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> [waveshare ESP32-S3 3.5-inch Capacitive Touch Display Development Board User Manual](#)

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waveshare ESP32-S3 3.5-inch Capacitive Touch Display Development Board User Manual

1. INTRODUCTION

This manual provides essential information for setting up, operating, and maintaining your waveshare ESP32-S3 3.5-inch Capacitive Touch Display Development Board. Please read these instructions carefully to ensure proper use and to maximize the functionality of your device.

The ESP32-S3-Touch-LCD-3.5 is a versatile development board featuring an ESP32-S3R8 Xtensa 32-bit LX7 dual-core processor, a 3.5-inch 320x480 pixel IPS capacitive touch display, and integrated Wi-Fi and Bluetooth 5 (LE) connectivity. It is designed for various smart device development applications, including human-machine interaction, data recording, and media playback.

2. KEY FEATURES

- **Processor:** Equipped with ESP32-S3R8 Xtensa 32-bit LX7 dual-core processor, up to 240MHz main frequency.
- **Wireless Connectivity:** Supports 2.4GHz Wi-Fi (802.11 b/g/n) and Bluetooth 5 (LE) with an onboard antenna.
- **Memory:** Built-in 512KB SRAM and 384KB ROM, with onboard 8MB PSRAM and an external 16MB Flash memory.
- **Display:** 3.5-inch capacitive touch display with 320 × 480 resolution and 262K colors. Features an IPS panel for wide viewing angles.
- **Display & Touch Drivers:** Built-in ST7796 display driver (SPI communication) and FT6336 capacitive touch chip (I2C communication).
- **Sensors:** Onboard QMI8658 6-axis IMU (3-axis accelerometer and 3-axis gyroscope) for motion detection.
- **Real-Time Clock (RTC):** Onboard PCF85063 RTC chip, powered by main Lithium battery via AXP2101, with a reserved RTC battery header for backup.
- **Power Management:** Adopts AXP2101 IC for efficient power management, supporting multiple voltage outputs, battery charging, and optimization.
- **Connectivity:** Type-C connector, I2C, UART, USB, and multiple GPIO pins for peripherals and debugging.
- **Storage:** Onboard TF card slot for extended storage and data transfer.
- **Camera Interface:** Compatible with mainstream cameras such as OV2640 and OV5640.
- **Audio:** Integrated audio input and output, enabling AI interaction and offline voice control.
- **Programmable Buttons:** Onboard PWR and BOOT buttons for custom function development.

ESP32-S3-Touch-LCD-3.5

Integrated Audio Input And Output, Enabling AI Interaction And Offline Voice Control

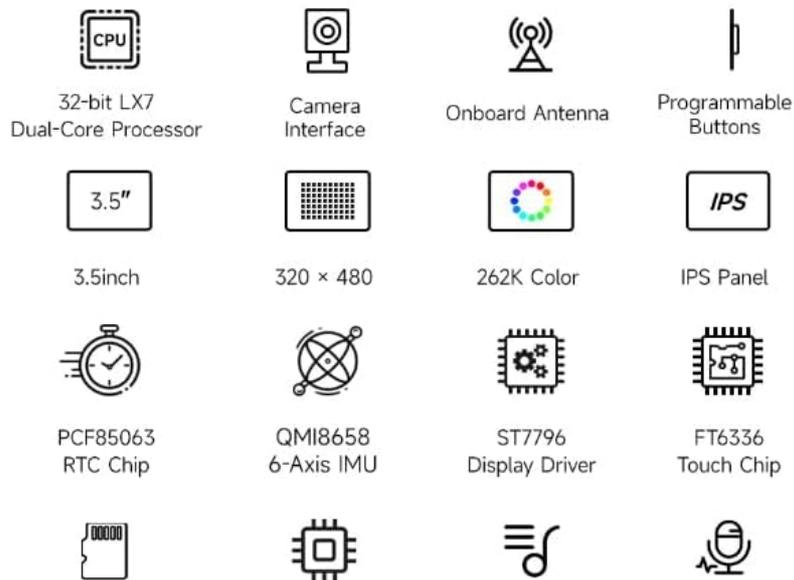


Figure 2.1: Overview of the waveshare ESP32-S3 3.5-inch Capacitive Touch Display Development Board, highlighting its integrated audio, Wi-Fi, and BLE 5 capabilities.

Onboard Audio Codec

Supports High-Quality Audio Processing, Providing Clear And High-Quality Audio Input And Output

 Audio Playback

 Audio Input

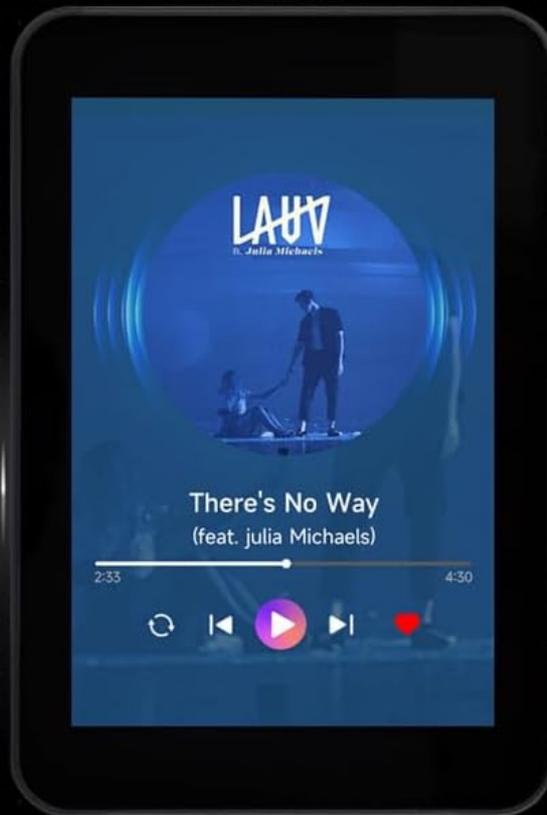


Figure 2.2: The development board supports 2.4GHz Wi-Fi (802.11 Ax/B/G/N) and Bluetooth 5 (LE) for robust wireless communication.

IPS Display Panel

Excellent Display Performance, 262K Color, Wide Viewing Angle



Supports ESP-IDF, Arduino IDE

Comprehensive SDK, Dev Resources, Tutorials To Help You Easily Get Started



ESP-IDF

With free open source development tools, supports IDEs such as VSCode and Eclipse easier for developers to use.



Arduino IDE

Arduino IDE is an open source electronic prototyping platform, convenient and flexible, easy to get started.

Figure 2.3: The IPS display panel offers excellent display performance with 262K colors and a wide viewing angle of 178 degrees.

3. SETUP INSTRUCTIONS

3.1 Power Connection

1. Connect the development board to a power source using the Type-C USB connector. This port also facilitates data communication and programming.
2. If using a Lithium battery, connect it to the onboard 3.7V MX1.25 Lithium battery recharge/discharge header. The AXP2101 IC manages battery charging and power.
3. For RTC backup, a dedicated RTC battery header is available for connecting a backup battery.

3.2 Software Environment

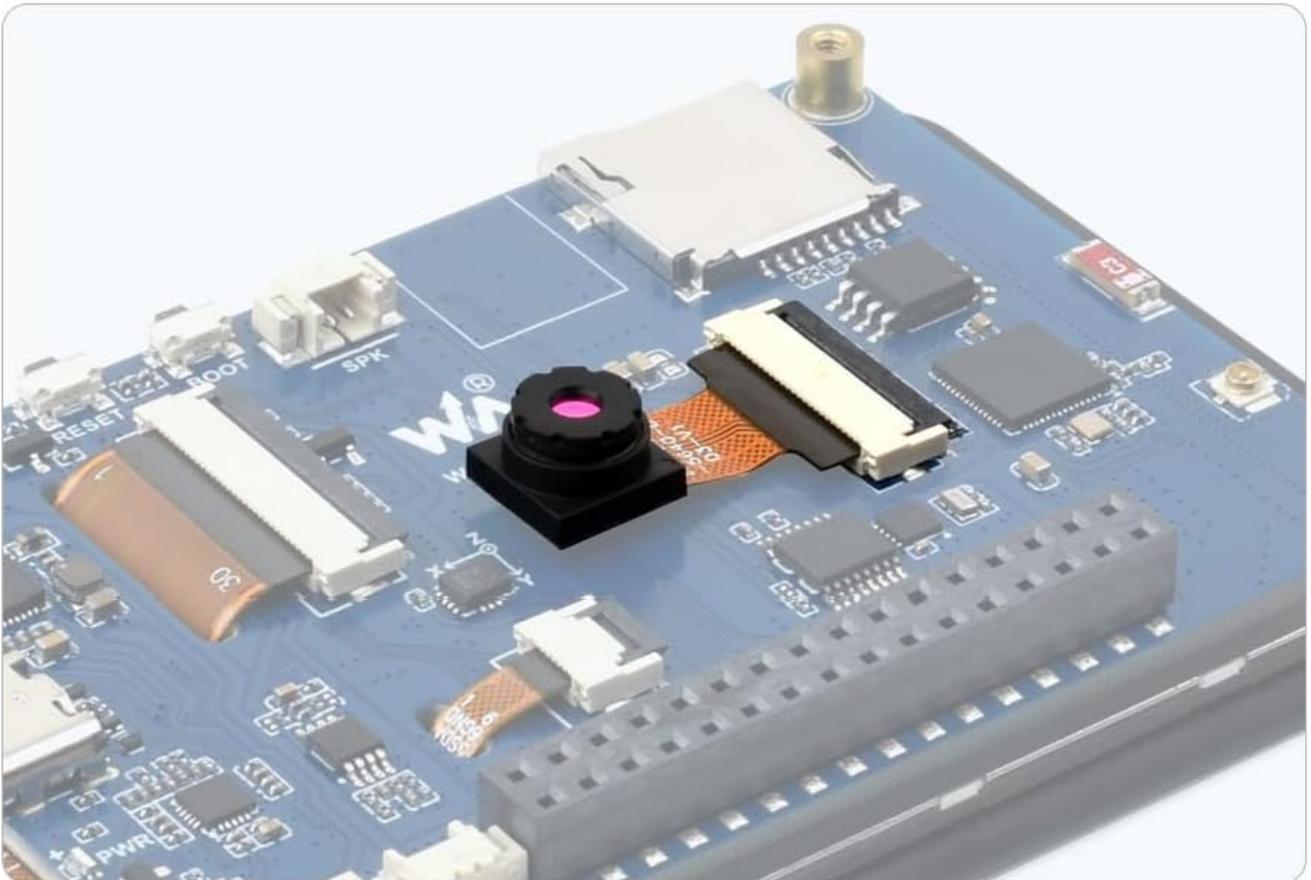
The ESP32-S3-Touch-LCD-3.5 supports popular development environments:

- **ESP-IDF:** Espressif IoT Development Framework, a comprehensive SDK for ESP32 series.
- **Arduino IDE:** An open-source electronic prototyping platform, convenient for beginners and experienced developers.

Refer to the official waveshare development resources for detailed guides on setting up these environments and getting started with programming examples.

Supports OV2640 / OV5640 And Other Mainstream Cameras

Optional For OV5640 5MP Camera Module, Suitable For Image Capture, Video Monitoring And
Other Applications To Meet Different Needs



* The OV5640 5MP camera module is only included in the ESP32-S3-Touch-LCD-3.5-C version.

Figure 3.1: The board supports both ESP-IDF and Arduino IDE, offering comprehensive SDKs and tutorials for easy development.

4. OPERATING INSTRUCTIONS

4.1 Basic Operation

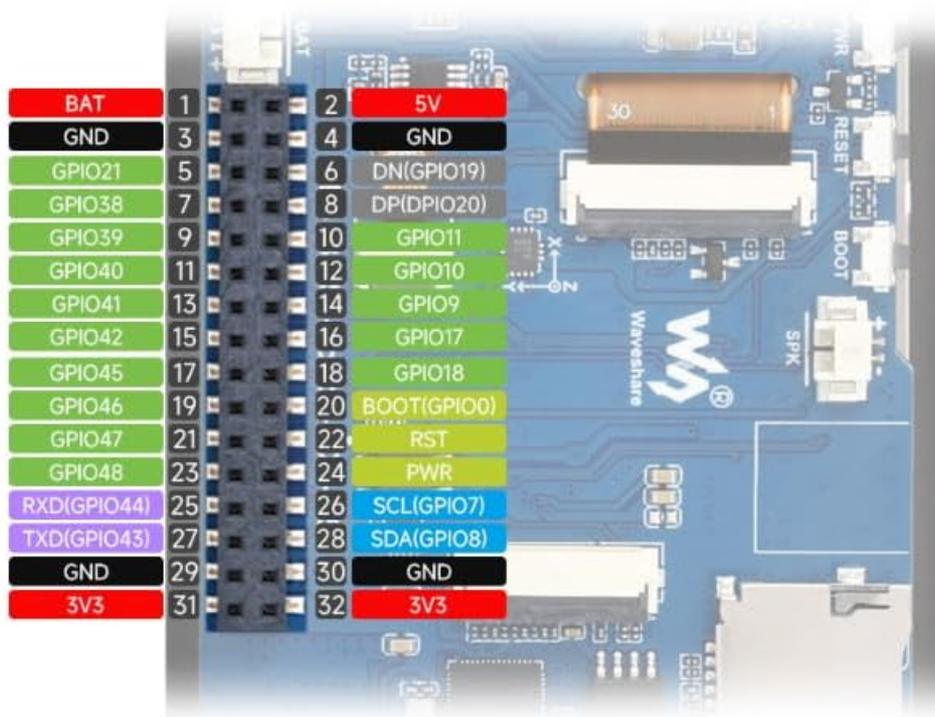
- **Power On/Off:** Connect the Type-C USB cable to power the board. The PWR button can be programmed for specific power control functions.
- **Capacitive Touch Display:** Interact with the 3.5-inch display using touch gestures. The FT6336 chip handles touch input.
- **Programmable Buttons:** The PWR and BOOT buttons can be configured for various functions within your application. The BOOT button is typically used for entering download mode during firmware flashing.

Capacitive Touch

Suitable For Various Smart Device Development, Enabling Human-Machine Interaction



Pin Definition



■ Power ■ Ground ■ GPIO ■ UART ■ I2C ■ KEY ■ USB

Figure 4.1: The capacitive touch display allows for intuitive human-machine interaction, suitable for various smart device applications.

4.2 Advanced Functionality

- **AI Interaction & Voice Control:** Utilize the integrated audio input and output for AI speech interaction and offline voice control applications.
- **Camera Integration:** Connect compatible cameras (e.g., OV2640, OV5640) to the onboard camera interface for image capture and video monitoring.
- **External Peripherals:** Use the I2C, UART, USB, and GPIO pins to connect and control various external sensors, actuators, and modules.
- **Data Storage:** Insert a TF card into the dedicated slot for extended storage, data logging, and media playback.

5. PIN DEFINITION

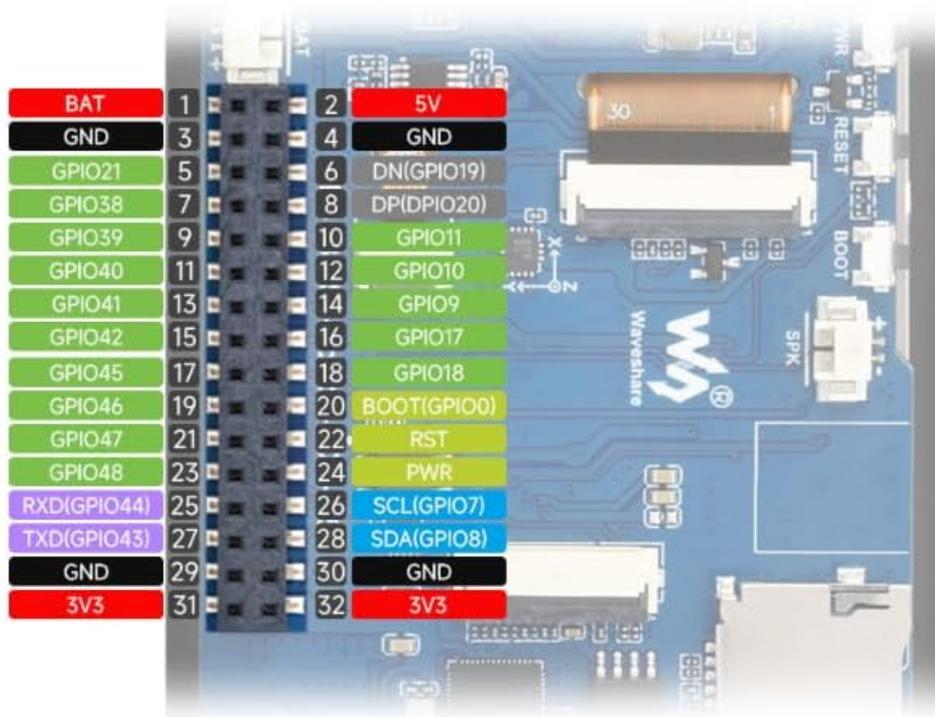
The development board provides a comprehensive set of GPIO pins and interfaces. Refer to the diagram below for the pinout and their functions.

Capacitive Touch

Suitable For Various Smart Device Development, Enabling Human-Machine Interaction



Pin Definition



■ Power ■ Ground ■ GPIO ■ UART ■ I2C ■ KEY ■ USB

Figure 5.1: Detailed pin definition diagram for the ESP32-S3-Touch-LCD-3.5 board, showing power, ground, GPIO, UART, I2C, KEY, and USB pins.

For specific pin assignments and their alternative functions, consult the official ESP32-S3 datasheet and waveshare

development resources.

6. ONBOARD COMPONENTS

The board integrates various components to enhance its functionality. The following diagram illustrates the layout and identification of these components.

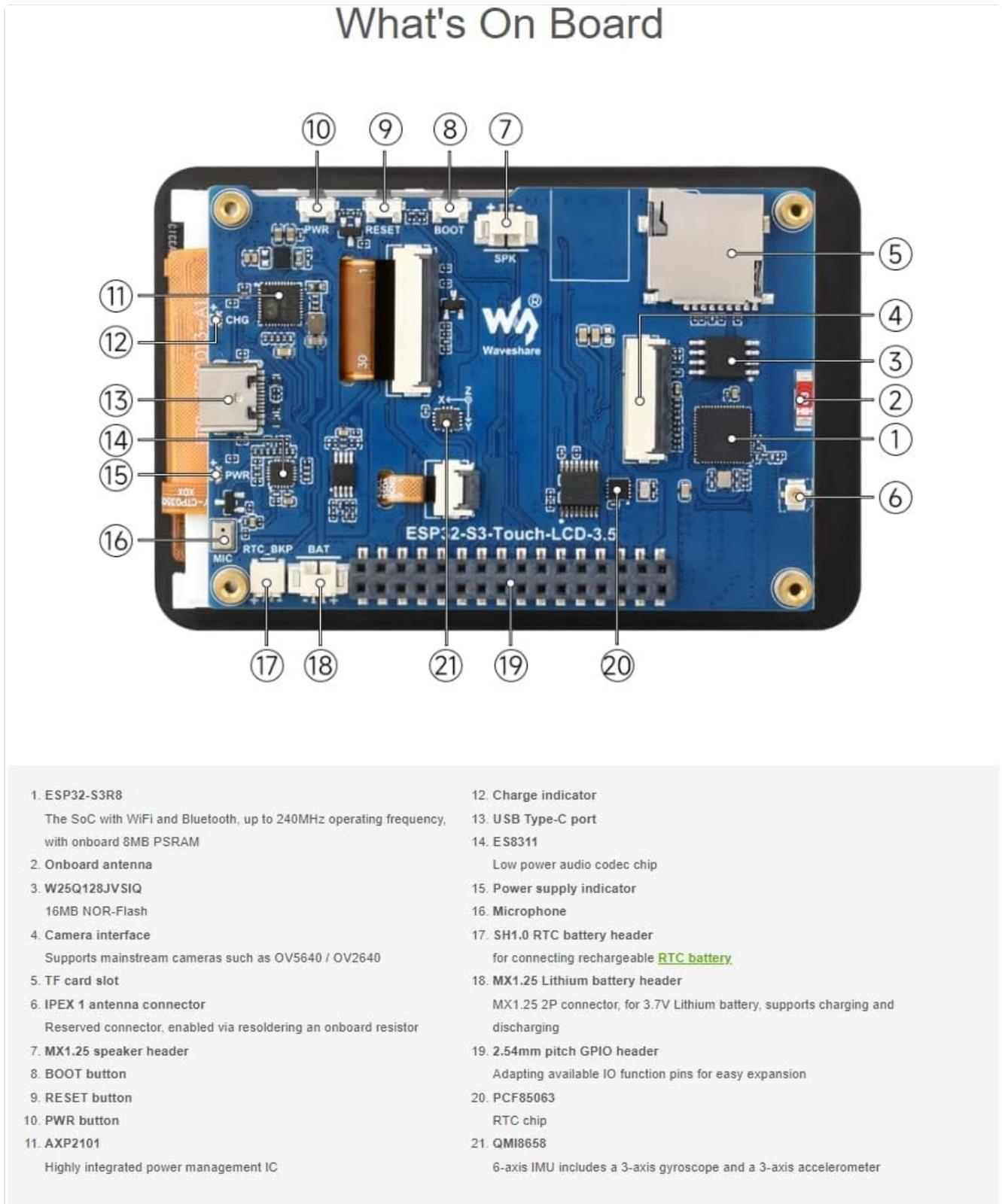


Figure 6.1: Diagram showing the various onboard components of the ESP32-S3-Touch-LCD-3.5, with numbered labels for identification.

1. ESP32-S3R8: The SoC with Wi-Fi and Bluetooth, up to 240MHz operating frequency, with onboard 8MB PSRAM.

2. Onboard antenna.
3. W25Q128JVSJQ: 16MB NOR-Flash.
4. Camera interface: Supports mainstream cameras such as OV5640 / OV2640.
5. TF card slot.
6. IPEX 1 antenna connector: Reserved connector, enabled via resoldering an onboard resistor.
7. MX1.25 speaker header.
8. RESET button.
9. PWR button.
10. AXP2101: Highly integrated power management IC.
11. Charge indicator.
12. USB Type-C port.
13. ES8311: Low power audio codec chip.
14. Power supply indicator.
15. Microphone.
16. SM1.0 RTC battery header: For connecting rechargeable RTC battery.
17. MX1.25 Lithium battery header: MX1.25 2P connector, for 3.7V Lithium battery, supports charging and discharging.
18. 2.54mm pitch GPIO header: Adapting available IO function pins for easy expansion.
19. PCF85063: RTC chip.
20. QMI8658: 6-axis IMU includes a 3-axis gyroscope and a 3-axis accelerometer.

7. CAMERA SUPPORT

The ESP32-S3-Touch-LCD-3.5 development board includes a camera interface compatible with mainstream camera modules such as OV2640 and OV5640. This allows for integration into applications requiring image capture, video monitoring, and other vision-based functionalities.

Wi-Fi And BLE 5 Support

ESP32-S3 Integrates 2.4 GHz Wi-Fi (802.11 Ax/B/G/N) With 40 MHz Of Bandwidth Support, Its Bluetooth Low Energy Subsystem Supports Bluetooth 5 (LE) And Bluetooth Mesh



Figure 7.1: The board's camera interface supports modules like the OV5640 5MP camera, suitable for image capture and video monitoring applications.

Note: The OV5640 5MP camera module is typically included only in the ESP32-S3-Touch-LCD-3.5-C version. Please check your product package for included accessories.

8. OUTLINE DIMENSIONS

The physical dimensions of the ESP32-S3-Touch-LCD-3.5 board are provided below for integration into custom enclosures or projects.

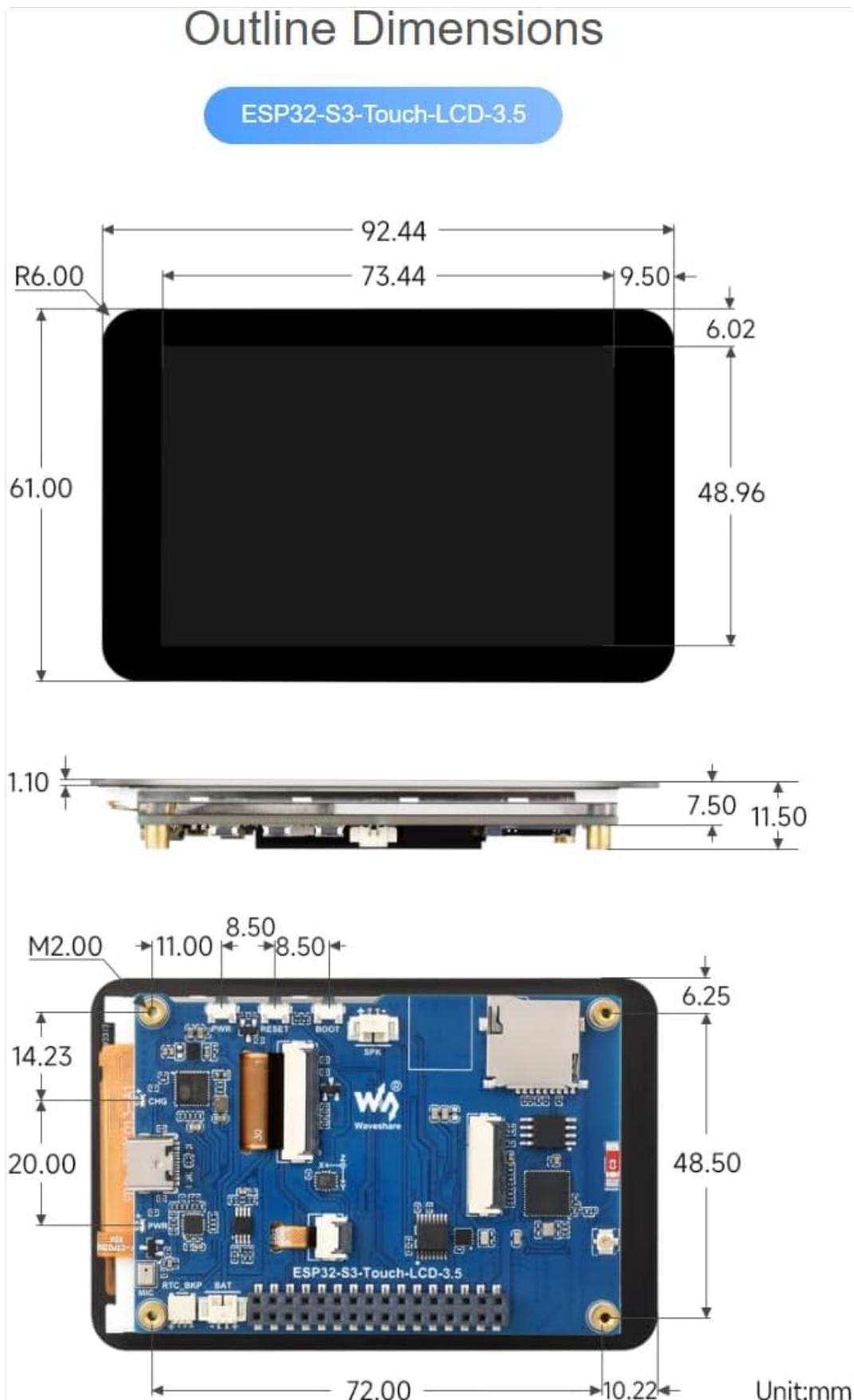


Figure 8.1: Detailed outline dimensions of the ESP32-S3-Touch-LCD-3.5 development board in millimeters.

9. SPECIFICATIONS

Feature	Detail
Processor	ESP32-S3R8 Xtensa 32-bit LX7 dual-core, up to 240MHz

Feature	Detail
Wireless Connectivity	2.4GHz Wi-Fi (802.11 b/g/n), Bluetooth 5 (LE)
Onboard Memory	512KB SRAM, 384KB ROM, 8MB PSRAM
External Flash	16MB Flash memory
Display Size	3.5 inches
Display Resolution	320 × 480 pixels
Display Type	IPS, 262K color
Touch Type	Capacitive
IMU	QMI8658 6-axis (3-axis accelerometer, 3-axis gyroscope)
RTC Chip	PCF85063
Power Management IC	AXP2101
USB Connector	Type-C
Storage Expansion	TF card slot
Camera Interface	Compatible with OV2640, OV5640
Package Dimensions	4 x 3 x 0.5 inches
Item Weight	2.46 ounces
Item Model Number	ESP32-S3 3.5inch Touch Scrrren
Date First Available	May 18, 2025

10. MAINTENANCE

- **Cleaning:** Use a soft, dry cloth to clean the display and board. Avoid using harsh chemicals or abrasive materials.
- **Handling:** Handle the board by its edges to avoid touching sensitive components. Static electricity can damage electronic components, so use anti-static precautions if possible.
- **Storage:** Store the board in a dry, cool environment, away from direct sunlight and extreme temperatures.
- **Battery Care:** If using a Lithium battery, follow standard battery safety guidelines. Avoid overcharging or deep discharging.

11. TROUBLESHOOTING

- **Board Not Powering On:** Ensure the Type-C USB cable is securely connected to a working power source. If using a battery, check its charge level and connection.
- **Display Not Working:** Verify power supply. Check for any loose connections to the display. Ensure your software is correctly initializing the ST7796 display driver.
- **Touch Not Responding:** Confirm that the FT6336 touch chip is correctly initialized in your software and that the I2C communication is functioning.
- **Wi-Fi/Bluetooth Issues:** Check antenna connection. Ensure your software configuration for Wi-Fi or Bluetooth

is correct, including SSID, password, and mode.

- **Programming Errors:** Double-check your code for syntax errors and logical flaws. Ensure the correct board and port are selected in your IDE. Try using the BOOT button to enter download mode if flashing fails.

For more detailed troubleshooting steps and common issues, refer to the waveshare development resources and community forums.

12. SUPPORT

waveshare provides comprehensive development resources, including documentation, code examples, and tutorials, to assist you with your projects. If you encounter any problems or require further assistance, please contact waveshare customer support.

You can find additional information and resources on the official waveshare website or through their Amazon store page: [Visit the waveshare Store](#)