WB3S Module Datasheet

Version: 20220414

Online Version

Contents

WB3S is a low-power embedded Wi-Fi+Bluetooth LE Dual protocol module that Tuya has developed. It consists of a highly integrated RF chip (BK7231T) and several peripheral components, with an embedded Wi-Fi network protocol stack and robust library functions.

1 Overview

WB3S contains a low-power 32-bit MCU, 1T1R WLAN module, 256-KB SRAM, 2 MB flash memory, and extensive peripherals.

WB3S is an RTOS platform that integrates all function libraries of the Wi-Fi MAC and TCP/IP protocols. You can develop embedded Wi-Fi products as required.

1.1 Features

- Embedded low-power 32-bit CPU, which can also function as an application processor
- Clock rate: 120 MHz
- Working voltage: 3.0 V to 3.6 V
- Peripherals: 9 GPIOs, 1 UART, and 1 ADC
- Wi-Fi connectivity
  - 802.11b/g/n
  - Channels 1 to 14 at 2.4 GHz
  - Support WEP, WPA/WPA2, WPA/WPA2 PSK (AES),WPA3 security modes
  - Up to +16 dBm output power in 802.11b mode
  - EZ net pairing mode for Android and iOS devices
  - Onboard PCB antenna with a gain of 1.5 dBi
  - Working temperature: –40°C to +85°C
- Bluetooth LE
  - Support Bluetooth LE (V4.2)
  - Maximum output power + 6dBm
  - Onboard PCB antenna with a gain of 1.5 dBi

1.2 Applications

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

2 Change history

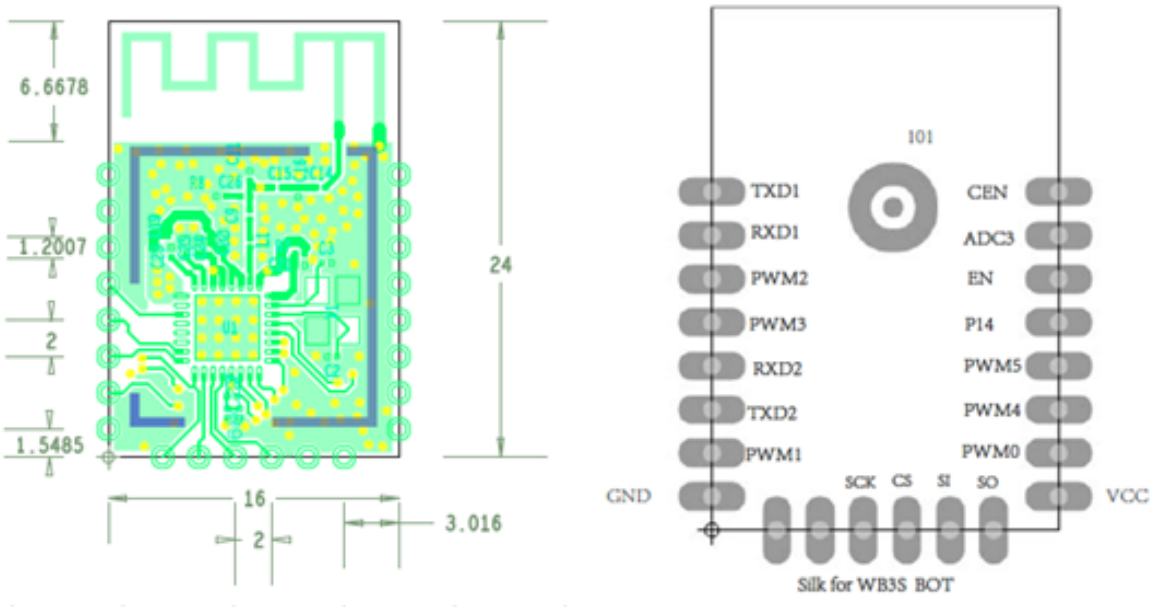
Date	Change Description	Version After Change
2019-11-22	This is the first release.	1.0.0

3 Module interfaces

3.1 Dimensions and footprint

WB3S has two rows of pins with the spacing of 2 mm. The WB3S dimensions (H x W x L) are 2.8 mm x 16 mm x 24 mm.

> **Note**: The default dimensional tolerance is ±0.35 mm. If the module is plugged vertically, the position tolerance is ±0.1 mm. The tolerance of the thickness of the board can be ±0.1 mm, and the tolerance of the shield case is ±0.15 mm.



3.2 Interface pin definition

Pin No.	Symbol	I/O type	Function
1	CEN	I	Low-level reset, high-level active (internally pulled high) Docking IC-CEN

Pin No.	Symbol	I/O type	Function
2	ADC3	AI	ADC pin, which is connected to the P23 pin on the internal IC
3	EN	Input	Enabling pin, which is internally pulled up and compatible with other module design
4	P14	I/O	Common GPIO, which is connected to the P14 pin on the internal IC
5	PWM5	I/O	GPIOP_26, which is connected to the P26 pin on the internal IC
6	PWM4	I/O	GPIOP_24, common GPIO, which is connected to the P24 pin on the internal IC
7	PWM0	I/O	GPIOP_6, which is connected to the P6 pin on the internal IC
8	VCC	P	Power supply pin (3.3 V)
9	GND	P	Power supply reference ground pin

Pin No.	Symbol	I/O type	Function
10	PWM1	I/O	GPIOP_7, which is connected to the P7 pin on the internal IC
11	TXD2	I/O	UART2_TXD, which is used to display the internal information of the module and connected to the P0 on the internal IC. Unavailable to customers.
12	RXD2	I/O	UART2_RXD, which is used to display the internal information of the module and connected to the P1 on the internal IC. Unavailable to customers.
13	PWM3	I/O	GPIOP_9, common GPIO, which is connected to the P9 pin on the internal IC
14	PWM2	I/O	GPIOP_8, which is connected to the P8 pin on the internal IC

Pin No.	Symbol	I/O type	Function
15	RXD1	I/O	UART1_RXD, which is used as a user-side serial interface pin and is connected to the P10 pin on the internal IC
16	TXD1	I/O	UART1_TXD, which is used as a user-side serial interface pin and is connected to the P11 pin on the internal IC

Note:

- P indicates power supply pins, I/O indicates input/output pins, and AI indicates analog input pins.
- CEN is only a hardware reset pin and cannot clear the Wi-Fi network configuration.
- UART1 is a user-side serial interface pin, which generates information when the module is powered on and starts.

3.3 Test Pin definition

Pin No.	Symbol	I/O Type	Function
1	SO	I/O	Data output pin when data is downloaded from the flash memory, which is used for module production and firmware burning and is connected to the P23 or ADC3 pin on the internal IC
2	SI	I/O	Data input pin when data is downloaded from the flash memory, which is used for module production and firmware burning and is connected to the P22 pin on the internal IC
3	CS	I/O	Chip selection pin when data is downloaded from the flash memory, which is used for module production and firmware burning and is connected to the P21 pin on the internal IC

Pin No.	Symbol	I/O Type	Function
4	SCK	I/O	Clock pin when data is downloaded from the flash memory, which is used for module production and firmware burning and is connected to the P20 pin on the internal IC

> **Note**: Test pins are not recommended.

4 Electrical parameters

4.1 Absolute electrical parameters

Parameter	Description	Minimum value	Maximum value	Unit
Ts	Storage temperature	–40	150	°C
VCC	Power supply voltage	–0.3	3.6	V
ESD voltage (human body model)	Tamb = 25°C	N/A	2	kV
ESD voltage (machine model)	Tamb = 25°C	N/A	0.5	kV

4.2 Electrical conditions

Parameter	Description	Minimum value	Typical value	Maximum value	Unit
Ta	Working tempera-ture	–40	N/A	85	°C
VCC	Power supply voltage	3.0	3.3	3.6	V
V_{IL}	I/O low-level input	–0.3	N/A	VCC x 0.25	V
V_{IH}	I/Ohigh-level input	VCC x 0.75	N/A	3.6	V

Parameter	Description	Minimum value	Typical value	Maximum value	Unit
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
I_{max}	I/O drive current	N/A	6	15	mA

4.3 RF Current consumption

Working status	Mode	Rate	TX Power / Receiving	Typical value	Unit
TX	802.11b	11 Mbit/s	+16 dBm	222	mA
	802.11g	54 Mbit/s	+14 dBm	195	mA
	802.11n HT20	MCS7	+12 dBm	185	mA
RX	802.11b	11 Mbit/s	Constant receiving	98	mA
	802.11g	54 Mbit/s	Constant receiving	98	mA
	802.11n HT20	MCS7	Constant receiving	98	mA

4.4 Working current

Working ode	Working status (Ta = 25°C)	Average value	Peak value^*^(Typical value)	Unit
Quick connection network status (Bluetooth network)	The module is in the fast network configuration state, and the Wi-Fi indicator flashes quickly	100	260	mA
Fast connection network status (AP network configuration)	The module is in the fast connection network configuration state, the Wi-Fi indicator flashes slowly	70	305	mA
Quick Connect Network Status (EZ Network)	The module is in the fast network configuration state, and the Wi-Fi indicator flashes quickly	60	300	mA
No operation during connection	The module is connected to the network and the Wi-Fi indicator is always on	40	270	mA

Working ode	Working status (Ta = 25°C)	Average value	Peak value^*^(Typical value)	Unit
Operation being performed during connection	The module is connected to the network and the Wi-Fi indicator is always on	50	280	mA
Disconnected	Module is offline	100	260	mA

5 RF features

5.1 Basic RF features

Parameter	Description
Frequency band	2.412 GHz to 2.484 GHz
Wi-Fi standard	IEEE 802.11b/g/n (channels 1 to 14)
Bluetooth LE standard	Bluetooth LE 4.2
Data transmission rate	802.11b: 1, 2, 5.5, or 11 (Mbit/s)
	802.11g: 6, 9, 12, 18, 24, 36, 48, or 54 (Mbit/s)
	802.11n: HT20 MCS0 to MCS7
Antenna type	Onboard PCB antenna with a gain of 1.5 dBi

5.2 TX performance

Parameter	Minimum value	Typical value	Maximum value	Unit
Average RF output power, 802.11b CCK mode 11 Mbit/s	N/A	16	N/A	dBm
Average RF output power, 802.11g OFDM mode 54 Mbit/s	N/A	14	N/A	dBm

Parameter	Minimum value	Typical value	Maximum value	Unit
Average RF output power, 802.11n OFDM mode MCS7	N/A	13	N/A	dBm
Frequency error	–2	N/A	+2	ppm
EVM under 802.11b CCK, 11 Mbit/s 16 dBm		–18		dB
EVM under 802.11g OFDM, 54 Mbit/s, 14 dBm	–26	–27	–29	dB
EVM under 802.11n OFDM, MCS7, 13 dBm	–26	–27	–29	dB

5.3 RX performance

Parameter	Minimum value	Typical value	Maximum value	Unit
PER < 8%, 802.11b CCK mode 1 Mbit/s	N/A	–92	N/A	dBm
PER < 10%, 802.11g OFDM mode 54 Mbit/s	N/A	–75	N/A	dBm

Parameter	Minimum value	Typical value	Maximum value	Unit
PER < 10%, 802.11n OFDM mode MCS7	N/A	–68	N/A	dBm
PER < 10%,Bluetooth LE 1M	NA	–95	NA	dBm

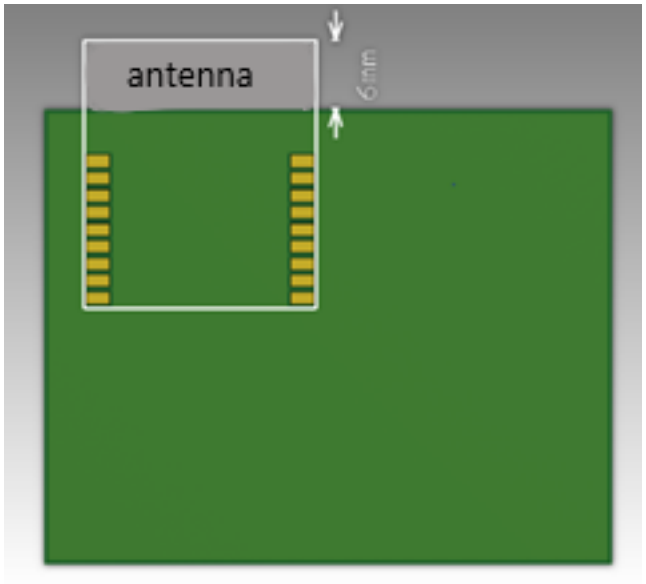
6 Antenna

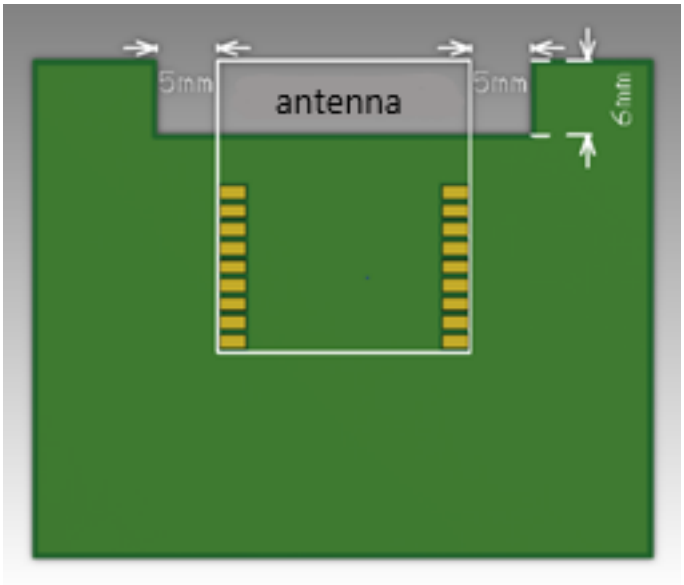
6.1 Antenna type

WB3S uses an onboard PCB antenna, antenna gain 1.5dBi.

6.2 Antenna interference reduction

To ensure optimal Wi-Fi performance when the Wi-Fi 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. Deploy the antenna based on the antenna placement solutions as shown in the following figure



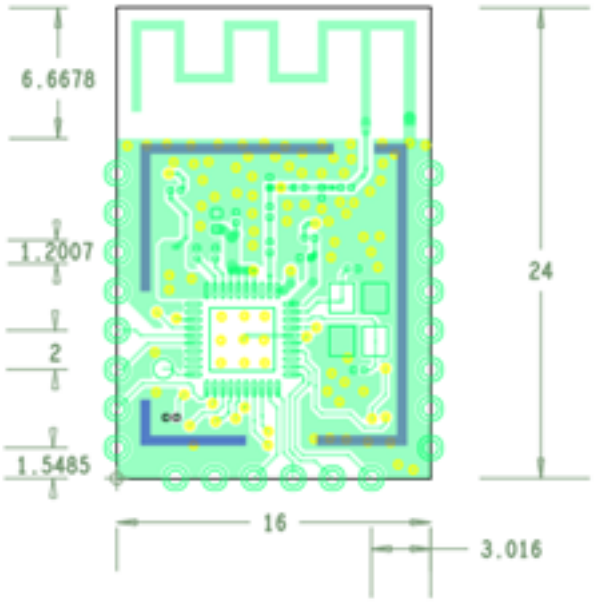


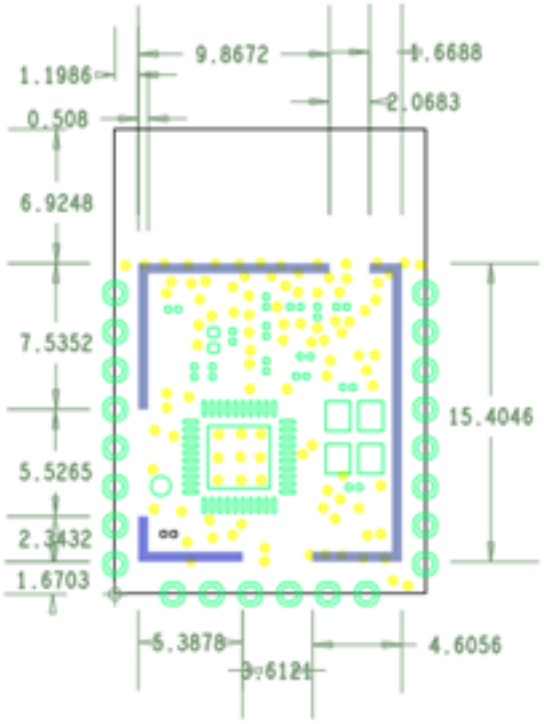
6.3 Antenna connector specifications

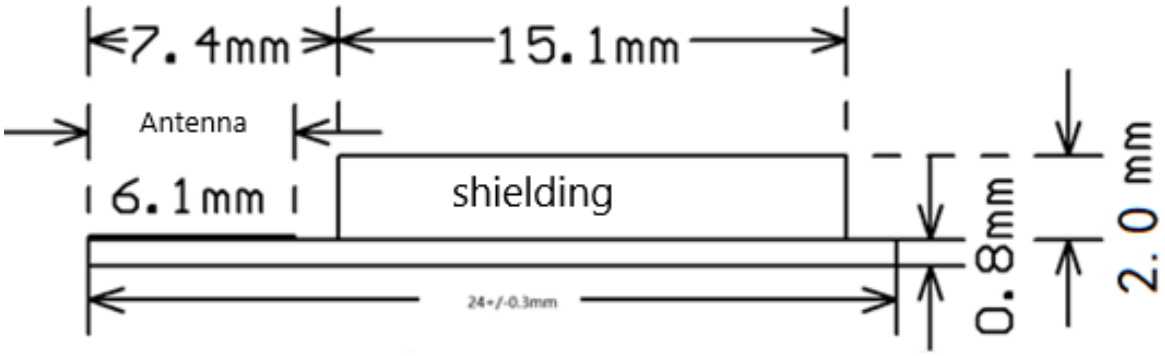
WB3S does not use an antenna connector.

7 Packaging information and production instructions

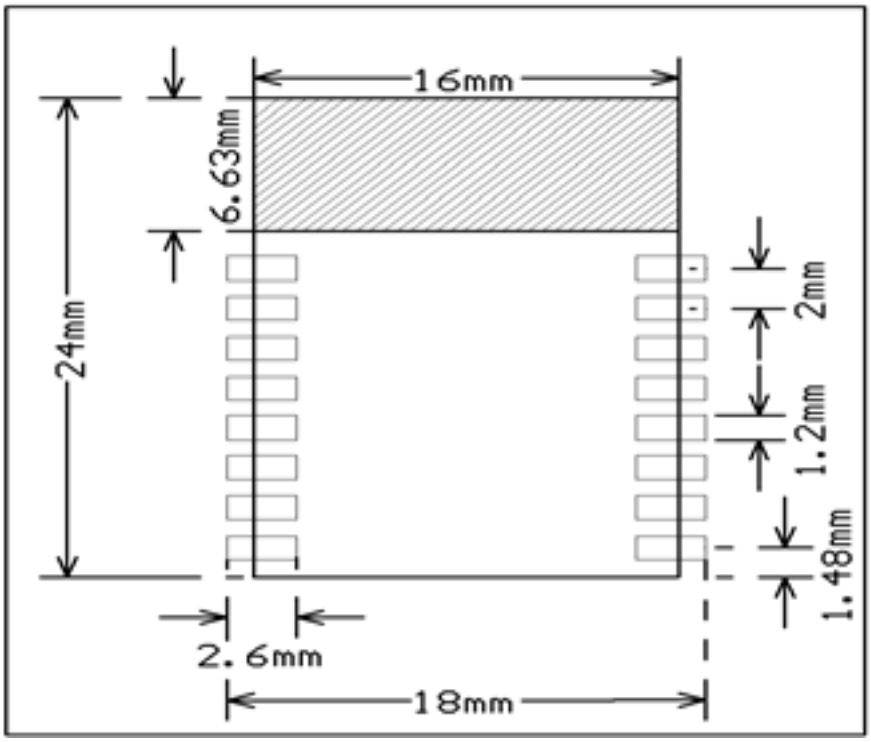
7.1 Mechanical dimensions




9.8672
1.6688
1.1986
2.0683
0.508
6.9248
7.5352
15.4046
5.5265
2.3432
1.6703
5.3878
4.6056


7.4mm
15.1mm
Antenna
6.1mm
shielding
0.8mm
2.0 mm
24+/-0.3mm

7.2 Recommended PCB layout



7.3 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.

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

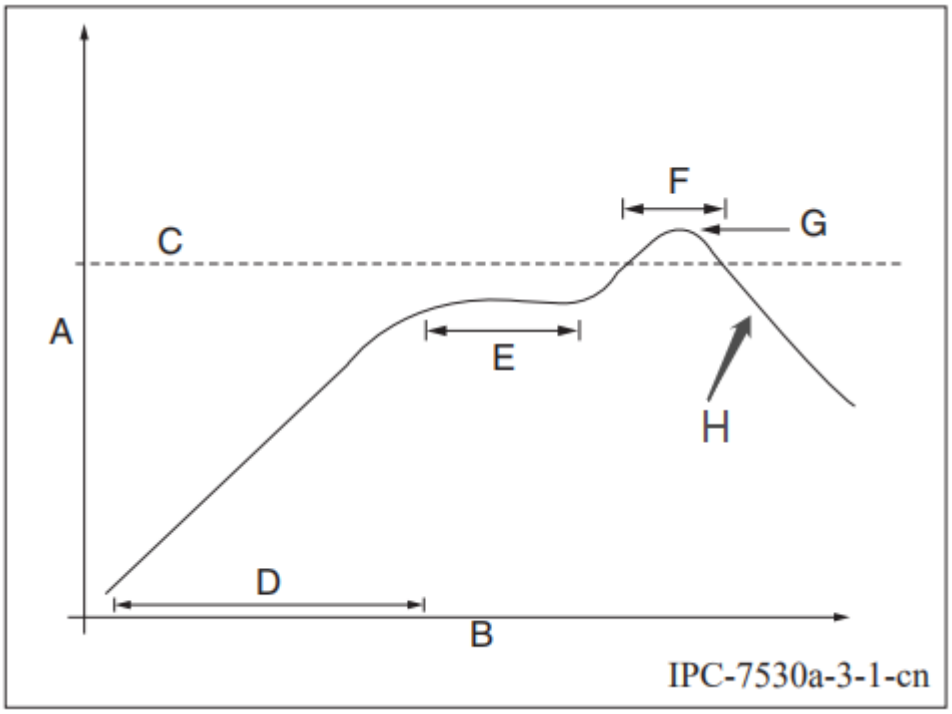
4. Baking settings:

   - Temperature: 60°C and ≤ 5% RH for reel package and 125°C and ≤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°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.

7.4 Recommended oven temperature curve

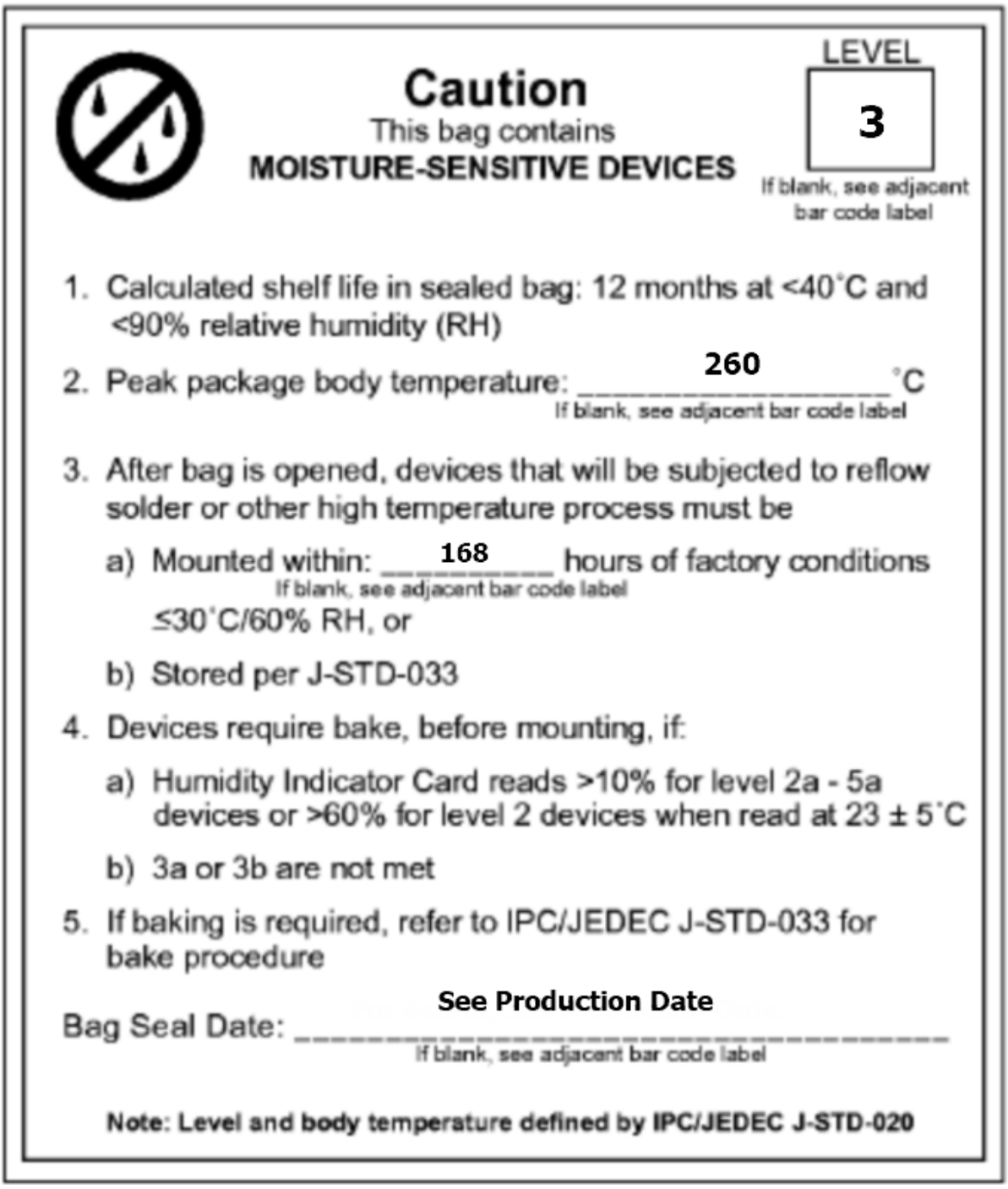
Set oven temperatures according to the following temperature curve of reflow soldering. The peak temperature is 245°C.



- 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.

7.5 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 be
   a) Mounted within: **168** hours of factory conditions
      If blank, see adjacent bar code label
      ≤30˚C/60% RH, or
   b) Stored per J-STD-033
4. Devices require bake, before mounting, if:
   a) Humidity Indicator Card reads >10% for level 2a - 5a devices or >60% for level 2 devices when read at 23 ± 5˚C
   b) 3a or 3b are not met
5. If baking is required, refer to IPC/JEDEC J-STD-033 for bake procedure

Bag Seal Date: **See Production Date**
If blank, see adjacent bar code label

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

8 MOQ and packaging information

Product model	MOQ (pcs)	Packing method	Modules per reel	Reels per carton
WB3S	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 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-WB3S. The end product must be labeled in a visible area with the following: “Contains Transmitter Module FCC ID: 2ANDL-WB3S”.

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.