ESP32-S3-WROOM-1
ESP32-S3-WROOM-1U

Datasheet

2.4 GHz Wi-Fi (802.11 b/g/n) and Bluetooth® 5 (LE) module
Built around ESP32-S3 series of SoCs, Xtensa® dual-core 32-bit LX7 microprocessor
Flash up to 16 MB, PSRAM up to 8 MB
36 GPIOs, rich set of peripherals
On-board PCB antenna

ESP32-S3-WROOM-1

ESP32-S3-WROOM-1U

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Espressif Systems
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1 Module Overview

Note:

Check the link or the QR code to make sure that you use the latest version of this document:
https://www.espressif.com/documentation/esp32-s3-wroom-1_wroom-1u_datasheet_en.pdf

1.1 Features

CPU and On-Chip Memory

- ESP32-S3 series of SoCs embedded, Xtensa® dual-core 32-bit LX7 microprocessor, up to 240 MHz
- 384 KB ROM
- 512 KB SRAM
- 16 KB SRAM in RTC
- Up to 8 MB PSRAM

Wi-Fi

- 802.11 b/g/n
- Bit rate: 802.11n up to 150 Mbps
- A-MPDU and A-MSDU aggregation
- 0.4 s guard interval support
- Center frequency range of operating channel: 2412 ~ 2484 MHz

Bluetooth

- Bluetooth LE: Bluetooth 5, Bluetooth mesh
- Speed: 125 Kbps, 500 Kbps, 1 Mbps, 2 Mbps
- Advertising extensions
- Multiple advertisement sets
- Channel selection algorithm #2
- Internal co-existence mechanism between Wi-Fi and Bluetooth to share the same antenna

Peripherals

- GPIO, SPI, LCD interface, Camera interface, UART, I2C, I2S, remote control, pulse counter, LED PWM, USB 1.1 OTG, USB Serial/JTAG controller, MCPWM, SDIO host, GDMA, TWAI® controller (compatible with ISO 11898-1), ADC, touch sensor, temperature sensor, timers and watchdogs

Note:

* Please refer to *CQN10+Q1 QcMcq B_r_qfccr* for detailed information about the module peripherals.

Integrated Components on Module

- 40 MHz crystal oscillator
- Up to 16 MB Quad SPI flash

Antenna Options

- On-board PCB antenna (ESP32-S3-WROOM-1)
- External antenna via a connector (ESP32-S3-WROOM-1U)

Operating Conditions

- Operating voltage/Power supply: 3.0 ~ 3.6 V
- Operating ambient temperature:
  - 65 °C version: –40 ~ 65 °C
  - 85 °C version: –40 ~ 85 °C
  - 105 °C version: –40 ~ 105 °C

Certification

- RF certification: See certificates
- Green certification: RoHS/REACH

Test

- HTOL/HTSL/uHAST/TCT/ESD

1.2 Description

ESP32-S3-WROOM-1 and ESP32-S3-WROOM-1U are two powerful, generic Wi-Fi + Bluetooth LE MCU modules that are built around the ESP32-S3 series of SoCs. On top of a rich set of peripherals, the acceleration for neural network computing and signal processing workloads provided by the SoC make the modules an ideal choice for a wide variety of application scenarios related to AI and Artificial Intelligence of Things (AIoT), such as wake word detection, speech commands recognition, face detection and recognition, smart home, smart appliances, smart control panel, smart speaker, etc.

ESP32-S3-WROOM-1 comes with a PCB antenna. ESP32-S3-WROOM-1U comes with an external antenna connector. A wide selection of module variants are available for customers as shown in Table 1 and 2. Among the module variants, those embed ESP32-S3R8 operate at –40 ~ 65 °C ambient temperature, ESP32-S3-WROOM-1-H4 and ESP32-S3-WROOM-1U-H4 operate at –40 ~ 105 °C ambient temperature, and other module variants operate at –40 ~ 85 °C ambient temperature. Please note that for R8 series modules (8-line PSRAM embedded), if the PSRAM ECC function is enabled, the maximum ambient temperature can be improved to 85 °C, while the usable size of PSRAM will be reduced by 1/16.

Table 1: ESP32-S3-WROOM-1 Series Comparison[1]

Ordering Code	Flash	PSRAM[2]	Ambient Temp.[3] (°C)	Size[4] (mm)
ESP32-S3-WROOM-1-N4	4 MB (Quad SPI)	-	–40 ~ 85	18.0 × 25.5 × 3.1
ESP32-S3-WROOM-1-N8	8 MB (Quad SPI)	-	–40 ~ 85	
ESP32-S3-WROOM-1-N16	16 MB (Quad SPI)	-	–40 ~ 85	
ESP32-S3-WROOM-1-H4	4 MB (Quad SPI)	-	–40 ~ 105	
ESP32-S3-WROOM-1-N4R2	4 MB (Quad SPI)	2 MB (Quad SPI)	–40 ~ 85	
ESP32-S3-WROOM-1-N8R2	8 MB (Quad SPI)	2 MB (Quad SPI)	–40 ~ 85	
ESP32-S3-WROOM-1-N16R2	16 MB (Quad SPI)	2 MB (Quad SPI)	–40 ~ 85	
ESP32-S3-WROOM-1-N4R8	4 MB (Quad SPI)	8 MB (Octal SPI)	–40 ~ 65	
ESP32-S3-WROOM-1-N8R8	8 MB (Quad SPI)	8 MB (Octal SPI)	–40 ~ 65	
ESP32-S3-WROOM-1-N16R8	16 MB (Quad SPI)	8 MB (Octal SPI)	–40 ~ 65	

[1] This table shares the same notes presented in Table 2 below.

Table 2: ESP32-S3-WROOM-1U Series Comparison

Ordering Code	Flash[2]	PSRAM	Ambient Temp.[3] (°C)	Size[4] (mm)
ESP32-S3-WROOM-1U-N4	4 MB (Quad SPI)	-	–40 ~ 85	18.0 × 19.2 × 3.2
ESP32-S3-WROOM-1U-N8	8 MB (Quad SPI)	-	–40 ~ 85	
ESP32-S3-WROOM-1U-N16	16 MB (Quad SPI)	-	–40 ~ 85	
ESP32-S3-WROOM-1U-H4	4 MB (Quad SPI)	-	–40 ~ 105	
ESP32-S3-WROOM-1U-N4R2	4 MB (Quad SPI)	2 MB (Quad SPI)	–40 ~ 85	
ESP32-S3-WROOM-1U-N8R2	8 MB (Quad SPI)	2 MB (Quad SPI)	–40 ~ 85	
ESP32-S3-WROOM-1U-N16R2	16 MB (Quad SPI)	2 MB (Quad SPI)	–40 ~ 85	
ESP32-S3-WROOM-1U-N4R8	4 MB (Quad SPI)	8 MB (Octal SPI)	–40 ~ 65	
ESP32-S3-WROOM-1U-N8R8	8 MB (Quad SPI)	8 MB (Octal SPI)	–40 ~ 65	
ESP32-S3-WROOM-1U-N16R8	16 MB (Quad SPI)	8 MB (Octal SPI)	–40 ~ 65	

[2] The modules use PSRAM integrated in the chip's package.

[3] Ambient temperature specifies the recommended temperature range of the environment immediately outside the Espressif module.

[4] For details, refer to Section 7.1 *Nfwqpa_j Bpkclqpmlq*.

At the core of the modules is an ESP32-S3 series of SoC *, an Xtensa® 32-bit LX7 CPU that operates at up to 240 MHz. You can power off the CPU and make use of the low-power co-processor to constantly monitor the peripherals for changes or crossing of thresholds.

ESP32-S3 integrates a rich set of peripherals including SPI, LCD, Camera interface, UART, I2C, I2S, remote control, pulse counter, LED PWM, USB Serial/JTAG controller, MCPWM, SDIO host, GDMA, TWAI® controller (compatible with ISO 11898-1), ADC, touch sensor, temperature sensor, timers and watchdogs, as well as up to 45 GPIOs. It also includes a full-speed USB 2.0 On-The-Go (OTG) interface to enable USB communication.

Note:

* For more information on ESP32-S3 series of SoCs, please refer to *CQN10+Q1 Qcpjcq B_r_qfccr*.

1.3 Applications

- Generic Low-power IoT Sensor Hub
- Generic Low-power IoT Data Loggers
- Cameras for Video Streaming
- Over-the-top (OTT) Devices
- USB Devices
- Speech Recognition
- Image Recognition
- Mesh Network
- Home Automation
- Smart Building
- Industrial Automation
- Smart Agriculture
- Audio Applications
- Health Care Applications
- Wi-Fi-enabled Toys
- Wearable Electronics
- Retail & Catering Applications

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