液 晶 模 组 说 明

LCD Module Description

☑初定规格 Preliminary specification

☐正式规格 Official specifications

项目编号 Project No.	TFT-H043A28 Series
产品描述 Product Description	TFT LCD Module 480(RGB) x 272 Pixels 4.3 Inch TFT LCD

客 户 确 认 签 章:
Signature by customer:

☐小批量试产 Trial Production ☐大批量生产 Mass Production

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HotDisplay Technology Co.,Ltd

深圳市鑫洪泰电子科技有限公司

鑫洪泰（东莞）显示技术有限公司

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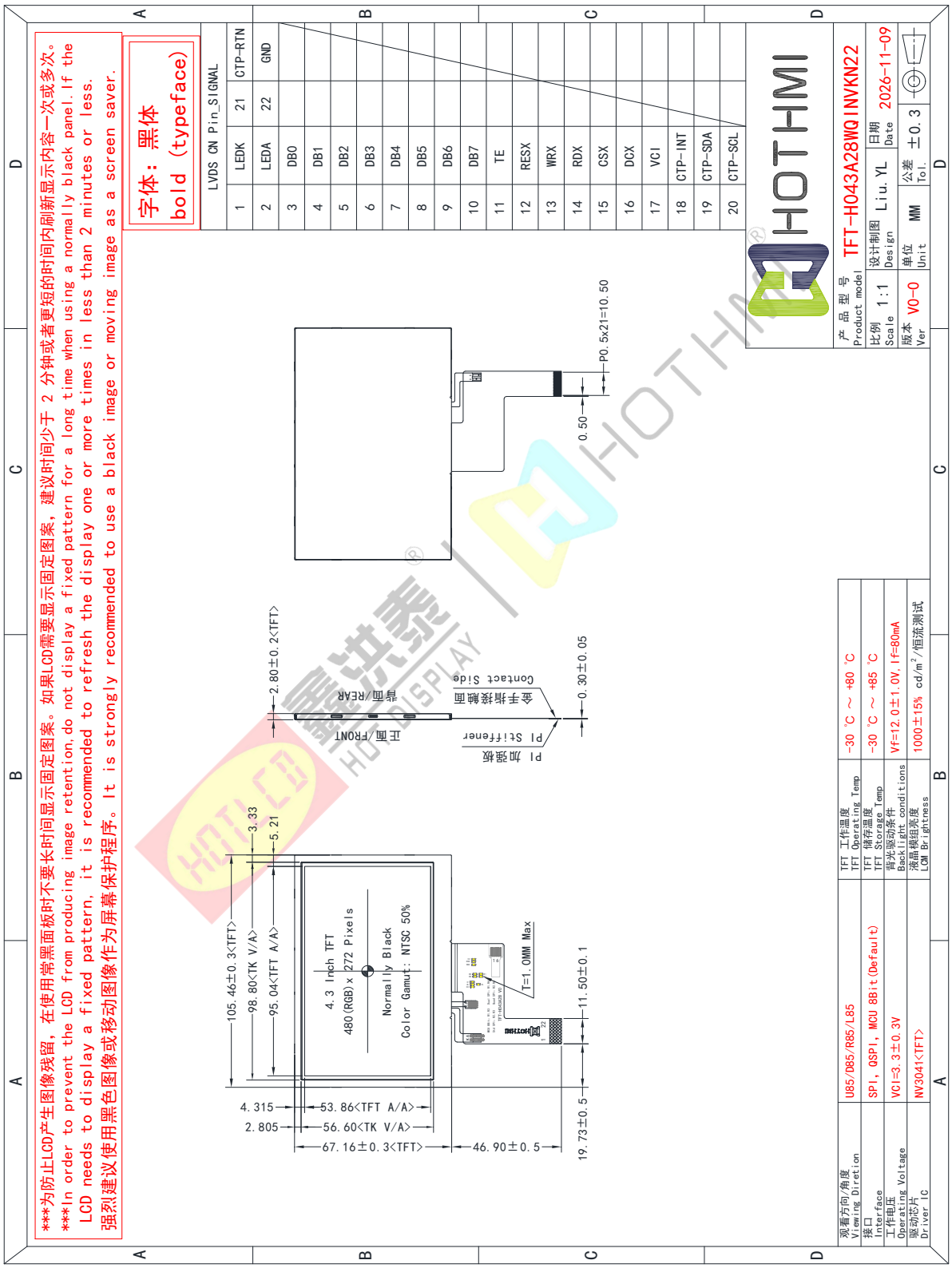
一、基本特征 General Feature:

项目 Item	标准值 Standard Value			单位 Unit
TFT 显示尺寸 TFT Display Size	4.3			英寸 Inch
TFT 分辨率 TFT Number of Pixels	480(RGB) (H) x 272 (V)			像素 Pixel
TFT 显示有效区域 TFT Display Active Area	95.04 (H) x 53.86 (V)			毫米 mm
TFT 模组外形尺寸 TFT Module Dimensions	105.46(H) x 67.16(V) x 2.80(D) <TFT> 105.46(H) x 67.16(V) x 4.60(D) <TFT+CTP>			毫米 mm
TFT 观看方向 TFT Viewing Direction	U85/D85/R85/L85			度数 Deg.
TFT 模组接口 TFT Module Interfaces	SPI, QSPI, MCU 8Bit(Default)			-
TFT 驱动芯片 TFT Driver IC	NV3041 <ShaiHai, China>			-
电容触摸屏驱动芯片 CTP Driver IC	GT911 <China>			
触摸屏 Touch Panel	☑不带触摸屏 Whitout TP	☐带电阻触摸屏 With RTP	☑带电容触摸屏 With CTP	-
TFT 模组重量 TFT Module Weight	不带触摸屏 Without TP	37.35 ±3%		克 g
	带电容触摸屏 With CTP	64.25 ±3%		
	带电阻触摸屏 With RTP	T.B.D ±3%		

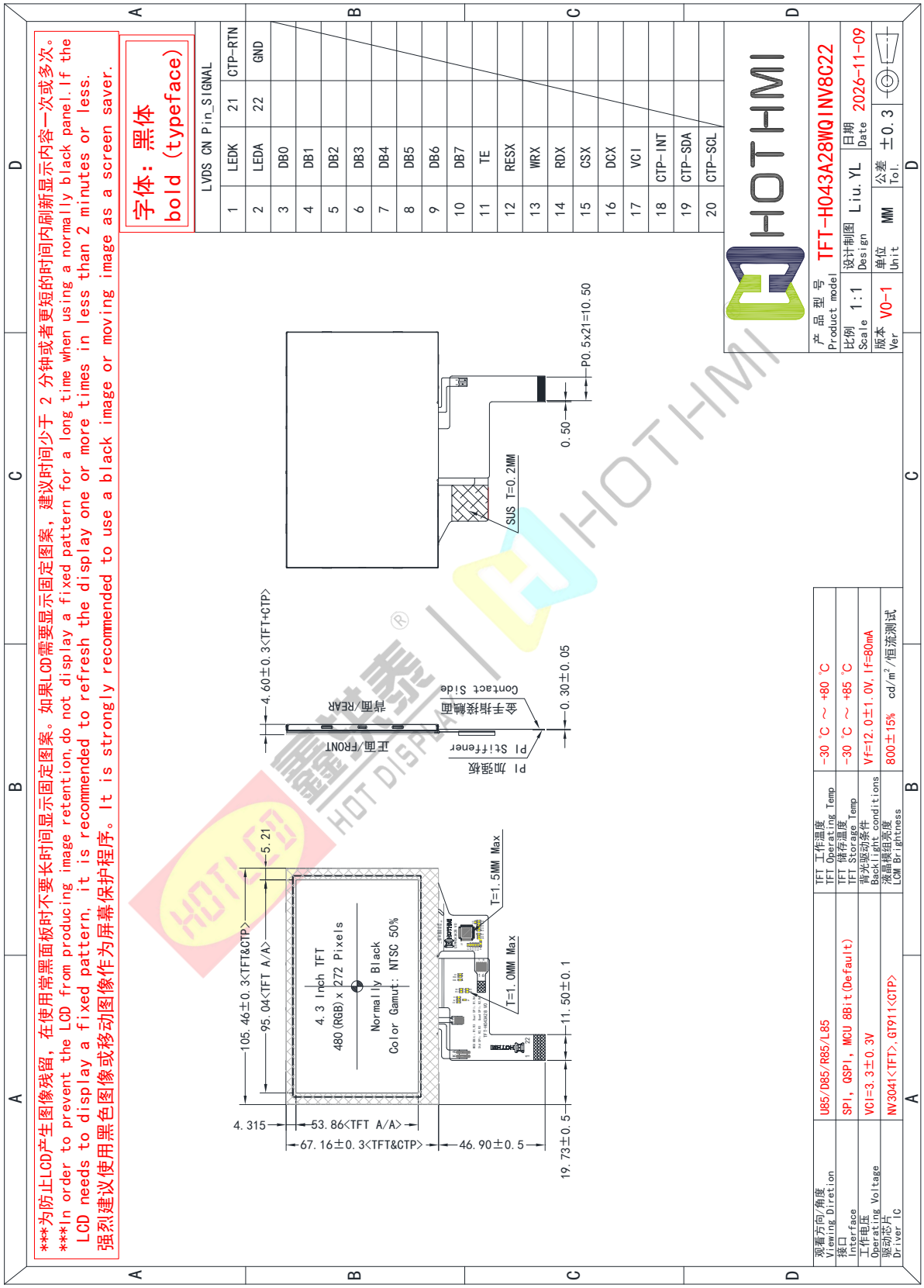
说明 Description:

二、外形尺寸 Outline Dimensions

TFT-H043A28WQINVKN22_V0-0 <NO TP_1000cd/m²_MCU 接口-8 bit>



TFT-H043A28WQINV8C22_V0-1 <Have CTP_800cd/m²_MCU 接口-8 bit>



三、引脚说明 Pin Description

3.1 模组引脚说明 TFT Pin Description

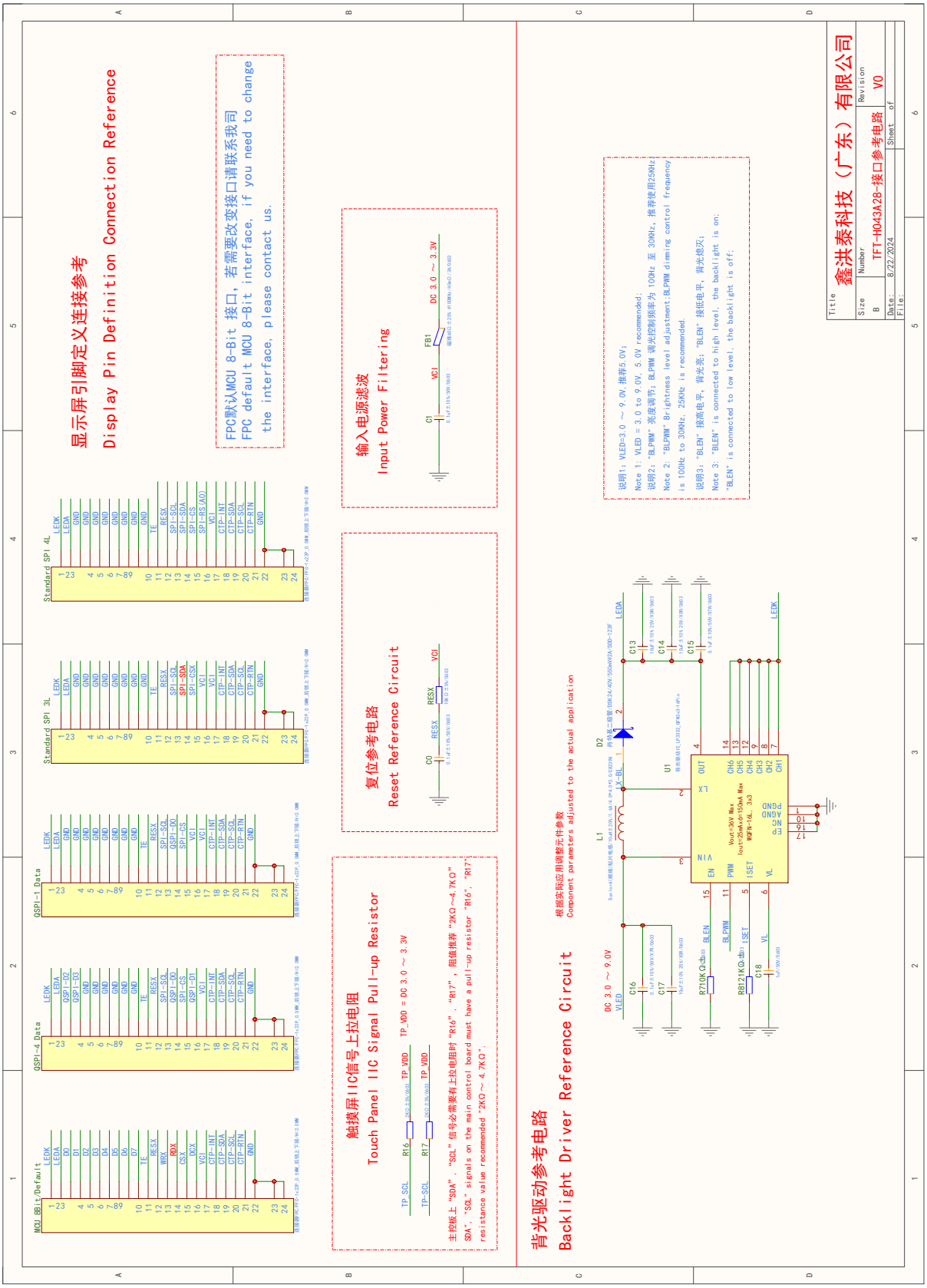
引脚编号 Pin NO.	标号 Symbol	详细描述 Description
1	LEDK	LED阴极 LED cathode
2	LEDA	LED阳极 LED anode
3～10	DB[0～7]	数据总线 Data bus
11	TE	撕裂效应输出引脚用于同步 MCU 帧写入，由 S/W 命令激活。当该引脚未激活时（TE 功能关闭），该引脚为接地电平。 Tearing effect output pin is used to synchronize MCU frame writing, activated by S/W command. When this pin is not activated (TE function OFF), this pin is GND level.
12	RESX	全局复位。低电平有效，内部拉高。 Global reset. Active low, Internal pull high.
13	WRX	MCU 并行接口中的写入使能；MCU 串行接口中的串行时钟。 Write enable in MCU parallel interface;serial clock in MCU serial interface.
14	RDX	MCU 并行接口读使能输入；串行通信数据输入和输出。 MCU parallel interface read enable input;Serial communication data input and output.
15	CSX	芯片选择，内部高电平上拉。信号为低电平有效。 Chip select,internal pull high.Signal is active low.
16	DCX	显示数据/命令选择引脚。 Display data/command selection pin. DCX=’H’ :display data or parameter; DCX=’L’ :command data.
17	VCI	电源 Power supply
- 下一页 - - Next Page -		

引脚编号 Pin NO.	标号 Symbol	详细描述 Description
18	TP-INT	中断信号 Interrupt signal
19	TP-SDA	I2C 数据信号 I2C data signal
20	TP-SCL	I2C 时钟信号 I2C clock signal
21	TP-RTN	系统复位脚 Reset pin
22	GND	电源地 Power supply ground
- 结束 - - END -		

3.2 电容触摸引脚说明 CTP Pin Description

引脚编号 Pin NO.	标号 Symbol	详细描述 Description
1	-	未定义 Undefined
2	-	未定义 Undefined
3	-	未定义 Undefined
4	-	未定义 Undefined
5	-	未定义 Undefined
6	-	未定义 Undefined
- 结束 - - END -		

3.3 接口参考电路图 Interface Reference Circuit Diagram



四、电气特性 Electrical Characteristics

4-1 TFT面板工作条件 TFT Panel 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	VCI	-	3.0	-	3.3	伏特 V
接口工作电压 IO Supply Voltage	IOVCC	-	-	-	-	伏特 V
待机电流 Standby Current	Isc	No Load@ FR=60Hz	-	-	-	微安 uA
工作电流 Operation Current	Ioc		-	-	-	毫安 mA
TFT 工作温度 TFT Operating Temp	TOPR	-	-30	25	+80	摄氏度 ℃
TFT 储存温度 TFT Storage Temp	TSTG	-	-30	-	+85	摄氏度 ℃

4-2 电容触摸屏工作条件 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
表面硬度 Surface hardness	-	铅笔	-	6H	-	硬度
透光率 Transmittance	-	-	80	-	-	百分比
数字电源 Digital Power	VDD	-	3.0	3.30	3.60	伏特 V
I/O 电源 I/O Power	IOVDD	-	3.0	3.30	3.60	伏特 V
工作温度 Operation Temperature	-	20%-90%RH;	-20	-	+70	摄氏度 ℃
储存温度 Storage Temperature	-		-30	-	+80	摄氏度 ℃

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

Backlighting 1:

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	VF	恒流 constant current	12.0	12.8	13.6	伏特 V
工作电流 Forward current	IF		-	80	-	毫安 mA
亮度（带LCD） Luminance(With LCD)	Lv	不带触摸 Without TP	-	1000	-	坎德拉/平方米 cd/m²
		带触摸 With TP	-	800	-	
LED寿命 LED life time	Hr	Ta=25±3 ℃	20,000	30,000	-	小时 Hour

Backlighting 2:

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	VF	恒流 constant current	-	-	-	伏特 V
工作电流 Forward current	IF		-	-	-	毫安 mA
亮度（带LCD） Luminance(With LCD)	Lv	不带触摸 Without TP	-	-	-	坎德拉/平方米 cd/m²
		带触摸 With TP	-	-	-	
LED寿命 LED life time	Hr	Ta=25±3 ℃	20,000	30,000	-	小时 Hour

注释 Note:

1. LED 寿命 (Hr) 定义为在 Ta=25±3 ℃,上表所示的典型电压电流值条件下持续工作直至亮度低于 50% 的时间。

LED life time (Hr) can be defined as the time in which it continues to operate under the condition:Ta=25±3 ℃, typical IL value indicated in the above table until the brightness becomes less than 50%.

2. 以上结果是按 MTBF 計算方式预估判定的 LED 失效时间，实际测试 LED 在 Ta=25±3 ℃点亮 5000H，亮度衰减 8%.

The above results are estimated and judged by the MTBF calculation method of the LED failure time. The actual test LED is lit for 5000H at Ta=25±3 ℃, and the brightness decays by 8%.

五、液晶光学规格 TFT OPTICAL SPECIFICATION

5.1 概述 Overview

光学规格的测试应在暗室（环境亮度 1lux，温度=25 2℃）中使用亮度计系统（测角仪系统和TOPCON BM-5)设备进行测量,测试单元应位于大约 在 θ 和 Φ 等于 0 的视角下,距 LCD 表面 50cm 的距离。 显示面上测量点的中心应保持固定。 测量前背光应工作 30 分钟。

The test of Optical specifications shall be measured in a dark room (ambient luminance 1lux and temperature = 25 2℃) 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	Θ左/L	CR>10	80	85	-	Deg.	Note 1
		Θ右/R		80	85	-	Deg.	
	垂直 Vertical	Θ上/U		80	85	-	Deg.	
		Θ下/D		80	85	-	Deg.	
对比度 Contrast ratio		CR	Θ = 0°	800	1000	-	-	Note2
色域 Color Gamut		CG	CIE1931	40	50	-	%	
白色色度 White Chromaticity		Wx	Θ = 0°	-0.03	0.305	+0.03	-	Note4 (Based on C Light)
		Wy			0.336		-	
色彩还原 Reproduction of color	红 Red	Rx			0.603		-	
		Ry			0.307		-	
	绿 Green	Gx			0.314		-	
		Gy			0.557		-	
	蓝 Blue	Bx			0.145		-	
		By			0.153		-	
响应时间（上升 + 下降） Response Time (Rising + Falling)		Tr＋Tf	Θ = 0° Ta= 25℃	-	30	40	ms	Note5

注释 Note:

1. 视角是对比度大于10的角度。视角确定为相对于光轴的水平或3、9点钟方向和垂直或6、12点钟方向 垂直于 LCD 表面（见图 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. 对比度测量应在 θ= 0 的视角和 LCD 表面的中心进行。 亮度测量时，视场中的所有像素首先设置为白色，然后设置为暗（黑色）状态。（参见图 1）亮度对比度（CR）是通过数学定义的。

Contrast measurements shall be made at viewing angle of Θ= 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. 透射率是没有 APF 和没有 CG 的值。

Transmittance is the Value without APF and without CG.

4. 上表中规定的色度坐标应由所有像素首先测量的光谱数据计算为红色、绿色、蓝色和白色。 测量应在面板的中心进行。

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. 电光响应时间测量应如图 2 所示，通过打开和关闭“数据”输入信号来进行。 亮度从10%变化到90%所需的时间是Tr，90%到10%是Tf。

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 Tr, and 90% to 10% is Tf.

Figure1 Measurement Set Up

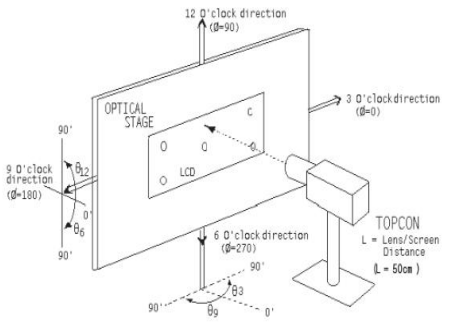


图 1

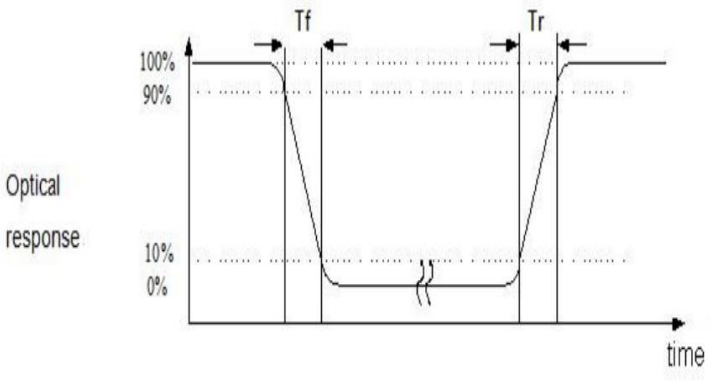
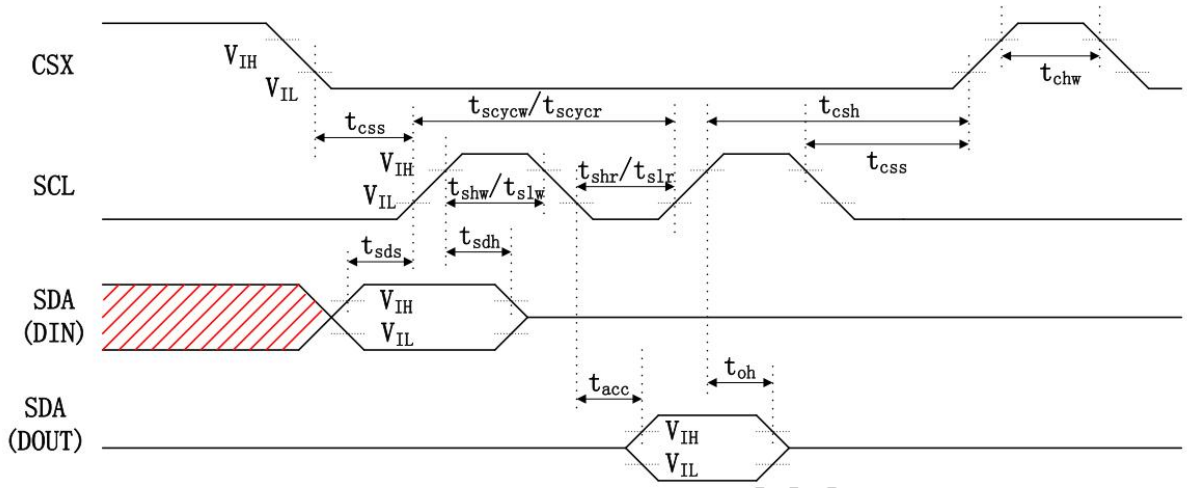


图 2

六、交流特性 AC characteristic

6.1. 串行显示接口（SPI/Dual-SPI/Quad-SPI）

Display Serial Interface (SPI/Dual-SPI/Quad-SPI)



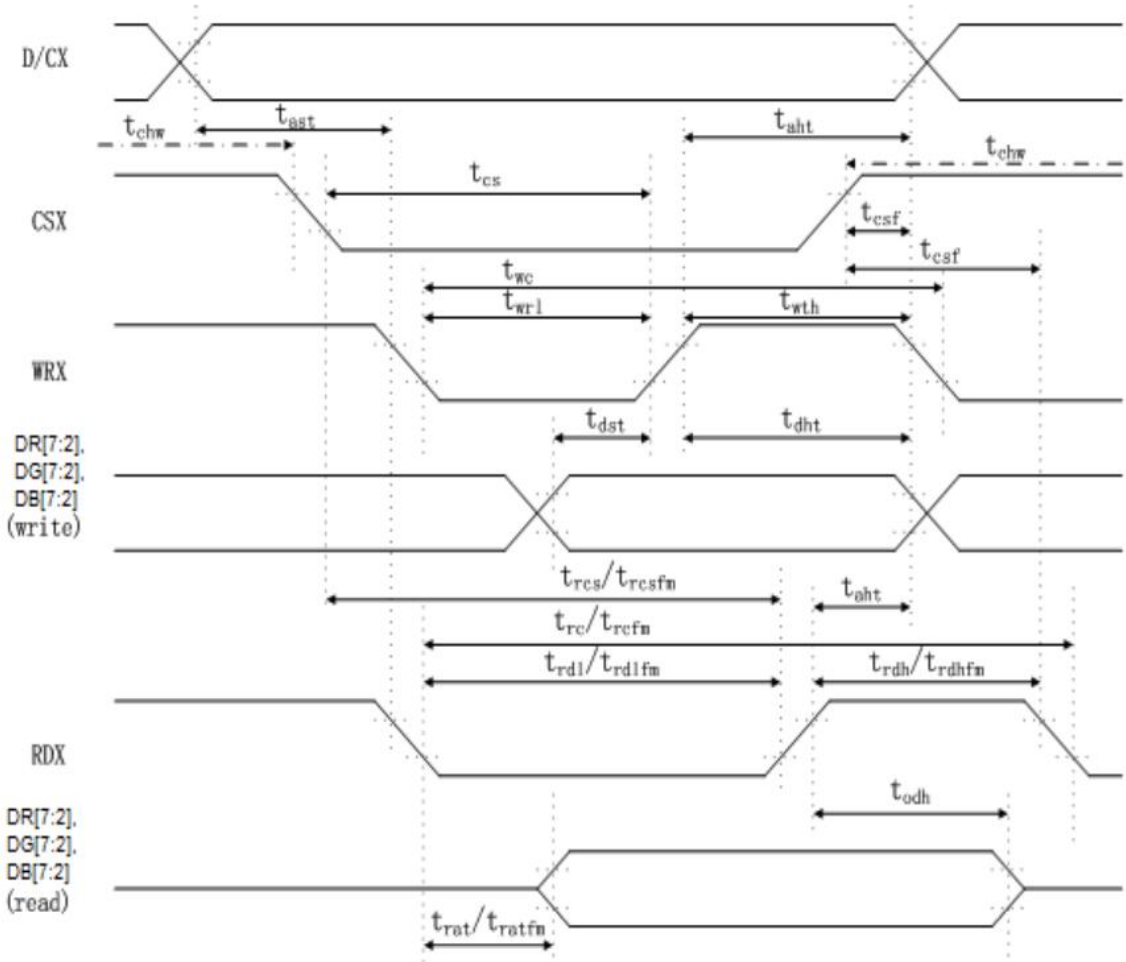
Serial Interface Characteristics

Signal	Symbol	Parameter	MIN	MAX	UNIT	Description
CSX	T_{CSS}	Chip Select Setup Time	10		ns	
	T_{CSH}	Chip Select Hold Time	30		ns	
	T_{CHW}	Chip Select "H" Pulse Width	30		ns	
SCL	T_{SCYCW}	Serial Clock Cycle(Write)	12.5		ns	QSPI 4 lane format (5-6-5): T_{SCYCW} >25ns (see "6.4.12.") QSPI 4 lane format (6-6-6): T_{SCYCW} >16ns(see "6.4.13") Other Format T_{SCYCW} >12.5ns
	T_{SHW}	S"L" "H" Pulse Width(Write)	T_{SCYCW} /2		ns	
	T_{SLW}	S"L" "L" Pulse Width(Write)	T_{SCYCW} /2		ns	
	T_{SCYCR}	Serial Clock Cycle(Read)	150		ns	
	T_{SHR}	S"L" "H" Pulse Width(Read)	T_{SCYCR} /2		ns	
	T_{SLR}	S"L" "L" Pulse Width(Read)	T_{SCYCR} /2		ns	
SDA(DIN) /(DOUT)	T_{SDS}	Data Setup Time	5		ns	
	T_{SDH}	Data Hold Time	5		ns	
	T_{ACC}	Access Time	5	50	ns	CLmax=30pF CLmin=8pF
	T_{OH}	Output Disable Time	10		ns	

4 wire Serial Interface Characteristics

Signal	Symbol	Parameter	MIN	MAX	UNIT	Description
CSX	T_{CSS}	Chip Select Setup Time	10		ns	
	T_{CSH}	Chip Select Hold Time	30		ns	
	T_{CHW}	Chip Select "H" Pulse Width	30		ns	
SCL	T_{SCYCW}	Serial Clock Cycle(Write)	12.5		ns	
	T_{SHW}	S "L" "H" Pulse Width(Write)	T_{SCYCW} /2		ns	
	T_{SLW}	S "L" "L" Pulse Width(Write)	T_{SCYCW} /2		ns	
	T_{SCYCR}	Serial Clock Cycle(Read)	150		ns	
	T_{SHR}	S "L" "H" "Pulse Width(Read)	T_{SCYCR} /2		ns	
	T_{SLR}	S"L" "L" Pulse Width(Read)	T_{SCYCR} /2		ns	
D/CX	T_{DCS}	D/CX Setup Time	5		ns	
	T_{DCH}	D/CX Hold Time	5		ns	
SDA(DIN) (DOUT)	T_{SDS}	Data Setup Time	5		ns	
	T_{SDH}	Data Hold Time	5		ns	
	T_{ACC}	Access Time	5	50	ns	CLmax=30pF CLmin=8pF
	T_{OH}	Output Disable Time	10		ns	

6.2. 并行 MCU 接口 Parallel MCU Interface

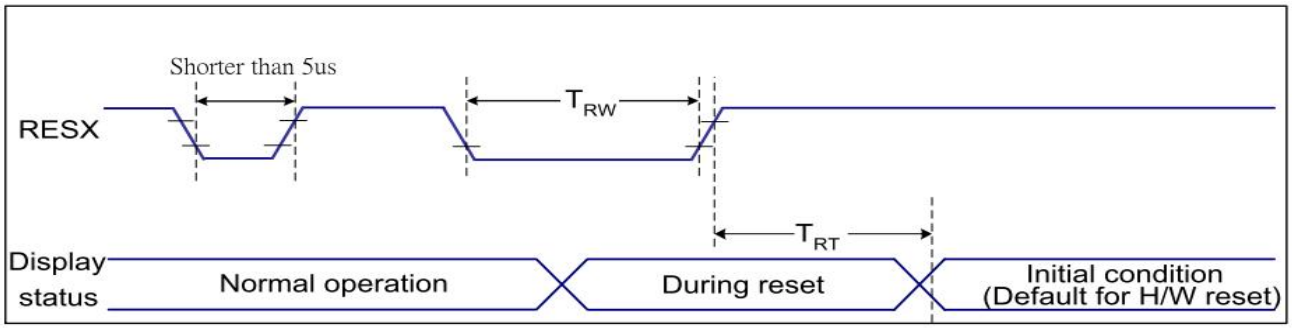


Note: Logic high and low levels are specified as 30% and 70% of IOVCC for Input signals.

Signal	Symbol	Parameter	MIN	MAX	UNIT	Description
D/CX	T_{AST}	Address Setup Time	0		ns	
	T_{AHT}	Address Hold Time (W/R)	10		ns	
CSX	T_{CHW}	"S" "H" Pulse Width	25		ns	
	T_{CS}	Chip Select Setup Time(W)	10		ns	
	T_{RCS}	Chip Select Setup Time (Read ID)	45		ns	
	T_{RCSFM}	Chip Select Setup Time (Read FM)	355		ns	
	T_{CSF}	Chip Select Wait Time (W/R)	10		ns	

Signal	Symbol	Parameter	MIN	MAX	UNIT	Description
WRX	T_{WC}	Write Cycle	50		ns	MCU 16 Bit Format (5-6-5): Twc>100ns (see "6.4.8.") MCU 16 Bit Format (6-6-6): Twc>66ns (see "6.4.9." Figure 6.4.9.4) Other Format Twc>50ns
	T_{WRH}	Control Pulse H Duration	T_{WC} /2		ns	
	T_{WRL}	Control Pulse L Duration	T_{WC} /2		ns	
RDX	T_{RC}	Read Cycle(ID)	160		ns	When Read ID
	T_{RDH}	Control Pulse H Duration(ID)	T_{RC} /2		ns	
	T_{RDL}	Control Pulse L Duration(ID)	T_{RC} /2		ns	
RDX	T_{RCFM}	Read Cycle(FM)	450		ns	When Read From Frame Memory
	T_{RDHFM}	Control Pulse H Duration(FM)	T_{RCFM} /2		ns	
	T_{RDLFM}	Control Pulse L Duration(FM)	T_{RCFM} /2		ns	
DR[7:2], DG[7:2], DB[7:2]	T_{DST}	Data Setup Time	10		ns	CLmax=30pF Clmin=8pF
	T_{DHT}	Data Hold Time	10		ns	
	T_{RAT}	Read Access Time(ID)		40	ns	
	T_{RATFM}	Read Access Time(FM)		340	ns	
	T_{ODH}	Output Disable Time	20	80	ns	

6.3. 复位时序 Reset Timing



VDDI=1.8,VDD=2.8, AGND=DGND=0V, Ta=25 ℃

Related Pins	Symbol	Parameter	MIN	MAX	Unit
RESX	TRW	Reset pulse duration	10	-	us
	TRT	Reset cancel	-	5 (Note 1, 5)	ms
				120(Note 1, 6, 7)	ms

注释 Notes:

1. 复位取消还包括将 ID 字节、VCOM 设置和其他设置从 NVM（或类似设备）加载到寄存器所需的时间。 每次在 RESX 上升沿后 5 ms 内有硬件复位取消时间（tRT）时，都会执行此加载。

The reset cancel includes also required time for loading ID bytes, VCOM setting and other settings from NVM (or similar device) to registers. This loading is done every time when there is HW reset cancel time (tRT) within 5 ms after a rising edge of RESX.

2. 根据下表，由于 RESX 线路上的静电放电引起的尖峰不会导致不规则的系统复位

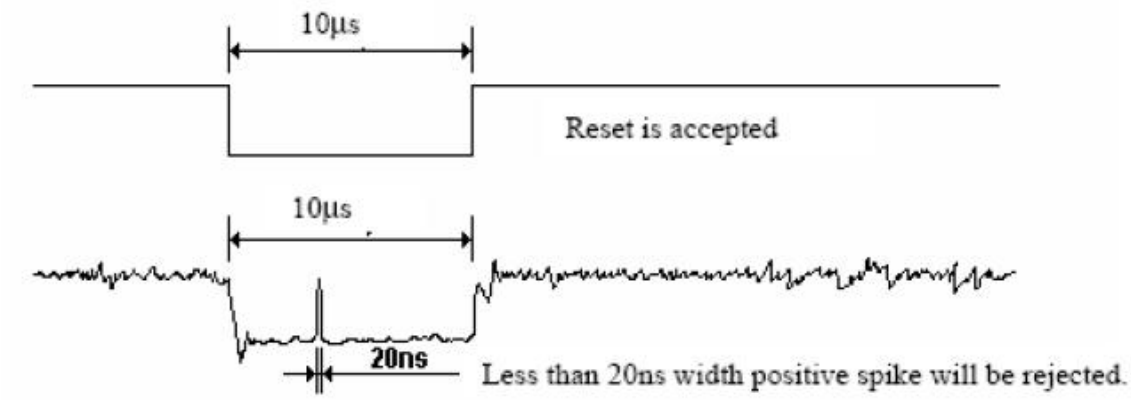
Spike due to an electrostatic discharge on RESX line does not cause irregular system reset according to the table below:

RESX Pulse	Action
Shorter than 5us	Reset Rejected
Longer than 9us	Reset
Between 5us and 9us	Reset starts

3. 在复位期间，显示屏将被消隐（显示屏进入消隐序列，最长持续时间为 120 毫秒，此时 Reset Starts in Sleep Out －mode。显示屏在 Sleep In －mode 中保持消隐状态。）然后返回 硬件复位的默认条件。

4. During the Resetting period, the display will be blanked (The display is entering blanking sequence, which maximum time is 120 ms, when Reset Starts in Sleep Out －mode. The display remains the blank state in Sleep In －mode.) and then return to Default condition for Hardware Reset.

4. 尖峰抑制也适用于有效复位脉冲期间，如下所示：
   Spike Rejection also applies during a valid reset pulse as shown below:



5. 在进入睡眠期间应用复位时
   When Reset applied during Sleep In Mode.
6. 在退出睡眠期间应用复位时
   When Reset applied during Sleep Out Mode.
7. 释放 RESX 后需要等待 5 毫秒以上才能发送命令。也不能在 120 毫秒内发送睡眠退出命令。
   It is necessary to wait 5msec after releasing RESX before sending commands. Also Sleep Out command cannot be sent for 120msec.

6.4. 开机上电顺序 Power-on sequence

IOVCC 和 VCI 可以按任何顺序应用或断电。 在关机序列期间，如果 LCD 处于休眠模式，则 VCI 和 IOVCC 必须在至少 120 毫秒内断电。 如果 LCD 处于休眠模式，VCI 和 IOVCC 可以在 RESX 释放后至少 0 毫秒内断电。 CSX 可以在任何时间应用，也可以永久接地。 RESX 的优先级高于 CSX。

IOVCC and VCI can be applied or powered down in any order. During the Power Off sequence, if the LCD is in the Sleep Out mode, VCI and IOVCC must be powered down with minimum 120msec. If the LCD is in the Sleep In mode, VCI and IOVCC can be powered down with minimum 0msec after the RESX is released. CSX can be applied at any timing or can be permanently grounded. RESX has high priority over CSX.

备注 Notes:

1. 如果不满足电源顺序，TFT 不会损坏。

   TFT will not be damaged if the power sequence is not met.

2. 在电源开/关序列期间，显示面板上不会有异常的可见效果。

   There will be no abnormal visible effects on the display panel during the Power On/Off Sequences.

3. 在 Power On Sequence 结束和收到 Sleep Out 命令之前，以及在收到 Sleep In 命令和 Power Off Sequence 之间，显示屏上不会出现异常可见的效果。

   There will be no abnormal visible effects on the display between the end of Power On Sequence and before receiving the Sleep Out command, and also between receiving the Sleep In command and the Power Off Sequence.

4. 如果在第 6.4.1 节中定义的开机序列期间主机没有稳定地保持 RESX 线，则有必要在主机开机序列完成后应用硬件复位（RESX）以确保 正确的操作。 否则，无法保证所有功能。

   If the RESX line is not steadily held by the host during the Power On Sequence as defined in Sections 6.4.1, then it will be necessary to apply the Hardware Reset (RESX) after the completion of the Host Power On Sequence to ensure correct operations. Otherwise, all the functions are not guaranteed.

6.4.1. 不受控制的断电 Uncontrolled Power Off

非受控断电是指在没有受控断电序列的情况下取出电池的情况。 它不会损坏模块或主机接口。

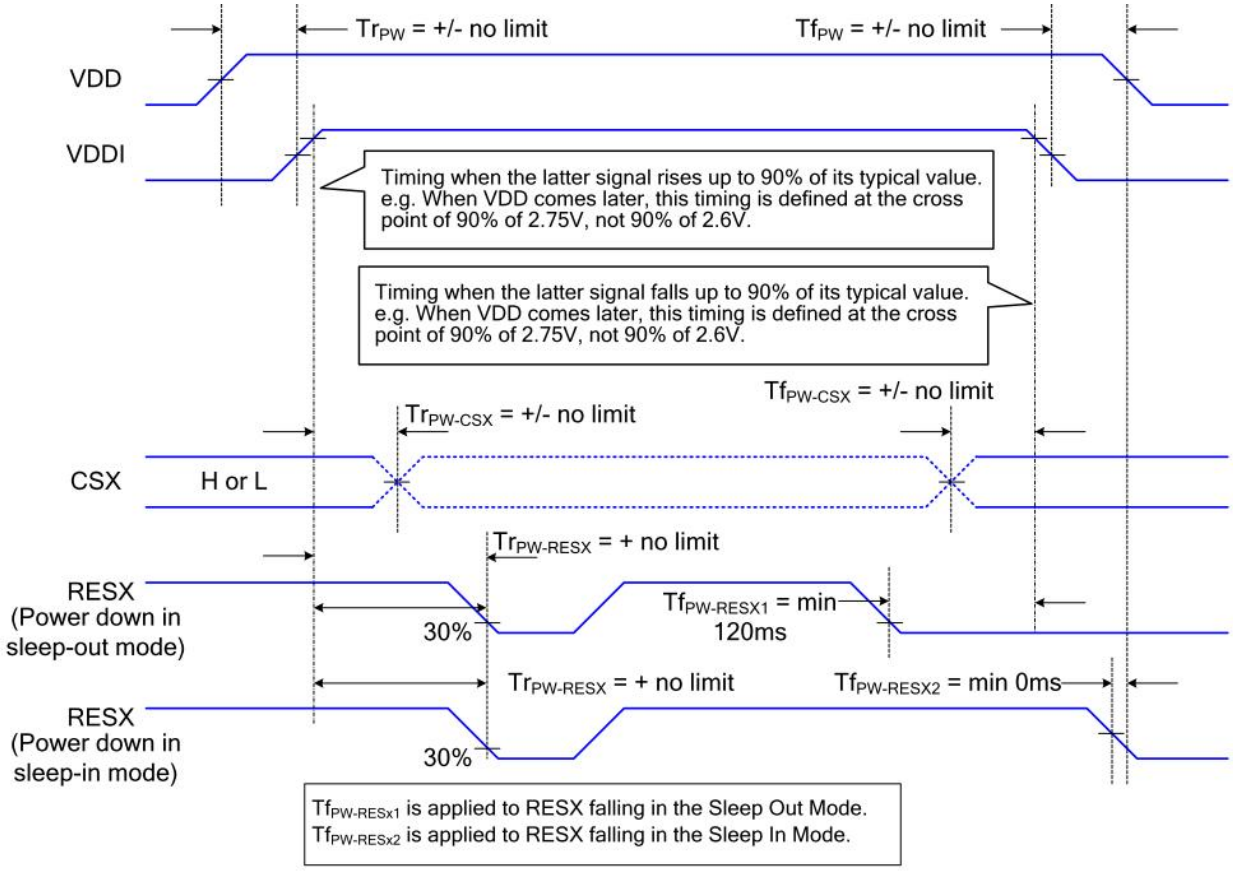
The uncontrolled power-off means a situation which removed a battery without the controlled power off sequence. It will neither damage the module or the host interface.

如果发生不受控制的断电，显示屏将变为空白，显示屏上不会有任何可见效果（空白显示）并保持空白，直到“Power On Sequence”启动它。

If uncontrolled power-off happened, the display will go blank and there will not any visible effect on the display (blank display) and remains blank until “Power On Sequence” powers it up.

电源开/关顺序如下图所示

The power on/off sequence is illustrated below



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=+85 ℃, 120hrs	
低温储存 Low Temperature Storage	Ta=-30 ℃, 120hrs	
高温运行试验 High Temperature Operation	Ta=+80 ℃, 120hrs	
低温运行试验 Low Temperature Operation	Ta=-30 ℃, 120hrs	
高温高湿（运行测试） High Temperature and High Humidity (Operating)	Ta=+60 ℃, 90%RH, 120hrs	

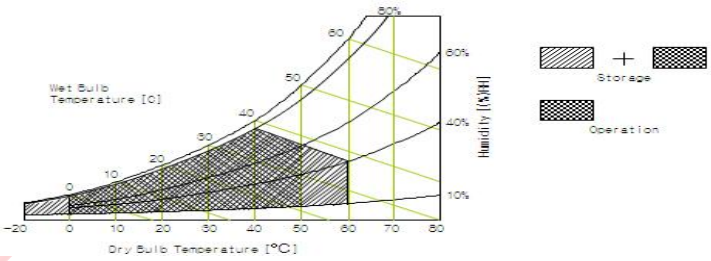
注释 Note:

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 ℃ 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, abormal display etc).

4. 所有显示判断均在面板温度恢复到室温2小时后进行

All display judgments are made after the panel temperature returns to room temperature for 2 hours

5. Ta：环境温度

Ta：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)	● Shock level:980m/s^2 ● Waveform:1/2 Sine wave,6msec ● ±X, ±Y ±Z,each axis 1 times
包装振动(非操作) Packing Vibration (Non-Operation)	● 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,330Ω, Contact±4KV,Air :±8KV.Note 1
	200pF,0Ω, ±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

♦由于液晶模组是玻璃材质，请勿对其施加强烈的机械冲击或静载荷。请小心搬运，因为冲击、振动和粗心的搬运可能会严重影响产品。如果从高处坠落或受到强烈冲击 ，玻璃可能碎了。

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.

♦在规定的电压限制内驱动 LCM 是必不可少的，因为高于限制的电压会导致 LCM 的寿命缩短。 由直流引起的电化学反应会导致 LCM 出现不良劣化，因此应避免使用直流驱动。

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.

♦请勿在电源开启时将 LCM 连接到系统或从系统断开连接。

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

♦切勿在高温高湿的异常条件下使用 LCM。

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

♦当暴露于剧烈的温度波动（热到冷或冷到热）时，LCM可能会受到影响； 具体来说，从冷到热的剧烈温度波动会在 LCM 表面产生露水，这可能会影响 LCM 上偏振片的运行。

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.

♦在低于工作温度范围的温度下，响应时间将极度延迟，另一方面，在高于其工作范围的温度下，LCM 可能会变黑。 然而，这些现象并不意味着 LCM 出现故障或故障。 一旦温度恢复到正常运行的推荐温度范围，LCM 将恢复正常运行。

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.

♦为防止LCD产生图像残留，在使用常黑面板时不要长时间显示固定图案。 如果LCD需要显示固定图案，建议时间少于 2 分钟或者更短的时间内刷新显示内容一次或多次。强烈建议使用黑色图像或移动图像作为屏幕保护程序。

In order to prevent the LCD from producing image retention, do not display a fixed pattern for a long time when using a normally black panel. If the LCD needs to display a fixed pattern, it is recommended to refresh the display one or more times in less

than 2 minutes or less. It is strongly recommended to use a black image or moving image as a screen saver.

♦强烈的光照会导致 LCD 偏光片和彩色滤光片退化。 不准在强光或高温高湿下长期存放或直接运行。

Strong sunlight can cause LCD polarizers and color filters to degrade. Long-term storage or direct operation under strong light or high temperature and humidity is not allowed.

8-2 防静电措施 Caution Against Static Charge

♦LCM 使用 C-MOS LSI 驱动器，因此建议客户将任何未使用的输入端连接到 Vdd 或 Vss，上电前不要输入任何信号，并将您的身体、工作/装配区、装配设备接地 防止静电。

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.

♦缓慢去除保护膜，保持去除方向与面板表面不垂直约 30 度，如有可能，在离子风机等 ESD 控制装置下，工作室内湿度应保持在 50%RH 以上，以减少静电风险

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.

♦避免使用合成纤维制成的工作服。 我们推荐棉质衣服或其他经过导电处理的纤维。

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

♦在处理 LCM 时，请戴上不带电材料的手套。 对地导电手腕和对地导电鞋是必需的

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 Initialization code

```
Void Panel_Initial_code(void)
{
//================上电复位操作===============//
LCD_RESET=1;
Delayms(1);          //Delay 1ms
LCD_RESET=0;
Delayms(10);          //Delay 10ms
LCD_RESET=1;
Delayms(120);         //Delay 120ms
//=============================================//
//SPI, MCU 接口初始化代码共用       SPI, MCU interface initialisation code share
//---------Start Initial Code ------//
SPI_WriteComm(0xff);
WriteData(0xa5);
WriteComm(0xE7);//TE_output_en
WriteData(0x10);
WriteComm(0x35);//TE_ interface_en
WriteData(0x01);
WriteComm(0x3A);
WriteData(0x01);//00---666//01--565
WriteComm(0x40);
WriteData(0x01);
WriteComm(0x41);
WriteData(0x01);//01--8bit//03--16bit
WriteComm(0x55);
WriteData(0x01);
WriteComm(0x44);
WriteData(0x15);
WriteComm(0x45);
WriteData(0x15);
WriteComm(0x7d);
WriteData(0x03);
WriteComm(0xc1);
WriteData(0xab);
WriteComm(0xc2);
WriteData(0x17);
WriteComm(0xc3);
WriteData(0x10);
```

```
WriteComm(0xc6);
WriteData(0x3a);
WriteComm(0xc7);
WriteData(0x25);
WriteComm(0xc8);
WriteData(0x11);
WriteComm(0x7a);
WriteData(0x49);
WriteComm(0x6f);
WriteData(0x2f);
WriteComm(0x78);
WriteData(0x4b);
WriteComm(0x73);
WriteData(0x08);
WriteComm(0x74);
WriteData(0x12);
WriteComm(0xc9);
WriteData(0x00);
WriteComm(0x67);
WriteData(0x11);

WriteComm(0x51);
WriteData(0x20);
WriteComm(0x52);
WriteData(0x7c);
WriteComm(0x53);
WriteData(0x1c);
WriteComm(0x54);
WriteData(0x77);

WriteComm(0x46);
WriteData(0x0a);
WriteComm(0x47);
WriteData(0x2a);
WriteComm(0x48);
WriteData(0x0a);
WriteComm(0x49);
WriteData(0x1a);

WriteComm(0x56);
```

```
WriteData(0x43);
WriteComm(0x57);
WriteData(0x42);
WriteComm(0x58);
WriteData(0x3c);
WriteComm(0x59);
WriteData(0x64);
WriteComm(0x5a);
WriteData(0x41);
WriteComm(0x5b);
WriteData(0x3c);
WriteComm(0x5c);
WriteData(0x02);
WriteComm(0x5d);
WriteData(0x3c);
WriteComm(0x5e);
WriteData(0x1f);
WriteComm(0x60);
WriteData(0x80);
WriteComm(0x61);
WriteData(0x3f);
WriteComm(0x62);
WriteData(0x21);
WriteComm(0x63);
WriteData(0x07);
WriteComm(0x64);
WriteData(0xe0);
WriteComm(0x65);
WriteData(0x01);
WriteComm(0xca);
WriteData(0x20);
WriteComm(0xcb);]
WriteData(0x52);
WriteComm(0xcc);]
WriteData(0x10);
WriteComm(0xcD);
WriteData(0x42);

WriteComm(0xD0);
WriteData(0x20);
```

```
WriteComm(0xD1);
WriteData(0x52);
WriteComm(0xD2);
WriteData(0x10);
WriteComm(0xD3);
WriteData(0x42);
WriteComm(0xD4);
WriteData(0x0a);
WriteComm(0xD5);
WriteData(0x32);
WriteComm(0xe5);
WriteData(0x06);
WriteComm(0xe6);
WriteData(0x00);
WriteComm(0x6e);
WriteData(0x14);
//gammma 01
WriteComm(0x80);
WriteData(0x04);
WriteComm(0xA0);
WriteData(0x00);
WriteComm(0x81);
WriteData(0x07);
WriteComm(0xA1);
WriteData(0x05);
WriteComm(0x82);
WriteData(0x06);
WriteComm(0xA2);
WriteData(0x04);
WriteComm(0x83);
WriteData(0x39);
WriteComm(0xA3);
WriteData(0x39);
WriteComm(0x84);
WriteData(0x3a);
WriteComm(0xA4);
WriteData(0x3a);
WriteComm(0x85);
WriteData(0x3f);
WriteComm(0xA5);
```

```
WriteData(0x3f);
WriteComm(0x86);
WriteData(0x2c);
WriteComm(0xA6);
WriteData(0x2a);
WriteComm(0x87);
WriteData(0x43);
WriteComm(0xA7);
WriteData(0x47);
WriteComm(0x88);
WriteData(0x08);
WriteComm(0xA8);
WriteData(0x08);
WriteComm(0x89);
WriteData(0x0f);
WriteComm(0xA9);
WriteData(0x0f);
WriteComm(0x8a);
WriteData(0x17);
WriteComm(0xAa);
WriteData(0x17);
WriteComm(0x8b);
WriteData(0x10);
WriteComm(0xAb);
WriteData(0x10);
WriteComm(0x8c);
WriteData(0x16);
WriteComm(0xAc);
WriteData(0x16);
WriteComm(0x8d);
WriteData(0x14);
WriteComm(0xAd);
WriteData(0x14);
WriteComm(0x8e);
WriteData(0x11);
WriteComm(0xAe);
WriteData(0x11);
WriteComm(0x8f);
WriteData(0x14);
```

```
WriteComm(0xAf);
WriteData(0x14);

WriteComm(0x90);
WriteData(0x06);
WriteComm(0xB0);
WriteData(0x06);
WriteComm(0x91);
WriteData(0x0f);
WriteComm(0xB1);
WriteData(0x0f);
WriteComm(0x92);
WriteData(0x16);
WriteComm(0xB2);
WriteData(0x16);
WriteComm(0xff);
WriteData(0x00);
WriteComm(0x11);
Delayms (200);
WriteComm(0x29);
Delayms (120);
}


Void Panel_SleepIn_Mode (void)
{
WriteComm(0x28);
Delayms (120);
WriteComm(0x10);
Delayms (120);
}

Void Panel_SleepOut_Mode (void)
{
WriteComm(0x11);
Delayms (120);
WriteComm(0x29);
Delayms (120);
}
```

文档修订记录

Document revision history :

版本 Version	日期 DATE	修改说明 Modify description	编辑 Editorial
0-0	2024-08-22	初次编制 First compilation.	YL
0-1	2026-11-09	纠正已知错误 Correct known errors	R.L

-- 结束 --

-- END --