TO :

Date : May,08 2005

HannStar Product Information

Model : HSD050I551 -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	May. 08, 2005	A**	HSD050I551 Product Information was first issued.

Contents

1.0 GENERAL DESCRIPTION

1.1 Introduction

HannStar Display model HSD050I551-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 5.0 inch diagonally measured active display area with 960 x 234 dot (320 horizontal by 234 vertical pixel) resolution.

1.2 Features

- 5 inch (4:3 diagonal) configuration
- Compatible with NTSC & PAL system
- Image Reversion: UP/DOWN and LEFT/RIGHT

1.3 Applications

- Portable TV
- Portable DVD
- Door Phone
- Multimedia applications and Others AV system

1.4 General information

Item	Specification	Unit
Outline Dimension	119.3 x 91.4 x 7.5 (Typ.)	mm
Display area	102.72(H) x 74.53(V)	mm
Number of Pixel	320RGB(H) x234(V)	pixels
Pixel pitch	0.321(H) x 0.3185(V)	mm
Pixel arrangement	RGB Vertical stripe	
Display mode	Normally white	
Surface treatment	Antiglare, Hard-Coating(3H) with WV film	
Weight	120 (Typ.)	g
Back-light	Single CCFL (Side-Light type)	

1.5 Mechanical Information

Item		Min.	Typ.	Max.	Unit
Module Size	Horizontal(H)	119.0	119.3	119.6	mm
	Vertical(V)	91.1	91.4	91.7	mm
	Depth(D)	—	7.5	7.8	mm
Weight (Without inverter)		—	(120)	(130)	g
Torque of customer screw hole		—	—	2.0	Kgf•Cm

2.0 ABSOLUTE MAXIMUM RATINGS

2.1 Electrical Absolute Rating

2.1.1 TFT LCD Module

Item	Symbol	Min.	Max.	Unit	Note
Power supply voltage	DV_{DD}	-0.3	6	V	GND=0
	V_{GH}	-0.3	40	V	GND=0
	V_{GL}	-20	0.3	V	GND=0
	AV_{DD}	-0.2	AV_{DD}+0.2	V	AGND=0
	V_{COM}	-1.1	4.5	V	
Analog Signal Input Level	V_R, V_G, V_B	-0.2	AV_{DD}+0.2	V	
Logic Signal Input Level	V_I	-0.3	DV_{DD} +0.3	V	

2.1.2 Back-Light Unit

Item	Symbol	Min.	Max.	Unit	Note
Lamp voltage	V_{FL}	0	1500	$V_{(rms)}$	(1) (2)
Lamp current	I_L	0	(7.0)	mA	(1) (2)
Lamp frequency	f_L	0	100	KHz	(1) (2)

3.0 OPTICAL CHARACTERISTICS

3.1 Optical specification

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Contrast		CR	Θ=0 Normal viewing angle	250	350	—		(1)(2)
Response time	Rising	T_R		—	(5)	—	msec	(1)(3)
	Falling	T_F		—	(20)	—		
White luminance (Center)		Y_L		340	400	—	cd/m^2	(1)(4) (I_L=6.0mA)
Color chromaticity (CIE1931)	White	W_x		0.25	0.30	0.35		(1)(4)
		W_y		0.30	0.35	0.40		
Viewing angle	Hor.	Θ_L	CR>10	50	60	—		
		Θ_R		50	60	—		
	Ver.	Θ_U		30	40	—		
		Θ_D		50	60	—		
	Hor.	Θ_L	CR>5	60	(70)	—		
		Θ_R		60	(70)	—		
	Ver.	Θ_U		40	(50)	—		
		Θ_D		60	(70)	—		
Brightness uniformity		B_{UNI}	Θ=0	70	—	—	%	(5)

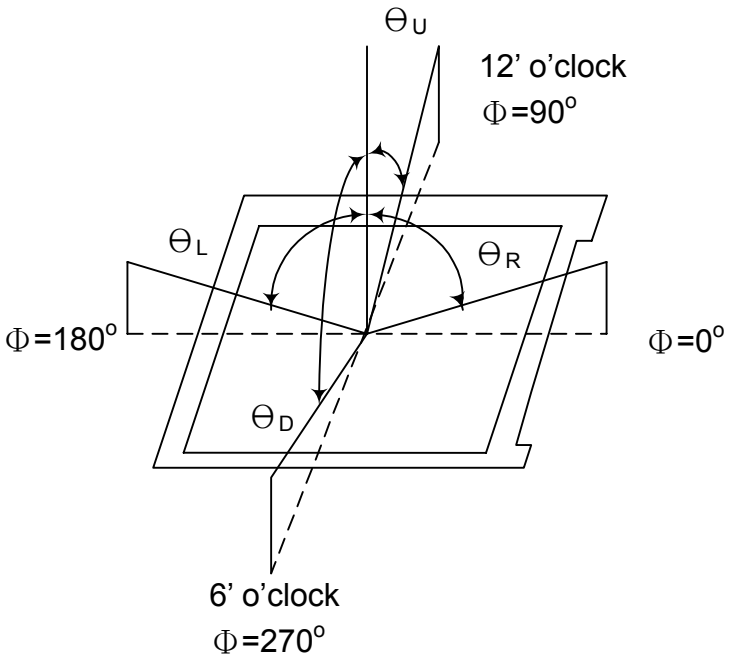
3.2 Measuring Condition

- Measuring surrounding : dark room
- Lamp current I_{FL} : 6.0±0.1mA(rms), Lamp freq. F_L=50KHz, Inverter : HIU-766-22pF
- Ambient temperature : 25±2°C
- 30min. warm-up time.

3.3 Measuring Equipment

- Otsuka Electrics Corp., which utilized MCPD-3000 for Chromaticity and BM-5 for other optical characteristics.
- Measuring spot size : 10 ~ 12 mm

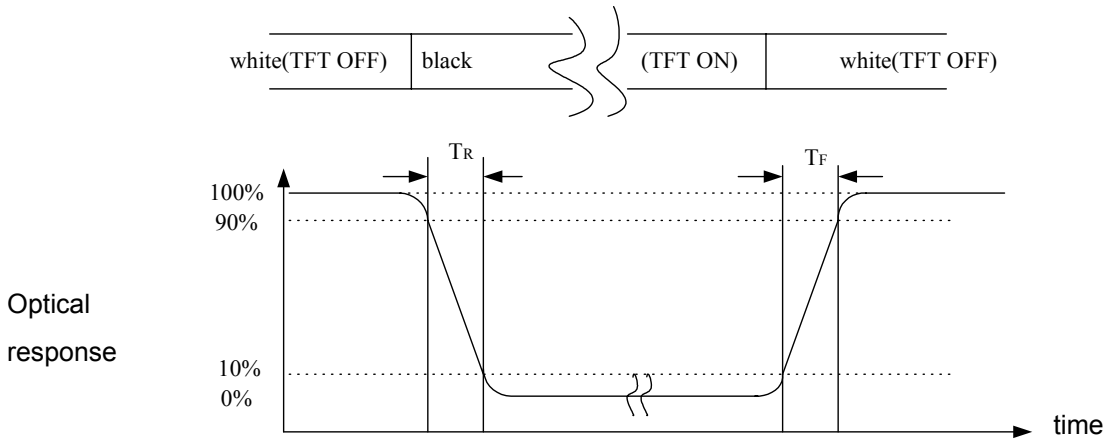
Note (1) Definition of Viewing Angle :



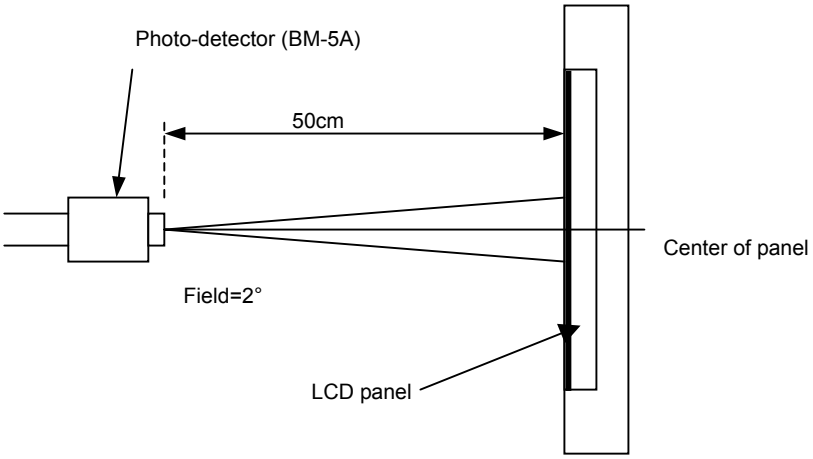
Note (2) Definition of Contrast Ratio(CR) :
measured at the center point of panel

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

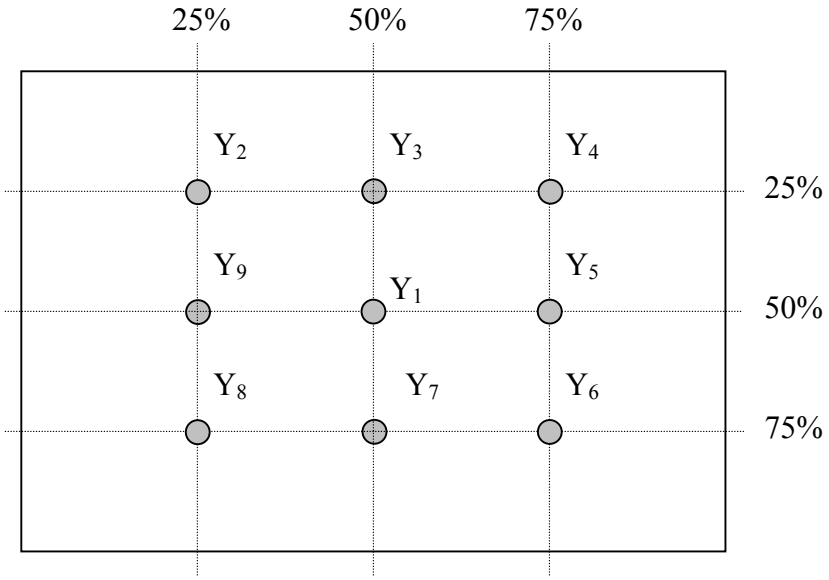
Note (3) Definition of Response Time : Sum of T_R and T_F



Note (4) Definition of brightness uniformity



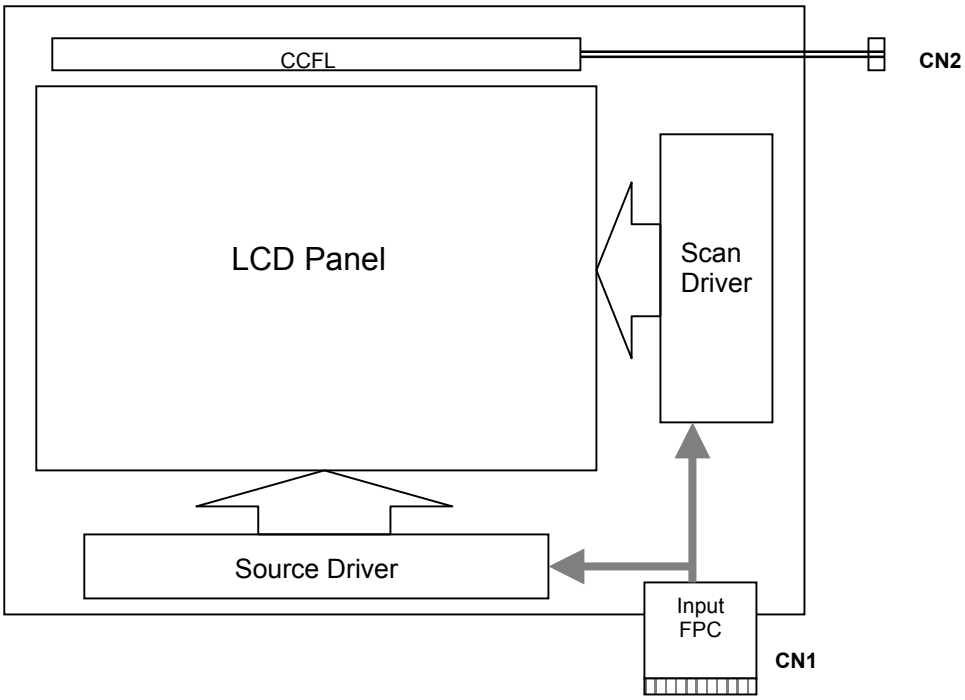
Note (5) Definition of brightness uniformity



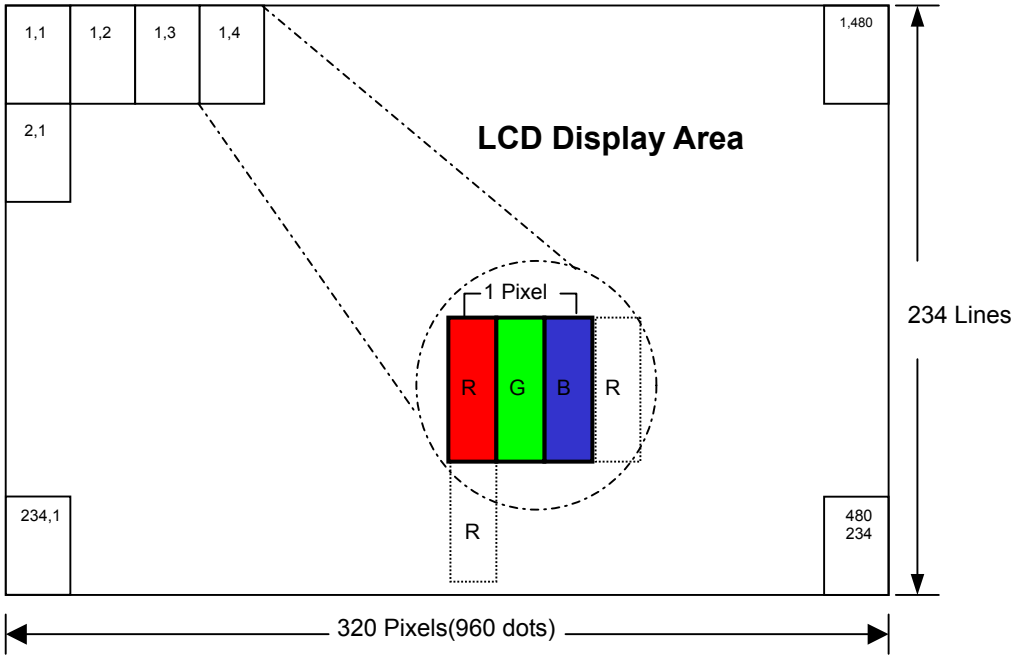
$$\text{Luminance uniformity} = \frac{\text{(Min Luminance of 9 points)}}{\text{(Max Luminance of 9 points)}} \times 100\%$$

4.0 BLOCK DIAGRAM

4.1 TFT LCD Module



4.2 Pixel Format



5.0 INTERFACE PIN CONNECTION

5.1 TFT LCD Module

CN1 (Input signal): FPC Down Connector, 30 pins, pitch: 0.5mm

Terminal no.	Symbol	I/O	Function	Note
1	STV1	I/O	Vertical start pulse	(1)
2	CKV	I	Shift clock input for scan (Gate) driver	
3	VGL	I	Power for scan (Gate) driver (DC voltage)	
4	NC		No Connection	
5	VGL	I	Power for scan (Gate) driver (DC voltage)	
6	NC		No Connection	
7	OEV	I	Output enable input for scan (Gate) driver	
8	DGND	-	Ground for logic circuit	
9	DVDD	I	Supply voltage of logic control circuit for scan (Gate) driver	
10	NC		No Connection	
11	VGH	I	Positive power for scan (Gate) driver	
12	NC		No Connection	
13	U/D	I	UP/DOWN control input for scan (Gate) driver	(2)
14	STV2	I/O	Vertical start pulse	(1)
15	VCOM	I	Common electrode driving signal	
16	STH1	I/O	Start pulse for horizontal (Source) driver	(1)
17	DVDD	I	Supply voltage of logic control circuit for data(Source) driver	
18	DGND	-	Ground for logic circuit	
19	AVDD	I	Supply voltage for analog circuit	
20	AGND	-	Ground for analog circuit	
21	L/R	I	LEFT/RIGHT control(Source driver) input	(2)
22	V_R	I	Alternated video signal input(Red)	
23	V_G	I	Alternated video signal input(Green)	
24	V_B	I	Alternated video signal input(blue)	
25	CPH1	I	Sampling and shifting clock pulse for data (Source) driver	
26	CPH2	I	Please connect to DGND	(2)
27	CPH2	I	Please connect to DGND	(2)
28	STH2	I/O	Start pulse for horizontal scan (Source) line	(1)
29	OEH	I	Output enable input for data (Source) driver	
30	NC		No Connection	

Note (1) Selection of scanning mode (please refer to the following table)

Setting of scan control input		IN/OUT state for start pulse				Scanning direction
U/D(pin13)	L/R(pin21)	STV1	STV2	STH1	STH2	
GND	V_{DD}	Output	Input	Output	Input	up to down, and from left to right.
V_{CC}	GND	Input	Output	Input	Output	down to up, and from right to left.
GND	GND	Output	Input	Input	Output	up to down, and from right to left.
V_{CC}	V_{DD}	Input	Output	Output	Input	down to up, and from left to right.

Note (2) The MOD had internal connect to H level as a simultaneous sampling. Please connect the CPH2 and CPH3 to DGND.

5.2 Back-Light Unit

CN2 CCFL Power Source (**BHSR-02VS-1**) / JAPAN SOLDERLESS TERMINAL MFG CO., LTD.

Mating Connector: (**SBHT-002T-P0.5**) / JAPAN SOLDERLESS TERMINAL MFG CO., LTD.

Terminal no.	Symbol	Function
1	VL	CCFL power supply (high voltage)
2	GL	CCFL power supply (low voltage)

6.0 ELECTRICAL CHARACTERISTICS

6.1 TFT LCD Module

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Supply Voltage	DV_{DD}	3	5	5.5	V	
	V_{GH}	14.3	15	15.7	V	
	V_{GL}	-10.5	-10	-9.5	V	
	AV_{DD}	4.5	5	5.5	V	
Video signal amplitude (VR,VG,VB)	V_{iA}	0.4	-	AV_{DD}-0.4	V	
	V_{iAC}	-	3	-	V	AC component,
	V_{iDC}	-	$AV_{DD}/2$	-	V	DC component
VCOM	V_{CAC}		5.6		VP-P	AC component
	V_{CDC}	1.5	1.7	1.9	V	DC component, (1)
Input signal voltage	V_{iH}	0.8 DV_{DD}	-	DV_{DD}	V	(2)
	V_{iL}	0	-	0.2 DV_{DD}	V	(2)
Current of power supply	$I_{DD(3.3V)}$	-	(4.3)	TBD	mA	DV_{DD} =3.3V
	I_{ADD}	-	(5.8)	TBD	mA	AV_{DD}=5V
	I_{GH}	-	(0.06)	TBD	mA	V_{GH}=15V
	I_{GL}	-	(0.5)	TBD	mA	V_{GL}=-10V

Note (1): The brightness of LCD panel could be changed by adjusting the AC component of V_{COM}.

Note (2): STH1, STH2, OEH, L/R, CPH1~CPH3, STV1, STV2, OVE, CKV, U/D

Note (3): Be sure to apply the power voltage as the power sequence spec.

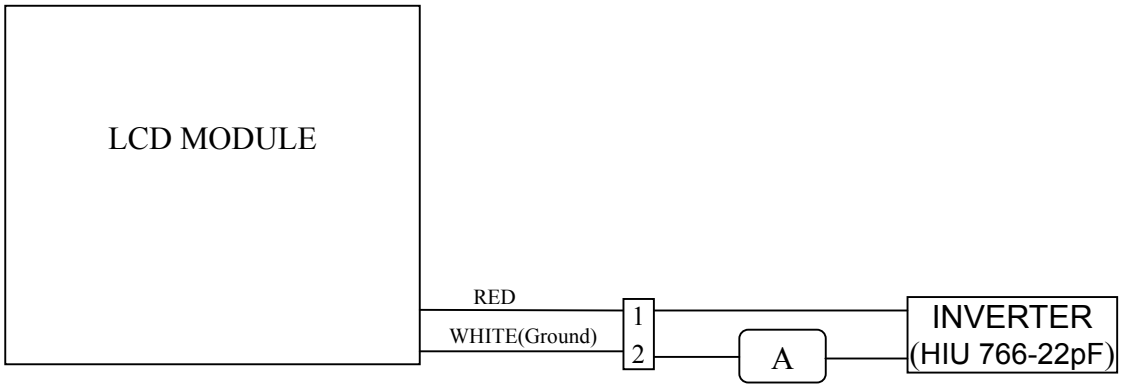
Note (4) : DGND=AGND=0V,)

6.2 Back-Light Unit

The back-light system is an edge-lighting type with 1 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	6.0	7.0	mA(rms)	(1)(6)
Lamp voltage	VL	(490)	(550)	(610)	V(rms)	(6)I_L=6.0mA
Frequency	fL	20	50	100	KHz	(2)
Operating lamp life time	Hr	10,000	—	—	Hour	(3)
Startup voltage	Vs	1500	—	—	V(rms)	(4)(5)at 25°C
		1900				(4)(5)at 0°C

Note (1) Lamp current is measured with current meter for high frequency as shown below. Specified valued are for 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=50kHz 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.

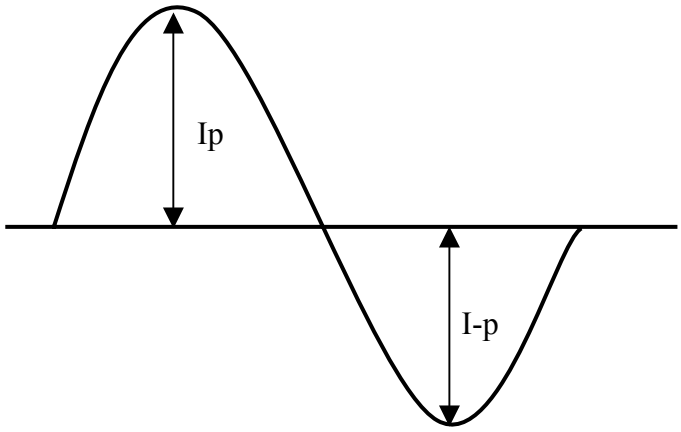
Note (5) The voltage over specified value (Vs) should be applied to the lamp more than 1 second after startup. Otherwise, the lamp may not be turned on. The used lamp current is the lamp typical current.

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 = $|I_p - I_{-p}| / I_{rms}$ x 100%

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

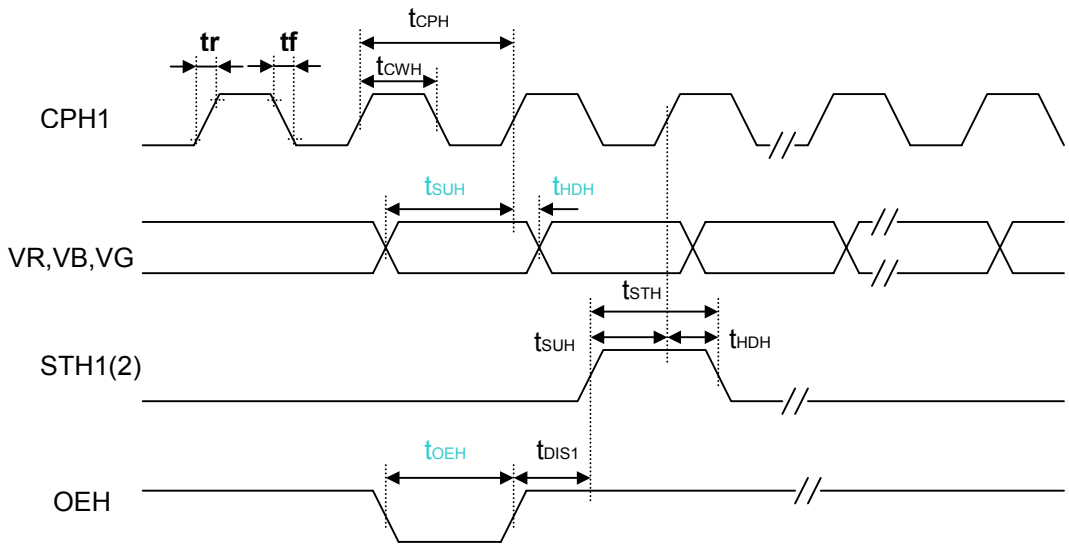
6.3 AC Characteristics

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Rising time	t_r	-	-	10	ns	(1)
Falling time	t_f	-	-	10	ns	(1)
High and low level pulse duty	t_{CPH}	-	156	-	ns	CPH1~CPH3
CPH pulse duty	t_{CWH}	40	50	60		CPH1~CPH3
STH setup time	t_{SUH}	20	-	-	ns	STHR,STHL
STH hold time	t_{HDH}	10	-	-	ns	STHR,STHL
STH pulse width	t_{STH}	-	1	-	t_{CPH}	STHR,STHL
STH period	t_H	61.5	63.5	65.5	μs	STHR,STHL
OEH pulse width	t_{OEH}	-	7	-	μs	OEH
Sample and hold disable time	t_{DIS1}	-	54	-	μs	
OEV pulse width	t_{OEV}	-	26	-	μs	OEV
CKV pulse width	t_{CKV}	-	40	-	μs	CKV
Clean enable time	t_{DIS2}	-	3.74	-	μs	
Horizontal display timing range	t_{DH}	-	1440	-	t_{CPH}/3	
STV setup time	t_{SUV}	200	-	-	ns	STV1,STV2
STV hold time	t_{HDV}	300	-	-	ns	STV2,STV2
STV pulse width	t_{STV}	-	1	-	t_H	STV1,STV2
Horizontal line per field	t_V	256	262	268	t_H	(2)
Vertical display start	t_{SV}		3	-	t_H	
Vertical display timing range	t_{DV}		234	-	t_H	
VCOM Rising time	t_{rCOM}		-	5	μs	
VCOM Falling time	t_{fCOM}		-	5	μs	
VCOM delay time	t_{DCOM}		-	3	μs	
RGB delay time	t_{DRGB}		*	1	μs	

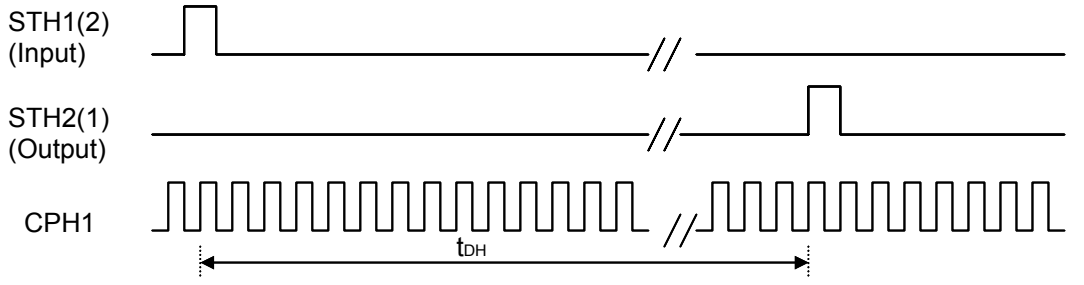
Note (1): For all of the logic signals.

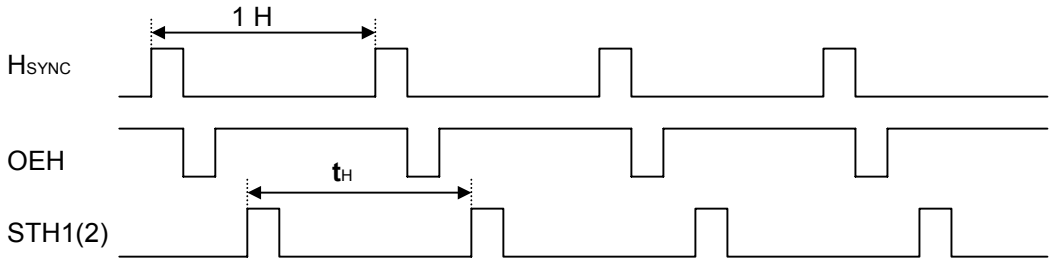
Note (2): Please don't use odd horizontal lines to drive LCD panel for both odd and even filed simultaneously.

6.4 Timing Diagram of Interface Signal

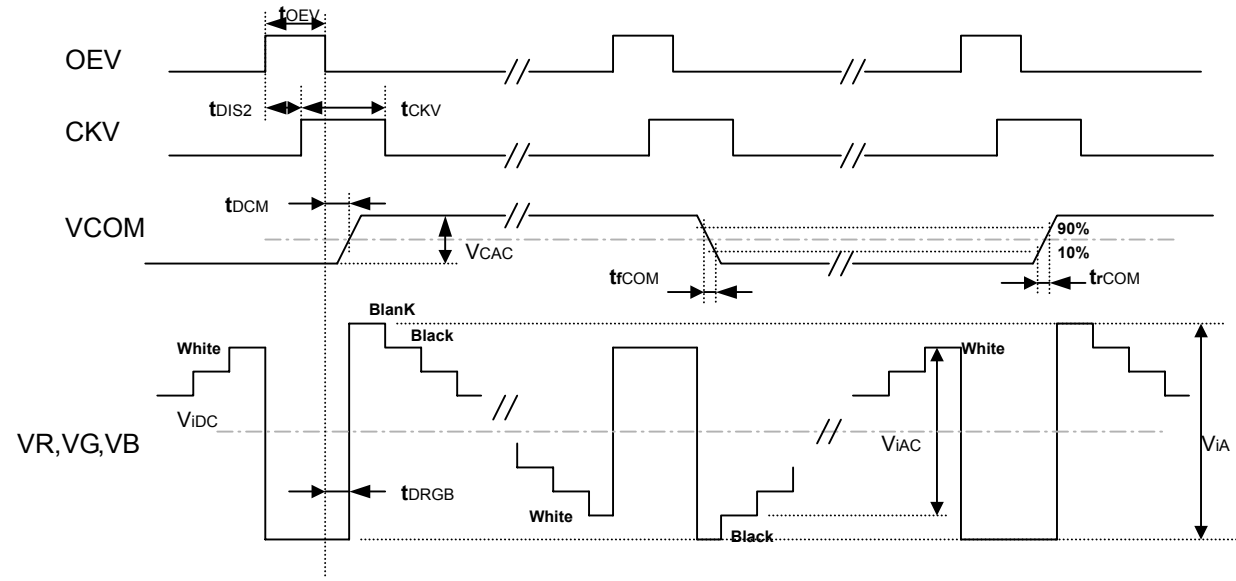


Sampling clock timing

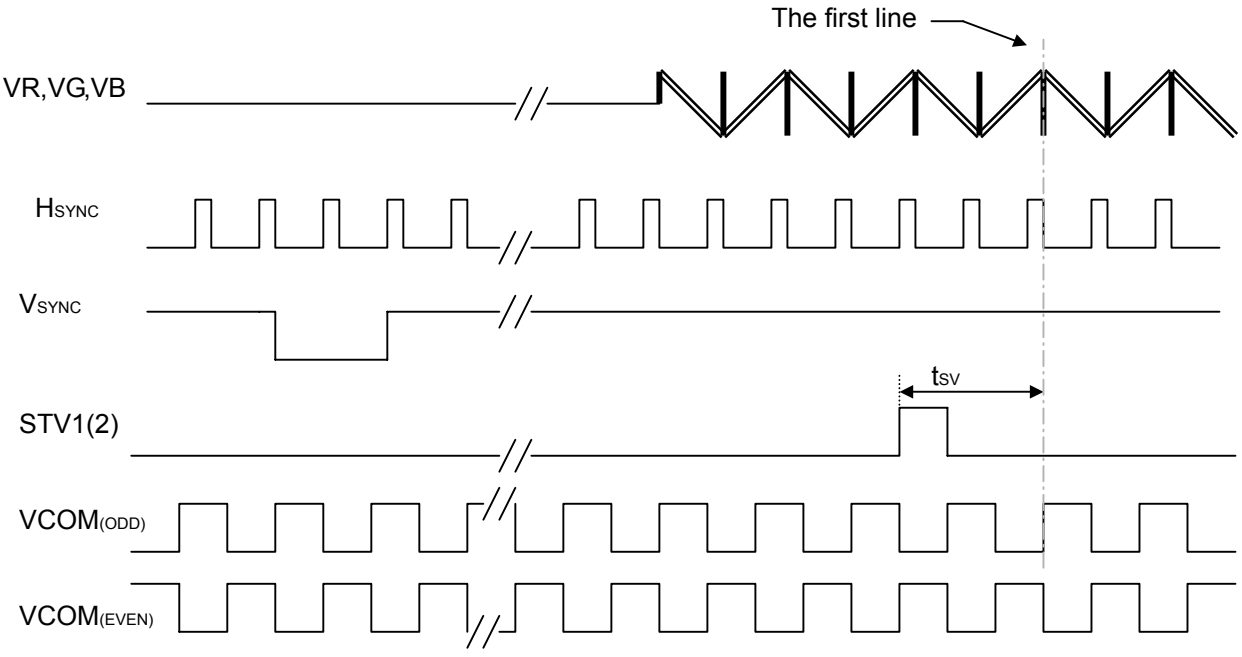




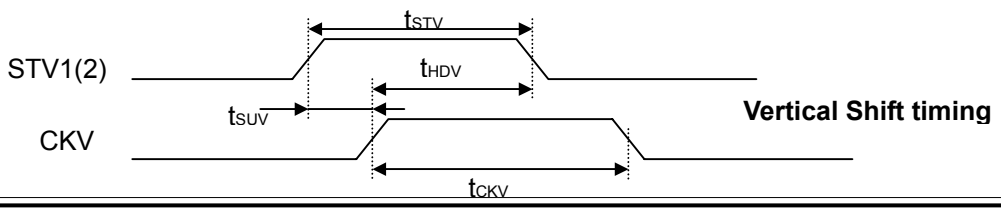
Horizontal display timing range



Detail Horizontal timing

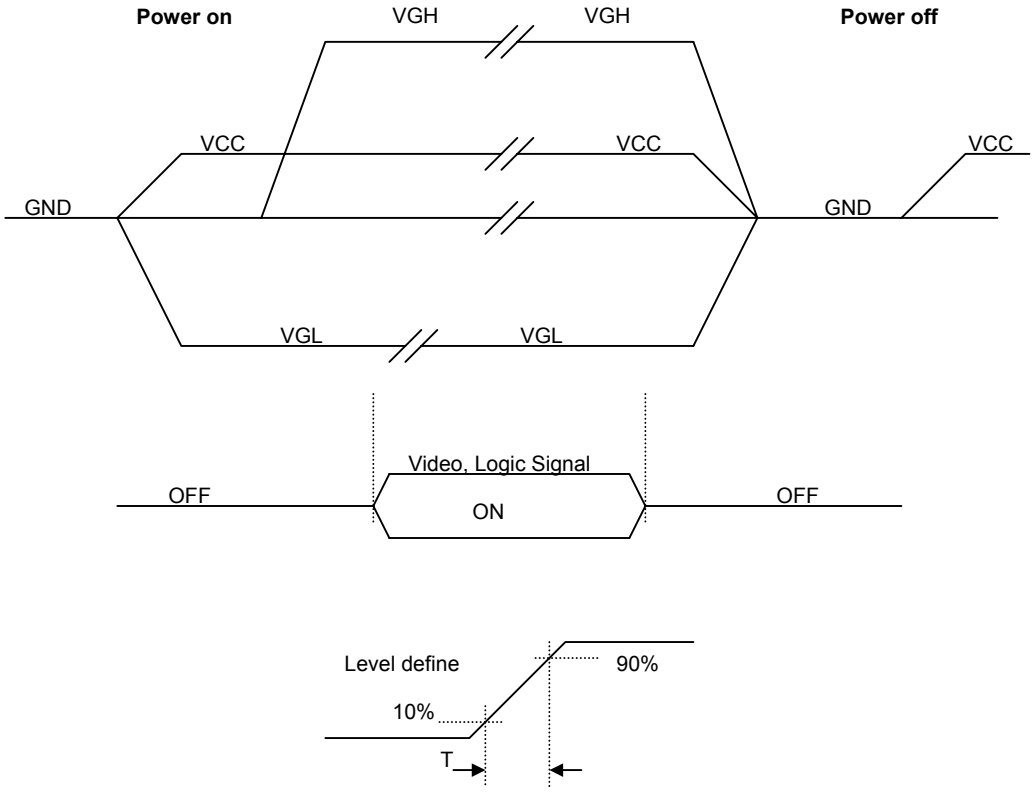


Vertical timing



Vertical Shift timing

6.5 Power Sequence



Power Sequence: VCC -> VGL -> VGH

(Undefined)

Note 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.

7.0 Reliability test items

No.	Item	Conditions	Remark
1	High Temperature Storage	Ta=+70°C, 240hrs	
2	Low Temperature Storage	Ta=-20°C, 240hrs	
3	High Temperature Operation	Ta=+60°C, 240hrs	
4	Low Temperature Operation	Ta=-10°C, 240hrs	
5	High Temperature and High Humidity (operation)	Ta=+60°C, 90%RH, 240hrs	
6	Thermal Cycling Test (non operation)	-20°C(30min)→ +70°C(30min), 200cycles	
7	Electrostatic Discharge	±200V,200pF(0Ω) 1 time/each terminal	
8	Vibration	Random: 1.04Grms, 10~500Hz, X/Y/Z 30min/each direction	
9	Shock	100G,6ms, ±X, ±Y, ±Z 3 time for each direction	JIS C7021, A-10 (Condition A)
10	Vibration (with carton)	Random: 1.04Grms, 10~500Hz, X/Y/Z 30min/each direction Fixed: 5Hz, 1.5Grms, X/Y/Z 30min/each direction	
11	Drop (with carton)	Height: 60cm 1 corner, 3 edges, 6 surfaces	JIS Z0202

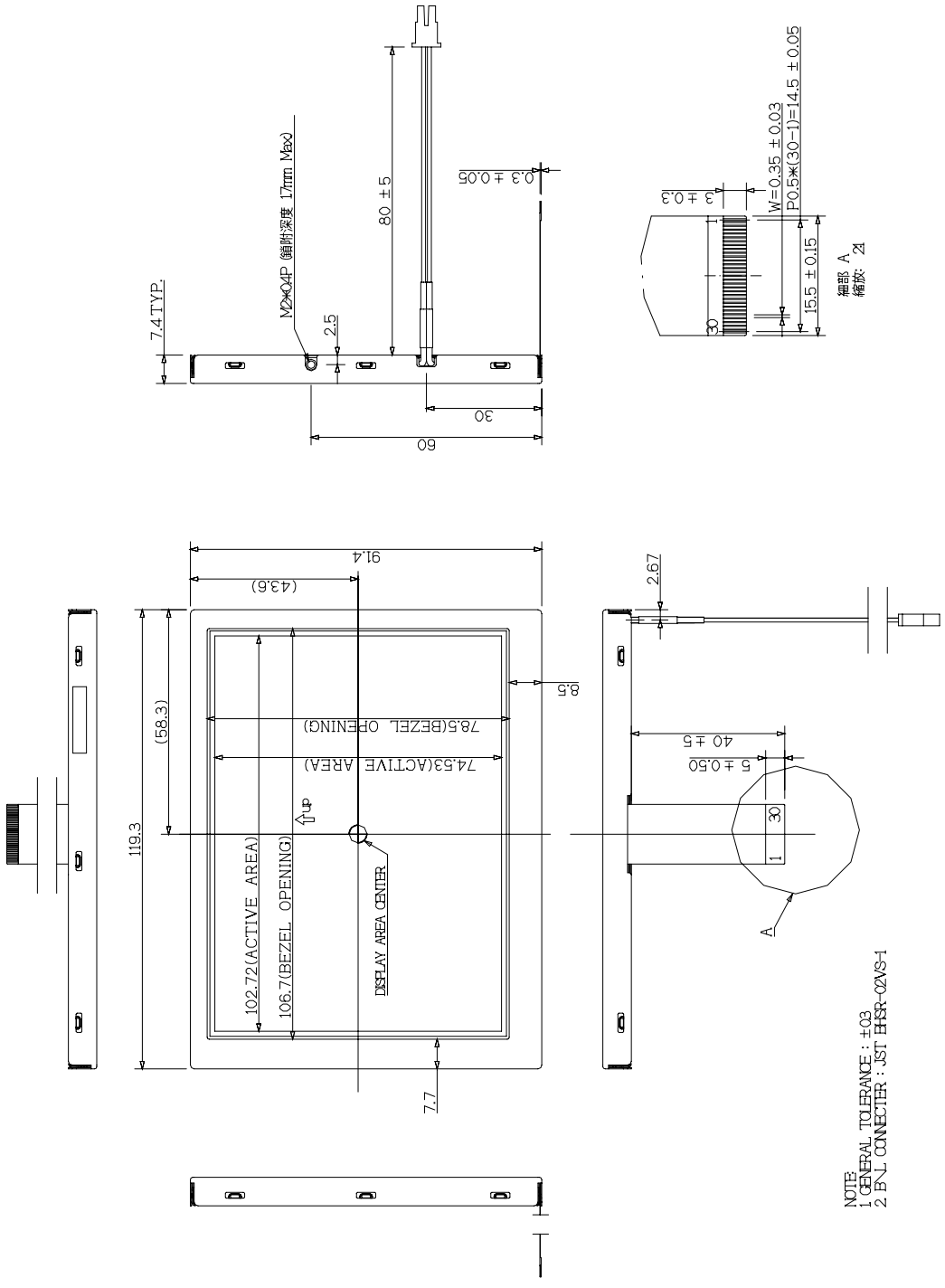
Note: There are no display function NG issue occurred, All the cosmetic specification is judged before the reliability stress.

8.0 OUTLINE DIMENSION

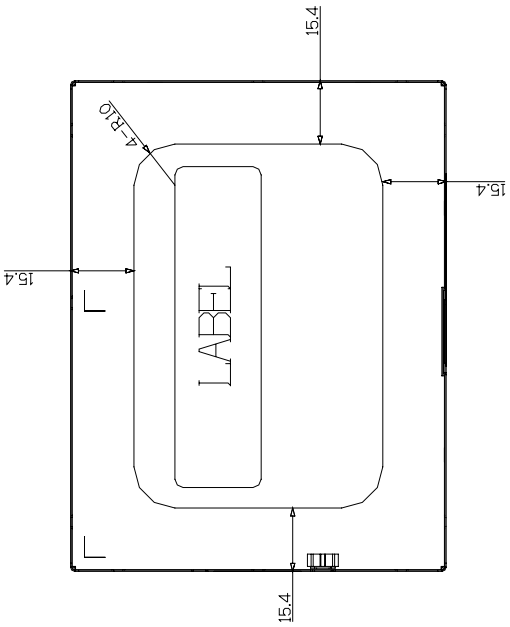
8.1 Outline Dimension

Unit : mm

8.1.1 Front view



8.1.2 Back View



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

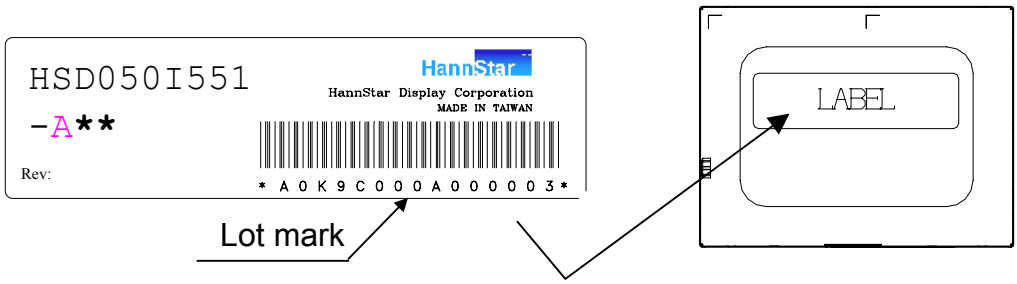
Year	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Mark	9	0	1	2	3	4	5	6	7	8

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 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.



10.0 PACKAGE SPECIFICATION

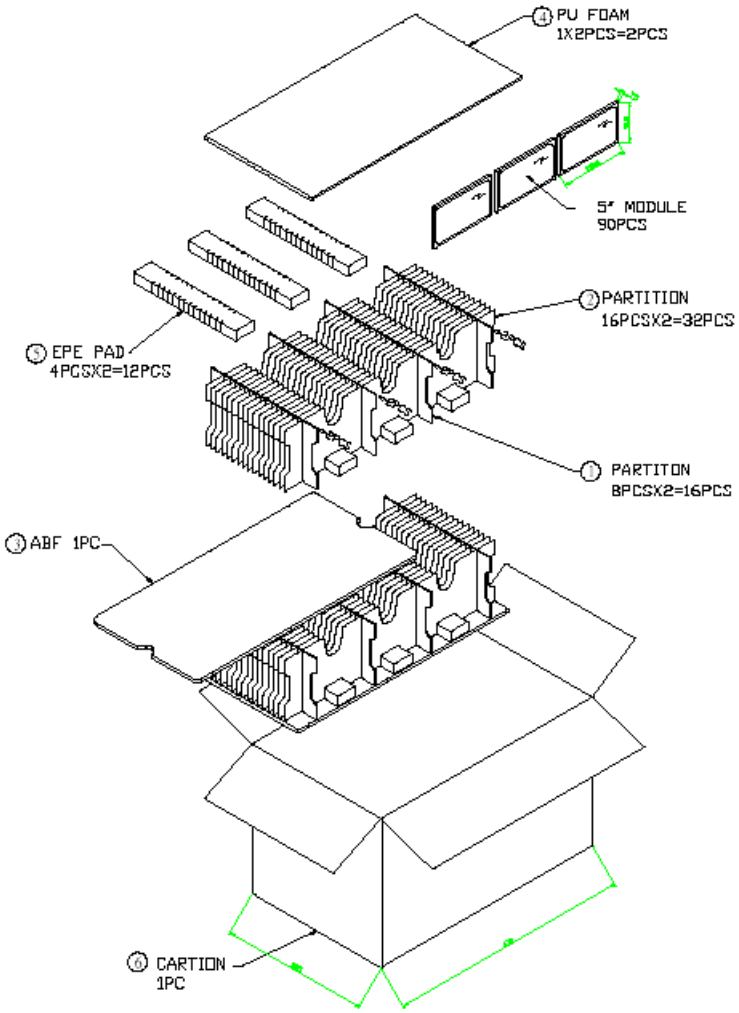
10.1 Packing form

(1) Package quantity in one carton: 90 pieces.

(2) Carton size: 464±3 mm×360±3 mm×370±3 mm.

(3) For domestic transportation only.

10.2 Packing assembly drawings



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

(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.

(2) If liquid crystal contacts mouth or eyes, rinse out with water immediately.

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

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

11.4 Electric Shock

(1) Disconnect power supply before handling LCD module.

(2) Do not pull or fold the CCFL cable.

(3) Do not touch the parts inside LCD modules and the fluorescent lamp's connector able in order to prevent electric shock.

11.5 Absolute Maximum Ratings and Power Protection Circuit

(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.

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

(3) It's recommended to employing protection circuit for power supply.

11.6 Operation

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

(2) Use fingerstalls of soft gloves in order to keep clean display quality, when personshandle the LCD module for incoming inspection or assembly.

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

(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.

(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

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

(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.