

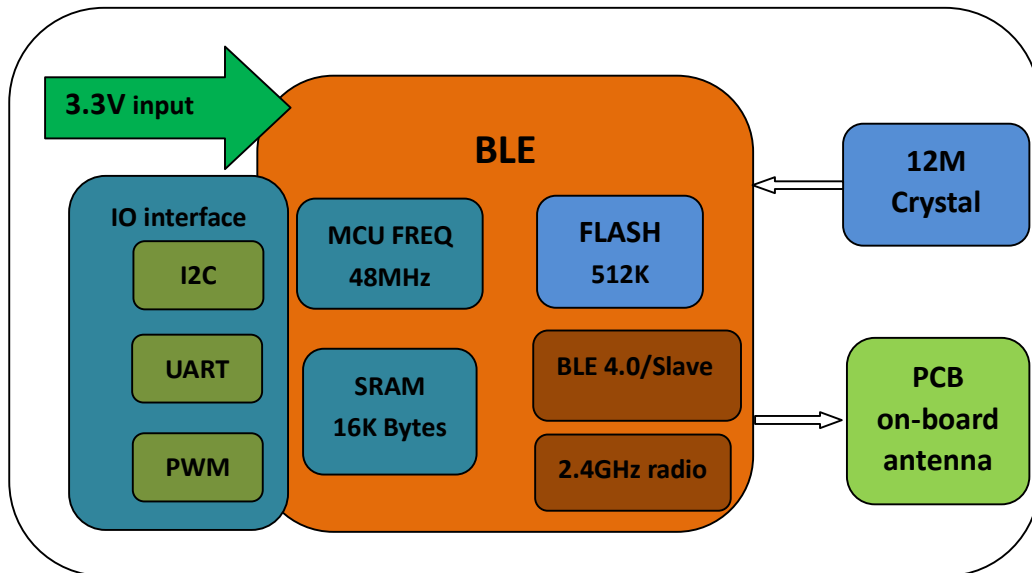
Bluetooth module

1. Product Overview

TYBT3 is a Bluetooth (BLE) module designed by HangZhouTuya Technology Corporation. The BLE Module consists of a highly integrated wireless Bluetooth chip TLSR8266 and some extra electric circuits that have been programmed with Bluetooth network protocol and plenty of software examples. TYBT3 includes a 32-bit CPU, BLE, 512K byte flash, 16k SRAM, and 9 multiplex IO pins.

Figure 1 shows the block diagram of the TYBT3.

Figure 1. The block diagram of the TYBT3



1.1 Features

- ✧ Integrated low power consumption 32-bit CPU, also known as application processor
- ✧ Basic frequency of the CPU can support 48 MHz
- ✧ Supply voltage range: 1.9V to 3.6V
- ✧ Peripherals: 5*PWM, 1*I2C, 1*UART
- ✧ BLE RF features:
 - Compatible with BLE 4.2
 - Transmitting data rate can go up to 1Mbps
 - TX transmitting power: +7dBm
 - RX receiving sensitivity: -92dBm
 - AES hardware encryption
 - On-board PCB antenna

- Operating temperature range: -20°C to 125°C

1.2 Main ApplicationFields

- ✧ Intelligent LED
- ✧ Intelligent household applications
- ✧ Intelligent low-power consumptionsensors

2. Dimensions and Footprint

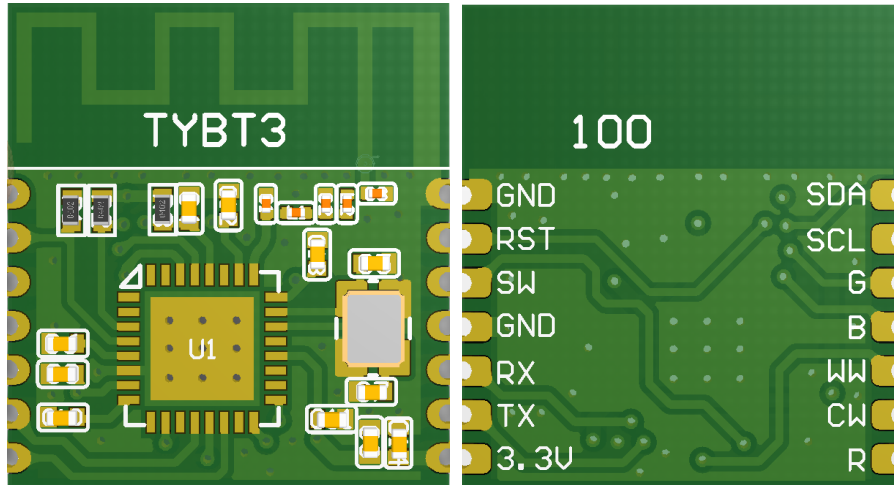
2.1 Dimensions

TYBT3 have double sides of pins. The distance between each Pin is 2.0mm.

Size of TYBT3: 15mm(W)*16.5mm(L).

Figure 2 shows the dimensions of TYBT3.

Figure 2. The dimensions of TYBT3



2.2 Pin Definition

Table 1 shows the general pin attributes of TYBT3

Table 1. The typical pin definition of TYBT3

PIN NO.	NAME	TYP E	DESCRIPTION
1	SDA	I/O	I2C, data interface, internal pull-up 4.7k resistance
2	SCL	I/O	I2C, clock interface, internal pull-up 4.7k resistance
3	G	I/O	normal IO pin, can be used as PWM output pin, default for Green LED line
4	B	I/O	normal IO pin, can be used as PWM output pin, default for Blue LED line
5	WW	I/O	normal IO pin, can be used as PWM output pin, default for Warm White LED line
6	CW	I/O	normal IO pin, can be used as PWM output pin, default for Cold White LED line
7	R	I/O	normal IO pin, can be used as PWM output pin, default for Red LED line
8	3.3V	P	Supply voltage

9	TX	I/O	UART TX,can be used as normal IO pin
10	RX	I/O	UART RX,can be used as normal IO pin
11	GND	P	Ground
12	SW	I/O	Bluetooth chipset burning pin
13	RST	I	reset pin for the module,internal pull-up 4.7k resistance
14	GND	P	Ground

Note: P: Power supply pins; I/O: Digital input or output pins.

SW pin is ONLY used for burning firmware, Can NOT be used for other functions.

There are 4.7 pull-up resistance internally for I2C pins, external pull-up resistances are not necessary.

When WW pin is outputting PWM signal, It has opposite phase comparing the PWM signal from R/G/B/CW pin.

If there's any customization needed for PWM output, please contact our BD manager.

3. Electrical Characteristics

3.1 Absolute Maximum Ratings

Table 2. Absolute Maximum Ratings

PARAMETERS	DESCRIPTION	MIN	MAX	UNIT
Ts	Storage temperature	-20	125	°C
VCC	Supply voltage	-0.3	3.9	V
Electrostatic release quantity (Human body model)	TAMB-25°C	-	2	KV
Electrostatic release quantity (Machine model)	TAMB-25°C	-	0.5	KV

3.2 Electrical Conditions

Table 3. Electrical Conditions

PARAMETERS	DESCRIPTION	MIN	TYPICAL	MAX	UNIT
Ta	Temperature for Commercial grade	-20	-	125	°C
VCC	Supply voltage	1.9	3.3	3.6	V
VIL	IO negative level input	-0.3	-	VCC*0.3	V
VIH	IO positive level input	VCC*0.7	-	VCC	V
VOL	IO negative level output	VSS	-	0.3	V
VoH	IO positive level output	VCC-0.3	-	VCC	V

3.3 Transmitting Current Consumptions

Table 4. TX current consumption

PARAMETERS	MODE	TYPICAL	UNIT
I _{tx}	Continuously transmitting, 0dBm power output	15	mA
I _{rx}	Continuously receiving	12	mA
IDC	Normal working mode	27	mA
I _{deepsleep}	Sleep mode	18	uA

4. Radio Specification

4.1 Basic Radio Frequency Characteristics

Table 5. Basic Radio frequency characteristics

PARAMETERS	DESCRIPTION
Working Frequency	2.4GHz ISM band
Radio standard	BLE 4.2
Data transmitting rate	1Mbps, 2Mbps
Type of Antenna	On-board PCB Antenna

4.2 Transmitting Power

Table 6. Transmitting power

PARAMETERS	MIN	TYPICAL	MAX	UNIT
RF Average output power consumption	3.8	7	8	dBm
20dB bandwidth (1M)	-	1300	-	KHz
20dB bandwidth (2M)	-	2600	-	KHz

4.3 Receiving Sensitivity

Table 7. Receiving sensitivity

PARAMETERS		MIN	TYPICAL	MAX	UNIT
RX sensitivity	1Mbps	-93	-92	-90	dBm
	2Mbps	-90	-89	-86	
Frequency bias error	1Mbps	-300	-	+300	KHz
	2Mbps	-200	-	+200	
Co-channel interference Restrain	-	-	-7	-	dB

5. Antenna Information

5.1 Antenna Type

Antenna for TYBT3 module is using 2.4 GHz MIFA On-board PCB antenna.

5.2 Reduce Antenna Interference

In order to have the best RF performance, it's recommended to keep a minimum 15mm distance between the antenna part and the other metal pieces.

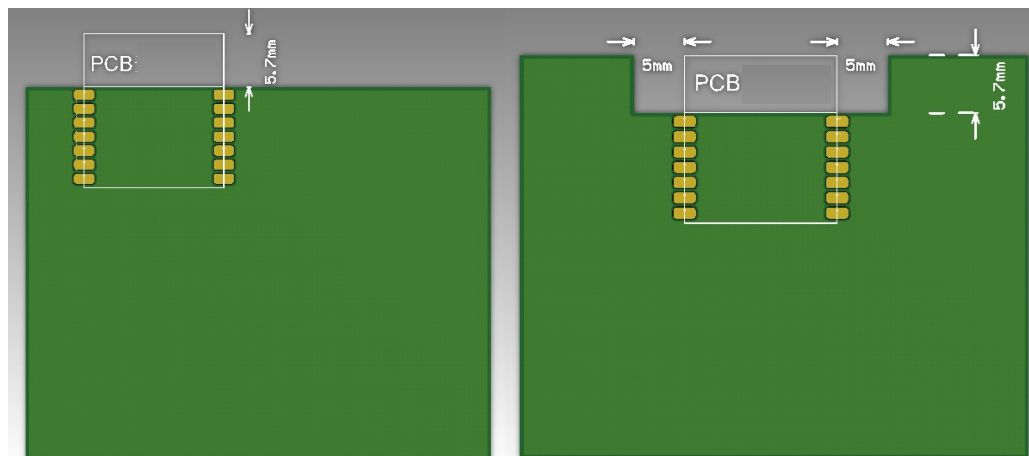
Since PCBA manufacture use SMT process to weld TYBT3 module and other electrical components onto the PCB board, RF performance will depend on the layout location and pattern of the On-board PCB antenna. The following figures are some recommended and dis-recommended demonstrations from our R&D team.

In demonstration 1 and 2 of figure 3, the on-board PCB antenna lays outside of the PCB frame. It's recommended to use layout pattern shown in demonstration 1 and 2. Either the on-board PCB antenna lays outside of the PCB frame directly or PCB frame carve out a certain area for the antenna. The overall PCBA performance for these two ways will be the same as testing the module independently.

Restricted due to some reason, if the on-board PCB antenna layout has to be inside the PCB frame, it's suggested to refer to demonstration 3. The antenna lays inside the PCB frame, but no copper or wire beneath the antenna. RF performance will have some loss, approximately 1~2 dBm.

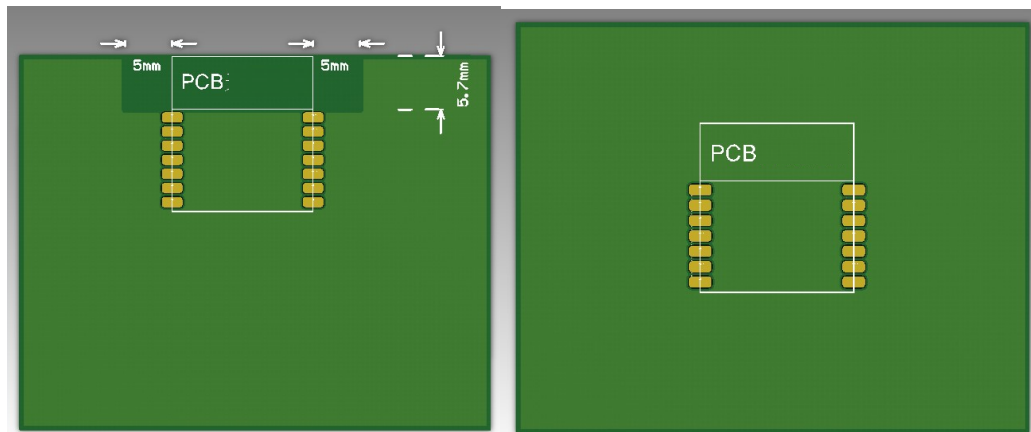
It's NOT recommended to use demonstration 4, the antenna lays inside the PCB frame, and there are copper and wire beneath it. RF performance will have significant attenuation.

Figure 3. layout demonstrations



Demonstration 1: Antenna lay outside the PCB frame

Demonstration 2: Antenna lay outside the PCB frame with carved area



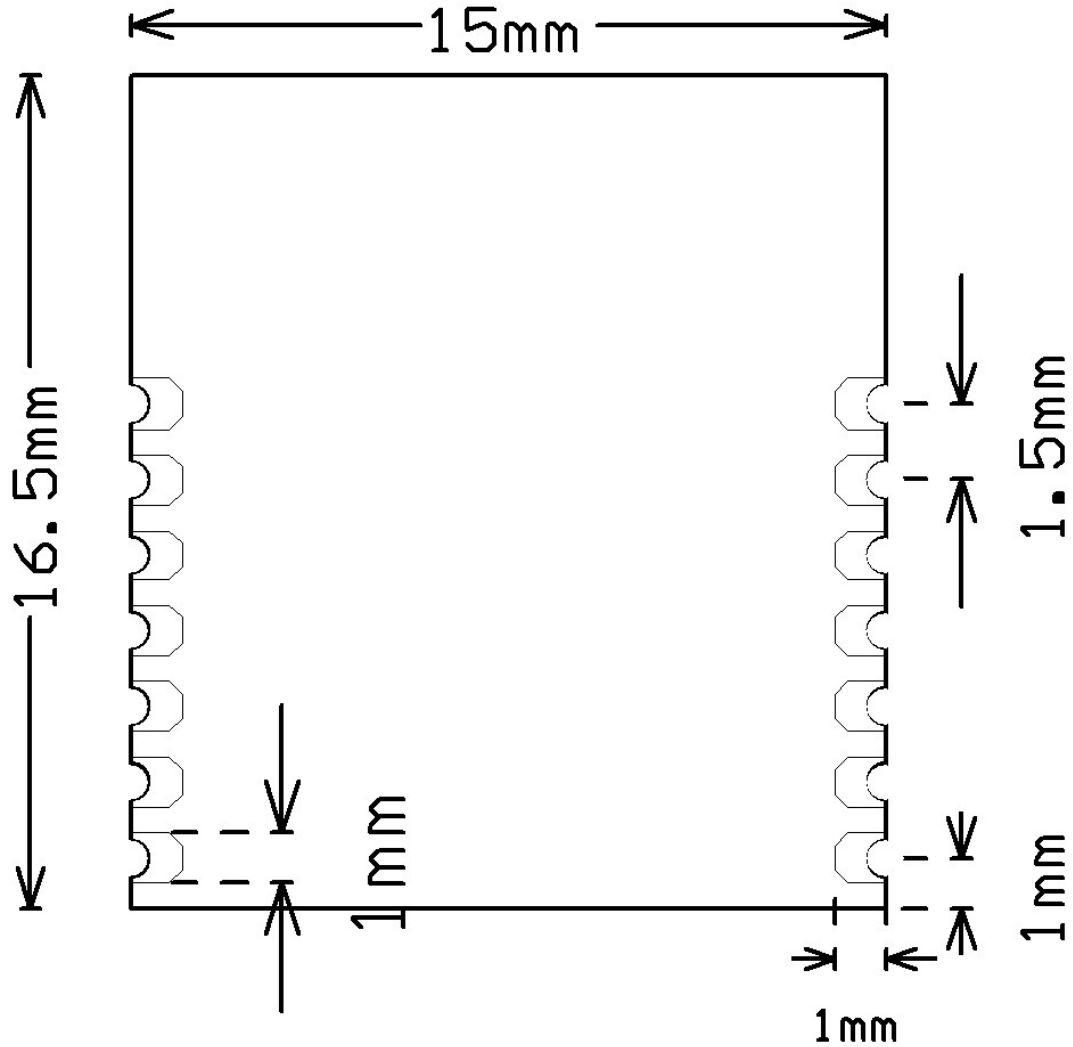
Demonstration 3: Antenna lay inside the PCB frame without copper or wire beneath it

Demonstration 4: Antenna lay inside the PCB frame with copper or wire beneath it

6. Packaging Information And Production Guide

6.1 Mechanical Dimensions

Figure 4. Dimensions of the module



6.2 Production Guide

- ✧ The storage for the delivered module should meet the following condition:
 1. The anti-moisture bag should be kept in the environment with temperature $< 30^{\circ}\text{C}$ and humidity $< 85\% \text{ RH}$.
 2. The expiration date is 6 months since the dry packaging products was sealed.
- ✧ Cautions:
 1. All the operators should wear electrostatic ring in the whole process of production.
 2. While operating, water and dirt should not have any contact with the modules.

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 equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment 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 equipment and receiver.
- Connect the equipment 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.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

FCC Radiation Exposure Statement

This modular complies with FCC RF radiation exposure limits set forth for an uncontrolled environment. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

Note 1: Compliance of this device in all final host configurations is the responsibility of the Grantee. OEM integrators are responsible to satisfy RF exposure requirements. SAR evaluation is valid for portable, mobile and fixed applications.

Note 2: Any modifications made to the module will void the Grant of Certification, this module is limited to OEM installation only and must not be sold to end-users, end-user has no manual instructions to remove or install the device, only software or operating procedure shall be placed in the end-user operating manual of final products.

Note 3: The device must not transmit simultaneously with any other antenna or transmitter.

Note 4: To ensure compliance with all non-transmitter functions the host manufacturer is responsible for ensuring compliance with the module(s) installed and fully operational. For example, if a host was previously authorized as an unintentional radiator under the Declaration of Conformity procedure without a transmitter certified module and a module is added, the host manufacturer is responsible for ensuring that the after the module is installed and operational the host continues to be compliant with the Part 15B unintentional radiator requirements. Since this may depend on the details of how the module is integrated with the host, The manufacturer shall provide guidance to the host manufacturer for compliance with the Part 15B requirements.

Note 5: FCC ID label on the final system must be labeled with "Contains FCC ID: XBI-TYBT3"

The transmitter module must be installed and used in strict accordance with the manufacturer's instructions as described in the user documentation that comes with the host product.

SUNGALE ELECTRONICS (SHENZHEN) CO.,LTD is responsible for the compliance of the module in all final hosts.