ORIENT DISPLAY

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SPECIFICATION
FOR
LCD MODULE

MODULE NO: AFL480272BL-5.0N-06A0-N
REVISION NO: A0

Customer's Approval:

	SIGNATURE	DATE
PREPARED BY (RD ENGINEER)	LYY	2012-4-30
CHECKED BY	GXH	2012-4-30
APPROVED BY	GXH	2012-4-30

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1. General Description

AFL480272BL-5.0N-06A0-N is a transmissive type a-Si TFT-LCD (amorphous silicon thin film transistor liquid crystal display) module, which is composed of a TFT-LCD panel, a driver circuit and a backlight unit. The panel size is 5.0 inch and the resolution is 480(RGB)*272, the panel can display up to 16.7M colors. The LCM can be easily accessed by micro-controller via parallel interface.

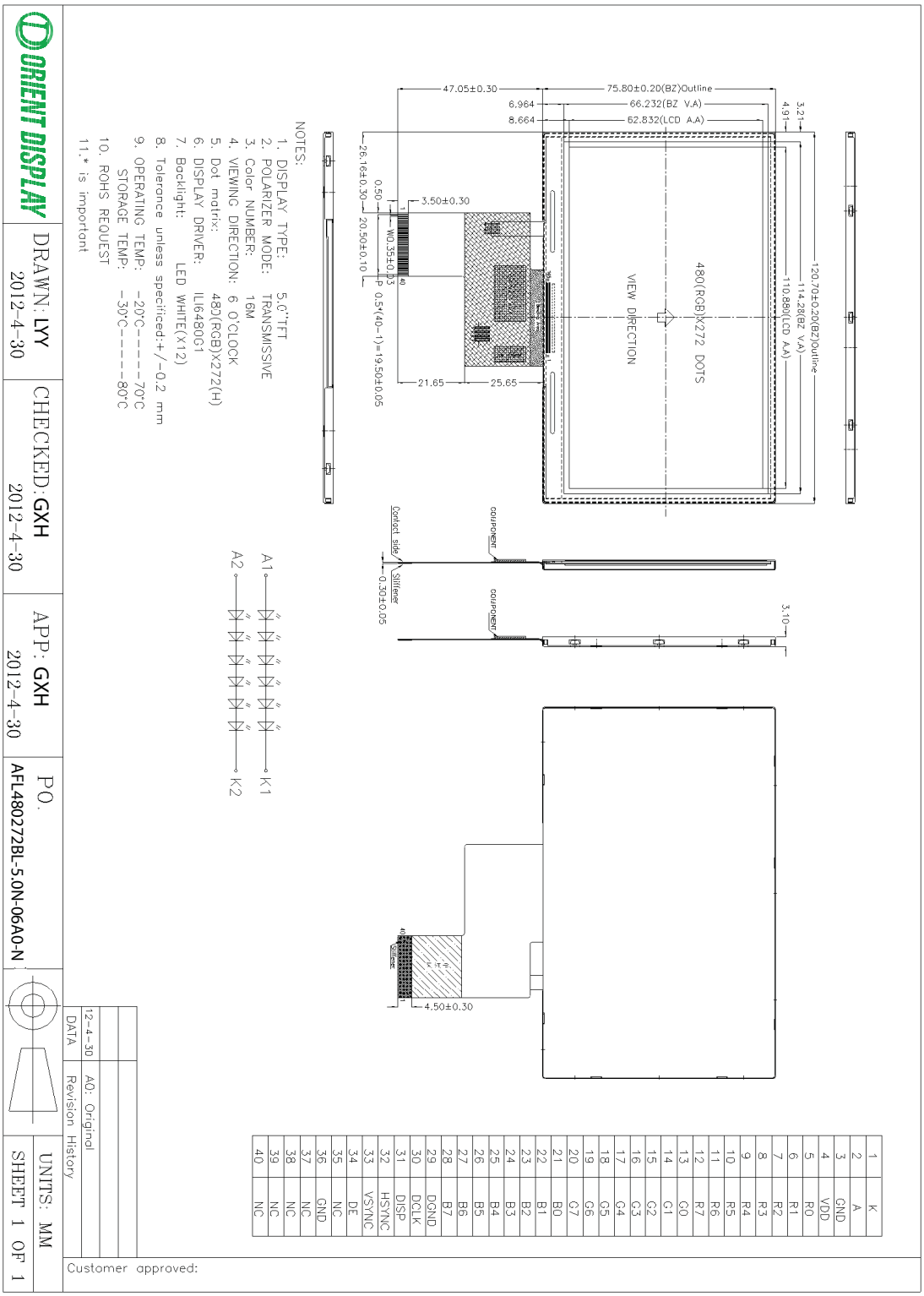
2. Physical Features

Display Mode	TFT-LCD Module
	Active matrix TFT, Transmissive type
Display Format	Graphic 480×RGB×272 Dot-matrix
Input Data	24 bit RGB interface
Viewing Direction	6 O'clock

3. Mechanical Specification

Item	Contents	Unit
Module size (W×H×T)	120.7(W)X75.8(H)X3.1(T)	mm
Number of dots	480(RGB) × 272	---
Active area (W×H)	110.88X62.83	mm

4. Outline Dimension



5. Absolute Maximum Ratings

Item	Symbol	Min	Max	Unit	Remark
Power Voltage	VCC	0.3	5.0	V	Note1、Note2
Input Voltage	VIN	-0.3	5.0	V	
Operating temperature	TOPR	-20	70	℃	
Storage temperature	TSTR	-30	80	℃	
Humidity	---	---	90	%RH	---

Remark:

Note 1) The driver IC may be permanently damaged if it is used under the condition exceeding the above absolute maximum values. It is also recommended to use the driver IC within the limit of its electric characteristics during normal operation. Exceeding the conditions may lead to malf unction of it and affect its credibility.

Note 2) The voltage from VSS.

6. Electrical Characteristics

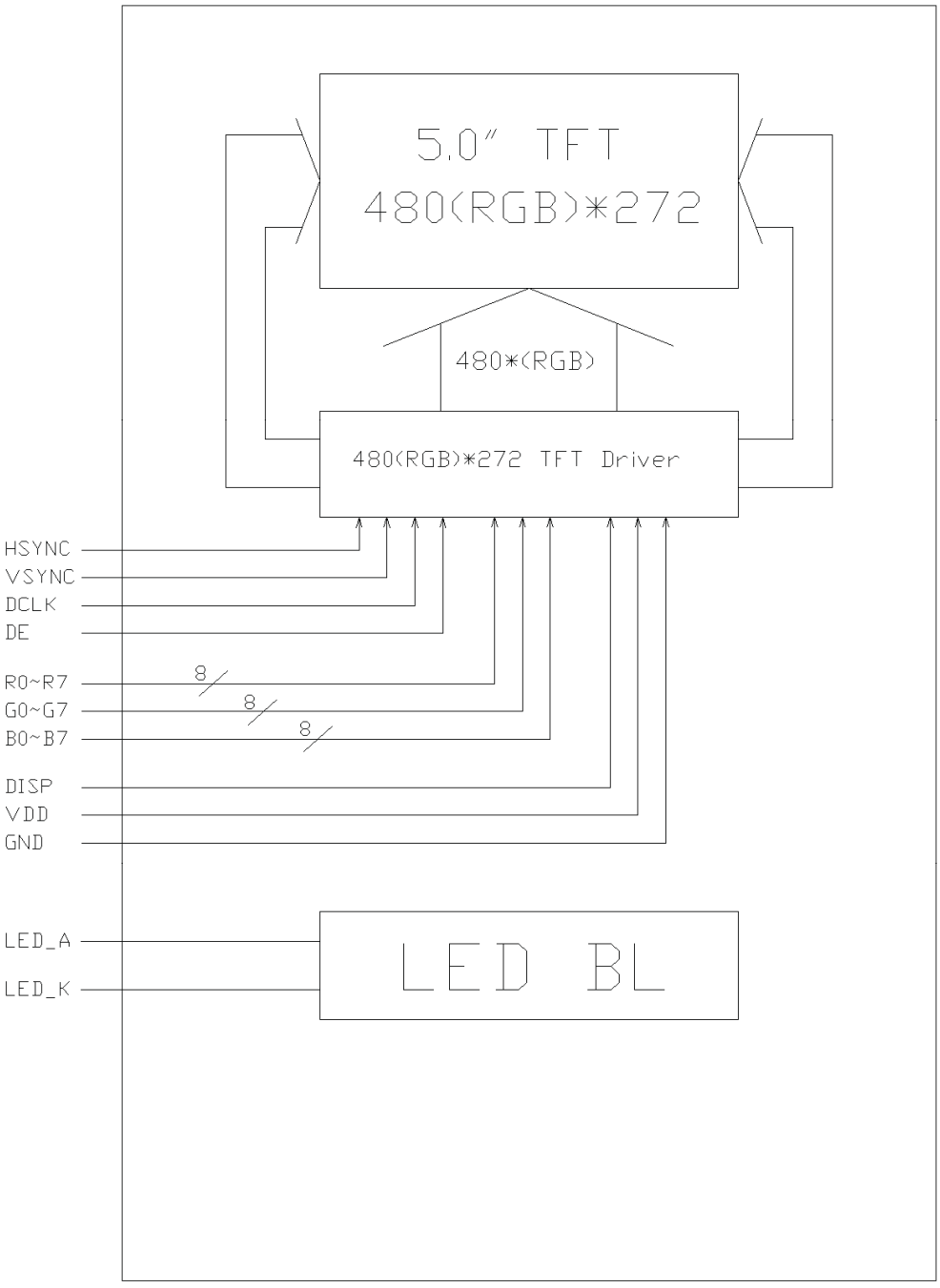
Item		Symbol	Rating			Unit	Remark
			Min	Typ	Max		
Power Voltage	Logic	VCC	3.0	3.3	3.6	V	Note1
Input Voltage	L level	VIL	GND	---	0.3*VCC	V	VCC=3.0 ~ 3.6V
	H level	VIH	0.7* VCC	---	VCC	V	
LCD Drive Power current		ILCD	---	7	---	mA	VCC=3.3V

Remark:

Note 1) Vcom must be adjusted to optimize display quality: Cross-talk, Contrast Ratio and etc.

7. Module Function Description

7-1. Block Diagram Of LCM



7-2. Pin Description

PIN NO.	Symbol	I/O	Description
1	K	P	Power for LED backlight cathode
2	A	P	Power for LED backlight anode
3	NC	--	No connect
4	DVDD	P	Power voltage
5~12	R0~R7	I	Red data
13~20	G0~G7	I	Green data
21~28	B0~B7	I	Blue data
29	GND	P	Power ground
30	CLK	I	Pixel clock
31	DISP	I	Display on/off
32	HSYNC	I	Horizontal sync signal
33	VSYNC	I	Vertical sync signal
34	DE	I	Data enable
35	NC	--	No connect
36	GND	P	Power ground
37	NC	--	No connect
38	NC	--	No connect
39	NC	--	No connect
40	NC	--	No connect

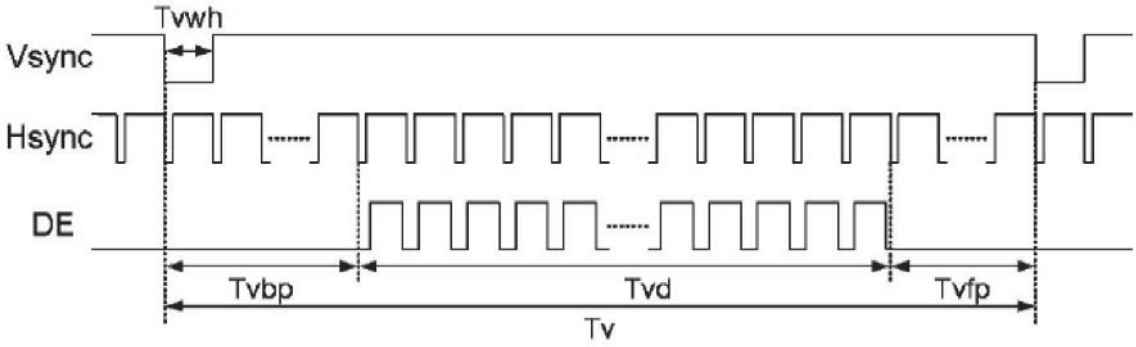
7-3. Timing Characteristics

7.3.1 Data Input Format

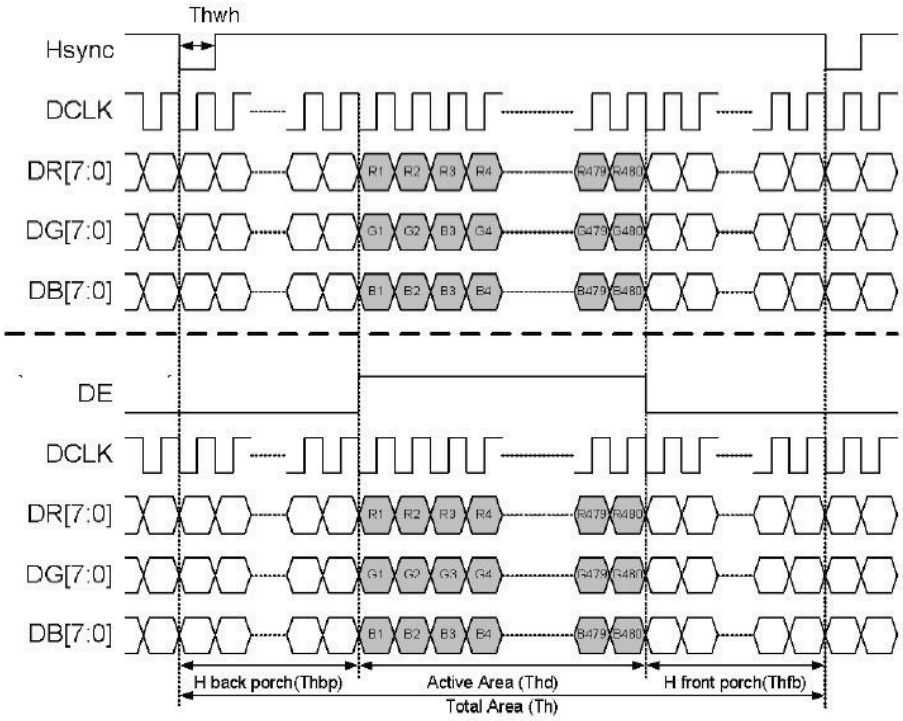
Parallel 24-bit RGB Input Timing Table

Parameters	Symbol	Min.	Typ.	Max.	Unit	Conditions
DCLK frequency	fclk	5	9	12	MHz	
VSYNC period time	Tv	277	288	400	Th	
VSYNC display area	Tvd		272		Th	
VSYNC back porch	Tvbp	3	8	31	Th	
VSYNC front porch	Tvfp	2	8	93	Th	
HSYNC period time	Th	520	525	800	DCLK	
HSYNC display area	Thd		480		DCLK	
HSYNC back porch	Thbp	36	40	255	DCLK	
HSYNC front porch	Thfp	4	5	65	DCLK	

Vertical Input Timing



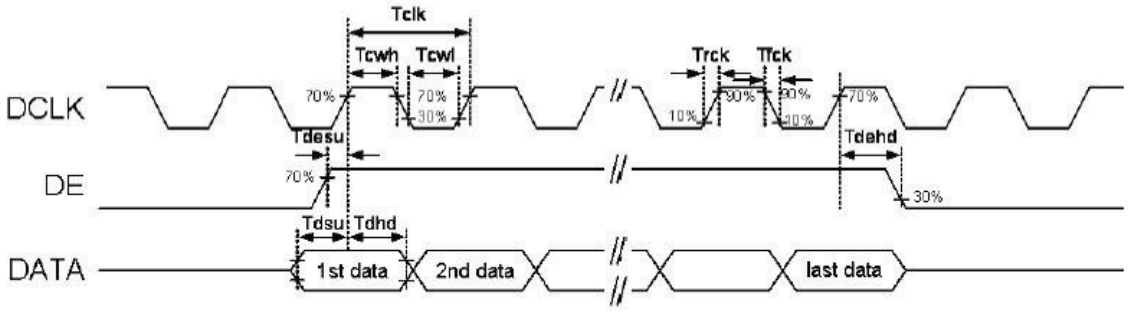
Parallel 24-bit RGB Mode Data Format (DE Mode)

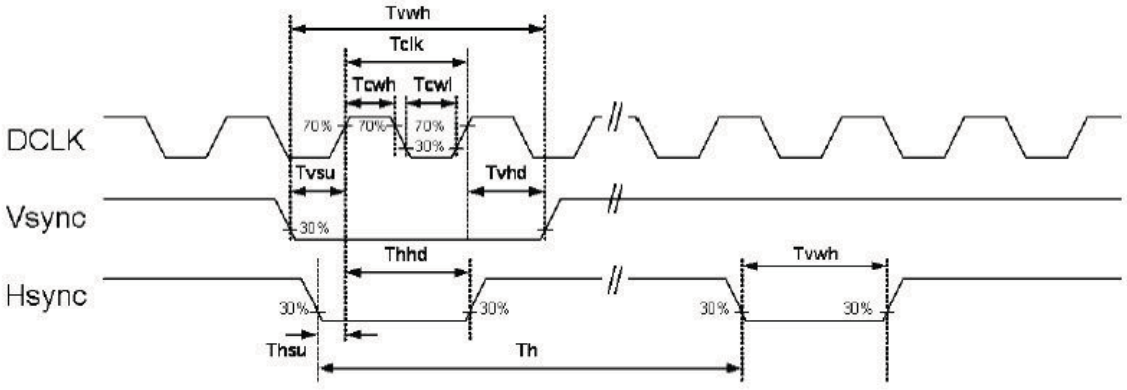


7.3.2 AC Electrical Characteristics

Parameters	Symbol	Min.	Typ.	Max.	Unit	Conditions
DCLK period time	Tclk	83.3	111.1	200	ns	Parallel 24-bit RGB mode
		33.3	37.0	41.7	ns	Serial 8-bit RGB mode
DCLK rising time	Trck	-	-	9	ns	
DCLK falling time	Tfck	-	-	9	ns	
DCLK pulse duty	Tcwh	40	50	60	%	
DE setup time	Tdesu	12	-	-	ns	
DE hold time	Tdehd	12	-	-	ns	
HSYNC pulse width	Thwh	1	-	-	DCLK	
HSYNC setup time	Thsu	12	-	-	ns	
HSYNC hold time	Thhd	12	-	-	ns	
VSYNC pulse width	Tvwh	1	-	-	Th	
VSYNC setup time	Tvsu	12	-	-	ns	
VSYNC hold time	Tvhd	12	-	-	ns	
Data setup time	Tdsu	12	-	-	ns	
Data hold time	Tdhd	12	-	-	ns	

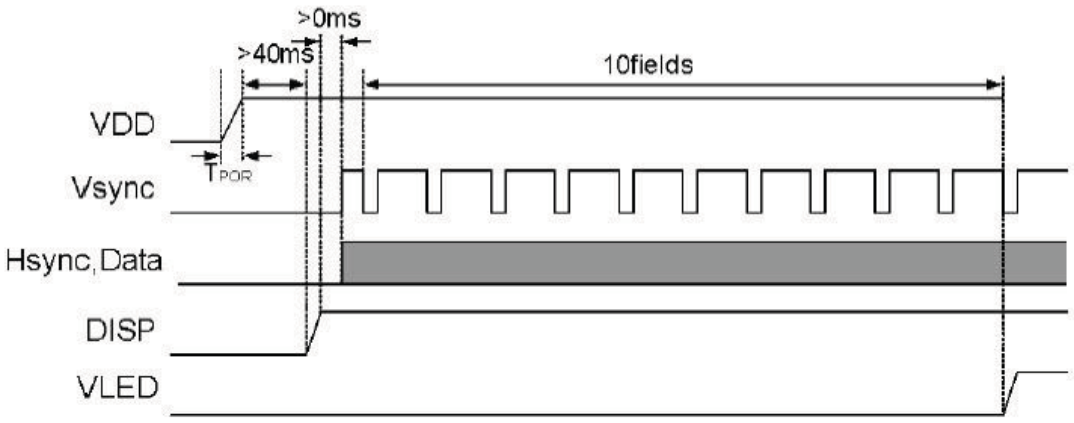
Clock and Data Input Timing Diagram



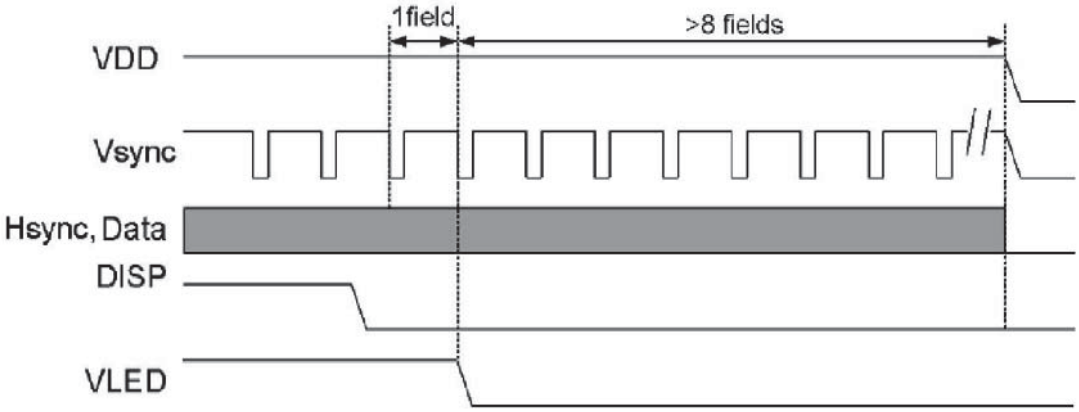


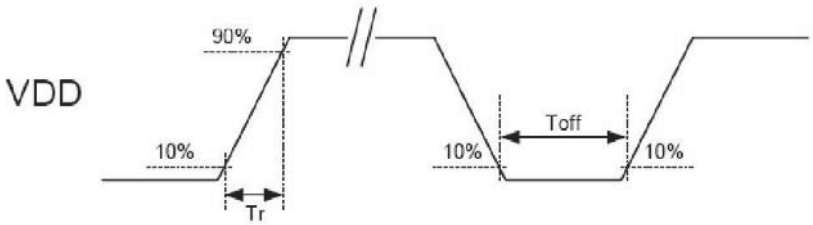
7.3.3 Power on/off Sequence

Power On Sequence



Power Off Sequence





VDD power input timing

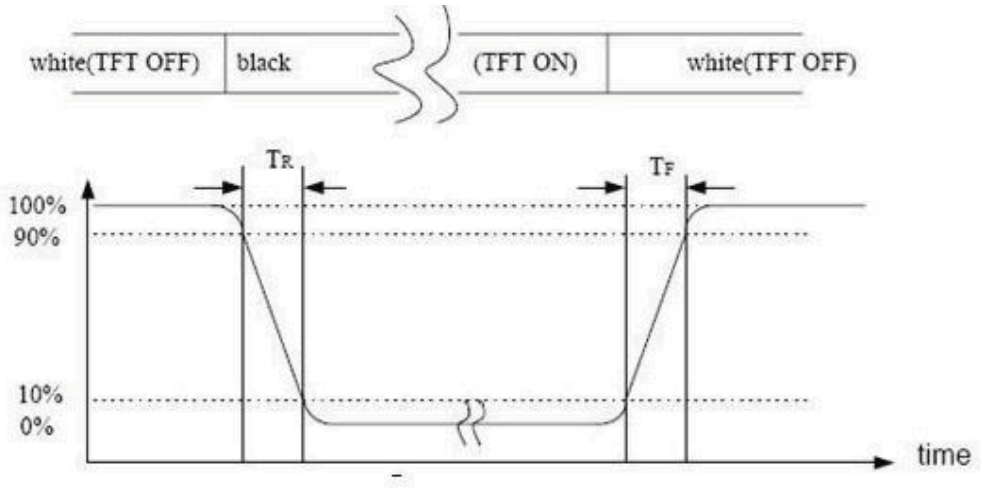
Notes:

Data include R0~R7, G0~G7, B0~B7, HSD, VSD, DCLK, DE
Power on sequence: VDD → DISP → Data → V_{LED}
Power off sequence: DISP → V_{LED} → Data → VDD
VDD power input timing: 0.5ms < Tr < 10ms; Toff > 500ms

8. Electro-Optical Characteristics

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Response time		Tr +Tf	θx = θy =0	---	30	45	ms	Note 1
Contrast Ratio		CR		250	280	---	---	Note 2
Transmittance		T%		5.0	5.6	---	%	
Color chromaticity	white	Wx		0.287	0.307	0.327	-	Reference Only
		Wy		0.325	0.345	0.365		
	Red	Rx		0.589	0.609	0.629		
		Ry		0.297	0.317	0.337		
	Gree	Gx		0.297	0.317	0.337		
		Gy		0.523	0.543	0.563		
	Blue	Bx		0.117	0.137	0.157		
		By		0.141	0.161	0.181		
Viewing angle	Hor.	θ_L	CR ≥ 10	--	65	---	Deg.	Note 3
		θ_R		--	65	---		
	Ver.	θ_U		--	65	---		
		θ_D		--	55	---		
Luminance (I_F = 20mA)		L		250	---	---	cd/m2	Note4

Note(1) Definition of Response Time:Sum of T_R and T_F

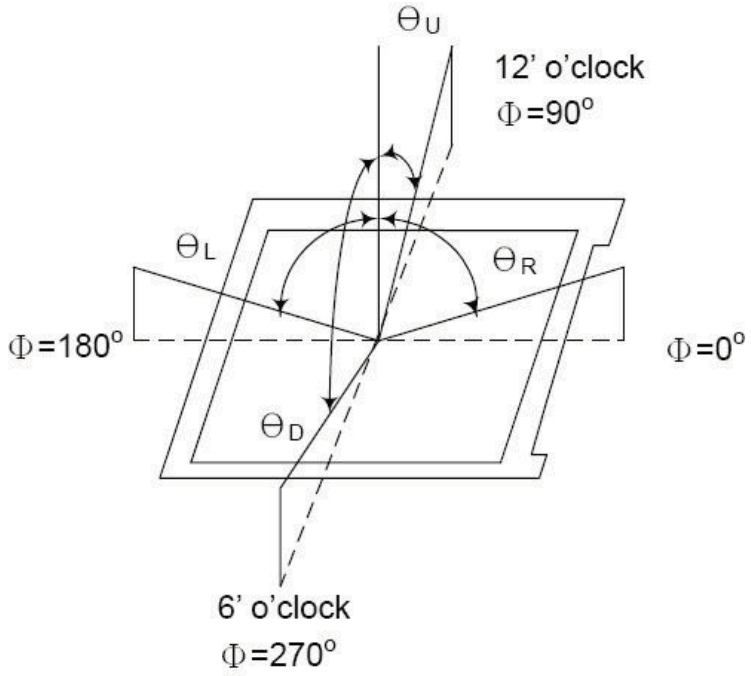


Optical response

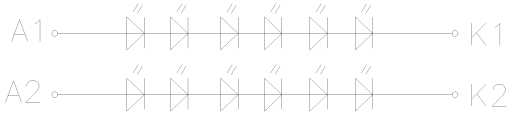
Note (2) Definition of Contrast Ratio(CR):measureed at the center point of panel

$$CR = \frac{\text{Luminance with all pixels white}}{\text{Luminance with all pixels black}}$$

Note (3) Definition of Viewing Angle x and y:



Note(4) Backlight circuit



9. Reliability

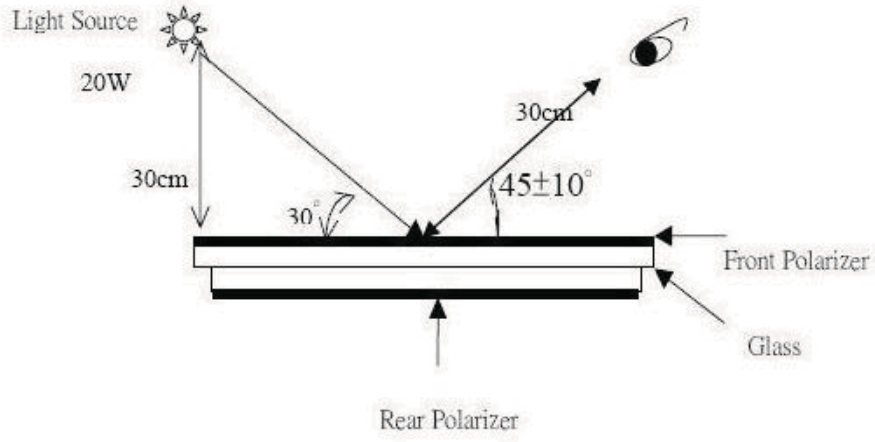
NO.	Item	Condition	Criterion
1	High Temperature Storage	80°C, 96Hrs	No abnormalities in function and appearance
2	High Temperature Operatign	70°C, 96Hrs	
3	Low Temperature Storage	-20°C, 96Hrs	
4	Low Temperature Operating	-30°C, 96Hrs	
5	High Temperature/Humidity Non-Operating Test	40°C,90%RH, 96Hrs	
6	Thermal Shock Test	-20°C (60Min) ← 25°C (5Min) → 70°C (60Min) 10 Cycles	

10. Inspection Standards

10.1 Basic conditions for inspection

The LCM face to us, in normal environment, the lux is 1000±200.(Darkroom's lux:100±50),

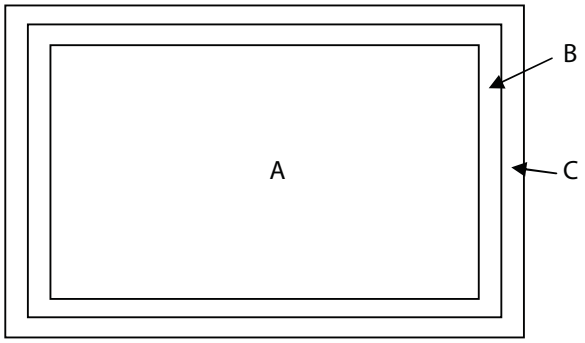
About an angle of incidence 30, a distance of 30cm with normal eye,with an angle of 45 degree to check the products without uncovering the film! (As shown below)



10.2. Inspection item and criteria

10.2.1 Definitions

1.1 Definitions of Display Area, Vi sible Area and Invisible Area



A: Display Area (D.A.)

B: Visible Area (V.A.)

C: Invisible Area (I.A.: After it is assembled, this area is invisible. Thus, the appearance defects of this area are Negligible.)

1.2 Defect Level and AQL Value

Level	Defect Descriptions	ALQ
Serious Defect	Imperfect display, over display, not-shining backlight and size beyond the blueprint.	0.4
Light Defect	Black and white points, bright/dark points (discovered through electrical logging), Glass breakage, bubbles, linear defects, bubbles between spectrometer cliff and glass.	1.0

1.3 Sampling Standars: GB2828 (MIL-STD -105E) General inspection level II

1.4 Definitions of Point Defects (Pixel Defects)

1.4.1 Pixel and Sub-pixel (refer to the following diagram)

A pixel = (a red sub-pixel + a green sub-pixel + a blue sub-pixel)

1.4.2 Definition of Point: if the area of a defect point is greater than half area of a sub-pixel, this defect point isconsidered as a point defect.

1.4.3 Bright Point: a very bright point, whose size does not change during the test screen changes, probably is noticed in the dark test screen.

1.4.4 Dark Point: a dim point, whose size does not change during the test screen changes, probably is noticed in the pure red/green/blue test screen.

1.4.5 Two Adjacent Points (Refer to the following diagram)

Right and left adjacent points

Up and down adjacent points

Diagonal adjacent points

* In this part, the black pixel point(s) refer(s) tothe defect point(s), the grey pixel point(s) refer(s) to normal point(s).

2.0 Functionality Requirement

2.1 Functional Defects

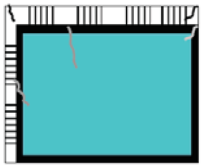
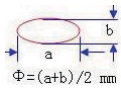
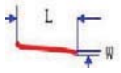
Defect Description	Schematic or Explanation	Criteria	Defect Level
Imperfect Display	Lack of vertical lines, horizontal lines or do not display, etc.	Not allowed	Serious Defect
Over Display	Too much vertical lines, horizontal lines, cross-lines, or do not display, etc.	Not allowed	Serious Defect

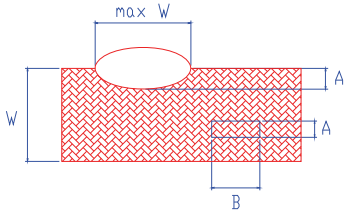
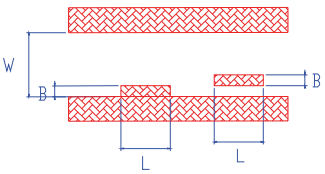
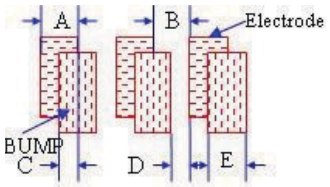
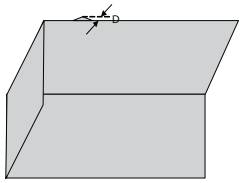
2.2 Point Defects (Bright Point and Dark Point)

Defect Description	Schematic or Explanation	Criteria Acceptable Quantity (V.A. & D.A .)					Defect Level
			< 3.5″	3.5 ~ 4.3	4.3 ~ 7.0	≥7.0	
Bright Point	Normal black screen: Every sub-pixel is dark.  Green bright point: In the black screen, every sub-pixel  should be dark. However, the green sub-pixel is bright.	Red/Green/ Blue Bright Point Adjacent Points	1 0	2 0	2 0	3 0	Light Defect
Dark Point	Normal white screen: Every sub-pixel is bright.  Green dark point: In the white screen, every sub-pixel should be bright.	Red/Green/ Blue Dark Point Adjacent Points	2 1	3 1	4 1	5 1	Light Defect

	However, the green sub-pixel is dark. (Equally applied to pure red/green/blue test screen) 						
Notes	The total quantity of point defects should be equal or less than		3	4	5	5	
	The least distance between two point defects is 5mm.						

2.3 Appearance Defects

Defect Description	Schematic or Explanation		Criteria Acceptable Quantity (V.A. & D.A.)				Defect Level
			< 3.5″	3.5 ~ 4.3	4.3 ~ 7.0	≥7.0	
Glass Cracks			Not allowed	Not allowed	Not allowed	Not allowed	Light Defect
Circular Defects (Black Point/ White Point)	 The least distance between defects is 5mm.	Φ≤0.10mm	Neglect	Neglect	Neglect	Neglect	Light Defect
		0.10mm<Φ≤0.15mm	2	3	3	3	
		0.15mm<Φ≤0.20mm	1	1	2	2	
		0.20mm<Φ≤0.25mm	1	1	1	2	
		0.25mm<Φ≤0.30mm	0	1	1	1	
		Φ>0.30mm	0	0	0	0	
		Note: the number of these defects, including point defects, is acceptable at most.	3	4	5	5	
Linear Defects (Black Line/ White Line)		W≤0.03mm & L≤1.0mm	Neglect	Neglect	Neglect	Neglect	Light Defect
		W≤0.05mm, L≤2.0mm	2	2	3	3	
		0.05mm<W≤0.10mm, L≤2.0mm	1	1	2	3	
		W>0.1mm or L>2.0mm	Decided by circular defects				
Polarizer	Refer to	Φ≤0.15mm	Neglect	Neglect			Light

Indentation, Bubbles	Circular Defects. The least distance between defects is 5mm.	0.15mm<Φ≤ 20mm0	2	3	Defect
		0.20mm<Φ≤0.3mm	2	2	
		Φ>0.30mm	0	0	
		Note: the number of these defects, including point defects, is acceptable at most.	3	4	
Polarizer Scratch	Refer to Linear Defects.		Refer to Linear Defects.		Light Defect
FPC Defects: Pinhole Defects, Line Defects	 W: Width.		A≤W/4 AND B ≤3W, NEGLECT. A>W/4 OR B>3W, REJECTION		Light Defect
FPC Defects: Etching Adverse (Wires Protuberance/ Copper Residual/ Burrs)	 W: Width between wires.		B≤W/4 AND L ≤3W, Immovable, NEGLECT B>W/4 OR L>3W, movable, REJECTION		Light Defect
FPC Defects: Crease/ Indentation	N/A		Acute Angle Crease, REJECTION Not-acute Angle Crease/ Indentation, NEGLECT		Light Defect
SMT ： Deviation of Component Welding			C≥E/2 AND D ≥B/2, NEGLECT C<E/2 OR D<B/2, REJECTION		Light Defect
Iron Frameworks			Allowable burr size on edges: D<0.05mm, NEGLECT D≥0.05mm, REJECTION		Light Defect
Touch Screen – Black Point/ White Point	Refer to Circular Defects.		Refer to Circular Defects.		Light Defect
Touch Screen – Pit	Refer to Polarizer Indentation.		Refer to Polarizer Indentation.		Light Defect

Touch Screen – Scratch	Refer to Linear Defects.	Refer to Linear Defects.	L ight Defect
Touch Screen – Newton's Ring	Regular Newton's Ring:  Irregular Newton's Ring: 	Area of Newton's Ring ⩽ 1/3 Total Display Ares, NEGLECT. Area of Newton's Ring > 1/3 Total Display Ares, REJECTION. Area of Newton's Ring ⩽ 1/2 Total Display Ares, NEGLECT Area of Newton's Ring > 1/2 Total Display Ares, REJECTION Note: if Newton's Ring causes graphic distortion, please REJECT.	Light Defect

11. Precautions For Using LCD Modules

11.1 Mounting method

The LCD panel of Orient Display LCD module consists of two thin glass plates with polarizers which easily be damaged. And since the module in so constructed as to be fixed by utilizing fitting holes in the printed circuit board.

Extreme care should be needed when handling the LCD modules.

11.2 Caution of LCD handling and cleaning

When cleaning the display surface, Use soft cloth with solvent [recommended below] and wipe lightly

- Isopropyl alcohol
- Ethyl alcohol

Do not wipe the display surface with dry or hard materials that will damage the polarizer surface.

Do not use the following solvent:

- Water
- Aromatics

Do not wipe ITO pad area with the dry or hard materials that will damage the ITO patterns

Do not use the following solvent on the pad or prevent it from being contaminated:

- Soldering flux
- Chlorine (Cl) , Salfur (S)

If goods were sent without being sili8con coated on the pad, ITO patterns could be damaged due to the corrosion as time goes on.

If ITO corrosion happen by miss-handling or using some materials such as Chlorine (Cl), Salfur (S) from customer, Responsibility is on customer.

11.3 Caution against static charge

The LCD module use C-MOS LSI drivers, so we recommended that you: Connect any unused input terminal to Vdd or Vss, do not input any signals before power is turned on, and ground your body, work/assembly areas, assembly equipment to protect against static electricity.

12. Records Of Version

REVISION HISTORY

Rev	Content	Date
A0	New released	2012-4-30