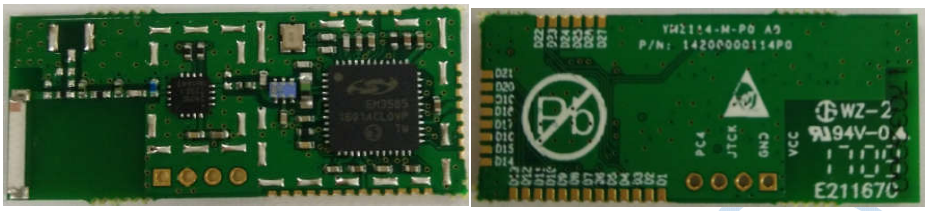
General Purpose ZigBee Module

Model：YMZ114-M-P0

V1.00



Features：

- ✧ **2.4GHz IEEE 802.15.4 transceiver & lower MAC**
- ✧ **ZHA、ZLL、ZSE、ZBA、ZigBee3.0 etc. standard protocols**
- ✧ **12 seconds ultra fast network self-healing function**
- ✧ **Support for Coo,routing, terminal nodes**
  Coo support distributed network and centralized network architecture
  Coo support HEX instruction and coprocessor mode
- ✧ **MESH networking**
- ✧ **OTA upgrade**
- ✧ **USART/IIC/SPI interface**
- ✧ **ADC、PWM、IQR and Timers interface**
- ✧ **12 highly configurable GPIOs with Schmitt trigger inputs**
- ✧ **Supports offline detection of routing devices and configurable detection time**
- ✧ **Support VCC voltage detection, no need to increase the external circuit**
- ✧ **2.1~3.6V wide power supply**
- ✧ **RF Output power adjustable**
- ✧ **Support RF channel adaptive and mandatory fixed configuration**
- ✧ **1.6uA ultra low sleep power current**
- ✧ **Support -20 ~ +85 ℃ wide operating temperature range**
  Can be ordered for -40 ~ +125 ℃ version
- ✧ **Miniaturized package 36.2 * 15 * 2.2mm (27PIN stamp hole)**

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Acronyms and Abbreviations

Acronym/Abbreviation	Meaning
IEEE	Institute of Electrical and Electronics Engineers
ADC	Analog-to -Digital Converter
USART	Universal Synchronous/Asynchronous Receiver/Transmitter
TX	Transmitter
RX	Receiver
RF	Radio Frequency
IRQ	Interrupt Request
DC	Direct Current
MAC	Medium Access Control Layer
ISM	Industrial, Scientific and Medical radio band
GPIO	General Purpose Input/Output
ESD	Electrostatic Discharge
MCU	Microprogrammed Control Unit
OTA	Over-The-Air Upgrade
PCB	Printed Circuit Board
RAM	Random Access Memory
PER	Package Error Ratio
SMA	Surface Mount Assembly
SPI	Serial Peripheral Interface
ZHA	ZigBee Home Automation
ZLL	ZigBee Light Link
ZES	ZigBee Smart Energy
ZBA	ZigBee Building Automation
FCC	Federal Communications Commission)
RED	Radio Equipment Directive
CE	CONFORMITE EUROPEENNE
ROHS	Restriction of the use of certain Hazardous Substances

1. Module introduction

1.1. General Description

The YMZ114-M-P0 is a low-power ZigBee module of external PA with a small footprint and superior communication distance. The module complies with FCC, RED (R & TTE), CE and ROHS Certification and can be used in a wide variety of environments.

The module conforms to the IEEE 802.15.4 specification and supports all ZigBee protocols such as the ZigBee Light Link protocol, the ZigBee Home Automation protocol, and the ZigBee3.0 protocol etc. Support MESH networking, network self-healing, cluster binding and other important functions. Can be applied to wireless sensor, control and data acquisition. Module leads to a wealth of external ports, can be easily embedded into the category of products. The company also provides customized services for the module software, so as to save a lot of time and investment for the development of customers, reduce the risk of R & D and save time for the product to the market .

1.2. Module Application

The module software supports three application modes:

- Mature software: The company has hundreds of products, have been developed to complete the mature module software. The communication protocol and external control mode can be directly provide. Customers can quickly design products based on these information.
- Customization： The company according to the specific application of customers, to provide customers with reliable, secure, efficient processing mechanism of the application.
- Transparent transmission: The customer can develop the program according to our HEX instruction procedure. (Only Coo)

Applications of the module include, but are not limited to:

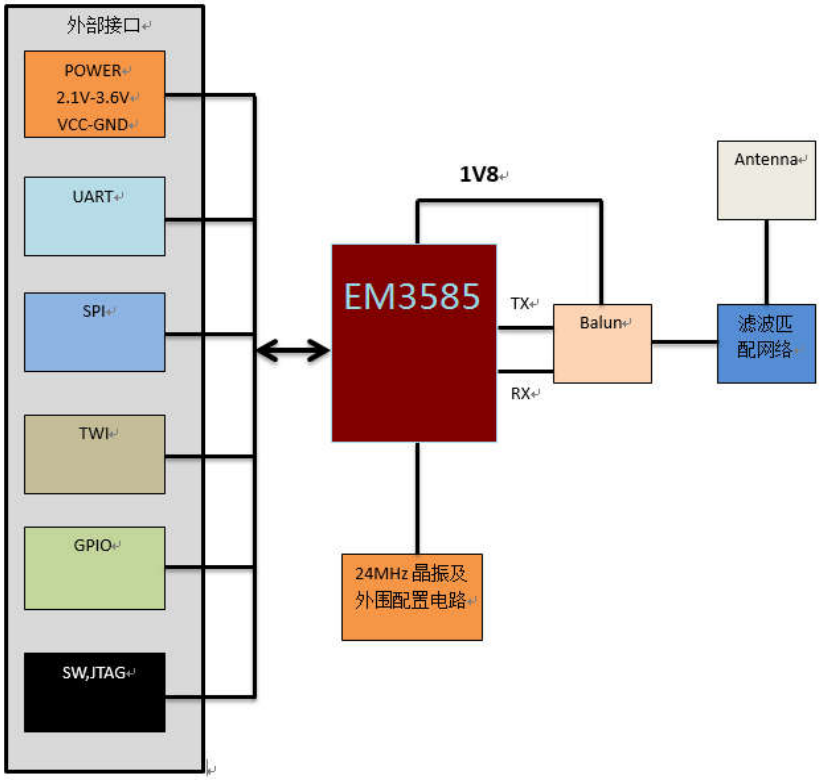
Main category	Typical subclasses
Intelligent security class	Door lock, Combustible gas detectors, carbon monoxide detectors, doors and windows magnetic, smoke detectors, human infrared detectors, leak detectors, SOS emergency button, sound and light alarm, etc.
Intelligent lighting class	Street lamps, bulb lights, RGB lights, downlights, spotlights, etc.

Intelligent switch control class	Touch switch panel, 86 box switch panel, scene switch panel, curtain motor switch panel, Promise dimmer switch panel, etc.
Intelligent environment monitoring class	Temperature and humidity detectors, PM2.5 detectors, etc.
Intelligent power control class	Mobile outlet, wall outlet, measuring socket, etc.
Intelligent remote control class	Infrared transponders, all kinds of remote control, etc.
Intelligent industrial control class	ZigBee to RS485/RS422/RS232/LAN/KNX converter
Others	Automatic meter reading, mechanical monitoring, plant system monitoring, etc.

2. Technical Specifications

2.1. Block Diagram of Modules

The following figure shows the block diagram of the module internal:



2.2. DC Electrical Characteristics

Parameter	Min	Type	Max	Unit
Power Supply	2.1	3.3	3.6	V
Sleep current	1.6	-	2.25	uA
RF receive current	-	36	-	mA
RF emission current	-	123.5#1	-	mA
I/O output current	-	-	4#2	mA
All I/O total output current	-	-	40	mA
I/O input drive current	-	-	0.5	uA
Analog input voltage	-0.3	-	2	V
I/O output logic 1	0.82*VCC	-	VCC	V
I/O output logic 0	0	-	0.18*VCC	V
I/O input high level	0.62*VCC	-	0.8*VCC	V
I/O input low level	0.42*VCC	-	0.5*VCC	V
I/O input pull-up/down resister	24	29	34	KΩ

Note#1：This RF emission current is + 3dBm transmission power under the parameters;

Note#2：Ordinary I/O output current is 4mA, but PA6, PA7, PB6, PB7, PC0 output current can up to 8mA (if the module leads to these I/O).

2.3. RF Characteristics

Parameter	Min	Type	Max	Unit
Operating frequency	2400	-	2500	MHz
Number of channels	-	16	-	个
Channel number	11	-	26	-
Channel spacing	-	5	-	MHz
TX power	-1	+20	+22	dBm
RX sensitivity	-102（20Byte Packet，1%PER）	-100	-	dBm
Transmission rate	-	-	250	Kbps
RF impedance	-	50	-	Ω
Built-in antenna average gain	-	0.5	-	dBi
Built-in antenna peak gain	-	2.5	-	dBi
Built-in Antenna VSWR	-	-	2	-
RX input Power	-	-	+15	dBm

2.4. Processor Performance

MCU of the module is EM3585 of Silicon Labs

Parameter	Specification	Unit
Core	32bit ARM CORTEX-M3	-
Flash	512	KB
RAM	32	KB
External crystal	24	MHz

2.5. Other Features

Parameter	Min	Type	Max	Unit
Shutdown time going into deep sleep	-	5	-	uS
System wake time from deep sleep	-	110	-	uS
UART baud rate	300	9600/115200	921600	bps
SPI clock frequency	-	-	12	MHz
IIC clock frequency	-	-	400	KHz

3. PIN Definitions

模块引脚号	引脚名称	可复用功能
1	GND	Ground
2	GND	Ground
3	PB7	GPIO/PWM/ADC2/TIM1/IRQC\D#3
4	PA1	GPIO/PWM/TIM2/IIC_SDA#4
5	SWCLK	SWCLK（Only for FW download）
6	SWDIO,PC4	SWDIO（Only for FW download）
7	PA5	GPIO/ADC5/nBOOTMODE#5
8	VCC	POWER
9	PA4	GPIO/ADC4/IRQC\D#3
10	PA2	GPIO/PWM/TIM2/IIC_SCL
11	GND	Ground
12	GND	Ground
13	GND	Ground
14	PB1	GPIO/UART_TXD/MOSI#6/MISO#6/IIC_SDA/PWM/TIM2

15	PB2	GPIO/UART_RXD/MISO[#7]/MOSI[#7]/IIC_SCL/PWM/TIM2
16	PA3	GPIO/PWM/TIM2/IRQC\D[#3]
17	GND	Ground
18	VCC	POWER
19	GND	Ground
20	PB3	GPIO/PWM/TIM2/UART_CTS/SPI1_CLK/IRQC\D[#3]
21	PB4	GPIO/PWM/TIM2/UART_RTS/SPI1_CS/IRQC\D[#3]
22	GND	Ground
23	RESET_N	RESET[#8]
24	PB5	GPIO/ADC0/TIM2CLK/TIM1MSK/IRQC\D[#3]
25	PC6	GPIO/OSC32B/IRQC\D[#3]
26	PB6	GPIO/PWM/TIM1/ADC1/IRQB\C\D[#3]
27	GND	Ground

Note: PC6 should not be used, the pin has been occupied, used to control the PA chip on the module.

Note#3：MCU supports up to four IRQs, channel A / B / C / D. The tag indicates that these channel numbers are supported.

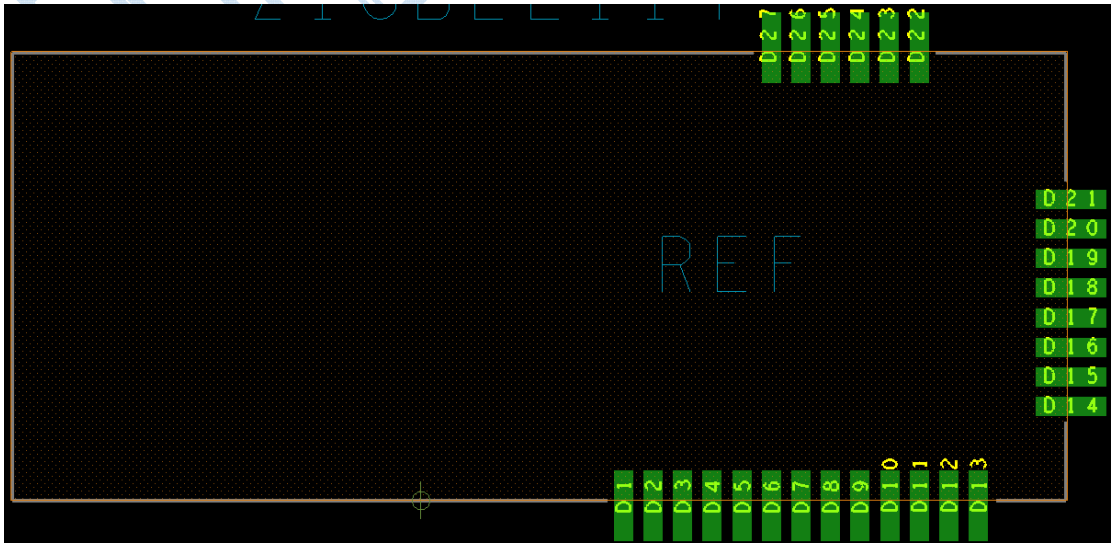
Note#4：Only supported for master mode.

Note#5：Normal use, not external pull down, otherwise it will enter bootmode, can not start normally.

Note#6：SPI output pin, be SPI_MOSI when configured as Master; be SPI_MISO when configured as Slaver.

Note#7：SPI input pin, be SPI_MISO when configured as Master; be SPI_MOSI when configured as Slaver.

Note#8：Power on the reset pin, active low，pay attention to the module power supply can not rise particularly slow, extreme cases have caused power Timing is not satisfied with the risk. MCU requires power stabilization to reset time for a minimum of 26uS. If the customer has a MCU on main board, can be reserved for 0Ω resistor to control it.



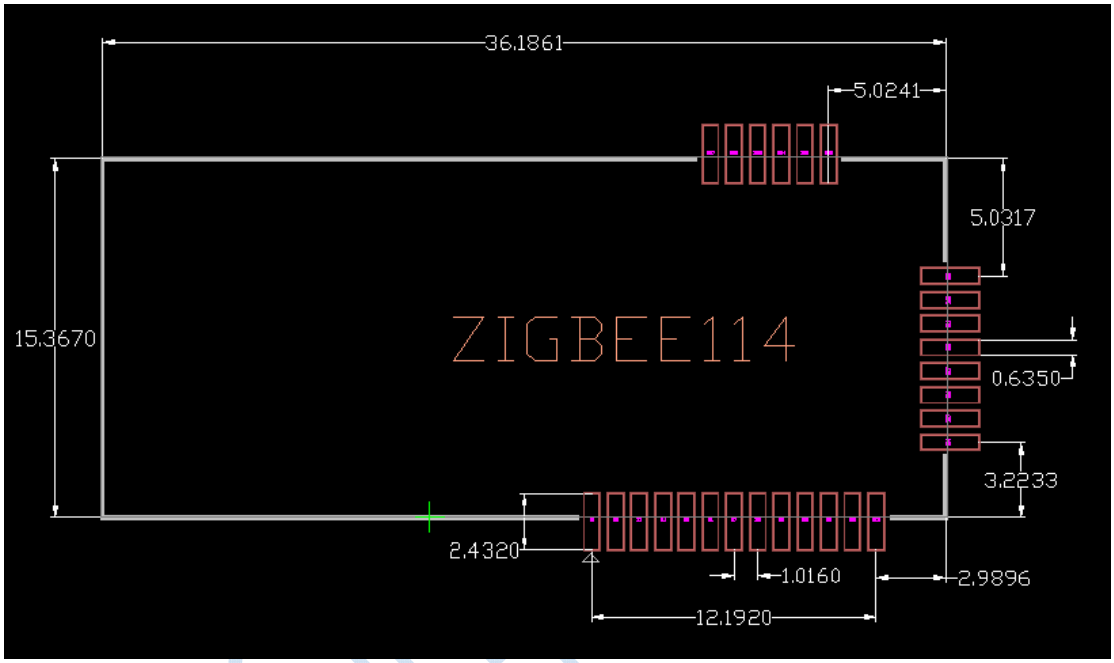
Pin Assignments

4. Physical Characteristics

Parameter	Specification	Unit	Remark
Physical size	36.2*15*2.2	mm	L*W*T
weight	3.0	g	
Operating temperature	-20~+85	℃	Can order -40 ~ +125 ℃ version
Operating relative humidity	≤95	%	
PCB Surface process	Gold-plated	-	
ESD（Human Body Model）	±2	KV	ON any PIN
ESD（Charge Device Model）	±0.4	KV	Non-RF PIN
ESD（Charge Device Model）	±0.225	KV	RF PIN

5. Footprint Recommendations

The following figure shows the recommended package size of the module, and also attached to the three commonly used EDA tool ready-made module package, in case EDA tool version is not compatible or different software, customers can design the footprint according to the figure below.



Commonly used three EDA tools are now available footprint as follows:

Allegro:	AD:	PADS:
YMZ114-M_Allegro.rar	YMZ114-M_AD.rar	YMZ114-M_PADS.zip

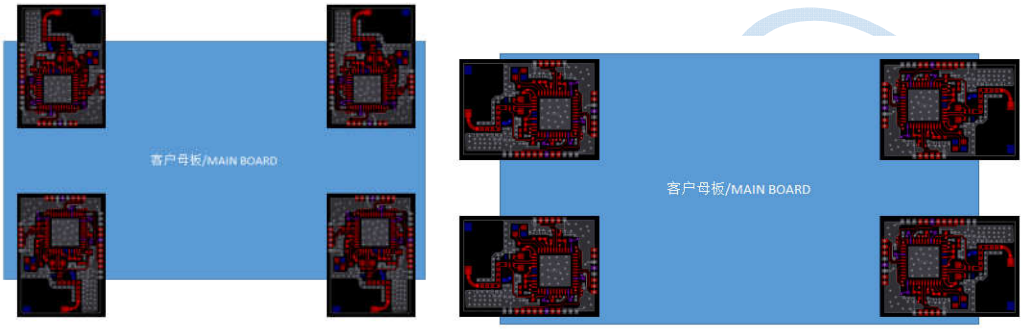
6. Standard Specification Test Results

	Item	Reference	Limit	Result
TX	TX Maximum Power	ETSI EN 300 328	<20dBm，-10dBw，100mW	PASS
	EIRP（TX Spectral Density）	ETSI EN 300 328	<10dBm/MHz	PASS
	Narrow Band Spurious	ETSI EN 300 328	<-30dBm（1MHz BW）	PASS
	Wide Band Spurious	ETSI EN 300 328	<-80dBm	PASS
	PSD（TX Power Spectral Density）	IEEE 802.15.4	>-20dB，-30dBm，100KHz，|f-fc|>3.5MHz	PASS
	EVM（Error Vector Magnitude）	IEEE 802.15.4	<35%	PASS
	TX Center Frequency Tolerance	IEEE 802.15.4	<±40ppm	PASS
	Min of Max TX Power	IEEE 802.15.4	>-3dBm	PASS
RX	Narrow Band RX Emissions	ETSI EN 300 328	<-47dBm（100KHz）	PASS
	Wide Band RX Emissions	ETSI EN 300 328	<-97dBm（100KHz）	PASS
	RX Sensitivity	IEEE 802.15.4	<-85dBm	PASS
	Adjacent Channel Rejection（N±1）	IEEE 802.15.4	>0dB	PASS
	Alternate Channel Rejection（N±2）	IEEE 802.15.4	>30dB	PASS
	RX Max Input Power	IEEE 802.15.4	>-20dBm	PASS

7. Layout Recommendations

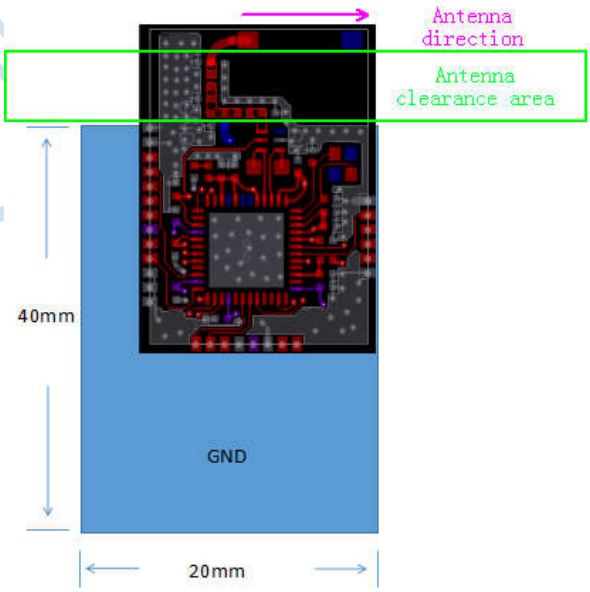
If the module is an external antenna, then only follow 4,5,6,8.

① The antenna of module should be placed as close as possible to the board edge, if placed in the PCB corner is better, and the module antenna clearance area should be prominent part of the motherboard floating is the best as shown below：



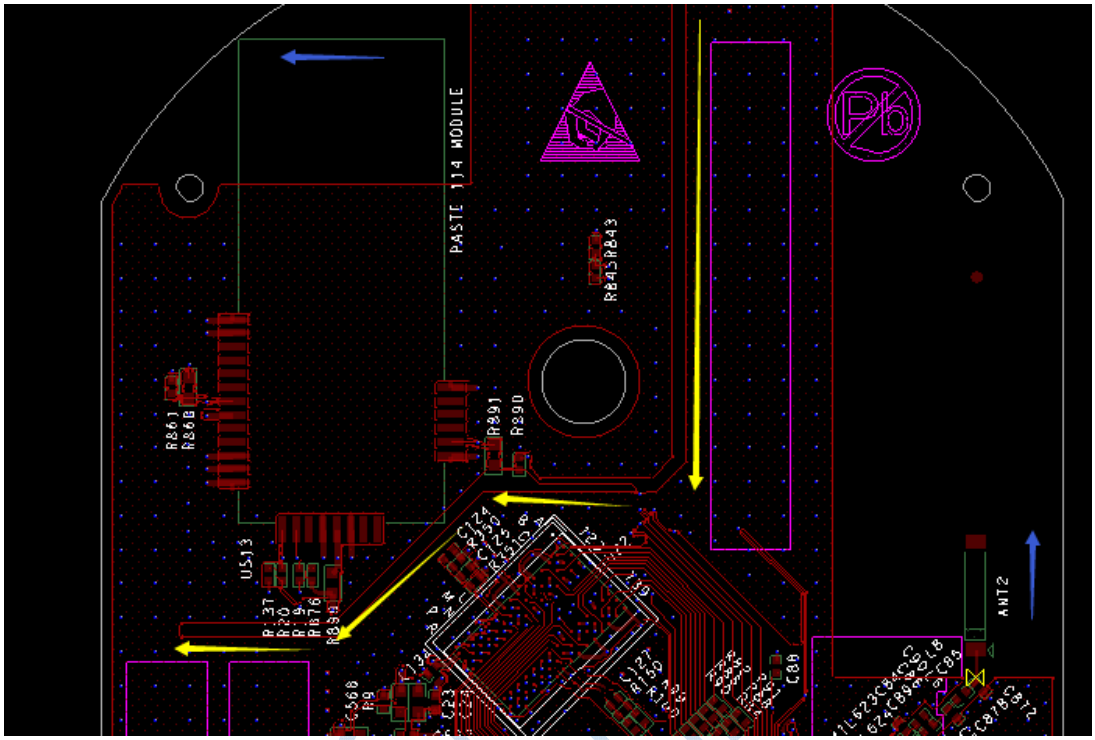
② The direction of transmission of the antenna should be towards the side without metal shielding, prohibiting the antenna direction of transmission down perpendicular to the main PCB board.

③ If the module can not be requirement as "1" to prominent the motherboard placed.The main board cannot place any component,line and ground at all layers in yellow frame below the figure. Including pasting the battery on the bottom. (This requirements only for the built-in antenna) Motherboard module surface GND copper area of 20 * 40mm is the best, and the antenna direction of the mother board copper as far as possible without extending the module edge as shown below：



④ Main board to the module GND and VCC pin trace as much as possible not less than the PIN width and as short as possible, GND VIA should not be too little.

⑤ If the main board has BLE, WIFI, GSM, 3G, LTE and other wireless circuits coexist, should pay attention to isolation (antenna away from each other, GND isolation as shown in the yellow arrow, the vertical direction of the antenna as shown below blue arrow).

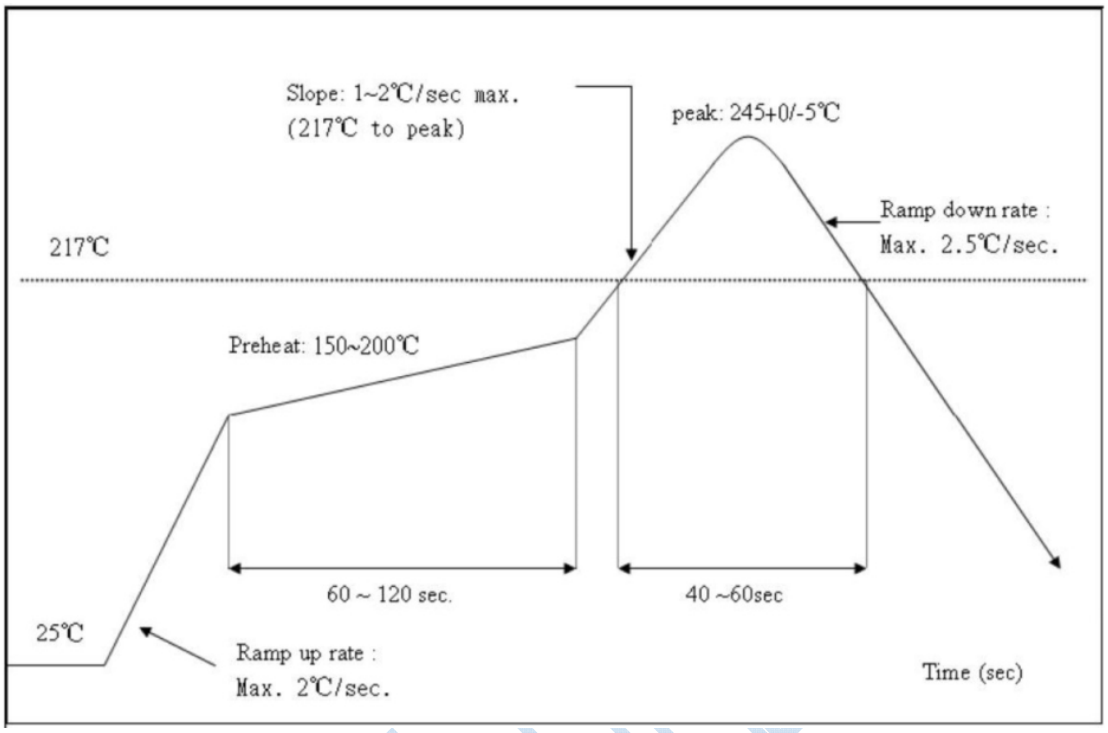


⑥ Module should be far away from the metal, high voltage circuit, switching power supply circuit, high-speed digital circuits, clock circuits and inductive magnetic devices etc.

⑦ Plastic shell should also be far away from the module built-in antenna position.

⑧ In addition to the above points, you should also consider the specific installation environment to determine the location and direction of the module layout.

8. Reflow Recommendations

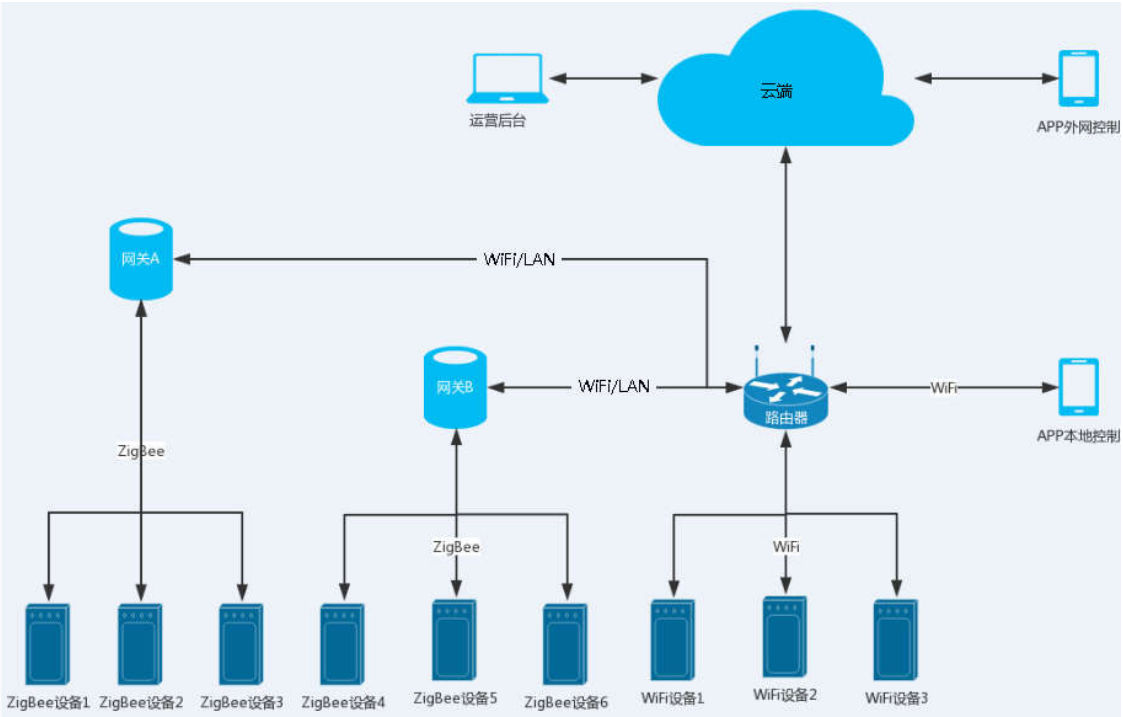


Note: the maximum temperature: ≤ 260 ℃, and not more than 10 seconds; module welding times are generally not more than 2 times

9. Typical Application Network Topology

Our ZigBee module is embedded in the ZigBee device in the following figure, through the ZigBee gateway (through other ZigBee routing devices or our proprietary relay devices to the gateway if the distance is too far), the gateway and then through the WIFI or LAN port to the router, WiFi terminal equipment directly connected to the router, the router and then through the internet to the cloud. Mobile phone can be through the local WiFi or external network such as 3G / 4G and other network equipment to control the end devices and receive state from the end devices. Cloud backstage can collect user information, user habits, terminal equipment information etc.

I have the total solution of the structure shown in the following diagram.



10. Special Reminders

- If the customer is not assured to use the module pin, PCB layout and alignment , we can provide free Review service.
- Note that the module itself is not very strong ESD immunity, so the customer should avoid ESD damage to the module when use it.
- Commonly the module only support the default high temperature of +85 ℃, if the customers have special needs of high temperature, please note that .And the version of high temperature module can support up to +125 ℃.

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. (2) This device must accept any interference received, including interference that may cause undesired operation.

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

---Reorient or relocate the receiving antenna.

---Increase the separation between the equipment and receiver.

---Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

---Consult the dealer or an experienced radio/TV technician for help.

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

LABEL OF THE END PRODUCT:

The final end product must be labelled in a visible area with the following "Contains TX FCC ID: 2AP73YMZ114-M-P0 If the size of the end product is smaller than 8x10cm, then additional FCC part 15.19 statement is required to be available in the users manual: This device complies with Part 15 of 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.

RF Exposure

This device has been evaluated and shown compliant with the FCC RF Exposure limits under fixed exposure conditions (antennas are greater than 20cm from a person's body) when installed in certain specific OEM configurations.

This modular complies with FCC RF radiation exposure limits set forth for an uncontrolled environment. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter. Due to missing shielding the module is strictly limited to integration by the Grantee himself or his dedicated OEM integrator under control of the Grantee. However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed.

IMPORTANT NOTE:

This module is intended for OEM integrator only and the OEM integrators and instructed to ensure that the end user has no manual instructions to remove or install the device. The OEM integrator is still responsible for the FCC compliance requirement of the end product, which integrates this module.

Integration is typically strictly restricted to Grantee himself or dedicated OEM integrators under control of the Grantee.

In the event that these conditions can not be met (for example certain laptop configurations or co-location with another transmitter. then the FCC authorization is no longer considered valid and the FCC ID can not be used on the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC authorization.

The module will be responsible to satisfy SAR/RF Exposure requirements, when the module integrated into any (portable, mobile, fixed) host device.

The module must in the end-product be installed in such manner that the authorized antennas can be used, any change of the antenna will void the certification.