CB2S-J Module Datasheet

Version: 20230911

Online Version

Contents

CB2S-J module is a Wi-Fi and Bluetooth Low Energy (LE) combo module developed by Tuya Smart. It is composed of a highly integrated radio-frequency identification (RFID) chip BK7231N and a few peripheral components. It can run in Wi-Fi station mode and access point (AP) mode as well as support connection over Bluetooth Low Energy.

1 Overview

CB2S-J has a built-in 32-bit MCU with a maximum running speed of 120 MHz, built-in 2 MB flash memory, and 256 KB RAM. The module supports cloud connectivity, and the MCU’ s extended instructions for signal processing enable it to efficiently implement audio encoding and decoding.

Various peripherals are available, such as PWM and UART. Up to five channels of 32-bit PWM output make the chip ideal for high-quality LED control.

1.1 Features

- Built-in low-power 32-bit CPU that also acts as an application processor.
- Clock rate of 120 MHz.
- Operating voltage range: 3.0V to 3.6V.
- Peripherals: five pulse-width modulators (PWMs) and one universal asynchronous receiver/transmitter (UART) pin.
- Wi-Fi connectivity
  - IEEE 802.11b/g/n.
  - Channels 1 to 14 at 2.4 GHz.
  - Support security protocols including WEP, WPA/WPA2, WPA/WPA2 PSK (AES), and WPA3.
  - The maximum output power is +16 dBm for IEEE 802.11b transmission.
  - Support STA, AP, and STA + AP combo working modes.
  - Two pairing modes are supported, namely Wi-Fi Easy Connect (EZ mode) and access point (AP) mode. Both modes are suitable for pairing with Android and iOS mobile phones.
  - The onboard PCB antenna has a peak gain of -0.26 dBi.
  - Operating temperature range: -40°C to +85°C.
- Bluetooth connectivity
  - Bluetooth Core Specification v5.2.
  - The transmitter power in Bluetooth mode is 6 dBm.
  - Integral Wi-Fi and Bluetooth coexistence interface.
  - The onboard PCB antenna has a peak gain of -0.26 dBi.

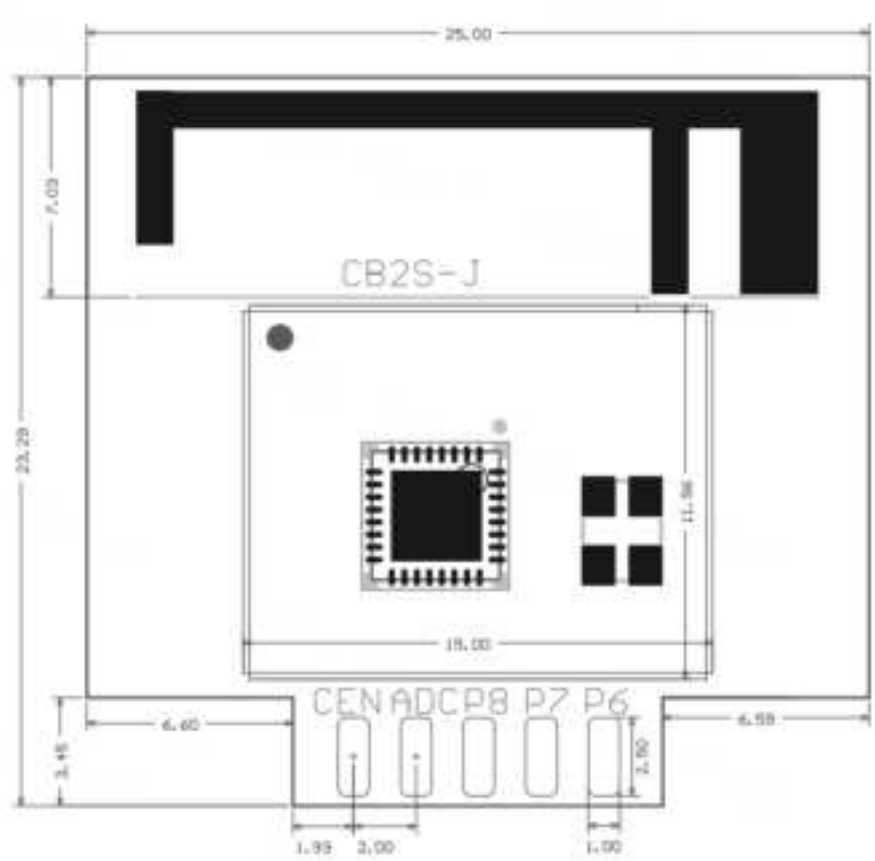
1.2 Scope of applications

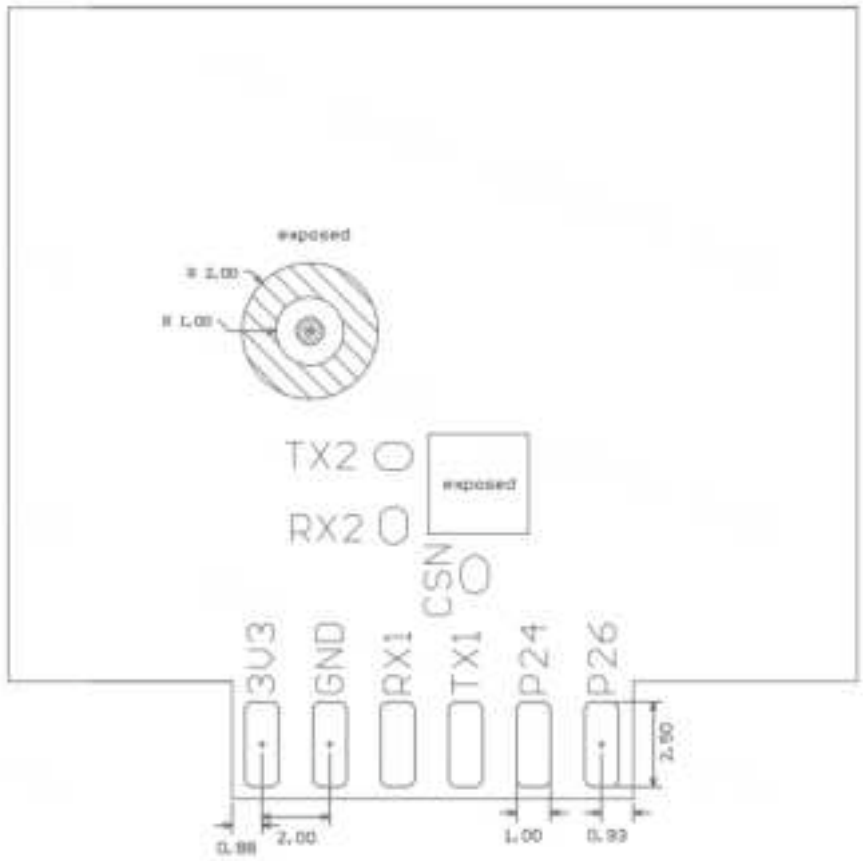
- Smart building
- Smart home and electrical appliance
- Smart socket and light
- Industrial wireless control
- Baby monitor
- IP camera
- Smart bus

2 Module interfaces

2.1 Dimensions and footprint

The CB2S-J dimensions are 25±0.35 mm (W) × 23.3±0.35 mm (L) × 2.3±0.15 mm (H). The following figure shows the dimensions and packaging design of the CB2S-J module.





2.2 Pin definition

Pin No.	Symbol	I/O type	Description
1	3V3	P	3.3V power pin.
2	P6	I/O	Support hardware PWM, corresponding to P6 on the IC.
3	GND	P	Ground pin.
4	P7	I/O	Support hardware PWM, corresponding to P7 on the IC.

Pin No.	Symbol	I/O type	Description
5	RX1	I/O	`UART_RX1` to receive user data, corresponding to Pin 10 on the IC. For more information about MCU general integration, see Hardware Design of CBx Series Modules .
6	P8	I/O	Support hardware PWM, corresponding to P8 on the IC.
7	TX1	I/O	`UART_TX1` to send user data, corresponding to P11 on the IC. For more information about MCU general integration, see Hardware Design of CBx Series Modules .
8	ADC	I/O	ADC pin, corresponding to P23 on the IC.
9	P24	I/O	Support hardware PWM, corresponding to P24 on the IC.
10	CEN	I/O	Reset pin.

Pin No.	Symbol	I/O type	Description
11	P26	I/O	Support hardware PWM, corresponding to P26 on the IC.
Test point	RX2	I/O	`UART_RX2`, corresponding to P1 on the IC. Do not use this pin.
Test point	TX2	I/O	`UART_TX2` supports log printing, corresponding to P0 on the IC.
Test point	CSN	I/O	Mode selection pin. Pulling CSN down before the module is powered on will start the test firmware, while floating it or pulling it up will start the application firmware. This pin is connected to P21 on the IC.

:::info

- `P` indicates the power pin, and I/O indicates the input and output pin.
- For more information about MCU general integration, see Hardware Design of CBx Series Modules.
  :::

3 Electrical parameters

3.1 Absolute electrical parameters

Parameter	Description	Min value	Max value	Unit
Ts	Storage temperature	-55	125	°C
VBAT	Supply voltage	-0.3	3.9	V
Electrostatic discharge voltage (human body model)	TAMB -25°C	-4	4	kV
Electrostatic discharge voltage (machine model)	TAMB -25°C	-200	200	V

3.2 Normal operating conditions

Parameter	Description	Min value	Typical value	Max value	Unit
Ta	Operating tempera-ture	-40	-	85	°C
VBAT	Supply voltage	3	3.3	3.6	V
VOL	I/O low-level output	VSS	-	VSS + 0.3	V

Parameter	Description	Min value	Typical value	Max value	Unit
VOH	I/O high-level output	VBAT − 0.3	-	VBAT	V
Imax	I/O drive current	-	6	20	mA

3.3 Radio frequency (RF) power

Working status	Mode	Rate	Transmit/Receive power	Average value	Peak (Typical) value	Unit
Transmit	11b	11 Mbit/s	+16 dBm	260	300	mA
Transmit	11g	54 Mbit/s	+15 dBm	240	286	mA
Transmit	11n	MCS7	+14 dBm	238	271	mA
Receive	11b	11 Mbit/s	Continuous reception	73	82	mA
Receive	11g	54 Mbit/s	Continuous reception	75	82	mA
Receive	11n	MCS7	Continuous reception	75	82	mA

> In order to test the transmitting operating current, the module is in the state of sending packets at 100% duty cycle.

3.4 Operating current

Work mode	Status (Ta = 25°C)	Average value	Peak (Typical) value	Unit
Quick pairing (Bluetooth)	The module is in EZ mode. The Wi-Fi network status indicator blinks quickly.	63	245	mA
Quick pairing (AP)	The module is in AP mode. The Wi-Fi network status indicator blinks slowly.	80	270	mA
Quick pairing (EZ)	The module is in EZ mode. The Wi-Fi network status indicator blinks quickly.	78	246	mA
Connected	The module is connected to the cloud. The Wi-Fi network status indicator is steady on.	25	342	mA

Work mode	Status (Ta = 25°C)	Average value	Peak (Typical) value	Unit
Weakly connected	The connection between the module and the hotspot is intermittent. The Wi-Fi network status indicator is steady on.	205	350	mA
Disconnected	The module is disconnected from the cloud. The Wi-Fi network status indicator is steady off.	63	242	mA
Module disabled	The module’s clock enable (CEN) pin is pulled down.	330	-	μA

4 RF parameters

4.1 Basic RF features

Parameter	Description
Operating frequency	2.412 to 2.484 GHz
Wi-Fi standard	IEEE 802.11b/g/n (channels 1–14)
Data transmission rate	11b: 1, 2, 5.5, and 11 Mbit/s
	11g: 6, 9, 12, 18, 24, 36, 48, and 54 Mbit/s
	11n: HT20 MCS0–7
Antenna type	PCB antenna

4.2 Wi-Fi transmitter (TX) performance

Parameter	Min value	Typical value	Max value	Unit
RF average output power, 802.11b CCK mode, 11M	-	16	-	dBm
RF average output power, 802.11g OFDM mode, 54M	-	15	-	dBm
RF average output power, 802.11n OFDM mode, MCS7	-	14	-	dBm

Parameter	Min value	Typical value	Max value	Unit
Frequency error	-20	-	20	ppm

4.3 Wi-Fi receiver (RX) performance

Parameter	Min value	Typical value	Max value	Unit
PER < 8%, RX sensitivity, 802.11b DSSS mode, 1M	-	-88	-	dBm
PER < 10%, RX sensitivity, 802.11g OFDM mode, 54M	-	-74	-	dBm
PER < 10%, RX sensitivity, 802.11g OFDM mode, MCS7	-	-73	-	dBm
PER < 10%, RX sensitivity, Bluetooth LE, 1M	-	-96	-	dBm

4.4 Bluetooth transmitter (TX) performance

Parameter	Min value	Typical value	Max value	Unit
Operating frequency	2402	-	2480	MHz

Parameter	Min value	Typical value	Max value	Unit
Transmission rate over the air	-	1	-	Mbit/s
Transmission power	-20	6	20	dBm
Frequency error	-150	-	150	kHz

4.5 Bluetooth receiver (RX) performance

Parameter	Min value	Typical value	Max value	Unit
RX sensitivity	-	-93	-	dBm
Max RF signal input	-10	-	-	dBm
Intermodulation	-	-	-23	dBm
Adjacent-channel rejection ratio	-	10	-	dB

5 Antenna information

5.1 Antenna type

The CB2S-J module uses an onboard PCB antenna.

5.2 Antenna interference reduction

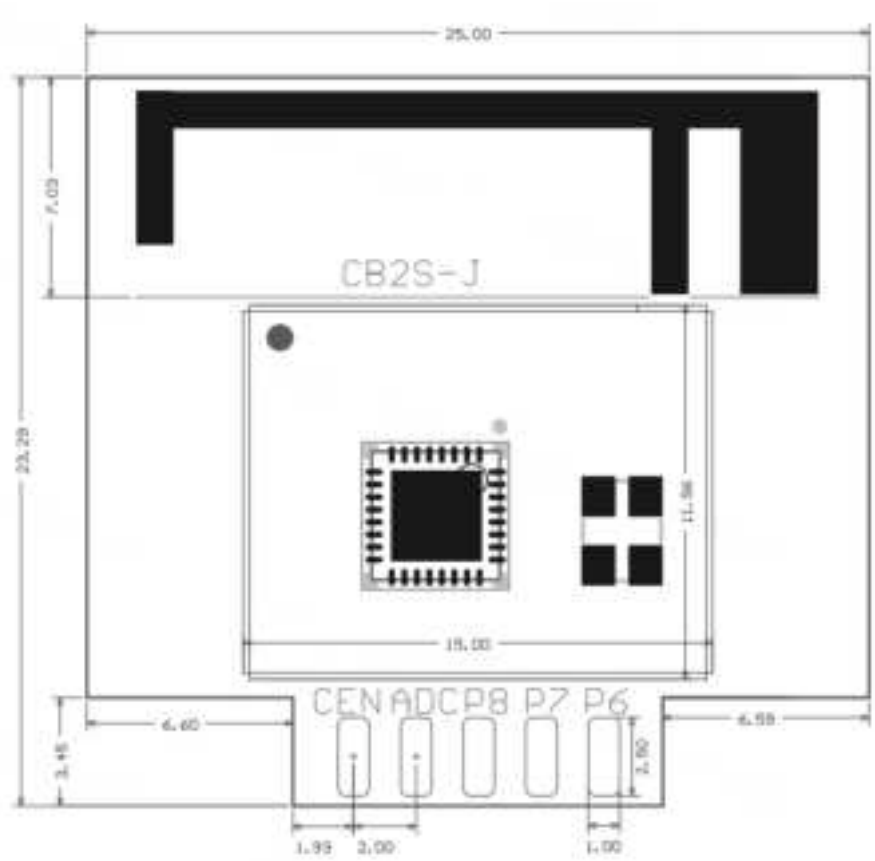
When a PCB antenna is used on a Wi-Fi module, we recommend that the module antenna is at least 15 mm away from other metal components. This can optimize the Wi-Fi performance.

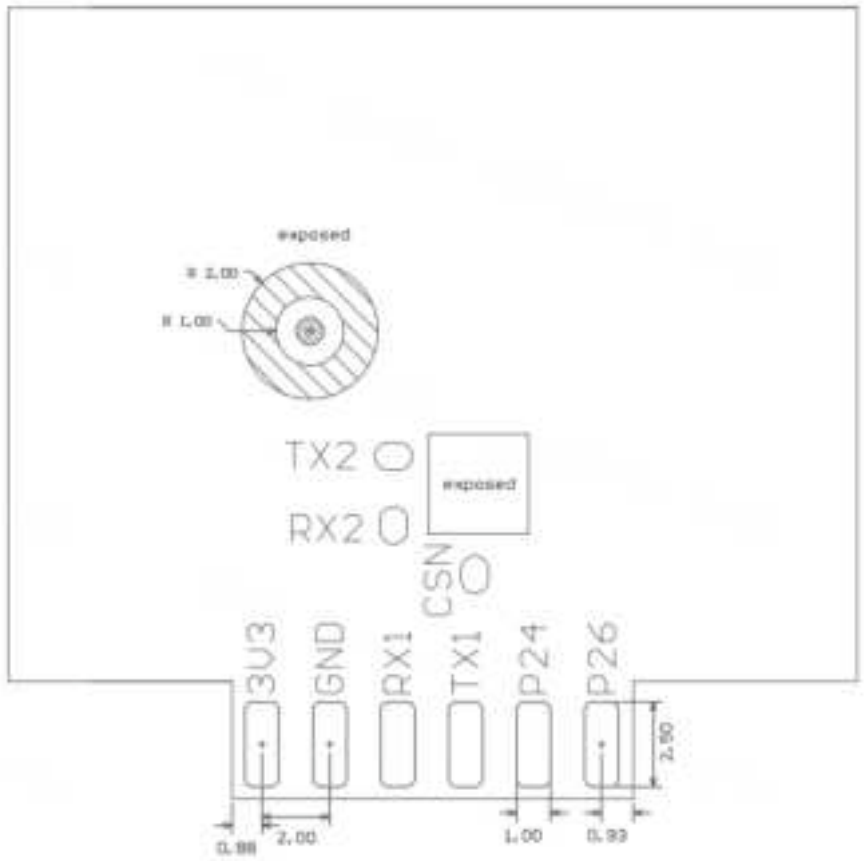
Make sure that the enclosure surrounding the antenna is not traced or filled with copper. Otherwise, the RF performance might be degraded.

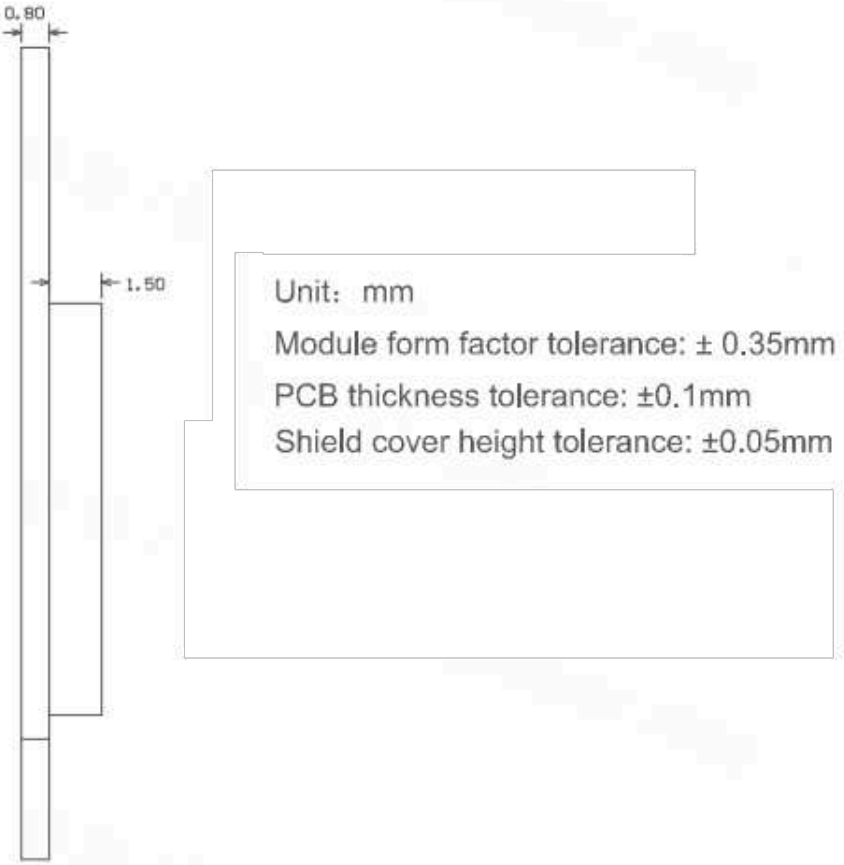
6 Packing and production instructions

6.1 Mechanical dimensions

Dimensions of the CB2S-J PCB are 25±0.35 mm (W) × 23.3±0.35 mm (L) × 0.8±0.1 mm (H).




exposed
TX2
RX2
CSN
exposed
3V3
GND
RX1
TX1
P24
P26
2.50
0.98
2.00
1.00
0.93



6.2 Production instructions

- A **wave soldering device** is recommended to solder Tuya' s DIP modules. Manual soldering is used only when wave soldering is unavailable. Complete soldering within 24 hours after the module is unpacked. Otherwise, place the module in a drying cupboard with a relative humidity level below 10%, or pack the module in vacuum again. Then, record the packing time and duration of exposure. The total exposure time cannot exceed 168 hours.
- Soldering device and materials:
  - Wave soldering device
  - Wave soldering fixture
  - Constant-temperature soldering iron
  - Tin bar, tin wire, and flux

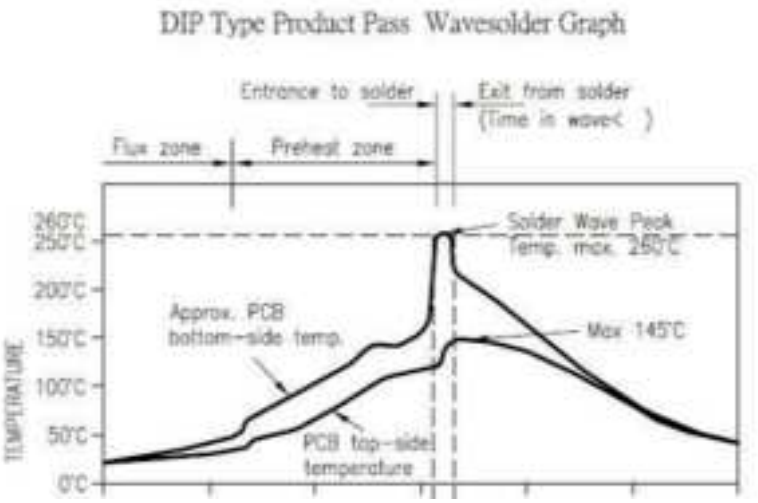
  - Thermal profiler

- Instruments or devices required for the baking process:
  - Cabinet oven
  - Anti-electrostatic and heat-resistant trays
  - Anti-electrostatic and heat-resistant gloves
- The module needs to be baked in the following cases:
  - The vacuum packaging bag is damaged before unpacking.
  - After unpacking, no HIC is found in the packaging bag.
  - After unpacking, the HIC indicates a humidity level of 10% or higher. In this case, the circle turns pink on the HIC.
  - The total exposure time has lasted for over 168 hours since unpacking.
  - More than 12 months have passed since the first sealing of the bag.
- The baking parameter settings are described below:
  - Baking temperature: 40°C for reel packaging with relative humidity ≤ 5%. And 125°C for tray packaging with relative humidity ≤ 5% (use the heat-resistant tray, rather than plastic containers).
  - Baking time: 168 hours for reel packaging and 12 hours for tray packaging.
  - Temperature for triggering an alert: 50°C for reel packaging and 135°C for tray packaging.
  - Production can begin after a module has cooled down to below 36°C under natural conditions.
  - 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 after exposure for more than 168 hours, do not use 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, device failure or poor soldering performance might occur.
- In the whole production process, take electrostatic discharge (ESD) protective measures.
- In order to ensure good product quality, focus on the amount of flux sprayed and peak height during production. Check whether the tin slag and copper contents in the wave soldering tank exceed the standard amount, whether the

fixture opening and thickness are appropriate, and whether the oven temperature curve of the wave soldering is proper.

6.3 Recommended oven temperature curve and temperature

Set the oven temperatures according to the following temperature curve of wave soldering. The peak temperature is 260°C±5°C.



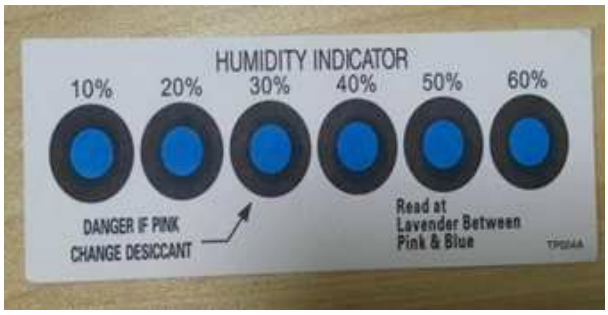
Suggestions on the soldering temperature:

Suggestions on wave soldering		Suggestions on manual soldering	
Preheat temperature	80°C to 130°C	Soldering temperature	360°C ± 20°C
Preheat duration	75s to 100s	Soldering duration	Less than 3s/point
Contact duration at the peak	3s to 5s	N/A	N/A
Solder tank temperature	260 ± 5°C	N/A	N/A
Ramp-up slope	≤ 2°C/s	N/A	N/A
Ramp-down slope	≤ 6°C/s	N/A	N/A

6.4 Storage conditions

A delivered module must meet the following storage requirements:

- The module must be packed in vacuum in a moisture-proof bag and 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.
- A humidity indicator card (HIC) is put in the sealed package.




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

7 MOQ and packaging information

Product model	MOQ (pcs)	Shipping packaging	Modules per reel (pcs)	Reels per carton
CB2S-J	4,400	Tape and reel	1,100	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 to 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 by 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 to 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-CB2S-J. The end product must be labeled in a visible area with the following: “Contains Transmitter Module FCC ID: 2ANDL-CB2S-J”.

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 from the human body.