Waveshare ESP32-S3-Nano-M

Waveshare ESP32-S3-Nano-M Microcontroller Development Board User Manual

Model: ESP32-S3-Nano-M

1. INTRODUCTION

The Waveshare ESP32-S3-Nano-M is a compact and powerful microcontroller development board designed for a wide range of applications, including IoT and MicroPython projects. It features the ESP32-S3R8 chip with a dual-core 32-bit LX7 processor, offering robust performance and integrated wireless communication capabilities. This manual provides essential information for setting up, operating, and understanding your development board.

Image 1.1: Top-down view of the Waveshare ESP32-S3-Nano-M Development Board.
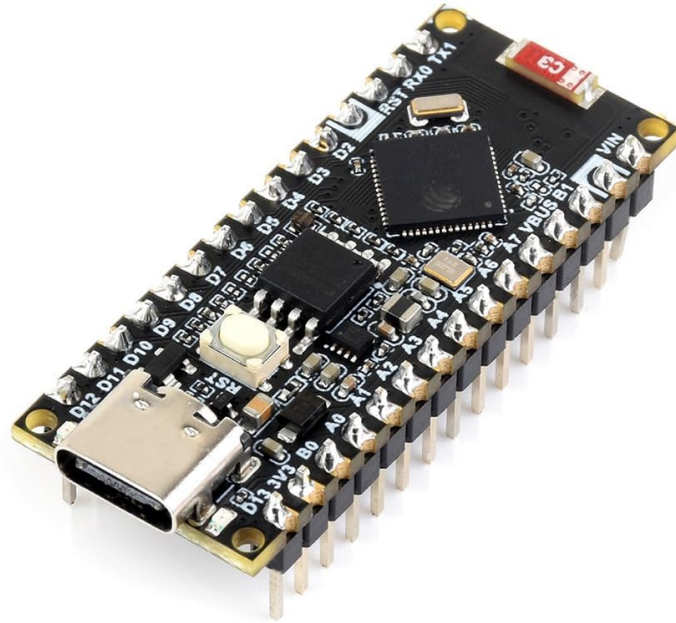
2. PACKAGE CONTENTS

Verify that all items listed below are included in your package:

- 1x Waveshare ESP32-S3-Nano-M Development Board with pre-soldered header

Package Content

ESP32-S3-Nano with pre-soldered header x1

Image 2.1: The Waveshare ESP32-S3-Nano-M board as included in the package.

3. PRODUCT OVERVIEW

3.1 Key Features

- Adopts ESP32-S3R8 chip with Xtensa 32-bit LX7 dual-core processor, capable of running at 240 MHz.
- Integrated 512KB SRAM, 384KB ROM, 8MB PSRAM, 16MB Flash memory.
- Integrated 2.4GHz Wi-Fi and Bluetooth LE dual-mode wireless communication, with superior RF performance.
- Supports seamlessly switching between Arduino and MicroPython programming, offering flexible usage.
- Compatible with Arduino IoT Cloud, allowing monitoring and control of projects remotely.
- Supports HID, emulating Human Interface Devices such as keyboards or mice via USB port for easier interaction with PC.

3.2 What's On Board

The following diagram illustrates the main components and their locations on the ESP32-S3-Nano-M development board:

Product Parameters Comparison

MODEL	R7FA4 PLUS A	R7FA4 PLUS B	ESP32-S3-NANO
MICROCONTROLLER	R7FA4 (32-bit ARM Cortex-M4)	R7FA4 (32-bit ARM Cortex-M4) ESP32-S3FN8 (Dual-core 32-bit Xtensa LX7)	ESP32-S3R8 (Dual-core 32-bit Xtensa LX7)
CLOCK FREQUENCY	R7FA4: 48MHz	R7FA4: 48MHz ESP32-S3FN8: 240MHz	ESP32-S3R8: 240MHz
STORAGE	R7FA4: 256kB Flash, 32kB RAM	R7FA4: 256kB Flash, 32kB RAM ESP32-S3FN8: 384kB ROM, 512kB RAM, 8MB Flash	ESP32-S3R8: 384kB ROM, 512kB RAM, 16MB Flash, 8MB PSRAM
WIRELESS COMMUNICATION	None	2.4GHz WiFi + Bluetooth LE	
OPERATING VOLTAGE	Options for 5V/3.3V, support more shields		3.3V
POWER INPUT	6~24V		6~21V
RESET BUTTON	Lateral, easier to use when connecting with shield		Vertical
IO PIN OUTPUT CURRENT	8mA		40mA
DIGITAL PINS	14		14
ANALOG PINS	6		8
DAC	2		None
PWM	6		5
UART	1		2
I2C	1		1
SPI	1		1
CAN	1		None
DC JACK	Low profile, shields won't be blocked anymore while connecting		None
POWER OUTPUT HEADER	Provides 5V OR 3.3V power output and common-grounding with other boards		None
5V POWER OUTPUT	Up to 2000mA Max, features higher driving capability		1000mA Max
EXPERIMENTAL BOARD	Support, solder pad is provided for DIY interfaces to connect with experimental board		Support

Image 3.1: Labeled components of the ESP32-S3-Nano-M board.

1. ESP32-S3R8 dual-core processor: Up to 240 MHz running frequency.

2. W25Q128JVSIQ: 16MB Flash for program and data storage.

3. MP2322GQH: 3.3V voltage regulator.

4. 2.4G ceramic antenna.

5. USB Type-C connector: For downloading programs and serial port debugging.

6. RST button: For resetting the ESP32-S3R8.

7. Arduino Nano Interface: Compatible with Arduino interface, adapting 2.54 pitch solder pad.

8. RGB indicator: Blinks and turns off during power on or reset, supports programmable control.

9. Power indicator.

10. User LED.

3.3 Pinout Definition and Outline Dimensions

Understanding the pinout is crucial for connecting peripherals and integrating the board into your projects. The following image details the pin assignments and the physical dimensions of the board.
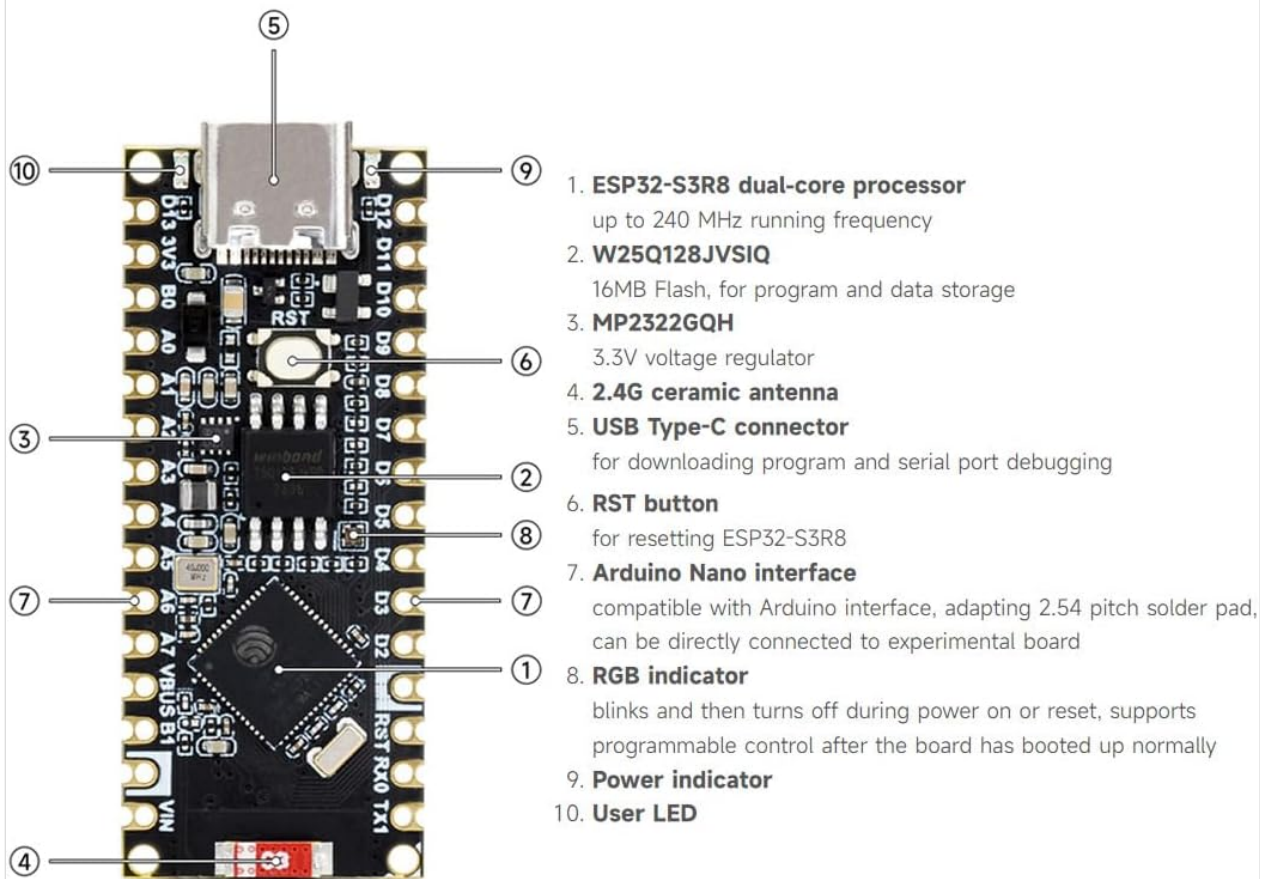
Image 3.2: Pinout definitions and outline dimensions (in mm) of the ESP32-S3-Nano-M board.

4. SPECIFICATIONS

Detailed technical specifications for the Waveshare ESP32-S3-Nano-M Development Board:

Feature	Specification
Microcontroller	ESP32-S3R8 (Dual-core 32-bit Xtensa LX7)
Clock Frequency	240 MHz
SRAM	512KB
ROM	384KB
PSRAM	8MB
Flash Memory	16MB
Wireless Communication	2.4GHz Wi-Fi + Bluetooth LE
Operating Voltage	3.3V
Power Input	6-21V
IO Pin Output Current	40mA
Digital Pins	14

Feature	Specification
Analog Pins	8
PWM Pins	5
UART	2
I2C	1
SPI	1
5V Power Output	1000mA Max
Dimensions	43.18 x 17.78 mm (approximate, refer to pinout diagram for exact details)
Weight	0.352 ounces

Version Options

ESP32-S3-Nano

ESP32-S3-Nano-M
with pre-soldered header (black)

Board Specifications

The **ESP32-S3-Nano** adopts **ESP32-S3R8** chip and is compatible with Arduino Nano ESP32. It is compact in size and powerful, suitable for applications such as IoT and MicroPython, and easy to integrate into your projects.

- Adopts ESP32-S3R8 chip with Xtensa® 32-bit LX7 dual-core processor, capable of running at 240 MHz
- Integrated 512KB SRAM, 384KB ROM, 8MB PSRAM, 16MB Flash memory
- Integrated 2.4GHz Wi-Fi and Bluetooth LE dual-mode wireless communication, with superior RF performance
- Supports seamlessly switching between Arduino and MicroPython programming, more flexible usage
- Compatible with Arduino IoT Cloud, allows monitoring and controlling your project from anywhere by using the Arduino IoT Cloud app
- Supports HID, emulating Human Interface Devices such as keyboards or mice via USB port for easier interaction with PC

Image 4.1: Comparison table highlighting key specifications of the ESP32-S3-Nano-M against other models.

5. SETUP

Follow these steps to set up your Waveshare ESP32-S3-Nano-M Development Board:

1. **Install Arduino IDE:** Download and install the latest version of the Arduino IDE from the official Arduino website (www.arduino.cc/en/software).

2. **Add ESP32 Board Support:**

   - Open Arduino IDE, go to *File > Preferences*.
   - In the 'Additional Boards Manager URLs' field, add the ESP32 board manager URL (typically https://raw.githubusercontent.com/espressif/arduino-esp32/gh-pages/package_esp32_index.json).
   - Go to *Tools > Board > Boards Manager...*. Search for 'ESP32' and install the 'esp32 by Espressif Systems' package.

3. **Select Board:** After installation, go to *Tools > Board > ESP32 Arduino* and select the appropriate board for ESP32-S3 (e.g., 'ESP32S3 Dev Module' or similar, depending on the installed package version).

4. **Connect the Board:** Connect the ESP32-S3-Nano-M to your computer using a USB Type-C cable.

5. **Select Port:** In the Arduino IDE, go to *Tools > Port* and select the serial port corresponding to your connected ESP32 board.

6. **Install Drivers (if necessary):** On some operating systems, you may need to install USB-to-serial drivers (e.g., CP210x or CH340/CH341) if the board is not recognized.

6. OPERATING INSTRUCTIONS

Once the board is set up, you can begin programming and operating it:

1. **Programming with Arduino IDE:**

   - Open an example sketch (*File > Examples*) or write your own code.
   - Click the 'Verify' button (checkmark icon) to compile your code.
   - Click the 'Upload' button (right arrow icon) to upload the compiled code to your ESP32-S3-Nano-M board. Ensure the correct board and port are selected.
   - Monitor serial output using the Serial Monitor (*Tools > Serial Monitor*) to debug or view program output.

2. **Programming with MicroPython:**

   - Install esptool.py: pip install esptool.
   - Erase flash: esptool.py --chip esp32s3 erase_flash.
   - Download the latest MicroPython firmware for ESP32-S3 from the official MicroPython website (micropython.org/download/esp32s3/).
   - Flash firmware: esptool.py --chip esp32s3 --port [YOUR_PORT] write_flash -z 0x0 [FIRMWARE_FILE.bin]. Replace [YOUR_PORT] with your board's serial port and [FIRMWARE_FILE.bin] with the downloaded firmware file.
   - Use a tool like Thonny IDE to connect to the board and write/upload MicroPython scripts.

3. **Using Arduino IoT Cloud:**

   - Create an account on the Arduino IoT Cloud website (create.arduino.cc/iot/).
   - Follow the on-screen instructions to register your ESP32-S3-Nano-M board as a new device.
   - Develop dashboards and integrate your board with cloud services for remote monitoring and control.

7. Troubleshooting

If you encounter issues with your ESP32-S3-Nano-M board, consider the following troubleshooting steps:

- **Board Not Detected:** Ensure the USB Type-C cable is fully inserted and functional. Try a different USB port or cable. Verify that the necessary USB-to-serial drivers are installed on your computer.
- **Upload Errors:** Check that the correct board type and serial port are selected in the Arduino IDE. Sometimes, pressing and holding the 'BOOT' button while pressing 'RST' (then releasing 'RST' and then 'BOOT') can put the ESP32 into bootloader mode for successful flashing.
- **Code Not Running:** After uploading, press the 'RST' button on the board to restart the program. Check your code for logical errors using the Serial Monitor.
- **Wi-Fi/Bluetooth Connectivity Issues:** Ensure your network credentials are correct in your code. Check for interference from other 2.4GHz devices. Verify antenna integrity.
- **Power Issues:** Ensure the power supply is within the specified 6-21V range. If using external power, ensure connections are secure and polarity is correct.

8. Warranty and Support

Waveshare products are designed for reliability and performance. For specific warranty information, please refer to the documentation provided with your purchase or visit the official Waveshare website. For technical support, resources, and community forums, please visit the Waveshare support page or contact their customer service directly.

Always ensure you are using the latest software and firmware versions for optimal performance and security updates.