

 HuaXin Display Technology Co.,Ltd	Module No:	ESHX395SQ0006B-A
	REV: V01	
SPEC TITLE DOCUMENT CONTROL SPECIFICATION	DATE:	2024-07-24

表单编码: ESHX-QR-RD-033A

LCD MODULE SPECIFICATION

PART NO: ESHX395SQ0006B-A

Approved	Checked	Prepared	Date Issued
		Xiao	2024-07-24

Customer Approval	☐ Approved ☐ Reject Comment:
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ESHX395SQ0006B-A

REV: V01

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3. GENERAL DESCRIPTION:

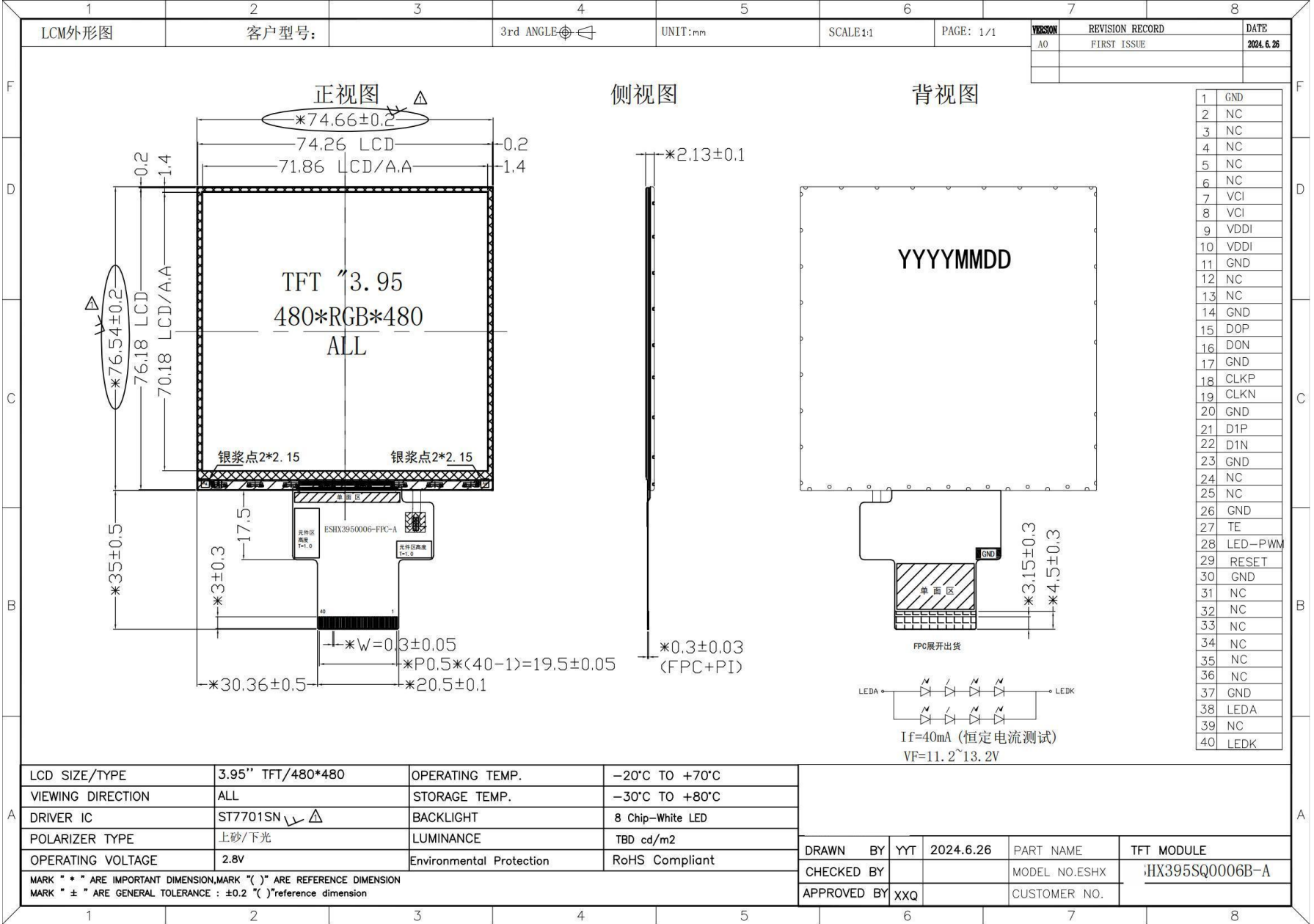
- 3.95”(TFT), 480×RGB×480dots, 16.7M colors, Transmissive, TFT LCD module.
- Viewing Direction: ALL
- Driving IC:ST7701SN
- Interface : MIPI
- Power voltage: 2.8V (typ.)

4 . MECHANICAL SPECIFICATIONS:

Item	Specifications	Unit
Outline Size	74.66x76.54x 2.13	mm
LCD active area	71.86x70.18	mm
Display format	480×RGB×480	dots
Color configuration	RGB stripes	mm
Pixel pitch	0.1462 x 0.1462	mm
Weight	TBD	g
Operation Temp.	-20~+70	℃
Storage Temp.	-30~+80	℃



5. OUTLINE DIMENSIONS





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6.PIN CONNECTIONS

NO.	PIN NAME	Description
1	GND	Ground
2~6	NC	No Connect
7~8	VCI	Supply Voltage 2.8V
9~10	VDDI	Supply Voltage (Logic) 1.8V
11	GND	Ground
12~13	NC	No Connect
14	GND	Ground
15	D0P	MIPI DSI differential data pair
16	D0N	MIPI DSI differential data pair
17	GND	Ground
18	CLKP	MIPI DSI differential clock pair.
19	CLKN	MIPI DSI differential clock pair.
20	GND	Ground
21	D1P	MIPI DSI differential data pair
22	D1N	MIPI DSI differential data pair
23	GND	Ground
24~25	NC	No Connect
26	GND	Ground
27	TE	No Connect
28	LED-PWM	The PWM frequency output for LCD driver control.
29	RESET	This signal will reset the device and it must be applied to properly initialize the chip
30	GND	Ground
31~36	NC	No Connect
37	GND	Ground
38	LEDA	Backlight LED power supply (Anode)
39	NC	No Connect
40	LEDK	Backlight LED power supply (cathode)

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7.MAXIMUM ABSOLUTE LIMIT:

ITEM	SYMBOL	MIN	MAX	UNIT
POWER SUPPLY	VCC	-0.3	4.6	V
POWER SUPPLY FOR Logic	IOVCC	-0.3	4.6	V
Driver Supply Voltage	VGH-VGL	-0.3	+29	V
Logic Input Voltage Range	V _{in}	-0.3	4.6	V
POWER SUPPLY FOR LED	V _{leda} -V _{ledk}	-0.3	13.2	V

Note: Note1: Absolute maximum rating is the limit value beyond which the IC maybe broken.

They do not assure operations.

Note2: Background color changes slightly depending on ambient temperature. This Phenomenon is reversible.

T_a ≤ 70℃: 75%RH max

T_a > 70℃: absolute humidity must be lower than the humidity of 75%RH at 70℃

Note3: T_a at -20℃ will be <48hrs, at 70℃ will be <120hrs

8.ELECTRICAL CHARACTERISTICS

8.1 DC Characteristics (V_{DD}=2.8V,T_a=25℃)

Item	Symbol	Min	Type	Max	Unit	Test condition
Operating voltage	VCC	2.65	2.8	3.3	V	-
Supply current	I _{VCC}	-	-	65	mA	V _{CC} =2.8V,T _a =25℃
Input voltage	V _{IH}	0.8VDDI	-	VDDI	V	-
	V _{IL}	0	-	0.2VDDI	V	

Note: Voltage greater than above may damage the module.

All voltages are specified relative to V_{SS}=0V.

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8.2 Backlight Electrical-optical Characteristics

1. Stander Lamp Styles (Edge Lighting Type):
The LED chips are distributed over the edge light area of the illumination unit, which gives the less power consumption:
2. The Main Advantages of the LED Backlight are as following:
2.1 The brightness of the backlight can simply be adjusted by a resistor or a potentiometer.
3. Data About LED Backlight:

Item	Symbol	MIN	TYP	MAX	UNIT	Test Condition	Note
Supply Voltage	Vf	11.2	12	13.2	V	If=40mA	-
Supply Current	If	-	40	-	mA	-	-
Reverse Voltage	Vr	-	-	5	V	-	-
Power dissipation	Pd	-	480	-	mW	-	-
Luminous Intensity for LCM	-	-	TBD	-	Cd/m ²	If=40 mA	-
Uniformity for LCM	-	80	-	-	%	If=40 mA	-
Backlight Color	White						

NOTE:

1. Uniformity = Min/Max * 100%

2. LED life time defined as follows:

The final brightness is at 70% of original brightness; Measured Method: (X*Y: Light Area);

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9. AC CHARACTERISTICS

9.1 MIPI Interface Characteristics:



DSI clock channel timing

$VDDI=1.8, VDD=2.8, AGND=DGND=0V, Ta=25\text{ }^{\circ}C$

Signal	Symbol	Parameter	MIN	MAX	Unit	Description
DSI-CLK+/-	$2xU_{INSTA}$	Double UI instantaneous	4	25	ns	
DSI-CLK+/-	U_{INSTA} U_{INSTB}	UI instantaneous halves	2	12.5	ns	$UI = U_{INSTA} = U_{INSTB}$
DSI-Dn+/-	t_{DS}	Data to clock setup time	0.15	-	UI	
DSI-Dn+/-	t_{DH}	Data to clock hold time	0.15	-	UI	

Mipi Interface- High Speed Mode Timing Characteristics



9.2 Power On Sequence

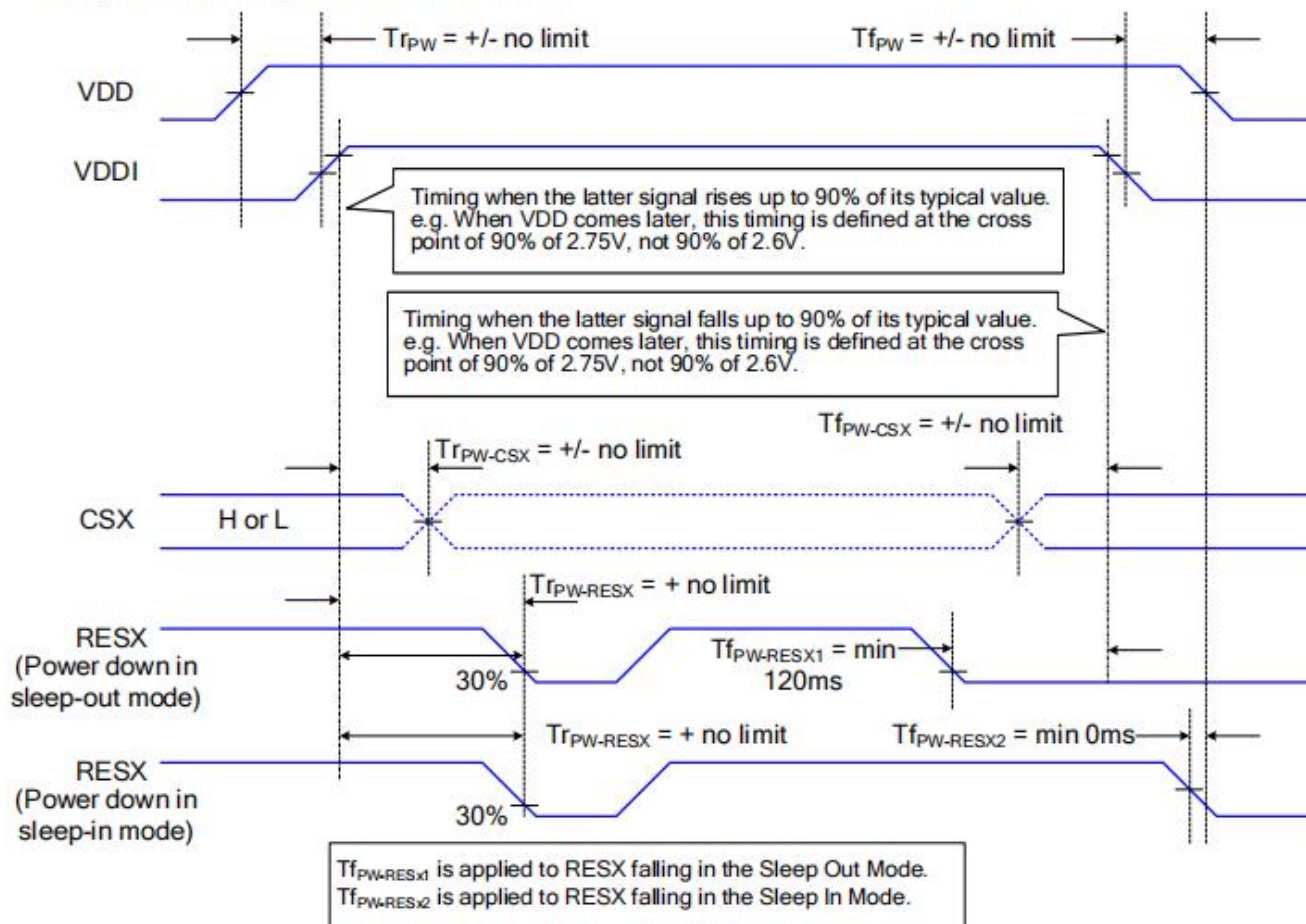
VDDI and VDDA can be applied or powered down in any order. During the Power Off sequence, if the LCD is in the Sleep Out mode, VDDA and VDDI must be powered down with minimum 120msec. If the LCD is in the Sleep In mode, VDDA and VDDI can be powered down with minimum 0msec after the RESX is released.

CSX can be applied at any timing or can be permanently grounded. RESX has high priority over CSX.

Notes:

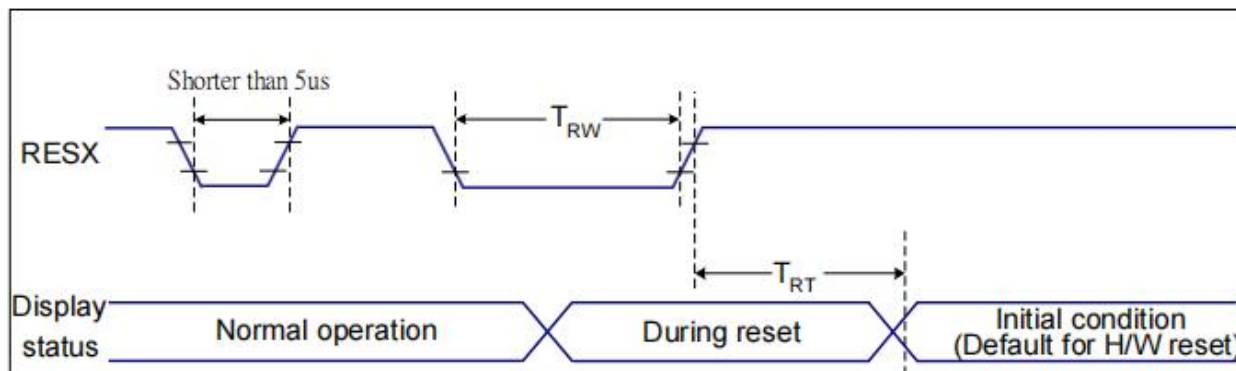
1. There will be no damage to the ST7701S if the power sequences are not met.
2. There will be no abnormal visible effects on the display panel during the Power On/Off Sequences.
3. There will be no abnormal visible effects on the display between the end of Power On Sequence and before receiving the Sleep Out command, and also between receiving the Sleep In command and the Power Off Sequence.
4. If the RESX line is not steadily held by the host during the Power On Sequence as defined in Sections 9.1 and 9.2, 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.

The power on/off sequence is illustrated below





9.3 Reset Timing:



Reset Timing

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

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

Reset Timing

Notes:

1. 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. 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. 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. Spike Rejection also applies during a valid reset pulse as shown below:

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10.OPTICAL CHARACTERISTICS:

Parameter		Symbol	Condition	Min.	Typ.	Max.	Unit
Viewing Angle range	Horizontal	Θ_3	CR > 10	80	85	-	Deg.
		Θ_9		80	85	-	Deg.
	Vertical	Θ_{12}		80	85	-	Deg.
		Θ_6		80	85	-	Deg.
Luminance Contrast ratio		CR	$\Theta = 0^\circ$	1000	1200	-	
Color Gamut	NTSC	CIE1931	$\Theta = 0^\circ$	65	70	-	%
Reproduction of color	White	W _x	$\Theta = 0^\circ$	Typ -0.03	0.302	Typ +0.03	
		W _y			0.337		
Response Time		Tr+Td	Ta= 25° C $\Theta = 0^\circ$	-	30	40	ms
Cross Talk		CT	$\Theta = 0^\circ$	-	-	2.0	%



SPEC TITLE

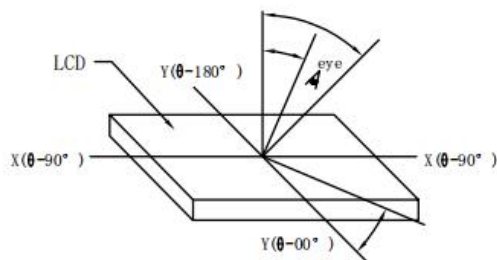
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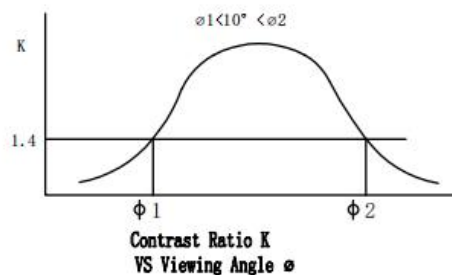
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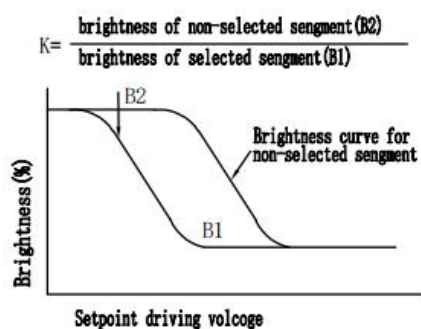
10.1 Definition of angle θ and ϕ



10.2 Definition of viewing angle ϕ_1 and ϕ_2

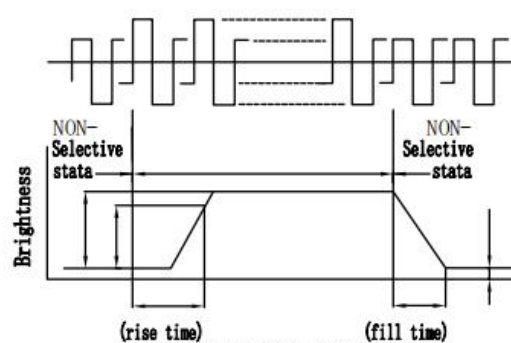


Definition of contrast "K"

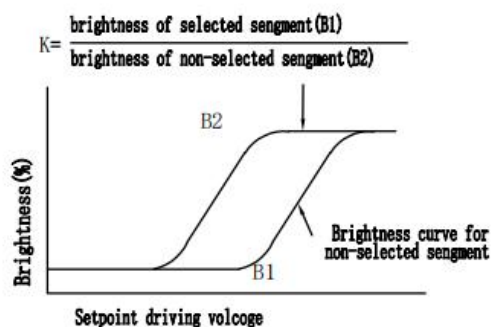


POSITIVE TYPE

Definition of optical response

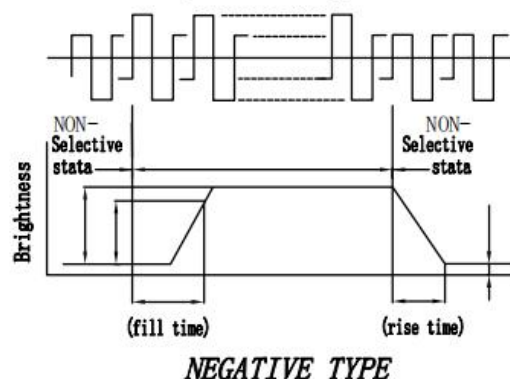


Definition of contrast "K"



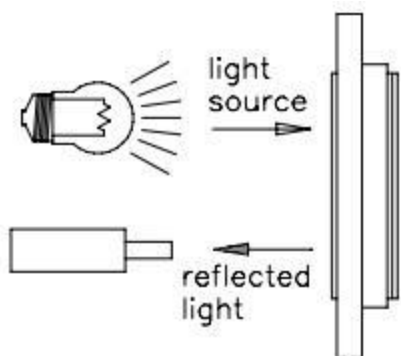
NEGATIVE TYPE

Definition of optical response

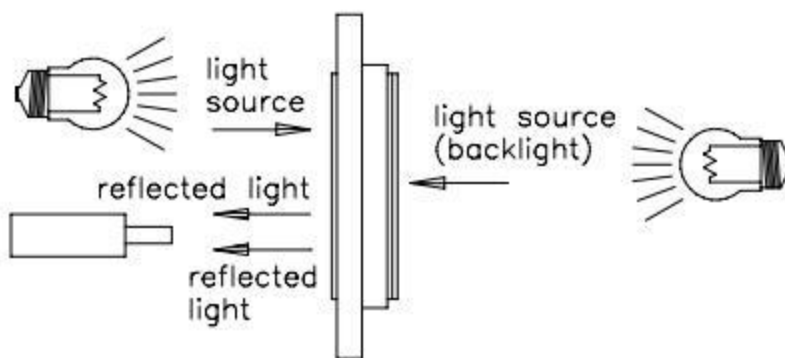




10.3 DESCRIPTION OF MEASURING EQUIPMENT



Reflective type



Transflective type

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11.QUALITY LEVEL

11.1 STANDARD SPECIFICATION FOR RELIABILITY

Item	Condition	Time(hrs)	Assessment
High temp. Storage	80±2°C	96	No abnormalities in functions and appearance
High temp. Operating	70±2°C	96	
Low temp. Storage	-30±2°C	96	
Low temp. Operating	-20±2°C	96	
Humidity	60±2°C/ 90±3%RH	96	
Thermal Shock Temp. Cycle	-20±2°C ← 25±2°C →70±2°C (0.5 hour ← 5 min → 0.5 hour)	10cycles	
ESD Test	Air Discharge: Apply ±4KV with 3 times ,150Pf/330 Ω Contact Discharge: Apply ±2KV with 3 times 150Pf/330 Ω	-	

Functions, performance, appearance, etc. shall be free from remarkable deterioration within 30,000 hours under ordinary operating and storage conditions room temperature (25±10°C), normal humidity (45±20% RH), and in area not exposed to direct sun light. (Life time of backlight, please refer to Data about backlight.)

Testing Conditions and Inspection Criteria:

For the final test the testing sample must be stored at room temperature for 24 hours, after the tests listed in up Table, Standard specifications for Reliability have been executed in order to ensure stability.

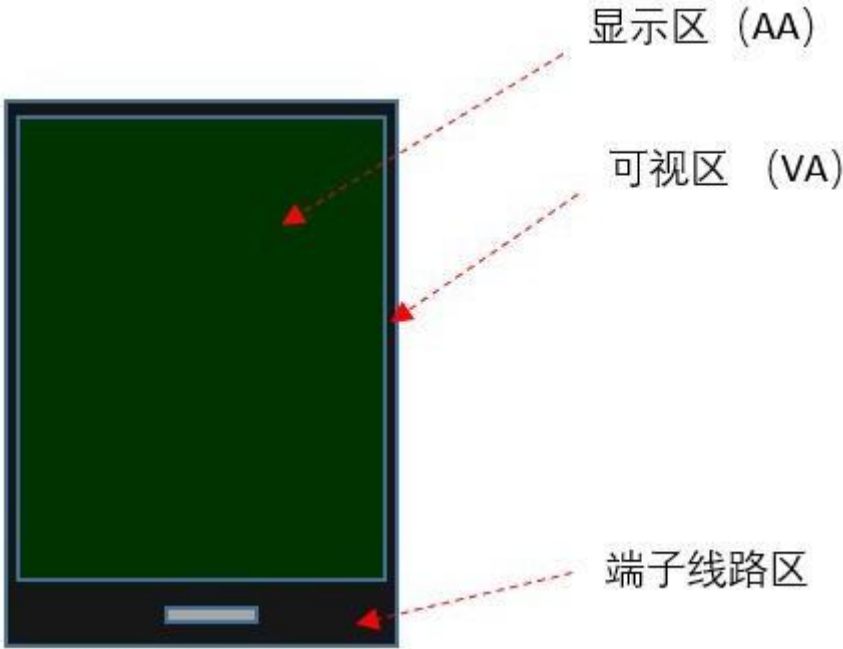
Item	Test Model	In section Criteria
Current Consumption	Refer To Specification	The current consumption should conform to the product specification.
Contrast	Refer To Specification	After the tests have been executed, the contrast must be larger than half of its initial value prior to the tests.
Appearance	Visual inspection	Defect free.

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1.1 TFT-LCM 成品的检验标准,确保我司产品最大限度地满足客户要求。

2.1 液晶显示屏的区域划分



可视区(VA 区): TFT-LCD 装机后可以目视到的区域;

显示区(AA 区): TFT-LCD 显示图形的区域称为显示区。

非可视区: 装机后看不见的区域, 为可视区边缘离玻璃边的距离。

端子线路区: IC Bonding 区域

2.2 缺陷等级划分

2.2.1 主要缺陷: 能引起失效或显著降低产品预期性能的缺陷。

2.2.2 次要缺陷: 不会显著降低产品的预期性能的缺陷, 偏离标准但只轻微影响产品的有效使用或操作的缺陷。

2.3 批的构成

由相同型号、相同设计、相同材料、相同制造工艺在同一周期内生产的一个或几个生产批构成。

3.0 检测条件

3.1 目测: 外观检查在台灯下进行,眼睛能清晰观察到所检查的项目即可。

3.2 电测: 电性检查设备为我司自制的工装,驱动电路(主板)安放在工装内。

3.3 检测距离: 30cm +/-5cm

3.4 视角方向

目视检验方向为视角方向与 TFT-LCD法线夹角0°——45°的范围内 (如图示)

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6. 1. 6	点缺陷	點狀缺陷微小亮點 / 異物亮 / 微弱亮 / 暗点	$\Phi \leq 0.10\text{mm}$	忽略	忽略	忽略	忽略	点亮、目测、菲林片对比	
			$0.10\text{mm} < \Phi \leq 0.15\text{mm}$	2	2	忽略 (ignore)	忽略 (ignore)		
			$0.15\text{mm} < \Phi \leq 0.20\text{mm}$	1	2	2	3		
			$0.20\text{mm} < \Phi \leq 0.25\text{mm}$	0	1	2	2		
			$0.25\text{mm} < \Phi \leq 0.3\text{mm}$	0	0	1	1		
			$0.3\text{mm} < \Phi$	0	0	0	0		
			$0.10 < \Phi \leq 0.30\text{mm}$ 允收总数	2	2	2	3		
		暗亮点总和	暗亮点总和	2	2	2	3		
		连续亮/暗点	亮点相连	0	0	0	0		
		其他点 (other dot)	同异物亮/细碎亮	同异物亮/细碎亮 (Particle/Small bright dot)					
		线状不良	$W \leq 0.02\text{mm}$	忽略	忽略	忽略	忽略		
			$0.02\text{mm} < W \leq 0.05\text{mm}$, 且 $L \leq 5\text{mm}$	1	2	忽略 (ignore)	忽略 (ignore)		
			$0.03\text{mm} < W \leq 0.05\text{mm}$, 且 $L \leq 3\text{mm}$	1	2	4	4		
			$W > 0.05\text{mm}$ 或 $L > 5\text{mm}$	0	0	0	0		
		备注 1 点缺陷亮点之间距离大于 10mm. 2 测试画面必须包含 红, 绿, 蓝, 白, 黑, 灰 3 正常日光灯环境下检测 (200~600LUX) 4 点不良数量比例不得超过单笔订单数量的 5% (之前没有这一条, 后面需要加进来)							

7.2 外观检验 Outer appearance inspection

序号	项目	内容					检查方法及工具
6.2.1	内容 (content)		<4.3	$4.3 \leq \text{尺寸} < 7.0$	$7.0 \leq \text{尺寸} < 10.1$	≥ 10.1	--
		$W \leq 0.02\text{mm}$	忽略	忽略	忽略	忽略	目视、菲林片



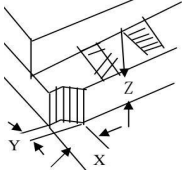
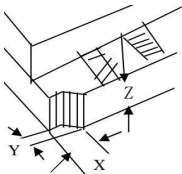
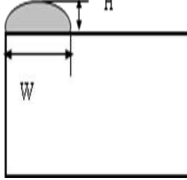
6.2.2	偏光片和背光缺陷 (polarizer & backlight defect)	异物/刮伤/气泡/凹凸等线状不良	0.02mm < W ≤ 0.05mm, 且 L ≤ 5mm	1	2	2	3	
			0.03mm < W ≤ 0.05mm, 且 L ≤ 3mm	1	2	2	2	
			W > 0.05mm 或 L > 5mm	0	0	0	0	
6.2.3		异物/刮伤/气泡/凹凸等点状不良	Φ ≤ 0.10mm	忽略	忽略	忽略	忽略	目视、菲林片
			0.10mm < Φ ≤ 0.15mm	1	1	忽略	忽略	
			0.15mm < Φ ≤ 0.20mm	1	1	2	3	
			0.20mm < Φ ≤ 0.25mm	0	0	2	2	
			0.25mm < Φ ≤ 0.3mm	0	0	1	1	
			0.30mm < Φ	0	0	0	0	
			0.10 < Φ ≤ 0.30mm 允收总数	2	2	2	3	
6.2.4		备注: 1. 线缺陷包括盒内毛线, 纤维, 贴片杂质, 偏光片划伤, 玻璃划伤 2. 偏光片偏移不超出玻璃边缘, 不可进入可视区 3. 检验照度 800~1200LUX (台灯下)						目视、菲林片
6.2.5	FPC缺陷 FPC defect	FPC 划伤/破损	不漏铜及未伤及线路	允许 (Acceptable)				目视
6.2.6		FPC 折痕	死折或伤及电路	不可有 (Not Acceptable)				目视
6.2.7		FPC 脏污残胶	金手指位置不可有, 其他位置可擦除可接受	允许 (Acceptable)				目视
6.2.8		金手指	残胶, 脏污, 氧化, 残锡, 破损	不可有 (Not Acceptable)				目视
6.2.9		焊接偏移	偏移量 ≤ 1/2 pin 宽	允许 (Acceptable)				目视
6.2.10		FPC 贴付偏移	图面位置公差 ≤ 0.5mm	允许 (Acceptable)				目视, 游标卡尺

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6.2.11		FPC 手焊	PIN 腳焊點有毛刺, 不平整, 不光滑. FPC燒焦, 發黑	不允許 (Not Acceptable)	目视
6.2.12			少錫, PIN 腳處焊錫未完全覆蓋 PIN 腳孔隙, 殘錫, 測試點殘錫	不允許 (Not Acceptable)	目视
6.2.13		FPC 氣泡	非線路區	允許 (Acceptable)	目视
6.2.14		FPC 異物	橫跨 ≥ 3 根 Pin 或造成電氣(性)不良	不允許 (Not Acceptable)	目视
6.2.15		FPC 其它不良	少器件, 分層, 錫尖, 燒焦發黑, 殘錫	不允許 (Not Acceptable)	目视
6.2.16		補強板不良	髒汙, 剝離, 脫落	不允許 (Not Acceptable)	目视
6.2.17		FPC 绝缘胶带	未覆盖焊接区	不可有 (Not Acceptable)	目视
6.2.18		胶带超出边缘	胶带超出边缘 $\leq 0.2\text{mm}$	允許 (Acceptable)	目视, 游标卡尺
6.2.19	組裝缺 Assem by defect	注胶涂布不良	未完全覆盖ITO 线路, 表面超出上偏光片	不可有 (Not Acceptable)	目视
6.2.20			破损, 气泡, 异物D $\leq 2\text{mm}$, 且未露出线路	允許 (Acceptable)	目视
6.2.21		IC 破损	裂纹	不可有 (Not Acceptable)	目视
6.2.22			崩边 $\leq 0.2\text{mm}$	允許 (Acceptable)	目视, 游标卡尺
6.2.23		易撕贴	上下傾斜不超过 30 度 貼付公差 $\pm 1\text{mm}$	允許 (Acceptable)	目视, 游标卡尺



6.2.24		胶框不良	胶框变形造成外观尺寸变化 $\geq 0.2\text{mm}$	不可有 (Not Acceptable)	目视, 游标卡尺
6.2.25		定位柱	定位柱变形, 皮损, 歪斜	不可有 (Not Acceptable)	目视
7.2.26		铁框变形	胶框变形造成外观尺寸变化 $\geq 0.2\text{mm}$	不可有 (Not Acceptable)	目视, 游标卡尺
6.2.27		铁框生锈	锈点直径 $>0.5\text{mm}$	不可有 (Not Acceptable)	目视、 菲林片
6.2.28		喷码/标签	无喷码/标签, 模糊, 错误	不可有 (Not Acceptable)	目视
6.2.29		裂痕 (Crack)		不可有 (Not Acceptable)	目视
6.2.30	玻璃缺陷 (glass defect)	崩边 (chipping)	 X=长度 (Length) (width)Z=厚度 (depth)	Z不计, Y $<1\text{mm}$, X 不计t为单层玻璃厚度	目视, 游标卡尺
6.2.31		台阶缺角 (Steps chipping)		Z 不计 Y* X $<1*4\text{mm}$ 不 伤及走线	目视, 游标卡尺
6.2.32		凸缘		H $\leq 0.2\text{mm}$, W 不计	目视 游标卡尺
6.2.33		logo 丝印		脏污不可有, 其他同点规格	目视, 菲林片
6.2.34		保护膜气泡		翘起面积小于 1/3 允收	目视, 游标卡尺

6.3 备注

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6.3.1 Polarizer 由外往内 0.5mm 区域忽略 刮伤 / 气泡线 /线状缺陷/ 气泡 / 凹凸点/黑&白点、异物(含 B/L 异物)/压痕/烧伤/BM 波动/偏光片保护膜破损/折痕

6.3.2 偏光片保护膜气泡(不夹异物)，不卡 （特殊要求另行规定）

6.3.3 FPC 表面脏污(silicon 胶或颗粒)：脏污颗粒可擦除 OK,不能擦除部份须<0.1mm;FPCa 表面与补强板连接处不允许有 silicon 胶残留; FPC 表面贴黑胶连接处允许有 silicon 胶残留。

6.3.4 不可溢胶到 Panel 背面

6.3.5 成品保护膜内异物依点/线缺陷判定，气泡/可擦拭脏污不卡，不可擦拭脏污/残胶不可有。

6.3.6 成品尺寸（长,宽,厚 需要参照产品图纸用游标卡尺做量测）每批抽测 5 片。

补充：针对点状/线状不良，降级品的检验标准如下：

B级品 (点状)	$\Phi \leq 0.15$	不计
	$0.15 < \Phi \leq 0.20$	2, 两点间距离不小于5mm
	$0.20 < \Phi \leq 0.30$	1
	$0.30 < \Phi$	0
B级品 (线状)	$W \leq 0.03$	不计
	$0.03 < W \leq 0.05, L \leq 3.0$	3
	$0.05 < W$	按黑白点判定

批量数 (片)	特殊检验水准				一般检验水准		
	S-1	S-2	S-3	S-4	I	II	III
1 至 8	A	A	A	A	A	A	B
9 至 15	A	A	A	A	A	B	C
16 至 25	A	A	B	B	B	C	D
26 至 50	A	B	B	C	C	D	E
51 至 90	B	B	C	C	C	E	F
91 至 150	B	B	C	D	D	F	G
151 至 280	B	C	D	E	E	G	H
281 至 500	B	C	D	E	F	H	J
501 至 1200	C	C	E	F	G	J	K
1201 至 3200	C	D	E	G	H	K	L
3201 至 10000	C	D	F	G	J	L	M
10001 至 35000	C	D	F	H	K	M	N
35001 至 150000	D	E	G	J	L	N	P
150001 至 500000	D	E	G	J	M	P	Q
500001 及以上	D	E	H	K	N	Q	R
1 至 8	A	A	A	A	A	A	B

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12 .PRECAUTIONS

Static charge

Since this LCD module contains CMOS LSI that are sensitive to static charge, care must be taken when handling it

Power on sequence

1. Input signals should not be applied to the LCD module before the logic system voltage has reached the specified voltage. If the above sequence is not kept, the LCD module might be permanently damaged.
2. When connecting the power supply, connect the LCD bias voltage after connecting the logic system voltage.
3. When disconnecting the power supply, disconnect the logic system voltage after the LCD bias voltage.
4. It is recommended to connect a serial resistor or fuse to the LCD bias power supply of the system as a current limiter. The value of the resistor depends on the kind of LCD used, but is typically 50~100 Ω

Operation

1. It is essential to drive the LCD within the specified voltage limits, since a higher driving voltage than allowed causes a shorter LCD lifetime. Under these circumstances, elector-chemical reactions will result in undesirable deterioration of the LCD.
2. The response time of the LC fluid is considerably longer at low temperature than in the normal operating temperature range. On the other hand, the LCD will show a dark blue color at high temperatures. Those phenomena do not indicate a malfunction or defect of the LCD. Back at normal temperatures, the LCD will return to its original behavior.
3. If the display area is pressed hard during operation, some abnormal display patterns might appear. However, the display will resume normal operation after turning the module off and on.
4. Moisture on the terminals could cause an elector-chemical reaction resulting in an open terminal connection. If the environmental temperature is higher than 50℃, it is required that the relative humidity is 50% or less.

Long-time storage

For long-term storage the following methods are highly recommended:

1. Store the product in a polyethylene bag with a sealed opening to prevent fresh air entering from the outside. Placing it with a desiccant is not necessary.
2. Store the product in a dark place, with the temperature in the range from -10℃ to 50℃.
3. Keep the sensitive polarizer surface of the LCD panels clear of any contact. We recommend using the container that was used by HXJ to deliver the products.

Cleaning of product

To clean the product make sure to use absorbent cotton cloth or other soft material like chamois. Make sure to rub it gently and do not use chemicals when cleaning.

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13. PACKAGING INFORMATION(TBD)

Packaging Material				
No.	Item	Model	Dimensions (mm)	Quantity
1	LCM	-	-	--
2	POF	-	-	--
3	TRAY	-	-	--
4	SMALL BOX	-	-	--
5	BIG BOX	-	390.0×320.0×380.0	1