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# SPECIFICATION FOR LCM MODULE

**MODULE NO.: AMG240128CR-M-B6NTFW-NV**  
**DOC.REVISION: 00**

**Customer Approval:**

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	SIGNATURE	DATE
PREPARED BY (RD ENGINEER)		MAY-22-2008
PREPARED BY (QA ENGINEER)		
CHECKED BY		
APPROVED BY		

## DOCUMENT REVISION HISTORY

<b>Version</b>	<b>DATE</b>	<b>DESCRIPTION</b>	<b>CHANGED BY</b>
00	MAY-22-2008	First issue	

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# 1. FUNCTIONS & FEATURES

- 1.1. Format : 240x128 Dots
- 1.2. LCD mode : STN / Negative Transmissive mode / Blue
- 1.3. Viewing direction : 6 o'clock
- 1.4. Driving scheme : 1/128 Duty cycle, 1/12.3 Bias
- 1.5. Power supply voltage ( $V_{DD}$ ) : 5.0V
- 1.6. LCD driving voltage : 17.5V
- 1.7. Operation temp : 0~50°C
- 1.8. Storage temp : -20~70°C
- 1.9. Backlight color : CCFL

# 2. MECHANICAL SPECIFICATIONS

- 2.1. Module size : 114.0mm(L)\*82.0mm(W)\* Max15.0(H)mm
- 2.2. Viewing area : 94.5mm(L)\*54.5mm(W)
- 2.3. Dot pitch : 0.38mm(L)\*0.38mm(W)
- 2.4. Dot size : 0.35mm(L)\*0.35mm(W)
- 2.5. Weight : Approx.

# 3. BLOCK DIAGRAM

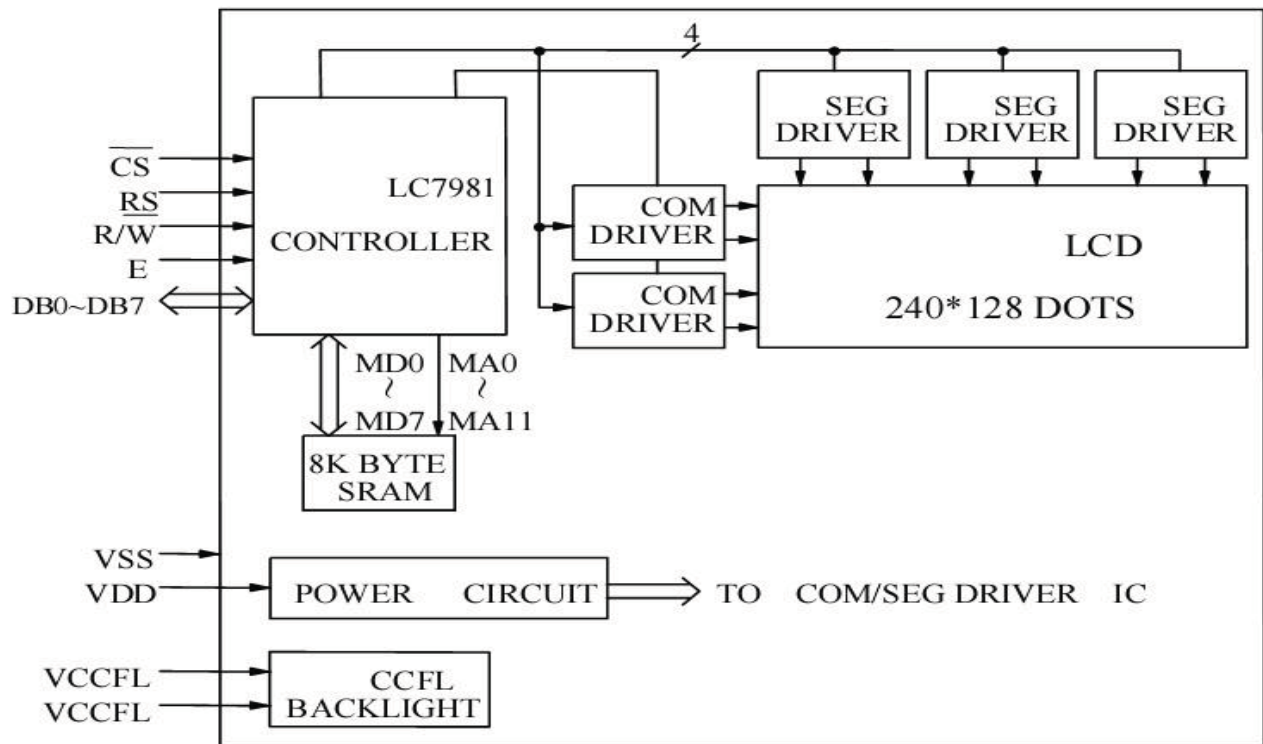


Figure 1. Block diagram

# 4.DIMENSIONAL OUTLIN

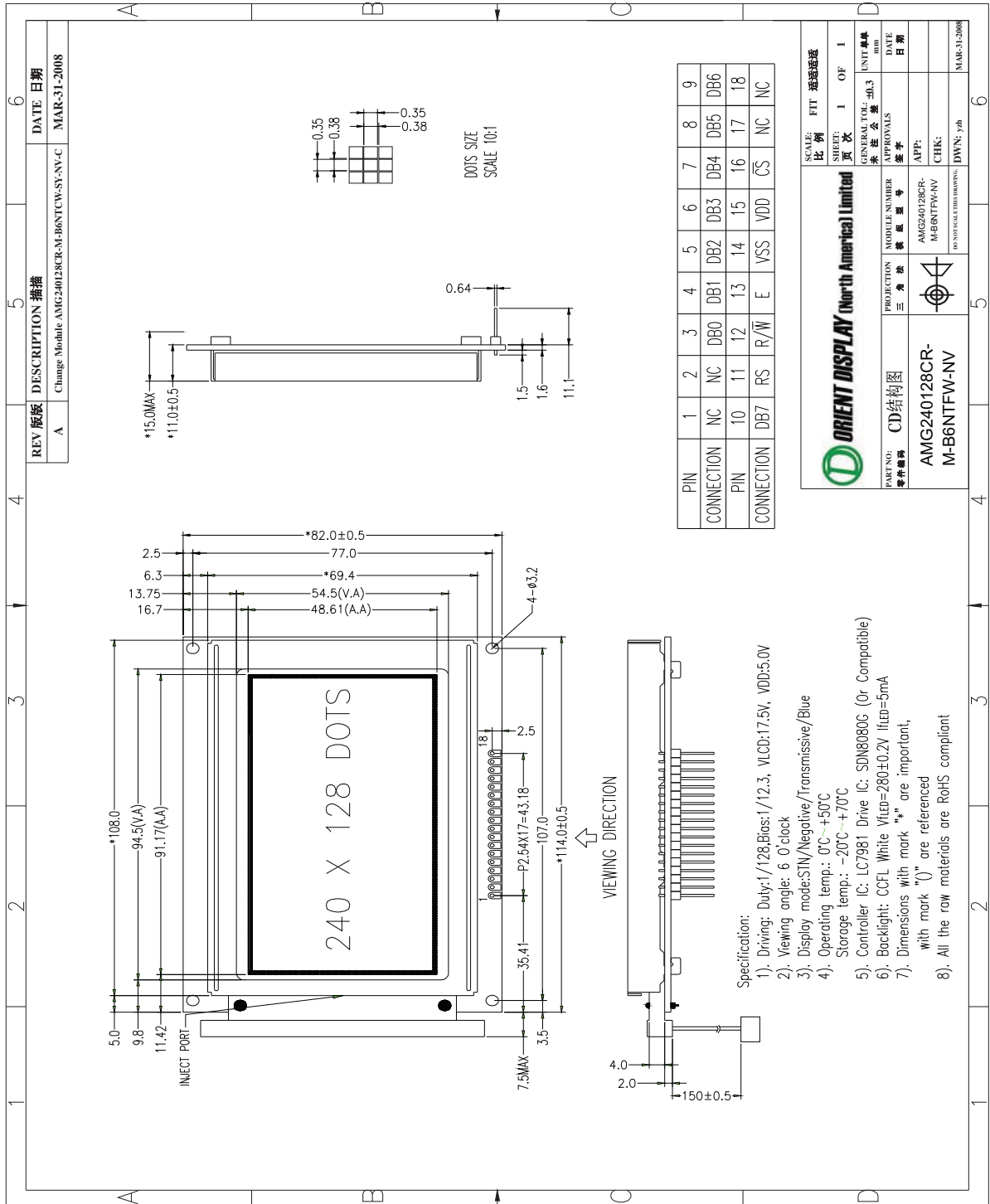


Figure 2. Dimensional outline

## **5. PIN DESCRIPTION**

No.	Symbol	Level	Function
1-2	NC	-	
3-10	DB0-DB7	H/L	Data bus line
11	RS	H/L	H: Instruction register L: Data register
12	R/W	H/L	Read/write selection
13	E	H→L	Enable signal
14	VSS	-	Ground
15	VDD	-	Power supply for logic circuit
16	/CS	L	Chip selection
17	NC	-	
18	NC	-	

### CCFL PIN ASSIGNMENT

No.	Symbol	Level	Function
1	VFL	-	Power Supply For CCFL Driving
2-3	NC	-	Non connection
4	VFL	-	Power Supply For CCFL Driving

## **6. MAXIMUM ABSOLUTE LIMIT**

Item	Symbol	Min	Max	Unit
Input Voltage	$V_I$	-0.3	VDD+0.3	V
Supply Voltage For Logic	VDD-V <sub>SS</sub>	-0.3	7.0	V
Operating Temperature	T <sub>op</sub>	0	50	°C
Storage Temperature	T <sub>str</sub>	-20	70	°C

## 7. ELECTRICAL CHARACTERISTICS

Item	Symbol	Condition	Min	Typ	Max	Unit
Supply Voltage For Logic	$V_{DD}-V_{SS}$	$T_a=25^{\circ}\text{C}$	4.5	5.0	5.5	V
Supply Voltage For LCD	$V_{DD}-V_0$	$T_a=25^{\circ}\text{C}$	17.0	17.5	18.0	V
Input High Volt.	$V_{IH}$	$T_a=25^{\circ}\text{C}$	$0.7 V_{DD}$	—	$V_{DD}$	V
Input Low Volt.	$V_{IL}$	$T_a=25^{\circ}\text{C}$	$V_{SS}$	—	$0.3 V_{DD}$	V
Supply Current	$I_{DD}$	$V_{DD}=5\text{V}$	—	—	50.0	mA
Supply Voltage of White backlight	$V_{FL}$	Forward current =5 mA&45HZ	—	280	—	V

## 8. BACK LIGHT CHARACTERISTICS

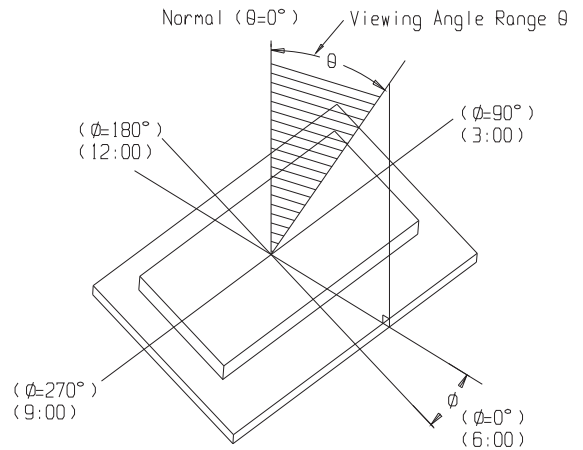
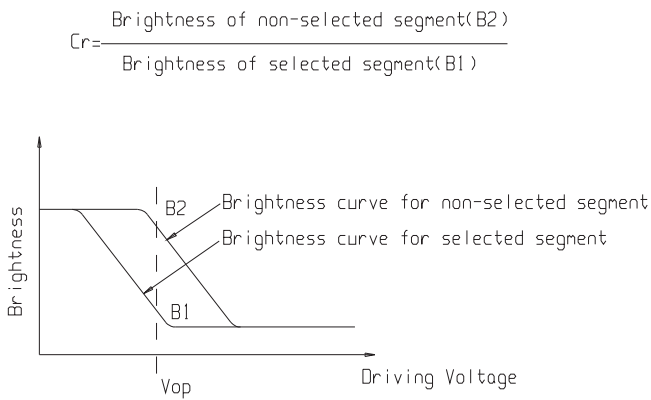
$T_a = 25^{\circ}\text{C}$

Item	Symbol	Condition	Min	Typ	Max	Unit
Forward Voltage	VF	IF=5mA	---	280	---	V
Luminous Intensity (With LCD dots off)	IV	IF=5mA	550	650	---	$\text{Cd/m}^2$
Color Coordinate (Without LCD)	X	IF=5mA	0.28	---	0.32	
	Y		0.29	---	0.33	
Color	White					

## 9. ELECTRO-OPTICAL CHARACTERISTICS

( $V_{OP} = 14.5V$ ,  $T_a = 25^\circ C$ )

Item	Symbol	Condition	Min	Typ	Max	Unit
Operating Voltage	Vop	Ta = -20°C	17.7	18.0	18.3	V
		Ta = 25°C	17.2	17.5	17.8	
		Ta = 70°C	16.7	17.0	17.3	
Response time	Tr	Ta = 25°C	---	185	---	ms
	Tf		---	200	---	ms
Contrast	Cr	Ta = 25°C	---	4	---	---
Viewing angle range	$\theta$	Cr $\geq 2$	-20	---	+35	deg
	$\Phi$		-30	---	+30	deg

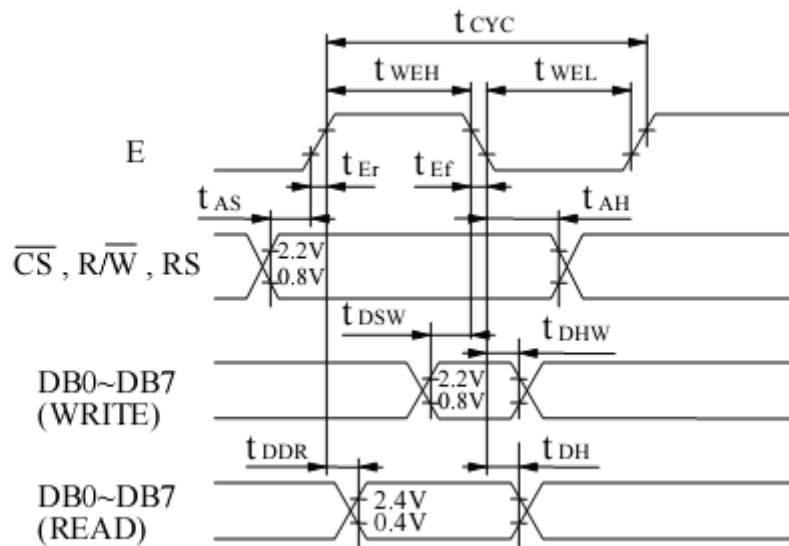




## 10. TIMING CHARACTERISTICS

VDD = 5.0 V

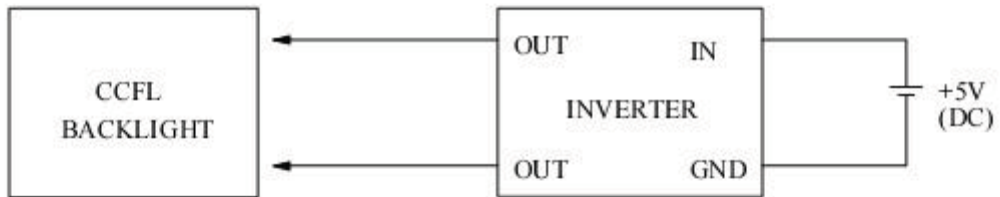
ITEM	SYMBOL	MIN	TYP	MAX	UNIT
Enable cycle time	t <sub>CYC</sub>	1.0	—	—	μs
Enable pulse width	H LEVEL	t <sub>WEH</sub>	—	—	μs
	L LEVEL	t <sub>WEL</sub>	—	—	μs
Enable rise time	t <sub>Er</sub>	—	—	25	ns
Enable fall time	t <sub>Ef</sub>	—	—	25	ns
Setup time	t <sub>AS</sub>	140	—	—	ns
Data setup time	t <sub>DSW</sub>	220	—	—	ns
Data delay time	t <sub>DDR</sub>	—	—	140	ns
Data hold time	t <sub>DHW</sub>	20	—	—	ns
Address hold time	t <sub>AH</sub>	10	—	—	ns
Data hold time	t <sub>DH</sub>	20	—	—	ns



# 11. POWER SUPPLY

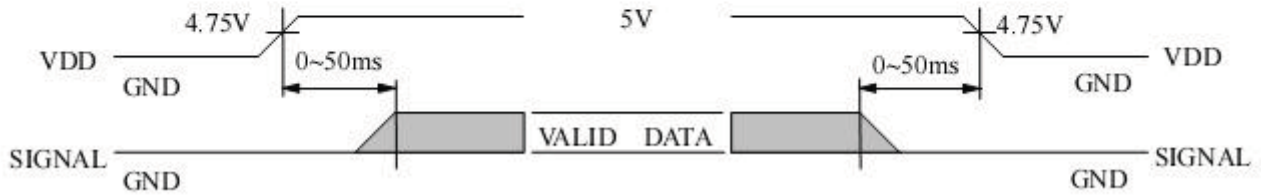


## 11.2 POWER SUPPLY FOR CCFL BACK - LIGHT



RECOMMENDED INVERTER : IA-EM02A

## 11.3 TIMING OF POWER SUPPLY AND INTERFACE SIGNAL

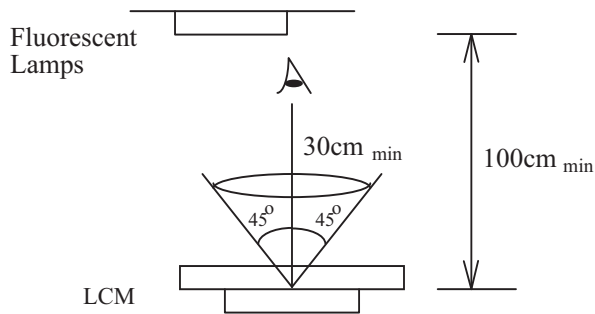


## **12.QUALITY SPECIFICATIONS**

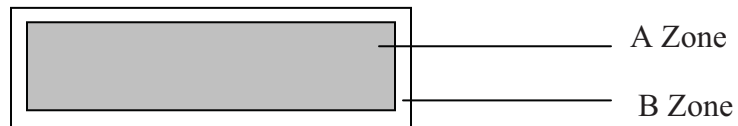
### **12.1 Standard of the product appearance test**

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: Active display area (minimum viewing area).

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

### **12.2 Specification of quality assurance**

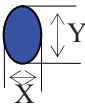
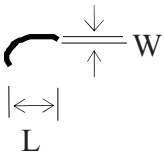
AQL inspection standard

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

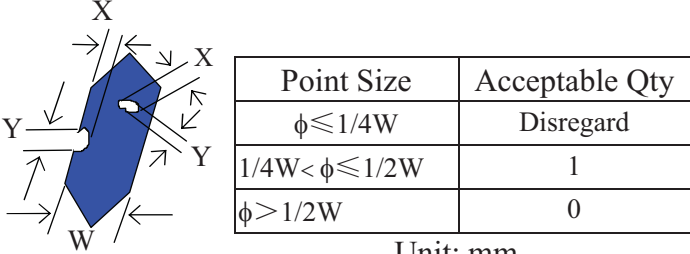
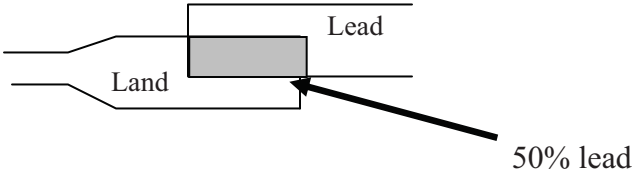
Defect classification (Note: \* is not including)

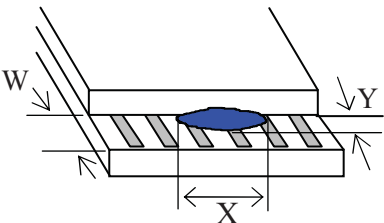
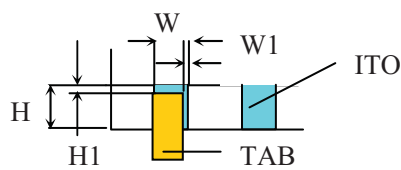
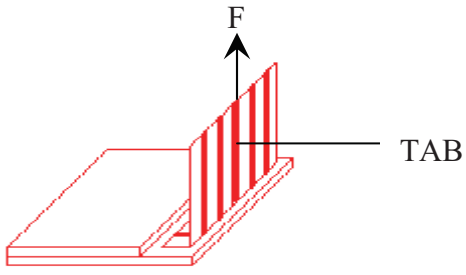
Classify	Item		Note	AQL
Major	Display state	Short or open circuit	1	0.65
		LC leakage		
		Flickering		
		No display		
		Wrong viewing direction		
		Contrast defect (dim, ghost)	2	
	Back-light	1,8		
	Non-display	Flat cable or pin reverse	10	
Wrong or missing component		11		
Minor	Display state	Background color deviation	2	1.0
		Black spot and dust	3	
		Line defect, Scratch	4	
		Rainbow	5	
		Chip	6	
		Pin hole	7	
	Polarizer	Protruded	12	
		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"> <thead> <tr> <th>Point Size</th> <th>Acceptable Qty.</th> </tr> </thead> <tbody> <tr> <td><math>\phi \leq 0.10</math></td> <td>Disregard</td> </tr> <tr> <td><math>0.10 &lt; \phi \leq 0.20</math></td> <td>3</td> </tr> <tr> <td><math>0.20 &lt; \phi \leq 0.25</math></td> <td>2</td> </tr> <tr> <td><math>0.25 &lt; \phi \leq 0.30</math></td> <td>1</td> </tr> <tr> <td><math>\phi &gt; 0.30</math></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								
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																					
4	Line defect, Scratch	 <table border="1"> <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><math>0.015 \geq W</math></td> <td>Disregard</td> </tr> <tr> <td><math>3.0 \geq L</math></td> <td><math>0.03 \geq W</math></td> <td rowspan="2">2</td> </tr> <tr> <td><math>2.0 \geq L</math></td> <td><math>0.05 \geq W</math></td> </tr> <tr> <td><math>1.0 \geq L</math></td> <td><math>0.1 &gt; W</math></td> <td>1</td> </tr> <tr> <td>---</td> <td><math>0.05 &lt; W</math></td> <td>Applied as point defect</td> </tr> </tbody> </table> <p>Unit: mm</p>	Line		Acceptable Qty.	L	W		---	$0.015 \geq W$	Disregard	$3.0 \geq L$	$0.03 \geq W$	2	$2.0 \geq L$	$0.05 \geq W$	$1.0 \geq L$	$0.1 > W$	1	---	$0.05 < W$	Applied as point defect
Line		Acceptable Qty.																				
L	W																					
---	$0.015 \geq W$	Disregard																				
$3.0 \geq L$	$0.03 \geq W$	2																				
$2.0 \geq L$	$0.05 \geq W$																					
$1.0 \geq L$	$0.1 > W$	1																				
---	$0.05 < W$	Applied as point defect																				
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>	<div> </div> <p>Acceptable criterion</p> <table border="1"> <thead> <tr> <th>X</th> <th>Y</th> <th>Z</th> </tr> </thead> <tbody> <tr> <td><math>\leq 2</math></td> <td>0.5mm</td> <td><math>\leq t/2</math></td> </tr> </tbody> </table> <div> </div> <p>Acceptable criterion</p> <table border="1"> <thead> <tr> <th>X</th> <th>Y</th> <th>Z</th> </tr> </thead> <tbody> <tr> <td><math>\leq 2</math></td> <td>0.5mm</td> <td><math>\leq t</math></td> </tr> </tbody> </table> <div> </div> <p>Acceptable criterion</p> <table border="1"> <thead> <tr> <th>X</th> <th>Y</th> <th>Z</th> </tr> </thead> <tbody> <tr> <td><math>\leq 3</math></td> <td><math>\leq 2</math></td> <td><math>\leq t</math></td> </tr> <tr> <td colspan="2">shall not reach to ITO</td> <td></td> </tr> </tbody> </table> <div> </div> <p>Acceptable criterion</p> <table border="1"> <thead> <tr> <th>X</th> <th>Y</th> <th>Z</th> </tr> </thead> <tbody> <tr> <td>Disregard</td> <td><math>\leq 0.2</math></td> <td><math>\leq t</math></td> </tr> </tbody> </table> <div> </div> <p>Acceptable criterion</p> <table border="1"> <thead> <tr> <th>X</th> <th>Y</th> <th>Z</th> </tr> </thead> <tbody> <tr> <td><math>\leq 5</math></td> <td><math>\leq 2</math></td> <td><math>\leq t/3</math></td> </tr> </tbody> </table>	X	Y	Z	$\leq 2$	0.5mm	$\leq t/2$	X	Y	Z	$\leq 2$	0.5mm	$\leq t$	X	Y	Z	$\leq 3$	$\leq 2$	$\leq t$	shall not reach to ITO			X	Y	Z	Disregard	$\leq 0.2$	$\leq t$	X	Y	Z	$\leq 5$	$\leq 2$	$\leq t/3$
X	Y	Z																																	
$\leq 2$	0.5mm	$\leq t/2$																																	
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$\leq 5$	$\leq 2$	$\leq t/3$																																	

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"> <thead> <tr> <th>Point Size</th> <th>Acceptable Qty</th> </tr> </thead> <tbody> <tr> <td><math>\phi \leq 1/4W</math></td> <td>Disregard</td> </tr> <tr> <td><math>1/4W &lt; \phi \leq 1/2W</math></td> <td>1</td> </tr> <tr> <td><math>\phi &gt; 1/2W</math></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:  <math>Y \leq 0.4</math></p>
13	TAB	<p>1. Position</p>  <div style="border: 1px solid black; padding: 5px; width: fit-content; margin-left: auto; margin-right: auto;"> <math>W1 \leq 1/3W</math>  <math>H1 \leq 1/3H</math> </div> <p>2 TAB bonding strength test</p>  <p> <math>P (=F/TAB \text{ bonding width}) \geq 650\text{gf/cm}</math> ,(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>



### 12.3 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	50°C	48	
Low temp. Storage	-20°C	48	
Low temp. Operating	0°C	48	
Humidity	40°C/ 90%RH	48	
Temp. Cycle	0°C ← 25°C → 50°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 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. The life time is not content the life time of the LED (for the life time of LED which decay only 50%,in the industry the experience value is 50000 hours, but there are not any experimentation data to support this)

### 12.4 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 made 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  $40^{\circ}\text{C}$  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.