SPECIFICATION
FOR
APPROVAL

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

Title	10.1” WX TFT LCD

Customer	Lenovo
MODEL	

SUPPLIER	LG Display Co., Ltd.
*MODEL	LP101WX2
Suffix	SLA1

*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
S. W. Paeng / Manager	
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K. C. Choi / Engineer	

Products Engineering Dept.
LG Display Co., Ltd

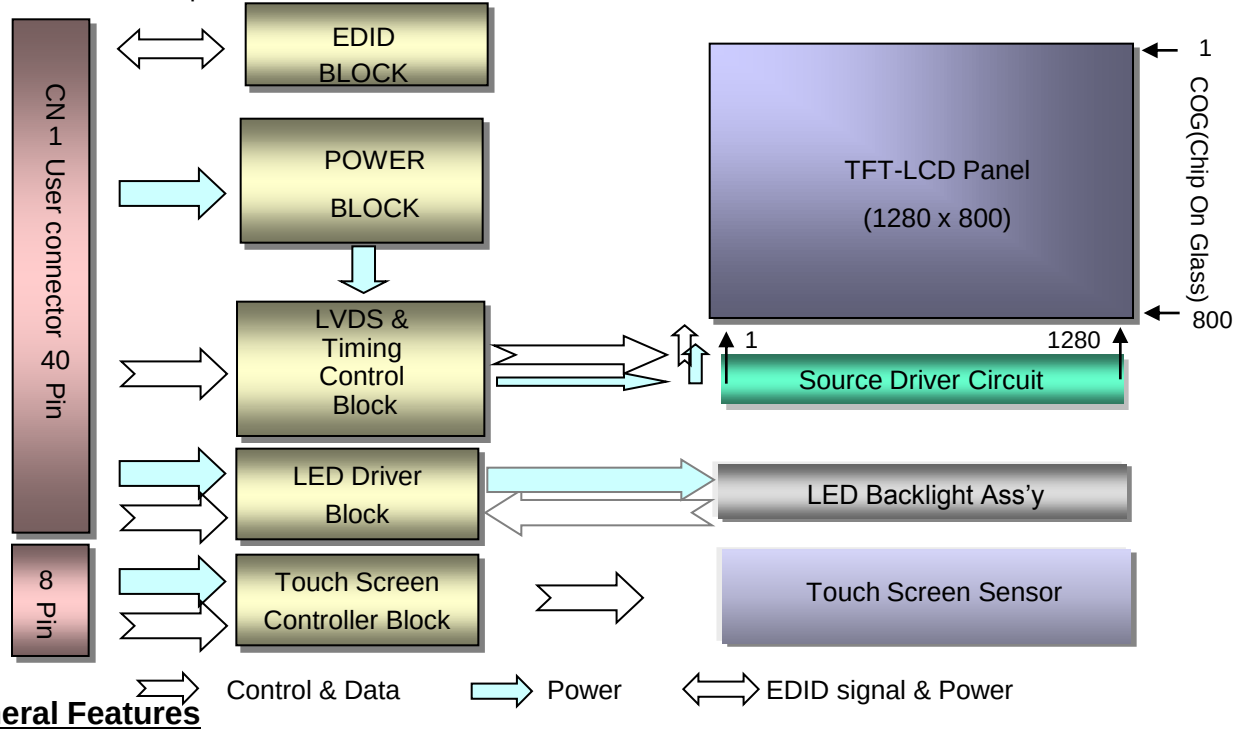
Contents

RECORD OF REVISIONS

Revision No	Revision Date	Page	Description	EDID ver
0.0	Nov. 08. 2011	All	First Draft (Preliminary Specification)	-
0.1	Feb. 22.2012	6	Idle current : 20mA → 15mA	
		17	Touch specification is added.	
		18	Color coordination is added.	
		19	Gray Scale is added.	
0.2	Mar.06.2012	6	$V_{PWM\_H,}$ VLED_EN_H is changed to 2.5V	
0.3	Mar.12.2012	12	Dclk typ. Is changed to 69.3Mhz	0.0
		4,6,8	VLED typ.min Voltage and power consumption are changed.	
		14	Power sequence is changed	
		24	Safety comment is changed.	
1.0	May.04.2012	9	Touch pinmap is modified	1.0
		16	Touch wake-up sequence is deleted because of not to use.	
		4	Depth	
			- LCM : 4.35mm → 4.45mm	
			- LCM+Touch : 5.8mm → 5.9mm	
			Luminance Spec. : Expression of 'wo./TSP Spec.' is deleted.	
			Color coordination : Expression of 'wo./TSP Spec.' is deleted.	
		4,20	Weight	
			- LCM : 145g → 155g	
			- LCM+Touch : 260g → 270g	
		21	LCM drawing is Updated. (AL Plate)	
			Label drawing is changed.	
1.1	May.10.2012	21	Camera hole size is added.	

1. General Description

The LP101WX2 is a Color Active Matrix Liquid Crystal Display with an integral LED backlight system and Touch Screen Panel. 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 10.1 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 LP101WX2 has been designed to apply the interface method that enables low power, high speed, low EMI. The LP101WX2 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 LP101WX2 characteristics provide an excellent flat display for office automation products such as Notebook PC.



General Features

Active Screen Size	10.1 inches diagonal
Outline Dimension	LCD : 228.60(H) × 148.15(V) x 4.45(D,Max.) [mm], w PCB C/Shield Area LCD + Touch : 257.20(H) × 175.40(V) x 5.9(D,Max.) [mm], w PCB (w/o Touch PCB)
Pixel Pitch	0.1695mm × 0.1695 mm
Pixel Format	1280 horiz. By 800 vert. Pixels RGB strip arrangement
Color Depth	6-bit+2bit FRC, 16,772,216 colors
Luminance, White	360cd/m^2 (Typ.5 point)
Power Consumption	Total 3.54W W(typ.) (Logic :0.52 W (typ. @ Mosaic, VCC=3.3V), B/L : 2.85W (typ.@ VLED 3.7V, Duty=100%),TSP: 0.17W(typ. @ VTSP=3.3V))
Weight	155g (Max.), 270g w/ TSP
Display Operating Mode	Transmissive mode, normally Black
Touch IC	LGD STM32F103(MCU) + LDC3001(ROIC,2)
Surface Treatment	LCD: Glare treatment of the front polarizer, Touch: AF(Anti-Finger) Coating
RoHS Compliance	Yes
BFR / PVC / As Free	Yes for all

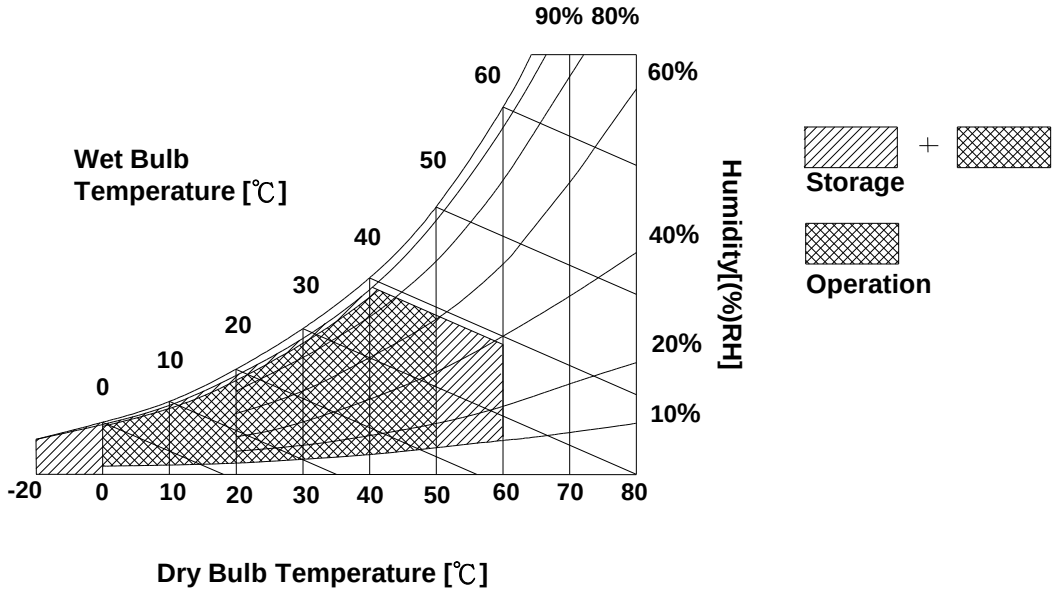
2. Absolute Maximum Ratings

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.



3. Electrical Specifications

3-1. Electrical Characteristics

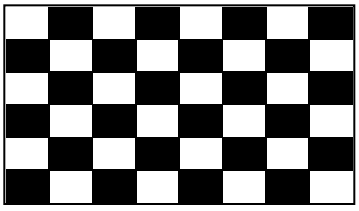
The LP101WX2 requires two power inputs. One is employed to power the LCD electronics and to drive the TFT array and liquid crystal. The second input which powers the LED BL.

Table 2. ELECTRICAL CHARACTERISTICS

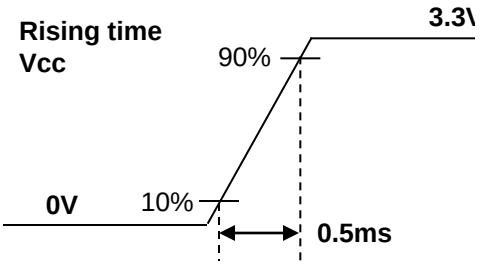
Parameter	Symbol	Values			Unit	Notes
		Min	Typ	Max		
LOGIC :						
Power Supply Input Voltage	VCC	3.2	3.3	4.2	V	1
Power Supply Input Current Mosaic	ICC	-	157	181	mA	2
Power Consumption	PCC	-	0.52	0.60	W	2
Power Supply Inrush Current	ICC_P	-		1500	mA	3
LVDS Impedance	ZLVDS	90	100	110	Ω	4
BACKLIGHT : (with LED Driver)						
LED Power Input Voltage	VLED	3.2	3.7	16	V	5
LED Power Input Current	ILED	-	770	797	mA	6
LED Power Consumption	PLED	-	2.85	2.95	W	6
LED Power Inrush Current	ILED_P	-		2000	mA	7
PWM Duty Ratio		5	-	100	%	8
PWM Jitter	-	0	-	0.2	%	9
PWM Impedance	ZPWM	20	40	60	kΩ	
PWM Frequency	FPWM	200	-	1000	Hz	
PWM High Level Voltage	V_{PWM_H}	2.5	-	5.3	V	
PWM Low Level Voltage	V_{PWM_L}	0	-	0.3	V	
LED_EN Impedance	ZPWM	20	40	60	kΩ	
LED_EN High Voltage	VLED_EN_H	2.5	-	5.3	V	
LED_EN Low Voltage	VLED_EN_L	0	-	0.3	V	
Life Time		15,000	-	-	Hrs	10
TSP SCREEN PANEL						
Power Supply Input Voltage	VTSP	3.0	3.3	3.6	V	
Power Supply Input Current	ITSP Active	-	52	59	mA	
	ITSP Idle		15	-		@10 Hz
Power Consumption	PTSP		0.17	0.19	W	11

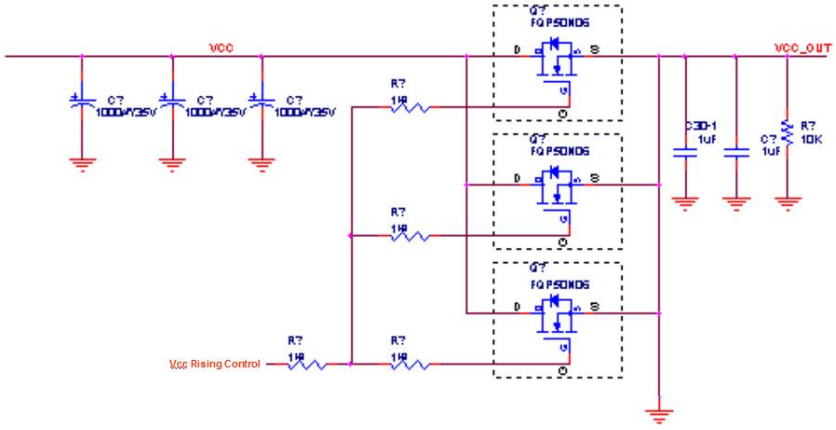
Note)

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

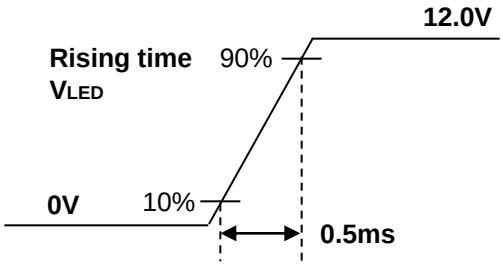


3. The below figures are the measuring Vcc condition and the Vcc control block LGD used. The Vcc condition is same as the minimum of T1 at Power on sequence.





4. This impedance value is needed for proper display and measured form LVDS Tx to the mating connector.
5. The measuring position is the connector of LCM and the test conditions are under 25℃.
6. The current and power consumption with LED Driver are under the Vled = 3.7V , 25℃, Dimming of Max luminance and White pattern with the normal frame frequency operated(60Hz).
7. The below figures are the measuring Vled condition and the Vled control block LGD used. VLED control block is same with Vcc control block.

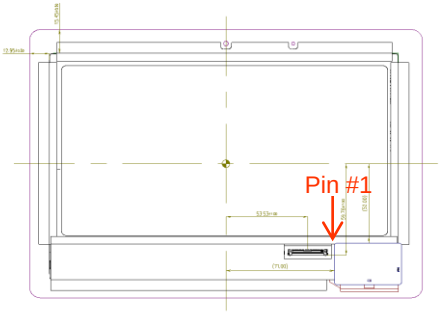


8. The operation of LED Driver below minimum dimming ratio may cause flickering or reliability issue.
9. This Spec. is not effective at 100% dimming ratio as an exception because it has DC level equivalent to 0Hz. In spite of acceptable range as defined, the PWM Frequency should be fixed and stable for more consistent brightness control at any specific level desired.
10. 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.
11. The specified ITSP current and power consumption (PTSP) are under the VTSP = 3.3V , 25℃, 100Hz at 1-finger and Active mode.

3-2. Interface Connections

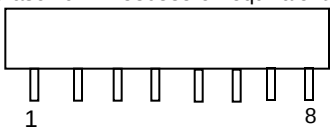
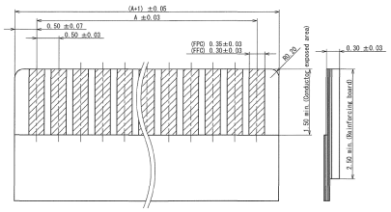
3-2-1. LCD Control Board Connection

This LCD employs two interface connections, a 40 pin connector used for the module electronics interface and the other connector used for the integral backlight system.

Pin	Symbol	Description	Notes
1	NC	No Connection	**[Interface Chip]** 1. LCD : SiW, SW0624(LCD Controller) Including LVDS Receiver. 2. System : * Pin to Pin compatible with LVDS **[Connector]** UJU IS050-L40B-C10 LSMtron GT05Q-40S-H10 or equivalent **[Mating Connector]** 20345-#40E-## series or equivalent **[Connector pin arrangement]**  [LCD Module Rear View]
2	VCC	LCD Logic and driver power (3.3V Typ.)	
3	VCC	LCD Logic and driver power (3.3V Typ.)	
4	V EEDID	DDC Power (3.3V)	
5	Test	Panel Self Test	
6	Clk EEDID	DDC Clock	
7	DATA EEDID	DDC Data	
8	ORX0-	Negative LVDS differential data input	
9	ORX0+	Positive LVDS differential data input	
10	GND	High Speed Ground	
11	ORX1-	Negative LVDS differential data input	
12	ORX1+	Positive LVDS differential data input	
13	GND	High Speed Ground	
14	ORX2-	Negative LVDS differential data input	
15	ORX2+	Positive LVDS differential data input	
16	GND	High Speed Ground	
17	ORXC-	Negative LVDS differential clock input	
18	ORXC+	Positive LVDS differential clock input	
19	GND	High Speed Ground	
20	ORX3-	Negative LVDS differential data input	
21	ORX3+	Positive LVDS differential data input	
22	GND	High Speed Ground	
23	NC	No Connection	
24	NC	No Connection	
25	GND	High Speed Ground	
26	NC	No Connection	
27	NC	No Connection	
28	GND	High Speed Ground	
29	NC	No Connection	
30	NC	No Connection	
31	GND	LED Backlight Ground	
32	GND	LED Backlight Ground	
33	GND	LED Backlight Ground	
34	NC	No Connection	
35	PWM	System PWM Signal input for dimming	
36	LED_EN	LED Backlight On/Off	
37	NC	No Connection	
38	VLED	LED Backlight Power (3.2V-4.2V)	
39	VLED	LED Backlight Power (3.2V-4.2V)	
40	VLED	LED Backlight Power (3.2V-4.2V)	

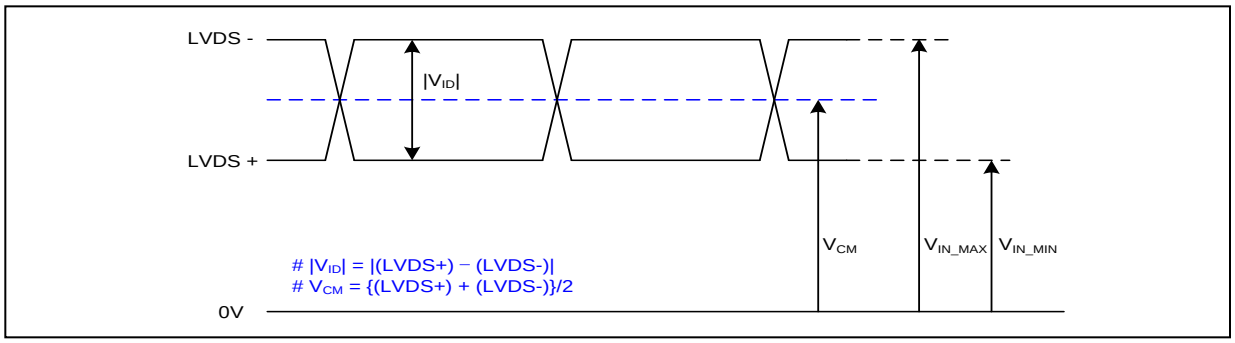
3-2. Touch Control Board Connection(for I2C)

This TSP employs a 8 pin connector used for the Touch I2C interface.

Pin	Symbol	Description	Notes
1	ID	Pull-Low, ID pin	**[Connector]** Panasonic AYF530835 or equivalent  **[Mating FPC]**  **A=3.5mm**
2	VDD_3.3V	Supply Voltage 3.3V	
3	I2C_SDA	I2C Data	
4	I2C_SCL	I2C Clock	
5	IRQ	Interrupt Signal (from Set)	
6	NC	No connection	
7	Wake	Wake-up Interrupt Signal (from Set)	
8	GND	Ground	

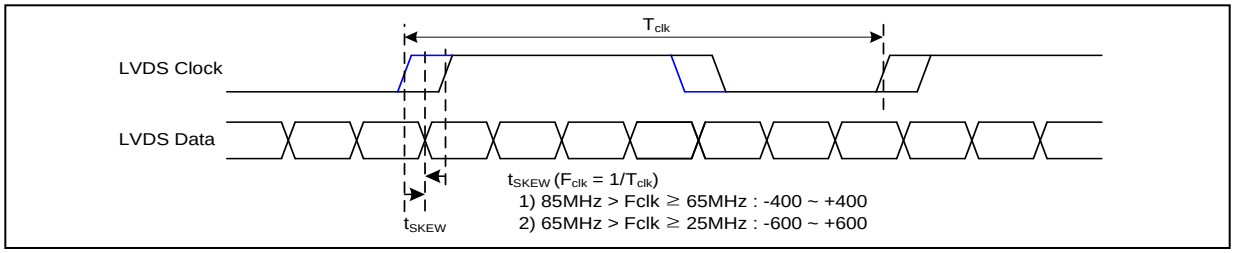
3-3. LVDS Signal Timing Specifications

3-3-1. DC Specification

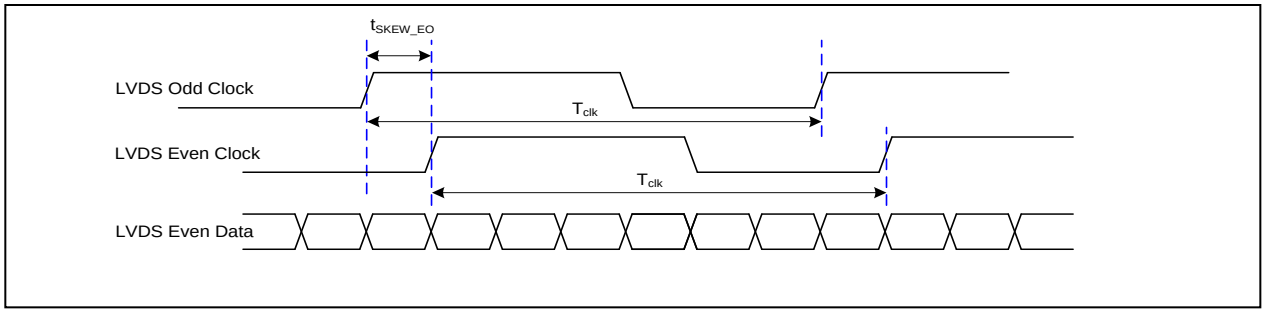


Description	Symbol	Min	Max	Unit	Notes
LVDS Differential Voltage	$\|V_{ID}\|$	100	600	mV	-
LVDS Common mode Voltage	V_{CM}	0.6	1.8	V	-
LVDS Input Voltage Range	V_{IN}	0.3	2.1	V	-

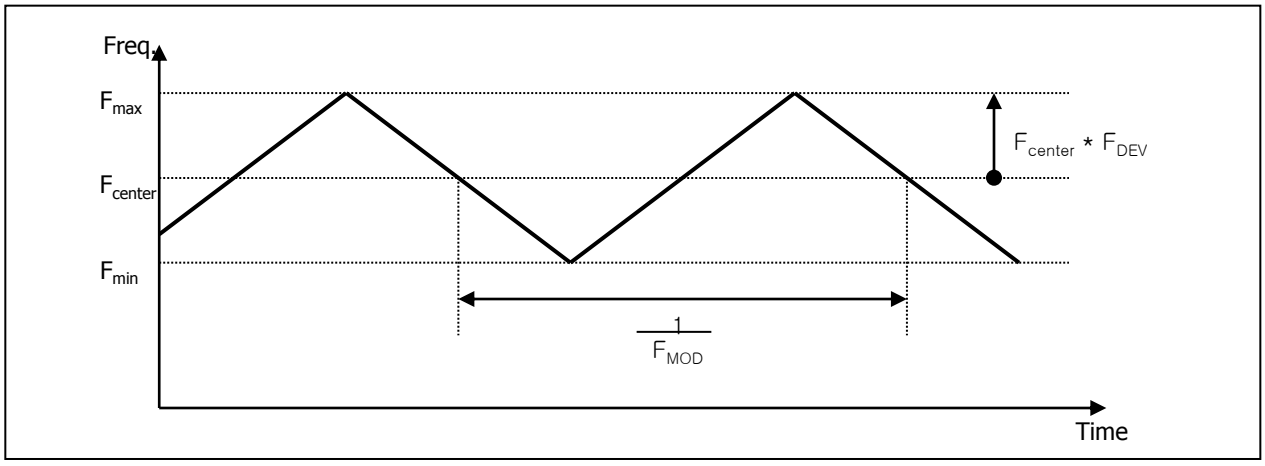
3-3-2. AC Specification



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	-



< Clock skew margin between channel >



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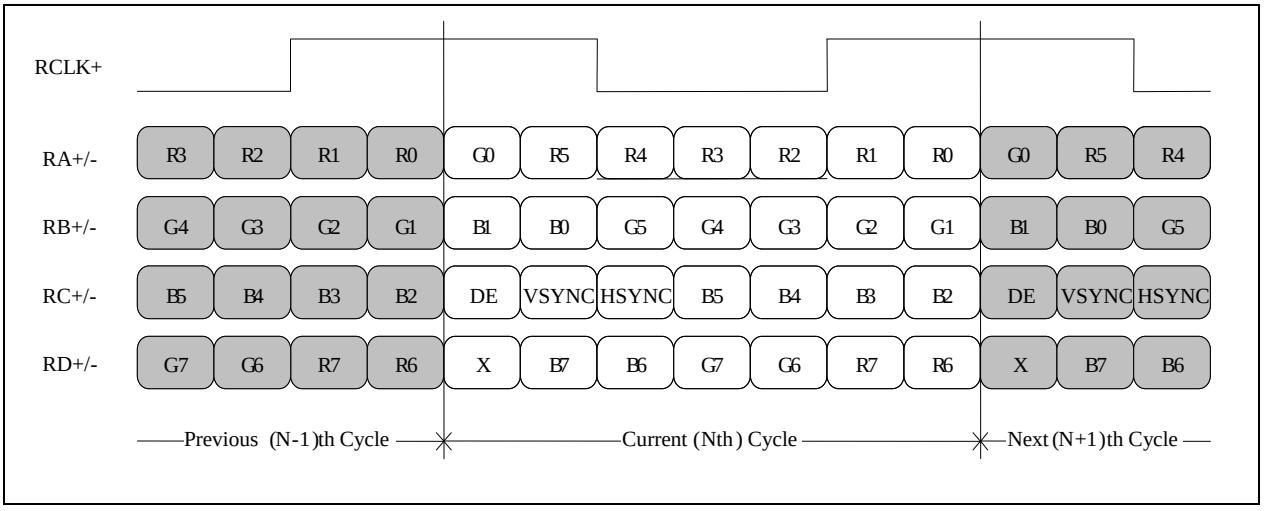
3-3-3. Data Format

- LVDS 1 Port



< LVDS Data Format >

3-4. Signal Timing Specifications

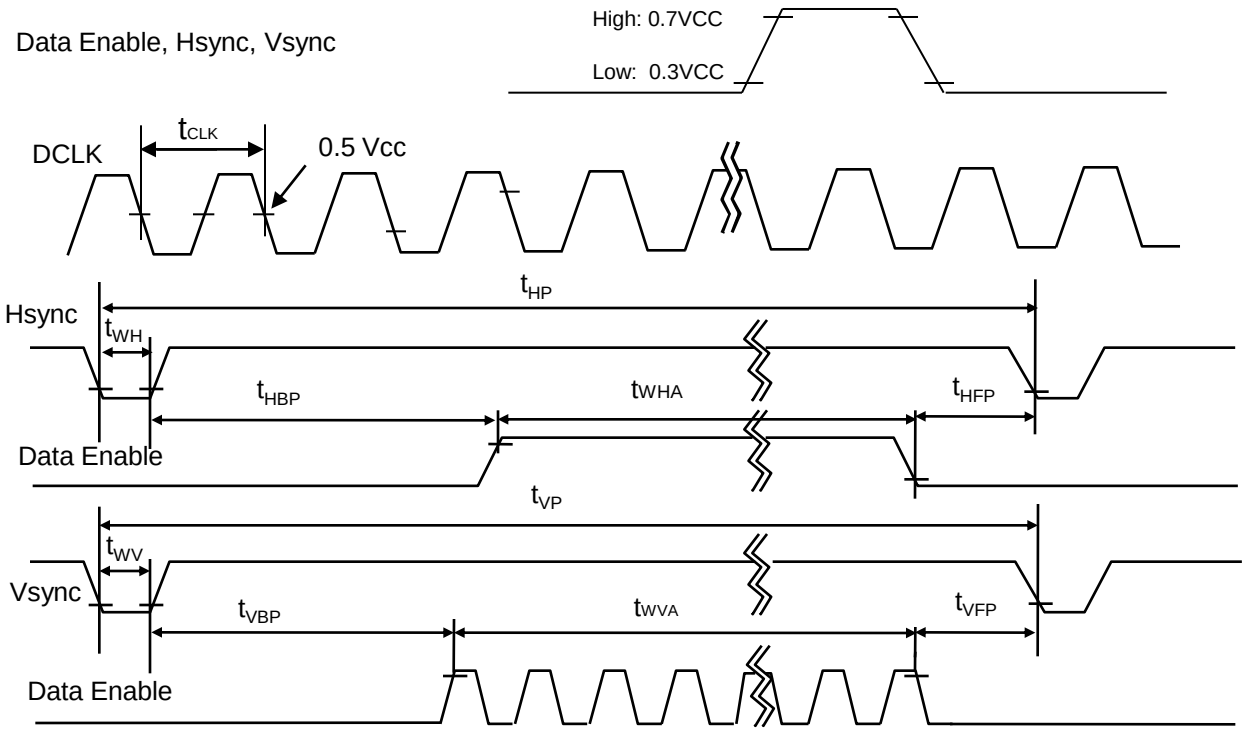
This is the signal timing required at the input of the User connector. All of the interface signal timing should be satisfied with the following specifications and specifications of LVDS Tx/Rx for its proper operation.

Table 5. TIMING TABLE

ITEM	Symbol		Min	Typ	Max	Unit	Note
DCLK	Frequency	f_{CLK}	67.5	69.3	74.5	MHz	
Hsync	Period	T_{hp}	1366	1404	1488	tCLK	
	Width	t_{WH}	16	32	48		
	Width-Active	t_{WHA}	1280	1280	1280		
Vsync	Period	t_{VP}	811	823	847	tHP	
	Width	t_{WV}	3	7	9		
	Width-Active	t_{WVA}	800	800	800		
Data Enable	Horizontal back porch	t_{HBP}	32	44	80	tCLK	
	Horizontal front porch	t_{HFP}	16	48	62		
	Vertical back porch	t_{VBP}	7	12	35	tHP	
	Vertical front porch	t_{VFP}	2	4	6		

3-5. Signal Timing Waveforms

Condition : VCC =3.3V



3-6. Color Input Data Reference

The brightness of each primary color (red,green and blue) is based on the 6-bit gray scale data input for the color ; the higher the binary input, the brighter the color. The table below provides a reference for color versus data input.

Table 7. 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

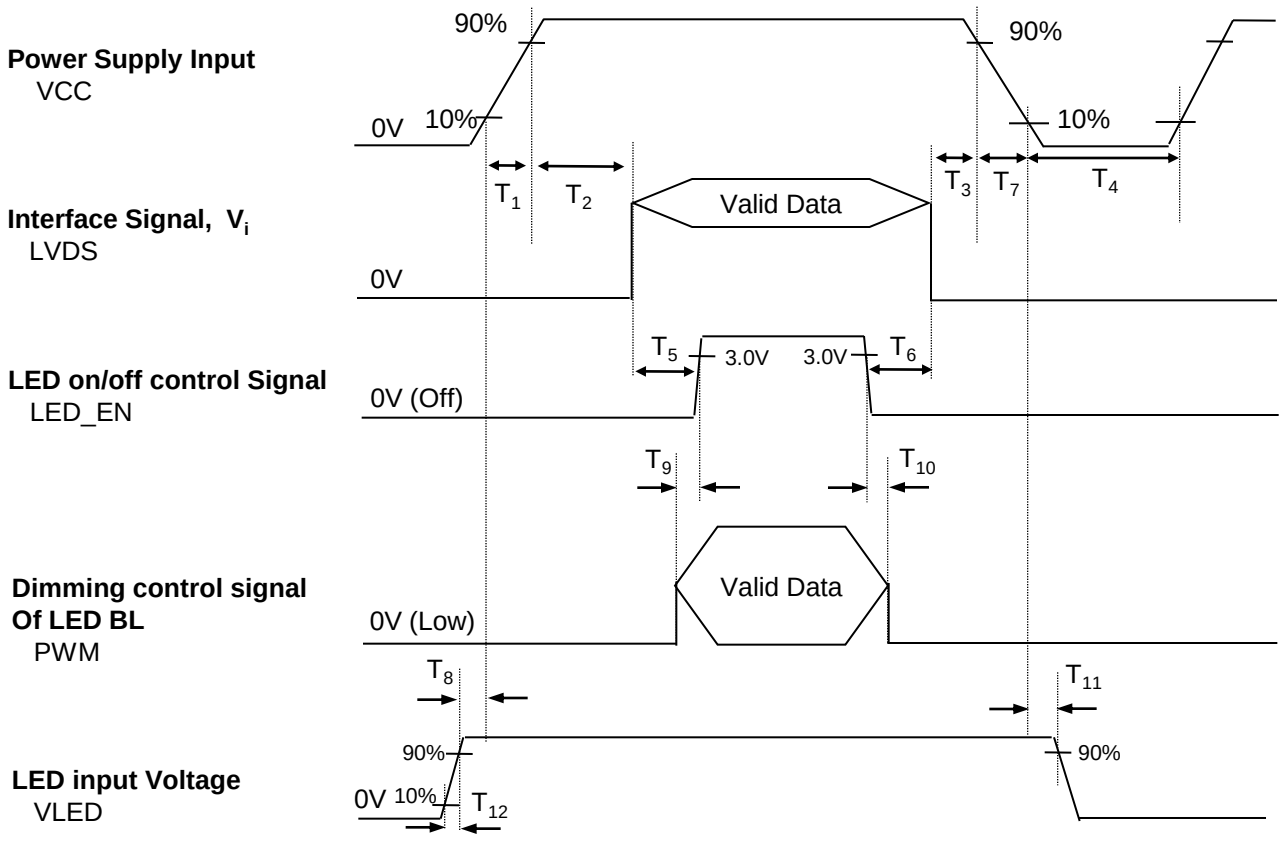


Table 6. POWER SEQUENCE TABLE

Logic Parameter	Value			Units
	Min.	Typ.	Max.	
T_1	0.5	-	10	ms
T_2	0	-	50	ms
T_3	0	-	50	ms
T_4	200	-	-	ms
T_5	200	-	-	ms
T_6	200	-	-	ms
T_7	3	-	10	ms

LED Parameter	Value			Units
	Min.	Typ.	Max.	
T_8	2	-	-	ms
T_9	0	-	-	ms
T_{10}	0	-	-	ms
T_{11}	1	-	-	ms
T_{12}	0.5	-	-	ms

Note)
1. Do not insert the mating cable when system turn on.
2. Valid Data have to meet "3-3. LVDS 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.

3-8. Power Sequence for touch

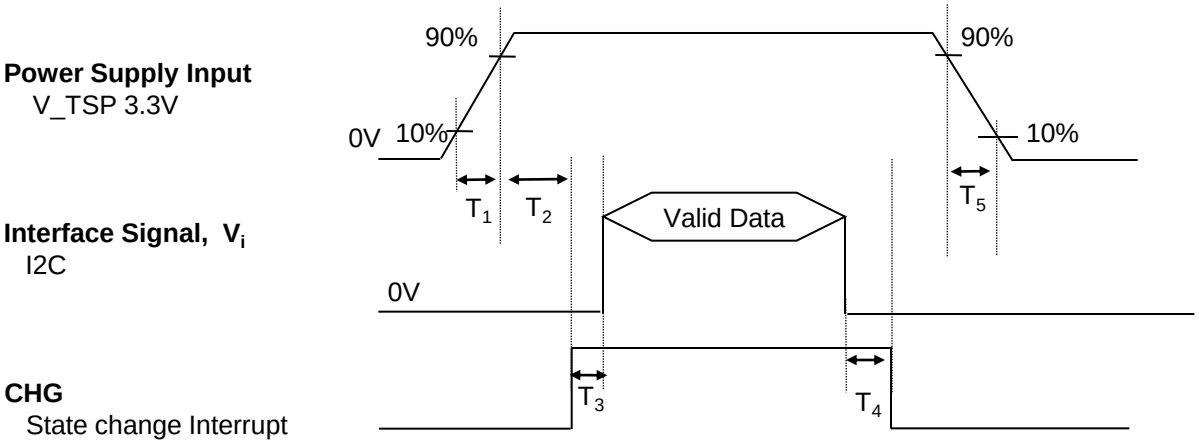


Table 6. POWER SEQUENCE TABLE

Parameter	Value			Units
	Min.	Typ.	Max.	
T_1	0.5	-	10	ms
T_2	15	-	-	ms
T_3	0.1	-	-	ms
T_4	-	-	0.5	ms
T_5	-	-	10	ms

4. Touch Specifications

4-1. General Specifications

The contents provide general characteristics for the model LP101WX2-SLA1.

	Item		Spec
General Specification	System		Projected, Capacitive type
	Multi touch points		10 points
	Active touch area		Same as LCD A/A
	Cover Lens	Outline	257.2 x 175.4 [mm]
		Type / Thickness	Dragon Trail / 0.7 [mm]
	Sensor Film	Outline	225.96 x 146.6 [mm]
		Type / Thickness	GF2 / 0.2 [mm]
	Resolution		1280 x 800
	Interface		I2C
Other Feature	Finger Separation		12 mm
	Water Rejection		Y
	Palm rejection		Y

4-2. Touch Performance

The contents provide general performance characteristics for the model LP101WX2-SLA1.

Parameter	Symbol	Values	Units	Notes
Sensitivity	ϕ	5		
Report Rate	–	100	Hz	@ 1 Point Touch
	–	60	Hz	@ 10 Point Touch
Accuracy		1.5	mm	Center
		1.5	mm	Edge

5. Optical Specification

Optical characteristics are determined after the unit has been 'ON' and stable for approximately 30 minutes in a dark environment at 25°C. The values specified are at an approximate distance 50cm from the LCD surface at a viewing angle of Φ and Θ equal to 0°.
FIG. 1 presents additional information concerning the measurement equipment and method.

FIG. 1 Optical Characteristic Measurement Equipment and Method

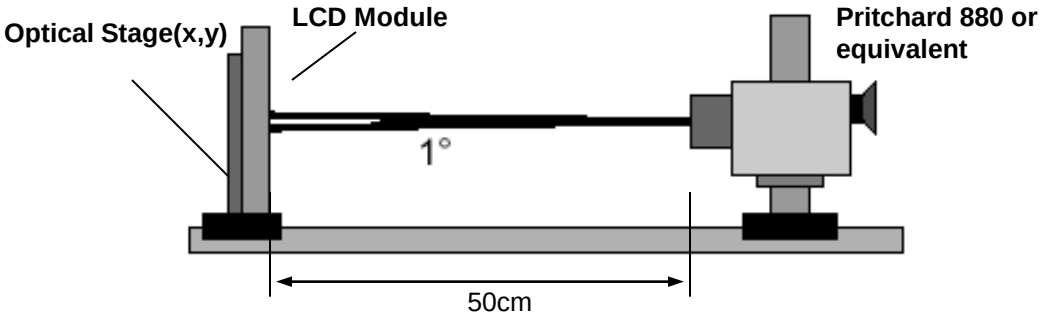


Table 8. OPTICAL CHARACTERISTICS

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

Parameter	Symbol	Values			Units	Notes
		Min	Typ	Max		
Contrast Ratio	CR	500	-	-		1
Surface Luminance, white	L_{WH}	300	360	-		2
Luminance Variation	δ_{WHITE}	-	1.4	1.6		3
Response Time	$Tr_R + Tr_D$	-	35	50	ms	4
Color Coordinates						
RED	RX	0.565	0.595	0.625		
	RY	0.325	0.355	0.385		
GREEN	GX	0.308	0.338	0.368		
	GY	0.536	0.566	0.596		
BLUE	BX	0.125	0.155	0.185		
	BY	0.088	0.118	0.148		
WHITE	WX	0.283	0.313	0.343		
	WY	0.299	0.329	0.359		
Viewing Angle						5
x axis, right(Φ=0°)	Θr	80	-	-	degree	
x axis, left (Φ=180°)	Θl	80	-	-	degree	
y axis, up (Φ=90°)	Θu	80	-	-	degree	
y axis, down (Φ=270°)	Θd	80	-	-	degree	
Gray Scale			2.2			6

Note)

1. Contrast Ratio(CR) is defined mathematically as

$$\text{Contrast Ratio} = \frac{\text{Surface Luminance with all white pixels}}{\text{Surface Luminance with all black pixels}}$$

2. Surface luminance is the average of 5 point across the LCD surface 50cm from the surface with all pixels displaying white. For more information see FIG 1.

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

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.

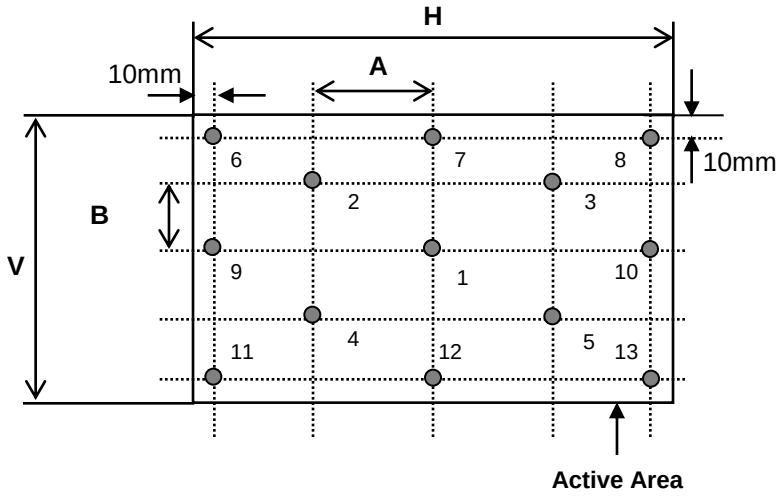
5. Viewing angle is the angle at which the contrast ratio is greater than 10. The angles are determined for the horizontal or x axis and the vertical or y axis with respect to the z axis which is normal to the LCD surface. For more information see FIG 4.

6. Gray scale specification * f_V = 60Hz

Gray Level	Luminance [%] (Typ)
L0	0.12
L7	0.80
L15	5.12
L23	13.6
L31	25.7
L39	41.5
L47	60.2
L55	79.9
L63	100

FIG. 2 Luminance

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



H,V : ACTIVE AREA
A : H/4 mm
B : V/4 mm
POINTS: 13 POINTS

FIG. 3 Response Time

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

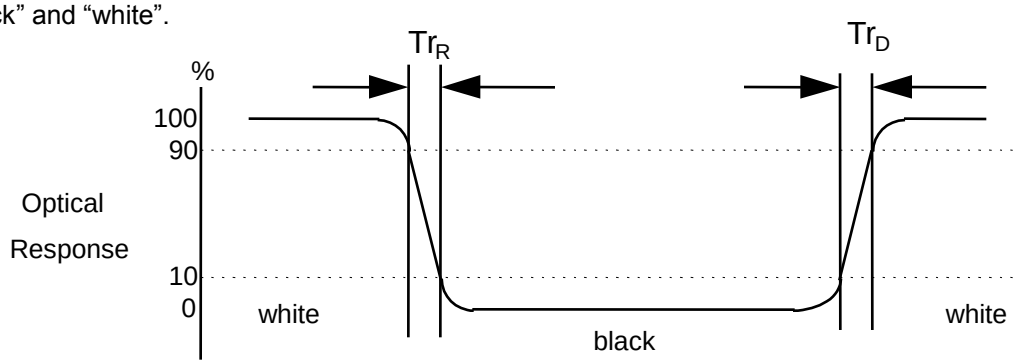
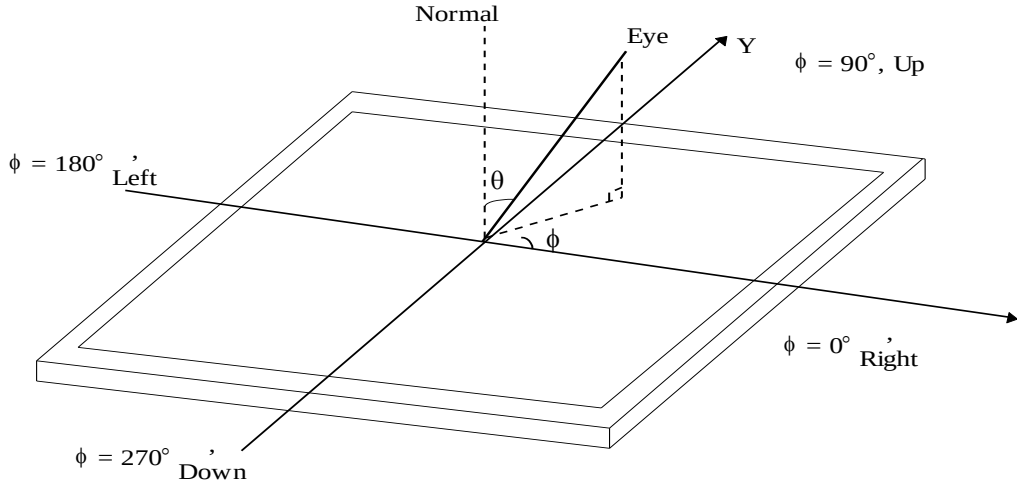


FIG. 4 Viewing angle



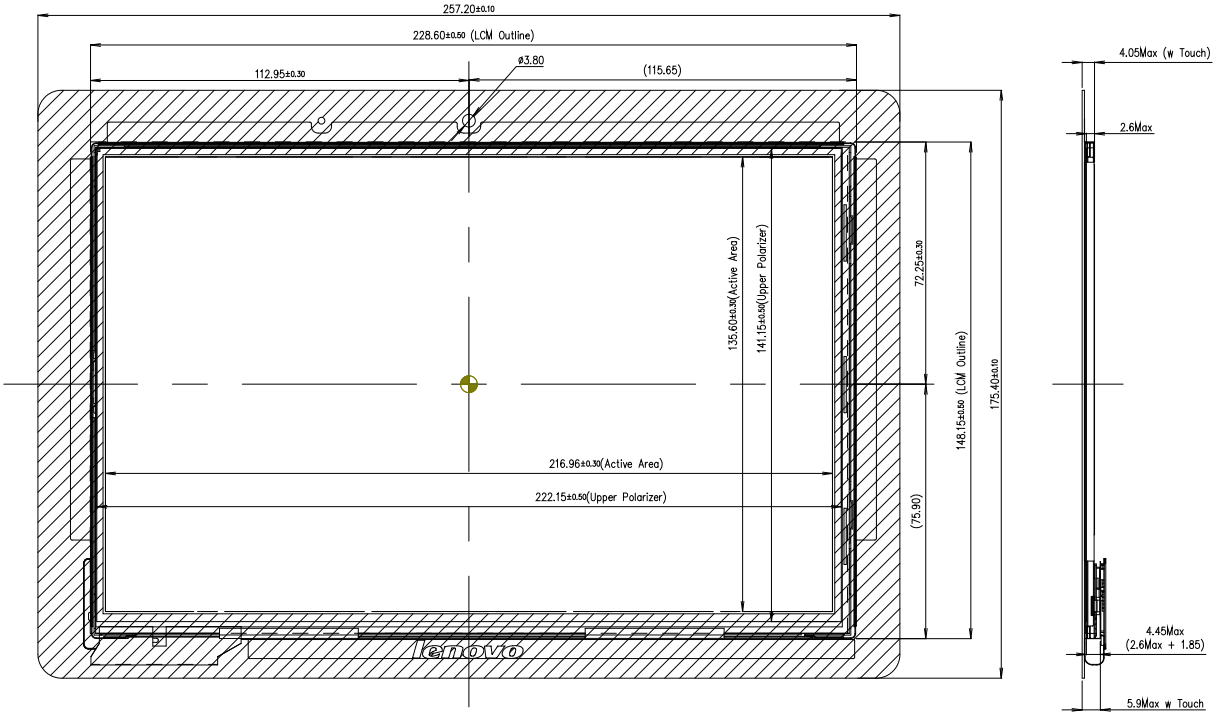
6. Mechanical Characteristics

The contents provide general mechanical characteristics for the model LP101WX2. In addition the figures in the next page are detailed mechanical drawing of the LCD.

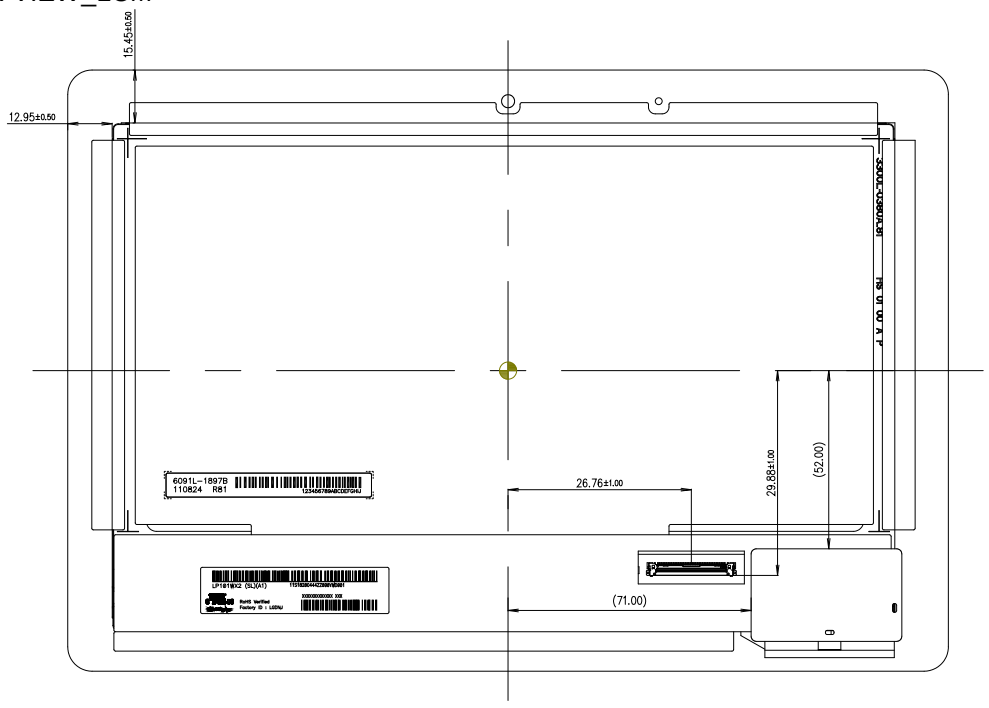
Outline Dimension	Horizontal	228.60 ± 0.5mm
	Vertical	148.15 ± 0.5mm
	Thickness	2.50mm (max), 4.45Max(w/ PCB C/Shield Area)
Active Display Area	Horizontal	216.96 mm
	Vertical	135.6 mm
Touch Screen Panel	Horizontal	257.2 mm
	Vertical	175.4 mm
	Thickness	1.45mm (max), 5.8Max(w/ PCB & w/o Touch PCB)
Weight	155g (Max.) w/o Touch, 270g (Max) w/ Touch	
Surface Treatment	LCD :Glare treatment of the front polarizer Touch : AF Coating	
Viewing Angle(Not fixed)	Viewing Angle(When Active area can be seen) ≤ 30°	

<FRONT VIEW_LCM>

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



<REAR VIEW_LCM>



7. 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)	Random, 1.0Grms, X,Y,Z Direction Test time : each direction 30min.
6	Shock test (non-operating)	Half sine wave, 180G, 2ms one shock of each six faces(I.e. run 180G 2ms for all six faces)
7	Altitude operating storage / shipment	0 ~ 10,000 feet (3,048m) 24Hr 0 ~ 40,000 feet (12,192m) 24Hr

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

8. International Standards

8-1. Safety

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

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

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

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

8-2. 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.

8-3. Environment

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

9. Packing

9-1. 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	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Mark	A	B	C	D	E	F	G	H	J	K

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.

9-2. Packing Form

a) Package quantity in one box : 40pcs

b) Box Size : 478*365*328

10. PRECAUTIONS

Please pay attention to the followings when you use this TFT LCD module.

10-1. 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.

10-2. 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.

10-3. 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.

10-4. PRECAUTIONS FOR STRONG LIGHT EXPOSURE

Strong light exposure causes degradation of polarizer and color filter.

10-5. 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.

10-6. HANDLING PRECAUTIONS FOR PROTECTION FILM

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

APPENDIX 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 EDID Version	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 0370h	**70**	01110000
	11	**0B**	(Hex. LSB first)	**03**	00000011
	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 2011 years	**15**	00010101
	18	**12**	EDID structure version # = 1	**01**	00000001
	19	**13**	EDID revision # = 3	**03**	00000011
Display Parameters	20	**14**	Video input Definition = Digital signal	**80**	10000000
	21	**15**	Max H image size (Rounded cm) = 22cm	**16**	00010110
	22	**16**	Max V image size (Rounded cm) = 14cm	**0E**	00001110
	23	**17**	Display gamma = (gamma*100)-100 = Example:(2.2*100)-100=120	**78**	01111000
	24	**18**	Feature Support (no_DPMS, no_Active Off/Very Low Power, RGB color display, Timing BLK 1,no_ GTF)	**0A**	00001010
Panel Color Coordinates	25	**19**	Red/Green Low Bits (RxRy/GxGy)	**D4**	11010100
	26	**1A**	Blue/White Low Bits (BxBy/WxWy)	**E5**	11100101
	27	**1B**	Red X Rx = 0.585	**95**	10010101
	28	**1C**	Red Y Ry = 0.349	**59**	01011001
	29	**1D**	Green X Gx = 0.341	**57**	01010111
	30	**1E**	Green Y Gy = 0.543	**8B**	10001011
	31	**1F**	Blue X Bx = 0.159	**28**	00101000
	32	**20**	Blue Y By = 0.127	**20**	00100000
	33	**21**	White X Wx = 0.313	**50**	01010000
	34	**22**	White Y Wy = 0.329	**54**	01010100
Established Timings	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 ID1 (01h if not used)	**01**	00000001
	39	**27**	Standard timing ID1 (01h if not used)	**01**	00000001
	40	**28**	Standard timing ID2 (01h if not used)	**01**	00000001
	41	**29**	Standard timing ID2 (01h if not used)	**01**	00000001
	42	**2A**	Standard timing ID3 (01h if not used)	**01**	00000001
	43	**2B**	Standard timing ID3 (01h if not used)	**01**	00000001
	44	**2C**	Standard timing ID4 (01h if not used)	**01**	00000001
	45	**2D**	Standard timing ID4 (01h if not used)	**01**	00000001
	46	**2E**	Standard timing ID5 (01h if not used)	**01**	00000001
	47	**2F**	Standard timing ID5 (01h if not used)	**01**	00000001
	48	**30**	Standard timing ID6 (01h if not used)	**01**	00000001
	49	**31**	Standard timing ID6 (01h if not used)	**01**	00000001
	50	**32**	Standard timing ID7 (01h if not used)	**01**	00000001
	51	**33**	Standard timing ID7 (01h if not used)	**01**	00000001
	52	**34**	Standard timing ID8 (01h if not used)	**01**	00000001
	53	**35**	Standard timing ID8 (01h if not used)	**01**	00000001

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)	69.3 MHz @ 60 Hz	**12**	00010010
	55	**37**	Pixel Clock/10,000 (MSB)		**1B**	00011011
	56	**38**	Horizontal Active (HA) (lower 8 bits)	1280 pixels	**00**	00000000
	57	**39**	Horizontal Blanking (HB) (lower 8 bits)	124 pixels	**7C**	01111100
	58	**3A**	Horizontal Active (HA) / Horizontal Blanking (HB) (upper 4:4bits)		**50**	01010000
	59	**3B**	Vertical Avtive (VA)	800 lines	**20**	00100000
	60	**3C**	Vertical Blanking (VB) (DE Blanking typ.for DE only panels)	23 lines	**17**	00010111
	61	**3D**	Vertical Active (VA) / Vertical Blanking (VB) (upper 4:4bits)		**30**	00110000
	62	**3E**	Horizontal Front Porch in pixels (HF) (lower 8 bits)	48 pixels	**30**	00110000
	63	**3F**	Horizontal Sync Pulse Width in pixels (HS) (lower 8 bits)	32 pixels	**20**	00100000
	64	**40**	Vertical Front Porch in lines (VF) : Vertical Sync Pluse Width in lines (VS) (lower 4 bits)	4 lines : 7 lines	**47**	01000111
	65	**41**	Horizontal Front Porch/ Sync Pulse Width/ Vertical Front Porch/ Sync Pulse Width (upper 2bits)		**00**	00000000
	66	**42**	Horizontal Vedio Image Size (mm) (lower 8 bits)	217 mm	**D9**	11011001
	67	**43**	Vertical Vedio Image Size (mm) (lower 8 bits)	136 mm	**88**	10001000
	68	**44**	Horizontal Image Size / Vertical Image Size (upper 4 bits)		**00**	00000000
	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), DE only note : LSB is set to '1' if panel is DE-timing only. H/V can be ignored.		**1B**	00011011
Timing Descriptor #2	72	**48**	Flag		**00**	00000000
	73	**49**	Flag		**00**	00000000
	74	**4A**	Flag		**00**	00000000
	75	**4B**	Data Type Tag (Descriptor Defined by manufacturer)		**00**	00000000
	76	**4C**	Flag		**00**	00000000
	77	**4D**	Descriptor Defined by manufacturer		**00**	00000000
	78	**4E**	Descriptor Defined by manufacturer		**00**	00000000
	79	**4F**	Descriptor Defined by manufacturer		**00**	00000000
	80	**50**	Descriptor Defined by manufacturer		**00**	00000000
	81	**51**	Descriptor Defined by manufacturer		**00**	00000000
	82	**52**	Descriptor Defined by manufacturer		**00**	00000000
	83	**53**	Descriptor Defined by manufacturer		**00**	00000000
	84	**54**	Descriptor Defined by manufacturer		**00**	00000000
	85	**55**	Descriptor Defined by manufacturer		**00**	00000000
	86	**56**	Descriptor Defined by manufacturer		**00**	00000000
	87	**57**	Descriptor Defined by manufacturer		**00**	00000000
	88	**58**	Descriptor Defined by manufacturer		**00**	00000000
	89	**59**	Descriptor Defined by manufacturer		**00**	00000000
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**	Alphanumeric Data String (ASCII String)	L	**4C**	01001100
	96	**60**	Alphanumeric Data String (ASCII String)	G	**47**	01000111
	97	**61**	Alphanumeric Data String (ASCII String)		**20**	00100000
	98	**62**	Alphanumeric Data String (ASCII String)	D	**44**	01000100
	99	**63**	Alphanumeric Data String (ASCII String)	i	**69**	01101001
	100	**64**	Alphanumeric Data String (ASCII String)	s	**73**	01110011
	101	**65**	Alphanumeric Data String (ASCII String)	p	**70**	01110000
	102	**66**	Alphanumeric Data String (ASCII String)	l	**6C**	01101100
	103	**67**	Alphanumeric Data String (ASCII String)	a	**61**	01100001
	104	**68**	Alphanumeric Data String (ASCII String)	y	**79**	01111001
	105	**69**	Manufacturer P/N(If<13 char--> 0Ah, then terminate with ASCⅡ code 0Ah,set remaining char = 20h)		**0A**	00001010
	106	**6A**	Manufacturer P/N(If<13 char--> 0Ah, then terminate with ASCⅡ code 0Ah,set remaining char = 20h)		**20**	00100000
	107	**6B**	Manufacturer P/N(If<13 char--> 0Ah, then terminate with ASCⅡ code 0Ah,set remaining char = 20h)		**20**	00100000

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 (Alphanumeric Data String (ASCII String))		**FE**	11111110
	112	**70**	Flag		**00**	00000000
	113	**71**	Alphanumeric Data String (ASCII String)	L	**4C**	01001100
	114	**72**	Alphanumeric Data String (ASCII String)	P	**50**	01010000
	115	**73**	Alphanumeric Data String (ASCII String)	1	**31**	00110001
	116	**74**	Alphanumeric Data String (ASCII String)	0	**30**	00110000
	117	**75**	Alphanumeric Data String (ASCII String)	1	**31**	00110001
	118	**76**	Alphanumeric Data String (ASCII String)	W	**57**	01010111
	119	**77**	Alphanumeric Data String (ASCII String)	X	**58**	01011000
	120	**78**	Alphanumeric Data String (ASCII String)	2	**32**	00110010
	121	**79**	Alphanumeric Data String (ASCII String)	-	**2D**	00101101
	122	**7A**	Alphanumeric Data String (ASCII String)	S	**53**	01010011
	123	**7B**	Alphanumeric Data String (ASCII String)	L	**4C**	01001100
	124	**7C**	Alphanumeric Data String (ASCII String)	A	**41**	01000001
	125	**7D**	Alphanumeric Data String (ASCII String)	1	**31**	00110001
Chec	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)		**2C**	00101100