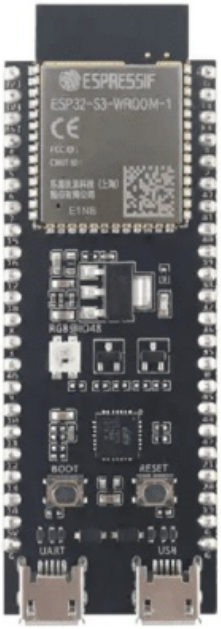
Contents [ hide ]



# ESPRESSIF ESP32-S3-WROOM-1 Development Board Bluetooth Module




## Product Usage Instructions

- The ESP32-S3-WROOM-1 and ESP32-S3-WROOM-1U modules come with different antenna configurations. The former has a PCB antenna, while the latter comes with an external antenna.
- The pin diagram below is applicable for both ESP32-S3-WROOM-1 and ESP32-S3-WROOM-1U, with the latter having no keepout zone.
- The module has 41 pins with various functions. For detailed explanations of pin names, function names, and configurations of peripheral pins, please refer to the ESP32-S3 Series Datasheet.

## Module Overview

### Features

#### CPU and OnChip 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

**WiFi**

- 802.11 b/g/n
- Bit rate: 802.11n up to 150 Mbps
- A-MPDU and A-MSDU aggregation
- 0.4 µs guard interval support
- Center frequency range of operating channel: 2412 ~ 2462 MHz

**Bluetooth**

- Bluetooth LE: Bluetooth 5, Bluetooth mesh
- 2 Mbps PHY
- Long-range mode
- Advertising extensions
- Multiple advertisement sets
- Channel selection algorithm #2

**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

**Integrated Components on Module**

- 40 MHz crystal oscillator
- Up to 16 MB 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
- Dimensions: See Table 1

**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 is available for customers, as shown in Table 1.
- Among the module variants, those that 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.

**Table 1: Ordering Information**

| Ordering Code | Chip Embedded | Flash (MB) | PSRAM (MB) | Dimensions (mm) |
|---|---|---|---|---|
| ESP32-S3-WROOM-1-N4 | ESP32-S3 | 4 | 0 | |
| ESP32-S3-WROOM-1-N8 | ESP32-S3 | 8 | 0 | |
| ESP32-S3-WROOM-1-N16 | ESP32-S3 | 16 | 0 | |

| | | | | |
|---|---|---|---|---|
| ESP32-S3-WROOM-1-H4 (105 °C) | ESP32-S3 | 4 | 0 | 18 × 25.5 × 3.1 |
| ESP32-S3-WROOM-1-N4R2 | ESP32-S3R2 | 4 | 2 (Quad SPI) | |
| ESP32-S3-WROOM-1-N8R2 | ESP32-S3R2 | 8 | 2 (Quad SPI) | |
| ESP32-S3-WROOM-1-N16R2 | ESP32-S3R2 | 16 | 2 (Quad SPI) | |
| ESP32-S3-WROOM-1-N4R8 (65 °C) | ESP32-S3R8 | 4 | 8 (Octal SPI) | |
| ESP32-S3-WROOM-1-N8R8 (65 °C) | ESP32-S3R8 | 8 | 8 (Octal SPI) | |
| ESP32-S3-WROOM-1-N16R8 (65 °C) | ESP32-S3R8 | 16 | 8 (Octal SPI) | |
| ESP32-S3-WROOM-1U-N4 | ESP32-S3 | 4 | 0 | 18 × 19.2 × 3. |
| ESP32-S3-WROOM-1U-N8 | ESP32-S3 | 8 | 0 | |
| ESP32-S3-WROOM-1U-N16 | ESP32-S3 | 16 | 0 | |
| ESP32-S3-WROOM-1U-H4 (105 °C) | ESP32-S3 | 4 | 0 | |
| ESP32-S3-WROOM-1U-N4R2 | ESP32-S3R2 | 4 | 2 (Quad SPI) | |
| ESP32-S3-WROOM-1U-N8R2 | ESP32-S3R2 | 8 | 2 (Quad SPI) | |
| ESP32-S3-WROOM-1U-N16R2 | ESP32-S3R2 | 16 | 2 (Quad SPI) | |

| | | | | |
|---|---|---|---|---|
| ESP32-S3-WROOM-1U-N4R8 (65 °C) | ESP32-S3R8 | 4 | 8 (Octal SPI) | 2 |
| ESP32-S3-WROOM-1U-N8R8 (65 °C) | ESP32-S3R8 | 8 | 8 (Octal SPI) | |
| ESP32-S3-WROOM-1U-N16R8 (65 °C) | ESP32-S3R8 | 16 | 8 (Octal SPI) | |

- 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 1.1 On-The-Go (OTG) interface to enable USB communication.

## Pin Definitions

### Pin Layout

pin diagram is applicable for ESP32-S3-WROOM-1 and ESP32-S3-WROOM-1U, but the latter has no keepout zone.

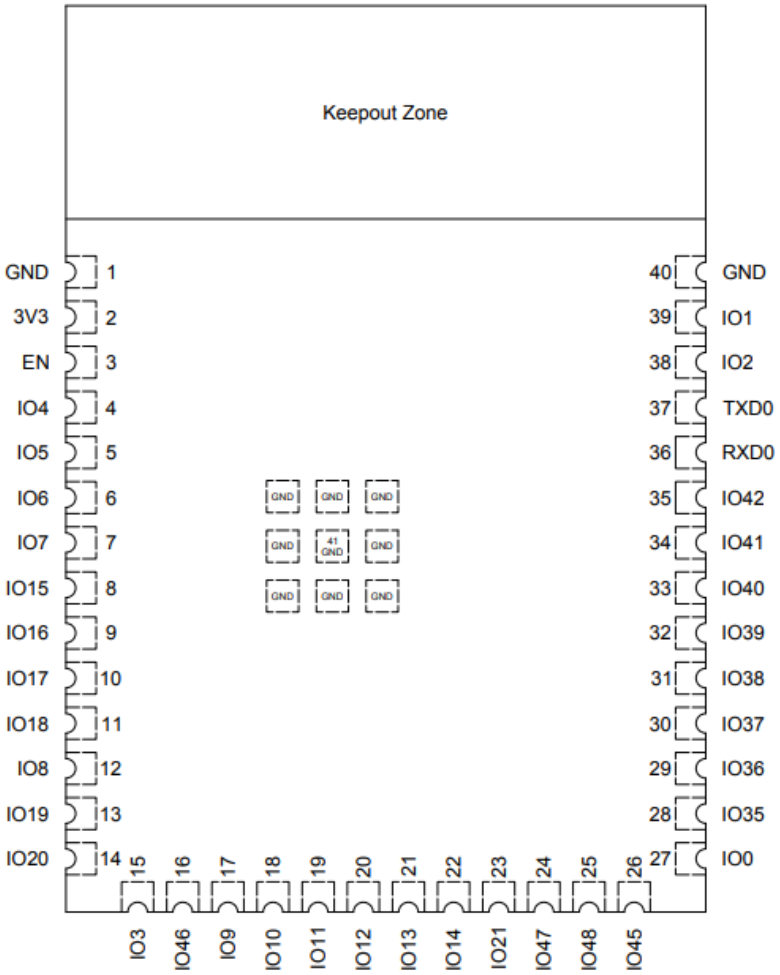



Figure 1: Pin Layout (Top View)

## Pin Description

- The module has 41 pins. See pin definitions in Table 2.
- For explanations of pin names and function names, as well as configurations of peripheral pins, please refer to the ESP32-S3 Series Datasheet.

### Table 2: Pin Definitions

| Name | No. | Type[a] | Function |
|---|---|---|---|
| GND | 1 | P | GND |
| 3V3 | 2 | P | Power supply |

| | | | |
|---|---|---|---|
| EN | 3 | I | High: On enables the chip. Low: The chip powers off.<br><br>Note: Do not leave the EN pin floating. |
| IO4 | 4 | I/O/T | RTC_GPIO4, GPIO4, TOUCH4, ADC1_CH3 |
| IO5 | 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 | 11 | 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 | 16 | 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,<br>SUBSPICS0 |
| IO11 | 19 | I/O/T | RTC_GPIO11, GPIO11, TOUCH11, ADC2_CH0, FSPID, FSPIIO5,<br>SUBSPID |
| IO12 | 20 | I/O/T | RTC_GPIO12, GPIO12, TOUCH12, ADC2_CH1, FSPICLK, FSPIIO6,<br>SUBSPICLK |
| IO13 | 21 | I/O/T | RTC_GPIO13, GPIO13, TOUCH13, ADC2_CH2, FSPIQ, FSPIIO7,<br>SUBSPIQ |
| IO14 | 22 | I/O/T | RTC_GPIO14, GPIO14, TOUCH14, ADC2_CH3, FSPIWP, FSPIDQS,<br>SUBSPIWP |
| IO21 | 23 | I/O/T | RTC_GPIO21, GPIO21 |
| IO47 | 24 | 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[b] | 28 | I/O/T | SPIIO6, GPIO35, FSPID, SUBSPID |
| IO36[b] | 29 | I/O/T | SPIIO7, GPIO36, FSPICLK, SUBSPICLK |
| IO37[b] | 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 |

| Name | No. | Type[a] | Function |
|---|---|---|---|
| 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 | GND |
| EPAD | 41 | P | GND |

- P: power supply; I: input; O: output; T: high impedance. Pin functions in bold font are

the default pin functions.
- In module variants that have embedded OSPI PSRAM, i.e., that embed ESP32-S3R8, pins IO35, IO36, and IO37 connect to the OSPI PSRAM and are not available for other uses.

## U.S. FCC Statement

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

- This device may not cause harmful interference.
- This device must accept any interference received, including interference that may cause undesired operation.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment to an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Any changes or modifications not expressly approved by the party responsible for compliance could void the user’s authority to operate the equipment.

This equipment complies with the FCC RF radiation exposure limits set forth for an uncontrolled environment. This device and its antenna must not be co-located or

operating in conjunction with any other antenna or transmitter. The antennas used for this transmitter must be installed to provide a separation distance of at least 20 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter.

**OEM Integration Instructions**

- This device is intended only for OEM integrators under the following conditions.
- The module can be used for installation on another host.
- The antenna must be installed such that 20 cm is maintained between the antenna and users, and the transmitter module may not be co-located with any other transmitter or antenna.
- The module shall be used only with the integral antenna(s) that have been originally tested and certified with this module. As long as 3 conditions above are met, further transmitter tests will not be required.
- However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirement with this module installed (for example, digital device emission, PC peripheral requirements, etc)

**Notice:**

In the event that these conditions cannot be met (for example, certain laptop configurations or colocation with another transmitter), then the FCC authorization for this module in combination with the host equipment is no longer considered valid, and the FCC ID of the module cannot be used on the final product. In these and circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC authorization.

**End Product Labeling**

This transmitter module is authorized only for use in devices where the antenna may be installed such that 20 cm may be maintained between the antenna and the user. The final end product must be labeled in a visible area with the following:

- “Contains FCC ID: SAK-ESP32S3
- Host Marketing Name(HMN) – Smart Smoke/CO Alarm

**IC Statement**

This device complies with Industry Canada's licence-exempt RSSs. Operation is subject to the following two conditions:

• This device may not cause interference, and
• This device must accept any interference, including interference that may cause undesired operation of the device.

**Radiation Exposure Statement**

This equipment complies with IC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with a minimum distance of 20 cm between the radiator & your
body.

**RSS247 Section 6.4 (5)**
The device could automatically discontinue transmission in case of the absence of information to transmit or operational failure. Note that this is not intended to prohibit transmission of control or signaling information or the use of repetitive codes where required by the technology.

**This device is intended only for OEM integrators under the following conditions: (For module device use)**

- The antenna must be installed such that 20 cm is maintained between the antenna and the users, and
- The transmitter module may not be co-located with any other transmitter or antenna.

As long as 2 conditions above are met, further transmitter tests will not be required. However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed.

**IMPORTANT NOTE:**
In the event that these conditions can not be met (for example, certain laptop

configurations or colocation with another transmitter), then the Canada authorization is no longer considered valid, and the IC ID can not be used on the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate Canada authorization.
This transmitter module is authorized only for use in devices where the antenna may be installed such that 20 cm may be maintained between the antenna and the user. The final end product must be labeled in a visible area with the following:

- “Contains IC: 7145-ESP32S3”.
- Host Marketing Name(HMN) – Smart Smoke/CO Alarm

Manual Information To the End User The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user’s manual of the end product that integrates this module. The end user manual shall include all required regulatory information/warning as shown in this manual.

## Related Documentation and Resources

### Related Documentation

- ESP32-S3 Series Datasheet – Specifications of the ESP32-S3 hardware.
- ESP32-S3 Technical Reference Manual – Detailed information on how to use the ESP32-S3 memory and peripherals.
- ESP32-S3 Hardware Design Guidelines – Guidelines on how to integrate the ESP32-S3 into your hardware product.
- Certificates http://espressif.com/en/support/documents/certificates
- Documentation Updates and Update Notification Subscription http://espressif.com/en/support/download/documents

### Developer Zone

- ESP-IDF Programming Guide for ESP32-S3 – Extensive documentation for the ESP-IDF development framework.
- ESP-IDF and other development frameworks on GitHub. http://github.com/espressif
- ESP32 BBS Forum – Engineer-to-Engineer (E2E) Community for Espressif products,

where you can post questions, share knowledge, explore ideas, and help solve problems with fellow engineers. http://esp32.com/

- The ESP Journal – Best Practices, Articles, and Notes from Espressif folks. http://blog.espressif.com/
- See the tabs SDKs and Demos, Apps, Tools, and AT Firmware. http://espressif.com/en/support/download/sdks-demos

**Products**

- ESP32-S3 Series SoCs – Browse through all ESP32-S3 SoCs. http://espressif.com/en/products/socs?id=ESP32-S3
- ESP32-S3 Series Modules – Browse through all ESP32-S3-based modules. http://espressif.com/en/products/modules?id=ESP32-S3
- ESP32-S3 Series DevKits – Browse through all ESP32-S3-based devkits. http://espressif.com/en/products/devkits?id=ESP32-S3
- ESP Product Selector – Find an Espressif hardware product suitable for your needs by comparing or applying filters. http://products.espressif.com/#/product-selector?language=en

**Revision History**

| Date | Version | Release notes |
|---|---|---|
| 2021-10-29 | v0.6 | Overall update for chip revision 1 |
| 2021-07-19 | v0.5.1 | Preliminary release, for chip revision 0 |

**Disclaimer and Copyright Notice**

Information in this document, including URL references, is subject to change without notice.

ALL THIRD-PARTY INFORMATION IN THIS DOCUMENT IS PROVIDED AS IS WITH

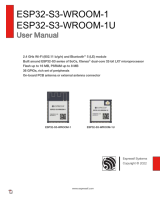
### Contact

- See the tabs Sales Questions, Technical Enquiries, Circuit Schematic & PCB Design Review, Get Samples (Online stores), Become Our Supplier, Comments & Suggestions. http://espressif.com/en/contact-us/sales-questions
- www.espressif.com

### FAQ

- What are the differences between ESP32-S3-WROOM-1 and ESP32-S3-WROOM-1U?
  - The main difference lies in the antenna configuration. The ESP32-S3-WROOM-1 has a PCB antenna, while the ESP32-S3-WROOM-1U comes with an external antenna.
- Can I leave the EN pin floating?
  - No, it is not recommended to leave the EN pin floating. Ensure it is connected to either a high or low signal to properly enable or disable the chip.

## Documents / Resources

| | |
|---|---|
|  | ESPRESSIF ESP32-S3-WROOM-1 Development Board Bluetooth Module [pdf] User Manual<br>ESP32S3WROOM1, ESP32S3WROOM1U, ESP32-S3-WROOM-1 Development Board Bluetooth Module, ESP32-S3-WROOM-1, Development Board Bluetooth Module, Board Bluetooth Module, Bluetooth Module |

## References

- User Manual

ESPRESSIF

Bluetooth Module, Board Bluetooth Module, Development Board Bluetooth Module, ESP32- S3- WROOM -1, ESP32-S3-WROOM-1 Development Board Bluetooth Module, ESP32S3WROOM1, ESP32S3WROOM1U, espressif

# Leave a comment

Your email address will not be published. Required fields are marked *

Comment *

Name

Email

Website

Save my name, email, and website in this browser for the next time I comment.

Post Comment

## Search:

e.g. whirlpool wrf535swhz

Search