1. Product Overview

TYLC4 is a low-power embedded Wi-Fi module developed by Hangzhou Tuya Information Technology Co., Ltd., which consists of a highly integrated RF chip ESP8266 and a few peripheral components with built-in Wi-Fi network protocol stack and abundant library functions. TYLC4 is embedded with low power 32-bit CPU, 1 Mbyte flash memory and rich peripheral resources.

TYLC4 is a RTOS platform which integrates all the function libraries of Wi-Fi MAC and TCP/IP protocol, base on which, users are enabled to develop embedded Wi-Fi products according to their specific requirements.

1.1 Features

The embedded low-power 32-bit CPU can also be used as application processor

- CPU Clock Speed: 80MHz and 160MHz
  - ◇ Working voltage: 3.0V-3.6V
  - ◇ Peripheral: 5×GPIOs, 1×UART
  - ◇ Wi-Fi connectivity
    - ● 802.11 b/g/n
    - ● Channels 1-11@2.4GHz
    - ● In support of WPA/WPA2 safe mode
    - ● In support of STA/AP/STA+AP operating mode
    - ● In support of two distribution networks including SmartConfig and AP(Android and IOS devices included)
    - ● Operating temperature: -20℃ to 125℃

1.2 Main applications

- ◇ Intelligent building
- ◇ Smart home/home appliances
- ◇ Smart power plug, intelligent light
- ◇ Industrial wireless control
- ◇ Baby monitors
- ◇ Webcams
- ◇ Intelligent public transportation

2. Module Interfaces

2.1 Size Package

TYLC4 has two rows of pins and the spacing between each two pins is 2mm.

TYLC4 size: 16.69mm (W)×16.66mm (L) ×3.5mm (H). TYLC4 size is shown in figure2：
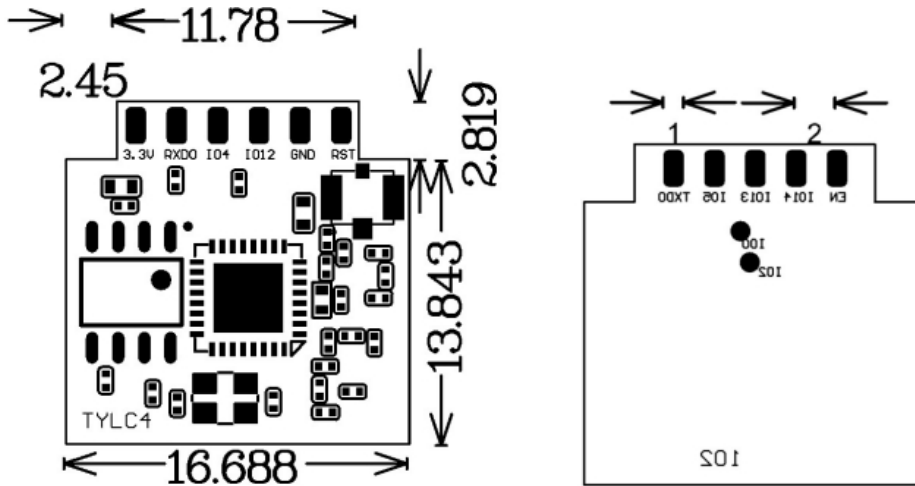
Figure 2.1, TYLC4 dimensional drawing

Figure 2　TYLC4 Dimensional Drawing

2.2 Pin definition

The interface pin definition is shown in Chart 1:

Chart 1 TYLC4 Interface Pin Configuration Instruction

Table 2.1，WR1 pins description

Pin	Symbol	IOType	Function
1	RST	I/O	Hardware reset pin (effective at low electrical level, with pull-up resistor inside)
2	EN	I	Module enabling pin needs to receive 3.3V power supply
3	GND	P	Power reference ground
4	GPIO14	I/O	GPIO_14
5	GPIO12	I/O	GPIO_12
6	GPIO13	I/O	GPIO_13
7	GPIO4	I/O	GPIO_04
8	GPIO5	I/O	GPIO_05
9	RXD0	I/O	UART0_RXD 1
10	TXD0	O	UART0_TXD 1
11	VCC	P	Module's power pin (3.3V)

Notes: P stands for power pin, I/O stands for input/output pin.

RST is only the module hardware reset pin, which cannot erase WiFi distribution network information.

Version1.0.0

(1): UART0 is the user serial port; when the module is powered up, the serial port has information output and user can ignore it.

2.3 Test Point Definition

The test pin definition is shown in Chart 2:

Chart 2 TYLC4 Test Pin Configuration Instruction

Pin	Symbol	IOType	Function
-	TEST1	I/O	GPIO2, used for module production test
-	TEST2	I/O	GPIO0, used for module production test

3. Electrical Parameters

3.1 Absolute electrical parameters

Chart 3 Absolute Parameters

Parameters	Description	Minimum value	Maximum value	Unit
Ts	Storage temperature	-20	85	℃
VCC	Supply voltage	-0.3	3.6	V
Electrostatic Discharge Voltage (human model)	TAMB-25℃	-	2	KV
Electrostatic Discharge Voltage (machine model)	TAMB-25℃	-	0.5	KV

3.2 Operating conditions

Chart 4 Normal Operating Conditions

Parameters	Description	Min	Typ	Max	Unit
Ta	Operating temperature	-20	-	125	℃
VCC	Operating voltage	3.0	3.3	3.6	V
VIL	IO low electrical level input	-0.3	-	VCC*0.25	V

Version1.0.0

VIH	IO high electrical level input	VCC*0.75	-	VCC	V
VOL	IO low electrical level output	-	-	VCC*0.1	V
VoH	IO high electrical level output	VCC*0.8	-	VCC	V
Imax	IO drive current	-	-	12	mA

3.3   Wi-Fi Transmitting Power

Chart 5 TX Continuous Transmitting Power

Symbol	Mode	Power	Typ	Unit
Mode	Mode	Rate	Transmitting Power	
IRF	11b	1Mbps	+19.40	dBm
IRF	11g	6Mbps	+21.74	dBm
IRF	11n	MCS0	+21.26	dBm

3.4 Wi-Fi Receiving Power

Chart 6 RX Continuous Receiving

Symbol	Mode	Rate	Typ	Unit
IRF	11b	1Mbps	76	mA
IRF	11g	6Mbps	76	mA
IRF	11n	MCS0	76	mA

3.5   Power in Operating Mode

Operation Mode	Operating condition, TA=25℃	Typ	Peak	Unit
Fast connection distribution network	When the module is in a state of fast connection distribution network, WiFi indicator light flashes quickly	80	151	mA
Hot spot distribution network	When the module is in a state of hot spot distribution network, WiFi indicator light flashes slowly	90	451	mA
Internet connection	When the module is with internet connection, WiFi indicator light goes on	58.5	411	mA
Offline	When the module is offline, WiFi indicator light goes out	80	430	mA

4. RF Characteristics

4.1 Basic RF characteristics

Chart 8 RF Basic Characteristics

Parameter	Description
Operating frequency	2.412~2.462GHz
Wi-Fi standard	IEEE 802.11b/g/n (channel 1-11)
Data transmitting rate	11b:1,2,5.5, 11 (Mbps) 11g:6,9,12,18,24,36,48,54(Mbps) 11n:HT20 MCS0~7
Antenna type	One welding monopole antenna for TYLC4, TYLC4-IPEX has one replaceable IPEX Connector, using monopole antenna or FPC antenna

Version1.0.0

4.2 Wi-Fi output power

Chart 9 TX Continuous Transmitting Power

Parameter		Min	Typ	Max	Unit
RF average output power, 802.11b CCK Mode	1Mbps	-	+19.40dBm	-	dBm
RF average output power, 802.11g OFDM Mode	6Mbps	-	+21.74dBm	-	dBm
RF average output power, 802.11n OFDM Mode	MCS0	-	+21.26dBm	-	dBm
Frequency Error	-	-10	-	10	ppm

4.3 Wi-Fi RX sensitivity

Chart 10 RX Sensitivity

Parameter		Min	Typ	Max	Unit
PER<8%, RX sensitivity, 802.11b CCK Mode	1Mbps	-	-91	-	dBm
PER<10%, RX sensitivity, 802.11g OFDM Mode	6Mbps	-	-75	-	dBm
PER<10%, RX sensitivity, 802.11n OFDM Mode	MCS0	-	-72	-	dBm

5. Antenna Information

5.1 Antenna type

TYLC4 has one welding monopole antenna, TYLC4-IPEX has one replaceable IPEX Connector, using monopole antenna or FPC antenna.

5.2 Reduction of Antenna Interference

When using antenna with IPEX terminals on the Wi-Fi module, to ensure the best Wi-Fi performance, it is recommended that the distance between the module antenna and other metal parts should be at least 10mm.

6.Packaging Information and Manufacturing Instructions
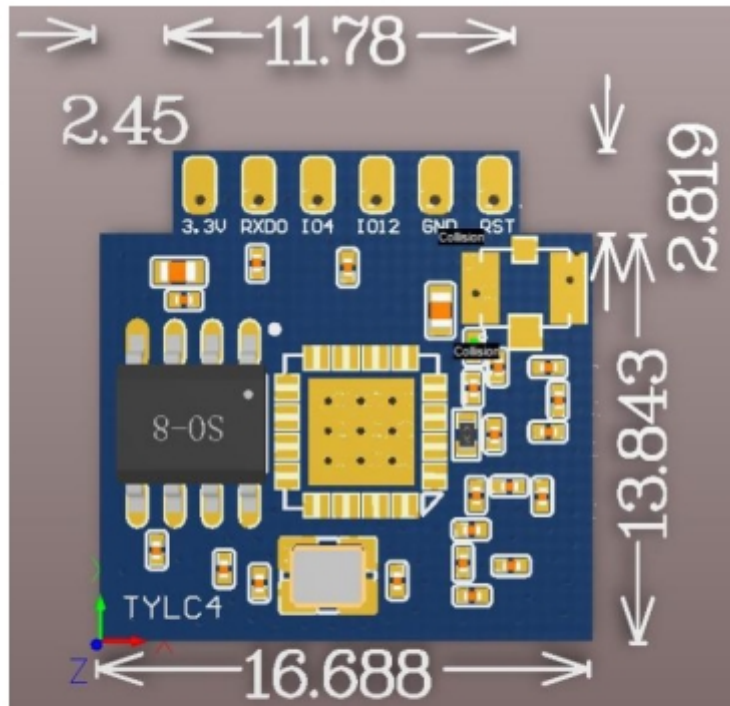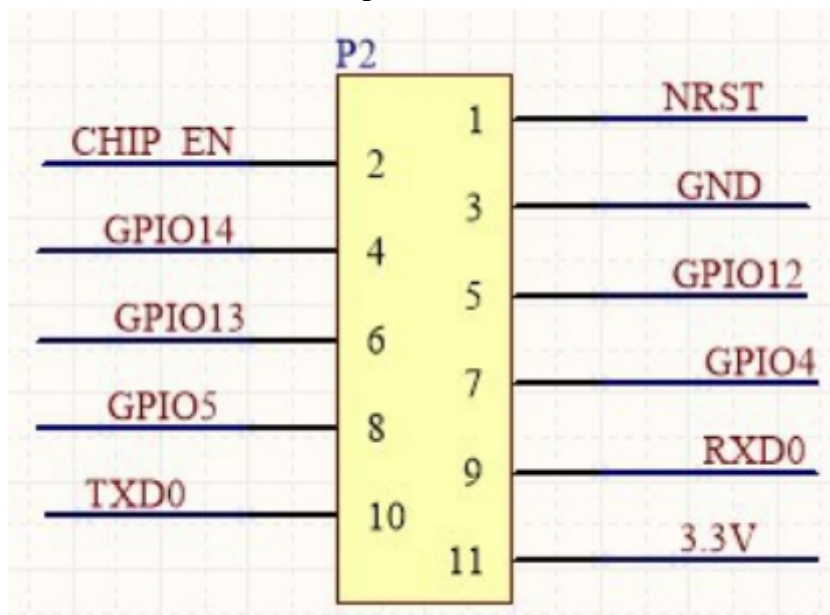
6.1 Mechanical dimensions

Chart 3 TYLC4 Mechanical Dimensional Drawing

6.2 Recommended furnace temperature curve
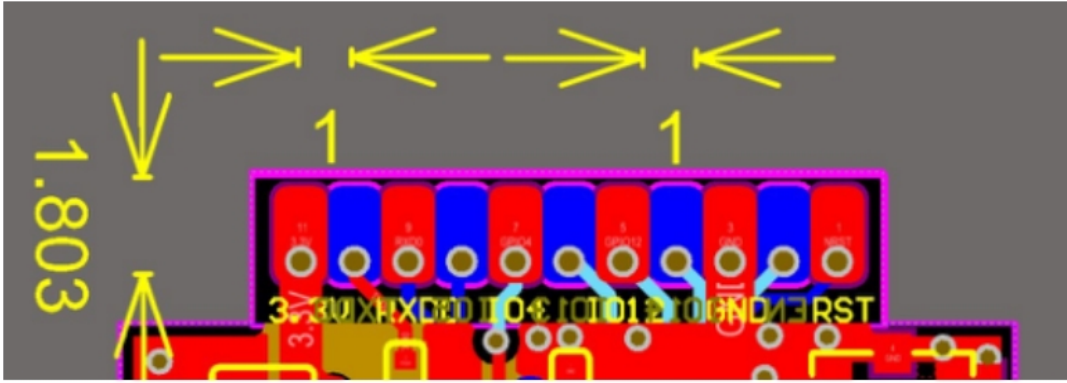

Version1.0.0

Chart 5 TYLC4 Schematic Diagram and Corresponding Diagram of Pins

6.3 Production guide

The storage conditions of modules after leaving the factory are shown as follows:

1.The moisture barrier bag must be stored in an environment where the temperature is lower than 30℃ and the humidity is lower than 85%RH.

2.Product in dry package has a guarantee period of 6 month since it is sealed in the package

Matters needing attention:.

1. During the whole production process, each operator must wear an electrostatic ring.

2.When operating, protect the modules from water or contaminants.

6.4 Recommended furnace temperature curve
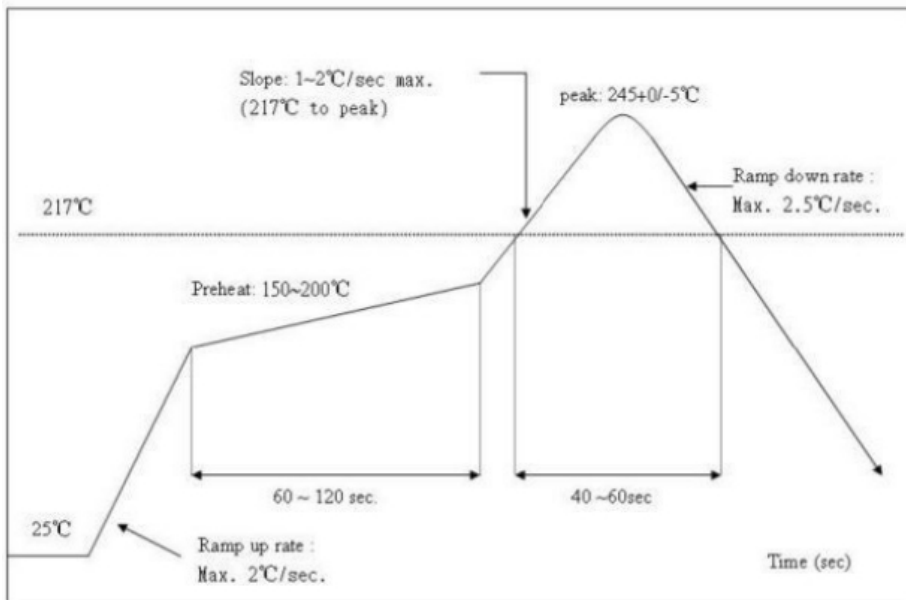
Regulatory Module Integration Instructions

2.2 List of applicable FCC rules

This device complies with part 15.247 of the FCC Rules.

2.3 Summarize the specific operational use conditions

This module can be used in household electrical appliances as well as lighting

equipments. The input voltage to the module should be nominally 3.0~3.6 V_{DC} ,typical

value 3.3V_{DC} and the ambient temperature of the module should not exceed 125℃.

TYLC4 has one welding monopole antenna with antenna gain 1dBi, TYLC4-IPEX has

one replaceable IPEX Connector, using monopole antenna with antenna gain 1dBi or

FPC antenna with antenna gain 3dBi.

If the antenna needs to be changed, the certification should be re-applied.

2.4 Limited module procedures

This module can be used in lighting equipment, smart frontpanel, household electrical

appliances. Normally host device should provide a power supply in range 3.0-3.6V,

typically 3.3V for this module. The limited module manufacturer will reviews detailed test

data or host designs prior to giving the host manufacturer approval.

2.5 Trace antenna designs

Not applicable

2.6 RF exposure considerations

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. If the device built into a host as a portable usage,

the additional RF exposure evaluation may be required as specified by§ 2.1093.

2.7 Antennas

TYLC4 has one welding monopole antenna, TYLC4-IPEX has one replaceable IPEX antenna, using monopole antenna or FPC antenna.

2.8 Label and compliance information

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-TYLC4 ",or "Contains FCC ID: 2ANDL-TYLC4", Any

similar wording that expresses the same meaning may be used.

2.9 Information on test modes and additional testing requirements

a) The modular transmitter has been fully tested by the module grantee on the required

number of channels, modulation types, and modes, it should not be necessary for the

host installer to re-test all the available transmitter modes or settings. It is

recommended that the host product manufacturer, installing the modular transmitter,

perform some investigative measurements to confirm that the resulting composite

system does not exceed the spurious emissions limits or band edge limits (e.g., where a

different antenna may be causing additional emissions).

b) The testing should check for emissions that may occur due to the intermixing of

emissions with the other transmitters, digital circuitry, or due to physical properties of

the host product (enclosure). This investigation is especially important when integrating

multiple modular transmitters where the certification is based on testing each of them in

a stand-alone configuration. It is important to note that host product manufacturers

should not assume that because the modular transmitter is certified that they do not

have any responsibility for final product compliance.

c) If the investigation indicates a compliance concern the host product manufacturer is

obligated to mitigate the issue. Host products using a modular transmitter are subject to

all the applicable individual technical rules as well as to the general conditions of

operation in Sections 15.5, 15.15, and 15.29 to not cause interference. The operator of

the host product will be obligated to stop operating the device until the interference has

been corrected

Below are steps for TX verification：

tx_contin_en 1　　　// return：wifi tx continuous test!

wifitxout　< parameter 1>　< parameter 2>　

：Send channel option and allowed number is 1~11.

：Send data rate option, the relationship between input parameters and

rates is shown in table 1.

：Send power attenuation, which is 8 bits directed number and 0.25 dB

unit.

　　　for，4 equals power decrease 1dB，252 equals power increase 1dB。

Table 1: allowed input for speed of receiving or sending data package

11b mode		11g mode		11n mode	
Input	Dial Speed	Input	Dial Speed	Input	Dial Speed
0x0	1M	0xb	6M	0x10	6.5M / MCS0
0x1	2M	0xf	9M	0x11	13M / MCS1
0x2	5.5M	0xa	12M	0x12	19.5M / MCS2

0x3	11M	0xe	18M	0x13	26M / MCS3
		0x9	24M	0x14	39M / MCS4
		0xd	36M	0x15	52M / MCS5
		0x8	48M	0x16	58.5M / MCS6
		0xc	54M	0x17	65M / MCS7

cmdstop　　// Stop sending data package command

2.10 Additional testing, Part 15 subpart B disclaimer

The final host / module combination 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.

The host integrator installing this module into their product must ensure that the final composite product complies with the FCC requirements by a technical assessment or evaluation to the FCC rules, including the transmitter operation and should refer to guidance in KDB 996369.

Frequency spectrum to be investigated

For host products with certified modular transmitter, the frequency range of investigation of the composite system is specified by rule in Sections 15.33(a)(1) through (a)(3), or the range applicable to the digital device, as shown in Section 15.33(b)(1), whichever is the higher frequency range of investigation.

Operating the host product

When testing the host product, all the transmitters must be operating.The transmitters can

be enabled by using publicly-available drivers and turned on, so the transmitters are

active. In certain conditions it might be appropriate to use a technology-specific call box

(test set) where accessory devices or drivers are not available.

When testing for emissions from the unintentional radiator, the transmitter shall be placed

in the receive mode or idle mode, if possible. If receive mode only is not possible then, the

radio shall be passive (preferred) and/or active scanning. In these cases, this would need

to enable activity on the communication BUS (i.e., PCIe, SDIO, USB) to ensure the

unintentional radiator circuitry is enabled. Testing laboratories may need to add

attenuation or filters depending on the signal strength of any active beacons (if applicable)

from the enabled radio(s). See ANSI C63.4, ANSI C63.10 and ANSI C63.26 for further

general testing details.

The product under test is set into a link/association with a partnering WLAN device, as per

the normal intended use of the product. To ease testing, the product under test is set to

transmit at a high duty cycle, such as by sending a file or streaming some media content.

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