SPECIFICATION
FOR
APPROVAL

( ) **Preliminary Specification**
(◆) **Final Specification**

Title	12.1” WXGA TFT LCD

Customer	HP
MODEL	

SUPPLIER	LG Display Co., Ltd.
*MODEL	LP121WX3
Suffix	TPB1

*When you obtain standard approval,
please use the above model name without suffix

APPROVED BY	SIGNATURE
/	
/	
/	

Please return 1 copy for your confirmation with your signature and comments.

APPROVED BY	SIGNATURE
H. S. Kim / G. Manager	
REVIEWED BY	
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PREPARED BY	
K.Y. Kwon / Engineer	

Products Engineering Dept.
LG Display Co., Ltd

Contents

RECORD OF REVISIONS

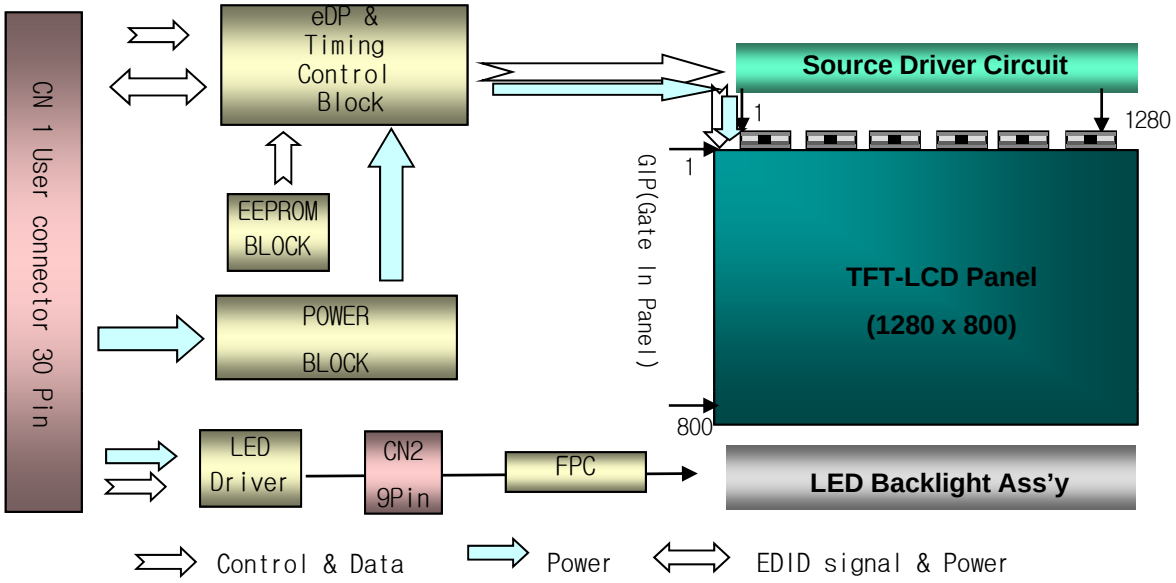
Revision No	Revision Date	Page	Description	EDID ver
0.0	Feb. 10, 2009	All	First Draft (Preliminary Specification)	-
0.1	Jul. 07, 2009	4,6,7	Electrical Characteristics is updated	0.0
		12	Power Sequence is updated	
		17,18	Mechanical Characteristics is updated	
		21	International Standards is updated	
		25 ~ 27	EDID Data is updated	
0.2	Dec. 07, 2009	6	Updated the Electrical Characteristics	0.1
		12	Updated the Power Sequence	
		25 ~ 27	Updated the EDID Data	
1.0	Feb. 22, 2010	30 ~ 32	Updated the EDID data	1.0
		All	Final Specification	

1. General Description

The LP121WX3 is a Color Active Matrix Liquid Crystal Display with an integral LED 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 WXGA resolution(800 vertical by 1280 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 LP121WX3 has been designed to apply the interface method that enables low power, high speed, low EMI.

The LP121WX3 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 LP121WX3 characteristics provide an excellent flat display for office automation products such as Notebook PC.



General Features

Active Screen Size	12.1 inches diagonal
Outline Dimension	275.8 (H) × 178.1 (V) × 5.5(D, max) mm
Pixel Pitch	0.204 mm × 0.204 mm
Pixel Format	1280 horiz. By 800 vert. Pixels RGB strip arrangement
Color Depth	6-bit, 262,144 colors
Luminance, White	200 cd/m^2(Typ.5 point)
Power Consumption	Total 4.2 Watt(Max.) @ LCM circuit 1.0Watt(Max @ Mosaic), B/L input 3.2Watt(Max.)
Weight	285g (Max.)
Display Operating Mode	Transmissive mode, normally white
Surface Treatment	Anti-glare treatment of the front polarizer
RoHS Comply	Yes

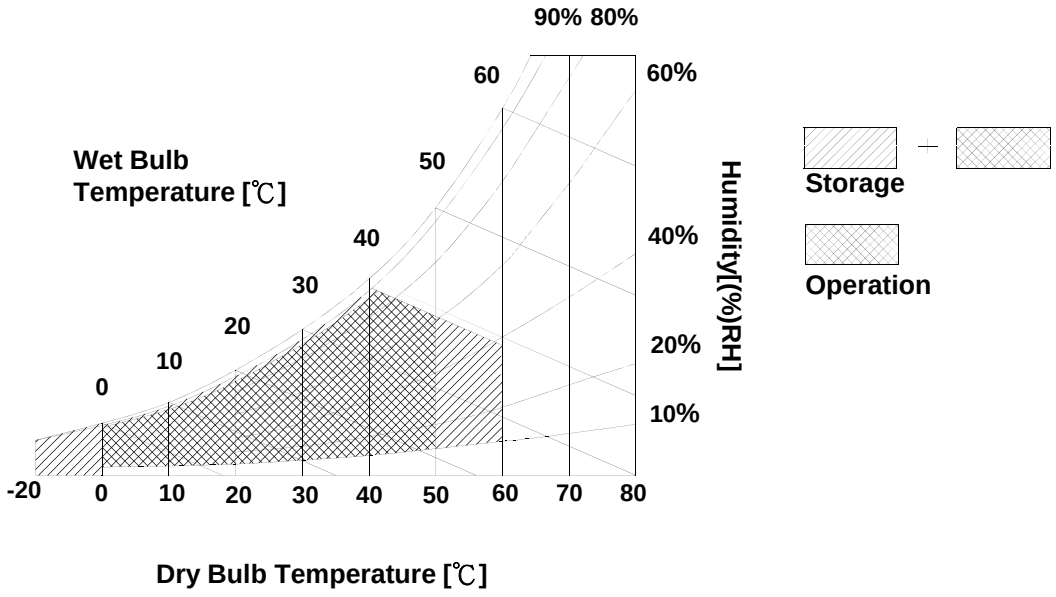
2. Absolute Maximum Ratings

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

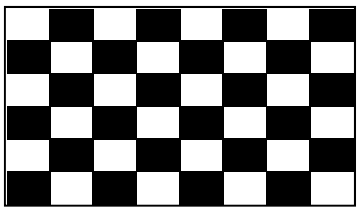
The LP121WX3 requires two power inputs. The first logic is employed to power the LCD electronics and to drive the TFT array and liquid crystal. The second backlight is the input about LED B/L.with LED Driver.

Table 2. ELECTRICAL CHARACTERISTICS

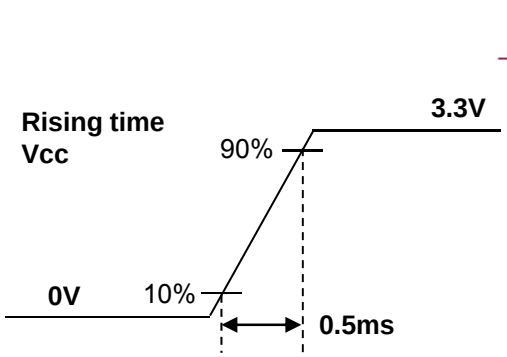
Parameter		Symbol	Values			Unit	Notes
			Min	Typ	Max		
LOGIC :							
Power Supply Input Voltage		V_{CC}	3.0	3.3	3.6	V	1
Power Supply Input Current	Mosaic	I_{CC}	-	275	315	mA	2
Power Consumption		P_{CC}	-	0.9	1.0	W	2
Power Supply Inrush Current		I_{CC_P}	-	-	2000	mA	3
eDP Impedance		Z_{eDP}	90	100	110	Ω	4
BACKLIGHT : (with LED Driver)							
LED Power Input Voltage		V_{LED}	7.0	12.0	21.0	V	5
LED Power Input Current		I_{LED}	-	250	265	mA	6
LED Power Consumption		P_{LED}	-	3.0	3.2	W	6
LED Power Inrush Current		I_{LED_P}	-		2000	mA	7
PWM Duty Ratio			5	-	100	%	8
PWM Jitter		-	0	-	0.3	%	9
PWM Impedance		Z_{PWM}	20	40	60	kΩ	
PWM Frequency		F_{PWM}	200	-	1700	Hz	10
PWM High Level Voltage		V_{PWM_H}	3.0	-	5.3	V	
PWM Low Level Voltage		V_{PWM_L}	0	-	0.3	V	
LED_EN Impedance		Z_{PWM}	20	40	60	kΩ	
LED_EN High Voltage		$V_{LED\_EN\_H}$	3.0	-	5.3	V	
LED_EN Low Voltage		$V_{LED\_EN\_L}$	0	-	0.3	V	
Life Time			12,000	-	-	Hrs	11

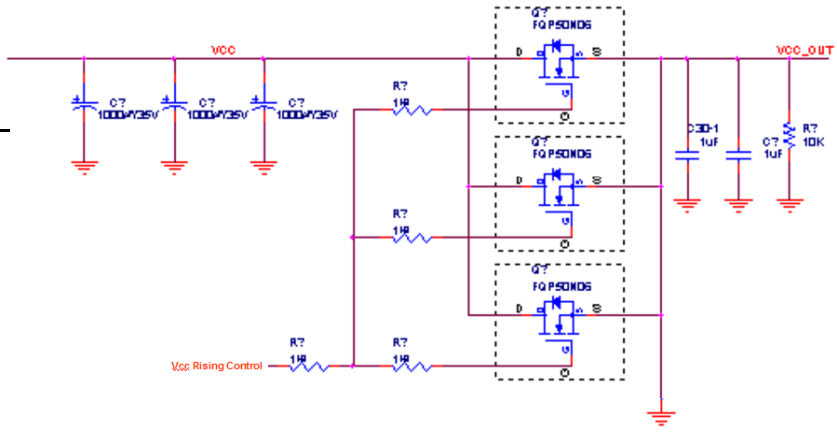
Note)

1. The measuring position is the connector of LCM and the test conditions are under 25℃, fv = 60Hz, Black pattern.
2. The specified Icc current and power consumption are under the Vcc = 3.3V , 25℃, fv = 60Hz condition whereas Mosaic pattern is displayed and fv is the frame frequency.

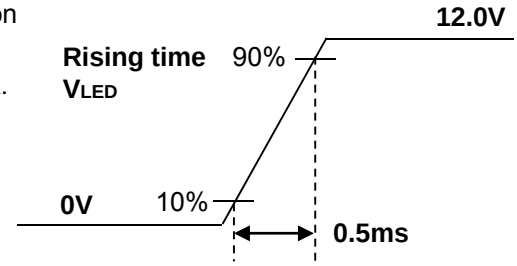


3. The below figures are the measuring Vcc condition and the Vcc control block LGD used. The Vcc condition is same the minimum of T1 at Power on sequence.





4. This impedance value is needed to proper display and measured form eDP Tx to the mating connector.
5. The measuring position is the connector of LCM and the test conditions are under 25℃.
6. The current and power consumption with LED Driver are under the Vled = 12.0V , 25℃, Dimming of Max luminance whereas White pattern is displayed and fv is the frame frequency.
7. The below figures are the measuring Vled condition and the Vled control block LGD used. VLED control block is same with Vcc control block.



8. The operation of LED Driver below minimum dimming ratio may cause flickering or reliability issue.
9. If Jitter of PWM is bigger than maximum. It may cause flickering.
10. This Spec. is not effective at 100% dimming ratio as an exception because it has DC level equivalent to 0Hz. In spite of acceptable range as defined, the PWM Frequency should be fixed and stable for more consistent brightness control at any specific level desired.
11. The life time is determined as the time at which the typical brightness of LCD is 50% compare to that of initial value at the typical LED current. These LED backlight has 6 strings on it and the typical current of LED's string is base on 20mA.

3-2. Interface Connections

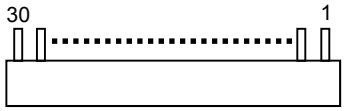
This LCD employs two interface connections, a 30 pin connector is used for the module electronics interface and the other connector is used for the integral backlight system.
The electronics interface connector is a model CABLINE-VS RECE ASS'Y manufactured by I-PEX.

Table 3. MODULE CONNECTOR PIN CONFIGURATION (CN1)

Pin	Symbol	Description	Notes
1	NC	No Connection	
2	GND	LCM Ground	
3	NC	No Connection	
4	NC	No Connection	
5	GND	LCM Ground	
6	ML0-	Complement Signal-Lane 0	
7	ML0+	True Signal-Main Lane 0	
8	GND	LCM Ground	
9	AUX+	True Signal-Auxiliary Channel	
10	AUX-	Complement Signal-Auxiliary Channel	
11	GND	LCM Ground	
12	VCC	LCD Logic and driver power (3.3V Typ.)	
13	VCC	LCD Logic and driver power (3.3V Typ.)	
14	NC	No Connection	
15	GND	LCM Ground	
16	GND	LCM Ground	
17	HPD	HPD signal pin	
18	GND	LCM Ground (LED Backlight Ground)	
19	GND	LCM Ground (LED Backlight Ground)	
20	GND	LCM Ground (LED Backlight Ground)	
21	GND	LCM Ground (LED Backlight Ground)	
22	LED_EN	LED Backlight On/Off	
23	PWM	System PWM Signal input for dimming	
24	NC	No Connection	
25	NC	No Connection	
26	VLED	LED Backlight Power (7V-21V)	
27	VLED	LED Backlight Power (7V-21V)	
28	VLED	LED Backlight Power (7V-21V)	
29	VLED	LED Backlight Power (7V-21V)	
30	NC	No Connection	

1, Interface chips
1.1 LCD : IDT, VPP1420 (LCD Controller) including eDP Receiver
1.2 System : TBD or equivalent
* Pin to Pin compatible with eDP

2. Connector
2.1 LCD : CABLINE-VS RECE ASS'Y, I-PEX or its compatibles
2.2 Mating : CABLINE-VS PLUG CABLE ASS'Y or equivalent.
2.3 Connector pin arrangement

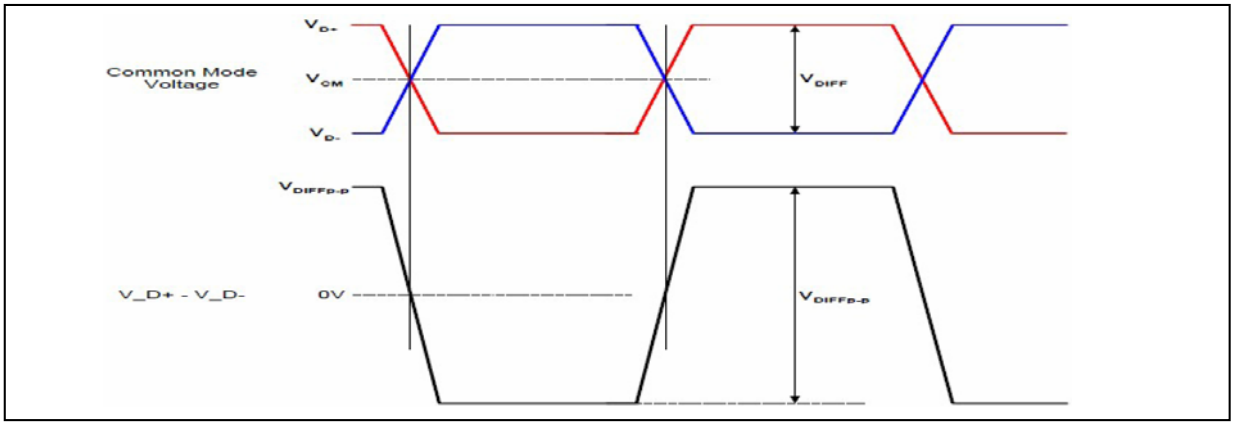


[LCD Module Rear View]

3-3. eDP Signal Timing Specifications

3-3-1. DC Specification

The VESA Display Port related AC specification is compliant with the VESA Display Port Standard v1.1a.



Description	Symbol	Min	Max	Unit	Notes
Differential peak-to-peak Input voltage	VDIFF p-p	120	-	mV	For high bit rate
		40	-		For reduced bit rate
Rx DC common mode voltage	VCM	0	2.0	V	-

3-3-2. AC Specification

The VESA Display Port related AC specification is compliant with the VESA Display Port Standard v1.1a.

Description	Symbol	Min	Typ	Max	Unit	Notes
Unit Interval for high bit rate (2.7Gbps/lane)	UI_High_Rate	-	370	-	ps	Range is nominal ±350ppm. DisplayPort Link Rx does not require local crystal for link clock generation
Unit Interval for high bit rate (1.62Gbps/lane)	UI_Low_Rate	-	617	-	ps	
Lane-to-Lane skew	V Rx-SKEW-INTER_PAIR	-	-	5200	ps	-
Lane intra-pair skew	V Rx-SKEW-INTRA_PAIR	-	-	100	ps	For high bit rate
		-	-	300	ps	For reduced bit rate

3-4. Signal Timing Specifications

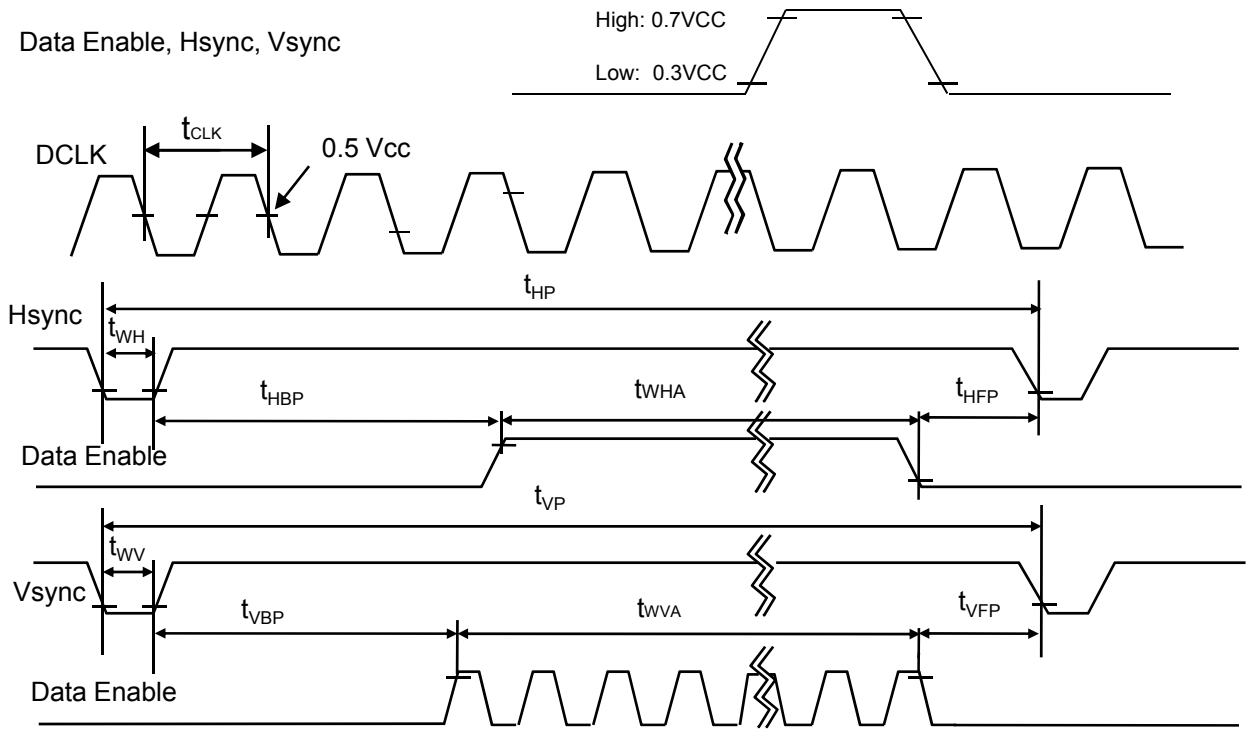
This is the signal timing required at the input of the User connector. All of the interface signal timing should be satisfied with the following specifications and specifications of eDP Tx/Rx for its proper operation.

Table 4. TIMING TABLE

ITEM	Symbol		Min	Typ	Max	Unit	Note
DCLK	Frequency	f_{CLK}	-	69.3	-	MHz	
Hsync	Period	t_{HP}	1376	1408	1480	tCLK	
	Width	t_{WH}	24	32	40		
	Width-Active	t_{WHA}	1280	1280	1280		
Vsync	Period	t_{VP}	810	820	832	tHP	
	Width	t_{WV}	2	4	6		
	Width-Active	t_{WVA}	800	800	800		
Data Enable	Horizontal back porch	t_{HBP}	56	72	96	tCLK	
	Horizontal front porch	t_{HFP}	16	24	64		
	Vertical back porch	t_{VBP}	6	12	18	tHP	
	Vertical front porch	t_{VFP}	2	4	8		

3-5. Signal Timing Waveforms

Condition : VCC =3.3V



3-6. 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 5. 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

3-7. Power Sequence

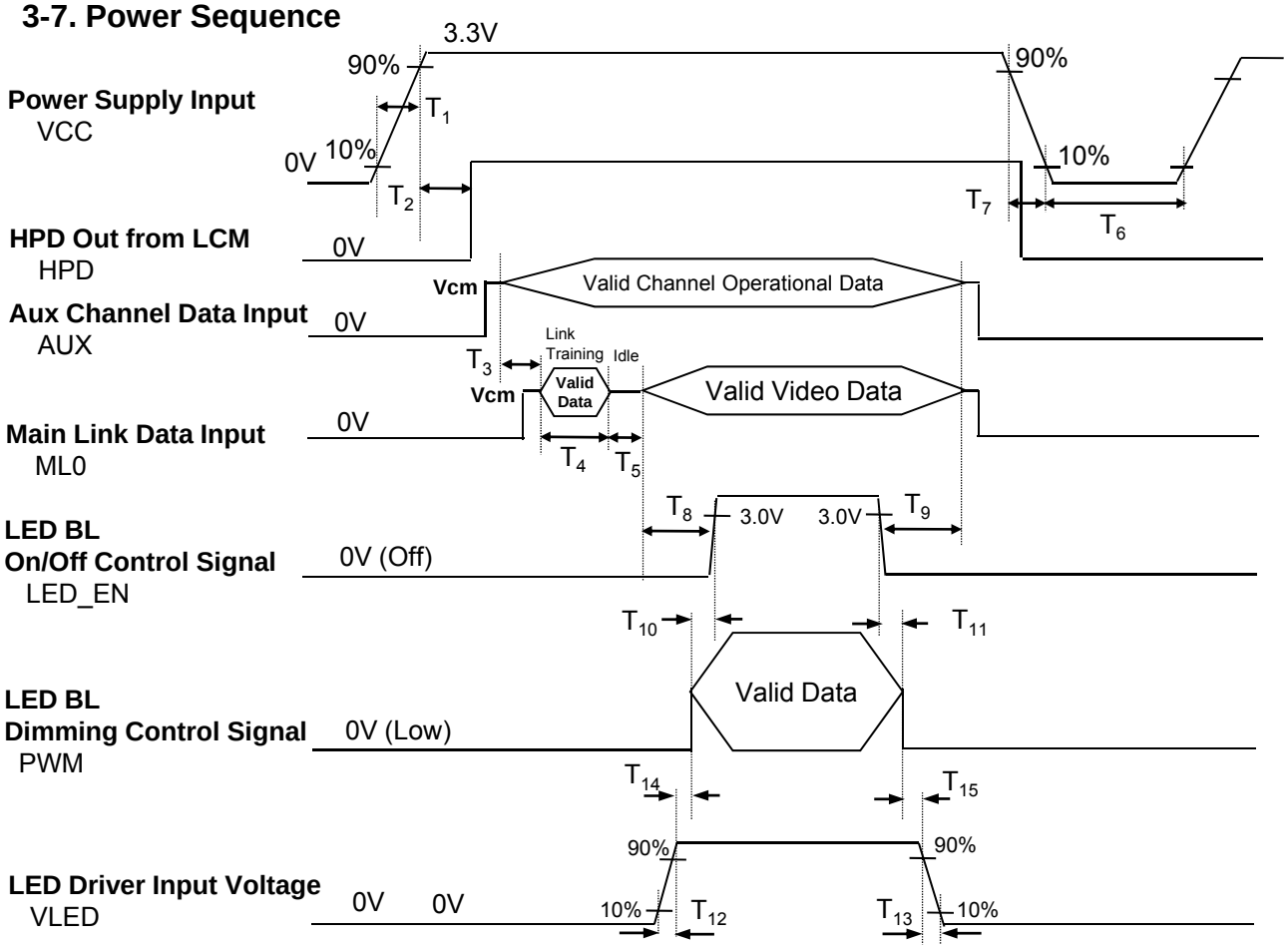


Table 6. POWER SEQUENCE TABLE

Logic Parameter	Value			Units	LED Parameter	Value			Units
	Min.	Typ.	Max.			Min.	Typ.	Max.	
T_1	0.5	-	10	ms	T_9	200	-	-	ms
T_2	0	-	200	ms	T_{10}	0	-	-	ms
T_3	50	75	-	ms	T_{11}	0	-	-	ms
T_4	0	-	-	ms	T_{12}	0.5	-	-	ms
T_5	0	-	-	ms	T_{13}	0	-	5000	ms
T_6	500	-	-	ms	T_{14}	10	-	-	ms
T_7	3	-	10	ms	T_{15}	10	-	-	ms
T_8	200	-	-	ms					

Note)
1. Do not insert the mating cable when system turn on.
2. Valid Data have to meet "3-3. eDP Signal Timing Specifications"
3. eDP, LED_EN and PWM need to be on pull-down condition on invalid status.
4. LGD recommend the rising sequence of VLED after the Vcc and valid status of eDP turn on.

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

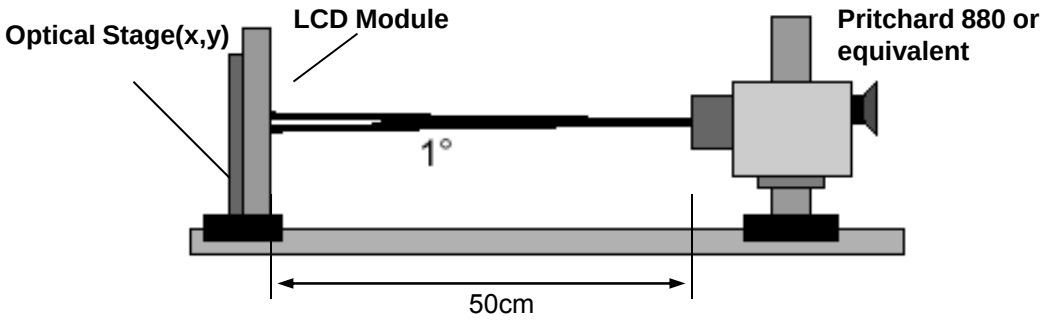


Table 8. OPTICAL CHARACTERISTICS

Ta=25°C, VCC=3.3V, fv=60Hz, f_{CLK}= 69.3MHz

Parameter	Symbol	Values			Units	Notes
		Min	Typ	Max		
Contrast Ratio	CR	200	300	-		1
Surface Luminance, white	L_{WH}	170	200	-	cd/m²	2
Luminance Variation	δ_{WHITE}	-	-	1.6		3
Response Time	Tr_R+ Tr_D	-	16	-	ms	4
Color Coordinates						
RED	RX	0.562	0.592	0.622		
	RY	0.321	0.351	0.381		
GREEN	GX	0.304	0.334	0.364		
	GY	0.519	0.549	0.579		
BLUE	BX	0.124	0.154	0.184		
	BY	0.100	0.130	0.160		
WHITE	WX	0.283	0.313	0.343		
	WY	0.299	0.329	0.359		
Viewing Angle						5
x axis, right(Φ=0°)	Θr	40	-	-	degree	
x axis, left (Φ=180°)	Θl	40	-	-	degree	
y axis, up (Φ=90°)	Θu	10	-	-	degree	
y axis, down (Φ=270°)	Θd	30	-	-	degree	
Gray Scale						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 average of 5 point across the LCD surface 50cm from the surface with all pixels displaying white. For more information see FIG 1.

$$L_{WH} = \text{Average}(L_1, L_2, \ldots L_5) \text{ (@ PWM Duty 100\%)}$$

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

$$\delta_{WHITE} = \frac{\text{Maximum}(L_1, L_2, \ldots L_{13})}{\text{Minimum}(L_1, L_2, \ldots L_{13})}$$

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

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

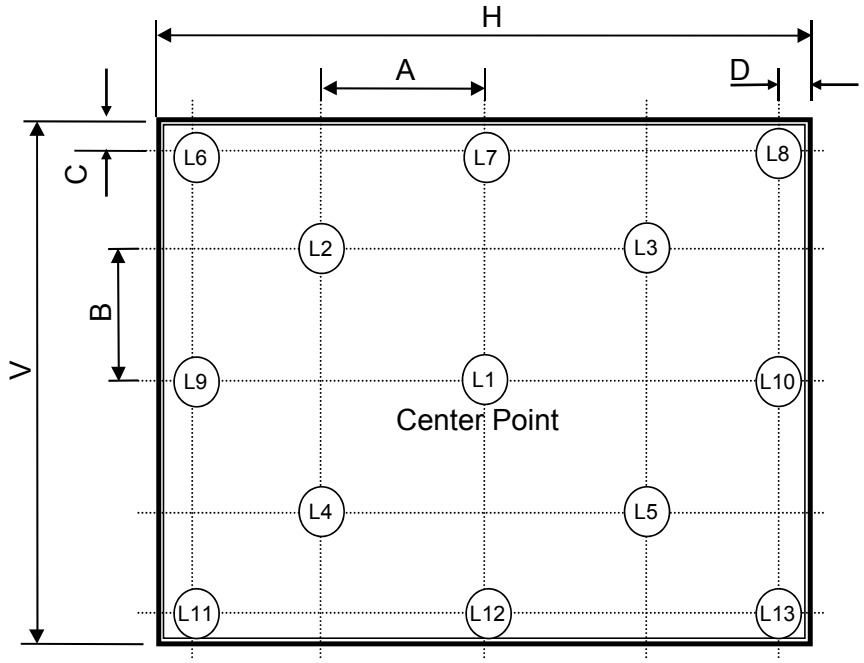
6. Gray scale specification

* f_V = 60Hz

Gray Level	Luminance [%] (Typ)
L0	0.30
L7	2.02
L15	6.35
L23	12.7
L31	20.7
L39	33.4
L47	50.9
L55	72.8
L63	100

FIG. 2 Luminance

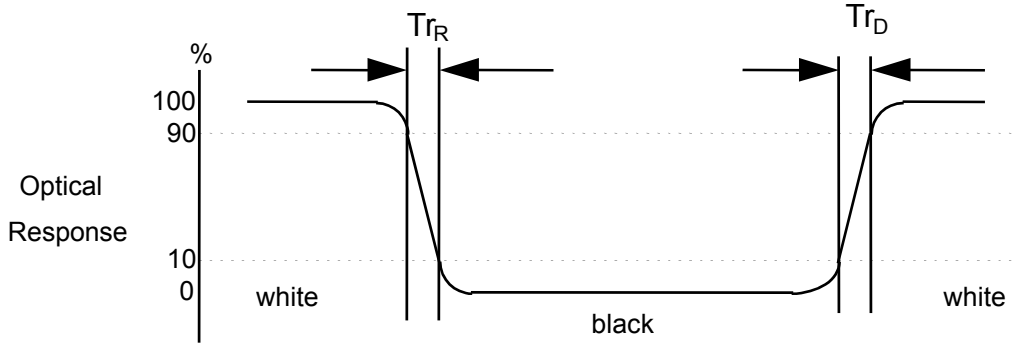
<measuring point for surface luminance & measuring point for luminance variation>



H,V : ACTIVE AREA
A : H/4 mm
B : V/4 mm
C : 10 mm
D : 10 mm
POINTS : 13 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”.



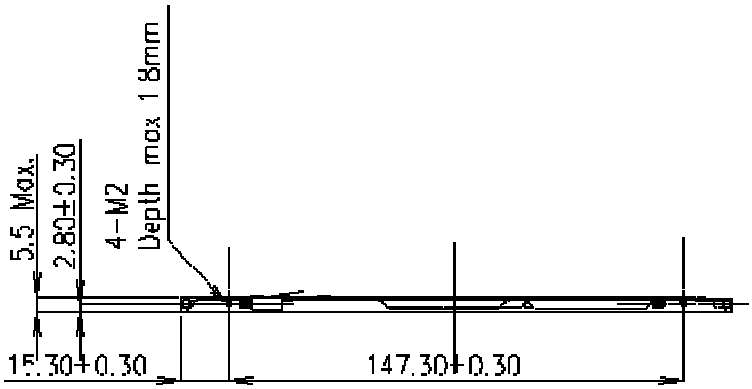
5. Mechanical Characteristics

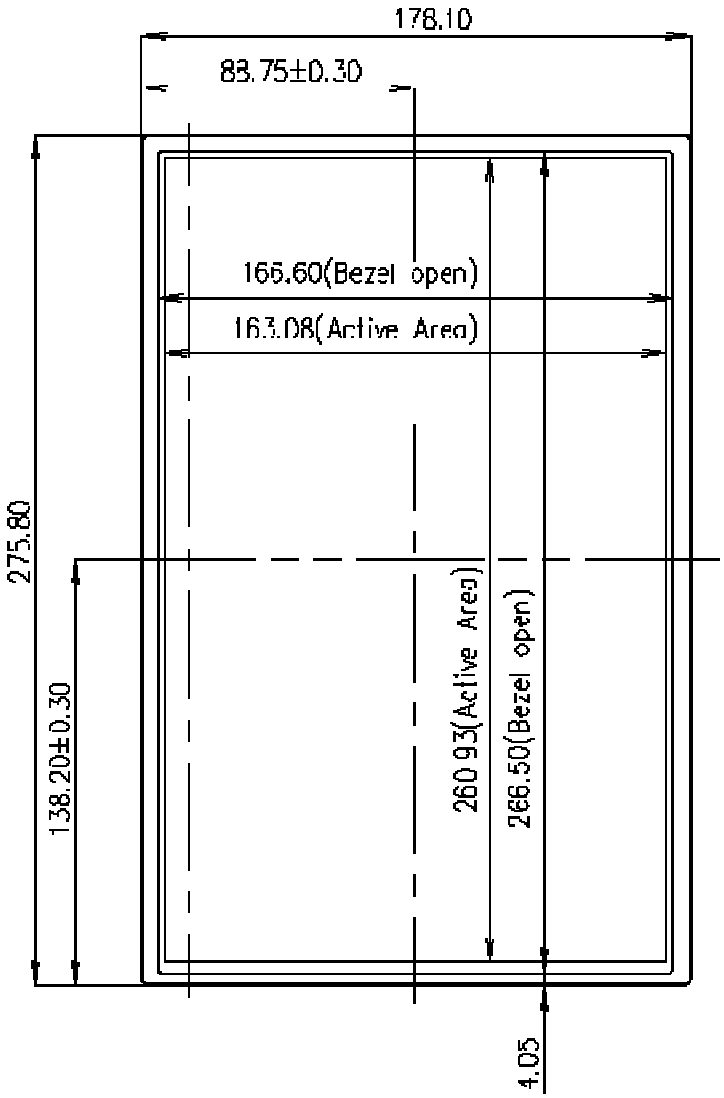
The contents provide general mechanical characteristics for the model LP121WX3. In addition the figures in the next page are detailed mechanical drawing of the LCD.

Outline Dimension	Horizontal	275.8 ± 0.5mm
	Vertical	178.1 ± 0.5mm
	Thickness	5.5mm (Max)
Bezel Area	Horizontal	266.5 ± 0.5mm
	Vertical	166.6 ± 0.5mm
Active Display Area	Horizontal	260.93 ± 0.3mm
	Vertical	163.08 ± 0.3mm
Weight	285g (Max)	
Surface Treatment	Anti-glare treatment of the front polarizer	

<FRONT VIEW>

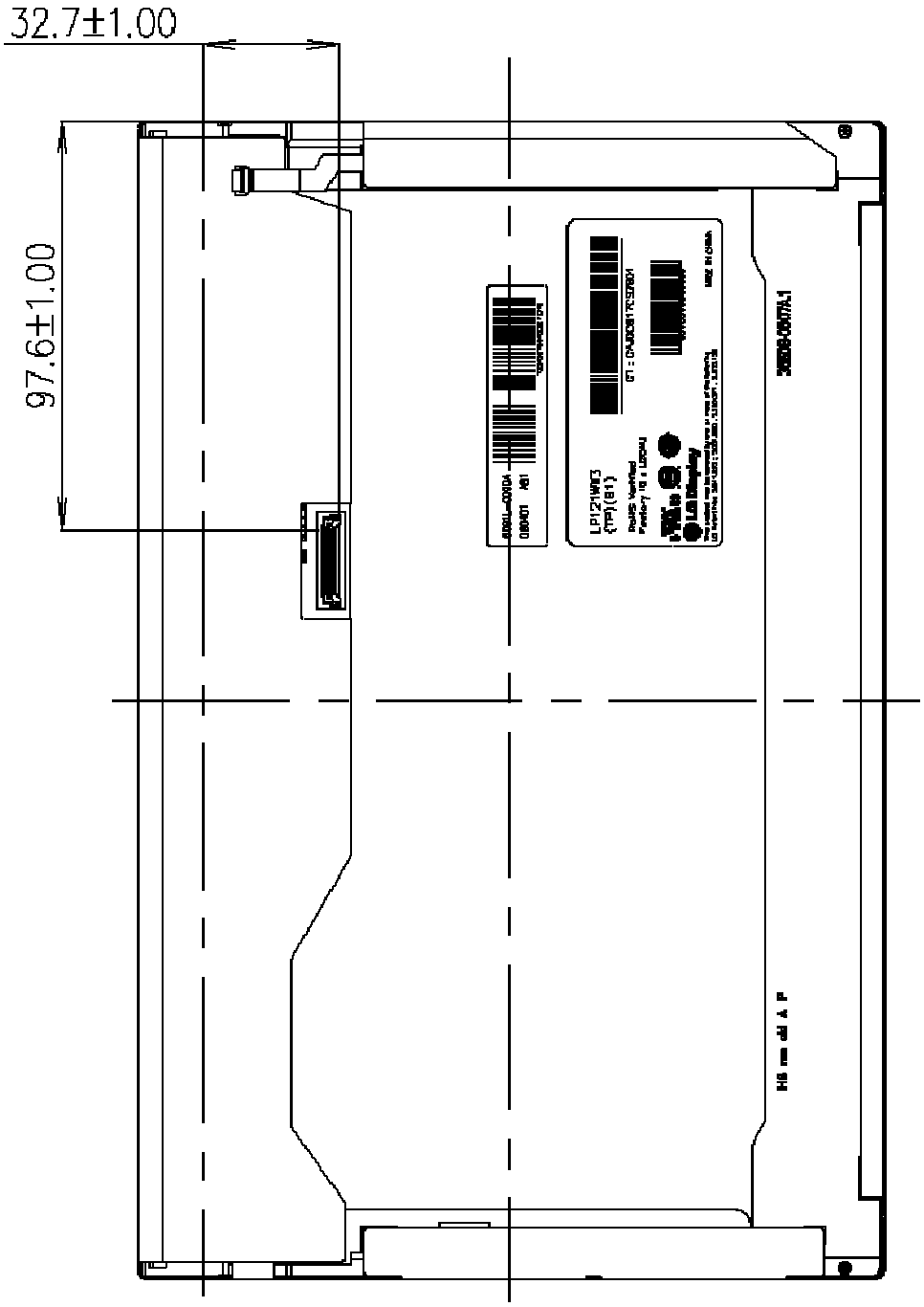
Note) Unit:[mm], General tolerance: ± 0.5mm



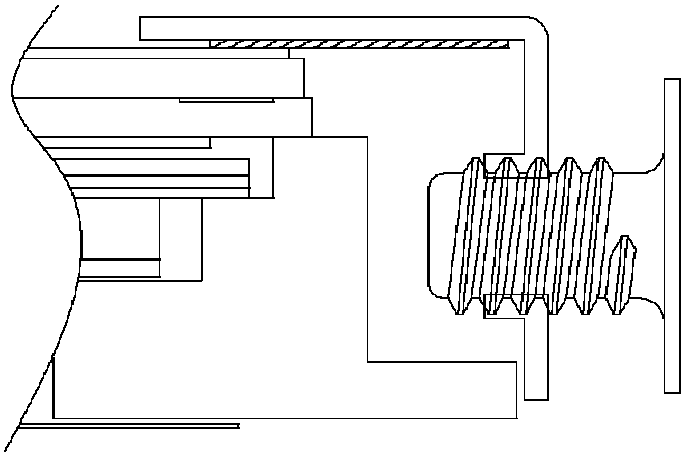


<REAR VIEW>

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



[DETAIL DESCRIPTION OF SIDE MOUNTING SCREW]



***Screw Torque (4 point): Max. 2kgf·cm**

***Mounting SCREW Depth : 1.8mm max**

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

6. Reliability

Environment test condition

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

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

7. International Standards

7-1. Safety

a) UL 60950-1, Second Edition, Underwriters Laboratories Inc.
Information Technology Equipment - Safety - Part 1 : General Requirements.

b) CAN/CSA C22.2 No.60950-1-07, Second Edition, Canadian Standards Association.
Information Technology Equipment - Safety - Part 1 : General Requirements.

c) EN 60950-1:2006 + A11:2009, European Committee for Electrotechnical Standardization (CENELEC).
Information Technology Equipment - Safety - Part 1 : General Requirements.

d) IEC 60950-1:2005, Second Edition, The International Electrotechnical Commission (IEC).
Information Technology Equipment - Safety - Part 1 : General Requirements.

7-2. EMC

a) ANSI C63.4 “American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.” American National Standards Institute (ANSI), 2003.

b) CISPR 22 “Information technology equipment – Radio disturbance characteristics – Limit and methods of measurement." International Special Committee on Radio Interference (CISPR), 2005.

c) CISPR 13 “Sound and television broadcast receivers and associated equipment – Radio disturbance characteristics – Limits and method of measurement." International Special Committee on Radio Interference (CISPR), 2006.

7-3. Environment

a) RoHS, Directive 2002/95/EC of the European Parliament and of the council of 27 January 2003

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(INCH)
D : YEAR
E : MONTH
F ~ M : SERIAL NO.

Note

1. YEAR

Year	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Mark	1	2	3	4	5	6	7	8	9	0

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 : 30 pcs

b) Box Size : 480mm × 348mm × 243mm

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.

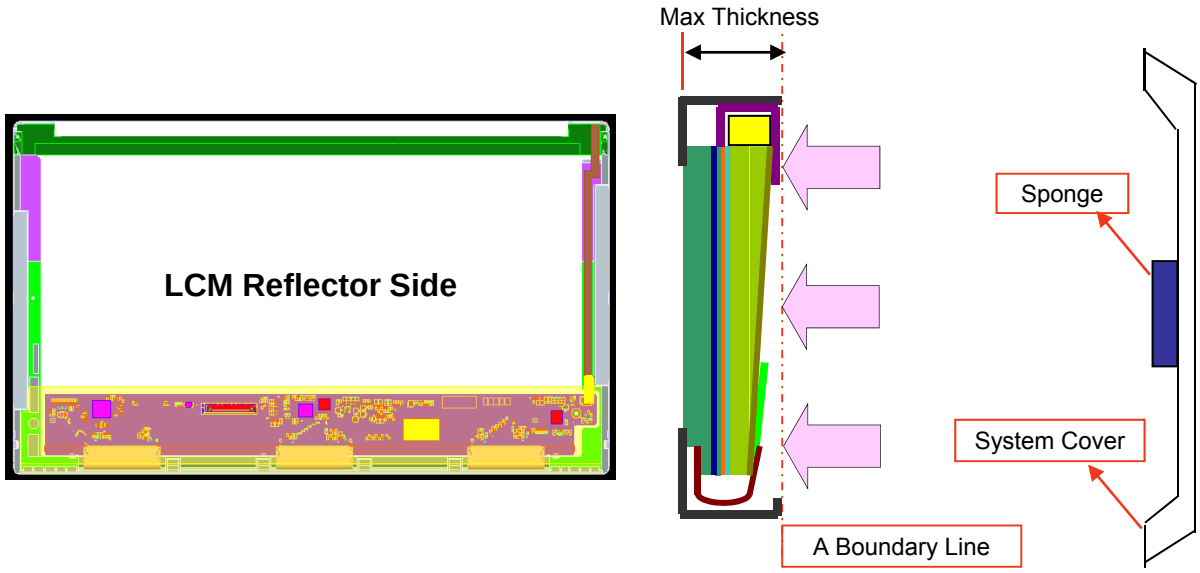
(1) Store them in a dark place. Do not expose the module to sunlight or fluorescent light. Keep the temperature between 5°C and 35°C at normal humidity.
(2) The polarizer surface should not come in contact with any other object.
It is recommended that they be stored in the container in which they were shipped.

9-6. HANDLING PRECAUTIONS FOR PROTECTION FILM

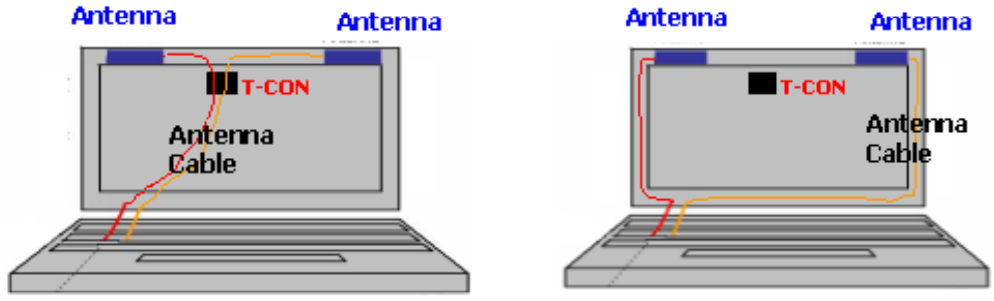
(1) When the protection film is peeled off, static electricity is generated between the film and polarizer. This should be peeled off slowly and carefully by people who are electrically grounded and with well ion-blown equipment or in such a condition, etc.
(2) The protection film is attached to the 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.

LGD Proposal for system cover design. (Appendix A)

1	Gap check for securing the enough gap between LCM and System cover.	



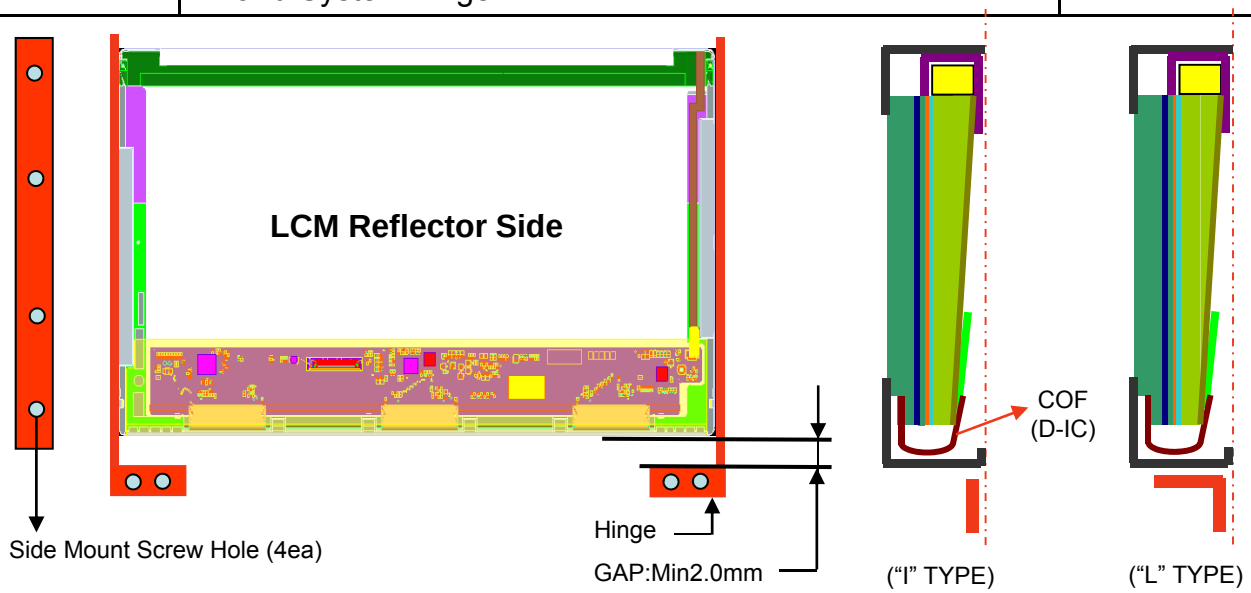
Notes	1.Rear side of LCM is sensitive against external stress,and previous check about interference is highly needed. 2.In case there is something from system cover comes into the boundary above,mechanical interference may cause the FOS defects. (Eg:Ripple,White spot..)
2	Check if antenna cable is sufficiently apart from T-CON of LCD Module.



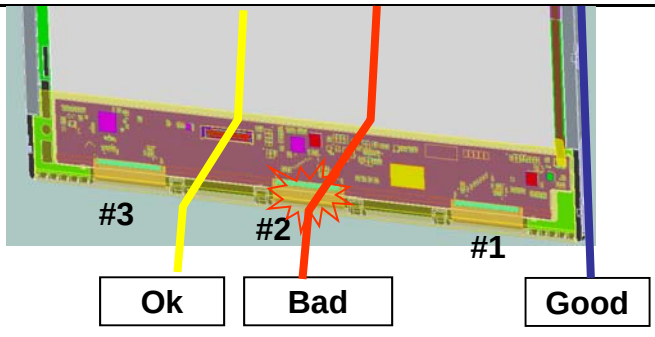
Notes	1.If system antenna is overlapped with T-CON,it might be cause the noise.

LGD Proposal for system cover design. (Appendix A)

3	Gap check for securing enough gap between LCM and System hinge.	



Notes	1. At least 2.0mm gap is required to secure from any damage during shock test. 2. "L" type hinge is more recommended than "I" type to get better performance for shock test.
4	Checking the path of the System wire.

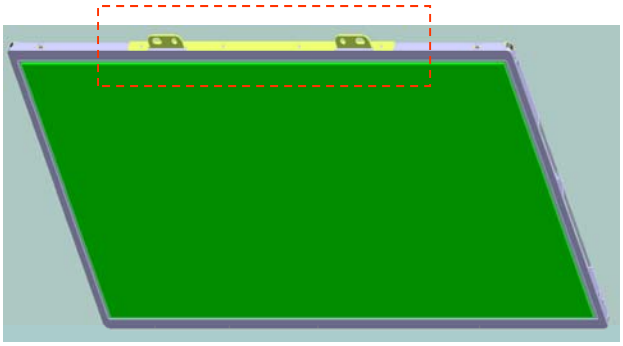


Notes	1. It is required to handle COF area carefully . 2. Good : Wire path does not overlap with LCM OK : Wire path is located between COFs. BAD : Wire path overlapped with COF area. Flat type cable is highly recommended if cable should be located on bad case

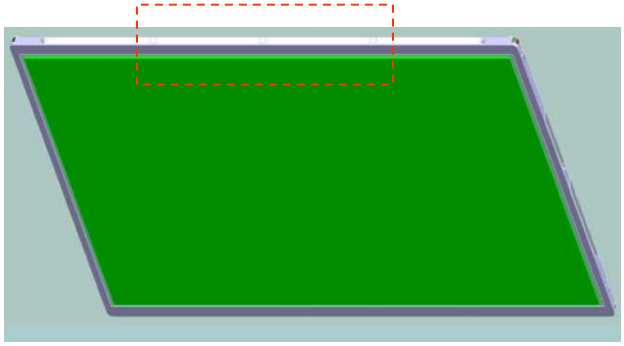
LGD Proposal for system cover design. (Appendix A)

5	Using a bracket on the top of LCM is not recommended.	

bracket

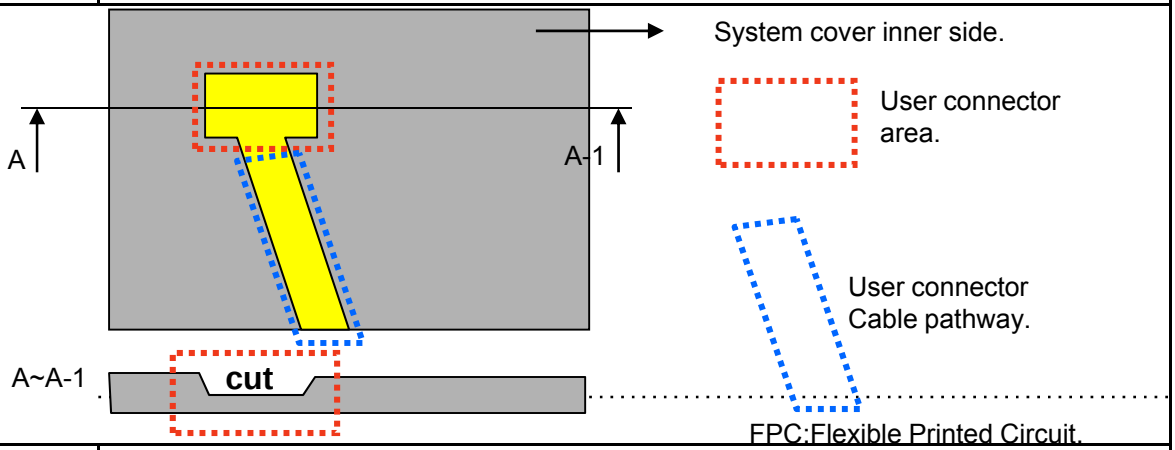


With bracket



Without bracket

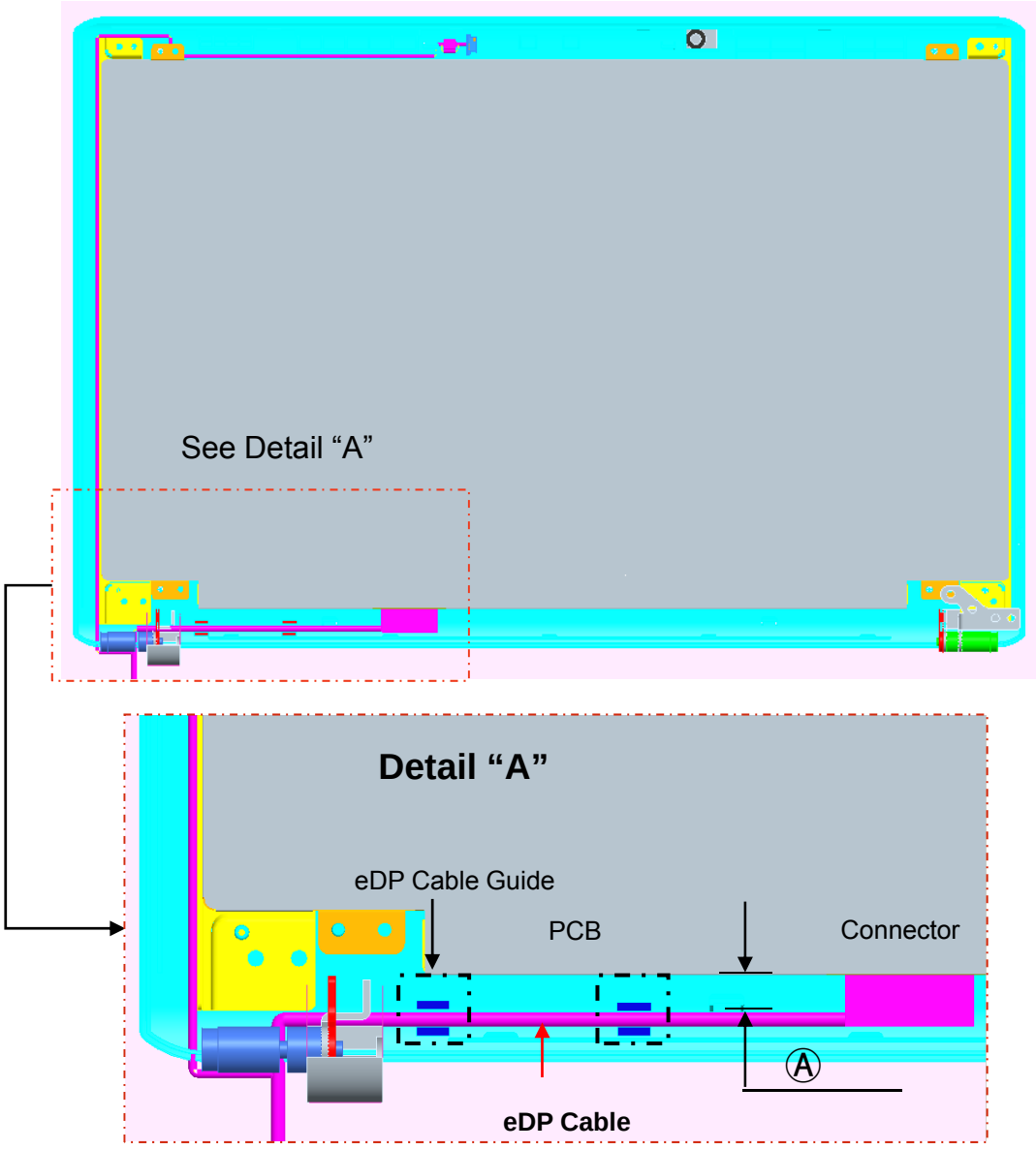
Notes	1.Condition without bracket is good for mechanical noise,and can minimize the light leakage from deformation of bracket. 2.The results shows that there is no difference between the condition with or without bracket.
6	Securing additional gap on CNT area..



Notes	1.CNT area is specially sensitive against external stress,and additional gap by cutting on system cover will be helpful on removing the Ripple. 2.Using a thinner CNT will be better. (eg: FPC type)

LGD Proposal for system cover design. (Appendix A)

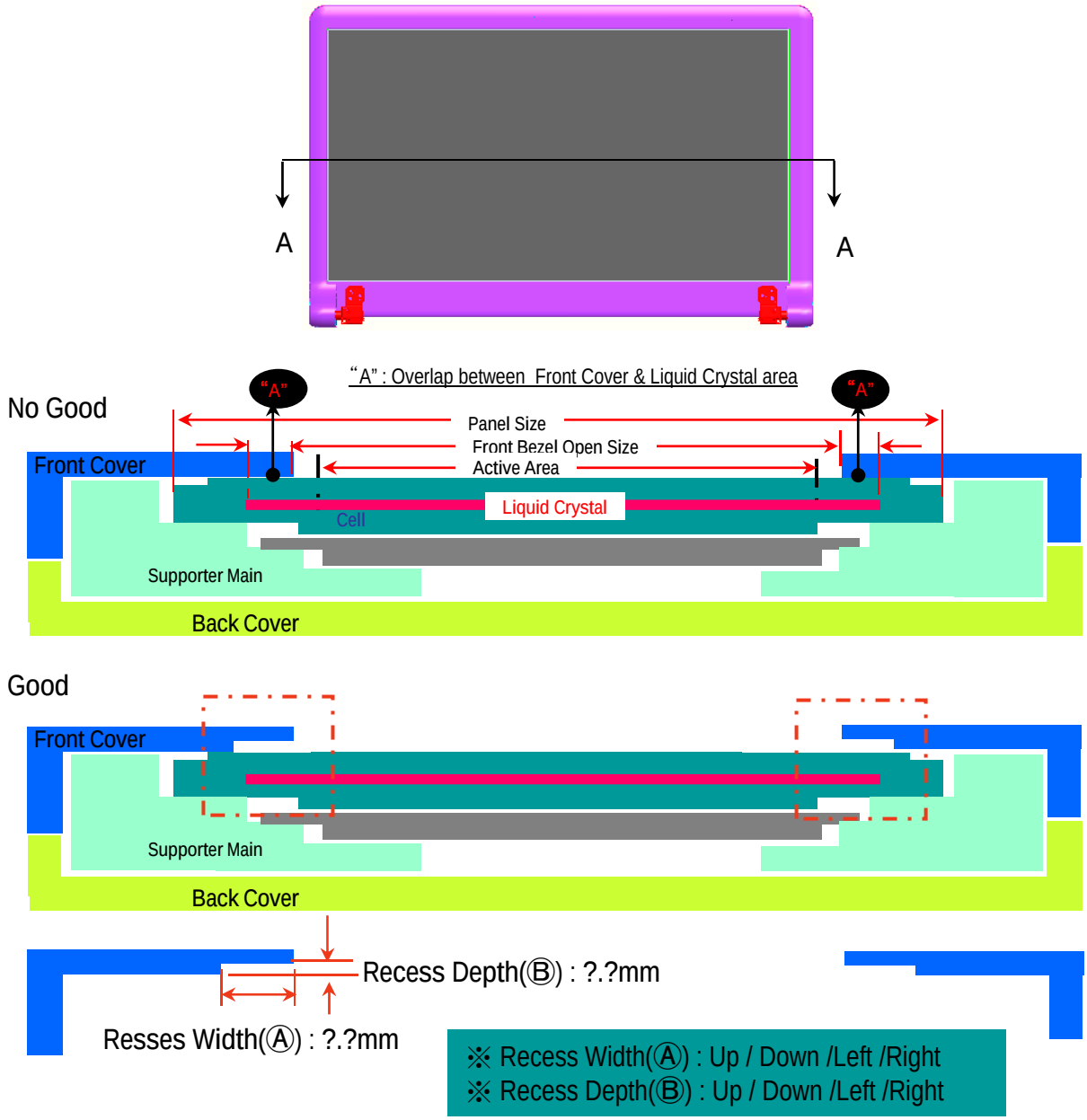
7	Checking the path of System eDP Cable.



Notes	1. At least 1.0mm gap (Ⓐ) is required to secure from any damage by overlapping system cable and LCM (This overlap may cause a Abnormal Display after hinge test)
	2.”Flat” type of eDP cable is more recommended than “Cylinderical” type . 3. Making eDP Cable Guide will give better performance . (Refer to detail “A”)

LGD Proposal for system cover design. (Appendix A)

8	Securing additional gap between front cover & LCD at edge of front cover.



Notes	1.Active area which is filled with Liquid Crystal is sensitive against external stress, so additional gap to make recess area on the edge of front cover will be helpful to prevent mechanical Ripple. (Dimension of Recess depends on each model design)

APPENDIX B. Enhanced Extended Display Identification Data (EEDID™) 1/3

	Byte (Dec)	Byte (Hex)	Field Name and Comments	Value (Hex)	Value (Bin)
Header	0	00	Header	00	00000000
	1	01	Header	FF	11111111
	2	02	Header	FF	11111111
	3	03	Header	FF	11111111
	4	04	Header	FF	11111111
	5	05	Header	FF	11111111
	6	06	Header	FF	11111111
	7	07	Header	00	00000000
EDID Vendor / Product Version	8	08	ID Manufacture Name LGD	30	00110000
	9	09	ID Manufacture Name	E4	11100100
	10	0A	ID Product Code 024Fh	4F	01001111
	11	0B	(Hex. LSB first)	02	00000010
	12	0C	ID Serial No. - Optional ("00h" if not used, Number Only and LSB First)	00	00000000
	13	0D	ID Serial No. - Optional ("00h" if not used, Number Only and LSB First)	00	00000000
	14	0E	ID Serial No. - Optional ("00h" if not used, Number Only and LSB First)	00	00000000
	15	0F	ID Serial No. - Optional ("00h" if not used, Number Only and LSB First)	00	00000000
	16	10	Week of Manufacture - Optinal 00 weeks	00	00000000
	17	11	Year of Manufacture 2010 years	14	00010100
	18	12	EDID structure version # = 1	01	00000001
	19	13	EDID revision # = 4	04	00000100
Display Parameters	20	14	Video input Definition = Input is a Digital Video signal Interface , Colo Bit Depth : Color Bit Depth is undefined , Digital Video Interface Standard Supported: Digital Interface is not defined	80	10000000
	21	15	Horizontal Screen Size (Rounded cm) = 26 cm26 cm	1A	00011010
	22	16	Vertical Screen Size (Rounded cm) = 16 cm16 cm	10	00010000
	23	17	Display Transfer Characteristic (Gamma) = (gamma*100)-100 = Example:(2.2*100)-100=120 = 2.2 Gamma	78	01111000
	24	18	Feature Support [Display Power Management(DPM) : Standby Mode is not supported, Suspend Mode is not supported, Active Off = Very Low Power is not supported ,Supportted Color Encoding Formats : RGB 4:4:4 ,Other Feature Support Flags : No_sRGB, Preferred Timing Mode, No_Display is continuous frequency (Multi-mode_Base EDID and Extension Block).]	02	00000010
Panel Color Coordinates	25	19	Red/Green Low Bits (RxRy/GxGy)	BA	10111010
	26	1A	Blue/White Low Bits (BxBy/WxWy)	95	10010101
	27	1B	Red X Rx = 0.592	97	10010111
	28	1C	Red Y Ry = 0.351	59	01011001
	29	1D	Green X Gx = 0.334	55	01010101
	30	1E	Green Y Gy = 0.549	8C	10001100
	31	1F	Blue X Bx = 0.154	27	00100111
	32	20	Blue Y By = 0.130	21	00100001
	33	21	White X Wx = 0.313	50	01010000
	34	22	White Y Wy = 0.329	54	01010100
Established	35	23	Established timing 1 (Optional_00h if not used)	00	00000000
	36	24	Established timing 2 (Optional_00h if not used)	00	00000000
	37	25	Manufacturer's timings (Optional_00h if not used)	00	00000000
Standard Timing ID	38	26	Standard timing ID 1 (Optional_01h if not used)	01	00000001
	39	27	Standard timing ID 1 (Optional_01h if not used)	01	00000001
	40	28	Standard timing ID 2 (Optional_01h if not used)	01	00000001
	41	29	Standard timing ID 2 (Optional_01h if not used)	01	00000001
	42	2A	Standard timing ID 3 (Optional_01h if not used)	01	00000001
	43	2B	Standard timing ID 3 (Optional_01h if not used)	01	00000001
	44	2C	Standard timing ID 4 (Optional_01h if not used)	01	00000001
	45	2D	Standard timing ID 4 (Optional_01h if not used)	01	00000001
	46	2E	Standard timing ID 5 (Optional_01h if not used)	01	00000001
	47	2F	Standard timing ID 5 (Optional_01h if not used)	01	00000001
	48	30	Standard timing ID 6 (Optional_01h if not used)	01	00000001
	49	31	Standard timing ID 6 (Optional_01h if not used)	01	00000001
	50	32	Standard timing ID 7 (Optional_01h if not used)	01	00000001
	51	33	Standard timing ID 7 (Optional_01h if not used)	01	00000001
	52	34	Standard timing ID 8 (Optional_01h if not used)	01	00000001
	53	35	Standard timing ID 8 (Optional_01h if not used)	01	00000001

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

	Byte (Dec)	Byte (Hex)	Field Name and Comments	Value (Hex)	Value (Bin)
Timing Descriptor #1	54	36	Pixel Clock/10,000 (LSB) 69.3 MHz @ 60Hz	12	00010010
	55	37	Pixel Clock/10,000 (MSB)	1B	00011011
	56	38	Horizontal Active (lower 8 bits) 1280 Pixels	00	00000000
	57	39	Horizontal Blanking(Thp-HA) (lower 8 bits) 128 Pixels	80	10000000
	58	3A	Horizontal Active / Horizontal Blanking(Thp-HA) (upper 4:4bits)	50	01010000
	59	3B	Vertical Aavtive 800 Lines	20	00100000
	60	3C	Vertical Blanking (Tvp-HA) (DE Blanking typ for DE only panels) 20 Lines	14	00010100
	61	3D	Vertical Active : Vertical Blanking (Tvp-HA) (upper 4:4bits)	30	00110000
	62	3E	Horizontal Sync. Offset (Thfp) 24 Pixels	18	00011000
	63	3F	Horizontal Sync Pulse Width (HSPW) 32 Pixels	20	00100000
	64	40	Vertical Sync Offset(Tvfp) : Sync Width (VSPW) 4 Lines : 4 Lines	44	01000100
	65	41	Horizontal Vertical Sync Offset/Width (upper 2bits)	00	00000000
	66	42	Horizontal Image Size (mm) 260 mm	04	00000100
	67	43	Vertical Image Size (mm) 160 mm	A0	10100000
	68	44	Horizontal Image Size / Vertical Image Size	10	00010000
	69	45	Horizontal Border = 0 (Zero for Notebook LCD)	00	00000000
	70	46	Vertical Border = 0 (Zero for Notebook LCD)	00	00000000
	71	47	Non-Interlace, Normal display, no stereo, Digital Separate [Vsync_NEG, Hsync_NEG (outside of V-sync)]	18	00011000
Timing Descriptor #2	72	48	Pixel Clock/10,000 (LSB) 46.2 MHz @ 40Hz	0C	00001100
	73	49	Pixel Clock/10,000 (MSB)	12	00010010
	74	4A	Horizontal Active (lower 8 bits) 1280 Pixels	00	00000000
	75	4B	Horizontal Blanking(Thp-HA) (lower 8 bits) 128 Pixels	80	10000000
	76	4C	Horizontal Active / Horizontal Blanking(Thp-HA) (upper 4:4bits)	50	01010000
	77	4D	Vertical Aavtive 800 Lines	20	00100000
	78	4E	Vertical Blanking (Tvp-HA) (DE Blanking typ for DE only panels) 20 Lines	14	00010100
	79	4F	Vertical Active : Vertical Blanking (Tvp-HA) (upper 4:4bits)	30	00110000
	80	50	Horizontal Sync. Offset (Thfp) 24 Pixels	18	00011000
	81	51	Horizontal Sync Pulse Width (HSPW) 32 Pixels	20	00100000
	82	52	Vertical Sync Offset(Tvfp) : Sync Width (VSPW) 4 Lines : 4 Lines	44	01000100
	83	53	Horizontal Vertical Sync Offset/Width (upper 2bits)	00	00000000
	84	54	Horizontal Image Size (mm) 260 mm	04	00000100
	85	55	Vertical Image Size (mm) 160 mm	A0	10100000
	86	56	Horizontal Image Size / Vertical Image Size	10	00010000
	87	57	Horizontal Border = 0 (Zero for Notebook LCD)	00	00000000
	88	58	Vertical Border = 0 (Zero for Notebook LCD)	00	00000000
	89	59	Non-Interlace, Normal display, no stereo, Digital Separate [Vsync_NEG, Hsync_NEG (outside of V-sync)]	18	00011000
Timing Descriptor #3	90	5A	Blank for nvDPS	00	00000000
	91	5B	Blank for nvDPS	00	00000000
	92	5C	Blank for nvDPS	00	00000000
	93	5D	Blank for nvDPS	00	00000000
	94	5E	Blank for nvDPS	00	00000000
	95	5F	Blank for nvDPS	00	00000000
	96	60	Blank for nvDPS	00	00000000
	97	61	Blank for nvDPS	00	00000000
	98	62	Blank for nvDPS	00	00000000
	99	63	Blank for nvDPS	00	00000000
	100	64	Blank for nvDPS	00	00000000
	101	65	Blank for nvDPS	00	00000000
	102	66	Blank for nvDPS	00	00000000
	103	67	Blank for nvDPS	00	00000000
	104	68	Blank for nvDPS	00	00000000
	105	69	Blank for nvDPS	00	00000000
	106	6A	Blank for nvDPS	00	00000000
	107	6B	Blank for nvDPS	00	00000000

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

	Byte (Dec)	Byte (Hex)	Field Name and Comments	Value (Hex)	Value (Bin)
Timing Descriptor #4	108	6C	Detailed Timing Descriptions #4	00	00000000
	109	6D	Flag	00	00000000
	110	6E	Reserved	00	00000000
	111	6F	For Brightness Table and Power consumption	02	00000010
	112	70	Flag	00	00000000
	113	71	PWM % [7:0] @ Step 0 6 % @ 12 nit	0F	00001111
	114	72	PWM % [7:0] @ Step 5 27 % @ 60 nit	44	01000100
	115	73	PWM % [7:0] @ Step 10 90 % @ 200 nit	E5	11100101
	116	74	Nits [7:0] @ Step 0	0C	00001100
	117	75	Nits [7:0] @ Step 5	3C	00111100
	118	76	Nits [7:0] @ Step 10	64	01100100
	119	77	Panel Electronicx Power @ 32 x 32 Chess Pattern = 950 mW	18	00011000
	120	78	Backlight Power @ 60 nits = 860 mW	16	00010110
	121	79	Backlight Power @ Step 10 = 3120 mW	27	00100111
	122	7A	Nits @ 100% PWM Duty = 200 nit	64	01100100
	123	7B	Flag	00	00000000
	124	7C	Flag	00	00000000
	125	7D	Flag	00	00000000
	126	7E	Extension flag (# of optional 128 panel ID extension block to follow, Typ = 0)	00	00000000
Checksum	127	7F	Check Sum (The 1-byte sum of all 128 bytes in this panel ID block shall = 0)	66	01100110