



ZTLC5 Module Datasheet

Version: 20210602

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ZTLC5 is a low-power embedded Zigbee module that Tuya has developed. It consists of a highly integrated RF processing chip (Z2), a few peripherals, a built-in 802.15.4 PHY/MAC Zigbee network protocol stack, and rich library functions. ZTLC5 is embedded with a low-power 32-bit CPU, 1-MB flash program memory, 64-KB RAM, and abundant peripheral resources.

1 Overview

ZTLC5 is a FreeRTOS platform that integrates all function libraries of the Zigbee MAC and TCP/IP protocols. You can develop embedded Zigbee products as required.

1.1 Features

- Embedded with low-power 32-bit CPU processor
- The clock rate: 48 MHz
- Wide working voltage: 1.8 to 3.6 V
- Peripherals: 3 general-purpose input/output (GPIO), 1 universal asynchronous receiver/transmitter (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
 - The terminal equipment connects to the network actively.
 - Monopole antenna with a gain of 1.8 dBi
 - Working 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
- Network camera
- Intelligent bus

1.3 Change history

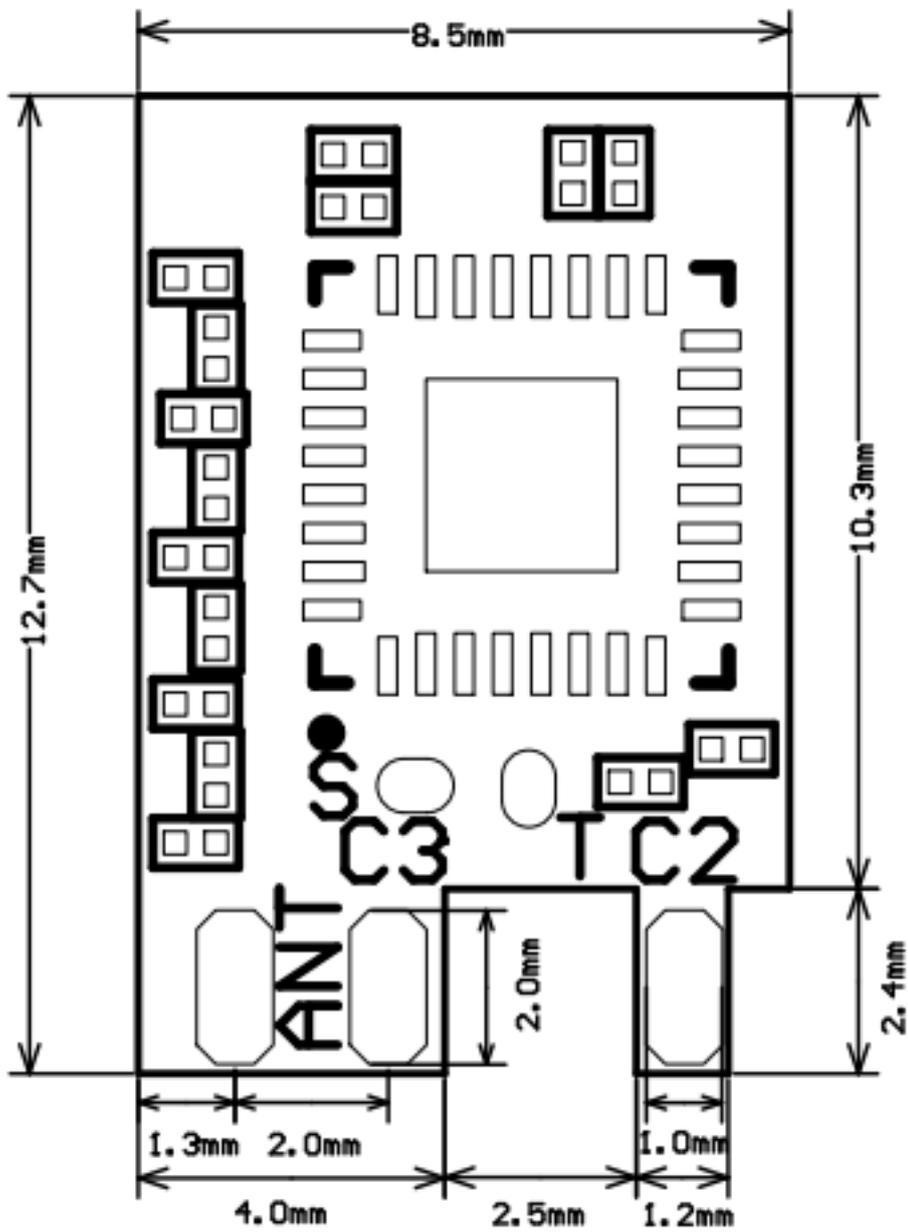
Date	Updated content	Version after update
01/07/2021	This is the first release.	V1.0.0

2 Module interfaces

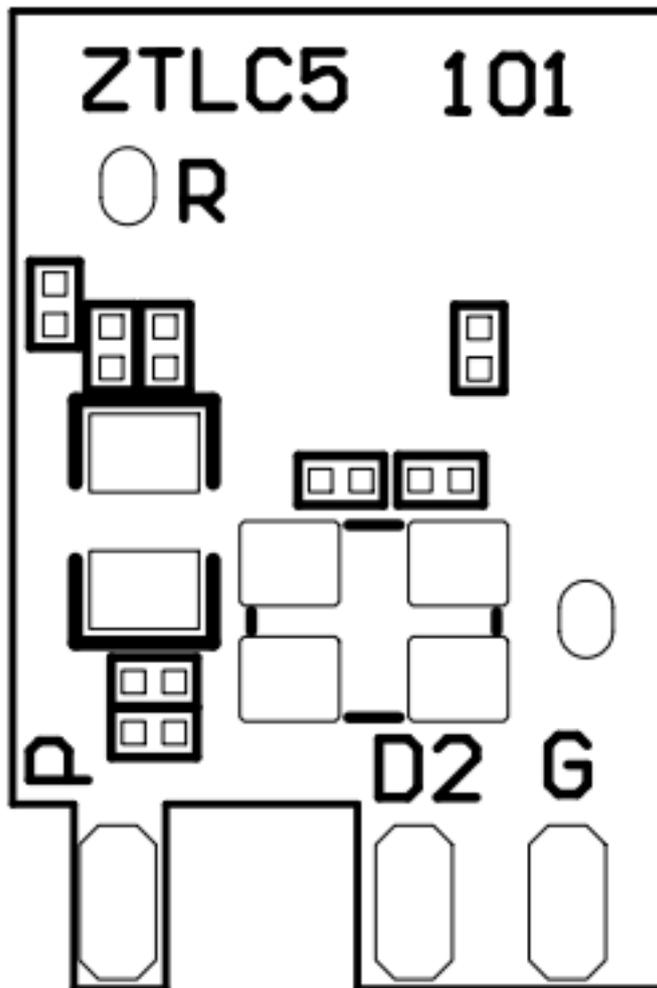
2.1 Dimensions and package

ZTLC5 has six pins on the front and back for plug-in assembly. The ZTLC5 dimensions are 8.50 ± 0.35 mm (W) \times 12.7 ± 0.35 mm (L) \times 3.2 ± 0.15 mm (H).

The dimensions of ZTLC5 are as follows:



2.2 Pin definition



Pin number	Symbol	I/O type	Function
1	ANT	I/O	Antenna pin, external monopole antenna
2	GND	P	Power supply reference ground

Pin number	Symbol	I/O type	Function
3	C3	I/O	Support hardware PWM and correspond to C3 (Pin 23) on the internal IC
4	D2	I/O	Support hardware PWM and correspond to D2 (Pin 31) on the internal IC
5	C2	I/O	Support hardware PWM and correspond to C2 (Pin 22) on the internal IC
6	3V3	P	Power supply pin of the module (The typical power supply voltage: 3.3V)
R	RXD	I/O	Uart_RXD, which corresponds to B7 (Pin 17) on the internal IC
T	TXD	I/O	Uart_TXD, which corresponds to B1 (Pin 6) of the IC
S	SWS	I/O	Burning pin, which corresponds to SWS (Pin 5) on the internal IC

Note: P indicates a power supply pin and I/O indicates an input/output pin. R, T, S are the test points

3 Electrical parameters

3.1 Absolute electrical parameters

Parameter	Description	Minimum value	Maximum value	Unit
Ta	Working temperature	-40	105	°C
VBAT	Power supply voltage	1.8	3.6	V
Static electricity discharge voltage (human body model)	TAMB-25°C	-	2	KV
Static electricity discharge voltage (machine model)	TAMB-25°C	-	0.5	KV

3.2 Normal working conditions

Parameter	Description	Minimum Value	Typical Value	Maximum Value	Unit
Ta	Working temperature	-40	-	105	°C
VCC	Working voltage	1.8	3.3	3.6	V

Parameter	Description	Minimum Value	Typical Value	Maximum Value	Unit
VIL	I/O low level input	-	-	VDD*0.3	V
VIH	I/O high level input	VDD*0.7	-	-	V
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	3.85	3.89	mA
Transmit	-	250 Kbps	+10 dBm	8.66	8.78	mA
Receive	-	250 Kbps	Constantly receive	6.54	6.58	mA

3.4 Working 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	8.23	8.67	mA
Network connection state	The module is connected to the network	8.13	9.64	mA
Deep sleep mode	Deep sleep mode, reserve 32-KB SRAM	1.4	-	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 1.8 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	-15	-	15	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 Antenna information

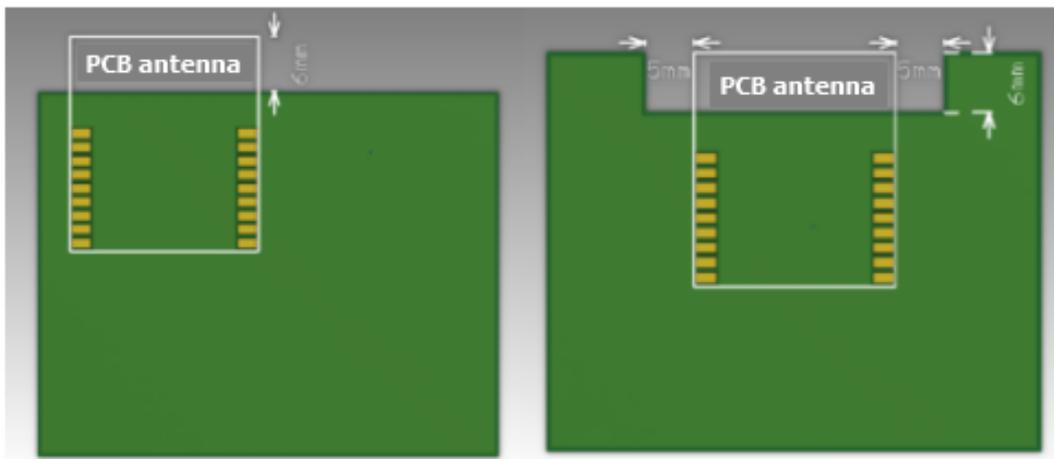
5.1 Antenna type

ZTLC5 uses a monopole antenna.

5.2 Antenna interference reduction

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

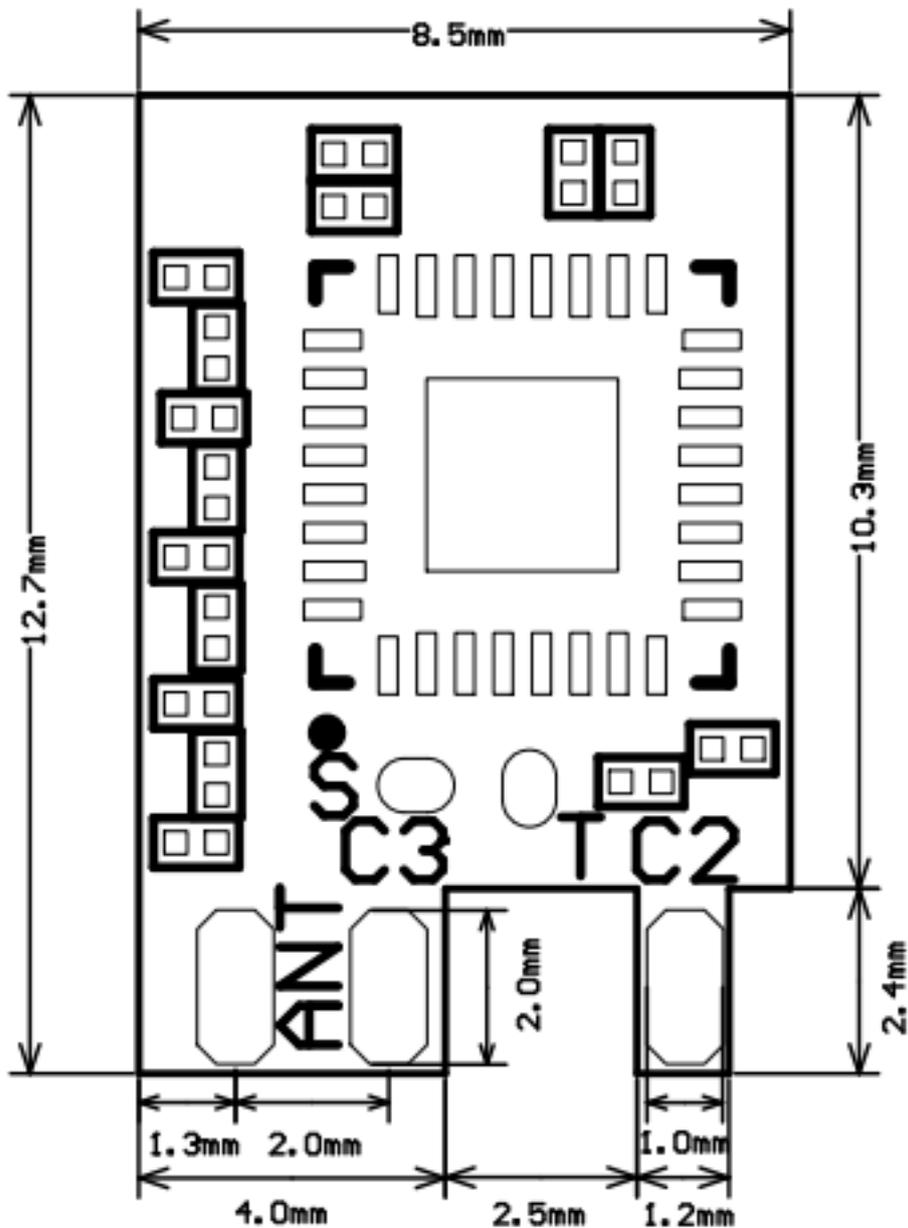
To prevent an adverse impact on the antenna radiation performance, avoid copper or traces along the antenna area on the PCB.



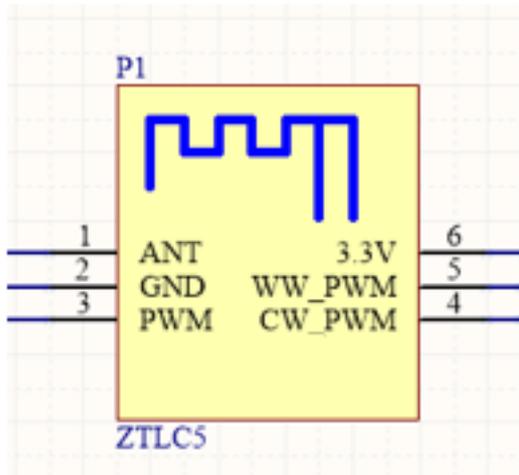
6 Packaging information and production instructions

6.1 Mechanical dimensions

The PCB dimensions are 12.7 ± 0.35 mm (L) \times 8.5 ± 0.35 mm (W) \times 3.2 ± 0.15 mm (H).

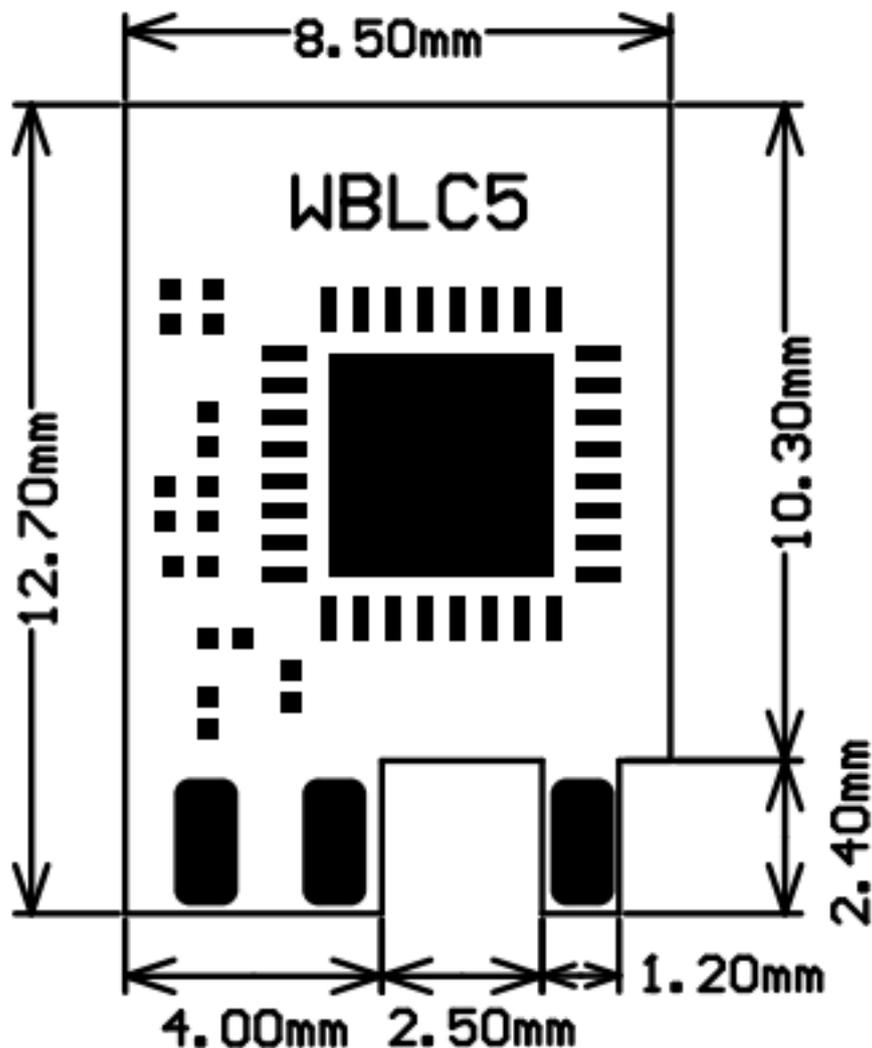


6.2 The schematic diagram of a packaging



6.3 Recommended PCB Encapsulation-Pin header

ZTLC5 module is inserted and welded.



6.4 Production instructions

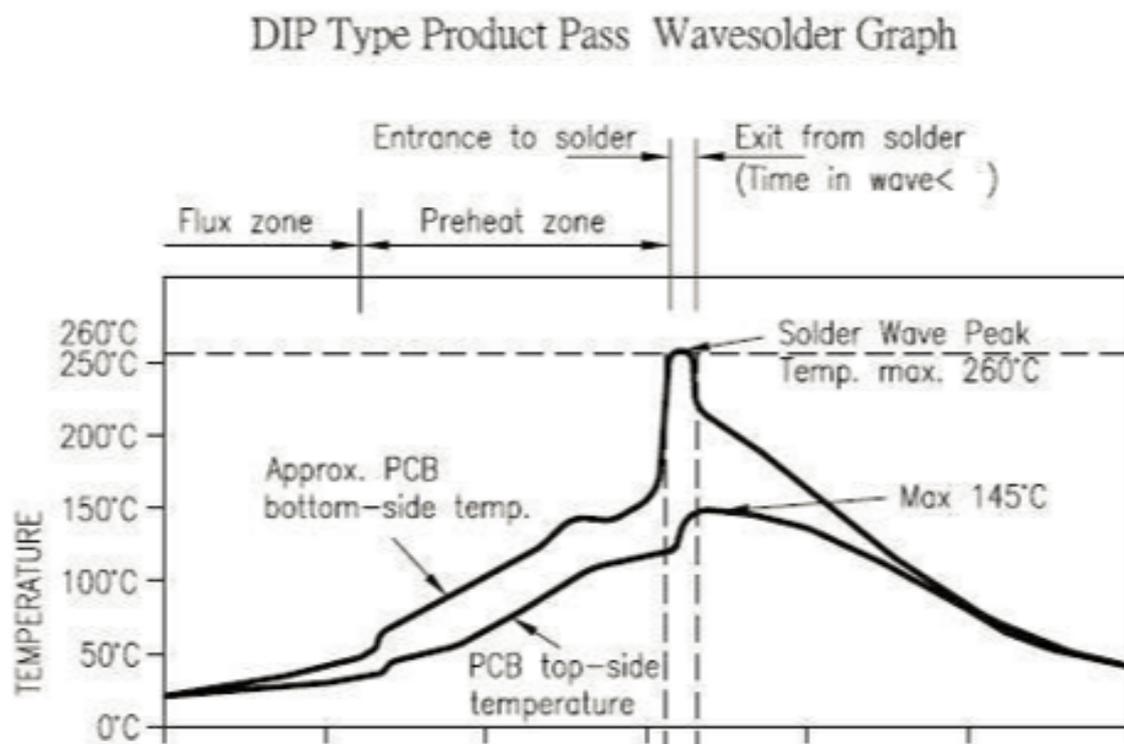
- For the in-line module developed by Tuya, the wave soldering equipment is most preferred and manual soldering is less preferred. After being unpacked, the module must be soldered within 24 hours. Otherwise, it must be put into the drying cupboard where the RH is not greater than 10%, or it needs to be packaged under vacuum again and record the exposure time (the total exposure time cannot exceed 168 hours).
- Soldering equipment and materials:
 - Wave soldering equipment
 - Wave soldering fixture

- Constant-temperature soldering iron
 - Tin bar, tin wire, and flux
 - Oven temperature tester
 - Baking equipment:
 - Cabinet oven
 - Anti-static heat-resistant pallets
 - Anti-static heat-resistant gloves
 - The module needs to be baked in the following cases:
 - The vacuum packing bag was found to be damaged before being unpacked.
 - There is no humidity indicator card (HIC) in the vacuum packing bag.
 - After being unpacked, 10% and above circles on the HIC become pink.
 - The total exposure time has been more than 168 hours since unpacking.
 - More than 12 months have passed since the sealing date of the bag.
 - Baking settings:
 - Temperature: 60°C and $\leq 5\%RH$ for reelizing and 125°C and $\leq 5\%RH$ for palletizing (please use heat-resistant pallet rather than plastic pallet)
 - Time: 48 hours for reelizing and 12 hours for palletizing
 - Alarm temperature: 65°C for reelizing and 135°C for palletizing
 - Production ready temperature after natural cooling: $< 36^\circ C$
 - The number of drying times: 1
 - Re-baking requirement: If a module remains unused for 168 hours after being unpacked, it must be baked again.
- Important:** If this batch of modules is not baked within 168 hours, do not use the wave soldering to solder them. Because the modules are 3-level moisture-sensitive components, they are very likely to get damp when exposed outside. In this case, if they are soldered at high temperatures, it may result in component failure or poor soldering.
- In the whole production process, take electrostatic discharge (ESD) protective measures.
 - To guarantee the quality of products, you must pay attention to the following items:

- The amount of soldering flux.
- The height of the wave peak.
- Whether the tin slag and copper content in the wave soldering tank exceed standards.
- Whether the window and thickness of the wave soldering fixture are appropriate.
- Whether the wave soldering oven temperature curve is reasonable.

6.5 Recommended oven temperature curve and temperature

For oven temperature setting, refer to oven temperatures for wave soldering. The peak temperature is $260^{\circ}\text{C} \pm 5^{\circ}\text{C}$. The wave soldering temperature curve is shown below:



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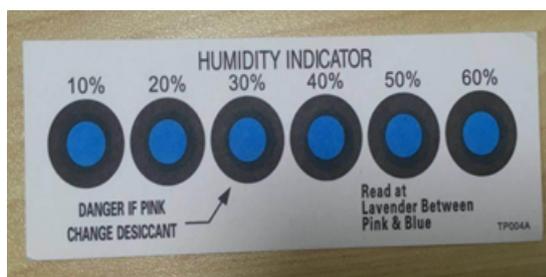
Recommended soldering temperature:

Recommended wave soldering oven temperature		Recommended manual soldering temperature	
Preheat temperature	80 to 130 °C	Soldering temperature	360±20°C
Preheat time	75 to 100s	Soldering time	< 3s/point
Peak contact time	3 to 5s	NA	NA
Temperature of tin cylinder	260±5°C	NA	NA
Ramp-up slope	≤2°C/s	NA	NA
Ramp-down slope	≤6°C/s	NA	NA

6.6 Storage conditions

Storage conditions for a delivered module are as follows:

- The moisture-proof bag is 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.
- The package contains a humidity indicator card (HIC).





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

7 MOQ and packaging information

Product number	MOQ (pcs)	Shipping packaging method	The number of modules per reel	The number of reels per carton
ZTLC5	4000	Tape reel	1000	4

8 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 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.

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 operating 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-ZTLC5. The end product must be labeled in a visible area with the following: “Contains Transmitter Module FCC ID: 2ANDL-ZTLC5”.

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 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.