SPECIFICATION
FOR
APPROVAL

( ) **Preliminary Specification**
(V) **Final Specification**

Title	14.1” XGA TFT LCD

BUYER	DELL
MODEL	

SUPPLIER	LG.Philips LCD Co., Ltd.
*MODEL	LP141XB
Suffix	C1C4

*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	
W.Y. Park / Engineer	
/ Engineer	

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

Contents

No	ITEM	Page
	COVER	1
	CONTENTS	2
	RECORD OF REVISIONS	3
1	GENERAL DESCRIPTION	4
2	ABSOLUTE MAXIMUM RATINGS	5
3	ELECTRICAL SPECIFICATIONS	
3-1	ELECTRICAL CHARACTREISTICS	6
3-2	INTERFACE CONNECTIONS	7
3-3	SIGNAL TIMING SPECIFICATIONS	9
3-4	SIGNAL TIMING WAVEFORMS	9
3-5	COLOR INPUT DATA REFERNECE	10
3-6	POWER SEQUENCE	11
4	OPTICAL SFECIFICATIONS	12
5	MECHANICAL CHARACTERISTICS	16
6	RELIABLITY	20
7	INTERNATIONAL STANDARDS	
7-1	SAFETY	21
7-2	EMC	21
8	PACKING	
8-1	DESIGNATION OF LOT MARK	22
8-2	PACKING FORM	22
9	PRECAUTIONS	23
A	APPENDIX. Inspection Criteria	25

RECORD OF REVISIONS

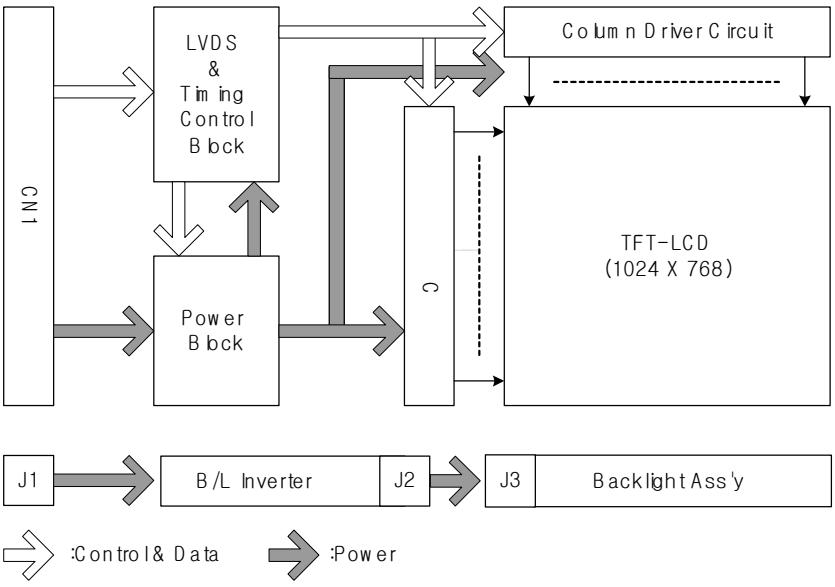
Revision No	Revision Date	Page	Description	Note
1.0	APR. .10. 2002	-	Final	

1. General Description

The LP141XB(C1C4) 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 14.1 inches diagonally measured active display area with XGA resolution(768 vertical by 1024 horizontal pixel array). Each pixel is divided into Red, Green and Blue sub-pixels or dots which are arranged in vertical stripes. Gray scale or the brightness of the sub-pixel color is determined with a 6-bit gray scale signal for each dot, thus, presenting a palette of more than 262,144 colors.

The LP141XB(C1C4) has been designed to apply the interface method that enables low power, high speed, low EMI.

The LP141XB(C1C4) 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 LP141XB(C1C4) characteristics provide an excellent flat display for office automation products such as Notebook PC.



General Features

Active Screen Size	14.1 inches(35.814cm) diagonal
Outline Dimension	298.5(H) × 226.5(V) × 5.7(D) mm (Typ.)
Pixel Pitch	0.279 mm × 0.279 mm
Pixel Format	1024 horiz. By 768 vert. Pixels RGB strip arrangement
Color Depth	6-bit, 262,144 colors
Luminance, White	170 cd/m^2(Typ.)
Power Consumption	Total 5.96 Watt(Typ.) @ LCM circuit 1.06Watt(Typ.), B/L input 4.9Watt(Typ.)
Weight	490g (Typ.), 505g(Max.) w/ inverter and bracket
Display Operating Mode	Transmissive mode, normally white
Surface Treatment	Hard coating(3H) Anti-glare treatment of the front polarizer

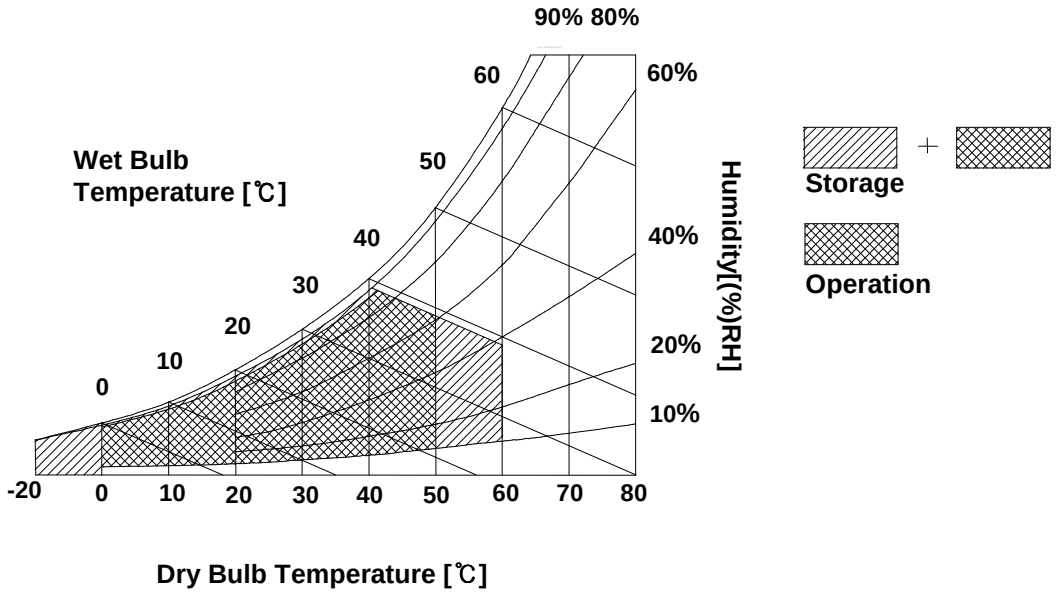
2. Absolute Maximum Ratings

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.



3. Electrical Specifications

3-1. Electrical Characteristics

The LP141XB(C1C4) 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}	-	320	360	mA	1
Power Consumption	Pc	-	1.06	1.19	Watt	1
Differential Impedance	Zm	90	100	110	Ohm	2
LAMP :						
Operating Voltage	V_{BL}	680(6mA)	725(5mA)	910(2.7mA)	V_{RMS}	
Operating Current	I_{BL}	2.7	5.0	6.0	mA_{RMS}	3
Operating Frequency	f_{BL}	45	58	80	kHz	
Discharge Stabilization Time	Ts	-	-	3	Min	4
Life Time		10,000	-	-	Hrs	5
INVERTER :						
Input Voltage	V_{IN}	9.0	14.4	21.0	V_{DC}	
Input Current	I_{IN}	290	340	390	mA	6
Input Power Consumption	P_{IN}	4.17	4.90	5.62	W	6
Backlight On/Off Control	FPVEE_High	2.0	-	5.25	V_{DC}	
	FPVEE_Low	-0.3	-	0.8	V_{DC}	
Backlight Adjust (I_{BL} Control)		FF_H	-	00_H	-	
Output Voltage	V_{OUT}	580	680	780	V_{RMS}	6
Output Current (Aging 30minutes)	I_{OUT}_FF	-	2.0	2.3	mA_{RMS}	7
	I_{OUT}_00	5.3	5.8	6.0	mA_{RMS}	7
Operating Frequency	Freq.	45	60	75	KHz	7
Output Power Consumption	P_{OUT}	3.36	3.94	4.52	W	6
Open Lamp Voltage	V_{OPEN}	1450	-	-	V_{RMS}	8
Efficiency	η	75	-	-	%	9
Striking Time	T_S	0.5	-	1.4	sec	10

Note)
1. The specified current and power consumption are under the Vcc = 3.3V , 25℃, fv = 60Hz condition whereas full black 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 typical operating current is for the typical surface luminance (L_{WH}) in optical characteristics.

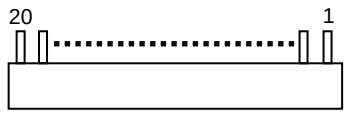
Note)

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, I_{OUT} = 5.8mA.
7. V_{IN} = 9 ~ 21V.
8. No Load, V_{IN} = 9V.
9. V_{IN} =9V, 00_H.
10. No Load, V_{IN} = 9 ~ 21V, 00_H

3-2. Interface Connections

This LCD employs two interface connections, a 20 pin connector is used for the module electronics interface and the other connector is used for the integral backlight system.
The electronics interface connector is a model GT122-20P-H15-R manufactured by LG Cable.

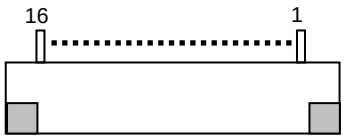
Table 3. MODULE CONNECTOR PIN CONFIGURATION (CN1)

Pin	Symbol	Description	Notes
1	VCC	Power Supply, 3.3V Typ.	
2	VCC	Power Supply, 3.3V Typ.	[LVDS Transmitter] TI, SN75LVDS84 or equivalent
3	GND	Ground	
4	GND	Ground	[LVDS Receiver] TI, SN75LVDS88B
5	R_{IN} 0-	Negative LVDS differential data input (R0~R5,G0)	
6	R_{IN} 0+	Positive LVDS differential data input (R0~R5,G0)	[Connector] LCD: GT122-20P-H15-R, LG Cable Mating : FI-SE20M, JAE or compatibles
7	GND	Ground	
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)	[Connector pin arrangement]
10	GND	Ground	LCD module rear view 
11	R_{IN} 2-	Negative LVDS differential data input (B2~B5,HS,VS,DE)	
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	NC	Reserved	
18	NC	Reserved	
19	GND	Ground	
20	GND	Ground	

The inverter interface connector(J1) is a WR-L16S-VF-HD2-1 model manufactured by JAE. 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_{IN}	Power for the inverter	
2	V_{IN}	Power for the inverter	
3	V_{IN}	Power for the inverter	
4	GND	Ground	[Connector] WR-L16S-VF-HD2-1 , JAE
5	GND	Ground	
6	GND	Ground	[Connector pin arrangement]
7	5V_SUS	Power for the control circuit	LCD module rear view
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	1(GND)	
14	PANEL_ID2	0(GND)	
15	PANEL_ID1	1(OPEN)	
20	PANEL_ID0	0(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 yellow

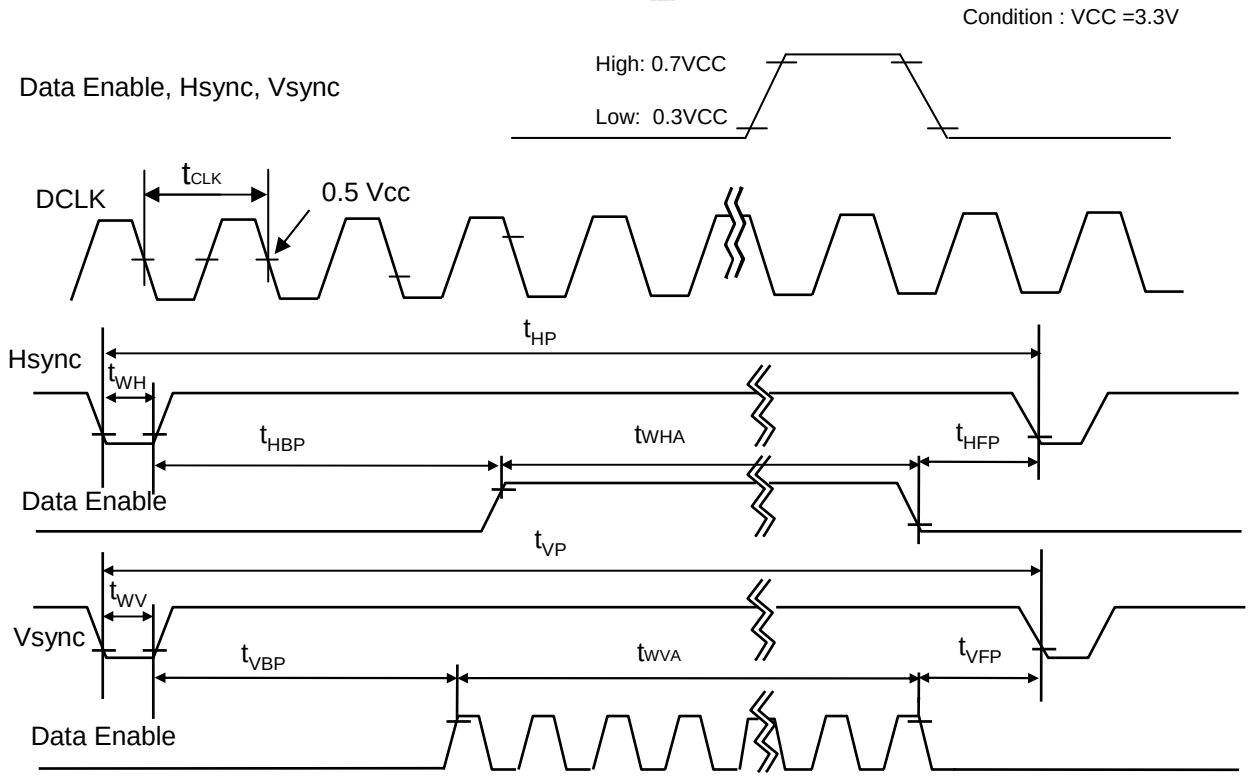
3-3. Signal Timing Specifications

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	f_{CLK}	65	65	65	MHz	15.4ns
Hsync	Period	t_{HP}	1206	1344	1364	t_{CLK}	
	Width	t_{WH}	8	136	240		
Vsync	Period	t_{VP}	780	806	830	t_{HP}	
	Width	t_{WV}	1	6	24		
Data Enable	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	-		

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 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

3-6. Power Sequence

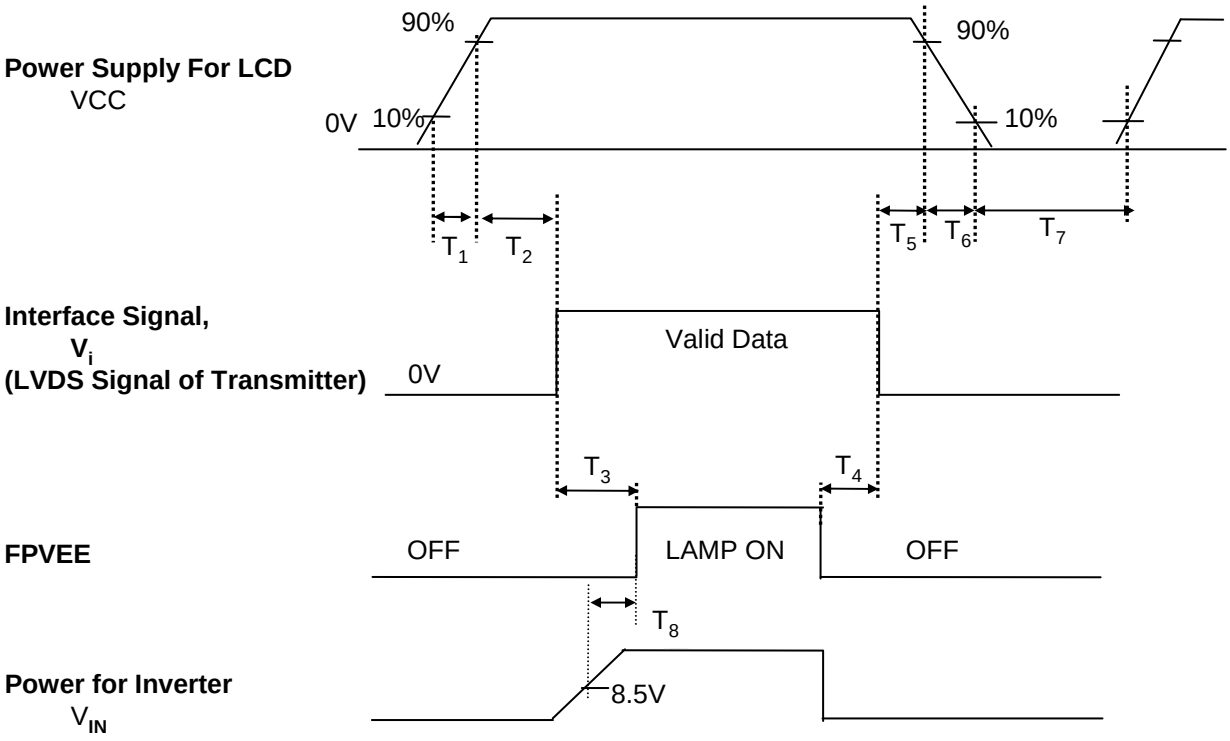


Table 8. POWER SEQUENCE TABLE

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

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

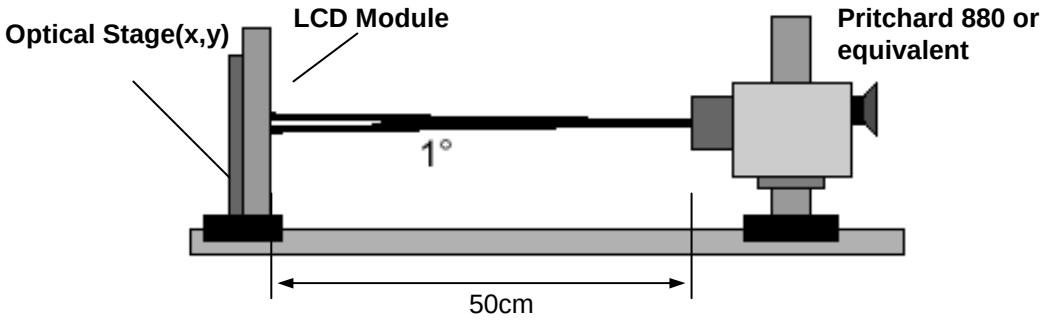


Table 9. OPTICAL CHARACTERISTICS

Ta=25°C, VCC=3.3V, fv=60Hz, f_{CLK}= 65MHz, Iout = 5.8mA(SMB-DAT=00H)

Parameter	Symbol	Values			Units	Notes
		Min	Typ	MAx		
Contrast Ratio	CR	150	250	-		1
Surface Luminance, white	L_{WH}	140	170	-	cd/m^2	2
Luminance Variation	δ_{WHITE}	-	-	1.45		3
Response Time						4
Rise Time	Tr_R	-	20	40	ms	
Decay Time	Tr_D	-	30	50	ms	
Color Coordinates						
RED	RX	0.555	0.585	0.615		
	RY	0.303	0.333	0.363		
GREEN	GX	0.284	0.314	0.344		
	GY	0.512	0.542	0.572		
BLUE	BX	0.121	0.151	0.181		
	BY	0.102	0.132	0.162		
WHITE	WX	0.287	0.317	0.347		
	WY	0.300	0.330	0.360		
Viewing Angle						5
x axis, right(Φ=0°)	Θr	40	45	-	degree	
x axis, left (Φ=180°)	Θl	40	45	-	degree	
y axis, up (Φ=90°)	Θu	10	15	-	degree	
y axis, down (Φ=270°)	Θd	30	35	-	degree	
Gray Scale						6

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 (δ_{WHITE}) is determined by measuring L_N at each test position 1 through 9, and then dividing the maximum L_N of 9 points luminance by minimum L_N of 9 points luminance. For more information see FIG 2.

$$\delta_{WHITE} = \text{Maximum}(L_1, L_2, \ldots L_9) / \text{Minimum}(L_1, L_2, \ldots L_9)$$

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.

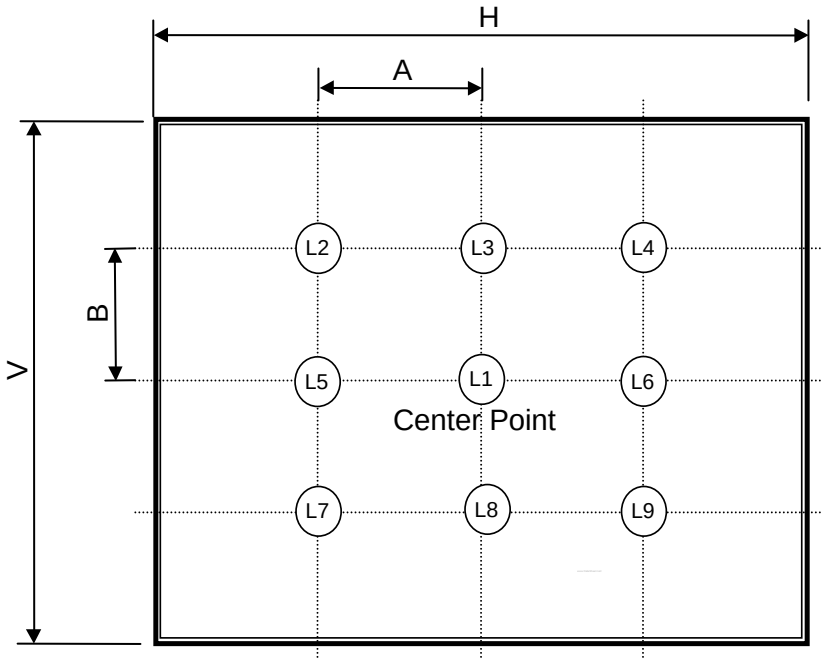
6. Gray scale specification

* f_V=60Hz

Gray Level	Luminance [%] (Typ)
L0	0.4
L7	1.3
L15	5.0
L23	11.0
L31	21.5
L39	35.5
L47	54.5
L55	75.0
L63	100

FIG. 2 Luminance

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



H,V : ACTIVE AREA
A : H/4 mm
B : V/4 mm
POINTS: 9 POINTS

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”.

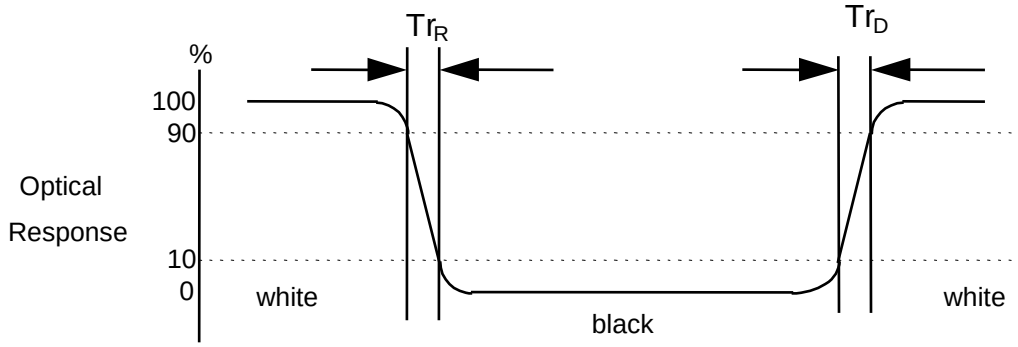
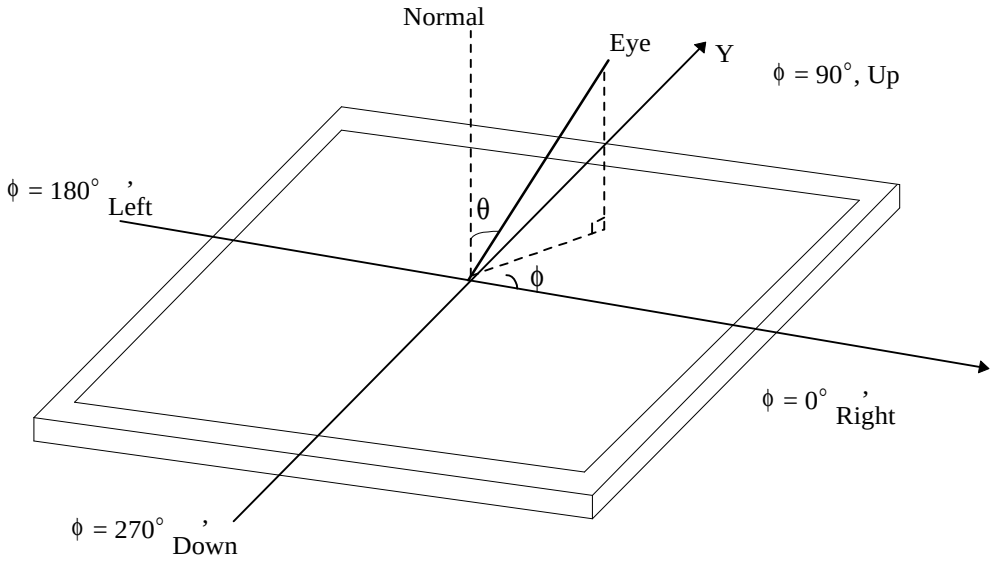


FIG. 4 Viewing angle

<Dimension of viewing angle range>



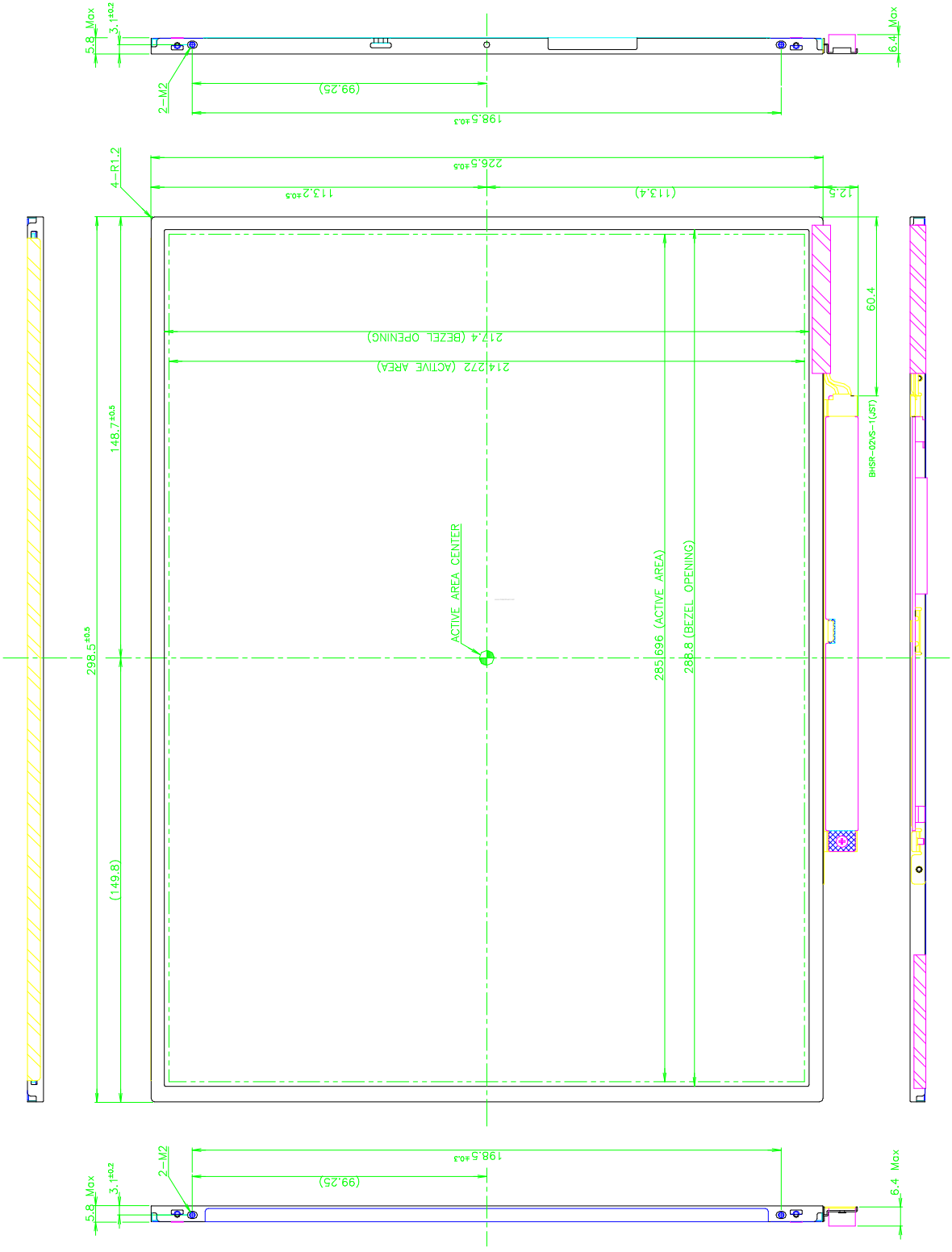
5. Mechanical Characteristics

The contents provide general mechanical characteristics for the model LP141XB(C1C4). In addition the figures in the next page are detailed mechanical drawing of the LCD.

Outline Dimension	Horizontal	298.5 ± 0.5mm
	Vertical	226.5 ± 0.5mm
	Depth	5.7 ± 0.5mm User CNT area : Max. 6.1mm
Bezel Area	Horizontal	288.8 ± 0.5mm
	Vertical	217.4 ± 0.5mm
Active Display Area	Horizontal	285.696 mm
	Vertical	214.272 mm
Weight	490g (Typ.) 505g (Max.) w/ inverter and bracket	
Surface Treatment	Hard coating(3H) Anti-glare treatment of the front polarizer	

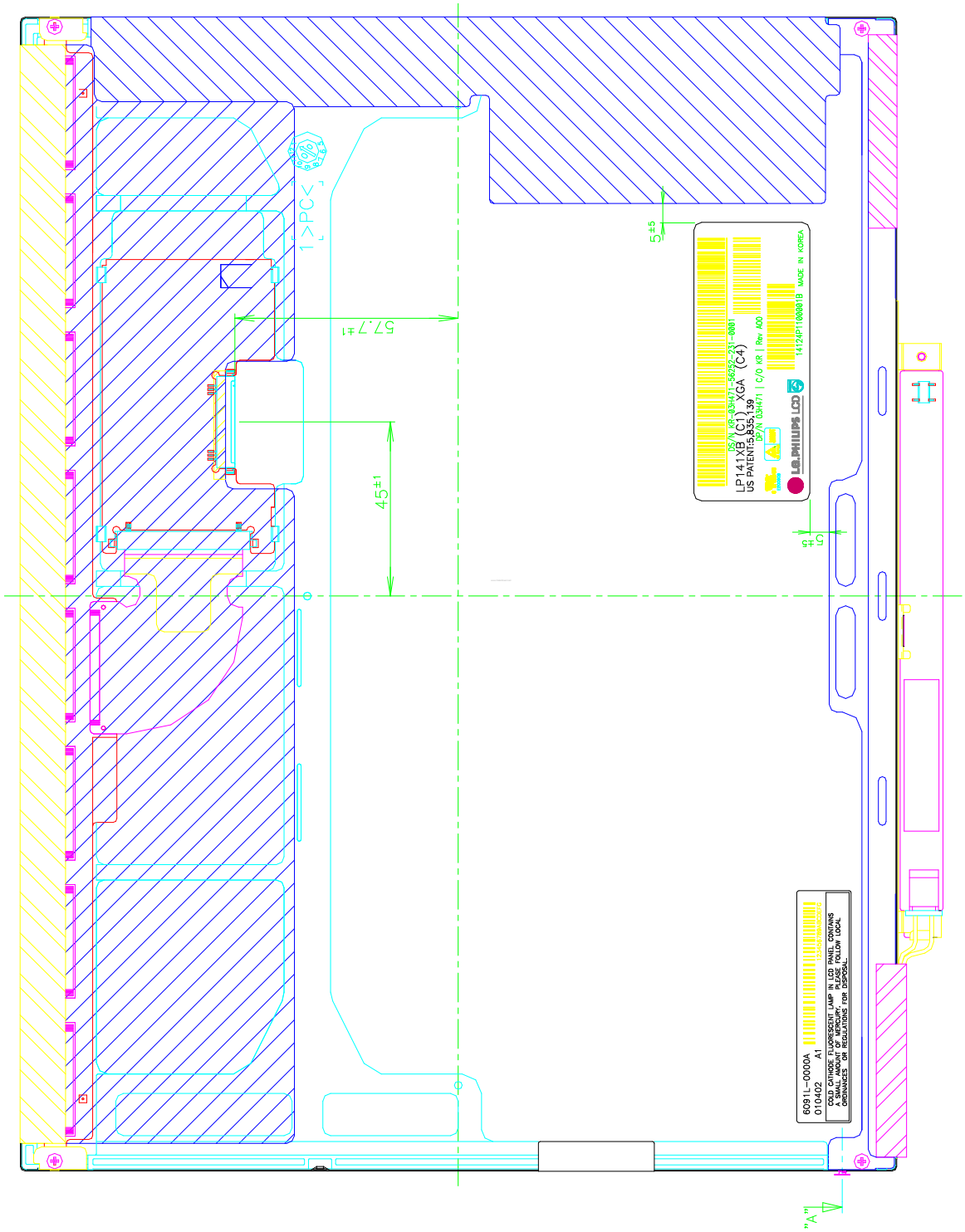
<FRONT VIEW>

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



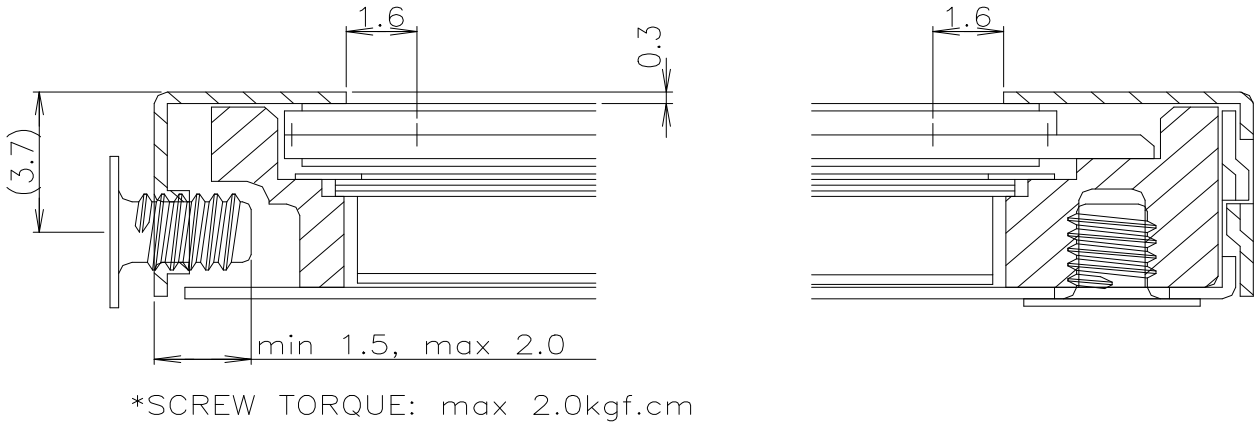
<REAR VIEW>

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

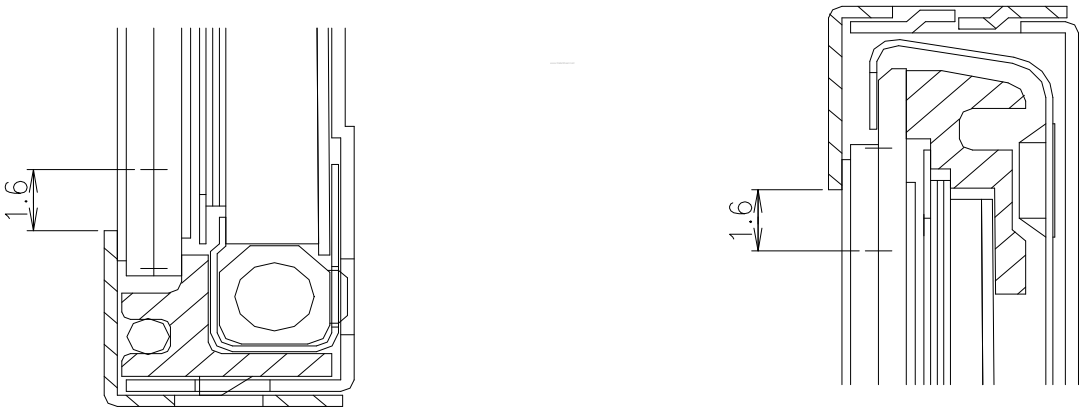


[DETAIL DESCRIPTION OF SIDE MOUNTING SCREW]

* Screw Torque : Max 2.0 kgf cm



*SCREW TORQUE: max 2.0kgf.cm



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

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 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.

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 : 386mm × 323mm × 302mm

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=± 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.

APPENDIX A. 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 ---------- 2 Max
- G 1 dot ---------- 1 Max
- Adjacent 2 dots(R, B) ---------- 1 Max
- Adjacent 2 dots(G, vertical) ---------- 0 Max
- Total amount of Bright dots ---------- 2 Max
- Minimum Distance between bright dots ------ 15 mm
- Total bright dot in screen center ---------- 0 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 ---------- 7 Max
- Adjacent 2 dots ---------- 2 Max
- Total amount of Dark dot ---------- 7 Max
- Minimum Distance between dark dots -------- 5 mm

1.3. Total amount of Dot Defects ---------- 7 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 ---------- 0 Max
- G 1 dot ---------- 0 Max
- Adjacent 2 dots(R, B) ---------- 0 Max
- Adjacent 2 dots(G, vertical) ---------- 0 Max
- Total amount of Bright dots ---------- 0 Max
- Total bright dot in screen center ---------- 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 -------- 5 mm

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.)

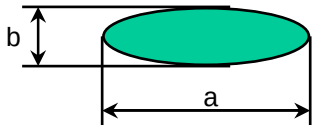
APPENDIX B. Inspection Criteria 2/2

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

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



W :Width
L : Length
D : Average diameter

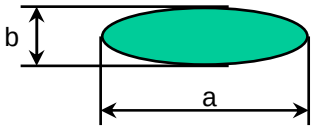
b. Linear : a > 2b , Circular : a ≤ 2b
c. Extraneous substances which can be wiped out, like Finger Print, Particles, are not considered as a defect.
d. Defects which is on the Black Matrix(outside of Active Area) are not considered as a defect.

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

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



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.