ESP32-S3-WROOM-1
&
ESP32-S3-WROOM-1U
User Manual

Chengdu Ebyte Electronic Technology Co.,Ltd.

Contents

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1 Overview

1.1 Introduction

ESP32-S3-WROOM-1 and ESP32-S3-WROOM-1U are two general-purpose Wi-Fi + Bluetooth low energy modules , equipped with Espressif ESP32-S3 series chips. In addition to rich peripheral interfaces, the module also has powerful neural network computing capabilities and signal processing capabilities, which are suitable for various application scenarios in the AIoT field, such as wake-up word detection and voice command recognition, face detection and recognition, smart Home, smart appliances, smart control panels, smart speakers, etc.

ESP32-S3-WROOM-1 uses a PCB onboard antenna, and ESP32-S3-WROOM-1U uses an IPEX antenna . Wi-Fi and Bluetooth coexist and share the same antenna .

ESP32-S3-WROOM-1

ESP32-S3-WROOM-1 U

1.2 Features and functions

- Built-in ESP32-S3 series chip, equipped with Xtensa® dual-core 32-bit LX7 microprocessor (supporting single-precision floating-point unit) ;
- Supports clock frequencies up to 240 MHz ;
- Has 8 MB Quad SPI flash;
- Supports 2.4 GHz Wi-Fi (802.11 b/g/n) + Bluetooth® 5 (LE);
- Has a wealth of peripheral interfaces, such as GPIO, SPI, LCD, Camera interface, UART, I2C, I2S, etc.;
- The working temperature can be between –40 ~ 85 °C;

2 Electrical Characteristics

2.1 Absolute Maximum Ratings

symbol	parameter	minimum value	maximum value	unit
VDD33	Power pin voltage	–0.3	3.6	V
TSTORE	storage temperature	–40	85	°C

2.2 Recommended working conditions

symbol	parameter	minimum value	typical value	maximum value	unit
VDD33	Power pin voltage	3.0	3.3	3.6	V
IVDD	Supply current from external power supply	0.5	—	—	A
T	Recommended operating temperature	–40	—	85	°C
Humidity	humidity	—	85	—	%RH

2.3 DC electrical characteristics (3.3V, 25°C)

symbol	parameter	minimum value	typical value	maximum value	unit
CIN	Pin capacitance	—	2	—	pF
VIH	High level input voltage	0.75×VDD [1]	—	VDD [1] +0.3	V
VIL	Low level input voltage	–0.3	—	0.25×VDD [1]	V
IIH	High level input current	—	—	50	nA
IIL	Low level input current	—	—	50	nA
VOH [2]	High level output voltage	0.8×VDD [1]	—	—	V
VOL [2]	Low level output voltage	—	—	0.1×VDD [1]	V

IOH	High level source current (VDD1= 3 .3 V, VOH>=2.64 V, PAD_DRIVER=3)	—	40	—	mA
IOL	Low level sink current (VDD1=3.3 V, VOL =0.495 V, PAD_DRIVER=3)	—	28	—	mA
RP U	Internal weak pull-up resistor	—	45	—	kΩ
RP D	Internal weak pull-down resistor	—	45	—	kΩ
VIH_nRST	Chip reset release voltage (EN pin should meet the voltage range)	0.75 × VDD [1]	—	VDD [1] +0.3	V

[1] VDD is the power supply for I/O.

[2] VOH and VOL are measured when the load is high impedance.

2.4 Power Consumption Characteristics

2.4.1 RF power consumption in Active mode

Operating mode	describe		Peak(mA)
Active (RF work)	TX	802.11b, 1 Mbps, @20.5 dBm	355
		802.11g, 54Mbps, @18dBm	297
		802.11n, HT20, MCS7, @17.5 dBm	286
		802.11n, HT40, MCS7, @17dBm	285
	RX	802.11b/g/n, HT20	95
		802.11n, HT40	97

1. The above power consumption data is based on the test results completed at the RF interface with a 3.3 V power supply and an ambient temperature of 25 °C . All emission data is based on 100% duty cycle.
2. When measuring RX power consumption data, the peripherals are turned off and the CPU is idle.

2.5 Wi-Fi Radio

2.5.1 Wi-Fi RF Standards

name		describe
Working channel center frequency range [1]		2412 ~ 2484 MHz
Wi-Fi protocol		IEEE 802.11b/g/n
data rate	20 MHz	11b: 1, 2, 5.5, 11 Mbps 11g: 6, 9, 12, 18, 24, 36, 48, 54 Mbps 11n: MCS0-7, 72.2 Mbps (Max)
	40MHz	11n: MCS0-7, 150 Mbps (Max)
Antenna type		PCB antenna, external antenna connector [2]

[1] The central frequency range of the working channel shall comply with the national or regional norms and standards. The software can configure the center frequency range of the working channel .

[2] The output impedance of the module with an external antenna connector is 50, and the module without an external antenna connector does not need to pay attention to the output impedance.

2.5.2 Wi-Fi RF Transmitter (TX) Specifications

Depending on product or certification requirements, you can configure the transmitter target power. For details about the default power, see Table 1. The spectrum mask and the transmit power when the EVM complies with the 802.11 standard.

rate	minimum value (dBm)	typical value (dBm)	maximum value (dBm)
802.11b, 1 Mbps	—	20.5	—
802.11b, 11Mbps	—	20.5	—
802.11g, 6Mbps	—	20.0	—
802.11g, 54Mbps	—	18.0	—
802.11n, HT20, MCS 0	—	19.0	—
802.11n, HT20, MCS 7	—	17.5	—
802.11n, HT40, MCS 0	—	18.5	—
802.11n, HT40, MCS 7	—	17.0	—

Table 1 Transmit power when the spectrum mask and EVM comply with the 802.11 standard

rate	minimum value (dB)	typical value (dB)	standard limit (dB)
802.11b, 1 Mbps, @20.5 dBm	—	–24.5	– 10
802.11b, 11 Mbps, @20.5 dBm	—	–24.5	– 10
802.11g, 6Mbps, @20dBm	—	–23.0	–5
802.11g, 54Mbps, @18dBm	—	–29.5	–25
802.11n, HT20, MCS 0, @19 dBm	—	–24.0	–5
802.11n, HT20, MCS 7, @17.5dBm	—	–30.5	–27
802.11n, HT40, MCS 0, @18.5dBm	—	–25.0	–5

Table 2 Launch EVM Test

2.5.3 Wi-Fi Radio Frequency Receiver (RX) Specifications

rate	minimum value (dBm)	typical value (dBm)	maximum value (dBm)
802.11b, 1 Mbps	—	–98.2	—
802.11b, 2 Mbps	—	–95.6	—
802.11b, 5.5Mbps	—	–92.8	—
802.11b, 11Mbps	—	–88.5	—
802.11g, 6Mbps	—	–93.0	—
802.11g, 9Mbps	—	–92.0	—
802.11g, 12Mbps	—	–90.8	—
802.11g, 18Mbps	—	–88.5	—
802.11g, 24Mbps	—	–85.5	—
802.11g, 36Mbps	—	–82.2	—
802.11g, 48Mbps	—	–78.0	—
802.11g, 54Mbps	—	–76.2	—
802.11n, HT20, MCS 0	—	–93.0	—
802.11n, HT20, MCS 1	—	–90.6	—
802.11n, HT20, MCS 2	—	–88.4	—
802.11n, HT20, MCS 3	—	–84.8	—
802.11n, HT20, MCS 4	—	–81.6	—
802.11n, HT20, MCS 5	—	–77.4	—

802.11n, HT20, MCS 6	—	–75.6	—
802.11n, HT20, MCS 7	—	–74.2	—
802.11n, HT40, MCS 0	—	–90.0	—
802.11n, HT40, MCS 1	—	–87.5	—
802.11n, HT40, MCS 2	—	–85.0	—
802.11n, HT40, MCS 3	—	–82.0	—
802.11n, HT40, MCS 4	—	–78.5	—
802.11n, HT40, MCS 5	—	–74.4	—
802.11n, HT40, MCS 6	—	–72.5	—
802.11n, HT40, MCS 7	—	–71.2	—

Table 3 Receiving sensitivity

rate	minimum value (dBm)	typical value (dBm)	maximum value (dBm)
802.11b, 1Mbps	—	5	—
802.11b, 11Mbps	—	5	—
802.11g, 6Mbps	—	5	—
802.11g, 54Mbps	—	0	—
802.11n, HT20, MCS 0	—	5	—
802.11n, HT20, MCS 7	—	0	—
802.11n, HT40, MCS 0	—	5	—
802.11n, HT40, MCS 7	—	0	—

Table 4 Maximum receiving level

rate	minimum value (dB)	typical value (dB)	maximum value (dB)
802.11b, 1Mbps	—	35	—
802.11b, 11Mbps	—	35	—
802.11g, 6Mbps	—	31	—
802.11g, 54Mbps	—	14	—
802.11n, HT20, MCS 0	—	31	—
802.11n, HT20, MCS 7	—	13	—
802.11n, HT40, MCS 0	—	19	—
802.11n, HT40, MCS 7	—	8	—

Table 5 Receiving adjacent channel suppression

2.6 Bluetooth Low Energy Radio

parameter	minimum value (MHz)	typical value (MHz)	maximum value (MHz)
Working channel center frequency	2402	—	2480

Table 6 Bluetooth Low Energy Frequency

2.6.1 Bluetooth Low Energy RF Transmitter (TX) Specifications

parameter	describe	minimum value	typical value	maximum value	unit
RF transmit power	RF power control range	–24.00	0	20.00	dBm
	Gain Control Step Size	—	3.00	—	dB
Carrier Frequency Offset and Drift	|fn |n=0 , 1 , 2 , . .k maximum value	—	2.50	—	kHz
	|f0 − fn | maximum value	—	2.00	—	kHz
	|fn − fn −5 | maximum value	—	1.40	—	kHz
	|f1 − f0 |	—	1.00	—	kHz
modulation characteristics	Δ f 1avg	—	249.00	—	kHz
	Δ f2max minimum value (at least 99.9% of Δ f2max)	—	198.00	—	kHz
	Δf2avg/Δf1avg	—	0.86	—	—
In-band spurious emissions	± 2 MHz offset	—	–37.00	—	dBm
	± 3 MHz offset	—	–42.00	—	dBm
	> ± 3 MHz offset	—	–44.00	—	dBm

Table 7 Transmitter Characteristics - Bluetooth Low Energy 1 Mbps

parameter	describe	minimum value	typical value	maximum value	unit
RF transmit power	RF power control range	–24.00	0	20.00	dBm
	Gain control step size	—	3.00	—	dB
Carrier frequency offset and drift	|fn |n=0 , 1 , 2 , . .k maximum value	—	2.50	—	kHz
	|f0 − fn | maximum value	—	2.00	—	kHz
	|fn − fn −5 | maximum value	—	1.40	—	kHz
	|f1 − f0|	—	1.00	—	kHz
modulation characteristics	Δf 1avg	—	499.00	—	kHz
	Δ f2max minimum (at least 99 .9% of Δ f2max)	—	416.00	—	kHz
	Δf2avg/Δf1avg	—	0.89	—	—
In-band spurious emissions	± 4 MHz offset	—	–42.00	—	dBm
	± 5 MHz offset	—	–44.00	—	dBm
	> ± 5 MHz offset	—	–47.00	—	dBm

Table 8 Transmitter Characteristics - Bluetooth Low Energy 2 Mbps

parameter	describe	minimum value	typical value	maximum value	unit
RF transmit power	RF power control range	–24.00	0	20.00	dBm
	Gain Control Step Size	—	3.00	—	dB
Carrier frequency offset and drift	|fn |n=0 , 1 , 2 , . .k maximum value	—	0.80	—	kHz
	|f0 − fn | maximum value	—	1.00	—	kHz
	|fn − fn −3|	—	0.30	—	kHz
	|f0 − f3|	—	1.00	—	kHz
modulation characteristics	Δf 1avg	—	248.00	—	kHz
	Δ f 1max minimum (at least 99.9% of Δ f 1max)	—	222.00	—	kHz
In-band spurious emissions	±2 MHz offset	—	–37.00	—	dBm
	±3 MHz offset	—	–42.00	—	dBm
	> ±3 MHz offset	—	–44.00	—	dBm

Table 9 Transmitter Characteristics - Bluetooth Low Energy 125 Kbps

parameter	describe	minimum value	typical value	maximum value	unit
RF transmit power	RF power control range	–24.00	0	20.00	dBm
	Gain Control Step Size	—	3.00	—	dB
Carrier Frequency Offset and Drift	|fn |n=0 , 1 , 2 , . .k maximum value	—	0.80	—	kHz
	|f0 − fn | maximum value	—	1.00	—	kHz
	|fn − fn −3|	—	0.85	—	kHz
	|f0 − f3|	—	0.34	—	kHz
Modulation characteristics	Δf2avg	—	213.00	—	kHz
	Δ f2max minimum value (at least 99 .9% of Δ f2max)	—	196.00	—	kHz
In-band spurious emissions	±2 MHz offset	—	–37.00	—	dBm
	±3 MHz offset	—	–42.00	—	dBm
	> ±3 MHz offset	—	–44.00	—	dBm

Table 10 Transmitter Characteristics - Bluetooth Low Energy 500 Kbps

2.6.2 Bluetooth Low Energy RF Receiver (RX) Specifications

parameter	describe	minimum value	typical value	maximum value	unit
Sensitivity@30.8% PER	—	—	–96.5	—	dBm
Maximum Received Signal@30.8% PER	—	—	8	—	dBm
Common channel suppression ratio C/I	F = F0 MHz	—	8	—	dB
Adjacent channel selective inhibition ratio C/I	F=F0+1MHz	—	4	—	dB
	F = F0 – 1 MHz	—	4	—	dB
	F = F0 + 2 MHz	—	-twenty three	—	dB
	F = F0 – 2 MHz	—	-twenty three	—	dB
	F = F0 + 3 MHz	—	–34	—	dB
	F = F0 – 3 MHz	—	–34	—	dB
	F>F0+3MHz	—	–36	—	dB
	F > F0 – 3 MHz	—	–37	—	dB
mirror frequency	—	—	–36	—	dB
Adjacent channel image frequency	F = Fimage + 1MHz	—	–39	—	dB

interference	F = Fimage - 1 MHz	—	–34	—	dB
out-of-band blocking	30 MHz ~ 2000 MHz	—	– 12	—	dBm
	2003 MHz ~ 2399 MHz	—	– 18	—	dBm
	2484 MHz ~ 2997 MHz	—	– 16	—	dBm
	3000 MHz ~ 12.75 GHz	—	– 10	—	dBm
Intermodulation	—	—	–29	—	dBm

Table 11 Receiver Characteristics - Bluetooth Low Energy 1 Mbps

parameter	describe	minimum value	typical value	maximum value	unit
Sensitivity@30.8% PER	—	—	–92	—	dBm
Maximum Received Signal@30.8% PER	—	—	3	—	dBm
Co-channel interference C/I	F = F0 MHz	—	8	—	dB
Adjacent channel selective inhibition ratio C/I	F = F0 + 2 MHz	—	4	—	dB
	F = F0 – 2 MHz	—	4	—	dB
	F = F0 + 4 MHz	—	–27	—	dB
	F = F0 – 4 MHz	—	–27	—	dB
	F = F0 + 6 MHz	—	–38	—	dB
	F = F0 – 6 MHz	—	–38	—	dB
	F > F0 + 6 MHz	—	–41	—	dB
	F > F0 – 6 MHz	—	–41	—	dB
mirror frequency	—	—	–27	—	dB
Adjacent channel image frequency interference	F = Fimage + 2 MHz	—	–38	—	dB
	F = Fimage – 2 MHz	—	4	—	dB
out-of-band blocking	30 MHz ~ 2000 MHz	—	– 15	—	dBm
	2003 MHz ~ 2399 MHz	—	-twenty one	—	dBm
	2484 MHz ~ 2997 MHz	—	-twenty one	—	dBm
	3000MHz~12.75GHz	—	-9	—	dBm
Intermodulation	—	—	–29	—	dBm

Table 12 Receiver Characteristics - Bluetooth Low Energy 2 Mbps

parameter	describe	minimum value	typical value	maximum value	unit
Sensitivity@30.8% PER	—	—	– 103.5	—	dBm
Maximum Received Signal@30.8% PER	—	—	8	—	dBm
Common channel suppression ratio C/I	F = F0 MHz	—	4	—	dB
Adjacent channel selective inhibition ratio C/I	F = F0 + 1 MHz	—	1	—	dB
	F = F0 – 1 MHz	—	2	—	dB
	F = F0 + 2 MHz	—	–26	—	dB
	F = F0 – 2 MHz	—	–26	—	dB
	F = F0 + 3 MHz	—	–36	—	dB
	F = F0 – 3 MHz	—	–39	—	dB
	F > F0 + 3 MHz	—	–42	—	dB
	F > F0 – 3 MHz	—	–43	—	dB
mirror frequency	—	—	–42	—	dB
Adjacent channel image frequency interference	F = Fimage + 1 MHz	—	–43	—	dB
	F = Fimage - 1 MHz	—	–36	—	dB

Table 13 Receiver Characteristics - Bluetooth Low Energy 125 Kbps

parameter	describe	minimum value	typical value	maximum value	unit
Sensitivity@30.8% PER	—	—	– 100	—	dBm
Maximum Received Signal@30.8% PER	—	—	8	—	dBm
Common channel suppression ratio C/I	F = F0 MHz	—	4	—	dB
Adjacent channel selective inhibition ratio C/I	F=F0+1MHz	—	1	—	dB
	F = F0 – 1 MHz	—	0	—	dB
	F = F0 + 2 MHz	—	-twenty four	—	dB
	F = F0 – 2 MHz	—	-twenty four	—	dB
	F = F0 + 3 MHz	—	–37	—	dB
	F = F0 – 3 MHz	—	–39	—	dB
	F > F0 + 3 MHz	—	–38	—	dB
	F > F0 – 3 MHz	—	–42	—	dB
mirror frequency	—	—	–38	—	dB
Adjacent channel image frequency interference	F=Fimage+1MHz	—	–42	—	dB
	F = Fimage - 1 MHz	—	–37	—	dB

Table 14 Receiver Characteristics - Bluetooth Low Energy 500 Kbps

3 Hardware Description

3.1 Functional block diagram

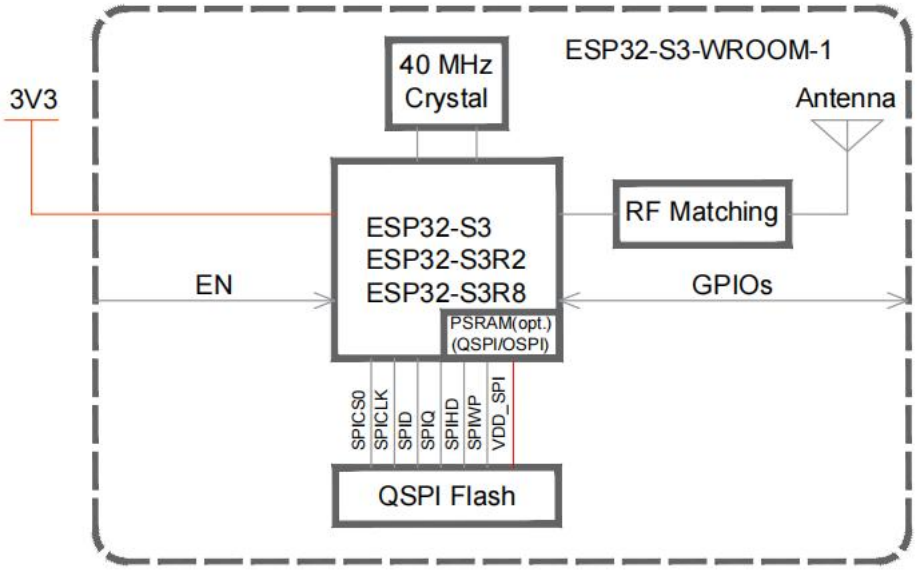


Figure 1 Functional block diagram of ESP32-S3-WROOM-1

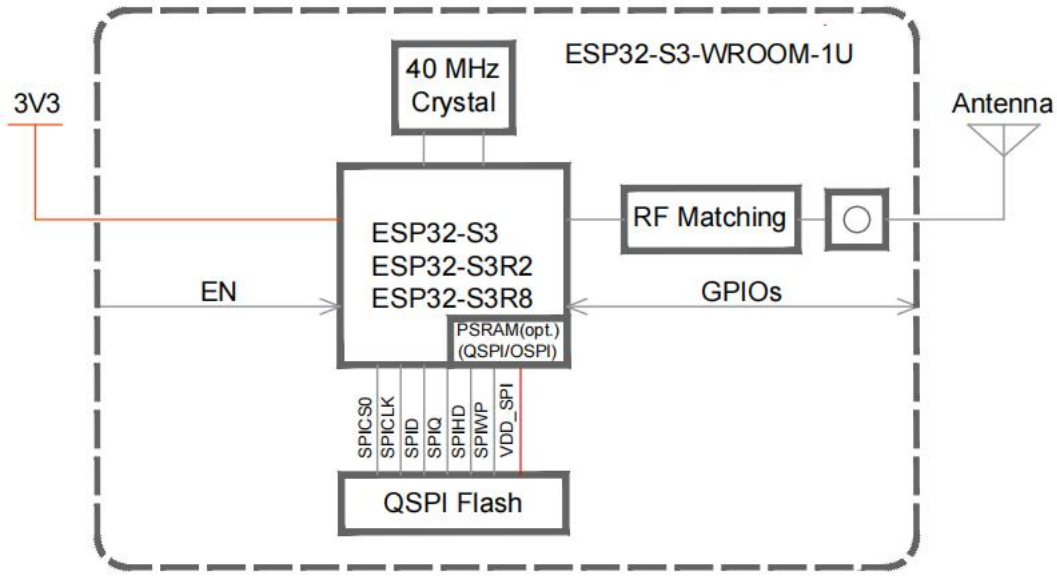


Figure 2 ESP32-S3-WROOM-1U functional block diagram

3.2 Mechanical size and pin definition

The pin layout diagram shows the approximate location of the pins on the module. Please refer to Figure 3.3 Module Dimensions for the actual layout drawn to scale .

ESP32-S3-WROOM-1U has no Keepout Zone, and the pin layout is the same as that of ESP32-S3-WROOM-1.

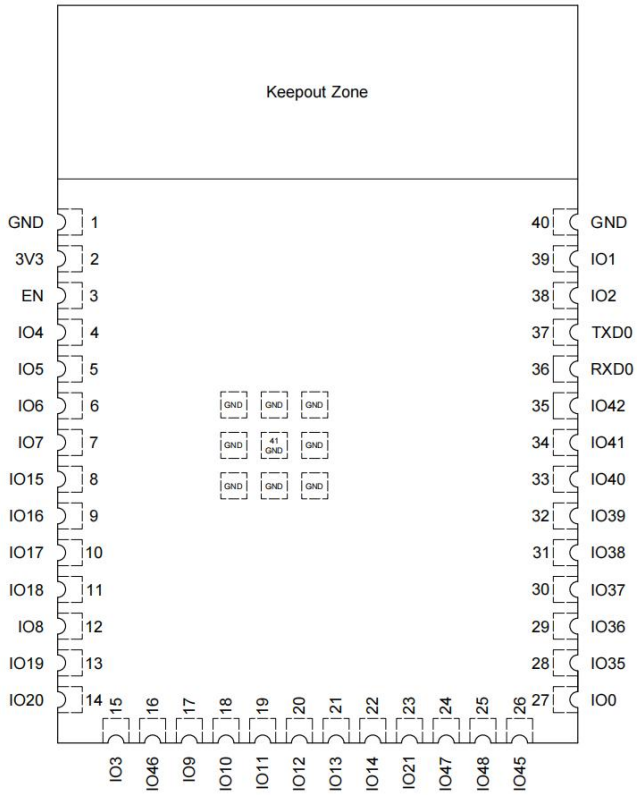


Chart 3 - 1 pin layout diagram

Pin definition:

name	serial number	type [a]	Function
GND	1	P	grounding
3V3	2	P	powered by
EN	3	I	High level: chip enable; Low level: the chip is off; Be careful not to leave the EN pin floating.
IO 4	4	I/O/T	RTC_GPIO4, **GPIO4** , TOUCH4, ADC1_CH3
IO 5	5	I/O/T	RTC_GPIO5, **GPIO5** , TOUCH5, ADC1_CH4
IO6	6	I/O/T	RTC_GPIO6, **GPIO6** , TOUCH6, ADC1_CH5

IO7	7	I/O/T	RTC_GPIO7, **GPIO7** , TOUCH7, ADC1_CH6
IO15	8	I/O/T	RTC_GPIO15, **GPIO15** , U0RTS, ADC2_CH4, XTAL_32K_P
IO16	9	I/O/T	RTC_GPIO16, **GPIO16** , U0CTS, ADC2_CH5, XTAL_32K_N
IO17	10	I/O/T	RTC_GPIO17, **GPIO17** , U1TXD, ADC2_CH6
IO18	1 1	I/O/T	RTC_GPIO18, **GPIO18** , U1RXD, ADC2_CH7, CLK_OUT3
IO8	12	I/O/T	RTC_GPIO8, **GPIO8** , TOUCH8, ADC1_CH7, SUBSPICS1
IO19	13	I/O/T	RTC_GPIO19, GPIO19, U1RTS, ADC2_CH8, CLK_OUT2, **USB_D-**
IO20	14	I/O/T	RTC_GPIO20, GPIO20, U1CTS, ADC2_CH9, CLK_OUT1, **USB_D+**
IO3	15	I/O/T	RTC_GPIO3, **GPIO3** , TOUCH3, ADC1_CH2
IO46	1 6	I/O/T	**GPIO46**
IO9	17	I/O/T	RTC_GPIO9, **GPIO9** , TOUCH9, ADC1_CH8, FSPIHD, SUBSPIHD
IO10	18	I/O/T	RTC_GPIO10, **GPIO10** , TOUCH10, ADC1_CH9, FSPICS0, FSPIIO4, SUBSPICS0
IO11	19	I/O/T	RTC_GPIO11, GPIO11 , TOUCH11, ADC2_CH0, FSPID, FSPIIO5, SUBSPID
IO12	20	I/O/T	RTC_GPIO12, **GPIO12** , TOUCH12, ADC2_CH1, FSPICLK, FSPIIO6, SUBSPICLK
IO13	twenty one	I/O/T	RTC_GPIO13, **GPIO13** , TOUCH13, ADC2_CH2, FSPIQ, FSPIIO7, SUBSPIQ
IO14	twenty two	I/O/T	RTC_GPIO14, **GPIO14** , TOUCH14, ADC2_CH3, FSPIWP, FSPIDQS, SUBSPIWP
IO21	twenty three	I/O/T	RTC_GPIO21, **GPIO21**
IO47	twenty four	I/O/T	SPICLK_P_DIFF, **GPIO47** , SUBSPICLK_P_DIFF
IO48	25	I/O/T	SPICLK_N_DIFF, **GPIO48** , SUBSPICLK_N_DIFF
IO45	26	I/O/T	**GPIO45**
IO0	27	I/O/T	RTC_GPIO0, **GPIO0**
IO35	28	I/O/T	SPIIO6, **GPIO35** , FSPID, SUBSPID
IO36	29	I/O/T	SPIIO7, **GPIO36** , FSPICLK, SUBSPICLK
IO37	30	I/O/T	SPIDQS, **GPIO37** , FSPIQ, SUBSPIQ
IO38	31	I/O/T	**GPIO38** , FSPIWP, SUBSPIWP
IO39	32	I/O/T	**MTCK** , GPIO39, CLK_OUT3, SUBSPICS1
IO40	33	I/O/T	**MTDO** , GPIO40, CLK_OUT2
IO41	34	I/O/T	**MTDI** , GPIO41, CLK_OUT1

IO42	35	I/O/T	**MTMS** , GPIO42
RXD0	36	I/O/T	**U0RXD** , GPIO44, CLK_OUT2
TXD0	37	I/O/T	**U0TXD** , GPIO43, CLK_OUT1
IO2	38	I/O/T	RTC_GPIO2, **GPIO2** , TOUCH2, ADC1_CH1
IO1	39	I/O/T	RTC_GPIO1, **GPIO1** , TOUCH1, ADC1_CH0
GND	40	P	grounding
EPAD	41	P	grounding

[a] P: power supply; I: input; O: output; T: can be set to high impedance. Bold font is the default function of the pin.

of pins 28 ~ 30

The default functionality is determined by the eFuse bit.

3.2 Module schematic diagram

3.2.1 ESP32-S3-WROOM-1 module schematic diagram

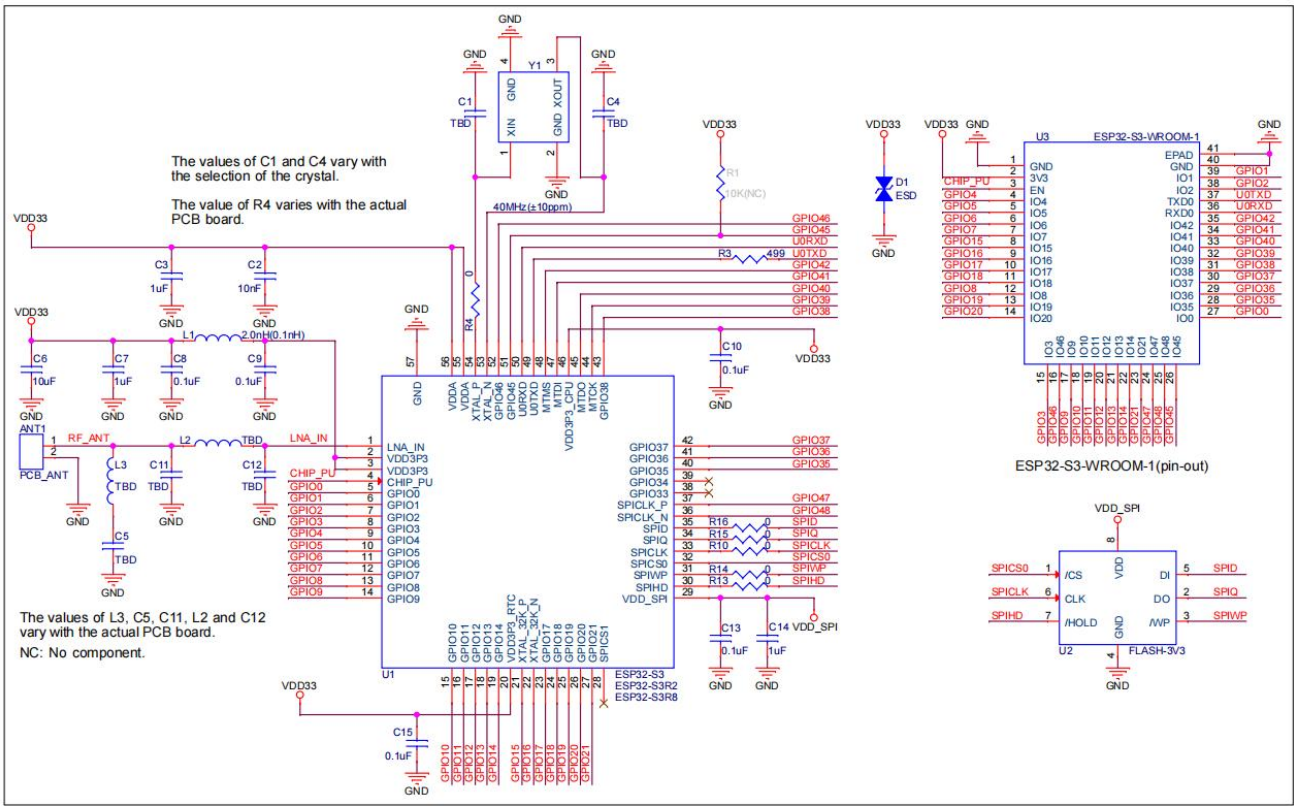


Chart 3 - 2 schematic diagram

3.2.2 ESP32-S3-WROOM-1U module schematic diagram

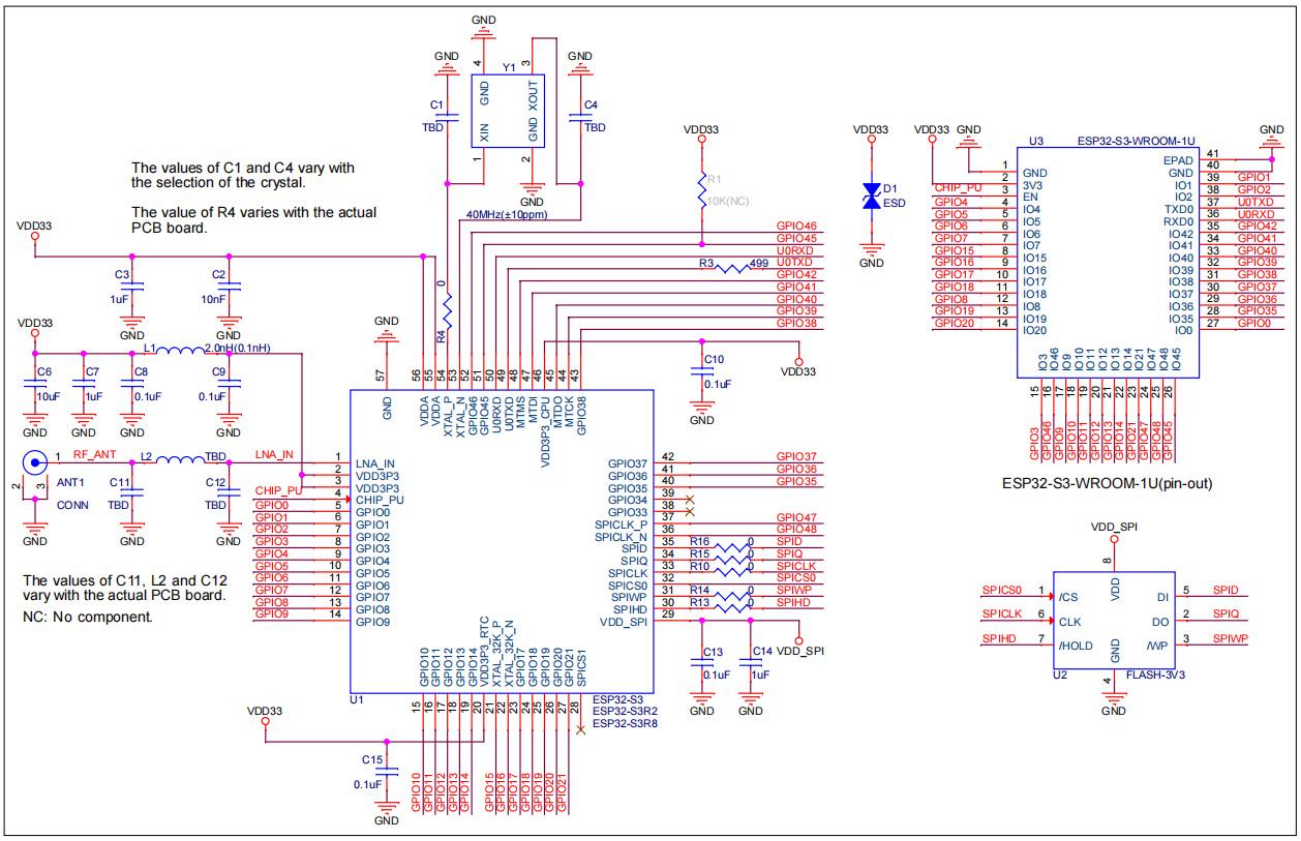


Chart 3 - 3 schematic diagram

Note : Since the default working voltage of the module's flash is 3.3 V (VDD_SPI output), the pull-up resistor R1 of the module's internal IO45 is disabled by default. At the same time, please pay attention to ensure that the external circuit will not pull IO45 high when the module is powered on when using IO45.

3.3 Module size

3.3.1 ESP32-S3-WROOM-1 dimension drawing

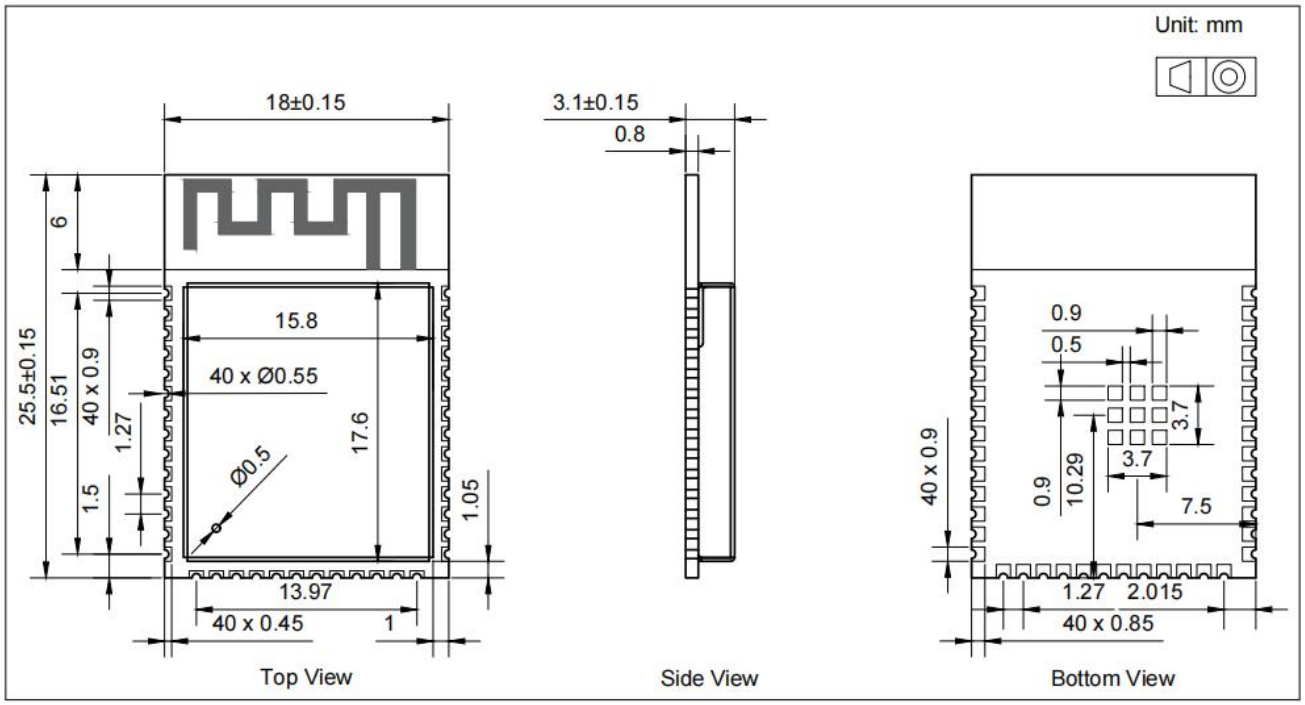


Chart 3 - 4 module size

3.3.1 ESP32-S3-WROOM-1U Dimension Drawing

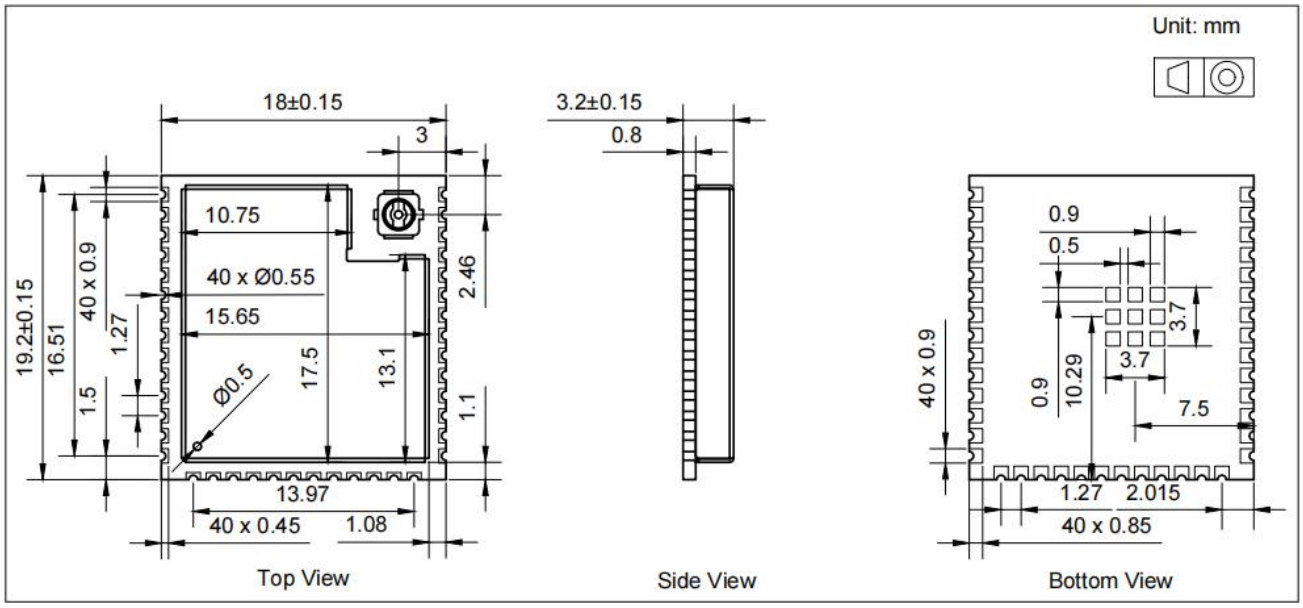


Chart 3 - 5 module size

3.4 PCB Package Graphics

3.4.1 ESP32-S3-WROOM-1 PCB Package Graphics

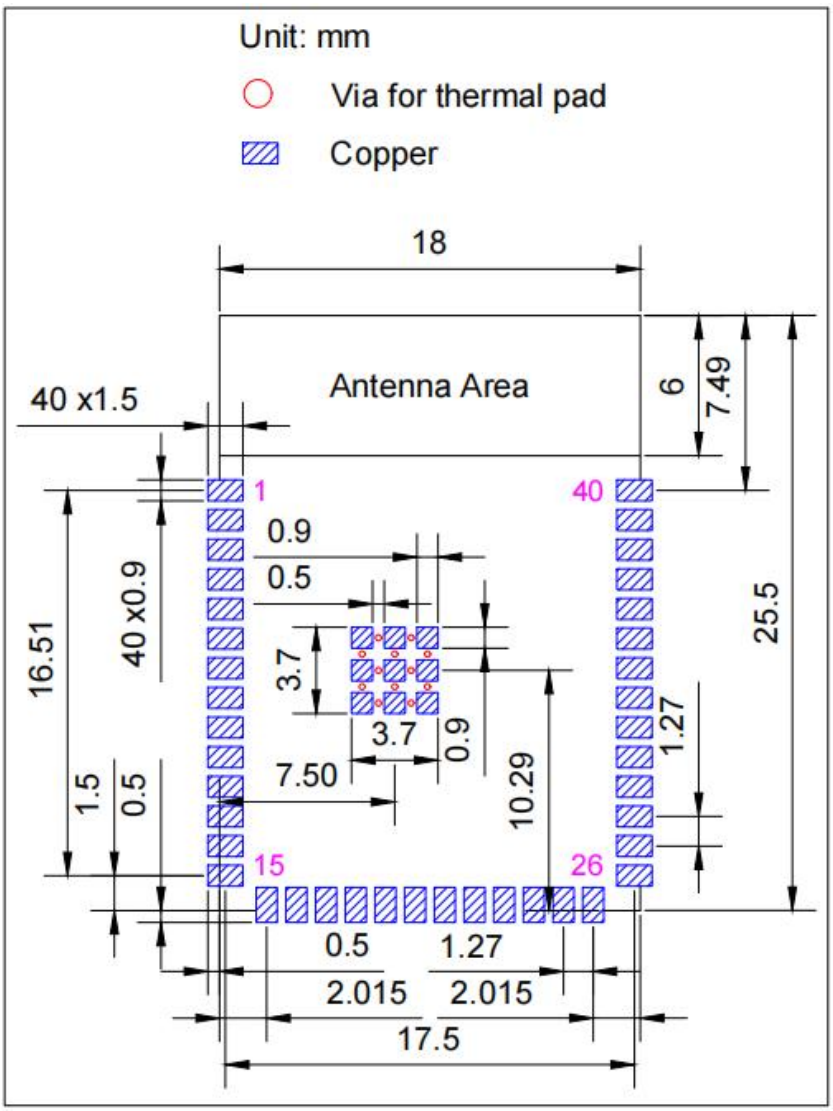


Chart 3 - 6 ESP32-S3-WROOM-1 PCB packaging

3.4.2 ESP32-S3-WROOM-1U PCB package pattern

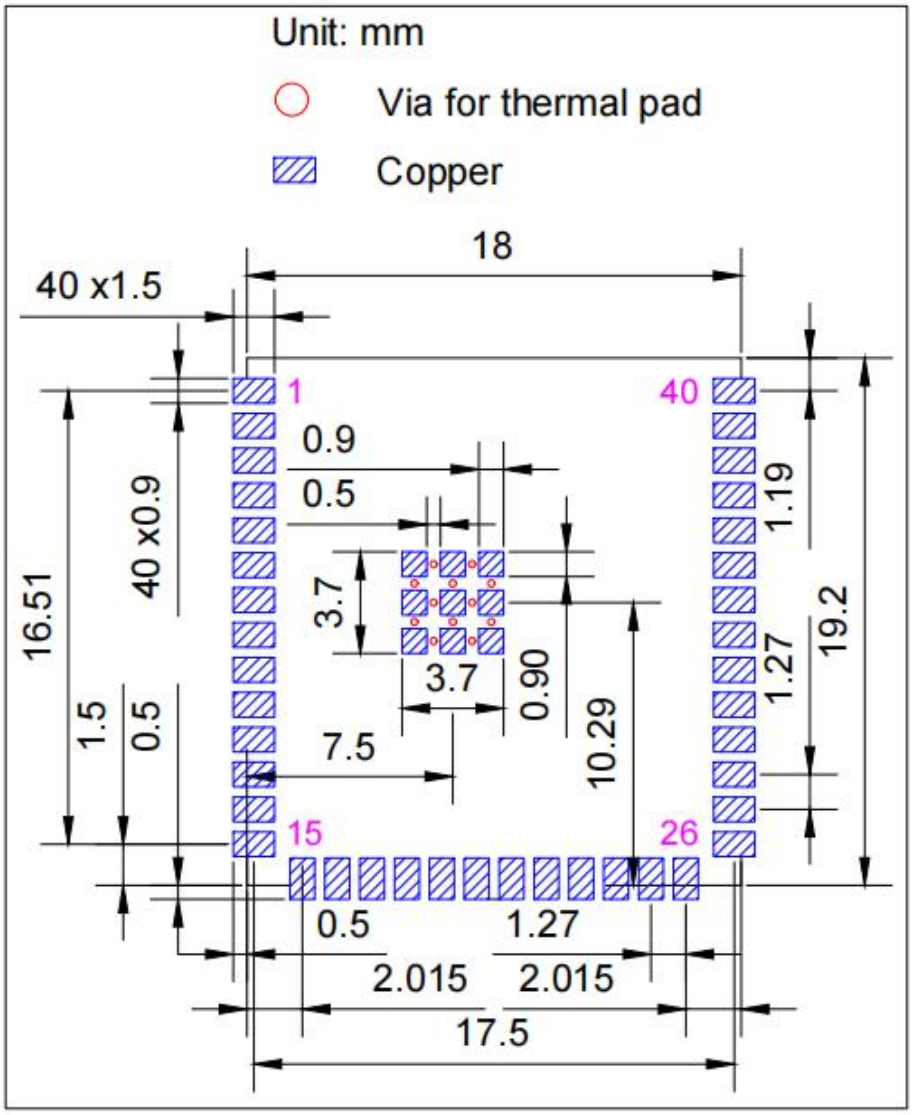


Chart 3 - 7 ESP32-S3-WROOM-1 U PCB package

3.5 External antenna connector dimensions

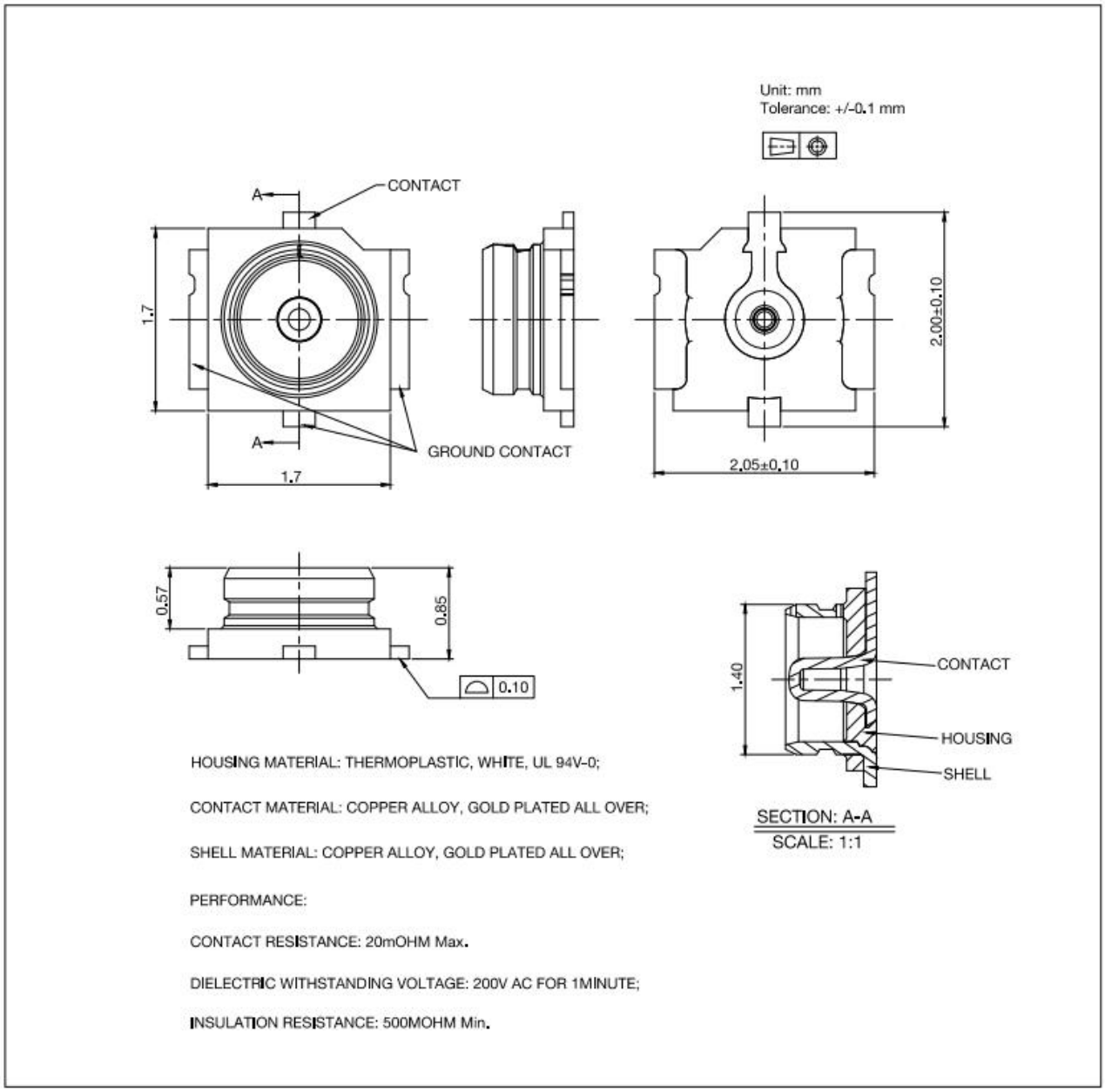


Chart 3 - 8 External antenna connector dimensions

4 Frequently Asked Questions

4.1 Transmission distance is not ideal

- When there is a straight-line communication obstacle, the communication distance will be attenuated accordingly;
- Temperature, humidity, and co-channel interference will increase the communication packet loss rate;
- The ground absorbs and reflects radio waves, and the test effect is poor when it is close to the ground;
- Seawater has a strong ability to absorb radio waves, so the seaside test results are poor;
- There are metal objects near the antenna, or placed in a metal case, the signal attenuation will be very serious;
- The power register is set incorrectly, and the air speed is set too high (the higher the air speed, the closer the distance);
- The low voltage of the power supply at room temperature is lower than the recommended value, and the lower the voltage, the lower the output power;

4.2 The module is easily damaged

- Please check the power supply to ensure that it is between the recommended power supply voltage, if it exceeds the maximum value, it will cause permanent damage to the module;
- Please check the stability of the power supply, the voltage cannot fluctuate greatly and frequently;
- Please ensure anti-static operation during installation and use, and high-frequency devices are electrostatically sensitive;
- Please ensure that the humidity during installation and use should not be too high, some components are humidity sensitive devices;
- If there is no special requirement, it is not recommended to use it at too high or too low temperature.

4.3 Bit error rate is too high

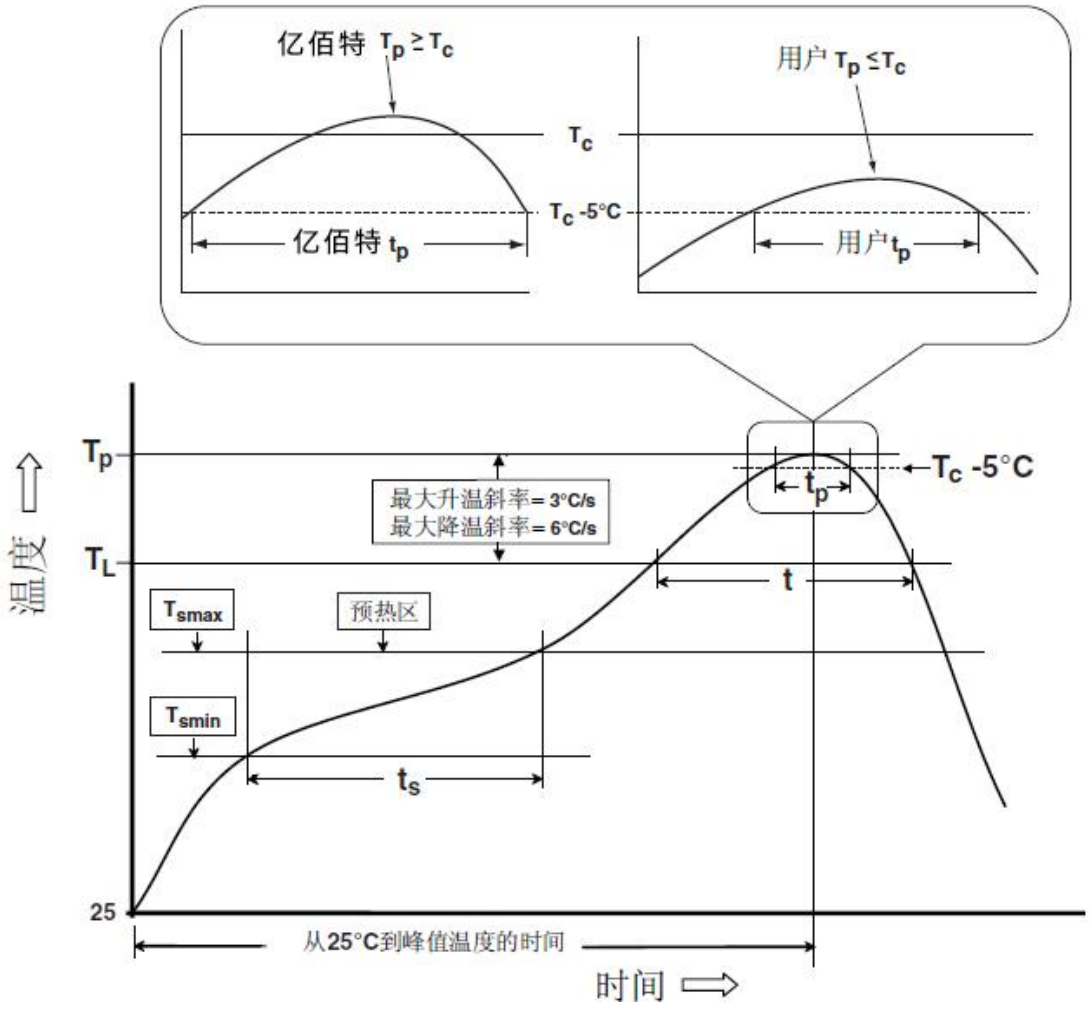
- There is co-channel signal interference nearby, stay away from the source of interference or modify the frequency and channel to avoid interference;
- The clock waveform on the UART is not standard, check whether there is interference on the UART line;
- Unsatisfactory power supply may also cause garbled characters, so be sure to ensure the reliability of the power supply;

5 Welding Operation Guidance

5.1 Reflow soldering temperature

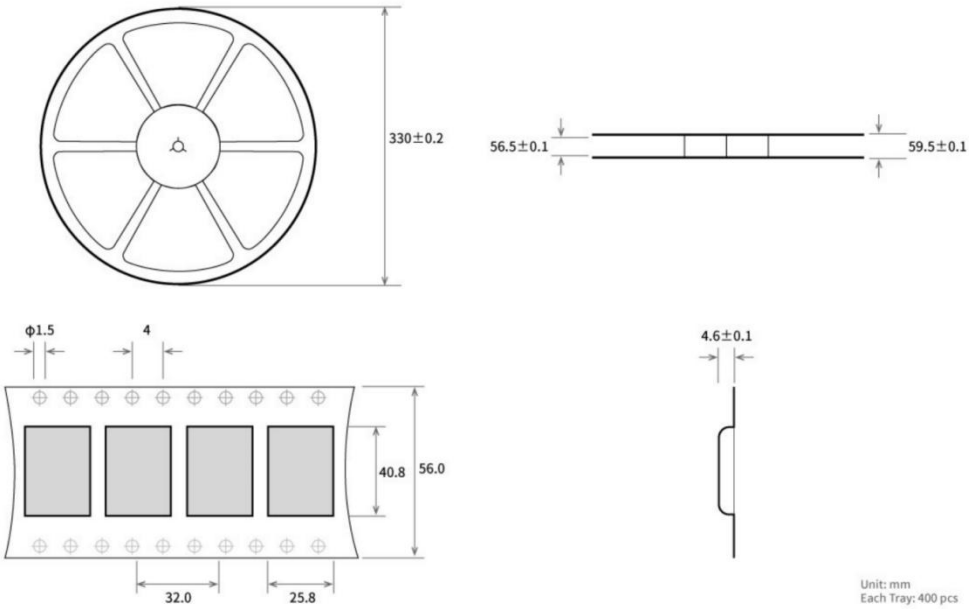
Reflow soldering curve characteristics		Lead process assembly	Lead-free process assembly
Preheat/keep warm	Minimum temperature (Tsmin)	100℃	150℃
	Maximum temperature (T smax)	150℃	200℃
	Time (T smin ~T smin)	60-120 seconds	60-120 seconds
Temperature rise slope (T L ~T p)		3℃/second, maximum	3℃/second, maximum
Liquidus temperature (TL)		183℃	217℃
Holding time above T L		60~ 90 seconds	60~ 90 seconds
Package peak temperature T p		Users should not exceed the temperature indicated on the product's "Moisture Sensitivity" label.	Users should not exceed the temperature indicated on the product's "Moisture Sensitivity" label.
p) within 5°C of the specified classification temperature (Tc) , see the figure below		20 seconds	30 seconds
Cooling slope (T p ~T L)		6℃/second, maximum	6°C/sec, max.
Time from room temperature to peak temperature		6 minutes, maximum	8 minutes, maximum
※ The peak temperature (Tp) tolerance definition of the temperature curve is the upper limit of the user			

5.2 Reflow soldering curve

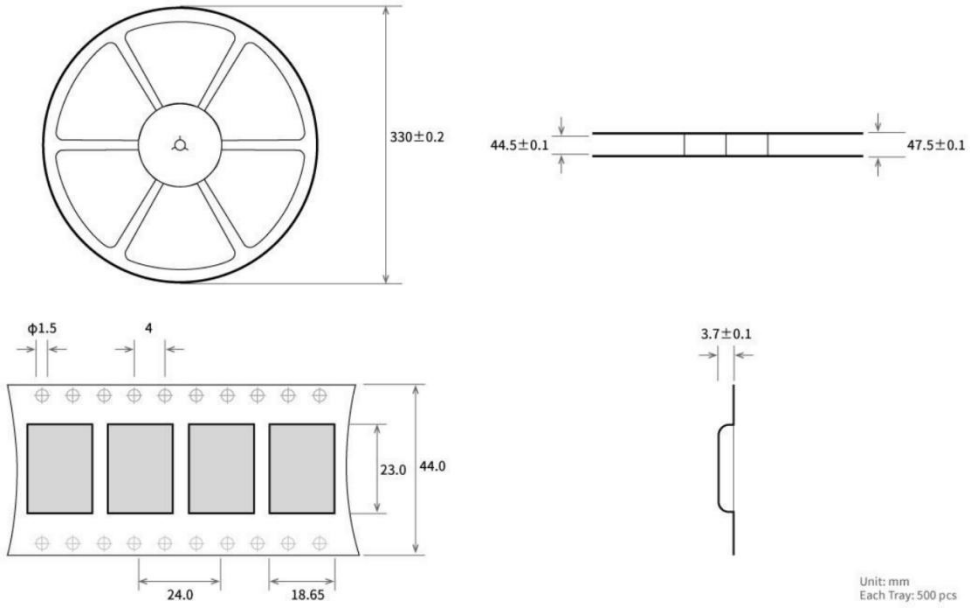


6 Package

6.1 ESP32-S3-WROOM-1 package



6.2 ESP32-S3-WROOM-1U package



7 Disclaimer

- This manual makes a comprehensive and detailed introduction on the basis of existing materials as much as possible. The company reserves the right to modify the content of the manual without further notice
- This manual is only used as a guide, and all information in the manual does not constitute any express or implied guarantee

Revision History

Version	Revision date	Revision Notes	Maintenance man
1.0	202 3-9-4	initial version	Hao

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