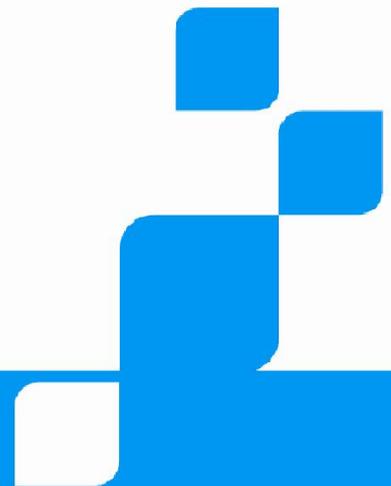


# **ZTE MG2639 Module Hardware Design User Manual**

**Version: V1.2**



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## Preface

### Summary

This document describes ZTE MG2639 module's product principle diagram, module's PINs, hardware interface and module's structure, and instructs the users to perform hardware design of modules, and quickly and conveniently design different kinds of wireless terminals on the basis of this module.

### Target Readers

This document mainly applies to the following engineers:

- System designing engineers
- Mechanical engineers
- Hardware engineers
- Software engineers
- Test engineers

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# 1 General description of module

Developed by ZTE Corporation, ZTE MG2639 is a kind of GSM850/EGSM900/DCS1800/PCS1900 industrial module, which can be built in the Set-Top-Box, vehicle-mounted terminals through a 60-PIN stamp-hole interface, and it allows users to send/receive Emails, browse the web pages and download at high speed anywhere and anytime.

In a place where the GSM network is covered, users can get access to the Internet any time, send/receive SMS and dial/answer voice calls, etc. In the field of mobile data communication, it provides a highly free and convenient solution to users and truly realizes the dream of mobile office.

This chapter mainly provides a general description of the module, including basic functions and logic block diagram.

## 1.1 Introduction of module's functions

See the functions of ZTE MG2639 module in table 1-1:

Table 1-1 Module's functions

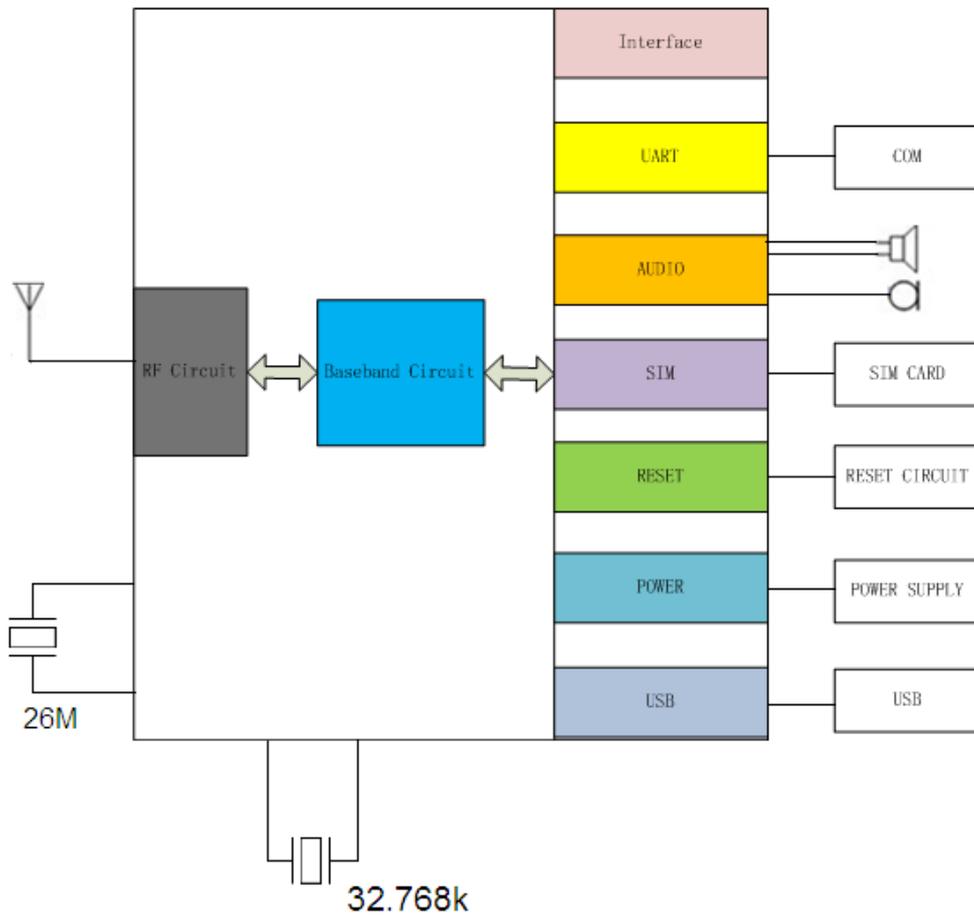
Parameters	ZTE MG2639
General Features	
Frequency bands	GSM850/EGSM900/DCS1800/PCS1900
Dimensions	30.0 × 25.0 x 3.0mm
Weight	7g
Operating temperature	-40°C~+80°C
Limited temperature range	-40°C~+80°C
Storage temperature	-40°C~+80°C
Performance	
Operating voltage	3.4V~4.2V Typical=: 3.8V
Standard power consumption	Standby current: 24mA@-75dBm
	Sleep current: 1mA
	Talk Current: 128mA@-75dBm Max. Current: 300mA@-104dBm
Max. TX power	GSM850/EGSM900: Class 4 (2W)
	DCS1800/PCS1900: Class 1 (1W)
Rx. signal sensitivity	<-106dBm
Interfaces	
Connector	60pin Stamp-hole interface

Parameters	ZTE MG2639
Antenna	SMT 50Ω antenna connector
Integrated Full Duplex UART	AT commands/Data transmission
SIM card socket level	1.8V/3.0V
Data service	
GPRS	Class 12
Mobile Station	Class B
Max Downlink	85.6kbps
Max Uplink	42.8kbps
Protocol	Internal TCP/IP & UDP protocol stack
	Embedded FTP
SMS	
	Support TEXT/PDU Mode
	Point-to-point MO/MT
	SMS Cell Broadcast
Voice call	
	Audio encoder HR/FR/EFR/AMR//
	Echo Cancellation/Volume Control/DTMF
AT Command Set	
	GSM 07.05/GSM 07.07/ZTE Proprietary AT Commands

## 1.2 Module's application block diagram

See the application block diagram of ZTE MG2639 in the following figure:

Figure 1-1 Module's application block diagram



### 1.3 Abbreviations

<b>A</b>		
<b>ADC</b>	Analog-Digital Converter	
<b>AFC</b>	Automatic Frequency Control	
<b>AGC</b>	Automatic Gain Control	
<b>ARFCN</b>	Absolute Radio Frequency Channel Number	
<b>ARP</b>	Antenna Reference Point	
<b>ASIC</b>	Application Specific Integrated Circuit	
<b>B</b>		
<b>BER</b>	Bit Error Rate	
<b>BTS</b>	Base Transceiver Station	
<b>C</b>		
<b>CDMA</b>	Code Division Multiple Access	
<b>CDG</b>	CDMA Development Group	
<b>CS</b>	Coding Scheme	
<b>CSD</b>	Circuit Switched Data	

<b>CPU</b>	Central Processing Unit	
<b>D</b>		
<b>DAI</b>	Digital Audio interface	
<b>DAC</b>	Digital-to-Analog Converter	
<b>DCE</b>	Data Communication Equipment	
<b>DSP</b>	Digital Signal Processor	
<b>DTE</b>	Data Terminal Equipment	
<b>DTMF</b>	Dual Tone Multi-Frequency	
<b>DTR</b>	Data Terminal Ready	
<b>E</b>		
<b>EDGE</b>	Enhanced Data Rate for GSM Evolution	
<b>EFR</b>	Enhanced Full Rate	
<b>EGSM</b>	Enhanced GSM	
<b>EMC</b>	Electromagnetic Compatibility	
<b>EMI</b>	Electro Magnetic Interference	
<b>ESD</b>	Electronic Static Discharge	
<b>ETS</b>	European Telecommunication Standard	
<b>F</b>		
<b>FDMA</b>	Frequency Division Multiple Access	
<b>FR</b>	Full Rate	
<b>G</b>		
<b>GPRS</b>	General Packet Radio Service	
<b>GSM</b>	Global Standard for Mobile Communications	
<b>GPS</b>	Global Positioning System	
<b>H</b>		
<b>HR</b>	Half Rate	
<b>I</b>		
<b>IC</b>	Integrated Circuit	
<b>IMEI</b>	International Mobile Equipment Identity	
<b>ISO</b>	International Standards Organization	
<b>ITU</b>	International Telecommunications Union	
<b>L</b>		
<b>LCD</b>	Liquid Crystal Display	
<b>LED</b>	Light Emitting Diode	
<b>M</b>		
<b>MCU</b>	Machine Control Unit	
<b>MMI</b>	Man Machine Interface	
<b>MS</b>	Mobile Station	
<b>MTBF</b>	Mean Time Before Failure	
<b>P</b>		
<b>PCB</b>	Printed Circuit Board	
<b>PCL</b>	Power Control Level	
<b>PCS</b>	Personal Communication System	
<b>PDU</b>	Protocol Data Unit	
<b>PLL</b>	Phase Locked Loop	
<b>PPP</b>	Point-to-point protocol	
<b>R</b>		
<b>RAM</b>	Random Access Memory	
<b>RF</b>	Radio Frequency	
<b>ROM</b>	Read-only Memory	

<b>RMS</b>	Root Mean Square	
<b>RTC</b>	Real Time Clock	
<b>S</b>		
<b>SIM</b>	Subscriber Identification Module	
<b>SMS</b>	Short Message Service	
<b>SMT</b>	Surface Mount Technology	
<b>SRAM</b>	Static Random Access Memory	
<b>T</b>		
<b>TA</b>	Terminal adapter	
<b>TDMA</b>	Time Division Multiple Access	
<b>TE</b>	Terminal Equipment also referred it as DTE	
<b>U</b>		
<b>UART</b>	Universal asynchronous receiver-transmitter	
<b>UIM</b>	User Identifier Management	
<b>USB</b>	Universal Serial Bus	
<b>USIM</b>	Universal Subscriber Identity Module	
<b>V</b>		
<b>VSWR</b>	Voltage Standing Wave Ratio	
<b>Z</b>		
<b>ZTE</b>	ZTE Corporation	

## 2 Descriptions of module's external interfaces

ZTE MG2639 module connects externally through a 60PIN stamp-hole interface.

### 2.1 Definitions of module's interfaces

See the definitions of ZTE MG2639 module's 60PIN stamp-hole interface in the following table:

Table 2-1 60pin stamp-hole definitions

PIN No.	PIN Name	Functions	Default signal direction, whether or not used for GPIO (X)	Descriptions	Remarks
1	GND	Ground		Ground	
2	RF_ANT	RF	I/O	RF antenna plug	
3	GND	Ground		Ground	
4	RING	UART1	Output, GPIO9	Ringer signal indication	The voltage varies upon an incoming call or receipt of text message. 2.8V IO
5	GND	Ground		Ground	
6	VBAT	Power	Input	Work voltage	3.4~4.2V
7	RSSI_LED	LED	Output, GPIO58	Network signal indication	--Need add dynatron to drive. The 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	Output, GPIO47	Ready to send	2.8V IO
9	UCTS1	UART1	Input, GPIO48	Clear to send	2.8V IO
10	DCD1	UART1	Output, GPIO15	Carrier detection	2.8V IO
11	SIM_RST	SIM card	Output	SIM card reset	
12	SIM_CLK	SIM card	Output	SIM card clock	
13	SIM_DATA	SIM card	I/O	SIM card data	
14	VSIM	SIM card	Output	SIM card voltage	
15	GND	Ground		Ground	

16	NC	NC			
17	GND	Ground		Ground	
18	NC	NC			
19	NC	NC			
20	NC	NC			
21	NC	NC			
22	NC	NC			
23	BATSNS	Charging control	Input	Battery voltage detection	Need externally connect charging circuit
24	ISENSE	Charging control	Input	Charging current detection	Need externally connect charging circuit
25	VCHG	Power	Input	Charging power	4.3V~5V
26	CHR_LDO	Charging control	Output	Charging ON/OFF	2.8V
27	GATDRV	Charging control	Output	Charging dynatron control	Need externally connect charging circuit
28	ADCIN	Analogue signal input	Input	ADC voltage detection	0~2.8V
29	URXD1/SPIM OSI	UART1/SPI	Input, GPIO20	Receiving data for serial port, UART1 can be used as SPI interface when not used	2.8V IO
30	UTXD1/SPIMI SO	UART1/SPI	Output, GPIO21	Port sending, UART1 can be used as SPI interface when not used	2.8V IO
31	SYSRST_N	Reset	Input	Reset signal	Valid at low level
32	EAR_L	Analogue audio	Output	Earpiece speaker anode	
33	RECP	Analogue audio	Output	Receiver speaker anode	
34	RECN	Analogue audio	Output	Receiver speaker cathode	
35	MIC_P1	Analogue audio	Input	Earpiece MIC anode	
36	MIC_P0	Analogue audio	Input	Receiver MIC anode	
37	MIC_N0	Analogue audio	Input	Receiver MIC cathode	
38	PWRKEY_N	Power key	Input	Power on/off	Valid at low level; need external connect a open-collector or open-drain switch.
39	DTR1	UART1	Input, GPIO5	Data terminal ready_WAKEUP	2.8V IO
40	DSR1	UART1	Output, GPIO19	Data set ready	2.8V IO
41	VDDIO	LDO output	Output	2.8V	
42	GND	Ground		Ground	

43	URXD2	UART2	Input, GPIO22	Receiving data from serial port	2.8V IO
44	UTXD2	UART2	Output, GPIO23	Transmitting data from serial port	2.8V IO
45	USB_DM	USB	I/O	USB data -	
46	USB_DP	USB	I/O	USB data +	
47	LSDA0	Serial LCD	Output, GPIO38	Serial LCD data cable data0	1.8V IO
48	LSCE0B0	Serial LCD	Output, GPIO40	Serial LCD enabled	1.8V IO
49	LSRSTB	Serial LCD	Output, GPIO46	Serial LCD reset	1.8V IO
50	LSCK0	Serial LCD	Output, GPIO37	Serial LCD clock cable	1.8V IO
51	LSDI0	Serial LCD	Input, GPIO39	Serial LCD data cable input	1.8V IO
52	LSA0DA0	Serial LCD	Output, GPIO36	Serial LCD data cable1	1.8V IO
53	SDA28/SPICS	I2C/SPI	I/O, GPIO2	I2C data cable, also used for SPI chip select	2.8V IO
54	SCL28/SPISCK	I2C/SPI	Output, GPIO1	I2C clock cable, also used for SPI clock;	2.8V IO
55	PWM/EARDET	PWM output	Output, GPIO0	PWM output, PWM can be used as earpiece insert detection when not used	2.8V IO
56	PCMRST	PCM reset	Output, GPIO56	Reset external PCM settings	2.8V IO
57	PCMOUT	PCM	Output, GPIO54	PCM data output	2.8V IO
58	PCMCLK	PCM	Output, GPIO50	PCM clock	2.8V IO
59	PCMSYNC	PCM	Output, GPIO55	PCM bytes SYNC	2.8V IO
60	PCMIN	PCM	Input, GPIO53	PCM data input	2.8V IO

## 2.2 Antenna Interface

Regarding the antenna of ZTE MG2639 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 the standard for mobile devices, the stationary wave ratio of ZTE MG2639 module's antenna should be between 1.1 and 1.5, and input impedance is 50 ohm. Different environments may have different requirements on the antenna's gain. Generally, the larger gain in the band and smaller outside the band, the better performance the antenna has.

Isolation degree 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, isolation degree should be more than 30dB.

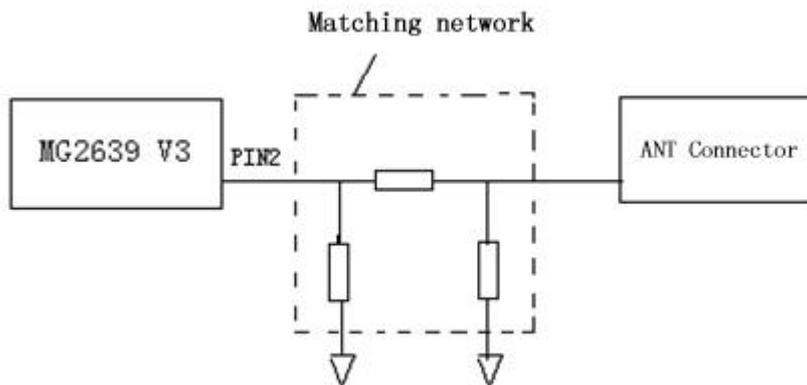
ZTE MG2639 module provides both GSM, and either interface provides both RF socket and stamp-hole connection method; therefore users can select reasonably according to the product form to optimize the cost of BOM.

#### Scenario 1:

PIN2 and PIN16 are respectively used as the input pin for GSM. Pay attention to the following when using it as the antenna's feed PIN:

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

Figure 2-1  $\pi$  shape matching network diagram



- (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.

Scenario 2:

When using GSM RF socket as the antenna feed, disconnect PIN2 from the main board and make sure there are some empty areas below or around PIN2. Keep 2mm distance between the surface of PIN2 and GND, and drill holes below PIN2. It's not suggested to use the compatible design of PIN2 at the same time when using the RF connector.

Figure 2-2 Antenna interface diagram

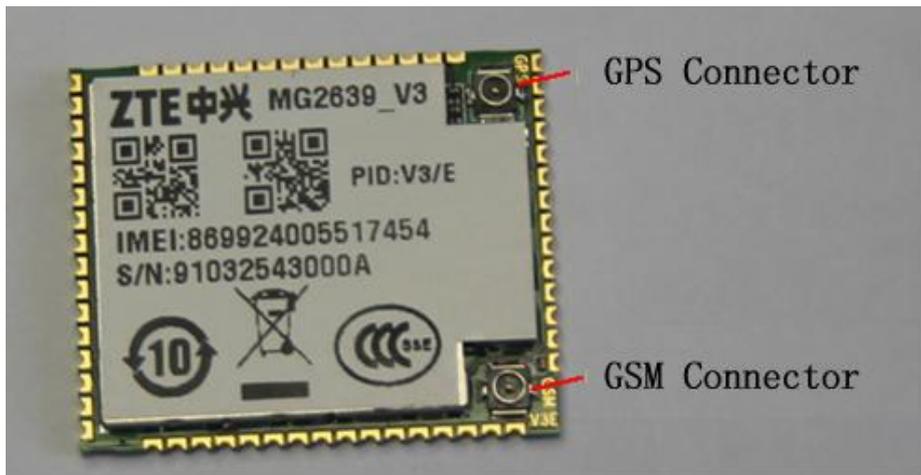
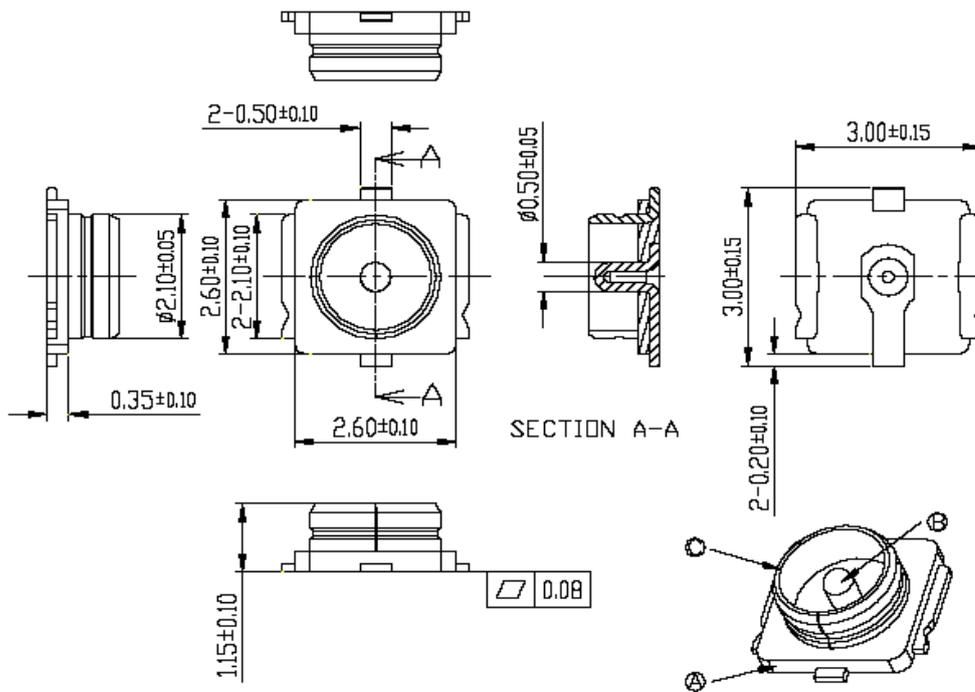


Figure 2-3 RF test socket dimensions



## 2.3 Antenna interface's RF performance

See the antenna interface's RF performance in table 2-2:

Table 2-2 Antenna interface's RF performance

Antenna interface's RF performance	Module's uplink (MS->BTS)	Module's downlink (BTS->MS)	Max. Tx. Power (dBm)	Antenna interface's Rx. sensitivity
GSM850	824MHz-849MHz	869MHz-894MHz	33±2	< -107dBm
EGSM900	880MHz-915MHz	925MHz-960MHz	33±2	< -107dBm
DCS1800	1710MHz-1785MHz	1805MHz-1880MHz	29±2	< -106dBm
PCS1900	1850MHz-1910MHz	1930MHz-1990MHz	29±2	< -106dBm

## 2.4 Antenna

It is recommended to use an external antenna 50 ohm impedance or sucker rod antenna, the antenna gain requirement in -5 dbi to 5 dbi, generally requires the use of -5 dbi antenna.

Antenna installation using distance away from the human body must keep a distance of more than 20 cm, in case of electromagnetic radiation.

## 3 Module's electrical characteristics

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

### 3.1 Descriptions of levels of interface signals

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

#### 3.1.1 Reset

The reset PIN is pulled up to 2.8V ( $V_{max}=2.9V$ ,  $V_{min}=2.7V$ , 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

ZTE MG2639 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.

Table 3-1 UART interface signal definitions

Classification	No.	Definitions	I/O	Description	Remarks
UART1	29	URXD1	Output	Receiving data from serial port	2.8V IO
	30	UTXD1	Input	Transmitting data from serial port	2.8V IO
UART2	43	URXD2	Output	Receiving data from serial port	2.8V IO
	44	UTXD2	Input	Transmitting data from serial port	2.8V IO

#### 3.1.3 I2C

ZTE MG2639 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 I2C interface signal definitions

Classification	No.	Definitions	I/O	Description	Remarks
----------------	-----	-------------	-----	-------------	---------

I2C	53	SDA	I/O	I2C data cable	2.8V IO
	54	SCL	Output	I2C clock cable	2.8V IO

**Note: the software doesn't support this interface by default, therefore it requires customization.**

### 3.1.4 SPI

ZTE MG2639 module provides one SPI BUS interface, SPICS & SPISCK signal multiplex with the I2C interface, while SPIMOSI & SPIMISO signals multiplex with the UART interface. When UART2 and I2C function are not used, it can be configured as the SPI interface.

Table 3-3 SPI Interface signal definitions

Classification	No.	Definitions	I/O	Description	Remarks
SPI	53	SPICS	Output	SPI chip select	2.8V IO
	54	SPISCK	Output	SPI clock	2.8V IO
	29	SPIMOSI	Input	SPI data input	2.8V IO
	30	SPIMISO	Output	SPI data output	2.8V IO

**Note: the software doesn't support this interface by default, therefore it requires customization.**

### 3.1.5 PCM

ZTE MG2639 module adopts its 56-60 PINs as the PCM interface, through which users can expand the audio DAC.

Table 3-4 PCM interface signal definitions

Classification	No.	Definitions	I/O	Description	Remarks
PCM	56	PCMRST	Output	Reset external PCM settings	2.8V IO
	57	PCMOUT	Output	PCM data output	2.8V IO
	58	PCMCLK	Output	PCM clock	2.8V IO
	59	PCMSYNC	Output	PCM bytes SYNC	2.8V IO
	60	PCMIN	Input	PCM data input	2.8V IO

**Note: the software doesn't support this interface by default, therefore it requires customization.**

### 3.1.6 USB

ZTE MG2639 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 USB interface signal definitions

Classification	No.	Definitions	I/O	Description	Remarks
USB	45	USB_DM	I/O	USB data -	
	46	USB_DP	I/O	USB data +	

### 3.1.7 ADC

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

Table 3-6 ADC interface signal definitions

Classification	No.	Definitions	I/O	Description	Remarks
ADC	28	ADCIN	Input	Analogue signal input	0-2.8V

*Note: the software doesn't support this interface by default, therefore it requires customization.*

### 3.1.8 PWM

Table 3-7 PWM interface signal definitions

Classification	No.	Definitions	I/O	Description	Remarks
PWM	55	PWM	output	Pulse width modulation output	2.8V IO

*Note: the software doesn't support this interface by default, therefore it requires customization.*

### 3.1.9 LCD

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

Table 3-8 LCD interface signal definitions

Classification	No.	Definitions	I/O	Description	Remarks
LCD	47	LSDA0	Output	Serial LCD data cable data0	
	48	LSCE0B0	Output	Serial LCD enabled	
	49	LSRSTB	Output	Serial LCD reset	
	50	LSCK0	Output	Serial LCD clock cable	
	51	LSDI0	Output	Serial LCD data cable input	
	52	LSA0DA0	Output	Serial LCD data cable data1	

**Note: the software doesn't support this interface by default, therefore it requires customization.**

### 3.1.10 Charging

ZTE MG2639 module provides the charging of Li battery through the design of external circuits.

See section 4.5 for external reference design.

Table 3-11 Charging interface signal definitions

Classification	No.	Definitions	I/O	Description	Remarks
Charging	23	BATSNS	Input	Charging control	Battery voltage detection
	24	ISENSE	Input	Charging control	Battery current detection
	25	VCHG	Input	Power	Charging power supply
	26	CHR_LDO	Output	Charging control	Charging on/off
	27	GATDRV	Output	Charging control	Charging dynatron control

**Note: the software doesn't support this interface by default, therefore it requires customization.**

### 3.1.11 SIM card interface

ZTE MG2639 module supports the SIM card interface conforming to ISO 7816-3 standard, 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 SIM card interface signal definitions

Classification	No.	Definitions	I/O	Description	Remarks
----------------	-----	-------------	-----	-------------	---------

SIM	14	VSIM	Output	SIM card voltage	1.8V/3V, Max. output current 30 mA
	11	SIM_RST	Output	SIM card reset	
	12	SIM_CLK	Output	SIM card clock	
	13	SIM_DATA	I/O	SIM card data	

### 3.1.12 Audio interface

ZTE MG2639 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 signals in the table 3-2:

Table 3-13 Audio interface signal definitions

Classification	No.	Definition	I/O	Description	Remarks
AUDIO	37	MIC_N0	Input	Receiver on the host	Differential input
	36	MIC_P0	Input	Receiver on the host	
	35	MIC_P1	Input	Receiver on the earpiece	Differential input
	34	RECN	Output	Speaker on the host	Differential output
	33	RECP	Output	Speaker on the host	
	32	EAR_L	Output	Speaker on the earpiece	Single-ended output

### 3.1.13 Network signal indication

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 Module's power consumption

It describes the module's power consumption under each status:

Table 3-14 ZTE MG2639 (GPRS) power consumption

Status	Frequency	Rx. power	Min.	Average	Max.	Remarks
Power-off				15uA		VBAT=4.0V
Sleep				2mA		
Standby				24 mA		
Call	GSM850			240mA		
	EGSM900			240mA		

	GSM1800			180 mA		
	GSM1900			175 mA		
Network searching				78mA		

### 3.3 Reliability characteristics

The module’s reliability testing items include: High/low temperature operation, high/low temperature storage, thermal shock, alternating temperature humidity, etc. The test results must conform to the industrial requirements. See the module’s working temperature in the table below:

Table 3-15 ZTE MG2639 module’s temperature characteristics

Parameters	Descriptions	Min.	Max.	Remarks
To	Operation temperature	-30℃	70℃	
Ta	Limited temperature	-35℃	+75℃	Make sure not to compromise the RF performance apparently
Ts	Storage temperature	-35℃	+75℃	

### 3.4 ESD characteristics

See the ESD characteristics at room temperature.

Table 3-16 ESD characteristics

Interface	Testing items	Testing requirements	Performance
Antenna interface	Air discharge	±8 kV	Nothing unusual
	Contact discharge	±6 kV	Nothing unusual
SIM card interface	Air discharge	±8 kV	Nothing unusual
	Contact discharge	±6 kV	Nothing unusual

## 4 Interface circuit design

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 design

See the reference design principle of power and reset circuit in 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 Power & reset circuit reference design principle diagram

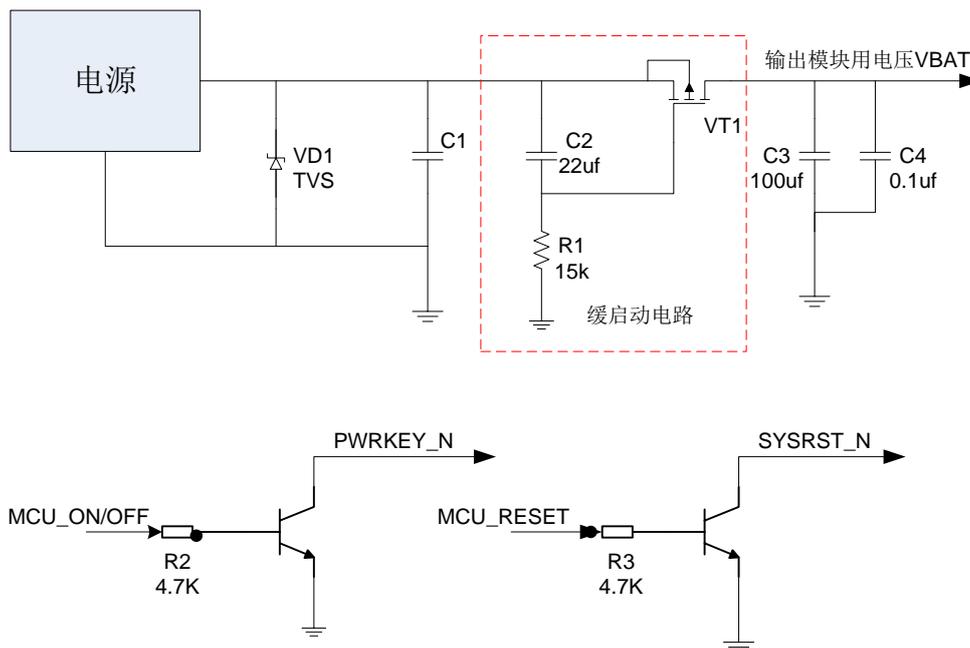
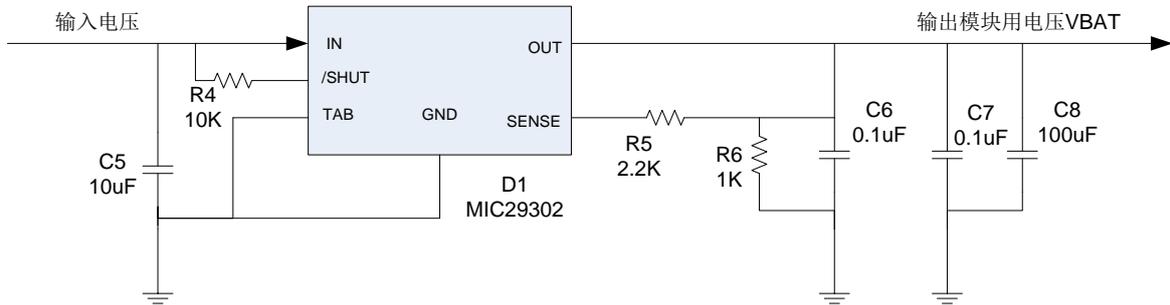


Figure 4-2 Power reference circuit



- Power design

ZTE MG2639 module is powered by VBAT. If the external power cannot be stably started, it's recommended to add buffer circuit in the circuit. See the module's required voltage characteristics in table 4-1.

Table 4-1 Voltage characteristics

Classification	Vmin	Typical	Vmax
Input voltage	3.4V	3.8V	4.2V
Input current	1mA	--	300mA (Depends on 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 integrity 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.

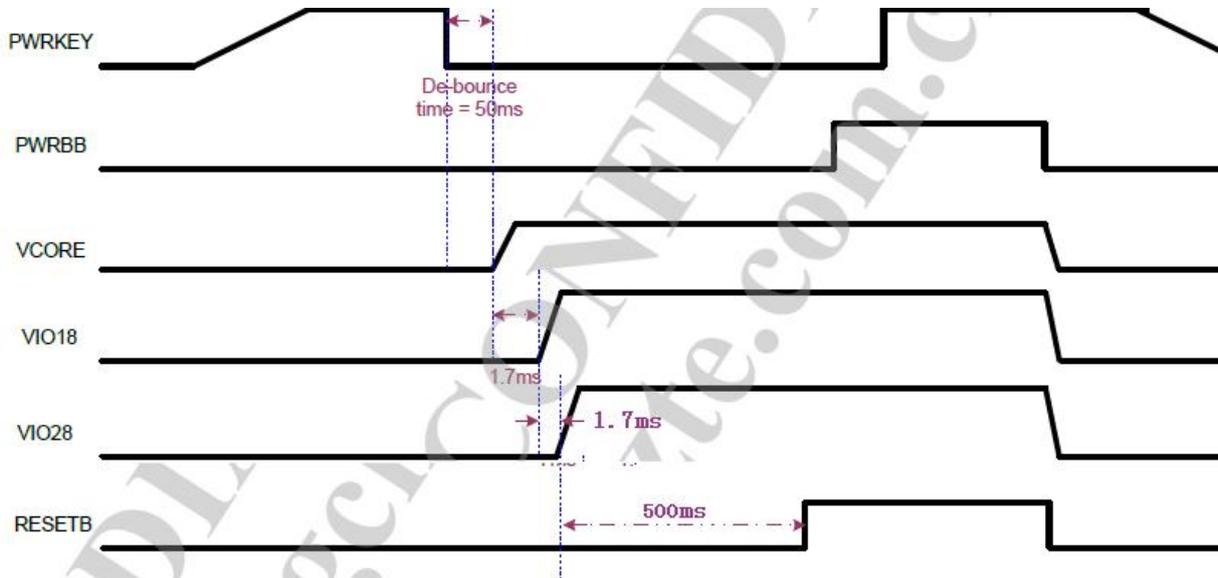
- Reset

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 time sequence



- 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

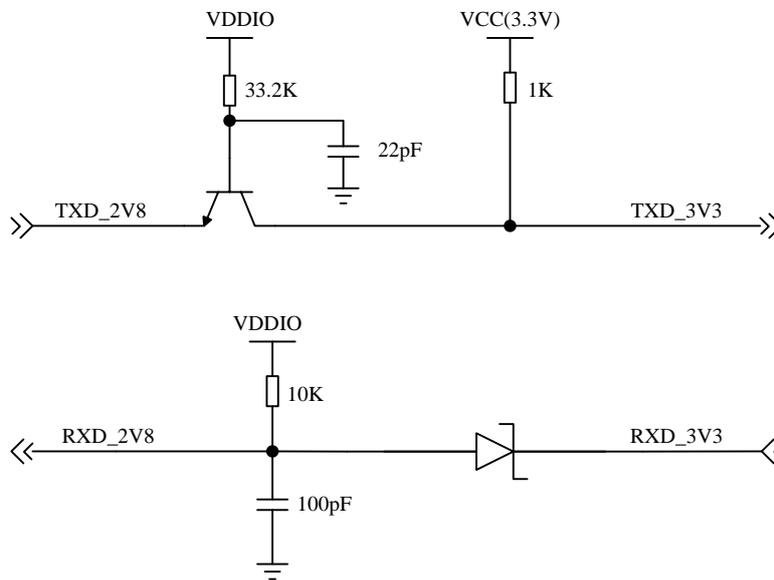
In order to make sure the data is saved safely and guarantee the safety of module's data, please don't cut off the power when the module is on.

## 4.2 UART interface

ZTE MG2639 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.

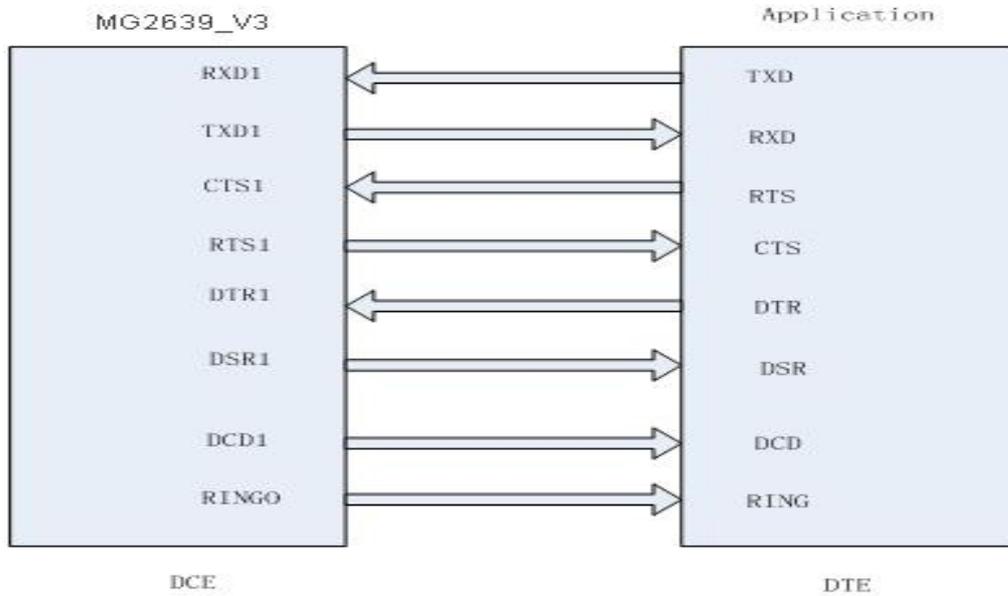
ZTE MG2639 module's output I/O level is 2.8V, therefore it needs level conversion when connecting with standard 3.3V or 5V logic circuit (such as MCU or RS232 drive chip MAX3238). The most common method is to use a dynatron to realize the level conversion. Figure 4-3 shows the level conversion to 3.3V through the UART interface of ZTE MG2639. The resistance and capacitance in figure 4-3 are just for reference, and they need to be recalculated during the design. The diode in Figure 4-4 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 UART interface reference design diagram



### 4.2.1 Descriptions of UART1 interface

Figure 4-5 UART1 DCE—DTE connection relationship diagram



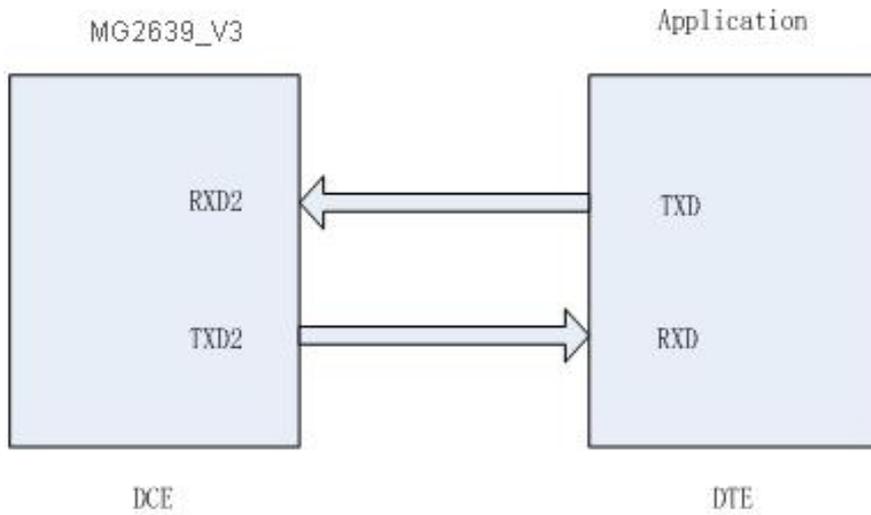
See the definitions of UART1 interface in table 4-3.

Table 4-3 UART1 interface definitions

Classification	No.	Definitions	I/O	Descriptions	Remarks
UART	29	RXD1	Input	Receiving data	DTE transmits serial data
	8	RTS1	Output	Ready to send	DTE informs DCE to send
	30	TXD1	Output	Transmitting data	DTE receives serial data
	39	DTR1	Input	Data terminal ready	DTE is ready
	9	CTS1	Input	Clear to send	DCE has switched to Rx. mode
	4	RING	Output	Ringtone indication	Inform DTE upon a remote call
	40	DSR1	Output	Data set ready	DCE is ready
	10	DCD1	Output	Carrier detection	Data link connected

### 4.2.2 Descriptions of UART2 interface

Figure 4-6 UART2 DCE—DTE connection relationship diagram



See the definitions of UART2 interface in table 4-4.

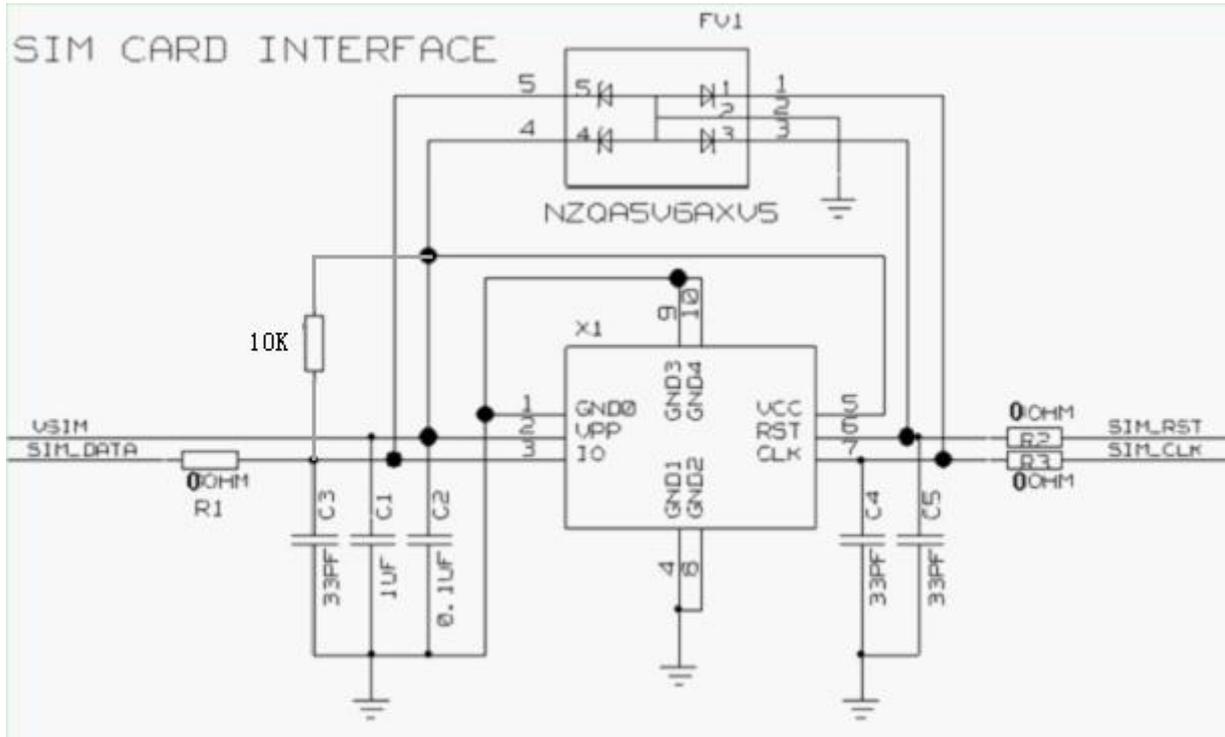
Table 4-4 UART2 interface definitions

Classification	No.	Definitions	I/O	Descriptions	Remarks
UART	43	RXD2	Input	Receiving data	DTE transmits serial data
	44	TXD2	Output	Transmitting data	DTE receives serial data

### 4.3 SIM card interface

ZTE MG2639 module supports 1.8V or 3.0V SIM card. Refer to figure 4-7 for design.

Figure 4-7 SIM card circuit reference design diagram



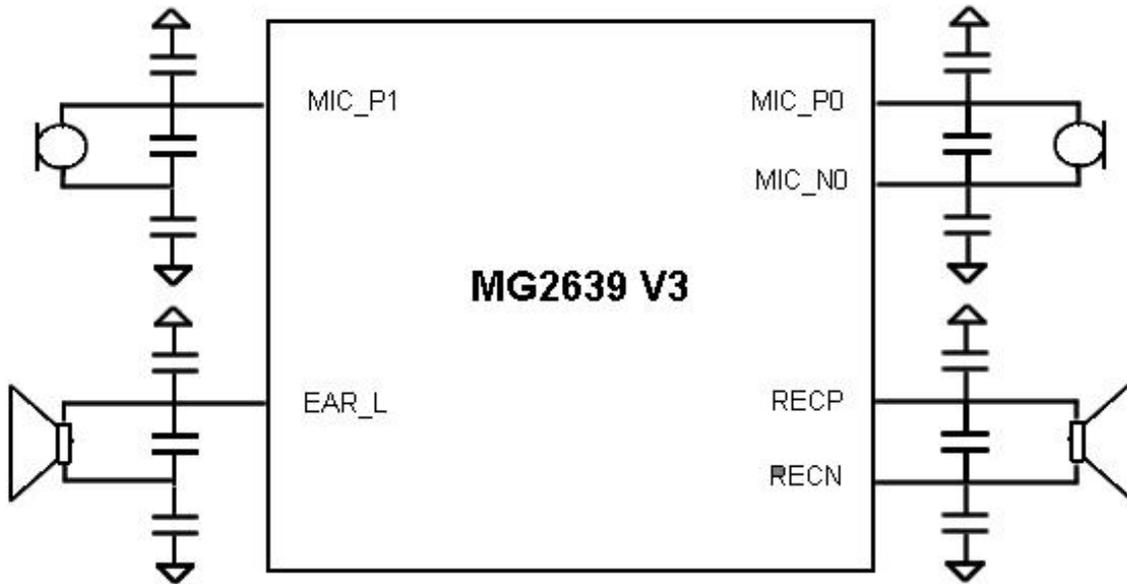
**NOTE:**

- (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

ZTE MG2639 module 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 interface circuit in figure 4-8.

Figure 4-8 Audio interface circuit reference design principle diagram



- **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 the audio interface on the receiver

Select the microphone with the sensitivity lower than -51.5dB since the max. gain inside MIC0 can reach 51.5dB. The level of MIC1\_P0 is about 1.48V

**Note:** if other kind of audio input method is adopted, the dynamic range of input signals should be within 0.5V. If the dynamic range is lower than 0.5V, then the pre-amplifier should be added. If the dynamic range is higher than 0.5V, then network attenuation should be added.

- Design of the audio interface on the earpiece

Select the microphone with the sensitivity lower than -51.5dB since the max. gain in MIC1 can reach 51.5dB. The level of MIC\_P1 is about 1.73V.

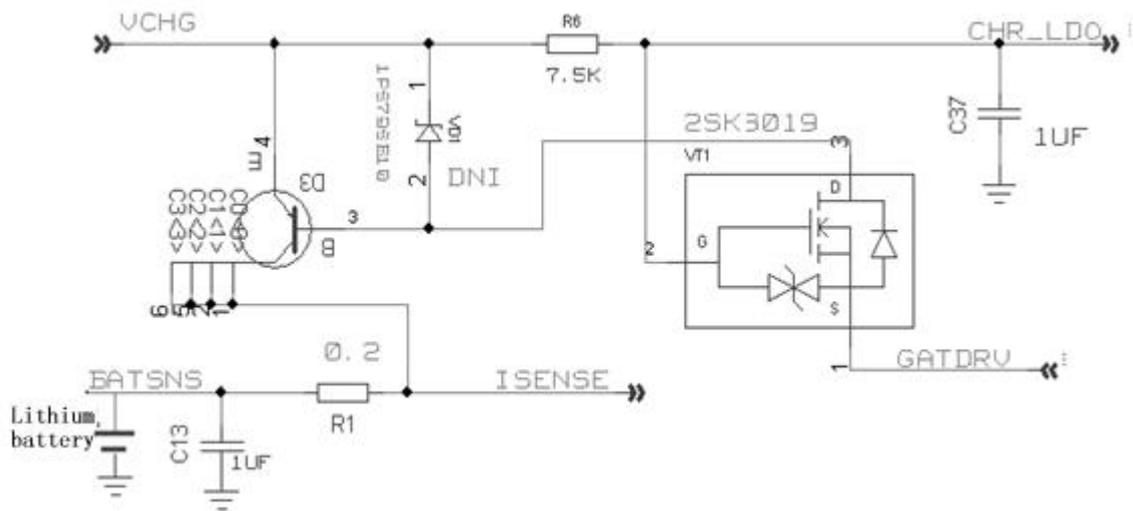
Note: In order to get better audio effect for users, we present the following suggestions:

- 1) During the process of using ZTE MG2639 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.

## 1.1 Charging interface

The PINs used for ZTE MG2639 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 0.2 $\Omega$  current inspection resistance, which requires 1206 encapsulation.

Figure 4-9 Charging interface circuit reference design principle diagram



## 5 PCB design

### 5.1 PCB design

- 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.

## 6 Module Board' s Mounting Process and Baking Guide

### 6.1 Module' s mounting process

Now with the increasing number of module board products in our company, customers have encountered numerous welding problems of module boards during the process of using the products. Therefore, we specially formulate the guide to the module board's mounting process for customers in order to ensure the FTT of soldering at the client-end. The current standard of flatness in our company is 0.15mm (measurement method: put the module at the marble surface, use the feeler gauge to measure the clearance width at the maximum cocked position. Do not exert a force on the module during the measurement). If there is any question, please contact the relevant staff in our company. The module must be baked at 125°C for 8 hours prior to second reflow.

#### 6.1.1 Process Routing Selection

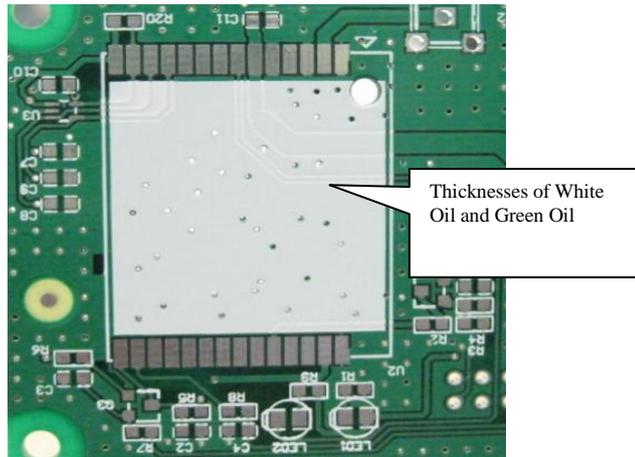
As our module boards are manufactured with the lead-free technology and meet the ROHS requirements, we recommend that the lead-free manufacturing process should be used upon the selection of process routing for module board and interface board.

#### 6.1.2 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. Make sure the thickness of solder paste at the module's PAD is between 0.18mm and 0.2mm during the printing.

#### 6.1.3 Design of interface board' s PAD & thicknesses of green oil and white oil at the module on the interface board

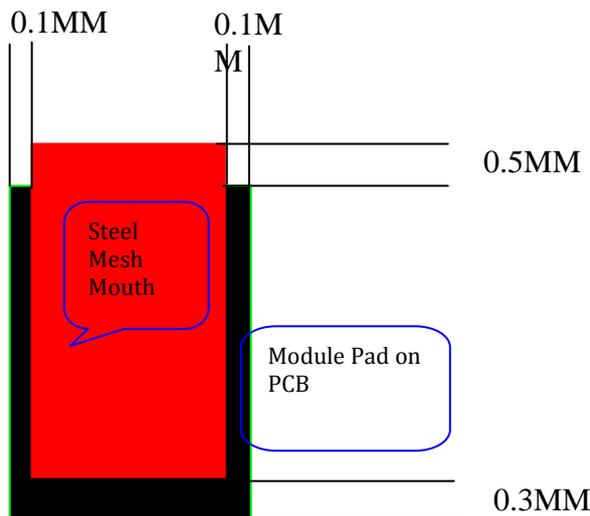
For the design of interface board's pad, please refer to the standard pad design recommended by ZTE Mobile Telecom Co., Ltd. It is recommended that the sum of the thickness of the green oil and white oil at the module on the interface board should be less than 0.02mm because the greater thickness would affect the welding quality of module board and interface board.



(The diagram is just for your reference; it does not represent the actual module encapsulation)  
 In addition, other components cannot be arranged within 2mm around the module on the interface board to ensure the maintenance of the module.

### 6.1.4 Design of steel mesh aperture at the module board' s pad on the interface board

The thickness of the steel mesh on the interface board is selected based on the principle of comprehensive consideration according to the encapsulation type of components on the interface board. The expected thickness of steel mesh at the module on the interface board is 0.15mm (locally increased to 0.18MM at the module position), or just 0.18mm. In respect of the steel mesh aperture, the inner side of the pad is cut by 0.3mm, the two sides are respectively cut by 0.1mm, and the outside is extended by 0.5mm.



### 6.1.5 Module Board's Mounting

The pallets, which are suitable for mounting, have been made for many modules. If our company has offered the pallets, customers can directly apply them in Pick & placement machine; otherwise, customers need make a loading tool similar to the pallet. Customers can take out the modules from the packaging box, put them into the pallet according to the sequence and direction, and then start mounting.

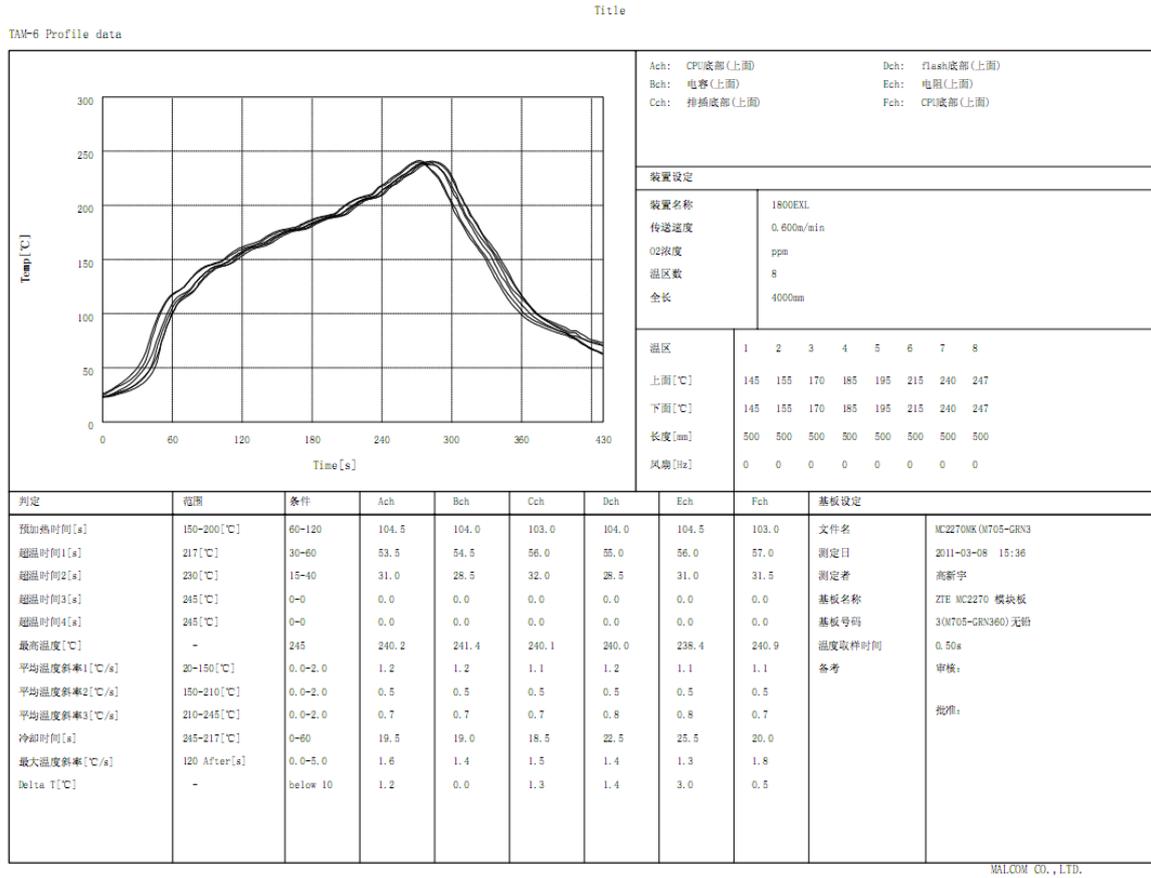


Loading pallet

**Mounting Pressure:** In order to ensure a good contact between the module and the tin of the interface board, and the convenient welding, the pressure of placing the module board on the interface board is 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.

### 6.1.6 Furnace Temperature Curve

As for the furnace temperature curve of module, we recommend that the peak temperature should be about 240~245°C. The time of the temperature above 217°C is 30~60 seconds. Besides, the temperature at the preheating area is kept at 150~200°C, and the time is 60~120 seconds.



The furnace temperature test board must be a physical board mounted on the interface board, and there must be the testing wires at the module board.

### 6.1.7 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.

### 6.1.8 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

## 6.2 Module's Baking Guide

The module must be baked prior to second reflow.

## 6.2.1 Module' s 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.



Lead-free



Anti-static



Caution



Wear a wrist strap



Wear finger cots

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

## 6.2.2 Baking Devices and Operation Procedure

Baking device: any oven where the temperature can rise up to 125°C 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.

## 6.2.3 Parameter Settings of Baking Devices

Baking temperature: 125°C±5°C

Baking duration: 8 hours

## 7 Mechanical dimensions

### 7.1 Appearance diagram

Figure 7-1 ZTE MG2639 appearance diagram



- Dimensions (L×W×H): 30.0 × 25.0 × 3.0mm
- Weight: <6g

## 7.2 Module's assembly diagram

See the module's assembly diagram in figure 7-2.

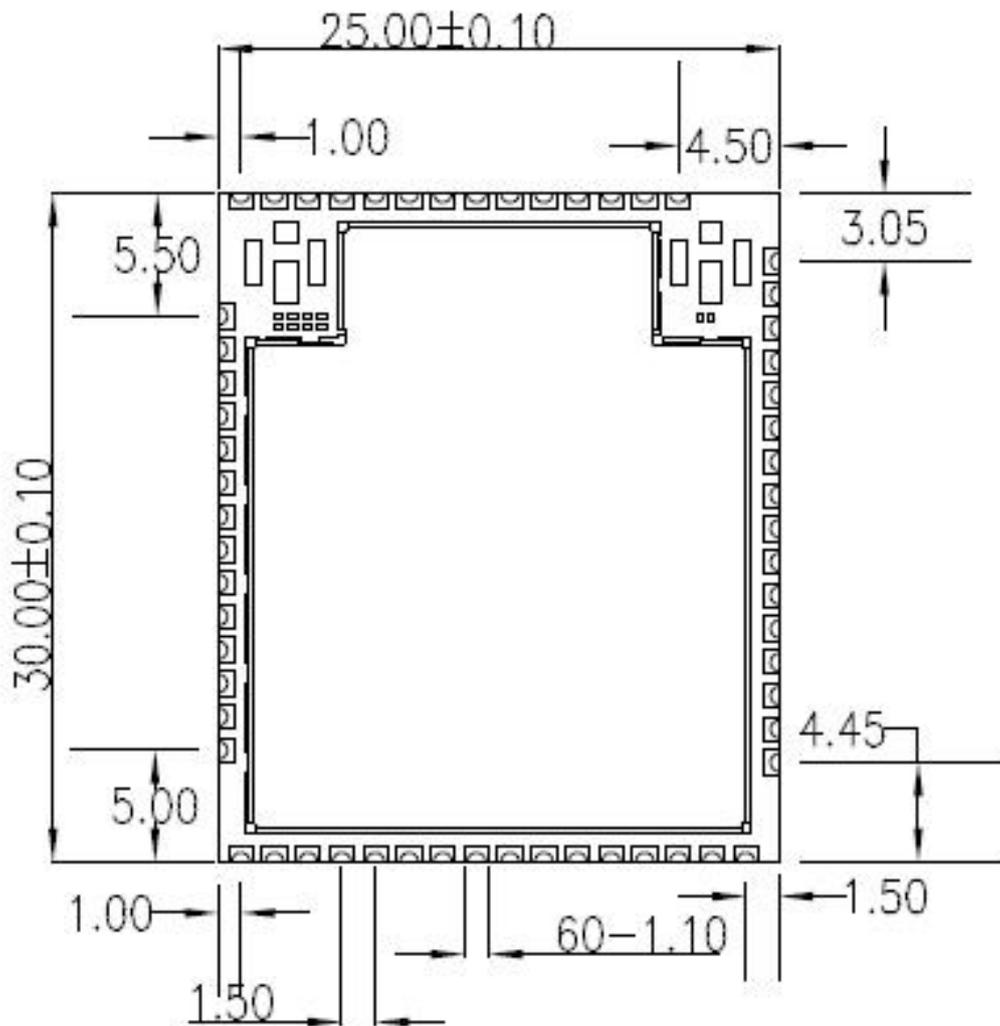


Figure 7-2 Module's assembly diagram

### 7.3 Module's PCB package dimensions

See the module's PCB package dimensions in figure 7-3.

Figure 7-3 Relevant package dimensions from TOP view

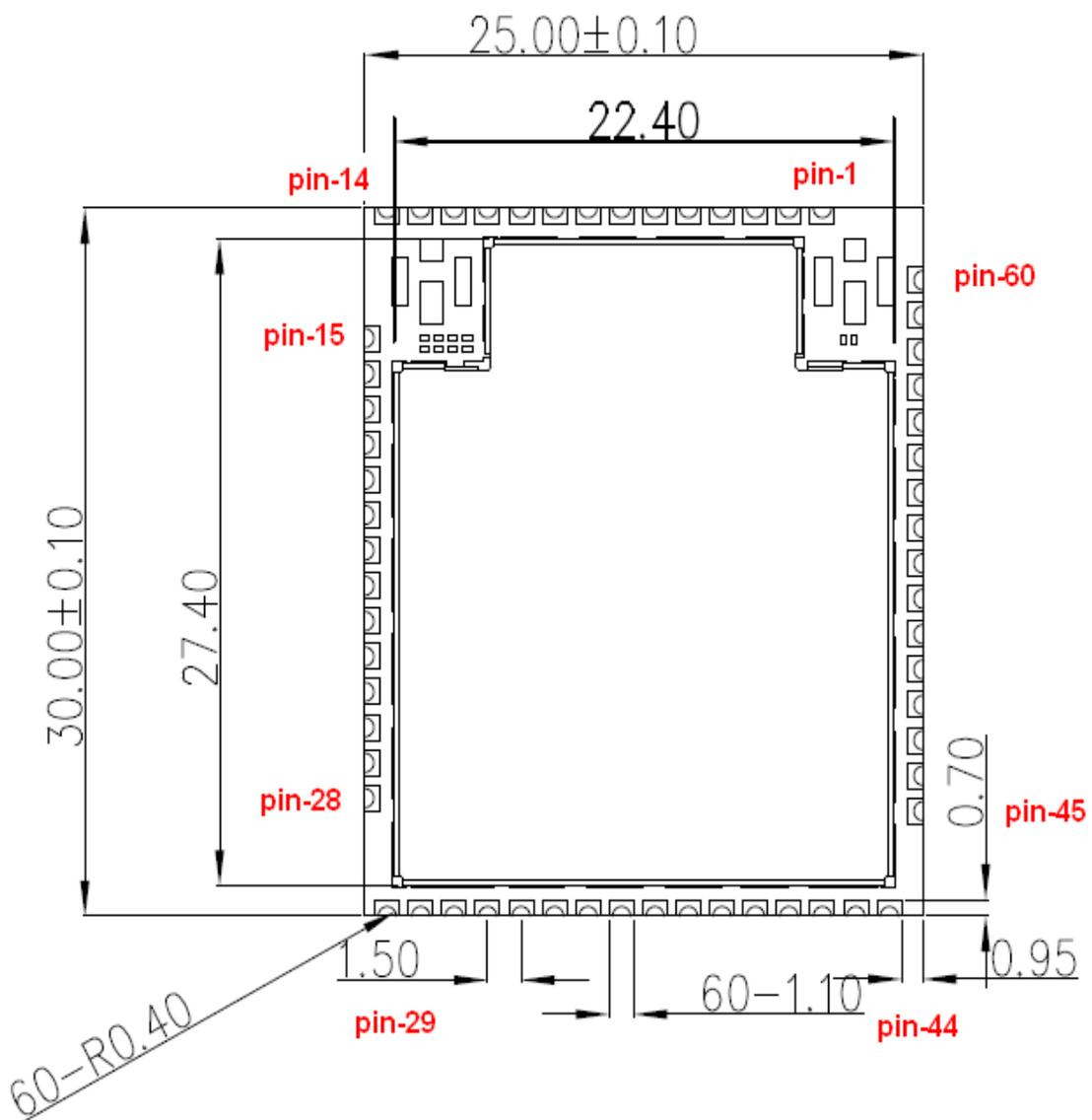
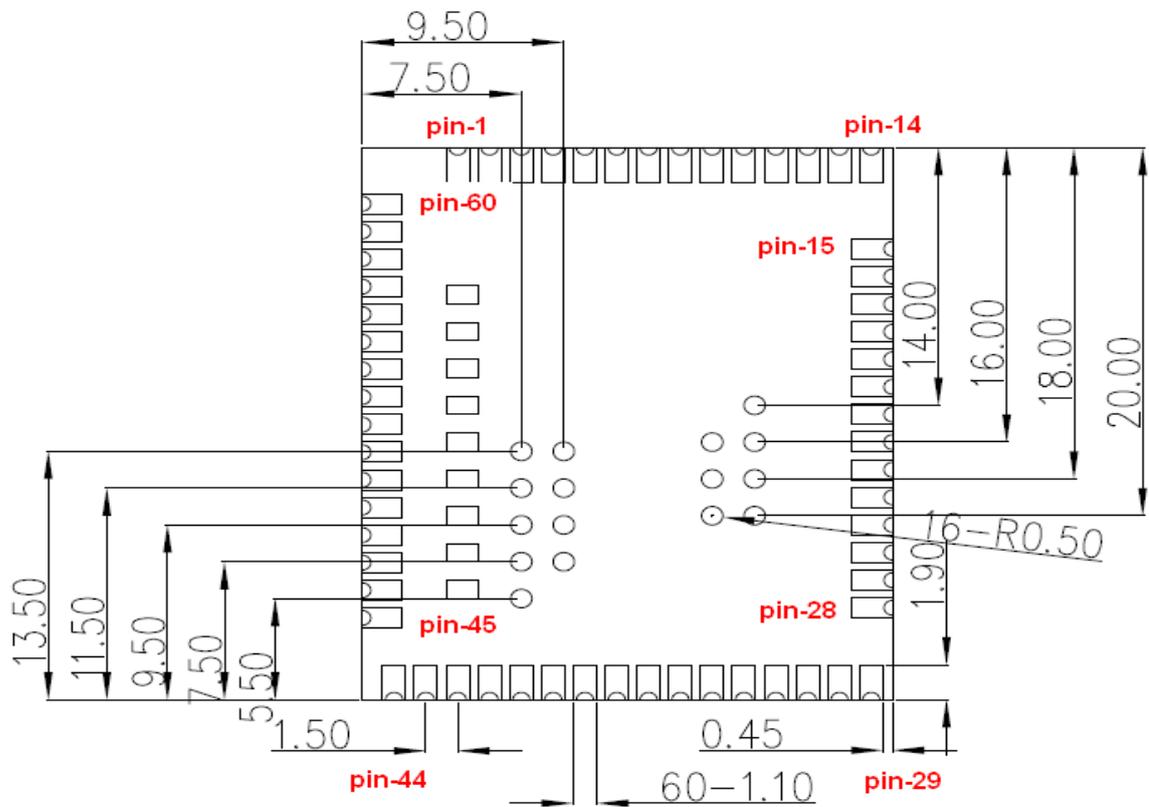


Figure 7-4 Relevant package dimensions from BOTTOM view



## 8 Declaration of Conformity

We

ZTE CORPORATION

ZTE Plaza, Keji Road South, Hi-Tech Industrial Park, Nanshan District, Shenzhen, P.R. China

Declare under our sole responsibility that the product ZTE MG2639 To which this declaration relates, is in conformity with the following standards

EN 301 511 V9.0.2;

EN 301 489-1 V1.9.2; EN 301 489-7 V1.3.1; EN 55022:2010; EN 55024:2010;

EN 50385:2002; EN 50383:2002;

EN 60950-1:2006+A11:2009+A1:2010+A12:2011

We hereby declare that [all essential radio test suites have been carried out and that] the above named product is in conformity to all the essential requirement of Directive 1999/5/EC.

The conformity assessment procedure referred to in Article 10 and detailed in Annex [III] or [IV] of Directive 1999-5-EC has been followed with the involvement of the following Notified Body (ies): PHOENIX TESTLAB Gm bH, Königswinkel 10, D-32825 Blomberg, Germany

Identification mark : **CE0700**

The device complies with RF specifications when the device used at 20 cm form your body.

## 9 Important announcement

### **FCC Radiation Exposure Statement:**

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator & your body.

### **IMPORTANT NOTE**

This module is intended for OEM integrator. The OEM integrator is still responsible for the FCC compliance requirement of the end product, which integrates this module.

20cm minimum distance has to be able to be maintained between the antenna and the users for the host this module is integrated into. Under such configuration, the FCC radiation exposure limits set forth for a population/uncontrolled environment can be satisfied.

Any changes or modifications not expressly approved by the manufacturer could void the user's authority to operate this equipment.

### **USERS MANUAL OF THE END PRODUCT:**

In the users manual of the end product, the end user has to be informed to keep at least 20cm separation with the antenna while this end product is installed and operated. The end user has to be informed that the FCC radio-frequency exposure guidelines for an uncontrolled environment can be satisfied. The end user has to also be informed that any changes or modifications not expressly approved by the manufacturer could void the user's authority to operate this equipment. If the size of the end product is smaller than 8×10cm, the additional FCC part 15.19 statement is required to be available in the users' manual: This device complies with Part 15 of FCC rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference and (2) this device must accept any interference received, including interference that may cause undesired operation.

### **LABEL OF THE END PRODUCT:**

The final end product must be labeled in a visible area with the following "Contains TX FCC ID: SRQ-MG2639". If the size of the end product is larger than 8×10cm, then the following FCC part 15.19 statement has to also be available on the label: This device complies with Part 15 of FCC rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference and (2) this device must accept any interference received, including interference that may cause undesired operation.