HannStar Product Information

MODEL : HSD150MX46
-A
ISSUE DATE: 2001-10-19

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.	Date	Description of change
		Modify page6, response time 35ms to 25 ms Modify page23, CN1, CN2,CN3,CN4

Contents

1.0 GENERAL DESCRIPTION

1.1 Introduction

HannStar Display model HSD150MX46-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, a driving circuit and a back light system. This TFT LCD has a 15 inch diagonally measured active display area with XGA resolution (768 vertical by 1024 horizontal pixel array) and can display up to 8bit colors.

1.2 Features

- ■ High brightness with low power consumption
- ■ Wide viewing angle
- ■ Compact and light weight design
- ■ 4 CCFLs(Cold Cathode Fluorescent Lamp)
- ■ Input timing □DE+Hs+Vs mode
- ■ 2ch-TTL interface system with 8bit color data

1.3 Applications

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

1.4 General information

Item	Specification	Unit
Display area	304.128(W) x 228.096(H)	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	True 8 bit	colors
Display mode	Normally white	
Surface treatment	Antiglare, Hard-Coating(3H)	
Weight	1500(max)	g
Back-light	4-CCFLs at up & Bottom side	
Input signal	2-ch TTL	
Power consumption	TBD	W
Optimum viewing direction	6 o'clock	

1.5 Mechanical Information

Item		Min.	Typ.	Max.	Unit
Module Size	Horizontal(H)	---	331.6	---	mm
	Vertical(V)	---	255.5	---	mm
	Depth(D)	---	14.7	---	mm
Weight (Without inverter)		---	TBD	1500	g

2.0 ABSOLUTE MAXIMUM RATING

2.1 Absolute Rating of Environment

Item	Symbol	Min.	Max.	Unit	Note
Storage temperature	T_{STG}	-20	65	°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) 10-500Hz sweep/cycle, sine wave, X,Y,Z each directions, 0.5hr each
(2) 11ms, ±X, ±Y, ±Z direction, one time each, half sine wave. 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) 2hrs. (10000 feet)
(5) 24hrs. (50000 feet)

2.2 Electrical Absolute Rating

2.2.1 TFT LCD Module

Item	Symbol	Min.	Max.	Unit	Note
Power supply voltage	V_{DD}	-0.3	4.0	V	(1)
Logic input voltage	V_{IN}	-0.3	VDD+0.3	V	(1)

2.2.2 Back-Light Unit

Item	Symbol	Min.	Max.	Unit	Note
Lamp voltage	V_L	0	2000	V_{rms}	(1)
Lamp current	I_{FL}	--	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 normally operating conditions.

3.0 OPTICAL CHARACTERISTICS

3.1 Optical specification

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Contrast		CR	Θ=0° Φ=0° Normal viewing angle	--	250	--		(1)(2)
Response time	Rising	T_R		--	T_R+T_F	--	msec	(1)(3)
	Falling	T_F		--	=25ms	--		
White luminance (center of screen)		Y_L		--	350 (I_{FL}=6mA)	--	cd/m^2	
Color chromaticity (CIE1931)	Red	Rx		TBD	0.62	TBD		(1)(4)
		Ry		TBD	0.35	TBD		
	Green	Gx		TBD	0.293	TBD		
		Gy		TBD	0.579	TBD		
	Blue	Bx		TBD	0.144	TBD		
		By		TBD	0.09	TBD		
	White	Wx		TBD	0.29	TBD		
		Wy		TBD	0.32	TBD		
Viewing angle	Hor.	Θ_L	CR>10		(60)	--		
		Θ_R			(60)	--		
	Ver.	Θ_U			(40)	--		
		Θ_D			(50)	--		
Brightness uniformity		B_{UNI}	Θ=0°	70	--	--	%	(5)
Cross Talk		CT(n)	Φ=0°	--	--	1.3	%	(6)

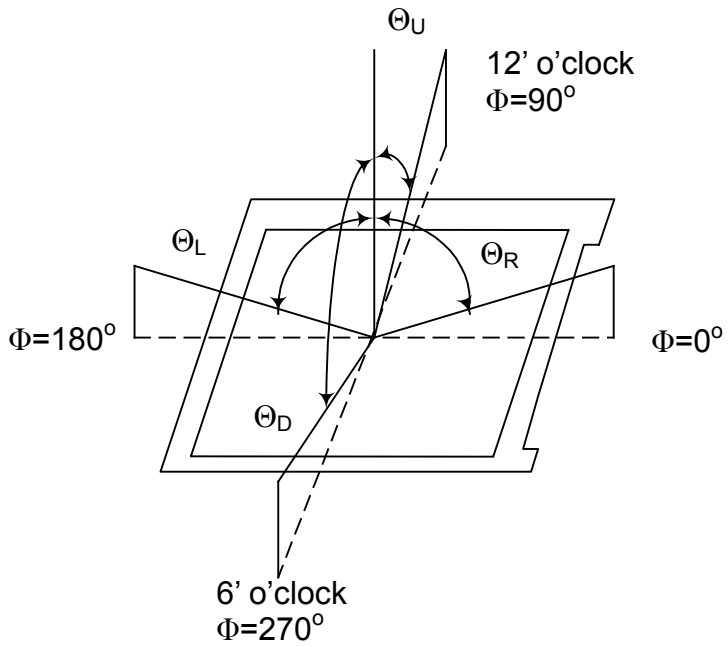
3.2 Measuring Condition

- Measuring surrounding : dark room
- Lamp current I_{FL} : 6mA, lamp freq. F_L=50KH_Z
- V_{DD}=3.3V ±0.3V
- Surrounding temperature : 25°C

3.3 Measuring Equipment

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

Note (1) Definition of Viewing Angle :

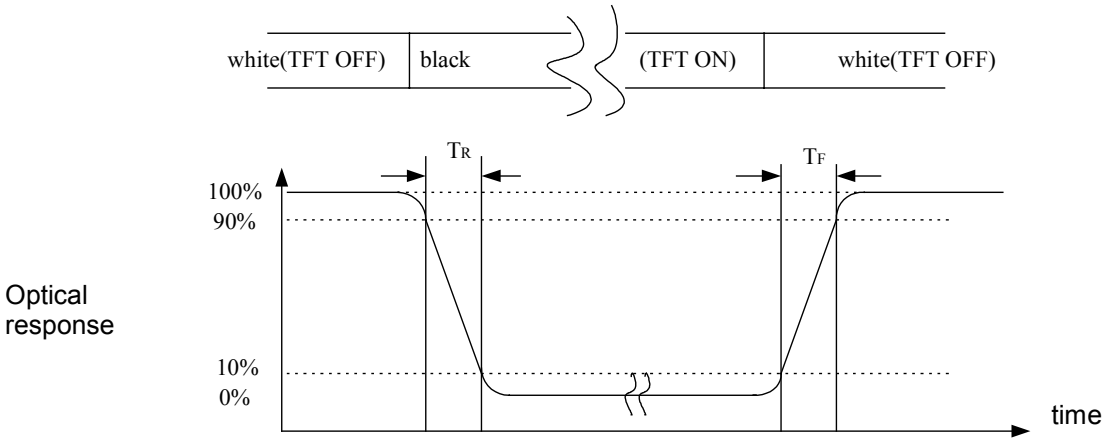


Note (2) Definition of Contrast Ratio(CR) :

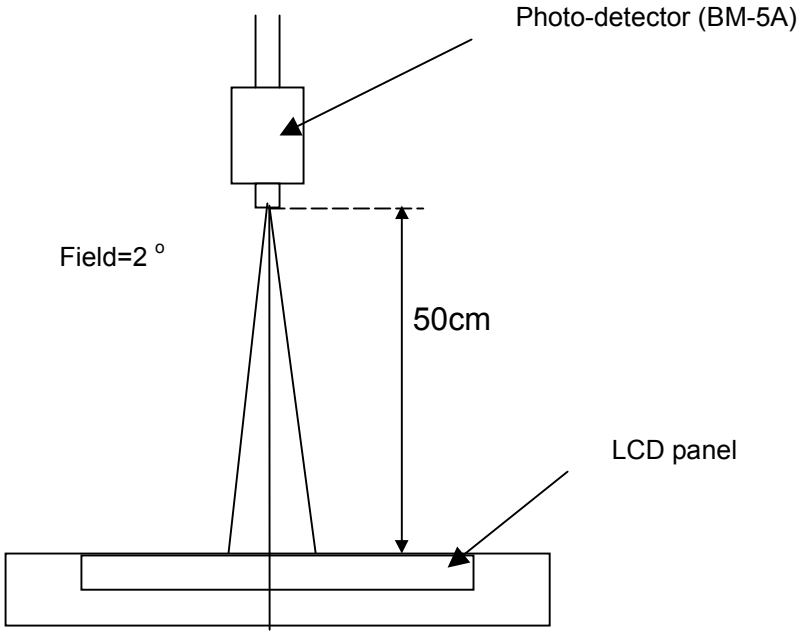
measured at the center point of panel

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

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

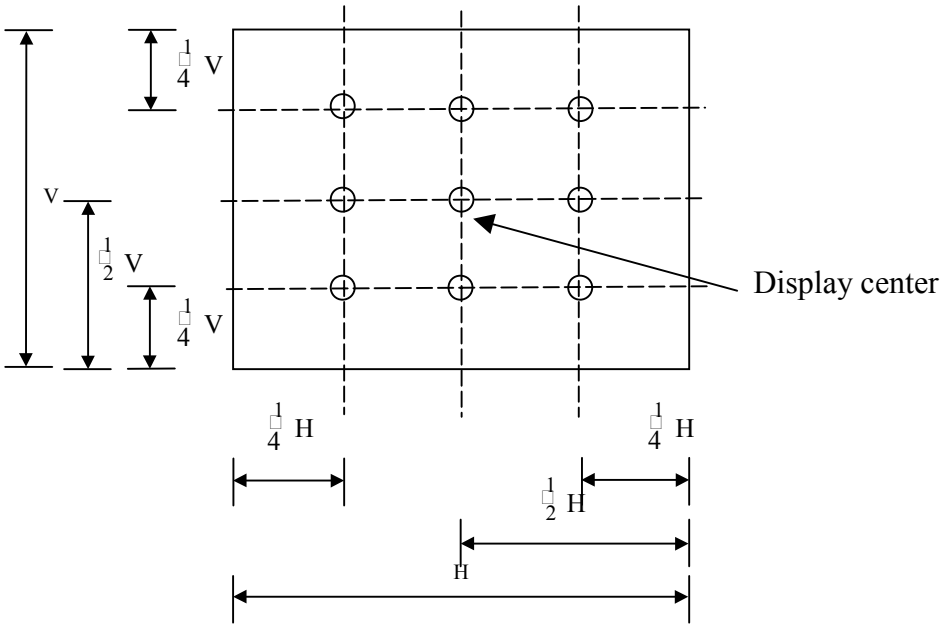


Note (4) Definition of brightness uniformity



Note (5) Definition of brightness uniformity

Luminance uniformity=(Min Luminance)/(Max Luminance)x100%

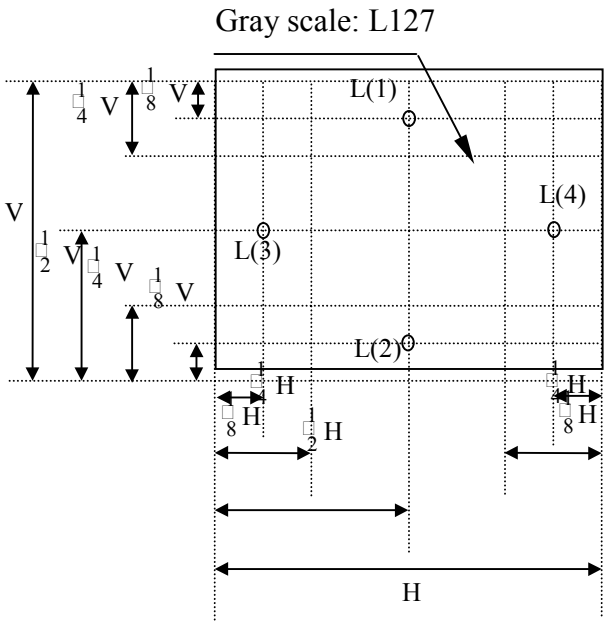


Note (6) Definition of crosstalk CT(1) ~ CT(4)

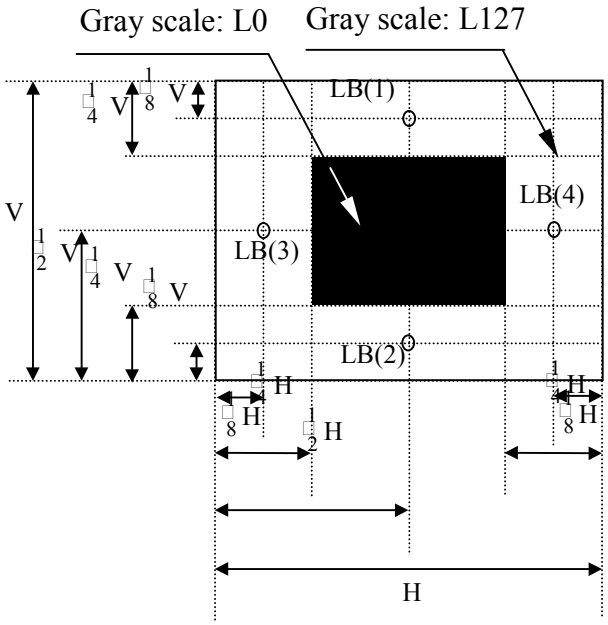
$$CT(n) = \frac{|L(n) - LB(n)|}{L(n)} \times 100\% \text{ , } n = 1 \sim 4$$

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
L255 : Luminance with all pixels white



Pattern A



Pattern B

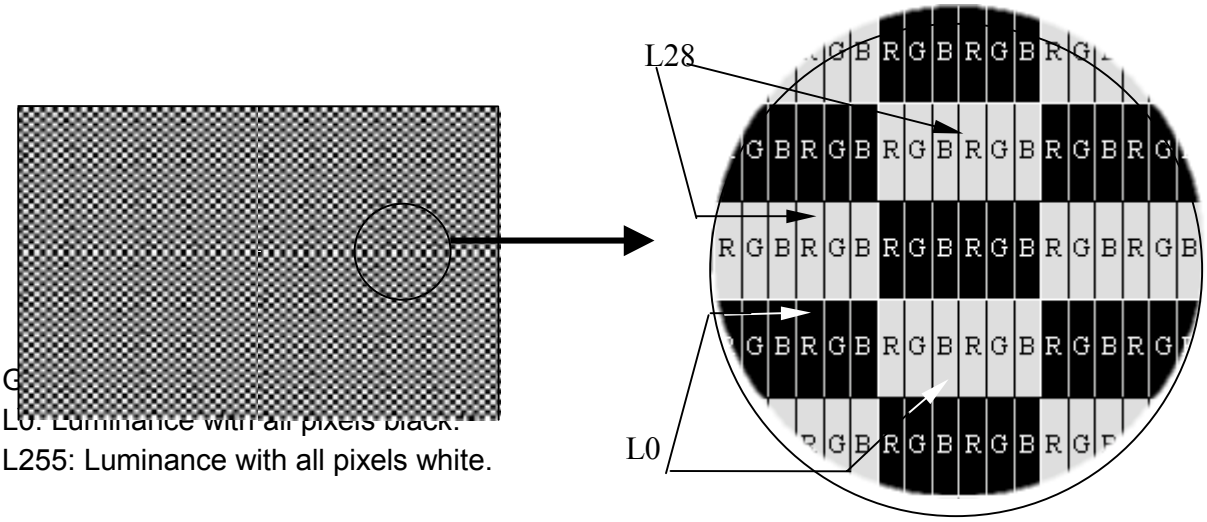
4.0 ELECTRICAL CHARACTERISTICS

4.1 TFT LCD Module

Item	Symbol	Min.	Typ.	Max.	Unit	Note

Voltage of power supply		V_{DD}	3.0	3.3	3.6	V	
Input voitage	High	V_{IH}	2.4	--	3.6	V	
	Low	V_{IL}	0	--	0.9	V	
Current of power supply	Mosaic	I_{DD}	--	TBD	--	mA	(1)
Vsync frequency		f_V	--	60.00	75.00	Hz	
Hsync frequency		f_H	--	48.35	60.00	KHz	
Main frequency		f_{DCLK}	--	32.50	39.37	MHz	

Note (1) Mosaic : Dot checker image



G
L0: Luminance with all pixels black.
L255: Luminance with all pixels white.

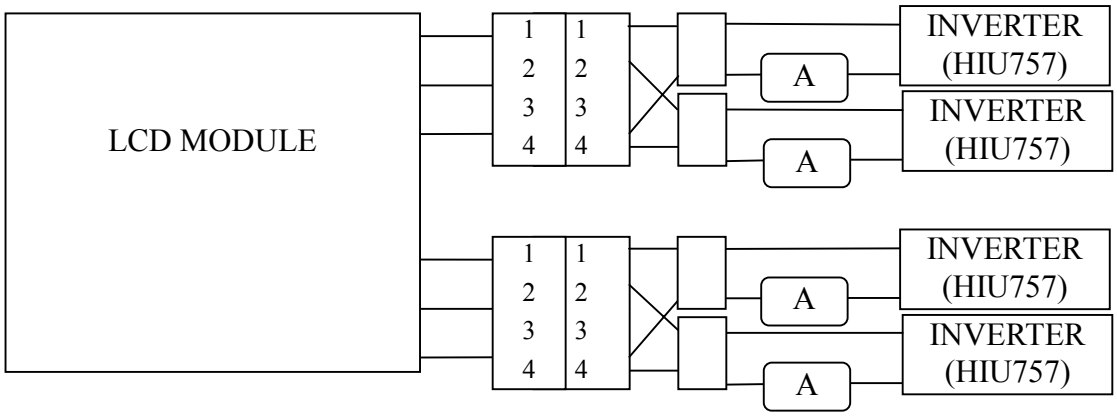
Note (2) When f_v is too low, a flicker may be occurred on the display.

4.2 Back-Light Unit

The back-light system is an edge-lighting type with 4 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	IL	3.0	6.0	7.0	mA(rms)	(1)
Lamp voltage	VL	--	640	--	V(rms)	I_L=6.0mA
Frequency	fL	30	50	80	KHz	(2)
Operating life time	Hr	30,000	--	--	Hour	(3)
Startup voltage	Vs	--	--	1220	V(rms)	at 25°C
				1410		at 0°C

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



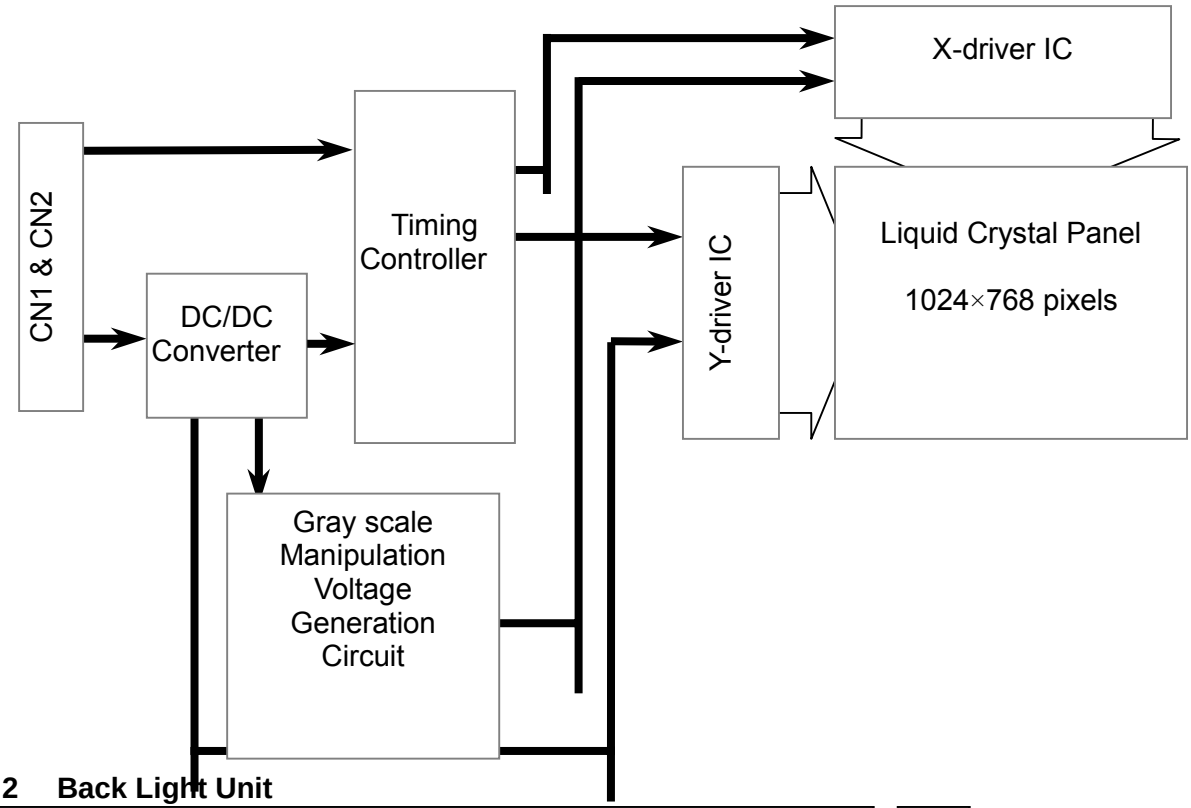
Note (2) Lamp frequency may produce interference with horizontal synchronous frequency and this may cause line flow on the display. Therefore lamp frequency shall be detached from the horizontal synchronous frequency and its harmonics as far as possible in order to avoid interference.

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

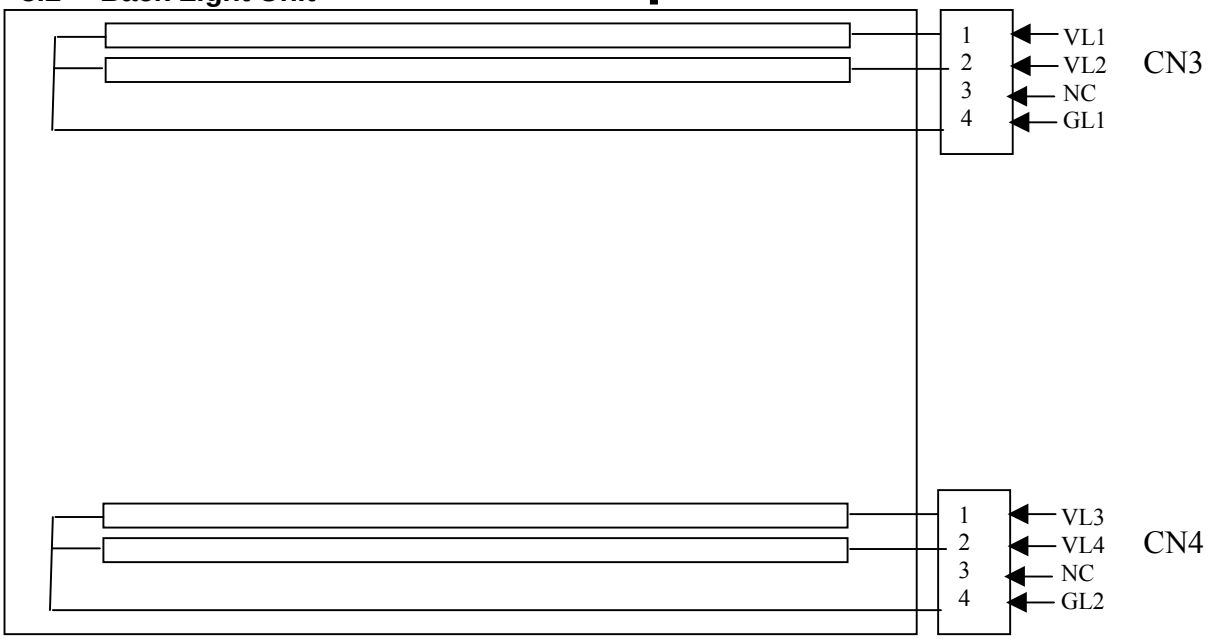
1. When the brightness becomes 50%
2. When the startup voltage(Vs) at 0°C becomes higher than the maximal Value of Vs specified above.

5.0 BLOCK DIAGRAM

5.1 TFT LCD Module



5.2 Back Light Unit



6.0 INTERFACE PIN CONNECTION

6.1 TFT LCD Module

CN1[1)2)] : Data Signal and Power Supply (IL-FHR-45S-HF /JAE)

Terminal No.	Symbol	Function
1	GND	Ground
2	CLK	Dot clock
3	GND	Ground
4	DENA	Data enable
5	GND	Ground
6	VS	Vertical sync
7	GND	Ground
8	HS	Horizontal sync
9	GND	Ground
10	NC	(HMS)
11	GND	Ground
12	BO7	Blue odd data(MSB)
13	BO6	Blue odd data
14	BO5	Blue odd data
15	BO4	Blue odd data
16	GND	Ground
17	BO3	Blue odd data
18	BO2	Blue odd data
19	BO1	Blue odd data
20	BO0	Blue odd data(LSB)
21	GND	Ground
22	GO7	Green odd data(MSB)
23	GO6	Green odd data
24	GO5	Green odd data
25	GO4	Green odd data
26	GND	Ground
27	GO3	Green odd data
28	GO2	Green odd data
29	GO1	Green odd data
30	GO0	Green odd data(LSB)
31	GND	Ground
32	RO7	Red odd data(MSB)
33	RO6	Red odd data
34	RO5	Red odd data
35	RO4	Red odd data
36	GND	Ground
37	RO3	Red odd data
38	RO2	Red odd data
39	RO1	Red odd data
40	RO0	Red odd data(LSB)
41	VCC	Power supply
42	VCC	Power supply
43	NC	No Connection
44	NC	No Connection
45	TEST	Should be open during operation (Internal test only)

Note 1) Please connect NC pin & Test pin to nothing. Don't connect it to ground nor to other signal input.

Note 2) Please connect GND pin to ground. Don't use it as no-connect nor connect with high impedance.

CN2 : Data Signal (IL-FHR-F30S-HR / JAE)

Terminal No.	Symbol	Function
1	GND	Ground
2	BE7	Blue even data(MSB)
3	BE6	Blue even data
4	BE5	Blue even data
5	BE4	Blue even data
6	GND	Ground
7	BE3	Blue even data
8	BE2	Blue even data
9	BE1	Blue even data
10	BE0	Blue even data (LSB)
11	GND	Ground
12	GE7	Green even data(MSB)
13	GE6	Green even data
14	GE5	Green even data
15	GE4	Green even data
16	GND	Ground
17	GE3	Green even data
18	GE2	Green even data
19	GE1	Green even data
20	GE0	Green even data (LSB)
21	GND	Ground
22	RE7	Red even data(MSB)
23	RE6	Red even data
24	RE5	Red even data
25	RE4	Red even data
26	GND	Ground
27	RE3	Red even data
28	RE2	Red even data
29	RE1	Red even data
30	RE0	Red even data (LSB)

6.2 Back-Light Unit

CN3[1)] CCFL Power Source (BHR-04VS-1/Japan Solderless Terminal MFG Co., LTD)

Terminal No.	Symbol	Function
1	VL1	CCFL power supply (high voltage)
2	VL2	CCFL power supply (high voltage)
3	NC[1)]	
4	GL1	CCFL power supply (low voltage)

CN4[1)] CCFL Power Source (BHR-04VS-1/Japan Solderless Terminal MFG Co., LTD)

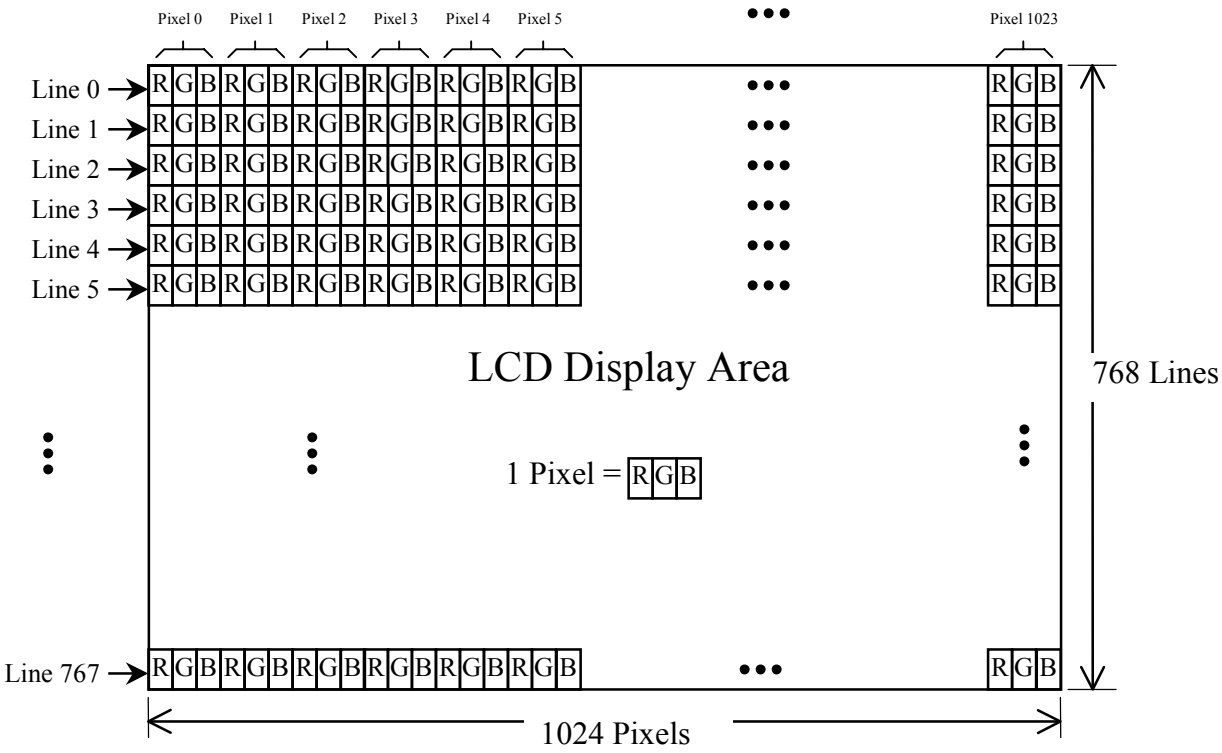
Terminal No.	Symbol	Function
1	VL3	CCFL power supply (high voltage)
2	VL4	CCFL power supply (high voltage)
3	NC[1)]	
4	GL2	CCFL power supply (low voltage)

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

6.3 Relationship Between Displayed Color and Input

		MSB							LSB	MSB							LSB	MSB							LSB	Gray scale
	Display	R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4	G3	G2	G1	G0	B7	B6	B5	B4	B3	B2	B1	B0	level
Basic color	Black	L	L	L	L	L	L	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	L	L	L	L	H	H	H	H	H	H	H	H	-
	Green	L	L	L	L	L	L	L	L	H	H	H	H	H	H	H	H	L	L	L	L	L	L	L	L	-
	Light Blue	L	L	L	L	L	L	L	L	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	-
	Red	H	H	H	H	H	H	H	H	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	-
	Purple	H	H	H	H	H	H	H	H	L	L	L	L	L	L	L	L	H	H	H	H	H	H	H	H	-
	Yellow	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	L	L	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	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	L	L	L	L	L	L	L0
	Dark	L	L	L	L	L	L	L	H	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L1
		L	L	L	L	L	L	H	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L2
	↑	□								□								□								L3…L251
	↓	H	H	H	H	H	L	H	H	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L252
		H	H	H	H	H	H	L	H	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L253
	Light	H	H	H	H	H	H	H	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L254
	Red	H	H	H	H	H	H	H	H	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	Red L255
Gray scale of Green	Black	L	L	L	L	L	L	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	H	L	L	L	L	L	L	L	L	L1
		L	L	L	L	L	L	L	L	L	L	L	L	L	L	H	L	L	L	L	L	L	L	L	L	L2
	↑	□								□								□								L3…L251
	↓	L	L	L	L	L	L	L	L	H	H	H	H	H	L	H	H	L	L	L	L	L	L	L	L	L252
		L	L	L	L	L	L	L	L	H	H	H	H	H	H	L	H	L	L	L	L	L	L	L	L	L253
	Light	L	L	L	L	L	L	L	L	H	H	H	H	H	H	H	L	L	L	L	L	L	L	L	L	L254
	Green	L	L	L	L	L	L	L	L	H	H	H	H	H	H	H	H	L	L	L	L	L	L	L	L	Green L255
Gray scale of Blue	Black	L	L	L	L	L	L	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	L	L	L	L	L	L	H	L1
		L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	H	L	L2
	↑	□								□								□								L3…L251
	↓	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	H	H	H	H	H	L	H	H	L252
		L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	H	H	H	H	H	H	L	H	L253
	Light	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	H	H	H	H	H	H	H	L	L254
	Blue	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	H	H	H	H	H	H	H	H	Blue L255
Gray scale of White & Black	Black	L	L	L	L	L	L	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	H	L	L	L	L	L	L	L	H	L	L	L	L	L	L	L	H	L1
		L	L	L	L	L	L	H	L	L	L	L	L	L	L	H	L	L	L	L	L	L	L	H	L	L2
	↑	□								□								□								L3…L251
	↓	H	H	H	H	H	L	H	H	H	H	H	H	H	L	H	H	H	H	H	H	H	L	H	H	L252
		H	H	H	H	H	H	L	H	H	H	H	H	H	H	L	H	H	H	H	H	H	H	L	H	L253
	Light	H	H	H	H	H	H	H	L	H	H	H	H	H	H	H	L	H	H	H	H	H	H	H	L	L254
	White	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	White L255

6.4 Pixel Format



7.0 INTERFACE TIMING 1)2)3)4)5)6)

7.1 Timing Parameters (Hsync, Vsync and DE mode)

Item		Symbol	Min.	Typ.	Max.	Unit	Remarks
Vertical display term	Period	t1	778×t4 □	806×t4 16.67	860×t4 □	□ ms	1) 5)
	Active	t2	□	768×t4 15.88	□	□ ms	1)
	Display start	t3	4×t4 □	□	256×t4 □	□ ms	1)
Horizontal display term	Period	t4	590×t7 □	672×t7 20.68	700×t7 □	□ µs	1) 5)
	Active	t5	□	512×t7 15.76	□	□ µs	1)
	Display Start	t6	16×t7 □	□	512×t7 □	□ µs	1)
Clock	Period	t7	25.00	30.77	□	ns	5)
	Low time	t8	9	□	□	ns	
	High time	t9	9	□	□	ns	
Data	Setup time	t10	2	□	□	ns	
	Hold time	t11	5	□	□	ns	

Note 1) Refer to TIMING CHART at page19 and 20.

Note 2) In case of using the long frame period, the deterioration of display quality, noise etc. may be occurred.

Note 3) When ENAB is fixed to “L” level after NCLK input, the panel is displayed as black. However, a flicker may be occurred on the display. When ENAB is fixed to “H” level after NCLK input, the panel will be damaged.

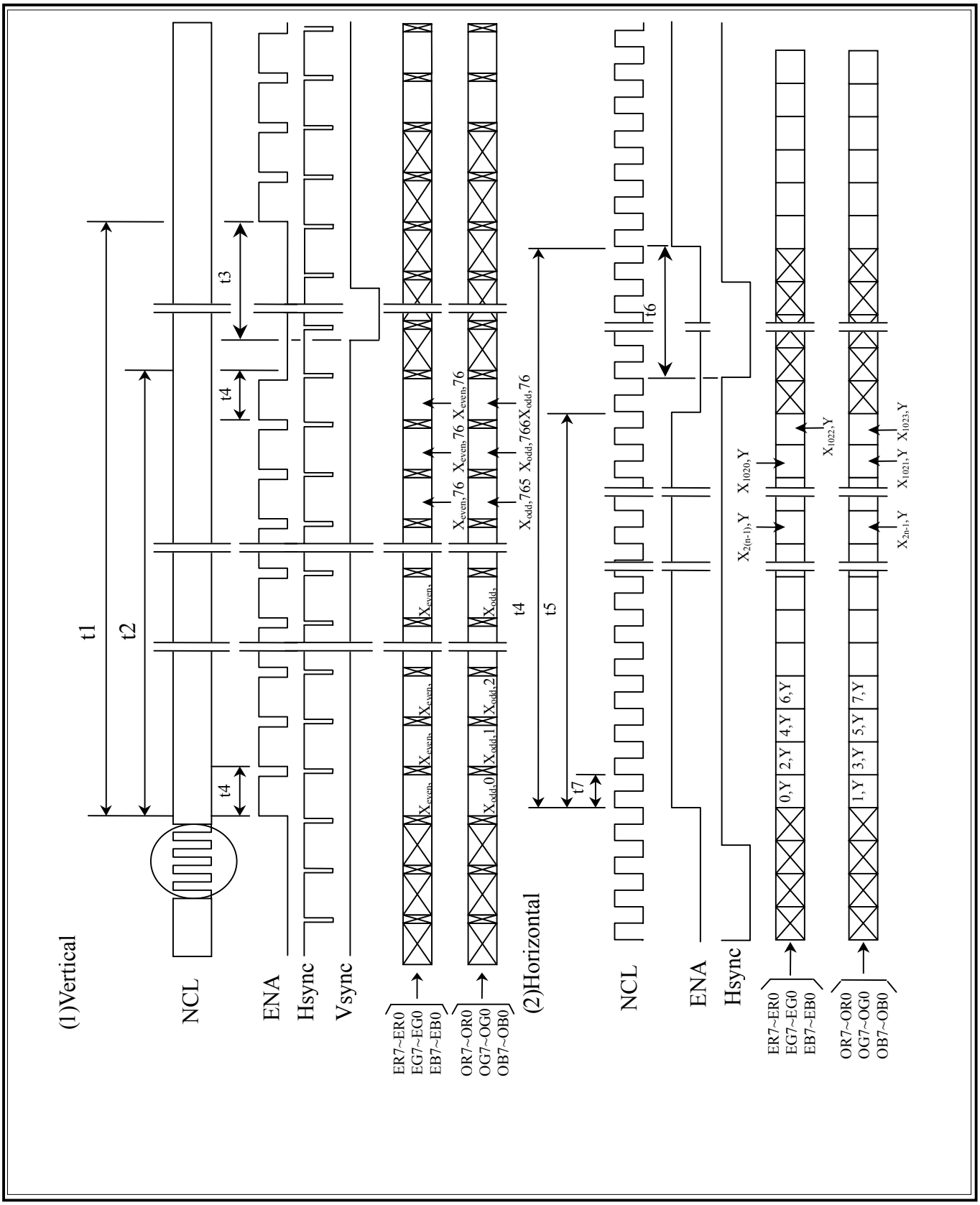
Note 4) Do not fix NCLK to “H” or “L” level while the V_{DD} (+3.3V) is supplied. If NCLK is fixed to “H” level or “L” level for certain period while the V_{DD} (+3.3V) is supplied, the panel may be damaged.

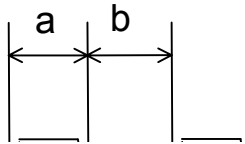
Note 5) Do not change t1 and t4 values in the operation. When t1 or t4 is changed, the panel is displayed as black.

Note 6) 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).

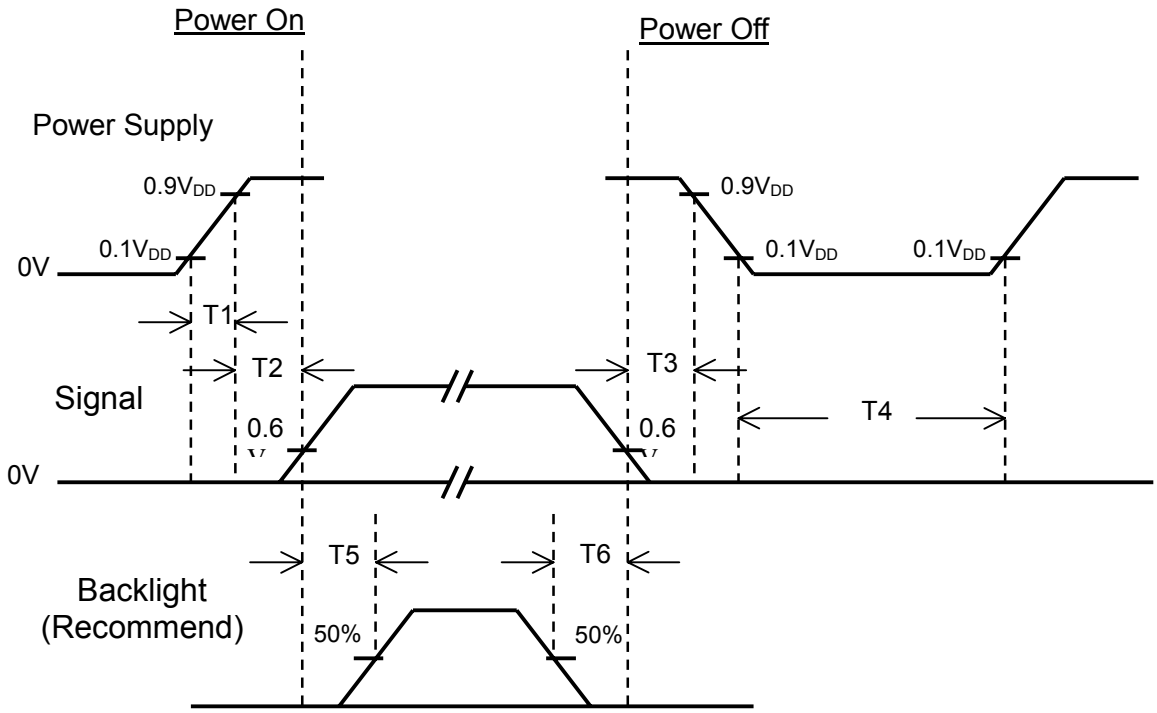
7.2 Timing Diagram of Interface Signal (Hsync, Vsync and DE mode)

24 Bit two pixel/clock input mode





7.3 Power ON/OFF Sequence



Item	Min.	Typ.	Max.	Unit	Remark
T1	0	□	10	msec	
T2	0	□	50	msec	
T3	0	□	50	msec	
T4	1	□	□	sec	
T5	200	□	□	msec	
T6	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 V_{DD} = off level, please keep the level of input signal on the low or keep a high impedance.

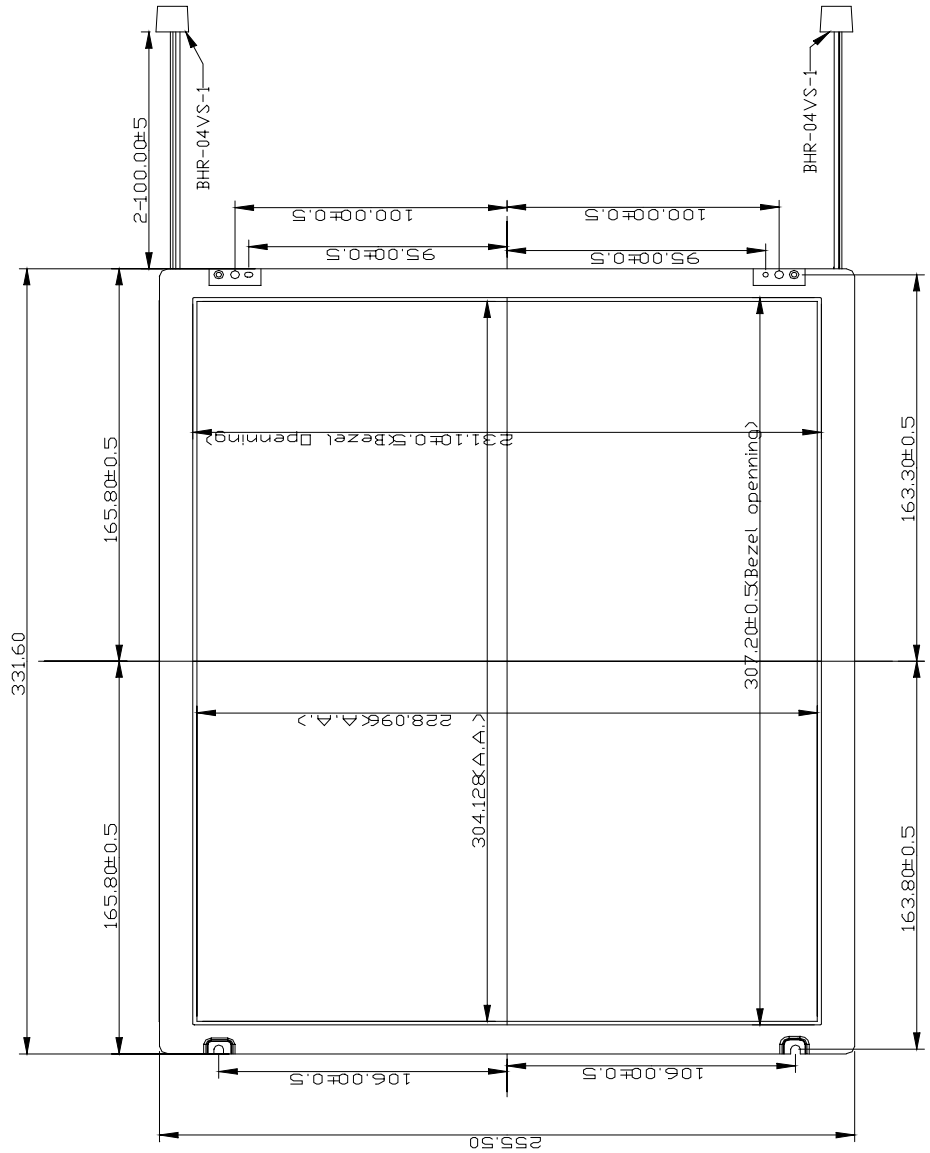
(4) T4 should be measured after the module has been fully discharged between power off and on period.

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

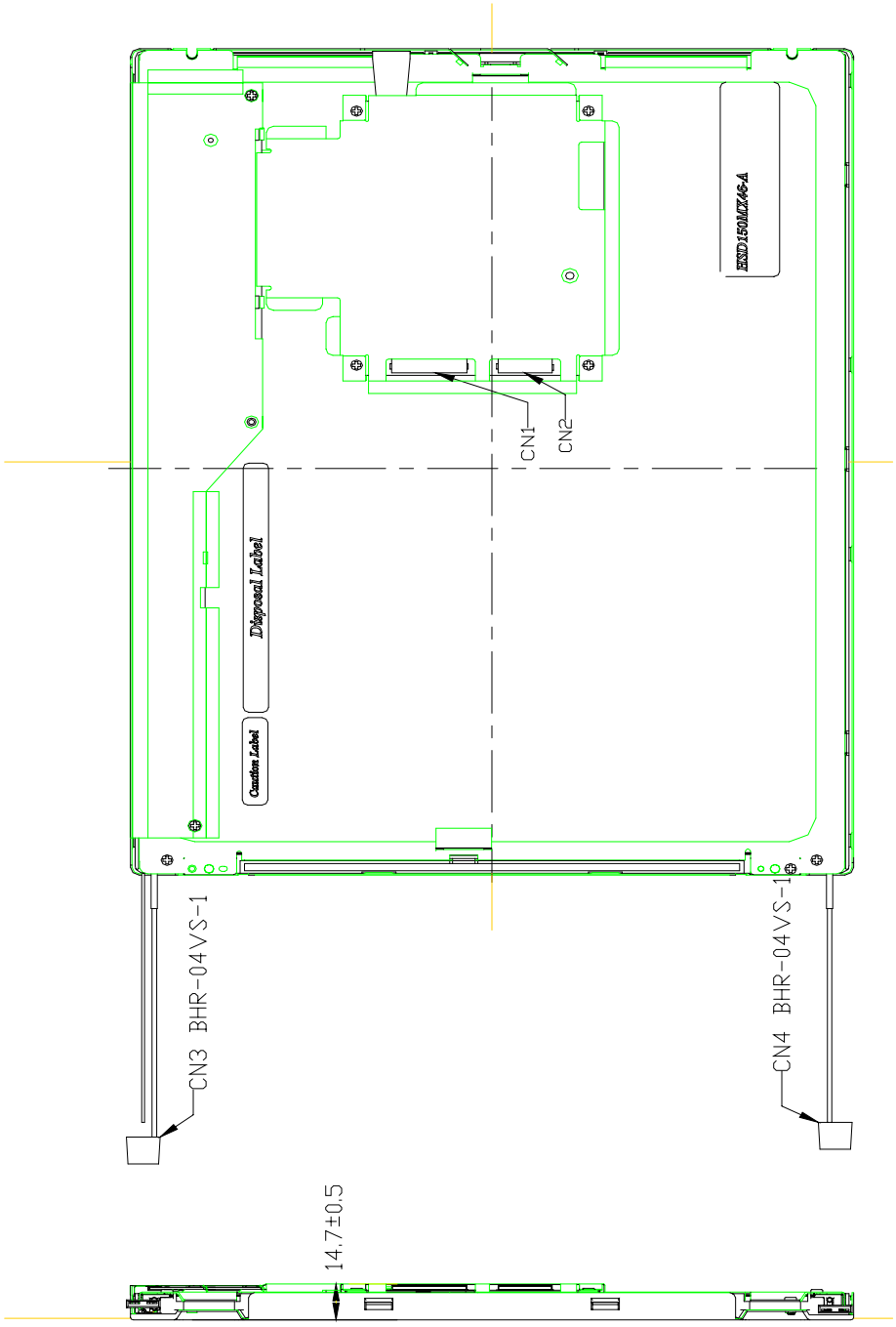
8.0 OUTLINE DIMENSION

8.1 Front View

Unit : mm



8.2 Back View



9.0 LOT MARK

9.1 Lot Mark

									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

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

9.3.1 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.

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

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

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

10.4 Electric Shock

9.4.1 Disconnect power supply before handling LCD module.

9.4.2 Do not pull or fold the CCFL cable.

9.4.3 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

9.5.1 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.

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

9.5.3 It's recommended to employ protection circuit for power supply.

10.6 Operation

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

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

9.6.3 When the surface is dusty, please wipe gently with absorbent cotton or other soft

material.

9.6.4 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 colo r fading.

9.6. 5When 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 mouting holes arranged in four corners tightly.

10.8 Static Electricity

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

9.8.2 Because LCD module use 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.

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.