



# BP3L Module Datasheet

Version: 20210817

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BP3L is a low-power embedded Bluetooth module that Tuya has developed. Embedded with the Bluetooth communication protocol stack and rich library functions, it mainly consists of a highly integrated Bluetooth chip (PHY6222) and a few peripheral circuits.

## 1 Product overview

BP3L contains a low-power 32-bit MCU, a Bluetooth LE 5.1/2.4-G Radio, 128-KB to 8-MB flash memory, 64-KB SRAM, and 11 reusable I/O ports.

### 1.1 Features

- Embedded with a low-power 32-bit MCU, which can also function as an application processor.
- Operating voltage: 1.8 to 3.6V
- Peripherals: 5 PWMs, 1 ADC, 4 GPIOs, and 1 UART
- Bluetooth RF features
  - Bluetooth LE 5.1
  - The RF data rate can be up to 1 Mbps.
  - TX power: +8 dBm
  - RX sensitivity: -97 dBm@ 1 Mbps
  - Embedded hardware AES encryption
  - Onboard antenna with a gain of 1.09 dBi
  - Operating temperature: -40°C to +105°C

### 1.2 Applications

- Smart LED
- Smart home

### 1.3 Change history

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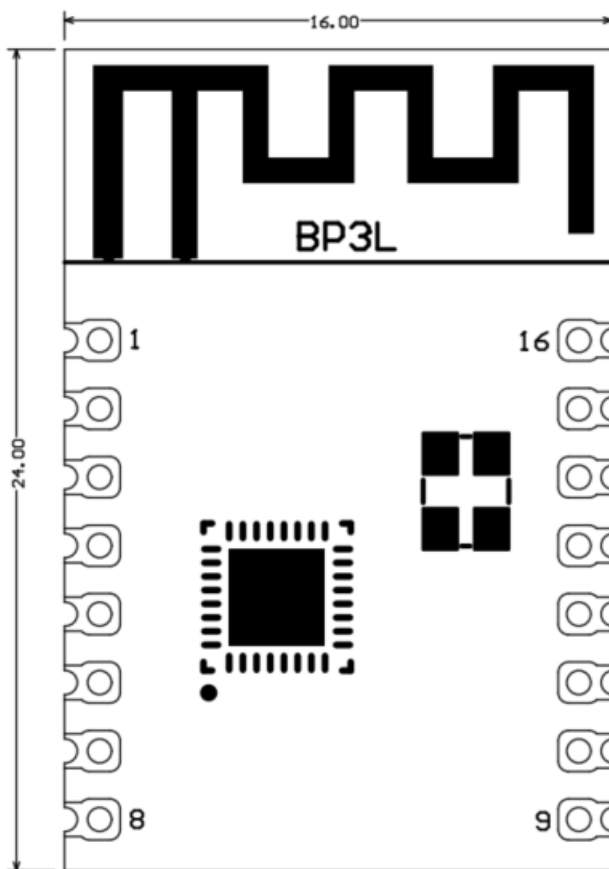
Update date	Updated content	Version after update
07/01/2021	This is the first release.	V1.0.0

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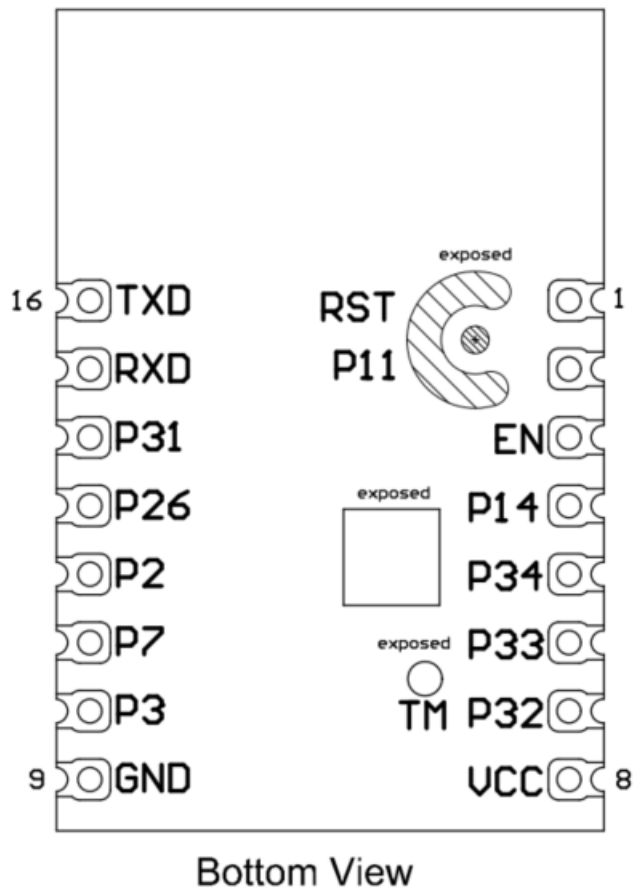
## 2 Module interfaces

### 2.1 Dimensions and footprint

BP3L has 2 lines of pins, 16 pins in total, with a spacing of 2 mm. The BP3L dimensions are  $16 \pm 0.35$  mm (W)  $\times$   $24 \pm 0.35$  mm (L)  $\times$   $3.3 \pm 0.15$  mm (H). The thickness of the PCB is  $0.8 \pm 0.1$  mm.



Top View



## 2.2 Pin definition

The definitions of pins are shown in the following table:

Pin No.	Symbol	I/O type	Function
1	RESET_N	I/O	Reset pin (low active), correspond to RESET_N of the internal IC.

Pin No.	Symbol	I/O type	Function
2	P11	AI	ADC port, 12 bit/s, which can be reused as a common I/O interface and corresponds to P11 of the IC
3	EN	I/O	Enabling pin, which is directly connected to the pin RESET_N. During normal operation of the module, do not connect the pin to anything.
4	P14	I/O	Common I/O pin, which corresponds to P14 on the internal IC
5	P34	I/O	Common I/O interface, which can be used as PWM output of the LED drive and corresponds to P34 of the IC
6	P33	I/O	Common I/O interface, which can be used as PWM output of the LED drive and corresponds to P33 of the IC

Pin No.	Symbol	I/O type	Function
7	P32	I/O	Common I/O interface, which can be used as PWM output of the LED drive and corresponds to P32 of the IC
8	VCC	P	Power supply pin (Typical value: 3.3V)
9	GND	P	Power supply reference ground
10	P3	I/O	Common I/O pin, which corresponds to P3 on the internal IC
11	P7	I	Common I/O pin, which corresponds to P7 on the internal IC
12	P2	I/O	Common I/O pin, which corresponds to P2 on the internal IC
13	P26	I/O	Common I/O interface, which can be used as PWM output of the LED drive and corresponds to P26 of the IC



Pin No.	Symbol	I/O type	Function
14	P31	I/O	Common I/O interface, which can be used as PWM output of the LED drive and corresponds to P31 of the IC
15	RXD	I/O	Receiving pin, which can be reused as a common I/O interface and corresponds to P10 of the internal IC
16	TXD	I/O	Transmitting pin, which can be reused as a common I/O interface and corresponds to P9 of the internal IC
Test point	TM	I	Mode selection pin, which is pulled high in burning mode, but pulled down or not connected to anything in other modes.

**Note:**

- P indicates a power supply pin and I/O indicates an input/output pin.
- If you have any special requirements on the light color controlled by the

| PWM output, please contact Tuya business personnel.

### 3 Electrical parameters

#### 3.1 Absolute electrical parameters

Parameter	Description	Minimum value	Maximum value	Unit
T <sub>s</sub>	Storage temperature	-65	150	°C
VCC	Power supply voltage	-0.3	3.9	V
ESD voltage (human body model)	TAMB-25°C	-	2	kV
ESD voltage (machine model)	TAMB-25°C	-	0.5	kV

#### 3.2 Working conditions

Parameter	Description	Minimum value	Typical value	Maximum value	Unit
T <sub>a</sub>	Operating temperature	-40	-	105	°C
VCC	Operating voltage	1.8	3.3	3.6	V
V <sub>IL</sub>	I/O low-level input	VSS	-	VCC*0.3	V
V <sub>IH</sub>	I/O high-level input	VCC*0.7	-	VCC	V

Parameter	Description	Minimum value	Typical value	Maximum value	Unit
$V_{OL}$	I/O low-level output	VSS	-	$VCC*0.1$	V
$V_{OH}$	I/O high-level output	$VCC*0.9$	-	VCC	V

### 3.3 Power consumption in working mode

Symbol	Conditions	Maximum value (Typical value)	Unit
$I_{tx}$	Constantly transmit with the output power of 8 dBm	24	mA
$I_{rx}$	Constantly receive	15	mA
IDC	Average value in mesh networking state	13	mA
IDC	Peak value in mesh networking state	23	mA

## 4 RF parameters

### 4.1 Basic RF features

Parameter	Description
Working frequency	2.4 GHz ISM band
Wireless standard	Bluetooth LE 5.1
Data transmission rate	1 Mbps
Antenna type	PCB antenna

### 4.2 RF output power

Parameter	Minimum value	Typical value	Maximum value	Unit
Average RF output power	-20	8	10	dBm
Bandwidth of 20-dB modulation signal (1M)	-	2500	-	KHz

### 4.3 RF receiving sensitivity

Parameter	Minimum value	Typical value	Maximum value	Unit
RX sensitivity 1 Mbps	-	-97	-	dBm
Frequency offset error 1 Mbps	-250	-	+300	KHz

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Parameter	Minimum value	Typical value	Maximum value	Unit
Co-channel interference suppression	-	-10	-	dB

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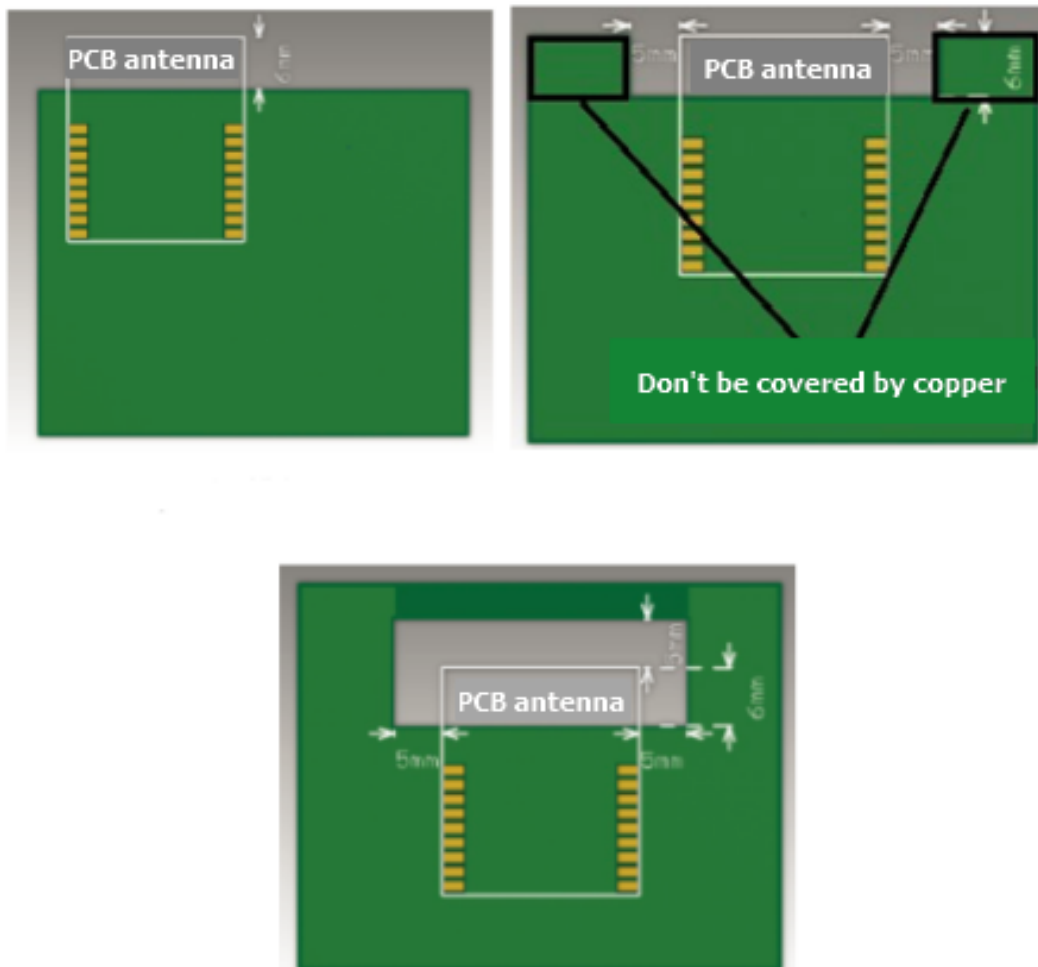
## 5 Antenna information

### 5.1 Antenna type

BP3L uses the PCB antenna with a gain of 1.09 dBi.

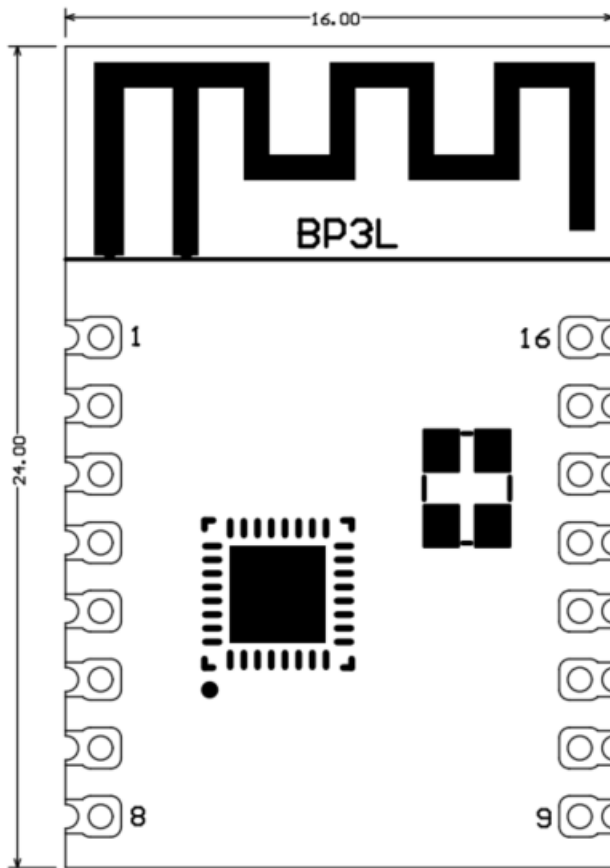
### 5.2 Antenna interference reduction

To ensure the best RF performance, it is recommended that the antenna be at least 15 mm away from other metal parts. If metal materials wrap around the antenna, the wireless signal will be greatly attenuated, thereby deteriorating the RF performance. When designing the finished product, please leave enough space for the antenna.



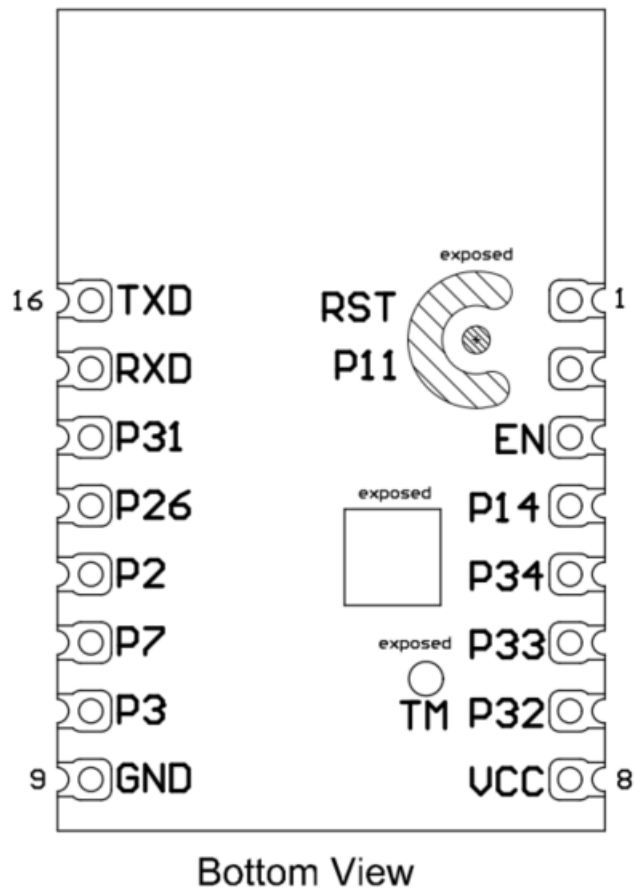
## 6 Packaging information and production instructions

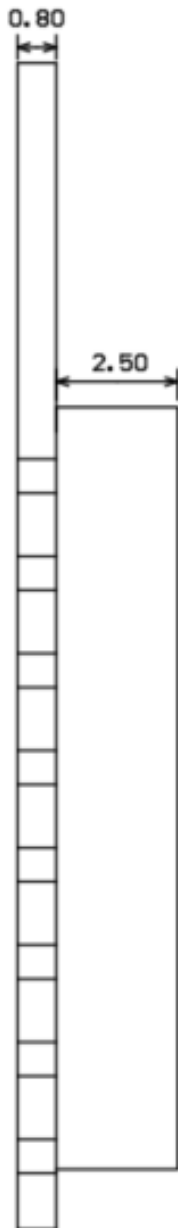
### 6.1 Mechanical dimensions and dimensions of the back of the pad



Top View







Unit: mm

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

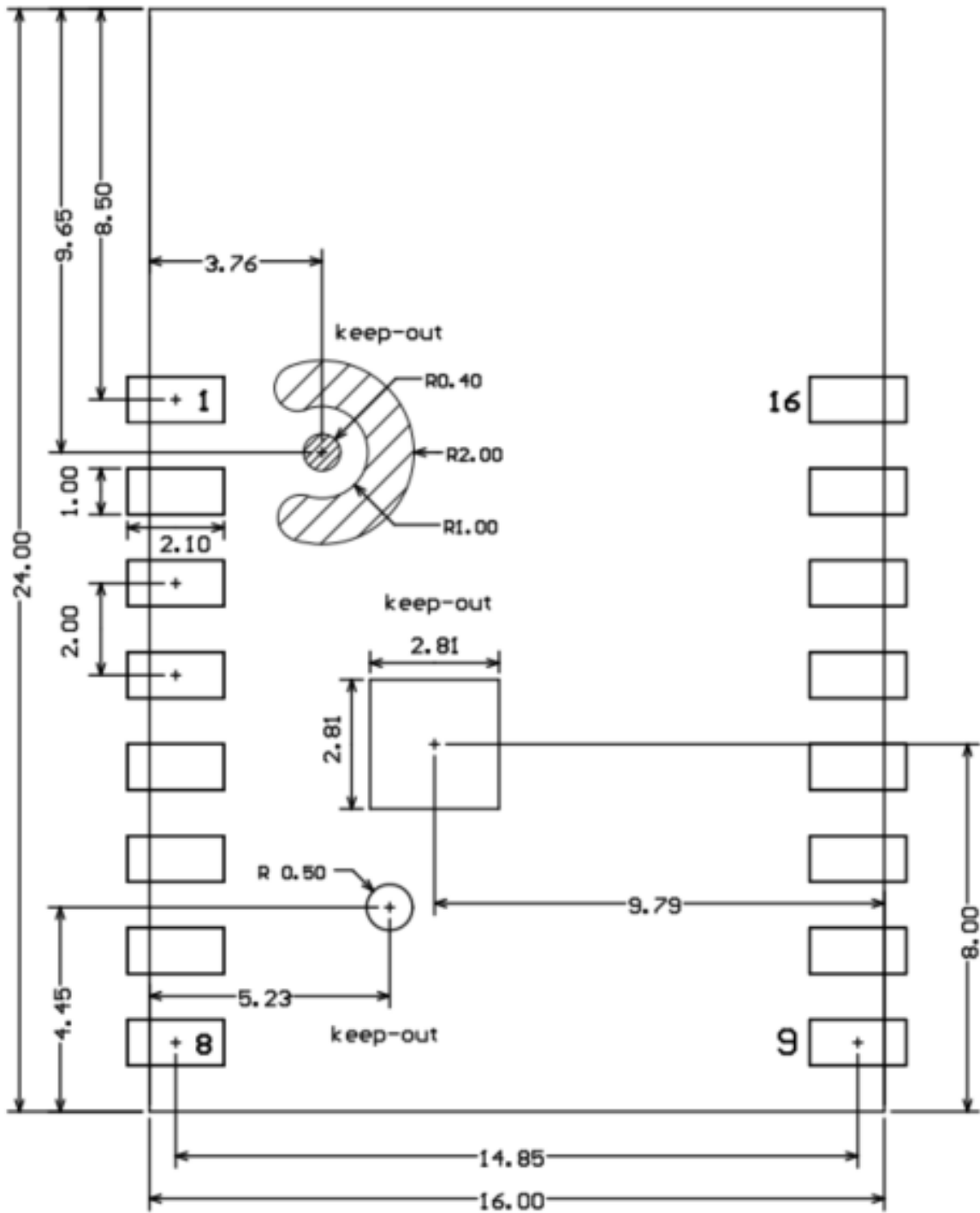
PCB thickness tolerance:  $\pm 0.1\text{mm}$

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

## Side View

Recommended PCB footprint

### Recommended footprint



The default outline dimension tolerance is  $\pm 0.35$  mm, and the critical dimension tolerance is  $\pm 0.1$  mm. If you have specific requirements on dimensions, specify them clearly in the datasheet after communication.

## 6.2 Production instructions

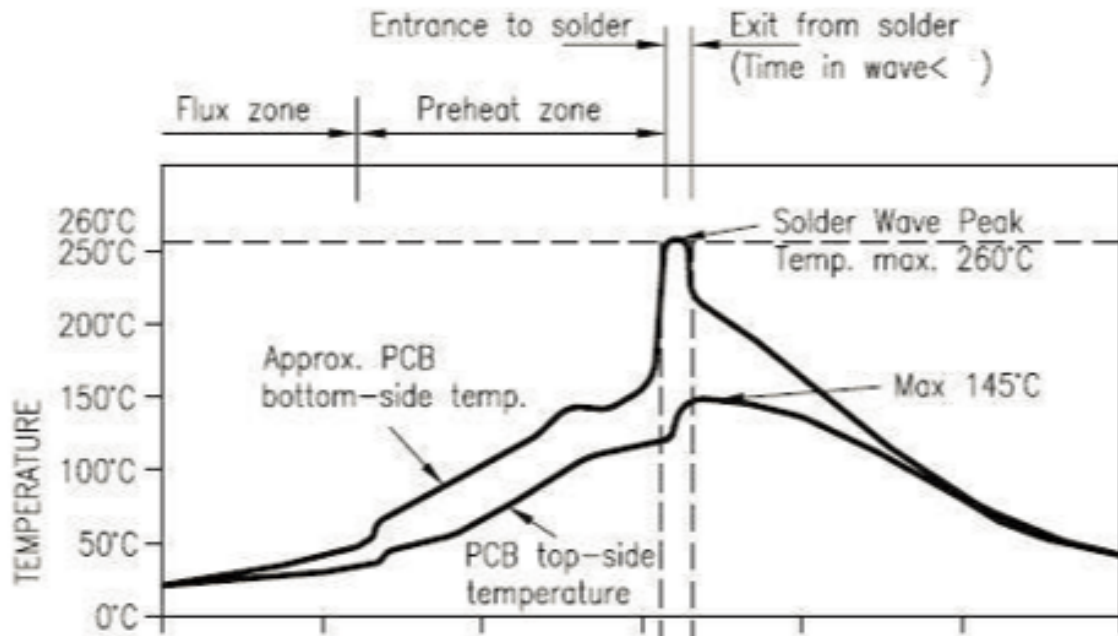
1. For the Tuya in-line module, wave soldering is most preferred and manual soldering is less preferred. After being unpacked, the module must be soldered within 24 hours. Otherwise, it must be put into the drying cupboard where the RH is not greater than 10%; or it needs to be packaged under vacuum again and record the exposure time (the total exposure time cannot exceed 168 hours).
2. Wave soldering devices and materials:
  - Wave soldering equipment
  - Wave soldering fixture
  - Constant-temperature soldering iron
  - Tin bar, tin wire, and flux
  - Thermal profiler
3. Baking devices:
  - Cabinet oven
  - Anti-electrostatic and heat-resistant trays
  - Anti-electrostatic and heat-resistant gloves
4. 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.
5. Baking settings:
  - Temperature: 60°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: 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 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.
6. In the whole production process, take electrostatic discharge (ESD) protective measures.
  7. To guarantee the quality of products, you must pay attention to the following items: The amount of soldering flux, the height of the wave peak, whether the tin slag and copper content in the wave soldering tank exceed standards, whether the window and thickness of the wave soldering fixture are appropriate, and whether the wave soldering oven temperature curve is appropriate.

### **6.3 Recommended oven temperature curve and temperature**

Set oven temperatures according to the following temperature curve of wave soldering. The peak temperature is  $260^{\circ}\text{C}\pm 5^{\circ}\text{C}$ .

DIP Type Product Pass Wavesolder Graph



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Recommended soldering temperature:

Suggestions on oven temperature curve of wave soldering

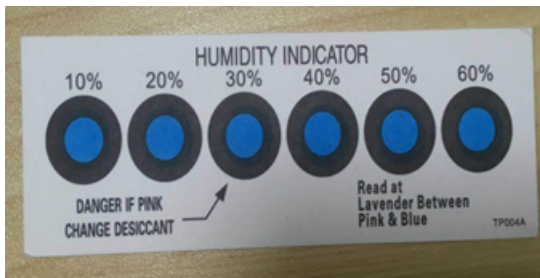
Suggestions on manual soldering temperature


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

## 6.4 Storage conditions

Storage conditions for a delivered module:

- The moisture-proof bag is 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.



	<p><b>Caution</b> This bag contains <b>MOISTURE-SENSITIVE DEVICES</b></p>	<p><b>LEVEL</b> <b>3</b></p>
		<p>If blank, see adjacent bar code label</p>
<p>1. Calculated shelf life in sealed bag: 12 months at &lt;math&gt;&lt;40^{\circ}\text{C}&lt;/math&gt; and &lt;math&gt;&lt;90\%&lt;/math&gt; relative humidity (RH)</p>		
<p>2. Peak package body temperature: _____ <b>260</b> _____ <math>^{\circ}\text{C}</math> If blank, see adjacent bar code label</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: _____ <b>168</b> _____ hours of factory conditions If blank, see adjacent bar code label <math>\leq 30^{\circ}\text{C}/60\% \text{ RH}</math>, 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 &gt;10% for level 2a - 5a devices or &gt;60% for level 2 devices when read at <math>23 \pm 5^{\circ}\text{C}</math></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><b>See Production Date</b></p>
<p>Bag Seal Date: _____ If blank, see adjacent bar code label</p>		
<p><b>Note: Level and body temperature defined by IPC/JEDEC J-STD-020</b></p>		



## 7 MOQ and packaging information

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Product model	MOQ (pcs)	Packing method	Modules per reel	Reels per carton
BP3L	3600	Tape reel	900	4

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## 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-BP3L. The end product must be labelled in a visible area with the following: “Contains Transmitter Module FCC ID: 2ANDL-BP3L” .

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.