waveshare ESP32-S3-1.47inch-LCD-B

Waveshare ESP32-S3-LCD-1.47B Development Board User Manual

Detailed instructions for the ESP32-S3-LCD-1.47B microcontroller development board, designed for HMI applications.

1. Product Overview

The Waveshare ESP32-S3-LCD-1.47B is a microcontroller development board featuring a 1.47-inch IPS LCD display. It integrates a high-performance Xtensa 32-bit LX7 dual-core processor, supporting 2.4GHz Wi-Fi and Bluetooth BLE 5. This board is equipped with onboard Flash and PSRAM, a TF card slot, a 6-axis IMU, and an RGB LED, making it suitable for rapid development of Human-Machine Interface (HMI) applications.

Image 1.1: The ESP32-S3-LCD-1.47B Development Board with its 1.47-inch LCD and included pin headers.

Key Features:

- **Processor:** High-performance Xtensa 32-bit LX7 dual-core, up to 240MHz.
- **Wireless Connectivity:** 2.4GHz Wi-Fi (802.11 b/g/n) and Bluetooth 5 (LE) with onboard antenna.
- **Memory:** Built-in 512KB S-R-A-M, 384KB ROM, onboard 16MB Flash, and 8MB PSRAM.
- **Display:** 1.47-inch IPS LCD, 172×320 resolution, 262K color, supports GUI programs like LVGL.
- **Sensors:** Onboard QMI8658 6-axis IMU (3-axis accelerometer and 3-axis gyroscope).
- **Storage:** Onboard TF card slot for external storage.
- **Power Management:** Battery charging management module, supports Lithium battery power via GPIO header.
- **User Interface:** Built-in RGB LED with clear acrylic panel for customizable lighting effects.
- **Interfaces:** Multiple IO interfaces, full-speed USB standard.

2. Setup Guide

This section outlines the initial steps to get your ESP32-S3-LCD-1.47B Development Board operational.

2.1 Package Contents

Verify that all components are present in your package:

- ESP32-S3-LCD-1.47B Development Board × 1
- Black header × 2

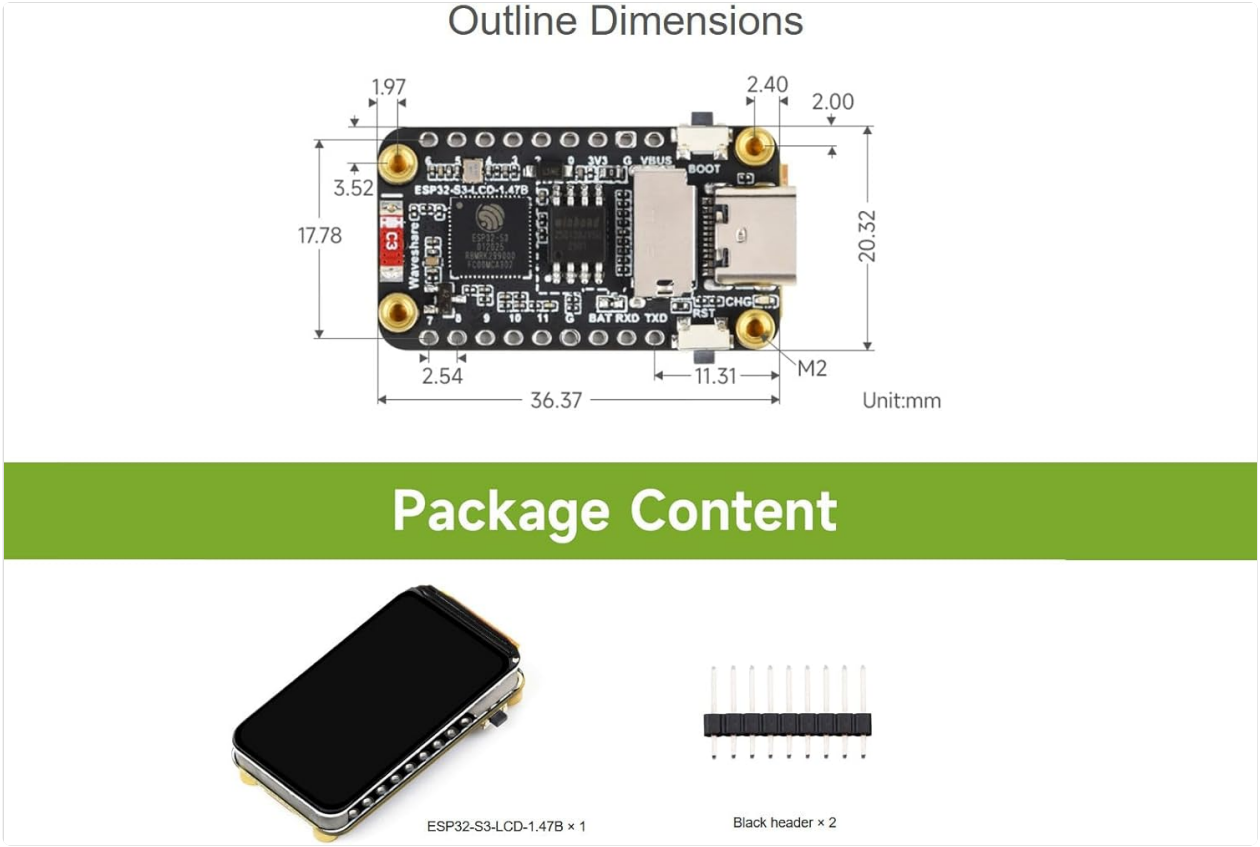

Image 2.1: The standard package contents for the development board.

2.2 Powering the Board

The board can be powered via the USB Type-C interface or a Lithium battery.

- **USB Power:** Connect a USB Type-C cable to the board's USB port and to a power source (e.g., computer USB port, USB wall adapter). This also enables communication for firmware downloading.
- **Lithium Battery:** The board includes a battery charging management module. A Lithium battery can be connected to the dedicated battery interface located at the GPIO header for portable power. Ensure correct polarity when connecting the battery.

2.3 Initial Connection

For development, connect the board to your computer using a USB Type-C cable. This connection facilitates power, data transfer, and firmware flashing.

3. Operating Instructions

This section details the various functionalities and how to utilize them.

3.1 Wireless Communication (Wi-Fi and BLE 5)

The ESP32-S3 chip supports 2.4GHz Wi-Fi (802.11 b/g/n) and Bluetooth 5 (LE). The onboard antenna provides reliable wireless connectivity. Developers can use the ESP-IDF framework or other compatible SDKs to implement Wi-Fi and Bluetooth functionalities for network communication, data transfer, and device control.

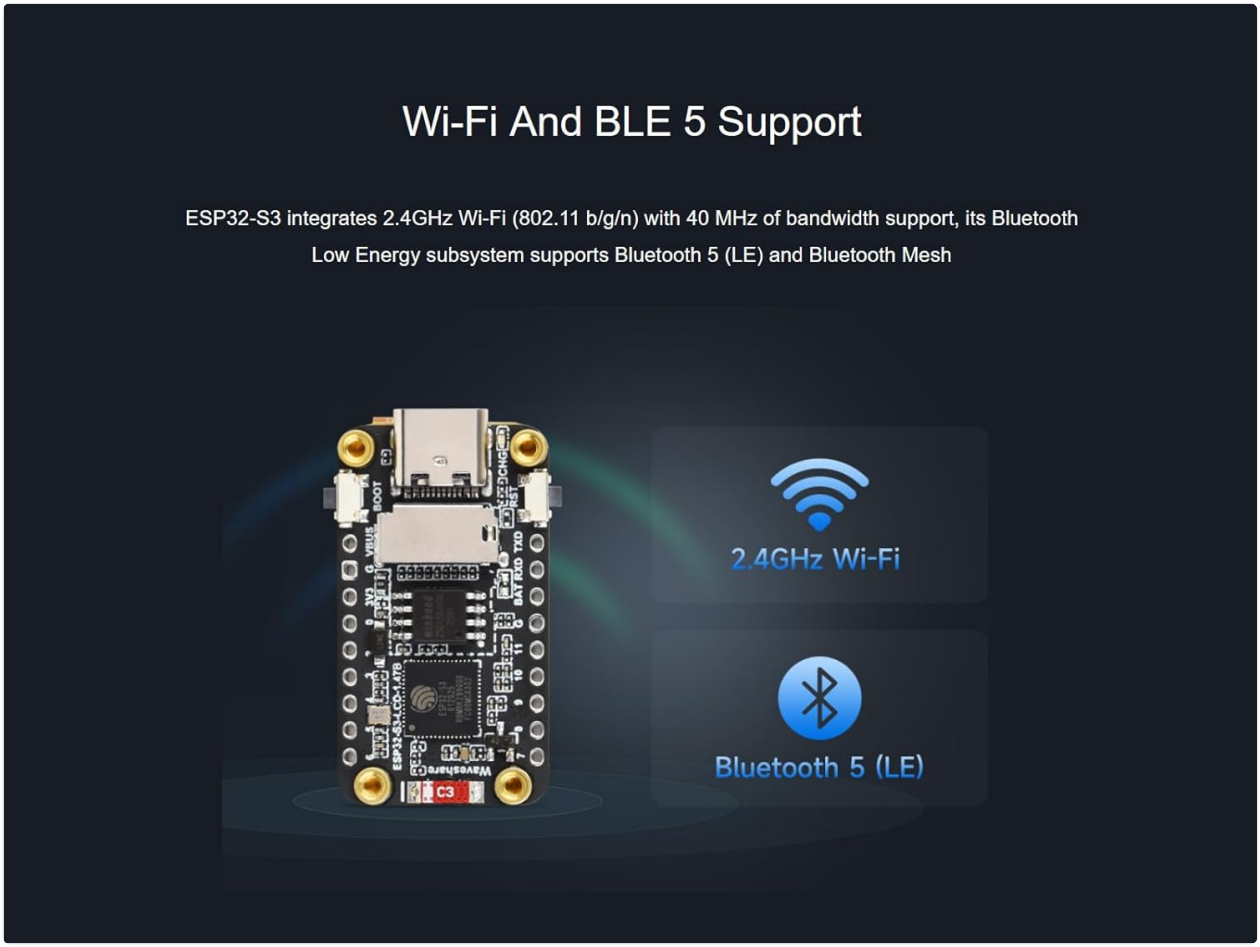

Image 3.1: The board's support for 2.4GHz Wi-Fi and Bluetooth 5 (LE).

3.2 LCD Display Operation

The 1.47-inch IPS LCD with 172×320 resolution and 262K colors is ideal for HMI applications. It can smoothly run GUI programs, including those developed with LVGL (Light and Versatile Graphics Library). The display interface is 3-wire SPI.

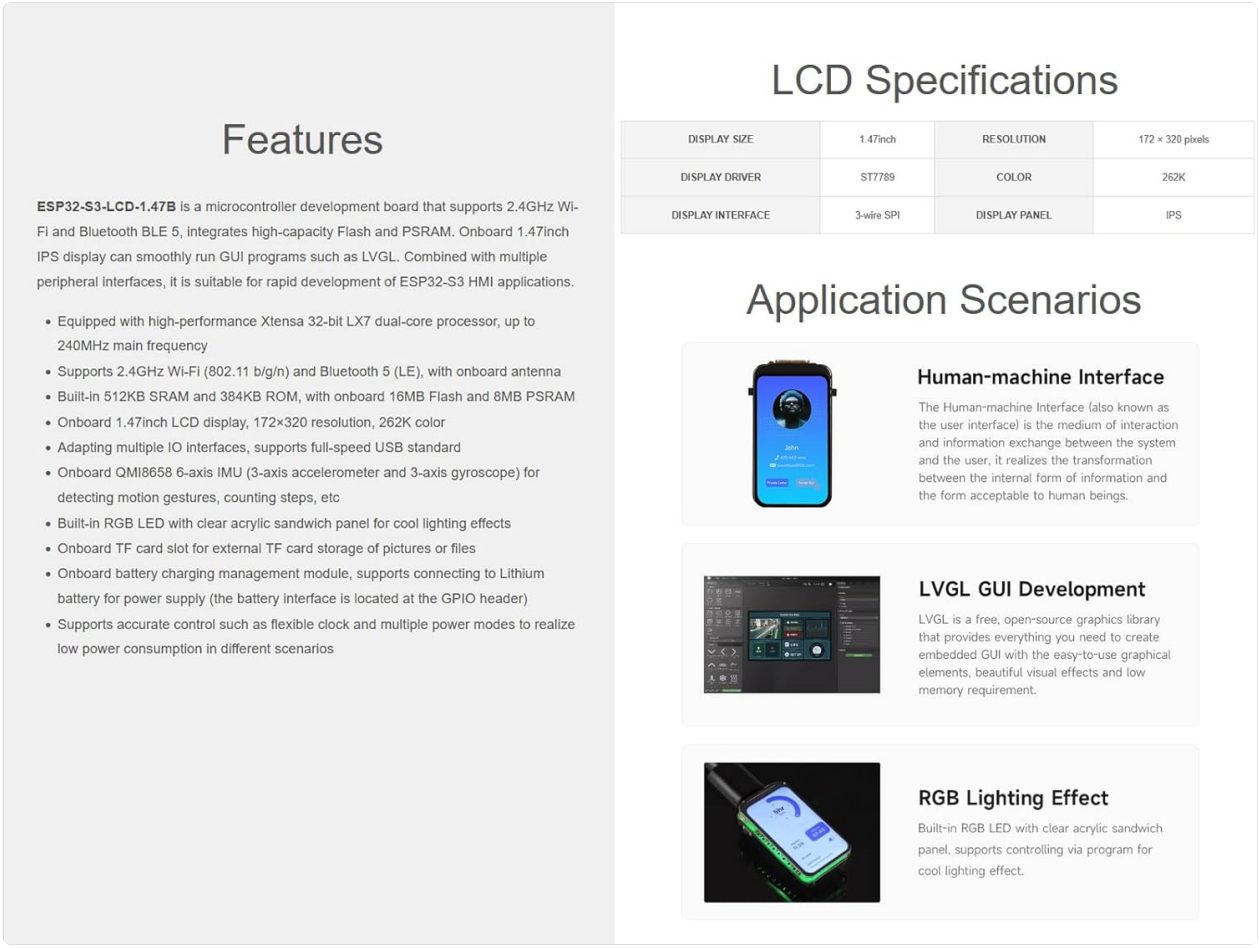

Image 3.2: Details on LCD specifications, HMI application scenarios, LVGL GUI development, and RGB lighting.

3.3 6-Axis IMU (QMI8658)

The onboard QMI8658 6-axis IMU combines a 3-axis accelerometer and a 3-axis gyroscope. This sensor enables the detection of motion gestures, step counting, orientation tracking, and other motion-related applications. Developers can interface with the IMU via I2C or SPI protocols, depending on the specific pin configuration and library support.

3.4 TF Card Slot

The integrated TF card slot allows for external storage of pictures, files, or application data. This is useful for applications requiring larger storage capacity than the onboard Flash memory provides, such as logging data or storing display assets.

3.5 RGB LED

The built-in RGB LED, located behind a clear acrylic sandwich panel, can be controlled via software to produce various lighting effects. This feature can be used for status indicators, visual feedback, or aesthetic enhancements in your projects.

4. Pin Definition and Onboard Components

Understanding the pinout and onboard components is essential for effective development.

4.1 Pin Definition

The board supports the expansion of multiple peripherals via its GPIO header. Refer to the diagram below for the pin assignments.

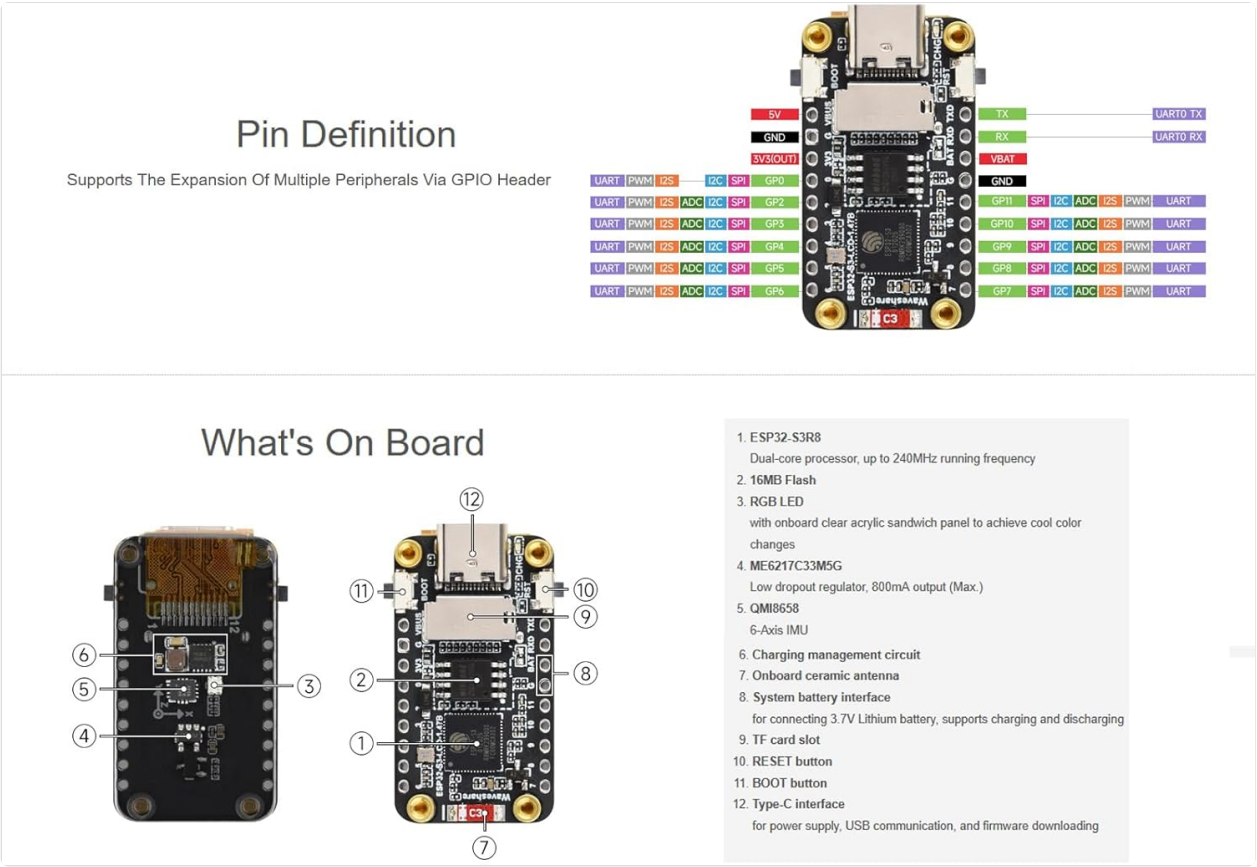

Image 4.1: Pinout diagram illustrating the various GPIOs and their functions.

4.2 Onboard Components

The following diagram and list identify the key components on the ESP32-S3-LCD-1.47B board:

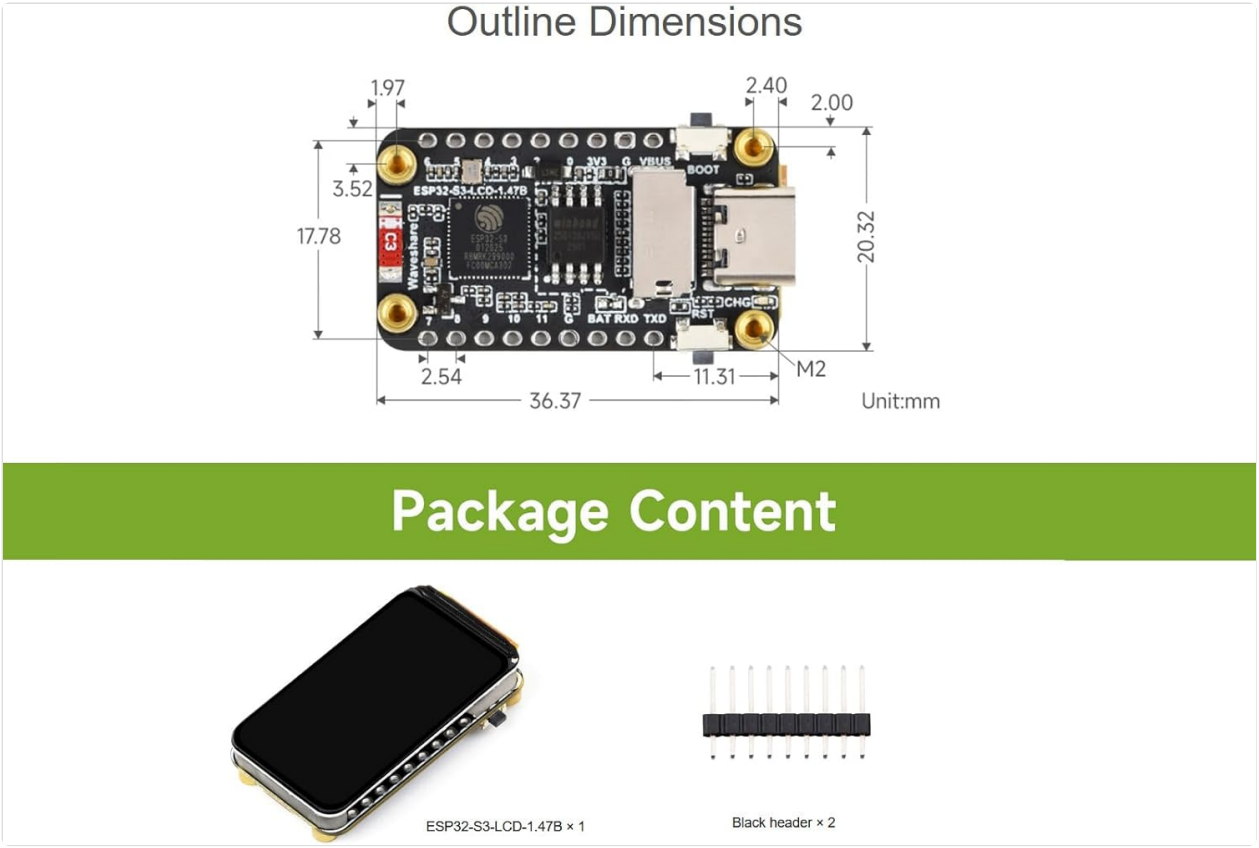

Image 4.2: Numbered components on the development board.

1. ESP32-S3R8: Dual-core processor, up to 240MHz running frequency.

2. 16MB Flash.
3. RGB LED: With clear acrylic sandwich panel for cool lighting effects.
4. ME6217C33M5G: Low dropout regulator, 800mA output (Max.).
5. QMI8658: 6-Axis IMU.
6. Charging management circuit.
7. Onboard ceramic antenna.
8. System battery interface: For connecting 3.7V Lithium battery, supports charging and discharging.
9. TF card slot.
10. RESET button.
11. BOOT button.
12. Type-C Interface: For power supply, USB communication, and firmware downloading.

5. Maintenance

Proper care ensures the longevity and reliable operation of your development board.

- **Handling:** Handle the board by its edges to avoid touching components, especially the display surface.
- **Cleaning:** Use a soft, dry cloth to clean the board. For stubborn dirt, a small amount of isopropyl alcohol can be used on a cloth, ensuring the board is powered off and completely dry before re-powering.
- **Storage:** Store the board in an anti-static bag in a cool, dry environment when not in use.
- **Power Management:** The onboard battery charging management module helps protect connected Lithium batteries. However, always use compatible batteries and avoid over-discharging or over-charging.

6. Troubleshooting

If you encounter issues, consider the following general troubleshooting steps:

- **No Power:** Ensure the USB Type-C cable is securely connected to a functional power source. If using a battery, verify it is charged and correctly connected.
- **Display Not Working:** Check power supply. Ensure your firmware correctly initializes and drives the LCD.
- **USB Connection Issues:** Try a different USB cable or port on your computer. Ensure necessary drivers are installed for the ESP32-S3.
- **Firmware Upload Failure:** Verify the correct COM port is selected in your development environment. Ensure the board is in bootloader mode if required (often by holding the BOOT button while pressing and releasing RESET).
- **Component Malfunction:** Double-check all external connections (e.g., to GPIOs, TF card).

7. Specifications

Detailed technical specifications for the ESP32-S3-LCD-1.47B Development Board.

Feature	Specification

Feature	Specification
Processor	Xtensa 32-bit LX7 dual-core, up to 240MHz
Wi-Fi	2.4GHz (802.11 b/g/n)
Bluetooth	Bluetooth 5 (LE)
S-R-A-M	512KB
ROM	384KB
Flash Memory	16MB
PSRAM	8MB
Display Size	1.47 inch
Display Resolution	172×320 pixels
Display Color	262K
Display Panel Type	IPS
IMU	QMI8658 6-axis (3-axis accelerometer, 3-axis gyroscope)
External Storage	TF Card Slot
USB Interface	Type-C, Full-speed USB standard
Power Input	USB Type-C, Lithium battery via GPIO header
Item Weight	0.16 ounces
Product Dimensions (LxWxH)	1.43 x 0.8 x 0.2 inches (36.37 x 20.32 x 5.08 mm)

7.1 Outline Dimensions

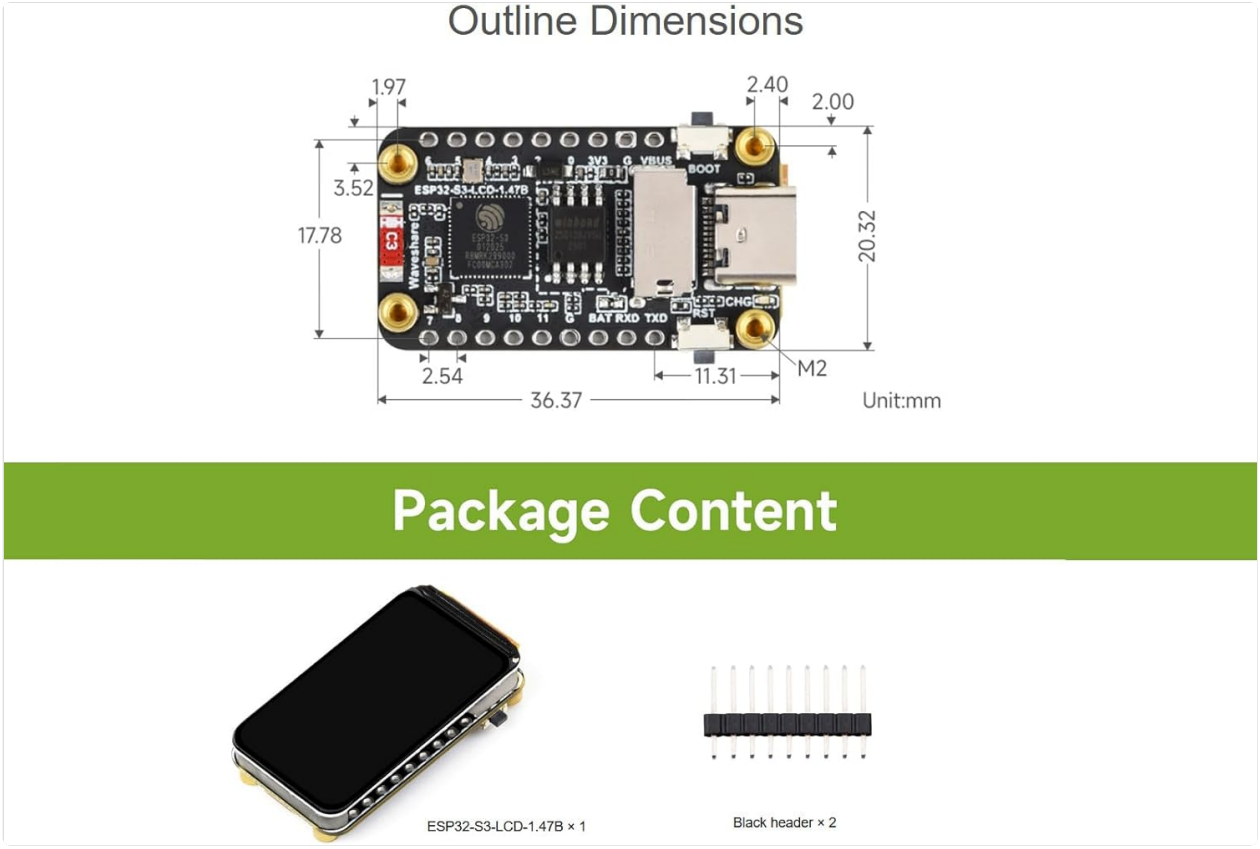

Image 7.1: Detailed outline dimensions of the board in millimeters.

8. Support

Waveshare provides online development resources and technical support for this product. If you encounter any problems or require assistance, please refer to the official Waveshare documentation and support channels. Contact information can typically be found on the Waveshare website or through your purchase platform.