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SPECIFICATION FOR APPROVAL

- (●) Preliminary Specification
 () Final Specification

Title	17.3" Full HD TFT LCD
-------	-----------------------

BUYER	HP
MODEL	

SUPPLIER	LG Display Co., Ltd.
*MODEL	LP173WF2
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
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PREPARED BY	
H. M. Yoon / Engineer	_____
J. K. Han / Engineer	_____

**Product Engineering Dept.
 LG Display Co., Ltd**

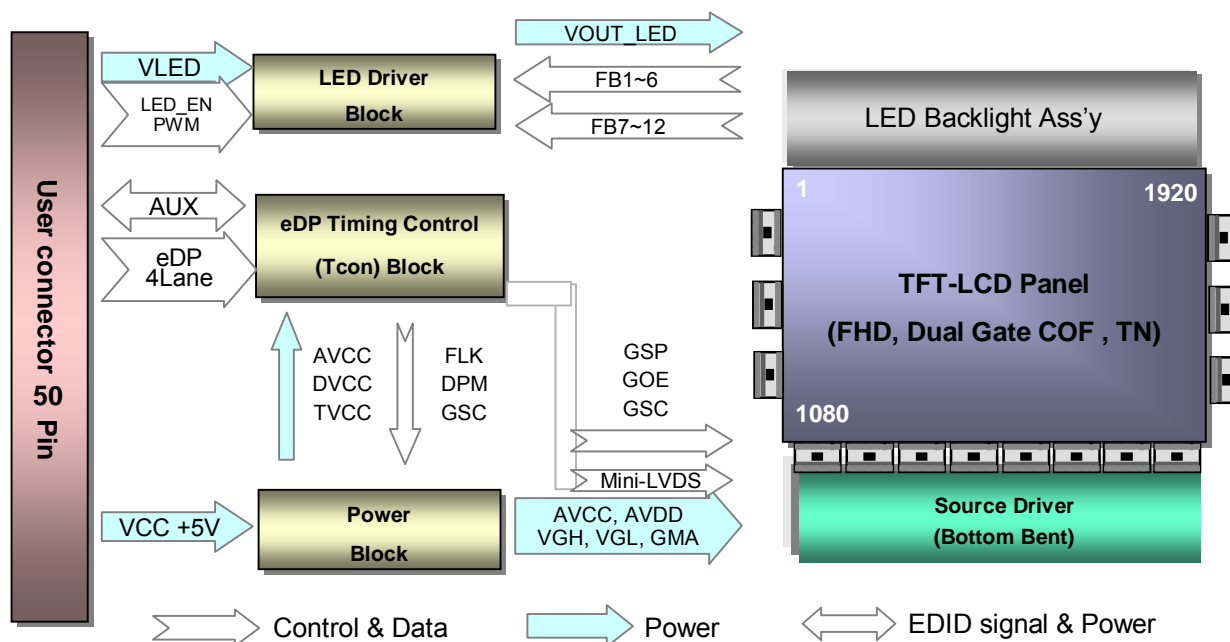
Product Specification

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1. General Description

The LP173WF2 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 17.3 inches diagonally measured active display area with FHD resolution (1920 horizontal by 1080 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 LP173WF2 has been designed to apply the interface method that enables low power, high speed, low EMI. The LP173WF2 is intended to support applications where thin thickness, high brightness are critical factors and graphic displays are important. In combination with the vertical arrangement of the sub-pixels, the LP173WF2 characteristics provide an excellent flat display for office automation products such as Notebook PC.



General Features

Active Screen Size	17.3 inches diagonal
Outline Dimension	381.888(Typ. H) × 214.812(Typ. V) × 6.5(D, Max.) [mm]
Pixel Pitch	0.199 × 0.199 mm
Pixel Format	1920 horiz. by 1080 vert. Pixels RGB strip arrangement
Color Depth	6-bit, 262,144 colors
Luminance, White	400 cd/m ² (Typ.)
Power Consumption	Total 2D TBD W/ 3D TBD W(Typ.)
Weight	650g(Max.)
Display Operating Mode	Transmissive mode, normally white
Surface Treatment	Anti-Glare treatment of the front Polarizer
RoHS Compliance	Yes
BFR / PVC / As Free	Yes for all.

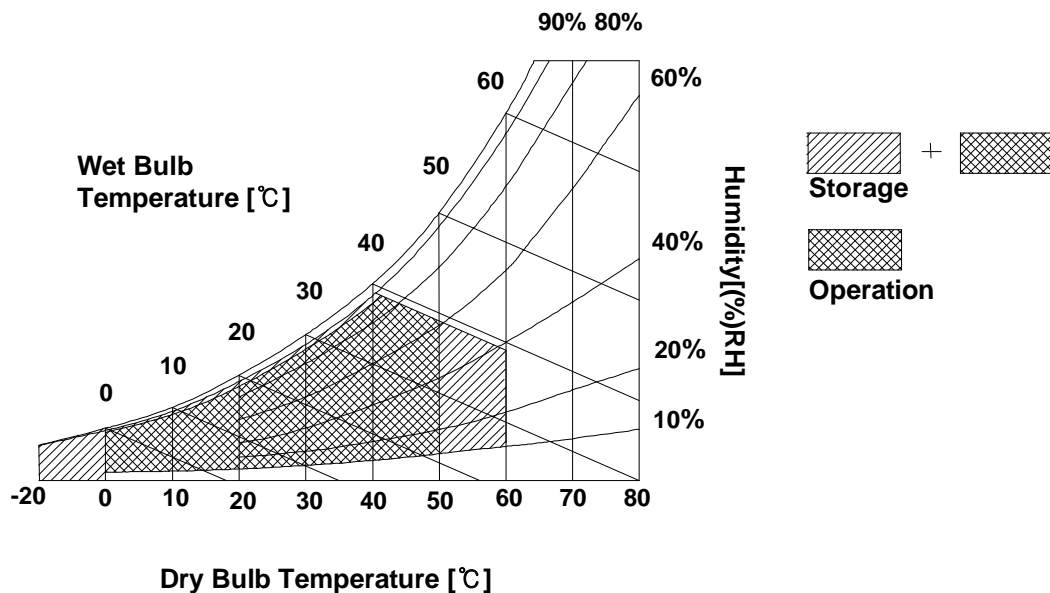
2. Absolute Maximum Ratings

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.



Product Specification

3. Electrical Specifications

3-1. Electrical Characteristics

The LP173WF2 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 BL with LED Driver.

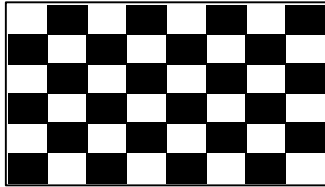
Table 2. ELECTRICAL CHARACTERISTICS

Parameter	Symbol	Values			Unit	Notes	
		Min	Typ	Max			
LOGIC :							
Power Supply Input Voltage	V _{CC}	4.5	5.0	5.5	V	1	
Power Supply Input Current (2D) : Not Fixed	Mosaic	I _{CC}	-	TBD	920	mA	
	Black	I _{CC} _60Hz	-	TBD	1260		
Power Supply Input Current (3D) : Not Fixed	Mosaic	I _{CC}	-	TBD	1620		
	Black	I _{CC} _120Hz + VBI	-	TBD	2300		
Power Consumption (2D) : Not Fixed	Mosaic	P _{CC}	-	TBD	4.6		W
	Black	P _{CC} _60Hz	-	TBD	6.3		
Power Consumption(3D) : Not Fixed	Mosaic	P _{CC}	-	TBD	8.1		
	Black	P _{CC} _120Hz+VBI	-	TBD	11.5		
Power Supply Inrush Current	I _{CC_P}	-	-	TBD	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 : Not Fixed	I _{LED}	-	TBD	970	mA	6	
LED Power Consumption : Not Fixed	P _{LED}	-	TBD	11.6	W	6	
LED Power Inrush Current	I _{LED_P}	-	-	1000	mA	7	
PWM Duty Ratio		5	-	100	%	8	
PWM Jitter	-	0	-	0.2	%	9	
PWM Impedance	Z _{PWM}	20	40	60	kΩ		
PWM Frequency	F _{PWM}	TBD	-	1000	Hz	10	
PWM High Level Voltage	V _{PWM_H}	3.0	-	3.6	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	-	3.6	V		
LED_EN Low Voltage	V _{LED_EN_L}	0	-	0.3	V		
Life Time		12,000	-	-	Hrs	11	

Product Specification

Note)

1. The measuring position is the connector of LCM and the test conditions are under 25°C, $f_v = 60\text{Hz}$.
2. The specified I_{cc} current and power consumption are under the $V_{cc} = 5\text{V}$, 25°C, $f_v = 60\text{Hz}$ or 120Hz+VBI condition.

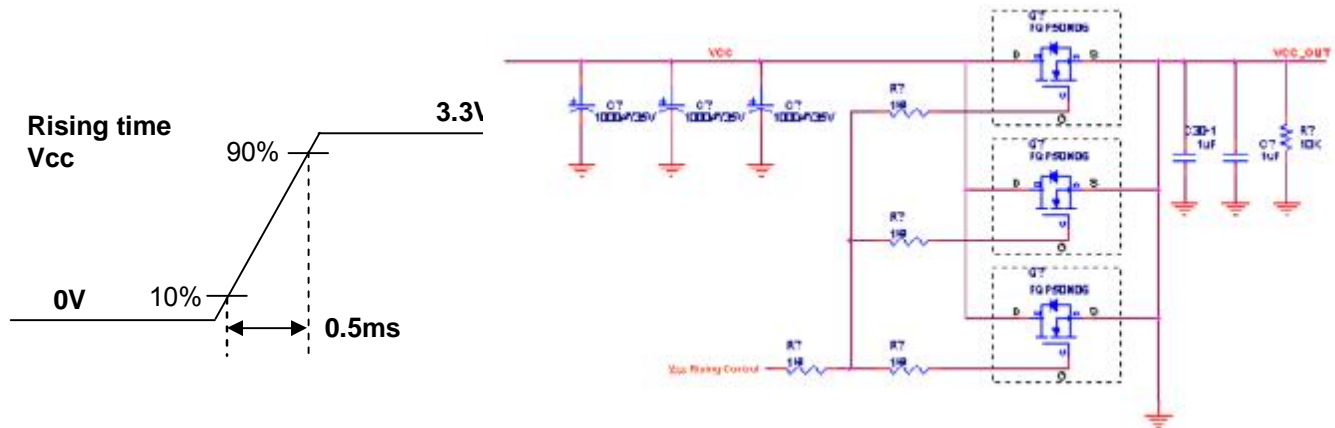


White Pattern

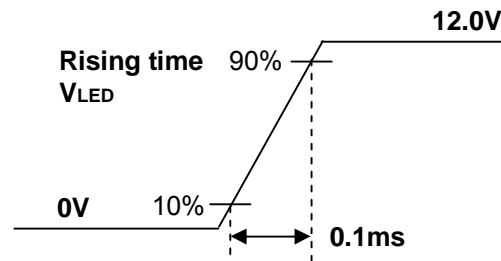


Black Pattern

3. This Spec. is the max load condition for the cable impedance designing.
4. The below figures are the measuring V_{cc} condition and the V_{cc} control block LGD used.
The V_{cc} condition is same as the minimum of T1 at Power on sequence.



5. This impedance value is needed for proper display and measured from eDP Tx to the mating connector.
6. The measuring position is the connector of LCM and the test conditions are under 25°C.
7. The current and power consumption with LED Driver are under the $V_{LED} = 12.0\text{V}$, 25°C, Dimming of Max luminance and White pattern with the normal frame frequency operated(60Hz).
8. The below figures are the measuring V_{LED} condition and the V_{LED} control block LGD used.
 V_{LED} control block is same with V_{cc} control block.



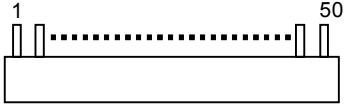
9. The operation of LED Driver below minimum dimming ratio may cause flickering or reliability issue.
10. If Jitter of PWM is bigger than maximum, it may induce flickering.
11. This Spec. is not effective at 100% dimming ratio as an exception because it has DC level equivalent to 0Hz. In spite of acceptable range as defined, the PWM Frequency should be fixed and stable for more consistent brightness control at any specific level desired.
12. The life time is determined as the time at which brightness of LCD is 50% compare to that of minimum value specified in table 7. under general user condition.

Product Specification

3-2. Interface Connections

This LCD employs two interface connections, a 50 pin connector used for the module electronics interface and the other connector used for the integral backlight system.

Table 3. MODULE CONNECTOR PIN CONFIGURATION (CN1)

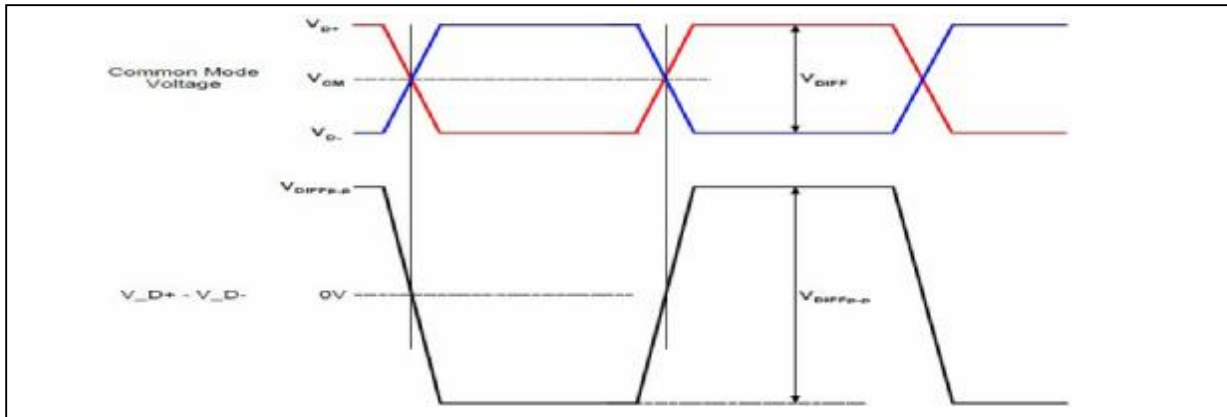
Pin	Symbol	Description	Notes
1	2D_3D	2D/3D Contents communication	[Interface Chip] 1. LCD : MStar, MST7329Y(LCD Controller) Including eDP Receiver. 2. System : TBD or equivalent
2	GND	Ground	
3	VLED	LED Power Supply 7V ~ 20V	
4	VLED	LED Power Supply 7V ~ 20V	
5	VLED	LED Power Supply 7V ~ 20V	
6	VLED	LED Power Supply 7V ~ 20V	
7	GND	Ground	
8	Data I2C	Data I2C (Pvcom, Pgamma Setting)	[Connector] JAE FI-VHP50 or equivalent
9	CLK I2C	CLK I2C (Pvcom, Pgamma Setting)	
10	PWM	PWM for Luminance Control	[Mating Connector] JAE FI-VHP50 series or equivalent (micro-coax type)
11	LED_EN	Back Light On/Off Control	
12	GND	Ground	
13	GND	Ground	
14	GND	Ground	
15	GND	Ground	[Connector pin arrangement]  [LCD Module Rear View]
16	HPD	Hot Plug Detection pin	
17	GND	Ground	
18	NC	No Connection (Reserved)	
19	GND	Ground	
20	GND	Ground	
21	GND	Ground	
22	GND	Ground	
23	VCC	Power Supply (5.0V typ.)	
24	VCC	Power Supply (5.0V typ.)	
25	VCC	Power Supply (5.0V typ.)	
26	VCC	Power Supply (5.0V typ.)	
27	VCC	Power Supply (5.0V typ.)	
28	VCC	Power Supply (5.0V typ.)	
29	VCC	Power Supply (5.0V typ.)	
30	VCC	Power Supply (5.0V typ.)	
31	VCC	Power Supply (5.0V typ.)	
32	VCC	Power Supply (5.0V typ.)	
33	GND	Ground	
34	AUX_CH_N	Complement Signal-Auxiliary Channel	
35	AUX_CH_P	True Signal-Auxiliary Channel	
36	GND	Ground	
37	Lane0_P	True Signal-Main Lane 0	
38	Lane0_N	Complement Signal-Lane 0	
39	GND	Ground	
40	Lane1_P	True Signal-Main Lane 1	
41	Lane1_N	Complement Signal-Lane 1	
42	GND	Ground	
43	Lane2_P	True Signal-Main Lane 2	
44	Lane2_N	Complement Signal-Lane 2	
45	GND	Ground	
46	Lane3_P	True Signal-Main Lane 3	
47	Lane3_N	Complement Signal-Lane 3	
48	GND	Ground	
49	NC	No connect.	
50	NC	No connect.	

Product Specification

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	$V_{DIFF\ p-p}$	120	-	mV	For high bit rate
		40	-		For reduced bit rate
Rx DC common mode voltage	V_{CM}	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 ± 350 ppm. 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

Product Specification

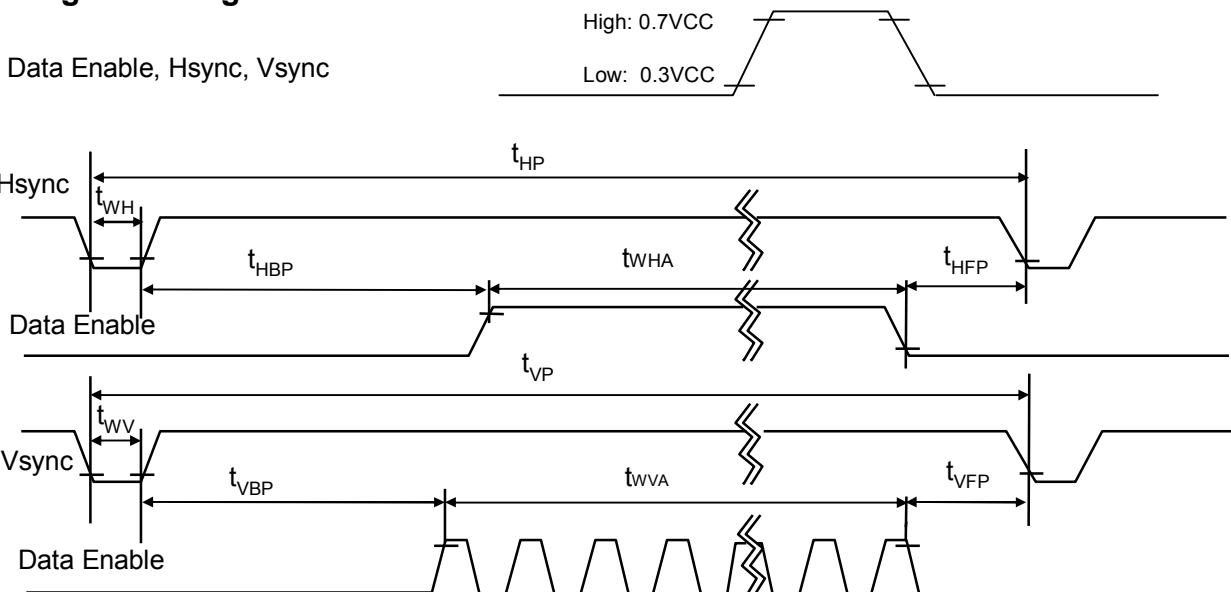
3-4. Signal Timing Specifications

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}	-	37.1	100	MHz	2D (145MHz@60Hz) 3D (396MHz@120+VBI)
Hsync	Period	t_{HP}	TBD	550	TBD	tCLK	Not Fixed
	Width	t_{WH}	TBD	11	TBD		
	Width-Active	t_{WHA}	480	480	480		
Vsync	Period	t_{VP}	TBD	1125	TBD	tHP	Not Fixed
	Width	t_{WV}	TBD	5	TBD		
	Width-Active	t_{WVA}	1080	1080	1080		
Data Enable	Horizontal back porch	t_{HBP}	TBD	37	TBD	tCLK	Not Fixed
	Horizontal front porch	t_{HFP}	TBD	22	TBD		Not Fixed
	Vertical back porch	t_{VBP}	TBD	36	TBD	tHP	Not Fixed
	Vertical front porch	t_{VFP}	TBD	4	TBD		Not Fixed

3-5. Signal Timing Waveforms



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		
		R 5	R 4	R 3	R 2	R 1	R 0	G 5	G 4	G 3	G 2	G 1	G 0	B 5	B 4	B 3	B 2	B 1	B 0
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

Product Specification

3-7. Power Sequence

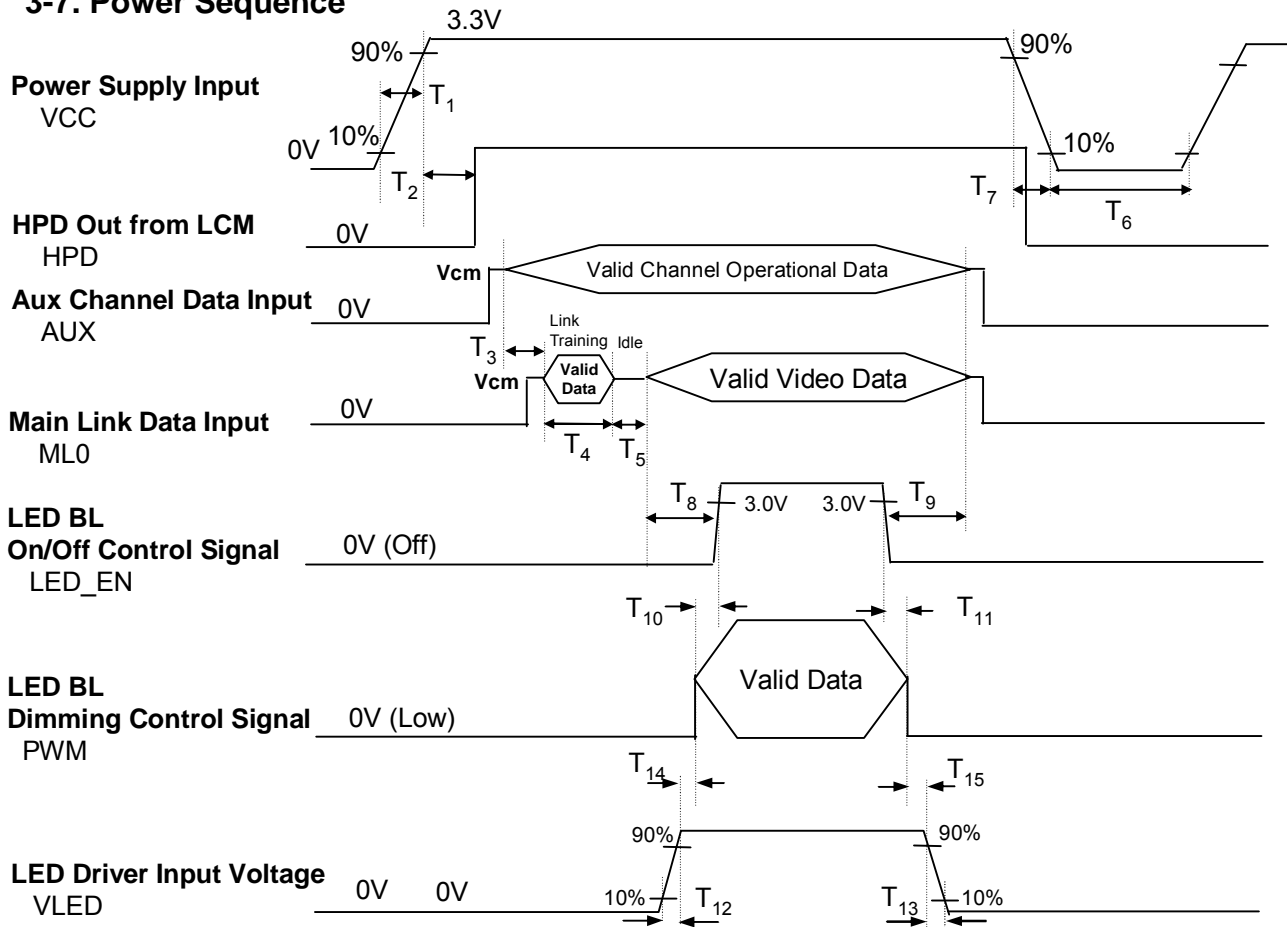


Table 6. POWER SEQUENCE TABLE

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. LVDS, 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 LVDS turn on.

Product Specification

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.

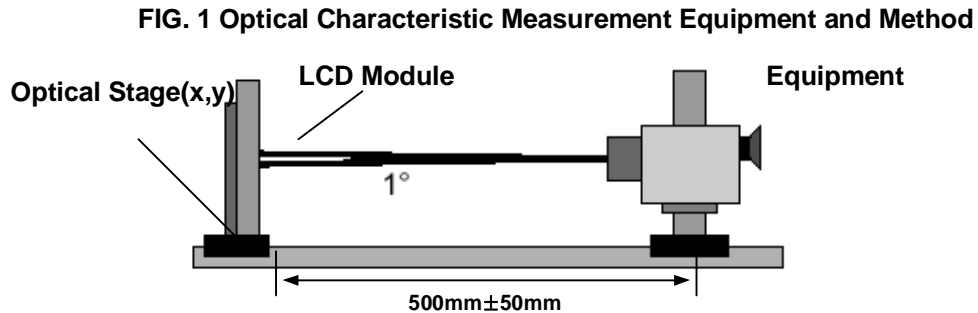


Table 7. OPTICAL CHARACTERISTICS

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

Parameter	Symbol	Values			Units	Notes
		Min	Typ	Max		
Contrast Ratio	CR	500	-	-		1
Surface Luminance, white	L _{WH}	340	400	-	cd/m ²	2
Luminance Variation	δ_{WHITE}	-	1.4	1.6	%	3
Response Time	Black to White	T _R +T _D	5	12	ms	4
	Gray to Gray	T _R +T _D	-	TBD	6	ms
Color Coordinates						
RED	RX	TBD	TBD	TBD		
	RY	TBD	TBD	TBD		
GREEN	GX	TBD	TBD	TBD		
	GY	TBD	TBD	TBD		
BLUE	BX	TBD	TBD	TBD		
	BY	TBD	TBD	TBD		
WHITE	WX	0.283	0.313	0.343		
	WY	0.299	0.329	0.359		
Viewing Angle						
x axis, right($\Phi=0^\circ$)	Θ_r	60	-	-	degree	6
x axis, left ($\Phi=180^\circ$)	Θ_l	60	-	-	degree	
y axis, up ($\Phi=90^\circ$)	Θ_u	50	-	-	degree	
y axis, down ($\Phi=270^\circ$)	Θ_d	50	-	-	degree	
Gray Scale						7
Color Gamut	C/G	-	72	-	%	

Product Specification

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.

$$\text{LWH} = \text{Average}(\text{L1}, \text{L2}, \dots \text{L5})$$

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

$$\delta \text{ WHITE} = \frac{\text{Maximum}(\text{L1}, \text{L2}, \dots \text{L13}) - \text{Minimum}(\text{L1}, \text{L2}, \dots \text{L13})}{\text{Maximum}(\text{L1}, \text{L2}, \dots \text{L13})} * 100(\%)$$

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

5. The gray to gray response time is defined as the following table and shall be measured by switching the input signal for "Gray To Gray".

- Gray step : 5 step
- TGTG (Typ) is the typical specification of total average time at rising time and falling time for 'Gray to Gray'.
- TGTG (Max) is the maximum specification of total average time at rising time and falling time for 'Gray to Gray'.

Gray to Gray		Rising Time				
		G63	G47	G31	G15	G0
Falling Time	G63					
	G47					
	G31					
	G15					
	G0					

6. 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.

Product Specification

7. Gray scale specification

* fV = 60Hz

Gray Level	Luminance [%] (Typ)
L0	TBD
L7	TBD
L15	TBD
L23	TBD
L31	TBD
L39	TBD
L47	TBD
L55	TBD
L63	100

FIG. 2 Luminance

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

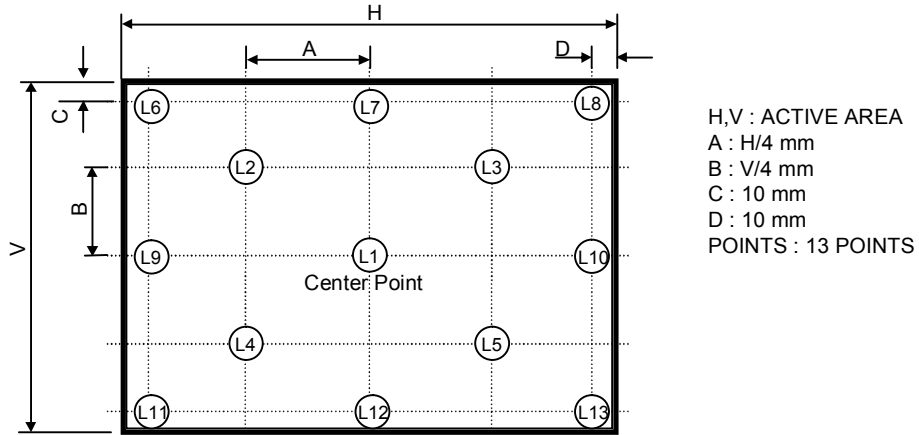


FIG. 3 Response Time

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

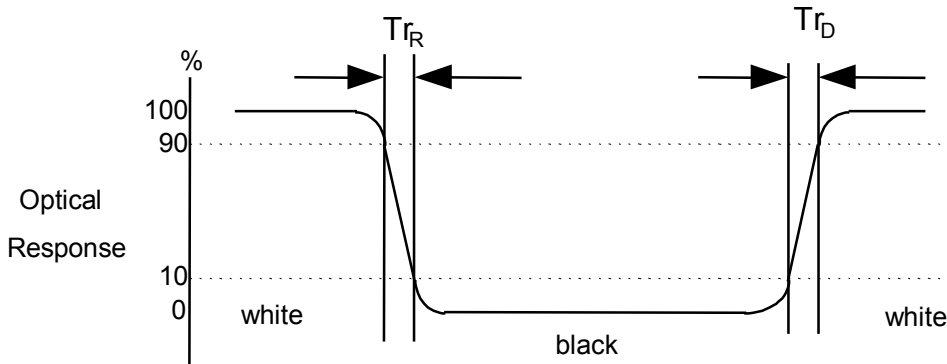
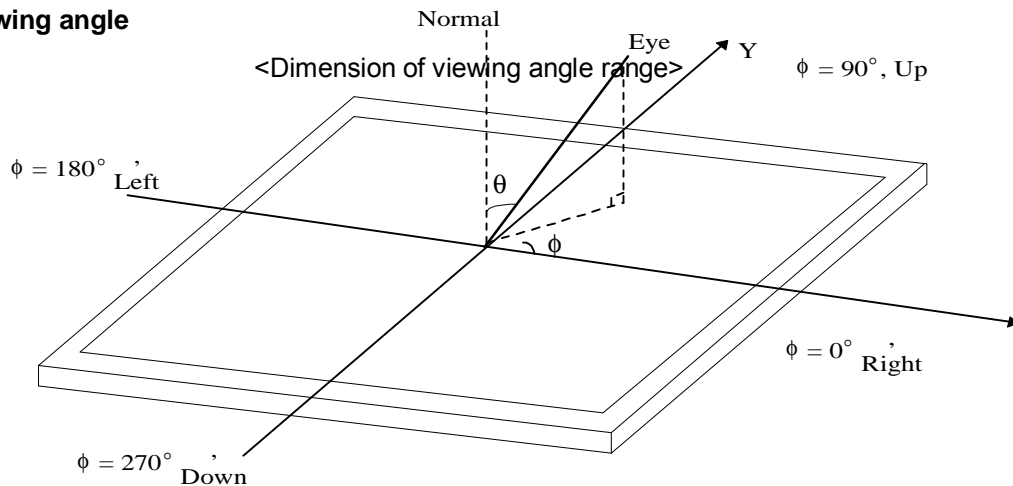


FIG. 4 Viewing angle



Product Specification

5. Mechanical Characteristics

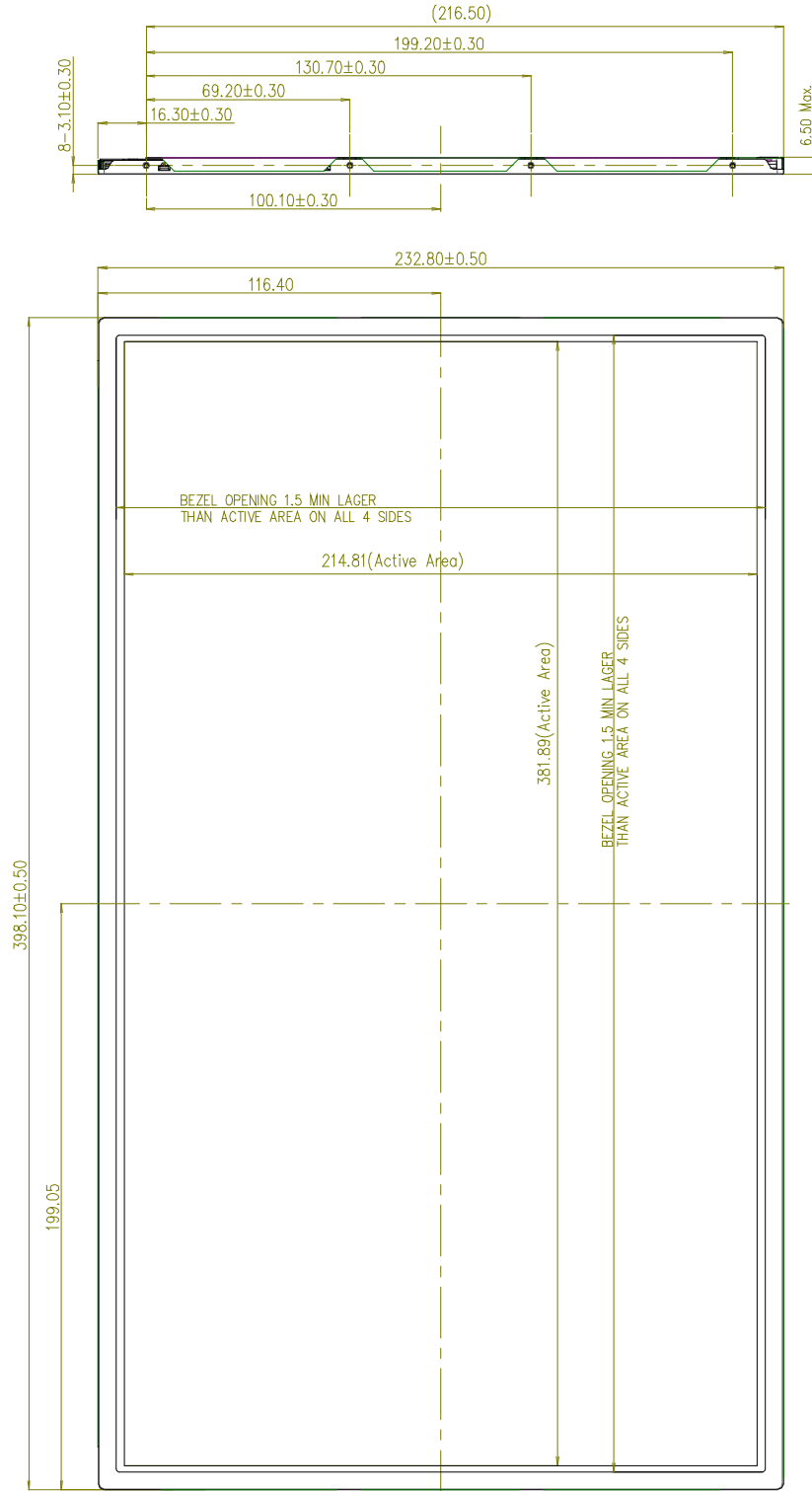
The contents provide general mechanical characteristics for the model LP173WF2.
 In addition the figures in the next page are detailed mechanical drawing of the LCD.

Outline Dimension	Horizontal (A)	398.1 ± 0.50mm
	Vertical (B)	232.8 ± 0.50mm
	Thickness	6.5mm(Max.)
Bezel Area	Horizontal	1.5mm Min.(Lager than Active Display Area)
	Vertical	1.5mm Min.(Lager than Active Display Area)
Active Display Area	Horizontal	381.89mm
	Vertical	214.81mm
Weight	650g (Max.)	
Surface Treatment	Anti-Glare treatment of the front polarizer (Haze 44%)	

Product Specification

<FRONT VIEW>

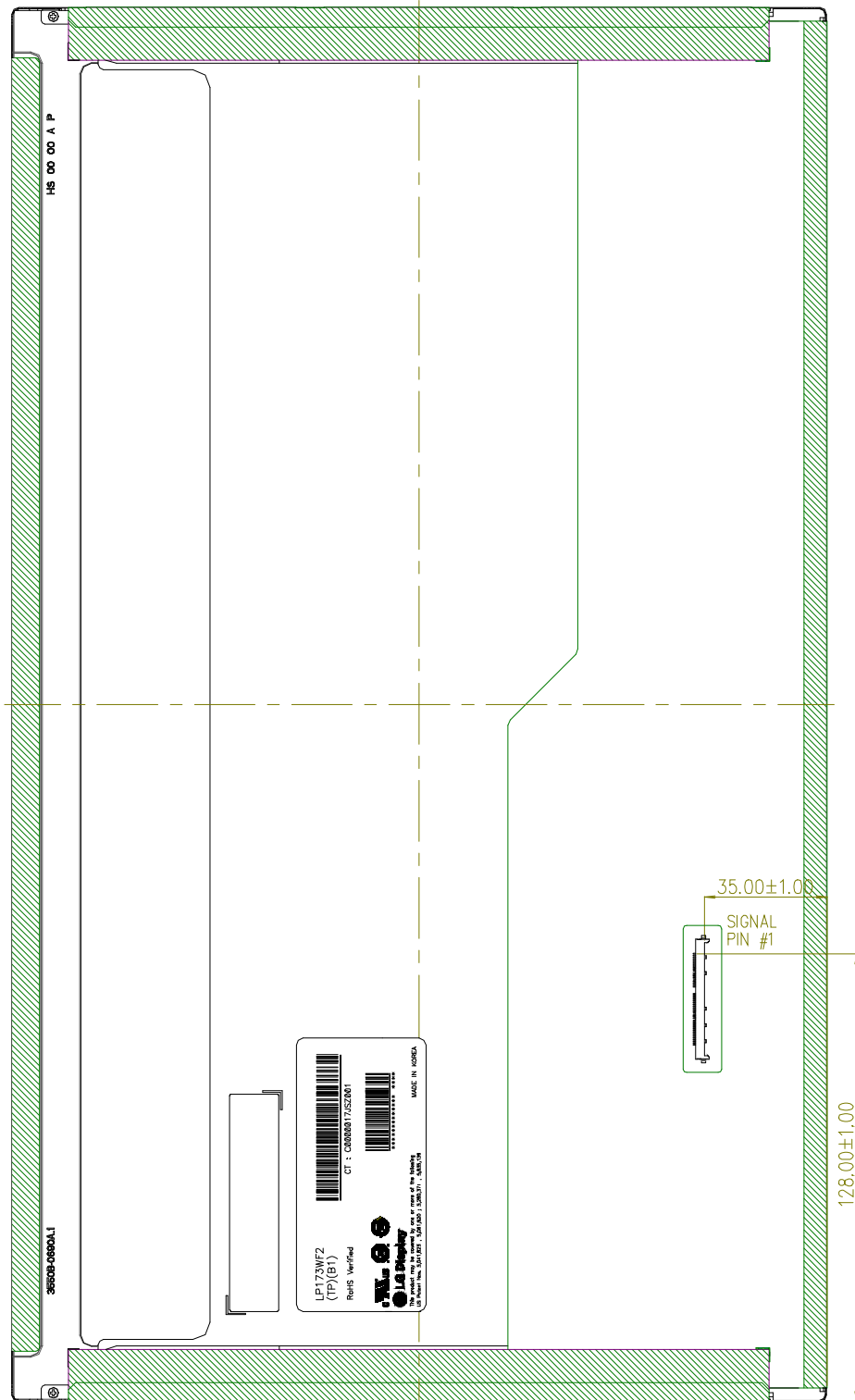
Note) Unit:[mm], General tolerance: $\pm 0.5\text{mm}$



Product Specification

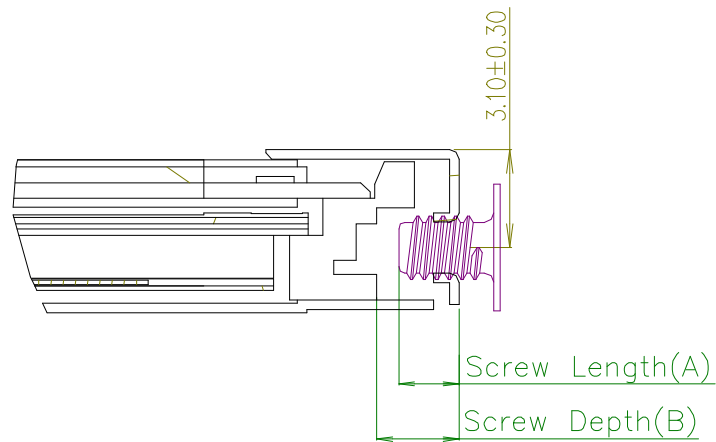
<REAR VIEW>

Note) Unit:[mm], General tolerance: $\pm 0.5\text{mm}$



Product Specification

[DETAIL DESCRIPTION OF SIDE MOUNTING SCREW]



- * Screw Length(A) : Max : 2.5, Min : 2.0
- * Screw Depth(B) : Min 2.5
- * Screw Torque : Max 2.5kgf.cm
 (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.


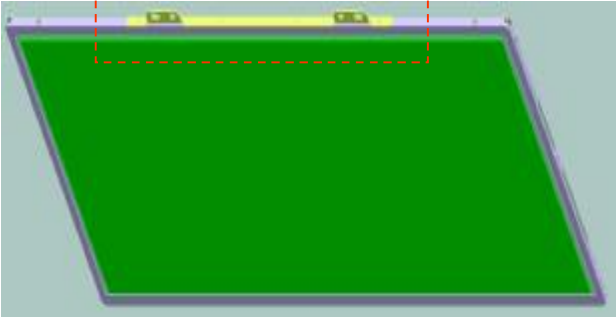
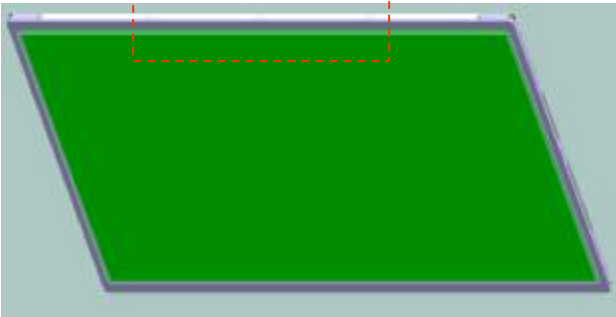
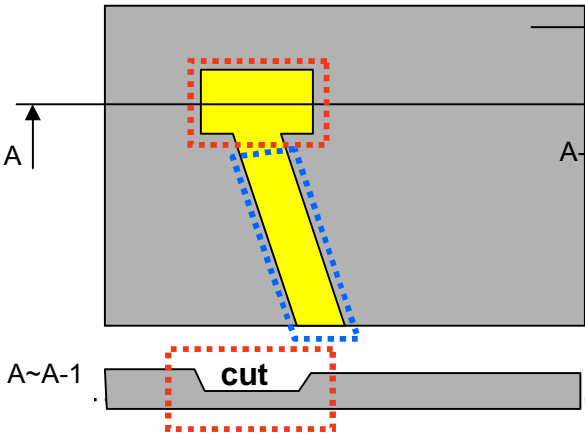
LGD Proposal for system cover design.(Appendix)

1	Gap check for securing the enough gap between LCM and System cover.	
<p>The diagram illustrates the assembly of the LCM (Liquid Crystal Module) and the system cover. On the left, a top-down view of the 'LCM Reflector Side' is shown with various colored components. To the right, a cross-sectional view shows the LCM being inserted into a housing. A double-headed arrow indicates the 'Max Thickness' of the LCM. A dashed red line marks 'A Boundary Line' at the top of the LCM. Three pink arrows point from the LCM towards the housing. To the right of the housing, a blue rectangular block labeled 'Sponge' is positioned between the housing and the 'System Cover'.</p>		
Notes	<p>1.Rear side of LCM is sensitive against external stress,and previous check about interference is highly needed.</p> <p>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..)</p>	
2	Check if antenna cable is sufficiently apart from T-CON of LCD Module.	
<p>Two diagrams of a laptop illustrate the correct placement of the antenna cable. The left diagram, labeled 'NO GOOD', shows the antenna cable (red and orange lines) overlapping the T-CON (black square) on the back of the LCD module. The right diagram, labeled 'GOOD', shows the antenna cable routed away from the T-CON, ensuring no overlap.</p>		
Notes	1.If system antenna is overlapped with T-CON,it might be cause the noise.	

LGD Proposal for system cover design.

3	Gap check for securing enough gap between LCM and System hinge.	
<p style="text-align: center;">LCM Reflector Side</p> <p>Side Mount Screw Hole (4ea)</p> <p>Hinge</p> <p>GAP: Min 2.0mm</p> <p>COF (D-IC)</p> <p>("I" TYPE) ("L" TYPE)</p>		
Notes	<ol style="list-style-type: none"> 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.	
<p>#3 #2 #1</p> <p>Ok Bad Good</p>		
Notes	<ol style="list-style-type: none"> 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. <p>Flat type cable is highly recommended if cable should be located on bad case</p>	

LGD Proposal for system cover design.

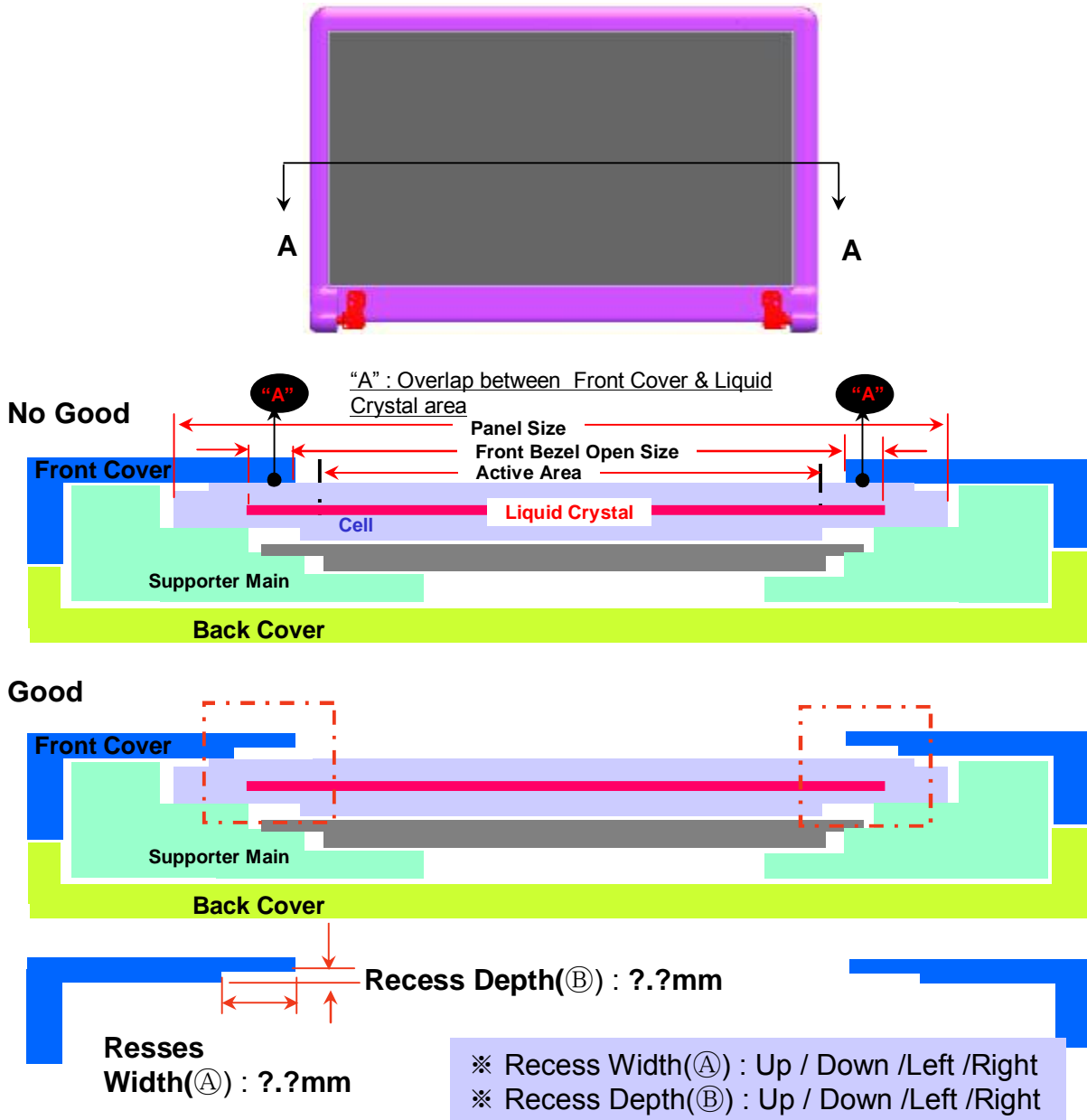
5	Using a bracket on the top of LCM is not recommended.	
<div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;">  <p>bracket</p> </div> </div> <div style="display: flex; justify-content: space-around; align-items: center; margin-top: 20px;"> <div style="text-align: center;">  <p>With bracket</p> </div> <div style="text-align: center;">  <p>Without bracket</p> </div> </div>		
Notes	<p>1. Condition without bracket is good for mechanical noise, and can minimize the light leakage from deformation of bracket.</p> <p>2. The results shows that there is no difference between the condition with or without bracket.</p>	
6	Securing additional gap on CNT area..	
 <p style="text-align: right;">System cover inner side.</p> <p style="text-align: right;">User connector area.</p> <p style="text-align: right;">User connector Cable pathway.</p> <p style="text-align: right;">FPC:Flexible Printed Circuit.</p>		
Notes	<p>1. CNT area is specially sensitive against external stress, and additional gap by cutting on system cover will be helpful on removing the Ripple.</p> <p>2. Using a thinner CNT will be better. (eg: FPC type)</p>	

LGD Proposal for system cover design.

7	Checking the path of System LVDS Cable.
Notes	<ol style="list-style-type: none"> 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 LVDS cable is more recommended than "Cylindrical" type . 3. Making LVDS Cable Guide will give better performance (Refer to detail "A")

LGD Proposal for system cover design.

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

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 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

Product Specification

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)

E : MONTH

D : YEAR

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 : 20pcs

b) Box Size : 490mm X 390mm X 298mm

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 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.
- (10) When handling the LCD module, it needs to handle with care not to give mechanical stress to the PCB and Mounting Hole area."

9-2. OPERATING PRECAUTIONS

- (1) The spike noise causes the mis-operation of circuits. It should be lower than following voltage :
 $V = \pm 200\text{mV}$ (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 minimize the interference.

9-3. ELECTROSTATIC DISCHARGE CONTROL

Since a module is composed of electronic circuits, it is not strong to electrostatic discharge. Make certain that treatment persons are connected to ground through wrist band etc. And don't touch interface pin directly.

9-4. PRECAUTIONS FOR STRONG LIGHT EXPOSURE

Strong light exposure causes degradation of polarizer and color filter.

9-5. STORAGE

When storing modules as spares for a long time, the following precautions are necessary.

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

9-6. HANDLING PRECAUTIONS FOR PROTECTION FILM

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

Product Specification

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
EEDID / Vendor / Product Version	8	08	IT Manufacturer Name 16C	30	00111111
	9	09	IT Manufacturer Name	E4	11111111
	10	0A	IT Product Code 10C4b	C4	00000000
	11	0B	(Item 12C first)	02	00000000
	12	0C	IT Serial No. - Optional (C00b if Encased, Random Code and LSC First)	00	00000000
	13	0D	IT Serial No. - Optional (C00b if Encased, Random Code and LSC First)	00	00000000
	14	0E	IT Serial No. - Optional (C00b if Encased, Random Code and LSC First)	00	00000000
	15	0F	IT Serial No. - Optional (C00b if Encased, Random Code and LSC First)	00	00000000
	16	10	Week of Manufacture - Optional 00 weeks	00	00000000
	17	11	Year of Manufacture 2009 year	14	00000000
Display Parameters	18	12	Panel structure version # = 1	01	00000000
	19	13	Panel structure # = 4	04	00000000
	20	14	Video input interface = Input is a Digital Video signal interface, Color Bit Depth = 8 Bits per Primary Color, Horizontal Resolution = 1280, Vertical Resolution = 800, Display Refresh Rate = 60 Hz	95	10000000
	21	15	Number of Bits in Panel (Physical) = 8 bits per	26	00100000
Panel Color Coordinates	22	16	Panel Red Min. Value (Gamma = 2.2) = 0.0408	15	00000000
	23	17	Panel Green Min. Value (Gamma = 2.2) = 0.0408	78	01110000
	24	18	Features Support (Display Color Management/DFM): Steady Mode is not supported, Special Mode is not supported, Screen Off Mode Power is not supported, Supported Color Gamuts: Formats: sRGB, 4-4-4, Other Feature Support Flags: No sRGB, Default Timing Mode, No Display in Standby, Power off Mode = 4, no DDC, 1.156, no eDP)	02	00000000
	25	19	Red/Green/Blue Bits (R,G,B/Color)	00	00000000
	26	1A	Blue/White/Red Bits (B,W,R/Color)	05	00000000
	27	1B	Red-X Ys = 00	00	00000000
	28	1C	Red-Y Ys = 00	00	00000000
	29	1D	Green-X Xs = 00	00	00000000
	30	1E	Green-Y Ys = 00	00	00000000
	31	1F	Blue-X Xs = 00	00	00000000
32	20	Blue-Y Ys = 00	00	00000000	
33	21	White-X Xs = 0.013	50	00000000	
34	22	White-Y Ys = 0.025	54	01000000	
Established Timin	35	23	Standard timing 1 (Color = 11.1 Panel use E)	00	00000000
	36	24	Standard timing 2 (Color = 11.1 Panel use E)	00	00000000
	37	25	Standard timing 3 (Color = 00.0 Panel use E)	00	00000000
Standard Timing ID	38	26	Standard timing 01 (Optional, Panel use E)	01	00000000
	39	27	Standard timing 02 (Optional, Panel use E)	01	00000000
	40	28	Standard timing 03 (Optional, Panel use E)	01	00000000
	41	29	Standard timing 04 (Optional, Panel use E)	01	00000000
	42	2A	Standard timing 05 (Optional, Panel use E)	01	00000000
	43	2B	Standard timing 06 (Optional, Panel use E)	01	00000000
	44	2C	Standard timing 07 (Optional, Panel use E)	01	00000000
	45	2D	Standard timing 08 (Optional, Panel use E)	01	00000000
	46	2E	Standard timing 09 (Optional, Panel use E)	01	00000000
	47	2F	Standard timing 10 (Optional, Panel use E)	01	00000000
	48	30	Standard timing 11 (Optional, Panel use E)	01	00000000
	49	31	Standard timing 12 (Optional, Panel use E)	01	00000000
	50	32	Standard timing 13 (Optional, Panel use E)	01	00000000
	51	33	Standard timing 14 (Optional, Panel use E)	01	00000000
	52	34	Standard timing 15 (Optional, Panel use E)	01	00000000
	53	35	Standard timing 16 (Optional, Panel use E)	01	00000000

Will be updated

Product Specification

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

	Byte (Dec)	Byte (Hex)	Field Name and Comments	Value (Hex)	Value (Bin)	
Not fixed	14	36	Pixel Clock (MHz) (MSR)	147.164MHz (6 Hz)	02	0000000
	15	37	Pixel Clock (MHz) (MSD)		5A	0011000
	16	38	Horizontal Active (Lower 8 bits)	1020 Pixels	80	1000000
	17	39	Horizontal Active (Upper 8 bits)	880 Pixels	18	0001000
	18	3A	Horizontal Active / Horizontal Blanking (Top EA) (upper 4 bits)		71	0111111
	19	3B	Vertical Active	1080 Lines	38	0011000
	20	3C	Vertical Blanking (Top EA) (DE Blanking type for DE only panels)	45 Lines	2D	0111111
	21	3D	Vertical Active / Vertical Blanking (Top EA) (upper 4 bits)		40	0100000
	22	3E	Horizontal Sync Offset (Top)	88 Pixels	58	1001100
	23	3F	Horizontal Sync Offset (Bottom)	44 Pixels	2C	0001000
	24	40	Vertical Sync Offset (Top) / Sync Width (VSPW)	1 Lines / 1 Lines	45	0100000
	25	41	Horizontal Sync Offset/Width (upper 2 bits)		00	0000000
	26	42	Horizontal Image Size (mm)	283 mm	7F	0111100
	27	43	Vertical Image Size (mm)	215 mm	D7	1011111
	28	44	Horizontal Image Size / Vertical Image Size		10	0000000
29	45	Horizontal Border = 0 (Zero for Notebook LCD)		00	0000111	
30	46	Vertical Border = 1 (Zero for Notebook LCD)		00	0000000	
31	47	Resolution, Normal display, no stereo, Digital Separate (Sync_HB0, Sync_VB0) (outside of VSPW)		19	0001000	
Not fixed	32	48	Pixel Clock (MHz) (MSR)	156.25MHz @ 100Hz_VDD12V	D3	1000111
	33	49	Pixel Clock (MHz) (MSD)		9A	0111000
	34	1A	Horizontal Active (Lower 8 bits)	1920 Pixels	80	1000000
	35	4B	Horizontal Active (Upper 8 bits)	1080 Pixels	A0	0001000
	36	1C	Horizontal Active / Horizontal Blanking (Top EA) (upper 4 bits)		70	0111000
	37	4D	Vertical Active	1080 Lines	38	0111111
	38	4E	Vertical Blanking (Top EA) (DE Blanking type for DE only panels)	98 Lines	FC	0001000
	39	4F	Vertical Active / Vertical Blanking (Top EA) (upper 4 bits)		41	0000111
	40	50	Horizontal Sync Offset (Top)	91 Pixels	14	0101000
	41	51	Horizontal Sync Offset (Bottom)	29 Pixels	14	1011100
	42	52	Vertical Sync Offset (Top) / Sync Width (VSPW)	1 Lines / 1 Lines	35	0100000
	43	53	Horizontal Sync Offset/Width (upper 2 bits)		00	0000000
	44	54	Horizontal Image Size (mm)	395 mm	7E	0111100
	45	55	Vertical Image Size (mm)	215 mm	D7	1001000
	46	56	Horizontal Image Size / Vertical Image Size		10	0011111
47	57	Horizontal Border = 0 (Zero for Notebook LCD)		00	0000000	
48	58	Vertical Border = 0 (Zero for Notebook LCD)		00	0000111	
49	59	Resolution, Normal display, no stereo, Digital Separate (Sync_HB0, Sync_VB0) (outside of VSPW)		19	0001000	
Timing Descriptor #3	50	5A	Link Source DDC		00	0000000
	51	5B	Link Source DDC		00	0000000
	52	5C	Link Source DDC		00	0000000
	53	5D	Link Source DDC		00	0000111
	54	5E	Link Source DDC		00	0000000
	55	5F	Link Source DDC		00	0000111
	56	60	Link Source DDC		00	0000000
	57	61	Link Source DDC		00	1000100
	58	62	Link Source DDC		00	0000000
	59	63	Link Source DDC		00	0000000
	60	64	Link Source DDC		00	0000000
	61	65	Link Source DDC		00	0000000
	62	66	Link Source DDC		00	0000111
	63	67	Link Source DDC		00	0000000
	64	68	Link Source DDC		00	0000111
65	69	Link Source DDC		00	0000000	
66	6A	Link Source DDC		00	1000100	
67	6B	Link Source DDC		00	0000111	

Product Specification

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

	Byte (Dec)	Byte (Hex)	Field Name and Comments	Value (Hex)	Value (Bin)
<i>Timing Descriptor #4</i>	1E	6E	Standard Timing Description #4	00	00000000
	1F	6D	Flag	00	00000000
	20	6E	Reserved	00	00000000
	21	6F	Function/Source Label	01	00000000
	22	70	Flag	00	00000000
	23	71	Power @ 70 Hz @ Step 1	0C	00000000
	24	72	Power @ 72 Hz @ Step 1	00	00000000
	25	73	Power @ 75 Hz @ Step 1	EA	00000000
	26	74	Data [7D] @ Step 2	00	00000000
	27	75	Data [7D] @ Step 3	3C	00000000
	28	76	Data [7D] @ Step 10	00	00000000
	29	77	Power @ 77 Hz @ Step 1	00	00000000
	2A	78	Power @ 78 Hz @ Step 1	00	00000000
	2B	79	Power @ 79 Hz @ Step 1	00	00000000
	2C	7A	Power @ 80 Hz @ Step 1	00	00000000
	2D	7B	Flag	00	00000000
	2E	7C	Flag	00	00000000
2F	7D	Flag	00	00000000	
<i>Check</i>	2E	7E	Extension Flag (0 of optional L2B panel II extension block to follow. Typ = 0)	00	00000000
	2F	7F	Checksum (The 14-bit sum of all 128 bytes in this area. To check all = 0)	5F	00000000