HannStar Display Corp.

Document Title	**HSD280MUW1- A** Formal Specification	Page No.	1 / 26
Document No.		Revision	1.0

To : 深耕

Date : May., 05, 2009

Formal Specification

Model : **HSD280MUW1 - A****

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.
3.The mark " ** " of Model means sub-model code.

Record of Revisions

Rev.	Date	Sub-Model	Description of change
1.0	Jan.29.2007	-A00	Formal specification for HSD280MUW1-A was first issued.

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1.0 GENERAL DESCRIPTIONS

1.1 Introduction

HannStar Display model **HSD280MUW1-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 28-inch diagonally measured active display area with WUXGA resolution (1920 vertical by 1200 horizontal pixel array).

1.2 Features

- 28” WUXGA TN mode TFT LCD panel
- High speed response time
- Supported WUXGA (H: 1920 pixels, V: 1200 lines) resolution
- With LCD Timing Controller
- RoHS compatible
- With inverter

1.3 General information

Item	Specification		Unit
Outline dimension	629.0× 417.0× 30.0 (typ.)		mm
Display area	593.28 (H) x370.8 (V)		mm
Number of Pixel	1920(H) x 1200(V)		Pixels
Pixel pitch	0.309(H) x 0.309(V)		mm
Pixel arrangement	RGB Vertical stripe		
Display color	16.7M (6-bit+HiFRC)		
Display mode	Normally white		
Surface treatment	Antiglare, Hard-Coating (3H)		
Response Time	Tr + Tf	5 (TYP.)	Msec
	GTG	3 (TYP.)	
Weight	4800		G
Input signal	2-ch LVDS		
Power consumption	Logic system	6.2 (TYP.)	W
	B/L system	75 (TYP)	W

1.4 Applications

- Desktop and Multi-function monitors
- Display terminals for AV applications
- Monitors for industrial applications

1.5 Mechanical Information

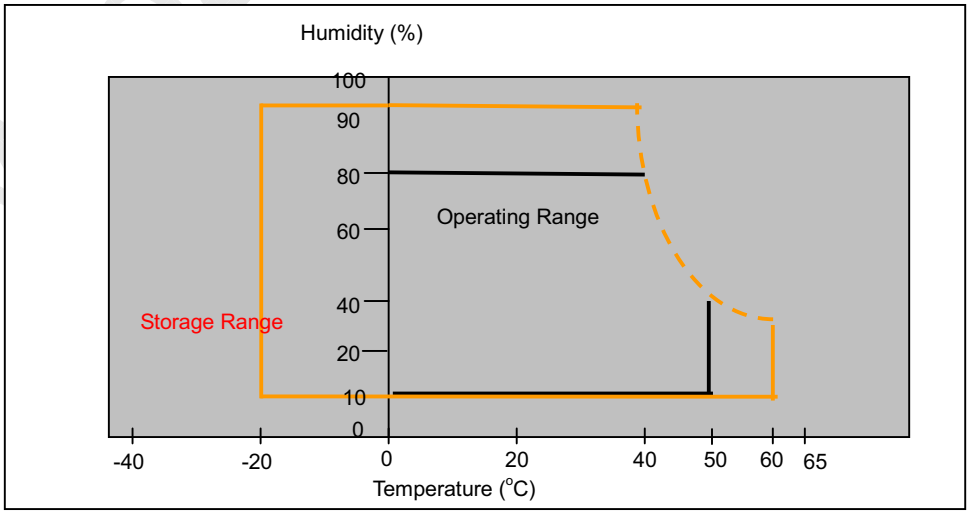
Item		Min.	Typ.	Max.	Unit
Module Size	Horizontal(H)	628.0	629.0	630.0	mm
	Vertical(V)	416.0	417.0	418.0	mm
	Depth(D)	29.5	30.0	30.5	mm
Weight (With Inverter)		4600	4800	5000	g
Torque of customer screw hole				3.0	Kgf*Cm

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	(1)
Vibration (non-operating)	V_{NOP}	--	1.5	G	(2)
Shock (non-operating)	S_{NOP}	--	50	G	(3)
Storage humidity	H_{STG}	10	90	%RH	(3)
Operating humidity	H_{OP}	10	80	%RH	(4)
Low pressure (operating)	P_{LOP}	697	--	HPa	(5)
Low pressure (non-operating)	P_{LNOP}	116	--	HPa	(6)

Note (1) Storage /Operating temperature



(2) 10-500Hz sine wave, X,Y,Z each directions, 30min/cycle.
(3) 11ms, ±X, ±Y, ±Z direction, one time each. For this shock test,
It is necessary to fill the silicon rubber between the shock jigs as buffer.
(4) Max wet bulb temp. =39°C
(5) 2 hrs. (10000 feet)
(6) 24hrs. (50000 feet)

2.2 Electrical Absolute Rating:

2.2.1 TFT LCD Module:

Item	Symbol	Min.	Max.	Unit.	Note
Power supply Voltage	VDD	-0.3	6.0	V(DC)	(1)(2)

2.2.2 Inverter Unit:

Item	Symbol	Min.	Max.	Unit	Note
Power supply Voltage / Inverter	Vin	21.6	26.4	V	(1)(2)
B/L On/Off Control Input Voltage	ON/OFF	2.5	5.0	V	(1)(2)
Brightness Control Input Voltage	V_{BRT}	0	5.0	V	(1)(2)

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.
(2) Within Ta=25±2℃

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	600	800	--		(1)(2)
Response time	Rising	TR		--	5 (Tr+Tf)	10 (Tr+Tf)	msec	(1)(3)
	Falling	TF		--				
White luminance (center of screen)		Y_L		400	500		cd/m^2	(1)(4)(7) (IL=6.5mA)
Color chromaticity (CIE1931)	Red	Rx		0.620	0.650	0.680		(1)(5)
		Ry		0.300	0.330	0.360		
	Green	Gx		0.270	0.300	0.330		
		Gy		0.590	0.620	0.650		
	Blue	Bx		0.110	0.140	0.170		
		By		0.035	0.065	0.095		
	White	Wx		0.280	0.310	0.340		
		Wy		0.300	0.330	0.360		
Viewing angle	Hor.	Θ_L	CR>10	75	85	--		
		Θ_R		75	85	--		
	Ver.	Θ_H		75	80	--		
		Θ_L		75	80	--		
Brightness uniformity		B_{UNI}	$\Theta=0^o$ $\phi=0^o$	75	--	--	%	(6)

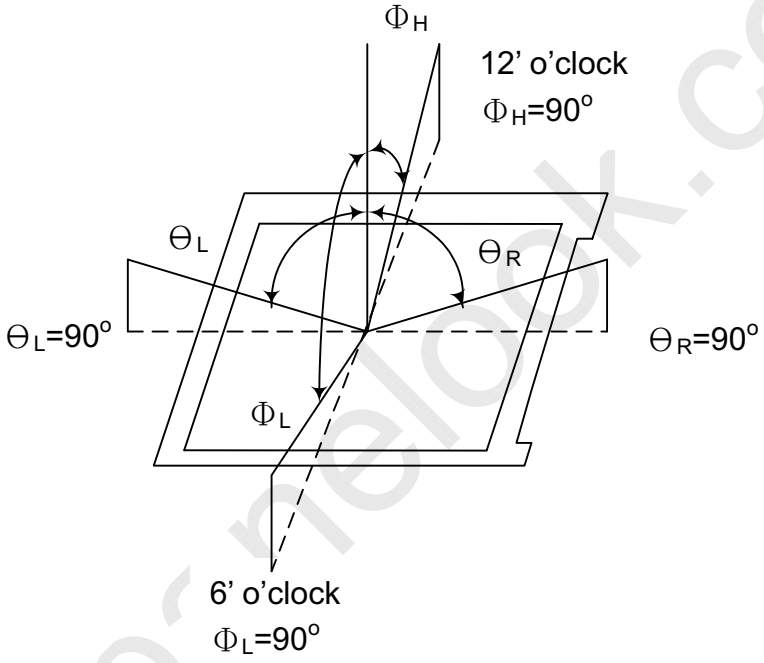
3.2 Measuring Condition

- Measuring surrounding: dark room
- Lamp current I_{BL}: Inverter: JST PHR-12
- V_{DD1}=5.0V, I_{bl}=6.5mA, f_V=60Hz, f_{DCLK}=77MHz
- Surrounding temperature: 25±2°C
- 30min. Warm-up time.

3.3 Measuring Equipment

- FPM520 of Westar Display technologies, INC., which utilized SR-3 for Chromaticity and BM-5A for other optical characteristics.
- Measuring spot size : 20~21mm

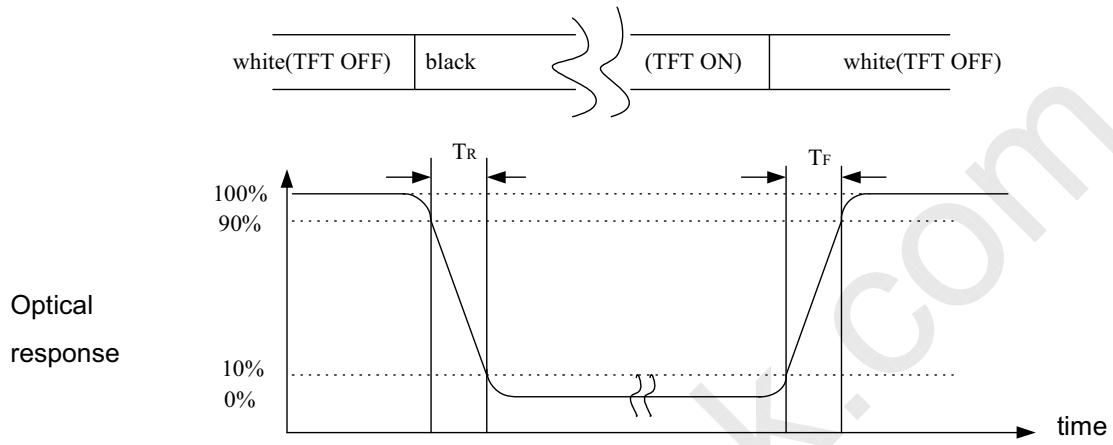
Note (1) Definition of Viewing Angle:



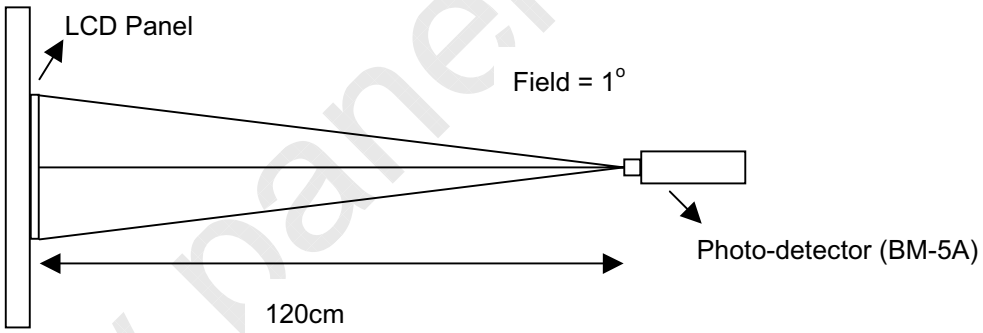
Note (2) Definition of Contrast Ratio(CR) :
measured at the center point of panel

$$CR = \frac{\text{Luminance with all pixels white (L255)}}{\text{Luminance with all pixels black (L0)}}$$

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

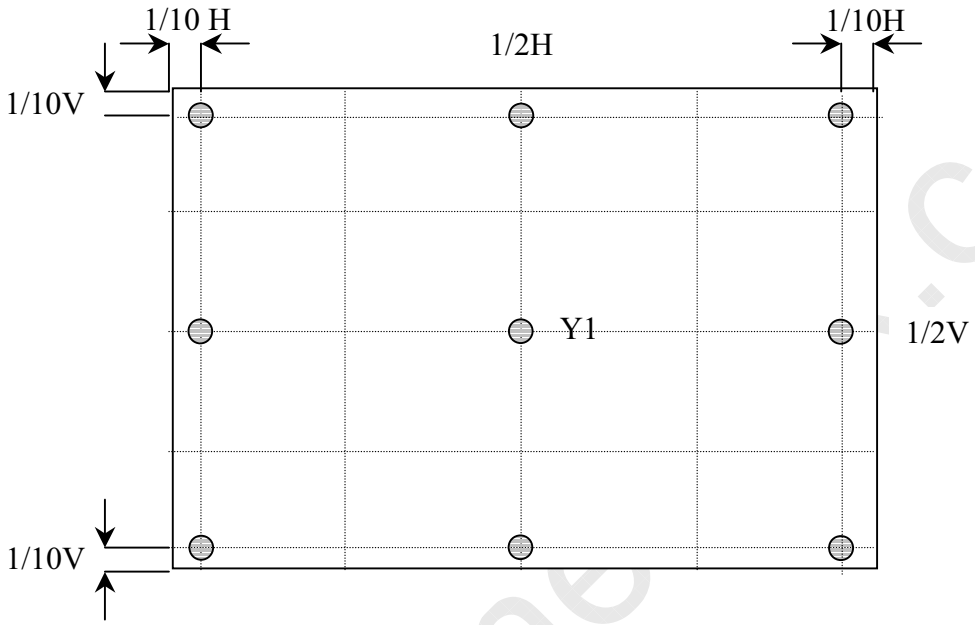


Note (4) Optical characteristic measurement setup



Note (5) Definition of Center Luminance of White

Center Luminance= Y1

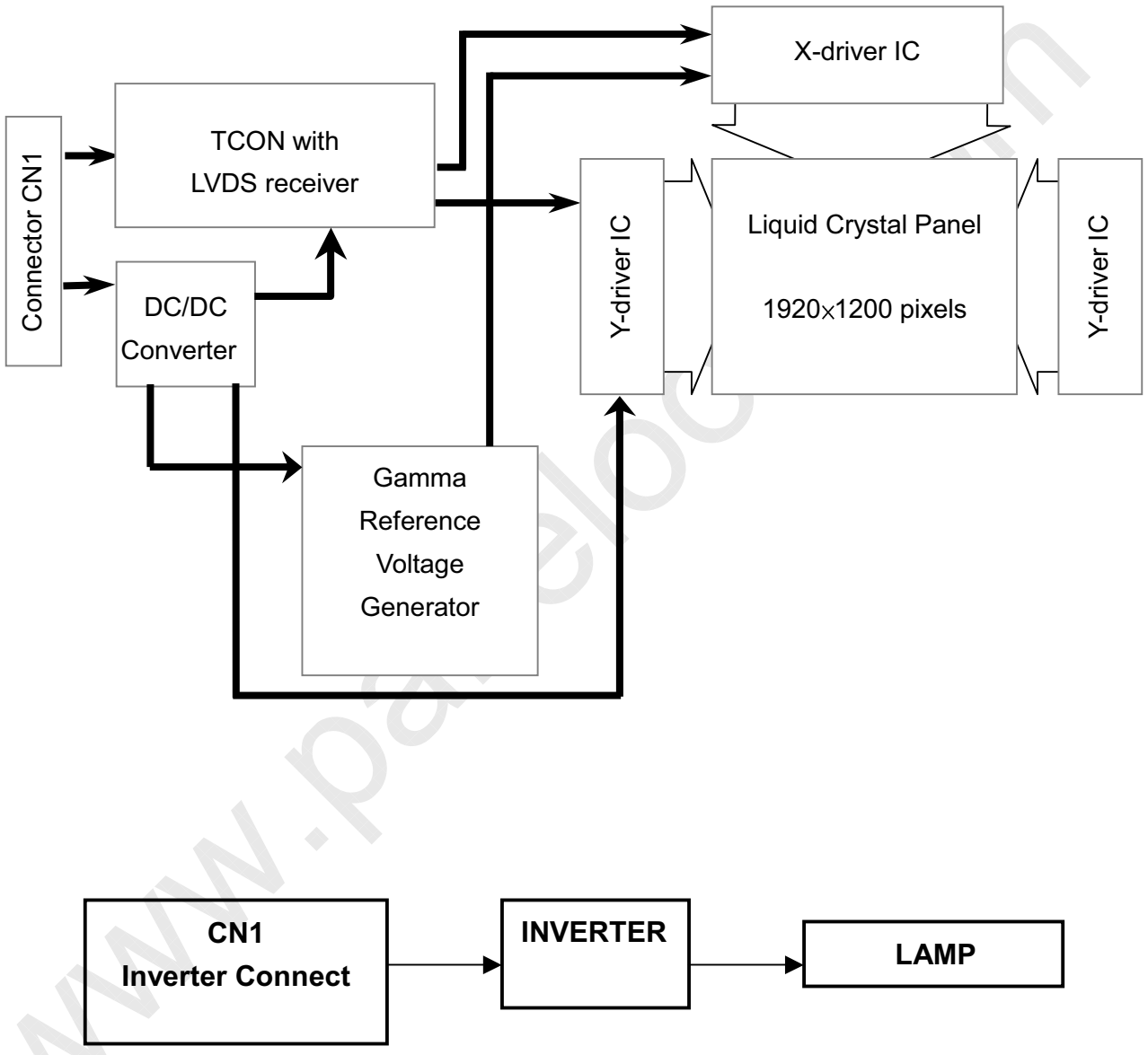


Note (6) Definition of brightness uniformity

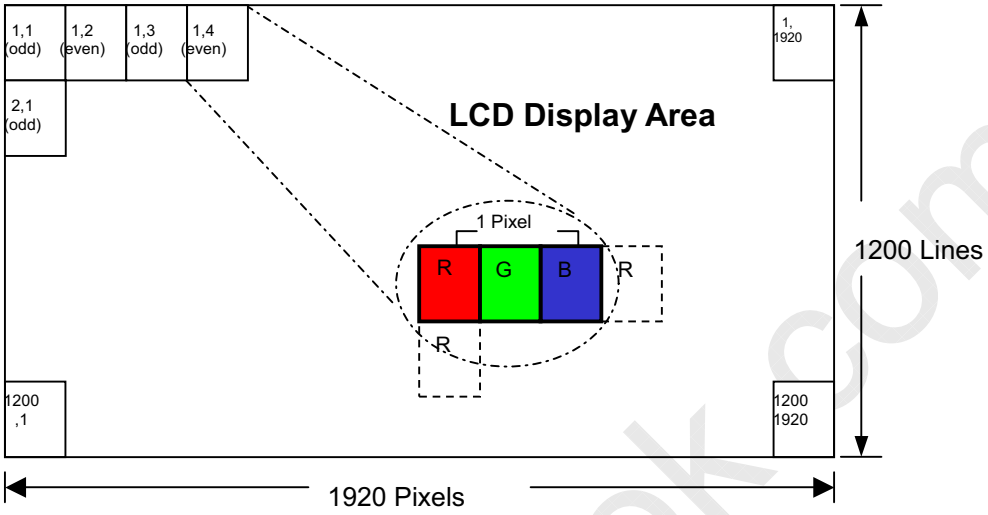
$$\text{Luminance uniformity} = \frac{\text{(Min Luminance of 9 points)}}{\text{(Max Luminance of 9 points)}} \times 100\%$$

4.0 BLOCK DIAGRAM

4.1 LCD Module Block Diagram:



4.2 Pixel Format



4.3 Relationship Between Displayed Color and Input

	Display	MSB R7	R6	R5	R4	R3	R2	R1	LSB R0	MSB G7	G6	G5	G4	G3	G2	G1	LSB G0	MSB B7	B6	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	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
	Light	H	H	H	H	H	H	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L255
		H	H	H	H	H	H	L	H	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L255
		H	H	H	H	H	H	H	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L255
	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
	Light	L	L	L	L	L	L	L	L	H	H	H	H	H	H	L	L	L	L	L	L	L	L	L	L	L255
		L	L	L	L	L	L	L	L	H	H	H	H	H	H	L	H	L	L	L	L	L	L	L	L	L255
		L	L	L	L	L	L	L	L	H	H	H	H	H	H	H	L	L	L	L	L	L	L	L	L	L255
	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
	Light	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	H	H	H	H	H	H	L	L	L255
		L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	H	H	H	H	H	H	L	H	L255
		L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	H	H	H	H	H	H	H	L	L255
	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
	Light	H	H	H	H	H	H	L	L	H	H	H	H	H	H	L	L	H	H	H	H	H	H	L	L	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
		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

5.0 I/O CONNECTION PIN ASSIGNMENT

5.1 Interface Connector (30-pins) (JAE: FI-X30SSL-HF or equivalent)

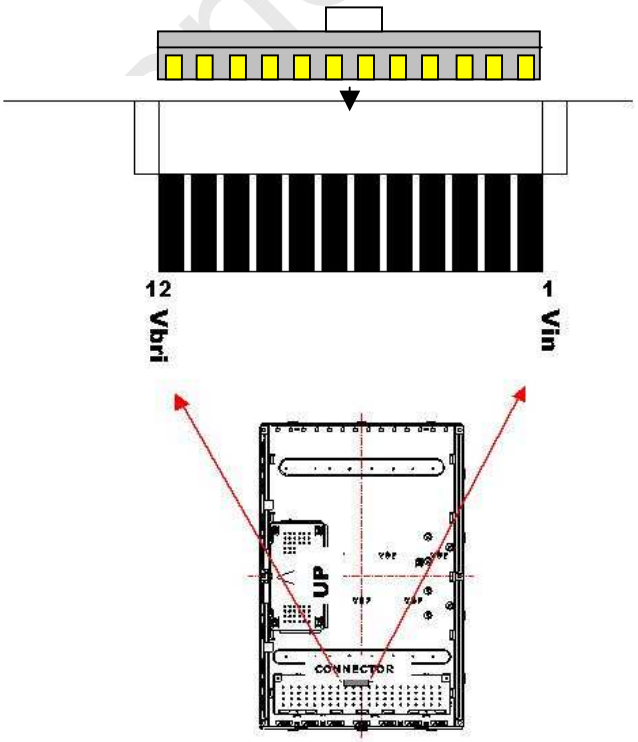
Pin No.	Signal	Description
1	RinO0-	Receiver Signal (-)
2	RinO0+	Receiver Signal (+)
3	RinO1-	Receiver Signal (-)
4	RinO1+	Receiver Signal (+)
5	RinO2-	Receiver Signal (-)
6	RinO2+	Receiver Signal (+)
7	VSS	Ground
8	RinOC-	Clock Signal (-)
9	RinOC+	Clock Signal (+)
10	RinO3-	Receiver Signal (-)
11	RinO3+	Receiver Signal (+)
12	RinE0-	Receiver Signal (-)
13	RinE0+	Receiver Signal (+)
14	VSS	Ground
15	RinE1-	Receiver Signal (-)
16	RinE1+	Receiver Signal (+)
17	VSS	Ground
18	RinE2-	Receiver Signal (-)
19	RinE2+	Receiver Signal (+)
20	RinEC-	Clock Signal (-)
21	RinEC+	Clock Signal (+)
22	RinE3-	Receiver Signal (-)
23	RinE3+	Receiver Signal (+)
24	VSS	Ground
25	NC	SDA
26	NC	SCL
27	NC	NC
28	VDD+5V	Power Supply, 5V (Typical)
29	VDD+5V	Power Supply, 5V (Typical)
30	VDD+5V	Power Supply, 5V (Typical)

5.2 Inverter Connector Pin Assignment

CN1 (INPUT SIGNAL): JST JST-PHR-12 or equivalent

Pin No.	Symbol	Description
1	Vin	Input Voltage
2	Vin	Input Voltage
3	Vin	Input Voltage
4	Vin	Input Voltage
5	Vin	Input Voltage
6	GND	Ground
7	GND	Ground
8	GND	Ground
9	GND	Ground
10	GND	Ground
11	Von/off	Inverter on/off control 0V—>OFF, 5V→ON
12	Vbri	Brightness control 5~0V→light~dark

NOTE: START FROM RIGHT SIDE



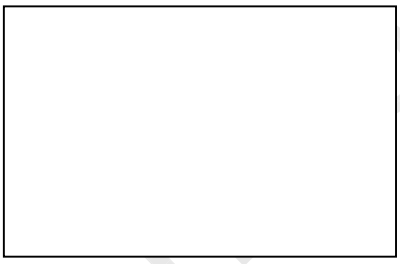
6.0 ELECTRICAL CHARACTERISTICS

6.1 TFT LCD Module:

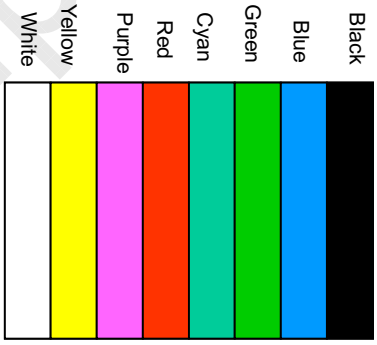
Item	Symbol	Min.	Typ.	Max.	Unit	Note
Voltage of power supply	V_{DD}	4.5	5.0	5.5	V	
Current of power supply	I_{DD0}	750	850	950	mA	(1)
	I_{DD1}	1135	1235	1335	mA	(1)
	I_{DD}	1995	2095	2195	mA	(1)
Vsync frequency	f_V	48	60	68	Hz	(2)
Hsync frequency	f_H	58.89	74.04	83.74	KHz	
Frequency	f_{DCLK}	60.5	80	88	MHz	
Input rush current	I_{RUSH}	---	---	6	A	(3)

Note (1)

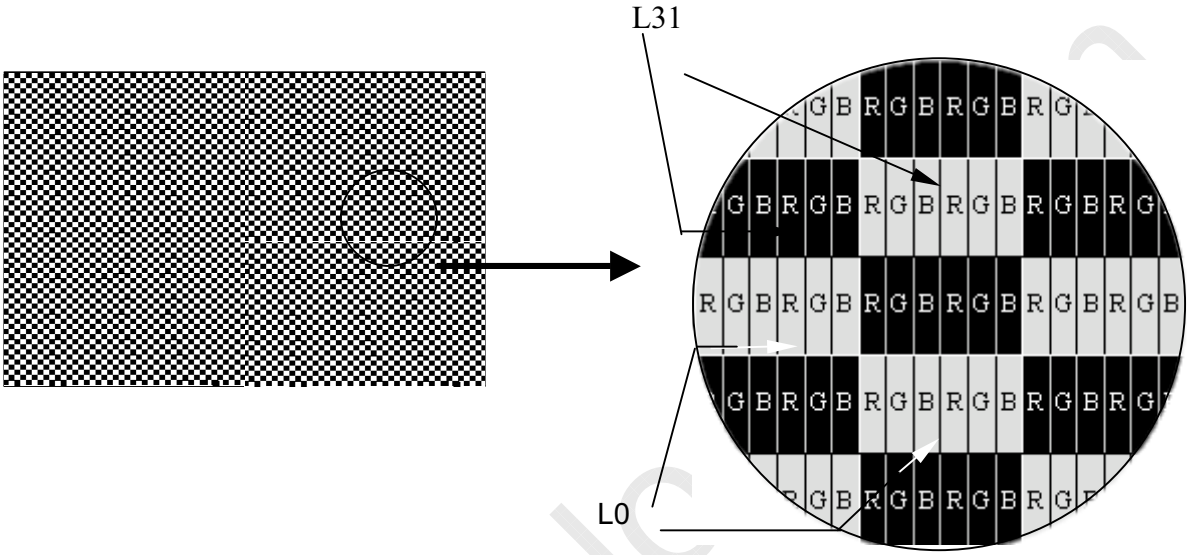
(a)White:



(b).V-Color :

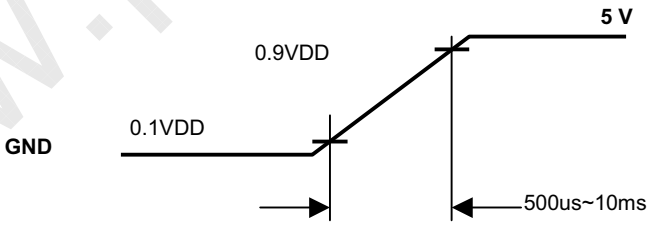


(c)Mosaic : 2 Dot checker image



Grey scale:L0~L255
L0: Luminance with all pixels black.
L255: Luminance with all pixels white.

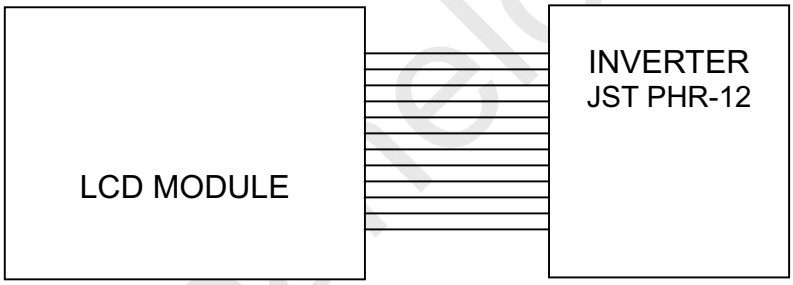
Note (2) When fv is too low, a flicker may be occurred on the display.
Note (3) Input Rush Current condition



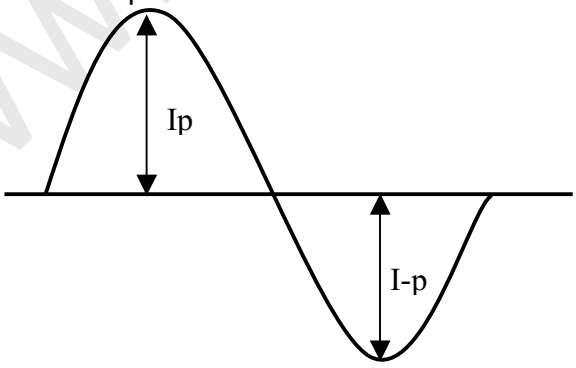
6.2 Inverter Electrical Characteristics

Item	Symbol	Min.	Typ.	Max.	Unit	Remarks
Voltage of Power Supply	Vin	21.6	24	26.4	V	
B/L ON/OFF Control Input Voltage	ON/OFF	2.5	--	5.0	V	CFL (turn ON)
	ON/OFF	0.0	--	2.5	V	CFL (turn OFF)
Brightness Control Input Voltage	V_{BRT}	0	--	5	V	0V: Min. brightness control 5V: Max. brightness control
Input Current of Power Supply	Iin	--	3.4	4.0	A	Vin= 24.0V, V_{BRT}= 0.0V, stable condition
Lamp Lifetime		--	50000	--	Hrs	Note (1)

Note (1) Lamp life time (Hr) can be defined as the time in which it continues to operate under the condition: Ta=25±3°C, typical lamp current until the brightness becomes less than 50%.



a. The asymmetry rate of the inverter waveform should be less than 10%.
b. The distortion tae of the waveform should be within √2±10%.
c. The inverter output waveform should be better similar to the ideal sine wave.



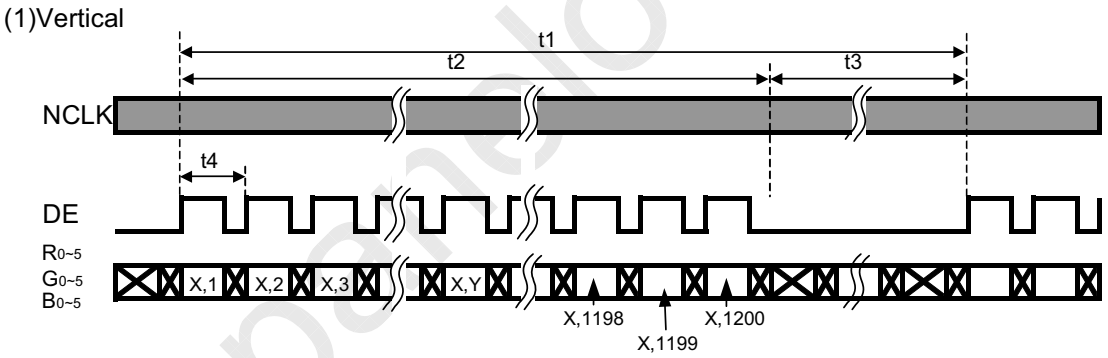
Asymmetry rate = $|I_p - I_{-p}| / I_{rms} \times 100\%$
Distortion rate = I_p (or I_{-p}) / I_{rms}

6.3 Interface Timing (DE mode)

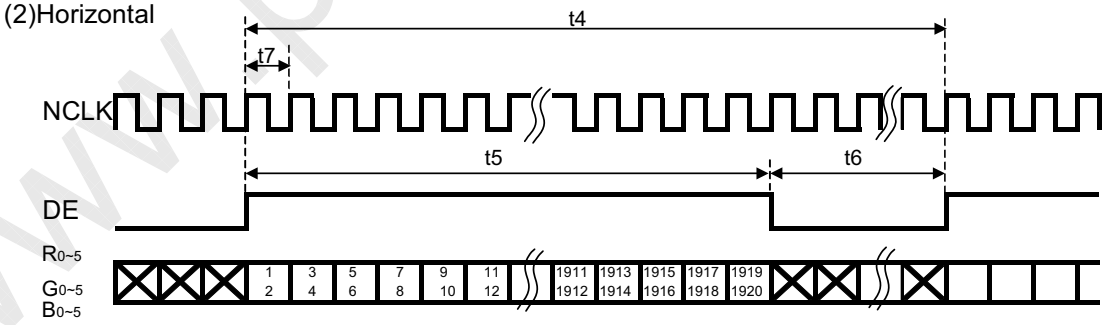
Item	Symbol	Min.	Typ.	Max.	Unit
Frame Rate	--	48	60	68	Hz
Frame Period	t1	1206	1235	1350	line
Vertical Display Time	t2	1200	1200	1200	line
Vertical Blanking Time	t3	6	35	150	line
1 Line Scanning Time	t4	1040	1075	1200	clock
Horizontal Display Time	t5	960	960	960	clock
Horizontal Blanking Time	t6	80	115	240	clock
Clock Rate	t7	60.5	80	88	MHz

Timing Diagram of Interface Signal (DE mode)

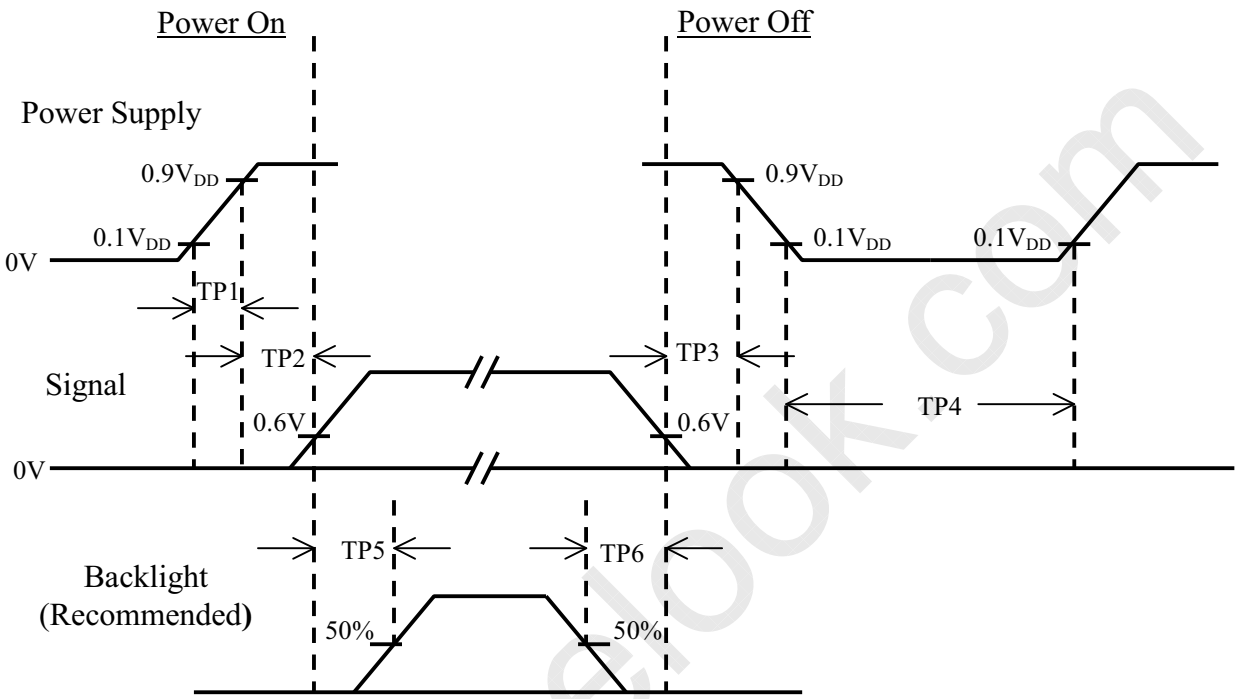
(1)Vertical



(2)Horizontal



6.4 Power On / Off Sequence：



Item	Min.	Typ.	Max.	Unit	Remark
TP1	0.5	--	10	msec	
TP2	0	--	50	msec	
TP3	0	--	50	msec	
TP4	500	--	--	msec	
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.

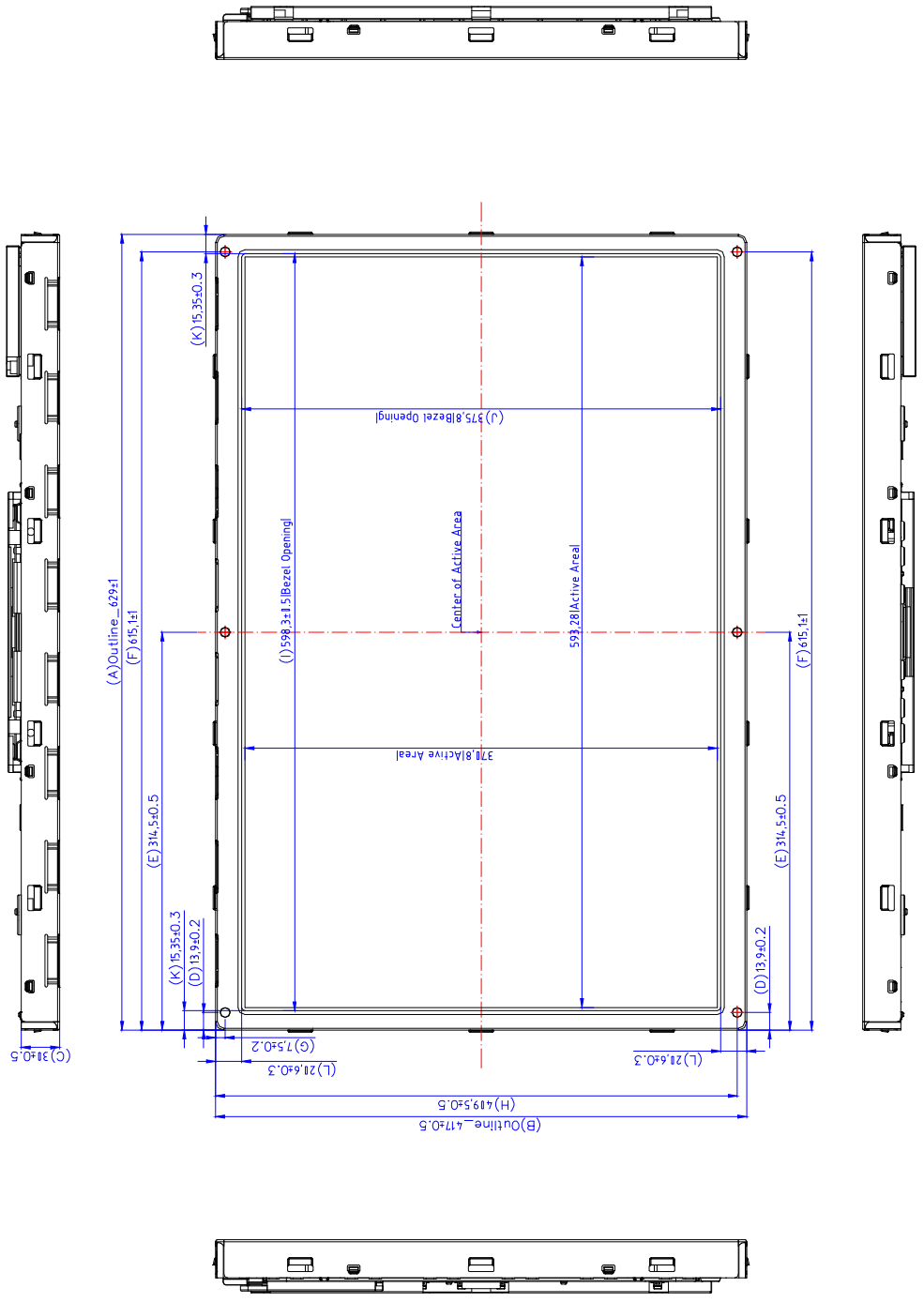
(3) In case of VDD = off level, please keep the level of input signal on the low or keep a high impedance.

(4) TP4 should be measured after the module has been fully discharged between power off and on period.

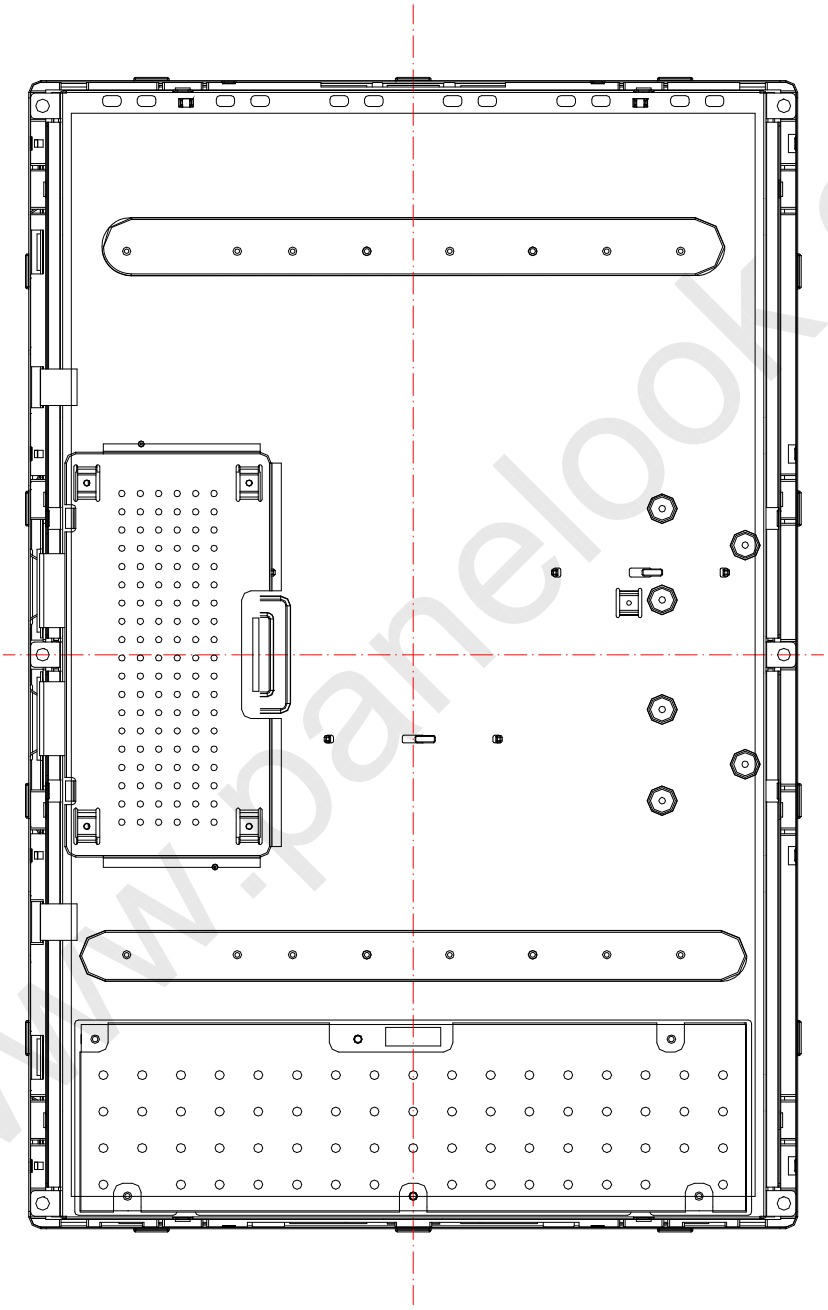
(5) Interface signal shall not be kept at high impedance when the power is on.

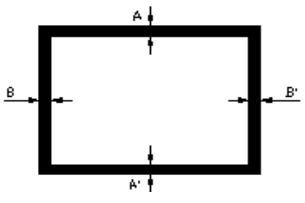
7.0 OUTLINE DIMENSION

7.1 Front View:



7.2 Back View:





BM Assembly Tolerance

| A-A' | ≤ 1 (mm)

| B-B' | ≤ 1 (mm)

8.0 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

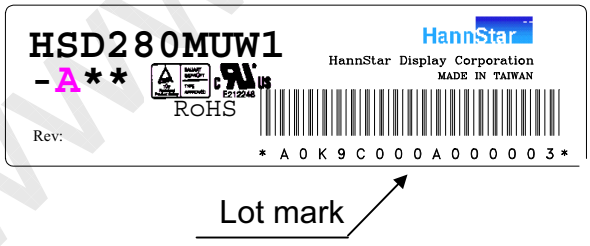
Year	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Mark	9	0	1	2	3	4	5	6	7	8

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 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

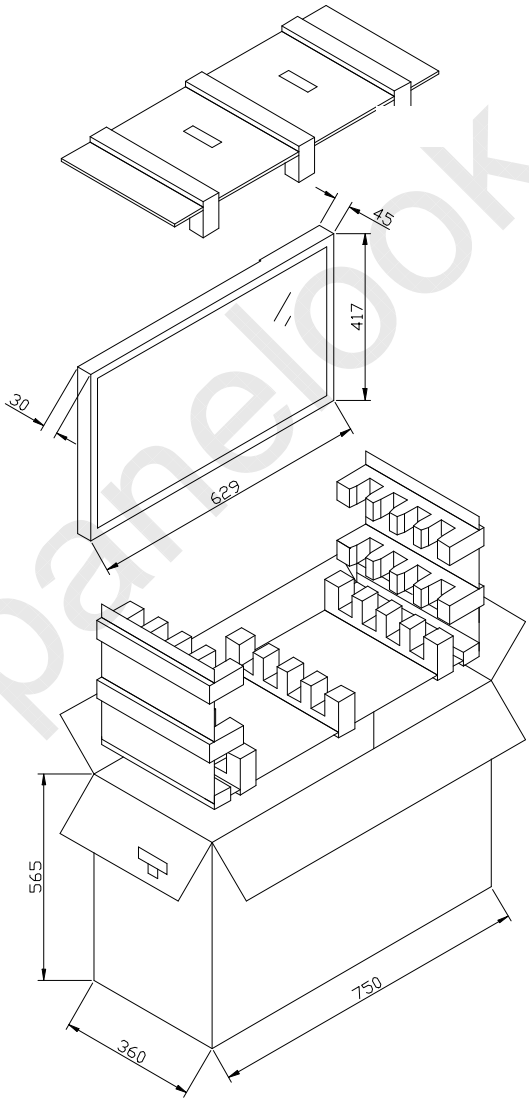
9.1 Packing form

(1) package quantity in one carton: 4 pieces.

(2) carton size: 746±3 mm×356±3 mm×553^{H}±3 mm.

(3) for domestic transportation only.

9.2 Packing assembly drawings



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

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

10.6.3 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.

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.