

# Tuya Smart

## Tuya Zigbee Module

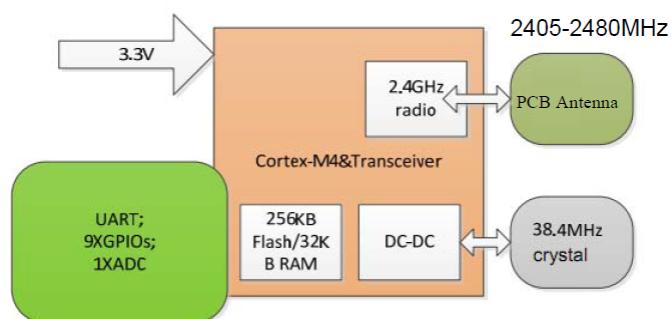
### 1. Product Overview

TYZS1 is a low power consumption module with built-in Zigbee connectivity solution designed by Hangzhou Tuya Information Technology Co., Ltd. The Zigbee Module consists of a highly integrated wireless radio chip EFR32MG1B132 and some extra component that has been programmed with Zigbee network protocol 802.15.4 PHY/MAC and plenty of software examples. TYZS1 include a 32-bit ARM Cortex-M4 CPU, 256K byte flash, 32k SRAM and various peripheral resources.

TYZS1 is a FreeRTOS platform, embedded with all the Zigbee MAC and TCP/IP protocol function examples, users can customize their Zigbee product by using these software examples.

Figure 1 shows the block diagram of the TYZS1.

Figure 1. The block diagram of the TYZS1



#### 1.1 Features

- ✧ Integrated low power consumption 32-bit ARM Cortex-M4 CPU, with DSP command and float computing unit also using for application processor
- ✧ Basic frequency of the CPU can support 40MHz
- ✧ Supply voltage : DC3.3V
- ✧ Peripherals: 9 GPIO channels, 1 UART, 1 ADC
- ✧ Zigbee connectivity:
  - 802.15.4 MAC/PHY
  - Channel 11 to 26 @ 2.405-2.480 GHz, radio rate 250 kbps
  - Embedded DC-DC circuit, maximally improving power efficiency
  - +9.56dBm output power
  - 1.4uA standby current at 63uA/MHz
  - Automatic pairing for terminals
  - On-board PCB antenna
  - Operating temperature range: -40°C to 85°C
  - Hardware encryption, AES 128/256

## 1.2 Main Application Fields

- ✧ Intelligent Building
- ✧ Intelligent home, Intelligent household applications
- ✧ Smart socket, smart lighting
- ✧ Industrial wireless control
- ✧ Health and measurement management
- ✧ Asset trace

## 2. Dimensions and Footprint

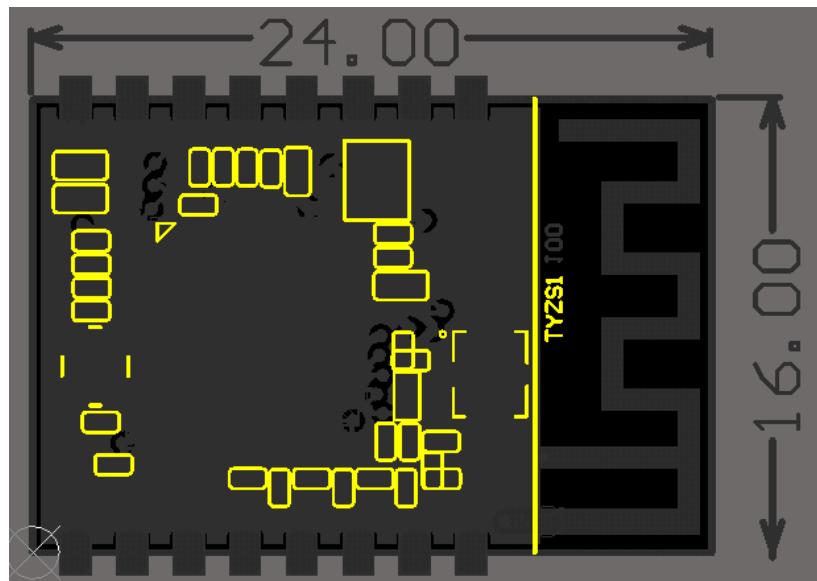
### 2.1 Dimensions

TYZS1 has 2 columns of Pins. The distance between each Pin is 2mm.

Size of TYZS1: 16mm(W)\*24mm(L)\*3.5mm(H)

Figure 2 shows the dimensions of TYZS1.

Figure 2. The dimensions of TYZS1



### 2.2 Pin Definition

Table 1 shows the general pin attributes of TYZS1

Table 1. The typical pin definition of TYZS1

PIN NO.	NAME	TYP E	DISCREPTION
1	nRST	I	hardware reset pin, low level effects; the module will reset while booting, user could ignore the pin just in case
2	ADC	AI	ADC terminal(12-bits SAR ADC) <sup>(1)</sup>
3	NC	-	NC
4	GPIO0	I/O	GPIO0
5	SWO	I/O	also used for universal GPIO, can be used for output pin while in JLINK communication status
6	PWM3	I/O	also used for universal GPIO
7	PWM1	I/O	also used for universal GPIO
8	VCC	P	Supply voltage (3.3V)
9	GND	P	Ground
10	GPIO2	I/O	also used for universal GPIO
11	SWDIO	I/O	JLINK SWDIO burning pin, also used for universal GPIO

12	SWCLK	I/O	JLINK SWCLK burning pin, also used for universal GPIO
13	PWM2	I/O	also used for universal GPIO
14	GPIO3	I/O	also used for universal GPIO
15	RXD	I/O	UART0_RXD
16	TXD	O	UART0_TXD

Note: S: Power supply pins; I/O: Digital input or output pins; AI: Analog input. RST pin is the module hardware reset pin; it cannot eliminate Zigbee module pairing information.

(1) This pin can only be used as ADC input, cannot use it as normal I/O. when not using, just connect nothing. When used as ADC input, the input voltage range is 0~AVDD, can be configured by firmware.

### 2.3 Test Pin Definition

Table 2 shows the general test pin definition of TYZS1

Table 2. The general test pin definition of TYZS1

PIN NO.	SYMBOL	TYPE	DESCRIPTION
-	-	I	Used for module's production test

Note: This test pin is not recommended to use.

### 3. Electrical Characteristics

#### 3.1 Absolute Maximum Ratings

Table 3. Absolute Maximum Ratings

PARAMETERS	DESCRIPTION	MIN	MAX	UNIT
T <sub>s</sub>	Storage temperature	-50	150	°C
V <sub>CC</sub>	Supply voltage	3.0	3.8	V
Static electricity voltage (human model)	TAMB-25°C	-	2.5	KV
Static electricity voltage (machine model)	TAMB-25°C	-	0.5	KV

#### 3.2 Electrical Conditions

Table 4. Electrical Conditions

PARAMETERS	DESCRIPTION	MIN	TYPICAL	MAX	UNIT
T <sub>a</sub>	Working temperature	-40	-	85	°C
V <sub>CC</sub>	Working voltage	3.0	3.3	3.8	V
V <sub>IL</sub>	IO low level input	-0.3	-	V <sub>CC</sub> *0.25	V
V <sub>IH</sub>	IO high level input	V <sub>CC</sub> *0.75	-	V <sub>CC</sub>	V
V <sub>OL</sub>	IO low level output	-	-	V <sub>CC</sub> *0.1	V
V <sub>OH</sub>	IO high level output	V <sub>CC</sub> *0.8	-	V <sub>CC</sub>	V
I <sub>max</sub>	IO drive current	-	-	12	mA

#### 3.3 Zigbee Transmitting Current Consumptions

Table 5. Zigbee TX current consumption

PARAMETERS	RATE	Transmitting power	TYPICAL	UNIT
IRF	250kbps	+9.56dBm	32	mA
IRF	250kbps	+9.55dBm	17	mA
IRF	250kbps	+7.10dBm	11.8	mA

Note: continuously transmitting data while testing the result shown above, duty cycle=100%

#### 3.4 Zigbee Receiving Current Consumptions

Table 6. Zigbee RX current consumption

PARAMETERS	RATE	TYPICAL	UNIT
IRF	250kbps	8	mA

Note: Receiving current 14mA while in active mode.

### 3.5 Working Mode Current Consumptions

Table 7. The module working current consumption

WORK MODE	AT TA=25 °C	TYPICAL	MAX*	UNIT
Quick pairing Mode	TYZS1 is under quick paring mode with Gateway.	10	40	mA
Connection Mode	TYZS1 is connected	0.005	1	mA
Deep sleep Mode	TYZS1 is in deep sleep mode, reserving 64KB flash	1.4	3	uA

## 4. WLAN Radio Specification

### 4.1 Basic Radio Frequency Characteristics

Table 8. Basic Radio frequency characteristics

PARAMETERS	DESCRIPTION
Frequency band	2.405GHz to 2.480GHz
Zigbee standard	IEEE 802.15.4
Data transmitting rate	250kbps
Antenna type	On-board PCB Antenna
Visible transmitting distance	>120m

### 4.2 Zigbee Transmitting Power

Table 9. Zigbee transmitting power

PARAMETERS	MIN	TYPICAL	MAX	UNIT
Maximum output power	-	+9.56	-	dBm
Minimum output power	-	+7.10	-	dBm
Output power adjust step	-	0.5	1	dB
The Frequency error	-15	-	+15	ppm
Output frequency adjacent channel suppression		-31		dBc

Note: If more coverage expansion needed, it's recommended to use TYZS3 module, the module has pin definition compatible with TYZS1 but with higher penetration performance.

### 4.3 Zigbee Receiving Sensitivity

Table 9. Zigbee Receiving sensitivity

PARAMETERS	MIN	TYPICAL	MAX	UNIT
PER<10%, Receiving sensitivity, 250kbps @ OQPSK	-	-102	-	dBm

## 5. Antenna Information

### 5.1 Antenna Type

Antenna default connected using On-board PCB antenna

### 5.2 Reduce Antenna Interference

While using the On-board PCB antenna, in order to have the best Zigbee performance, it's recommended to keep a minimum 15mm distance between the antenna part and the other metal pieces.

User's own PCBA design is recommended NOT to pass any wire, NOT do copper pour under the region of the module's antenna, to avoid interferences.

## 6. Packaging Information And Production Guide

### 6.1 Mechanical Dimensions

Figure 3. Top view of the module

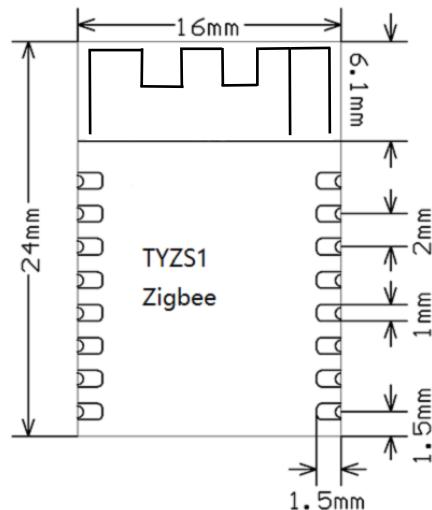
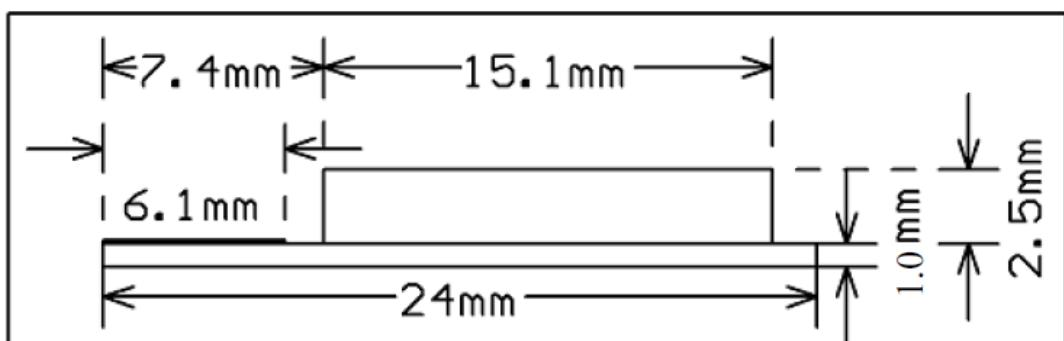
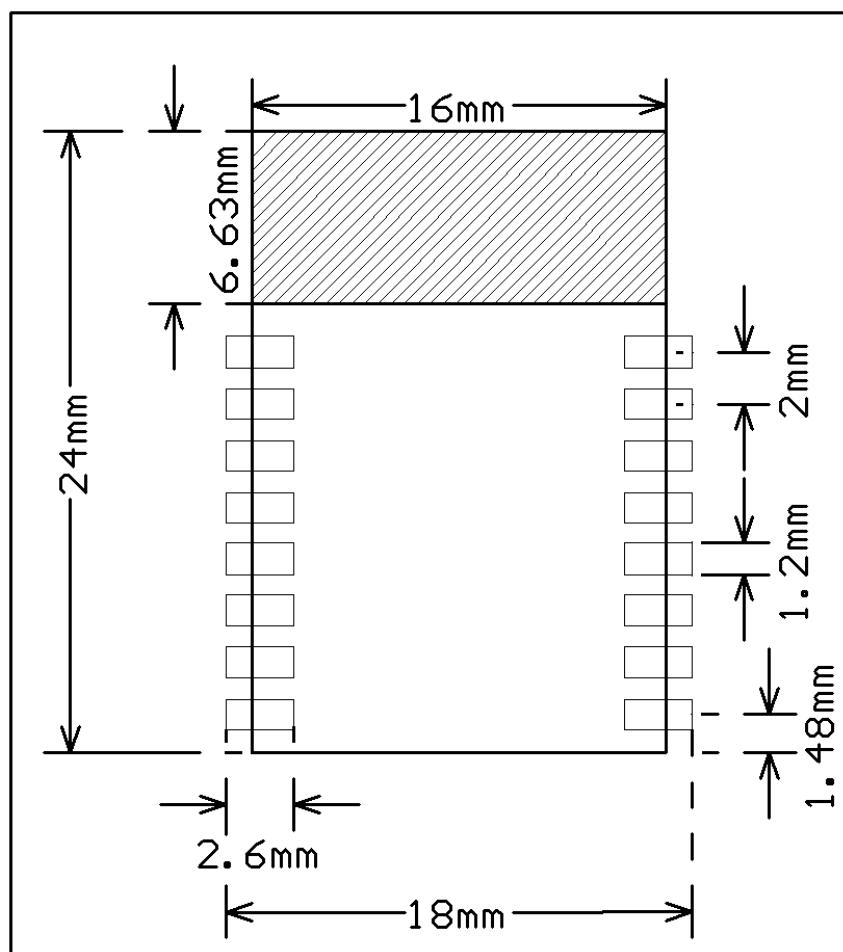


Figure 4. The module's mechanical view



### 6.2 PCB Recommended Package

Figure 5. PCB Package Drawing



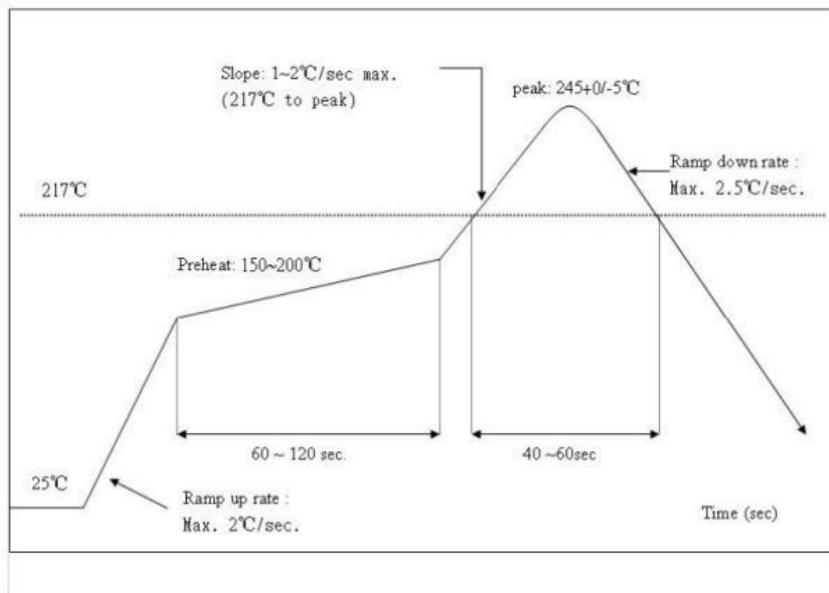
### 6.3 Production Guide

- ✧ 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.

### 6.4 Recommended furnace temperature curve

Figure 6. PCB Package Drawing Recommended furnace temperature curve

Refer to IPC/JEDEC standard ; Peak Temperature :  $<250^{\circ}\text{C}$  ; Number of Times:  $\leq 2$  times ;



#### 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-TYZS1", or "Contains FCC ID:2ANDL-TYZS1", Any similar wording that expresses the same meaning may be used.