



**SPECIFICATION
FOR
LCD MODULE**

**MODULE NO: AFS800480TG-5.0-A010001
REVISION NO: 00**

Customer's Approval:

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	SIGNATURE	DATE
PREPARED BY (RD ENGINEER)	Fr. L & CL	2011-09-26
CHECKED BY	YLH	2011-09-26
APPROVED BY	Sean	2011-09-26

DOCUMENT REVISION HISTORY

Version	DATE	DESCRIPTION	CHANGED BY
00	Sep-23-2011	First Issue	Fr.li
01	Sep-26-2011	Changed "Dimensional Outline"	Fr.li

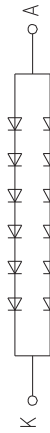
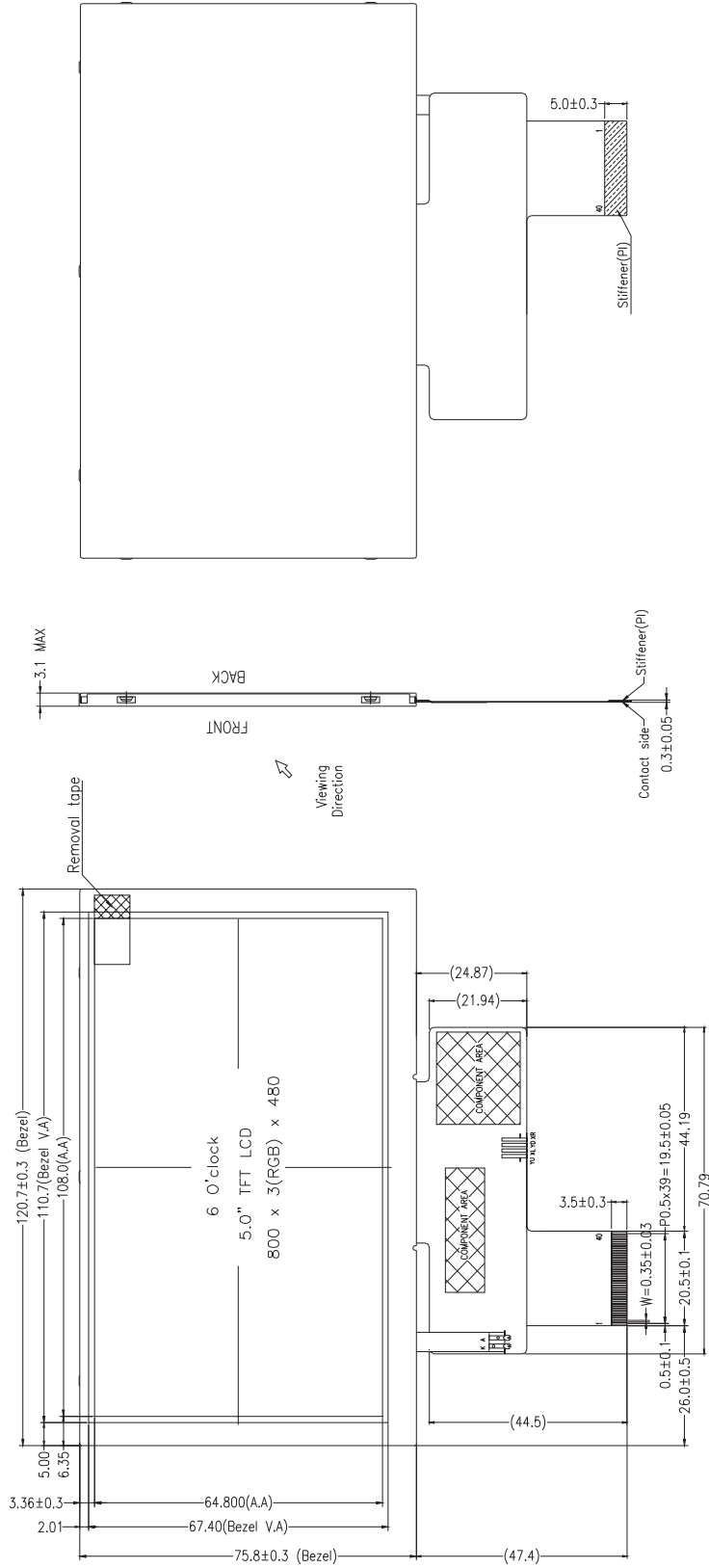
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1. Features & Mechanical Specifications

Item	Contents	Unit
	LCD	
LCD Type	TFT / Transmissive / Normally White	--
Viewing direction	6 O'clock	--
Backlight	White LED x 12	--
Interface	RGB-24bit parallel interface	--
Driver IC	OTD9960&OTA7001	--
Outline Dimension	120.7(W) × 75.8(H) × 3.1(T)	mm
Glass area (W×H×T)	115.6 × 69.4 / 73.9 × 1.0	mm
Active area (W×H)	108 × 64.8	mm
Number of Dots	800(RGB)×480	--
Dot pitch (W×H)	0.135 × 0.135	mm
Pixel pitch (W×H)	0.045 × 0.135	mm
Operating Temperature	-20 ~ +70	°C
Storage temperature	-30 ~ +80	°C

PIN	DESCRIPTION
1	LEDK
2	LEDA
3	GND
4	VDD
5	RO
6	R1
7	R2
8	R3
9	R4
10	R5
11	R6
12	R7
13	G0
14	G1
15	G2
16	G3
17	G4
18	G5
19	G6
20	G7
21	B0
22	B1
23	B2
24	B3
25	B4
26	B5
27	B6
28	B7
29	GND
30	DCLK
31	DISP
32	HSYNC
33	VSYNC
34	DE
35	NC
36	GND
37	NC(XR)
38	NC(YD)
39	NC(XL)
40	NC(YU)



(CIRCUIT DIAGRAM)

- Specification:**
- 1). Viewing angle: 6 O'clock
 - 2). Display mode: 262K TFT/Transmissive/Normal White
 - 3). Operating temp.: -20°C~+70°C
Storage temp.: -30°C~+80°C
 - 4). IC: OTA7001 & OTD9960
 - 5). Backlight: 12 chip White LED, In Series, If=40mA (Vf=19.2v)
 - 6). All the raw material are Rohs compliant
 - 7). Dimensions with mark "*" are important, with mark "(" are referenced

3. Block Diagram

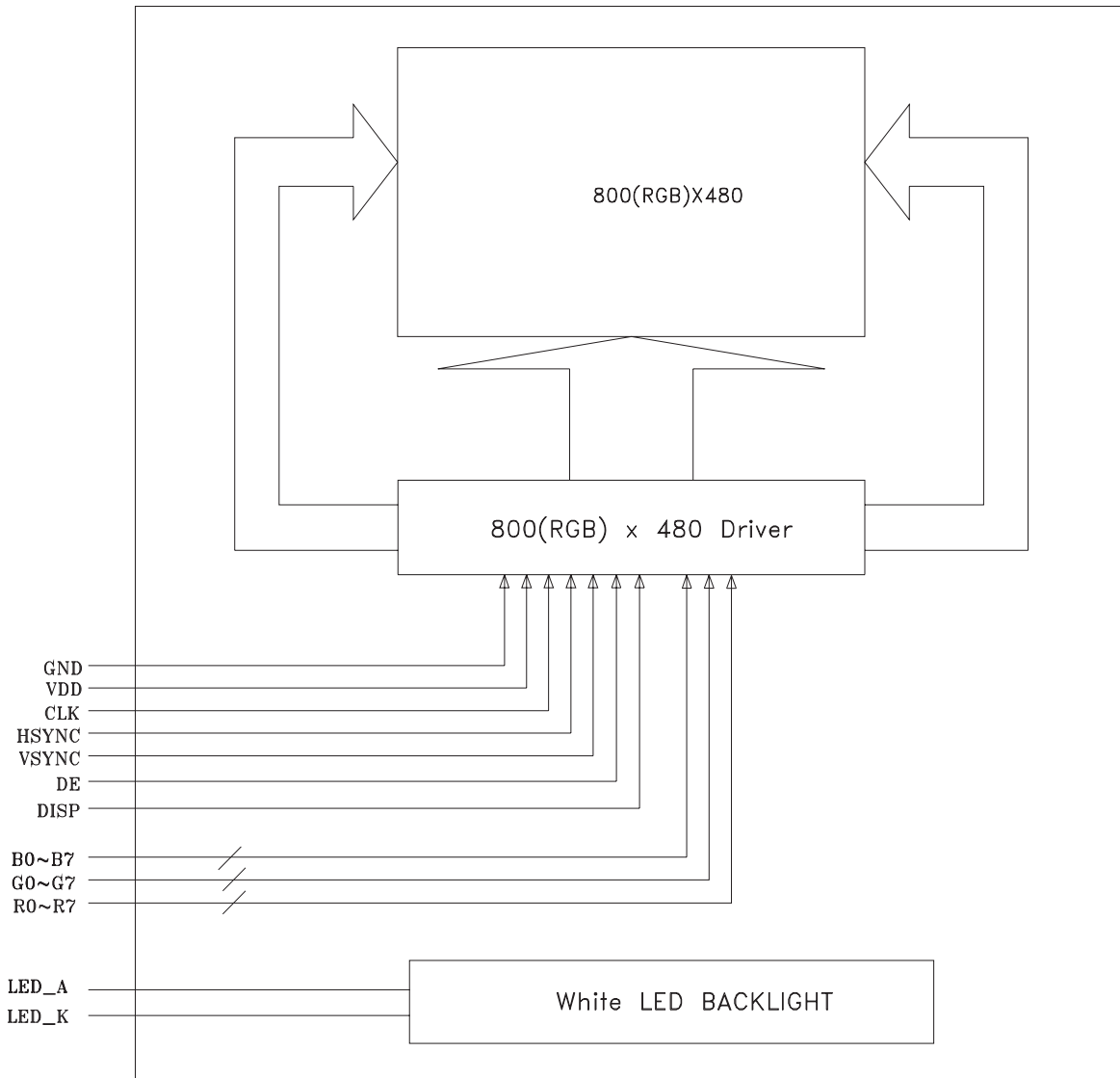


Figure 2. Block diagram

4. Pin Description

PIN No.	SYMBOL	Function
1	LED_K	LED Backlight Cathode
2	LED_A	LED Backlight Anode
3	GND	Ground
4	VDD	Power Supply
5~12	R0~R7	Red Data Input
13~20	G0~G7	Green Data Input
21~28	B0~B7	Blue Data Input
29	GND	Ground
30	CLK	Clock input
31	DISP	Standby mode control. STBYB="L", enter standby mode STBYB="H", normal operation
32	VSYNC	Vertical sync input
33	HSYNC	Horizontal sync input
34	DE	Input data enable control
35	NC	No Connection
36	GND	Ground
37	NC(XR)	No Connection
38	NC(YD)	No Connection
39	NC(XL)	No Connection
40	NC(YU)	No Connection

5. Absolute Maximum Ratings

Item	Symbol	Rating	Unit
Power supply	VDD	-0.5 to +5.0	V
Operating Temperature range	TOP	-20 to +70	°C
Storage Temperature range	TST	-30 to +80	°C

6. Electrical Characteristics

DC Characteristics

Item	Symbol	Min.	Type.	Max.	Unit
Digital Power Supply Voltage	VDD	3.0	3.3	3.6	V

7. Backlight Characteristics

(White LED × 6 in series) × 2 in Parallel

(Ta = 25°C)

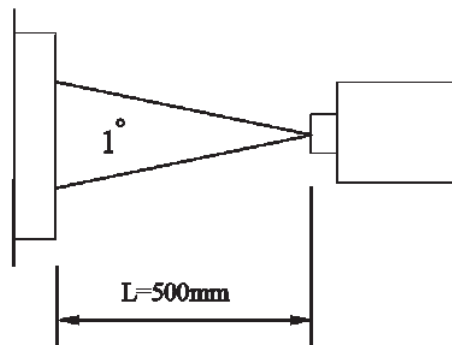
Item	Symbol	Condition	Min	Typ	Max	Unit
Forward Voltage	VF	IF=32mA	-	19.2	-	V
Uniformity	△Bp	-	80	-	-	%
Luminance for LCD	Lv	IF=32mA	-	4000	-	cd/m ²

8. Electro-Optical Characteristics

ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	REMARK
Transmittance	T		3.3	3.97		%	
Contrast Ratio	CR	*1)		350	-	-	Note 3
Response Time	Tr+ Tf	*3)	-	20		ms	Note 4
Viewing Angle	U	$\theta^{*2)}$	CR \geq 10	45	50	-	Note 5
	D			55	60	-	
	L	$\psi^{*2)}$		60	65	-	
	R			60	65	-	
Color Filter Chromacity	White	x y Y	$\theta=\phi=0^\circ$	0.297	0.317	0.337	Note 6
				0.304	0.324	0.344	
				27.5	30.5	33.5	
	Red	x y Y	$\theta=\phi=0^\circ$	0.613	0.633	0.653	
				0.321	0.341	0.361	
				18.3	21.3	24.3	
	Green	x y Y	$\theta=\phi=0^\circ$	0.304	0.324	0.344	
				0.531	0.551	0.571	
				48.4	52.4	56.4	
	Blue	x y Y	$\theta=\phi=0^\circ$	0.133	0.153	0.173	
				0.123	0.143	0.163	
				14.8	17.8	20.8	
NTSC			-	50%	-		

Note 1. Ambient condition : 25°C±2°C , 60±10%RH , under 10 Lux in the darkroom .

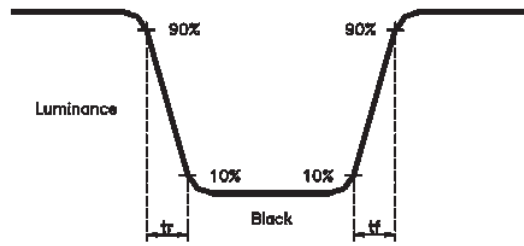
Note 2. Measure device : BM-5A (TOPCON) , viewing cone=1° , I_L=20mA .



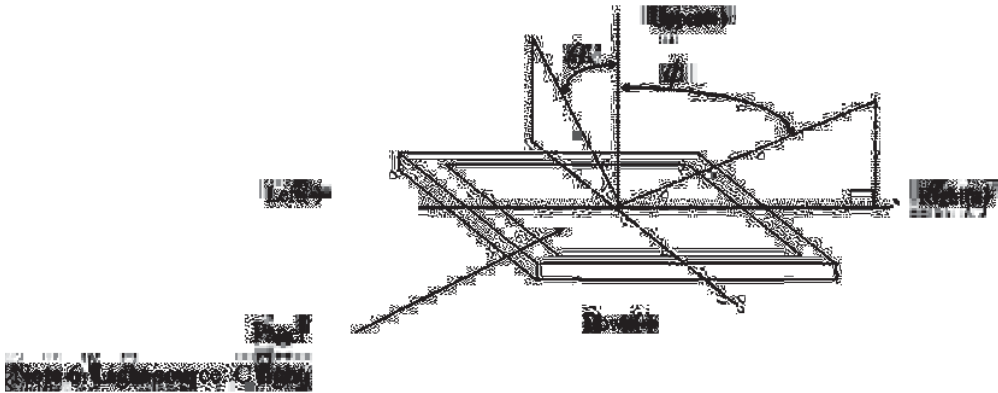
Note 3. Definition of Contrast Ratio :

$$CR = \text{White Luminance (ON)} / \text{Black Luminance (OFF)}$$

Note 4. Definition of response time : The response time is defined as the time interval between the 10% and 90% amplitudes.



Note 5. Definition of view angle(θ , ψ) :



9. AC Characteristics

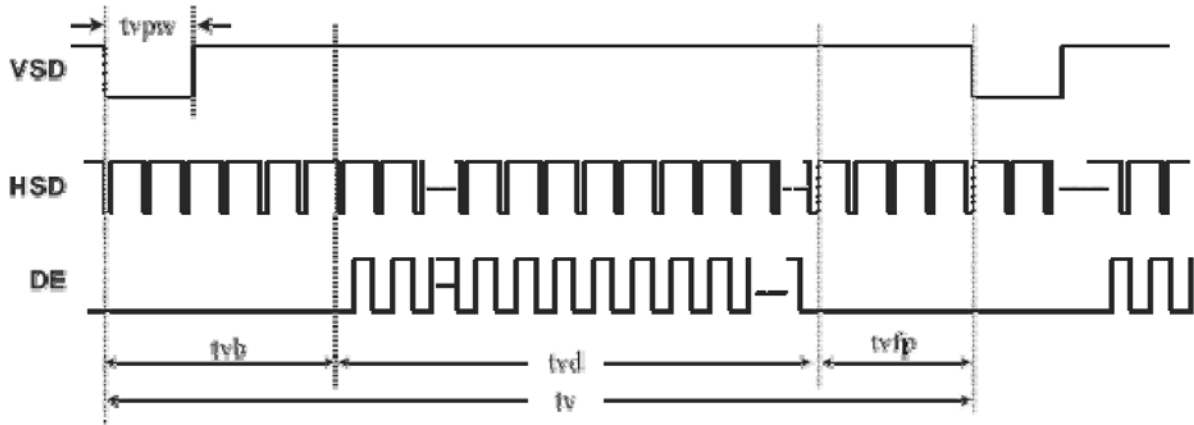
Horizontal input timing

	thd	800			DCLK
	fclk	-	30	50	MHz
	th	928			DCLK
	thpw	1			
		48			
		-			
	thb	-	88	-	
thfp	-	40	-		

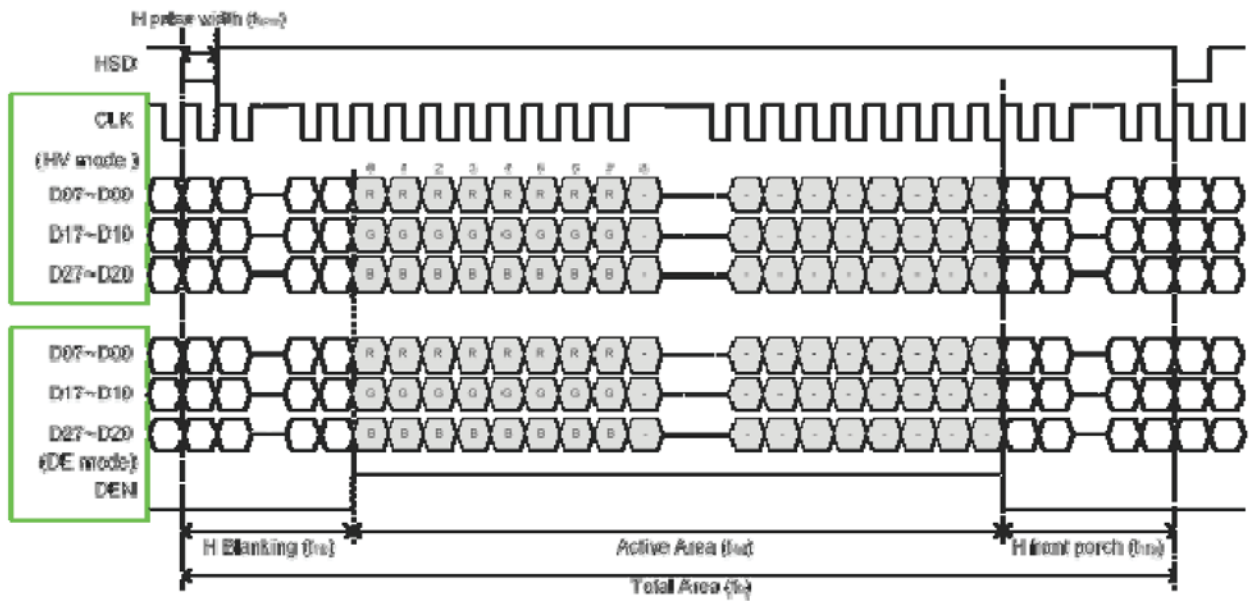
Vertical input timing

	tvd	480			H
	tv	-	525	-	H
	tvpw	-	3	-	H
	tvb	-	32	-	H
	tvfp	-	13	-	H

Vertical input timing



Horizontal input timing



10. Quality Specifications

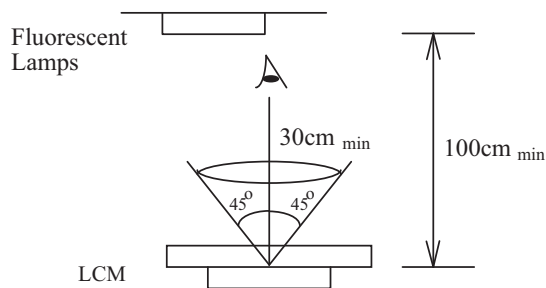
All The raw material are Rohs compliant.

10.1 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 30 cm or more.

Viewing direction for inspection is 45° from vertical against LCM.



Definition of zone:



A Zone: viewing area

B Zone: outside viewing area

10.2 Specification of quality assurance


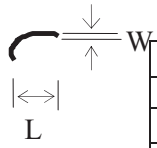
AQL inspection standard

Sampling method: MIL-STD-105E, Level II, single sampling

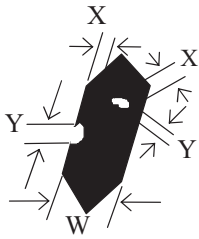
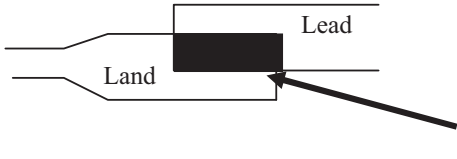
Defect classification (Note: * is not including)

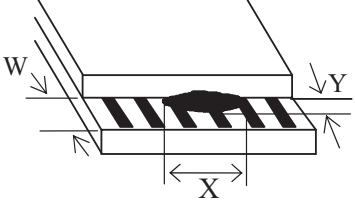
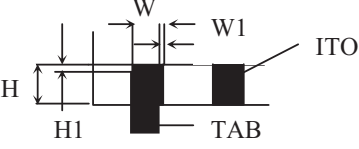
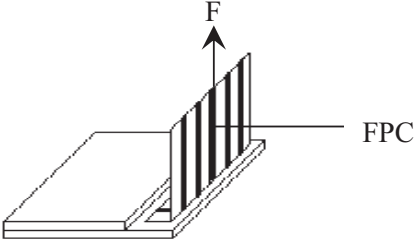
Classify	Item		Note	AQL
Major	Display state	Short or open circuit	1	0.65
		LC leakage		
		Flickering		
		No display		
		Wrong viewing direction		
		Contrast defect (dim, ghost)		
	Back-light	1,8		
	Non-display	Flat cable or pin reverse	10	
Wrong or missing component		11		
Minor	Display state	Background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

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="901 903 1295 1171"> <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>$0.10 < \phi \leq 0.20$</td> <td>3</td> </tr> <tr> <td>$0.20 < \phi \leq 0.25$</td> <td>2</td> </tr> <tr> <td>$0.25 < \phi \leq 0.30$</td> <td>1</td> </tr> <tr> <td>$\phi > 0.30$</td> <td>0</td> </tr> </tbody> </table> <p>Unit: mm</p>	Point Size	Acceptable Qty.	$\phi \leq 0.10$	Disregard	$0.10 < \phi \leq 0.20$	3	$0.20 < \phi \leq 0.25$	2	$0.25 < \phi \leq 0.30$	1	$\phi > 0.30$	0								
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$0.25 < \phi \leq 0.30$	1																					
$\phi > 0.30$	0																					
4	Line defect, Scratch	 <table border="1" data-bbox="812 1333 1307 1591"> <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>$0.02 \geq W$</td> <td>Disregard</td> </tr> <tr> <td>$4.0 \geq L$</td> <td>$0.03 \geq W > 0.02$</td> <td rowspan="2">2</td> </tr> <tr> <td>$2.0 \geq L$</td> <td>$0.05 \geq W > 0.03$</td> </tr> <tr> <td>$1.0 \geq L$</td> <td>$0.1 > W > 0.05$</td> <td>1</td> </tr> <tr> <td>---</td> <td>$0.1 < W$</td> <td>Applied as point defect</td> </tr> </tbody> </table> <p>Unit: mm</p>	Line		Acceptable Qty.	L	W		---	$0.02 \geq W$	Disregard	$4.0 \geq L$	$0.03 \geq W > 0.02$	2	$2.0 \geq L$	$0.05 \geq W > 0.03$	$1.0 \geq L$	$0.1 > W > 0.05$	1	---	$0.1 < W$	Applied as point defect
Line		Acceptable Qty.																				
L	W																					
---	$0.02 \geq W$	Disregard																				
$4.0 \geq L$	$0.03 \geq W > 0.02$	2																				
$2.0 \geq L$	$0.05 \geq W > 0.03$																					
$1.0 \geq L$	$0.1 > W > 0.05$	1																				
---	$0.1 < W$	Applied as point defect																				
5	Rainbow	Not more than two color changes across the viewing area.																				

No	Item	Criterion																																	
6	<p data-bbox="310 373 370 401">Chip</p> <p data-bbox="310 470 412 497">Remark:</p> <p data-bbox="363 506 483 562">X: Length direction</p> <p data-bbox="363 583 483 640">Y: Short direction</p> <p data-bbox="363 661 516 718">Z: Thickness direction</p> <p data-bbox="363 739 509 795">t: Glass thickness</p> <p data-bbox="363 816 516 873">W: Terminal Width</p>	<div data-bbox="602 407 943 575"> </div> <p data-bbox="964 401 1203 428">Acceptable criterion</p> <table border="1" data-bbox="964 436 1317 510"> <thead> <tr> <th>X</th> <th>Y</th> <th>Z</th> </tr> </thead> <tbody> <tr> <td>≤ 2</td> <td>0.5mm</td> <td>$\leq t/2$</td> </tr> </tbody> </table> <div data-bbox="587 701 919 869"> </div> <p data-bbox="954 684 1193 711">Acceptable criterion</p> <table border="1" data-bbox="954 720 1320 793"> <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> <div data-bbox="594 940 909 1150"> </div> <p data-bbox="967 951 1206 978">Acceptable criterion</p> <table border="1" data-bbox="967 987 1320 1094"> <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> <div data-bbox="587 1268 954 1436"> </div> <p data-bbox="954 1297 1193 1325">Acceptable criterion</p> <table border="1" data-bbox="954 1333 1320 1407"> <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> <div data-bbox="594 1549 919 1717"> </div> <p data-bbox="954 1564 1193 1591">Acceptable criterion</p> <table border="1" data-bbox="954 1600 1292 1673"> <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	≤ 2	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																																	
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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="893 556 1307 714"> <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: center;">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: auto; margin-right: auto;"> $W1 \leq 1/3W$ $H1 \leq 1/3H$ </div> <p>2 FPC bonding strength test</p>  <p> $P (=F/FPC \text{ bonding width}) \geq 650\text{gf/cm}$,(speed rate: 1mm/min) 5pcs per SOA (shipment) </p>
14	Total no. of acceptable Defect	<p>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>

10.3 Reliability of LCM

Reliability test condition:

Item	Condition	Time (hrs)	Assessment
High temp. Storage	60°C	48	No abnormalities in functions and appearance
High temp. Operating	50°C	48	
Low temp. Storage	-10°C	48	
Low temp. Operating	0°C	48	
Humidity	40°C/ 90%RH	48	
Temp. Cycle	-10°C ← 25°C →60°C (60 min ← 5 min → 60min)	10cycles	

Recovery time should be 24 hours minimum. Moreover, functions, performance and appearance shall be free from remarkable deterioration within 50,000 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.

10.4 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 isopropyl alcohol, ethyl alcohol or trichlorotrifluoroethane, 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 Orient Display.
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

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

1. The liability of Orient Display is limited to repair or replacement on the terms set forth below. Orient Display 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 Orient Display and the customer, Orient Display will only replace or repair any of its LCD which is found defective electrically or visually when inspected in accordance with Orient Display 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.