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TFT MODULE SPECIFICATION FOR CUSTOMER'S APPROVAL

CUSTOMER : _____

MODULE TYPE: GDT-5.0S480854N005-CT

APPROVED BY: (FOR CUSTOMER USE ONLY)

Prepared By	Checked By	Approved By	MT File NO.	Date Issued
LIN				2024-11-11

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To be very careful!

The TFT drivers ICs are made by COMS process, which are very easy to be damaged by static charge, make sure the user is grounded when handling the LCM.

1、 Features

NO.	Item	Contents	Unit
1	Power supply	+3.3	V
2	LCD Size	5.0	inch
3	Resolution	480(RGB) * 854	
4	LCD Type	a-SI TFT/ Transmissive	
5	Display Mode	Normally black	-
6	Display Colors	16.7M	colors
7	Viewing Direction	ALL	O'clock
8	TFT Drive IC	GC9503V	
9	Interface	SPI + 24BIT RGB	
10	Backlight	12 White LED	-
11	Luminance(cd/m2)	350 (TYP)	Cd/m2
12	Touch IC	GT911	
	Surface hardness		
	Touch structure	GFF	
	ROHS Compliant		

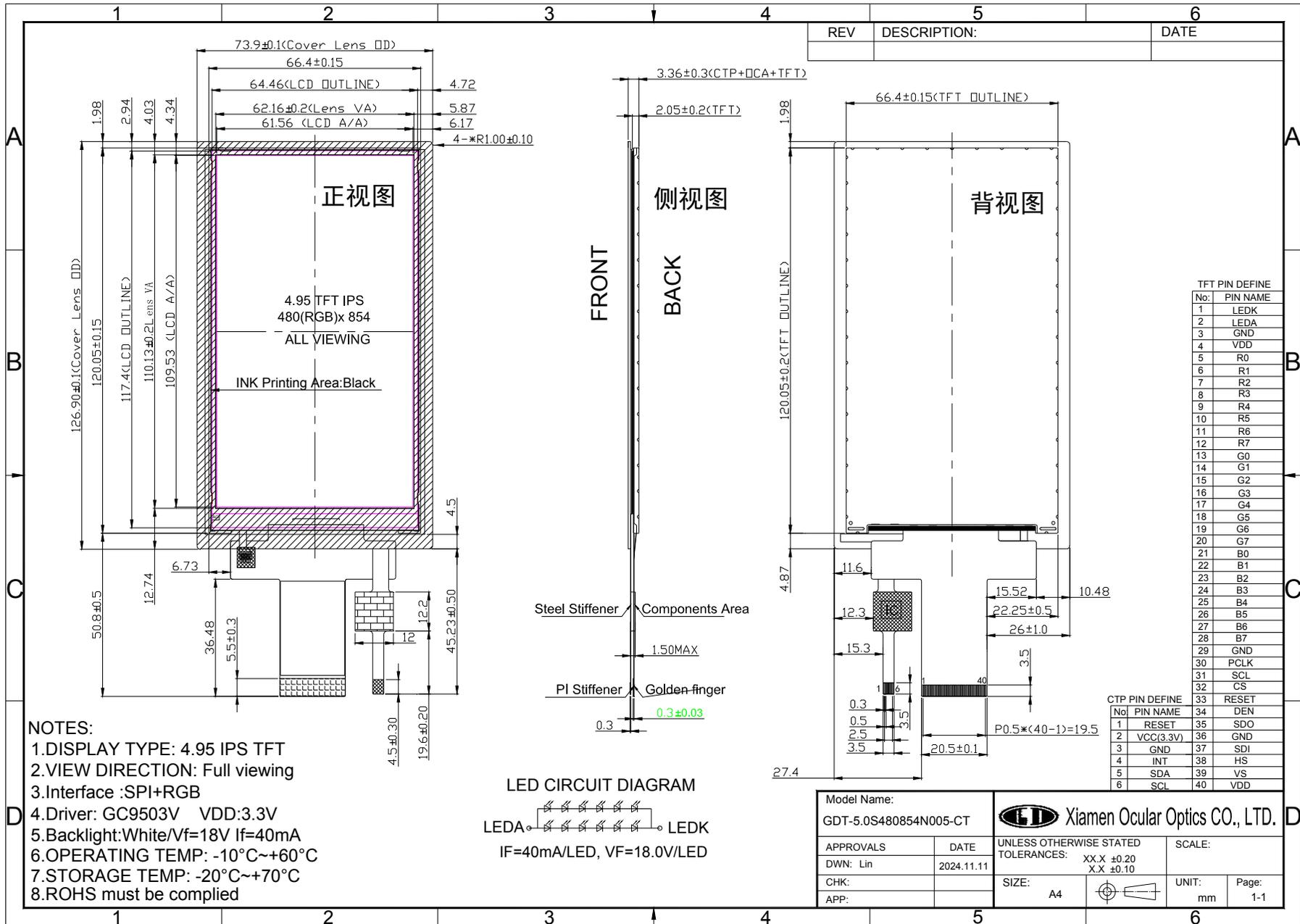
2、 Mechanical Specifications

Item	Dimension	Unit
Viewing Area (W*H)	62.16 * 110.13	mm
Active Area(W*H)	61.56 * 109.53	mm
Pixel Size (W*H)	0.12852(RGB) * 0.12852	mm
Module Size (W*H*D)	73.9 * 126.9 * 3.35	mm

3、 Absolute Maximum Ratings

Item	Symbol	Min	Max	Unit
Power supply for Logic	V _{DD} -V _{SS}	-0.3	3.6	V
Input voltage	V _{IN}	-0.3	VDD	
Supply Power for LED backlight	V _{LED}	-	19.5	
Supply current for LED backlight	I _{LED}	-	50	mA
Operating temperature range	Top	-10	+60	°C
Storage temperature range	Tst	-20	+70	

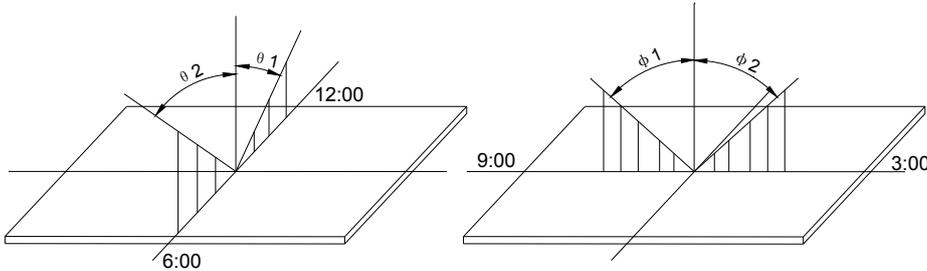
4、Outline dimension



5、Interface Pin Description

Pin No.	Symbol	I/O	Function
1	VLEDK	I	Power for LED backlight cathode
2	VLEDA	I	Power for LED backlight anode
3	GND	I	Ground.
4	VDD	I	Power voltage for I/O System
5-12	R0-R7	I	DATA BUS
13-20	G0-G7	I	DATA BUS
21-28	B0-B7	I	DATA BUS
29	GND	I	Ground.
30	PCLK	I	Dot Clock Signal
31	SCL	I	Serial input clock
32	/CS	I	Chip select signal, When /CS='L', the chip select becomes active, and data/command I/O is enabled
33	RESET	I	Global reset pin
34	DE	I	Input Data Enable Control
35	SDO	O	Serial output signal in SPI I/F
36	GND	I	Ground.
37	SDI	I	Serial input data
38	HS	I	Horizontal synchronization signal
39	VS	I	Vertical synchronization signal
40	VDD	I	Power voltage for I/O System

6、 Optical characteristics

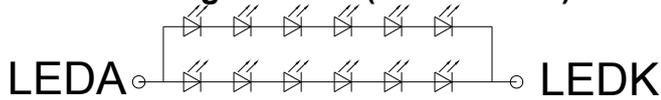


TFT type display module (Ta=25°C)

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Viewing angle	$\theta 1$	$C_r \geq 10$		80		deg
	$\theta 2$			80		
	$\Phi 1$			80		
	$\Phi 2$			80		
Contrast ratio	C_r		600	800	-	-
Response time (rise)	T_r	-	-	15		ms
Response time (fall)	T_f	-	-	20		

7、 Electrical characteristics

LED Backlight circuit (color: White)



LED ratings

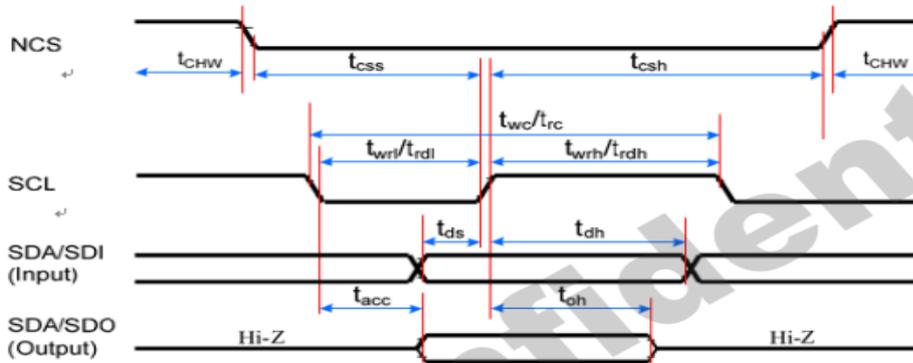
Item	Symbol	Min	Typ.	Max	Unit
Forward Voltage	V_f	16	18	19	V
Forward current	I_f		40	50	mA
Power	P			0.95	W
Color Chromaticity	W_x		0.298		
	W_y		0.339		
Luminance	L_v	300	350	-	Cd/m ²
Operating LED life time	H_r	20000			Hours
Operating temperature range	V_{op}	-20	-	+70	°C
Storage temperature range	V_{st}	-30	-	+80	

DC characteristics

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Power Supply voltage	V_{DD}		2.4	2.8	3.3	V
Standby Current	I_{SC}		-	-	50	uA
Operation Current	I_{OC}	No Load@ FR=60Hz	-	10	-	mA
“H” level input voltage	V_{IH}		0.7V _{DD}	-	V _{DD}	V
“L” level input voltage	V_{IL}		0	-	0.3V _{DD}	
“H” level output voltage	V_{OH}		0.75V _{DD}	-	-	
“L” level output voltage	V_{OL}		-	-	0.4	

8.8 AC Characteristics

8.8.1 Display Serial Interface Timing Characteristics (3-line SPI system)

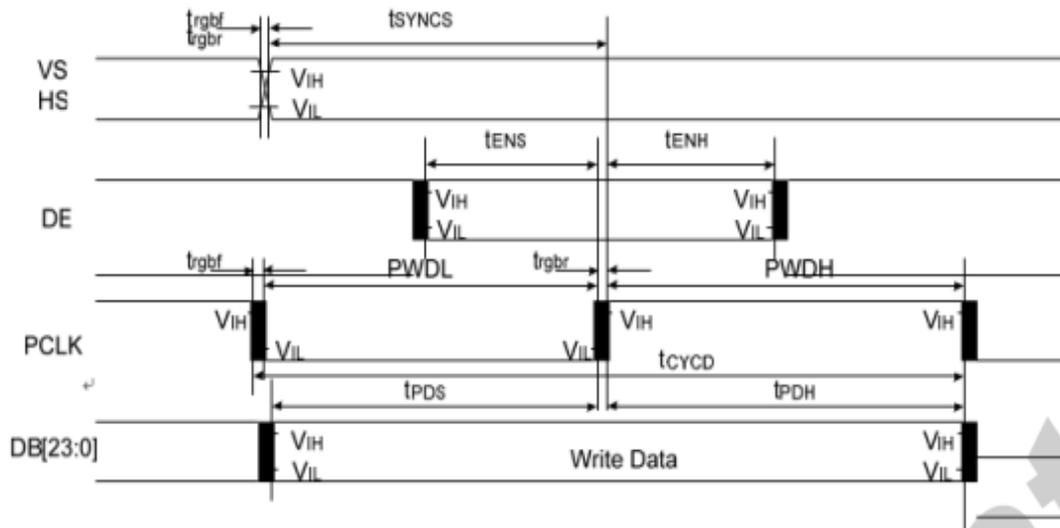


Signal	Symbol	Parameter	min	max	Unit	Description ^{1,2}
CSX ¹	t _{CSS}	Chip select time (Write)	15	-	ns ¹	
	t _{CSH}	Chip select hold time (Read)	15	-	ns	
	t _{CHW}	CS "H" pulse width	40	-	ns	
SCL ¹	t _{WC/TC}	Serial clock cycle (Write)	30	-	ns	
	t _{WRH}	SCL "H" pulse width (Write)	10	-	ns	
	t _{WRL}	SCL "L" pulse width (Write)	10	-	ns	
	t _{RC}	Serial clock cycle (Read)	150	-	ns	
	t _{RDH}	SCL "H" pulse width (Read)	60	-	ns	
	t _{RDL}	SCL "L" pulse width (Read)	60	-	ns ¹	
SDA/SDO ¹ (Output) ²	t _{ACC}	Access time (Read)	10	100	ns	For maximum CL=30pF ¹
SDA/SDO ¹ (Output) ²	t _{OH}	Output disable time (Read)	15	100	ns	For minimum CL=8pF ¹
SDA/SDI ¹ (Input) ²	t _{DS}	Data setup time (Write)	10	-	ns ¹	
	t _{DH}	Data hold time (Write)	10	-	ns ¹	

Note:

1. Ta = -30 to 70 °C, VDDI=1.65V to 3.6V, VDD=2.5V to 3.6V, T=10+/-0.5ns.
2. Does not include signal rise and fall times.

8.8.2 Parallel 24/18/16-bit RGB Interface Timing Characteristics



Signal	Symbol	Parameter	min	max	Unit	Description
	tSYNCS	VS/HS setup time	5	-	ns	24/18/16-bit bus RGB interface mode
	tSYNCH	VS/HS hold time	5	-	ns	
DE	tENS	DE setup time	5	-	ns	
	tENH	DE hold time	5	-	ns	
DB[23:0]	tPOS	Data setup time	5	-	ns	
	tPDH	Data hold time	5	-	ns	
PCLK	PWDH	PCLK high-level period	13	-	ns	
	PWDL	PCLK low-level period	13	-	ns	
	tCYCD	PCLK cycle time	28	-	ns	
	trgbr , trgbf	PCLK,HS,VS rise/fall time	-	15	ns	

Note: Ta = -30 to 70 °C, VDDI=1.65V to 3.6V, VDD=2.5V to 3.6V, DGND=0V

9. Commands

Refer to the Technical Manual for the GC9503V

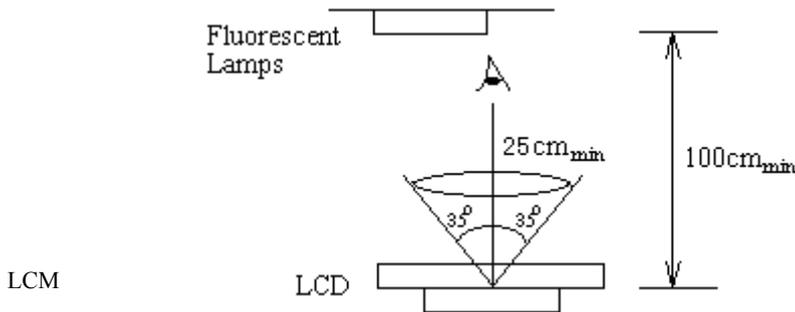
10. Initializing By Instruction

11、 Quality Specifications

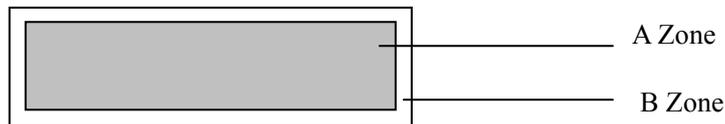
1) Standard of the product appearance test

Manner of appearance test: The inspection should be performed in using 20W x 2 fluorescent lamps. Distance between LCM and fluorescent lamps should be 100 cm or more. Distance between LCM and inspector eyes should be 25 cm or more.

Viewing direction for inspection is 35° from vertical against LCM.



Definition of zone:



A Zone: Active display area (minimum viewing area).

B Zone: Non-active display area (outside viewing area).

2) Specification of quality assurance

AQL inspection standard

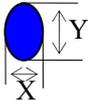
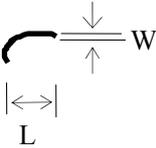
Sampling method: GB2828-87, Level II, single sampling

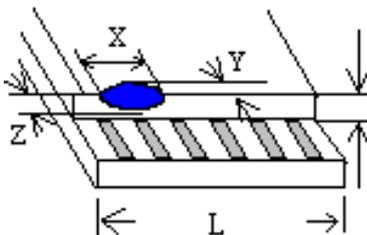
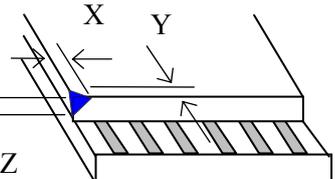
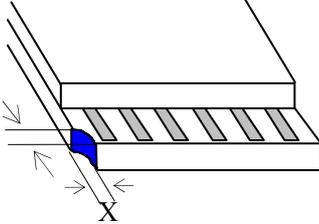
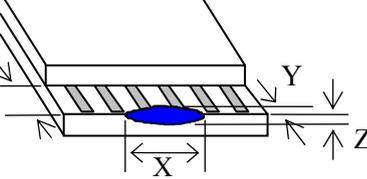
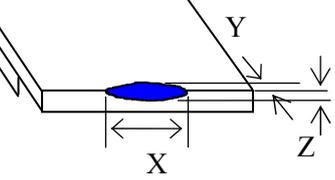
Defect classification **(Note: * is not including)**

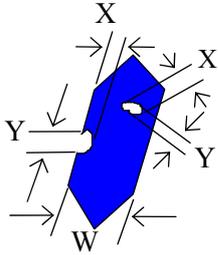
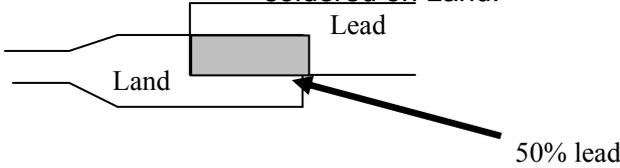
Classify	Item		Note	AQL
Major	Display state	Short or open circuit	1	0.65
		LC leakage		
		Flickering		
		No display		
		Wrong viewing direction		
		Contrast defect (dim, ghost)	2	
	Back-light	1,8		
Non-display	Flat cable or pin reverse	10		
	Wrong or missing component	11		
Minor	Display state	Background color deviation	2	1.0
		Black spot and dust	3	
		Line defect, Scratch	4	
		Rainbow	5	
		Chip	6	
		Pin hole	7	
		Protruded	12	
	Polarizer	Bubble and foreign material	3	
	Soldering	Poor connection	9	
	Wire	Poor connection	10	
	TAB	Position, Bonding strength	13	

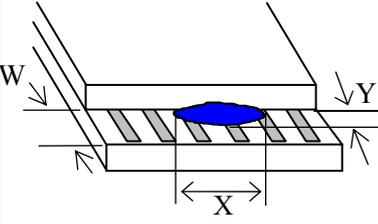
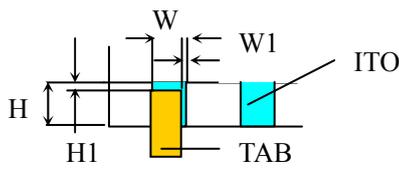
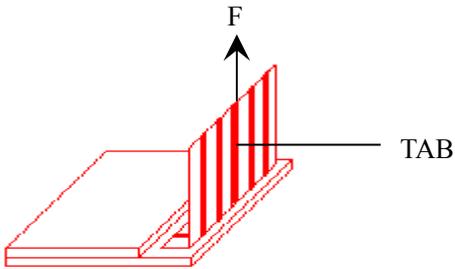
GDT-5.0S480854N005-CT

Note on defect classification

No.	Item	Criterion													
1	Short or open circuit	Not allow													
	LC leakage														
	Flickering														
	No display														
	Wrong viewing direction														
	Wrong Back-light														
2	Contrast defect	Refer to approval sample													
	Background color deviation														
3	Point defect, Black spot, dust (including Polarizer) $\phi = (X+Y)/2$	 <table border="1" data-bbox="863 808 1299 1059"> <thead> <tr> <th>Point Size</th> <th>Acceptable Qty.</th> </tr> </thead> <tbody> <tr> <td>$\phi \leq 0.10$</td> <td>Disregard</td> </tr> <tr> <td>$0.10 < \phi \leq 0.15$</td> <td>2</td> </tr> <tr> <td>$0.15 < \phi \leq 0.25$</td> <td>1</td> </tr> <tr> <td>$\phi > 0.25$</td> <td>0</td> </tr> </tbody> </table> <p style="text-align: center;">Unit: Inch²</p>	Point Size	Acceptable Qty.	$\phi \leq 0.10$	Disregard	$0.10 < \phi \leq 0.15$	2	$0.15 < \phi \leq 0.25$	1	$\phi > 0.25$	0			
Point Size	Acceptable Qty.														
$\phi \leq 0.10$	Disregard														
$0.10 < \phi \leq 0.15$	2														
$0.15 < \phi \leq 0.25$	1														
$\phi > 0.25$	0														
4	Line defect, Scratch	 <table border="1" data-bbox="791 1288 1342 1467"> <thead> <tr> <th colspan="2">Line</th> <th>Acceptable Qty.</th> </tr> <tr> <th>L</th> <th>W</th> <th></th> </tr> </thead> <tbody> <tr> <td>---</td> <td>$0.05 > W$</td> <td rowspan="3">Disregard</td> </tr> <tr> <td>$3.0 > L$</td> <td>$0.1 > W > 0.05$</td> </tr> <tr> <td>$2.0 > L$</td> <td>$0.15 \geq W > 0.1$</td> </tr> </tbody> </table> <p style="text-align: center;">Unit: mm</p>	Line		Acceptable Qty.	L	W		---	$0.05 > W$	Disregard	$3.0 > L$	$0.1 > W > 0.05$	$2.0 > L$	$0.15 \geq W > 0.1$
Line		Acceptable Qty.													
L	W														
---	$0.05 > W$	Disregard													
$3.0 > L$	$0.1 > W > 0.05$														
$2.0 > L$	$0.15 \geq W > 0.1$														
5	Rainbow	Not more than two color changes across the viewing area.													

No	Item	Criterion																																	
6	<p>Chip</p> <p>Remark:</p> <p>X: Length direction</p> <p>Y: Short direction</p> <p>Z: Thickness direction</p> <p>t: Glass thickness</p> <p>W: Terminal Width</p> <p>L: Glass length</p>	 <p>Acceptable criterion</p> <table border="1" data-bbox="933 324 1324 403"> <thead> <tr> <th>X</th> <th>Y</th> <th>Z</th> </tr> </thead> <tbody> <tr> <td>$< L/8$</td> <td>0.5mm</td> <td>$\leq t/2$</td> </tr> </tbody> </table>  <p>Acceptable criterion</p> <table border="1" data-bbox="917 638 1324 705"> <thead> <tr> <th>X</th> <th>Y</th> <th>Z</th> </tr> </thead> <tbody> <tr> <td>≤ 2</td> <td>0.5mm</td> <td>$\leq t$</td> </tr> </tbody> </table>  <p>Acceptable criterion</p> <table border="1" data-bbox="933 929 1324 1041"> <thead> <tr> <th>X</th> <th>Y</th> <th>Z</th> </tr> </thead> <tbody> <tr> <td>≤ 3</td> <td>≤ 2</td> <td>$\leq t$</td> </tr> <tr> <td colspan="2">shall not reach to ITO</td> <td></td> </tr> </tbody> </table>  <p>Acceptable criterion</p> <table border="1" data-bbox="917 1310 1324 1377"> <thead> <tr> <th>X</th> <th>Y</th> <th>Z</th> </tr> </thead> <tbody> <tr> <td>Disregard</td> <td>≤ 0.2</td> <td>$\leq t$</td> </tr> </tbody> </table>  <p>Acceptable criterion</p> <table border="1" data-bbox="917 1590 1292 1668"> <thead> <tr> <th>X</th> <th>Y</th> <th>Z</th> </tr> </thead> <tbody> <tr> <td>≤ 5</td> <td>≤ 2</td> <td>$\leq t/3$</td> </tr> </tbody> </table>	X	Y	Z	$< L/8$	0.5mm	$\leq t/2$	X	Y	Z	≤ 2	0.5mm	$\leq t$	X	Y	Z	≤ 3	≤ 2	$\leq t$	shall not reach to ITO			X	Y	Z	Disregard	≤ 0.2	$\leq t$	X	Y	Z	≤ 5	≤ 2	$\leq t/3$
X	Y	Z																																	
$< L/8$	0.5mm	$\leq t/2$																																	
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No.	Item	Criterion								
7	Segment pattern $W = \text{Segment width}$ $\phi = (X+Y)/2$	(1) Pin hole $\phi < 0.10\text{mm}$ is acceptable.  <table border="1" data-bbox="853 465 1316 638"> <thead> <tr> <th>Point Size</th> <th>Acceptable Qty</th> </tr> </thead> <tbody> <tr> <td>$\phi \leq 1/4W$</td> <td>Disregard</td> </tr> <tr> <td>$1/4W < \phi \leq 1/2W$</td> <td>1</td> </tr> <tr> <td>$\phi > 1/2W$</td> <td>0</td> </tr> </tbody> </table> <p style="text-align: right;">Unit: mm</p>	Point Size	Acceptable Qty	$\phi \leq 1/4W$	Disregard	$1/4W < \phi \leq 1/2W$	1	$\phi > 1/2W$	0
Point Size	Acceptable Qty									
$\phi \leq 1/4W$	Disregard									
$1/4W < \phi \leq 1/2W$	1									
$\phi > 1/2W$	0									
8	Back-light	(1) The color of backlight should correspond its specification. (2) Not allow flickering								
9	Soldering	(1) Not allow heavy dirty and solder ball on PCB. (The size of dirty refer to point and dust defect) (2) Over 50% of lead should be soldered on Land. 								
10	Wire	(1) Copper wire should not be rusted (2) Not allow crack on copper wire connection. (3) Not allow reversing the position of the flat cable. (4) Not allow exposed copper wire inside the flat cable.								
11*	PCB	(1) Not allow screw rust or damage. (2) Not allow missing or wrong putting of component.								

No	Item	Criterion
12	Protruded W: Terminal Width	 <p>Acceptable criteria: $Y \leq 0.4$</p>
13	TAB	<p>1. Position</p>  <div style="border: 1px solid black; padding: 5px; width: fit-content; margin-left: 100px;"> $W1 \leq 1/3W$ $H1 \leq 1/3H$ </div> <p>2. TAB bonding strength test</p>  <p> $P (=F/TAB \text{ bonding width}) \geq 650gf/cm$,(speed rate: 1mm/min) 5pcs per SOA (shipment) </p>
14	Total no. of acceptable Defect	<p style="text-align: center;">A. Zone</p> <p>Maximum 2 minor non-conformities per one unit. Defect distance: each point to be separated over 10mm</p> <p>B. Zone</p> <p>It is acceptable when it is no trouble for quality and assembly in customer's end product.</p>

3) Reliability of LCM

Reliability test condition:

Item	Condition	Time (hrs)	Assessment
High temp. Storage	70°C	48	No abnormalities in functions and appearance
High temp. Operating	60°C	48	
Low temp. Storage	-20°C	48	
Low temp. Operating	-10°C	48	
Humidity	40°C/ 90%RH	48	
Temp. Cycle	-10°C ← 25°C → 60°C (30 min ← 5 min → 30min)	10cycles	

Recovery time should be 24 hours minimum. Moreover, functions, performance and appearance shall be free from remarkable deterioration within 20,000 hours under ordinary operating and storage conditions room temperature (20±8°C), normal humidity (below 65% RH), and in the area not exposed to direct sun light.

Precaution for using LCD/LCM

LCD/LCM is assembled and adjusted with a high degree of precision. Do not attempt to make any alteration or modification. The followings should be noted.

General Precautions:

1. LCD panel is made of glass. Avoid excessive mechanical shock or applying strong pressure onto the surface of display area.
2. The polarizer used on the display surface is easily scratched and damaged. Extreme care should be taken when handling. To clean dust or dirt off the display surface, wipe gently with cotton, or other soft material soaked with sopropyl alcohol, ethyl alcohol or trichlorotrifloroethane, do not use water, ketone or aromatics and never scrub hard.
3. Do not tamper in any way with the tabs on the metal frame.
4. Do not make any modification on the PCB without consulting XIAMEM OCULAR
5. When mounting a LCM, make sure that the PCB is not under any stress such as bending or twisting. Elastomer contacts are very delicate and missing pixels could result from slight dislocation of any of the elements.
6. Avoid pressing on the metal bezel, otherwise the elastomer connector could be deformed and lose contact, resulting in missing pixels and also cause rainbow on the display.
7. Be careful not to touch or swallow liquid crystal that might leak from a damaged cell. Any liquid crystal adheres to skin or clothes, wash it off immediately with soap and water.

Static Electricity Precautions:

1. CMOS-LSI is used for the module circuit; therefore operators should be grounded whenever he/she comes into contact with the module.
2. Do not touch any of the conductive parts such as the LSI pads; the copper leads on the PCB and the interface terminals with any parts of the human body.
3. Do not touch the connection terminals of the display with bare hand; it will cause disconnection or defective insulation of terminals.
4. The modules should be kept in anti-static bags or other containers resistant to static for storage.
5. Only properly grounded soldering irons should be used.
6. If an electric screwdriver is used, it should be grounded and shielded to prevent sparks.
7. The normal static prevention measures should be observed for work clothes and working benches.
8. Since dry air is inductive to static, a relative humidity of 50-60% is recommended.

Soldering Precautions:

1. Soldering should be performed only on the I/O terminals.
2. Use soldering irons with proper grounding and no leakage.

3. Soldering temperature: $280^{\circ}\text{C}\pm 10^{\circ}\text{C}$
4. Soldering time: 3 to 4 second.
5. Use eutectic solder with resin flux filling.
6. If flux is used, the LCD surface should be protected to avoid spattering flux.
7. Flux residue should be removed.

Operation Precautions:

1. The viewing angle can be adjusted by varying the LCD driving voltage V_o .
2. Since applied DC voltage causes electro-chemical reactions, which deteriorate the display, the applied pulse waveform should be a symmetric waveform such that no DC component remains. Be sure to use the specified operating voltage.
3. Driving voltage should be kept within specified range; excess voltage will shorten display life.
4. Response time increases with decrease in temperature.
5. Display color may be affected at temperatures above its operational range.
6. Keep the temperature within the specified range usage and storage. Excessive temperature and humidity could cause polarization degradation, polarizer peel-off or generate bubbles.
7. For long-term storage over 40°C is required, the relative humidity should be kept below 60%, and avoid direct sunlight.

Limited Warranty

XIAMEM OCULAR LCDs and modules are not consumer products, but may be incorporated by XIAMEM OCULAR's customers into consumer products or components thereof, XIAMEM OCULAR does not warrant that its LCDs and components are fit for any such particular purpose.

1. The liability of XIAMEM OCULAR is limited to repair or replacement on the terms set forth below. XIAMEM OCULAR will not be responsible for any subsequent or consequential events or injury or damage to any personnel or user including third party personnel and/or user. Unless otherwise agreed in writing between XIAMEM OCULAR and the customer, XIAMEM OCULAR will only replace or repair any of its LCD which is found defective electrically or visually when inspected in accordance with XIAMEM OCULAR general LCD inspection standard. (Copies available on request)
2. No warranty can be granted if any of the precautions state in handling liquid crystal display above has been disregarded. Broken glass, scratches on polarizer mechanical damages as well as defects that are caused accelerated environment tests are excluded from warranty.
3. In returning the LCD/LCM, they must be properly packaged; there should be detailed description of the failures or defect.