深圳华迪创显科技有限公司

Shenzhen Huadichuangxian TECHNOLOGY CO.,LTD

Product Specification

产品规格书

产品生产商：深圳华迪创显科技有限公司

产品名称　：3.2寸240*320点阵彩屏模组

规格型号　：HD32021C40

部门确认：

研发	工程	品管	审核

印　　章：

日　　期：

客户回签：

采购	工程	品管	确认

印　章：

日　期：

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REVISION HISTORY

Rev	Description	Page	Date
1.0	Initial Release	All	2024-10-23

1. GENERAL DESCRIPTION

1.1 DESCRIPTION

HD32021C40 is a transmissive type color active matrix TFT (Thin Film Transistor) liquid crystal display (LCD) that uses amorphous silicon TFT as a switching device. This model is composed of a TFT-LCD module (TFT-LCD panel, driver IC and FPC), a back-light unit and. The resolution of 3.2" contains 240 RGB X320 pixels and can display up to 262k colors.

1.2 GENERAL INFORMATION

Items	Specification	Unit	Note
Drive element	a-Si TFT	-	-
LCM outline size	55.04 (H) x 77.50 (V)	mm	
Active area	48.60 (H) x 64.80 (V)	mm	-
Number of pixels	240(H)X320(V)	pixels	-
Pixel arrangement	RGB stripe	-	-
Pixel Pitch	51.6x 56.8	mm	-
Display color	262K	color	-
Viewing direction	ALL	-	-
Controller / Driver	ST7789T3	-	-
Data interface	MCU/SPI	-	
Backlight	5 White LED	-	
Weight	TBD	g	

2. ABSOLUTE MAXIMUM RATING

(Ta=25±2°C, Vss=GND=0V)

Characteristics	Symbol	Min.	Typ	Max.	Unit	Notes
Supply Voltage	IOVCC	-0.3	-	4.6	V	
	VCI	-0.3	-	4.6	V	
TFT Gate On voltage	VGH	-0.3	-	30	V	
TFT Gate Off voltage	VGL	-0.3	-	30	V	
Backlight Forward Current	I_F	-		100	mA	
Operating Temperature	T_{OPR}	-20		+70	°C	(1), (3)
Storage Temperature	T_{STG}	-30		+80	°C	(2), (3)
Humidity	RH	-		90	%	Max. 60 °C

Notes:

(1) In case of below 0°C, the response time of liquid crystal (LC) becomes slower and the color of panel becomes darker than normal one. Level of retardation depends on temperature, because of the LC characteristics.

(2) If product is exposed to high temperatures for extended time, there is a possibility of the polarizer film damage which could degrade the optical characteristics.

(3) Permanent damage to the device may occur if maximum values are exceeded or reverse voltage is loaded.
Functional operation should be restricted to the conditions described under normal operating conditions.

3. ELECTRICAL CHARACTERISTICS

3.1 LCM DC CHARACTERISTICS

(Ta=25±2°C)

Characteristics	Symbol	Min.	Typ.	Max.	Unit	Note
Power Supply Voltage 1	IOVCC	1.65	1.8	3.3	V	
Power Supply Voltage 2	VCI	2.4	2.75	3.3	V	
Power Supply Voltage 3	-	-	-	-	V	
Power Supply for MTP	VPP	-	-	-	V	
Current Consumption	I_{DD}	-	TBD	-	mA	Normal mode
	$I_{DD-SLEEP}$		TBD		uA	Sleep mode
Input voltage “L” Level	V_{IL}	GND	-	0.3IOVCC	V	IOVCC=1.65~3.3
Input voltage “H” Level	V_{IH}	0.7IOVCC	-	IOVCC	V	
Output voltage “L” Level	V_{oL}	GND	-	0.2IOVCC	V	I_{OL}=1mA
Output voltage “H” Level	V_{oH}	0.8IOVCC	-	IOVCC	V	I_{OH}=-1mA

3.2 BACK-LIGHT UNIT CHARACTERISTICS

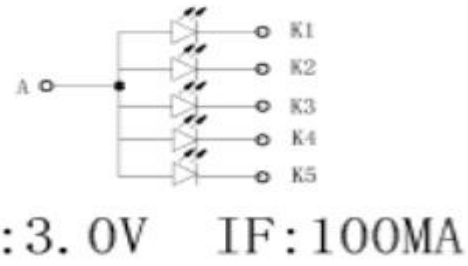
The back-light system is an edge-lighting type with 4 white LEDs. The characteristics of the back-light are shown in the following tables.

(Ta=25±2°C)

Characteristics	Symbol	Condition	Min.	Type	Max.	Unit	Notes
Forward Voltage	Vf	I_L=100mA	2.8	3.0	3.2	V	-
Forward current	I_L		-	100	-	mA	-
Luminance	Lv	I_L=100mA	-	500	--	cd/m^2	-
LED life time	-	I_L=100mA	20,000	25,000	--	Hr	Note 1

Note:

(1) The “LED life time” is defined as the module brightness decrease to 50% of original brightness at I_L=80mA. The LED life time could be decreased if operating I_L is larger than 80mA.



Bcklight circuit diagram shown in below:

4. OPTICAL CHARACTERISTICS

The following items are measured under stable conditions. The optical characteristics should be measured in a dark room.

Measuring equipment: BM-5AS, BM-7, EZ-Contrast.

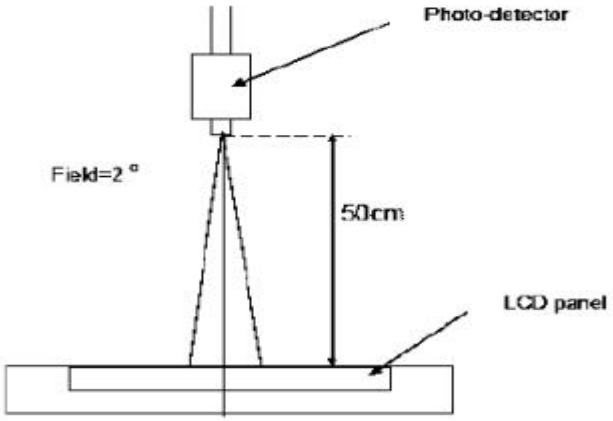
(Ta=25±2°C)

Parameter		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Contrast Ratio (Center point)		C/R	-	-	1200	-	-	BM-7 Note(2)
Luminance of white (Center point)		L_w	B/L on	15%	TBD	15%	cd/m^2	CA-210
Luminance uniformity		U_W	θ = 0. Normal viewing angle B/L On Note(1)	80	-	-	%	BM-7 Note(3)
Response Time		Tr + Tf		-	30	35	ms	BM-5AS Note(4)
Color Chromaticity (CIE 1931)	White	W_X		0.277	0.307	0.337	-	CA-210 Note(5)
		W_X		0.312	0.342	0.372		
	Red	R_X		0.592	0.612	0.632		
		R_Y		0.309	0.329	0.349		
	Green	G_X		0.279	0.299	0.319		
		G_y		0.547	0.567	0.587		
	Blue	B_X		0.124	0.144	0.164		
		B_Y		0.090	0.110	0.130		
Viewing Angle	Hor.	θ_T	C/R≥10	-	80	-	Deg	EZ Contrast Note(6)
		θ_B		-	80	-		
	Ver.	θ_L		-	80	-		
		θ_R		-	80	-		
Optima View Direction			ALL					Note(7)

* This condition will be changed by the evaluation circumstance. If product is exposed to high temperatures for extended time, there is a possibility of the polarizer film damage which could degrade the optical characteristics.

Notes:

(1) Test Equipment Setup: After stabilizing and leaving the panel alone at a given temperature for 30min, the measurement should be executed. Measurement should be executed in a stable, windless, and dark room 30min after lighting the back-light. This should be measured in the center of screen.

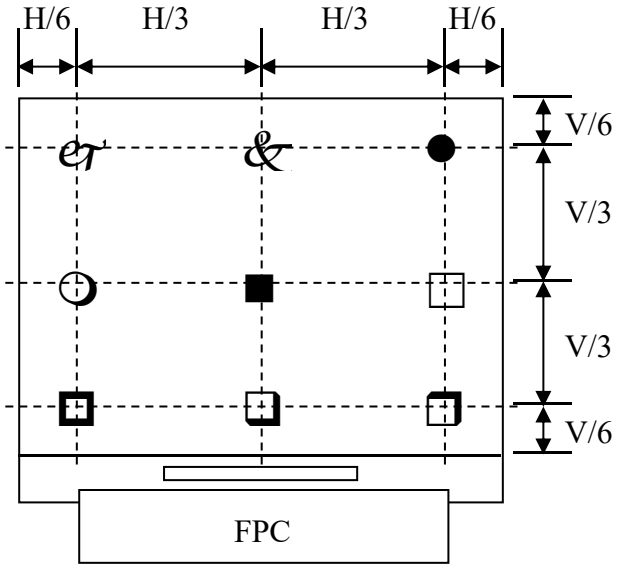


(2) Definition of Contrast Ratio (CR):

$$\text{Contrast Ratio (CR)} = \frac{\text{Luminance measured when LCD on the “white” state}}{\text{Luminance measured when LCD on the “black” state}}$$

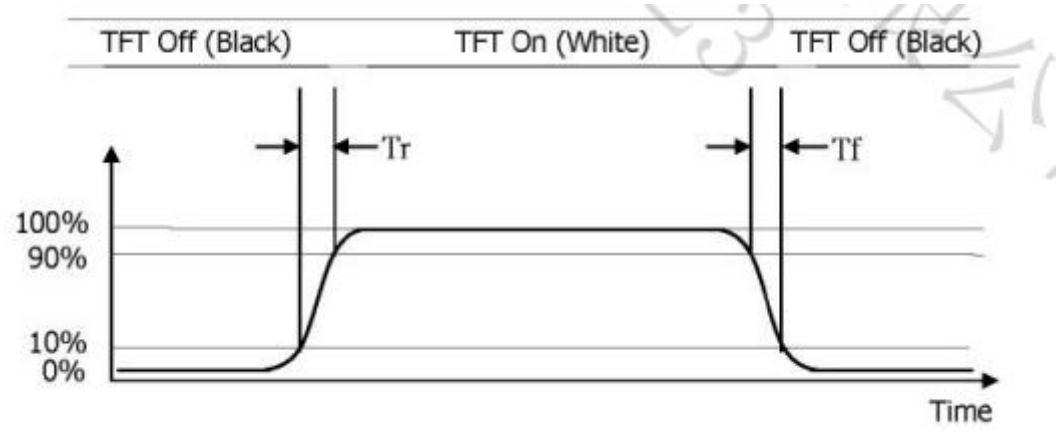
(3) Definition of Luminance Uniformity: Active area is divided into 9 measuring areas (Shown in below), every measuring point is placed at the center of each measuring area.

$$\text{Luminance Uniformity} = \frac{\text{Min Luminance of white among 9-points}}{\text{Max Luminance of white among 9-points}} \times 100\%$$

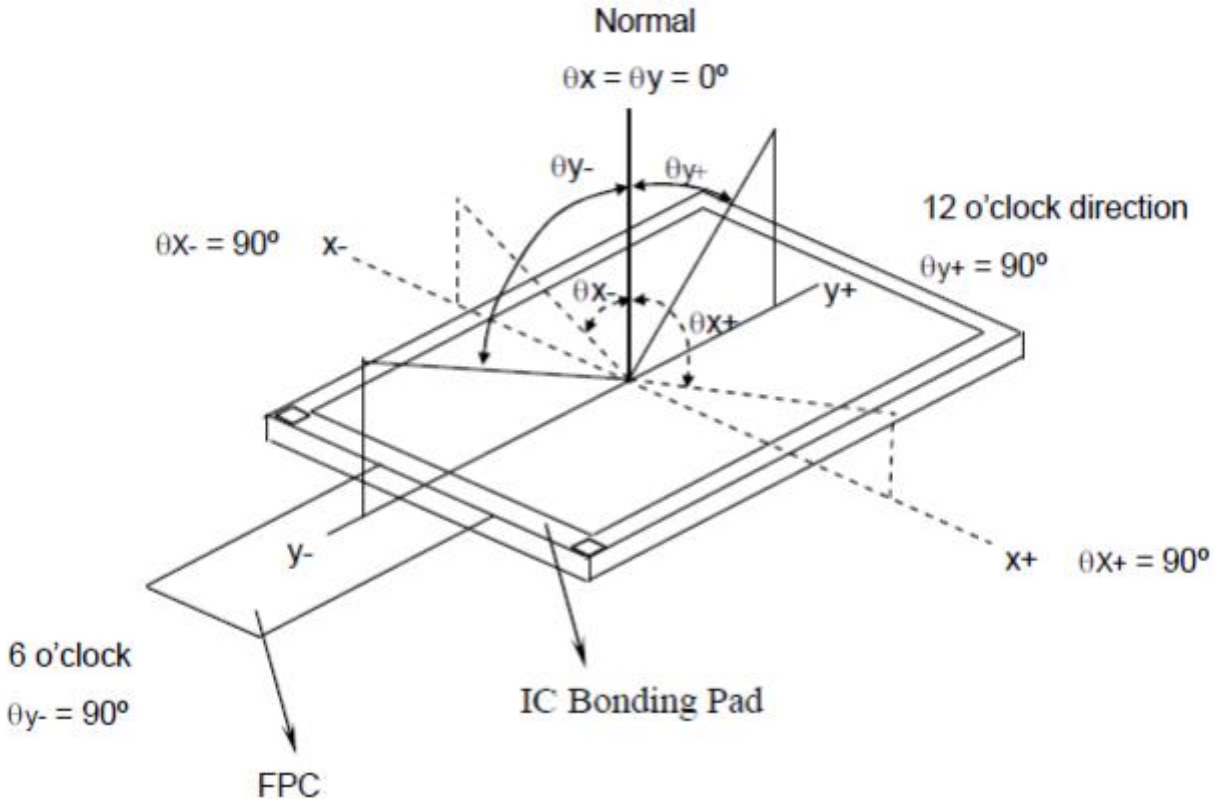


The spot locations for luminance measurement

(4) Definition of Response time: Sum of Tr and Tf.



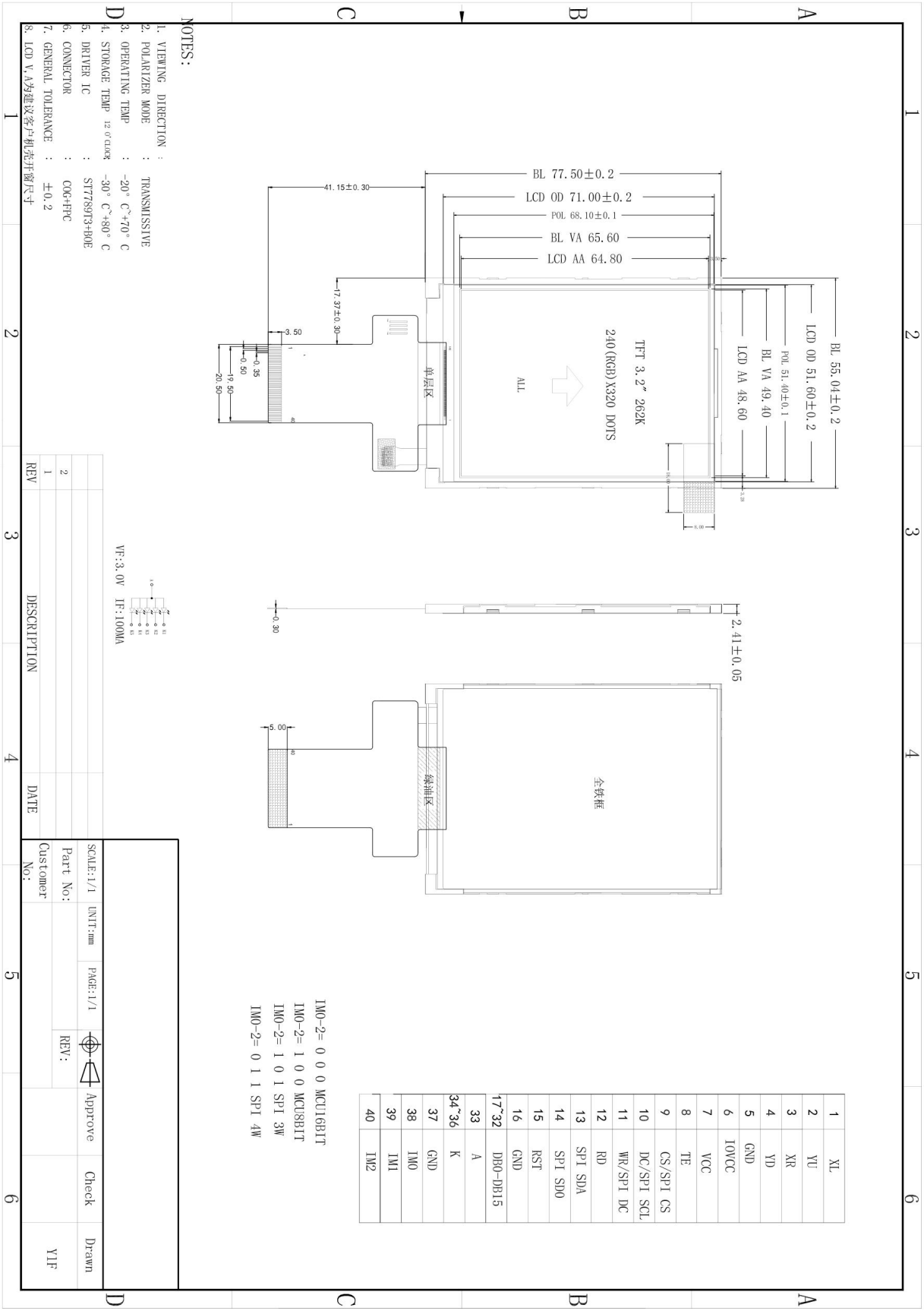
(5) Definition of Viewing Angle: The viewing angle range that the CR≥10.



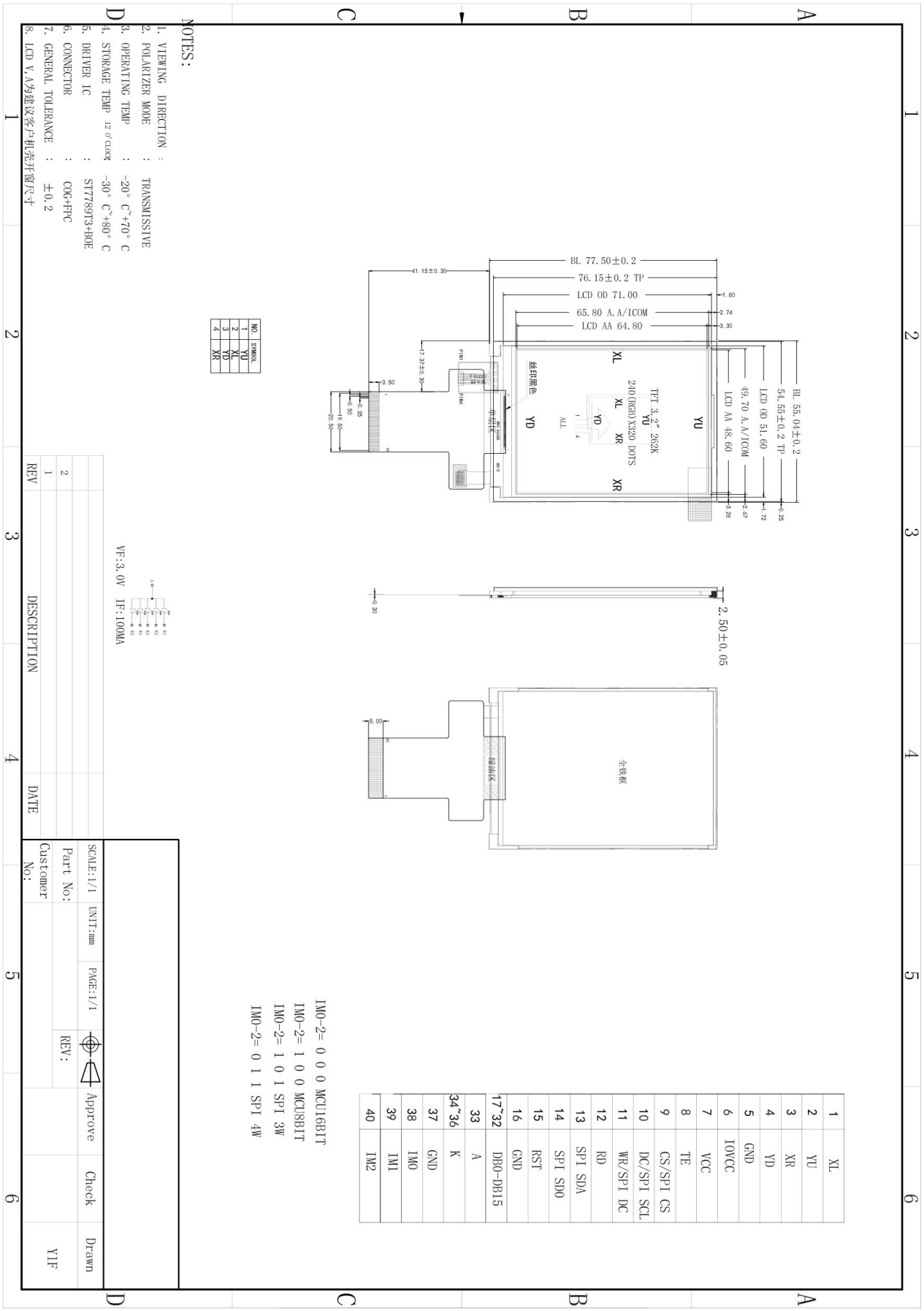
(6) Definition of Color Chromaticity (CIE 1931)
Color coordinate of white & red, green, blue at center point.

(7) The different Rubbing Direction will cause the different optima view direction.

5.MODULE OUTLINE DIMENSION



5.


NOTES:
1. VIEWING DIRECTION : 12 O' CLOCK
2. POLARIZER MODE : TRANSMISSIVE
3. OPERATING TEMP : -20° C~+70° C
4. STORAGE TEMP : -30° C~+80° C
5. DRIVER IC : ST7789T3+BOE
6. CONNECTOR : COG+FPC
7. GENERAL TOLERANCE : ±0.2
8. LCD V,A为建议客户机壳开窗尺寸
BL 77.50±0.2
76.15±0.2 TP
LCD OD 71.00
65.80 A.A/ICOM
LCD AA 64.80
BL 55.04±0.2
54.55±0.2 TP
LCD OD 51.60
49.70 A.A/ICOM
LCD AA 48.60
TFT 3.2" 262K
240(RGB)X320 DOTS
丝印黑色
2.50±0.05
金铁框
绿油区
VF:3.0V IF:100MA
IM0-2= 0 0 0 MCU16BIT
IM0-2= 1 0 0 MCU8BIT
IM0-2= 1 0 1 SPI 3W
IM0-2= 0 1 1 SPI 4W
1 XL
2 YU
3 XR
4 YD
5 GND
6 IOVCC
7 VCC
8 TE
9 CS/SPI CS
10 DC/SPI SCL
11 WR/SPI DC
12 RD
13 SPI SDA
14 SPI SDO
15 RST
16 GND
17~32 DB0-DB15
33 A
34~36 K
37 GND
38 IM0
39 IM1
40 IM2
REV DESCRIPTION DATE
SCALE:1/1 UNIT:mm PAGE:1/1
Part No: REV:
Customer No:
Approve Check Drawn
YLF

6. MODULE INTERFACE DESCRIPTION

Pin No.	Symbol	Description
1	XL	TP
2	YU	TP
3	XR	TP
4	YD	TP
5	GND	Power Ground
6	IOVCC	Power supply for interface logic circuits(1.8-2.8V)
7	VCC	Power supply for interface logic circuits(2.8-3.3V)
8	TE	frame alignment
9	CS/ SPI CS	Chip select input pin
10	DC/SPI SCL	Display data/command selection pin in parallel interface. -This pin is used to be serial interface clock
11	WR/SPI DC	Write enable clock input pin. - Display data/command selection pin in 4-line serial interface.
12	RD	Read enable
13	SDA	input signal
14	SD0	output signal
15	RST	Reset input pin
16	GND	Power Ground
17-32	DB0-DB15	16-bit parallel bi-directional data bus for MCU system
33	A	Back-light Anode
34-36	K	Back-light Cathode
37	GND	Power Ground
38	IM0	Select the MCU interface mode
39	IM1	Select the MCU interface mode
40	IM2	Select the MCU interface mode

7. REFERENCE APPLICATION CIRCUIT

Please consult our technical department for detail information.

8. TIMINGS FOR SPI MCU Interface

7.4.2 Serial Interface Characteristics (3-line serial):

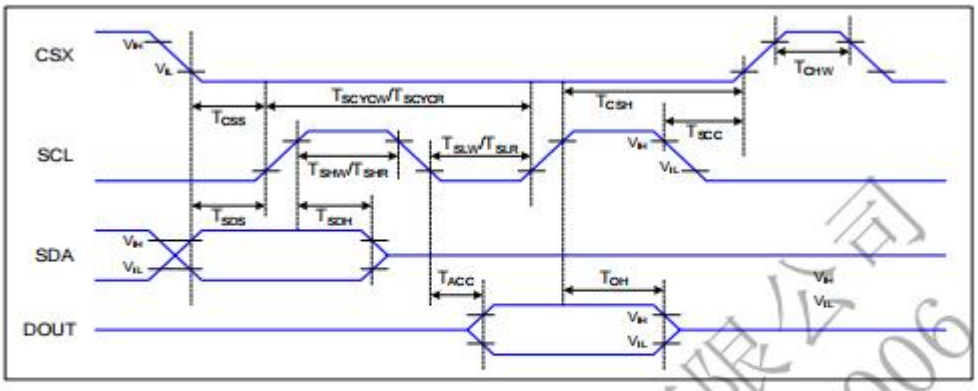


Figure 4 3-line serial Interface Timing Characteristics

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

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)	16		ns	
	T_{SHW}	SCL "H" pulse width (Write)	7		ns	
	T_{SLW}	SCL "L" pulse width (Write)	7		ns	
	T_{SCYCR}	Serial clock cycle (Read)	150		ns	
	T_{SHR}	SCL "H" pulse width (Read)	60		ns	
	T_{SLR}	SCL "L" pulse width (Read)	60		ns	
SDA (DIN)	T_{SDS}	Data setup time	7		ns	
	T_{SDH}	Data hold time	7		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

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7.4.3 Serial Interface Characteristics (4-line serial):

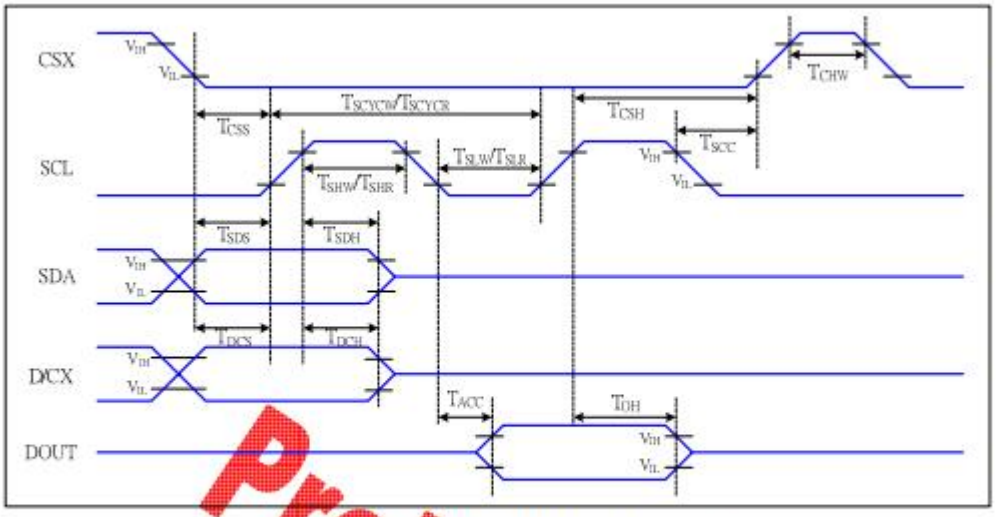


Figure 5 4-line serial Interface Timing Characteristics

VDDI=1.65 to 3.3V, VDD=2.4 to 3.3V, AGND=DGND=0V, Ta=-30 to 70 ℃

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

Table 6 4-line serial Interface Characteristics

Preliminary

7.4.1 8080 Series MCU Parallel Interface Characteristics: 18/16/9/8-bit Bus

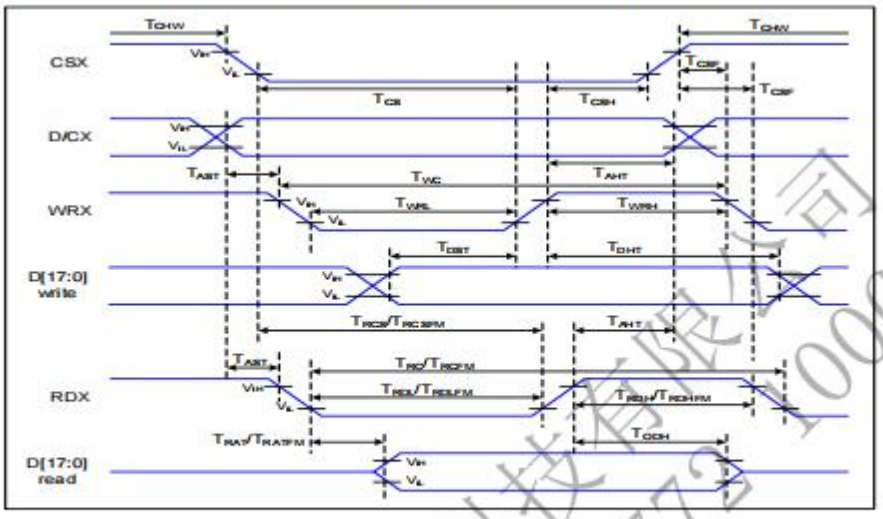


Figure 1 Parallel Interface Timing Characteristics (8080-Series MCU Interface)

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

Signal	Symbol	Parameter	Min	Max	Unit	Description
D/CX	T_{AST}	Address setup time	0		ns	-
	T_{AHT}	Address hold time (Write/Read)	10		ns	
CSX	T_{CHW}	Chip select "H" pulse width	0		ns	-
	T_{CS}	Chip select setup time (Write)	15		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 (Write/Read)	10		ns	
	T_{CSH}	Chip select hold time	10		ns	
WRX	T_{WC}	Write cycle	66		ns	
	T_{WRH}	Control pulse "H" duration	15		ns	
	T_{WRL}	Control pulse "L" duration	15		ns	
RDX (ID)	T_{RC}	Read cycle (ID)	160		ns	When read ID data
	T_{RDH}	Control pulse "H" duration (ID)	90		ns	
	T_{RDL}	Control pulse "L" duration (ID)	45		ns	
RDX (FM)	T_{RCFM}	Read cycle (FM)	450		ns	When read from frame memory
	T_{RDHFM}	Control pulse "H" duration (FM)	90		ns	
	T_{RDLFM}	Control pulse "L" duration (FM)	355		ns	
D[17:0]	T_{DST}	Data setup time	10		ns	For CL=30pF

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9. RELIABILITY TEST CONDITIONS

No.	Test Item	Test Condition	Notes
1	High Temperature Storage	+80°C / 240H	Inspection after 2~4h storage at room temperature, the sample shall be free from defects: 1. Air bubble in the LCD; 2. Seal leak; 3. Non-display; 4. Missing segments; 5.Glass crack; 6. The surface shall be free from damage. 7. The electrical characteristics requirements shall be satisfied.
2	Low Temperature Storage	-30°C / 240H	
3	High Temperature Operating	+70°C / 240H	
4	Low Temperature Operating	-20°C / 240H	
5	Temperature Cycle	Ta=-10°C~+25~+50°C,10 Cycle,per30min	
6	High Temperature /Humidity storage	60°C ,90%RH / 120H	
7	Vibration Test	Frequency: 10Hz~55Hz~10Hz Amplitude:1.5mm, 2 hours for each direction of X, Y, Z	
8	Packing Drop Test	Drop to the ground from 1m height, 1 corner, 3 edges, 6 surfaces.	
9	ESD test	Voltage:±8KV R: 330Ω C: 150pF Air discharge, Three or five times.	

Remarks:

(1) The test samples should be applied to only one test item.

(2) Sample size for each test item is 5~10pcs.

(3) For High Temperature/Humidity storage test, pure water (resistance>10MΩ) should be used.

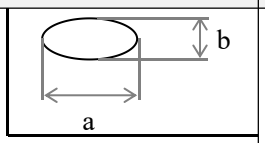
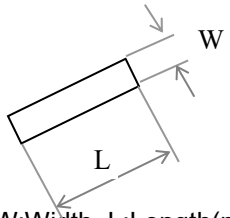
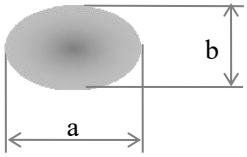
(4) In case of malfunction defect caused by ESD damage, if it would be recovered to normal state after resetting, it would be judge as a good part.

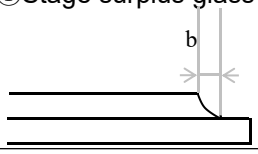
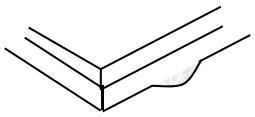
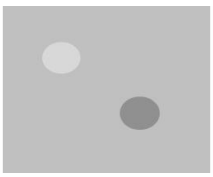
(5) Failure judgment criterion: basic specification, electrical characteristic, mechanical characteristic, optical characteristic.

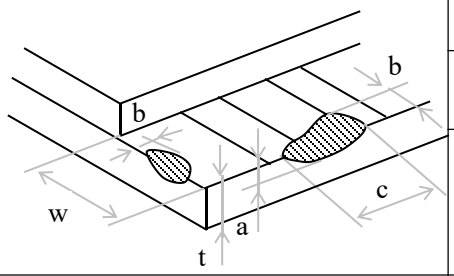
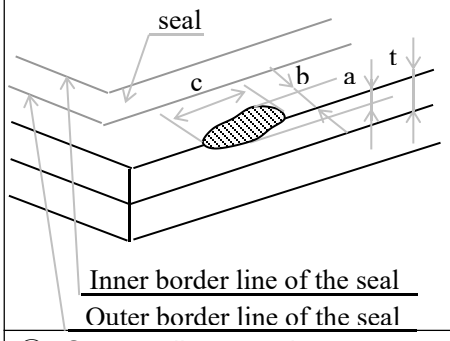
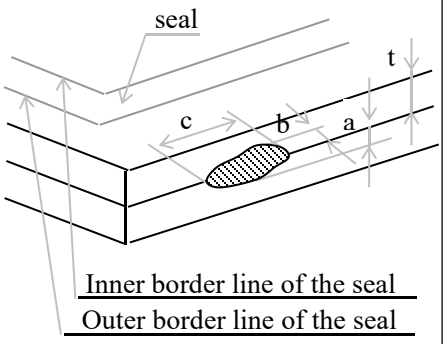
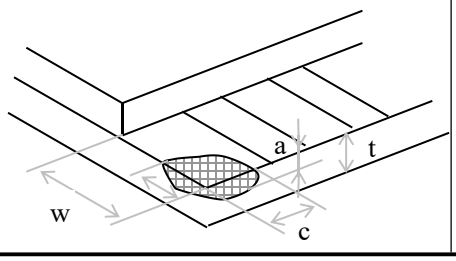
10. PACKING SPECIFICATION

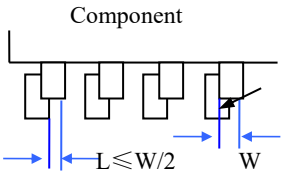
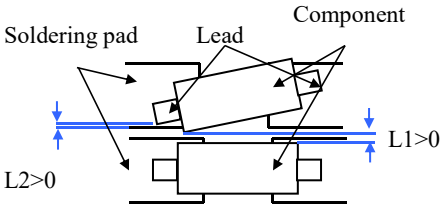
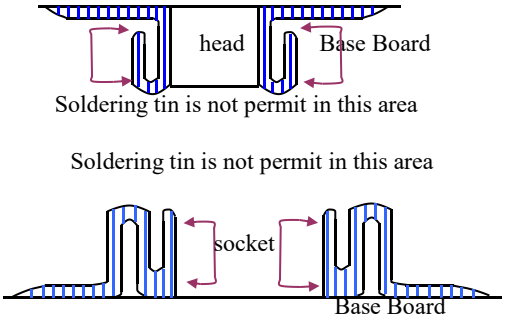
TBD

11. INSPECTION CRITERION

Inspection item			Judgement standard			
			Category		Acceptable number	
					A zone	B zone
1	Black spot, White spot, Bright Spot, Pinhole Foreign Particle, Bubble and Particle Between polarizer and glass, scratch on polarizer	 Φ=(a+b)/2(mm)	A B C	Φ≦0.10 0.10<Φ≦0.20 Φ>0.2	Ignored 2 0	Ignored
			Total defective point(B,C)		3	
	Pixel point defect	Bright spot	0.15<Φ≦0.20		N≤2	Ignored
		Dark spot/ Black spot	0.15<Φ≦0.20		N≤2	
		Attached to the two pixels are bright spots	0.15<Φ≦0.20		N≤2	
		Even a two pixel is dark	0.15<Φ≦0.20		N≤2	
		Pixel total number	0.15<Φ≦0.20		N≤2	
		Note1: the spot defect caused by foreign matter is judged according to the defect of the foreign body. Note 2: when the light is not wired to show the type of defects.				
2	Black line, White line, Bubble and Particle Between Polarizer and glass, Scratch on polarizer	 W:Width, L:Length(mm)	A B C	W≦0.03 L≦3.0 0.03<W≦0.05 L≦3.0 0.05<W	Ignored 2 0	Ignored
			Total defective point(B,C)		2	
3	Contrast variation	 Φ=(a+b)/2(mm)	A B C	Φ≦0.1 0.1<Φ≦0.3 Φ>0.3	Ignored 2 0	Ignored
			Total defective point(B,C)		2	
4	Bubble inside cell		any size		none	none
5	Polarizer defect (if Polarizer is used)	Scratch and damage on polarizer, particle on polarizer or between polarizer and glass.	Refer to item 1 and item 2.			
		Bubble, dent and convex	A B C	Φ≦0.3 0.3<Φ≦0.5 0.5<Φ	Ignored 2 0	Ignored
			Total defective point(B,C)		2	

Inspection item		Judgement standard		
		Category	Acceptable number	
			A zone	B zone
6	Surplus glass	①Stage surplus glass 	b≦0.3mm	
		②Surrounding surplus glass 	Should not influence outline dimension and assembling.	
7	MURA	①MURA	Naked eye examination: red, green, blue screen does not allow the appearance, black screen requires visual is not obvious, the specific reference limit samples. Note: the principle of closing the sample is to be installed on the whole machine and the end user will not find it in the normal usage scenario. Inspection basis: 6%ND (MURA mainly in the black screen and indoor light is relatively dark will be found, it is recommended to turn off the indoor lighting inspection.)	
		②Point Black / White / point(MURA)	1, under the black / gray screen check: D≦0.10mm Ignored; 0.10mm<D≦0.3mm, N≦2; D>0.3mm: Unqualified。 2, switch to the red, green, blue in which any one of the screen appears black or white or point to point white or point of failure. 	

<table>
<tr><th colspan="3" rowspan="2">Inspection item</th><th colspan="2">Judgment standard</th></tr>
<tr><th colspan="2">Category(application: B zone)</th></tr>
<tr><td rowspan="5">8</td><td rowspan="5">Glass defect crack</td><td rowspan="4">①The front of lead terminals

</td><td>A</td><td>If a≦t and b ≦1.0,　c is not limited</td></tr>
<tr><td>B</td><td>a≦t, 1≦b≦2mm, c≦3mm</td></tr>
<tr><td>C</td><td>If glass crack cover alignment mark, b≦0.5mm.</td></tr>
<tr><td>D</td><td>Crack at two sids of lead terminals should not cover patterns and alignment mark</td></tr>
<tr><td>②Surrounding crack—non-contact side

</td><td colspan="2">b < Inner borderline of the seal</td></tr>
<tr><td>③ Surrounding crack— contact side

</td><td colspan="2">b < Outer borderline of the seal</td></tr>
<tr><td>④Corner

</td><td>A</td><td>a ≦ t, b ≦ 3.0, c ≦ 3.0
*Glass crack should not cover patterns used for</td></tr>
</table>

Inspection item			Judgement standard
9	FPC defect	Component soldering: No cold soldering, short/open circuit, burr, tin ball. The flat encapsulation component position deviation must be less than 1/2 width of the pin (Pic.1)； The sheet component deviation: pin deviates from the pad and contact with the near components is not permitted（Pic.2）	
		lead defect: The lead lack must be less than 1/2of its width; The lead burr must be less than 1/2 of the seam; Impurities connect with the near leads is not permitted	
		Connector soldering: Soldering tin is at contact position of the plug and socket is not permitted No foundation is scald Serious cave distortion on plug and socket contact pin is not permitted	

12. GENERAL PRECAUTIONS

1.1 HANDING

(1) When the module is assembled, it should be attached to the system firmly. Be careful not to twist and bent the module.

(2) Refrain from strong mechanical shock and / or any force to the module. In addition to damage, this may cause improper operation or damage to the module and back-light unit.

(3) Note that display modules are very fragile and could be easily damaged. Do not press or scratch the surface harder than a HB pencil lead.

(4) Wipe off water droplets or oil immediately. If you leave the droplets for a long time, straining and discoloration may occur.

(5) If the display module surface becomes contaminated, breathe on the surface and gently wipe it with a soft dry cloth. If it is heavily contaminated, should be wiped by moisten cloth with isopropyl alcohol or ethyl alcohol solvents, DO NOT with water, ketone type materials (e.g. acetone), aromatic, toluene, ethyl acid or methyl chloride, and so on.

(6) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contact with hands, legs or clothes, it must be washed away thoroughly with soap.

(7) Use finger-stalls with sort gloves in order to keep display clean during the incoming inspection and assembly process.

(8) Protection film for polarizer on the module shall be slowly peeled off just before use so that the electrostatic charge can be minimized.

(9) Do not touch directly conductive parts such as the CMOS LSI pad and the interface terminals with bare hands, therefore operations should be grounded whenever he/she comes into contact with the modules.

(10) Do not exceed the absolute maximum rating value. (The supply voltage variation, input voltage variation, variation in part contents and environmental temperature, and so on), otherwise the module may be damaged.

1.2 SOLDERING

(1) Use soldering irons with proper grounding and no leakage.

(2) For No RoHS Product: soldering temperature is 290~350°C, soldering time is 3~5s; for RoHS Product: soldering temperature is 340~370°C, soldering time is 3~5s.

(3) If soldering flux is used, be sure to remove any remaining flux after soldering (This does not apply in the case of a non-halogen type of flux).

1.3 STORAGE

(1) DO NOT leave the module in high temperature and high humidity for a long times, keep the temperature from 0°C to 35°C and relative humidity of less than 60%.

(2) It is highly recommended to store the module in a dark place. The Liquid crystal is deteriorated by ultraviolet, DO NOT leave it in direct sunlight and strong ultraviolet ray for many hours.