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› waveshare ESP32-C6 1.47inch Display Development Board User Manual

waveshare ESP32-C6 1.47inch Display-M

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Model: ESP32-C6 1.47inch Display-M

1. INTRODUCTION

The waveshare ESP32-C6 1.47inch Display Development Board (Model: ESP32-C6 1.47inch Display-M) is a microcontroller development board designed for various applications, particularly in the Internet of Things (IoT) and Human-Machine Interface (HMI) domains. It features a 1.47-inch LCD display with 172x320 resolution and 262K colors, integrated with an ESP32-C6 chip. This board supports Wi-Fi 6 and Bluetooth 5 (LE) connectivity, making it suitable for wireless communication projects. It includes a pre-soldered header for easy integration into existing systems or breadboards.



Figure 1: waveshare ESP32-C6 1.47inch Display Development Board.

2. KEY FEATURES

- **Microcontroller:** ESP32-C6, featuring a high-performance 32-bit RISC-V processor (up to 160 MHz) and a low-power 32-bit RISC-V processor (up to 20 MHz).
- **Display:** Onboard 1.47-inch TFT LCD with 172x320 resolution and 262K colors, controlled by the ST7789 chip.
- **Wireless Connectivity:** Supports 2.4GHz Wi-Fi 6 (802.11 b/g/n) and Bluetooth 5 (LE) with an onboard antenna.
- **Memory:** Built-in 320KB ROM, 512KB HP SRAM, 16KB LP SRAM, and 4MB Flash memory.
- **Peripherals:** Multiple IO interfaces, full-speed USB port, and an onboard TF card slot for external storage.
- **Power Management:** Supports flexible clock and multiple power modes for low power consumption.
- **LED:** Built-in RGB LED with a clear acrylic sandwich panel for lighting effects.

ESP32-C6 Suitable For AIoT Applications

Powered By A High-Performance 32-Bit RISC-V Processor And A Low-Power 32-Bit RISC-V Processor, The Main Frequency Is Up To 160 MHz, Powerful AI Computing Capability & Reliable Security Features



WIFI 6 And BLE 5 Support

ESP32-C6 Integrates 2.4 GHz Wi-Fi 6 (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 2: ESP32-C6 chip architecture suitable for AIoT applications.

Application Scenarios



Human-machine Interface

The Human-machine Interface (also known as the user interface) is the medium of interaction and information exchange between the system and the user, it realizes the transformation between the internal form of information and the form acceptable to human beings.



LVGL GUI Development

LVGL is a free, open-source graphics library that provides everything you need to create embedded GUI with the easy-to-use graphical elements, beautiful visual effects and low memory requirement.



RGB Lighting Effect

Built-in RGB LED with clear acrylic sandwich panel, supports controlling via program for cool lighting effect.

Figure 3: Wi-Fi 6 and Bluetooth 5 (LE) connectivity features.

3. SETUP INSTRUCTIONS

To begin using your ESP32-C6 1.47inch Display Development Board, follow these general setup steps:

1. **Power Connection:** Connect the board to a power source using the USB Type-C port. A standard USB cable (not included) can be used to connect to a computer or a 5V USB power adapter.
2. **Driver Installation:** Depending on your operating system, you may need to install USB-to-serial drivers (e.g., CP210x or CH340 drivers) to allow your computer to communicate with the ESP32-C6 board. Refer to the official Espressif documentation or Waveshare resources for specific driver requirements.

3. **Development Environment Setup:** Install a suitable Integrated Development Environment (IDE) such as Arduino IDE with ESP32 board support, or Espressif's ESP-IDF. These environments provide the necessary tools for writing, compiling, and uploading code to the board.
4. **First Program Upload:** Connect the board to your computer via USB. Select the correct board model and serial port in your IDE. Upload a simple test program, such as a 'Hello World' example for the serial monitor or a basic display test, to verify communication and functionality.

4. OPERATING THE BOARD

The ESP32-C6 1.47inch Display Development Board operates by executing firmware uploaded to its flash memory. Interaction typically involves:

- **Programming:** Use your chosen development environment (e.g., Arduino IDE, ESP-IDF) to write C/C++ code. This code defines the board's behavior, including display output, sensor readings, network communication, and peripheral control.
- **Uploading Firmware:** After compiling your code, upload it to the board via the USB Type-C connection. The board will automatically reset and run the new firmware.
- **Display Interaction:** Utilize libraries like LVGL (Light and Versatile Graphics Library) to create graphical user interfaces on the 1.47-inch LCD. The display can show text, images, and interactive elements.
- **Network Communication:** Implement Wi-Fi 6 for internet connectivity or local network communication, and Bluetooth 5 (LE) for short-range wireless data exchange with other devices.
- **Peripheral Control:** Access and control external components connected to the GPIO pins, such as sensors, actuators, or other modules.

5. APPLICATION SCENARIOS

The versatility of the ESP32-C6 1.47inch Display Development Board makes it suitable for a range of applications:

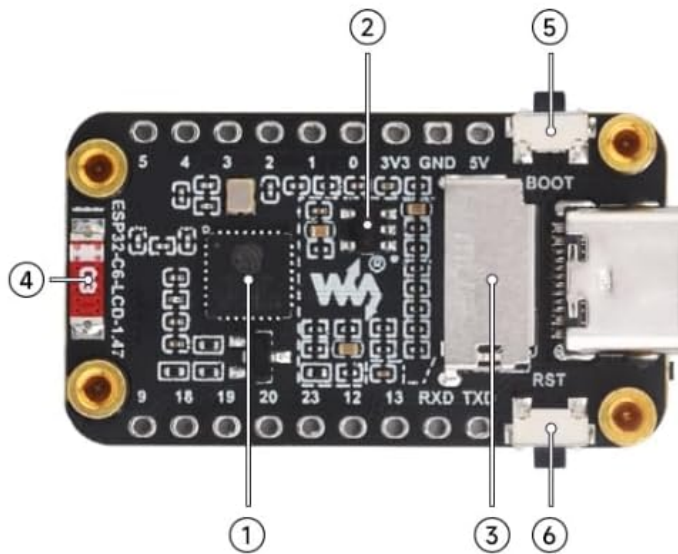
- **Human-Machine Interface (HMI):** Develop interactive user interfaces for control panels, smart home devices, or industrial equipment. The integrated display allows for direct user feedback and input.
- **LVGL GUI Development:** Leverage the LVGL graphics library to create rich, embedded graphical user interfaces with visual effects, optimized for low memory requirements.
- **IoT Devices:** Build connected devices that require both display capabilities and robust wireless communication (Wi-Fi 6, Bluetooth 5 LE) for data logging, remote control, or sensor monitoring.
- **Wearable Technology:** Its compact size and display make it a candidate for prototyping small, display-enabled wearable devices.
- **Educational Projects:** An excellent platform for learning about embedded systems, microcontrollers, wireless communication, and GUI development.

Supports Multiple Peripherals

Supports The Expansion Of Multiple Peripherals Via GPIO Header



What's On Board



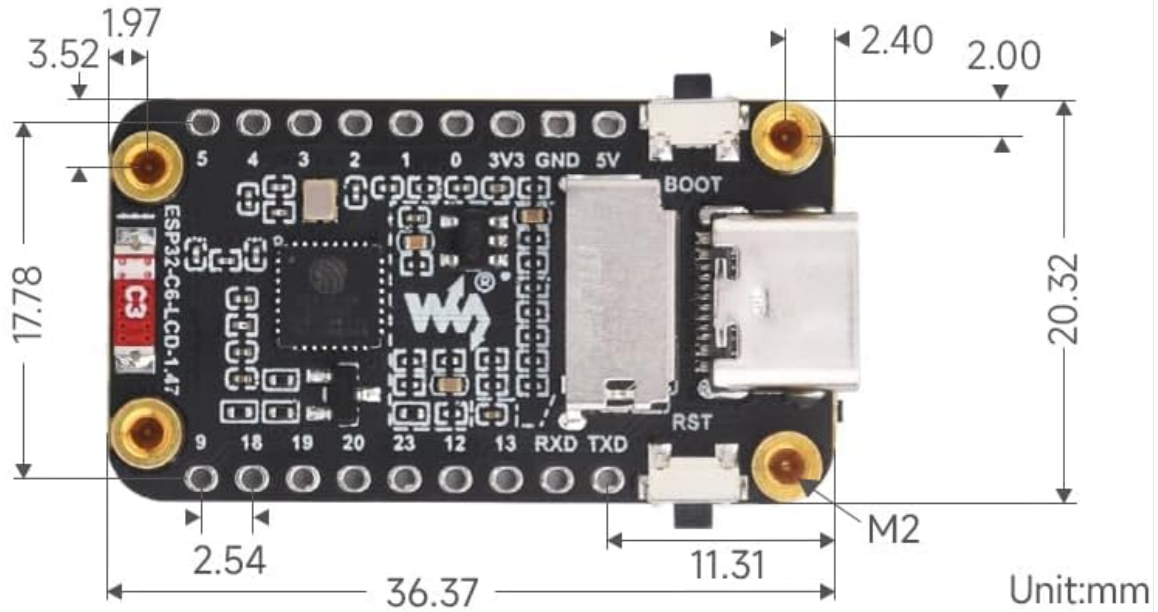
- 1. ESP32-C6FH4
- 2. ME6217C33M5G
Low dropout regulator, 800mA output (Max.)
- 3. TF card slot
- 4. Onboard ceramic antenna
- 5. BOOT button
- 6. RESET button

Figure 4: Visual examples of potential application scenarios for the development board.

6. PINOUT AND ONBOARD COMPONENTS

Understanding the pinout and onboard components is crucial for connecting external peripherals and utilizing the board's full capabilities.

Outline Dimensions



Parameter Name	Parameter
Interface	USB Type-C
Master chip	ESP32-C6
Display type	TFT
Display control chip	Display: ST7789
Onboard device	Micro SD

Figure 5: Pinout and labeled components of the ESP32-C6 1.47inch Display Development Board.

6.1 Key Onboard Components:

1. **ESP32-C6FH4:** The main microcontroller unit.
2. **ME6217C33M5G:** Low dropout regulator, providing 800mA output (Max.).
3. **TF card slot:** For external Micro SD card storage of pictures or files.
4. **Onboard ceramic antenna:** For Wi-Fi and Bluetooth connectivity.
5. **BOOT button:** Used for entering download mode.
6. **RESET button:** Resets the ESP32-C6 chip.

6.2 GPIO Pin Functions:

The board provides various General Purpose Input/Output (GPIO) pins, which can be configured for different functions such as UART, I2C, SPI, PWM, and ADC. Refer to the pinout diagram (Figure 5) for specific pin assignments and capabilities. These pins allow for expansion with multiple peripherals via the GPIO header.

7. SPECIFICATIONS

Detailed technical specifications for the ESP32-C6 1.47inch Display Development Board:

Parameter Name	Value
Brand	waveshare
Model Name	ESP32-C6 1.47inch Display-M
Master Chip	ESP32-C6
CPU Speed	160 MHz (High-performance RISC-V)
Connectivity Technology	Wi-Fi 6 (802.11 b/g/n), Bluetooth 5 (LE)
Display Type	TFT LCD
Display Size	1.47 inch
Display Resolution	172 × 320 pixels
Display Color Depth	262K colors
Display Control Chip	ST7789
RAM Memory Technology	SRAM (512KB HP SRAM, 16KB LP SRAM)
Flash Memory	4MB
Onboard Device	Micro SD card slot
Interface	USB Type-C
Compatible Devices	Cameras, Computers (PCs, laptops, tablets), Storage devices (TF cards)
Item Weight	0.01 Kilograms
UPC	788046389784

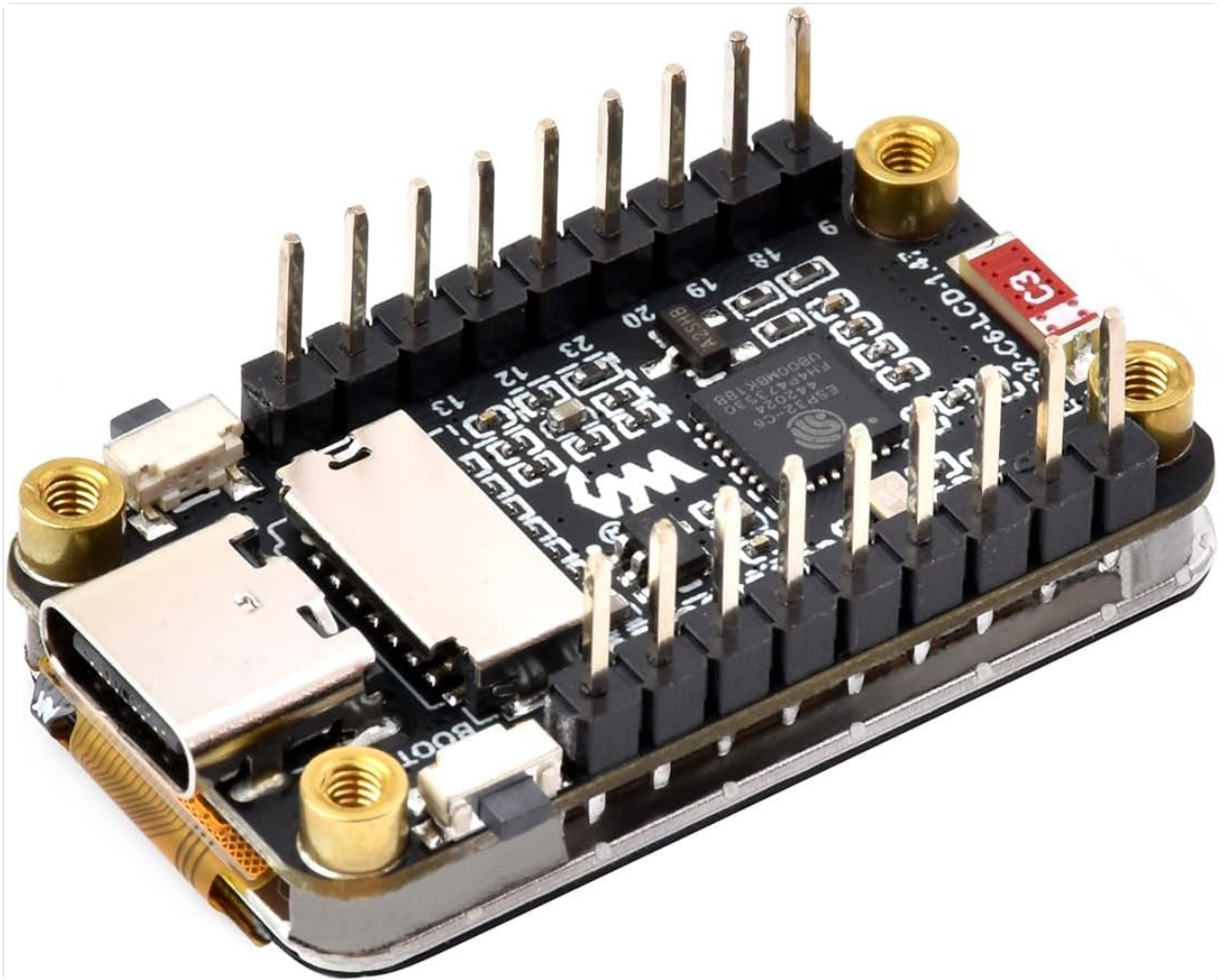


Figure 6: Outline dimensions of the development board.

8. TROUBLESHOOTING

This section addresses common issues you might encounter during the use of your development board.

8.1 Serial Port Connection or Burning Failure

Problem: The serial port cannot be connected, or the program burning (uploading) fails after re-downloading a module program.

Solution: This often occurs when the module is not in download mode. To resolve this:

1. **Press and Hold BOOT:** Long press the **BOOT** button on the board.
2. **Press RESET:** While holding the **BOOT** button, briefly press the **RESET** button.
3. **Release RESET:** Release the **RESET** button.
4. **Release BOOT:** Finally, release the **BOOT** button.

At this point, the module should enter download mode, allowing you to connect via the serial port and successfully upload your program. This procedure can resolve most issues related to inability to download firmware.

9. MAINTENANCE

To ensure the longevity and proper functioning of your ESP32-C6 1.47inch Display Development Board, observe the following maintenance guidelines:

- **Handle with Care:** Avoid dropping the board or subjecting it to physical shock, which can damage components or solder joints.
- **Static Discharge:** Always handle the board in an environment free of static electricity. Use anti-static mats or wrist straps when working with electronic components.
- **Power Supply:** Use a stable 5V power supply. Over-voltage can permanently damage the board.
- **Environmental Conditions:** Store and operate the board in a dry environment, away from extreme temperatures, humidity, and corrosive substances.
- **Cleaning:** If necessary, gently clean the board with a soft, dry brush or compressed air to remove dust. Avoid using liquids or harsh chemicals.
- **Firmware Updates:** Regularly check for and apply firmware updates for the ESP32-C6 chip and relevant libraries to benefit from bug fixes and new features.

10. WARRANTY AND SUPPORT

For warranty information, technical support, and additional resources, please refer to the official waveshare website or contact their customer service directly. Keep your purchase receipt as proof of purchase for any warranty claims.

Online Resources:

- Visit the waveshare Store on Amazon for product updates and related items.
- Consult the official Espressif documentation for detailed information on the ESP32-C6 chip.