Hardware Development Guide of Module Product

Product Model No:ZM5202

Document Version: 2.0

Release Date: 2013-05-31

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Revision History

Version	Date	Description
1.0	2010-04-15	1st version
2.0	2013-03-20	1. Delete the part of 3.13 and 3.14 in former version 2. Change Logo of the header, footer and front cover 3. Modify the legal information
	2013-05-13	4. Modify the Reference document list in chapter 1.3 5. Add the module dimensions of top plane and thickness 6. Modify the chapter 7.7 of Recommended Product Upgrading Plan 7. Modify the Standby current from 3.5mA to 5mA in Table 2-1 8. Modify the peak current from ≤470mA to ≤2A and modify the Working temperature from 70 to 75°C in Table 2-1 9. Modify the Pin 32-35,64,65,67,68 and description in chapter 3.1.3 10. Modify chapter 3.8.3 to support of 8 wire UART 11. Modify the MODULE_WAKEUP_AP interface application 12. Modify the product test environment in Table 6-2 and 6-4 13. Modify the product test result in Table 6-6 14. Update the Figure 3-1 of PIN Configuration Diagram Modify the Figure 7-2 of Main and AGPS Antenna Welding Pad Interface 15. Modify the Figure 7-1 of Main Antenna RF Connector Interface 16. Modify Figure 2-1 of Product Illustration
	2013-05-31	17. Release as Version 2.0

TABLE OF CONTENTS

Figures

Tables

1 About This Document

1.1 Application Range

This document is applicable as the hardware development guide of ZM5202 WCDMA module products. The user can design ZM5202 according to the requirement and guidance in this document. It is only applicable for the hardware application and development of ZM5202 WCDMA module products.

1.2 Purpose

This document provides the design and development fundamentals for the users of ZM5202. By reading this document, the user can have an overall knowledge of ZM5202 and a clear understanding of the technical parameters. With this document, the user can successfully fulfill the application and development of wireless 3G Internet product or equipment.

Besides the product features and technical parameters, this document also provides the product reliability tests and related testing standards, service function implementation flow, RF performance indexes and a guide on the design of user circuits, to provide the user with a complete design reference.

1.3 Supported & Reference Document List

Besides the hardware development document, ZTEWelink also provides the board operation guide, software development guide and upgrading plan guide of ZM5202. Table 1-1 is the list of supported documents.

Table 1-1 Supported Document List

NO.	Document Name
1	ZTEWelink ZM5202 Module Specification.pdf
2	ZTEWelink LGA Type Ⅱ Module Dev Board User Guide.pdf
3	ZM5202 Software Development Guide of Module Product.pdf

1.4 Abbreviations

Table 1-2 is a list of abbreviations involved in this document, as well as the English full names.

Table 1-2 Abbreviation List

Abbreviations	Full Name
ESD	Electro-Static discharge
GPRS	General Packet Radio Service
GSM	Global Standard for Mobile Communications
I/O	Input/output
LED	Light Emitting Diode
SPI	Serial Peripheral Interface
WCDMA	Wideband Code Division Multi Access
UMTS	Universal Mobile Telecommunication System
BER	Bit Error Rate
DL	Downlink
DPCH	Dedicated Physical Channel
DPCH_Ec	Average energy per PN chip for DPCH. DPCH
SIM	Subscriber Identification Module

2 Product Overview

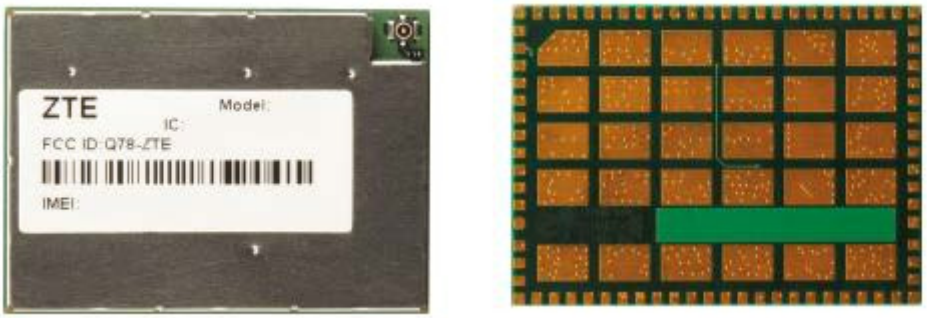
ZM5202 is one WCDMA wireless Internet module with LGA interface. It is widely applied to but not limited to the various products and equipment such as laptops, vehicle-mounted terminals, and electric devices, by providing data services. The features of ZM5202 module are described as below.

1. It can support UMTS 850(900)/1900/2100MHz frequency band, and GSM/GPRS/EDGE 850/900/1800/ 1900MHz frequency band.

2. It can provide high-speed data access service under the mobile environment.

3. It provides the SPI interface, I2C interface, (U)SIM card interface (3.0V/1.8V), USB2.0 interface, UART interface, SD2.0 interface, power-on/power-off, and resetting.

Figure 2-1 Product Illustration



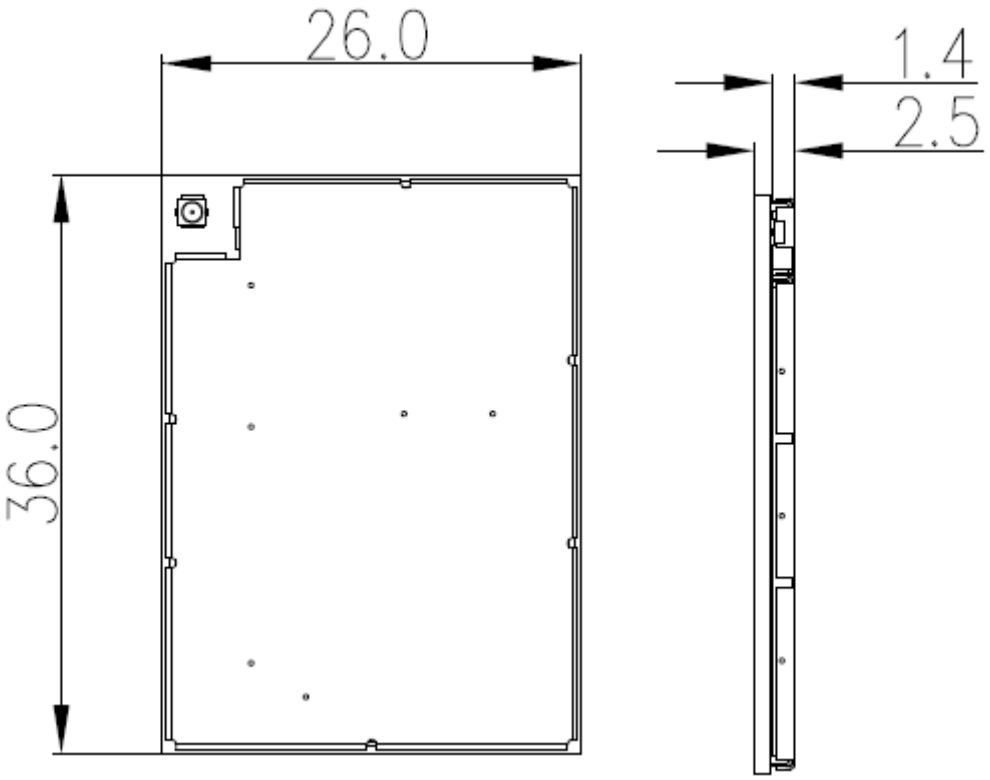
2.1 Mechanic Features

ZM5202 is a 108-pin LGA encapsulation module. Except for the signal PIN, there are many dedicated heat-dissipation ground wielding panel to improve the grounding performance, mechanical strength and heat-dissipation performance. There are altogether 30 heat-dissipation ground wielding panels, evenly distributed at the bottom of PCB. The dimensions of 108-pin LGA encapsulation are 26*36mm, and the height is 2.5+/-0.2mm. The location of PIN 1 is identified by the ground wielding panel with an inclination at the bottom, and its angle orientates to the top

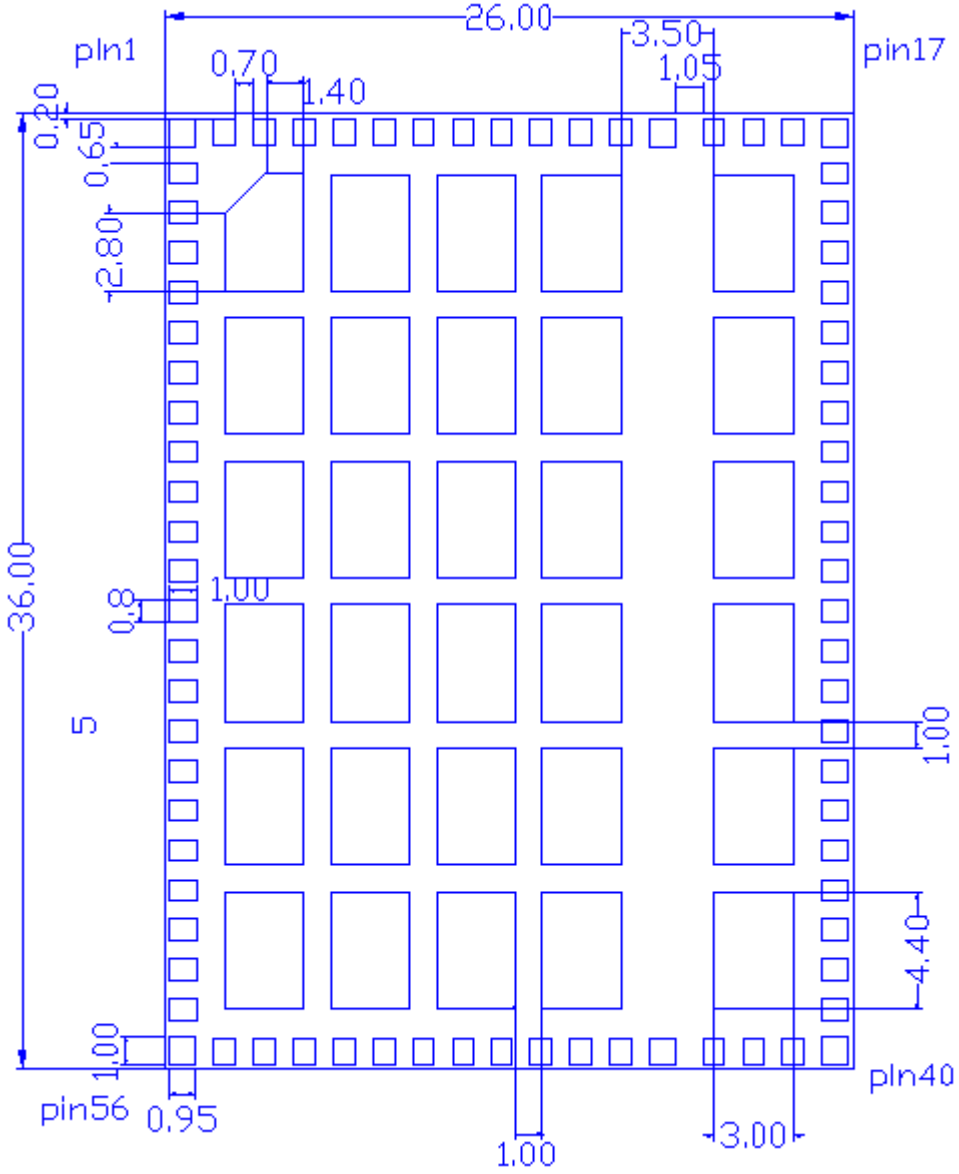
welding panel of the corresponding module. Figure 2-2 is a figure about the dimensions of ZM5202 module.

Figure 2-2 Module Dimensions

(a)Dimensions on Top plane (b) Thickness



(c) Bottom



2.2 Technical Parameters

The major features of ZM5202 can be described from the aspects of mechanic feature, base band, radio frequency, technical standard and environment feature. Table 2-1 is a list of the major technical parameters and features supported by ZM5202.

Table 2-1 Major Technical Parameters

Name	Parameter Item	Specifications	
Mechanical Feature	Dimensions	36mm * 26mm * (2.5+/-0.2)mm	
	Weight	About 5.2g	
	Encapsulation type	LGA package(108 Pin)	
Baseband	Processor architecture	ARM 9 architecture	
	(U)SIM/SIM	Standard 6 PIN SIM card interface 3V SIM card and 1.8V SIM card	
	Memory	32MByte/128MByte	
	USB interface	USB 2.0 HIGH SPEED	
	Maximum power consumption [1]	2.2W	
	Voltage	DC 3. 4V-4.2V, typical: 3.8V	
	Working current[2]	Peak current	≤2A (3.8V) note1
		Average normal working current	≤150mA (3.8V) note2
		Average normal working current (without services)	≤75mA
		Standby current	≤5mA (3.8V) note3
RF	GSM band	EDGE/GPRS/GSM: 1900/1800/900/850MHz	
	UMTS band	/WCDMA: 2100/1900/850(900)MHz;	
	RxDiv Band	NA note4	
	Max. transmitter power	UMTS2100/1900/850(900): Power Class 3 (+24dB +1/-3dBm) GSM/GPRS 850MHz/900MHz: Power Class 4 (+33dBm ±2dBm) GSM/GPRS 1800MHz/1900MHz: Power Class 1 (+30dBm ±2dBm) EDGE 850MHz/900MHz: Power Class E2 (+27dBm ±3dBm) EDGE 1800MHz/1900MHz: Power Class E2 (+26dBm -4/+3dBm)	
	Receiving sensitivity	WCDMA2100 : ≤-106.7dBm WCDMA1900/850 : ≤-104.7dBm WCDMA900 : ≤-103.7dBm	

Name	Parameter Item	Specifications
		GSM850/900/1800/1900 : ≤-102dBm
	Equalization	Support
	Main antenna interface	Support
	Receive diversity (GPS) antenna interface	Support the GPS wielding panel interface, support the diversity antenna interface; but they are not supported simultaneously. ZTEWelink does not provide the antenna, and the antenna is provided by the third party.
Technical Standard	Data rate	GSM CS: UL 9.6kbps/DL 9.6kbps GPRS: Multi-slot Class 10 EDGE: Multi-slot Class 12 WCDMA CS: UL 64kbps/DL 64kbps WCDMA PS: UL 384kbps/DL 384kbps
	GPRS type	Class B
	3GPP protocol	R99
	Operating system	Windows XP (SP2 and later)
		Windows Vista
		Windows 7
		Linux
		Android
Environment Feature	Working temperature	-20 to 75° C
	Storage temperature	-40 to 85° C
	Humidity	5%~ 95%
Application	RAS dialup	Support
	SMS	Support
	Network locking	Optionally support
	SIM READER	Not support
	Upgrading	Support

Note: 1. Test condition: The value is measured in Max. transmit power.

Note 2: Testing condition: The value is measured in transmit power of 0dBm and band of WCDMA 2100MHz.

Note 3: Testing condition: The value is measured in cell power of -75dBm and DRX=640.

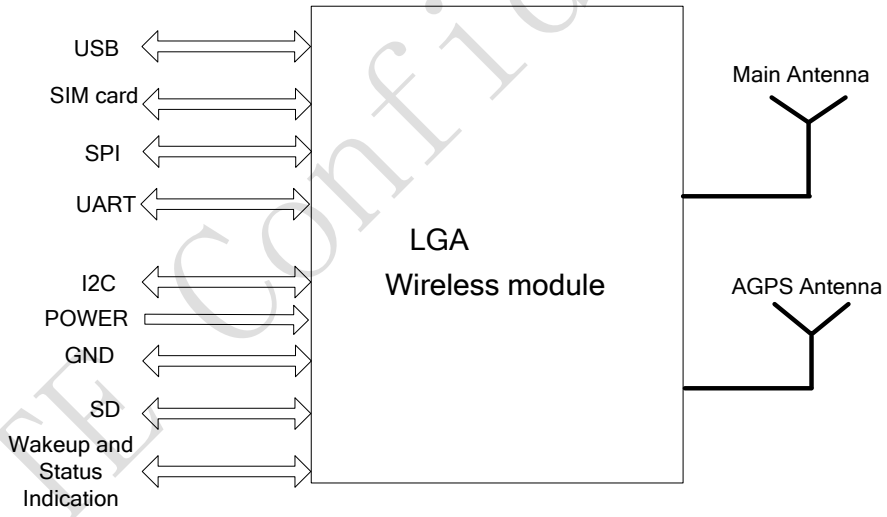
Note 4: NA means unrelated.

2.3 Function Overview

2.3.1 Baseband Function

The baseband part of ZM5202 mainly includes the following signal groups: USB signal, (U)SIM card signal, wakeup signal, working status indicator signal, UART signal, SD interface signal, I2C interface signal, module power-on/resetting signal, SPI, main antenna interface, AGPS antenna interface and power-supply interface. Figure 2-3 is a diagram of the system connection structure.

Figure 2-3 System Connection Structure



2.3.2 Radio Frequency Function

The radio frequency function of ZM5202 can be viewed from the aspect of over-the-air wireless bearer network, frequency band, whether the receive diversity feature is supported, and the GPS function.

1. Support WCDMA 850(900)/1900/2100MHz;

2. Support GSM/EDGE/GPRS 850/900/1800/1900 MHz;

3. Support GPS/AGPS;

The working frequency band of ZM5202 transceiver transmitter is as shown in Table 2-2.

Table 2-2 Working Frequency Band

Working Frequency Band	Uplink Frequency Band	Downlink Frequency Band
UMTS850	824 MHz — 849 MHz	869 MHz — 894 MHz
UMTS900	880 MHz — 915 MHz	925 MHz — 960 MHz
UMTS1900	1850 MHz — 1910 MHz	1930 MHz — 1990 MHz
UMTS2100	1920 MHz — 1980 MHz	2110 MHz — 2170 MHz
GSM850	824 MHz — 849MHz	869 MHz — 894 MHz
GSM900	890 MHz — 915MHz	935 MHz — 960MHz
GSM1800	1710 MHz — 1785MHz	1805 MHz — 1880MHz
GSM1900	1850 MHz — 1910MHz	1930 MHz — 1990MHz

3 Interfaces

3.1 Definition of PINs

3.1.1 Definition of PIN I/O Parameters

The definition of ZM5202 I/O parameter is as shown in Table 3-1.

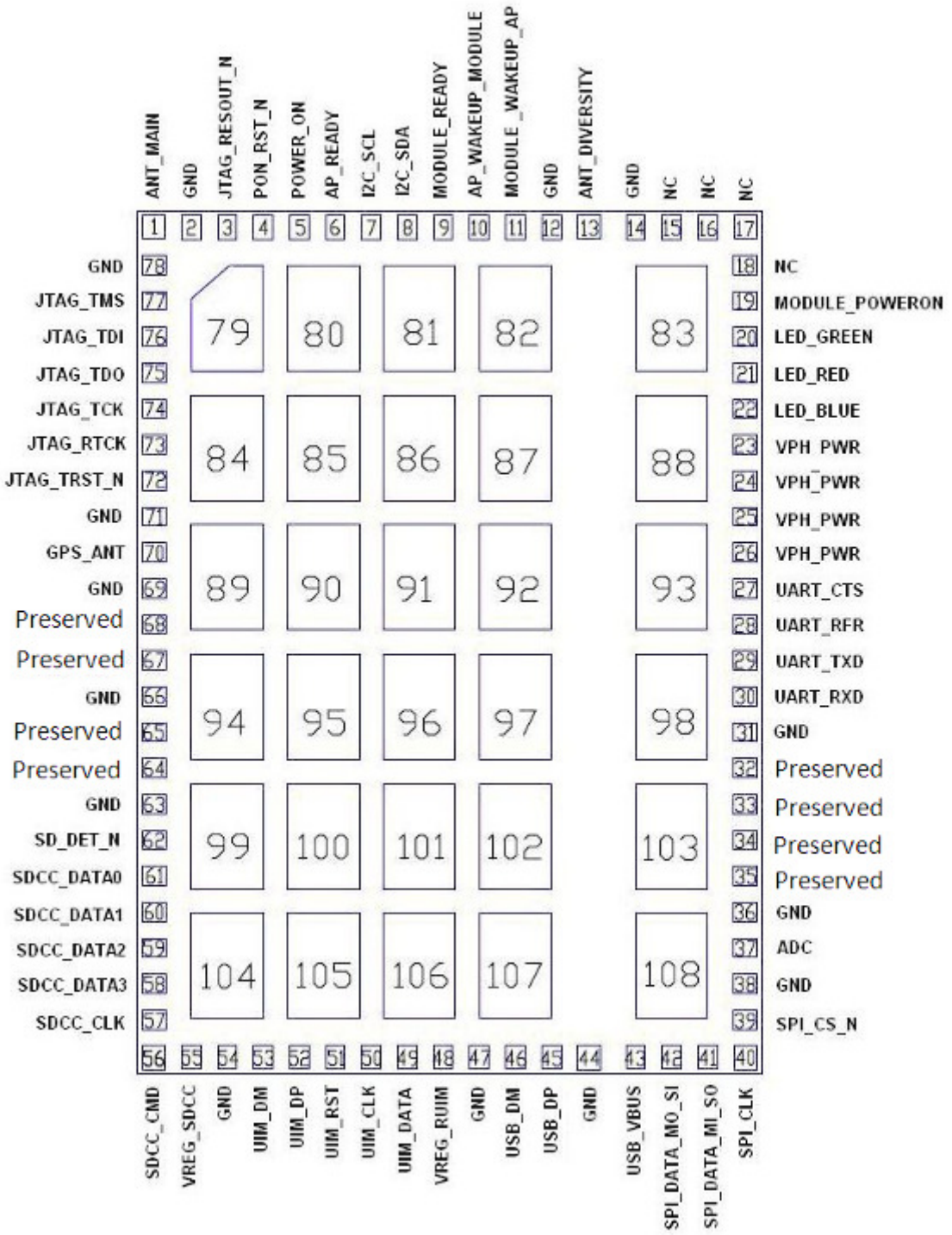
Table 3-1 PIN Parameters

PIN Attribute	Description
I	Input PIN
O	Output PIN
B	Two-way digital port, CMOS input
Z	High-resistance output
P1	PIN group 1, the power supply voltage is VDD_P1
P2	PIN group 2, the power supply voltage is VDD_P2
PU	PIN internal pull-up
PD	PIN internal pull-down
A, AI, AO, AIO	Analog circuit

3.1.2 PIN Configuration Diagram

The PIN sequence of interfaces on ZM5202 is defined as shown in Figure 3-1.

Figure 3-1 PIN Configuration Diagram



3.1.3 PIN Description

Table 3-2 PIN Interface Definition

PIN	Signal Definition	Pin Voltage	I/O	PIN Attribute	PU/PD Status	Remark
1	ANT_MAIN	--	AI, AO	Main antenna feedback point	--	Mandatory
2	GND	--	--	Ground	--	Mandatory
3	JTAG_RESOUT_N	P1	DI	JTAG reset LGA	--	If it is not used, NC
4	PON_RST_N	P1	DI	Module reset	--	If it is not used, NC
5	POWER_ON	P1	DI	Power-on/Power-off PIN	PU	Mandatory
6	AP_READY	P1	DI	Module queries AP sleep status	--	If it is not used, NC
7	I2C_SCL	P1	B	I2C clock	--	If it is not used, NC
8	I2C_SDA	P1	B	I2C data	--	If it is not used, NC
9	MODULE_READY	P1	DO	AP queries Module sleep status	--	If it is not used, NC
10	AP_WAKEUP_MODULE	P1	DI	AP wakes up Module	--	Low-power level wakeup. To make the module standby, the primary server needs to raise up this low signal. If it is not used, NC
11	MODULE _WAKEUP_AP	P1	DO	Module wakes up AP	--	If it is not used, NC
12	GND	--	--	--	--	Mandatory
13	NC	--	--	--	--	--
14	GND	--	--	--	--	Mandatory
15	NC	--	--	--	--	--
16	NC	--	--	--	--	--
17	NC	--	--	--	--	--
18	NC	--	--	--	--	--
19	MODULE_POWERON	P1	DO	MODULE power-on status indicator	--	If it is not used, NC
20	LED_GREEN	P1	AI	Signal indicator interface	--	If it is not used, NC
21	LED_RED	P1	AI	Signal indicator interface	--	If it is not used, NC

PIN	Signal Definition	Pin Voltage	I/O	PIN Attribute	PU/PD Status	Remark
22	LED_BLUE	P1	AI	Signal indicator interface	--	If it is not used, NC
23	VPH_PWR	3.8V	AI	Signal indicator interface	--	System power supply, mandatory
24	VPH_PWR				--	
25	VPH_PWR				--	
26	VPH_PWR				--	
27	UART_CTS	P1	DI(HV)	UART interface CTS signal	--	If it is not used, NC
28	UART_RFR	P1	DO	UART Interface RFR signal	--	If it is not used, NC
29	UART_TXD	P1	DO	UART interface TXD signal	--	If it is not used, NC
30	UART_RXD	P1	DI	UART interface RXD signal	--	If it is not used, NC
31	GND	--	--	Ground	--	--
32	Preserved	--	--	--	--	--
33	Preserved	--	--	--	--	--
34	Preserved	--	--	--	--	--
35	Preserved	--	--	--	--	--
36	GND	--	--	Ground	--	Mandatory
37	ADC	--	AI	Analog signal input	--	If it is not used, NC
38	GND	--	--	Ground	--	Mandatory
39	SPI_CS_N	P1	DO	SPI interface channel signal	--	If it is not used, NC
40	SPI_CLK	P1	DO	SPI clock signal	--	If it is not used, NC
41	SPI_DATA_MI_SO	P1	B	SPI data IO signal	--	If it is not used, NC
42	SPI_DATA_MO_SI	P1	B	SPI data IO signal	--	If it is not used, NC
43	USB_VBUS	--	AI	USB _VBUS power	--	Pay attention o the power-on sequence of VPH_PWR, mandatory.
44	GND	--	--	ground	--	Mandatory
45	USB_DP	--	AI/AO	USB data cable	--	Mandatory
46	USB_DM	--	AI/	USB data cable	--	Mandatory

PIN	Signal Definition	Pin Voltage	I/O	PIN Attribute	PU/PD Status	Remark
			AO			
47	GND	--	--	Ground	--	Mandatory
48	VREG_RUIM	P1/ P2	AO	UIM card power signal	--	Mandatory
49	UIM_DATA	P1/ P2	B	UIM card data signal	--	Mandatory
50	UIM_CLK	P1/ P2	DO	UIM card clock signal	--	Mandatory
51	UIM_RST	P1/ P2	DO	UIM card reset signal	--	Mandatory
52	UIM_DP	P1/ P2	AI, AO	Data signal	--	If it is not used, NC
53	UIM_DM	P1/ P2	AI, AO	Data signal	--	If it is not used, NC
54	GND	--	--	Ground	--	Mandatory
55	VREG_SDCC	P2	AO	SD card power	--	If it is not used, NC
56	SDCC_CMD	P2	B	SD card control signal	--	If it is not used, NC
57	SDCC_CLK	P2	DO	SD card clock signal	--	If it is not used, NC
58	SDCC_DATA3	P2	B	SD card data signal	--	If it is not used, NC
59	SDCC_DATA2	P2	B	SD card data signal	--	If it is not used, NC
60	SDCC_DATA1	P2	B	SD card data signal	--	If it is not used, NC
61	SDCC_DATA0	P2	B	SD card data signal	--	If it is not used, NC
62	SD_DET_N	--	--	NC	--	Reserved
63	GND	--	--	Ground	--	Mandatory
64	Preserved	--	--	--	--	--
65	Preserved	--	--	--	--	--
66	GND	--	--	Ground	--	Mandatory
67	Preserved	--	--	--	--	--
68	Preserved	--	--	--	--	--
69	GND	--	--	Ground	--	Mandatory
70	GPS_ANT	--	--	GPS antenna	--	If it is not used, NC
71	GND	--	--	Ground	--	If it is not used, NC
72	JTAG_TRST_N	P1	--	NC	--	If it is not used, NC
73	JTAG_RTCK	P1	--	NC	--	If it is not used, NC
74	JTAG_TCK	P1	--	NC	--	If it is not used, NC

PIN	Signal Definition	Pin Voltage	I/O	PIN Attribute	PU/PD Status	Remark
75	JTAG_TDO	P1	--	NC	--	If it is not used, NC
76	JTAG_TDI	P1	--	NC	--	If it is not used, NC
77	JTAG_TMS	P1	--	NC	--	If it is not used, NC
78	GND	--	--	Ground	--	Mandatory
79.-108.	GND	--	--	Heat-dissipation welder	--	Mandatory

Note: “NC” indicates Not Connected. That is, there is no connection inside the module. P1 and P2 refer to the power-supply signal level group 1 and 2.

3.2 Working Condition

Table 3-3 Working Condition

Signal	Description	Min	Typical	Max	Unit
VPH_PWR	Main power supply of the module	3.4	3.8	4.2	V
USB_VBUS	Power supply PIN of USB PHY	3.3	5	5.25	V
ADC	Analog input	0	--	2.2	V
VDD_P1	Voltage of PIN group P1	1.65	1.8	1.95	V
VDD_P2	Voltage of PIN group P2	2.7	2.85	3	V

Note: The typical voltage refers to the default I/O voltage of P1 and P2 PIN group. It is required that the external input PIN provides this voltage. 2. The voltage design of external circuit interfaces should match that of the ZM5202 PINs. 3. When VPH_PWR works within the voltage range, it can reach good whole-set performance. If it is lower than the minimum value, the whole-set performance will be affected, or the module cannot work normally. If it is higher than the maximum value, the module might be damaged.

3.3 Feature of Interface Power Level

3.3.1 Feature of Digital Power Level Signal

Table 3-4 Power Level Range of Digital Signal

Signal	Description	Min	Max	Units
VIH	High level of input voltage	0.65*VDD_PX	VDD_PX+0.3	V
VIL	Low level of input voltage	-0.3	0.35* VDD_PX	V
VOH	High level of output voltage	VDD_PX-0.45	VDD_PX	V
VOL	Low level of output voltage	0	0.45	V

3.4 Power Interface

3.4.1 Description of Power PINs

Power VPH_PWR signal (PIN No: 23-26). This is the positive signal of 3.8V power supply.

GND signal (PIN No: 2/12/14/31/36/38/44/47/54/63/66/69/71/78). This is the power ground and signal ground of ZM5202, which needs to be connected to the ground on the system board. If the GND signal is not connected completely, the performance of ZM5202 will be affected. Besides, there are altogether 30 heat-dissipation wielding panel with PIN No. 79-108.

3.4.2 Requirement of Power Supply

The power supply is recommended to be within the range of 3.4~4.2V. If the network is in poor situation, the antenna will transmit at the maximum power, and the transient maximum peak current under 2G mode can reach as high as 2A. So the power supply capacity for peak current needs to be ab ove 2.5A, and the average peak current needs to be above 0.9A.

3.5 (U)SIM Card Interface

3.5.1 Description of PINs

ZM5202 WCDMA module baseband processor integrates the (U)SIM card interface in compliance with ISO 7816-3 standards, and supports to automatically detect 3.0V/1.8V (U)SIM cards. The signals on SIM card interface is as shown in Table 3-5.

Table 3-5 Definition & Description of (U)SIM Card Signal Group

PIN	Protocol Signal	Signal Definition	Signal Description
48	VREG_RSIM	SIM card power	Output range: 1.5-3.0V
49	UIM_RST	SIM card reset PIN	--
50	UIM_DATA	SIM card data PIN	--
51	UIM_CLK	SIM card clock PIN	--
52	UIM_DP	Data cable	USIM card data signal, applied on a large-capacity SIM card
53	UIM_DM	Data cable	USIM card data signal, applied on a large-capacity SIM card

3.5.2 Electric Feature

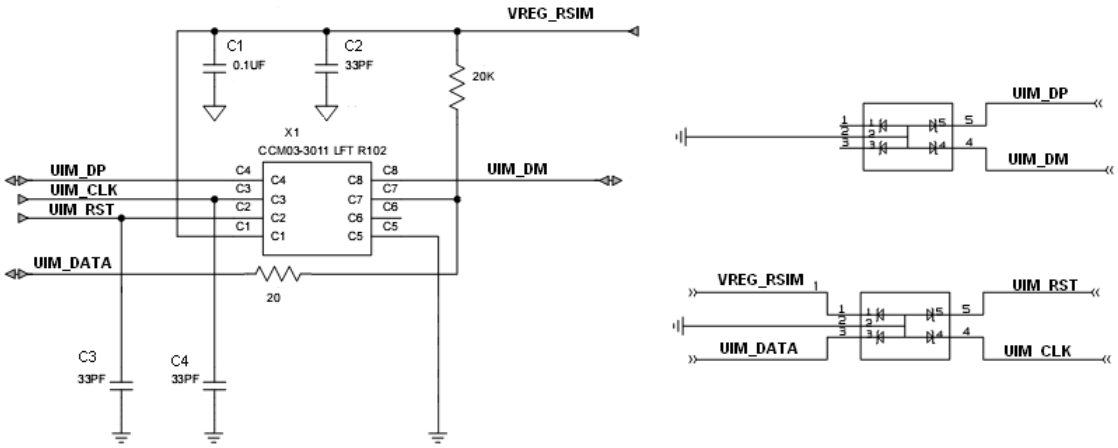
On the line close to the (U)SIM card console, be sure to add the ESD circuit protection during the design.

To comply with the requirements of 3GPP TS 51.010-1 and EMC authentication, it is recommended to place (U)SIM card console close to the (U)SIM card interface, to prevent the wiring from being too long, which might seriously distort the waveform and thus affect the signal integrity. It is recommended to make the grounding protection for UIM_CLK and UIM_DATA signal wiring. Cascade one 0.1uF and 33pF capacitor between VREG_RSIM and GND, and cascade a 33pF capacitor

between UIM_CLK, UIM_RST and GND, to filter out the interference by RF signals. It is recommended to cascade a 20ohm resistance on UIM_DATA cable.

3.5.3 Application of (U)SIM Card Interface

Figure 3-2 (U)SIM Card Signal Connection Circuit



3.6 SD Card Interface

3.6.1 Description of PINs

The SD card interface of ZM5202 module is the storage card based on FLASH, embedded with 4-bit and 1-bit SD controller, supporting SD and Mini SD cards. Its PIN signals are as shown in Table 3-6.

Table 3-6 Definition of SD Card Signal Interface

PIN	Signal Name	Description	Function
61	SDCC_DATA0	SD card data cable PIN	SD card data cable
60	SDCC_DATA1	SD card data cable PIN	
59	SDCC_DATA2	SD card data cable PIN	
58	SDCC_DATA3	SD card data cable PIN	
57	SDCC_CLK	SD card clock cable PIN	SD control clock output can reach up to 20MHz
56	SDCC_CMD	SD card control PIN	--
55	VREG_MMC	SD card power	3V

3.6.2 Electric Feature

SDCC_CLK: Clock signal, host2device, default is 0~25MHz.

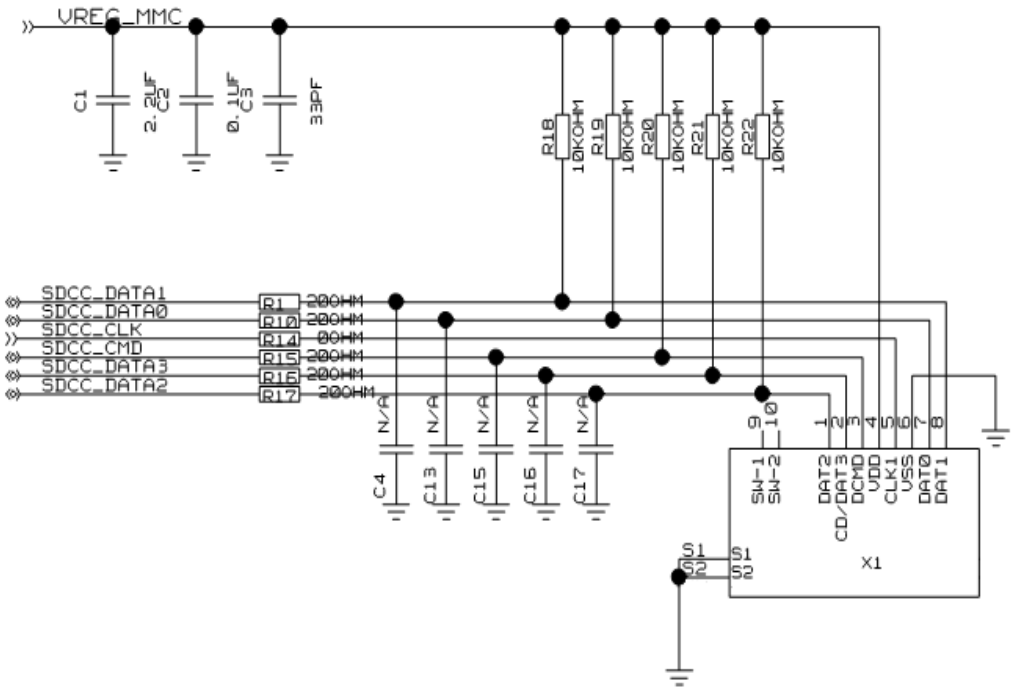
SDCC_CMD: Command/response, two-way: the command can sent from the host to a single card/all cards, the response is sent from a single card/all cards to the host.

SDCC_DATA[3..0]: Data cable, two-way, default is 0~12.5MB/sec.

3.6.3 Application of SD Card Interface

Figure 3-3 is the reference design diagram for the SD interface. The detection of SD card adopts the polling mode of DATA3 signal cable to judge whether T card is inserted or not.

Figure 3-3 SD Typical Application Circuit



3.7 USB2.0 Interface

3.7.1 Description of PINs

ZM5202 has the high-speed USB2.0 interface, which supports both the full-speed mode and the high-speed mode. The main processor (AP) is connected with the module via the USB interface to transmit data.

3.7.2 Electric Feature

The USB interface complies with the USB2.0 specifications and the electric features. USB_DP, USB_DA are wired strictly according to the differential mode, and the length difference between the two cables should be restricted within 1mm.

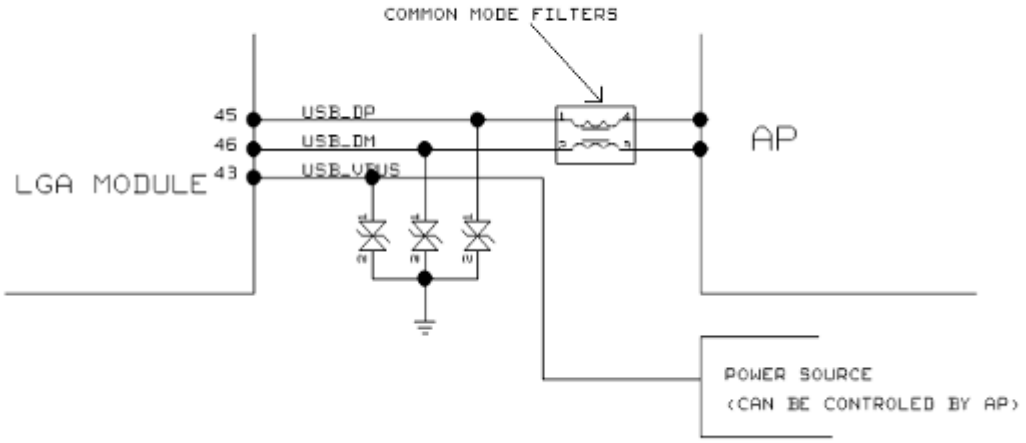
Note: The differential impedance should be controlled within 90ohm.

It is recommended to connect to a high-speed common-mode echo filter on the USB differential signal wire. If the cable is exposed to the external environment, it is suggested to add a n ESB protection device. The power capacity of the ESD protection device should be kept within 1.5pF.

3.7.3 Application of USB Interface

The USB bus is mainly used in data transmission, software upgrading and modular program detection. Figure 3-4 shows a reference circuit design.

Figure 3-4 USB Typical Circuit Application



3.8 Serial Interface

3.8.1 SPI (Serial Peripheral Interface) Bus Interface

3.8.1.1 Description of PINs

The definition of SPI interface signaling is defined as shown in Table 3-7.

Table 3-7 Definition of SPI Signal

PIN	Signal Name	I/O Type	Function
39	SPI_ CS_N	O	SPI segment
40	SPI_ CLK	O	SPI clock
41	SPI_MISO_DATA	B	Main input, slave output
42	SPI_MOSI_DATA	B	Main input, slave output

3.8.1.2 Electric Feature

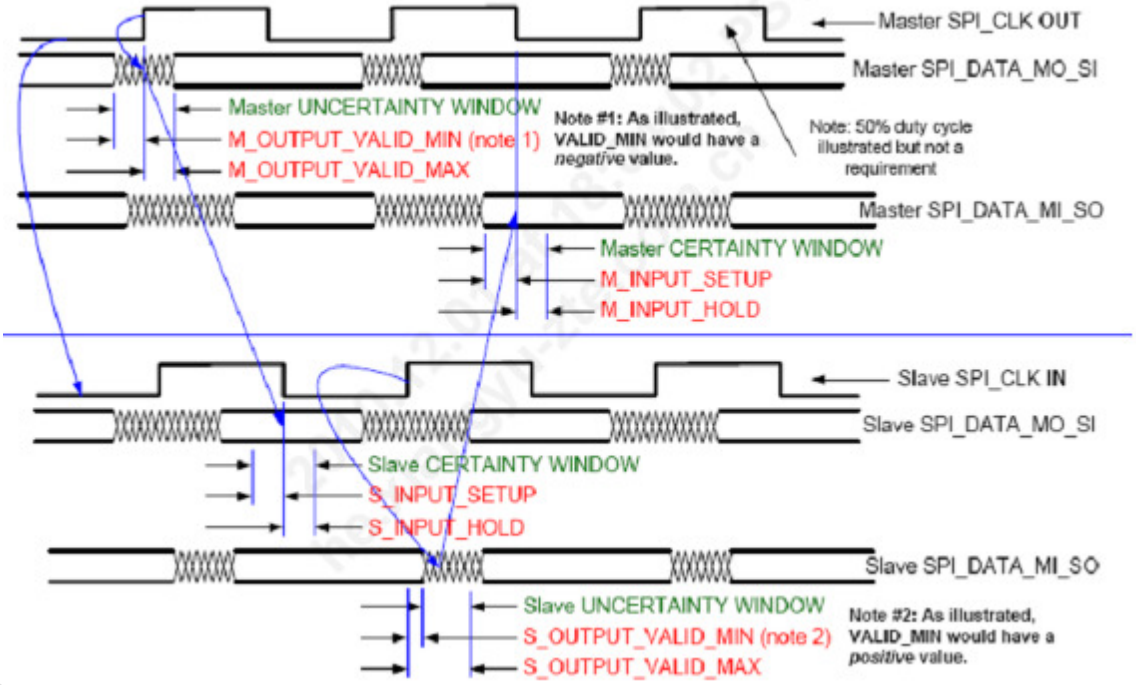
The SPI bus of ZM5202 is configured as the master equipment, and there are three modes for SPI:

Running mode: Basic running mode.

Waiting mode: The waiting mode of SPI is a configurable low-power mode, enabled by the byte of the control registered. In the waiting mode, if the waiting byte is cleared, SPI works under the similar running mode. However, if SPI waits for the position byte, SPI clock stops and enters the low-power status.

Stop mode: Under the stop mode, SPI is not available, so the power consumption is reduced. If SPI is configured as the master equipment, any transmission process will be stopped, but it can enter the running mode when the waiting mode stops. Figure 3-5 is the SPI bus sequence chart.

Figure 3-5 SPI Bus Sequence Chart



3.8.2 I2C Bus

3.8.2.1 Description of PINs

I2C is the two-wire bus for the communication between ICs, which supports any IC process (NMOS, CMOS, dual-polarity). The two signal wires, serial data (SDA) and serial clock (SCL), can transmit information between the connected equipment. Each equipment is identified by the unique address (such as the micro controller, storage, LCD driver, audio DAC or keyboard interface). Due to the different functions of the equipment, it can be used as both the sender and the receiver.

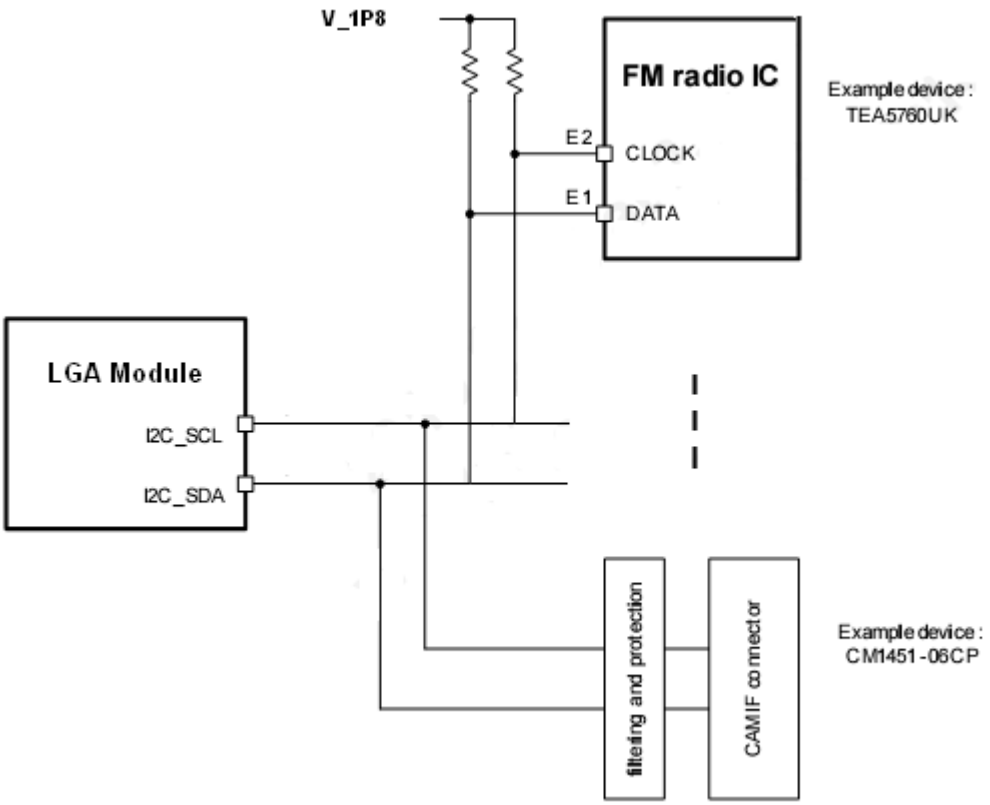
3.8.2.2 Electric Feature

The I2C interface has the following features:

1. The two-wire bus is used for the communication between ICs.
2. It supports any external equipment of any manufacturing technology (1.8V).
3. It supports the external functions, such as the image sensor, micro controller, FM radio chip, LCD chip, audio DAC and keyboard interface.

The I2C interface has two working modes with different transmission ratios: standard mode with a speed as high as 100kbps; high-speed mode with a speed as high as 400kbps. Figure 3-6 is the I2C reference circuit design diagram.

Figure 3-6 I2C Reference Circuit Diagram



3.8.3 UART Interface

3.8.3.1 Description of PINs

ZM5202 module provides a circuit of serial communication interface UART, which complies with the RS-232 interface protocol, and supports the 8-byte serial bus interface or 2-byte serial interface is Via the UART interface. But the 8-byte serial bus UART interface and the SPI bus interface are not supported simultaneously. The module can perform the serial communication and AT instruction interaction with external.

This UART port supports the programmable data width, programmable data stop digit and programmable odd/even checksum, and has an independent TX and RX FIFOs (512 bytes for each). For the normal UART application (non-Bluetooth), the maximum baud r ate is 230400bps, the 4Mbps high baud rate is only used on Bluetooth 2.0 application, and the default baud rate is 115200bps. The PINs are defined as shown in Table 3-8.

Table 3-8 Definition of UART Signal

PIN	Signal Name	Description	Function
27	UART1_CTS	UART port CTS clearing sending	UART power level is 1.8V.
28	UART1_RFR	UART port RFR preparing to receive	
29	UART1_TXD	UART port TXT sending data	
30	UART1_RXD	UART port RXD data receiving	
40	UART_DTR	DTE is ready	--
41	UART_RI	Ring indicator	--
42	UART_DSR	Data is ready	--
39	UART_DCD	Carrier detect	--

3.8.3.2 Electric Feature

During the software interconnection process, there is a method of capturing logs, and it is recommended that this interface be kept during the design and the testing point be reserved. If the module is used together with the application processor, and the PWL matches with 1.8V, the connection mode is as shown in Figure 3-7. The

4-wire or 2-wire mode can be used for connection. The module interface PWL is 1.8V. If it does not match the PWL of AP interface, it is recommended to add the PWL conversion circuit.

The connection of ZM5202 UART port and standard RS-232-C interface can be through the chip like class 232. The design involves the transformation of TTL level and EIA level. We recommend to use the chip of NLSX5014MUTAG. If using the 2-byte serial bus interface, MAX3232 is recommended, and if using the 8-byte serial bus interface, SP3238 or MAX3238 is recommended. The connection mode is as shown in Figure 3-7

Figure 3-7 Module Serial Port & AP Application Processor

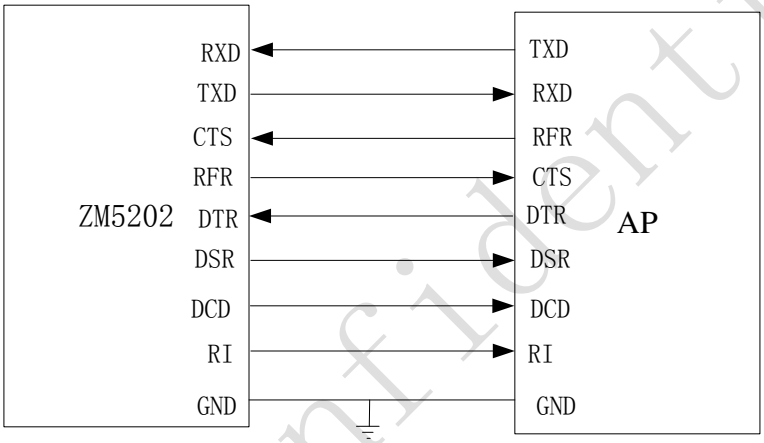
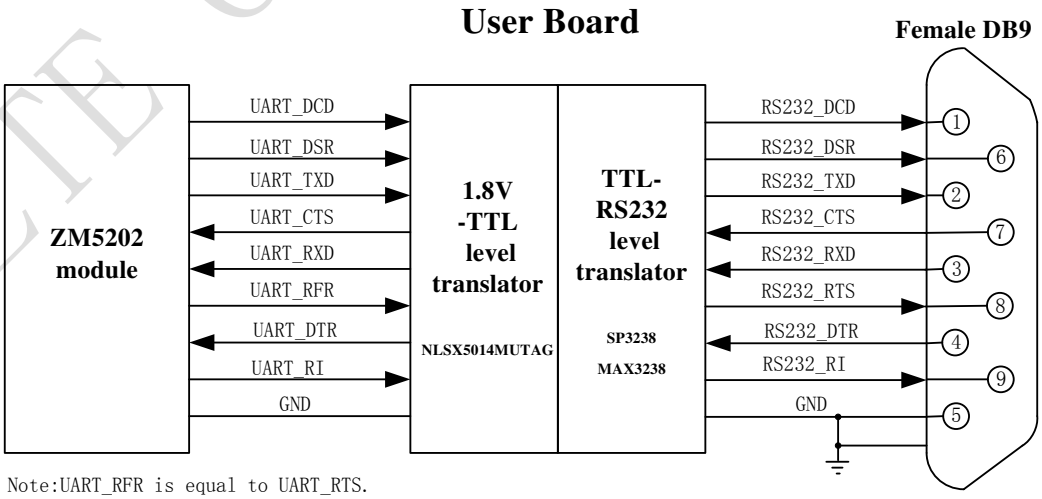


Figure 3-8 The connection of ZM5202 UART and Standard RS-232-C interface



Note:UART_RFR is equal to UART_RTS.

3.9 JTAG (Joint Test Action Group) Interface

3.9.1 Description of PINs

The JTAG interface complies with the ANSI/ICEEE Std. 1149.1-1990 standard, and the interface is defined as shown in Table 3-9.

Table 3-9 Definition of JTAG Signal

PIN	Signal Name	I/O Type	Function
3	JTAG_RESOUT_N	DI	LGA reset
72	JTAG_TRST_N	DI-PD	JTAG reset
73	JTAG_RTCK	DO	JTAG return clock
74	JTAG_TCK	DI-PU	JTAG clock input
75	JTAG_TDO	Z	JTAG test data output
76	JTAG_TDI	DI-PU	JTAG test data input
77	JTAG_TMS	DI-PU	JTAG test mode select
78	GND	--	Grounding

3.9.2 Application of JTAG Interface

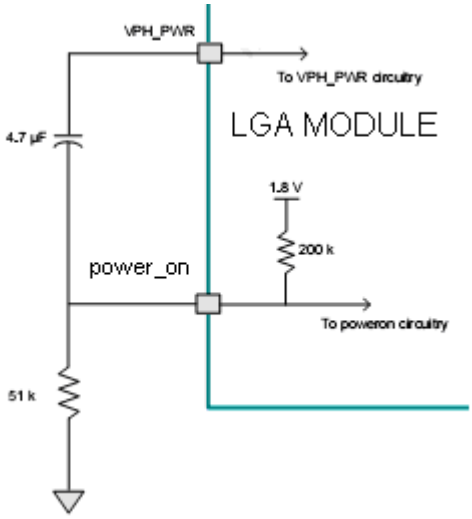
On the system board, you need to reserve the testing point or interface of the related JTAG signal, so as to solve the un-repairable fault of LGA module due to emergencies such as downloading interruption.

3.10 Power-on/Power-off & Reset Signal

3.10.1 Description of PINs

The power-on process of ZM5202 module is: Push the POWER_ON PIN for more than 50ms, pull this PIN upward and then power on. Under the power-on status, push POWER_ON PIN for more than 5s, then pull this PIN higher, and then power off. Within the module, POWER_ON PIN is pulled via a 200 K resistance to 1.8V power. To power on, if it does not need to be powered down, process POWER_ON according to the figure below.

Figure 3-9 Module Power-on Plan

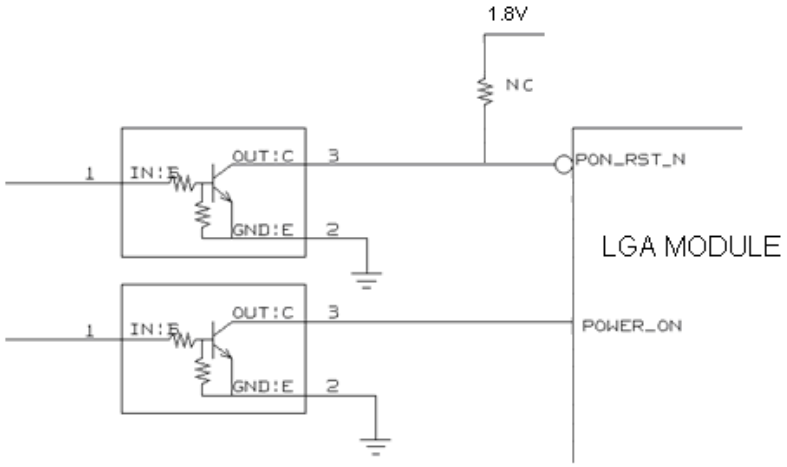


PON_RST_N PIN is used to reset the module. After pushing PON_RST_N PIN for 50ms, pull it higher again and then reset the module.

3.10.2 Interface Application

The POWER_ON and PON_RST_N circuits can refer to the design circuit as shown in Table 3-9. In this figure, the two input signals on the left are the input control signals for reset and power-on respectively.

Figure 3-10 Recommended Circuit for Power-on/Power-off & Reset



3.11 Interactive Application Interface

3.11.1 Description of PINs

Table 3-10 mainly describes the interfaces interacting with the application processor, including the following three types of interfaces: querying, wakeup and status indication.

Table 3-10 Interactive Application Interface

PIN	Signal Name	I/O Type	Function
6	AP_READY	DI	Module querying AP sleep status
9	MODULE_READY	DO	AP querying Module sleep status
10	AP_WAKEUP_MODULE	DI	AP wakeup Module
11	MODULE _WAKEUP_AP	DO	Module wakeup AP
19	MODULE_POWERON	DO	MODULE power-on status indication

3.11.2 Interface Application

The ZM5202 module provides 5 handshake signals for the communication with the application processor (AP). By MODULE_POWERON, AP can query whether LGA is powered on and is working normally. By MODULE_READY, AP queries whether the LGA module has entered the sleep status, wakes up the module under the sleep status by AP_WAKEUP _MODULE. In the same way, when AP is in the sleep status, the LGA module can query the AP status by AP_READY, and wakes up AP by MODULE _WAKEUP_AP.

AP_READY: Indicates that the AP server is sleep: the high PWL indicates the sleep status, and the low PWL indicates the wakeup status.

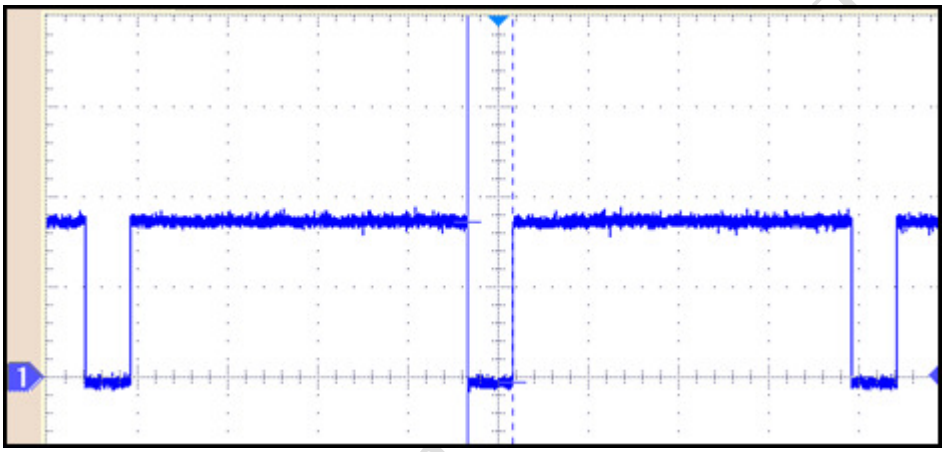
MODULE_READY: Indicates that the module is sleep: the high PWL indicates the sleep status, and the low PWL indicates the wakeup status.

AP_WAKEUP_MODULE: After the module has entered the sleep status, the AP server can wake up the module by the low PWL control; if it's always on the low

PWL, the module cannot enter the sleep status. After the AP server enters the high PWL, the module enters the sleep status.

MODULE_WAKEUP_AP: Make sure that the function of remote wake up is enabled in the config file. When a SMS or call is receiving, the output level of this pin is shown in the following figure: low for 2s—high for 15s—low for 2s—high for 15s—low for 2s before return its default high level to wakeup the AP side.

Figure 3-11 The output of MODULE_WAKEUP_AP



MODULE_POWERON: After the module is powered on, this signal is set to high, and kept until the system is restarted or powered down. Low signal indicates that the server is not powered on, during the power-on process or is being restarted.

3.12 LED Indicator Interface

3.12.1 Description of PINs

Table 3-11 Definition of LED PIN Signal

PIN	Signal Name	I/O Type	Function
20.	LED_GREEN	AI	Module signal indicator interface
21.	LED_RED	AI	Module signal indicator interface
22.	LED_BLUE	AI	Module signal indicator interface

3.12.2 Interface Application

The LGA module has three PINs to control the LED indicator, used to indicate the network connection status. The different modes of status indicator flashing indicate different network statuses. All the three PINs use the current sink type of current source for control, which connects to the negative end of LED and connects to VPH_PWR externally, to directly drive LED. Figure 3-12 is the reference circuit design diagram. The flashing of indicator is controlled by the switch of RF, and the LED PIN transmits the control signal to the external. The indicator status is as defined in Table 3-12. If the RF control is not needed, the AP server can design the status of control indicator by itself.

Figure 3-12 Reference Circuit of Status Indicator

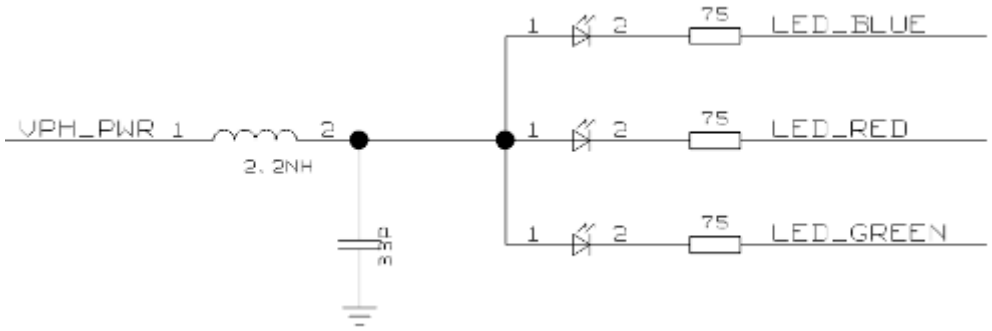


Table 3-12 Definition of Indicator Status

Indicator Status	Module Working Status
RED indicator always on	Not registered to the network
GREEN indicator always on	Have been registered to 2G network
GREEN indicator flashing	Have been registered to 2G network, and there is data service as well.
BLUE indicator always on	Have been registered to 3G network
BLUE indicator flashing	Have been registered to 3G network, and there is data service as well.

4 Electric Feature

4.1 Power Feature

4.1.1 Power Supply

The input voltage range of ZM5202 is DC 3.4V~4.2V, and the typical value is 3.8V, as shown in Table 4-1.

Table 4-1 Input Voltage

Parameter	Min	Typical	Max
Input voltage	3.4V	3.8V	4.2V

4.1.2 Working Current

The working current range of ZM5202 is as shown in Table 4-2. The IDLE mode indicates the power consumption of the module when there is no service. The table also provides the working current range under GSM and WCMA mode when there is data service.

Table 4-2 Working Current

Mode	Status	Average	Remark
GSM	With no service	≤75mA	IDLE mode
	With data transmission	≤380mA	GPRS/EDGE mode
WCDMA	With no service	≤75mA	IDLE mode
	With data transmission	≤470mA	HSPA mode

Note: The above average current is acquired under the maximum transmission power. Under different environments, the testing results might be slightly different. Take the actual situation as the reference.

4.2 Power-on/Power-off Flow

To guarantee the user can power on and power off stably, you can refer to the power-on sequence chart as shown in Figure 4-1 and the power-off sequence chart as shown in Figure 4-2. Table 4-3 shows the power-on and resetting time, which needs to be paid attention to during the module power-on process.

1. Once VPH_PWR is powered on, the POWER_ON signal will be synchronized and be established as the high PWL.

2. After VPH_PWR is established normally, the interval between it to the POWER_ON signal cannot be too short. Refer to T2 parameter. ZTEWelink recommends that VPH_PWR adopt the power-off plan that does not disconnect the power supply.

3. The power-on startup time takes the lower level of POWER_ON as the starting point, and POWER_ON needs to be released after being kept on the low PWL for a period.

4. SUB_VBUS is the USB PHY power supply. It is not recommended to be established before VPH_PWR.

During the process of establishing the module PINs, pay attention to the following items:

1. To power off by the POWER_ON signal, the T4 period needs to be designed as required.

2. After VPH_PWR and USB_VBUS are powered off, it is recommended not to disconnect the power supply.

Figure 4-1 Power-on Sequence Chart of ZM5202 Module

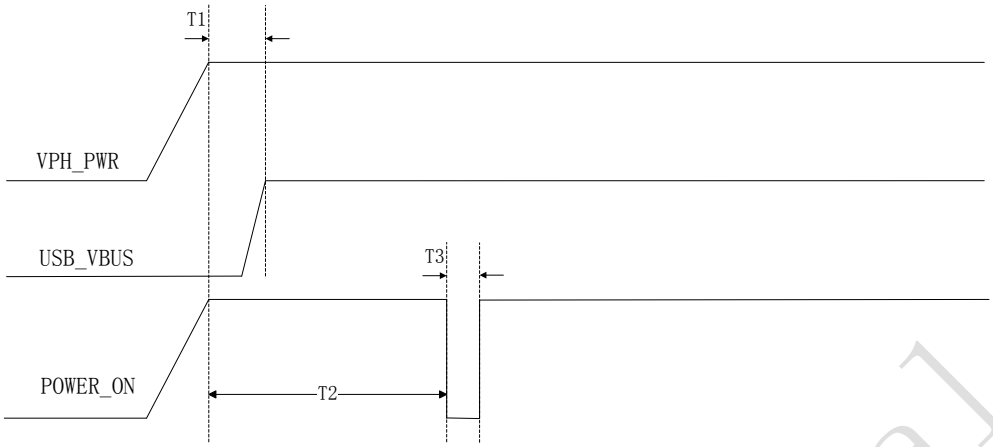


Figure 4-2 Power-off Sequence Chart of ZM5202 Module

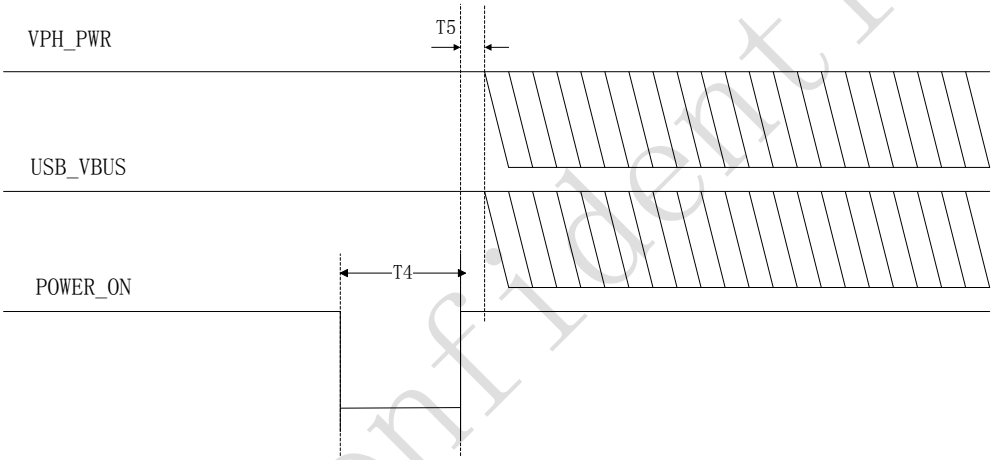


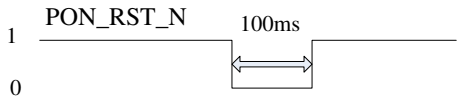
Table 4-3 Power-on/Power-off Time

Parameter	Description	Min	Typical	Max	Unit
T1	From powering on VPH_PWR to establishing USB_VBUS	0	0.5	1	second
T2	From powering on VPH_PWR to Power-on taking effect	1	1.5	--	second
T3	The period that the Power-on signal for power on operation is kept on the low PWL	0.05	0.1	--	second
T4	The period that the Power-on signal for power off operation is kept on the low PWL	4	5	--	second
T5	From the releasing the Power-on button for power off operation to the power off of VPH_PWR and USB_VBUS	1	2	--	second

4.3 Resetting Flow

The PON_RST_N reset signal of ZM5202 module is the increasing resetting, so it is reset after decreasing this PIN by 100ms. Figure 4-3 is the module resetting flow.

Figure 4-3 Module Resetting Flow



5 Technical Index of Radio Frequency

5.1 Technical Index of Radio Frequency under UMTS Mode

5.1.1 UMTS (WCDMA)

The RF index should be tested strictly in accordance with the related testing specifications of 3GPP. The RF indexes of UMTS2100/1900/850 should satisfy the requirements of 3GPP TS 34.121 protocol.

5.2 Technical Index of Radio Frequency under GPRS/GSM/EDGE Mode

The RF indexes of GSM/GPRS/EDGE850/900/1800/1900 should satisfy the requirements of 3GPP TS 05.05 protocol.

5.3 Technical Parameters of Antenna Testing Console

ZM5202 supports the AGPS function, so the system equipment needs to add the AGPS antennal. The design of AGPS antenna is consistent with that of the main antenna, and its efficiency index can be 3dB lower. The separation degree between the main antenna and the diversity antenna is required to be greater than 12dB. The antenna index is divided into the sourceless index and s ourced index. The sourceless index includes S11, efficiency, gains, orientation diagram and polarity, which can be used as the parameter measuring the performance of the antenna itself. The sourced index is also called the OTA index, including TRP (all-round radiation power), TIS (all-round receiving sensitivity), radiation orientation diagram, which is an important index measuring the radiation performance of the whole set (including the antenna, module, circuit main board).

5.3.1 Sourceless Index

The sourceless indexes of antenna are different according to the different requirements of wireless Internet products. Here, taking the 3G Internet notepad as an example, the sourceless index of the antenna is recommended to reach the standards as described below.

Table 5-1 Sourceless Index of Main Antenna (Recommended)

Frequency Band	824-960MHz	1710-2170MHz
VSWR in Free Space	<3:1	<3:1
Peak Gain in Free Space	>0dBi	>0dBi
3-D Average Gain in Free Space	-3dBi	-3dBi
Antenna Efficiency	>50%	>50%

5.3.2 Sourced Index

The sourced indexes of antenna are different according to the different requirements of the product type. Here, taking the 3G Internet notepad as an example, the sourced index of the antenna is recommended as below.

TRP: <W850/W900/W1900/W2100>18dBm;

GSM850>27dBm, GSM900>27dBm;

DCS1800>24dBm, PCS1900>24dBm>;

TIS: <W850/W900<-100dBm; W1900/W2100<-103dBm;

GSM850<-100dBm, GSM900<-100dBm;

DCS1800/PCS1900<-102dBm.

6 Related Test & Testing Standard

6.1 Testing Reference

The related tests of ZM5202 comply with the IEC standard, including the equipment running under high/low temperature, storage under high/low temperature, temperature shock and EMC. Table 6-1 is the list of testing standard, which includes the related testing standards for ZM5202.

Table 6-1 Testing Standard

Testing Standard	Document Reference
IEC6006826	Environmental testing-Part2.6:Test FC: Sinusoidal Vibration
IEC60068234	Basic environment testing procedures part2.
IEC60068264	Environmental testing-part2-64: Test FH: vibration, broadband random and guidance.
IEC60068214	Environmental testing-part 2-14: Test N:change of temperature.
IEC60068229	Basic environmental testing procedures-part2: Test EB and guidance.
IEC6006822	Environmental testing-part2-2:Test B:dry heat
IEC6006821	Environment testing-part2-1: Test A: cold.
GB/T 15844.2	MS telecommunication RF wireless phone-set environment requirement & experimental method – part 4: Strict level of experimental condition
GB/T 2423.17	Basic environment experiment of electronic products-Experiment Ka: Salt mist experiment method
GB/T 2423.5	Basic environment experiment of electronic products-Part2:Experiment method Try Ea & Introduction: Shock
GB/T 2423.11	Basic environment experiment of electronic products-Part2:Experiment method Try Fd: Broad frequency band random vibration (General requirement)
TIA/EIA 603 3.3.5	TIA Standard-part3-5:Shock Stability

Note: 1. IECL International Electro technical Commission; 2. GB/T: Recommended national standard

6.2 Description of Testing Environment

The working temperature range of ZM5202 is divided into the normal working temperature range and the extreme working temperature range. Under the normal working temperature range, the testing result of RF complies with the requirements of 3GPP specifications, and its function is normal. Under the extreme temperature range, the RF index basically complies with the 3GPP specifications, and the quality of data communication is affected to a certain extent, but its normal function is not affected. ZM5202 has passed the EMC test. Table 6-2 is the requirement for the testing environment, and Table 6-3 lists out the instruments and devices that might be used during the test.

Table 6-2 Testing Environment

Working Condition	Min Temperature	Max Temperature	Remark
Normal working condition	-20° C	75° C	All the indexes are good.
Extreme working condition	-40° C	85° C	Some indexes become poorer.
Storage	-40° C	85° C	Storage environment of ZM5202

Table 6-3 Testing Instrument & Device

Testing Item	Instrument & Device
RF test	Comprehensive testing device
	RF cable
	Tower antenna
	Microwave darkroom
High/Low-temperature running & storage test	High/Low-temperature experimental box
Temperature shock test	Temperature shock experimental box
Vibration test	Vibration console

6.3 Reliability Testing Environment

The reliability test includes the vibration test, high/low-temperature running, high/low-temperature storage and temperature shock experiment test. Refer to Table 6-4 for the specific parameters.

Table 6-4 Reliability Features

Testing Item	Testing Condition	Testing Standard
Random vibration	Frequency range: 5-20Hz, PSD:1.0m2/s3 Frequency range: 20-200Hz, -3dB/oct 3 axis, 1 hour for each axis	IEC 68-2-6
Temperature shock	Low temperature: -40°C ±2°C High temperature: +80°C ±2°C Temperature changing period: less than 30seconds Test duration: 2 hours Cycle: 10	IEC 68-2-14 Na
High-temperature running	Normal high temperature: 75 ° C Extreme high temperature: 85° C Duration: 24 hours	ZTE standard
Low-temperature running	Normal low temperature: -20° C Extreme low temperature: -40° C Duration: 24 hours	ZTE standard
High temperature & high humidity	Temperature: +60°C Humidity: 95% Duration: 48 hours	ZTE standard
High temperature storage:	Temperature: 85° C Duration: 24 hours	IEC 68-2-1 Ab
Low temperature storage:	Temperature: -40° C Duration: 24 hours	IEC 68-2-2 Bb

6.4 Reliability Testing Result

Table 6-5 Temperature Testing Result Under Windless Environment

Mode	Temperature	Voltage	Transmission Power	Duration	Testing Result
GPRS Class 10	+25 ℃	(3.8±10%)V	Max	≥1hour	Pass
EDGE Class 12	+25 ℃	(3.8±10%)V	Max	≥1 hour	Pass
WCDMA	+25 ℃	(3.8±10%)V	Max	≥1 hour	Pass

Table 6-6 High/Low-temperature Running & Storage Testing Result

Testing Item	Testing Condition & Standard	Testing Content	Testing Result
Random vibration	Refer to Table 6-4	RF test & function test	Pass
Temperature shock	Refer to Table 6-4	RF test & function test	Pass
Low-temperature working	Refer to Table 6-4	RF test & function test	Pass
High-temperature working	Refer to Table 6-4	RF test & function test	Pass
Extreme low-temperature working	Refer to Table 6-4	RF test & function test	Pass
Extreme high-temperature working	Refer to Table 6-4	RF test & function test	Pass
Low-temperature storage	Refer to Table 6-4	RF test & function test	Pass
High-temperature storage	Refer to Table 6-4	RF test & function test	Pass

7 Design Guide

This chapter provides the general design guide for ZM5202, used as a reference for the user during the design process, so that the product can reach better performance.

7.1 General Design Rule & Requirement

When the user is designing the peripheral circuits of ZM5202, he needs to first guarantee that the external circuit has the sufficient power supply capability, and the USB of high-speed signal cable is required to have 90ohm differential resistance. For the common signal interface, it is required to design according to ZTEWelink requirements, which needs to comply with the power level of interface signal, so as to prevent the impedance from damaging the module. The RF index of this product itself is good, and the user needs to design the antenna circuit of the main board and make the corresponding impedance control. Otherwise, the RF index of the whole set will be affected.

7.2 Power Supply Circuit Design

It is required that the power supply capability of VPH_PWR on the system board reach 2.5A or above, so as to satisfy the requirement of peak current on the module. And the average current of the power on the system side should also reach 0.9A or above. The power cable on the system board should be thick enough, and should form a good reflux with the ground. Besides, in the power supply circuit design, the user needs to add the large storage capacitor on the kilo level, to guarantee the transient power supply capability.

7.3 RF Circuit Design

7.3.1 RF Antenna Circuit Design

There are two interfaces on the RF antenna of ZM5202: main antenna interface, and GPS antenna. The main antenna supports two access modes of RF signal: by PDA wielding panel mode and by RF connector mode. The GPS antenna only supports the access mode of LGA wielding panel. Figure 7-1 is the main antenna connector interface, and Figure 7-2 Interface of Main Antenna and AGPS Antenna Welding Pad

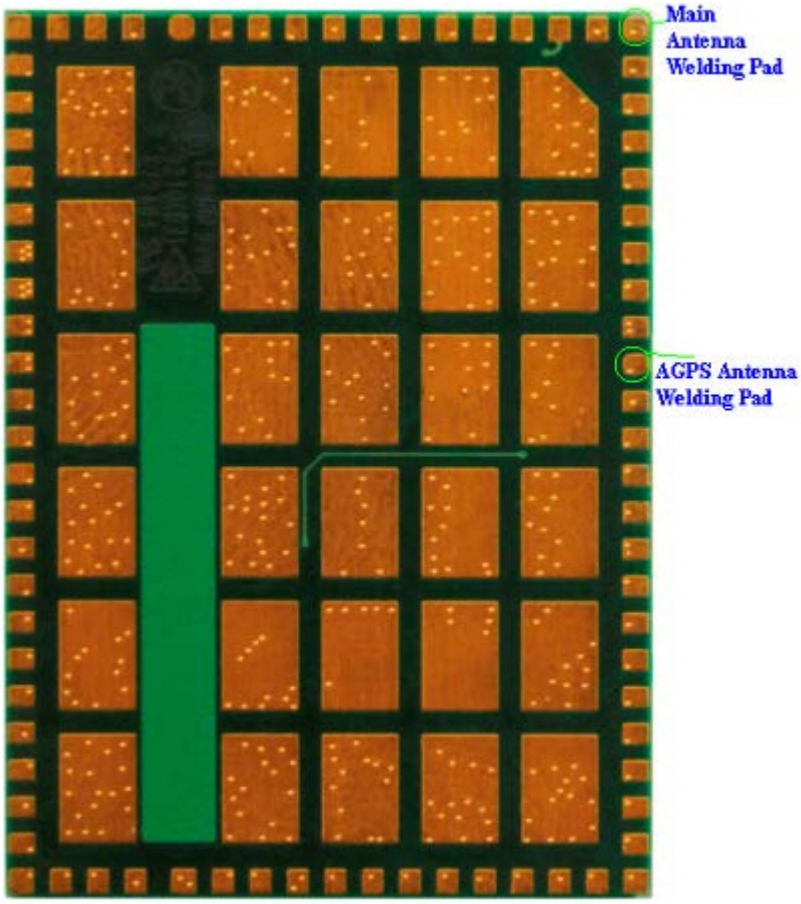


Figure 7-3 shows the interface between the antenna and the GPS antenna. Currently, ZTEWelink adopts the W.FL-R-SMT-1 RF connector testing console from HRS company, as shown in

Figure 7-1 Main Antenna RF Connector Interface

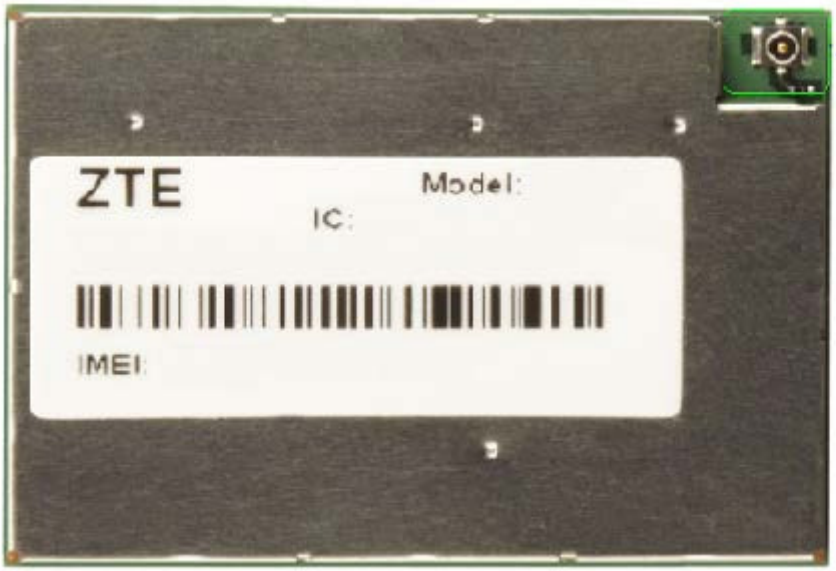


Figure 7-2 Interface of Main Antenna and AGPS Antenna Welding Pad

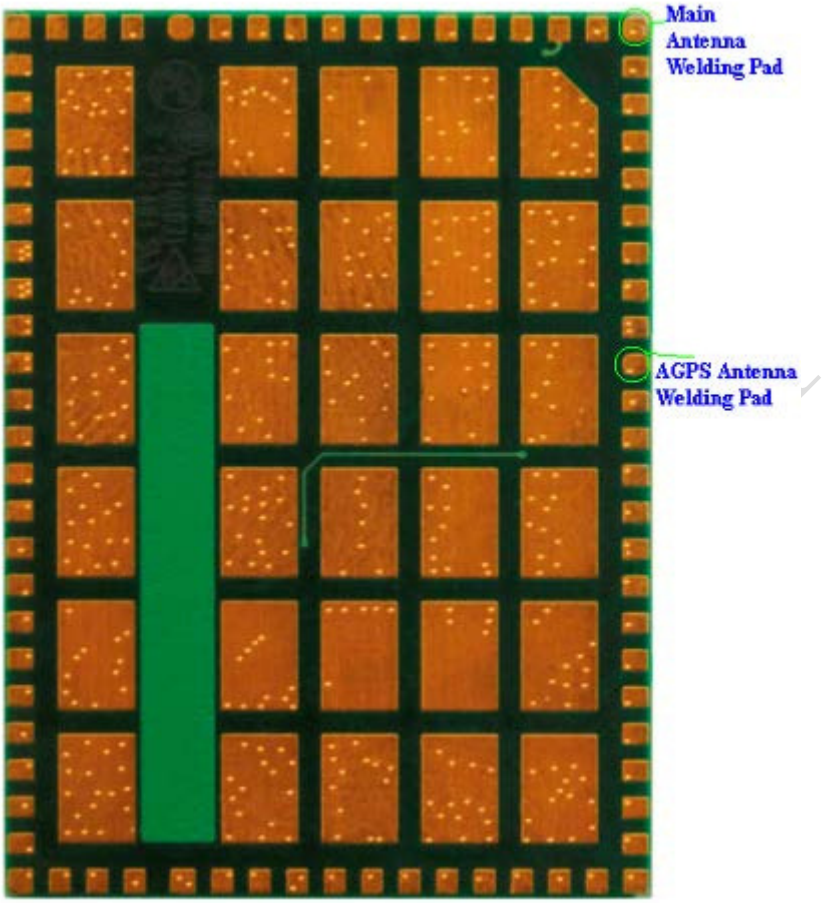
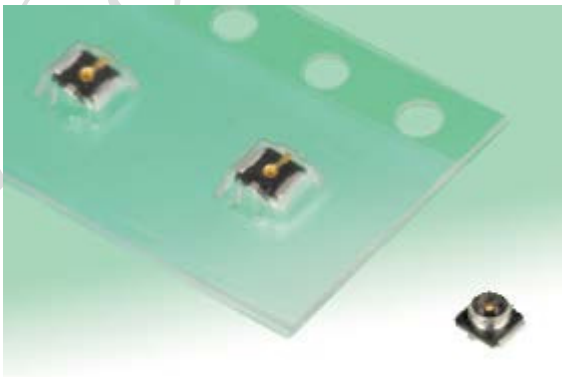
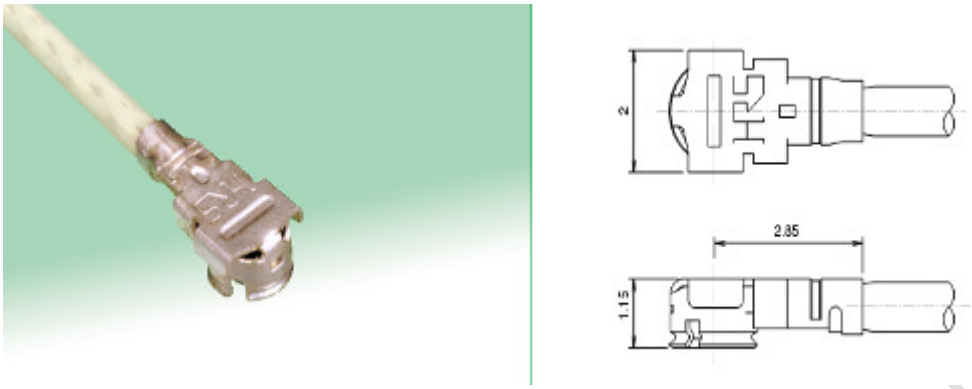


Figure 7-3 RF Interface Testing Console (W.FL-R-SMT-1 from HRS)



If the main antenna is access by the RF connector, the corresponding cables of RF interface are recommended to use the W.FL-LP-04N of HRS company, as shown in Figure 7-4. When this connection mode is adopted, the antenna RF connector can be directly inserted to the RF testing console of the module, so it saves the connection between the RF port and the antenna interface.

Figure 7-4 Testing Cable



If the main antenna is accessed by the PDA wielding panel, the RF main antenna wield pane of the module itself needs to be connected to the antenna interface on main board via the wield pane and micro stripline or stripline. The micro stripline or stripline is designed according to the 50ohm impedance, and the dual-L model matching circuit is reserved.

For the different terminal products, the dimensions are different, the requirements for the antenna performance are different, so the size and location of antenna are different as well. Taking the 3G Internet notepad as an example, its antenna space is recommended to be above 7mm*10mm*100mm, and be placed above the top of LCD screen.

The design of AGPS antenna is consistent with the main antenna, and its efficiency index is allowed to be 3dB lower. The separation degree between the main antenna and the diversity antenna is required to be greater than 12dB.

7.3.2 Precautions During the Initial Design of Antenna

7.3.2.1 Preliminary Evaluation

When choosing the antenna position, make sure that the antenna and the base station are kept on the horizontal level, so as to reach the highest efficiency. Then, avoid the place the antenna close to the switch power or data cable, chip or another device that might result in electromagnetic interference. Place the antenna in a location that the hand cannot reach, to prevent from the attenuation generated by the body. Also take into consideration the reduction of radiation and the feasibility of

its structure. Therefore, during the initial design, make the layout evaluation with the structure, ID, circuit and antenna engineers together.

7.3.2.2 Suggested Antenna Location

For the notepad, the ideal location position for the antenna is on the left corner or right corner of LCD, because this position is relatively far away from the main board, so the electromagnetic interface is little. Besides, this position is relatively far away from the human body, so the SAR index can be easily satisfied. Another suggested position is on the left or right of LCD. For the other products such as the router or electronic book, make the evaluation according to the feature of the product itself.

7.3.2.3 Suggested Antenna Occupancy Space

As different antenna manufacturers might adopt different antenna modes, the reserved space of the antenna is also different. Taking the 3G Internet laptop as an example (coverage frequency: W2100/W1900/W900/W850, GSM850/GSM900/ GSM1800/GSM1900), it is recommended to set the antenna size as 5mm (width) * 12mm (width) * 80mm (length).

7.3.2.4 Main Board Layout

The interference on the main board area is very strong. According to the testing result, when the module is placed in these interference areas, its performance becomes poorer. When designing the notepad, it's better to separate the module form the main board PCB, instead of installing the module on the main board. If they are not separated, the module should better be far away from the chip, storage, power interface, data cable interface and other module or device that might generate EMI.

7.3.2.5 Antenna RF Connection Cable

The RF connection cable of the antenna should better be short. Taking consideration of the transmission power los, it is recommended to adopt a thicker RF cable. At the same time, the RF cable should better be far away from FSB, chip and storage, power interface, data cable interface, and other modules or devices that might generate EMI. The connection antenna and the RF connection cable of

3G module cannot go on the right angle, cannot be crushed or worn. The RF cable should better be wired close to the ground of main board.

7.3.2.6 Matching Circuit of Antenna

If the module RF interface needs to be transferred with the antenna interface, when designing the main board circuit, the micro stripline or stripline between the module RF testing console and the antenna interface RF testing console should be designed by the 50ohm impedance, and the dual-L model matching circuit is reserved. If the antenna RF connector is directly inserted to the module RF testing console, the transfer between the module RF port and the antenna interface can be saved.

7.3.2.7 Type of Antenna RF Cable & RF Connector

The antenna RF connection cable usually adopts GBE(TW) and Shenyu (Mainland), or Japanese Somitomo and Shin Din. The antenna RF cable usually adopts a line width of 1.37mm. The antenna RF connector usually adopts Japanese IPX, or HRS, while the price of the latter is higher.

7.4 Suggestions for EMC & ESD Design

During the design of the whole set, the user needs to fully consider the EMC problem caused by the signal integrity and power integrity. During the layout and wiring of peripheral circuits, for the wiring of power and signal cables, keep a distance of 2 t imes of the line width, so as to effectively reduce the coupling between signals and keep a clean reflux path for the signal. During the design of peripheral power circuits, the de-coupled capacitor should be placed closed to the module power PIN, the high-frequency high-speed circuit and the sensitive circuit should be placed far away from the border of PCB. They should better be separated during layout, so as to reduce the interference between them and protect the sensitive signal. For the circuit or device on the side of system board that might interfere the module, it should be shielded during design.

ZM5202 is embedded on the side of system board, so the user needs to make the ESD protection during design. For the key input/output signal interface, such as the

(U)SIM card signal interface, the ESD device should be placed closely for protection. Besides, on the side of main board, the user should reasonably design the structure and PCB layout, guarantee that the metallic shielding shell is fully grounded, so as to leave a smooth discharge channel for ESD.

7.5 Suggestions for PCB Wielding Panel Design

When the user is designing the encapsulation wielding panel on main board, the 30 heat wielding panels in the center are recommended to be designed according to the dimensions as described in Figure 2-1. The surrounding 78 wielding panels should be extended by more than 0.3mm, and the other three sides of the wielding panel are extended by 0.05mm. For the right angles of wielding panels for the main antenna PIN1 and A GPS antenna PIN70, they are recommended to be rounded into a round angel with a radius of 0.3mm. In this way, it is convenient for the import of interference and the radiation of RF signal.

7.6 Suggestions for Heat-dissipation Design

The module will dissipate heat during the working process, and might also be affected by other high-temperature devices. The heat dissipation is taken into full consideration during the product design, as 30 heat wielding panels are reserved in the center of the module. During the connection with the system board, make sure that these wielding panes are grounded well, which is greatly helpful to heat conductivity and heat balance, and is greatly beneficial to the electric performance of the whole set as well.

Note:

1. Keep this product away from heat-dissipation devices with high power, to prevent the temperature of the module from being too high. .

2. Do not put the module close to the large heat-dissipation devices, such as CPU or bridge. The high temperature will affect the RF performance.

7.7 Recommended Product Upgrading Plan

It's recommended to use the one-click software upgrade tool to upgrade through the USB port provided by ZTEWelink in the Windows system. If the customer wants to upgrade the module in other operation systems, ZTEWelink provides the corresponding reliable tools too.

8 Manufacturing Guide

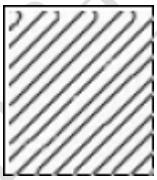
8.1 Design of Steel Mesh

During the design of steel mesh, note:

1. When manufacturing the steel mesh of thermal pad on the bottom of the module, narrow the mouth of the steel mesh to 75% of the original size, so as to reduce the risk of shortcut between the module thermal and the peripheral PINs. This method is effective.

2. It is recommended to design to the mouth of steel mesh on the thermal pad wielding panel to the lattice form. Figure 8-1 shows the recommended pattern for the steel mesh.

Figure 8-1 Recommended Pattern of Steel Mesh on Wielding panel



8.2 Furnace Temperature Curve

The furnace temperature curve greatly affects the wielding quality and the material status, so it needs to be paid great attention to. The temperature increasing speed cannot be too fast, with the increase speed from the room temperature to 150℃ less than 3℃/second. At the same time, if the temperature is above 217℃, the duration should be kept within 70 seconds, while the interim value 55 seconds is ideal. Otherwise, the great temperature shock will make certain devices ineffective, causing the quality to decrease and the maintenance difficulty to increase. At the same, keep the precise maximum temperature to be below 245℃, as certain materials (such as the crystal) might crack under the high temperature and won't not vibrate any more, so the product function is affected. Refer to Table 8-1 for the setting of furnace temperature curve, refer to Figure 8-2 for the furnace temperature

curve, and refer to Figure 8-3 for the testing result. Figure 8-2 and Figure 8-3 are only a reference, and refer to Table 8-1 for the detailed requirements.

9 FCC Regulations:

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Changes or modifications not expressly approved by the party responsible for compliance could void the user‘s authority to operate the equipment.

This device has been tested and found to comply with the limits for a Class B digital device , pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiated radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

-Reorient or relocate the receiving antenna.
-Increase the separation between the equipment and receiver.
-Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
-Consult the dealer or an experienced radio/TV technician for help.

Caution: Changes or modifications not expressly approved by the party responsible for compliance could void the user‘s authority to operate the equipment.

RF Exposure Information

This device complies with FCC radiation exposure limits set forth for an uncontrolled environment. In order to avoid the possibility of exceeding the FCC radio frequency exposure limits, human proximity to the antenna shall not be less than 20cm (8 inches) during normal operation.

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 an 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 8x10cm, then 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-ZM5202". If the size of the end product is larger than 8x10cm, 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.

Table 8-1 Curve Temperature Curve Parameter Setting

Lead-free Curve Temperature Curve		
Phase	Temperature	Duration
Pre-heat	Temperature is increased from room temperature to 150℃	Temperature increasing ratio <3℃/second
Temperature keeping	150℃~200℃	40~110 seconds
Wielding	Greater than 217℃	40~70 seconds
	Above 230℃	15~45 seconds
	Peak temperature	MAX: 245℃
		MIN: 230℃

Figure 8-1 Furnace Temperature Curve Reference Diagram

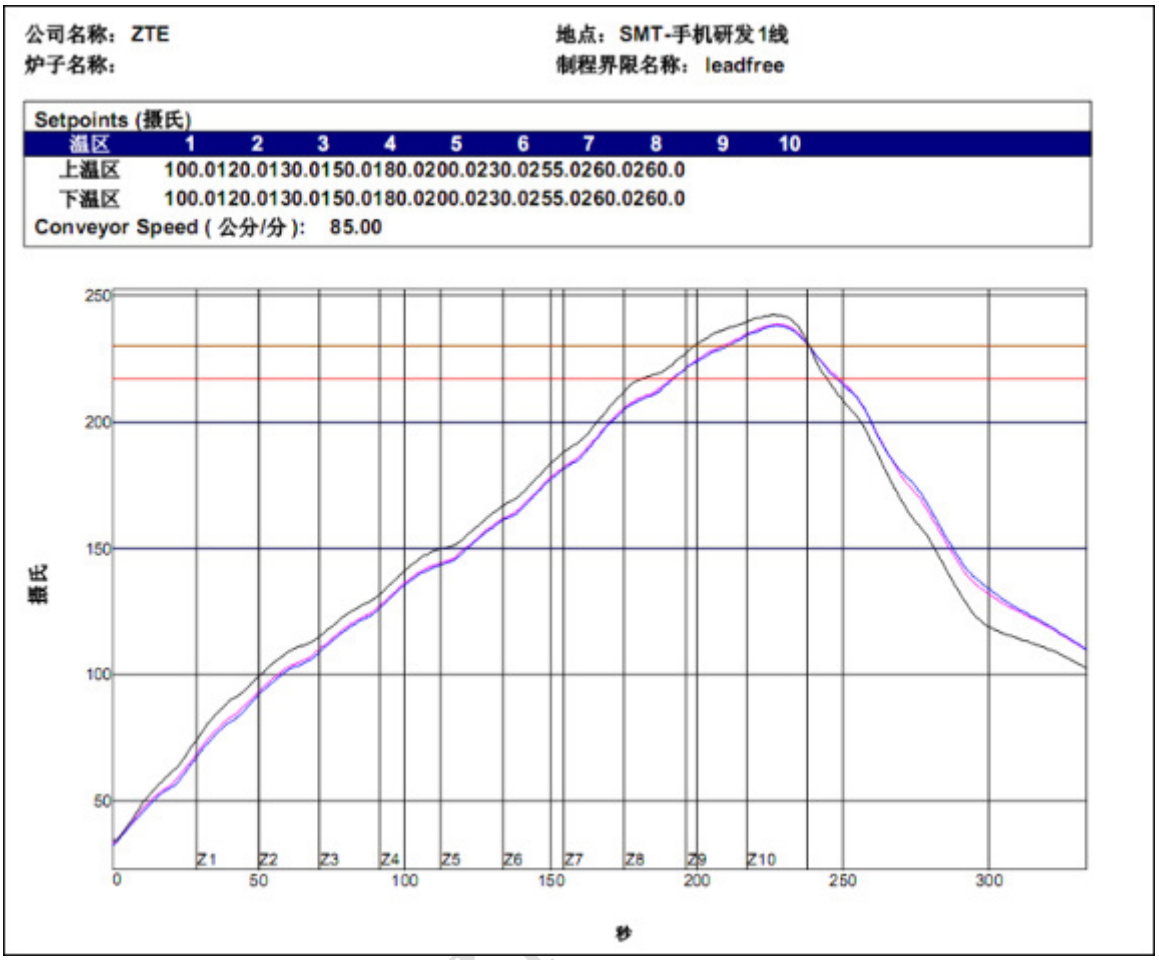


Figure 8-2 Testing Result

PWI= 74%	最高上升斜率		最高下降斜率		预热150至200C		回流时间 /217C		最高温度		总共 时间 /230C	
模块边点	1.3	-34%	-1.9	55%	49.6	-72%	57.4	16%	238.7	16%	29.5	-3%
模块底部	1.3	-35%	-1.8	60%	49.1	-74%	56.2	8%	238.1	8%	28.2	-12%
芯片	1.4	-29%	-2.1	46%	52.7	-64%	63.6	57%	242.5	66%	39.6	64%
温差	0.1		0.3		3.6		7.4		4.3		11.4	

制程界限:

锡膏: Define Your Own Spec

统计数名称		最低界限		最高界限	单位
最高温度上升斜率 (目标=2.0) (计算斜率的时间距离=20秒)		0.0		3.0	度/秒
最高温度下降斜率 (计算斜率的时间距离=20秒)		-5.0		-1.0	度/秒
预热时间150-200C		40		110	秒
回流以上时间 - 217C		40		70	秒
最高温度	230		245		度 摄氏
在230C以上时间		15		45	秒

