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LILYGO T-PicoC3

LILYGO T-PicoC3 Development Board User Manual

Model: T-PicoC3

1. INTRODUCTION

The LILYGO T-PicoC3 is a versatile development board integrating two powerful microcontrollers: the Raspberry Pi RP2040 and the Espressif ESP32-C3. This dual-MCU design allows for flexible programming and diverse application development. It features built-in Wi-Fi and Bluetooth Low Energy (BLE) connectivity, along with a 1.14-inch ST7789V IPS LCD display for user interaction and data visualization. This manual provides essential information for setting up, operating, and maintaining your T-PicoC3 board.

2. PRODUCT OVERVIEW

2.1 Key Features

- **Dual MCUs:** Raspberry Pi RP2040 and Espressif ESP32-C3, enabling simultaneous operation.
- **Wireless Connectivity:** Integrated Wi-Fi and Bluetooth 5.0 + BLE support via ESP32-C3.
- **Display:** 1.14-inch ST7789V IPS LCD with 135x240 resolution, full-color TFT display, 4-wire SPI interface, and 3.3V working power supply.
- **Flash Memory:** 4MB for program storage.
- **Programming Languages:** Supports C/C++ and MicroPython.
- **Machine Learning:** Support for TensorFlow Lite.
- **Onboard Functions:** Two user-programmable buttons (IO06, IO07) and battery power detection.

2.2 Components and Layout

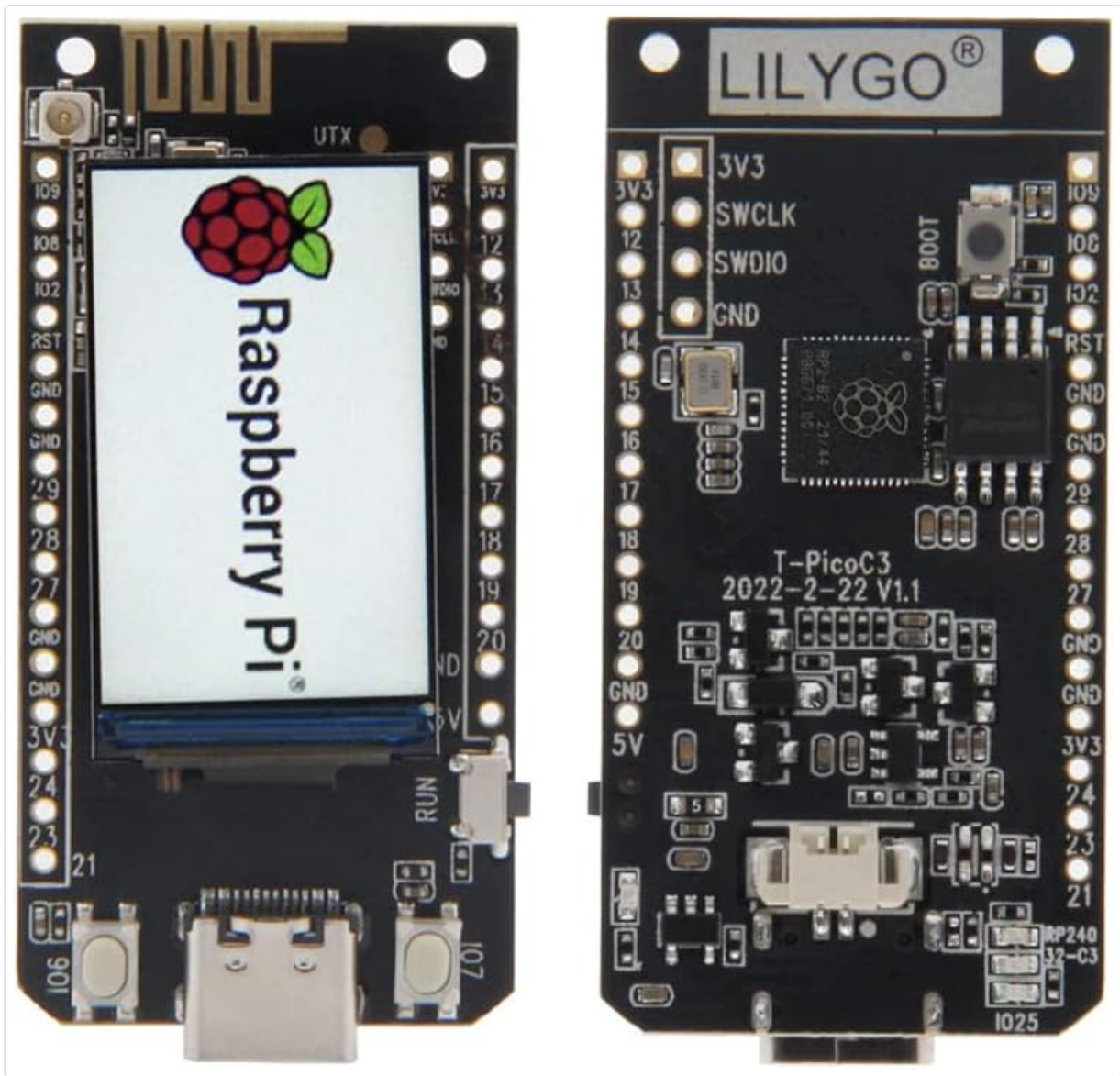


Figure 1: Front and back view of the LILYGO T-PicoC3 development board. The front features the 1.14-inch IPS LCD and USB-C port, while the back shows the Raspberry Pi RP2040 and ESP32-C3 chips.

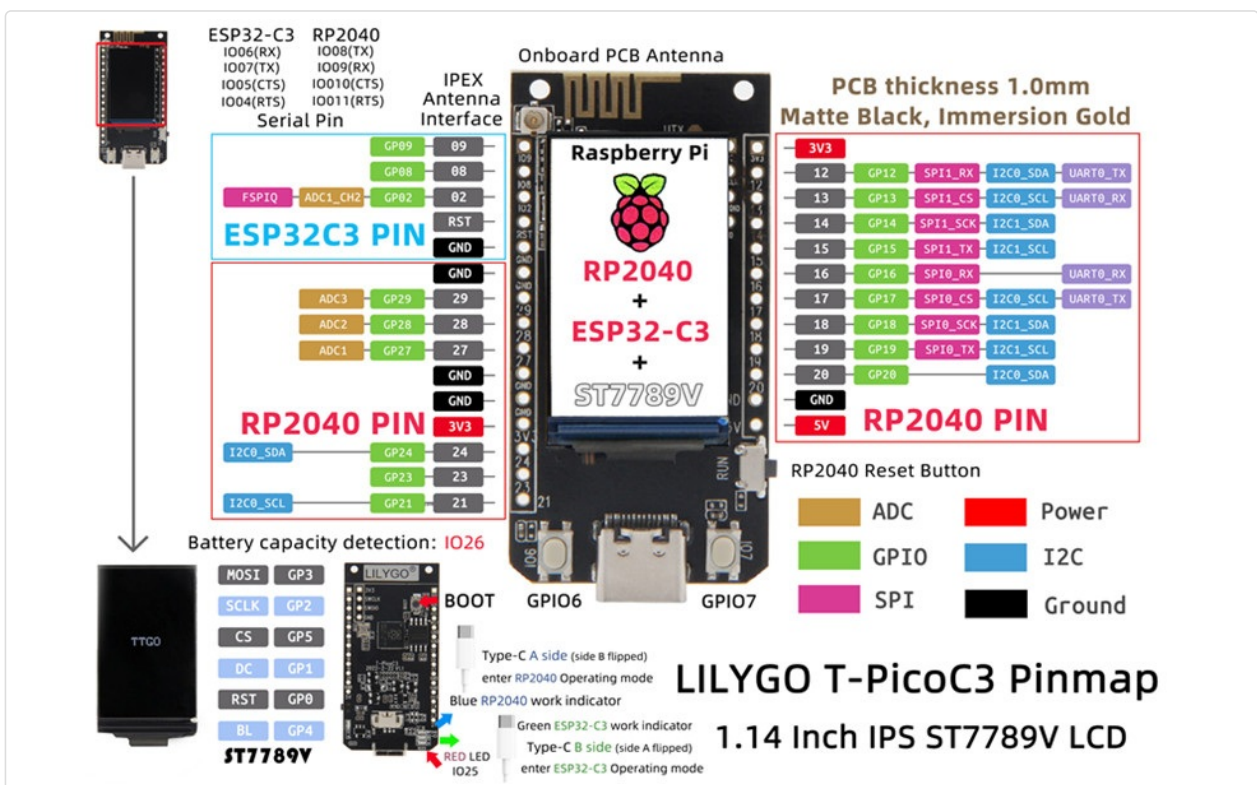


Figure 2: Detailed overview of the LILYGO T-PicoC3's main features, including MCU specifications, display details, and onboard functionalities.

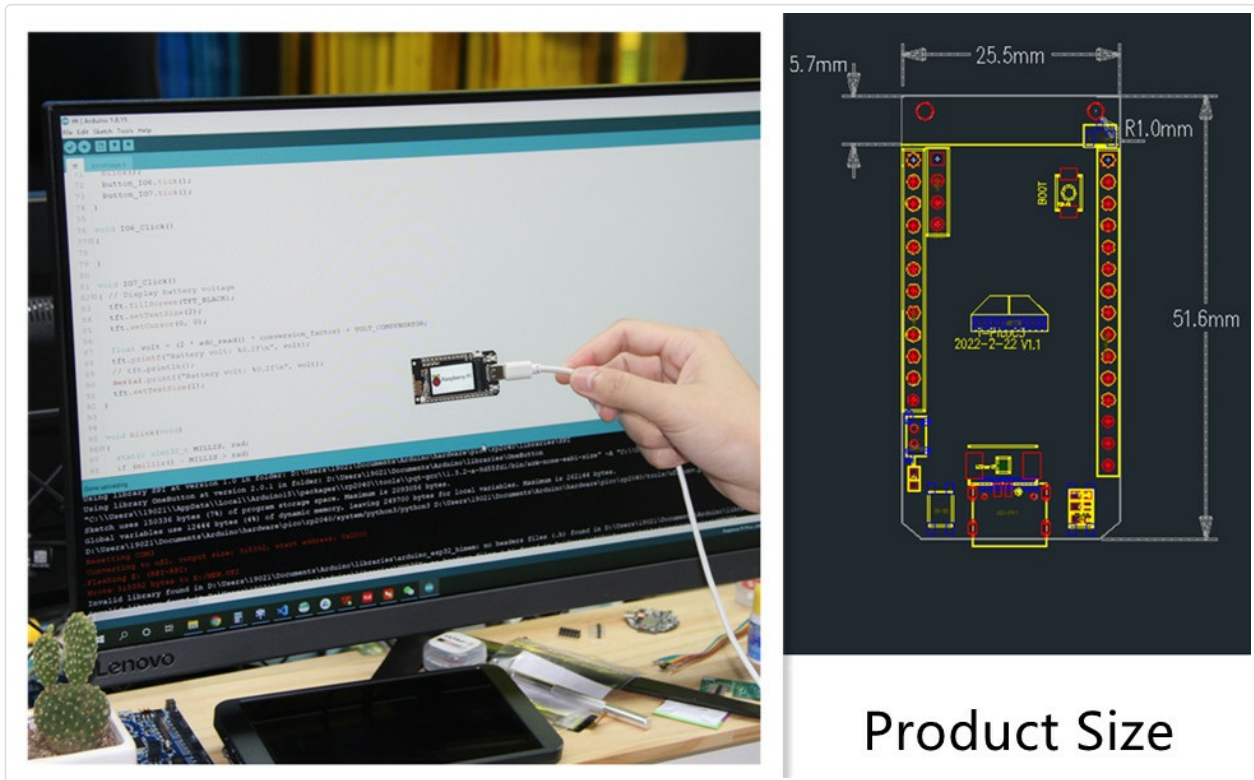


Figure 3: Illustration of the LILYGO T-PicoC3's compact dimensions and an example of it connected to a computer for development.

3. SETUP

3.1 Initial Connection

1. Connect the LILYGO T-PicoC3 board to your computer using a USB-C cable. Ensure the cable is capable of data transfer, not just charging.
2. The board should power on, and the integrated display may show a default boot screen or logo.
3. Install necessary drivers if the board is not automatically recognized by your operating system. Refer to the official LILYGO GitHub repository for driver information.

3.2 Working Mode Selection

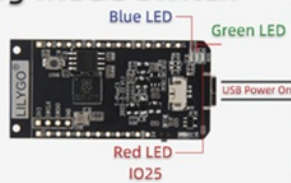
The T-PicoC3 features a unique mechanism for selecting which MCU (RP2040 or ESP32-C3) is active for programming and operation. This is determined by the orientation of the USB-C cable when inserted.

MCU: RP2040 Dual ARM Cortex-M0+ Flash:4MB
ESP32-C3 Support Wi-Fi , Bluetooth V5.0+BLE
Programming language: **C/C++**, **MicroPython**
Support machine learning library **TensorFlow Lite**
Onboard functions: Buttons:IO06+IO07, **battery power** detection

1.14 inch ST7789V IPS LCD:

Resolution: **135X240**, Full color TFT Display
4-Wire SPI interface, Working Power Supply: 3.3V
Operating Temperature: -20 ~ 70°C

Working mode switch



When the **blue LED** is on,
enter **RP2040 mode**
(To switch the mode, you need to
reverse the USB insertion direction)
enter **ESP32-C3 mode**
When the **green LED** is on

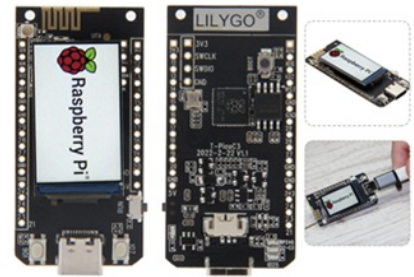


Figure 4: Diagram illustrating the working mode selection based on USB-C cable insertion direction. Blue LED indicates RP2040 mode, Green LED indicates ESP32-C3 mode.

- **RP2040 Mode:** When the blue LED is illuminated, the board is operating in RP2040 mode. This mode is typically activated by inserting the USB-C cable in one specific orientation (Type-A side flipped).
- **ESP32-C3 Mode:** When the green LED is illuminated, the board is operating in ESP32-C3 mode. This mode is typically activated by inserting the USB-C cable in the opposite orientation (Type-C side flipped).

Observe the LED indicators to confirm the active MCU before attempting to upload code or interact with specific functionalities.

4. OPERATING INSTRUCTIONS

4.1 Development Environment Setup

To program the LILYGO T-PicoC3, you will need to set up a suitable development environment. Common choices include:

- **Arduino IDE:** Install the ESP32 and Raspberry Pi RP2040 board packages.
- **PlatformIO:** A powerful extension for VS Code supporting both ESP32 and RP2040.
- **ESP-IDF:** Espressif IoT Development Framework for ESP32-C3 specific development.
- **MicroPython:** Flash MicroPython firmware to either MCU and program using a serial terminal.

Detailed instructions and example code can be found on the official LILYGO GitHub repository:
github.com/Xinyuan-LilyGO/T-PicoC3.

4.2 Programming and Uploading Code

1. Select the desired MCU mode (RP2040 or ESP32-C3) by inserting the USB-C cable in the correct orientation, as indicated by the blue or green LED.
2. Open your chosen development environment (e.g., Arduino IDE).
3. Select the appropriate board from the tools menu (e.g., "ESP32-C3 Dev Module" or "Raspberry Pi Pico").

4. Select the correct serial port corresponding to the connected board.
5. Write or load your code.
6. Click the "Upload" button to compile and transfer your code to the board.
7. Observe the serial monitor for output from your program.

For specific boot modes or flashing procedures, consult the GitHub repository or the respective MCU documentation.

5. PINOUT DIAGRAM

Understanding the pinout is crucial for connecting external components and utilizing the full capabilities of the T-PicoC3 board. The board provides access to GPIOs, power pins, and communication interfaces for both the RP2040 and ESP32-C3.

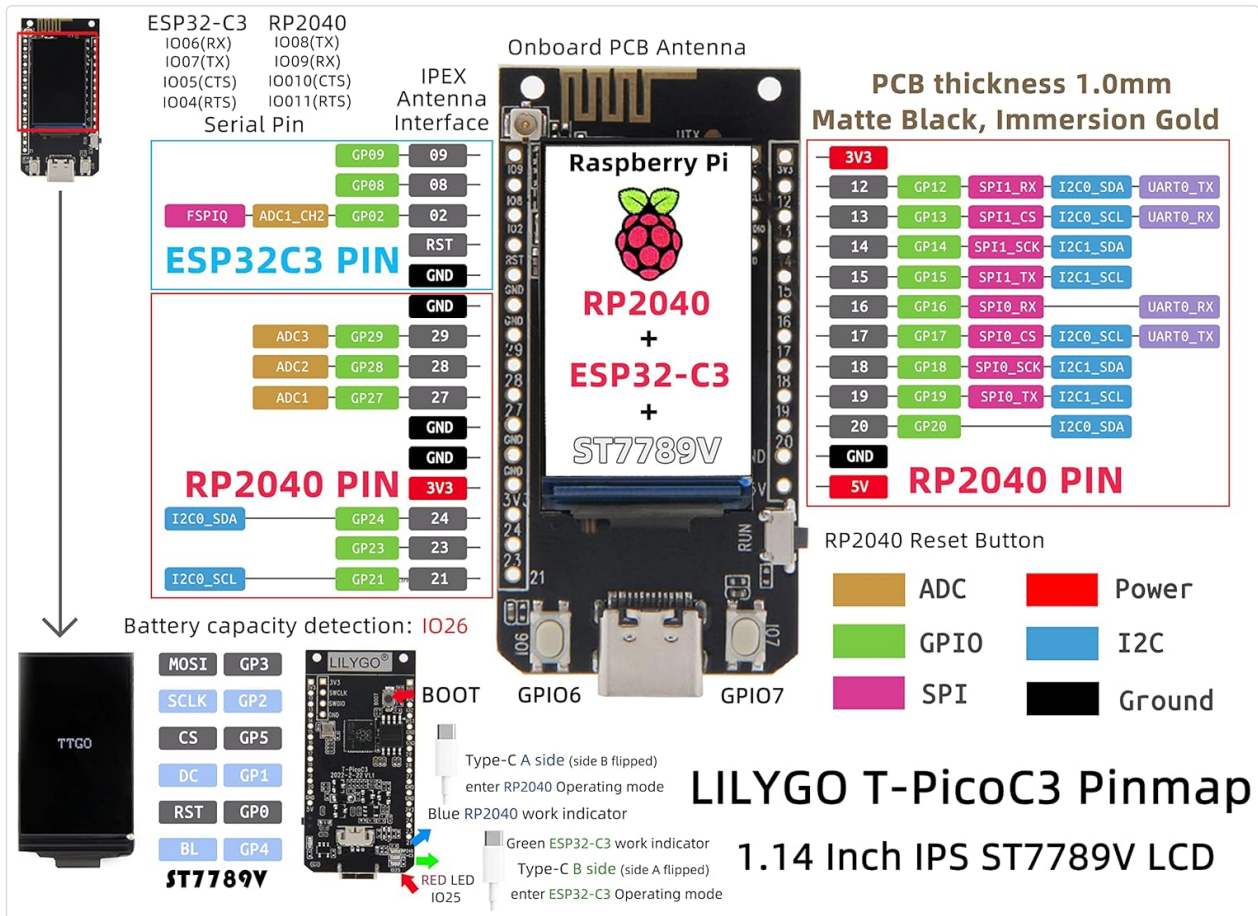


Figure 5: Comprehensive pinout diagram for the LILYGO T-PicoC3, detailing the functions of each pin for both ESP32-C3 and RP2040, including power, ground, ADC, GPIO, I2C, and SPI connections.

Refer to this diagram when designing your circuits and connecting sensors, actuators, or other modules to the T-PicoC3.

6. SPECIFICATIONS

Feature	Specification
Main MCUs	Raspberry Pi RP2040 (Dual ARM Cortex-M0+), Espressif ESP32-C3
Flash Memory	4MB

Feature	Specification
Wireless Connectivity	Wi-Fi (2.4 GHz), Bluetooth 5.0 + BLE (via ESP32-C3)
Display	1.14 inch ST7789V IPS LCD, 135x240 resolution, Full color TFT, 4-wire SPI
Operating Voltage	3.3V (for display), 5V via USB-C
Programming Languages	C/C++, MicroPython
Operating Temperature	-20°C to 70°C
Dimensions	Approximately 5.3 cm (H) x 2.4 cm (W)
Item Weight	0.704 ounces (approx. 20 grams)

7. MAINTENANCE

Proper care and maintenance will extend the lifespan of your LILYGO T-PicoC3 development board.

- **Handling:** Always handle the board by its edges to avoid touching sensitive components, especially the display and exposed pins.
- **Storage:** Store the board in an anti-static bag or a protective enclosure when not in use to prevent electrostatic discharge (ESD) damage.
- **Cleaning:** Use a soft, dry brush or compressed air to remove dust. For stubborn grime, a lint-free cloth lightly dampened with isopropyl alcohol can be used, ensuring the board is powered off and completely dry before re-powering.
- **Power Supply:** Use a stable 5V power supply via the USB-C port. Avoid over-voltage or reverse polarity connections.
- **Environment:** Operate the board within its specified temperature range (-20°C to 70°C) and avoid high humidity environments.

8. TROUBLESHOOTING

This section addresses common issues you might encounter with your T-PicoC3 board.

8.1 Board Not Recognized by Computer

- **USB Cable:** Ensure you are using a high-quality USB-C cable that supports data transfer. Some cables are charge-only.
- **USB Port:** Try a different USB port on your computer.
- **Drivers:** Verify that the necessary USB-to-Serial drivers (e.g., CP210x or CH340, depending on the board's specific USB-UART bridge) are installed. Check the LILYGO GitHub for driver links.
- **Cable Orientation:** For some systems, the USB-C cable orientation might affect recognition. Try flipping the cable.

8.2 Unable to Flash Firmware/Upload Code

- **MCU Mode:** Confirm that the board is in the correct MCU mode (RP2040 or ESP32-C3) for the firmware you are trying to upload, as indicated by the blue or green LED.
- **Serial Port:** Ensure the correct serial port is selected in your development environment.
- **Boot Mode:** For ESP32-C3, you might need to manually put the board into bootloader mode. Typically, this involves holding down the "BOOT" button (often labeled IO9 or similar) while pressing and releasing

the "RESET" button, then releasing "BOOT". Refer to the pinout diagram for button locations.

- **Development Environment:** Check your development environment settings (e.g., board selection, flash size, partition scheme).
- **Power:** Ensure the board is receiving adequate power.

8.3 Display Not Working or Showing Incorrect Output

- **Initialization Code:** Verify that your code correctly initializes the ST7789V display with the correct parameters (e.g., resolution, SPI pins).
- **Library:** Ensure you are using a compatible display library (e.g., Adafruit GFX and Adafruit ST7789 libraries).
- **Connections:** While the display is integrated, ensure no physical damage or loose connections if the board has been tampered with.

9. SUPPORT AND WARRANTY

For further technical assistance, detailed documentation, and community support, please visit the official LILYGO GitHub repository:

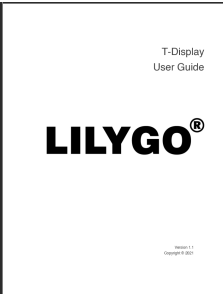
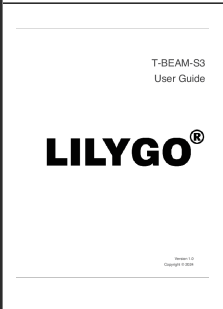
github.com/Xinyuan-LilyGO/T-PicoC3

This repository contains example code, schematics, and other resources that can aid in your development process.

Information regarding specific warranty terms for the LILYGO T-PicoC3 board is typically provided at the point of purchase. Please refer to your retailer's warranty policy or contact LILYGO directly for warranty-related inquiries.

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Related Documents - T-PicoC3

 <p>T-Display User Guide</p> <p>LILYGO[®]</p> <p>Version 1.1 Copyright © 2023</p>	<p>LILYGO T-Display User Guide</p> <p>A user guide for the LILYGO T-Display development board, covering setup, Arduino integration, and basic commands for ESP32 module development.</p>
 <p>T-BEAM-S3 User Guide</p> <p>LILYGO[®]</p> <p>Version 1.0 Copyright © 2023</p>	<p>LILYGO T-BEAM-S3 User Guide: Setup and Development</p> <p>This user guide provides comprehensive instructions for setting up the LILYGO T-BEAM-S3 development board. Learn how to configure the software environment using Arduino IDE, connect the board, and utilize its Wi-Fi, BLE, GPS, and LoRa capabilities for IoT projects.</p>

<p>T-Dongle-S3 User Guide</p> <p>LILYGO®</p> <p><small>Version 1.0 Copyright © 2021</small></p>	<p>LILYGO T-Dongle-S3 User Guide: Getting Started with ESP32-S3 Development</p> <p>A comprehensive user guide for the LILYGO T-Dongle-S3 development board. Learn how to set up your Arduino development environment, program the ESP32-S3 module, and explore Wi-Fi and Bluetooth features.</p>
<p>T-Deck User Guide</p> <p>LILYGO®</p> <p><small>Version 1.0 Copyright © 2021</small></p>	<p>LILYGO T-Deck ESP32-S3 User Guide for Arduino Development</p> <p>Comprehensive user guide for the LILYGO T-Deck development board, detailing setup of the Arduino IDE, ESP32-S3 configuration, Wi-Fi and LoRa functionality, and SSC command reference for IoT applications.</p>
<p>T-WATCH-V3 User Guide</p> <p>LILYGO®</p> <p><small>Version 1.0 Copyright © 2021</small></p>	<p>LILYGO T-WATCH-V3 User Guide</p> <p>A comprehensive user guide for the LILYGO T-WATCH-V3 development board, detailing setup, software development, and SSC command reference for ESP32 applications.</p>
<p>T-Embed User Guide</p> <p>LILYGO®</p> <p><small>Version 1.0 Copyright © 2021</small></p>	<p>LILYGO T-Embed User Guide</p> <p>A comprehensive user guide for the LILYGO T-Embed development board, covering setup, Arduino IDE integration, and Wi-Fi command reference.</p>