7inch Resistive Touch LCD

User Manual



Chinese website: www.waveshare.net
English website: www.wvshare.com
Data download: www.waveshare.net/wiki

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1. Overview

7inch Resistive Touch LCD module is a 7 inch TFT-LCD with no LCD controller included. It adopts AT070TN92 as its LCD screen and XPT2046 as resistive touch control chip. AT070TN92 can provide 800*480 pixel resolution with 24 bit pixel depth. And XPT2046 is a 4-wire resistive touch controller.

1.1 AT070TN92

Here are the basic parameters of AT070TN92.

Module Type	TFT
Interfaces	24-bit parallel RGA data input
Backlight	LED
Display area(mm)	154.08(W)×85.92(H)
Dot pitch (mm)	0.0642(W)×0.1790(H)
Aspect ratio	8:5
Resolution	800*480 (Pixel)
Scan frequency	60Hz
Display colors	16.7M

When applying AT070TN92, a MCU with LCD controller is required, since the LCD controller is not included in this LCD. Here is the basic sequence of AT070TN92.

Data Input Format



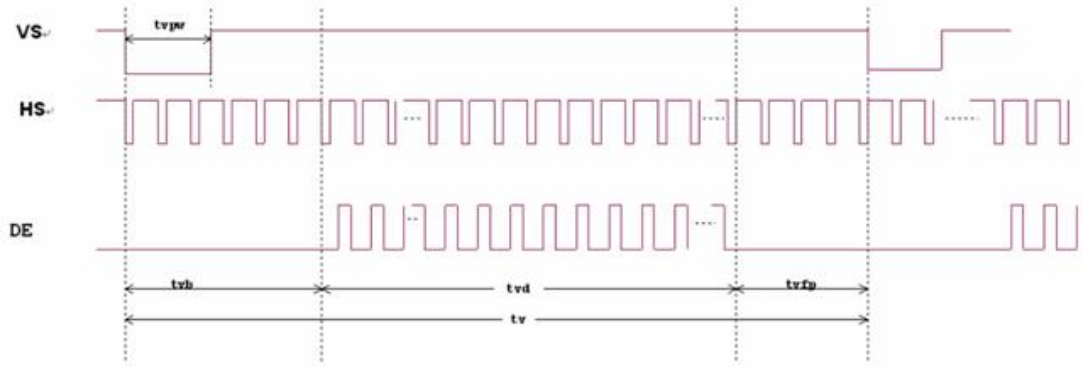


Table 1: Pin description

Symbol	Description
HS	Horizontal sync signal, which indicates the starting to scan a new line
VS	Vertical sync signal, which indicates the starting to scan a new frame. One frame refers to one picture shown in the LCD
DCLK	LCD clock
R0-R7	Red pallet data line
G0-G7	Green pallet data line
B0-B7	Blue pallet data line
DE	Input data enable control

Table 2: The meanings of symbols in the sequence diagram

Item	Symbol	Values			Unit	Remark
		Min.	Typ.	Max.		
Horizontal Display Area	thd	-	800	-	DCLK	
DCLK Frequency	fclk	26.4	33.3	46.8	MHz	
One Horizontal Line	th	862	1056	1200	DCLK	
HS pulse width	thpw	1	-	40	DCLK	
HS Blanking	thb	46	46	46	DCLK	
HS Front Porch	thfp	16	210	354	DCLK	

Item	Symbol	Values			Unit	Remark
		Min.	Typ.	Max.		
Vertical Display Area	tvd	-	480	-	TH	
VS period time	tv	510	525	650	TH	
VS pulse width	tvpw	1	-	20	TH	
VS Blanking	tvb	23	23	23	TH	
VS Front Porch	tvfp	7	22	147	TH	

Remarks:

(1) Unit: CLK=1/f_{CLK}, it is the duration for scanning a pixel; H=th, it is the duration for scanning a line.

(2) This table is referenced from AT070TN92.pdf

From the table above, we can see that:

The clock of this LCD is come from an external clock source with the frequency of 26.4-46.8MHz. Notices that thfp+thb=46 and tvfp+tvb=23.

From the figure above, we can learn that:

The total time for scanning a line is: th = thp + thb + thd + thf; in the period of thd, when a clock plus comes, a pixel data will be transmitted via the parallel data interface. And there are 800 pixels each line for this LCD, so thd=800;

The duration for scanning a frame is: tv = tvp + tvb + tvd + tvf； Hsync can be regarded as the clock of vertical signals. A clock cycle of Hsync refers to the duration for LCD displaying a line. When a falling edge comes in Hsync, a new line will be displayed in the LCD. However, the actual data transmission only occurs in the period of tvd. And the LCD will display the new line in this case. There are 480 lines for this LCD, so tvd = 480.

Other parameters can be modified as required, according to the specifications listed in the tables above.

1.2 XPT2046

- XPT2046 is a 4-wire resistive touch screen controller with a 12-bit 125 kHz sampling SAR type A/D converter;
- XPT2046 supports digital I/O interface voltage from 1.5V to 5V;
- XPT2046 enables to detect the pressed screen location by performing two A/D conversions, and measure touch screen pressure as well;
- XPT2046 has an on-chip temperature sensor;
- For more detailed information, please refer to *XPT2046 Data Sheet*;

Note: 7inch Resistive Touch LCD has no XPT2046 on board, so external circuit is required.

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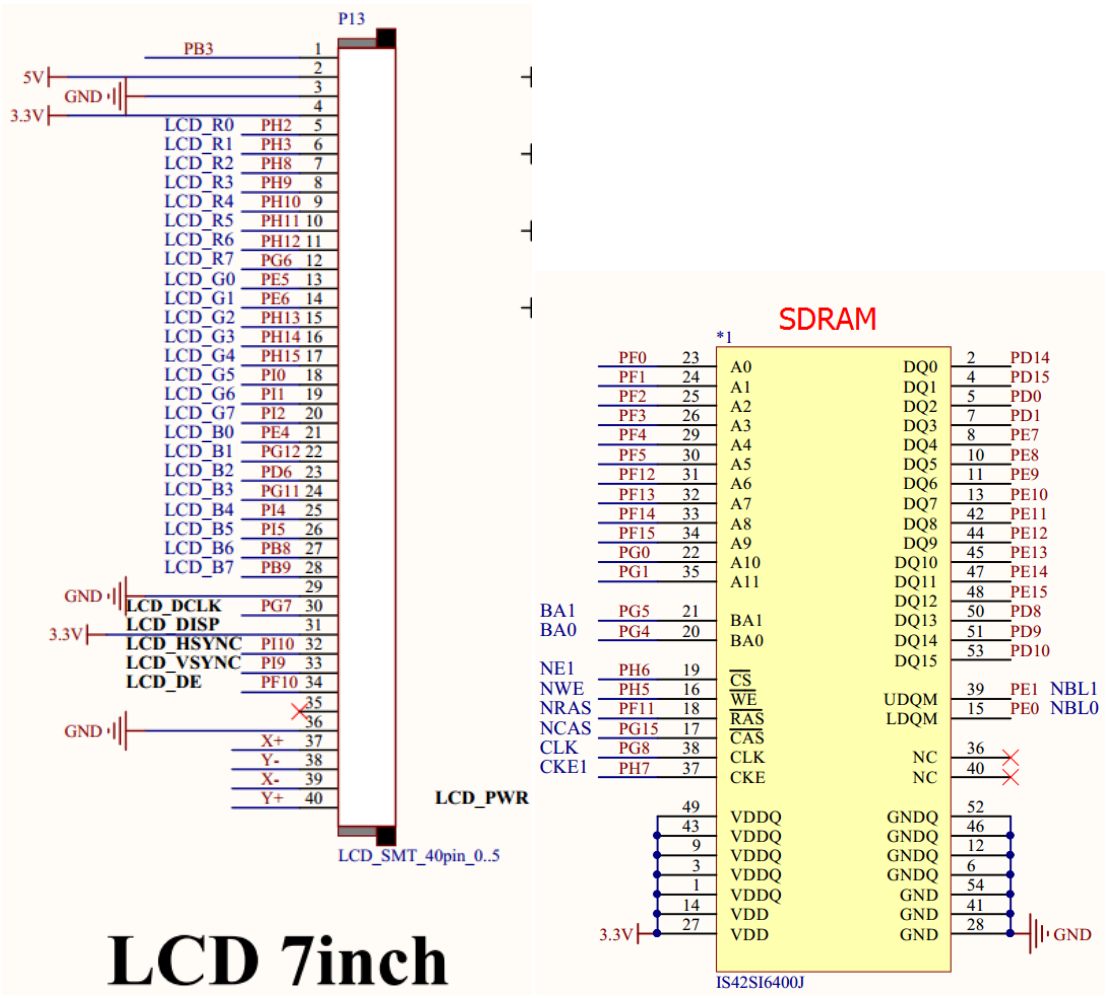
2. Hardware description

Pin No.	Symbol	Descriptions	I/O	Functions
1	VLED-	Backlight negative polarity	I	Backlight negative polarity, connected to GND or PWM
2	VLED+	Backlight positive	I	Backlight positive polarity,

		polarity		connected to 5V power supply
3	GND	Power ground	I	Ground
4	VCC	Power supply positive	I	Power supply, connected to 3.3V power adapter
5	R0	Data line	I	Red pallet data line
6	R1			
7	R2			
8	R3			
9	R4			
10	R5			
11	R6			
12	R7			
13	G0	Data line	I	Green pallet data line
14	G1			
15	G2			
16	G3			
17	G4			
18	G5			
19	G6			
20	G7			
21	B0	Data line	I	Blue pallet data line
22	B1			
23	B2			
24	B3			
25	B4			
26	B5			
27	B6			
28	B7			
29	GND	Ground	I	GND
30	DCLK	LCD clock	I	LCD clock signal source
31	DISP	Display on/off mode control	I	Control display on/off mode, connected to VCC
32	HSYNC	Horizontal synchronization	I	Horizontal sync signal input
33	VSYNC	Vertical synchronization	I	Vertical sync signal input
34	DE	Input data enable control	I	DE=0:SYNC mode DE=1:DE mode
35	NC			
36	GND	Ground	O	GND
37	Y+	Touch panel Y+	O	Resistive touch panel Y+ analog output

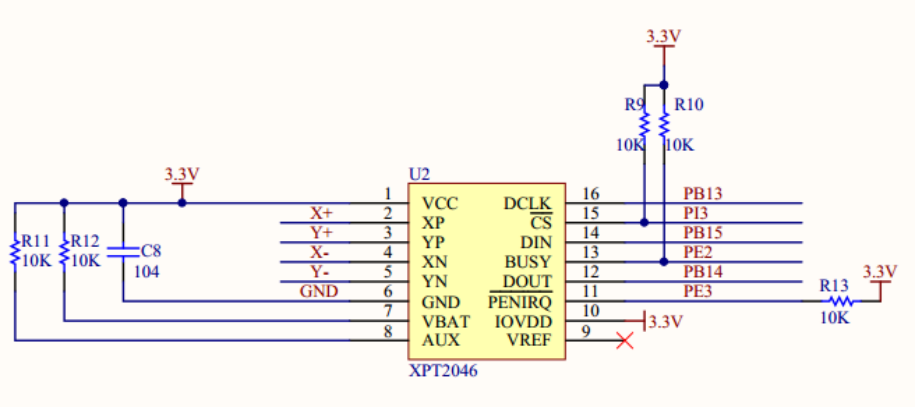
38	Y-	Touch panel Y-	O	Resistive touch panel Y- analog output
39	X+	Touch panel X+	O	Resistive touch panel X+ analog output
40	X-	Touch panel X-	O	Resistive touch panel X- analog output

The following figures show the connection of the LCD hardware interfaces based on Open429I-C development board.



The hardware connection presented above is based on the TFT-LCD controller integrated in the STM32F429IGT6. In this application, the display is controlled by STM32F429IGT6. MCU reads/writes data from/to the resistive touch control chip XPT2046 via SPI.

In this application, SDRAM serves as the data buffer of LCD. TFT-LCD controller reads data from SDRAM and displays what it got on LCD. The data will be refreshed by the controller all the time, so when there is any change in SDRAM, the picture displayed on the LCD will be updated immediately. Hence, you only need to configure the registers of the TFT-LCD controller, and then manage the data in SDRAM to control the display on the LCD screen. The refresh frequency depends on the LCD clock cycle.
The interfaces of the resistive touch function are shown as follow.

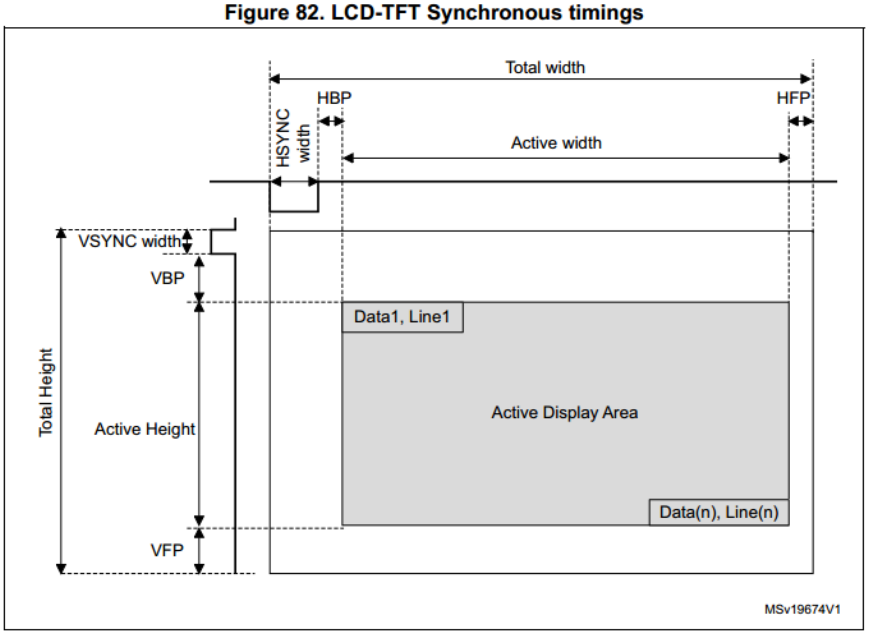


3. Software description

The following program is written based on the application developed with Open407I-C. The MCU of Open407I-C development board is STM32F429IGT6, which integrates a TFT-LCD controller with 800*600 pixel resolution.

The controller integrated in STM32F429IGT6 is as the figure below shows.

Figure 82. LCD-TFT Synchronous timings



HBP is for horizontal back porch and HFP is for horizontal front porch;

VBP is for vertical back porch and VFP is for vertical front porch.

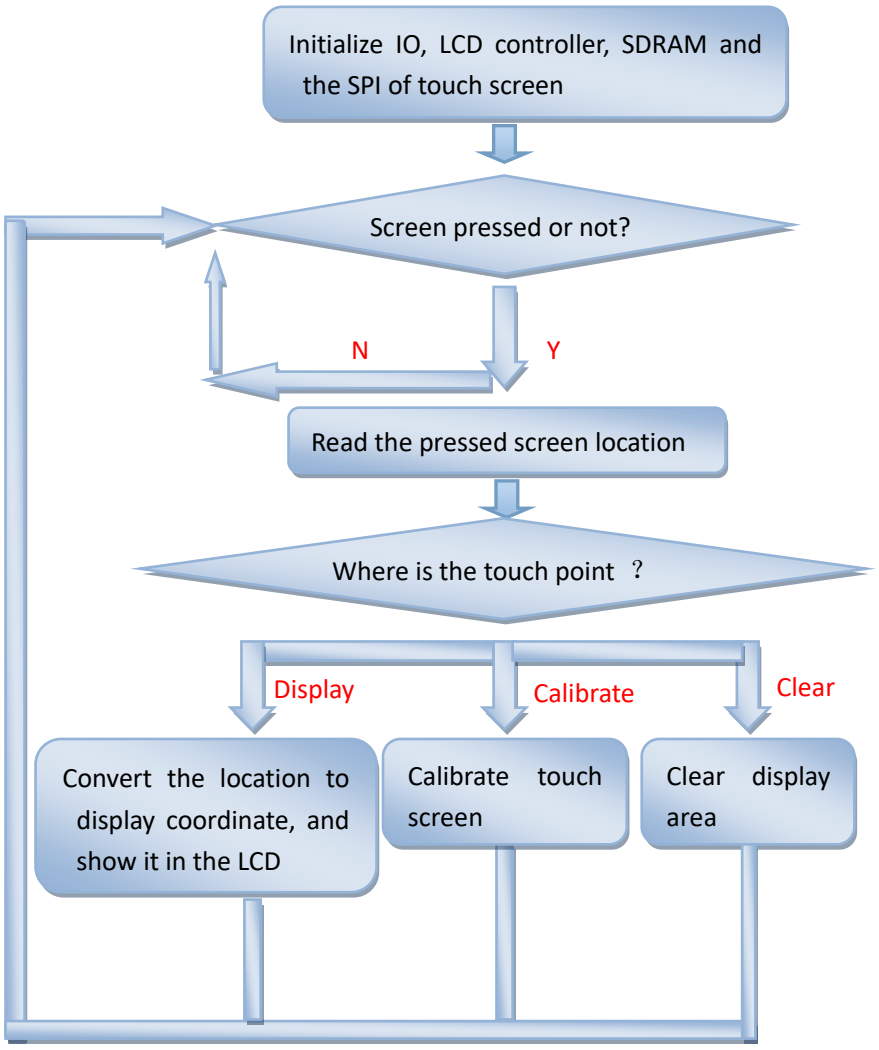
- HSYNC Width and VSYNC Height: HSYNC Width is for Horizontal Synchronization Width and VSYNC Height is Vertical Synchronization Height. They can be set by the bits HSW(LTDC_SSCR[27:16]) and VSH(LTDC_SSCR[10:0]) of LTDC_SSCR register, where HSW= HSYNC Width – 1, and VSH = VSYNC Height – 1;

- HBP and VBP can be set by the bits AHBP(LTDC_BPCR[27:16]) and AVBP(LTDC_BPCR[10:0]) of LTDC_BPCR register, where AHBP= HSYNC Width + HBP – 1, and AVBP= VSYNC Height + VBP – 1;

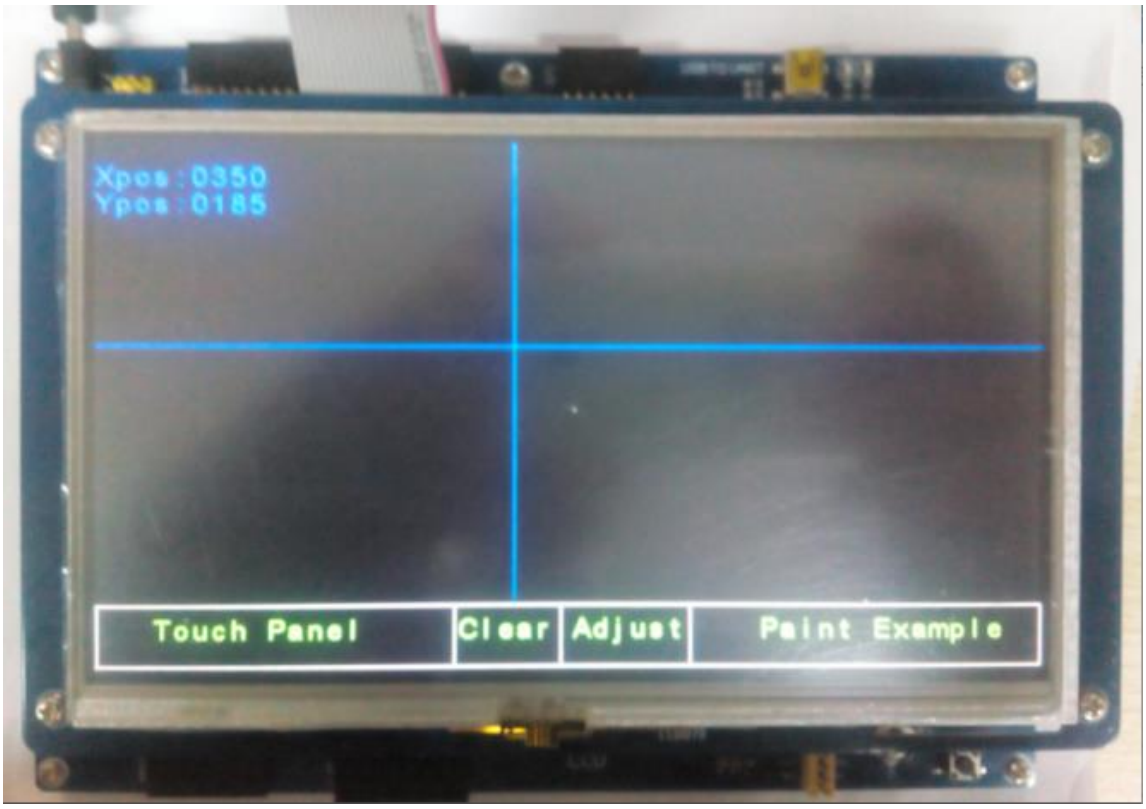
- Active Width and Active Height can be set by the bits AAW(LTDC_AWCR[27:16]) and AAH(LTDC_AWCR[10:0]) of LTDC_AWCR register, where AAW= HSYNC Width + HBP+ Active Width – 1, and AAH= VSYNC Height + VBP+ Active Height – 1;

- Total Width and Total Height can be set by the bits TOTALW(LTDC_TWCR[27:16]) and TOTALH(LTDC_TWCR[10:0]) of LTDC_TWCR register, where TOTALW= HSYNC Width + HBP+ Active Width +HFP – 1, and TOTALH= VSYNC Height + VBP+ Active Height +VFP – 1.

LCD program flow chart:



4. Test result



5. Dimensions

