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waveshare RP2350-1.28inch-Touch-LCD

Waveshare RP2350 MCU Board with 1.28-inch Touch Display User Manual

1. INTRODUCTION

The Waveshare RP2350 MCU Board is a high-performance microcontroller unit featuring a 1.28-inch capacitive touch display. This board integrates a Li-ion battery recharge manager and a 6-axis sensor (3-axis accelerometer and 3-axis gyroscope), making it suitable for various embedded applications. It is based on the Raspberry Pi RP2350 microcontroller chip, which utilizes a unique dual-core and dual-architecture design. This manual provides essential information for setting up, operating, and maintaining your RP2350 MCU Board.



Image: The Waveshare RP2350 MCU Board, highlighting its 1.28-inch touch display, Type-C port, dual-core architecture, and 65K color support.

2. KEY FEATURES

- **Microcontroller:** Based on Raspberry Pi RP2350 chip with dual-core Arm Cortex-M33 and dual-core Hazard3 RISC-V processors, clock up to 150 MHz.
- **Memory:** 520KB SRAM and 16MB onboard Flash memory.
- **Display:** Integrated 1.28-inch capacitive touch LCD with 240×240 pixels and 65K color support.
- **Connectivity:** Type-C USB 1.1 connector with device and host support.
- **Power Management:** Lithium battery recharge/discharge header for mobile applications.
- **Sensors:** Onboard 6-axis sensor (3-axis accelerometer and 3-axis gyroscope).
- **GPIO:** 6 × GPIO pins available via SH1.0 connector.
- **Programming:** Supports drag-and-drop programming via USB mass storage, C/C++, MicroPython, and Arduino.
- **Additional Features:** Low-power sleep and dormant modes, accurate clock and timer, temperature sensor.

3. PACKAGE CONTENTS

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

- RP2350-Touch-LCD-1.28 Board x1
- SH1.0 12PIN cable x1

4. HARDWARE OVERVIEW

The following diagram illustrates the main components and interfaces of the RP2350 MCU Board.

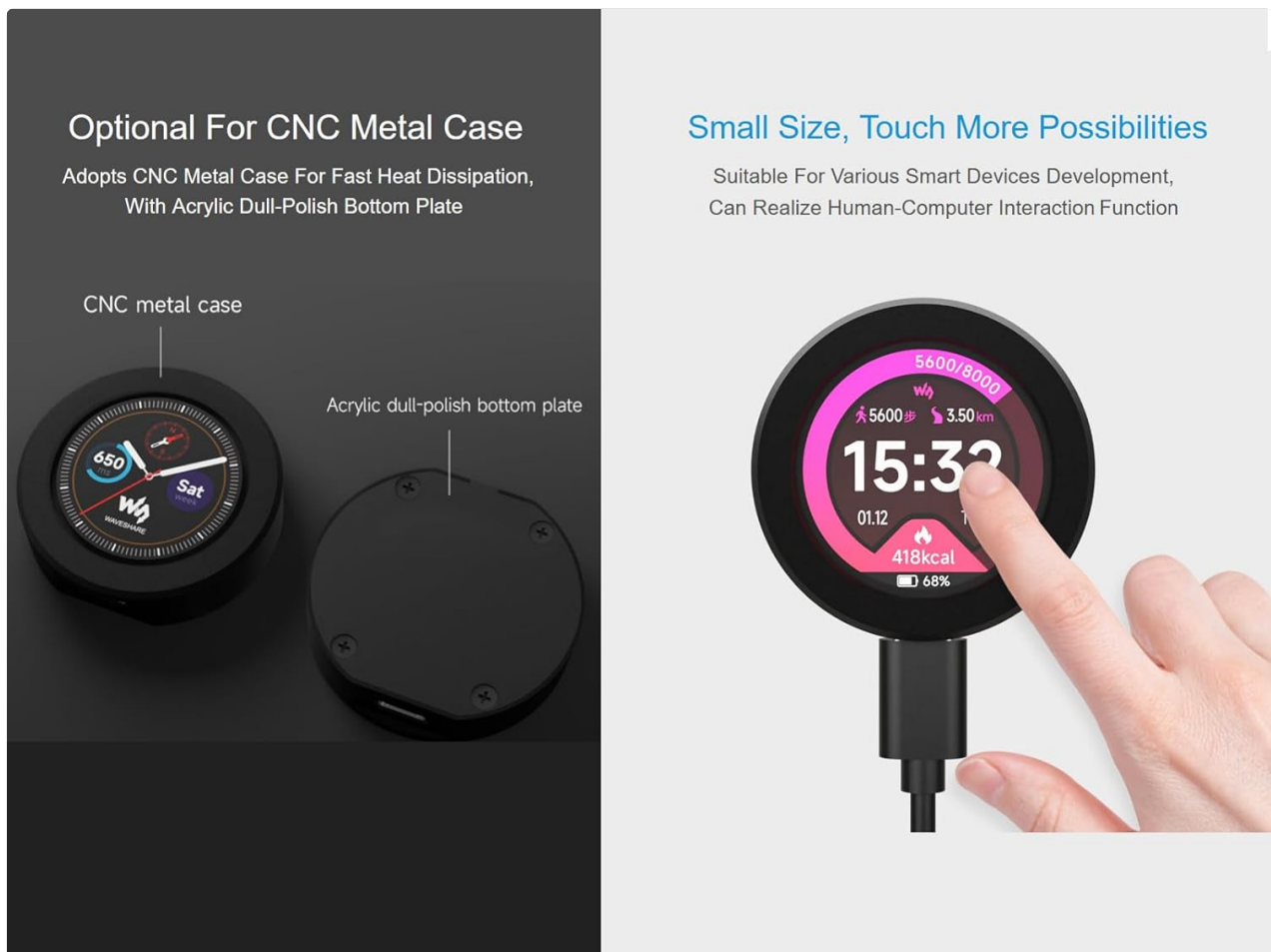


Image: RP2350 MCU Board with key components labeled for identification.

1. **USB Type-C connector:** For program burning and USB 1.1 communication (device and host support).
2. **ETA6098:** High-efficiency Lithium battery recharge manager.
3. **RT9193-33PB:** 300mA low dropout, low noise, ultra-fast LDO.
4. **W25Q128JVSQ:** 16MB NOR-Flash memory.
5. **RP2350:** Dual-core and dual-architecture design, up to 150 MHz operating frequency.
6. **QMI8658:** 6-axis IMU (3-axis gyroscope and 3-axis accelerometer).
7. **BOOT button:** Press when resetting to enter download mode.
8. **RESET button:** Resets the board.
9. **MX1.25 2P battery header:** For 3.7V Lithium battery, supports charging and discharging.

5. PIN DEFINITION

Understanding the pinout is crucial for connecting peripherals and developing applications. The following diagram details the pin assignments for the RP2350 MCU Board.



C/C++, MicroPython, Arduino Support

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

Pico C/C++ SDK



The Raspberry Pi official C SDK can be used from the command line, or from popular integrated development environments like Visual Studio Code and Eclipse.



MicroPython

MicroPython is a full implementation of the Python 3 programming language that runs directly on embedded hardware like Raspberry Pi Pico



Arduino IDE

Arduino IDE is an open source electronic prototyping platform, convenient and flexible, easy to get started. After a simple learning, you can start to develop quickly.

Image: Pinout diagram for the RP2350 MCU Board, showing GPIO, power, and system control pins.

Key pin categories include:

- **Power:** VBUS, 3V3, 3V3_EN, VSYS
- **Ground:** GND
- **GPIO, PIO and PWM:** GPIO0-GPIO29 (specific pins are highlighted in the diagram)
- **System Control:** RUN, BOOT, RESET

6. SETUP INSTRUCTIONS

6.1 Initial Connection

1. Connect the RP2350 MCU Board to your computer using a Type-C USB cable.

2. Ensure the board powers on. The integrated display should illuminate.
3. For initial programming, you may need to press and hold the **BOOT** button while connecting the USB cable, then release it. This will put the board into USB mass storage mode, allowing you to drag-and-drop firmware files.

6.2 Driver Installation

Typically, the RP2350 board will be recognized as a mass storage device or a serial port without requiring specific drivers on most modern operating systems (Windows, macOS, Linux). If issues arise, refer to the official Raspberry Pi Pico 2 documentation for driver information.

6.3 Powering the Board

- **USB Power:** The board can be powered directly via the Type-C USB port.
- **Battery Power:** Connect a 3.7V Lithium battery to the MX1.25 2P battery header. The onboard ETA6098 chip manages battery charging and discharging.

7. OPERATING INSTRUCTIONS

7.1 Programming the Board

The RP2350 MCU Board supports multiple programming methods:

- **Drag-and-Drop (UF2):** When the board is in bootloader mode (hold BOOT, then connect USB), it appears as a USB mass storage device. You can drag and drop UF2 firmware files directly onto this drive to program the board.
- **SDKs:** Utilize the official C/C++ SDK, MicroPython, or Arduino IDE for more advanced development. Refer to the respective documentation for detailed instructions on setting up your development environment.

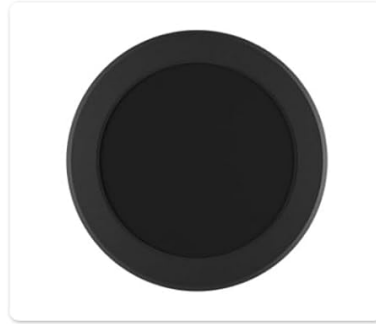
7.2 Using the Touch Display

The 1.28-inch capacitive touch display allows for interactive applications. Your custom firmware will define the display's content and touch response. Example code and libraries are typically available in the Waveshare development resources to assist with display initialization and graphic rendering.

Version Options



RP2350-Touch-LCD-1.28
without case



RP2350-Touch-LCD-1.28-B
with CNC metal case

Features

RP2350-Touch-LCD-1.28 is a low-cost, high-performance MCU board designed by Waveshare. Tiny size with onboard 1.28inch capacitive touch display, Li-ion battery recharge manager, 6-axis sensor (3-axis accelerometer and 3-axis gyroscope) and so on, which makes it easy for you to integrate it into products quickly.

Key features include:

- RP2350 microcontroller chip designed by Raspberry Pi in the United Kingdom
- Adopts unique dual-core and dual-architecture design: dual-core Arm Cortex-M33 processor and dual-core Hazard3 RISC-V processor, flexible clock running up to 150 MHz
- 520KB of SRAM, and 16MB of onboard Flash memory
- Type-C connector, keeps it up to date, easier to use
- Onboard 1.28inch capacitive touch LCD, 240x240 pixels, supports 65K color for clear color picture display
- Lithium battery recharge/discharge header, suitable for mobile devices
- USB 1.1 with device and host support
- Low-power sleep and dormant modes
- Drag-and-drop programming using mass storage over USB
- Accurate clock and timer on-chip
- Temperature sensor
- 6 x GPIO pin via SH1.0 connector

Image: The RP2350 MCU Board's 1.28-inch touch display showing a graphical user interface, demonstrating its interactive capabilities.

7.3 Utilizing Onboard Sensors

The integrated 6-axis IMU (accelerometer and gyroscope) can be accessed via I2C or SPI interfaces, depending on the specific sensor and library used. Consult the Waveshare documentation or sensor datasheet for programming examples to read sensor data.

8. DEVELOPMENT ENVIRONMENT SUPPORT

The RP2350 MCU Board offers broad compatibility with popular development tools:

What's On Board



- 1. **USB Type-C connector**
for program burning, USB 1.1 with device and host support
- 2. **ETA6098**
high efficiency Lithium battery recharge manager
- 3. **RT9193-33PB**
300mA low dropout, low noise, ultra-fast LDO
- 4. **W25Q128JVSIQ**
16MB NOR-Flash
- 5. **RP2350**
Dual-core and dual-architecture design, up to 150 MHz operating frequency
- 6. **QMI8658**
6-axis IMU includes a 3-axis gyroscope and a 3-axis accelerometer.
- 7. **BOOT button**
Press it when resetting to enter download mode
- 8. **RESET button**
- 9. **MX1.25 battery header**
MX1.25 2P connector, for 3.7V Lithium battery, supports charging and discharging

Pin Definition

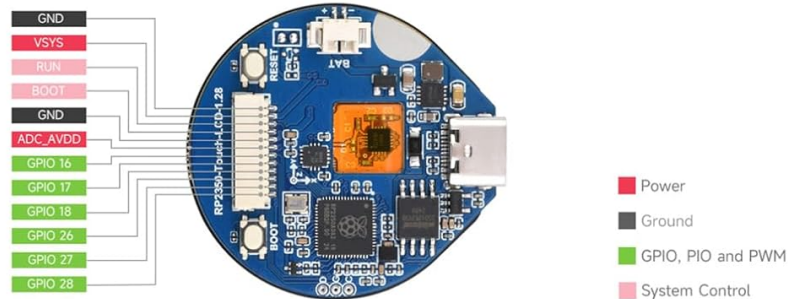


Image: Overview of supported development environments: Pico C/C++ SDK, MicroPython, and Arduino IDE.

8.1 Pico C/C++ SDK

The official Raspberry Pi C/C++ SDK can be used for bare-metal programming. It supports command-line compilation and integration with popular IDEs like Visual Studio Code and Eclipse.

8.2 MicroPython

MicroPython provides a Python 3 implementation optimized for embedded hardware. It allows for rapid development and prototyping on the RP2350 board.

8.3 Arduino IDE

The Arduino IDE offers a user-friendly environment for programming. With the appropriate board package installed, you can leverage Arduino's extensive libraries and community support.

9. TECHNICAL SPECIFICATIONS

Microcontroller	Raspberry Pi RP2350 (Dual-core Arm Cortex-M33 & Dual-core Hazard3 RISC-V)
Clock Speed	Up to 150 MHz
SRAM	520 KB
Flash Memory	16 MB (onboard)
Display	1.28-inch Capacitive Touch LCD, 240×240 pixels, 65K colors
USB Interface	Type-C, USB 1.1 (device and host support)
Sensors	6-axis IMU (3-axis accelerometer, 3-axis gyroscope)
Battery Support	3.7V Lithium battery (recharge/discharge manager onboard)
GPIO Pins	6 × GPIO via SH1.0 connector
Operating System Support	Linux (as per product data, likely referring to development host OS)
Connectivity Technology	USB
Compatible Devices	USB devices (e.g., keyboards, mice, storage devices), Arduino, Raspberry Pi models, SH1.0 compatible devices

10. OUTLINE DIMENSIONS

The physical dimensions of the RP2350 MCU Board are provided below for integration into projects and enclosures.

Outline Dimensions

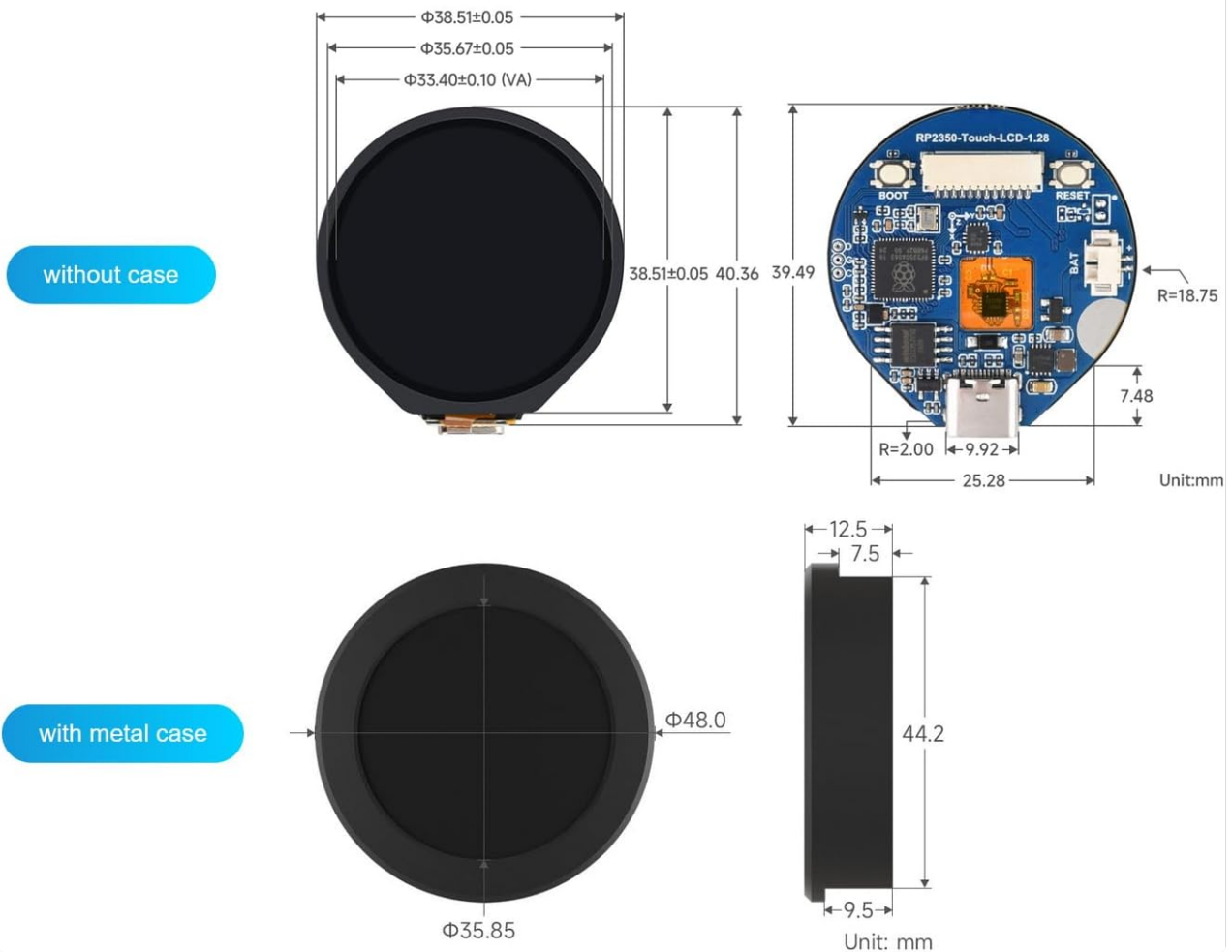


Image: Detailed outline dimensions of the RP2350 MCU Board, including measurements for the board itself and with an optional metal case (units in millimeters).

All dimensions are in millimeters (mm).

- **Board Diameter:** Approximately 38.51 mm
- **Display Diameter:** Approximately 33.40 mm (VA area)
- **Board Thickness:** Approximately 7.48 mm (excluding connectors)
- **With Metal Case:** Diameter approximately 48.0 mm, Thickness approximately 9.5 mm

11. TROUBLESHOOTING

If you encounter issues with your RP2350 MCU Board, consider the following troubleshooting steps:

- **Board Not Powering On:**
 - Ensure the USB cable is securely connected to both the board and the power source/computer.
 - Try a different USB cable or USB port.
 - If using battery power, verify the battery is charged and correctly connected to the MX1.25 2P header.
- **Board Not Recognized by Computer:**

- Try connecting the board while holding the **BOOT** button to enter mass storage mode.
- Ensure your operating system's USB drivers are up to date.
- Restart your computer.
- **Display Not Working:**
 - Check for any visible damage to the display or its connector.
 - Verify that your firmware includes the necessary display initialization code.
 - Ensure sufficient power is supplied to the board.
- **Programming Errors:**
 - Double-check your code for syntax errors or logical flaws.
 - Ensure the correct board and port are selected in your IDE (if applicable).
 - Refer to the specific SDK or IDE documentation for common programming issues.
- **Unexpected Behavior:**
 - Perform a hard reset using the **RESET** button.
 - Re-flash a known working firmware to rule out software issues.
 - Check for short circuits or incorrect wiring if external components are connected.

12. MAINTENANCE

To ensure the longevity and optimal performance of your RP2350 MCU Board, follow these maintenance guidelines:

- **Storage:** Store the board in a dry, anti-static environment, away from direct sunlight and extreme temperatures.
- **Cleaning:** Use a soft, dry brush or compressed air to remove dust. For stubborn dirt, use a lint-free cloth lightly dampened with isopropyl alcohol. Ensure the board is powered off and completely dry before re-applying power.
- **Handling:** Always handle the board by its edges to avoid touching sensitive components. Use anti-static precautions when working with the board.
- **Firmware Updates:** Regularly check the Waveshare official website or relevant community forums for firmware updates and bug fixes to ensure your board runs with the latest improvements.

13. TECHNICAL SUPPORT AND RESOURCES

For further assistance, development resources, and technical support, please refer to the official Waveshare documentation and support channels. Online development resources and tutorials are available to help you get started and resolve any issues.

You can typically find detailed guides, example code, and community forums on the [Waveshare official website](#).

