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LG Display

LP154WU2
Liquid Crystal Display

Product Specification

SPECIFICATION
FOR
APPROVAL

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

Title	15.4” WUXGA TFT LCD

Customer	DELL
MODEL	HT009

SUPPLIER	LG Display Co., Ltd.
*MODEL	LP154WU2
Suffix	TLA2

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

Products Engineering Dept.
LG Display Co., Ltd

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RECORD OF REVISIONS

Revision No	Revision Date	Page	Description	EDID ver
0.0	Nov.22.2007		First Draft.	
0.1	July.10.2008	30~32	Updated EDID data	0.1
1.0	Sep.22.2008	6	Updated B/L power : 4.42W → 4.38W	
		12	Change DCLK : 150.75Mhz → 151.7Mhz for WWAN	
		19~20	Updated Mechanical Drawing	
		30~32	Updated EDID data for WWAN	1.0

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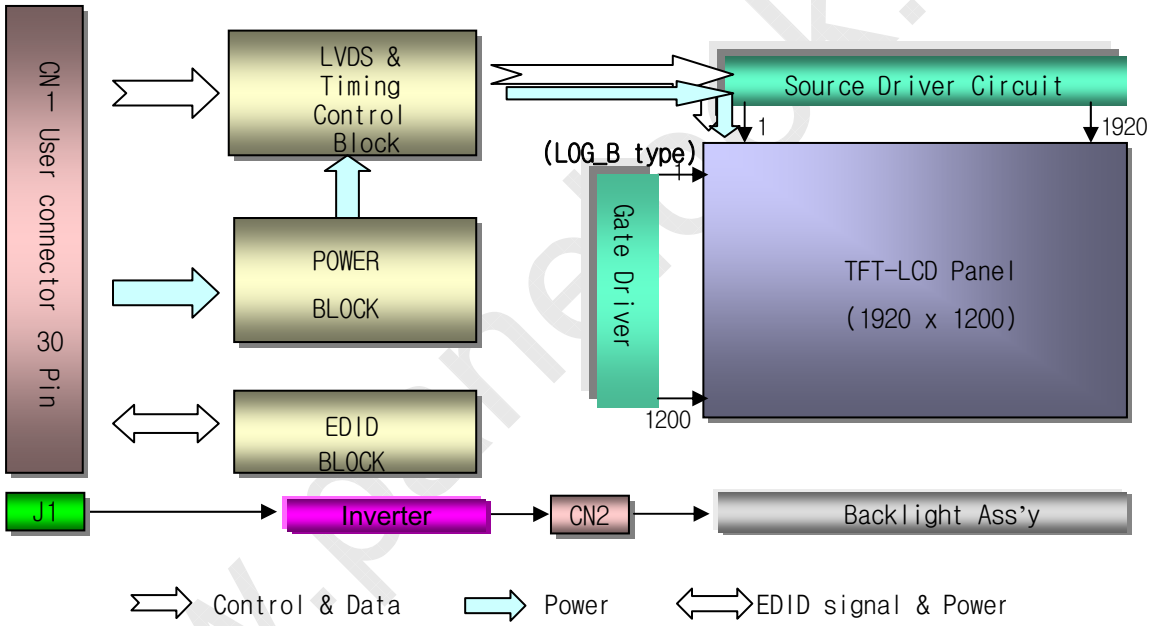
1. General Description

The LP154WU2 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 15.4 inches diagonally measured active display area with WXGA resolution(1200 vertical by 1920 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 LP154WU2 has been designed to apply the interface method that enables low power, high speed, low EMI.

The LP154WU2 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 LP154WU2 characteristics provide an excellent flat display for office automation products such as Notebook PC.



General Features

Active Screen Size	15.4 inches diagonal
Outline Dimension (Max.)	344.5 (H) × 225.5 (V) × 7.0(D,Max) mm
Pixel Pitch	0.1725 mm × 0. 1725 mm
Pixel Format	1920 horiz. by 1200 vert. Pixels RGB strip arrangement
Color Depth	6-bit, 262,144 colors
Luminance, White	340 cd/m^2(Typ.) , 5 point
Power Consumption	Total 10.33 Watt(Typ.) @ LCM circuit 1.49 Watt(Typ.), B/L input 8.76 Watt(Typ.)
Weight	650 g (Max.) without inverter & bracket
Display Operating Mode	Transmissive mode, normally white
Surface Treatment	Anti-glare treatment of the front polarizer
RoHS Comply	Yes

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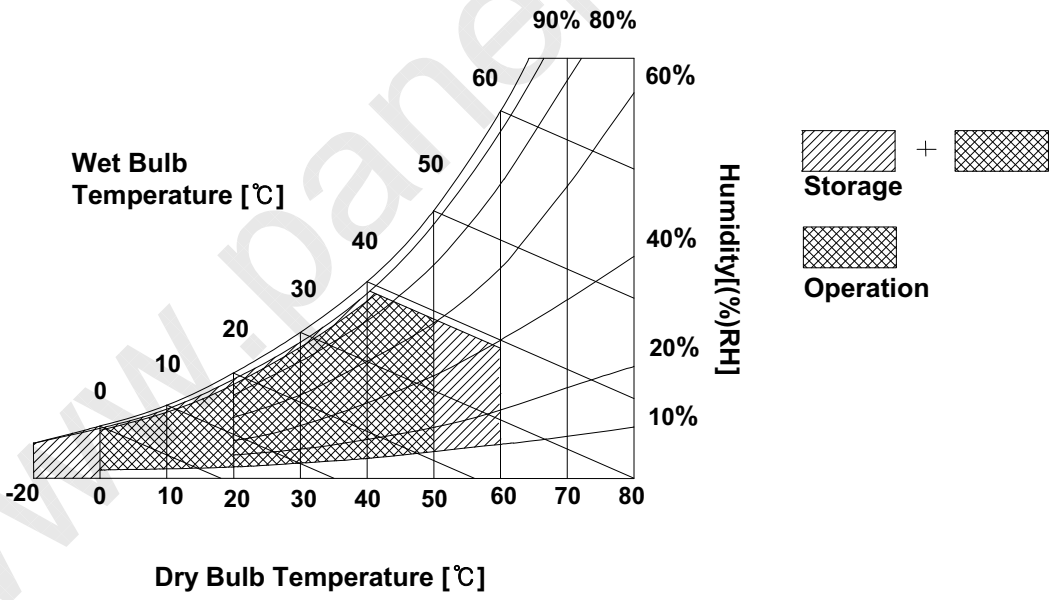
2. Absolute Maximum Ratings

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.



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3. Electrical Specifications

3-1. Electrical Characteristics

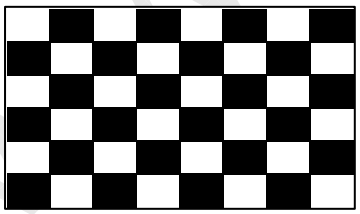
The LP154WU2 requires two power inputs. One is employed to power the LCD electronics and to drive the TFT array and liquid crystal. The second input which powers the CCFL, is typically generated by an inverter. The inverter is an external unit to the LCD.

Table 2. ELECTRICAL CHARACTERISTICS

Parameter	Symbol	Values			Unit	Notes
		Min	Typ	Max		
MODULE :						
Power Supply Input Voltage	V_{CC}	3.0	3.3	3.6	V_{DC}	
Power Supply Input Current	I_{CC} Mosaic	-	450	518	mA	1
Power Consumption	Pc	-	1.49	1.71	Watt	1
Differential Impedance	Zm	90	100	110	Ohm	2
LAMP :						
Operating Voltage	V_{BL}	660(7.0mA)	675(6.5mA)	830(3.0mA)	V_{RMS}	
Operating Current	I_{BL}	3.0	6.5	7.0	mA_{RMS}	3
Power Consumption	P_{BL}	-	4.38	4.62		
Operating Frequency	f_{BL}	40	60	80	kHz	
Discharge Stabilization Time	Ts	-	-	3	Min	4
Life Time		15,000	-	-	Hrs	5
Established Starting Voltage at 25℃ at 0 ℃	Vs			 1200 1500	 V_{RMS} V_{RMS}	

Note)

1. The specified 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.



2. This impedance value is needed to proper display and measured form LVDS Tx to the mating connector.
3. The typical operating current is for the typical surface luminance (L_{WH}) in optical characteristics.
4. Define the brightness of the lamp after being lighted for 5 minutes as 100%, Ts is the time required for the brightness of the center of the lamp to be not less than 95%.
5. The life time is determined as the time at which brightness of lamp is 50% compare to that of initial value at the typical lamp current.

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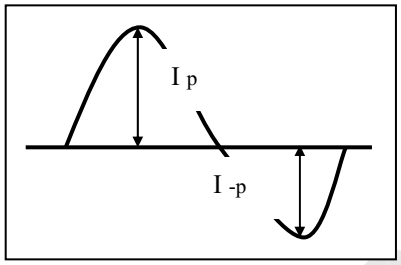
Note)

6. The output of the inverter must have symmetrical(negative and positive) voltage waveform and symmetrical current waveform.(Asymmetrical ratio is less than 10%) Please do not use the inverter which has asymmetrical voltage and asymmetrical current and spike wave.
   Lamp frequency may produce interface with horizontal synchronous frequency and as a result this may cause beat on the display. Therefore lamp frequency shall be as away possible from the horizontal synchronous frequency and from its harmonics in order to prevent interference.
7. It is defined the brightness of the lamp after being lighted for 5 minutes as 100%.
   T_S is the time required for the brightness of the center of the lamp to be not less than 95%.
8. The lamp power consumption shown above does not include loss of external inverter.
   The applied lamp current is a typical one.
9. Requirements for a system inverter design, which is intended to have a better display performance, a better power efficiency and a more reliable lamp, are following.
   It shall help increase the lamp lifetime and reduce leakage current.
   a. The asymmetry rate of the inverter waveform should be less than 10%.
   b. The distortion rate of the waveform should be within $\sqrt{2} \pm 10\%$.
   * Inverter output waveform had better be more similar to ideal sine wave.



* Asymmetry rate:

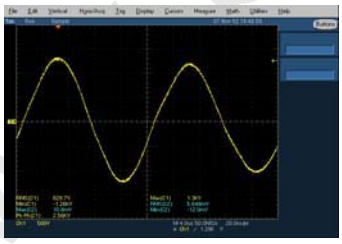
$| I_p - I_{-p} | / I_{rms} * 100\%$

* Distortion rate

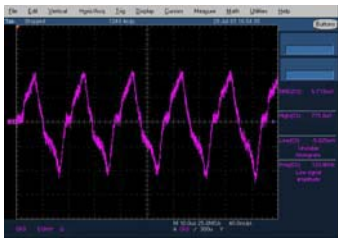
I_p (or I_{-p}) / I_{rms}

10. Inverter open voltage must be more than lamp voltage for more than 1 second for start-up. Otherwise, the lamps may not be turned on.
    ※ 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.

Ex of current wave)



Normal current wave - Standard



Abnormal current wave - Bad

Abnormal current wave - Bad

Abnormal current wave - Bad

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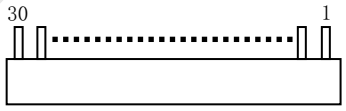
3-2. Interface Connections

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 FI-XB30SRL-HF11 manufactured by JAE.

Table 3. MODULE CONNECTOR PIN CONFIGURATION (CN1)

Pin	Symbol	Description	Notes
1	GND	Ground	
2	VCC	Power Supply, 3.3V Typ.	
3	VCC	Power Supply, 3.3V Typ.	
4	V EEDID	DDC 3.3V power	1, Interface chips Siw, 2port LVDS Receiver
5	NC	Reserved for supplier test point	
6	Clk EEDID	DDC Clock	
7	DATA EEDID	DDC Data	
8	R_{IN} 0-	Odd channel differential data input	2. Connector 2.1 LCD : FI-XB30SRL-HF11 (JAE) or its compatibles 2.2 Mating : FI-X30M or equivalent. 2.3 Connector pin arrangement
9	R_{IN} 0+	Odd channel differential data input	
10	GND	Ground	
11	R_{IN} 1-	Odd channel differential data input	
12	R_{IN} 1+	Odd channel differential data input	
13	GND	Ground	
14	R_{IN} 2-	Odd channel differential data input	
15	R_{IN} 2+	Odd channel differential data input	
16	GND	Ground	
17	CLKIN-	Odd channel differential clock input	
18	CLKIN+	Odd channel differential clock input	
19	GND	Ground	
20	RA2-	Even channel differential data input	
21	RA2+	Even channel differential data input	
22	GND	Ground	
23	RB2-	Even channel differential data input	
24	RB2+	Even channel differential data input	
25	GND	Ground	
26	RC2-	Even channel differential data input	
27	RC2+	Even channel differential data input	
28	GND	Ground	
29	RCLK2-	Even channel differential clock input	
30	RCLK2+	Even channel differential clock input	



[LCD Module Rear View]

The backlight interface connector is a model BHSR-02VS-1, manufactured by JST or Compatible.
The mating connector part number is SM02B-BHSS-1 or equivalent.

Table 4. BACKLIGHT CONNECTOR PIN CONFIGURATION (J3)

Pin	Symbol	Description	Notes
1	HV	Power supply for lamp (High voltage side)	1
2	LV	Power supply for lamp (Low voltage side)	1

Notes : 1. The high voltage side terminal is colored pink and the low voltage side terminal is black. (Lamp #1)
The high voltage side terminal is colored white and the low voltage side terminal is yellow. (Lamp #2)

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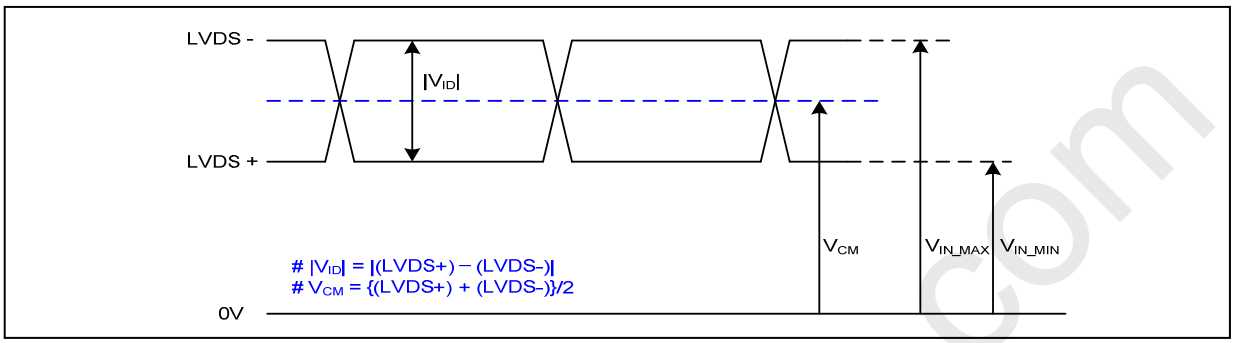
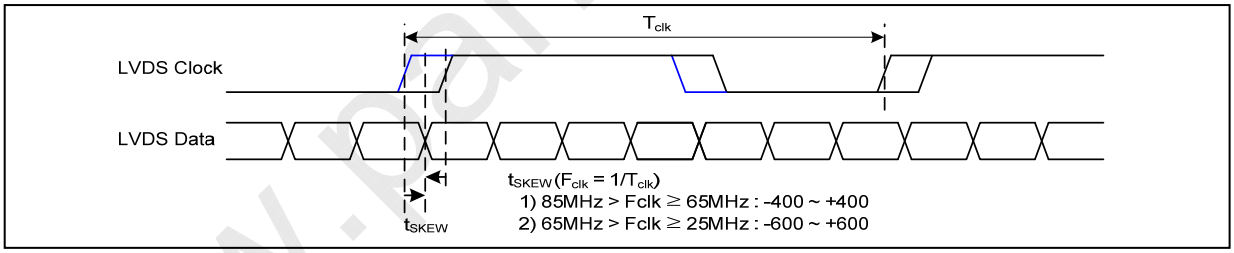
3-3. LVDS Signal Timing Specifications

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	-

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	-

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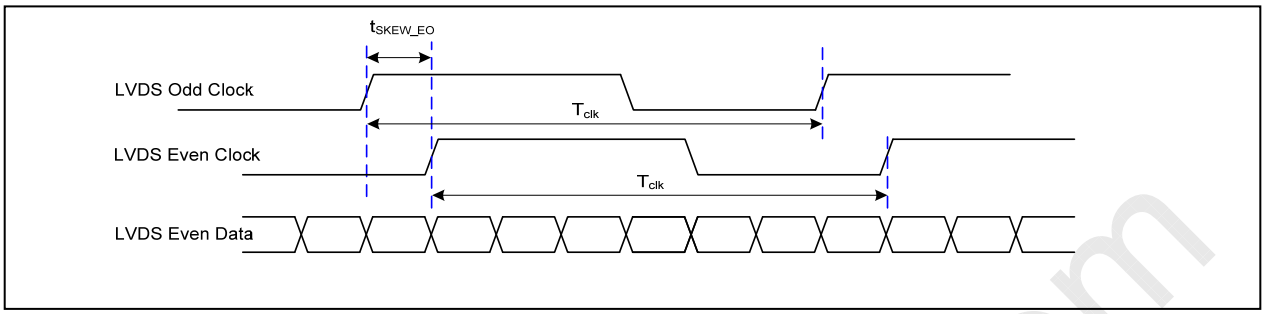
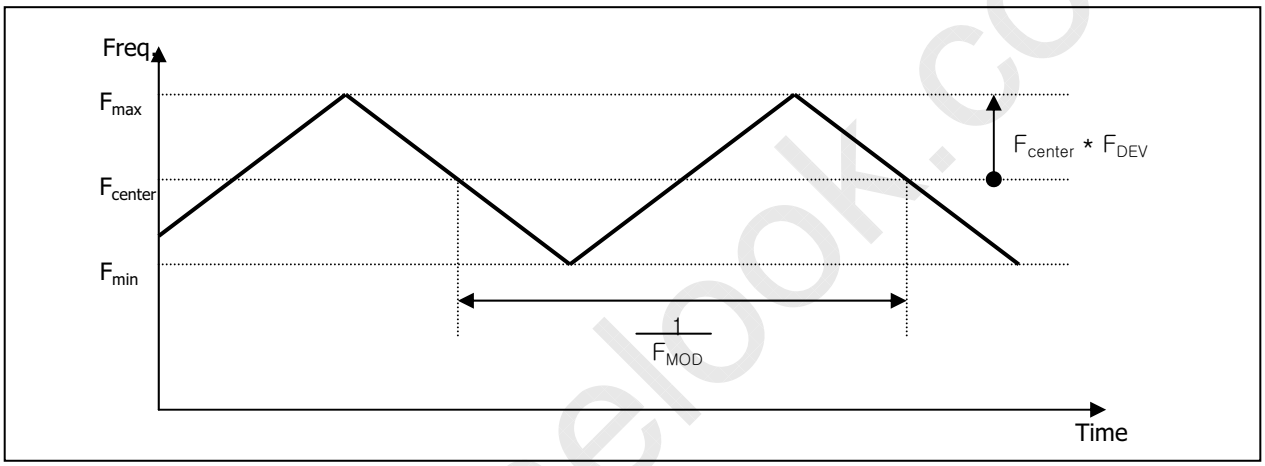


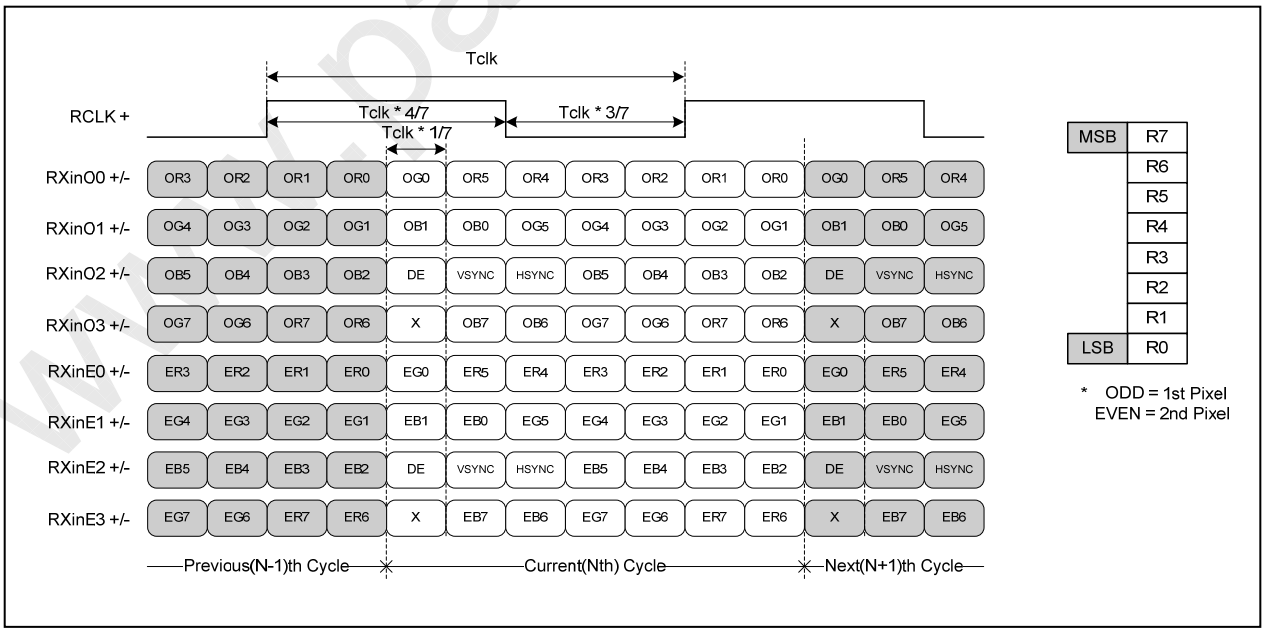
< Clock skew margin between channel >



< Spread Spectrum >

3-3-3. Data Format

1) LVDS 2 Port



< LVDS Data Format >

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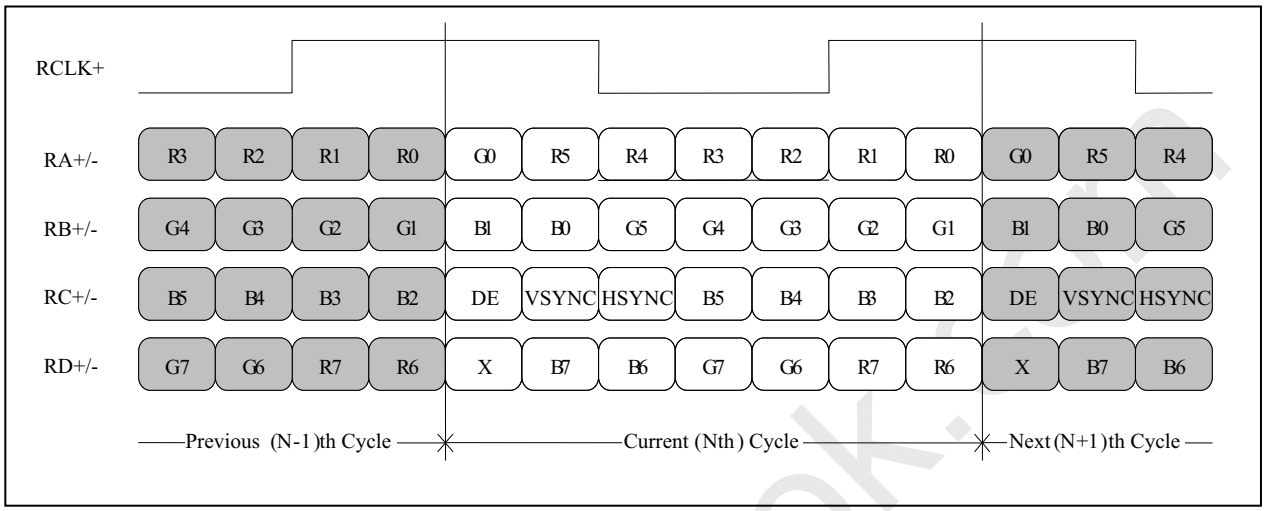
2) LVDS 1 Port



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3-4. Signal Timing Specifications

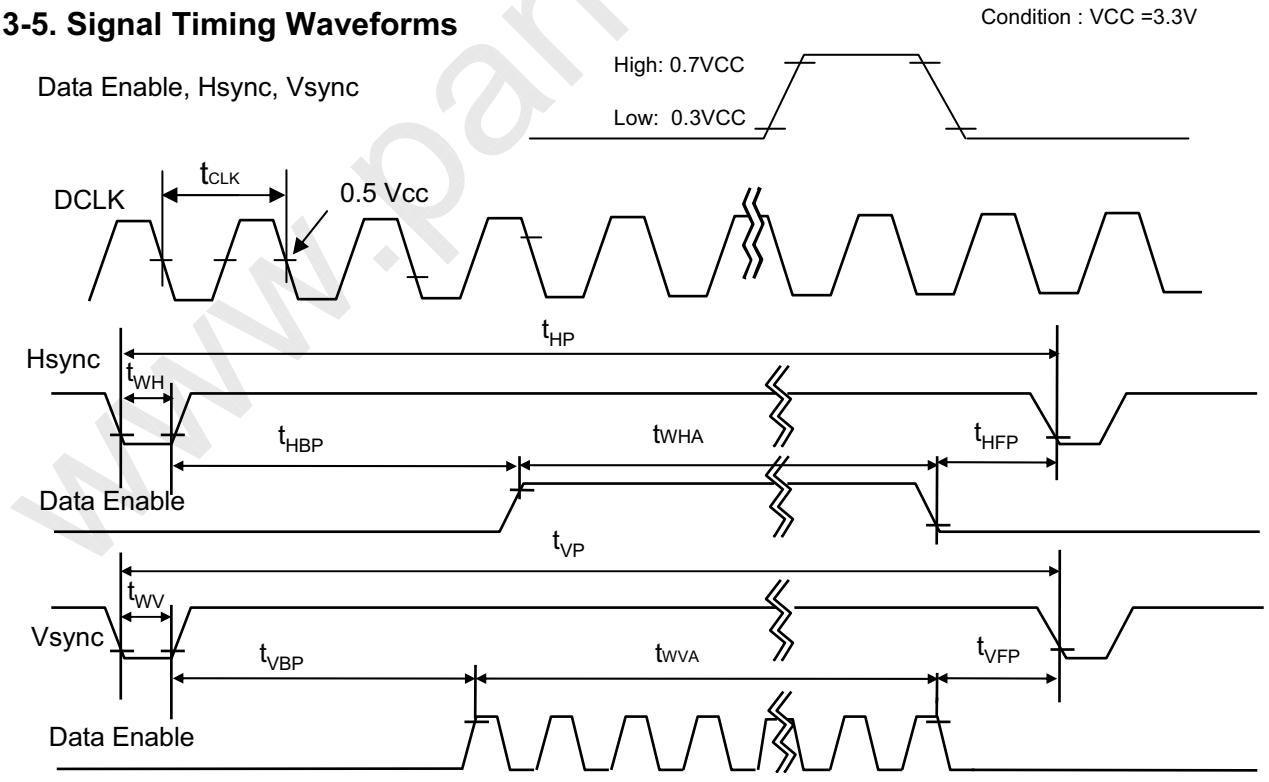
This is the signal timing required at the input of the User connector. All of the interface signal timing should be satisfied with the following specifications and specifications of LVDS Tx/Rx for its proper operation.

Table 6. TIMING TABLE

ITEM	Symbol		Min	Typ	Max	Unit	Note
DCLK	Frequency	f_{CLK}	-	75.85	-	MHz	
Hsync	Period	Thp	990	1007	1040	tCLK	
	Width	t_{WH}	10	15	40		
	Width-Active	t_{WHA}	960	960	960		
Vsync	Period	t_{VP}	1207	1256	1400	tHP	
	Width	t_{WV}	1	6	12		
	Width-Active	t_{WVA}	1200	1200	1200		
Data Enable	Horizontal back porch	t_{HBP}	16	-	-	tCLK	
	Horizontal front porch	t_{HFP}	8	-	-		
	Vertical back porch	t_{VBP}	5	-	-	tHP	
	Vertical front porch	t_{VFP}	1	-	-		

3-5. Signal Timing Waveforms

Condition : VCC =3.3V



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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 7. COLOR DATA REFERENCE

Color		Input Color Data																	
		RED						GREEN						BLUE					
		MSB					LSB	MSB					LSB	MSB					LSB
		R5	R4	R3	R2	R1	R0	G5	G4	G3	G2	G1	G0	B5	B4	B3	B2	B1	B0
Basic Color	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	Green	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
	Cyan	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1
	Magenta	1	1	1	1	1	1	0	0	0	0	0	0	1	1	1	1	1	1
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0
	White	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
RED	RED (00)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RED (01)	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	...			...						...						...			
	RED (62)	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	RED (63)	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
GREEN	GREEN (00)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	GREEN (01)	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
	...			...						...						...			
	GREEN (62)	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0
	GREEN (63)	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
BLUE	BLUE (00)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	BLUE (01)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	...			...						...						...			
	BLUE (62)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0
	BLUE (63)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1

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3-7. Power Sequence

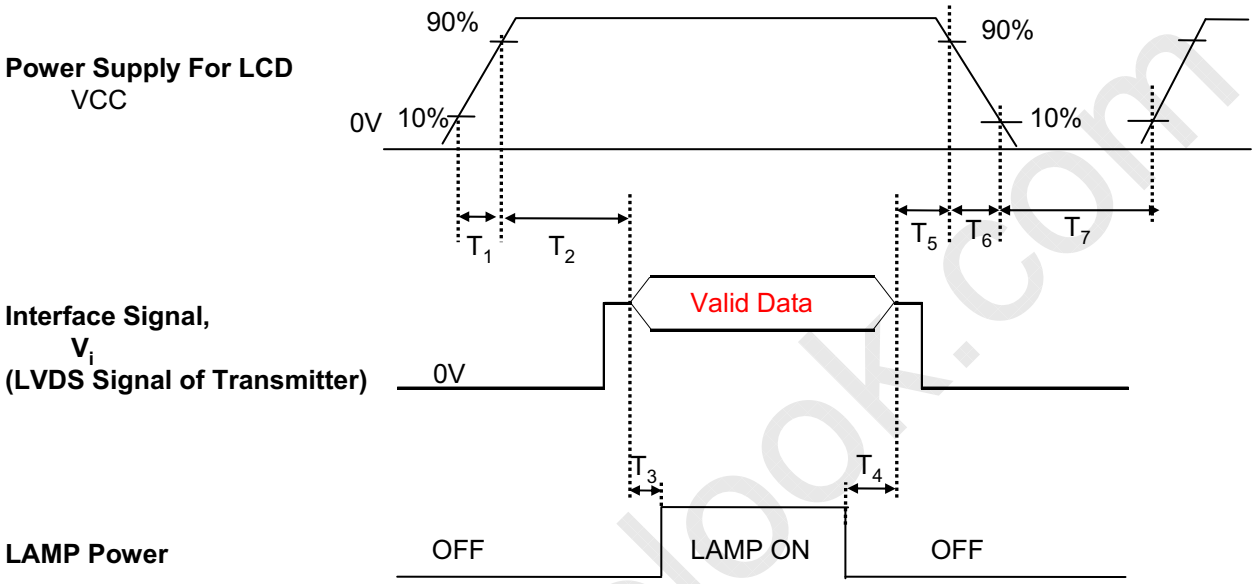

Table 8. POWER SEQUENCE TABLE

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

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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

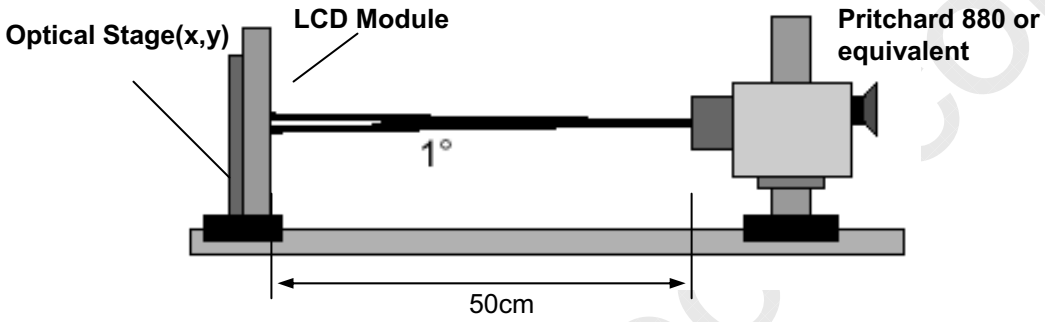

Table 9. OPTICAL CHARACTERISTICS

Ta=25°C, VCC=3.3V, fv=60Hz, f_{CLK}= 150.75MHz, F_{BL} = 60KHz , I_{BL}= 6.5mA

Parameter	Symbol	Values			Units	Notes
		Min	Typ	Max		
Contrast Ratio	CR	500	-	-		1
Surface Luminance, white	L_{WH}	300	340	-	cd/m^2	2
Luminance Variation	δ_{WHITE}	-	-	2.0		3
Response Time	Tr_R + Tr_D	-	16	30	ms	4
Color Coordinates						±0.03
RED	RX	0.600	0.630	0.660		
	RY	0.312	0.342	0.372		
GREEN	GX	0.245	0.275	0.305		
	GY	0.582	0.612	0.642		
BLUE	BX	0.118	0.148	0.178		
	BY	0.060	0.090	0.120		
WHITE	WX	0.283	0.313	0.343		
	WY	0.299	0.329	0.359		
Viewing Angle						5
x axis, right(Φ=0°)	Θr	55	-	-	degree	
x axis, left (Φ=180°)	Θl	55	-	-	degree	
y axis, up (Φ=90°)	Θu	45	-	-	degree	
y axis, down (Φ=270°)	Θd	45	-	-	degree	
Gray Scale						

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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.

$$L_{WH} = \text{Average}(L_1, L_2, \ldots L_5)$$

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	0.1
L7	1.5
L15	6.5
L23	14
L31	23.5
L39	36.9
L47	53.9
L55	75.6
L63	100

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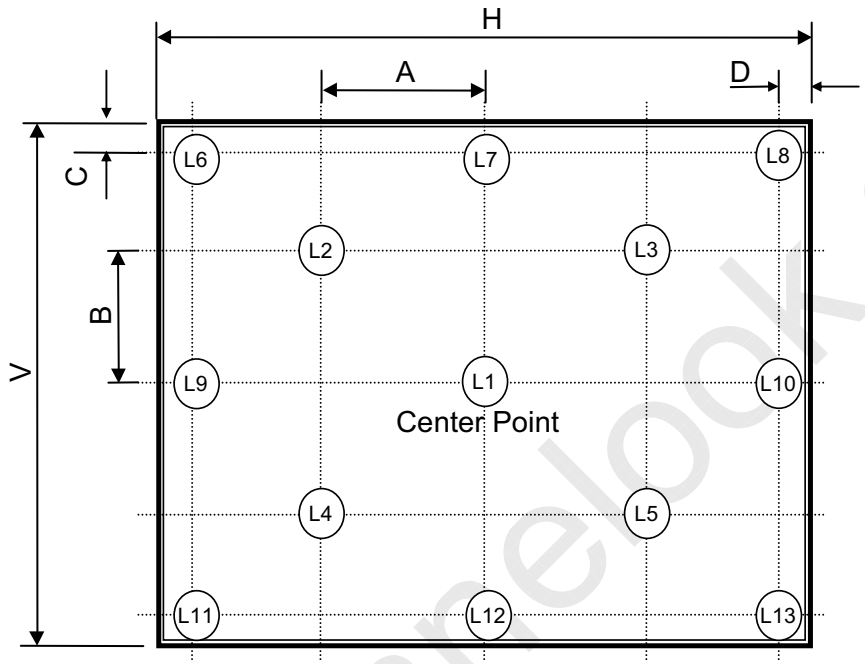
FIG. 2 Luminance

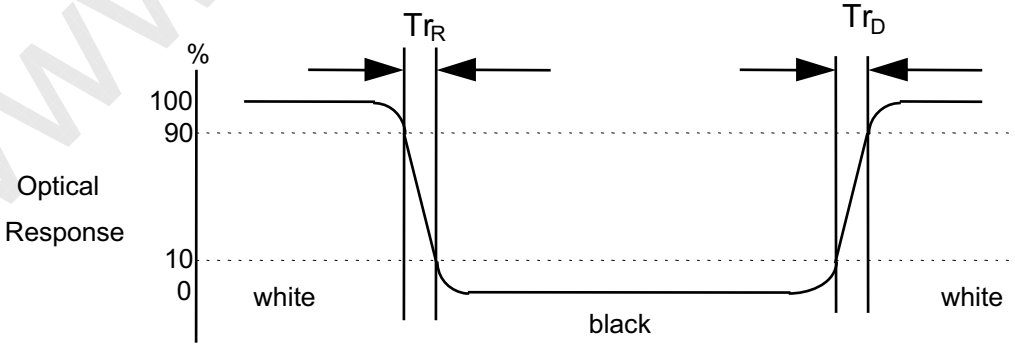
<measuring point for surface luminance & measuring point for luminance variation>



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”.



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5. Mechanical Characteristics

The contents provide general mechanical characteristics for the model LP154WU2. In addition the figures in the next page are detailed mechanical drawing of the LCD.

Outline Dimension	Horizontal	344.0 ± 0.5mm
	Vertical	225.0 ± 0.5mm
	Depth	6.7(typ) ± 0.3mm
Bezel Area	Horizontal	335.0 ± 0.5mm
	Vertical	210.7 ± 0.5mm
Active Display Area	Horizontal	331.2 mm
	Vertical	207.0 mm
Weight	650 g (Max.) without inverter & bracket	
Surface Treatment	Anti-glare treatment of the front polarizer	

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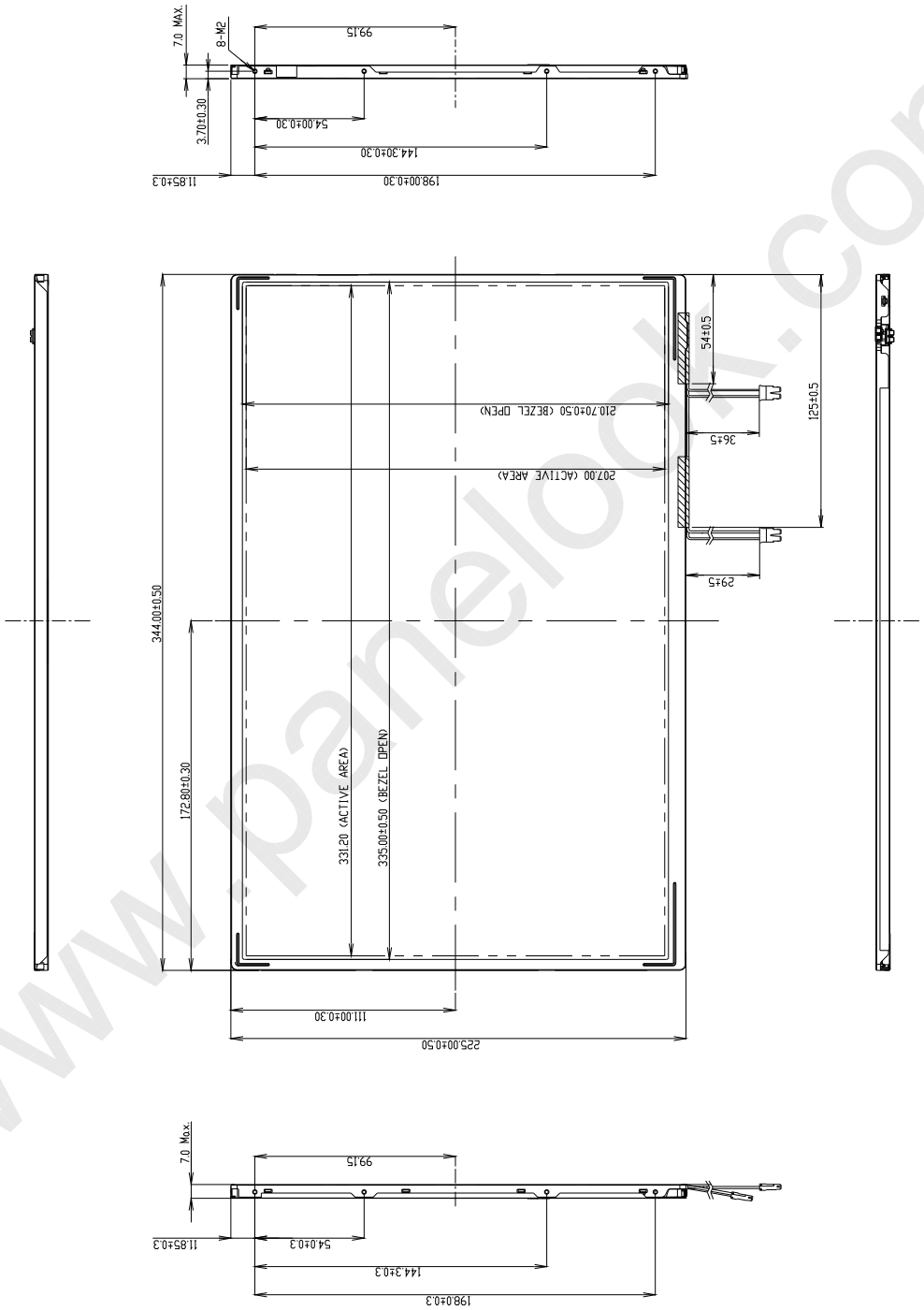
<FRONT VIEW>

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



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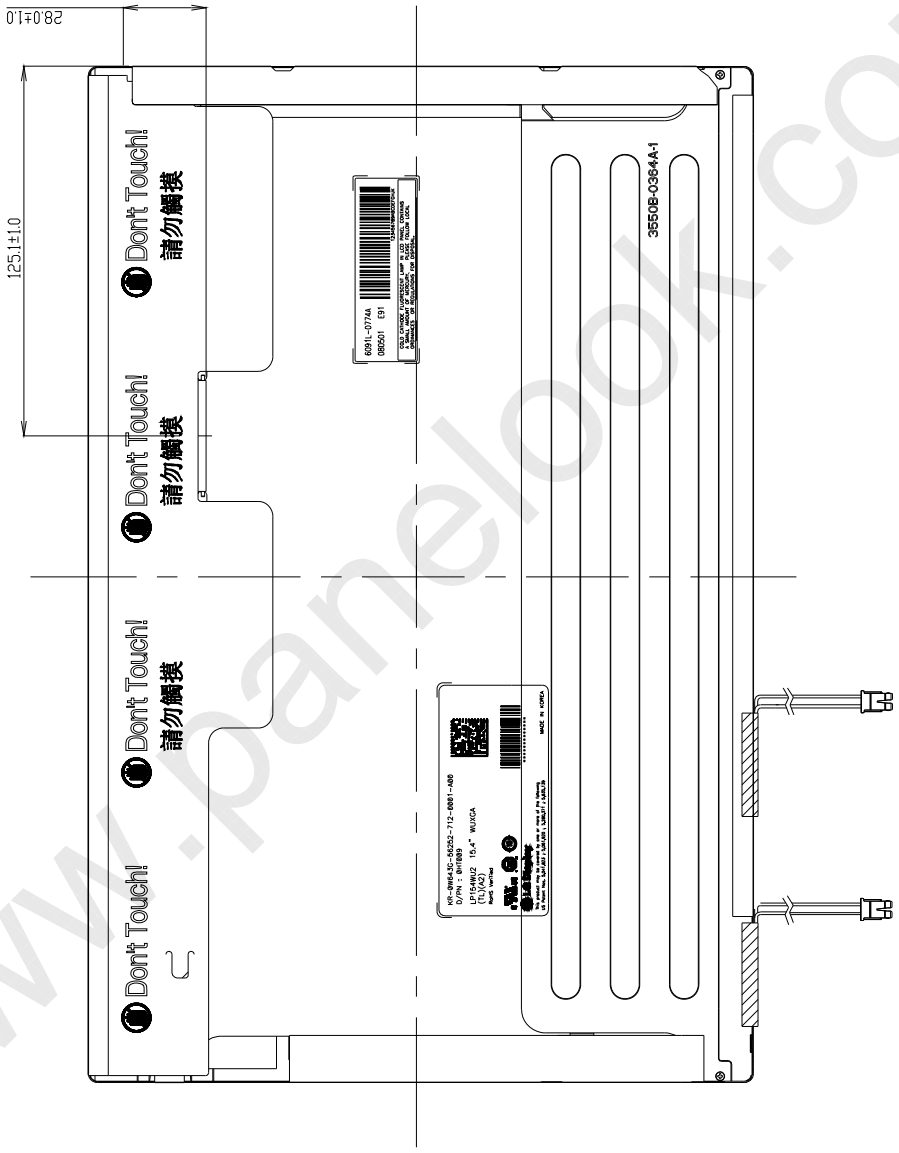
<REAR VIEW>

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



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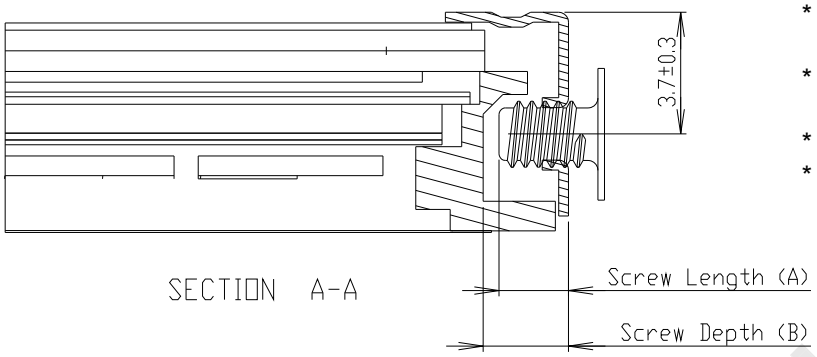
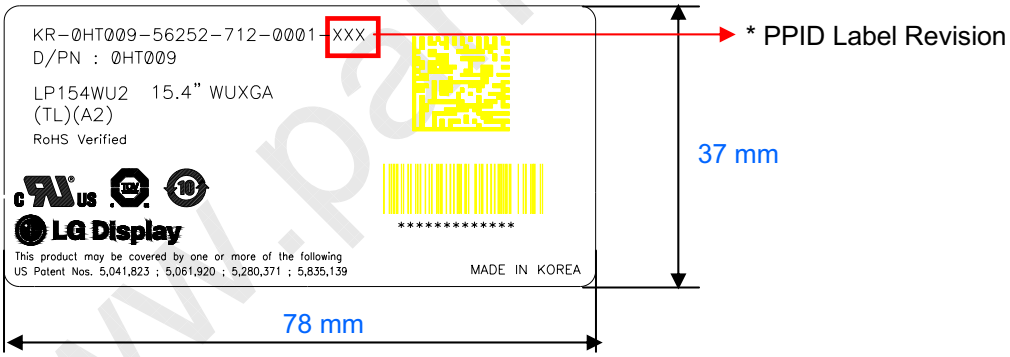
[DETAIL DESCRIPTION OF SIDE MOUNTING SCREW]



* Mounting Screw Length (A)
  = 2.0(Min) / 2.5(Max)
* Mounting Screw Hole Depth (B)
  = 2.5(Min)
* Mounting hole location : 3.7(typ.)
* Torque : 2.5 kgf.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.

[DETAIL INFORMATION OF PPID LABEL AND REVISION CODE]



* PPID Label Revision :
  It is subject to change with Dell event. Please refer to the below table for detail.

Classification	No Change	1st Revision	2nd Revision	…	9th Revision	…
SST(WS)	X00	X01	X02	…	A09	…
PT(ES)	X10	X11	X12	…	A19	…
ST(CS)	X20	X21	X22	…	A29	…
XB(MP)	A00	A01	A02	…	A09	…

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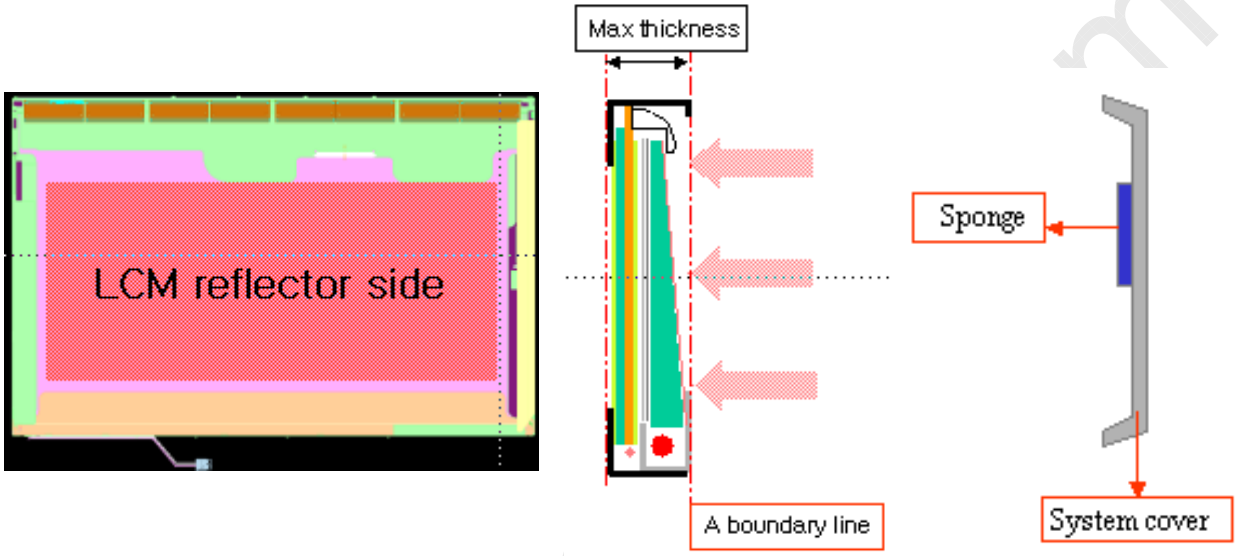
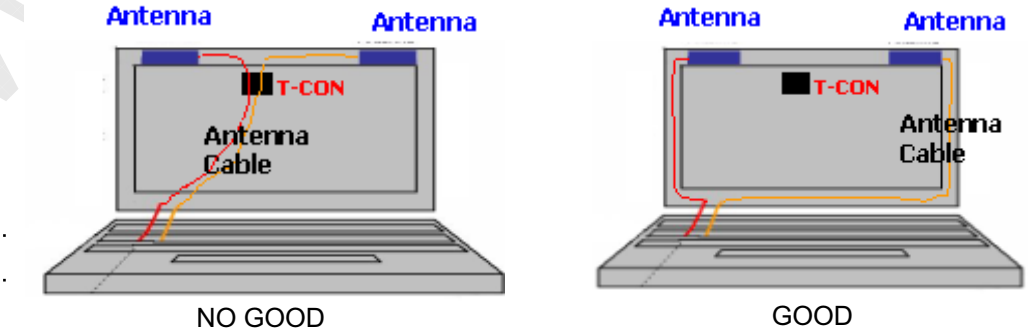
LPL Proposal for system cover design.(Appendix)

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.

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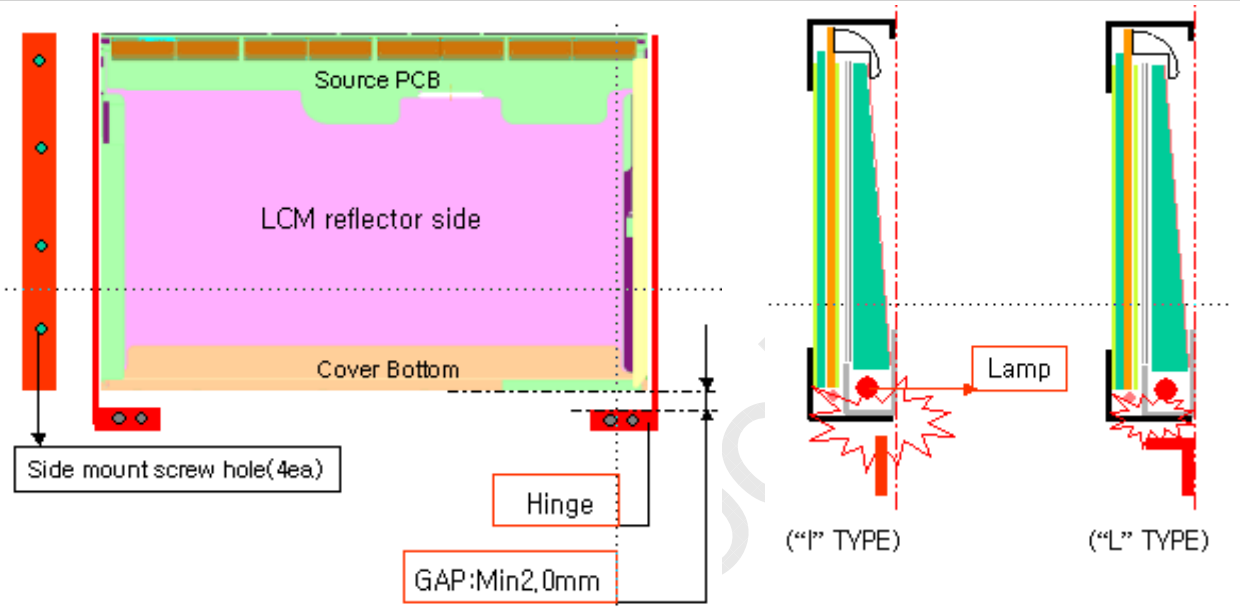
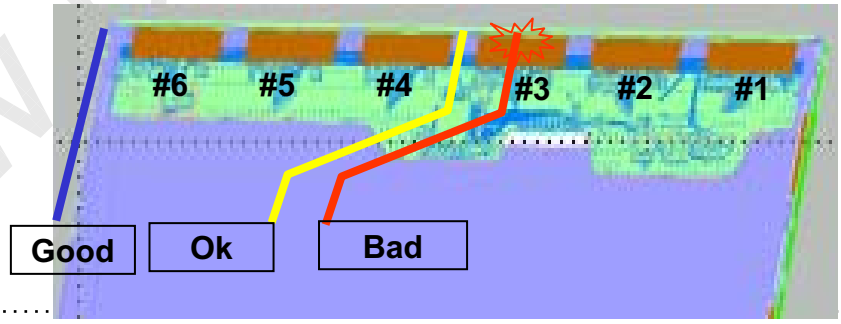
LPL Proposal for system cover design.

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.

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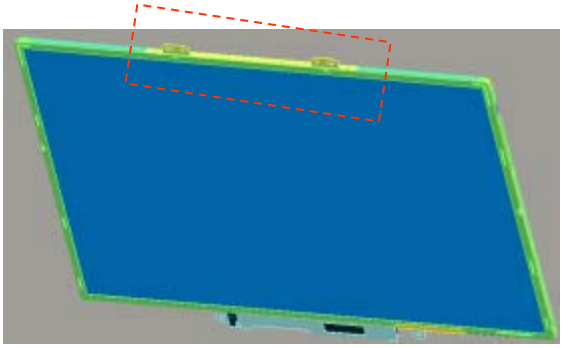
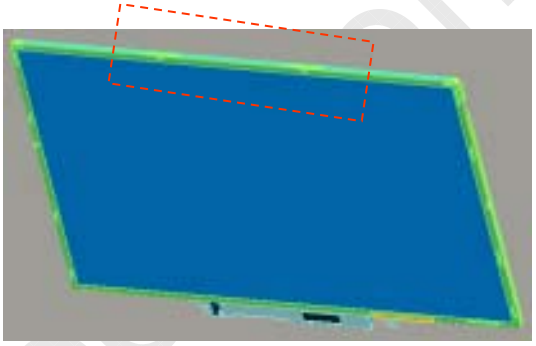
LPL Proposal for system cover design.

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

bracket

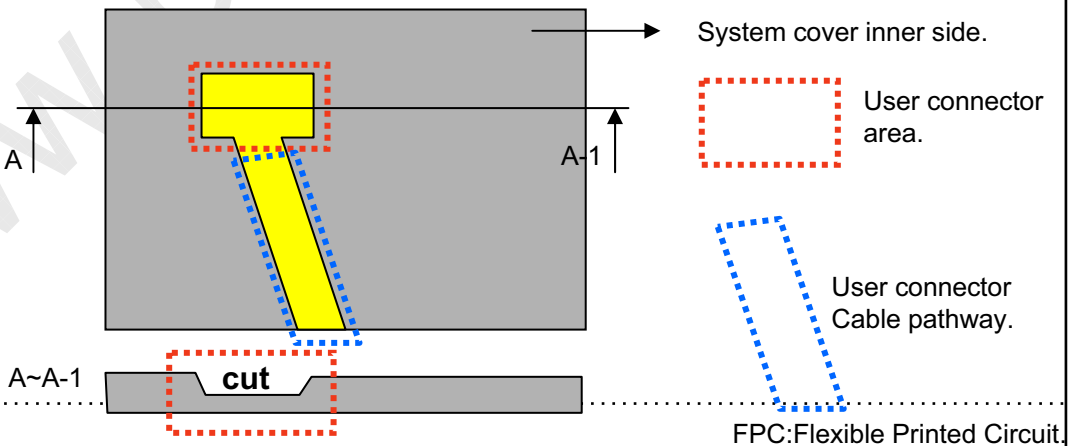


With bracket



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)

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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, 180G, 2ms one shock of each six faces(I.e. run 180G 6ms for all six faces)
7	Altitude operating storage / shipment	0 ~ 10,000 feet (3,048m) 24Hr 0 ~ 40,000 feet (12,192m) 24Hr

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

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7. International Standards

7-1. Safety

a) UL 60950-1:2003, First Edition, Underwriters Laboratories, Inc.,
Standard for Safety of Information Technology Equipment.
b) CAN/CSA C22.2, No. 60950-1-03 1st Ed. April 1, 2003, Canadian Standards Association,
Standard for Safety of Information Technology Equipment.
c) EN 60950-1:2001, First Edition,
European Committee for Electrotechnical Standardization(CENELEC)
European Standard for Safety of Information Technology 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
(Including A1: 2000)

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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 : 20 pcs

b) Box Size : 395mm ×390mm × 309mm

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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.

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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.

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APPENDIX A. 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
Vendor / Product	8	08	EISA manufacture code (3 Character ID) LGD	30	00110000
	9	09	EISA manufacture code (Compressed ASCII)	E4	11100100
	10	0A	Panel Supplier Reserved - Product Code 018Fh	8F	10001111
	11	0B	(Hex. LSB first)	01	00000001
	12	0C	LCD Module Serial No - Preferred but Optional ("0" if not used)	00	00000000
	13	0D	LCD Module Serial No - Preferred but Optional ("0" if not used)	00	00000000
	14	0E	LCD Module Serial No - Preferred but Optional ("0" if not used)	00	00000000
	15	0F	LCD Module Serial No - Preferred but Optional ("0" if not used)	00	00000000
	16	10	Week of Manufacture : 00 weeks	00	00000000
	17	11	Year of Manufacture 2008 year	12	00010010
	18	12	EDID structure version # = 1	01	00000001
	19	13	EDID revision # = 3	03	00000011
Display	20	14	Video input Definition = Digital signal	80	10000000
	21	15	Max H image size (Rounded cm) = 33 cm	21	00100001
	22	16	Max V image size (Rounded cm) = 21 cm	15	00010101
	23	17	Display gamma = (gamma*100)-100 = Example:(2.2*100)-100=120 = 2.2 Gamma	78	01111000
	24	18	Feature Support (no_DPMS, no_Active Off/Very Low Power, RGB color display, Timing BLK 1, no_ GTF)	0A	00001010
Vendor / Product	25	19	Red/Green Low Bits (RxRy/GxGy)	BE	10111110
	26	1A	Blue/White Low Bits (BxBy/WxWy)	85	10000101
	27	1B	Red X Rx = 0.596	98	10011000
	28	1C	Red Y Ry = 0.351	59	01011001
	29	1D	Green X Gx = 0.323	52	01010010
	30	1E	Green Y Gy = 0.549	8C	10001100
	31	1F	Blue X Bx = 0.158	28	00101000
	32	20	Blue Y By = 0.148	26	00100110
	33	21	White X Wx = 0.313	50	01010000
	34	22	White Y Wy = 0.329	54	01010100
Established	35	23	Established timing 1 (00h if not used)	00	00000000
	36	24	Established timing 2 (00h if not used)	00	00000000
	37	25	Manufacturer's timings (00h if not used)	00	00000000
Standard Timing ID	38	26	Standard timing ID 1 (01h if not used)	01	00000001
	39	27	Standard timing ID 1 (01h if not used)	01	00000001
	40	28	Standard timing ID 2 (01h if not used)	01	00000001
	41	29	Standard timing ID 2 (01h if not used)	01	00000001
	42	2A	Standard timing ID 3 (01h if not used)	01	00000001
	43	2B	Standard timing ID 3 (01h if not used)	01	00000001
	44	2C	Standard timing ID 4 (01h if not used)	01	00000001
	45	2D	Standard timing ID 4 (01h if not used)	01	00000001
	46	2E	Standard timing ID 5 (01h if not used)	01	00000001
	47	2F	Standard timing ID 5 (01h if not used)	01	00000001
	48	30	Standard timing ID 6 (01h if not used)	01	00000001
	49	31	Standard timing ID 6 (01h if not used)	01	00000001
	50	32	Standard timing ID 7 (01h if not used)	01	00000001
	51	33	Standard timing ID 7 (01h if not used)	01	00000001
	52	34	Standard timing ID 8 (01h if not used)	01	00000001
	53	35	Standard timing ID 8 (01h if not used)	01	00000001

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APPENDIX A. 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) 151.7 MHz @ 59.97Hz	42	01000010
	55	37	Pixel Clock/10,000 (MSB)	3B	00111011
	56	38	Horizontal Active (lower 8 bits) 1920 Pixels	80	10000000
	57	39	Horizontal Blanking(Thp-HA) (lower 8 bits) 94 Pixels	5E	01011110
	58	3A	Horizontal Active / Horizontal Blanking(Thp-HA)(upper 4:4bits)	70	01110000
	59	3B	Vertical Active 1200 Lines	B0	10110000
	60	3C	Vertical Blanking (Tvp-HA)(DE Blanking typ for DE only panels) 56 Lines	38	00111000
	61	3D	Vertical Active : Vertical Blanking (Tvp-HA) (upper 4:4bits)	40	01000000
	62	3E	Horizontal Sync. Offset (Thfp) 30 Pixels	1E	00011110
	63	3F	Horizontal Sync Pulse Width (HSPW) 30 Pixels	1E	00011110
	64	40	Vertical Sync Offset(Tvfp) : Sync Width (VSPW) 3 Lines : 6 Lines	36	00110110
	65	41	Horizontal Vertical Sync Offset/Width (upper 2bits)	00	00000000
	66	42	Horizontal Image Size (mm) 331 mm	4B	01001011
	67	43	Vertical Image Size (mm) 207 mm	CF	11001111
	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_POS)	1A	00011010
Timing Descriptor #2	72	48	Pixel Clock/10,000 (LSB) 151.7 MHz @ 39.98Hz	42	01000010
	73	49	Pixel Clock/10,000 (MSB)	3B	00111011
	74	4A	Horizontal Active (lower 8 bits) 1920 Pixels	80	10000000
	75	4B	Horizontal Blanking(Thp-HA) (lower 8 bits) 94 Pixels	5E	01011110
	76	4C	Horizontal Active / Horizontal Blanking(Thp-HA)(upper 4:4bits)	70	01110000
	77	4D	Vertical Active 1200 Lines	B0	10110000
	78	4E	Vertical Blanking (Tvp-HA)(DE Blanking typ for DE only panels) 684 Lines	AC	10101100
	79	4F	Vertical Active : Vertical Blanking (Tvp-HA) (upper 4:4bits)	42	01000010
	80	50	Horizontal Sync. Offset (Thfp) 30 Pixels	1E	00011110
	81	51	Horizontal Sync Pulse Width (HSPW) 30 Pixels	1E	00011110
	82	52	Vertical Sync Offset(Tvfp) : Sync Width (VSPW) 3 Lines : 6 Lines	36	00110110
	83	53	Horizontal Vertical Sync Offset/Width (upper 2bits)	00	00000000
	84	54	Horizontal Image Size (mm) 331 mm	4B	01001011
	85	55	Vertical Image Size (mm) 207 mm	CF	11001111
	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_POS)	19	00011001
Timing Descriptor #3	90	5A	Flag	00	00000000
	91	5B	Flag	00	00000000
	92	5C	Flag	00	00000000
	93	5D	Data Type Tag : Alphanumeric Data String (ASCII String)	FE	11111110
	94	5E	Flag	00	00000000
	95	5F	Dell P/N 1st Character = H	48	01001000
	96	60	Dell P/N 2nd Character = T	54	01010100
	97	61	Dell P/N 3rd Character = 0	30	00110000
	98	62	Dell P/N 4th Character = 0	30	00110000
	99	63	Dell P/N 5th Character = 9	39	00111001
	100	64	EDID Revision Build Name = MP(X-Build) , Revision # = A00	80	10000000
	101	65	Manufacturer P/N = 1	31	00110001
	102	66	Manufacturer P/N = 5	35	00110101
	103	67	Manufacturer P/N = 4	34	00110100
	104	68	Manufacturer P/N = W	57	01010111
	105	69	Manufacturer P/N = U	55	01010101
	106	6A	Manufacturer P/N = 2	32	00110010
	107	6B	Manufacturer P/N(If<13 char--> 0Ah,then terminate with ASC II code 0Ah,set remaining char = 20h)	0A	00001010

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APPENDIX A. 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	Flag	00	00000000
	109	6D	Flag	00	00000000
	110	6E	Flag	00	00000000
	111	6F	Data Type Tag : Descriptor Defined by manufacturer	00	00000000
	112	70	Flag	00	00000000
	113	71	SMBUS Value(Step #1) = 10 nits	00	00000000
	114	72	SMBUS Value(Step #2) = 17 nits	00	00000000
	115	73	SMBUS Value(Step #3) = 24 nits	00	00000000
	116	74	SMBUS Value(Step #4) = 30 nits	00	00000000
	117	75	SMBUS Value(Step #5) = 60 nits	00	00000000
	118	76	SMBUS Value(Step #6) = XXX nits	00	00000000
	119	77	SMBUS Value(Step #7) = XXX nits	00	00000000
	120	78	SMBUS Value(Step #8) = max nits (Typically = FFh, Max nits)	00	00000000
	121	79	Dual channel LVDS, No RTC support	02	00000010
	122	7A	BIST support	01	00000001
	123	7B	(If<13 char--> 0Ah, then terminate with ASCII code 0Ah, set remaining char = 20h)	0A	00001010
	124	7C	(If<13 char--> 0Ah, then terminate with ASCII code 0Ah, set remaining char = 20h)	20	00100000
	125	7D	(If<13 char--> 0Ah, then terminate with ASCII code 0Ah, set remaining char = 20h)	20	00100000
Checksum	126	7E	Extension flag (# of optional 128 panel ID extension block to follow, Typ = 0)	00	00000000
	127	7F	Check Sum (The 1-byte sum of all 128 bytes in this panel ID block shall = 0)	B7	10110111

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