ESP32-WROOM-32

Technical Specifications

version 2.9

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illustration

1. overview

The ESP32-WROOM-32 is a versatile Wi-Fi+BT+BLE MCU module that is powerful and versatile for low-power sensor networks and demanding tasks such as voice coding, audio streaming, and MP3 decoding.

At the heart of this module is the ESP32-D0WDQ6 chip*, which is scalable and adaptive. The two CPU cores can be controlled separately. The clock frequency can be adjusted from 80 MHz to 240 MHz. Users can cut off power to the CPU and utilize low-power coprocessors to constantly monitor for changes in the state of peripherals or for certain analog quantities to exceed thresholds. The ESP32 also integrates a rich set of peripherals, including capacitive touch sensors, Hall sensors, low-noise sensing amplifiers, SD card interfaces, Ethernet interfaces, high-speed SDIO/SPI, UARTs, and moreI2S and I2C, etc.

Illustrate:

* For the product model description of ESP32 series chips, please refer to the ESP32 Technical Specification.

The module integrates traditional Bluetooth, Bluetooth Low Energy and Wi-Fi, and has a wide range of uses: Wi-Fi supports a wide range of communication connections, and also supports direct Internet connection through routers; Bluetooth allows users to connect to a mobile phone or broadcast BLE Beacon for easy signal detection. The ESP32 chip's sleep current is less than 5 μA, making it suitable for battery-powered wearable electronics. The module supports data rates of up to 150 Mbps and antenna output power of up to 20 dBm for maximum range wireless communication. As a result, the module has industry-leading technical specifications and excellent performance in terms of high integration, wireless transmission distance, power consumption, and network connectivity.

The operating system for ESP32 is freeRTOS with LwIP and TLS 1.2 with built-in hardware acceleration. The chip also supports OTA encrypted upgrades, which is convenient for users to continue upgrading after the product is released.

Table 1 lists the product specifications for the ESP32-WROOM-32.

表 1: ESP32-WROOM-32 **产品规格**

category	project	Product Specifications:
authentication	RF Certified	FCC/CE-RED/IC/TELEC/KCC/SRRC/NCC
	Wi-Fi certified	Wi-Fi Alliance
	Bluetooth certified	BQB
	Environmental certifications	RoHS/REACH
Test	reliability	HTOL/HTSL/uHAST/TCT/ESD
Wi-Fi	agreement	802.11 b/g/n（802.11n，速度高达 150 Mbps）
		A-MPDU 和 A-MSDU 聚合,支持 0.4 μs 保护间隔
	Frequency range	2.4 GHz ~ 2.5 GHz
Bluetooth	agreement	符合蓝牙 v4.2 BR/EDR 和 BLE 标准
	rf	NZIF receiver with –97 dBm sensitivity
		Class-1, Class-2 和 Class-3 发射器
		AFH
	audio	CVSD 和 SBC 音频

1. Overview

category	project	Product Specifications:
hardware	Module interface	SD 卡、UART、SPI、SDIO、I2C、LED PWM、电机 PWM、I2S、IR、脉冲计数器、GPIO、电容式触摸传感器、ADC、DAC
	On-chip sensor	Hall sensors
	Integrated crystal oscillator	40 MHz 晶振
	集成 SPI flash	4 MB
	Operating voltage/supply voltage	3.0 V ~ 3.6 V
	Operating current	Average: 80 mA
	Supply current	最小：500 mA

2. Pin definition

	Recommended operating temperature range	–40 °C ~ +85 °C
	Package size	(18.00±0.10) mm × (25.50±0.10) mm × (3.10±0.10) mm
	Moisture sensitivity level (MSL)	Level 3

2. Pin definition

name	numbering	type	function
GND	1	P	earthing
3V3	2	P	Power supply
IN	3	I	Enable the module, active high.
SENSOR_VP	4	I	GPIO36, ADC1_CH0, RTC_GPIO0
SENSOR_VN	5	I	GPIO39, ADC1_CH3, RTC_GPIO3
IO34	6	I	GPIO34, ADC1_CH6, RTC_GPIO4

2. Pin definition

IO35	7	I	GPIO35, ADC1_CH7, RTC_GPIO5
IO32	8	I/O	GPIO32, XTAL_32K_P (32.768 kHz 晶振输入), ADC1_CH4, TOUCH9, RTC_GPIO9

2.1 Pin layout

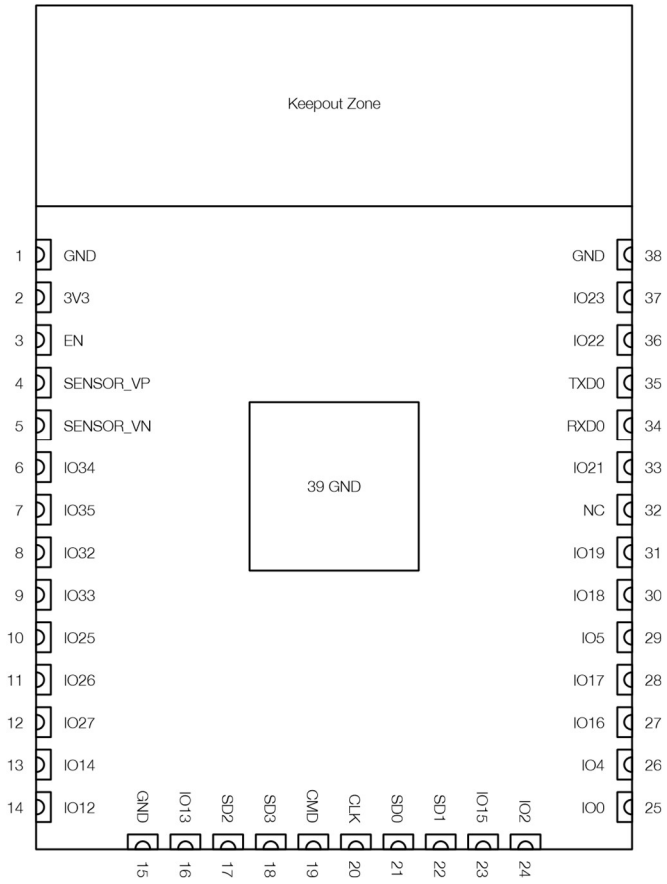

Figure 1: ESP32-WROOM-32 **Pin Layout (Top View).**

2.2 Pin definition

ESP32-WROOM-32 has a total of 38 pins, which are described in Table 2.

Table 2: **Pin definitions**

2. Pin definition

name	numbering	type	function
IO33	9	I/O	GPIO33, XTAL_32K_N (32.768 kHz 晶振输出), ADC1_CH5, TOUCH8, RTC_GPIO8
IO25	10	I/O	GPIO25, DAC_1, ADC2_CH8, RTC_GPIO6, EMAC_RXD0
IO26	11	I/O	GPIO26, DAC_2, ADC2_CH9, RTC_GPIO7, EMAC_RXD1
IO27	12	I/O	GPIO27, ADC2_CH7, TOUCH7, RTC_GPIO17, EMAC_RX_DV
IO14	13	I/O	GPIO14, ADC2_CH6, TOUCH6, RTC_GPIO16, MTMS, HSPICLK, HS2_CLK, SD_CLK, EMAC_TXD2
IO12	14	I/O	GPIO12, ADC2_CH5, TOUCH5, RTC_GPIO15, MTDI, HSPIQ, HS2_DATA2, SD_DATA2, EMAC_TXD3
GND	15	P	earthing
IO13	16	I/O	GPIO13, ADC2_CH4, TOUCH4, RTC_GPIO14, MTCK, HSPID, HS2_DATA3, SD_DATA3, EMAC_RX_ER
SHD/SD2*	17	I/O	GPIO9, SD_DATA2, SPIHD, HS1_DATA2, U1RXD
SWP/SD3*	18	I/O	GPIO10, SD_DATA3, SPIWP, HS1_DATA3, U1TXD
SCS/CMD*	19	I/O	GPIO11, SD_CMD, SPICS0, HS1_CMD, U1RTS
SCK/CLK*	20	I/O	GPIO6, SD_CLK, SPICLK, HS1_CLK, U1CTS
SDO/SD0*	21	I/O	GPIO7, SD_DATA0, SPIQ, HS1_DATA0, U2RTS
SDI/SD1*	22	I/O	GPIO8, SD_DATA1, SPID, HS1_DATA1, U2CTS
IO15	23	I/O	GPIO15, ADC2_CH3, TOUCH3, MTDO, HSPICS0, RTC_GPIO13, HS2_CMD, SD_CMD, EMAC_RXD3
IO2	24	I/O	GPIO2, ADC2_CH2, TOUCH2, RTC_GPIO12, HSPIWP, HS2_DATA0, SD_DATA0
IO0	25	I/O	GPIO0, ADC2_CH1, TOUCH1, RTC_GPIO11, CLK_OUT1, EMAC_TX_CLK
IO4	26	I/O	GPIO4, ADC2_CH0, TOUCH0, RTC_GPIO10, HSPIHD, HS2_DATA1, SD_DATA1, EMAC_TX_ER
IO16	27	I/O	GPIO16, HS1_DATA4, U2RXD, EMAC_CLK_OUT
IO17	28	I/O	GPIO17, HS1_DATA5, U2TXD, EMAC_CLK_OUT_180
IO5	29	I/O	GPIO5, VSPICS0, HS1_DATA6, EMAC_RX_CLK
IO18	30	I/O	GPIO18, VSPICLK, HS1_DATA7
IO19	31	I/O	GPIO19, VSPIQ, U0CTS, EMAC_TXD0
NC	32	-	-
IO21	33	I/O	GPIO21, VSPIHD, EMAC_TX_EN

RXD0	34	I/O	GPIO3, U0RXD, CLK_OUT2
TXD0	35	I/O	GPIO1, U0TXD, CLK_OUT3, EMAC_RXD2
IO22	36	I/O	GPIO22, VSPIWP, U0RTS, EMAC_TXD1
IO23	37	I/O	GPIO23, VSPID, HS1_STROBE
GND	38	P	earthing

Note:

* 管脚 SCK/CLK,SDO/SD0,SDI/SD1,SHD/SD2,SWP/SD3,和 SCS/CMD,即 GPIO6 至 GPIO11 用于连接模组上集成的 SPI flash,不建议用于其他功能。

2.3 Strapping 管脚

The ESP32 has a total of 5 strapping pins, which can be found in Chapter 6 Schematic

- MTDI
- GPIO0
- GPIO2
- MTDO
- GPIO5

软件可以读取寄存器“GPIO_STRAPPING”中这 5 个管脚 strapping 的值。

During the release of the chip's system reset (power-on reset, RTC watchdog reset, undervoltage reset), the strapping pin samples the level and stores it in the latch as "0" or "1" and holds it until the chip is powered down or turned off.

Each strapping pin is connected to an internal pull-up/pull-down. If a strapping pin has no external connections or the connected external line is in a high impedance state, the weak internal pull-up/pull-down will determine the default value of the input level of the strapping pin.

To change the value of strapping, the user can apply an external pull-down/pull-up resistor, or apply the host MCU's GPIO to control the ESP32 when the power-on reset is released Strapping pin level.

After the reset is released, the Strapping pin functions the same as the normal pin.

配置 Strapping 管脚的详细启动模式请参阅表 3 。

表 3: Strapping 管脚

内置 LDO (VDD_SDIO) 电压			
Pins	default	3.3 V	1.8 V

MTDI	Drop down	0	1
System boot mode			
Pins	default	SPI boot mode	Download boot mode
GPIO0	Pull up	1	0
GPIO2	Drop down	Unrelated items	0
During system startup, control U0TXD printing			
Pins	default	U0TXD 正常打印	U0TXD 上电不打印
MTDO	Pull up	1	0

SDIO slave signal input and output timing					
Pins	default	Falling edge samples falling edge output	Falling edge sampling rising edge output	Rising edge samples falling edge output	Rising edge samples rising edge output
MTDO	Pull up	0	0	1	1
GPIO5	Pull up	0	1	0	1

Illustrate:

- The firmware can change the settings of "Built-in LDO (VDD_SDIO) Voltage" and "SDIO Slave Signal Input and Output Timing" after boot by configuring some register bits.
- Because the module has a built-in 3.3 V SPI flash, the MTDI cannot be set to 1 when powering on.

3. Description of the function

3. Function DescriptionThis

chapter describes the individual

modules and functions of ESP32-WROOM-32.

3.1 CPU 和片上存储

ESP32-D0WDQ6 内置两个低功耗 Xtensa® 32-bit LX6 MCU。 片上存储包括：

- 448 KB of ROM for program startup and kernel function calls
- 520 KB on-chip SRAM for data and instruction storage
- RTC Fast Memory, which is 8 KB of SRAM, can be used for data storage and access by the main CPU when the RTC is booted in Deep-sleep mode
- RTC slow memory, 8 KB of SRAM, can be accessed by a coprocessor in deep-sleep mode
- 1 Kbit of eFuse, of which 256 bits are system-specific (MAC address and chip settings); The remaining 768 bits are reserved for user programs, which include flash encryption and chip IDs

3.2 外部 Flash 和 SRAM

The ESP32 supports multiple external QSPI flash and static random access memory (SRAM). For more information, please refer to the SPI chapter of the ESP32 Technical Reference Manual. ESP32 also supports AES-based hardware encryption and decryption to protect developers from their flash programs.

The ESP32 provides caching access to external QSPI flash and SRAM:

- External flash can be mapped to both CPU instructions and read-only data space.
  - When mapped to the CPU instruction space, you can map up to 11 MB + 248 KB at a time. If a mapping exceeds 3 MB + 248 KB at a time, cache performance may be degraded due to speculative reads by the CPU.
  - When mapped to a read-only data space, you can map up to 4 MB at a time. Supports 8-bit, 16-bit, and 32-bit reads.
- External SRAM can be mapped to the CPU data space. You can map up to 4 MB at a time. Supports 8-bit, 16-bit, and 32-bit access.

ESP32-WROOM-32 集成了 4 MB 的 SPI flash,连接 ESP32 的管脚 GPIO6,GPIO7,GPIO8,GPIO9,GPIO10 和 GPIO11。 这六个管脚不建议用于其他功能。

3.3 Crystal oscillator

The module uses a 40

MHz crystal oscillator.

3.4 RTC and low-power management

The ESP32 uses advanced power management technology to switch between different power consumption modes.

For details on the current consumption of the ESP32 in different power modes, please refer to the ESP32 Datasheet section "RTC and Low Power Management".

4. Peripheral interfaces and sensors

For details, please refer to the Peripheral Interfaces and Sensors section of the ESP32 Technical Datasheet.

Illustrate:

GPIO6-11 has been used to connect to the SPI flash integrated on the module, and other peripherals can use any GPIO other than GPIO6-11, as detailed in the schematic in Chapter 6.

5. Electrical characteristics

5.1 Absolute maximum rating

Exceeding the absolute maximum rating table may result in permanent damage to the device. These are only highlighted ratings and do not address the functional operation of the device beyond these or other specifications. Please refer to Table 5 for the recommended working conditions.

Table 4: Absolute **Maximum Ratings**

symbol	parameter	minimum	maximum	unit
VDD33	Supply voltage	–0.3	3.6	V
Ioutput1	The total IO output current	-	1,100	but
Tstore	Storage temperature	–40	150	°C

1. 模组的 IO 输出总电流的测试条件为 25 °C 环境温度，VDD3P3_RTC, VDD3P3_CPU, VDD_SDIO 三个电源域的管脚输出高电平且直接接地。 此时模组在保持工作状态 24 小时后，仍能正常工作。 其中 VDD_SDIO 电源域的管脚不包括连接 flash 和/或 PSRAM 的管脚。
2. 关于电源域请参考《ESP32 技术规格书》附录中表 IO_MUX。

5.2 Recommended working conditions

Table 5: Recommended **working conditions**

symbol	parameter	minimum	Typical	maximum	unit
VDD33	Supply voltage	3.0	3.3	3.6	V
IV DD	Supply current from an external power supply	0.5	-	-	A
T	Operating temperature	–40	-	85	°C

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

table 6: **DC electrical characteristics** (3.3 V, 25 °C)

symbol	parameter	minimum	Typical	maximum	unit
CIN	Pin capacitors	-	2	-	pF
HIV	High input voltage	0.75×VDD1	-	VDD1+0.3	V
VILE	Low level input voltage	–0.3	-	0.25×VDD1	V
IIH	High input current	-	-	50	on

IIL	Low input current		-	-	50	on
VOH	High output voltage		0.8×VDD1	-	-	V
THEFT	Low level output voltage		-	-	0.1×VDD1	V
IOH	High level pull current (VDD1 = 3.3 V, VOH >= 2.64 V, The pin output intensity is set to the maximum).	VDD3P3_CPU Power domain1,2	-	40	-	but
		VDD3P3_RTC Power domain1,2	-	40	-	but
		VDD_SDIO Power domain1,3	-	20	-	but
IOL	Low level-sink current (VDD1 = 3.3 V, VOL = 0.495 V, The pin output intensity is set to the maximum)		-	28	-	but

symbol	parameter	minimum	Typical	maximum	unit
RPU	Pull-up resistor	-	45	-	kΩ
RPD	Pull-down resistors	-	45	-	kΩ
VIL_*nRST*	CHIP_PU Turn off the chip's low-level input voltage	-	-	0.6	V

Illustrate:

1. VDD be I/O power supply。 For more information about power domains, refer to 《ESP32 Technical Specifications》 Table in the Appendix IO_MUX。
2. VDD3P3_CPU 和 VDD3P3_RTC The source current of a single pin of a power domain pin decreases as the number of pins increases，From the approx 40 mA Reduce to approx 29 mA。
3. VDD_SDIO The pins of the power domain do not include connections flash 和/或 PSRAM pins。

5.4 Wi-Fi radio frequency

表 7: Wi-Fi **RF characteristics**

parameter	condition	minimum	Typical	maximum	unit
Operating frequency range 1	-	2412	-	2484	MHz
Output impedance 2	-	-	See Note 2	-	Oh
Output power 3	11n, MCS7	12	13	14	dBm
	11b mode	17.5	18.5	20	dBm

sensitivity	11b, 1 Mbps	-	–98	-	dBm
	11b, 11 Mbps	-	–89	-	dBm
	11g, 6 Mbps	-	–92	-	dBm
	11g, 54 Mbps	-	–74	-	dBm
	11n, HT20, MCS0	-	–91	-	dBm
	11n, HT20, MCS7	-	–71	-	dBm
	11n, HT40, MCS0	-	–89	-	dBm
	11n, HT40, MCS7	-	–69	-	dBm
Adjacent tract inhibition	11g, 6 Mbps	-	31	-	dB
	11g, 54 Mbps	-	14	-	dB
	11n, HT20, MCS0	-	31	-	dB
	11n, HT20, MCS7	-	13	-	dB

1. The operating frequency range should conform to the national or regional normative standards. The software can be configured to operate over a frequency range.
2. Modules using IPEX antennas have an output impedance of 50 Ω, and modules without IPEX antennas do not need to pay attention to the output impedance.
3. Depending on the requirements of the product or certification, the user can configure the target power.

5.5 Bluetooth Low Energy RF

5.5.1 receiver

Table 8: **Bluetooth Low Energy receiver characteristics**

parameter	condition	minimum	Typical	maximum	unit
Common channel rejection ratio @30.8% PER	-	-	–97	-	dBm
Maximum received signal @30.8% PER	-	0	-	-	dBm
Common channel rejection ratio C/I	-	-	+10	-	dB
Adjacent tract inhibition ratio C/I	F = F0 + 1 MHz	-	–5	-	dB
	F = F0 –1 MHz	-	–5	-	dB
	F = F0 + 2 MHz	-	–25	-	dB
	F = F0 –2 MHz	-	–35	-	dB
	F = F0 + 3 MHz	-	–25	-	dB
	F = F0 –3 MHz	-	–45	-	dB

Out-of-band blockage	30 MHz ~ 2000 MHz	–10	-	-	dBm
	2000 MHz ~ 2400 MHz	–27	-	-	dBm
	2500 MHz ~ 3000 MHz	–27	-	-	dBm
	3000 MHz ~ 12.5 GHz	–10	-	-	dBm
Intermodulation	-	–36	-	-	dBm

5.5.2 Transmitters

Table 9: **Bluetooth Low Energy transmitter characteristics**

parameter	condition	minimum	Typical	maximum	unit
RF transmit power	-	-	0	-	dBm
Gain controls the step size	-	-	3	-	dBm
RF power control range	-	–12	-	+9	dBm
Adjacent transmit power	F = F0 ± 2 MHz	-	–52	-	dBm
	F = F0 ± 3 MHz	-	–58	-	dBm
	F = F0 ± > 3 MHz	-	–60	-	dBm
Δf1avg	-	-	-	265	kHz
Δf2max	-	247	-	-	kHz
Δf2avg/Δf1avg	-	-	–0.92	-	-
ICFT	-	-	–10	-	kHz
Drift rate	-	-	0.7	-	kHz/50 μs
offset	-	-	2	-	kHz

5.6 Reflow soldering temperature profile

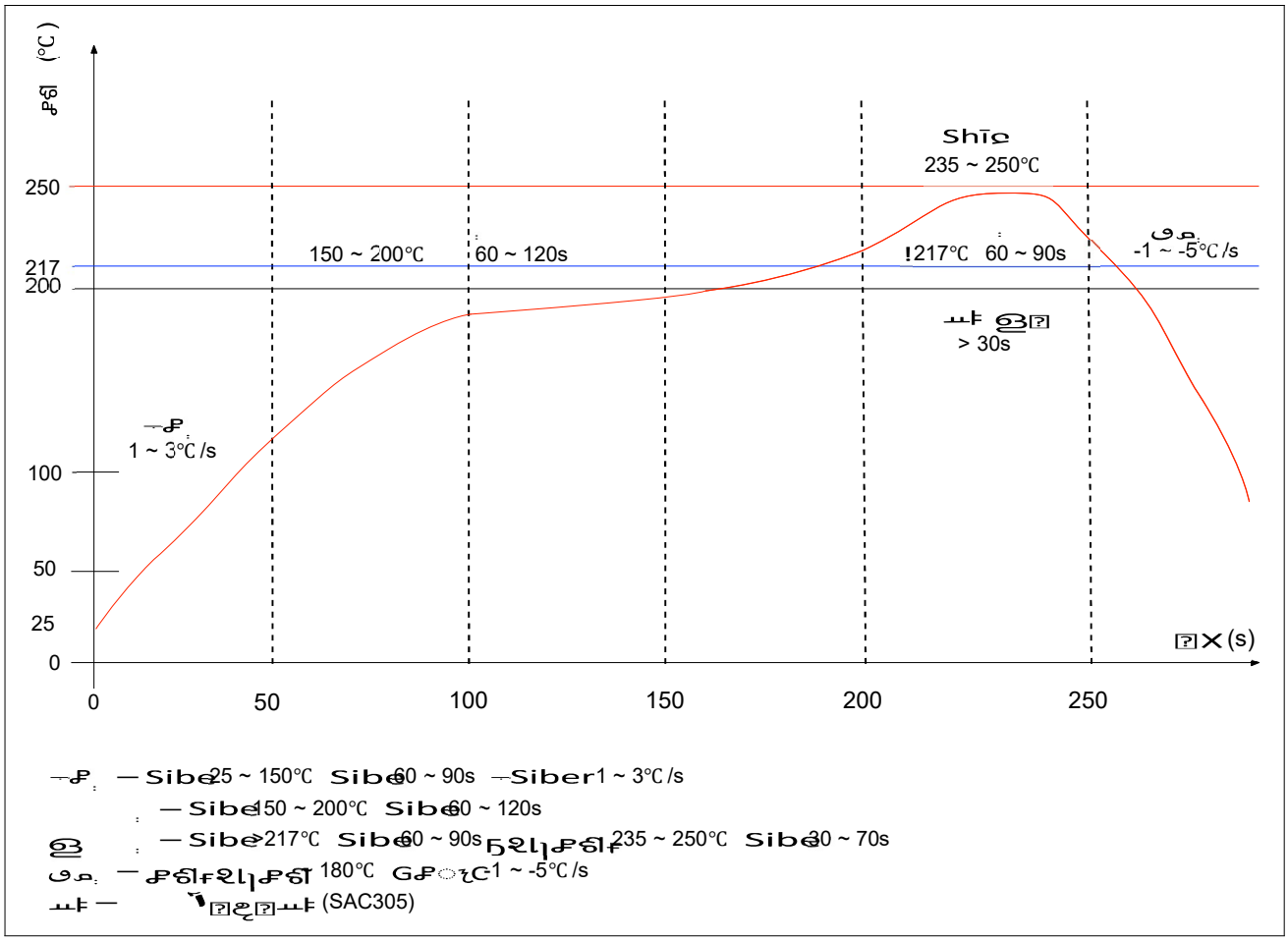

Figure 2: **Reflow soldering temperature profile**

6. Schematic diagram of the circuit

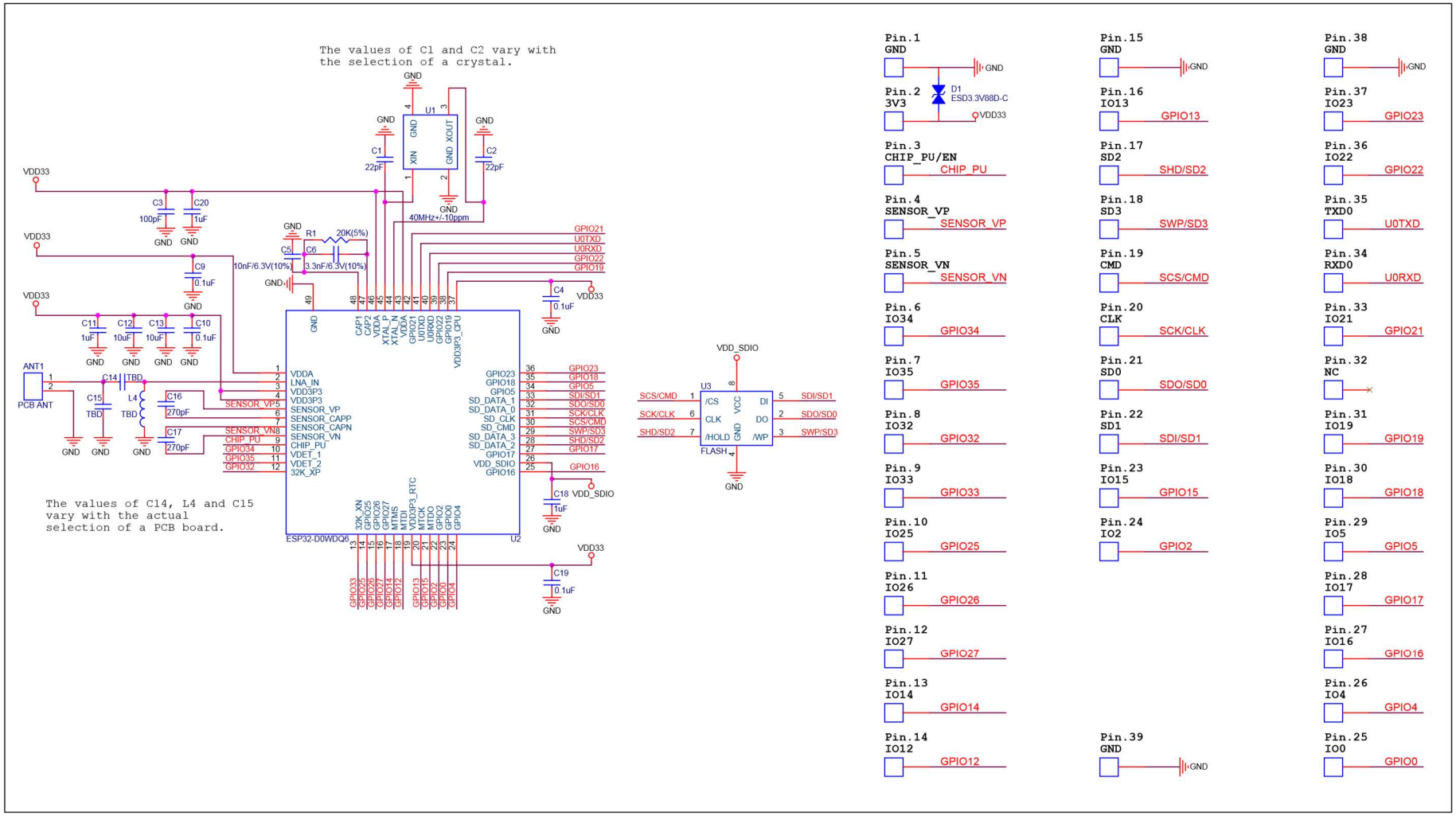

Figure 3: Schematic diagram of the ESP32-WROOM-32 **circuit**

7. Peripheral schematic

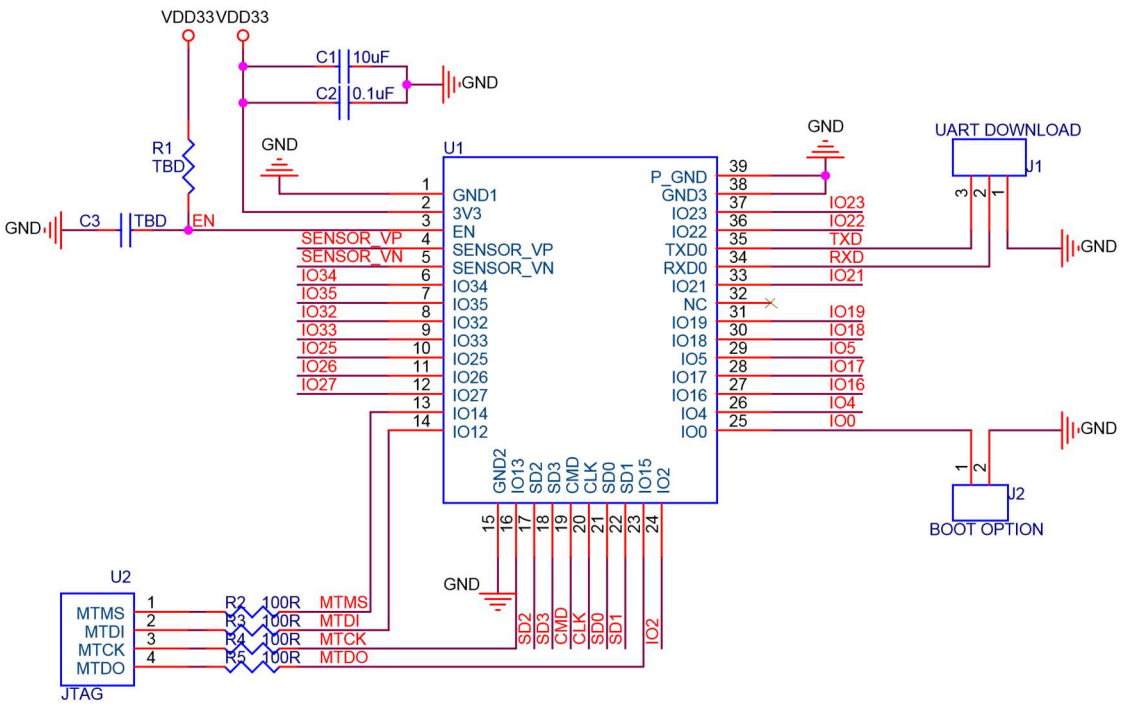

图 4: ESP32-WROOM-32 **Peripheral schematic**

Illustrate:

- MTDI It should be kept low。
- ESP32-WROOM-32 Pin 39, can be soldered to the base plate. If the user solders the pin to the base plate, make sure to use the appropriate amount of solder paste.
- To ensure proper power supply when the chip is powered up, an RC delay circuit needs to be added at the EN pins. RC is generally recommended to be R = 10 kΩ and C = 0.1 μF, but the exact value needs to be adjusted according to the power-on timing of the module power supply and the power-on reset timing of the chip. The power-on reset timing diagram of the chip can be found in the Power Management section of the ESP32 Data Sheet.

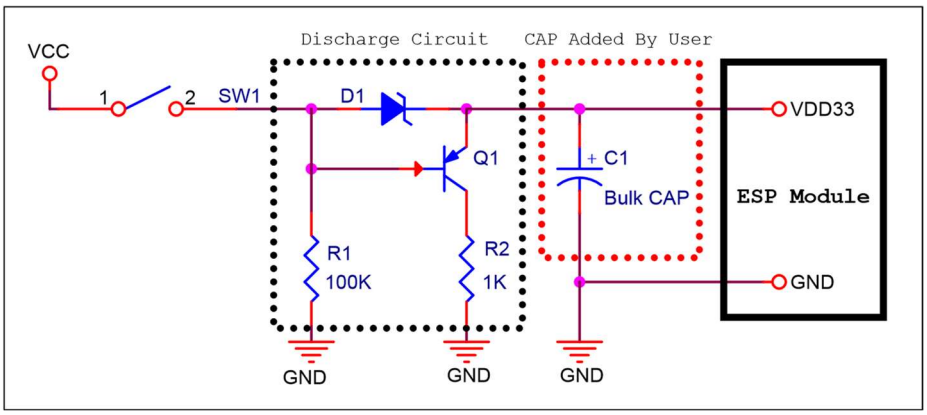

Figure 5: VDD33 **discharge circuit diagram**

7. Peripheral schematics

Illustrate:

Discharge circuits are used in scenarios where the VDD33 needs to be switched on and off quickly and repeatedly, and there is a large capacitance on the VDD33's peripheral circuitry. For details, please refer to the Power Management section of the ESP32 Technical Datasheet.

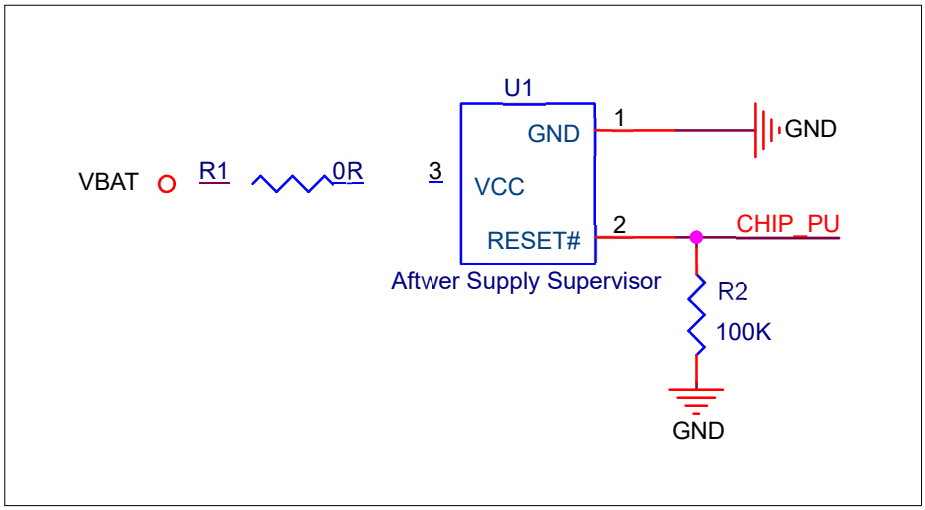

Figure 6: **Reset circuit**

Illustrate:

When using the battery gives ESP32 When the series chips and modules are supplied with power, in order to avoid the battery voltage being too low, the chip cannot be started normally due to abnormal state,

External is generally recommended Power Supply Supervisor。 It is recommended that the supply be detected ESP32 The voltage is lower than 2.3V time ESP32 的 CHIP_PU Foot pull low。

8. Module size

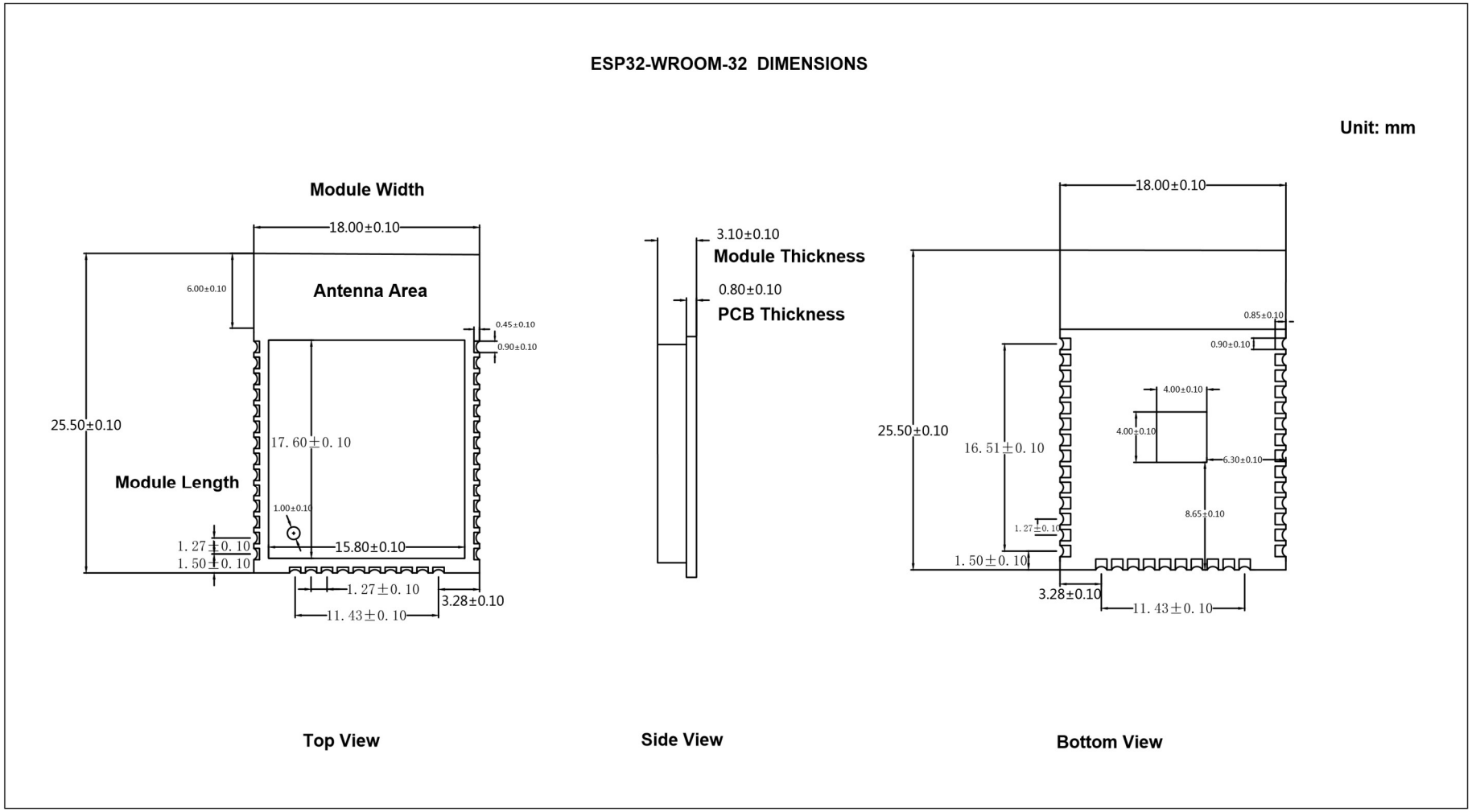

图 7: ESP32-WROOM-32 **尺寸**

9. PCB footprint graphics

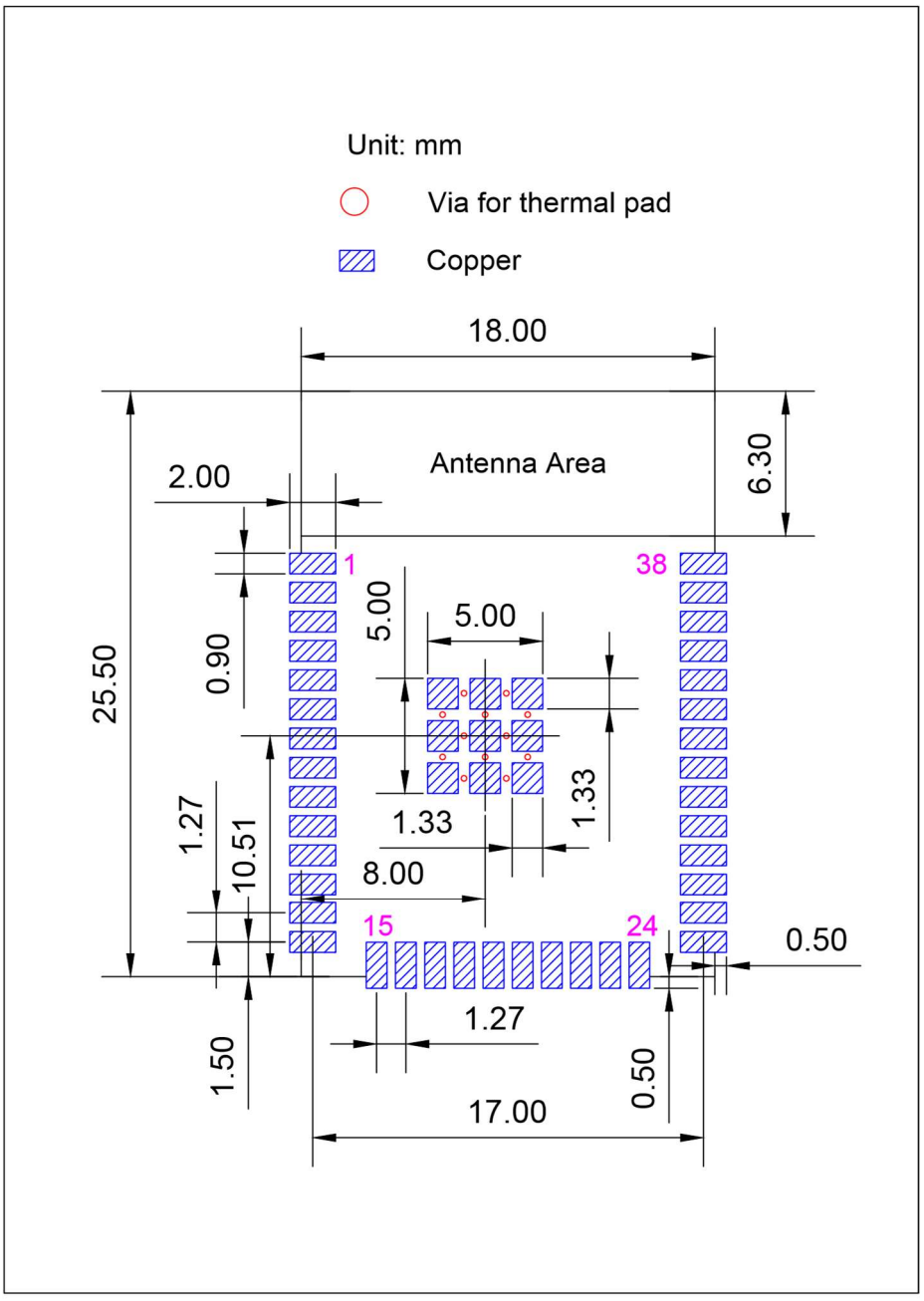

图 8: PCB 封装图形

10. Learning resources

10.1 Must Read:

Visit the following link to download documentation on ESP32 .

- ESP32 Technical Specification

  This document provides users with an overview of the ESP32 hardware specifications, including an overview, pin definitions, function descriptions, peripheral interfaces, electrical characteristics, and more.

- 《ESP-IDF 编程指南》

  A summary of ESP32 related development documents, including hardware manuals, software API introductions, etc.

- ESP32 Technical Reference Manual

  The manual provides specific information about the ESP32, including the internal architecture, function description, and register configuration of each function module.

- ESP32 hardware resources

  The package provides hardware schematics, PCB layouts, manufacturing specifications, and bills of materials for ESP32 modules and boards.

- ESP32 Hardware Design Guide

  The brochure provides hardware information for the ESP32 series, including ESP32 chips, ESP32 modules, and development boards.

- ESP32 AT Instruction Set and Usage ExamplesThis document describes the functions and usage methods of the ESP32 AT instruction set, and introduces several common AT instruction usage examples. Among them, AT instructions include basic AT instructions, Wi-Fi function AT instructions, and TCP/IP-related ATs directives, etc.; Examples include single-connection TCP clients, UDP transmissions, transparent transmissions, multi-connection TCP servers, and more.

- Espressif System Product Ordering Information

10.2 A must-have resource

Here are some of the must-have resources for ESP32.

- ESP32 Online Community

  An engineer-to-engineer (E2E) community where users can ask questions, share knowledge, explore ideas, and solve problems with other engineers.

- ESP32 GitHub

  Espressif has a number of open source development projects on GitHub.

- ESP32 tools

  ESP32 flash download tool and ESP32 Certification Test Guide.

- ESP-IDF

  ESP32 所有版本 IDF。

- ESP32 Resource Collection

  All documentation and tool resources related to ESP32.

Revision History

Revision History

date	version	Release notes
2019.09	V2.9	• Change the supply voltage range from 2.7 V ~ 3.6 V to 3.0 V ~ 3.6 V; • Add Moisture Sensitivity Level (MSL) 3 *to the ESP32-WROOM-32* product specification in Table 1; • Add descriptions of Operating Frequency Range and Output Power under Table 7 *Wi-Fi* Radio Characteristics; • Updated the peripheral schematic in Chapter 7 and added a description of the RC delay circuit; • Update Figure 8 *PCB* footprint drawing.
2019.01	V2.8	Change the "RF Power Control Range" in Table 9 from –12 ~ +12 to –12 ~ +9 dBm.
2018.10	V2.7	Add "Total IO Output Current" to Table 4 "Absolute Maximum Ratings"; Add the average source current for each power domain in Table 6, "DC DC Electrical Characteristics".

2018.08	V2.6	• In Table 1 "ESP32-WROOM-32 Product Specifications", the reliability test items are added and the software-related content is deleted. • Updated Section 3.4 RTC and Low Power Management; • The size of the module is changed from (18±0.2) mm x (25.5 ±0.2) mm x (3.1±0.15) mm Instead (18.00±0.10) mm x (25.50±0.10) mm x (3.10±0.10) mm; • Updated module size drawing; • Update Table 7: Wi-Fi Shooting Characteristics.
2018.06	V2.5	• 将模组名称改为 ESP32-WROOM-32; • Delete the temperature sensor in Table 1 ESP32-WROOM-32 Product Specification; • Updated Section 3 Feature Description; • Added Chapter 8 PCB Footprint Graphics; Updates related to electrical characteristics: • Update Table 4 Absolute Maximum Ratings; • Add Table 5 Recommended Working Conditions; • Add Table 6 DC electrical characteristics; • Updated the "Gain Control Step" and "Adjacent Transmit Power" parameters in Table 9 Bluetooth Low Energy transmitter characteristics.
2018.03	V2.4	Update Table 1 in Chapter 1.
2018.01	V2.3	Removed content related to ultra-low noise pre-analog amplifiers; Updated Section 3.4 RTC and Low Power Management; Added a reset circuit diagram in Chapter 7.
2017.10	V2.2	Updated section 2.3 Strapping pins for the description of system-on-chip resets; Delete "Associative Sleep Mode" in the table "Power Consumption in Different Power Consumption Modes". Added about Active sleep and Description of Modem-sleep ; Modify the description of the exterior design schematic in Section 7; Add VDD33 discharge circuit diagram.
2017.09	V2.1	Update the operating voltage/supply voltage range is 2.7 ~ 3.6V; Updated Chapter 7.

2017.08	V2.0	Change the BLE receive sensitivity of the NZIF receiver in Table 1 to -97 dBm; Update the module size; Updated the table "Power Consumption in Different Power Consumption Modes" and added two descriptions; Updating Tables 4, 7, 8, 9; Added Chapter 8 module size; Added a link to download the product certificate.
		Add a note to Section 2.1 Pin Layout; Updated Chapter 3.3 Crystal Oscillator;

2017.06 V1.9 Revision History

date	version	Release notes
		Updated the schematic diagram of the circuit in Figure 3 ; Added document change notifications.
2017.05	V1.8	更新图 1 ESP-WROOM-32 俯视图和侧视图。
2017.04	V1.7	Increase the error value of module size; 将表 7 Wi-Fi 射频输入阻抗值 50 Ω 改为输出阻抗值 30+j10 Ω。
2017.04	V1.6	Add the reflow temperature profile in Figure 2.
2017.03	V1.5	Updated Section 2.2 Pin Description; Updated Section 3.2 External Flash and SRAM; Updated Chapter 4 Peripheral Interface and Sensor Descriptions.
2017.03	V1.4	Updated Chapter 1 Preface; Updated Chapter 2 pin definitions; Updated Section 3 Feature Description; update the table to recommend working conditions; Update Table 7 Wi-Fi Radio Frequency;

		Updated Section 5.6 Reflow Soldering Temperature Profile; Added Chapter 10 learning resources.
2016.12	V1.3	Updated Chapter 2.1 pin layout.
2016.11	V1.2	Figure 7 Peripheral Schematic has been added.
2016.11	V1.1	Updated the schematic diagram for Figure 6.
2016.08	V1.0	First release.