

LP141WX5 Liquid Crystal Display

🕒 LG Display

**Product Specification** 

# SPECIFICATION FOR APPROVAL

- $( \blacklozenge )$  Preliminary Specification
  - ) Final Specification
    - Title

Customer	
MODEL	

14.1 WAGA IFI LOD	14.1"	WXGA	TFT	LCD
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SUPPLIER	LG Display Co., Ltd.
*MODEL	LP141WX5
Suffix	TPP1

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

APPROVED BY	SIGNATURE
/	
/	
/	
Please return 1 copy for ye your signature and comme	our confirmation with ents.

APPROVED BY	SIGNATURE
H.S. Kim / G.Manager	
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Ver. 0.0

Mar. 29, 2010

LP141WX5



Liquid Crystal Display

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## **RECORD OF REVISIONS**

Revision No	Revision Date	Page	Description	EDID ver
0.0	Mar. 29. 2010	All	First Draft (Preliminary Specification)	0.0

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#### 1. General Description

The LP141WX5 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 (1280 horizontal by 800 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 LP141WX5 has been designed to apply the interface method that enables low power, high speed, low EMI. The LP141WX5 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 LP141WX5 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, Typ.) × 206.5(V, Typ.) × 5.5(D, Max.) mm
Pixel Pitch	0.2373mm X 0.2373 mm
Pixel Format	1280 horiz. by 800 vert. Pixels RGB strip arrangement
Color Depth	6-bit, 262,144 colors
Luminance, White	220 cd/m²(Typ., @ I <sub>LED</sub> = 18 mA)
Power Consumption	Total 4.7 W(Typ.) Logic : 1.5 W (Typ.@ Mosaic), B/L : 3.2 W (Typ.@ 18mA )
Weight	375g (Max.)
Display Operating Mode	Transmissive mode, normally white
Surface Treatment	Anti-Glare treatment (3H) of the front Polarizer
RoHS Compliance	Yes
BFR / PVC / As Free	Yes for all
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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.

Deremeter	Symbol	Val	ues	Linita	Notes	
Farameter	Symbol	Min	Max	Units		
Power Input Voltage	ver Input Voltage VCC			Vdc	at 25 $\pm$ 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	

#### Table 1. ABSOLUTE MAXIMUM RATINGS

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 LP141WX5 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.

Parameter		Symbol	Values			Unit	Notos
		Symbol	Min	Тур	Max	Unit	NOLES
LOGIC :							
Power Supply Input Voltage		VCC	3.0	3.3	3.6	V	1
Power Supply Input Current	Mosaic	ICC	-	450	520	mA	2
Power Consumption		PCC	-	1.5	1.7	W	2
Power Supply Inrush Current		ICC_P	-	-	2000	mA	3
eDP Impedance		ZeDP	90	100	110	Ω	4
BACKLIGHT : ( with LED Driver)							
LED Power Input Voltage		V <sub>LED</sub>	7.5	12.0	21.0	V	5
LED Power Input Current		I <sub>LED</sub>	-	18	21	mA	6
LED Power Consumption		P <sub>LED</sub>	-	3.2	3.4	W	6
LED Power Inrush Current		I <sub>LED_P</sub>	-	-	2000	mA	7
PWM Duty Ratio			5	-	100	%	8
PWM Jitter		-	0	-	0.2	%	9
PWM Impedance		Z <sub>PWM</sub>	20	40	60	kΩ	
PWM Frequency		F <sub>PWM</sub>	200	-	1000	Hz	10
PWM High Level Voltage		V <sub>PWM_H</sub>	3.0	-	5.3	V	
PWM Low Level Voltage		V <sub>PWM_L</sub>	0	-	0.3	V	
LED_EN Impedance		Z <sub>PWM</sub>	20	40	60	kΩ	
LED_EN High Voltage		V <sub>LED_EN_H</sub>	3.0	-	5.3	V	
LED_EN Low Voltage		V <sub>LED_EN_L</sub>	0	-	0.3	V	
Life Time			15,000	-	-	Hrs	11

Table 2.	<b>ELECTRICAL CHARACTERISTICS</b>
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#### Note)

- 1. The measuring position is the connector of LCM and the test conditions are under 25 °C, fv = 60Hz, Black pattern.
- 2. The specified lcc current and power consumption are under the Vcc = 3.3V , 25 °C, fv = 60Hz condition and Mosaic pattern.



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



- 5. This impedance value is needed for proper display and measured form 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 VIed = 12.0V , 25 °C , Dimming of Max luminance and White pattern with the normal frame frequency operated(60Hz).
- 8. The below figures are the measuring Vled condition and the Vled control block LGD used.
  VLED control block is same with Vcc control block.
  Rising time 90%
  VLED



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 sum of the continuous operation time at which brightness of LCD at the typical LED current is 50% compare to that of minimum value specified in table 7 under general user condition.

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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.

Pin	Symbol	Description	Notes
1	PAID	Conn. Continuity Test	[Interface Chip]
2	GND	High Speed (Main Link) Ground	1. LCD :
3	Lane1_N	Complement Signal-Lane 1 ( No Connection )	Including eDP Receiver.
4	Lane1_p	True Signal-Main Lane 1 ( No Connection )	2. System : TBD or equivalent
5	GND	High Speed (Main Link) Ground	* Pin to Pin compatible with eDP
6	Lane0_N	Complement Signal-Lane 0	[Connector]
7	Lane0_p	True Signal-Main Lane 0	CABLINE-VS RECE ASS'Y, I-PEX
8	GND	High Speed (Main Link) Ground	or its compatibles
9	AUX_P	True Signal-Auxiliary Channel	[Mating Connector]
10	AUX_N	Complement Signal-Auxiliary Channel	CABLINE-VS PLUG CABLE ASS'Y or
11	GND	High Speed (Main Link) Ground	
12	VCC	LCD Logic and driver power (3.3V Typ.)	[Connector pin arrangement]
13	VCC	LCD Logic and driver power (3.3V Typ.)	30 1 П ПП П
14	BIST	LCD Panel Self Test Enable	
15	GND	Ground	
16	GND	Ground	
17	HPD	HPD signal pin	
18	GND	LED Backlight Ground	
19	GND	LED Backlight Ground	
20	GND	LED Backlight Ground	
21	GND	LED Backlight Ground	
22	LED_EN <mark>(NC)</mark>	LED Backlight On/Off	
23	PWM	System PWM Signal input for dimming	
24	SMBUS_CLK	Backlight Control Clk	
25	SMBUS_DATA	Backlight Control Data	
26	VLED	LED Backlight Power (7.5V-21V)	
27	VLED	LED Backlight Power (7.5V-21V)	
28	VLED	LED Backlight Power (7.5V-21V)	
29	VLED	LED Backlight Power (7.5V-21V)	
30	PAID	Conn. Continuity Test	

#### Table 3. MODULE CONNECTOR PIN CONFIGURATION (CN1)

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## 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		120	-	m)/	For high bit rate
Differential peak-to-peak input voltage	VDIFF p-p	40	-		For reduced bit rate
Rx DC common mode voltage	VCM	0	2.0	V	-

## 3-3-2. AC Specification

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

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

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Condition : VCC = 3.3V



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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 eDP Tx/Rx for its proper operation. **Table 4. TIMING TABLE** 

ITEM	Symbol		Min	Тур	Max	Unit	Note
DCLK	Frequency	f <sub>CLK</sub>	-	74.8	-	MHz	
	Period	Thp	1376	1472	1600		
Hsync	Width	t <sub>wH</sub>	32	44	56	tCLK	
	Width-Active	t <sub>WHA</sub>	1280	1280	1280		
	Period	t <sub>VP</sub>	807	846	885		
Vsync	Width	t <sub>WV</sub>	2	8	16	tHP	
	Width-Active	t <sub>WVA</sub>	800	800	800		
	Horizontal back porch	t <sub>HBP</sub>	32	94	172	+CL K	
Data Enable	Horizontal front porch	t <sub>HFP</sub>	32	54	92	IULK	
	Vertical back porch	t <sub>VBP</sub>	4	29	54	+UD	
	Vertical front porch	t <sub>VFP</sub>	1	9	18	I.L.L.	

## 3-5. Signal Timing Waveforms

Data Enable, Hsync, Vsync





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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.

								Inp	out Co	olor D	)ata								
	Color			RE	Ð					GRE	EEN					BL	UE		
	50101	MSE	3				LSB	MSE	3				LSB	MSE	3				LSB
		R5	R4	R3	R2	R1	R0	G 5	G4	G3	G2	G 1	G0	B 5	Β4	Β3	B 2	B 1	В0
	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
Basic	Blue	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
Color	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 (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																			
	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 (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				· · · · · ·	· · · · ·					•••••	 	•••••				•••••	 		
	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	0	0	0	0	0	 0
	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	 1
BLUE	· · · · · · · · · · · · · · · · · · ·			•••••						•••••	 	•••••		••••			 		
	BLUE (62)	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

Table 5.	COLOR	DATA	REFERENCE
	OCLOIN	0/11/1	

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Parameter

 $T_1$ 

 $T_2$ 

 $T_3$ 

T₄

 $T_5$ 

 $T_6$ 

 $T_7$ 

T<sub>8</sub>

Note)

Ver. 0.0

Min.

0.5

0

50

0

0

500

3

200

Тур.

-

\_

75

\_

-

-

-

\_

1. Do not insert the mating cable when system turn on.

Max.

10

200

\_

\_

-

-

10

-

2. Valid Data have to meet "3-3. eDP Signal Timing Specifications"

ms

ms

ms

ms

ms

ms

ms

ms

3. LVDS, LED\_EN and PWM need to be on pull-down condition on invalid status.





Parameter

Т<sub>9</sub>

 $T_{10}$ 

 $T_{11}$ 

T<sub>12</sub>

T<sub>13</sub>

T<sub>14</sub>

 $T_{15}$ 

Min.

200

200

0

0.5

0

0

50

Тур.

-

\_

-

\_

-

-

\_

Max.

\_

\_

50

\_

5000

-

\_

ms

ms

ms

ms

ms

ms

ms

12/30

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4. LGD recommend the rising sequence of VLED after the Vcc and valid status of LVDS turn on.

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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  $\Phi$  and  $\Theta$  equal to 0°.

FIG. 1 presents additional information concerning the measurement equipment and method.



## FIG. 1 Optical Characteristic Measurement Equipment and Method

 Table 7. OPTICAL CHARACTERISTICS

Deremeter	Sympol		Values		Linita	Notos	
Parameter	Зушоо	Min	Тур Мах		Units	NOLES	
Contrast Ratio	CR	300	-	-		1	
Surface Luminance, white	L <sub>WH</sub>	200	220		cd/m <sup>2</sup>	2	
Luminance Variation	$\delta_{\text{WHITE}}$	-	1.4	1.6		3	
Response Time	Tr <sub>R</sub> + Tr <sub>D</sub>		16		ms	4	
Color Coordinates					1		
RED	RX	0.550	0.580	0.610	1		
	RY	0.315	0.345	0.375			
GREEN	GX	0.307	0.337	0.367			
	GY	0.526	0.556	0.586			
BLUE	BX	0.129	0.159	0.189			
	BY	0.104	0.134	0.164			
WHITE	WX	0.283	0.313	0.343			
	WY	0.299	0.329	0.359			
Viewing Angle	[				]	5	
x axis, right(Φ=0°)	Θr	40	45		degree		
x axis, left ( $\Phi$ =180°)	ΘΙ	40	45	-	degree		
y axis, up ( $\Phi$ =90°)	Θu	10			degree		
y axis, down (Φ=270°)	Θd	30	35		degree		
Gray Scale			2.2			6	

Ta=25°C, VCC=3.3V, fv=60Hz, f<sub>CLK</sub>= 69.3MHz

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Note)

1. Contrast Ratio(CR) is defined mathematically as Surface Luminance with all white pixels

Contrast Ratio =

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.

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

3. The variation in surface luminance , The panel total variation ( $\delta_{WHITE}$ ) is determined by measuring L<sub>N</sub> at each test position 1 through 13 and then defined as following numerical formula. For more information see FIG 2.

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

- 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<sub>v</sub> = 60Hz

Gray Level	Luminance [%] (Typ)
LO	0.2
L7	1.7
L15	5.8
L23	12.5
L31	21.6
L39	35.8
L47	54.8
L55	77.5
L63	100



🕒 LG Display LP141WX5 Liquid Crystal Display **Product Specification** FIG. 2 Luminance <measuring point for surface luminance & measuring point for luminance variation> Н Α 10mm ۲ ..... Ò .... 7 8 6 10mm  $\downarrow$ 3 2 В H,V: ACTIVE AREA Ó A: H/4 mm V 9 10 1 B : V/4 mm **POINTS: 13 POINTS** 4 5 13 11 12 **Active Area** 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 LP141WX5. In addition the figures in the next page are detailed mechanical drawing of the LCD.

	Horizontal	$319.5\pm0.5 \text{mm}$			
Outline Dimension	Vertical	$206.5\pm0.5\text{mm}$			
	Thickness	5.5mm (max.)			
Pozol Aroo	Horizontal	312.5 ± 0.5mm			
Dezel Area	Vertical	$193.8\pm0.5 mm$			
Active Display Area	Horizontal	303.74 mm			
Active Display Area	Vertical 189.84 mm				
Weight	375g (Max.)				
Surface Treatment	Anti-glare treatment of the front	polarizer			

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🕒 LG Display LP141WX5 Liquid Crystal Display **Product Specification** <FRONT VIEW> Note) Unit:[mm], General tolerance:  $\pm 0.5$ mm 8-3.10±0.30 Max. -M2.0X2.5mm DEPTH MAX 8 PLACES 5.5 - [ æ 0 193.80(Bezel open) 189.84(Active area) open) 303.744(Achtive area) 319.50±0.50 309.90±0.50 312.50±0.50(bezel (Bezel open) 96.90±0.30 159.75±0.30 100.95±0.30 206.50±0.50 Я 2-18.15±0.30 61.50±0.30 118.50±0.30 168.60±0.30 17 / 30 Ver. 0.0 Mar. 29, 2010

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 $\oslash$ 

🕒 LG Display LP141WX5 Liquid Crystal Display **Product Specification** Note) Unit:[mm], General tolerance: ± 0.5mm Minit (© ) 15,00 84,40±1.0 Don't Touch!請勿觸摸 Pin 1 6 159.53±1.0 30,00 Don't Touch!
 請勿觸摸 Keep Out (80x80mm) attach here. 309,90±0,10 Don't ・Don't Touch 請勿觸摸 KR-@6HWVV-56252-XXX-XXX-XXX-XXX J/PN : @6HWVV ed by one or more of the following 5,061,920 - 5,2835. 6091L-0000 090000 A01 LP141WX5 14.1' WXGA (TP)(P1) 0 annannin o P <u>ø2.</u>80

<REAR VIEW>

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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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## LGD Proposal for system cover design.(Appendix)





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#### LGD Proposal for system cover design.





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#### LGD Proposal for system cover design.







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## LGD Proposal for system cover design. 8 Securing additional gap between front cover & LCD at edge of front cover. Α Α "A" : Overlap between Front Cover & Liquid No Good <u>Crystal area</u> Panel Size Front Bezel Open Size Front Cover Active Area Liquid Crystal Supporter Main **Back Cover** Good ront Cover **Supporter Main Back Cover** Recess Depth(B): ?.?mm Resses ※ Recess Width(A): Up / Down /Left Width(A) : ?.?mm /Right ※ Recess Depth(B): Up / Down /Left 1.Active area which is filled with Lic /Right external stress, so additional gap to make recess area on the edge of Notes front cover will be helpful to prevent mechanical Ripple. (Dimension of Recess depends on each model design)

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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.

One step solution for LCD / PDP / OLED panel application: Datasheet, inventory and accessory! www.panelook.com



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#### 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

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8. Packing	

#### 8-1. Designation of Lot Mark

a) Lot Mark



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	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mark	1	2	3	4	5	6	7	8	9	А	В	С

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 : 490mm imes 393mm imes 284mm



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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 :  $V=\pm 200 mV$ (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 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<sup>™</sup>) 1/3

	e e	Byte (Hex)	Field Name and Comments	Value (Hex)	Value (Bin)
	0	00	Header	00	00000000
	1	01	Header	FF	11111111
	2	02	Header	FF	11111111
der	3	03	Header	FF	11111111
lea	4	04	Header	FF	11111111
44	5	05	Header	FF	11111111
	6	06	Header	FF	11111111
	7	07	Header	00	00000000
	8	08	ID Manufacture Name LGD	30	00110000
	9	09	ID Marafacture Name	<b>E4</b>	11100100
	10	0A	ID Product Code 0249h	49	01001001
nct	11	0B	(Hex.LSB first )	02	00000010
og	12	00	ID Serial No Optional ("00h" finot used, Number Only and LSB First)	00	00000000
<u>क</u>	13	0D	ID Serial No Optional ("00h" finot used, Number Only and LSB First)	00	00000000
1	14	0E	ID Serial No Optional ("00h" finot used, Number Only and LSB First)	00	00000000
rde .	15	0F	ID Serial No Optional ("00h" finot used, Number Only and LSB First)	00	00000000
La A	16	10	Week of Manufacture - Optinal 00 weeks	00	00000000
	17	11	Vear of Manufacture 2010 years	14	00010100
	18	12	EDID structure version # = 1	01	00000001
	19	13	EDID revision #= 4	04	00000100
	20	14	Video input Definition = Input is a Digital Video signal Interface , Colo Bit Depth : 6 Bits per Primary Color , Digital Video Interface Standard Supported: DisplayPort is supported	95	10010101
~	21	15	Horizontal Screen Size (Rounded cm) = 30 cm	1E	00011110
al a	22	16	Vertical Screen Size (Rounded cm) = 19 cm	13	00010011
15	23	17	Display Bransfer Characteristic (Gamma)=(gamma*100)100 = Example:(22*100)100=120 = 2.2 Gamma	78	01111000
Τ	24	18	Feature Support [Display Power Management(DPM): Standby Mode is not supported, Suspend Mode is not supported, Active Off= Very Low Power is not supported, Supported Color Encoding Formats: RGB 4:4:4, Other Feature Support Flags: No_sRGB, Preferred Timing Mode, No_Display is continuous frequency (Multi-mode_Base EDID and Extension Block).]	02	00000010
	25	19	Red/Green Low Bits (RcRy/GxGy)	95	10010101
	26	1A	Bhe/White Low Bits (BxBy/Wh/Wy)	<b>D</b> 5	11010101
nct	27	1B	Red X Rx = 0.580	94	10010100
og	28	10	Red Y Ry=0345	58	01011000
<u>4</u>	29	1D	Green X Gr = 0.337	56	01010110
i i i	30	1E	Green V Gy=0.556	8E	10001110
ndı	31	1F	Bhe X Bx = 0.159	28	00101000
10/1	32	20	Bhe Y By = 0.134	22	00100010
	33	21	White X Wx = 0.313	50	01010000
	34	22	White Y Wy=0329	54	01010100
2.2	35	23	Established timing 1 (Optional_00h ifnot used)	00	00000000
ttal hev	36	24	Established timing 2 (Optional 00h ifnot used)	00	00000000
ធ្វើ ន	37	25	Manufacturer's timings ( Optional_00h ifnot used)	00	00000000
	38	26	Standard timing ID 1 ( Optional_01h if not used)	01	00000001
	-39	27	Standard timing ID 1 ( Optional_01h if not used)	01	00000001
	40	28	Standard timing ID 2 ( Optional_01h if not used)	01	00000001
	41	29	Standard timing ID2 ( Optional_01h ifnot used)	01	00000001
0	42	2A	Standard timing ID3 ( Optional_01h if not used)	01	00000001
17 60	43	2 <b>B</b>	Standard timing ID3 ( Optional_01h if not used)	01	00000001
, in	44	2C	Standard timing ID4 ( Optional_01h ifnot used)	01	00000001
Tum	45	2 <b>D</b>	Standard timing ID4 ( Optional_01h if not used)	01	00000001
a	46	2 <b>E</b>	Standard timing ID 5 ( Optional_01h if not used)	01	00000001
da)	47	2 <b>F</b>	Standard timing ID 5 ( Optional_01h if not used)	01	00000001
an	48	30	Standard timing ID6 ( Optional_01h if not used)	01	00000001
S	49	31	Standard timing ID6 ( Optional_01h if not used)	01	00000001
	50	32	Standard timing ID7 ( Optional_01h if not used)	01	00000001
	51	33	Standard timing ID7 ( Optional_01h if not used)	01	00000001
	52	34	Standard timing ID8 ( Optional_01h if not used)	01	00000001
	53	35	Standard timing ID8 ( Optional_01h ifnot used)	01	00000001

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## APPENDIX A. Enhanced Extended Display Identification Data (EEDID<sup>™</sup>) 2/3

	e di	Byte (Hex)	Field Name and Comments	Value (Hex)	Value (Bin)
	54	36	Pixel Clock/10,000 (LSB) 74.8 MHz @ 60.1Hz	38	00111000
	55	37	Pixel Clock/10,000 (MSB)	1D	00011101
	56	38	Horizontal Active (HA) (lower 8 bits) 1280 Pixels	00	00000000
	57	39	Horizontal Blanking (HB) (lower 8 bits) 192 Pixels	CO	11000000
	58	3A	Horizontal Active / Horizontal Blanking(HA HB) (upper 4:4bits)	50	01010000
<b>1</b> #	- 59	3B	Vertical Avtive (VA) 800 Lines	20	00100000
24	60	3C	Vertical Blanking (VB)(DE Blanking typ for DE only panels) 46 Lines	2 <b>E</b>	00101110
ipte	61	3D	Vertical Active / Vertical Blanking (VA VB) (upper 4:4bits)	30	00110000
scr	62	3E	Horizontal Front Porch in pixels (HF) (lower 8 bits)54 Pixels	36	00110110
å	63	3F	Horizontal Sync Pulse Width in pixels (HS) (lower 8 bits) 44 Pixels	20	00101100
8	64	40	Vertical Front Porch in lines (VF) (lower 4 bits) : Vertical Sync Pluse Width in lines (VS) (lower 4 bits) 9 Lines : 8 L	98	10011000
mi	65	41	Horizontal Front Porch/Sync Pulse Width/ Vertical Front Porch/Sync Pulse Width (upper 2bits)	00	00000000
П	66	42	Horizontal Vedio Image Size (nm.) (lower 8 bits) 304 nm	30	00110000
	67	43	Vertical Vedio Image Size (nnn)(lower 8 bits) 190 mm	BE	10111110
	68	44	Horizontal Image Size / Vertical Image Size (upper 4 bits)	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, Nomal display, no stereo, Digital Separate [ Vsync_NEG, Hsync_P OS (outside of V-sync)]	1A	00011010
	72	48	Pixel Clock/10,000 (LSB) 49.87 MHz @ 40.1Hz	7 <b>B</b>	01111011
	73	49	Pizel Clock/10,000 (MSB)	13	00010011
	74	4A	Horizontal Active (HA) (lower 8 bits) 1280 Pixels	00	00000000
	75	4B	Horizontal Blanking (HB) (lower 8 bits) 192 Pixels	CO	11000000
	76	4C	Horizontal Active / Horizontal Blanking(HA HB)(upper 4:4bits)	50	01010000
<b>3</b> #	77	4D	Vertical Avtive (VA) 800 Lines	20	00100000
o,	78	4E	Vertical Blanking (VB)(DE Blanking typ for DE only panels) 46 Lines	2 <b>E</b>	00101110
ipt	79	4F	Vertical Active / Vertical Blanking (VA VB) (upper 4:4bits)	30	00110000
105	80	50	Horizontal Front Porch in pixels (HF) (lower 8 bits)54 Pixels	36	00110110
ď	81	51	Horizontal Sync Pulse Width in pixels (HS) (lower 8 bits) 44 Pixels	20	00101100
яu	82	52	Vertical Front Porch in lines (VF) (lower 4 bits) : Vertical Sync Phase Width in lines (VS) (lower 4 bits) 9 Lines : 8 L	98	10011000
imi	83	53	Horizontal Bront Porch/Sync Pulse Width/ Vertical Bront Porch/Sync Pulse Width (upper 2bits)	00	00000000
12	84	54	Horizontal Vedio Image Size (mm.) (lower 8 bits) 304 mm	30	00110000
	85	55	Vertical Vedio Image Size (nm)(lower 8 bits) 190 mm	BE	10111110
	86	56	Horizontal Image Size / Vertical Image Size (upper 4 bits)	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-Interface, Normal display, no stareo, Dignal Separate [ Vsync_NEUs, Hsync_PUS (outside of V-sync)]	IA	00011010
	90	5A	Flag	00	00000000
	91	5B	Fing The second s	00	00000000
	92	50	nag Den Ber Album ein Den Geiter (1998) Geiter	00	00000000
	93	50	Data 1ype 1ag : Auptaniumeric Data Suring (ASULI Suring) 20. –	FE	000000000
~	94	SE		00	00000000
<b>#</b>	95	51	Dell P/N ist Ukaracter = 0	30	00110110
tor	90	00	Del P/N And LINATCHETE H	48	01001000
rip	97	01	Del P/N STA Character = W	57	01010111
asc.	98	0Z	Dell P/N 4th Unatacter = V Dell DAT 6th Character = V	50	01010110
Q.	99	03	Dell PAY din Unitatief = V TENTE Durining Durity Durity Durity Durining He 200	00	100000000
'nε	100	64	LL/L/ REVISION BUILD HAIRE = MP(X-BUILD), REVISION # = AUU	08	10000000
lm.	101	60	Manufacturer PAT - 1 Manufacturer DAT - A	31	00110100
1	102	67	Manual Dal +	34	00110100
	105	60	Information Print - 1 Manufacturer D.01 - 111	51	01010101
	104	60	Manual DAI - W	57	01010111
	105	64	Manufacturer D.01	36	00110100
	107	6P	mananan an Frist - J Maanafachanan DAL/Wei 12 shan than tarminata mith ASC 11 so da 0 Ab sat ramaining shar = 2005	0.4	00001010
	107	VD	managed a PAT(1 ~ 15 that, there deminate with AS's 1 to de OARSet leidering that = 20f)	0K	00001010

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## APPENDIX A. Enhanced Extended Display Identification Data (EEDID<sup>™</sup>) 3/3

	e e	Byte (Hex)	Field Name and Comments	Value (Hex)	Value (Bin)
	108	6C	Flag	00	00000000
	109	6 <b>D</b>	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	Color Management [ No +2 FRC Support, True Color Depth : 6 bit ]	00	00000000
5	114	72	Panel Type [WLED], Configuration [Single light bar], Number Lamp or LED Light Bar [one]	41	01000001
ipt.	115	73	Prame Rate Details [Minimum Prame Rate : 40Hz, Maximum Prame Rate : 65Hz , Tcon provides native Intel DRRS / sDRRS support ]	31	00110001
scr	116	-74	Controller Interface and Maximum Luminance [SMBUS type, 220 nit.]	16	00010110
-	117	75	Front Surface / Polarizer [ Anti-Glare, No Transflective ] , Pixel Structure [ RGB v-stripe ]	00	00000000
50	118	76	Multi-Media Features [Color Management : NTSC, Dynamic Backlight Control : No ]	00	00000000
100	119	77	Multi-Media Features [Motion Bhr : No support, Active Gamma Control : No support]	00	00000000
12	120	78	Special Features [Wireless Enhancement Hardware : No support , In-Cell Scarner : No support ]	00	00000000
	121	79	Special Features [Number of LVDS channels or eDP lanes : one , Overdrive : No ,Interface : eDP , In-Cell Touch Support : No ]	09	00001001
	122	7A	Special Features [BIST Support : yes , Electronic Privacy : No electronic privacy hardware support , 3-D Support : No ]	01	00000001
	123	7B	(If×13 char> 0.Ah, then terminate with ASC II code 0.Ah,set remaining char = 20h)	0A	00001010
	124	70	(If×13 char> 0.Ah, then terminate with ASC II code 0.Ah,set remaining char = 20h)	20	00100000
	125	7D	(If×13 char> 0 Ah, then terminate with ASC II code 0 Ah, set remaining char = 20h)	20	00100000
w	126	7E	Extension flag (# of optional 128 panel ID extension block to follow, Typ = 0)	00	00000000
Checksu	127	7 <b>F</b>	Check Sum (The 1-byte sum of all 128 bytes in this panel ID block shall = 0)	94	10010100

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