WBRU Module Datasheet

Version: 20210525

Contents

WBRU is a low-power-consumption embedded Wi-Fi+Bluetooth 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 (W701H-VT2-CG).

1 Overview

With the maximum CPU clock rate of 100 MHz, WBRU also contains a low-power-consumption KM4 MCU, a WLAN MAC, a 1T1R WLAN, a 256-KB SRAM, a 2-MB flash memory, and extensive peripherals.

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

1.1 Features

- Embedded low-power-consumption KM4 MCU, which can also function as an application processor Main clock rate: 100 MHz
- Working voltage: 3.0 to 3.6 V
- Peripherals: 14 GPIOs, 1 UART, and 1 log transmitter
- Wi-Fi and 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 WEP, WPA, WPA2, and WPA2 PSK (AES) security modes
  - Support Bluetooth Low Energy 4.2
  - Up to + 20 dBm output power in 802.11b mode
  - Support the SmartConfig function 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

2 Module interfaces

2.1 Dimensions and package

WBRU has 3 rows of pins. The spacing of pins at the two sides is 1.4 mm, and the spacing of pins at the bottom is 1.8 mm.

The dimensions of WBRU are 15.8±0.35 mm (W)×20.3±0.35 mm (L) ×2.7±0.15 mm (H). The dimensions of WBRU are as follows:
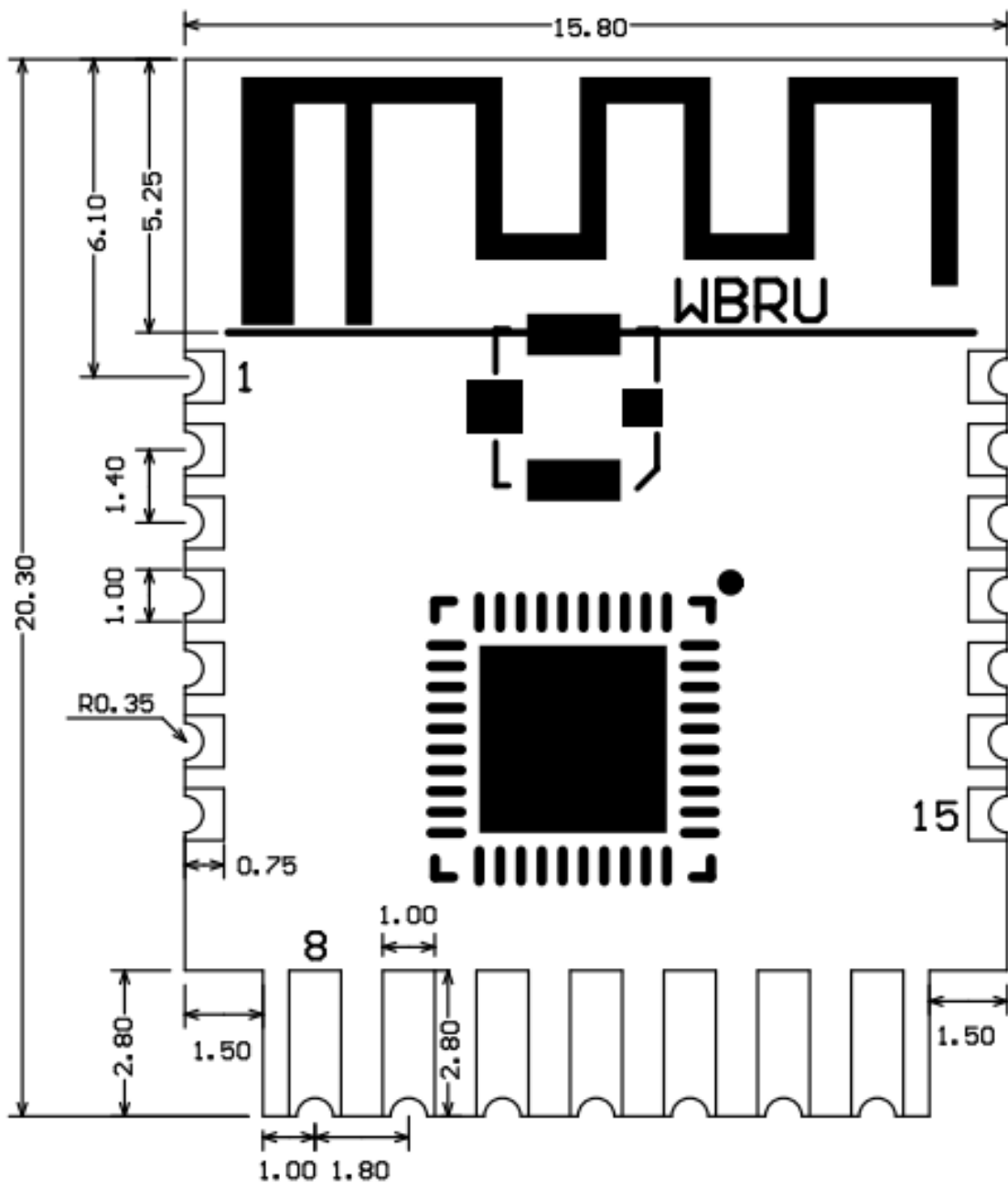
Top View

2.2 Pin definition

Pin number	Symbol	II/O type	Function
1	PA8	I/O	GPIOA_8, common GPIO, which can be reused as SPI_SCK and corresponds to Pin 22 of the IC
2	PA9	I/O	GPIOA_9, common GPIO, which can be reused as SPI_MOSI and corresponds to Pin 23 of the IC
3	PA2	I/O	GPIOA_2, hardware PWM, correspond to Pin 18 of the IC
4	PA3	I/O	GPIOA_3, hardware PWM, correspond to Pin 19 of the IC
5	PA4	I/O	GPIOA_4, hardware PWM, correspond to Pin 20 of the IC
6	L_RX	I/O	GPIOA_15, UART_Log_RXD (used to receive the external logs of the module), which can be configured as a common GPIO

Pin number	Symbol	II/O type	Function
7	L_TX	I/O	GPIOA_16, UART_Log_TXD (used to send the internal logs of the module), which can be configured as a common GPIO
8	PA11	I/O	GPIOA_11, hardware PWM, correspond to Pin 25 of the IC
9	PA12	I/O	GPIOA_12, hardware PWM, correspond to Pin 26 of the IC
10	PA17	I/O	GPIOA_17, hardware PWM, correspond to Pin 38 of the IC
11	PA18	I/O	GPIOA_18, hardware PWM, correspond to Pin 39 of the IC
12	PA19	I/O	GPIOA_19, hardware PWM, correspond to Pin 40 of the IC
13	GND	P	Power supply reference ground
14	VCC	P	Power supply pin (3.3V)

Pin number	Symbol	II/O type	Function
15	TX	I/O	GPIOA_14, UART0_TXD (user serial interface)
16	RX	I/O	GPIOA_13, UART0_RXD (user serial interface)
17	PA20	I/O	GPIOA_20, common GPIO, correspond to Pin 1 of the IC
18	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
19	PA0	I/O	GPIOA_0, not recommend to pull it to the high level. If it is pulled to a high level, it will enter the test mode. Correspond to Pin 15 of the IC

Pin number	Symbol	II/O type	Function
20	PA10	I/O	GPIOA_10, common GPIO, which can be reused as SPI_MISO and corresponds to Pin 24 of the IC
21	PA7	I/O	GPIOA_7, hardware PWM, which can be reused as SPI_CS and corresponds to Pin 21 of the IC

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	125	℃
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 temperature	-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 capacitance	-	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	217	268	mA
IRF	11b 11Mbps	18 dBm	231	283	mA
IRF	11g 54Mbps	15 dBm	159	188	mA

Symbol	Mode	Power	Average value	Peak value (Typical value)	Unit
IRF	11g 54Mbps	17.5 dBm	177	213	mA
IRF	11n BW20 MCS7	13 dBm	145	167	mA
IRF	11n BW20 MCS7	16.5 dBm	165	193	mA

RX power consumption:

Symbol	Mode	Average value	Peak value (Typical value)	Unit
IRF	11B 11M	63	65	mA
IRF	11G 54M	65	67	mA
IRF	11N HT20 MCS7	65	67	mA

3.4 Working power consumption

Working mode	Working status, TA = 25°C	Average value	Peak value (Typical value)	Unit
Quick network connection state (EZ)	The module is in the fast network connection state and the Wi-Fi indicator flashes fast	75	324	mA

Working mode	Working status, TA = 25°C	Average value	Peak value (Typical value)	Unit
No operation during network connection	The module is connected to the network and the Wi-Fi indicator is always on	64	314	mA
Operations are being performed during network connection	The module is connected to the network and the Wi-Fi indicator is always on	66	305	mA
Disconnected state	The module is disconnected and the Wi-Fi indicator is off	66	309	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)
Data transmission rate	11n: HT20 MCS0 to 7

Parameter	Description
Antenna type	PCB antenna with a gain of 1.2 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, Bluetooth 4.2 1M	-	6.5	-	dBm
Frequency error	-20	-	20	ppm
EVM@802.11b CCK 11 Mbps Mode 17.5 dBm	-	-	-10	dB

Parameter	Minimum value	Typical value	Maximum value	Unit
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
PER<10%, RX sensitivity, Bluetooth 4.2 1M	-	-93	-	dBm

5 Antenna information

5.1 Antenna type

WBRU uses only the onboard PCB antenna with a gain of 1.2 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.
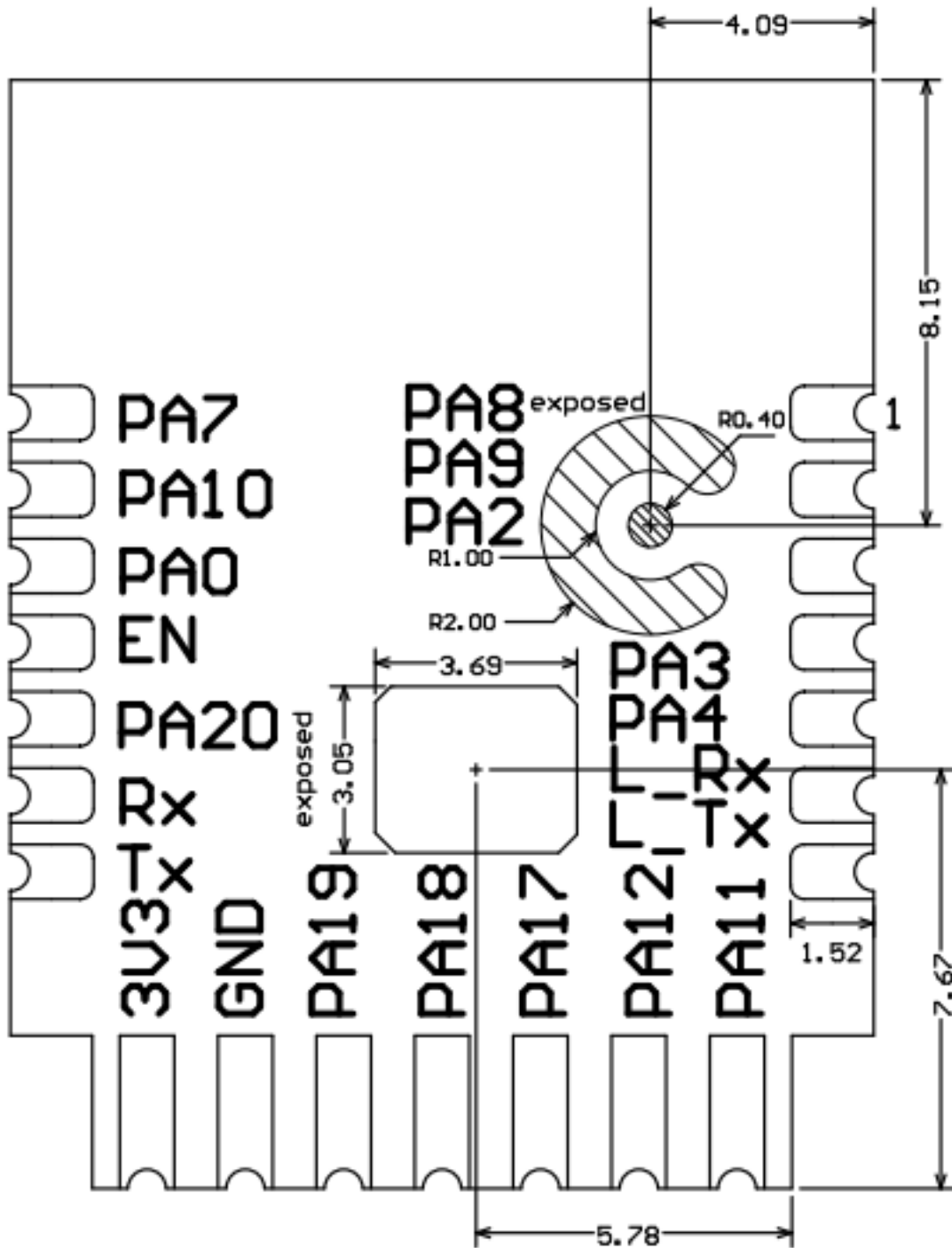
6 Packaging information and production instructions

6.1 Mechanical dimensions

The mechanical dimensions of the PCB of WBRU are 15.8±0.35 mm (W)×20.3±0.35 mm (L) ×1.0±0.1 mm (H). The following figure shows the mechanical dimensions of WBRU:
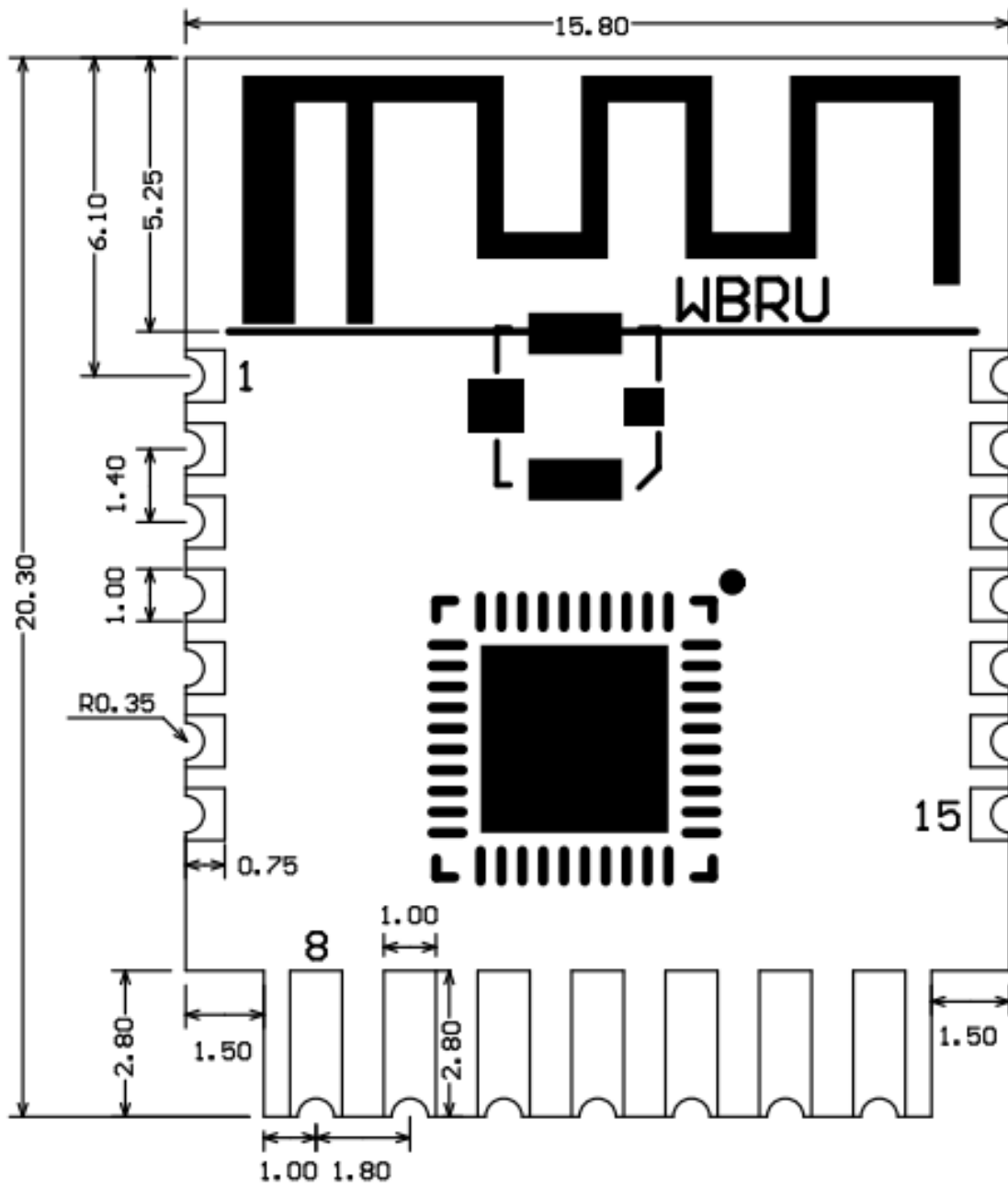
Top View

Bottom View

1.00

1.70

Unit: mm

Module form factor tolerance: ± 0.35mm

PCB thickness tolerance: ±0.1mm

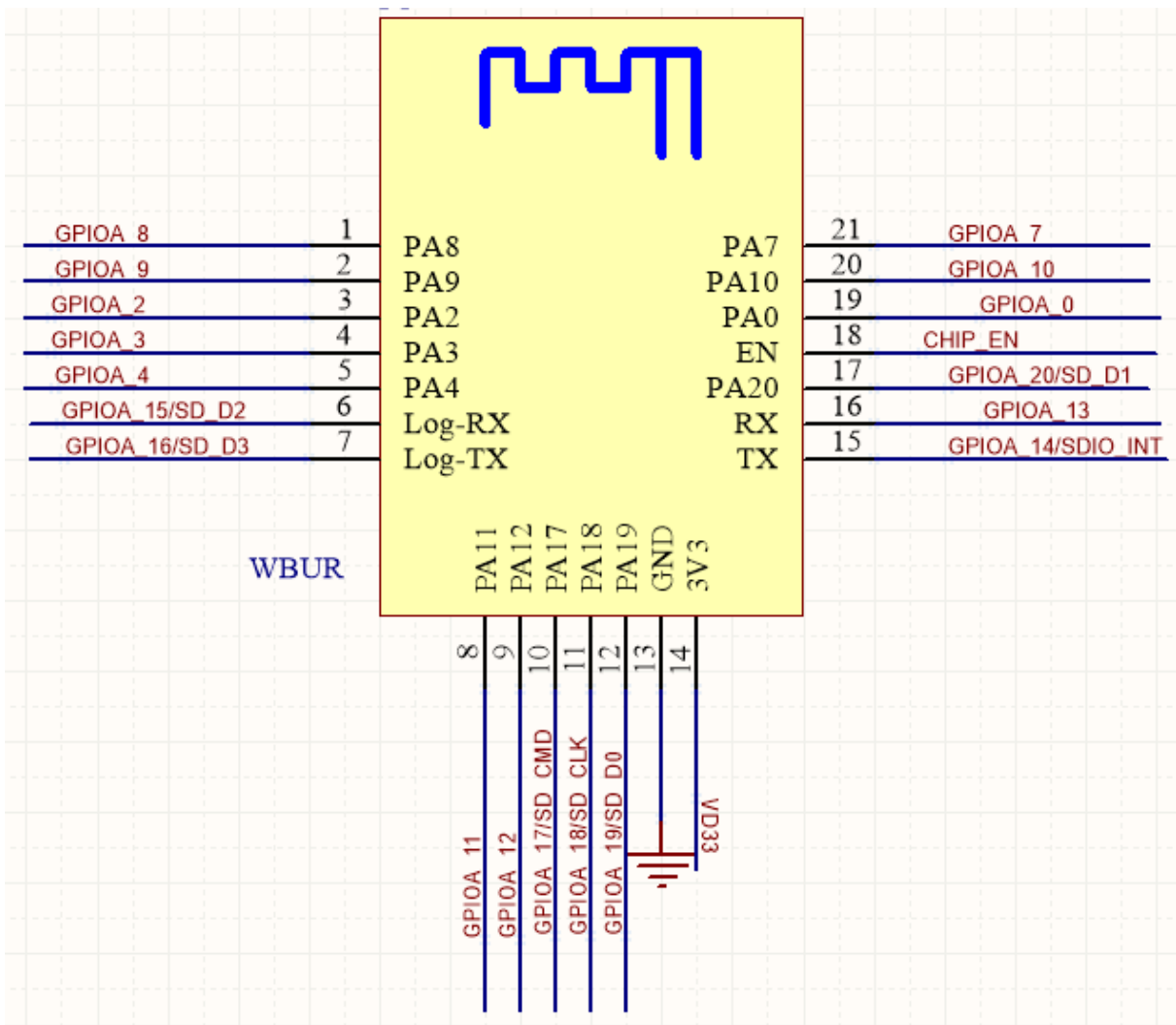Shield case height tolerance: ±0.05mm

Side View

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

6.2 Recommended PCB packaging

The following figure is the schematic diagram of WBRU:

The following figure is the diagram of PCB packaging:
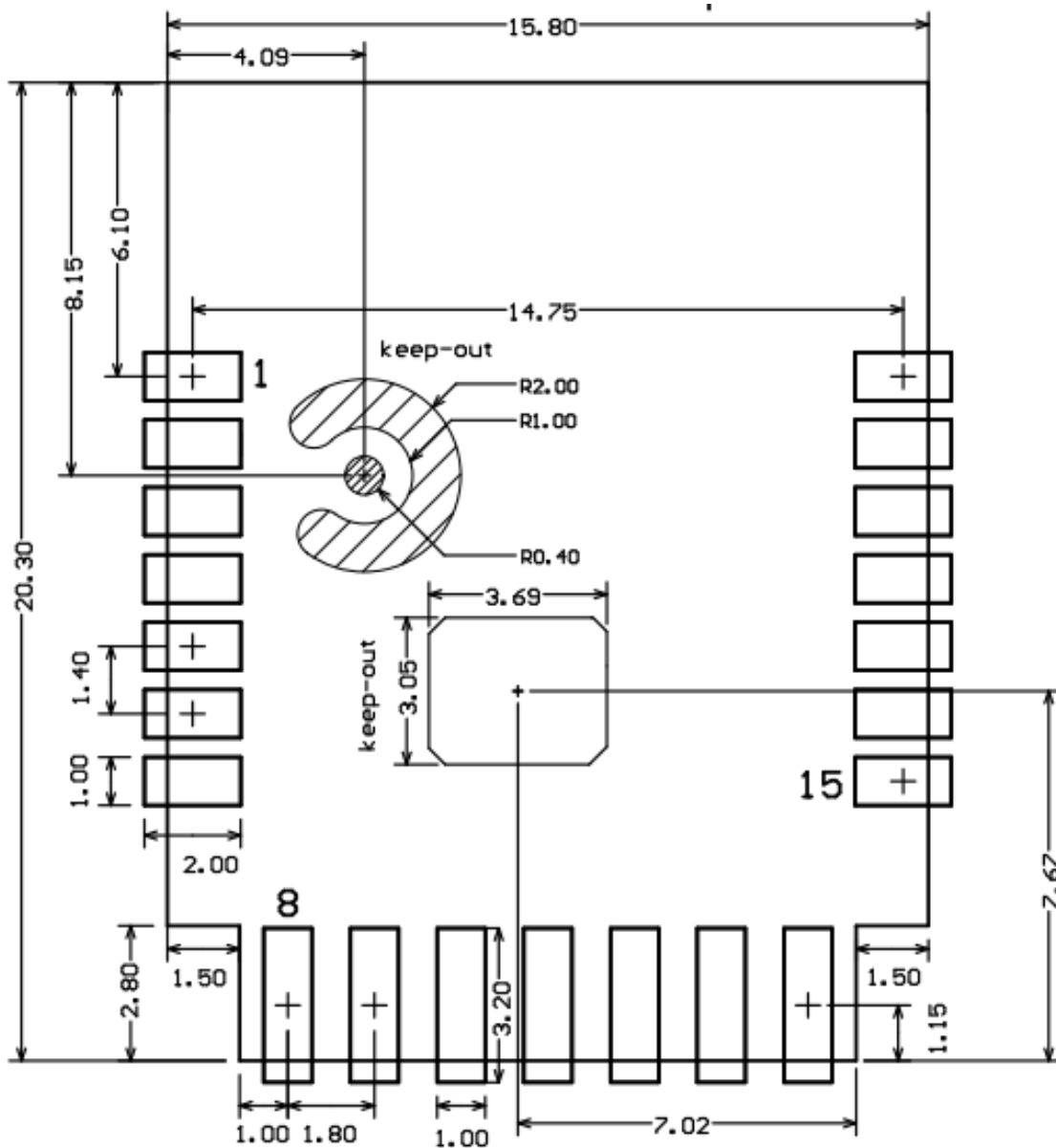
6.3 Production instructions

1. For the modules that can be packaged with the SMT or in the in-line way, you
   can select either of them according to the PCB design solutions of customers. If
   a PCB is designed to be SMT-packaged, package the module with the SMT. If a
   PCB is designed to be in-line-packaged, package the module in an in-line way.
   After being unpacked, the module must be soldered within 24 hours. Other-
   wise, it needs to be put into the drying cupboard where the relative humidity is

not greater than 10%; or it needs to be packaged again under vacuum and the exposure time needs to be recorded (the total exposure time cannot exceed 168 hours).

- (SMT process) SMT devices:
    - Mounter
    - SPI
    - Reflow soldering machine
    - Thermal profiler
    - Automated optical inspection (AOI) equipment
- (Wave soldering process) Wave soldering devices:
    - Wave soldering equipment
    - Wave soldering fixture
    - Constant-temperature soldering iron
    - Tin bar, tin wire, and flux
    - Thermal profiler
- 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.
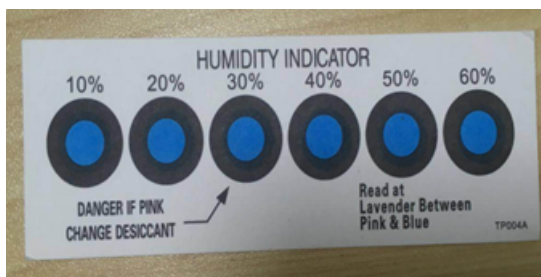
3. The module needs to be baked in the following cases:

- The packaging bag is damaged before unpacking.

- There is no 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 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 or 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, 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.

6.4 Recommended oven temperature curve

Select a proper soldering manner according to the process. For the SMT process, please refer to the recommended oven temperature curve of reflow soldering. For the wave soldering process, please refer to the recommended oven temperature curve of wave soldering. There are some differences between the set temperatures and the actual temperatures. All the temperatures shown in this module datasheet are obtained through actual measurements.

Manner 1: SMT process (Recommended oven temperature curve of reflow soldering)

Set oven temperatures according to the following curve.

IPC-7530a-3-1-cn
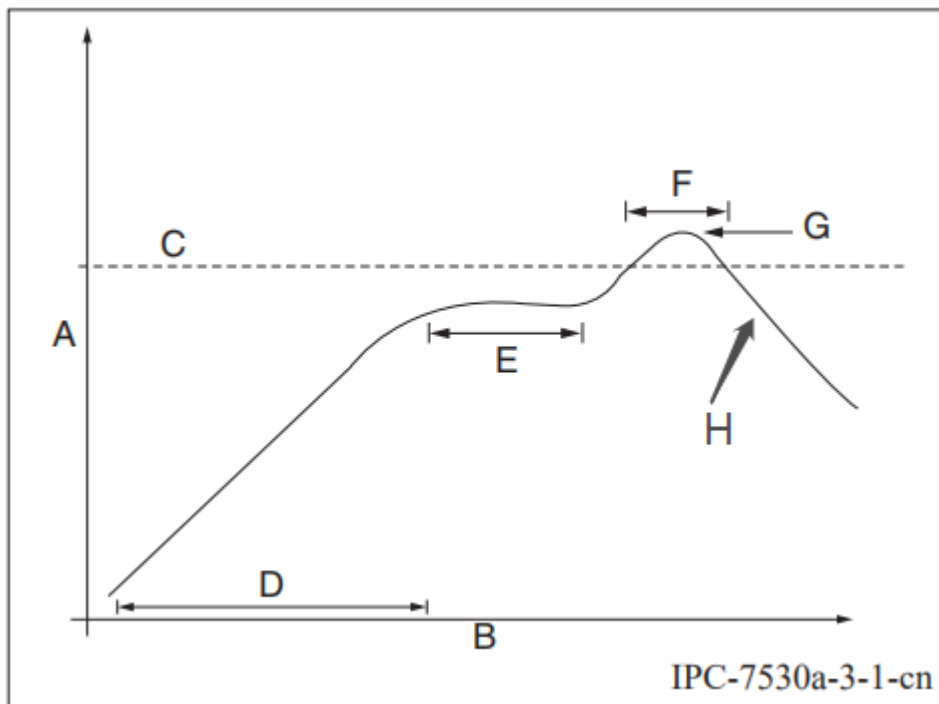
- A: Temperature axis

- 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.

Manner 2: Wave soldering process (Oven temperature curve of wave soldering)

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

DIP Type Product Pass Wavesolder Graph
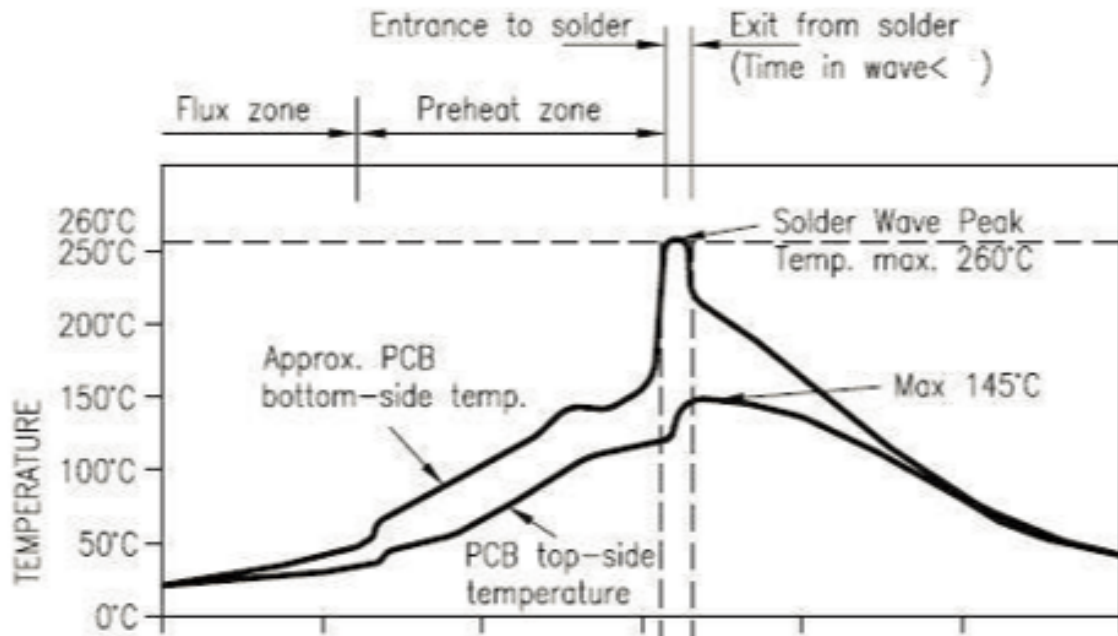
{width=100%}

Suggestions on oven temperature curve of wave soldering		Suggestions on manual soldering temperature	
Preheat temperature	80 to 130 °C	Soldering temperature	360±20°C
Preheat time	75 to 100s	Soldering time	< 3s/point
Peak contact time	3 to 5s	NA	NA
Temperature of tin cylinder	260±5°C	NA	NA
Ramp-up slope	≤2°C/s	NA	NA
Ramp-down slope	≤6°C/s	NA	NA

6.5 Storage conditions

LEVEL

3

If blank, see adjacent bar code label

Caution
This bag contains
MOISTURE-SENSITIVE DEVICES

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

See Production Date
Bag Seal 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 number	MOQ (pcs)	Shipping packaging method	The number of modules per reel	The number of reels per carton
WBRU	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-WBRU. The end product must be labeled in a visible area with the following: "Contains Transmitter Module FCC ID: 2ANDL-WBRU".

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.