1. Feature

WIFI	802.11 b/g/n/e/i
	• 802.11 n (2.4 GHz) with speeds up to 150 Mbps
	• 802.11 e: QoS mechanism for wireless multimedia technology
	• WMM-PS, UAPSD
	• A-MPDU and A-MSDU frame aggregation technology
	• Block reply
	• Fragmentation and reorganization
	• Beacon automatic monitoring / scanning
	• 802.11 i security features: pre-authentication and TSN
	• Support WPA/WPA2/WPA2-Enterprise/WPS encryption
	• Infrastructure BSS Station Mode / SoftAP Mode
	• Wi-Fi Direct (P2P), P2P discovery, P2P GO mode and P2P power management
	• UMA compatibility and certification
	• Antenna diversity and selection
bluetooth	• Bluetooth v4.2 complete standard, including traditional Bluetooth (BR / EDR) and Bluetooth Low Energy (BLE)
	• Supports standard Class-1, Class-2 and Class-3 without external power amplifier
	• Enhanced precision power control
	• Output power up to +10dBm
	• NZIF receiver has BLE receiving sensitivity of -98dBm
	• Adaptive Frequency Hopping (AFH)
	• Standard HCI based on SDIO/SPI/UART interface
	• High speed UARTHCI up to 4Mbps
	• Support BT4.2controller and host protocol stack
	• Service Discovery Protocol (SDP)
	• Universal Access Application (GAP)
	• Security Management Protocol (SMP)
	• Low power Bluetooth
	• ATT/GATT
	• HID
	• Supports all GATT-based Bluetooth low energy applications
	• SPP-Like low power Bluetooth data transparent transmission protocol
	• BLEBeacon

	• A2DP/AVRCP/SPP, HSP/HFP, RFCOMM
	• CVSD and SBC audio codec algorithms
	• Bluetooth piconet (Piconet) and Scatternet (Scatternet)
CPU and storage	• Xtensa® 32-bit LX6 dual-core processor with up to 600 DMIPS
	• 448 KByte ROM
	• 520 KByte SRAM
	• 16 KByte SRAM in RTC
	• QSPI can connect up to 4 Flash/SRAMs, each with a FlashMax of 16 MBytes
	• Power supply voltage: 2.2V to 3.6V
Clock and timer	• Built-in 8 MHz oscillator with self-calibration
	• Built-in RC oscillator for self-calibration
	• Support external 2 MHz to 40 MHz crystal oscillator
	• Support for external 32 kHz crystal for RTC, self-calibration
	• 2 timer groups, each consisting of 2 64-bit general-purpose timers and 1 main system watchdog
	• RTC timer with sub-second precision
	• RTC Watchdog
Peripheral interface	• 12-bit SAR ADC with up to 18 channels
	• 2 8-bit D/A converters
	• 10 touch sensors
	• Temperature Sensor
	• 4 SPI
	• 2 I2S
	• 2 I2C
	• 3 UARTs
	• 1 Host SD/eMMC/SDIO
	• 1 Slave SDIO/SPI
	• Ethernet MAC interface with dedicated DMA, supports IEEE 1588
	• CAN 2.0
	• IR (TX/RX)
	• Motor PWM
	• LED PWM, up to 16 channels
	• Hall sensor
	• Ultra low power pre-amplifier
Security Mechanism	• Supports all IEEE 802.11 security features including WFA, WPA/WPA2 and WAPI

	• Safe start
	• Flash encryption
	• 1024-bit OTP, up to 768 bits available to users
	• Encryption Hardware Accelerator:
	- AES
	- HASH (SHA-2) library
	- RSA
	- ECC
	- Random Number Generator (RNG)
Application	• Universal low power IoT sensor Hub
	• Universal low power IoT recorder
	• Camera video streaming
	• OTT TV box / set top box equipment
	•music player
	- network music player
	- audio streaming device
	• Wi-Fi toys
	- counter
	- toy anti-lost device
	• Wi-Fi voice recognition device
	• Headset
	• Smart socket
	• Home automation
	• Mesh network
	• Industrial wireless control
	• Baby monitor
	• Wearable electronics
	• Wi-Fi location-aware device
	• Security ID tag
	• Health care
	- motion monitoring and anti-lost alarm
	- Logger

2. ESP32-WROOM-32 pin function definition

Name	Number	Function
GND	1	GND
3V3	2	Power
EN	3	Enable the chip, active high.
SENSOR_VP	4	GPI36, SENSOR_VP, ADC_H, ADC1_CH0, RTC_GPIO0
SENSOR_VN	5	GPI39, SENSOR_VN, ADC1_CH3, ADC_H, RTC_GPIO3

IO34	6	GPI34, ADC1_CH6, RTC_GPIO4
IO35	7	GPI35, ADC1_CH7, RTC_GPIO5
IO32	8	GPIO32, XTAL_32K_P (32.768 kHz crystal oscillator input), ADC1_CH4, TOUCH9, RTC_GPIO9
IO33	9	GPIO33, XTAL_32K_N (32.768 kHz crystal oscillator output), ADC1_CH5, TOUCH8, RTC_GPIO8
IO25	10	GPIO25, DAC_1, ADC2_CH8, RTC_GPIO6, EMAC_RXD0
IO26	11	GPIO26, DAC_2, ADC2_CH9, RTC_GPIO7, EMAC_RXD1
IO27	12	GPIO27, ADC2_CH7, TOUCH7, RTC_GPIO17, EMAC_RX_DV
IO14	13	GPIO14, ADC2_CH6, TOUCH6, RTC_GPIO16, MTMS, HSPICLK, HS2_CLK, SD_CLK, EMAC_TXD2
IO12	14	GPIO12, ADC2_CH5, TOUCH5, RTC_GPIO15, MTDI, HSPIQ, HS2_DATA2, SD_DATA2, EMAC_TXD3
GND	15	GND
IO13	16	GPIO13, ADC2_CH4, TOUCH4, RTC_GPIO14, MTCK, HSPID, HS2_DATA3, SD_DATA3, EMAC_RX_ER
SHD/SD2	17	GPIO9, SD_DATA2, SPIHD, HS1_DATA2, U1RXD
SWP/SD3	18	GPIO10, SD_DATA3, SPIWP, HS1_DATA3, U1TXD
SCS/CMD	19	GPIO11, SD_CMD, SPICS0, HS1_CMD, U1RTS
SCK/CLK	20	GPIO6, SD_CLK, SPICLK, HS1_CLK, U1CTS
SDO/SD0	21	GPIO7, SD_DATA0, SPIQ, HS1_DATA0, U2RTS
SDI/SD1	22	GPIO8, SD_DATA1, SPID, HS1_DATA1, U2CTS
IO15	23	GPIO15, ADC2_CH3, TOUCH3, MTDO, HSPICS0, RTC_GPIO13, HS2_CMD, SD_CMD, EMAC_RXD3
IO2	24	GPIO2, ADC2_CH2, TOUCH2, RTC_GPIO12, HSPIWP, HS2_DATA0, SD_DATA0
IO0	25	GPIO0, ADC2_CH1, TOUCH1, RTC_GPIO11, CLK_OUT1, EMAC_TX_CLK
IO4	26	GPIO4, ADC2_CH0, TOUCH0, RTC_GPIO10, HSPIHD, HS2_DATA1, SD_DATA1, EMAC_TX_ER
IO16	27	GPIO16, HS1_DATA4, U2RXD, EMAC_CLK_OUT
IO17	28	GPIO17, HS1_DATA5, U2TXD, EMAC_CLK_OUT_180
IO5	29	GPIO5, VSPICS0, HS1_DATA6, EMAC_RX_CLK
IO18	30	GPIO18, VSPICLK, HS1_DATA7
IO19	31	GPIO19, VSPIQ, U0CTS, EMAC_TXD0
NC	32	-
IO21	33	GPIO21, VSPIHD, EMAC_TX_EN
RXD0	34	GPIO3, U0RXD, CLK_OUT2
TXD0	35	GPIO1, U0TXD, CLK_OUT3, EMAC_RXD2
IO22	36	GPIO22, VSPIWP, U0RTS, EMAC_TXD1
IO23	37	GPIO23, VSPID, HS1_STROBE
GND	38	GND

ESP32-WROOM-32

ESP32-WROOM-32

Note that the module must be fully powered,
preferably powered independently and must be grounded.

ESP32-WROOM-32 boot mode configuration

Pin	Default	SPI boot mode	Download boot mode
GPIO0	pull up	1	0
GPIO2	drop down	Irrelevant item	0

3. Shape and size

The ESP32-WROOM-32 module has an external dimensions of 18mm*25.50mm*(2.8 ± 0.1)mm (as shown). The module uses a 4MB capacity, packaged as WSOP-8 SPI Flash. The module uses a 3DBi PCB onboard antenna.

ESP32-WROOM-32 module size comparison table

Length	Width	High	PAD size (bottom 1⁄4‰)	Pin spacing	Shield cover height	PCB thickness
18 mm	25.5 mm	2.8 ± 0.1 mm	0.45 mm x 0.9 mm	1.27 mm	2 mm	0.8 ± 0.1 m
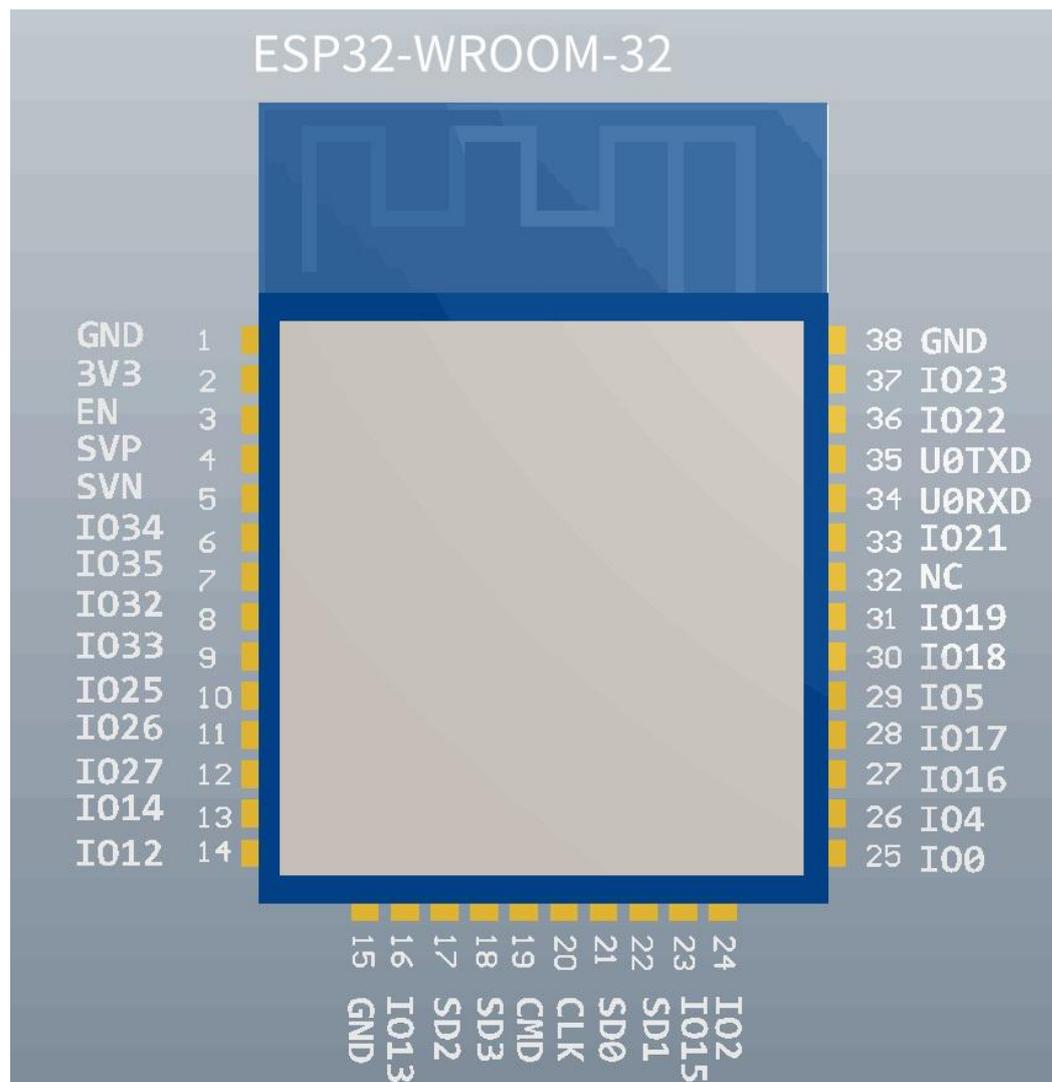
4. ESP32-wroom-32 function description

The ESP32-wroom-32 features a low-power Xtensa® LX6 32-bit dual-core processor with the following features:

4.1 CPU1 CPU

• 7-stage pipeline architecture supporting clock frequencies up to 240 MHz
• 16-bit/24-bit instruction set increases code density
• Support for floating point units (FPU)
• Support for DSP instructions such as 32-bit amplifiers, 32-bit dividers and 40-bit accumulator multipliers (MAC)
• Support for 32 interrupt vectors from approximately 70 interrupt sources

Dual-core processor interfaces include:
• Xtensa RAM/ROM instruction and data interface
• Xtensa local storage interface for quick access to external registers
• Interrupts with internal and external interrupt sources
• JTAG interface for debugging

4.2 on-chip storage on-chip storage

ESP32-wroom-32 on-chip storage includes:
• 448 KBytes ROM for program startup and kernel function calls
• 520 KBytes on-chip SRAM for data and instruction storage
• 8 KBytes of SRAM in RTC, RTC slow memory, which can be accessed by the coprocessor in Deep-sleep mode.
• 8 kBytes of SRAM in RTC, RTC fast memory, which can be used for data storage and access by the main CPU when RTC is started in Deep-sleep mode.
• 1 kbit EFUSE, of which 256 bits are system specific (MAC address and chip settings); the remaining 768 bits are reserved for user applications, including Flash encryption and chip ID

4.3 External Flash and SRAM

The ESP32-wroom-32 supports up to four 16 MBytes of external QSPI Flash and Static Random Access Memory (SRAM) with AES-based hardware encryption to protect developers' programs and data.
ESP32-wroom-32 accesses external QSPI Flash and SRAM via cache:
• Up to 16 MBytes of external Flash mapped to CPU code space, support for 8-bit, 16-bit and 32-bit access, and executable code.
• Up to 8 MBytes of external Flash and SRAM mapped to CPU data space, supporting 8-bit, 16-bit and 32-bit access. Flash only supports read operations, and SRAM supports read and write operations.

4.4 Max rating

Rating	Condition	Value	Unit
storage temperature		-40 to 125	℃
Max soldering temperature		260	℃
Supply voltage	IPC/JEDEC J-STD-020	+2.8to +3.6	V

4.5 Suggested working environment

Working environment	Name	Min.	Typical value	Max.	Unit
Operating temperature		-40	20	125	℃
Supply voltage	VDD	2.8	3.3	3.6	V

4.6 Digital Port Features

Working environment	Name	Min.	Typical value	Max.	Unit
Low input logic level	VIL	0		0.3VDD	V
Input logic level is high	VIH	0.7VDD		VDD	V
Low output logic level	VOL	N		0.1VDD	V
High output logic level	VOH	0.8VDD		N	V