

**Product Specification**

# SPECIFICATION FOR APPROVAL

( ♦ ) Preliminary Specification

(   ) Final Specification

Title	14.1" XGA TFT LCD
-------	-------------------

BUYER	Dell(Compal)
MODEL	Connery

SUPPLIER	LG.Philips LCD Co., Ltd.
*MODEL	LP141X8
SUFFIX	A1

\* When you obtain standard approval ,  
please use the above model name without suffix.

SIGNATURE	DATE
/	_____
/	_____
/	_____

Please return 1 copy for your confirmation with your signature and comments.

APPROVED BY	DATE
S.H.Kang / S. Manager	_____
REVIEWED BY S.C.Yoon / Manager B.H.Koo / Manager	_____
PREPARED BY M.J.Lee / Engineer M.K.Jang / Engineer	_____

Product Engineering Dept.  
LG.Philips LCD Co., Ltd.

The preliminary document is subject to change without prior notice.

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**RECORDS OF REVISIONS**

Version No	Date	Page	DESCRIPTION
0.0	AUG 30, 2000	-	First Draft
0.1	SEP 19, 2000	4,18	Change the weight, for the application of VERTICAL ASSEMBLY (Added INVERTER)
		6	Change 3-1. Electrical Characteristics Added and changed Table 2 (Parameter) * Backlight, Inverter parts
		13,14	Add 3-7. Enhanced Extended Display Identification Data (EEDID™)
		17	Change the gray scale specification.
0.2	NOV 03, 2000	4,16	Change the outline dimensions(Depth)
		6	Change 3-1. Electrical Characteristics
		9	Change 3-3. Signal TimingI specifications(Table 6)
		10	Change 3-4. Signal TimingI Waveforms
		12	Change 3-6. Power Sequence (Add PWR_SRC)
		13	Change 4. Optical specifications(Table 8)
		14	Change the gray scale specification.
		18	Add Note) 2.
		25, 26	Change APPENDIX[A] Enhanced Extended Display Identification Data (EEDID™)

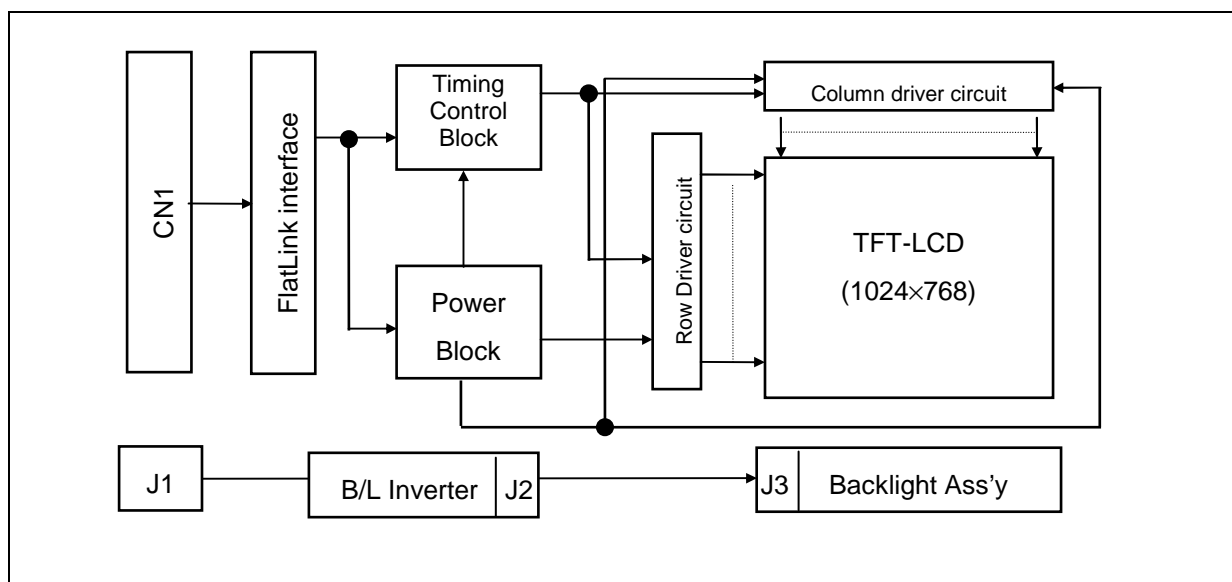
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## **1. General Description**

The LP141X8-A1 is a Color Active Matrix Liquid Crystal Display with an integral Cold Cathode Fluorescent Lamp(CCFL) backlight system. The matrix employs a-Si Thin Film Transistor as the active element. It is a transmissive type display operating in the normally white mode. This TFT-LCD has a 14.1 inches diagonally measured active display area with XGA resolution(768 vertical by 1024 horizontal pixel array). Each pixel is divided into Red, Green and Blue sub-pixels or dots which are arranged in vertical stripes. Gray scale or the brightness of the sub-pixel color is determined with a 6-bit gray scale signal for each dot, thus, presenting a palette of more than 262,144 colors.

The LP141X8-A1 has been designed to apply the interface method that enables low power, high speed, low EMI. Flat Link must be used as a LVDS(Low Voltage Differential Signaling) chip.

The LP141X8-A1 is intended to support applications where thin thickness, low power are critical factors and graphic displays are important. In combination with the vertical arrangement of the sub-pixels, the LP141X8-A1 characteristics provide an excellent flat panel display for office automation products such as Notebook PC.



## **General Features**

Active screen size	14.1 inches(35.814cm) diagonal
Outline dimensions	299(H) × 227(V) × 5.7(D) mm (Typ.)
Pixel pitch	0.279 mm × 0.279 mm
Pixel format	1024 horiz. by 768 vert. pixels
	RGB stripe arrangement
Color depth	6-bit, 262,144 colors
Luminance,White	150 cd/m <sup>2</sup> (Typ.)
Power Consumption	Total 6.02Watt(Typ.)
	LCM Circuit 1.12Watt(Typ.), Backlight Inverter Input 4.90Watt(Typ.)
Weight	509g (Typ.), 521g (Max.) with the inverter and bracket.
Display operating mode	Transmissive mode, normally white
Surface treatments	Hard coating (3H), Anti-glare treatment of the front polarizer

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## 2. Absolute Maximum Ratings

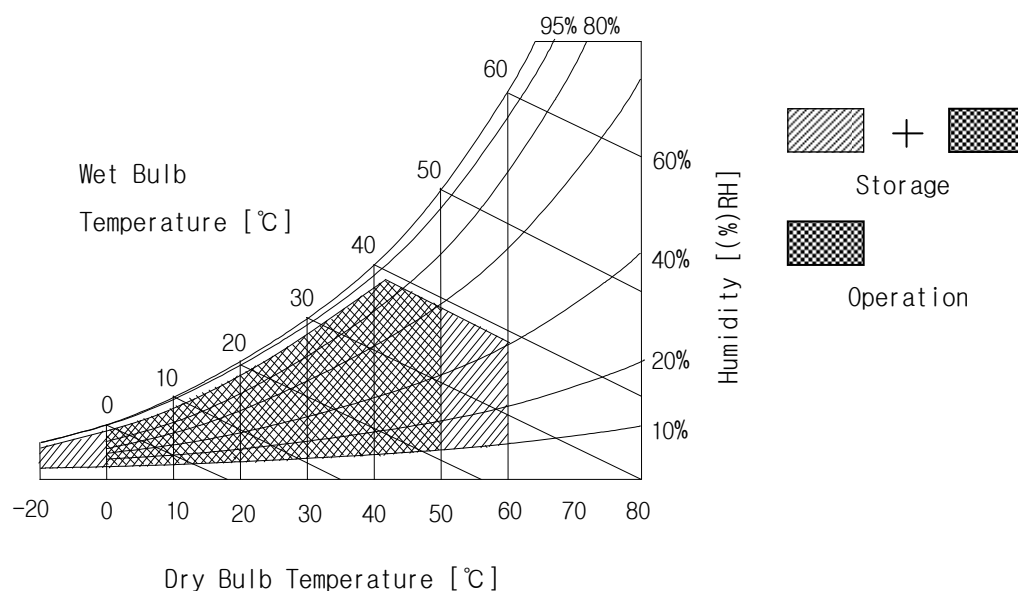
The following are maximum values which, if exceeded, may cause faulty operation or damage to the unit.

**Table 1 ABSOLUTE MAXIMUM RATINGS**

Parameter	symbol	Values		Units	Notes
		Min.	Max.		
Power Input Voltage	$V_{CC}$	-0.3	4.0	Vdc	at 25 $\pm$ 5 $^{\circ}$ C
Operating Temperature	$T_{OP}$	0	50	$^{\circ}$ C	1
Storage Temperature	$T_{ST}$	-20	60	$^{\circ}$ C	1
Operating Ambient Humidity	$H_{OP}$	10	90	%RH	1
Storage Humidity	$H_{ST}$	10	90	%RH	1

Note: 1. Temperature and relative humidity range are shown in the figure below.

Wet bulb temperature should be 39 $^{\circ}$ C Max, and no condensation of water.



**Product Specification**
**3. Electrical Specifications**
**3-1. Electrical Characteristics**

The LP141X8-A1 requires two power inputs. One is employed to power the LCD electronics and to drive the TFT array and liquid crystal. The second input is powers of the Inverter.

**Table 2 ELECTRICAL CHARACTERISTICS:**
**(Ta= 25 ± 2 °C)**

Parameter	Symbol	Values			Units	Notes
		Min.	Typ.	Max.		
<b>MODULE</b>						
Power Supply Input Voltage	V <sub>CC</sub>	3.0	3.3	3.6	Vdc	1 2 1
Power Supply Input Current	I <sub>CC</sub>	-	0.340	0.375	A	
Differential Impedance	Z <sub>m</sub>	90	100	110	Ohm	
Power Consumption	P <sub>c</sub>	-	1.12	1.24	W	
Rush Current	I <sub>RUSH</sub>	-	1.0	1.5	A	
Duration of rush current	T <sub>RUSH</sub>	-	-	30	ms	
<b>BACKLIGHT</b>						
Operating Voltage	V <sub>L</sub>	680(6mA)	725(5mA)	910(2.7mA)	V <sub>rms</sub>	3 4 I <sub>L</sub> =6.0mA
Operating Current	I <sub>L</sub>	2.7	5.0	6.0	mA <sub>rms</sub>	
Operating Frequency	F <sub>L</sub>	45	58	80	kHz	
Discharge Stabilization Time	T <sub>S</sub>	-	-	3	min	
Life Time		10,000	-	-	Hours	

Parameter	Symbol	Condition	Values			Units	Notes
			Min.	Typ.	Max.		
<b>INVERTER (Ambit/Sumida)</b>							
Input Voltage	INV-SRC	(=Vin, PWR_SRC)	9.0	14.4	21.0	Vdc	
Input Current	I <sub>in</sub>	Vin=14.4V, Iout=5.8mA	290	340	390	mA	
Input Power Consumption	P <sub>in</sub>	Vin=14.4V, Iout=5.8mA	4.17	4.90	5.62	W	
Backlight On/Off Control	FPVEE	FRVEE=High	2.0	-	5.25	Vdc	
		FRVEE=Low	-0.3	-	0.8	Vdc	
Backlight Adjust (Lamp Current Control)	SMB-DAT	* 00H=Luminance max.	FFH	-	00H	-	
Output Voltage	V <sub>out</sub>	Vin=14.4V, Iout=5.8mA	580	680	780	Vrms	
Output Curren	I <sub>out</sub>	Ta=25℃,Aging 20minutes					
		SMB-DAT=FFH (min.)	2.7	3.0	3.3	mA <sub>Arms</sub>	
Operating Frequency	Freq.	SMB-DAT=00H (max.)	5.5	5.8	6.0	mA <sub>Arms</sub>	
		Vin=14.4V, Iout=5.8mA	50	60	70	KHz	
Output Power Consumption	P <sub>out</sub>	Vin=14.4V, Iout=5.8mA	3.36	3.94	4.52	W	
Open Lamp Voltage	V <sub>open</sub>	No Load, Vin=9V	1450	-	-	Vrms	
Efficiency	η	Vin=9V, Iout=5.8mA	80	-	-	%	
Striking Time	T <sub>s</sub>		0.6	1.0	1.4	sec	

Notes: 1. The specified current and power consumption are under the V<sub>cc</sub> = 3.3V , 25 °C , f<sub>v</sub> = 60Hz condition whereas full black pattern is displayed and f<sub>v</sub> is the frame frequency.

2. This impedance value is needed to proper display and measured from LVDS Tx to the mating connector.

3. Define the brightness of the lamp after being lighted for 5 minutes as 100, T<sub>s</sub> is the time required for the

brightness of the center of the lamp to be not less than 95%.

4. The life time is determined as the time at which brightness of lamp is 50% compared to that of initial value at the typical lamp current on condition of continuous operating at 25 ± 2 °C.

5. The specified total power consumption is the sum of the module and inverter input under the V<sub>cc</sub> = 3.3V , f<sub>v</sub> = 60Hz, Dclk=65MHz, 25 °C , Vin=14.4V, Iout=5.8mA, SMB-DAT=00H

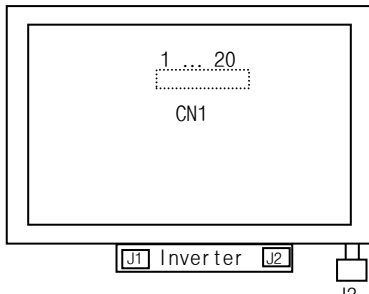
**Product Specification**
**3-2. Interface Connections**

The interface connections are compatible with **ISP (Industry Standard Panels) 14.1" Mounting and Top Level Interface Requirements (Version2, June,2000)** defined by **SPWG (Standard Panels Working Group)**.

This LCD employs two interface connections, a 20 pin connector is used for the module electronics and the other connector is used for the integral backlight system.

The electronics interface connector is a model GT122-20P-H15-R manufactured by LG Cable. The pin configuration for the connector is shown in the table below.

**Table 3 MODULE CONNECTOR PIN CONFIGURATION (LVDS) [CN1]**

Pin	Symbol	Description	Notes
1	Vcc	LCD VDD (3.3V)	1. Interface chips 1.1 LCD : SN75LVDS88B (TI) (SN75LVDS84 core + Timing Controller) 1.2 System : SN75LVDS86(TI)  2. Connector (SPWG Style "A" compatible) 2.1 LCD : GT122-20P-H15-R (LG Cable) 2.2 Mating : FI-SE20M-HF(JAE) or compatible 2.3 Connector pin arrangement  
2	Vcc	LCD VDD (3.3V)	
3	GND	Ground	
4	GND	Ground	
5	A0M	Differential Signal	
6	A0P	Differential Signal	
7	GND	Ground	
8	A1M	Differential Signal	
9	A1P	Differential Signal	
10	GND	Ground	
11	A2M	Differential Signal	
12	A2P	Differential Signal	
13	GND	Ground	
14	CLKM	Differential Signal	
15	CLKP	Differential Signal	
16	GND	Ground	
17	VEDID	VEDID	
18	NC	No Connection	
19	Clk_EDID	Clk_EDID	
20	Data_EDID	Data_EDID	

The backlight interface connector(J3) is a BHSR-02VS-1(JST, 2pin), and the mating connector(J2) is a SM02B-BHSS-1(JST) or equivalent. The Inverter interface connector(J1) is a WR-L16S-VF-HD2-1(JAE, 16pin).

The pin configuration for the connector is shown in the table belows.

**Table 4 BACKLIGHT INVERTER CONNECTOR PIN CONFIGURATION(J1, J3)**
**Inverter interface connector (J1)**

Pin	Symbol	Voltage	Description	Notes
1	PWR_SRC	9.0V to 21V	This power rail should be used as a power source for inverter.	
2	PWR_SRC	9.0V to 21V	This power rail should be used as a power source for inverter.	
3	GND	0V	Ground	
4	PWR_SRC	9.0V to 21V	This power rail should be used as a power source for inverter.	
5	GND	0V	Ground	
6	GND	0V	Ground	
7	5V_SUS	4.85V to 5.2V	This should be used as a power source for the control circuit on the inverter.	
8	5V_ALW	4.85V to 5.2V	This should be used as a power source that store the brightness values and interface with SMB_CLK and SMB_DAT.	
9	SMB_DAT	(= FPVEE)	SMBus interface for sending brightness information to the inverter.	
10	SMB_CLK		SMBus interface for sending brightness information to the inverter.	
11	Backlight_On		Control signal input into the inverter to turn the backlight ON.	
12	NC		No Connection	
13	PANEL_ID3		0 (Connected to GND)	
14	PANEL_ID2		0 (Connected to GND)	
15	PANEL_ID1		1 (OPEN)	
16	PANEL_ID0		1 (OPEN)	

**Backlight interface connector(J3)**

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Pin	Symbol	Description	Terminal Color	Notes
1	HV	Power supply for lamp (High voltage side)	Pink	
2	LV	Power supply for lamp (Low voltage side)	White	

Notes: 1. The PANEL\_ID of LP141X8-A1 is 0011(ID3 to ID0).

**Table 5 REQUIRED SIGNAL ASSIGNMENT FOR FlatLink Transmitter**

Pin #	Pin Name	Require Signals	Pin #	Pin Name	Require Signals
1	D4	R4	48	D3	R3
2	Vcc	Vcc	47	D2	R2
3	D5	R5	46	GND	GND
4	D6	G0	45	D1	R1
5	GND	GND	44	D0	R0
6	D7	G1	43	NC	NC
7	D8	G2	42	LVDS GND	LVDS GND
8	Vcc	Vcc	41	Y0M	A0M
9	D9	G3	40	Y0P	A0P
10	D10	G4	39	Y1M	A1M
11	GND	GND	38	Y1P	A1P
12	D11	G5	37	LVDS Vcc	LVDS Vcc
13	D12	B0	36	LVDS GND	LVDS GND
14	NC	NC	35	Y2M	A2M
15	D13	B1	34	Y2P	A2P
16	D14	B2	33	CLKOUTM	CLKM
17	GND	GND	32	CLKOUTP	CLKP
18	D15	B3	31	LVDS GND	LVDS GND
19	D16	B4	30	PLL GND	PLL GND
20	D17	B5	29	PLL Vcc	PLL Vcc
21	Vcc	Vcc	28	PLL GND	PLL GND
22	D18	HSYNC	27	SHDN	SHDN
23	D19	VSYNC	26	CLKIN	Dclk
24	GND	GND	25	D20	DE(Data Enable)

Notes : Refer to LVDS Transmitter Data Sheet for detail descriptions.



**Product Specification**

### 3-3. Signal Timing Specifications

This is the signal timing required at the input of the LVDS Transmitter. All of the interface signal timing should be satisfied with the following specifications for it's proper operation.

**Table 6 Timing Table**

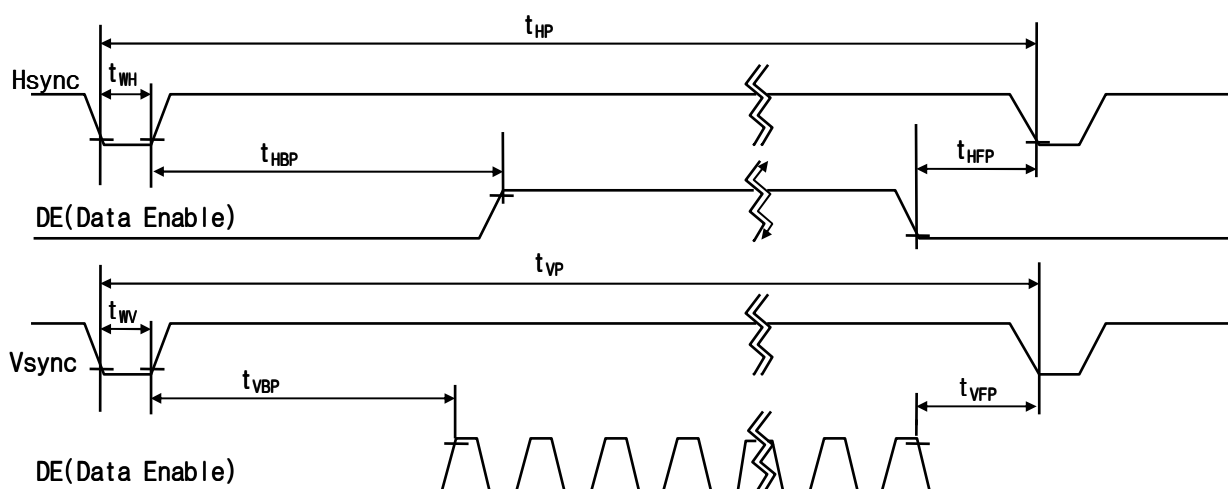
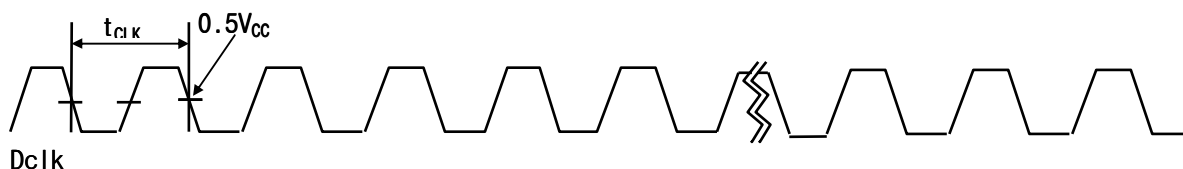
ITEM	SYMBOL		MIN.	Typ.	MAX.	UNIT	NOTE
Dclk	Period	$t_{CLK}$	15.4	15.4	15.4	ns	65MHz
Hsync	Period	$t_{HP}$	1206	1344	1364	$t_{CLK}$	
	Width	$t_{WH}$	8	136	240		
Vsync	Period	$t_{VP}$	780	806	830	$t_{HP}$	
	Frequency	$f_V$	60	60	60	Hz	
	Width	$t_{WV}$	1	6	24	$t_{HP}$	
DE (Data Enable)	Horizontal Valid	$t_{HV}$	1024	1024	1024	$t_{CLK}$	
	Horizontal Back Porch	$t_{HBP}$	10	160	-		
	Horizontal Front Porch	$t_{HFP}$	10	24	-	$t_{HP}$	$t_{WH} + t_{HBP} + t_{HFP}$
	Horizontal Blank	-	24	~	$t_{HP} - t_{HV}$		
	Vertical Valid	$t_W$	768	768	768		
	Vertical Back Porch	$t_{VBP}$	2	29	-		
	Vertical Front Porch	$t_{VFP}$	1	3	-		$t_{WV} + t_{VBP} + t_{VFP}$
	Vertical Blank	-	4	~	$t_{VP} - t_W$		

\* The Maximum Dclk jitter is 2.0nsec.

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**3-4. Signal Timing Waveforms**

$DcIk, Hsync, Vsync, DTMG, DATA$ 

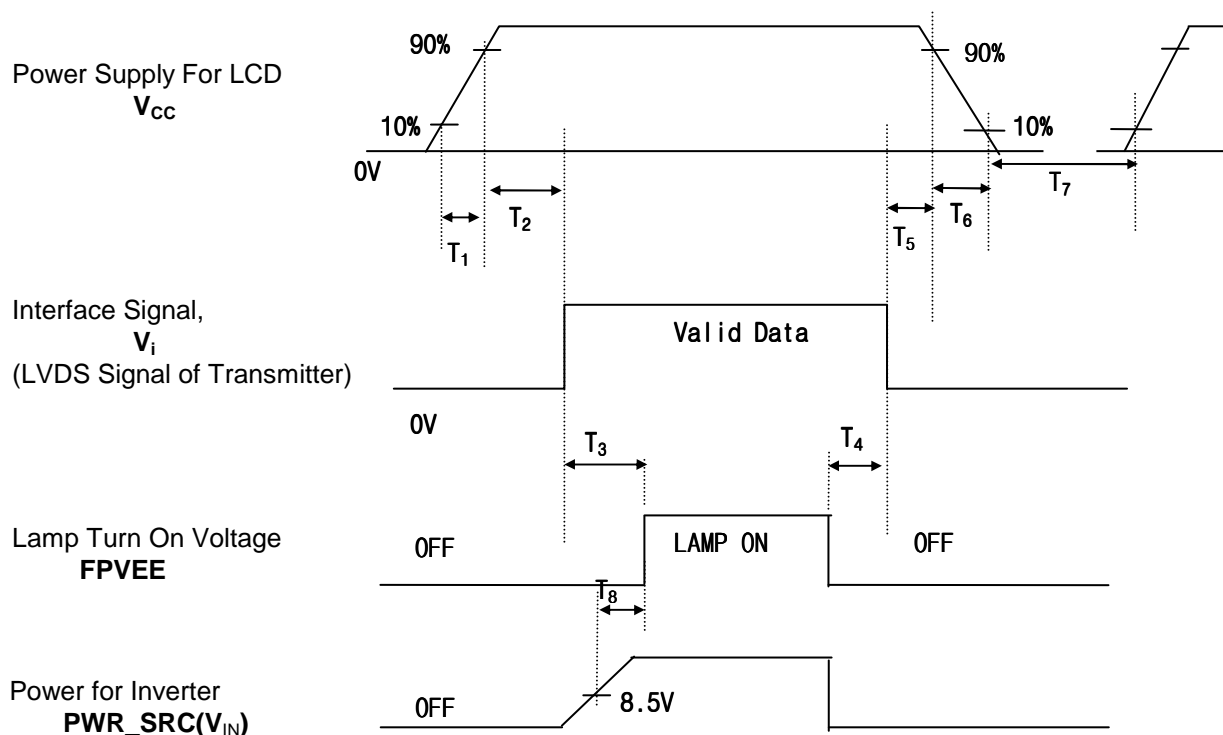
**Product Specification**
**3-5. Color Input Data Reference**

The brightness of each primary color(red, green and blue) is based on the 6-bit gray scale data input for the color; the higher the binary input, the brighter the color. The table below provides a reference for color versus data input.

**Table 7 COLOR DATA REFERENCE**

Color		Input Color Data																	
		Red						Green						Blue					
		MSB			LSB			MSB			LSB			MSB			LSB		
		R5	R4	R3	R2	R1	R0	G5	G4	G3	G2	G1	G0	B5	B4	B3	B2	B1	B0
Basic Colors	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(63)	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	Green(63)	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
	Blue(63)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
	Cyan	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1
	Magenta	1	1	1	1	1	1	0	0	0	0	0	0	1	1	1	1	1	1
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0
	White	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Red	Red(00) Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(01)	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	Red(02)	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Red(61)	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	Red(62)	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(63) Bright	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
Green	Green(00)Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green(01)	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
	Green(02)	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Green(61)	0	0	0	0	0	0	1	1	1	1	0	1	0	0	0	0	0	0
	Green(62)	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0
	Green(63)Bright	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
Blue	Blue(00) Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Blue(01)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Blue(02)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Blue(61)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	1
	Blue(62)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0
	Blue(63) Bright	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1

**3-6. Power Sequence**

**Product Specification**


Parameter	Values			Units
	Min.	Typ.	Max.	
$T_1$	-	-	10	ms
$T_2$	0	-	50	
$T_3$	200	-	-	
$T_4$	200	-	-	
$T_5$	0	-	50	
$T_6$	0	-	100	
$T_7$	400	-	-	
$T_8$	10	-	-	

- Notes:
1. Please avoid floating state of interface signal at invalid period.
  2. When the interface signal is invalid, be sure to pull down the power supply for LCD  $V_{CC}$  to 0V.
  3. Lamp power must be turn on after power supply for LCD and interface signal are valid.

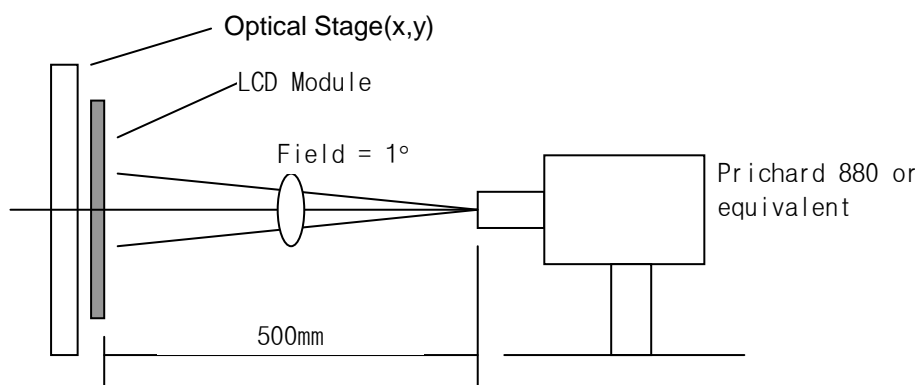
**4. Optical Specifications**

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Optical characteristics are determined after the unit has been 'ON' and stable for approximately 30 minutes in a dark environment at 25°C. The values specified are at an approximate distance 50cm from the LCD surface at a viewing angle of  $\Phi$  and  $\theta$  equal to 0°.

FIG.1 presents additional information concerning the measurement equipment and method.

**FIG. 1 Optical Characteristic Measurement Equipment and Method**



**Table 8 OPTICAL CHARACTERISTICS** (Ta=25°C, Vcc=3.3V, f<sub>v</sub>=60Hz, Dclk=65MHz, I<sub>BL</sub>=5.8mA)

Parameter	Symbol	Values			Units	Notes
		Min.	Typ.	Max.		
Contrast Ratio	CR	150	250	-		1
Surface Luminance, white	L <sub>WH</sub>	130	170	-	cd/m <sup>2</sup>	2
Luminance Variation	$\delta$ WHITE	-	-	1.45		3
Response Time	T <sub>r</sub>	-	-	-	ms	4
Rise Time	T <sub>rR</sub>	-	20	40		
Decay Time	T <sub>rD</sub>	-	30	50		
CIE Color Coordinates						
Red	x <sub>R</sub>	0.550	0.580	0.610		
	y <sub>R</sub>	0.300	0.330	0.360		
Green	x <sub>G</sub>	0.280	0.310	0.340		
	y <sub>G</sub>	0.508	0.538	0.568		
Blue	x <sub>B</sub>	0.121	0.151	0.181		
	y <sub>B</sub>	0.098	0.128	0.158		
White	x <sub>W</sub>	0.283	0.313	0.343		
	y <sub>W</sub>	0.299	0.329	0.359		
Viewing Angle						5
x axis, right ( $\Phi=0^\circ$ )	$\theta_r$	40	45	-	degree	
x axis, left ( $\Phi=180^\circ$ )	$\theta_l$	40	45	-		
y axis, up ( $\Phi=90^\circ$ )	$\theta_u$	10	15	-		
y axis, down ( $\Phi=270^\circ$ )	$\theta_d$	30	35	-		
Gray Scale		-	-	-		6

Notes 1. Contrast Ratio (CR) is defined mathematically as :

$$\text{Contrast Ratio} = \frac{\text{Surface Luminance with all white pixels}}{\text{Surface Luminance with all black pixels}}$$

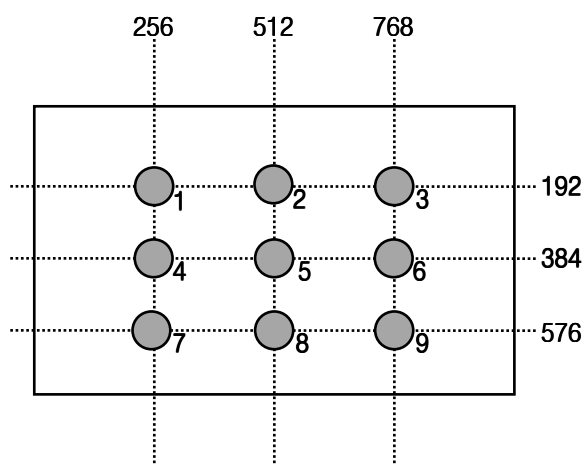
## Product Specification

2. Surface luminance is the center point across the LCD surface 50cm from the surface with all pixels displaying white. For more information see FIG. 2.  
When  $I_{BL}=5.8mA$ ,  $L_{WH}= 130cd/m^2$  (Min.) 150cd/m<sup>2</sup> (Typ.)
3. The variation in surface luminance,  $\delta$  WHITE is determined by measuring  $L_{ON}$  at each test position 1 through 9, and then dividing the maximum  $L_{ON}$  of 9 points luminance by minimum  $L_{ON}$  of 9 points luminance. For more information see FIG. 2.  
$$\delta \text{ WHITE} = \text{Maximum } (L_{ON1}, L_{ON2}, \dots, L_{ON9}) \div \text{Minimum } (L_{ON1}, L_{ON2}, \dots, L_{ON9})$$
4. Response time is the time required for the display to transition from white to black (Rise Time,  $Tr_R$ ) and from black to white (Decay Time,  $Tr_D$ ). For additional information see FIG. 3.
5. Viewing angle is the angle at which the contrast ratio is greater than 10. The angles are determined for the horizontal or x axis and the vertical or y axis with respect to the z axis which is normal to the LCD surface. For more information see FIG. 4.
6. Gray scale specification.

Gray Level	Luminance(%) (Typ.)
L0	0.4
L7	1.1
L15	4.4
L23	9.8
L31	18.8
L39	32.2
L47	50.7
L55	72.4
L63	100

FIG. 2 Luminance

<measuring point for luminance variation>



<measuring point for surface luminance >

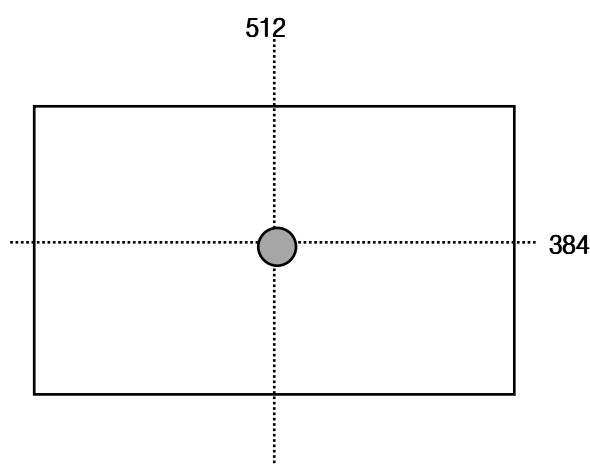


FIG. 3 Response Time

The response time is defined as the following figure and shall be measured by

Product Specification

switching the input signal for "black" and "white".

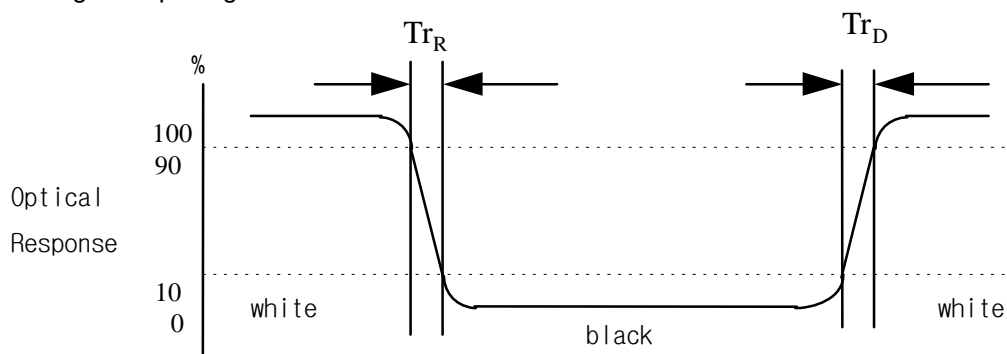
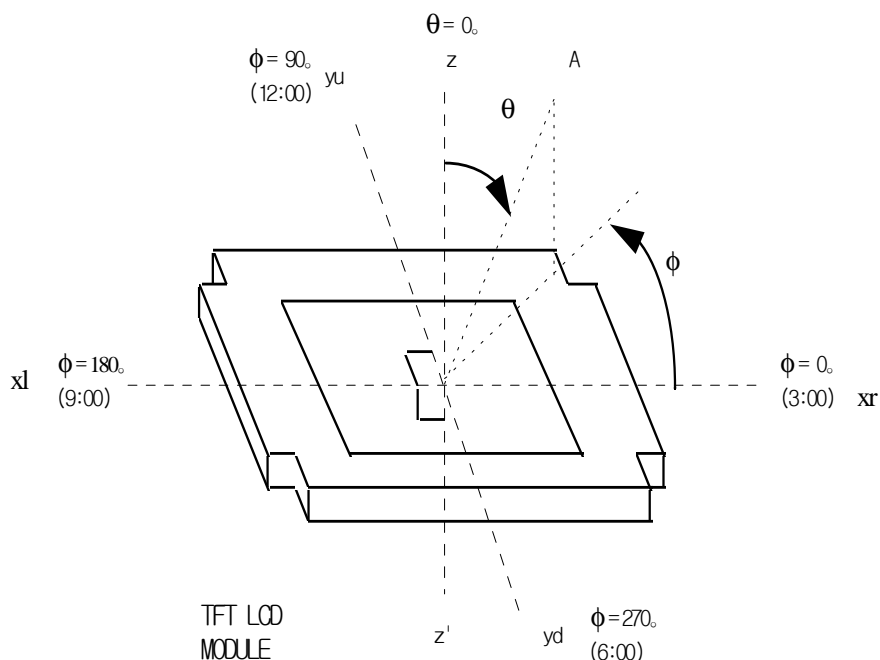


FIG. 4 Viewing angle

<Definition of viewing angle range>



## 5. Mechanical Characteristics

The contents provide general mechanical characteristics for the model LP141X8-A1 LCD. And the mechanical

**Product Specification**

characteristics is compatible with **14.1" STANDARD PANEL CRITICAL DIMENSIONS** in the **ISP (Industry Standard Panels) 14.1" Mounting and Top Level Interface Requirements (Version2, June,2000)** defined by **SPWG (Standard Panels Working Group)**.

In addition, the figures in the next page are detailed mechanical drawings of the LCD.

Outside dimensions :

Horizontal	299 ±0.5 mm
Vertical	227.0 ±0.5 mm
Depth	5.7 ± 0.3 mm

Bezel area :

Horizontal	288.9 ±0.5 mm
Vertical	217.5 ±0.5 mm

Active Display area :

Horizontal	285.696 mm
Vertical	214.272 mm

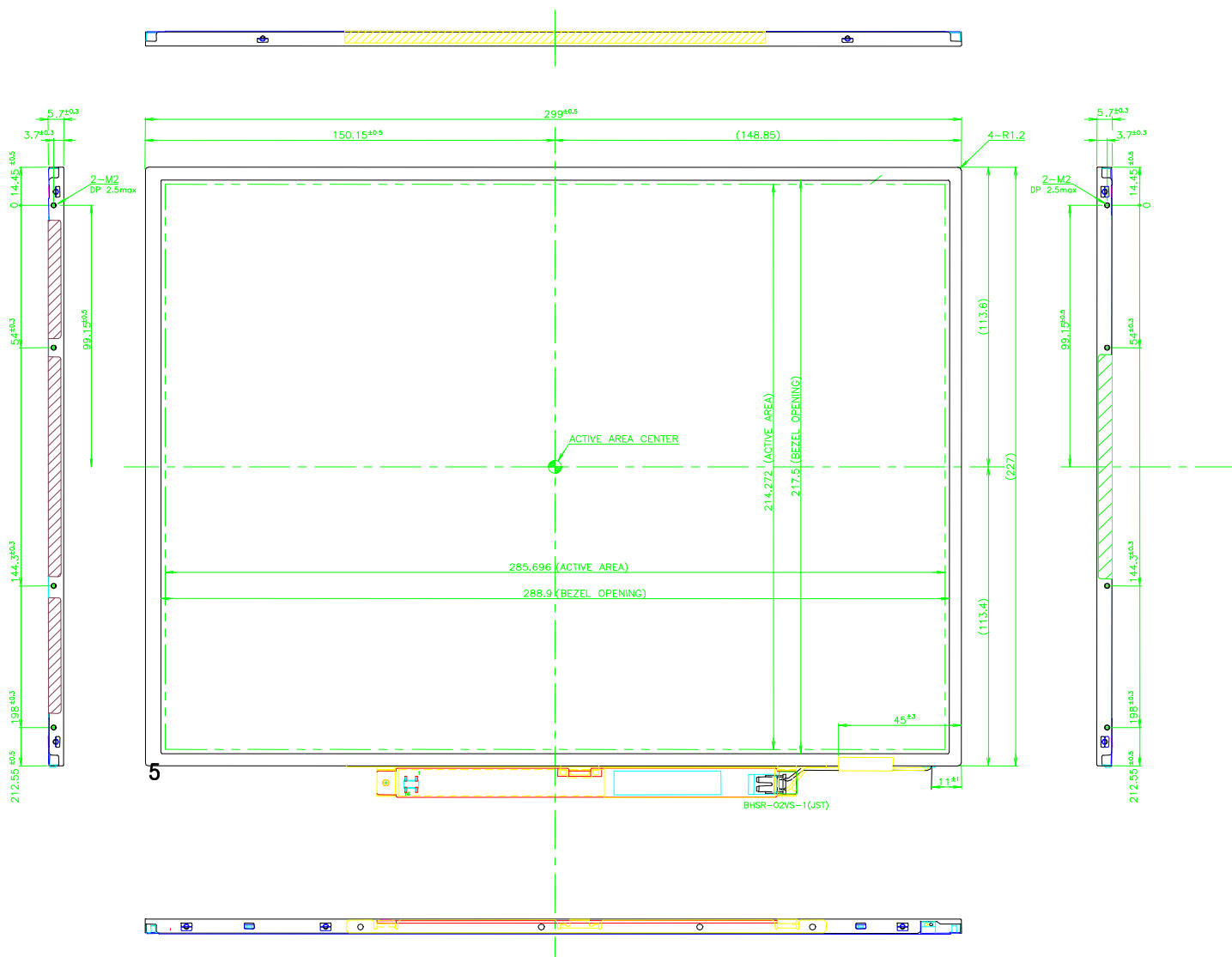
Weight (approximate) :	Total	509g(Typ.), 521g(Max.)
	LCM(with Inverter bracket)	500g(Typ.), 510g(Max.)
	INVERTER	9g(Typ.), 11g(Max.)

Surface Treatment : Hard coating (3H)  
Anti-glare treatment of the front polarizer

< FRONT VIEW >

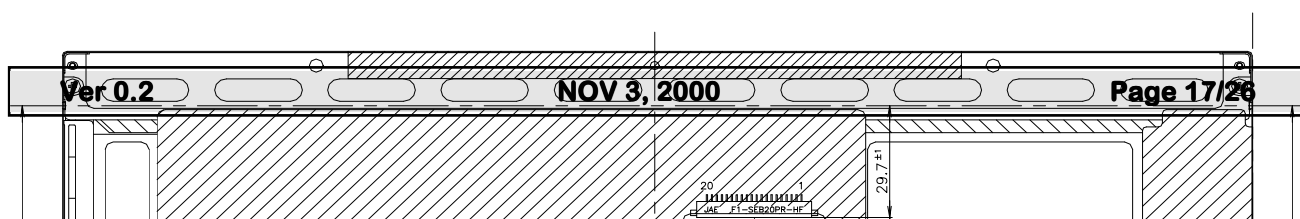


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Note) 1.General Tolerance is  $\pm 0.5\text{mm}$ .

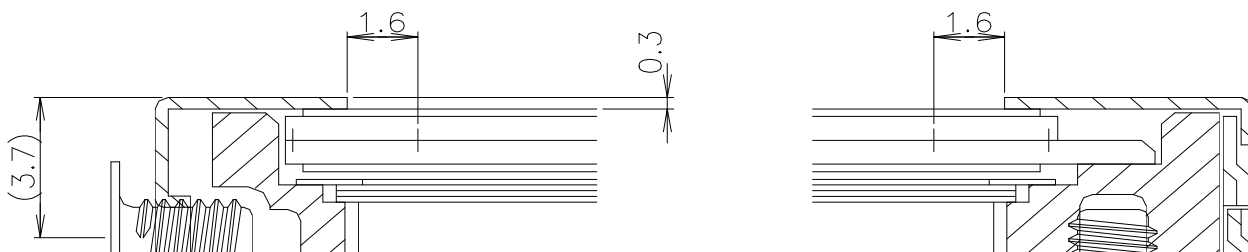
<REAR VIEW>



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Note) 1. General Tolerance is  $\pm 0.5\text{mm}$ .  
 2. The LCD depth of user connector area is Max 6.3mm.

**<Detail description of side mounting screw>**



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## **6. Reliability**

- Environment test condition

No.	Test Item	Conditions
1	High temperature storage test	Ta = 60℃ 240h
2	Low temperature storage test	Ta = -20℃ 240h
3	High temperature operation test	Ta = 50℃ 50%RH 240h
4	Low temperature operation test	Ta = 0℃ 240h
5	Vibration test (non-operating)	Sine wave, 10~500~10Hz, 1.5G, 0.37oct/min, 3 axis, 1 hour/axis
6	Shock test (non-operating)	Half sine wave, 180G, 2ms, one shock of each six faces (i.e. run 180G 2ms for all six faces.)
7	Altitude operating storage / shipment	0 - 10,000 feet (3,048m) 0 - 40,000 feet (12,192m)

{Result Evaluation Criteria}

There should be no change which might affect the practical display function when the display quality test is conducted under normal operating condition.

- ON/OFF Cycle

: The display module will be capable of being operated over 24,000 ON/OFF cycles (Lamp power & Vcc ON/OFF)

- Mean Time Between Failure

: The LCD Panel and interface board assembly (excluding the CCFL) have a mean time between failures of 30,000 hours with a confidence level 90%.

**Product Specification****7. International Standards****7-1. Safety**

- a) UL 1950 Third Edition, Underwriters Laboratories, Inc. Jan. 28, 1995.  
Standard for Safety of Information Technology Equipment Including Electrical Business Equipment.
- b) CAN/CSA C22.2 No. 950-95 Third Edition, Canadian Standards Association, Jan. 28, 1995.  
Standard for Safety of Information Technology Equipment Including Electrical Business Equipment.
- c) EN 60950 : 1992 + A1 : 1993 + A2 : 1993 + A3 : 1995 + A4 : 1997 + A11 : 1997  
IEC 950 : 1991 + A1 : 1992 + A2 : 1993 + A3 : 1995 + A4 : 1996  
European Committee for Electro technical Standardization (CENELEC)  
EUROPEAN STANDARD for Safety of Information Technology Equipment Including Electrical Business Equipment.

**7-2. EMC**

- a) ANSI C63.4 "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9kHz to 40GHz." American National Standards Institute(ANSI),1992.
- b) C.I.S.P.R "Limits and Methods of Measurement of Radio Interference Characteristics of Information Technology Equipment." International Special Committee on Radio Interference
- c) EN 55022 "Limits and Methods of Measurement of Radio Interference Characteristics of Information Technology Equipment." European Committee for Electro technical Standardization (CENELEC),1988

**Product Specification**

## **8. Packing**

### **8-1. Designation of Lot Mark**

a) Lot Mark

A	B	C	D	E	F	G	H	I	J	K	L	M
---	---	---	---	---	---	---	---	---	---	---	---	---

A, B, C : SIZE  
D : YEAR  
E : MONTH  
F, G : PANEL CODE  
H : ASSEMBLY CODE  
I, J, K, L, M : SERIAL NO.

Note : 1. YEAR

YEAR	97	98	99	2000	2001	2002	2003	2004	2005	2006	2007
Mark	7	8	9	0	1	2	3	4	5	6	7

2. 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

b) Location of Lot Mark

Serial NO. Is printed on the label. The label is attached to the backside of the LCD module.  
This is subject to change without prior notice.

### **8-2. Packing Form**

- a) Package quantity in one box : 10 pcs
- b) Box Size : 386 mm X 323 mm X 302 mm

**Product Specification****9. PRECAUTIONS**

Please pay attention to the followings when you use this TFT LCD module.

**9.1 MOUNTING PRECAUTIONS**

- (1) You must mount a module using holes arranged in four corners or four sides.
- (2) You should consider the mounting structure so that uneven force (ex. twisted stress) is not applied to the module.  
And the case on which a module is mounted should have sufficient strength so that external force is not transmitted directly to the module.
- (3) Please attach a transparent protective plate to the surface in order to protect the polarizer.  
Transparent protective plate should have sufficient strength in order to resist external force.
- (4) You should adopt radiation structure to satisfy the temperature specification.
- (5) Acetic acid type and chlorine type materials for the cover case are not desirable because the former generates corrosive gas of attacking the polarizer at high temperature and the latter causes circuit break by electro-chemical reaction.
- (6) Do not touch, push or rub the exposed polarizer with glass, tweezers or anything harder than HB pencil lead. And please do not rub with dust clothes with chemical treatment.  
Do not touch the surface of polarizer for bare hand or greasy cloth. (Some cosmetics are detrimental to the polarizer.)
- (7) When the surface becomes dusty, please wipe gently with absorbent cotton or other soft materials like chamois soaked with petroleum benzene. Normal-hexane is recommended for cleaning the adhesives used to attach front / rear polarizer. Do not use acetone, toluene and alcohol because they cause chemical damage to the polarizer.
- (8) Wipe off saliva or water drops as soon as possible. Their long time contact with polarizer causes deformations and color fading.
- (9) Do not open the case because inside circuits do not have sufficient strength.

**9.2 OPERATING PRECAUTIONS**

- (1) The spike noise causes the mis-operation of circuits. It should be lower than following voltage :  
 $V = \pm 200\text{mV}$  (Over and under shoot voltage).
- (2) Response time depends on the temperature. (In lower temperature, it becomes longer.)
- (3) Brightness depends on the temperature. (In lower temperature, it becomes lower.)  
And in lower temperature, response time (required time that brightness is stable after turned on ) becomes longer.
- (4) Be careful for condensation at sudden temperature change. Condensation makes damage to polarizer or electrical contacted parts. And after fading condensation, smear or spot will occur.
- (5) When fixed patterns are displayed for a long time, remnant image is likely to occur.
- (6) Module has high frequency circuits. Sufficient suppression to the electromagnetic interference shall be done by system manufacturers. Grounding and shielding methods may be important to minimize the interference.

**9.3 ELECTROSTATIC DISCHARGE CONTROL**

### Product Specification

Since a module is composed of electronic circuits, it is not strong to electrostatic discharge. Make certain that treatment persons are connected to ground through wrist band etc . And don't touch interface pin directly.

## 9.4 PRECAUTIONS FOR STRONG LIGHT EXPOSURE

Strong light exposure causes degradation of polarizer and color filter.

## 9.5 STORAGE

When storing modules as spares for a long time, the following precautions are necessary.

- (1) Store them in a dark place. Do not expose the module to sunlight or fluorescent light. Keep the temperature between 5°C and 35°C at normal humidity.
- (2) The polarizer surface should not come in contact with any other object.  
It is recommended that they be stored in the container in which they were shipped.

## 9.6 HANDLING PRECAUTIONS FOR PROTECTION FILM

- (1) When the protection film is peeled off, static electricity is generated between the film and polarizer.  
This should be peeled off slowly and carefully by people who are electrically grounded and with well ion- blown equipment or in such a condition, etc.
- (2) The protection film is attached to the polarizer with a small amount of glue. If some stress is applied to rub the protection film against the polarizer during the time you peel off the film, the glue is apt to remain on the polarizer.  
Please carefully peel off the protection film without rubbing it against the polarizer.
- (3) When the module with protection film attached is stored for a long time, sometimes there remains a very small amount of glue still on the polarizer after the protection film is peeled off.
- (4) You can remove the glue easily. When the glue remains on the polarizer surface or its vestige is recognized, please wipe them off with absorbent cotton waste or other soft material like chamois soaked with normal-hexane .

## APPENDIX [A] - Enhanced Extended Display Identification Data (EEDID™)

Byte# (decimal)	Byte# (HEX)	Field Name and Comments	Value (HEX)	Value (binary)	Notes
0	00	Header	00		
<b>Ver 0.2</b>		<b>NOV 3, 2000</b>	<b>Page 23/26</b>		

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1	01		FF	11111111	Header
2	02		FF	11111111	
3	03		FF	11111111	
4	04		FF	11111111	
5	05		FF	11111111	
6	06		FF	11111111	
7	07		00	00000000	
8	08	EISA manufacturer code = LGP	30	00110000	Vender / Productor ID
9	09		F0	11110000	
10	0A	Product code = 148	46	01000110	
11	0B	(Hex, LSB first)	98	10011000	
12	0C	ID (32-bit) serial number = don't care	00	00000000	
13	0D		00	00000000	
14	0E		00	00000000	
15	0F		00	00000000	EDID Version / Revision
16	10	Week of manufacture = don't care	00	00000000	
17	11	Year of manufacture = don't care	00	00000000	
18	12	EDID Structure version # = 1	01	00000001	Display Parameter
19	13	EDID Revision # = 3	03	00000011	
20	14	Video input definition=Digital I/P, non TMDS CRGB	80	10000000	
21	15	Max H image size(cm)=28.5696 cm	1D	00011101	
22	16	Max V image size(cm)=21.4272 cm	15	00010101	Color Characteristic
23	17	Display gamma = 2.2	78	01111000	
24	18	Feature support(DPMS) = Active off, RGB Color	28	00101000	
25	19	Red/Green low Bits	57	01010111	
26	1A	Blue/White Low Bits	F4	11110100	
27	1B	Red X Rx =0.580	94	10010100	
28	1C	Red Y Ry =0.330	54	01010100	
29	1D	Green X Gx =0.310	4F	01001111	
30	1E	Green Y Gy =0.538	89	10001001	Established Timings
31	1F	Blue X Bx =0.151	26	00100110	
32	20	Blue Y By =0.128	20	00100000	
33	21	White X Wx = 0.313	50	01010000	
34	22	White Y Wy = 0.329	54	01010100	Standard Timing ID
35	23	Established Timing I	00	00000000	
36	24	Established Timing II	00	00000000	
37	25	Manufacturer's Timings	00	00000000	
38	26	Standard Timing Identification 1 was not used	01	00000001	
39	27	Standard Timing Identification 1 was not used	01	00000001	
40	28	Standard Timing Identification 2 was not used	01	00000001	
41	29	Standard Timing Identification 2 was not used	01	00000001	
42	2A	Standard Timing Identification 3 was not used	01	00000001	
43	2B	Standard Timing Identification 3 was not used	01	00000001	
44	2C	Standard Timing Identification 4 was not used	01	00000001	
45	2D	Standard Timing Identification 4 was not used	01	00000001	
46	2E	Standard Timing Identification 5 was not used	01	00000001	Detailed Timing Description #1
47	2F	Standard Timing Identification 5 was not used	01	00000001	
48	30	Standard Timing Identification 6 was not used	01	00000001	
49	31	Standard Timing Identification 6 was not used	01	00000001	
50	32	Standard Timing Identification 7 was not used	01	00000001	
51	33	Standard Timing Identification 7 was not used	01	00000001	
52	34	Standard Timing Identification 8 was not used	01	00000001	
53	35	Standard Timing Identification 8 was not used	01	00000001	
54	36	Detailed Timing Descriptor #1	64	01100100	
55	37	1024 x 768 @ 60 Hz mode : pixel clock = 65.00 MHz	19	00011001	
56	38	Horizontal Active = 1024 pixels	00	00000000	
57	39	Horizontal Blanking = 320 pixels	40	01000000	
58	3A	Horizontal Active : Horizontal Blanking	41	01000001	
59	3B	Vertical Active = 768 lines	00	00000000	
60	3C	Vertical Blanking = 38 lines	26	00100110	
61	3D	Vertical Active : Vertical Blanking	30	00110000	
62	3E	Horizontal Sync. Offset =24 pixels	18	00011000	
63	3F	Horizontal Sync Pulse Width = 136 pixels	88	10001000	
64	40	Vertical Sync Offset = 3 lines, Sync Width = 6 lines	36	00110110	

Byte# (decimal)	Byte# (HEX)	Field Name and Comments	Value (HEX)	Value (binary)	Notes
65	41	Horizontal Vertical Sync Offset/Width upper 2bits	20	00100000	Detailed Timing
66	42	Horizontal Image Size = 285.696 mm	1E	00011110	
67	43	Vertical Image Size = 214.272 mm	D6	11010110	
68	44	Horizontal & Vertical Image Size	10	00010000	



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69	45	Horizontal Border = 0	00	00000000	Description #1
70	46	Vertical Border = 0	00	00000000	
71	47	Non-interlaced, Normal display, no stereo, Digital separate sync, H/V pol negatives	18	00011000	
72	48	Detailed Timing Descriptor #2	00	00000000	Detailed Timing Description #2
73	49		00	00000000	
74	4A		00	00000000	
75	4B		00	00000000	
76	4C		00	00000000	
77	4D		00	00000000	
78	4E		00	00000000	
79	4F		00	00000000	
80	50		00	00000000	
81	51		00	00000000	
82	52		00	00000000	
83	53		00	00000000	
84	54		00	00000000	
85	55		00	00000000	
86	56		00	00000000	
87	57		00	00000000	
88	58		00	00000000	
89	59		00	00000000	
90	5A	Detailed Timing Descriptor #3	00	00000000	Detailed Timing Description #3
91	5B		00	00000000	
92	5C		00	00000000	
93	5D		00	00000000	
94	5E		00	00000000	
95	5F		00	00000000	
96	60		00	00000000	
97	61		00	00000000	
98	62		00	00000000	
99	63		00	00000000	
100	64		00	00000000	
101	65		00	00000000	
102	66		00	00000000	
103	67		00	00000000	
104	68		00	00000000	
105	69		00	00000000	
106	6A		00	00000000	
107	6B		00	00000000	
108	6C	Detailed Timing Descriptor #4	00	00000000	Detailed Timing Description #4
109	6D		00	00000000	
110	6E		00	00000000	
111	6F		00	00000000	
112	70		00	00000000	
113	71		00	00000000	
114	72		00	00000000	
115	73		00	00000000	
116	74		00	00000000	
117	75		00	00000000	
118	76		00	00000000	
119	77		00	00000000	
120	78		00	00000000	
121	79		00	00000000	
122	7A		00	00000000	
123	7B		00	00000000	
124	7C		00	00000000	
125	7D		00	00000000	
126	7E	Extension flag = 00	00	00000000	Extension Flag
127	7F	Checksum	47	01000111	Checksum