SPECIFICATION
FOR
APPROVAL

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

Title	20.1" WSXGA+ TFT LCD

BUYER	DELL
MODEL	

SUPPLIER	LG.Philips LCD Co., Ltd.
*MODEL	LP201WE1
Suffix	SL01

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

SIGNATURE	DATE
/	
/	
/	

Please return 1 copy for your confirmation with your signature and comments.

SIGNATURE	DATE
J.H. Park / G.Manager	
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Products Engineering Dept.
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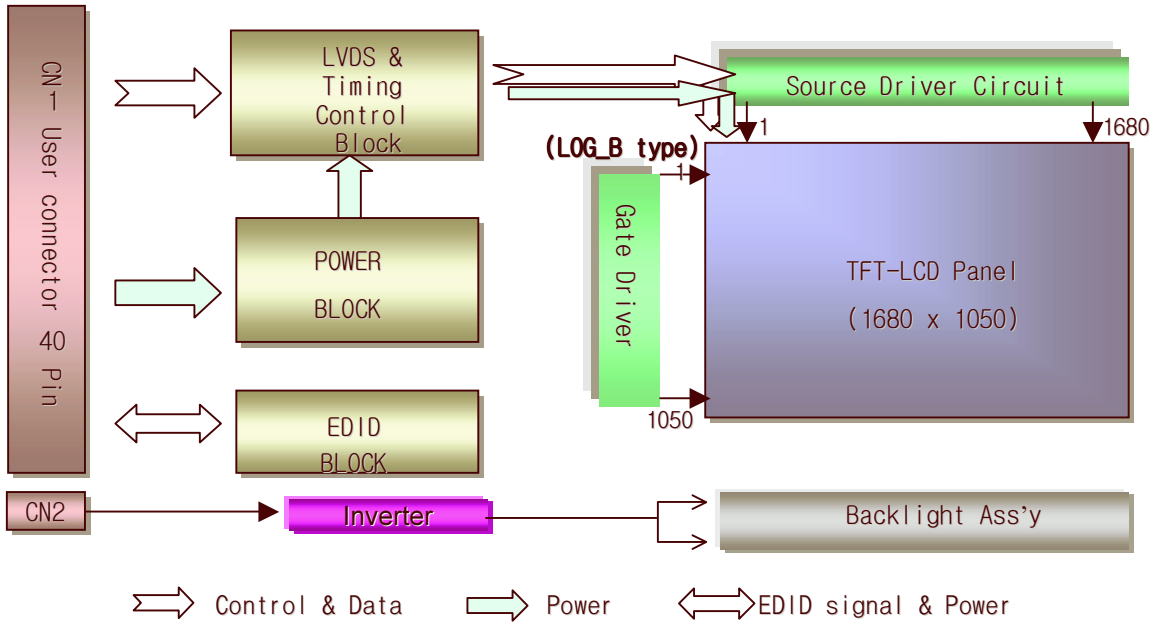
Contents

RECORD OF REVISIONS

Revision No	Revision Date	Page	Description	Note
0.1	7 . SEP, 2005	-	**Preliminary Specification**	
0.2	4. NOV, 2005			
	"	4	**Power consumption changed** **(**Circuit: 6.5 → 5.84Watt,B/L:10 → 10.8Watt)	
	"	6	**The power of Mosaic pattern added** **The current spec of VEDID added** **The picture of pattern in power measurement added** **The power in White pattern changed (1.3→1.15, 6.5→5.75)**	
	"	12	**The power of sequence of VEDID added**	
	"	13	**Response time added (Gray to Gray:Min/Max)**	
	"	19/21	**Detail description of boss for aligning position added**	
	"	27	The EDID data changed (Check sum: FE → 01)	
0.3	12.JAN.2006	4	**Power consumption changed** **(**Circuit: 5.84 → 4.2Watt,)	
	"	6	**The current spec changed** **The power in Mosaic pattern changed (Pvedid : 0.76W, Pvcc :3.4W)**	
	"	9	Backlight connector pin configuration changed	
	"	10	Timing Max spec. added	
	"	12	Sequence time from Power supply for EDID to Power for LCD changed (200ms → 3s) T7 Min. value changed (400ms → 1000ms)	
	"	13	Response Time Typ. Spec. added(Tr :12ms, Tf :11ms) Color Coordinates changed.	
	"	17	Gray scale spec. changed	
	"	19/21	Mechanical detail description changed	
0.4	19.JAN.2006	21	Screw Torque size added(Glass(POL) to screw : 3.80±0.3)	
1.0	05.APR.2006	27/29	EDID data update(checksum : 94)	

1. General Description

LP201WE1 is a Color Active Matrix Liquid Crystal Display with an integral Cold Cathode Fluorescent 2 Lamp(CCFL) backlight system. The matrix employs a-Si Thin Film Transistor as the active element. It is a transmissive type display operating in the normally black mode. It has a 20.1 inch diagonally measured active display area with WSXGA+ resolution (1050 vertical by 1680 horizontal pixel array) Each pixel is divided into Red, Green and Blue sub-pixels or dots which are arranged in vertical stripes. Gray scale or the brightness of the sub-pixel color is determined with a 8-bit gray scale signal for each dot, thus, presenting a palette of more than 16,7M(True) colors.
It has been designed to apply the 8Bit 2 port LVDS interface.
It is intended to support displays where high brightness, super wide viewing angle, and high color are important.



General Features

Active Screen Size	20.1 inches(511.133mm) diagonal (Aspect ratio 16:10)
Outline Dimension	453.5(H) x 294.5 (V) x 11.5(D) mm (Typ.)
Pixel Pitch	0.258mm x 0.258mm
Pixel Format	1680 horiz. By 1050 vert. Pixels RGB strip arrangement
Color Depth	8bit, 16,7 M colors
Luminance, White	300 cd/m^2 (Center 5 point, Typ.)
Viewing Angle (CR>10)	Viewing Angle Free (R/L 176(Typ.), U/D 176(Typ))
Power Consumption	Total 15.0Watt(Typ.) (4.2Watt@VLCD(Mosaic),Typ10.8Watt 300cd/m2 Lamp=7.0mA)
Weight	**1500g Max**
Display Operating Mode	Transmissive mode, normally black
Surface Treatment	Hard coating & Glare (2H) treatment of the front polarizer

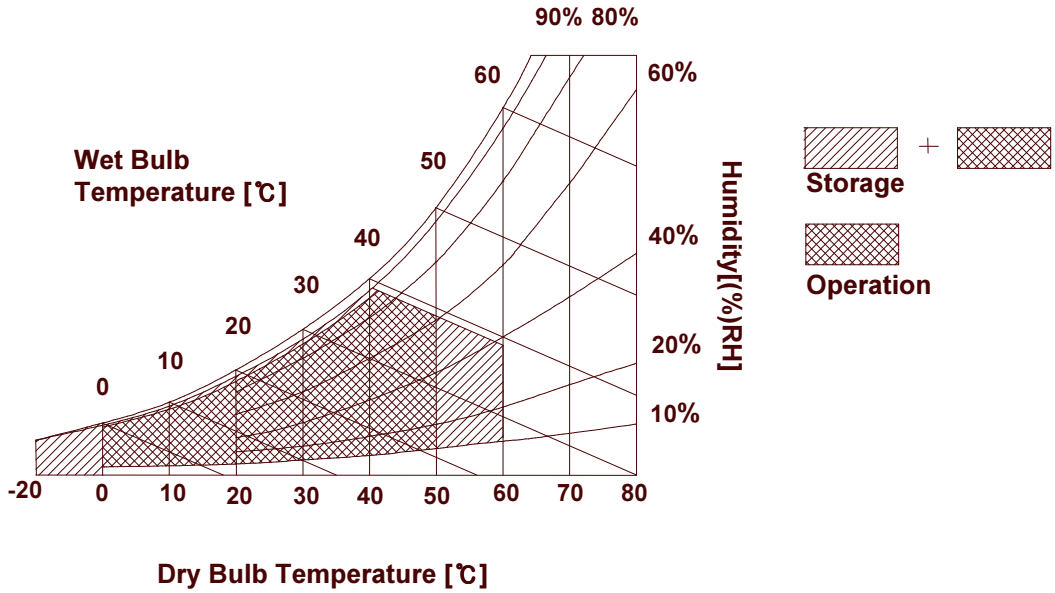
2. Absolute Maximum Ratings

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	6.0	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

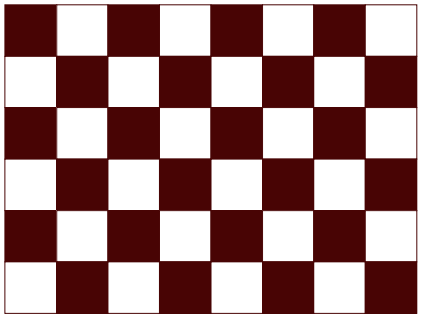
The LP201WE1(F11)requires two power inputs. One is employed to power the LCD electronics and to drive the TFT array and liquid crystal. The second input which powers the CCFL, is typically generated by an inverter. The inverter is an external unit to the LCD.

Table 2. ELECTRICAL CHARACTERISTICS

Parameter	Symbol	Values			Unit	Notes
		Min	Typ	Max		
MODULE :						
Power Supply Input Voltage	VEDID	3.0	3.3	3.6	V_{DC}	
Power Supply Input Current	I_{EDID}	195	230	265	mA	1
		195	230	265	mA	2
Power Supply Input Voltage	VCC	4.5	5.0	5.5	V_{DC}	
Power Supply Input Current	I_{VCC}	580	680	780	mA	1
		800	940	1080	mA	2
Power Consumption	Pvedid	-	0.76	-	Watt	1
Power Consumption	Pvcc	-	3.40	-	Watt	1
Differential Impedance	Zm	90	100	110	Ohm	3
LAMP (By 1Lamp)						
Operating Voltage	V_{BL}	730	770	880	V_{RMS}	4
Operating Current	I_{BL}	3.0	7.0	8.0	mA_{RMS}	5
Power Consumption	P_{BL}	-	5.4	6.0		10
Operating Frequency	f_{BL}	40	60	80	kHz	8
Discharge Stabilization Time	Ts	-	-	3	Min	6
Life Time		15,000	-	-	Hrs	7
Established Starting Voltage at 25℃ at 0 ℃	Vs			 1650 1950	 V_{RMS} V_{RMS}	9

Note)

1. The specified current and power consumption are under the Vcc = 5.0V , 25℃, fv = 60Hz condition whereas Mosaic pattern is displayed and fv is the frame frequency.
2. The current is specified at the maximum current pattern.

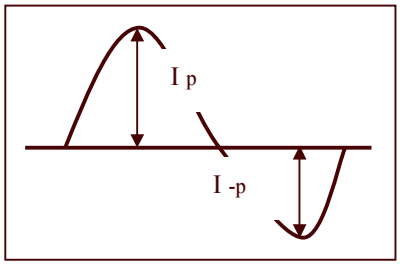


Mosaic Pattern(8 x 6) White : 255Gray
Black : 0Gray

Maximum current pattern:
White Pattern

Note)

3. This impedance value is needed to proper display and measured form LVDS Tx to the mating connector.
4. The variance of the voltage is ± 10%.
5. The typical operating current is for the typical surface luminance (L_{WH}) in optical characteristics.
6. Define the brightness of the lamp after being lighted for 5 minutes as 100%, Ts is the time required for the brightness of the center of the lamp to be not less than 95%.
7. The life time is determined as the time at which brightness of lamp is 50% compare to that of initial value at the typical lamp current.
8. The output of the inverter must have symmetrical(negative and positive) voltage waveform and symmetrical current waveform.(Asymmetrical ratio is less than 10%) Please do not use the inverter which has asymmetrical voltage and asymmetrical current and spike wave.
   Lamp frequency may produce interface with horizontal synchronous frequency and as a result this may cause beat on the display. Therefore lamp frequency shall be as away possible from the horizontal synchronous frequency and from its harmonics in order to prevent interference.
9. The voltage above VS should be applied to the lamps for more than 1 second for start-up. Otherwise, the lamps may not be turned on. The used lamp current is the lamp typical current.
10. The lamp power consumption shown above does not include loss of external inverter.
    The applied lamp current is a typical one.
11. Requirements for a system inverter design, which is intended to have a better display performance, a better power efficiency and a more reliable lamp, are following.
    It shall help increase the lamp lifetime and reduce leakage current.
    a. The asymmetry rate of the inverter waveform should be less than 10%.
    b. The distortion rate of the waveform should be within √2 ±10%.
    * Inverter output waveform had better be more similar to ideal sine wave.



* Asymmetry rate:

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

* Distortion rate

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

※ Do not attach a conducting tape to lamp connecting wire.
If the lamp wire attach to a conducting tape, TFT-LCD Module has a low luminance and the inverter has abnormal action. Because leakage current is occurred between lamp wire and conducting tape.

3-2. Interface Connections

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

Table 3. MODULE CONNECTOR PIN CONFIGURATION (CN1)

Pin	Symbol	Description	Notes
1	Vss	Ground	
2	VCC	Power Supply, 5.0V Typ.	
3	VCC	Power Supply, 5.0V Typ.	
4	VCC	Power Supply, 5.0V Typ.	
5	Test	Panel Test	
6	VEEDID	Digital Power supply (3.3 Typ)	
7	AI_O	Adaptive Image Output	
8	Clk EEDID	Two wire serial interface clock	
9	DATA EEDID	Two wire serial interface data	
10	Vss	Ground	
11	RXin00-	- LVDS differential data input, Chan 0-Odd	
12	RXin00+	+ LVDS differential data input, Chan 0-Odd	
13	Vss	Ground	
14	RXin01	- LVDS differential data input, Chan 1-Odd	
15	RXin01+	+ LVDS differential data input, Chan 1-Odd	
16	Vss	Ground	
17	RXin02-	- LVDS differential data input, Chan 2-Odd	
18	RXin02+	+ LVDS differential data input, Chan 2-Odd	
19	Vss	Ground	
20	RXOC-	- LVDS Differential Clock input (Odd)	
21	RXOC+	+ LVDS Differential Clock input (Odd)	
22	Vss	Ground	
23	RXin03-	- LVDS differential data input, Chan 3-Odd	
24	RXin03+	+ LVDS differential data input, Chan 3-Odd	
25	Vss	Ground	
26	RXinE0-	- LVDS differential data input, Chan 0-Even	
27	RXinE0+	+ LVDS differential data input, Chan 0-Even	
28	Vss	Ground	
29	RXinE1-	- LVDS differential data input, Chan 1-Even	
30	RXinE1+	+ LVDS differential data input, Chan 1-Even	
31	Vss	Ground	
32	RXinE2-	- LVDS differential data input, Chan 2-Even	
33	RXinE2+	+ LVDS differential data input, Chan 2-Even	
34	Vss	Ground	
35	RXEC-	- LVDS Differential Clock input (Even)	
36	RXEC+	+ LVDS Differential Clock input (Even)	
37	Vss	Ground	
38	RXinE3-	- LVDS differential data input, Chan 3-Even	
39	RXinE3+	+ LVDS differential data input, Chan 3-Even	
40	NC	AI/SRGB test pin	

Notes:

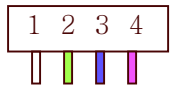
1, Interface chips
1.1 LCD : 0IHIL-0062A (Donau)
including LVDS Receiver
(THINE, THC63LVD824)
1.2 System : THC63LVDF823A or equivalent

2. Connector
2.1 LCD : Tyco or
its compatibles
2.2 Mating : Tyco or equivalent.
2.3 Connector pin arrangement

[LCD Module Rear View]

The backlight interface connector is a model BHSR-04VS-1, manufactured by JST or Compatible

Table 4. BACKLIGHT CONNECTOR PIN CONFIGURATION (J3)

Pin	Symbol	Description	Notes
1	High line	AC high voltage for CCFL driving	 [LCD Module Rear View]
2	Low line	AC low voltage from the CCFL	
3	Low line	AC low voltage from the CCFL	
4	High line	AC high voltage for CCFL driving	

3-3. Signal Timing Specifications

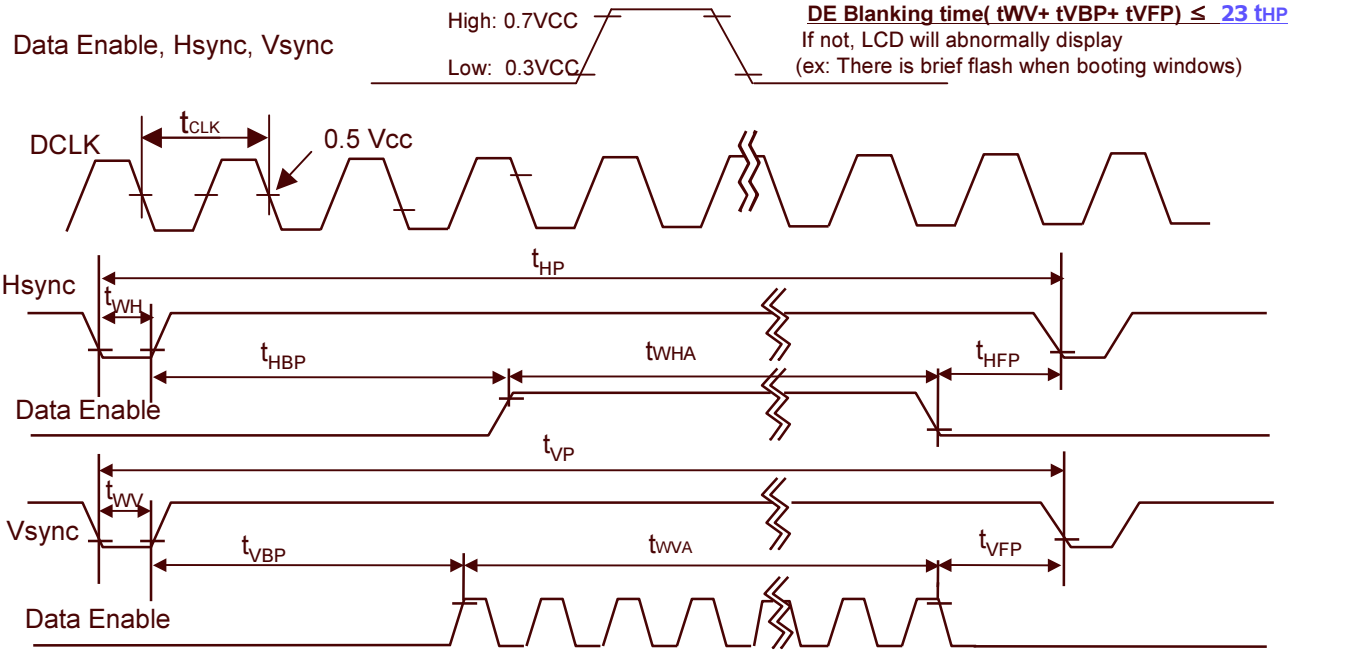
This is the signal timing required at the input of the User connector. All of the interface signal timing should be satisfied with the following specifications and specifications of LVDS Tx/Rx for its proper operation.

Table 5. TIMING TABLE

ITEM	Symbol		Min	Typ	Max	Unit	Note
DCLK	Period	t_{CLK}	8.33	8.40	8.47	ns	
	Frequency	f_{CLK}	118.0	119.0	120.0	MHz	
Hsync	Period	t_{HP}	1826	1840	1852	t_{CLK}	
	Width	t_{WH}	30	32	34		
	Active	t_{WHA}	1680	1680	1680		
Vsync	Period	t_{VP}	1073	1078	1084	t_{HP}	
	Width	t_{WV}	4	6	7		
	Active	t_{WVA}	1050	1050	1050		
Data Enable	Horizontal back porch	t_{HBP}	76	80	84	t_{CLK}	
	Horizontal front porch	t_{HFP}	40	48	54		
	Vertical back porch	t_{VBP}	17	19	23	t_{HP}	
	Vertical front porch	t_{VFP}	2	3	4		

3-4. Signal Timing Waveforms (Normal status)

Cautions
- Case1: BIST status
  VCC =3.3V, No video signal
- Case 2: System Power On⇔Maker Logo⇔Window logo⇔Log On
  DE Blanking time(tWV+ tVBP+ tVFP) ≤ 23 t_{HP}
  If not, LCD will abnormally display
  (ex: There is brief flash when booting windows)



3-5. Color Input Data Reference

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

Table 6. COLOR DATA REFERENCE

Color		Input Color Data																							
		RED								GREEN								BLUE							
		MSB							LSB	MSB							LSB	MSB							LSB
		R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4	G3	G2	G1	G0	B7	B6	F11	B4	B3	B2	B1	B0
Basic Color	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red (255)	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green (255)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	Blue (255)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Cyan	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Magenta	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	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	1	1	1	1	1	1
RED	RED (000) Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RED (001)	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	...					...								...								...			
	RED (254)	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RED (255)	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GREEN	GREEN (000) Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	GREEN (001)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
	...					...								...								...			
	GREEN (254)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0
	GREEN (255)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
BLUE	BLUE (000) Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	BLUE (001)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	...					...								...								...			
	BLUE (254)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0
	BLUE (255)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1

3-6. Power Sequence

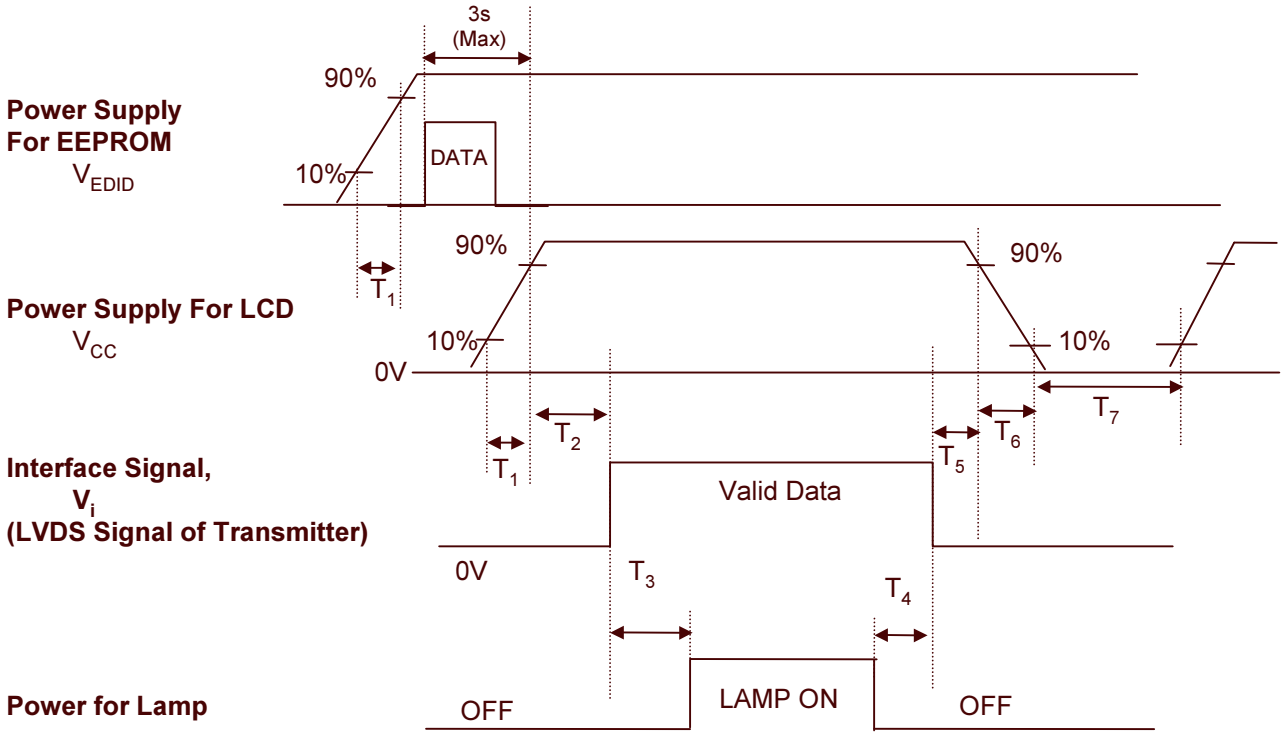


Table7. POWER SEQUENCE TABLE

Parameter	Value			Units
	Min.	Typ.	Max.	
T_1	-	-	10	(ms)
T_2	0	-	50	(ms)
T_3	200	-	-	(ms)
T_4	200	-	-	(ms)
T_5	0	-	50	(ms)
T_6	0	-	10	(ms)
T_7	1000	-	-	(ms)

Note)
1. Please avoid floating state of interface signal at invalid period.
2. When the interface signal is invalid, be sure to pull down the power supply for LCD VCC to 0V.
3. Lamp power must be turn on after power supply for LCD and interface signal are valid.

4. Optical Specification

Optical characteristics are determined after the unit has been 'ON' and stable for approximately 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

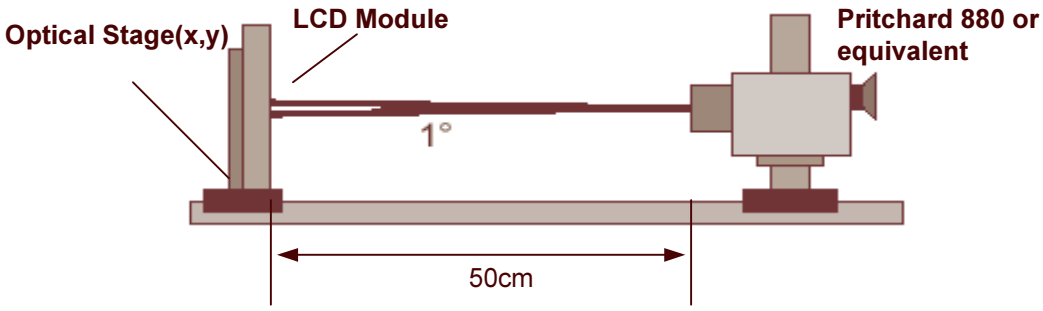


Table 8. OPTICAL CHARACTERISTICS Ta=25°C, VCC=5.0V, fv=60Hz, f_{CLK}= 119MHz, Iout = 7mA

Parameter		Symbol	Values			Units	Notes
			Min	Typ	Max		
Contrast Ratio		CR	400	600	-		1
Surface Luminance		L_{WH}	260	300	-	cd/m^2	2
Luminance Variation		δ_{WHITE}	-	-	2.0		3
Response Time	Rise Time	Tr_R	-	12	15	ms	4
	Decay Time	Tr_D	-	11	15	ms	4
	Gray To Gray	T_{GTG_AVR}	-	16.0	-	ms	5
		T_{GTG_MAX}	-	24.0	-	ms	5
Color Coordinates [CIE1931]	RED	Rx	Typ -0.03	**0.599**	Typ +0.03		
		Ry		**0.349**			
	GREEN	Gx		**0.324**			
		Gy		**0.549**			
	BLUE	Bx		**0.157**			
		By		**0.140**			
	WHITE	Wx		0.315			
		Wy		0.330			
Color shift							6
	Horizontal	θ_{CST_H}	-	176	-	degree	
	Vertical	θ_{CST_V}	-	176	-		
Viewing Angle (CR>10)							
General	Horizontal	θ_H	170	176	-	degree	7
	Vertical	θ_V	170	176	-		
Effective	Horizontal	θ_{GMA_H}	-	176	-	degree	8
	Vertical	θ_{GMA_V}		176			
Gray Scale				2.2			9

Note)

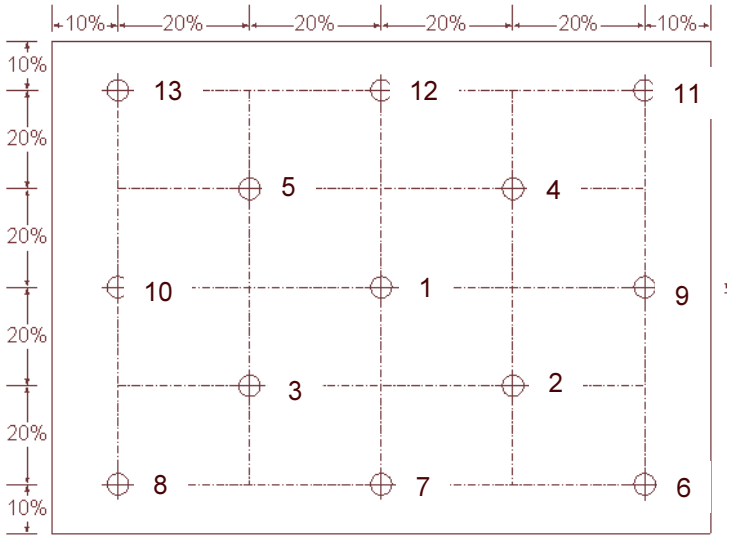
1. Contrast Ratio(CR) is defined mathematically as

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

2. Surface luminance is the 5point (1~5)average across the LCD surface 50cm from the surface with all pixels displaying white (7.0mA). For more information see FIG 2.

3. Luminance % uniformity is measured for 13 point For more information see FIG 2.
   δ WHITE = Maximum(LN1,LN2, ….. LN13) ÷ Minimum(LN1,LN2, ….. LN137)

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



Measuring Point
@ H,V: Active Area
H : 433.44 mm
V : 270.90 mm

FIG. 2 Measure Point for Luminance

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.

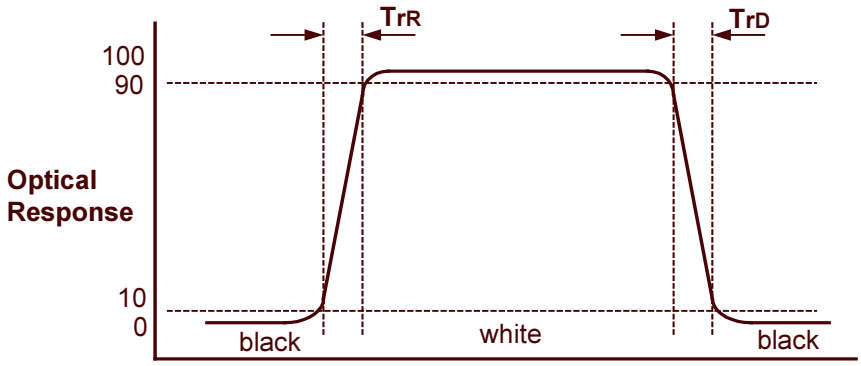


FIG. 3 Response Time

5. The Gray to Gray response time is defined as the following figure and shall be measured by switching the input signal for “Gray To Gray “.
   - Gray step : 5 Step
   - TGTG_AVR is the total average time at rising time and falling time for “Gray To Gray “.
   - TGTG_MAX is the max time at rising time or falling time for “Gray To Gray “.

Gray to Gray		Rising Time				
		G255	G191	G127	G63	G0
Falling Time	G255					
	G191					
	G127					
	G63					
	G0					

6. **Color shift** is the angle at which the color difference is lower than 0.04.

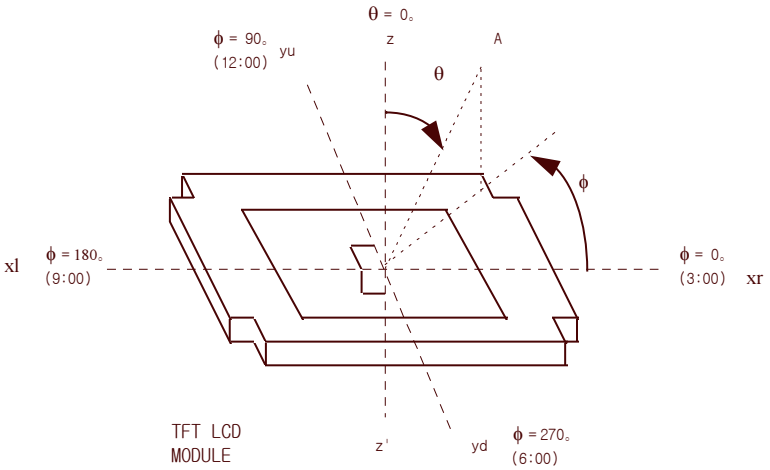
- Color difference(Δ u'v')

$$u' = \frac{4x}{-2x + 12y + 3} \qquad v' = \frac{9y}{-2x + 12y + 3}$$

$$\Delta u'v' = \sqrt{(u'_1-u'_2)^2+(v'_1-v'_2)^2}$$

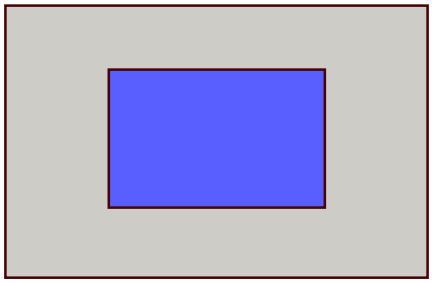
u'1, v'1 : u'v' value at viewing angle direction
u'2, v'2 : u'v' value at front (Θ=0)

- Pattern size : 25% Box size
- Viewing angle direction of color shift : Horizontal, Vertical



Viewing angle direction

25% Box size



Average RGB values in Bruce RGB for Macbeth Chart

	Dark skin	Light skin	Blue sky	Foliage	Blue flower	Bluish green
R	98	206	85	77	129	114
G	56	142	112	102	118	199
B	45	123	161	46	185	178
	Orange	Purplish blue	Moderate red	Purple	Yellow green	Orange yellow
R	219	56	211	76	160	230
G	104	69	67	39	193	162
B	24	174	87	86	58	29
	Blue	Green	Red	Yellow	Magenta	cyan
R	26	72	197	241	207	35
G	32	148	27	212	62	126
B	145	65	37	36	151	172
	White	Neutral 8	Neutral 6.5	Neutral 5	Neutral 3.5	black
R	240	206	155	110	63	22
G	240	206	155	110	63	22
B	240	206	155	110	63	22

7. **Viewing angle(general)** is the angle at which the contrast ratio is greater than 10.

8. **Effective viewing angle** is the angle at which the gamma shift of gray scale is lower than 0.3.

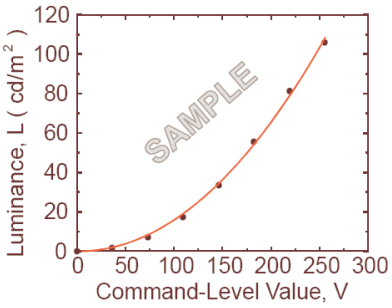


Fig. 1. Sample Luminance vs. gray scale (using a 256 bit gray scale).

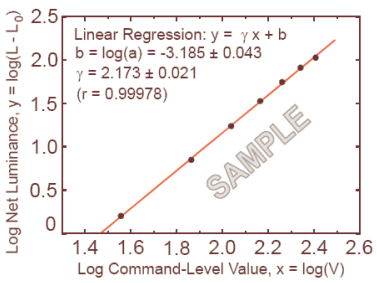


Fig. 2. Sample Log-log plot of luminance vs. gray scale.

$$L = aV^{r} + L_b$$

$$\log(L - L_b) = r\log(V) + \log(a)$$

Here the Parameter α and γ relate the signal level V to the luminance L.
The GAMMA we calculate from the log-log representation (Fig. 2)

9. Gray scale specification
Gamma Value is approximately 2.2. For more information see Table 10.

Table 9. Gray Scale Specification

Gray Level	Luminance [%] (Typ)
L0	0.1
L15	0.2
L31	0.8
L47	1.9
L63	3.6
L79	6.2
L95	9.5
L111	13.0
L127	18.0
L143	25.0
L159	33.0
L175	42.0
L191	52.0
L207	63.0
L223	75.0
L239	88.0
L255	100

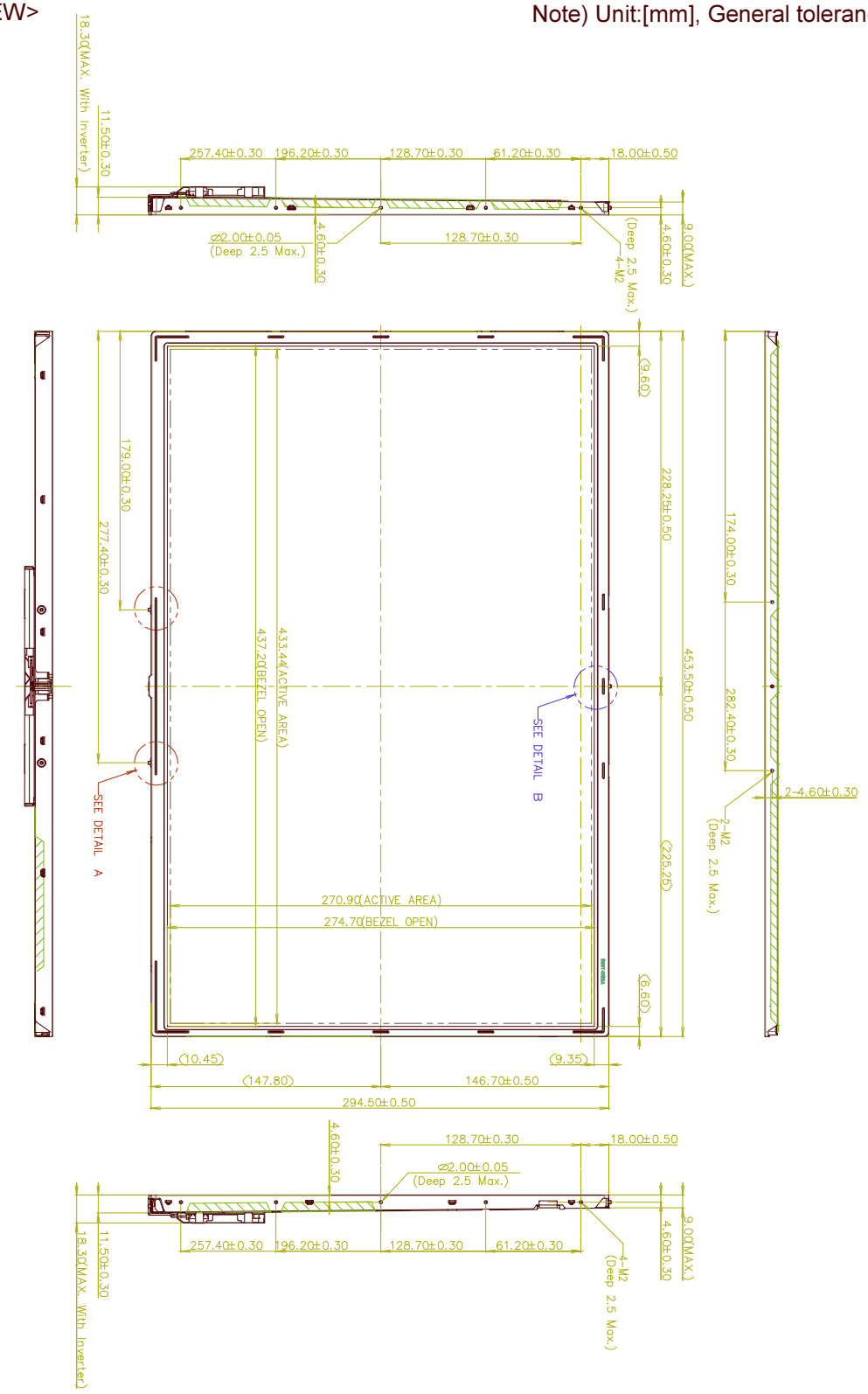
5. Mechanical Characteristics

The contents provide general mechanical characteristics for the model LP201WE1(F11). In addition the figures in the next page are detailed mechanical drawing of the LCD.

Outline Dimension	Horizontal	453.5 ± 0.5mm
	Vertical	294.5 ± 0.5mm
	Depth (Max)	11.8mm
Bezel Area	Horizontal	437.2 ± 0.5mm
	Vertical	274.7 ± 0.5mm
Active Display Area	Horizontal	433.44 mm
	Vertical	270.9 mm
Weight	1500	
Surface Treatment	Hard coating(2H) Glare treatment of the front polarizer	

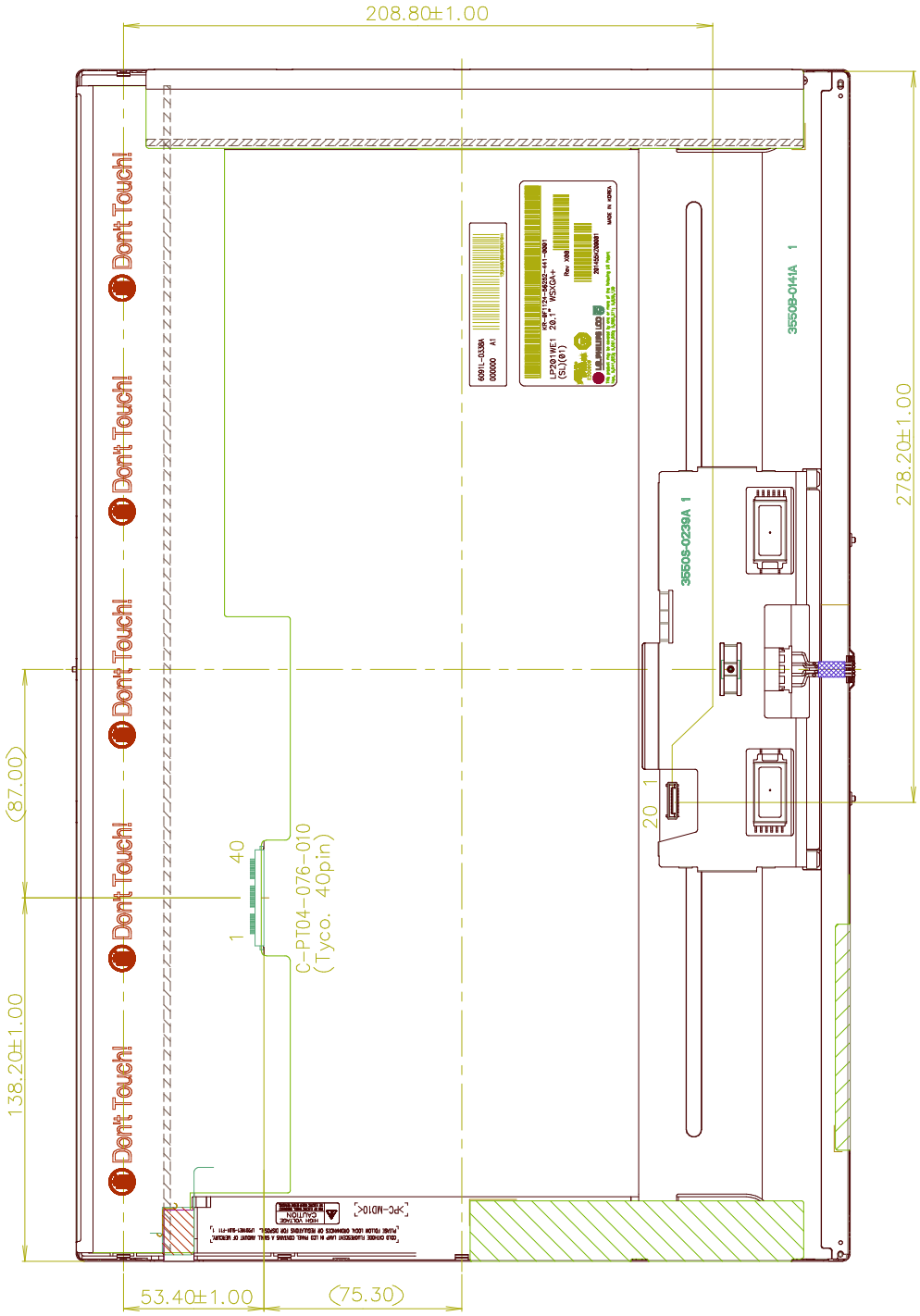
<FRONT VIEW>

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



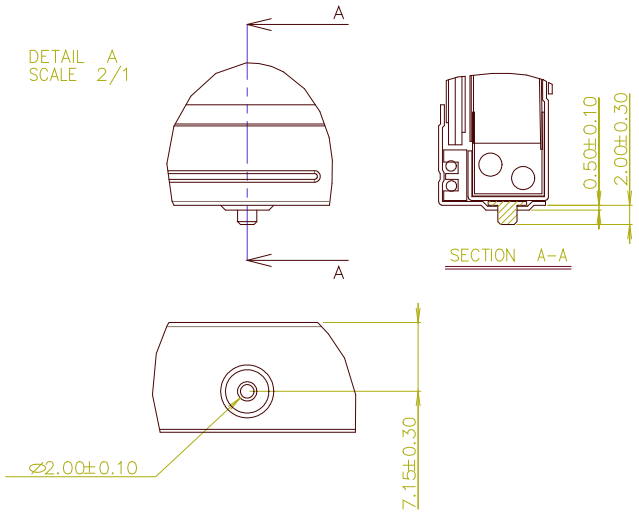
<REAR VIEW>

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

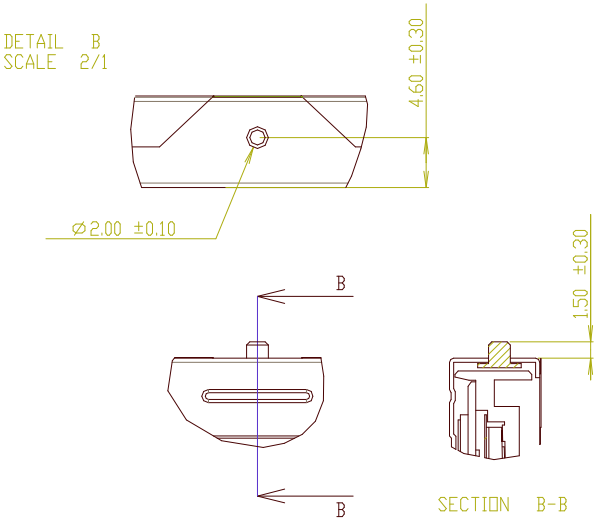


[DETAIL DESCRIPTION OF SIDE MOUNTING SCREW]

“ Detail A ”

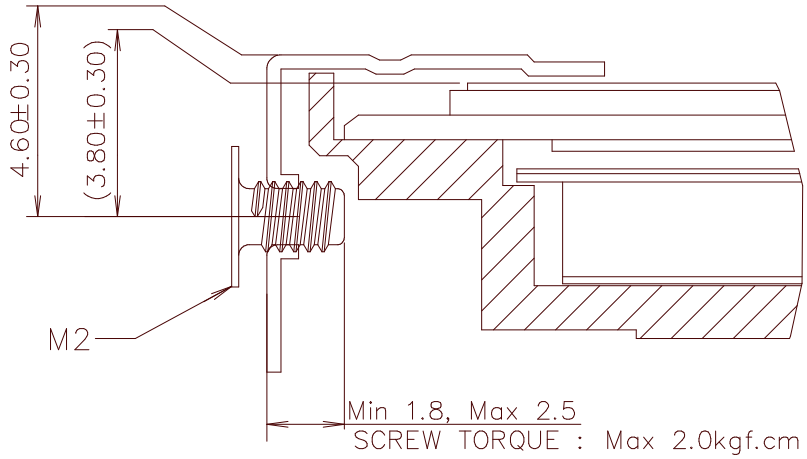


“ Detail B ”



[DETAIL DESCRIPTION OF SIDE MOUNTING SCREW]

***Screw Torque (10 point):**



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

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 200 G in a half sine pulse no longer than 2 ms to the display module - No functional defects following a shock delivering at least 260 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, Third Edition, Underwriters Laboratories, Inc., Dated Dec. 11, 2000.
Standard for Safety of Information Technology Equipment, Including Electrical Business Equipment.
b) CAN/CSA C22.2, No. 60950, Third Edition, Canadian Standards Association, Dec. 1, 2000.
Standard for Safety of Information Technology Equipment, Including Electrical Business Equipment.
c) EN 60950 : 2000, Third Edition
IEC 60950 : 1999, Third Edition
European Committee for Electrotechnical Standardization(CENELEC)
EUROPEAN STANDARD for Safety of Information Technology Equipment Including Electrical Business Equipment.

7-2. EMC

a) ANSI C63.4 "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electrical Equipment in the Range of 9kHZ to 40GHz. "American National Standards Institute(ANSI), 1992
b) C.I.S.P.R "Limits and Methods of Measurement of Radio Interface Characteristics of Information Technology Equipment." International Special Committee on Radio Interference.
c) EN 55022 "Limits and Methods of Measurement of Radio Interface Characteristics of Information Technology Equipment." European Committee for Electrotechnical Standardization.(CENELEC), 1998
(Including A4K4: 2000)

8. Packing

8-1. Designation of Lot Mark

a) Lot Mark

A	B	C	D	E	F	G	H	I	J	K	L	M

A,B,C : SIZE(INCH)
D : YEAR
E : MONTH
F : PANEL CODE
G : FACTORY CODE
H : ASSEMBLY CODE
I,J,K,L,M : SERIAL NO.

Note

1. YEAR

Year	97	98	99	2000	2001	2002	2003	2004	2005	2006	2007
Mark	7	8	9	0	1	2	3	4	5	6	7

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

3. PANEL CODE

Panel Code	P1 Factory	P2 Factory	P3 Factory	P4 Factory	P5 Factory	Hydis Panel
Mark	1	2	3	4	5	H

4. FACTORY CODE

Factory Code	LPL Gumi	LPL Nanjing	HEESUNG
Mark	K	C	D

5. SERIAL NO.

Year	1 ~ 99999	100000 ~
Mark	00001 ~ 99999	A0001 ~ A9999, ... , Z9999

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 : 10 pcs

b) Box Size : 530mm ×319mm × 380mm

9. PRECAUTIONS

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

9-1. MOUNTING PRECAUTIONS

(1) You must mount a module using holes arranged in four corners or four sides.
(2) You should consider the mounting structure so that uneven force (ex. Twisted stress) is not applied to the module. And the case on which a module is mounted should have sufficient strength so that external force is not transmitted directly to the module.
(3) Please attach the surface transparent protective plate to the surface in order to protect the polarizer. Transparent protective plate should have sufficient strength in order to the resist external force.
(4) You should adopt radiation structure to satisfy the temperature specification.
(5) Acetic acid type and chlorine type materials for the cover case are not desirable because the former generates corrosive gas of attacking the polarizer at high temperature and the latter causes circuit break by electro-chemical reaction.
(6) Do not touch, push or rub the exposed polarizers with glass, tweezers or anything harder than HB pencil lead. And please do not rub with dust clothes with chemical treatment.
Do not touch the surface of polarizer for bare hand or greasy cloth.(Some cosmetics are detrimental to the polarizer.)
(7) When the surface becomes dusty, please wipe gently with absorbent cotton or other soft materials like chamois soaks with petroleum benzene. Normal-hexane is recommended for cleaning the adhesives used to attach front / rear polarizers. Do not use acetone, toluene and alcohol because they cause chemical damage to the polarizer.
(8) Wipe off saliva or water drops as soon as possible. Their long time contact with polarizer causes deformations and color fading.
(9) Do not open the case because inside circuits do not have sufficient strength.

9-2. OPERATING PRECAUTIONS

(1) The spike noise causes the mis-operation of circuits. It should be lower than following voltage :
V=± 200mV(Over and under shoot voltage)

(2) Response time depends on the temperature.(In lower temperature, it becomes longer.)
(3) Brightness depends on the temperature. (In lower temperature, it becomes lower.)
And in lower temperature, response time(required time that brightness is stable after turned on) becomes longer.
(4) Be careful for condensation at sudden temperature change. Condensation makes damage to polarizer or electrical contacted parts. And after fading condensation, smear or spot will occur.
(5) When fixed patterns are displayed for a long time, remnant image is likely to occur.
(6) Module has high frequency circuits. Sufficient suppression to the electromagnetic interference shall be done by system manufacturers. Grounding and shielding methods may be important to minimized the interference.

9-3. ELECTROSTATIC DISCHARGE CONTROL

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

9-4. PRECAUTIONS FOR STRONG LIGHT EXPOSURE

Strong light exposure causes degradation of polarizer and color filter.

9-5. STORAGE

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

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

9-6. HANDLING PRECAUTIONS FOR PROTECTION FILM

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

APPENDIX A. Enhanced Extended Display Identification Data (EEDID™) 1/3

	Byte (hex)	Field Name and Comments	Value (hex)	Value (binary)
Header	0	Header	00	00000000
	1	Header	FF	11111111
	2	Header	FF	11111111
	3	Header	FF	11111111
	4	Header	FF	11111111
	5	Header	FF	11111111
	6	Header	FF	11111111
	7	Header	00	00000000
Vendor / Product EDID Version	8	EISA manufacture code = 3 Character ID = LPL	32	00110010
	9	EISA manufacture code (Compressed ASCII)	0C	00001100
	0A	Panel Supplier Reserved – Product Code	00	00000000
	0B	Panel Supplier Reserved – Product Code	3D	00111101
	0C	LCD module Serial No - Preferred but Optional (“0” if not used)	00	00000000
	0D	LCD module Serial No - Preferred but Optional (“0” if not used)	00	00000000
	0E	LCD module Serial No - Preferred but Optional (“0” if not used)	00	00000000
	0F	LCD module Serial No - Preferred but Optional (“0” if not used)	00	00000000
	10	Week of manufacture	00	00000000
	11	Year of manufacture =2006	10	00010000
	12	EDID structure version # = 1	01	00000001
	13	EDID revision # = 3	03	00000011
Display Parameters	14	Video I/P definition = Digital I/P (80h)	80	10000000
	15	Max H image size = 43.344cm(43)	2B	00101011
	16	Max V image size = 27.09cm(27)	1B	00011011
	17	Display gamma = (2.2 * 100) – 100 = 120	78	01111000
	18	Feature support (no DPMS, Active off, RGB, timing BLK 1)	0A	00001010
Panel Color Coordinates	19	Red/Green Low bit (RxRy/GxGy)	FE	11111110
	1A	Blue/White Low bit (BxBy/WxWy)	09	00001001
	1B	Red X Rx = 0.597	98	10011000
	1C	Red Y Ry = 0.347	58	01011000
	1D	Green X Gx = 0.324	52	01010010
	1E	Green Y Gy = 0.549	8C	10001100
	1F	Blue X Bx = 0.157	28	00101000
	20	Blue Y By = 0.137	23	00100011
	21	White X Wx = 0.315	50	01010000
	22	White Y Wy = 0.330	54	01010100
Established Timings	23	Established timings 1 (00h if not used)	00	00000000
	24	Established timings 2 (00h if not used)	00	00000000
	25	Manufacturer’s timings (00h if not used)	00	00000000
Standard Timing ID	26	Standard timing ID1 (01h if not used)	01	00000001
	27	Standard timing ID1 (01h if not used)	01	00000001
	28	Standard timing ID2 (01h if not used)	01	00000001
	29	Standard timing ID2 (01h if not used)	01	00000001
	2A	Standard timing ID3 (01h if not used)	01	00000001
	2B	Standard timing ID3 (01h if not used)	01	00000001
	2C	Standard timing ID4 (01h if not used)	01	00000001
	2D	Standard timing ID4 (01h if not used)	01	00000001
	2E	Standard timing ID5 (01h if not used)	01	00000001
	2F	Standard timing ID5 (01h if not used)	01	00000001
	30	Standard timing ID6 (01h if not used)	01	00000001
	31	Standard timing ID6 (01h if not used)	01	00000001
	32	Standard timing ID7 (01h if not used)	01	00000001
	33	Standard timing ID7 (01h if not used)	01	00000001
	34	Standard timing ID8 (01h if not used)	01	00000001
	35	Standard timing ID8 (01h if not used)	01	00000001

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

Timing Descripter #1	36	Pixel Clock/10,000 119Mhz (LSB)	7C	01111100
	37	Pixel Clock/10,000 119Mhz (MSB)	2E	00101110
	38	Horizontal Active = 1680 pixels (lower 8 bits)	90	01001000
	39	Horizontal Blanking (Thbp) = 160 pixels (lower 8 bits)	A0	10100000
	3A	Horizontal Active/Horizontal blanking (Thbp) (upper4:4 bits)	60	01100000
	3B	Vertical Active = 1050 lines	1A	00011010
	3C	Vertical Blanking (Tvbp) = 28 lines (DE Blanking typ. for DE only panels)	1C	00011100
	3D	Vertical Active : Vertical Blanking (Tvbp) (upper4:4 bits)	40	01000000
	3E	Horizontal Sync, Offset (Thfp) = 48 pixels	30	00110000
	3F	Horizontal Sync, Pulse Width = 32 pixels	20	00100000
	40	Vertical Sync, Offset (Tvfp) = 3 lines Sync Width = 6 lines	36	00110110
	41	Horizontal Vertical Sync Offset/Width upper 2 bits	00	00000000
	42	Horizontal Image Size =43.344 cm	B1	10110001
	43	Vertical image Size = 27.09 cm	0F	00001111
	44	Horizontal Image Size / Vertical image size	11	00010001
	45	Horizontal Border = 0 (Zero for Notebook LCD)	00	00000000
	46	Vertical Border = 0 (Zero for Notebook LCD)	00	00000000
	47	Non-interlaced, Normal, no stereo, Separate sync, H/V pol Negatives, **DE only note: LSB is set to "1" if panel is DE-timing only. H/V can be ignored.**	19	00011001
Timing Descripter #2	48	Not used	00	00000000
	49	Not used	00	00000000
	4A	Not used	00	00000000
	4B	Not used	00	00000000
	4C	Not used	00	00000000
	4D	Not used	00	00000000
	4E	Not used	00	00000000
	4F	Not used	00	00000000
	50	Not used	00	00000000
	51	Not used	00	00000000
	52	Not used	00	00000000
	53	Not used	00	00000000
	54	Not used	00	00000000
	55	Not used	00	00000000
	56	Not used	00	00000000
	57	Not used	00	00000000
	58	Not used	00	00000000
	59	Module "A" Revision = 00 Example: 00, 01, 02, 03, etc.	00	00000000
Timing Descripter #3 Dell specific information	5A	Flag	00	00000000
	5B	Flag	00	00000000
	5C	Flag	00	00000000
	5D	Dummy Descriptor	FE	11111110
	5E	Flag	00	00000000
	5F	Dell P/N 1st Character = **Y**	59	01011001
	60	Dell P/N 2nd Character = **9**	39	00111001
	61	Dell P/N 3rd Character = **1**	31	00110001
	62	Dell P/N 4th Character = **1**	31	00110001
	63	Dell P/N 5th Character = **6**	36	00110110
	64	LCD Supplier EEDID Revision # = 0.2	02	00000010
	65	Manufacturer P/N = 2	32	00110010
	66	Manufacturer P/N = 0	30	00110000
	67	Manufacturer P/N = 1	31	00110001
	68	Manufacturer P/N = W	57	01010111
	69	Manufacturer P/N = E	45	01000101
	6A	Manufacturer P/N = 1	31	00110001
	6B	Manufacturer P/N (If <13 char, then terminate with ASCII code 0Ah, set remaining char = 20h)	0A	00001010

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

Timing Descripter #4	6C	Flag	00	00000000
	6D	Flag	00	00000000
	6E	Flag	00	00000000
	6F	Data Type Tag:	FE	11111110
	70	Flag	00	00000000
	71	SMBUS Value = 30 nits	37	00110111
	72	SMBUS Value = 38 nits	3F	00111111
	73	SMBUS Value = 50 nits	4A	01001010
	74	SMBUS Value = 70 nits	58	01011000
	75	SMBUS Value = 100 nits	6D	01101101
	76	SMBUS Value = 150 nits	8D	10001101
	77	SMBUS Value = 220 nits	B7	10111001
	78	SMBUS Value = max nits (Typically = 32h)	FF	11111111
	79	Number of LVDS receiver chips = '01' or '02'	02	00000010
	7A	BIST Enable: Yes = '01' No = '00'	01	00000001
	7B	(If <13 char, then terminate with ASCII code 0Ah, set remaining char = 20h)	0A	00001010
	7C	(If <13 char, then terminate with ASCII code 0Ah, set remaining char = 20h)	20	00100000
	7D	(If <13 char, then terminate with ASCII code 0Ah, set remaining char = 20h)	20	00100000
Checksum	7E	Extension flag (# of optional 128 EDID extension blocks to follow, Typ = 0)	00	00000000
	7F	Checksum (The 1-byte sum of all 128 bytes in this EDID block shall = 0)	94	10010100