT Conmand Manual_V1.1" for details

2.5.3 Sleep wake up

When the module is in sleep mode, the following method can awaken the module.

- The AT version pulls the WAKEUP_IN pin down to awaken the module. After the pin of WAKEUP_IN is pulled down for 20 ms, the serial port is activated.
- GPIO is interrupted.
- Receive incoming calls or GPRS data to wake up the module.
- Receive text messages to wake up the module.

2.6 Mode switching summary

Table 2-4 Summary of Mode Switching

Current Mode	Next mode		
	Shutdown	Normal mode	Sleep Mode
Shutdown		Boot with PWRKEY	
Normal mode	Use PWRKEY pins, or emerg_off pins, or VBAT voltage lower than shutdown voltage		Software Calls Sleep Interface, AT Version does not act for 30 seconds , then it is automatically dormant.
Sleep Mode	Use PWRKEY or emerg_off pin or VBAT voltage lower than shutdown voltage	GPIO pin interrupts, timer, receive SMS or GPRS data	

2.7 Serial port

The module provides two universal asynchronous transceivers: main serial port UART1 and auxiliary serial port UART2. Module supports fixed baud rate and adaptive baud rate. Adaptive baud rate support ranges from 4800bps to 115200bps.

Main serial port

- UART1_TXD: sending data to RXD side of DTE device
- UART1_RXD: Receiving Data from the TXD End of the DTE Device
- UART1_RTS: DTE Request to Send Data to DCE
- UART1_CTS: Clear Sending

By default, the hardware flow control of the module is turned off. When the user needs hardware flow control, pin RTS, CTS must be connected to the client, AT command "AT + IFC = 2, 2" can be used to turn on hardware flow control. The AT command "AT + IFC = 0, 0" can be used to turn off the flow control. Refer specifically to "GOSUNCN MG2608-G Module AT Conmand Manual_V1.1".

Auxiliary serial port UART2

- UART2_TXD: Serial Port for Sending Data to DTE
- UART2_RXD: Receiving Data from DTE's Serial Port

The serial logic level is shown in the table below:

Table2-5 Serial port logic level

Parameter	Minimum	Maximum	Unit
VIL :	Zero	0.25 x VDDIO	V
VIH	0.75 x VDDIO	VDDIO + 0.3	V
VOL	Zero	0.15 x VDDIO	V
VOH	0.85 x VDDIO	VDDIO	V

Table2-6 Serial pin definition

INTERFACE	Designation	Pin	Acting
Main serial port UART1	UART1_TXD	9	Serial data
	UART1_RXD	10	Serial port receiving data
	UART1_CTS	7	Clear to Send
	UART1_RTS	8	DTE request to send data
Secondary serial port UART2	UART2_RXD	28	Serial port receives data
	UART2_TXD	29	Serial data

2.7.1 Main serial port

2.7.1.1 Main serial port feature

- Including data line TXD and RXD, hardware flow control line RTS and CTS.
- 8 data bits, no parity verification, one stop bit.
- Hardware flow control is turned off by default.
- For AT command transmission, GPRS data transmission, CSD fax and so on.
- Support baud rates are as follows: 1200, 2400, 4800, 9600, 14400, 19200, 28800, 38400, 57600, 115200, 230400, 460800, 921600
- By default, the AT instruction version of the module is an adaptive baud rate (AT + IPR = 0). In the adaptive baud rate mode, initialization information (starting with "RDY") will not be returned to the host computer after booting. After the module starts up for 2-3 seconds, the AT command can be sent to the module. The master computer is required to firstly send "AT" character to the module to train the baud rate of the master computer. At this time, the module will report the initialization information, indicating that the training is successful. The user can send a "AT + IPR = x: & W" command to the module (x is the baud rate, such as 9600), the function of it is used to set a fixed baud rate and save, and after these configurations are completed, after the module is started each time, it will automotically returns to the serial port to URC initialization information (starting with "RDY").

To make better use of adaptive baud rate functionality, the following conditions need to be noted:

Synchronization between module and host machine:

When the adaptive baud rate function is turned on, when the module is powered on, it is best to wait 2-3 seconds before sending the "AT" character. When the module reports the boot initialization information, it indicates that the baud rate training is successful and synchronized with the upper computer.

In adaptive baud rate mode, if the master needs boot information, it must be synchronized first. Otherwise the boot initialization information will not be reported.

Adaptive baud rate operation configuration:

- The serial port is configured as 8-bit data bit, no parity bit, 1-bit stop bit (ex-factory configuration)
- Only the string "AT" can train the baud rate when the module is booted. ("at", "At" or "aT" cannot be identified)
- After the baud rate training is successful, the AT command that recognizes the combination of uppercase, lowercase, or case can be identified.
- In adaptive baud rate mode, URC information such as "RDY", "+ CFUN: 1" and "+ CPIN: READY" will not be reported if the module is started without synchronization.
- Switching to adaptive baud rate mode is not recommended in fixed baud rate mode.
- In adaptive baud rate mode, switching to software multiplexing mode is not recommended.

2.7.1.2 Main serial connection mode

Three-wire serial port please refer to the following connection:

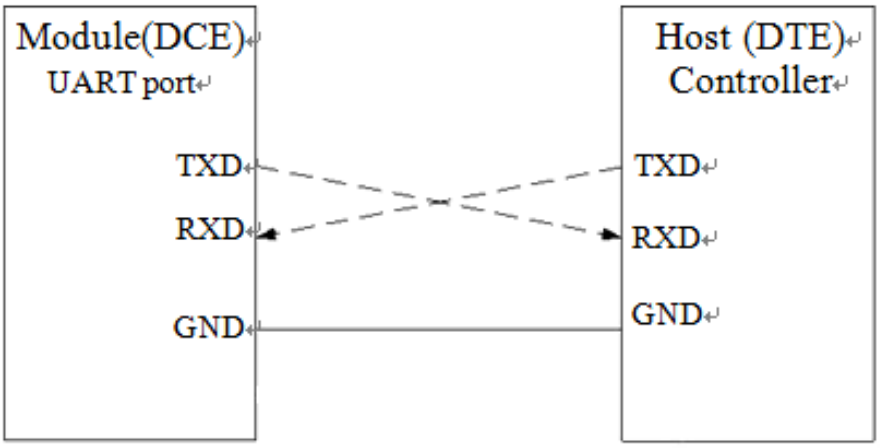

Chart2-10 Serial Port Three Wire System Connection Mode Sketch

The serial connection with flow control please refer to the following circuit connection, this connection mode can improve the reliability of large amount of data transmission, to prevent data loss.

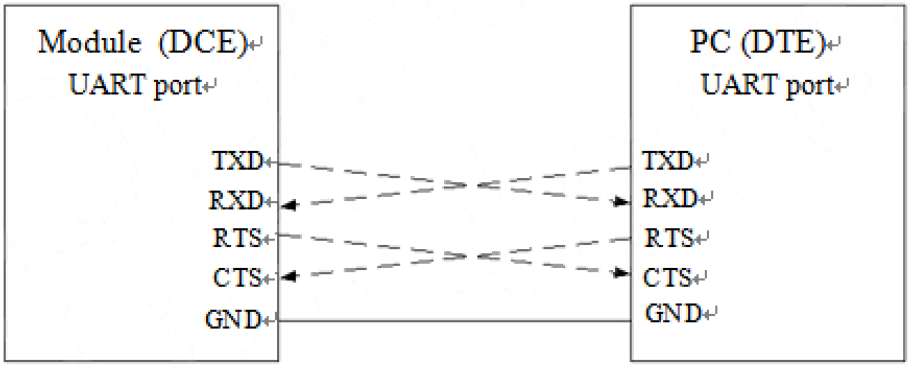

Chart2-11Sketch of Serial Port Connection with Flow Control

2.7.2 Auxiliary serial port UART2

UART2 supports only three-wire serial ports, please refer to the following connection:

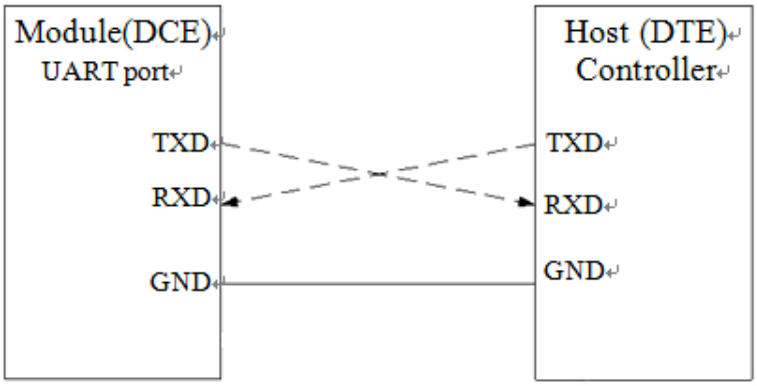

Chart 2-12 Three-wire serial connection diagram

2.7.3 Commissioning serial port

- Data lines: HOST_TXD and HOST_RXD
- The debug port is used for software debugging only, the baud rate is 921600 bps
- The serial port automatically outputs log information to the outside

The debug serial connection, refer to the following way:

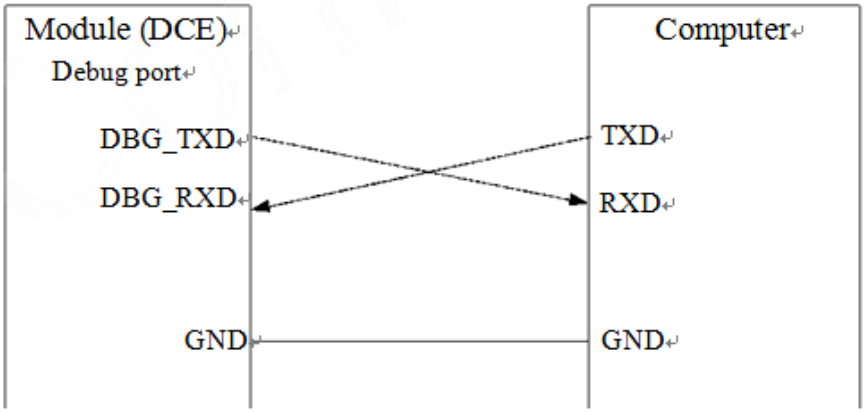

Chart 2-13 Software debugging connection diagram

2.7.4 Serial port application

For the reference of the serial level matching circuit in the case of 3.3 V voltage system, it is strongly recommended that the voltage be divided to 2.8 V by using the partial voltage resistor on the input ports of RXD and other modules.

In the case of a 3V system, it is suggested that the resistor of 5.6 K should be changed to the resistor of 10K according to the principle of partial voltage. In the case that the user does not permit partial voltage, it is also recommended to connect 1K resistance in series

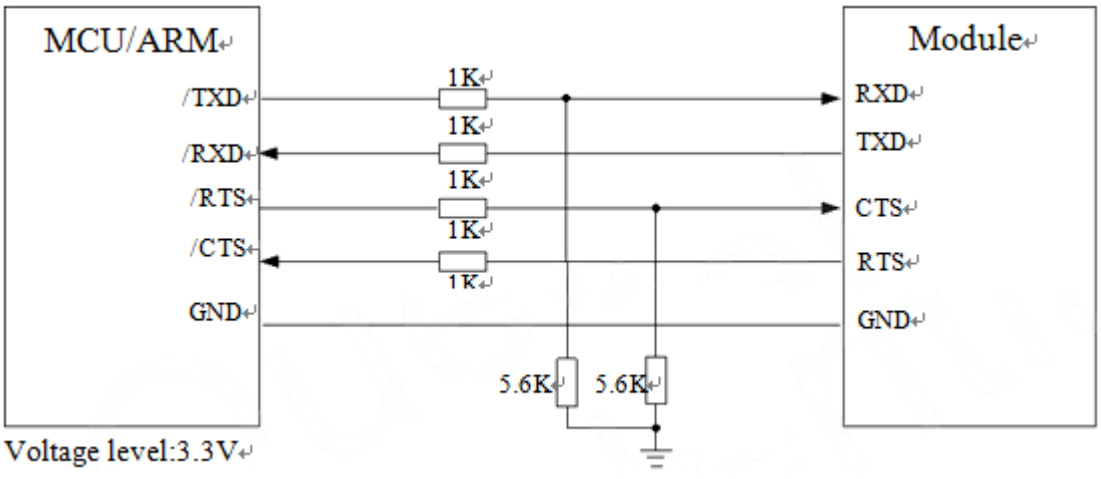

Chart2-14 3. 3 V level conversion circuit

For the level matching of 5V system, the level matching between module and peripheral device, refer to the following connection mode; for the dashed line part, refer to the above solid line circuit (the circuit design of the dashed line part module transmitts the reference module TXD, the circuit design of the dashed line part module receives the reference module RXD).

VCC_MCU is the I/O level voltage of the user. VDDIO is the output I/O level voltage of the module.

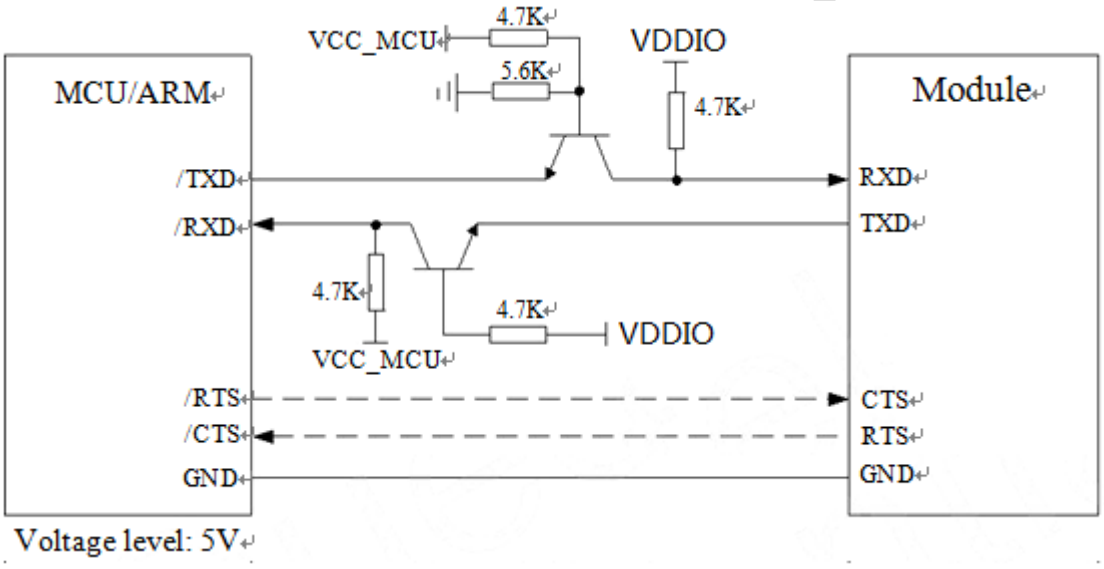

Chart2-15 5V Level Conversion Circuit

When the module communicates with the PC, it is required to add the RS232 level conversion circuit between them. Because the serial port configuration of the module is not RS232 level, only CMOS level is supported. The following picture shows the serial level conversion circuit when the module communicates with the PC.

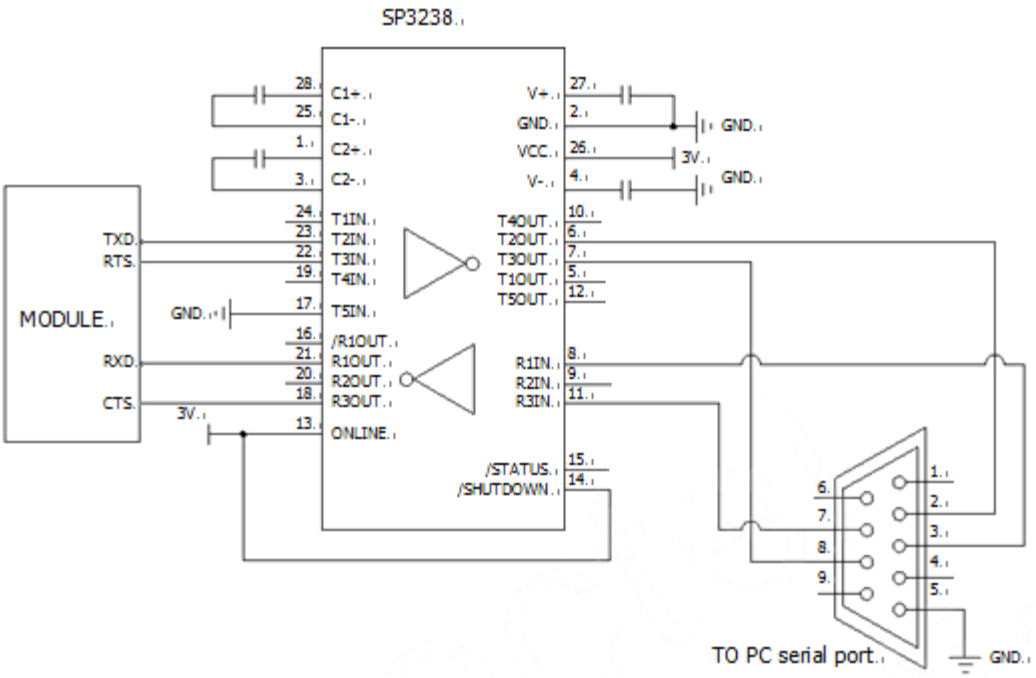

Chart2-16 RS232 Level Conversion Circuit

2.8 Audio interface

The module provides one-way analog audio input channel and one-way analog output channel to support calls, recording and playback functions.

Table2-7 Audio interface pin definition

INTERFACE	Interface name	Interface number	Acting
AIN	MICP	5	Audio input positive
	MICN	6	Audio input negative
AOUT	SPKP	3	Audio output positive end
	SPKN	4	Audio output negative

AIN can be used as microphone input or analog audio signal input. Microphones are usually electret microphones. AIN1 is a differential input.

The AOUT channel can drive the 8 ohm horn directly. AOUT channels are differential outputs.

2.8.1 Preventing TDD noise and other noise

Hand handles and hands-free microphones are recommended to use electret microphones with built-in RF filtering dual capacitors (e.g. 10pF and 33pF) to filter RF interference from the source, which will greatly improve the coupling TDD noise. The 33pF capacitor is used to filter the high frequency interference when the module is operating at 900MHz frequency. If the capacitor is not added, the TDD noise may be heard during the call. At the same time, the capacitance of 10 pF is used to

filter the high frequency interference at 1800 MHz. It should be noted that since the resonant point of the capacitor is largely determined by the material of the capacitor and the manufacturing process, when selecting the capacitor, it is necessary to consult the supplier of the capacitor and select the most appropriate capacitance to filter the high-frequency noise at GSM850MHz, GSM900MHz, DCS1800MHz and PCS1900MHz.

The severity of high-frequency interference when GSM is emitted usually depends on the application design of the customer. In some cases, the TDD noise of GSM900 is more serious, while in some cases, the TDD noise of DCS1800 is more serious. Therefore, the customer can choose the filter capacitors needed according to the test results, and sometimes do not need to paste this kind of filter capacitors.

The position of the RF filter capacitor on the PCB board should be as close as possible to the audio device or the audio interface, the line should be as short as possible, first pass through the filter capacitor and then to the other points

The position of the antenna is as far away from the audio component and the audio wire as possible, reducing the radiation interference, the power wire and the audio wire cannot be parallel, and the power wire is as far away from the audio wire as possible.

The differential audio line must follow the Layout rule of the differential signal.

2.8.2 Microphone interface reference circuit

AIN channel built-in electret microphone bias voltage. The microphone channel reference circuit below shows:

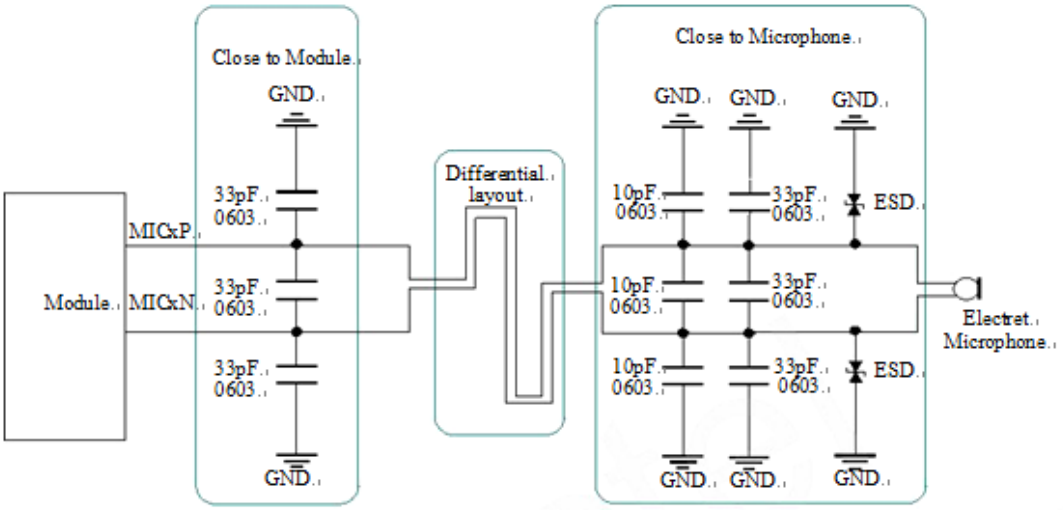

Chart 2-17 AIN microphone channel interface circuit

2.8.3 Audio output interface reference circuit

SPK audio output interface can be directly with the drive 8 ohm horn.

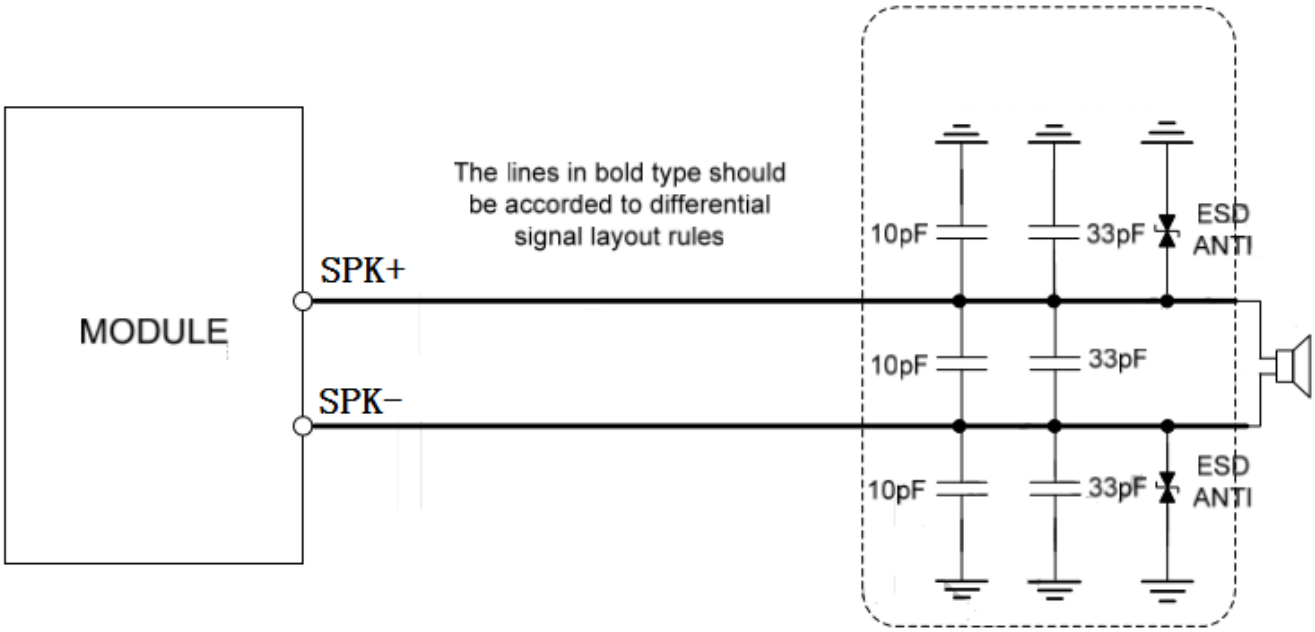

Chart2-18 reference line

2.8.4 Audio electrical characteristics

Table2-8 Typical Characteristic Parameters of Electret Microphone

Parameter	Minimum value	typ.	Maximum value	Unit
Operating voltage	1.0	1.25	2.0	V
Operating Current			500	μa
impedance		2.2		Omega

Table2-9 Typical characteristic parameters of table audio interface

Parameter			Minimum value	typ.	Maximum value	Unit
AOUT	Single-ended output	Load		8		Ω
		Reference level	Zero		2.4	Vpp
	Differential output	Load		8		Ω
		Reference level	Zero		4.8	Vpp

2.9 SIM card holder

SIM card interface supports GSM Phase 1 specification, GSM Phase 2 + specification and FAST64 kbps SIM card (for SIM application kit)

The SIM card is powered by a power supply inside the module, supporting 1.8 V and 3.0 V.

2.9.1 SIM connector

The following table describes the interface pin definition for SIM.

Table 2-10 SIM Card Interface Pin Definition

Pin name	Pin No.	Acting
SIM0_VCC	15	SIM0 card power supply. Automatic detection of SIM card operating voltage. Precision 3.0 V + 10% and 1.8 V + 10%. Maximum supply current is 10 mA.
SIM0_RESET	12	SIM0 card reset foot
SIM0_DATA	14	SIM0 card data line
SIM0_CLK	13	SIM0 card clock line
SIM1_VCC	47	SIM1 card power supply. Automatic detection of SIM card operating voltage. Precision 3.0 V + 10% and 1.8 V + 10%. Maximum supply current is 10 mA.
SIM1_RESET	45	SIM1 card reset foot
SIM1_DATA	46	SIM1 card data line
SIM1_CLK	44	SIM1 card clock line

The following figure is a reference circuit for the SIM interface, using a 6 pin SIM card holder.

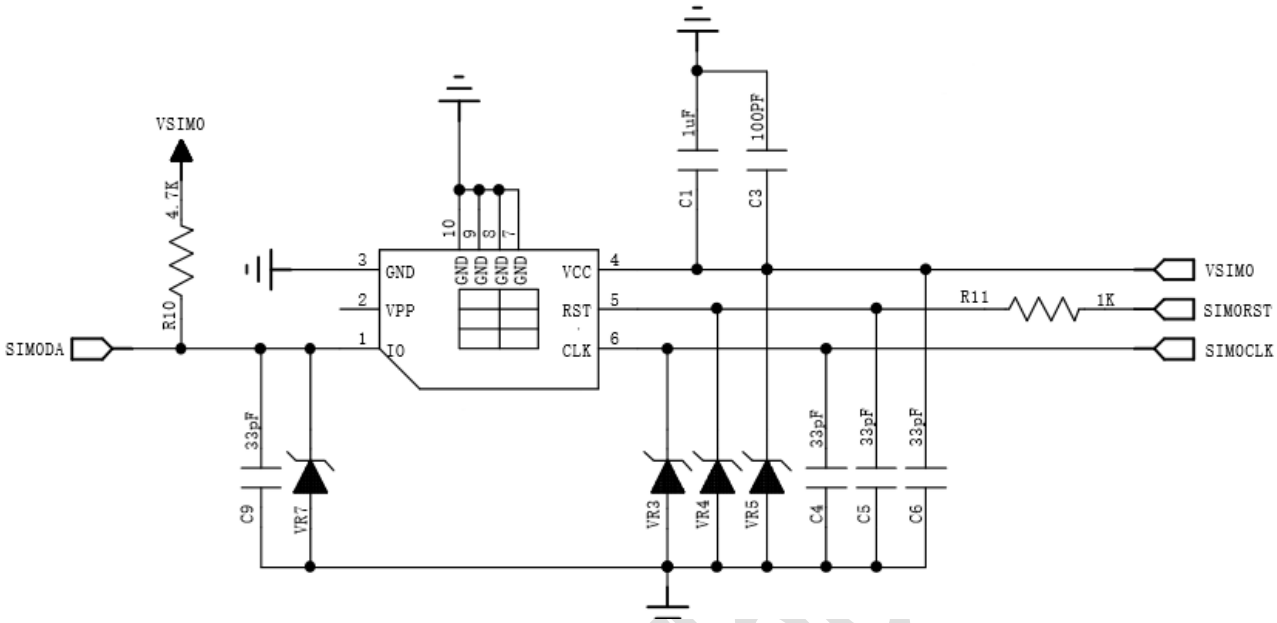

Chart2-19 Reference Circuit Diagram (SIM) Using 6pin SIM Block

In the circuit design of SIM card interface, in order to ensure the good function performance of SIM card and not be damaged, it is suggested that the following design principles should be followed in the circuit design:

- SIM card holder and module can not be too far away, the nearer the better, as far as possible to ensure that the SIM card signal line wiring not more than 20 cm.
- SIM card signal wire routing away from the RF line and VBAT power line.
- The wiring width of SIM_VDD is not less than 0.3 mm, and the bypass circuit between SIM_VDD and SIM_GND is not more than 1 uF, and is arranged near the SIM card base.
- In order to prevent the possible crosstalk of SIM_CLK signals to SIM_DATA signals, the two routes should not be too close to each other and should be shielded between the two routes. The SIM_RST signal shall be protected too.
- In order to ensure good ESD protection, it is recommended that TVS tube be added and placed near SIM card seat. The parasitic capacitance of the selected ESD device is not more than 50 pF, such as WILL (http://www.wilsemi.com) ESDA6V8AV6. The resistance of 22 ohms can also be connected between the module and the SIM card to suppress spurious EMI and enhance ESD protection. The peripheral circuit of the SIM card must be as close as possible to the SIM card holder.

2.9.2 6-pin SIM card holder

Using the 6-pin SIM card holder, Amphenol's C70710M0065122 is recommended. See http://www.amphenol.com for more information.

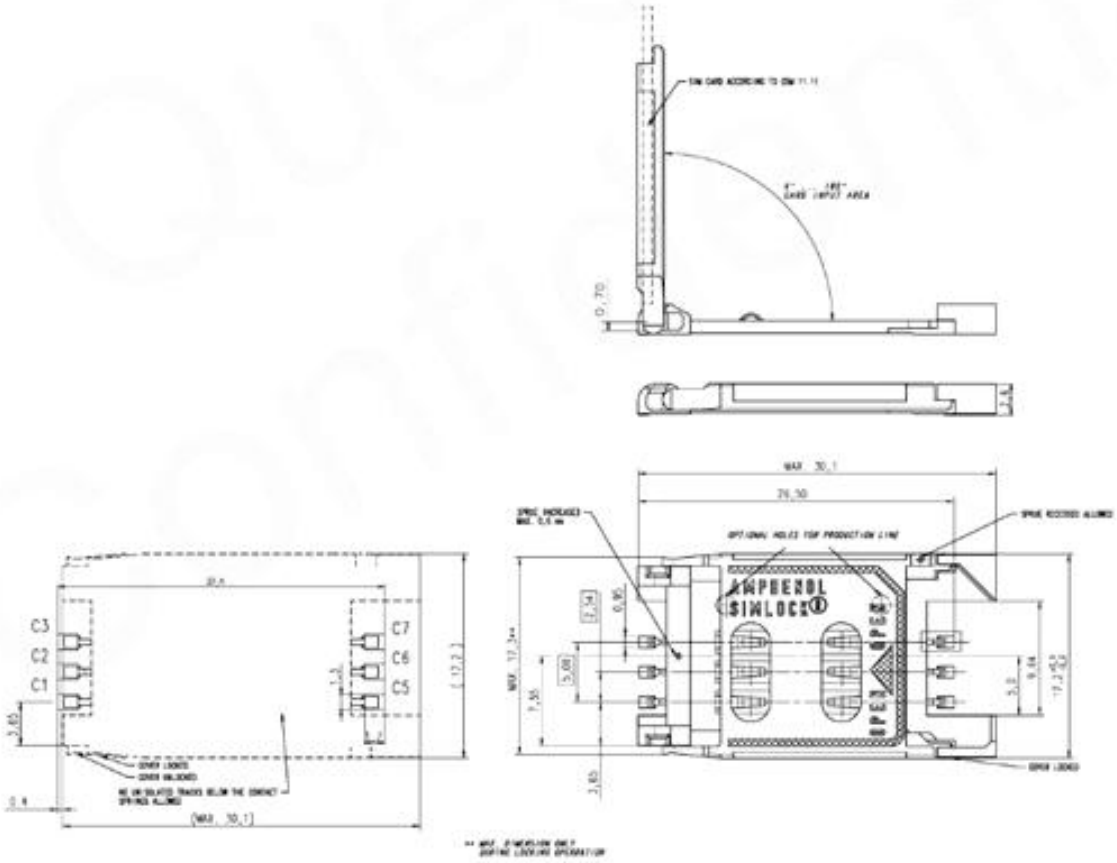

Chart2-20 Amphenol C707 10M006 5122 SIM card holder

2.10 Network status indication

SYS_STATE pin signals can be used to indicate the state of the network. This pin works as shown in the table below:

Table2-10 SYS_STATE WORKING STATE

Status	Module function
CLOSE	Shutdown
Period 1 Hz, duty cycle 50%	contact fault
Cycle 0.3 Hz, duty cycle 10%	On-line
Cycle 10 Hz, duty cycle 50%	Data Send

The reference circuit is as follows:

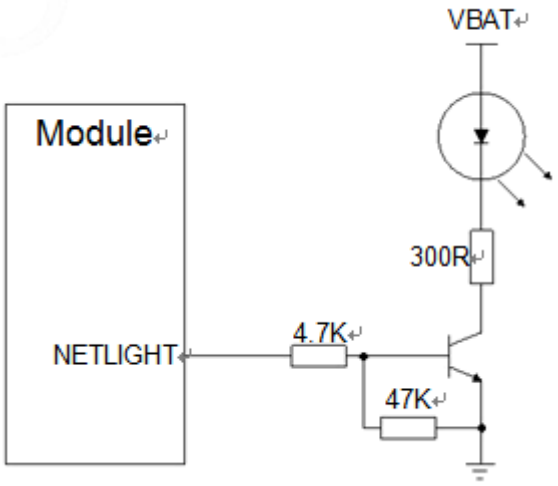

Chart2-21 ETLIGHT reference circuit

2.11 Wake

Table 2-11 Awakening Pin Definition

Pin name	Pin No.	Acting
WAKEUP_OUT (GPIO_33)	16	Module awakening host signal If an external wake-up event is received, the pin outputs a default low 1S level pulse signal
WAKEUP_IN (GPIO_33)	18	Used for the external device awakening module, while the module sleeps, the external can awaken the module through the pin. To use, add a pull-up resistance to the external circuit. The edge triggers and the descending edge awakens the module;

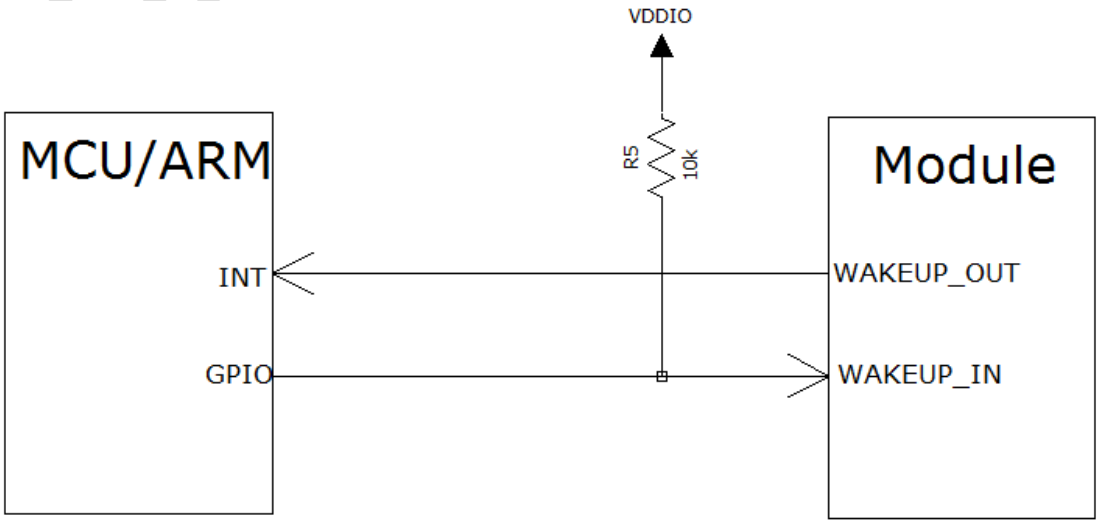

Chart2-22 Awakening Interface Description

2.12 SDIO

Table 2-12 SDIO interface table

Pin name	Pin No.	Acting
SD_CLK (GPIO_8) (SPI_CLK)	41	SD card clock signal SPI interface clock signal
SD_DAT0 (GPIO_10) SPI_CS	42	SD card data signal line 0 SPI interface chip selection signal
SD_DAT1 (GPIO_11) SPI_DO	52	SD card data signal line 1 SPI interface data output
SD_DAT2 (GPIO_12) SPI_DI	43	SD card data signal line 2 SPI interface data input
SD_DAT3 (GPIO_13)	48	SD card data signal line 3
SD_CMD (GPIO_9)	49	SD card command line
SD_VCC	51	Power supply to external SD card, also can be used as general LDO Output 2.8/3.0/3.2 V adjustable, 150 mA

The reference circuit is as follows:

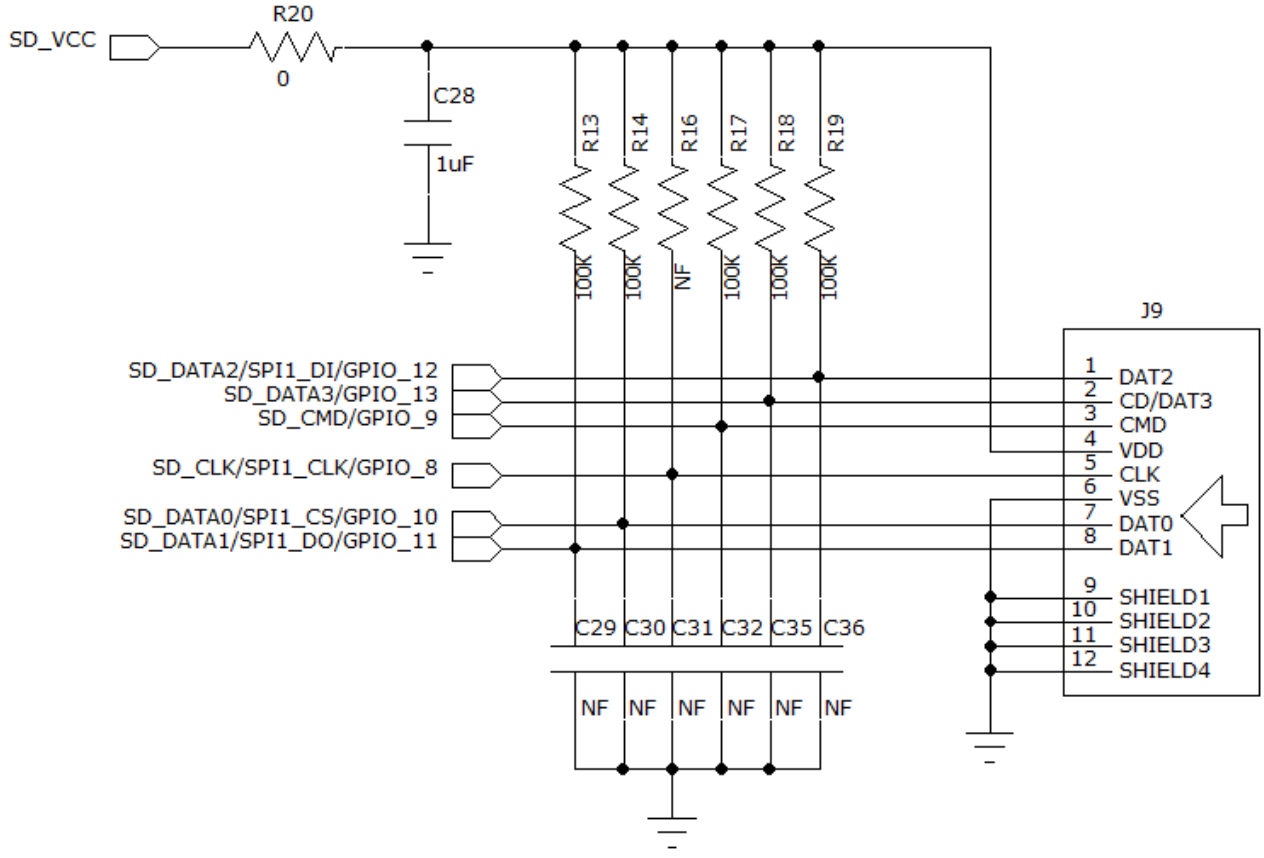

Chart2-23 SD card reference circuit

2.13 PWM

MG2608-G supports two PWM outputs: PWM and LPG, multiplexed by UART2_RX and UART2_TXD, respectively.

Table 2-13 UART interface

UART2					
Pin name	**Pin No**	**I/O**	**Pin description**	**Electrical characteristics**	**Remarks**
UART2_RXD (GPIO_4) (SPI2_DI) (Liquefied petroleum gases)	2	i	Hardware UART2	VILmin=-0. 3V VIL max=0. 25 x VDDIO VIHmin=0. 75 x VDDIO VIHmax=VDDIO+0. 3 VOHmin=0. 85 x VDDIO VOLmax=0. 15 x VDDIO	If it is not used, then it is suspended
UART2_TXD (GPIO_5) (PWM)	1	O			

When LPG (Light Pulse Generation) is used for low frequency applications, such as driving LED flickers, only 7 fixed cycles can be set: 125, 250, 500, 100, 150, 200, 250, 300 0, and 15 high-level times.

PWM, frequency range (80-65535HZ), and various duty cycle can be set.

Please refer to the corresponding AT directive document for details

3 RF interface

The pin 27 is the RF antenna input. RF interface 50 ohm impedance matching.

Table3-1 RF_ANT Pin Definitions

Pin name	Pin No.	Acting
RF_ANT	27	Radio frequency welding pad

3.1 Radio frequency reference circuit

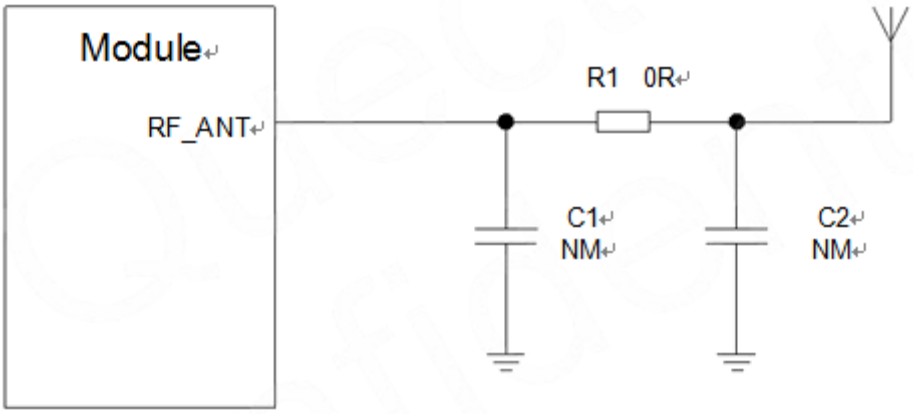

Chart3-1 Radio frequency reference circuit

MG2608-G provides an RF antenna pad as an antenna connection interface. The RF wire connected to the module RF antenna pad must be microstrip or other type of RF wire and the impedance must be controlled at about 50 ohms. In order to achieve better RF performance, the RF input port has a grounding pad on both sides.

Caution must be exercised in the design to minimize loss on RF wires or RF cables. The recommended insertion loss must meet the following conditions:

- GSM850/EGSM900< 1dB
- DCS 1800/PCS 1900 < 1.5 dB

3.2 RF output power

Table3-2 RF conduction power

Frequency range	Maximum value	Minimum value
GSM850	32.5 dBm +-1.5 dB	5 dBm + 5 dB
EGSM900	32.5 dBm +-1.5 dB	5 dBm + 5 dB

DCS1800	29.5 dBm +-1.5 dB	0dBm + 5dB
PCS1900	29.5 dBm +-1.5 dB	0dBm + 5dB

Note: The maximum output power decreases by 2.5 dB in GPRS network 4-slot transmission mode. The design conforms to the GSM specification described in section 13.16 of 3GPP TS 51.010-1.

3.3 RF conduction sensitivity

Table3-3 RF conduction sensitivity

Frequency range	Receiving sensitivity
GSM850	<-108.5dBm
EGSM900	<-108.5 dBm
DCS1800	<-108.5 dBm
PCS1900	<-108.5 dBm

3.4 Operating frequency

Table3-4Working frequency of module

Frequency range	Receiving frequency	Transmitting frequency	ARFCN
GSM850	869-894 MHz	824-849 MHz	128-251
EGSM900	925-960 MHz	880 ~ 915 MHz	0 ~ 124, 975 ~ 1023
DCS1800	1805 ~ 1880 MHz	1710 ~ 1785 MHz	512-885
PCS1900	1930 ~ 1990 MHz	1850 ~ 1910 MHz	512-810

3.5 Recommended RF welding

If the RF connector connecting the external antenna is connected to the module by welding, be sure to pay attention to the wire stripping method and welding method of the connecting wire, especially if the wire is fully welded, please follow the correct welding method in the following diagram to avoid increasing the line loss due to poor welding.

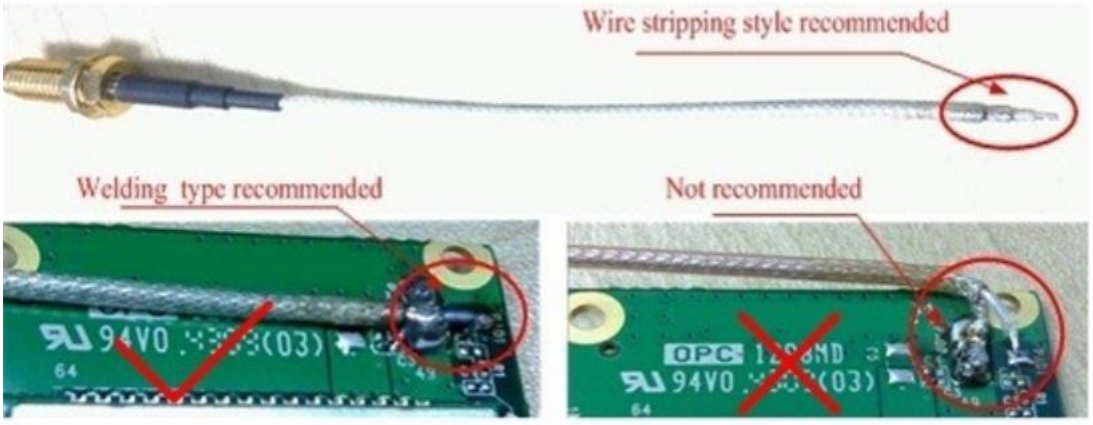

Chart3-2 Recommendations for radio frequency welding

4 Electrical characteristics, reliability, RF characteristics

4.1 Absolute maximum

The following table shows the module digital, analog pin power supply voltage and current maximum tolerant value.

Table4-1 Absolute maximum value

Parameter	Minimum value	Maximum value	Unit
VBAT	-0.3	4.2	V
Power supply peak current	Zero	2	a
Power supply average current (TDMA one frame time)	Zero	0.7	a
Digital pin voltage	-0.3	3.3	V
Analog pin voltage	-0.3	3.0	V
Digital/Analog Pin Voltage in Shutdown Mode	-0.25	0.25	V

4.2 Service Temperature

Table4-2 Service Temperature

Temperature	Min.	typ.	Max.	Unit
Normal service temperature	-40	25	85	℃
Storage Temperature	45		90	℃

4.3 Voltage rating

Table4-3 Module power supply rating

Parameter	Description:	Condition		Minimum	typ.	Maximum	Unit
VBAT	Supply Voltage	Voltage must be within this range, including voltage drop, ripple and spike time		3.4	4.0	4.2	V
	Voltage drop during burst emission	GSM850/GSM900 Maximum Transmit Power Level				400	MV
IVBAT	Average	Power Off	Power up for the		34		UA

	supply current	mode	first time				
			Shutdown after boot (RTC works normally)		195		UA
		Bottom current			1.02		MA
		Standby current	DRX=2		1.6		MA
			DRX=5		1.34		MA
			DRX=9		1.23		MA
		Flight mode AT + CFUN = 4			1.096		MA
		Minimum function mode AT + CFUN = 0			0.963		MA
		Boot up the registry network, connect to a server, stay connected only, not send data			3.0		MA
		GPRS mode (2 rounds, 2 rounds)	GSM8501)		281.6		MA
			EGSM 9001)		315.9		MA
			DCS18002)		208.7		MA
			PCS19002)		195.6		MA
		GPRS mode (4 receives, 1 receives)	GSM8501)		189.4		MA
			EGSM 9001)		203.5		MA
			DCS18002)		150.1		MA
			PCS19002)		136.3		MA
Peak current (under maximum transmit time slot per GSM850/GSM900)		GSM850/GSM900 Maximum Transmit Power Level			1.8	2	a

1) Power Level 5 2) Power Level 0

4.4 Protection against electrostatic

In the application of the module, the static electricity generated by the body and the static electricity generated by the electrified friction between the microelectronics may cause certain damage to the module by the discharge of various ways, therefore, attention must be paid to the ESD protection. No matter in the process of assembly, test, research and development, especially in the product design, the protection measures should be taken to ESD, such as circuit design at the interface or susceptible to ESD point to increase ESD protection, production with anti-ESD gloves and so on.

The following table shows the ESD voltage tolerance of the module's PIN pins.

Table4-4 ESD performance parameters (temperature: 25℃, humidity: 45%)

Pin name	Contact Discharge	Air Discharge
VBAT, GND	+ 5 KV	+ 10 KV
RF_ANT	+ 5 KV	+ 10 KV
TXD, RXD	+ 2 KV	+ 4 KV
Other	+ 0.5 KV	+ 1 KV

5 Mechanical size

This section describes the mechanical dimensions of the module and the recommended packaging dimensions that user use to design the module.

5.1 Module mechanical dimension

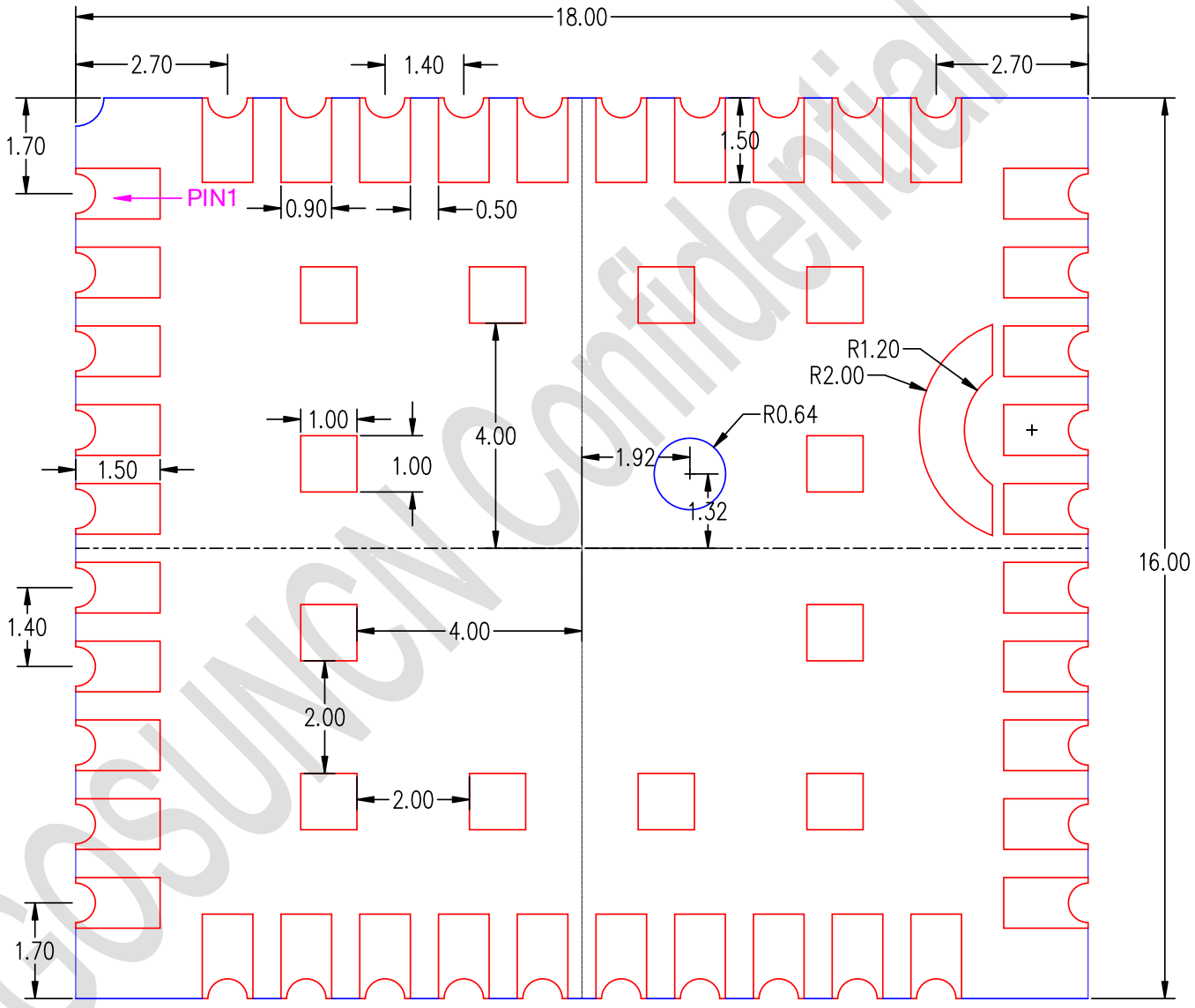

Chart5-1 MG2608-G Front view (in millimeters)

5.2 Recommended PCB packaging

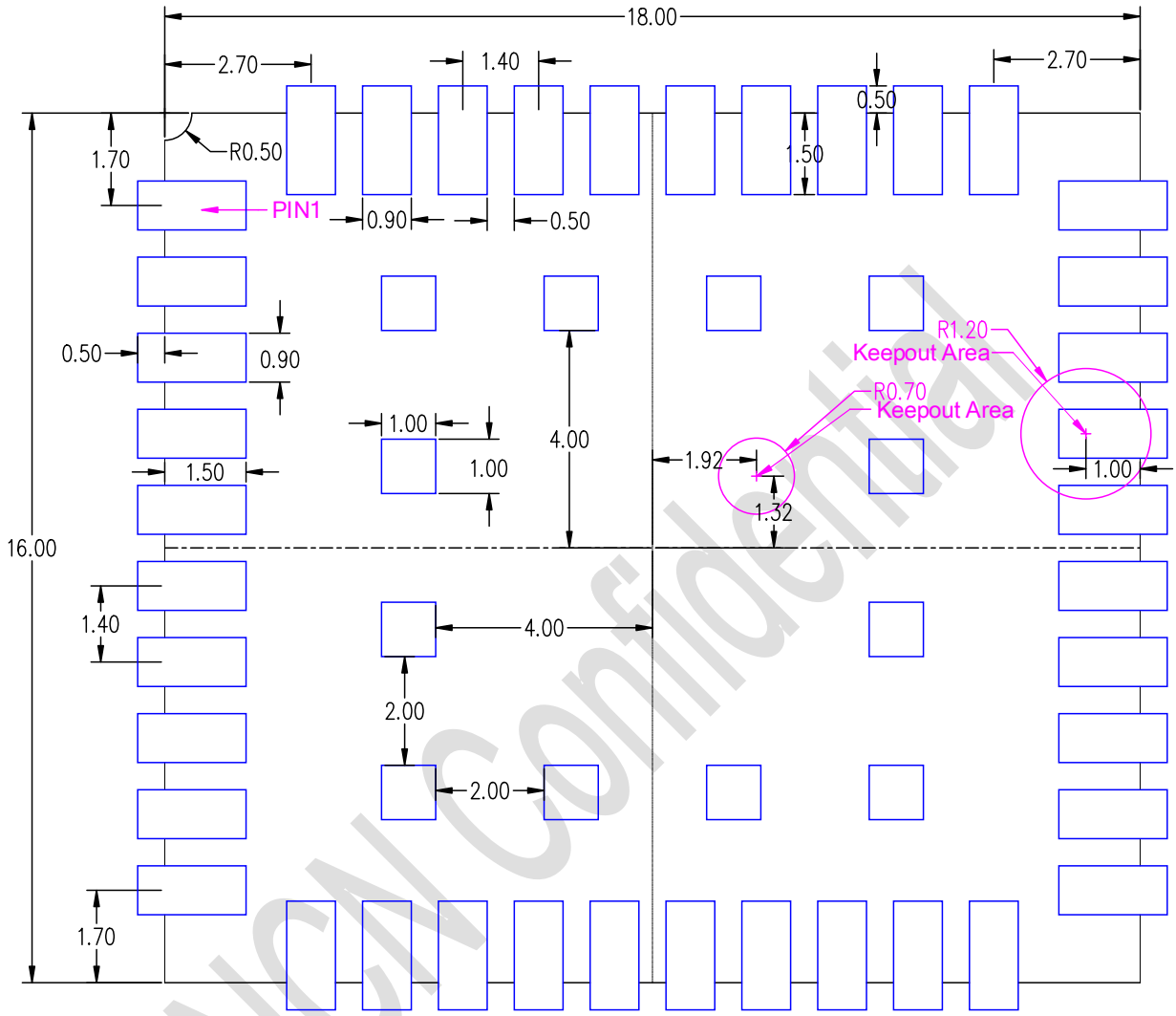

Chart5-2 Recommends PCB encapsulation (in millimeters)

Note: Ensure a minimum of 3 mm spacing between modules and other components on PCB board.

5.3 Module forward view

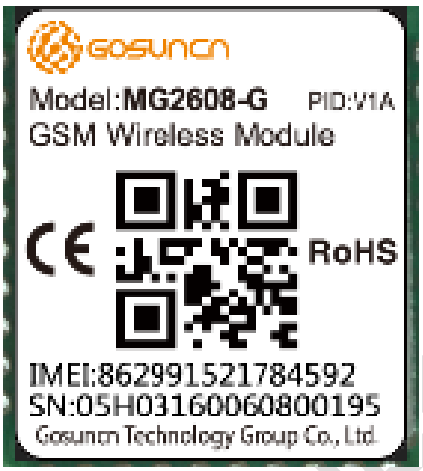

Chart5-3 Module Front View

5.4 Module bottom view

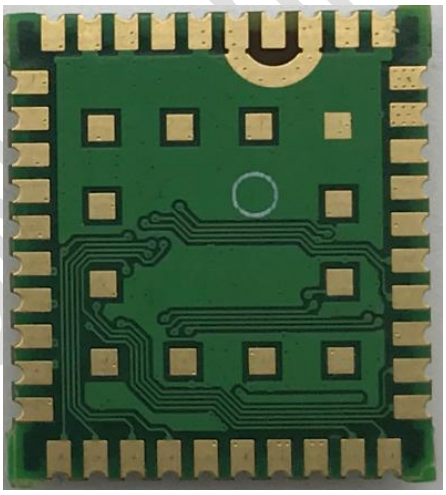

Diagram 5-4 Module Bottom View

6 Storage and production

6.1 Storage

MG2608-G is shipped in the form of vacuum sealing bags. Module storage follows the following conditions

When the ambient temperature is below 40 degrees Celsius and the air humidity is less than 90%, the module can be stored in a vacuum sealing bag for 12 months.

When the vacuum sealing bag is opened, the module may be directly reflow welded or other high temperature processes if the following conditions are satisfied:

- Module ambient temperature less than 30 degrees Celsius, air humidity less than 60%, factory within 72 hours to complete the patch.
- Air humidity less than 10%

If the module is in the following condition, it needs to be baked in front of the patch:

- When the ambient temperature is 23 degrees Celsius (allowing fluctuations up or down 5 degrees Celsius), the humidity indicator shows that the humidity is more than 10%
- When the vacuum sealing bag is opened, the ambient temperature of the module is below 30 degrees Celsius and the humidity of the air is less than 60%, but the factory is not able to finish the patch within 72 hours
- When the vacuum seal is opened, the module stores more than 10% air humidity

If the module needs to be baked, bake for 48 hours at 125 degrees Celsius (allowing fluctuations up or down 5 degrees Celsius).

Note: The module packing cannot withstand such high temperature. Please remove the module packing before it is baked. Refer to the IPC/JEDECJ-STD-033 specification for short baking.

6.2 Production Welding

The solder paste is printed on the screen with the printing scraper to make the solder paste leak through the opening of the screen to be printed on the PCB. The strength of the printing scraper should be adjusted appropriately. In order to ensure the quality of the mould paste, the thickness of the steel mesh corresponding to the solder pad of the MG2608-G module should be 0.2 mm.

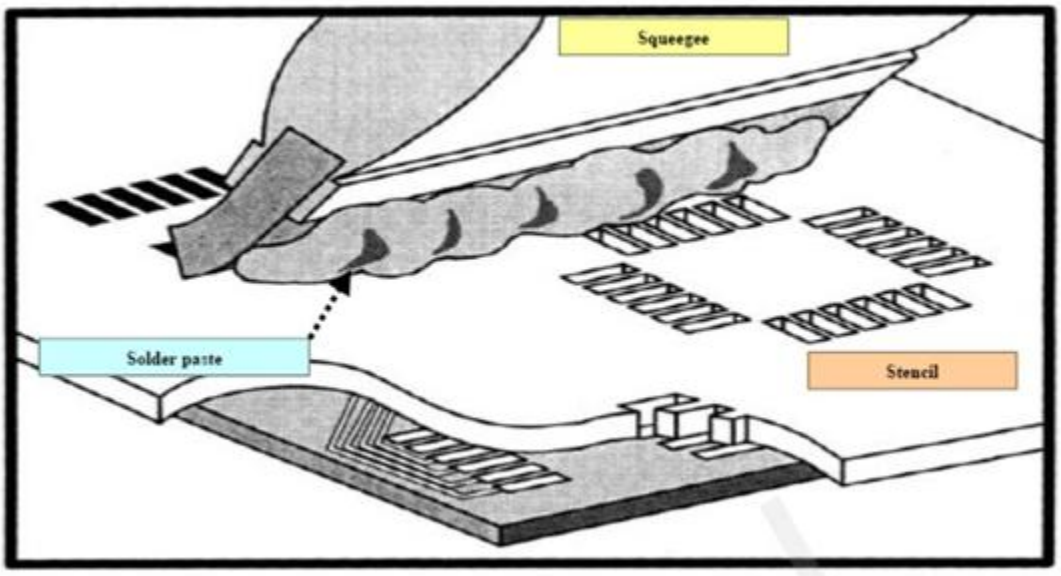

Chart6-1 Printing and paste Diagram

In order to avoid repeated heat damage to the module, it is recommended that the customer PCB finish the first side of the reflow welding before sticking the module. The recommended furnace temperature diagram is shown as follows:

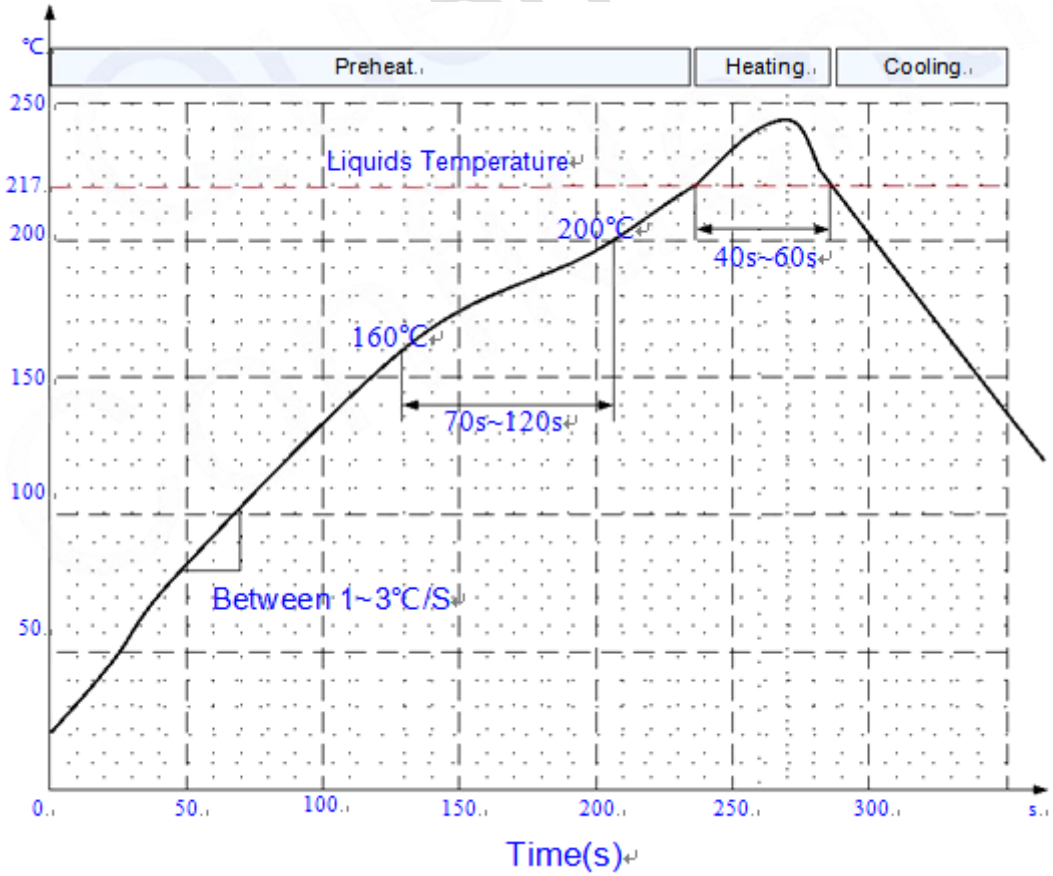

Chart6-2Furnace Temperature Curve