# 1. Introduction to Testing Platform

Development Board : ESP32-WROOM-32E devKit

MCU : ESP32-32E module

Frequency : 240MHz

# 2. Pin connection instructions

The display module can be directly plugged into the ESP32-32E development

board, as shown in the following figure:



Picture1. Module inline ESP32-32E development board





	E	SP32-32E	Test Program Pin Dir	ect Insertion Instructions
Number		Module pins	Corresponding ESP32-32E development board wiring pins	Remarks
	1	GND	GND	LCD Power ground
	2	VCC	5V/3.3V	LCD power positive(It is recommended to connect to 5V. When connected to 3.3V, the backlight brightness will be slightly dim)

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3	SCL	IO14	LCD SPI bus clock signal
4	SDA	IO13	LCD SPI bus write data signal
5	RES	1027	LCD reset control signal, Low level reset
6	DC	102	LCD command / data selection control signal High level: data, low level: command
7	CS	1015	LCD selection control signal, Low level active
8	BLK	1021	LCD backlight control signal (If you need control, please connect the pins. If you don't need control, you can skip it)

# 3. Demo Function Description

This sample program uses the ESP32 hardware HSPI bus, which is located in **Demo\_MSP0964\_ESP32-WROOM-32E\_HSPI** directory, as shown in the following figure:

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C O ♥ L « Demo_ESP32 > Demo_MSP0964_ESP32-WROOM-32E_HSPI > ♥ ↔				
文件(F) 绐	扁辑(E) 查看(V) 工具(T) 帮助(H)			
组织▼	包含到库中▼ 共享▼ 新建文件夹			
🍇 🔦	名称	修改日期	类型	
<b>S</b>	Example_01_Simple_test	2023/10/11 14:21	文件夹	
8	Example_02_colligate_test	2023/10/11 14:21	文件夹	
	Example_03_display_graphics	2023/10/11 14:21	文件夹	
8	Example_04_display_scroll	2023/10/11 14:21	文件夹	
- Ø	L Example_05_display_clock	2023/10/11 14:21	文件夹	
	5 个对象			

### ♦ Description of sample program content

A. Example\_01\_Simple\_Test is a screen brushing test program, which does not

rely on any software library;

- B. Example\_02\_colligate\_Test is a comprehensive testing program that displays graphics, lines, and counts program runtime;
- C. Example\_03\_ display\_ Graphics is a graphic display testing program that displays various graphics;
- D. Example\_ 04\_ display\_ Scroll is a scrolling test program that displays text scrolling;
- E. Example\_05\_ display\_ Scroll is a scrolling test that displays text scrolling;

## 4. Demo Usage Instructions

#### ♦ Building Development Environment

For specific methods of building a development environment, please refer to the "Arduino\_development\_environment\_construction\_for-ESP32-EN" document in this directory.

#### ♦ Installing software library

After the development environment is set up, the software library used by the sample program needs to be copied to the project library directory so that the sample program can be called. The software library is located in the **Install libraries** directory, as shown in the following figure:



Among them:

TFT\_ eSPI is an Arduino graphics library for TFT-LCD LCD screens, supporting multiple platforms and LCD driver ICs

The software library have been configured and can be directly copied to the project library directory for use. The default path for the engineering library directory is C:\Users\Administrator\Documents\Arduino\libraries. You can also change the project library directory: open the Arduino IDE software, click File ->Preferences, and reset the Sketchbook location in the pop-up interface, as shown in the following figure:

ſ	💿 clear_Screen   A	rduino 1.8.19		Preferences			×
<u>File</u> Edit <u>Sketch</u> Tools <u>H</u> elp				Settings Network			
	Eile Edit Sketch 1 New Open Open Recent Sketchbook Examples Close Save Save As Page Setup Print Preferences Quit //Arduino Meg	Lools Help Ctrl+N Ctrl+O Ctrl+O Ctrl+S Ctrl+Shift+S Ctrl+Shift+P Ctrl+Comma Ctrl+Q Ja2560 10	, I J , Ti o; n : oni nec	Settings Network Sketchbook location: C:\Users\Administrator\Docu Editor language: Editor font size: Interface scale: Theme: Show verbose output during: Compiler warmings: Display line numbers Verify code after upload Check for updates on sta Use accessibility featur Additional Boards Manager U Wore preferences can be defined C:\Users\Addinistrator\Administrator\	ments\Arduino English (English) 16 VAutomatic 100 % Default theme v (re Compilation V uplo None v I rtup es RLs: p://espressif.gith ted directly in the fine	<pre>(requires restart of Arduino) quires restart of Arduino) ad     Enable Code Folding     Use external editor     V Save when verifying or u ub.io/arduino-esp32/package_esp32_ exences iti </pre>	(requires restart of Arduino)
	(edit only when Arduino is not running)						

If you do not want to use the already configured library, you can download the latest version of the library from Github at the following download address and then configured:

#### https://github.com/Bodmer/TFT\_eSPI

After the library download is completed, unzip it (for easy differentiation, rename the unzipped library folder, as shown in the Install libraries directory), and then copy it to the engineering library directory. Next, proceed with library configuration. The files that need to be replaced are located in the **Replaced files** directory, as shown in the following figure:

00	Markov Mar Na se	ed files	• ◆ 搜索/				
文件(F) 约	文件(F) 编辑(E) 查看(V) 工具(T) 帮助(H)						
组织▼ 包含到库中▼ 共享▼ 新建文件夹							
	名称	修改日期	类型				
8	ST7789_Defines.h	2023/9/23 14:48	H文件				
<b>e</b>	ST7789_Init.h	2023/9/23 14:48	H文件				
	ST7789_Rotation.h	2023/9/23 12:08	H 文件				
18 v.	📄 User_Setup.h	2023/9/23 15:20	H 文件				

#### TFT\_ eSPI library configuration:

First rename the **User\_Setup.h** file which is in the top-level directory of the **TFT\_eSPI** library of the engineering library directory to **User\_Setup\_bak.h**,then copy the **User\_Setup.h** file which is in the **Replaced files** directory to the top-level directory of the **TFT\_eSPI** library, As shown in the following figure:



First, set the TFT in the engineering library directory\_ ESPI Library TFT\_ ST7789 in the Drivers directory\_ Init. h, ST7789\_ Rotation. h, ST7789\_ Define. h These three files are renamed as ST7789 respectively\_ Init. h\_ Bak. h, ST7789\_ Rotation\_ Bak. h, ST7789\_ Definitions\_ Bak. h, and then replace ST7789 in the Replaced files

directory\_ Init. h, ST7789\_ Rotation. h, ST7789\_ Define. h three copies to TFT in the engineering library directory\_ ESPI Library TFT\_ Drivers directory, as shown in the following figure:

00-	↓ ≪ Arduino → libraries → TFT_eSP	I ▶ TFT_Drivers	· + 搜索	TFT_Drivers	م
文件(F) 编	扁辑(E) 查看(V) 工具(T) 帮助(H)				
◆       ◆       Arduino ◆       libraries ◆       TFT_eSPI ◆       TFT_Drive         文件(F) 编辑(E) 查看(V) 工具(T) 帮助(H)         组织 ◆       ジ打开 共享 ◆       电子邮件 新建文件夹         ◇       文档库         IFT_Drivers         名称       修改E         ST7789_2_Init.h       2023/         ST7789_2_Rotation.h       2023/         ST7789_Defines.h       2023/         ST7789_Defines_bak.h       2023/         ST7789_Init.h       2023/         ST7789_Rotation.h       2023/         ST7789_Rotation.h       2023/         ST7789_Rotation_bak.h       2023/         ST7796_Defines.h       2023/         ST7796_Rotation.h       2023/         ST7796_Rotati	新建文件夹		· · ·	9	
	<mark>文档库</mark> TFT_Drivers			排列方式: 文件夹▼	
	名称	修改日期	类型	大小	•
	ST7789_2_Init.h	2023/3/18 12:56	H文件	1 KB	
	ST7789_2_Rotation.h	2023/3/18 12:56	H文件	3 KB	
	ST7789_Defines.h	2023/9/23 14:48	H文件	6 KB	
	ST7789_Defines_bak.h	2023/3/18 12:56	H文件	6 KB	
	📄 ST7789_Init.h	2023/9/23 14:48	H文件	6 KB	
<b>*</b>	📄 ST7789_Init_bak.h	2023/3/18 12:56	H文件	6 KB	
	📄 ST7789_Rotation.h	2023/9/23 12:08	H 文件	3 KB	
1990 - C	ST7789_Rotation_bak.h	2023/3/18 12:56	H 文件	3 KB	
<b>A</b>	ST7796_Defines.h	2023/3/18 12:56	H 文件	3 KB	
4	ST7796_Init.h	2023/3/18 12:56	H 文件	4 KB	=
4	ST7796_Rotation.h	2023/3/18 12:56	H文件	2 KB	-
100 v	•	III		•	•
AR       修改日期       类型       大小         ST7789_2_Init.h       2023/3/18 12:56       H 文件       1 KB         ST7789_2_Rotation.h       2023/3/18 12:56       H 文件       3 KB         ST7789_Defines.h       2023/9/23 14:48       H 文件       6 KB         ST7789_Init.h       2023/9/23 14:48       H 文件       6 KB         ST7789_Init.h       2023/9/23 14:48       H 文件       6 KB         ST7789_Init.h       2023/9/23 14:48       H 文件       6 KB         ST7789_Rotation.h       2023/3/18 12:56       H 文件       6 KB         ST7789_Rotation.h       2023/3/18 12:56       H 文件       3 KB         ST7789_Rotation.h       2023/3/18 12:56       H 文件       3 KB         ST7796_Defines.h       2023/3/18 12:56       H 文件       4 KB         ST7796_Rotation.h       2023/3/18 12:56       H 文件       4 KB         ST7796_Rotation.h       2023/3/18 12:56       H 文件       4 KB         ST7796_Rotation.h       2023/3/18 12:56       H 文件       2 KB         E选择 6 个项 修改日期: 2023/3/18 12:56 - 20       创建日期: 2023/9/23 14:52       上 公式       上 公式         L       III       III       III       III       III       III					

#### ♦ Compile and Run Programs

After the library installation is completed, the sample program can be compiled and run as follows:

 Plug the display module directly into the ESP32 development board, and connect the development board to a PC to power on;

B. Open Any sample program in the

Demo\_MSP0962\_MSP0963\_ESP32-WROOM-32E\_HSPI directory, as shown

in the following figure (using the colligate test test program as an example):

<del>C</del> -	Demo_MSP0964_ESP32-WROOM-32E	_HSPI	_colligate_test 🕨 co	lligate_test 🗸 😽
文件(F) 编	辑(E) 查看(V) 工具(T) 帮助(H)			
组织▼	包含到库中▼  共享▼ 新建文件夹			
^ 🕸	名称	修改日期	类型	大小
₩ ₩ ₩	💿 colligate_test.ino	2023/9/23 14:55	Arduino file	16 KB

C. After opening the sample program, select the ESP32 device, as shown in the

#### following figure:

🙁 colligate_test   Ar	duino 1.8.19		
File Edit Sketch To	ols Help		
colligate_test // IMPORTANT // CONFIGURE	Auto Format Archive Sketch Fix Encoding & Reload Manage Libraries Serial Monitor Serial Plotter	Ctrl+T Ctrl+Shift+I Ctrl+Shift+M Ctrl+Shift+L	
//This progr //of the lib	Teensy 4 Security WiFi101 / WiFiNINA Firmware Updater	LCD.	A ESP32S3 Dev Module ESP32C3 Dev Module
//the SDA pi //if you don //other pins //pin usage	Board: "ESP32 Dev Module" Upload Speed: "921600" CPU Frequency: "240MHz (WiFi/BT)" Flash Frequency: "80MHz"	Boards Manager Arduino AVR Boards ESP32 Arduino Teensyduino	ESP322 Dev Module     ESP32 Dev Module     ESP32-WROOM-DA Module     ESP32 Wrover Module     ESP32 Wrover Module     FSP32 PICO-D4

#### D. Configure ESP32 Flash, PSRAM, ports, etc. as shown in the following figure:

💿 colligate_test   Ar	duino 1.8.19		
File Edit Sketch To	ols Help		
Colligate_test	Auto Format Archive Sketch Fix Encoding & Reload	Ctrl+T	
// IMPORTANT // CONFIGURE	Manage Libraries Serial Monitor	Ctrl+Shift+I Ctrl+Shift+M	
//This progr //of the lib	Teensy 4 Security WiFi101 / WiFiNINA Firmware Updater	Ctri+Snift+L	
//when using	Board: "ESP32 Dev Module"	•	L
//if you don	Upload Speed: "921600"	•	i
//other pins	CPU Frequency: "240MHz (WiFi/BT)"	•	
//pin usage	Flash Frequency: "80MHz"	) – E	
// //ESP32-WROO	Flash Mode: "QIO" Flash Size: "4MB (32Mb)"	► ►	G G
//Remember t	Partition Scheme: "Default 4MB with spiffs (1.2MB APP/1.5MB SPIFFS)" Core Debug Level: "None"	e e e e e e e e e e e e e e e e e e e	
/*******	PSRAM: "Disabled"	+ .	*
* @attention	Arduino Runs On: "Core 1"	÷.	
*	Events Run On: "Core 1"	÷	
* THE PRESEN	Erase All Flash Before Sketch Upload: "Disabled"	÷	
* WITH CODIN	JTAG Adapter: "Disabled"	+	
* TIME. AS A	Port	+	
* DIRECT, IN	Get Board Info		
* FROM THE C * CODING INF	Programmer: "Esptool"	•	

E. Click the **upload** button to compile and download the program, as shown in the

following figure:

😊 colligate_test   Arduino 1.8.19					
<u>F</u> ile <u>E</u> dit <u>S</u> ketch <u>T</u> ools <u>H</u> elp					
colligate_test					
<pre>// IMPORTANT: LCDWIKI_SPI LIBRARY MUST BE SPECIFICALLY // CONFIGURED FOR EITHER THE TFT SHIELD OR THE BREAKOUT BOARD.</pre>					
<pre>//This program is a demo of how to use most of the functions //of the library with a supported display modules.</pre>					
<pre>//when using the BREAKOUT BOARD only and using these hardware spi lines to the LC //the SDA pin and SCK pin is defined by the system and can't be modified. //if you don't need to control the LED pin,you can set it to 3.3V and set the pin //other pins can be defined by youself,for example</pre>					
// CS DC/RS RESET SDI/MOSI SCK SDO/MISO LED VCC GN					
//ESP32-WROOM-32E: 15 2 27 13 14 12 21 5V GM					
//Remember to set the pins to suit your display module!					
/*************************************					

F. If the following prompt appears, it indicates that the program has been compiled

and downloaded successfully, and has already been run:

😋 GetChipID   Arduino 1.8.19	X
<u>Eile Edit Sketch T</u> ools <u>H</u> elp	
	ø
GetChipID	•
/* The true EQD32 chin ID is essentially its MAC address	÷
Done uploading.	
<pre>Writing at 0x00024f8b (33 %) Writing at 0x0002a2bd (44 %) Writing at 0x0002f6ab (55 %) Writing at 0x000358af (66 %) Writing at 0x0003fe94 (77 %) Writing at 0x00045d9a (88 %) Writing at 0x0004b2ff (100 %) Wrote 261040 bytes (144184 compressed) at 0x00010000 in 2.5 seconds Hash of data verified.</pre>	́(е
Leaving Hard resetting via RTS pin	4
rf80lt 4MB with spiffs (1.2MB APP/1.5MB SPIFFS), 240MHz (WiFi/BT), QIO, 80MHz, 4MB (32Mb), 921800, Core 1, Core 1, None, Disabled on COI	M47

G. If the display module displays content, it indicates that the program has run

successfully.