ZTE Welink

Welink Your Smart

Hardware Development Guide of Module Product

MG2639_V3

Version 1.3, 2014-09-15

ZTE中兴

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Revision History

Version	Author	Description	Date
V1.0	Cai Zongfei	1st released	2013-09-06
V1.1	Cai Zongfei	Add chapter 4.6 of GPS interface	2013-11-08
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Preface

Summary

This document provides the hardware solutions and development fundamentals for a product with the ZTEWelink MG2639_V3 module. By reading this document, the user can have an overall knowledge of MG2639_V3 and a clear understanding of the technical parameters. With this document, the user can successfully fulfill the application and development of wireless Internet product or equipment.

Besides the product features and technical parameters, this document also provides a guide on the design of user circuits, to provide the user with a complete design reference.

Target Readers

- System designing engineers
- Hardware engineers
- Software engineers
- Testing engineers

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1 Product Overview

MG2639_V3 is a wireless Internet module with LCC interface. It is widely applied to but not limited to the various products and equipment such as laptops, vehicle-mounted terminals, and electric devices, by providing data services, transceiver Email, web browsing, high speed download and so on.

It can support GSM850/EGSM900/DCS1800/PCS1900 frequency band.

In places with GSM network coverage, you can send and receive SMS, use high-speed data access service, voice calls and other functions under the mobile environment, provides users with a high degree of freedom, convenient solution to realize mobile office dreams.

This section describes the basic functions and logic diagram of the module MG2639_V3.

1.1 Technical Parameters

Table 1-1 is a list of the major technical parameters and features supported by MG2639_V3:

Table 1–1 Major Technical Parameters

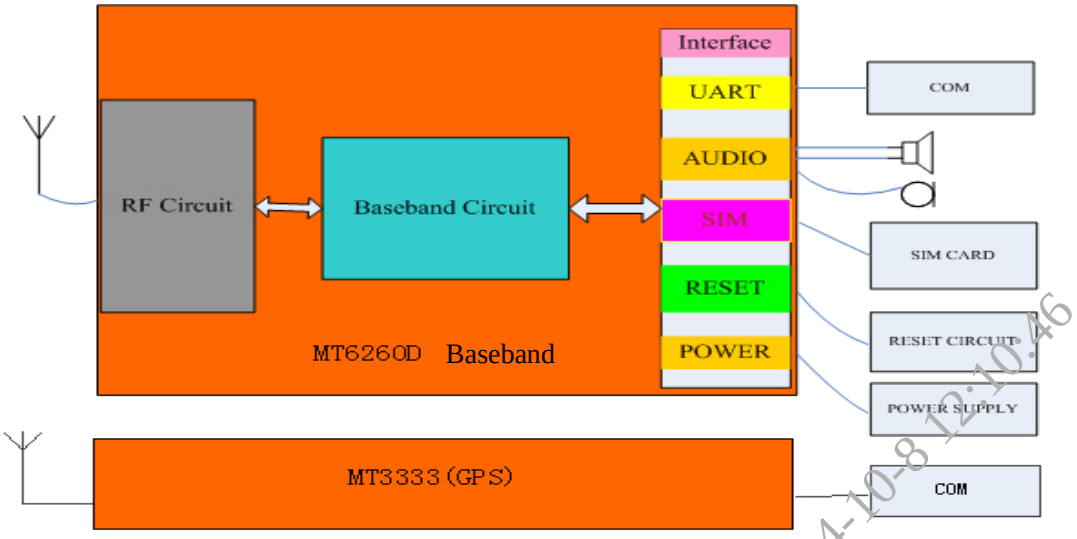
Parameter	MG2639_V3
Major Technical Parameters	
Bands	GSM850/EGSM900/DCS1800/PCS1900
GPS	GPS/GLONASS/BD
Dimensions	30.0×25.0×2.68mm
Weight	7g
Operating Temperature	-35℃~+75℃
Extreme working condition	-40℃~+85℃
Storage Temperature	-40℃~+85℃
Performance	
Power supply	3.4V~4.2V Typical: 3.8V
Working current	Standby current: 24mA@-75dBm
	Sleep current: 2mA
	Call current: 128mA@-75dBm
	Max. current: 300mA@-104dBm
Max. Transmitter Power	GSM850/EGSM900: Class 4 (2W)
	DCS1800/PCS1900: Class 1 (1W)
Receiving sensitivity	<-106dBm

Parameter	MG2639_V3
Interface	
Encapsulation type	60pin LCC
Antenna interface	SMT 50Ω Antenna interface
Integrated full duplex serial port	AT Command, Data transport
(U)SIM/SIM	Support 3V SIM card and 1.8V SIM card
Data Service	
GPRS	Class 10
Mobile base stations	Class B
Maximum downlink speeds	85.6kbps
Maximum uplink speeds	42.8kbps
Protocol	Embedded TCP/IP, UDP/IP Protocol
	Embedded FTP
SMS	
	Support TEXT/PDU mode
	Point to point MO and MT.
	SMS Cell Broadcast
Voice	
	Audio encoder: HR/FR/EFR/AMR
	Support DTMF, Echo cancellation, volume control
AT Command	
	GSM 07.05/GSM 07.07/ZTE extended AT commands

1.2 Application Frame

The application frame of module MG2639_V3 is as follows:

Figure 1–1 Application Frame



1.3 Abbreviations

A		
ADC	Analog-Digital Converter	模数转换
AFC	Automatic Frequency Control	自动频率控制
AGC	Automatic Gain Control	自动增益控制
ARFCN	Absolute Radio Frequency Channel Number	绝对射频信道号
ARP	Antenna Reference Point	天线参考点
ASIC	Application Specific Integrated Circuit	专用集成电路
B		
BER	Bit Error Rate	比特误码率
BTS	Base Transceiver Station	基站收发信台
C		
CDMA	Code Division Multiple Access	码分多址
CDG	CDMA Development Group	CDMA 发展组织
CS	Coding Scheme	译码图案
CSD	Circuit Switched Data	电路交换数据
CPU	Central Processing Unit	中央处理单元
D		
DAI	Digital Audio interface	数字音频接口
DAC	Digital-to-Analog Converter	数模转换
DCE	Data Communication Equipment	数据通讯设备
DSP	Digital Signal Processor	数字信号处理
DTE	Data Terminal Equipment	数据终端设备
DTMF	Dual Tone Multi-Frequency	双音多频
DTR	Data Terminal Ready	数据终端准备好
E		
EDGE	Enhanced Data Rate for GSM Evolution	提高数据速率的 GSM 演进技术

EFR	Enhanced Full Rate	增强型全速率
EGSM	Enhanced GSM	增强型 GSM
EMC	Electromagnetic Compatibility	电磁兼容
EMI	Electro Magnetic Interference	电磁干扰
ESD	Electronic Static Discharge	静电放电
ETS	European Telecommunication Standard	欧洲通信标准
F		
FDMA	Frequency Division Multiple Access	频分多址
FR	Full Rate	全速率
G		
GPRS	General Packet Radio Service	通用分组无线业务
GSM	Global Standard for Mobile Communications	全球移动通讯系统
GPS	Global Positioning System	全球定位系统
H		
HR	Half Rate	半速率
I		
IC	Integrated Circuit	集成电路
IMEI	International Mobile Equipment Identity	国际移动设备标识
ISO	International Standards Organization	国际标准化组织
ITU	International Telecommunications Union	国际电信联盟
L		
LCD	Liquid Crystal Display	液晶显示器
LED	Light Emitting Diode	发光二极管
M		
MCU	Machine Control Unit	机器控制单元
MMI	Man Machine Interface	人机交互接口/人机界面
MS	Mobile Station	移动台
MTBF	Mean Time Before Failure	平均故障间隔时间
P		
PCB	Printed Circuit Board	印刷电路板
PCL	Power Control Level	功率控制等级
PCS	Personal Communication System	个人通讯系统
PDU	Protocol Data Unit	协议数据单元
PLL	Phase Locked Loop	锁相环
PPP	Point-to-point protocol	点到点协议
R		
RAM	Random Access Memory	随机访问存储器
RF	Radio Frequency	无线频率
ROM	Read-only Memory	只读存储器
RMS	Root Mean Square	均方根
RTC	Real Time Clock	实时时钟
S		
SIM	Subscriber Identification Module	用户识别卡
SMS	Short Message Service	短消息服务
SMT	Surface Mount Technology	表面安装技术
SRAM	Static Random Access Memory	静态随机访问存储器
T		

TA	Terminal adapter	终端适配器
TDMA	Time Division Multiple Access	时分多址
TE	Terminal Equipment also referred it as DTE	终端设备，也指 DTE
U		
UART	Universal asynchronous receiver-transmitter	通用异步接收/发送器
UIM	User Identifier Management	用户身份管理
USB	Universal Serial Bus	通用串行总线
USIM	Universal Subscriber Identity Module	用户识别模块
V		
VSWR	Voltage Standing Wave Ratio	电压驻波比
Z		
ZTE	ZTE Corporation	中兴通讯股份有限公司

2 Interfaces

MG2639_V3 module connects externally through a 60PIN stamp-hole interface.

2.1 PIN Description

The pin deification of module MG2639_V3 is as follows:

Table 2–1 PIN Interface Definition

PIN	Signal Definition	Function	I/O (Whether can be used as GPIO)	Description	Remark
1	GND	Ground		Ground	
2	RF_ANT	RF	I/O	RF antenna plug	
3	GND	Ground		Ground	
4	RING	UART1	O,GPIO9	Ring signal indicator	When there is a call or sms, the voltage level of this pin is changed. 2.8V IO
5	GND	Ground		Ground	
6	VBAT	Power supply	I	Power supply	3.4~4.2V
7	RSSI_LED	LED	O, GPIO58	Network signal indicator interface	A LED need to be connected to this pin, and LED is on at high level. -Power on state: the LED is off; - Network searching state: the LED blinks at 3Hz - Idle state: the LED blinks at 1Hz -Traffic state (call, data): the LED blinks at 5Hz
8	URTS1	UART1	O,GPIO47	Ready to send	2.8V IO
9	UCTS1	UART1	I,GPIO48	Clear to send	2.8V IO
10	DCD1	UART1	O,GPIO15	Data carrier detect	2.8V IO
11	SIM_RST	SIM Card	O	SIM card reset	
12	SIM_CLK	SIM Card	O	SIM card clock	

PIN	Signal Definition	Function	I/O (Whether can be used as GPIO)	Description	Remark
13	SIM_DATA	SIM Card	I/O	SIM card data	
14	VSIM	SIM Card	O	Power supply for SIM card.	
15	GND	Ground		Ground	
16	GPS_ANT	GPS	I	GPS antenna	
17	GND	Ground		Ground	
18	V_GPS	GPS	I	GPS power supply	3.4V~4.2V
19	GPS_URXD	GPS	I	GPS serial interface	2.8V IO
20	GPS_UTXD	GPS	O	GPS serial interface	2.8V IO
21	VRTC	GPS RTC power supply	I	Connect button battery	2.0V~3.3V
22	GPS_FIXED_LED	GPS	NC	NC	Not connect
23	BATSNS	Charge Control	I	Battery voltage detection	2.8V IO, externally connect dynatron to drive the LED
24	ISENSE	Charge Control	I	Charge current detection	Need externally connect charging circuit
25	VCHG	Power supply	I	Charging power	4.3V~5V
26	CHR_LDO	Charge Control	O	Management of charge on/off	2.8V
27	GATDRV	Charge Control	O	Charging dynatron control	Need externally connect charging circuit
28	ADCIN	Analog input	I	ADC voltage detection	0~2.8V
29	URXD1/SPIMOSI	UART1/SPI	I, GPIO20	UART port data receiving, if not used, can be reused as SPI interface	2.8V IO
30	UTXD1/SPIMISO	UART1/SPI	O, GPIO21	UART port data sending, if not used, can be reused as SPI interface	2.8V IO
31	SYSRST_N	Reset	I	Resetting signal	Active low
32	EAR_L	Analog audio	O	Earpiece speaker anode	
33	RECP	Analog audio	O	Receiver speaker anode	

PIN	Signal Definition	Function	I/O (Whether can be used as GPIO)	Description	Remark
34	RECN	Analog audio	O	Receiver speaker cathode	
35	MIC_P1	Analog audio	I	Earpiece MIC anode	
36	MIC_P0	Analog audio	I	Receiver MIC anode	
37	MIC_N0	Analog audio	I	Receiver MIC cathode	
38	PWRKEY_N	Power-on/off	I	Module power-on/off control	Valid at low level; need external connect a open-collector or open-drain switch.
39	DTR1	UART1	I, GPIO5	Data terminal is ready	2.8V IO
40	DSR1	UART1	O, GPIO19	Data is ready	2.8V IO
41	VDDIO	LDO output	O	2.8V	
42	GND	Ground		Ground	
43	URXD2	UART2	I, GPIO22	Receiving data from serial port	2.8V IO
44	UTXD2	UART2	O, GPIO23	Transmitting data from serial port	2.8V IO
45	USB_DM	USB	I/O	USB differential data I/O, (-) side	
46	USB_DP	USB	I/O	USB differential data I/O, (+) side.	
47	LSDA0	LCD	O, GPIO38	LCD data signal data0	1.8V IO
48	LSCE0B0	LCD	O, GPIO40	LCD Enable signal	1.8V IO
49	LSRSTB	LCD	O, GPIO46	LCD Reset signal	1.8V IO
50	LSCK0	LCD	O, GPIO37	LCD interface clock signal	1.8V IO
51	LSDI0	LCD	I, GPIO39	LCD data signal data input	1.8V IO
52	LSA0DA0	LCD	O, GPIO36	LCD data signal data1	1.8V IO
53	SDA28/SPICS	I2C/SPI	I/O, GPIO2	I2C serial data, can be reused as SPI chip select	2.8V IO
54	SCL28/SPISCK	I2C/SPI	O, GPIO1	I2C serial clock, can be reused as SPI clock signal	2.8V IO

PIN	Signal Definition	Function	I/O (Whether can be used as GPIO)	Description	Remark
55	PWM/EARDET	PWM output	O, GPIO0	PWM output, if not use PWM, it can be used as headphones insert detection	2.8V IO
56	PCMRST	PCM Reset	O, GPIO56	Reset peripheral PCM set	2.8V IO
57	PCMOUT	PCM	O, GPIO54	PCM data output	2.8V IO
58	PCMCLK	PCM	O, GPIO50	PCM clock.	2.8V IO
59	PCMSYNC	PCM	O, GPIO55	PCM bytes synchronization .	2.8V IO
60	PCMIN	PCM	I, GPIO53	PCM data input	2.8V IO

2.2 Antenna Interface

Regarding the antenna of MG2639_V3 module, proper measures should be taken to reduce the access loss of effective bands, and good shielding should be established between external antenna and RF connector. Besides, external RF cables should be kept far away from all interference sources such as high-speed digital signal or switch power supply.

According to mobile station standard, stationary wave ratio (SWR) of antenna should be between1.1 to 1.5, and input impedance is 50 ohm. Different environments may have different requirements on the antenna's gain. Generally, the larger in-band gain and smaller out-band gain, the better performance the antenna has. Isolation among ports must more than 30dB when multi-ports antenna is used. For example, between two different polarized ports on dual-polarized antenna, two different frequency ports on dual-frequency antenna, or among four ports on dual-polarized dual-frequency antenna, the isolation should be more than 30dB.

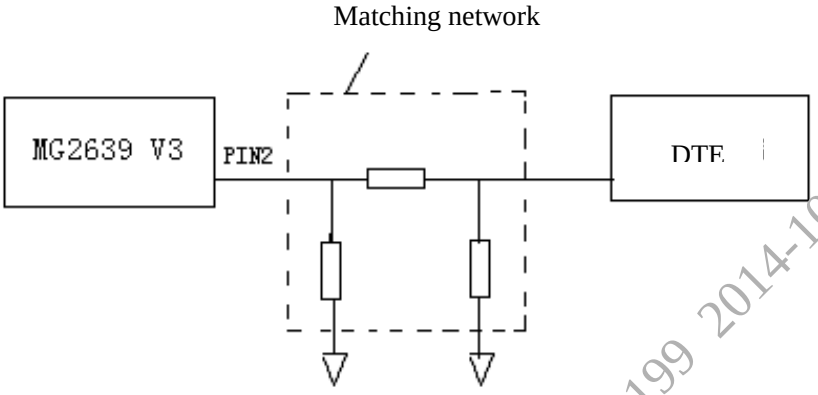
MG2639_V3 module provides both GSM and GPS antenna interface, and either interface provides both RF socket and stamp-hole connection method; therefore users can select reasonably according to the product form to optimize the cost of BOM.

- **Scheme 1:**

RF_ANT, GPS_ANT (PIN2, PIN16) are respectively used as the input pin for GSM and GPS antenna. when using these pin pads as the antenna feed pins, customers need pay attention to the following:

（1） The feed connected to PIN2 or PIN 16 is 50ohm micro-strip or strip line. To approach the module, put π shape matching network for later tuning. See π shape matching network in the diagram below:

Figure 2–1 π type model matching circuit



（2）The RF wires must be kept away from the GND, and generally the distance should be 3 times of the width of RF wires.

（3）It’s forbidden to put some interference sources such as DC to DC, WIFI module around RF wires or RF port.

- **Scheme 2:**

When using RF/GPS interface test console as antenna feed, PIN2/PIN16 should disconnect from the main board, and ensure that the surrounding area of PIN2/PIN16 is certain clearance. Keep 2mm distance between the surface of PIN2/PIN16 and GND, and drill holes below PIN2/PIN16. It’s not suggested to use the compatible design of PIN2/PIN16 at the same time when using the RF connector.

Proper measures should be taken to reduce the access loss of effective bands, and well shielding should be established between the external antenna and the RF connector. Besides, the external RF cables should be kept far away from all interference sources such as high-speed digital signal or switch power supply. Figure 2–3 is the dimensions of the RF connector .

Figure 2–2 Antennal Interface Diagram

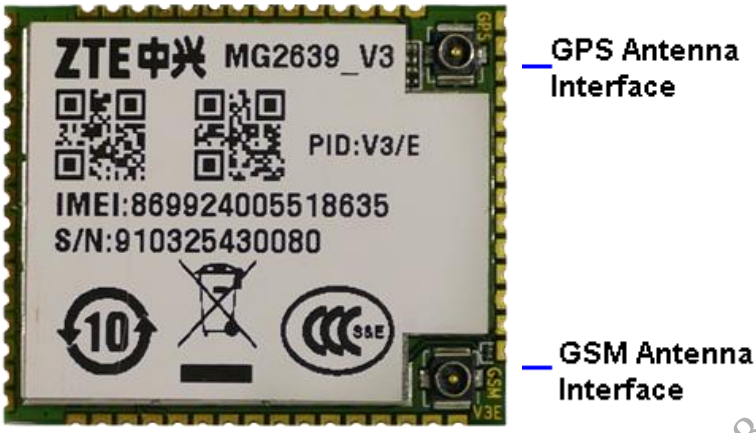
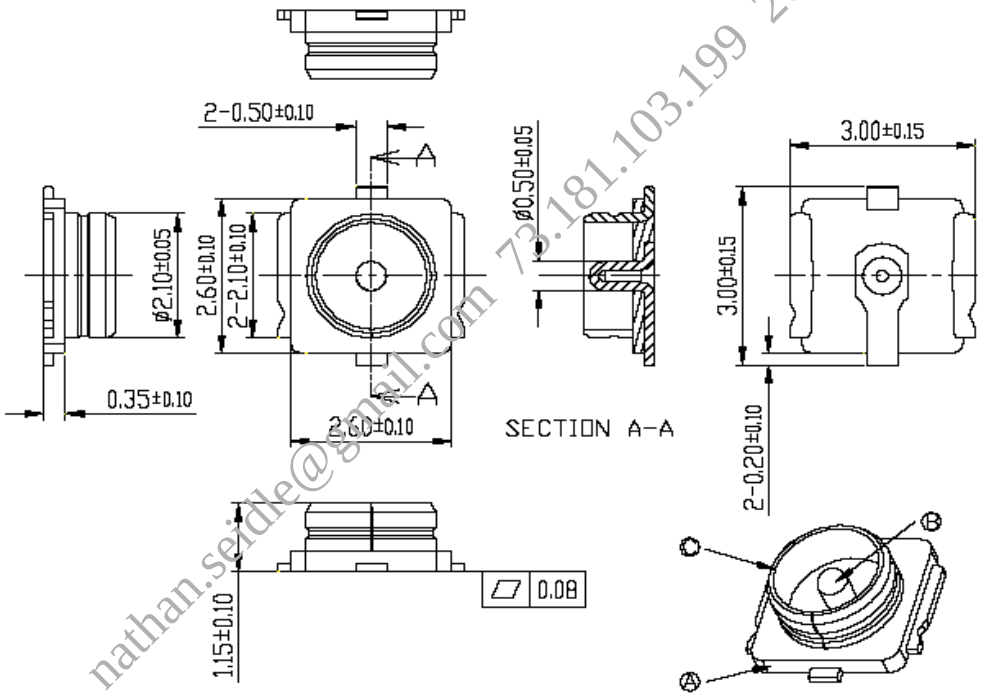


Figure 2–3 Dimensions of the RF connector (Unit：mm)



2.3 RF Performance of antenna interface

The RF performance of antenna interface is shown in Table 2-2:

Table 2–2 RF Performance of antenna interface

Working Frequency Band	Uplink Frequency Band （MS->BTS）	Downlink Frequency Band （BTS->MS）	Max. Transmitter Power（dBm）	Receiving sensitivity

GSM850	824MHz-849MHz	869MHz-894MHz	33±2	< -107dBm
EGSM900	880MHz-915MHz	925MHz-960MHz	33±2	< -107dBm
DCS1800	1710MHz-1785MHz	1805MHz-1880MHz	30±2	< -106dBm
PCS1900	1850MHz-1910MHz	1930MHz-1990MHz	30±2	< -106dBm

3 Electric Features

This chapter mainly describes the module's electrical characteristics, including the level, power consumption, reliability of module's interfaces.

3.1 Voltage level of Interfaces

It describes the MAX, MIN and typical value of the level of module's external interfaces.

3.1.1 Reset Interface

The reset PIN is pulled up to 2.8V（Vmax=2.9V，Vmin=2.7V，Typical=2.8V）through the resistance inside the module.

The SYSRST_N PIN is used to reset the module's main chipset. Pull down the SYSRST_N signal 500ms to reset the module.

3.1.2 UART Interface

MG2639_V3 module provides three serial interfaces. The UART1 supports 8-wire serial BUS interface (see signal definitions in table 4-3); while UART2 supports 2-wire serial interface only. The module can communicate externally and input the AT commands through the UART interface. The GPS UART is used for GPS information output.

Table 3–1 Definition and Description of UART Interface

Function	PIN	Definition	I/O	Signal Description	Remark
UART1	29	URXD1	I	Receiving data from serial port	2.8V IO
	30	UTXD1	O	Transmitting data from serial port	2.8V IO
UART2	43	URXD2	I	Receiving data from serial port	2.8V IO
	44	UTXD2	O	Transmitting data from serial port	2.8V IO
GPS UART	19	GPS_URXD	I	Receiving data from serial port	2.8V IO
	20	GPS_UTXD	O	Transmitting data from serial port	2.8V IO

3.1.3 I2C Interface

MG2639_V3 module provides one I2C BUS interface. SCL and SDA have been pulled up to 2.8V through 2.2K resistance inside the module, and it supports 7BIT/10BIT seeking and high-speed transmission mode.

Table 3–2 Definition and Description of I2C Interface

Function	PIN	Definition	I/O	Description	Remark
I2C	53	SDA	I/O	I2C data signal	2.8V IO
	54	SCL	O	I2C clock signal	2.8V IO

NOTE: The software doesn't support this interface in default. It require customization if the users of MG2639_V3 need this function.

3.1.4 SPI Interface

The module MG2639_V3 provides a SPI interface. The pin of SPICS, SPISCK can be reused as I2C interface, and SPIMOSI, SPIMISO can be reused as UART2 interface. When the users don't need the function of UART2 and I2C, the pins can be configured as SPI interface.

The definition of SPI interface signaling is defined as shown in Table below.

Table 3–3 Definition and Description of SPI Interface

Function	PIN	Definition	I/O	Description	Remark
SPI	53	SPICS	O	SPI chip select	2.8V IO
	54	SPISCK	O	SPI clock	2.8V IO
	29	SPIMOSI	I	SPI data input	2.8V IO
	30	SPIMISO	O	SPI data output	2.8V IO

NOTE: The software doesn't support this interface in default. It require customization if the users of MG2639_V3 need this function.

3.1.5 PCM Interface

MG2639_V3 module adopts its 56-60 PINs as the PCM interface, through which users can expand the audio DAC.

Table 3–4 Definition and Description of PCM Signal Group

Function	PIN	Definition	I/O	Description	Remark
PCM	56	PCMRST	O	Reset external PCM settings	2.8V IO
	57	PCMOUT	O	PCM data output	2.8V IO
	58	PCMCLK	O	PCM clock	2.8V IO
	59	PCMSYNC	O	PCM bytes SYNC	2.8V IO
	60	PCMIN	I	PCM data input	2.8V IO

NOTE: The software doesn't support this PCM function in default. It require customization if the users of MG2639_V3 need this function.

3.1.6 USB Interface

MG2639_V3 module integrates the USB interface and conforms to USB1.1 interface specifications. The module can connect the host through the interface and provide up to 12Mbps data rate. Users can upgrade the software via the interface.

Table 3–5 Definition and Description of USB Interface

Function	PIN	Definition	I/O	Description	Remark
USB	45	USB_DM	I/O	USB differential data I/O, (-) side	
	46	USB_DP	I/O	USB differential data I/O, (+) side.	

3.1.7 ADC Interface

MG2639 module's 28th pin can provide up to 98.1 KSPS sampling rate and 10BIT A/D conversion function.

Table 3–6 Definition and Description of ADC Interface

Function	PIN	Definition	I/O	Description	Remark
ADC	28	ADCIN	I	Analog input	0-2.8V。

NOTE: The software doesn't support this function in default. It require customization if the users of MG2639_V3 need this function.

3.1.8 PWM Interface

Table 3–7 Definition and Description of PWM Interface

Function	PIN	Definition	I/O	Description	Remark
PWM	55	PWM	O	Pulse width modulation output	2.8V IO

NOTE: The software doesn't support this function in default. It require customization if the users of MG2639_V3 need this function.

3.1.9 LCD Interface

MG2639 V3 module provides a serial LCD interface and supports the LCD device with serial communication. It supports up to 480*320 resolutions.

Table 3–8 Definition and Description of LCD Interface

Function	PIN	Definition	I/O	Description	Remark
LCD	47	LSDA0	O	LCD data signal data0	
	48	LSCE0B0	O	LCD Enable signal	
	49	LSRSTB	O	LCD Reset signal	
	50	LSCK0	O	LCD interface clock signal	
	51	LSD0	O	LCD data signal data input	
	52	LSA0DA0	O	LCD data signal data1	

NOTE: The software doesn't support this interface in default. It require customization if the users of MG2639_V3 need this function.

3.1.10 GPS/GLONASS/BD(Optional)

MG2639_V3 module's GPS function is completely independent from its wireless data communication. The GPS cell provides independent power input and PIN to output the GPS information through the serial port.

Table 3–9 Definition and Description of GPS/GLONASS/BD Interface

Function	PIN	Definition	I/O	Description	Remark
GPS	16	GPS_ANT	I	GPS antenna	

	18	V_GPS	I	GPS power supply	3.4-4.3V
	19	GPS_URXD	I	GPS serial interface	NMEA data format
	20	GPS_UTXD	O	GPS serial interface	NMEA data format
	21	VRTC	I	RTC Power supply	Can connect to the button battery
	22	GPS_FIXED _LED	NC	NC	NC

Table 3–10 Basic parameters of GPS

Frequency	C/N0 (-130Db)	Star Search Current	STANDBY mode Current(3.8V)	SLEEP mode Current (3.8V)	BACKUP mode Current (3.8V)
1575.42MHz	40	28mA	400uA	6mA	50uA

3.1.11 Charging Interface

The module MG2639 V3 provides the charging of Lithium battery through the designing of external circuit. The external circuit is shown as Figure 4-5.

Table 3–11 Definition and Description of Charging Interface

Function	PIN	Signal Definition	I/O	Signal Description	Remark
Charging	23	BATSNS	I	Charging Control	Battery voltage detection
	24	ISENSE	I	Charging Control	Charge current detection
	25	VCHG	I	Power supply	The main power supply by external adapter
	26	CHR_LDO	O	Charging Control	Management of charge on/off
	27	GATDRV	O	Charging Control	control charge transistor

NOTE: The software doesn't support this function in default. It require customization if the users of MG2639_V3 need this function.

3.1.12 SIM Card Interface

MG2639_V3 has SIM card interface complied with the standard of ISO 7816-3, and it supports SIM cards with two different standards: 1.8V and 3.0V.

Users should note that the SIM card's electrical interface should be defined exactly the same as the SIM card socket.

Table 3–12 Definition and Description of USIM Card Signal Group

Function	PIN	Definition	I/O	Description	Remark
SIM	14	VSIM	O	SIM card power	1.8V/3V, Maximum output current is 30 mA
	11	SIM_RST	O	SIM card reset signal	
	12	SIM_CLK	O	SIM card clock signal	
	13	SIM_DATA	I/O	SIM card DATA signal	

3.1.13 Audio Interface

MG2639_V3 module supports 2CH audio signal inputs/outputs. The two MIC inputs are internally capacitive coupled with the offset voltage, and directly connected to the receiver.

See the audio interface deification and circuit in Table below:

Table 3–13 Definition and Description of audio interface

Function	PIN	Definition	I/O	Description	Remark
AUDIO	37	MIC_N0	I	Receiver on the host	Differential audio input channel
	36	MIC_P0	I	Receiver on the host	
	35	MIC_P1	I	Receiver on the earpiece	Single-end audio input channel
	34	RECN	O	Speaker on the host	Differential audio output channel
	33	RECP	O	Speaker on the host	
	32	EAR_L	O	Speaker on the earpiece	Single-end audio output channel

3.1.14 LED Indicator Interface

A LED need to be connected to this pin, and the RSSI_LED is driven at high level.

---Power-on status: the LED turns off;

---Network searching status: the LED blinks at 3Hz;

---Idle status: the LED blinks at 1Hz;

---Traffic status (call, data): the LED blinks at 5Hz.

The output status of RSSI_LED PIN is defined according to the software protocol. The RSSI_LED PIN is a general I/O port with the output driving capability 4mA

3.2 Power Consumption

The power consumption of module MG2639_V3 is shown as the Table below:

Table 3–14 Power Consumption of MG2639_V3

State	Band	Received power	Min.	Average	Max.	Remark
Power off state				15uA		VBAT=4.0V
Sleep state				2mA		
Standby state				24 mA		
Call state	GSM850			240mA		
	EGSM900			240mA		
	GSM1800			180 mA		
	GSM1900			175 mA		
Network registration state				78mA		

3.3 Reliability Test

The reliability test of module includes the items as follows: High/low temperature operation, high/low temperature storage, thermal shock, alternating temperature humidity, etc. The test results must conform to the industrial requirements. Module testing environment of temperature is shown as the Table below.

Table 3–15 MG2639_V3 Module testing environment of temperature

Parameter	Working Condition	Min	Max	Remark
To	Operation temperature	-35℃	75℃	All the indexes are good
Ta	Limited temperature	-40℃	+85℃	Some indexes become poorer.
Ts	Storage temperature	-40℃	+85℃	Storage environment of MG2639_V3

3.4 ESD Characteristic

The measured ESD values of module at the normal temperature are shown as the following table.

Table 3–16 ESD Endurance

Test point	Test program	Test requirements	Result
Antenna Interface	Air discharge	±8 kV	Normal
	Contact discharge	±6 kV	Normal
SIM Interface	Air discharge	±8 kV	Normal
	Contact discharge	±6 kV	Normal

4 Reference Circuit of Module Interfaces

The chapter provides the reference design on the interface circuit according to the module's functions and describes the precautions.

4.1 Reset and Power Designing

Reference circuit of power supply and reset interface is shown as Figure 4-1. Select appropriate parameters according to the actual selected power supply since VD1 is TVS tube, and select CJ2305 from Changjiang Electronics or DMP2305U-7 from DIODES since VT1 is MOS tube. Refer to figure 4-2 for the design of power circuit. Select MIC29302 and adjust the output voltage through the adjustment of R5 and R6. Please refer to MIC29302's specification for detailed parameters design. Please note that the components in the figure are just for your reference. For details, please adjust according to the actual circuit.

Figure 4–1 Reference Circuit of Power Supply and Reset Interface

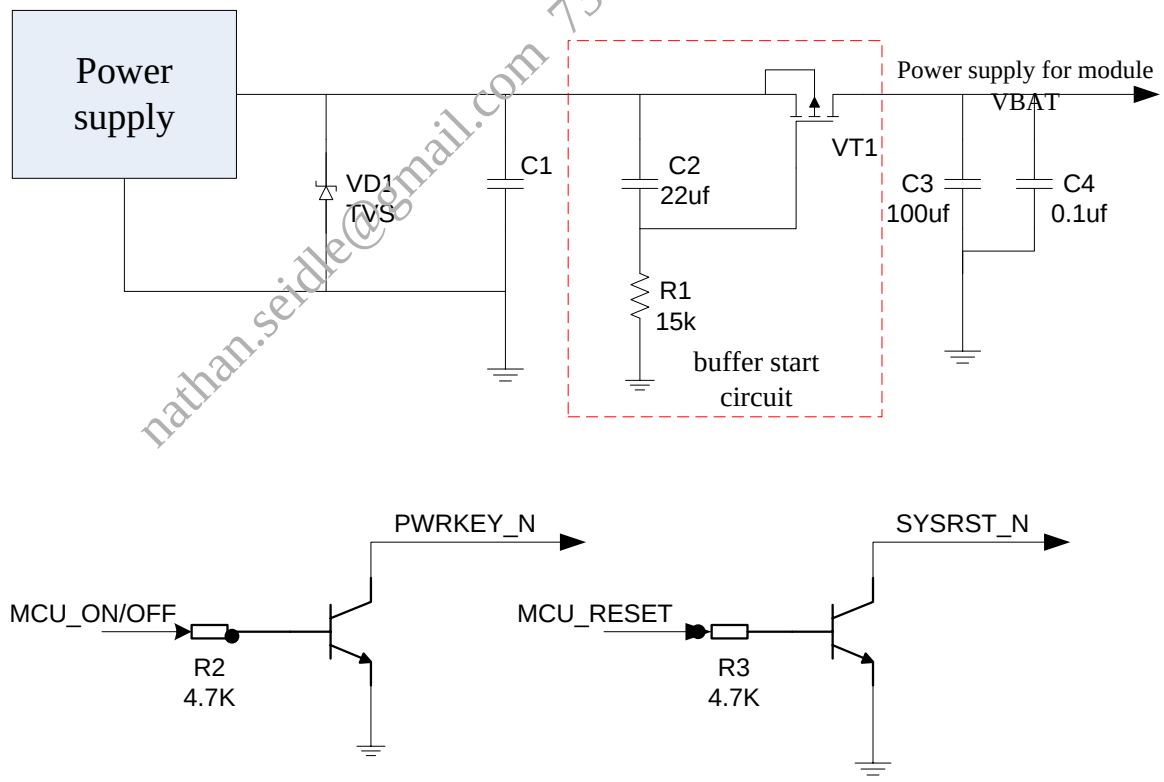
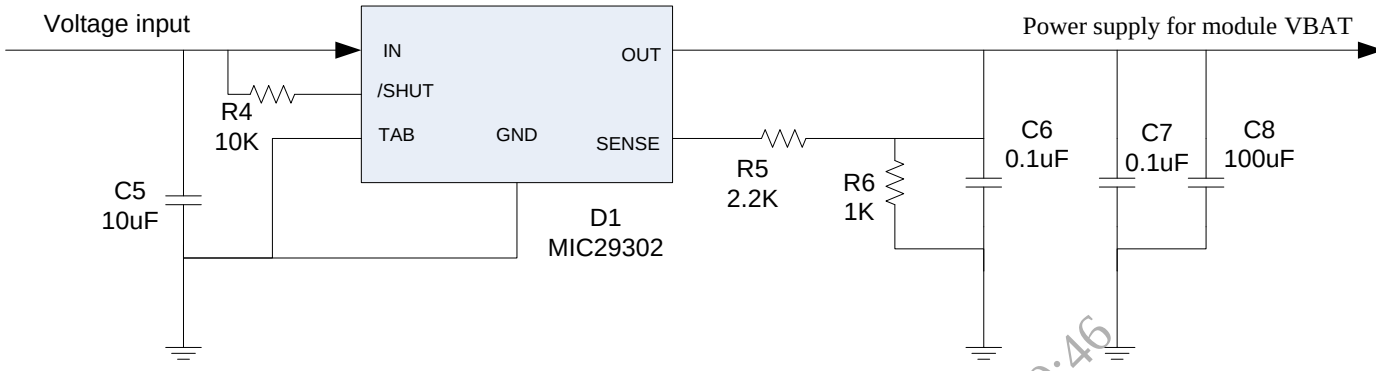


Figure 4–2 Reference Circuit of Power Supply Interface



- Power Designing

VBAT is the power supply pin of module MG2639_V3. If the starting of external power supply is unstable, it's recommended to add buffer circuit in the circuit. See the module's required voltage characteristics in Table 4-1:

Table 4–1 Working Condition

Type	Vmin	Typical	Vmax
Input Voltage	3.4V	3.8V	4.2V
Input Current	1mA	--	300mA (Depending on the condition of the network signal)

The module is very strict with the requirements on the power supply and grounding:

(1) The filtering must be performed on the power and grounding, and the power ripple must be controlled under 50Mv. Do not power any other part in the system because it might affect the RF performance.

(2) Select the power cables with at least 80mil traces during the layout and keep the integrality of ground line.

(3) Make sure the Max. instantaneous output current is larger than 2A if the Max. input current is very high.

- Power-on

The module is under power-off status after it's normally powered on. To turn on the module, provide a 2s-5s low level pulse to the PWRKEY_N PIN. If one 1K resistance is connected with the PWRKEY_N PIN, the module can be automatically powered on after connected to the power supply.

- Power-off

To turn off the module, use AT command “AT+ZPWROFF” or provide a 2s~5s low level pulse to the PWRKEY_N PIN.

- Reset

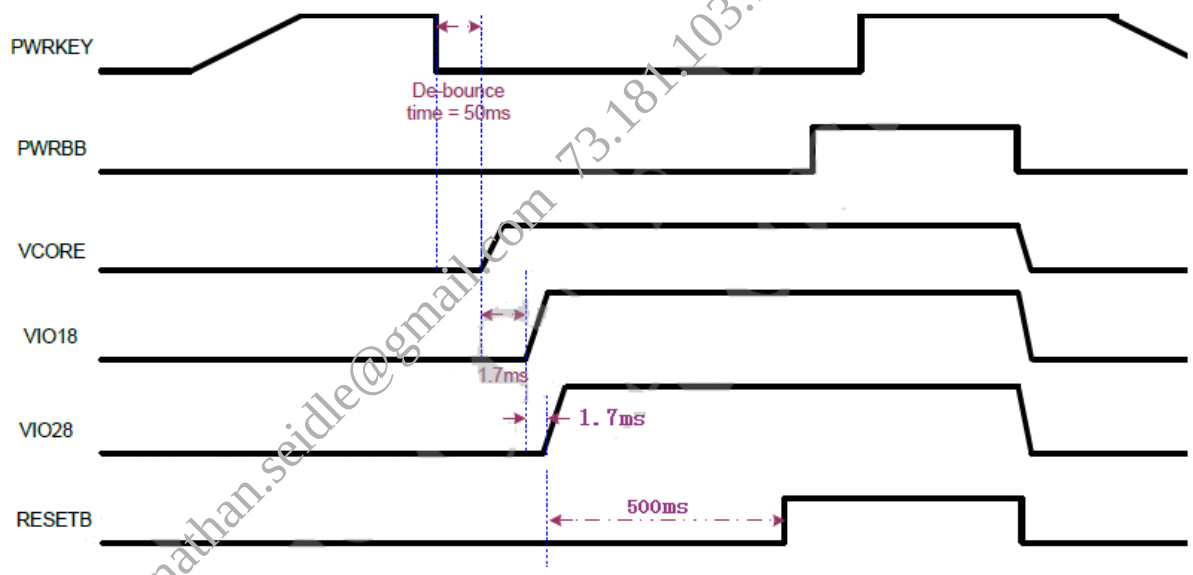
Use the above method to firstly “power-off” and then “power-on” to hard reset the module.

If the external reset function has to be used, provide a low level pulse lasting at least 500ms to the SYSRST_N PIN within 2 seconds after the module is turned on. Before that, the external MCU_RESET signal must be kept at low level. See the reset circuit design in figure 4-1.

Suspend the SYSRST_N PIN if not used.

See the module’s power-on/off time sequence in figure 4-3 below:

Figure 4–3 Power-on/off Sequence Chart of Module



- **VDDIO**

The module has one LDO voltage output pin, which can be used to supply external power to the main board. The voltage output is available only when the module is on. The normal output voltage is 2.8V, and users should absorb the current from this pin as little as possible (less than 10mA). Generally, it is recommended to use this pin to pull up the chipset PIN as per the requirements of level matching. Therefore, it’s not recommended to use this pin for other purposes.

- **Other Advice**

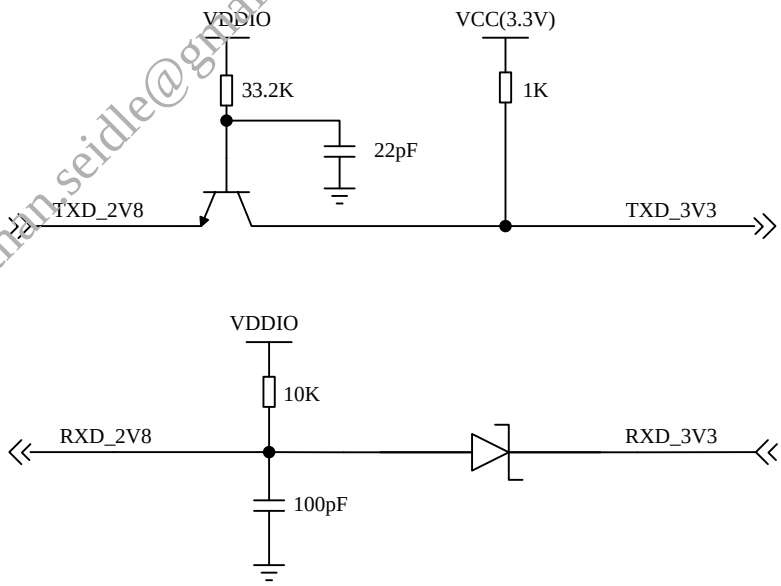
In order to make sure the data is saved safely, please do not cut off the power when the module is on. It's strongly recommended to use PWRKEY_N pin or AT command to turn off the module.

4.2 UART Interface

MG2639_V3 module provides an integrated full duplex UART1 interface (shortly referred to as UART interface) and an accessorial UART2 interface. The default baud rate is 115200bps and the external interface adopts 2.8V CMOS level signal, which conforms to RS-232 interface protocol. The UART1 interface could be used as serial interface for AT commands, data service. The UART2 interface can be used to debug the applications.

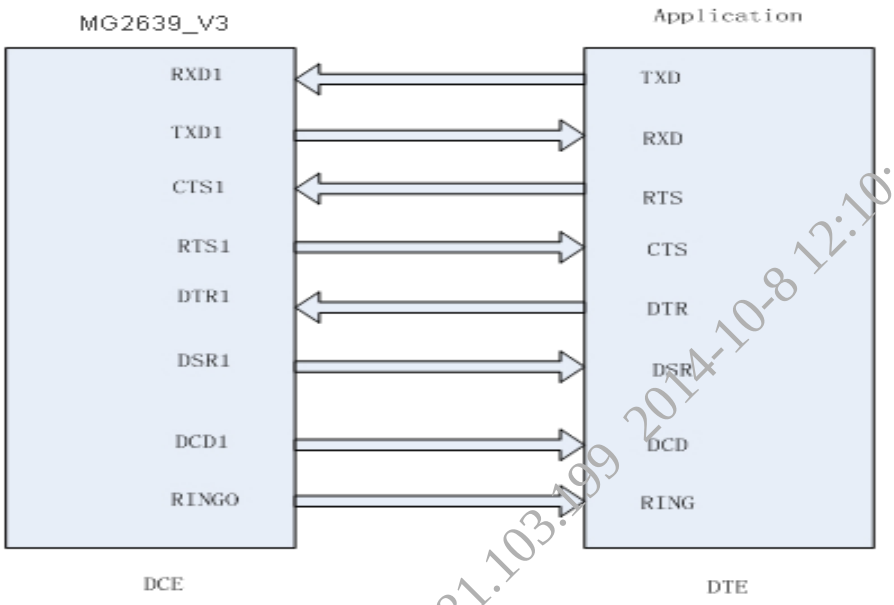
MG2639_V3 module's output I/O level is 2.8V, therefore it needs level conversion when connecting with standard 3.3V or 5V logic circuit（such as MCU or RS232 drive chip MAX3238）. The most common method is to use a dynatron to realize the level conversion. Figure 4-4 shows the level conversion to 3.3V through the UART interface of MG2639_V3. The resistance and capacitance in figure 4-4 are just for reference, and they need to be recalculated during the design. The diode in this Figure is Schottky diode (forward voltage drop is 0.3V). If you select other diodes, please select one with lower forward voltage drop to make sure RXD_2V8 is below the threshold when inputting low level.

Figure 4–4 Reference Circuit of UART Interface



4.2.1 UART1 Interface

Figure 4–5 UART1 Connection between DCE－DTE



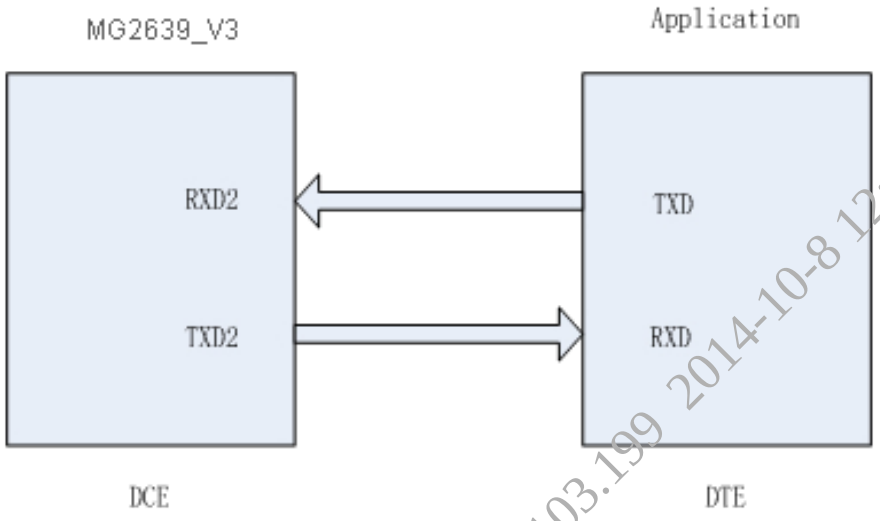
The UART1 interface definition is shown in Table 4-2 below:

Table 4–2 UART1 Interface Definition

Function	PIN	Definition	I/O	Description	Remark
UART	29	RXD1	I	Receiving data	DTE transmits serial data
	8	RTS1	O	Ready to send	DTE informs DCE to send
	30	TXD1	O	Transmitting data	DTE receives serial data
	39	DTR1	I	Data terminal ready	DTE is ready
	9	CTS1	I	Clear to send	DCE has switched to Rx. mode
	4	RING	O	Ringtone indication	Inform DTE upon a remote call
	40	DSR1	O	Data set ready	DCE is ready
	10	DCD1	O	Carrier detection	Data link connected

4.2.2 UART2 Interface

Figure 4–6 UART2 Connection between DCE－DTE



The UART2 interface definition is shown in Table 4-3 below:

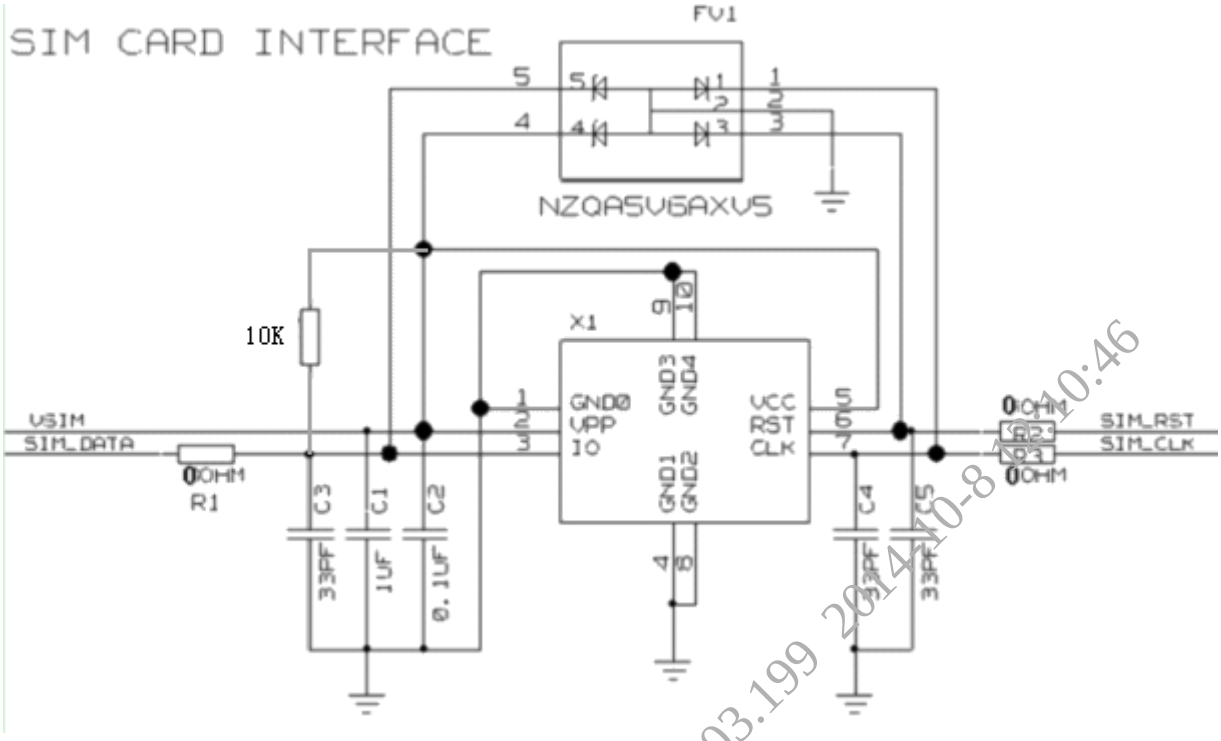
Table 4–3 UART2 Interface Deification

Function	PIN	Definition	I/O	Description	Remark
UART	43	RXD2	I	Receiving data	DTE transmits serial data
	44	TXD2	O	Transmitting data	DTE receives serial data

4.3 SIM Card Interface

Module MG2639_V3 supports two kinds of SIM card of 1.8V and 3V. The following Figure shows the reference design of the SIM card.

Figure 4–7 Reference Circuit of SIM Card Interface



Note:

(1) The SIM card PCB wiring should be laid closely around the module as much as possible.

(2) The VSIM, CLK, DATA and RST signals should be enveloped by the ground wires. The position of 33pF capacitance should be reserved on CLK, DATA and RST signals wiring and the position should be close to the SIM card socket to prevent the interference sources from affecting the SIM card's reading/writing.

(3) Since the ESD components are very close to the SIM card socket, it's recommended to add TVS components on 4-CH SIM card signals, meanwhile, the signal wires need go through TVS component before entering the module's baseband processor during the layout to avoid damaging the module.

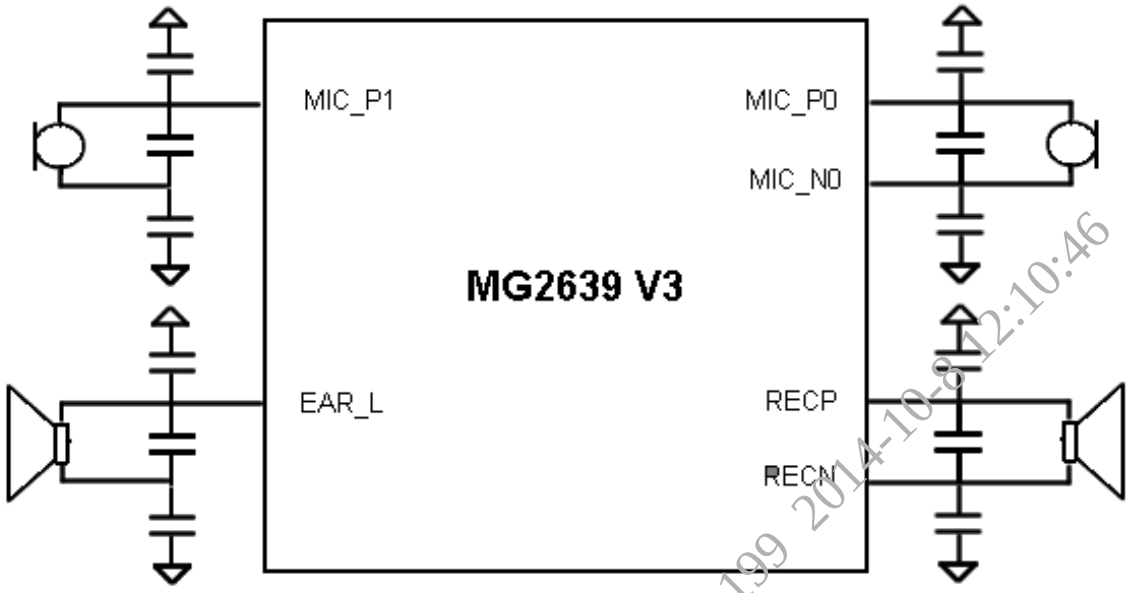
(4) The width of VSIM power wiring should be above 6mil at least (recommended to use 8mil).

(5) The filter capacitance of VSIM power wiring adopts 1uf (the value can't be larger than 10uf or smaller than 1uf), and then 0.1uf capacitance is added.

4.4 Audio Interface

The module MG2639_V3 provides audio input and output interfaces through its PINs. There are 2 Speaker interfaces and 2 Microphone interfaces. Only one pair I/O works at the same time. See the audio reference circuit in Figure below.

Figure 4–8 Reference Circuit of Audio Interface



- **Microphone**

The MIC_N0 & MIC_P0 are both differential interfaces, and they can also be used for single-ended input. It's recommended to use differential method to reduce the noises. The MIC2_P interface is used for single-ended input. Directly connect to the microphone since these two inputs are internally coupled and 1.9V offset voltage is generated.

- **Speaker**

The RECP & RECN are both differential interfaces with 32 ohm impedance, while the EAR_L is single-ended interface with 32 ohm impedance.

GSM/GPRS module audio interface is designed as below:

- **Design of audio interface on the receiver**

Select the microphone with the sensitivity lower than -51.5dB since and the max. gain inside MIC0 can reach 51.5dB. The voltage level of MIC_P0 is about 1.48V.

NOTE:
If other kind of audio input method is adopted, the input signal should be within 0.5V. If the signal voltage is lower than this value, then the pre-amplifier should be added. If the signal voltage is higher than this value, then attenuation network should be added

- **Design of audio interface on the earpiece**

Select the microphone with the sensitivity lower than -51.5dB since and the max. gain inside MIC1 reaches 51.5dB. The voltage level of MIC_P1 is about 1.73V.

Note: In order to achieve well voice effects, it's recommended that:

1）During the process of using MG2639_V3 module, it's advised to use 100pf & 33pf capacitance on its external audio path, and serially connect with the beads to improve the audio quality.

2）Connect TVS tube or pressure sensitive resistance on the audio path (approaching the module's interface) to prevent the ESD from damaging the module.

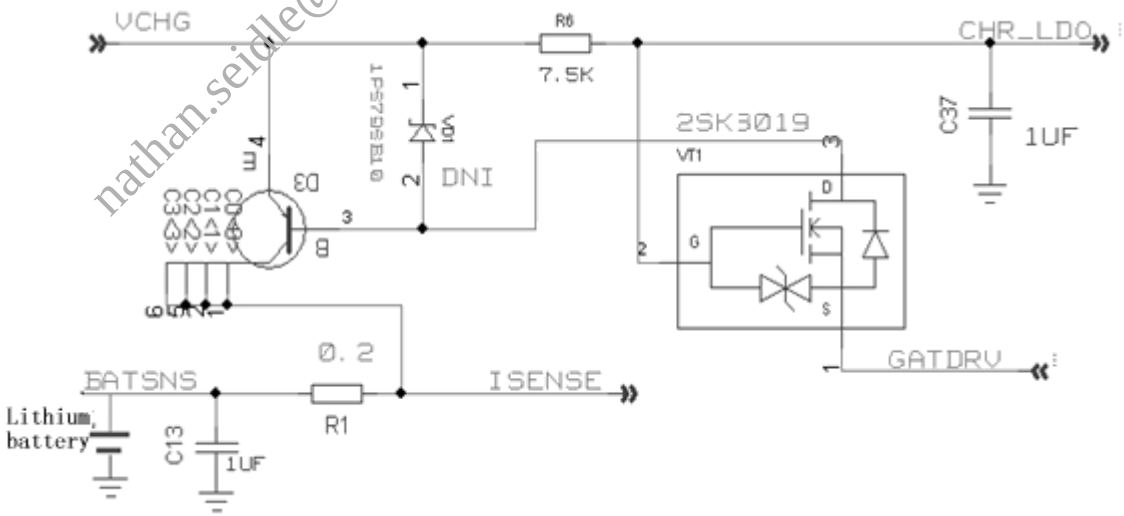
3）Make sure the use environment and module are well grounded and there is no mutual influence.

4）The power ripple supplied to the module is less than 50mV.

4.5 Charging Interface

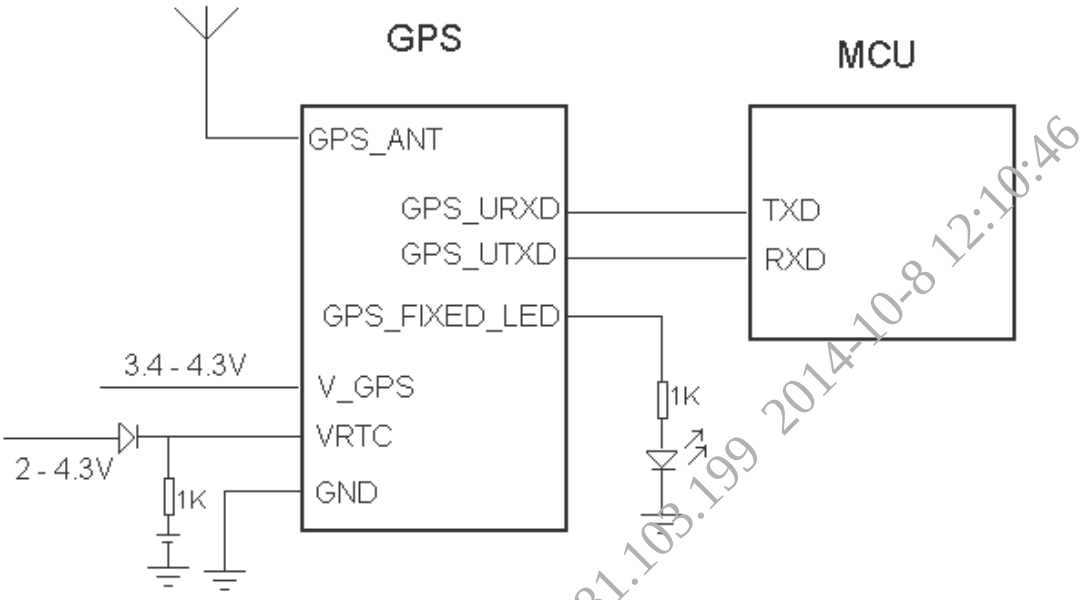
The PINs used for MG2639_V3 module's charging interface are 23-27 PINs. See the charging external connection in the figure below: D3 adopts CJ10P20DE6G or MBT35200MT1; VT1 adopts 2SK3019, NTA4001NT1 or SSM3K15FS; R1 is 0.2Ω current inspection resistance, which requires 1206 encapsulation.

Figure 4-9 Reference Circuit of Charging Interface



4.6 GPS Interface

Figure 4–10 Reference Circuit of GPS Interface

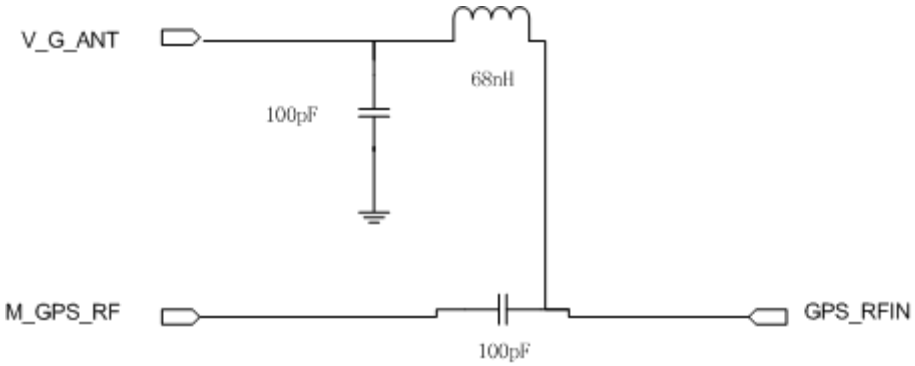


It's recommended to connect with GPS RF socket through a 50Ω RF cable. The good matching of antenna and module enables GPS to obtain better receiving sensitivity. V_GPS works as the PIN to supply 3.4-4.3V power to GPS; VRTC works as the PIN to supply 2-4.3V power to RTC; a button battery can also supply power to RTC. Keep power supplied by RTC can effectively shorten first positioning time as V_GPS powers up after power-down. If you don't ask too much of first positioning time as V_GPS powers up, you can directly connect VRTC to V_GPS power supply.

4.7 Connection Method of GPS Active Antenna

In the figure below, V_G_ANT works as the power supply of GPS antenna. Set V_G_ANT voltage according to the requirements of selected GPS active antenna, connect M_GPS_RF to GPS_ANT, and connect GPS_RFIN to GPS active antenna. The resistance of RF cable in the figure is 50Ω.

Figure 4-11 Active GPS antenna circuit reference design principle diagram



5 Mounting Process and Baking Guide

5.1 Recommended PAD Design and Requirements for main board

When using ZTE module, customers should refer to IPC-SM-782A and the following descriptions to design the main board's PAD.

5.1.1 Recommended PAD for main board

When designing the pad of main board, the following dimensions marked in the Figure below should be taken into consideration.

Figure 5–1 Module's dimensions

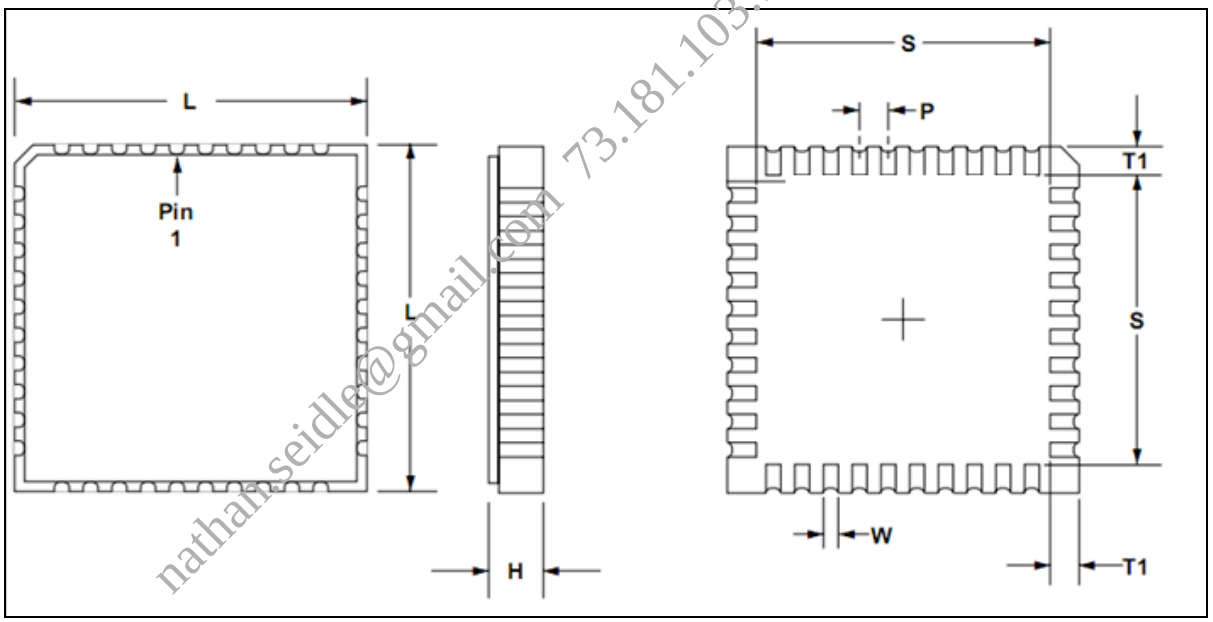


Figure 5–2 Recommended dimensions of corresponding main board

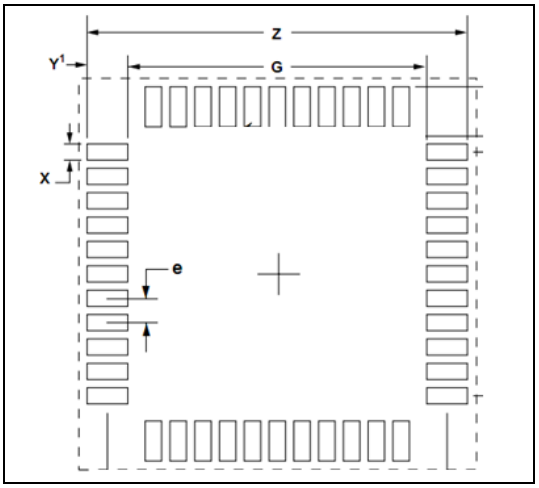
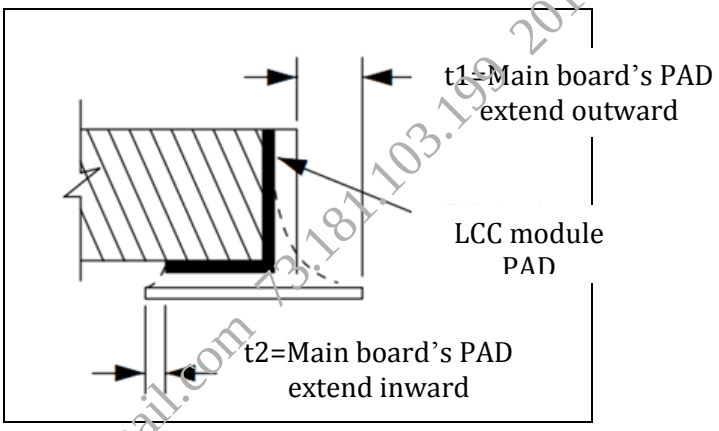


Figure 5–3 Module board's PAD mounted on main board



Refer to the recommended PAD dimensions of main board at client end in the table below:

Table 5–1 Recommended PAD dimensions of main board

Limited conditions of module board's dimensions	Main board's recommended PAD dimensions						
	Y1=T1+t1+t2			X	Z	G	e
	/	t1	t2				
When H<1mm, P-W<0.5mm	T1	H/2	0.05mm	W	L+2*t1	S-2*t2	P
When H<1mm P-W≥0.5mm		H/2	0.05mm	W(min) (W+0.2mm)(max)	L+2*t1	S-2*t2	P
When H≥1mm,and P-W<0.5mm		0.5mm	0.05mm(min) 0.1mm(max)	W	L+2*t1	S-2*t2	P

When H≥1mm,and P-W≥0.5mm		0.5mm	0.05mm(min) 0.1mm(max)	W(min) (W+0.2mm)(max)	L+2*t1	S-2*t2	P

5.1.2 Requirements of Module's Position on Main board

It is recommended that the thickness of green oil at the module's position on main board should be less than 0.02mm. Do not cover with white oil or cover white oil on the green oil layer to avoid excessive thickness. As the excessive thickness may cause the module cannot be effective contact with the solder paste thus affecting the quality of welding.

Figure 5–4 Green oil and white oil at module's position on main board

(The figure is just for your reference, it doesn't represent the actual module encapsulation)

In addition, do not lay out other components within 2mm around the module's position on main board to ensure the maintenance of the module.

5.2 Recommended SMT Process Parameters

5.2.1 Module Planeness Standard

ZTE module's planeness is required to be 0.15mm. Measurement method: put the module on the marble plane, use the feeler gage to measure the gap width at the position of maximum warp, and do not exert force on the module during the measurement.

5.2.2 Process Routing Selection

ZTE modules are manufactured with the lead-free process and meet the ROHS requirements, therefore it's recommended to follow the lead-free manufacturing process upon the selection of process routing for module board and main board.

5.2.3 Solder Paste Selection

The solder pastes with metal particle TYPE3 and TYPE4 can fulfill the welding requirements. It is accordingly recommended to use the no-clean solder paste. If the solder paste which needs cleaning is used, we cannot guarantee the components on the module board could withstand the washing of the cleaning solvents. This might cause the functional problems of such components and affect the appearance of the module. During the printing process, make sure the solder paste's thickness at the position of module's PAD is within 0.18mm -0.20mm.

5.2.4 Design of module PAD's steel mesh opening on main board

The thickness of the steel mesh on main board is selected according to the encapsulation type of components on the main board. Pay attention to the following requirements:

1） Make sure to design the module PAD on main board according to section 3.1.

2） The thickness of steel mesh is 0.15mm or 0.18mm, but the thickness at the position of module pad can be increased to 0.18~0.20mm or the thickness of steel mesh is directly 0.18mm~0.20mm on main board.

3） Requirements on the thickness of solder paste: control the thickness between 0.18mm and 0.20mm.

4） See the LCC module PAD's steel mesh opening in the following table:

Table 5–2 LCC module PAD's steel mesh opening

Module PAD GAP (G)=Center Distance (e)－PAD width (X)	Steel mesh opening

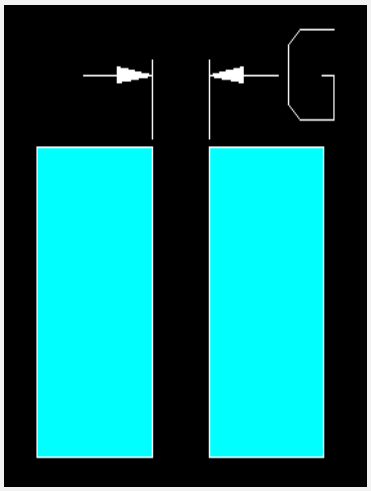
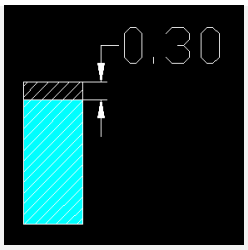
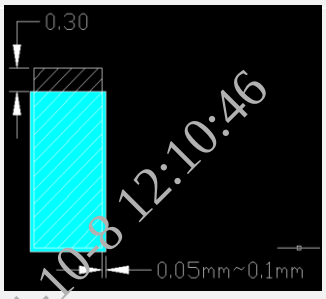
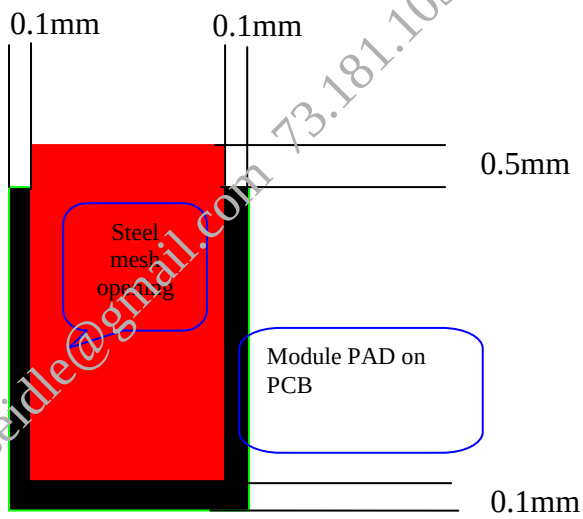
	G≥0.5mm	Drill holes at 100% scale in the direction of width; extend 0.3mm outward in the direction of length	
	G＜0.5mm	Contract 0.05mm~0.1mm in the direction of width; Contract 0.05mm~0.1mm inward in the direction of length, extend 0.5mm outward in the direction of length.	

Figure 5–5 Module Board's Steel Mesh Diagram



5.2.5 Module Board's SMT process

1) SMT Pallets:

The pallets, which are suitable for SMT, have been made for most ZTE modules. If the module has provided the pallets itself and meets the SMT requirements, customers can directly use it for module SMT.

Figure 5–6 ZTE Material Module Pallet

(The figure is just for reference)

Otherwise, customers need make a loading tool similar to the pallet. Customers can take out the module from the packaging box, put them into the pallet according to the sequence and direction, and then start SMT.

2） Mounting Pressure:

In order to ensure a good contact between the module and the solder paste on main board, the pressure of placing the module board on main board should be 2-5N according to our experiences. Different modules have different numbers of pads, therefore the pressure selected are different. Customers can select proper pressure based on their own situations to suppress the module paste as little as possible, in order to avoid the surface tension of the solder paste melts too much to drag the module during reflow.

5.2.6 Module Soldering Reflow Curve

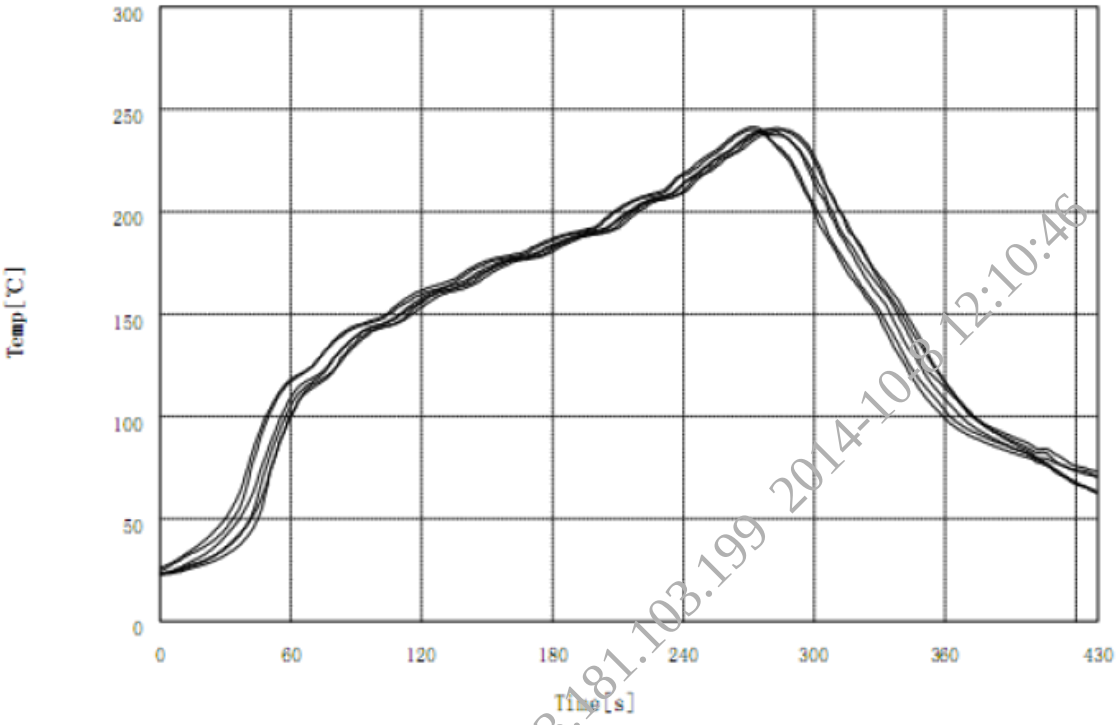
Module soldering furnace temperature curve is:

Table 5–3 Recommended SMT Furnace Temperature Settings for the Modules

Furnace Temperature Curve for the Lead-free Process		
Phase	Temperature	Time
Temperature Preservation	150°C to 200°C	60 to 120 seconds
Welding	> 217°C	30 to 60 seconds
	Peak temperature	Max: 245°C
		Min: 240°C

You can set furnace temperature parameters correctly as guided in Figure 5-1.

Figure 5–7 Reference of SMT Furnace Temperature Curve



5.2.7 Reflow Method

If the interface board used by customers is a double-sided board, it is recommended to mount the module board at the second time. In addition, it is preferable for the interface board to reflow on the mesh belt at the first mounting and the second mounting. If such failure is caused by any special reason, the fixture should be also used to reflow in order to avoid the deformation of PCB during the reflow process.

5.2.8 Maintenance of Returned Defects

If any poor welding occurs to the module board and the interface board, e.g., pseudo soldering of the module board and the interface board, the welder can directly use the soldering iron to repair welding according to the normal welding parameters of our company

5.3 Module Baking Environment

The operators must wear dust-free finger cots and anti-static wrist strap under the lead-free and good static-resistant environment.

See the following environment requirements.

During the process of transportation, storage and disposal, you must conform to the IPC/JEDEC J-STD-033 standard.

- Baking device and operation procedure

Baking device: any oven where the temperature can rise up to 125℃ or above.

Precautions regarding baking: during the baking process, the modules should be put in the high-temperature resistant pallet flatly and slightly to avoid the collisions and frictions between the modules. During the baking process, do not overlay the modules directly because it might cause damage to the module's chipset.

- Parameter Settings of Baking Devices

Baking temperature: 125℃ ±5℃

Baking duration: 8 hours

6 Mechanic Features

6.1 Appearance diagram

Figure 6–1 Top and bottom view of module MG2639_V3

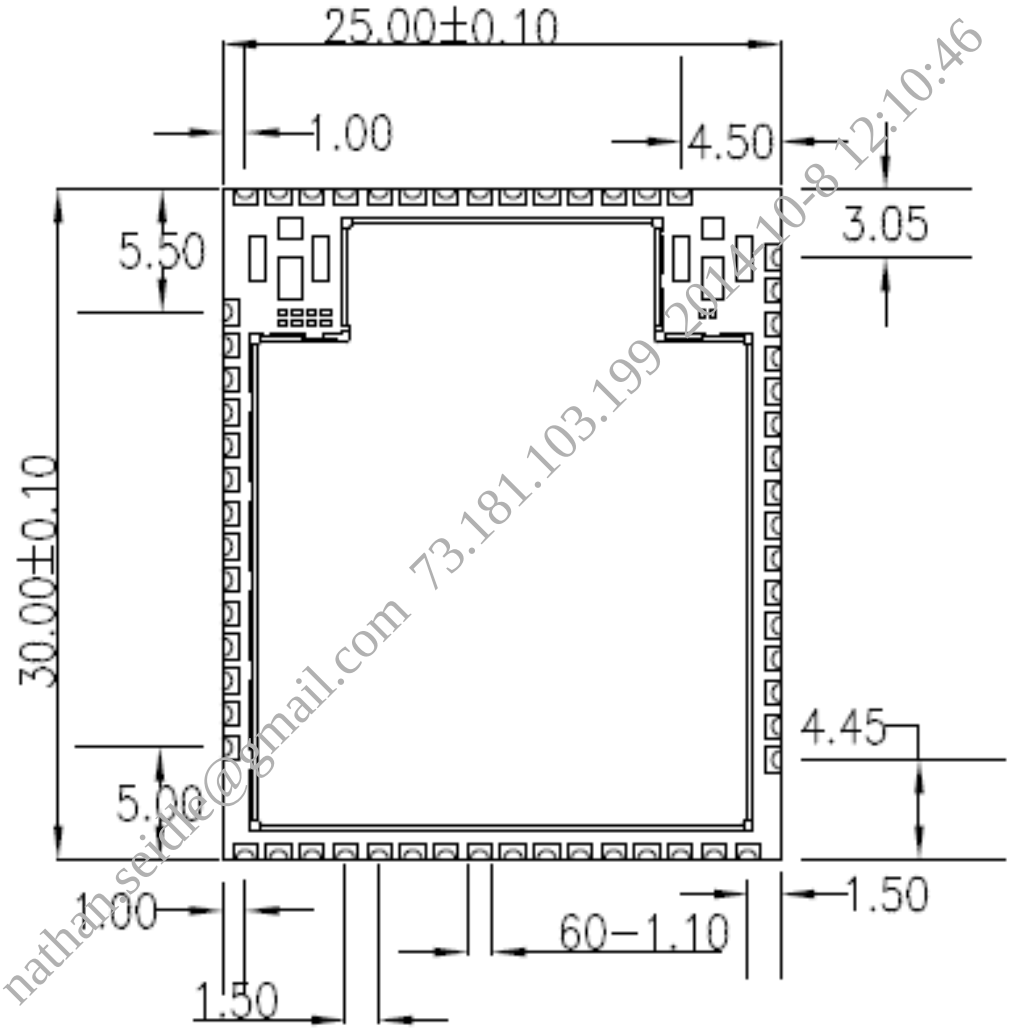
(The figure above is just for reference, please take the actual products as the reference)

- **Dimensions**（Length×Width×Thickness）： 30.0×25.0×2.68mm
- **Weight :** <6g

6.2 Dimensions

See the assembly diagram of MG2639_V3 module in Figure 6-2 (Unit: mm):

Figure 6–2 Module Dimensions



6.3 PCB Package Dimensions of module on main board

The PCB package dimensions of module on main board are shown in Figure 6-3 (Unit: mm):

Figure 6–3 The package size of module (Top view)

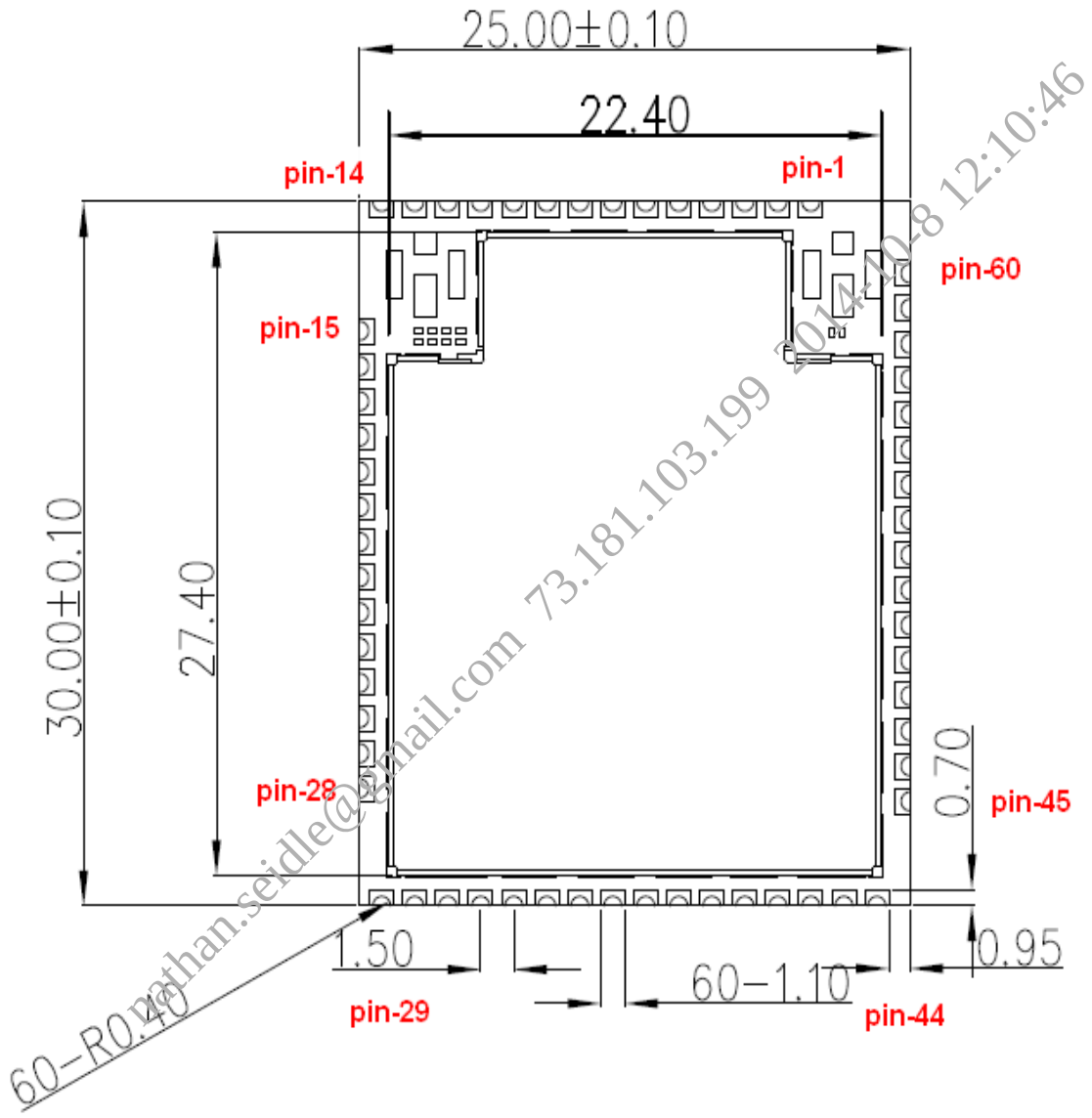
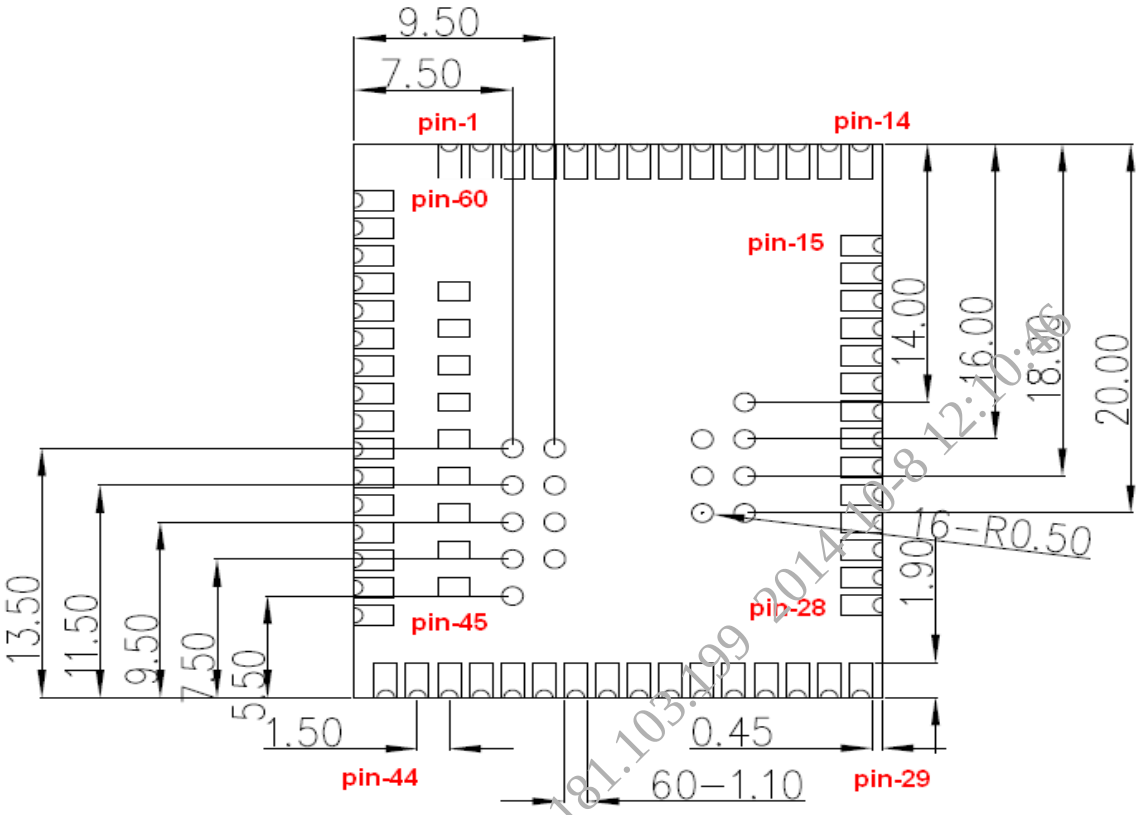


Figure 6–4 The package size of module (Bottom view)



6.4 PCB Designing

1）Enough Pad area must be reserved for the module's grounding pin to guarantee adequate grounding and avoid interference on the sensitivity.

2）Copper-clad and wiring are forbidden in the nearby areas of the RF stamp-hole.

3）For the convenience of testing and maintenance, it is recommended to drill holes on the PCB to expose JTAG test points.

4）The wiring between the SIM card socket and MCU should be as short as possible to prevent signals from being affected by long wiring, which might result in the failure of SIM card recognition.

7 Safety Information

The following safety precautions must be observed during all phases of the operation, such as usage, service or repair of any cellular terminal incorporating ZM5330 module. Manufacturers of the cellular terminal should send the following safety information to users, operating personnel and to incorporate these guidelines into all manuals supplied with the product.

The use of this product may be dangerous and has to be avoided in the following areas:

- Where it can interfere with other electronic devices in environments such as hospitals, aircrafts, airports, etc, switch off before boarding an aircraft. Make sure the cellular terminal is switched off in these areas. The operation of wireless appliances in the hospitals, aircrafts and airports are forbidden to prevent interference with communication systems.
- Areas with potentially explosive atmospheres including fuelling areas, below decks on boats, fuel or chemical transfer or storage facilities, areas where the air contains chemicals or particles such as gasoline stations, oil refineries, etc make sure that wireless devices are turned off.

It's the responsibility of users to enforce other country regulations and the specific environment regulations. And our company does not take on any liability for customer failure to comply with these precautions.

