# CR2S Module Datasheet

Hardware Product Development > Network Modules > Wi-Fi & BLE

Dual Mode Module > CR Series Module

Version: 20210304

Online Version

# Contents

CR2S is a low-power embedded Wi-Fi+BLE module that Tuya has developed. Embedded with the Wi-Fi network protocol stack and rich library functions, it consists of a highly integrated RF chip (RTL8720CM). With the maximum CPU clock rate of 100 MHz, CR2S also contains a low-power Real-M300 (KM4) microcontroller unit (MCU), a WLAN MAC, a 1T1R WLAN, a 4-MB pseudo-static random-access memory (PSRAM), 4-MB flash memory, and rich extensive peripherals.

# 1 Overview

CR2S is an RTOS platform that integrates all function libraries of the Wi-Fi MAC and TCP/IP. You can develop embedded Wi-Fi products as required.

## 1.1 Features

- Embedded low-power KM4 MCU, which can also function as an application processor

  Main clock rate: 100 MHz

- Working voltage: 3.0 to 3.6 V
- Peripherals: 6 (general-purpose input/output) GPIOs and 1 universal asynchronous receiver/transmitter (UART)
- Wi-Fi/Bluetooth connectivity
  - 802.11 B/G/N20
  - Channels 1 to 14@2.4 GHz (CH1 to 11 for US/CA and CH1 to 13 for EU/CN)
  - Support BLE (Bluetooth Low Energy) 4.2
  - Support WEP, WPA, WPA2, and WPA2 PSK (AES) security modes
  - MAX EIRP: + 20dBm output power in 802.11b mode
  - Support SmartConfig functions for Android and iOS devices
  - Onboard PCB antenna
  - Passed CE and FCC certifications
  - Working temperature: -20℃ to 85℃

## 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

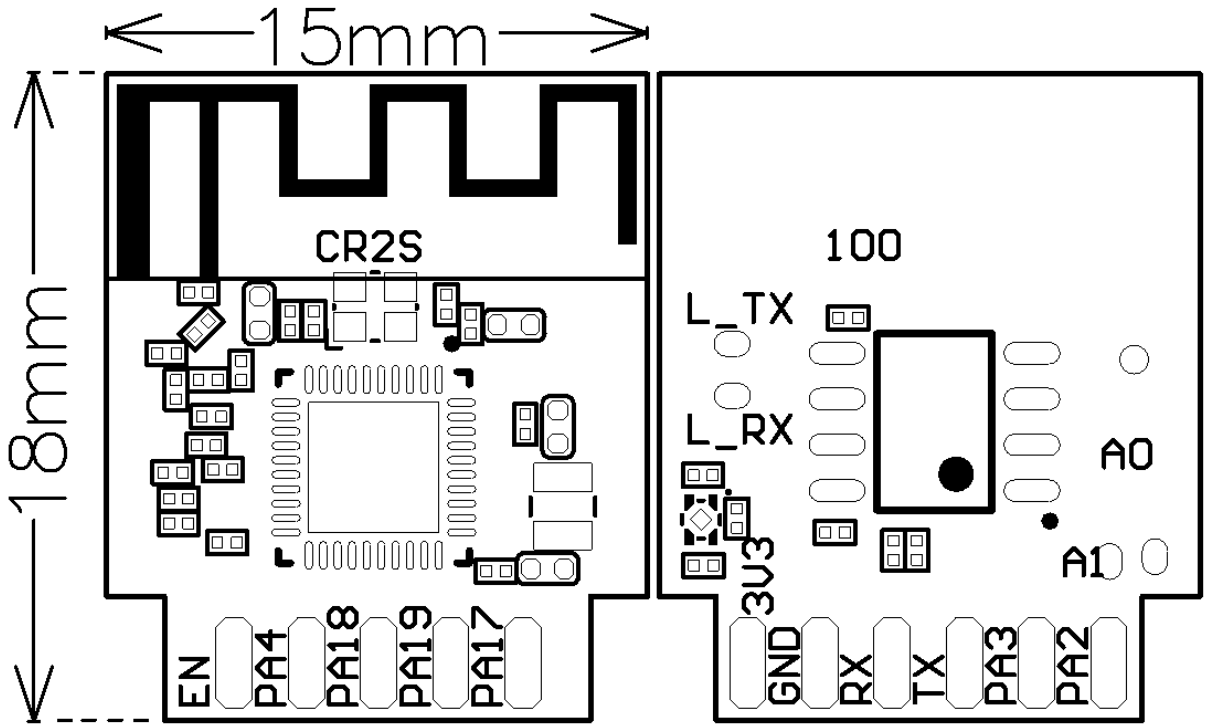
| Update date | Updated content | Version after update |
|---|---|---|
| 2021-01-28 | This is the first release. | V1.0.0 |

## 2 Module interfaces

### 2.1 Dimensions and package

CR2S has 2 rows of pins with a spacing of 2 mm.

The CR2S dimensions are 15±0.35 mm (W)×18±0.35 mm (L)× 4.45±0.15 mm (H). The height of the back panel is 1.55 mm. The dimensions of CR2S are as follows:

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## 2.2 Pin definition

The definition of interface pins is shown in the following table:

| Pin number | Symbol | I/O Type | Function |
|---|---|---|---|
| 1 | 3V3 | P | Power supply pin (3.3V) |
| 2 | PA17 | I/O | GPIOA_17, hardware PWM, IC Pin 38 |
| 3 | GND | P | Power supply reference ground |
| 4 | PA19 | I/O | GPIOA_19, hardware PWM, IC Pin 40 |
| 5 | RX | I/O | GPIOA_13, UART0_RXD (user serial interface) |
| 6 | PA18 | I/O | GPIOA_18, hardware PWM, IC Pin 39 |
| 7 | TX | I/O | GPIOA_14, UART0_TXD (user serial interface) |
| 8 | PA4 | I/O | GPIOA_4, hardware PWM, IC Pin 20 |
| 9 | PA3 | I/O | GPIOA_3, hardware PWM, IC Pin 19 |

| Pin number | Symbol | I/O Type | Function |
|---|---|---|---|
| 10 | EN | I/O | Enabling pin, active at the high level. The module has been pulled to the high level and the user can control the pin externally |
| 11 | PA2 | I/O | GPIOA_2, hardware PWM, IC Pin 18 |

> **Note**: P indicates a power supply pin and I/O indicates an input/output pin.

# 3 Electrical parameters

## 3.1 Absolute electrical parameters

| Parameter | Description | Minimum value | Maximum value | Unit |
|---|---|---|---|---|
| Ts | Storage temperature | -40 | 105 | ℃ |
| VDD | Power supply voltage | -0.3 | 3.6 | V |
| Static electricity discharge voltage (human body model) | TAMB-25℃ | - | 2 | KV |
| Static electricity discharge voltage (machine model) | TAMB-25℃ | - | 0.5 | KV |

## 3.2 Working conditions

| Parameter | Description | Minimum value | Typical value | Maximum value | Unit |
|---|---|---|---|---|---|
| Ta | Working tempera-ture | -20 | - | 85 | ℃ |
| VDD | Working voltage | 3.0 | - | 3.6 | V |

| Parameter | Description | Minimum value | Typical value | Maximum value | Unit | |
|---|---|---|---|---|---|---|
| VIL | I/O low level input | - | - | 0.8 | V | |
| VIH | I/O high level input | 2.0 | - | - | V | |
| VOL | I/O low level output | | - | - | 0.4 | V |
| VOH | I/O high level output | 2.4 | - | - | | V |
| Imax | I/O drive current | - | - | 16 | mA | |
| Cpad | Input pin capaci-tance | - | 2 | - | pF | |

### 3.3 RF power consumption

TX power consumption:

| Symbol | Mode | Power | Average value | Peak value (Typical value) | Unit |
|---|---|---|---|---|---|
| IRF | 11b 11Mbps | 17 dBm | 222 | 256 | mA |
| IRF | 11b 11Mbps | 18 dBm | 237 | 272 | mA |
| IRF | 11g 54Mbps | 15 dBm | 155 | 225 | mA |

| Symbol | Mode | Power | Average value | Peak value (Typical value) | Unit |
|---|---|---|---|---|---|
| IRF | 11g 54Mbps | 17.5 dBm | 173 | 259 | mA |
| IRF | 11n BW20 MCS7 | 13 dBm | 143 | 203 | mA |
| IRF | 11n BW20 MCS7 | 16.5 dBm | 165 | 244 | mA |

RX power consumption:

| Symbol | Mode | Average Value | Peak Value (Typical Value) | Unit |
|---|---|---|---|---|
| IRF | 11B 11M | 62 | 67 | mA |
| IRF | 11G 54M | 61 | 68 | mA |
| IRF | 11N HT20 MCS7 | 62 | 69 | mA |

### 3.4 Working power consumption

| Working mode | Working status, TA = 25°C | Average value | Peak value (Typical value) | Unit |
|---|---|---|---|---|
| Quick network pairing state (EZ) | The module is in the fast network pairing state and the Wi-Fi indicator flashes fast | 77 | 331 | mA |

| Working mode | Working status, TA = 25°C | Average value | Peak value (Typical value) | Unit |
|---|---|---|---|---|
| Idle state | The module is connected to the network and the Wi-Fi indicator is always on | 68 | 321 | mA |
| Network connection operation state | The module is connected to the network and the Wi-Fi indicator is always on | 67 | 316 | mA |
| Disconnected state | The module is disconnected and the Wi-Fi indicator is dark | 67 | 312 | mA |

# 4 RF parameters

## 4.1 Basic RF features

| Parameter | Description |
|---|---|
| Frequency range | 2.400 to 2.4835 GHz |
| Wi-Fi standard | IEEE 802.11b/g/n (channels 1 to 14) |
| Bluetooth standard | Bluetooth 4.2 |
| Data transmission rate | 11b: 1, 2, 5.5, 11 (Mbps) |
| Data transmission rate | 11g: 6, 9, 12, 18, 24, 36, 48, 54 (Mbps) |

| Parameter | Description |
| --- | --- |
| Data transmission rate | 11n: HT20 MCS0 to 7 |
| Antenna type | PCB antenna with a peak gain of 1.7 dBi |

### 4.2 TX performance

TX performance

| Parameter | Minimum value | Typical value | Maximum value | Unit |
| --- | --- | --- | --- | --- |
| Average RF output power, 802.11b CCK Mode 1M | - | 17.5 | - | dBm |
| Average RF output power, 802.11g OFDM Mode 54M | - | 14.5 | - | dBm |
| Average RF output power, 802.11n OFDM Mode MCS7 | - | 13.5 | - | dBm |
| Average RF output power, BLE 4.2 1M | - | 6.5 | - | dBm |
| Frequency error | -20 | - | 20 | ppm |

| Parameter | Minimum value | Typical value | Maximum value | Unit |
|---|---|---|---|---|
| EVM@802.11b CCK 11 Mbps Mode 17.5 dBm | - | - | -10 | dB |
| EVM@802.11g OFDM 54 Mbps Mode 14.5 dBm | - | - | -29 | dB |
| EVM@802.11n OFDM MCS7 Mode 13.5 dBm | - | - | -30 | dB |

RX Performance

| Parameter | Minimum Value | Typical Value | Maximum Value | Unit |
|---|---|---|---|---|
| PER<8%, RX sensitivity, 802.11b CCK Mode 1M | - | -97 | - | dBm |
| PER<10%, RX sensitivity, 802.11g OFDM Mode 54M | - | -75 | - | dBm |
| PER<10%, RX sensitivity, 802.11n OFDM Mode MCS7 | - | -72 | - | dBm |

| Parameter | Minimum Value | Typical Value | Maximum Value | Unit |
|---|---|---|---|---|
| PER<10%, RX sensitivity, BLE 4.2 1M | - | -93 | - | dBm |

# 5 Antenna information

## 5.1 Antenna type

CR2S uses only an onboard PCB antenna with a peak gain of 1.7 dBi.

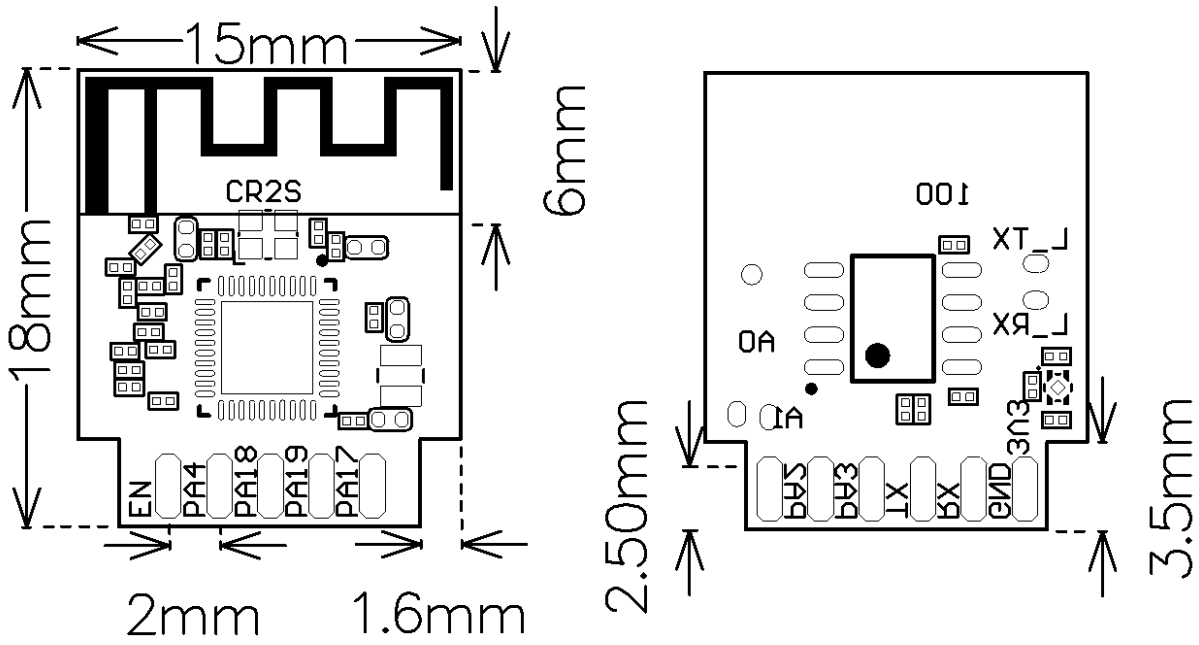
## 5.2 Antenna interference reduction

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.

# 6 Packaging information and production instructions

## 6.1 Mechanical dimensions

The mechanical dimensions of the PCB of CR2S are 15±0.35 mm (W)×18±0.35 mm (L) ×0.8±0.1 mm (H). The following figure shows the mechanical dimensions of CR2S:

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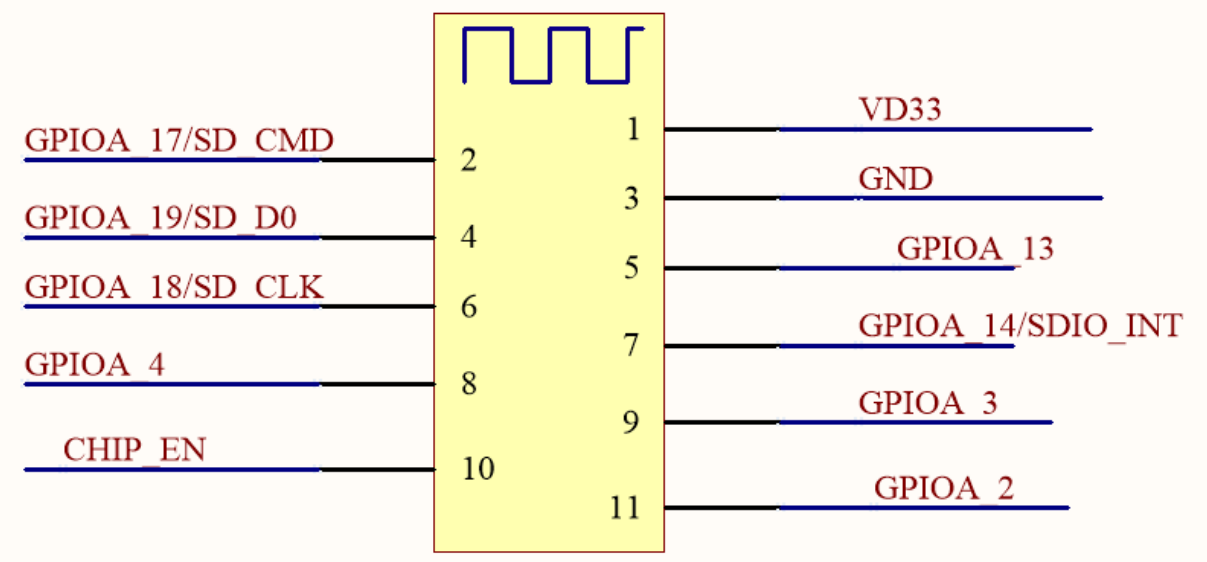
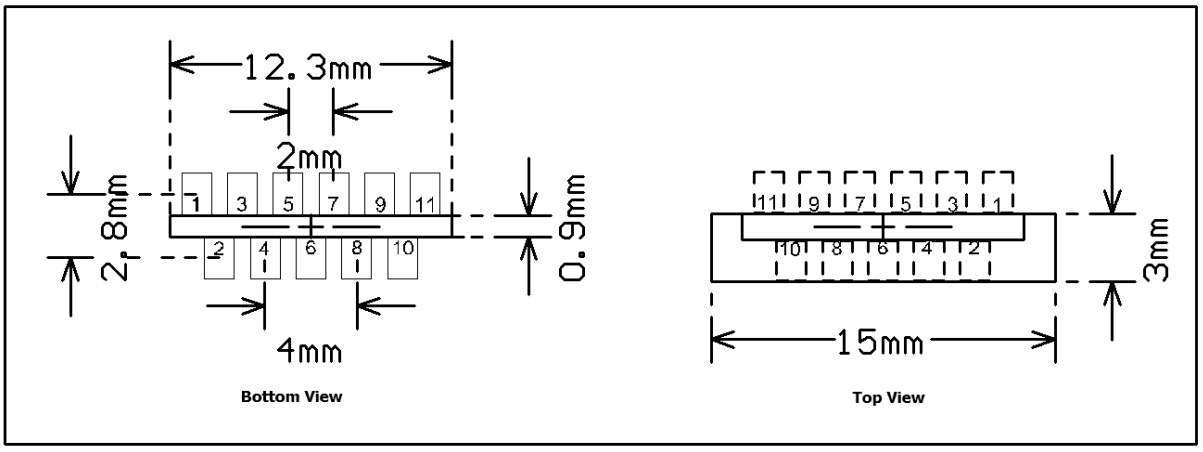
> **Note**: The default dimensional tolerance is ±0.35 mm. If you have specific requirements on dimensions, make them clear in the module datasheet after communication.

## 6.2 Recommended PCB packaging

The following figure is a schematic diagram of CR2S which shows how pins correspond to each other:




The following is the diagram of the packaging of the PCB of CR2S:




### 6.3 Production instructions

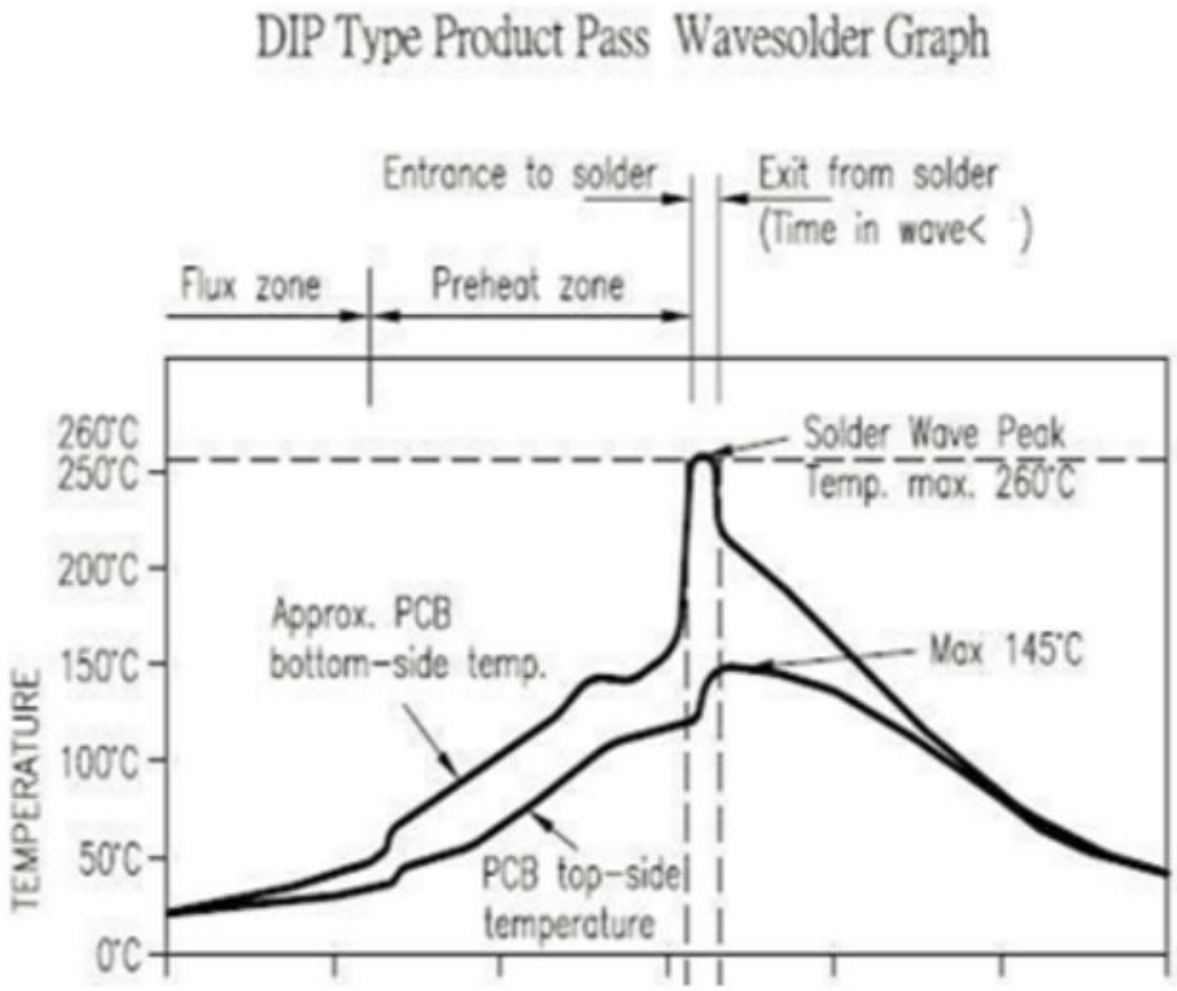
1. For the in-line module developed by Tuya, wave soldering equipment is most preferred and manual soldering is less preferred. After being unpacked, the module must be soldered within 24 hours; otherwise, it needs to be packaged again under vacuum.
2. Soldering equipment and materials:
   - Wave soldering equipment:
     - Wave soldering fixture
     - Constant-temperature soldering iron

  - Tin bar, tin wire, and flux
  - Oven temperature tester
- Baking equipment:
  - Cabinet oven
  - Anti-static heat-resistant trays
  - Anti-static heat-resistant gloves

3. The module developed by Tuya needs to be baked in the following cases:
   - Vacuum packaging bag was damaged before unpacking.
   - There is no humidity indicator card (HIC) in the vacuum packaging bag.
   - After unpacking, 30% and above circles on the HIC become pink.
   - Production is not completed within 72 hours after unpacking.
   - More than 6 months have passed since the sealing date of the bag.
4. Baking settings:
   - Baking temperature: reel packing 65±5℃, pallet packing 125±5℃
   - Baking time: reel packing 48 hours, pallet packing 12 hours
   - Alarm temperature: reel packing 70℃, pallet packing 130℃
   - Production ready temperature after natural cooling: < 36°C
   - The number of drying times: 1
   - Rebaking condition: The module is not soldered within 72 hours after baking.
5. Do not use wave soldering to process modules that have been unpacked for more than 3 months, because electroless nickel/immersion gold (ENIG) is used for PCBs and they will seriously be oxidized for more than 3 months. The wave soldering is very likely to cause pseudo and missing soldering. Tuya is not liable for such problems and consequences.
6. In the production process, take electrostatic discharge (ESD) protective measures.
7. To ensure the quality of products, you should pay attention to the amount of soldering flux, the wave peak, whether the content of the tin slag and copper in the wave soldering tank exceeds the standards, whether the window and thickness of the wave soldering fixture are appropriate, and whether the wave soldering oven temperature curve is reasonable.

### 6.4 Recommended oven temperature curve and temperature

For oven temperature setting, refer to oven temperatures for wave soldering. The peak temperature is 260℃±5℃. The wave soldering temperature curve is as below:

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Recommended soldering temperature:

Recommended wave soldering oven temperature curve

Recommended manual soldering temperature curve

Pre-heat temperature

80 to 130℃

Soldering temperature

360℃±20℃

</ tr>

Pre-heat time

75 to 100s

Soldering time

<3s/point

Peak contact time

3 to 5s

NA

NA

Temperature of tin tank

260±5℃

NA

NA

Ramp-up slope

≤2℃/s

NA

NA

Cooling slope

≤6℃/s

NA

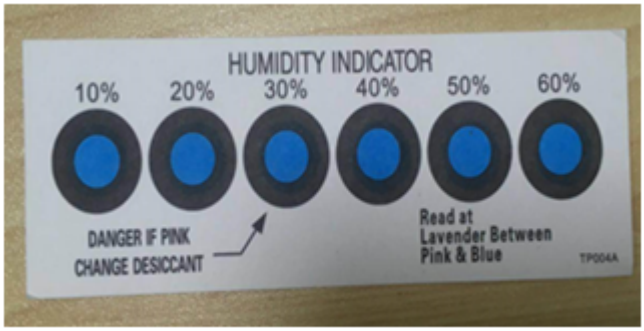
NA

### 6.5 Storage conditions

Storage conditions for a delivered module are as follows:

- The moisture-proof bag is placed in an environment where the temperature is less than 30°C and the relative humidity is less than 70%.
- The shelf life of a dry-packaged product is 6 months from the date when the product is packaged and sealed.

- The package contains a humidity indicator card (HIC).




# 7 MOQ and packaging information

| Product number | MOQ (pcs) | Shipping packaging method | The number of modules per reel | The number of reels per carton |
|---|---|---|---|---|
| CR2S | 4400 | Tape reel | 1100 | 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-CR2S. The end product must be labeled in a visible area with the following: “Contains Transmitter Module FCC ID: 2ANDL-CR2S”.

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.