LG.PHILIPS LCD

Product Specification

SPECIFICATION
FOR
APPROVAL

(♦) Preliminary Specification
(   ) Final Specification

Title	13.3" XGA TFT LCD

BUYER	
MODEL	

SUPPLIER	LG.Philips LCD CO., Ltd.
MODEL	LP133X7
SUFFIX	P2IB

*** 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. W. Lee /G.Manager	_____
REVIEWED BY	
J.H.Park / Manager B.H.Koo / Manager	_____
PREPARED BY	
C.J.Jun /Engineer W.J.Lee / Engineer	_____

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

Product Specification

Product Specification

RECORDS OF REVISIONS

| Revision No	Revision No	Page	DESCRIPTION
0.0	Dec 29, 2000	-	First Draft

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1. General Description

The LP133X7-P2IB 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 13.3 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 LP133X7-P2IB 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 LP133X7-P2IB 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 LP133X7-P2IB characteristics provide an excellent flat display for office automation products such as Notebook PC.
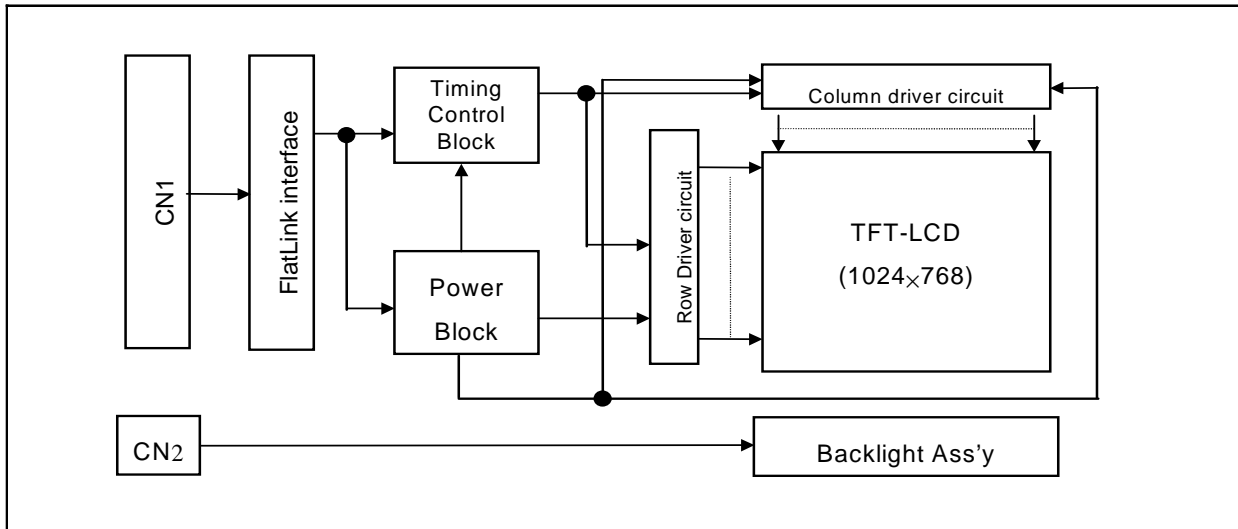
General Features

|	
Active screen size	13.3 inches(33.78cm) diagonal
Outline Dimension	284(H) x 214.5(V) x 5.8(D) mm(Typ.)
Pixel Pitch	0.264 mm x 0.264mm
Pixel format	1024 horiz. by 768 vert. Pixels RGB stripes arrangement
Color depth	6-bit, 262,144 colors
Luminance, white	150 cd/m^2(Typ.)
Power Consumption	Total 4.6 Watt(Typ.)
Weight	485g(Typ.)
Display operating mode	Transmissive mode, normally white
Surface treatments	Hard coating(3H) Anti-glare treatment of the front polarizer Maker : LG Chemical , Model Number :LGC-STAG1-D302T

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 $25 \pm 5°C$
Operating Temperature	T_{OP}	0	50	°C	1
Storage Temperature	T_{ST}	-20	60	°C	1
Operating Ambient Humidity	H_{OP}	10	90	%RH	1
Storage Humidity	H_{ST}	10	90	%RH	1

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

2. The surface temperature caused by self heat radiation of cell itself is specified on this item.
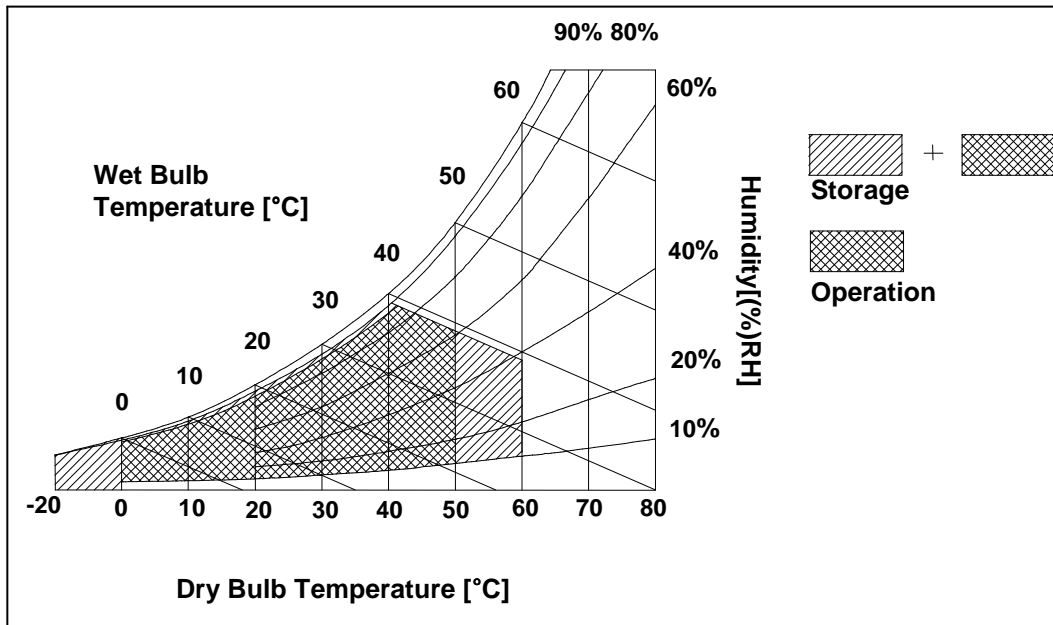
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3. Electrical Specifications

3-1. Electrical Characteristics

The LP133X8-C2IB 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			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}	-	0.240	0.270	A	1
Differential Impedance	Zm	90	100	110	ohm	2
Power Consumption	P_C	0.61	0.79	0.89	Watts	1
Rush Current	I_{RUSH}	-	1.5	1.8	A	
Rush Current Duration		-	-	30	ms	
LAMP :						
Operating Voltage	V_{BL}	625	640	875	V_{RMS}	3
Operating Current	I_{BL}	3.0	6.0	6.0	mA	
Established Starting Voltage	V_S					4
at 25 °C		-	-	1080	V_{RMS}	
at 0 °C		-	-	1450	V_{RMS}	
Operating Frequency	f_{BL}	45	58	80	kHz	5
Discharge Stabilization Time	T_S	-	-	3	Minutes	6
Power Consumption	P_{BL}	-	3.8	4.1	Watts	7
Life Time		10,000	15,000	-	Hrs	8

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°C,f_V=60Hz condition whereas full black pattern is displayed 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 variance of the voltage is ± 10%.
4. 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.

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5. The output of the inverter must have symmetrical(negative and positive) voltage waveform and symmetrical current waveform.(Unsymmetrical ratio is less than 10%) Please do not use the inverter which has unsymmetrical voltage and unsymmetrical 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.

6. Let's define 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%.

7. The lamp power consumption shown above does not include loss of external inverter.

8. The life time 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 $25 \pm 2°C$.

9. 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.

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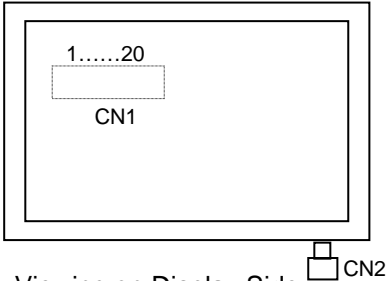
3-2. Interface Connections

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

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

The electronics interface connector is a model GT122-20P-H15R (LG cable) or equivalent .

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

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

Pin	Symbol	Description	Notes
1	Vcc	Power(3.3V)	1. Interface chips
2	Vcc	Power(3.3V)	1.1 LCD : KZ4E038C12CFP(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 TI LVDS
6	A1P	Differential Signal	
7	GND	Ground	2. Connector
8	A2M	Differential Signal	2.1 LCD : GT122-20P-H15R(LG cable) or equivalent
9	A2P	Differential Signal	2.2 Mating : DF19G-20S-1C or equivalent
10	GND	Ground	2.3 Connector pin arrangement
11	A3M	Differential Signal	
12	A3P	Differential Signal	
13	GND	Ground	
14	CLKM	Differential Signal	
15	CLKP	Differential Signal	
16	GND	Ground	
17	NC	No Connection	
18	NC	No connection	
19	GND	Ground	
20	GND	Ground	Viewing on Display Side

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

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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 it's proper operation.

Table 6. Timing Table

ITEM	SYMBOL		MIN.	Typ.	MAX.	UNIT	NOTE
Dclk	Frequency	F_{CLK}	62	65	68	MHz	15ns(typ)
	Width-Low	t_{WCL}	3	–	–	ns	
	Width –High	t_{WCH}	3	–	–		
Hsync	Period	t_{HP}	1206	1344	1364	T_{CLK}	
	Width	t_{WH}	8	136	240		
	Active Period	t_{WHA}	1024	1024	1024		
Vsync	Period	t_{VP}	780	806	830	T_{HP}	
	Width	T_{WV}	1	–	24		
	Active Period	t_{WVA}	768	768	768		
DTMG (DE)	Set up Time	T_{SI}	3	–	–	NS	for Dclk
	Hold Time	T_{HI}	3	–	–		
	Horizontal Back Porch	T_{HBP}	10	–	–	T_{CLK}	
	Horizontal Front Porch	T_{HFP}	10	–	–		
	Vertical Back Porch	T_{VBP}	2	–	–	t_{HP}	
	Vertical Front Porch	T_{VFP}	1	–	–		
DATA	Set up Time	t_{SD}	3	–	–	NS	for Dclk
	Hold Time	t_{HD}	3	–	–		

The Maximum Dclk jitter is 2.0nsec.

3-4. Signal Timing Waveforms
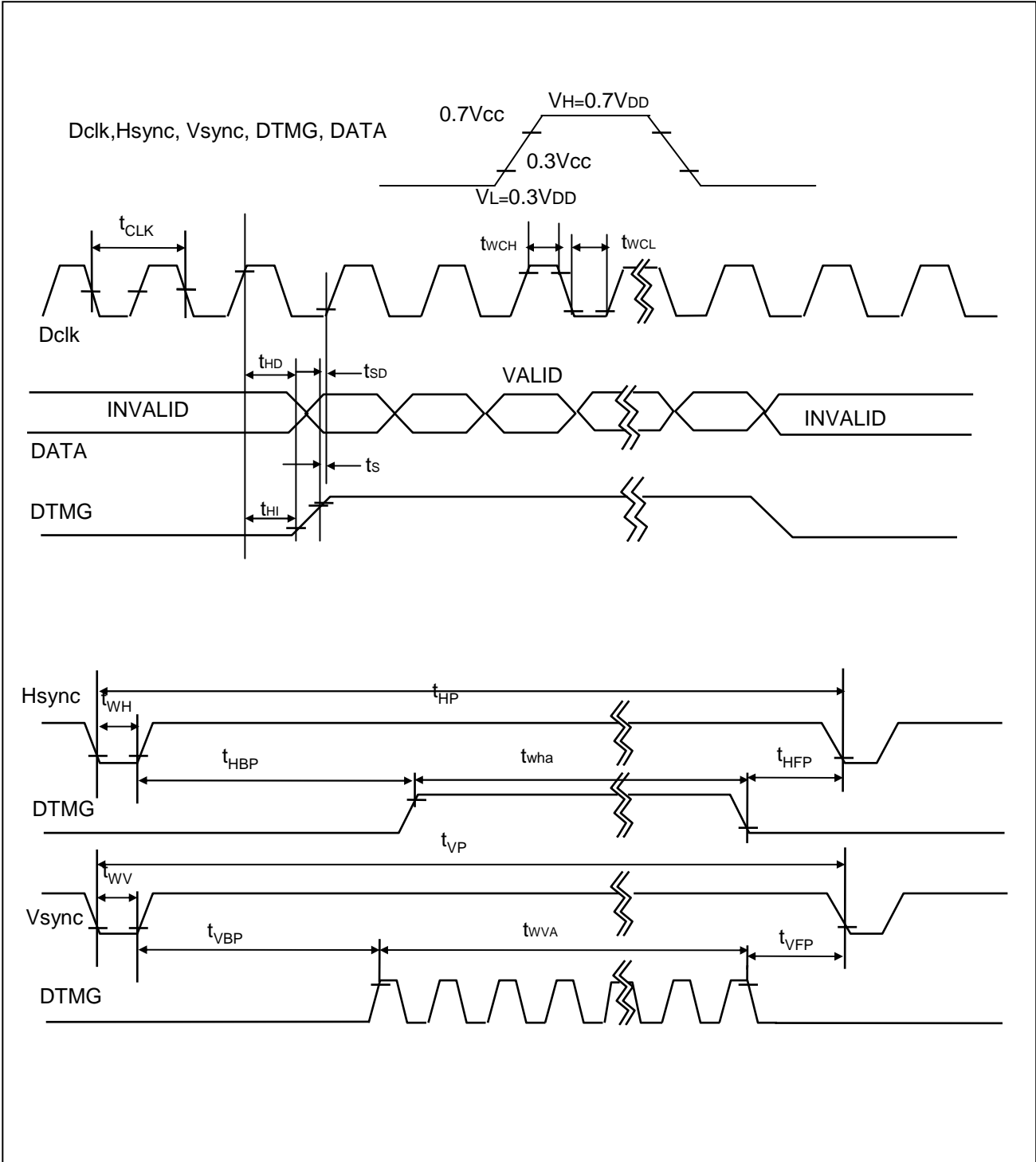
3-5. Color Input Data Reference

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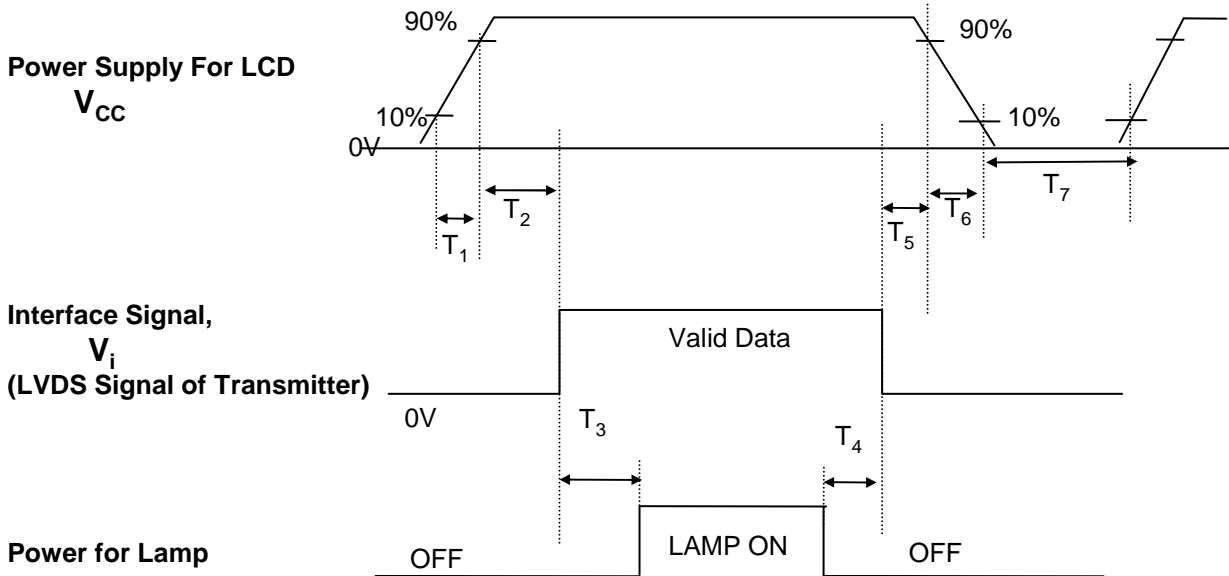
Parameter	Values			Units
	Min.	Typ.	Max.	
T_1	-	-	10	ms
T_2	0	-	50	ms
T_3	200	-	-	ms
T_4	200	-	-	ms
T_5	0	-	50	ms
T_6	-	-	10	ms
T_7	100	-	-	ms

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.

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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

Field = 1 °

Prichard 880 or equivalent

500mm
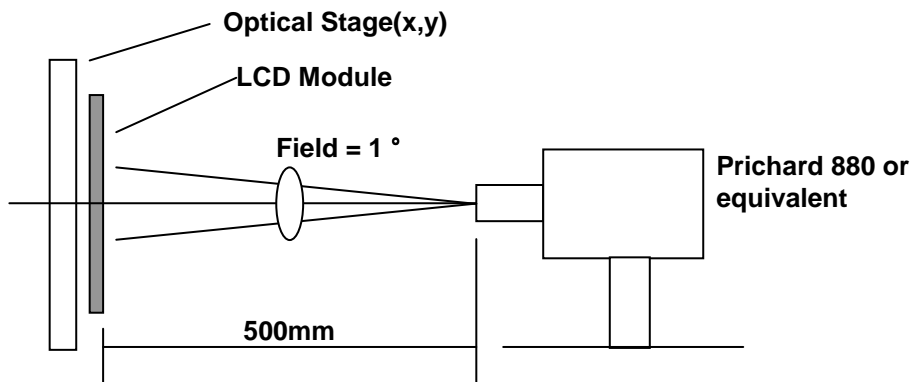
Table 8. OPTICAL CHARACTERISTICS   (Ta=25 °C, V_{CC}=3.3V, f_V=60Hz, Dclk=65MHz, I_{BL}=6mA)

Parameter	Symbol	Values			Units	Notes
		Min.	Typ.	Max.		
Contrast Ratio	CR	140	170	-		1
Surface Luminance, white	L_{WH}	100	150	-	cd/m^2	2
Luminance Variation (Total Variation)	δ_{TOTAL}		1.35	1.45		3
Response Time	Tr					4
Rise Time	Tr_R	-	30	50	ms	
Decay Time	Tr_D	-	30	50		
CIE Color Coordinates						
Red	X_R	0.542	0.572	0.602		
	Y_R	0.301	0.331	0.361		
Green	X_G	0.289	0.319	0.349		
	Y_G	0.512	0.542	0.572		
Blue	X_B	0.126	0.156	0.186		
	Y_B	0.103	0.133	0.163		
White	X_W	0.297	0.327	0.357		
	Y_W	0.297	0.337	0.357		
Viewing Angle						
x axis, right(ϕ=0°)	θr	40	-	-	degree	5
x axis, left (ϕ=180°)	θl	40	-	-		
y axis, up (ϕ=90°)	θu	10	-	-		
y axis, down (ϕ=270°)	θd	30	-	-		
Gray Sclae	-	-	-	-		6

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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 center point across the LCD surface 50cm from the surface with all pixels displaying white. For more information see [FIG-1]
When I_{BL}=6mA, $L_{WH=}$100cd/m^2(Min.) 150cd/m^2(Typ.)

3. The variation in surface luminance , **The Panel total variation (δ WHITE)** is determined by measuring L_{ON} at each test position 1 through 9, and then dividing the maximum L_{ON} of 9 points luminance by minimum L_{ON} of 9 points luminance.
For more information see Appendix A-1.
δ WHITE = Maximum(L_{ON1},L_{ON2}, ….. L_{ON9}) ÷ Minimum(L_{ON1},L_{ON2}, ….. L_{ON9})

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 Appendix A-2.

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 Appendix A-3

6. Gray scale specification

* Gamma Value = 2.2

Gray Level	Luminance(%) (Typ.)
L0	0.35
L7	0.90
L15	3.71
L23	9.49
L31	20.6
L39	35.4
L47	54.5
L55	76.0
L63	100

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7. Measured by MCPD7000, Standard tool in IBM.

Comment.

1. Remarkable luminance unevenness shall not be exist on the whole display area.
   (Ex. B/L Mura ,Light leackage etc….)

2. Image Persistence shall not occur under the current IBM test Condition.

5. Mechanical Characteristics

The contents provide general mechanical characteristics for the model LP133X8-C2IB. In addition the figures in the next page are detailed mechanical drawing of the LCD.

Outside dimensions	Horizontal	284 ± 0.5mm
	Vertical	214.5 ± 0.5mm
	Depth	5.2mm(Typ),5.9(Max)
Bezel area	Horizontal	273.6 ± 0.5mm
	Vertical	206 ± 0.5mm
Active display area	Horizontal	270.34mm
	Vertical	202.77mm
Weight(approximate)	396g(Typ.), 410g(Max.)	
Surface Treatment	Hard coating(3H) Anti-glare treatment of the front polarizer	

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<FRONT VIEW>
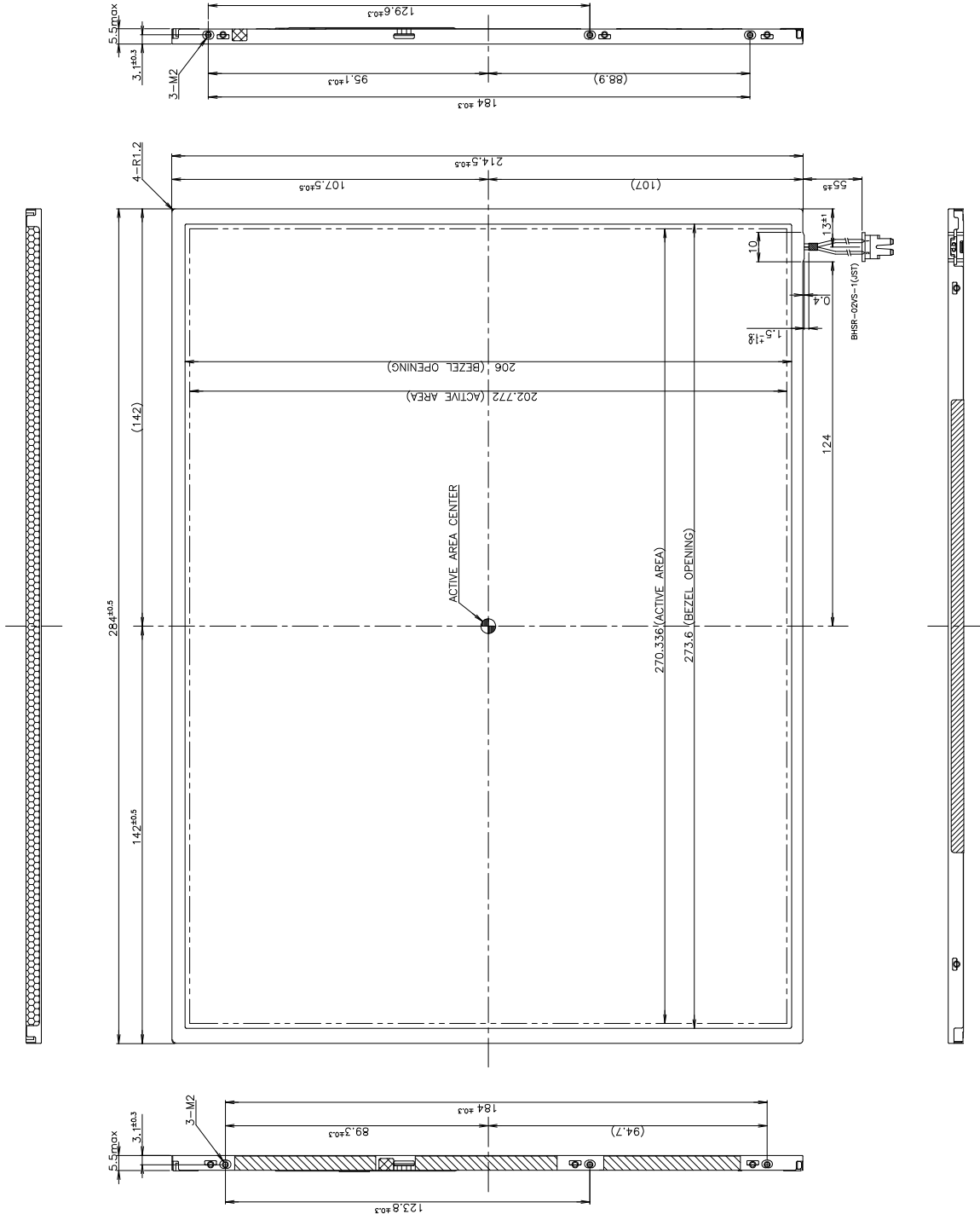
Note) Unspecified dimensional tolerances are ±0.5mm

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<REAR VIEW>

Thickness : 5.7typ , 5.9max

Thickness : 5.6typ , 5.8max

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<DETAIL DESCRIPTION OF SIDE MOUNTING SCREW>

TOP CASE (SUS 304)

Supporter Main (PC)

Panel

6.782

2.582

1.632

3.1 ±0.3

5

Min1.7

Max2.2

6-M2

2.55
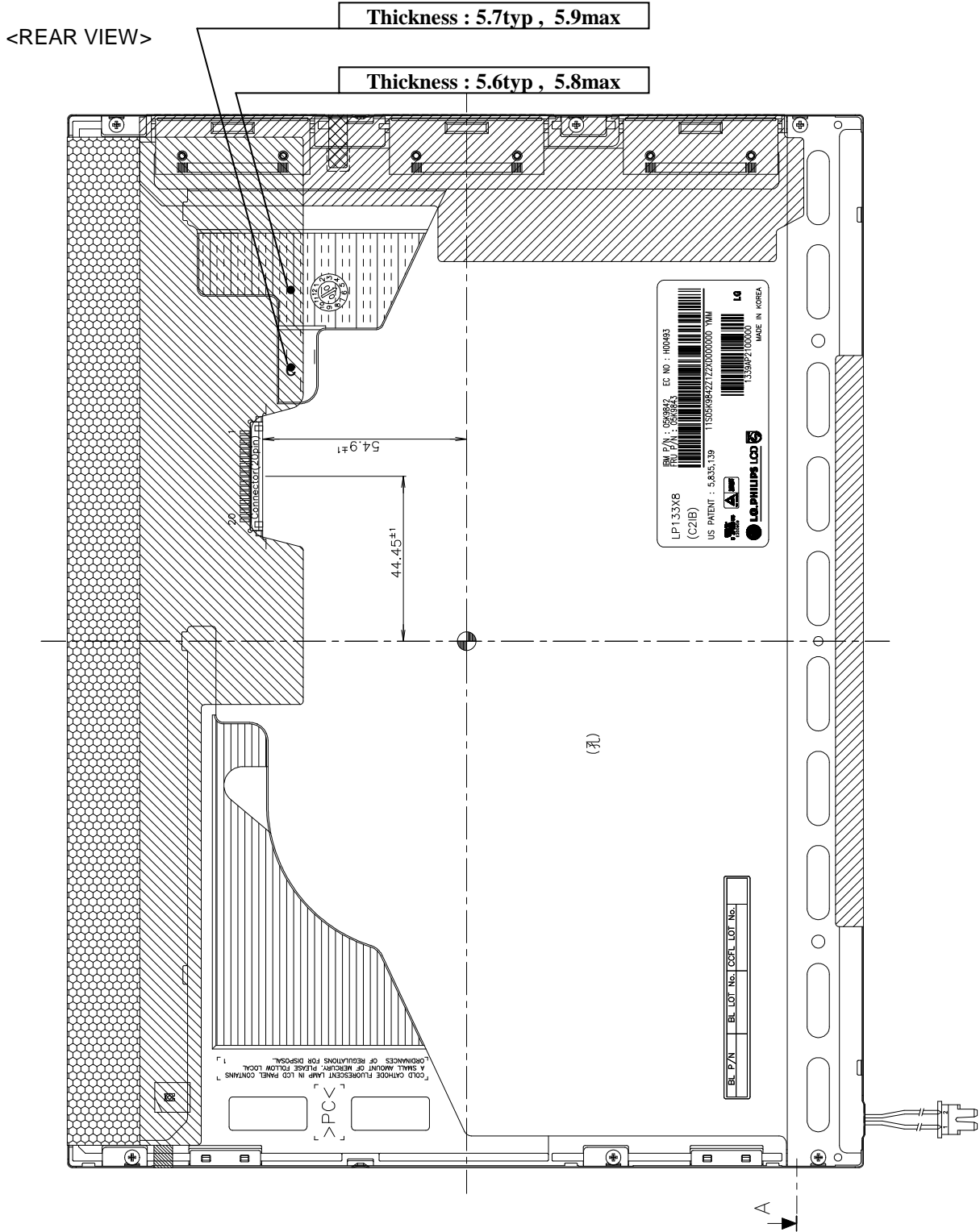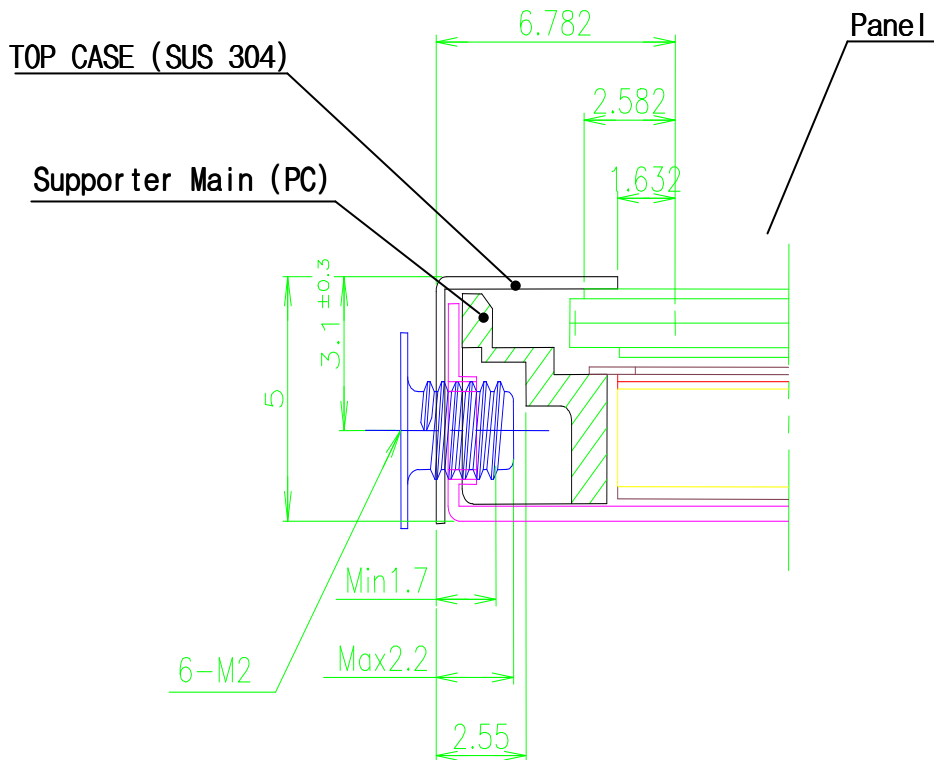
*Mounting Screw depth : Min 1.7/Max 2.2mm
*SCREW(6ea) TORQUE :   2Kgf/Cm max

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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, 100G, 6ms one shock of each six faces(I.e. run 100G 6ms for all six faces)
7	Altitude operating storage / shipment	0 - 10,000 feet (3048m) 0 - 40,000 feet (12192m)

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

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

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

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 : 374mm X 329mm X 311mm

Product Specification

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°C and 35°C at normal humidity.
(2) The polarizer surface should not come in contact with any other object.
    It is recommended that they be stored in the container in which they were shipped.

9-6. HANDLING PRECAUTIONS FOR PROTECTION FILM

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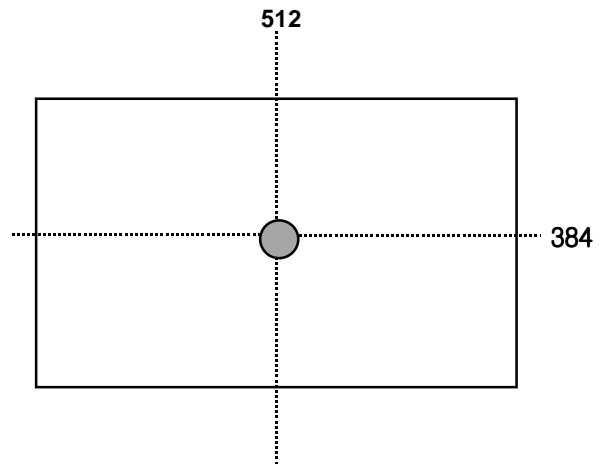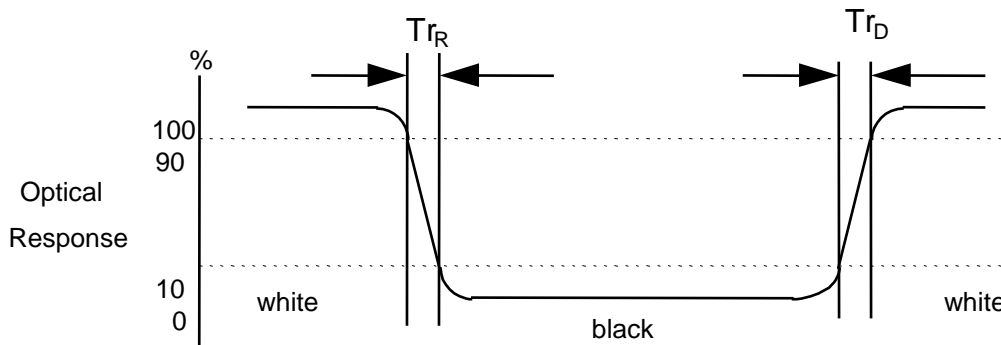
Product Specification

A- 1 Luminance

<measuring point for luminance variation>   <measuring point surface luminance>
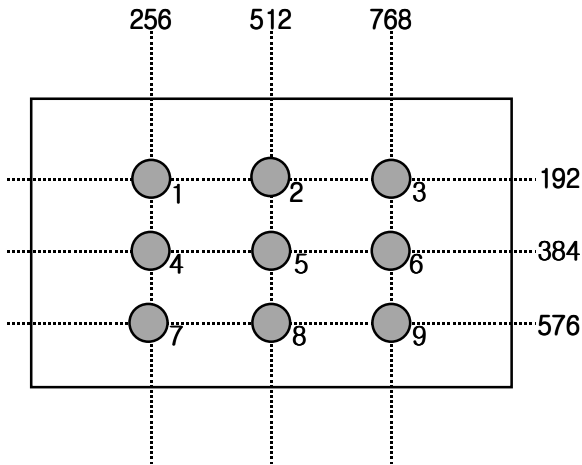
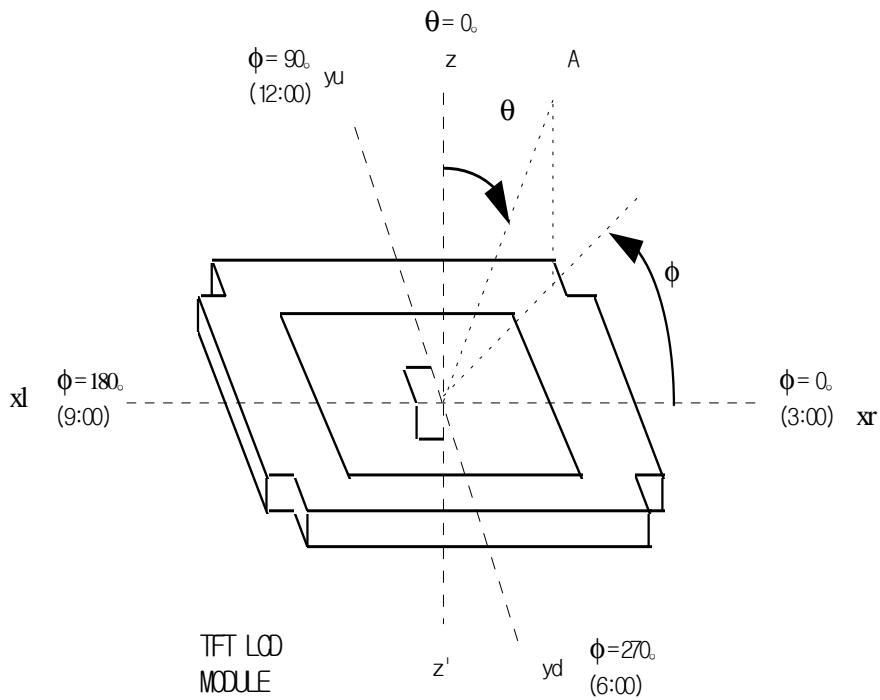Note) The Adjacent point must be opposite horizontally or vertically.

A- 2 Response Time

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

A- 3 Viewing angle

LG.PHILIPS LCD

Product Specification

INCOMING INSPECTION STANDARD
FOR
APPROVAL

Title	13.3" XGA TFT LCD

BUYER	IBM
MODEL	Toronto-3

SUPPLIER	LG.Philips LCD CO., Ltd.
*MODEL	LP133X8
SUFFIX	C2IB

*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**

J. H. Kim / G.Manager   _____

REVIEWED BY

Richard Kim / Manager   _____

PREPARED BY

Frank Kang / Engineer   _____

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

Contents

Revision Status

R/No.	Chapter	Contents	Date	Prepared by
1.0	All	Originated IIS	12/Oct/99	Robert Moon

Product Specification

1.0 Introduction

1.1. Scope

This Incoming Inspection Standard shall be applied to TFT-LCD modules(hereafter called the "LCMs") supplied by LG (hereafter called the "Supplier") to its Customer.

1.2. Incoming inspection Right

The Customer shall have the right to conduct at its own cost and expense, an incoming inspection of the LCMs at the destination specified in the relevant B/L(Bills of Lading) in accordance with the LCM's specifications separately agreed upon and the inspection criteria set forth in this article.

The Customer shall notify the Supplier in writing of the inspection results(accepted or rejected) in accordance with the said Incoming Inspection Standard within 40 days from the date of the B/L.

Should the Customer fail to notify the results to Supplier within 40 days period, the right to reject the LCMs shall then lapse, and the said LCMs shall be deemed to have been accepted by the Customer.

1.3. Handling Precautions

- LCD Devices are made of fragile material such as Glass and plastic and may be broken or cracked if dropped it, so **PLEASE** handle them with care.
- **DO NOT** press the area covered with PET or such materials. These are weak point of LCDs since of TCPs(Driver ICs) and PWBs.
- **PLEASE** support the Bezel with your finger when connecting the interface cable.
- Please **DO NOT** touch the surface of the Glass(Polariser).
- **PLEASE** wear the Wrist Strap when handling.
  Semi-conductive devices are included in the LCDs and they should be handled with care to prevent any electrostatic discharge(ESD).
- **PLEASE** keep the LCDs in the specified, original packing boxes when storage.
- **DO NOT** stack the LCDs too high without wrapping material such as AIR CAP.
- Before use the LCDs, **PLEASE** check the Engineering specification.
- LCDs contain a small amount of Liquid Crystal and Mercury. **PLEASE** follow local ordinances or regulations for disposal.

Product Specification

2.0 Generals

2.1. Sampling Method

Unless otherwise agreed upon in writing, the sampling inspection shall be applied to the Customer's incoming inspection.

2.1.1. Lot size   : Quantity per shipment lot
2.1.2. Sampling type   : Normal inspection, Single sampling
2.1.3. Inspection level : II
2.1.4. Sampling table : MIL-STD-105E

2.2. Acceptable Quality Level(AQL)

The AQL for major and minor defects shall be respectively set forth below.

2.2.1. Major = 0.65%
2.2.2. Minor = 1.5 %

2.3. Classification of defects

Defects are classified as either a major defect or a minor defect based on the degree of defect defined herein.

2.2.1. Major defect
  The major defect is a defect that is likely to result in product failure, or reduction in the product's intended usage.

2.2.2. Minor defect
  The minor defect is a defect that has little bearing on the effective use or operation of the product.

Specific criteria of judgment of major and/or minor defects or other related issues shall be in accordance with the Appendix A, "Classification of Defects".

2.4. Determination of acceptability and subsequent disposal

If the number of defects found in the LCD sampling lot is equal to or less than the applicable acceptance level, the lot shall be accepted.

If the number of defects found in the LCD sampling lot is greater than the applicable acceptance level, the lot shall be rejected. The Customer shall inform the Supplier of the results of such inspection detailly within the time period stipulated in chapter 1.2. "Incoming inspection Right".

2.4.1. Accepted lot

An acceptance under the above incoming inspection shall constitute an acceptance by the Customer of such lot of the LCDs in terms of the landed quality thereof.

2.4.2. Rejected lot

If a shipment lot of products is rejected under the above incoming inspection due to any defects of which the Supplier is responsible and such a fact is clearly confirmed by the Supplier through a separate inspection or as otherwise decided, the Supplier shall choose one of the following three options which must be determined by mutual consent.

The Supplier shall advise the Customer of its choice not later than 10 working days (Monday through Friday) of receipt of the "Customer's notification of rejected lot" :

a. The Customer shall return the rejected lot to the place to be designated by the Supplier and the Supplier shall screen all of the products in the lot and repair or replace the defective LCDs.

b. The Supplier shall screen all of the LCDs in the lot and repair or replace the defective LCDs within a reasonable time period at the Customer's facility.

c. The Customer shall screen the entire lot of LCMs at the expense of Supplier's, and the expense must be agreed by the Supplier.
The rejected LCDs shall be returned to the place designated by the Supplier.

2.5. Inspection Method

2.5.1. Ambient conditions

   a. Temperature   : 20~25 °C
   b. Humidity   : 65 + 5, - 5 % RH
   c. Illumination   : Single 20W fluorescent lamp non-directive
                          (300 to 700 Lux)

2.5.2. Viewing distance

The distance between the LCM and the inspector's eyes shall be at least 35Cm.

2.5.3. Viewing Angle

The inspection shall be conducted within normal viewing angle range.
Refer to the CAS for viewing angle.

Product Specification

3.0 Inspection Criteria

3.1. Dot Defect

3.1.1. Bright Dot

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

- R,G or B 1 dot   ----------------------------------- 7 Max
- Adjacent 2 dots   ----------------------------------- 2 Max
- Total amount of Bright dots --------------------- 7 Max
- Minimum Distance between bright dots ------ Within 20mm, Max 2

3.1.2. Dark Dot

Dots(sub-pixels) which appeared darkly in the screen when the LCD
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 20mm, Max 2

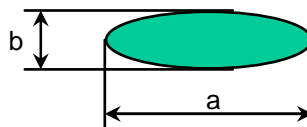3.1.3. Total amount of Dot Defects ---------------------- 8 Max(Combination)

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

3.2. Polariser Defects

Items		Criteria
Scratches	Linear	$0.05 <= W <= 0.10$, $0.3 <= L <= 3.0$, $N <= 4$
Dent	Circular	$D <= 0.5$, $N <= 3$

Note)
   a. Average Diameter

b. Linear :   a >2b ,   Circular : a<=2b

W :Width
L : Length
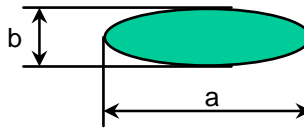D : Average diameter

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

Note) continued

c. Extraneous substances which can be wiped out, like Finger Print, Particles, are not considered as a defect.
b. Defects which is on the Black Matrix(Outer side of Active Area) are not considered as a defect.

3.3 Foreign Material

Items		Criteria
Foreign Material	Linear	0.2<=W<=0.5, 0.3<=L<=3.0 N<=4
	Circular	0.2<=D<=0.5, N<=5

Note)

a. Average Diameter

b. Linear : a >2b ,   Circular : a<=2b

W :Width
L : Length
D : Average diameter

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

3.4. Line Defect

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

3.5. Bezel Appearance

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

3.6. Others

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

Product Specification

4.0 RMAs

4.1. Verification

The Supplier can verify the defective LCDs to segregate the responsibilities at Customer's facility.

This verification result shall be agreed mutually by the Customer and Supplier.

This result can be corrected/changed after detail failure analysis at Supplier's facilities.

4.2. Supplier Induced Defects

All of the Supplier induced defective LCDs shall be returned to the Supplier for repair or replacement.

Before return the defective LCDs, the Customer needs Supplier's confirmation with RMA Number.

All of the returned LCDs shall be returned to the Customer within agreed time period.

4.3. Customer Induced Defects

The Customer can return the customer induced defective LCDs to the Supplier for repair.

The repair cost for Customer induced defective LCDs shall be agreed with both parties, Customer and Supplier.

5.0 Warranty

5.1. Warranty Period

The In- warranty is Eighteen(18) Months from manufacturing month.

Note) The manufacturing Month is on the LCDs as Supplier's serial No.

5.2. Repair Warranty

The repair warranty is Twelve(12) Months from repaired month for repaired LCDs.

Note) The Label for repair will be added after repairing.

5.3. Warranty avoidance

The warranty will be avoid in cases below,

a. When the warranty period is expired

b. The Customer induced defective LCDs

c. When the LCDs were repaired by 3rd party without Supplier's approval.

d. When the LCDs were treated like Disassemble and Rework by the Customer
    and/or Customer's representatives without Supplier's approval.

6. Others

If any problems arise with the LCMs supplied by LGE, the Customer and Supplier
will cooperate and make efforts to solve it with mutual confidence and respect.

Product Specification

Appendix A. Classification of Defects

Defect Mode	Criterion for Defect	Class
Operating Frequency	Specified range in the CAS	Major
Power Consumption	Specified range in the CAS	Major
Contrast Ratio	Specified range in the CAS	Major
Line Defect	Not allowed any Vertical,Horizontal,and Cross line	Major
Polariser Defects	Shall be accordance with the item 3.0 "Inspection Criteria" in this standard	Minor
Extraneous Substance	Shall be accordance with the item 3.0 "Inspection Criteria" in this standard	Minor
Dot Defect	Shall be accordance with the item 3.0 "Inspection Criteria" in this standard	Minor
Bezel Claw Forming	The bezel claw is not formed sufficiently	Minor
Image persistence	Specified range in the CAS	Minor