

液晶模组规格书

LCM Specification

初定规格 Preliminary specification

正式规格 Official specifications

项目编号 Project No.	TFT-H024C8QVTST2N18		
客户名称 Customer			
客户型号 Module No.			
产品描述 Product Description	TFT LCD Module 240 x 320 Dots 2.4" TFT LCD		
客户确认签章: Signature by customer:			
<input type="checkbox"/> 小批量试产 Trial production <input type="checkbox"/> 大批量生产 Mass production			
编制	电子审核	结构审核	批准
Liu.YL			

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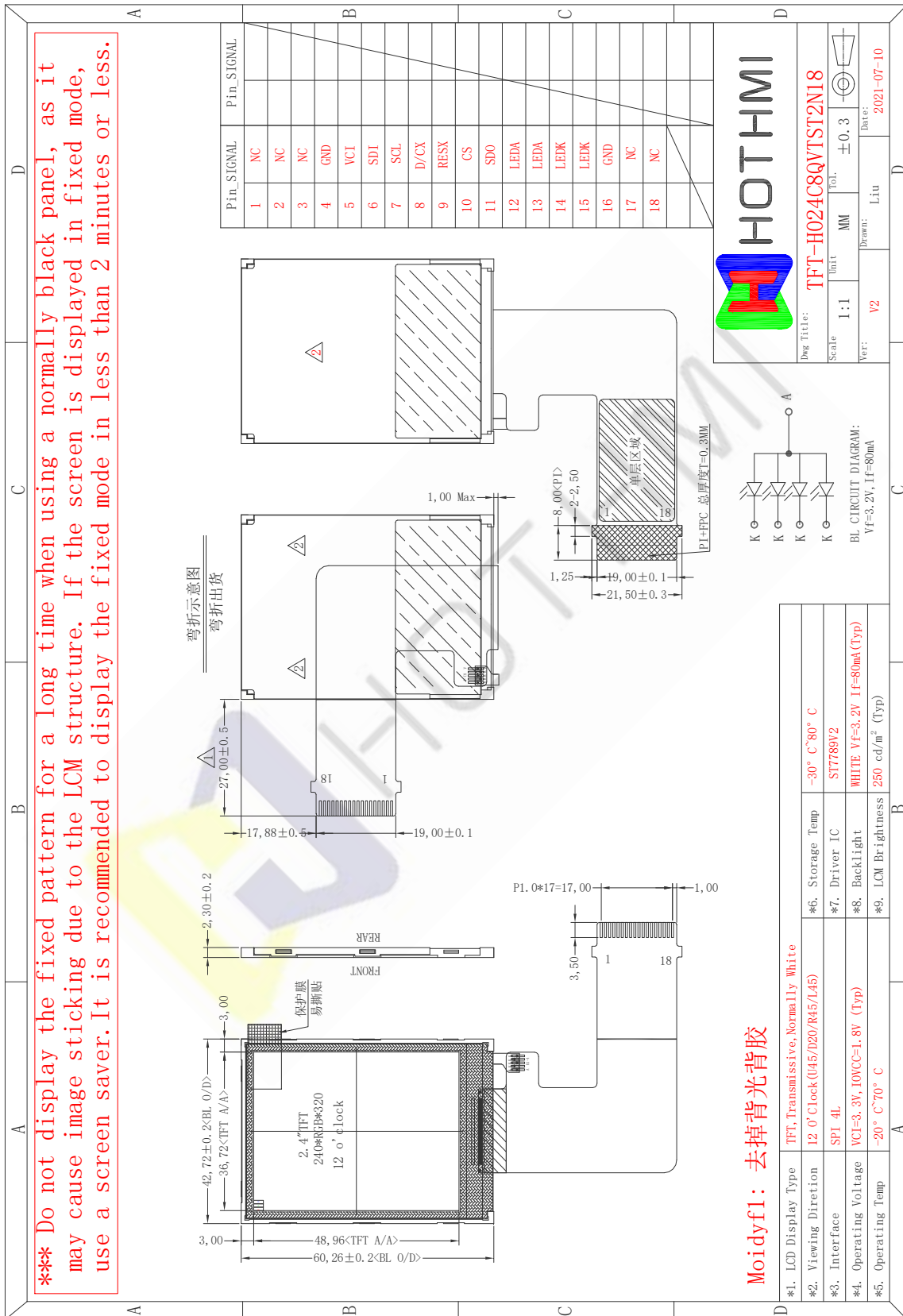
文档修订记录 Document revision history :

版本 Version	日期 DATE	修改说明 Modify description	编制 PREPARED BY
0	2021-07-27	初次编制	Liu. YL

一、基本特征 General Feature:

项目 Item	标准值 Standard Value	单位 Unit
显示尺寸 Display Size	2.4"	--
分辨率 Number of Pixels	240 (H) x3 (RGB) *320 (V)	--
显示区域 Active Area	36.72 (H) * 48.96 (V)	mm
外形尺寸 Outline Dimension	42.72 (H) * 60.26 (V) * 2.30 (D) <TFT>	mm
观看方向 Viewing Direction	12 点 12 O' Clock	-
接口 Interface	SPI 4L	-
驱动芯片 Driver IC	ST7789V2	-
驱动电压 Driver Condition	VCI=2.8V, IOVCC=1.8V	V
背光 Backlight	白色 LED White LED	-
触摸屏 Touch Panel	不带触摸屏 Whitout Touch Panel	-
触摸屏驱动芯片 CTP Driver IC	- - -	
摸屏驱动电压 CTP Driver Condition	VDD=3.3V	
液晶工作温度 Operation Temperature	-20~70	℃
液晶储存温度 Storage Temperature	-30~80	℃

二、外形尺寸 Outline Dimensions



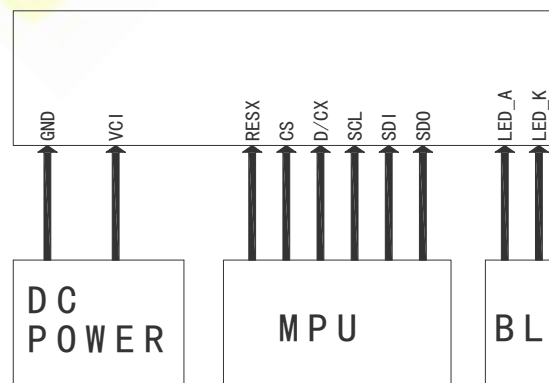
三、引脚说明 Pin Description

3.1 模组引脚说明 TFT Pin Description

引脚编号 Pin NO.	标号 Symbol	详细描述 Description
1	NC	Open Pin
2	NC	Open Pin
3	NC	Open Pin
4	GND	Ground
5	VCI	Analog Power(2.6 ~ 3.3 V, 2.8V Type)
6	SDI	Serial data input/output bi-direction pin
7	SCL	SCL pin as Serial Clock
8	D/CX	Display data/command selection pin
9	RESX	Global reset pin. Active low to enter reset state.
10	CS	Chip select input signal
11	SDO	Serial data output
12	LEDA	Backlight positive voltage
13	LEDA	Backlight positive voltage
14	LEDK	Backlight negative voltage
15	LEDK	Backlight negative voltage
16	GND	Ground
17	NC	Open Pin
18	NC	Open Pin

---END---

3.2 接线说明 Wiring instructions



四、电气特性 Electrical Characteristics

4-1 TFT 模组工作条件 TFT LCD Module Operating Conditions

项目 Item	标号 Symbol	条件 Condition	最小值 Min	典型值 Type	最大值 Max	单位 Unit
数字电源 Digital Power	IOVCC	-	1.75	1.8	3.3	V
模拟电源 Digital Power	VCI	-	2.6	2.8	3.3	V
TFT 栅极导通电压 TFT Gate on voltage	VGH	-	10.0	12.0	14.0	V
TFT 栅极关断电压 TFT Gate off voltage	VGL	-	-14.0	-12.0	-10.0	V

4-2 背光工作条件 LED back light specification

项目 Item	标号 Symbol	条件 Condition	最小值 Min	典型值 Type	最大值 Max	单位 Unit
工作电压 Forward voltage	Vt	If=20mA	3.0	3.2	3.4	V
工作电流 Forward current	Ipn	/1-chip	-	80	-	mA
亮度 (带 LCD) Luminance (With LCD)	Lv	If=40mA	-	250	-	cd/m ²
颜色 Luminous color	白色 White					

4-3 触摸屏工作条件 CTP Operating Conditions

项目 Item	标号 Symbol	条件 Condition	最小值 Min	典型值 Type	最大值 Max	单位 Unit
模拟电源 Digital Power	VDD	-	2.8	3.30	3.60	V
I/O 数字电源 I/O Digital Power	IOVDD	-	2.8	3.30	3.60	V
工作温度 Operation Temperature	-	-	-	-	-	°C
储存温度 Storage Temperature	-	-	-	-	-	°C

五、液晶光学规格 TFT OPTICAL SPECIFICATION

5.1 概述 Overview

The test of Optical specifications shall be measured in a dark room (ambient luminance 1lux and temperature = 25 °C) with the equipment of Luminance meter system (Goniometer system and TOPCON BM-5) and test unit shall be located at an approximate distance 50cm from the LCD surface at a viewing angle of θ and Φ equal to 0°. The center of the measuring spot on the Display surface shall stay fixed. The backlight should be operating for 30 minutes prior to measurement.

5.2 光学规格 Optical Specifications

参数 Parameter		标号 Symbol	条件 Condition	最小值 Min.	典型值 Typ.	最大值 Max.	单位 Unit	备注 Remark
视角范围 Viewing Angle Range	水平 Horizontal	⊙L	CR>10	-	45	-	Deg.	Note 1
		⊙R		-	45	-	Deg.	
	垂直 Vertical	⊙U		-	45	-	Deg.	
		⊙D		-	20	-	Deg.	
对比度 Contrast ratio		CR	$\theta = 0^\circ$	-	250	-		Note2
色域 Color Gamut		CG		-	-	-	%	
白色色度 White Chromaticity		Wx	$\theta = 0^\circ$	-0.03	0.308	+0.03		Note4 (Based on C Light)
		Wy			0.325			
色彩还原 Reproduct ion of color	红 Red	Rx			0.612			
		Ry			0.329			
	绿 Green	Gx			0.299			
		Gy			0.567			
	蓝 Blue	Bx			0.144			
		By			0.110			
响应时间 (上升 + 下降) Response Time (Rising + Falling)		Tr+Tf	$\theta = 0^\circ$ Ta= 25°C	-	25	35	ms	Note5
透光率 (带偏光片) Transmittance (with Polarizer)		Tr		-	4.65	-	%	Note3

Note:

1. Viewing angle is the angle at which the contrast ratio is greater than 10. The viewing angles are determined for the horizontal or 3, 9 o'clock direction and the vertical or 6, 12 o'clock direction with respect to the optical axis which is normal to the LCD surface (see FIGURE 1).

2. Contrast measurements shall be made at viewing angle of $\Theta = 0$ and at the center of the LCD surface. Luminance shall be measured with all pixels in the view field set first to white, then to the dark (black) state. (see FIGUR 1) Luminance Contrast Ratio (CR) is defined mathematically.

$$CR = \frac{\text{Luminance when displaying a white raster}}{\text{Luminance when displaying a black raster}}$$

3. Transmittance is the Value without APF and without CG.

4. The color chromaticity coordinates specified in the above table shall be calculated from the spectral data measured with all pixels first in red, green, blue and white. Measurements shall be made at the center of the panel.

5. The electro-optical response time measurements shall be made as FIGURE 2 by switching the “data” input signal ON and OFF. The times needed for the luminance to change from 10% to 90% is T_r , and 90% to 10% is T_f .

Figure1 Measurement Set Up

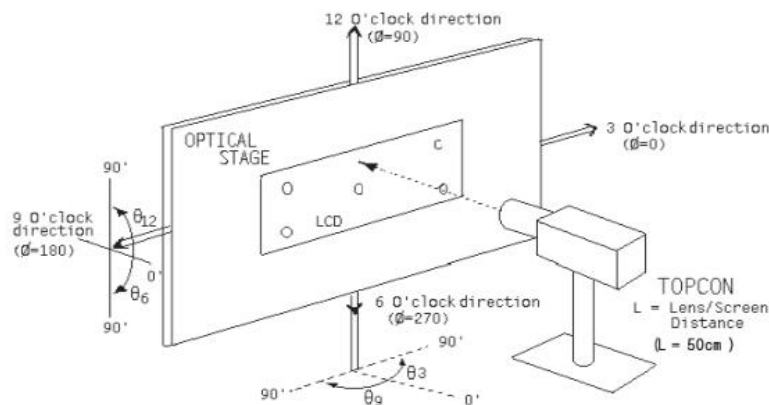
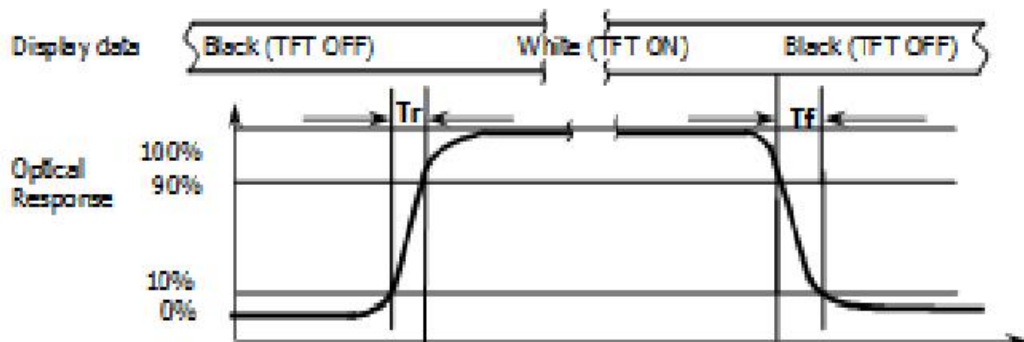
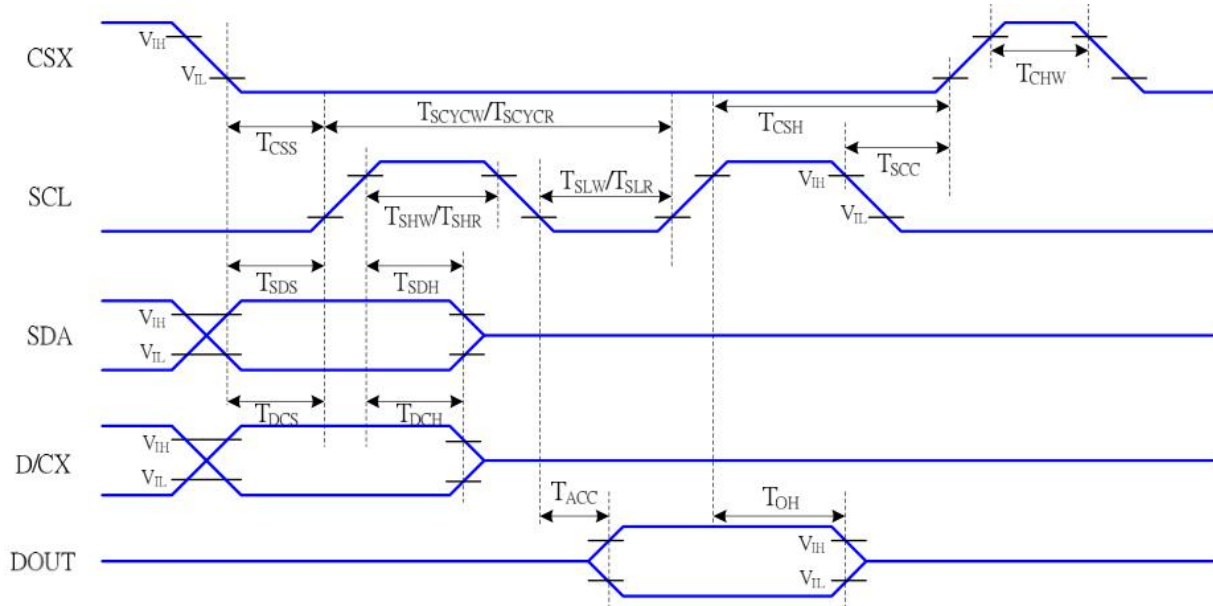


Figure2 Response Time Testing



六、时序特性 Timing Characteristics

6-1 串行接口特性 / Serial Interface Characteristics(4-line serial)



VDDI=1.65 to 3.3V, VDD=2.4 to 3.3V, AGND=DGND=0V, Ta=25°C

Signal	Symbol	Parameter	MIN	MAX	Unit	Description
CSX	T_{CSS}	Chip select setup time (write)	15		ns	
	T_{CSH}	Chip select hold time (write)	15		ns	
	T_{CSS}	Chip select setup time (read)	60		ns	
	T_{SCC}	Chip select hold time (read)	65		ns	
	T_{CHW}	Chip select "H" pulse width	40		ns	
SCL	T_{SCYCW}	Serial clock cycle (Write)	66		ns	-write command & data ram
	T_{SHW}	SCL "H" pulse width (Write)	15		ns	
	T_{SLW}	SCL "L" pulse width (Write)	15		ns	
	T_{SCYCR}	Serial clock cycle (Read)	150		ns	-read command & data ram
	T_{SHR}	SCL "H" pulse width (Read)	60		ns	
	T_{SLR}	SCL "L" pulse width (Read)	60		ns	
D/CX	T_{DCS}	D/CX setup time	10		ns	
	T_{DCH}	D/CX hold time	10		ns	
SDA (DIN)	T_{SDS}	Data setup time	10		ns	
	T_{SDH}	Data hold time	10		ns	
DOUT	T_{ACC}	Access time	10	50	ns	For maximum CL=30pF
	T_{OH}	Output disable time	15	50	ns	For minimum CL=8pF

Notes:

1. $T_a = -30$ to 70 ° C, $I_{OVCC} = 1.65V$ to $3.3V$, $V_{CI} = 2.5V$ to $3.3V$, $AGND = DGND = 0V$
2. The rising time and falling time (T_r , T_f) of input signal are specified at 15 ns or less. Logic high and low levels are specified as 30% and 70% of VDDI for Input signals.

七、可靠性测试 RELIABILITY TEST

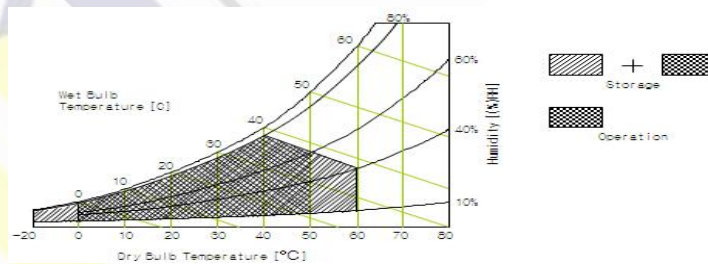
7-1 温度和湿度 Temperature and Humidity

测试项目 TEST ITEMS	条件 CONDITIONS	注释 NOTE
高温储存 High Temperature Storage	Ta=+80 °C, 240hrs	
低温储存 Low Temperature Storage	Ta=-30 °C, 240hrs	
高温运行试验 High Temperature Operation	Ta=+70 °C, 240hrs	
低温运行试验 Low Temperature Operation	Ta=-20 °C, 240hrs	
高温高湿（运行测试） High Temperature and High Humidity (Operating)	Ta=+60 °C, 90%RH, 240hrs	

注释 Note:

1. 液晶驱动电压。由于液晶材料的特性，该电压随环境温度而变化。Liquid Crystal driving voltage. Due to the characteristics of LC Material, this voltage varies with environmental temperature.

2. 温度和相对湿度范围如下图所示。湿球温度最高应为39℃。并且没有冷凝水。Temperature and relative humidity range are shown in the figure below. Wet bulb temperature should be 39 °C max. and no condensation of water.



3. 产品经可靠性测试后，仅保证功能正常，无任何致命缺陷（不显示、线路缺陷、显示异常等）。After the reliability test, the product only guarantee function normally without any fatal defect (non-display, line defect, abnormal display etc).

4. 所有显示判断均在面板温度恢复到室温后进行 All judgments of display are performed after temp of panel returns to room temperature

5. Ta: 环境温度 Ambient temperature

7-2 冲击和振动 Shock and Vibration

测试项目 TEST ITEMS	条件 CONDITIONS
包装冲击(非操作) Packing Shock (Non-Operation)	<ul style="list-style-type: none"> ● Shock level:980m/s² ● Waveform:1/2 Sine wave,6msec ● ±X, ±Y ±Z, each axis 1 times
包装振动(非操作) Packing Vibration (Non-Operation)	<ul style="list-style-type: none"> ● Frequency range:8-33.3HZ ● Stoke:1.0mm ● Sweep: 10Hz-50Hz ● x, y, z 2 hours for each direction

7-3 静电放电测试 Electrostatic Discharge

测试项目 TEST ITEMS	条件 CONDITIONS
ESD (Non-operation)	150pF, 330 Ω, Contact ±4KV, Air : ±8KV. Note 1
	200pF, 0 Ω, ±200V Contact test. Note 2

测量点 Measure Point:

1. LCD玻璃和金属边框 LCD glass and metal bezel
2. 连接器引脚 IF connector pins

八、处理和注意事项 HANDDLING & CAUTIONS

8-1 操作注意事项 Caution For Operation

◆Since the LCM is made of glass, do not apply strong mechanical impact or static load onto it. Handling with care since shock, vibration, and careless handling may seriously affect the product. If it falls from a high place or receives a strong shock, the glass maybe broken.

◆It is indispensable to drive the LCM within the specified voltage limit since the higher voltage than the limit causes LCM's life shorter. An electro-chemical reaction due to DC causes undesirable deterioration of the LCM so that the use of DC drive should avoid.

◆Do not connect or disconnect the LCM to or from the system when power is on.

◆Never use the LCM under abnormal conditions of high temperature and high humidity.

◆When expose to drastic fluctuation of temperature(hot to cold or cold to hot), the LCM may be affected; specifically, drastic temperature fluctuation from cold to hot, produces dew on the LCM's surface which may affect the operation of the polarizer on the LCM.

◆Response time will be extremely delay at lower temperature than the operating temperature range and on the other hand LCM may turn black at temperature above its operational range. However those phenomenon do not mean malfunction or out of order with the LCM. The LCM will revert to normal operation once the temperature returns to the recommended temperature range for normal operation.

◆ Do not display the fixed pattern for a long time when using a normally black panel, as it may cause image sticking due to the LCM structure. If the screen is displayed in fixed mode, use a screen saver. It is recommended to display the fixed mode in less than 2 minutes or less. Black image or moving image is strongly recommended as a screen save.

8-2 防静电措施 Caution Against Static Charge

◆The LCM use C-MOS LSI drivers, so customers are recommended that any unused input terminal would be connected to Vdd or Vss, do not input any signals before power is turn on, and ground you body, work/assembly area, assembly equipments to protect against static electricity.

◆Remove the protective film slowly, keeping the removing direction approximate 30-degree not vertical from panel surface, if possible, under ESD control device like ion blower, and the humidity of working room should be kept over 50%RH to reduce the risk of static charge.

◆Avoid the use work clothing made of synthetic fibers. We recommend cotton clothing or other conductivity-treated fibers.

◆In handling the LCM, wear non-charged material gloves. And the conducting wrist to the earth and the conducting shoes to the earth are necessary

九、初始化代码 LCD display initialization code

```

Void Panel_Initial_code(void)
{
    //Resolution: 240x320
    //Interface: SPI 4L
    //=====上电复位操作=====//
    LCD_RESET=1;
    Delays(1);          //Delay 1ms
    LCD_RESET=0;
    Delays(10);         //Delay 10ms
    LCD_RESET=1;
    Delays(120);        //Delay 120ms
    //=====//
    WriteComm(0x11);Delays(120));          //Delay 120ms
    //--Display Setting-----//
    WriteComm(0x36);WriteData(0x00);
    WriteComm(0x3a);WriteData(0x55); // COLOR MODE 565
    //--ST7789V Frame rate setting----//
    WriteComm(0xb2);WriteData(0x0c);WriteData(0x0c);WriteData(0x00);WriteData(0x33);
    WriteData(0x33);
    WriteComm(0xb7);WriteData(0x35);
    //---ST7789V Power setting-----//
    WriteComm(0xbb);WriteData(0x2b);
    WriteComm(0xc0);WriteData(0x2c);
    WriteComm(0xc2);WriteData(0x01);
    WriteComm(0xc3);WriteData(0x11);
    WriteComm(0xc4);WriteData(0x20);
    WriteComm(0xc6);WriteData(0x0f);
    WriteComm(0xd0);WriteData(0xa4);WriteData(0xa1);
    //--ST7789V gamma setting-----//
    WriteComm(0xe0);WriteData(0xd0);WriteData(0x00);WriteData(0x05);WriteData(0x0e);
    WriteData(0x15);WriteData(0x0d);WriteData(0x37);WriteData(0x43);WriteData(0x47);
    WriteData(0x09);WriteData(0x15);WriteData(0x12);WriteData(0x16);WriteData(0x19);

    WriteComm(0xe1);WriteData(0xd0);WriteData(0x00);WriteData(0x05);WriteData(0x0d);
    WriteData(0x0c);WriteData(0x06);WriteData(0x2d);WriteData(0x44);WriteData(0x40);
    WriteData(0x0e);WriteData(0x1c);WriteData(0x18);WriteData(0x16);WriteData(0x19);

    Delays(120);        //Delay 120ms

```

```
WriteComm(0x29);  
Delays(120);          //Delay 120ms  
  
}
```

```
Void EnterSleep_Code(void)  
{  
WriteComm(0x28) //Display off  
Delays(10);  
WriteComm(0x10); // Internal oscillator will be stopped  
Delays(120);  
}
```

```
Void ExitSleep_Code(void)  
{  
WriteComm(0x11); // Sleep out  
Delays(120);  
WriteComm(0x29) //Display on  
Delays(120);  
}
```

--END--