

**Product Specification**

# SPECIFICATION FOR APPROVAL

(    ) **Preliminary Specification**

( V ) **Final Specification**

<b>Title</b>	<b>15.0" XGA TFT LCD</b>
--------------	--------------------------

BUYER	DELL
MODEL	

SUPPLIER	LG.Philips LCD Co., Ltd.
*MODEL	LP150X2
Suffix	A2P5

\*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.

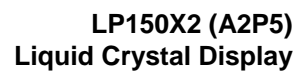
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Product Specification

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## Product Specification

## RECORD OF REVISIONS

[illegible]

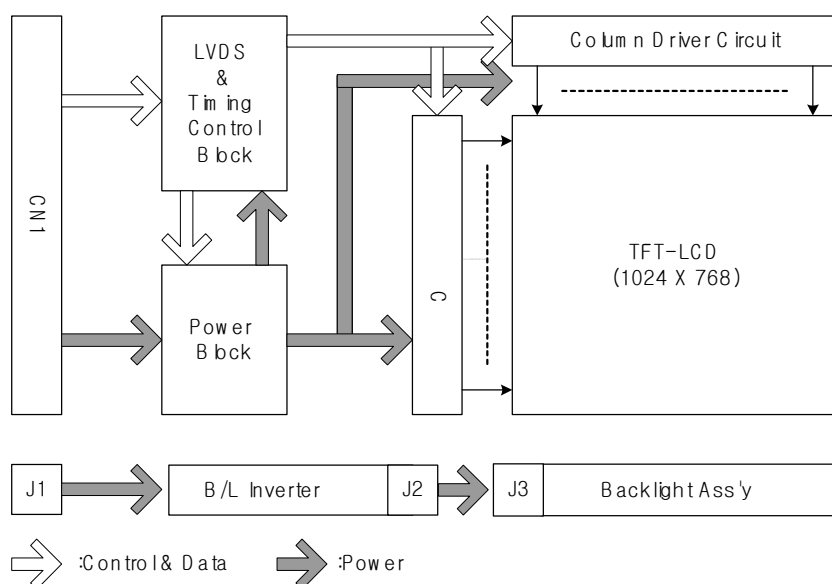
## Product Specification

### 1. General Description

The LP150X2(A2P5) 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 15.0 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 LP150X2(A2P5) has been designed to apply the interface method that enables low power, high speed, low EMI.

The LP150X2(A2P5) is intended to support applications where thin thickness, low power are critical factors and graphic display are important. In combination with the vertical arrangement of the sub-pixels, the LP150X2(A2P5) characteristics provide an excellent flat display for office automation products such as Notebook PC.



### General Features

Active Screen Size	15.0 inches(38.1cm) diagonal
Outline Dimension	317.3(H) × 241.5(V) × 7.0(D) mm (Typ.)
Pixel Pitch	0.297 mm × 0.297 mm
Pixel Format	1024 horiz. By 768 vert. Pixels RGB strip arrangement
Color Depth	6-bit, 262,144 colors
Luminance, White	180 cd/m <sup>2</sup> (Typ.)
Power Consumption	Total 5.8 Watt(Typ.)
Weight	695 g (Typ.)
Display Operating Mode	Transmissive mode, normally white
Surface Treatment	Hard coating(3H) Anti-glare treatment of the front polarizer

## Product Specification

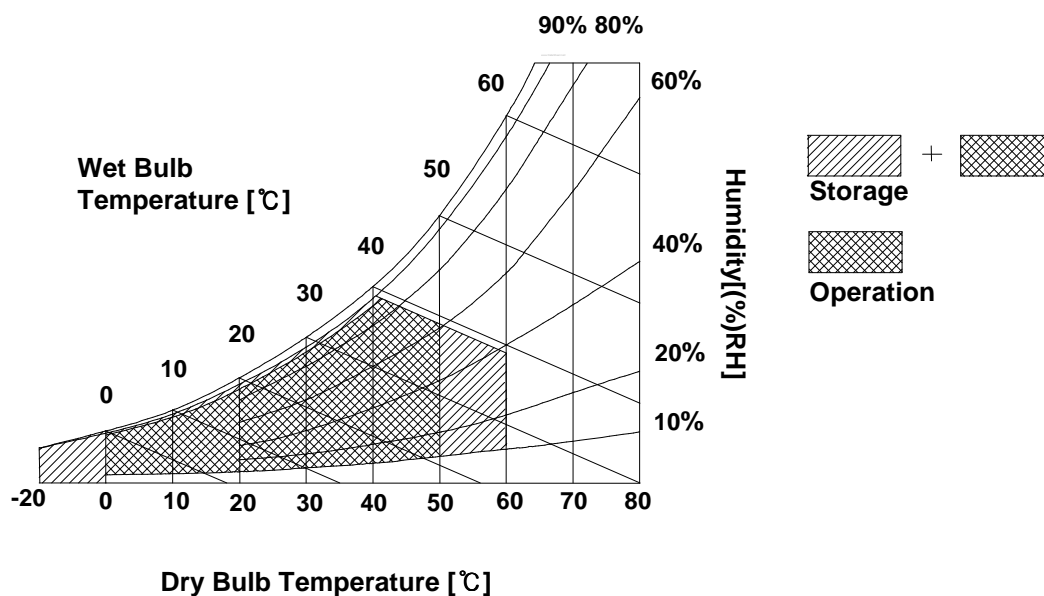
### 2. Absolute Maximum Ratings

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	VCC	-0.3	4.0	Vdc	at 25 ± 5°C
Operating Temperature	TOP	0	50	°C	1
Storage Temperature	HST	-20	60	°C	1
Operating Ambient Humidity	HOP	10	90	%RH	1
Storage Humidity	HST	10	90	%RH	1

Note : 1. Temperature and relative humidity range are shown in the figure below.  
Wet bulb temperature should be 39°C Max, and no condensation of water.



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

The LP150X2(A2P5) requires two power inputs. One is employed to power the LCD electronics and to drive the TFT array and liquid crystal. The second input which powers the CCFL, is typically generated by an inverter. The inverter is an external unit to the LCD.

**Table 2. ELECTRICAL CHARACTERISTICS**

Parameter	Symbol	Values			Unit	Notes
		Min	Typ	Max		
MODULE :						
Power Supply Input Voltage	VCC	3.0	3.3	3.6	V <sub>DC</sub>	
Power Supply Input Current	I <sub>CC</sub>	-	290	330	mA	1
Power Consumption	P <sub>c</sub>	-	0.9	1	Watt	1
Differential Impedance	Z <sub>m</sub>	90	100	110	Ohm	2
LAMP :						
Operating Voltage	V <sub>BL</sub>	-	680	-	V <sub>RMS</sub>	
Operating Current	I <sub>BL</sub>	2.5	6.0	6.5	mA <sub>RMS</sub>	3
Operating Frequency	f <sub>BL</sub>	-	58	-	kHz	
Discharge Stabilization Time	T <sub>s</sub>	-	-	3	Min	4
Life Time		10,000	-	-	Hrs	5
INVERTER :						
Input Voltage	V <sub>IN</sub>	9.0	14.4	21.0	V <sub>DC</sub>	
Input Current	I <sub>IN</sub>	-	340	390	mA	6
Input Power Consumption	P <sub>IN</sub>	-	4.90	5.62	W	6
Backlight On/Off Control	FPVEE_High	2.0	-	5.25	V <sub>DC</sub>	
	FPVEE_Low	-0.3	-	0.8	V <sub>DC</sub>	
Backlight Adjust (I <sub>BL</sub> Control)		FF_H	-	00_H	-	
Output Voltage	V <sub>OUT</sub>	580	680	780	V <sub>RMS</sub>	6
Output Current (Aging 30minutes)	I <sub>OUT_FF</sub>	1.35	1.75	2.15	mA <sub>RMS</sub>	7
	I <sub>OUT_00</sub>	5.5	6.0	6.5	mA <sub>RMS</sub>	7
Operating Frequency	Freq.	45	60	75	KHz	7
Output Power Consumption	P <sub>OUT</sub>	3.48	4.08	4.68	W	6
Open Lamp Voltage	V <sub>OPEN</sub>	1450	-	-	V <sub>RMS</sub>	8
Efficiency	η	75	-	-	%	9
Striking Time	T <sub>s</sub>	0.3	-	1.4	sec	10
Start and Delay time	ST + DT	-	50	100	Us	11
Burst Mode Frequency	f <sub>B</sub>	-	-	195	sec	

Note)

1. The specified current and power consumption are under the V<sub>cc</sub> = 3.3V , 25°C , f<sub>v</sub> = 60Hz, f<sub>CLK</sub>=65MHz 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 form LVDS Tx to the mating connector.

## Product Specification

Note)

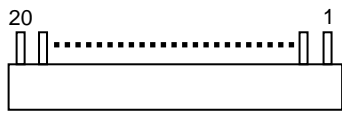
3. The typical operating current is for the typical surface luminance( $L_{WH}$ ) in optical characteristics.
4. Define the brightness of the lamp after being lighted for 5 minutes as 100%, TS is the time required for the brightness of the center of the lamp to be not less than 95%.
5. The life time is determined as the time at which brightness of lamp is 50% compare to that of initial value at the typical lamp current.
6.  $V_{IN} = 14.4V$ , SMB\_DAT = 00\_H( $I_{OUT} = 6mA$ ).
7.  $V_{IN} = 9 \sim 21V$ .
8. No Load,  $V_{IN} = 9V$ .
9.  $V_{IN} = 9V$ , SMB\_DAT = 00\_H.
10. No Load,  $V_{IN} = 9 \sim 21V$ , SMB\_DAT = 00\_H.
11. SMB\_DAT = FF\_H

### 3-2. Interface Connections

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 FI-SEB20P-HF-13 manufactured by JAE or equivalent.

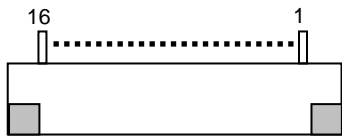
**Table 3. MODULE CONNECTOR PIN CONFIGURATION (CN1)**

Pin	Symbol	Description	Notes
1	VCC	Power Supply, 3.3V Typ.	[LVDS Transmitter] TI, SN75LVDS84 or equivalent
2	VCC	Power Supply, 3.3V Typ.	
3	GND	Ground	
4	GND	Ground	
5	$R_{IN} 0-$	Negative LVDS differential data input (R0~R5,G0)	[LVDS Receiver] THINE, THC63LVDF64A
6	$R_{IN} 0+$	Positive LVDS differential data input (R0~R5,G0)	
7	GND	Ground	[Connector] LCD: FI-SEB20P-HF-13, JAE or equivalent
8	$R_{IN} 1-$	Negative LVDS differential data input (G1~G5,B0~B1)	
9	$R_{IN} 1+$	Positive LVDS differential data input (G1~G5,B0~B1)	
10	GND	Ground	
11	$R_{IN} 2-$	Negative LVDS differential data input (B2~B5,HS,VS,DE)	[Connector pin arrangement]  LCD module rear view 
12	$R_{IN} 2+$	Positive LVDS differential data input (B2~B5,HS,VS,DE)	
13	GND	Ground	
14	CLK-	Clock -	
15	CLK+	Clock +	
16	GND	Ground	
17	$V_{EDID}$	Power for EDID	
18	NC	Reserved	
19	CLK <sub>EDID</sub>	Clock for EDID	
20	DATA <sub>EDID</sub>	EDID data	

## Product Specification

The inverter interface connector(J1) is a model 52207-1670(FPC Connector) manufactured by MOLEX. The pin configuration for the connector is shown in the table below.

**Table 4. BACKLIGHT INVERTER CONNECTOR PIN CONFIGURATION (J1)**

Pin	Symbol	Description	Notes
1	V <sub>IN</sub>	Power for the inverter	<p>[Connector] 52207-1670 (FPC Connector), MOLEX</p> <p>[Connector pin arrangement]</p> <p>LCD module rear view</p> 
2	V <sub>IN</sub>	Power for the inverter	
3	V <sub>IN</sub>	Power for the inverter	
4	GND	Ground	
5	GND	Ground	
6	GND	Ground	
7	5V_SUS	Power for the control circuit	
8	5V_ALW	Power for storing a brightness values	
9	SMB_DAT	Brightness data	
10	SMB_CLK	Clock for brightness data	
11	FPVEE	Enable for lamp turn on and off	
12	NC	No connection	
13	PANEL_ID3	0(GND)	
14	PANEL_ID2	1(OPEN)	
15	PANEL_ID1	0(GND)	
20	PANEL_ID0	1(OPEN)	

The backlight interface connector is a model BHSR-02VS-1, manufactured by JST. The mating connector part number is SM02B-BHSS-1 or equivalent.

**Table 5. BACKLIGHT CONNECTOR PIN CONFIGURATION (J3)**

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

Notes : 1. The high voltage side terminal is colored pink and the low voltage side terminal is white



## Product Specification

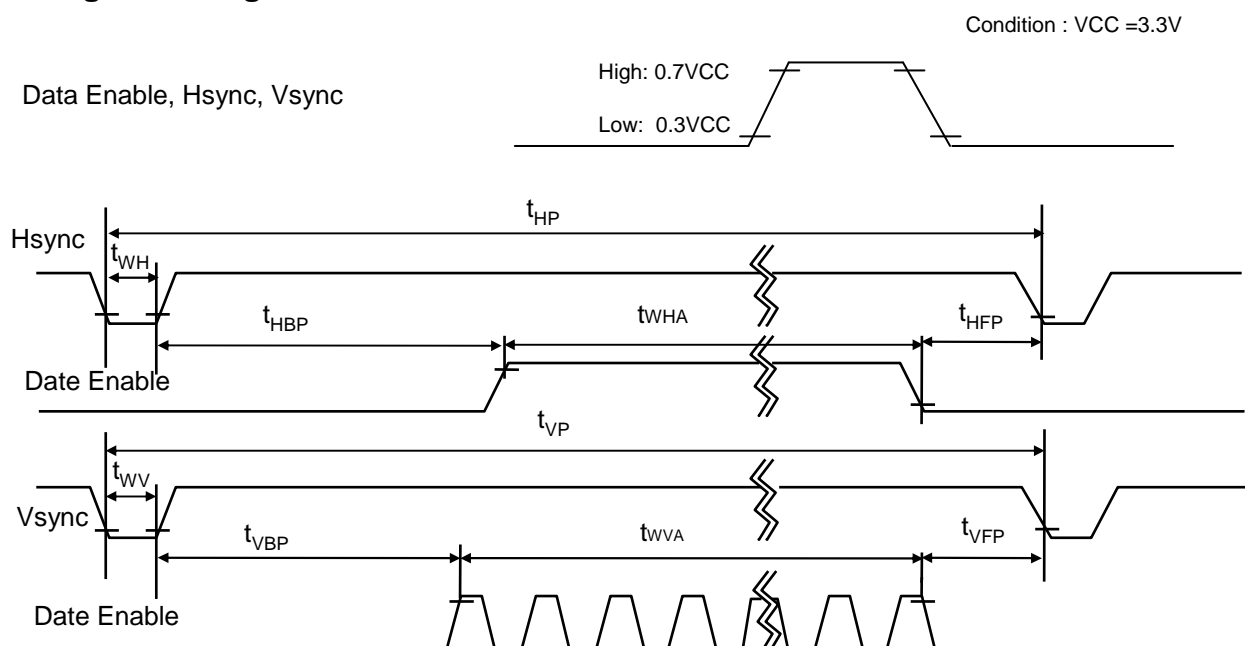
### 3-3. Signal Timing Specifications

This is the signal timing required at the input of the User connector. All of the interface signal timing should be satisfied with the following specifications and specifications of LVDS Tx/Rx for it's proper operation.

**Table 6. TIMING TABLE**

ITEM	Symbol		Min	Typ	Max	Unit	Note
DCLK	Frequency	fCLK	62	65	68	MHz	
Hsync	Period	tHP	1206	1344	1364	tCLK	
	Width	tWH	8	-	-		
Vsync	Period	tVP	780	806	830	tHP	
	Width	tWV	2	-	-		
Data Enable	Horizontal back porch	tHBP	16	-	-	tCLK	
	Horizontal front porch	tHFP	16	-	-		
	Vertical back porch	tVBP	3	-	-	tHP	
	Vertical front porch	tVFP	2	-	-		

### 3-4. Signal Timing Waveforms

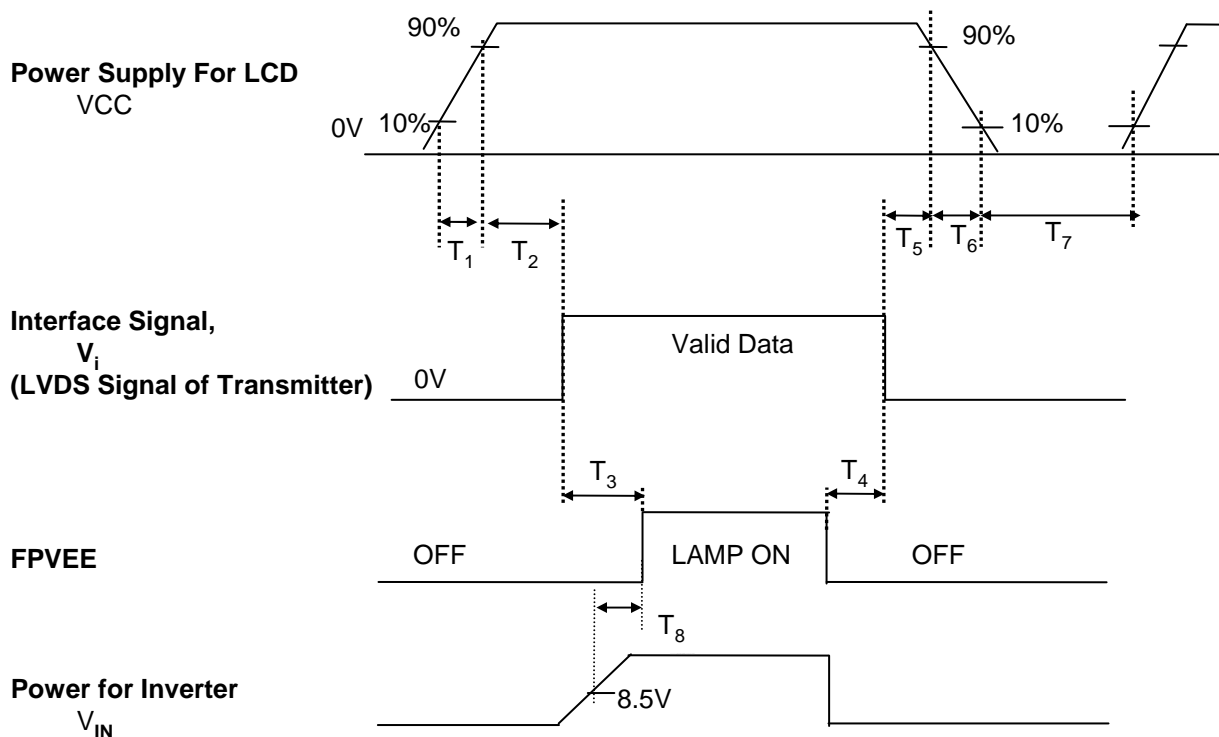


**Product Specification**
**3-5. Color Input Data Reference**

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		
		R 5	R 4	R 3	R 2	R 1	R 0	G 5	G 4	G 3	G 2	G 1	G 0	B 5	B 4	B 3	B 2	B 1	B 0
Basic Color	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	Green	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
	Blue	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)	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 (62)	1	1	1	1	1	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	GREEN (00)	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 (62)	0	0	0	0	0	0	1	1	1	1	1	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	BLUE (00)	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 (62)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0
	BLUE (63)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1

**Product Specification**
**3-6. Power Sequence**

**Table 8. POWER SEQUENCE TABLE**

Parameter	Value			Units
	Min.	Typ.	Max.	
T <sub>1</sub>	-	-	10	(ms)
T <sub>2</sub>	0	-	50	(ms)
T <sub>3</sub>	200	-	-	(ms)
T <sub>4</sub>	0	-	-	(ms)
T <sub>5</sub>	0	-	50	(ms)
T <sub>6</sub>	-	-	100	(ms)
T <sub>7</sub>	400	-	-	(ms)
T <sub>8</sub>	10	-	-	(ms)

Note)

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 VCC to 0V.
3. Lamp power must be turn on after power supply for LCD and interface signal are valid.

## Product Specification

### 4. Optical Specification

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

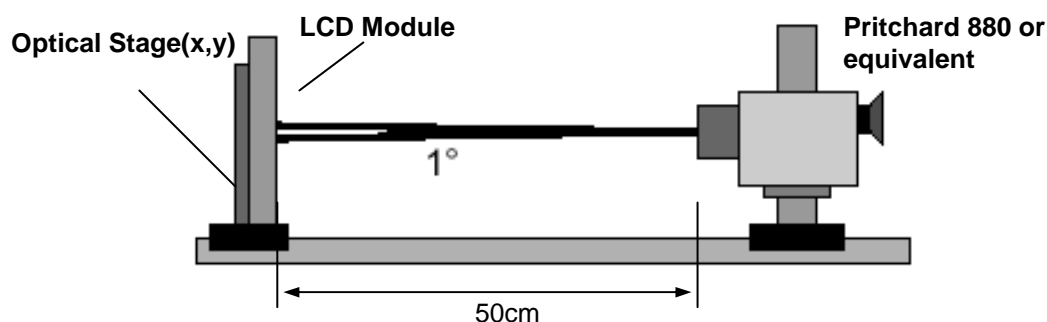


Table 9. OPTICAL CHARACTERISTICS

Ta=25°C, VCC=3.3V, fv=60Hz, Dclk= 65MHz, VIN=14.4V, IL=6.0mA

Parameter	Symbol	Values			Units	Notes
		Min	Typ	MAx		
Contrast Ratio	CR	150	250	-		1
Surface Luminance, white	L <sub>WH</sub>	150	180	-	cd/m <sup>2</sup>	2
Luminance Variation	$\delta_{\text{WHITE}}$	-	-	1.45		3
Response Time						4
Rise Time	Tr <sub>R</sub>	-	30	50	ms	
Decay Time	Tr <sub>D</sub>	-	30	50	ms	
Color Coordinates						
RED	RX	0.537	0.567	0.597		
RY		0.299	0.329	0.359		
GREEN	GX	0.287	0.317	0.347		
GY		0.506	0.536	0.566		
BLUE	BX	0.126	0.156	0.184		
BY		0.104	0.134	0.164		
WHITE	WX	0.281	0.311	0.341		
WY		0.294	0.324	0.354		
Viewing Angle						5
x axis, right( $\Phi=0^\circ$ )	$\Theta_r$	40	-	-	degree	
x axis, left ( $\Phi=180^\circ$ )	$\Theta_l$	40	-	-	degree	
y axis, up ( $\Phi=90^\circ$ )	$\Theta_u$	10	-	-	degree	
y axis, down ( $\Phi=270^\circ$ )	$\Theta_d$	30	-	-	degree	
Gray Scale						6

## Product Specification

Note)

1. Contrast Ratio(CR) is defined mathematically as

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

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 1.

3. The variation in surface luminance, The Panel total variation ( $\delta_{\text{WHITE}}$ ) is determined by measuring  $L_{\text{ON}}$  at each test position 1 through 5, and then dividing the maximum  $L_{\text{ON}}$  of 5 points luminance by minimum  $L_{\text{ON}}$  of 5 points luminance. For more information see FIG 2.

$$\delta_{\text{WHITE}} = \text{Maximum}(L_1, L_2, \dots L_5) / \text{Minimum}(L_1, L_2, \dots L_5)$$

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

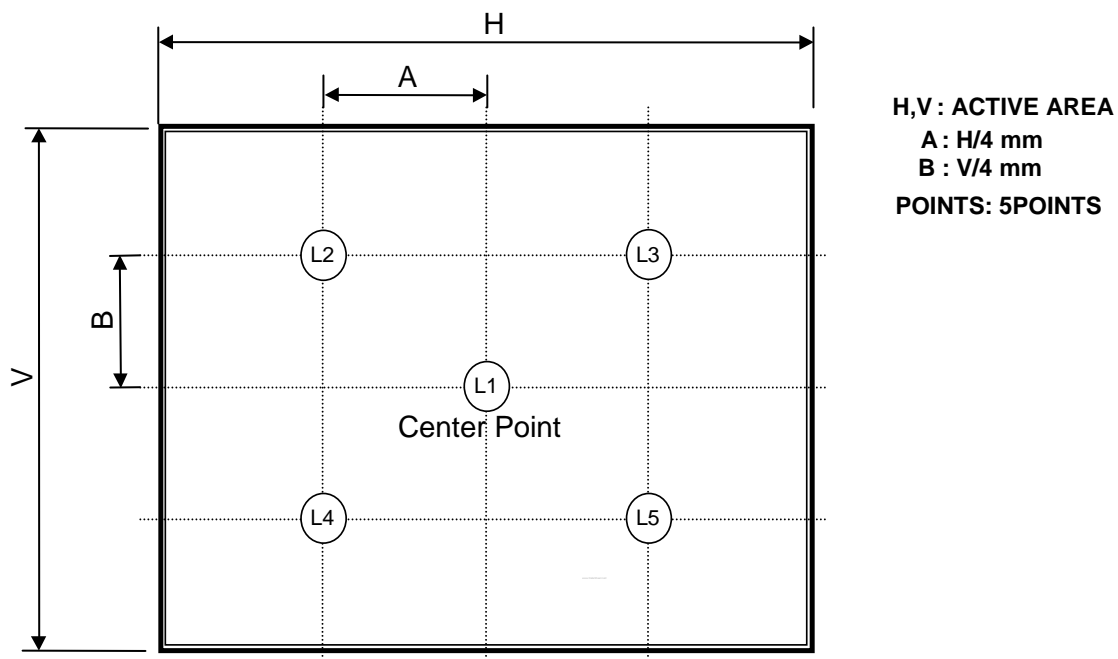
\*  $f_v=60\text{Hz}$

Gray Level	Luminance [%] (Typ)
L0	0.32
L7	0.98
L15	4.22
L23	10.7
L31	22.5
L39	38.1
L47	57.8
L55	79.0
L63	100

**Product Specification**

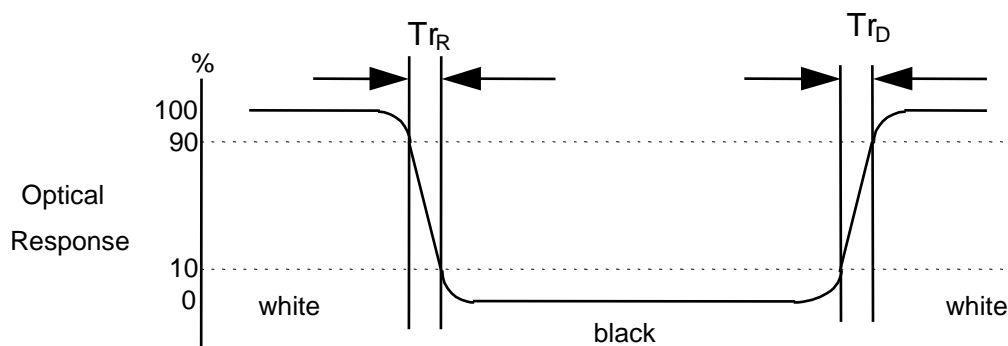
**FIG. 2 Luminance**

<measuring point for surface luminance & measuring point for luminance variation>



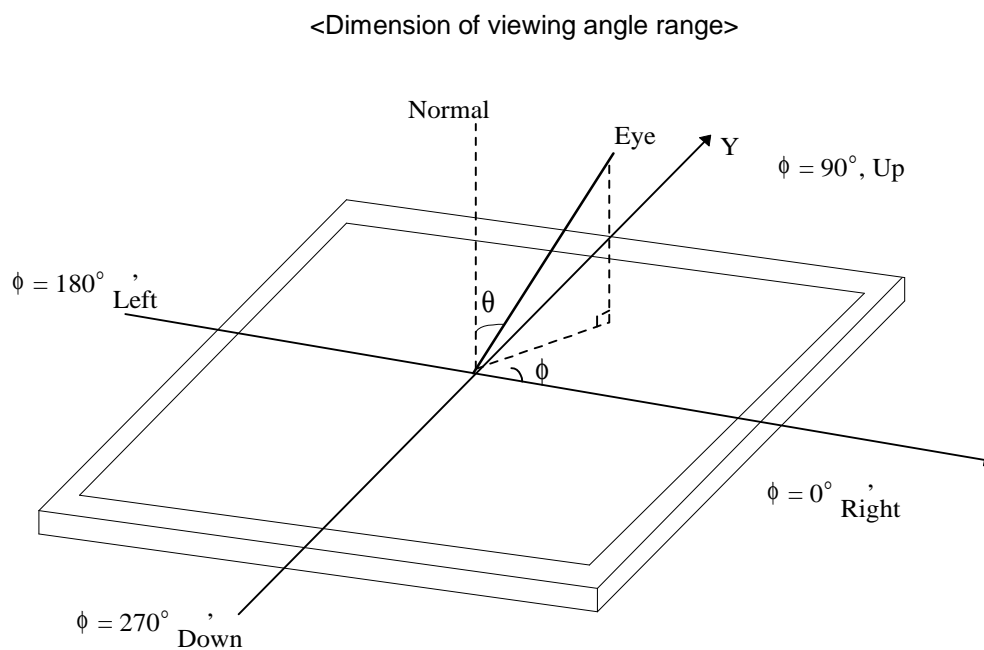
**FIG. 3 Response Time**

The response time is defined as the following figure and shall be measured by switching the input signal for "black" and "white".



**Product Specification**

**FIG. 4 Viewing angle**



**Product Specification**

## 5. Mechanical Characteristics

The contents provide general mechanical characteristics for the model LP150X2(A2P5). In addition the figures in the next page are detailed mechanical drawing of the LCD.

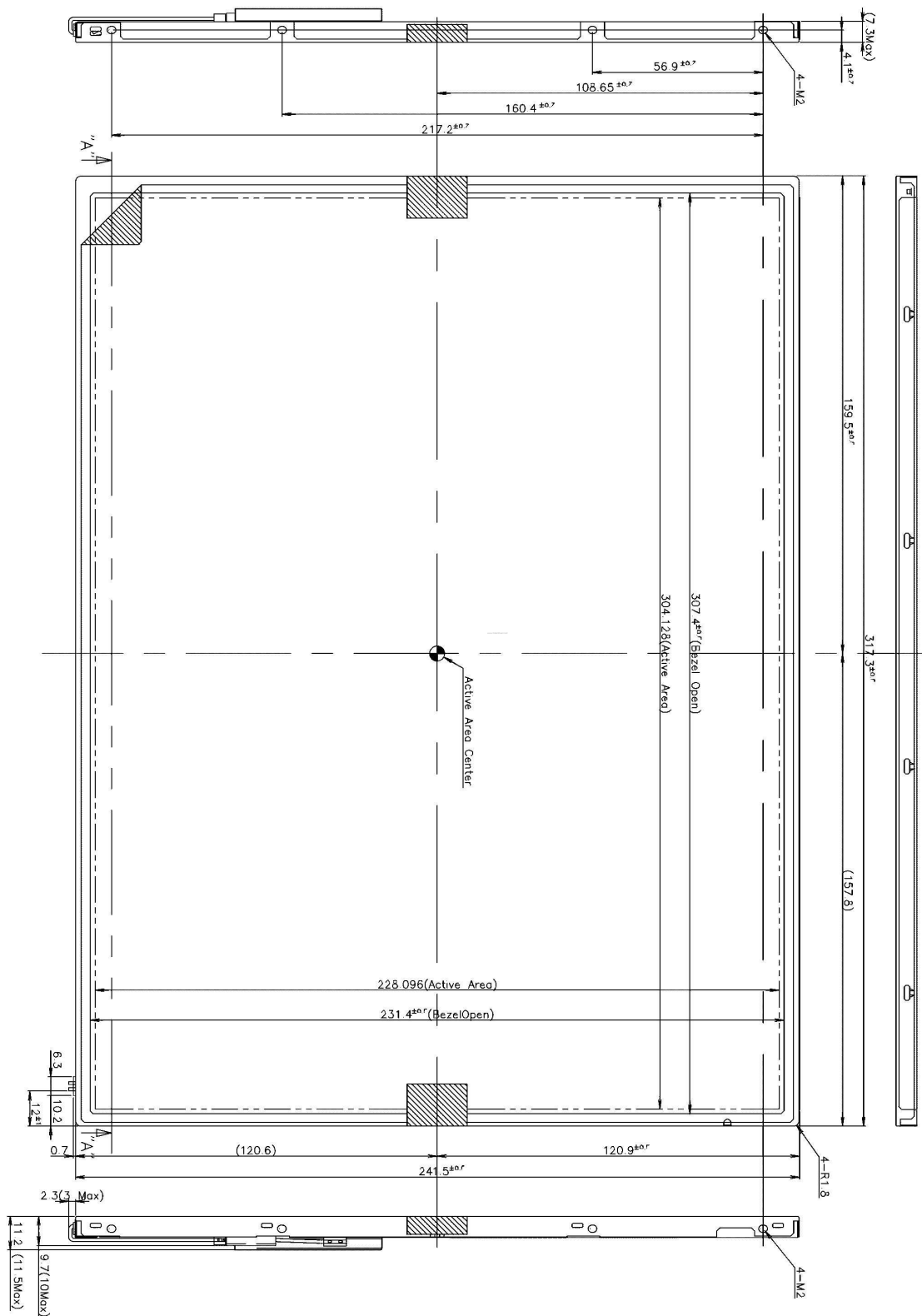
Outline Dimension	Horizontal	317.3 ± 0.5mm
	Vertical	241.5 ± 0.5mm
	Depth	Typ. 7.0 mm, Max. 7.3mm
Bezel Area	Horizontal	307.4 ± 0.5mm
	Vertical	231.4 ± 0.5mm
Active Display Area	Horizontal	304.128 mm
	Vertical	228.096 mm
Weight	695g (Typ.) 710g (Max.) LCM            680g(Typ.) INVERTER    15g(Max.)	
Surface Treatment	Hard coating(3H) Anti-glare treatment of the front polarizer	



**Product Specification**

<FRONT VIEW>

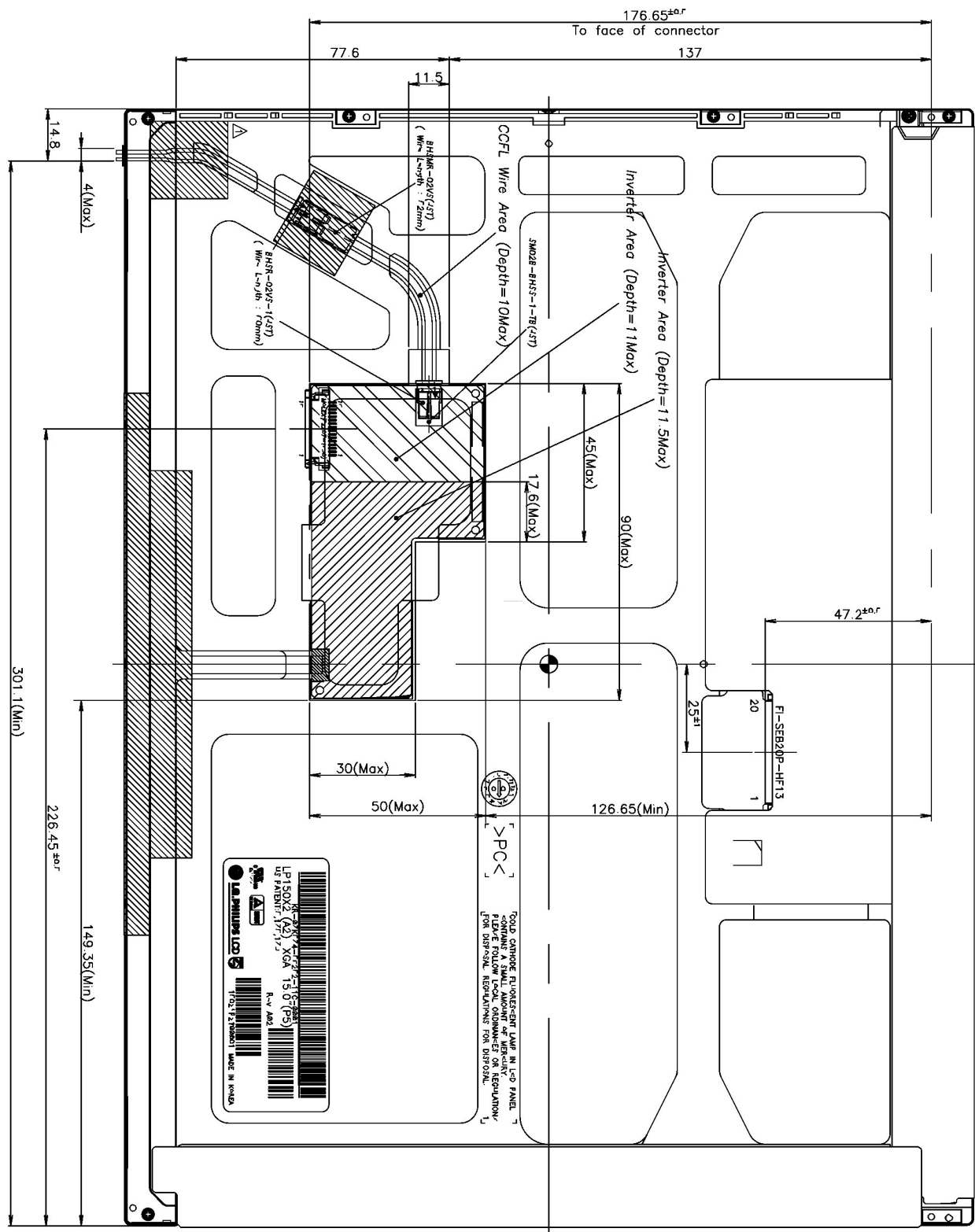
Note) Unit:[mm], General tolerance:  $\pm 0.5\text{mm}$



**Product Specification**

<REAR VIEW>

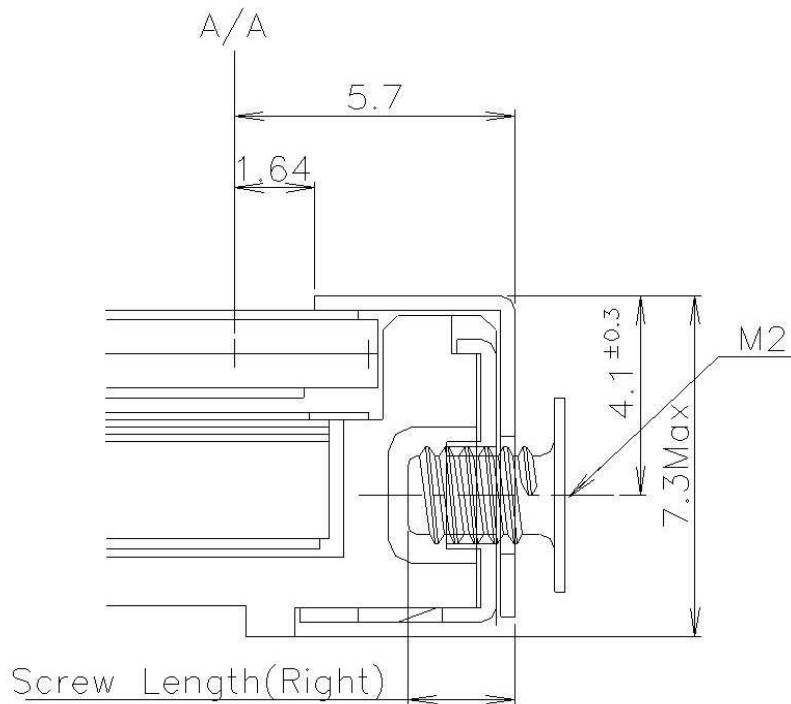
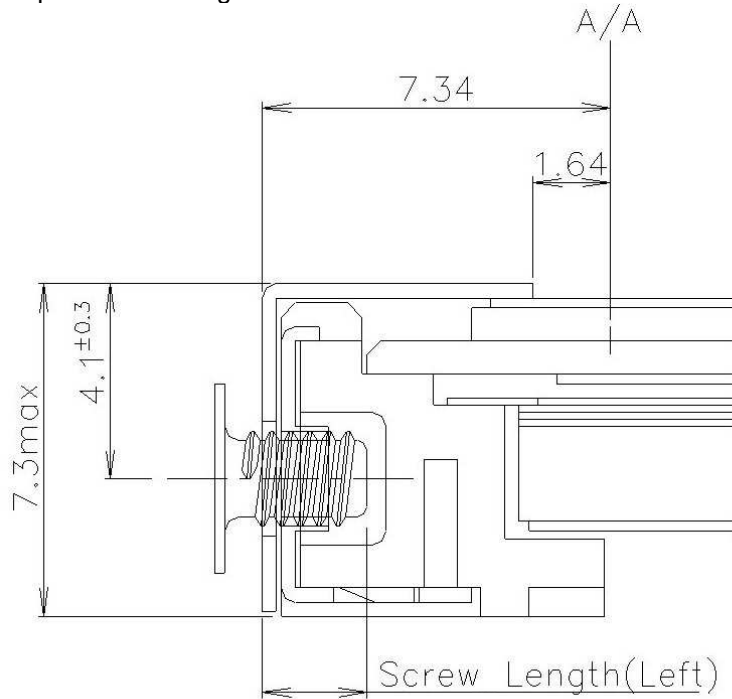
Note) Unit:[mm], General tolerance:  $\pm 0.5\text{mm}$



**Product Specification**

[ DETAIL DESCRIPTION OF SIDE MOUNTING SCREW ]

- \* Screw Length : Left and Right (Max: 2.6, Min 1.8)
- \* Screw Torque : Max 2.0 kgf cm



Note) Unit:[mm], General tolerance: ± 0.5mm

**Product Specification**
**6. Reliability**

Environment test condition

No.	Test Item	Conditions
1	High temperature storage test	Ta= 60°C, 240h
2	Low temperature storage test	Ta= -20°C, 240h
3	High temperature operation test	Ta= 50°C, 50%RH, 240h
4	Low temperature operation test	Ta= 0°C, 240h
5	Vibration test (non-operating)	Sine wave, 10 ~ 500 ~ 10Hz, 1.5G, 0.37oct/min 3 axis, 1hour/axis
6	Shock test (non-operating)	Half sine wave, 180G, 2ms one shock of each six faces(l.e. run 180G 6ms for all six faces)
7	Altitude operating storage / shipment	0 ~ 10,000 feet (3,048m) 24Hr 0 ~ 40,000 feet (12,192m) 24Hr

{ 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.

**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 Electrotechnical 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 Electrical 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 Interface Characteristics of Information Technology Equipment." International Special Committee on Radio Interference.
- c) EN 55022 "Limits and Methods of Measurement of Radio Interface Characteristics of Information Technology Equipment." European Committee for Electrotechnical Standardization.(CENELEC), 1998

## 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	4	4	5	6	7	8	9	A	B	C

##### 3. Serial No

Serial No.	1 ~ 99,999	100,000 ~
Mark	00001 ~ 99999	A0001 ~ A9999, - - - - , Z9999

##### 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 : 360mm × 322mm × 391mm

**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 the surface 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 polarizers 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 polarizers. 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.

**Product Specification****9-3. ELECTROSTATIC DISCHARGE CONTROL**

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) The protection film is attached to the bezel with a small masking tape.  
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) 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 bezel after the protection film is peeled off.
- (3) You can remove the glue easily. When the glue remains on the bezel surface or its vestige is recognized, please wipe them off with absorbent cotton waste or other soft material like chamois soaked with normal-hexane.



**Product Specification**
**APPENDIX A. Enhanced Extended Display Identification Data (EEDID™) 1/3**

Byte#	Byte#	Field Name and Comments	Value		Value	
DEC	HEX		HEX	BIN		
0	00	Header	0	0	00000000	Header
1	01		F	F	11111111	
2	02		F	F	11111111	
3	03		F	F	11111111	
4	04		F	F	11111111	
5	05		F	F	11111111	
6	06		F	F	11111111	
7	07		0	0	00000000	
8	08	EISA manufacturer code = LGP	3	0	00110000	Vender/ Product ID
9	09		F	0	11110000	
10	0A	Product code = 152(LP150X2)	4	6	01000110	
11	0B	(Hex, LSB first)	B	2	10110010	
12	0C	32-bit serial number =Don't care	0	0	00000000	
13	0D		0	0	00000000	
14	0E		0	0	00000000	
15	0F		0	0	00000000	
16	10	Week of manufacture = Don't care	0	0	00000000	EDID Version /Revision
17	11	Year of manufacture = Don't care	0	0	00000000	
18	12	EDID Structure version # = 1	0	1	00000001	Display Parameter
19	13	EDID Revision # = 3	0	3	00000011	
20	14	Video input definition = Digital I/p,non TMDS CRGB	8	0	10000000	
21	15	Max H image size(cm)= 30.4128cm(30)	1	E	00011110	
22	16	Max V image size(cm)= 22.8096cm(22)	1	6	00010110	
23	17	Display gamma = 2.2	7	8	01111000	
24	18	Feature support(DPMS) = Active off, RGB Color	2	8	00101000	
25	19	Red/Green low Bits	0	2	00000010	Color Characteristic
26	1A	Blue/White Low Bits	D	F	11011111	
27	1B	Red X Rx =0.567	9	1	10010001	
28	1C	Red Y Ry =0.329	5	4	01010100	
29	1D	Green X Gx =0.317	5	1	01010001	
30	1E	Green Y Gy =0.536	8	6	10000110	
31	1F	Blue X Bx =0.156	2	7	00100111	
32	20	Blue Y By =0.134	2	2	00100010	
33	21	White X Wx = 0.311	5	1	01010001	Established Timings
34	22	White Y Wy = 0.324	5	2	01010010	
35	23	Established Timing I	0	0	00000000	Standard Timing ID
36	24	Established Timing II	0	0	00000000	
37	25	Manufacturer's Timings	0	0	00000000	
38	26	Standard Timing Identification 1 was not used	0	1	00000001	
39	27	Standard Timing Identification 1 was not used	0	1	00000001	
40	28	Standard Timing Identification 2 was not used	0	1	00000001	
41	29	Standard Timing Identification 2 was not used	0	1	00000001	
42	2A	Standard Timing Identification 3 was not used	0	1	00000001	
43	2B	Standard Timing Identification 3 was not used	0	1	00000001	
44	2C	Standard Timing Identification 4 was not used	0	1	00000001	
45	2D	Standard Timing Identification 4 was not used	0	1	00000001	
46	2E	Standard Timing Identification 5 was not used	0	1	00000001	
47	2F	Standard Timing Identification 5 was not used	0	1	00000001	
48	30	Standard Timing Identification 6 was not used	0	1	00000001	

Product Specification

APPENDIX A. Enhanced Extended Display Identification Data (EEDID™) 2/3

Byte#	Byte#	Field Name and Comments	Value			
DEC	HEX		HEX	BIN		
49	31	Standard Timing Identification 6 was not used	0	1	00000001	Standard Timing ID
50	32	Standard Timing Identification 7 was not used	0	1	00000001	
51	33	Standard Timing Identification 7 was not used	0	1	00000001	
52	34	Standard Timing Identification 8 was not used	0	1	00000001	
53	35	Standard Timing Identification 8 was not used	0	1	00000001	
54	36	Detailed Timing Descriptor #1	6	4	01100100	Detailed Timing Description #1
55	37	1024 x768@60Hz mode : pixel clock = 65MHz	1	9	00011001	
56	38	Horizontal Active = 1024 pixels	0	0	00000000	
57	39	Horizontal Blanking = 320 pixels	4	0	01000000	
58	3A	Horizontal Active : Horizontal Blanking	4	1	01000001	
59	3B	Vertical Avtive = 768 lines	0	0	00000000	
60	3C	Vertical Blanking = 38 lines	2	6	00100110	
61	3D	Vertical Active : Vertical Blanking	3	0	00110000	
62	3E	Horizontal Sync. Offset = 24 pixels	1	8	00011000	
63	3F	Horizontal Sync Pulse Width = 136 pixels	8	8	10001000	
64	40	Vertical Sync Offset = 3 lines,Sync Width = 6 lines	3	6	00110110	
65	41	Horizontal Vertical Sync Offset/Width upper 2bits	2	0	00100000	
66	42	Horizontal Image Size = 304.128mm(304)	3	0	00110000	
67	43	Vertical Image Size = 228.096mm(228)	E	4	11100100	
68	44	Horizontal & Vertical Image Size	1	0	00010000	
69	45	Horizontal Border = 0	0	0	00000000	
70	46	Vertical Border = 0	0	0	00000000	
71	47	Non-interlaced, Normal display ,no stereo, Digital separate sync	1	8	00011000	
72	48	Detailed Timing Descriptor #2	0	0	00000000	Detailed Timing Description #2
73	49		0	0	00000000	
74	4A		0	0	00000000	
75	4B		0	0	00000000	
76	4C		0	0	00000000	
77	4D		0	0	00000000	
78	4E		0	0	00000000	
79	4F		0	0	00000000	
80	50		0	0	00000000	
81	51		0	0	00000000	
82	52		0	0	00000000	
83	53		0	0	00000000	
84	55		0	0	00000000	
85	55		0	0	00000000	
86	56		0	0	00000000	
87	57		0	0	00000000	
88	58		0	0	00000000	
89	59		0	0	00000000	
90	5A	Detailed Timing Descriptor #3	0	0	00000000	Detailed Timing Description #3
91	5B		0	0	00000000	
92	5C		0	0	00000000	
93	5D		0	0	00000000	
94	5E		0	0	00000000	
95	5F		0	0	00000000	
96	60		0	0	00000000	
97	61		0	0	00000000	

Product Specification

APPENDIX A. Enhanced Extended Display Identification Data (EEDID™) 3/3

Byte#	Byte#	Field Name and Comments	Value		Value	
DEC	HEX		HEX		BIN	
98	62		0	0	00000000	Detailed Timing Description #3
99	63		0	0	00000000	
100	64		0	0	00000000	
101	65		0	0	00000000	
102	66		0	0	00000000	
103	67		0	0	00000000	
104	68		0	0	00000000	
105	69		0	0	00000000	
106	6A		0	0	00000000	Detailed Timing Description #4
107	6B		0	0	00000000	
108	6C	Detailed Timing Descriptor #4	0	0	00000000	
109	6D		0	0	00000000	
110	6E		0	0	00000000	
111	6F		0	0	00000000	
112	70		0	0	00000000	
113	71		0	0	00000000	
114	72		0	0	00000000	
115	73		0	0	00000000	
116	74		0	0	00000000	
117	75		0	0	00000000	
118	76		0	0	00000000	
119	77		0	0	00000000	
120	78		0	0	00000000	
121	79		0	0	00000000	
122	7A		0	0	00000000	
123	7B		0	0	00000000	
124	7C		0	0	00000000	
125	7D		0	0	00000000	
126	7E	Extension flag = 00	0	0	00000000	Extension Flag
127	7F	Checksum	7	7	01110111	Checksum

## Product Specification

### APPENDIX B. Inspection Criteria 1/2

#### 1. Dot

##### 1.1. Bright Dot

Dots(sub-pixels) which appeared brightly in the screen when the LCM displayed with dark pattern.

- R,G or B 1 dot ----- 0 Max
- Adjacent 2 dots ----- 0 Max
- Total amount of Bright dots ----- 0 Max

##### 1.2. Dark Dot

Dots(sub-pixels) which appeared darkly in the screen when the LCM displayed with bright pattern.

- 1 dot ----- 7 Max
- Adjacent 2 dots ----- 2 Max
- Total amount of Dark dot ----- 7 Max
- Minimum Distance between dark dots ----- Within 5 mm, Max 0

##### 1.3. Total amount of Dot Defects ----- 7 Max(Combination)

Note)

- a. Every dot herein means Sub-Pixel(Each Red,Green, or Blue Color)
- b. Bright & Dark dots are larger than half sub-pixel.  
(Dots smaller than half sub-pixel are not counted as a defect dots.)

#### 2. Polarizer

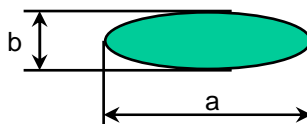
Items		Accept Criteria
Scratches	Linear	$W \leq 0.1, L \leq 5.0, N \leq 3$
Dent	Circular	$D \leq 0.5, N \leq 4$

W :Width  
L : Length  
D : Average diameter

Note)

##### a. Average Diameter

$$D = \frac{a+b}{2}$$



- b. Linear :  $a > 2b$  , Circular :  $a \leq 2b$
- c. Extraneous substances which can be wiped out, like Finger Print, Particles, are not considered as a defect.
- d. Defects which is on the Black Matrix(outside of Active Area) are not considered as a defect.

## Product Specification

### APPENDIX B. Inspection Criteria 2/2

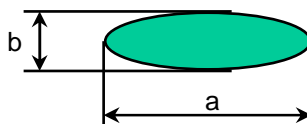
#### 3. Foreign Material

Items		Accept Criteria
Foreign Material	Linear	$W \leq 0.07, L \leq 1.0, N \leq 4$
	Circular	$D \leq 0.5, N \leq 4$

Note)

a. Average Diameter

$$D = \frac{a+b}{2}$$



W :Width  
L : Length  
D : Average diameter

b. Linear :  $a > 2b$  , Circular :  $a \leq 2b$

#### 4. Line(s)

All kinds of line defects such as vertical, horizontal or cross are not allowed.

#### 5. Bezel Appearance

Scratches, minor bents, stains, particles on the Bezel frame are not considered as a defect.

#### 6. Others

Issues which is not defined in this criteria shall be discussed with both parties, Customer and Supplier, for better solution.