SPECIFICATION
FOR
APPROVAL

(◆) Preliminary Specification
( ) Final Specification

Title	12.1” XGA TFT LCD

BUYER	APPLE
MODEL	

SUPPLIER	LG.Philips LCD CO., Ltd.
*MODEL	LP121X04
SUFFIX	C2

*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 / G.Manager	
REVIEWED BY	
J. H. Park / Manager	
PREPARED BY	
S. R. Kim / Engineer	

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

RECORDS OF REVISIONS

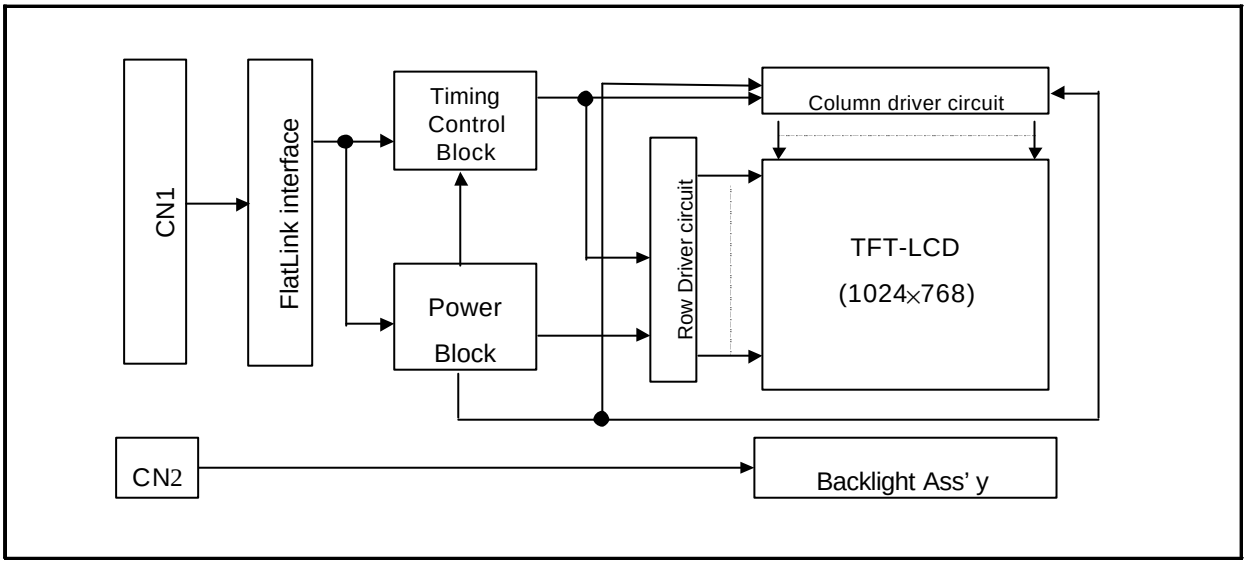
Revision No	Revision Date	Page	DESCRIPTION
0.0	FEB 18, 2002	-	First Draft.

1. General Description

The LP121X04 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 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 LP121X04 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 LP121X04 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 5.1(D) mm(Typ.)
Pixel Pitch	0.240 mm x 0.240mm
Pixel format	1024 horiz. By 768 vert. Pixels RGB stripes arrangement
Color depth	6-bit, 262,144 colors
Luminance, white	143 cd/m^2(Typ.) , Average 5point @ 5.5㎃
Power Consumption	Total 4.0 Watt(Typ.)
Weight	300g(Typ.)
Display operating mode	Transmissive mode, normally white
Surface treatments	Hard coating(3H) Anti-glare treatment of the both(front,back) polarizer, HAZE(13%)

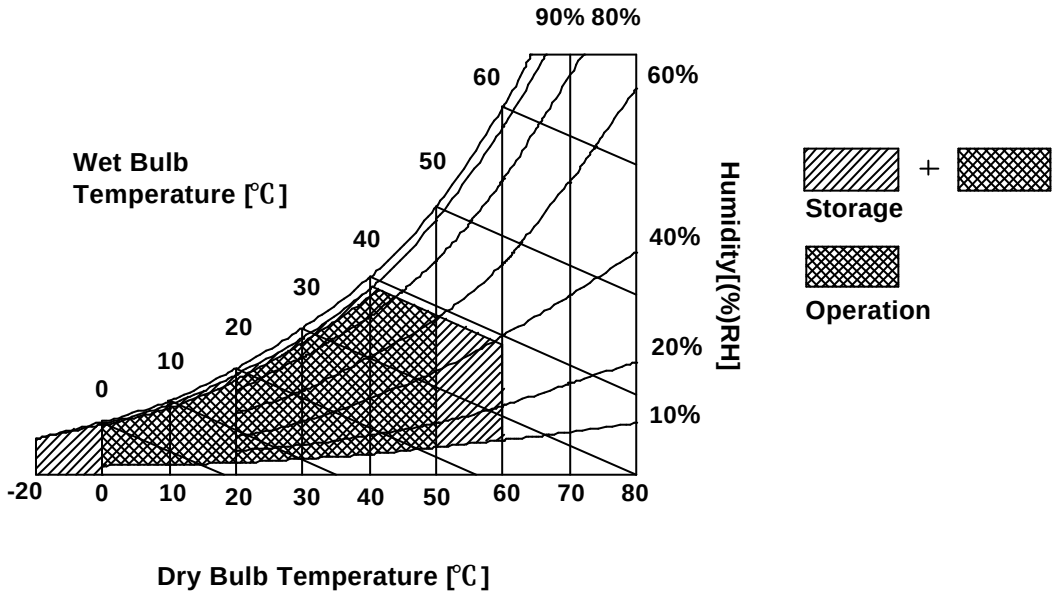
2. Absolute Maximum Ratings

The following are maximum values which, if exceeded, may cause 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 ± 5℃
Operating Temperature	T_{OP}	0	50	℃	1
Storage Temperature	T_{ST}	-20	60	℃	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 ℃ Max, and no condensation of water.



3. Electrical Specifications

3-1. Electrical Characteristics

The LP121X04requires 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			Units	Notes
		Min.	Typ.	Max.		
MODULE :						
Power Supply Input Voltage	V_{CC}	3.0	3.3	3.6	Vdc	
Power Supply Input Current	I_{CC}	-	0.238	0.411	A	1
Differential Impedance	Zm	90	100	110	ohm	2
Power Consumption	P_C	-	0.79	1.35	Watts	1
Rush Current	I_{RUSH}		1.0	1.8	A	3
LAMP :						
Operating Voltage	V_{BL}	550	580	750	V_{RMS}	4
Operating Current	I_{BL}	2.0	5.5	6.5	mA	
Established Starting Voltage	V_S					5
at 25 ℃		-	-	1010	V_{RMS}	
at 0 ℃		-	-	1210	V_{RMS}	
Operating Frequency	f_{BL}	50	65	80	kHz	4
Discharge Stabilization Time	T_S			3	Minutes	5
Power Consumption	P_{BL}	-	3.2	3.52	Watts	6
Life Time		10,000	-	-	Hrs	7

Note : **The design of the inverter must have specification for the lamp in LCD Assembly.**
The performance of the Lamp in LCM, for example life time or brightness, is extremely influenced by the characteristics of the DC-AC inverter. So all the parameters of an inverter should be carefully designed so as not to produce too much leakage current from high-voltage output of the inverter.
When you design or order the inverter, please make sure unwanted lighting caused by the mismatch of the lamp and the inverter(no lighting, flicker, etc) never occurs. When you confirm it, the LCD Assembly should be operated in the same condition as installed in you instrument.

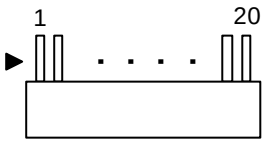
1. The specified current and power consumption are under the V_{CC}=3.3V, 25 ℃,f_V=60Hz condition whereas mosaic pattern is displayed in Typ(in case of Max is 2 line vertical pattern) and f_V is the frame frequency.
2. This impedance value is needed to proper display and measured from LVDS T_X to the mating connector.
3. The duration of rush current is about 20ms.
4. The variance of the voltage is ± 10%.
5. 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.

6. 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.
7. It is defined the brightness of the lamp after being lighted for 5 minutes as 100%.
   T_S is the time required for the brightness of the center of the lamp to be not less than 95%.
8. The lamp power consumption shown above does not include loss of external inverter.
   The used lamp current is the lamp typical current.
9. The life is determined as the time at which brightness of the lamp is 50% compared to that of initial value at the typical lamp current on condition of continuous operating at 25 ± 2 ℃.
10. Do not attach a conducting tape to lamp connecting wire.
    If the lamp wire attach to a conducting tape, TFT-LCD Module has a low luminance and the inverter has abnormal action. Because leakage current is occurred between lamp wire and conducting tape.

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 forthe connector is shown in the table below.

Table 3. MODULE CONNECTOR PIN CONFIGURATION(LVDS)

Pin	Symbol	Description	Notes
1	Vcc	Power(3.3V)	1. Interface chips
2	Vcc	Power(3.3V)	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(Ver.79),
9	A2P	Differential Signal	HIROSE or equivalent
10	GND	Ground	2.2 Mating : DF19G-20S-1C(Ver.79) or equivalent.
11	A3M	Differential Signal	2.3 Connector pin arrangement
12	A3P	Differential Signal	
13	GND	Ground	
14	CLKM	Differential Signal	
15	CLKP	Differential Signal	
16	GND	Ground	
17	VCC_EDID	DDC 3.3V Power	**[LCD Module Rear View]**
18	NC	No Connection	
19	CLK_EDID	DDC Clock	
20	DATA_EDID	DDC Data	

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 yellow.

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	PLLGND	PLL GND
20	D17	B5	29	PLLVcc	PLL Vcc
21	Vcc	Vcc	28	PLLGND	PLL GND
22	D18	HSYNC	27	$\overline{\text{SHDN}}$	$\overline{\text{SHDN}}$
23	D19	VSYNC	26	CLKIN	Dclk
24	GND	GND	25	D20	DE(Data Enable)

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

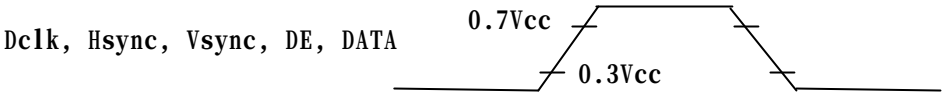
3-3. Signal Timing Specifications

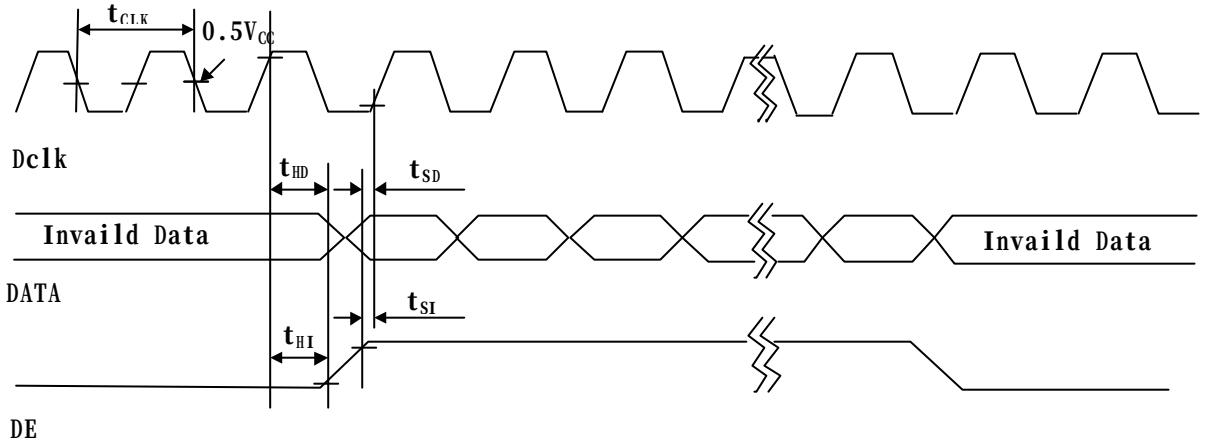
This is the signal timing required at the input of the LVDS Transmitter. All of the interface signal timing should be satisfied with the following specifications for its proper operation.

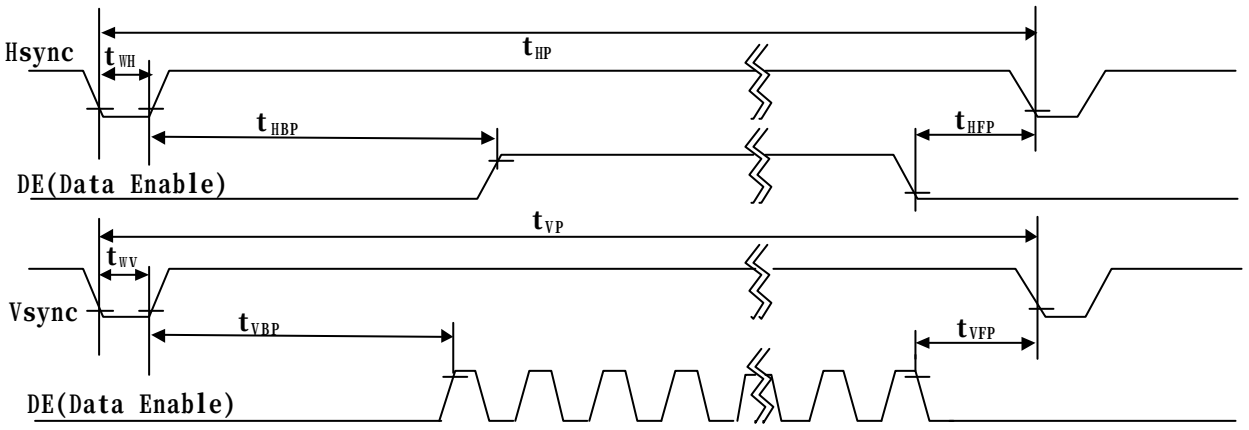
Table 6. Timing Table

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







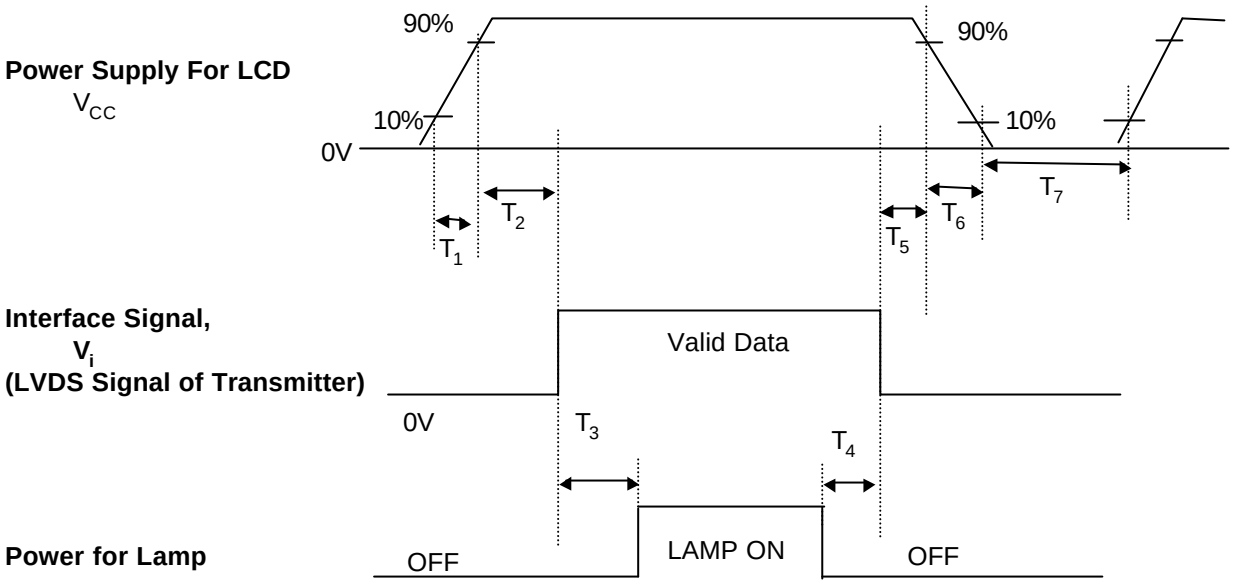
3-5. Color Input Data Reference

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



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

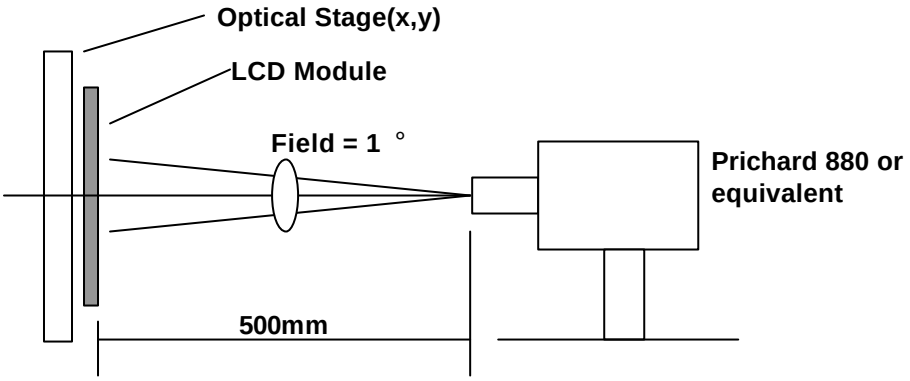
Notes : 1. Please avoid floating state of interface signal at invalid period.
2. When the interface signal is invalid, be sure to pull down the power supply for LCD V_{CC} to 0V.
3. Lamp power must be turn on after power supply for LCD and interface signal are valid.

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 ℃. 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



(Ta=25 ℃, V_{CC}=3.3V, f_V=60Hz Dclk=65MHz, I_{BL}=5.5mA)

Table 8. OPTICAL CHARACTERISTICS

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}	-	-	1.7		3
Response Time	Tr				ms	4
Rise Time	Tr_R	-	20	40		
Decay Time	Tr_D	-	30	50		
CIE Color Coordinates						
Red	XR	0.532	0.562	0.592		
	YR	0.302	0.332	0.362		
Green	XG	0.283	0.313	0.343		
	YG	0.509	0.539	0.569		
Blue	XB	0.126	0.156	0.186		
	YB	0.103	0.133	0.163		
White	XW	0.285	0.315	0.345		
	YW	0.300	0.330	0.360		
Viewing Angle						
x axis, right(ϕ=0 °)	θr	40	-	-	degree	5
x axis, left (ϕ=180 °)	θl	40	-	-		
y axis, up (ϕ=90 °)	θu	15	-	-		
y axis, down (ϕ=270 °)	θd	30	-	-		
Gray Scale	-	-	-	-		6

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

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

2. Surface luminance is the average 5 point across the LCD surface 50cm from the surface with all pixels displaying white. For more information see FIG 2.
When I_{BL}=5.5mA, $L_{WH=}$143cd/m^2(Typ.)

3. The variation in surface luminance , δWHITE is determined by measuring L_{ON} at each test position 1 through 13, and then dividing the maximum L_{ON} of 13 points luminance by minimum L_{ON} of 13 points luminance. For more information see FIG 2.

$$\delta WHITE = Maximum(L_{ON1}, L_{ON2}, \ldots\ldots L_{ON13}) \div Minimum(L_{ON1}, L_{ON2}, \ldots\ldots L_{ON13})$$

4. Response time is the time required for the display to transition from to black(Rise Time, Tr_R) and from black to white(Decay Time, Tr_D). For additional information see FIG 3.

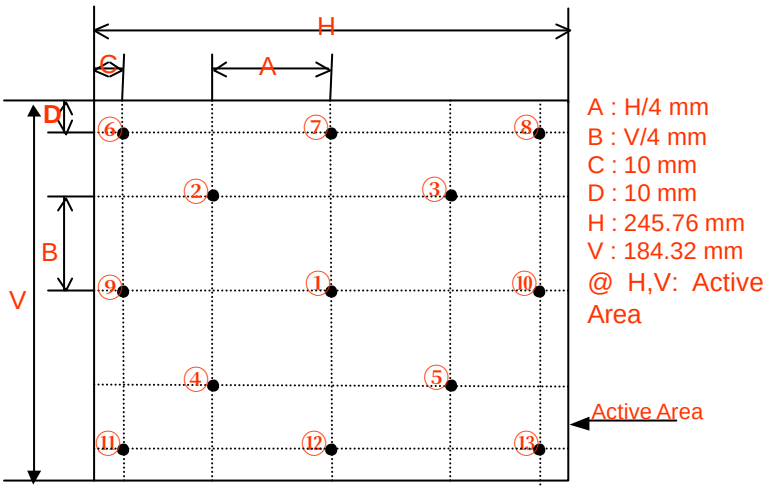
5. Viewing angle is the angle at which the contrast ratio is greater than 10. The angles are determined for the horizontal or x axis and the vertical or y axis with respect to the z axis which is normal to the LCD surface. For more information see FIG 4.

6. Gray scale specification

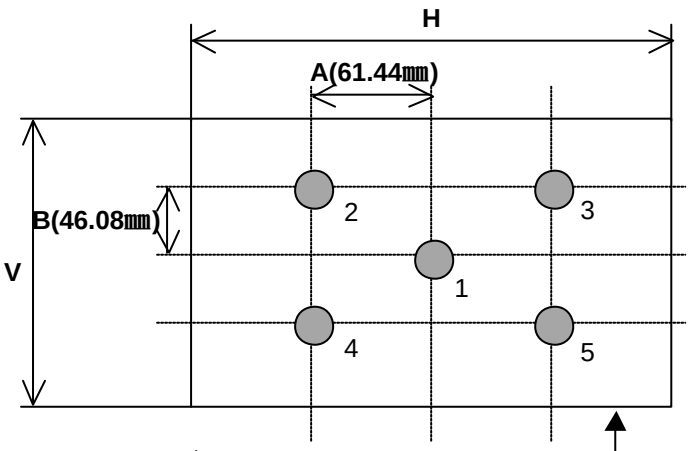
Gray Level	Luminance(%) (Typ.)
L0	TBD
L7	TBD
L15	TBD
L23	TBD
L31	TBD
L39	TBD
L47	TBD
L55	TBD
L63	TBD

FIG. 2 Luminance

<measuring point for luminance variation>



<The measuring point for Surface luminance >



A : H/4 mm
B : V/4 mm
H : 245.76 mm
V : 184.32 mm
@ H,V : Active Area

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".

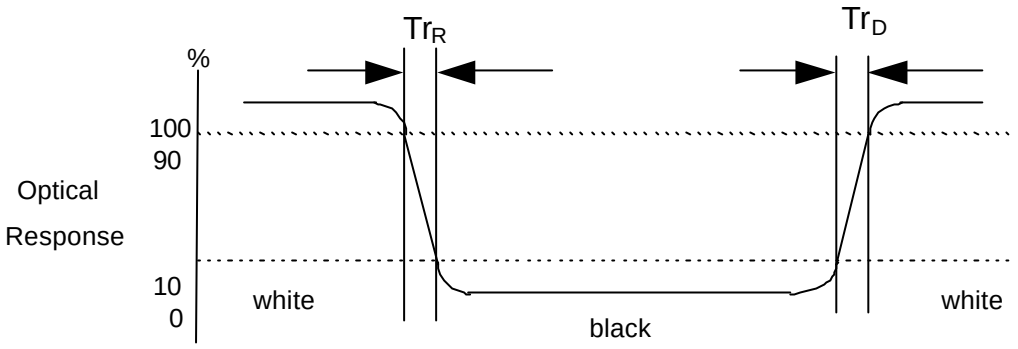
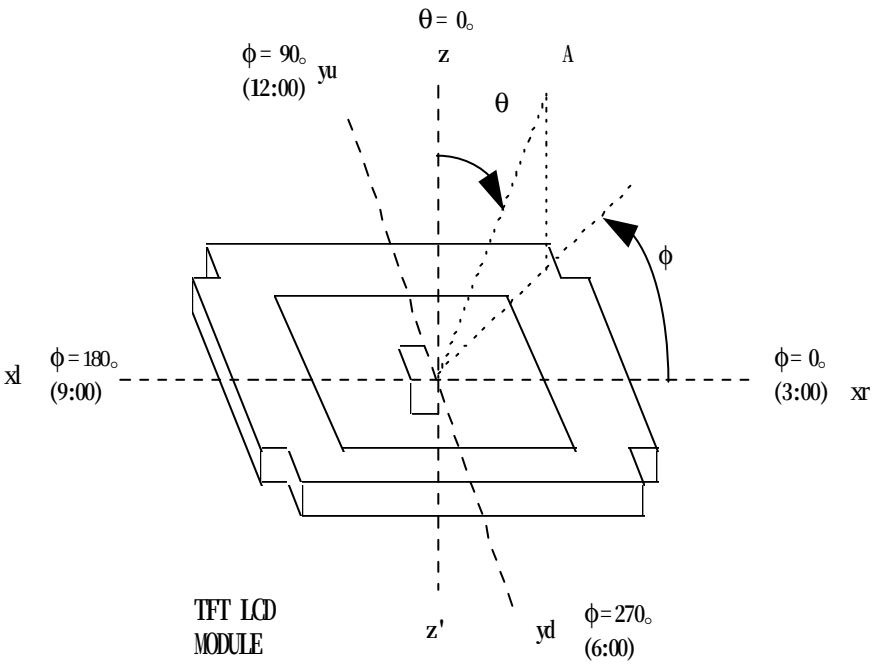


FIG. 4 Viewing angle

<dimension of viewing angle range>



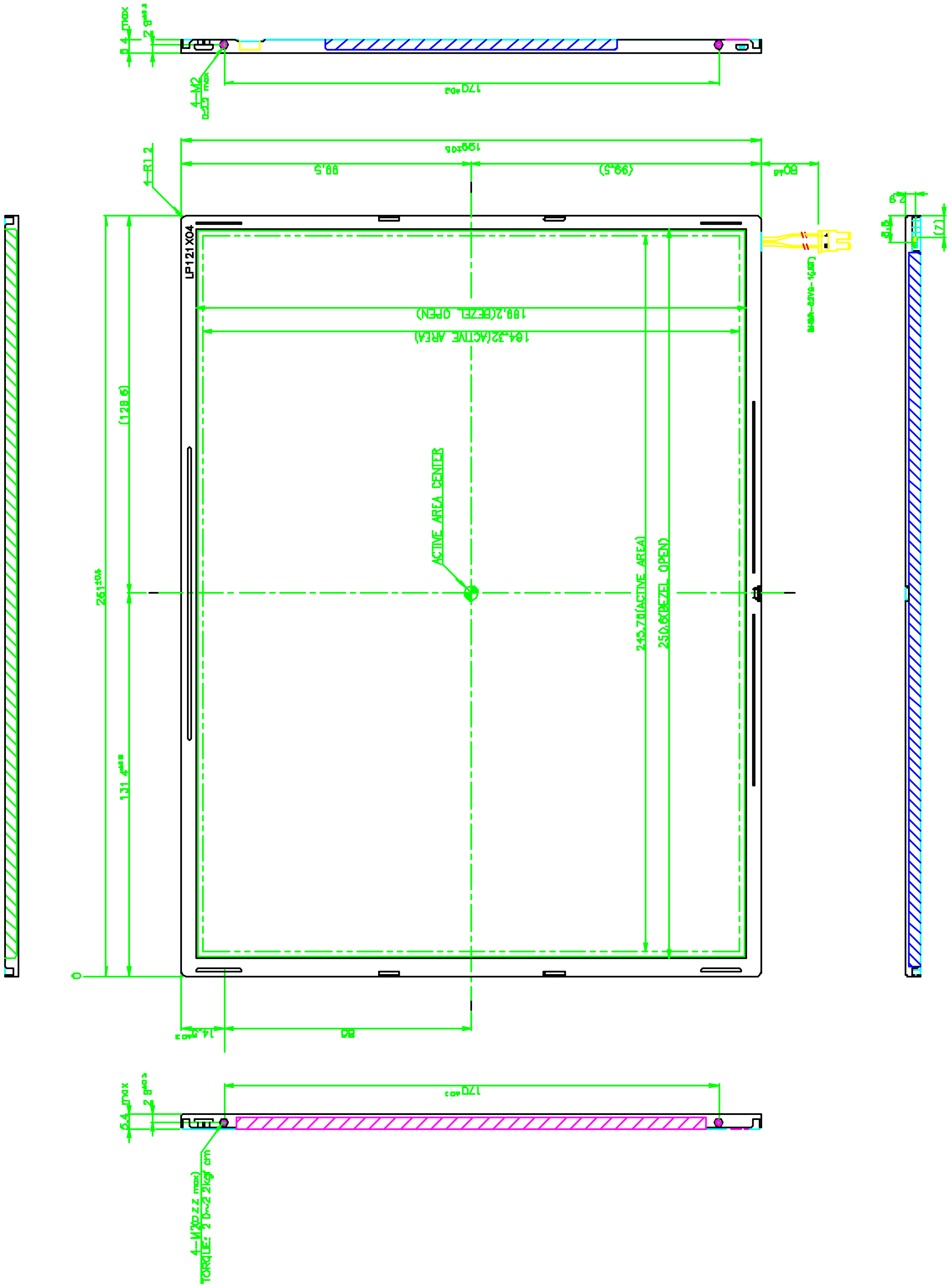
A : Eye of Observer

5. Mechanical Characteristics

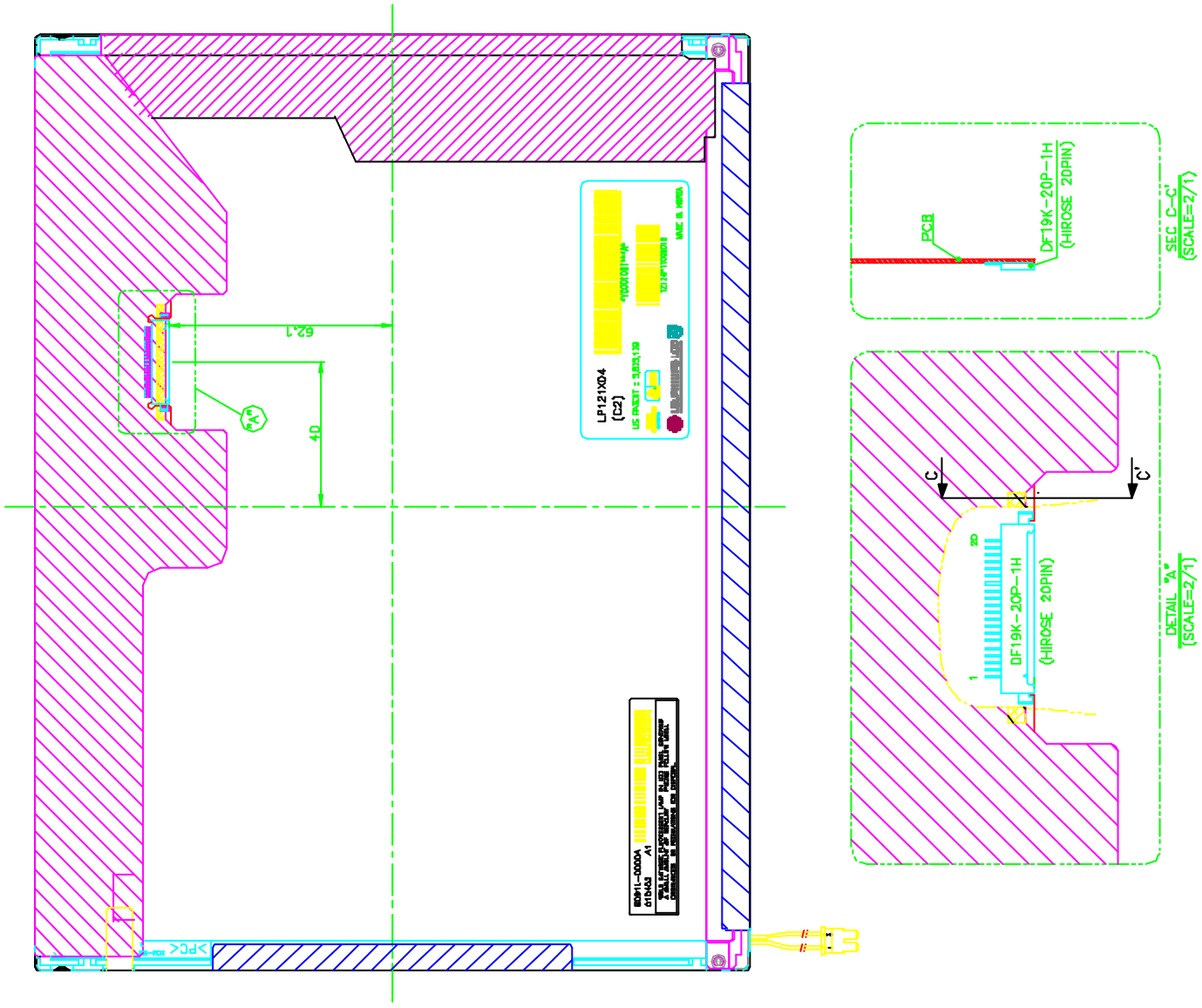
The contents provide general mechanical characteristics for the model LP121X04. In addition the figures in the next page are detailed mechanical drawing of the LCD.

Outside dimensions	Horizontal	261 ± 0.5mm
	Vertical	199 ± 0.5mm
	Depth	5.1㎜(Typ), 5.4㎜(Max)
Bezel area	Horizontal	250.6 ± 0.5mm
	Vertical	189.2 ± 0.5mm
Active display area	Horizontal	245.76mm
	Vertical	184.32mm
Weight(approximate)	300g(Typ.), 310g(Max.)	
Surface Treatment	Hard coating(3H) Anti-glare treatment of the both(front,back) polarizer Haze(13%)	

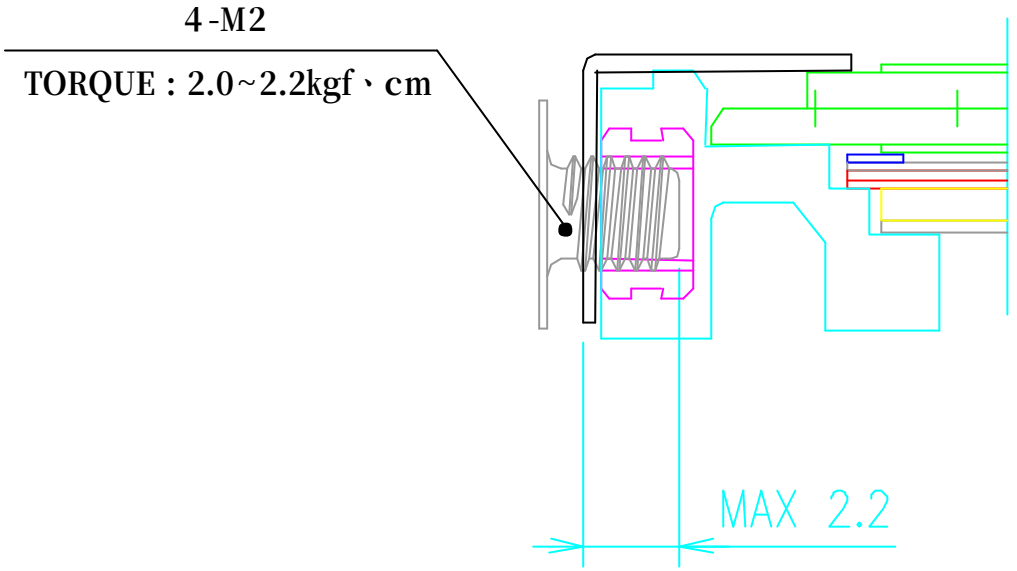
<FRONT VIEW>



<REAR VIEW>


62.1
40
LP121X04
(C2)
PCB
DF19K-20P-1H
(HIROSE 20PIN)
SEC C-C'
(SCALE=2/1)
DETAIL "A"
(SCALE=2/1)

<DETAIL DESCRIPTION OF SIDE MOUNTING SCREW>



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℃ 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, 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) 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.

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	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 : 329mm ×278mm ×285mm

9. PRECAUTIONS

Please pay attention to the following 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 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 describe 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 determined 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=±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℃ and 35℃ 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.

10. EDID DATA

Byte# (decimal)	Byte# (HEX)	Field Name and Comments	Value (HEX)		Value (binary)	
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 = APP	0	6	00000110	Vender/ Product ID
9	09		1	0	00010000	
10	0A	Product code	1	9	00011001	
11	0B	(Hex, LSB first)	9	C	10011100	
12	0C	32-bit serial number	0	0	00000000	
13	0D		0	0	00000000	
14	0E		0	0	00000000	
15	0F		0	0	00000000	
16	10	Week of manufacture	0	0	00000000	
17	11	Year of manufacture = 2002	0	C	00001100	
18	12	EDID Structure version # = 1	0	1	00000001	EDID Version/ Revision
19	13	EDID Revision # = 3	0	3	00000011	
20	14	Video input definition = Digital I/p,non TMDS CRGB	8	0	10000000	Display Parameter
21	15	Max H image size(cm)=24.576cm(24)	1	8	00011000	
22	16	Max V image size(cm)=18.432cm(18)	1	2	00010010	
23	17	Display gamma = 2.2	7	8	01111000	
24	18	Feature support(DPMS) = Active off, RGB Color	0	A	00001010	
25	19	Red/Green low Bits	7	3	01110011	Color Characteristic
26	1A	Blue/White Low Bits	C	1	11000001	
27	1B	Red X Rx =0.562	8	B	10001011	
28	1C	Red Y Ry =0.332	5	4	01010100	
29	1D	Green X Gx =0.313	5	0	01010000	
30	1E	Green Y Gy =0.539	8	9	10001001	
31	1F	Blue X Bx =0.156	2	7	00100111	
32	20	Blue Y By =0.133	2	2	00100010	
33	21	White X Wx = 0.315	5	3	01010011	
34	22	White Y Wy = 0.330	5	4	01010100	
35	23	Established Timing I	0	0	00000000	Established Timings
36	24	Established Timing II	0	8	00001000	
37	25	Manufacturer's Timings	0	0	00000000	
38	26	Standard Timing Identification 1 was not used	0	1	00000001	Standard Timing ID
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	
49	31	Standard Timing Identification 6 was not used	0	1	00000001	
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	

Byte# (decimal)	Byte# (HEX)	Field Name and Comments	Value (HEX)		Value (binary)	
54	36	Detailed Timing Descriptor #1	6	4	01100100	
55	37	1024 x 768 @ 60Hz mode : pixel clock = 65.00MHz	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	Detailed
61	3D	Vertical Active : Vertical Blanking	3	0	00110000	Timing
62	3E	Horizontal Sync. Offset =24 pixels	1	8	00011000	Description
63	3F	Horizontal Sync Pulse Width = 136 pixels	8	8	10001000	#1
64	40	Vertical Sync Offset = 3 lines,Sync Width = 6 lines	3	6	00110110	
65	41	Horizontal Vertical Sync Offset/Width upper 2bits = 0	0	0	00000000	
66	42	Horizontal Image Size = 245.76 mm(245)	F	5	11110101	
67	43	Vertical Image Size = 184.32 mm(184)	B	8	10111000	
68	44	Horizontal & Vertical Image Size	0	0	00000000	
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,H/V pol negatives	1	8	00011000	
72	48	Detailed Timing Descriptor #2	0	0	00000000	
73	49		0	0	00000000	
74	4A		0	0	00000000	
75	4B		F	E	11111110	
76	4C		0	0	00000000	
77	4D	L	4	C	01001100	
78	4E	P	5	0	01010000	Detailed
79	4F	1	3	1	00110001	Timing
80	50	2	3	2	00110010	Description
81	51	1	3	1	00110001	#2
82	52	X	5	8	01011000	
83	53	0	3	0	00110000	
84	55	4	3	4	00110100	
85	55		2	0	00100000	
86	56		2	0	00100000	
87	57		2	0	00100000	
88	58		2	0	00100000	
89	59		0	0	00000000	
90	5A	Detailed Timing Descriptor #3	0	0	00000000	
91	5B		0	0	00000000	
92	5C		0	0	00000000	
93	5D		F	E	11111110	
94	5E		0	0	00000000	
95	5F	L	4	C	01001100	
96	60	P	5	0	01010000	Detailed
97	61	1	3	1	00110001	Timing
98	62	2	3	2	00110010	Description
99	63	1	3	1	00110001	#3
100	64	X	5	8	01011000	
101	65	0	3	0	00110000	
102	66	4	3	4	00110100	
103	67		2	0	00100000	
104	68		2	0	00100000	
105	69		2	0	00100000	
106	6A		2	0	00100000	
107	6B		0	0	00000000	

Byte# (decimal)	Byte# (HEX)	Field Name and Comments	Value (HEX)		Value (binary)	
108	6C	Detailed Timing Descriptor #4	0	0	00000000	
109	6D		0	0	00000000	
110	6E		0	0	00000000	
111	6F		F	C	11111100	
112	70		0	0	00000000	
113	71	C	4	3	01000011	
114	72	O	4	F	01001111	Detailed
115	73	L	4	C	01001100	Timing
116	74	O	4	F	01001111	Description
117	75	R	5	2	01010010	#4
118	76		2	0	00100000	
119	77	L	4	C	01001100	
120	78	C	4	3	01000011	
121	79	D	4	4	01000100	
122	7A		0	A	00001010	
123	7B		2	0	00100000	
124	7C		2	0	00100000	
125	7D		2	0	00100000	
126	7E	Extension flag = 00	0	0	00000000	Extension Flag
127	7F	Checksum	7	0	01110000	Checksum