Global Intelligent Platform

Product Manual

Tuya ZS2S Zigbee Module

Version: 1.0.0 **Date: 2019-12-06** **No.: 0000000001**

1 Product Overview

ZS2S is a low-power embedded Zigbee module that Tuya has developed. It consists of a highly integrated Zigbee chip (EFR32MG21A020F768) and several peripheral circuits, with an embedded Zigbee network protocol stack and robust library functions. ZS2S also contains a 32-bit, 80 MHz, low-power Arm Cortex-M33 core, 768 KB flash memory, 64 KB static random-access memory (SRAM), and extensive peripherals.

1.1 Features

- ✧ Embedded low-power 32-bit microcontroller unit (MCU), which can also function as an application processor
  - Clock rate: 80 MHz
- ✧ Working voltage: 2.0 V to 3.8 V
- ✧ Peripherals: five pulse width modulation (PWM) pins, one analog to digital converter (ADC), and one universal asynchronous receiver/transmitter (UART)
- ✧ Zigbee RF features
  - Channels 11 to 26 at 2.400 GHz to 2.483 GHz, 250 kbit/s air interface rate
  - TX power: +20 dBm; dynamic output power: > 35 dB
  - Runtime power consumption: 60 µA/MHz; current in sleep mode: 5 µA
  - Embedded Advanced Encryption Standard (AES) hardware encryption
  - Onboard PCB antenna
  - Working temperature: –20°C to +85°C

1.2 Application Scenarios

- ✧ Intelligent building
- ✧ Smart household and home appliances
- ✧ Smart low-power sensors
- ✧ Smart socket and light
- ✧ Asset tracing
- ✧ Industrial wireless control

Change History

No.	Date	Change Description	Version After Change
1	2019-12-06	This is the first release.	1.0.0

Contents

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2 Module Interfaces

2.1 Dimensions and Footprint

ZS2S has two rows of pins with a 2 mm pin spacing.

The ZS2S dimensions (H x W x L) are 2.8±0.15 mm x 14.9±0.35 mm x 17.9±0.35 mm. The PCB thickness is 0.8±0.1 mm. Figure 2-1 shows the ZS2S front and rear views.

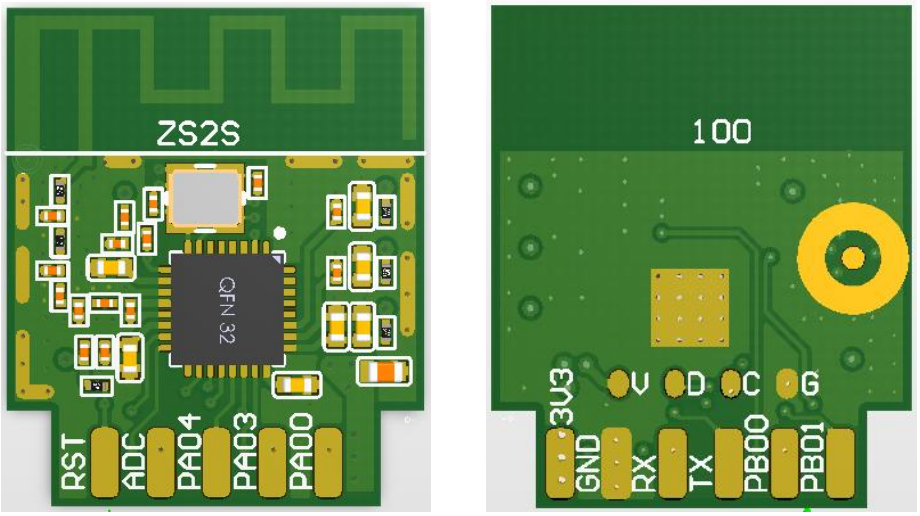

Figure 2-1 ZS2S front and rear views

2.2 Interface Pin Definition

Table 2-1 ZS2S interface pins

Pin No.	Symbol	I/O Type	Function
1	3V3	P	Power supply pin (3.3 V)
2	PA00	I/O	Common I/O pin, which can be used as a PWM output of the LED drive and is connected to the PA00 pin on the internal IC
3	GND	P	Power supply reference ground pin
4	PA03	I/O	Common I/O pin, which can be used as a PWM output of the LED drive and is connected to the PA03 pin on the internal IC
5	RX	I/O	Serial interface receiving pin (UART RX), which

Pin No.	Symbol	I/O Type	Function
			is connected to the PA06 pin on the internal IC
6	PA04	I/O	Common I/O pin, which can be used as a PWM output of the LED drive and is connected to the PA04 pin on the internal IC
7	TX	I/O	Serial interface transmission pin (UART TX), which is connected to the PA05 pin on the internal IC
8	ADC	Input	ADC pin, which is connected to the PC01 pin on the internal IC
9	PB00	I/O	Common I/O pin, which can be used as a PWM output of the LED drive and is connected to the PB00 pin on the internal IC
10	RST	Input	Reset pin, which is connected to the RESETn pin on the internal IC
11	PB01	I/O	Common I/O pin, which can be used as a PWM output of the LED drive and is connected to the PB01 pin on the internal IC

Note:

P indicates a power supply pin, and **I/O** indicates an input/output pin.

If you have special requirements for light colors controlled by PWM outputs, contact Tuya business personnel.

3 Electrical Parameters

3.1 Absolute Electrical Parameters

Table 3-1 Absolute electrical parameters

Parameter	Description	Minimum Value	Maximum Value	Unit
Ts	Storage temperature	–50	150	°C

Parameter	Description	Minimum Value	Maximum Value	Unit
VCC	Power supply voltage	–0.3	3.8	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 Working Conditions

Table 3-2 Normal working conditions

Parameter	Description	Minimum Value	Typical Value	Maximum Value	Unit
Ta	Working temperature	–20	N/A	85	°C
VCC	Working voltage	2.0	3.0	3.8	V
VIL	I/O low-level input	N/A	N/A	0.3 x IOVDD	V
VIH	I/O high-level input	0.7 x IOVDD	N/A	N/A	V
VOL	I/O low-level output	N/A	N/A	0.2 x IOVDD	V
VOH	I/O high-level output	0.8 x IOVDD	N/A	N/A	V

3.3 RF Current Consumption

Table 3-3 RF current consumption

Working Status	Parameter			Average Value	Maximum Value (Typical Value)	Unit
	Mode	Rate	TX Power/ Receiving			
TX		250 kbit/s	+20 dBm	200	210	mA
		250 kbit/s	+10 dBm	62	64	mA
		250 kbit/s	+0 dBm	26	28	mA
RX		250 kbit/s	Constant receiving	10	12	mA
		250 kbit/s	Constant receiving	10	12	mA
		250 kbit/s	Constant receiving	10	12	mA

3.4 Working Current

Table 3-4 Working current

Working Mode	Working Status (Ta = 25°C)	Average Value	Maximum Value (Typical Value)	Unit
EZ	The module is in EZ mode.	10	40	mA
Connected and idle	The module is connected to the network.	4.2	5	mA
Deep sleep mode	The module is in deep sleep mode, with 64 KB flash memory.	5	N/A	μA

4 RF Features

4.1 Basic RF Features

Table 4-1 Basic RF features

Parameter	Description
Working frequency	2.4 GHz ISM band
Wireless standard	IEEE 802.15.4
Data transmission rate	125 kbit/s, 250 kbit/s, 1 Mbit/s, or 2 Mbit/s
Antenna type	Onboard PCB antenna

4.2 RF TX Power

Table 4-2 Power during constant transmission

Parameter	Minimum Value	Typical Value	Maximum Value	Unit
Average RF output power	–30	20	N/A	dBm
Output power fluctuation (–40°C to +125°C)	N/A	1.5	N/A	dB
Output power fluctuation (3.0 V to 3.8 V)	N/A	0.8	N/A	dB

4.3 RF RX Sensitivity

Table 4-3 RX sensitivity

Parameter		Minimum Value	Typical Value	Maximum Value	Unit
RX sensitivity	125 kbit/s	N/A	–103	N/A	dBm
	250 kbit/s	N/A	–102	N/A	
	1 Mbit/s	N/A	–97	N/A	
	2 Mbit/s	N/A	–94	N/A	

5 Antenna Information

5.1 Antenna Type

ZS2S uses an onboard PCB antenna.

5.2 Antenna Interference Reduction

To ensure optimal RF performance, it is recommended that the antenna be at least 15 mm away from other metal parts. If metal materials are wrapped around the antenna, the wireless signals will be reduced greatly, deteriorating the RF performance. As a dual in-line package (DIP), ZS2S is through-hole mounted onto the PCB. Sufficient space needs to be reserved for the antenna.

6 Packaging Information and Production Instructions

6.1 Mechanical Dimensions and Rear Solder Pad Dimensions

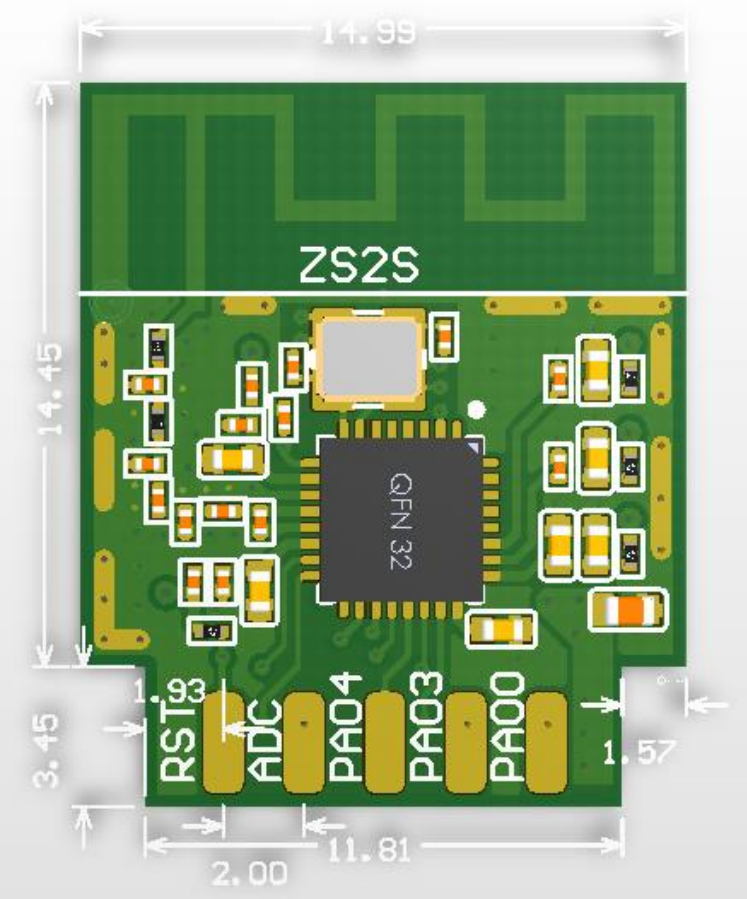

Figure 6-1 ZS2S mechanical dimensions and rear solder pad dimensions

6.2 Production Instructions

1. Preferentially use the wave soldering machine to solder the module, which is recommended for Tuya-developed modules that are through-hole mounted onto PCBs. Use hand soldering only when there is no operational wave soldering machine. Complete soldering within 24 hours after the module is unpacked. If not, vacuum pack the module again.
2. Required materials for soldering:
    i. Wave soldering machine
    ii. Wave soldering fixture

iii. Constant-temperature iron

iv. Wave solder bar, wire, and flux

v. Oven temperature tester

(1) Baking equipment:

i. Cabinet oven

ii. Anti-static heat-resistant trays

iii. Anti-static heat-resistant gloves

3. Bake the module if any of the following conditions is met:

(1) The vacuum package is damaged before the module is unpacked.

(2) The package does not contain a humidity indicator card (HIC).

(3) After the module is unpacked, the HIC shows that the 30% and higher rate circles are pink.

(4) Production is not completed within 72 hours after the module is unpacked.

(5) The module has been packed for more than six months.

4. Baking settings:

(1) Baking temperature: 65±5°C in reel pack mode and 125±5°C in tray pack mode

(2) Baking time: 48 hours in reel pack mode and 12 hours in tray pack mode

(3) Alarm temperature: 70°C in reel pack mode and 130°C in tray pack mode

(4) Production ready temperature after natural cooling: < 36°C

(5) Number of baking times: 1

(6) Rebaking condition: Production is not completed within 72 hours after baking.

5. Do not wave solder modules that have been 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. Throughout the production process, take electrostatic discharge (ESD) protective measures.

7. For a good product quality, ensure that the following items meet requirements:

(1) Flux amount

(2) Wave height

(3) Amount of tin dross and copper in the solder pot

(4) Wave soldering fixture window and thickness

(5) Oven temperature curve for wave soldering

6.3 Recommended Oven Temperature Curve

Set the oven temperature to a value recommended for wave soldering. The peak temperature is 260±5℃. Figure 6-2 shows the oven temperature curve for wave soldering.

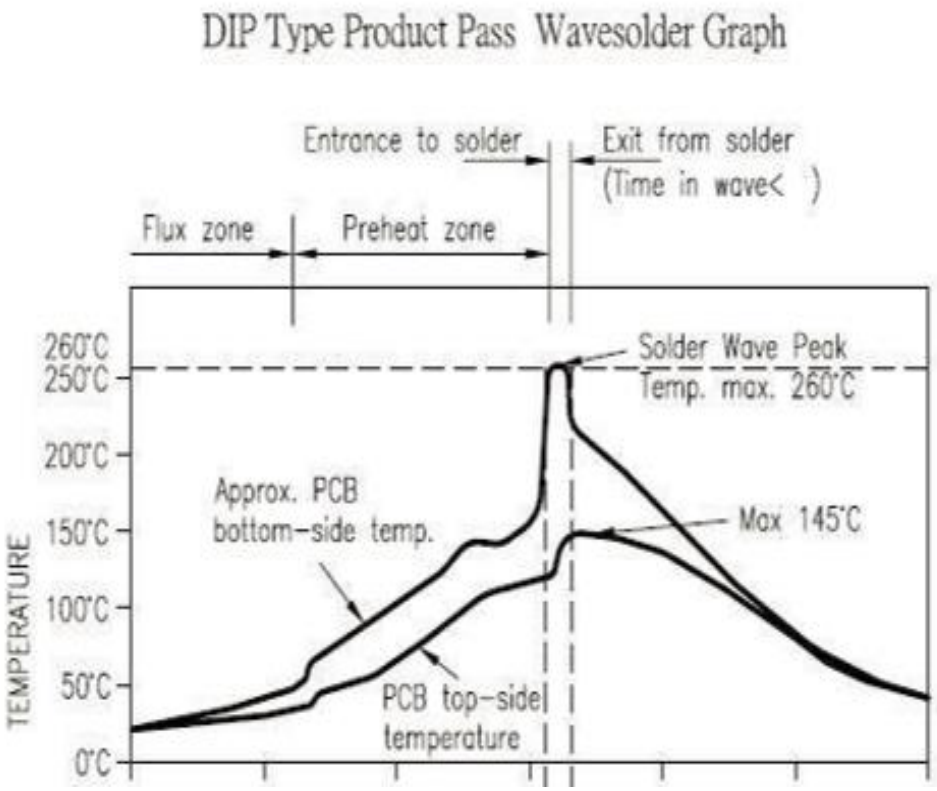

Figure 6-2 Oven temperature curve

Table 6-1 Recommended wave soldering temperature

Wave Soldering		**Hand Soldering**	
Preheat temperature	80°C to 130°C	Wave soldering temperature	360±20°C
Preheat time	75s to 100s	Soldering time	< 3s per point
Contact time	3s to 5s	N/A	N/A

Wave Soldering		Hand Soldering	
Solder pot temperature	260±5°C	N/A	N/A
Temperature increase rate	≤ 2°C per second	N/A	N/A
Temperature drop rate	≤ 6°C per second	N/A	N/A

6.4 Storage Conditions

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 HIC.

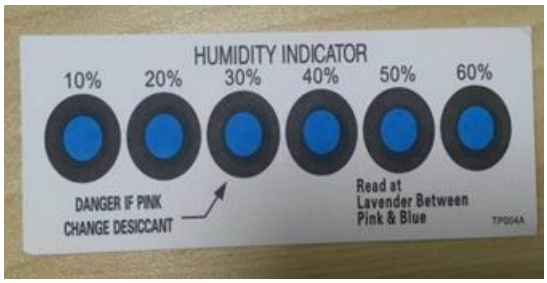

Figure 6-3 HIC for ZS2S

7 MOQ and Packing Information

MOQ and packing information				
Product Model	**MOQ**	**Packing Method**	**Number of Modules in Each Reel Pack**	**Number of Reel Packs in Each Box**
ZS2S	3600	Carrier tape and reel packing	900	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.

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.

Radiation Exposure Statement

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

Important Note

This radio module must not be installed to co-locate and operate simultaneously with other radios in host system except in accordance with FCC multi-transmitter product procedures. Additional testing and equipment authorization may be required to operating simultaneously with other radio.

The availability of some specific channels and/or operational frequency bands is country dependent and are firmware programmed at the factory to match the intended destination. The firmware setting is not accessible by the end user.

The host product manufacturer is responsible for compliance to any other FCC rules that apply to the host not covered by the modular transmitter grant of certification. The final host product still requires Part 15 Subpart B compliance testing with the modular transmitter installed.

The end user manual shall include all required regulatory information/warning as shown in this manual, including: This product must be installed and operated with a minimum

distance of 20 cm between the radiator and user body.

This device has gotten an FCC ID: 2ANDL-ZS2S. The final end product must be labeled in a visible area with the following: "Contains Transmitter Module FCC ID: 2ANDL-ZS2S"

This device is intended only for OEM integrators under the following conditions:

1. The antenna must be installed such that 20 cm is maintained between the antenna and users.
2. The transmitter module may not be co-located with any other transmitter or antenna.

As long as two conditions above are met, further transmitter test will not be required. However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed.

Declaration of Conformity European Notice

Hereby, Hangzhou Tuya Information Technology Co., Ltd declares that this module product is in compliance with essential requirements and other relevant provisions of Directive 2014/53/EU, 2011/65/EU. A copy of the Declaration of conformity can be found at https://www.tuya.com

This product must not be disposed of as normal household waste, in accordance with EU directive for waste electrical and electronic equipment (WEEE-2012/19/EU). Instead, it should be disposed of by returning it to the point of sale, or to a municipal recycling collection point.

The device could be used with a separation distance of 20 cm to the human body.