

# ESP32-S3 Development Board USB Type-C Kit (N16R8)

## Technical Specification Sheet — Seller Edition

**Product type:** Wi-Fi + Bluetooth 5 (LE) development board / IoT prototyping board

**Core module:** Espressif ESP32-S3-WROOM-1-N16R8

**Form factor:** 44-pin (2 x 22), 2.54 mm pitch, USB Type-C

**Applies to SKUs:** 44-pin dual USB-C variant (standard), 44-pin single USB-C variant, U.FL antenna variant

**Document version:** v1.0 | **Language:** English (for platform listing, customer sharing, and CS scripts)

**Reading note:** All values marked ★ are reference values for the category. They **must be confirmed against the actual product, the production batch, or measured data** before publishing or quoting to a customer. Values without ★ describe the standard ESP32-S3-WROOM-1-N16R8 board configuration and may still vary by board revision or batch.

**Section 5 (Market and Regulatory Configuration) takes precedence over every other section.** A board built for one market is not automatically sellable in another; shipping the wrong configuration is both a compliance problem and the top driver of customer disputes.

## 1. Product Overview

The ESP32-S3 Development Board (N16R8) is a full-featured Wi-Fi + Bluetooth 5 (LE) development board built around the Espressif **ESP32-S3-WROOM-1-N16R8** module. The "N16R8" suffix defines the memory configuration: **16 MB SPI flash + 8 MB PSRAM**, giving headroom for large firmware images, buffered sensor data, audio pipelines, and lightweight on-device AI (TinyML) workloads. The board is powered and programmed over **USB Type-C**, breaks out **44 pins** in the standard 2 x 22 layout, and ships with an onboard addressable RGB LED plus BOOT and RST buttons — a ready-to-use platform for IoT nodes, edge-AI experiments, and embedded teaching.

### Key selling points

- Genuine Espressif ESP32-S3-WROOM-1 module: Xtensa dual-core 32-bit LX7, up to 240 MHz, with vector instructions for on-device AI acceleration.
- Large memory configuration (16 MB flash / 8 MB PSRAM) — no upgrade needed for camera, audio, LVGL UI, or MicroPython projects.
- USB Type-C programming and power (no Micro-USB cable needed); native USB Serial/JTAG plus a USB-to-UART bridge on dual-port variants.
- 44-pin standard breakout (2 x 22, 2.54 mm pitch, 25.4 mm row spacing) — breadboard and dupont-wire friendly; most shields and expansion base boards fit directly.
- Onboard WS2812 addressable RGB LED, BOOT and RST buttons, power / TX / RX indicators — visible status without extra wiring.
- First-class toolchain support: ESP-IDF, Arduino IDE, MicroPython, PlatformIO, ESPHome, Tasmota.
- **License-free radio:** Wi-Fi and BLE operation requires no operator licence in any major market — unlike licensed-band radio products.

### Positioning

Mid-to-high tier in the ESP32-S3 board family: above N8R2 / N8R8 boards by memory capacity, below ESP32-S3 boards with camera, SD, and display interfaces integrated on the PCB. Best value for customers who need memory headroom but want a clean, standard 44-pin footprint.

### Typical applications

IoT sensor nodes and gateways; smart-home devices (Matter / MQTT / Home Assistant); TinyML and speech or image classification demos; USB HID projects (macropads, custom controllers, USB adapters); robotics and motor-control carriers; education and university lab kits; LVGL / display HMI prototypes; Wi-Fi + BLE Mesh networks.

## 2. Core Specifications

| Item                 | Specification                                                                   | Notes                                                                 |
|----------------------|---------------------------------------------------------------------------------|-----------------------------------------------------------------------|
| Core module          | ESP32-S3-WROOM-1-N16R8                                                          | Espressif original module, onboard PCB antenna                        |
| Processor            | Xtensa dual-core 32-bit LX7, up to 240 MHz                                      | Single-precision FPU; AI vector instructions                          |
| Flash                | 16 MB SPI flash                                                                 | Octal/quad configuration ★ confirm on module label                    |
| PSRAM                | 8 MB SPI PSRAM                                                                  | Octal SPI ★                                                           |
| Internal SRAM        | 512 KB                                                                          | Plus 16 KB RTC SRAM                                                   |
| ROM                  | 384 KB                                                                          | —                                                                     |
| Wireless (Wi-Fi)     | 2.4 GHz IEEE 802.11 b/g/n                                                       | 1T1R, up to 150 Mbps PHY ★                                            |
| Wireless (Bluetooth) | Bluetooth 5 (LE) + Bluetooth Mesh                                               | Coded PHY (long range) and 2 Mbps PHY supported                       |
| USB ports            | 2 x USB Type-C (dual-port variant) / 1 x USB Type-C (single-port variant)       | Port A: USB-to-UART bridge; Port B: native USB OTG / USB Serial-JTAG  |
| USB-UART bridge chip | CH340K / CH343 / CP2102 (by batch)                                              | ★ Confirm the exact bridge chip per production batch                  |
| Total pins           | 44 pins (2 x 22), 2.54 mm pitch                                                 | Row spacing 25.4 mm                                                   |
| Usable GPIO          | 33 programmable GPIO on this board                                              | Module exposes 36 of the chip's 45 GPIO ★ confirm per revision        |
| Digital interfaces   | Up to 4 x SPI, 3 x UART, 2 x I2C, 2 x I2S, 1 x USB OTG, SD/MMC host, TWAI (CAN) | Not all are exposed on the 44-pin header                              |
| Analog interfaces    | 2 x 12-bit SAR ADC, up to 20 channels; 14 x capacitive touch IOs                | ADC usable on designated pins only ★                                  |
| PWM / RMT            | LEDC PWM; RMT 4 x TX + 4 x RX channels                                          | For IR, WS2812, precise timing                                        |
| Logic / I/O voltage  | 3.3 V DC                                                                        | <b>Not 5 V tolerant</b> — level shifting required for 5 V peripherals |
| Input voltage        | 5 V DC via USB Type-C, or the 5 V pin                                           | 5 V pin range approx. 2.0 – 6.0 V DC through the onboard regulator ★  |

| Item                        | Specification                               | Notes                                                           |
|-----------------------------|---------------------------------------------|-----------------------------------------------------------------|
| 3V3 pin                     | 3.3 V DC direct input to module             | Bypasses the onboard regulator — feed 3.3 V only                |
| Onboard regulator           | ME6211C33 / AMS1117-3.3 (by batch)          | ★ Confirm regulator P/N and max output current with the factory |
| Reverse-polarity protection | Schottky diode on the combined USB VBUS net | Protects against back-feed when both ports are powered ★        |
| Onboard RGB LED             | WS2812 addressable RGB                      | Typical data pin GPIO48 ★ verify for your batch                 |
| Buttons                     | BOOT (download mode) and RST (reset)        | BOOT typically on GPIO0 ★                                       |
| Status LEDs                 | Power, TX, RX                               | —                                                               |
| Antenna                     | Onboard PCB antenna                         | U.FL / IPEX variant available ★                                 |
| Operating temperature       | -40 °C to +65 °C (board)                    | Module rating -40 °C to +85 °C ★                                |
| Board dimensions            | Approx. 57.2 x 28.0 x 6.6 mm (dual-port)    | ★ Varies by batch — measure your own stock                      |
| Net weight                  | Approx. 9 g per board (bare)                | ★ Weigh the actual packed unit                                  |

**Sales note:** Customers ask two questions first — "Is it the original Espressif module or a clone?" and "How many GPIO can I actually use?" The honest answers: this board carries a genuine ESP32-S3-WROOM-1 module (show the shield photo with the Espressif marking), and **33 GPIO are usable** even though the chip has 45 — the remainder are consumed by flash/PSRAM or are not broken out. Put both answers in the listing. Never advertise "45 usable GPIO on the header".

### 3. Module Variant Guide — Which "N\_R\_" Do You Need?

All variants below are ESP32-S3-WROOM-1 modules; the suffix defines memory only.

| Variant      | Flash        | PSRAM               | Best for                                                | Notes                                  |
|--------------|--------------|---------------------|---------------------------------------------------------|----------------------------------------|
| N4           | 4 MB         | None                | Simple Wi-Fi/BLE nodes, no OTA                          | Lowest cost                            |
| N8           | 8 MB         | None                | Standard IoT firmware, OTA                              | Mainstream entry                       |
| N8R2         | 8 MB         | 2 MB (quad)         | Small LVGL UI, light buffering                          | PSRAM options can clash with some pins |
| N8R8         | 8 MB         | 8 MB (octal)        | Camera, audio, larger UI                                | Octal PSRAM occupies more pins         |
| <b>N16R8</b> | <b>16 MB</b> | <b>8 MB (octal)</b> | <b>Camera + audio + TinyML + MicroPython, large OTA</b> | <b>This product</b>                    |
| N16R2        | 16 MB        | 2 MB                | Maximum flash, light PSRAM                              | —                                      |
| N32R8        | 32 MB        | 8 MB (octal)        | Very large assets, multi-partition OTA                  | Premium cost                           |

### Selection logic (copy-paste answer for CS):

- Only Wi-Fi/BLE + sensors → N4 or N8 is enough; do not upsell.
- Display (LVGL) or audio → requires PSRAM; N8R2 minimum, N8R8 preferred.
- Camera, speech recognition, or MicroPython with many modules → **N16R8** (this board).
- Multiple OTA slots plus large asset storage → N32R8.

**Sales note:** "R" in the part number means PSRAM. A customer complaining "my camera sketch crashes" is usually on an **N8R2 board with 2 MB PSRAM**, not holding a defective unit. Route that message to this table instead of issuing a replacement.

## 4. SKU Comparison (This Product Family)

| SKU                                  | USB-C ports | UART bridge    | Flash / PSRAM | Antenna     | Typical buyer                                |
|--------------------------------------|-------------|----------------|---------------|-------------|----------------------------------------------|
| S3-44-D2C-N16R8 (standard)           | 2           | CH340K / CH343 | 16 MB / 8 MB  | PCB         | Most projects; flashing + native USB at once |
| S3-44-S1C-N16R8                      | 1           | CH343 / CP2102 | 16 MB / 8 MB  | PCB         | Cost-sensitive builds                        |
| S3-44-D2C-N8R2                       | 2           | CH343          | 8 MB / 2 MB   | PCB         | Entry level, light UI                        |
| S3-44-D2C-N16R8-UFL                  | 2           | CH343          | 16 MB / 8 MB  | U.FL / IPEX | Metal enclosures, external antenna           |
| Kit option (board + headers + cable) | 2           | CH343          | 16 MB / 8 MB  | PCB         | Education, retail kits                       |

★ Final SKU list, port count, bridge chip, and antenna option must be frozen per production batch before listing.

**Sales note:** Always state **port count** in the title. Buyers asking for "dual USB-C" mean one port for flashing while the other runs USB HID/OTG simultaneously. A single-port board cannot do both at once — that is the most common return reason in this category.

## 5. Market and Regulatory Configuration

**This section takes precedence over all others.** The board itself is license-free (Wi-Fi/BLE), but the **certificate you may legally claim depends on the market**, and the Wi-Fi channel plan is region-limited by firmware. Confusing the two is how sellers end up shipping a product with a claim they cannot support.

| Market | Required certification to claim                  | Wi-Fi 2.4 GHz channels in use | Operator licence | Notes                                                         |
|--------|--------------------------------------------------|-------------------------------|------------------|---------------------------------------------------------------|
| USA    | FCC (module-level ID + end-product verification) | 1 – 11                        | Not required     | Do not claim FCC on a board whose certificate you cannot show |

| Market         | Required certification to claim | Wi-Fi 2.4 GHz channels in use | Operator licence | Notes                                                  |
|----------------|---------------------------------|-------------------------------|------------------|--------------------------------------------------------|
| Canada         | ISED / IC                       | 1 – 11                        | Not required     | —                                                      |
| EU / EEA       | CE-RED (+ EMC, RoHS, REACH)     | 1 – 13                        | Not required     | Align default firmware channel list with the EU plan ★ |
| UK             | UKCA                            | 1 – 13                        | Not required     | Separate mark from CE since 2021                       |
| Mainland China | SRRC                            | 1 – 13                        | Not required     | Required for radio products sold in China              |
| Japan          | MIC / TELEC (Giteki)            | 1 – 13 (+ ch 14, low power)   | Not required     | Giteki mark required                                   |
| South Korea    | KC                              | 1 – 13                        | Not required     | —                                                      |
| Australia / NZ | RCM                             | 1 – 13                        | Not required     | —                                                      |
| India          | WPC / BIS                       | 1 – 13                        | Not required     | Import licence applies to the radio module             |
| Brazil         | ANATEL                          | 1 – 13                        | Not required     | —                                                      |

### Configuration rules

- Firmware channel plan is a legal parameter, not a preference.** A board shipped to the USA must not default to channel 12–14 in Wi-Fi AP mode; set the country code in firmware or in the Wi-Fi driver configuration.
- The module's certificate belongs to the module, not to your board.** Claiming CE / FCC for a finished board requires your own declaration or verification for that assembly; get written confirmation from your supplier for each claim you publish.
- Antenna variant changes the certification.** A PCB-antenna board and a U.FL / external-antenna board are different radio configurations. A certificate obtained on the PCB-antenna version does not cover the external-antenna version without re-testing.
- Keep market-bound stock physically separated** and label it at the carton level; mixed stock is how the wrong configuration reaches the wrong market.
- Changing the antenna, output configuration, or radio module invalidates previously issued certificates.** Re-test, do not re-label.

**Sales note:** Safe listing wording: "Built on the ESP32-S3-WROOM-1 module, which carries module-level radio certifications. End-product certification for the destination market is the buyer's responsibility unless otherwise agreed in writing." Never write "CE / FCC certified" on a listing unless you hold the certificate for **the board you ship**. For EU and US order enquiries, ask the destination country before quoting — it decides which certificate applies.

## 6. Compatibility

| Platform / device              | Compatibility           | Notes                                                                  |
|--------------------------------|-------------------------|------------------------------------------------------------------------|
| ESP-IDF v5.x                   | Full                    | Reference target; USB Serial/JTAG flashing supported                   |
| Arduino IDE (ESP32 core 3.x)   | Full                    | Board: "ESP32S3 Dev Module"; enable PSRAM = OPI PSRAM                  |
| MicroPython                    | Full                    | Octal PSRAM firmware build required for 8 MB PSRAM                     |
| PlatformIO                     | Full                    | board = esp32-s3-devkitc-1                                             |
| ESPHome / Home Assistant       | Full                    | Widely deployed; pin map published                                     |
| Tasmota / ESPEasy              | Supported               | Choose the build variant matching 16 MB flash                          |
| Windows 10 / 11                | Full                    | Bridge-chip driver needed for the UART port; native USB is driver-free |
| macOS / Linux                  | Full                    | Native USB usually driver-free                                         |
| 3.3 V sensors and modules      | Full                    | I2C / SPI / UART at 3.3 V logic                                        |
| 5 V sensors and modules        | Requires level shifting | <b>3.3 V logic — 5 V on a GPIO can destroy the module</b>              |
| 5 V relays, motors, LED strips | Requires a driver stage | Use a transistor / MOSFET / driver board with a shared ground          |
| 44-pin expansion base boards   | Compatible              | Must match 2 x 22, 25.4 mm row spacing                                 |
| 830-point breadboard           | Compatible              | With presoldered headers                                               |

**Sales note:** Put this line in bold on the detail page: "**3.3 V logic. Do not feed 5 V into any GPIO.**" Most "dead board" claims in this category are 5 V back-feed or a shorted 5 V / 3V3 rail, and they are not a manufacturing defect. Ask for a photo of the wiring before discussing a replacement.

## 7. Structure and Build Quality

- **PCB:** multi-layer FR-4, RoHS-compliant, matte-black solder mask with white silkscreen; every header pin labelled on the top side.
- **Module:** genuine ESP32-S3-WROOM-1-N16R8, castellated pads soldered on all edges, metal shield can with Espressif marking.
- **Antenna:** onboard 2.4 GHz PCB antenna at the module end with keep-out clearance. Keep that end free of metal, batteries, and copper tape inside customer enclosures.
- **USB connectors:** Type-C receptacles with through-hole / reinforced pads; strain relief recommended for field units.
- **Buttons:** BOOT and RST tactile switches, rated ★ 100,000 operations.
- **Power stage:** 3.3 V LDO with a decoupling network at the module supply pin; reverse-polarity Schottky protection on VBUS ★.
- **Indicators:** WS2812 addressable RGB, plus Power / TX / RX LEDs.
- **Headers:** standard 2.54 mm pin headers, presoldered on standard SKUs; loose headers supplied in kit SKUs.

### Durability and protection

- ESD-sensitive device — ship in antistatic packaging only.
- No conformal coating by default ★ (optional coating available on request).
- Intended for indoor, benchtop, or enclosed use; not IP-rated.

## 8. Power Supply

| Parameter                       | Value                                           | Notes                                                    |
|---------------------------------|-------------------------------------------------|----------------------------------------------------------|
| Primary input                   | 5 V DC via USB Type-C                           | Either port on dual-port SKUs ★                          |
| 5 V pin input                   | Approx. 2.0 – 6.0 V DC                          | Passes through the onboard regulator ★                   |
| 3V3 pin input                   | 3.3 V DC only                                   | Bypasses the regulator; wrong voltage damages the module |
| I/O logic level                 | 3.3 V                                           | Not 5 V tolerant                                         |
| Module supply range             | 3.0 – 3.6 V DC                                  | —                                                        |
| Regulator max output            | ★ Confirm with factory (typically 500 mA – 1 A) | Must exceed peak module current                          |
| Idle current (Wi-Fi off)        | Approx. 40 – 60 mA ★ measure                    | Varies with firmware and clock                           |
| Active current (Wi-Fi TX burst) | Peak up to approx. 350 – 500 mA ★ measure       | Peak, not average                                        |
| BLE-only operation              | Approx. 80 – 130 mA ★ measure                   | —                                                        |
| Recommended USB supply          | 5 V / 1 A or higher                             | 500 mA phone chargers may brown out during Wi-Fi TX      |
| Onboard charging circuit        | None                                            | This board has no battery charger                        |
| Both ports powered at once      | Diode-protected ★                               | Do not power two independent sources simultaneously      |

**Why boards "randomly reboot":** the Wi-Fi transmit burst draws a current peak far above the average draw. If the supply or cable cannot deliver it, the rail collapses and the module resets. This is a power-delivery symptom, not a firmware or hardware defect.

**Sales note:** If a customer says "the board keeps rebooting when Wi-Fi connects", the cause is almost always an undersized USB port or a thin cable. Tell them: use a **5 V / 1 A or better** supply and a **short, quality cable**, or feed the 5 V pin from a bench supply — that gives the most stable result.

## 9. Firmware and Software

| Item         | Detail                                               |
|--------------|------------------------------------------------------|
| Official SDK | ESP-IDF v5.x (C/C++)                                 |
| Arduino      | ESP32 Arduino core 3.x — select "ESP32S3 Dev Module" |
| Python       | MicroPython (ESP32-S3 build, octal PSRAM variant)    |

| Item                       | Detail                                                                                            |
|----------------------------|---------------------------------------------------------------------------------------------------|
| Build systems              | PlatformIO, ESP-IDF CMake, Arduino CLI                                                            |
| Flashing — UART port       | USB-to-UART bridge; hold BOOT, press RST, release BOOT to enter download mode if auto-reset fails |
| Flashing — native USB port | USB Serial/JTAG, driver-free on most systems                                                      |
| Factory firmware           | ★ State exactly what is preloaded (blank / AT / demo sketch); never let the buyer guess           |
| Driver requirement         | Windows needs the bridge-chip driver for the UART port; native USB needs none                     |
| PSRAM setting              | Must be enabled in the build (OPI / Octal) or the 8 MB PSRAM stays invisible                      |
| OTA update                 | Supported; partition table must be sized for 16 MB flash                                          |
| Wi-Fi country code         | ★ Must be set per destination market — see Section 5                                              |
| Debugging                  | USB Serial/JTAG, UART, or an external JTAG probe on the header ★                                  |
| Security features          | Secure boot, flash encryption, AES / SHA / RSA / ECC / HMAC / RNG hardware acceleration           |

**Sales note:** Two settings cause roughly 90% of "the board is dead" tickets: (1) PSRAM not enabled in the IDE, so the customer believes the 8 MB is missing; (2) the wrong board selected, so upload fails. Send these two lines **before** discussing a return, and always ask for a photo of the IDE settings screen.

## 10. Durability and Testing

| Test             | Method / Standard                                   | Target                                    | Status                 |
|------------------|-----------------------------------------------------|-------------------------------------------|------------------------|
| Function test    | 100% power-on, boot, Wi-Fi connect, USB enumeration | Every unit                                | ★ Confirm with factory |
| Burn-in / aging  | Powered soak test                                   | ★ e.g. 2 – 4 h per batch                  | ★                      |
| USB-C insertion  | Repeated plug / unplug cycles                       | ★ 3,000 – 10,000 cycles                   | ★                      |
| Button life      | Tactile switch actuation                            | ★ 100,000 cycles                          | ★                      |
| Drop test        | Packed unit, 1 corner + 1 face, 6 drops             | ★ 76 cm per ISTA 1A                       | ★                      |
| Vibration        | Transport simulation                                | ★ ISTA 1A                                 | ★                      |
| ESD              | Human body model, connector contact                 | ★ Contact 4 kV / Air 8 kV                 | ★                      |
| Thermal          | Full-load soak at rated ambient                     | No thermal shutdown                       | ★                      |
| Rail short check | 5 V to GND, 3V3 to GND                              | No short on 100% of units                 | ★                      |
| Flash endurance  | SPI flash write cycles                              | Module rating, typically 100,000 cycles ★ | ★                      |

AQL level and test reports are available on request ★.

## 11. Packaging and Shipping

| Item              | Detail                                                                           |
|-------------------|----------------------------------------------------------------------------------|
| Unit packaging    | Antistatic bag with desiccant, sealed                                            |
| Kit contents      | 1 x development board; 2 x 22-pin headers (kit SKU); 1 x USB-C cable (kit SKU) ★ |
| Accessory list    | ★ Freeze per SKU — mismatched accessories are a top complaint source             |
| Retail box option | ★ Custom printed box on request, MOQ applies                                     |
| Inner carton      | ★ e.g. 100 pcs per inner box                                                     |
| Master carton     | ★ Dimensions, pcs per carton, gross weight — measure and confirm                 |
| Carton label      | Product name, SKU, quantity, batch / lot code, date code, made-in marking        |
| Barcode           | ★ EAN-13 / UPC-A per customer request; confirm code ownership                    |
| Net weight        | ★ Approx. 9 g per bare board; packed weight must be measured                     |
| MOQ               | ★ Confirm per SKU and per packaging option                                       |
| Lead time         | ★ Confirm current production and shipping lead time before quoting               |
| Shipping mode     | Air / sea / express ★                                                            |
| Handling notes    | ESD-safe handling; keep the antenna end clear; do not stack heavy cartons on top |

**Sales note:** Quote **accessory content and carton data only after weighing and counting your own stock**. This is the one block where an incorrect number immediately creates a refund claim — buyers weigh the parcel.

## 12. Certifications and Compliance

| Item                                    | Status                                                              | Notes                                                                      |
|-----------------------------------------|---------------------------------------------------------------------|----------------------------------------------------------------------------|
| RoHS                                    | ★ Confirm per order                                                 | Declaration from supplier / module level                                   |
| REACH                                   | ★ Confirm per order                                                 | —                                                                          |
| CE                                      | ★ Module carries CE; finished-product mark requires your own DoC    | The module certificate does not automatically transfer to the board        |
| FCC                                     | ★ Module FCC ID available; end-product verification may be required | Quote the module's FCC ID only if you can show the certificate             |
| UKCA                                    | ★ On request                                                        | For UK sales                                                               |
| CE-RED (radio)                          | ★ Required for EU radio sales                                       | Wi-Fi + BLE are radio functions                                            |
| SRRC                                    | ★ Required for mainland China radio sales                           | —                                                                          |
| ISED / IC, MIC / TELEC, KC, RCM, ANATEL | ★ On request                                                        | Per destination market — see Section 5                                     |
| Bluetooth SIG                           | ★ Declared through the Espressif module declaration                 | Confirm the module is on the qualified list before claiming BLE compliance |
| Battery / UN38.3                        | Not applicable                                                      | No battery in this product                                                 |

| Item                       | Status                                           | Notes                                       |
|----------------------------|--------------------------------------------------|---------------------------------------------|
| WEEE / packaging directive | ★ Per destination country                        | —                                           |
| Warranty                   | ★ e.g. 12 months from shipment, excluding misuse | State the period and define what is covered |

**Sales note:** Never write "CE / FCC certified" unless you hold the certificate for **the board you ship**. Safe wording: "Built on the ESP32-S3-WROOM-1 module, which carries the module-level radio certifications. End-product certification is the buyer's responsibility unless otherwise agreed in writing."

## 13. FAQ

### Q1. Is this the original Espressif module or a clone?

It uses the genuine ESP32-S3-WROOM-1-N16R8 module, identified by the shield marking and the module label. Show the module photo in the listing, and ask buyers to check the marking on arrival.

### Q2. How much memory do I actually get?

16 MB SPI flash and 8 MB SPI PSRAM, plus 512 KB internal SRAM. The PSRAM must be enabled in the IDE — otherwise it shows as unavailable.

### Q3. How many GPIO can I use?

33 GPIO are usable on this 44-pin board. The chip has 45; the remainder are used by flash/PSRAM or are not broken out. Do not promise "45 usable GPIO".

### Q4. Why does it keep rebooting when Wi-Fi connects?

The Wi-Fi transmit burst draws a current peak that an undersized USB port or thin cable cannot supply. Use a 5 V / 1 A or better supply and a short quality cable, or feed the 5 V pin from a bench supply.

### Q5. The board is not detected and upload fails. What should I do?

Check three things: the correct bridge-chip driver is installed (UART port), "ESP32S3 Dev Module" is selected, and download mode is entered by holding BOOT, pressing RST, then releasing BOOT.

### Q6. Can I power it from a battery or a 5 V supply?

There is no onboard battery charger. Use a 5 V supply on the 5 V pin (approx. 2.0 – 6.0 V DC) or 3.3 V directly on the 3V3 pin — never both, and never exceed 3.6 V on the 3V3 pin or on any GPIO.

### Q7. Can I connect a camera, display, or SD card?

Yes — the chip provides a DVP camera interface, an LCD interface, and an SD/MMC host, and the 16 MB / 8 MB memory configuration supports them. Note that not every interface pin is exposed on the 44-pin header; check the pin map for your board revision.

### Q8. Will it work in my country?

Wi-Fi and BLE are license-free, but the Wi-Fi channel plan is region-limited and the certificate you may claim depends on the market. See Section 5; the destination country decides which configuration and which certificate apply.

### Q9. Can I sell the finished product under my own brand?

Yes, but certification of the finished assembly is yours to obtain unless your supplier has agreed otherwise in writing. Keep the module's certificate on file as evidence of the radio component.

#### Q10. What is covered by the warranty?

★ State the warranty period and scope (e.g. 12 months against manufacturing defects). Damage from 5 V on a GPIO, reverse polarity, shorted rails, liquid, or physical abuse is excluded. Return requests should include photos of the wiring and the IDE settings.

## 14. Usage and Care Recommendations

1. Use a 5 V / 1 A or better power source and a short, quality USB-C cable; avoid sharing a laptop port with other high-draw devices.
2. Treat all GPIO as 3.3 V logic. Add a level shifter for any 5 V signal; never feed 5 V directly into a pin.
3. Never connect two independent power sources at once (for example both USB ports plus the 5 V pin) unless the design explicitly supports it.
4. Handle with ESD precautions: discharge yourself before touching the board, and keep it in the antistatic bag when not in use.
5. Keep the antenna end of the board clear of metal, batteries, and copper tape for reliable Wi-Fi and BLE range.
6. Check polarity three times before wiring a new peripheral, and use a current-limited bench supply for first power-up.
7. Do not exceed the onboard regulator's output current — power high-current loads such as motors, relays, and LED strips from a separate supply with a shared ground.
8. Set the Wi-Fi country code in firmware to match the destination market before shipping.
9. Store in the sealed antistatic bag with desiccant at room temperature and low humidity; do not stack heavy items on the carton.

## Disclaimer

This specification sheet is a seller-edition reference document. Values marked ★ are mainstream category reference figures and **must be replaced with measured or factory-confirmed data for the exact production batch before publication, quotation, or use in customer communication.** Unmarked values describe the standard ESP32-S3-WROOM-1-N16R8 board configuration and may vary between board revisions, batches, and the specific SKU shipped.

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