To :

Date : Nov. 18, 2003

HannStar Product Information

Model : HSD150SXA1 -A

Note : 1. The information contained herein is preliminary and may be changed without prior notices.
2. Please contact HannStar Display Corp. before designing your product based on this module specification.
3. The information contained herein is presented merely to indicate the characteristics and performance of our products. No responsibility is assumed by HannStar for any intellectual property claims or other problems that may result from application based on the module described herein.

Record of Revisions

Rev.	Updated No.	Date	Description of change
1.0	---	Aug.29,2002	Product Information of HSD150SXA1 was first issued.
2.0	---	Oct.15,2002	Modify the AC timing char. Modify the Power Sequence.
30.	---	Oct.22,2002	Modify the Connector type in page 15.
4.0	---	Nov. 29,2002	Add Package Specification in page 29.
5.0	---	Mar. 26,2003	Modify AC Timing char in page 21,22 and 26 Add current of power supply and ripple spec in page 17 and 18. .
6.0	---	Nov. 18,2003	Add suggested timing on page 26. Add sub model code definition on page 30.

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1.0 GENERAL DESCRIPTIONS

1.1 Introduction

HannStar Display model **HSD150SXA1-A** is a color active matrix thin film transistor (TFT) liquid crystal display (LCD) that uses amorphous silicon TFT as a switching device. This model is composed of a TFT LCD panel, the voltage reference, common voltage, DC-DC converter, column, and row driver circuit. This TFT LCD has a 15-inch diagonally measured active display area with XGA resolution (768 vertical by 1024 horizontal pixel array).

1.2 Features

15" XGA TFT LCD panel

2 CCFLs Backlight system

RSDS, 1 pixel/clock

Supported XGA (V:768 lines, H:1024 pixels) resolution

Supported to 75Hz refresh rate

Without LCD Timing Controller

1.3 General information

Item	Specification	Unit
Outline dimension	321.0×249.0×10.2 (Max.)	mm
Display area	304.1(H) x 228.1(V) (15.0" diagonal)	mm
Number of Pixel	1024(H) x 768(V)	pixels
Pixel pitch	0.297(H) x 0.297(V)	mm
Pixel arrangement	RGB Vertical stripe	
Display color	6-bits driver with RSDS I/F	
Display mode	Normally white	
Surface treatment	Antiglare, Hard-Coating (3H)	
Weight	940 (TYP.)	g
Back-light	2-CCFLs, Top & bottom edge side	
Input signal	Source and Gate Driver control signals	
Power consumption	11 W (Typ.), with back light	W
Optimum viewing direction	6 o' clock	

1.4 Applications

Desktop monitors

Display terminals for AV applications

Monitors for industrial applications

1.5 Mechanical Information

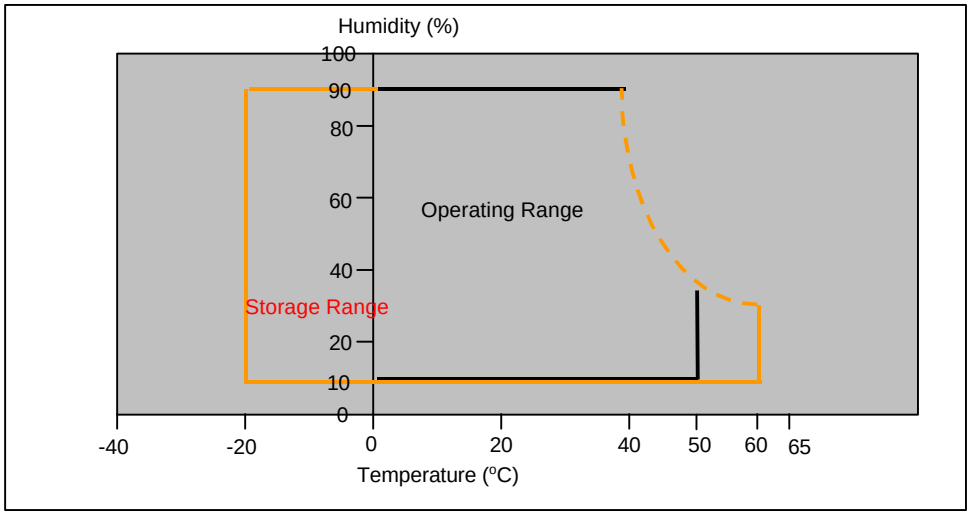
Item		Min.	Typ.	Max.	Unit
Module Size	Horizontal(H)	-	321.0	-	mm
	Vertical(V)	-	249.0	-	mm
	Depth(D)	-	9.9	10.2	mm
Weight (without inverter)		-	940	1000	g

2.0 ABSOLUTE MAXIMUM RATINGS

2.1 Absolute Rating of Environment

Item	Symbol	Min.	Max.	Unit	Note
Storage temperature	T_{STG}	-20	60	°C	
Operating temperature	T_{OPR}	0	50	°C	
Vibration (non-operating)	V_{NOP}	--	1.5	G	(1)
Shock (non-operating)	S_{NOP}	--	70	G	(2)
Storage humidity	H_{STG}	10	90	%RH	(3)
Operating humidity	H_{OP}	10	80	%RH	(3)
Low pressure (operating)	P_{LOP}	697	--	HPa	(4)
Low pressure (non-operating)	P_{LNOP}	116	--	HPa	(5)

Note (1) 5-500-5 Hz sine wave, X,Y,Z each directions, 30 min/cycle.
(2) 11ms, ±X, ±Y, ±Z direction, one time each. For this shock test, it is necessary to fill the silicon rubber between the shock jig as buffer.
(3) Max wet bulb temp. =39°C
(4) 2 hrs. (10000 feet)
(5) 24hrs. (50000 feet)



2.2 Electrical Absolute Rating:

2.2.1 TFT LCD Module:

Item	Symbol	Condition	Value		Unit
			min.	max.	
Input Power Voltage 1	V_{DD1}	Normal	+3.0	+3.8	V(DC)
Logic Signal input voltage	V_{SIG}	Normal	-0.3	V_{DD1} +0.3	V
Input Power Voltage 2	V_{DD2}	Normal	+10.0	+14.0	V(DC)

2.2.2 Back Light Unit:

Item	Symbol	Min.	Max.	Unit	Note
Lamp voltage	V_L	0	2000	V(rms)	(1)
Lamp current	I_L	—	7.0	mA	(1)
Lamp frequency	f_L	0	100	KHz	(1)

Note: (1)Permanent damage may occur to the LCD module if beyond this specification. Functional operation should be restricted to the conditions described under Normal Operating Conditions.

3.0 OPTICAL CHARACTERISTICS

3.1 Measuring Condition

Measuring surrounding: dark room

Lamp current I_{BL}: (6.0)±0.1mA, lamp freq. F_L=50KHz

V_{DD1}=3.3V, f_V=60Hz, f_{DCLK}=32.5MHz

Surrounding temperature: 25±2°C. 30min. Warm-up time.

3.2 Measuring Equipment

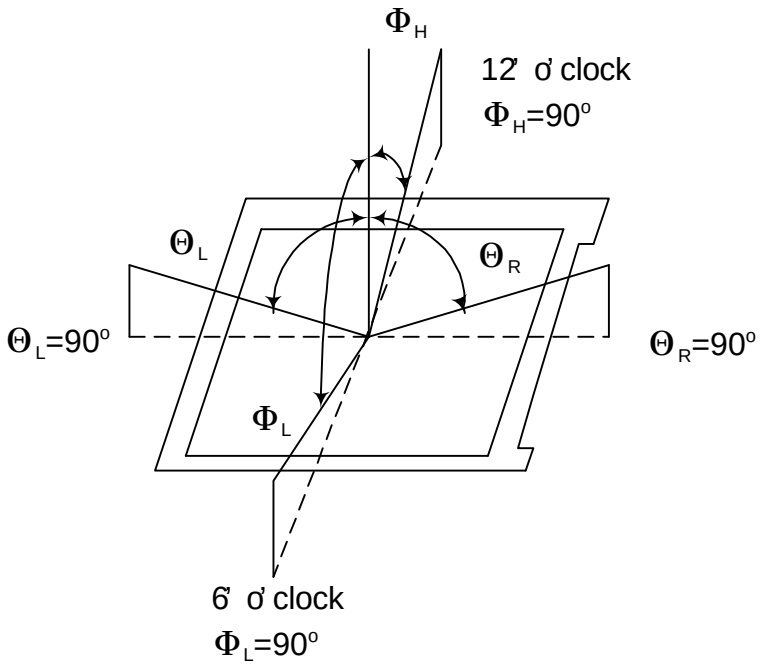
LCD-7000 of Otsuka Electric Corp., which utilized MCPD-7000 for Chromaticity and BM-5A for other optical characteristics.

Measuring spot size: 10~12mm

3.3 Optical specification

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Contrast		CR	Θ=0° ϕ=0° Normal viewing angle	--	400	--		(1)(2)
Response time	Rising	T_R		--	TR +TF =35	--	msec	(1)(3)
	Falling	T_F		--		--		
White luminance (center of screen)		Y_L		200	250	--	cd/m²	(1)
Color chromaticity (CIE1931)	Red	Rx		0.597	0.627	0.657		(1)(4)
		Ry		0.308	0.338	0.368		
	Green	Gx		0.266	0.296	0.326		
		Gy		0.566	0.596	0.626		
	Blue	Bx		0.119	0.149	0.179		
		By		0.086	0.116	0.146		
	White	Wx		0.285	0.315	0.345		
		Wy		0.303	0.333	0.363		
Viewing angle	Hor.	$Θ_L$	CR>10	--	60	--		
		$Θ_R$		--	60	--		
	Ver.	$Θ_H$		--	40	--		
		$Θ_L$		--	50	--		
Viewing angle	Hor.	$Θ_L$	CR>5	--	80	--		
		$Θ_R$		--	80	--		
	Ver.	$Θ_H$		--	50	--		
		$Θ_L$		--	65	--		
Brightness uniformity		B_{UNI}	Θ=0° ϕ=0°	--	75	--	%	(5)
Cross talk		CT(n)		--	--	1.2		(6)

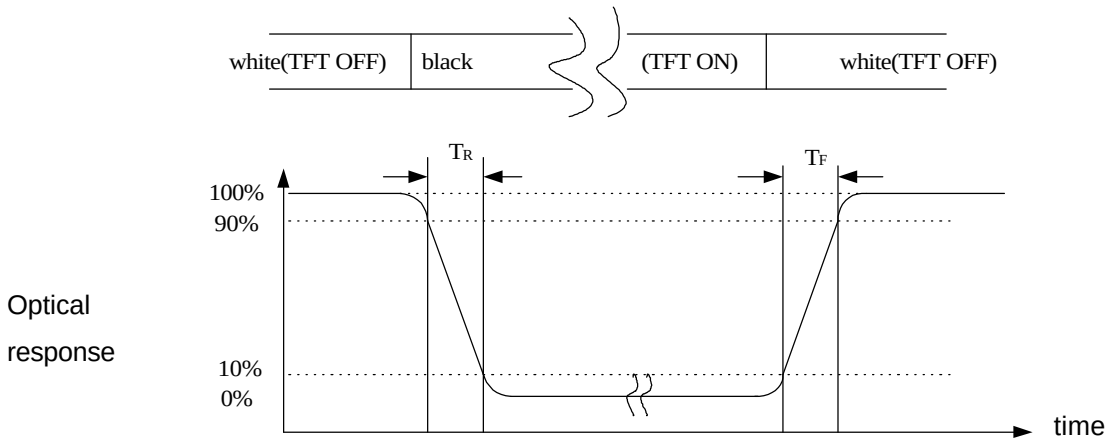
Note (1) Definition of Viewing Angle:



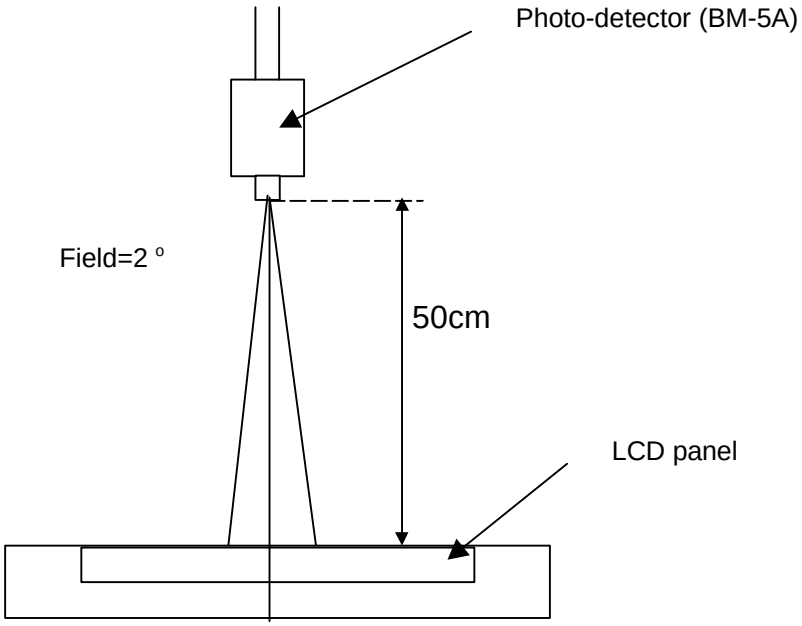
Note (2) Definition of Contrast Ratio(CR) :
measured at the center point of panel

$$CR = \frac{\text{Luminance with all pixels white (L63)}}{\text{Luminance with all pixels black (L0)}}$$

Note (3) Definition of Response Time: Sum of T_R and T_F

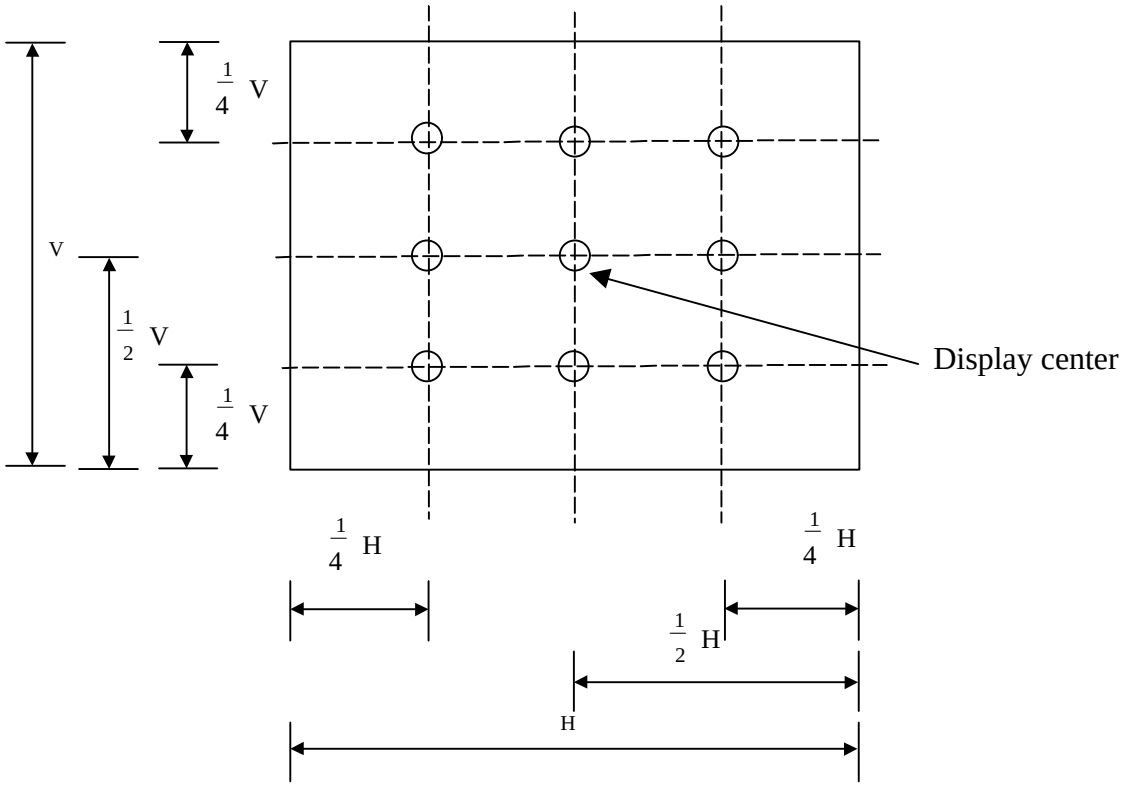


Note (4) Optical characteristic measurement setup



Note (5) Definition of brightness uniformity

Luminance uniformity =(Min Luminance)/(Max Luminance) x 100%



Note (6) Definition of crosstalk CT (1) ~ CT (4)

$$CT(n) = \frac{|L(n) - LB(n)|}{L(n)} \times 100\% \text{ , } n = 1 \sim 4$$

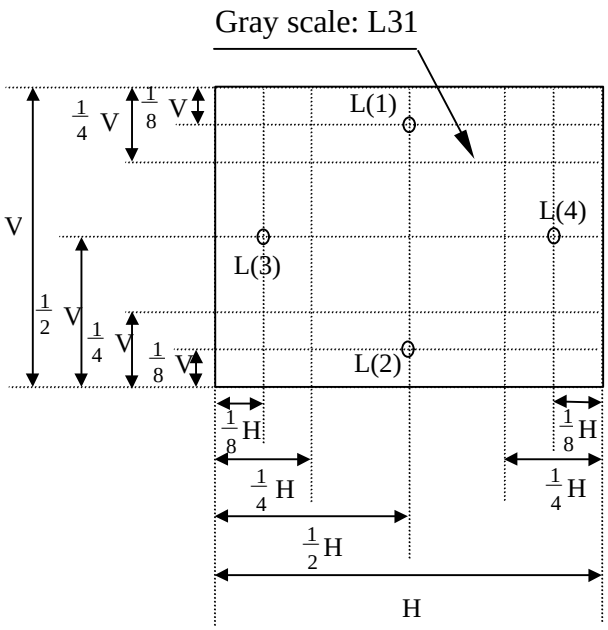
Where L(n) = Luminance of point "n" at pattern A (cd/m^2) , n=1 4

LB(n) = Luminance of point "n" at pattern B (cd/m^2) , n=1 4

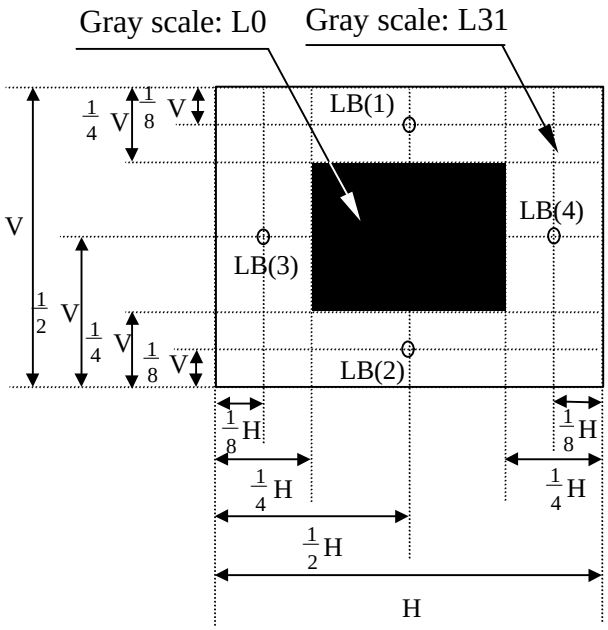
The location measured will be exactly the same in both patterns.

L0: Luminance with all pixels black

L63: Luminance with all pixels white



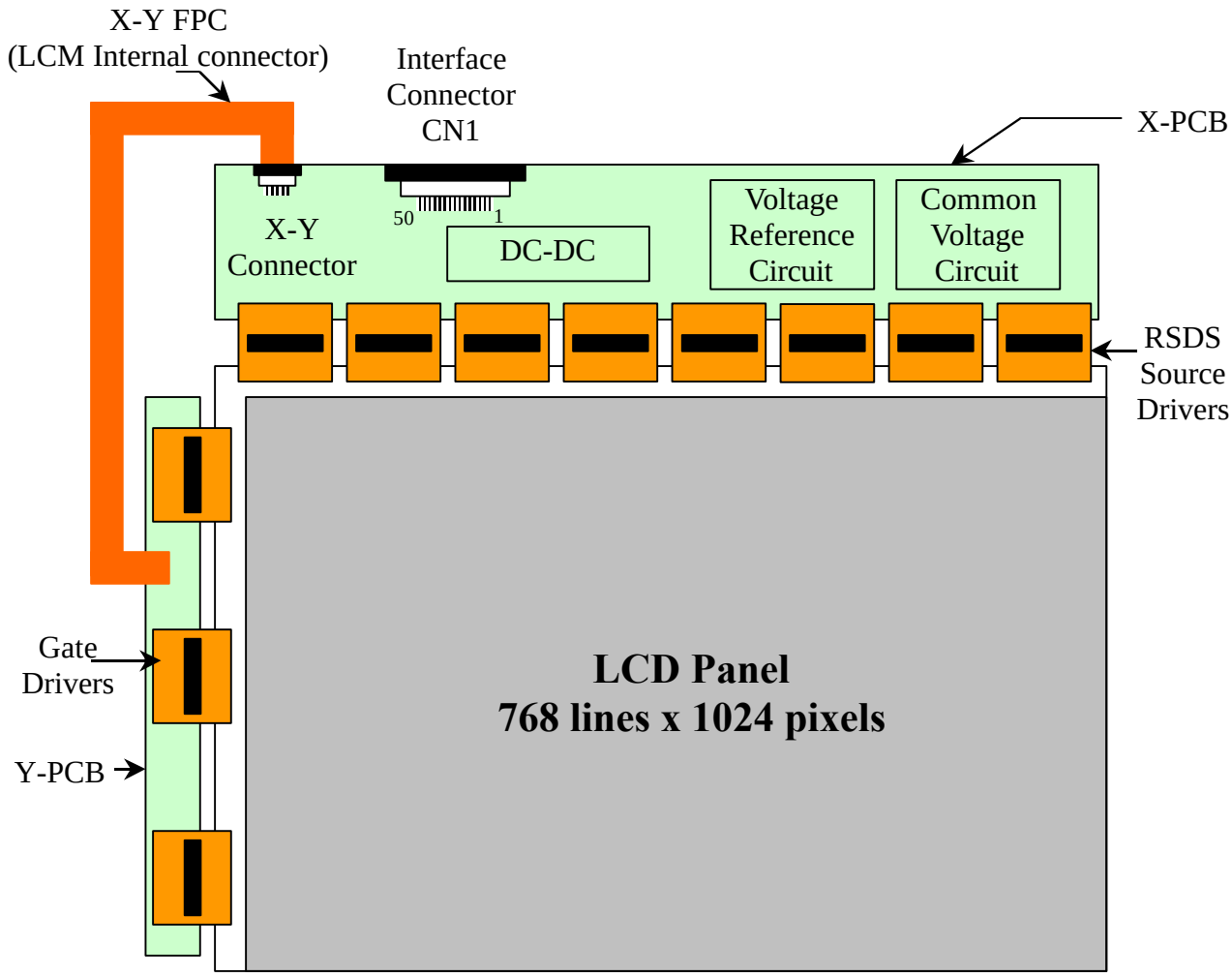
Pattern A



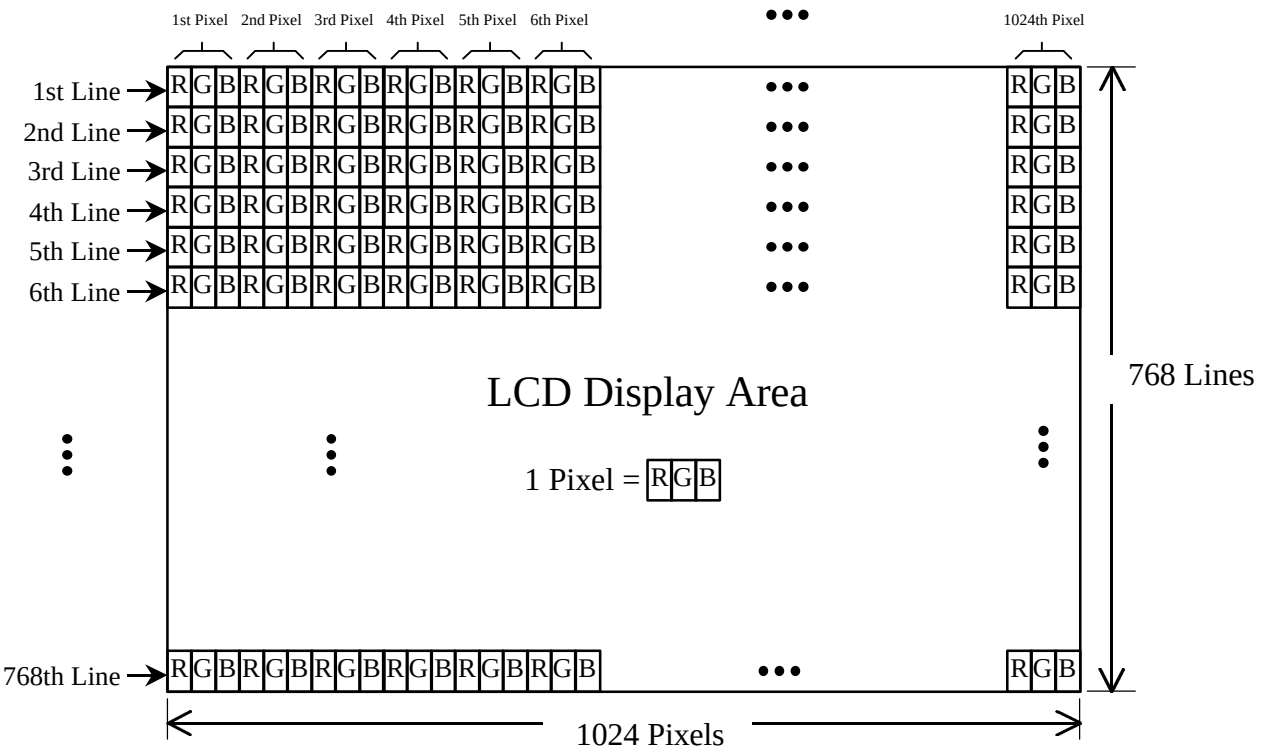
Pattern B

4.0 BLOCK DIAGRAM

4.1 LCD Module Block Diagram:



4.2 Pixel Format



4.3 Relationship between Displayed Color and Input Data

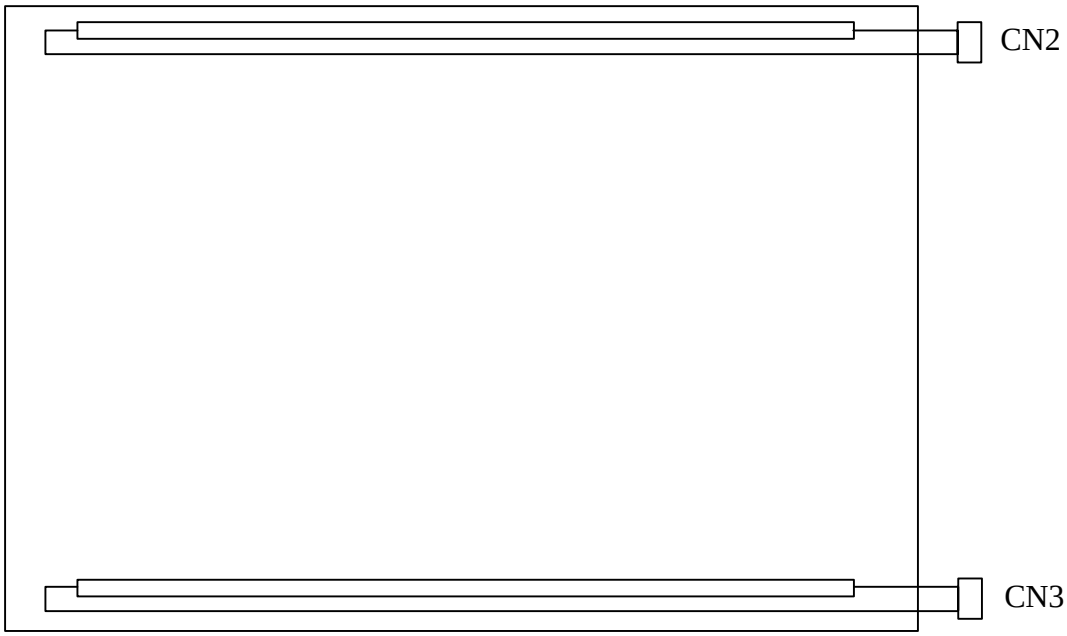
	Display	MSB R5	R4	R3	R2	R1	LSB R0	MSB G5	G4	G3	G2	G1	LSB G0	MSB B5	B4	B3	B2	B1	LSB B0	Gray scale level
Basic color	Black	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	-
	Blue	L	L	L	L	L	L	L	L	L	L	L	L	H	H	H	H	H	H	-
	Green	L	L	L	L	L	L	H	H	H	H	H	H	L	L	L	L	L	L	-
	Light Blue	L	L	L	L	L	L	H	H	H	H	H	H	H	H	H	H	H	H	-
	Red	H	H	H	H	H	H	L	L	L	L	L	L	L	L	L	L	L	L	-
	Purple	H	H	H	H	H	H	L	L	L	L	L	L	H	H	H	H	H	H	-
	Yellow	H	H	H	H	H	H	H	H	H	H	H	H	L	L	L	L	L	L	-
	White	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	-
Gray scale of Red	Black	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L0
	Dark	L	L	L	L	L	H	L	L	L	L	L	L	L	L	L	L	L	L	L1
		L	L	L	L	H	L	L	L	L	L	L	L	L	L	L	L	L	L	L2
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	L3 ..L60
	Light	H	H	H	H	L	H	L	L	L	L	L	L	L	L	L	L	L	L	L61
		H	H	H	H	H	L	L	L	L	L	L	L	L	L	L	L	L	L	L62
	Red	H	H	H	H	H	H	L	L	L	L	L	L	L	L	L	L	L	L	Red L63
Gray scale of Green	Black	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L0
	Dark	L	L	L	L	L	L	L	L	L	L	L	H	L	L	L	L	L	L	L1
		L	L	L	L	L	L	L	L	L	L	H	L	L	L	L	L	L	L	L2
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	L3 ..L60
	Light	L	L	L	L	L	L	H	H	H	H	L	H	L	L	L	L	L	L	L61
		L	L	L	L	L	L	H	H	H	H	H	L	L	L	L	L	L	L	L62
	Green	L	L	L	L	L	L	H	H	H	H	H	H	L	L	L	L	L	L	Green L63
Gray scale of Blue	Black	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L0
	Dark	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	H	L1
		L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	H	L	L2
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	L3 ..L60
	Light	L	L	L	L	L	L	L	L	L	L	L	L	H	H	H	H	L	H	L61
		L	L	L	L	L	L	L	L	L	L	L	L	H	H	H	H	H	L	L62
	Blue	L	L	L	L	L	L	L	L	L	L	L	L	H	H	H	H	H	H	Blue L63
Gray scale of White and Black	Black	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L0
	Dark	L	L	L	L	L	H	L	L	L	L	L	H	L	L	L	L	L	H	L1
		L	L	L	L	H	L	L	L	L	L	H	L	L	L	L	L	H	L	L2
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	L3 ..L60
	Light	H	H	H	H	L	H	H	H	H	H	L	H	H	H	H	H	L	H	L61
		H	H	H	H	H	L	H	H	H	H	H	L	H	H	H	H	H	L	L62
	White	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	White L63

5.0 I/O CONNECTION PIN ASSIGNMENT

5.1 Interface FPC Connector CN1 (50-pins x 1) (FH12-50S-0.5SH)

I/F FRC Connector CN1		
Pin No.	Symbol	Description
1	GND	Ground
2	D22P	RSDS Receiver Data + (Blue)
3	D22N	RSDS Receiver Data - (Blue)
4	GND	Ground
5	D21P	RSDS Receiver Data + (Blue)
6	D21N	RSDS Receiver Data - (Blue)
7	GND	Ground
8	D20P	RSDS Receiver Data + (Blue)
9	D20N	RSDS Receiver Data - (Blue)
10	GND	Ground
11	D12P	RSDS Receiver Data + (Green)
12	D12N	RSDS Receiver Data - (Green)
13	GND	Ground
14	D11P	RSDS Receiver Data + (Green)
15	D11N	RSDS Receiver Data - (Green)
16	GND	Ground
17	D10P	RSDS Receiver Data + (Green)
18	D10N	RSDS Receiver Data - (Green)
19	GND	Ground
20	CLKP	RSDS Receiver clk +
21	CLKN	RSDS Receiver clk -
22	GND	Ground
23	D02P	RSDS Receiver Data + (Red)
24	D02N	RSDS Receiver Data - (Red)
25	GND	Ground
26	D01P	RSDS Receiver Data + (Red)
27	D01N	RSDS Receiver Data - (Red)
28	GND	Ground
29	D00P	RSDS Receiver Data + (Red)
30	D00N	RSDS Receiver Data - (Red)
31	GND	Ground
32	STH	Start pulse I/O
33	LOAD	CK1
34	POL	Odd & Even change
35	REV	Data polarity inversion
36	GND	Ground
37	CPV	Vertical shift clock input
38	STV	Shift data I/O
39	OE	Output enable pin
40	NC	
41	GND	Ground
42	VDD1	3.3V Power Input
43	VDD1	3.3V Power Input
44	VDD1	3.3V Power Input
45	GND	Ground
46	VDD2	12V Power Input
47	VDD2	12V Power Input
48	NC	NC
49	NC	NC
50	NC	NC

5.2 Back Light Unit (CCFL) Connectors:



CN2, 3: CCFL Power Source (BHR-03VS-1/Japan Solderless Terminal MFG Co., LTD)

Mating connector: SM02 (8.0)B-BHS-1/ Japan Solderless Terminal MFG Co., LTD

Terminal No.	Symbol	Function
1	VL	CCFL power supply (high voltage)
2	NC[1)]	No connection
3	GL	CCFL power supply (low voltage)

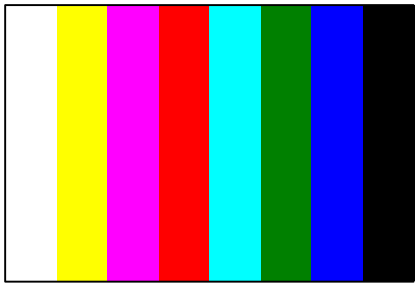
Note 1) Please connects NC pin to nothing. Don't connect it to ground nor to other signal Input. (NC pin should be open.)

6.0 ELECTRICAL CHARACTERISTICS

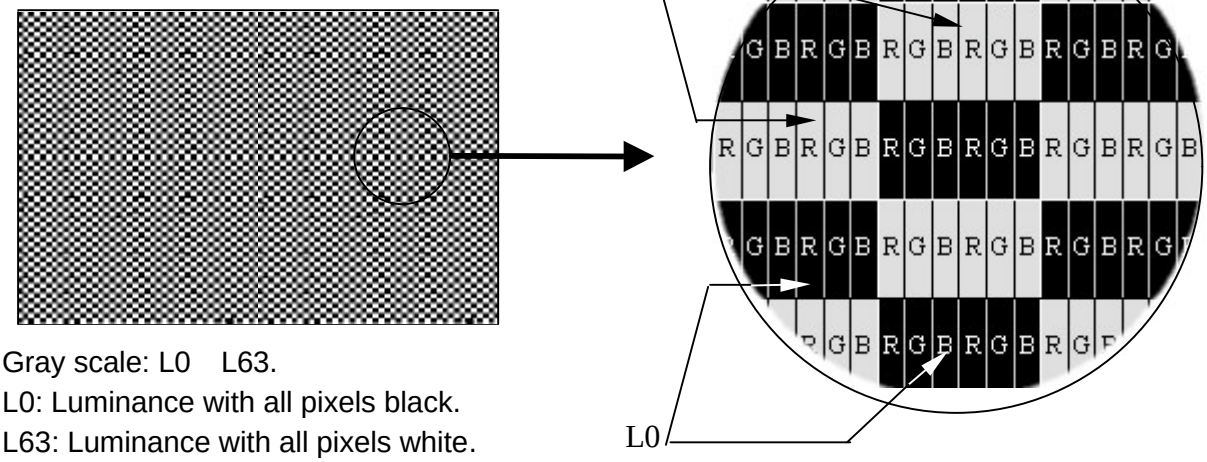
6.1 Electrical System of LCD Module:

Item		Symbol	Condition	Value			Unit	Note
				Min.	Typ.	Max.		
Input Voltage		V_{DD1}		+3.0	+3.3	+3.6	V(DC)	
		V_{DD2}		+10.8	+12.0	+13.2		
Voltage ripple		VDD1				100	mV	
		VDD2				200	mV	
Input Signal voltage		V_{IH}	High Level	2.4	3.3	VDD1+0.2	V	
		V_{IL}	Low Level	0	—	0.9	V	
Differential input threshold voltage	High	V_{IH}		—	—	100	mV	V_{CM}=1.2V
	Low	V_{IL}		-100	—	—	mV	
Current of power supply	Color Bar	$I_{DD}1$	Vdd1	—	19.7	—	mA(rms)	(1)
	Mosaic	$I_{DD}2$	Vdd1	—	25	—	mA(rms)	(2)
Current of power supply	Color Bar	$I_{DD}1$	Vdd2	—	82	—	mA(rms)	(1)
	Mosaic	$I_{DD}2$	Vdd2	—	90	—	mA(rms)	(2)

Note (1) Color Bar



Note (2) Mosaic : Dot checker image



Gray scale: L0 L63.
L0: Luminance with all pixels black.
L63: Luminance with all pixels white.

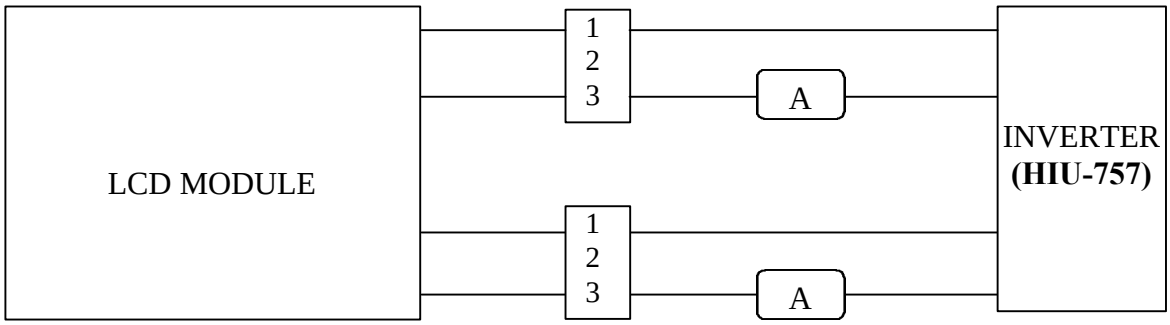
Note (3) When f_v is too low, a flicker may be occurred on the display.

6.2 Back-Light Unit:

The backlight system is an edge-lighting type with 2-CCFL (Cold Cathode Fluorescent Lamp). The characteristics of four lamps are shown in the following tables.

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Lamp current	I_L	3.0	6.0	7.0	mA(rms)	(1)
Lamp voltage	V_L	594	660	—	V(rms)	I_L=6.0 mA
Frequency	f_L	50	55	80	KHz	(2)
Operating life time	Hr	30,000	40,000	—	Hour	(3)
Startup voltage	Vs	1150	—	—	V(rms)	at 25°C
		1350				at 0°C

Note: (1) Lamp current is measured with current meter for high frequency as shown below. Specified values are for a lamp.



(2) Lamp frequency may produce interference with horizontal synchronous frequency and this may cause line flow on the display. Therefore lamp frequency shall be detached from the horizontal synchronous frequency and its harmonics as far as possible in order to avoid interference.

(3) Life time (Hr) can be defined as the time in which it continues to operate under the condition: Temp. =25±3ºC, I_L=6.0mA(rms.) and f_L=50 KHz until one of the following event occurs:

1.When the brightness becomes 50%.

2.When the startup voltage (Vs) at 0ºC becomes higher than the maximal value of Vs specified above.

6.3 AC Electrical Characteristics:

6.3.1 AC Timing: (VDD1=3.0V~3.6V, T_{OPR}=25 °C) [5)]

Item		Symbol	Min.	Typ.	Max.	Unit	Signals	Note
Reference Signal (Pixel Clock)	Periodic	F1 T1=CLK T2=T1*2	50 12.5 25	65 15.384 30.769	80 20 40	MHz n-Sec n-Sec		
Reference Signal (DENB)	Line Periodic	T3=Line	526	672	900	T2		
	Line Active	T4	512	512	512	T2		
	Line Blank	T5	14	160	388	T2		
	Frame Periodic	T6	773	806	950	Lines		
	Frame Active	T7	768	768	768	Lines		
	Frame Blank	T8	5	---	---	Lines		
Vertical Periodic	Periodic	T6	773	806	950	Lines	STV	
	Pulse Width	T9	1	1	---	Lines		
	Rising Time	T11	---	40	60	n-Sec		
	Falling Time	T12	---	40	60	n-Sec		
	Set-up Time	T13	700	800	---	n-Sec		
	Hold Time	T14	700	800	---	n-Sec		
Horizontal Periodic	Period	T15	---	1	---	Lines	OE CPV LOAD	
	Pulse Width	T16A T16B T16C	1 1 2	 64	 100	u-Sec u-Sec T2		
	Rising Time	T17A T17B T17C	 2	40 40 4	60 60	n-Sec		
	Falling Time	T18A T18B T18C	 2	40 40 4	60 60	n-Sec		

Item		Symbol	Min.	Typ.	Max.	Unit	Signals	Note
Clock	Pulse width	T19	12.5	---	---	n-Sec	CLKP-CLKN	
	Pulse low period	T19A	6	---	---	n-Sec		
	Pulse high period	T19B	6	---	---	n-Sec		
Start pulse	Data setup time	T20	2	---	---	n-Sec	STH	
	Data hold time	T21	1	---	---	n-Sec		
	Setup time	T22	4	---	---	n-Sec		
	Hold time	T23	2	---	---	n-Sec		
	Signal pulse width	T24	1CLKP	---	2CLKP	n-Sec		
Load	Load high pulse width	T25	5CLKP	---	2μs	CLKP period	LOAD	
	Load to STH setup time	T26	5CLKP	---	---	CLKP period		
	Last data time	T27	1CLKP	---	---	CLKP period		
	Load(rising)~ CLK(falling)	T28	4	---	---	n-Sec		
	POL(rising) or (falling) ~ Load(rising)	T29	14	---	---	n-Sec		
	Load(falling)~ POL(rising)or (falling)	T30	10	---	---	n-Sec		

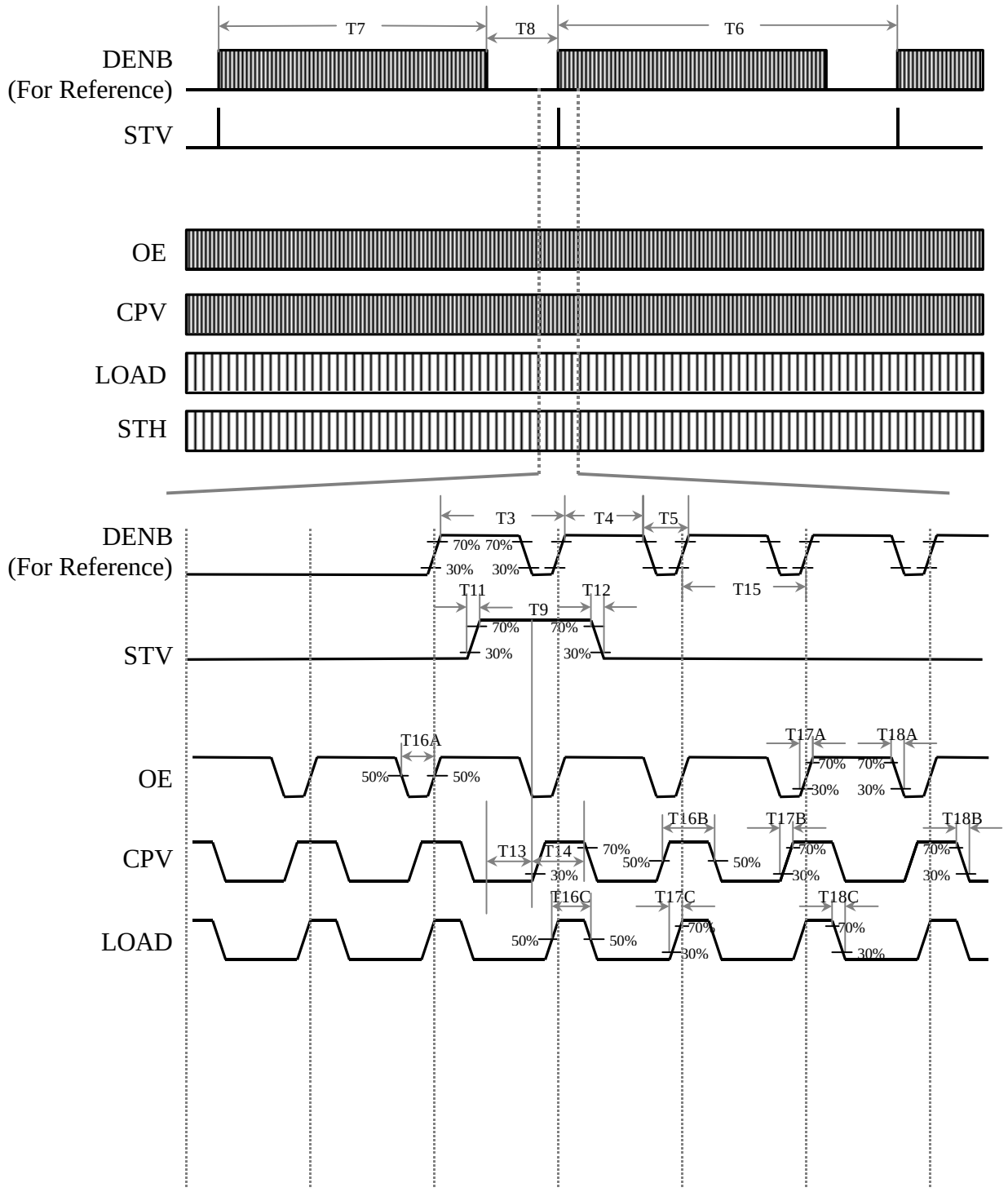
Note 1) Refer to VESA standard.

Note 2) Please adjust LCD operating signal timing and FL driving frequency, to optimize the display quality. There is a possibility that flicker is observed by the interference of LCD operating signal timing and FL driving condition (especially driving frequency).

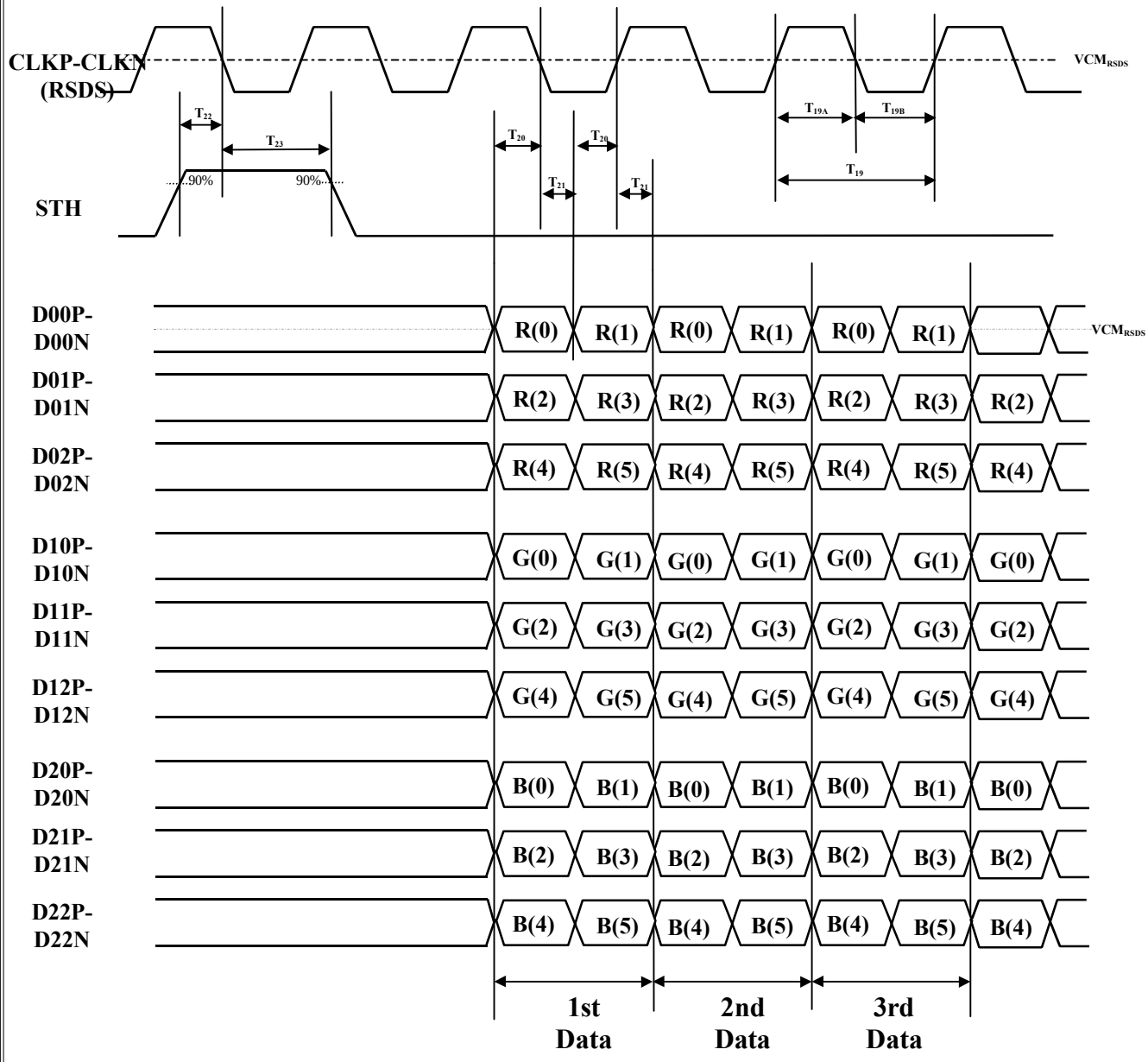
Note 3) All the timing setting should be confirmed with HannStar's FAE persons.

6.3.2 AC Timing Charts:

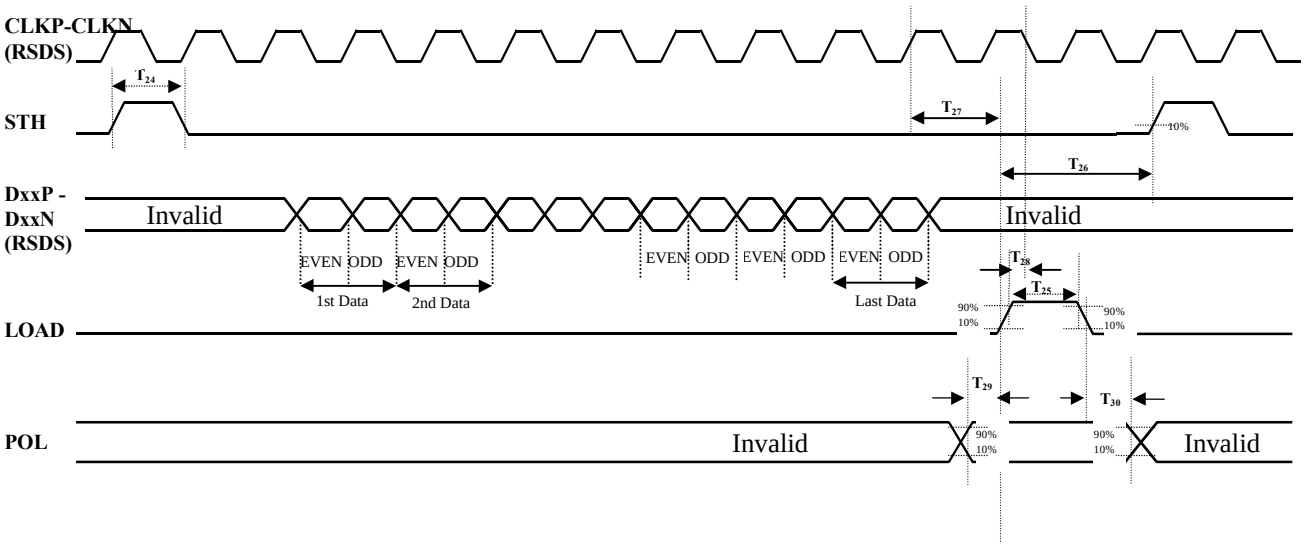
(1). Vertical Periodic (STV, OE, CPV):



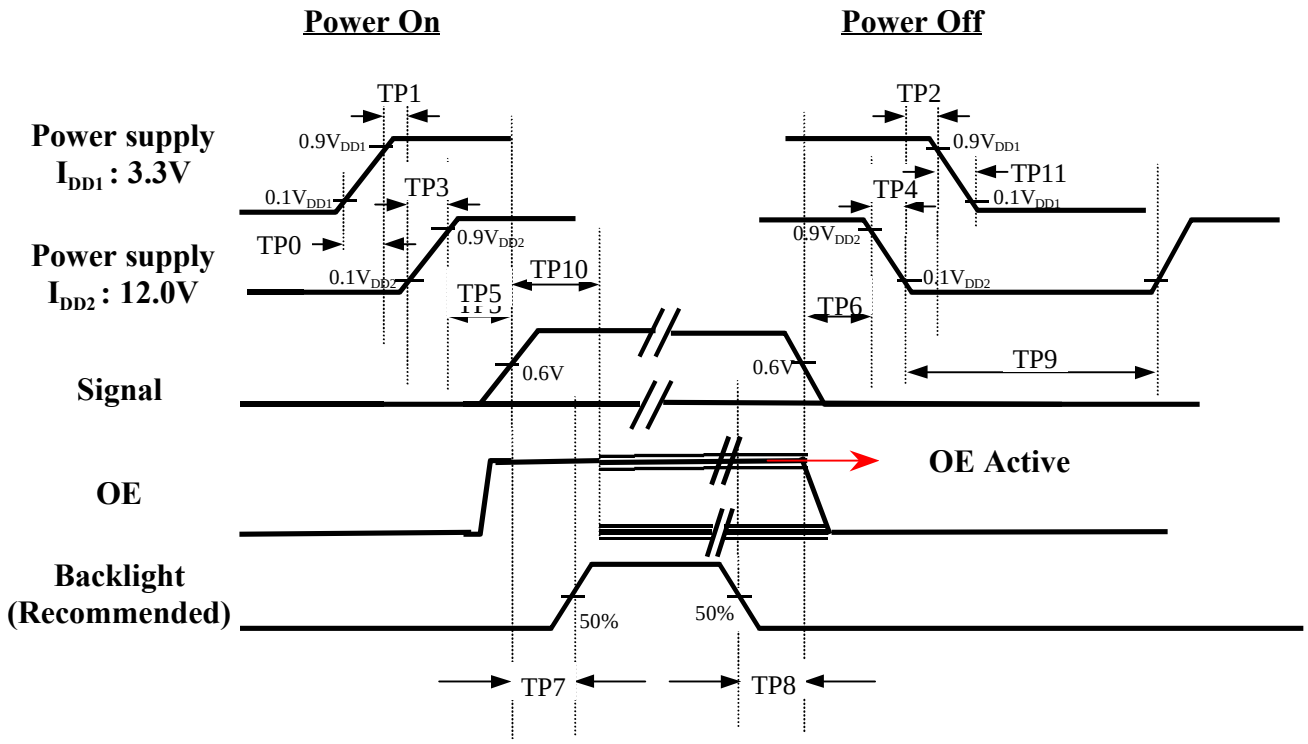
(2). Horizontal Periodic 1 (STH, CLK, DATA):



(4). Horizontal Periodic 2 (CLK, LOAD, STH, POL):



6.4 Power On / Off Sequence：



Item	Min.	Suggested	Max.	Unit	Remark
TP0	0.4	0.5	10	msec	
TP1	100	500	--	ì sec	
TP2	100	500	--	ì sec	
TP3	0.4	0.5	10	msec	
TP4	0	--	10	msec	
TP5	0	50	50	msec	
TP6	0	--	50	msec	
TP7	200	--	--	msec	
TP8	200	--	--	msec	
TP9	1	--	--	sec	
TP10	35	40	100	msec	
TP11	0	--	10	msec	

Note：(1) The supply voltage of the external system for the module input should be the same as the definition of V_{DD}.

(2) Apply the lamp volatge within the LCD operation range. When the back-light turns on before the LCD operation or the LCD truns off before the back-light turns off, the display may momentarily become white.

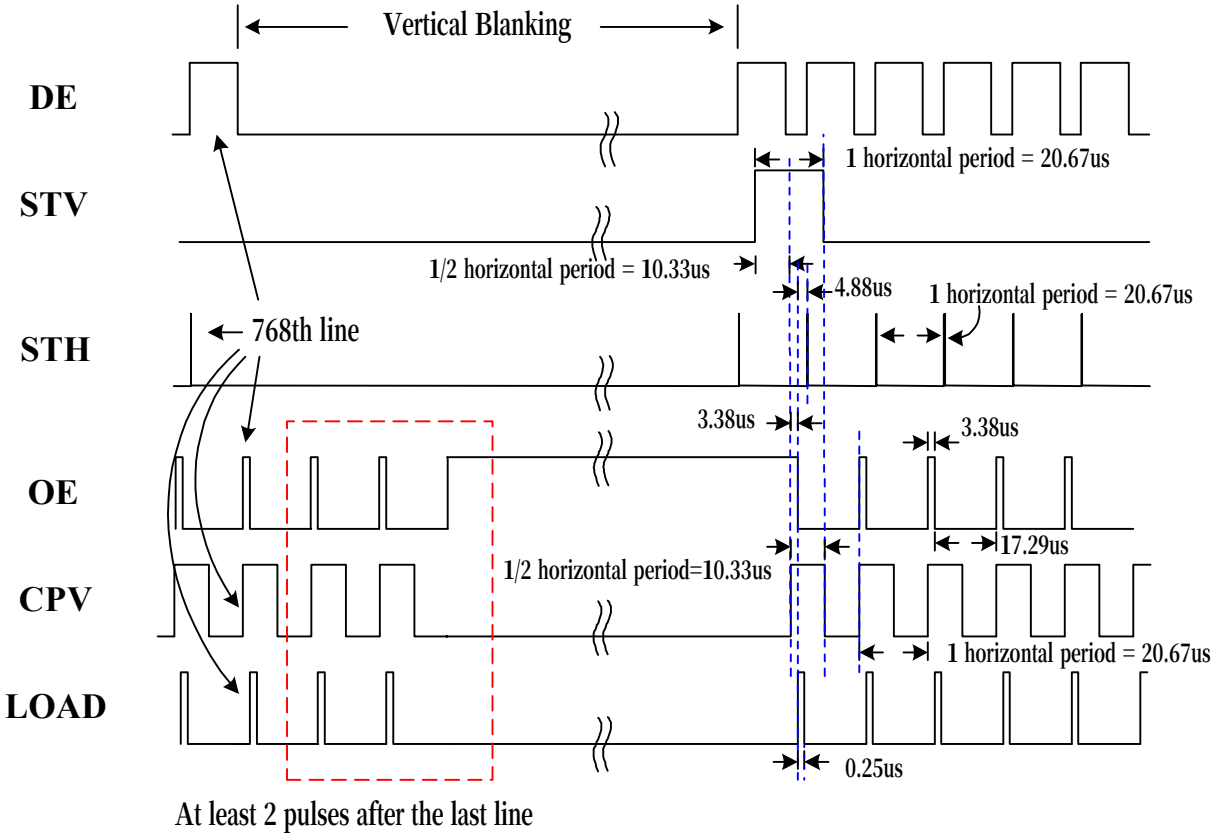
(3) In case of V_{DD} = off level, please keep the level of input signal on the low.

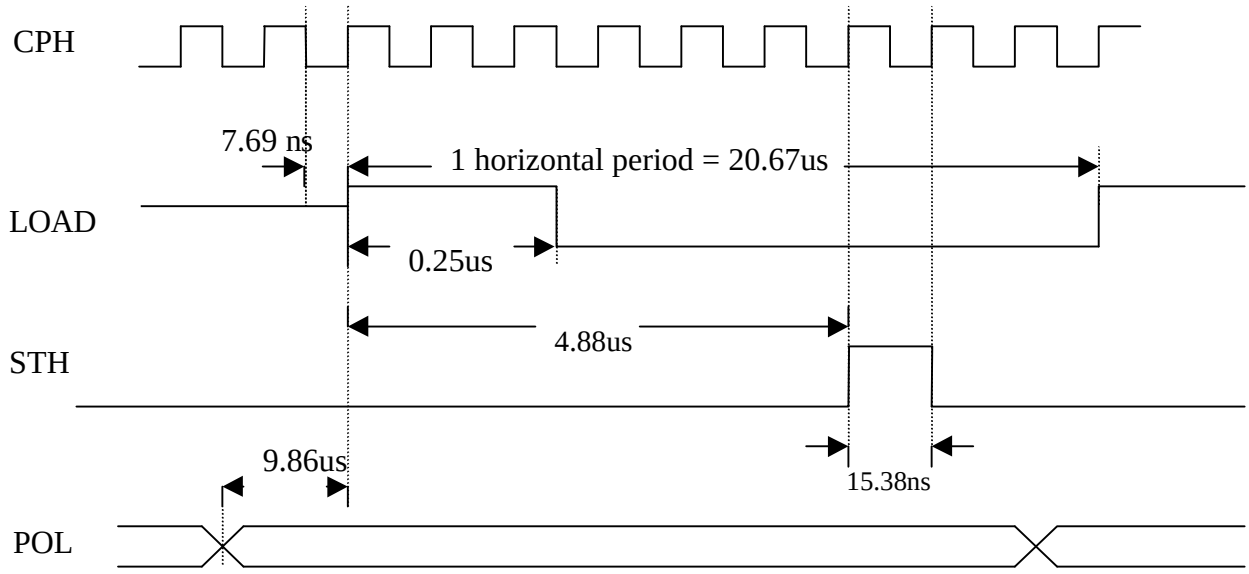
(4) TP9 should be measured after the module has been fully discharged between power off and on period.

(5) Interface signal shall not be kept at high impedance when the power is on.

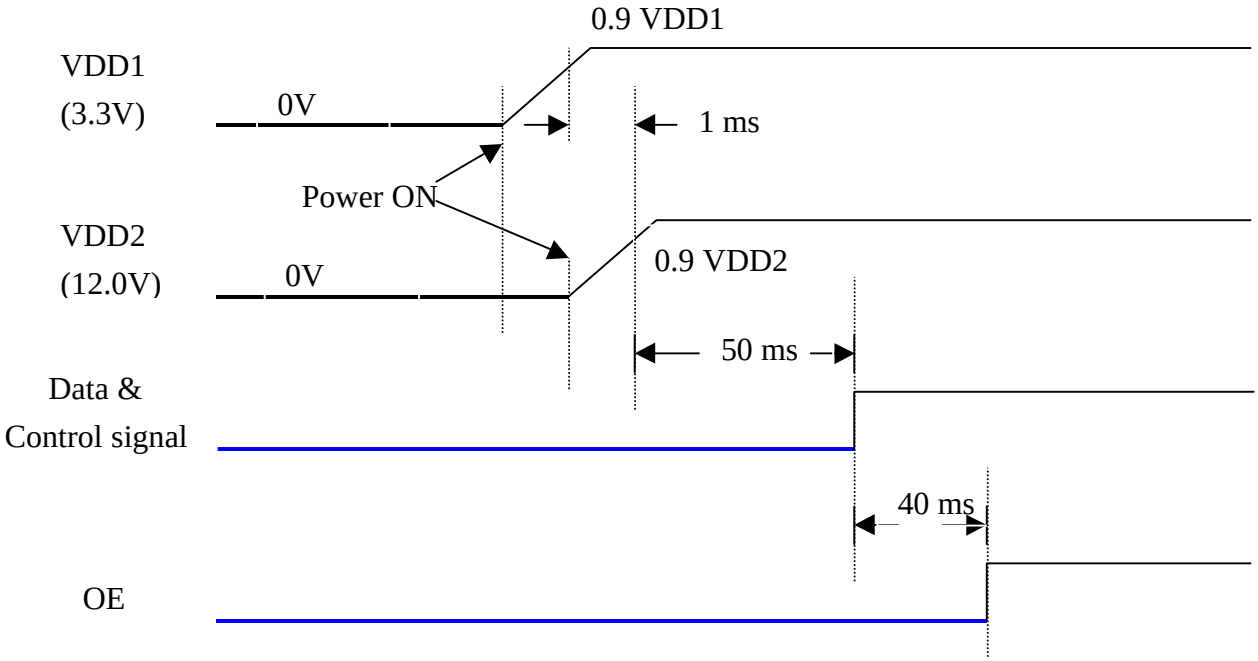
(6) OE have to keep high in the power on initial situaction for more than 35ms, or it may leads to power on fail.

6.5 Suggested Timing (VESA – 1024x768/60Hz) :





6.6 Initial State:

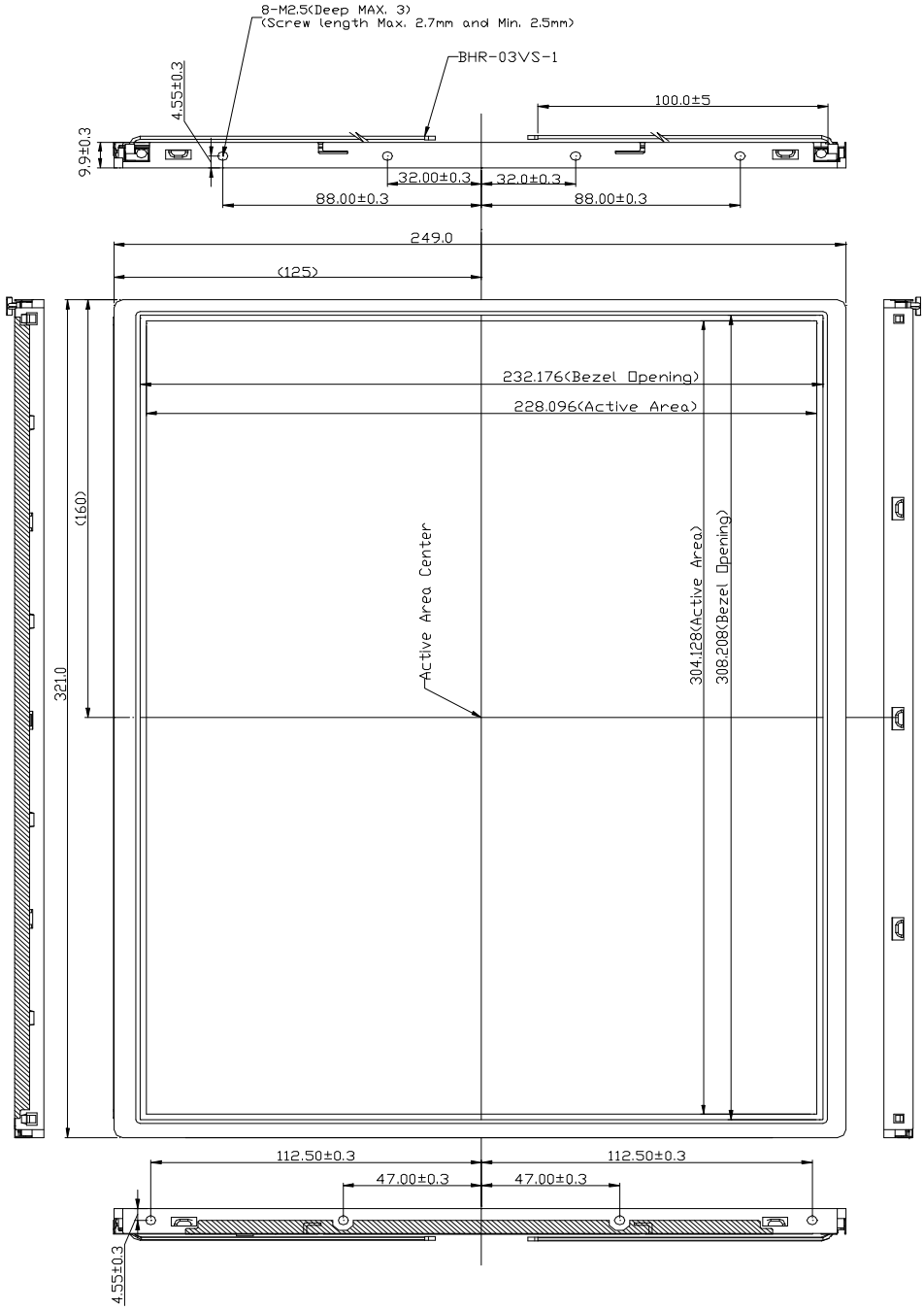


* Input Power (VDD1 & VDD2) should be 0V(GND) before Power-ON.
* All signals (including control signals and data) should be kept **low** before it is active.

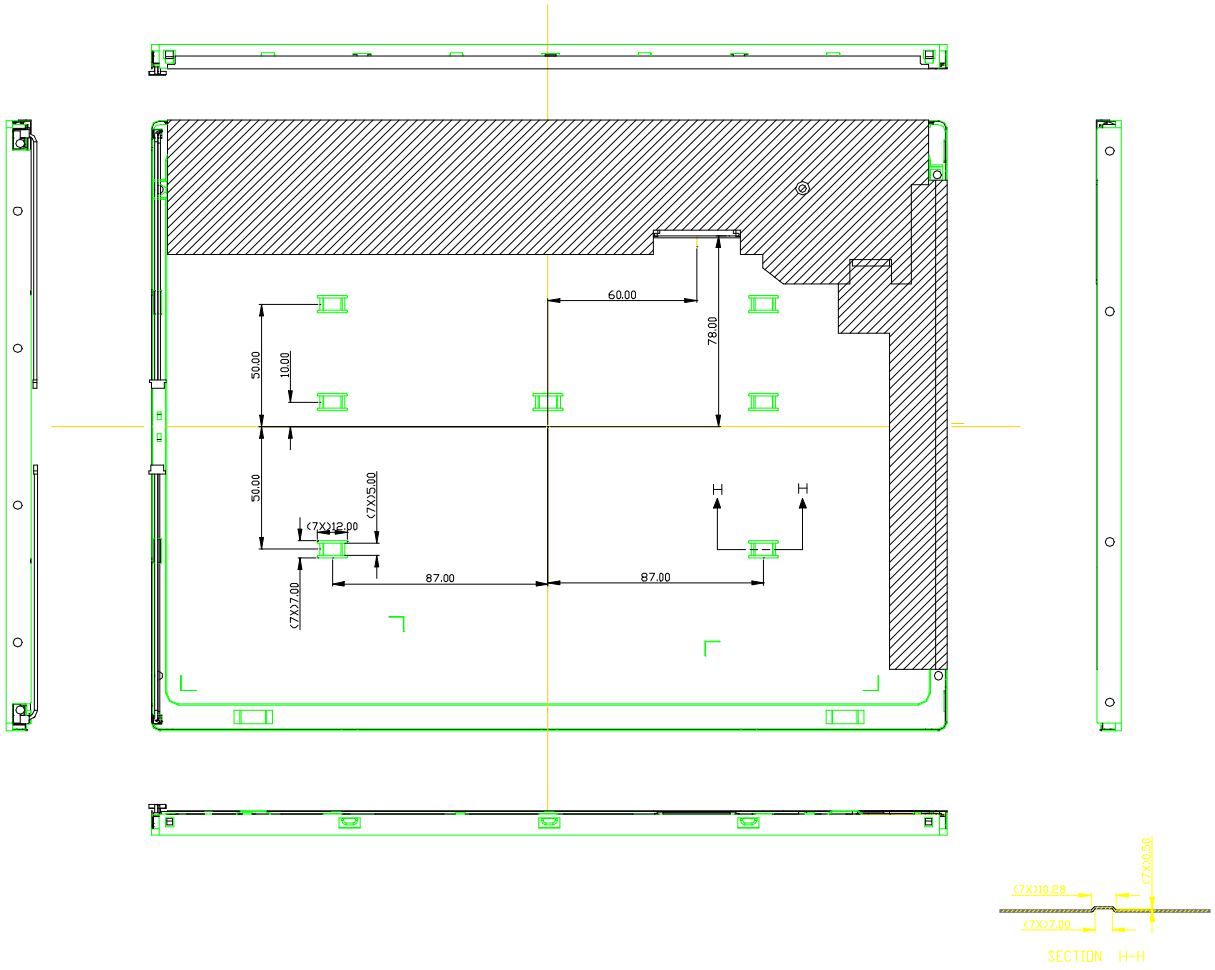
7.0 OUTLINE DIMENSION

7.1.1 Front View:

Date: 20020315



7.1.2 Back View: **Date: 20020315**



8. LOT MARK

8.1 Lot Mark

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

code 1,2,3,4,5,6: HannStar internal flow control code.
code 7: production location.
code 8: production year.
code 9: production month.
code 10,11,12,13,14,15: serial number.

Note (1) Production Year

Year	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Mark	9	0	1	2	3	4	5	6	7	8

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

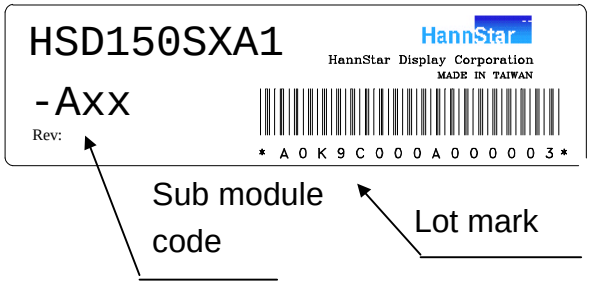
8.2 Sub Model Code

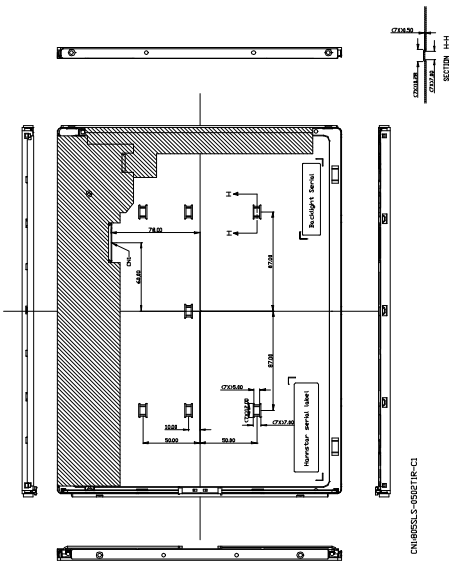
1	2	3

code 1: Panel sub model code of type. (A~Z)
code 2,3: Panel product sub model code of serial number. (00~99)

8.3 Location of Lot Mark

(1) The label is attached to the backside of the LCD module.
(2) This is subject to change without prior notice.





9.0 PACKAGE SPECIFICATION

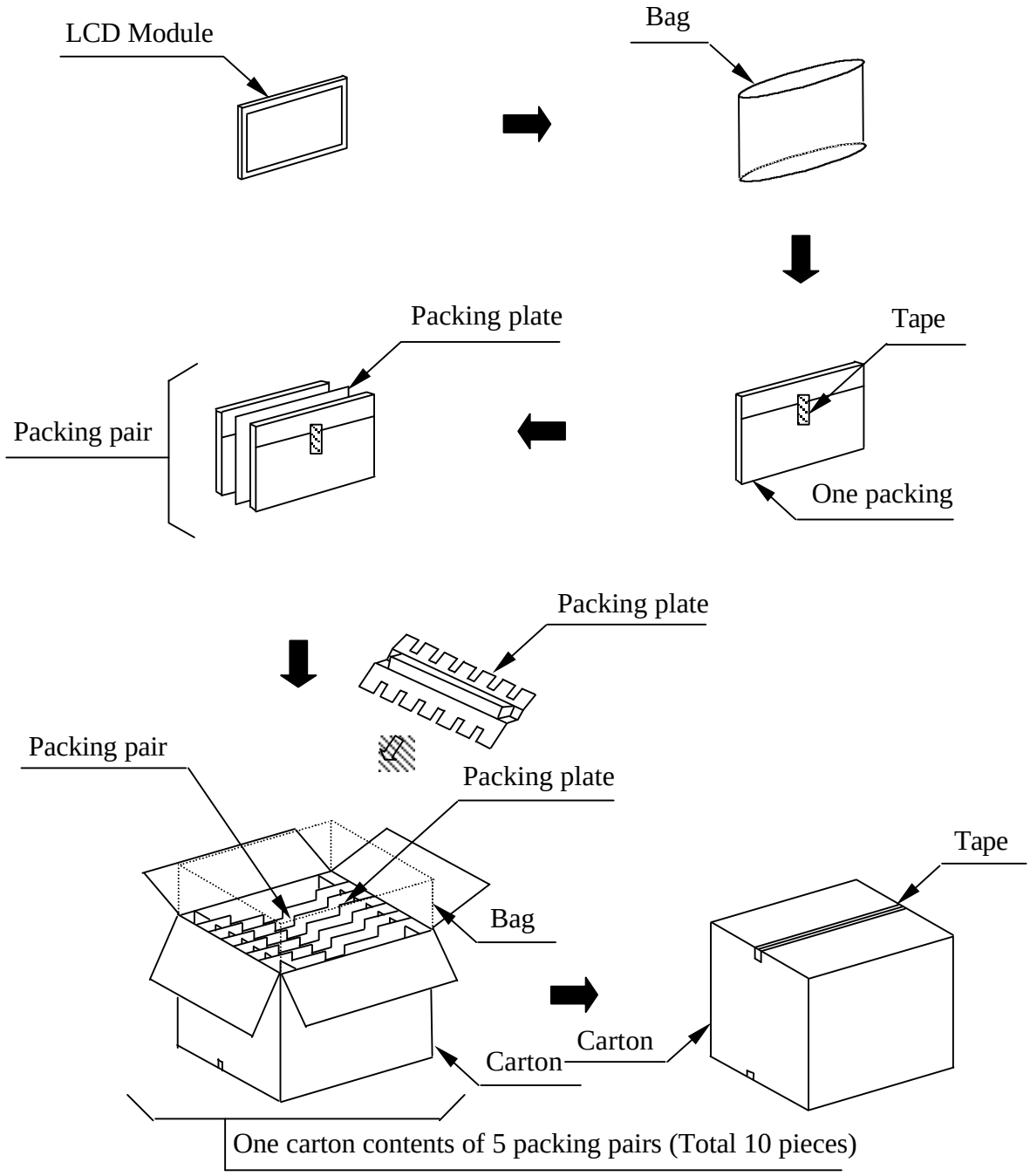
9.1 packing form

(1) package quantity in one carton: 10 pieces.

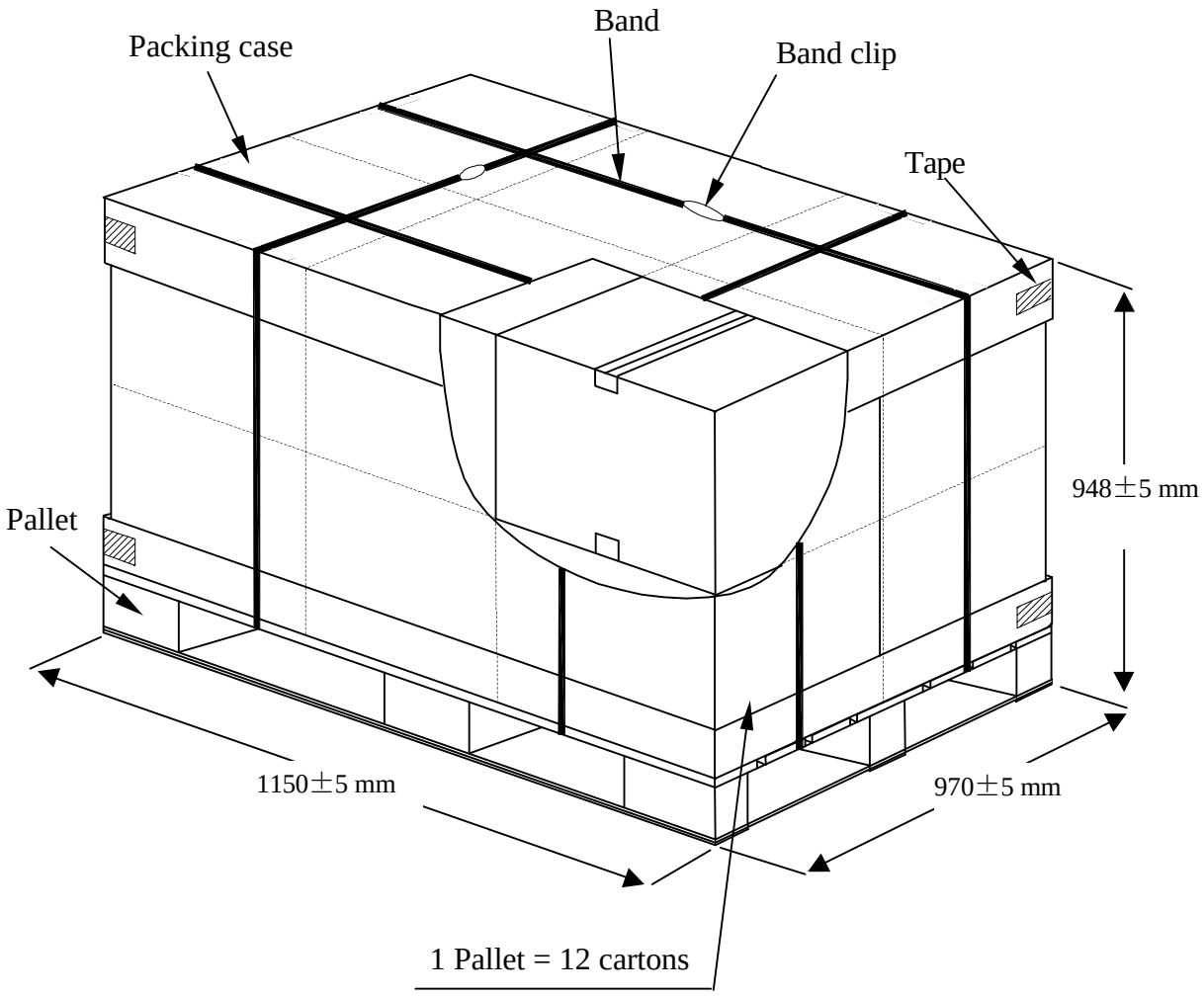
(2) carton size: 453±3 mm×360±3 mm×403±3 mm.

(3) for domestic transportation only.

9.2 packing assembly drawings



9.3 Pallet transportation specification



10.0 GENERAL PRECAUTION

10.1 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.

10.2 Disassembling or Modification

Do not disassemble or modify the module. It may damage sensitive parts inside LCD module, and may cause scratches or dust on the display. HannStar does not warrant the module, if customers disassemble or modify the module.

10.3 Breakage of LCD Panel

10.3.1 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.

10.3.2 If liquid crystal contacts mouth or eyes, rinse out with water immediately.

10.3.3 If liquid crystal contacts skin or cloths, wash it off immediately with alcohol and rinse thoroughly with water.

10.3.4 Handle carefully with chips of glass that may cause injury, when the glass is broken.

10.4 Electric Shock

10.4.1 Disconnect power supply before handling LCD module.

10.4.2 Do not pull or fold the CCFL cable.

10.4.3 Do not touch the parts inside LCD modules and the fluorescent lamp' s connector or cables in order to prevent electric shock.

10.5 Absolute Maximum Ratings and Power Protection Circuit

10.5.1 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.

10.5.2 Please do not leave LCD module in the environment of high humidity and high temperature for a long time.

10.5.3 It' s recommended employing protection circuit for power supply.

10.6 Operation

10.6.1 Do not touch, push or rub the polarizer with anything harder than HB pencil lead.

10.6.2 Use fingerstalls of soft gloves in order to keep clean display quality, when persons handle the LCD module for incoming inspection or assembly.

10.6.3 When the surface is dusty, please wipe gently with absorbent cotton or other soft material.

10.6.4 Wipe off saliva or water drops as soon as possible. If saliva or water drops contact with polarizer for a long time, they may causes deformation or color fading.

10.6.5 When cleaning the adhesives, please use absorbent cotton wetted with a little petroleum benzine or other adequate solvent.

10.7 Mechanism

Please mount LCD module by using mounting holes arranged in four corners tightly.

10.8 Static Electricity

10.8.1 Protection film must remove very slowly from the surface of LCD module to prevent from electrostatic occurrence.

10.8.2 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.

10.8.3 Persons who handle the module should be grounded through adequate methods.

10.9 Strong Light Exposure

The module shall not be exposed under strong light such as direct sunlight. Otherwise, display characteristics may be changed.

10.10 Disposal

When disposing LCD module, obey the local environmental regulations.