ESP32-S3-MINI-1 & ESP32-S3-MINI-1U

User Manual

成都亿佰特电子科技有限公司

Chengdu Ebyte Electronic Technology Co.,Ltd.

Contents

Disclaimer and Copyright Notice

The information in this document, including the URL address for reference, is subject to change without notice. The document is provided "as is" without any guarantee responsibility, including any guarantee for marketability, suitability for a specific purpose, or non-infringement, and any guarantee for any proposal, specification or sample mentioned elsewhere. This document does not bear any responsibility, including the responsibility for infringement of any patent rights caused by the use of the information in this document. This document does not grant any license for the use of intellectual property rights in estoppel or other ways, whether express or implied.

The test data obtained in the article are all obtained by the Ebyte laboratory, and the actual results may vary slightly.

We hereby declared that all brand names, trademarks and registered trademarks mentioned in this document are the property of their respective owners.

The final interpretation right belongs to Chengdu Ebyte Electronic Technology Co., Ltd.

Notice :

Due to product version upgrades or other reasons, the contents of this manual may be changed. Ebyte Electronic Technology Co., Ltd. reserves the right to modify the contents of this manual without any hint or noticet. This manual is only used as a guide. Chengdu Ebyte Electronic Technology Co., Ltd. makes every effort to provide accurate information in this manual. However, we does not guarantee that the contents of the manual are completely free of errors. All statements, information and suggestions in this manual do not constitute any express or implied guarantee.

Chapter 1 Overview

1.1 Introduction

ESP32-S3-MINI-1 and ESP32-S3-MINI-1U are two general-purpose Wi-Fi + BLE modules, equipped with Espressif ESP32-S3 chip. In addition to rich peripheral interfaces, the module also has powerful neural network computing capabilities and signal processing capabilities. It is suitable for a variety of application scenarios in the AIoT field, such as wake word detection and voice command recognition, face detection and recognition, smart Home, smart appliances, smart control panels, smart speakers, etc.

ESP32-S3-MINI-1 uses PCB on-board antenna, and ESP32-S3-MINI-1U uses IPEX antenna. Wi-Fi and Bluetooth coexist and share the same antenna.

ESP32-S3-MINI-1

ESP32-S3-MINI-1U

1.2 Features

- Built-in ESP32-S3 series chip, equipped with Xtensa® dual-core 32-bit LX7 microprocessor (supports single-precision floating point operation unit);
- Support clock frequency up to 240 MHz;
- With 8 MB flash;
- Support 2.4 GHz Wi-Fi (802.11 b/g/n) + Bluetooth® 5 (LE);
- With rich peripheral interfaces, such as GPIO, SPI, LCD, Camera interface, UART, I2C, I2S, etc.;
- Operating temperature can be between –40 ~ 85 °C;
- The communication distance can reach 200 meters under ideal conditions；

Chapter 2 Electrical characteristics

2.1 absolute maximum ratings

Symbol	Parameter	Min.value	Max.value	Unit
VDD33	Power pin voltage	–0.3	3.6	V
TSTORE	storage temperature	–40	85	°C

2.2 Recommended working conditions

Symbol	Parameter	Min.value	Typical value	Max.value	Unit
VDD33	Power pin voltage	3.0	3.3	3.6	V
IVDD	Current supply 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℃）

Symbol	Parameter	Min.value	Typical value	Max.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 (VDD[1]= 3.3V,VOH>= 2.64V,PAD_DRIVER=3)	—	40	—	mA
IOL	Low level sink current (VDD[1]=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
VIL_nRST	Chip reset voltage (EN pin should meet the voltage range)	–0.3	—	0.25×VDD[1]	V

1 VDD is the power supply for I/O.

2 VOH and VOL are measured values when the load is high resistance.

2.4 Power consumption characteristics

2.4.1 RF power consumption in Active mode

Working Mode	Description		Peak (mA)
Active (RF work)	TX	802 . 11b, 1 Mbps, @20 .5 dBm	355
		802 . 11g, 54 Mbps, @18 dBm	297
		802 . 11n, HT20, MCS7, @17 .5 dBm	286
		802 . 11n, HT40, MCS7, @17 dBm	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 are measured 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 frequency

2.5.1 Wi-Fi RF standards

Name	Description
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)
	40 MHz	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 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 50Ω, 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 default power, see Table 1 “spectrum template and transmit power when EVM complies with 802.11 standard.”

Rate	Min. value (dBm)	Typical value (dBm)	Max. value (dBm)
802 . 11b, 1 Mbps	—	20.5	—
802 . 11b, 11 Mbps	—	20.5	—
802 . 11g, 6 Mbps	—	20.0	—
802 . 11g, 54 Mbps	—	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 spectrum template and transmit power when EVM complies with 802.11 standard

Rate	Min. value (dB)	Typical value (dB)	Standard limits (dB)
802 . 11b, 1 Mbps, @20 .5 dBm	—	–24.5	– 10
802 . 11b, 11 Mbps, @20 .5 dBm	—	–24.5	– 10
802 . 11g, 6 Mbps, @20 dBm	—	–23.0	–5

802 . 11g, 54 Mbps, @18 dBm	—	–29.5	–25
802 . 11n, HT20, MCS 0, @19 dBm	—	–24.0	–5
802 . 11n, HT20, MCS 7, @17 .5 dBm	—	–30.5	–27
802 . 11n, HT40, MCS 0, @18 .5 dBm	—	–25.0	–5
802.11n, HT40, MCS 7, @17 dBm	—	–30.5	–27

Table 2 Launch EVM test

2.5.3 Wi-Fi Radio Receiver (RX) Specifications

Rate	Min. value (dBm)	Typical value (dBm)	Max. value (dBm)
802 . 11b, 1 Mbps	—	–98.2	—
802 . 11b, 2 Mbps	—	–95.6	—
802 . 11b, 5 .5 Mbps	—	–92.8	—
802 . 11b, 11 Mbps	—	–88.5	—
802 . 11g, 6 Mbps	—	–93.0	—
802 . 11g, 9 Mbps	—	–92.0	—
802 . 11g, 12 Mbps	—	–90.8	—
802 . 11g, 18 Mbps	—	–88.5	—
802 . 11g, 24 Mbps	—	–85.5	—
802 . 11g, 36 Mbps	—	–82.2	—
802 . 11g, 48 Mbps	—	–78.0	—
802 . 11g, 54 Mbps	—	–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	Min. value (dBm)	Typical value (dBm)	Max. value (dBm)
802 . 11b, 1 Mbps	—	5	—
802 . 11b, 11 Mbps	—	5	—
802 . 11g, 6 Mbps	—	5	—
802 . 11g, 54 Mbps	—	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	Min. value (dB)	Typical value (dB)	Standard limits (dB)
802 . 11b, 1 Mbps	—	35	—
802 . 11b, 11 Mbps	—	35	—
802 . 11g, 6 Mbps	—	31	—
802 . 11g, 54 Mbps	—	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 Receive adjacent channel suppression

2.6 Bluetooth low energy radio frequency

Parameter	Min. Value (MHz)	Typical value (MHz)	Max. 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	Description	Min. Value	Typical value	Max. 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 Max. value	—	2.50	—	kHz
	|f0 − fn | Max. value	—	2.00	—	kHz
	|fn − fn −5 | Max. value	—	1.40	—	kHz
	|f1 − f0 |	—	1.00	—	kHz
Modulation characteristics	Δ f 1avg	—	249.00	—	kHz
	Δ f2max Min. Value (at least 99 .9% of Δ f2max)	—	198.00	—	kHz
	Δ f2avg/Δ f 1avg	—	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	Description	Min. Value	Typical value	Max. 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 Max. value	—	2.50	—	kHz
	|f0 − fn | Max. value	—	2.00	—	kHz
	|fn − fn −5 | Max. value	—	1.40	—	kHz
	|f1 − f0 |	—	1.00	—	kHz

Modulation characteristics	Δ f 1avg	—	499.00	—	kHz
	Δ f2max Min. Value (at least 99 .9% of Δ f2max)	—	416.00	—	kHz
	Δ f2avg/Δ f 1avg	—	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	Description	Min. Value	Typical value	Max. 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 Max. value	—	0.80	—	kHz
	|f0 − fn | Max. value	—	1.00	—	kHz
	|fn − fn −3 |	—	0.30	—	kHz
	|f0 − f3 |	—	1.00	—	kHz
Modulation characteristics	Δ f 1avg	—	248.00	—	kHz
	Δ f 1max Min. Value (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	Description	Min. Value	Typical value	Max. 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 Max. value	—	0.80	—	kHz
	|f0 − fn | Max. value	—	1.00	—	kHz
	|fn − fn −3 |	—	0.85	—	kHz
	|f0 − f3 |	—	0.34	—	kHz
Modulation characteristics	Δ f2avg	—	213.00	—	kHz
	Δ f2max Min. 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	Description	Min. Value	Typical value	Max. value	Unit
Sensitivity @30 .8% PER	—	—	–96.5	—	dBm
Maximum received signal @30 .8% PER	—	—	8	—	dBm
Common channel rejection ratio C/I	F = F0 MHz	—	8	—	dB
Adjacent channel selective inhibition ratio C/I	F = F0 + 1 MHz	—	4	—	dB
	F = F0 – 1 MHz	—	4	—	dB
	F = F0 + 2 MHz	—	–23	—	dB
	F = F0 – 2 MHz	—	–23	—	dB
	F = F0 + 3 MHz	—	–34	—	dB
	F = F0 – 3 MHz	—	–34	—	dB
	F > F0 + 3 MHz	—	–36	—	dB
	F > F0 – 3 MHz	—	–37	—	dB
Mirror frequency	—	—	–36	—	dB
Adjacent channel mirror frequency interference	F = Fimage + 1 MHz	—	–39	—	dB
	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	Description	Min. Value	Typical value	Max. value	Unit
Sensitivity @30 .8% PER	—	—	–92	—	dBm

Maximum received signal @30 .8% PER	—	—	3	—	dBm
Common channel rejection ratio 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 mirror 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	—	–21	—	dBm
	2484 MHz ~ 2997 MHz	—	–21	—	dBm
	3000 MHz ~ 12 .75 GHz	—	–9	—	dBm
Intermodulation	—	—	–29	—	dBm

Table 12 Receiver Characteristics - Bluetooth Low Energy 2 Mbps

Parameter	Description	Min. Value	Typical value	Max. value	Unit
Sensitivity @30 .8% PER	—	—	– 103.5	—	dBm
Maximum received signal @30 .8% PER	—	—	8	—	dBm
Common channel rejection 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 mirror frequency interference	F = Fimage + 1 MHz	—	–43	—	dB
	F = Fimage – 1 MHz	—	–36	—	dB

Table 12 Receiver Characteristics - Bluetooth Low Energy 125 Kbps

Parameter	Description	Min. Value	Typical value	Max. value	Unit
Sensitivity @30 .8% PER	—	—	– 100	—	dBm
Maximum received signal @30 .8% PER	—	—	8	—	dBm
Common channel rejection 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	—	0	—	dB
	F = F0 + 2 MHz	—	–24	—	dB
	F = F0 – 2 MHz	—	–24	—	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 mirror frequency interference	F = Fimage + 1 MHz	—	–42	—	dB
	F = Fimage – 1 MHz	—	–37	—	dB

Table 14 Receiver Characteristics - Bluetooth Low Energy 500 Kbps

Chapter 3 Hardware description

3.1 Functional block diagram

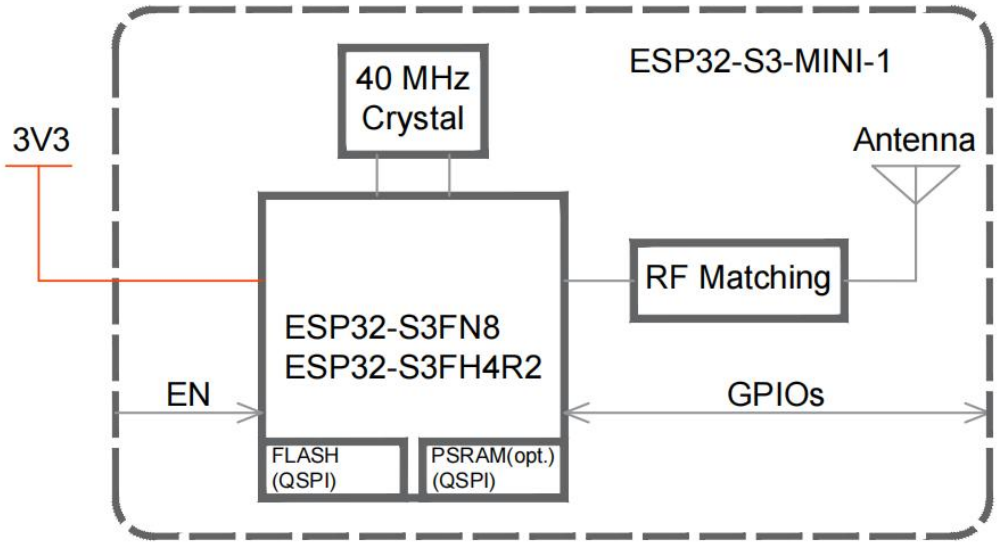


Figure 1 ESP32-S3-MINI-1 functional block diagram

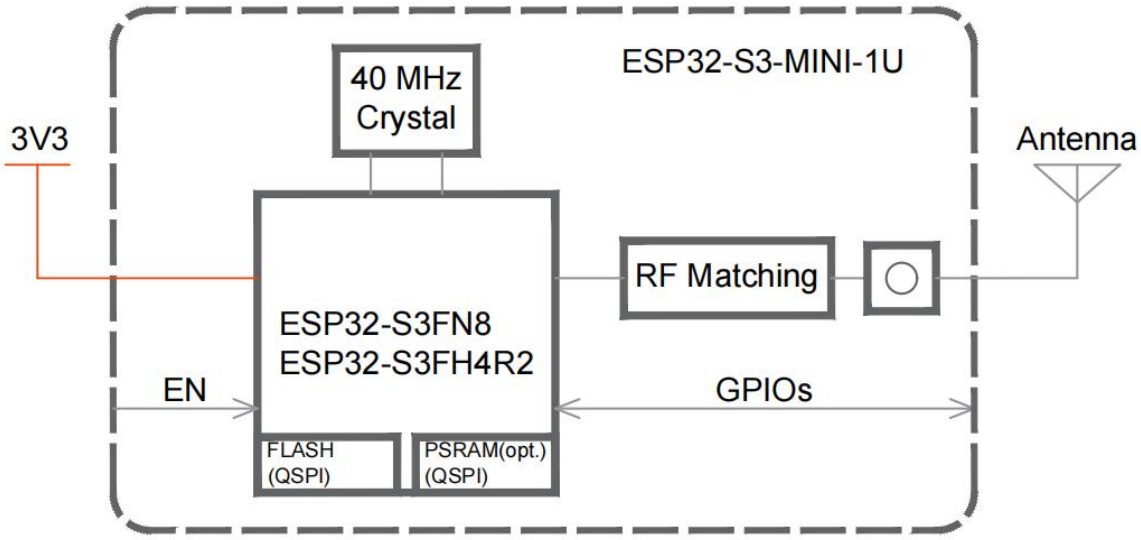


Figure 2 ESP32-S3-MINI-1U functional block diagram

3.2 Mechanical dimensions and pin definitions

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

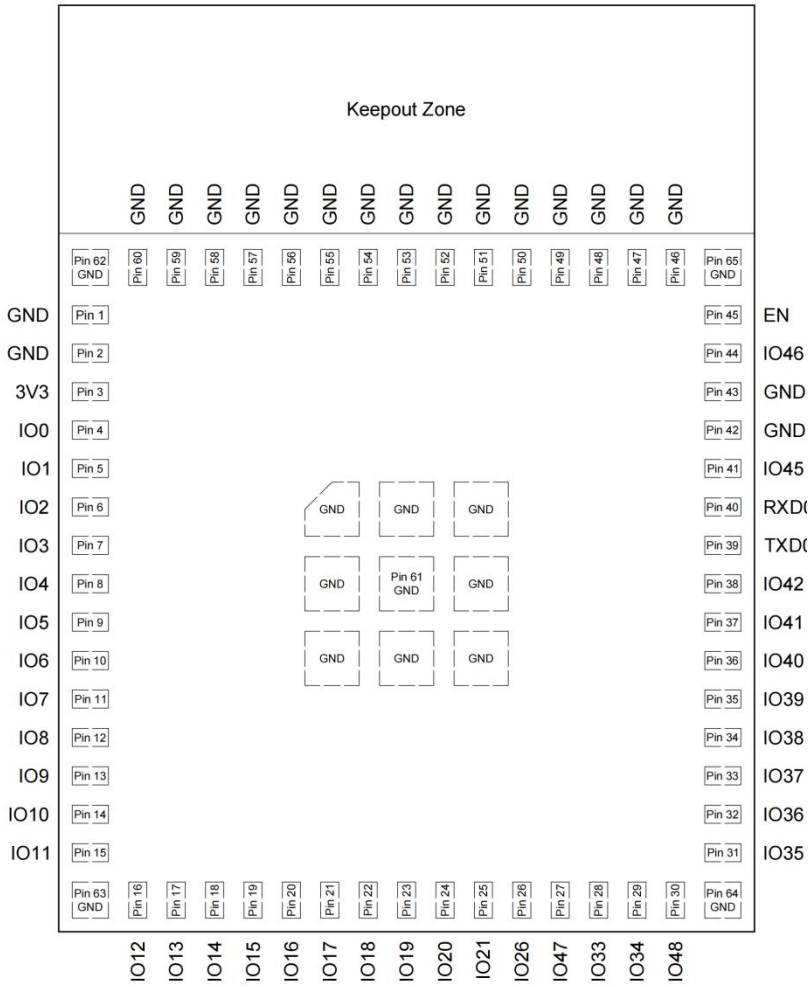


Chart 3-1 Pin layout diagram

Pin definition:

Name	Serial Number	Type[a]	Function
GND	1, 2, 42, 43, 46-65	P	gounding
3V3	3	P	Powered by
IO0	4	I/O/T	RTC_**GPIO0**, GPIO0
IO1	5	I/O/T	RTC_GPIO1, **GPIO1**, TOUCH1, ADC1_CH0
IO2	6	I/O/T	RTC_GPIO2, **GPIO2**, TOUCH2, ADC1_CH1

IO3	7	I/O/T	RTC_GPIO3, **GPIO3**, TOUCH3, ADC1_CH2
IO4	8	I/O/T	RTC_GPIO4, **GPIO4**, TOUCH4, ADC1_CH3
IO5	9	I/O/T	RTC_GPIO5, **GPIO5**, TOUCH5, ADC1_CH4
IO6	10	I/O/T	RTC_GPIO6, **GPIO6**, TOUCH6, ADC1_CH5
IO7	11	I/O/T	RTC_GPIO7, **GPIO7**, TOUCH7, ADC1_CH6
IO8	12	I/O/T	RTC_GPIO8, **GPIO8**, TOUCH8, ADC1_CH7, SUBSPICS1
IO9	13	I/O/T	RTC_GPIO9, **GPIO9**, TOUCH9, ADC1_CH8, FSPIHD, SUBSPIHD
IO10	14	I/O/T	RTC_GPIO10, **GPIO10**, TOUCH10, ADC1_CH9, FSPICS0, FSPIIO4,SUBSPICS0
IO11	15	I/O/T	RTC_GPIO11, **GPIO11**, TOUCH11, ADC2_CH0, FSPID, FSPIIO5,SUBSPID
IO12	16	I/O/T	RTC_GPIO12, **GPIO12**, TOUCH12, ADC2_CH1, FSPICLK, FSPIIO6,SUBSPICLK
IO13	17	I/O/T	RTC_GPIO13, **GPIO13**, TOUCH13, ADC2_CH2, FSPIQ, FSPIIO7,SUBSPIQ
IO14	18	I/O/T	RTC_GPIO14, **GPIO14**, TOUCH14, ADC2_CH3, FSPIWP, FSPIDQS,SUBSPIWP
IO15	19	I/O/T	RTC_GPIO15, **GPIO15**, U0RTS, ADC2_CH4, XTAL_32K_P
IO16	20	I/O/T	RTC_GPIO16, **GPIO16**, U0CTS, ADC2_CH5, XTAL_32K_N
IO17	21	I/O/T	RTC_GPIO17, **GPIO17**, U1TXD, ADC2_CH6
IO18	22	I/O/T	RTC_GPIO18, **GPIO18,** U1RXD, ADC2_CH7, CLK_OUT3
IO19	23	I/O/T	RTC_GPIO19, GPIO19, U1RTS, ADC2_CH8, CLK_OUT2, **USB_D-**
IO20	24	I/O/T	RTC_GPIO20, GPIO20, U1CTS, ADC2_CH9, CLK_OUT1, **USB_D+**
IO21	25	I/O/T	RTC_GPIO21, **GPIO21**
IO26	26	I/O/T	SPICS1, **GPIO26**
IO47	27	I/O/T	SPICLK_P_DIFF, **GPIO47**, SUBSPICLK_P_DIFF
IO33	28	I/O/T	SPIIO4, **GPIO33**, FSPIHD, SUBSPIHD
IO34	29	I/O/T	SPIIO5, **GPIO34**, FSPICS0, SUBSPICS0
IO48	30	I/O/T	SPICLK_N_DIFF, **GPIO48**, SUBSPICLK_N_DIFF
IO35	31	I/O/T	SPIIO6, **GPIO35**, FSPID, SUBSPID
IO36	32	I/O/T	SPIIO7, **GPIO36**, FSPICLK, SUBSPICLK
IO37	33	I/O/T	SPIDQS, **GPIO37**, FSPIQ, SUBSPIQ
IO38	34	I/O/T	**GPIO38**, FSPIWP, SUBSPIWP
IO39	35	I/O/T	**MTCK**, GPIO39, CLK_OUT3, SUBSPICS1
IO40	36	I/O/T	**MTDO**, GPIO40, CLK_OUT2
IO41	37	I/O/T	**MTDI**, GPIO41, CLK_OUT1
IO42	38	I/O/T	**MTMS**, GPIO42

TXD0	39	I/O/T	**U0TXD,** GPIO43, CLK_OUT1
RXD0	40	I/O/T	**U0RXD,** GPIO44, CLK_OUT2
IO45	41	I/O/T	**GPIO45**
IO46	42	I/O/T	**GPIO46**
EN	43	I	High level: chip enable; Low level: the chip is turned off; Be careful not to let the EN pin float.

[a] P：power supply；I：input；O：output；T：Can be set to high impedance. Bold font is the default function of the pin. The default function of pins 28 ~ 29, and pins 31 ~ 33 is determined by the eFuse bit.

3.2 Module schematic diagram

3.2.1 ESP32-S3-MINI-1 Module schematic diagram

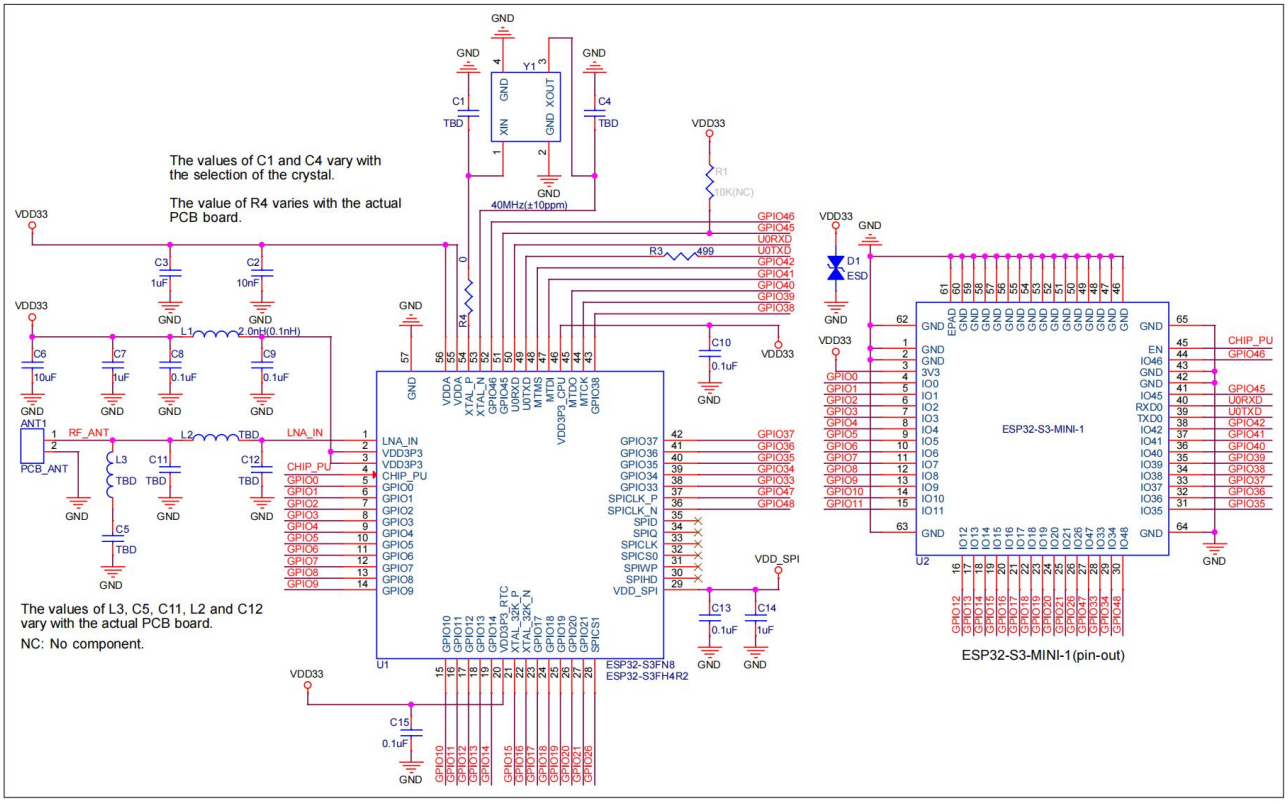


Chart 3-2 Schematic

3.2.2 ESP32-S3-MINI-1U Module schematic diagram

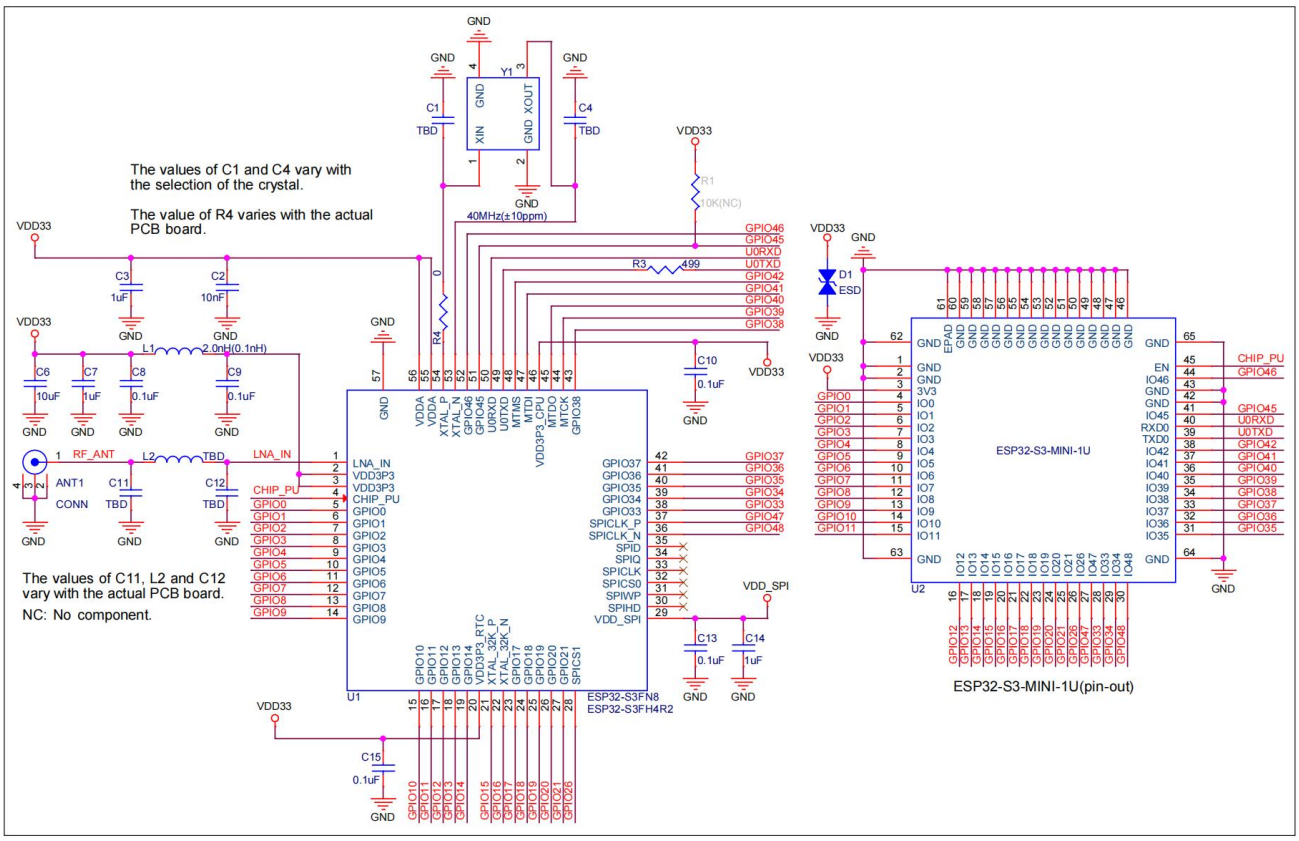


Chart 3-3 Schematic

3.3 Module dimensions

3.3.1 ESP32-S3-MINI-1 Dimensions

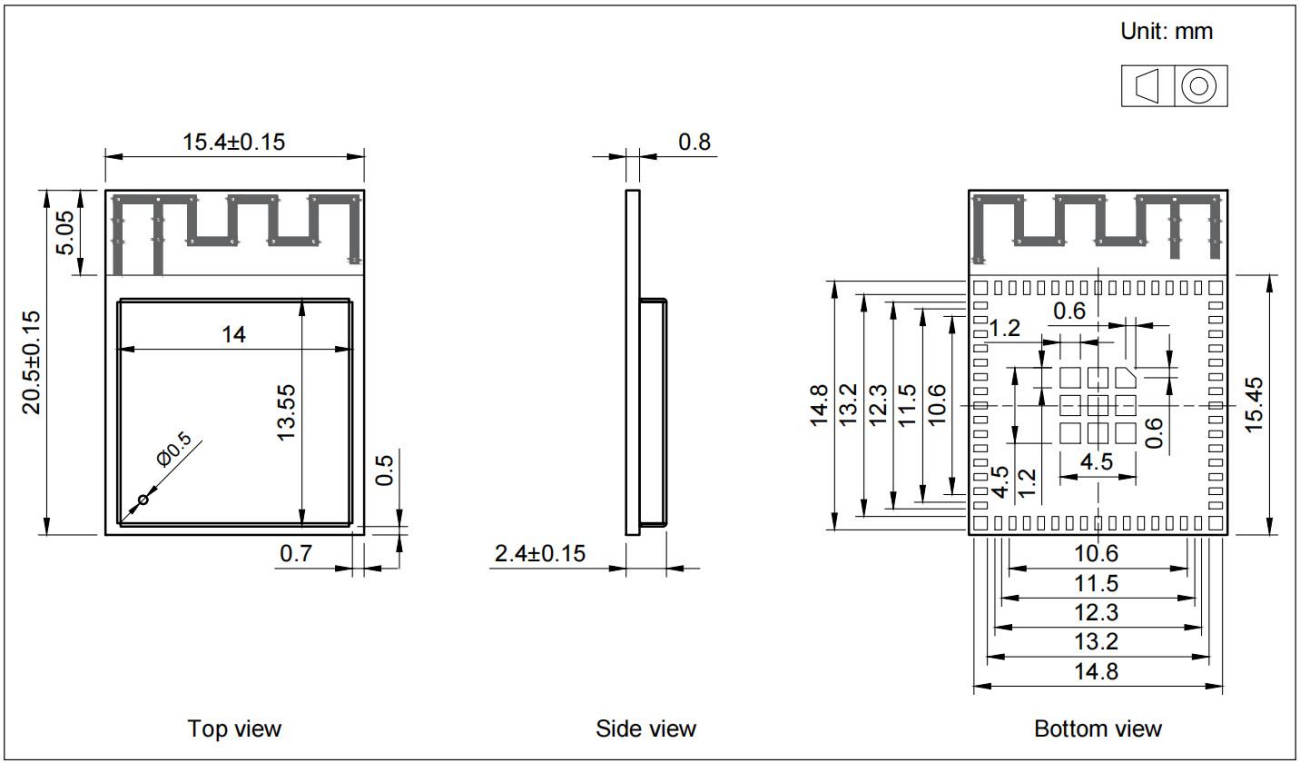


Chart 3-4 module dimensions

3.3.1 ESP32-S3-MINI-1U Dimensions

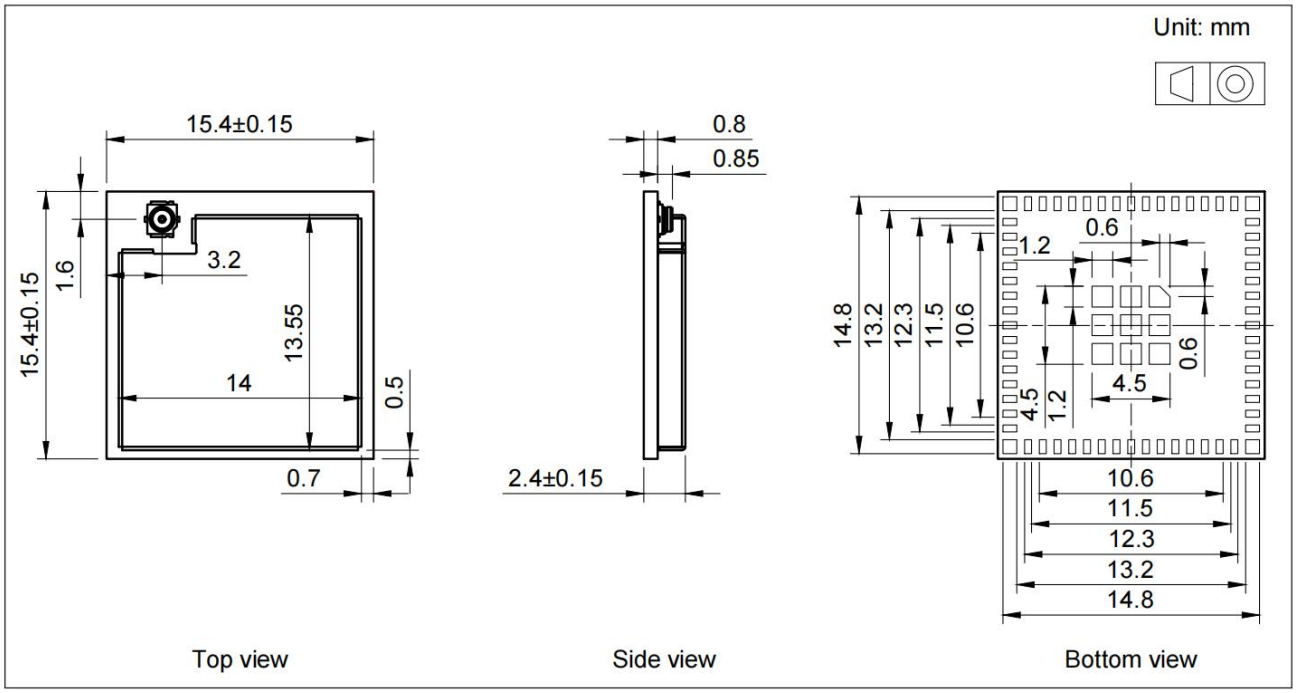


Chart 3- 5 module dimensions

3.4 PCB package graphics

3.4.1 ESP32-S3-MINI-1 PCB package graphics

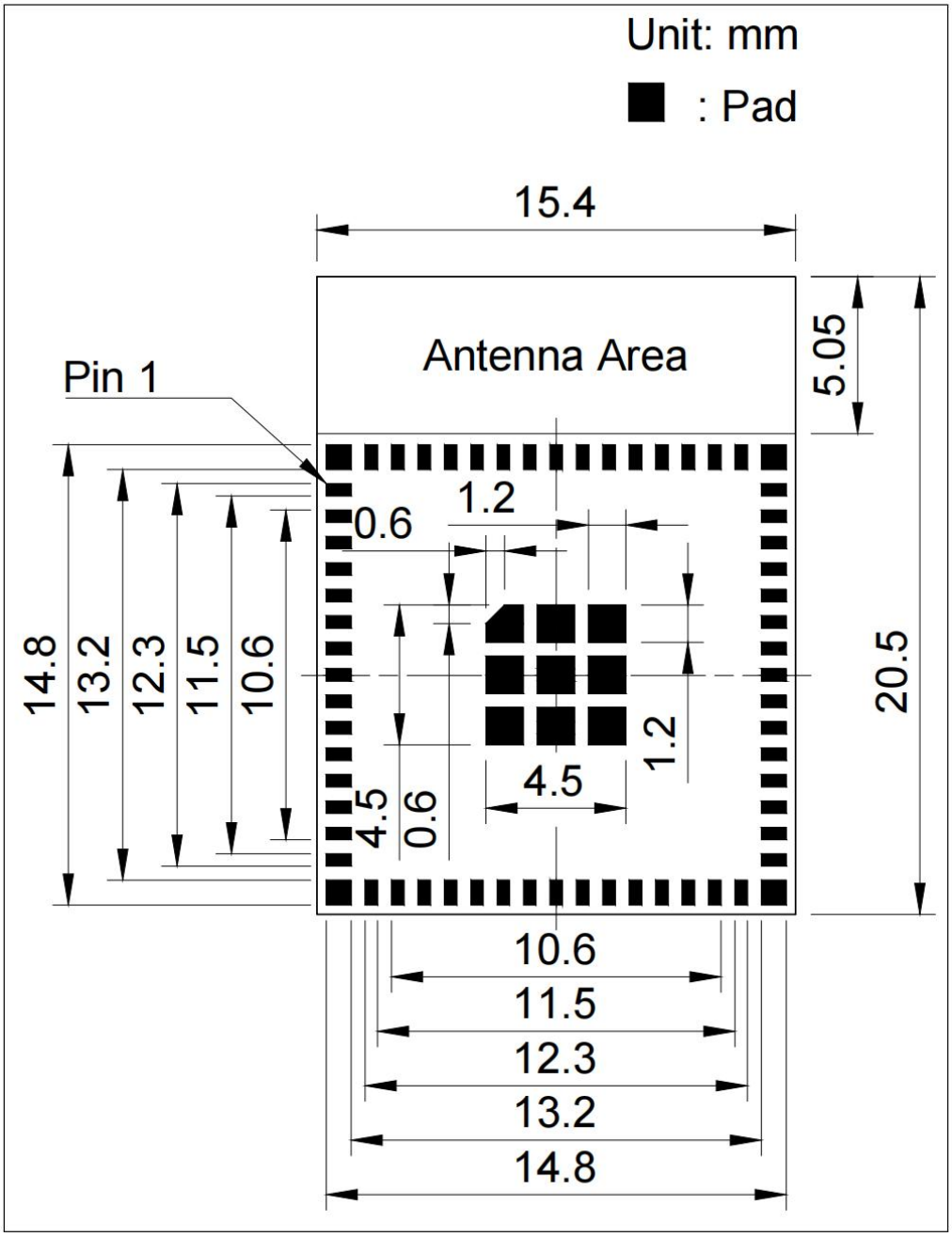


Chart 3- 6 ESP32-S3-MINI-1 PCB package graphics

3.4.2 ESP32-S3-MINI-1U PCB package graphics

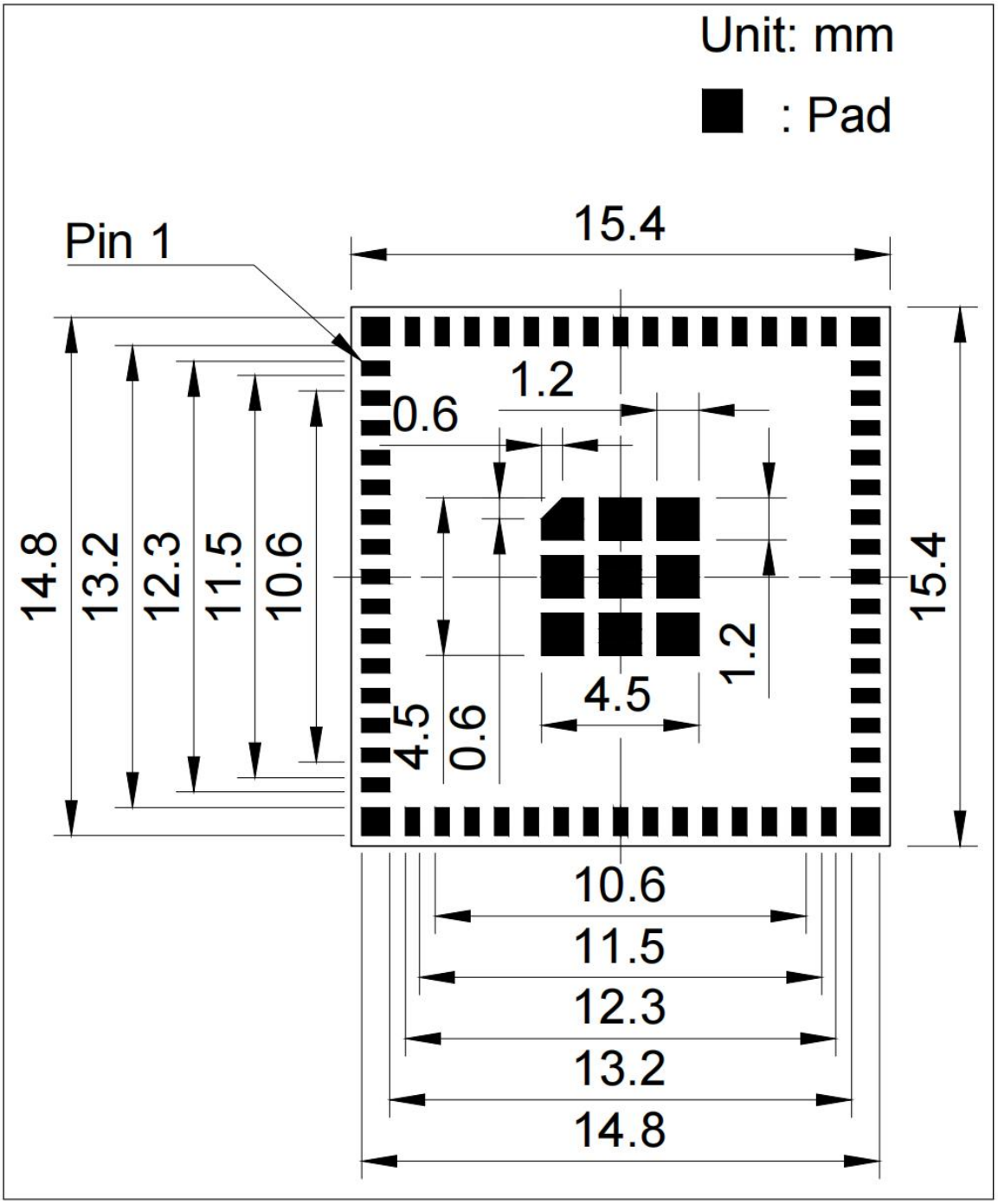


Chart 3- 7 ESP32-S3-MINI-1U PCB package graphics

3.5 External antenna connector dimensions

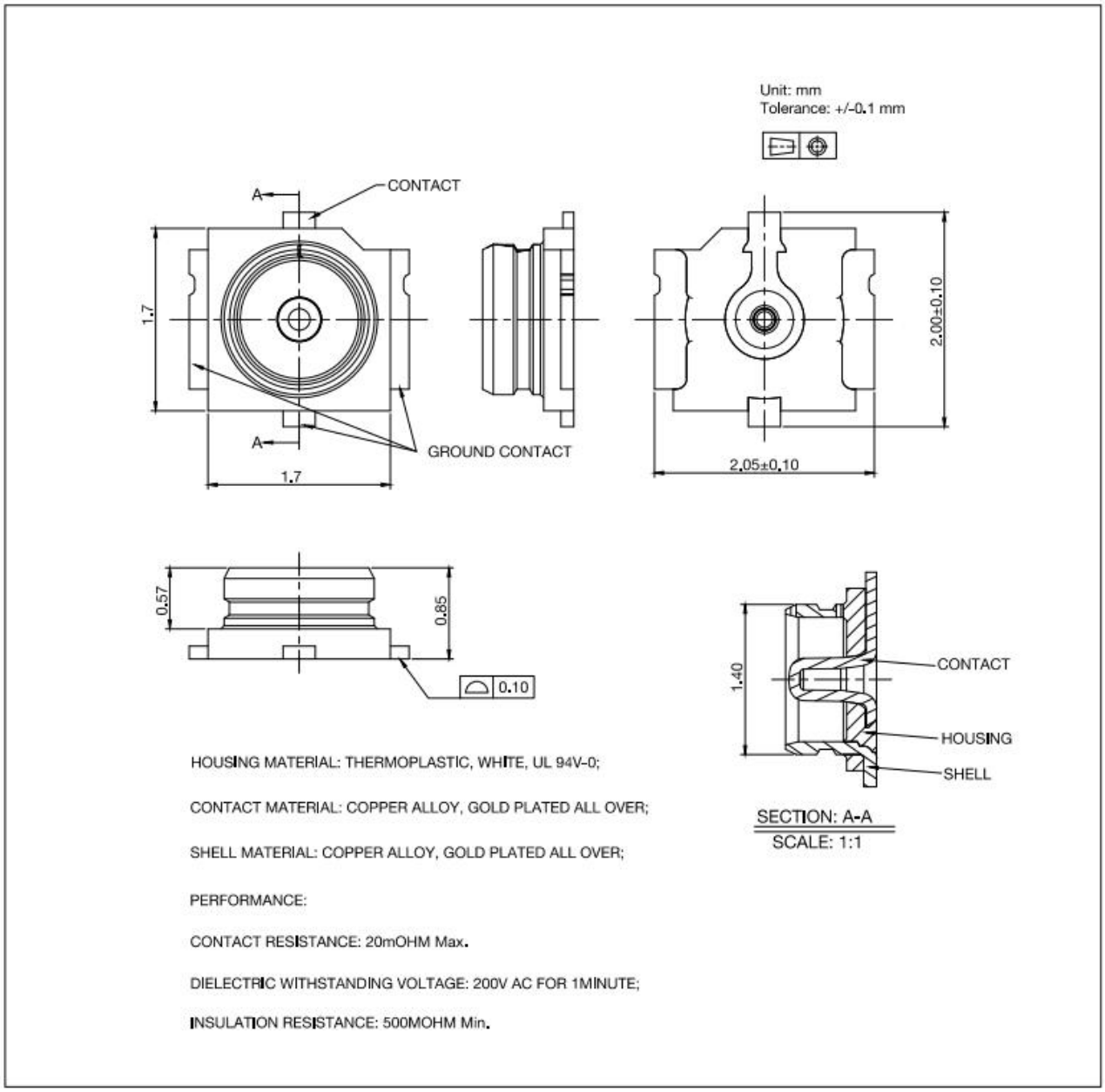


Chart 3- 8 External antenna connector dimensions

Chapter 4 FAQ

4.1 Transmission distance is not ideal

- When there are straight-line communication obstacles, the communication distance will be correspondingly attenuated;
- Temperature, humidity, and co-channel interference will lead to increased communication packet loss rate;
- The ground will absorb and reflect wireless radio wave, so the performance will be poor when testing module near ground.
- Sea water has great ability in absorbing wireless radio wave, so performance will be poor when testing near the sea
- The signal will be attenuated seriously when there is metal objects near the antenna or module is put in a metal case.
- Power register was set incorrectly, air data rate is set too high (the higher the air data rate, the shorter the transmission distance).
- The power supply voltage is lower than the recommended value under room temperature. (the lower the voltage, the lower the transmitting power.)
-

4.2 Module is easily damaged

- Please check the power supply, ensure it is in right range, voltage higher than max value will damage the module.
- Please check the stability of power supply, the voltage cannot fluctuate too much.
- Please ensure anti-static operation during installation and in use, high-frequency devices are sensitive to static electricity
- Please ensure that the humidity during installation and in use should not be too high, some components are sensitive to humidity.
- Please avoid using modules at too high or too low temperature if there is no special requirement.

4.3 BER(Bit Error Rate) is high

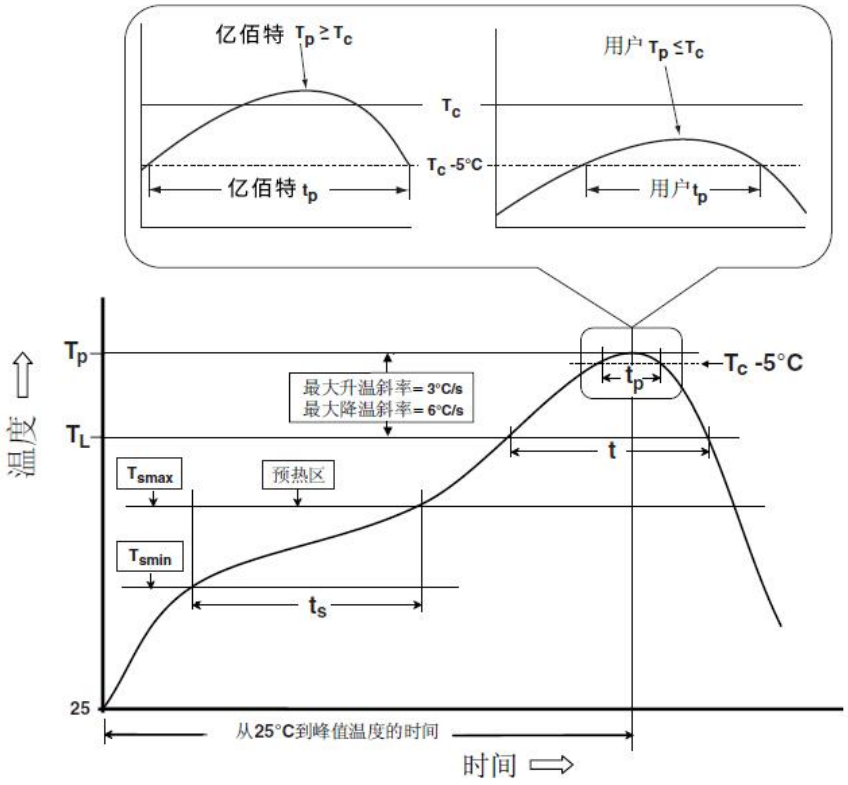
- There are co-channel signal interference nearby, please be away from interference sources or modify frequency and channel to avoid interference;
- The clock waveform on the UART is not standard, check whether there is interference on the UART line;
- Poor power supply may cause messy code. Make sure that the power supply is reliable.

Chatper 5 Welding Operation Guidance

5.1 Reflow soldering temperature

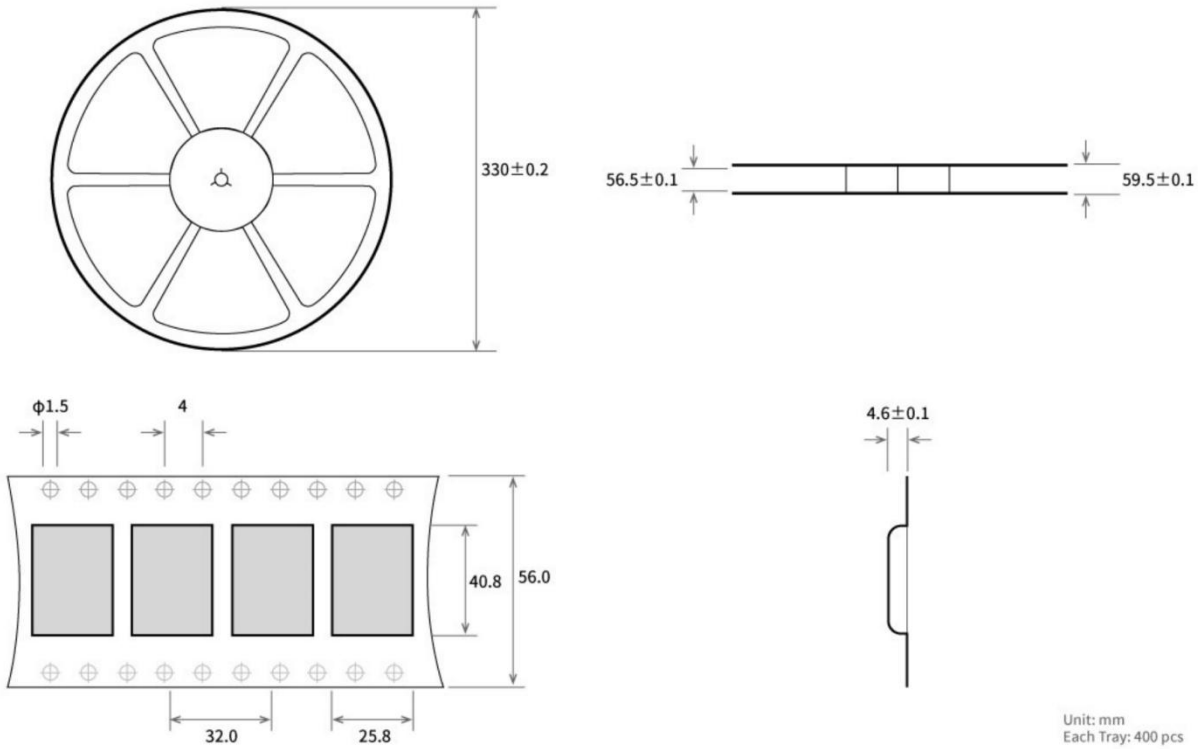
Reflow soldering curve characteristics		Lead-based process assembly	Lead-free process assembly
Preheat/keep warm	Minimum temperature（Tsmin）	100℃	150℃
	Maximum temperature（Tsmax）	150℃	200℃
	Time（Tsmin~Tsmin）	60-120 seconds	60-120 seconds
Heating slope（TL~Tp）		3℃/seconds，maximum	3℃/seconds，maximum
Liquidous Temperature（TL）		183℃	217℃
Holding time above TL		60~90 seconds	60~90 seconds
Package peak temperature Tp		It should not exceed the temperature indicated on the product's "Moisture Sensitivity" label.	It should not exceed the temperature indicated on the product's "Moisture Sensitivity" label.
The time (Tp) within 5℃ of the specified classification temperature (Tc), see the figure below		20 seconds	30 seconds
Cooling slope（Tp~TL）		6℃/seconds，maximum	6℃/seconds，maximum
Time from room temperature to peak temperature		6 minutes，maximum	8 minutes，maximum
※ The peak temperature (Tp) tolerance definition of the temperature profile is an upper limit for the user			

5.2 Reflow soldering curve

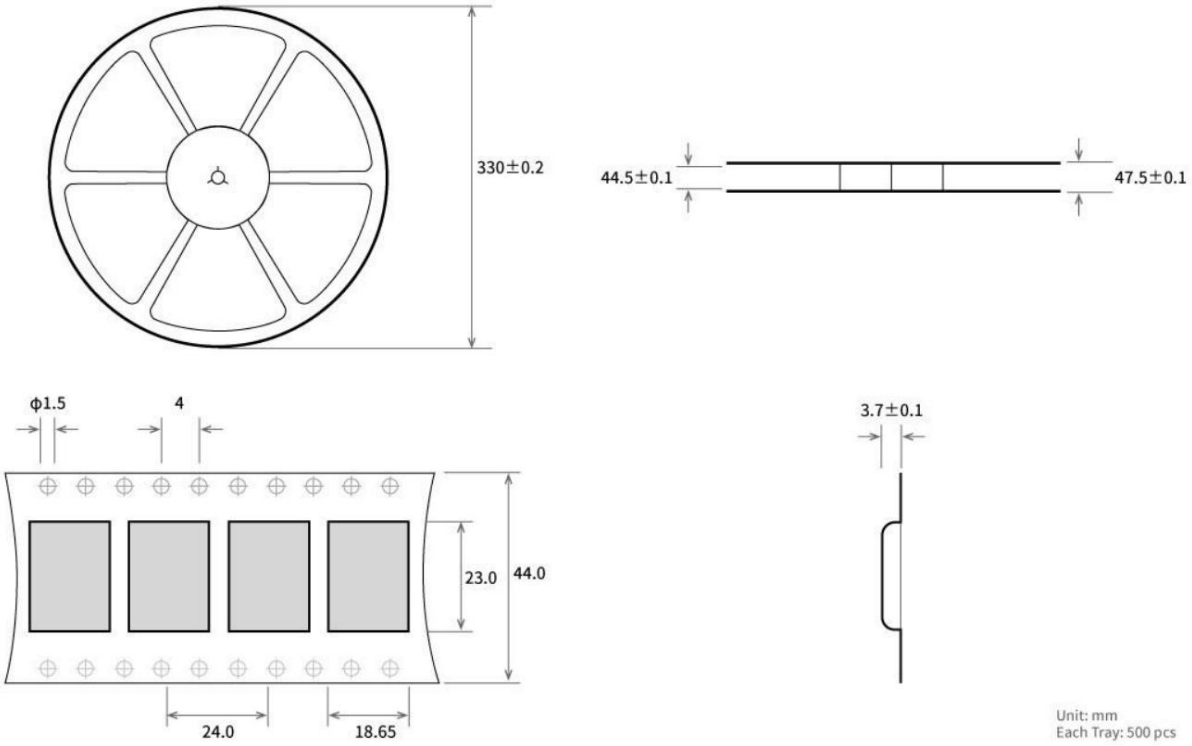


Chapter 6 Packing

6.1 ESP32-S3-MINI-1 packing



6.2 ESP32-S3-MINI-1U packing



Chapter 7 Disclaimer

- This manual is as comprehensive and detailed as possible based on the existing information. The company reserves the right to modify the content of the manual without further notice.
- This manual is only used as a guide. All information in the manual does not constitute any express or implied warranty.

Revision History

Version	Revision date	Revision notes	Maintenance Man
1.0	2023-9-4	Initial version	Hao

About us

Technical support: support@cdebyte.com
Documents and RF Setting download link: www.cdebyte.com
Thank you for using Ebyte products! Please contact us with any questions or suggestions: info@cdebyte.com
---
Official hotline:028-61543675
Web: www.cdebyte.com
Address: , Building B5, Mould Industrial Park, 199# Xiqu Ave, High-tech Zone, Chengdu, 611731, Sichuan, China

Chengdu Ebyte Electronic Technology Co.,Ltd.