Date

Customer Acceptance Specification

Model : HSD070I651-F00-02991
HSD070I651-F01-02991
HSD070I651-F02-02991
HSD070I651-F10-02991

Accepted by:	
Signature	Date
Proposed by: Technical Service Division	
Signature	Date

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.

Record of Revisions

Rev.	Date	Sub-Model	Description of change
1.0	2009/07/02	F001-02991/ F011-02991/ F021-02991/ F101-02991	Preliminary Product Specification was first issued.

Contents

1.0 GENERAL DESCRIPTION

1.1 Introduction

HannStar Display model HSD070I651-F**-02991 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 7.0 (16:9) inch diagonally measured active display area with 1440 x 234 dot (480 horizontal by 234 vertical pixel) resolution.

1.2 Features

■ 7 (16:9 diagonal) inch configuration
■ Compatible with NTSC & PAL system
■ Image Reversion: UP/DOWN and LEFT/RIGHT
■ RoHS Compliance & Halogen-Free Compliance

1.3 General information

Item	Specification	Unit
Outline Dimension	162.6(H) x 96.6 (V)	mm
Display area	154.08(H) x 86.58(V)	mm
Number of Pixel	480 RGB (H) x234 (V)	pixels
Pixel pitch	0.321(H) x 0.370(V)	mm
Pixel arrangement	RGB Vertical stripe	
Display mode	Normally white	

2.0 ABSOLUTE MAXIMUM RATINGS
2.1 Electrical Absolute Rating
2.1.1 TFT LCD Module (**Absolute Maximum Rating**)(1)

Item	Symbol	Min.	Max.	Unit	Note
Power supply voltage	DV_{DD}	-0.3	6.0	V	GND=0
	AV_{DD}	-0.3	6.0	V	AGND=0
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	

Note:(1) Stresses above those listed under "Absolute Maximum Rating" may cause permanent damage to the device. These are stress ratings only. Functional operation of this device at indicated in the operational sections(6.1) of this specification.

2.2 Environment Absolute Rating

Item	Symbol	Min.	Max.	Unit	Note
Operating Temperature	T_{opa}	-20	70	℃	
Storage Temperature	T_{stg}	-30	80	℃	

3.0 OPTICAL CHARACTERISTICS

3.1 Optical specification

| Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Threshold voltage		Vsat		—	2.48	—	V	(1)
		Vth		—	1.47	—	V	(1)
Transmittance (With PZ)		T		—	8.91	—		
Contrast		CR		400	500	—		(2)(3)
Response time	Rising	T_R		—	5	7	msec	(2)(4)
	Falling	T_F		—	20	28		
Color gamut		S		—	49	—	%	C light
Color chromaticity (CIE1931)	White	W_x	$\Theta=0$ Normal viewing angle	0.296	0.311	0.326		(2)(5) CF Glass C light
		W_y		0.341	0.356	0.371		
	Red	R_x		0.616	0.631	0.646		
		R_y		0.327	0.342	0.357		
	Green	G_x		0.306	0.321	0.336		
		G_y		0.538	0.553	0.568		
	Blue	B_x		0.133	0.148	0.163		
		B_y		0.173	0.188	0.203		
Viewing angle	Hor.	Θ_L	CR>10	60	70	—		
		Θ_R		60	70	—		
	Ver.	Θ_U		55	65	—		
		Θ_D		55	65	—		
Brightness uniformity		B_{UNI}	$\Theta=0$	70	—	—	%	(6)
Optima View Direction			6 O' clock					(7)

3.2 Measuring Condition
■ Measuring surrounding: dark room
■ Ambient temperature: $25\pm2^{o}C$
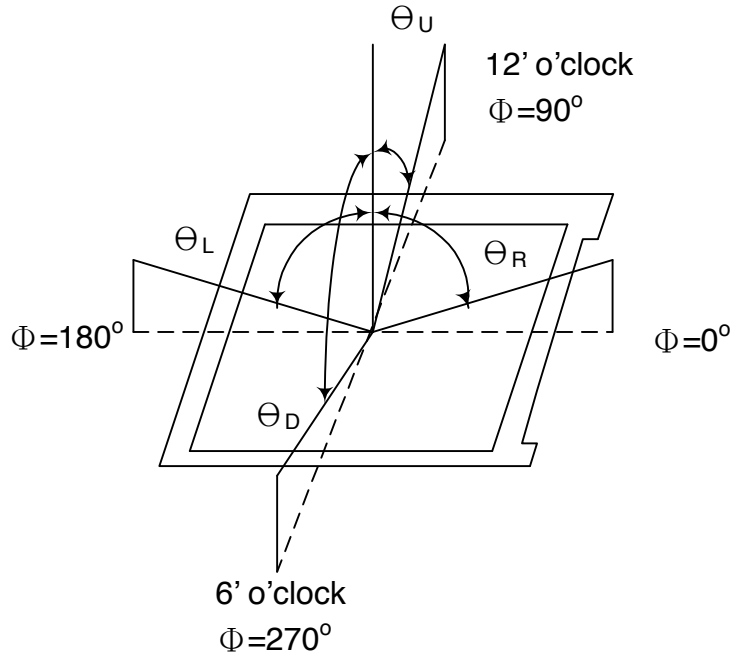■ 15min. warm-up time.

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 ~ 21 mm

Note (1) Definition of Vsat and Vth (at $20^{0}C$)
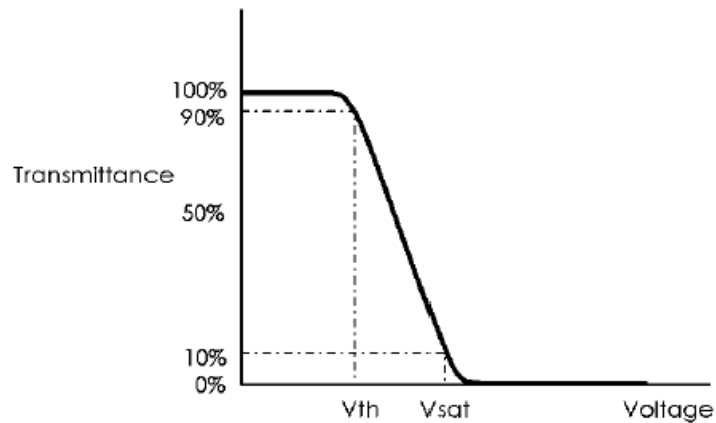
Note (2) Definition of Viewing Angle:

Θ_U

12' o'clock
$\Phi=90^o$
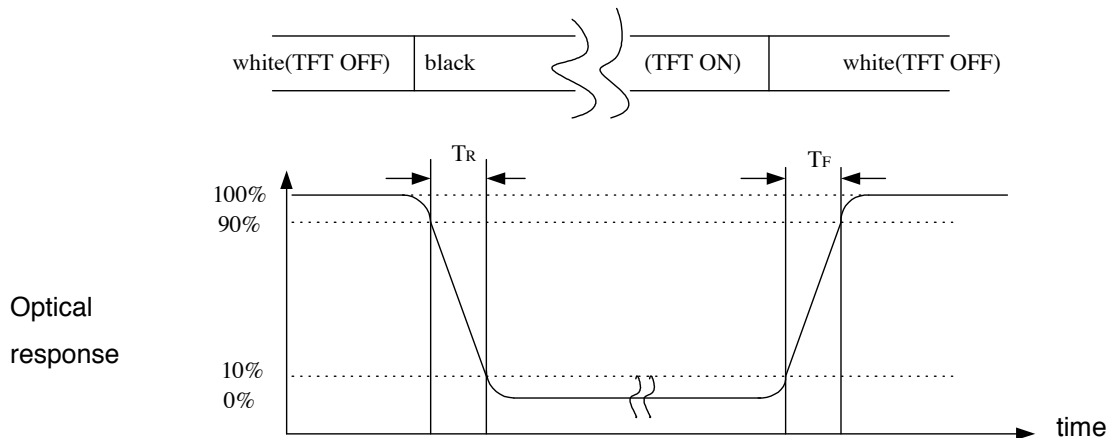
Θ_L

Θ_R

$\Phi=180^o$

$\Phi=0^o$

Θ_D

6' o'clock
$\Phi=270^o$

Note (3) Definition of Contrast Ratio (CR):
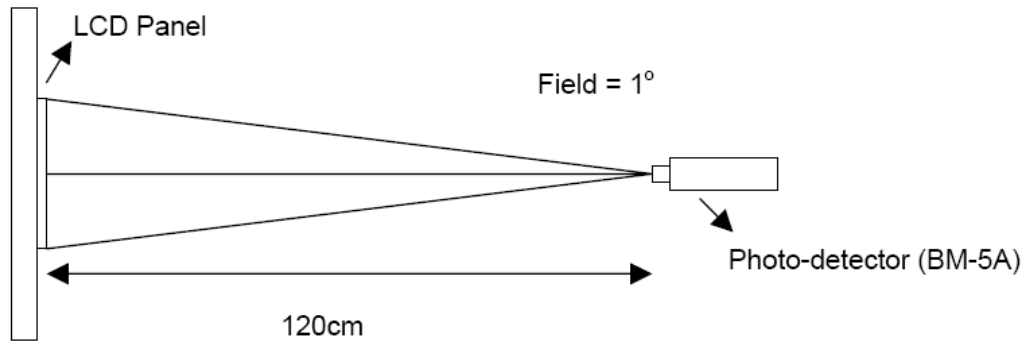　　　　Measured at the center point of panel

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

Note (4) Definition of Response Time: Sum of T_R and T_F

white(TFT OFF)	black	≀	(TFT ON)	white(TFT OFF)

T_R　　　　　　　　T_F

100%
90%

Optical

response

10%
0%

time

Note (5) Definition of optical measurement setup

LCD Panel

Field = 1°

Photo-detector (BM-5A)

120cm

Note (6) Rubbing Direction (The different Rubbing Direction will cause the different optima view direction.

4.0 BLOCK DIAGRAM
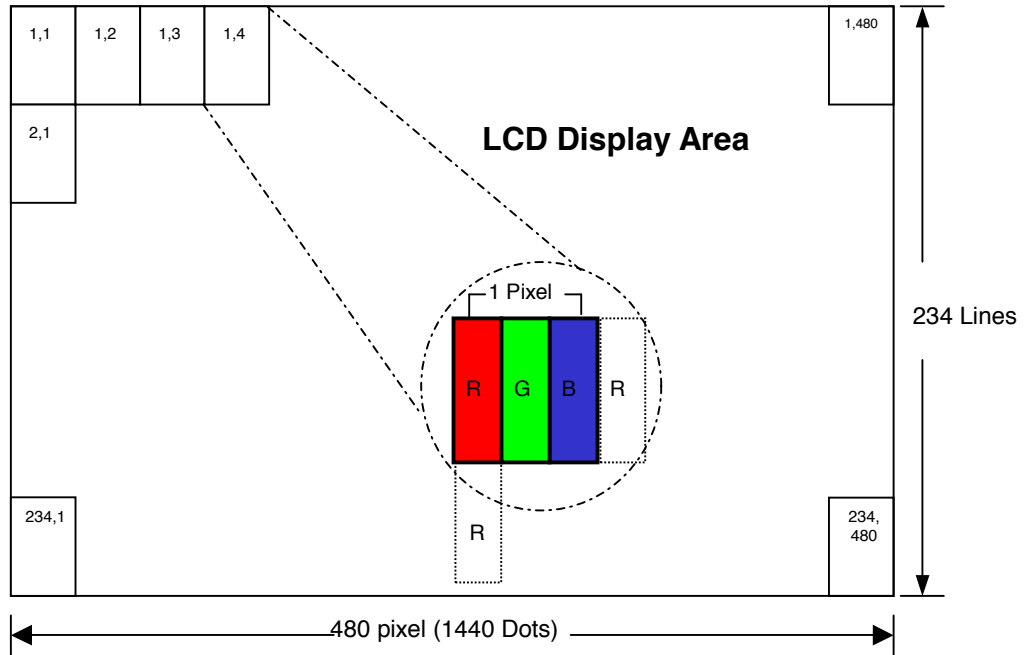
5.0 INTERFACE PIN CONNECTION

5.1 TFT LCD Module

Terminal no.	Symbol	I/O	Function	Note
1	DGND	-	Ground for logic circuit	
2	DV_{DD}	I	Supply voltage of logic control circuit for scan (Gate) driver	
3	V_{GL}	I	Negative power for scan (Gate) driver	
4	V_{GH}	I	Positive power for scan (Gate) driver	
5	STVD	I/O	Vertical start pulse	(1)
6	STVU	I/O	Vertical start pulse	(1)
7	CKV	I	Shift clock input for scan (Gate) driver	
8	U/D	I	UP/DOWN scan control input	(1)
9	OEV	I	Output enable input for scan(Gate) driver	
10	V_{COM}	I	Common electrode driving signal	
11	V_{COM}	I	Common electrode driving signal	
12	L/R	I	LEFT/RIGHT scan control input	(1)
13	MOD	I	Sequential sampling and simultaneous sampling setting	(2)
14	OEH	I	Output enable input for data (Source) driver	
15	STHL	I/O	Start pulse for horizontal scan (Gate) line	(1)
16	STHR	I/O	Start pulse for horizontal scan (Gate) line	(1)
17	CPH3	I	Sampling and shifting clock pulse for data (Source) driver	(2)
18	CPH2	I	Sampling and shifting clock pulse for data (Source) driver	(2)
19	CPH1	I	Sampling and shifting clock pulse for data (Source) driver	
20	DV_{DD}	I	Supply voltage of logic control circuit for data(Source) driver	
21	DGND	-	Ground for logic circuit	
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	AV_{DD}	I	Supply voltage for analog circuit	
26	AGND	-	Ground for analog circuit	

6.0 ELECTRICAL CHARACTERISTICS

6.1 TFT LCD Module (Operation Rating)

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Supply Voltage	DV_{DD}	2.7	3.3	5.5	V	
	V_{GH}	14.3	15	15.7	V	
	V_{GL}	-10.5	-10	-9.5	V	
	AV_{DD}	3	-	5.5	V	
Video signal amplitude (VR,VG,VB)	V_{iA}	0.4	-	AV_{DD}-0.4	V	
	V_{iAC}	-	4	-	V	AC component,
	V_{iDC}	-	AV_{DD}/2	-	V	DC component
VCOM	V_{CAC}		5.5		Vp-p	AC component
	V_{CDC}	1.6	1.8	2.0	V	DC component, (1)
Input signal voltage	V_{iH}	$0.7DV_{DD}$	-	DV_{DD}	V	(2)
	V_{iL}	0	-	$0.3DV_{DD}$	V	(2)
Current of power supply	I_{DD}	-	4.2	-	mA	DV_{DD} =3.3V
	I_{ADD}	-	3.7	-	mA	AV_{DD}=5V(Black)
	I_{GH}	-	60	-	uA	V_{GH}=15V
	I_{GL}	-	400	-	uA	V_{GL}=-10V

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

Note (2):   STHL, STHR, OEH, L/R, CPH1~CPH3, STVD, STVU, OEV, CKV, U/D

6.2 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}	100	103	-	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}	-	1.23	-	µs	OEH
Sample and hold disable time	t_{DIS1}	-	8.19	-	µs	
OEV pulse width	t_{OEV}	-	4.77	-	µs	OEV
CKV pulse width	t_{CKV}	-	3.91	-	µs	CKV
Clean enable time	t_{DIS2}	-	3.90	-	µs	
Horizontal display timing range	t_{DH}	-	1440	-	$t_{CPH}/3$	
STV setup time	t_{SUV}	200	-	-	ns	STVD,STVU
STV hold time	t_{HDV}	300	-	-	ns	STVD,STVU
STV pulse width	t_{STV}	-	1	-	t_H	STVD,STVU
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.

6.3 Timing Diagram of Interface Signal
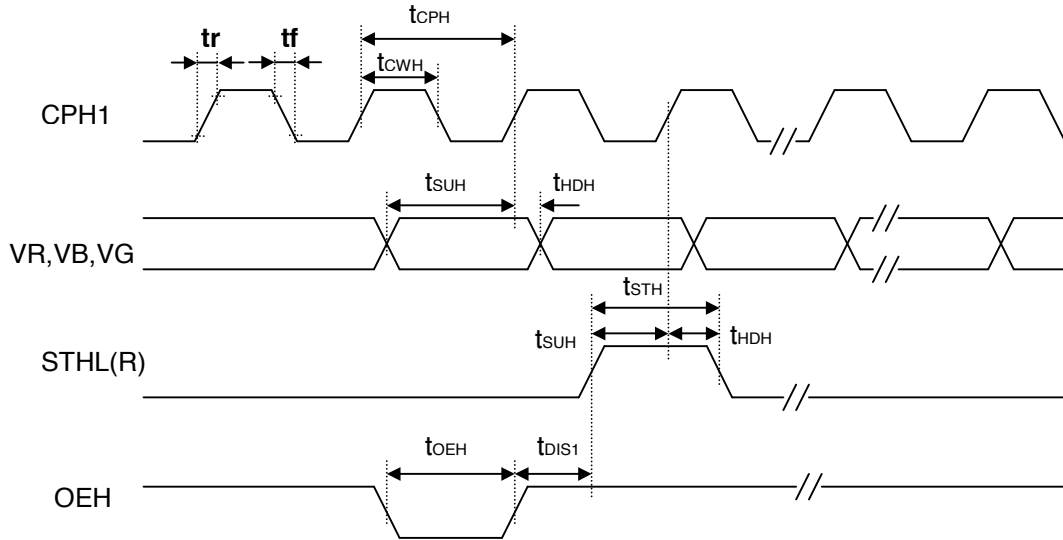
Sampling clock timing
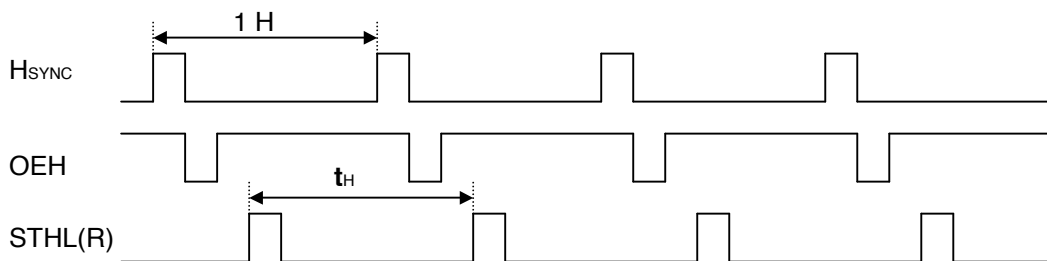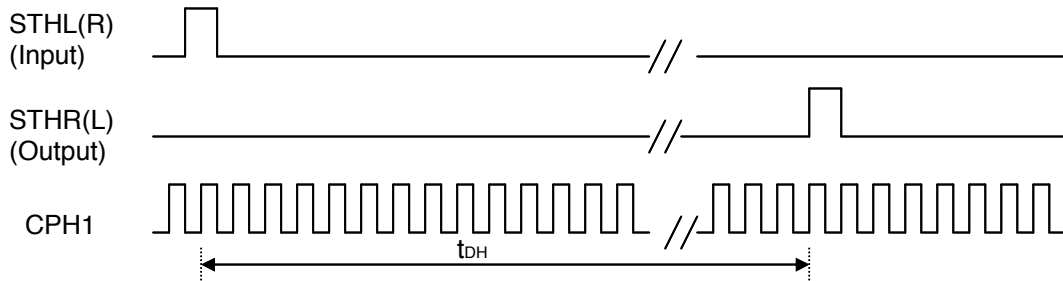
Horizontal display timing range
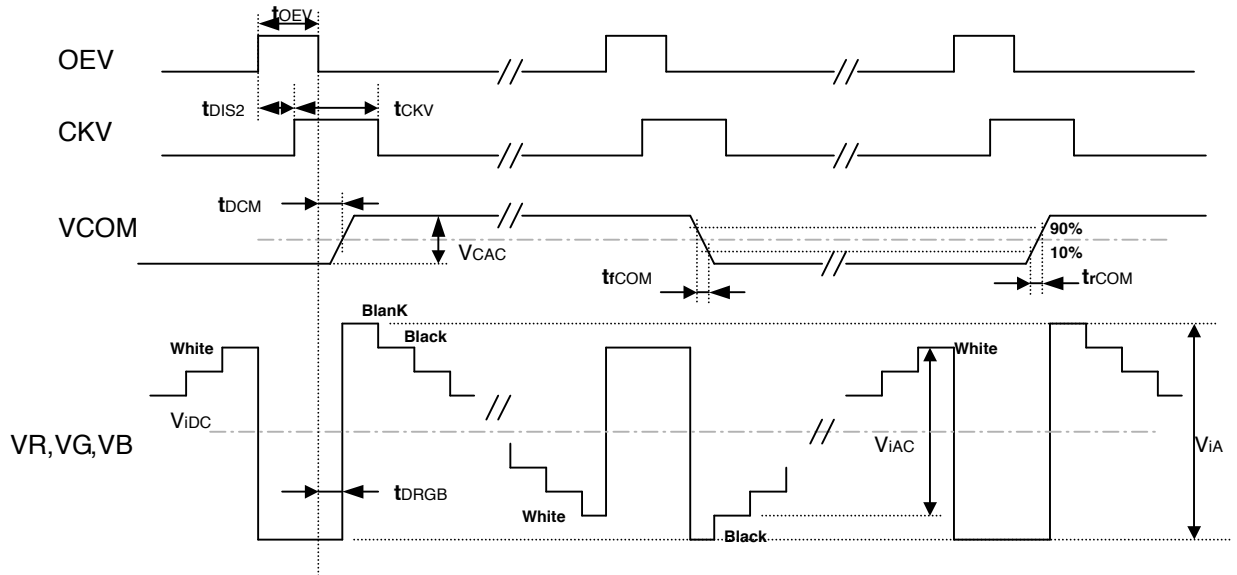
Detail Horizontal timing
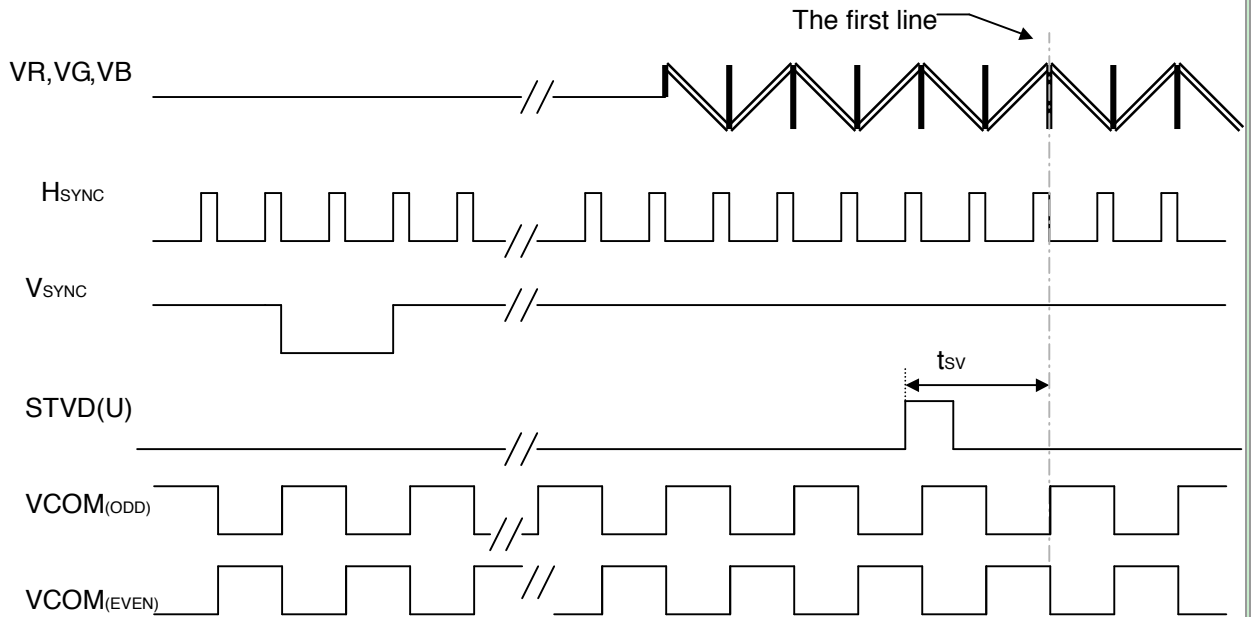
Vertical timing
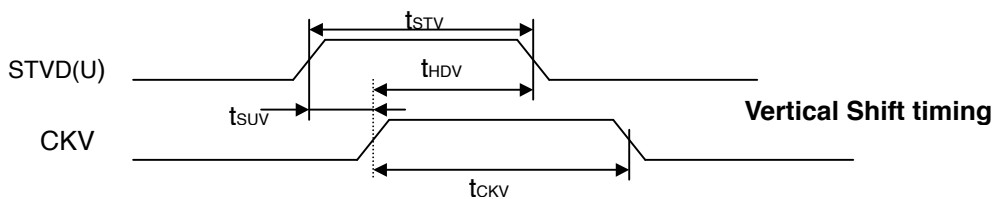
Vertical Shift timing
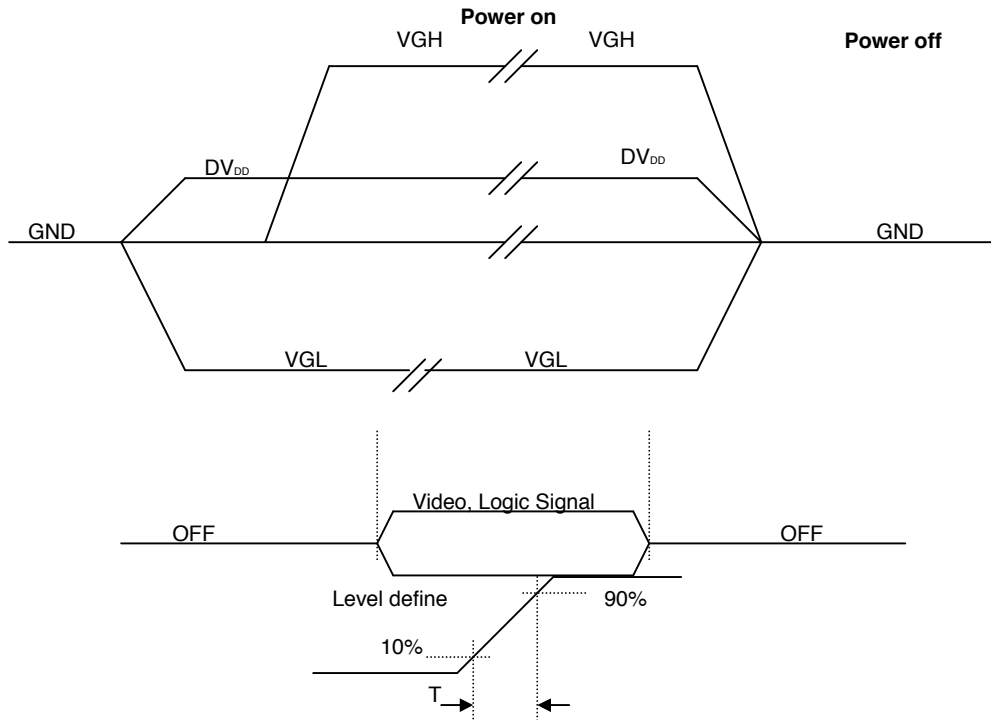
6.4 Power Sequence

Power Sequence: DV_{DD} -> VGL -> VGH

Note: Apply the LED 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=+80°C, 240hrs	
2	Low Temperature Storage	Ta=-30°C, 240hrs	
3	High Temperature Operation	Ta=+70°C, 240hrs	
4	Low Temperature Operation	Ta=-20°C, 240hrs	
5	High Temperature and High Humidity (operation)	Ta=+60°C, 90%RH, 240hrs	
6	Thermal Cycling Test (non operation)	-30°C(30min) → +80°C(30min), 200cycles	
7	Electrostatic Discharge	±200V,200pF(0Ω) 1 time/each terminal	
8	Packing	1. Sine, 1.5G, 5~200Hz, 1hr X, Y, Z direction 2. Random, 1.5Grms, 5~200Hz, 15min/ X, Y, Z direction 3. Half-Sine, 70G, 11ms+ X axis, 2 Times 4. Half-Sine, 200G, 2ms+ X axis, 2 Times 5. 90 degree topples to dash against the hard- face of table.	
9	Altitude Test (non operation)	50000ft, 24hr (25℃)	
10	Altitude Test (operation)	10000ft, 02hr (25℃)	
11	Pressure cooker Test	121℃, 100%R.H., 2atm, 16hr/20hr	

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

8.0 OUTLINE DIMENSION

HSD070I65-F00-02991/ F01-02991 / F02-02991
FPC Length: 42.38 mm

Unit: mm
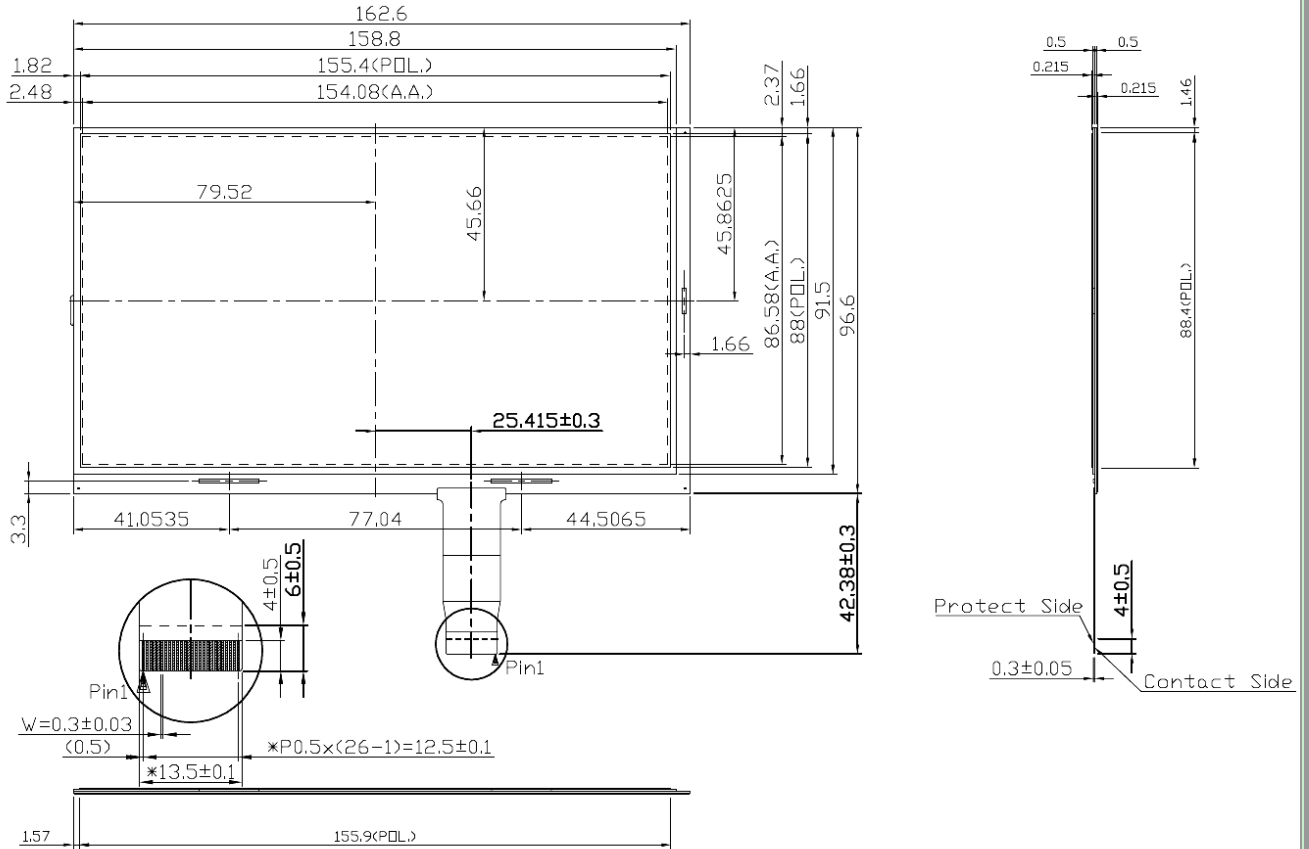
Note: General Tolerance: +/- 0.3mm

Unit: mm

HSD070I65-F10-02991，FPC Length: 73.2849 m
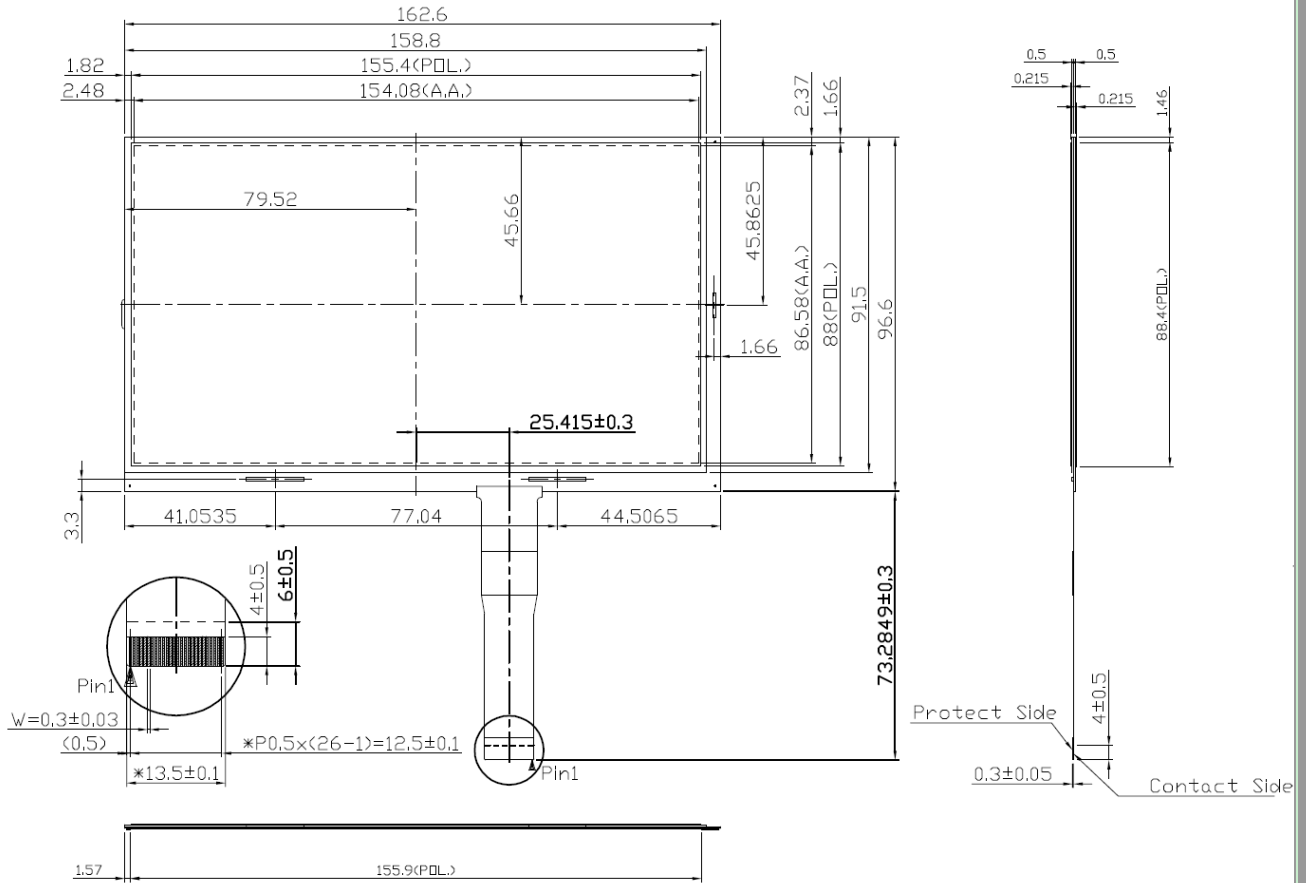
Note: General Tolerance: +/- 0.3mm

9.0   LOT MARK
8.1 Lot Mark

1	2	3	4	5	6	7	8	9	10	11	12
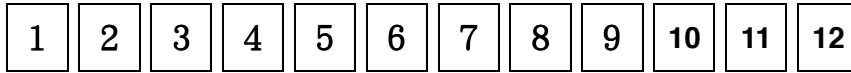
code 1,2: HannStar internal flow control code.
code 3: production location.
code 4: production classification.
code 5: production year.
code 6: production month.
code 7,8,9,10,11,12: serial number.

Note (1) Production Year

Year	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Mark	3	4	5	6	7	8	9	A	B	C

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

 FPC Length: 42.28 mm   FPC Length: 73.19 mm
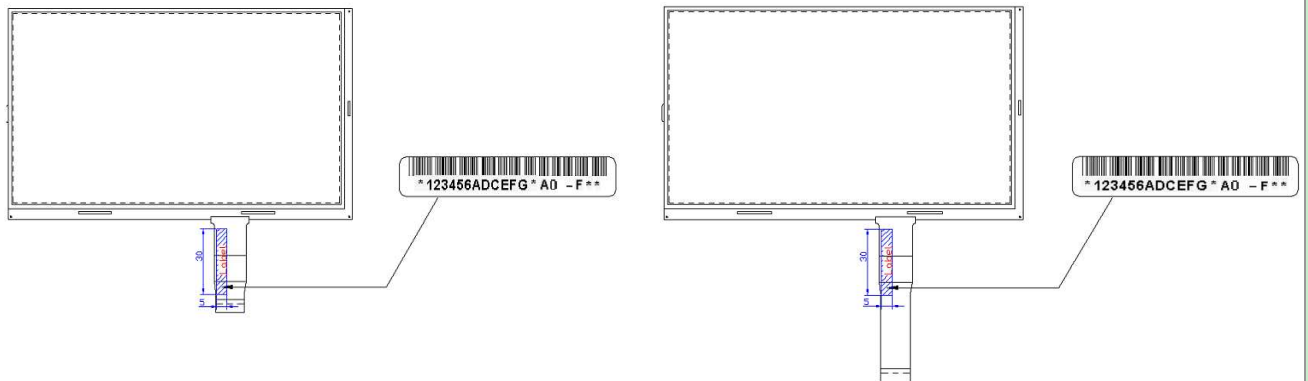
*123456ADCEFG*A0 -F**   *123456ADCEFG*A0 -F**

10.0 PACKAGE SPECIFICATION

10.1 7.0 inch Open Cell Package (80 in 1)
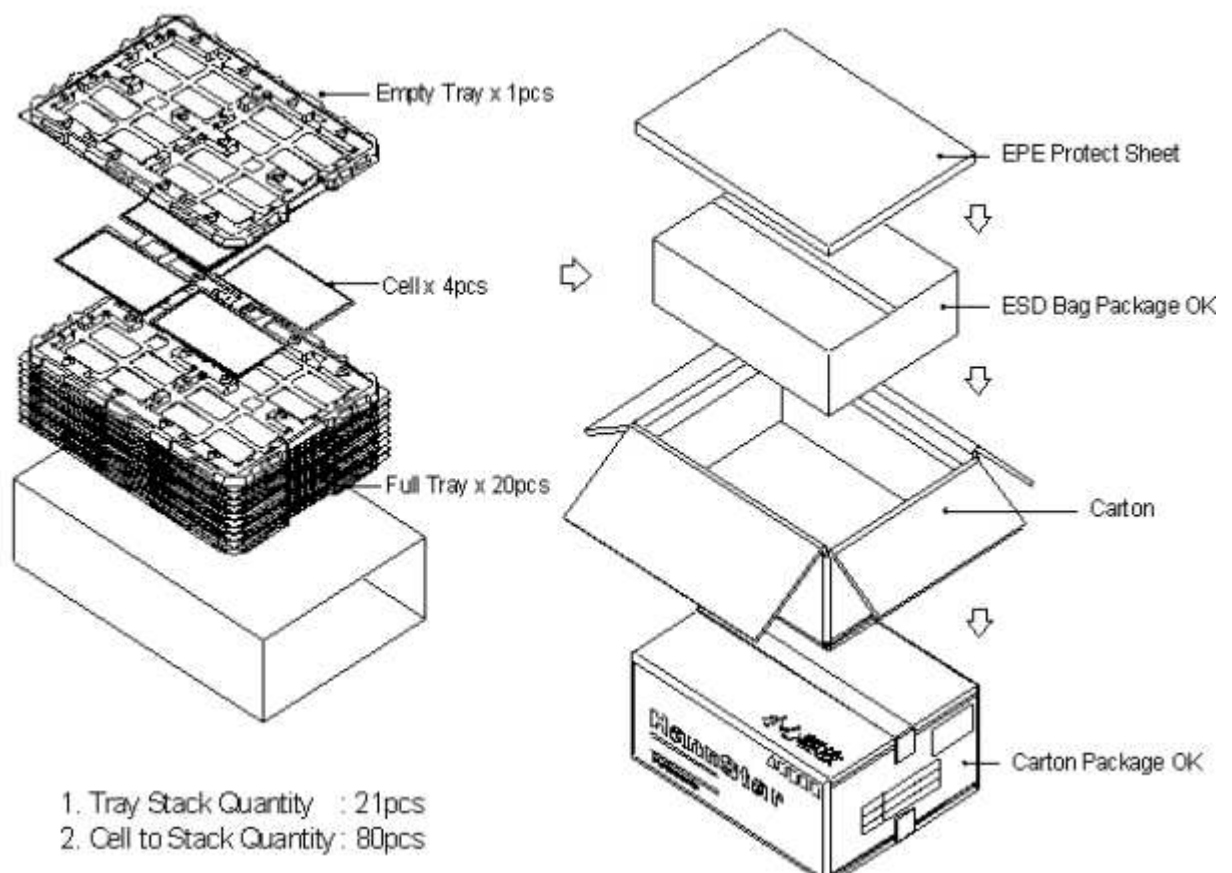
Empty Tray x 1pcs
Cell x 4pcs
Full Tray x 20pcs

1. Tray Stack Quantity : 21pcs
2. Cell to Stack Quantity : 80pcs

EPE Protect Sheet
ESD Bag Package OK
Carton
Carton Package OK

10.2 Pallet drawing

Belt

Pallet

1055±10

1200±5

1000±5
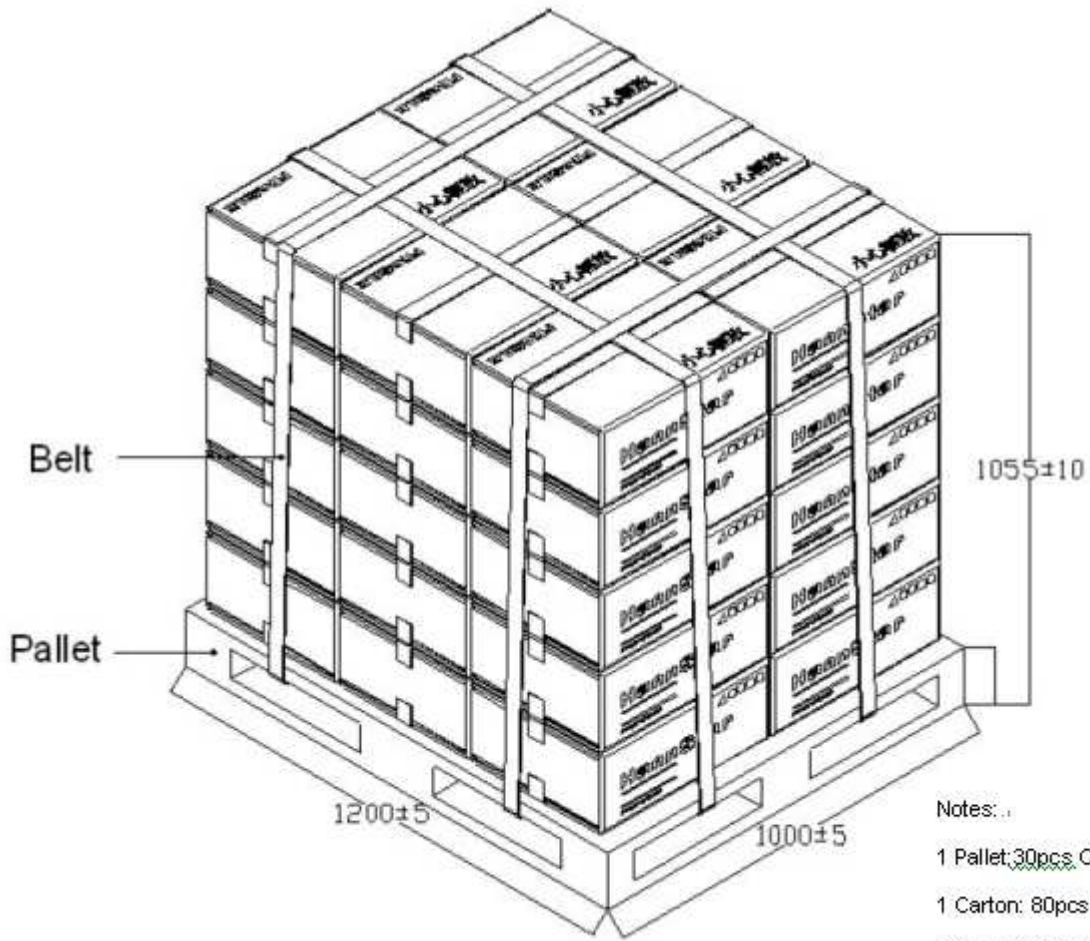
Notes:

1 Pallet: 30pcs Cartons.

1 Carton: 80pcs Cells.

1 Pallet: 2400 Cells.

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 ASSEMBLY PRECAUTION

11.2.1 Please use the mounting hole on the module side in installing and do not bending or wrenching LCD in assembling. And please do not drop, bend or twist LCD module in handling.

11.2.2 Please design display housing in accordance with the following guide lines.

11.2.2.1 Housing case must be destined carefully so as not to put stresses on LCD all sides and not to wrench module. The stresses may cause non-uniformity even if there is no non-uniformity statically.

11.2.2.2 Keep sufficient clearance between LCD module back surface and housing when the LCD module is mounted. The clearance in the design is recommended taking into account the tolerance of LCD module thickness and mounting structure height on the housing.

11.2.3 Please do not push or scratch LCD panel surface with any-thing hard. And do not soil LCD panel surface by touching with bare hands. (Polarizer film, surface of LCD panel is easy to be flawed.)

11.2.4 Please do not press any parts on the rear side such as source IC, gate IC, and FPC during handling LCD module. If pressing rear part is unavoidable, handle the LCD module with care not to damage them.

11.2.5 Please wipe out LCD panel surface with absorbent cotton or soft cloth in case of it being soiled.

11.2.6 Please wipe out drops of adhesives like saliva and water on LCD panel surface immediately. They might damage to cause panel surface variation and color change.

11.2.7 Please do not take a LCD module to pieces and reconstruct it. Resolving and reconstructing modules may cause them not to work well.

11.3 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.

11.4 Breakage of LCD Panel

11.4.1 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.

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

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

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

11.5 Absolute Maximum Ratings and Power Protection Circuit

11.5.1 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.

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

11.5.3 It's recommended employing protection circuit for power supply.

11.6 Operation

11.6.1 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.

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

11.6.3 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 benzine or other adequate solvent.

11.7 Static Electricity

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

11.7.2 Because LCD module uses CMOS-IC on TFT-LCD panel, it is very weak to electrostatic discharge. Please be careful with electrostatic discharge.

11.7.3 Persons who handle the module should be grounded through adequate methods.

11.8 Disposal

When disposing LCD module, obey the local environmental regulations.

11.9 OTHERS

11.9.1 A strong incident light into LCD panel might cause display characteristics' changing inferior because of polarizer film, color filter, and other materials becoming inferior. Please do not expose LCD module direct sunlight land strong UV rays.

11.9.2 Please pay attention to a panel side of LCD module not to contact with other materials in preserving it alone.

11.9.3 For the packaging box, please pay attention to the followings:

11.9.3.1 Packaging box and inner case for LCD are designed to protect the LCDs from the damage or scratching during transportation. Please do not open except picking LCDs up from the box.

11.9.3.2 Please do not pile them up more than 6 boxes. (They are not designed so.) And please do not turn over.

11.9.3.3 Please handle packaging box with care not to give them sudden shock and vibrations. And also please do not throw them up.

11.9.3.4 Packing box and inner case for LCDs are made of cardboard. So please pay attention not to get them wet. (Such like keeping them in high humidity or wet place can occur getting them wet.)