ORIENT DISPLAY

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SPECIFICATION
FOR
LCD MODULE

MODULE NO: AFS480272TG-4.3-C000001
REVISION NO: 00

Customer's Approval:

	SIGNATURE	DATE
PREPARED BY (RD ENGINEER)	YLH	2011-2-28
CHECKED BY	FR. LI	2011-2-28
APPROVED BY	SEAN	2011-2-28

Orient Display (N.A.) Ltd.
145 Royal Crest Court Unit 42, Markham, ON, Canada L3R 9Z4
Tel: 905-477-1166 Fax: 905-477-1782

Orient Display (USA) Corp.
1315 NW Mall St. Suite 5, Issaquah, WA, USA 98027
Tel: 425-392-6880 Fax: 425-557-6560

DOCUMENT REVISION HISTORY

Version	DATE	DESCRIPTION	CHANGED BY
00	Feb-28-2011	First Issue	Ylh

CONTENTS

1. Features & Mechanical Specifications

Item	Contents	Unit
	LCD	
LCD Type	TFT / Transmissive / Normal White	--
Viewing direction	6 O′clock	--
Backlight	8 Chip White LED in Series	--
Interface	RGB interface	--
Driver IC	OTA5180A	--
Outline Dimension	105.5(W) × 67.2 (H) × 2.9(T)	mm
Glass area (W×H×T)	102.04 × 58.756 /63.006 × 0.5	mm
Active area (W×H)	95.04 × 53.856	mm
Number of Dots	480(RGB) × 272	--
Dot pitch (W×H)	0.066 × 0.198	mm
Pixel pitch (W×H)	0.198 × 0.198	mm
Operating Temperature	-20 ～ +70	°
Storage temperature	-30 ～ +80	°

2. Dimensional Outline

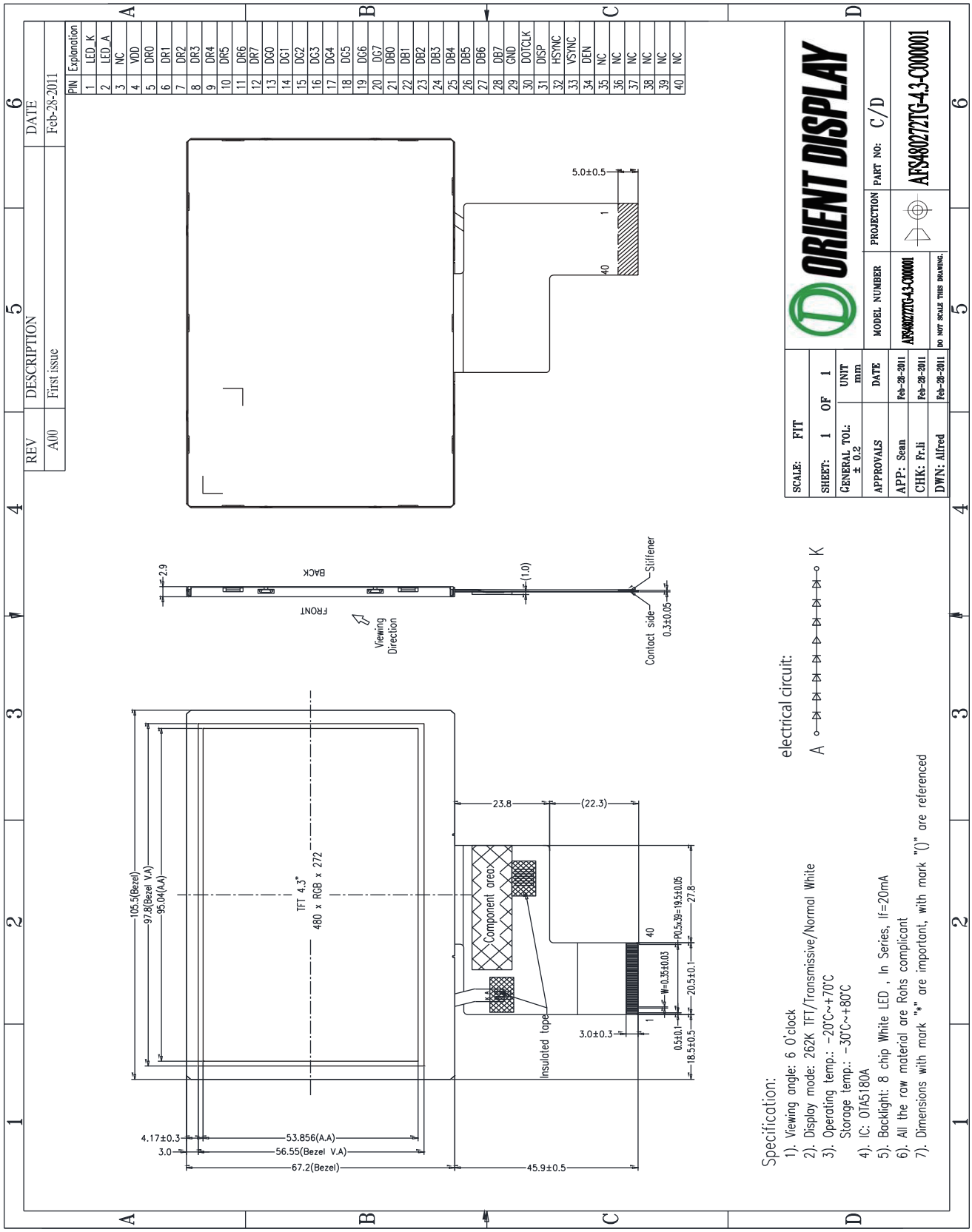


Figure 1. Dimensional outline

3. Block Diagram

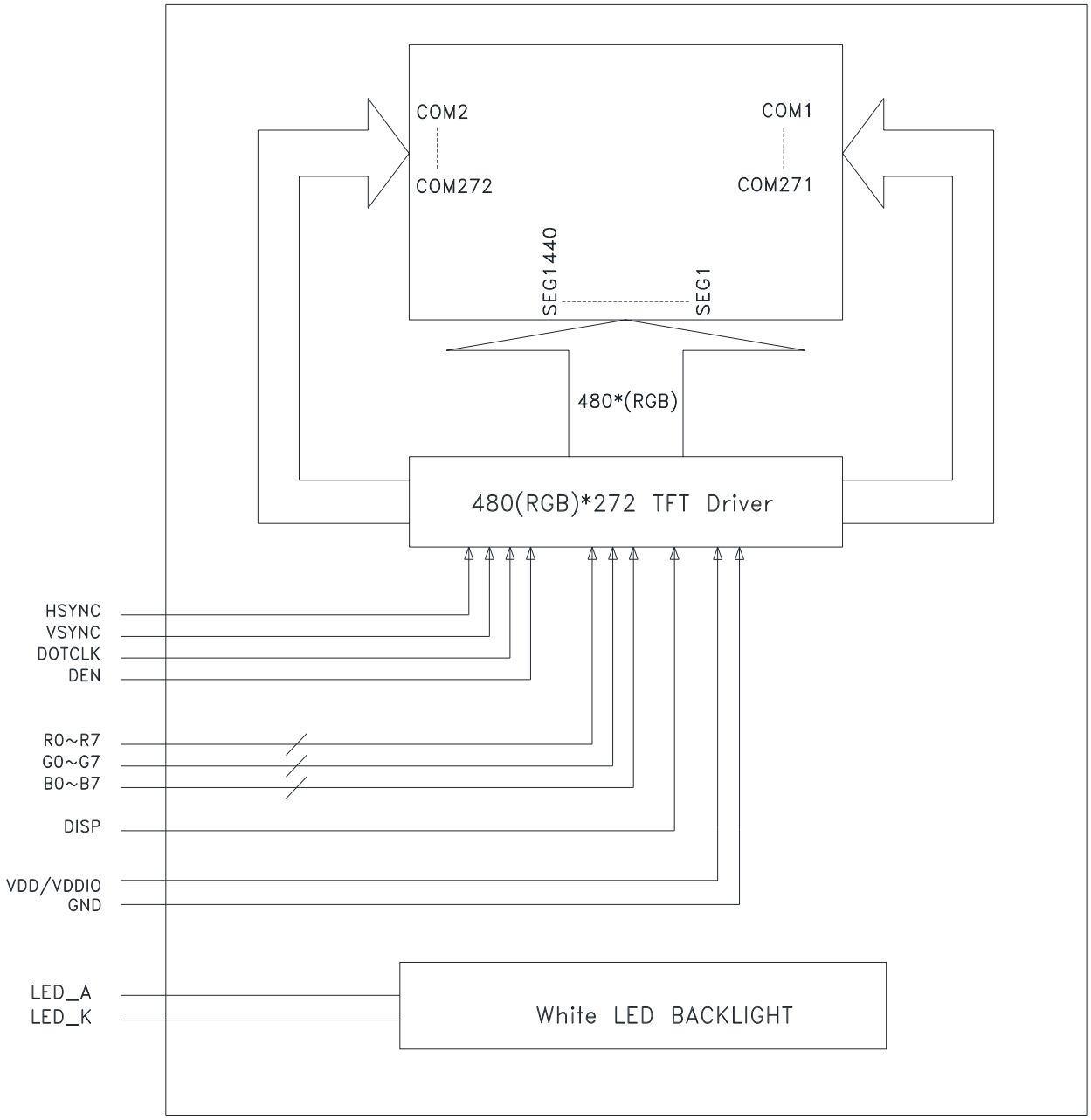


Figure 2. Block diagram

4. Pin Description

PIN No.	SYMBOL	Function
1	LED_K	Backlight LED Cathode
2	LED_A	Backlight LED Anode
3	NC	No Connection
4	VDD	Power supply
5~12	DR0~DR7	8-bit digital Red data input
13~20	DG0~DG7	8-bit digital Green data input
21~28	DB0~DB7	8-bit digital Blue data input
29	GND	Ground
30	DOTCLK	Clock signal; latching data at the falling edge
31	DISP	Display control / standby mode selection. DISP = "Low" : Standby DISP = "High" : Normal display
32	HSYNC	Horizontal sync signal; negative polarity
33	VSYNC	Vertical sync signal; negative polarity
34	DEN	Data input enable. Active High to enable the data input.
35~40	NC	No Connection

5. Absolute Maximum Ratings

Item	Symbol	Rating	Unit
Supply Voltage range	VDD	-0.3 to +4.5	V
Operating Temperature range	TOP	-20 to +70	℃
Storage Temperature range	TST	-30 to +80	℃

6. Electrical Characteristics

DC Characteristics

Item	Symbol	Min.	Type.	Max.	Unit
Logic Supply Voltage	VDD	3	3.3	3.6	V

7. Backlight Characteristics

White LED (in series) **(Ta = 25°C)**

Item	Symbol	Condition	Min	Typ	Max	Unit
Forward Voltage	VF	IF = 20mA	-	25.6	-	V
Uniformity	△ Bp	-	80	-	-	%
Luminance for LCD	Lv	IF = 20mA	3000	-	-	cd/m^2

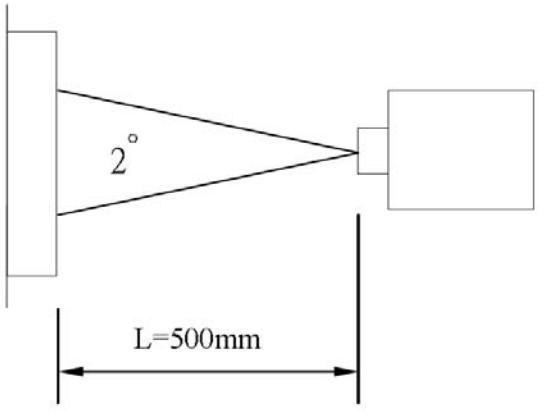
8. Electro-Optical Characteristics

(Taransmittance、contrast、RT、viewing angle results are using CPT LC+ EWV Polarizer+ CPT's BLU (2L1D) reference only) (Note1，Note2)

ITEM		SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	REMARK
Transmittance		T		5.7	6.0		%	Note 2
Contrast Ratio		CR	*1)	250	350	--	--	Note 3
Response Time		Tr+ Tf	*3)	-	30	45	ms	Note 4
Viewing Angle	Vertical	θ *2)	CR≧10	90	110	--		
						--		Note 5
	Horizontal	ϕ *2)		110	130	--		
						--		
Color Filter Chromacicity with C light	White	x	$\theta=\phi=0°$	0.288	0.308	0.328		Note 6
		y		0.320	0.340	0.360		
	Red	x	$\theta=\phi=0°$	0.584	0.604	0.624		
		y		0.306	0.326	0.346		
	Green	x	$\theta=\phi=0°$	0.297	0.317	0.337		
		y		0.527	0.547	0.567		
	Blue	x	$\theta=\phi=0°$	0.119	0.139	0.159		
		y		0.140	0.160	0.180		
	NTSC			-	47.4%	-		

Note 1.Ambient condition：25℃±2℃，60±10%RH，under 10 Lunx in the darkroom。

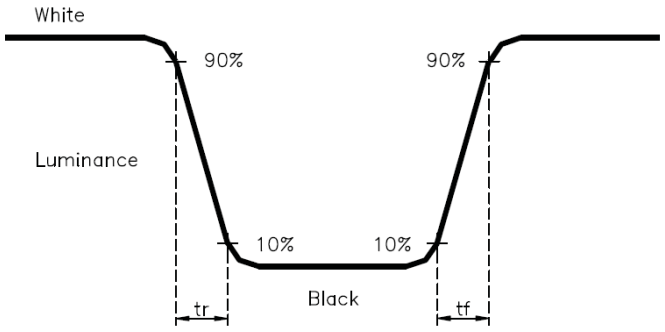
Note 2.Measure device：BM-5A (TOPCON)，viewing cone=2°，I_L=20mA。



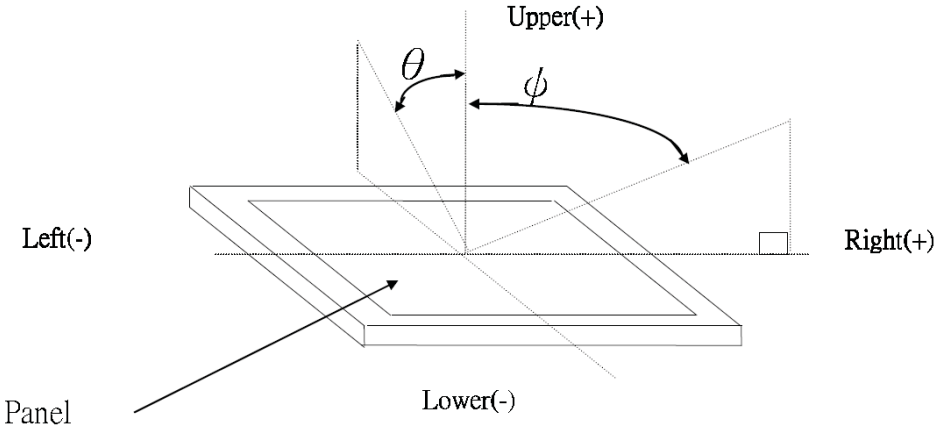
Note 3. Definition of Contrast Ratio：

CR = White Luminance (ON) / 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)：



Note 6. Light source: C light.

9. Instruction Description

No.	Register Address								Register Data (Default)							
	R/W	A6	A5	A4	A3	A2	A1	A0	D7	D6	D5	D4	D3	D2	D1	D0
R17	0	0	0	1	0	0	0	1	X	VCOMH (0110100)						
R18	0	0	0	1	0	0	1	0	X	VCOML (0101000)						

X: reversed, please set to '0'

Note:

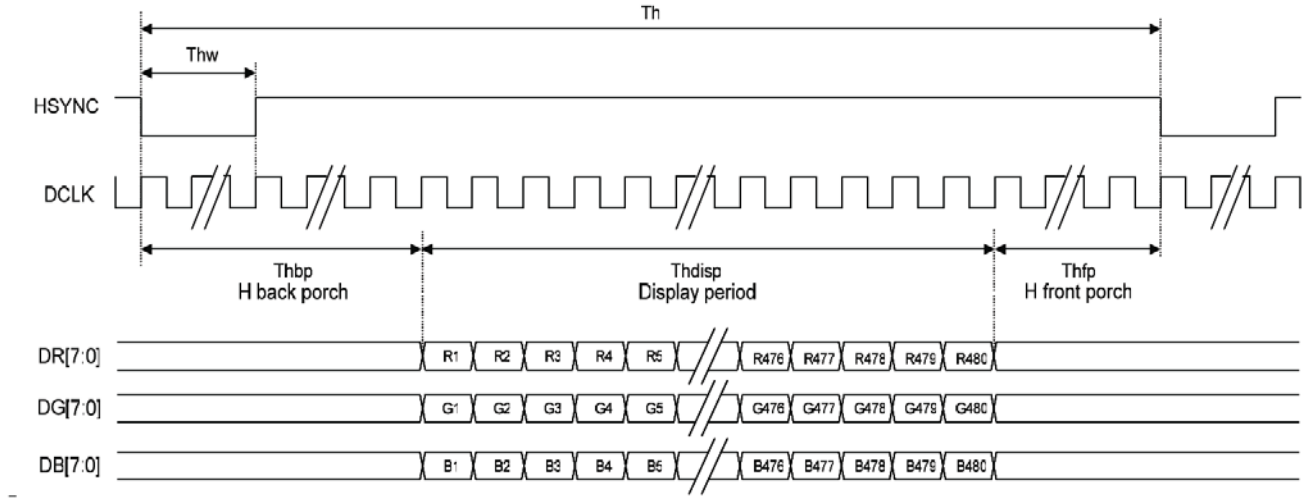
1. When GRB is low, all registers reset to default values
2. Serial commands are executed at next VSYNC signal

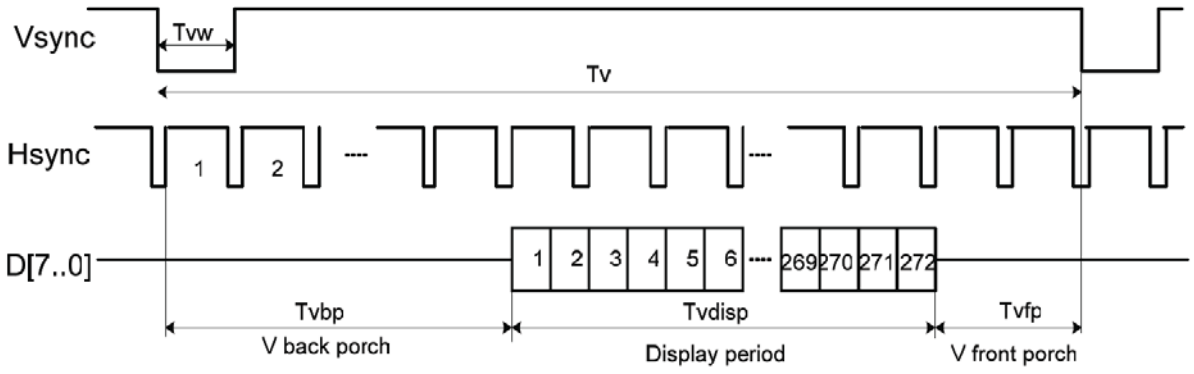
10. AC Characteristics

Parallel RGB Input Timing Table

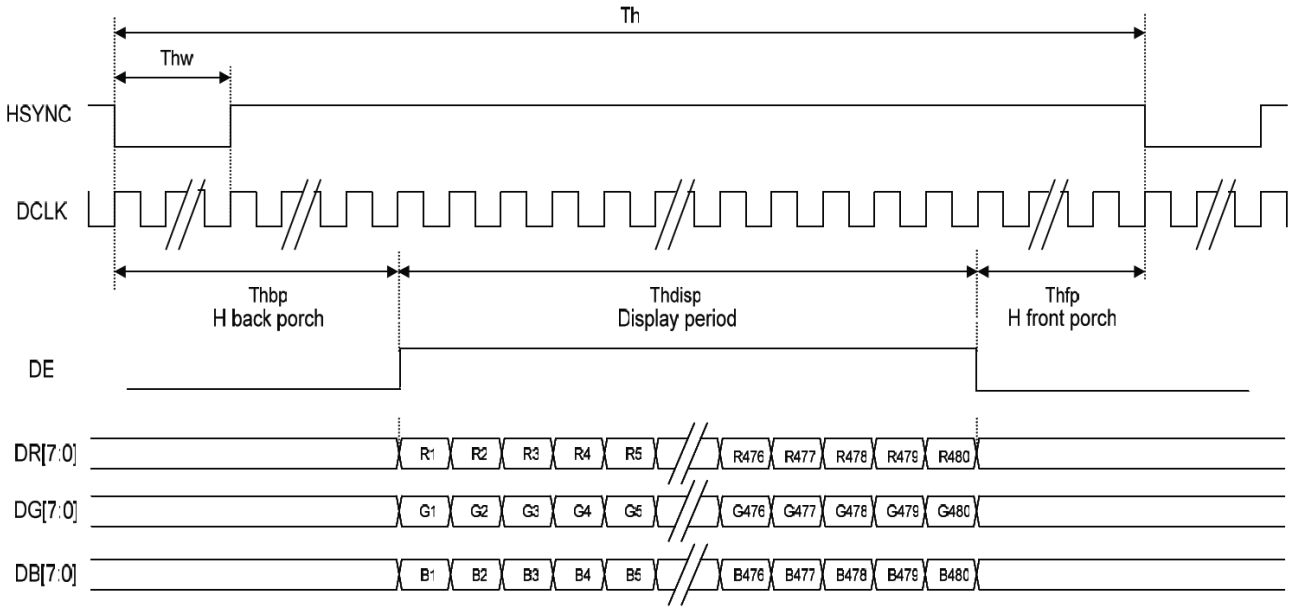
Item		Symbol	Min.	Typ.	Max.	Unit	
DCLK Frequency		Fclk	5	9	12	MHz	
DCLK Period		Tclk	83	110	200	ns	
Hsync	Period Time	Th	490	531	605	DCLK	
	Display Period	Thdisp		480		DCLK	
	Back Porch	Thbp	8	43		DCLK	By H_BLANKING setting
	Front Porch	Thfp	2	8		DCLK	
	Pulse Width	Thw	1			DCLK	
Vsync	Period Time	Tv	275	288	335	H	
	Display Period	Tvdisp		272		H	
	Back Porch	Tvbp	2	12		H	By V_BLANKING setting
	Front Porch	Tvfp	1	4		H	
	Pulse Width	Tvw	1	10		H	

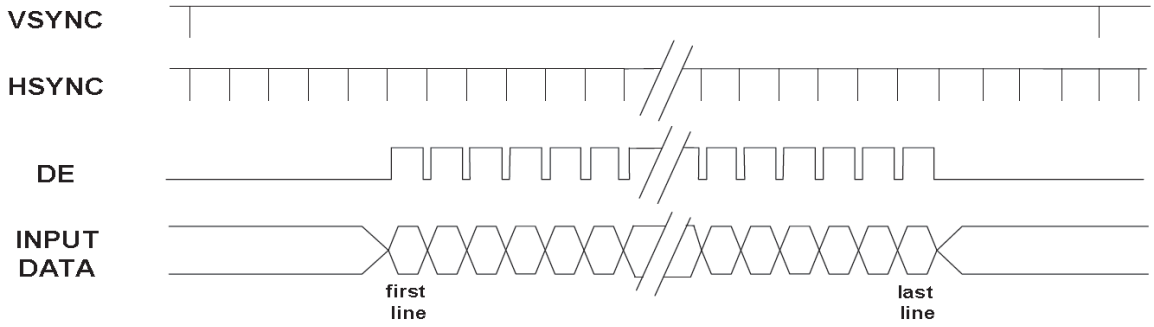
SYNC Mode Timing Diagram





SYNC-DE Mode Timing Diagram





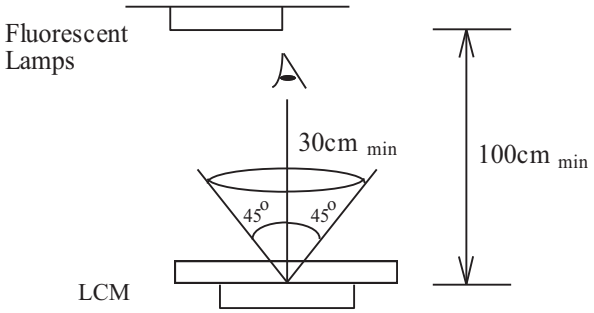
11.Quality Specifications

All The raw material are Rohs complicant.

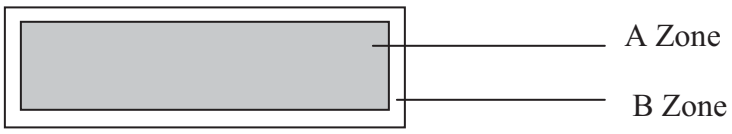
11.1 Standard of the product appearance test

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° from vertical against LCM.



Definition of zone:



A Zone: viewing area
B Zone: outside viewing area

11.2 Specification of quality assurance

AQL inspection standard

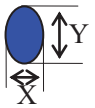
Sampling method: MIL-STD-105E, Level II, single sampling

Defect classification (Note: * is not including)

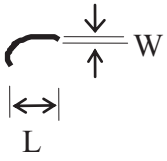
Classify	Item		Note	AQL
Major	Display state	Short or open circuit	1	0.65
		LC leakage		
		Flickering		
		No display		
		Wrong viewing direction		
		Contrast defect (dim, ghost)	2	
		Back-light	1,8	
	Non-display	Flat cable or pin reverse	10	
		Wrong or missing component	11	
Minor	Display state	Background 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	

Note on defect classification

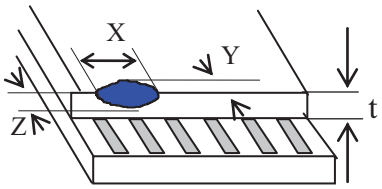
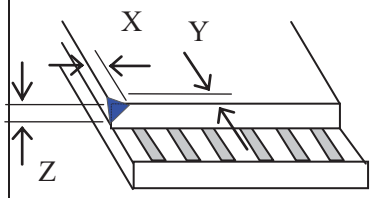
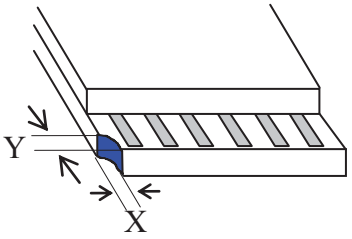
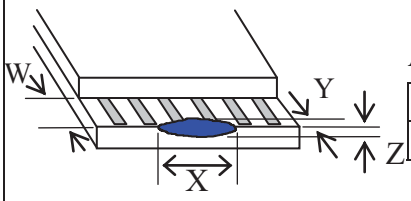
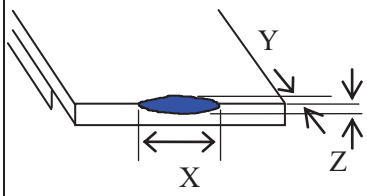
<table>
<tr><th>No.</th><th>Item</th><th>Criterion</th></tr>
<tr><td rowspan="6">1</td><td>Short or open circuit</td><td rowspan="6">Not allow</td></tr>
<tr><td>LC leakage</td></tr>
<tr><td>Flickering</td></tr>
<tr><td>No display</td></tr>
<tr><td>Wrong viewing direction</td></tr>
<tr><td>Wrong Back-light</td></tr>
<tr><td rowspan="2">2</td><td>Contrast defect</td><td rowspan="2">Refer to approval sample</td></tr>
<tr><td>Background color deviation</td></tr>
<tr><td>3</td><td>Point defect,
Black spot, dust
(including Polarizer)

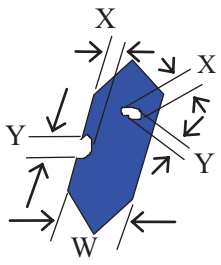
Φ= (X+Y)/2</td><td> 

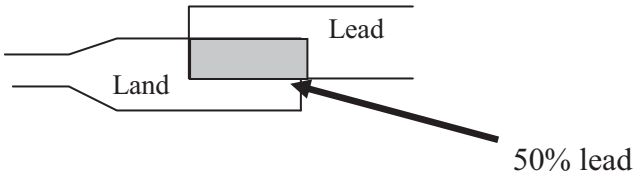
<table>
<tr><th>Point
Size</th><th>Acceptable Qty.</th></tr>
<tr><td>Φ≤0.10</td><td>Disregard</td></tr>
<tr><td>0.10<Φ≤ 0.20</td><td>3</td></tr>
<tr><td>0.20<Φ≤ 0.25</td><td>2</td></tr>
<tr><td>0.25<Φ≤ 0.30</td><td>1</td></tr>
<tr><td>Φ>0.30</td><td>0</td></tr>
</table>
Unit：mm</td></tr>
<tr><td>4</td><td>Line defect,

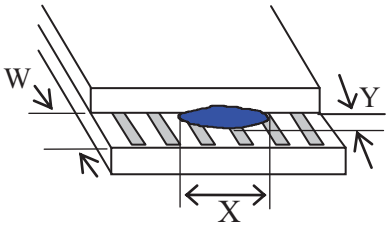
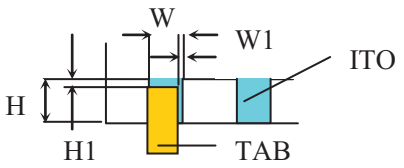
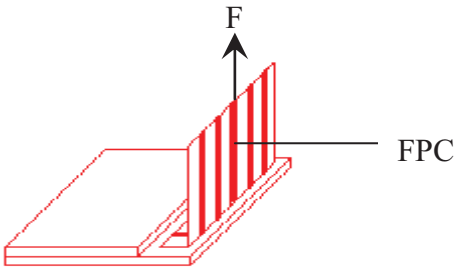
Scratch</td><td> 

<table>
<tr><th colspan="2">Line</th><th>Acceptable Qty.</th></tr>
<tr><td>L</td><td>W</td><td></td></tr>
<tr><td>---</td><td>0.015≥ W</td><td>Disregard</td></tr>
<tr><td>3.0≥ L</td><td>0.03≥ W</td><td rowspan="2">2</td></tr>
<tr><td>2.0≥ L</td><td>0.05≥ W</td></tr>
<tr><td>1.0≥ L</td><td>0.1＞W</td><td>1</td></tr>
<tr><td>---</td><td>0.05<W</td><td>Applied as point defect</td></tr>
</table>
Unit: mm</td></tr>
<tr><td>5</td><td>Rainbow</td><td>Not more than two color changes across the viewing area.</td></tr>
</table>

No	Item	Criterion
6	Chip Remark: X: Length direction Y: Short direction Z: Thickness direction t: Glass thickness W: Terminal Width	 Acceptable criterion X: ≤ 2; Y: 0.5mm; Z: ≤ t/2  Acceptable criterion X: ≤ 2; Y: 0.5mm; Z: ≤ t  Acceptable criterion X: ≤ 3; Y: ≤ 2; Z: ≤ t shall not reach to ITO  Acceptable criterion X: Disregard; Y: ≤ 0.2; Z: ≤ t  Acceptable criterion X: ≤ 5; Y: ≤ 2; Z: ≤ t/3

<table>
<tr><th>No.</th><th>Item</th><th>Criterion</th></tr>
<tr><td>7</td><td>Segment
pattern
W = Segment width
Φ= (X+Y)/2</td><td>(1) Pin hole
Φ < 0.10mm is acceptable.
 

<table>
<tr><th>Point Size</th><th>Acceptable Qty</th></tr>
<tr><td>Φ≤ 1/4 W</td><td>Disregard</td></tr>
<tr><td>1/4 W< Φ≤ 1/2 W</td><td>1</td></tr>
<tr><td>Φ> 1/2 W</td><td>0</td></tr>
</table>
Unit: mm</td></tr>
<tr><td>8</td><td>Back-light</td><td>(1) The color of backlight should correspond its specification.
(2) Not allow flickering</td></tr>
<tr><td>9</td><td>Soldering</td><td>(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.
 
</td></tr>
<tr><td>10</td><td>Wire</td><td>(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.</td></tr>
<tr><td>11*</td><td>PCB</td><td>(1) Not allow screw rust or damage.
(2) Not allow missing or wrong putting of component.</td></tr>
</table>

No	Item	Criterion
12	Protruded W: Terminal Width	 Acceptable criteria: Y ≤ 0.4
13	TAB	1. Position  W1≤ 1/3W H1≤ 1/3H 2 FPC bonding strength test  P (=F/FPC bonding width) ≥ 650gf/cm ,(speed rate: 1mm/min) 5pcs per SOA (shipment)
14	Total no. of acceptable Defect	A. Zone Maximum 2 minor non-conformities per one unit. Defect distance: each point to be separated over 10mm B. Zone It is acceptable when it is no trouble for quality and assembly in customer's end product.

11.3 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	-20°C	48	
Low temp. Operating	-10°C	48	
Humidity	40°C/ 90%RH	48	
Temp. Cycle	-20°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.

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 isoproply alcohol, ethyl alcohol or trichlorotriflorothane, 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: $280^{\circ}C \pm 10^{\circ}C$
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 Vo.
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 Displaywill 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.