Product information

To:

Product Name: M236MWN4 R0

Document Issue Date: 2012/02/13

Customer	InfoVision Optoelectronics
SIGNATURE _____ _____ _____ – Please return 1 copy for your confirmation with your signature and comments.	**SIGNATURE** **REVIEWED BY** **QA** _____ **PREPARED BY** **FAE** _____

Note: 1. Please contact InfoVision Company. before designing your product based on this product.
2. The information contained herein is presented merely to indicate the characteristics and performance of our products. No responsibility is assumed by IVO for any intellectual property claims or other problems that may result from application based on the module described herein.

FQ-7-30-0-009-03D

Revision	Date	Page	Old Description	New Description	Remark
00	2012/02/13	-	-	First issued.	-

Contents

1 General Descriptions

1.1 Introduction

The M236MWN4 is a Color Active Matrix Thin Film Transistor (TFT) Liquid Crystal Display (LCD) module, which uses amorphous Silicon TFT as a switching device. It is composed of a TFT LCD panel, a timing controller, voltage reference, common voltage, column driver, and row driver circuit. This TFT LCD has a 23.6 inch (diagonally measured) active display area with resolution (1,920 horizontal by 1,080 vertical pixel array). It provides an excellent 3D display with Film-type Patterned Retarder (FPR).

1.2 Features

- 23.6” TFT LCD Panel
- LED Backlight System
- Supports Resolution : H×V :1,920×1,080
- Compatible with RoHS and GP Standard
- Provide an excellent 3D display

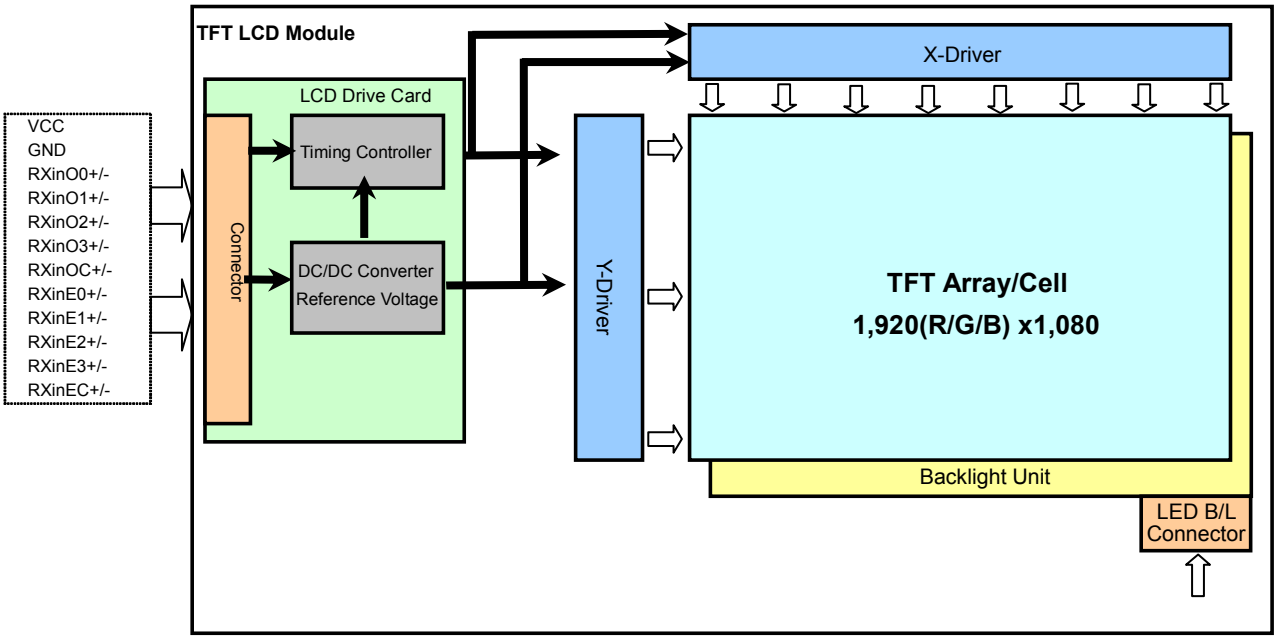
1.3 Product Summary

Items	Specifications	Unit	Remark
Screen Diagonal	23.6	inch	-
Active Area	521.3x293.2	mm	-
Pixels(H x V)	1,920x1,080	-	-
Pixel Pitch	0.2715x0.2715	mm	-
Pixel Arrangement	R.G.B. Vertical Stripe	-	-
Display Mode	TN Mode, Normally White	-	-
White Luminance	TBD	cd/ m^2	-
Contrast Ratio	1,000:1	-	-
Response Time	5	ms	-
View Angle(H/V)	TBD	-	-
Input Voltage	+5.0	V	-
Power Consumption	17.7	Watt	-
Module Weight	TBD	g	-
Outline Dimension(H x V x D)	544.8(typ)x320.5(typ)x11.9(max)	mm	-
Electrical Interface (Logic)	2ch LVDS	-	-
Support Color	16.7	M	-
NTSC	TBD	%	-
Optimum Viewing Direction	6 o’clock	-	-
Surface Treatment	Semi-glare, AG+ Clear, Hardness ≧3H	-	-

1.4 Functional Block Diagram

Figure 1 shows the functional block diagram of the LCD module.

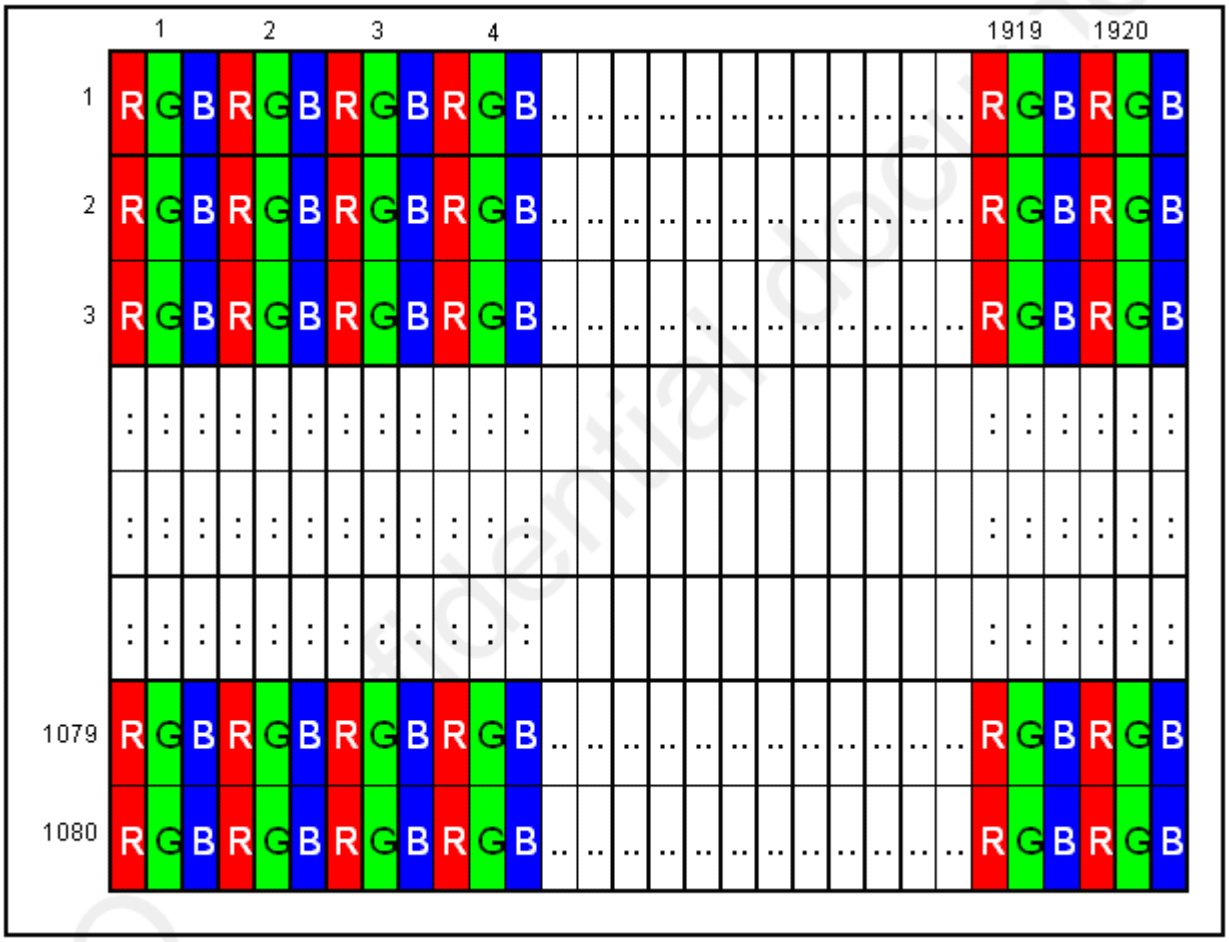
Figure 1 Block Diagram



1.5 Pixel Format Image

Figure 2 shows the relationship of the input signals and LCD pixel format image.

Figure 2 Pixel Format



2 Absolute Maximum Ratings

The followings are maximum values which, if exceeded, may cause faulty operation or damage to the LCD module.

Table 1 Absolute Ratings of Environment

Item	Symbol	Min.	Max.	Unit	Conditions
Supply Voltage	V_{DD}	-0.3	6.0	V	-
Input Signal	-	-0.3	2.7	V	LVDS Signals
Operating Temperature	TOP	0	50	℃	Note(3)
Operating Humidity	HOP	10	80	%RH	Note(3)
Storage Temperature	TST	-20	60	℃	Note(3)
Storage Humidity	HST	10	90	%RH	Note(3)
Vibration	Level	-	1.5	G	30min. for X, Y, Z axis
	Bandwidth	-	10～500~10	Hz	
Shock	Level	-	50	G	Half sine waveform, 11ms
LED Current	$I_{\_LED}$	-	60	mA	Per LED Chip

Note:

(1) Maximum Wet-Bulb should be 39℃ and No condensation.

(2) When you apply the LCD module for OA system, please make sure to keep the temperature of LCD module under 60℃.

(3) Storage /Operating temperature & humidity.

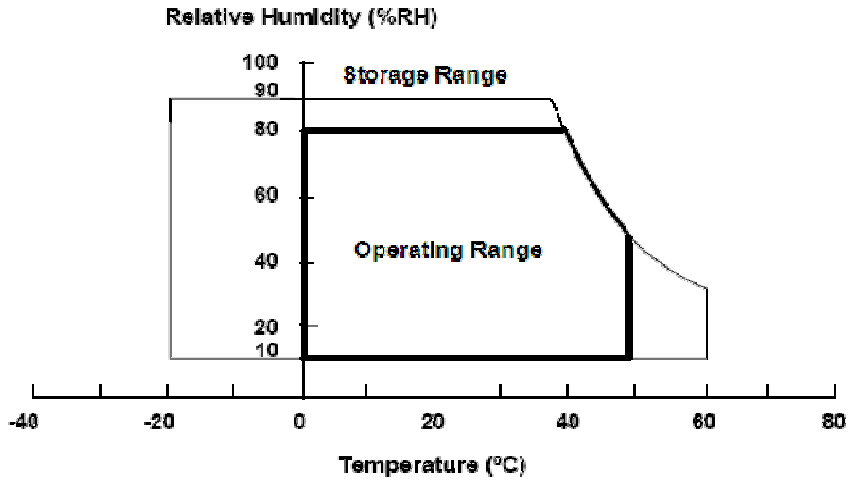


Figure 3 Absolute Ratings of Environment of the LCD Module

3 Electrical Specification

3.1 Electrical Characteristics

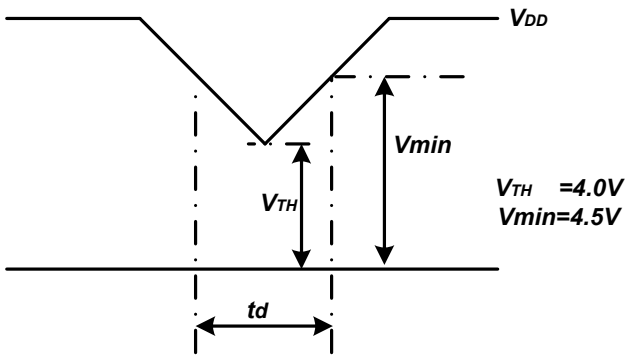
Table 2 Electrical Characteristics

Symbol	Parameter	Min.	Typ.	Max.	Units	Condition
V_{DD}	Logic/LCD Drive Voltage	4.5	5.0	5.5	V	Note (1)
I_{DD}	V_{DD} Current	-	770	900	mA	Black Pattern, 60Hz
P_{DD}	V_{DD} Power	-	3.9	4.5	W	Black Pattern, 60Hz
Irush	Rush Current	-	-	2.5	A	Note (2)
$V_{DD}rp$	Allowable Logic/LCD Drive Ripple Voltage	-	-	300	mVp-p	-
$V_{\_LED}$	LED Input	25.2	28.8	31.5	V	-
V_F	LED Forward Voltage	2.8	3.2	3.5	V	-
I_F	LED Forward Current	-	60	-	mA	-
I_{PIN}	LED Light Bar Pin Current	0	120	125	mA	Pin1, Pin2, Pin5 and Pin6 refer to figure 5.
P_{LED}	LED Power Consumption	-	13.8	15.8	W	Note(3)
L_T	LED Life Time	30,000	-	-	Hours	Note(4)

Note:

(1) V_{DD} Power Dip Condition

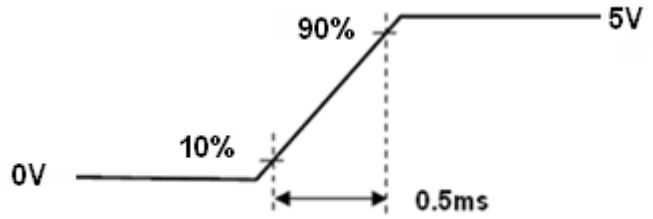
Figure 4 V_{DD} Power Dip



If $V_{TH} < V_{DD} \leq V_{min}$ and $t_d \leq 10ms$, our panel must revive automatically when the voltage returns to normal.

(2) Measure Condition

Figure 5 V_{DD} rising time



VDD Rising Time

(3) PLED is calculation value for reference. PLED =72 x VF (Normal Distribution) x IF (Normal Distribution)；LED Light Bar circuit is 4 parallel, 9 series, and each serie has 2 LED chips in parallel.

(4) The lifetime of LED is defined as the time when LED packages continue to operate under the conditions at Ta = 25℃ and I_F= 60mA (per chip) until the brightness becomes≦50% of its original value.

(5) All values are measured at condition of IF =60mA and Ta=25℃.

3.2 Interface Connections

Table 3 LVDS Connector Name / Designation

Manufacturer	Starconn (or equivalent)
Type / Part Number	093G30-B2001A-M4(Starconn)

Table 4 LVDS Signal Pin Assignment

Pin #	Signal Name	Description	Remarks
1	RXinO0-	Negative LVDS differential data input(0)	-
2	RXinO0+	Positive LVDS differential data input(0)	-
3	RXinO1-	Negative LVDS differential data input(1)	-
4	RXinO1+	Positive LVDS differential data input(1)	-
5	RXinO2-	Negative LVDS differential data input(2)	-
6	RXinO2+	Positive LVDS differential data input(2)	-
7	GND	Power Ground	-
8	RXOC-	Negative LVDS differential data input(clock)	-
9	RXOC+	Positive LVDS differential data input(clock)	-
10	RXinO3-	Negative LVDS differential data input(3)	-

11	RXinO3+	Positive LVDS differential data input(3)	-
12	RXinE0-	Negative LVDS differential data input(0)	-
13	RXinE0+	Positive LVDS differential data input(0)	-
14	GND	Power Ground	-
15	RXinE1-	Negative LVDS differential data input(1)	-
16	RXinE1+	Positive LVDS differential data input(1)	-
17	GND	Power Ground	-
18	RXinE2-	Negative LVDS differential data input(2)	-
19	RXinE2+	Positive LVDS differential data input(2)	-
20	RXEC-	Negative LVDS differential data input(clock)	-
21	RXEC+	Positive LVDS differential data input(clock)	-
22	RXinE3-	Negative LVDS differential data input(3)	-
23	RXinE3+	Positive LVDS differential data input(3)	-
24	GND	Power Ground	-
25	NC	No Contact	-
26	BIST	When BIST = HIGH and no any LVDS input signals, the internal pattern generator actives. Keep low for normal operation.	-
27	NC	No Contact	-
28	VDD	Power Supply	5V(Typ.)
29	VDD	Power Supply	5V(Typ.)
30	VDD	Power Supply	5V(Typ.)

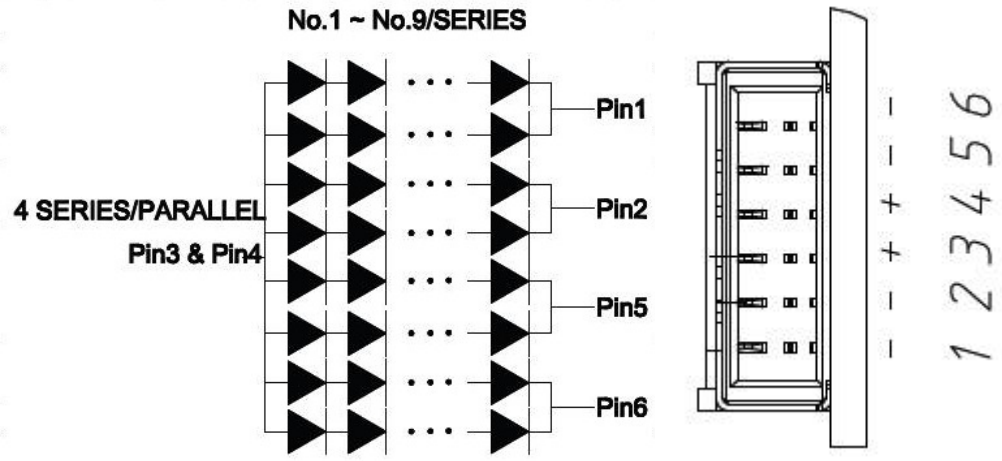
Note: All input signals shall be at low or Hi-Z state when V_{DD} is off.

Table 4 Backlight Connector Pin Assignment

Pin No.	Symbol	Description
1	IRLED1	LED current sense for string1
2	IRLED2	LED current sense for string2
3	VLED	LED power supply
4	VLED	LED power supply
5	IRLED3	LED current sense for string3
6	IRLED4	LED current sense for string4

Note: Backlight connector type is ENTERY 3707K-Q06N-01L.

Figure 6 LED Circuit Diagram and LED Connector



3.3 LVDS Receiver

The built-in LVDS receiver is compatible with (ANSI/TIA/TIA-644) standard.

Table 5 LVDS Receiver Electrical Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Differential Input High Threshold	V_{th}	-	-	+100	mV	V_{cm}=+1.2V
Differential Input Low Threshold	V_{tl}	-100	-	-	mV	V_{cm}=+1.2V
Magnitude Differential Input	$\|V_{id}\|$	100	-	600	mV	-
Common Mode Voltage	V_{cm}	1.0	1.2	1.4	V	Vth-Vtl

Note:

(1) Input signals shall be at low or Hi-Z state when VDD is off.

(2) All electrical characteristics for LVDS signal are defined and shall be measured at the interface connector of LCD.

(3) All values are measured at condition of VDD =5V and Ta=25℃.

Figure 7 Voltage Definitions

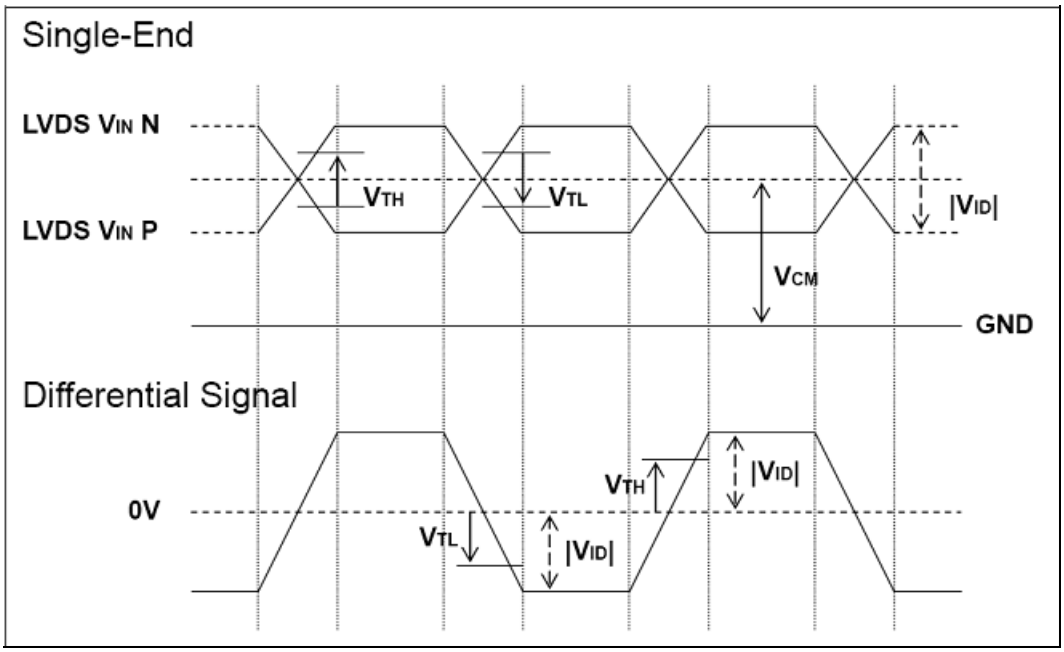


Figure 8 Measurement System

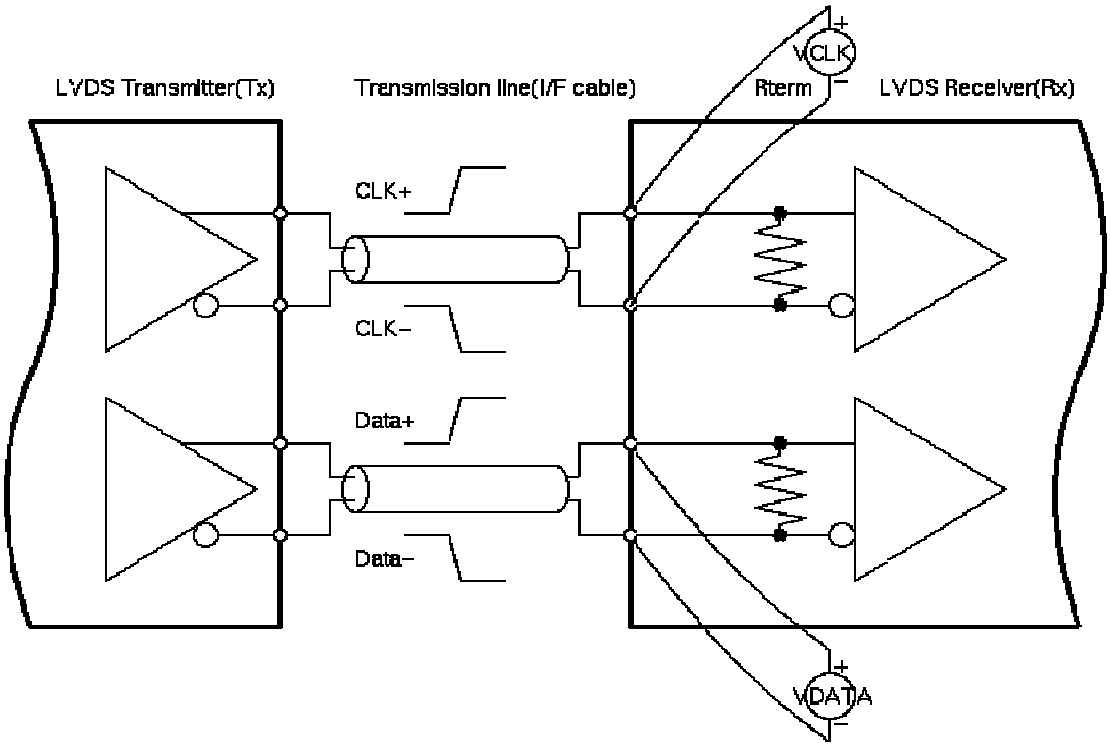
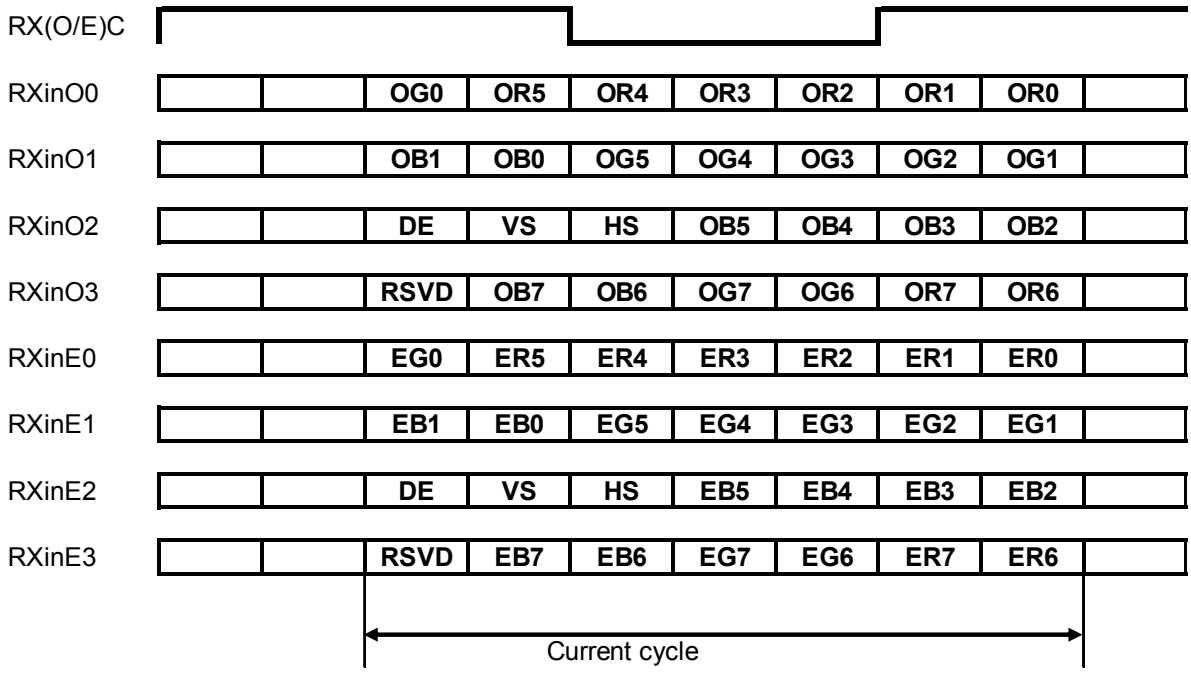


Figure 9 LVDS Data Mapping

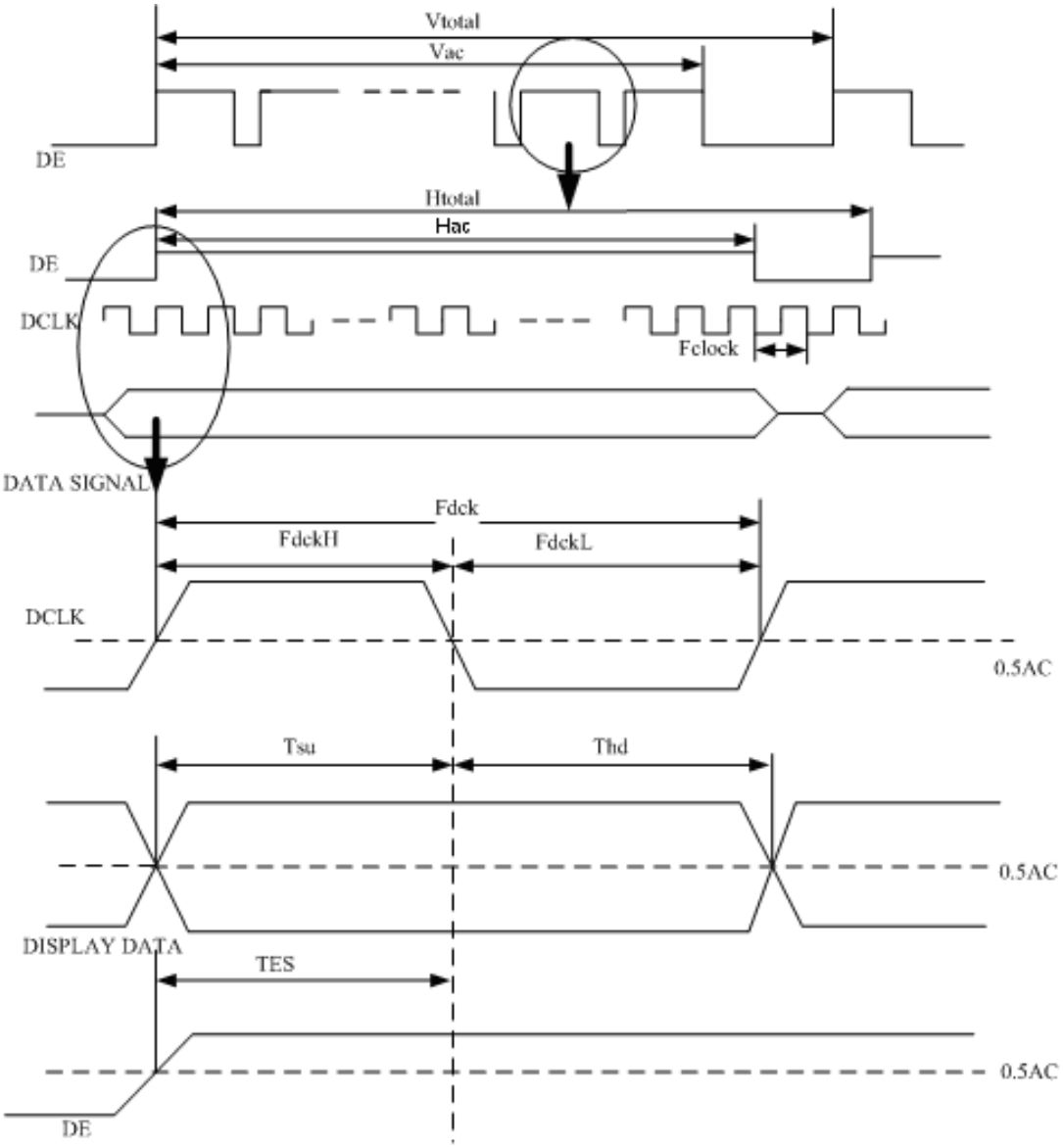


3.4 Interface Timings

Table 6 Interface Timings

Parameter		Symbol	Unit	Min.	Typ.	Max.
LVDS Clock (dual)	Frequency	F_{dck}	MHz	57.8	73.3	96.7
	Spread Spectrum Modulation Range	F_{clkin_mod}	MHz	0.97* F_{dck}	-	1.03* F_{dck}
	Spread Spectrum Modulation Frequency	F_{SSM}	KHz	-	-	200
H Total Time		H_{total}	Clocks	1,050	1,100	1,150
H Active Time		H_{ac}	Clocks	960	960	960
V Total Time		V_{total}	Lines	1,100	1,110	1,121
V Active Time		V_{ac}	Lines	1,080	1,080	1,080
Frame Rate		V_{sync}	Hz	50.0	60.0	75.0

Figure 10 Timing Characteristics



Note: TES is data enable signal setup time.

3.5 Power ON/OFF Sequence

V_{DD} power, interface signals, and lamp on/off sequence are showing on Figure 11. Signals shall be Hi-Z state or low level when V_{DD} is off.

Figure 11 On/off sequence

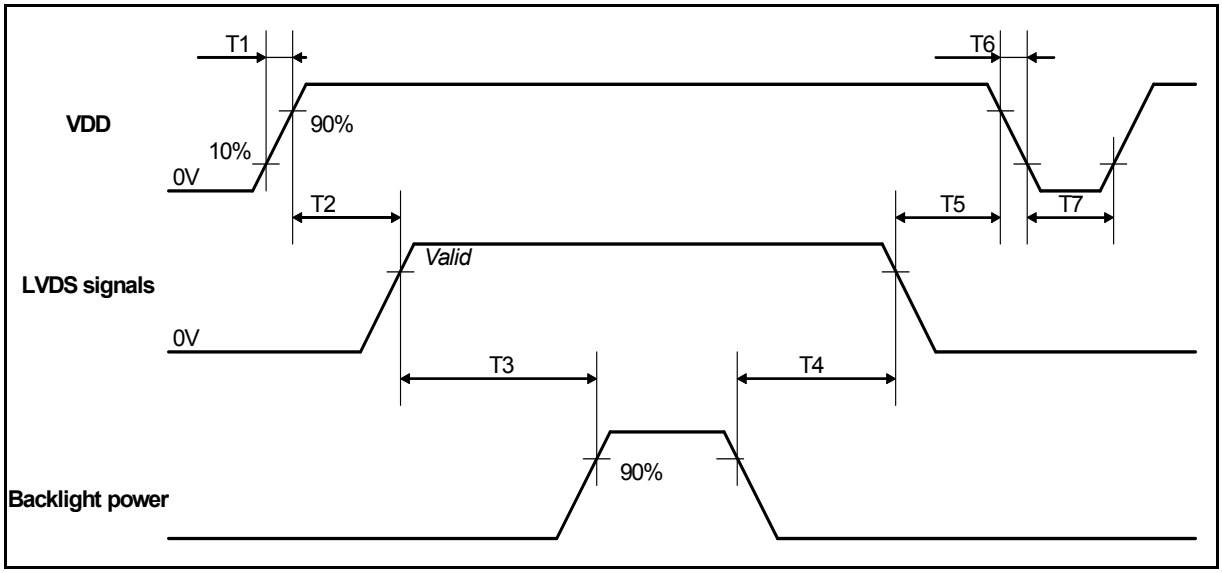


Table 7 Power Sequencing Requirements

Parameter	Symbol	Unit	Min.	Typ.	Max.
VDD Rise Time	T1	ms	0.5	-	10
VDD Good to Signal Valid	T2	ms	0	-	50
Signal Valid to Backlight On	T3	ms	200	-	450
Backlight Off to Signal Disable	T4	ms	200	-	450
Signal Disable to Power Down	T5	ms	0	-	50
VDD Fall Time	T6	ms	0	-	100
Power Off	T7	ms	500	-	-

4 Optical Characteristics

The optical characteristics are measured under stable conditions as following notes.

Table 8 Optical Characteristics

Item		Conditions		Specification				
				Min.	Typ.	Max.	Unit	Note
Viewing Angle	2D (Contrast Ratio>10)	Horizontal	$\theta_{x+}+\theta_{x-}$(Left+ Right)	150	TBD	-	Deg.	(1,2)
		Vertical	$\theta_{y+}+\theta_{y-}$(Up+ Down)	140	TBD	-		
	3D (Crosstalk ≤10%)	Horizontal	θ_{x-} (Left)	-	40	-		(1,6)
			θ_{x+} (Right)	-	40	-		(1,6)
		Vertical	$\theta_{y+}+\theta_{y-}$(Up+ Down)	8	12	-		(1,6)
White Luminance	2D	$I_{\_LED}$ =60mA,center		TBD	TBD	-	cd/m^2	(1,3)
	3D			TBD	TBD	-		(1,6)
3D Crosstalk		Mid Axis (Center of Cone Angle)		-	1.8	3.0	%	(1,6)
Luminance Uniformity		$I_{\_LED}$ =60mA, 9points		70	80	-	%	(1,5)
Contrast Ratio		Center		700	1,000	-	-	(1,3)
Response Time		Rising		-	1.3	-	ms	(1,4)
		Falling		-	3.7	-		
		Rising + Falling		-	5.0	8.0		
Color Chromaticity (CIE1931)		Red x		Typ. -0.03	TBD	Typ. +0.03	-	(1)
		Red y			TBD			
		Green x			TBD			
		Green y			TBD			
		Blue x			TBD			
		Blue y			TBD			
		White x			0.313			
		White y			0.329			
3D Watching Distance (Suggest)		Mid Axis (Center of Cone Angle)		50	70	-	cm	(6)

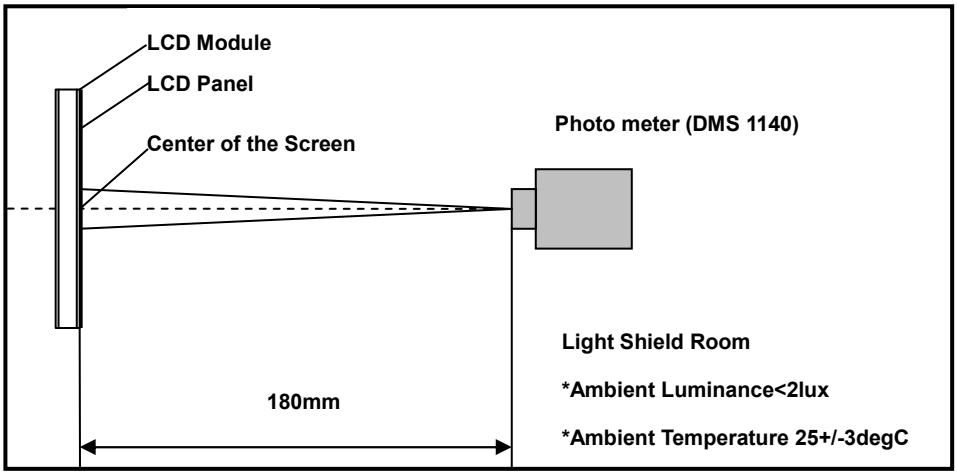
Note:

(1) Measurement Setup

The LCD module should be stabilized at condition of I_F =60mA and Ta=25℃ for 30 minutes to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement

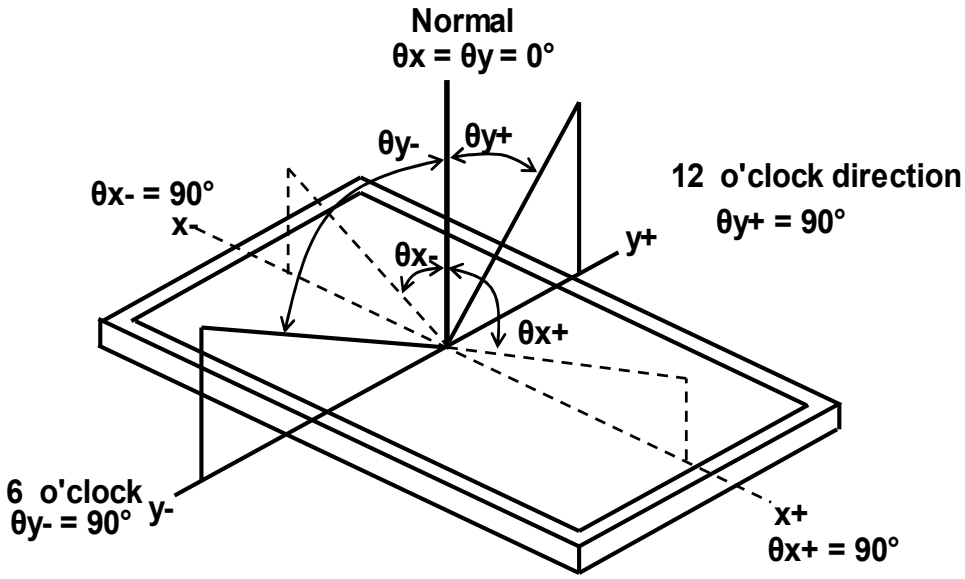
should be executed after lighting backlight for 30 minutes in a windless room.

Figure 12 Measurement Setup



(2) Definition of Viewing Angle

Figure 13 Definition of Viewing Angle



(3) Definition of Contrast Ratio (CR)

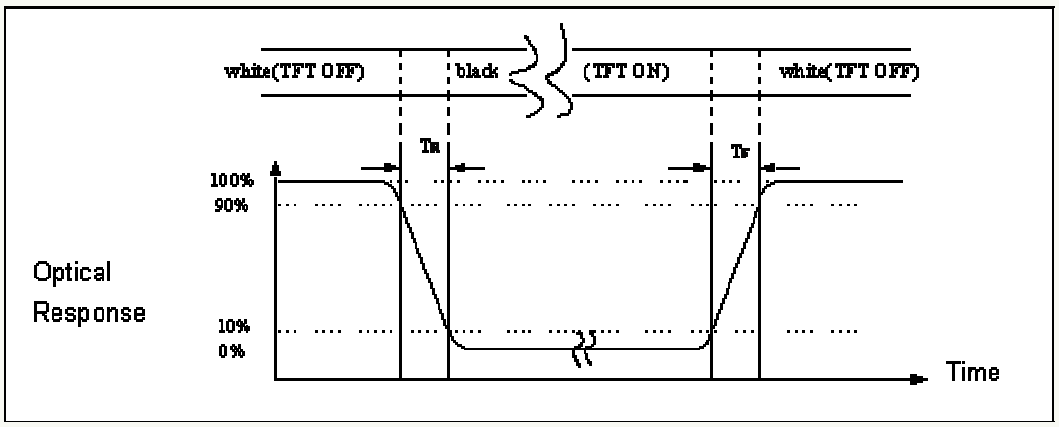
The contrast ratio can be calculated by the following expression

Contrast Ratio (CR) = L255 / L0

L255: Luminance of gray level 255, L0: Luminance of gray level 0

(4) Definition of Response Time (TR, TF)

Figure 14 Definition of Response Time

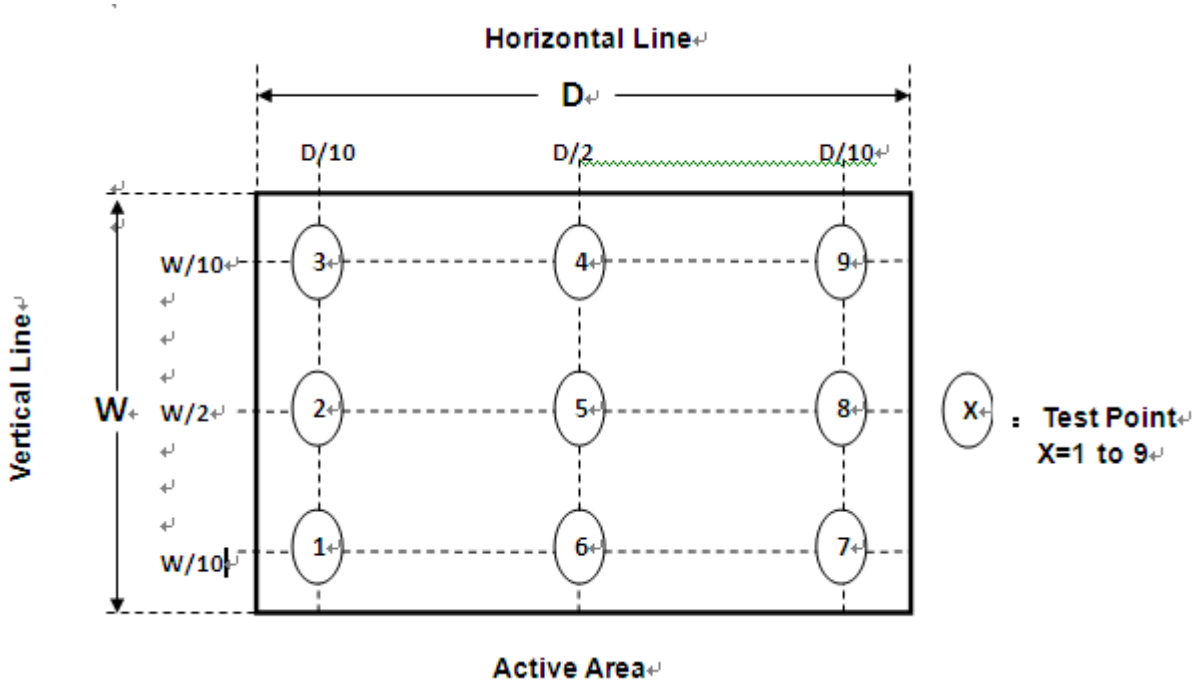


(5) Definition of White Luminance and Luminance Uniformity:

Measure the luminance of gray level 255 at point 5 (Fig.15).

$$\text{Luminance Uniformity} = \frac{\text{Minimum Brightness of nine points (P1~P9)}}{\text{Maximum Brightness of nine points (P1~P9)}}$$

Figure 15 Measurement Locations of 9 Points



(6) 3D performance specification is expressed by 3D luminance, 3D Crosstalk and 3D viewing angle.3D luminance and 3D crosstalk is measured at center 1-point.In order to measure 3D

luminance, 3D crosstalk and 3D viewing angle, it need to be prepared as below;

a) Definition of 3D Test Pattern Image

L_W -R_W: White for left and right eye;

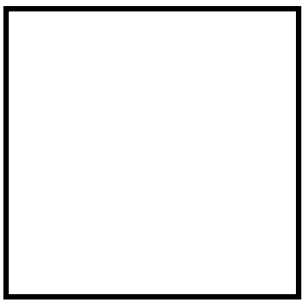
L_W -R_B: White for left eye and Black for right eye;

L_B-R_W: Black for left eye and white for right eye;

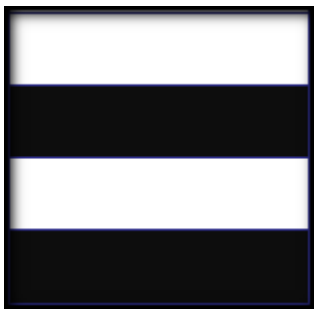
L_B -R_B: Black for left eye and right eye;

Image files where black and white lines are displayed on even or odd lines.

Figure 16 3D Test Pattern Image

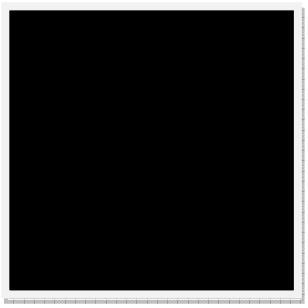


(a) White/White (L_W -R_W)



(b) White/Black (L_W -R_B)

(c) Black/White (L_B-R_W)



(d) Black/Black (L_B -R_B)

b) Definition of 3D Measurement Setup

Find the angle where luminance is minimum, the following measurements should be performed at the angle of minimum transmittance of eyeglass.

Figure 17 3D Measurement Setup

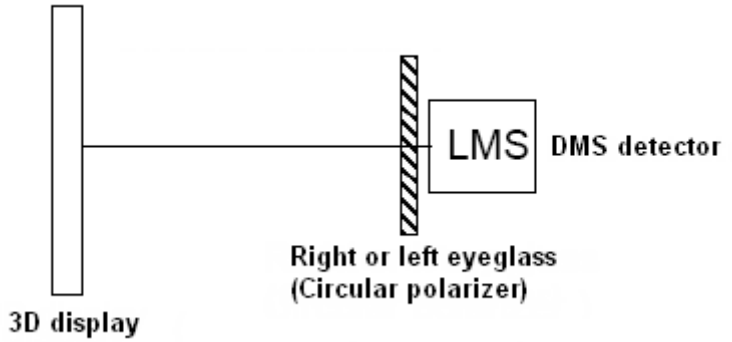
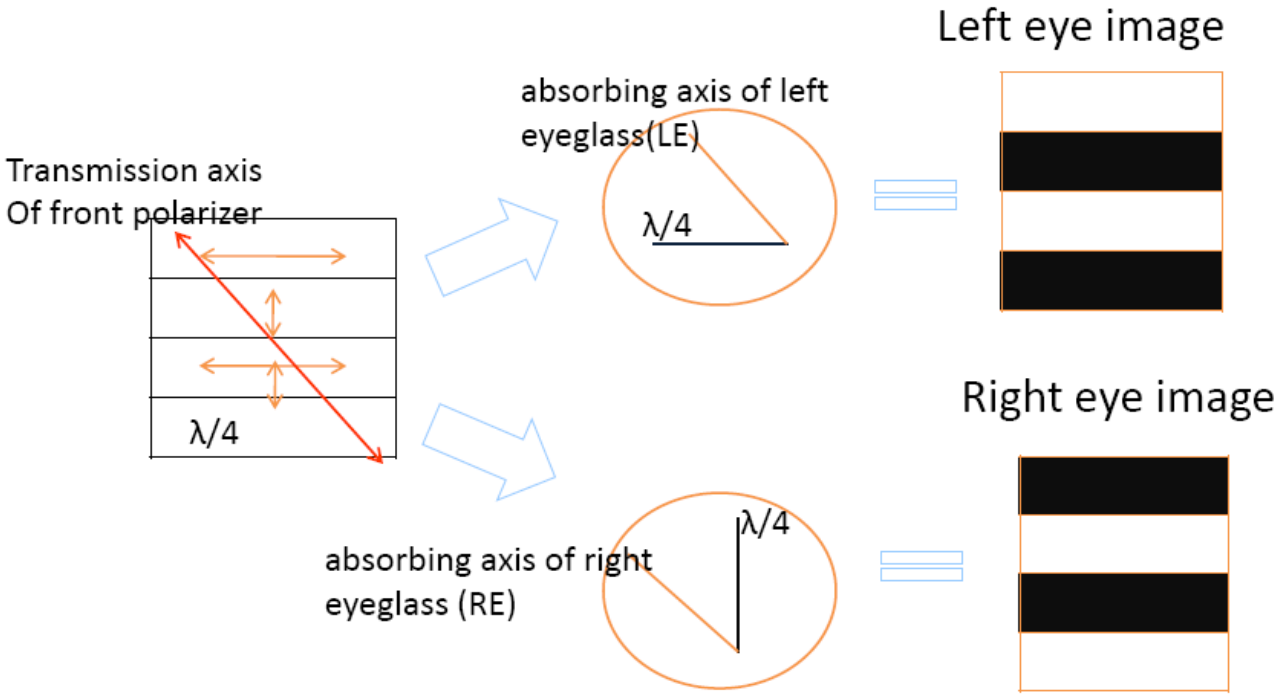


Figure 18 Position of eyeglass



c) Definition of 3D luminance

Test image L_W -R_W is displayed, Left or right eyeglass are placed in front of LMS

Successively, 3D luminance is measured at center point 5 (Fig.15) where the notation for luminance measurement is “Lum(L_W -R_W，left / right)”.

d) Definition of 3D crosstalk

Test image (L_B -R_W, L_W –R_B , L_W -R_W and L_B –R_B) is displayed，Right or left eyeglass are placed in front of LMS successively and luminance is measured for center point 5 (Fig.15). The right eye crosstalk defines as SCT_R, and the left eye crosstalk defines as SCT_L.

$$SCT_R = \frac{Lum(L_W - R_B) - Lum(L_B - R_B)}{Lum(L_B - R_W) - Lum(L_B - R_B)}, \qquad SCT_L = \frac{Lum(L_B - R_W) - Lum(L_B - R_B)}{Lum(L_W - R_B) - Lum(L_B - R_B)}$$

e) Definition of 3D Viewing Angle

3D viewing angle is the angle at which the 3D crosstalk is under 10%. The angles are determined for the vertical or y axis which is normal to the LCD module surface and measured for center position , see the Fig 13.

f) Suggest 3D Watching Distance ≥ 70 cm.

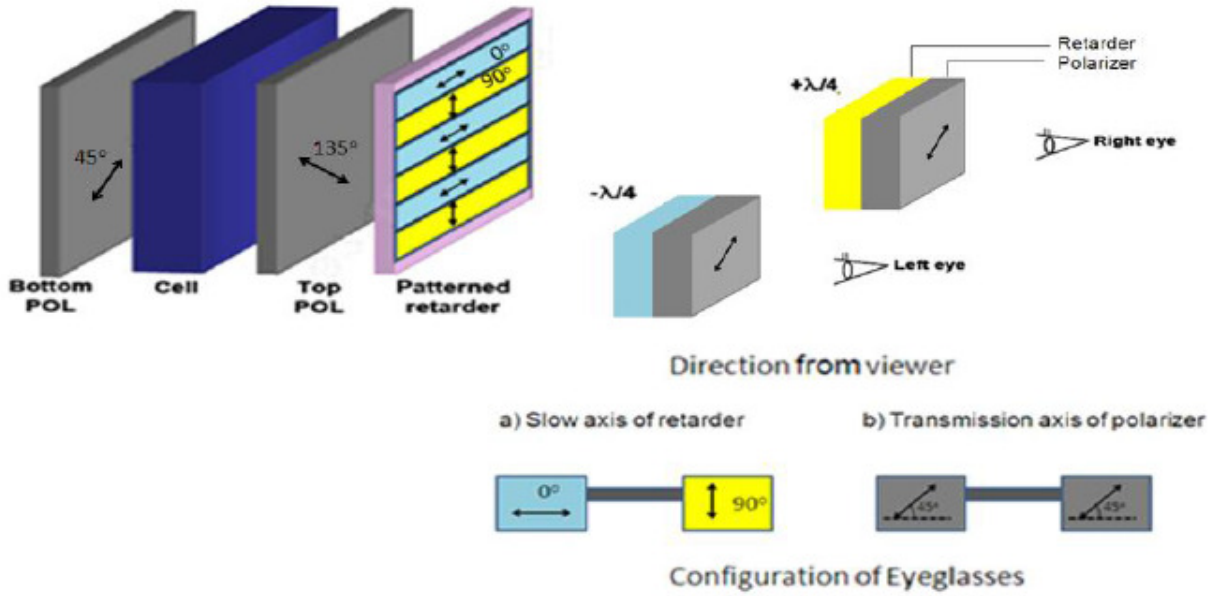
g) Standard Specification of 3D Eyeglasses

For each item, depending on the eyeglass manufacturer tolerances may occur, this tolerance can affect 3D performance.(3D Crosstalk, 3D luminance, 3D viewing angle)

Table 9 Standard Specification of 3D Eyeglasses

Design item of eyeglasses		Left	Right	Remark
Optical axis	a) Slow axis of retarder	0°	90°	Refer to drawing
	a) Transmission axis of polarizer	45°	45°	
Retardation value	Retarder	125nm		@550nm

Figure 19 Performance of 3D Eyeglasses



5 Mechanical Characteristics

Figure 20 Reference Outline Drawing (Front Side)

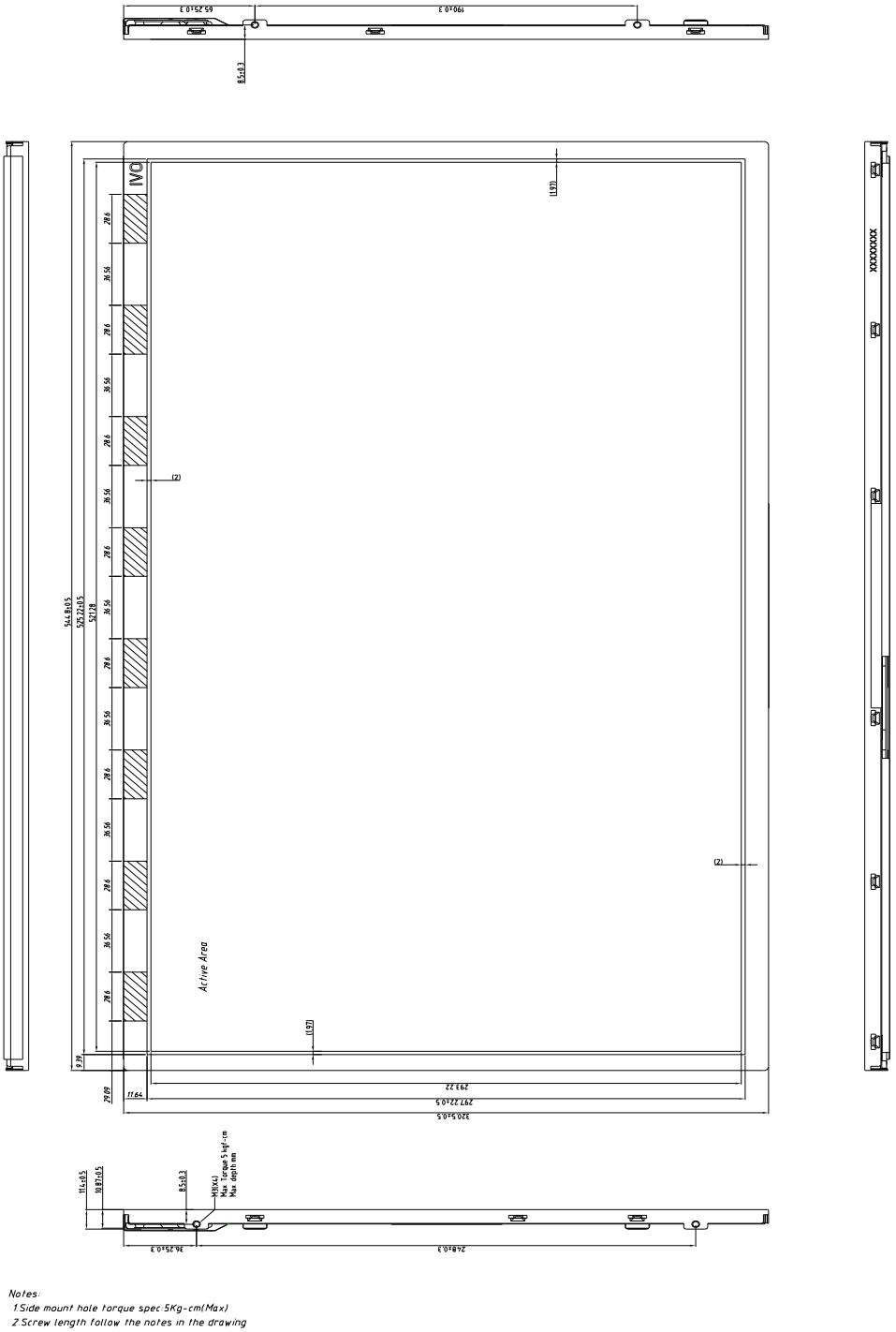
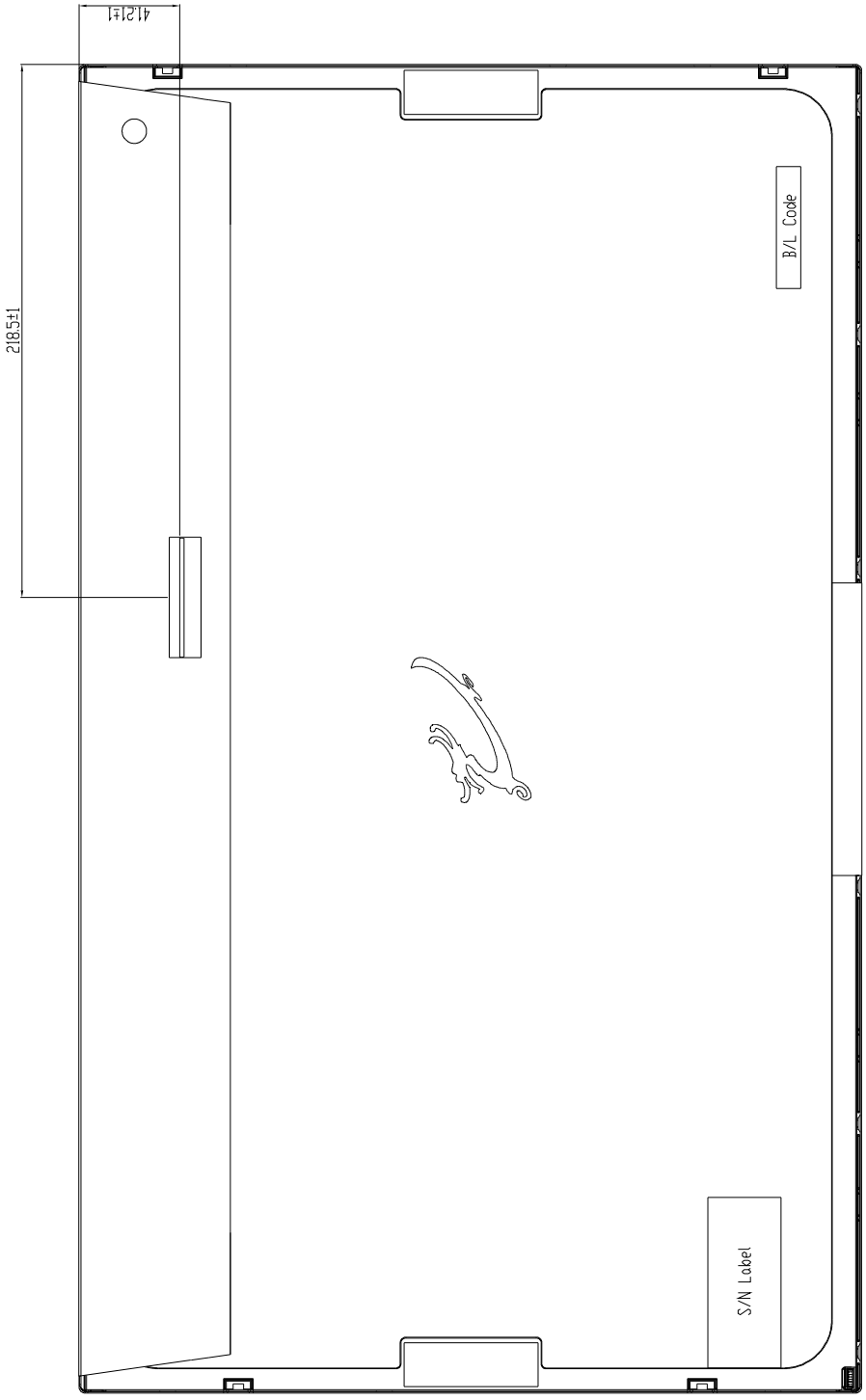


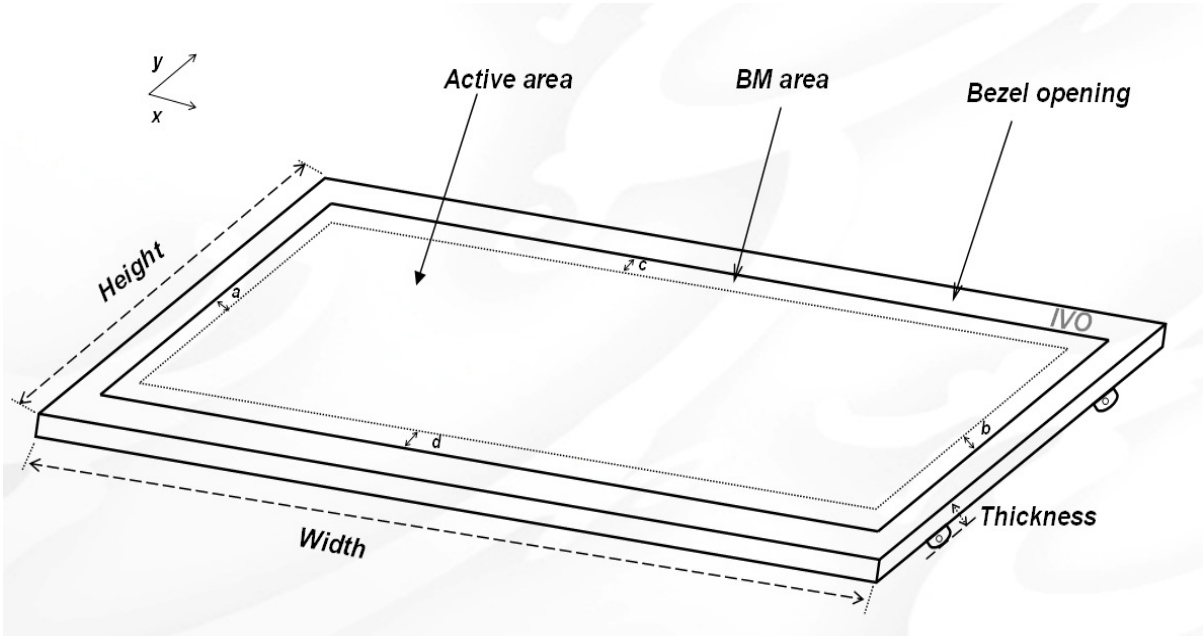
Figure 21 Reference Outline Drawing (Back Side)



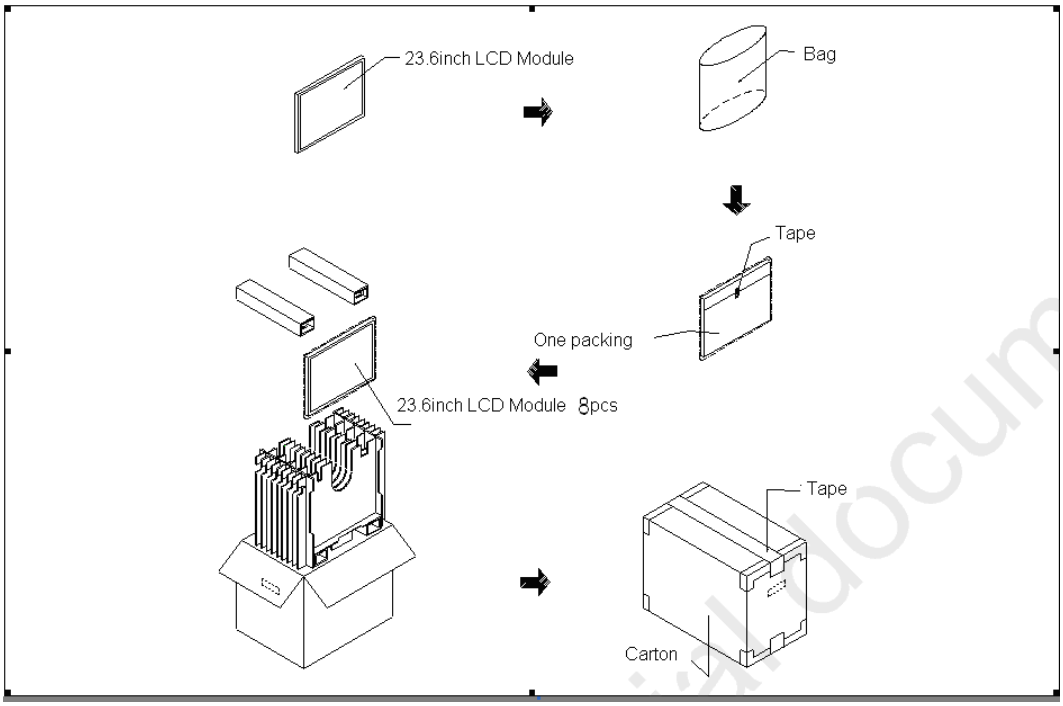
5.1 Dimension Specifications

Table 10 Dimension Specifications

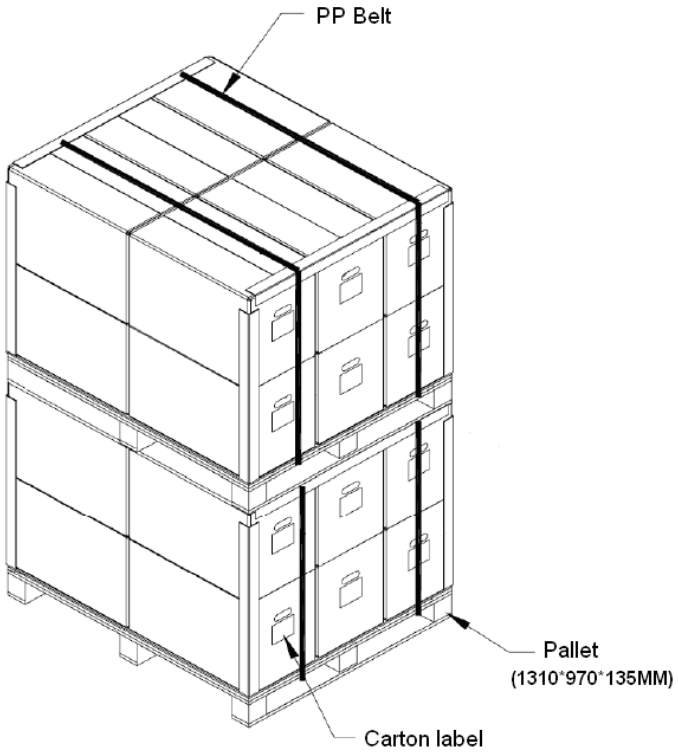
Item		Value	Unit
Width		544.8±0.5	mm
Height		320.5±0.5	mm
Thickness		TBD	mm
Bezel Opening	X	525.22±0.3	mm
	Y	297.22±0.3	mm
Weight		TBD	g
BM Width	| a-b | & | c-d |	≤1.0	mm



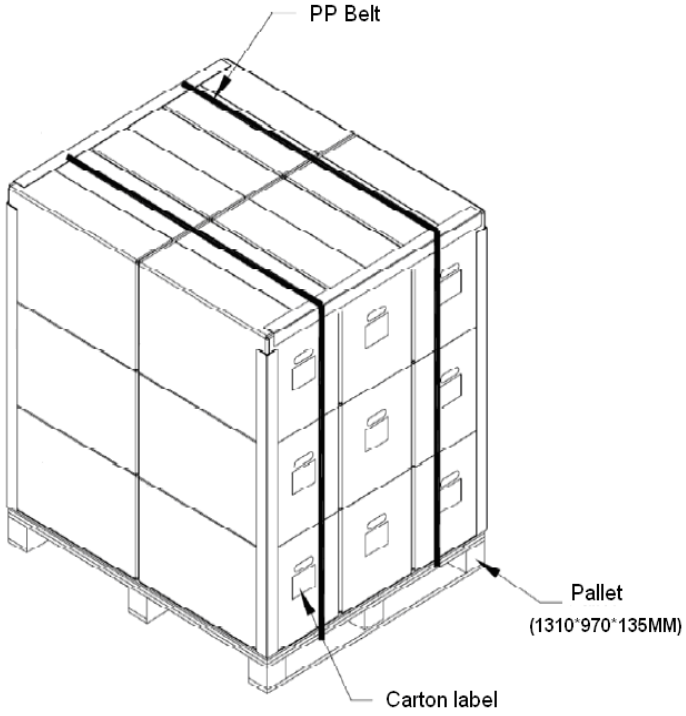
6 Package Specification



Sea Transportation



Air Transportation



7 Lot Mark

Module name

Development product name

H/W: 2nd source/ version

F/W: EDID Version (NB Product only)

23 Product code

Overseas

Lot mark

7.1 Lot Mark

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20

Code 1,2,4,5,6,7,8,9,10,11,16: IVO internal flow control code.
Code 3: Production Location.
Code 12: Production Year.
Code 13: Production Month.
Code 14,15: Production Date.
Code 17,18,19,20: Serial Number.

Note (1) Production Year

Year	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Mark	6	7	8	9	A	B	C	D	E	F

Note (2) Production Month

Month	Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Sep.	Oct	Nov.	Dec.
Mark	1	2	3	4	5	6	7	8	9	A	B	C

7.2 23 product barcode

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23

Code 1,2: MD Module Domain.
Code 3,4,5,6,7: IVO Internal Module Name.
Code 8,9,10,13,16: IVO Internal Flow Control Code.
Code 11,12: Cell location “Suzhou” is defined as “SZ”.
Code 14 ,15: Module line “kunshan” is defined as” KS”.
Code 17,18,19 : Year, Month, Day Refer to IVO Barcode Note(1),Note(2) in Page23.
Code 20~23 : Serial Number.

8 General Precaution

8.1 Use Restriction

This product is not authorized for use in life supporting systems, aircraft navigation control systems, military systems and any other application where performance failure could be life-threatening or otherwise catastrophic.

8.2 Handling Precaution

1) Please mount LCD module by using mounting holes arranged in four corners tightly.
2) Do not disassemble or modify the module. It may damage sensitive parts inside LCD module, and may cause scratches or dust on the display. IVO does not warrant the module, if customers disassemble or modify the module.
3) If LCD panel is broken and liquid crystal spills out, do not ingest or inhale liquid crystal, and do not contact liquid crystal with skin. If liquid crystal contacts mouth or eyes, rinse out with water immediately. If liquid crystal contacts skin or cloths, wash it off immediately with alcohol and Rinse thoroughly with water.
4) Disconnect power supply before handling LCD module.
5) Refrain from strong mechanical shock and /or any force to the module.
6) Do not exceed the absolute maximum rating values, such as the supply voltage variation, input voltage variation, variation in parts' parameters, environmental temperature; etc otherwise LCD module may be damaged. It's recommended employing protection circuit for power supply.
7) Do not touch, push or rub the polarizer with anything harder than HB pencil lead. And please do not push the panel hard or rub with dust clothes with chemical treatment. Do not touch the surface of polarizer for bare hand or greasy cloth. (Some cosmetics are detrimental to the polarizer.)
8) When the surface is dusty, please wipe gently with absorbent cotton or other soft Material. When cleaning the adhesives, please use absorbent cotton wetted with a little petroleum benzene. Normal-hexane is recommended for cleaning the adhesives used to attach front/ rear polarizer. Do not use acetone, toluene and alcohol because they cause chemical damage to the polarizer.
9) Wipe off saliva or water drops as soon as possible. Their long time contact with polarizer causes deformations and color fading.
10) Protection film must be removed very slowly from the surface of LCD module to prevent from electrostatic occurrence.
11) Because LCD module uses CMOS-IC on circuit board and TFT-LCD panel, it is very weak to electrostatic discharge, Please be careful with electrostatic discharge .Persons who handle the module should be grounded through adequate methods.
12) Do not adjust the variable resistor located on the module.

8.3 Storage Precaution

1) Please do not leave LCD module in the environment of high humidity and high temperature for a long time.
2) The module shall not be exposed under strong light such as direct sunlight. Otherwise, Display characteristics may be changed.
3) The module should be stored in a dark place. It is prohibited to apply sunlight or fluorescent light in storage.

8.4 Operation Precaution

1) Do not connect or disconnect the module in the "Power On" condition.

2) Power supply should always be turned on/off by "Power on/off sequence".
3) Module has high frequency circuits. Sufficient suppression to the electromagnetic interference should be done by system manufacturers. Grounding and shielding methods may be important to minimize the interference.
4) After installation of the TFT Module into an enclosure, do not twist nor bend the TFT Module even momentary. At designing the enclosure, it should be taken into consideration that no bending/twisting forces are applied to the TFT Module from outside. Otherwise the TFT Module may be damaged.

8.5 Others

1) Ultra-violet ray filter is necessary for outdoor operation.
2) Avoid condensation of water which may result in improper operation or disconnection of electrode.
3) If the module keeps displaying the same pattern for a long period of time, the image may be "Sticked" to the screen.
4) This module has its circuitry PCB on the rear side and should be handled carefully in order not to be stressed.

8.6 Disposal

When disposing LCD module, obey the local environmental regulations.