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Date : Jan. 28th, 2004

HannStar Product Information

**Model : HSD230WX01
-A-**

ISSUE DATE: 2004-01-28

- 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.

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Record of Revisions

Rev.	Date	Description of change
1.0	Mar. 28, 2003	Tentative spec. was first issued.
2.0	Jun. 12, 2003	Modify the Display color from 16777216 colors to 16.2M colors on page 4. Remove the gray to gray response time specification on page 7.
2.1	Jun. 16, 2003	Modify the electrical characteristics on page 11. Modify the timing parameters on page 20.
2.2	Aug. 05, 2003	Modify the Response Time specification on page 7.
2.3	Aug. 25, 2003	Modify the Measuring Condition of Optical Characteristics on page 8. Modify the Electrical Characteristics of Back-light Unit on page 12.
3.0	Sep. 09, 2003	Modify the front view outline dimension on page 23.
4.0	Oct. 29, 2003	Modify the Optical Characteristics on page 8. Modify the Electrical Characteristics on page 12 and 13. Modify the Outline Dimension on page 24 and 25. Add the Package Specification on page 27.
4.1	Nov. 03, 2003	Modify the back view of outline dimension on page 25.
4.2	Nov. 17, 2003	Add lamp current measurement method on page 13. Add the inverter screw hole spec. in the back view of outline dimension on page 25. Add sub module code on page 26.
4.3	Dec. 19, 2003	Modify the back view of outline dimension on page 25.
4.4	Jan. 28, 2004	Modify the Inverter Model on page 9 and 12.



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1.0 GENERAL DESCRIPTION

1.1 Introduction

HannStar Display model HSD230WX01-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 22.92-inch diagonally measured active display area with Wide XGA resolution (768 vertical by 1280 horizontal pixel array) and can display up to 16.2million colors.

1.2 Features

- | 22.92" WXGA for TV application panel
- | High brightness and wide view angle
- | Fast response time & High color reproduction
- | LVDS interface system.
- | Long lamp lifetime.
- | 72% high color gamut

1.3 Applications

- | High Definition TV application
- | Public Display
- | Measuring Instrument
- | New media equipment

1.4 General information

Item	Specification	Unit
Display area	499.20(H) x 299.52(V)	mm
Display area	499.20(H) x 299.52(V)	mm
Number of Pixel	1280(H) x 768(V)	pixels
Pixel pitch	0.39(H) x 0.39(V)	mm
Pixel arrangement	RGB Vertical stripe	
Display color	16,2M	colors
Display mode	Normally Black	
Surface treatment	Anti-reflective, Hard-Coating(3H)	
Weight(without inverter)	2500	g
Back-light	12 CCFL	
Input signal	1-ch LVDS	



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1.5 Mechanical Information

Item		Min.	Typ.	Max.	Unit
Module Size	Horizontal(H)	539.0	540.0	541.0	mm
	Vertical(V)	339.5	340.0	340.5	mm
	Depth(D)	29.8	30.3	30.8	mm
Weight (Without inverter)		2400	2500	2600	g

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2.0 ABSOLUTE MAXIMUM RATING

2.1 Absolute Rating of Environment

Item	Symbol	Min.	Max.	Unit	Note
Storage temperature	T_{STG}	-20	60	°C	(1)
Operating temperature	T_{OPR}	0	50	°C	(1)
Vibration(non-operating)	V_{nop}	-	1.2	G	(2)
Shock(non-operating)	S_{nop}	-	30	G	(3)
Storage humidity	H_{STG}	10	90	%RH	(4)
Operating humidity	H_{OP}	10	80	%RH	(4)
Low pressure(operating)	H_{LOP}	697	-	hPa	(5)
Low pressure(non-operating)	H_{LNO}	116	-	hPa	(6)

Note (1) Temperature and Humidity should be applied to the glass surface of a TFT module, not to the system installed with a module.

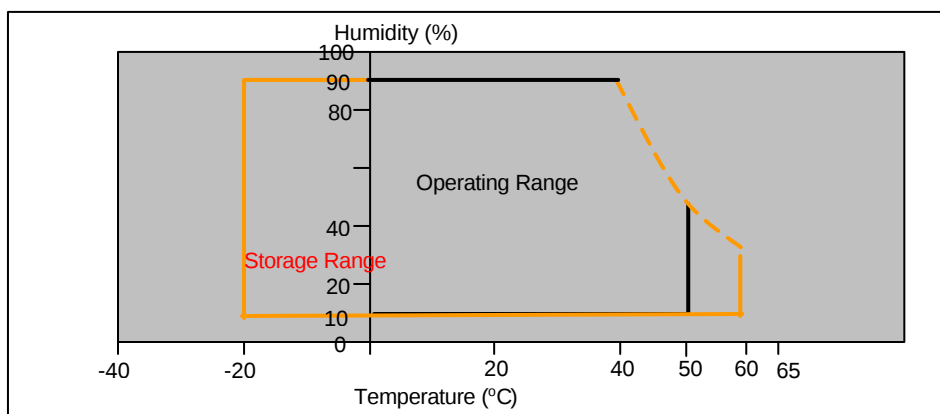
(2) 10-500-10Hz,sine wave, 30min/cycle, X/Y/Z each one cycle except for resonant frequency.

(3) 11ms/ $\pm X$, $\pm Y$, $\pm Z$ direction, half-sine wave.

(4) Max wet bulb temp =39°C

(5) 2hours. (10000 feet)

(6) 24hours. (50000 feet)



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2.2 Electrical Absolute Rating

2.2.1 TFT LCD Module

Item	Symbol	Min.	Max.	Unit	Note
Power supply voltage	V_{DD}	-0.3	5.5	V	(1)
Logic input voltage	V_{IN}	-0.3	3.6	V	(1)

2.2.2 Back-Light Unit

Item	Symbol	Min.	Max.	Unit	Note
Lamp voltage	V_L	0	2500	V_{rms}	(1)
Lamp current	I_L	-	8.0	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.

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3.0 OPTICAL CHARACTERISTICS

3.1 Optical specification

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Contrast		CR	$\Theta = 0$ $\Phi = 0$ Normal viewing angle	250	400	-		(1)(2)
Response time	Rising	T _R		-	12	-	msec	(1)(3)
	Falling	T _F		-	13	-		
luminance of white(center)		Y _L		350	500	-	cd/m ²	(1)(4)(5) (I _L =6.0mA)
Color chromaticity (CIE1931)	Red	R _x		0.60	0.64	0.68		(1)(4)
		R _y		0.30	0.34	0.38		
	Green	G _x		0.25	0.29	0.33		
		G _y		0.57	0.61	0.65		
	Blue	B _x		0.10	0.14	0.18		
		B _y		0.03	0.07	0.11		
	White	W _x		(0.243)	(0.283)	(0.323)		
		W _y		(0.257)	(0.297)	(0.337)		
Viewing angle	Hor.	Θ _L	CR>10	-	85	-		
		Θ _R		-	85	-		
	Ver.	Θ _U		-	85	-		
		Θ _D		-	85	-		
Brightness uniformity		B _{UNI}		-	20	25	%	(6)

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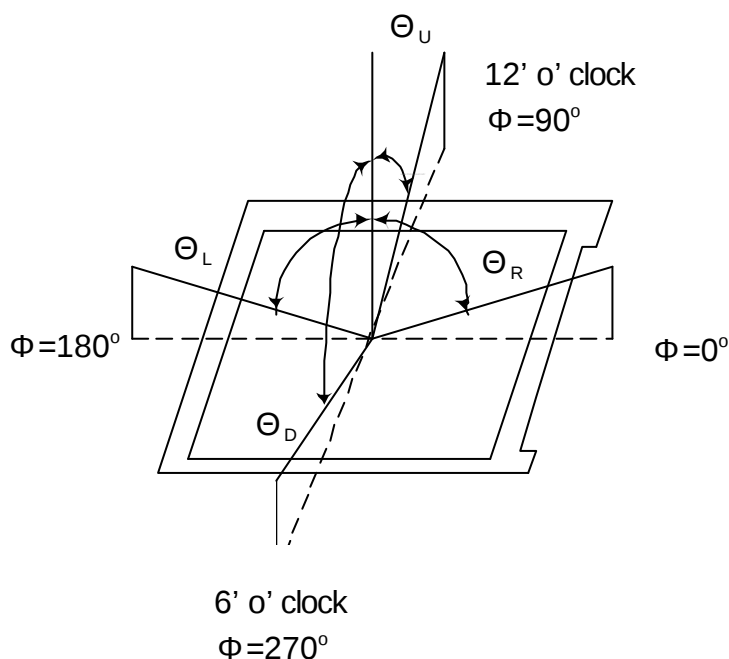
3.2 Measuring Condition

- Measuring surrounding : dark room
- Lamp current I_L : 6.0mA, lamp freq. F_L = 60KHz
- V_{DD} = +5.0V, f_V = 60Hz, f_{DCLK} = 65MHz
- Inverter Model: PLCD09231202 (Emax)
- Surrounding temperature : 25°C
- 30min. warm-up time

3.3 Measuring Equipment

- MD-3000V 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:



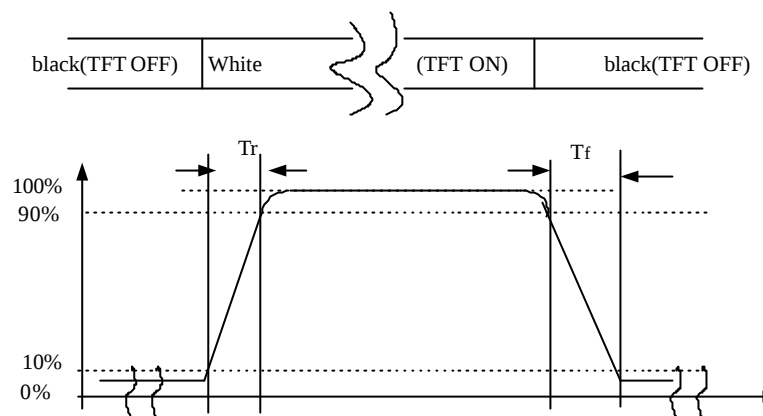
Note (2) Definition of Contrast Ratio(CR) :

Measured at the center point of panel

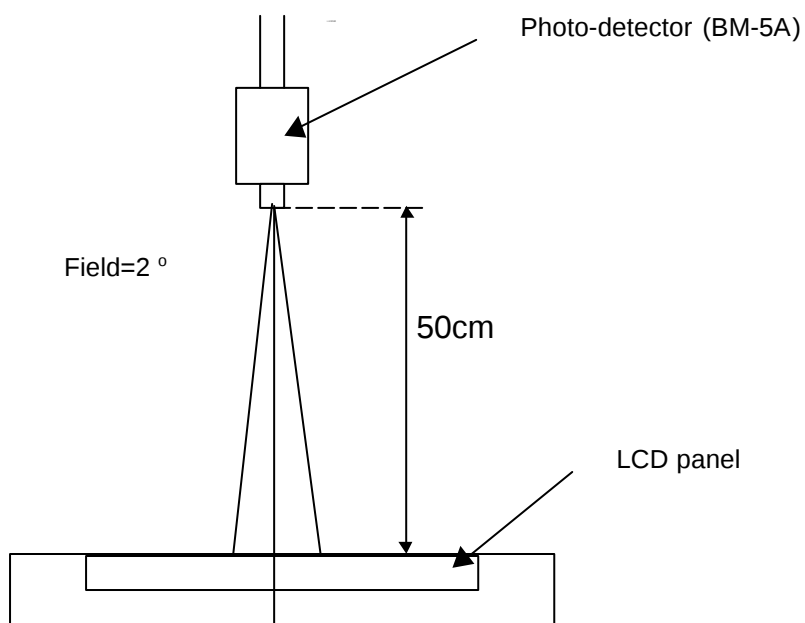
$$CR = \frac{\text{Luminance with all pixels white}}{\text{Luminance with all pixels black}}$$

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Note (3) Definition of Response Time: Sum of T_r and T_f



Note (4) Optical Characteristic Measurement Setup



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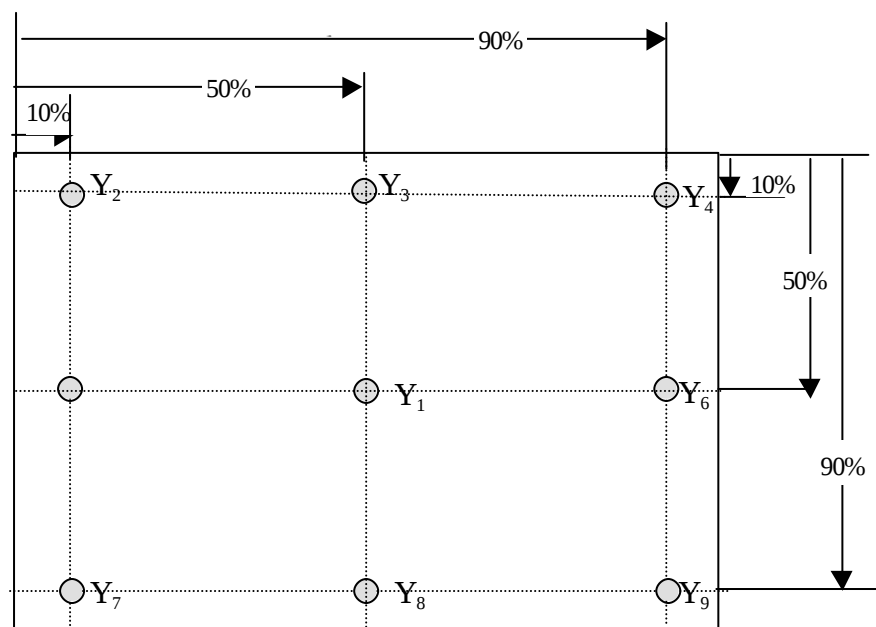
Note (5) Definition of Luminance of White: measured the luminance of white at Y1

Luminance of white = Y_1

Note (6) Definition of Brightness Uniformity (B_{UNI})

$$B_{UNI} = \frac{\text{Max}_i |Y_i - Y_{avg}|}{Y_{avg}} \times 100\% (i=1 \sim 9)$$

$$\text{Where } Y_{avg} = \frac{\sum_{i=1}^9 Y_i}{9}$$



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4.0 ELECTRICAL CHARACTERISTICS

4.1 TFT LCD Module

Item		Symbol	Min.	Typ.	Max.	Unit	Note
Voltage of power supply		V _{DD}	4.5	5.0	5.5	V	
Differential input threshold voltage	High	V _{IH}	-	-	100	mV	V _{CM} =1.2V
	Low	V _{IL}	-100	-	-	mV	
Current of power supply	L255	I _{DD}	-	1100	1500	mA	
Vsync frequency		f _v	50	60	70	Hz	(1)
Hsync frequency		f _H	40.3	48.4	56.5	kHz	
Main frequency		f _{DCLK}	54	65.0	85	MHz	

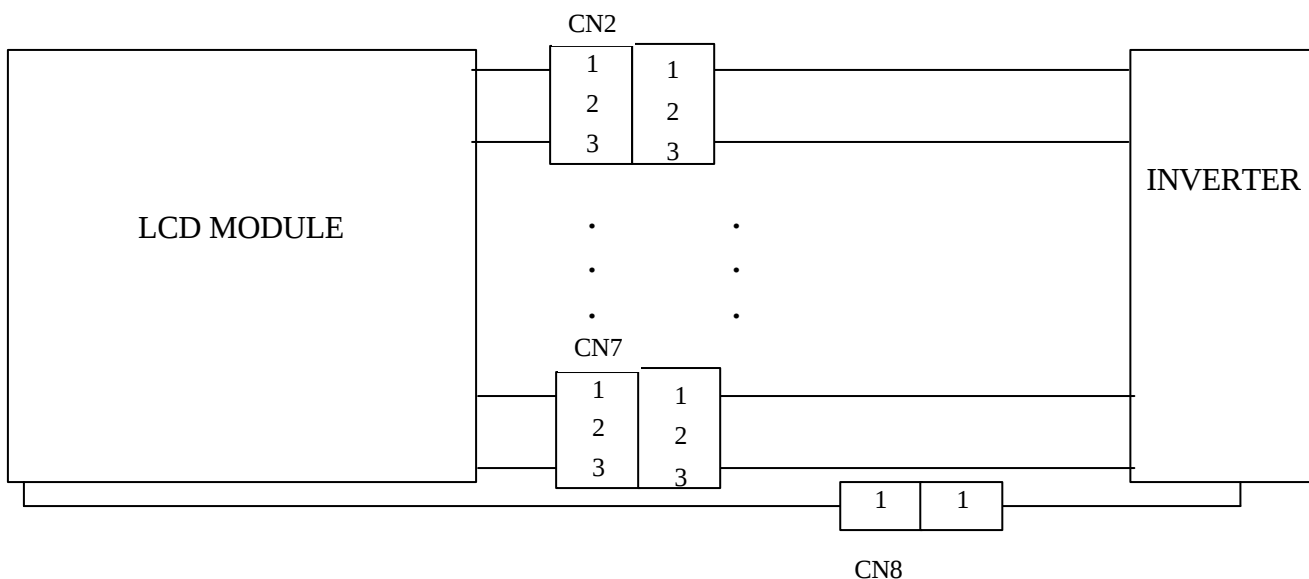
Note (1) When f_V is too low, a flicker may be occurred on the display.

4.2 Back-Light Unit

The back-light system is 12 CCFL(Cold Cathode Fluorescent Lamp).

The characteristics of the lamp are shown in the following tables.

INVERTER: PLCD09231202 (Emax)(1)



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Item	Symbol	Min.	Typ.	Max.	Unit	Note
Lamp current	IL	3.0	6.0	9.0	mA(rms)	(1)
Lamp voltage	VL	801	890	979	V(rms)	$I_L=6.0mA$
Frequency	fL	40	60	80	KHz	(2)
Lamp Operating life time	Hr		50000	--	Hour	(3)
Startup voltage	Vs	1220	--	--	V(rms)	at 25°C
		1530				at 0°C

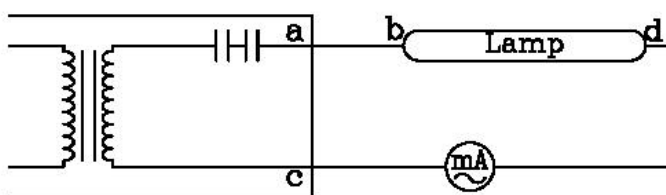
Note (1) Lamp current is measured with current meter for high frequency as shown below. Specified valued are for a lamp.

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) Lamp operating Life time (Hr) can be defined as the time in which it Continues to operate under the condition: $T_a=25\sim35^{\circ}C$, $I_L=6.0mA(typ)$ until when the brightness becomes 50% less than the initial brightness.

Lamp Characteristic Measurement

Lamp Current Measurement Circuit



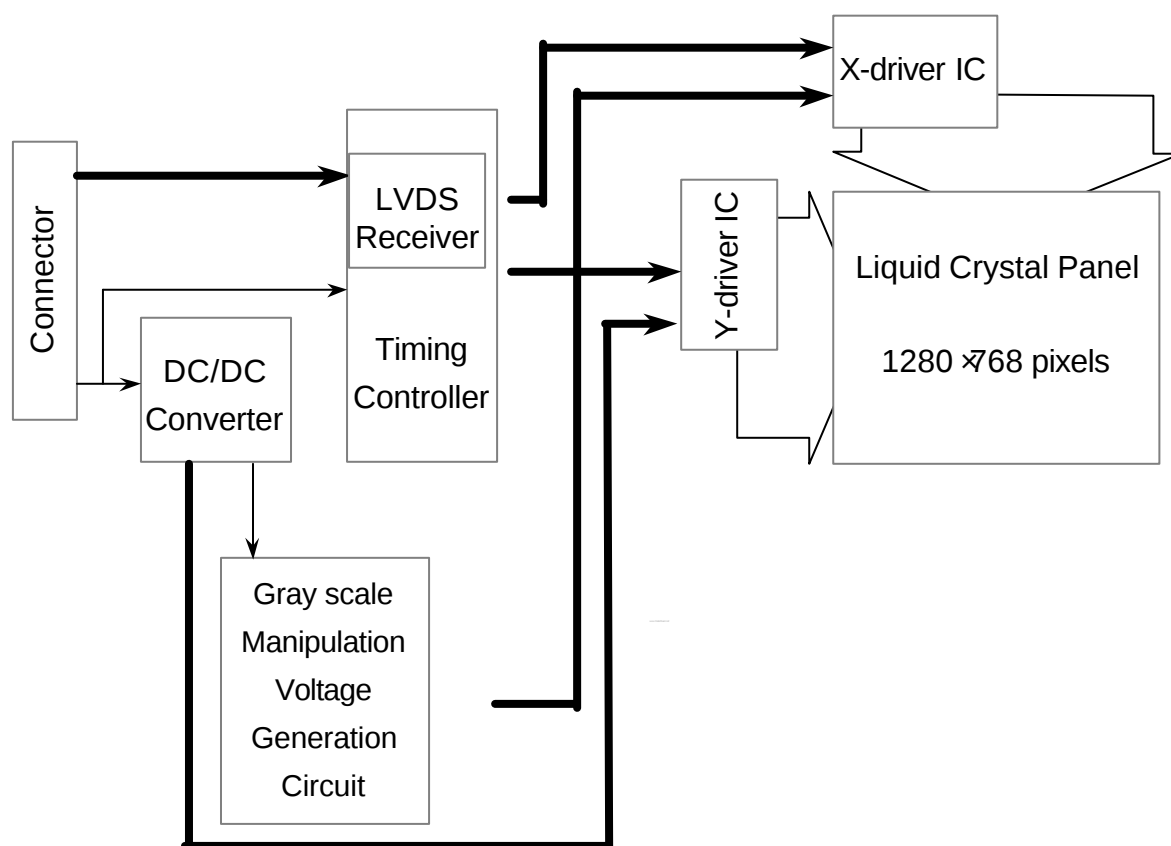
Inverter

Measurement Items	Measuring Equipment
Lamp Current	Thermocouple  meter YOKOGAWA TYPE : 2016

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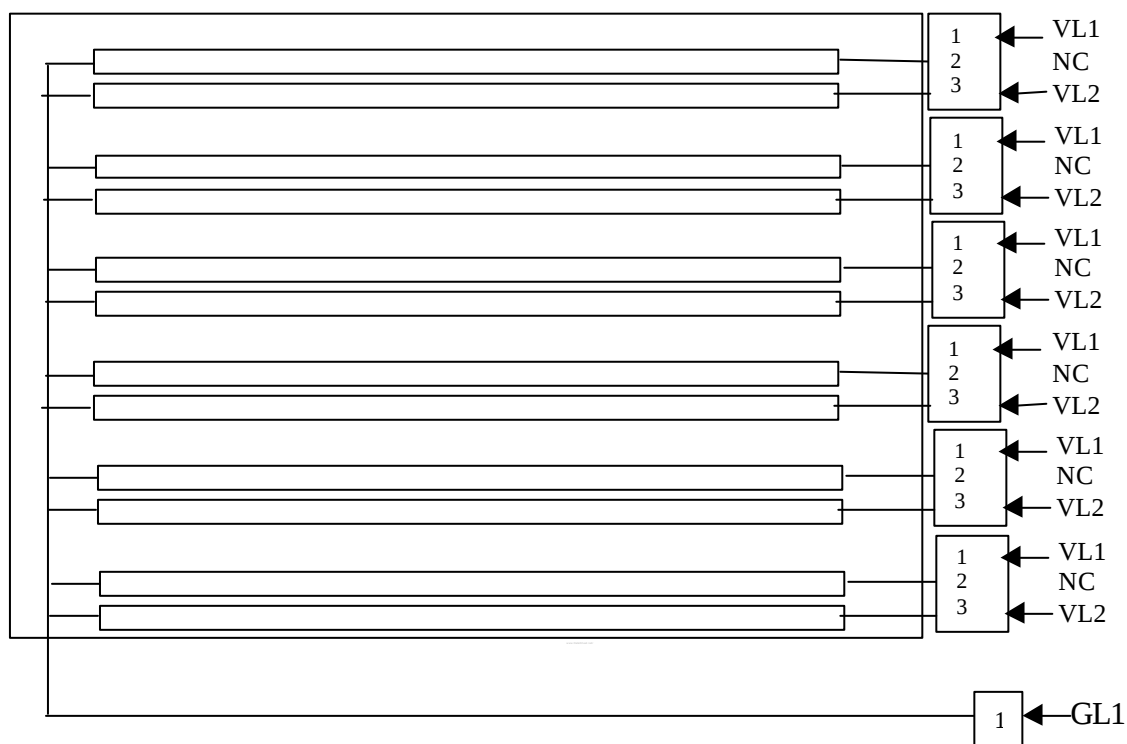
5.0 BLOCK DIAGRAM

5.1 TFT LCD Module



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5.2 Back Light Unit



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6.0 INTERFACE PIN CONNECTION

6.1 TFT LCD Module

Connector : HRS:DF14-20P-1.25H

Matching Socket : HRS:DF14-20P-1.25C

Pin No.	Symbol	Function	Polarity	Remark
1	VDD	Power Supply : +5.0V	-	
2	VDD	Power Supply : +5.0V	-	
3	GND	Ground	-	
4	GND	Ground	-	
5	IN0-	Transmission Data of Pixels 0	Negative	
6	IN0+	Transmission Data of Pixels 0	Positive	
7	GND	Ground		
8	IN1-	Transmission Data of Pixels 1	Negative	
9	IN1+	Transmission Data of Pixels 1	Positive	
10	GND	Ground		
11	IN2-	Transmission Data of Pixels 2	Negative	
12	IN2+	Transmission Data of Pixels 2	Positive	
13	GND	Ground	-	
14	CLK-	Sampling Clock	Negative	
15	CLK+	Sampling Clock	Positive	
16	GND	Ground		
17	IN3-	Transmission Data of Pixels 3	Negative	
18	IN3+	Transmission Data of Pixels 3	Positive	
19	GND	Ground		
20	GND	Ground		

6.2 Back-Light Unit

High Voltage connector:

CN2—CN7: BHR-03VS-1/Japan Solderless Terminal MFG Co., LTD

Terminal no.	Symbol	Function
1	VL1	CCFL power supply (high voltage)
2	GND	NC
3	VL2	CCFL power supply (high voltage)



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Low Voltage connector:

CN8: ZHR-02/Japan Solderless Terminal MFG Co., LTD

Terminal no.	Symbol	Function
1	GL1	CCFL power supply (low voltage)

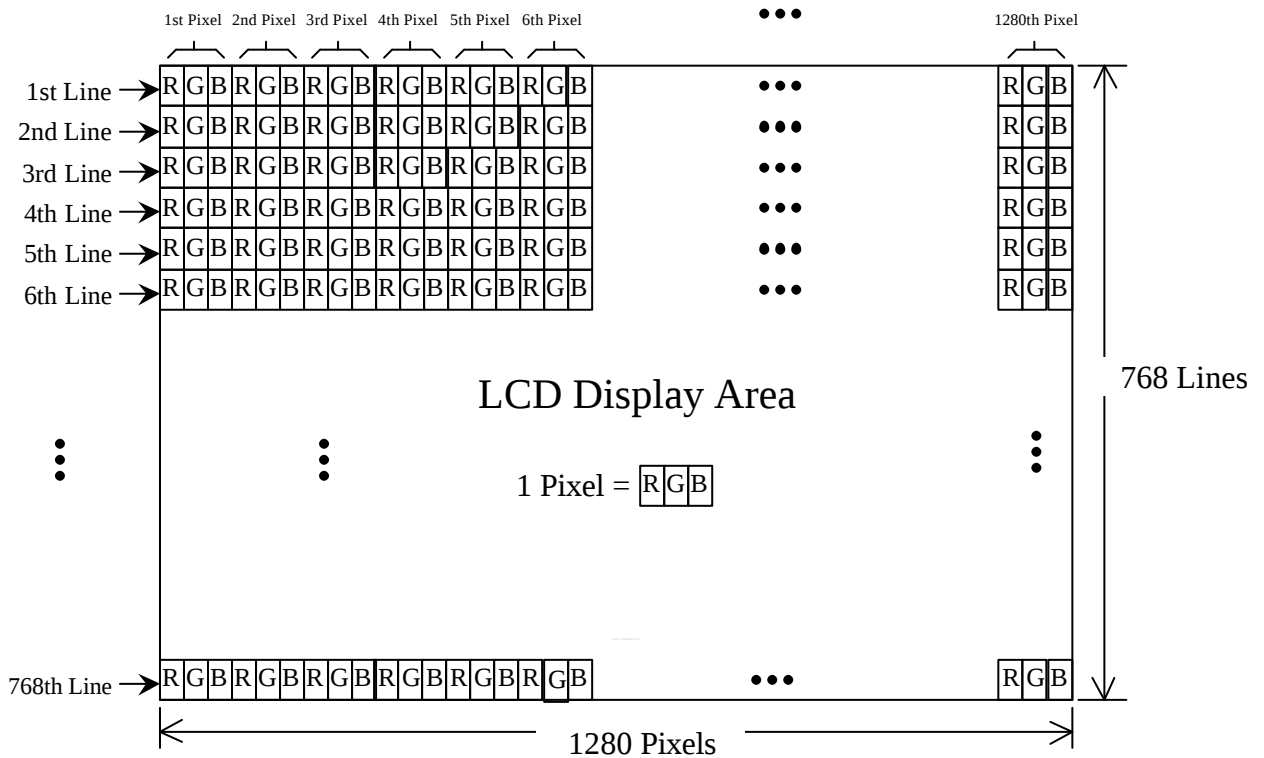
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6.3 Relationship Between Displayed Color and Input

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6.4 Pixel Format

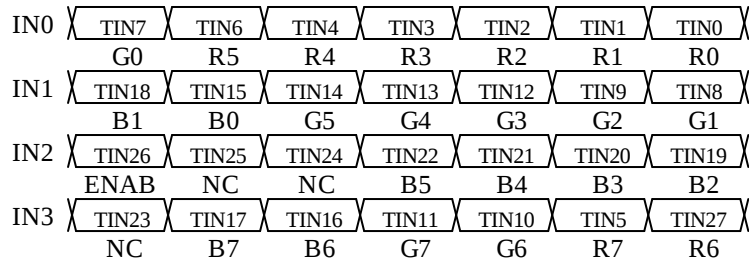


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6.5 Recommended Transmitter to HSD230WX01-A Interface Assignment

8bit Transmitter

DS90CF386 or equivalent					
Input terminal no.	Input signal		Output signal	To HSD230WX01-A interface(CN1)	
Symbol	Symbol	Function	Symbol	Terminal	Symbol
Txin0	R0	RED Pixels Display Data	TOUT0-TOUT0+	No. 5 No. 6	IN0-IN0+
Txin1	R1	RED Pixels Display Data			
Txin2	R2	RED Pixels Display Data			
Txin3	R3	RED Pixels Display Data			
Txin4	R4	RED Pixels Display Data			
Txin6	R5	RED Pixels Display Data(MSB)			
Txin7	G0	RED Pixels Display Data			
Txin8	G1	RED Pixels Display Data	TOUT1-TOUT1+	NO.8 NO.9	IN1-IN1+
Txin9	G2	GREEN Pixels Display Data			
Txin12	G3	GREEN Pixels Display Data			
Txin13	G4	GREEN Pixels Display Data			
Txin14	G5	GREEN Pixels Display Data(MSB)			
Txin15	B0	BLUE Pixels Display Data			
Txin18	B1	BLUE Pixels Display Data			
Txin19	B2	BLUE Pixels Display Data	TOUT2-TOUT2+	NO.11 NO.12	IN2-IN2+
Txin20	B3	BLUE Pixels Display Data			
Txin21	B4	BLUE Pixels Display Data			
Txin22	B5	BLUE Pixels Display Data (MSB)			
Txin24	NC	Non Connection (open)			
Txin25	NC	Non Connection (open)			
Txin26	ENAB	Compound Synchronization Signal			
Txin27	R6	RED Pixels Display Data(LSB)	TOUT3-TOUT3+	NO.17 NO.18	IN3-IN3+
Txin5	R7	RED Pixels Display Data			
Txin10	G6	GREEN Pixels Display Data(LSB)			
Txin11	G7	GREEN Pixels Display Data			
Txin16	B6	BLUE Pixels Display Data (LSB)			
Txin17	B7	BLUE Pixels Display Data			
Txin23	NC	Non Connection (open)			
CLK IN	NCLK	DATA SAMPLING CLOCK	TCLK OUT-TCLK OUT+	NO. 14 NO. 15	CLK IN-CLK IN+



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7.0 INTERFACE TIMING ¹⁾²⁾³⁾⁴⁾⁵⁾⁶⁾

7.1 Timing Parameters (DE mode)

Item	Symbol	Min.	Typ.	Max.	Unit	Remarks
Frame period	t1	784×t3	806×t3	836×t3	-	^{1) 5)}
Vertical display term	t2	768×t3	768×t3	768×t3	-	¹⁾
One line Scanning time	t3	1312×t5	1344×t5	1688×t5	-	^{1) 5)}
Horizontal display term	t4	1×t5	1280×t5		-	¹⁾
Clock period	t5	11.76	15.4	-	ns	⁵⁾

Note 1) Refer to TIMING CHART at page20, 21 and LVDS specification (DS90C385) by National Semiconductor Corporation.

Note 2) When ENAB is fixed to “H” level or “L” level after NCLK is supplied, the panel displays black with some flicker.

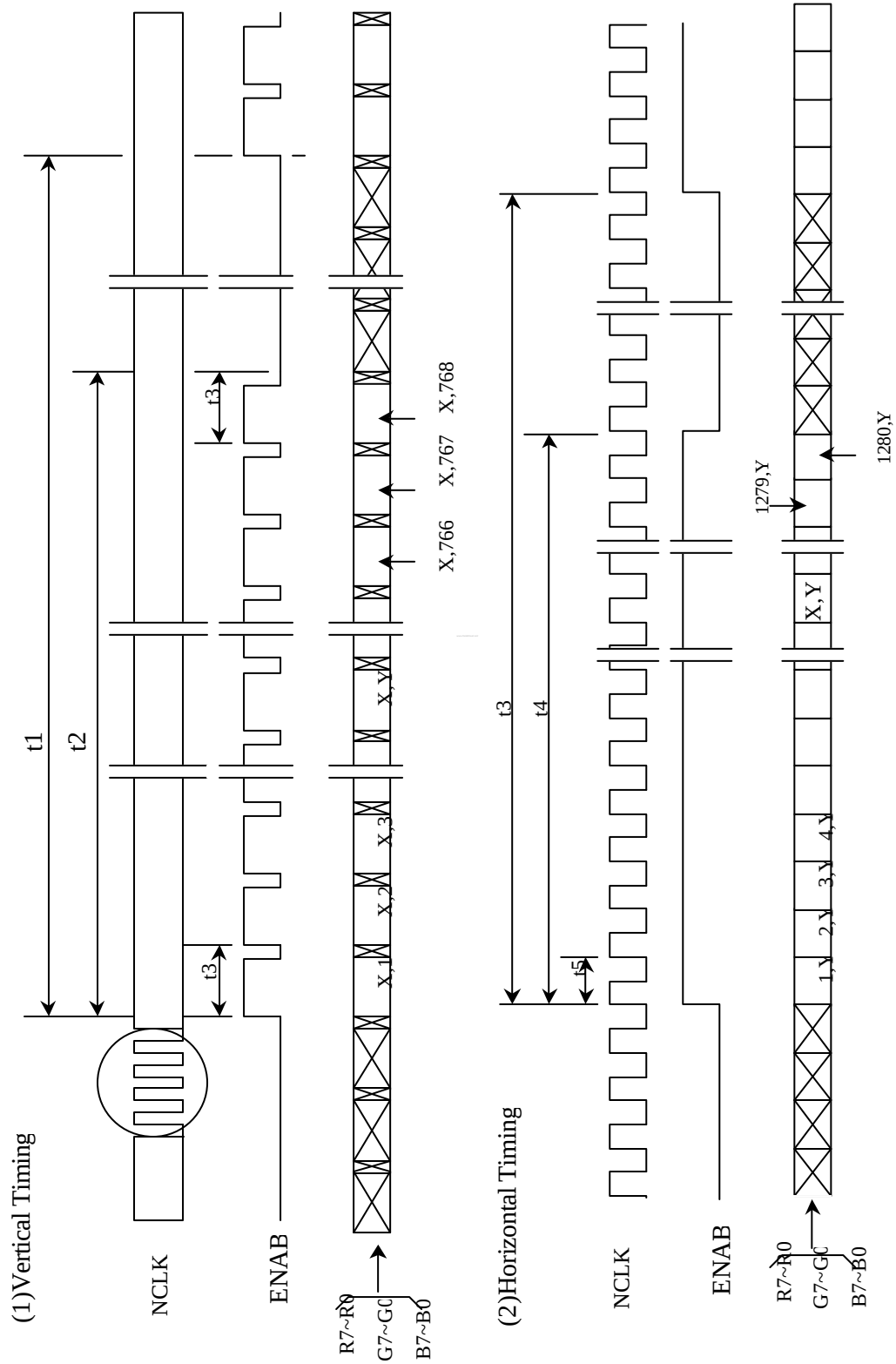
Note 3) If NCLK is fixed to “H” level or “L” level, for certain period while ENAB is supplied, the panel may be damaged.

Note 4) Do not make t1 and t3's fluctuate. If t1 or t3 is fluctuating, the panel displays black.

Note 5) 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).

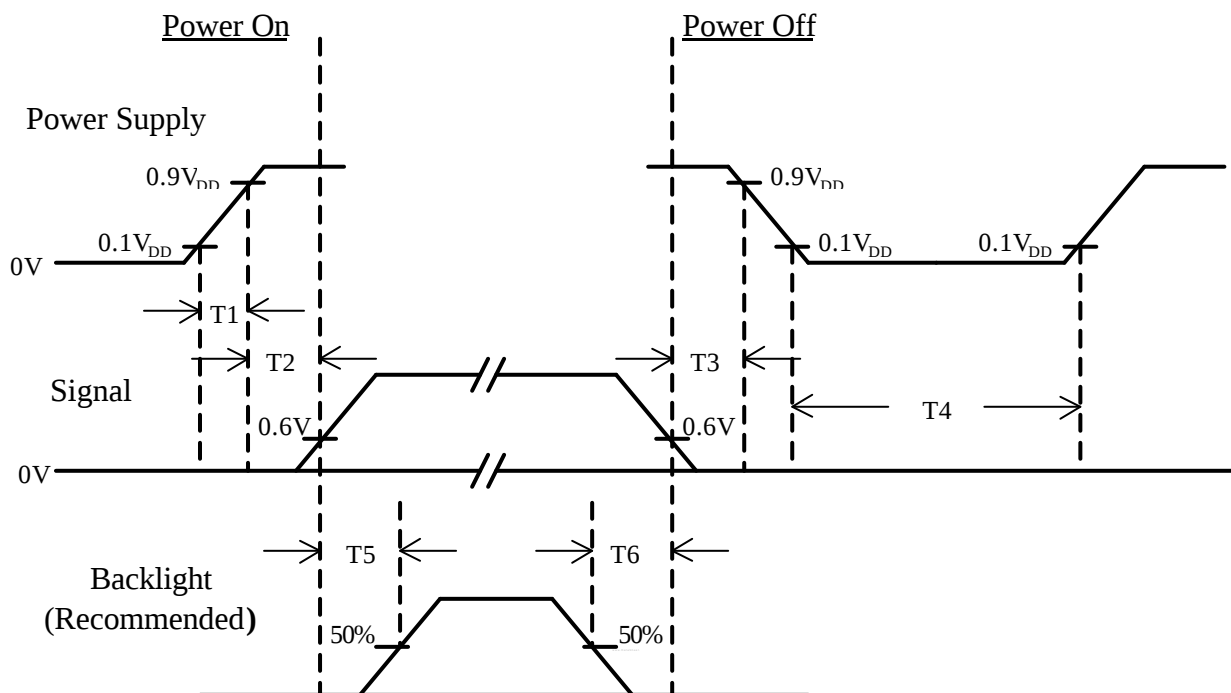
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7.2 Timing Diagram of Interface Signal (DE mode)



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7.3 Power ON/OFF Sequence



Item	Min.	Typ.	Max.	Unit	Remark
T1	0.4	-	10	msec	
T2	100	-	200	msec	
T3	0	-	50	msec	
T4	1000	-	-	msec	
T5	200	-	-	msec	
T6	200	-	-	msec	

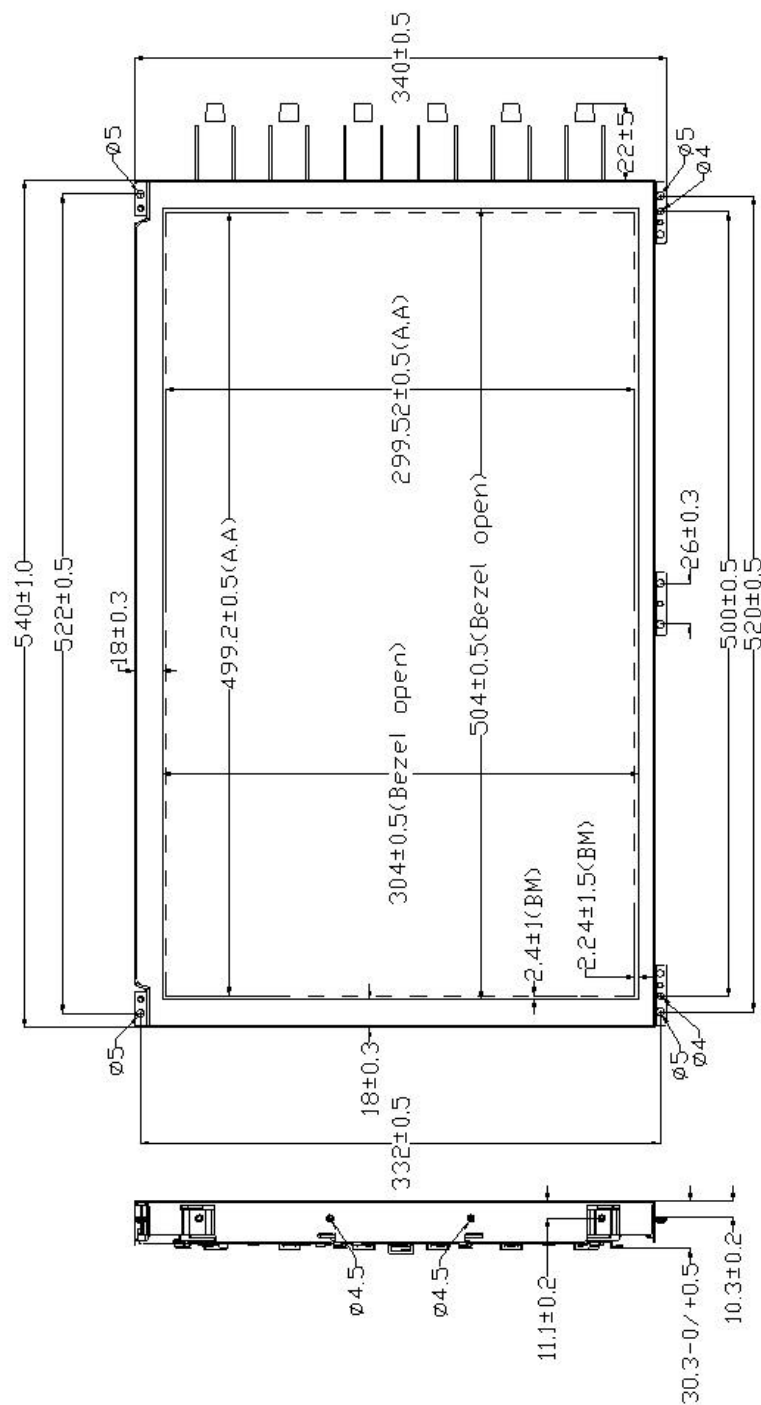
- (1) The supply voltage of the external system for the module input should be the same as the definition of V_{DD}.
- (2) Apply the lamp voltage within the LCD operation range. When the back-light turns on before the LCD operation or the LCD turns off before the back-light turns off, the display may 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.

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8.0 OUTLINE DIMENSION

(1) Front view outline dimension

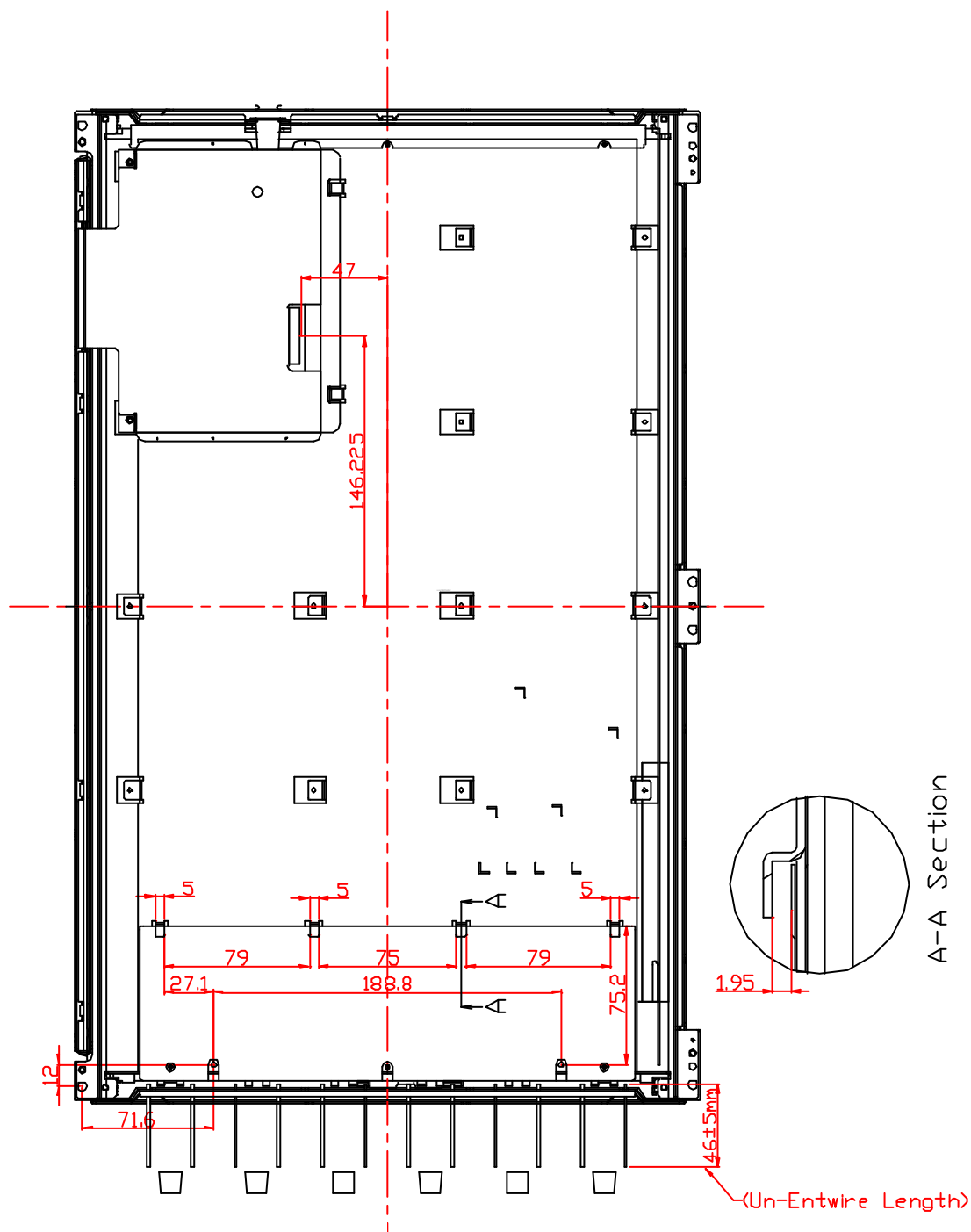
Unit: mm



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(2) Back view outline dimension

Unit: mm



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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

9.2 Sub Model Code

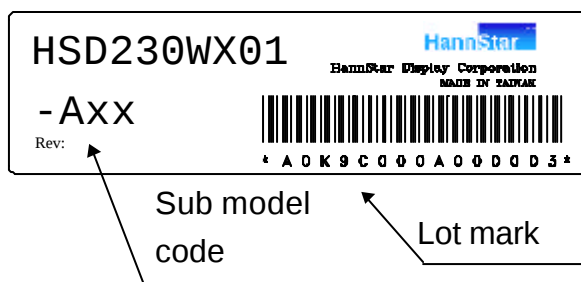
1	2	3
---	---	---

code 1: Panel sub model code of type. (A~Z)

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

9.3 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.



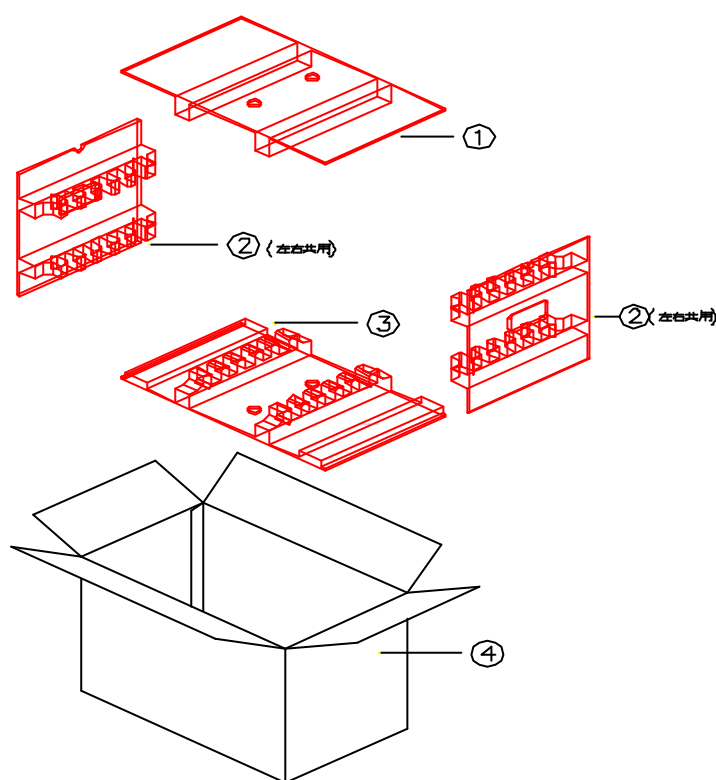
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10.0 PACKAGE SPECIFICATION

10.1 packing form

- (1) package quantity in one carton: 5 pieces.
- (2) carton size: 666 ±6 mm ×397 ±6 mm ×478 ±6 mm.
- (3) for domestic transportation only.

10.2 packing assembly drawings



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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.

11.2 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.

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.

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.

11.5 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 to employ protection circuit for power supply.

11.6 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.

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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.

11.7 Mechanism

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

11.8 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 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.

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.