

**PRODUCT SPECIFICATION****TFT-LCD MODULE****Module No: 100360-01**☒ Preliminary Specification☐ Approval Specification

Designed by	Checked by	Approved by

Final Approval by Customer

Approved by	Comment

For more information, contact us:

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※The specification of "TBD" should refer to the measured value of sample . If there is difference between the design specification and measured value, we naturally shall negotiate and agree to solution with customer.

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1.Document Revision History

Version	Contents	Date	Note
V0	Initial version	2024.08.06	

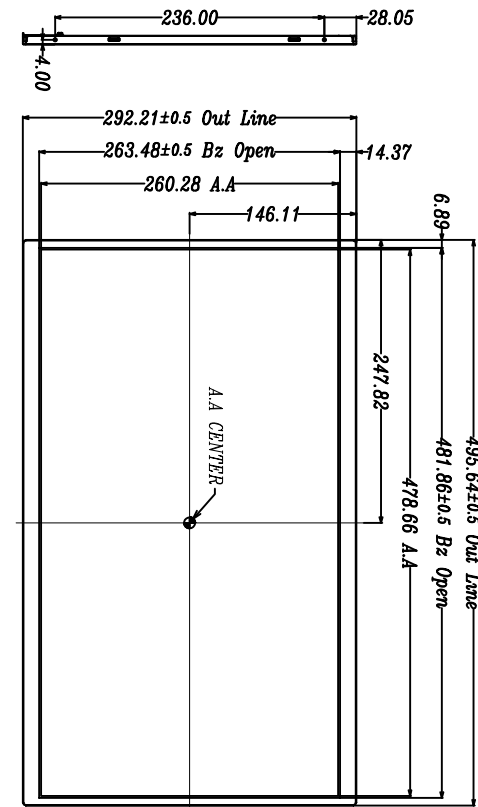
2. General Description

N0	Item	Specification	Unit	Remark
1	LCD Size	TFT"21.5	inch	-
2	Panel Type	IPS	-	-
3	Number of pixels	1920 x RGB x 1080	pixel	-
4	Display mode	Normally Black	-	-
5	Display colors	16.7M	-	8bit
6	LCM Module size	495.74(W)×292.21(H)×10.30(T)	mm	Note
7	Active Area	478.66(W)×260.28(V)	mm	Note
8	Pixel Pitch	0.2493(H) x(RGB)x0.241 (V)	mm	-
9	Weight	TBD	g	-
10	Light Source	White LED	-	-
11	Interface	LVDS	-	-

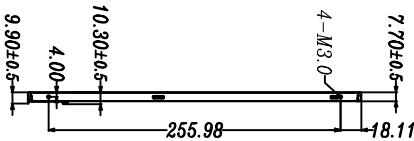
Note : Please refer to the mechanical drawing;

3.Mechanical Drawing

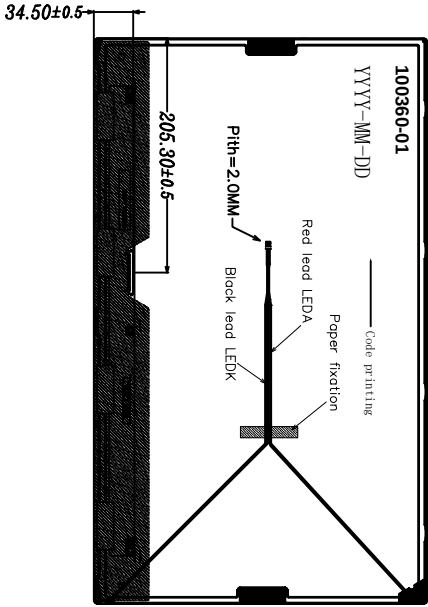
Front View



Side View



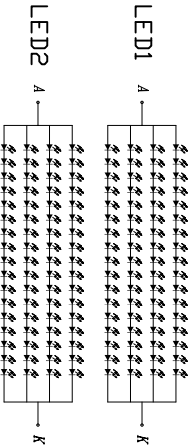
Back View



PIN	SYMBOL
1	RO(O)N
2	RO(O)P
3	RO(1)N
4	RO(1)P
5	RO(2)N
6	RO(2)P
7	GND
8	ROCLK-
9	ROCLK+
10	RO(3)N
11	RO(3)P
12	RE(O)N
13	RE(O)P
14	GND
15	RE(1)N
16	RE(1)P
17	GND
18	RE(2)N
19	RE(2)P
20	RECLK-
21	RECLK+
22	RE(3)N
23	RE(3)P
24	GND
25	WP
26	SCL
27	SDA
28	5V
29	5V
30	5V

Notes:

1. Display: 21.5", TFT
2. Resolution: 1920*RGB*1080
3. LCD Viewing Direction: ALL
4. Display Mode: Normally Black/Transmissive
5. LCM Brightness: 750cd/m²(TYP), Uniformity ≥80%
6. *:Critical dimension: () Reference dimension
7. Operating Temperature: -0°C~+50°C
8. Storage Temperature: -10°C~+60°C
9. Requirements on Environmental Protection: ROHS



CURRENT If=60mA=240mA*2=480mA
15C*4B=60LED*2=120LED
VF=43V (TYP) If=480mA (TYP)

△	
△	
△	
△	
REV	
	NEW
	DESCRIPTION
	DATE
	NAME

DCLTEK

SCALE: 1/1	UNIT: mm	PAGE: 1/1	Approve	Check	Drawn
Part No.:	100360-01	VER: V0			
Customer No.:					

4. Input Terminal Pin Assignment

4.1 Interface Pin Assignment

CN1: 1-301223-0 (XINDAYITONG) or equivalent (see Note (1))

Pin No.	Symbol	Description	Note
1	RO[0]N	Odd LVDS Signal -	
2	RO[0]P	Odd LVDS Signal +	
3	RO[1]N	Odd LVDS Signal -	
4	RO[1]P	Odd LVDS Signal +	
5	RO[2]N	Odd LVDS Signal -	
6	RO[2]P	Odd LVDS Signal +	
7	GND	Ground	
8	ROCLK-	Odd LVDS Clock -	
9	ROCLK+	Odd LVDS Clock +	
10	RO[3]N	Odd LVDS Signal -	
11	RO[3]P	Odd LVDS Signal +	
12	RE[0]N	Even LVDS Signal -	
13	RE[0]P	Even LVDS Signal +	
14	GND	Ground	
15	RE[1]N	Even LVDS Signal -	
16	RE[1]P	Even LVDS Signal +	
17	GND	Ground	
18	RE[2]N	Even LVDS Signal -	
19	RE[2]P	Even LVDS Signal +	
20	RECLK-	Even LVDS Clock -	
21	RECLK+	Even LVDS Clock +	
22	RE[3]N	Even LVDS Signal -	
23	RE[3]P	Even LVDS Signal +	
24	GND	Ground	
25	WP	Write Protect (High: Write Enable, Low or Open: Write Disable)	
26	SCL	I2C Serial Clock (for adjust VCOM)	
27	SDA	I2C Serial Data (for adjust VCOM)	
28	5V	DC power supply	
29	5V	DC power supply	
30	5V	DC power supply	

Note:

(1)The direction of pin assignment is shown as below:

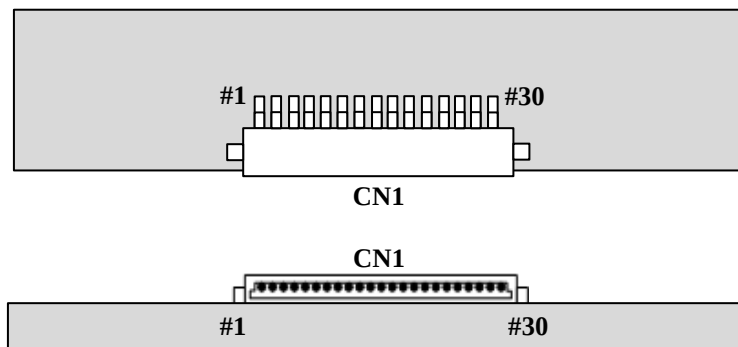


Fig. 4.1 LVDS connector direction sketch map

(2) a. Please let it open (Do not line out from PCBA connector) if it do not used.(for example : TV set)

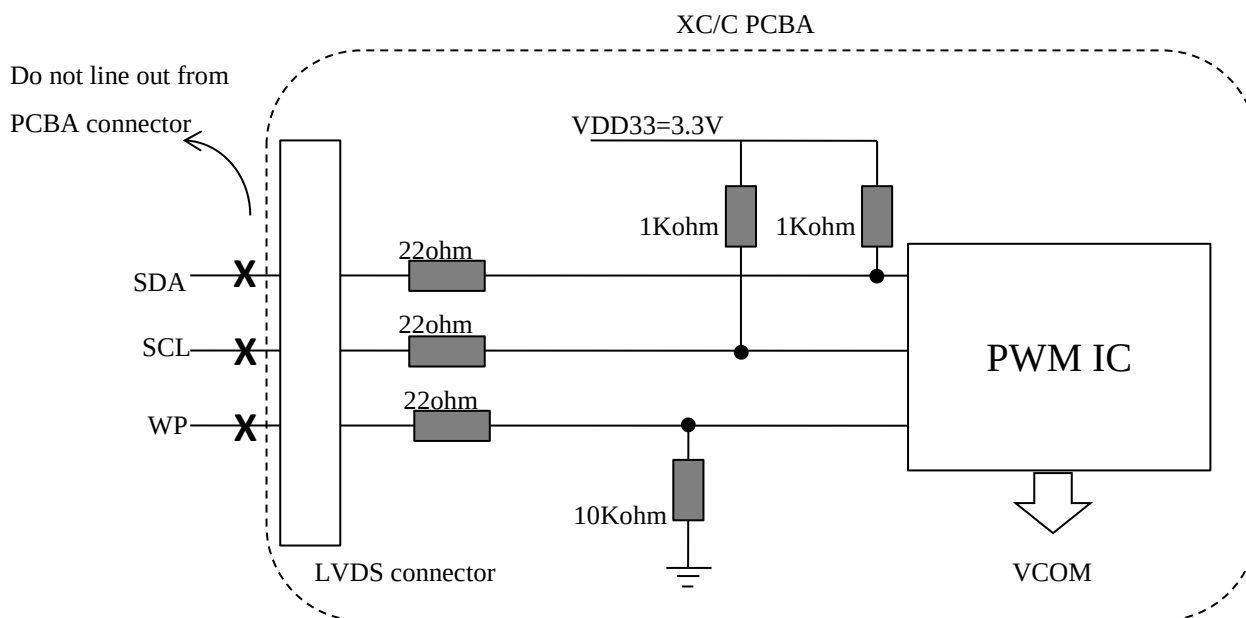


Fig. 4.2 WP/SDA/SCL PCBA set

4.2 Backlight Circuit Characteristics

PARAMETER	Sym.	Min.	Typ.	Max.	Unit	Test Condition	Note
LED Current	IF	—	480	—	mA	—	—
LED Voltage	VF	—	43	—	V	—	—
LCM_Brightness	Lv	—	750	—	Nits	@CA310	
Life Time		—	20000		Hr.	I ≤ 480mA	—
Color	White						

5.0 Absolute Maximum Ratings

5.1 Absolute Maximum Ratings ($T_A = 25 \pm 2 \text{ }^\circ\text{C}$)

The followings are maximum values which, if exceeded, may cause damage to the unit.

Item	Symbol	Value		Unit
		Min.	Max.	
Power Supply Voltage	V_{CC}	-0.3	5.0	V
Input Signal Voltage	V_{IN}	-0.3	3.6	V

5.2 Environment Requirement (Based on CSOT's BLU)

(1) Temperature and relative humidity range are shown as below.

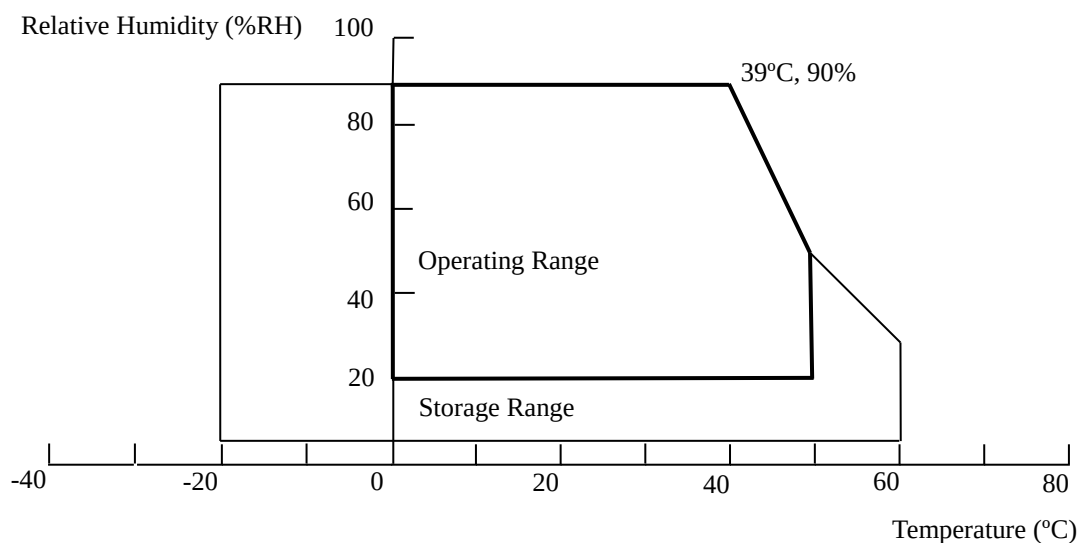


Fig. 2.1 Operating and storage environment

(a) 90%RH maximum ($T_A \leq 39 \text{ }^\circ\text{C}$).

(b) Wet-bulb temperature should be 39°C maximum ($T_A > 39 \text{ }^\circ\text{C}$).

(c) No condensation.

(2) The storage temperature is between $-10 \text{ }^\circ\text{C}$ to $60 \text{ }^\circ\text{C}$, and the operating ambient temperature is between $0 \text{ }^\circ\text{C}$ to $50 \text{ }^\circ\text{C}$

The maximum operating temperature is based on the test condition that the surface temperature of display area is less than or equal to 65°C with LCD module in a temperature controlled chamber alone. Thermal management should be considered in final product design to prevent the surface temperature of display area from being over 65°C . The range of operating temperature may degrade in case of improper thermal management in the end product design.

(3) The rating of environment is based on LCD module. Leave LCD cell alone, this environment condition can't be guaranteed.

Except LCD cell, the customer has to consider the ability of other parts of LCD module and LCD module process.

5.3 Absolute Ratings of Environment (Open Cell)

When storing open cell as spares for a long time, please follow the precaution instructions:

(1) Do not store the open cell in high temperature and high humidity for a long time. It is highly recommended to store the open cell with temperature from 20°C to 30°C in normal humidity ($50 \pm 10\% \text{RH}$) with shipping package.

(2) The open cell should be kept within one month shelf life.

6.0 Electrical Specifications

6.1 Open Cell Power Consumption (TA = 25 ± 2 °C)

Parameter		Symbol	Value			Unit	Note
			Min.	Typ.	Max.		
Power Supply Voltage		V _{CC}	4.5	5	5.5	V	(1)
Rush Current		I _{RUSH}	-	-	1.21	A	(2)
Power Supply Current	White Pattern	-	-	0.72	0.93	A	(3) 60Hz
	Horizontal Stripe	-	-	0.78	1.01	A	
	Black Pattern	-	-	0.54	0.71	A	
Power Supply Current	White Pattern	-	-	0.83	1.07	A	(3) 75Hz
	Horizontal Stripe	-	-	0.9	1.17	A	
	Black Pattern	-	-	0.62	0.81	A	
Power Consumption	Horizontal Stripe			3.51	4.56	Watt	60Hz
	Horizontal Stripe			4.05	5.26	Watt	75Hz

Note:

- (1) The ripple voltage should be controlled less than 10% of V_{CC}.
- (2) Measurement condition: V_{CC} = 5V, rising time = 470μs.

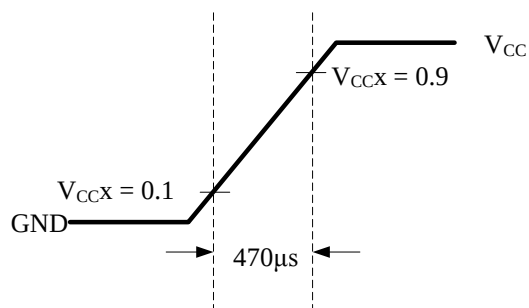


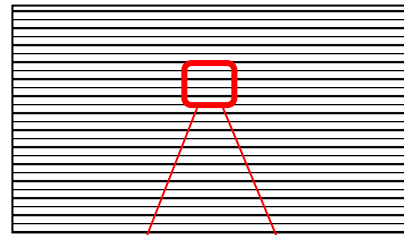
Fig. 3.1 V_{CC} rising time condition

(3) Measurement condition: $V_{CC} = 5V$, $T_a = 25 \pm 2^\circ C$, $F = 75$ Hz. The test patterns are shown as below.

A. White Pattern



B. Horizontal Pattern



C. Black Pattern

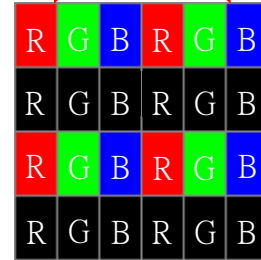


Fig. 3.2 Test patterns

6.2 LVDS Characteristics

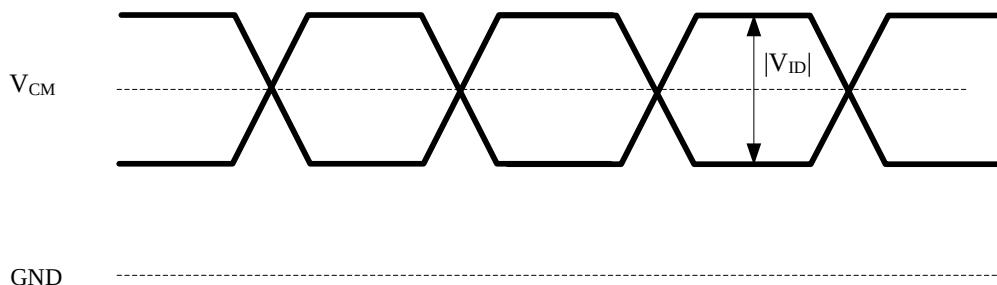
Parameter		Symbol	Value			Unit	Note
			Min.	Typ.	Max.		
LVDS Interface	Differential Input High Threshold Voltage	V_{TH}	+100	-	-	mV	(1)
	Differential Input Low Threshold Voltage	V_{TL}	-	-	-100	mV	
	Common Input Voltage	V_{CM}	1.0	1.2	1.4	V	
	Differential Input Voltage	$ V_{ID} $	100	-	600	mV	
	Terminating Resistor	R_T	87.5	100	112.5	ohm	
CMOS Interface	Input High Threshold Voltage	V_{IH}	2.7	-	3.3	V	
	Input Low Threshold Voltage	V_{IL}	0	-	0.7	V	

Note:

(1) The product should be always operated within above ranges.

(2) The LVDS input signal has been defined as follows:

Single end Signals



Differential Signal

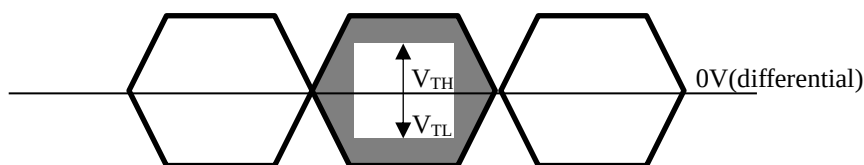


Fig. LVDS input signal

6.3 Temperature Specifications

Parameter	Symbol	Specification			Unit	Recommend test pattern	Note
		Min.	Typ.	Max.			
Surface Temperature	T_{TCON}	–	–	105	$^{\circ}C$	Horizontal Pattern	(1)
	T_{Driver}	–	–	115		Horizontal Pattern	(1)

Note:

- (1) Any point on the IC surface must be less than Max. specification under any condition ,If the surface temperature is out of the specification, thermal solutions should be applied to avoid be damaged;

6.4 Driver IC ESD Specification

The Electro-Static Discharge tolerance of Source COF IC is $\pm 2KV$ tested by ESD Gun. Especially if the LCD module is designed with the Plastic Bezel, we suggest ESD protection solutions should be applied to avoid be damaged, as shown in Fig.3.4.

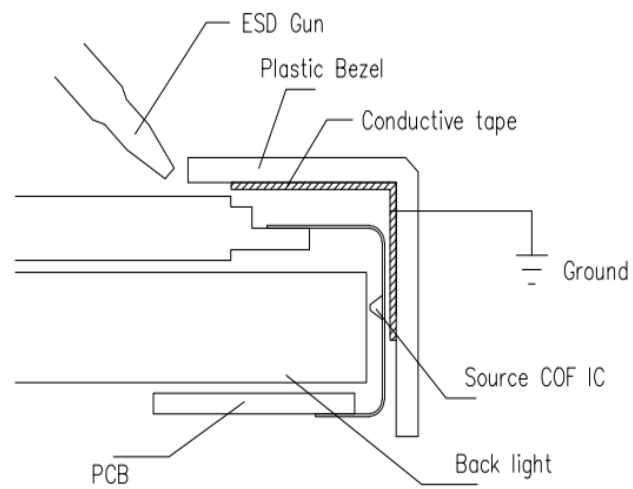


Fig. 3.4. Diver IC ESD protection

b. For the VCOM (Flicker) regulation and control, SDA and SCL must pull high in the flicker set, and the flicker set's VDD must be ready before the input power (VCC5V)

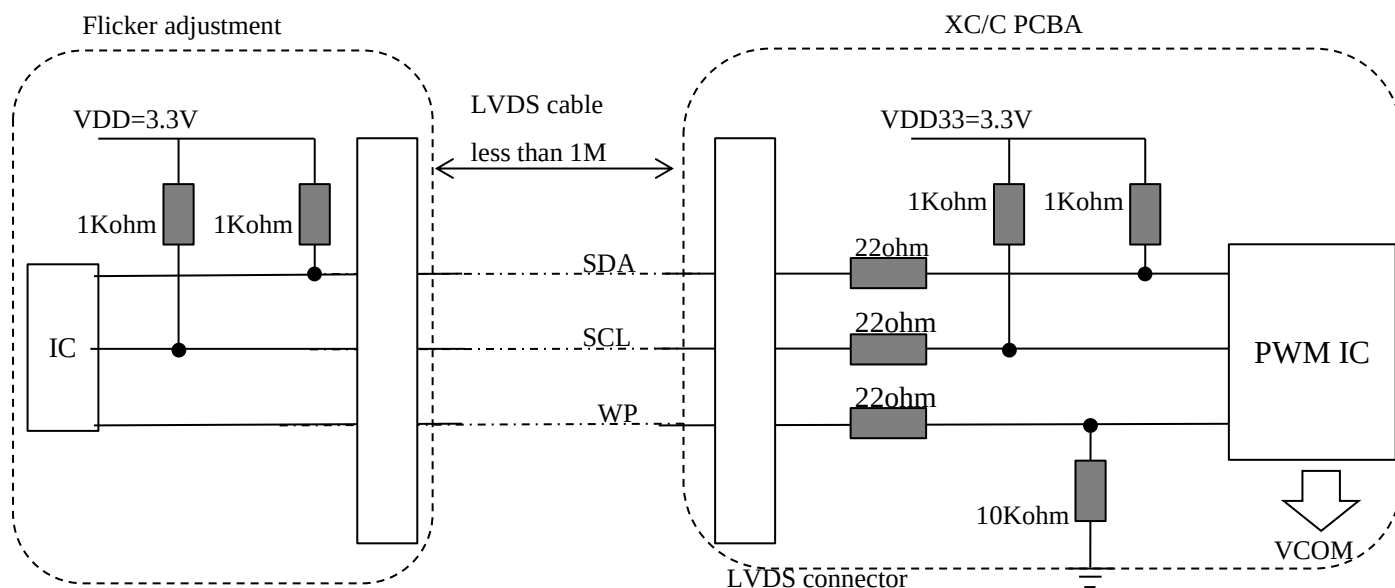


Fig. WP/SDA/SCL flicker set

7.0 Block Diagram of Interface

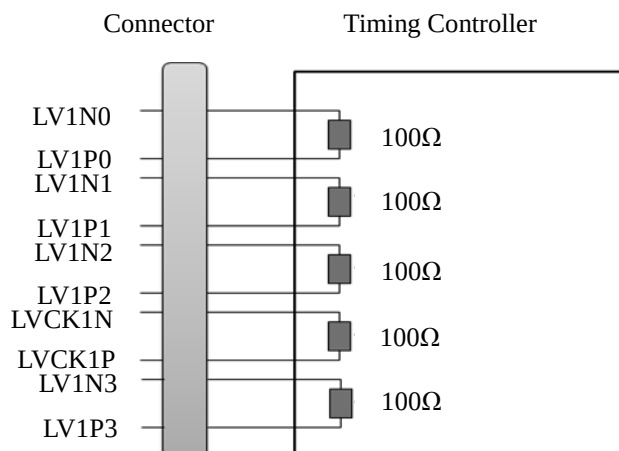


Fig. Block diagram of interface

Attention:

- (1) This open cell uses a 100 ohms (Ω) resistor between positive and negative lines of each receiver input.
- (2) LVDS cable impedance shall be 50 ohms per signal line or about 100 ohms per twist-pair line respectively.

7.1 LVDS Interface

7.1.1 VESA Format

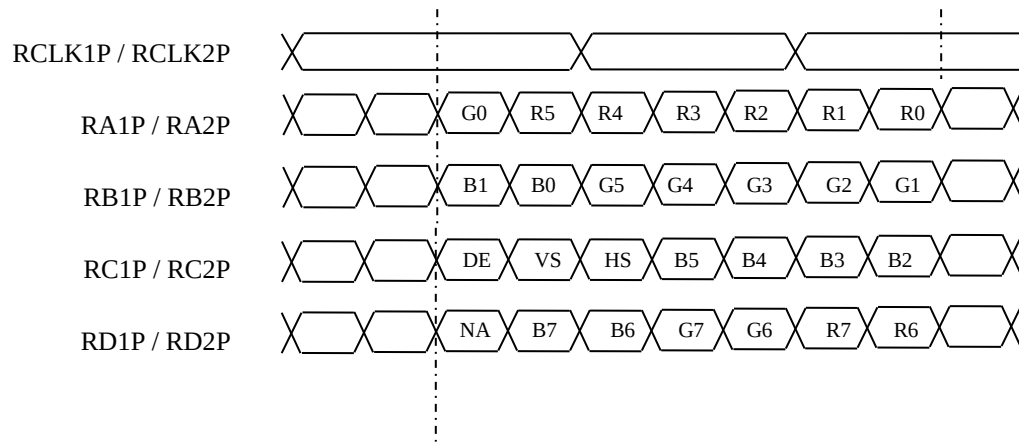
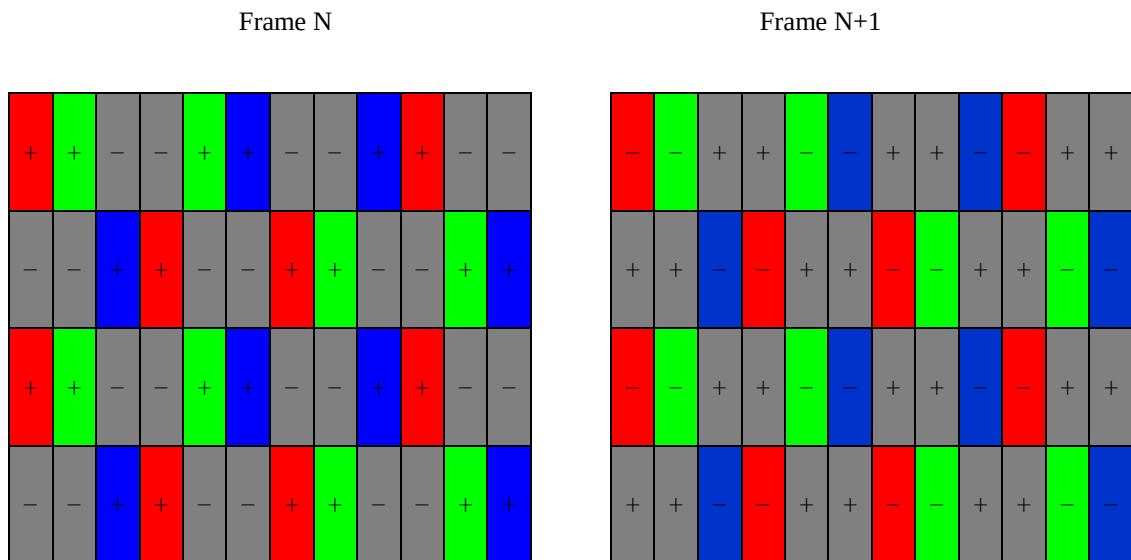


Fig. VESA format

8.0 Flicker Pattern

Flicker should be adjusted by the 2 Dot on/off pattern, where are displayed alternately at vertical line. (2 Dot inversion)

2 Dot on/off pattern



9.0 Interface Timing

9.1 Timing Table (DE Only Mode)

Signal	Item	Symbol	Min.	Typ.	Max.	Unit	Note
LVDS Receiver Clock	Frequency	Fclkin (=1/T _{CLK})	64	74.25	96	MHz	(1) (2)
	Input cycle to cycle jitter	Trcl	—	—	200	ps	(3)
	Spread spectrum modulation range	Fclkin_mod	Fclkin-3%	—	Fclkin+3%	MHz	(4)
	Spread spectrum modulation frequency	F _{SSM}	30	—	200	KHz	
LVDS Receiver Data	Receiver Skew Margin	T _{RSM}	-400	—	400	ps	(5)
Vertical Active Display Term	Frame Rate	F	48	60	75	Hz	
	Total	T _V	1092	1125	1745	T _H	T _V = T _{VD} + T _{VB}
	Display	T _{VD}	1080				1080
	Blank	T _{VB}	12	45	665	T _H	
Horizontal Active Display Term	Total	T _H	1046	1100	1174	T _{CLK}	T _H = T _{HD} + T _{HB}
	Display	T _{HD}	960				
	Blank	T _{HB}	86	140	214	T _{CLK}	

Note:

(1) The TFT LCD open cell is operated in DE only mode, H sync and V sync input signal have no effect on normal operation.

(2) Please make sure the range of pixel clock follows the following equations:

$$F_{clkin(max)} \geq F_{max} \times T_v \times T_h \quad F_{min} \times T_v \times T_h \geq F_{clkin(min)}$$

Main frequency Max is 96Mhz without spread spectrum

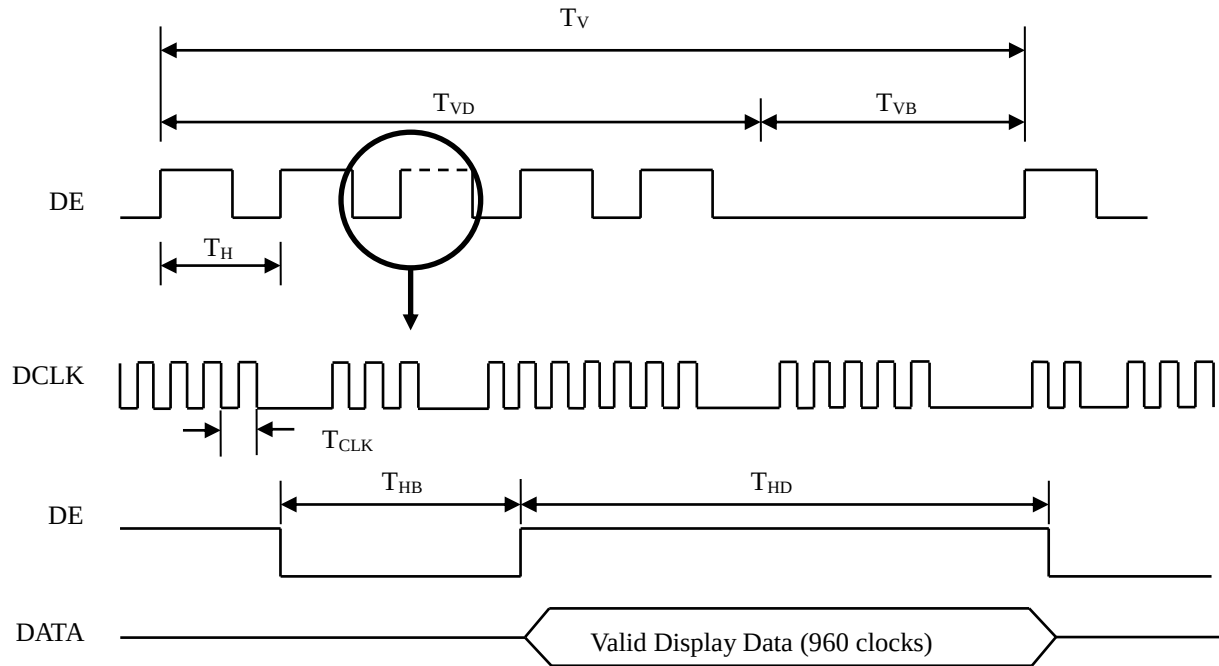


Fig. 5.1 Interface signal timing diagram

(3)The input clock cycle-to-cycle is defined as below figures.

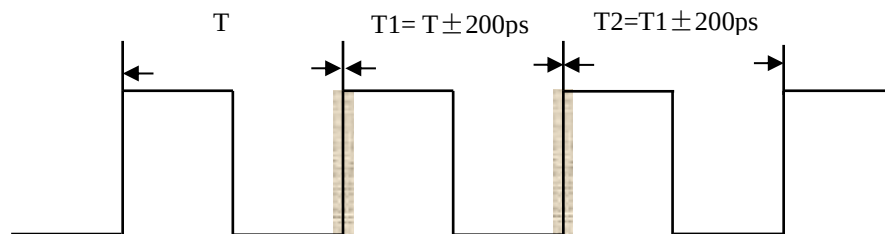


Fig. 5.2 Jitter

(4) The SSCG (Spread Spectrum Clock Generator) is defined as the following figure.

The LVDS SSCG 's suggestion is off by default, SOC board must test all validation if SOC board open the LVDS SSCG.

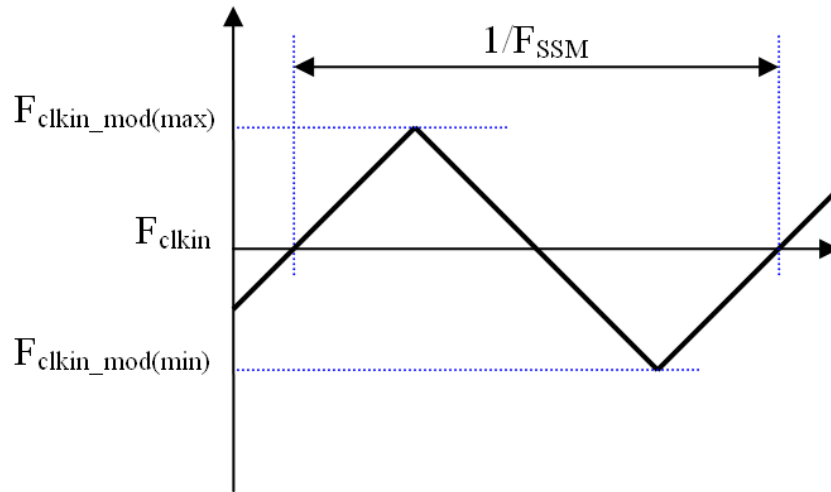


Fig. 5.3 SSCG

(5) The LVDS timing diagram and setup/hold time is defined and showed as the following figure.

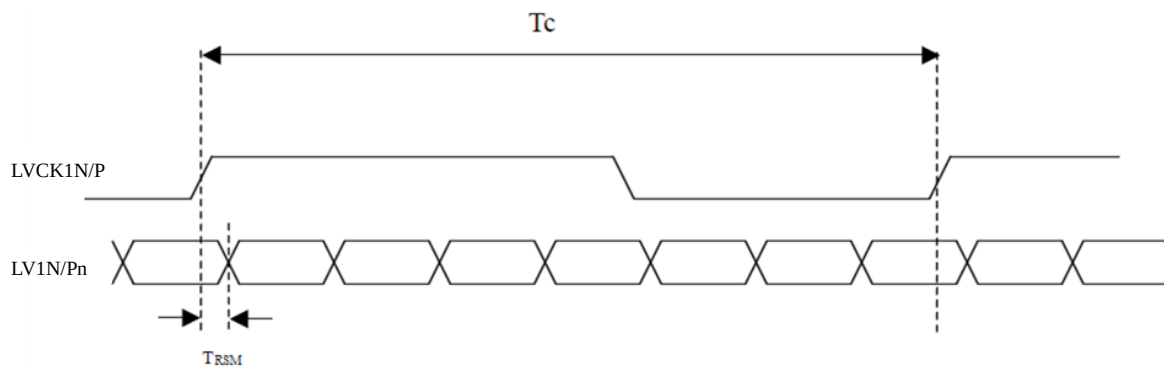


Fig.5.4 LVDS receive interface timing diagram

9.2 Power On/Off Sequence

To prevent a latch-up or DC operation of the Open cell, the power on/off sequence should be as the diagram below.

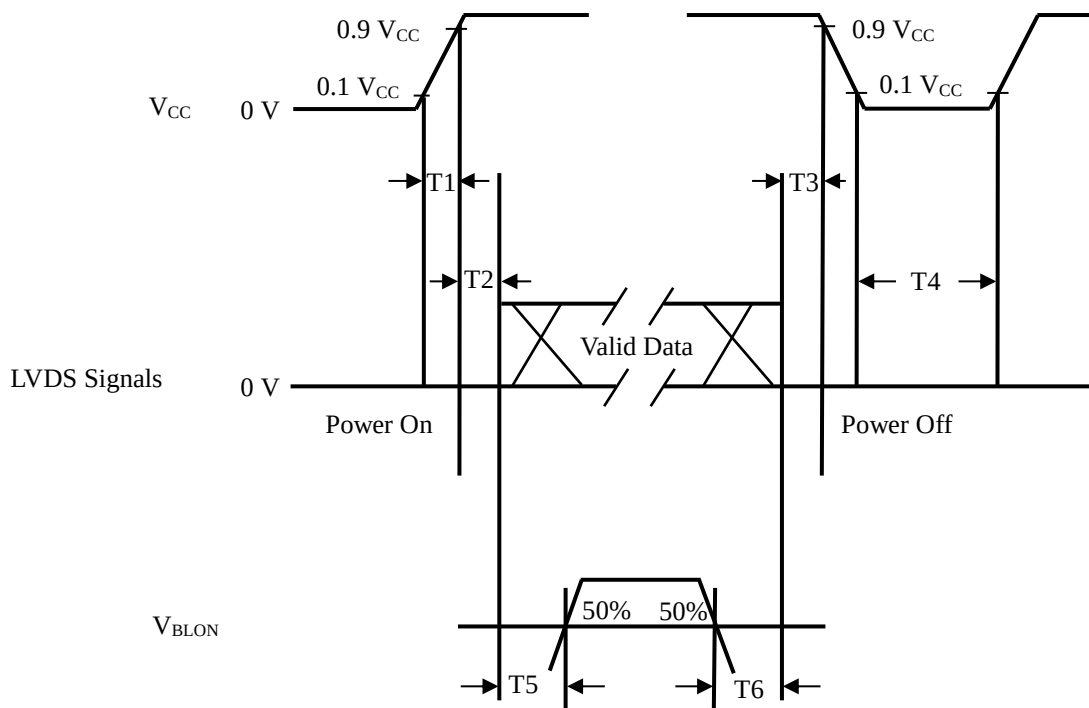


Fig.5.5 Power on/off sequence

Parameter	Values			Unit
	Min.	Typ.	Max.	
T1	0.5	-	10.0	ms
T2	0.0	-	50	ms
T3	0.0	-	50	ms
T4	1000.0	-	-	ms
T5	500.0	-	-	ms
T6	100.0	-	-	ms

Attention:

- (1) The supply voltage of the external system for the open cell input should follow the definition of V_{CC} .
- (2) When the customer's backlight turns on before the LCD operation or the LCD turns off before the backlight turns off, the display may momentarily become abnormal screen.
- (3) In case that V_{CC} is in off level, please keep the level of input signals on the low or high impedance. If $T2 < 0$, that may cause electrical overstress.
- (4) $T4$ should be measured after the module has been fully discharged between power off and on period.
- (5) Interface signal shall not be kept at high impedance when the power is on.

10.0 Optical Characteristics

10.1 Measurement Conditions

The table below is the test condition of optical measurement.

Item	Symbol	Value	Unit
Ambient Temperature	T_A	25 ± 2	$^{\circ}\text{C}$
Ambient Humidity	H_A	50 ± 10	%RH
Supply Voltage	V_{CC}	5	V
Driving Signal	Refer to the typical value in Chapter 3: Electrical Specification		
Vertical Refresh Rate	F_R	60	Hz

To avoid abrupt temperature change during optical measurement, it's suggested to warm up the LCD module more than 60 minutes after lighting the backlight and in the windless environment.

To measure the LCD cell, it is suggested to set up the standard measurement system as Fig. 6.1. The measuring area S should contain at least 500 pixels of the LCD cell as illustrated in Fig.6.2 (A means the area allocated to one pixel). In this model, for example, the minimum measuring distance Z is 370mm when θ is 2 degree. Hence, 500mm is the typical measuring distance. This measuring condition is referred to 301-2H of VESA FPDMS 2.0 about viewing distance, angle, and angular field of view definition.

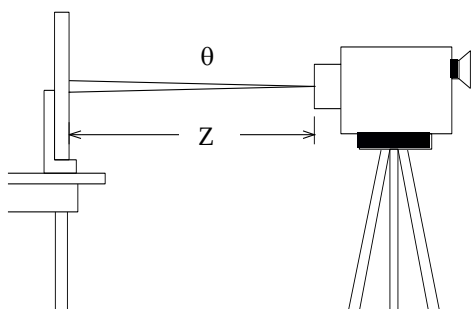


Fig. 6.1 The standard set-up system of measurement

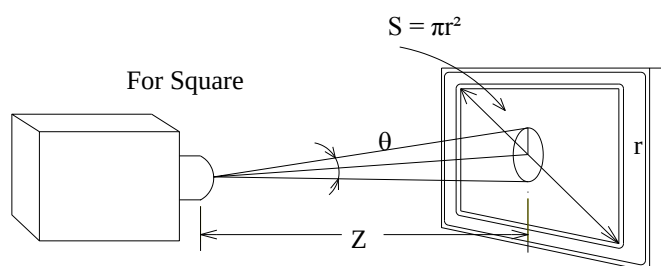


Fig. 6.2 The area S contains at least 500 pixels to be measured

$$N = \frac{S}{A} \geq 500 \text{ pixels}$$

N means the actual number of the pixels in the area S .

10.2 Optical Specifications

The table below of optical characteristics is measured by MINOLTA CS2000, MINOLTA CA310, ELDIM OPTI Scope-SA and ELDIM EZ contrast in dark room.

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Static Contrast Ratio		CR	$\theta_H = 0^\circ, \theta_V = 0^\circ$ Normal direction at center point with CSOT's BLU	2000	3000	-	-	(1) (2)
Response Time(OD off)		T _L		-	14	21	ms	(3)
Center Transmittance		T%		-	4.80	-	%	(2) (4)
Crosstalk		CT-2D		-	-	4%	-	(2) (5)
Color Chromaticity (CIE1931)	Red	R _X		Typ. - 0.03	0.638	Typ. + 0.03	-	(2) (6)
		R _Y			0.339		-	
	Green	G _X			0.306		-	
		G _Y			0.612		-	
	Blue	B _X			0.150		-	
		B _Y			0.069		-	
	White	W _X			0.280		-	
		W _Y			0.312		-	
	Color Gamut			CG	-	72	-	% NTSC
Viewing Angle	Horizontal	θ_{H+}	CR≥10	85	89	-	Deg.	(7)
		θ_{H-}		85	89	-		
	Vertical	θ_{V+}		85	89	-		
		θ_{V-}		85	89	-		

Note:

(1) Definition of static contrast ratio (CR):

It's necessary to switch off all the dynamic and dimming function when measuring the static contrast ratio.

$$\text{Static Contrast Ratio (CR)} = \frac{\text{CR} - W}{\text{CR} - D}$$

CR-W is the luminance measured by LMD (light-measuring device) at the center point of the LCD module with full-screen displaying white. The standard setup of measurement is illustrated in Fig. 6.3; CR-D is the luminance measured by LMD at the center point of the LCD module with full-screen displaying black. The LMD in this item is CS2000.

(2) The LMD in the item could be a spectroradiometer such as (KONICA MINOLTA) CS2000, CS1000 (TOPCON), SR-UL2 or the same level spectroradiometer. Other display color analyzer (KONICA MINOLTA) CA210, CA310 or (TOPCON) BM-7 could be involved after being calibrated with a spectroradiometer on each stage of a product.

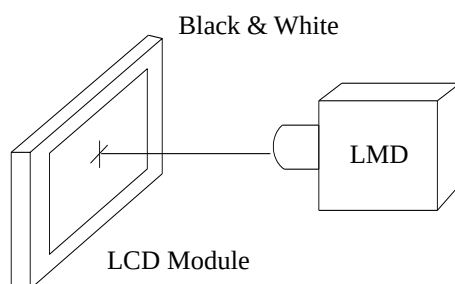


Fig. 6.3 The standard setup of CR measurement

- (3) Response time T_L is defined as the average transition time in the response time matrix. The table below is the response time matrix in which each element $t_{X \text{ to } Y}$ is the transition time from luminance ratio X to Y . X and Y are two different luminance ratios among 0%, 25%, 50%, 75%, and 100% luminance. The transition time $t_{X \text{ to } Y}$ is defined as the time taken from 10% to 90% of the luminance difference between X and Y ($X < Y$) as illustrated in Fig.6.4. When $X > Y$, the definition of $t_{X \text{ to } Y}$ is the time taken from 90% to 10% of the luminance difference between X and Y . The response time is optimized on refresh rate $F_r = 60\text{Hz}$.

Measured Transition Time		Luminance Ratio of Previous Frame				
		0%	25%	50%	75%	100%
Luminance Ratio of Current Frame	0%		$t_{25\% \text{ to } 0\%}$	$t_{50\% \text{ to } 0\%}$	$t_{75\% \text{ to } 0\%}$	$t_{100\% \text{ to } 0\%}$
	25%	$t_{0\% \text{ to } 25\%}$		$t_{50\% \text{ to } 25\%}$	$t_{75\% \text{ to } 25\%}$	$t_{100\% \text{ to } 25\%}$
	50%	$t_{0\% \text{ to } 50\%}$	$t_{25\% \text{ to } 50\%}$		$t_{75\% \text{ to } 50\%}$	$t_{100\% \text{ to } 50\%}$
	75%	$t_{0\% \text{ to } 75\%}$	$t_{25\% \text{ to } 75\%}$	$t_{50\% \text{ to } 75\%}$		$t_{100\% \text{ to } 75\%}$
	100%	$t_{0\% \text{ to } 100\%}$	$t_{25\% \text{ to } 100\%}$	$t_{50\% \text{ to } 100\%}$	$t_{75\% \text{ to } 100\%}$	

$t_{X \text{ to } Y}$ means the transition time from luminance ratio X to Y .

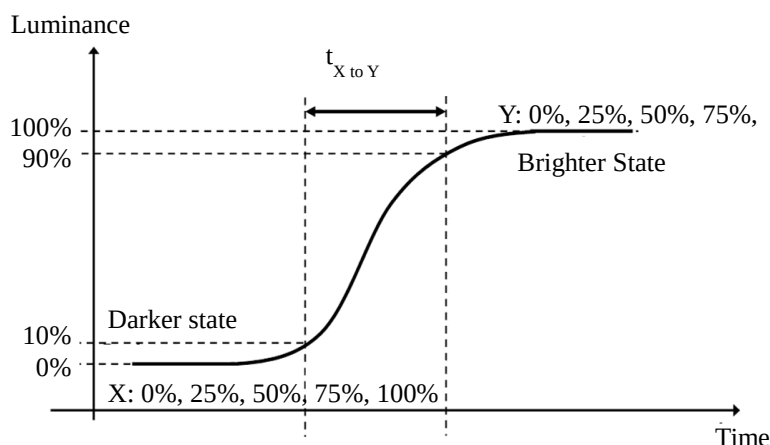


Fig. 6.4 The definition of $t_{X \text{ to } Y}$

All the transition time is measured at the center point of the LCD module by ELDIM OPTI Scope-SA.

(4) Definition of center Transmittance (T %):

The transmittance is measured with full white pattern (Gray 255)

$$\text{Transmittance (T\%)} = \frac{\text{Luminance of LCD module}}{\text{Luminance of backlight}}$$

(5) Definition of the crosstalk(CT-2D):

YA = Luminance of measured location without gray level 255 pattern (cd/m²)

YB = Luminance of measured location with gray level 255 pattern(cd/m²)

Definition of the crosstalk: $CT = \frac{YB-YA}{YA}$

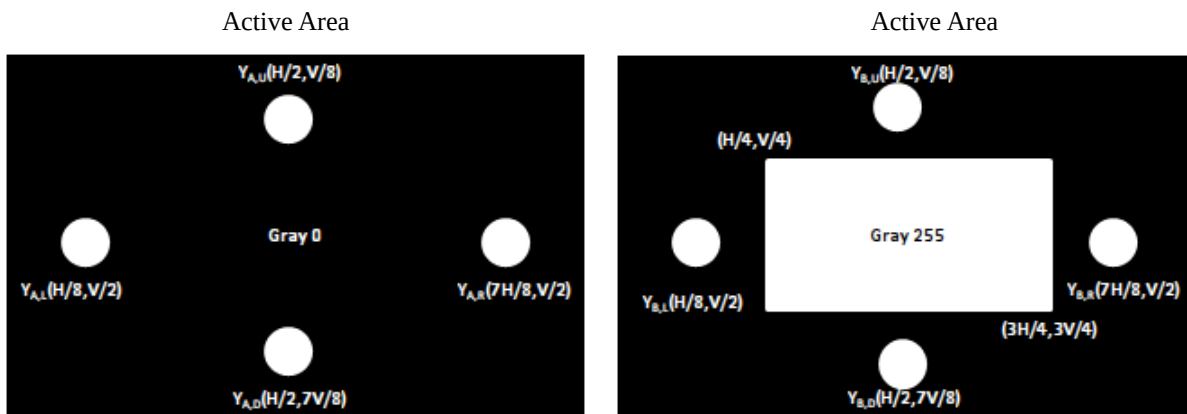


Fig. 6.5 The definition of 2D mode crosstalk

(6) Definition of color chromaticity:

Each chromaticity coordinates (x, y) are measured in CIE1931 color space when full-screen displaying primary color R, G, B and white. The color gamut is defined as the fraction in percent of the area of the triangle bounded by R, G, B coordinates and the area is defined by NTSC 1953 color standard in the CIE color space. Chromaticity coordinates are measured by CS2000 and the standard setup of measurement is shown in Fig. 6.6.

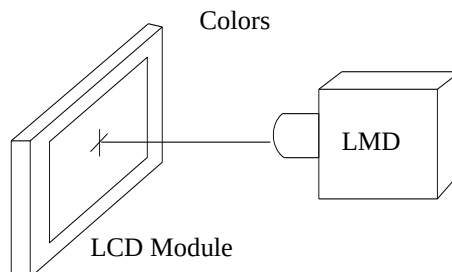


Fig. 6.6 The standard setup of color chromaticity measurement

(7) Definition of viewing angle coordinate system (θ_H , θ_V):

The contrast ratio is measured at the center point of the LCD module. The viewing angles are defined at the angle that the contrast ratio is larger than 10 at four directions relative to the perpendicular direction of the LCD module (two vertical angles: up θ_{V+} and down θ_{V-} ; and two horizontal angles: right θ_{H+} and left θ_{H-}) as illustrated in Fig. 6.7. The contrast ratio is measured by ELDIM EZ Contrast.

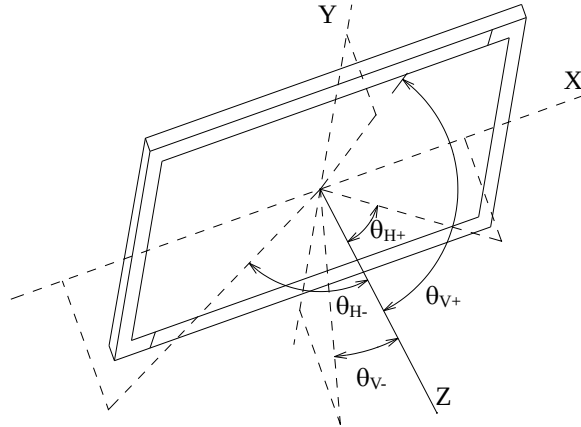


Fig. 6.7 Viewing angle coordination system

10.3 Reliability test items

No.	Test Item	Test Condition	Notes
1	High Temp. Storage	+60°C / 48H	1. Functional test is OK. Missing Segment, short, unclear segment non-display, display abnormally and liquid crystal leakage un-allowed. 2. No low temperature bubbles, end seal loose and fall, frame rainbow.
2	Low Temp. Storage	-10°C / 48H	
3	High Temp. Operating	+50°C / 48H	
4	Low Temp. Operating	-0°C / 48H	
5	High Temperature / Humidity storage	40°C x 90%RH / 48H	
6	Thermal and cold shock	Static state, -20°C (30min) ~60°C (30min), 50 cycles	
7	ESD test	±2KV, Human Body Mode, 150pF/330Ω; ±4KV, Air Mode, 150pF/330Ω;	

Note: All tests above are practiced at module type.

There is no display function NG issue occurred, All the cosmetic specification is judged before the reliability stress.

11.0 General Precaution

11.1 Use Restriction

This product is not authorized for use in life supporting systems, aircraft navigation control systems, military systems and any other application where performance failure could be life-threatening or otherwise catastrophic.

11.2 Assembly Precaution

- 1、 Please use the mounting hole on the module side in installing and do not bending or wrenching LCD in assembling. And please do not drop, bend or twist LCD module in handling.
 - 2、 Please design display housing in accordance with the following guide lines.
 - 3、 Housing case must be destined carefully so as not to put stresses on LCD all sides and not to wrench module. The stresses may cause non-uniformity even if there is no non-uniformity statically.
 - 4、 Keep sufficient clearance between LCD module back surface and housing when the LCD module is mounted. The clearance in the design is recommended taking into account the tolerance of LCD module thickness and mounting structure height on the housing.
 - 5、 Please do not push or scratch LCD panel surface with any-thing hard. And do not soil LCD panel surface by touching with bare hands. (Polarizer film, surface of LCD panel is easy to be flawed.)
 - 6、 Please do not press any parts on the rear side such as source IC, gate IC, and FPC during handling LCD module. If pressing rear part is unavoidable, handle the LCD module with care not to damage them.
 - 7、 Please wipe out LCD panel surface with absorbent cotton or soft cloth in case of it being soiled.
 - 8、 Please wipe out drops of adhesives like saliva and water on LCD panel surface immediately. They might damage to cause panel surface variation and color change.
- 11.2.7 Please do not take a LCD module to pieces and reconstruct it. Resolving and reconstructing modules may cause them not to work well.

11.3 Disassembling or Modification

Do not disassemble or modify the module. It may damage sensitive parts inside LCD module, and may cause scratches or dust on the display. does not warrant the module, if customers disassemble or modify the module.

11.4 Breakage of LCD Panel

- 1、 If LCD panel is broken and liquid crystal spills out, do not ingest or inhale liquid crystal, and do not contact liquid crystal with skin.
- 2、 If liquid crystal contacts mouth or eyes, rinse out with water immediately.
- 3、 If liquid crystal contacts skin or cloths, wash it off immediately with alcohol and rinse thoroughly with water.
- 4、 Handle carefully with chips of glass that may cause injury, when the glass is broken.

11.5 Absolute Maximum Ratings and Power Protection Circuit

- 1、 Do not exceed the absolute maximum rating values, such as the supply voltage variation, input voltage variation, variation in parts' parameters, environmental temperature, etc., otherwise LCD module may be damaged.
- 2、 Please do not leave LCD module in the environment of high humidity and high temperature for a long time.
- 3、 It's recommended employing protection circuit for power supply.

11.6 Operation

- 1、 Do not touch, push or rub the polarizer with anything harder than HB pencil lead. Use fingerstalls of soft gloves in order to keep clean display quality, when persons handle the LCD module for incoming inspection or assembly.
- 2、 When the surface is dusty, please wipe gently with absorbent cotton or other soft material.
- 3、 Wipe off saliva or water drops as soon as possible. If saliva or water drops contact with polarizer for a long time, they may causes deformation or color fading.
- 4、 When cleaning the adhesives, please use absorbent cotton wetted with a little petroleum benzine or other adequate solvent.

11.6 Static Electricity

- 1、 Protection film must remove very slowly from the surface of LCD module to prevent from electrostatic occurrence.
- 2、 Because LCD module uses CMOS-IC on TFT-LCD panel, it is very weak to electrostatic discharge. Please be careful with electrostatic discharge.
- 3、 Persons who handle the module should be grounded through adequate methods.

11.7 Disposal

When disposing LCD module, obey the local environmental regulations.

11.8 OTHERS

- 1、 A strong incident light into LCD panel might cause display characteristics' changing inferior because of polarizer film, color filter, and other materials becoming inferior. Please do not expose LCD module direct sunlight land strong UV rays.
- 2、 Please pay attention to a panel side of LCD module not to contact with other materials in preserving it alone.
- 3、 For the packaging box, please pay attention to the followings:
- 4、 Packaging box and inner case for LCD are designed to protect the LCDs from the damage or scratching during transportation. Please do not open except picking LCDs up from the box.
- 5、 Please do not pile them up more than 6 boxes. (They are not designed so.) And please do not turn over.
- 6、 Please handle packaging box with care not to give them sudden shock and vibrations. And also please do not throw them up.
- 7、 Packing box and inner case for LCDs are made of cardboard. So please pay attention not to get them wet. (Such like keeping them in high humidity or wet place can occur getting them wet.)

12.0 Packing form-TBD

深圳市丽台电子有限公司

Incoming Inspection Standards

来料检验标准

Model No. / 产品型号: Applies More than 21.5 Inches Touch Display Screen**Updated Date / 生效日期:** 2022-05-20**Version / 版本:** A0**Customer confirmation :** _____

Record of Revision / 修订履历

Version / 版本	Revision Record / 修订内容	Reviser / 修订人	Revision Date / 修订日期
V0	首发 / Starting		2022.05.20

1.Scope of application /适用范围.

This document shall be applied to more than 10.0 inches touch display screen.

本文件适用于5.5~10.0 寸触摸显示屏.

2.Inspection conditions and environment /检验条件与环境.

2.1 Inspection Conditions /检验条件:

(1) Inspection Distance /检测距离: 35cm ±5cm.

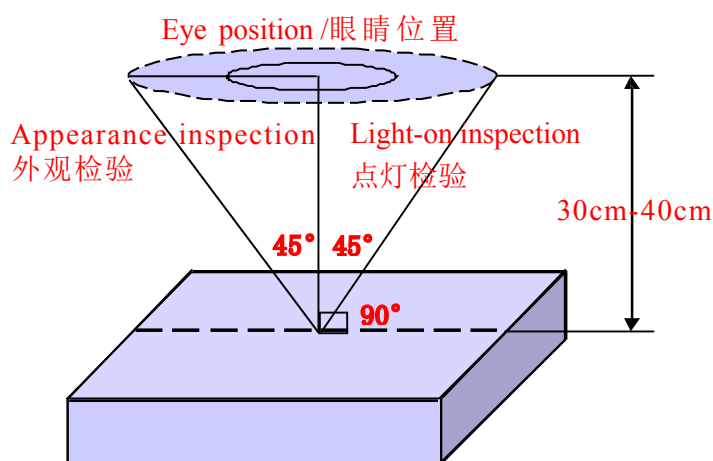
(2) Check time /检验时间:

Displays performance test /功能测试: 3~5S /Image, Cosmetic Inspection /外观检验:12~15S.

(3) Check the viewing angle /检验视角:

Light-on Inspection Angle /点灯检验角度: ±45°.

Cosmetic Inspection Angle /外观检验角度: ±45°.



(Perpendicular to LCD panel surface /垂直于LCD表面)

2.2 Inspection environment /检验环境:

Ambient Temperature 温度		25°C±5°C
Ambient Humidity 湿度		55±5%RH
Ambient Illumination 亮度	Cosmetic Inspection 外观检验	800-1000 Lux
	Functional Inspection 点灯检验	200~300Lux

2.3 Sampling Conditions /抽样条件:

(1) Quantity to be inspected /批量: Quantity of shipment lot per model /单次运送单一型号数量.

(2) Sampling method /抽样方法:

Sampling Plan /抽样计划		GB/T 2828.1- 2003
		Normal Inspection , Single Sampling 正常检验、单次抽样
		General inspection level: II 一般检验水平: 二级
AQL	Major Defect /主要缺陷	0.65
	Minor Defect /次要缺陷	1.0

(3) The classification of Major(MA) and Minor(MI) defects is shown as “3.1 Classification of defects” .
主缺(MA)及次缺(MI)定义于”3.1缺陷分类”.

3.Terms And Definitions /术语和定义

3.1 Classification of defects / 缺陷分类:

(1) Major defects /主要缺陷:

A major defect is a defect that is likely to result in failure, or to reduce materially the usability of the product for its intended purpose .

可导致产品功能失效或减少产品可用性的缺陷.

(2) Minor defects /次要缺陷:

It will not cause the product to fail and reduce the defects in the effective use and operation of the product.

不会导致产品功能失效和减少产品的有效使用与操作的缺陷.

3.2 Point defects /点状缺陷:

The size of the point defect is defined by the diameter D, and the average diameter of the defect is

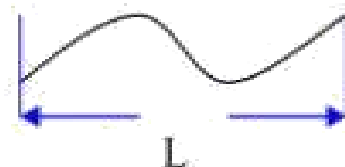
$$D=1/2 (W+L) .$$

点状缺陷的大小是由直径 D 定义的, 缺陷的平均直径 $D=1/2(W+L)$.

3.3 Linear defects /线状缺陷:

When defect size $L \geq 2W$, the defect count as liner type defect. Size of linear defect is defined by length (L) and the maximum width (W).

当缺陷尺寸 $L \geq 2W$ 时, 被视为线状缺陷, 线状缺陷是由长度 (L) 和最大宽度 (W) 定义的.



3.4 LCD sub-pixel dot /LCD子像素点

(1) Definition /定义 : The point defect area is greater than 50% of the LCD sub-pixel area, and is visible through ND5% filter masking .

子像素点缺陷面积大于 50% LCD子像素面积, 且透过 ND5%遮盖是可见的.

(2) The drawing of 1/2 area sub-pixel definition / 1/2 面积的子像素定义绘图:

The 1/2 area sub-pixel can be defined as below one or more of specific shapes

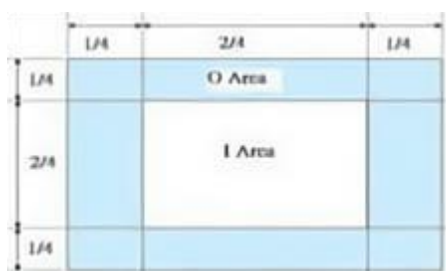
1/2 面积的子像素可以定义为如下一个或多个特定形状图:



3.5 Small bright dot /细碎亮点 :

Point defects smaller than "LCD sub-pixels" /小于“LCD子像素点”的点缺陷.

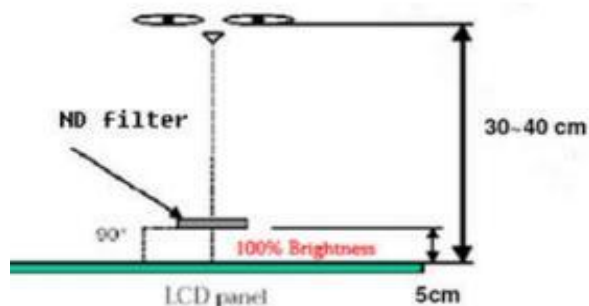
(Ratio of Zone I to Zone O /I 区与 O 区比例: 1: 2: 1)



3.6 ND filter inspection method /ND卡的检验方法:

Hold the ND filter about 5cm above the display area, with your eyes 30-40cm away from the panel, and observe for 2~3 seconds.

在显示区域上方大约 5cm 处握住 ND 卡, 眼睛距离面板 30-40cm, 观察2~3 秒.



3.7 Any FPC surface problems that do not leak copper on the surface and do not cause functional failure are acceptable.

任何 FPC 表面问题, 表面未露铜和不造成功能失效是可以接受.

3.8 Extraneous substances that can be wiped out , like Finger point,Particles are not considered as a defect .

可以被擦拭干净的表面物质不视为缺陷 (如手指印, 尘粒) .

3.9 Defects that can be covered by the material and are not visible in appearance are not considered defects.

能被物料覆盖，外观不可见的缺陷不视为缺陷。

3.10 Panel damage /面板损伤：

Glass damage outside the AA display area that does not affect the effective wiring is acceptable.

AA 显示区域以外的玻璃损伤，不影响有效线路是可以接受的。

3.11 Issues not specified or defined in this acceptance standard shall be handled through friendly negotiation between the two parties.

本允收标准中未规定或定义的问题，双方友好协商处理。

4. Inspection standards /检验标准

4.1 Structural Dimensions /结构尺寸规格

Serial Number 序号	Measurement items /测量项目		Specification /规格	Remark /备注
	名称 /Name	Unit /单位	Tolerance /公差	
1	Outside dimension: Length 尺寸：长	mm /毫米	0.15mm~0.30mm	Please refer to the product specification for detailed dimensions and tolerances 详细的尺寸规格和公差请参考产品规格书
2	Outside dimension: Width 尺寸：宽	mm /毫米	0.15mm~0.30mm	
3	Outside dimension: Thickness 尺寸：高	mm /毫米	0.30mm~0.50mm	

4.2 Appearance Inspection Specification /外观检验规格

(D : diameter, W : width, L : length, N : quantity, DS : spacing)

Inspection area 检验区域	Inspection items 检验项目	Inspection specifications 检验规格	Defect category 缺陷类别	
Glass 玻璃	Wire(on Array) 线路	Can't be damaged 不能损伤	MA	
	Chipping/corner breaking 崩边/破角	Can't affect the effective lines and functions 不能影响有效线路和功能	MA	
	Edge 边缘	There must be no extensional cracks 不可有延伸性裂纹	MA	
Silicone 硅胶	Silicone coating 硅胶涂布	The height must not exceed the LCD CF surface 高度不能超过LCD CF面		MI
	Glue overflow 溢胶	Can't cover FPC, POL, etc 不能覆盖到FPC、POL等		MI

Inspection area 检验区域	Inspection items 检验项目	Inspection specifications 检验规格	Defect category 缺陷类别	
PCBA FPC Connector 连接器	Appearance 外观	Scratches or injuries are not allowed to cause copper exposure 划伤或损伤不允许表面出现露铜		MI
	Component 元器件	Can't be damaged and lack 不能损伤和缺少	MA	
	Goldfinger oxidation 金手指氧化	Not allowed 不允许		MI
	Connection status 连接状况	The connection must be accurate and stable 必须准确稳定连接	MA	
	Break 破裂	Not allowed 不允许	MA	
	Soldering, false soldering/tinning/tin beads 假焊/连锡/锡珠	Not allowed 不允许	MA	
POL 偏光片	Scratches 划伤	1. $W \leq 0.10\text{mm}$; $L \leq 5\text{mm}$, Ignore (忽略) 2. $0.10\text{mm} < W \leq 0.15\text{mm}$; $L \leq 5\text{mm}$; $N \leq 5$; $DS \geq 10\text{mm}$ 3. $0.15\text{mm} < W$; $5\text{mm} < L$, Not allowable (不允许)		MI
	Dent 凹凸印	1. $D \leq 0.25\text{mm}$, Ignore (忽略) 2. $0.25\text{mm} < D \leq 0.50\text{mm}$; $N \leq 5$; $DS \geq 10\text{mm}$ 3. $0.50\text{mm} < D$, Not allowable (不允许)		MI
	Bubbles 气泡	1. $D \leq 0.25\text{mm}$, Ignore (忽略) 2. $0.25\text{mm} < D \leq 0.50\text{mm}$; $N \leq 5$; $DS \geq 10\text{mm}$ 3. $0.50\text{mm} < D$, Not allowable (不允许)		MI
	Point defects 点状不良	1. $D \leq 0.25\text{mm}$, Ignore (忽略) 2. $0.25\text{mm} < D \leq 0.50\text{mm}$; $N \leq 5$; $DS \geq 10\text{mm}$ 3. $0.50\text{mm} < D$, Not allowable (不允许)		MI
	Edge bubbles 边缘气泡	1. Within 1/2BM of the display area, it is not allowed 显示区往外 1/2BM 区域内, 不允许 2. The display area is 1/2 outside the BM area, and it is not controlled 显示区往外 1/2BM 区域以外, 不管控		MI
	Dirty/watermarked 脏污/水印	No dirt/water lines/finger marks are allowed, and must be wiped clean 不允许有脏污/水印/手指印, 须擦拭干净方可		MI
	Warping 起翘	Not allowed 不允许		MI
	Attaching offset 贴偏	It is necessary to completely cover the display area outward, within the 1/2BM area, or without leaking POL edges after TP is attached 需完整覆盖显示区往外、1/2BM 区以内或贴合 TP 后不会出现漏偏光片边缘		MI
	Mixture 混料	Mixing different types of POL or not using POL as required by the BOM, not allowed 不允许混贴不同型号的 POL 或未按 BOM 要求使用 POL	MA	

Inspection area 检验区域	Inspection items 检验项目	Inspection specifications 检验规格	Defect category 缺陷类别	
TP&CG	Point defects 点状不良	1. $D \leq 0.25\text{mm}$, Ignore (忽略) 2. $0.25\text{mm} < D \leq 0.50\text{mm}$; $N \leq 5$; $DS \geq 10\text{mm}$ 3. $0.50\text{mm} < D$, Not allowable (不允许)		MI
	Scratches 划伤	1. $W \leq 0.10\text{mm}$; $L \leq 5\text{mm}$, Ignore (忽略) 2. $0.10\text{mm} < W \leq 0.15\text{mm}$; $L \leq 5\text{mm}$; $N \leq 5$; $DS \geq 10\text{mm}$ 3. $0.15\text{mm} < W$; $5\text{mm} < L$, Not allowable (不允许) 4. There is a feeling scratch, Not allowable 有感划伤, 不允许		MI
	Edges and corners cracked 崩角/崩边	1. Product front / 产品正面: Edge and corner chipping is not allowed 崩角、崩边不允许 2. Product back / 产品背面: $X \leq 0.5$, $Y \leq 0.5$, $Z \leq 1/2T$; $N \leq 5$; $DS \geq 10\text{mm}$		MI
	Silk screen 丝印	The silk screen is clear, complete and correct 丝印清晰、完整、内容正确		MI
	Dirty 脏污	Non-wipeable dirt, not allowed 不可擦拭的脏污, 不允许		MI
	Broken 破损	Not allowable 不允许	MA	
	Ink color aberration 油墨色差	$\Delta E > 1$, Not allowable (不允许)		MI
	Cover pinholes 针孔	1. $D \leq 0.20\text{mm}$, $N \leq 5$, $DS \geq 10\text{mm}$, allowable 2. $D > 0.20\text{mm}$, intensive pinholes (密集型针孔), Not allowable (不允许)		MI
	IR holes IR孔	Dirt, deviation, color difference, etc. are not allowed 不允许脏污、偏位、色差等		MI
BL 背光	Backlight separation 背光分离	Not allowable 不允许		MI
	Deformation of rubber iron and rubber frame 胶铁、胶框变形	Use the plug gauge 0.3mm on the flat surface and can snap in and judge NG 在平面上使用塞规0.3mm卡翘曲位置, 能卡进判定NG		MI
	The iron frame is oxidized and not tightened 铁框氧化、卡不紧	Not allowable 不允许		MI
	Backlight sticky solder beads, glue, etc 背面粘锡珠、残胶等	Not allowable 不允许		MI
	Inkjet coding, Barcode, QR code 喷码/条码/二维码	The Inkjet coding is clear and complete, the barcode and QR code can be scanned normally, and the content and format match 喷码清晰完整、条码和二维码可正常扫描, 内容和格式相符		MI
	Accessories (protective film, double-sided tape, insulating adhesive, etc.) 辅料(保护膜、双面胶、绝缘胶等)	Defects such as missing pastes, sticking deviations, defects, and fractures are not allowed 不允许有漏贴、贴偏、残缺、断裂等缺陷		MI

4.3 Electrical test specifications /电性检查规格

(D : diameter, W : width, L : length, N : quantity, DS : spacing)

Inspection items 检验项目	Inspection specifications 检验规格	Defect category 缺陷类别	
Glass bright spots/dark spots 玻璃亮点/暗点	1. $D \leq 0.25\text{mm}$, Ignore (忽略) 2. $0.25\text{mm} < D \leq 0.50\text{mm}$; $N \leq 5$; $DS \geq 10\text{mm}$ 3. $0.50\text{mm} < D$, Not allowable (不允许)		MI
Mura	Use ND5% filter masking, visual invisibility is OK, 200~300Lux 使用ND5%遮盖, 目视不可见即为OK, 200~300Lux		MI
Small bright dot 细碎亮点	Use ND5% filter masking, visual invisibility is OK 使用ND5%遮盖, 目视不可见即为OK		MI
Light leakage 漏光	1. Use ND5% filter masking, visual invisibility is OK 使用ND5%遮盖, 目视不可见即为OK 2. If necessary, sign off on the sample 必要时, 签限定样		MI
Backlight black/white dots 背光黑点/白点	1. $D \leq 0.25\text{mm}$, Ignore (忽略) 2. $0.25\text{mm} < D \leq 0.50\text{mm}$; $N \leq 5$; $DS \geq 10\text{mm}$ 3. $0.50\text{mm} < D$, Not allowable (不允许)		MI
Linear foreign bodies 线状异物 (异物毛丝等)	1. $W \leq 0.10\text{mm}$; $L \leq 5\text{mm}$, Ignore (忽略) 2. $0.10\text{mm} < W \leq 0.15\text{mm}$; $L \leq 5\text{mm}$; $N \leq 5$; $DS \geq 10\text{mm}$ 3. $0.15\text{mm} < W$; $5\text{mm} < L$, Not allowable (不允许)		MI
Black/White Print 黑印/白印	Use ND5% filter masking, visual invisibility is OK 使用ND5%遮盖, 目视不可见即为OK		MI
The display is uneven 显示不均匀	Use ND5% filter masking, visual invisibility is OK 使用ND5%遮盖, 目视不可见即为OK		MI
The brightness is uneven 亮度不均匀	Brightness uniformity $< 85.0\%$, Not allowable 亮度均匀性 $< 85.0\%$, 不允许		MI
Displacement of the membrane 膜材移位	Not allowable 不允许		MI
Interference pattern/Newtonian pattern 干涉纹/牛顿纹	Not allowable 不允许		MI
Display abnormal 显示异常	Not allowable 不允许	MA	
No display 无显示	Not allowable 不允许	MA	
Line/Missing Drawing 线条/缺画	Not allowable 不允许	MA	
Splash screen 闪屏	Not allowable 不允许	MA	
LCD grid LCD网格	Not allowable 不允许	MA	
Afterimage 残影	Not allowable 不允许	MA	
Wrong viewing angle 视角错误	Not allowable 不允许	MA	
No touch 无触摸	Not allowable 不允许	MA	
Touch the jump point 触摸跳点	Not allowable 不允许	MA	
Not sensitive 触摸不灵敏	Not allowable 不允许	MA	