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

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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		

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

ST	STM32F407ZGT6 microcontroller test program wiring instructions					
Numl	ber	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)
0			SPI bus read data signal (SD card and
9	3DO(IVII3O)	PD4	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)

STI	STM32F429IGT6 microcontroller test program wiring instructions					
Numb	er	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)
0		DEQ	SPI bus read data signal (SD card and
9	3DO(IVII3O)	PFO	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)

STM	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		

			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)
0		DD14	SPI bus read data signal (SD card and
	300(101130)	PD14	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)

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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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:

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:

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	名称	修改日期	类型	大小	*
	TOUCH.uvgui.IBM	2015/3/25 19:58	IBM 文件	139 KB	
	TOUCH.uvguix.Administrator	2023/6/1 15:23	ADMINISTRATO	173 KB	
	TOUCH.uvopt	2016/7/6 21:09	UVOPT 文件	20 KB	
	TOUCH.uvoptx	2023/6/1 15:18	UVOPTX 文件	16 KB	
2	TOUCH.uvproj.saved_uv4	2016/7/6 21:09	SAVED_UV4 文件	19 KB	=
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	15 个对象				

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:

♦ 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:

3.2inch_ILI9341_SPI_V1.0\2-STM32测试程序\STM32_Demo_S	TM32F103RCT6_Hardware_SPI\USER\TOUCH.uvproj - µ ¹	/ision 🗆 🖾
Debug Peripherals Tools SVCS Window Help		
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7 🖬 📄 main.c		▼ ×
🕼 Options for Target 'Target 1'	X	^
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C Use Simulator Settings	Use: J-LINK / J-TRACE Cortex V Settings	
Limit Speed to Real-Time		
▼ Load Application at Startup ▼ Run to main() ▼	Drop-down menu selection ✓ Load Application at Startup /✓ Run to main()	
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V Breakpoints V Toolbox	♥ Breakpoints ♥ Toolbox	*******
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DCM.DLL -pCM3	TCM.DLL -pCM3	
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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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Project	4 🖬 🔛 main.c	▼ ×
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B- ➡ Main.c	Device Target Output Listing User C/C++ Asm Linker Debug Utilities U	cc常亮
⊕- 🗈 test.c	C Use Simulator Settings @ Use: J-LINK/J-TRACE Cortex Settings	
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	Cortex JLink/JTrace Target Driver Setup	
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1	Cache Memory Download to Flash	

C. Select the microcontroller model, click on the magic wand icon ->Device ->select

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

E:\project\3.2inch\QDtech_3.2inch_ILI9	9341_SPI_V1.0\2-STM32测试程序\STM32_Demo_STM32F103RCT6_Hardware_SPI\USER\TOUCH.uvproj - μVision	
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B-3 Target 1	Options for Target 'Target 1'	23
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e- ≝ test.c ⊕- ≝ GULc	Device Database	
 B delay.c B system_stm32f10x.c B HARDWARE B key.c B lcd.c B mylic.c B 24cox.c B duch.c 	Vendor: STMicroelectronics Device: STM32F103RC Toolset ARM Search: StMar2F103RC STM32F103RC STM32F103RC STM32F103RC STM32F103RC STM32F103RC	E
Build Output	STM32F103RD STM32F103RE Select this MCU STM32F103RE select this MCU STM32F103RE select this MCU STM32F103RF model STM32F103RF and low-voltage operation is pared with first-class penipherals and low-power, low-voltage operation is pared with sight-lease penipherals and low-power, low-voltage operation is pared with sight-lease penipherals and low-power, low-voltage operation is pared with sight-lease penipherals and low-power, low-voltage operation is pared with sight-lease penipherals and low-power, low-voltage operation is pared with sight-lease penipherals and low-power, low-voltage operation is pared with sight-lease penipherals and low-power, low-voltage operation is pared with sight-lease penipherals and low-power, low-voltage operation is pared with sight-lease penipherals and low-power, low-voltage operation is pared with sight-lease penipherals and low-power, low-voltage operation is pared with sight-lease penipherals and low-power, low-voltage operation is pared with sight-lease penipherals and low-power, low-voltage operation is pared with sight-lease penipherals and low-power, low-voltage operation is pared with sight-lease penipherals and low-power, low-voltage operation is pared with sight-lease penipherals and low-power, low-voltage operation is pared with sight-lease penipherals and low-power, low-voltage operation is pared with sight-lease penipherals and low-power, low-voltage operation is pared with sight-lease penipherals and low-power, low-voltage operation is pared with sight-lease penipherals and low-power, low-voltage operation is pared with sight-lease penipherals and low-power, low-voltage operation is pared with sight-lease penipherals and low-power, low-voltage operations is pared with sight-lease penipherals and low-power, low-voltage operations is pared with sight-lease penipherals and low-power, low-voltage operations is pared with sight-lease penipherals and low-power, low-power, low-power, low-power, low-power, low-power, low-power, low-power, low-power,	-

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:

1 E:\project\3.2inch\QDtech_3.2inch_ILI9341_SPI_V1.0\2-STM32测试程序	۹\STM32_Demo_STM32F103RCT6_Hardware_SPI\USER\TOUCH.uvproj - µVision 📃 🗵 🍡
File Edit View Project Flash Debug Peripherals Tools SVCS Window	Help
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Project 📮 🔝 😭 main.c	▼ X
Options for Target 'Target 1'	× -
Device Target Output Listing User C/C++ Asm Linker Configure Flash Menu Command © Use Target Driver for Flash Programming	Debug Utilities 5) 如果不需要控制可接VCC常完 接 Vuse Debug Driver 6
Use Debug Driver Settings	Add Flash Programming Algorithm
Cortex JLink/JTrace Target Driver Setup Debug Trace Flash Download Download Function Erase Full Cl IP Program RAM for A	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 STM32F10x High-density 16B On-chip Flash Device Family Package STM32F10x High-density 4M Ext Flash SPI MDK Core RC28F640.3x Dual Flash 16M Ext Flash 32-bit MDK Core S29GL064N Dual Flash 16M Ext Flash 32-bit MDK Core
:art:	d\Keil_v5\ARM\PACK\Keil\STM32F1xx_DFP\1.0.4\Flash\STM32F10x_512.FLM
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:

E:\project\3.2inch\QDtech_3.2inch_IL	I9341_SPI_V1.0\	2-STM32测试程序\STM32_Demo_STM32F103	RCT6_Hardwar 📼 💷 🐰
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B→ Main.c B→ Metst.c B→ Metst.c	30 // 39 // 40 41 // 42 // 43 // 44 // 45 // 46 // 47 //	LLD 接PB3 // 肖/C注前 SDO (MISO) 接PB14 //SPI读信号 不使用触摸或者模块本身不带触摸, T_CLK 接PC0 //触摸SPI总 T_CS 接PC3 //触摸SPI总 T_DIN 接PC2 //触摸SPI总 T_IRQ 接PC1 //触摸屏中谢	le 5 (周电十元元) 如果不 妙如无需读取可不接 触摸屏接线====================================
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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:

翌 E\project\3.2inch\QDtech_3.2inch_ILI9341_SPLV1.0\2-STM32测试程序\STM32_Demo_STM32F103RCT6_Hardware_SPI\USER\T		
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B Target 1 Options for Target 'Target 1'	^	
B B Device Target Output Listing User C/C++ Asm Linker Debug Utilities	要控制可	
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B - B sys Use Debug Driver Settings Update Target before Debugging		
B G HARD	-	
B Icd		
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E F FWLib		
Programming Algorithm	-	
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Programming Do		
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	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