HannStar Display Corp.

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Hannstar Product Information

Model : HSD230WX12 -B01

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.

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Record of Revisions

Rev.	Date	Sub-Model	Description of change
1.0	June 1st, 2005	B01	HSD230WX12-B01 product information was first issued.

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1.0 GENERAL DESCRIPTIONS

1.1 Introduction

HannStar Display model HSD230WX12-B01 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 22.92-inch diagonally measured active display area with Wide XGA resolution (768 vertical by 1280 horizontal pixel array) and can display up to 16.7 million colors.

1.2 Features

- 22.92" WXGA for TV application panel
- High brightness and wide view angle
- Fast response time & High color reproduction
- LVDS interface system.
- Long lamp lifetime.

1.3 Applications

- High Definition TV application
- Public Display
- Measuring Instrument
- New media equipment

1.4 General information

Item	Specification	Unit
Display area	499.20(H) x 299.52(V)	mm
Number of Pixel	1280(H) x 768(V)	pixels
Pixel pitch	0.39(H) x 0.39(V)	mm
Pixel arrangement	RGB Vertical stripe	
Display color	16,7M	colors
Display mode	Normally Black	
Surface treatment	Anti-Glare, Hard-Coating(3H)	
Weight(without inverter)	2500	g
Back-light	12 CCFL	
Input signal	1-ch LVDS 8bit	

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1.5 Mechanical Information

Item		Min.	Typ.	Max.	Unit
Module Size	Horizontal(H)	539.5	540.0	540.5	mm
	Vertical(V)	339.5	340.0	340.5	mm
	Depth(D)	30.1	30.6	31.3	mm
Weight (Without inverter)		--	2500	2700	g

Customer screw torque suggestion value :

Side Mount: Not Suggest.

Front Mount: M3: 3 to 6 kgf-cm

M3.5: 4 to 8 kgf-cm

M4: 6 to 10 kgf-cm

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2.0 ABSOLUTE MAXIMUM RATINGS

Item	Symbol	Min.	Max.	Unit	Note
Storage temperature	T_{STG}	-20	60	^{o}C	(1)
Operating temperature	T_{OPR}	0	50	^{o}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	(4)
Operating humidity	H_{OP}	10	80	%RH	(4)
Low pressure(operating)	H_{LOP}	697		hPa	(5)
Low pressure(non-operating)	H_{LNOP}	116		hPa	(6)

2.1 Absolute Rating of Environment

Note(1) Temperature and Humidity should be applied to the glass surface of a TFT module, not to the system installed with a module.

Storage /Operating temperature
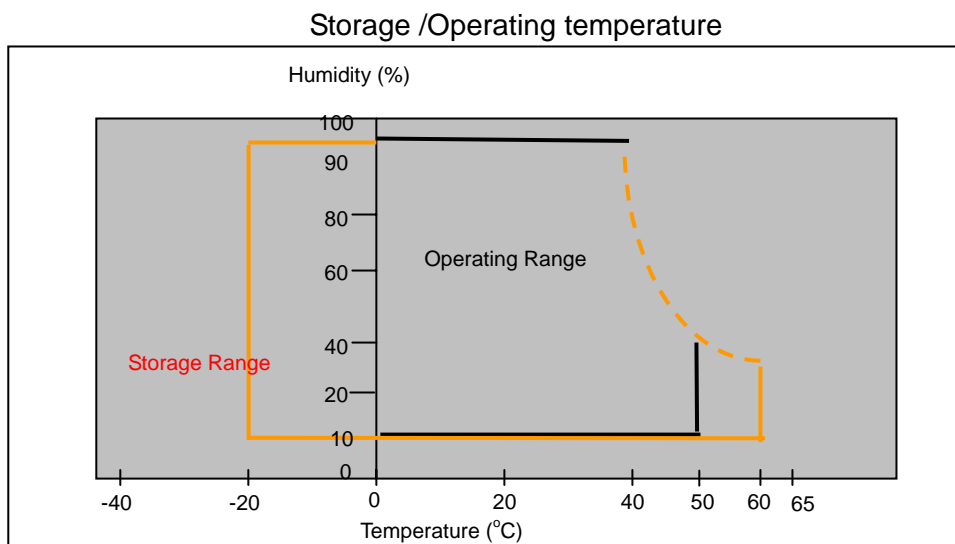
(2) 10-500Hz, Random, 30min/cycle, X/Y/Z each one cycle except for resonant frequency.

(3) 11ms, ±X, ±Y, ±Z direction, one time each.

(4) Max wet bulb temp. =39°C

(5) 2 hrs. (10000 feet)

(6) 24hrs. (50000 feet)

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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	V	(1)
Logic input voltage	V_{IN}	-0.3	4	V	(1)

2.2.2 Back Light Unit:

Item	Symbol	Min.	Max.	Unit	Note
Lamp voltage	V_L	--	2500	V_{rms}	(1)
Lamp current	I_L	-	8.0	mA	(1)
Lamp frequency	f_L	25	100	kHz	(1)

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) To exceed 6.0 mA (by each one lamp), lift time accelerate drop down and if to Exceed 9.0 mA has safety problem. If current lower than 3.5 mA , CCFL would Be unstable or damage.

(3) Within Ta = 25 +/- 2℃

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3.0 OPTICAL CHARACTERISTICS

3.1 Optical specification

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Contrast		CR		400	500		-	(1)(2)
Response time	Rising	Tr			16	13	msec	(1)(3)
	Falling	Tf				13		
luminance of white(center)		Y_L		400	500		cd/m^2	(1)(4)(5) (I_L=6.0mA)
Color chromaticity (CIE1931)	Red	R_x	=0 =0 Normal viewing angle	0.610	0.640	0.670	-	(1)(4)
		R_y		0.291	0.321	0.351	-	
	Green	G_x		0.255	0.285	0.315	-	
		G_y		0.573	0.603	0.633	-	
	Blue	B_x		0.112	0.142	0.172	-	
		B_y		0.042	0.072	0.102	-	
	White	W_x		0.253	0.283	0.313	-	
		W_y		0.268	0.298	0.328	-	
Viewing angle	Hor.	θ_R	CR>10		85		Deg	
		θ_L			85			
	Ver.	θ_U			85			
		θ_D			85			
Brightness uniformity		B_{UNI}		70	80		%	(6)

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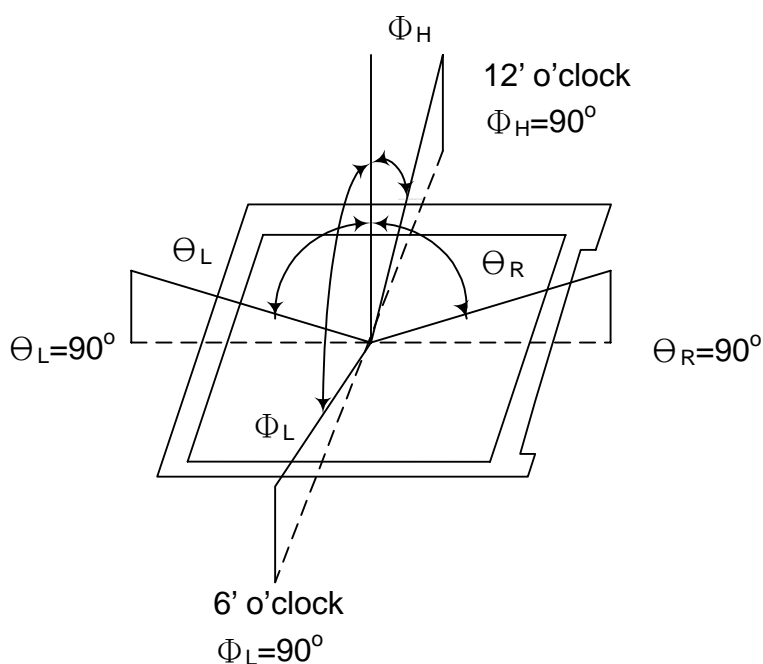| Document Title	HSD230WX12 Product Information	Page No.	9/31
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3.2 Measuring Condition

- ■ Measuring surrounding : dark room
- ■ Single Lamp current I_L :6.0mA+-0.5mA, lamp freq. F_L= 50KHz
- ■ V_{DD}=+5.0V, f_V=60Hz, f_{DCLK}=65MHz
- ■ Inverter Model:PLCD09231202(EMax)
- ■ Surrounding temperature : 25°C
- ■ 40min. warm-up time (Vertically Set)

3.3 Measuring Equipment

- ■ MD-3000V of Otsuka Electrics Corp., which utilized MCPD-7000 for Chromaticity and BM-5 for other optical characteristics.
- ■ Measuring spot size : 10 ~ 12 mm

Note (1) Definition of Viewing Angle:

Φ_H

12' o'clock
Φ_H=90°

Θ_L Θ_R

Θ_L=90° Θ_R=90°

Φ_L

6' o'clock
Φ_L=90°

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

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

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

black(TFT OFF)   White   (TFT ON)   black(TFT OFF)

100%
90%

10%
0%

Tr   Tf
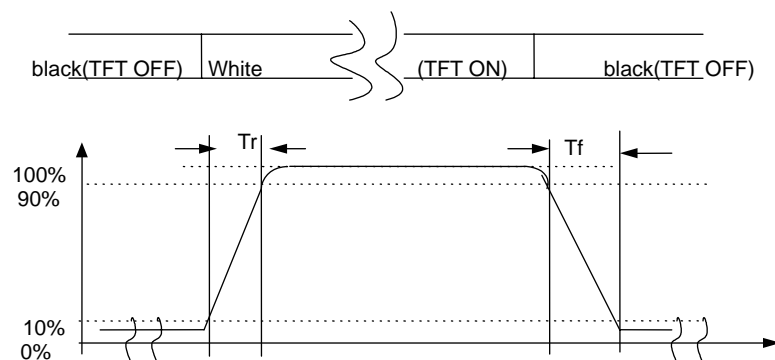
Note (4) Optical characteristic measurement setup

Photo-detector (BM-5A)

50cm

Field=2°

Center of panel

LCD panel

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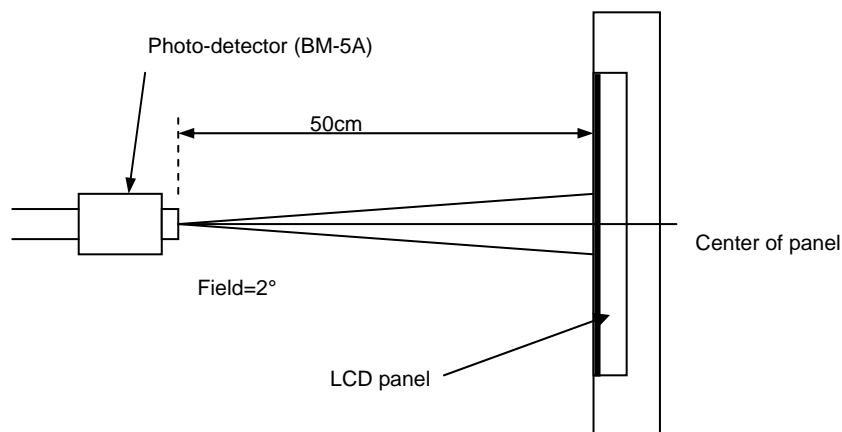
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Note (5) Definition of Average Luminance of White (center)
Average Luminance $=$ Y1
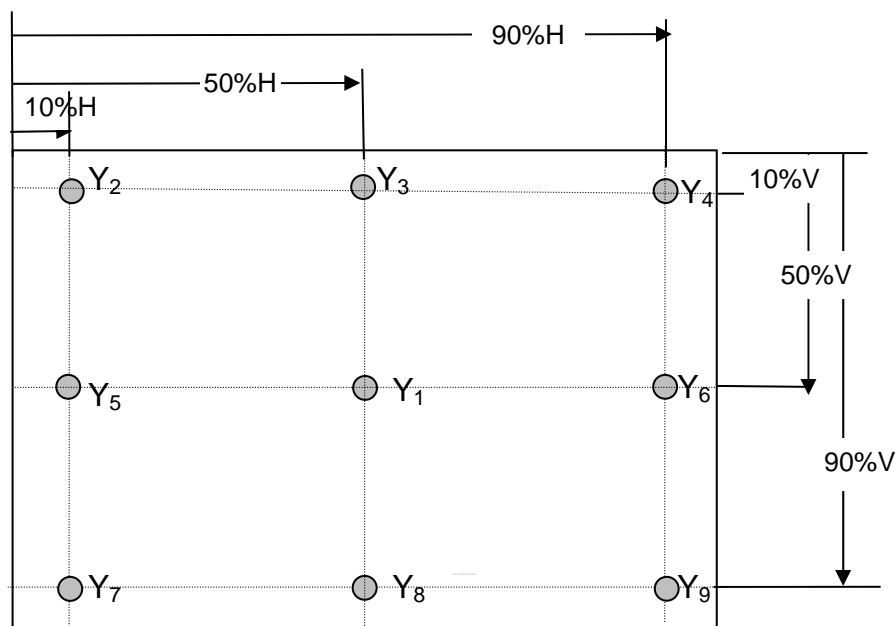
Note (6) Definition of brightness uniformity (9pt)

$$\text{Luminance uniformity} = \frac{\text{(Min Luminance of Y1~Y9 points)}}{\text{(Max Luminance of Y1~Y9 points)}} \times 100\%$$

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4.0 BLOCK DIAGRAM

4.1 LCD Module Block Diagram:

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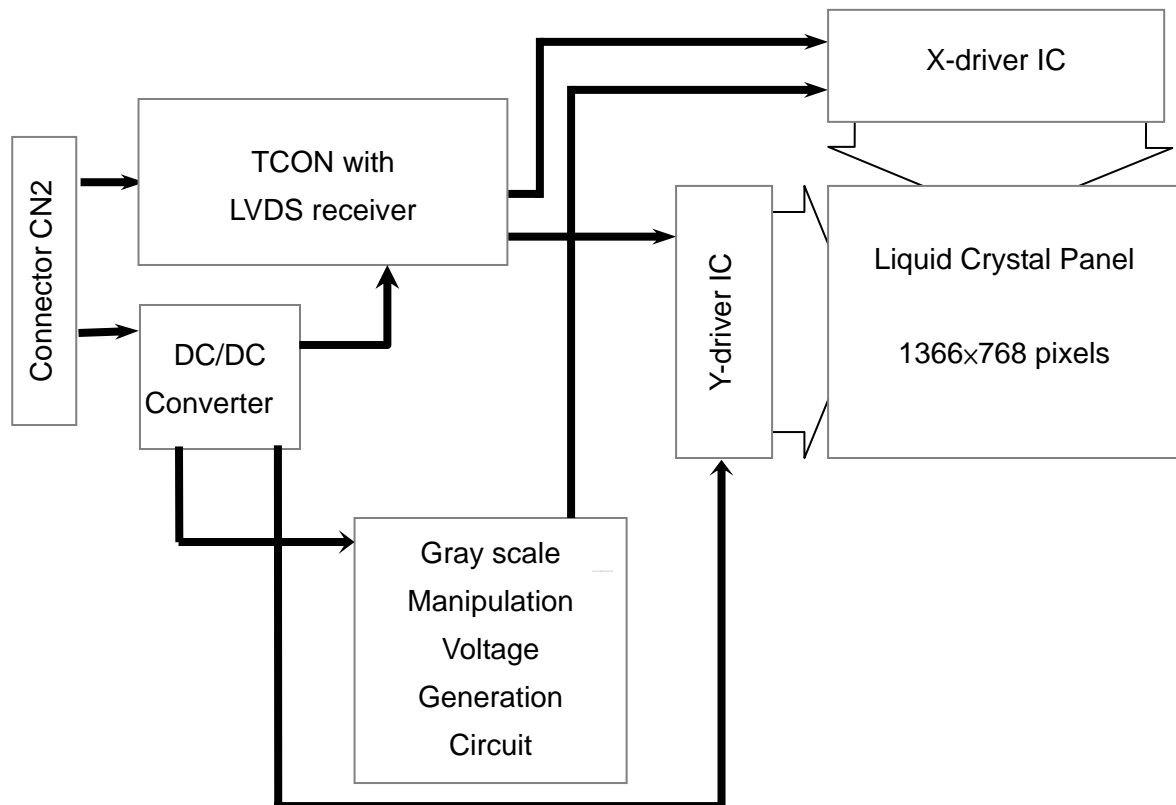
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4.2 Back Light Unit

4.3 Pixel Format

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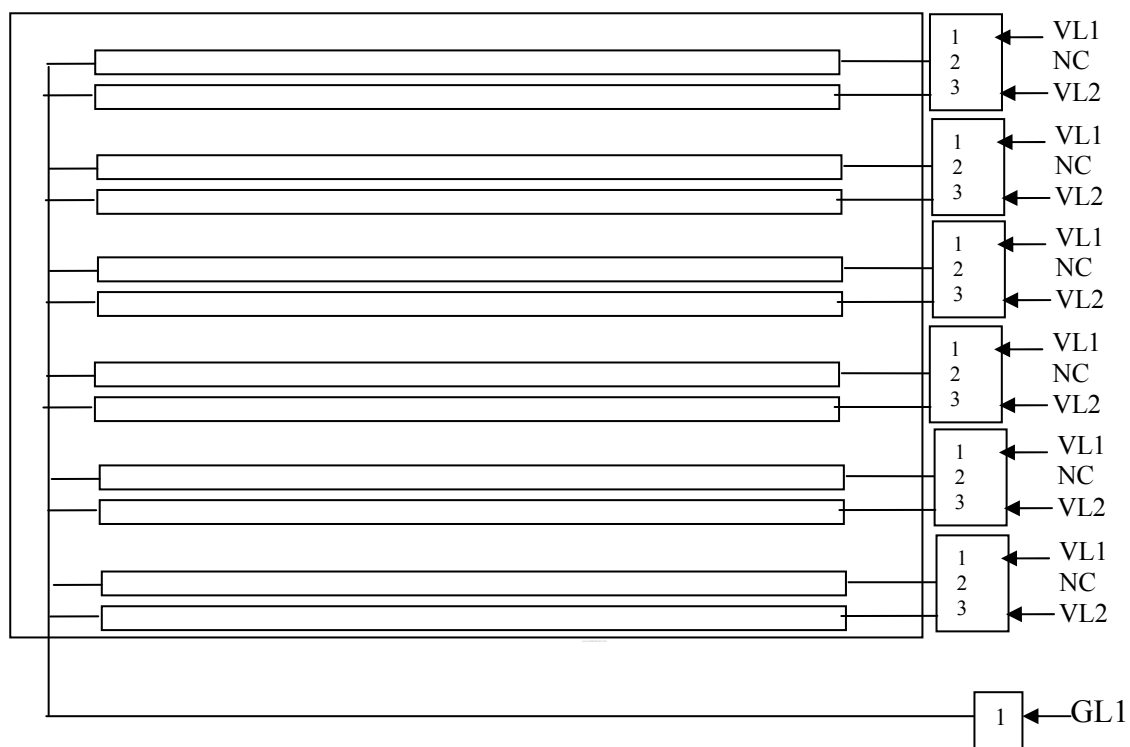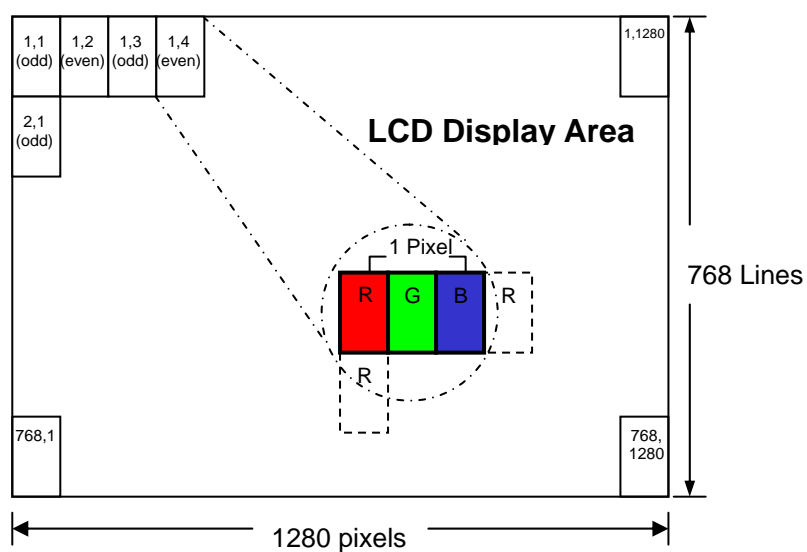
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4.4 Relationship between Displayed Color and Input

	Display	R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4	G3	G2	G1	G0	B7	B6	B5	B4	B3	B2	B1	B0	Gray scale Level
		MSB							LSB	MSB							LSB	MSB							LSB	
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
	Dark	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
	↓	H	H	H	H	H	L	H	H	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L252
	Light	H	H	H	H	H	H	L	H	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L253
	Light	H	H	H	H	H	H	H	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L254
	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
	Dark	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
	↓	L	L	L	L	L	L	L	L	H	H	H	H	H	L	H	H	L	L	L	L	L	L	L	L	L252
	Light	L	L	L	L	L	L	L	L	H	H	H	H	H	H	L	H	L	L	L	L	L	L	L	L	L253
	Light	L	L	L	L	L	L	L	L	H	H	H	H	H	H	H	L	L	L	L	L	L	L	L	L	L254
	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
	Dark	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
	↓	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	H	H	H	H	H	L	H	H	L252
	Light	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	H	H	H	H	H	H	L	H	L253
	Light	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	H	H	H	H	H	H	H	L	L254
	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
	Dark	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
	↓	H	H	H	H	H	L	H	H	H	H	H	H	H	L	H	H	H	H	H	H	H	L	H	H	L252
	Light	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
	Light	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

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5.0 I/O CONNECTION PIN ASSIGNMENT

5.1 Interface Connector (20-pins x 1)

Connector : HRS:DF14-20P-1.25H

Matching Socket : HRS:DF14-20P-1.25C

Pin No.	Symbol	Function	Polarity	Remark
1	VDD	Power Supply : +5.0V		
2	VDD	Power Supply : +5.0V		
3	GND	Ground		
4	GND	Ground		
5	IN0-	Transmission Data of Pixels 0	Negative	
6	IN0+	Transmission Data of Pixels 0	Positive	
7	GND	Ground		
8	IN1-	Transmission Data of Pixels 1	Negative	
9	IN1+	Transmission Data of Pixels 1	Positive	
10	GND	Ground		
11	IN2-	Transmission Data of Pixels 2	Negative	
12	IN2+	Transmission Data of Pixels 2	Positive	
13	GND	Ground		
14	CLK-	Sampling Clock	Negative	
15	CLK+	Sampling Clock	Positive	
16	GND	Ground		
17	IN3-	Transmission Data of Pixels 3	Negative	
18	IN3+	Transmission Data of Pixels 3	Positive	
19	GND	Ground		
20	GND	Ground		

5.2 Back Light Unit   Connectors:

5.2.1 High Voltage connector Assignment :

CN2—CN7: BHR-03VS-1/Japan Solderless Terminal MFG Co., LTD

Terminal no.	Symbol	Function
1	VL1	CCFL power supply (high voltage)
2	GND	NC
3	VL2	CCFL power supply (high voltage)

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Low Voltage connector:

CN8: ZHR-02/Japan Solderless Terminal MFG Co., LTD

Terminal no.	Symbol	Function
1	GL1	CCFL power supply (low voltage)

6.0 ELECTRICAL CHARACTERISTICS

6.1 TFT LCD Module:

Item		Symbol	Min.	Typ.	Max.	Unit	Note
Voltage of power		V_{DD}	4.5	5.0	5.5	V	
Differential input threshold voltage	High	V_{IH}			100	mV	$V_{CM}=1.2$ V
	Low	V_{IL}	-100			mV	
Current of power supply	L255	I_{DD}		800	1100	mA	(1)
Vsync frequency		f_V	50	60	70	Hz	(2)
Hsync frequency		f_H	40.3	48.4	56.5	kHz	
Main frequency		f_{DCLK}	54	65.0	76	MHz	
Inrush current		I rh	-	-	2	mA	(3)

Note   (1). White pattern

Grey scale: L0～L255.

L0: Luminance with all pixels black.

L255: Luminance with all pixels white.

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

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Note (3) Input Rush Current condition

12V

$0.9V_{DD}$

$0.1V_{DD}$

GND

470us~10ms
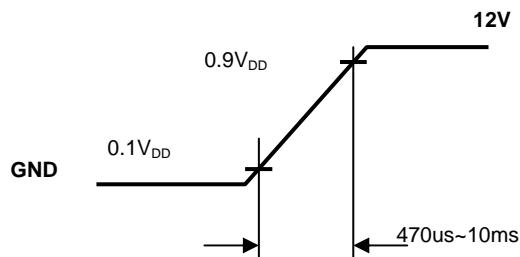
The duration of inrush current is about 0.5ms and rising time of power input
Is 1 ms (min)

6.2 Back-Light Unit

The back-light system is 12 CCFL(Cold Cathode Fluorescent Lamp).
The characteristics of the lamp are shown in the following tables.
INVERTER: PLCD09231202 (EMax)(1

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Lamp current	IL	4.0	6.0	8.0	mA(rms)	(1)
Lamp voltage	VL	630	700	770	V(rms)	I_L=6.0mA
Frequency	fL	40	50	80	KHz	(2)
Lamp Operating life time	Hr	50000	--	--	Hour	(3)
Startup voltage	Vs	1210	--	--	V(rms)	at 25°C
		1540				at 0°C (note 4)

CN2

LCD MODULE

CN7

CN8

INVERTER

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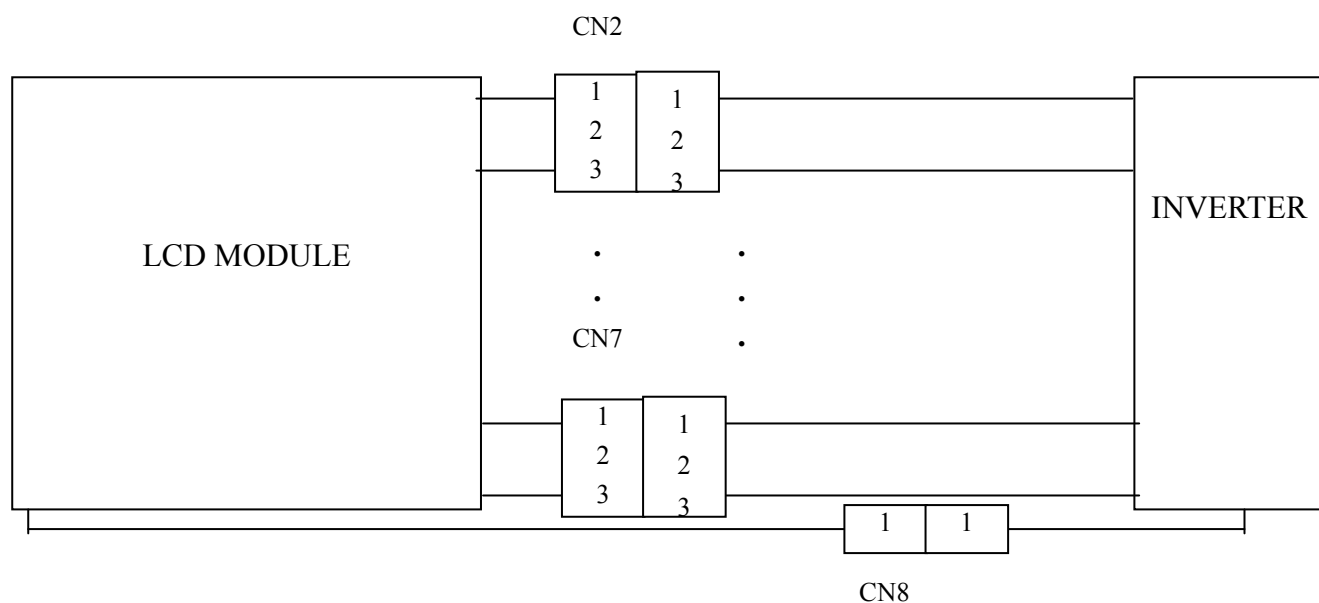
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Note (1) Lamp current is measured with current meter for high frequency as shown below. Specified valued are for a lamp.

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=56kHz 6mA 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.
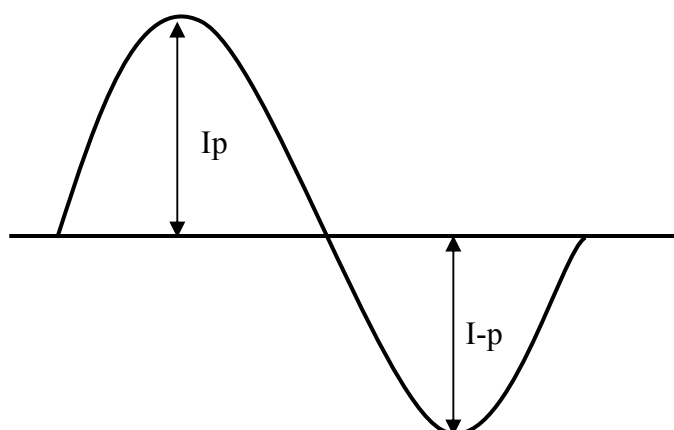
Asymmetry rate = |Ip-I-p| / Irms x 100%
Distortion rate = Ip (or I-p) / Irms

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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	V_{IN}=2.2V,V_{DD}=3.6V
				±10	uA	V_{IN}=0.6V,V_{DD}=3.6V
Input Voltage Range(Signal ended)	V_{IN}	0.6		2.2	V	
Differential input Voltage	$|V_{ID}|$	100		600	V	
Common Mode Voltage Offset	V_{CM}	0.6+$|V_{ID}|$/2		2.2-$|V_{ID}|$/2	V	
Clock Frequency	fc		65		MHz	
LVDS Skew Margin	t_{RSKM}			400	pS	$V_{DD=}$3.3V,25℃ At fc=65MHz
LVDS Input Clock Jitter Tolerance				±2.5	%	center spread

RCLK

Rin0

Rin1

Rin2

Rin3

t_{RSKM}
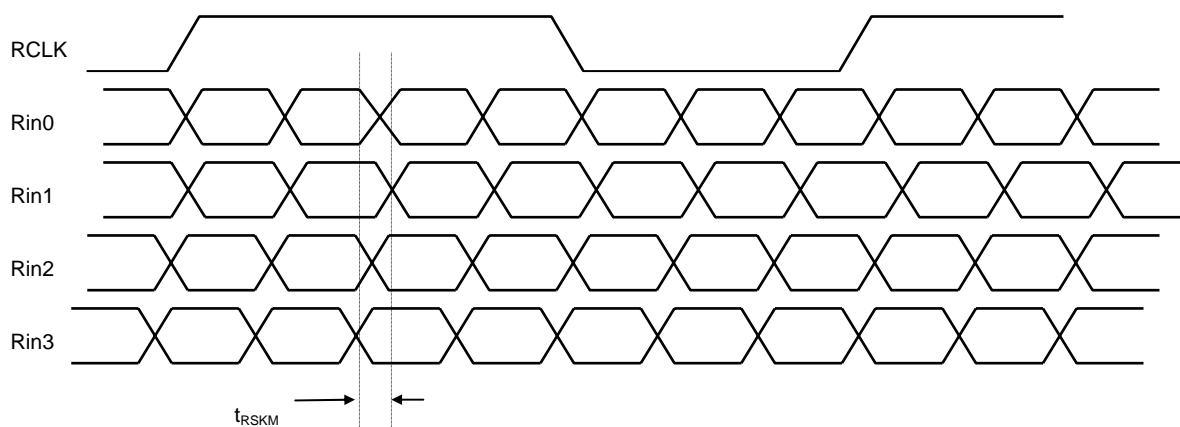
LVDS Receiver skew margin

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6.4 Bit Mapping & Interface Definition

LVDS Input Timing Definition

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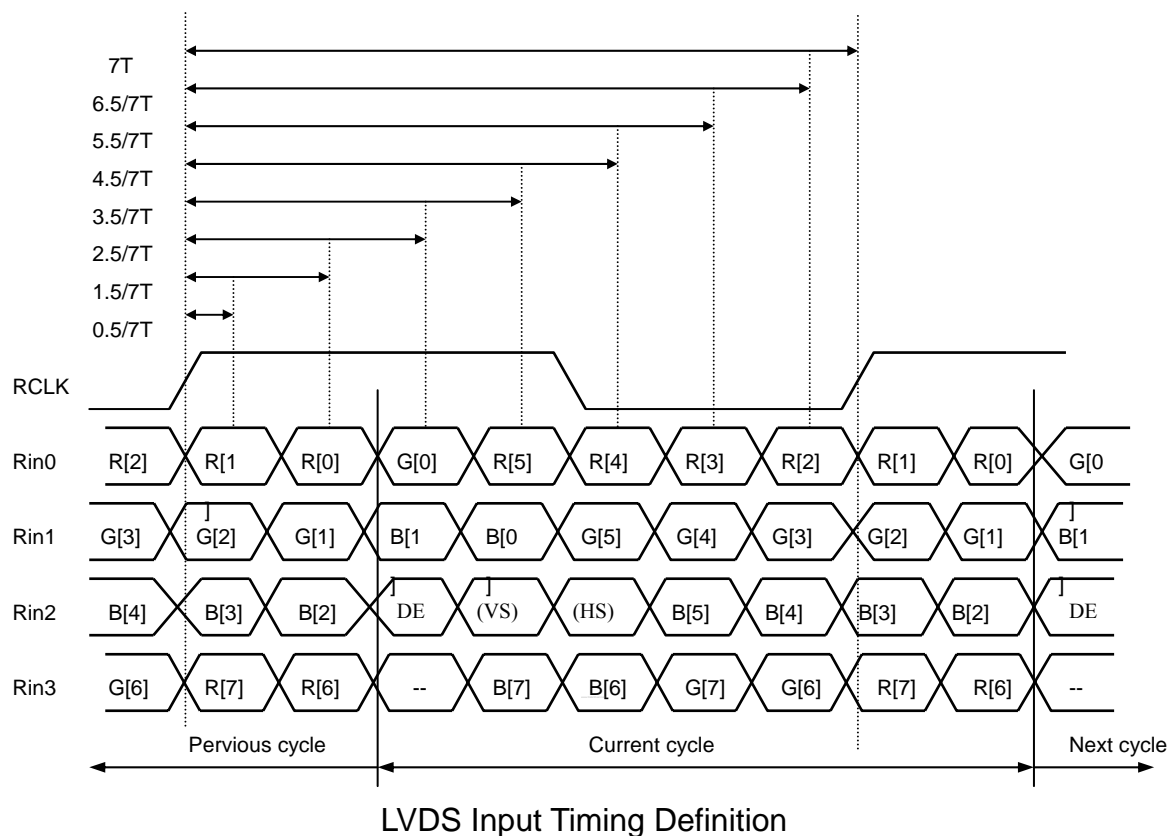
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6.5 Interface Timing (DE mode)

Item	Symbol	Min.	Typ.	Max.	Unit	Remarks
Frame period	t1	772xt3	806*t3 16.7	1024xt3	ms	1) 5)
Vertical display term	t2		768×t3 15.9		ms	1)
One line Scanning time	t3	1300xt5	1344*t5 20.7	1688xt5	μs	1) 5)
Horizontal display term	t4		1280×t5 19.7	--	μs	1)
Clock period	t5	--	15.4		ns	5)

(frame rate=60Hz)

Note 1) Refer to TIMING CHART at page20, 21 and LVDS specification (DS90C385) by National Semiconductor Corporation.

Note 2) When ENAB is fixed to "H" level or "L" level after NCLK is supplied, the panel displays black with some flicker.

Note 3) If NCLK is fixed to "H" level or "L" level, for certain period while ENAB is supplied, the panel may be damaged.

Note 4) Do not make t1 and t3's fluctuate. If t1 or t3 is fluctuating, the panel displays black.

Note 5) Please adjust LCD operating signal timing and FL driving frequency, to optimize the display quality. There is a possibility that flicker is observed by the interference of LCD operating signal timing and FL driving condition (especially driving frequency).

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Timing Diagram of Interface Signal (DE mode)

(1)Vertical Timing

NCLK

ENAB

R7~R0
G7~G0
B7~B0

t1
t2
t3
t3

x,1 x,2 x,3 x,y
X,766 X,767 X,768

(2)Horizontal Timing

NCLK

ENAB

R7~R0
G7~G0
B7~B0

t3
t4
t5

1,y 2,y 3,y 4,y
X,Y
1279,Y 1280,Y

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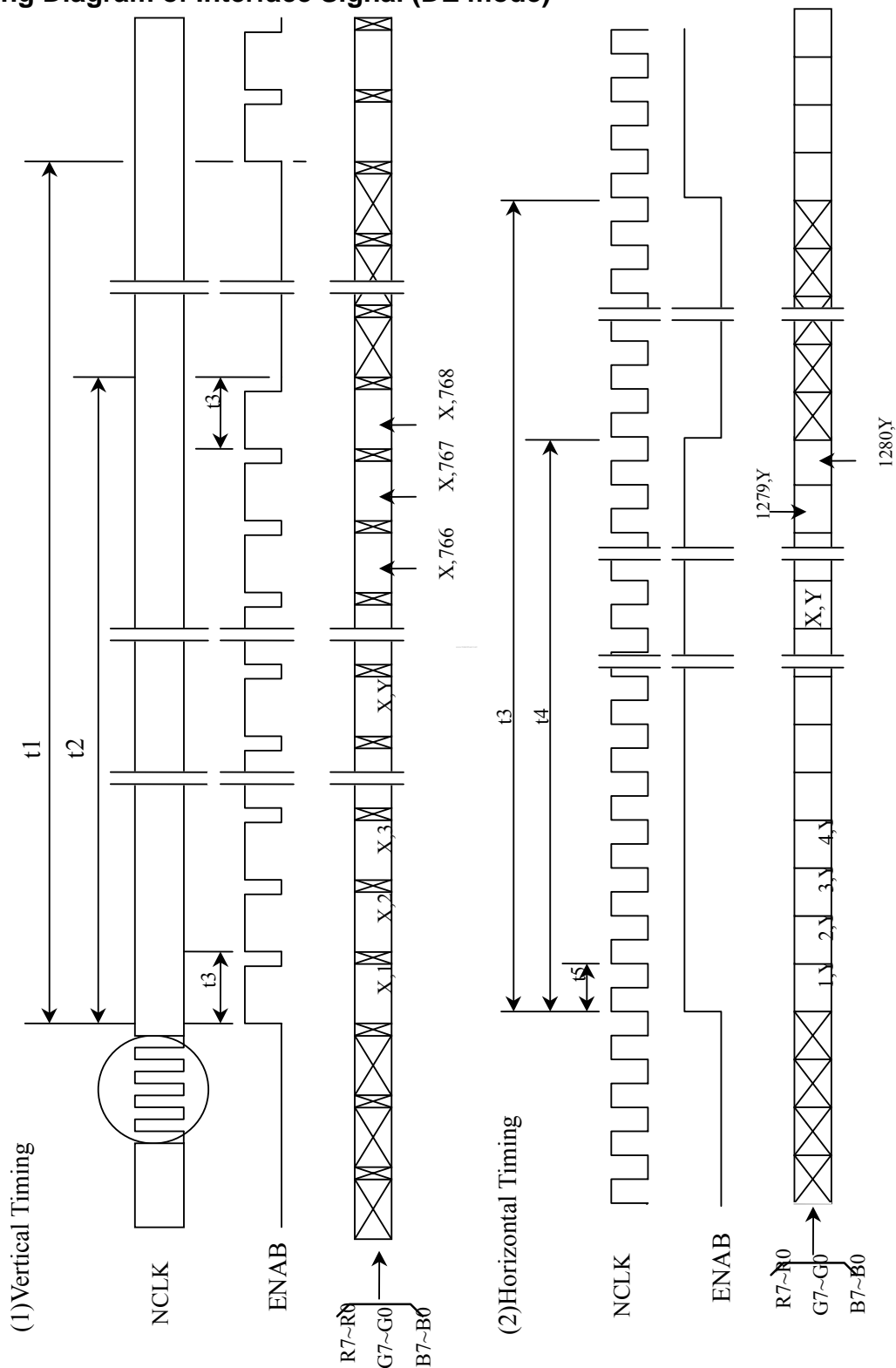
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6.6 Power ON/OFF Sequence

Power On   Power Off

Power Supply V_{DD}

90%

10%

0V

T1

T2

10%   Valid Signal   10%

Signal

10%   10%

Power Supply
for B/L Unit

T5   T6

50%   50%

90%

10%   10%

T3

T4
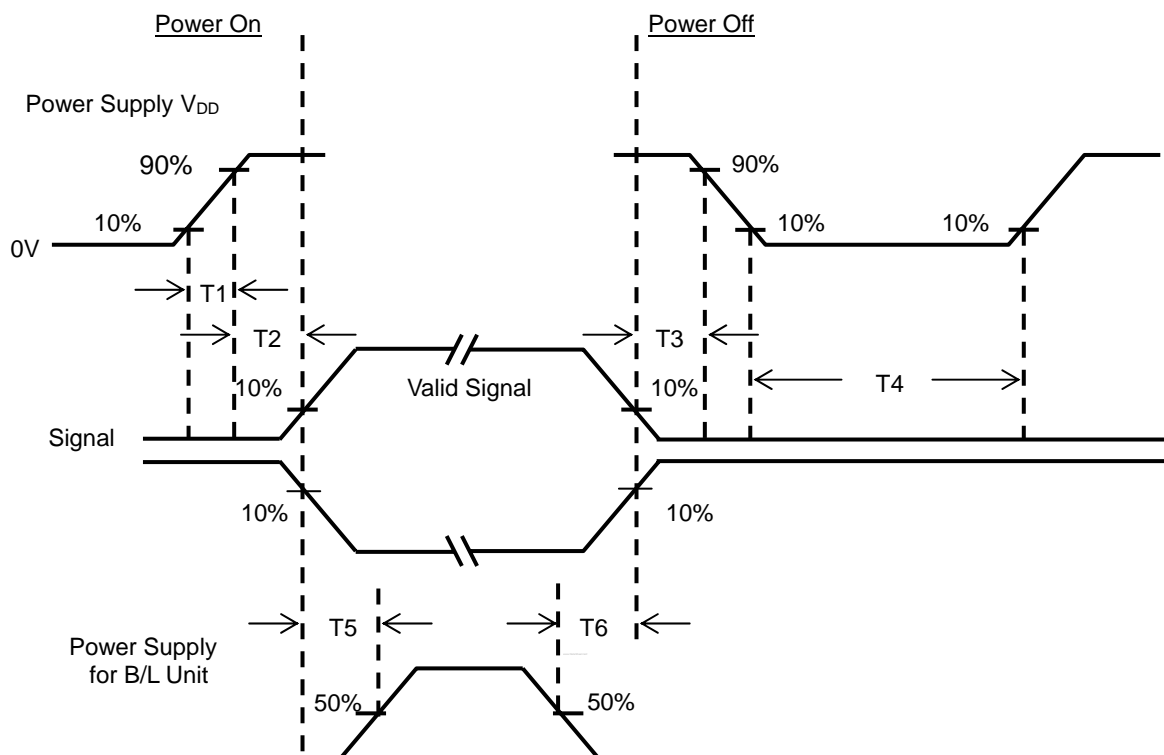
Power ON/OFF Sequence

Item	Min.	Typ.	Max.	Unit	Remark
T1	1.0	—	10	msec	
T2	0	—	50	msec	
T3	0	—	50	msec	
T4	1000	—	—	msec	
T5	200	—	—	msec	
T6	200	—	—	msec	

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Note
  (1) The supply voltage of the external system for the module input should be the same as the definition of VDD.
  (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) T4 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.

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7.0 OUTLINE DIMENSION

Unit : mm

7.1 Front View:
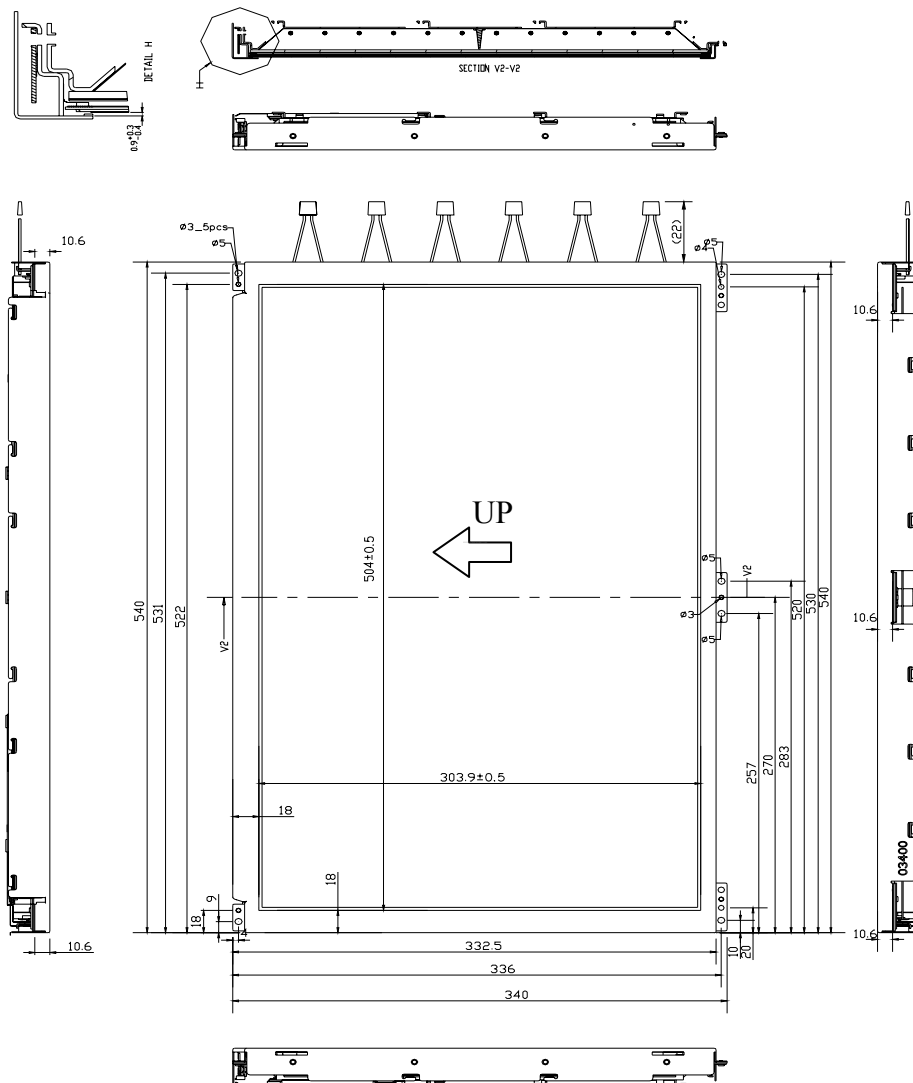
Unspecified Dimension Tolerance Definition:
1. L>=500mm, Tolerance=±1.0mm
2. 500>L>=200, Tolerance=±0.5mm
3. 200>L, Tolerance=±0.3mm
4. Diameter Tolerance=±0.2mm
5. Length of Leadwire Tolerance=±5mm
6. Pitch Tolerance of Connector(CN2~CN7)=±5mm

7.2 Back View:

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8.0 LOT MARK

8.1 Lot Mark

								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

HSD230WX12
-B01
Rev:A

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HannStar Display Corporation
MADE IN TAIWAN

* A 0 K 9 C 0 0 0 A 0 0 0 0 0 3 *

Lot mark

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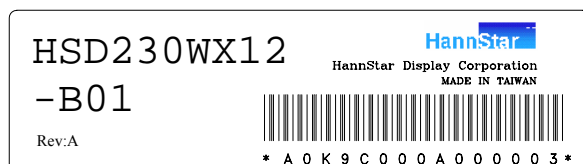
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9.0 PACKAGE SPECIFICATION

9.1 Packing form

(1) package quantity in one carton: 5 pieces.

(2) carton size: 666±6 mm×397±6 mm×478±6 mm.

(3) for domestic transportation only.

9.2 packing assembly drawings
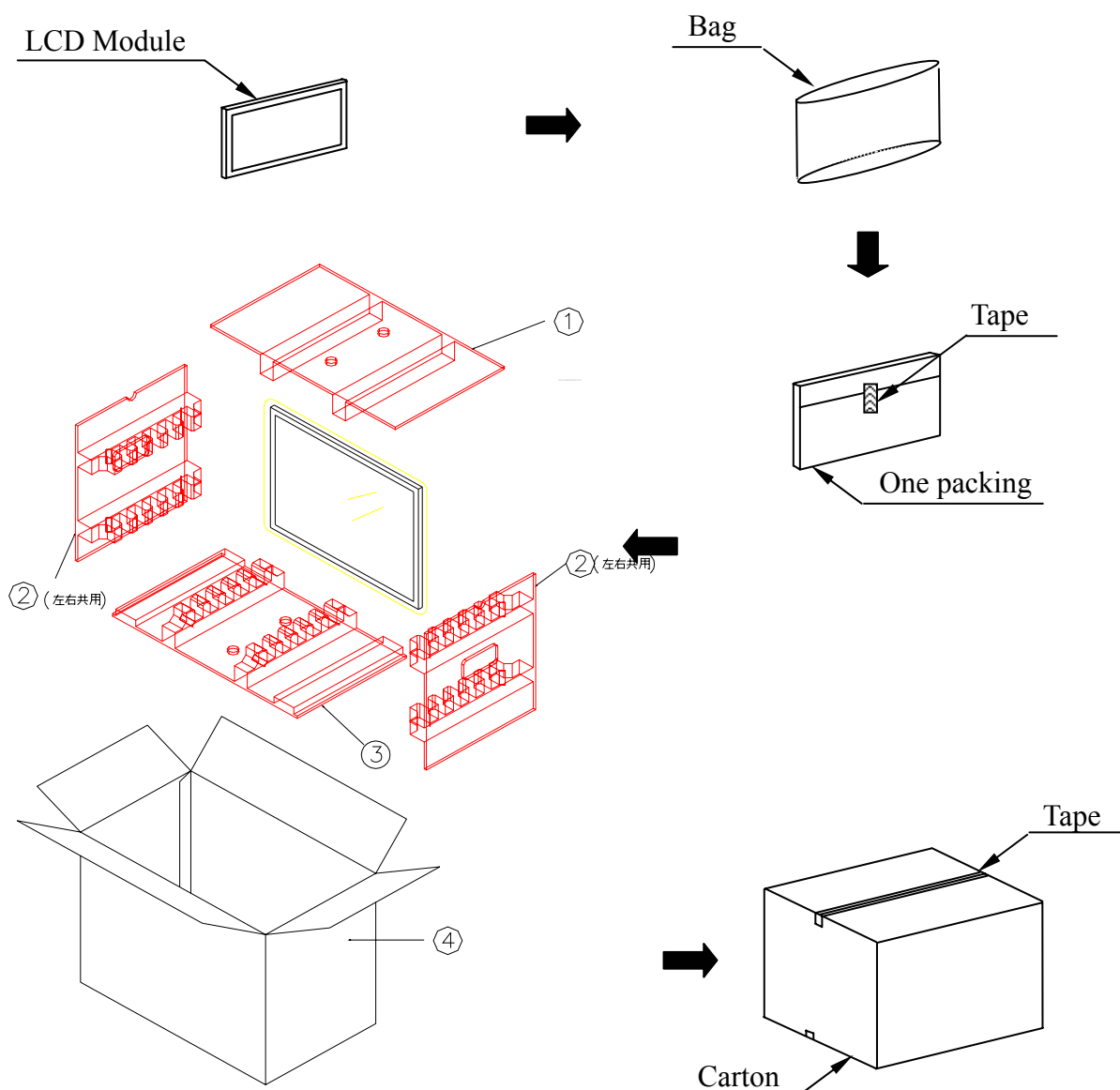
LCD Module

Bag

Tape

One packing

①

②（左右共用）

②（左右共用）

③

④

Tape

Carton

9.3 Pallet transportation specification
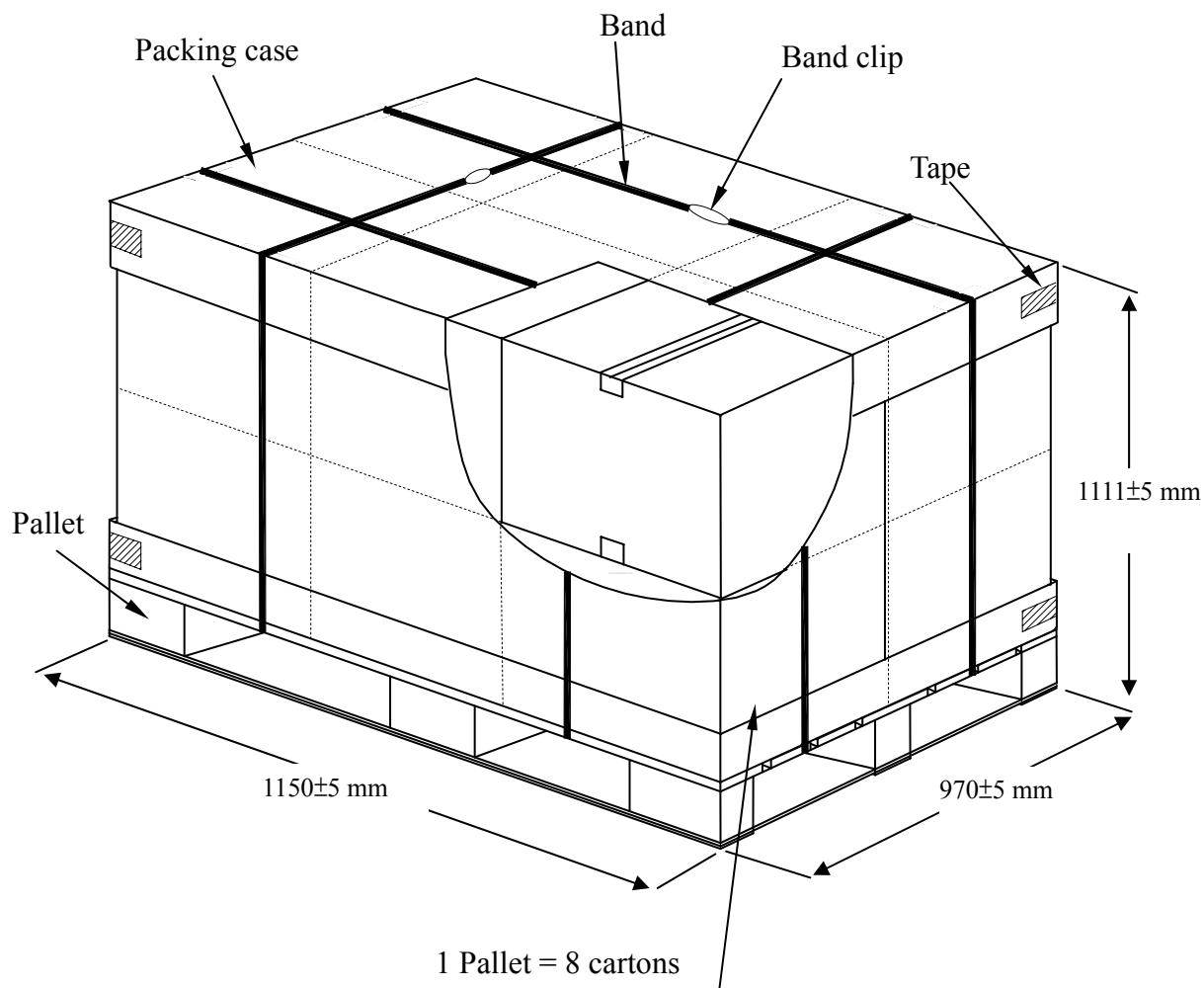
Outer box dimension (length*Width*highness):1150*1150*1150 mm ,with supporting board highness

Supporting board highness :115 mm   Inner box arrangement as above figure
Each supporting board has 4 boxes , total 4 boxes* 2 layers =8 boxes , 40 pieces

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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

10.6.2 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 benzene or other adequate solvent.

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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.