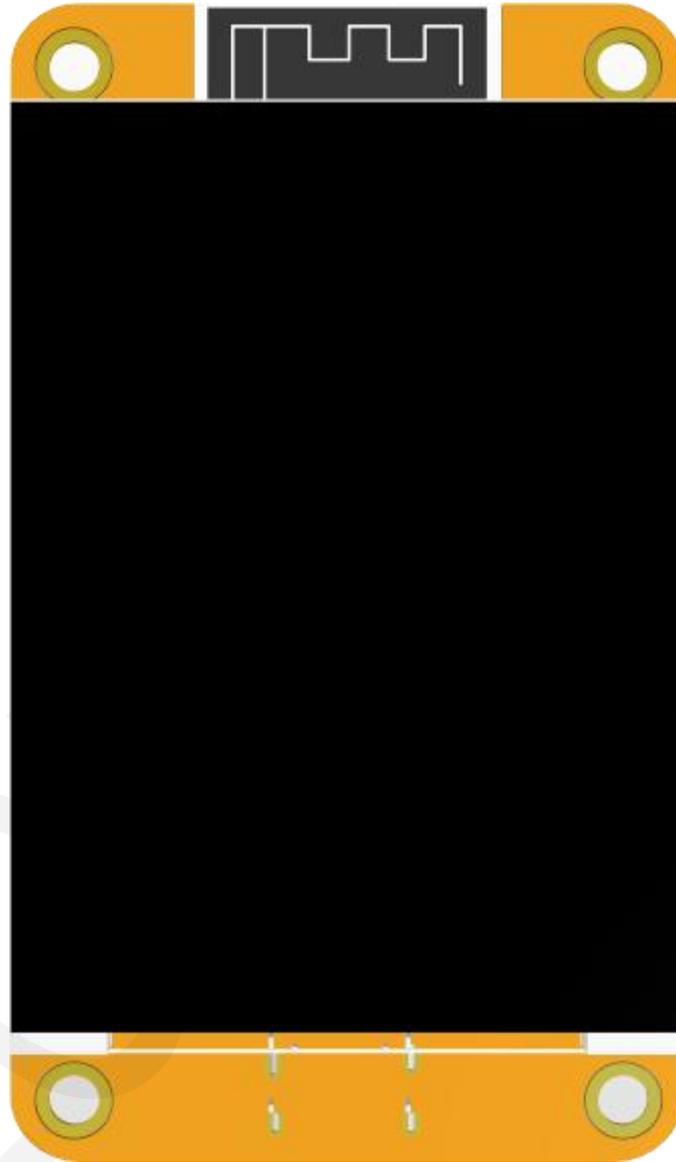# E32R24P

2.4 inch ESP32 Display Module

Specification

ShenZhen QDtech electronic technology Co.,LTD.

REV	Record	Date
V1.0	First Release	2025-06-14

CONTENTS

1. GENERAL DESCRIPTION

1.1. Product Introduction

  The E32R24P is a 2.4-inch display module with an integrated ESP32-WROOM-32E main control module. The product uses the ST7789 display driver IC, with a resolution of 240x320. It can be connected to a variety of peripheral devices, such as audio speakers, lithium batteries, MicroSD cards, serial ports, and extended IO devices, etc. It also has a touch function, which greatly facilitates users in various DIY projects and meets the needs of users for IoT and human-computer interaction function development.

1.2. Image
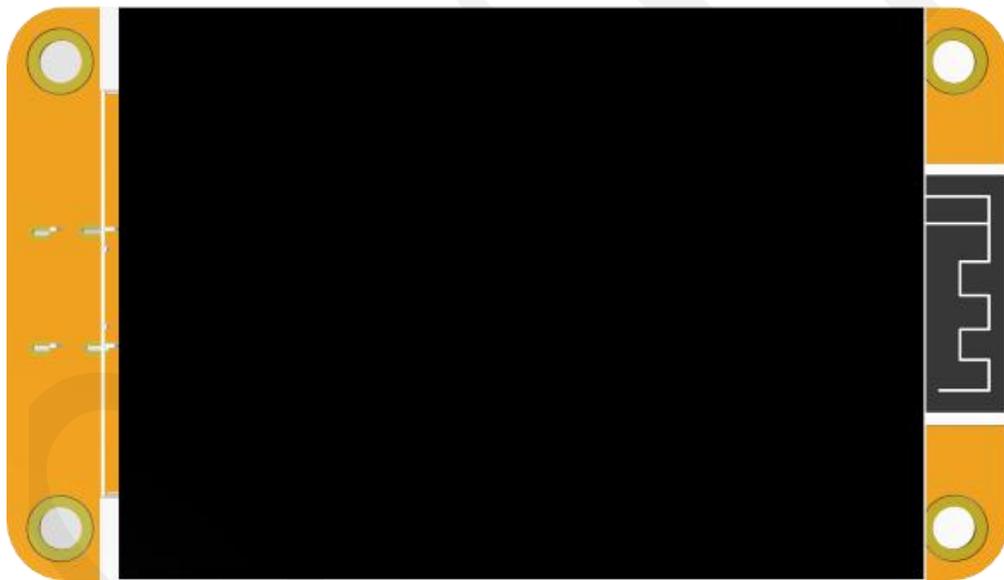
Font
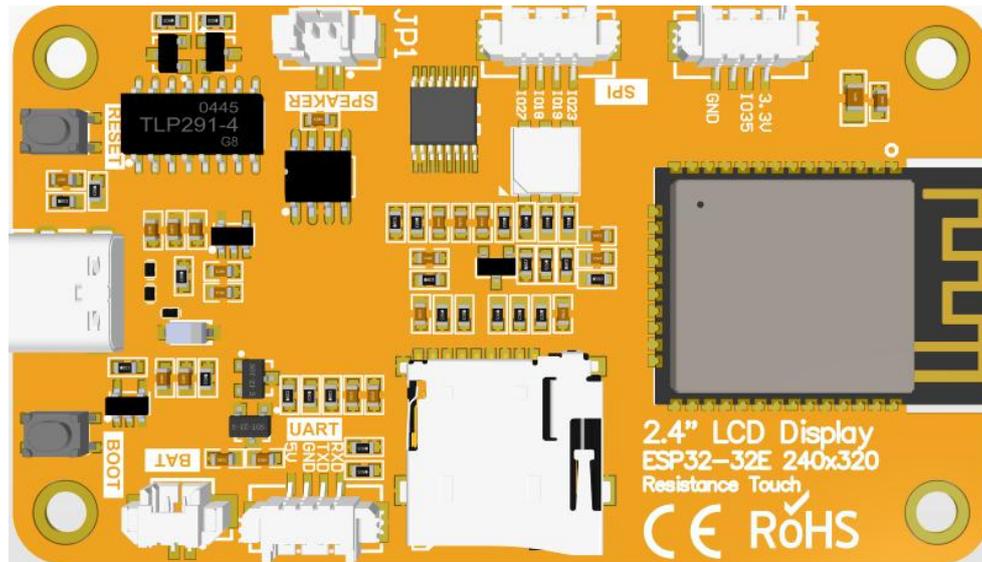
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Figure 1.1 E32R24P product diagram

1.3. Accessory List

Configure a 4P 1.25mm to 2.54mm terminal wire and a Type-C data power line.

The terminal wire is 20cm long, and the Type-C line is about 1m long.

Figure 1.3 4P 1.25mm to 2.54mm terminal wire connector

Figure 1.4 Type-C data power cable

2. PRODUCT FEATURES

2.1. Feature Description

● Equipped with an ESP32-32E module, sufficient development resources, and convenient development

● 2.4-inch IPS color screen with240x320 resolution, supporting up to 262K colors

(RGB666), offering rich display colors

- Rich interfaces for easy connection various peripherals (SPI,UART,extended IO,etc.)

- Supports external speakers to play audio

- Equipped with a microphone, supporting audio input

- Equ with RGB three-color indicator lights, offering rich status indications

- Equipped with a capacitive touch screen, facilitating human-machine interaction

- Standard TYPE-C interface for convenient program and power supply

- Equipped with a micro TF card slot, convenient for expanding storage

- Supports external lithium batteries, lightweight and portable

- Equipped with battery charging management circuit, safe battery charging and discharging

- Provides rich example programs for easy learning

- Provides low-level driver technical support, and WIKI materials are updated online

- The module undergone aging tests and multiple inspections to meet military-grade standards, supporting long-term stable operation

3. PRODUCT PARAMETERS

3.1. ESP32 main control parameters

item	Parameters	Unit
Main control chip	ESP32-32E	-
CPU	ESP32-D0WD-V3, Xtensa dual-core 32-bit LX6 microprocessor	-
Clock frequency	240MHz (max)	-
Storage	448KB ROM+520KB SRAM+16KB RTC SRAM+4M external SPI Flash	-

WIFI	2.4GHz, 802.11b/g/n mode	-
Bluetooth	Bluetooth V4.2 BR/EDR and Bluetooth LE standard	-
Working voltage	3.0~3.6	V
Working temperature	−40~85	℃

3.2. TFT Parameters

item	Parameters	Unit
Screen size	2.4	inch
Screen type	IPS TFT	-
Screen resolution	240xRGBx320	pixels
Effective display area	36.2(W)x49(H)	mm
Number of colors	MAX：262K（RGB666） TYP：56K（RGB565）	-
Driving IC	ST7789	-
Display interface	4-Line SPI(Received on ESP32)	-
Pixel size	0.15(H)x0.15	mm
Viewing angle	ALL'CLOCK	deg
Back brightness (typical value)	220	cd/m^2
Backlight lamp type	White LED*4	-
Operating temperature	-20~60	℃
Storage temperature	-30~70	℃

3.3. Touch Screen Parameters

item	Parameters	Unit
Effective area size	2.4	inch
Touch screen type	Capacitive touch screen	-
Driver IC	XPT2046	-
Effective touch area	38.36(W)x50.7(H)	mm
Communication	SPI	-

interface		
Structural material	ITO 膜+ITO 玻璃	-
Operating temperature	-20~60	℃
temperature	-30~70	℃

3.4. Size Parameters

item	Parameters	Unit
LCD screen size	42.6±0.2(W)x60±0.2(H)x2.34±0.1(D) (No solder paste or back adhesive)	mm
Touch screen size	42.6±0.1(W)x57.25±0.1(H)x1.0(D)±0.1(D) (No solder paste or back adhesive)	mm
Module size	42.89(W)x74.33(H)x5.44(D)	mm

3.5. Battery charging parameters

item	Parameters	Unit
Charging voltage;	Range: 4.2~6.5 Typical value: 5.0	V
Charging current;	Maximum value: 500; Module actual: 367;	mA
Charging saturation voltage;	4.2	V
Charging temperature;	Module actual maximum value: 62	℃
Charging battery specifications	3.7V lithium polymer battery	-

3.6. Basic Parameters

item	Parameters	Unit
SKU	E32R24P	-
Power interface	TYPE-C	-

Weight (including packaging)		g

4. PRODUCT INTERFACE

4.1. Interface Function Description
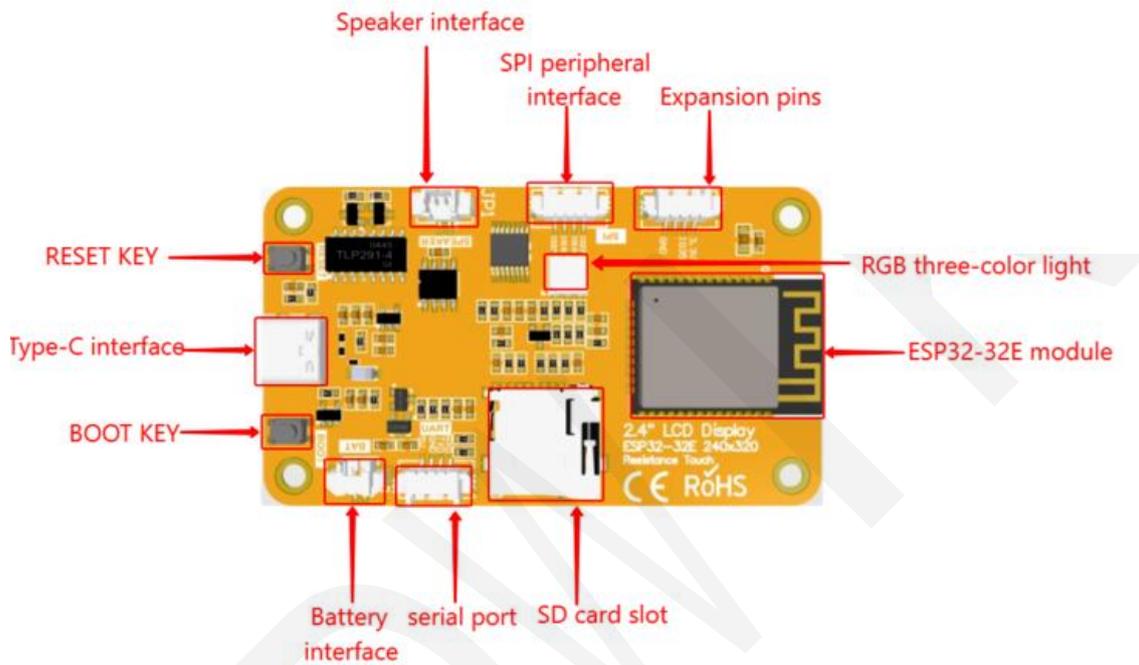
Figure 4.1 E32R24P product interface diagram

Interface name	Function Description
ESP32-32E module	Display module main control, controlling onboard peripherals and external peripherals.
SD card slot	Insert a SD card to expand storage space, such as storing large data content such as font libraries, images, audio files, etc.
RGB tricolor light	Contains LEDs of three colors: red, green, blue. It has a built-in control IC and only needs one IO port to control. It can be used for LED testing and status indication.
Serial port	1.25mm4P socket. It can be used for serial port debugging, downloading, and communication. An external USB to serial port module is required.

Battery interface	1.25mm 2P socket. Used to connect to a 3.7V polymer lithium battery, charge the battery through the battery management circuit, and can also be used for battery power supply. Note the positive and negative terminals of the interface.
BOOT button	Used to enter the download mode or key test. Press and this key to power up, then release to enter the download mode, or after powering up, press and hold this key, then press the RESET key, release the RES key and then release this key, you can also enter the download mode. When you don't need to enter the download mode, this key can be used as a normal key
TYPE-C interface	This interface is used for powering the module and downloading programs. It is connected to the one-key download circuit on the module, enabling automatic entry into the download mode (without the need to press the BOOT button).
RESET button	For ESP32 main control and LCD reset, press to reset low level.
Expansion pin	1.25mm 4P socket. Four pins are GPIO2, GPIO3, GPIO14, GPIO21. It can be used to connect other peripherals.
Loudspeaker interface	1.25mm P socket. Used to connect the speaker to play audio. Used to connect the speaker to play audio (maximum support 1.5W (8Ω) or 2W4Ω) speaker).
SPI peripheral interface	1.25mm 4-pin connector. It is used for external SPI communication devices. This SPI interface shares the same port with MicroSD. It can also be used as regular I/O.

4.2. ESP32 pin allocation

Device	ESP32-S3 pin	pin allocation
LCD	GPIO15	Liquid crystal display chip selection control signal, with low level being the effective state
	GPIO2	LCD screen command/data select control signal High level: data low level: command

	GPIO14	LCD screen SPI bus clock signal
	GPIO13	LCD screen SPI bus write data signal
	EN	LCD screen reset control signal, low level reset (shared with the ESP32-32E main controller for reset pin)
	GPIO21	LCD screen backlight control signal (high level indicates backlight on, low level indicates backlight off)
Capacitive touch screen	GPIO25	Resistive touch screen SPI bus clock signal
	GPIO32	Resistance touch screen SPI bus write data signal
	GPIO39	Resistive touch screen SPI bus read data signal
	GPIO33	Resistor touch screen selection control signal, valid with low level
	GPIO36	The resistance touch screen detects touch interruption signals. When a touch occurs, it inputs a low level signal to the main controller.
RGB light	GPIO22	Red LED light (common anode, lights up when at low voltage, turns off when at high voltage)
	GPIO16	Green LED light (common anode, lights up when at low voltage, turns off when at high voltage)
	GPIO17	Blue LED light (common anode, lights up when at low voltage, turns off when at high voltage)
MicroSD Card	GPIO5	SD card selects signal, with low level being the valid state.
	GPIO23	SD card SPI bus write data signal (shared by MicroSD card and SPI peripheral)
	GPIO18	SD card SD card SPI bus clock signal (shared by MicroSD card and SPI peripheral)
	GPIO19	SD card SPI bus read data signal (shared by MicroSD card and SPI peripheral)
Battery	GPIO34	Battery voltage ADC value acquisition signal (input)
Audio	GPIO26	Audio signal DAC output signal
	GPIO4	Audio enable signal, low level enables, high level disables

Button	IO0	Download mode selection button (Press this button to power on, and then release it to enter the download mode)
	EN	ESP32-32E reset button, low-level reset (shared with LCD screen reset)
Serial port	RXD0(IO3)	ESP32-32E serial port 0 receive signal interface (if the serial port communication function is not used, it can be used as a IO port)
	TXD0(IO1)	ESP32-32E serial port sends signals (if not using the serial port, it can be used as regular IO)
SPI expansion	GPIO27	SPI peripheral chip select signal, with low level being the effective state (if the SPI device is not used, it can be used as an ordinary IO)
	GPIO18	The SPI peripheral's SPI bus clock pin (shared by the SPI peripheral and the MicroSD card. If the SPI device or SD card is not used, it can be used as an ordinary IO pin.)
	GPIO19	The SPI bus read data pin of the SPI peripheral (this pin is shared by the SPI peripheral and the MicroSD card. If the SPI device or the SD card is not used, it can be used as an ordinary IO pin)
	GPIO23	The SPI bus write data pin of the SPI peripheral (shared by the SPI peripheral and the MicroSD card. If the SPI device or SD card is not used, it can be used as an ordinary IO)
Expansion pin	GPIO35	Can only be used for input/output operations.

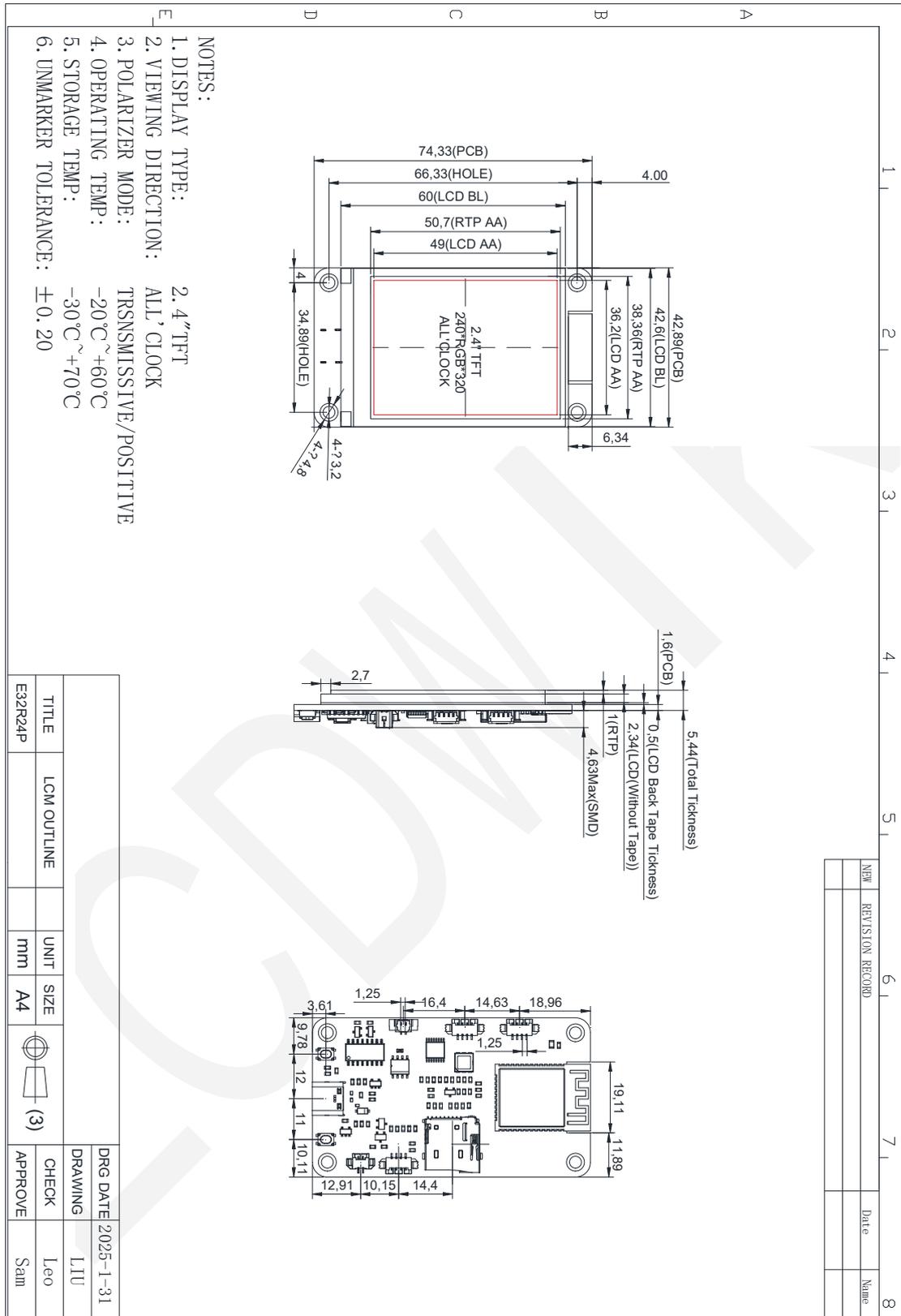# 5. PRODUCT OUTLINE DRAWING

Figure 5.1 E32R24P Outline Drawing

6. PRECAUTIONS

6.1. Safe Use of Products

➢ Do not press or hit the screen violently to avoid damaging the screen

➢ Do not scrape the screen with hard objects to avoid scratching the screenDo not place heavy objects on the product to avoid crushing the screen

➢ Please keep the product clean, do not drop water or oil on the screen

➢ Please use a clean, soft dry cloth to wipe the screen, do not spray water or cleaning agent directly on the screen

➢ Do not disassemble the product at will to avoid damaging the screen or the F

➢ Do not place the product in a high temperature and high humidity environment

➢ Please place the product face up on a flat surface to avoid falling and breaking the product

➢ Please use the voltage to connect the product to avoid damage to the product due to excessive voltage

➢ When using the product, do not touch the components or pins with wet hands to avoid causing a short and damaging the product

➢ When not using the product for a long time, please unplug the power supply

➢ When charging the battery, pay attention to ventilation and heat dissipation to avoid damage the product due to high temperature

➢ When charging the battery, pay attention to do not touch the charging management IC to avoid being burned by high

6.2. Frequently asked questions FAQ

➢ **Question 1：No response after powering up the product after burning the program; the screen is also not lit.**

Analysis：

  This product needs to pull up the backlight control pin to turn on the backlight, so make sure that the ESP32 main control has flashed with a program that contains the function to turn on the backlight. If the relevant program has been flashed and the backlight is still not on, check the voltage the power

interface and the contact of the power line. If using battery power, check if the battery is sufficiently charged.

If the backlight still does not respond after the operations, it is speculated that there may be a hardware circuit fault.

➢ **Question 2：The backlight is on after powering up the product after burning the program, but there is no display.**

Analysis：

The backlight being on indicates that the module has been powered up normally, but to display images properly, the SPI communication and control signals must also fully functional. It is necessary to check if the programmed code matches correctly, including the selection of the display driver IC, GPIO definitions, etc.

It is recommended to use tested example program for the first time, compile and download the program without any modifications to rule out the possibility of the display not lighting up due to code changes. Also, pay attention whether the compilation and download of the example program prompts success and whether the display module operates normally.

If the display still cannot be normal after multiple attempts following the above steps, it necessary to use necessary tools such as a multimeter/oscilloscope/logic analyzer to analyze and detect the signals, and contact our technical staff for assistance.

➢ **Question 3：The product can display normally, but there is no response to the touch.**

Analysis：

This situation may be due to the following reasons：

● The test program that is burned into the device does not have touch functionality;

● The GPIO related to touch screen control in the test software is not or defined incorrectly;

- The burned test program has a touch function, but the resistive touch screen has not been calibrated, or it has been calibrated but the calibration parameters have not been written into the program, or the calibration parameters written into the program are incorrect.

- This product uses the SPI bus for communication between the resistive touch screen and the display. However, the software has not properly handled this, which may lead to communication conflicts and result in the touch function not responding.

- Hardware damage, including damage to the touch control IC, broken or frayed touch screen cables, and so on.

> **Question 4：The product can display, but the backlight brightness is unstable and sometimes dark.**

Analysis：

The backlight circuit of this product is driven by a field-effect transistor. The backlight control pin inputs a high level to turn on the backlight and a low level to turn it off. The PWM signal can also be input through the backlight control pin to achieve the purpose of dimming. If the voltage at the backlight control pin changes, the backlight brightness will also change, which may lead to instability of the backlight. Additionally, unstable power supply voltage can also cause this phenomenon.

> **Question 5：The external battery of the product cannot be charged.**

Analysis：

The battery charging management circuit of this product is only suitable for charging 3.7V polymer lithium batteries. Charging an external battery is not possible and there could be the following reasons:

- The external battery category is incorrect;

- The positive and negative poles of the battery are connected in reverse;

- The battery power has reached saturation, and will stop charging if it is connected;

● The charging management IC is damaged.