LILYGO T-QT Pro

LILYGO T-QT Pro ESP32-S3 Development Board User Manual

Model: T-QT Pro | Brand: LILYGO

1. PRODUCT OVERVIEW

The LILYGO T-QT Pro is a compact development board featuring the ESP32-S3FN4R2 Xtensa LX7 microprocessor and a 0.85-inch GC9107 TFT IPS LCD display module. This board is designed for various embedded applications, offering Wi-Fi and Bluetooth connectivity, along with battery charging and discharging capabilities.

Figure 1: Front view of the LILYGO T-QT Pro module displaying a clock.

Key Features:

- **MCU:** ESP32-S3FN4R2 Xtensa LX7 microprocessor.
- **Display:** 0.85-inch GC9107 TFT IPS LCD.
- **Connectivity:** Wi-Fi (802.11b) and Bluetooth.
- **Power:** Integrated battery charging and discharging function.
- **USB:** Supports USB2.0 (USBA-USBC) and USB3.0 (USBC-USBC) protocols.
- **Programming:** Compatible with Arduino IDE and MicroPython.

Package Contents:

The LILYGO T-QT Pro package typically includes the following items:

- 1 x T-QT Pro main board with 0.85 inch GC9107 TFT IPS LCD Display Module
- 1 x Battery
- 2 x PH2.54 PIN (1*7P) headers
- 1 x JST 2.0mm 2P cable

- 1 x Female Connect Cable PH2.0 2P

Figure 2: Contents of the LILYGO T-QT Pro package.

2. SETUP AND HARDWARE OVERVIEW

Before using your LILYGO T-QT Pro, familiarize yourself with its hardware components and basic setup.

Hardware Features:

- Type-C USB port for power and data transfer.
- Boot and Custom buttons on both sides.
- Reset button on the side.
- JST-GH 1.25mm 2-pin battery interface on the back of the USB port.
- GPIO Pin extension definitions for expanded functionality.
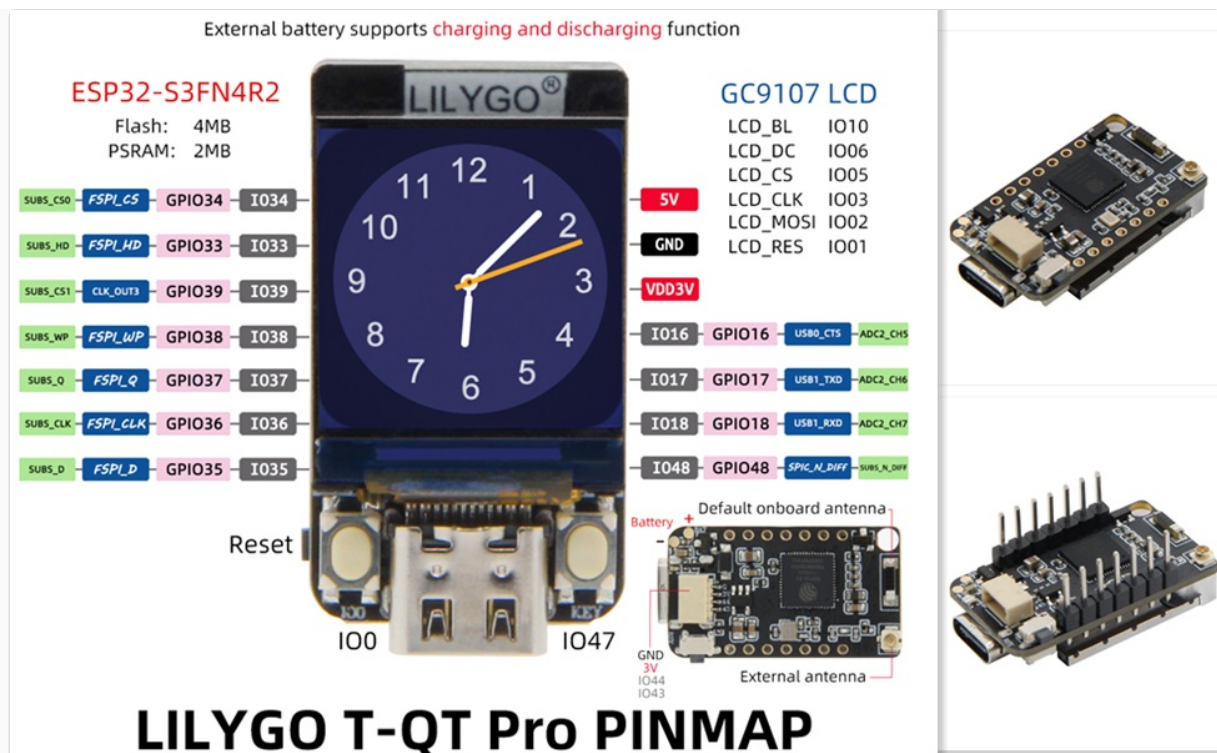- Reserved JST-SH 1.0mm 4-pin interface supporting STEMMA QT/Qwiic.

Figure 3: Detailed pinout diagram of the LILYGO T-QT Pro.

Initial Power-Up and Time Synchronization:

Upon connecting the battery and powering on, the device can automatically synchronize time if connected to a Wi-Fi network.

Video 1: Demonstrates unpacking, connecting the battery, powering on, and automatic time synchronization (0:09 - 1:20).

3. FIRMWARE INSTALLATION AND PROGRAMMING

The LILYGO T-QT Pro supports various programming platforms. Below are instructions for entering download mode and setting up your development environment.

Entering Download Mode:

There are two methods to enter download mode for flashing new firmware:

1. **Method 1:** Connect the USB cable, then press and hold the **BOOT** button, and while holding **BOOT**, press the **RESET** button.
2. **Method 2:** Press and hold the **BOOT** button, then connect the USB cable.

Video 2: Demonstrates both methods for entering download mode (2:30 - 3:00).

3.1. PlatformIO Installation/Burning:

PlatformIO is a professional development environment for embedded systems. Follow these steps to install and burn firmware:

1. Install necessary tools: Python, VS Code, and Git.
2. Open VS Code and install the PlatformIO IDE extension.
3. Clone the LILYGO T-Display-S3 GitHub repository.
4. Open the project in PlatformIO and configure the `platformio.ini` file.
5. Build and upload the firmware to your T-QT Pro board.

3.2. Arduino IDE Installation/Burning:

The Arduino IDE is a popular choice for hobbyists and professionals. To use it with your T-QT Pro:

1. Download and install the Arduino IDE from the official website.
2. Add the ESP32 board manager URL in Arduino IDE preferences.
3. Install the ESP32 boards package via the Boards Manager.
4. Select the correct board (ESP32-S3 Dev Module) and port.
5. Upload your sketch.

Video 4: Step-by-step instructions for Arduino IDE setup and firmware burning (7:50 - 14:40).

3.3. MicroPython Installation/Burning:

MicroPython is a lean and efficient implementation of the Python 3 programming language. To install MicroPython on your T-QT Pro:

1. Download the Thonny IDE.
2. Download the ESP32-S3 MicroPython firmware (.bin file) from micropython.org.
3. Use the ESP Flash Download Tool to flash the MicroPython firmware onto the board.
4. Connect to the board via Thonny and upload your MicroPython scripts.

Video 5: Guide for installing MicroPython and flashing firmware (14:40 - 18:50).

3.4. ESP-IDF Installation/Burning:

The ESP-IDF (Espressif IoT Development Framework) is the official development framework for ESP32. For advanced users:

1. Follow the official Espressif documentation for ESP-IDF setup on your operating system (Linux, macOS, or Windows).
2. Clone the ESP-IDF repository and set up the environment variables.
3. Navigate to an example project (e.g., `get-started/hello_world`).
4. Build and flash the project using `idf.py build` and `idf.py flash`.

Video 6: Instructions for setting up ESP-IDF and flashing a basic 'hello_world' example (18:50 - 23:20).

4. WI-FI CONFIGURATION

To connect your T-QT Pro to a Wi-Fi network, you can use the ESPTouch application on your smartphone. This is particularly useful for initial setup or when changing networks.

1. Download the ESPTouch application (available on iOS App Store and GitHub for Android).
2. Ensure your smartphone is connected to a 2.4GHz Wi-Fi network (5GHz is not supported).
3. Open the ESPTouch app, enter your Wi-Fi password, and initiate the connection process.
4. The T-QT Pro will attempt to connect to the configured network. Once successful, it will synchronize time and display relevant information.

Video 7: Demonstrates how to distribute Wi-Fi network credentials using the ESPTouch app (23:20 - 24:08).

5. SPECIFICATIONS

Feature	Detail
MCU	ESP32-S3FN4R2 Xtensa LX7 microprocessor
RAM	PSRAM
Wireless Type	802.11b, Bluetooth
Operating System	Linux
Product Dimensions	1.3 x 0.7 x 0.35 inches
Item Weight	2.4 ounces
CPU Manufacturer	Espressif Systems

6. TROUBLESHOOTING

- **No display after writing firmware:** If the screen remains blank after flashing, ensure you have selected the correct firmware file. Some firmware versions might not include display initialization. Try flashing the factory test firmware to verify hardware functionality.
- **USB port not recognized:** Ensure you have installed the necessary USB drivers for the ESP32-S3. Try a different USB cable or port.
- **Wi-Fi connection issues:** Confirm that your Wi-Fi network is 2.4GHz. The T-QT Pro does not support 5GHz networks. Double-check your Wi-Fi password.
- **Board not responding:** If the board becomes unresponsive, try entering download mode (Method 2: hold BOOT, then connect USB) and re-flash the firmware.

7. SUPPORT

For further assistance, documentation, and community support, please refer to the following resources:

- **GitHub Repository:** github.com/Xinyuan-LilyGO/T-QT (Contains code examples, schematics, and documentation).
- **Espressif Documentation:** For detailed information on the ESP32-S3, visit the official Espressif website.
- **Community Forums:** Engage with other users and developers for tips and troubleshooting.

Related Documents - T-QT Pro

T-QT Pro User Guide **LILYGO®** Version 1.0 Copyright 2022	[LILYGO T-QT Pro User Guide](#) A comprehensive user guide for the LILYGO T-QT Pro development board, detailing setup, configuration, and usage with Arduino and ESP32-S3 module.
T-BEAM-S3 User Guide **LILYGO®** Version 1.0 Copyright © 2024	[LILYGO T-BEAM-S3 User Guide: Setup and Development](#) 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.
T-Display-S3 User Guide **LILYGO®** Version 1.0 Copyright 2022	[LILYGO T-Display-S3 User Guide](#) A user guide for the LILYGO T-Display-S3 development board, covering setup, Arduino IDE usage, and basic Wi-Fi commands.
T-Dongle-S3 User Guide **LILYGO®** Version 1.0 Copyright 2022	[LILYGO T-Dongle-S3 User Guide: Getting Started with ESP32-S3 Development](#) 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.
T-WATCH S3 User Guide **LILYGO®** Version 1.0 Copyright © 2024	[LILYGO T-WATCH S3 User Guide: Setup and Development with Arduino](#) Learn to develop IoT applications with the LILYGO T-WATCH S3. This guide covers setting up the Arduino IDE, programming the ESP32-S3, and using SSC commands, provided by Xinyuan.

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LILYGO T-Embed User Guide

A comprehensive user guide for the LILYGO T-Embed development board, covering setup, Arduino IDE integration, and Wi-Fi command reference.