HannStar Display Corp.

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Document No.		Revision	1.0

TO :

Date : Aug.15 2008

HannStar Product Information

Model : **HSD156MGW1 -A****

Note:1.The information contained herein is tentative 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.
4. The mark " ** " of Model means sub-model code.

Record of Revisions

Rev.	Date	Sub-Model	Description of change
1.0	Aug.15, 2008	A00	Preliminary Product Spec was first released for customer

Contents

1.0 GENERAL DESCRIPTION

1.1 Introduction

HannStar Display model HSD156MGW1-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 15.6 inch diagonally measured active display area with WXGA+ resolution (768 vertical by 1366 horizontal pixel) and can display up to 16.7M (6-bit+HiFRC)colors.

1.2 Features

- 15.6 WXGA+ for Monitor application
- High Resolution: 1366*768
- 1-ch LVDS interface system
- **LCD Timing Controller**
- Wide Viewing Angle
- RoHS Compatible
- VESA Compatible
- Halogen Free

1.3 Applications

- Desktop Monitor
- Display terminals for AV applications
- Display terminals for industrial application

1.4 General information

Item		Specification	Unit
Outline Dimension		363.8 x 215.9 x 14.3 (Typ.)	mm
Display area		344.2 (H) x 193.5 (V)	mm
Number of Pixel		1366(H) x 768(V)	pixels
Pixel pitch		0.252(H) x 0.252(V)	mm
Pixel arrangement		RGB Vertical stripe	
Display color		16.7M (6-bit+HiFRC)	colors
Color Gamut		63% NTSC	
Display mode		Normally white	
Surface treatment		Antiglare (3H)	
Weight		1300	g
Back-light		2-CCFLs, Top & bottom edge side	
Input signal		1-ch LVDS	
Power Consumption	Logic System	TBD(TYP.)	W
	B/L System	(8.4)(TYP.)	W

1.5 Mechanical Information

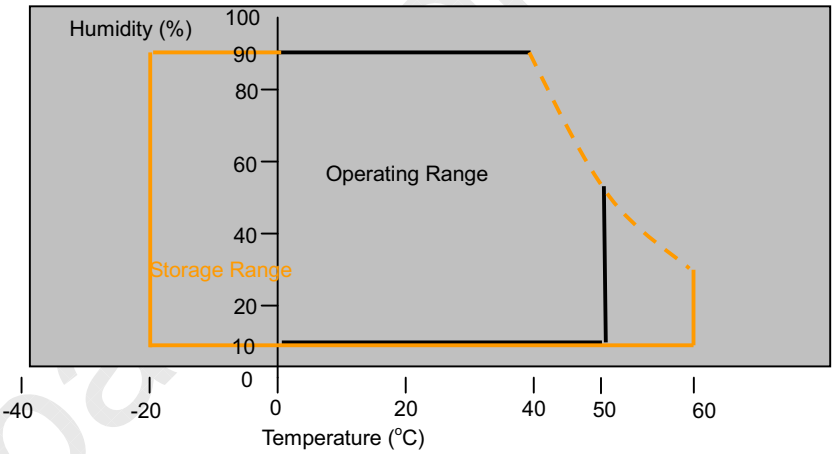
Item		Min.	Typ.	Max.	Unit
Module Size	Horizontal (H)	363.3	363.8	364.3	mm
	Vertical (V)	215.4	215.9	216.4	mm
	Depth (D)	(14.0)	(14.3)	(14.6)	mm
Weight (Without inverter)		-	1300	-	g
Torque of customer screw hole		-	-	3.0	Kgf•Cm

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}	—	70	G	(3)
Storage humidity	H_{STG}	10	90	%RH	(3)
Operating humidity	H_{OP}	10	90	%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) 5-500-5Hz 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 jig as buffer.

(4) Max wet bulb temp.= 39°C

(5) 2hrs. (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	V_{DD}	-0.3	6.0	V	(1) (2)
Logic input voltage	V_{IN}	-0.3	VDD+0.3	V	(1) (2)

2.2.2 Back-Light Unit

Item	Symbol	Min.	Max.	Unit	Note
Lamp current	I_L	3.0	8.0	mA	(1) (2)
Lamp frequency	f_L	40	60	KHz	(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) Ta =25±2℃

3.0 OPTICAL CHARACTERISTICS

3.1 Optical specification

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Contrast		CR	Θ=0 viewing angle - -	-	600	-		(1)(2)
Response time	Rising	T_R		-	(TBD)	-	msec	(1)(3)
	Falling	T_F		-	(TBD)	-		
	RT	T_R+T_F		-	8	-		
White luminance (Center)		Y_L		200	250	-	cd/m^2	(1)(4)(5) (I_L=7mA)
Color chromaticity (CIE1931)	Red	R_x		-	(TBD)	-		(1)(4)
		R_y		-	(TBD)	-		
	Green	G_x		-	(TBD)	-		
		G_y		-	(TBD)	-		
	Blue	B_x		-	(TBD)	-		
		B_y		-	(TBD)	-		
	White	W_x		0.283	0.313	0.343		
		W_y		0.299	0.329	0.359		
Viewing angle	Hor.	Θ_L	CR>10	-	70	-		
		Θ_R		-	70	-		
	Ver.	Θ_D		-	60	-		
		Θ_U		-	50	-		
Viewing angle	Hor.	Θ_L	CR>5	-	(TBD)	-		
		Θ_R		-	(TBD)	-		
	Ver.	Θ_D		-	(TBD)	-		
		Θ_U		-	(TBD)	-		
Brightness uniformity		B_{UNI}	Θ=0	70	75	-	%	(6)

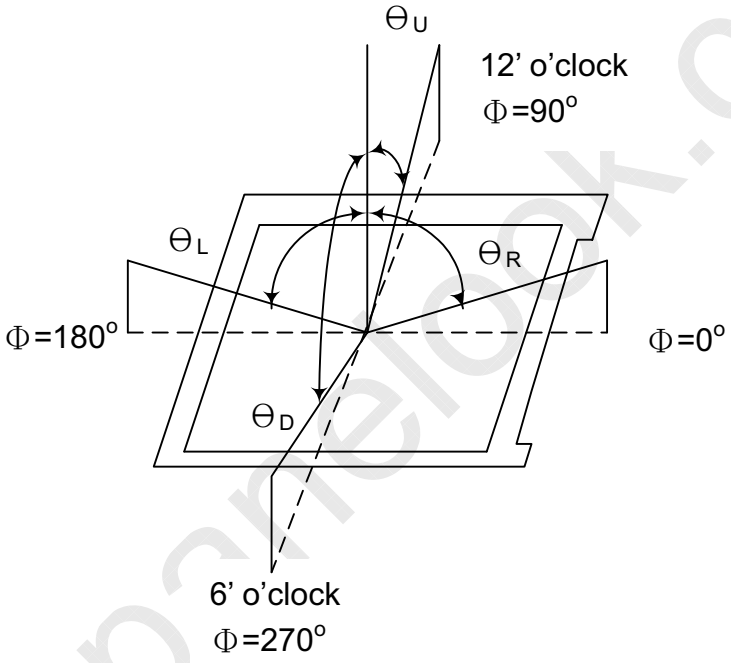
3.2 Measuring Condition

- Measuring surrounding: dark room
- Lamp current I_{BL}: 7.0±0.1mA, lamp freq. F_L=50 KHz, Inverter: TDK TBD315NR-1
- V_{DD}=5.0V, f_V=60Hz
- Ambient temperature: 25±2°C
- 30min. Warm-up time.

3.3 Measuring Equipment

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

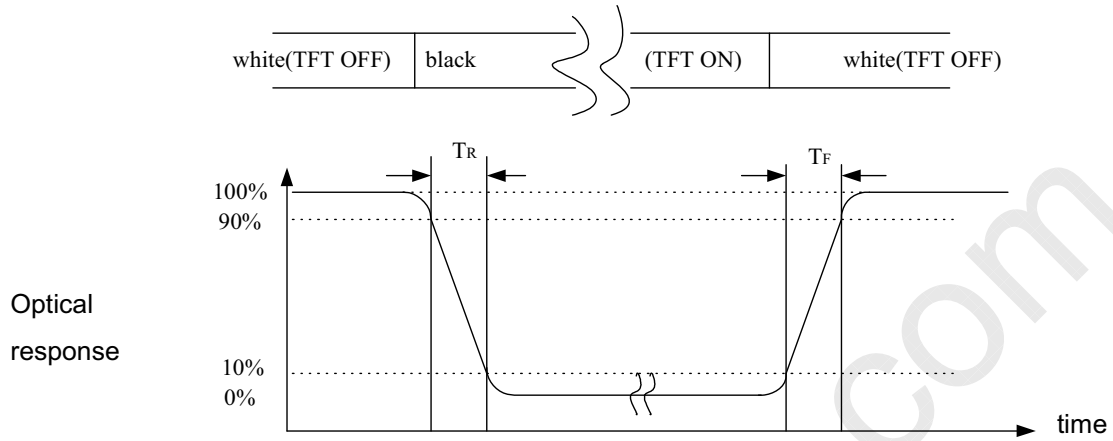
Note (1) Definition of Viewing Angle:



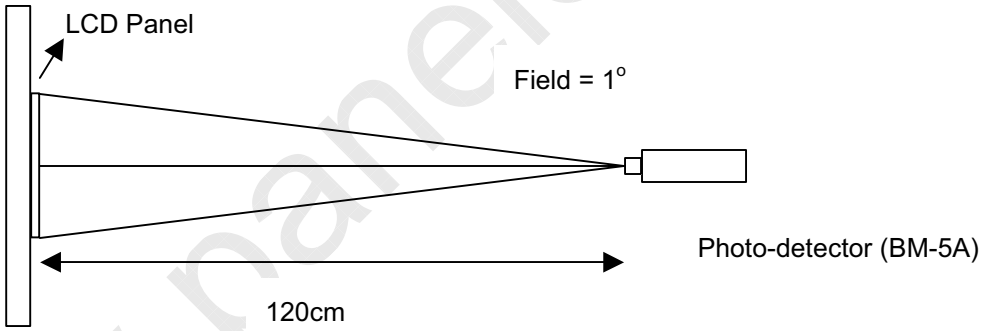
Note (2) Definition of Contrast Ratio (CR): measured at the center point of panel

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

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

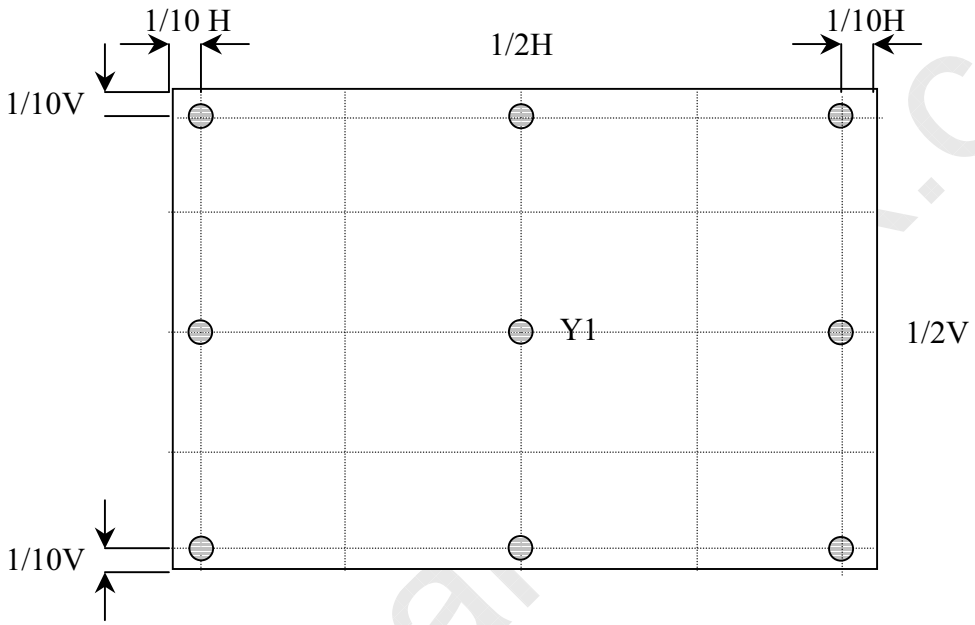


Note (4) Optical characteristic measurement setup



Note (5) Definition of Average Luminance of White

Center Luminance = Y_1

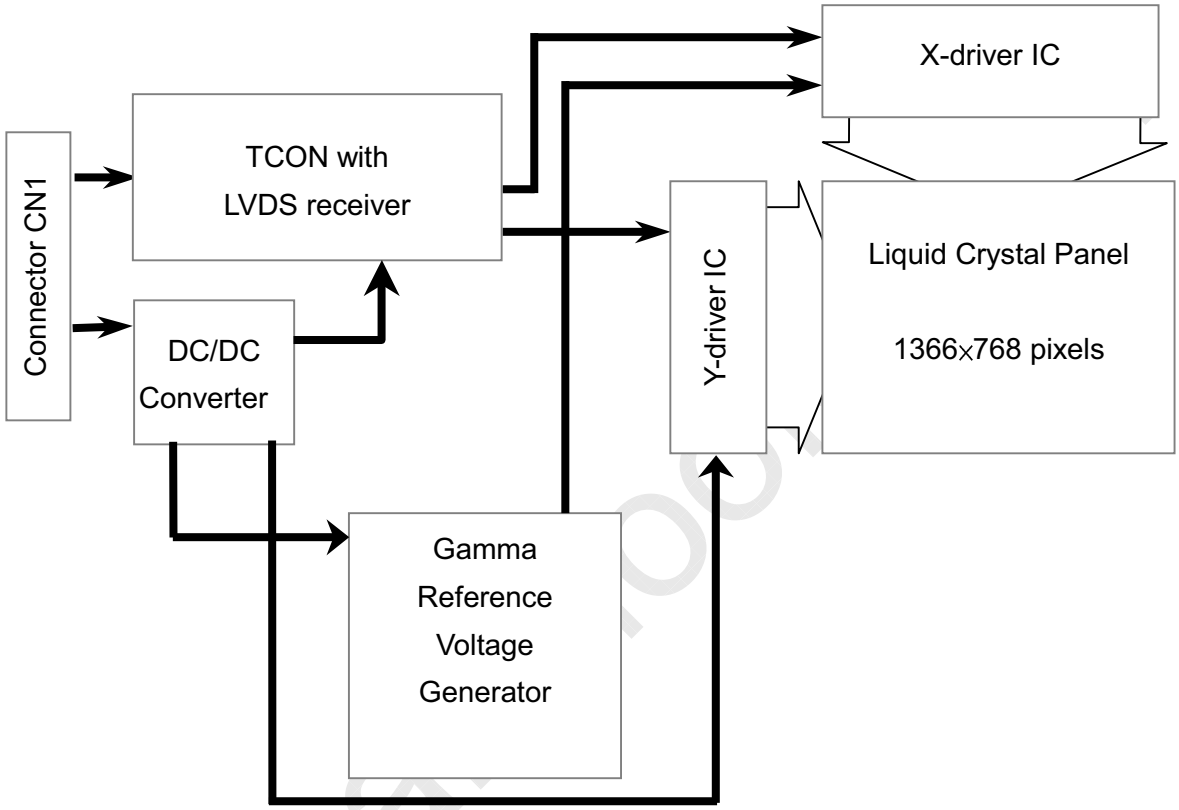


Note (6) Definition of brightness uniformity

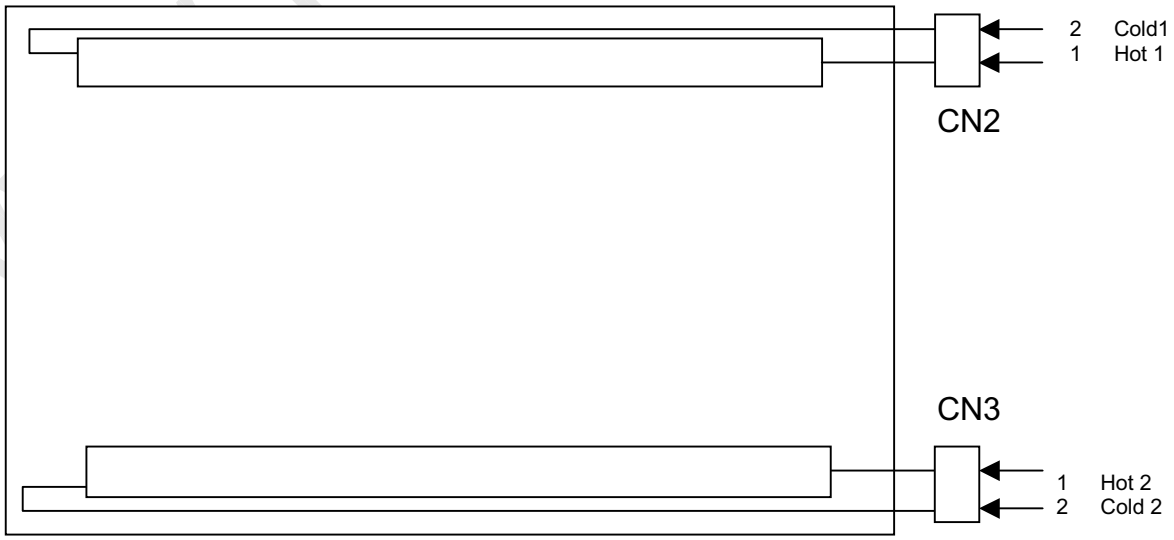
$$\text{Luminance uniformity} = \frac{\text{(Min Luminance of 9 points)}}{\text{(Max Luminance of 9 points)}} \times 100\%$$

4.0 BLOCK DIAGRAM

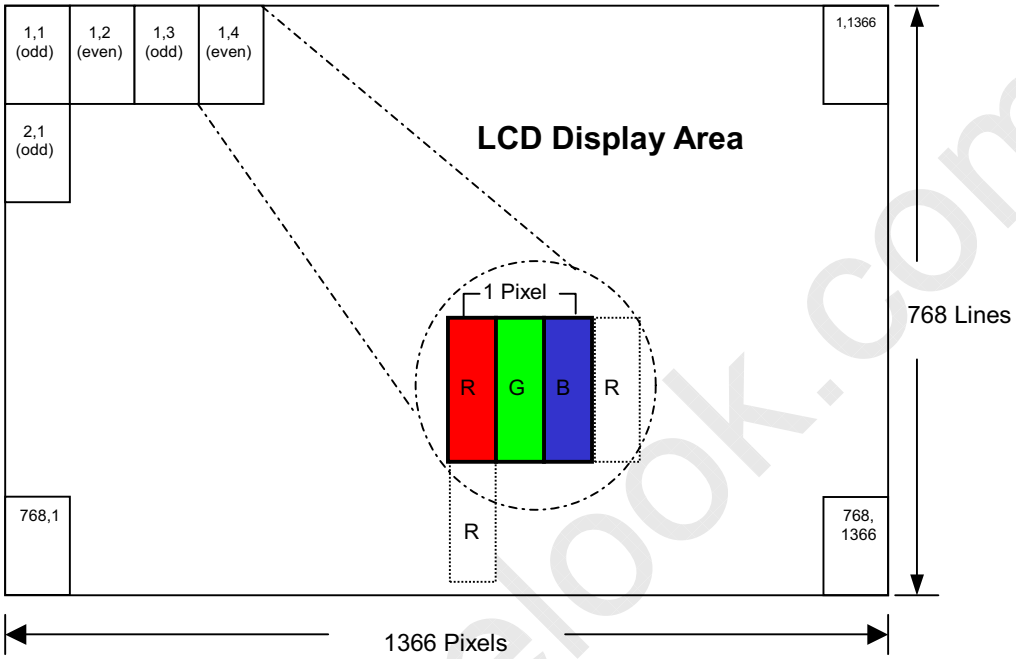
4.1 TFT LCD Module



4.2 Back Light Unit



4.3 Pixel Format



4.4 Relationship Between Displayed Color and Input

	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 & 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 INTERFACE PIN CONNECTION

5.1 TFT LCD Module

Interface Connector (30-pins) (JAE/FI-XB30SSRL-HF16 or equivalent)

Pin No.	Signal	Description
Frame	Vss	Ground
1	NC	No Connection
2	NC	No Connection
3	NC	No Connection
4	VSS	Ground
5	Rin0-	-LVDS differential data input, Chan 0
6	Rin0+	+LVDS differential data input, Chan 0
7	VSS	Ground
8	Rin1-	-LVDS differential data input, Chan 1
9	Rin1+	+LVDS differential data input, Chan 1
10	VSS	Ground
11	Rin2-	-LVDS differential data input, Chan 2
12	Rin2+	+LVDS differential data input, Chan 2
13	VSS	Ground
14	RinC-	-LVDS Differential Clock input
15	RinC+	+LVDS Differential Clock input
16	VSS	Ground
17	Rin3-	-LVDS differential data input, Chan 3
18	Rin3+	+LVDS differential data input, Chan 3
19	VSS	Ground
20	NC	No Connection
21	NC	No Connection
22	NC	No Connection
23	VSS	Ground
24	VSS	Ground
25	VSS	Ground
26	VDD+5V	Power Supply, 5V (Typical)
27	VDD+5V	Power Supply, 5V (Typical)
28	VDD+5V	Power Supply, 5V (Typical)
29	VDD+5V	Power Supply, 5V (Typical)
30	VDD+5V	Power Supply, 5V (Typical)
Frame	Vss	Ground

5.2 Back-Light Unit

CN2, 3: CCFL Power Source (YEONHO 35001HS –02L or equivalent)

Mating connector: SM02B-BHSS-1-TB or equivalent

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

6.0 ELECTRICAL CHARACTERISTICS

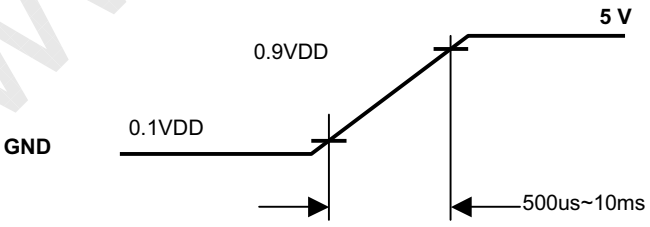
6.1 TFT LCD Module

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_{DD}	-	TBD	-	mA	(1)
Vsync frequency	f_V	(40)	60	(76)	Hz	(2)
Hsync frequency	f_H	(32.24)	48.36	(61.26)	KHz	
Frequency	f_{DCLK}	(50.3)	75.44	(85)	MHz	
Input rush current	I_{Rush}	-	-	3.0	A	(3)

Note (1) V_{DD} =5.0V, Black pattern (L0)

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

Note (3) Input Rush Current condition



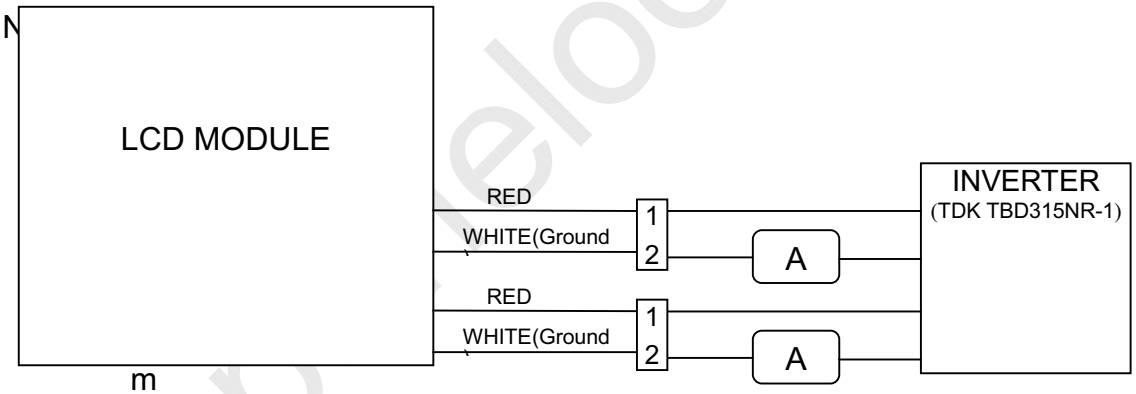
6.2 Back-Light Unit

The back- light system is an edge-lighting type with 2 CCFL.

The characteristic of the lamp is shown in the following tables.

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Lamp current	IL	3.0	7.0	8.0	mA(rms)	(1)(6)
Lamp voltage	VL	540	600	660	V(rms)	(6) I_L=7.0mA
Frequency	fL	40	50	60	KHz	(2)
Operating lamp life time	Hr	50,000	-	-	Hour	(3) I_L=7.0mA
Startup voltage	Vs	1100	-	-	V(rms)	(4)(5) at 25±2℃
		1520				(4)(5) at 0±2℃

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



m

p 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.

*Suggest the inverter frequency avoid fL=41~49KHz

Note (3) Lamp life time (Hr) can be defined as the time in which it continues to operate under the condition: Ta=25±2 °C, typical IL value indicated in the above table 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.

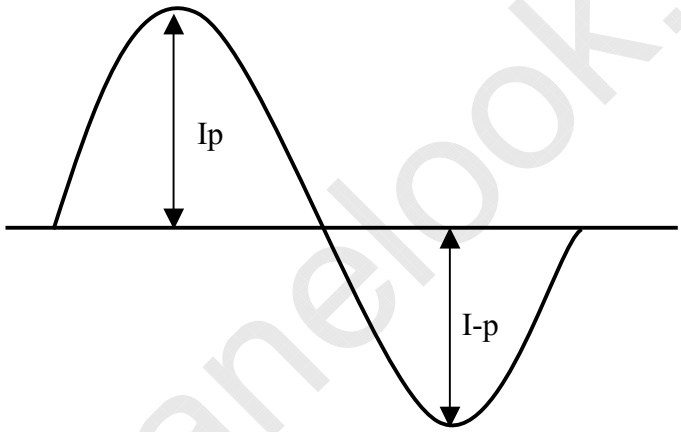
Note (5) The voltage over specified value (Vs) should be applied to the lamp more than 1 second after startup. Otherwise, the lamp may not be turned on. The used lamp current is the lamp typical current.

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 √2±10%.

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

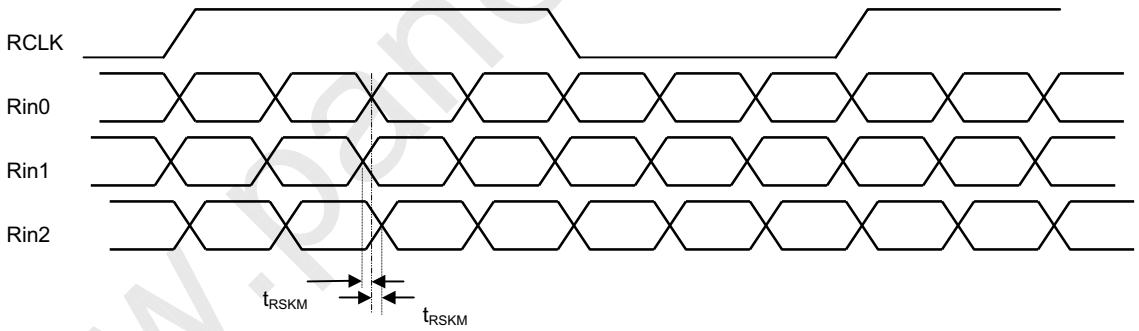


Asymmetry rate = |Ip-I-p| / Irms x 100%

Distortion rate = Ip (or I-p) / Irms

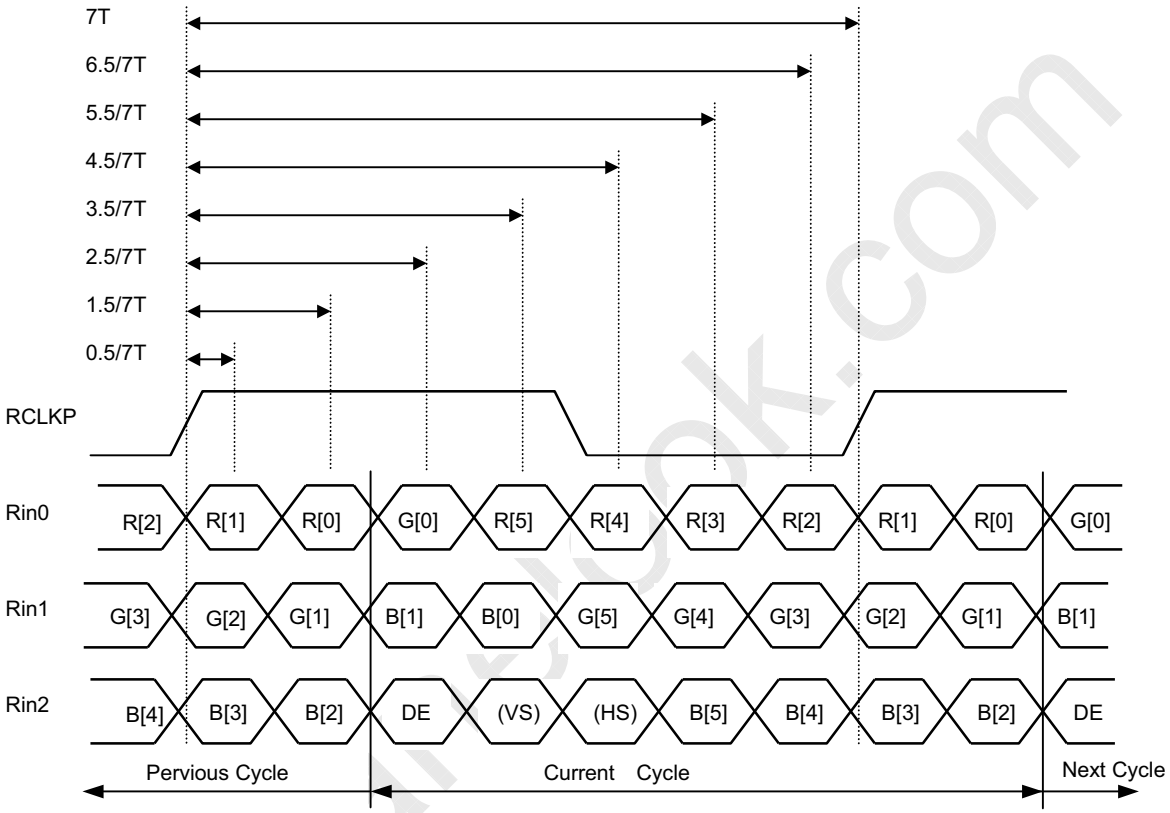
6.3 Switching Characteristics for LVDS Receiver

Item	Symbol	Min.	Typ.	Max.	Unit	Conditions
Differential Input High Threshold	Vth	100	—	—	mV	V_{CM}=1.2V
Differential Input Low Threshold	Vtl	—	—	-100	mV	
Input Current	I_{IN}	—	—	±10	uA	
		—	—	±10	uA	
Input Voltage Range(Signal ended)	V_{IN}	1.25-(|V_{ID}|)/2	—	1.25+(|V_{ID}|)/2	V	
Differential input Voltage	|V_{ID}|	200	—	600	mV	
Common Mode Voltage Offset	V_{CM}	(|VID|/2)	—	1.8-0.4-(|VID|/2)	V	
Clock Frequency	fc	(50.3)	75.44	(85)	MHz	
LVDS Skew Margin	t_{RSKM}	—	—	400	pS	At fc=85MHz
LVDS Input Clock Jitter Tolerance	—	—	—	TBD	%	center spread



LVDS Receiver skew margin

6.4 Bit Mapping & Interface Definition



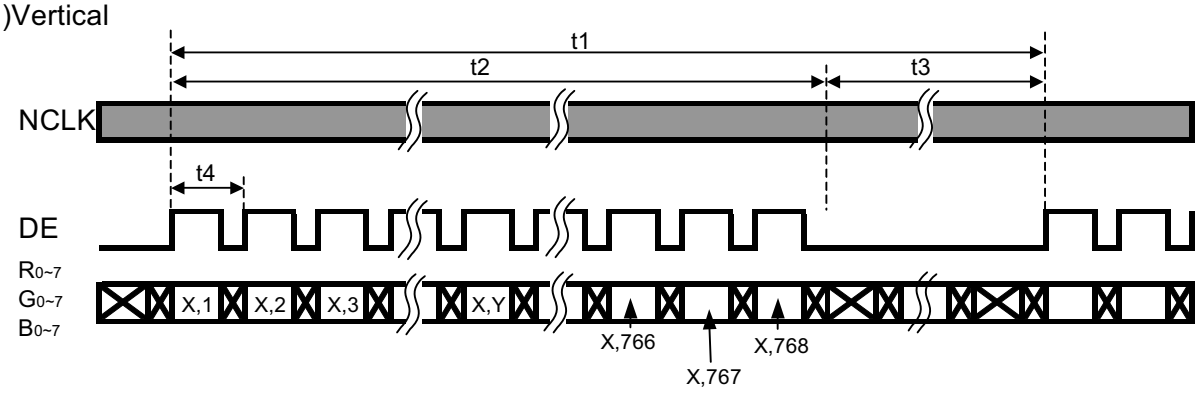
Bit Mapping & Timing Definition

6.5 Interface Timing (DE mode)

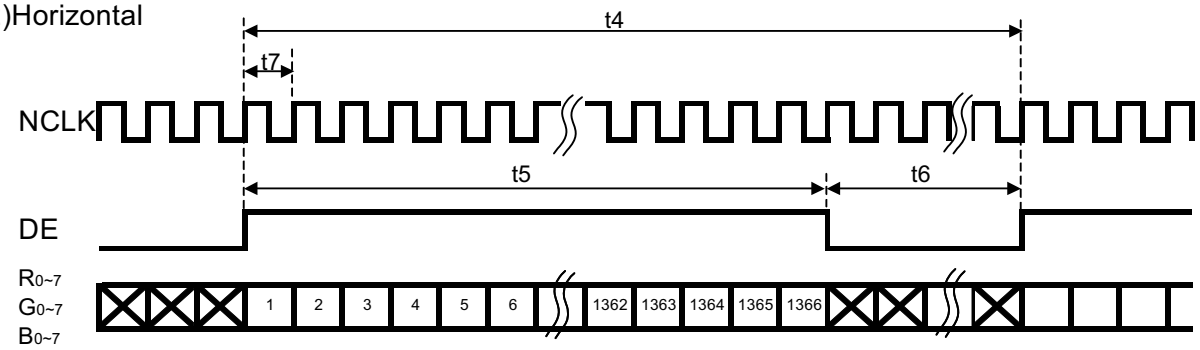
Item	Symbol	Min.	Typ.	Max.	Unit
Frame Rate	--	(40)	60	76	Hz
Frame Period	t1	(778)	(806)	(888)	line
Vertical Display Time	t2	768	768	768	line
Vertical Blanking Time	t3	t1-t2	38	t1-t2	line
1 Line Scanning Time	t4	(1446)	(1560)	(1936)	clock
Horizontal Display Time	t5	1366	1366	1366	clock
Horizontal Blanking Time	t6	t4-t5	194	t4-t5	clock
Clock Rate	t7	50.3	75.44	85	MHz

Timing Diagram of Interface Signal (DE mode)

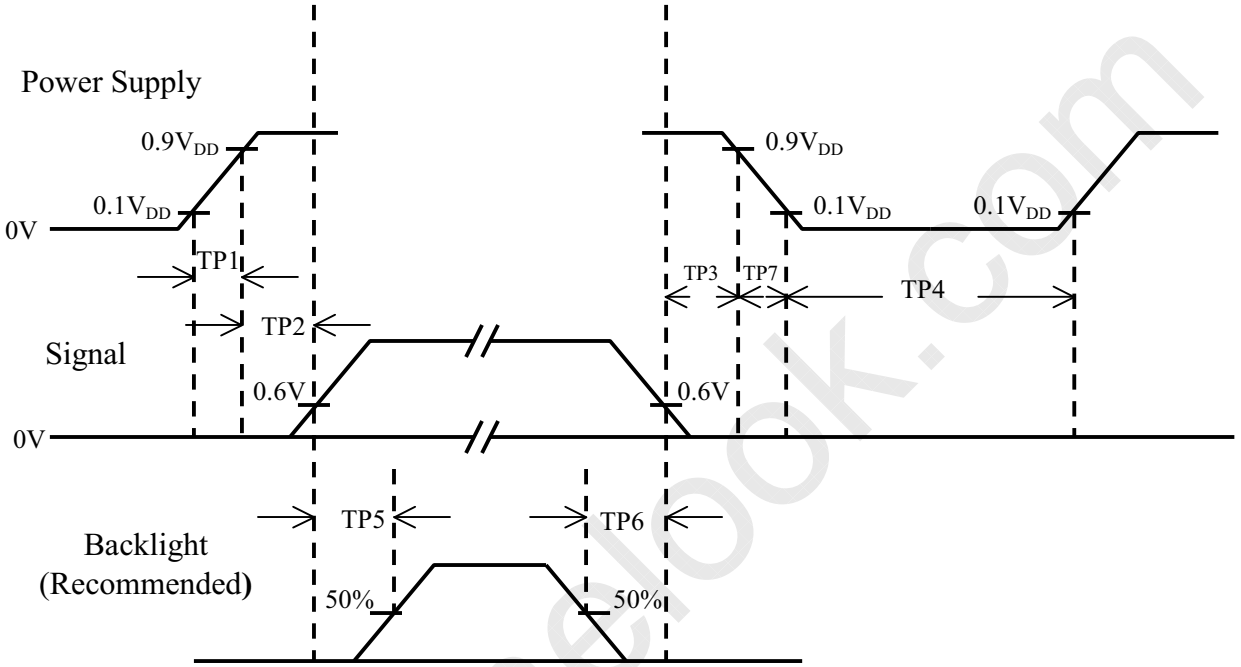
(1)Vertical



(2)Horizontal



6.6 Power ON/OFF Sequence



Item	Min.	Typ.	Max.	Unit	Remark
TP1	0.5	--	10	msec	
TP2	0.01	--	50	msec	
TP3	20	35	50	msec	
TP4	1000	--	--	msec	
TP5	200	--	--	msec	
TP6	200	--	--	msec	
TP7	1	--	10	msec	

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

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

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

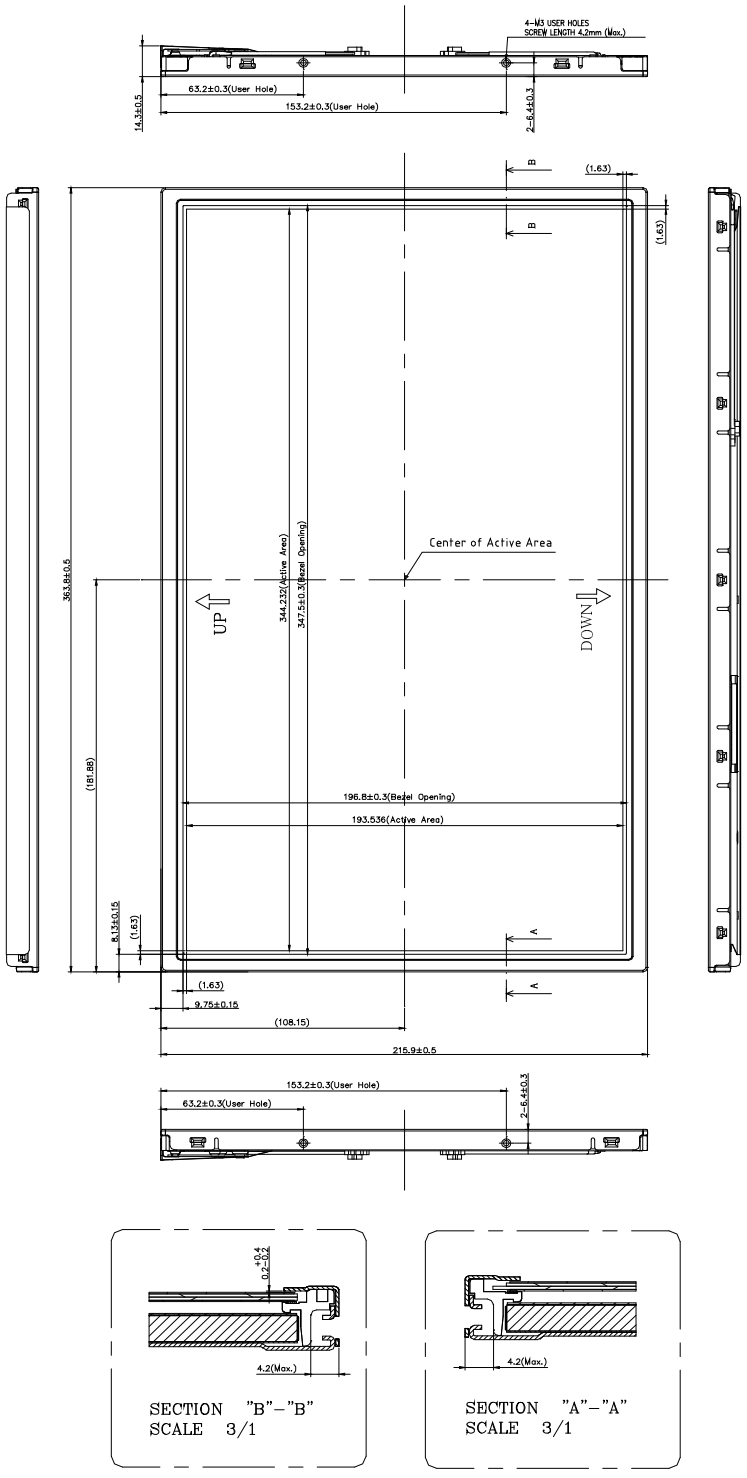
(4) TP4 should be measured after the module has been fully discharged between power off and on period.

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

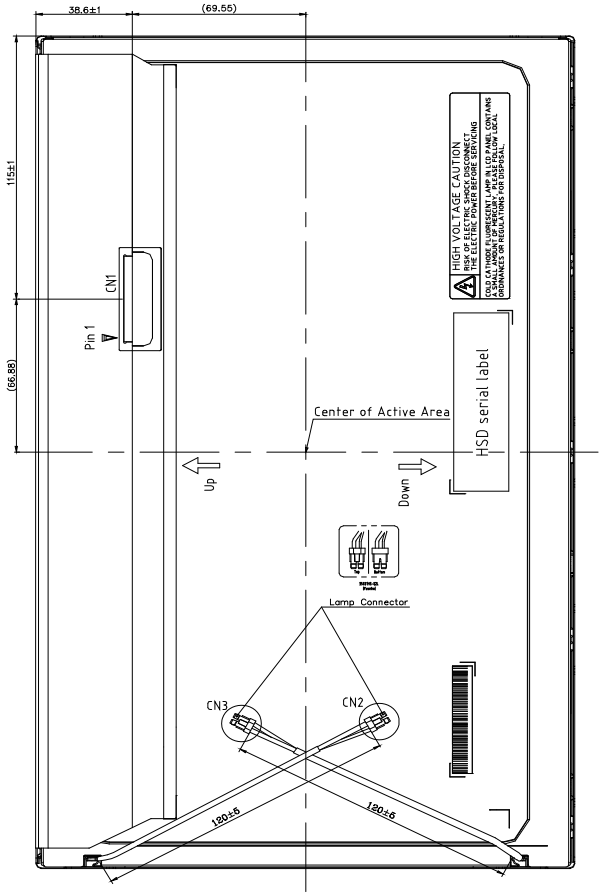
7.0 OUTLINE DIMENSION

7.1 Front View Outline Dimension

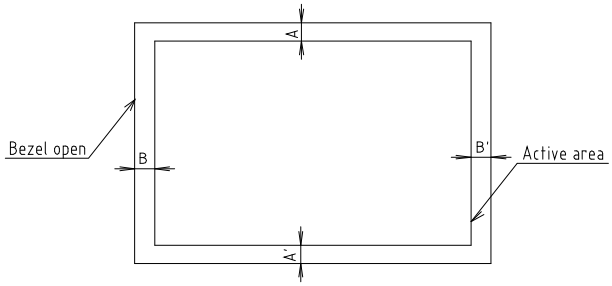
Unit : mm



7.2 Back View Outline Dimension



1.Backlight: 2 CCFL
2. I/F Connector Specification (CN1):
   FI-XB30SSRL-HF16 or Equivalent
3. Lamp Connector (CN2~CN3) / Wire Specification:
   Yeon-Ho 35001HS-02L or Equivalent / Pin x L120mm
4. User Mounting Torque Spec: 3 Kgf-cm Max.
5. Unspecificed Tolerance is ±0.5mm.
6. Tilt and partial disposition tole rance of display area as following
   (1) Y-Direction : |A-A'|≤1.0
   (2) X-Direction : |B-B'|≤1.0



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

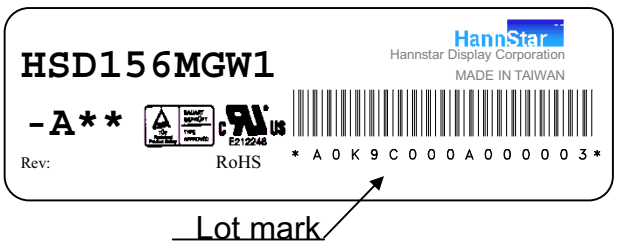
Year	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Mark	9	0	1	2	3	4	5	6	7	8

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.



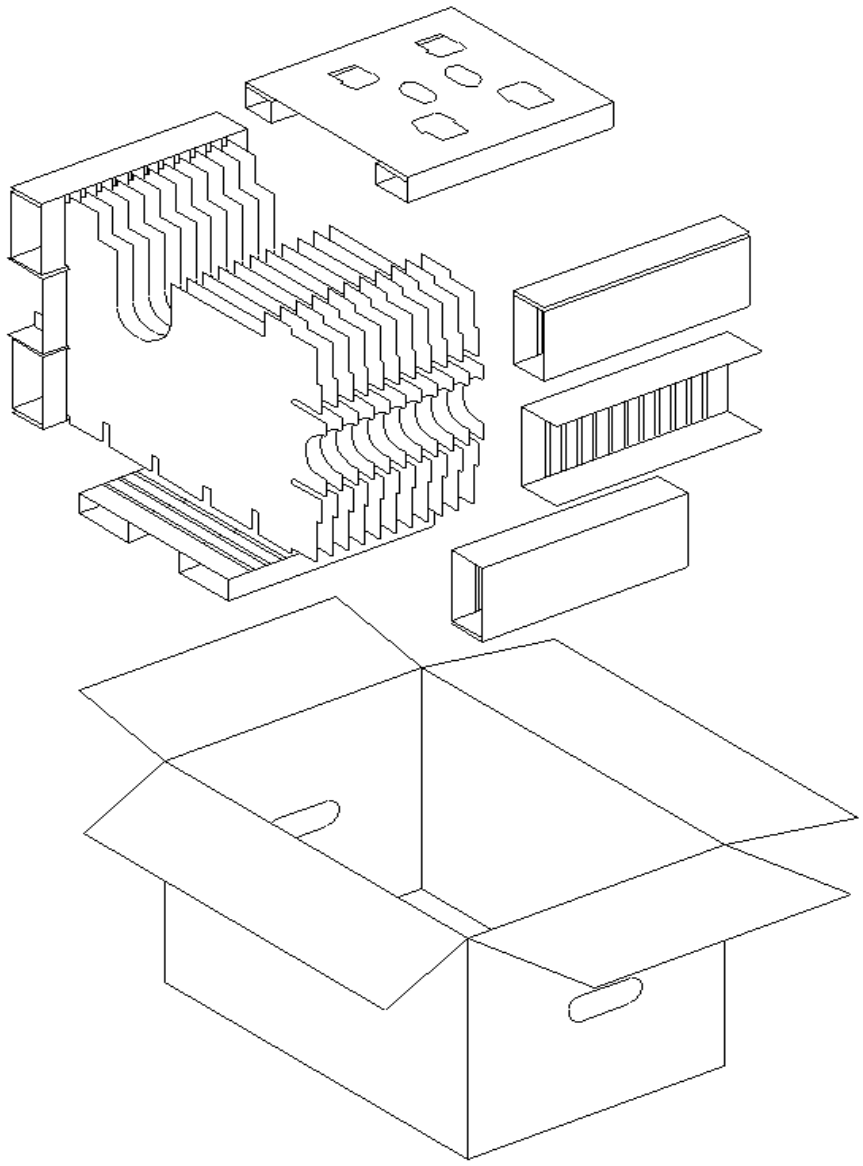
9.0 PACKAGE SPECIFICATION

9.1 packing form

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

(2) Carton size: : 462 x 312 x 318 (mm)

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 to employ protection circuit for power supply.

10.6 Operation

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

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

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

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

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

10.7 Mechanism

Please mount LCD module by using mouting 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 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.