



CB3S Module Datasheet

Version: 20240902

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 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 11@2.4 GHz
- Support WEP, WPA/WPA2, WPA/WPA2 PSK (AES), WPA3 security modes
- Up to +13 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 2.54 dBi
- Working temperature: -40°C to 85°C
- Bluetooth connectivity
- Support the Bluetooth LE V5.2
- Support the transmit power of 6 dBm in the Bluetooth mode
- Complete Bluetooth coexistence interface
- Onboard PCB antenna with a gain of 2.54 dBi

1.2. Applications

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

2.1. Dimensions and package

Unit: mm

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

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

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

| 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 | GPIO_P_26, which corresponds to P26 of the IC, PWM 5 |
| 6 | P24 | I/O | GPIO_P_24, which corresponds to P24 of the IC, PWM 4 |
| 7 | P6 | I/O | GPIO_P_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 | GPIO_P_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 | GPIO_P8, which corresponds to P8 of the IC, PWM 2 |
| 14 | P7 | I/O | GPIO_P7, 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. 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) GPIO_P22, 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.) GPIO_P20, 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 |
|--------------------------------|------------------------|---------------|---------------|------|
| T _s | Storage temperature | −55 | 125 | °C |
| V _{BAT} | Power supply voltage | −0.3 | 3.9 | V |
| ESD voltage (human body model) | T _{AMB} -25°C | −4 | 4 | KV |
| ESD voltage (machine model) | T _{AMB} -25°C | −200 | 200 | V |

3.2. Normal working conditions

| Parameter | Description | Minimum value | Typical value | Maximum value | Unit |
|------------------|-----------------------|-----------------------|---------------|----------------------|------|
| T _a | Working temperature | −40 | - | 85 | °C |
| V _{BAT} | Power supply voltage | 3 | 3.3 | 3.6 | V |
| V _{OL} | I/O low level output | V _{SS} | - | V _{SS} +0.3 | V |
| V _{OH} | I/O high level output | V _{BAT} -0.3 | - | V _{BAT} | V |
| I _{max} | I/O drive current | - | 6 | 20 | mA |

| Parameter | Description | Minimum value | Typical value | Maximum value | Unit |
|-----------|--------------------|---------------|---------------|---------------|-------|
| θ | Power supply slope | 100 | - | - | mV/ms |

3.3. RF power consumption

| Working status | Mode | Rate | Transmit power/ receive | 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 |
|--------------|---------------------------|---------------|----------------------------------|------|
|--------------|---------------------------|---------------|----------------------------------|------|

| 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 |
| Connected | 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 |
|------------------|--|---------------|-------------------------------|------|
| Weakly connected | The module and the hotspot are weakly connected and the Wi-Fi indicator light is always on | 205 | 350 | mA |
| Disconnected | 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 | - | μA |

4. RF parameters

4.1. Basic RF features

| Parameter | Description |
|------------------------|--|
| Working frequency | 2.412 to 2.462 GHz |
| Wi-Fi standard | IEEE 802.11 b/g/n (channels 1 to 11) |
| 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 | - | 13 | - | dBm |
| Average RF output power, 802.11g OFDM Mode 54M | - | 13 | - | dBm |
| Average RF output power, 802.11n OFDM Mode MCS7 | - | 12 | - | 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 |

5. Antenna information

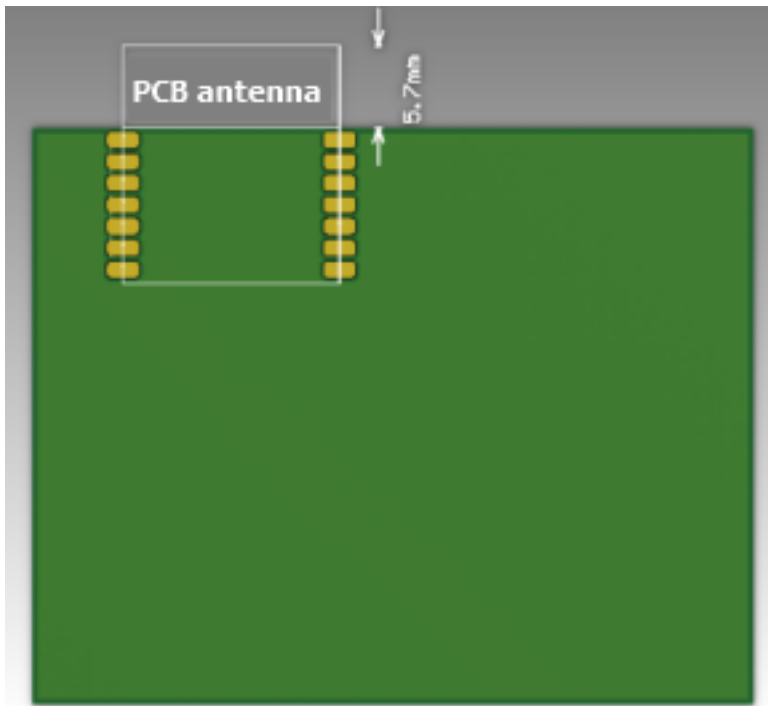
5.1. Antenna type

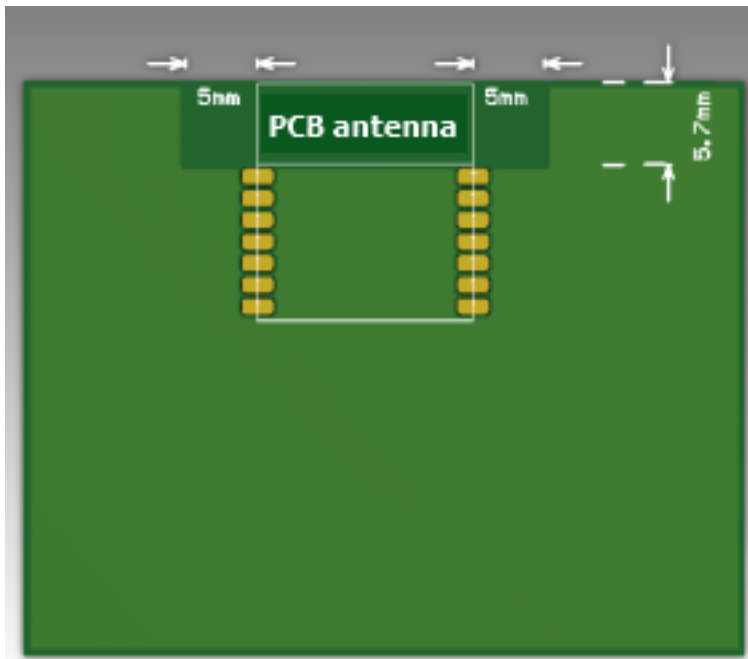
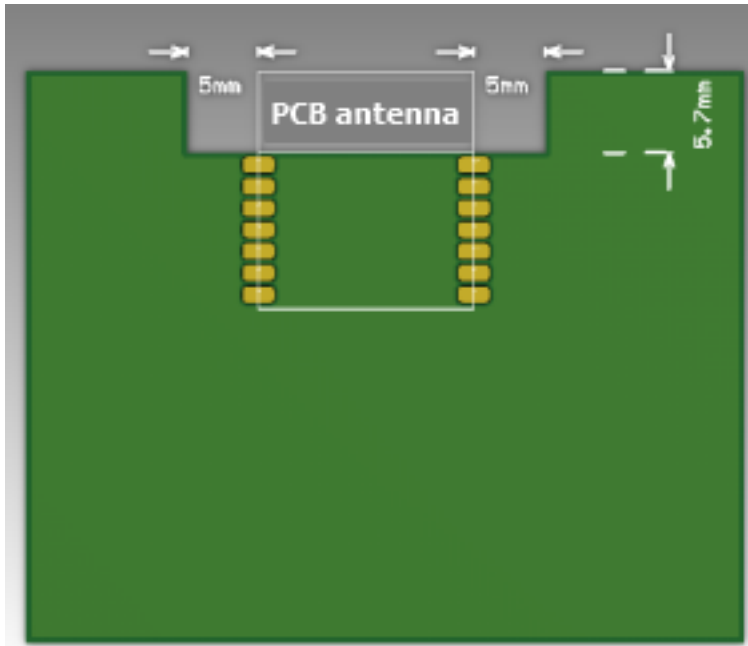
CB3S uses the PCB antenna with a gain of 1.3 dBi.

5.2. Antenna interference reduction

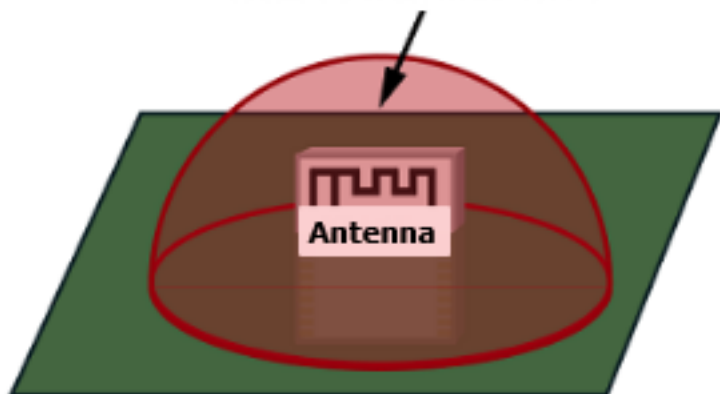
To ensure optimal Wi-Fi performance when the Wi-Fi module uses an onboard PCB antenna, it is recommended that the antenna be at least 15 mm away from other metal parts.

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



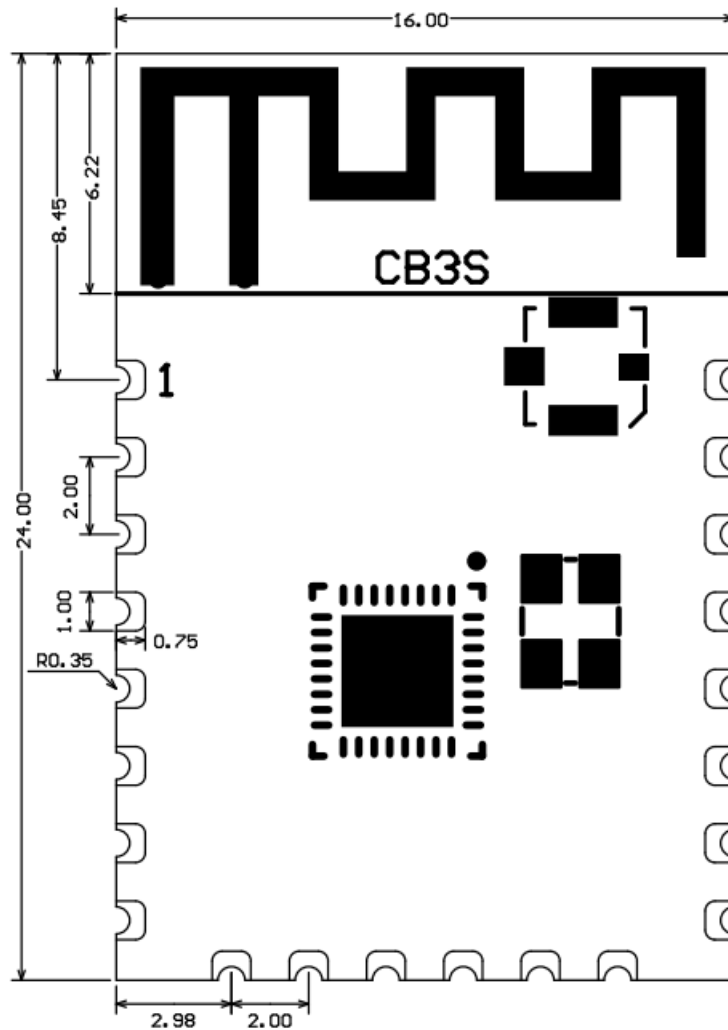


**Do not place any metal in the red area above the antenna.
The recommended diameter of the circular arc is greater than 3 cm.**

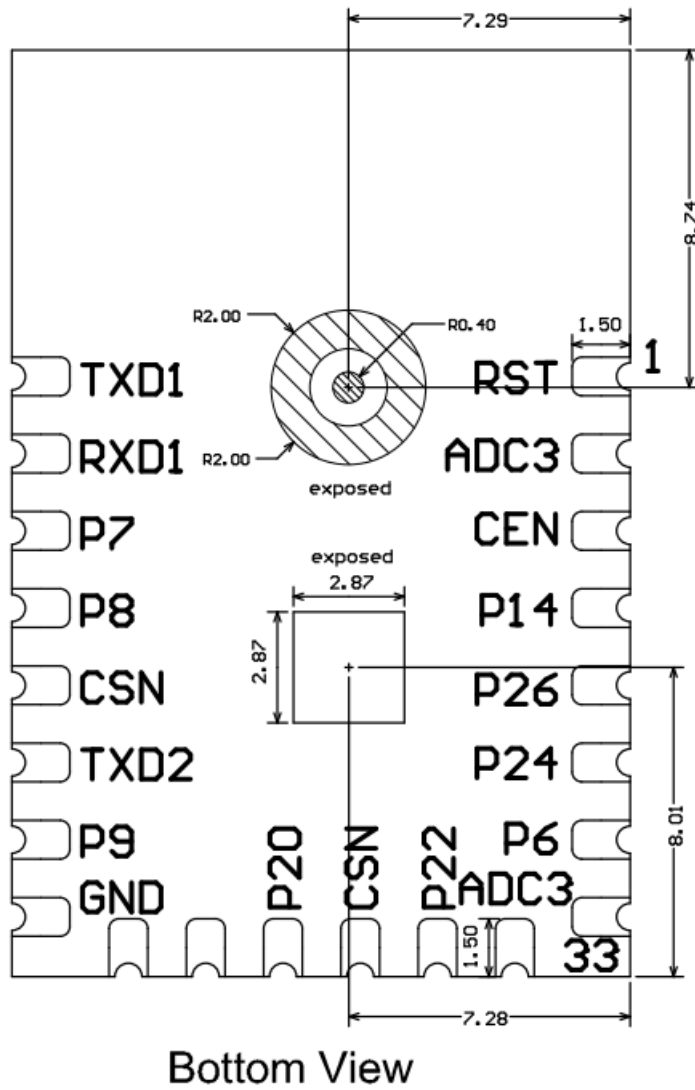


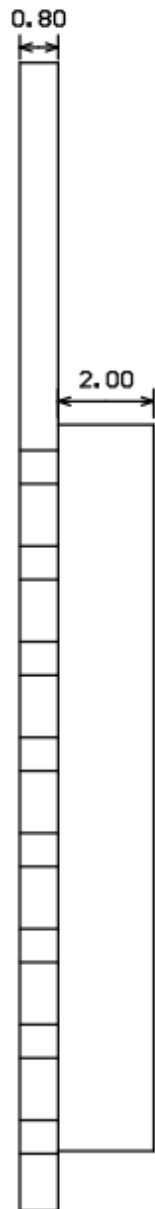
6. Packaging information and production instructions

6.1. Mechanical dimensions



Top View





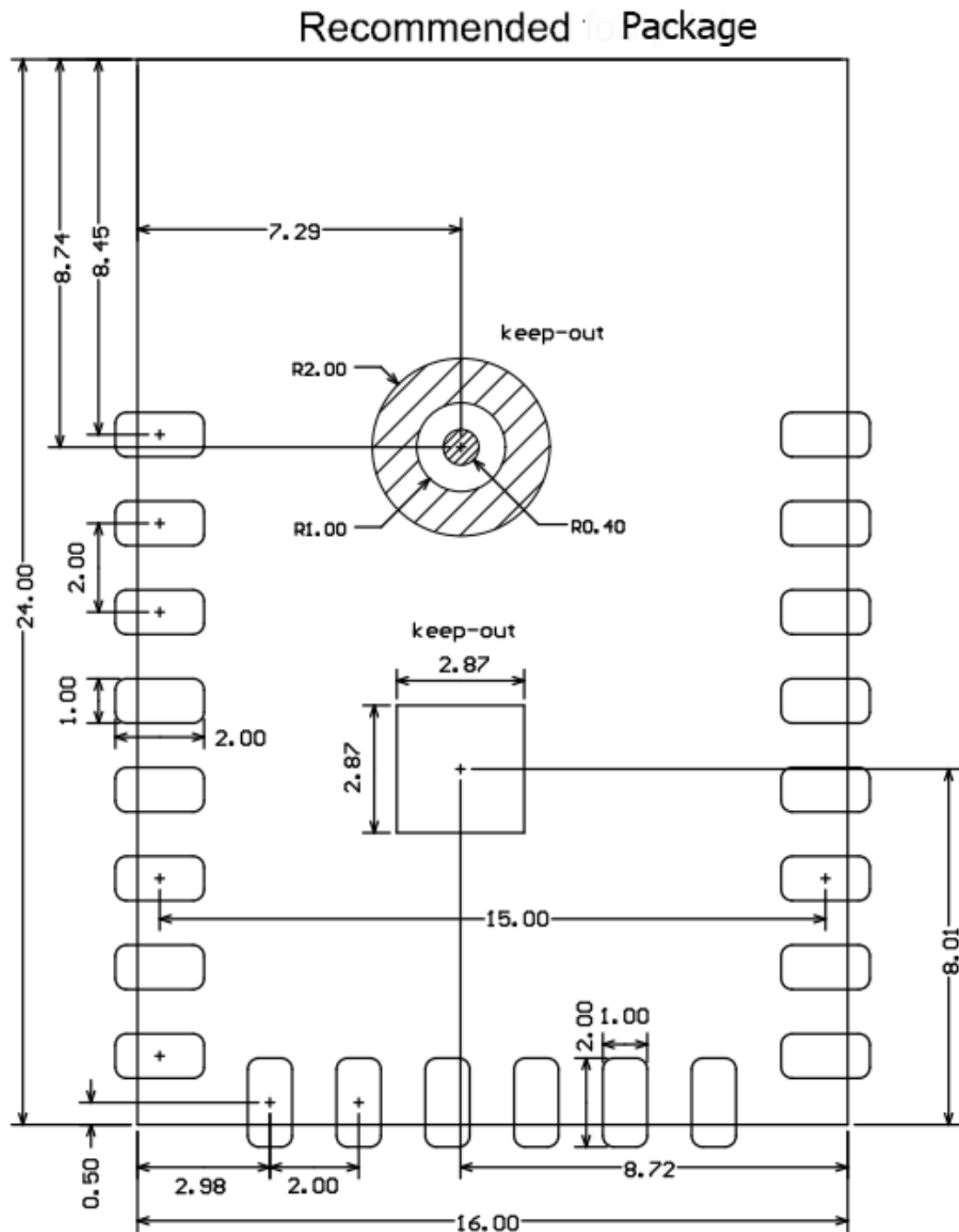
Unit: mm

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

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

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

Side View

**i**

The area indicated as **keep-out** in the diagram above does not require tinning and should not have any traces routed through it.

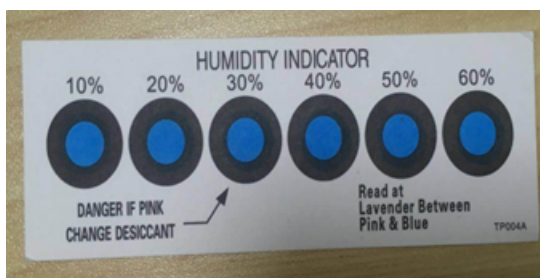
6.2. Production instructions

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.



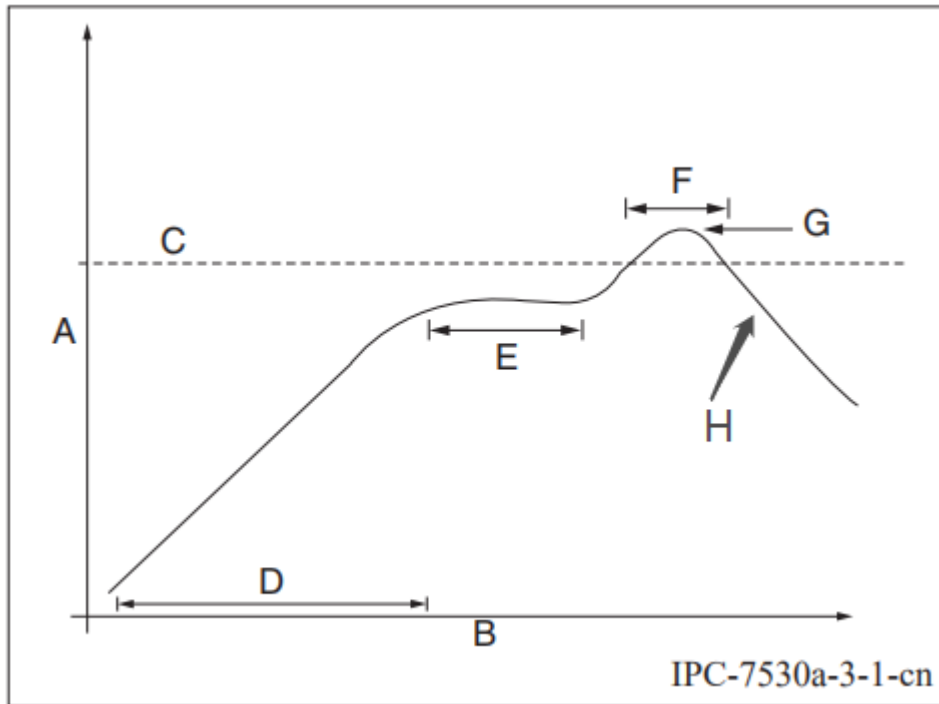
3. The module needs to be baked in the following cases:

- 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: 40°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: 168 hours for reel package and 12 hours for tray package
 - Alarm temperature: 50°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 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

| | | |
|--|---|--|
|  | <h2 style="margin: 0;">Caution</h2> <p style="margin: 0;">This bag contains MOISTURE-SENSITIVE DEVICES</p> | <div style="border: 1px solid black; padding: 5px; display: inline-block;">LEVEL 3</div> <p style="font-size: small; margin-top: 5px;">If blank, see adjacent bar code label</p> |
| <p>1. Calculated shelf life in sealed bag: 12 months at <40°C and <90% relative humidity (RH)</p> | | |
| <p>2. Peak package body temperature: <u>260</u> °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> ≤30°C/60% 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 ± 5°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>Bag Seal Date: <u>See Production Date</u> <small>If blank, see adjacent bar code label</small></p> | | |
| <p>Note: Level and body temperature defined by IPC/JEDEC J-STD-020</p> | | |

7. MOQ and packaging information

| Product model | MOQ (pcs) | Packaging method | Number of modules per reel | Number of reels per carton |
|---------------|-----------|------------------|----------------------------|----------------------------|
| CB3S | 3600 | Tape reel | 900 | 4 |

Integration instructions for host product manufacturers according to KDB 996369 D03 OEMManual v01

Conditions on using Shenzhen Linktop IOT Co., Ltd regulatory approvals:

- A. Customer must ensure that its product (The "WIFI/Bluetooth MODULE") is electrically identical to Shenzhen Linktop IOT Co., Ltd reference designs. Customer acknowledges that any modifications to Shenzhen Linktop IOT Co., Ltd reference designs may invalidate regulatory approvals in relation to the CUSTOMER Product, or may necessitate notifications to the relevant regulatory authorities.
- B. Customer is responsible for ensuring that antennas used with the product are of the same type, with same or lower gains as approved and providing antenna reports to Shenzhen Linktop IOT Co., Ltd.
- C. Customer is responsible for regression testing to accommodate changes to Shenzhen Linktop IOT Co., Ltd reference designs, new antennas, and portable RF exposure safety testing/approvals.
- D. Appropriate labels must be affixed to the CUSTOMER Product that comply with applicable regulations in all respects.
- E. A user's manual or instruction manual must be included with the customer product that contains the text as required by applicable law. Without limitation of the foregoing, an example (for illustration purposes only) of possible text to include is set forth below:

2.2 List of applicable FCC rules

FCC Part 15 Subpart C 15.247

2.3 Specific operational use conditions

Radio Technology: Bluetooth BLE
Operation frequency: 2402-2480MHz
Channel No.: 40 channels
Data rate: 1Mbps
Channel Separation: 2MHz
Modulation: GFSK
Antenna Type: PCB antenna, max gain 2.54dBi.

Radio Technology: 2.4G WIFI
Operation frequency: 2412MHz-2462MHz for IEEE 802.11 b, g, n/HT20
Channel No.: 802.11b/802.11g /802.11n (HT20): 11
Modulation type: IEEE 802.11b: DSSS (CCK, DQPSK, DBPSK)
IEEE 802.11g: OFDM (64QAM, 16QAM, QPSK, BPSK)
IEEE 802.11n: OFDM (64QAM, 16QAM, QPSK, BPSK)
Antenna Type: PCB antenna, max gain 2.54dBi.

The module can be used for mobile or portable applications with a maximum 2.54dBi antenna. The host manufacturer installing this module into their product must ensure that the final composite product complies with the FCC requirements by a technical assessment or evaluation to the FCC rules, including the transmitter operation. The host manufacturer has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user's manual of the end product which integrates this module. The end user manual shall include all required regulatory information/warning as shown in this manual.

2.4 Limited module procedures

Not applicable. The module is a Single module and complies with the requirement of FCC Part 15.212.

2.5 Trace antenna designs

The antenna used is the PCB antenna on the module.

2.6 RF exposure considerations

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. Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with 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 equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment 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 equipment and receiver.
- Connect the equipment 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.

The antennas used for this transmitter must be installed to provide a separation distance of at least 20cm from all persons and must not be located or operating in conjunction with any other antenna or transmitter.

2.7 Antennas

Antenna Specification are as follows:

Antenna Type: PCB antenna

Antenna Gain(Peak):2.54 dBi (Provided by customer)

This device is intended only for host manufacturers under the following conditions:

The transmitter module may not be co-located with any other transmitter or antenna;

As long as the conditions above are met, further transmitter test will not be required. However, the host manufacturer is still responsible for testing their end-product for any additional compliance requirements required with this module installed (for example, digital device emissions, PC peripheral requirements, etc.).

2.8 Label and compliance information

Host product manufacturers need to provide a physical or e-label stating "Contains FCC ID: 2BCSG-BZBK003" With their finished product.

2.9 Information on test modes and additional testing requirements

Radio Technology: Bluetooth BLE

Operation frequency: 2402-2480MHz

Channel No.: 40 channels

Data rate: 1Mbps

Channel Separation: 2MHz

Modulation: GFSK

Antenna Type: PCB antenna, max gain 2.54dBi.

Radio Technology: 2.4G WIFI

Operation frequency: 2412MHz-2462MHz for IEEE 802.11 b, g, n/HT20

Channel No.: 802.11b/802.11g /802.11n (HT20): 11

Modulation type: IEEE 802.11b: DSSS (CCK, DQPSK, DBPSK)

IEEE 802.11g: OFDM (64QAM, 16QAM, QPSK, BPSK)

IEEE 802.11n: OFDM (64QAM, 16QAM, QPSK, BPSK)

Antenna Type: PCB antenna, max gain 2.54dBi.

Host manufacturer must perform test of radiated & conducted emission and

spurious emission, etc according to the actual test modes for a stand-alone modular transmitter in a host, as well as for multiple simultaneously transmitting modules or other transmitters in a host product.

Only when all the test results of test modes comply with FCC requirements, then the end product can be sold legally.

2.10 Additional testing, Part 15 Subpart B disclaimer

The modular transmitter is only FCC authorized for FCC Part 15 Subpart C 15.247 that the host product manufacturer is responsible for compliance to any other FCC rules that apply to the host not covered by the modular transmitter grant of certification. If the grantee markets their product as being Part 15 Subpart B compliant (when it also contains unintentional-radiator digital circuitry), then the grantee shall provide a notice stating that the final host product still requires Part 15 Subpart B compliance testing with the modular transmitter installed.