waveshare ESP32-S3-Nano

Waveshare ESP32-S3-Nano Development Board User Manual

Model: ESP32-S3-Nano

1. Introduction

The Waveshare ESP32-S3-Nano Development Board is a compact and powerful microcontroller board designed for Internet of Things (IoT) and embedded applications. It integrates the ESP32-S3R8 chip, offering robust Wi-Fi and Bluetooth LE connectivity, making it suitable for a wide range of projects. This manual provides essential information for setting up, operating, and maintaining your development board.

2. Package Contents

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

- ESP32-S3-Nano Development Board x1
- 40PIN male pinheader (black) x2

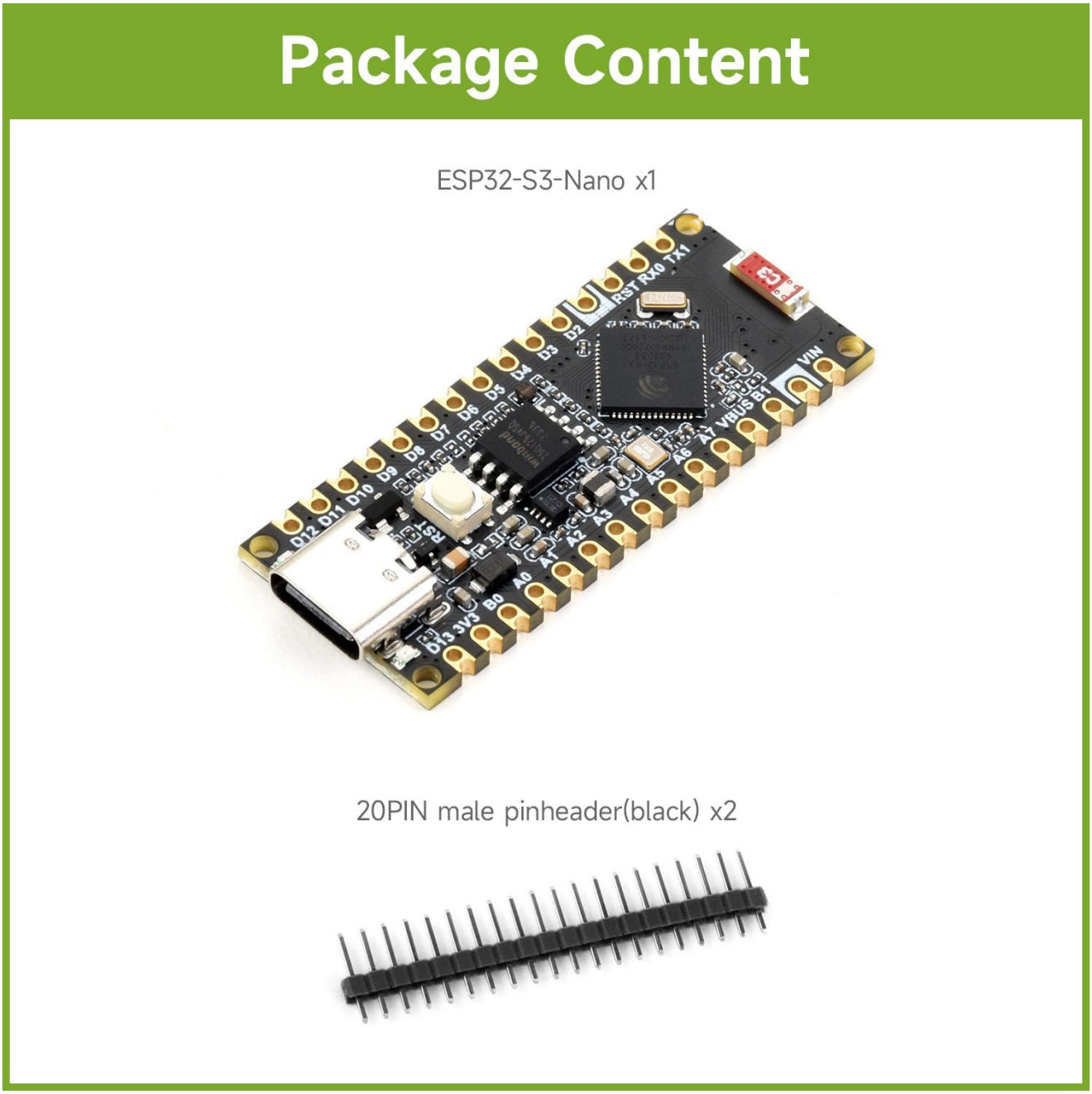

Image: Waveshare ESP32-S3-Nano Development Board and two 40-pin male pin headers, as included in the package.

3. Product 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 options.
- Compatible with Arduino IoT Cloud, allowing remote monitoring and control of your projects via the Arduino IoT Cloud app.
- Supports Human Interface Device (HID) emulation, enabling the board to act as a keyboard or mouse via its USB port for easier PC interaction.

4. Product Overview

4.1 What's On 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: Detailed diagram of the ESP32-S3-Nano board with key components labeled, including the ESP32-S3R8 processor, USB Type-C connector, voltage regulator, ceramic antenna, and various indicators.

4.2 Pinout Definition

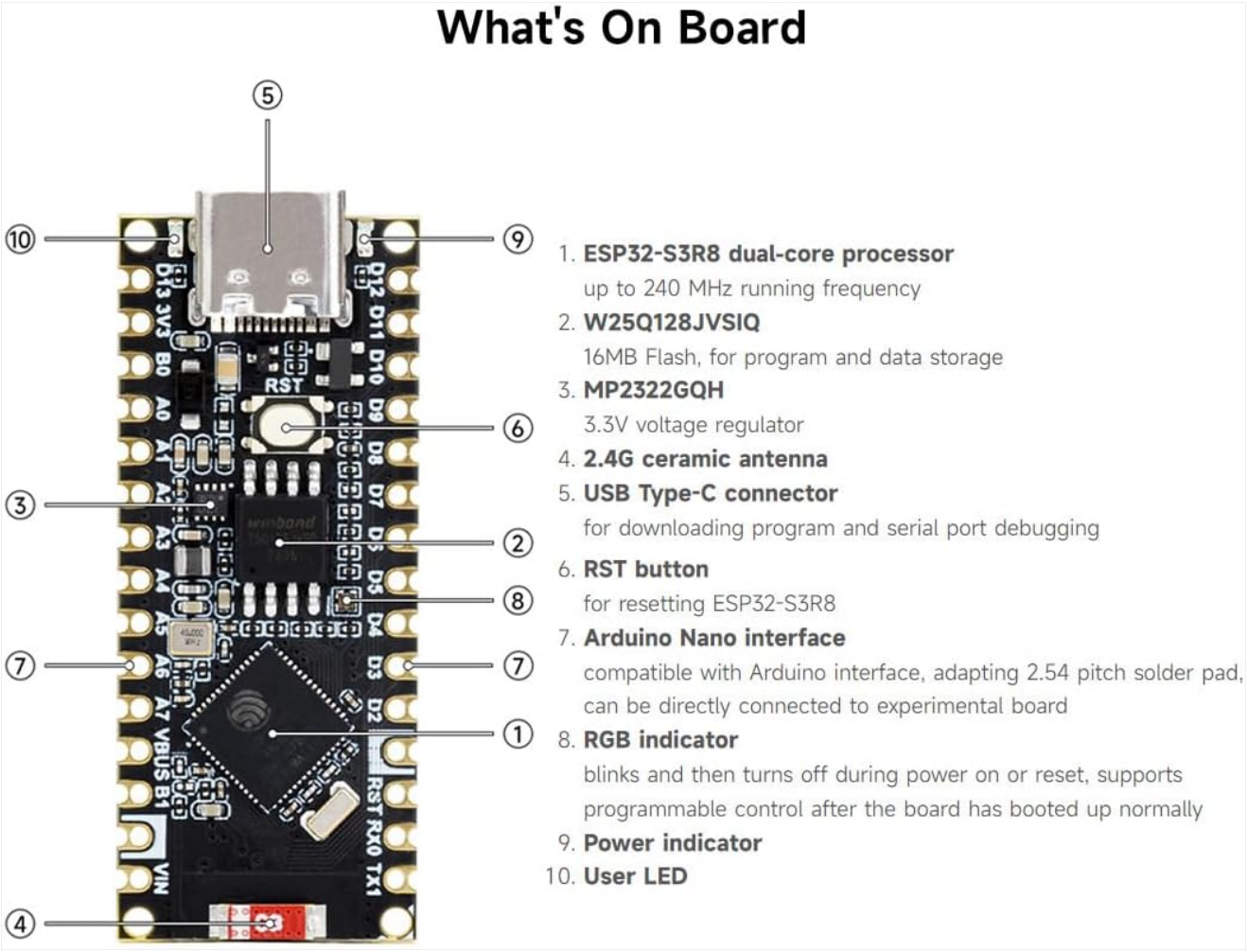

Image: Comprehensive pinout diagram for the ESP32-S3-Nano, illustrating the function of each pin, including GPIOs, power pins, and communication interfaces like SPI and I2C.

4.3 Outline Dimensions

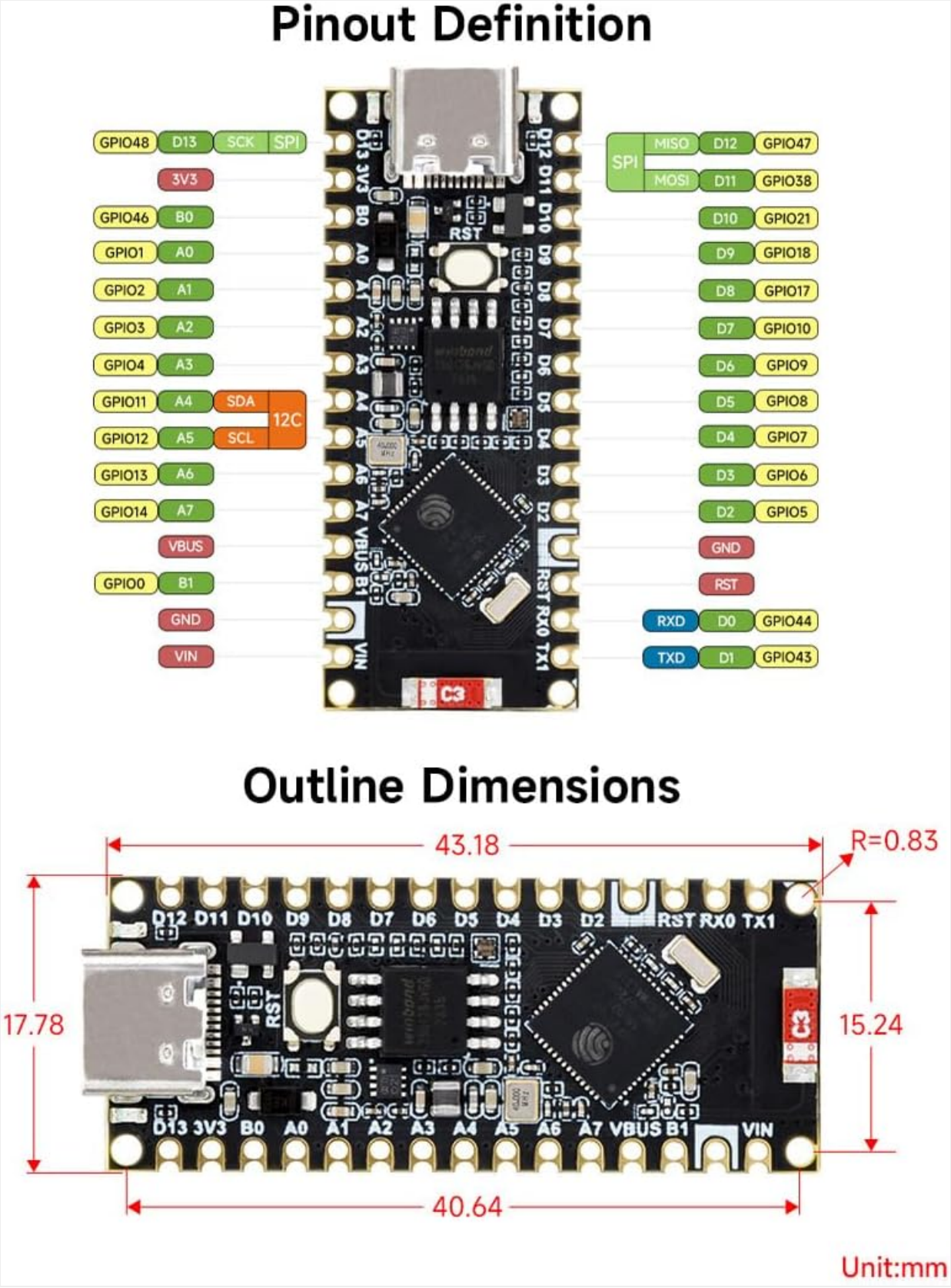

Image: Technical drawing showing the outline dimensions of the ESP32-S3-Nano Development Board in millimeters, highlighting its compact form factor.

5. Specifications

Feature	Detail
Processor	Xtensa 32-bit LX7 dual-core (ESP32-S3R8)
CPU Speed	Up to 240 MHz

Feature	Detail
RAM	512KB SRAM, 8MB PSRAM
Flash Memory	16MB
Wireless Type	2.4GHz Wi-Fi, Bluetooth LE
Operating System Support	MicroPython, Arduino
Item Weight	0.704 ounces
Package Dimensions	3.19 x 2.76 x 1.18 inches
Digital Pins	14
Analog Pins	8
I2C	1
SPI	1
UART	2
5V Power Output	1000mA Max

6. Setup

To begin using your Waveshare ESP32-S3-Nano Development Board, follow these general setup steps:

1. **Install Arduino IDE or MicroPython:** Download and install the latest version of the Arduino IDE or set up your MicroPython development environment.
2. **Install ESP32 Board Package:** For Arduino IDE, open Preferences, add the ESP32 board manager URL, then go to Tools > Board > Board Manager and install the ESP32 boards. Ensure you select the correct board (e.g., "Arduino Nano ESP32" or a compatible ESP32-S3 board).
3. **Solder Pin Headers:** If your board came without pre-soldered headers, carefully solder the included 40PIN male pin headers to the board. This allows for easy use with breadboards or custom PCBs.
4. **Connect the Board:** Connect the ESP32-S3-Nano to your computer using a USB-C cable.
5. **Select Port and Board:** In your IDE, select the correct serial port and the appropriate board model from the Tools menu.
6. **Upload a Test Sketch:** Upload a simple test sketch, such as the "Blink" example, to verify that the board is correctly recognized and programmable.

7. Operating

Once set up, you can operate the Waveshare ESP32-S3-Nano for various applications:

- **Programming:** Write your code in Arduino C++ or MicroPython. Utilize the extensive libraries available for ESP32 to access Wi-Fi, Bluetooth, GPIOs, and other peripherals.
- **Power Supply:** The board can be powered via the USB-C port or through the VIN pin (typically 5V). Ensure your power source provides stable voltage and sufficient current.
- **Communication:** Use the USB-C port for serial communication with your computer for debugging and data transfer. The board also supports Wi-Fi and Bluetooth LE for wireless communication.
- **IoT Cloud Integration:** Leverage its compatibility with Arduino IoT Cloud to connect your projects to the internet for remote control and data logging.

8. Maintenance

Proper care ensures the longevity and reliable performance of your development board:

- **Handling:** Always handle the board by its edges to avoid touching components, especially the sensitive ESP32 module.
- **Storage:** Store the board in an anti-static bag or container when not in use to protect it from electrostatic discharge and dust.
- **Cleaning:** If necessary, gently clean the board with a soft, dry brush or compressed air. Avoid using liquids or abrasive materials.
- **Power Safety:** Disconnect power before making any physical changes to the wiring or components connected to the board.

9. Troubleshooting

If you encounter issues, consider the following troubleshooting steps:

- **Board Not Detected:**
  - Ensure the USB-C cable is fully connected and functional.
  - Check if the correct USB driver is installed on your computer.
  - Verify that the correct serial port is selected in your IDE.
- **Upload Errors:**
  - Confirm that the correct board type (e.g., "Arduino Nano ESP32" or a generic ESP32-S3 Dev Module) is selected in your IDE.
  - Press and hold the BOOT button, then press and release the RST button, then release the BOOT button to enter bootloader mode if uploads fail.
  - Check for syntax errors in your code.
- **Wi-Fi/Bluetooth Connectivity Issues:**
  - Ensure your Wi-Fi credentials (SSID, password) are correct.
  - Check the signal strength and proximity to your Wi-Fi router or Bluetooth device.
  - Verify that the antenna is properly connected (if applicable).
- **Power Issues:**
  - Ensure your power supply meets the board's voltage and current requirements.
  - Avoid short circuits on the board or connected components.

10. Warranty and Support

For warranty information, technical support, or further assistance, please refer to the official Waveshare website or contact their customer service. Keep your purchase receipt for warranty claims.