SPECIFICATION
FOR
APPROVAL

(◆) Preliminary Specification
( ) Final Specification

Title	15.4” WSXGA+ TFT LCD

BUYER	
MODEL	

SUPPLIER	LG.Philips LCD CO., Ltd.
*MODEL	LP154W02
SUFFIX	B1K1

*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.

APPROVED BY	SIGNATURE
J. H. Lee / S.Manager	
REVIEWED BY	
K. K. Jang / Manager	
PREPARED BY	
J.Y. Park / Engineer	

Product Engineering Dept.
LG. Philips LCD Co., Ltd

RECORDS OF REVISIONS

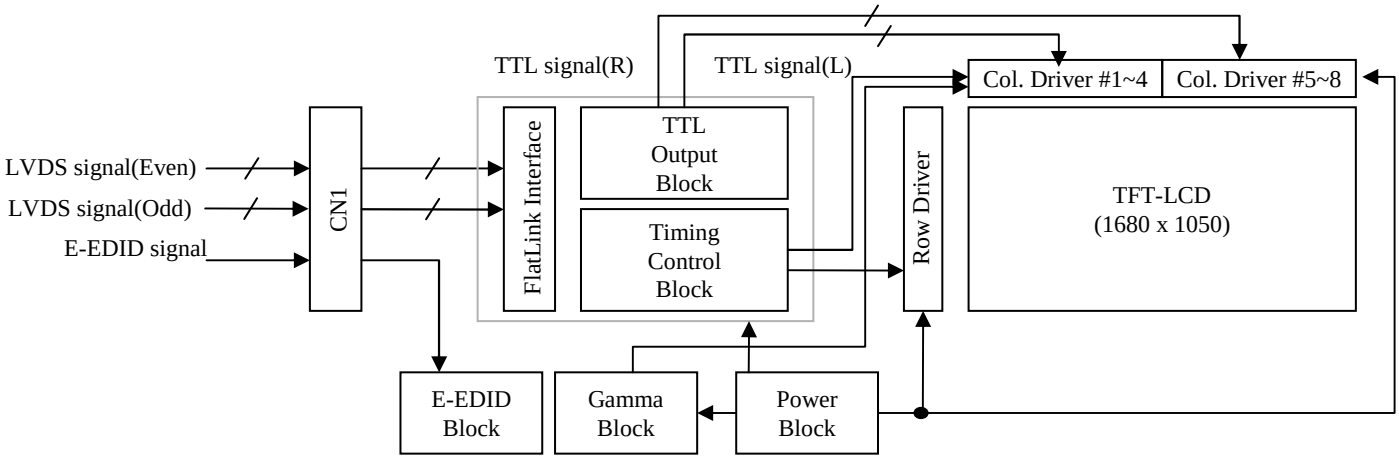
Revision No	Revision Date	Page	Description	EDID ver
0.0		-	First Draft	-
0.1	July,18. 2005	-	EDID data is revised.	0.3

1. General Description

The LP154W02(B1K1) is a Color Active Matrix Liquid Crystal Display with an integral Cold Cathode Fluorescent Lamp(CCFL) backlight system. The matrix employs a-Si Thin Film Transistor as the active element.
It is a transmissive type display operating in the normally white mode. This TFT-LCD has 15.4 inches diagonally measured active display area with WSXGA+ resolution(1680 vertical by 1050 horizontal pixel array) Each pixel is divided into Red, Green and Blue sub-pixels or dots which are arranged in vertical stripes. Gray scale or the brightness of the sub-pixel color is determined with a 6-bit gray scale signal for each dot, thus, presenting a palette of more than 262,144 colors.

The LP154W02(B1K1) has been designed to apply the interface method that enables low power, high speed, low EMI. Flat Link must be used as a LVDS(Low Voltage Differential Signaling) chip.

The LP154W02(B1K1) is intended to support applications where thin thickness, low power are critical factors and graphic display are important. In combination with the vertical arrangement of the sub-pixels, the LP154W02(B1K1) characteristics provide an excellent flat display for office automation products such as Notebook PC.



General Features

Active screen size	15.4 inches diagonal
Outline Dimension	344.0(H)[typ.] x 222.0(V)[typ.] x 6.5(D) mm[Max.]
Pixel Pitch	0.19725 mm x 0.19725mm
Pixel format	1680 horiz. By 1050 vert. Pixels RGB stripes arrangement
Color depth	6-bit, 262,144 colors
Luminance, white	185 cd/m^2(typ.), 5p average
Power Consumption	5.78 (Typ.)
Weight	560 g (Max.)
Display operating mode	Transmissive mode, normally white
Surface treatments	Antiglare treatment of the front/lower polarizer, HAZE(12%)

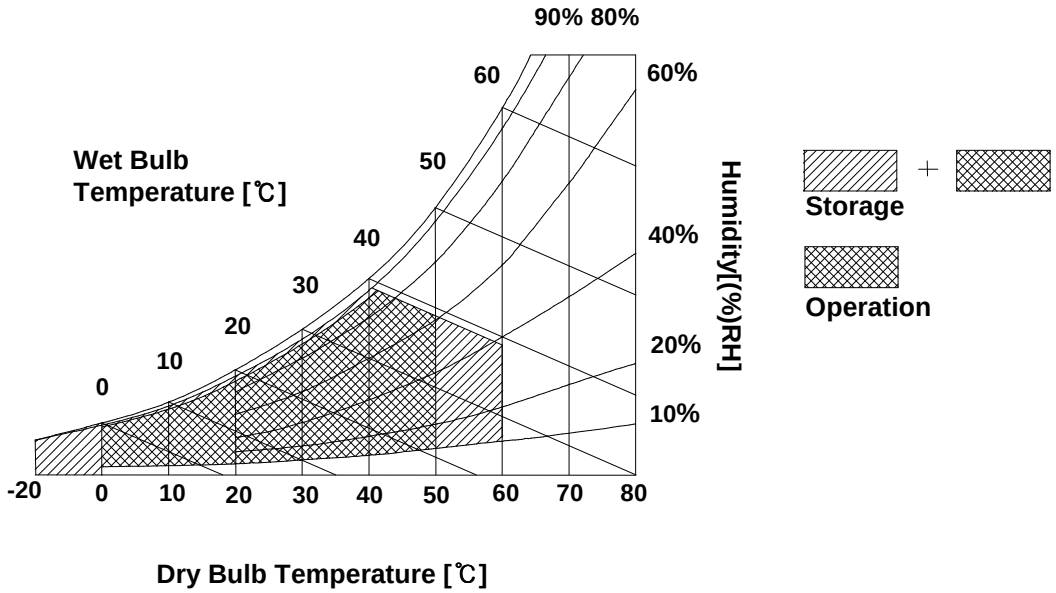
2. Absolute Maximum Ratings

The following are maximum values which, if exceeded, may cause operation or damage to the unit.

Table 1. ABSOLUTE MAXIMUM RATINGS

Parameter	symbol	Values		Units	Notes
		Min.	Max.		
Power Input Voltage	V_{CC}	-0.3	4.0	Vdc	At 25 ± 5°C
Operating Temperature	T_{OP}	0	50	°C	1
Storage Temperature	T_{ST}	-20	60	°C	1
Operating Ambient Humidity	H_{OP}	10	90	%RH	1
Storage Humidity	H_{ST}	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 LP154W02(B1K1) 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.

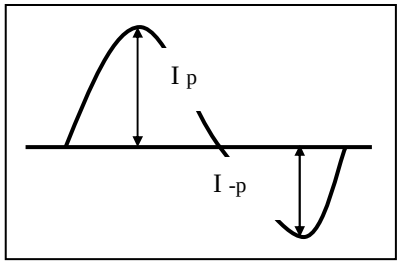
Table 2. ELECTRICAL CHARACTERISTICS

Parameter	Symbol	Values			Units	Notes
		Min.	Typ.	Max.		
MODULE						
Power Supply Input Voltage	V_{CC}	3.0	3.3	3.6	Vdc	
Power Supply Input Current	I_{CC}	-	510	610	mA	1
Differential Impedance	Zm	90	100	110	ohm	2
Power Consumption	P_C		1.68	2.01	Watts	1
LAMP						
Operating Voltage	V_{BL}	675	690	830	V_{RMS}	3
Operating Current	I_{BL}	3.0	6.0	6.5	mA	
Established Starting Voltage	V_S					4
at 25 °C		-	-	1200	V_{RMS}	
at 0 °C		-	-	1500	V_{RMS}	
Operating Frequency	f_{BL}	40	60	80	kHz	5
Discharge Stabilization Time	T_S			3	Minutes	6
Power Consumption	P_{BL}	-	4.1	4.55	Watts	7
Life Time		12,000	-	-	Hrs	8

Note : **The design of the inverter must have specification for the lamp in LCD Assembly.**
The performance of the Lamp in LCM, for example life time or brightness, is extremely influenced by the characteristics of the DC-AC inverter. So all the parameters of an inverter should be carefully designed so as not to produce too much leakage current from high-voltage output of the inverter.
When you design or order the inverter, please make sure unwanted lighting caused by the mismatch of the lamp and the inverter(no lighting, flicker, etc) never occurs. When you confirm it, the LCD Assembly should be operated in the same condition as installed in you instrument.

1. The specified typical current and power consumption are under the V_{CC}=3.3V, 25°C,fv=60Hz condition whereas Mosaic pattern is displayed and fv is the frame frequency.
   The specified max current and power consumption are under the VCC=3.3V, 25°C,fv=60Hz condition whereas black pattern is displayed and fv is the frame frequency.
2. This impedance value is needed to proper display and measured from LVDS T_X to the mating connector.
3. The variance of the voltage is ± 10%.
4. The voltage above V_S should be applied to the lamps for more than 1 second for start-up. Otherwise, the lamps may not be turned on.

5. 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.
6. It is defined the brightness of the lamp after being lighted for 5 minutes as 100%.
   T_S is the time required for the brightness of the center of the lamp to be not less than 95%.
7. The lamp power consumption shown above does not include loss of external inverter.
   The used lamp current is the lamp typical current.
8. The life is determined as the time at which brightness of the lamp is 50% compared to that of initial value at the typical lamp current on condition of continuous operating at 25 ± 2°C.
9. 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.
10. Requirements for a system inverter design, which is intended to have a better display performance, a better power efficiency and a more reliable lamp, are following.
    It shall help increase the lamp lifetime and reduce leakage current.
    a. The asymmetry rate of the inverter waveform should be less than 10%.
    b. The distortion rate of the waveform should be within $\sqrt{2}$ ±10%.
    * Inverter output waveform had better be more similar to ideal sine wave.



* Asymmetry rate:

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

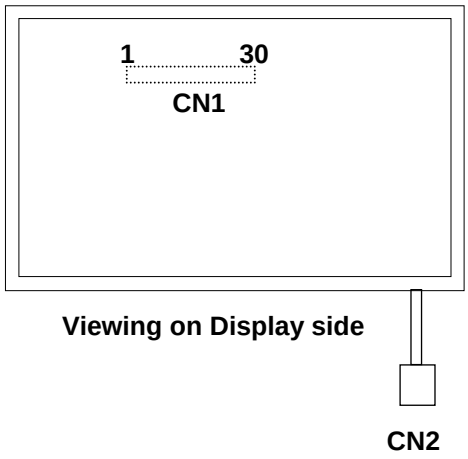
* Distortion rate

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

3-2. Interface Connections

Interface chip must be used FlatLink, part No. THC63LVDF823A(Transmitter made by Thine Inc or equivalence.
This LCD employs two interface connections, a 30-pin-connector is used for the module electronics and the other connector is used for the integral backlight system.
The electronics interface connector is a model FI-XB30SR-HF11 manufactured by JAE or equivalent.
The pin configuration for the connector is shown in the table below.

Table 3. MODULE CONNECTOR PIN CONFIGURATION(LVDS)

Pin	Symbol	Description	Notes
1	GND	Ground	1. Interface chips 1.1 LCD : KZ4E053G11(LCD Controller) including LVDS Receiver 1.2 System : THC63LVD823 or equivalent *Pin to Pin compatible with TI LVDS 2. Connector 2.1 LCD : FI-XB30SR-HF11,JAE or equivalent 2.2 Mating : FI-X30M or equivalent. 2.3 Connector pin arrangement 
2	Vcc	Power(3.3V)	
3	Vcc	Power(3.3V)	
4	VEDID	DDC 3.3V Power	
5	NC	No connect	
6	CLKEDID	DDC clock	
7	DATAEDID	DDC data	
8	Odd_A1M	Differential Signal	
9	Odd_A1P	Differential Signal	
10	GND	Ground	
11	Odd_A2M	Differential Signal	
12	Odd_A2P	Differential Signal	
13	GND	Ground	
14	Odd_A3M	Differential Signal	
15	Odd_A3P	Differential Signal	
16	GND	Ground	
17	Odd_CLKM	Differential Signal	
18	Odd_CLKP	Differential Signal	
19	GND	Ground	
20	Even_A1M	Differential Signal	
21	Even_A1P	Differential Signal	
22	GND	Ground	
23	Even_A2M	Differential Signal	
24	Even_A2P	Differential Signal	
25	GND	Ground	
26	Even_A3M	Differential Signal	
27	Even_A3P	Differential Signal	
28	GND	Ground	
29	Even_CLKM	Differential Signal	
30	Even_CLKP	Differential Signal	

The backlight interface connector is a model BHSR-02VS-1, manufactured by JST. The mating connector part number is SM02B-BHSS-1 or equivalent.
The pin configuration for the connector is shown in the table below.

Table 4. BACKLIGHT CONNECTOR PIN CONFIGURATION

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

Notes : 1. The high voltage side terminal is colored pink. The low voltage side terminal is black

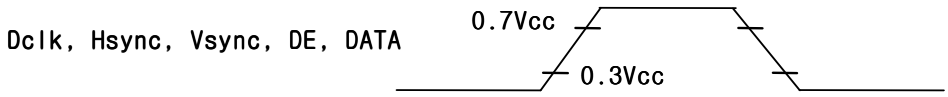
3-3. Signal Timing Specifications

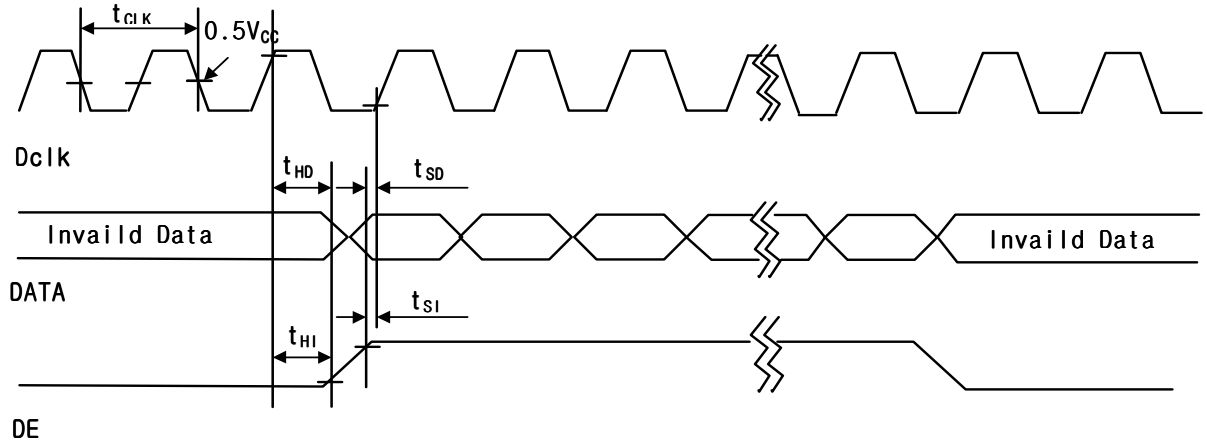
This is the signal timing required at the input of the LVDS Transmitter. All of the interface signal timing should be satisfied with the following specifications for its proper operation.

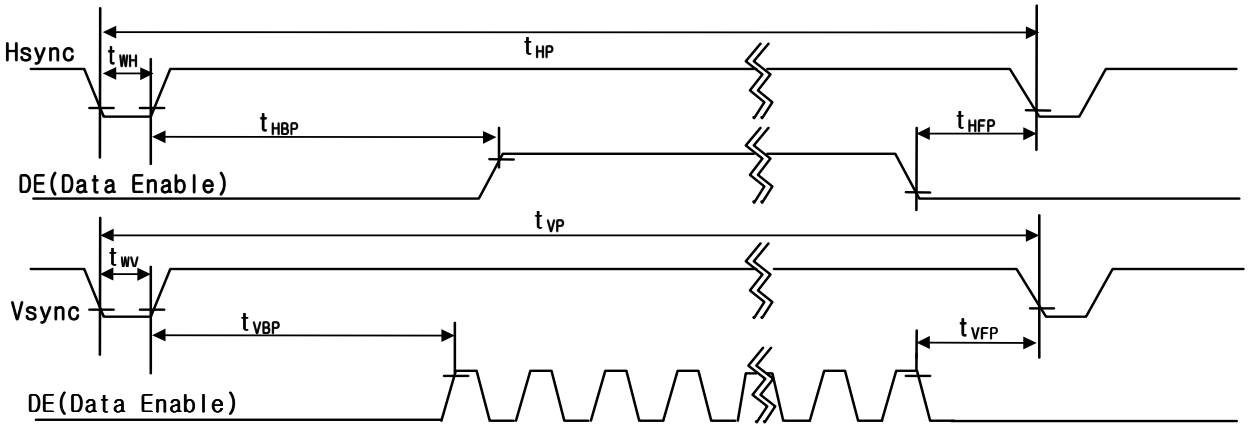
Table 6. Timing Table

ITEM		SYMBOL	MIN	TYP.	MAX.	UNIT	NOTES
Dclk	Frequency	f_{CLK}	55	61	69	MHz	
	Width-Low	t_{WCL}	3	-	-	ns	
	Width-High	t_{WCH}	3	-	-	ns	
	Duty	D	0.4	0.5	0.6		D= t_{CLKH} /t_{CLK}
Hsync	Period	t_{HP}	864	952	1288		
	Width	t_{WH}	8	-	-	t_{HP}	
Vsync	Period	t_{VP}	1057	1066	1082	t_{HP}	
	Width active	t_{WV}	1		-	t_{HP}	
DE	Set up Time	t_{SI}	3	-	-	ns	For Dclk
	Hold Time	t_{HI}	3	-	-		
	Horizontal Back Porch	t_{HBP}	8	-	-	t_{CLK}	
	Horizontal Front Porch	t_{HFP}	8	-	-		
	Vertical Back Porch	t_{VBP}	5	-	-	t_{HP}	
	Vertical Front Porch	t_{VFP}	1	-	-		
DATA	Set up Time	t_{SD}	3	-	-	ns	For Dclk
	Hold Time	t_{HD}	3	-	-		
Input Voltage	High	t_{rH}	0.7Vcc				
	Low	t_{rL}			0.3Vcc		

3-4. Signal Timing Waveforms







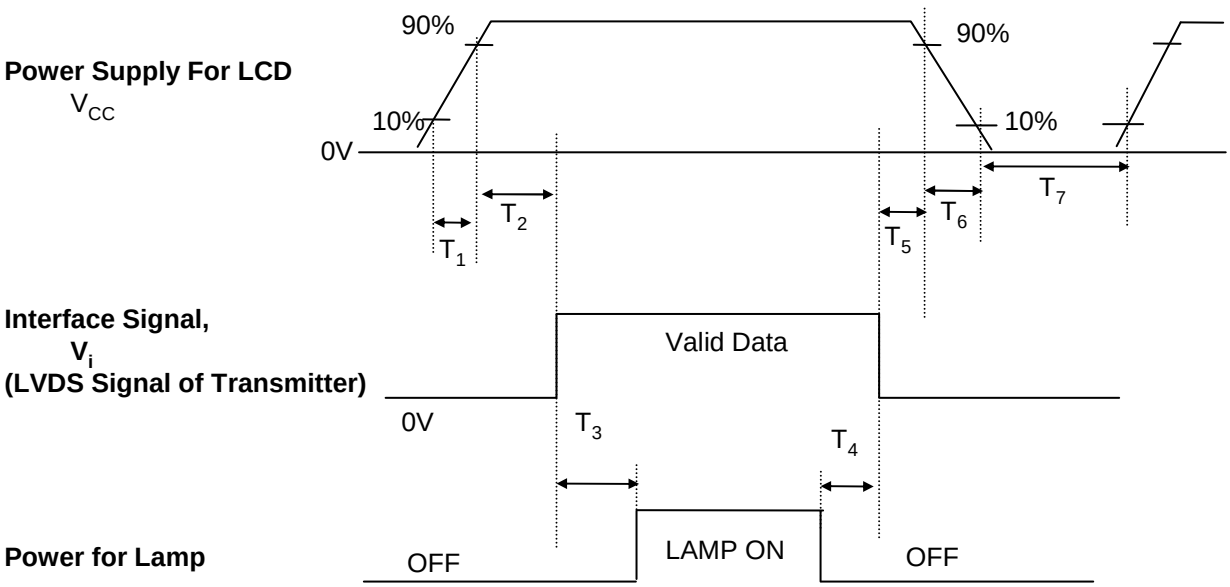
3-5. Color Input Data Reference

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 7. COLOR DATA REFERENCE

Color		Input Color Data																	
		Red						Green						Blue					
		MSB					LSB	MSB					LSB	MSB					LSB
		R5	R4	R3	R2	R1	R0	G5	G4	G3	G2	G1	G0	B5	B4	B3	B2	B1	B0
Basic Colors	Black	0	0	0	0	0	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(63)	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
	Blue(63)	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) Dark	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(02)	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Red(61)	1	1	1	1	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) Bright	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
Green	Green(00)Dark	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(02)	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Green(61)	0	0	0	0	0	0	1	1	1	1	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)Bright	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
Blue	Blue(00) Dark	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(02)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Blue(61)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	1
	Blue(62)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0
	Blue(63) Bright	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1

3-6. Power Sequence



Parameter	Values			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	-	-	10	ms
T_7	400	-	-	ms

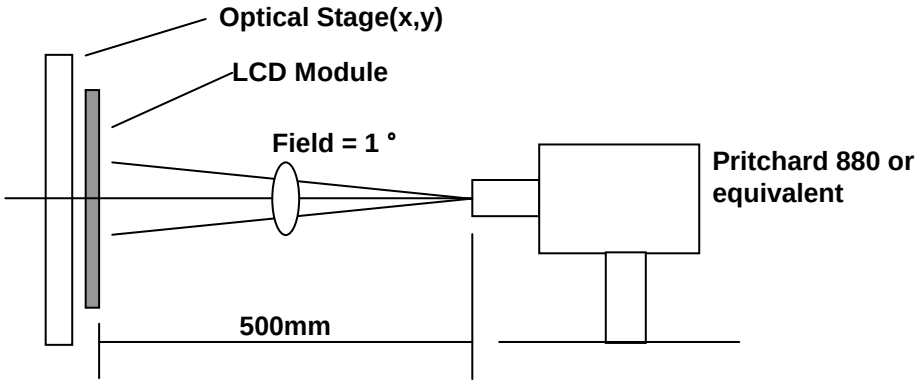
Notes : 1. Please avoid floating state of interface signal at invalid period.
2. When the interface signal is invalid, be sure to pull down the power supply for LCD V_{CC} to 0V.
3. Lamp power must be turn on after power supply for LCD and interface signal are valid.

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



(Ta=25 °C, V_{CC}=3.3V, f_V=60Hz Dclk=60.9MHz, I_{BL}=6.0mA)

Table 8. OPTICAL CHARACTERISTICS

Parameter	Symbol	Values			Units	Notes
		Min.	Typ.	Max.		
Contrast Ratio	CR	-	400	-		1
Surface Luminance, white	L_{WH}	150	185		cd/m^2	2
Luminance % uniformity	δ_{WHITE}	-	-	2.0		3
Response Time	Tr					4
Rise Time + Decay Time	$Tr_{R+}Tr_D$	-	25	40	ms	
CIE Color Coordinates						
Red	XR	0.554	0.584	0.614		±0.03
	YR	0.301	0.331	0.361		
Green	XG	0.293	0.323	0.353		
	YG	0.517	0.547	0.577		
Blue	XB	0.124	0.154	0.184		
	YB	0.109	0.139	0.169		
White	XW	0.283	0.313	0.343		
	YW	0.299	0.329	0.359		
Viewing Angle						
x axis, right(ϕ=0°)	θr	60				5
x axis, left (ϕ=180°)	θl	60				
y axis, up (ϕ=90°)	θu	50			degree	
y axis, down (ϕ=270°)	θd	50				
Gray Scale	-	-	2.2	-		6

Notes : 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. For more information see FIG 2.
When I_{BL}= 6.0mA, $L_{WH=}$185cd/m^2(typ.)

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

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.

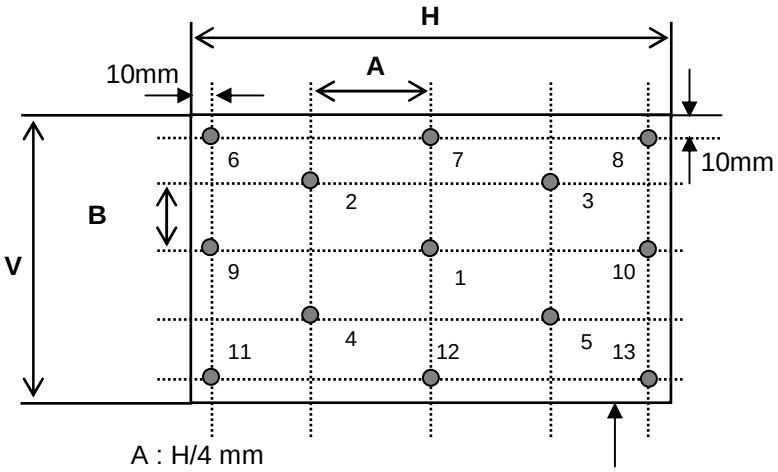
5. Viewing angle is the angle at which the contrast ratio is greater than 10. The angles are determined for the horizontal or x axis and the vertical or y axis with respect to the z axis which is normal to the LCD surface. For more information see FIG 4.

6. Gray scale specification * fv=60Hz

Gray Level	Luminance(%) (Typ.)
L0	0.12
L7	0.60
L15	3.85
L23	10.0
L31	19.0
L39	32.0
L47	50.3
L55	74.0
L63	100

FIG. 2 Luminance

<measuring point for luminance variation/surface luminance>



A : H/4 mm
B : V/4 mm
H : 331.38 mm
V : 207.11 mm
@ H,V : 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”.

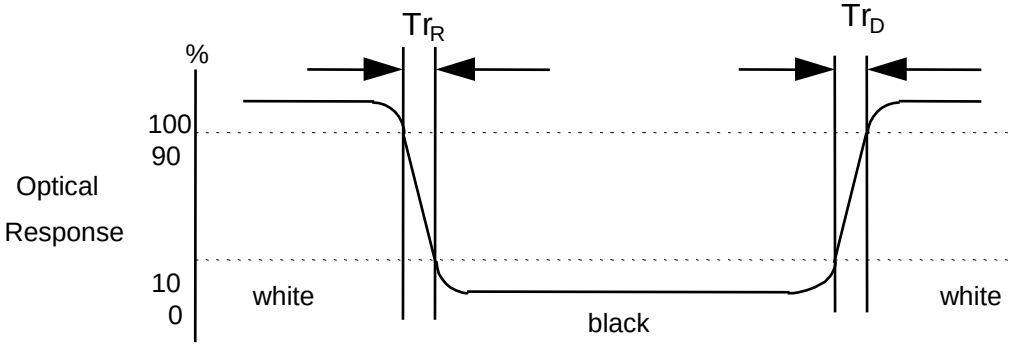
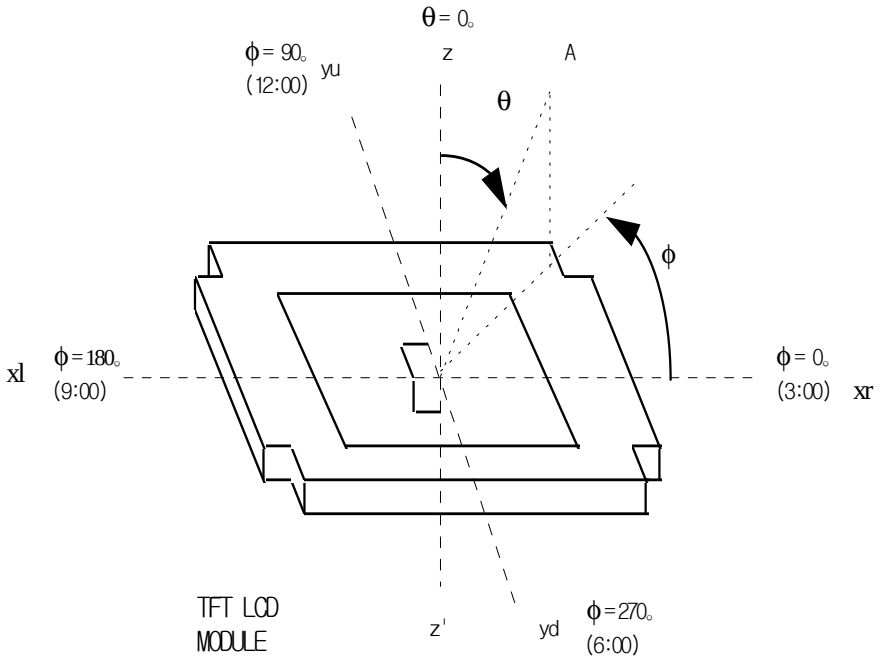


FIG. 4 Viewing angle

<dimension of viewing angle range>



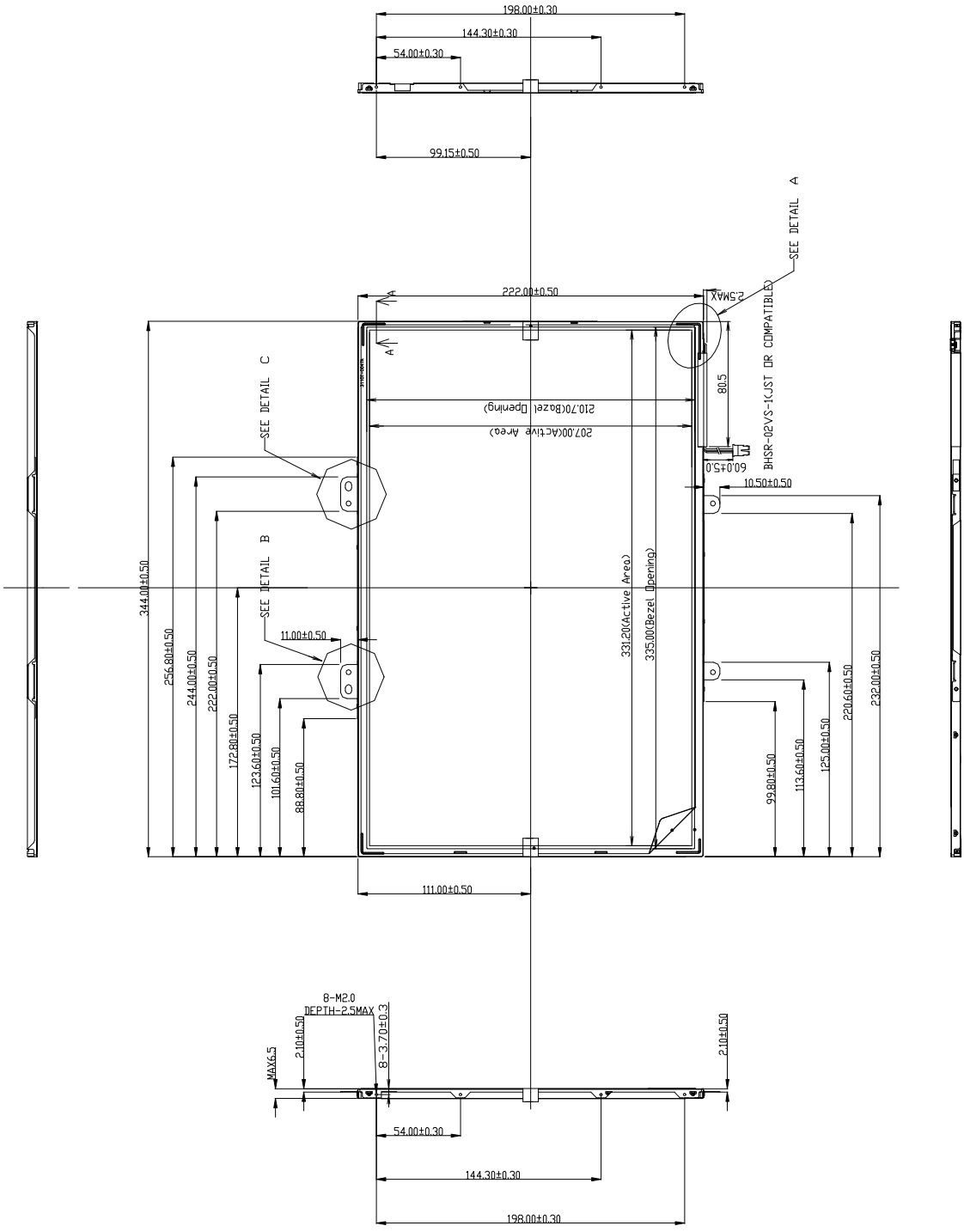
A : Eye of Observer

5. Mechanical Characteristics

The contents provide general mechanical characteristics for the model LP154W02(B1K1). In addition the figures in the next page are detailed mechanical drawing of the LCD.

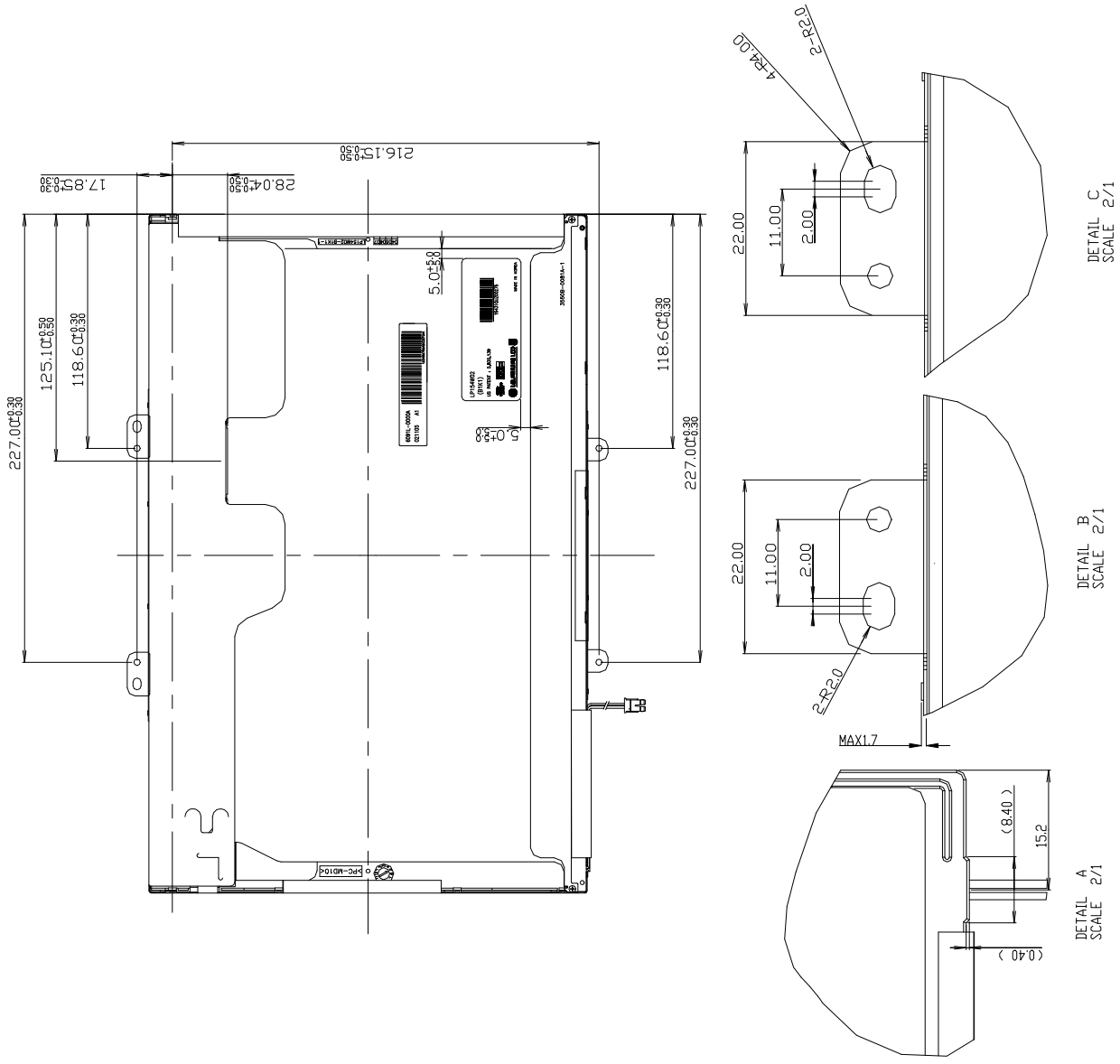
Outside dimensions	Horizontal	344.0 ± 0.5mm
	Vertical	222.0 ± 0.5mm
	Depth	6.2㎜(Typ), 6.5㎜(Max)
Bezel area	Horizontal	335.0± 0.5mm
	Vertical	210.7 ± 0.5mm
Active display area	Horizontal	331.38mm
	Vertical	207.11mm
Weight(approximate)	560g(Max)	
Surface Treatment	Antiglare treatment of the front/lower polarizer, HAZE(12%)	

<FRONT VIEW>



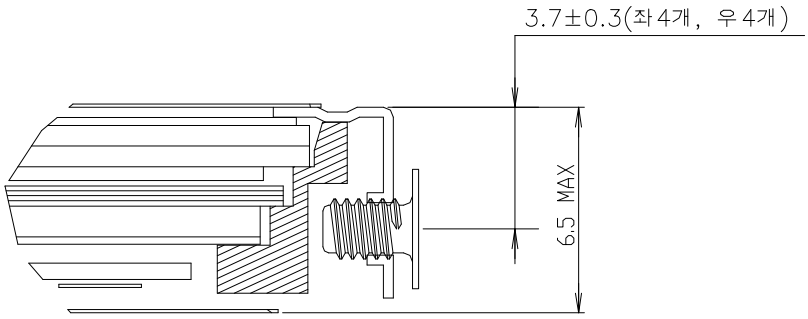
Note. unspecified dimensional tolerance are +/-0.5mm

<REAR VIEW>



Note. unspecified dimensional tolerance are +/-0.5mm

<DETAIL DESCRIPTION OF SIDE MOUNTING SCREW>



SECTION A-A
SCALE 5/1

*SCREW(8ea) TORQUE : max 2kgf.cm

*Mounting SCREW Depth : max 2.5

*SCREW Length : max 2.5, min 2.0

Note. unspecified dimensional tolerance are +/-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, 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 face (i.e. run 180G 2ms for all six faces)
7	Altitude operating storage / shipment	 0 - 10,000 feet(3,048m) 0 - 40,000 feet(12,192m)

{ 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 A1: 2000)

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	4	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
Mark	K	C

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 : 437mm ×369mm × 339mm

9. PRECAUTIONS

Please pay attention to the following 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 a 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 describe 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 determined 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# (decimal)	Byte# (HEX)	Field Name and Comments	Value (HEX)		Value (binary)	
0	00	Header	0	0	0000 0000	Header
1	01	Header	F	F	1111 1111	
2	02	Header	F	F	1111 1111	
3	03	Header	F	F	1111 1111	
4	04	Header	F	F	1111 1111	
5	05	Header	F	F	1111 1111	
6	06	Header	F	F	1111 1111	
7	07	Header	0	0	0000 0000	
8	08	EISA manufacturer code(3 Character ID) = LPL	3	2	0011 0010	Vender/ Product ID
9	09	Compressed ASCII	0	C	0000 1100	
10	0A	Panel Supplier Reserved - Product code	7	9	0111 1001	
11	0B	(Hex, LSB first)	1	3	0001 0011	
12	0C	LCD Module Serial No. = 0 (If not used)	0	0	0000 0000	
13	0D	LCD Module Serial No. = 0 (If not used)	0	0	0000 0000	
14	0E	LCD Module Serial No. = 0 (If not used)	0	0	0000 0000	
15	0F	LCD Module Serial No. = 0 (If not used)	0	0	0000 0000	
16	10	Week of Manufacture = 00	0	0	0000 0000	
17	11	Year of Manufacture = 2005	0	F	0000 1111	
18	12	EDID Structure version # = 1	0	1	0000 0001	EDID Version/ Revision
19	13	EDID Revision # = 2	0	2	0000 0010	
20	14	Video Input Definition = Digital I/P,non TMDS CRGB	8	0	1000 0000	Display Parameter
21	15	Max H image size(cm)=33.138cm(33)	2	1	0010 0001	
22	16	Max V image size(cm)=20.711cm(21)	1	5	0001 0101	
23	17	Display gamma =2.2	7	8	0111 1000	
24	18	Feature support(DPMS) = Active off, RGB Color	0	A	0000 1010	
25	19	Red/Green low Bits	B	C	1011 1100	Color Characteristic
26	1A	Blue/White Low Bits	A	5	1010 0101	
27	1B	Red X = 0.584	9	5	1001 0101	
28	1C	Red Y = 0.331	5	4	0101 0100	
29	1D	Green X = 0.323	5	2	0101 0010	
30	1E	Green Y = 0.547	8	C	1000 1100	
31	1F	Blue X = 0.154	2	7	0010 0111	
32	20	Blue Y = 0.139	2	3	0010 0011	
33	21	White X = 0.313	5	0	0101 0000	
34	22	White Y = 0.329	5	4	0101 0100	
35	23	Established Timing I = 00h(If not used)	0	0	0000 0000	Established Timings
36	24	Established Timing II = 00h(If not used)	0	0	0000 0000	
37	25	Manufacturer's Timings = 00h(If not used)	0	0	0000 0000	
38	26	Standard Timing Identification 1 was not used	0	1	0000 0001	Standard Timing ID
39	27	Standard Timing Identification 1 was not used	0	1	0000 0001	
40	28	Standard Timing Identification 2 was not used	0	1	0000 0001	
41	29	Standard Timing Identification 2 was not used	0	1	0000 0001	
42	2A	Standard Timing Identification 3 was not used	0	1	0000 0001	
43	2B	Standard Timing Identification 3 was not used	0	1	0000 0001	
44	2C	Standard Timing Identification 4 was not used	0	1	0000 0001	
45	2D	Standard Timing Identification 4 was not used	0	1	0000 0001	
46	2E	Standard Timing Identification 5 was not used	0	1	0000 0001	
47	2F	Standard Timing Identification 5 was not used	0	1	0000 0001	
48	30	Standard Timing Identification 6 was not used	0	1	0000 0001	
49	31	Standard Timing Identification 6 was not used	0	1	0000 0001	
50	32	Standard Timing Identification 7 was not used	0	1	0000 0001	
51	33	Standard Timing Identification 7 was not used	0	1	0000 0001	
52	34	Standard Timing Identification 8 was not used	0	1	0000 0001	
53	35	Standard Timing Identification 8 was not used	0	1	0000 0001	

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

Byte# (decimal)	Byte# (HEX)	Field Name and Comments	Value (HEX)		Value (binary)	
54	36	Pixel Clock/10,000 (LSB) => main clock = 122MHz	A	8	1010 1000	Timing Descriptor #1
55	37	Pixel Clock/10,000 (MSB) / 1680 x 1050 @ 60Hz pixel clock = 60.9MHz	2	F	0010 1111	
56	38	Horizontal Active = 1680 pixels	9	0	1001 0000	
57	39	Horizontal Blanking = 224 pixels	E	0	1110 0000	
58	3A	Horizontal Active : Horizontal Blanking	6	0	0110 0000	
59	3B	Vertical Avtive = 1050 lines	1	A	0001 1010	
60	3C	Vertical Blanking = 16 lines	1	0	0001 0000	
61	3D	Vertical Active : Vertical Blanking	4	0	0100 0000	
62	3E	Horizontal Sync. Offset = 32 pixels	2	0	0010 0000	
63	3F	Horizontal Sync Pulse Width = 64 pixels	4	0	0100 0000	
64	40	Vertical Sync Offset = 1 lines : Sync Width = 3 lines	1	3	0001 0011	
65	41	Horizontal Vertical Sync Offset/Width upper 2bits = 0	0	0	0000 0000	
66	42	Horizontal Image Size = 33.138cm(331)	4	B	0100 1011	
67	43	Vertical Image Size = 20.711cm(207)	C	F	1100 1111	
68	44	Horizontal & Vertical Image Size	1	0	0001 0000	
69	45	Horizontal Border = 0	0	0	0000 0000	
70	46	Vertical Border = 0	0	0	0000 0000	
71	47	Non-interlaced,Normal display,no stereo,Digital separate sync,H/V pol negatives	1	9	0001 1001	
72	48	Detailed Timing Descriptor #2	0	0	0000 0000	Timing Description #2
73	49		0	0	0000 0000	
74	4A		0	0	0000 0000	
75	4B		0	0	0000 0000	
76	4C		0	0	0000 0000	
77	4D		0	0	0000 0000	
78	4E		0	0	0000 0000	
79	4F		0	0	0000 0000	
80	50		0	0	0000 0000	
81	51		0	0	0000 0000	
82	52		0	0	0000 0000	
83	53		0	0	0000 0000	
84	54		0	0	0000 0000	
85	55		0	0	0000 0000	
86	56		0	0	0000 0000	
87	57		0	0	0000 0000	
88	58		0	0	0000 0000	
89	59		0	0	0000 0000	
90	5A	Detailed Timing Descriptor #3	0	0	0000 0000	Timing Description #3
91	5B		0	0	0000 0000	
92	5C		0	0	0000 0000	
93	5D		F	E	1111 1110	
94	5E		0	0	0000 0000	
95	5F	L	4	C	0100 1100	
96	60	G	4	7	0100 0111	
97	61	P	5	0	0101 0000	
98	62	h	6	8	0110 1000	
99	63	i	6	9	0110 1001	
100	64	l	6	C	0110 1100	
101	65	i	6	9	0110 1001	
102	66	p	7	0	0111 0000	
103	67	s	7	3	0111 0011	
104	68	L	4	C	0100 1100	
105	69	C	4	3	0100 0011	
106	6A	D	4	4	0100 0100	
107	6B	LF	0	A	0000 1010	

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

Byte# (decimal)	Byte# (HEX)	Field Name and Comments	Value (HEX)		Value (binary)	
108	6C	Detailed Timing Descriptor #4	0	0	0000 0000	Timing Description #4
109	6D		0	0	0000 0000	
110	6E		0	0	0000 0000	
111	6F		F	E	1111 1110	
112	70		0	0	0000 0000	
113	71	L	4	C	0100 1100	
114	72	P	5	0	0101 0000	
115	73	1	3	1	0011 0001	
116	74	5	3	5	0011 0101	
117	75	4	3	4	0011 0100	
118	76	W	5	7	0101 0111	
119	77	0	3	0	0011 0000	
120	78	2	3	2	0011 0010	
121	79	-	2	D	0010 1101	
122	7A	B	4	2	0100 0010	
123	7B	1	3	1	0011 0001	
124	7C	K	4	B	0100 1011	
125	7D	1	3	1	0011 0001	
126	7E	Extension flag = 00	0	0	0000 0000	Extension Flag
127	7F	Checksum	B	5	1011 0101	Checksum