

1. Product Overview

TYLC6E is a low-power embedded Wi-Fi module that Tuya has developed. It consists of a highly integrated RF chip (ESP8285) and several peripheral components, with an embedded Wi-Fi network protocol stack and robust library functions. TYLC6E is embedded with a low-power 32-bit CPU, 2 MB flash memory, and 50 KB static random-access memory (SRAM), and has extensive peripherals.

TYLC6E is an RTOS platform that integrates all function libraries of the Wi-Fi MAC and TCP/IP protocols. You can develop embedded Wi-Fi products as required.

1.1 Features

- ✧ Embedded low-power 32-bit CPU, which can also function as an application processor
 - Dominant frequencies: 80 MHz and 160 MHz
- ✧ Working voltage: 3.0 V to 3.6 V
- ✧ Peripherals: five GPIOs
- ✧ Wi-Fi connectivity
 - 802.11b/g/n
 - Channels 1 to 14 at 2.4 GHz
 - WPA and WPA2 security modes
 - Up to +20 dBm output power in 802.11b mode
 - STA, AP, and STA+AP working modes
 - Smart and AP network configuration modes for Android and iOS devices
 - External helical antenna with a gain of 1.0 dBi
 - Working temperature: -20°C to +105°C

1.2 Applications

- ✧ Intelligent building
- ✧ Smart household and home appliances
- ✧ Smart socket and light
- ✧ Industrial wireless control
- ✧ Baby monitor
- ✧ Network camera
- ✧ Intelligent bus

Change History

No.	Date	Change Description	Version After Change
1	2019-03-19	This is the first release.	1.0.0
2	2019-07-24	Added GPIO information.	1.0.1

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2. Module Interfaces

2.1 Dimensions and Footprint

TYLC6E has two rows of pins with a 2 mm pin spacing. The TYLC6E dimensions (HxWxD) are 3 ± 0.1 mm x 12 ± 0.15 mm x 14 ± 0.15 mm. The PCB thickness is 1.0 ± 0.1 mm. The shield cover height is 2.0 ± 0.05 mm. Figure 2 shows the TYLC6E front and rear views.

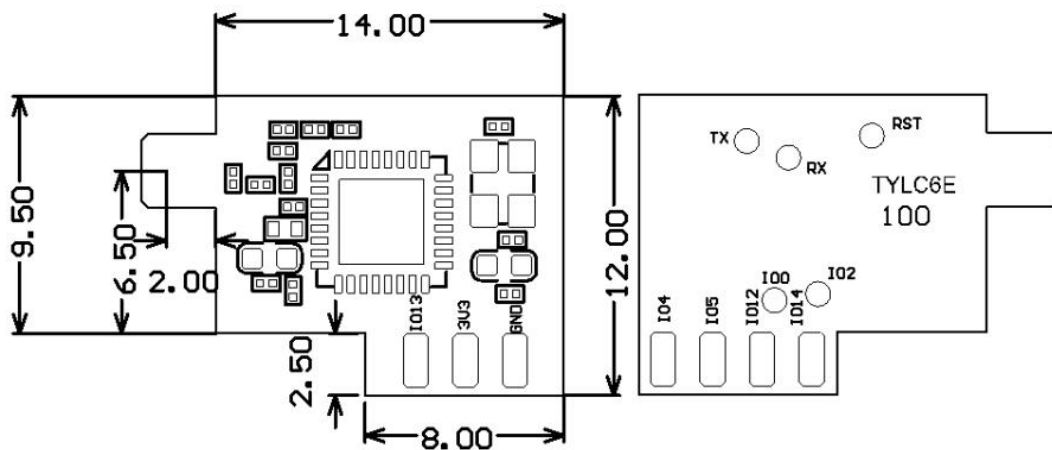


Figure 2-1 TYLC6E front and rear views

2.2 Interface Pin Definition

Table 2-1 TYLC6E interface pins

Pin No.	Symbol	I/O Type	Function
1	GPIO14	I/O	Used as a GPIO, which is connected to MTMS (pin 9) on the internal IC
2	GPIO13	I/O	Used as a GPIO, which is connected to MTCK (pin 12) on the internal IC
3	GPIO12	I/O	Used as a GPIO, which is connected to MTDI (pin 10) on the internal IC
4	VCC	P	Power supply pin (3.3 V)
5	GPIO5	I/O	Used as a GPIO, which is connected to GPIO5 (pin 24) on the internal IC

Pin No.	Symbol	I/O Type	Function
6	GND	P	Power supply reference ground pin
7	GPIO4	I/O	Used as a GPIO, which is connected to GPIO4 (pin 16) on the internal IC

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

2.3 Test Pin Definition

Table 2-2 TYLC6E test pins

Pin No.	Symbol	I/O Type	Function
N/A	TP1	I/O	GPIO2, used for query of the module printing information
	TP2	I/O	GPIO0, used for the module production test
	TP3	RST	Hardware reset pin, which cannot clear the Wi-Fi network configuration
	TP4	UART0_TXD	User-side serial interface, which generates information for the module production test when the module is powered on and starts
	TP5	UART0_RXD	User-side serial interface, which generates information for the module production test when the module is powered on and starts

Note:

1. Test pins are not recommended.
2. RST is only a hardware reset pin and cannot clear the Wi-Fi network configuration.
3. UART0 is a user-side serial interface, which generates information when the module is powered on and starts.

3. Electrical Parameters

3.1 Absolute Electrical Parameters

Table 3-1 Absolute electrical parameters

Parameter	Description	Minimum Value	Maximum Value	Unit
Ts	Storage temperature	−40	125	°C
VCC	Power supply voltage	−0.3	3.6	V
Static electricity voltage (human body model)	Tamb = 25°C	N/A	2	kV
Static electricity voltage (machine model)	Tamb = 25°C	N/A	0.5	kV

3.2 Electrical Conditions

Table 3-2 Normal electrical conditions

Parameter	Description	Minimum Value	Typical Value	Maximum Value	Unit
Ta	Working temperature	−20	N/A	105	°C
VCC	Power supply voltage	3.0	3.3	3.6	V
V _{IL}	I/O low-level input	−0.3	N/A	VCC x 0.25	V
V _{IH}	I/O high-level input	VCC x 0.75	N/A	VCC	V
V _{OL}	I/O low-level output	N/A	N/A	VCC x 0.1	V

Parameter	Description	Minimum Value	Typical Value	Maximum Value	Unit
V _{OH}	I/O high-level output	VCC x 0.8	N/A	VCC	V
I _{max}	I/O drive current	N/A	N/A	12	mA

3.3 RF Current

Table 3-3 Current during constant transmission and receiving

Working Status	Parameter			Typical Value	Unit
	Mode	Rate	TX Power/Receiving		
TX	802.11b	11 Mbit/s	+17 dBm	220	mA
	802.11g	54 Mbit/s	+15 dBm	110	mA
	802.11n	MCS0	+14 dBm	120	mA
	802.11n	MCS7	+13 dBm	100	mA
RX	802.11b	11 Mbit/s	Constant receiving	76	mA
	802.11g	54 Mbit/s	Constant receiving	76	mA
	802.11n	MCS7	Constant receiving	76	mA

3.4 Working Current

Table 3-4 TYLC6E working current

Working Mode	Working Status (Ta = 25°C)	Average Value	Maximum Value	Unit
EZ	The module is in EZ mode, and the Wi-Fi indicator blinks quickly.	80	151	mA
AP	The module is in AP mode, and the Wi-Fi indicator blinks slowly.	90	451	mA
Connected	The module is connected to the network, and the Wi-Fi indicator is steady on.	58.5	411	mA
Disconnected	The module is disconnected from the network, and the Wi-Fi indicator is steady off.	80	430	mA

4. RF Features

4.1 Basic RF Features

Table 4-1 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	802.11b: 1, 2, 5.5, or 11 (Mbit/s) 802.11g: 6, 9, 12, 18, 24, 36, 48, or 54 (Mbit/s) 802.11n: HT20 MCS0 to MCS7
Antenna type	External helical antenna with a gain of 1 dBi

4.2 TX Performance

Table 4-2 Performance during constant transmission

Parameter		Minimum Value	Typical Value	Maximum Value	Unit
Average RF output power, 802.11b CCK mode	11 Mbit/s	N/A	17	N/A	dBm
Average RF output power, 802.11g OFDM mode	54 Mbit/s	N/A	14	N/A	dBm
Average RF output power, 802.11n OFDM mode	MCS7	N/A	13	N/A	dBm
Frequency error		-10	N/A	+10	ppm
EVM under 802.11b CCK 11 Mbit/s 17.5 dBm			-15		dB
EVM under 802.11g OFDM 54 Mbit/s 15.0 dBm			-29		dB
EVM under 802.11n OFDM MCS7 14.0 dBm			-30		dB

4.3 RX Performance

Table 4-3 RX sensitivity

Parameter		Minimum Value	Typical Value	Maximum Value	Unit
PER < 8%, 802.11b CCK mode	1 Mbit/s	N/A	-91	N/A	dBm
PER < 10%, 802.11g OFDM mode	54 Mbit/s	N/A	-75	N/A	dBm
PER < 10%, 802.11n OFDM mode	MCS7	N/A	-72	N/A	dBm

5. Antenna Information

5.1 Antenna Type

An external antenna can be soldered onto the ANT solder pad of the module.

An 11.5 mm antenna is recommended. Figure 5-1 shows the antenna dimensions.

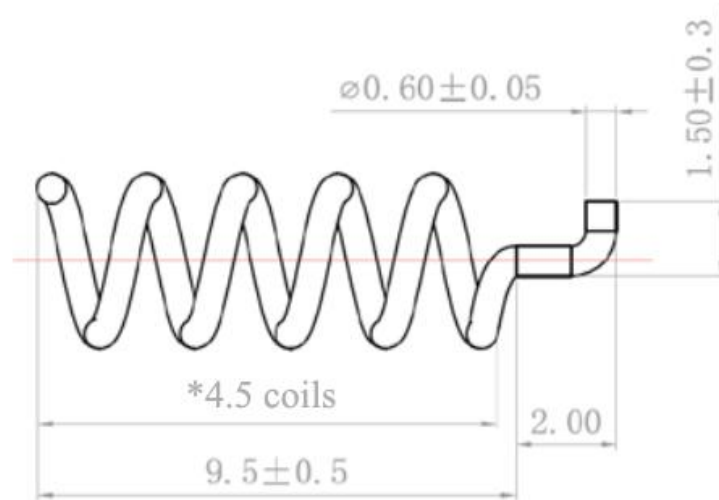


Figure 5-1 Antenna dimensions

5.2 Antenna Interference Reduction

To ensure optimal Wi-Fi performance when the Wi-Fi module uses an external antenna, it is recommended that the antenna be at least 15 mm away from other metal parts.

5.3 Antenna Connector Specifications

TYLC6E does not use an antenna connector.

6. Packaging Information and Production Instructions

6.1 Mechanical Dimensions

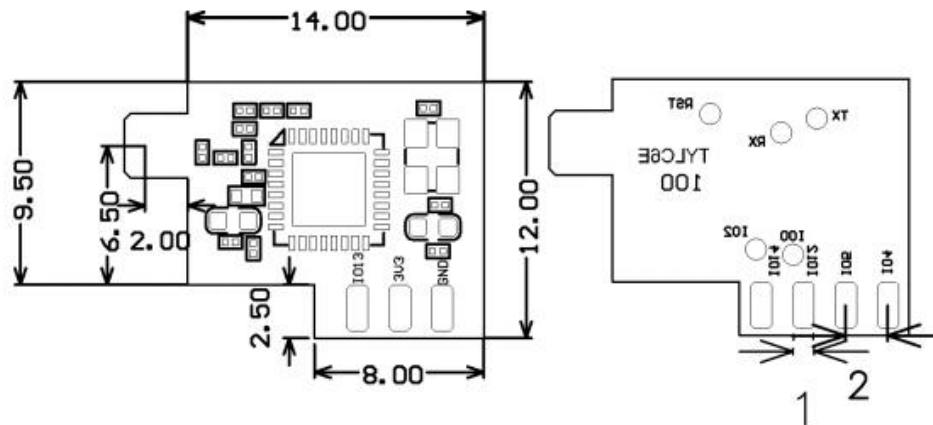


Figure 6-1 TYLC6E mechanical dimensions

Note: The default dimensional tolerance is ± 0.35 mm. If a customer has other requirements, clearly specify them in the datasheet after communication.

6.2 Recommended PCB Encapsulation

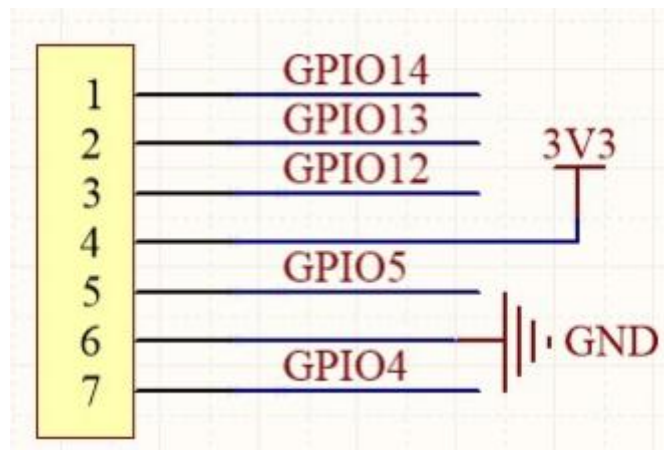


Figure 6-2 TYLC6E pins

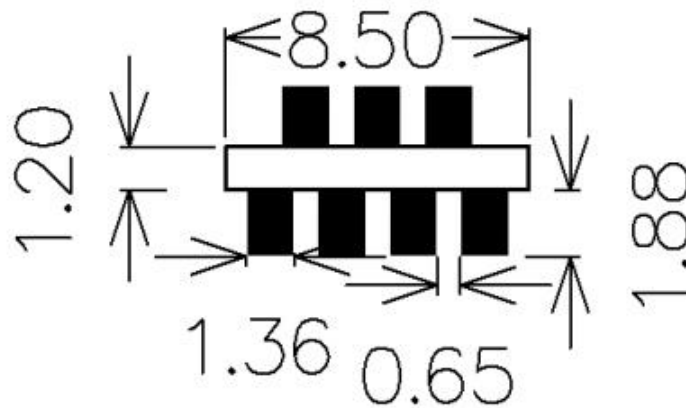


Figure 6-3 PCB encapsulation diagram of TYLC6E

6.3 Production Instructions

1. Use an SMT placement machine to mount components to the stamp hole module that Tuya produces within 24 hours after the module is unpacked and the firmware is burned. If not, vacuum pack the module again. Bake the module before mounting components to the module.
 - (1) SMT placement equipment
 - i. Reflow soldering machine
 - ii. Automated optical inspection (AOI) equipment
 - iii. Nozzle with a 6 mm to 8 mm diameter
 - (2) Baking equipment
 - i. Cabinet oven
 - ii. Anti-static heat-resistant trays
 - iii. Anti-static heat-resistant gloves
2. Storage conditions for a delivered module are as follows:
 - (1) The moisture-proof bag is placed in an environment where the temperature is below 30°C and the relative humidity is lower than 70%.
 - (2) The shelf life of a dry-packaged product is six months from the date when the product is packaged and sealed.
 - (3) The package contains a humidity indicator card (HIC).

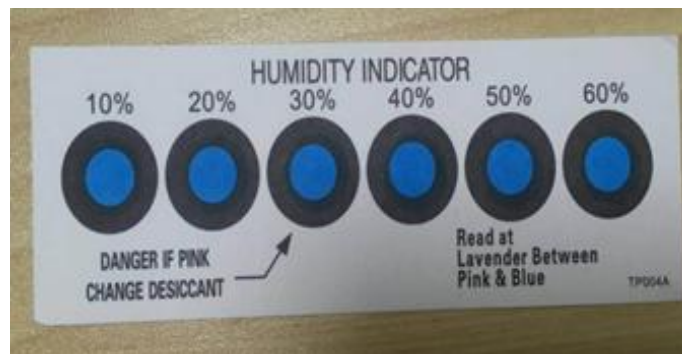


Figure 6-4 HIC for TYLC6E

3. Bake a module based on HIC status as follows when you unpack the module package:
 - (1) If the 30%, 40%, and 50% circles are blue, bake the module for 2 consecutive hours.
 - (2) If the 30% circle is pink, bake the module for 4 consecutive hours.
 - (3) If the 30% and 40% circles are pink, bake the module for 6 consecutive hours.
 - (4) If the 30%, 40%, and 50% circles are pink, bake the module for 12 consecutive hours.
4. Baking settings:
 - (1) Baking temperature: $125 \pm 5^{\circ}\text{C}$
 - (2) Alarm temperature: 130°C
 - (3) SMT placement ready temperature after natural cooling: $< 36^{\circ}\text{C}$
 - (4) Number of drying times: 1
 - (5) Rebaking condition: The module is not soldered within 12 hours after baking.
5. Do not use SMT to process modules that have unpacked for over three months. Electroless nickel immersion gold (ENIG) is used for the PCBs. If the solder pads are exposed to the air for over three months, they will be oxidized severely and dry joints or solder skips may occur. Tuya is not liable for such problems and consequences.
6. Before SMT placement, take electrostatic discharge (ESD) protective measures.
7. To reduce the reflow defect rate, draw 10% of the products for visual inspection and AOI before first SMT placement to determine a proper oven temperature and component placement method. Draw 5 to 10 modules every hour from subsequent batches for visual inspection and AOI.

6.4 Recommended Oven Temperature Curve

Perform SMT placement based on the following reflow oven temperature curve. The highest temperature is 245°C.

Based on the IPC/JEDEC standard, perform reflow soldering on a module at most twice.

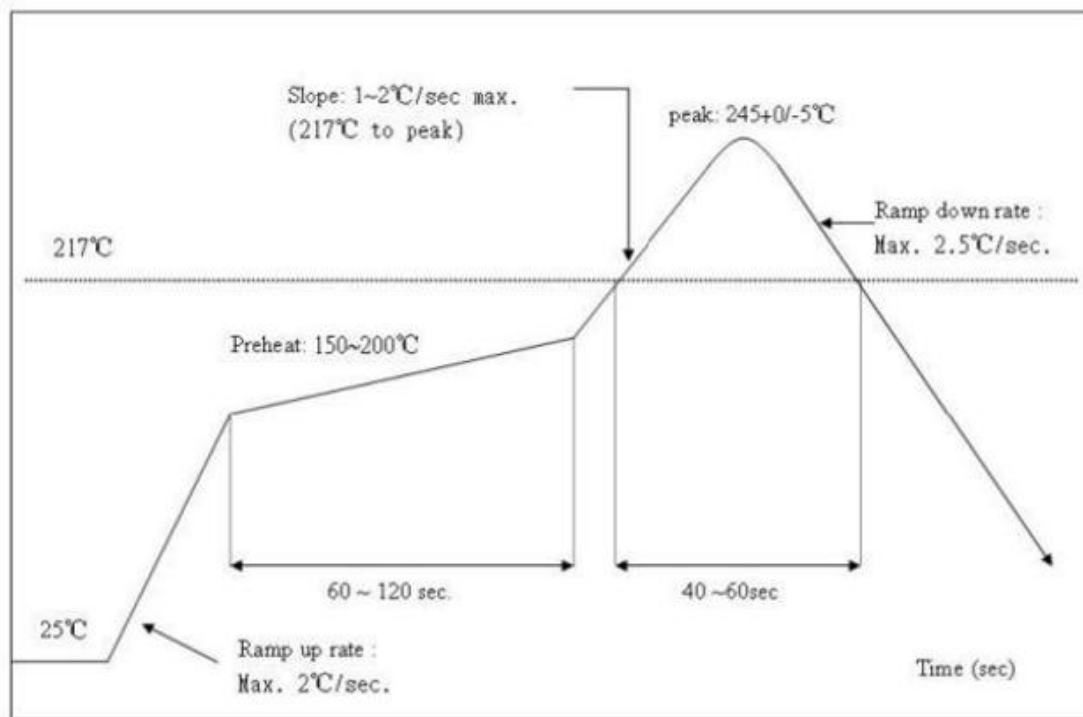


Figure 6-5 Oven temperature curve

6.5 Storage Conditions

	CAUTION This bag contains MOISTURE-SENSITIVE DEVICES	LEVEL <div style="border: 1px solid black; padding: 5px; display: inline-block;"> 3 </div>
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: <u>260</u> °C <small>If Blank, see adjacent bar code label</small>		
3. After bag is opened, devices that will be subjected to reflow solder or other high temperature process must		
a) Mounted within: <u>168</u> hrs. of factory conditions <small>If Blank, see adjacent bar code label</small>		
≤ 30°C/60%RH, OR		
b) Stored at <10% RH		
4. Devices require bake, before mounting, if:		
a) Humidity Indicator Card is > 10% when read at 23 ± 5°C		
b) 3a or 3b not met.		
5. If baking is required, devices may be baked for 48 hrs. at 125 ± 5°C		
Note: If device containers cannot be subjected to high temperature or shorter bake times are desired, reference IPC/JEDEC J-STD-033 for bake procedure		
Bag Seal Date: _____ <small>If Blank, see adjacent bar code label</small>		
Note: Level and body temperature defined by IPC/JEDEC J-STD-020		

7 MOQ and Packing Information

MOQ and packing information				
Product Model	MOQ (pcs)	Carrier tape and reel packing	Number of Modules in Each Reel Pack	Number of Reel Packs in Each Box
TYLC6E	4400	Packing Method	1100	4

8 Appendix: Statement

Federal Communications Commission (FCC) Declaration of Conformity

FCC Caution: Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this 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.

This device and its antenna(s) must not be co-located or operating in conjunction with any other antenna or transmitter.

15.105 Information to the user.

(b) For a Class B digital device or peripheral, the instructions furnished the user shall include the following or similar statement, placed in a prominent location in the text of the manual:

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 a 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.

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20 cm between the radiator and your body.

Radiation Exposure Statement:

This equipment complies with FCC 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.

The availability of some specific channels and/or operational frequency bands is country dependent and firmware programmed at the factory to match the intended destination.

The firmware setting is not accessible by the end user.

The final end product must be labeled in a visible area with the following:

"Contains Transmitter Module 2ANDL-TYLC6E"

This radio module must not be installed to co-locate and operating simultaneously with other radios in host system, additional testing and equipment authorization may be required to operating simultaneously with other radio.

Declaration of Conformity European notice



Hereby, Hangzhou Tuya Information Technology Co., Ltd. declares that this Wi-Fi module product is in compliance with essential requirements and other relevant provisions of Directive 2014/53/EC. A copy of the Declaration of conformity can be found at

<https://www.tuya.com>.

EN 300 328 V2.1.1

EN 301 489-1 V2.1.1; EN 301 489-17 V3.1.1

EN 62311:2008

EN 60950-1:2006+A11:2009+A1:2010+A12:2011+A2:2013