



ZN5 Datasheet

Device Development > Module > Zigbee Module

Version: 20200319

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1 Product Overview

ZN5 is a low-power embedded Zigbee module that Tuya has developed. It consists of a highly integrated RF chip (JN5189) and several peripheral components, with an embedded network protocol stack and robust library functions. ZN5 is embedded with a low-power 32-bit CPU, 152 KB random-access memory (RAM), 640 KB flash memory, and extensive peripherals. You can develop embedded Zigbee products as required.

1.1 Features

- Embedded low-power 32-bit Arm Cortex-M4 processor, which provides digital signal processor (DSP) instructions and floating-point units (FPUs) and can also function as an application processor
 - Clock rate: 48 MHz
- Working voltage: 2.3 V to 3.6 V
- Peripherals: seven GPIOs and one universal asynchronous receiver/transmitter (UART)
- Zigbee features
 - 802.15.4 MAC/PHY
 - Working channels 11 to 26 at 2.400 GHz to 2.483 GHz; 250 kbit/s air interface rate
 - Embedded DC-DC circuit, maximizing the power efficiency
 - Maximum output power: +11 dBm; dynamic power adjustment: > 46 dB
 - Runtime power consumption: 10 dBm/20.3 mA; current in sleep mode: 0.35 μ A
 - Proactive network pairing for terminals
 - Onboard PCB antenna with a gain of 1 dBi
 - Working temperature: -40°C to +85°C
 - AES-128 or AES-256 hardware encryption

1.2 Application Scenarios

- Intelligent building
- Smart household and home appliances

- Smart socket and light
- Industrial wireless control
- Baby monitor
- Network camera
- Intelligent bus

1.3 Change History

No.	Date	Change Description	Version After Change
1	2019-12-20	This is the first release.	1.0.0

2 Module Interfaces

2.1 Dimensions and Footprint

ZN5 has two rows of 14 pins with a 2 mm pin spacing. The ZN5 dimensions (H x W x D) are 2.3 ± 0.1 mm x 20.4 ± 0.35 mm x 14.8 ± 0.35 mm.

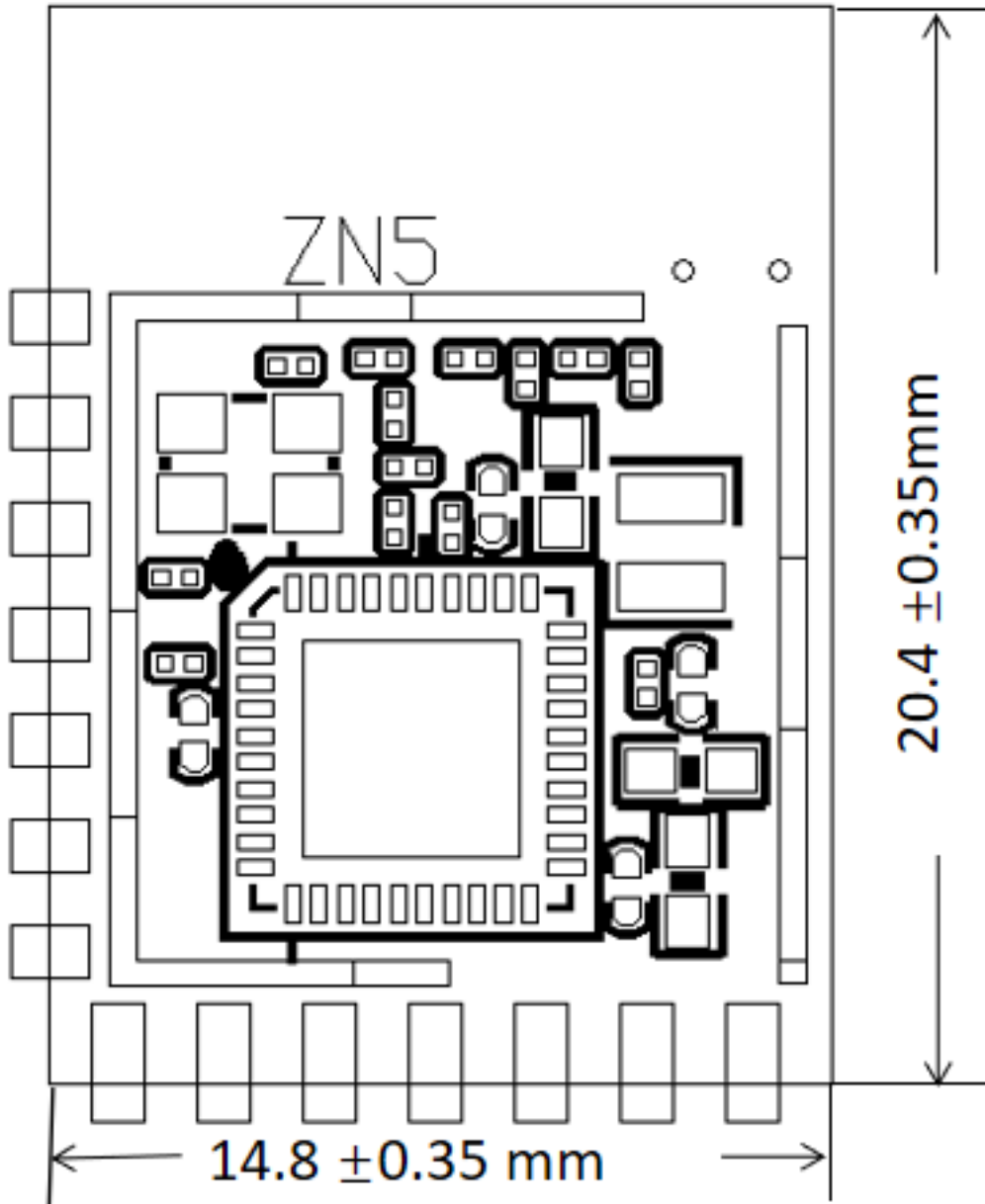


Figure 1: image.png

2.2 Interface Pin Definition

Pin No.	Symbol	I/O Type	Function
1	GND	P	Power supply reference ground pin
2	P7	I/O	Hardware PWM pin, which is connected to PIO7 (pin 10) on the internal IC
3	3V3	P	Power supply pin (3.3 V)
4	P15	I/O	SCL pin, which is connected to PIO15 (pin 18) on the internal IC
5	P16	I/O	SDA pin, which is connected to PIO16 (pin 19) on the internal IC
6	P4	I/O	Hardware PWM pin, which is connected to PIO4 (pin 7) on the internal IC
7	P3	I/O	Hardware PWM pin, which is connected to PIO3 (pin 6) on the internal IC
8	P5	I/O	ISP pin, which is connected to PIO5 (pin 8) on the internal IC
9	P6	I/O	Hardware PWM pin, which is connected to PIO6 (pin 9) on the internal IC
10	RX	I/O	UART0_RXD pin, which is connected to PIO9 (pin 12) on the internal IC
11	RST	I/O	Hardware reset pin, which is active at a low level and has been connected to a pull-up resistor
12	3V3	P	Power supply pin (3.3 V)
13	TX	I/O	UART0_TXD pin, which is connected to PIO8 (pin 11) on the internal IC
14	GND	P	Power supply reference ground pin

Note: **P** indicates a power supply pin, and **I/O** indicates an input/output pin.

2.3 Test Pin Definition

Pin No.	Symbol	I/O Type	Function
N/A	TEST	I/O	Used for the module product test.

Note: Test pins are not recommended.

3 Electrical Parameters

3.1 Absolute Electrical Parameters

Parameter	Description	Minimum Value	Maximum Value	Unit
T _s	Storage temperature	-40	125	°C
V _{BAT}	Power supply voltage	1.9	3.6	V
Static electricity voltage (human body model)	T _{amb} = 25°C	N/A	2	kV
Static electricity voltage (machine model)	T _{amb} = 25°C	N/A	0.5	kV

3.2 Working Conditions

Parameter	Description	Minimum Value	Typical Value	Maximum Value	Unit
T _a	Working temperature	-20	N/A	85	°C
V _{BAT}	Power supply voltage	2.3	3.3	3.6	V
V _{IL}	I/O low-level input	-0.3	N/A	VCC x 0.25	V
V _{IH}	I/O high-level input	VCC x 0.75	N/A	VCC	V
V _{OL}	I/O low-level output	N/A	N/A	VCC x 0.1	V
V _{OH}	I/O high-level output	VCC x 0.8	N/A	VCC	V

Parameter Description		Minimum Value	Typical Value	Maximum Value	Unit
I_{max}	I/O drive current	N/A	N/A	12	mA

3.3 Current Consumption

Working Status	Mode	Rate	TX Power/RX	Average Value	Maximum Value (Typical Value)	Unit
TX	OQPSI	250 kbit/s	+10 dBm	6	38	mA
TX	OQPSK	250 kbit/s	0 dBm	18	34	mA
RX	OQPSI	250 kbit/s	-99 dBm	4	38	mA

3.4 Working Current

Working Mode	Working Status (Ta = 25°C)	Average Value	Maximum Value (Typical Value)	Unit
EZ	The module is in EZ mode.	3	34	mA
Connected	The module is connected to the network.	1	6	mA

4 RF Features

4.1 Basic RF Features

Parameter	Description
Working frequency	2.400 GHz to 2.483 GHz
Physical layer standard	IEEE 802.15.4
Data transmission rate	250 kbit/s
Antenna type	Onboard PCB antenna with a gain of 1 dBi
Line-of-sight transmission distance	> 120 m

4.2 TX Performance

Continuous TX performance

Parameter	Minimum Value	Typical Value	Maximum Value	Unit
Maximum output power	N/A	+10	N/A	dBm
Minimum output power	N/A	-36	N/A	dBm
Output power adjustment step	N/A	0.5	1	dBm
Frequency error	-15	N/A	+15	ppm

4.3 RX Performance

RX sensitivity

Parameter	Minimum Value	Typical Value	Maximum Value	Unit
PER < 10%, 250 kbit/s, OQPSK	N/A	-99	N/A	dBm

5 Antenna Information

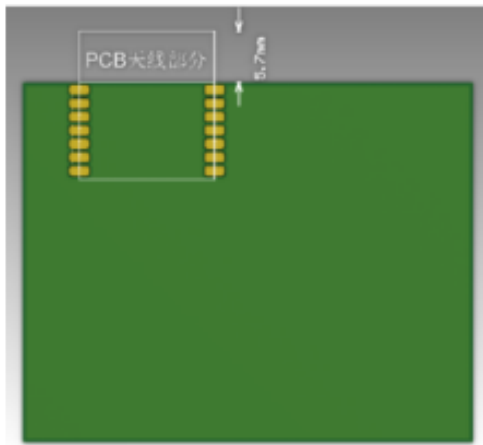
5.1 Antenna Type

By default, ZN5 uses an onboard PCB antenna.

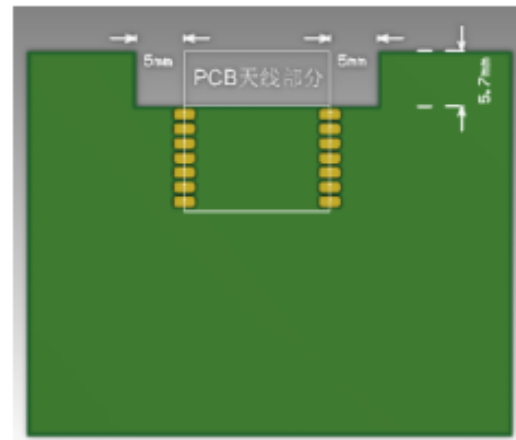
5.2 Antenna Interference Reduction

To ensure optimal RF performance, it is recommended that the antenna be at least 15 mm away from other metal parts.

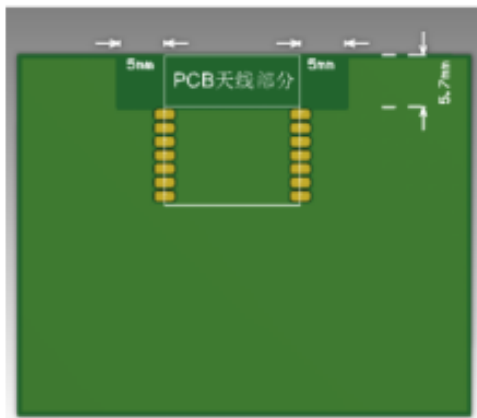
- Solutions 1 and 2 are recommended, where the antenna is placed outside the PCB frame and there is no or little RF attenuation.
- If the PCB antenna must be placed on the base plate due to design restrictions, solution 3 is recommended. The antenna is placed on the PCB along the edge without copper or wires nearby. The RF performance may be attenuated by 1 dBm to 2 dBm.
- Solution 4 is not recommended. If the antenna is placed on the PCB with copper or wires below, RF signals will be attenuated significantly.



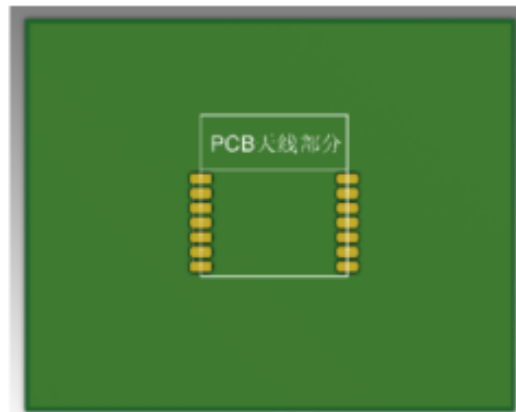
方案 1: 天线在板框外



方案 2: 天线沿板边放置, 且下方挖空



方案 3: 天线沿板边放置, 且下方均不覆铜



方案 4: 天线板框内, 且下方未净空

Figure 2: image.png

6 Packaging Information and Production Instructions

6.1 Mechanical Dimensions

The PCB dimensions (H x W x D) are 0.8 ± 0.1 mm x 20.4 ± 0.35 mm x 14.8 ± 0.35 mm.

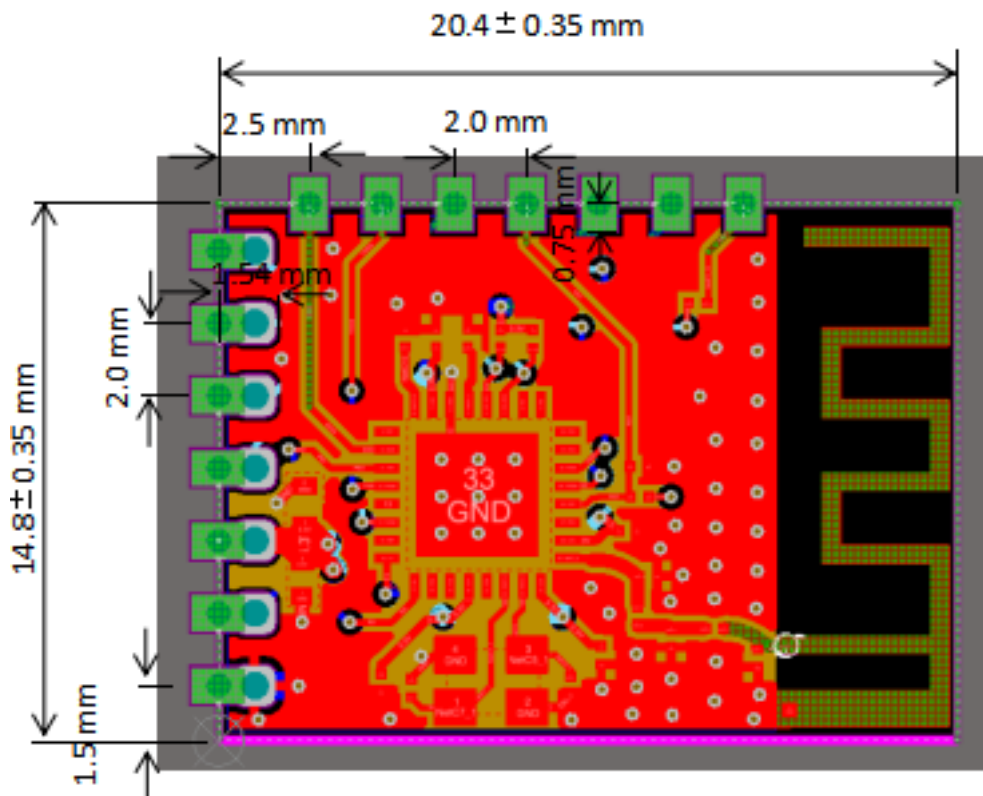


Figure 3: image.png

6.2 Side View

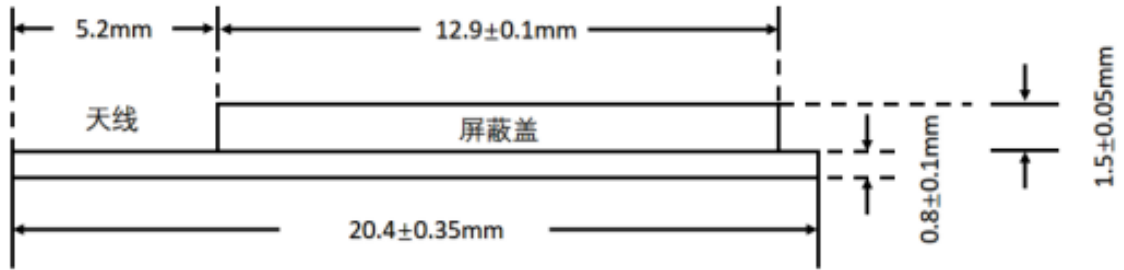


Figure 4: image.png

6.3 Pin Connections

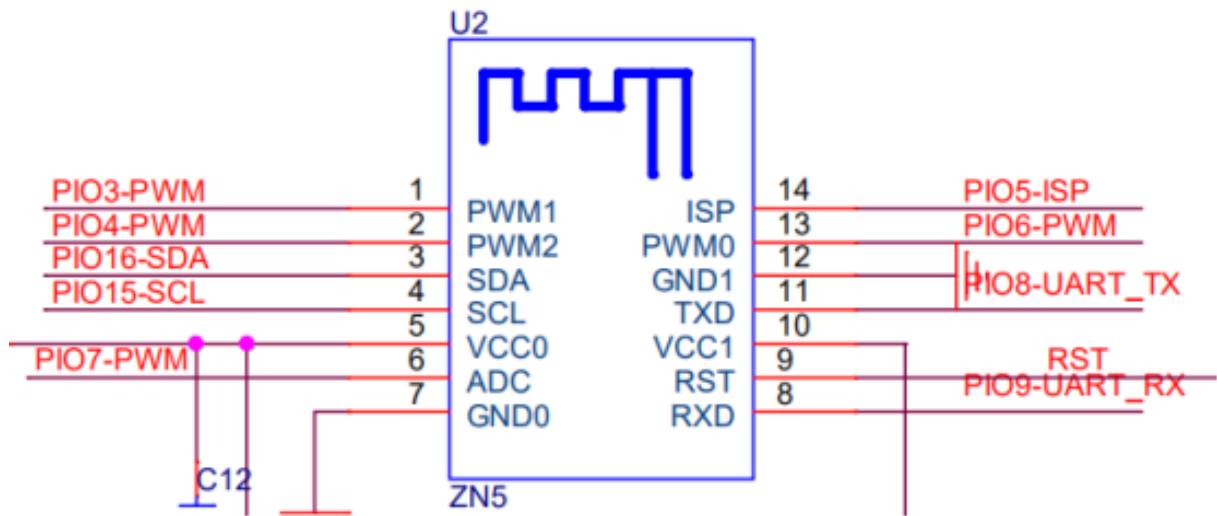


Figure 5: image.png

6.4 Layout of the PCB to Which ZN5 Applies

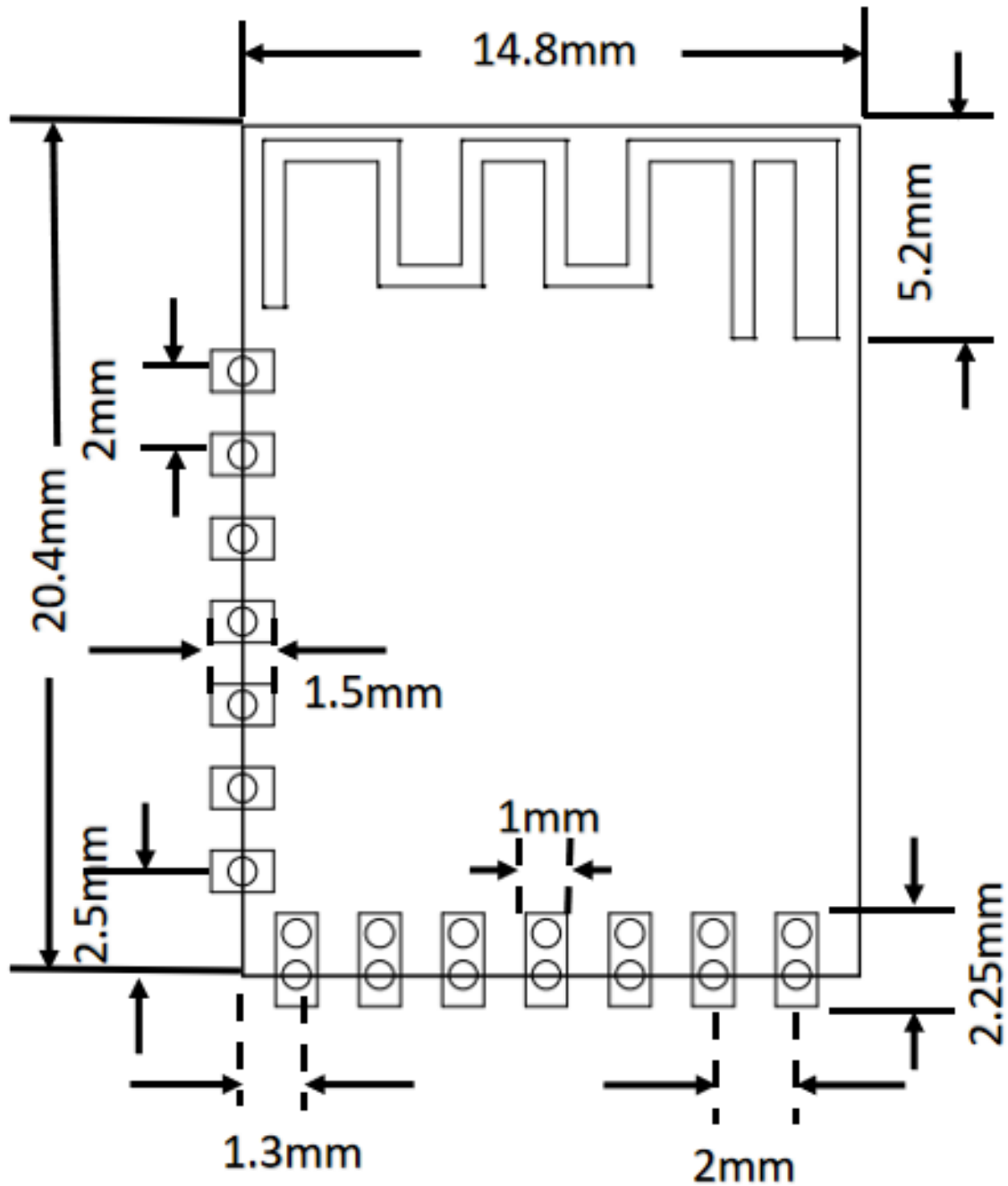


Figure 6: image.png

6.5 Production Instructions

1. Use an SMT placement machine to mount the stamp hole module that Tuya produces onto the PCB within 24 hours after the module is unpacked and the firmware is burned. If not, vacuum pack the module again. Bake the module before mounting it onto the PCB.

- (1) SMT placement equipment

- i. Reflow soldering machine
- ii. Automated optical inspection (AOI) equipment
- iii. Nozzle with a 6 mm to 8 mm diameter

- (2) Baking equipment

- i. Cabinet oven
- ii. Anti-static heat-resistant trays
- iii. Anti-static heat-resistant gloves

2. Storage conditions for a delivered module are as follows:

- (1) The moisture-proof bag is placed in an environment where the temperature is below 30°C and the relative humidity is lower than 70%.
- (2) The shelf life of a dry-packaged product is six months from the date when the product is packaged and sealed.
- (3) The package contains a humidity indicator card (HIC).

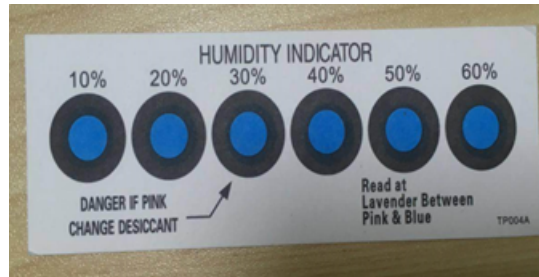


Figure 7: Figure 10

3. Bake a module based on HIC status as follows when you unpack the module package:
 - (1) If the 30%, 40%, and 50% circles are blue, bake the module for 2 consecutive hours.
 - (2) If the 30% circle is pink, bake the module for 4 consecutive hours.
 - (3) If the 30% and 40% circles are pink, bake the module for 6 consecutive hours.
 - (4) If the 30%, 40%, and 50% circles are pink, bake the module for 12 consecutive hours.
4. Baking settings:
 - (1) Baking temperature: $125 \pm 5^{\circ}\text{C}$
 - (2) Alarm temperature: 130°C
 - (3) SMT placement ready temperature after natural cooling: $< 36^{\circ}\text{C}$
 - (4) Number of drying times: 1
 - (5) Rebaking condition: The module is not soldered within 12 hours after baking.
5. Do not use SMT to process modules that have been unpacked for over three months. Electroless nickel immersion gold (ENIG) is used for the PCBs. If the

solder pads are exposed to the air for over three months, they will be oxidized severely and dry joints or solder skips may occur. Tuya is not liable for such problems and consequences.

6. Before SMT placement, take electrostatic discharge (ESD) protective measures.
7. To reduce the reflow defect rate, draw 10% of the products for visual inspection and AOI before first SMT placement to determine a proper oven temperature and component placement method. Draw 5 to 10 modules every hour from subsequent batches for visual inspection and AOI.

6.6 Recommended Oven Temperature Curve

Perform SMT placement based on the following reflow oven temperature curve. The highest temperature is 245°C.

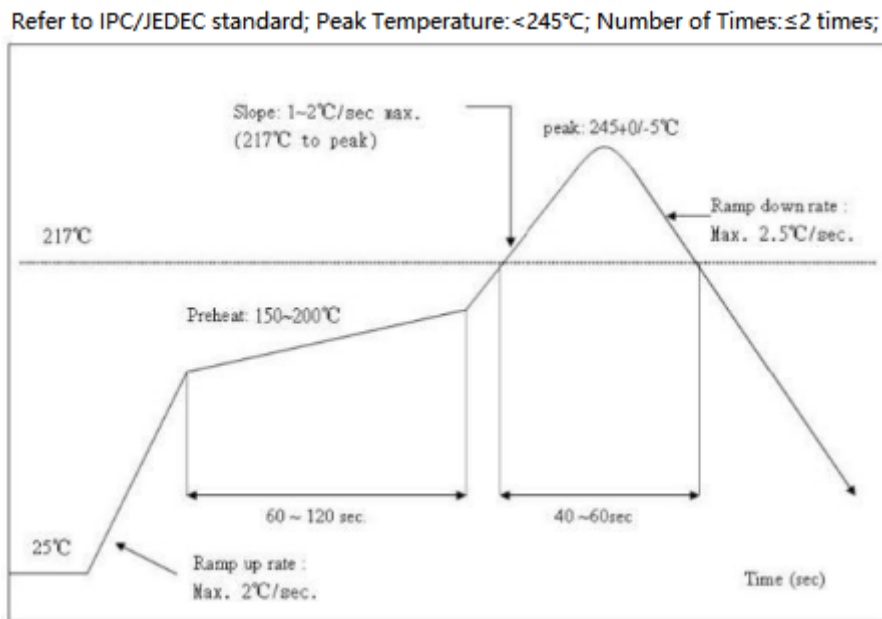


Figure 8: 图片 11

6.7 Storage Conditions



CAUTION
This bag contains
MOISTURE-SENSITIVE DEVICES

LEVEL
3

If Blank, see adjacent bar code label

1. Calculated shelf life in sealed bag: 12 months at < 40°C and < 90% relative humidity (RH)
2. Peak package body temperature: 260 °C
If Blank, see adjacent bar code label
3. After bag is opened, devices that will be subjected to reflow solder or other high temperature process must
 - a) Mounted within: 168 hrs. of factory conditions
If Blank, see adjacent bar code label
≤ 30°C/60%RH, OR
 - b) Stored at <10% RH
4. Devices require bake, before mounting, if:
 - a) Humidity Indicator Card is > 10% when read at 23 ± 5°C
 - b) 3a or 3b not met.
5. If baking is required, devices may be baked for 48 hrs. at 125 ± 5°C

Note: If device containers cannot be subjected to high temperature or shorter bake times are desired, reference IPC/JEDEC J-STD-033 for bake procedure

Bag Seal Date: _____
If Blank, see adjacent bar code label

Note: Level and body temperature defined by IPC/JEDEC J-STD-020

Figure 9: Figure 12

7 MOQ and Packing Information

Product Model	MOQ	Packing Method	Number of Modules in Each Reel Pack	Number of Reel Packs in Each Box
ZN5	4000	Carrier tape and reel packing	1000	4

8 Appendix: Statement

Federal Communications Commission (FCC) Declaration of Conformity

FCC Caution: Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

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.

This device and its antenna(s) must not be co-located or operating in conjunction with any other antenna or transmitter.

15.105 Information to the user.

(b) For a Class B digital device or peripheral, the instructions furnished the user shall include the following or similar statement, placed in a prominent location in the text of the manual:

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.

This equipment should be installed and operated with minimum distance 20 cm between the radiator and your body.

Radiation Exposure Statement

This equipment complies with FCC 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. The availability of some specific channels and/or operational frequency bands is country dependent and firmware programmed at the factory to match the intended destination.

The firmware setting is not accessible by the end user.

The final end product must be labeled in a visible area with the following:

“Contains Transmitter Module 2ANDL-ZN5”

This radio module must not be installed to co-locate and operating simultaneously with other radios in host system, additional testing and equipment authorization may be required to operating simultaneously with other radio.

The availability of some specific channels and/or operational frequency bands are country dependent and are firmware programmed at the factory to match the intended destination. The firmware setting is not accessible by the end user.

The host product manufacturer is responsible for compliance to any other FCC rules that apply to the host not covered by the modular transmitter grant of certification. The final host product still requires Part 15 Subpart B compliance testing with the modular transmitter installed.

The end user manual shall include all required regulatory information/warning as shown in this manual, including: This product must be installed and operated with a minimum distance of 20 cm between the radiator and user body.

This device have got a FCC ID: 2ANDL-ZN5. The final end product must be labeled in a visible area with the following: “Contains Transmitter Module FCC ID:2ANDL-ZN5”

This device is intended only for OEM integrators under the following conditions:

1) The antenna must be installed such that 20cm is maintained between the antenna and users, and

2) The transmitter module may not be co-located with any other transmitter or antenna. As long as 2 conditions above are met, further transmitter test will not be required. However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed.

Declaration of Conformity European Notice



Figure 10: Figure 13

Hereby, Hangzhou Tuya Information Technology Co., Ltd. declares that this module product is in compliance with essential requirements and other relevant provisions of Directive 2014/53/EC. A copy of the Declaration of Conformity can be found at <https://www.tuya.com>.



Figure 11: image.png

This product must not be disposed of as normal household waste, in accordance with EU directive for waste electrical and electronic equipment (WEEE- 2012/19/EU). Instead, it should be disposed of by returning it to the point of sale, or to a municipal recycling collection point.

EN 300 328 V2.1.1

EN 301 489-1 V2.1.1; EN 301 489-17 V3.1.1

EN 62311:2008

EN 60950-1:2006+A11:2009+A1:2010+A12:2011+A2:2013