



ZT2S Module Datasheet

Version: 20210911

Contents

1	Product overview	2
1.1	Features	2
1.2	Applications	2
1.3	Change history	2
2	Module interfaces	4
2.1	Pin distribution	4
2.2	Pin definition	5
3	Electrical parameters	9
3.1	Absolute electrical parameters	9
3.2	Normal working conditions	9
3.3	TX and RX power consumption	10
3.4	Operating current	10
4	RF parameters	12
4.1	Basic RF features	12
4.2	TX performance	12
4.3	RX performance	13
5	Module power-on timing requirements	14
6	Antenna information	16
6.1	Antenna type	16
6.2	Antenna interference reduction	16
7	Packaging information and production instructions	18
7.1	Mechanical dimensions	18
7.2	Recommended footprint	21
7.3	Production instructions	21
7.4	Recommended oven temperature curve and temperature	22
7.5	Storage conditions	24
8	MOQ and packaging information	26
9	Appendix: Statement	27



ZT2S is a Zigbee module that Tuya has developed. It consists of a highly integrated wireless RF chip (Z2) and some peripherals. ZT2S also contains a low-power 32-bit CPU, 1024-KB flash memory, 64-KB RAM, and rich peripherals.

1 Product overview

Based on ZT2S, you can develop Zigbee products as required.

1.1 Features

- Embedded with a low-power 32-bit CPU
- Clock rate: 48 MHz
- Wide operating voltage: 1.8 to 3.6V
- Peripherals: 5 GPIOs, 1 UART, and 1 ADC
- Zigbee connectivity
 - Support 802.15.4 MAC/PHY
 - Operating 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
 - Onboard PCB antenna
 - Onboard PCB antenna with a gain of 2 dBi
 - Operating temperature: -40°C to 85°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

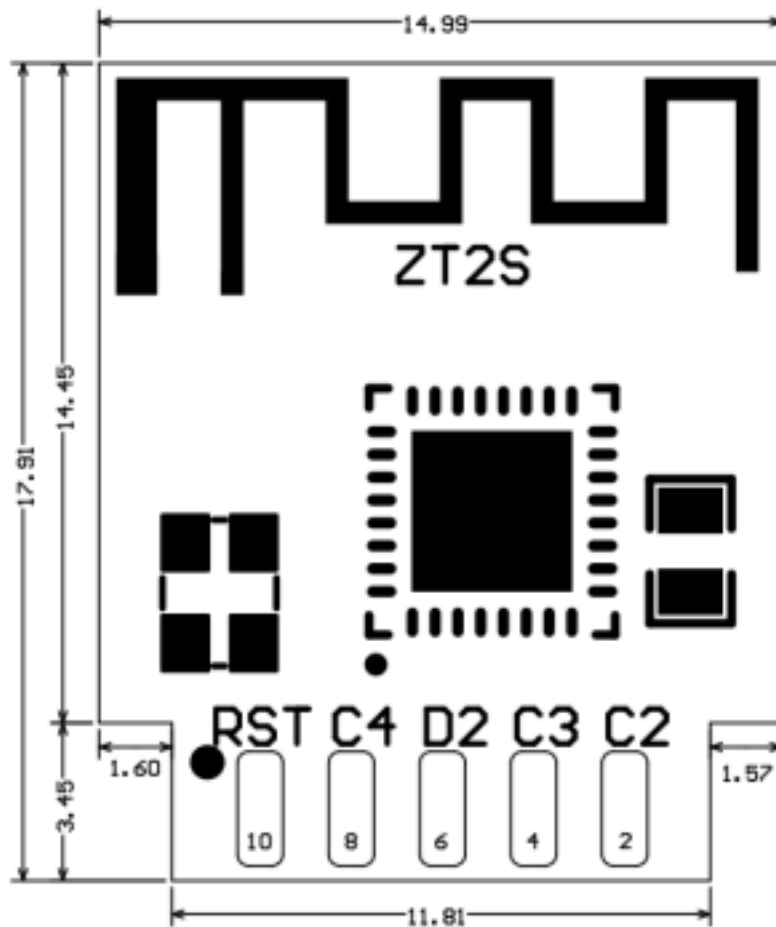
1.3 Change history

Update date	Updated content	Version after update
July 15th, 2021	This is the first release.	V1.0.0

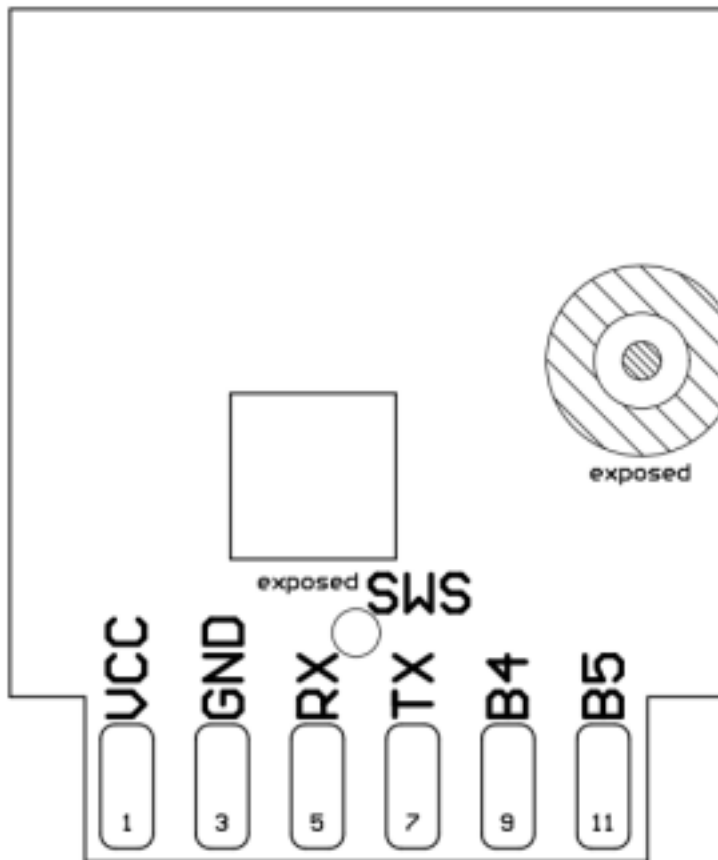
2 Module interfaces

2.1 Pin distribution

ZT2S has 2 lines of pins, 11 pins in total, with a spacing of 2 mm. The dimensions of ZT2S are: 14.99 ± 0.35 mm (W) \times 17.90 ± 0.35 mm (L) \times 2.80 ± 0.15 mm (H) The thickness of the PCB is 0.8 ± 0.1 mm.



Top View



Bottom View

2.2 Pin definition

Pin number	Symbol	Type	Function
1	VCC	P	Power supply pin (Typical value: 3.3V)

Pin number	Symbol	Type	Function
2	C2	I/O	Common I/O interface, which can be used as PWM output of the LED drive and corresponds to TL_C2 of the IC (Pin 22)
3	GND	P	Power supply reference ground
4	C3	I/O	Common I/O interface, which can be used as PWM output of the LED drive and corresponds to TL_C3 (Pin 23)
5	RX	I/O	Uart_RXD, which corresponds to B7 (Pin 17) on the internal IC
6	D2	I/O	Common I/O interface, which can be used as PWM output of the LED drive and corresponds to TL_D2 of the IC (Pin 31)
7	TX	I/O	Uart_TXD, which corresponds to B1 (Pin 6) on the internal IC

Pin number	Symbol	Type	Function
8	C4	I/O	ADC pin, which corresponds to TL_C4 (Pin 24) on the internal IC
9	B4	I/O	Common I/O interface, which can be used as PWM output of the LED drive and corresponds to TL_B4 of the IC (Pin 14)
10	RST	I	Reset pin (low active), correspond to RESETB (Pin 25) on the internal IC
11	B5	I/O	Common I/O interface, which can be used as PWM output of the LED drive and corresponds to TL_B5 of the IC (Pin15)
12	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.
- If you have any special requirements on the light colour controlled by the

| PWM output, please contact the Tuya business personnel.

3 Electrical parameters

3.1 Absolute electrical parameters

Parameter	Description	Minimum value	Maximum value	Unit
Ts	Operating temperature	-5	150	°C
VCC	Supply voltage	-0.3	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	-	85	°C
VCC	Operating voltage	1.9	3.3	3.6	V
VIL	Voltage input low	-	-	VDD*0.3	V
VIH	Voltage input high	VDD*0.7	-	-	V
VOL	Voltage output low	-	-	VDD*0.2	V

Parameter	Description	Minimum value	Typical value	Maximum value	Unit
VOH	Voltage output high	VDD*0.8	-	-	V

3.3 TX and RX power consumption

Operating status	Mode	Rate	Transmit power/receive	Average value	Peak value (Typical value)	Unit
Transmit	-	250 Kbps	+0 dBm	4.7	22.91	mA
Transmit	-	250 Kbps	+10 dBm	9.25	38.78	mA
Receive	-	250 Kbps	Constantly receive	7.35	7.61	mA

3.4 Operating current

Operating mode	Operating status, Ta = 25°C	Average value	Maximum value (Typical value)	Unit
Fast pairing	The module is in the fast network pairing state	9.15	9.49	mA
Connected	The module is connected to the network and in running state.	8.95	9.15	mA

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

4 RF parameters

4.1 Basic RF features

Parameter	Description
Operating frequency	2.405 to 2.480 GHz
Zigbee standard	IEEE 802.15.4
Data transmission rate	250 Kbps
Antenna type	PCB antenna with a gain of 2 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	1	dBm
Output power adjustment stepping	-	0.5	1	dBm
Output spectrum adjacent channel suppression	-	-31	-	dBc
Frequency error	-10	-	10	ppm

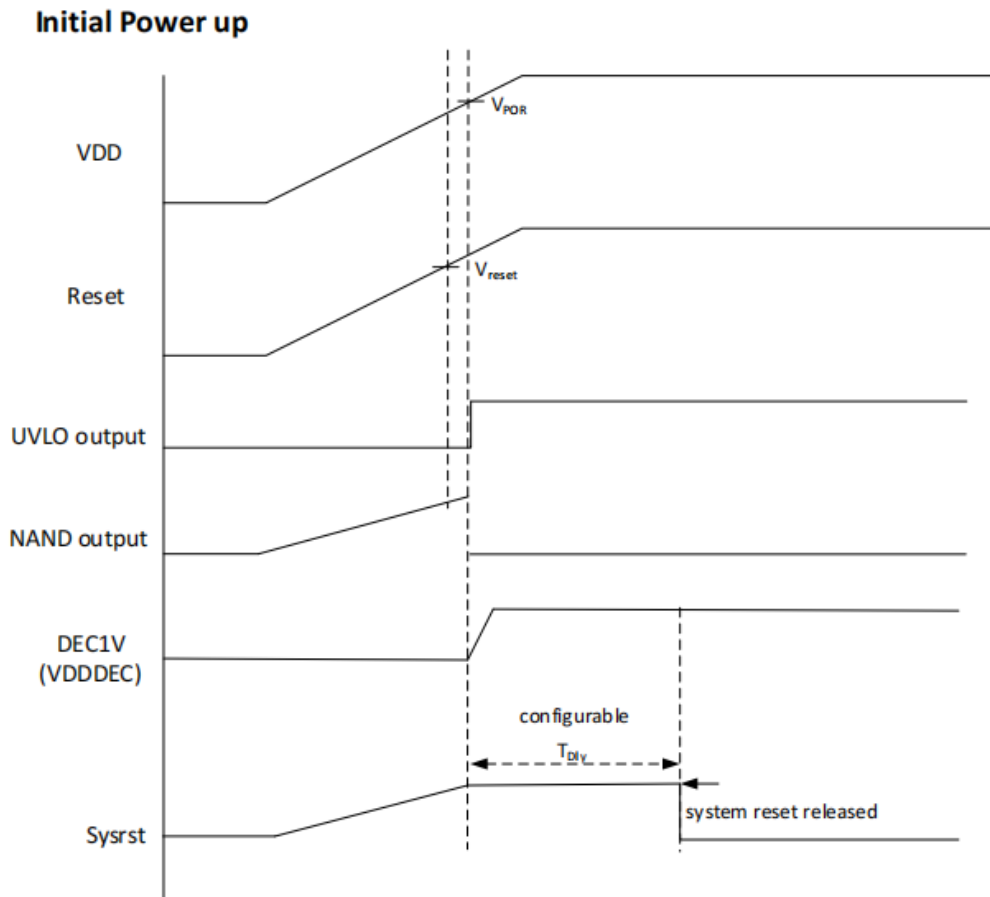
4.3 RX performance

RX sensitivity

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

5 Module power-on timing requirements

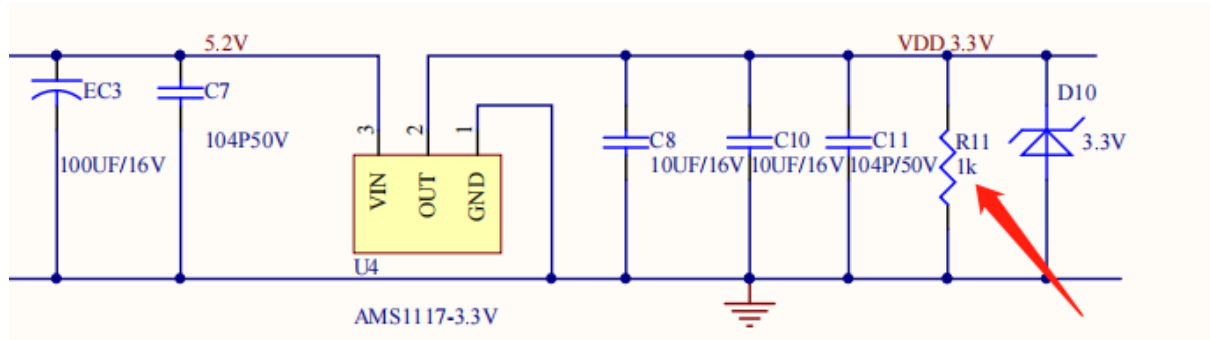
Figure 2-4 Initial Power-up sequence



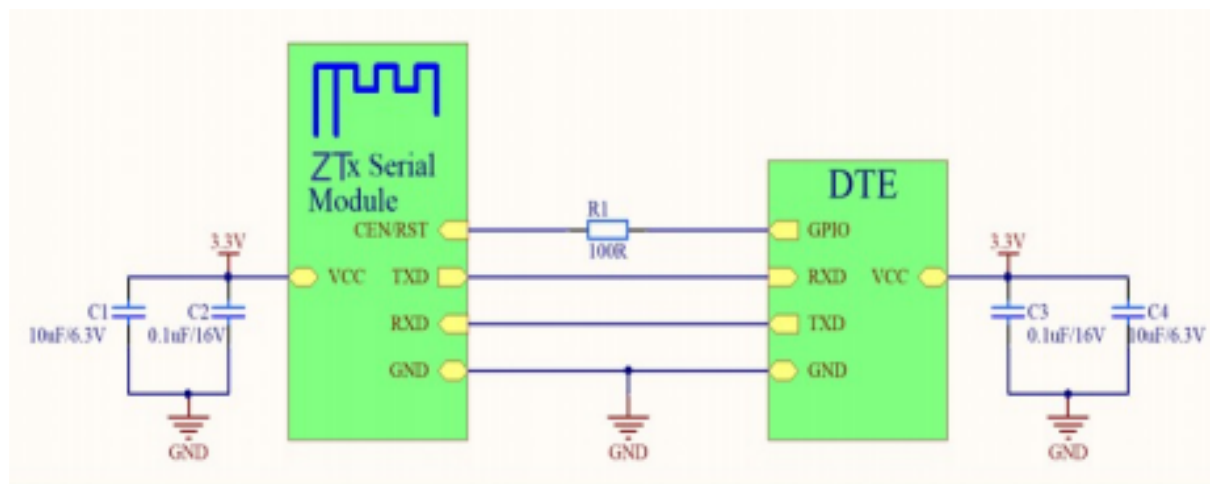
Symbol	Parameter	Min.	Typ.	Max.	Unit
V_{POR}	VDD voltage when V_{UVLO} turns to high level		1.62		V
V_{Pdn}	VDD voltage when V_{UVLO} turns to low level		1.55		V
Supply rise time (from 1.6V to 1.8V)	t_r		10	ms	

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.



As the voltage backflow occurs when interfaces of the module are connected to others, you can pull down the CEN or RST pin, to reduce the power consumption when the module doesn't work.



As shown above, the MCU controls the CEN or RST pin through the GPIO interface, so as to power on or off the module. When there're data to report, the GPIO interface outputs the high level, the module is powered on, the serial communication is established, and the MCU synchronizes the data to the Cloud and client end. After reporting the data, the GPIO interface outputs the low level, the module is in reset state, and the module consumes little power. Disadvantages: There is a 10-K pull-up resistor in the CEN or RST pin. When the module is in reset state, there is still an input current of 330uA.

6 Antenna information

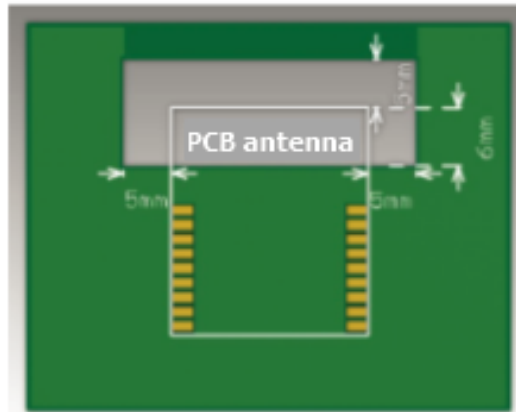
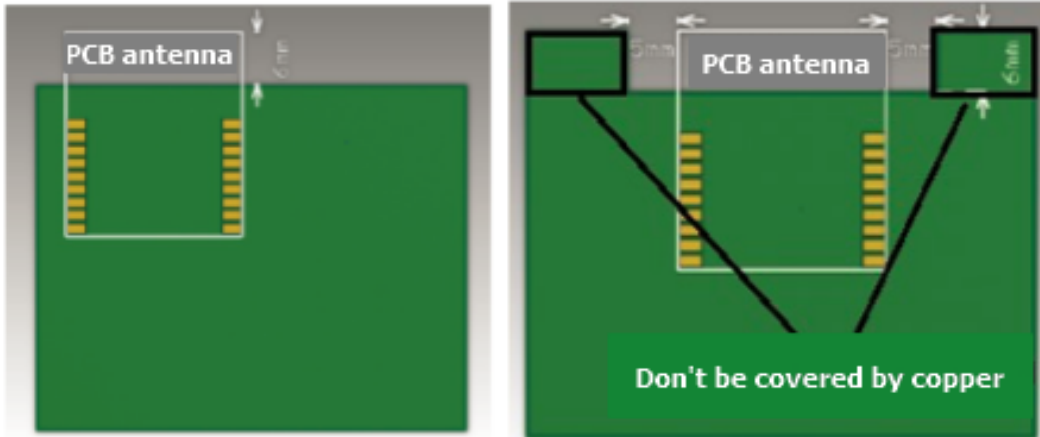
6.1 Antenna type

ZT2S uses the PCB antenna with a gain of 2 dBi.

6.2 Antenna interference reduction

To ensure the best RF performance, it is recommended that the antenna be at least 15 mm away from other metal parts. If metal materials wrap around the antenna, the wireless signal will be greatly attenuated, thereby deteriorating the RF performance. When designing the finished product, please leave enough space for the antenna.

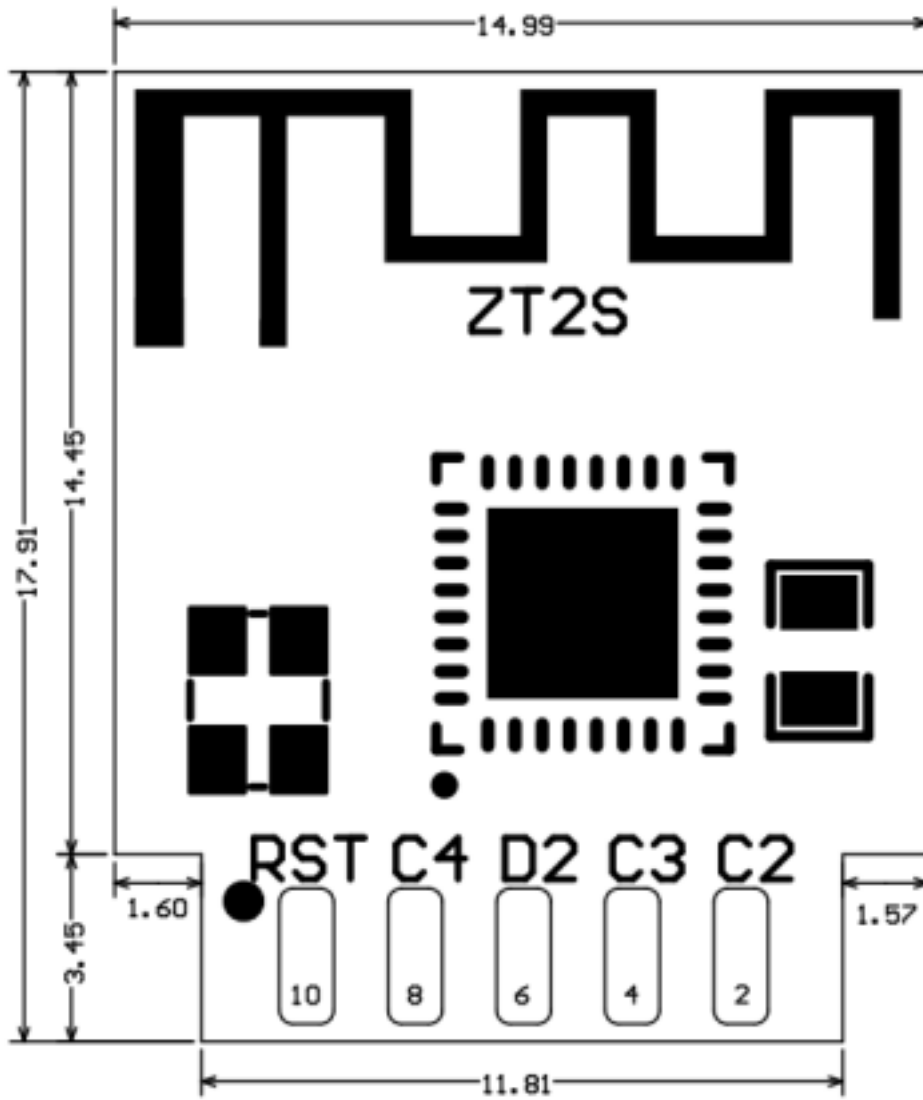
To prevent adverse impact on the antenna radiation performance, avoid copper or traces within the antenna area of the PCB.



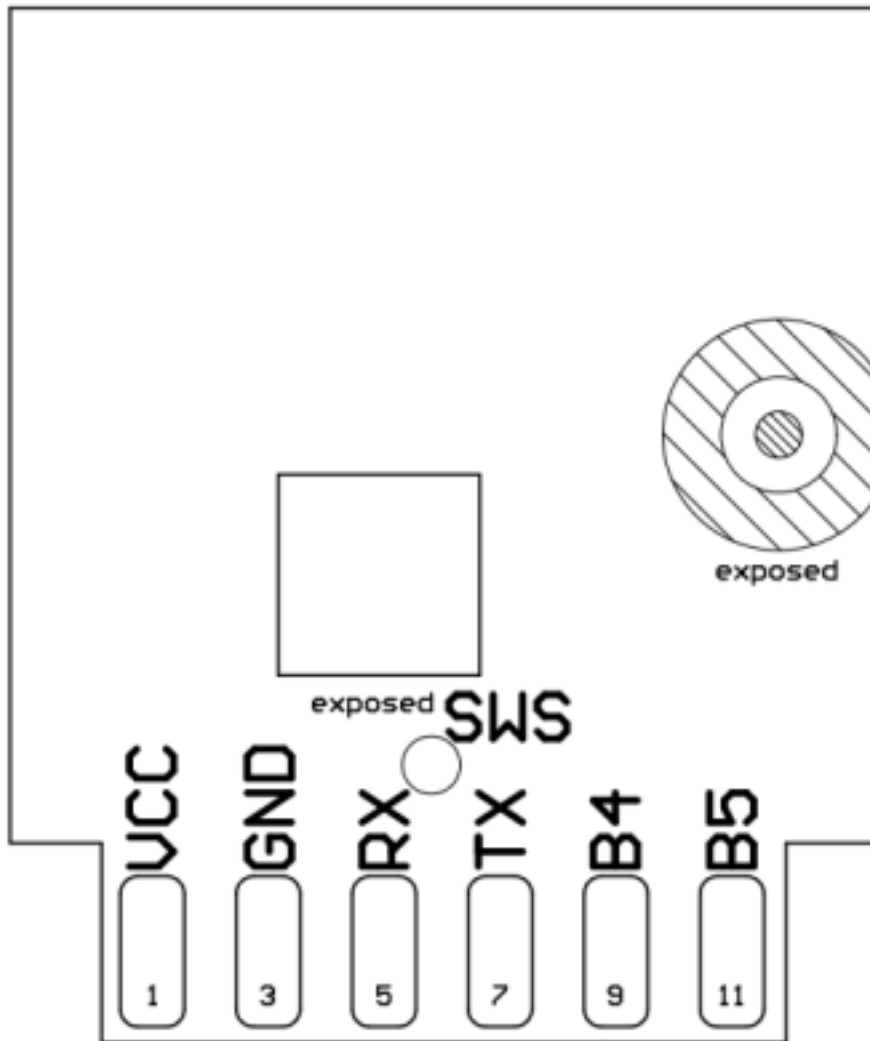
7 Packaging information and production instructions

7.1 Mechanical dimensions

The following figure shows the mechanical dimensions of ZT2S:



Top View



Bottom View



Unit: mm

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

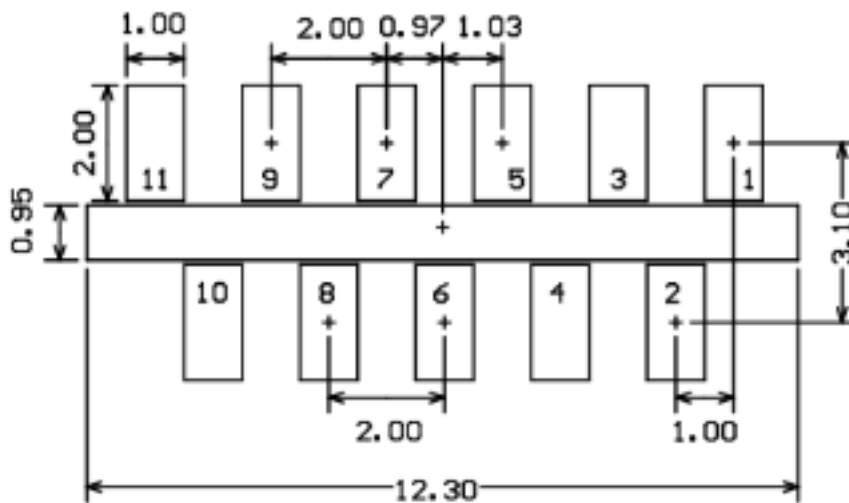
PCB thickness tolerance: $\pm 0.1\text{mm}$

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

Side View

7.2 Recommended footprint

Recommended footprint



7.3 Production instructions

1. For the Tuya in-line module, wave soldering 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).
2. Wave soldering devices and materials:
 - Wave soldering equipment
 - Wave soldering fixture
 - Constant-temperature soldering iron
 - Tin bar, tin wire, and flux
 - Thermal profiler
3. Baking devices:

- Cabinet oven
- Anti-electrostatic and heat-resistant trays
- Anti-electrostatic and heat-resistant gloves

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

- The packaging bag is damaged before unpacking.
- There is no humidity indicator card (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 have passed since the sealing of the bag.

5. Baking settings:

- Temperature: 60°C and $\leq 5\%$ RH for reel package and 125°C and $\leq 5\%$ RH for tray package (please use the heat-resistant tray rather than 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 wave 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.

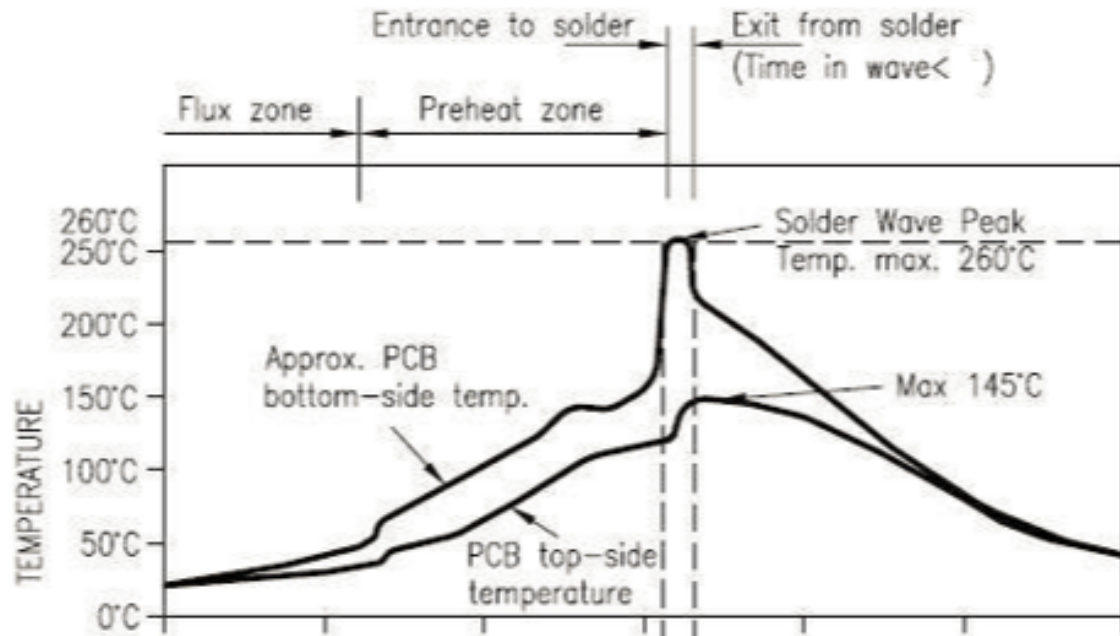
6. In the whole production process, take electrostatic discharge (ESD) protective measures.

7. 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, and whether the wave soldering oven temperature curve is appropriate.

7.4 Recommended oven temperature curve and temperature

Set oven temperatures according to the following temperature curve of wave soldering. The peak temperature is $260^\circ\text{C}\pm 5^\circ\text{C}$.

DIP Type Product Pass Wavesolder Graph



Recommended soldering temperature:

Suggestions on
oven temperature
curve of wave
soldering

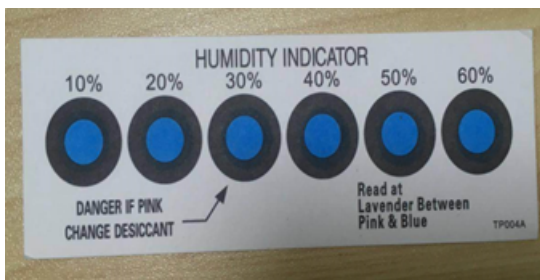
Suggestions on
manual soldering
temperature

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

7.5 Storage conditions

Storage conditions for a delivered module:

- 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.
- There is a humidity indicator card (HIC) in the packaging bag.



	<p style="text-align: center;">Caution This bag contains MOISTURE-SENSITIVE DEVICES</p>	LEVEL
		<div style="border: 1px solid black; padding: 10px; width: fit-content; margin: 0 auto;"> <p style="font-size: 24pt; font-weight: bold;">3</p> </div>
		<small>If blank, see adjacent bar code label</small>
<ol style="list-style-type: none"> <li data-bbox="274 613 1302 696">1. Calculated shelf life in sealed bag: 12 months at <math><40^{\circ}\text{C}</math> and <math><90\%</math> relative humidity (RH) <li data-bbox="274 707 1302 790">2. Peak package body temperature: _____ 260 _____^{°C} <small>If blank, see adjacent bar code label</small> <li data-bbox="274 826 1302 1043">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 data-bbox="327 929 1302 1012">a) Mounted within: _____ 168 _____ hours of factory conditions <small>If blank, see adjacent bar code label</small> <math>\leq 30^{\circ}\text{C}/60\% \text{ RH}</math>, or <li data-bbox="327 1066 745 1106">b) Stored per J-STD-033 <li data-bbox="274 1131 1302 1335">4. Devices require bake, before mounting, if: <ol style="list-style-type: none"> <li data-bbox="327 1193 1302 1274">a) Humidity Indicator Card reads >10% for level 2a - 5a devices or >60% for level 2 devices when read at $23 \pm 5^{\circ}\text{C}$ <li data-bbox="327 1299 719 1339">b) 3a or 3b are not met <li data-bbox="274 1359 1243 1442">5. If baking is required, refer to IPC/JEDEC J-STD-033 for bake procedure 		
<p>See Production Date</p>		
Bag Seal Date: _____ <small>If blank, see adjacent bar code label</small>		
<p>Note: Level and body temperature defined by IPC/JEDEC J-STD-020</p>		

8 MOQ and packaging information

Product model	MOQ (pcs)	Packing method	Modules per reel	Reels per carton
ZT2S	4400	Tape reel	1100	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 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-ZT2S. The end product must be labelled in a visible area with the following: “Contains Transmitter Module FCC ID: 2ANDL-ZT2S” .

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 complies 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.