

深圳市阿美林电子科技有限公司  
Shenzhen Amelin Electronic Technology Co. Ltd.

## 技术承认书

# SPECIFICATION FOR LCD MODULE

MODULE NO.: FRD3504402  
DOC.REVISION :V00

Customer Approval:

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	SIGNATURE	DATE
PREPARED BY	tina	2015.08.06
CHECKED BY		
APPROVED BY		

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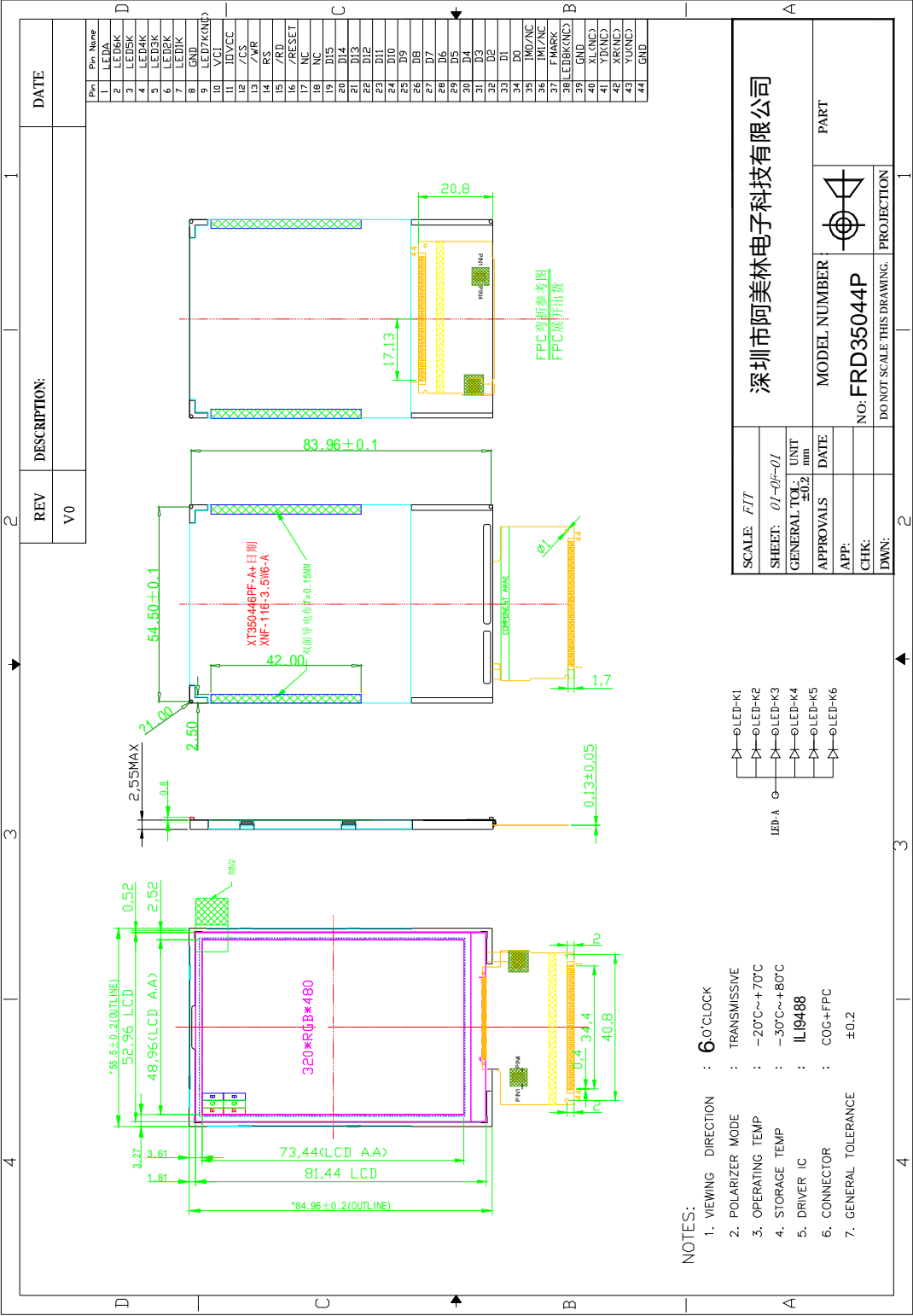
**1. Features & Mechanical Specifications**

Item	Contents	Unit
	LCD	
LCD Type	TFT Transmissive Normal White	--
Viewing direction	6:00	--
Backlight	White LED x6 in Parallel	--
Interface	8/16bit parallel bus interface	--
Driver IC	ILI9488	--
Outline Dimension	55.5(W) × 85(H) × 2.55(T)	mm
Glass area (W×H×T)	52.96*81.34*0.6	mm
Active area (W×H)	48.96*73.44	mm
Number of Dots	320(RGB) × 480	--
Pixel pitch (W×H)	0.174 × 0.174	mm
Operating Temperature	-20 ~ +70	℃
Storage temperature	-30 ~ +80	℃

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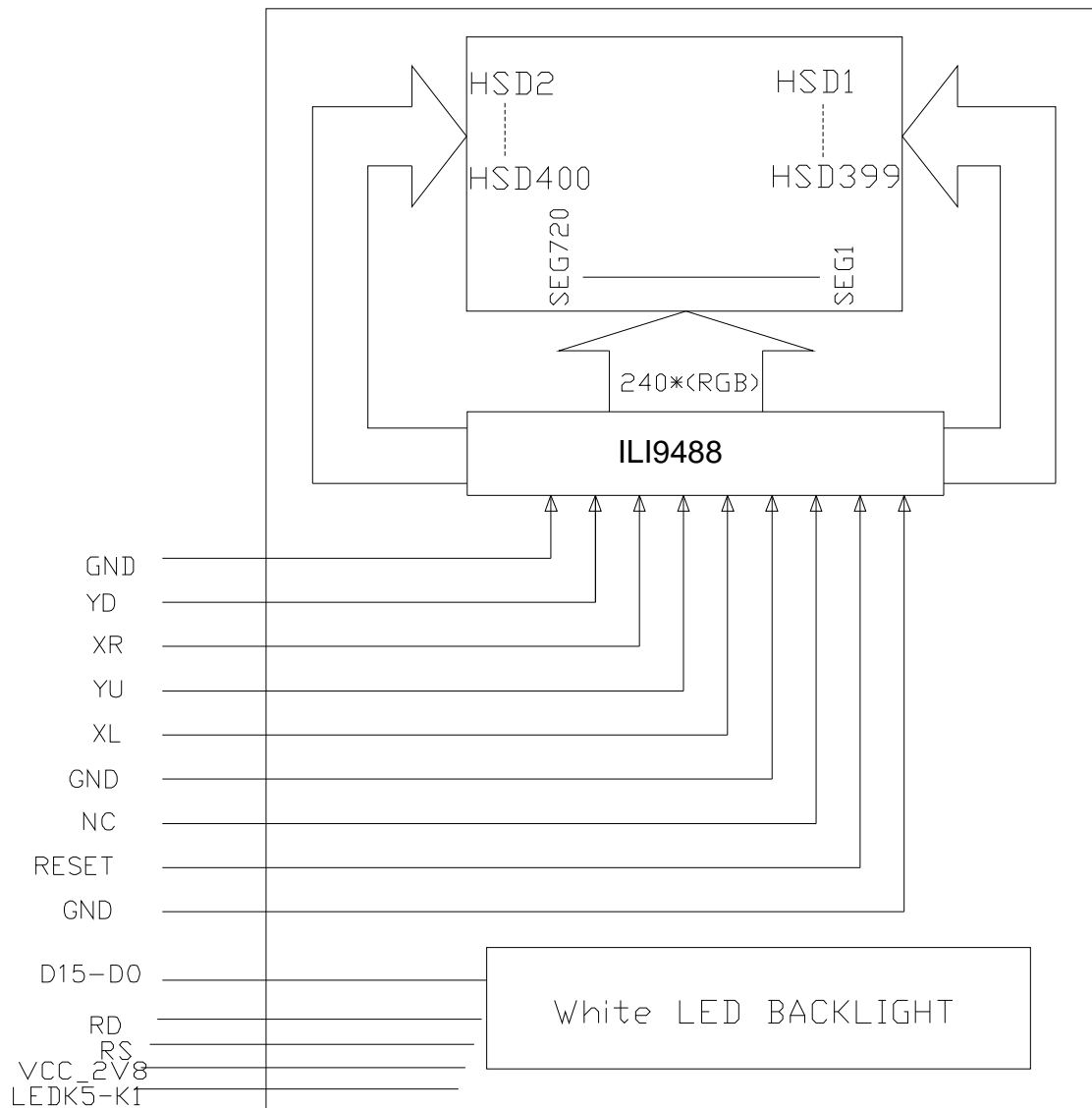
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2. Dimensional Outline



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3. Block Diagram



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**4. Pin Description**

<b>PIN No.</b>	<b>SYMBOL</b>	<b>Function</b>
1	LEDA	Backlight LED Anode.
2-7	LEDK6-LEDK1	Backlight LED Cathode
8	GND	Ground
9	LEDK7	NC
10	VCI	Power supply(2.8V)
11	IOVCC	Power supply(1.8/2.8V)
12	CS	Chip Select input pin. (Active Low)
13	WR	Write signal input pin. (Active Low)
14	RS	Data or command select pin. “H”: Date, “L”: Command.
15	RD	Read signal input pin. (Active Low)
16	/RESET	Reset Signal pin (“Low” is enable)
17-18	NC	NC
19-34	D15-D0	Data bus
35-36	IMO-IM1	NC
37	FMARK	Tearing effect output. If not used, please open this pin.
38	LEDK8	NC
39	GND	Ground
40	XL	Touch plane control signal pin
41	YD	Touch plane control signal pin
42	XR	Touch plane control signal pin
43	YU	Touch plane control signal pin
44	GND	Ground

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## **5. Absolute Maximum Ratings**

Item	Symbol	Rating			Unit
		MIN.	TYP.	MAX	
Supply Voltage range	VDD	-0.3	-	VDD+0.3	V
Power supply for gate drive	VGH		15.0		V
	VGL		-8.0		V
TFT Common Voltage	VcomH	2.5	-	4.0	V
	VcomL	-2.0	-	0	V
Operating Temperature range	TOP	-20	-	+70	°C
Storage Temperature range	TST	-30	-	+80	°C

## **6. Electrical Characteristics**

### **DC Characteristics**

Item	Symbol	Min.	Type.	Max.	Unit
Logic Supply Voltage	VDD		2.8-	3.3	V
I/O Supply Voltage	IOVCC	1.65	1.8-	3.0	V

## **7. Backlight Characteristics**

White LED ×6 n parallel

(Ta = 25°C)

Item	Symbol	Condition	Min	Typ	Max	Unit
Forward Voltage	VF	IF=120mA	-	3.2	-	V
Uniformity	△Bp	-	80	-	-	%
Luminance for LCD	Lv	IF=120mA	3500		-	cd/m <sup>2</sup>



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### 8. Electro-Optical Characteristics

Using LC+ Normal Polarizer+Corresponding Backlight, reference only (Note 1,Note 2)

Item		Symbol	Conditions	Specifications			Unit	Note
				Min.	Typ.	Max.		
Transmittance		T%	Viewing normal angle $\theta_x = \theta_y = 0^\circ$		4.7		%	All left side data are based on CMO's following condition – Type 767 NTSC: 60% LC:5066 Light : C light (Machine:BM5A) Normal Polarizer Without DBEF
Contrast Ratio		CR		150	250	-	-	
Response Time		T <sub>R</sub>		NA	10	20	ms	
		T <sub>F</sub>		NA	20	30	ms	
Chromaticity	Red	X <sub>R</sub>		0.603	0.633	0.663		
		Y <sub>R</sub>		0.299	0.329	0.359		
	Green	X <sub>G</sub>		0.264	0.294	0.324		
		Y <sub>G</sub>		0.546	0.576	0.606		
	Blue	X <sub>B</sub>		0.103	0.133	0.163		
		Y <sub>B</sub>		0.092	0.122	0.152		
	White	X <sub>W</sub>		0.278	0.308	0.338		
		Y <sub>W</sub>		0.316	0.346	0.376		
Viewing Angle	Hor.	θ <sub>X+</sub>		45	-	deg.		
		θ <sub>X-</sub>		45	-			
	Ver.	θ <sub>Y+</sub>		35	-			
		θ <sub>Y-</sub>		15	-			
			Center					
			CR≥10					

\*Note (1) Definition of Contrast Ratio (CR):

The contrast ratio can be calculated by the following expression.

$$\text{Contrast Ratio (CR)} = L_{63} / L_0$$

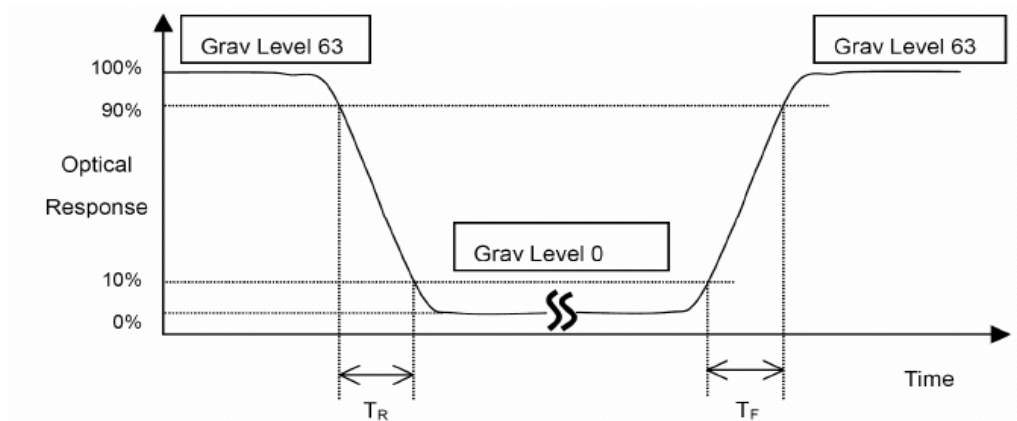
L63: Luminance of gray level 63

L0: Luminance of gray level 0

$$CR = CR(10)$$

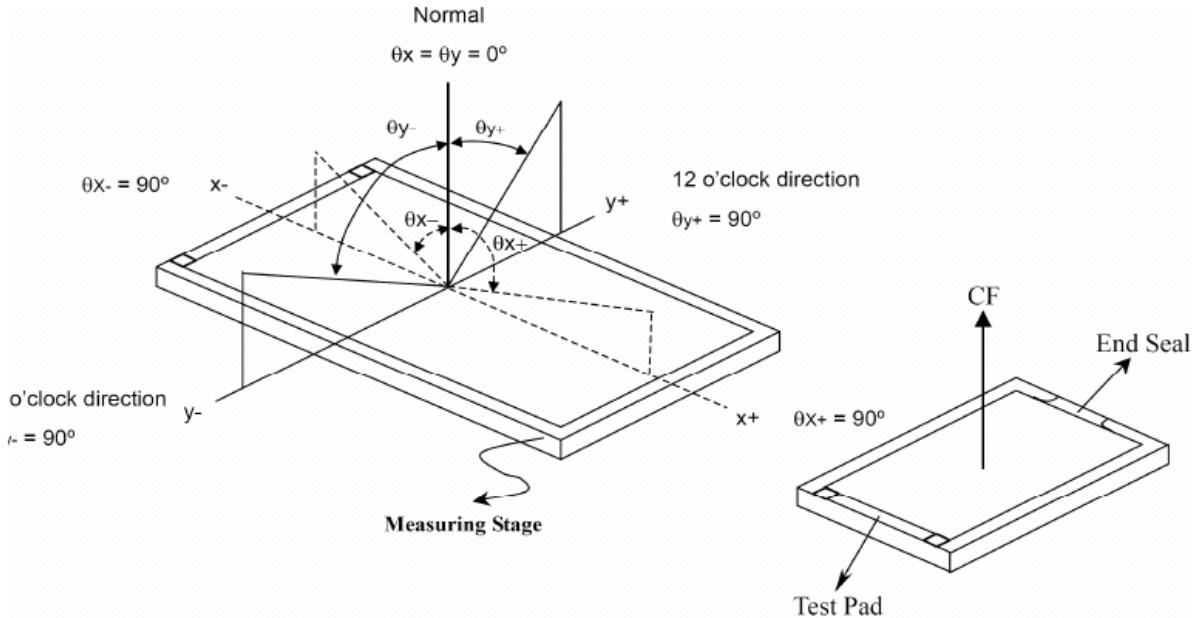
CR (X) is corresponding to the Contrast Ratio of the point X at Figure in Note (6).

\*Note (2) Definition of Response Time ( $T_R$ ,  $T_F$ ):



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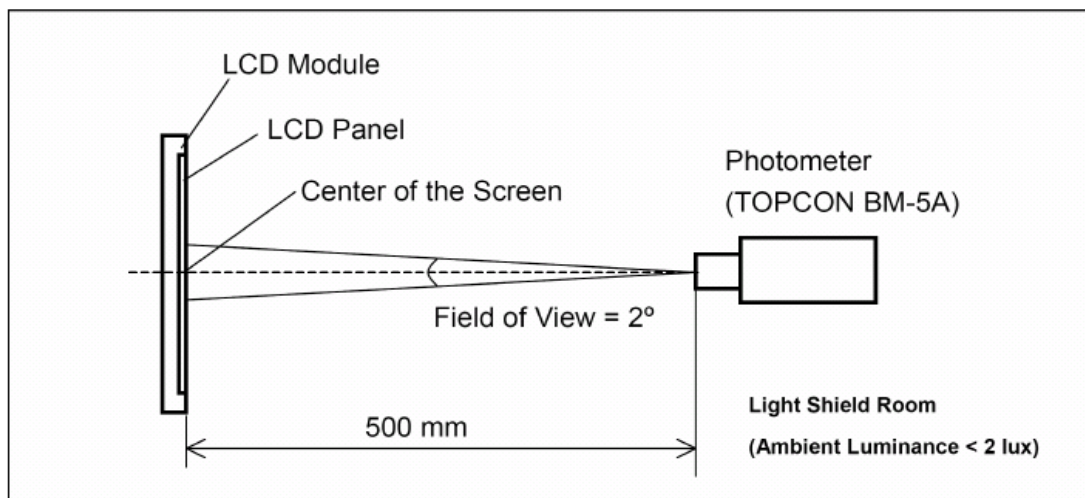
\*Note(3) Definition of Viewing Angle



\*\*\* The above "Viewing Angle" is the measuring position with Largest Contrast Ratio; not for good image quality. View Direction for good image quality is 6 O'clock. Module maker can increase the "Viewing Angle" by applying Wide View Film.

\*Note (4) Measurement Set-Up:

The LCD module should be stabilized at a given temperature for 20 minutes to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 20 minutes in a windless room.



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## 9. Instruction Description

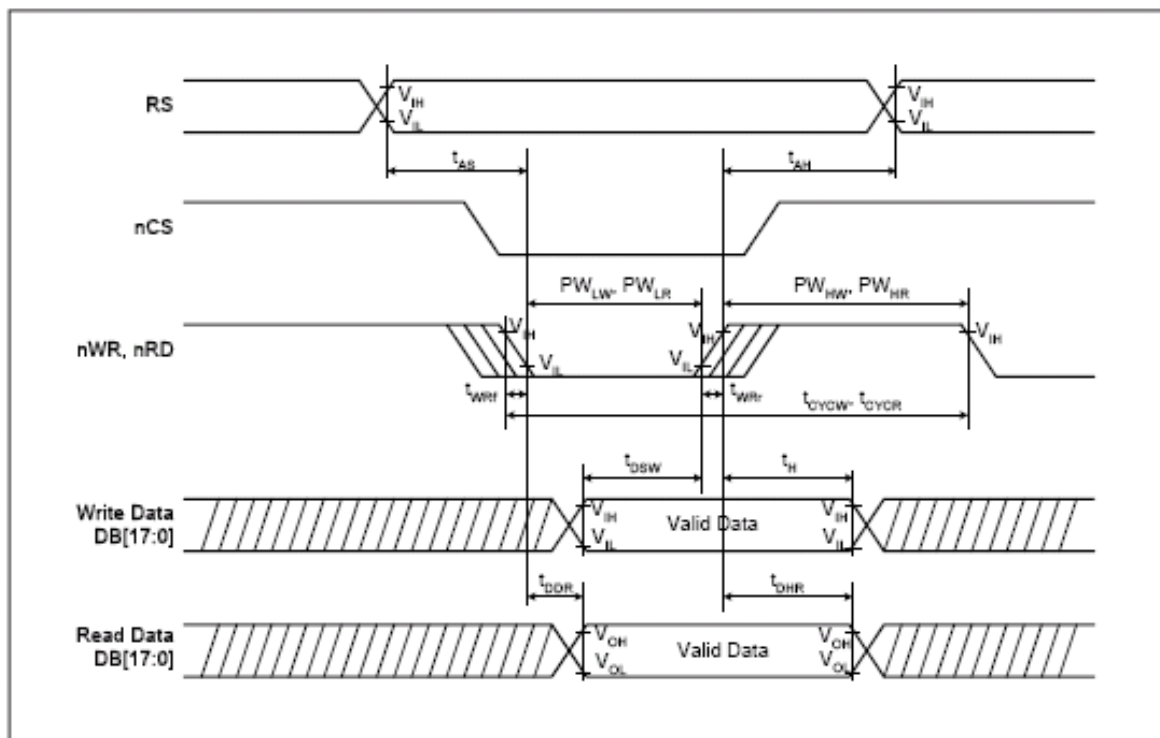
Please refer to ILI9327

## 10. AC Characteristics

### 8080-series MCU interface Timing Characteristics

Normal Write Mode (IOVCC = 1.65~3.3V, VCC=2.4~3.3V)

Item	Symbol	Unit	Min.	Typ.	Max.	Test Condition
Bus cycle time	Write	$t_{CYW}$	ns	100	-	-
	Read	$t_{CYR}$	ns	300	-	-
Write low-level pulse width	$PW_{LW}$	ns	50	-	500	-
Write high-level pulse width	$PW_{HW}$	ns	50	-	-	-
Read low-level pulse width	$PW_{LR}$	ns	150	-	-	-
Read high-level pulse width	$PW_{HR}$	ns	150	-	-	-
Write / Read rise / fall time	$t_{WR}/t_{WR}$	ns	-	-	25	-
Setup time	Write ( RS to nCS, E/nWR )	$t_{AS}$	ns	10	-	-
	Read ( RS to nCS, RW/nRD )		ns	5	-	-
Address hold time	$t_{AH}$	ns	5	-	-	-
Write data set up time	$t_{DSW}$	ns	10	-	-	-
Write data hold time	$t_H$	ns	15	-	-	-
Read data delay time	$t_{DDR}$	ns	-	-	100	-
Read data hold time	$t_{DHR}$	ns	5	-	-	-



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### **11.Quality Specifications**

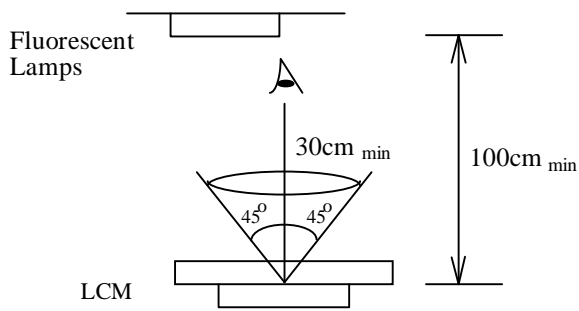
**All The raw material are Rohs complicant.**

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

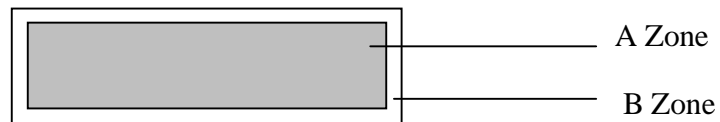
Manner of appearance test: The inspection should be performed in using 20W x 2 fluorescent lamps.

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  $45^{\circ}$  from vertical against LCM.



Definition of zone:



A Zone: viewing area

B Zone: outside viewing area

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### 11.2 Specification of quality assurance

AQL inspection standard

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

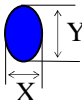
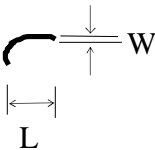
**Defect classification (Note: \* is not including)**

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	

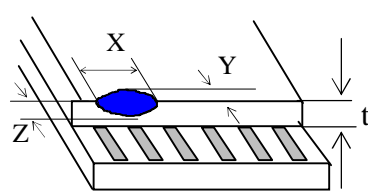
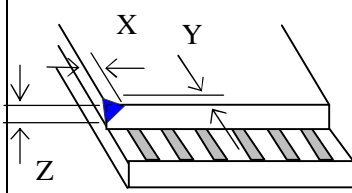
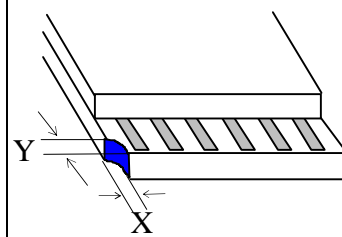
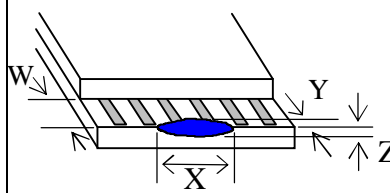
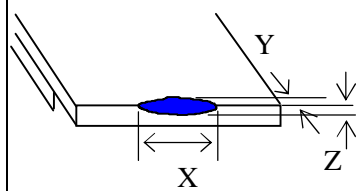
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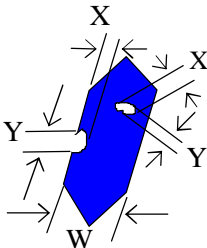
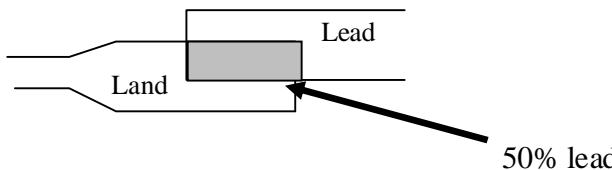
### Note on defect classification

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)  $\phi = (X+Y)/2$	<div></div> <table><tr><th>Point Size</th><th>Acceptable Qty.</th></tr><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>2（距离大于 5mm）</td></tr><tr><td><math>0.20 &lt; \phi \leq 0.25</math></td><td>1</td></tr><tr><td><math>\phi &gt; 0.25</math></td><td>0</td></tr></table> <div>Unit: mm</div>	Point Size	Acceptable Qty.	$\phi \leq 0.10$	Disregard	$0.10 < \phi \leq 0.20$	2（距离大于 5mm）	$0.20 < \phi \leq 0.25$	1	$\phi > 0.25$	0										
Point Size	Acceptable Qty.																					
$\phi \leq 0.10$	Disregard																					
$0.10 < \phi \leq 0.20$	2（距离大于 5mm）																					
$0.20 < \phi \leq 0.25$	1																					
$\phi > 0.25$	0																					
4	Line defect, Scratch	<div></div> <table><tr><th colspan="2">Line</th><th>Acceptable Qty.</th></tr><tr><th>L</th><th>W</th><th></th></tr><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></table> <div>Unit: mm</div>	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.																				

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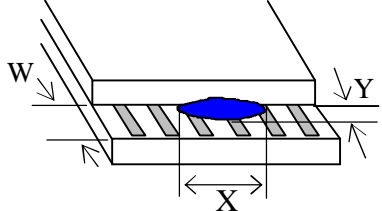
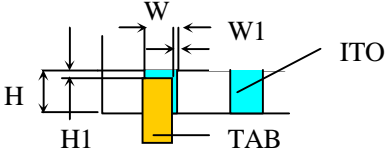
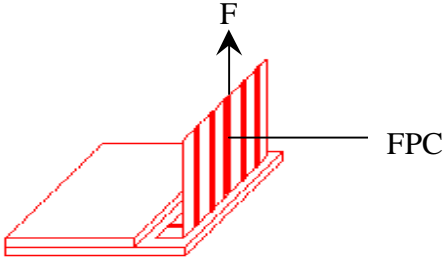
No	Item	Criterion																																
6	Chip  Remark: X: Length direction Y: Short direction Z: Thickness direction t: Glass thickness W: Terminal Width	<div></div> <div>Acceptable criterion</div> <table><tr><th>X</th><th>Y</th><th>Z</th></tr><tr><td>≤2</td><td>0.5mm</td><td>≤t/2</td></tr></table> <div></div> <div>Acceptable criterion</div> <table><tr><th>X</th><th>Y</th><th>Z</th></tr><tr><td>≤2</td><td>0.5mm</td><td>≤t</td></tr></table> <div></div> <div>Acceptable criterion</div> <table><tr><th>X</th><th>Y</th><th>Z</th></tr><tr><td>≤3</td><td>≤2</td><td rowspan="2">≤t</td></tr><tr><td colspan="2">shall not reach to ITO</td></tr></table> <div></div> <div>Acceptable criterion</div> <table><tr><th>X</th><th>Y</th><th>Z</th></tr><tr><td>Disregard</td><td>≤0.2</td><td>≤t</td></tr></table> <div></div> <div>Acceptable criterion</div> <table><tr><th>X</th><th>Y</th><th>Z</th></tr><tr><td>≤5</td><td>≤2</td><td>≤t/3</td></tr></table>	X	Y	Z	≤2	0.5mm	≤t/2	X	Y	Z	≤2	0.5mm	≤t	X	Y	Z	≤3	≤2	≤t	shall not reach to ITO		X	Y	Z	Disregard	≤0.2	≤t	X	Y	Z	≤5	≤2	≤t/3
X	Y	Z																																
≤2	0.5mm	≤t/2																																
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No.	Item	Criterion								
7	Segment pattern W = Segment width $\phi = (X+Y)/2$	<div>(1) Pin hole <math>\phi &lt; 0.10\text{mm}</math> is acceptable.</div> <div><table border="1" data-bbox="887 680 1335 853"><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><div>Unit: mm</div></div>	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	<div>(1) The color of backlight should correspond its specification.</div> <div>(2) Not allow flickering</div>								
9	Soldering	<div>(1) Not allow heavy dirty and solder ball on PCB. (The size of dirty refer to point and dust defect)</div> <div>(2) Over 50% of lead should be soldered on Land.</div> <div></div>								
10	Wire	<div>(1) Copper wire should not be rusted</div> <div>(2) Not allow crack on copper wire connection.</div> <div>(3) Not allow reversing the position of the flat cable.</div> <div>(4) Not allow exposed copper wire inside the flat cable.</div>								
11*	PCB	<div>(1) Not allow screw rust or damage.</div> <div>(2) Not allow missing or wrong putting of component.</div>								



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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;"> <math>W1 \leq 1/3W</math>  <math>H1 \leq 1/3H</math> </div> <p>2 FPC bonding strength test</p>  <p> <math>P (=F/\text{FPC 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>

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### 11.3 Reliability of LCM

Reliability test condition:

Item	Condition	Time (hrs)	Assessment
High temp. Storage	80°C	48	No abnormalities in functions and appearance
High temp. Operating	70°C	48	
Low temp. Storage	-30°C	48	
Low temp. Operating	-20°C	48	
Humidity	60°C/ 90%RH	48	
Temp. Cycle	-30°C ← 25°C → 80°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 ( $20\pm 8^{\circ}\text{C}$ ), normal humidity (below 65% RH), and in the area not exposed to direct sun light.

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### 11.4 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.
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.

# 深圳市阿美林电子科技有限公司

## Shenzhen Amelin Electronic Technology Co. Ltd.

### **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.