SPECIFICATION
FOR
APPROVAL

(   ) **Preliminary Specification**

(∨) **Final Specification**

Title	12.1" XGA TFT LCD

BUYER	
MODEL	

SUPPLIER	LG.Philips LCD Co., Ltd.
*MODEL	LP121X04
Suffix	B2P2

*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.

SIGNATURE	DATE
S.H. Kang / G.Manager	
REVIEWED BY	
J.H. Park / Manager	
/ Manager	
PREPARED BY	
S.R. Kim / Engineer	
/ Engineer	

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

Contents

<u>RECORD OF REVISIONS</u>

| Revision No	Revision Date	Page	Description	Note
1.0	JUL.09.2002	-	First Draft (Final)	

1. General Description

The LP121X04(B2P2) 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 12.1 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 LP121X04(B2P2) has been designed to apply the interface method that enables low power, high speed, low EMI.

The LP121X04(B2P2) 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 LP121X04(B2P2) characteristics provide an excellent flat display for office automation products such as Notebook PC.
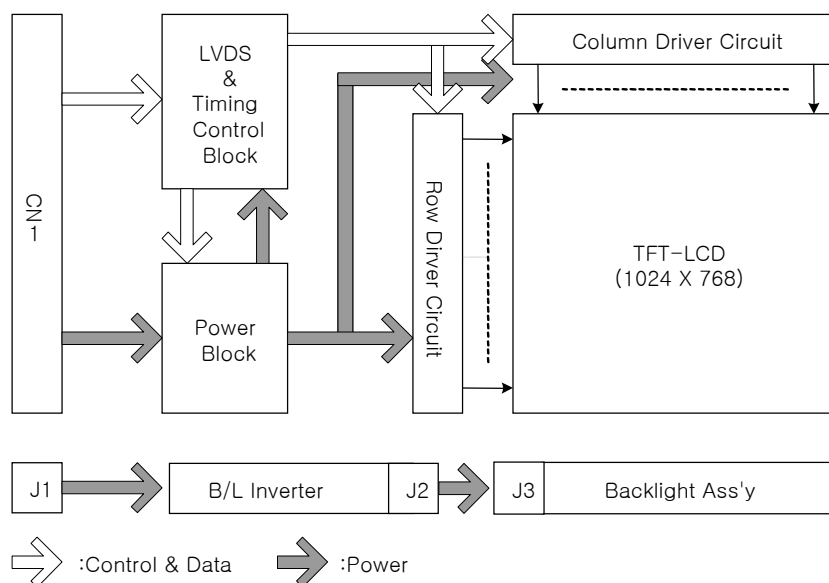
General Features

| Active Screen Size	12.1 inches(30.73cm) diagonal
Outline Dimension	261(H) x 199(V) x 5.0(D) mm(Typ.)
Pixel Pitch	0.240 mm x 0.240mm
Pixel Format	1024 horiz. By 768 vert. Pixels RGB strip arrangement
Color Depth	6-bit, 262,144 colors
Luminance, White	143 cd/m^2(Typ.), **5point average**
Power Consumption	Total 4.0 Watt(Typ.)
Weight	300 g (Typ.)
Display Operating Mode	Transmissive mode, normally white
Surface Treatment	Hard coating(3H) Anti-glare treatment of the front polarizer

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.

Dry Bulb Temperature [℃]
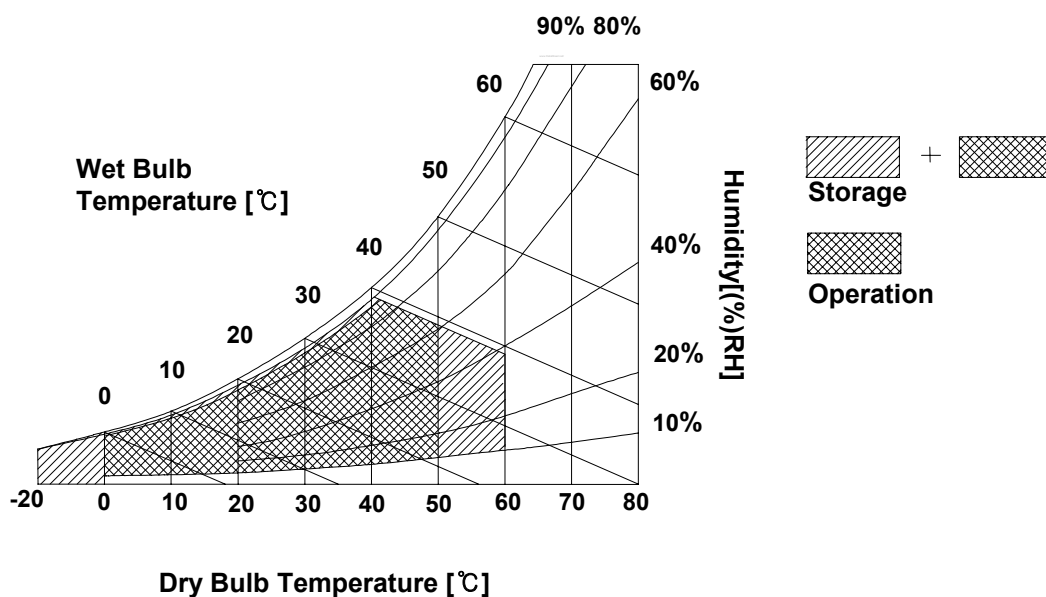
3. Electrical Specifications

3-1. Electrical Characteristics

The LP121X04(B2P2) 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_{DC}	
Power Supply Input Current	I_{CC}	-	238	274	mA	1
Differential Impedance	Zm	90	100	110	Ohm	2
Power Consumption	Pc	-	0.79	1.35	Watt	1
Rush Current	I_{RUSH}		1.0	1.8	A	3
LAMP :						
Operating Voltage	V_{BL}	-	580(5.5mA)	640(3.0mA)	V_{RMS}	4
Operating Current	I_{BL}	3.0	5.5	6.0	mA_{RMS}	5
Established Starting Voltage	V_S					6
at 25 °C		-	-	1010	V_{RMS}	
at 0 °C		-	-	1210	V_{RMS}	
Operating Frequency	f_{BL}	50	65	80	kHz	4
Discharge Stabilization Time	Ts	-	-	3	Min	7
Power consumption	P_{BL}		3.2	3.52	Watts	8
Life Time		10,000	-	-	Hrs	9

Note)
1. The specified current and power consumption are under the Vcc = 3.3V , 25℃, fv = 60Hz condition whereas mosaic(checker) pattern is displayed and fv is the frame frequency.
2. This impedance value is needed to proper display and measured form LVDS Tx to the mating connector.
3. The duration of rush current is about 20ms.
4. The variance of the voltage is ± 10%.
5. The typical operating current is for the typical surface luminance (L_{WH}) in optical characteristics.
6. The voltage above V_S should be applied to the lamps for more than 1 second for start-up.
    Otherwise, the lamps may not be turned on.
7. 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%.
8. The output of the inverter must have symmetrical(negative and positive) voltage waveform and symmetrical current waveform.(Asymmetrical ratio is less than 10%) Please do not use the inverter which has asymmetrical voltage and asymmetrical current and spike wave
    Lamp frequency may produce interface with horizontal synchronous frequency and as a result this may cause beat on the display. Therefore lamp frequency shall be as away possible from the horizontal synchronous frequency and from its harmonics in order to prevent interference.
9. 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.
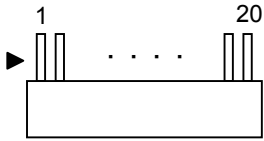
3-2. Interface Connections

Interface chip must be used FlatLink, part No. SN75LVDS84(Transmitter made by Texas Instrument Inc or equivalence.

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 DF19K-20P-1H manufactured by Hirose or equivalent.

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

Table 3. MODULE CONNECTOR PIN CONFIGURATION (CN1)

Pin	Symbol	Description	Notes
1	VCC	Power Supply, 3.3V Typ.	1. Interface chips
2	VCC	Power Supply, 3.3V Typ.	1.1 LCD : LPZ4E102S6L(LCD Controller)
3	GND	Ground	including LVDS Receiver
4	GND	Ground	1.2 System : SN75LVDS84 or equivalent
5	A1M	Differential signal	*Pin to Pin compatible with Thine LVDS
6	A1P	Differential signal	
7	GND	Ground	2. Connector
8	A2M	Differential signal	2.1 LCD : DF19K-20P-1H,HIROSE
9	A2P	Differential signal	or equivalent
10	GND	Ground	2.2 Mating : DF19G-20S-1C or equivalent.
11	A3M	Differential signal	2.3 Connector pin arrangement
12	A3P	Differential signal	
13	GND	Ground	1 20
14	CLKM	Differential signal	
15	CLKP	Differential signal	
16	GND	Ground	
17	NC	No connection	
18	NC	No connection	**[LCD Module Rear View]**
19	GND	Ground	
20	GND	Ground	

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

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

Table 4. BACKLIGHT CONNECTOR PIN CONFIGURATION

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. The low voltage side terminal is white

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 its proper operation.

Table 6. Timing Table

ITEM		SYMBOL	MIN	TYP.	MAX.	UNIT	NOTES
Dclk	Period	t_{CLK}	16.1	15.4	14.7	ns	
	Frequency	-	62	65	68	MHz	
Hsync	Period	t_{HP}	1196	1344	1364	t_{CLK}	
	Width	t_{WH}	8	136	240		
Vsync	Period	t_{VP}	780	806	830	t_{HP}	
	Frequency	f_V	-	60	-	Hz	
	Width	t_{WV}	1	6	24	t_{HP}	
DE (Data Enable)	Set up Time	t_{SI}	5	-	-	ns	For Dclk
	Hold Time	t_{HI}	5	-	-		
	Horizontal Back Porch	t_{HBP}	10	160	-	t_{CLK}	
	Horizontal Front Porch	t_{HFP}	10	24	-		
	Vertical Back Porch	t_{VBP}	2	29	-	t_{HP}	
	Vertical Front Porch	t_{VFP}	1	3	-		
DATA	Set up Time	t_{SD}	5	-	-	ns	For Dclk
	Hold Time	t_{HD}	5	-	-		

3-4. Signal Timing Waveforms

Dclk, Hsync, Vsync, DE, DATA   0.7Vcc

0.3Vcc
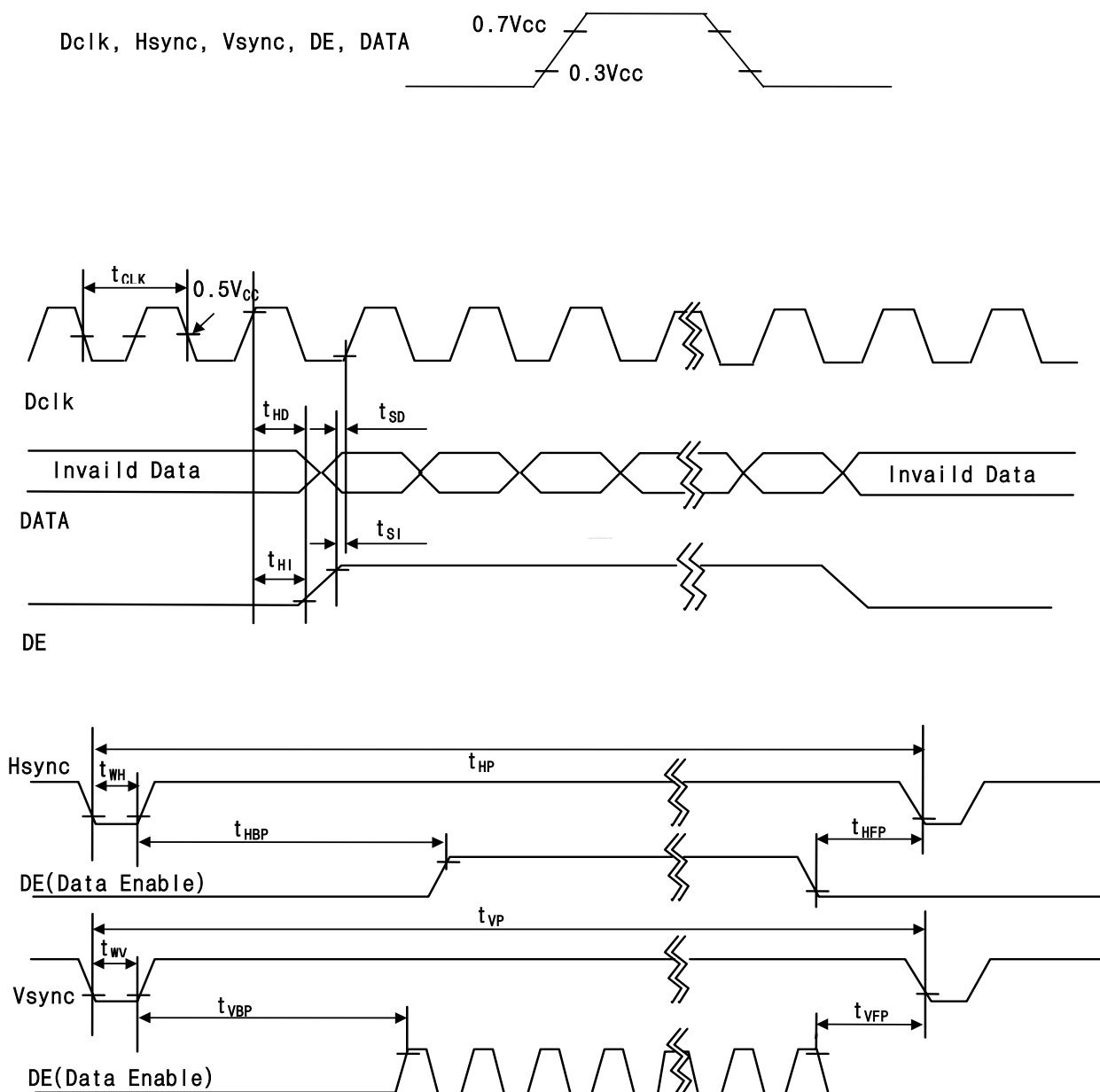
3-5. Color Input Data Reference

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		Red MSB					LSB	Green MSB					LSB	Blue 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
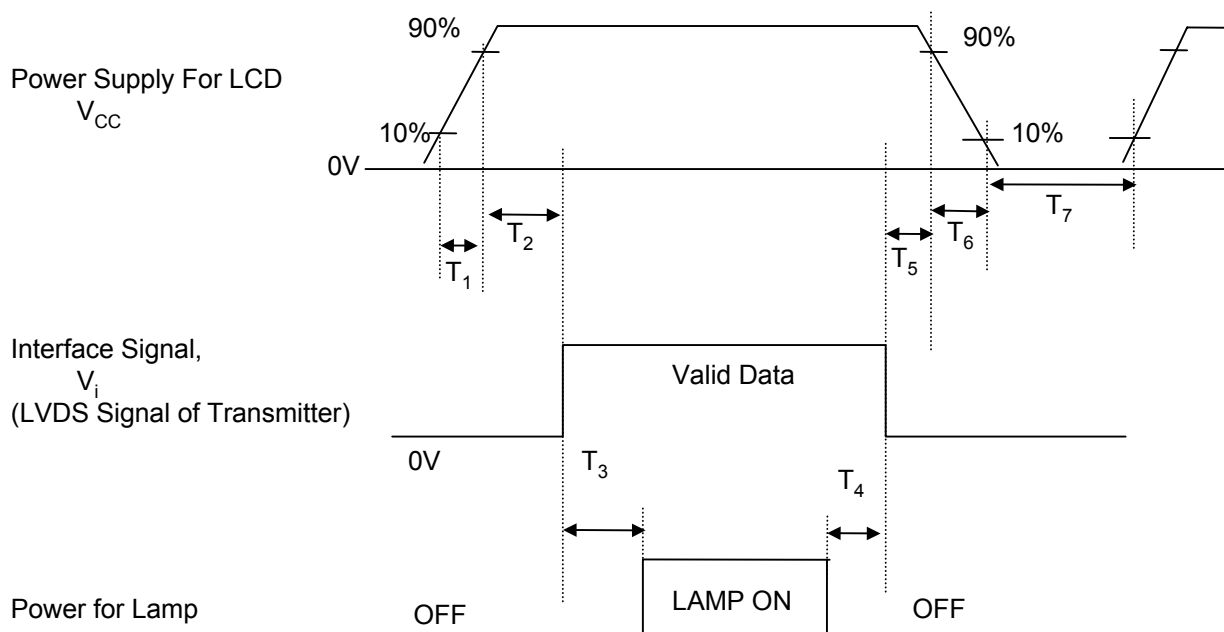
Parameter	Values			Units
	Min.	Typ.	Max.	
T_1	-	-	10	ms
T_2	0	-	50	ms
T_3	200	-	-	ms
T_4	200	-	-	ms
T_5	0	-	50	ms
T_6	-	-	10	ms
T_7	400	-	-	ms

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 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 Φ and Θ equal to 0°.
FIG. 1 presents additional information concerning the measurement equipment and method.

FIG. 1 Optical Characteristic Measurement Equipment and Method

Optical Stage(x,y)　　**LCD Module**　　**Pritchard 880 or equivalent**

1°

50cm
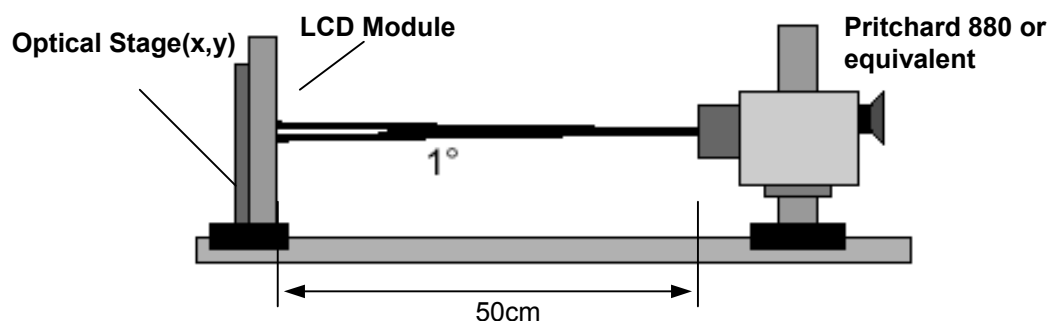
Table 9. OPTICAL CHARACTERISTICS

Ta=25°C, VCC=3.3V, fv=60Hz, f_{CLK}= 65MHz, Iout = 5.5mA

Parameter	Symbol	Values			Units	Notes
		Min	Typ	MAx		
Contrast Ratio	CR	200	250	-		1
Surface Luminance, white	L_{WH}	115	143	-	cd/m^2	2
Luminance Variation	δ_{WHITE}	-	-	1.8		3
Response Time	Tr	-			ms	4
Rise Time	Tr_R	-	20	40		
Decay Time	Tr_D	-	30	50		
Color Coordinates						
RED	RX	0.532	0.562	0.592		
	RY	0.302	0.332	0.362		
GREEN	GX	0.283	0.313	0.343		
	GY	0.509	0.539	0.569		
BLUE	BX	0.126	0.156	0.186		
	BY	0.103	0.133	0.163		
WHITE	WX	0.285	0.315	0.345		
	WY	0.300	0.330	0.360		
Viewing Angle						5
x axis, right(Φ=0°)	Θr	40	-	-	degree	
x axis, left (Φ=180°)	Θl	40	-	-	degree	
y axis, up (Φ=90°)	Θu	10	-	-	degree	
y axis, down (Φ=270°)	Θd	30	-	-	degree	
Gray Scale			2.2			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 average of 5 point across the LCD surface 50cm from the surface with all pixels displaying white. For more information see FIG 1.

$$L_{WH} = \text{Average}(L_1, L_2, \dots L_5)$$

3. The variation in surface luminance , The panel total variation (δ_{WHITE}) is determined by measuring L_N at each test position 1 through 13 and then defined as followed numerical formula.
   For more information see FIG 2.

$$\delta_{WHITE} = \frac{\text{Maximum}(L_1, L_2, \dots L_{13}) - \text{Minimum}(L_1, L_2, \dots L_{13})}{\text{Maximum}(L_1, L_2, \dots L_{13})} \times 100$$

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.
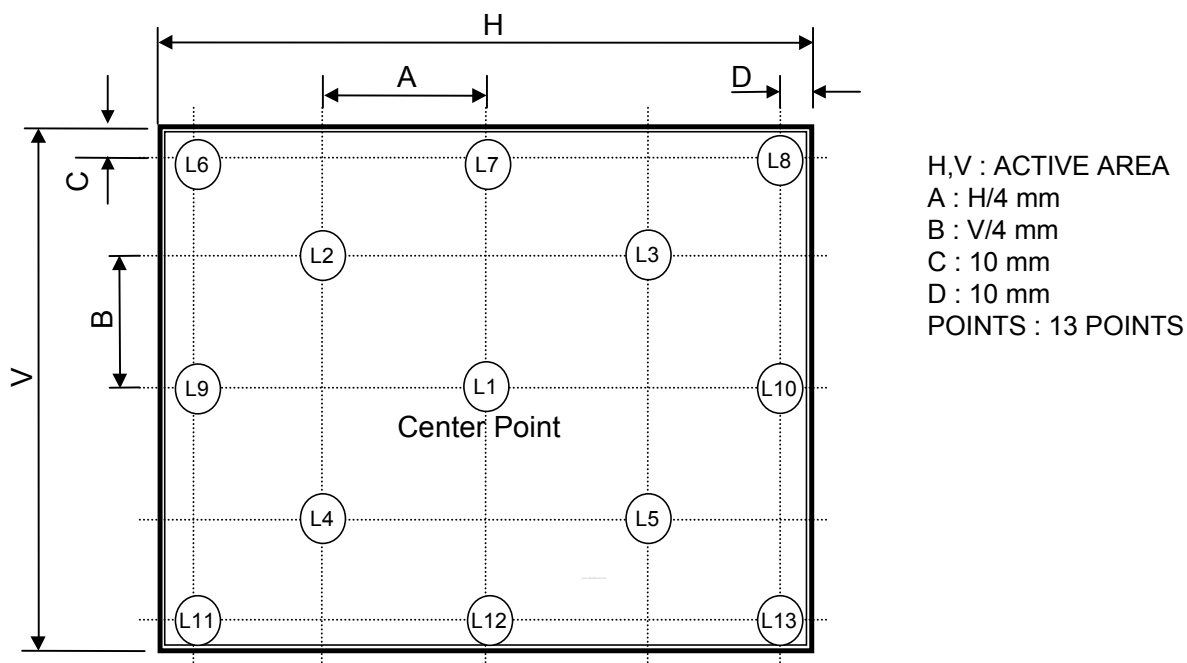
6. Gray scale specification   * f_V = 60Hz

Gray Level	Luminance [%] (Typ)
L0	0.30
L7	0.96
L15	3.8
L23	9.5
L31	19.1
L39	33.0
L47	52.2
L55	74.2
L63	100

FIG. 2 Luminance

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

H

A   D

L6   L7   L8   H,V : ACTIVE AREA
                                A : H/4 mm
C   B : V/4 mm
        L2   L3   C : 10 mm
B   D : 10 mm
V   L9   L1   L10   POINTS : 13 POINTS
            Center Point

        L4   L5

L11   L12   L13

FIG. 3 Response Time
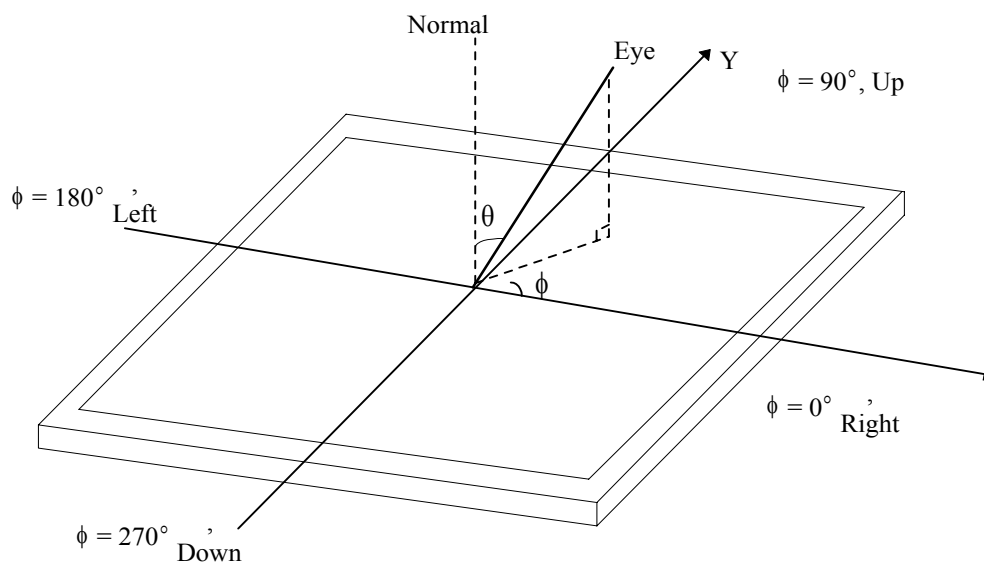
The response time is defined as the following figure and shall be measured by switching the input signal for "black" and "white".

Tr_R Tr_D

%

100
90

Optical

Response

10
0   white   black   white

FIG. 4 Viewing angle

<Dimension of viewing angle range>

5. Mechanical Characteristics

The contents provide general mechanical characteristics for the model LP121X04(B2P2). In addition the figures in the next page are detailed mechanical drawing of the LCD.

Outline Dimension	Horizontal	261± 0.3mm
	Vertical	199 ± 0.5mm
	Depth	5.0mm(Typ.) 5.3㎜(Max)
Bezel Area	Horizontal	250.6 ± 0.5mm
	Vertical	189.2 ± 0.5mm
Active Display Area	Horizontal	245.76 mm
	Vertical	184.32 mm
Weight	300g (Typ.) 310g (Max.)	
Surface Treatment	Hard coating(3H) Anti-glare treatment of the front polarizer	

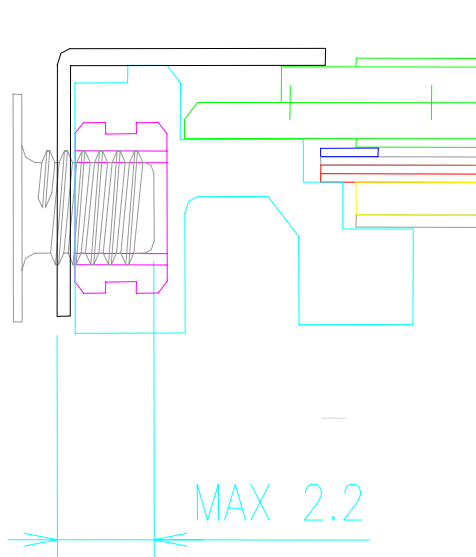Product Specification

<FRONT VIEW>

Product Specification

<REAR VIEW>

[DETAIL DESCRIPTION OF SIDE MOUNTING SCREW]

MAX 2.2

**Notes : 1. Screw plated through the method of non-electrolytic nickel plating is preferred
to reduce possibility that results in vertical and/or horizontal line defect due to
the conductive particles from screw surface.**

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(I.e. run 180G 2ms 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.

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

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 : 329mm × 278mm × 271mm

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 the 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 soaks 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=$\pm$ 200mV(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 minimized the interference.

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 B. Inspection Criteria 1/2

1. Dot
<Case I : Dell NFC, EMF, MDS, CCC>

1.1. Bright Dot

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

- R or B 1 dot   -------------------------------------- TBD Max
- G 1 dot   -- TBD Max
- Adjacent 2 dots(R, B) ------------------------------ TBD Max
- Adjacent 2 dots(G, vertical) --------------------- TBD Max
- Total amount of Bright dots --------------------- TBD Max
- Minimum Distance between bright dots ------ TBD mm
- Total bright dot in screen center ---------------- TBD Max
    Size of Window : 160mm x 120mm

1.2. Dark Dot

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

- 1 dot   --- TBD Max
- Adjacent 2 dots ------------------------------------ TBD Max
- Total amount of Dark dot ------------------------- TBD Max
- Minimum Distance between dark dots -------- TBD mm

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

<Case II : Dell APCC>

1.1. Bright Dot

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

- R or B 1 dot   -------------------------------------- TBD Max
- G 1 dot   -- TBD Max
- Adjacent 2 dots(R, B) ------------------------------ TBD Max
- Adjacent 2 dots(G, vertical) --------------------- TBD Max
- Total amount of Bright dots --------------------- TBD Max
- Minimum Distance between bright dots ------ TBD mm
- Total bright dot in screen center ---------------- TBD Max

1.2. Dark Dot

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

- 1 dot   --- TBD Max
- Adjacent 2 dots ------------------------------------ TBD Max
- Total amount of Dark dot ------------------------- TBD Max
- Minimum Distance between dark dots -------- TBD mm

1.3. Total amount of Dot Defects ---------------------- TBD 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.)
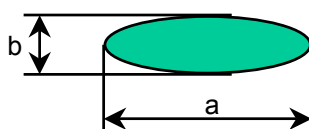
APPENDIX B. Inspection Criteria 2/2

2. Polarizer

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

Note)
a. Average Diameter

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

b
a

W :Width
L : Length
D : Average diameter

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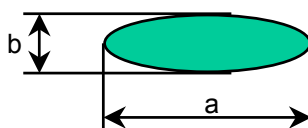d. Defects which is on the Black Matrix(outside of Active Area) are not considered as a defect.

3. Foreign Material

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

Note)
a. Average Diameter

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

b
a

W :Width
L : Length
D : Average diameter

b. Linear :   a > 2b ,   Circular : a ≤ 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.