



# **ZTC Module Datasheet**

Version: 20220620

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ZTC is a Zigbee module that Tuya has developed. It consists of a highly integrated RF processor chip (Z2) and a few peripherals. ZTC is embedded with a low-power 32-bit CPU, 1024-KB flash memory, 64-KB RAM, and rich peripherals.

## 1 Overview

Based on ZTC, customers can develop Zigbee products as required.

### 1.1 Features

- Embedded with low-power 32-bit CPU and ARM Cortex-M33 processor
- The clock rate: 48 MHz
- Wide operating voltage: 1.8 (2.8V or higher is recommended) to 3.6 V
- Peripherals: 5 GPIOs, 1 UART
- Zigbee connectivity
  - Support 802.15.4 MAC/PHY
  - Working channels 11 to 26 @2.400 to 2.483 GHz, air interface rate: 250 Kbps
  - Up to +10dBm output power and dynamic output power > 35 dB
  - Built in with a monopole antenna
  - Monopole antenna with a gain of 2.5 dBi
  - Operating temperature: -40°C to 105°C
  - Support hardware encryption and AES 128

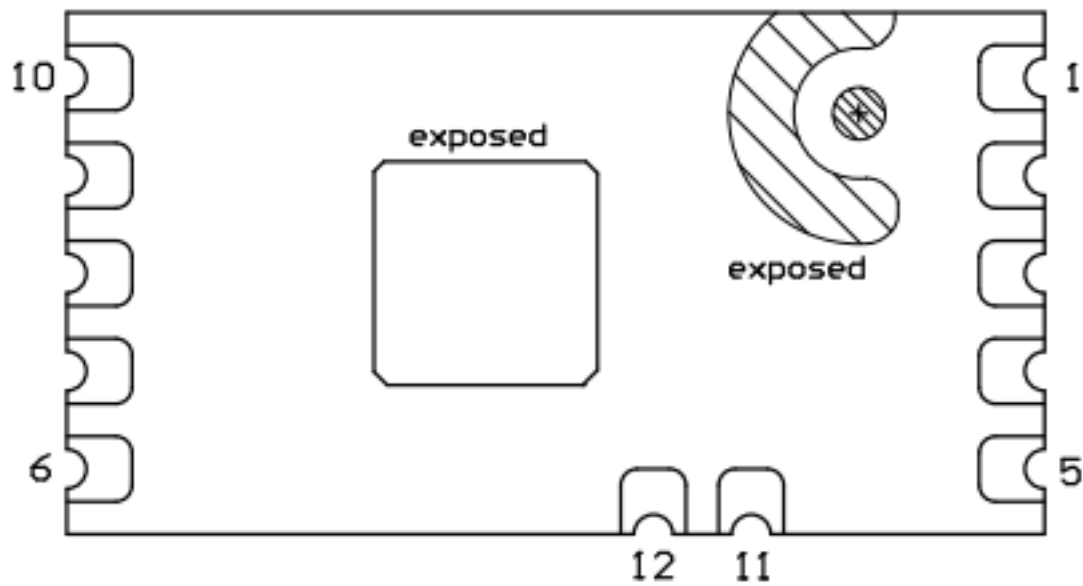
### 1.2 Applications

- Intelligent building
- Smart household and home appliances
- Smart socket and light
- Industrial wireless control
- Baby monitor
- Intelligent bus

### 1.3 Change history

| Date      | Updated content            | Version after update |
|-----------|----------------------------|----------------------|
| 6/16/2022 | This is the first release. | V1.0.0               |





## Bottom View

### 2.2 Pin definition

| Pin number | Symbol | I/O type | Function                                                              |
|------------|--------|----------|-----------------------------------------------------------------------|
| 2          | RXD    | I/O      | Uart_RXD, which corresponds to B7 (Pin 17) on the internal IC         |
| 3          | TXD    | I/O      | Uart_TXD, which corresponds to B1 (Pin 6) of the IC                   |
| 4          | C2     | I/O      | Support hardware PWM and correspond to C2 (Pin 22) on the internal IC |

| Pin number | Symbol | I/O type | Function                                                                |
|------------|--------|----------|-------------------------------------------------------------------------|
| 5          | C3     | I/O      | Support hardware PWM and correspond to C3 (Pin 23) on the internal IC   |
| 6          | D2     | I/O      | Support hardware PWM and correspond to D2 (Pin 31) on the internal IC   |
| 7          | B4     | I/O      | Support hardware PWM and correspond to B4 (Pin 14) on the internal IC   |
| 8          | B5     | I/O      | Support hardware PWM and correspond to B5 (Pin 15) on the internal IC   |
| 9          | GND    | P        | Power supply reference ground                                           |
| 10         | 3V3    | P        | Power supply pin of the module (The typical power supply voltage: 3.3V) |
| 11         | SWS    | I/O      | Burning pin, which corresponds to SWS (Pin 5) on the internal IC        |

| Pin number | Symbol | I/O type | Function                                               |
|------------|--------|----------|--------------------------------------------------------|
| 12         | RST    | I        | Hardware reset pin; by default, high level, low active |

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

### 3 Electrical parameters

#### 3.1 Absolute electrical parameters

| Parameter                      | Description           | Minimum value                       | Maximum value | Unit |
|--------------------------------|-----------------------|-------------------------------------|---------------|------|
| Ta                             | Operating temperature | -40                                 | 105           | °C   |
| V <sub>BAT</sub>               | Power supply voltage  | 1.8 (2.8V or higher is recommended) | 3.6           | V    |
| ESD voltage (human body model) | TAMB-25°C             | -                                   | 2             | KV   |
| ESD voltage (machine model)    | TAMB-25°C             | -                                   | 0.5           | KV   |

#### 3.2 Normal working conditions

| Parameter | Description           | Minimum value                       | Typical value | Maximum value | Unit |
|-----------|-----------------------|-------------------------------------|---------------|---------------|------|
| Ta        | Operating temperature | -40                                 | -             | 105           | °C   |
| VCC       | Operating voltage     | 1.8 (2.8V or higher is recommended) | 3.3           | 3.6           | V    |
| VIL       | I/O low level input   | -                                   | -             | VDD*0.3       | V    |
| VIH       | I/O high level input  | VDD*0.7                             | -             | -             | V    |

| Parameter | Description           | Minimum value | Typical value | Maximum value | Unit |
|-----------|-----------------------|---------------|---------------|---------------|------|
| VOL       | I/O low level output  | -             | -             | VDD*0.2       | V    |
| VOH       | I/O high level output | VDD*0.8       | -             | -             | V    |

### 3.3 TX and RX power consumption

| Working status | Mode | Rate     | Transmit power/receive | Average value | Peak value (Typical value) | Unit |
|----------------|------|----------|------------------------|---------------|----------------------------|------|
| Transmit       | -    | 250 Kbps | +0 dBm                 | 4.8           | 23                         | mA   |
| Transmit       | -    | 250 Kbps | +10 dBm                | 9.15          | 39                         | mA   |
| Receive        | -    | 250 Kbps | Constantly receive     | 7.35          | 7.39                       | mA   |

### 3.4 Operating current

| Working mode                   | Working status, Ta = 25°C                          | Average value | Maximum value (Typical value) | Unit |
|--------------------------------|----------------------------------------------------|---------------|-------------------------------|------|
| Quick connection network state | The module is in the fast network connection state | 9.15          | 9.49                          | mA   |
| Connected                      | The module is connected to the network             | 9             | 9.2                           | mA   |

| Working mode    | Working status, Ta = 25°C           | Average value | Maximum value (Typical value) | Unit |
|-----------------|-------------------------------------|---------------|-------------------------------|------|
| Deep sleep mode | Deep sleep mode, reserve 32-KB SRAM | 2.8           | -                             | uA   |

## 4 RF parameters

### 4.1 Basic RF features

| Parameter              | Description                             |
|------------------------|-----------------------------------------|
| Working frequency      | 2.405 to 2.480 GHz                      |
| Zigbee standard        | IEEE 802.15.4                           |
| Data transmission rate | 250 Kbps                                |
| Antenna type           | monopole antenna with a gain of 2.5 dBi |

### 4.2 TX performance

TX performance

| Parameter                                    | Minimum value | Typical value | Maximum value | Unit |
|----------------------------------------------|---------------|---------------|---------------|------|
| Maximum output power (250Kbps)               | -             | 10            | -             | dBm  |
| Minimum output power (250Kbps)               | -             | -25           | -             | dBm  |
| Output power adjustment stepping             | -             | 0.5           | 1             | dBm  |
| Output spectrum adjacent channel suppression | -             | -31           | -             | dBc  |
| Frequency error                              | -10           | -             | 10            | ppm  |

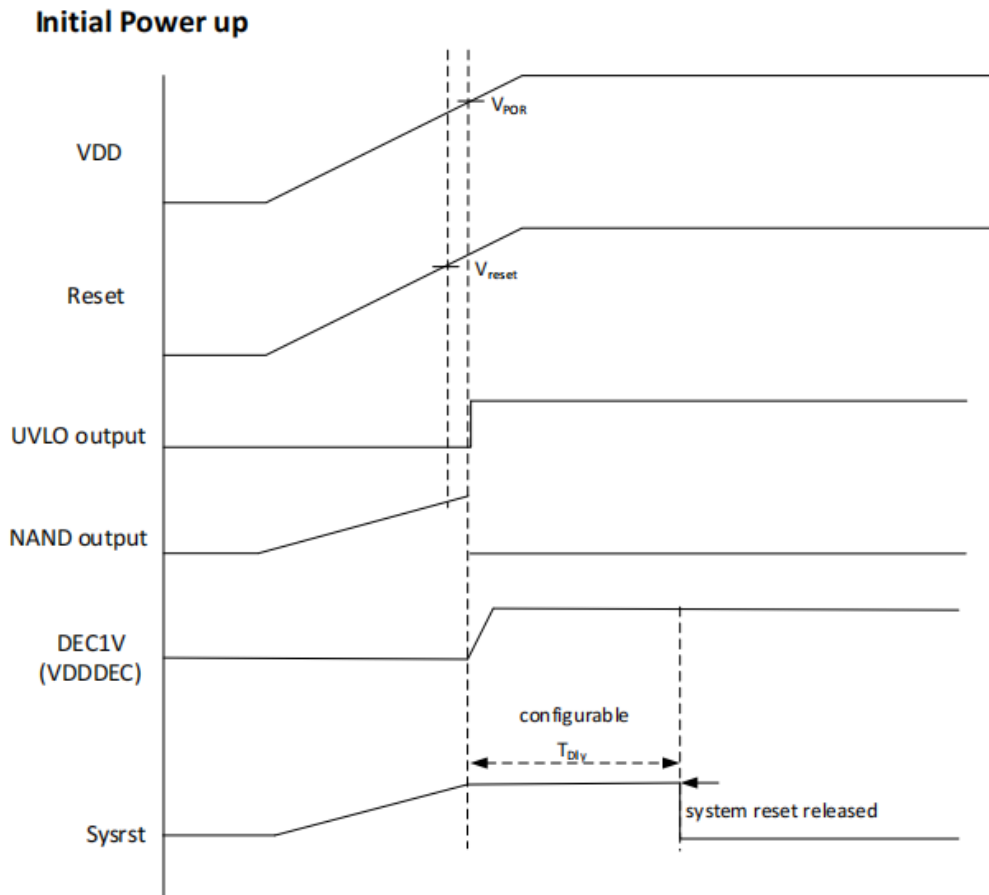
### 4.3 RX performance

#### RX sensitivity

| Parameter                         | Minimum value | Typical value | Maximum value | Unit |
|-----------------------------------|---------------|---------------|---------------|------|
| PER<8%, RX sensitivity (250 Kbps) | -102          | -101          | -99           | dBm  |

## 5 Requirements on power-on sequence

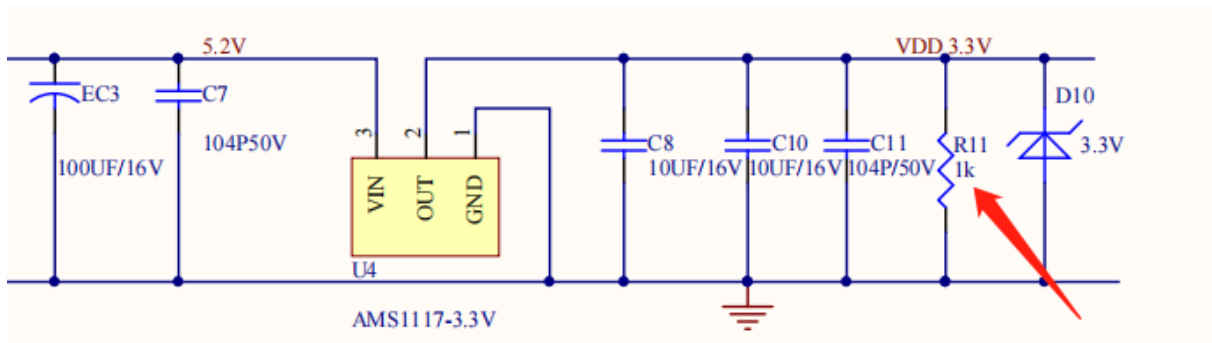
Figure 2-4 Initial Power-up sequence



| Symbol                               | Parameter                                       | Min.  | Typ. | Max. | Unit |
|--------------------------------------|-------------------------------------------------|-------|------|------|------|
| $V_{POR}$                            | VDD voltage when $V_{UVLO}$ turns to high level |       | 1.62 |      | V    |
| $V_{Pdn}$                            | VDD voltage when $V_{UVLO}$ turns to low level  |       | 1.55 |      | V    |
| Supply rise time (from 1.6V to 1.8V) |                                                 | $t_r$ |      | 10   | ms   |

The Z2 chip has requirements on the power-on sequence. During the power-on process, the system starts when the RST pin reaches 1.62V. At this time, the VCC needs to reach more than 1.8V within 10ms. Because the RST pin has the RC link, the VCC of the bare module is much more than 1.8V when the RST reaches 1.62V. In some cases that the large capacitance in the power driver connected to the Z2 chip module charges or discharges, if the module voltage is not fully discharged

below 0.6V, the module will probably crash when it is restarted. It is required that the power supply pin VCC\_3.3V of the module needs to be connected with a dummy load of 1K to release power quickly. You can refer to the following figure which shows parts of power-driven links.



## 6 Antenna information

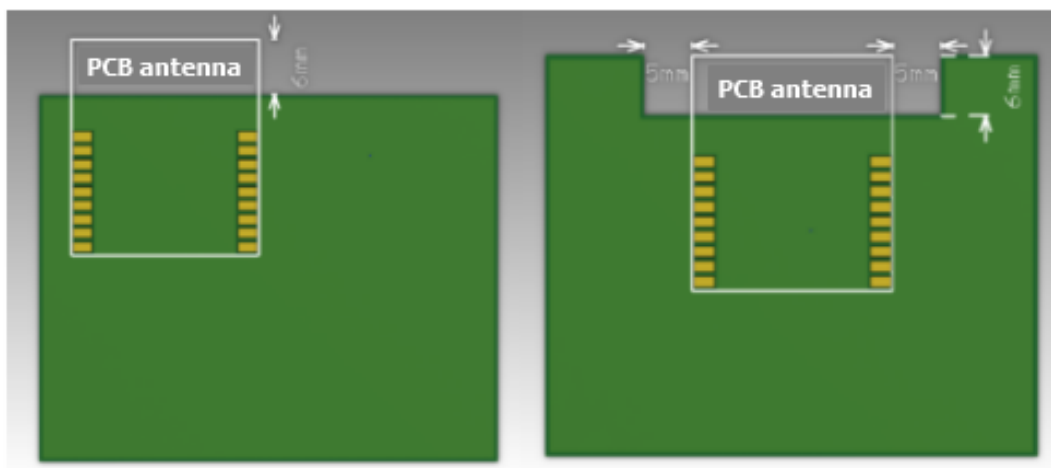
### 6.1 Antenna type

ZTC only uses the monopole antenna.

### 6.2 Antenna interference reduction

To ensure the optimal Zigbee performance when the Zigbee module uses an onboard PCB antenna, it is recommended that the antenna be at least 15 mm away from other metal parts.

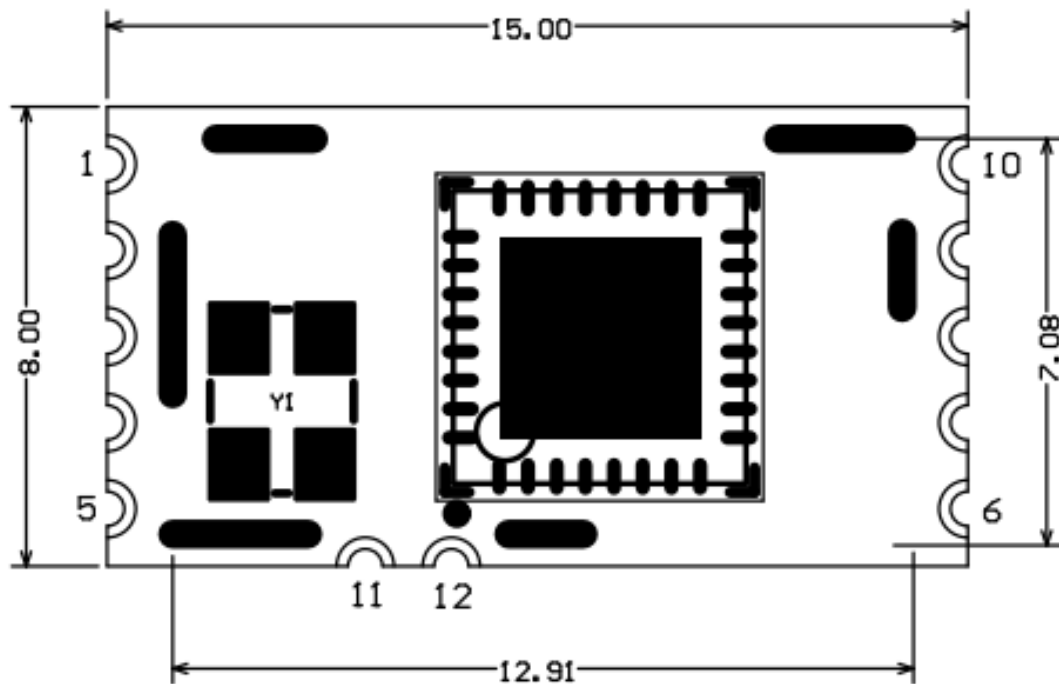
To prevent an adverse impact on the antenna radiation performance, avoid copper or traces along the antenna area on the PCB.



## 7 Packaging information and production instructions

### 7.1 Mechanical dimensions

The PCB dimensions are  $15 \pm 0.35$  mm (L)  $\times$   $8 \pm 0.35$  mm (W)  $\times$   $0.8 \pm 0.1$  mm (H).



Top View

## 7.2 Side view



Unit: mm

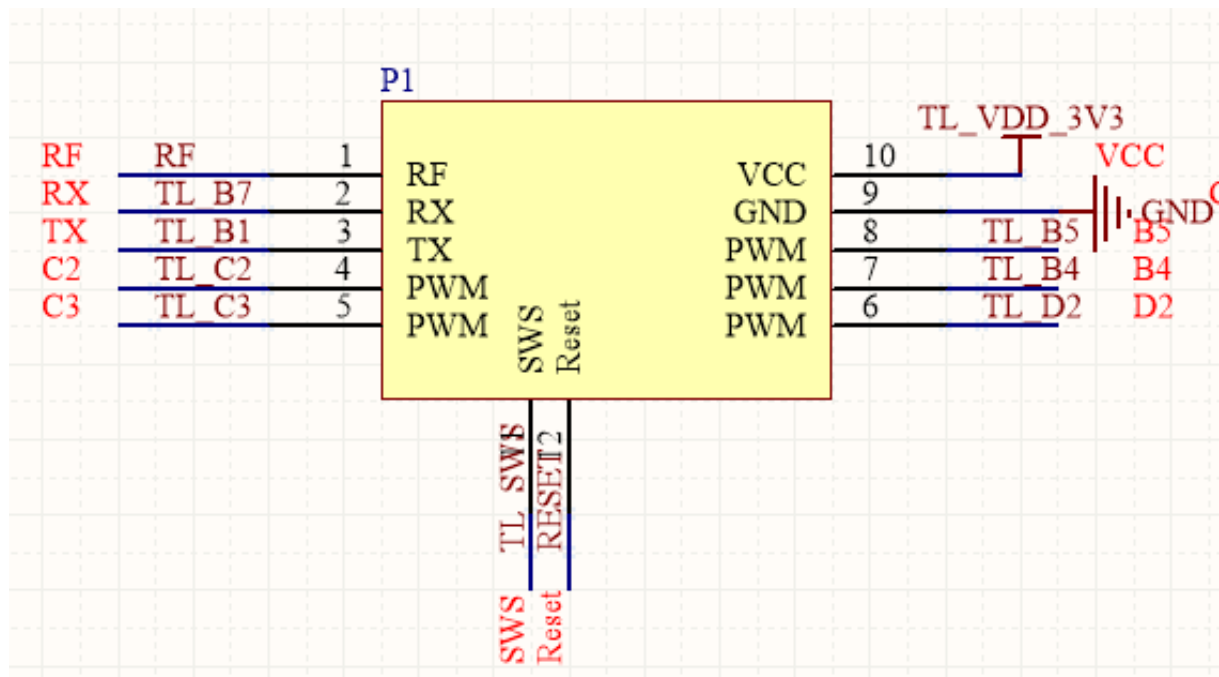
Module form factor tolerance:  $\pm 0.35\text{mm}$

PCB thickness tolerance:  $\pm 0.1\text{mm}$

Shield cover height tolerance:  $\pm 0.05\text{mm}$

Side View

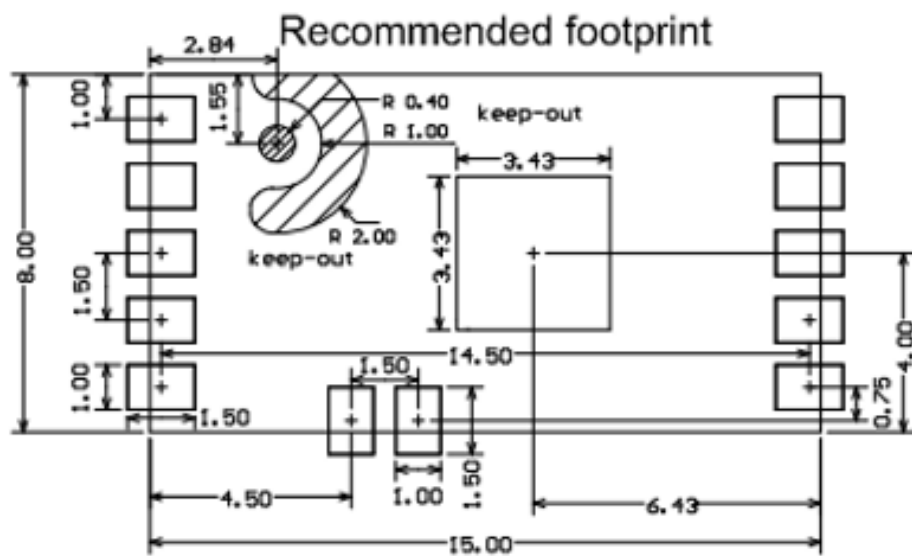
## 7.3 The schematic diagram of footprint



## 7.4 The diagram of PCB footprint

ZTC can choose SMT placement.

### 7.4.1 PCB footprint diagram-SMT



## 7.5 Production instructions

1. The Tuya SMT module should be mounted by the SMT device. After being unpacked, it should be soldered within 24 hours. Otherwise, it should be put into the drying cupboard where the RH is not greater than 10%; or it needs to be packaged under vacuum again and the exposure time needs to be recorded (the total exposure time cannot exceed 168 hours).

- SMT devices:
  - Mounter
  - SPI

- Reflow soldering machine
- Thermal profiler
- Automated optical inspection (AOI) equipment
- Baking devices:
  - Cabinet oven
  - Anti-electrostatic and heat-resistant trays
  - Anti-electrostatic and heat-resistant gloves

## 2. Storage conditions for a delivered module:

- The moisture-proof bag must be placed in an environment where the temperature is below 40°C and the relative humidity is lower than 90%.
- The shelf life of a dry-packaged product is 12 months from the date when the product is packaged and sealed.
- There is a humidity indicator card (HIC) in the packaging bag.

```
1 ! [HIC-SMT module.png] (https://airtake-public-data-1254153901.cos.ap
2 -shanghai.myqcloud.com/goat/20210410/48793a0e11ea40d4839db36535e47bf
3 5.png)
```

## 3. The module needs to be baked in the following cases:

- The packaging bag is damaged before unpacking.
- There is no HIC in the packaging bag.
- After unpacking, circles of 10% and above on the HIC become pink.
- The total exposure time has lasted for over 168 hours since unpacking.
- More than 12 months has passed since the sealing of the bag.

## 4. Baking settings:

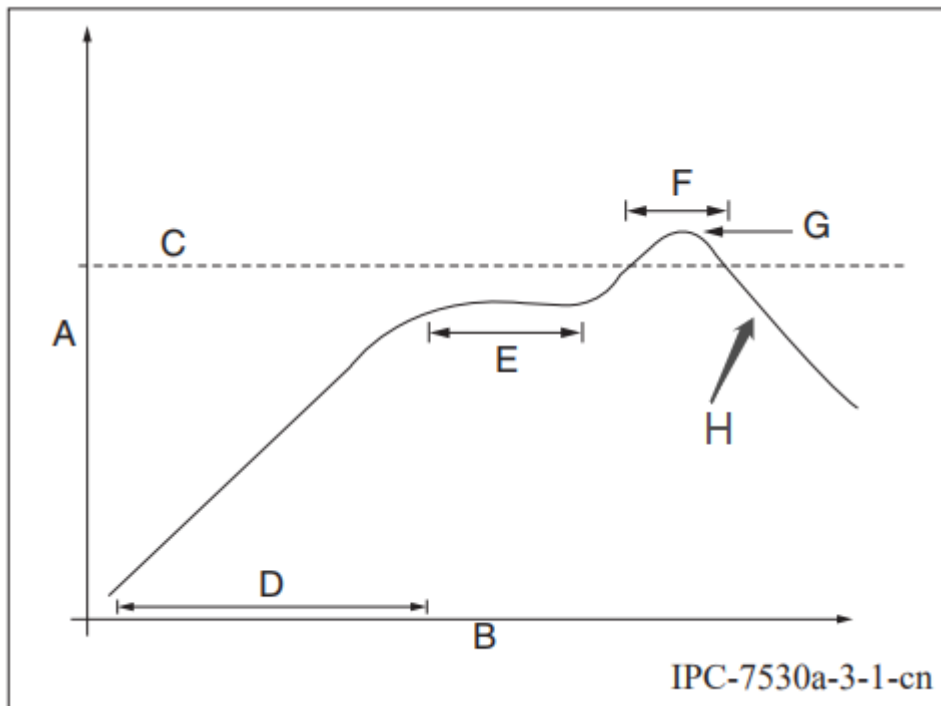
- Temperature: 60°C and  $\leq 5\%$  RH for reel package and 125°C and  $\leq 5\%$  RH for tray package (please use a heat-resistant tray rather than a plastic container)
- Time: 48 hours for reel package and 12 hours for tray package
- Alarm temperature: 65°C for reel package and 135°C for tray package
- Production-ready temperature after natural cooling:  $< 36^\circ\text{C}$
- Re-baking situation: If a module remains unused for over 168 hours after being baked, it needs to be baked again.
- If a batch of modules is not baked within 168 hours, do not use the reflow soldering to solder them. Because these modules are Level-3 moisture-sensitive devices, they are very likely to get damp when exposed beyond

the allowable time. In this case, if they are soldered at high temperatures, it may result in device failure or poor soldering.

5. In the whole production process, take electrostatic discharge (ESD) protective measures.
6. To guarantee the passing rate, it is recommended that you use the SPI and AOI to monitor the quality of solder paste printing and mounting.

## 7.6 Recommended oven temperature curve

Set oven temperatures according to the following temperature curve of reflow soldering. The peak temperature is 245°C.



- A: Temperature axis
- B: Time axis
- C: Liquidus temperature: 217 to 220°C
- D: Ramp-up slope: 1 to 3°C/s
- E: Duration of constant temperature: 60 to 120s; the range of constant temperature: 150 to 200°C
- F: Duration above the liquidus: 50 to 70s

- G: Peak temperature: 235 to 245°C
- H: Ramp-down slope: 1 to 4°C/s

**Note:** The above curve is just an example of the solder paste SAC305. For more details about other solder pastes, please refer to Recommended oven temperature curve in the solder paste specifications.

## 7.7 Storage conditions

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                          |                                                                                                                                                                    |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <b>Caution</b><br>This bag contains<br><b>MOISTURE-SENSITIVE DEVICES</b> | <div style="border: 1px solid black; padding: 5px; display: inline-block;"><b>LEVEL</b><br/><b>3</b></div><br><small>If blank, see adjacent bar code label</small> |
| <ol style="list-style-type: none"><li>1. Calculated shelf life in sealed bag: 12 months at <math>&lt;40^{\circ}\text{C}</math> and <math>&lt;90\%</math> relative humidity (RH)</li><li>2. Peak package body temperature: <u>260</u> <math>^{\circ}\text{C}</math><br/><small>If blank, see adjacent bar code label</small></li><li>3. After bag is opened, devices that will be subjected to reflow solder or other high temperature process must be<ol style="list-style-type: none"><li>a) Mounted within: <u>168</u> hours of factory conditions<br/><small>If blank, see adjacent bar code label</small><br/><math>\leq 30^{\circ}\text{C}/60\%</math> RH, or</li><li>b) Stored per J-STD-033</li></ol></li><li>4. Devices require bake, before mounting, if:<ol style="list-style-type: none"><li>a) Humidity Indicator Card reads <math>&gt;10\%</math> for level 2a - 5a devices or <math>&gt;60\%</math> for level 2 devices when read at <math>23 \pm 5^{\circ}\text{C}</math></li><li>b) 3a or 3b are not met</li></ol></li><li>5. If baking is required, refer to IPC/JEDEC J-STD-033 for bake procedure</li></ol> |                                                                          |                                                                                                                                                                    |
| <b>See Production Date</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                          |                                                                                                                                                                    |
| Bag Seal Date: _____<br><small>If blank, see adjacent bar code label</small>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                          |                                                                                                                                                                    |
| <b>Note: Level and body temperature defined by IPC/JEDEC J-STD-020</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                          |                                                                                                                                                                    |

## 8 MOQ and packaging information

| Product model | MOQ (pcs) | Shipping packaging method | The number of modules per reel | The number of reels per carton |
|---------------|-----------|---------------------------|--------------------------------|--------------------------------|
| ZTC           | 3600      | Tape reel                 | 900                            | 4                              |

## 9 Appendix: Statement

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

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.

**Note:** This device has been tested and found to comply with the limits for a Class B digital device, according to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This device generates, uses, and can radiate radio frequency energy and, if not installed and used following 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 device does cause harmful interference to radio or television reception, which can be determined by turning the device 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 device and receiver.
- Connect the device to 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.

### Radiation Exposure Statement

This device complies with FCC radiation exposure limits set forth for an uncontrolled rolled environment. This device should be installed and operated with a minimum distance of 20cm between the radiator and your body.

### Important Note

This radio module must not be installed to co-locate and operate simultaneously with other radios in the host system except following FCC multi-transmitter product procedures. Additional testing and device authorization may be required to operate simultaneously with other radios.

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 with 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/warnings 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 has got an FCC ID: 2ANDL-ZTC. The end product must be labeled in a visible area with the following: “Contains Transmitter Module FCC ID: 2ANDL-ZTC” .

This device is intended only for OEM integrators under the following conditions: 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 the 2 conditions above are met, further transmitter tests 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**



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/EU, 2011/65/EU. A copy of the Declaration of conformity can be found at <https://www.tuya.com>.



This product must not be disposed of as normal household waste, in accordance with

the 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.

The device could be used with a separation distance of 20cm to the human body.