XYGStudy RP2350-Plus-16MB-M

XYGStudy RP2350-Plus-16MB-M Development Board User Manual

Model: RP2350-Plus-16MB-M

1. Introduction

The XYGStudy RP2350-Plus-16MB-M Development Board is a high-performance, low-cost microcontroller unit (MCU) board designed for various embedded applications. It is based on the Raspberry Pi RP2350A dual-core and dual-architecture microcontroller, offering flexible clock speeds up to 150 MHz. This manual provides essential information for setting up, operating, and maintaining your RP2350-Plus board.

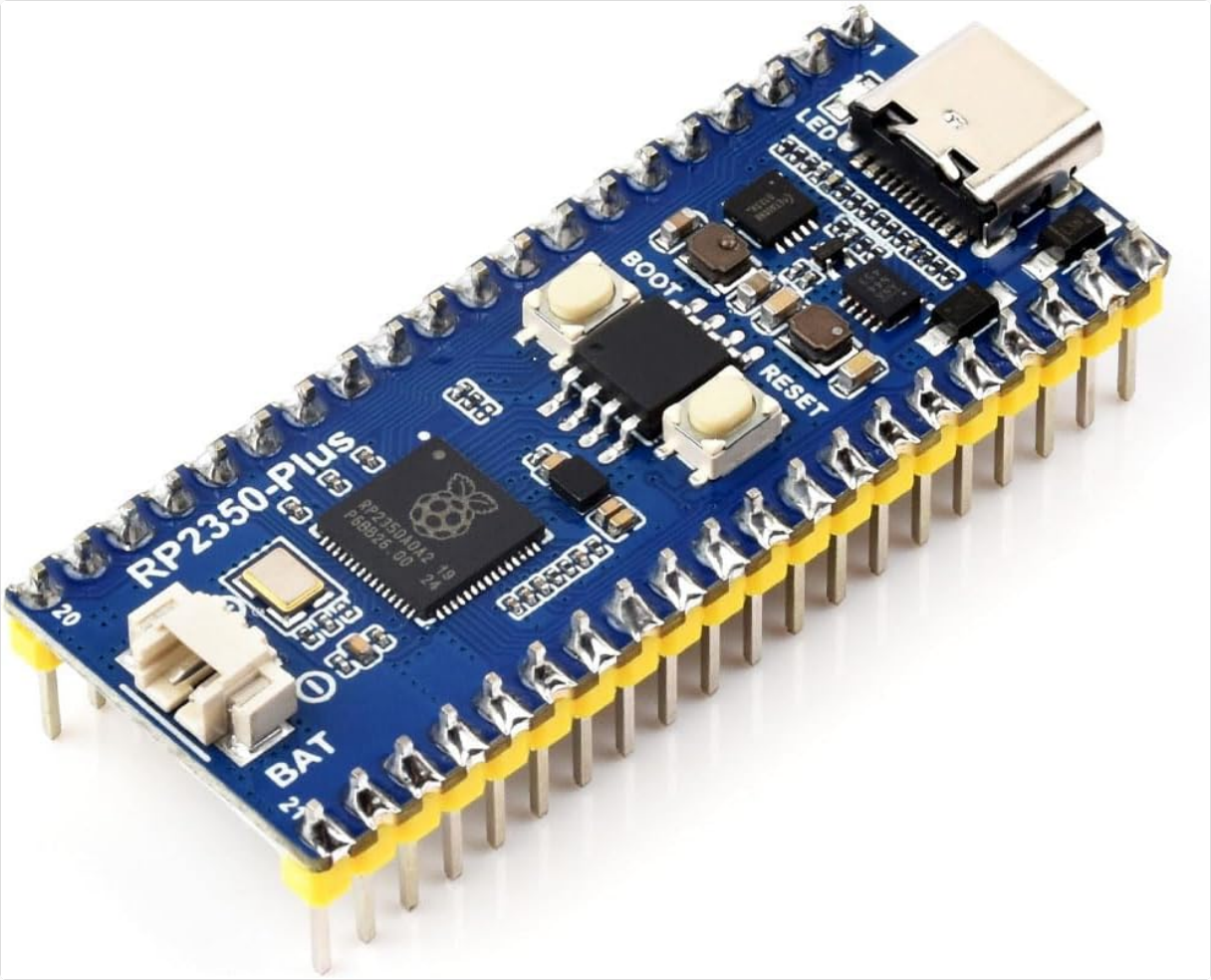


Figure 1: The XYGStudy RP2350-Plus Development Board, showcasing its compact design and Type-C USB connector.

2. Key Features

The RP2350-Plus Development Board incorporates several advanced features:

- **Microcontroller:** Raspberry Pi RP2350A, featuring a dual-core Arm Cortex-M33 processor and a dual-core Hazard 3 RISC-V processor.
- **Clock Speed:** Flexible clock running up to 150 MHz.
- **Memory:** 520KB of SRAM and 16MB on-board Flash memory.
- **Connectivity:** USB 1.1 with device and host support, Type-C connector.
- **Power Management:** Onboard DC-DC chip MP28164, high efficiency buck-boost, maximum 2A load current. Supports lithium battery charge/discharge.
- **GPIO:** 26 multi-function GPIO pins, configurable for various peripherals including SPI, I2C, UART, ADC, and PWM.
- **Low-Power Modes:** Supports low-power sleep and dormant modes.
- **Programming:** Drag-and-drop programming via USB mass storage.
- **Additional Features:** Castellated module for direct soldering, accurate clock and timer, temperature sensor, accelerated floating-point libraries, 12x Programmable I/O (PIO) state machines.

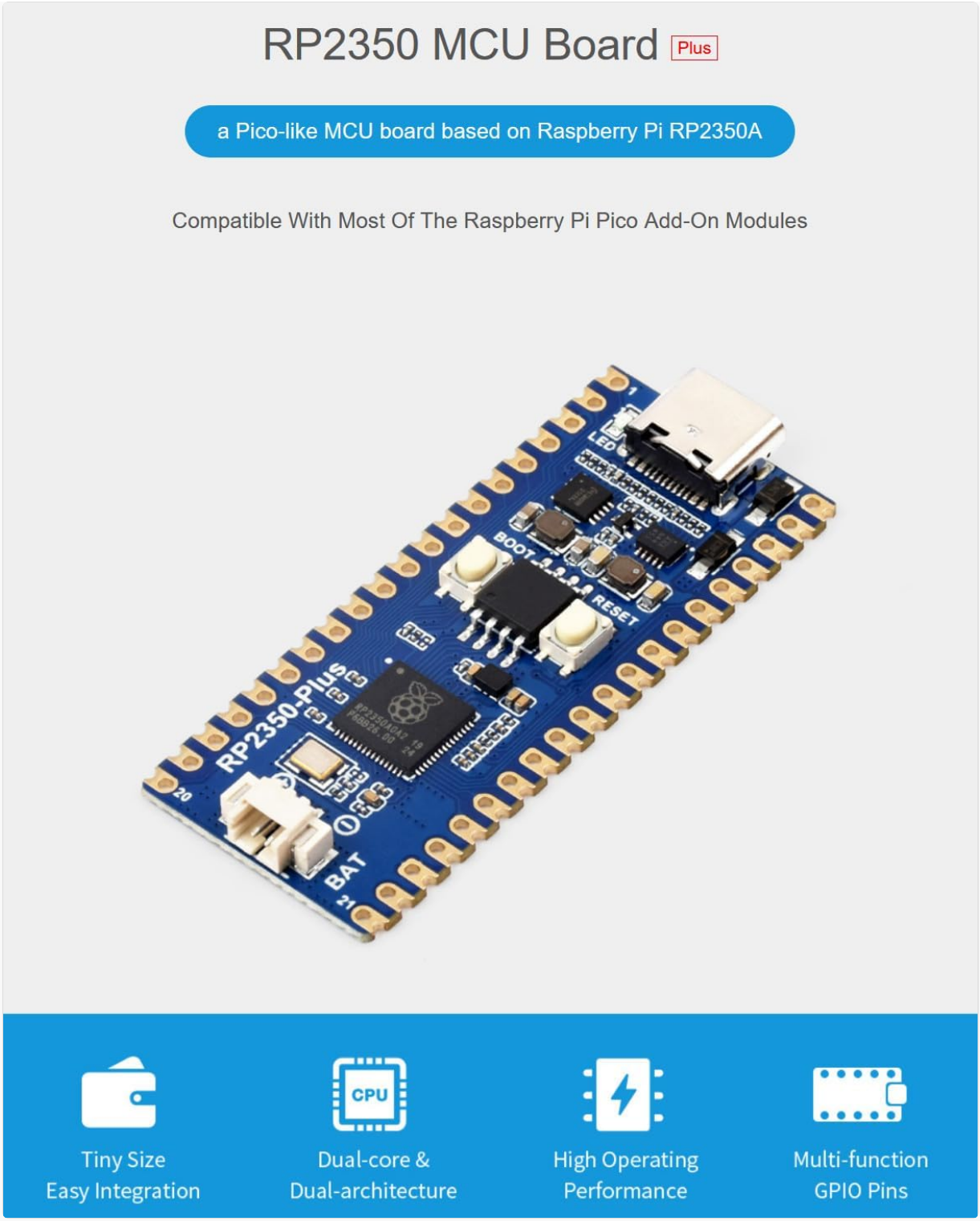
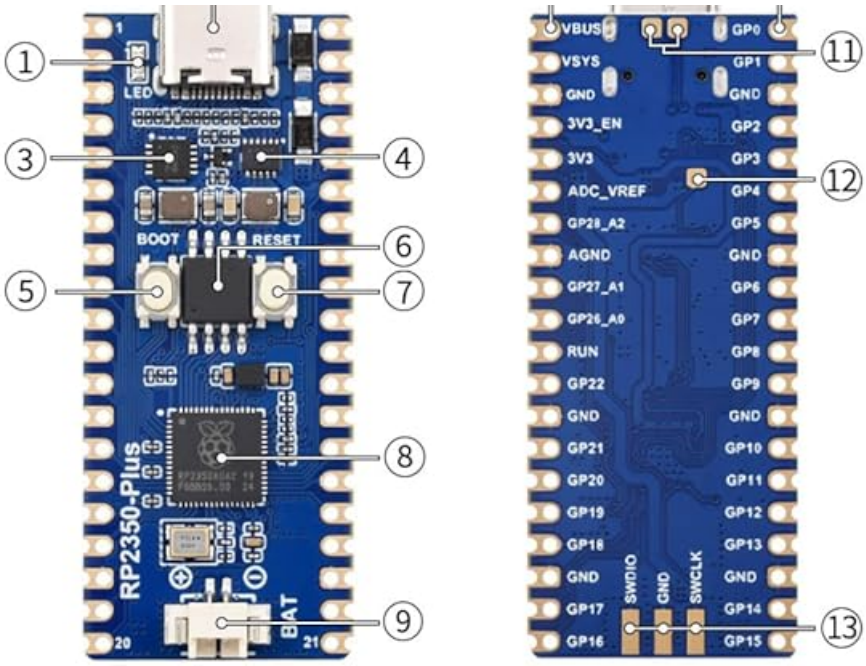


Figure 2: Overview of the RP2350-Plus MCU Board's key features, highlighting its compact size, dual-core architecture, high performance, and multi-function GPIO pins.

3. Board Layout and Pinout

Understanding the board's layout and pin assignments is crucial for proper integration and development. The RP2350-Plus features a standard pin header configuration and clearly labeled components.



1. **LED**
   user LED (not power indicator)
2. **USB Type-C connector**
3. **ETA6096**
   high efficiency Lithium battery recharge manager
4. **MP28164**
   high efficiency DC-DC buck-boost chip
5. **BOOT button**
   press it when resetting to enter download mode
6. **On-board flash memory**
   4MB: W25Q32JVSSIQ
   16MB: W25Q128JVSIQ
7. **RESET button**
8. **RP2350A**
   Dual-core and dual-architecture design, up to 150 MHz operating frequency
9. **Battery header**
   MX1.25 header, for 3.7V Lithium battery, allows recharging the battery and powering the board at the same time
10. **Pinout**
    compatible with Raspberry Pi Pico 2
11. **USB test points**
    connecting to USB interface
12. **BOOT test point**
    connecting to BOOT button
13. **DEBUG points**

Outline Dimensions

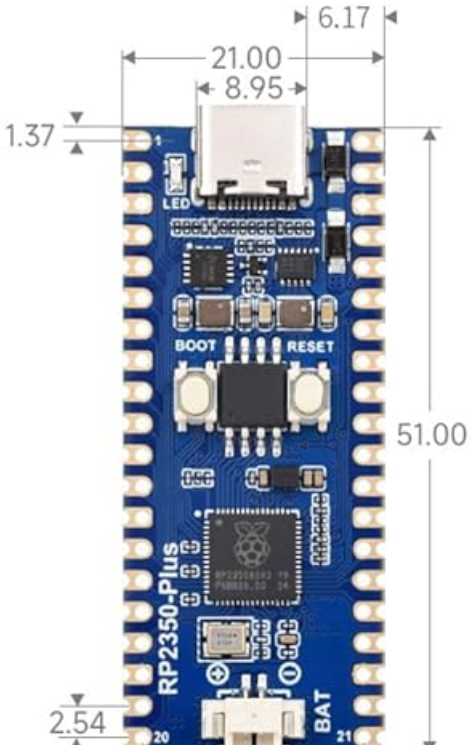


Figure 3: Detailed view of the RP2350-Plus board, indicating key components and their functions (e.g., LED, USB Type-C connector, BOOT/RESET buttons, RP2350A chip, battery header, debug points). This image also includes the board's outline dimensions.

3.1 Pin Descriptions

The board provides 26 multi-function GPIO pins. Refer to the pinout diagram for specific assignments:

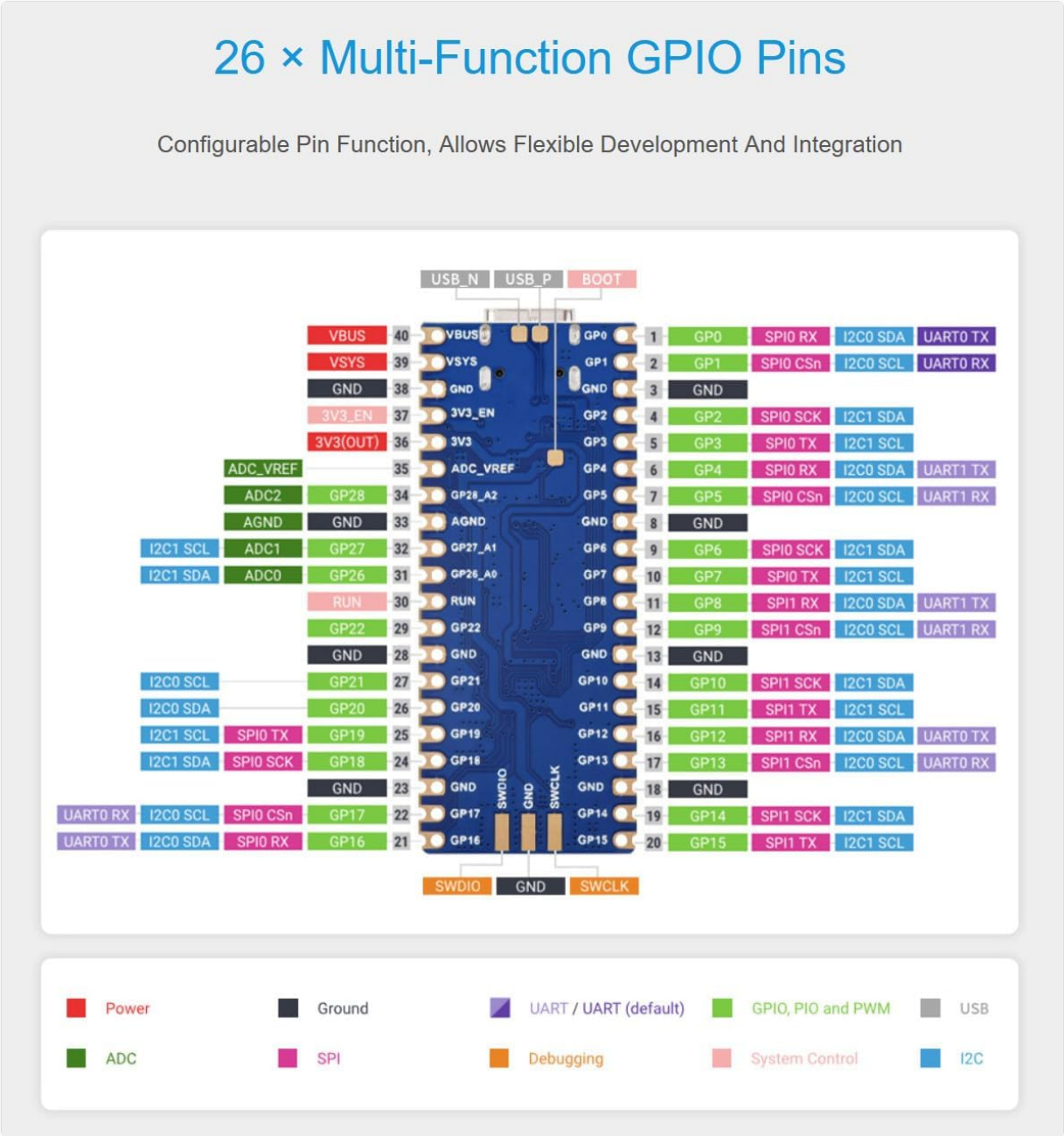


Figure 4: Comprehensive GPIO pinout diagram for the RP2350-Plus, illustrating the functions of each pin including Power, Ground, UART, ADC, SPI, Debugging, GPIO, PIO, PWM, and I2C.

Key pin functions include:

- **Power Pins:** VBUS, VSYS, 3V3_EN, 3V3(OUT), GND.
- **Analog-to-Digital Converter (ADC) Pins:** ADC0, ADC1, ADC2, ADC_VREF.
- **Serial Peripheral Interface (SPI) Pins:** SPI0 SCK, SPI0 TX, SPI0 RX, SPI0 CSn, SPI1 SCK, SPI1 TX, SPI1 RX, SPI1 CSn.

- **Inter-Integrated Circuit (I2C) Pins:** I2C0 SCL, I2C0 SDA, I2C1 SCL, I2C1 SDA.
- **Universal Asynchronous Receiver-Transmitter (UART) Pins:** UART0 TX, UART0 RX, UART1 TX, UART1 RX.
- **General Purpose Input/Output (GPIO) Pins:** GP0-GP28 (some shared with other functions).
- **Pulse Width Modulation (PWM) Channels:** 16 controllable PWM channels.

4. Setup Instructions

Follow these steps to prepare your RP2350-Plus Development Board for use:

1. **Power Supply:** Connect the board to a computer using a USB Type-C cable. The board can be powered via the USB port. Alternatively, a 3.7V lithium battery can be connected to the BAT header for portable applications, which will also charge the battery.
2. **Driver Installation (if necessary):** For most modern operating systems, the board will be recognized automatically. If issues arise, consult the official Raspberry Pi RP2350A documentation for specific driver requirements.
3. **Initial Connection:** When connecting for the first time, the board may appear as a mass storage device. This is normal and indicates it is ready for drag-and-drop programming.

5. Operating Instructions

The RP2350-Plus Development Board supports various programming methods and environments.

5.1 Programming the Board

- **Drag-and-Drop Programming:**
  To upload firmware (e.g., a UF2 file), press and hold the**BOOT** button, then connect the board to your computer via the USB Type-C cable. Release the **BOOT** button once the board appears as a removable drive (RPI-RP2). Drag and drop your compiled UF2 file onto this drive. The board will automatically reboot and run the new firmware.
- **Using the Pico C/C++ SDK:**
  The official Raspberry Pi C SDK can be used for advanced development. This involves compiling C/C++ code using command-line tools or integrated development environments like Visual Studio Code and Eclipse. Refer to the official Raspberry Pi Pico documentation for detailed setup and usage of the SDK.
- **Using MicroPython:**
  MicroPython is a Python 3 implementation optimized for embedded hardware. You can flash a MicroPython UF2 firmware to the board using the drag-and-drop method, then interact with the board using a serial terminal or an IDE that supports MicroPython, such as Thonny.

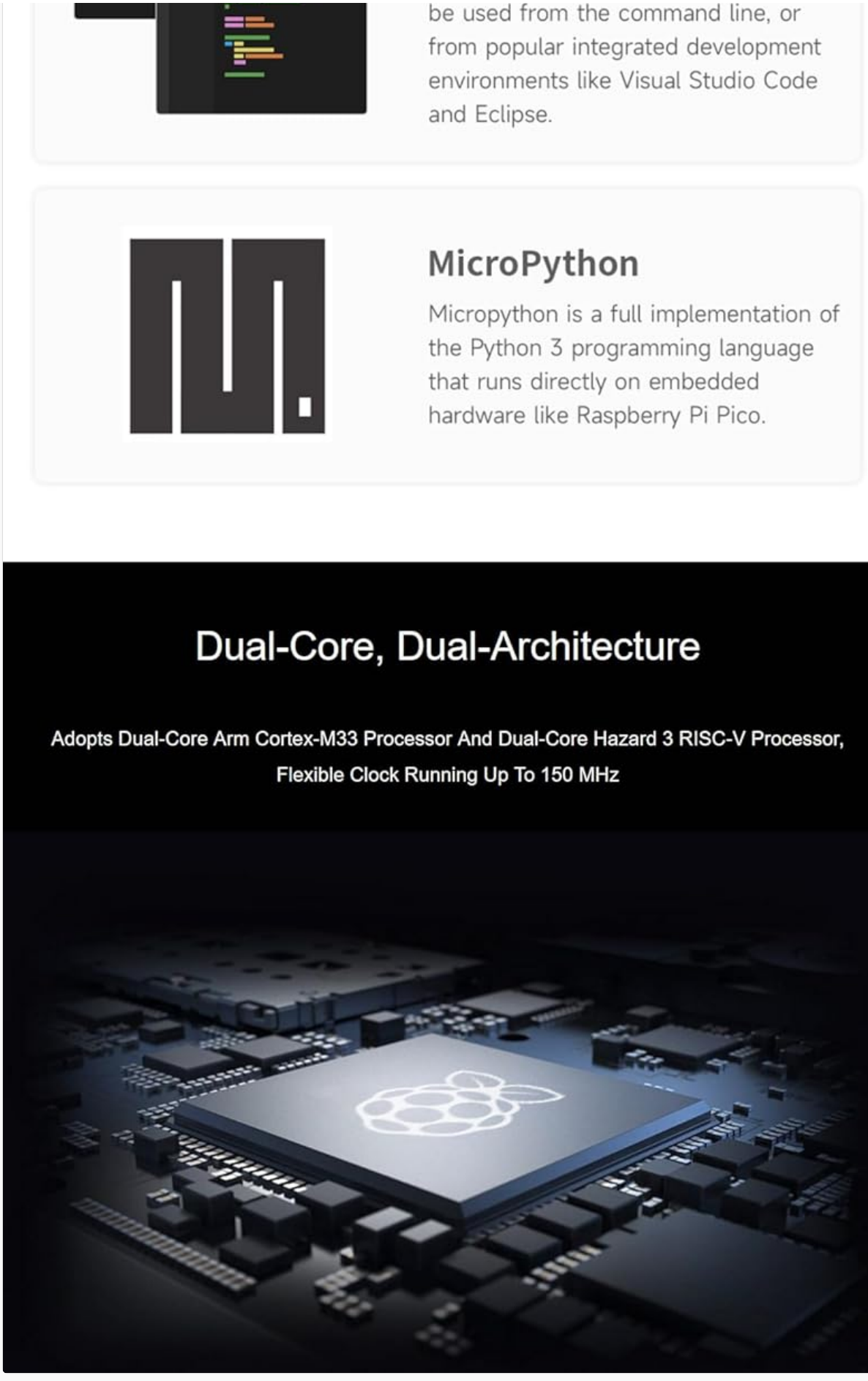


Figure 5: Illustration of C/C++ and MicroPython development support for the RP2350-Plus, showing typical development environments and the MicroPython logo.

5.2 Dual-Core Architecture

The RP2350A microcontroller features a unique dual-core and dual-architecture design:

- **Dual-core Arm Cortex-M33 Processor:** Provides robust general-purpose processing capabilities.
- **Dual-core Hazard 3 RISC-V Processor:** Offers additional processing power and flexibility for specialized tasks.

This architecture allows for complex applications, parallel processing, and efficient resource management.

6. Specifications

Detailed technical specifications for the XYGStudy RP2350-Plus-16MB-M Development Board:

Feature	Description
Part Number	RP2350-Plus-16MB-M
Microcontroller	Raspberry Pi RP2350A (Dual-core Arm Cortex-M33, Dual-core Hazard 3 RISC-V)
Clock Speed	Up to 150 MHz
SRAM	520KB
Flash Memory	16MB (on-board)
USB Interface	USB 1.1 (Device and Host support), Type-C connector
GPIO Pins	26 multi-function GPIO pins
Peripherals	2x SPI, 2x I2C, 2x UART, 4x 12-bit ADC, 16x controllable PWM channels, Temperature sensor, Accurate clock and timer, 12x PIO state machines
Power Management	Onboard DC-DC chip MP28164 (max 2A load), Lithium battery charge/discharge support
Low-Power Modes	Sleep and dormant modes
Module Type	Castellated module for direct soldering
UPC	795602423509

7. Maintenance

To ensure the longevity and proper functioning of your RP2350-Plus Development Board, observe the following maintenance guidelines:

- **Handling:** Always handle the board by its edges to avoid touching components, especially the pins, which can be sensitive to electrostatic discharge (ESD).
- **Storage:** Store the board in an anti-static bag when not in use, and keep it in a dry, dust-free environment.
- **Cleaning:** If necessary, gently clean the board with a soft, dry brush or compressed air. Avoid using liquids or abrasive materials.
- **Power:** Ensure the power supply voltage is within the specified limits. Over-voltage can damage the board.

8. Troubleshooting

If you encounter issues with your RP2350-Plus Development Board, consider the following common troubleshooting steps:

- **Board Not Recognized by Computer:**
  - Ensure the USB Type-C cable is fully inserted and functional.
  - Try a different USB port on your computer.
  - Attempt to enter bootloader mode (hold BOOT, then connect USB) to see if it appears as a mass storage device.
- **Program Not Running:**
  - Verify that the correct firmware (UF2 file) was successfully uploaded.
  - Check your code for errors and ensure it is compatible with the RP2350A architecture.
  - Press the **RESET** button to restart the program.
- **Power LED Not Illuminating:**
  - Confirm the power source (USB or battery) is providing adequate power.
  - Inspect the USB cable for damage.

9. Warranty and Support

Specific warranty details for the XYGStudy RP2350-Plus-16MB-M Development Board are not provided in this manual. For warranty claims, technical support, or further assistance, please contact the manufacturer or your point of purchase directly.
You may also refer to the official Raspberry Pi documentation and community forums for the RP2350A microcontroller for additional resources and support related to programming and development.