BLE module introduction–TYBT4L

Contents

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1. Product Overview

TYBT4L is a low power-consuming built-in Bluetooth module developed by Hangzhou Tuya Information Technology Co., Ltd. It consists of a highly integrated Bluetooth chip (TLSR8267) and several peripheral electrical circuits, with a built-in Bluetooth network communication protocol stack and robust library functions. TYBT4L also contains a low power-consuming 32-bit MCU, a BLE, a 512 KB flash, a 16 KB SRAM, and nine multiplex I/O ports.

1.1 Features

Built-in low power-consuming 32-bit CPU, which can also be used as an application processor
Basic frequency: 48 MHz supported
Working voltage: 1.9 V to 3.6 V
Peripherals: one I2C interface, five PWMs, and one UART
BLE RF features
Compatible with BLE 4.2
RF data rate: up to 1 Mbit/s
RX sensitivity: –92 dBm
Built-in AES encryption for hardware
Onboard PCB antenna
Working temperature: –20°C to +105°C

1.2 Major Application Fields
✧Intelligent LED
✧Intelligent home

◇Intelligent low-power sensors

2. Module Interfaces

2.1 Dimensions and Footprint

TYBT4L provides two rows of pins with the distance of 2.0 mm between every two pins.

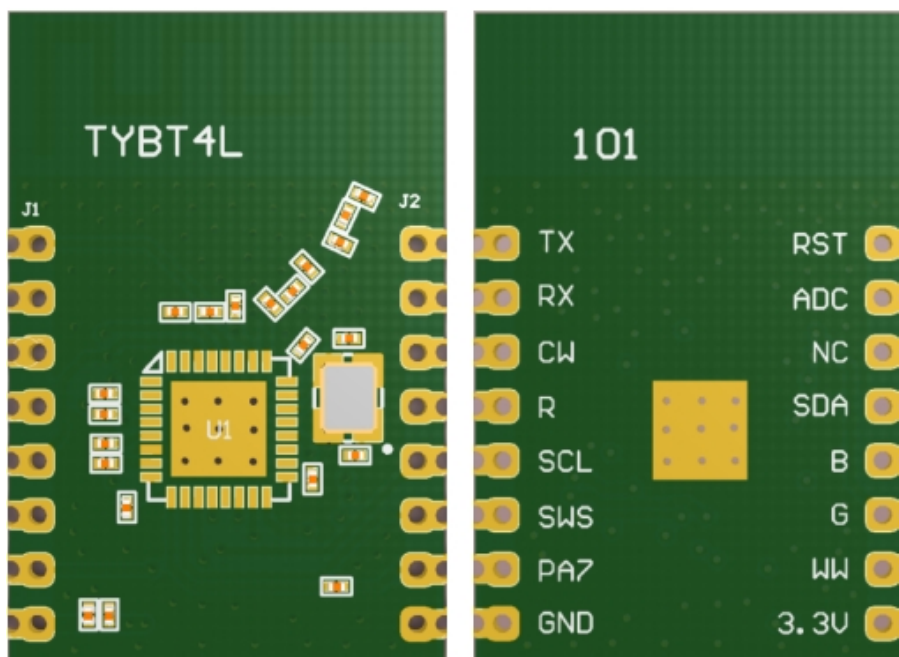TYBT4L dimensions: 16 mm (W) x 24 mm (L) (see figure 2.1)

Figure 2.1 TYBT4L footprint

2.2 Pin definition

Table 2.1 describes the interface pins.

Table 2.1 TYBT4L interface pins

No.	Symbol	I/O Type	Functions
1	RST	I	Module reset pin
2	ADC	I	External analog input
3	NC	/	NC interface, which is not connected
4	SDA	I/O	Pin for the data line of the I2C interface, which must be connected to a 4.7 kΩ pull-up resistor. This pin can also be used as the common I/O interface.
5	B	I/O	Common I/O interface, which can be used for PWM output of the LED driver. It controls the blue LED by default.
6	G	I/O	Common I/O interface, which can be used for PWM output of the LED driver. It controls the green LED by default.

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7	WW	I/O	Common I/O interface, which can be used for PWM output of the LED driver. It controls the warm white LED by default.
8	3.3 V	P	Module power supply input pin
9	GND	P	Module power supply reference ground pin
10	PA7	I/O	Used as the common I/O interface
11	SWS	I/O	Bluetooth chip programming pin
12	SCL	I/O	Pin for the clock line of the I2C interface, which must be connected to a 4.7 kΩ pull-up resistor. This pin can also be used as the common I/O interface.
13	R	I/O	Common I/O interface, which can be used for PWM output of the LED driver. It controls the red LED by default.
14	CW	I/O	Common I/O interface, which can be used for PWM output of the LED driver. It controls the cold white LED by default.
15	RX	I/O	Serial port TX pin, used as the common I/O interface
16	TX	I/O	Serial port TX pin, used as the common I/O interface

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

The SWS pin is used only for programming of module firmware.

The I2C pin does not provide a pull-up resistor. It must be connected to an external pull-up resistor.

When the WW pin is used for PWM output, its polarity is opposite to that of the R, G, B, and CW pins used for PWM output.

If you have special requirements for the light color controlled by PWM output, contact our business manager.

3. Electrical Characteristics

3.1 Absolute Electrical Characteristics

Table 3 .1Absolute electrical characteristics

PARAMETERS	DESCRIPTION	MIN	MAX	UNIT
Ts	Storage temperature	-40	125	°C
VCC	Power supply voltage	-0.3	3.9	V
Static electricity voltage (human model)	TAMB-25℃	-	2	KV
Static electricity voltage (machine model)	TAMB-25℃	-	0.5	KV

3.2 Electrical Conditions

Table 3.2 Normal electrical conditions

Parameters	Description	Min	Typ	Max	Unit
Ta	Working temperature	–20	-	105	°C
VCC	Working voltage	1.9	3.3	3.6	V
VIL	I/O low-level input	–0.3	-	VCC*0.3	V
VIH	I/O high-level input	VCC*0.7	-	VCC	V
VOL	I/O low-level output	VSS	-	0.3	V
VoH	I/O high-level output	VCC–0.3	-	VCC	V

3.3   Power Consumption in Operating Mode

Table 3.3 TX power consumption during constant emission

Symbol	Condition	Typical Value	Unit
Itx	Constant emission, with 0 dBm output power	15	mA
Irx	Constant receiving	12	mA
IDC	Mesh connected	27	mA
Ideepsleep	Sleep mode	18	uA

4. RF Features

4.1 Basic RF Features

Table 4.1 Basic RF features

Parameter	Description
Frequency band	2.4 GHz ISM band

Radio standard	BLE 4.2
Data transmitting rate	1 Mbit/s
Antenna type	Onboard PCB antenna

4.2 RF Output Power

Table 4.2 TX power during constant emission

PARAMETERS	MIN	TYPICAL	MAX	UNIT
RF output power	-	4.73	-	dBm
6 dB modulation signal bandwidth (1 M)	-	709	-	KHz

4.3 RF RX Sensitivity

Table 4.3 RX sensitivity

Parameter		Min	Typ	Max	Unit
RX sensitivity	1Mbit/s	-93	-92	-90	dBm
Frequency offset error	1Mbit/s	-300	-	+300	KHz
Co-channel interference suppression	-	-	-7	-	dB

5.Antenna Information

5.1 Antenna Types

TYBT4L has an on-board PCB antenna for BLE .

5.2 Antenna Interference Reduction

To ensure optimal RF performance, it is recommended that there be a space of at least 15 mm between the module antenna and other metal parts. TYBT4L is attached to the PCB with other components using the SMT. In this case, the routing position and method of the PCB antenna directly affect the RF performance. The following figures show the recommended and not recommended routing positions.

As shown in Figure 5.1, if most of the antenna is outside the PCB frame, solutions 1 and 2 are recommended. The antenna is placed outside the PCB frame or the PCB is carved to reserve an area for the antenna. By using these two solutions, the performance of TYBT4L is almost the same as that of the module when being tested independently. If the antenna must be routed on the PCB due to restrictions, solution 3 is recommended.

The antenna is placed inside the PCB frame and no copper or wire is routed near the antenna. If this solution is used, the performance is reduced by about 1–2 dBm. It is not recommended that solution 4 be used, in which the antenna is placed inside the PCB and copper and other wires are routed under the antenna. In this solution, the RF signal has significantly attenuation.
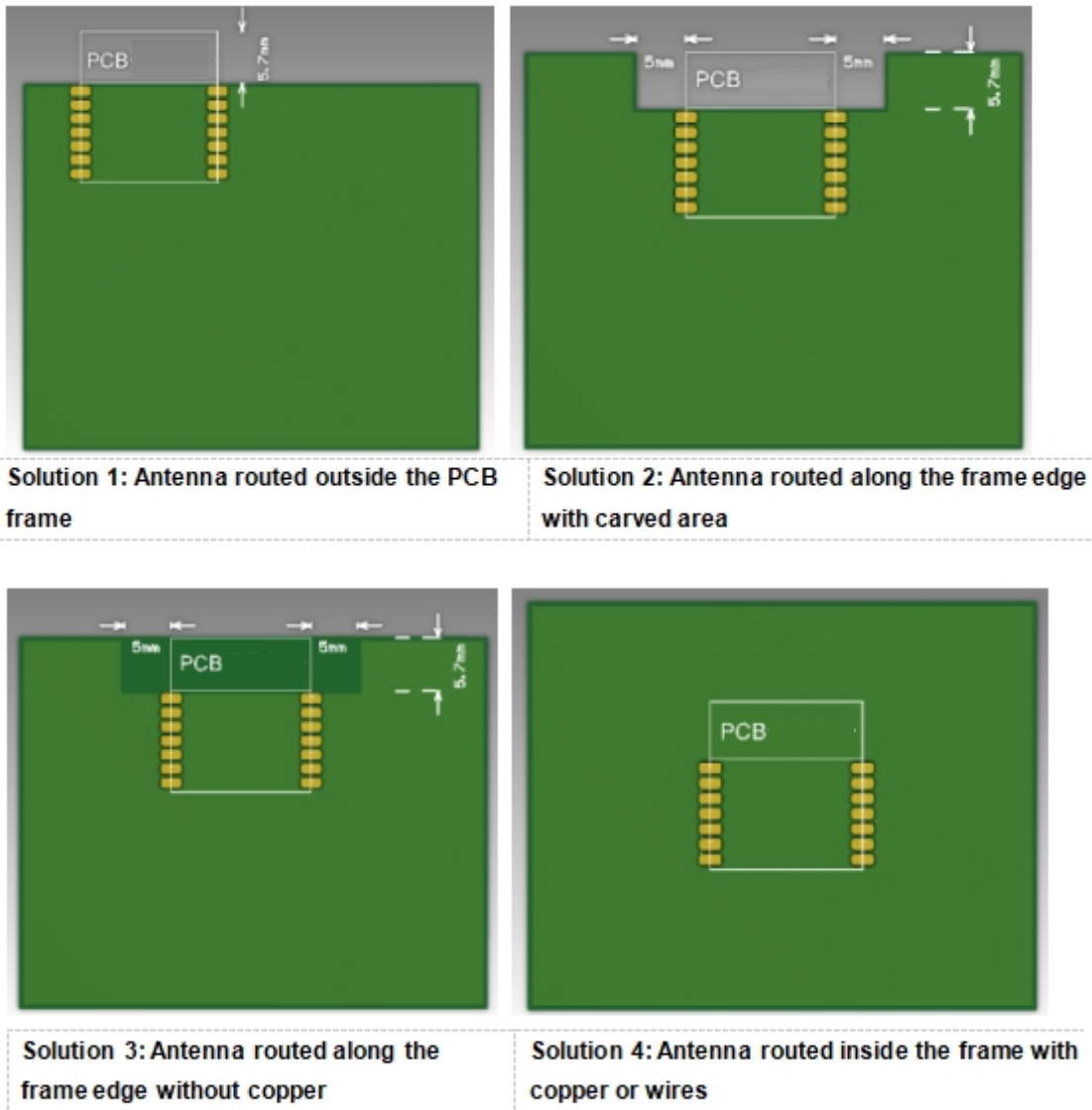
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Solution 1: Antenna routed outside the PCB frame

Solution 2: Antenna routed along the frame edge with carved area

Solution 3: Antenna routed along the frame edge without copper

Solution 4: Antenna routed inside the frame with copper or wires

Figure 5.1 TYBT4L antenna routing

6.Packaging information and production instruction

6.1 Mechanical Dimensions and Size of the Back Pad
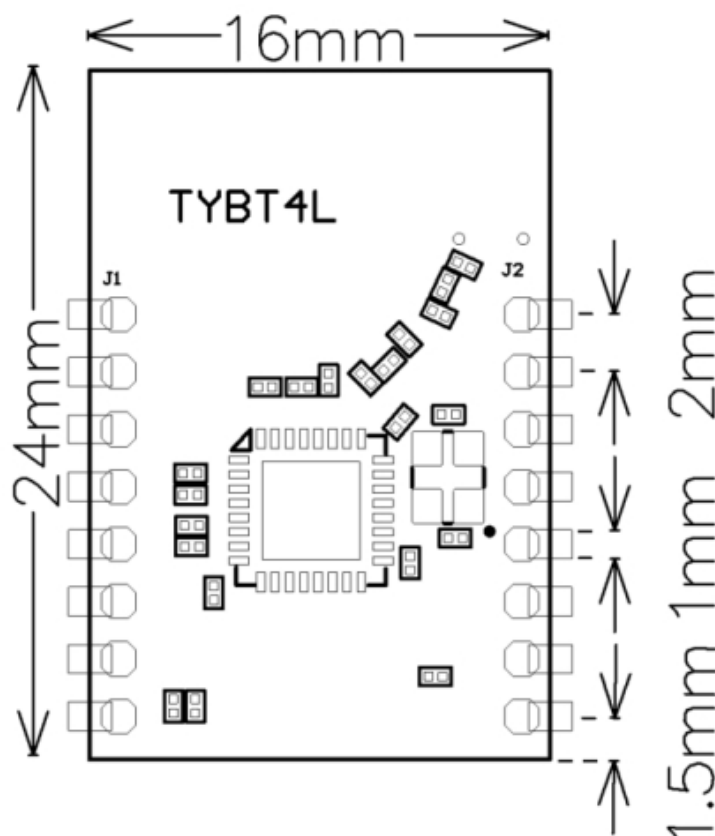
Figure 6.1 TYBT4L size diagram

Figure 6.1 TYBT4L dimensions

6.2 Production Instructions

Storage conditions of a delivered module are as follows:

1.The anti-moisture bag must be placed in an environment where the temperature is under 30°C and the relative humidity is under 85%.

2.The shelf life of a dry-packaged product is six months from the date when the product is packaged and sealed.

Precautions:

1.Throughout the production process, each involved operator must wear an electrostatic ring.

2.During the operation, strictly protect the module from water and strains.

Regulatory Module Integration Instructions
This device complies with part 15.247 of the FCC Rules.
The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user's manual of the end product which integrates this module.
The antenna is PCB Antenna and maximum gain is 2.0dBi .
This module has been granted modular approval for mobile applications. OEM integrators
for host products may use the module in their final products without additional FCC certification if they meet the following conditions. Otherwise, additional FCC approvals must be obtained.

The host product with the module installed must be evaluated for simultaneous transmission requirements.

The user's manual for the host product must clearly indicate the operating requirements and conditions that must be observed to ensure compliance with current FCC RF exposure guidelines.

To comply with FCC regulations limiting both maximum RF output power and human exposure to RF radiation, use this module only with the included onboard antenna.

The final host / module combination may also need to be evaluated against the FCC Part 15B criteria for unintentional radiators in order to be properly authorized for operation as a Part 15 digital device.

FCC Statement

Any Changes or modifications not expressly approved by the party responsible for compliance could

void the user's authority to operate the equipment.

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.

FCC Radiation Exposure Statement:

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled

environment .This equipment should be installed and operated with minimum distance 20cm

between the radiator& your body.

FCC Label Instructions:

The outside of final products that contains this module device must display a label referring to the

enclosed module. This exterior label can use wording such as: "Contains Transmitter Module

FCC ID: 2ANDL-TYBT4L",or "Contains FCC ID: 2ANDL-TYBT4L",

Any similar wording that expresses the same meaning may be used.