1. Introduction to Testing Platform

Development board: STM32F103C8T6, MiniSTM32, Elite STM32, Explorer STM32F4,

Apollo STM32F4/F7

MCU: STM32F103C8T6, STM32F103RCT6, STM32F103ZET6, STM32F407ZGT6,

STM32F429IGT6, STM32F767IGT6、STM32H743IIT6

Frequency: 72MHz、72MHz、72MHz、168MHz、180MHz、216MHz、400MHz

(Corresponding to the above MCU)

2. Pin connection instructions

This display module can be directly plugged into the STM32F103C8T6 development board, and can only be connected to other development boards through DuPont cables.

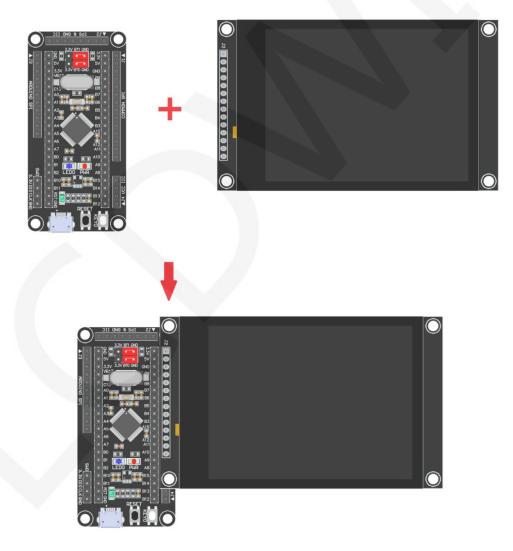


Figure 1: Module Inline STM32F103C8T6 Development Board

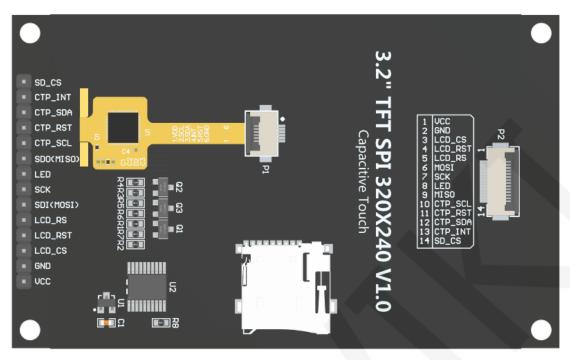


Figure 2 Module Back Pins

STM	STM32F103C8T6 Test Program Pin Direct Insertion Instructions					
Number	Module pins	Corresponding STM32F103 development board wiring pins	Remarks			
1	vcc	5V	LCD power positive			
2	GND	GND	LCD Power ground			
3	LCD_CS	PB9	LCD selection control signal, Low level active			
4	LCD_RST	PB8	LCD reset control signal, Low level reset			
5	LCD_RS	PB7	LCD command / data selection control signal High level: data, low level: command			
6	SDI(MOSI)	PA7	SPI bus write data signal(SD card and LCD screen used together)			
7	SCK	PA5	SPI bus clock signal(SD card and LCD screen used together)			
8	LED	PB6	LCD backlight control signal (If you need control, please connect the pins. If you don't need control, you can skip it)			
9	SDO(MISO)	PA6	SPI bus read data signal (SD card and LCD screen used together)			

			Capacitive touch screen IIC bus clock
10	CTP_SCL	PB5	signal (modules without touch screens do
			not need to be connected)
			Capacitor touch screen reset control signal,
11	CTP_RST	PA10	low-level reset (modules without touch
			screens do not need to be connected)
			Capacitive touch screen IIC bus data signal
12	CTP_SDA	PA9	(modules without touch screens do not
			need to be connected)
			Capacitor touch screen IIC bus touch
			interrupt signal, when generating touch,
13	CTP_INT	PA8	input low level to the main control (modules
			without touch screens do not need to be
			connected)
			SD card selection control signal, low level
14	SD_CS	NC	active (without SD card function, can be
			disconnected)

STM3	STM32F103RCT6 microcontroller test program wiring instructions					
Number	Module Pin	Corresponding to MiniSTM32 development board wiring pin	Remarks			
1	VCC	5V	LCD power positive			
2	GND	GND	LCD Power ground			
3	LCD_CS	PB11	LCD selection control signal, Low level active			
4	LCD_RST	PB12	LCD reset control signal, Low level reset			
5	LCD_RS	PB10	LCD command / data selection control signal High level: data, low level: command			
6	SDI(MOSI)	PB15	SPI bus write data signal(SD card and LCD screen used together)			
7	SCK	PB13	SPI bus clock signal(SD card and LCD screen used together)			
8	LED	PB9	LCD backlight control signal (If you need control, please connect the pins. If you don't need control, you can skip it)			
9	SDO(MISO)	PB14	SPI bus read data signal (SD card and			

			LCD screen used together)
			Capacitive touch screen IIC bus clock
10	CTP_SCL	PCO	signal (modules without touch screens do
			not need to be connected)
			Capacitor touch screen reset control signal,
11	CTP_RST	PC13	low-level reset (modules without touch
			screens do not need to be connected)
			Capacitive touch screen IIC bus data signal
12	CTP_SDA	PC3	(modules without touch screens do not
			need to be connected)
			Capacitor touch screen IIC bus touch
			interrupt signal, when generating touch,
13	CTP_INT	PC10	input low level to the main control (modules
			without touch screens do not need to be
			connected)
			SD card selection control signal, low level
14	SD_CS	NC	active (without SD card function, can be
			disconnected)

STM32F103ZET6 microcontroller test program wiring instructions					
Number	Module Pin	Corresponding to Elite STM32 development board wiring pin	Remarks		
1	VCC	5V	LCD power positive		
2	GND	GND	LCD Power ground		
3	LCD_CS	PB11	LCD selection control signal, Low level active		
4	LCD_RST	PB12	LCD reset control signal, Low level reset		
5	LCD_RS	PB10	LCD command / data selection control signal High level: data, low level: command		
6	SDI(MOSI)	PB15	SPI bus write data signal(SD card and LCD screen used together)		
7	SCK	PB13	SPI bus clock signal(SD card and LCD screen used together)		
8	LED	PB9	LCD backlight control signal (If you need control, please connect the pins. If you don't need control, you can skip it)		

9	SDO(MISO)	PB14	SPI bus read data signal (SD card and
			LCD screen used together)
			Capacitive touch screen IIC bus clock
10	CTP_SCL	PC0	signal (modules without touch screens do
			not need to be connected)
			Capacitor touch screen reset control
11	CTD DCT	DC12	signal, low-level reset (modules without
11	CTP_RST	PC13	touch screens do not need to be
			connected)
		PC3	Capacitive touch screen IIC bus data
12	CTP_SDA		signal (modules without touch screens do
			not need to be connected)
			Capacitor touch screen IIC bus touch
	CTP_INT	PC10	interrupt signal, when generating touch,
13			input low level to the main control (modules
			without touch screens do not need to be
			connected)
		NC	SD card selection control signal, low
14	SD_CS		level active (without SD card function,
			can be disconnected)

STM3	STM32F407ZGT6 microcontroller test program wiring instructions						
Number	Module Pin	Corresponding to Explorer STM32F4 development board wiring pin	Remarks				
1	VCC	5V	LCD power positive				
2	GND	GND	LCD Power ground				
3	LCD_CS	PB15	LCD selection control signal, Low level active				
4	LCD_RST	PB12	LCD reset control signal, Low level reset				
5	LCD_RS	PB14	LCD command / data selection control signal High level: data, low level: command				
6	SDI(MOSI)	PB5	SPI bus write data signal(SD card and LCD screen used together)				
7	SCK	PB3	SPI bus clock signal(SD card and LCD screen used together)				
8	LED	PB13	LCD backlight control signal (If you need				

			control, please connect the pins. If you
			don't need control, you can skip it)
9	SDO(MISO)	PB4	SPI bus read data signal (SD card and
			LCD screen used together)
			Capacitive touch screen IIC bus clock
10	CTP_SCL	PBO	signal (modules without touch screens do
			not need to be connected)
			Capacitor touch screen reset control signal,
11	CTP_RST	PC5	low-level reset (modules without touch
			screens do not need to be connected)
			Capacitive touch screen IIC bus data signal
12	CTP_SDA	PF11	(modules without touch screens do not
			need to be connected)
			Capacitor touch screen IIC bus touch
			interrupt signal, when generating touch,
13	CTP_INT	PB1	input low level to the main control (modules
			without touch screens do not need to be
			connected)
			SD card selection control signal, low level
14	SD_CS	NC	active (without SD card function, can be
			disconnected)

ST	STM32F429IGT6 microcontroller test program wiring instructions						
Numt	ber	Module Pin	Corresponding to Apollo STM32F4/F7 development board wiring pin	Remarks			
1		VCC	5V	LCD power positive			
2		GND	GND	LCD Power ground			
3		LCD_CS	PD11	LCD selection control signal, Low level active			
4		LCD_RST	PD12	LCD reset control signal, Low level reset			
5		LCD_RS	PD5	LCD command / data selection control signal High level: data, low level: command			
6		SDI(MOSI)	PF9	SPI bus write data signal(SD card and LCD screen used together)			
7		SCK	PF7	SPI bus clock signal(SD card and LCD screen used together)			

			LCD backlight control signal (If you need
8	LED	PD6	control, please connect the pins. If you
			don't need control, you can skip it)
9	SDO(MISO)	PF8	SPI bus read data signal (SD card and
9	300(101130)	FFO	LCD screen used together)
			Capacitive touch screen IIC bus clock
10	CTP_SCL	PH6	signal (modules without touch screens do
			not need to be connected)
			Capacitor touch screen reset control signal,
11	CTP_RST	PI8	low-level reset (modules without touch
			screens do not need to be connected)
			Capacitive touch screen IIC bus data signal
12	CTP_SDA	PI3	(modules without touch screens do not
			need to be connected)
			Capacitor touch screen IIC bus touch
			interrupt signal, when generating touch,
13	CTP_INT	PH11	input low level to the main control (modules
			without touch screens do not need to be
			connected)
			SD card selection control signal, low level
14	SD_CS	NC	active (without SD card function, can be
			disconnected)

STM32F767IGT6,STM32H743IIT6 microcontroller test program wiring instructions						
Number Module Pin		Corresponding to Apollo STM32F4/F7 development board wiring pin	Remarks			
1	VCC	5V	LCD power positive			
2	GND	GND	LCD Power ground			
3	LCD_CS	PD11	LCD selection control signal, Low level active			
4	LCD_RST	PD12	LCD reset control signal, Low level reset			
5	LCD_RS	PD5	LCD command / data selection control signal High level: data, low level: command			
6	SDI(MOSI)	PB15	SPI bus write data signal(SD card and LCD screen used together)			
7	SCK	PB13	SPI bus clock signal(SD card and LCD			

			1
			screen used together)
8	LED	PD6	LCD backlight control signal (If you need control, please connect the pins. If you don't need control, you can skip it)
9	SDO(MISO)	PB14	SPI bus read data signal (SD card and LCD screen used together)
10	CTP_SCL	PH6	Capacitive touch screen IIC bus clock signal (modules without touch screens do not need to be connected)
11	CTP_RST	PI8	Capacitor touch screen reset control signal, low-level reset (modules without touch screens do not need to be connected)
12	CTP_SDA	PI3	Capacitive touch screen IIC bus data signal (modules without touch screens do not need to be connected)
13	CTP_INT	PH11	Capacitor touch screen IIC bus touch interrupt signal, when generating touch, input low level to the main control (modules without touch screens do not need to be connected)
14	SD_CS	NC	SD card selection control signal, low level active (without SD card function, can be disconnected)

3. Demo Function Description

This testing program includes 7 MCU testing programs including STM32F103C8T6, STM32F103RCT6, STM32F103ZET6, STM32F407ZGT6, STM32F429IGT6, STM32F767IGT6, STM32H743IIT6. Each MCU testing program includes two functions: software SPI and hardware SPI, which are located in **Demo_STM32** directory, as shown in the following figure:

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	Demo_MSP3222_MSP3223_STM32F103C8T6_Software_SPI	
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=	Demo_MSP3222_MSP3223_STM32F103RCT6_Software_SPI	
(2)	Demo_MSP3222_MSP3223_STM32F103ZET6_Hardware_SPI	
(H)	IDemo_MSP3222_MSP3223_STM32F103ZET6_Software_SPI	=
	Demo_MSP3222_MSP3223_STM32F407ZGT6_Hardware_SPI	
	Demo_MSP3222_MSP3223_STM32F407ZGT6_Software_SPI	
	Demo_MSP3222_MSP3223_STM32F429IGT6_Hardware_SPI	
	Demo_MSP3222_MSP3223_STM32F429IGT6_Software_SPI	
	Demo_MSP3222_MSP3223_STM32F767IGT6_Hardware_SPI	
4	Demo_MSP3222_MSP3223_STM32F767IGT6_Software_SPI	
	Demo_MSP3222_MSP3223_STM32H743IIT6_Hardware_SPI	
•3	Demo_MSP3222_MSP3223_STM32H743IIT6_Software_SPI	v

The sample program includes the following test items:

- A. Main interface display;
- B. Read the display screen ID and GRAM color values;
- C. Simple screen swiping;
- D. Drawing and filling of rectangles;
- E. Draw and fill a circle;
- F. Triangle drawing and filling;
- G. English display;
- H. Chinese display;
- I. Image display;
- J. Dynamic digital display;
- K. Rotating display;
- L. Capacitive touch screen (including touch buttons and handwritten lines);

Example program display direction switching instructions:

Found macro definition **USE_HORIZONTAL** in **LCD. h**, as shown in the following:

www.lcdwiki.com

USE_HORIZONTAL 0 //0°rotate USE_HORIZONTAL 1 //90°rotate USE_HORIZONTAL 2 //180°rotate USE_HORIZONTAL 3 //270°rotate

4. Demo Usage Instructions

Installing development tool software

Firstly, you need to install the development tool software, which uses Keil5.

Please refer to the online download and installation methods for yourself.

♦ Installing Device Library

After the successful installation of the tool software, it is necessary to install several MCU device libraries, otherwise the project cannot be established, and compilation and download cannot be carried out. Please consult online for the installation method of the device library.

Compiling Programs

After the library installation is completed, open the **PROJECT** directory under the sample program, locate the **uvprojx** file, double-click to open the sample project, as shown in the following figure:

€	🗼 « Demo_MSP3222_MSP3223_STM32	► PROJECT ►	▼ 4 搜索 P ♀
文件(F) 编	辑(E) 查看(V) 工具(T) 帮助(H)		
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	DUCH.uvguix.Administrator	2023/5/20 10:59	ADMINISTRATO
-	TOUCH.uvopt	2016/7/6 21:09	UVOPT 文件
2	TOUCH.uvoptx	2023/5/6 17:04	UVOPTX 文件
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After opening the sample project, you can make modifications to the project code (or not). After the modifications are completed, click the compile button to compile the code. The following prompt appears, indicating successful compilation, as shown in the following figure:

😨 G:\project\3.2inch\3.2inch_common_spi_ctp\3.2inch_SPI_Module_ILI9341_MSP3222	X
File Edit View Project Flash Debug Peripherals Tools SVCS Window Help	
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"\OBJ\TOUCH.axf" - 0 Error(s), 0 Warning(s).	
Build Time Elapsed: 00:00:01	
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♦ Download and Run Programs

The development board supports SWD download and Jlink download

Here is an introduction to Jlink download. For other download methods, please refer to the documentation in the development board documentation package or consult the internet.

The steps for downloading Jlink are as follows (using the STM32F103RCT6 development board as an example):

A. After the program compilation is completed, proceed with the program download. First, connect JTAG to the computer and development board, click on the magic wand icon ->Debug ->drop-down menu, and select J-LINK/J-TRACE Cortex, as shown in the following figure:

MSP3222_MSP3223 STM32 Demo Instructions

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B. Click on Settings again, set ort to SW and Max to 2MHz, as shown in the following:

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⊟ 🔄 HARDWARE ⊕ 🗄 key.c	Debug Trace Flash Download	
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⊞– 🖹 myiic.c	SN: 308621590 V IDCODE Device Name Nove	-
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C. Select the microcontroller model, click on the magic wand icon ->Device ->select

the **STM32F103RC** microcontroller model, as shown in the following figure:

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E:\project\3.2inch\QDtech_3.2inch_ILI	9341_SPI_V1.0\2-STM32测试程序\STM32_Demo_STM32F103RCT6_Hardware_SPI\USER\TOUCH.uvproj - µVision 📄 💷 🛛 🛛	\$
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⊞– 🗄 delay.c	Vendor: STMicroelectronics Software Pack	
⊞– 🖆 system_stm32f10x.c	Device: STM32F103RC Pack: Keil.STM32F1xc_DFP.1.0.4	
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⊞– 🖹 24cxx.c	STM32F103RC	
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CORE FWLib	STM32F103RE close this Mori in voltage operation is paired with a high level of integration at	
	STM32F103RF model STM32F103RF model STM32F103RF model Typical applications include motor drives and application control, medical	
	GTN325102PC and handheld equipment industrial applications PLCs inverters printers	*
Project Books { } Funct 0, Temp	STM32F103T4 and scanners, alarm systems, video intercom, HVAC and home audio	
Build Output	STM32F103T6	
	STM32F103T8 - LCD parallel interface, 8080/6800 modes - 5 V-tolerant I/Os	*
	STM32F103TB - Timer with quadrature (incremental) encoder input - 96-bit unique ID	
	STM32F103V8	

D. Select the flash model (if selected, please ignore it), click

Utilities>Settings>Add>select STM32F10x High density Flash ->Add, as

shown in the following figure:

W E:\project\3.2inch\QDtech_3.2inch_ILI9341_SPI_V1.0\2-STM32测试程序\ File Edit View Project Flash Debug Peripherals Tools SVCS Window	STM32_Demo_STM32F103RCT6_Hardware_SPI\USER\TOUCH.uvproj - µVision 📃 🖂 🐰
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Device Target Output Listing User C/C++ Asa Linker D - Configure Flash Menu Command © Use Target Driver for Flash Programming Use Debug Driver Settings	Pebug Utilities 的如果不需要控制可接VCC常完 按 Vuse Debug Driver Add Flash Programming Algorithm
Cortex JLink/JTrace Target Driver Setup Debug Trace Flash Download Download Function C Erase Full C I Program G Erase Sector: I Verify C Do not Erase I Reset and Run	Description Flash Size Device Type Origin §TM32F10x High-density 512k On-chip Flash Device Family Package STM32F10x High-density 512k On-chip Flash Device Family Package LPC16xd/3x8 S2FL03z 16b Un-chip Flash Device Family Package LPC16xd/3x8 S2FL03z 4M Ext. Flash SPI MDK Core RC28F640J3x Dual Flash 16M Ext. Flash 32-bit MDK Core S29GL064N Dual Flash 16M Ext. Flash 32-bit MDK Core
Programming Algorithm Description Device Size Device Type STMS2F10x High-dens 512k On-chip Flash 05	
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Add Renove	Add Cancel

E. After setting up both JTAG and flash, the program can be downloaded. Download the program, click the **download** button, and download the hex file to the development board. If the prompt "**Programming Done. Verify OK.**" appears, it indicates successful download, as shown in the following figure:

MSP3222_MSP3223 STM32 Demo Instructions

	Peripherals Tools SVCS Window Help	
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F. After the program is successfully downloaded, if the module does not respond, you need to press the reset button or power off and restart to run normally. If you want the program to automatically run after successful download, you need to press the following settings:

Click on the magic wand icon ->Utilities ->Settings ->check Reset and run, as shown in the following figure:

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Verify OK. Application ru	

G. If the display module displays characters and graphics normally, it indicates that the program has run successfully.

NOTE:

A. When downloading the program, if the following error occurs, it indicates that the

JTAG setting is incorrect. Please follow step B to set it:

JLink - Cortex-M Error	JLink - Cortex-M Error
No JLink Device found	8 No Cortex-M SW Device Found
确定	确定
JLINK is not connected to the computer	JLINK is connected to the computer, but not connected to the development board

B. If the following error occurs, it indicates that the flash setting is incorrect. Please follow step D to set it:

μVision	X
Error: Flash Download	d failed - "Cortex-M3"
	确定