



CB3S-NL Module Datasheet

Version: 20220210

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CB3S-NL is an embedded low-power Wi-Fi module that Tuya has developed. It consists of a highly integrated RF chip BK7231NL and a few peripherals. CB3S-NL not only supports the Wi-Fi AP and STA modes, but also supports the Bluetooth LE.

1 Product overview

CB3S-NL is built in with a 32-bit MCU whose running speed can be up to 120 MHz, 2-MB flash memory, and 256-KB RAM, to connect to the Tuya IoT cloud. 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 six 32-bit PWM outputs, 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
- Clock rate: 120 MHz
- Operating voltage: 3.0 to 3.6V
- Peripherals: 6 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, and STA+AP modes
 - Support SmartConfig and AP network configuration manners for Android and iOS devices
 - Onboard PCB antenna with a gain of 1.37 dBi
 - Operating temperature: -40°C to 85°C
- Bluetooth connectivity
 - Support the transmit power of 6 dBm in the Bluetooth mode
 - Complete Bluetooth coexistence interface
 - Onboard PCB antenna with a gain of 1.37 dBi

1.2 Applications

- Intelligent buildings
- Smart household and home appliances

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

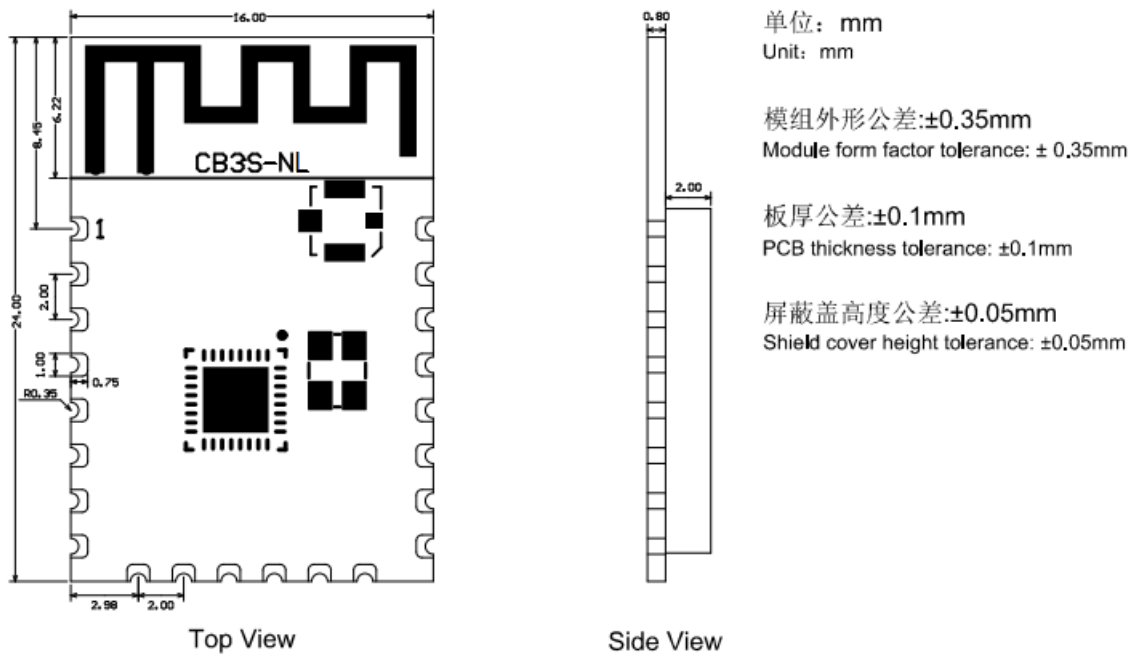
1.3 Change history

Update date	Updated content	Version after update
Jan. 25, 2022	This is the first release.	V1.0.0

2 Module interfaces

2.1 Dimensions and footprint

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



2.2 Pin definition

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, 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
11	TXD2	I/O	UART2_TXD (used to display the module internal information), which corresponds to P0 of the IC

Pin number	Symbol	I/O type	Function
12	CSN	I/O	Pin for control production tests. If it is used as a port, the level must be pulled up externally and cannot be pulled down before powering 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
15	RXD1	I/O	UART1_RXD (User serial port), which corresponds to P10 of the IC. Do not pull it up. By default, the docking serial port of the MCU needs to be in low-level state or high-impedance state.

Pin number	Symbol	I/O type	Function
16	TXD1	I/O	UART1_TXD (User serial port), which corresponds to P11 of the IC Do not pull it up. By default, the docking serial port of the MCU needs to be in low-level state or high-impedance state.
17	ADC3	AI	(Not recommended. If needed, please use Pin 2) ADC port, which corresponds to P23 of the IC. SPI burning pin
18	P22	I/O	(Not recommended) GPIOP_22, which corresponds to P22 of the IC. SPI burning pin.
19	CSN	I/O	A customer needs to use the pull-up resistor which cannot be pulled down before powering on and corresponds to P21 of the IC

Pin number	Symbol	I/O type	Function
20	P20	I/O	(Not recommended) GPIOP_20, which corresponds to P20 of the IC. SPI burning pin
21	NC		
22	NC		

Note: P indicates a power supply pin, I/O indicates an input/output pin, and AI indicates an analog input 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
T _s	Storage temperature	-55	125	°C
V _{BAT}	Supply voltage	-0.3	3.9	V
ESD voltage (human body model)	TAMB-25°C	-4	4	KV
ESD voltage (machine model)	TAMB-25°C	-200	200	V

3.2 Normal working conditions

Parameter	Description	Minimum value	Typical value	Maximum value	Unit
Ta	Operating temperature	-40	-	85	°C
V _{BAT}	Power supply voltage	2.3	3.3	3.6	V
VOL	Low voltage output	VSS	-	VSS+0.3	V
VOH	High voltage output	V _{BAT} -0.3	-	V _{BAT}	V
I _{max}	Drive current	-	6	20	mA

3.3 RF power consumption

Operating status	Mode	Rate	Transmit power/receive	Average value	Peak value (Typical value)	Unit
Transmit	11b	11Mbps	+16dBm	267	412	mA
Transmit	11g	54Mbps	+14dBm	258	412	mA
Transmit	11n	MCS7	+13dBm	253	304	mA
Receive	11b	11Mbps	Constantly receive	73	82	mA
Receive	11g	54Mbps	Constantly receive	75	82	mA

Operating status	Mode	Rate	Transmit power/receive	Average value	Peak value (Typical value)	Unit
Receive	11n	MCS7	Constantly receive	75	82	mA

Note: The requirement for testing the current in transmission state is that the module must constantly send packets.

3.4 Operating current

Operating mode	Operating status, Ta = 25°C	Average value	Maximum value (Typical value)	Unit
Quick network connection state (Bluetooth)	The module is connecting to the network and the Wi-Fi indicator flashes fast	63	404	mA
Quick network connection state (AP)	The module is connecting to the network and the Wi-Fi indicator flashes slowly	74	356	mA
Quick network connection state (EZ)	The module is connecting to the network and the Wi-Fi indicator flashes fast	74	404	mA

Operating mode	Operating status, Ta = 25°C	Average value	Maximum value (Typical value)	Unit
Connected	The module is connected to the network and the Wi-Fi indicator is always on	25	404	mA
Weakly connected	The module and the hotspot are weakly connected and the Wi-Fi indicator is always on	205	407	mA
Disconnected	The module is disconnected and the Wi-Fi indicator is always off	63	404	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;
Antenna type	PCB antenna

4.2 Wi-Fi transmission performance

Parameter	Minimum value	Typical value	Maximum value	Unit
Average output power, 802.11b CCK Mode 11M	-	16	-	dBm
Average output power, 802.11g OFDM Mode 54M	-	14	-	dBm
Average output power, 802.11n OFDM Mode MCS7	-	13	-	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
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
Inter-modulation	-	-	-23	dBm
Co-channel suppression ratio	-	10	-	dB

5 Antenna information

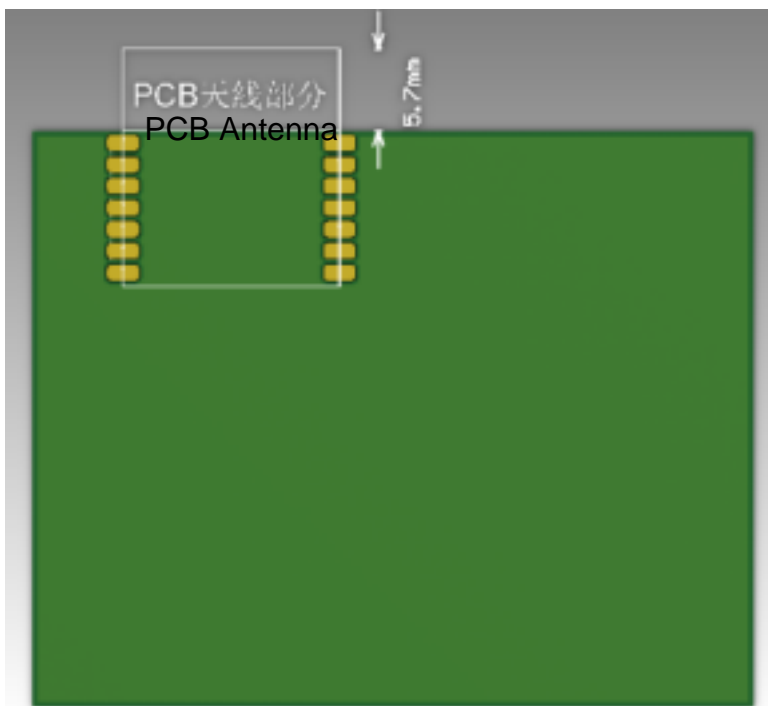
5.1 Antenna type

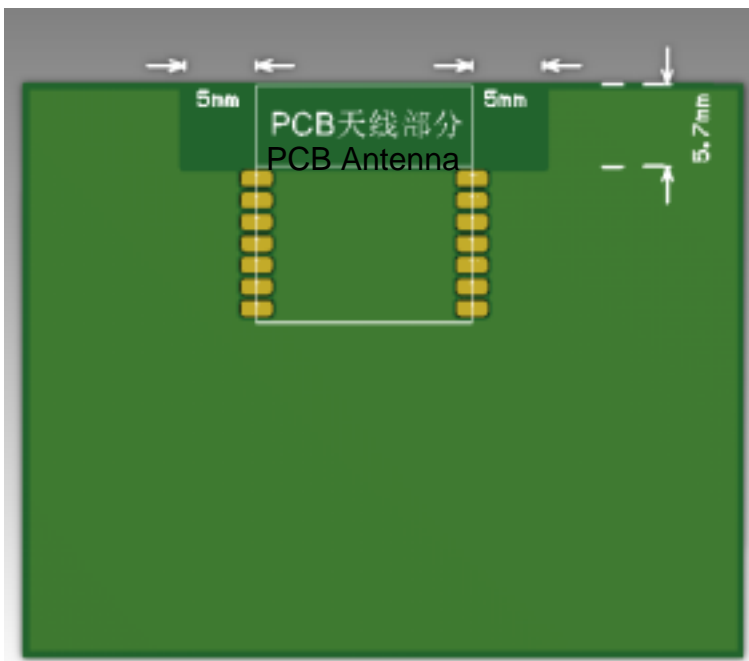
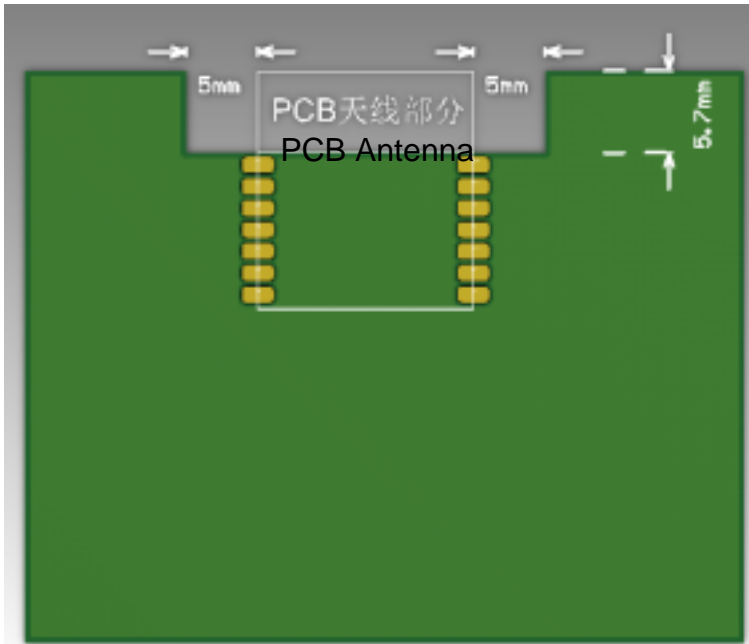
CB3S-NL uses the PCB antenna with a gain of 1.37 dBi.

5.2 Interference reduction

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

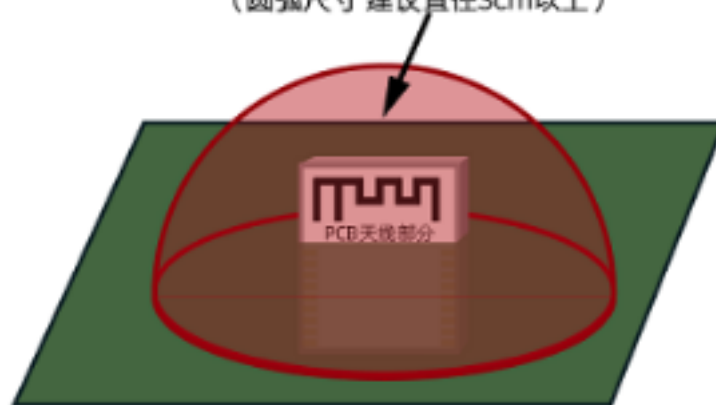
To prevent adverse impact on the antenna radiation performance, avoid copper or traces within the antenna area on the PCB.





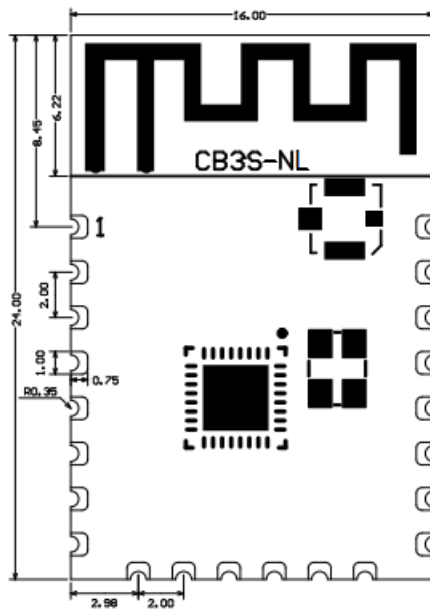
Do not place metal in the red area above the antenna
(Arc size is recommended to be more than 3cm in diameter)

天线以上该红色区域内请勿放置金属
(圆弧尺寸 建议直径3cm以上)



6 Packaging information and production instructions

6.1 Mechanical dimensions



Top View



Side View

单位: mm

Unit: mm

模组外形公差: $\pm 0.35\text{mm}$

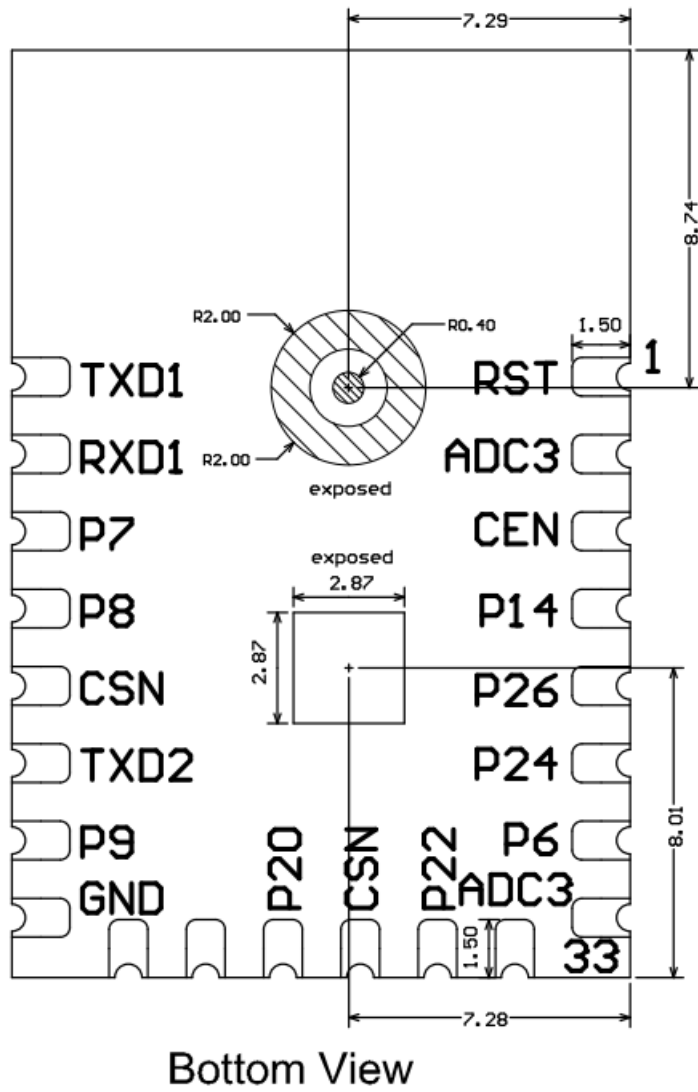
Module form factor tolerance: $\pm 0.35\text{mm}$

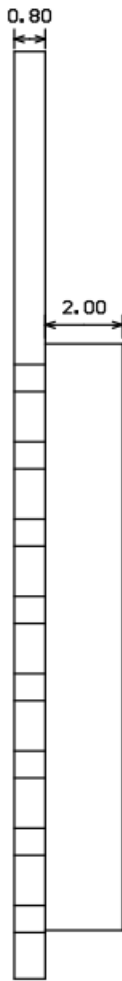
板厚公差: $\pm 0.1\text{mm}$

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

屏蔽盖高度公差: $\pm 0.05\text{mm}$

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





单位: mm

Unit: mm

模组外形公差: $\pm 0.35\text{mm}$

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

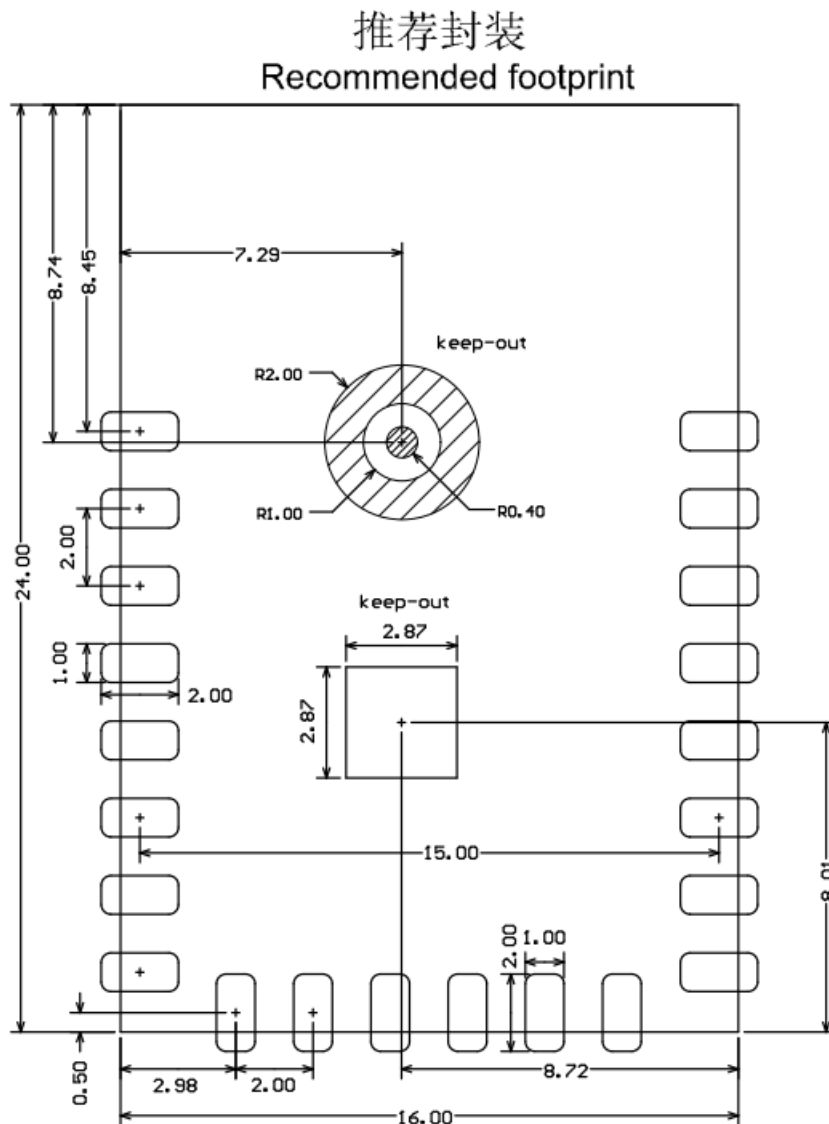
板厚公差: $\pm 0.1\text{mm}$

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

屏蔽盖高度公差: $\pm 0.05\text{mm}$

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

Side View



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 the 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 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 has passed since sealing of the bag.

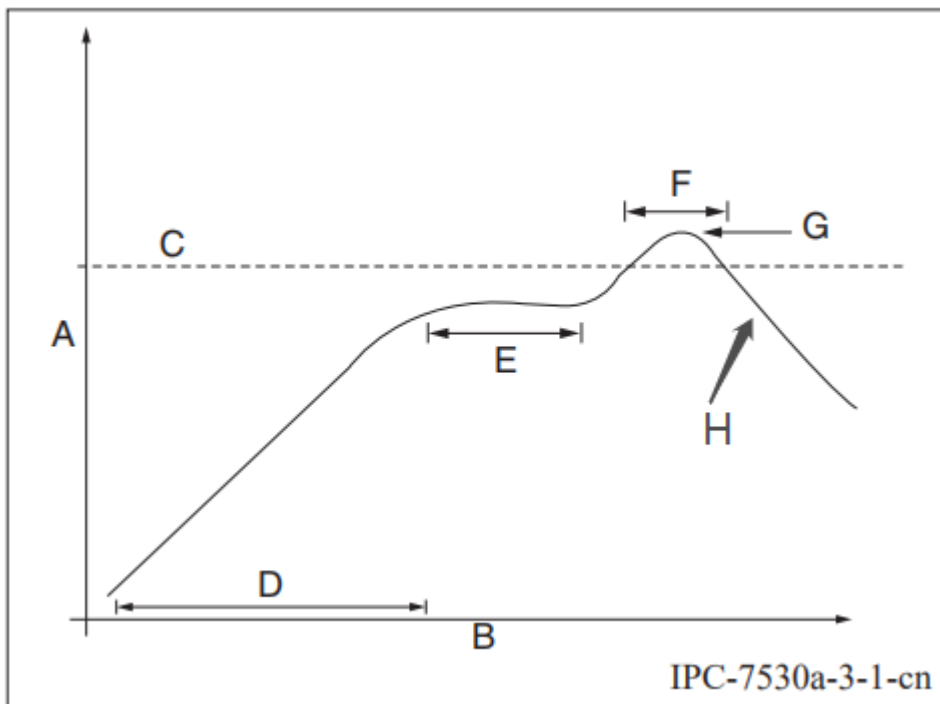
4. Baking settings: -Temperature: 60°C and \leq 5%RH for reel package and 125°C and \leq 5%RH for tray package (please use the heat-resistant tray rather than plastic container)

- 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 outside. 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 temperatures according to the following curve. 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

	Caution This bag contains MOISTURE-SENSITIVE DEVICES	LEVEL 3
		<small>If blank, see adjacent bar code label</small>
<p>1. Calculated shelf life in sealed bag: 12 months at $<40^{\circ}\text{C}$ and $<90\%$ relative humidity (RH)</p> <p>2. Peak package body temperature: <u>260</u> $^{\circ}\text{C}$ <small>If blank, see adjacent bar code label</small></p> <p>3. After bag is opened, devices that will be subjected to reflow solder or other high temperature process must be</p> <p>a) Mounted within: <u>168</u> hours of factory conditions <small>If blank, see adjacent bar code label</small> $\leq 30^{\circ}\text{C}/60\% \text{ RH}$, or</p> <p>b) Stored per J-STD-033</p> <p>4. Devices require bake, before mounting, if:</p> <p>a) Humidity Indicator Card reads $>10\%$ for level 2a - 5a devices or $>60\%$ for level 2 devices when read at $23 \pm 5^{\circ}\text{C}$</p> <p>b) 3a or 3b are not met</p> <p>5. If baking is required, refer to IPC/JEDEC J-STD-033 for bake procedure</p>		
<p style="text-align: center;">See Production Date</p> <p>Bag Seal Date: _____ <small>If blank, see adjacent bar code label</small></p>		
<p style="text-align: center;">Note: Level and body temperature defined by IPC/JEDEC J-STD-020</p>		

7 MOQ and packaging information

Product number	MOQ (pcs)	Shipping packaging method	The number of modules per reel	The number of reels per carton
CB3S-NL	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 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-CB3S-NL. The end product must be labelled in avisible area with the following: “Contains Transmitter Module FCC ID: 2ANDL-CB3S-NL” .

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>.

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



This product must not be disposed of as normal household waste, following 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.