



WL2H-U Module Datasheet

WL2H-U is a low-power embedded Wi-Fi module developed by Tuya. It consists of a highly integrated RF chip peripheral circuits and supports STA/AP/STA+AP modes and Bluetooth Low Energy (LE) connection.

Overview ↗

WL2H-U is embedded with a 32-bit microcontroller unit (MCU) that can operate at a frequency of up to 160 MHz, 512 KB flash memory (ROM), and 296 KB random-access memory (RAM). This enables the module to connect to Tuya IoT Cloud and execute extended instructions of the MCU for signal processing enable the module to encode and decode audio data. It also has extensive peripherals, such as pulse-width modulation (PWM), universal asynchronous receiver/transmitter (UART), and SPI interface (SPI). The 32-bit PWM output enables the chip to be suitable for high-quality LED control of RGB+CW.

Features ↗

- Embedded low-power 32-bit MCU, functioning as an application processor
- Clock rate: 160 MHz
- Working voltage: 3.0V to 3.6V
- Peripherals: five PWMs, two UARTs, and one SPI
- Wi-Fi connectivity
 - 802.11b/g/n
 - Channels 1 to 14 at 2.4 GHz
 - WEP, WPA/WPA2, WPA/WPA2 PSK (AES), and WPA3 security modes
 - Up to +16 dBm output power in 802.11b mode
 - STA/AP/STA+AP working modes
 - EZ and AP pairing modes for Android and iOS devices
 - Onboard PCB antenna, with up to 1.39 dBi antenna gain
 - Working temperature: -40°C to +105°C
- Bluetooth connectivity
 - 7 dBm transmitting power
 - Complete Bluetooth coexistence interface
 - Onboard PCB antenna, with up to 1.39 dBi antenna gain

Applications ↗

- Smart building
- Smart home and smart appliances
- Smart socket and light
- Industrial wireless control
- Baby monitor
- IP camera
- Smart public transportation

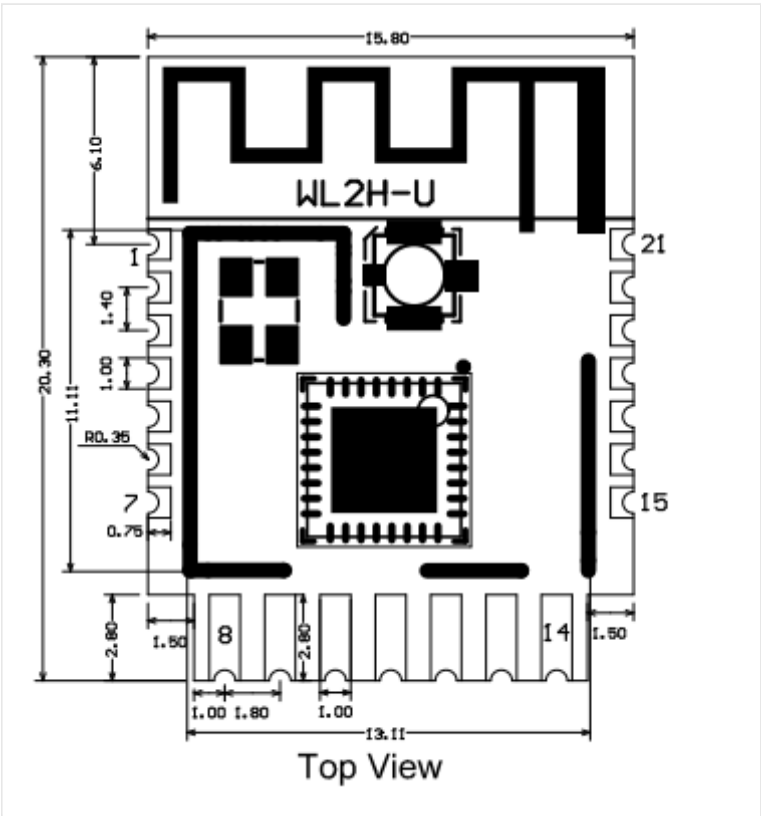
Change history ↗

Date	Change Description	Document Version
2022-6-16	This is the first release.	V1.0.0

Module interfaces ↗

Dimensions and packaging ↗

WL2H-U dimensions: 15.8±0.35 mm (W) × 20.3±0.35 mm (L) × 2.7±0.15 mm (H) The following figure shows the dimensions of the WL2H-U module.



Pin definition

Pin No.	Symbol	I/O Type	Description
1	GPIOA5	I/O	Common GPIO pin, which can be reused as SPI_SCK at 13 of the IC.
2	GPIOA6	I/O	Common GPIO pin, which can be reused as SPI_MOSI 14 of the IC.
3	GPIOA4	I/O	Common GPIO pin, corresponding to pin 12 of the IC.
4	GPIOA1	I/O	Common GPIO pin, corresponding to pin 9 of the IC.
5	ADC	I/O	ADC pin, corresponding to the GPIOA0 pin (pin 8) of the IC.
6	RX1	I/O	UART_RX1 pin, corresponding to the GPIOB8 pin (pin 2) of the IC.
7	TX1	I/O	UART_TX1 pin for log printing, corresponding to the GPIOB9 pin (pin 3) of the IC.
8	GPIOA7	I/O	PWM pin, corresponding to pin 15 of the IC.
9	GPIOA10	I/O	PWM pin, corresponding to pin 21 of the IC.
10	GPIOA11	I/O	PWM pin, corresponding to pin 22 of the IC.
11	GPIOA12	I/O	PWM pin, corresponding to pin 23 of the IC.
12	GPIOB3	I/O	PWM pin, corresponding to pin 24 of the IC.
13	GND	P	The ground wire.
14	3V3	P	3.3V power supply.
15	TX0	I/O	UART_TX0 pin for sending user data, corresponding to pin 10 of the IC.
16	RX0	I/O	UART_RX0 pin for receiving user data, corresponding to pin 11 of the IC.

17	GPIOB4	I/O	Common GPIO pin, which can be reused as ADC2 and of the IC.
18	RST	I/O	Reset pin, which is active at a low level, internally pulle with other module designs.
19	GPIOB5	I/O	Common GPIO pin, corresponding to pin 26 of the IC.
20	GPIOB6	I/O	Common GPIO pin, which can be reused as SPI_MISO 27 of the IC.
21	GPIOB7	I/O	Common GPIO pin, which can be reused as SPI_CS and of the IC.
Top side test point (burning pin)	GPIOA9	I/O	Mode selection pin, which is pulled down before power burning mode and corresponds to pin 17 of the IC.

Note: **P** indicates power-supply pins, and **I/O** indicates input/output pins.

Electrical parameters

Absolute electrical parameters

Parameter	Description	Minimum Value	Maximum Value
Ts	Storage temperature	-55	125
VBAT	Power supply voltage	-0.3	3.9
Electrostatic discharge voltage (human body model)	TAMB-25°C	-4	4
Electrostatic discharge voltage (machine model)	TAMB-25°C	-200	200

Normal working conditions

Parameter	Description	Minimum Value	Typical Value	Maximum Value	Unit
Ta	Working temperature	-40	-	105	°C

VBAT	Power supply voltage	3	3.3	3.6	V
VOL	I/O low-level output	VSS	-	VSS + 0.3	V
VOH	I/O high-level output	VBAT - 0.3	-	VBAT	V
I _{max}	I/O drive current	-	6	20	mA

RF power consumption

Working Status	Mode	Rate	TX Power/Receiving	Average Value	Peak Value (Typ
Transmitting	11b	11 Mbps	+16 dBm	297	375
Transmitting	11g	54 Mbps	+14 dBm	242	355
Transmitting	11n	MCS7	+13.5 dBm	236	353
Receiving	11b	11 Mbps	Constant receiving	78	90
Receiving	11g	54 Mbps	Constant receiving	78	90
Receiving	11n	MCS7	Constant receiving	78	90

Working current

Working Mode	Working Status (Ta = 25°C)	Average Value	Maximum Value (Typ
Bluetooth pairing	The module is in Bluetooth pairing mode, and the Wi-Fi indicator blinks quickly.	88	288
AP pairing	The module is in AP mode, and the Wi-Fi indicator blinks slowly.	105	370
EZ pairing	The module is in EZ mode, and the Wi-Fi indicator blinks quickly.	92	354
Connected	The module is connected to the network, and the Wi-Fi indicator is steady on.	93	222

Weakly connected	The module is weakly connected to the network, and the Wi-Fi indicator is steady on.	100	373
Disconnected	The module is disconnected from the network, and the Wi-Fi indicator is steady off.	96	388

RF parameters

Basic RF features

Parameter	Description
Frequency band	2.412 GHz to 2.484 GHz
Wi-Fi standard	IEEE 802.11b/g/n (channels 1 to 14)
Data transmission rate	11b: 1, 2, 5.5, 11 (Mbit/s) 11g: 6, 9, 12, 18, 24, 36, 48, 54 (Mbit/s) 11n: HT20 MCS0 to MCS7
Antenna type	PCB antenna, with an antenna gain of 1.39 dBi

Wi-Fi TX performance

Parameter	Minimum Value	Typical Value	Maximum Value
Average RF output power, 802.11b CCK mode, 11 Mbit/s	-	16	-
Average RF output power, 802.11b OFDM mode, 54 Mbit/s	-	14	-
Average RF output power, 802.11n OFDM mode, MCS7 (HT20)	-	13.5	-
Frequency error	-20	-	20

Wi-Fi RX performance

Parameter	Minimum Value	Typical Value	Maximum Value
PER < 8%, RX sensitivity, 802.11b DSSS mode, 11 Mbit/s	-	-88	-
PER < 10%, RX sensitivity, 802.11g OFDM Mode, 54 Mbit/s	-	-74	-
PER < 10%, RX sensitivity, 802.11n OFDM Mode, MCS7 (HT20)	-	-72	-
PER < 10%, RX sensitivity, Bluetooth, 1 Mbit/s	-	-90	-

Bluetooth TX performance

Parameter	Minimum Value	Typical Value	Maximum Value	Unit
Frequency band	2402	-	2480	MHz
Air rate	-	1	-	Mbit/s
Transmitting power	-20	7	20	dBm
Frequency error	-150	-	150	kHz

Bluetooth RX performance

Parameter	Minimum Value	Typical Value	Maximum Value	Unit
RX sensitivity	-	-94	-	dBm
Maximum RF signal input	-10	-	-	dBm
Inter-modulation	-	-	-23	dBm
Co-channel interference suppression	-	10	-	dB

Antenna information

Antenna type ↗

WL2H-U uses an onboard PCB antenna, with an antenna gain of 1.39 dBi.

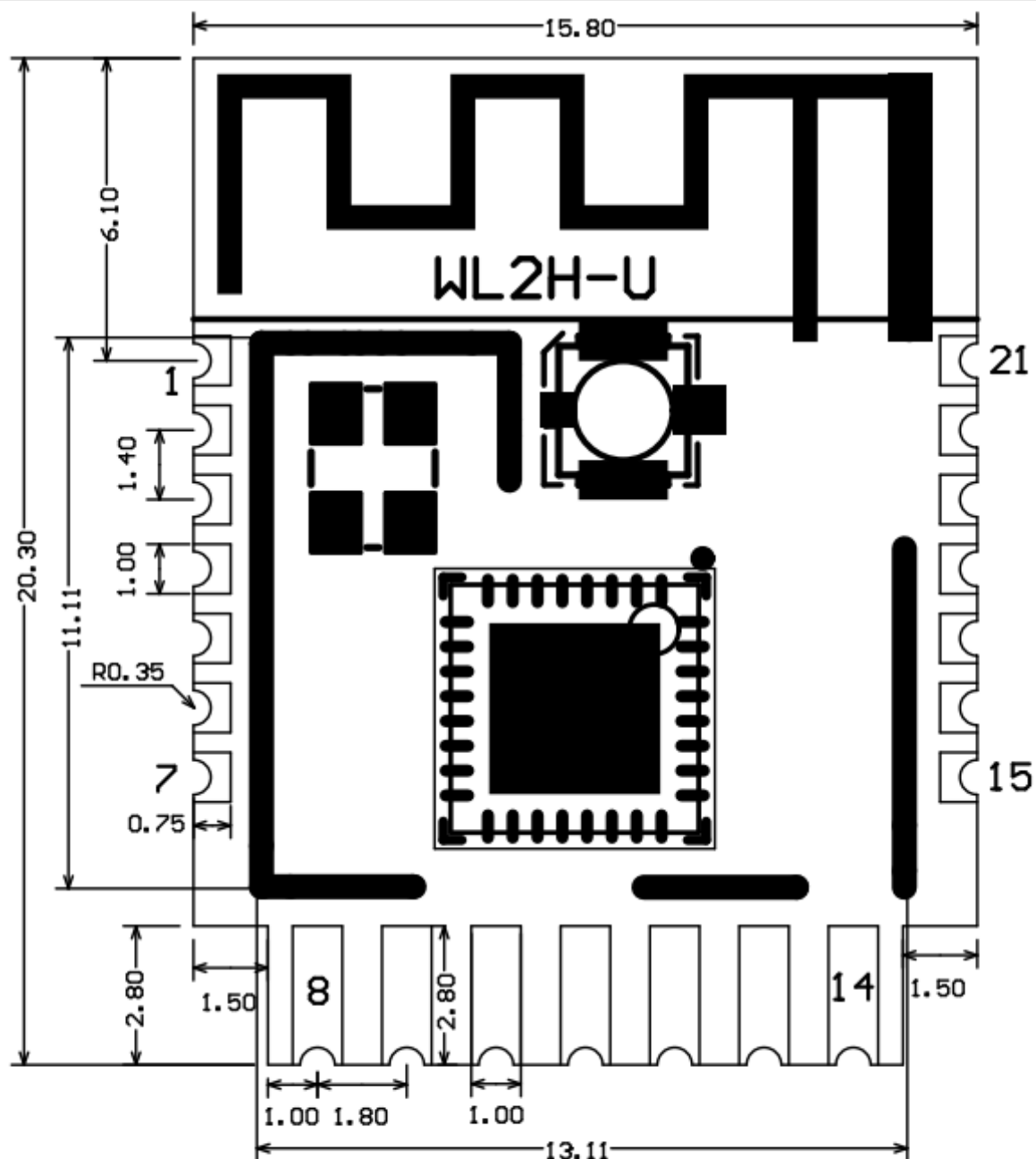
Antenna interference reduction ↗

To ensure optimal Wi-Fi performance when the module uses an onboard PCB antenna, we recommended that 15 mm away from other metal parts. To prevent adverse impact on the antenna performance, do not use copper on the antenna area on the PCB.

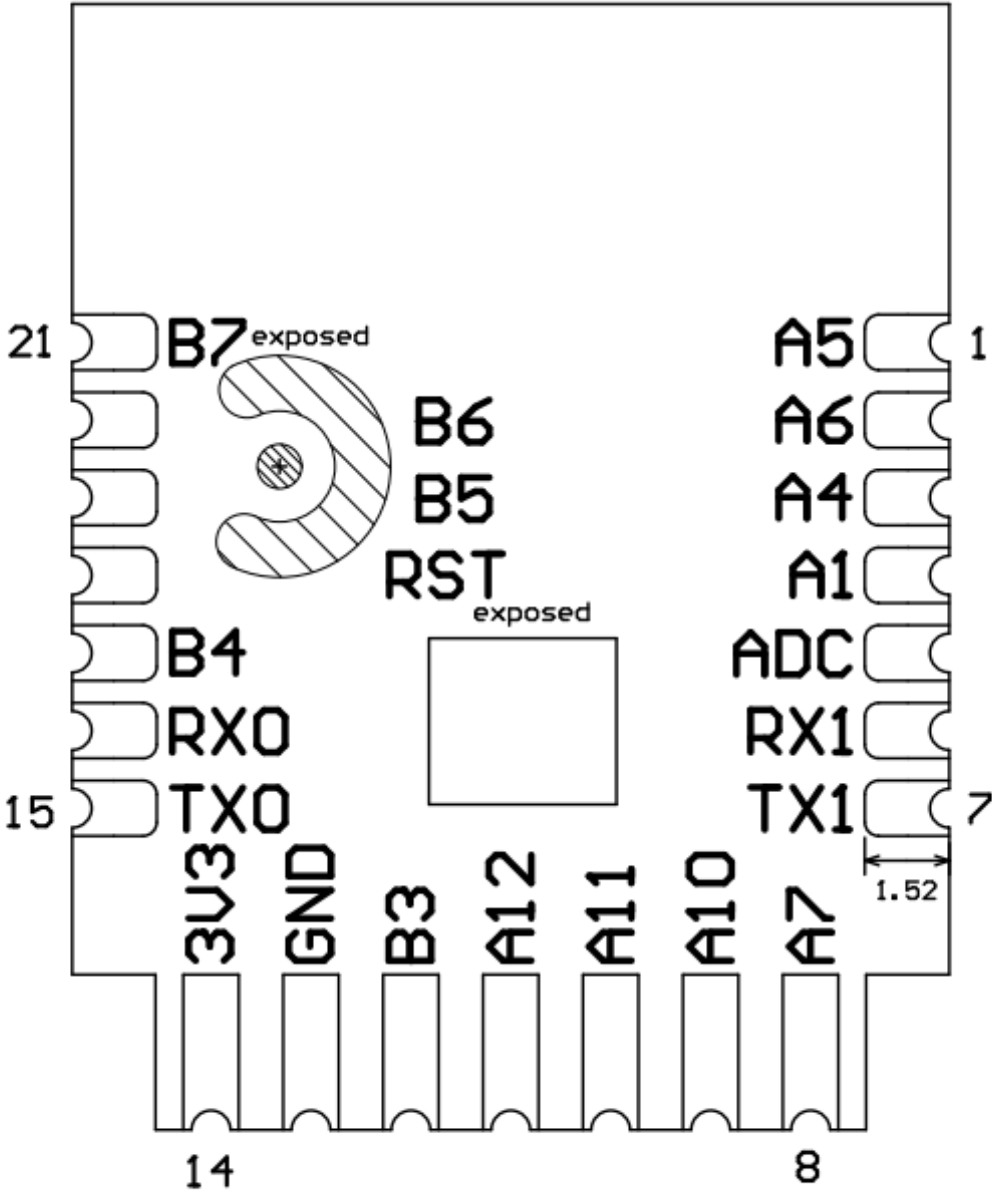
Packaging information and production instructions ↗

Mechanical dimensions ↗

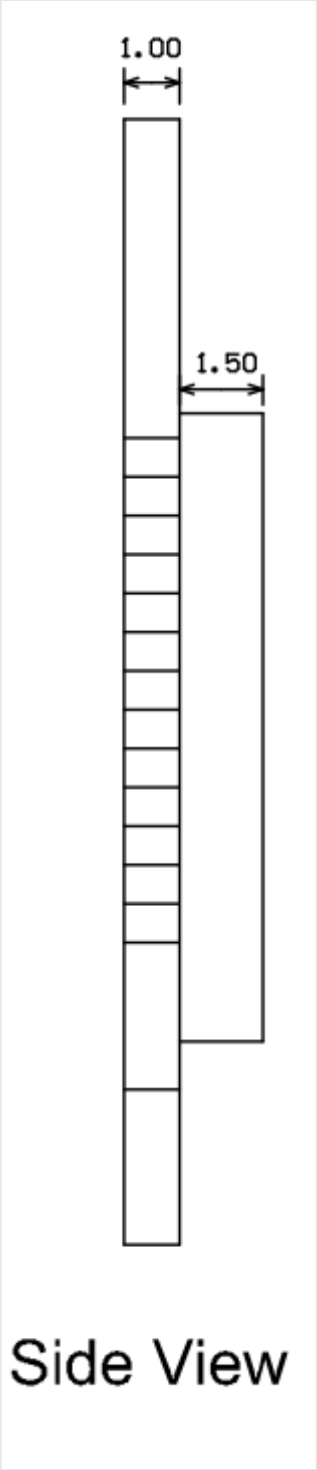
PCB dimensions: 15.8 ± 0.35 mm (W) $\times$ 20.3 ± 0.35 mm (L) $\times$ 1.0 ± 0.1 mm (H)



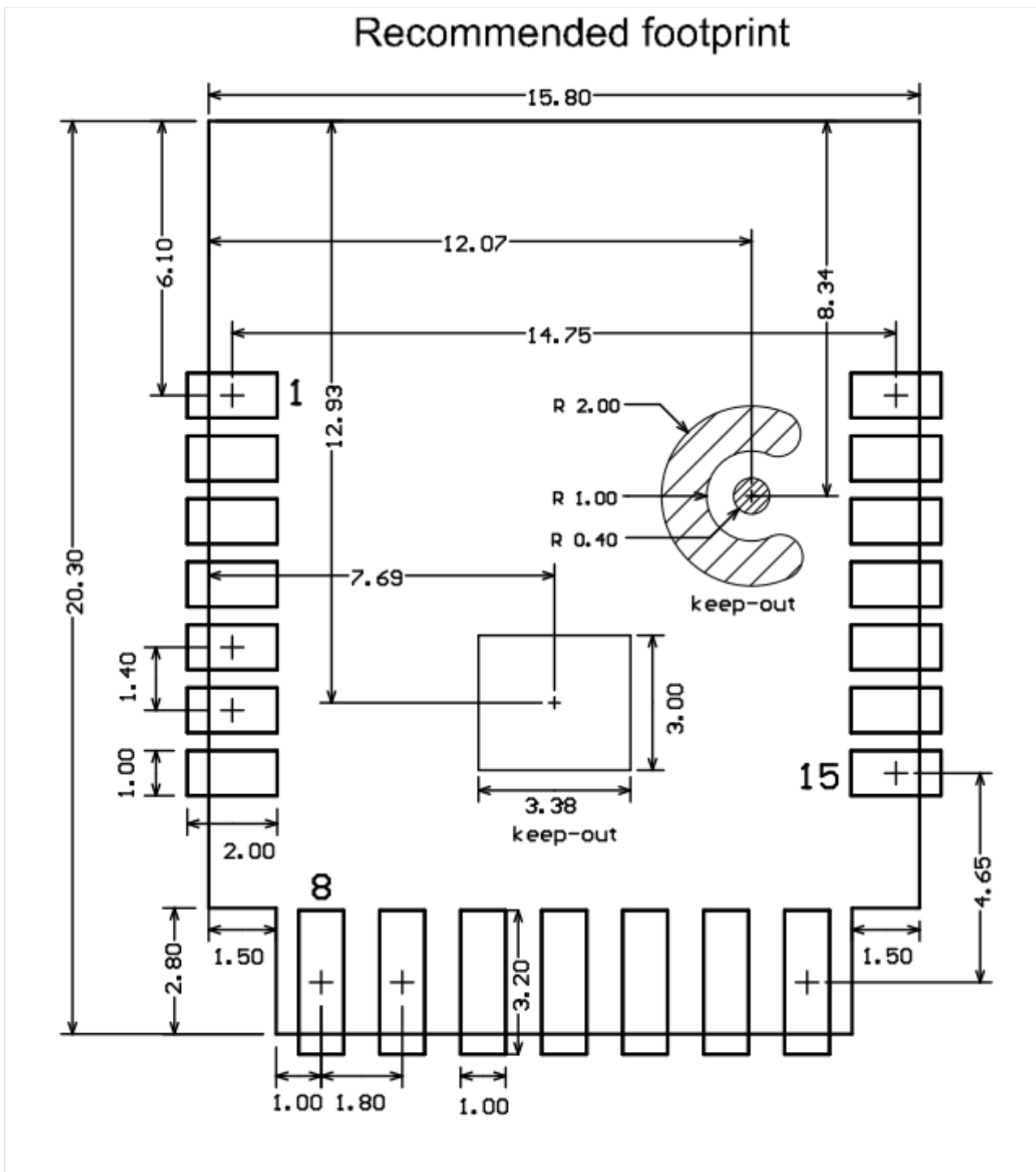
Top View



Bottom View



Recommended package ↔



Production instructions

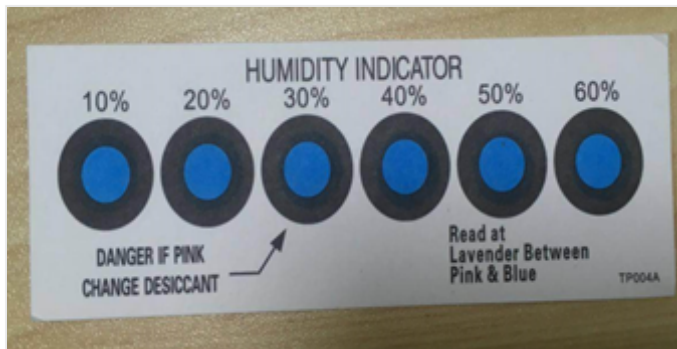
1. For the modules that can be packaged with the surface-mount technology (SMT) or in in-line form, you can package them according to the PCB design solutions of customers. If a PCB is designed to be SMT-packaged, package it with SMT. If a PCB is designed to use an in-line package, use wave soldering. After being unpacked, the module must be stored within 24 hours. Otherwise, it needs to be put into a drying cupboard where the relative humidity is not greater than 60% and the temperature is 40°C. After drying, the module must be put into a vacuum oven for 24 hours. The vacuum oven must be cooled to 40°C or below before being opened. After being cooled, the module must be put into a vacuum oven again with the exposure time recorded. The total exposure time cannot exceed 168 hours.

- Devices required for the SMT process:
 - Moulder
 - SPI
 - Reflow soldering machine
 - Thermal profiler

- Automated optical inspection (AOI) equipment
- Devices required for the wave soldering process:
 - Wave soldering machine
 - Wave soldering fixture
 - Constant-temperature soldering iron
 - Tin bar, tin wire, and flux
 - Thermal profiler
- Devices required for baking:
 - 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 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 first 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 a metal container rather than a 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: $< 36^\circ\text{C}$
- 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 or wave soldering process. If these modules are Level-3 moisture-sensitive devices, they are very likely to get damp when exposed to high humidity for a long time. In this case, if they are soldered at high temperatures, it may result in device failure or poor soldering quality.

5. In the whole production process, take electrostatic discharge (ESD) protective measures.

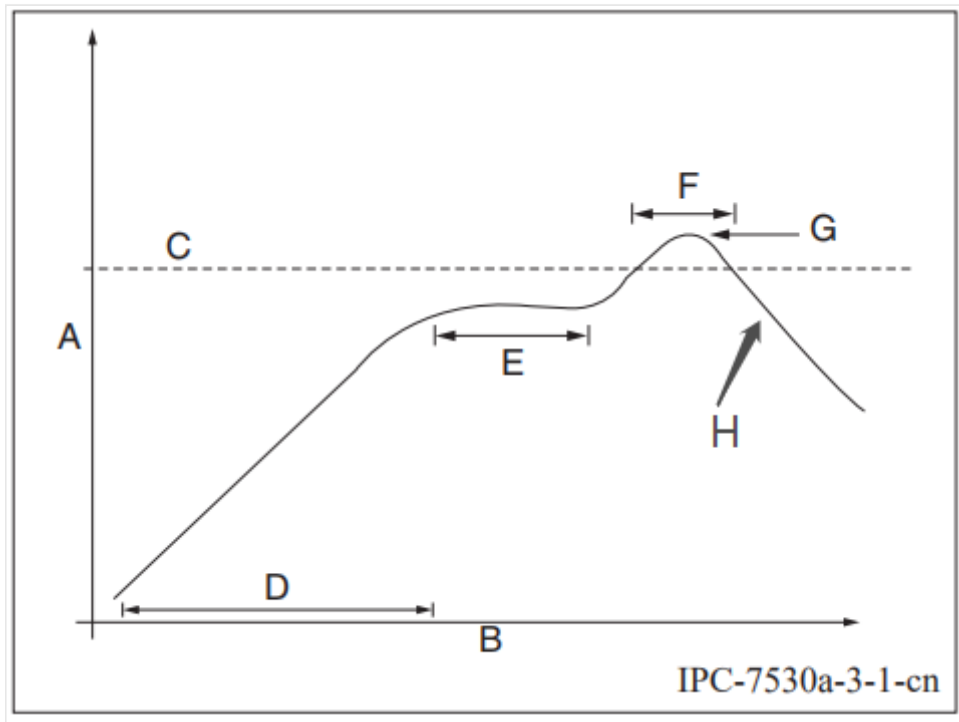
6. To guarantee the passing rate, we recommended that you use the SPI and AOI to monitor the quality of the soldering and mounting.

Recommended oven temperature curve ↗

Select a proper soldering technique according to the process. For the SMT process, see the recommended oven reflow soldering. For the wave soldering process, see the recommended oven temperature curve of wave soldering. All the temperatures and time differences between the set temperatures and the actual temperature measurements. All the temperatures and time differences obtained through actual measurements.

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

Set the oven temperatures according to the following curve.

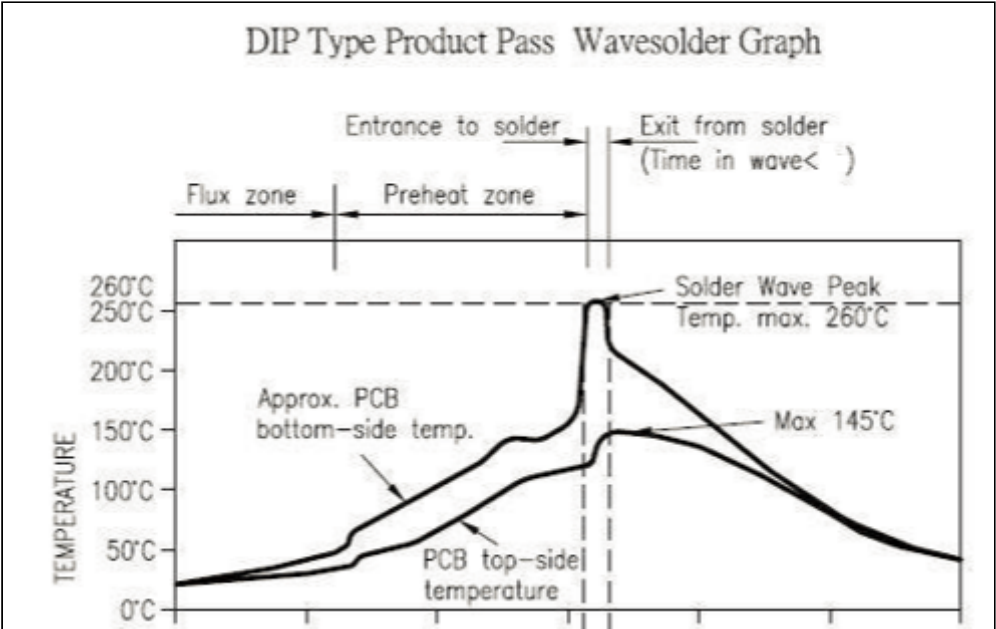


- A: Temperature axis
- B: Time axis
- C: Liquidus temperature: 217°C to 220°C
- D: Ramp-up slope: 1°C/s to 3°C/s
- E: Duration of constant temperature: 60s to 120s. The range of constant temperature: 150°C to 200°C
- F: Duration above the liquidus: 50s to 70s
- G: Peak temperature: 235°C to 245°C
- H: Ramp-down slope: 1°C/s to 4°C/s

Note: The above curve is just an example of the solder paste SAC305. For more information about other solder pastes, see the recommended oven temperature curve in the solder paste specifications.

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

Set the oven temperatures according to the following temperature curve of wave soldering. The peak temperature



| Suggestions on Oven Temperature Curve of Wave Soldering| | Suggestions on Manual Soldering Ten
-----|-----|-----| | Preheat temperature| 80°C to 130°C| Soldering temperature|360°C±20°C
100s| Soldering time|< 3s/point| | Peak contact time| 3s to 5s| - | | | Temperature of tin cylinder| 260°
slope| ≤ 2°C/s| - | - | | Ramp-down slope| ≤ 6°C/s| - | - |

Storage conditions ↔



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

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

MOQ and packaging information ⇄

Product model	MOQ (pcs)	Shipping Packaging Method	Number of Modules per Reel	Notes
WL2H-U	4400	Tape reel	1100	4

Appendix: Declaration

FCC Caution: Any changes or modifications not expressly approved by the party responsible for compliance with FCC 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 must 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 FCC Part 15. 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 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, 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 environment. This device should be used 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 home. Follow the following FCC multi-transmitter product procedures. Additional testing and device authorization may be required for simultaneous operation with other radios.

The availability of some specific channels and/or operational frequency bands are country dependent and are set 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 product. This module transmitter grant of certification. The final host product still requires Part 15 Subpart B compliance testing and certification with the transmitter installed.

The end-user manual shall include all required regulatory information/warnings as shown in this manual, including the requirement to 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-WL2H-U. The end product must be labeled in a visible area with the following information: Transmitter Module FCC ID: 2ANDL-WL2H-U".

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 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 must test 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 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 collection point.

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

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844-672-5646 (tel:844-672-5646)

24/7 Service Hotline (tel:24/7 Service Hotline)

Marketing Cooperation

marketing@tuya.com

(<mailto:marketing@tuya.com>)

Business

Cooperation

vip@tuya.com

(<mailto:vip@tuya.com>)

Customer Service

service@tuya.com

(<mailto:service@tuya.com>)

Media Inqui

pr@tuya.com

(<mailto:pr@tuya.com>)

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