LG Display

LP141WP2
Liquid Crystal Display

Product Specification

SPECIFICATION
FOR
APPROVAL

( ) **Preliminary Specification**
(●) **Final Specification**

Title	14.1" WXGA+ TFT LCD

BUYER	Lenovo
MODEL	Malibu-3

SUPPLIER	LG Display Co., Ltd.
*MODEL	LP141WP2
Suffix	TLB1

*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
K. J. Kwon / S.Manager	
REVIEWED BY	
G. J. Han / Manager	
PREPARED BY	
K. Y. Kwon / Engineer	

Product Engineering Dept.
LG Display Co., Ltd

Contents

RECORD OF REVISIONS

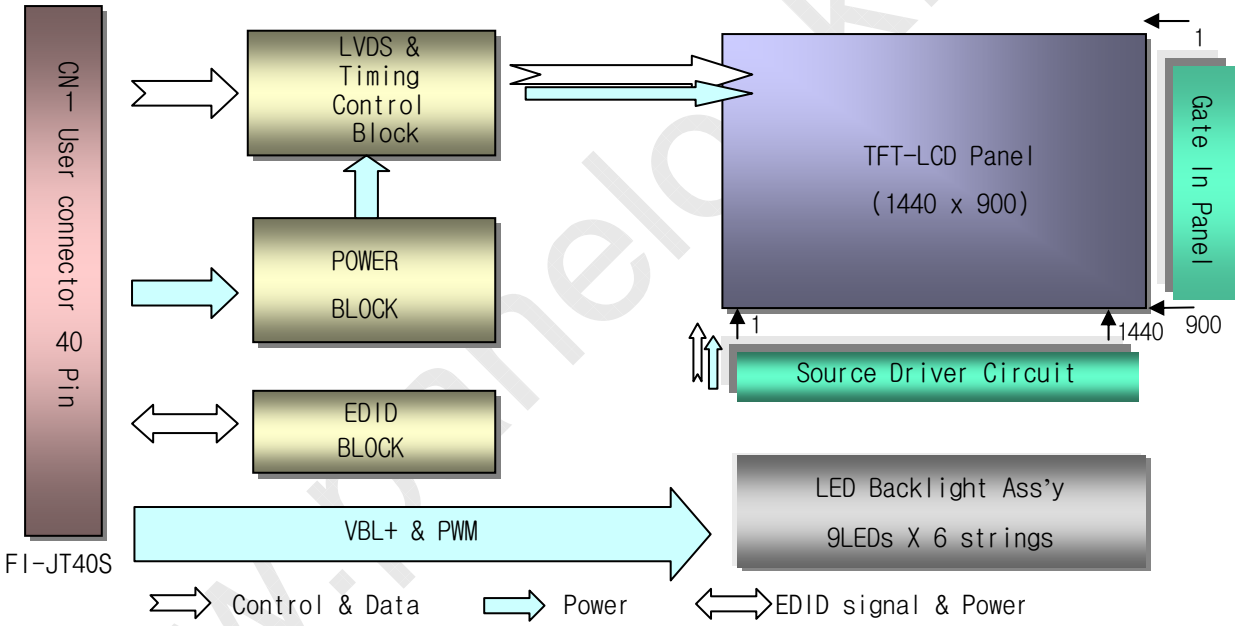
Revision No	Revision Date	Page	Description	EDID ver
0.0	1. Oct. 2007	-	First Draft (Preliminary Specification)	0.0
0.1	13. Mar. 2008	3	Change pixel strip structure (BGR→RGB)	
		5	Update LED Backlight Spec.	
		29~31	Update EDID Data	1.3
0.2	26. Mar. 2008	5	Update LED PWM Spec.	
		10	Update Signal Timing Spec. for WWAN	
		29~31	Update EDID Data	1.4
1.0	14. Apr. 2008	5	Update LED Backlight Spec.	
		-	Final Specification	
1.1	22. Apr. 2008	10	Update Timing table	
		12	T4 timing change (200→0)	

1. General Description

The LP141WP2 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 14.1 inches diagonally measured active display area with WXGA+ resolution(1440 horizontal by 900 vertical 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 LP141WP2 has been designed to apply the interface method that enables low power, high speed, low EMI.

The LP141WP2 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 LP141WP2 characteristics provide an excellent flat display for office automation products such as Notebook PC.



General Features

Active Screen Size	14.1 inches diagonal
Outline Dimension	319.5 (H) × 206.5 (V) × 5.5(D, max.) mm
Pixel Pitch	0.2106 mm × 0.2106 mm
Pixel Format	1440 horiz. by 900 vert. Pixels RGB strip arrangement
Color Depth	6-bit, 262,144 colors
Luminance, White	250 cd/m^2(Typ., @I_{LED}=15mA) , 5 points Average
Power Consumption	Total 4.61Watt @ LCM circuit 1.42W(Typ.), B/L 2.59 W (Typ.), LED Driver 0.6W(Typ.)
Weight	360g(Max.)
Display Operating Mode	Transmissive mode, normally white
Surface Treatment	Haze44% (ARC150T)
RoHS Comply	Yes

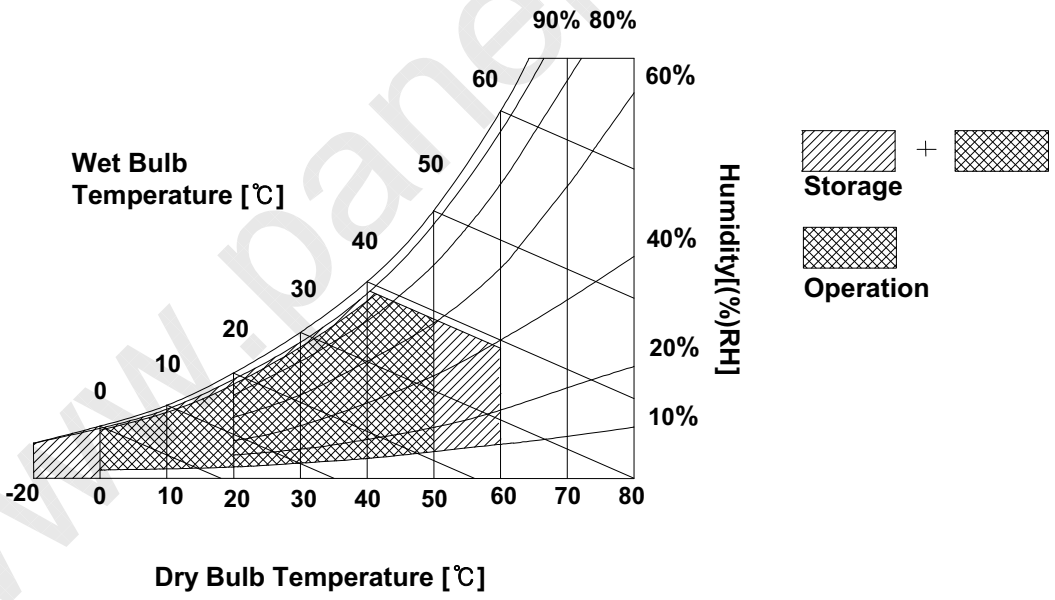
2. Absolute Maximum Ratings

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 LP141WP2 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 LED BLU.

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 (Window desktop pattern)	I_{CC}	365	430	495	mA	1
Power Consumption (Window desktop pattern)	Pc	-	1.42	1.63	Watt	1
Differential Impedance	Zm	90	100	110	Ohm	2
LED Backlight :						
Operating Voltage	V_{LED}	-	28.8	30.6	V	3
Operating Current per string	I_{LED}	-	15	-	mA	4
Power Consumption (dimming 100%)	P_{BL}	-	2.59	2.75	Watt	-
LED Driver power consumption	P_{Driver}	-	0.6	-	Watt	-
Life Time		10,000	-	-	Hrs	5
BL Input Voltage	BL_VCC	7	15	26	V	
PWM input signal :						
Input Frequency (for operating)	-	100	-	500	Hz	6
Input Frequency (for wavy)	-	220	225	230	Hz	
on threshold	-	2.1	-	-	V	
off threshold	-	-	-	0.8	V	
Duty Cycle	-	12.5	-	100	%	7, 8

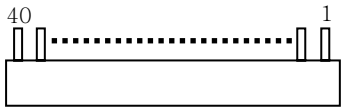
Note)

1. The specified current and power consumption are under the Vcc = 3.3V , 25℃, fv = 60Hz condition whereas Window desktop 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 variance of the voltage is ± 10%.
4. The typical operating current is for the typical surface luminance (L_{WH}) in optical characteristics. I_{LED} is the current of each LEDs' string, LED backlight has 6 strings on it.
5. The life time is determined as the time at which brightness of LED is 50% compare to that of initial value at the typical LED current.
6. LED Driver operating Frequency
7. There may be a flickering Under 6% dimming.
8. There is no reliability issue. (Under 12.5% duty cycle)
9. There is no reliability issue beyond input frequency 220 ~ 230. It is optimized frequency for wavy noise.

3-2. Interface Connections

This LCD employs two interface connections, a 40 pin connector is used for the module electronics interface and the other connector is used for the internal backlight system.
The electronics interface connector is a model FI-JT40S manufactured by JAE.

Table 3. MODULE CONNECTOR PIN CONFIGURATION (CN1)

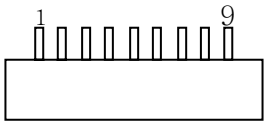
Pin	Symbol	Description	Notes
1	VSS	Ground/Connector test	1, Interface chips 1.1 LCD : SiW, ST2_BS (LCD Controller) including LVDS Receiver 1.2 System : * Pin to Pin compatible with LVDS 2.Connector 2.1 LCD :JAE FI-JT40S (1.0 mm thickness, lock-in type) 2.2 Mating:JAE FI-JT40 series or equivalent 2.3 Connector pin arrangement LCD rear view  [LCD Module Rear View]
2	VDD	Power Supply(3.3V typ.)	
3	VDD	Power Supply(3.3V typ.)	
4	VDD	Power Supply(3.3V typ.)	
5	V_EDID	DDC 3.3V power	
6	CLK_EDID	DDC Clock	
7	DATA_EDID	DDC Data	
8	Odd_Rin0-	Negative LVDS differential data input	
9	Odd_Rin0+	Positive LVDS differential data input	
10	VSS1	Ground	
11	Odd_Rin1-	Negative LVDS differential data input	
12	Odd_Rin1+	Positive LVDS differential data input	
13	VSS2	Ground	
14	Odd_Rin2-	Negative LVDS differential data input	
15	Odd_Rin2+	Positive LVDS differential data input	
16	VSS3	Ground	
17	Odd_ClkIN-	Negative LVDS differential clock input	
18	Odd_ClkIN+	Positive LVDS differential clock input	
19	VSS4	Ground	
20	Even_Rin0-	Negative LVDS differential data input	
21	Even_Rin0+	Positive LVDS differential data input	
22	VSS5	Ground	
23	Even_Rin1-	Negative LVDS differential data input	
24	Even_Rin1+	Positive LVDS differential data input	
25	VSS6	Ground	
26	Even_Rin2-	Negative LVDS differential data input	
27	Even_Rin2+	Positive LVDS differential data input	
28	VSS7	Ground	
29	Even_ClkIN-	Negative LVDS differential clock input	
30	Even_ClkIN+	Positive LVDS differential clock input	

31	BL_ON	Backlight On/Off Control	
32	BL_PWM	PWM for luminance control	
33	VSS	Ground	
34	BL_VCC	7V ~ 26V LED power	
35	BL_VCC	7V ~ 26V LED power	
36	BL_VCC	7V ~ 26V LED power	
37	BL_VSS	LED power return	
38	BL_VSS	LED power return	
39	BL_VSS	LED power return	
40	NC	No connection	

Note1)
BL_ON voltage supply more than 0.8V.

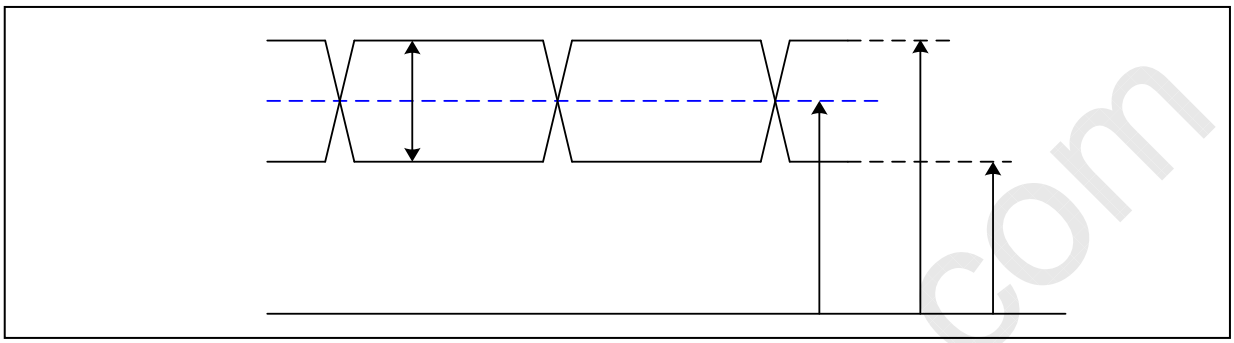
The LED backlight connector is a model TF12-9S-0.5H, manufactured by Hirose.

Table 4. BACKLIGHT CONNECTOR PIN CONFIGURATION (CN2)

Pin	Symbol	Description	Notes
1	Vdc(1,2,3,4,5,6)	LED Anode(Positive)	
2	Vdc(1,2,3,4,5,6)	LED Anode(Positive)	
3	NC	No Connection	
4	Vdc1	LED Cathode (Negative)	
5	Vdc2	LED Cathode (Negative)	
6	Vdc3	LED Cathode (Negative)	
7	Vdc4	LED Cathode (Negative)	
8	Vdc5	LED Cathode (Negative)	
9	Vdc6	LED Cathode (Negative)	

3-3. LVDS Signal Timing Specifications

3-3-1. DC Specification

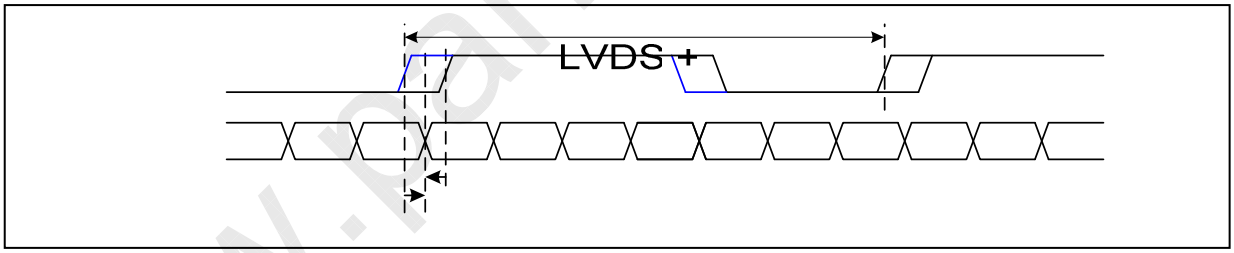


Description	Symbol	Min	Max	Unit	Notes
LVDS Differential Voltage	$\|V_{ID}\|$	100	600	mV	-
LVDS Common mode Voltage	V_{CM}	0.6	1.8	V	-
LVDS Input Voltage Range	V_{IN}	0.3	2.1	V	-

LVDS -

$|V_{ID}|$

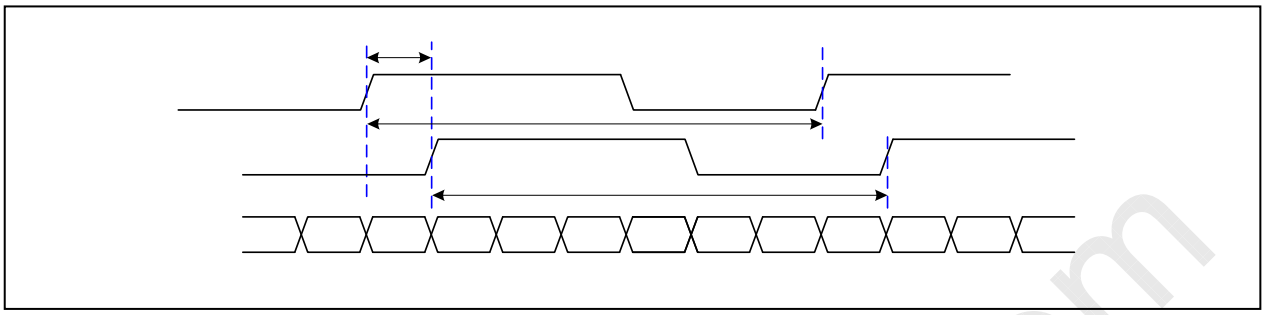
3-3-2. AC Specification



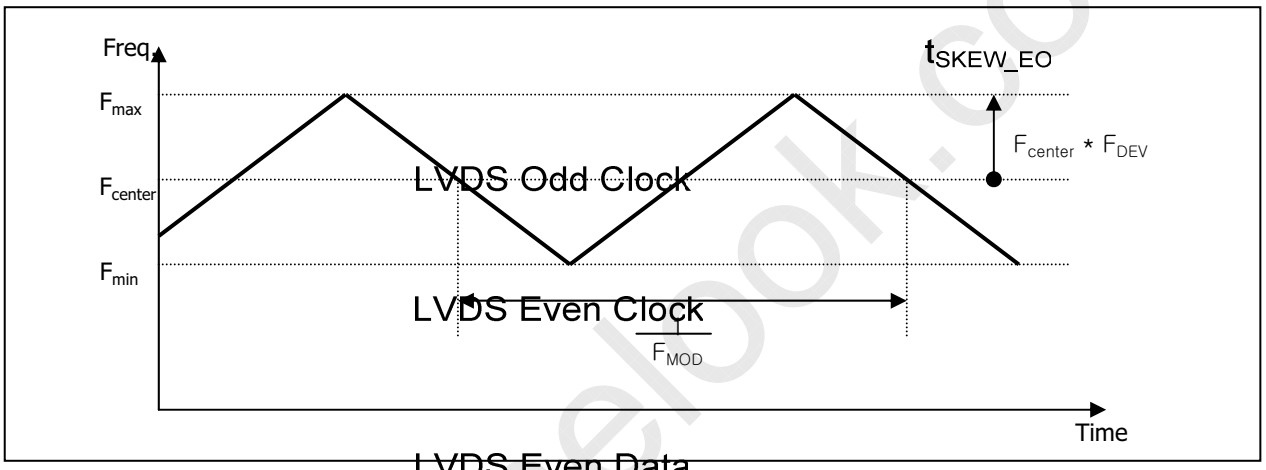
Description	Symbol	Min	Max	Unit	Notes
LVDS Clock to Data Skew Margin	t_{SKEW}	- 400	+ 400	ps	85MHz > Fclk ≥ 65MHz
	t_{SKEW}	- 600	+ 600	ps	65MHz > Fclk ≥ 25MHz
LVDS Clock to Clock Skew Margin (Even to Odd)	t_{SKEW_EO}	- 1/7	+ 1/7	T_{clk}	-
Maximum deviation of input clock frequency during SSC	F_{DEV}	-	± 3	%	-
Maximum modulation frequency of input clock during SSC	F_{MOD}	-	200	KHz	-

0V

$|V_{ID}| = |(LVDS+) - (LVDS-)|$
$V_{CM} = \{(LVDS+) + (LVDS-)\}/2$



< Clock skew margin between channel >

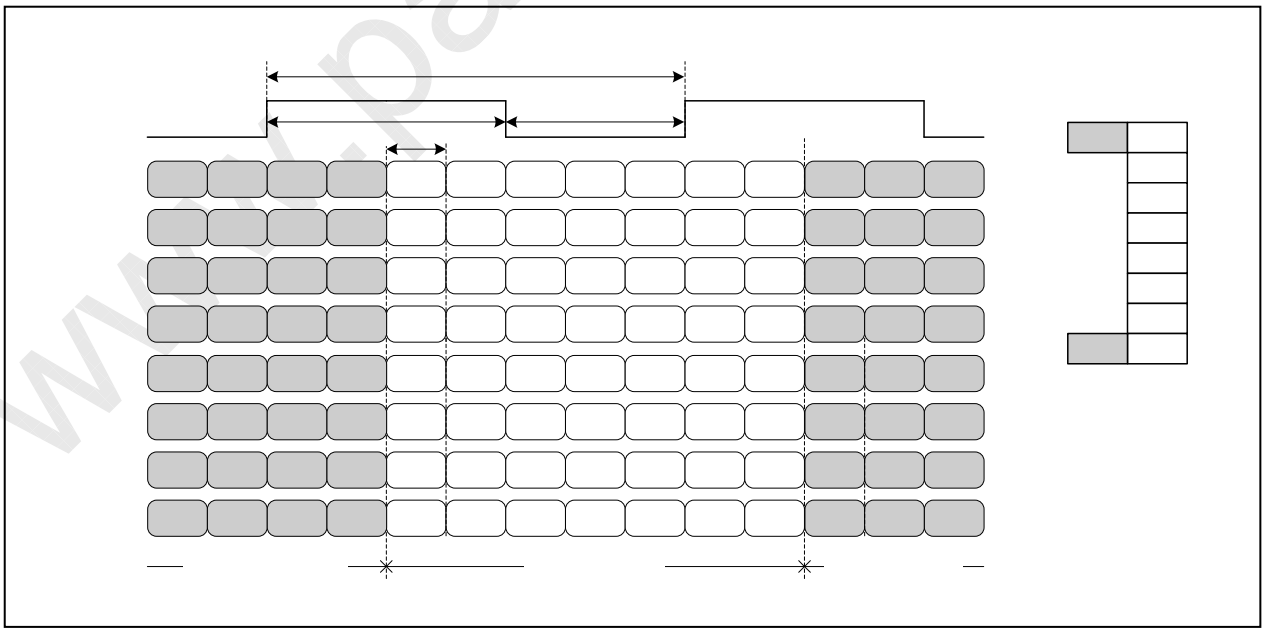


T_{clk}

< Spread Spectrum >

3-3-3. Data Format

- LVDS 2 Port



< LVDS Data Format >

3-3-4. Signal Timing Specifications

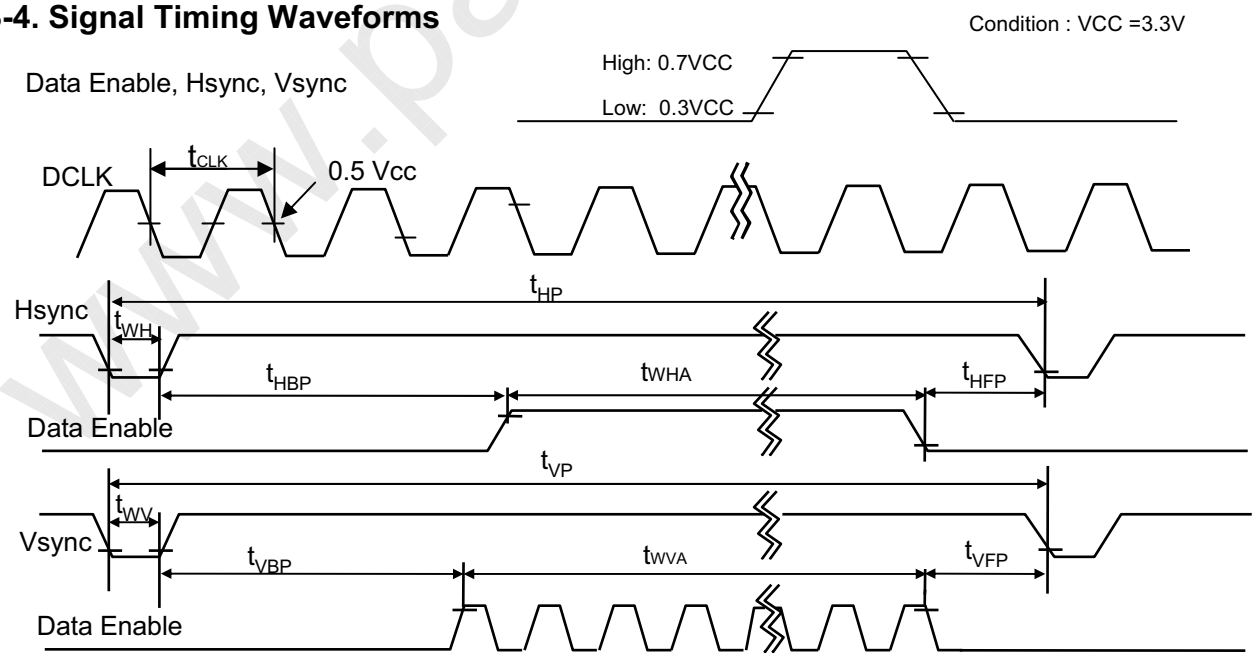
This is the signal timing required at the input of the User connector. All of the interface signal timing should be satisfied with the following specifications and specifications of LVDS Tx/Rx for its proper operation.

Table 5. TIMING TABLE

ITEM	Symbol		Min	Typ	Max	Unit	Note
DCLK	Frequency	f_{CLK}	-	50.8	-	MHz	
Hsync	Period	Thp	896	912	928	tCLK	
	Width	t_{WH}	16	16	16		
	Width-Active	t_{WHA}	720	720	720		
Vsync	Period	t_{VP}	920	926	939	tHP	
	Width	t_{WV}	3	6	10		
	Width-Active	t_{WVA}	900	900	900		
Data Enable	Horizontal back porch	t_{HBP}	144	152	160	tCLK	
	Horizontal front porch	t_{HFP}	20	24	28		
	Vertical back porch	t_{VBP}	12	17	23	tHP	
	Vertical front porch	t_{VFP}	2	3	6		

Note)
1. In this documentation, all reliabilities are specified for timing specification based on refresh rate of 60Hz. However, LP141WP2 has a good actual performance even at lower refresh rate(eg. 40Hz or 50Hz) for power saving mode, whereas LP141WP2 is secured only for function under lower refresh rate. 60Hz at Normal mode, 50Hz ,40 Hz at Power save mode. Don't care Flicker level (power save mode).

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 6. 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

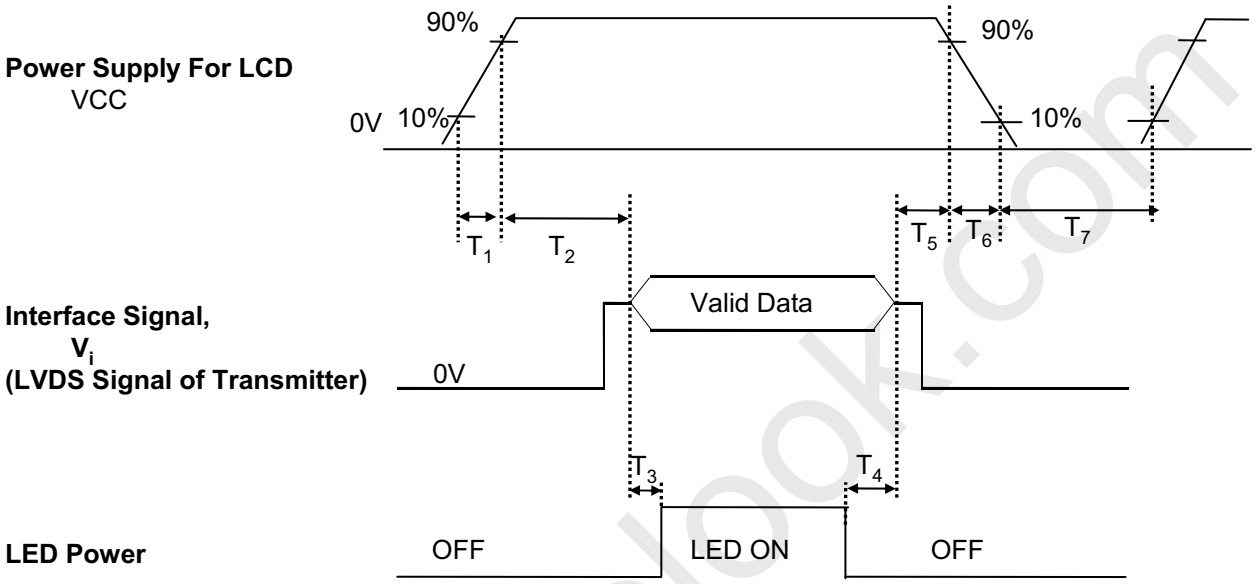


Table 7. POWER SEQUENCE TABLE

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	-	10	(ms)
T_7	150	-	-	(ms)

Note)
1. Valid Data is Data to meet “3-3. LVDS Signal Timing Specifications”
2. Please avoid floating state of interface signal at invalid period.
3. When the interface signal is invalid, be sure to pull down the power supply for LCD VCC to 0V.
4. 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 20 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

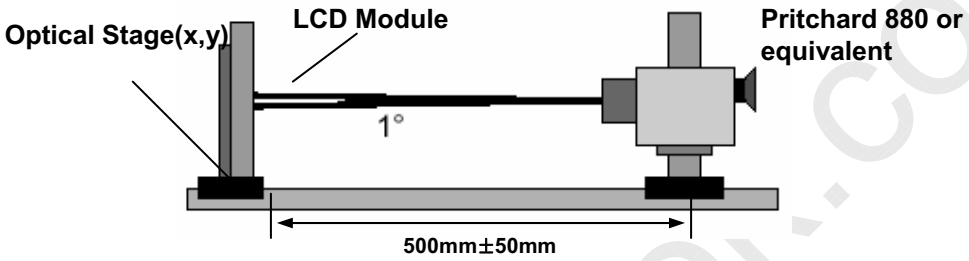


Table 8. OPTICAL CHARACTERISTICS

Ta=25°C, VCC=3.3V, fv=60Hz, f_{CLK}= 102MHz, I_{LED} = 15mA

Parameter	Symbol	Values			Units	Notes
		Min	Typ	Max		
Contrast Ratio	CR	-	300	-		1
Surface Luminance, white	L_{WH}	210	250	-	cd/m^2	2
Luminance Variation(13points)	δ_{WHITE}	60	70		%	3
Luminance Variation(5points)		70	80		%	
Response Time	Tr_R+ Tr_D		16	25	ms	4
Color Coordinates						
RED	RX	0.547	0.577	0.607		
	RY	0.319	0.349	0.379		
GREEN	GX	0.299	0.329	0.359		
	GY	0.520	0.550	0.580		
BLUE	BX	0.132	0.162	0.192		
	BY	0.103	0.133	0.163		
WHITE	WX	0.283	0.313	0.343		+/- 0.030
	WY	0.299	0.329	0.359		+/- 0.030
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	15	20	-	degree	
y axis, down (Φ=270°)	Θd	35	40	-	degree	
Gray Scale						6

Table 9. Color Chromaticity

	White		Red		Green		Blue	
	Wx	Wy	Rx	Ry	Gx	Gy	Bx	By
Max.	0.343	0.359	0.607	0.379	0.359	0.580	0.192	0.163
Typ.	0.313	0.329	0.577	0.349	0.329	0.550	0.162	0.133
Min.	0.283	0.299	0.547	0.319	0.299	0.520	0.132	0.103

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 5point (1~5)average across the LCD surface 50cm from the surface with all pixels displaying white. For more information see FIG 2.
   When I_{LED}= 15mA, L_{WH}=250cd/m^2(Typ.)

3. Luminance variation is measured for 13 point For more information see FIG 2.
   δ WHITE = [Minimum(LN1,LN2, ….. LN13) ÷ Maximum(LN1,LN2, ….. LN13)] X 100(%)

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

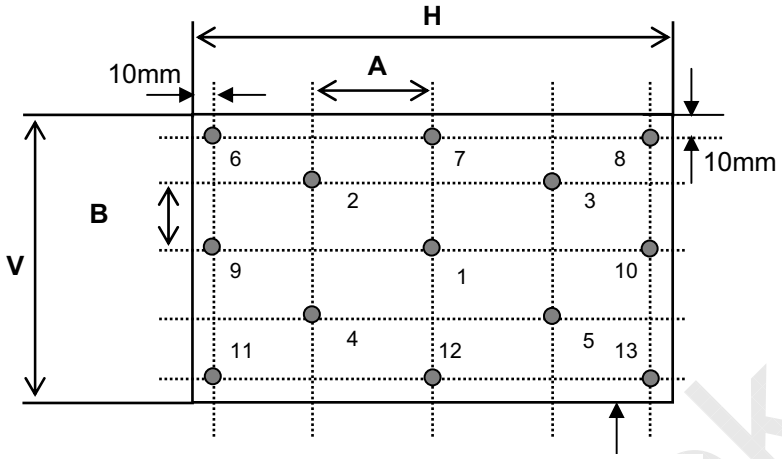
5. Viewing angle is the angle at which the contrast ratio is greater than 10. The angles are determined for the horizontal or x axis and the vertical or y axis with respect to the z axis which is normal to the LCD surface. For more information see FIG 4.

6. Gray scale specification * f_V=60Hz

Gray Level	Luminance [%] (Typ)
L0	0.33
L7	1.47
L15	4.5
L23	10.7
L31	19.9
L39	33.0
L47	50.8
L55	73.0
L63	100

FIG. 2 Luminance

<Measuring point for Average Luminance & measuring point for Luminance variation>



H,V : ACTIVE AREA
A : H/4 mm
B : V/4 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”.

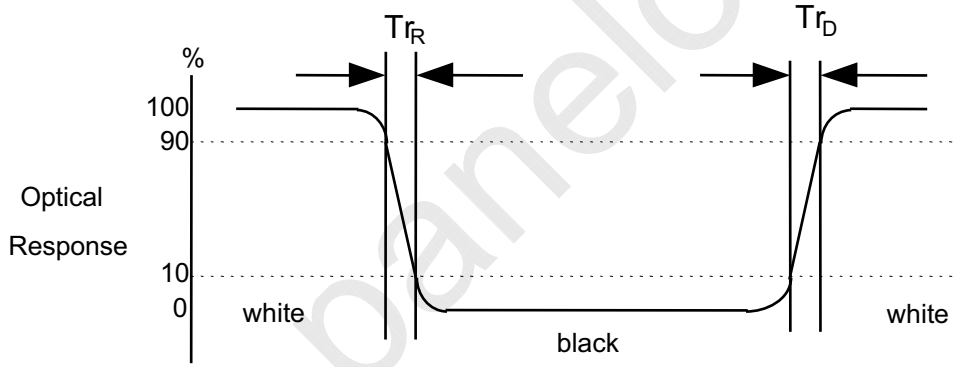
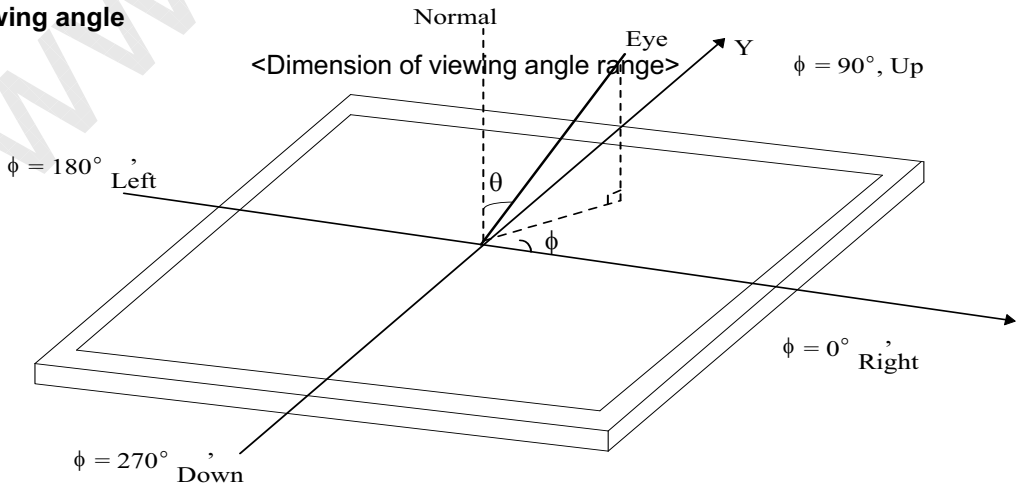


FIG. 4 Viewing angle



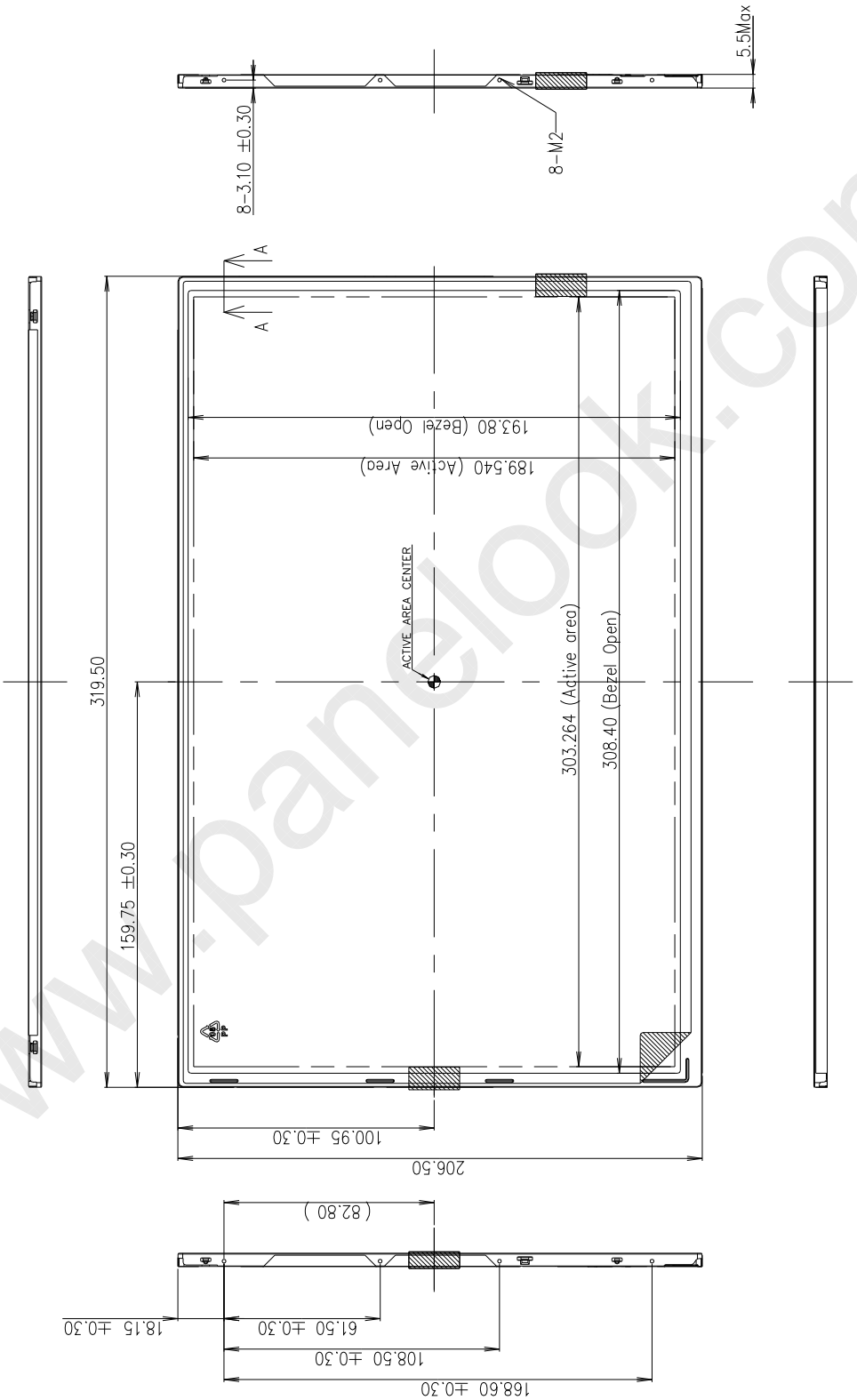
5. Mechanical Characteristics

The contents provide general mechanical characteristics for the model LP141WP2.
In addition the figures in the next page are detailed mechanical drawing of the LCD.

Outline Dimension	Horizontal	319.5 ± 0.50mm
	Vertical	206.5 ± 0.50mm
	Depth	5.5mm(Max.)
Bezel Area	Horizontal	308.4mm
	Vertical	193.8mm
Active Display Area	Horizontal	303.264mm
	Vertical	189.54 mm
Weight	360g (Max.)	
Surface Treatment	Haze44% (ARC150T)	

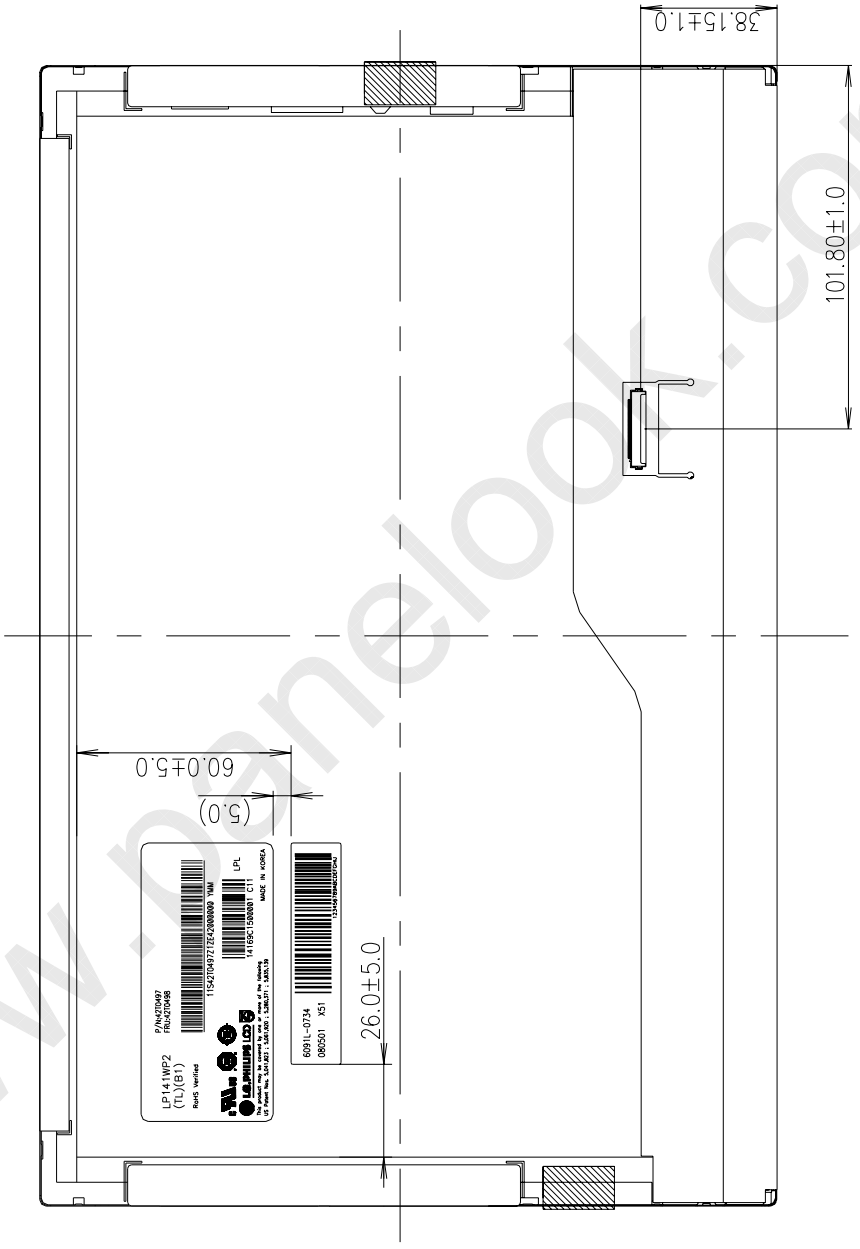
<FRONT VIEW>

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

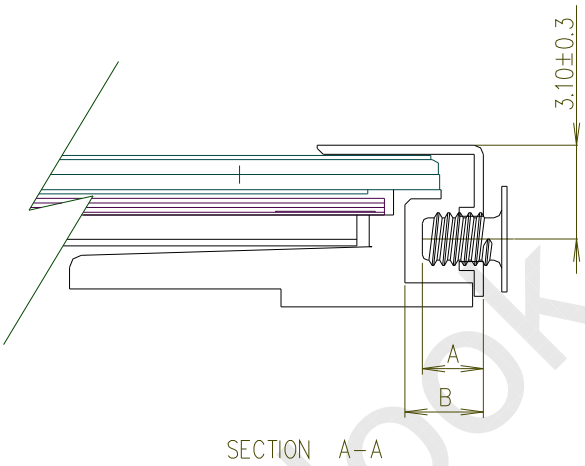


<REAR VIEW>

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



[DETAIL DESCRIPTION OF SIDE MOUNTING SCREW]

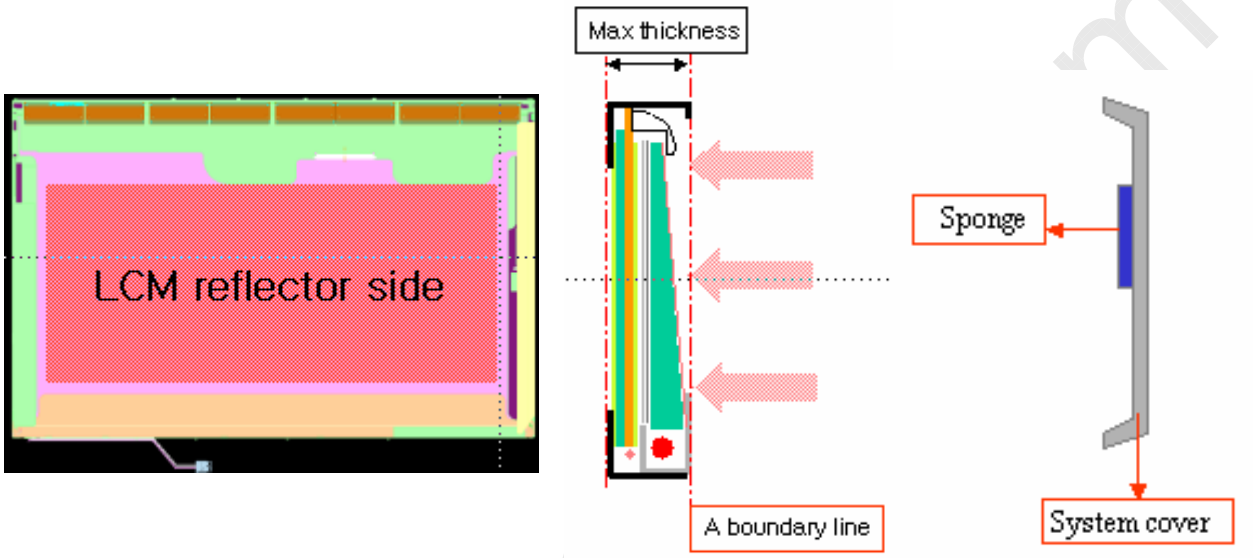


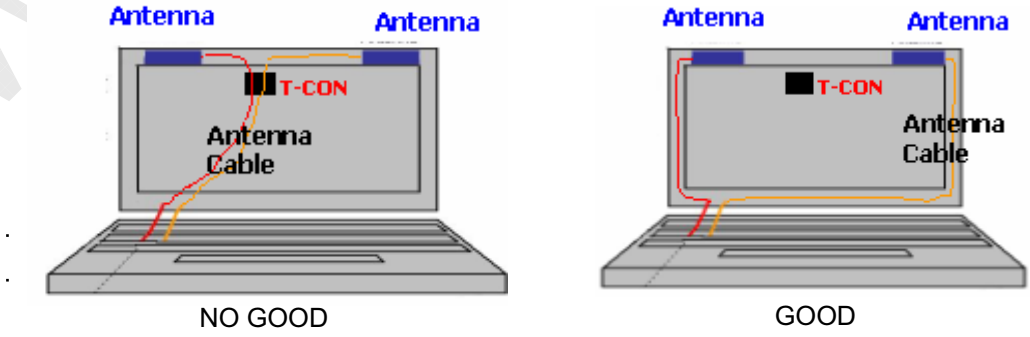
* Mounting screw length (A) : 2.0(Min.) / 2.5mm(Max.)
* Mounting screw hole Depth (B) : 2.5mm(Min.)
* Mounting hole location : 3.1mm(Typ.)
* Torque : 2.0(Min.) / 2.5kgf.cm(Max.)
  (Measurement gauge : Torque meter)

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.

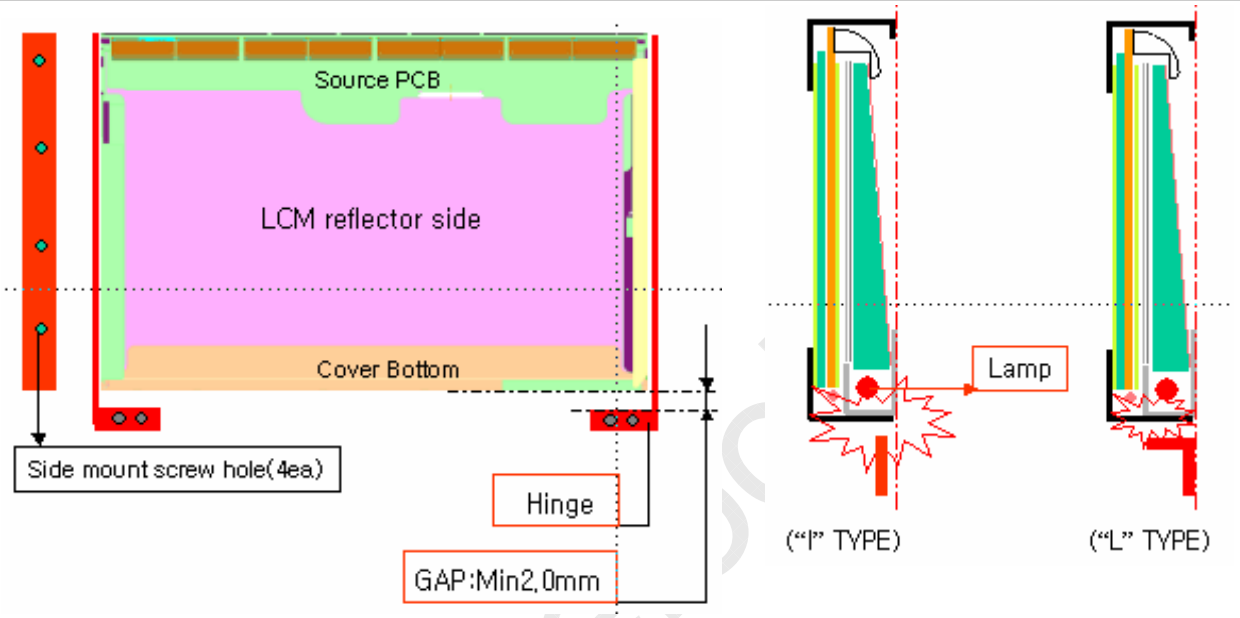
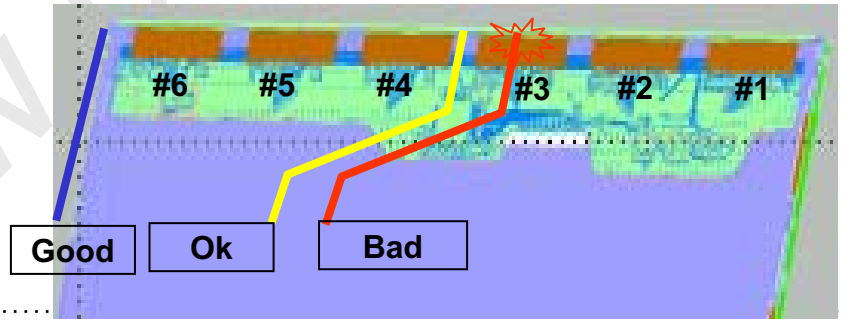
LPL Proposal for system cover design.(Appendix)

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



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

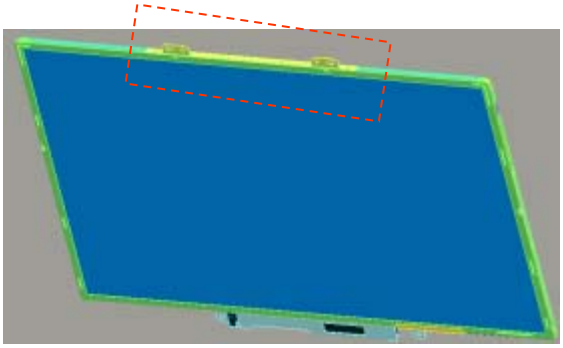
LPL Proposal for system cover design.

3	Gap check for securing the enough gap between LCM and System hinge.	
		
Define	1.At least 2.0mm of gap needs to be secured to prevent the shock related defects. 2."L" type of hinge is recommended than "I" type under shock test.	
4	Checking the path of the System wire.	
		
Define	1.COF area needs to be handled with care. 2.GOOD ➔Wire path design to system side. OK➔ Wire path is located between COFs. BAD➔Wire path overlapped with COF area.	

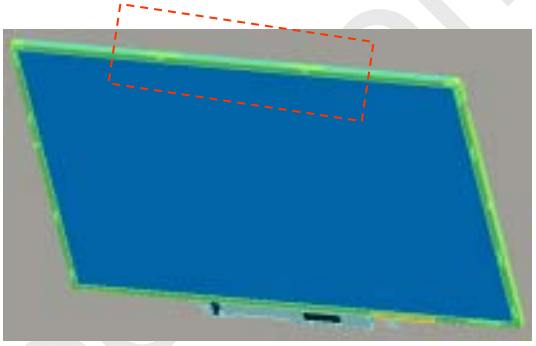
LPL Proposal for system cover design.

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

bracket

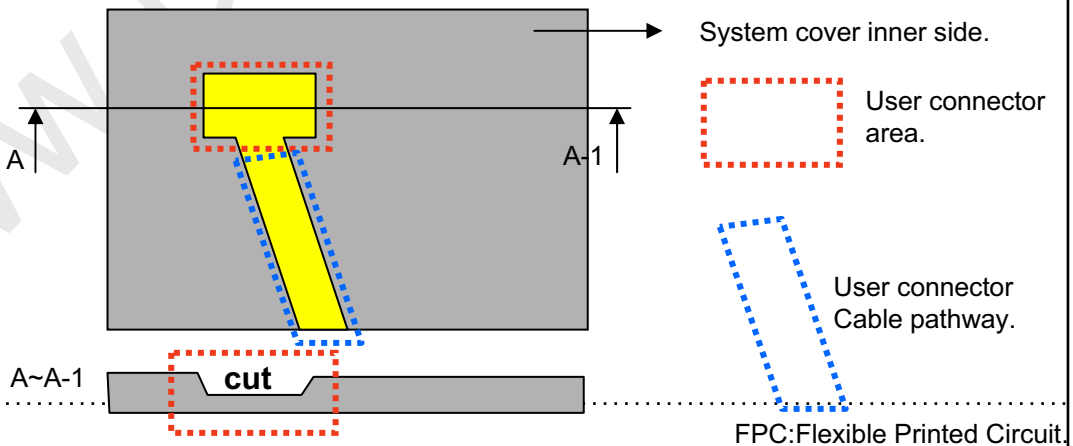


With bracket



Without bracket

Define	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..



Define	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)

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, 5 ~ 150Hz, 1.5G, 0.37oct/min 3 axis, 30min/axis
6	Shock test (non-operating)	- No functional or cosmetic defects following a shock to all 6 sides delivering at least 180 G in a half sine pulse no longer than 2 ms to the display module - No functional defects following a shock delivering at least 200 g in a half sine pulse no longer than 2 ms to each of 6 sides. Each of the 6 sides will be shock tested with one each display, for a total of 6 displays
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+A1: 1997+A11: 1997
IEC 950 : 1991+A1: 1992+A2: 1993+A3: 1995+A1: 1996
European Committee for Electro technical 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(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

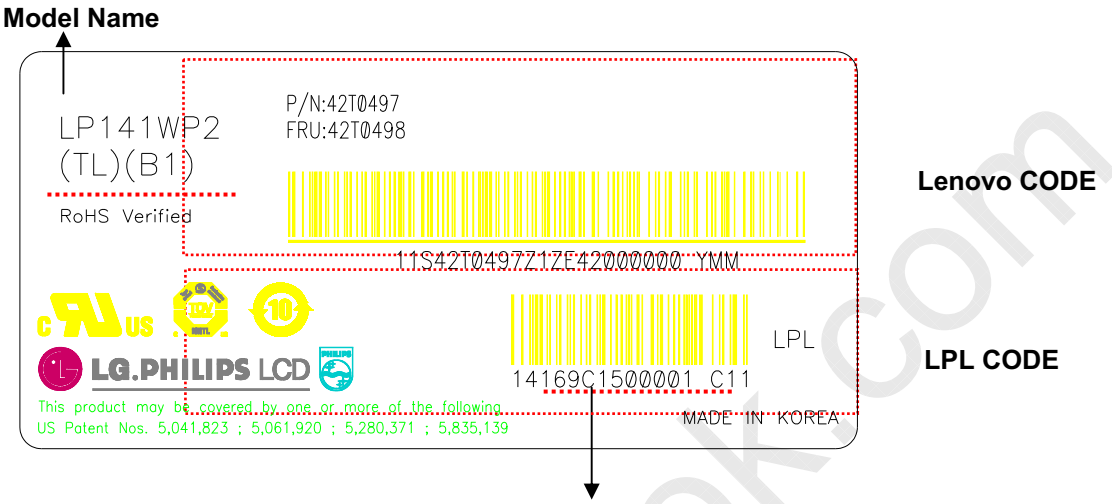
Serial No. is printed on the label. The label is attached to the backside of the LCD module.
This is subject to change without prior notice.

8-2. Packing Form

a) Package quantity in one box : 30 pcs

b) Box Size : 484mm × 372mm × 288mm

8-3. Label Description



LPL Code

(1) Model Name : L P 1 4 1 W P 2 - T L B 1

- Revision Code
- Product Type
- Display Mode
- Basic Model Serial No.
- Resolution : WXGA
- Size (inch) : 14.1”
- Application : NBPC
- LGPL Brand Initial: L

(2) Lot Mark : 1 4 1 6 9 C 1 5 0 0 0 0 1

- SERIAL NO.
- MONTH
- YEAR
- SIZE

Lenovo Code

(1) P/N : 42T0497

(2) FRU : 42T0498

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.

Appendix_1. E-EDID Table

Byte# (decimal)	Byte# (HEX)	Field Name and Comments	Data (DEC)	Data (HEX)	Data (BIN)	Input Value	Note
0	00	Header	0	00	00000000		
1	01	Header	255	FF	11111111		
2	02	Header	255	FF	11111111		
3	03	Header	255	FF	11111111		
4	04	Header	255	FF	11111111		
5	05	Header	255	FF	11111111		
6	06	Header	255	FF	11111111		
7	07	Header	0	00	00000000		
8	08	ID system Manufacturer Name	48	30	00110000	LEN	
9	09	Compressed ASCII	174	AE	10101110		
10	0A	ID Product Code (LSB)	54	36	00110110	WXGA+ (4036)	
11	0B	ID Product Code (MSB)	64	40	01000000		
12	0C	LCD Module Serial No.	0	00	00000000		
13	0D	LCD Module Serial No.	0	00	00000000		
14	0E	LCD Module Serial No.	0	00	00000000		
15	0F	LCD Module Serial No.	0	00	00000000		
16	10	Week of Manufacture	0	00	00000000		
17	11	Year of Manufacture	18	12	00010010	2008	
18	12	EDID Structure version	1	01	00000001	1	
19	13	EDID Revision	3	03	00000011	3	
20	14	Video Input Definition	128	80	10000000		
21	15	Max H image size(cm)	30	1E	00011110	30	
22	16	Max V image size(cm)	19	13	00010011	19	
23	17	Display gamma	120	78	01111000	2.2	
24	18	Feature support(DPMS)	234	EA	11101010		
25	19	Red/Green low Bits	75	4B	01001011		
26	1A	Blue/White Low Bits	133	85	10000101		
27	1B	Red X	146	92	10010010	0.571	
28	1C	Red Y	87	57	01010111	0.340	
29	1D	Green X	86	56	01010110	0.338	
30	1E	Green Y	138	8A	10001010	0.542	
31	1F	Blue X	40	28	00101000	0.158	
32	20	Blue Y	32	20	00100000	0.125	
33	21	White X	80	50	01010000	0.313	
34	22	White Y	84	54	01010100	0.329	
35	23	Established Timing I	0	00	00000000		
36	24	Established Timing II	0	00	00000000		
37	25	Manufacturer's Timings	0	00	00000000		
38	26	Standard Timing Identification 1	1	01	00000001		
39	27	Standard Timing Identification 1	1	01	00000001		
40	28	Standard Timing Identification 2	1	01	00000001		
41	29	Standard Timing Identification 2	1	01	00000001		
42	2A	Standard Timing Identification 3	1	01	00000001		
43	2B	Standard Timing Identification 3	1	01	00000001		
44	2C	Standard Timing Identification 4	1	01	00000001		
45	2D	Standard Timing Identification 4	1	01	00000001		
46	2E	Standard Timing Identification 5	1	01	00000001		
47	2F	Standard Timing Identification 5	1	01	00000001		
48	30	Standard Timing Identification 6	1	01	00000001		
49	31	Standard Timing Identification 6	1	01	00000001		
50	32	Standard Timing Identification 7	1	01	00000001		
51	33	Standard Timing Identification 7	1	01	00000001		
52	34	Standard Timing Identification 8	1	01	00000001		
53	35	Standard Timing Identification 8	1	01	00000001		

Appendix_2. E-EDID Table

Byte# (decimal)	Byte# (HEX)	Field Name and Comments	Data (DEC)	Data (HEX)	Data (BIN)	Input Value	Note
54	36	Pixel Clock/10,000 (LSB)	176	B0	10110000	101.6MHz	
55	37	Pixel Clock/10,000 (MSB) /	39	27	00100111		
56	38	Horizontal Active	160	A0	10100000	1440 pixels	
57	39	Horizontal Blanking	128	80	10000000	384 pixels	
58	3A	Horizontal Active : Horizontal Blanking	81	51	01010001		
59	3B	Vertical Avtive	132	84	10000100	900 lines	
60	3C	Vertical Blanking	26	1A	00011010	26 lines	
61	3D	Vertical Active : Vertical Blanking	48	30	00110000		
62	3E	Horizontal Sync. Offset	48	30	00110000	48 pixels	
63	3F	Horizontal Sync Pulse Width	32	20	00100000	32 pixels	
64	40	Vertical Sync Offset : Sync Width	54	36	00110110	3/6 lines	
65	41	Horizontal Vertical Sync Offset/Width upper 2bits	0	00	00000000	0	
66	42	Horizontal Image Size	48	30	00110000	304	
67	43	Vertical Image Size	190	BE	10111110	190	
68	44	Horizontal & Vertical Image Size (upper 4bit)	16	10	00010000		
69	45	Horizontal Border = 0	0	00	00000000		
70	46	Vertical Border = 0	0	00	00000000		
71	47	Non-interlaced,Normal display,no stereo,Digital separate sync,H/V pol negatives	25	19	00011001		
72	48	Pixel Clock/10,000 (LSB) 50Hz	112	70	01110000	85.6MHz	
73	49	Pixel Clock/10,000 (MSB) / 50Hz	33	21	00100001		
74	4A	Horizontal Active	160	A0	10100000	1440 pixels	
75	4B	Horizontal Blanking	152	98	10011000	408 pixels	
76	4C	Horizontal Active : Horizontal Blanking	81	51	01010001		
77	4D	Vertical Avtive	132	84	10000100	900 lines	
78	4E	Vertical Blanking	26	1A	00011010	26 lines	
79	4F	Vertical Active : Vertical Blanking	48	30	00110000		
80	50	Horizontal Sync. Offset	48	30	00110000	48 pixels	
81	51	Horizontal Sync Pulse Width	32	20	00100000	32 pixels	
82	52	Vertical Sync Offset : Sync Width	54	36	00110110	3/6 lines	
83	53	Horizontal Vertical Sync Offset/Width upper 2bits	0	00	00000000	0	
84	54	Horizontal Image Size	48	30	00110000	304	
85	55	Vertical Image Size	190	BE	10111110	190	
86	56	Horizontal & Vertical Image Size (upper 4bit)	16	10	00010000		
87	57	Horizontal Border = 0	0	00	00000000		
88	58	Vertical Border = 0	0	00	00000000		
89	59	Non-interlaced,Normal display,no stereo,Digital separate sync,H/V pol negatives	25	19	00011001		
90	5A	Detailed Timing Descriptor #3	0	00	00000000	0	
91	5B		0	00	00000000	0	
92	5C		0	00	00000000	0	
93	5D		15	0F	00001111	15	
94	5E		0	00	00000000	0	
95	5F	(Horizontal active pixel /8)-31	149	95	10010101	(1440/8)-31	
96	60	Image Aspect Ratio(16:10)	10	0A	00001010	16 : 10	
97	61	Low Refresh Rate #1(50Hz)	50	32	00110010	50	
98	62	(Horizontal active pixel /8)-31	149	95	10010101	(1440/8)-31	
99	63	Image Aspect Ratio(16:10)	10	0A	00001010	16 : 10	
100	64	Low Refresh Rate #2(40Hz)	40	28	00101000	40	
101	65	Brightness(1/10nit)	25	19	00011001	25	
102	66	Feature flag(TN mode)	25	19	00011001	TN / LED / BGR	
103	67	Reserved 00h	0	00	00000000	0	
104	68	EISA manufacturer code(3 Character ID)	50	32	00110010	LPL	
105	69	Compressed ASCII	12	0C	00001100		
106	6A	Panel Supplier Reserved - Product code	60	3C	00111100		
107	6B	(Hex, LSB first)	1	01	00000001		

Appendix_3. E-EDID Table

Byte# (decimal)	Byte# (HEX)	Field Name and Comments	Data (DEC)	Data (HEX)	Data (BIN)	Input Value	Note
108	6C	Detailed Timing Descriptor #4	0	00	00000000		
109	6D		0	00	00000000		
110	6E		0	00	00000000		
111	6F		254	FE	11111110		
112	70		0	00	00000000		
113	71	(Supplier S/N)	76	4C	01001100	L	
114	72	(Supplier S/N)	80	50	01010000	P	
115	73	(Supplier S/N)	49	31	00110001	1	
116	74	(Supplier S/N)	52	34	00110100	4	
117	75	(Supplier S/N)	49	31	00110001	1	
118	76	(Supplier S/N)	87	57	01010111	W	
119	77	(Supplier S/N)	80	50	01010000	P	
120	78	(Supplier S/N)	50	32	00110010	2	
121	79	(Supplier S/N)	45	2D	00101101	-	
122	7A	(Supplier S/N)	84	54	01010100	T	
123	7B	(Supplier S/N)	76	4C	01001100	L	
124	7C	(Supplier S/N)	66	42	01000010	B	
125	7D	(Supplier S/N)	49	31	00110001	1	
126	7E	Extension flag = 00	0	00	00000000		
127	7F	Checksum	**31**	1F	00011111		