ZX800-VG Module User Manual

Copyright and License Notice

ZXInfoTek(Shenzhen) Co., Ltd. (hereinafter referred to as ZXInfoTek) reserves the right to modify this document without prior notice. ZXInfoTek believes that the information provided is accurate and reliable. Notwithstanding the foregoing, ZXInfoTek assumes no responsibility for errors that may appear in this document. Please contact ZXInfoTek for the most current version of this device description prior to purchase. ZXInfoTek assumes no responsibility for patent disputes or third party infringement arising from the use of this device. Additionally, ZXInfoTek products are not recommended for use in life-related equipment or systems, and ZXInfoTek is not responsible for damages resulting from equipment or system malfunctions during use of this device. ZXInfoTek owns the copyright and other intellectual property rights of this manual and is protected by law. Without the authorization of ZXInfoTek, any unit or individual is not allowed to use, copy, modify, transcribe, disseminate, etc., this manual in any way or for any reason.

take note of

This is a document that is not readily available for disclosure by ZXInfoTek and contains confidential information. Please return it to ZXInfoTek without any confidentiality agreement or if ZXInfoTek unilaterally requests it. Anyone who is not a principal of ZXInfoTek should not use or refer to this document.

If you get this document, please take note:

- The contents of the document may not be disclosed
- Reproduction of all or part of the contents of the document is not permitted
- Do not modify all or part of the document

This document must be destroyed if

- ZXInfoTek has provided an updated version
- Failure to sign a confidentiality agreement or expired confidentiality agreement
- Separation of appointees

For our customers

We are constantly improving our products and the quality of our documentation. While we strive to ensure that the descriptions in this document are accurate, there may be errors that we have not identified. If you find any questions or errors in this document, please do not hesitate to contact us. Your understanding and support will make this document even better.

catalogs

Chart Index

Table Index

1.preface

This document describes the product parameters, hardware interface specifications, electrical characteristics and mechanical dimensions . With the help of this document, combined with our application manuals and user guides, customers can quickly apply the of the ZX800-VG LTE Cat.1 module in their wireless terminal products.

2.summarize

2.1 Main performance

Table1 Module Main Performance

hallmark	clarification
electricity supply	♦ VBAT 3.3V ~ 4.5V, 3.8V typical
firing power	♦ LTE-TDD: Class3 (23dBm± 2dB) ♦ LTE-FDD: Class3 (23dBm± 2dB)
LTE Features	♦ Maximum support for non-CA Cat.1 ♦ VoLTE support is available ♦ Support 1.4~20MHz bandwidth ♦ LTE-FDD: Maximum uplink rate 5Mbps, maximum downlink rate 10Mbps ♦ LTE-TDD: uplink and downlink configuration 2, maximum uplink rate 2Mbps, maximum downlink rate 8Mbps ♦ LTE-TDD: uplink and downlink configuration 1, maximum uplink rate 4Mbps, maximum downlink rate 6Mbps
network protocol characteristic	♦ TCP/UDP/PPP/FTP/HTTP/NITZ/CMUX/NDIS/NTP/HTTPS/PING /FILE/ supported.is
USIM card interface	♦ USIM/SIM card : 1.8V and 3Vsupport
USB port	♦ Compatible with USB 2.0 (slave mode only), data transfer rate up to 480Mbps ♦ For AT commands, data transfer, software debugging, software upgrades ♦ USB Virtual Serial Driver: Support USB driver under .x/4.1, Android 4.x/5.x/6.x/7.x and other operating systems.Windows 7/8.1/10, Linux 2.6.x/3

serial port (computing)	Debug UART: ♦ For log printing, firmware upgrades ♦ Only for debugging, does not support external devices MAIN UART: ♦ For AT commands and data transfer ♦ Supports 4/8-wire mode, 1.8V/3.3V level, default rate 115200bps AUX UART: ♦ 2-wire for data transfer, default rate 115200bps
SPI LCD	♦ Support, 1.8V Level ♦ Supports only 1-wire data, 3-wire 9-bit or 4-wire 8-bit modes
SPI Camera	♦ Support, 1.8V Level
keypads	♦ Support up to 5*5 matrix keyboard, some modules need to other functions be reused, refer to for details.IO MUX documentation
VOLTE	♦ supportable
WIFI	♦ Support WIFI Scan
bluetooth	♦ unsupported
GNSS	♦ selectable
Antenna Interface	♦ Characteristic impedance 50 ohms
temperature range	♦ Normal operating temperature: -35° C to +70° C ♦ Extreme operating temperature: -40° C to +85° C
RoHS	♦ All devices are fully RoHScompliant

2.2 Pin Definitions

Refer to Table 2 for ZX800-VG module pin definitions. For more detailed IO correspondence and multiplexing relationships, please refer to the document *"ZX800 Series Module Pin Definitions"*.

Table2 Module Pin Definitions

pinout serial number	ZX800-VG	Functional Description
1	GND	
2	RESERVED	
3	RESERVED	ZX800-VG does not support analog audio input and output, and requires an external Codec.
4	RESERVED	
5	RESERVED	
6	RESERVED	
7	PWRKEY	power switch
8	VCAMA	Camera Analog power supply, default 2.8V
9	ADC0	First ADC, default battery level detection, external voltage divider circuit required
10	GND	
11	USIM_DATA	First SIM card interface
12	USIM_RST	
13	USIM_CLK	
14	USIM_VDD	
15	RESET_N	system reset
16	NET_STATUS	
17	MAIN_RXD	First serial port
18	MAIN_TXD	
19	MAIN_DTR	
20	MAIN_RI	
21	MAIN_DCD	
22	MAIN_RTS	
23	MAIN_CTS	
24	VDD_EXT	
25	STATUS	
26	RESERVED	
27	GND	
28	AUX_RXD	Second serial port
29	AUX_TXD	
30	PCM_CLK	I2S/PCM Interface
31	PCM_SYNC	
32	PCM_DIN	
33	PCM_DOUT	
34	GND	

35	ANT_MAIN	
36	GND	
37	GND	
38	DBG_RXD	Debugging Serial Ports
39	DBG_TXD	
40	GND	
41	GND	
42	VBAT	
43	VBAT	
44	RESERVED	
45	GND	
46	GND	
47	GND	
48	GND	
49	LCD_RST	LCD SPI Interface
50	LCD_SPI_TXD	
51	LCD_DC	
52	LCD_SPI_CS	
53	LCD_SPI_CLK	
54	CAM_MCLK	Camera SPI Interface
55	CAM_SPI_DO	
56	RESERVED	
57	CAM_I2C_SCL	
58	CAM_I2C_SDA	
59	USB_DP	USB port
60	USB_DM	
61	USB_VBUS	
62	USIM2_CLK	USIM2_VDD only supports 1.8V supply
63	USIM2_RST	
64	USIM2_DATA	
65	USIM2_VDD	
66	I2C_SDA	
67	I2C_SCL	
68	RESERVED	
69	RESERVED	
70	GND	
71	GND	
72	GND	
73	GND	
74	KEYOUT0	
75	KEYIN0	
76	KEYOUT1	
77	KEYIN1	
78	LCD_TE	
79	USIM_CD	
80	CAM_SPI_CLK	
81	CAM_PWDN	

82	USB_BOOT	Pull down into the BOOT
83	KEYIN2	
84	RESERVED	
85	KEYOUT3	
86	KEYOUT4	
87	RESERVED	
88	GND	
89	GND	
90	GND	
91	GND	
92	GND	
93	GND	
94	GND	
95	GND	
96	ADC1	
97	RESERVED	
98	RESERVED	
99	RESERVED	
100	RESERVED	
101	RESERVED	
102	LCD_ISINK	LCD Backlight Negative
103	RESERVED	
104	RESERVED	
105	RESERVED	
106	RESERVED	

2.3 functional block diagram

The following figure shows the functional block diagram of the module, describing its main functions:ZX800-VG

- memory (unit)
- RF section
- power management
- interface section

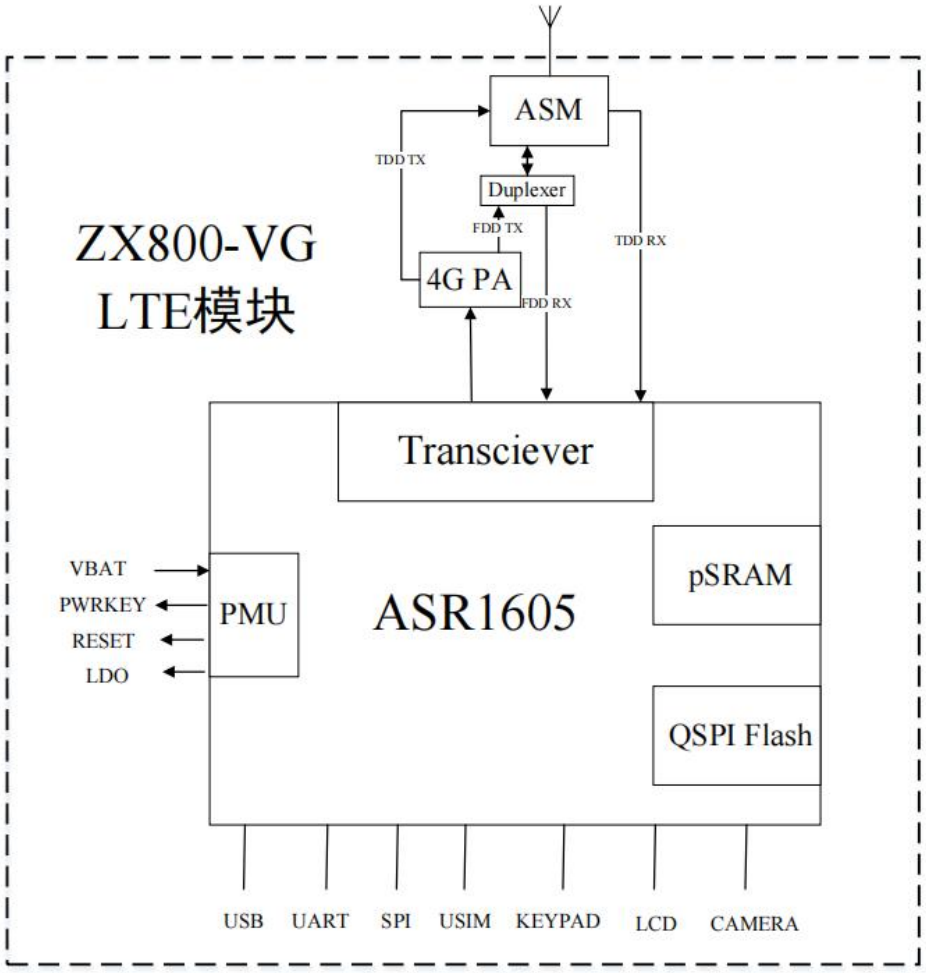


Diagram1 Functional Block Diagram

3.application interface

The module is in packaged an LGA package and the ZX800-VG has 106 SMT pads. The following sections describe in detail the function of interface of .each the ZX800-VG

3.1 Pin Description

The pin distribution diagram of ZX800 series modules is shown in 2. For detailed pin distribution diagrams of each model, please refer to the document Figure *"ZX800 Series Module Pin Distribution Diagram"*.

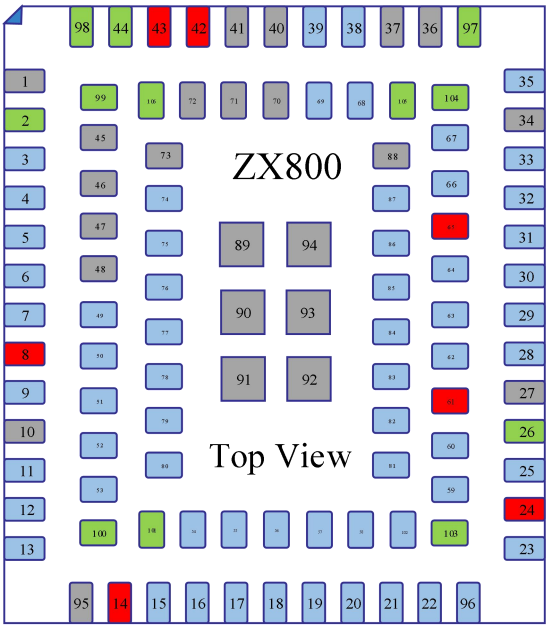


Diagram 2 Pinout (Front View)

Table3 Pin Descriptions

power supply						
pin name	pin	power-on	I/O	Pin Description	voltage	note
VBAT	42,43		PI	Module main power supply VBAT=3.3V~4.5V	VBAT	1. The maximum load current of the module in burst mode is 1.8A. 2. RF indicators deteriorate when voltage is below 3.3V
VDD_EXT	24	ON	PO	Output 1.2-3.3V , default 1.8V, IOmax=200mA	V_ 1V8	1. Recommended to be used as an external IO reference power supply, if not used, it will be left vacant. 2. If this pin is used for external power supply, it is recommended to connect a
VCAMA	8	ON	PO	Output 3.1V, analog voltage for Camera, IOmax=200mA	V_3V1	Default output 3.1V, can supply to power CAM AVDD, LCD AVDD or it is recommended to connect the beads in series.

GND	1,10,27. 34,36. 37,40. 41,45. 46,47. 48,70. 71,72. 73,88. 89,90. 91,92. 93,94. 95				GND	modularly
power switch						
pin name	pin	power-on	I/O	Pin Description	voltage	note
PWRKEY	7	INPUT PULL_UP	I	Module power on/off control pin, internal pull-up to VBAT	VBAT	1. Pull the pin down for more than 1.5s in the off state module power on 2. Pull the pin down for more than 1.5s in the power-on state to turn off the module
reset (a dislocated joint, an electronic device etc)						
pin name	pin	power-on	I/O	Pin Description	voltage	note
RESET_IN_N	15	INPUT PULL_UP	I	Module reset; internal pull-up to V_1V8	VBAT	1. Note that this reset pin internally pulls up to V_1V8 2. Internal pull-up, pull the pin low for more than 1s module reset 3. If not used, it is recommended to add 1uf
USB port						
pin name	pin	power-on	I/O	Pin Description	voltage	note
VBUS	61		PI	USB power, USB plug-in detection, Vmax=5.25V Vmin=3.3V Vnorm=5.0V	VBUS	If you don't use it, it hangs in the air.
USB_DP	59		IO	USB differential data+		USB 2.0, alignment control 90 ohm differential impedance
USB_DM	60		IO	USB Differential Data-		
USB_BOOT						
pin name	pin number	power-on state	I/O	Pin Description	voltage domain	note
USB_BOOT	82	OUTPUT PULL_UP	O	When a is detected during power-uplow level , the module is forced into download	V_ 1V8	For the convenience of firmware upgrade, it is recommended to reserve a test point; it is strongly

				mode.		recommended to in the design connect series in a 1KΩ resistor to prevent static electricity problems in use leading to pin damage.
RF interface						
pin name	pin number	power-on state	I/O	Pin Description	voltage domain	note
MAIN_ANT	35		I/O	LTE Antenna Interface		50 Ohm Characteristic Impedance
GNSS_ANT	2		I/O	GNSS antenna interface		50 Ohm Characteristic Impedance
analog audio						
pin name	pin number	power-on state	I/O	Pin Description	voltage domain	note
SPK_N	6		AO	Audio Output Differential Signal -		Class-AB mode, 32Ω 37mW max, differential alignment required
SPK_P	5		AO	Audio output differential signal +		
MIC_N	4		AI	Audio Input Differential Signal -		Differential alignment required
MIC_P	3		AI	Audio input differential signal +		
Main serial port MAIN UART, for AT command and data communication						
pin name	pin	power-on	I/O	Pin Description	voltage	note
MAIN_ TXD	18	OUTPUT PULL_UP	O	Module sends data	V_1V8/3V3	ZX800-VG TX and RX hardware selectable 3.3V/1.8V, other signals only support 1.8V
MAIN_RXD	17	INPUT PULL_UP	I	Module receives data		
MAIN _RTS	22	OUTPUT PULL_UP	O	DTE request to send data to the module		
MAIN_CTS	23	INPUT PULL_UP	I	Clear Send		
MAIN_DTR	19	INPUT PULL_UP	O	Data terminal preparation		
MAIN _RI	20	INPUT PULL_UP	I	ringer indication		
MAIN _DCD	21	INPUT PULL_UP	I	data carrier detection	V_1V8	1.8V level
Auxiliary serial port AUX_UART for data						
pin name	pin	power-on	I/O	Pin Description	voltage	note

AUX_TXD	29	OUTPUT PULL_UP	0	Module sends data	V _1V8	
AUX_RXD	28	INPUT PULL_UP	I	Module receives data		

Debug serial port for log printing and software downloads

pin name	pin	power-on	I/O	Pin Description	voltage	note
DBG_TXD	39		0	Output AP Log	V_ 1V8	Recommendation to reserve test points
DBG_RXD	38		I	Download Software		

I2C interface

pin name	pin	power-on	I/O	Pin Description	voltage	note
I2C_SCL	67	INPUT PULL_UP	0	I2C Interface Clock Signal	V_ 1V8	Requires external 1.8V pull-up when used for I2C; left blank when not in use.
I2C_SDA	66	INPUT PULL_UP	I/O	I2C interface data signal		

PCM interface

pin name	pin number	power-on state	I/O	Pin Description	voltage domain	note
I2S_MCLK	26	OUTPUT PULL_DOWN	0	I2S MCLK master clock	V_ 1V8	Outputs a typical frequency clock up to 26MHz, which can be used as an external Codec
PCM_CLK	30	INPUT PULL_DOWN	0	PCM clock signal	V_ 1V8	If you don't use it, it hangs in the air.
PCM_SYNC	31	INPUT PULL_DOWN	0	PCM frame synchronization signal	V_ 1V8	If you don't use it, it hangs in the air.
PCM_RXD	32	INPUT PULL_DOWN	I	PCM data reception	V_ 1V8	If you don't use it, it hangs in the air.
PCM_TXD	33	INPUT PULL_DOWN	0	PCM Data Transmission	V_ 1V8	If you don't use it, it hangs in the air.

SIM card interface

pin name	pin number	power-on state	I/O	Pin Description	voltage domain	note
USIM_VDD	14	OFF	PO	USIM card power supply	USIM_ VDD	The module automatically recognizes 1.8V or 3V(U) SIM cards.
USIM_DATA	11		I/O	USIM card data cable		
USIM_CLK	13		0	USIM Card Clock Cable		
USIM_RST_N	12		0	USIM card reset cable		

USIM_CD (GPIO_11)	79		I	USIM card 0 presence detection	V_1V8	If you don't use it, it hangs in the air.
USIM2_VDD	65	OFF	PO	USIM card power supply	USIM2_VDD	SIM2 can only recognize 1.8V SIM cards
USIM2_DATA	64		I/O	USIM card data cable		
USIM2_CLK	62		0	USIM Card Clock Cable		
USIM2_RST_N	63		0	USIM card reset cable		
ADC						
pin name	pin	power-on	I/O	Pin Description	voltage domain	note
ADC0	9		I	Analog-to-digital converter, input range 0~1.8V	V_ 1V8	ADC resolution 12bits, if not used, it will be left blank.
ADC1	96		I	Analog-to-digital converter, input range 0~1.8V	V_1V8	ADC resolution 12bits, if used as a battery power detection, need to add an external voltage divider
LCD Interface						
pin name	pin number	power-on state	I/O	Pin Description	voltage domain	note
LCD_CS	52	OUTPUT PULL_UP	0	SPI LCD Slice Selection	V_ 1V8	LCD IO only supports 1.8V, note the level matching
LCD_CLK	53	OUTPUT PULL_UP	0	SPI LCD clock signal		
LCD_TXD	50	OUTPUT PULL_UP	0	Write LCD data signal		
LCD_RST	49	OUTPUT PULL_UP	0	SPI LCD reset signal		
LCD_DC	51	OUTPUT PULL_UP	0	SPI LCD data/command selection		
LCD_TE (GPIO_20)	78	OUTPUT PULL_UP	0	LCD TE Signal		
LCD_ISINK	102		I	LCD Backlight Negative		LCD backlight negative pole, can control LCD backlight brightness, maximum current
Keyboard Array						
ZX800-VG matrix can be by multiplexed supported IO up to 5*5 matrix keyboard;						
Camera Interface						

pin name	pin number	power-on state	I/O	Pin Description	voltage domain	note
CAM_PWDN	81	OUTPUT PULL_DOWN	O	Close Camera	V_ 1V8	1. SPI Camera interface level is 1.8V, does not support 2.8V 2. Cmera power supply IOVDD (1.8V) and CAM_AVDD (3.1V) are reserved in the module or can be used externally
CAM_MCLK	54	OUTPUT PULL_DOWN	O	Camera Reference Clock	V_ 1V8	
CAM_SCK	80	INPUT PULL_DOWN	I	SPI Camera Clock Input	V_ 1V8	
CAM_DO	55	INPUT PULL_DOWN	I	SPI Camera data input 0	V_ 1V8	
CAM_D1	56	INPUT PULL_UP	I	SPI Camera Data Input 1	V_ 1V8	
CAM_I2C_SDA	58	INPUT PULL_UP	I/O	Camera I2C DATA	V_ 1V8	
CAM_I2C_SCL	57	OUTPUT PULL_UP	O	Camera I2C CLK	V_ 1V8	
GPIO						
pin name	pin number	power-on state	I/O	Pin Description	voltage domain	note
NET_STATUS	16	OUTPUT PULL_UP	I/O	Network Status Indication	V_ 1V8	
STATUS	25	OUTPUT PULL_UP	I/O	Module Status Indication	V_ 1V8	

3.2 operating mode

The following table briefly describes the various operating modes mentioned in the next few chapters.

Form4 Operating Modes

paradigm	state of affairs	functionality
proper functioning	SLEEP	The module automatically enters sleep mode when there are no tasks to be performed. In sleep mode, the power consumption of the module is reduced to a very low level, but the module is still able to send and receive data, SMS and incoming calls.
	IDLE	The software is functioning normally. The module registers on the network with no data, voice or SMS interaction.
	TALK/Data	The connection works properly. There is data or voice or SMS interaction. In this mode, the module power consumption depends on the strength of the ambient signal, the dynamic DTX control and the RF operating frequency.

shutdown mode	In this mode, the PMU stops supplying power to the baseband and RF, the software stops working, the serial port is not available, but the VBAT pin is still energized.
Minimum function mode (holding supply voltage)	In this mode, neither the RF nor the SIM card works, but the serial port can still be accessed
flight mode	AT+CFUN=0 can set the module to flight mode, this modethe module RF does not work in

3.3 power supply

3.3.1 Modular Power Supply Operating Characteristics

Power supply design is an important part of module application design. Since RF transmissions have a burst pulse of high current for a short period of time. The power supply must be able to deliver high peak currents during the burst pulse phase, otherwise there is a risk of supply voltage dips.

3.3.2 Reduced voltage drop

Module power supply VBAT voltage input range of 3.3V ~ 4.5V, but the module in the RF transmitter usually produces power supply voltage drop phenomenon in the VBAT power supply, this is due to the power supply or alignment path impedance caused by the general difficult to avoid. Therefore, special attention should be paid to the module's power supply design. At the VBAT input, it is recommended to connect a 100uF tantalum capacitor with low ESR (ESR=0.7Ω) in parallel, as well as 100nF, 33pF, and 10pF filter capacitors, and the reference circuit at the VBAT input is shown in Figure 3. It is also recommended that the PCB alignment of the VBAT be as short as possible and wide enough to reduce the equivalent impedance of the VBAT alignment, to ensure that there will not be too large a voltage drop under high currents at maximum transmit power. It is recommended that the width of the VBAT alignment should be not less than 1.5mm, and the longer the alignment, the wider the line width.

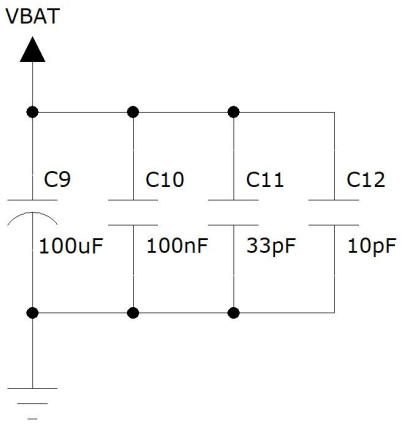


Diagram3 VBAT Input Reference Circuit

3.3.3 Power Supply Reference Circuit

The power supply design is critical to powering the module and it is important to select a power supply that can provide at least 1A current capability. In non-Lithium battery powered applications, a switching power converter is recommended.

DCDC power supply:

The following figure shows the reference design of DCDC switching power supply, which uses JW5033S switching power supply chip from JWT, its maximum output current is at 2A, while the input voltage range is 4.7V~20V. Note that the selection of C25 should be based on the input voltage to select the withstand voltage value.

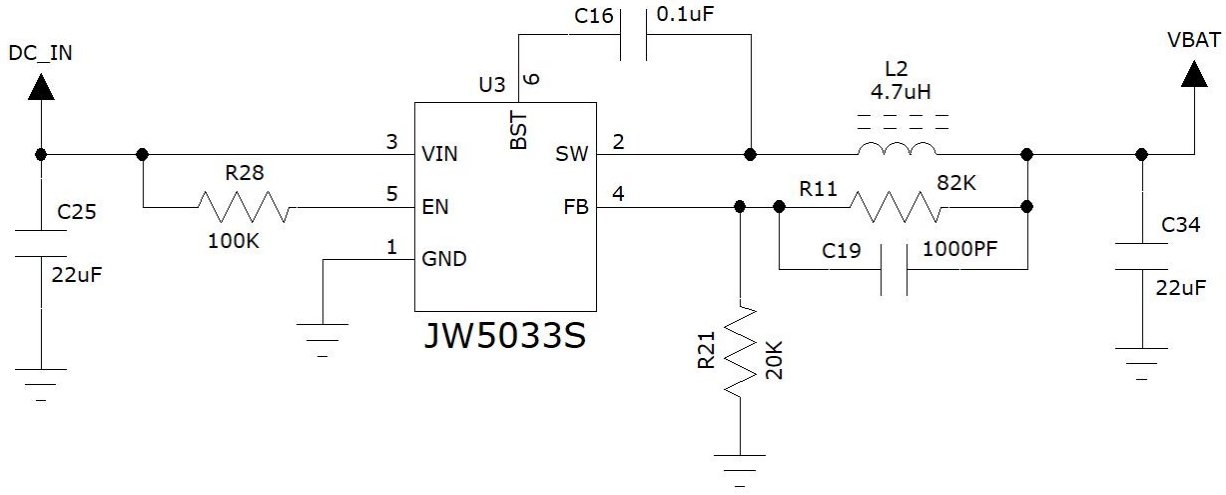


Diagram4 DCDC Power Supply Input Reference Design

3.4 power switch

3.4.1 press Ctrl-Alt-Delete

ZX800 module can be powered on by PWRKEY pin. If you press and hold the power on button for a period of time or more in the power off state, the module will enter the power on process, and the software will detect the voltage of the VBAT pin. If the voltage of the VBAT pin is greater than the power on voltage (3.1V) set by the software, the module will continue to power on until the system power on is completed; otherwise, the module will stop executing power on action, and the system will be shut down.

3.4.1.1 PWRKEY pin on

After the VBAT is powered on, the PWRKEY pin can start the module, pull the PWRKEY pin low for 1.5 seconds and then power on the module, and the PWRKEY pin can be released after the power on is successful. The level of V_ 1V8 pin can be detected to determine whether the module is powered on or not. It is recommended to use an open-collector driver circuit to control the PWRKEY pin. The following figure shows the reference circuit:

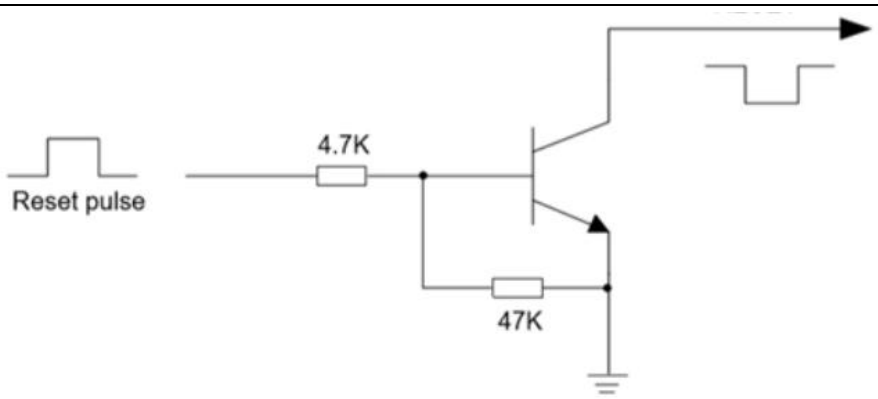


Diagram5 Open Set Driver Reference Power-Up Circuit

Another way to control the PWRKEY pin is to use a pushbutton switch directly. A TVS tube needs to be placed near the button for ESD protection. The figure below shows the reference circuit:

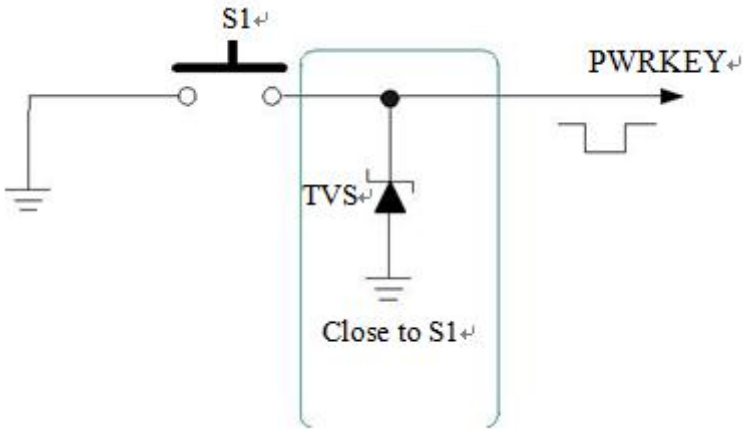


Diagram6 Pushbutton On Reference Circuit

Button power-up timing diagram:

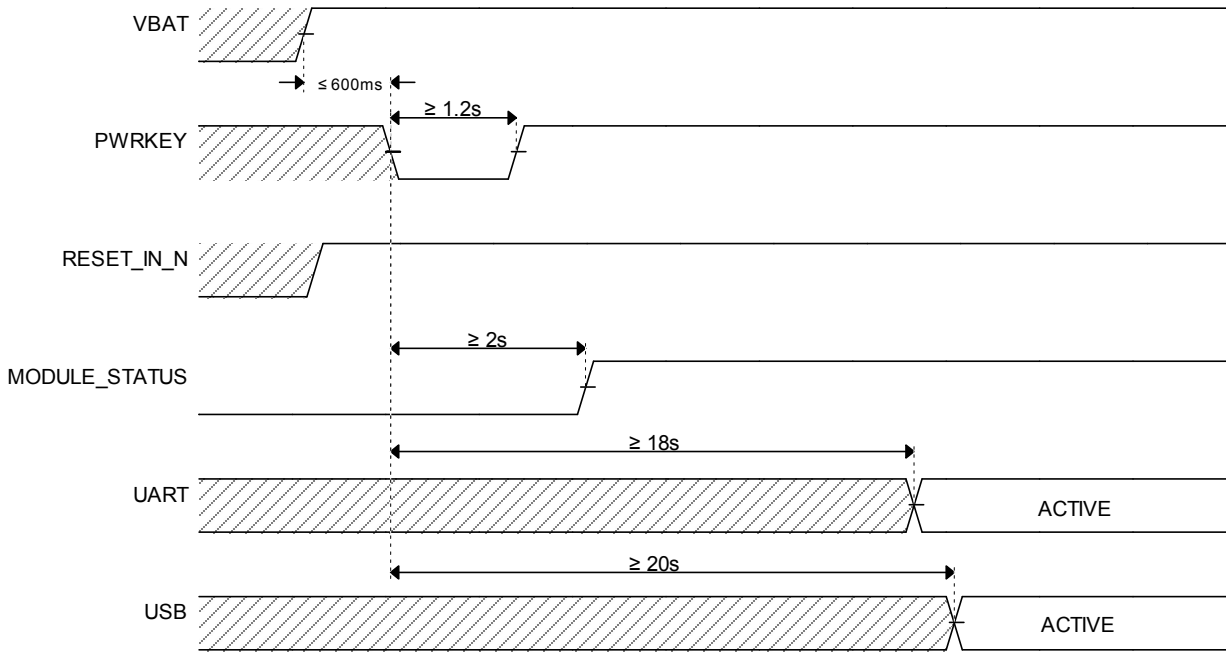


Diagram7 Key On Timing Chart

Note: The module will detect power on and off within 600ms after power on, pull down the PWRKEY within 600ms and greater than 1.2s to stabilize the power on. If no power-on event is detected after 600ms, the software will enter the shutdown process, which will last 1 to 2s, and if the PWRKEY is lowered at this time, it will not be detected. Therefore, if you can't guarantee that the PWRKEY will be lowered within 600ms of power-on, it is recommended that the PWRKEY time be extended to 4S or more to ensure stable power-on.

3.4.1.2 power on

The power-on auto power-on function can be realized by grounding the PWRKEY of the module directly. Note that in power-on mode, the module will not be able to shut down, as long as the voltage at the VBAT pin is greater than the power-on voltage, even if the software calls the shutdown interface, the module will still be powered on again. In addition, in this mode, in order to successfully power on the VBAT pin voltage should still be greater than the power-on voltage set by the software (3.1V), if it does not meet, the module will be shut down, and there will be repeated switching on and off.

Since the PWRKEY pin has an internal pull-up resistor, pulling PWRKEY low all the time will increase the leakage current.

The following ways are available to close the module:

- Normal shutdown: Shutdown using PWRKEY pin
- Normal shutdown: via AT command shutdown AT+CPOWD
- Low voltage auto shutdown: the module it detects low voltage (shuts down when).below 3.1V

3.4.2 turn off (a machine or device)

3.4.2.1 PWRKEY pin shutdown

The module performs a shutdown action when the PWRKEY pin is pulled low for more than 1.5s.

During the shutdown process, the module needs to log out of the network, the logout time is related to the current network status, which is measured to take about 2s~12s, so it is recommended to extend

the 12s before powering off or restarting to ensure that the software saves the important data before completely powering off. The timing diagram is as follows:

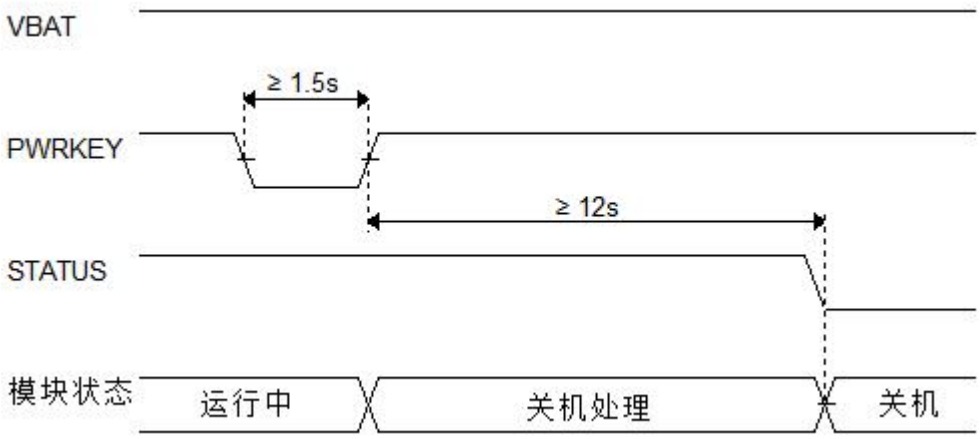


Diagram8 Push-button shutdown timing diagram

3.4.2.2 Low voltage auto shutdown

When the voltage of VBAT pin is lower than the shutdown voltage set by the software (default setting 3.5V), the software will perform shutdown action to shut down the module in order to prevent all kinds of abnormality under the operation of low-voltage state.

3.4.3 reset (a dislocated joint, an electronic device etc)

The RESpin can be used to reset the module. ET_IN_N Pulling down RESET_IN_N pin for more than can reset the module. the 150ms RESET_IN_N signal is sensitive to interference, so it is recommended that the wiring on the module interface board be as short as possible and be ground-protected.

Reference Circuit:

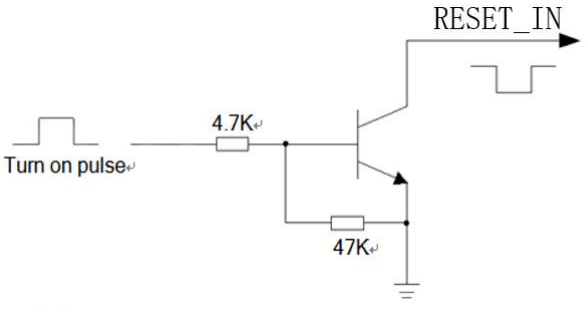


Diagram9 Hardware Reset Reference Circuit

Timing Diagram.

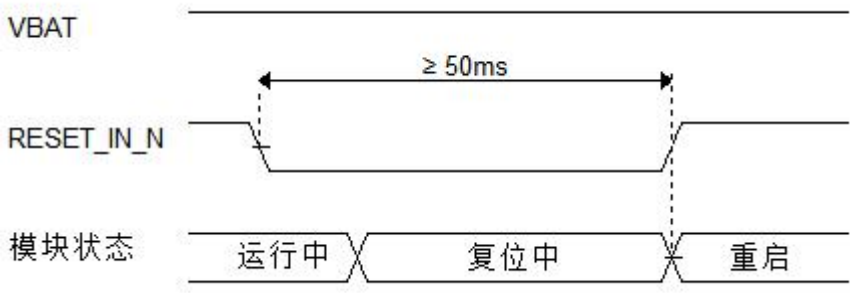


Diagram10 Reset Key Restart Timing Chart

Remarks:

1. The reset function is recommended for use only after AT+CPOWD and PWRKEY shutdown failures.

2. Make sure that the PWRKEY and RESET_IN_N pins do not have large load capacitors.

3. If RESET_IN_N is not used, it is recommended to connect a 1uf capacitor to ground in parallel.

3.5 power saving feature

Depending on the system requirements, there are two ways to put the module into a low power state. For the AT version, the "AT+CFUN" command can be used to put the module into the least functional state.

3.5.1 Minimum Function Mode/Flight Mode

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

- 0: Minimum function (disable RF and SIM card);
- 1: Full function (default);
- 4: Disable the RF send and receive function;

If you use "AT+CFUN=0" to set the module to the least function mode, the function of RF part and SIM card part will be disabled. And the serial port depends on
However, the AT commands related to the RF part and the SIM part are not available;

If you use "AT+CFUN=4" to set the module, the RF part of the function will be disabled, while the serial port is still valid. All AT commands related to the RF part are not available;

After the module is set by "AT+CFUN=0" or "AT+CFUN=4", it can be set to return to the full-function state by "AT+CFUN=1" command. The command "AT+CFUN=1" can be used to return to the full function state.

3.5.2 Sleep mode (slow clock mode)

Module power on default start automatic sleep control, in the case of system idle will automatically enter the sleep mode, you can wake up through the timer, IO interrupt, network message interrupt, alarm clock interrupt and so on. The control method for sleep mode is as follows:

3.5.2.1 Serial Applications

Two sleep modes are supported under serial applications:

- Sleep mode 1: send AT command through serial port to enter sleep
- Sleep mode 2: the module automatically goes to sleep after the serial port has been idle for a period of time

3.5.2.1.1 Sleep mode 1

Open conditions:

Send AT command AT+CSCLK=1

3.5.2.1.2 Sleep mode 2

Open conditions:

Send AT command AT+CSLCK=2

The module goes to sleep:

The serial port is idle for more than the time configured by AT+WAKETIM (default 5s), the module automatically enters sleep mode 2

The module exits sleep:

The serial port continuously sends AT until the module responds, then it exits sleep mode 2

Software function of 2:the module in sleep mode

Doesn't respond to AT commands, but receives data/SMS/incoming calls with URC reporting

How to wake up the HOST when the module receives data/SMS/incoming calls while the HOST is sleeping:

WAKEUP_OUT signal

3.5.2.2 USB applications

Open conditions:

HOST USB must support USB suspend/resume.

The module goes to sleep:

HOST initiates USB suspend

The module exits sleep:

HOST initiates USB resume

3.6 Mode switching summary

Table5 Mode Switching Summary

current mode	Next mode		
	turn off (a machine or	normal mode	sleep mode

turn off (a		Booting with PWRKEY	
normal mode	Using the PWRKEY pin, or VBAT voltage below the shutdown voltage		Software call sleep interface, AT version does not do the action of 30s automatic hibernation
sleep mode	Use PWRKEY or VBAT voltage below shutdown voltage	GPIO pin interrupt, timer, receive SMS or network data	

3.7 serial port (computing)

The module provides four general-purpose asynchronous transceivers: the main serial port MAIN UART, the communication serial port AUX UART, and the debug serial port AP UART.

3.7.1 MAIN UART

Table6 MAIN UART Pin Definitions

connector	name (of a thing)	pin	corresponds English -ity, -ism, -ization
main serial port MAIN UART	MAIN_ TXD	18	Module sends data
	MAIN_RXD	17	Module receives data
	MAIN _RTS	22	DTE request to send data to the module
	MAIN_CTS	23	Clear Send
	MAIN _DCD	21	data carrier detection
	MAIN_DTR	19	Data terminal preparation
	MAIN _RI	20	ringer indication

The MAIN UART is used to communicate with the module for AT commands. The MAIN UART supports fixed baud rate and adaptive baud rate. The adaptive baud rate supports a range of 9600bps to 115200bps.

By default, the hardware flow control of the module is turned off. When the client needs hardware flow control, pins RTS, CTS must be connected to the client, AT command "AT+IFC=2,2" can be used to turn on the hardware flow control, AT command "AT+IFC=0,0" can be used to turn off the flow control.

The MAIN UART is characterized as follows:

- Includes data lines TXD and RXD, and hardware flow control lines RTS and CTS.
- 8 data bits, no parity, one stop bit.
- Hardware flow control is turned off by default.
- Used for AT command transmission, digital transmission, etc.
- Support baud rate as follows:
  1200, 2400, 4800, 9600, 14400, 19200, 28800, 38400, 57600, 115200, 230400, 460800, 921600bps
- AT command version By default the module is adaptive baud rate (AT+IPR=0), in adaptive baud rate mode the initialization message (starts with "RDY") is sent back to the master at 115200 baud rate after power up. After the module is powered on for 2-3 seconds, AT command can be sent to the module. The main controller needs to send AT command first, after the command returns normally,

it means the training is successful. Users can send an "AT+IPR=x;&W" command to the module (x is the baud rate, for example, 9600), the function of this command is to set a fixed baud rate and save it, after completing these configurations, every time the module is powered on, it will automatically return the URC initialization information by the serial port (starting with "RDY").

The following conditions of use need to be noted for better use of the adaptive baud rate function:

Synchronization between :the module and the host computer

If the adaptive baud rate function is enabled, when the module is powered on, it is better to wait for 2~3 seconds before sending the "AT" character. When the module reports power-on initialization information, it indicates that the baud rate training is successful and the synchronization with the host computer is completed.

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

Adaptive baud rate operation configuration:

- Serial port configured with 8 data bits, no parity bits, 1 stop bit (factory configuration)
- Only the string "AT" can train the baud rate when the module is switched on. ("at", "At" or "aT" are not recognized)
- After successful baud rate training, AT commands can be recognized in upper case, lower case, or a combination of upper and lower case.
- In adaptive baud rate mode, if the module is turned on without first synchronizing, as "RDY", "+CFUN: URC messages such1" and "+CPIN: READY" will not be reported. messages will not be reported.
- Switching to adaptive baud rate mode while in fixed baud rate mode is not recommended.
- In adaptive baud rate mode, switching to software multiplexing mode is not recommended.

3.7.2 AUX UART

Table7 AUX UART Pin Definitions

connector	name (of a thing)	pin	corresponds English -ity, -ism, -ization
AUX UART	AXU_TXD	29	Receive data from the TXD side of the DTE device
	AUX_RXD	28	Send data to the RXD side of the DTE device

AUX UART is a general-purpose serial port that can communicate with peripherals such as WIFI/GPS/BT, note the level matching.

3.7.3 DEBUG UART

Table8 DEBUG UART Pin Definitions

connector	name (of a thing)	pin	corresponds English -ity, -ism, -ization
DBG UART	DBG_TXD	39	Output AP Log
	DBG_RXD	38	Download Software

DEBUG UART is used to output AP trace during software debugging and does not support connecting external devices.

3.7.4 Serial connection method

Serial port connection is more flexible, the following are three commonly used connection methods. Please refer to the following connection method for the 3-wire serial port:

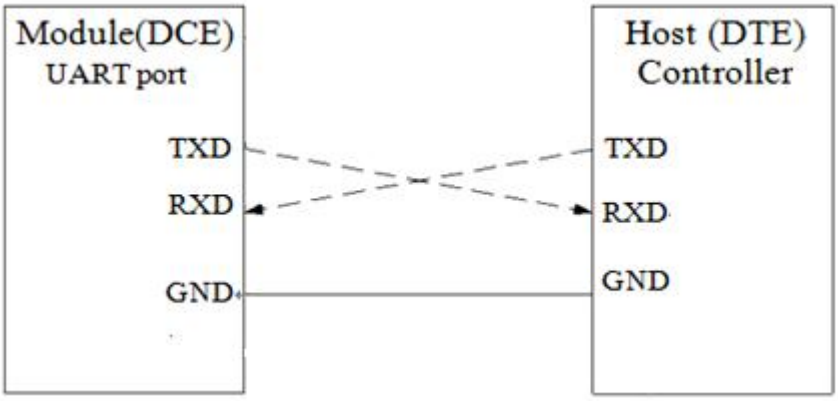


Diagram11 Diagram of 3-wire serial port connection method

For serial port connection with flow control, please refer to the following circuit connection. This connection can improve the reliability of large data volume transmission and prevent data loss.

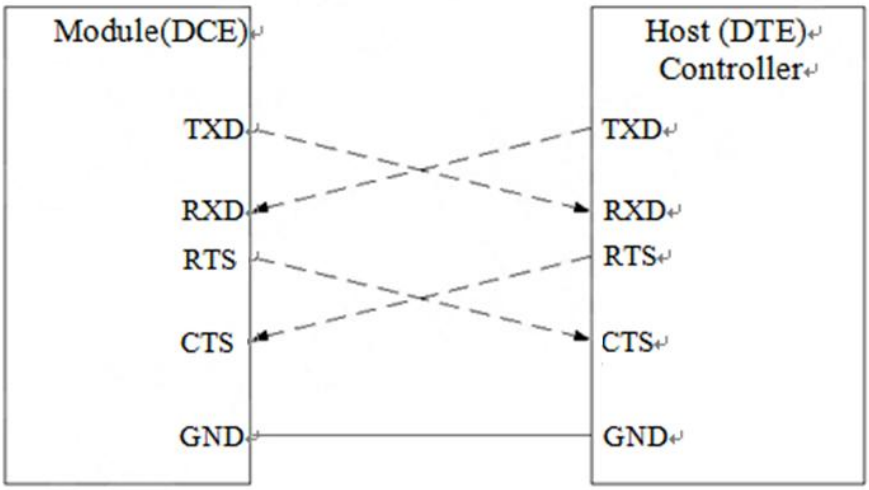


Diagram12 Diagram of serial port connection with flow control

3.7.5 Serial Voltage Conversion

The hardware of ZX800-VG MAIN serial port TX and RX signaling module has reserved level conversion circuits, which can support 3.3V, but you need to specify the corresponding hardware version, and the default is 1.8V, so we strongly recommend the customer the external circuitsto add tolevel conversion circuits .

The level shifting circuit is as follows:

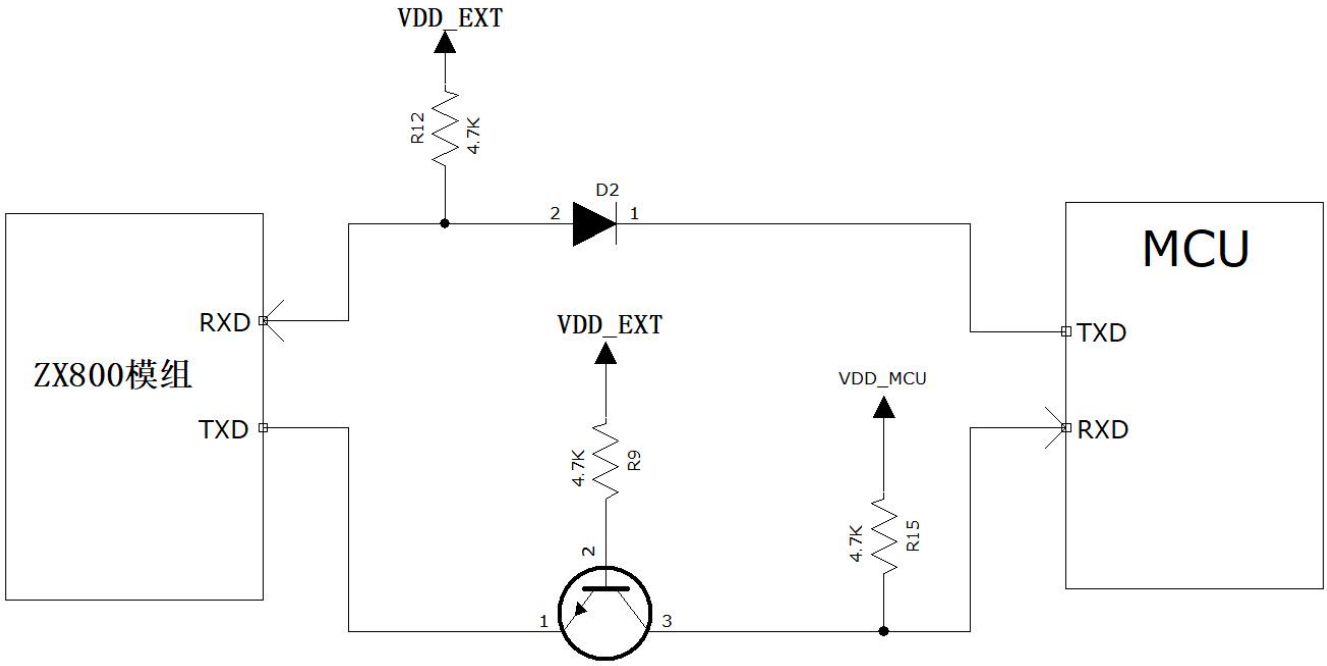


Diagram13 Level Conversion Circuit

VDD_EXT is the I/O level voltage of the module output. vdd_MCU is the I/O level voltage of the client. d2 is selected as a Schottky diode with low on-state drop.

Voltage conversion can also be achieved by an external level shifter chip.

3.8 USB port

The ZX800's USB is compliant with the USB 2.0 specification and supports both high-speed (480Mbps) and full-speed (12Mbps) modes. The interface can be used

For AT command transfer, data transfer, software debugging and software upgrades.

Table9 USB Pin Definitions

connector	name (of a	pin	corresponds English -ity, -ism, -ization
USB	USB_DP	59	USB differential data positive, 90 ohm
	USB_DM	60	USB differential data negative, 90 ohm
	VBUS	61	USB power supply for USB plug-in detection.

The notes are as follows:

1. USB alignment needs to be strictly controlled in accordance with the differential line to achieve parallel and equal length;

2. The impedance of the USB alignment needs to be controlled to a differential 90 ohms;

3. Need to minimize USB alignment stubs, reduce signal reflection;

Near the USB connector or test point to add TVS protection tube, due to the high rate of USB, need to pay attention to the selection of TVS tube, to ensure that the selection of TVS protection tube parasitic capacitance of less than 1pF

4.VBUS as USB insertion detection, must be connected to the USB power supply or external power supply, otherwise USB can not be detected, in addition to VBUS detection voltage should be greater than 3.3V

The USB interface reference design circuit is as follows:

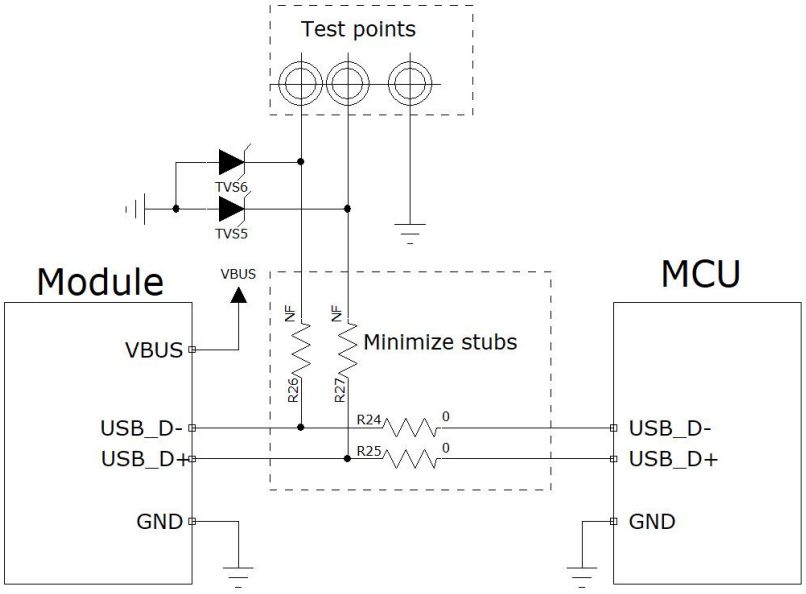


Diagram14 USB Interface Reference Design

3.9 SIM card interface

The SIM card interface supports ETSI and IMT-2000 card models, and supports 1.8V and 3.0V USIM cards.

3.9.1 SIM interface

The following table describes SIM0 and the interface pin definitions for SIM1.

Table10 SIM Card Interface Pin Definitions

pin name	pin number	corresponds English -ity, -ism, -ization
VDD_USIM	14	USIM card power supply. Automatic detection of SIM card operating voltage. Accuracy 3.0V±10% and 1.8V±10%. Maximum power supply current 10mA.
USIM_DATA	11	USIM card data cable
USIM_CLK	13	USIM Card Clock Cable
USIM_RST_N	12	USIM card reset pin
USIM_CD	79	USIM card insertion and removal detection
VDD_USIM2	65	USIM card power supply
USIM2_DATA	64	USIM card data cable
USIM2_CLK	62	USIM Card Clock Cable

USIM2_RST_N	63	USIM card reset cable

3.9.2 SIM interface reference circuit

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

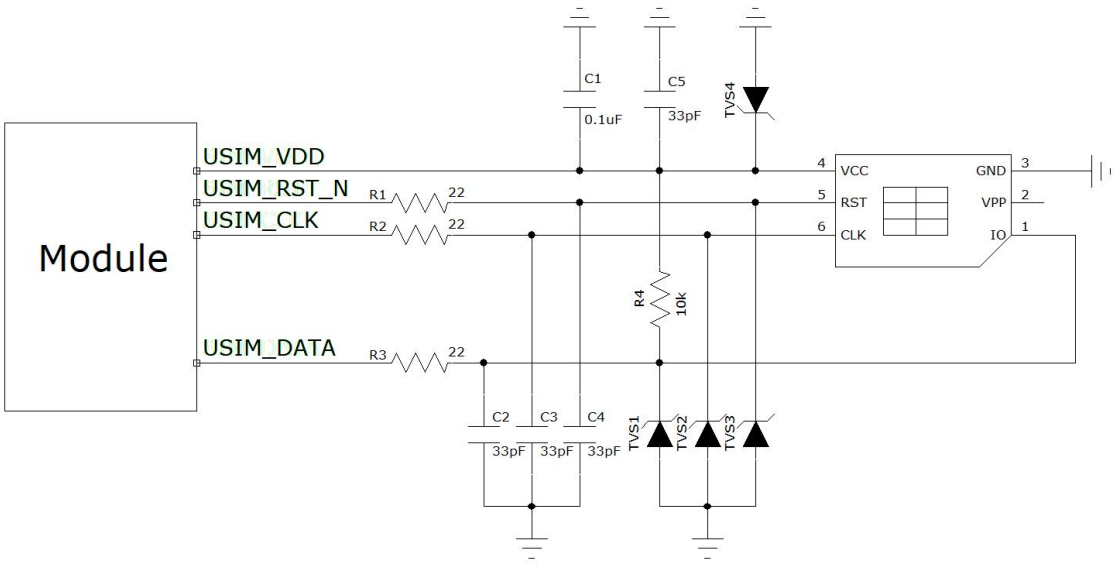


Diagram15 Reference Circuit Diagram Using 6pin SIM Card Holder (SIM)

If sim card presence detection is required, the recommended circuit is as follows:

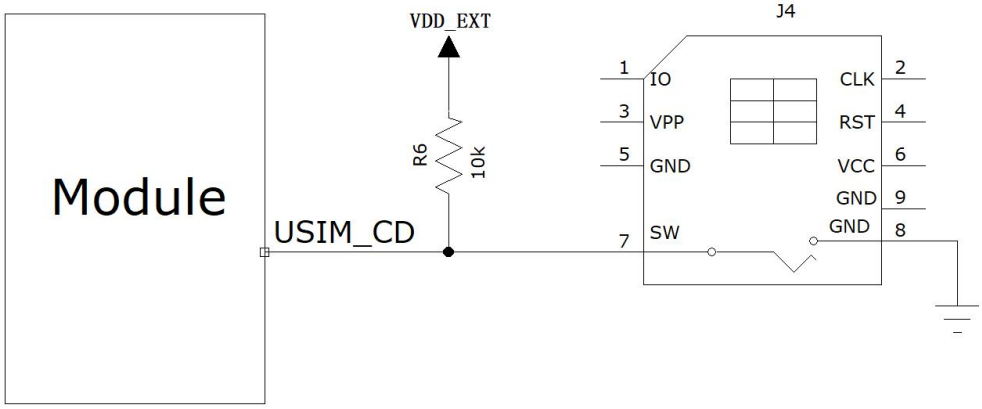


Diagram16 Reference Circuit Diagram for SIM Card Holder Using Band Detection PIN

In the circuit design of the SIM card interface, the following design principles are recommended in the circuit design in order to ensure good functional performance of the SIM card and not to be damaged:

- SIM card holder and module distance from the pendulum can not be too far, the closer the better, try to ensure that the SIM card signal line wiring does not exceed 20cm.
- SIM card signal wiring is routed away from the RF line and the VBAT power line.
- To prevent possible crosstalk of the USIM_CLK signal to the USIM_DATA signal, do not route the two too close together and add ground shielding between the two alignments. And ground protection is also required for the USIM_RST_N signal.
- To ensure good ESD protection, it is recommended to add TVS tubes and place them close to the SIM card holder. The parasitic capacitance of the selected ESD device should not be greater than 50pF. 22 ohm resistors can also be connected in series between the module and the SIM card to suppress stray EMI and enhance ESD protection. the peripheral circuits of the SIM card must be

placed as close as possible to the SIM card holder.
The second SIM card port is the same as above.

3.10 audio interface

Table11 Audio Interface Pin Definitions

connector	interface name	interface	corresponds English -ity, -ism,
Audio output AOUT	SPK_N	6	Negative analog audio output
	SPK_P	5	Positive analog audio output
Audio Input AIN	MIC_N	4	Negative analog audio input
	MIC_P	3	Positive analog audio input

ZX800-VG module itself does not support analog audio input/output, the module reserves a set of I2S/PCM interfaces for external Codec or DAC, the detailed circuit can be obtained from ZXInfoTek's hardware.

3.10.1 Audio Input Interface Reference Circuit

The audio input channel has a built-in electret microphone bias voltage that does not need to be applied externally, and differential alignment is recommended. The reference circuit is as follows, and note that the devices are placed close to the module.

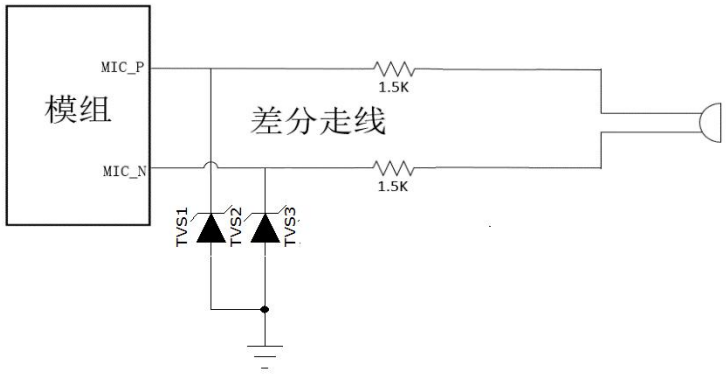


Diagram17 MIC Input Reference Circuit

3.10.2 Audio Output Interface Reference Circuit

SPK audio output interface drive ability is weak, it is recommended that the external audio PA, the reference circuit below is a direct drive 32Ω Reciever.

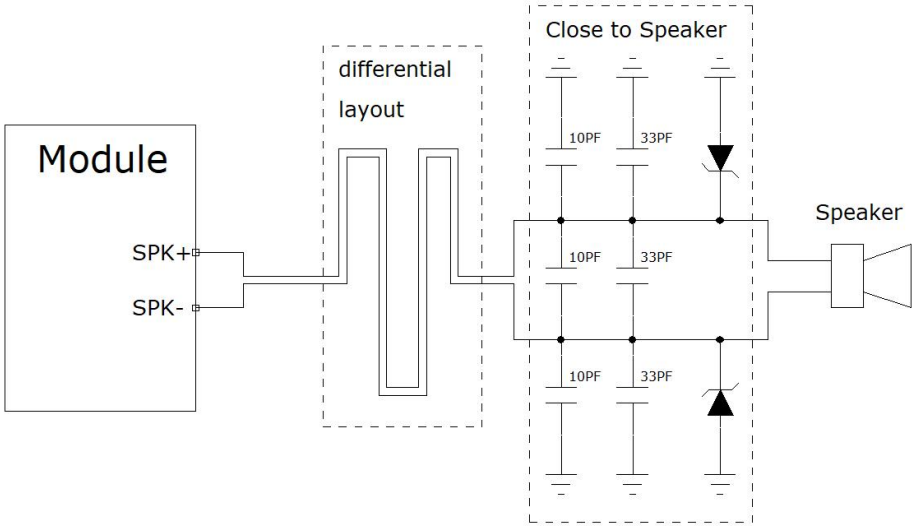


Diagram18 SPK Output Reference Circuit

4.RF interface

The antenna interface pins are defined below:

Table12 RF_ANT Pin Definitions

Pin Name	pin number	corresponds English -ity, -ism, -ization
MAIN_ANT	35	4G Antenna Interface

4.1 RF reference circuit

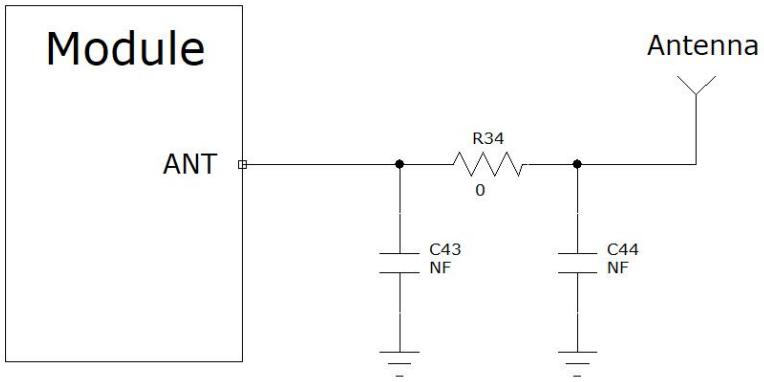


Diagram19 RF Reference Circuit

Attention:

- In the figure, R34 C43 C44 is a reserved Π-type matching circuit, which is convenient for tuning impedance matching; R34 is affixed with 0 ohm by default, and C43 C44 is empty;
- To prevent the RF port from being by damaged ESD, it is highly recommended to reserve an at the antenna endESD device , taking care that the parasitic capacitance does not exceed 0.5pF;

To ensure optimal RF signal transmission performance, all RF transmission lines must maintain a precise characteristic impedance of 50Ω. This impedance value is primarily determined by multiple

parameters including the dielectric constant of the substrate material, the signal line width (W), the spacing distance (S) between the signal line and the reference ground plane, as well as the thickness (H) of the dielectric layer.

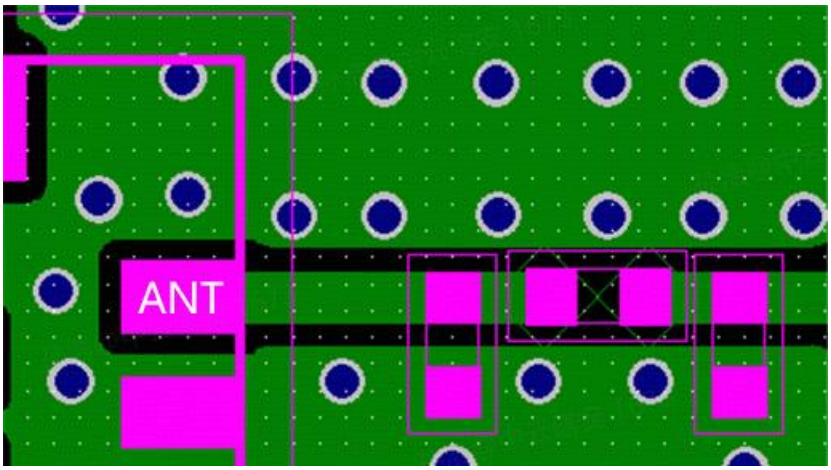


Diagram20 RF Reference PCB

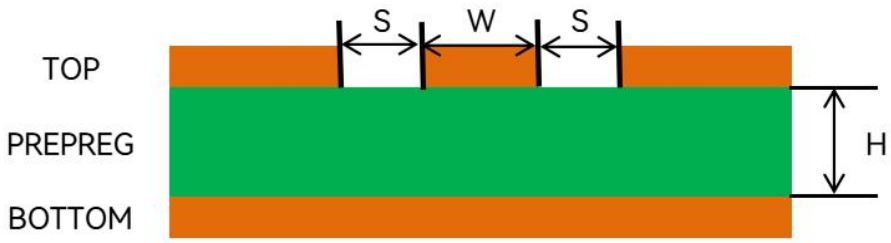


Diagram21 Coplanar Waveguide Structure on Double-Layer PCB

Attention:

- The RF trace connected to the module's RF antenna pad must utilize a microstrip line or other types of RF transmission lines. It is recommended to employ impedance simulation tools to achieve precise 50Ω impedance matching for the RF signal line.
- The π-type matching circuit should be placed as close as possible to the RF port,
- The reference ground plane of the RF signal line must remain intact and continuous. Additionally, adding an appropriate number of grounding vias around the signal line and reference ground plane can effectively enhance RF performance.
- The RF trace must be kept away from interference sources and should neither cross nor run parallel to any signal lines on adjacent layers.

4.2 4G RF Output Power

Table13 4G RF Conducted Power

(radio) band	greatest	minimal
LTE FDD B1/B3/B5/B8	23dBm± 2.7dB	<-44dBm
LTE TDD B34/B39/B40/B41	23dBm± 2.7dB	<-42dBm

4.3 4G RF conduction sensitivity

Table14 RF Conductivity Sensitivity

(radio) band	receiver sensitivity
LTE FDD B1 (10M)	< -98dBm
LTE FDD B3 (10M)	< -97dBm
LTE FDD B5 (10M)	< -98dBm
LTE FDD B8 (10M)	< -98dBm
LTE TDD B34 (10M)	< -98dBm
LTE TDD B39 (10M)	< -98dBm
LTE TDD B40 (10M)	< -98dBm
LTE TDD B41 (10M)	< -97dBm

4.4 Recommended RF Soldering Methods

If the RF connector connecting the external antenna is connected to the module by soldering, please be sure to pay attention to the stripping method of the connecting wires and the soldering method, especially the ground to be soldered sufficiently, please follow the correct soldering method in the following figure to avoid the increase of the wire loss due to the poor soldering.

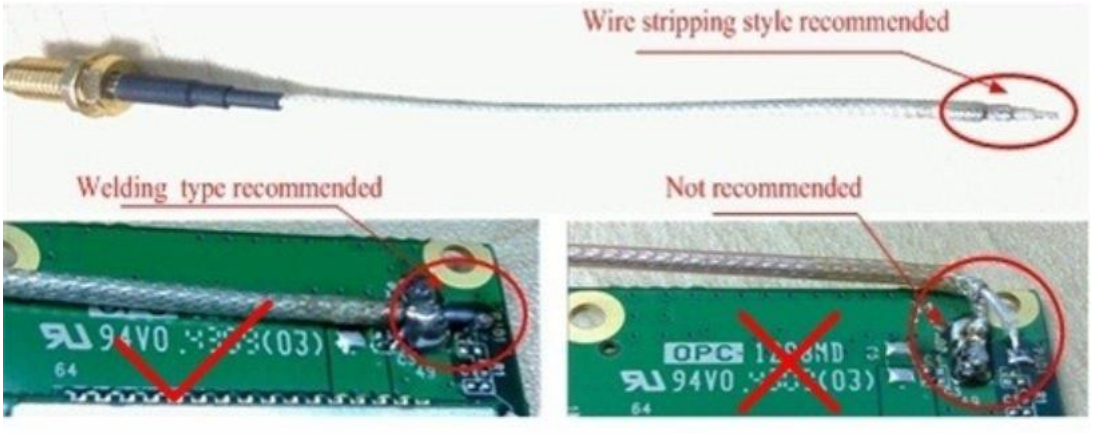


Diagram22 RF Welding Method Recommendations

5.Electrical Characteristics, Reliability

5.1 absolute maximum

The following table shows the maximum withstand values for the power supply voltage and current for the digital and analog pins of the module.

Table15 Absolute Maximum

parameters	minimal	greatest	unit (of measure)
V_{BAT}	-0.3	4.7	V
USB_VBUS	-0.3	5.5	V
Power supply peak current	0	2	A
Power supply average current	0	0.7	A
Voltage at digital pins	-0.3	VDDIO+0.3	V

5.2 Recommended working conditions

Form16 Recommended Working Conditions

parameters	minimal	typical case	greatest	unit (of measure)
V_{BAT}	3.3	3.8	4.3	V
USB_VBUS	3.0	5.0	5.25	V
Power supply peak current		0.7	2	A

5.3 operating temperature

Table17 Operating Temperature

temp	lowest	typical case	supreme	unit (of measure)
normal working temperature	-35	25	75	℃
Limit working temperature	-40~-35		75~85	℃
Storage temperature	-45		90	℃

5.4 power wastage

Refer to the hardware of each model for the power consumption of the module in various operating statestest report .

5.5 electrostatic protection

In the module application, due to human body static electricity, microelectronics between the

charged friction and other static electricity, through a variety of ways to discharge to the module, may cause some damage to the module, so the ESD protection must pay attention to, whether it is in the production and assembly, testing, research and development process, especially in the design of the product should be taken to prevent ESD protection measures. Such as circuit design at the interface or vulnerable to ESD points to increase ESD protection, production with anti-ESD gloves and so on. The following table shows the ESD withstand voltage of the key PIN pins of the module.

Table18 ESD Performance Parameters (Temperature: 25° C, Humidity: 45%)

pin name	contact discharge	air discharge
VBAT,GND	±5KV	±10KV
ANT_MAIN	±5KV	±10KV
TXD, RXD	±2KV	±4KV
Others	±0.5KV	±1KV

6.Mechanical dimensions

This section describes the mechanical dimensions of the module and the recommended package size for customer designs using the module.

6.1 Module Mechanical Dimensions

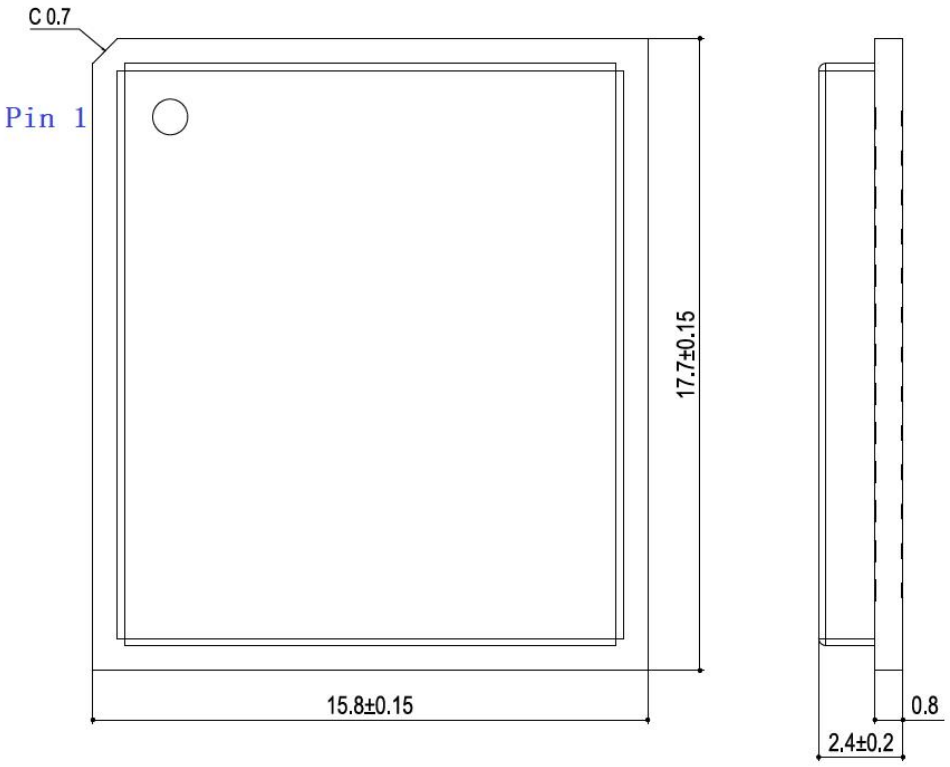


Diagram23 Module Dimensions (in millimeters)

6.2 Recommended PCB Packages

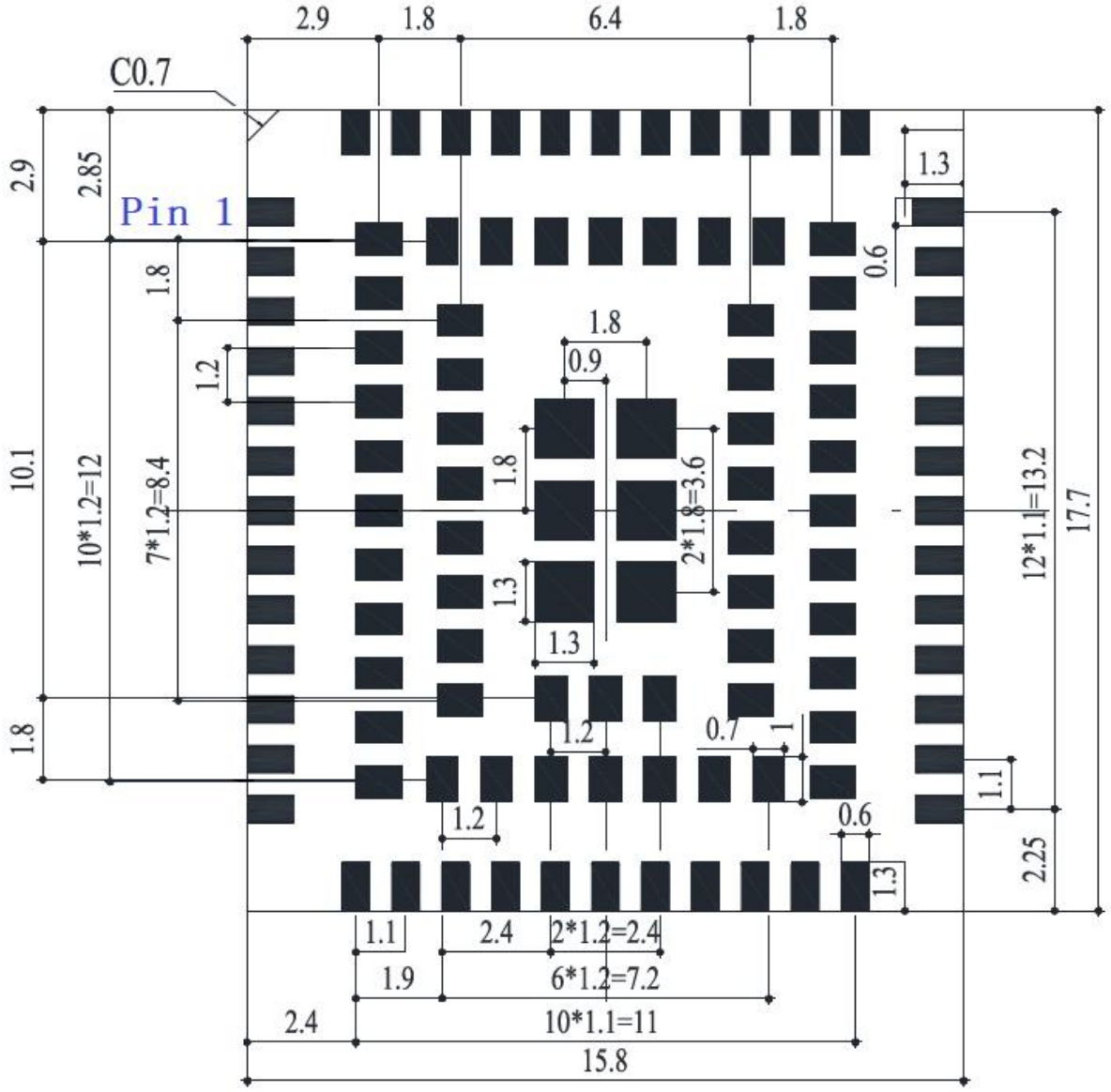


Diagram24 PCB package (front view in millimeters)

Attention:

1. The spacing between modules and other components on the is recommended to be at least PCB 3mm;

7.Storage and production

7.1 stockpile

The ZX800 is shipped in vacuum sealed bags. Storage of the modules is subject to the following conditions:

Modules can be stored in vacuum sealed bags for up to 12 months at ambient temperatures below 40 degrees Celsius and air humidity of less than 90%.
When the vacuum sealed bag is opened, the module can be directly reflowed or other high temperature processes if the following conditions are met:

- Module ambient temperature is less than 30 degrees Celsius, air humidity is less than 60%, and the factory completes the patch in less than 72 hours.
- Air humidity less than 10%

If the module is in the following conditions, it needs to be baked before placement:

- When the ambient temperature is 23 degrees Celsius (5 degrees Celsius fluctuation allowed), the humidity indicator card shows humidity greater than 10%.
- When the vacuum sealed bag is opened, the module ambient temperature is less than 30 degrees Celsius and the air humidity is less than 60%, but the factory fails to complete the patch in less than 72 hours
- Module storage air humidity greater than 10% when vacuum sealed bag is opened

If the modules need to be baked, bake them at 125 degrees Celsius (allowing for fluctuations of 5 degrees Celsius up or down) for 48 hours.

NOTE: The module packaging cannot withstand such high temperatures, remove module packaging before baking the module. If only a short period of baking is required, please refer to the specification. IPC/JEDECJ-STD-033

7.2 Production Welding

Print the solder paste on the stencil with a printing squeegee, so that the solder paste through the opening of the stencil leakage printed on the PCB, the strength of the printing squeegee needs to be adjusted appropriately, in order to ensure the quality of the module printing paste, ZX800 module pad part of the corresponding stencil thickness should be 0.2mm.

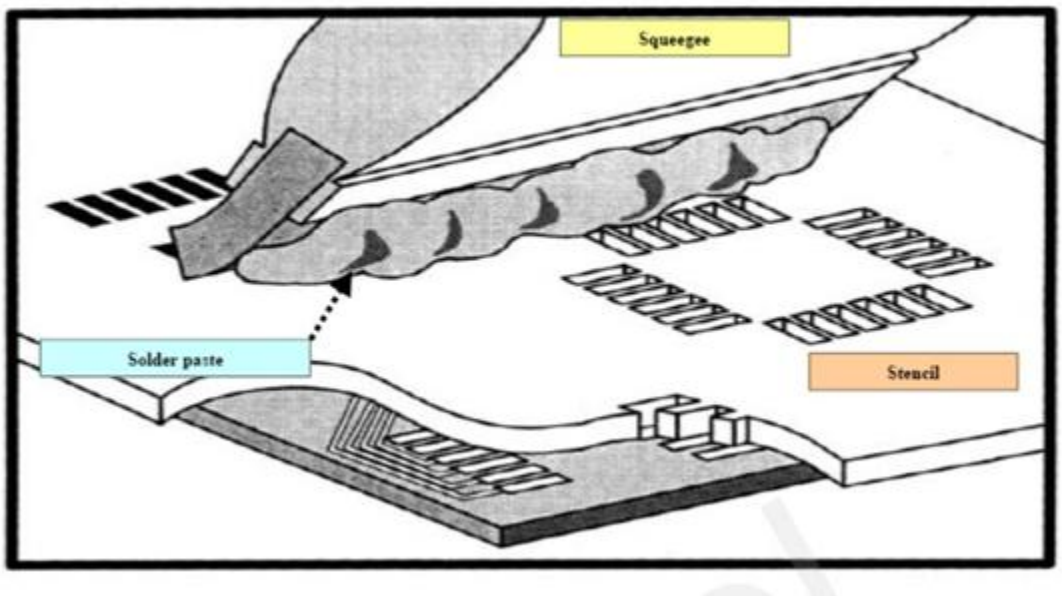


Diagram25 Paste Chart

In order to avoid repeated heat damage to the module, it is recommended that customers reflow the first side of the PCB board before attaching the module. The recommended oven temperature profile is shown below:

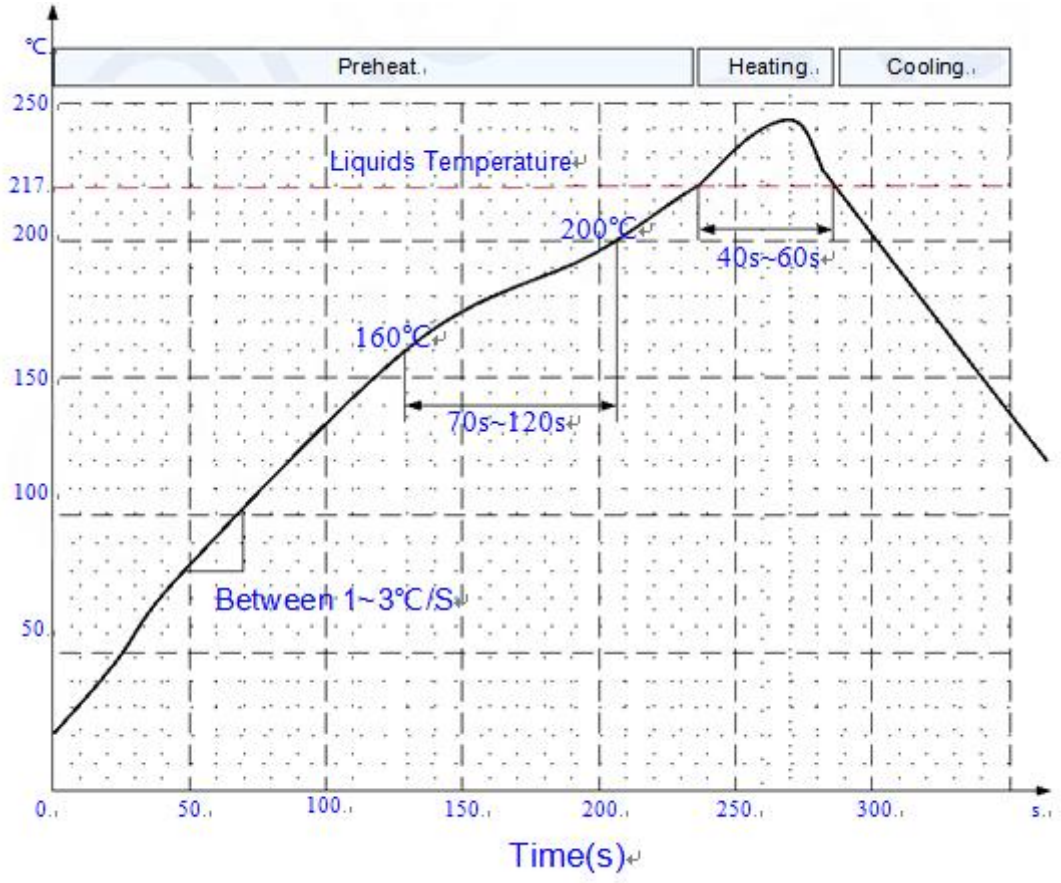


Diagram26 Furnace temperature profile

FCC Statement

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

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

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursua nt to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful inte rference in a residential installation. This equipment generates uses and can radiate radio frequency energy a nd, if not installed and used in accordance with the instructions, may cause harmful interference to radio com munications. 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 turn ing 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 receivingantenna.
- 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 important announcement

Important Note:

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 and your body.

Integration instructions for host product manufacturers according to KDB 996369 D03 OEM Manual v01r01

2.2 List of applicable FCC rules

This module has been tested for compliance to FCC Part 2, 22, 24, 27

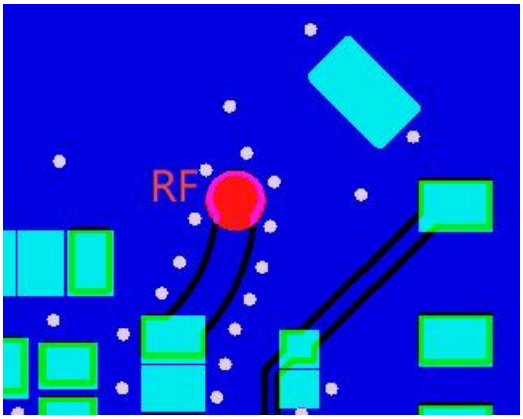
2.3 Specific operational use conditions

This module is stand-alone modular.If the end product will involve the Multiple simultaneously transmitting condition or different operational conditions for a stand-alone modular transmitter in a host, host manufacturer have to consult with module manufacturer for the installation method in end system.

2.4 Limited module procedures

Not applicable

2.5 Trace antenna designs



- The antenna feed point is located 3mm away from the module's antenna interface.
- The ground pad is located 3mm away from the antenna feed point.
- When controlling the RF trace impedance at 50 ohms, adding ground vias along the trace path can effectively enhance RF performance.

Not applicable

2.6 RF exposure considerations

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.

2.7 Antennas

This radio transmitter **FCC ID:2BL5O-ZX800-VG** has been approved by Federal Communications Commission to operate with the antenna types listed below, with the maximum permissible gain indicated. Antenna types not included in this list that have a gain greater than the maximum gain indicated for any type listed are strictly prohibited for use with this device.

Model No. of antenna:	Type of antenna:	Max. Gain Vs. Frequency range:
LJF01-20070104- R0A	FPC antenna	LTE Band 1 :1920-1980MHz Directional Antenna Gain: 2.18dBi LTE Band 2 :1850-1910MHz Directional Antenna Gain: 2.10dBi LTE Band 3 :1710-1785MHz Directional Antenna Gain: 1.98dBi LTE Band 4 :1710-1755MHz Directional Antenna Gain: 1.95dBi LTE Band 5 :824-849MHz Directional Antenna Gain: 1.36dBi LTE Band 7 :2500-2570MHz Directional Antenna Gain: 2.35dBi LTE Band 28 :703-748MHz Directional Antenna Gain: 0.14dBi

2.8 Label and compliance information

The final end product must be labeled in a visible area with the following" Contains **FCC ID: 2BL5O-ZX800-VG**".

2.9 Information on test modes and additional testing requirements

Host manufacturer is strongly recommended to confirm compliance with FCC requirements for the transmitter when the module is installed in the host.

2.10 Additional testing, Part 15 Subpart B disclaimer

Host manufacturer is responsible for compliance of the host system with module installed with all other applicable requirements for the system such as Part 15 B.

2.11 Note EMI Considerations

Host manufacture is recommended to use D04 Module Integration Guide recommending as "best practice" RF design engineering testing and evaluation in case non-linear interactions generate additional non-compliant limits due to module placement to host components or properties.

2.12 How to make changes

This module is stand-alone modular. If the end product will involve the Multiple simultaneously transmitting condition or different operational conditions for a stand-alone modular transmitter in a host, host manufacturer have to consult with module manufacturer for the installation method in end system. According to the KDB 996369 D02 Q&A Q12, that a host manufacture only needs to do an evaluation (i.e., no C2PC required when no emission exceeds the limit of any individual device (including unintentional radiators) as a composite. The host manufacturer must fix any failure.