Hannstar Product Information

Model : **HSD150SXA2**

– A00

Note: 1. Please contact HannStar Display Corp. before designing your product based on this module specification.

2. 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	—	—	HSD150SXA2-A product information was first issued.

Contents

1.0 GENERAL DESCRIPTIONS

1.1 Introduction

HannStar Display model **HSD150SXA2-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
- Supported XGA (V:768 lines, H:1024 pixels) resolution
- Supported to 75Hz refresh rate
- Compatible with PSWG standard
- Without LCD Timing Controller
- Compatible with RoHS standard

1.3 General information

Item		Specification	Unit
Outline dimension		326.5*253.5*10.6	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 interface	
Display mode		Normally white	
Surface treatment		Antiglare, Hard-Coating (3H)	
Weight		925(typ)	g
Back-light		2-CCFLs, Top & bottom edge side	
Input signal		Source and Gate Driver control signals	
Power consumption	Logic System	1.5(Typ)	W
	B/L System	11.2(Typ)	
Optimum viewing direction		6 o’clock	

1.4 Applications

- Desktop monitors
- Display terminals for AV applications
- Monitors for industrial applications

1.5 Mechanical Information

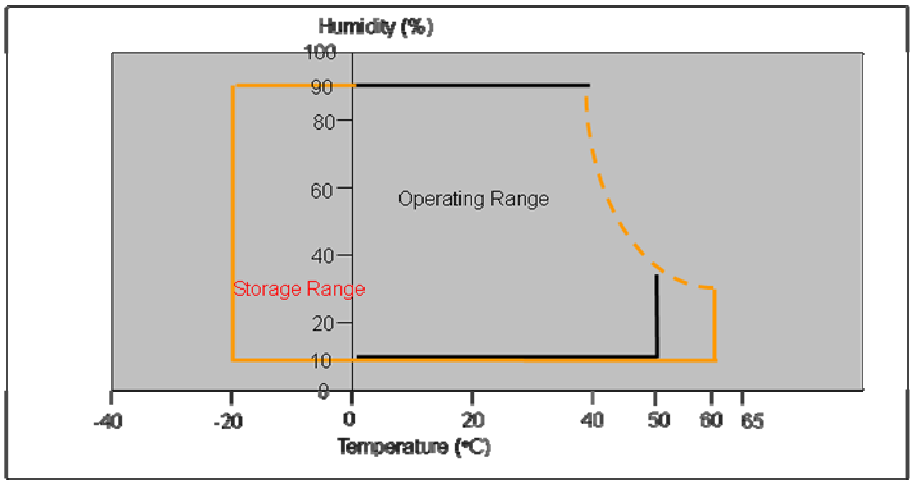
Item		Min.	Typ.	Max.	Unit
Module Size	Horizontal(H)	326.0	326.5	327.0	mm
	Vertical(V)	253.0	253.5	254.0	mm
	Depth(D)		10.6	10.9	mm
Weight (without inverter)		--	925	975	g
Torque of customer screw hole				3.0	Kgf*Cm

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	V_{DD}	Normal	-0.3	+4.0	V(DC)
Logic Signal input voltage	V_{SIG}	Normal	-0.3	V_{DD} +0.3	V

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	—	9.0	mA	(1)
Lamp frequency	f_L	—	80	KHz	(1)

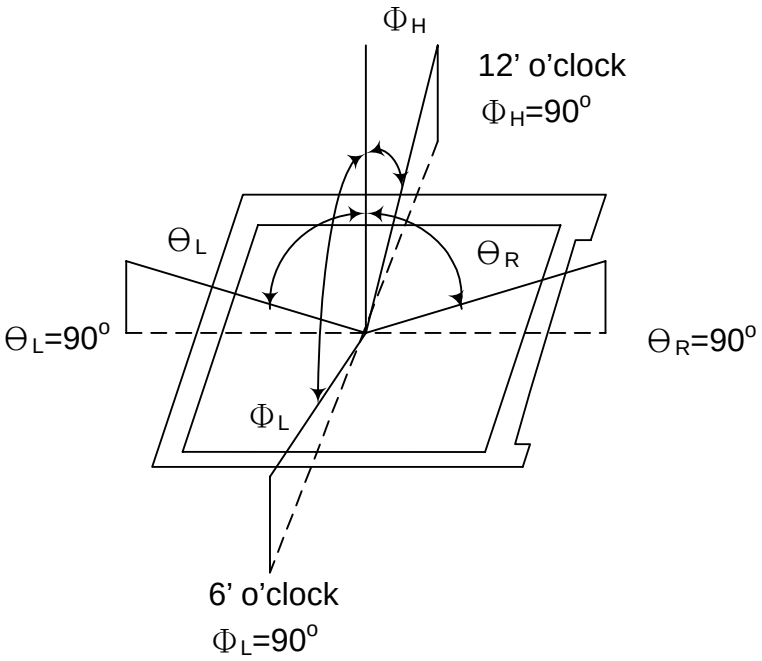
Note: (1) Permanent damage may occur to the LCD module if beyond this specification. Functional operation should be restricted to the conditions described under Normal Operating Conditions.

3.0 OPTICAL CHARACTERISTICS

3.1 Optical specification

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Contrast		CR	$\Theta=0^o$ $\phi=0^o$ Normal viewing angle --	400	500	--		(1)(2)
Response time	Rising	TR +TF			16	26	msec	(1)(3)
	Falling							
White luminance (center of screen)		Y_L		200	250		cd/m^2	(1)
Color chromaticity (CIE1931)	Red	Rx		0.604	0.634	0.664		(1)(4)
		Ry		0.309	0.339	0.369		
	Green	Gx		0.255	0.285	0.315		
		Gy		0.557	0.587	0.617		
	Blue	Bx		0.114	0.144	0.174		
		By		0.045	0.075	0.105		
	White	Wx		0.280	0.310	0.340		
		Wy		0.300	0.330	0.360		
Viewing angle	Hor.	Θ_L	CR>10	50	60			
		Θ_R		50	60			
	Ver.	Θ_H		35	45			
		Θ_L		45	55			
Brightness uniformity		B_{UNI}	$\Theta=0^o$ $\phi=0^o$	75			%	(5)
Cross talk		CT(n)				1.3	%	(6)

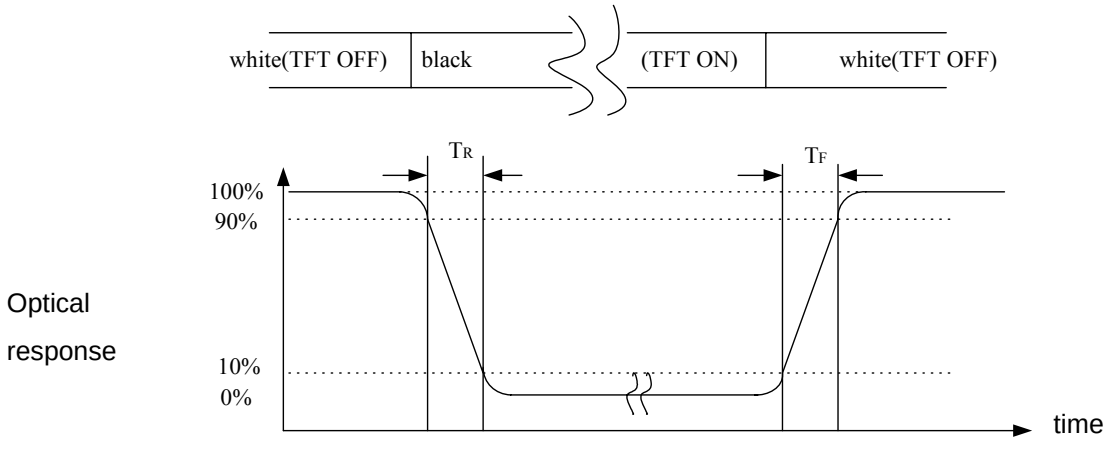
Note (1) Definition of Viewing Angle:



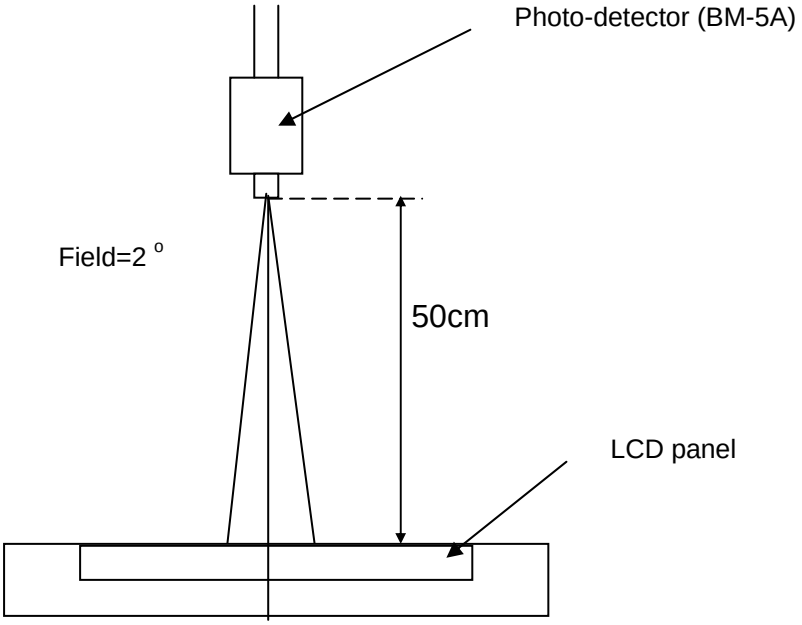
Note (2) Definition of Contrast Ratio(CR) :
measured at the center point of panel

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

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

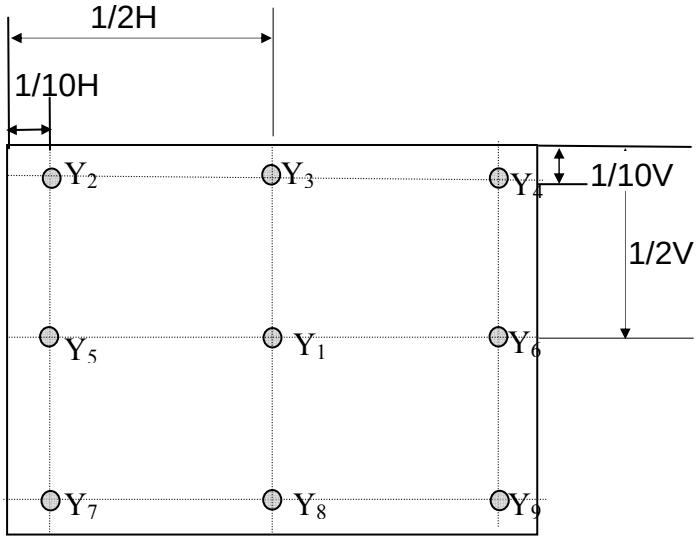


Note (4) Optical characteristic measurement setup



Note (5) Definition of brightness uniformity

$$\text{Luminance uniformity} = \frac{\text{Min Luminance of Y1~Y9}}{\text{Max Luminance of Y1~Y9}}$$



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

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

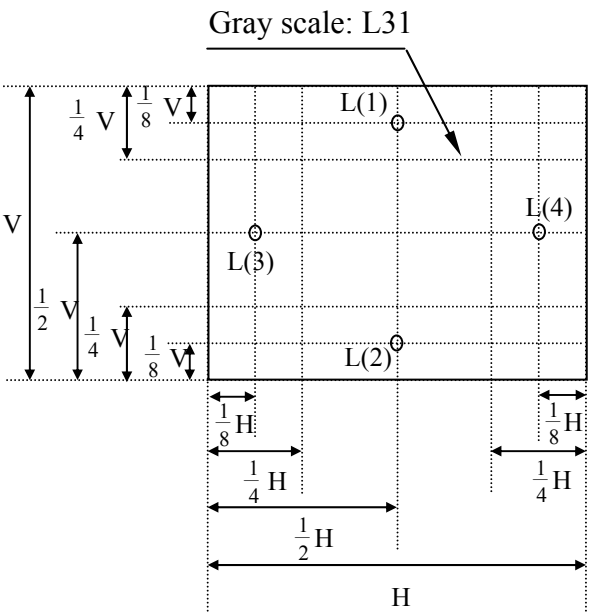
Where L(n) = Luminance of point "n" at pattern A (cd/m^2) , n=1～4

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

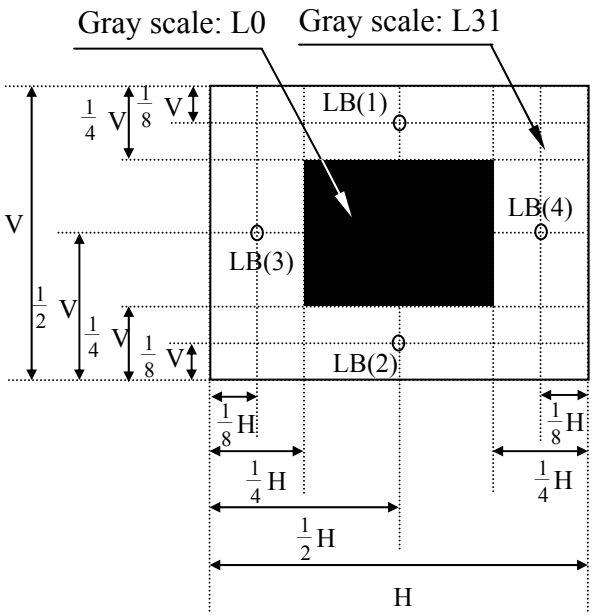
The location measured will be exactly the same in both patterns.

L0: Luminance with all pixels black

L63: Luminance with all pixels white



Pattern A



Pattern B

3.2 Measuring Condition

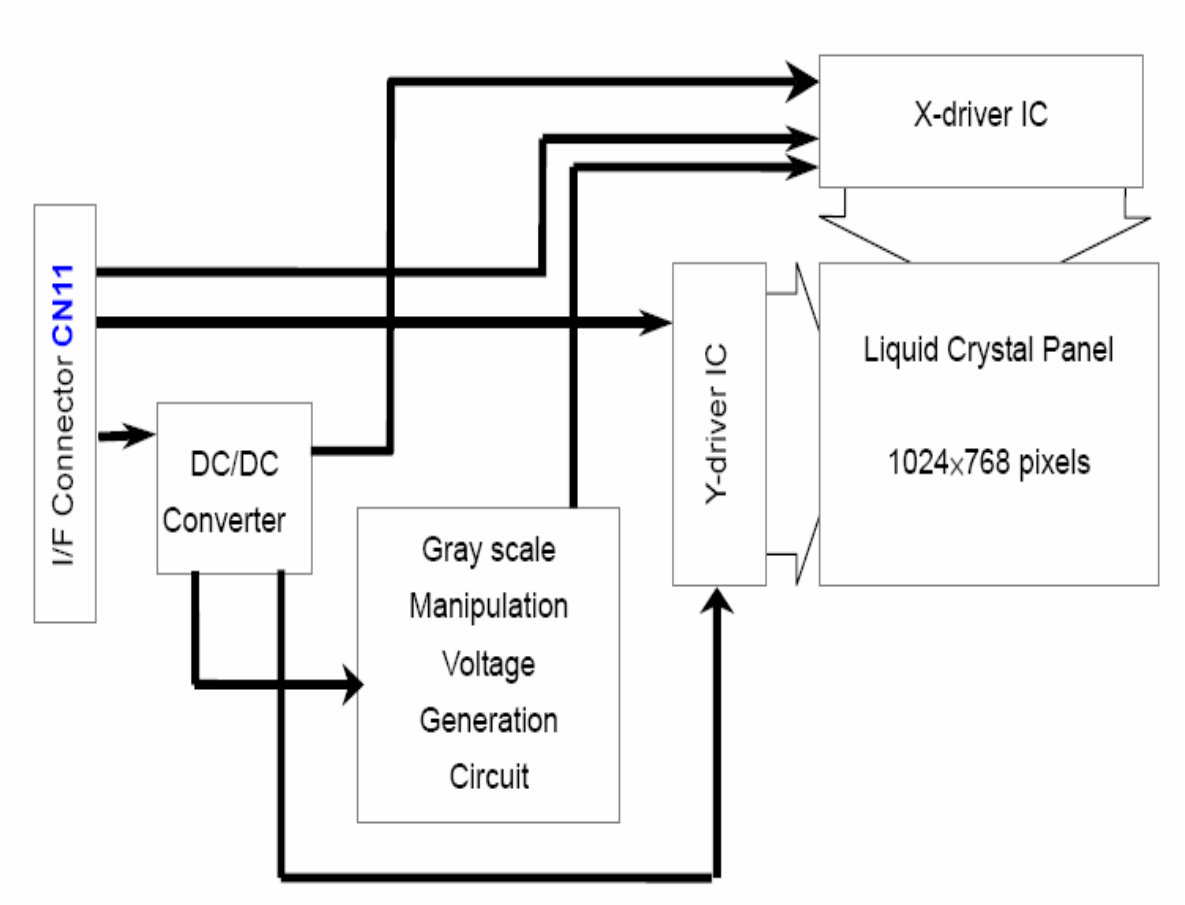
- Measuring surrounding : dark room
- Lamp current I_{BL} : (8.0)±0.1mA, lamp freq. F_L=52 KHz
- V_{DD1}=3.3V, f_V=60Hz, f_{DCLK}=32.5MHz
- Surrounding temperature : 25±2°C
- 30min. Warm-up time.

3.3 Measuring Equipment

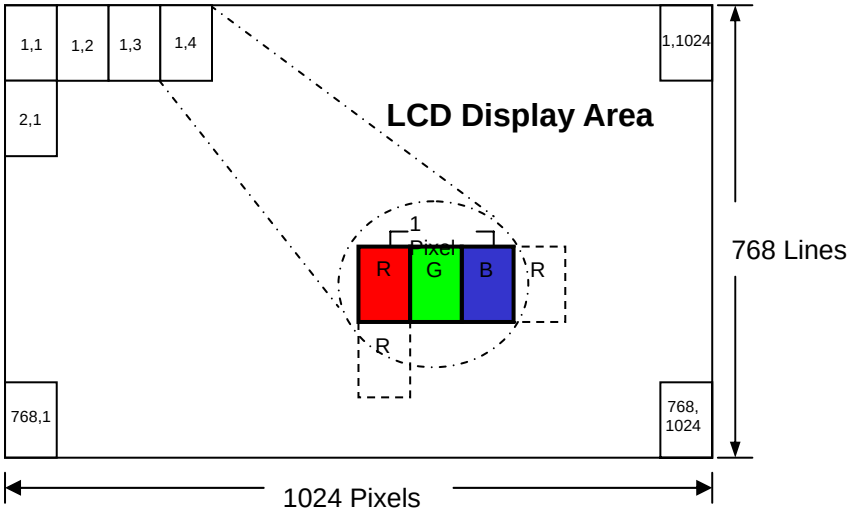
- LCD-7000 of Otsuka Electric Corp., which utilized MCPD-7000 for Chromaticity and BM-5A for other optical characteristics.
- Measuring spot size : 10~12mm

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 ↑ ↓ Light	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
		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 ↑ ↓ Light	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
		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 ↑ ↓ Light	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
		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 ↑ ↓ Light	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
		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

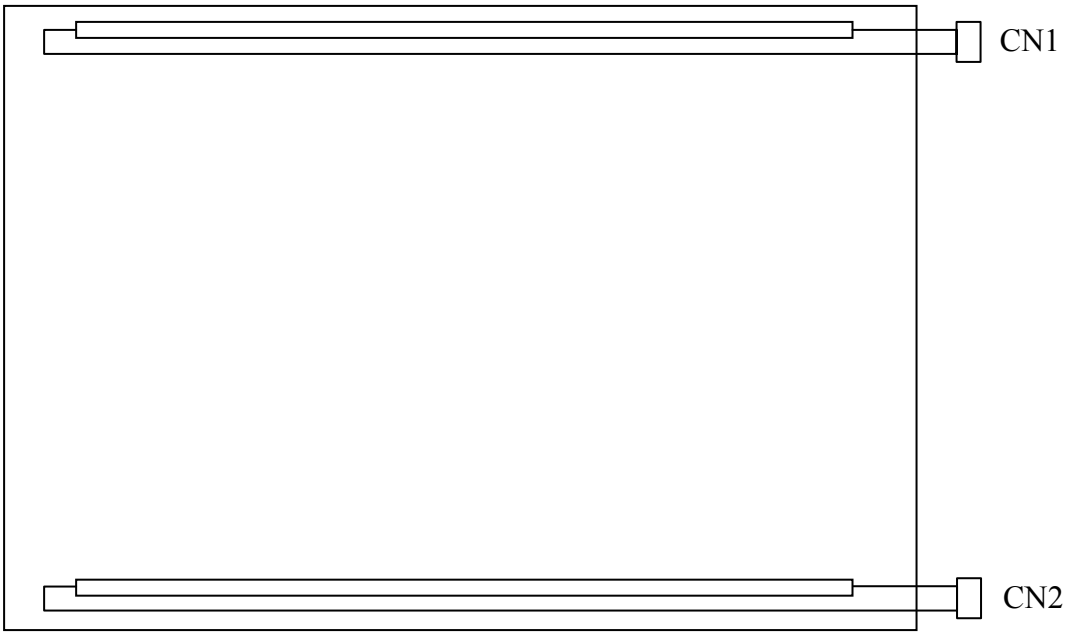
5.0 I/O CONNECTION PIN ASSIGNMENT

Pin assignment (AF7501-N2G1Z) 定義如下表

Pin No	Symbol	Function	Pin No	Symbol	Function
1	GND	Ground	26	R1P	RSDS Red Data +
2	B2P	RSDS Blue Data + (MSB)	27	R1N	RSDS Red Data -
3	B2N	RSDS Blue Data -	28	GND	Ground
4	GND	Ground	29	R0P	RSDS Red Data +
5	B1P	RSDS Blue Data +	30	R0N	RSDS Red Data -
6	B1N	RSDS Blue Data -	31	GND	Ground
7	GND	Ground	32	STH	Source Driver IC Start Pulse
8	B0P	RSDS Blue Data +	33	LOAD	Source Driver IC Latch Pulse
9	B0N	RSDS Blue Data -	34	POL	Source Driver IC M Signal
10	GND	Ground	35	INVH	Data Polarity Inverting pin
11	G2P	RSDS Green Data + (MSB)	36	GND	Ground
12	G2N	RSDS Green Data -	37	CLKV	
13	GND	Ground	38	STV	Shift Data pin
14	G1P	RSDS Green Data +	39	GOE	
15	G1N	RSDS Green Data -	40	NC	Vcom test pin
16	GND	Ground	41	GND	Ground
17	G0P	RSDS Green Data +	42	VDD	3.3V
18	G0N	RSDS Green Data -	43	VDD	3.3V
19	GND	Ground	44	VDD	3.3V
20	CLKP	Source Driver IC RSDS CLK +	45	GND	Ground
21	CLKN	Source Driver IC RSDS CLK -	46	NC	(Reserved)
22	GND	Ground	47	NC	(Reserved)
23	R2P	RSDS Red Data + (MSB)	48	ID0	Panel ID
24	R2N	RSDS Red Data -	49	ID1	Panel ID
25	GND	Ground	50	ID2	Panel ID

Note: NC pin should be open , Don’t connect it to ground nor to other signal input

5.1Back Light Unit (CCFL) Connectors:



CN1, 2: CCFL Power Source (BHR-03VS-1/Japan Solder less Terminal MFG Co., LTD)
Mating connector: SM02 (8.0)B-BHS-1/ Japan Solder less Terminal MFG Co., LTD

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

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

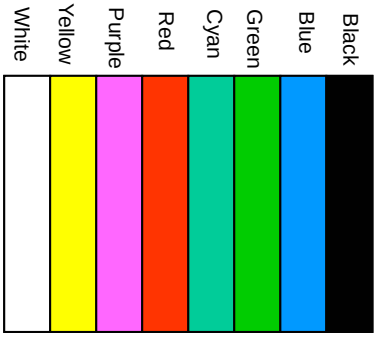
6.0 ELECTRICAL CHARACTERISTICS

6.1 Electrical System of LCD Module:

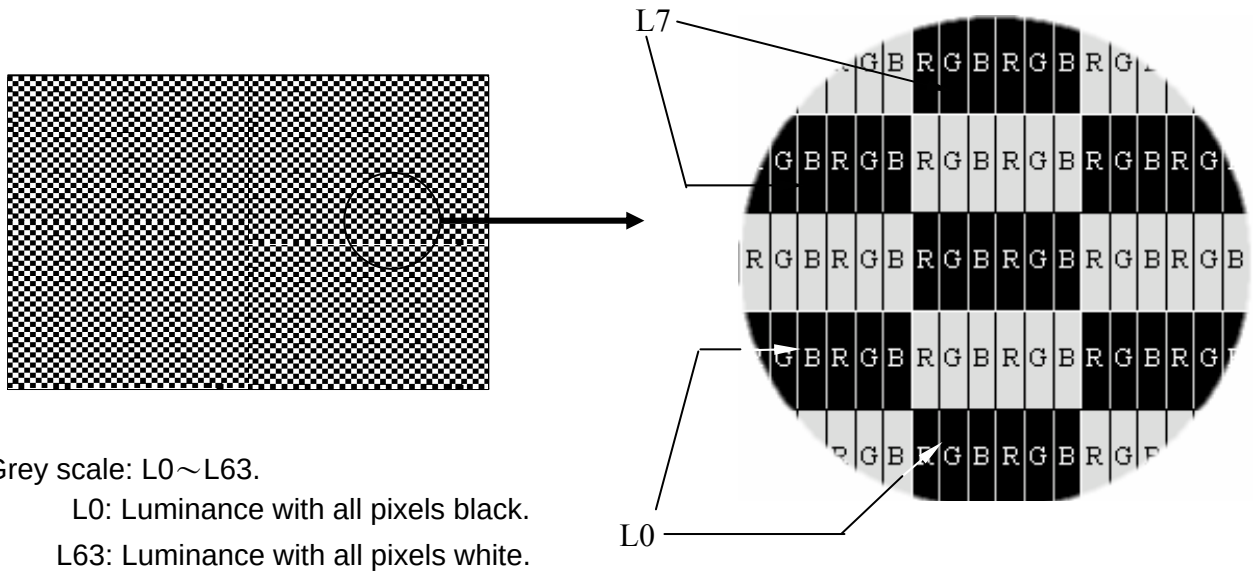
Item		Symbol	Value			Unit	Note
			Min.	Typ.	Max.		
Input Voltage		V_{DD}	+3.0	+3.3	+3.6	V(DC)	
Input Rush Current		Inrush			1.5	A	VDD = +3.3V Each Iout = max.
Input Signal voltage		V_{IH}	3.0	3.3	3.6	V	High Level
		V_{IL}	0	–	0.9	V	Low Level
RSDS high input voltage		VIH_{RSDS}	100	200	–	mV	VCM_{RSDS}= +1.2V
RSDS high input voltage		VIL_{RSDS}	–	-200	-100	mV	VCM_{RSDS}= +1.2V
RSDS common mode input voltage range		VCM_{RSDS}	1.0	–	1.4	V	VIH_{RSDS} =+100mV VILRSDS= -100mV
Current of power supply	V-Color	I_{DD1}	300	400	500	mA	(1)(3)
	Mosaic	I_{DD2}	325	425	525	mA	(1)(3)
Vsync frequency		f_V	-	60	75	Hz	(2)(3)
Hsync frequency		f_H	-	48.36	75	KHz	
Frequency		f_{DCLK}	-	65.00	80	MHz	

Note (1)

1). V-Color :



2). Mosaic : Dot checker image



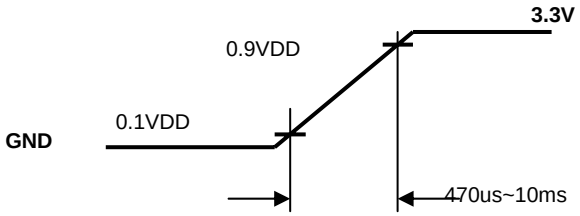
Grey scale: L0～L63.

L0: Luminance with all pixels black.

L63: Luminance with all pixels white.

Note (2) When fv is too low, a flicker may be occurred on the display.

Note (3) Input Rush Current condition



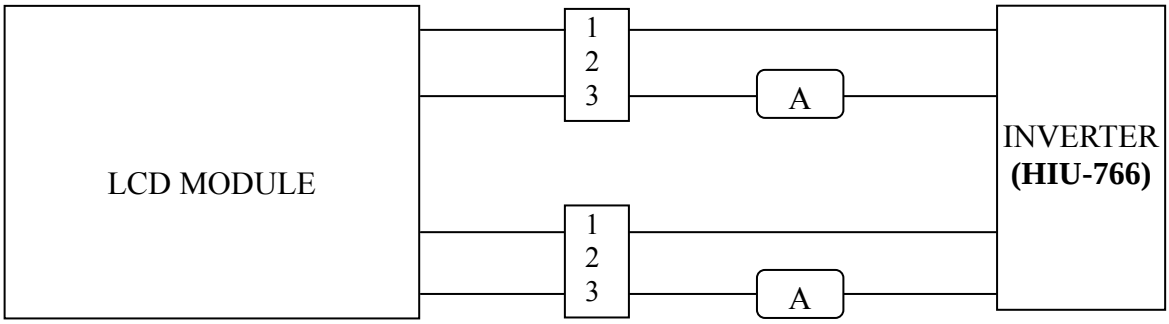
6.2 Back-Light Unit:

The back-light system is an edge-lighting type with 2 CCFL(Cold Cathode Fluorescent Lamp).
The characteristics of the lamp is shown in the following tables.

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Lamp current	IL	3.0	8.0	9.0	mA(rms)	(1)
Lamp voltage	VL	605	670	735	V(rms)	I_L=8.0mA
Frequency	fL	50	55	80	kHz	(2)
Operating lamp life time	Hr	30,000	--	--	Hour	(3)
Startup voltage	Vs	1140(25°C)	--	--	V(rms)	(4,5,6)
		1480(0°C)				

Note (1)

Lamp current is measured with current meter for high frequency as shown below. Specified values are for a single lamp.



Note (2)

Lamp frequency may produce interference with horizontal synchronous frequency and this may cause ripple noise on the display. Therefore lamp frequency shall be kept away from the horizontal synchronous frequency and its harmonics as far as possible in order to avoid interference.

Note (3)

Lamp life time (Hr) can be defined as the time in which it continues to operate under the condition : Ta=25±3°C, Typical IL value indicated in the above table and fL=52kHz until the brightness becomes less than 50%

Note (4)

CCFL inverter should be able to provide a voltage over specified value (Vs) in the above table. Lamp units need at least Vs value shown above to ignition.

Note (5)

The voltage over specified value (Vs) should be applied to the lamp more than 1 second after startup. Otherwise, the lamp may not be turned on. The used lamp current is the lamp typical current.

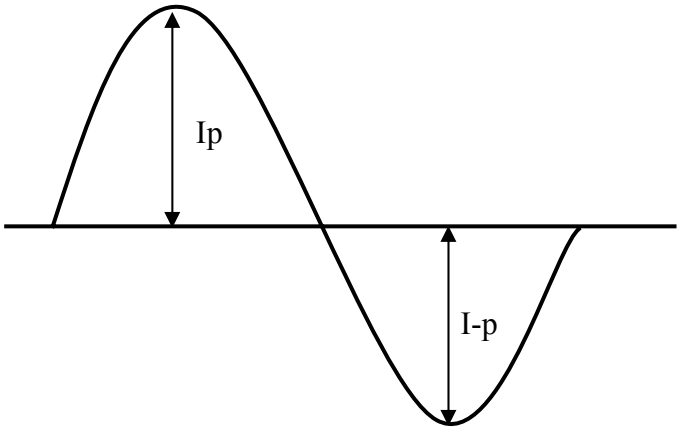
Note (6)

The output voltage waveform and current waveform of the inverter must be symmetrical (Unsymmetrical ratio is less than 10%). Please do not use the inverter which has unsymmetrical voltage and current waveform, and spike waveform. The inverter design which can provide the best optical performance, power efficiency, and lamp life should under the following conditions.

a. The asymmetry rate of the inverter waveform should be less than 10%.

b. The distortion tae of the waveform should be within $\sqrt{2}$±10%.

c. The inverter output waveform should be better similar to the ideal sine wave.



Asymmetry rate = $|I_p - I_{-p}| / I_{rms} \times 100\%$

Distortion rate = I_p (or I_{-p}) / I_{rms}

6.3 INTERFACE TIMING:

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	50 12.5	65 15.384	80 20	MHz n-Sec		
Reference Signal (DENB)	Line Periodic	T3=Line	1052	1344	1800	T1		
	Line Active	T4	1024	1024	1024	T1		
	Line Blank	T5	28	320	776	T1		
	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 OE CPV	
	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	CPH LOAD STH POL	
	Pulse Width	T16A T16B T16C	2.5 1 4	 128	5 200	u-Sec u-Sec T1		
	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 (Vcc= 3.3V)	12	---	---	n-Sec	CLKP-CLKN	
	Pulse low period	T19A	6	---	---	n-Sec		
	Pulse high period	T19B	6	---	---	n-Sec		
Start pulse	Data setup time	T20	4	---	---	n-Sec	STH	
	Data hold time	T21	0	---	---	n-Sec		
	Setup time	T22	2	---	---	n-Sec		
	Hold time	T23	4	---	---	n-Sec		
	Signal pulse width	T24	1CLKP	---	---	n-Sec		
Load	Load high pulse width	T25	5CLKP	---	---	CLKP period	LOAD	
	Load to STH setup time	T26	5CLKP	---	---	CLKP period		
	Last data time	T27	1CLKP	---	---	CLKP period		
	Load(rising)~ CLKP(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		

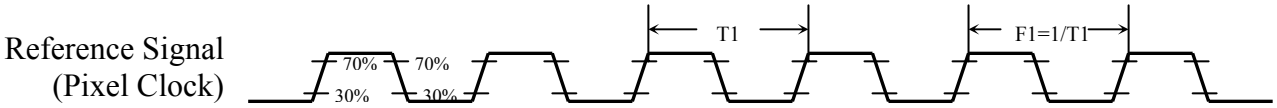
Note 1) Refer to VESA standard.

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).

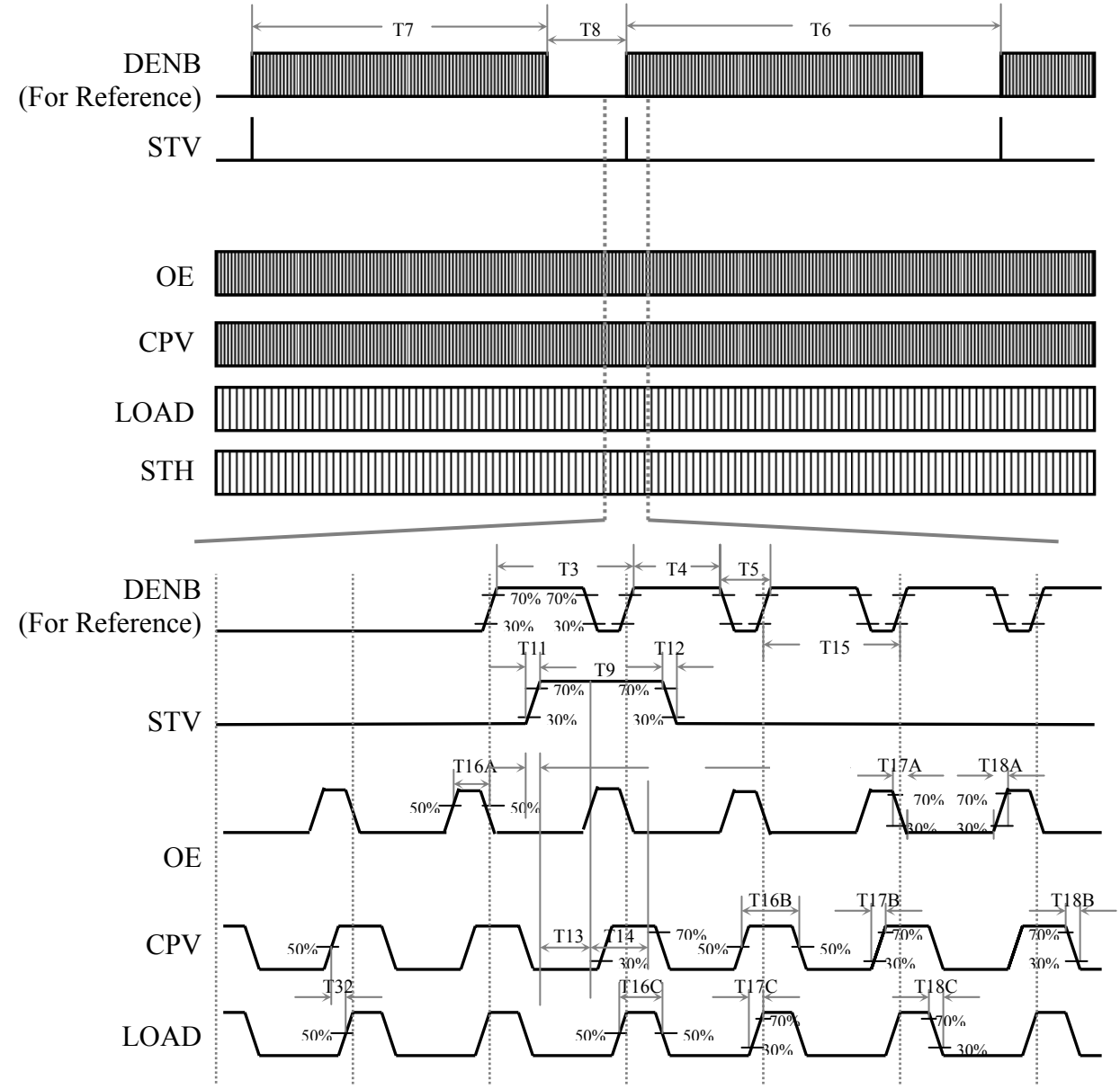
Note 3) All the timing setting should be confirmed with Hannstar FAE persons.

6.3.2 AC Timing Charts:

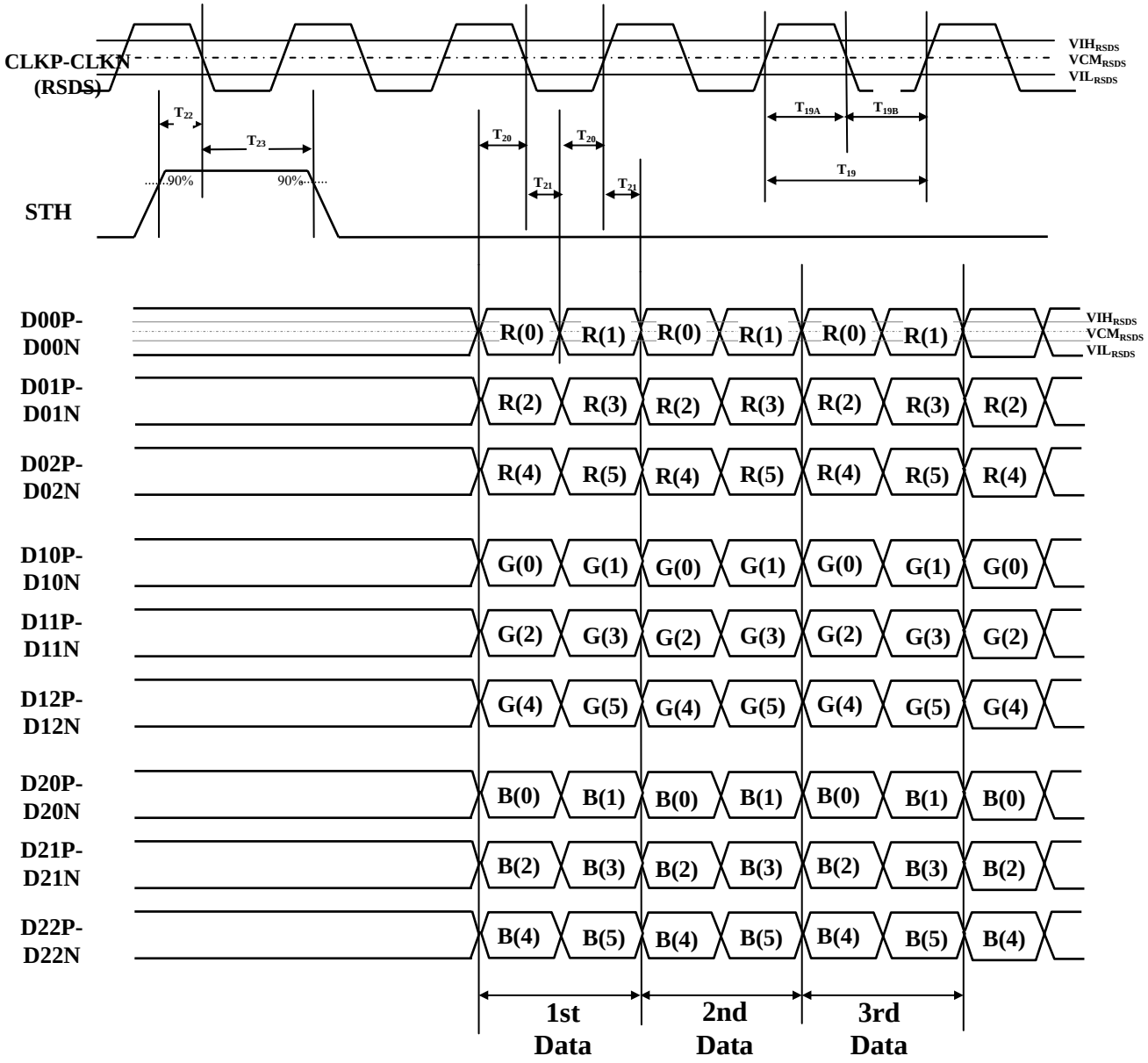
(1). Reference Signal (pixel clock):



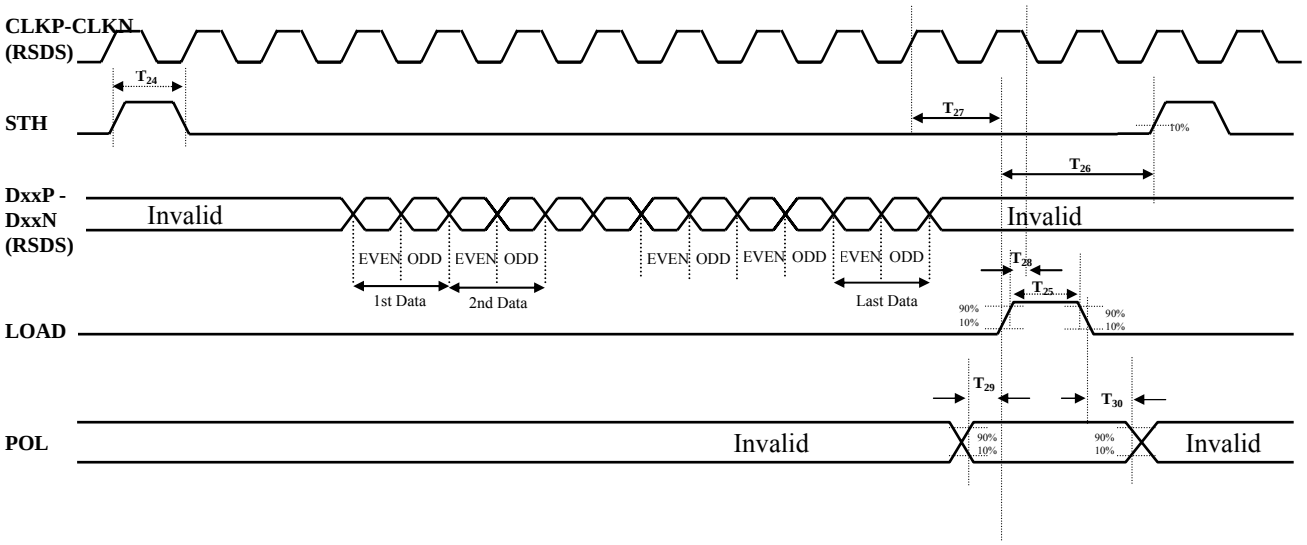
(2). Vertical Periodic (STV, OE, CPV):

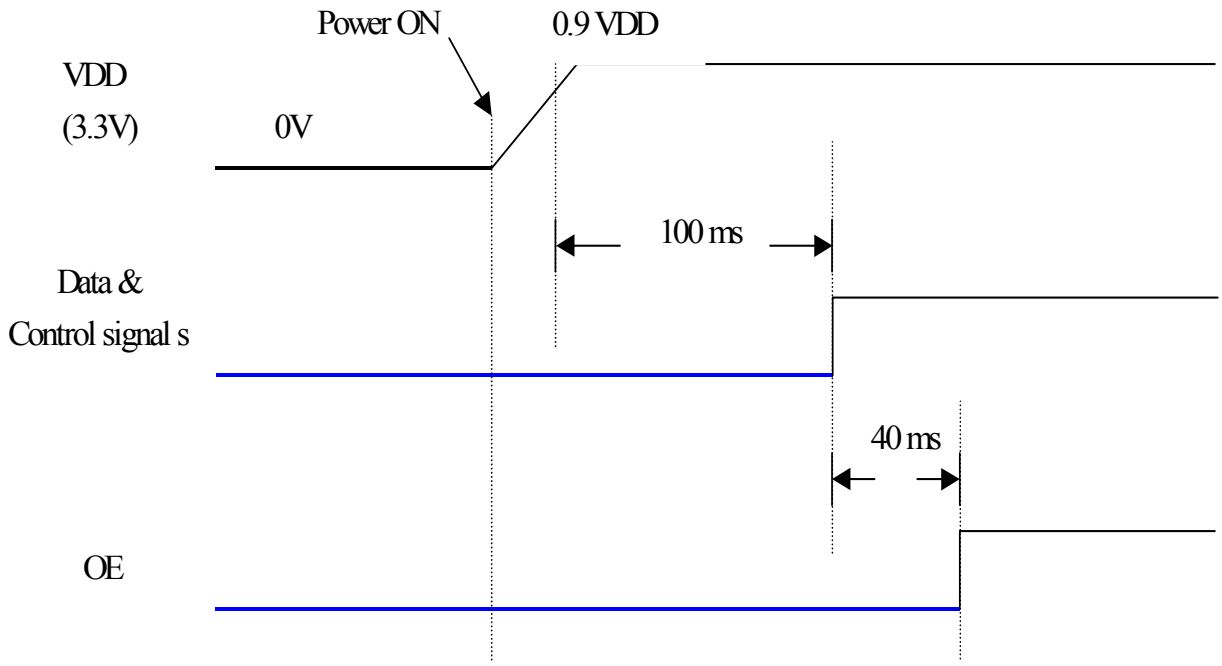


(3). Horizontal Periodic 1 (STH, CLK, DATA):



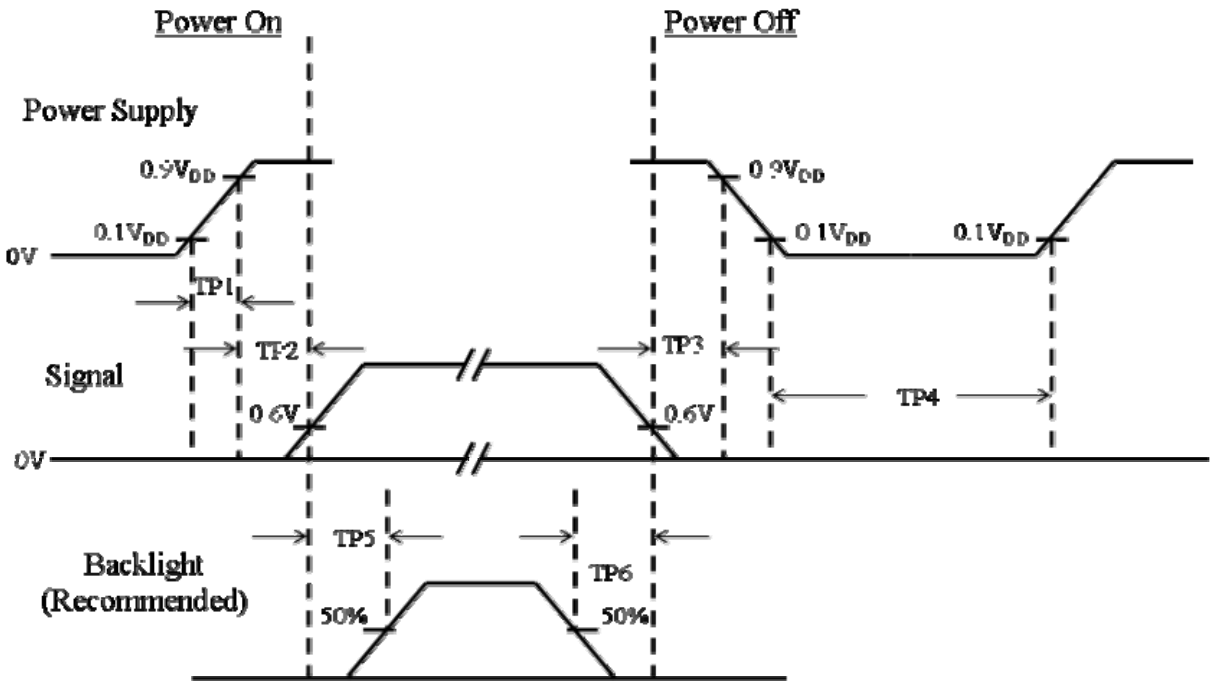
(4). Horizontal Periodic 2 (CLK, LOAD, STH, POL):





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

6.4 Power On / Off Sequence：



Item	Min.	Typ.	Max.	Unit	Remark
TP1	0.47	—	10	msec	
TP2	0	—	50	msec	
TP3	0	—	50	msec	
TP4	1	—	—	sec	
TP5	200	—	—	msec	
TP6	200	—	—	msec	

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

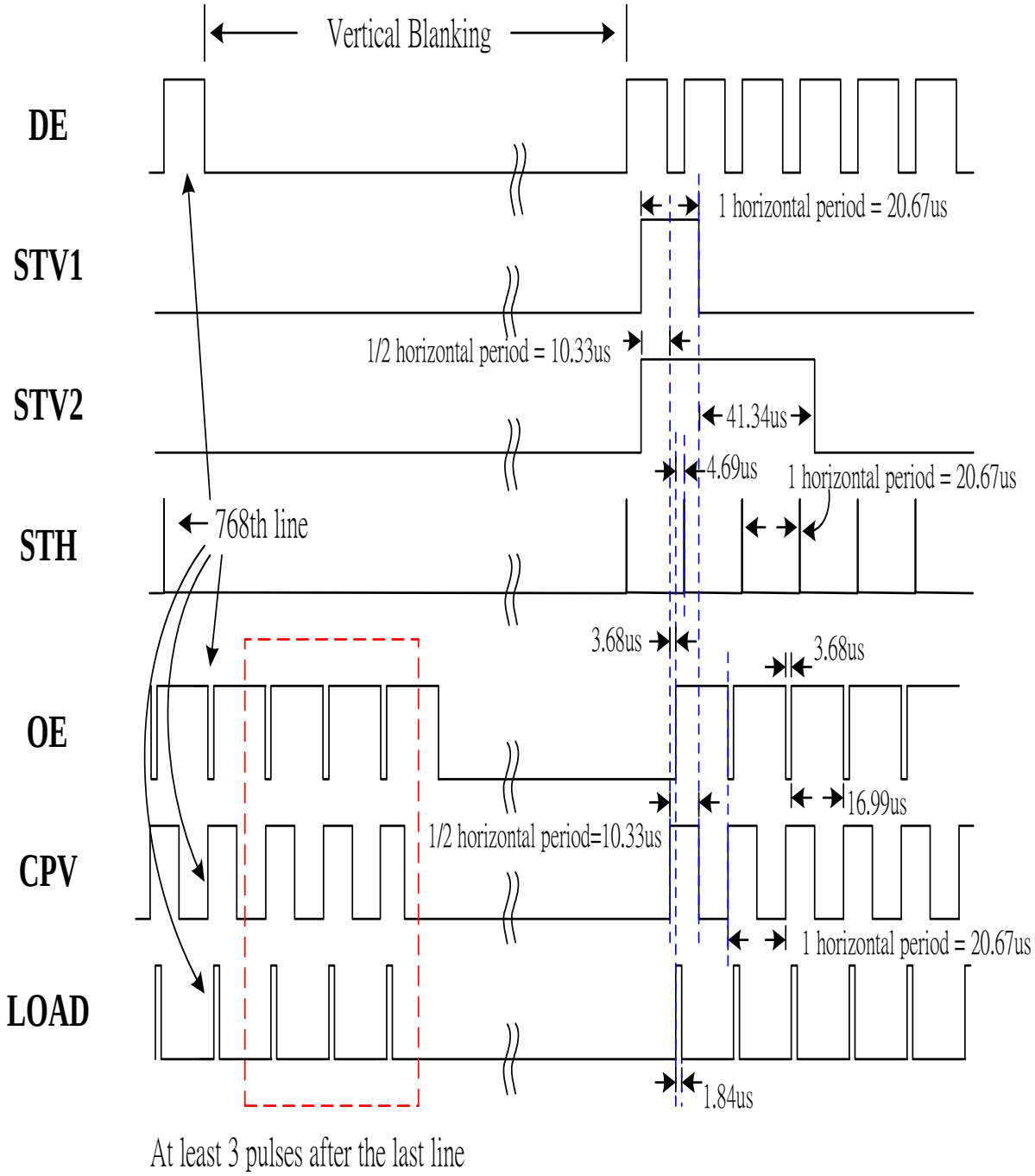
(2) Apply the lamp volatge within the LCD operation range. When the back-light turns on before the LCD operation or the LCD truns off before the back-light turns off, the display may momentarily become white.

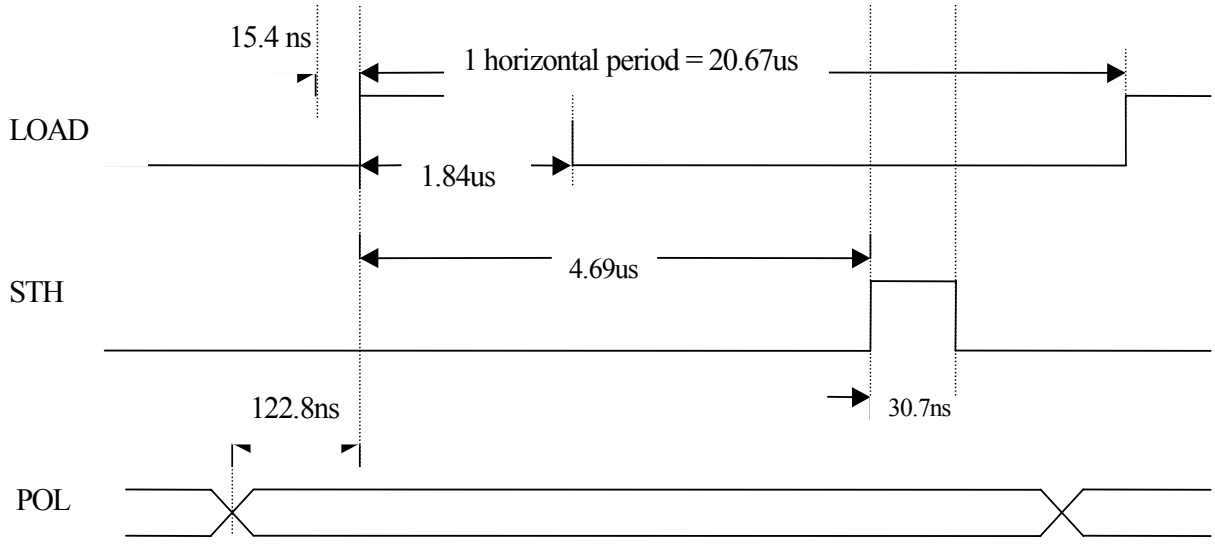
(3) In case of VDD = off level, please keep the level of input signal on the low or keep a high impedance.

(4) T4 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.

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

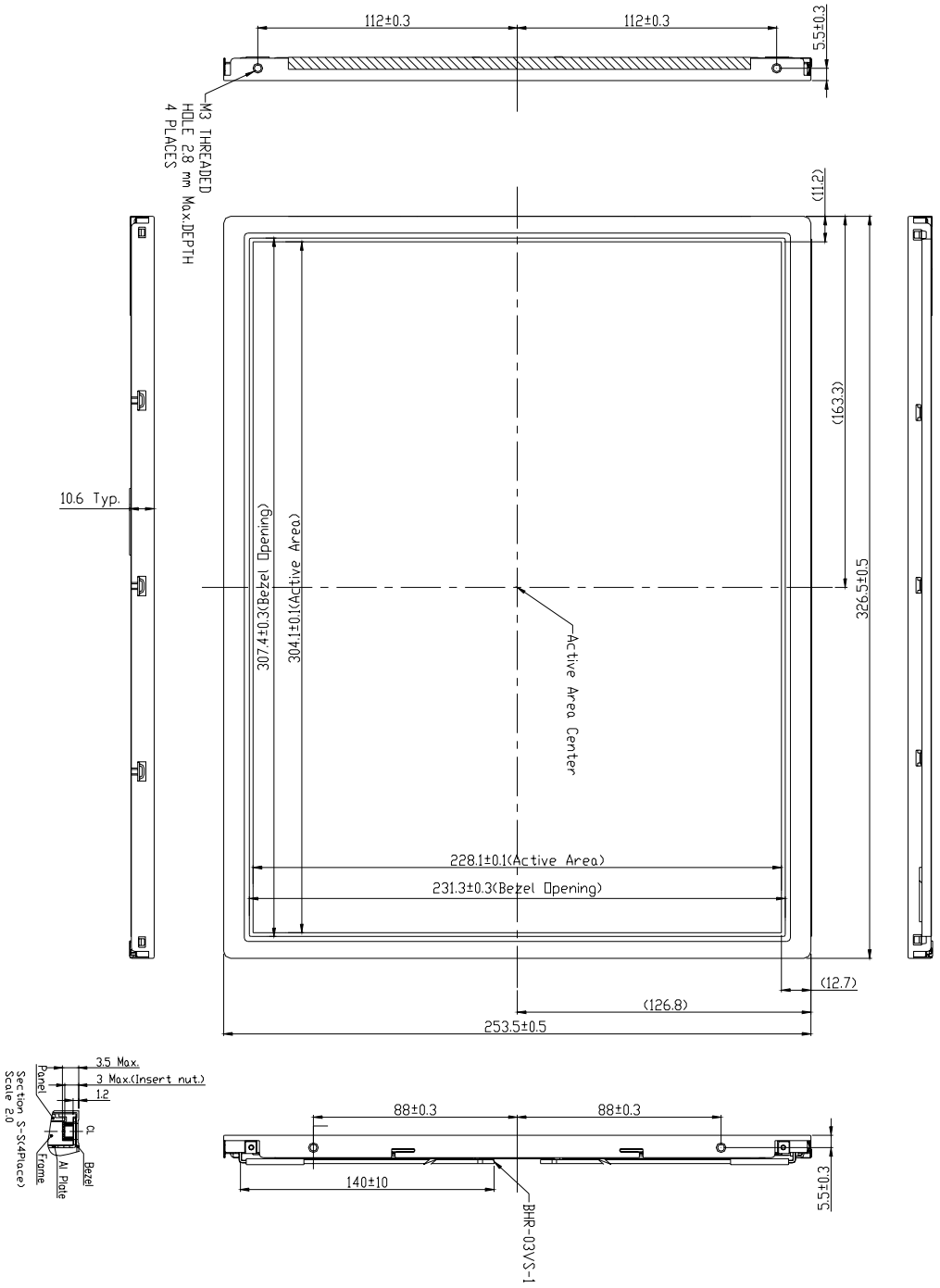



15.4 ns
1 horizontal period = 20.67us
LOAD
1.84us
4.69us
STH
122.8ns
30.7ns
POL

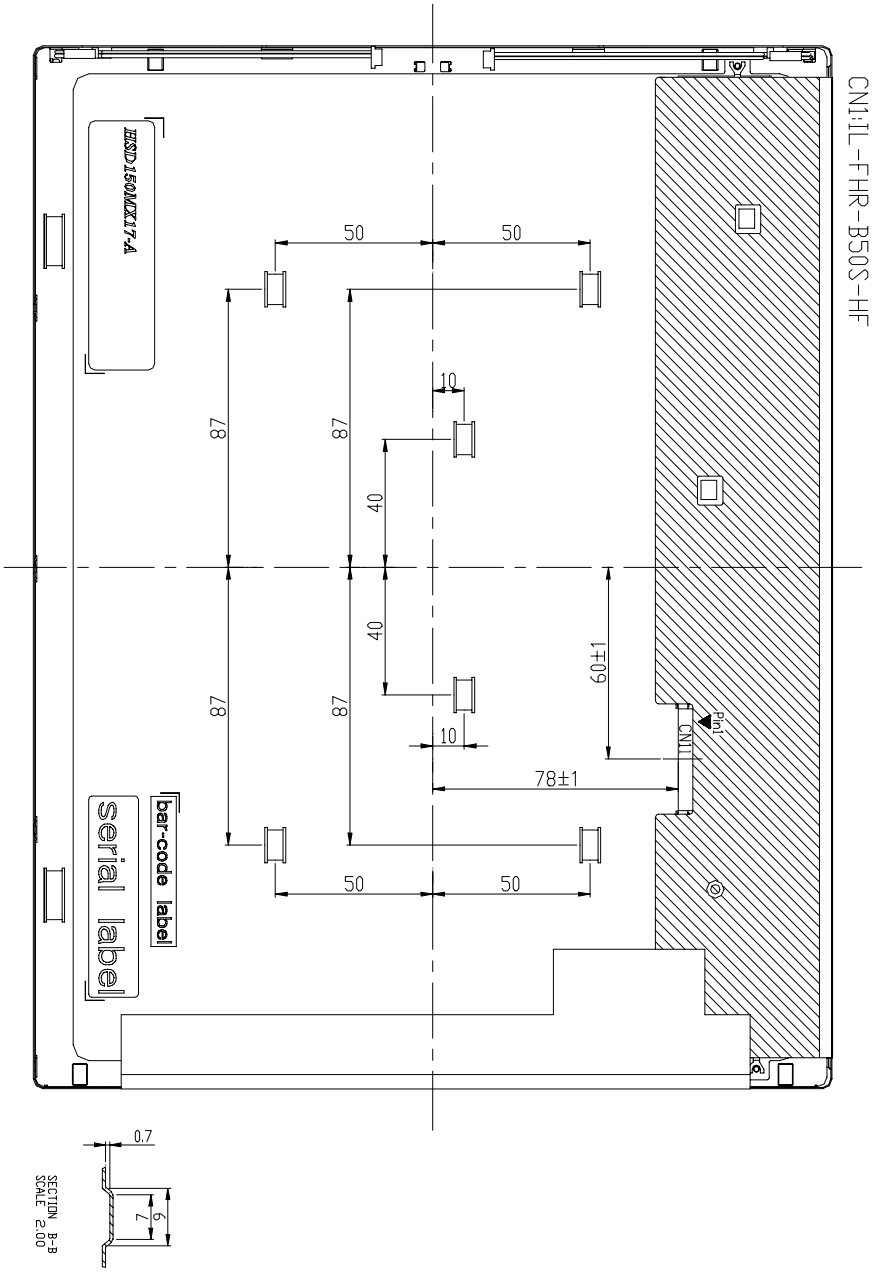
8.0 OUTLINE DIMENSION

8.1 Front View:

Date: 2004.02.24



8.2 Back View: **Date: 2004.02.24**



1. UNSPECIFIED DIMENSIONAL TOLERANCE ARE ±0.3mm

9.0 LOT MARK

9.1 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

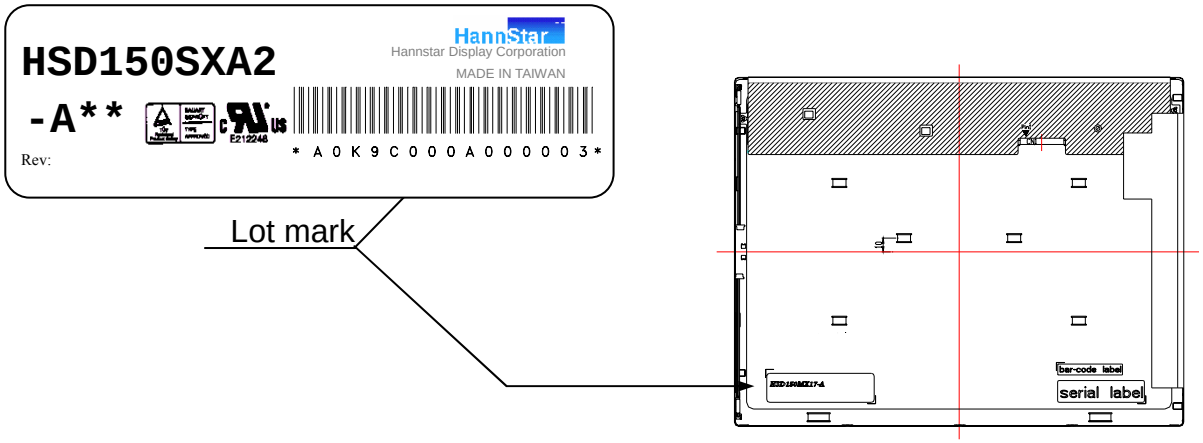
Year	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Mark	9	0	1	2	3	4	5	6	7	8

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

9.2Location of Lot Mark

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

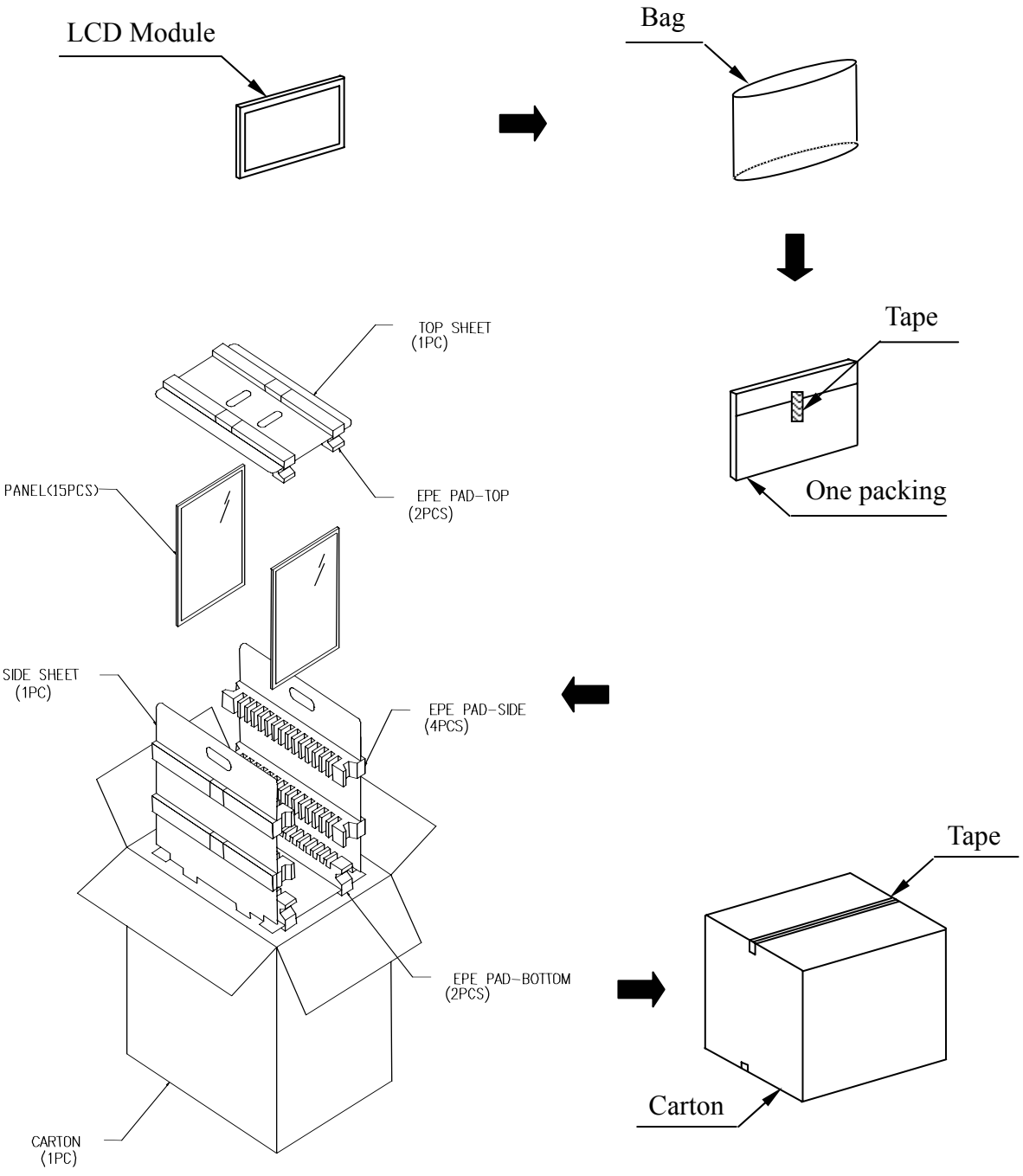


10.0 PACKAGE SPECIFICATION

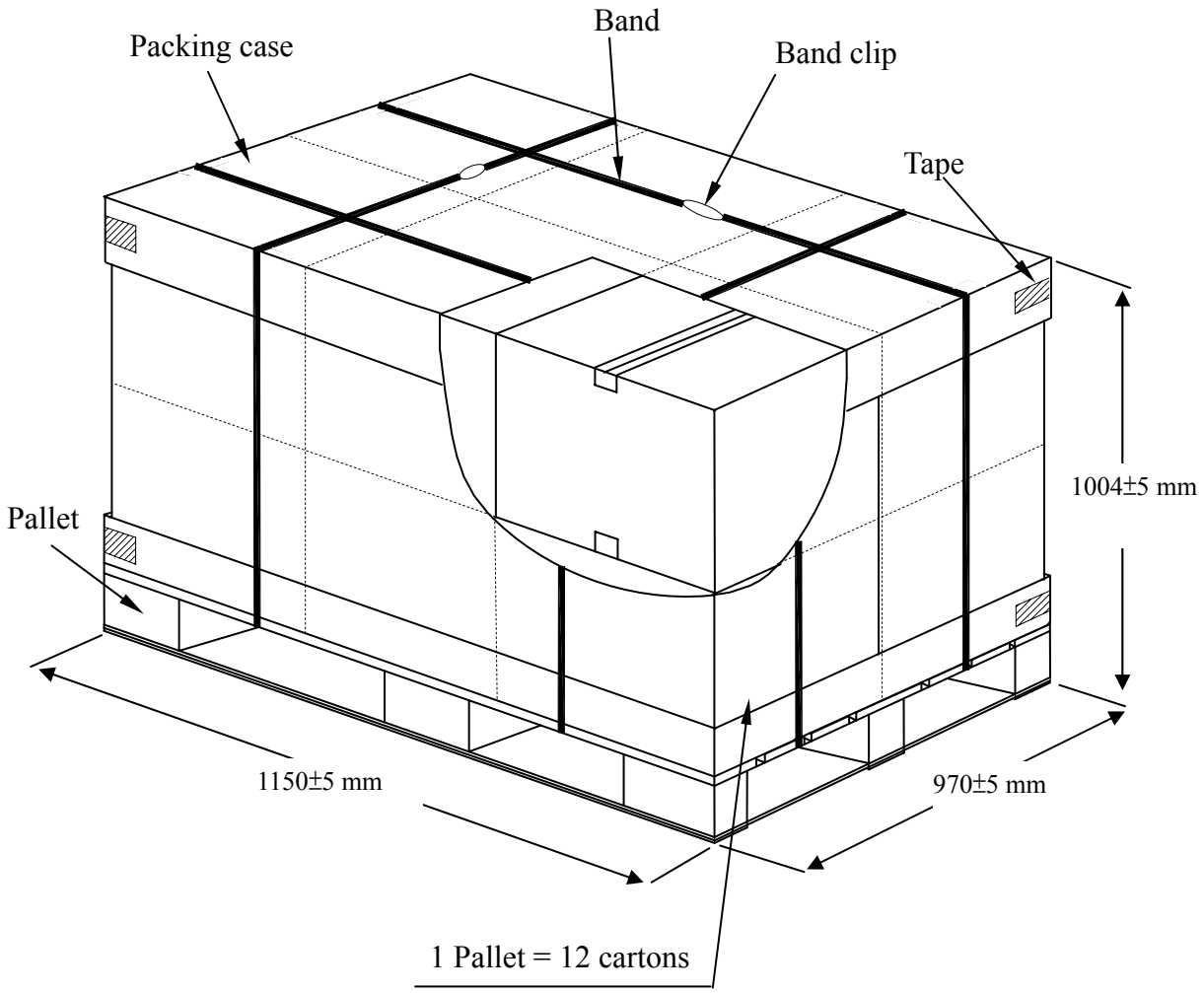
10.1 packing form

(1) package quantity in one carton: 15 pieces.
(2) carton size: 464±3 mm×360±3 mm×431^{H}±3 mm.
(3) for domestic transportation only.

10.2 packing assembly drawings



10.3 Pallet transportation specification



11.0 GENERAL PRECAUTION

11.1 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.

11.2Disassembling 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.

11.3 Breakage of LCD Panel

11.3.1 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.

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

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

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

11.4 Electric Shock

11.4.1 Disconnect power supply before handling LCD module.

11.4.2 Do not pull or fold the CCFL cable.

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

11.5 Absolute Maximum Ratings and Power Protection Circuit

11.5.1 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.

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

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

11.6 Operation

11.6.1 Do not touch, push or rub the polarizer with anything harder than HB pencil lead. Use fingerstalls of soft gloves in order to keep clean display quality, when persons handle the LCD module for incoming inspection or assembly.

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

11.6.3 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.

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

11.7 Mechanism

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

11.8 Static Electricity

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

11.8.2 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.

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

11.9 Strong Light Exposure

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

11.10 Disposal

When disposing LCD module, obey the local environmental regulations.