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To :

Date : Jul., 11 , 2013

HannStar Product Specification **(Formal)**

Model : HSD040I3N1-B**
(Module)

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.



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Record of Revisions

Rev.	Date	Sub-Model	Description of change
2.0	Jul., 11,2013	B**	Formal specification was first issued.

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1.0 GENERAL DESCRIPTION

1.1 Introduction

HannStar Display model HSD040I3N1-B is a color active matrix thin film transistor (TFT) liquid crystal display with polarizer. This model is composed of amorphous silicon TFT as a switching device. It is a transmissive type display operating in the normally white mode.

This TFT LCD has a 4-inch diagonally measured active display area with 320 x 240 dot (320 horizontal by 240 vertical pixel) resolution. Each pixel is divided into Red, Green, Blue dots which are arranged in vertical stripes.

1.2 Features

- 4 (4:3 diagonal) inch configuration
- 8-bit color depth with 256 gray-scale
- Parallel 24-bit RGB data input
- RoHS and Halogen-Free compliance

1.3 Applications

- Automobile

1.4 General information

Item	Specification	Unit
Outline Dimension	112.11 x 80.51 x 8.0 t (Typ.)	mm
Display area	82.08 (H) x 61.56 (V)	mm
Number of Pixel	320 RGB (H) x 240 (V)	pixels
Pixel pitch	0.2565 (H) x 0.2565 (V)	mm
Pixel arrangement	RGB Vertical stripe	
Display mode	Normally white	
Weight	95g (typ.)	g
Back-light	Single LED (Side-Light type)	
Power Consumption	B/L System : 4.41 (max.) Logic : 0.06 (max.)	W

1.5 Mechanical Information

Item		Min.	Typ.	Max.	Unit
Module Size	Horizontal (H)	111.81	112.11	112.41	mm
	Vertical (V)	80.21	80.51	80.81	mm
	Depth (D)	—	8	8.3	mm
Weight (Without inverter)		—	95	105	g

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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	V _{cc}	-0.3	4	V	GND=0
Logic Signal Input Level	V _I	-0.3	V _{cc} +0.3	V	

2.1.2 Back-Light Unit

Item	Symbol	Min.	Typ.	Max.	Unit	Note
LED current	I _L	—	420	—	mA	(1) (2)(3)
LED voltage	V _L	—	—	10.5	V	(1) (2)(3)

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) T_a = 25±2°C
- (3) Test Condition: LED current 420mA. The LED lifetime could be decreased if operating I_L is larger than 420mA.

2.2 Environment Absolute Rating

Item	Symbol	Min.	Max.	Unit	Note
Operating Temperature	T _{opa}	-30	80	°C	
Storage Temperature	T _{stg}	-40	95	°C	

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3.0 OPTICAL CHARACTERISTICS

3.1 Optical specification

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Contrast Ratio		CR	Normal viewing angle $\theta=0$	315	350	—	—	(1)(2)
Response time	Rising	T_R		—	4	8	msec	(1)(3)
	Falling	T_F		—	12	24		
White luminance (Center)		Y_L		4000	4700	—	cd/m ²	(1)(4)(7) ($I_L=420mA$)
Color gamut		S(%)		40	45	—	%	
Color chromaticity (CIE1931)	White	W_x	0.26	0.31	0.36		(1)(4)	
		W_y	0.28	0.33	0.38			
Viewing angle	Hor.	θ_L	CR>10	50	60	—	(1)	
		θ_R		50	60	—		
	Ver.	θ_U		50	60	—		
		θ_D		30	40	—		
Brightness uniformity		B_{UNI}	$\theta=0$	70	—	—	%	(5)
View Direction (Gray inversion)		4:30 O'clock						(6)

3.2 Measuring Condition

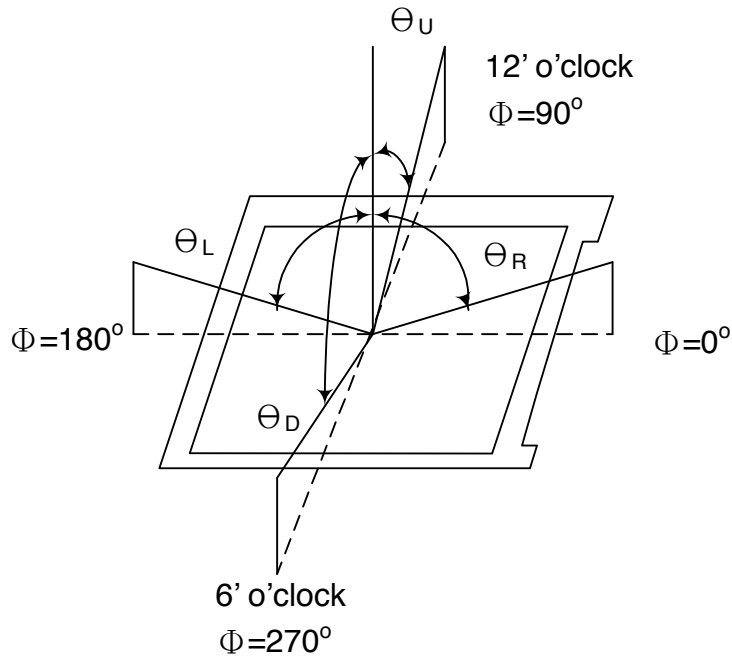
- Measuring surrounding : dark room
- LED current I_L : 420mA
- Ambient temperature : $25\pm 2^\circ C$
- 15min. warm-up time.

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

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Note (1) Definition of Viewing Angle :

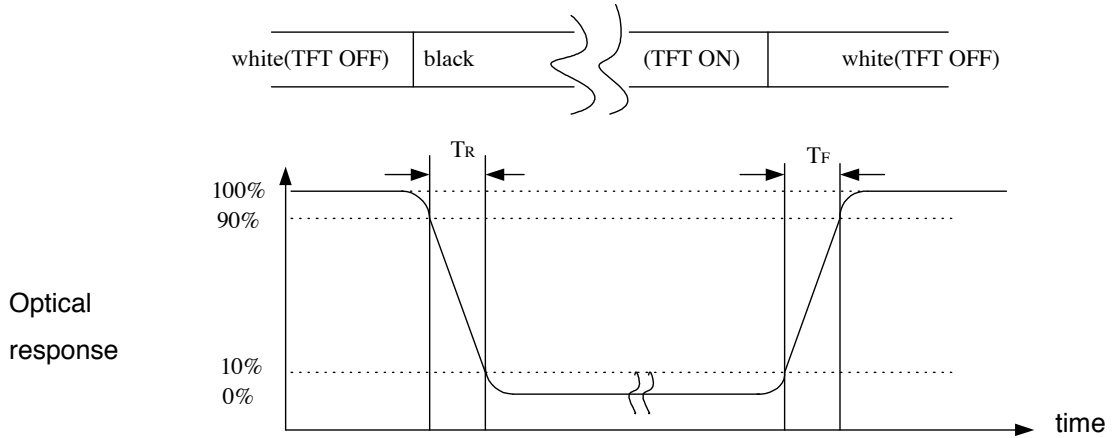


Note (2) Definition of Contrast Ratio(CR) :
measured at the center point of panel

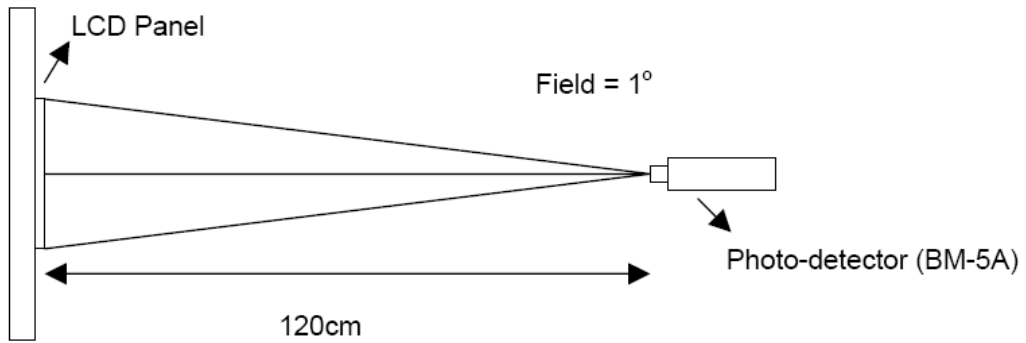
$$CR = \frac{\text{Luminance with all pixels white}}{\text{Luminance with all pixels black}}$$

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

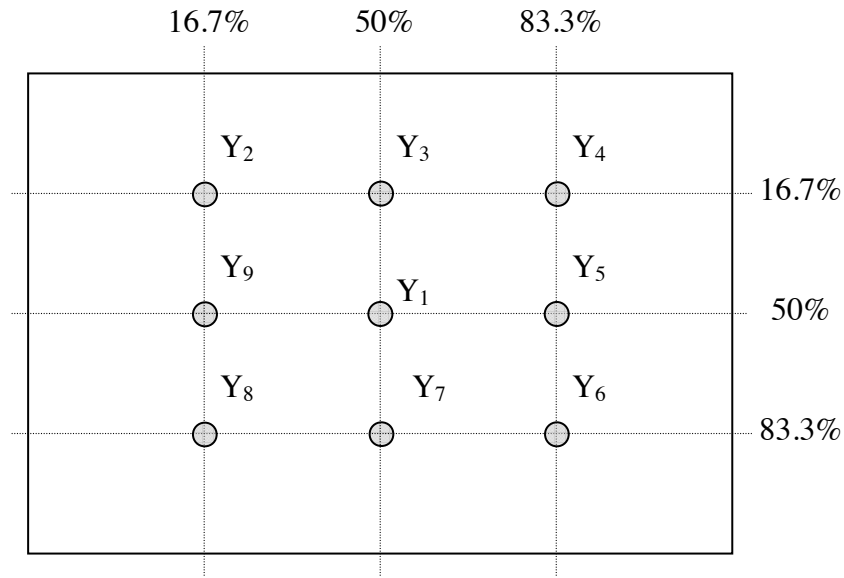


Note (4) Definition of optical measurement setup



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Note (5) Definition of brightness uniformity



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

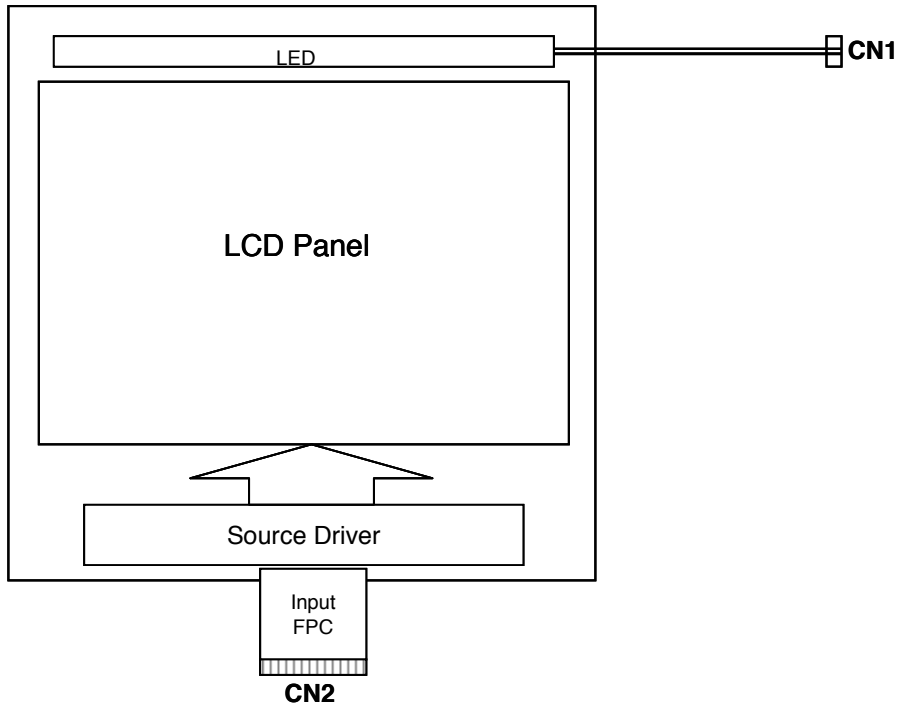
Note (6) Rubbing Direction (The different Rubbing Direction will cause the different optimal view direction.)

Note (7) Measured at the brightness of the panel when all terminals of LCD panel are electrically open.

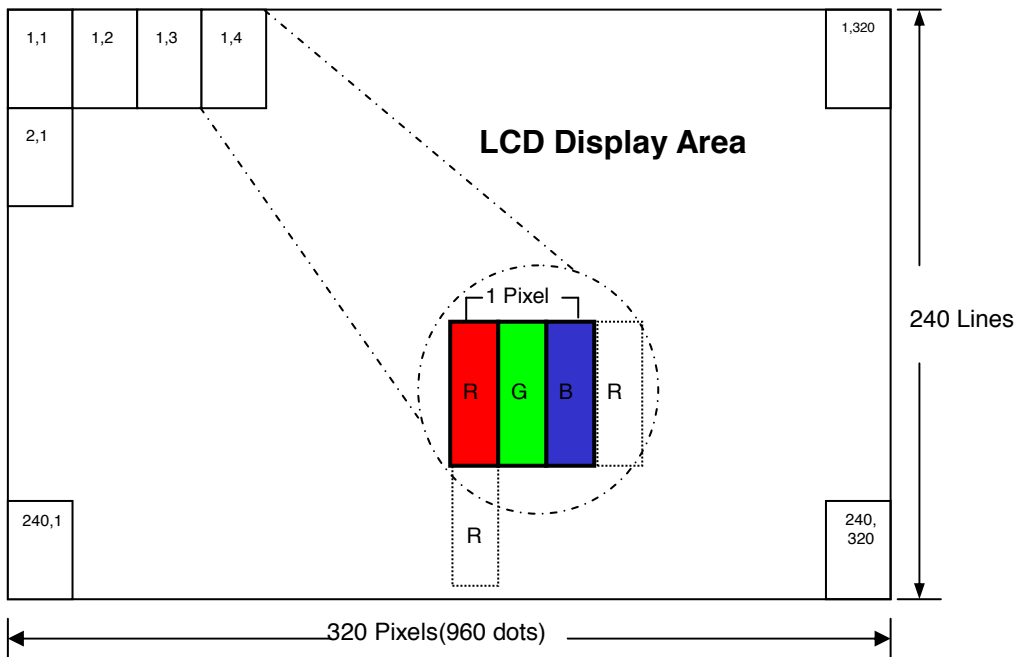
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4.0 BLOCK DIAGRAM

4.1 TFT LCD Module



4.2 Pixel Format



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5.0 INTERFACE PIN CONNECTION

5.1 FPC PIN ASSIGNMENT

No.	Symbol	Function	No.	Symbol	Function
1	Dummy	No connect	21	B0	Blue data (LSB)
2	Dummy	No connect	22	B1	Blue data
3	GND	Power ground	23	B2	Blue data
4	VDD	Vci=2.7~3.6V (analog)	24	B3	Blue data
5	R0 (D00)*	Red data (LSB)	25	B4	Blue data
6	R1 (D01)*	Red data	26	B5	Blue data
7	R2(D02)*	Red data	27	B6	Blue data
8	R3 (D03)*	Red data	28	B7	Blue data (MSB)
9	R4 (D04)*	Red data	29	GND	Power ground
10	R5 (D05)*	Red data	30	PCLK (BT-656 interface)*	- Clock signal - The input data is latched on the rising edge of CLK
11	R6 (D06)*	Red data	31	DISP (即 STB)	- Operation mode selection - When STB=L, ILI9322 enters the standby mode and all outputs stop. - When STB=H, ILI9322 enters normal operation mode.
12	R7 (D07)*	Red data (MSB)	32	HSYNC	Horizontal sync signal
13	G0	Green data (LSB)	33	VSYNC	Vertical sync signal
14	G1	Green data	34	DE	Data Enable
15	G2	Green data	35	nRESET	- A reset pin. - Initializes the ILI9322 with a low input. Be sure to execute a power-on reset after supplying power.
16	G3	Green data	36	IFSEL	IFSEL : L==> 24-bit Parallel RGB interface H==> ITU-R BT.656 (Default mode)
17	G4	Green data	37	NC	No connect
18	G5	Green data	38	SCL	- SPI clock signal. Fix to GND level when not in use.
19	G6	Green data	39	SDA	- SPI interface input pin. - The data is latched on the rising edge of the SCL signal. Fix to GND level when not in use.
20	G7	Green data (MSB)	40	CSB	- A chip select signal. - When CSB=L : the ILI9322 is selected and accessible - When CSB=H : the ILI9322 is not selected and not accessible. Fix to IOVCC level when not in use.

* BT656 interface : Pin 5~12(D00~D07) , Pin30(PCLK)

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5.2 Back-Light Unit

CN1 Mating Connector: JST BHSR-02VS-1 or equivalent

Terminal no.	Symbol	Function
1	VL (White) UL10368,AWG28 (300VAC) ϕ 0.92	LED power supply (high voltage)
2	GL (black) UL10368,AWG28 (300VAC) ϕ 0.92	LED power supply (low voltage)

6.0 ELECTRICAL CHARACTERISTICS

6.1 DC Electrical Characteristics

Parameters	Symbol	Min.	Typ.	Max.	Unit	Note
Supply voltage	V_{DD}	3.0	3.3	3.6	V	
Input signal voltage	V_{iH}	$0.7 V_{DD}$	—	V_{DD}	V	Note (1)
	V_{iL}	GND	—	$0.3 V_{DD}$	V	Note (1)
Current of power supply	I_{DD}	—	12.0	—	mA	$V_{DD} = 3.3V$

Note (1): HSYNC, VSYNC, DE, R/G/B Data

Note (2): GND = 0V

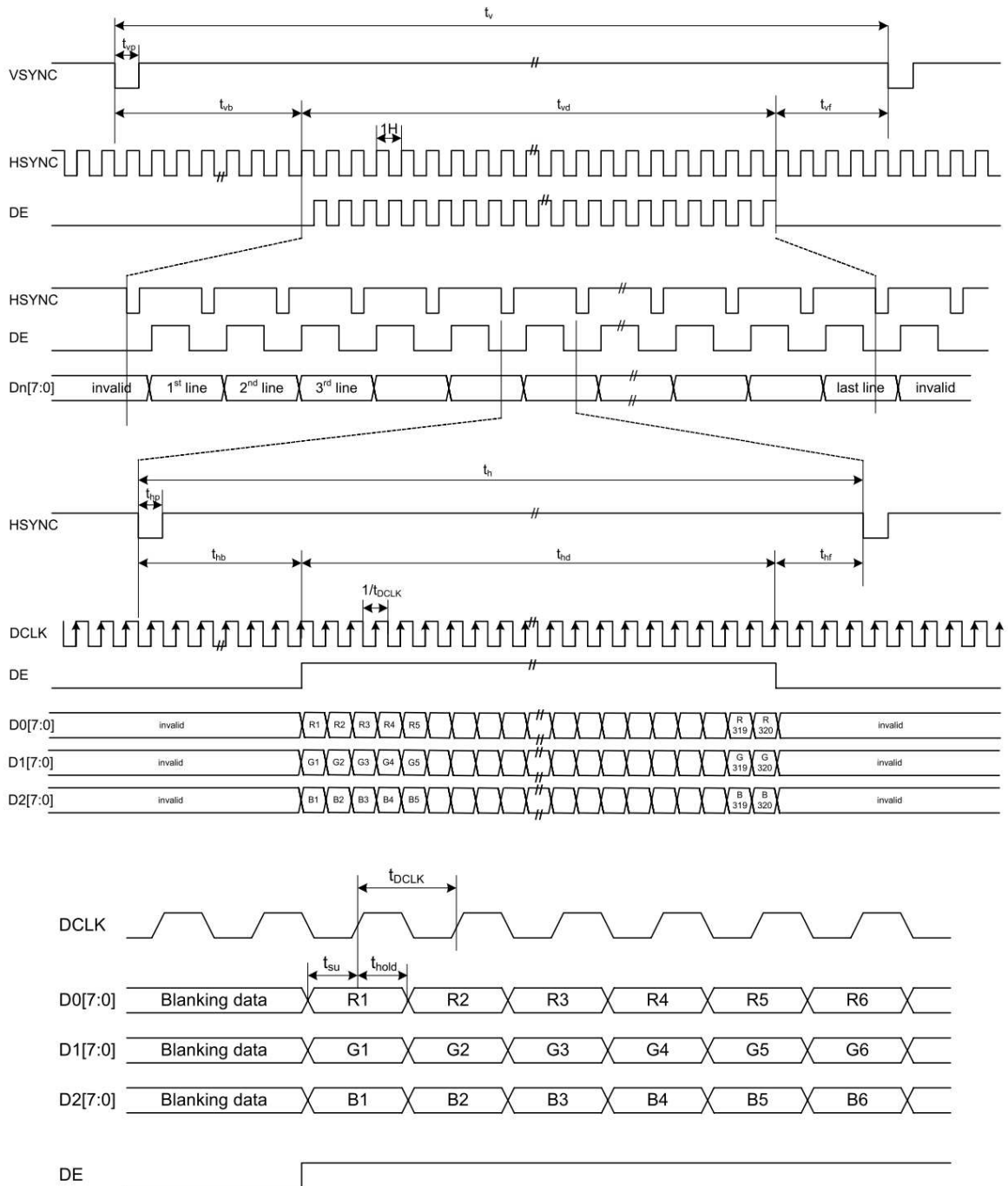
6.2 Data Input Format

Parallel 24-bit RGB Input Timing Table

Parameters	Symbol	Min.	Typ.	Max.	Unit	Conditions
DCLK frequency	$1/t_{DLCK}$	-	9	11	MHz	
HSYNC period time	t_h	-	560	-	t_{DLCK}	
HSYNC display area	t_{hd}	320	320	320	t_{DLCK}	
HSYNC back porch	t_{hb}	-	180	-	t_{DLCK}	
HSYNC front porch	t_{hf}	-	60	-	t_{DLCK}	
HSYNC pulse width	t_{hp}	1	10	-	t_{DLCK}	
VSYNC period time	t_v	-	262	-	t_h	
VSYNC display area	t_{vd}	240	240	240	t_h	
VSYNC back porch	t_{vb}	2	18	-	t_h	
VSYNC front porch	t_{vf}	2	4	-	t_h	
VSYNC pulse width	t_{vp}	1	1	-	t_h	
Data setup time	t_{su}	12	-	-	ns	
Data hold time	t_{hold}	12	-	-	ns	

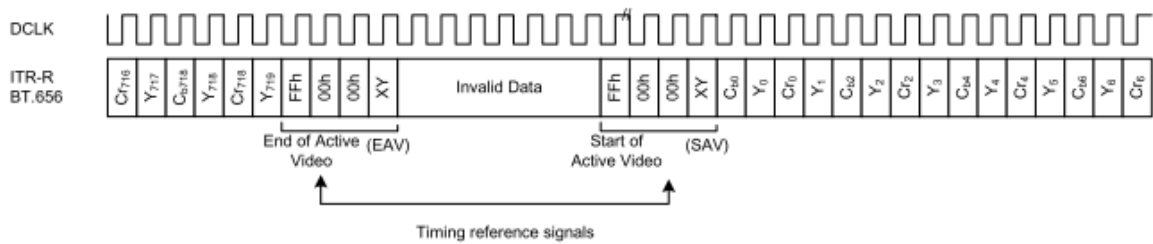
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Parallel 24-bit RGB Mode Data Format



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ITU-R BT.656 Interface



Note:

1. FFh, 00h, 00h, XY signals are involved with the HSYNC, VSYNC and Field signals

F: field indication

V: Vertical blanking indication

H: Horizontal blanking indication

P3 ~ P0: protection bits

$$P3 = V \oplus H, \quad P2 = F \oplus H, \quad P1 = F \oplus V, \quad P0 = F \oplus V \oplus H$$

Data bit number	First Word (FFh)	Second Word (00h)	Third Word (00h)	Fourth Word (XY)
7 (MSB)	1	0	0	1
6	1	0	0	F
5	1	0	0	V
4	1	0	0	H
3	1	0	0	P3
2	1	0	0	P2
1	1	0	0	P1
0 (LSB)	1	0	0	P0

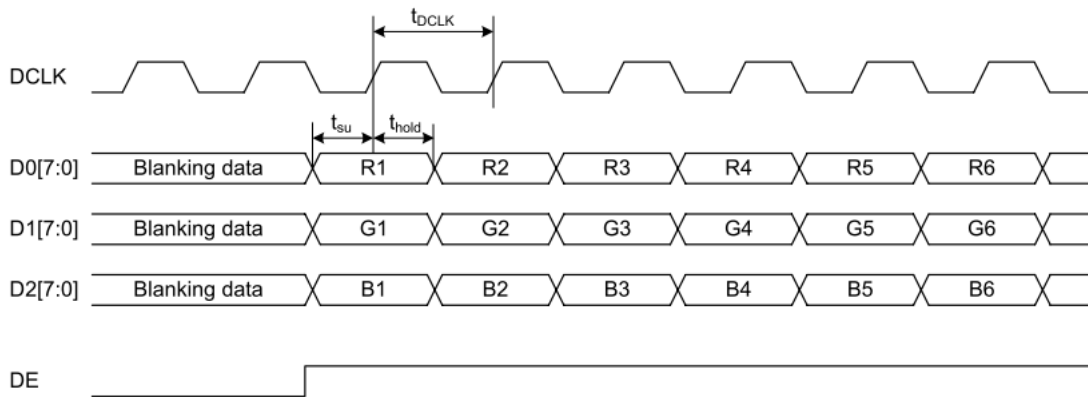
2. Horizontal blanking section consists of repeating pattern 80, 10, 80, 10.
3. Vertical back porch time (t_{vb}) is adjustable by setting register VBP; requirement of min. back porch and min. front porch time must be satisfied.
4. Interlace and non-interlace vertical input interfaces are acceptable.

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6.3 AC Electrical Characteristics

Parameters	Symbol	Min.	Typ.	Max.	Unit	Conditions
DCLK period time	t_{DCLK}		156	91	ns	Parallel 24-bit RGB mode
Data setup time	t_{SU}	12	-	-	ns	
Data hold time	t_{HOLD}	12	-	-	ns	

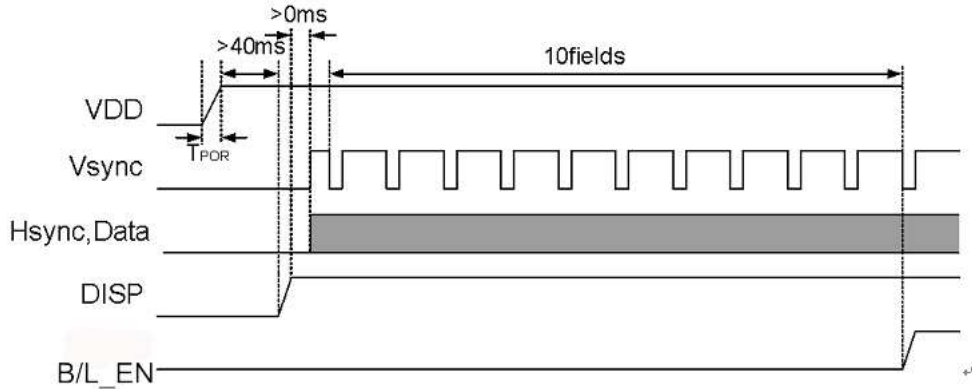
Data Input Timing Diagram



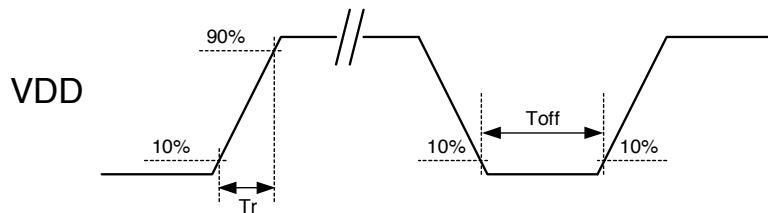
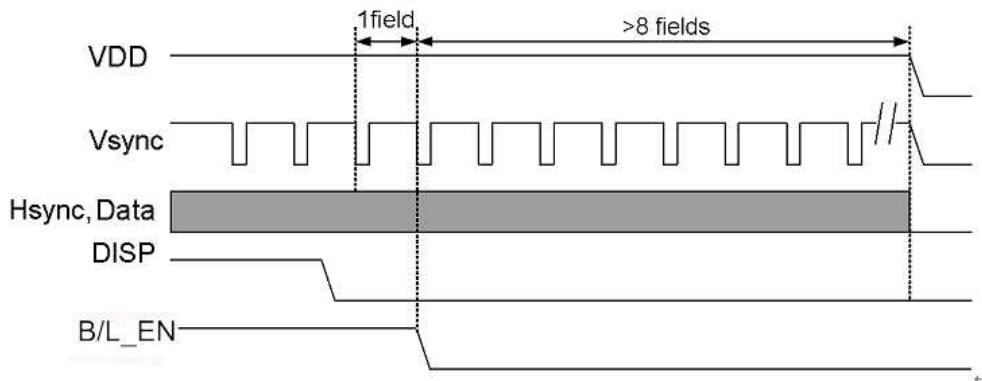
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6.4 Power On/Off Sequence

Power On Sequence



Power Off Sequence



VDD power input timing

Notes:

- Data include R0~R7, G0~G7, B0~B7, HSD, VSD, DCLK, DE
- Power on sequence: VDD → DISP → Data → B/L_EN
- Power off sequence: DISP → B/L_EN → Data → VDD
- VDD power input timing: $0.5\text{ms} < Tr < 10\text{ms}$; $Toff > 250\text{ms}$

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7.0 Reliability test items

No.	Item	Conditions	Remark
1	High Temperature Storage	Ta=+95°C, 240hrs	
2	Low Temperature Storage	Ta=-40°C, 240hrs	
3	High Temperature Operation	Ta=+80°C, 240hrs	
4	Low Temperature Operation	Ta=-30°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	Vibration	1. Random: 1.04Grms, 5~500Hz, X/Y/Z, 30min/each direction 2. Sine: Freq. Range: 8~33.3Hz Stoke: 1.3mm Sweep: 2.9G, 33.3~400Hz X/Z: 2hr, Y: 4hr, cyc: 15min	
9	Shock	100G, 6ms, ±X, ±Y, ±Z 3 time for each direction	JIS C7021, A-10 (Condition A)
10	Vibration (with carton)	Random: 0.015G ² /Hz, 5~200Hz -6dB/Octave, 200~400Hz XYZ each direction: 2hr	
11	Drop (with carton)	Height: 60cm 1 corner, 3 edges, 6 surfaces	JIS Z0202

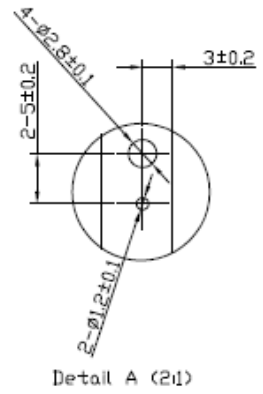
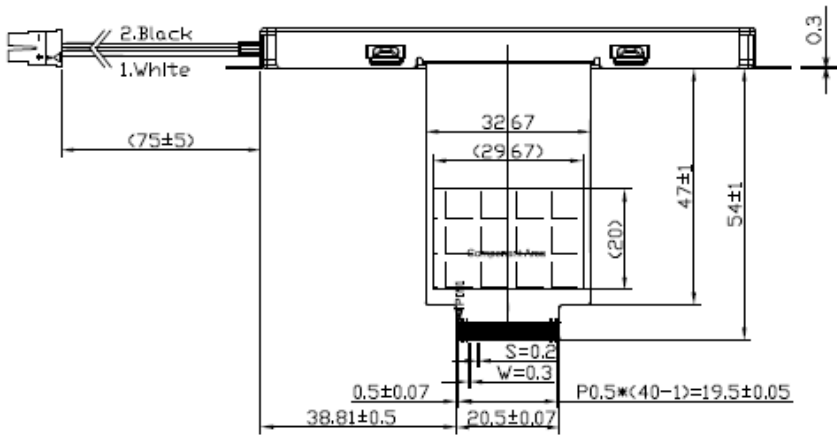
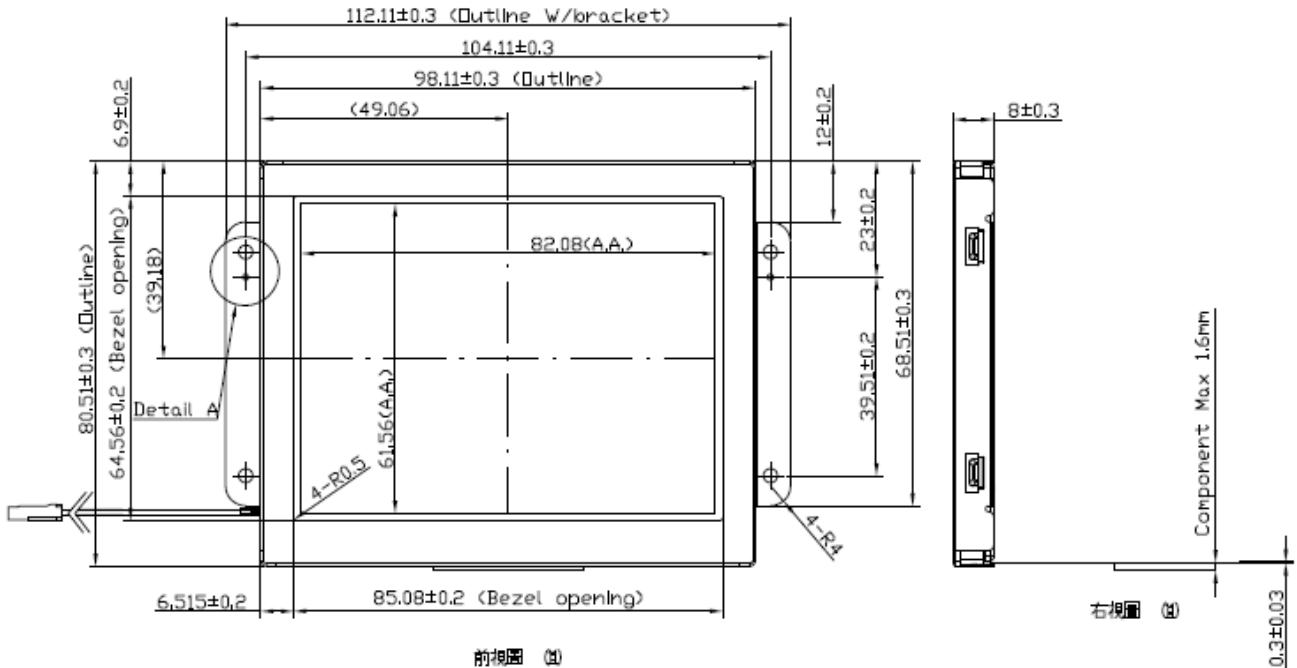
Note: (1) All tests above are practiced at module type.

(2) There is no display function NG issue occurred, all the cosmetic specification is judged before the reliability stress.

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8.0 OUTLINE DIMENSION

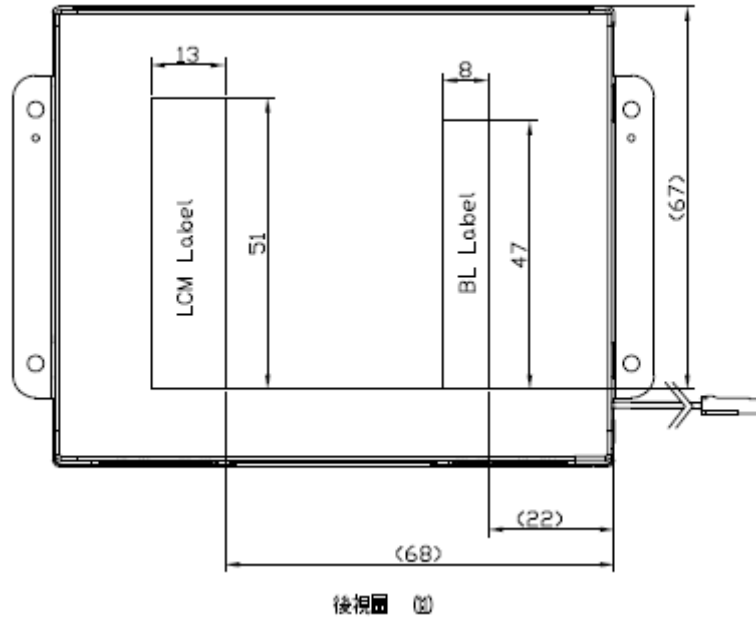
8.1 Outline Dimension



Note: General Tolerance: +/- 0.3mm

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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: Code 8 is defined by the last number of the year, for example

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Mark	5	6	7	8	9	0	1	2	3	4

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

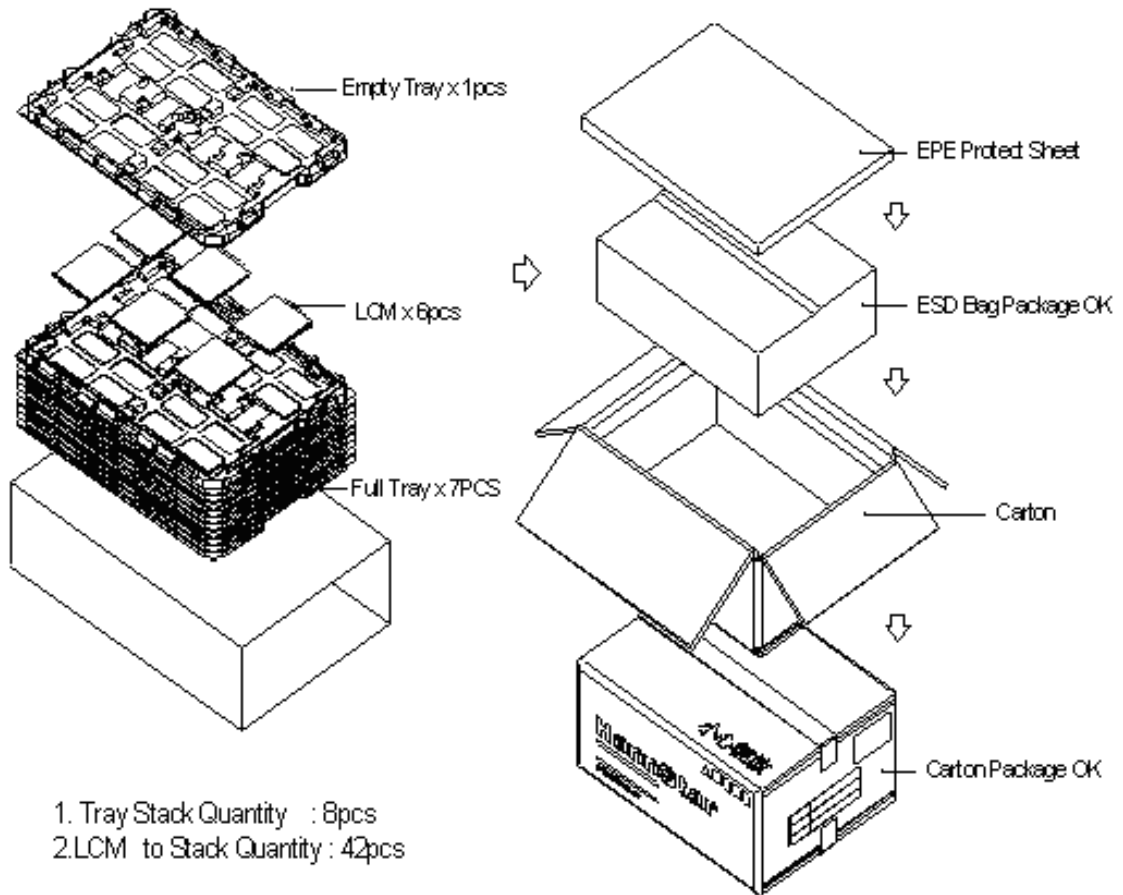
9.2 Location of Lot Mark

(1) Detail of the Mark: as attached below.

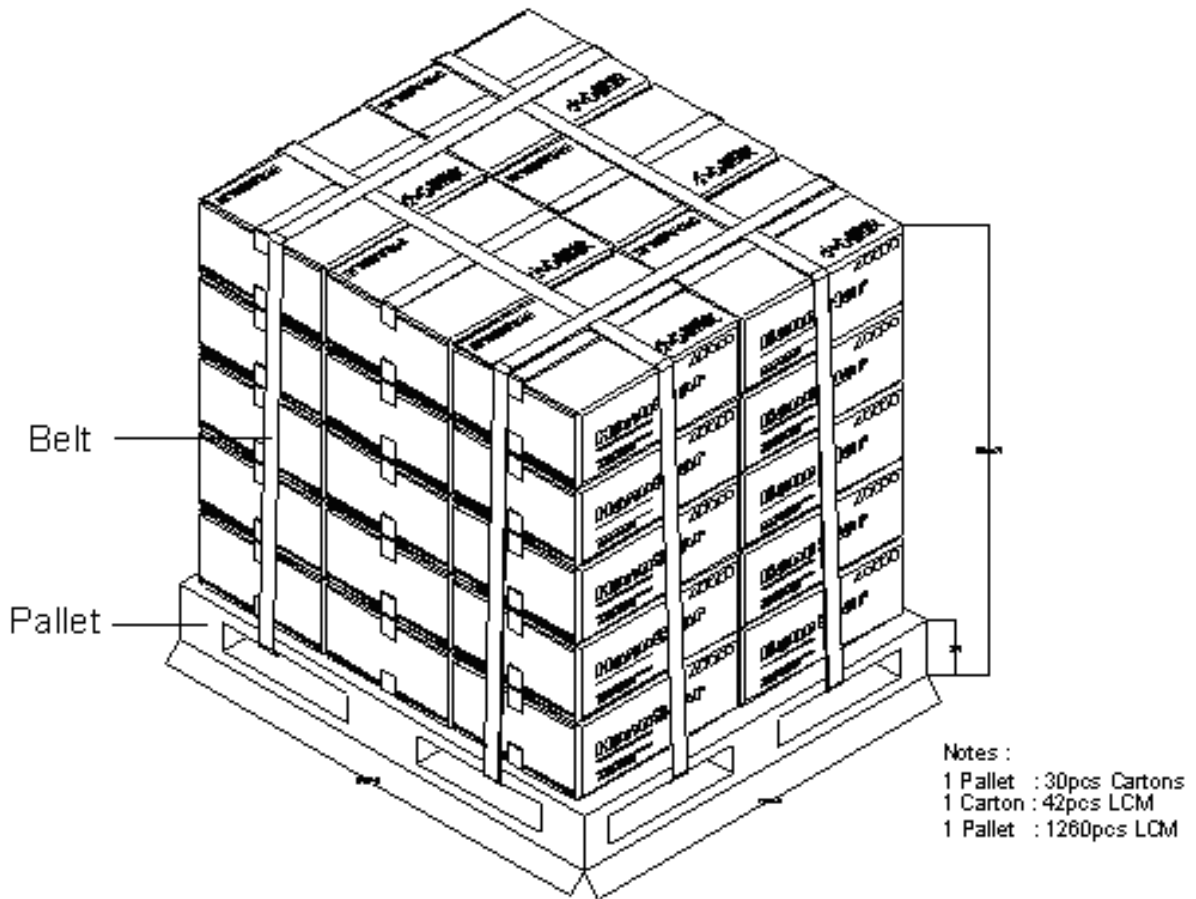
(2) This is subject to change without prior notice.

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10.0 PACKAGE SPECIFICATION



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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 LCD. It may damage sensitive parts inside LCD, and may cause scratches or dust on the display. HannStar does not warrant the LCD, 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 Absolute Maximum Ratings and Power Protection Circuit

- 11.4.1 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 may be damaged.
- 11.4.2 Please do not leave LCD in the environment of high humidity and high temperature for a long time.
- 11.4.3 It's recommended to employ protection circuit for power supply.

11.5 Operation

- 11.5.1 Do not touch, push or rub the polarizer with anything harder than HB pencil lead If the LCD attaches a polarizer.
- 11.5.2 Use fingerstalls of soft gloves in order to keep clean display quality, when persons handle the LCD for incoming inspection or assembly.
- 11.5.3 When the surface is dusty, please wipe gently with absorbent cotton or other soft material.
- 11.5.4 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.
- 11.5.5 When cleaning the adhesives, please use absorbent cotton wetted with a little petroleum benzine or other adequate solvent.

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11.6 Static Electricity

11.6.1 Protection film must remove very slowly from the surface of LCD to prevent from electrostatic occurrence if the LCD attaches a polarizer.

11.6.2 Because TFT-LCD panel is very weak to electrostatic discharge, please be careful with electrostatic discharge.

Persons who handle the LCD should be grounded through adequate methods.

11.7 Strong Light Exposure

The LCD shall not be exposed under strong light such as direct sunlight. Otherwise display characteristics may be changed.

11.8 Disposal

When disposing LCD, obey the local environmental regulations.