CB3S Module Datasheet

Version: 20210602

Online Version

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CB3S is a low-power embedded Wi-Fi module that Tuya has developed. It consists of a highly integrated RF chip BK7231N and a few peripherals. CB3S not only supports the Wi-Fi AP and STA modes but also supports the Bluetooth LE.

1 Product overview

CB3S is built in with a 32-bit MCU whose running speed can be up to 120 MHz, a 2-MB flash memory, and a 256-KB RAM, to support the Tuya cloud connection. The MCU instructions specially extended for signal processing can effectively implement audio encoding and decoding.

Besides, it has rich peripherals, such as PWM and UART. There are 5 channels of 32-bit PWM output, making the chip very suitable for high-quality LED control.

1.1 Features

- Built in with the low-power 32-bit CPU, which can also function as an application processor
- The clock rate: 120 MHz
- Working voltage: 3.0 to 3.6V
- Peripherals: 5 PWMs and 1 UART
- Wi-Fi connectivity
  - 802.11 b/g/n
  - Channels 1 to 14@2.4 GHz
  - Support WEP, WPA/WPA2, and WPA/WPA2 PSK (AES) security modes
  - Up to +16 dBm output power in 802.11b mode
  - Support STA/AP/STA+AP working mode
  - Support SmartConfig and AP network configuration manners for Android and iOS devices
  - Onboard PCB antenna with a gain of 1.3 dBi
  - Working temperature: -40℃ to 85℃
- Bluetooth connectivity
  - Support the transmit power of 6 dBm in the Bluetooth mode
  - Complete Bluetooth coexistence interface
  - Onboard PCB antenna with a gain of 1.3 dBi

1.2 Applications

- Intelligent building
- Smart household and home appliances

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

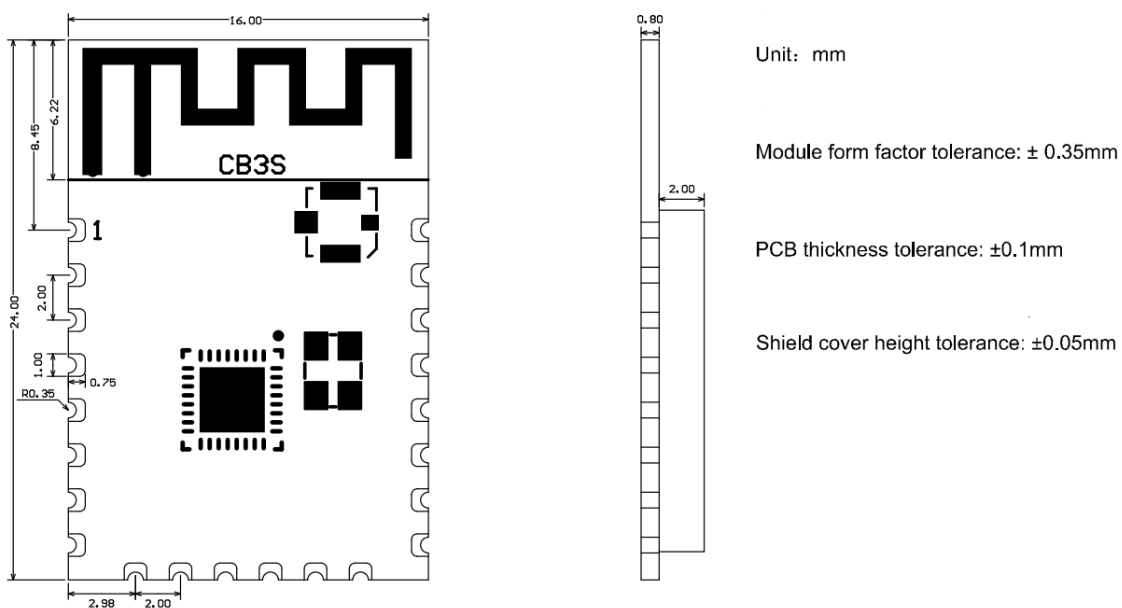
1.3 Change history

Update date	Updated content	Version after update
04/15/2021	This is the first release.	V1.0.0

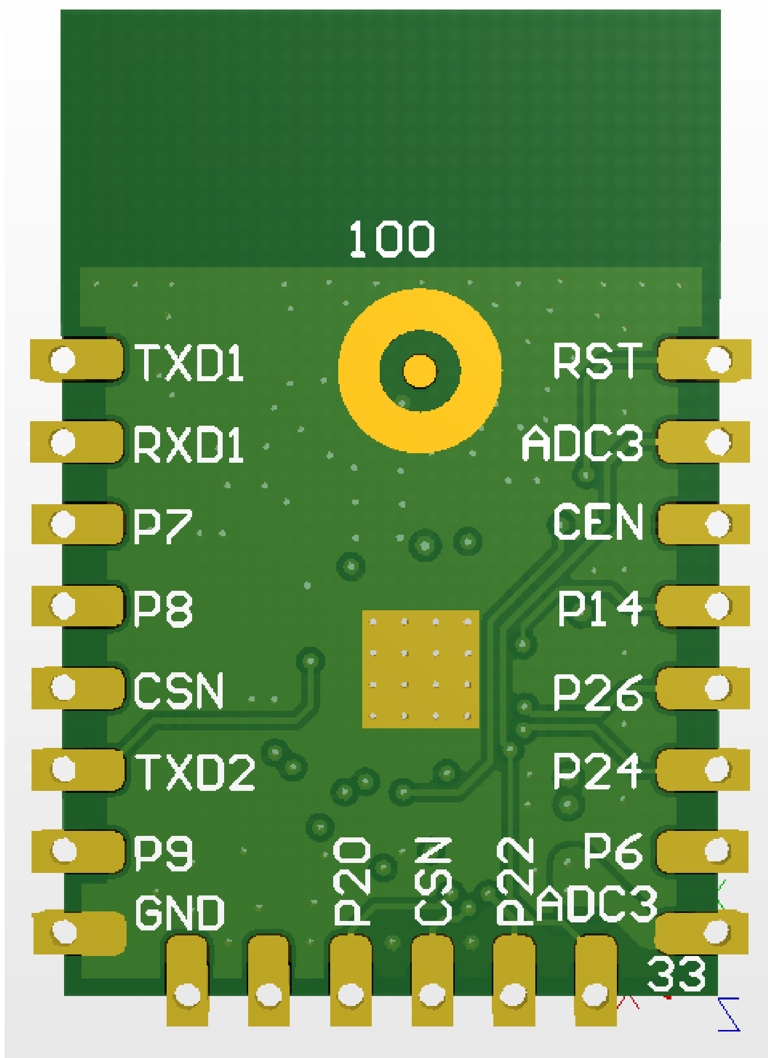
2 Module interfaces

2.1 Dimensions and package

The dimensions of CB3S are 16.00±0.35 mm (W)×24.00±0.35 mm (L) ×2.8±0.15 mm (H). The dimensions of CB3S are as follows:



The packaging drawing of CB3S is:



Pin number	Symbol	I/O type	Function
1	RST	I	Low-level reset, high level active (the pin has been pulled high internally), correspond to CEN of the IC
2	ADC3	AI	ADC pin, which corresponds to P23 of the IC

Pin number	Symbol	I/O type	Function
3	CEN	I	Enabling pin, which is pulled high internally to be compatible with other modules
4	P14	I/O	A common GPIO interface, which corresponds to P14 of the IC
5	P26	I/O	GPIOP_26, which corresponds to P26 of the IC, PWM 5
6	P24	I/O	GPIOP_24, which corresponds to P24 of the IC, PWM 4
7	P6	I/O	GPIOP_6，which corresponds to P6 of the IC, PWM 0
8	VCC	P	Power supply pin (3.3V)
9	GND	P	Power supply reference ground
10	P9	I/O	GPIOP_9, which corresponds to P9 of the IC, PWM 3

Pin number	Symbol	I/O type	Function
11	TXD2	I/O	UART2_TXD (used to display the module internal information), which corresponds to P0 of the IC
12	CSN	I/O	Production test control pin. If it is used as a common I/O pin, it must be connected to the VCC externally. Do not connect it to the ground before the module is powered on.
13	P8	I/O	GPIOP_8, which corresponds to P8 of the IC, PWM 2
14	P7	I/O	GPIOP_7, which corresponds to P7 of the IC, PWM 1

Pin number	Symbol	I/O type	Function
15	RXD1	I/O	UART1_RXD (user serial interface), which corresponds to P10 of the IC. Do not connect it to the VCC. By default, the MCU serial port should be in low-level or high-impedance state.
16	TXD1	I/O	UART1_TXD (user serial interface), which corresponds to P11 of the IC. Do not connect it to the VCC. By default, the MCU serial port should be in low-level or high-impedance state.
17	ADC3	AI	(Not recommended for use. If needed, please use Pin 2) ADC port, which corresponds to P23 of the IC. Programmed SPI

Pin number	Symbol	I/O type	Function
18	P22	I/O	(Not recommended for use.) GPIOP_22, which corresponds to P22 of the IC. Programmed SPI
19	CSN	I/O	The pull-up resistor is needed during usage of customers. Do not connect it to the ground before the module is powered on. Correspond to P21 of the IC.
20	P20	I/O	(Not recommended for use.) GPIOP_20, which corresponds to P20 of the IC. Programmed SPI
21	NC		
22	NC		

> **Note**: P indicates a power supply pin and I/O indicates an input/output pin. For the MCU solution, please refer to CBx Module.

3 Electrical parameters

3.1 Absolute electrical parameters

Parameter	Description	Minimum value	Maximum value	Unit
Ts	Storage temperature	-55	125	℃
VBAT	Power supply voltage	-0.3	3.9	V
Static electricity discharge voltage (human body model)	TAMB-25℃	-4	4	KV
Static electricity discharge voltage (machine model)	TAMB-25℃	-200	200	V

3.2 Normal working conditions

Parameter	Description	Minimum value	Typical value	Maximum value	Unit
Ta	Working temperature	-40	-	85	℃
VBAT	Power supply voltage	3	3.3	3.6	V

Parameter	Description	Minimum value	Typical value	Maximum value	Unit
VOL	I/O low level output	VSS	-	VSS+0.3	V
VOH	I/O high level output	VBAT-0. 3	-	VBAT	V
Imax	I/O drive current	-	6	20	mA

3.3 RF power consumption

Working status	Mode	Rate	Transmit power/re-ceive	Average value	Peak value (Typical value)	Unit
Transmit	11b	11Mbps	+16dBm	81	240	mA
Transmit	11g	54Mbps	+15dBm	82	238	mA
Transmit	11n	MCS7	+14dBm	85	234	mA
Receive	11b	11Mbps	Constantly receive	73	82	mA
Receive	11g	54Mbps	Constantly receive	75	82	mA
Receive	11n	MCS7	Constantly receive	75	82	mA

3.4 Working current

Working mode	Working status, Ta = 25°C	Average value	Maximum value (Typical value)	Unit
Quick network connection state (Bluetooth)	The module is in the fast network connection state and the Wi-Fi indicator flashes fast.	63	245	mA
Quick network connection state (AP)	The module is in the hotspot network connection state and the Wi-Fi indicator flashes slowly.	80	270	mA
Quick network connection state (EZ)	The module is in the fast network connection state and the Wi-Fi indicator flashes fast.	78	246	mA
Network connected state	The module is connected to the network and the Wi-Fi indicator is always on.	25	342	mA

Working mode	Working status, Ta = 25°C	Average value	Maximum value (Typical value)	Unit
Network disconnected state	The module is disconnected and the Wi-Fi indicator is always off.	63	242	mA
Module disabled	The CEN pin of the module is connected to the ground.	330	-	uA

4 RF parameters

4.1 Basic RF features

Parameter	Description
Working frequency	2.412 to 2.484 GHz
Wi-Fi standard	IEEE 802.11 b/g/n (channels 1 to 14)
Data transmission rate	11b: 1, 2, 5.5, 11 (Mbps);
	11g: 6, 9, 12, 18, 24, 36, 48, 54 (Mbps);
	11n: HT20 MCS 0 to 7;
	11n: HT40 MCS 0 to 7
Antenna type	PCB antenna

4.2 Wi-Fi transmission performance

Parameter	Minimum value	Typical value	Maximum value	Unit
Average RF output power, 802.11b CCK Mode 11M	-	16	-	dBm
Average RF output power, 802.11g OFDM Mode 54M	-	15	-	dBm
Average RF output power, 802.11n OFDM Mode MCS7	-	14	-	dBm
Frequency error	-20	-	20	ppm

4.3 Wi-Fi receiving performance

Parameter	Minimum value	Typical value	Maximum value	Unit
PER<8%, RX sensitivity, 802.11b DSSS Mode 11M	-	-88	-	dBm
PER<10%, RX sensitivity, 802.11g OFDM Mode 54M	-	-74	-	dBm

Parameter	Minimum value	Typical value	Maximum value	Unit
PER<10%, RX sensitivity, 802.11n OFDM Mode MCS7	-	-73	-	dBm
PER<10%, RX sensitivity, Bluetooth LE 1M	-	-96	-	dBm

4.4 Bluetooth transmission performance

Parameter	Minimum value	Typical value	Maximum value	Unit
Working frequency	2402	-	2480	MHz
Air rate	-	1	-	Mbps
Transmit power	-20	6	20	dBm
Frequency error	-150	-	150	KHz

4.5 Bluetooth receiving performance

Parameter	Minimum value	Typical value	Maximum value	Unit
RX sensitivity	-	-96	-	dBm
Maximum RF signal input	-10	-	-	dBm

Parameter	Minimum value	Typical value	Maximum value	Unit
Inter-modulation	-	-	-23	dBm
Co-channel suppression ratio	-	10	-	dB

5 Antenna information

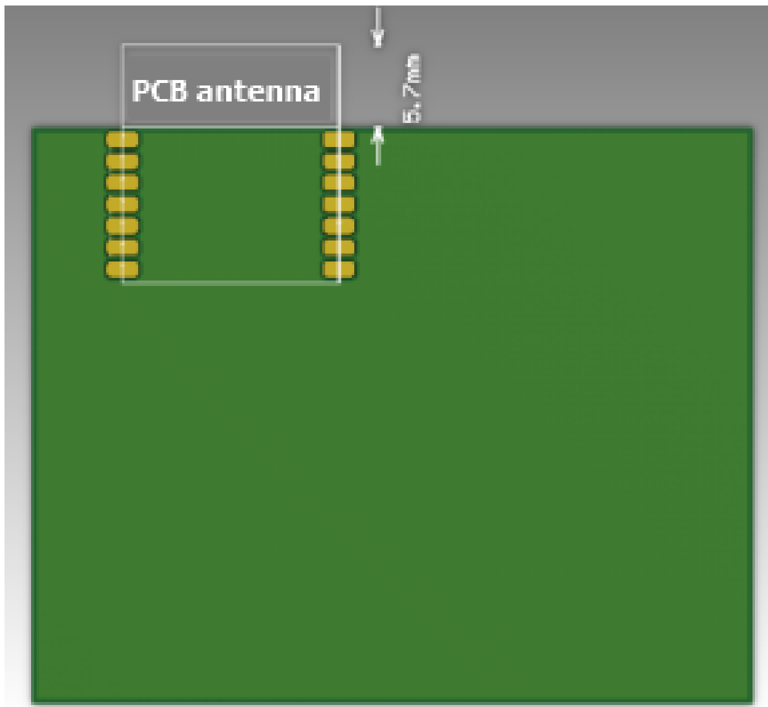
5.1 Antenna type

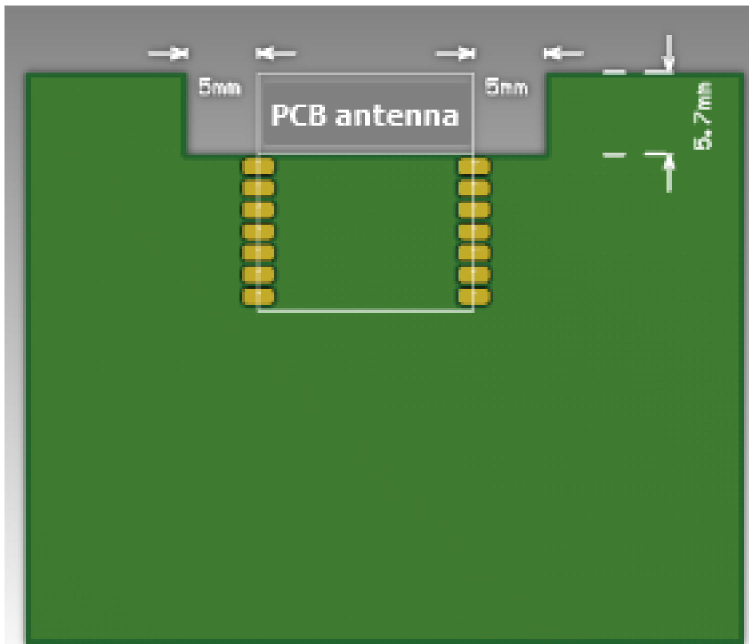
CB3S uses the PCB antenna with a gain of 1.3 dBi.

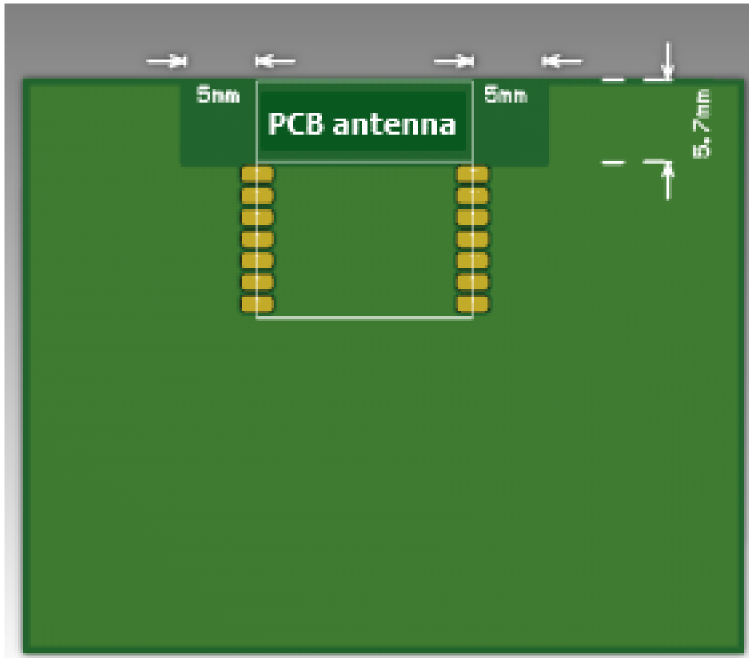
5.2 Antenna interference reduction

To ensure the 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.

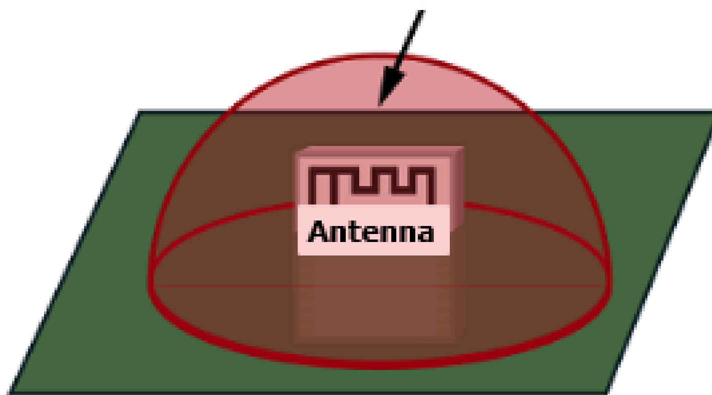
To prevent adverse impact on the antenna radiation performance, avoid copper or traces within the antenna area on the PCB.


PCB antenna
5.7mm


5mm
PCB antenna
5mm
5.7mm

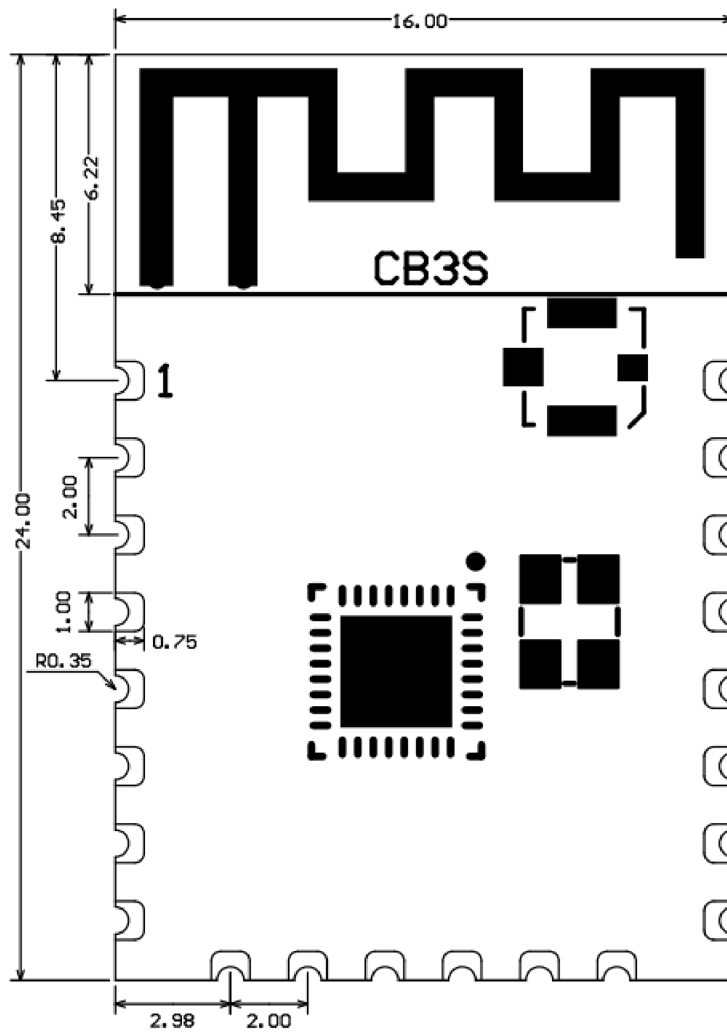


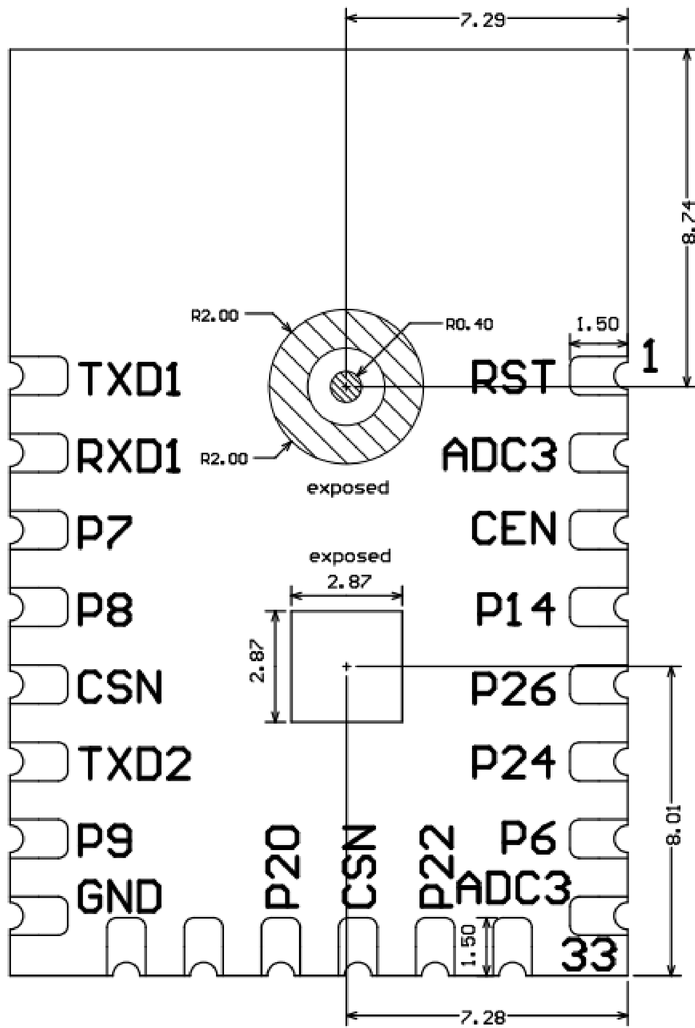
Do not place any metal in the red area above the antenna.
The recommended diameter of the circular arc is greater than 3 cm.

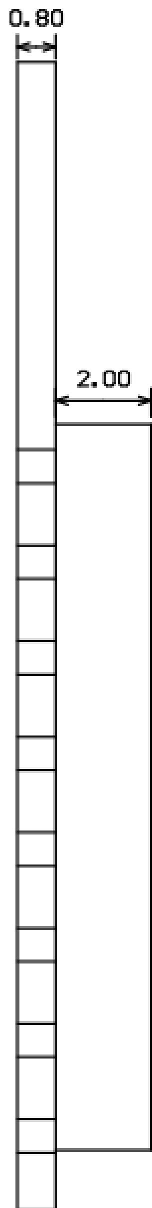


6 Packaging information and production instructions

6.1 Mechanical dimensions




7.29
8.74
R2.00
R0.40
1.50
1
TXD1
RST
RXD1
R2.00
ADC3
exposed
P7
CEN
exposed
2.87
P8
P14
2.87
CSN
P26
TXD2
P24
P9
P20
CSN
P22
P6
8.01
GND
ADC3
1.50
33
7.28
Bottom View



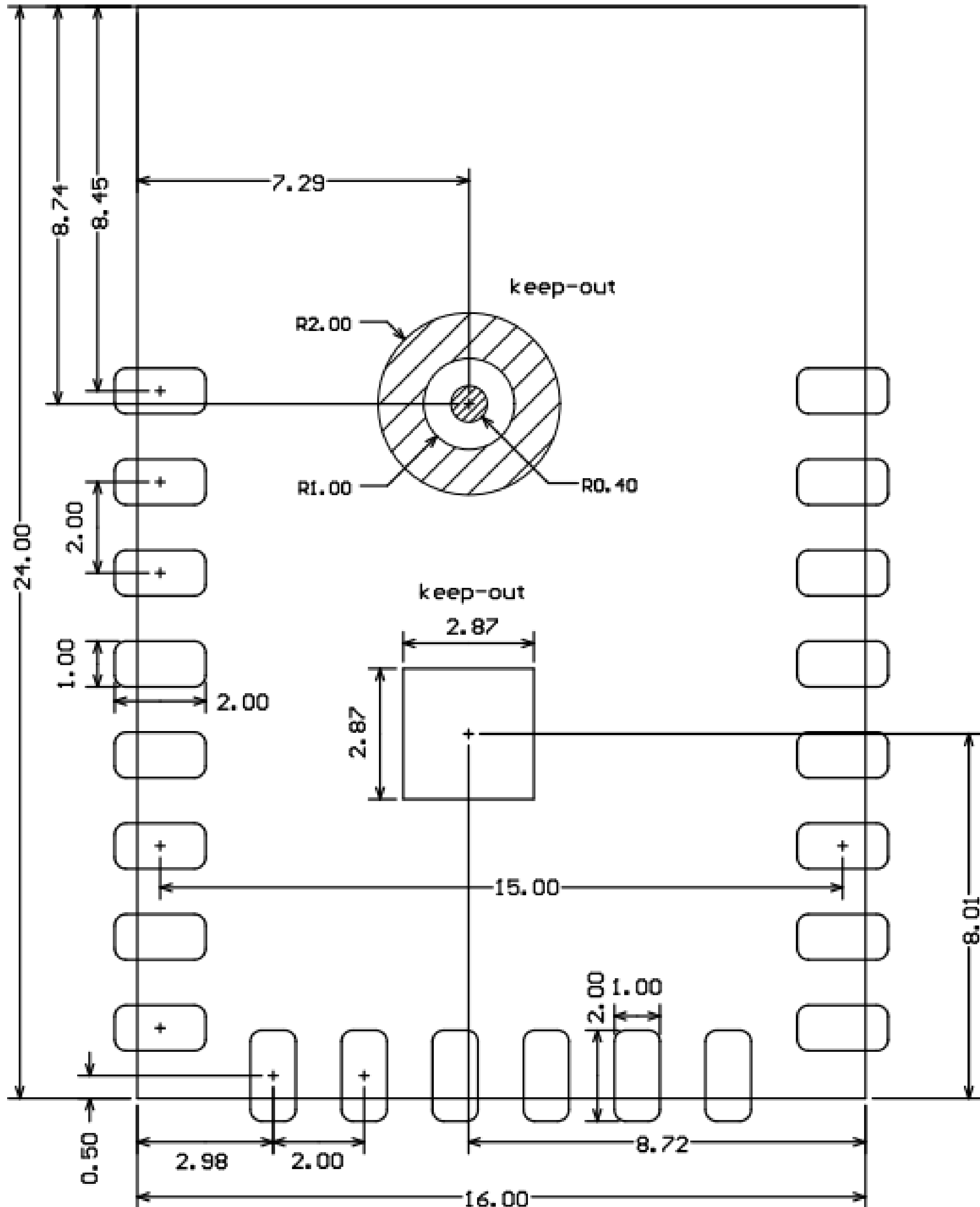
Unit: mm

Module form factor tolerance: ± 0.35mm

PCB thickness tolerance: ±0.1mm

Shield case height tolerance: ±0.05mm

Side View


Recommended Package
7.29
8.74
8.45
keep-out
R2.00
R1.00
R0.40
2.00
24.00
keep-out
2.87
1.00
2.00
2.87
15.00
8.01
2.00
1.00
0.50
2.98
2.00
8.72
16.00

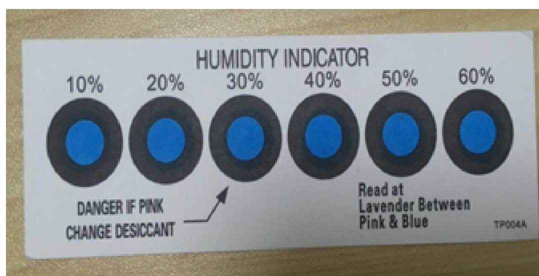
6.2 Production instructions

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.



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

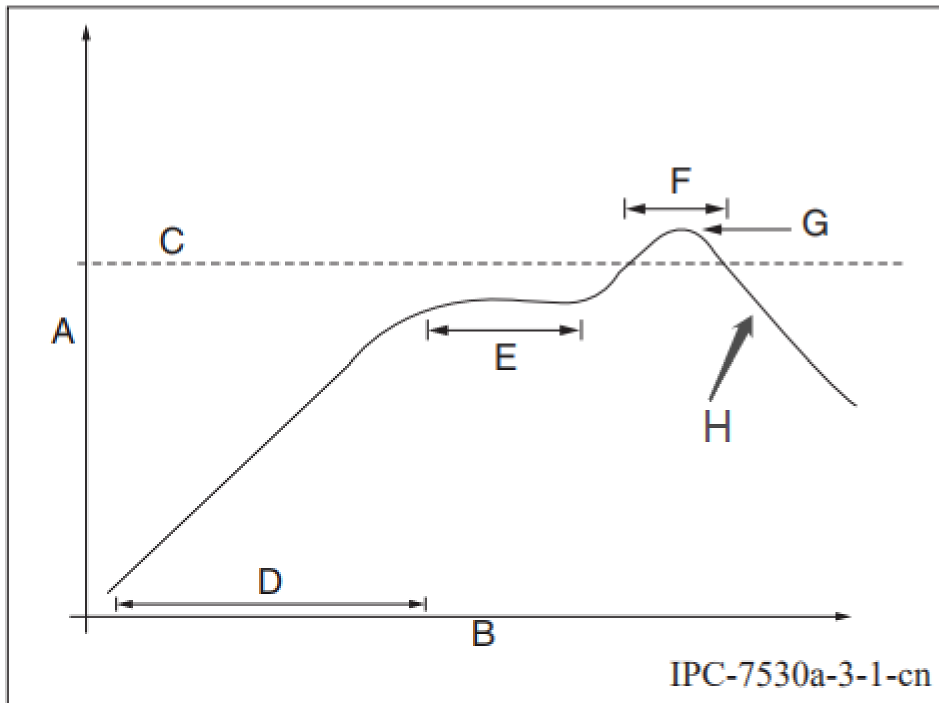
   - The packaging bag is damaged before unpacking.
   - There is no HIC in the packaging bag.
   - After unpacking, circles of 10% and above on the HIC become pink.
   - The total exposure time has lasted for over 168 hours since unpacking.

   - More than 12 months have 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.

6.3 Recommended oven temperature curve

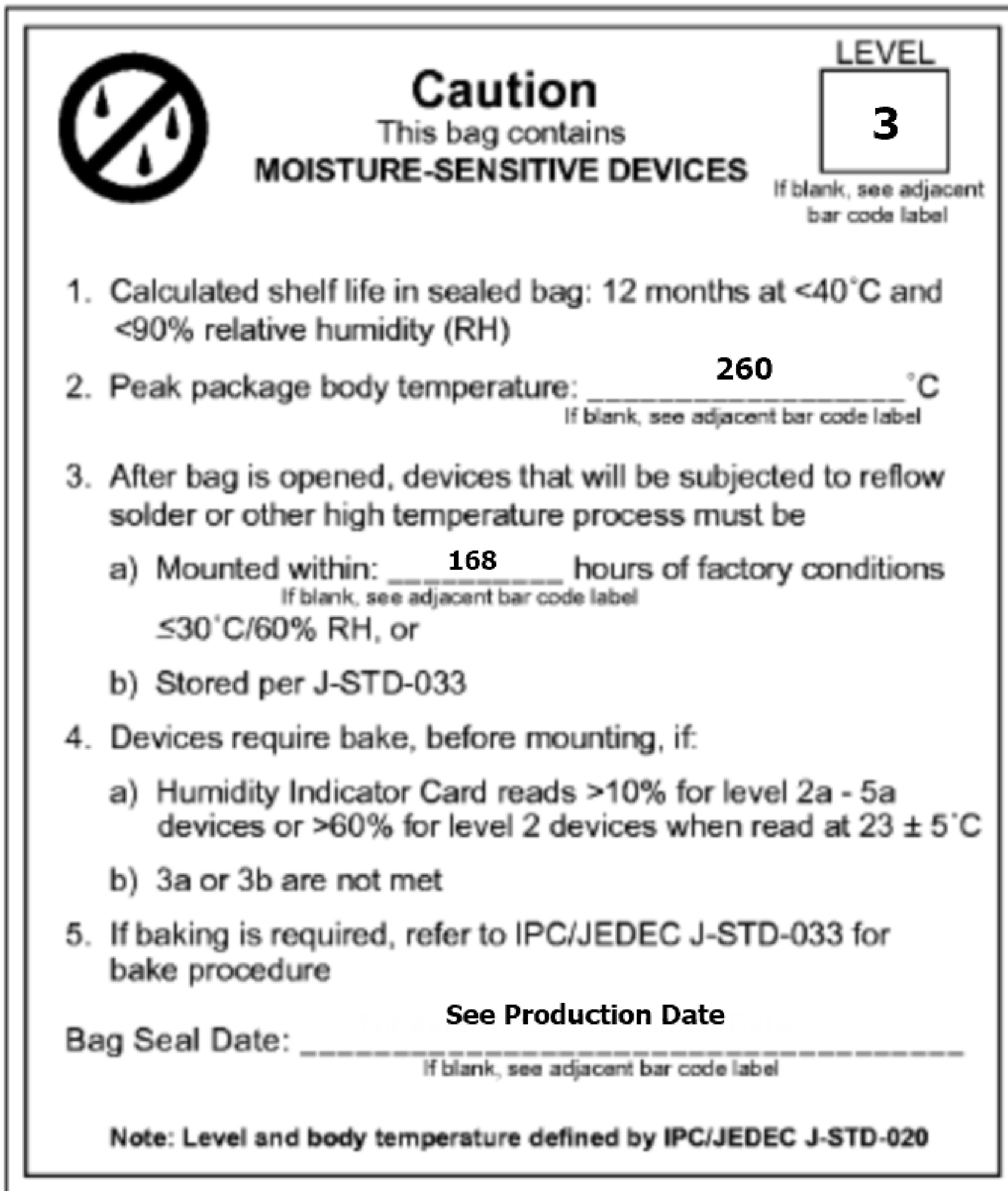
Set oven temperatures according to the following temperature curve of reflow soldering. The peak temperature is 245°C.



- 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.

6.4 Storage conditions



7 MOQ and packaging information

Product number	MOQ (pcs)	Packaging method	Qty of modules per reel	Qty of reels per carton
CB3S	3600	Tape reel	900	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".

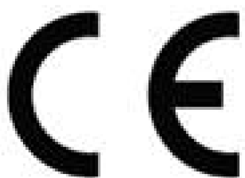
This device has got an FCC ID: 2ANDL-CB3S. The end product must be labelled in a visible area with the following: "Contains Transmitter Module FCC ID: 2ANDL-CB3S".

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.

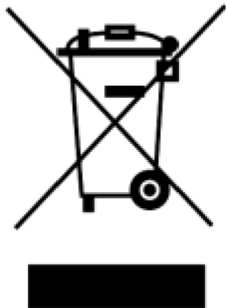
As long as the 2 conditions above are met, further transmitter tests will not be required. However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed.

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 Direc-

tive 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 a municipal recycling collection point.

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