ZX800-SG Module User Manual

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catalogs

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1. preface

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

2. summarize

2.1 Main performance

Tables1 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/ is supported. MQTT/SMS/DTMF
USIM card interface	♦ USIM/SIM card support: 1.8V and 3V
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 Windows 7/8.1/10, Linux 2.6.x/3.x/4.1, Android 4.x/5.x/6.x/7.x and other operating systems.

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 other functions to be reused, refer to IO MUX documentation for details.
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 RoHS compliant

2.2 Pin Definitions

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

Tables2 Module Pin Definitions

pinout serial number	ZX800-SG	Functional Description
1	GND	
2	ANT_GNSS/ RESERVED*	GNSS antenna interface
3	RESERVED	ZX800-SG 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 The ZX800-SG GPS version does not support this 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_D0	
56	RESERVED	
57	CAM_I2C_SCL	
58	CAM_I2C_SDA	
59	USB_DP	USB port
60	USB_DM	
61	USB_VBUS	
62	USIM2_CLK	
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_DET	
80	CAM_SPI_CLK	
81	CAM_PWDN	
82	USB_BOOT	ZX800-SG pull down into BOOT

83	KEYIN4	
84	RESERVED	
85	KEYOUT3	
86	KEYOUT2	
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	
107	NA	
108	NA	
109	NA	

2.3 functional block diagram

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

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

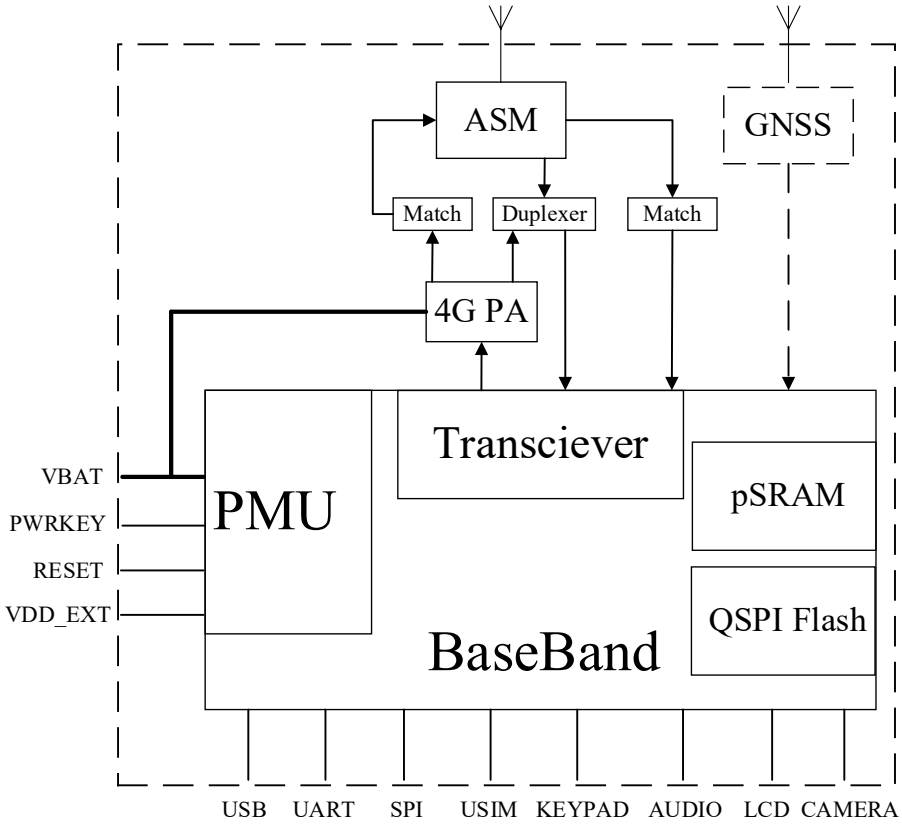

Chart1 Functional Block Diagram

3. application interface

The module is packaged in an LGA package and the ZX800 has 109 SMT pads. The following sections describe in detail the function of each ZX800 interface.

3.1 Pin Description

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

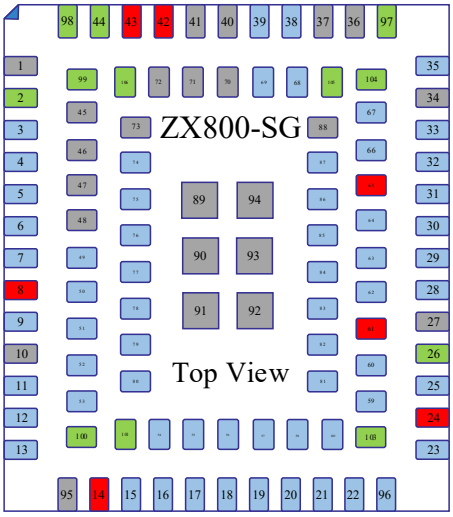

Chart2 Pin distribution schematic (front view)

Tables3 Pin Descriptions

power supply						
pin name	pin	power-on	I/O	Pin Description	voltage domain	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 decoupling capacitor of 2~4.7uF in parallel, and the load current should not exceed 50mA.
VCAMA	8	ON	PO	Output 2.8V, analog voltage to Camera, IOmax=200mA	V_2V8	Default output 2.8V, can supply power to LCD AVDD or CAM AVDD, 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 domain	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 number	power-on state	I/O	Pin Description	voltage domain	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 capacitor to ground
USB port						
pin name	pin	power-on	I/O	Pin Description	voltage domain	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 low level is detected during power-up, the module is forced into download mode.	V_ 1V8	For the convenience of firmware upgrade, it is recommended to reserve a test point; it is strongly recommended to connect a 1KΩ resistor in series in the design 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 domain	note
MAIN_ TXD	18	OUTPUT PULL_UP	O	Module sends data	V_1V8/3V3	ZX800-SG TX and RX hardware selectable 3.3V/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 communication						
pin name	pin	power-on	I/O	Pin Description	voltage domain	note
AUX_TXD	29	OUTPUT PULL_UP	O	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 domain	note
DBG_TXD	39		O	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 domain	note

I2C_SCL	67	INPUT PULL_UP	O	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		
I2C1_SCL	57	INPUT PULL_UP	O	I2C Interface Clock Signal	V_ 1V8	The ZX800-SG does not support this route.
I2C1_SDA	56	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	O	I2S MCLK master clock	V_ 1V8	Outputs a typical frequency clock up to 26MHz, which can be used as an external Codec master clock
PCM_CLK	30	INPUT PULL_DOWN	O	PCM clock signal	V_ 1V8	If you don't use it, it hangs in the air.
PCM_SYNC	31	INPUT PULL_DOWN	O	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	O	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		O	USIM Card Clock Cable		
USIM_RST_N	12		O	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	The module automatically recognizes 1.8V or 3V(U) SIM cards.
USIM2_DATA	64		I/O	USIM card data cable		
USIM2_CLK	62		O	USIM Card Clock Cable		
USIM2_RST_N	63		O	USIM card reset cable		

ADC						
pin name	pin number	power-on state	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 circuit, not used to suspend.
LCD Interface						
pin name	pin number	power-on state	I/O	Pin Description	voltage domain	note
LCD_CS	52	OUTPUT PULL_UP	O	SPI LCD Slice Selection	V_ 1V8	LCD IO only supports 1.8V, note the level matching
LCD_CLK	53	OUTPUT PULL_UP	O	SPI LCD clock signal		
LCD_TXD	50	OUTPUT PULL_UP	O	Write LCD data signal		
LCD_RST	49	OUTPUT PULL_UP	O	SPI LCD reset signal		
LCD_DC	51	OUTPUT PULL_UP	O	SPI LCD data/command selection		
LCD_TE (GPIO_20)	78	OUTPUT PULL_UP	O	LCD TE Signal		
LCD_ISINK	102		I	LCD Backlight Negative		LCD backlight negative pole, can control LCD backlight brightness, maximum current 100mA
Keyboard Array						
ZX800-SG matrix can be supported by multiplexed IO up to 5 * 5 matrix keyboards						
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 (2.8V) are reserved in the module, or an external supply can be used
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_D0	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.

Tables4 Working 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, the module RF does not work in this mode	

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.

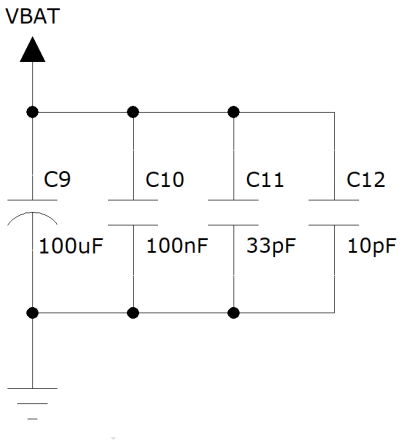

Chart3 VBAT Input Reference Circuit

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.

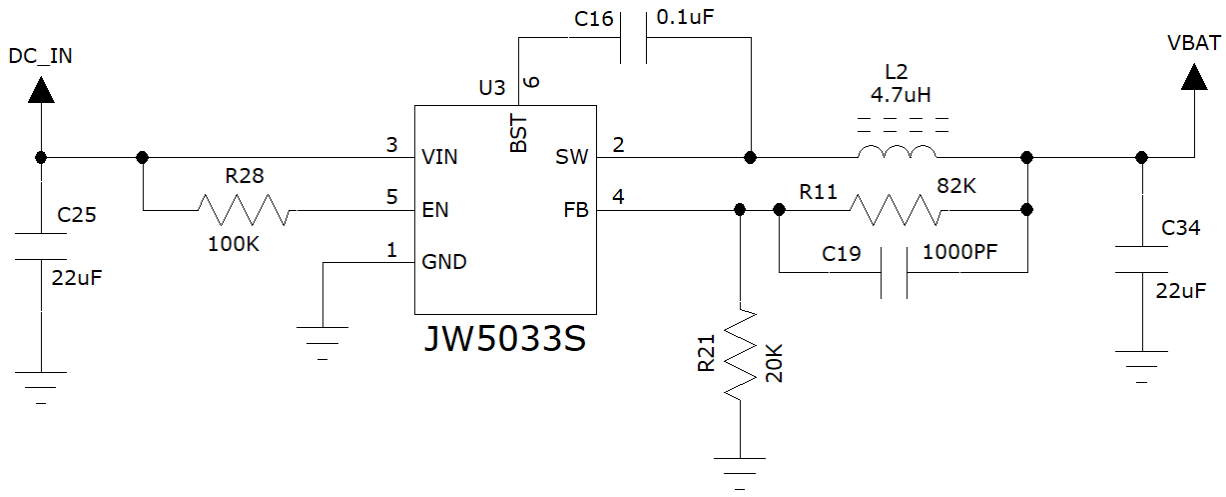

Chart4 DCDC Power Supply Input Reference Design

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:

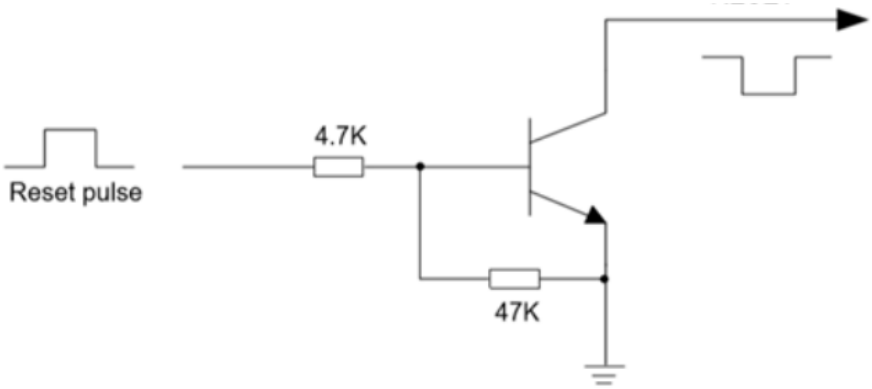

Chart5 Open set driver reference power-up circuit

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:

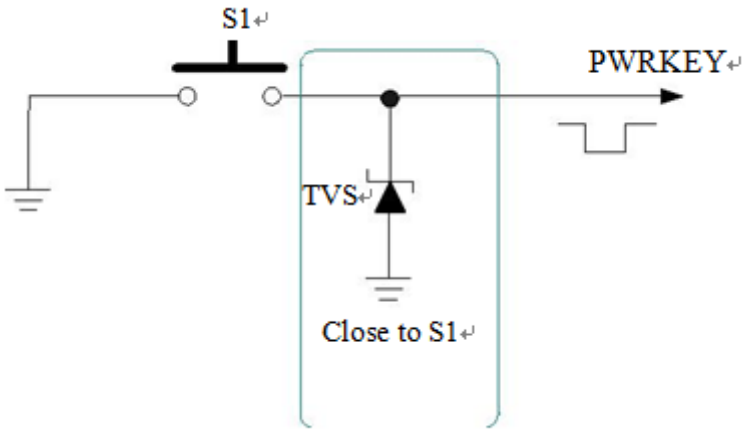

Chart6 Key On Reference Circuit

Button power-up timing diagram:

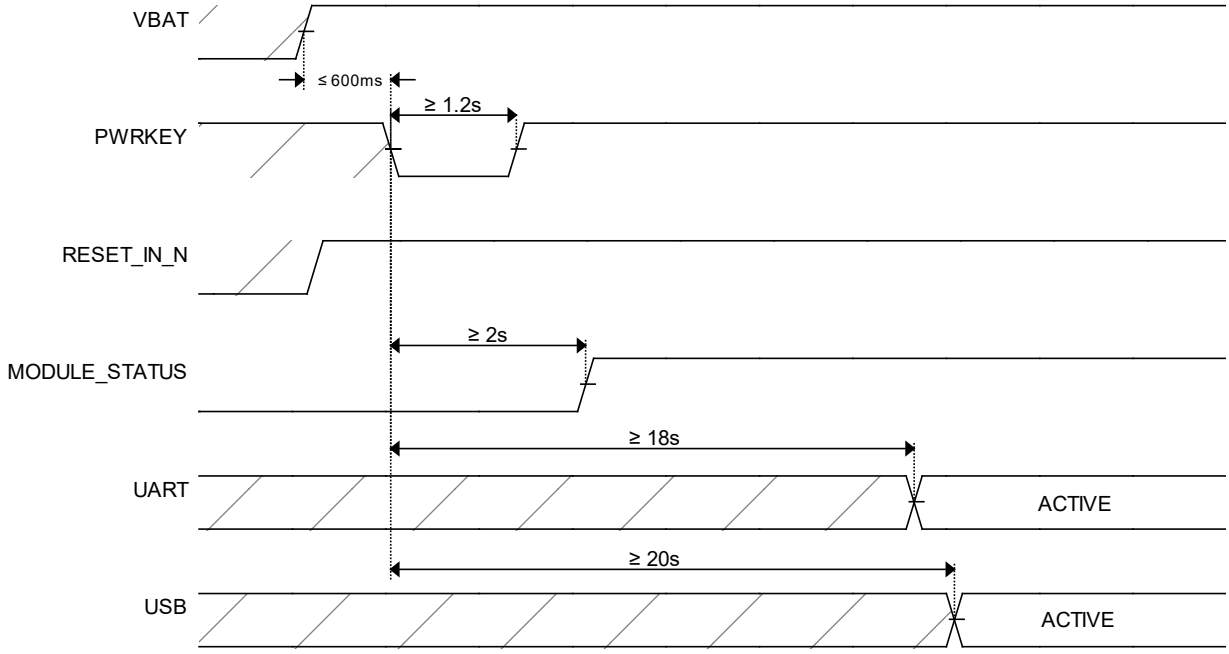

Chart7 Key On Timing Chart

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: shutdown via AT command AT+CPOWD
- Low voltage auto shutdown: the module shuts down when it detects low voltage (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:

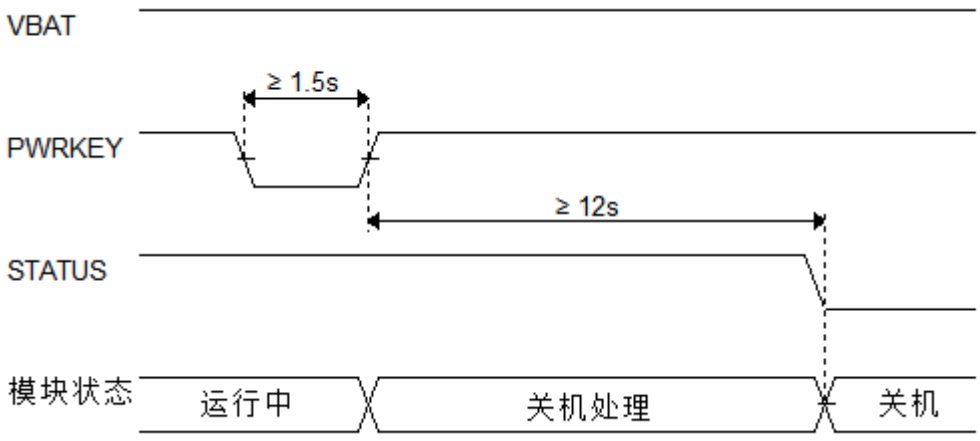

Chart8 Button Shutdown Timing Chart

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 RESET_IN_N pin can be used to reset the module. Pulling down the RESET_IN_N pin for more than 150ms can reset the module. the 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:

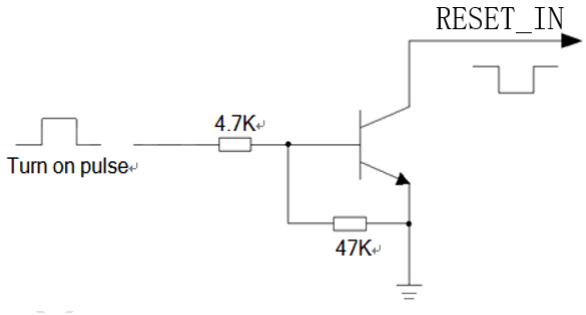

Chart9 Hardware Reset Reference Circuit

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 the module in sleep mode 2:

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

Tables5 Mode Switching Summary

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

Tables6 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, URC messages such as "RDY", "+CFUN: 1" 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

Tables7 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

Tables8 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:

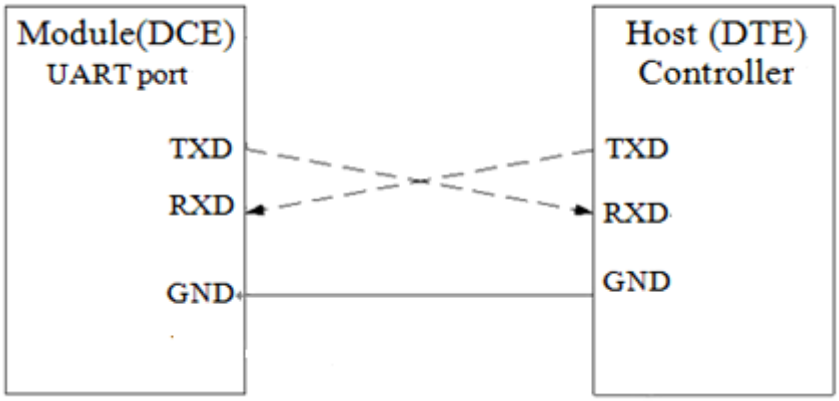

Chart10 Diagram of three-wire serial port connection method

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.

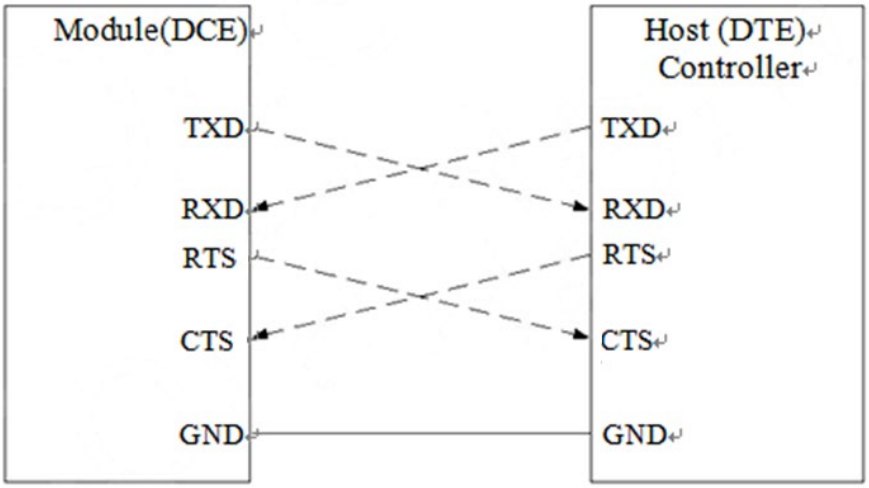

Chart11 Diagram of serial port connection with flow control

3.7.5 Serial Voltage Conversion

ZX800-SG MAIN serial port TX and RX signal module hardware reserved level conversion circuit, can support 3.3V, but need to specify the corresponding hardware version, the default is 1.8V, so we strongly recommend customers external circuitry to increase or decrease the level conversion circuit.

The level shifting circuit is as follows:

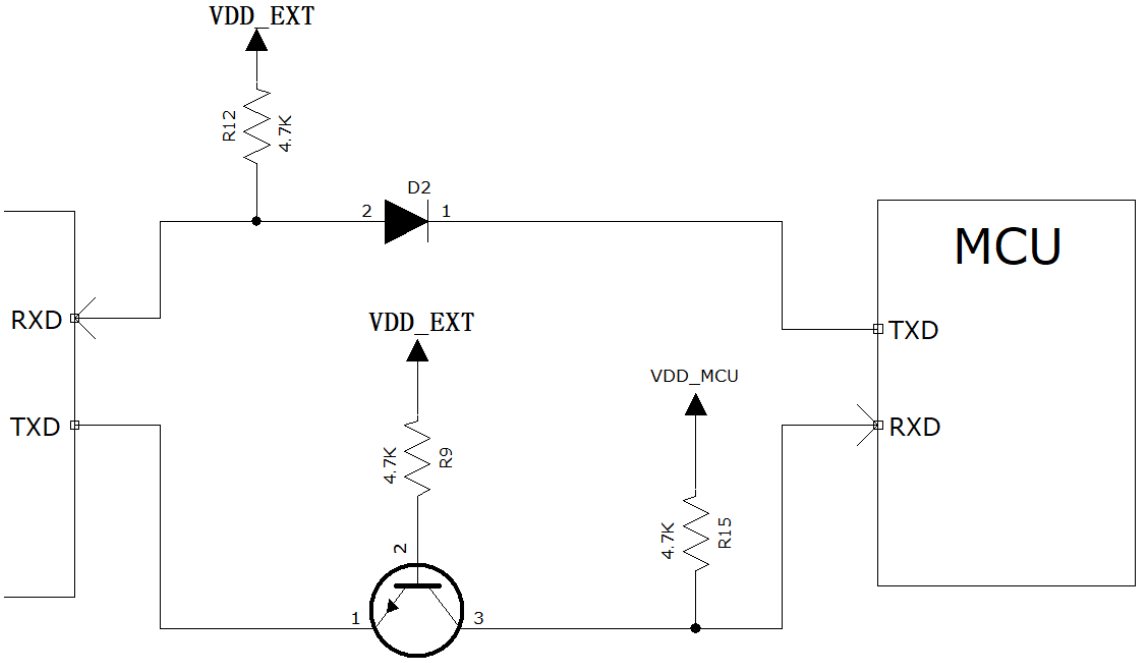

Chart12 Level Shifting Circuit

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.

Tables9 USB Pin Definitions

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

The notes are as follows:

1. USB alignment needs to be strictly in accordance with the differential line control, 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:

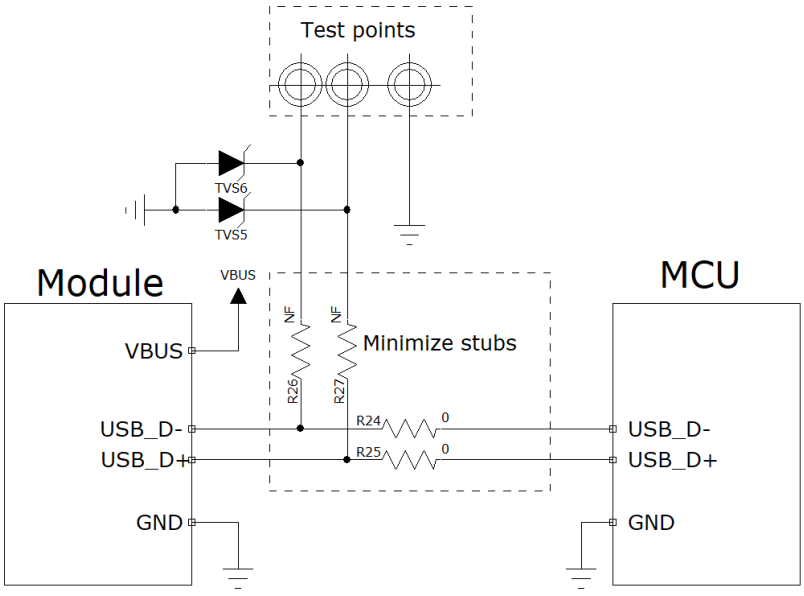

Chart13 USB Interface Reference Design

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 the interface pin definitions for SIM0 and SIM1.

Note: ZX800-SG SIM2 is dual SIM single standby;

Tables10 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.

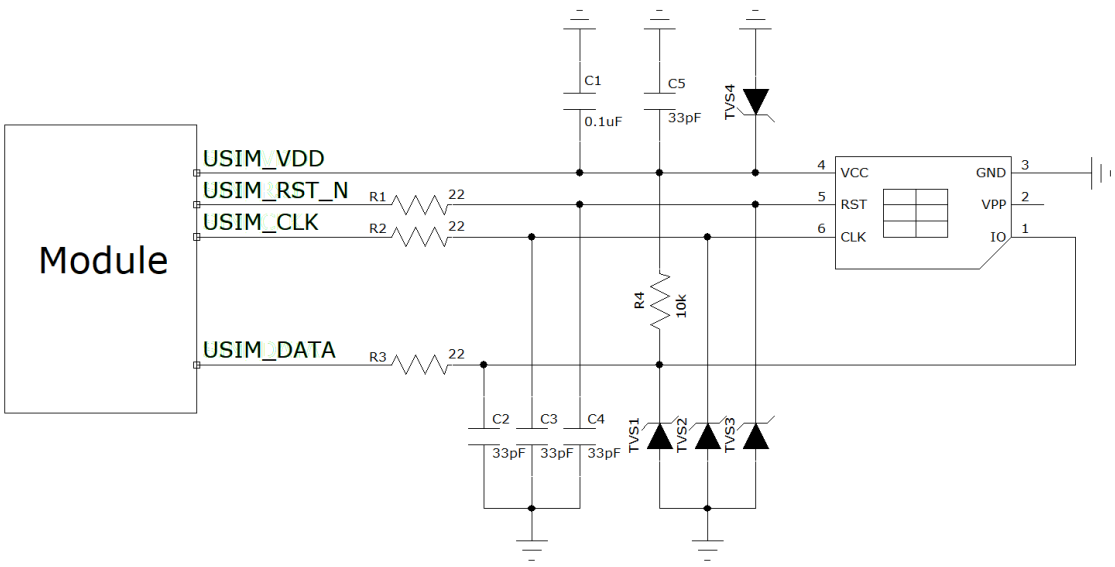

Chart14 Reference Circuit Diagram for Using a 6pin SIM Card Holder (SIM)

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

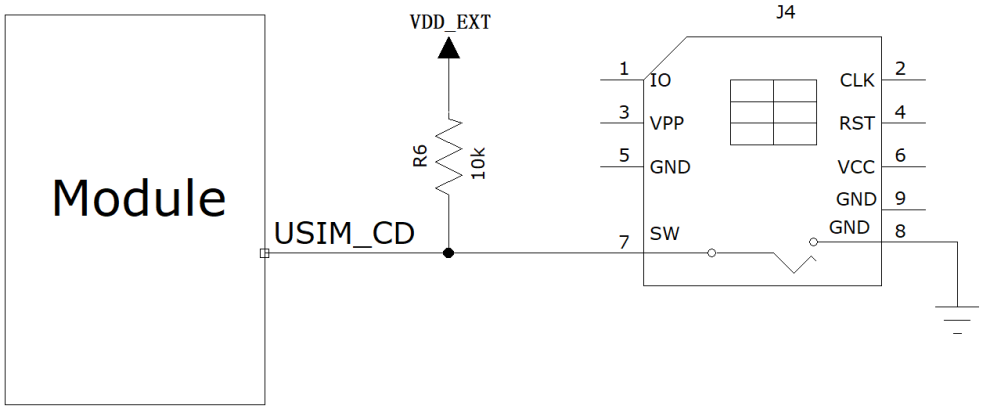

Chart15 Reference Circuit Diagram for Using a Band Detect PIN SIM Card Holder

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

Tables11 Audio Interface Pin Definitions

connector	interface name	interface	corresponds English -ity, -ism, -ization
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-SG 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 Zhongyunxinan 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.

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.

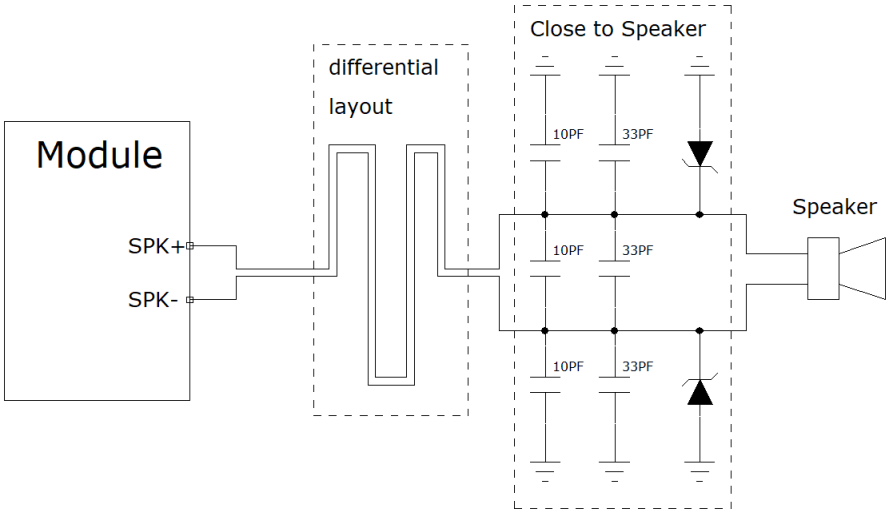

Chart16 SPK Output Reference Circuit

4. RF interface

The antenna interface pins are defined below:

Tables12 RF_ANT Pin Definitions

Pin Name	pin number	corresponds English -ity, -ism, -ization
MAIN_ANT	35	4G Antenna Interface
ANT_GNSS	2	GNSS antenna interface

4.1 RF reference circuit

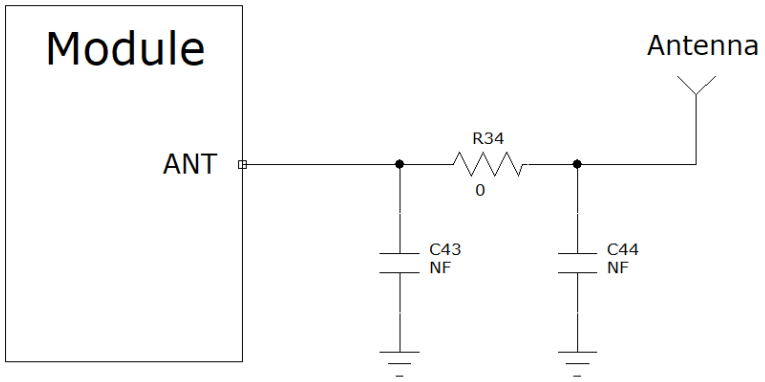

Chart17 RF Reference Circuit

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 damaged by ESD, it is highly recommended to reserve an ESD device at the antenna end, taking care that the parasitic capacitance does not exceed 0.5pF;
- The RF traces connected to the module's RF antenna pads must be microstrip or other types of RF traces with a controlled impedance of 50 ohms;
- The antenna feed point is as close to the module interface as possible;
- The GPS has a built-in LNA and a passive antenna is recommended.

4.2 4G RF Output Power

Tables13 4G RF Conducted Power

(radio) band	greatest	minimal
LTE FDD B1/B3/B5/B8	23dBm ±2dB	<-44dBm
lte tdd b34/b38/b39/b40/b41	23dBm ±2dB	<-42dBm

4.3 4G RF conduction sensitivity

Tables14 RF Conductivity Sensitivity

(radio) band	receiver sensitivity
LTE FDD B2/25	< -98dBm
LTE FDD B4/66	< -98dBm
LTE FDD B5 /26	< -98dBm
LTE FDD B7	< -97dBm
LTE FDD B12	< -97dBm

LTE FDD B13	< -97dBm
LTE TDD B38	< -97dBm
LTE TDD B40	< -98dBm
LTE TDD B41	< -97dBm

4.4 GNSS parameters

Tables 15 GNSS parameters

sports event	parameters
position accuracy	
Horizontal positioning accuracy (RMS)	< 2.0m
Elevation positioning accuracy (RMS)	< 3.0m
Speed Accuracy	0.1m/s
Sensitivity* GPS+BDS at -130 dBm signal input, the sensitivity index needs to ensure that CN0 is 41 dB.	
cold start	-147dBm
haunt	-160dBm
re-arrest	-158dBm
TTFF	
cold start	<28s
quick start	Unassisted time injection ≤ 6s; injection assisted time ≤ 3s
AGNSS	Unassisted time injection ≤ 6s; injection assisted time ≤ 3s
re-arrest	≤1s

4.5 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.

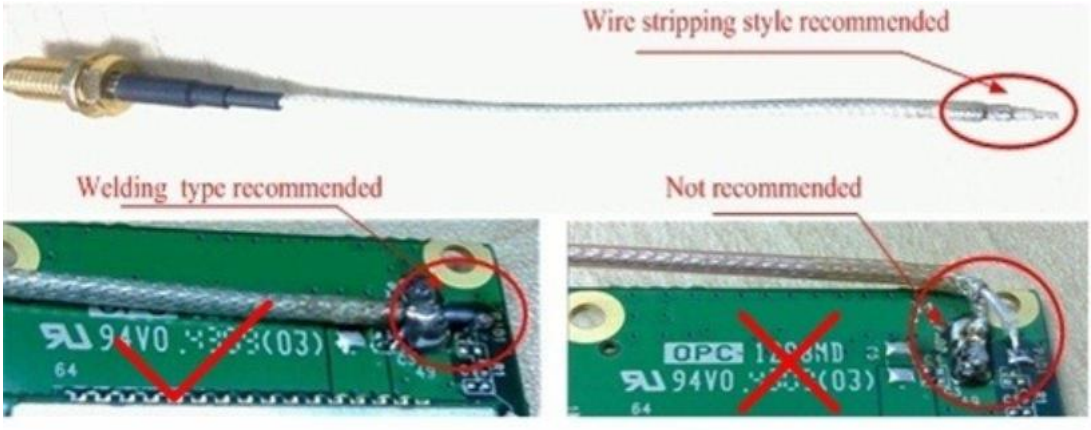

Chart18 RF Welding Method Recommendations

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.

Tables16 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

Tables17 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

Tables18 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 test report of each model for the power consumption of the module in various operating states.

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.

Tables19 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

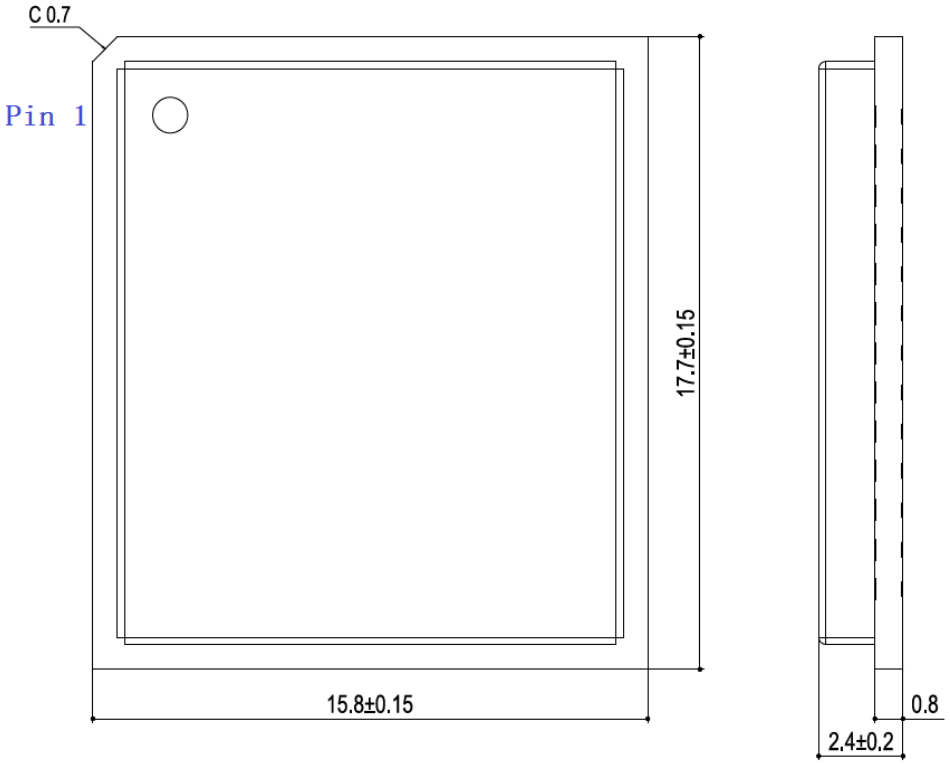

Chart19 Module Dimension Chart (in millimeters)

6.2 Recommended PCB Packages

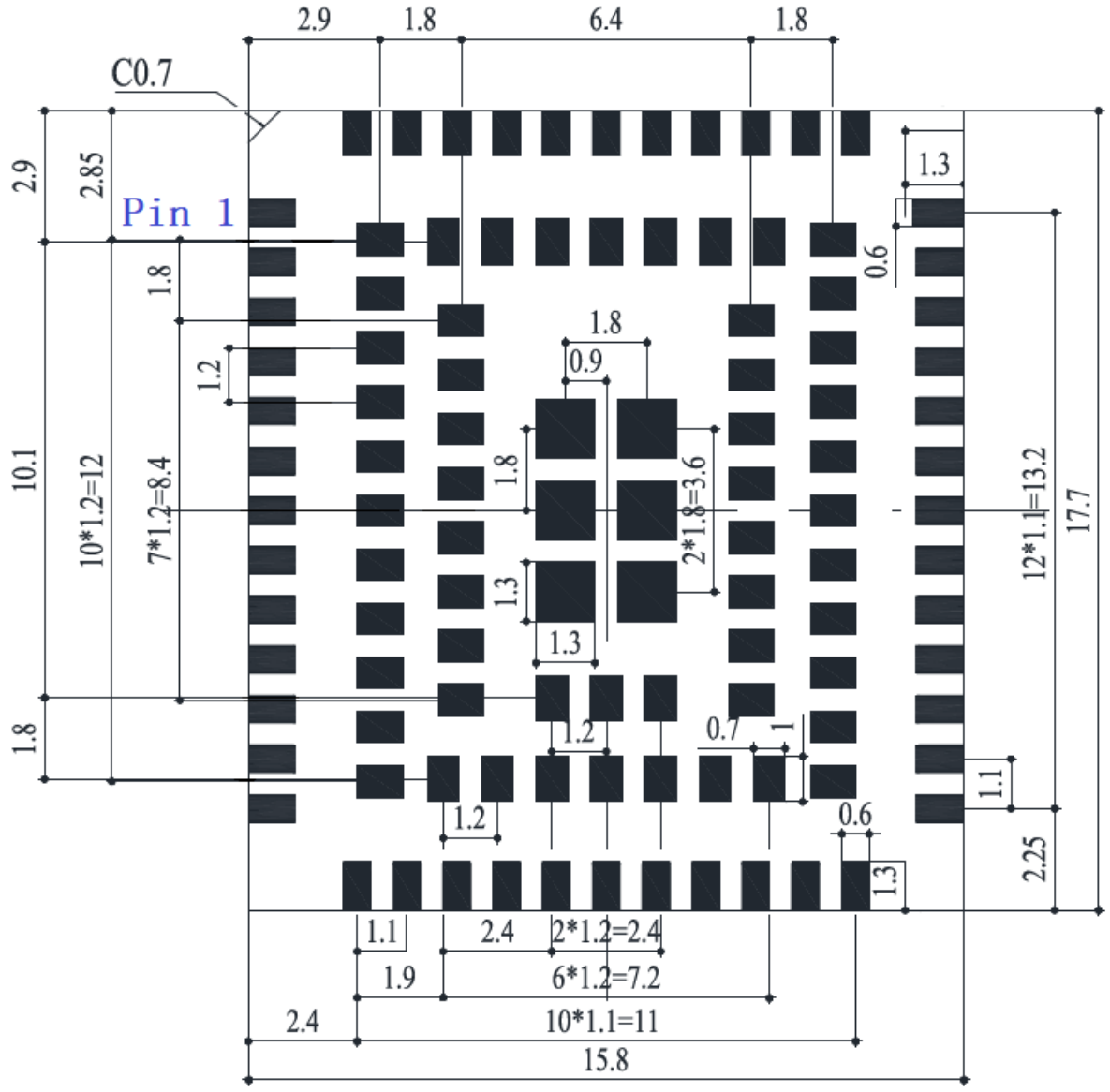

Chart20 PCB package (front view in millimeters)

Attention:

1. The spacing between modules and other components on the **PCB** is recommended to be at least **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 baking time is required, please refer to **IPC/JEDECJ-STD-033** specification.

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.

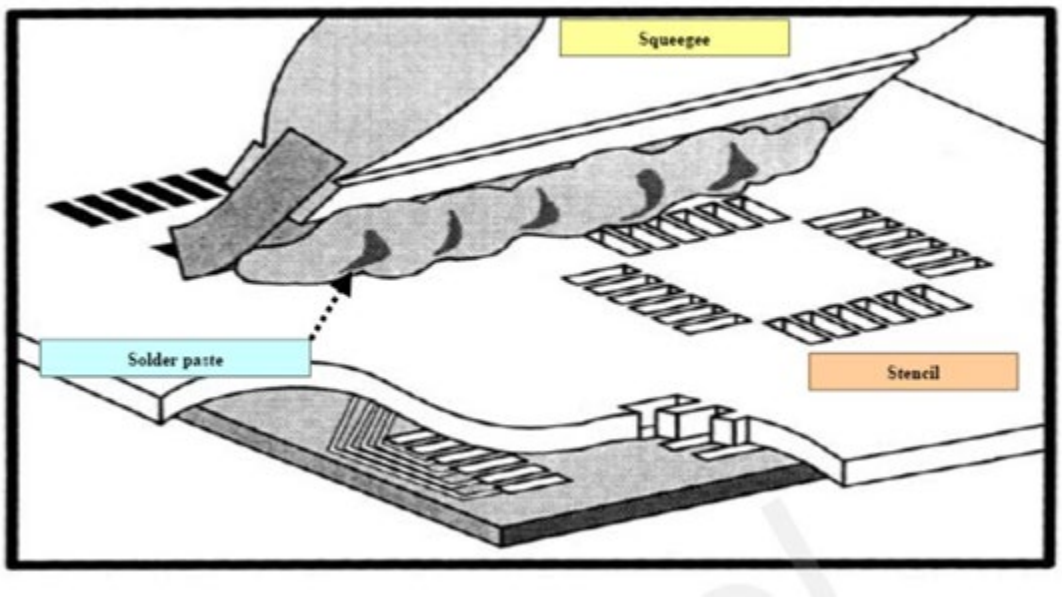

Chart21 Printing Paste Chart

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:

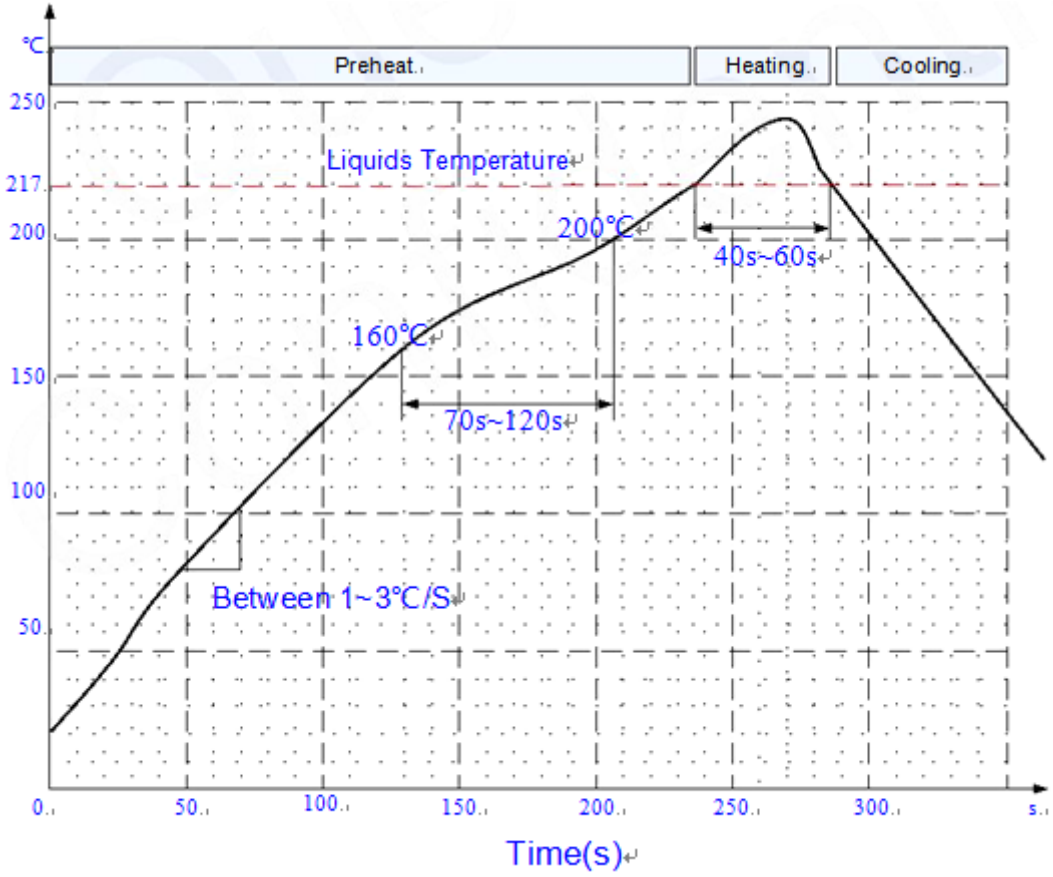

Chart22 Furnace Temperature Curve

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 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 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 and 90

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

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-SG** 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:
LJF01-19082601-R1A	FPC antenna	LTE Band 2 :1850-1910MHz Directional Antenna Gain：2.10dBi LTE Band 4:1710-1755MHz Directional Antenna Gain：1.89dBi LTE Band 5:824-849MHz Directional Antenna Gain：1.36dBi LTE Band 7:2500-2570MHz Directional Antenna Gain：2.35dBi LTE Band 12:699-716MHz Directional Antenna Gain： LTE Band 13:777-787MHz Directional Antenna Gain：-2.72dBi LTE Band 25:1850-1915MHz Directional Antenna Gain：-1.16dBi LTE Band 26:824-849MHzDirectional Antenna Gain：2.10dBi LTE Band 38:2570-2620MHzDirectional Antenna Gain：1.36dBi LTE Band 40:2305-2315 MHz Directional Antenna Gain：2.26dBi 2345-2360MHz Directional Antenna Gain：2.27dBi LTE Band 41:2496-2690MHz Directional Antenna Gain：2.35dBi LTE Band 66:1710-1780MHz Directional Antenna Gain：1.95dBi

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-SG**".

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.