SPECIFICATION
FOR
APPROVAL

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

Title	7.0” WVGA (800 x RGB x 480) TFT LCD

BUYER	SIEMENS-VDO
MODEL	

SUPPLIER	LG.Philips LCD Co., Ltd.
*MODEL	LB070WV1
Suffix	TD01

SIGNATURE	DATE
/	
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/	

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

SIGNATURE	DATE
C.S. KYEONG / G.Manager	
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Contents

RECORD OF REVISIONS

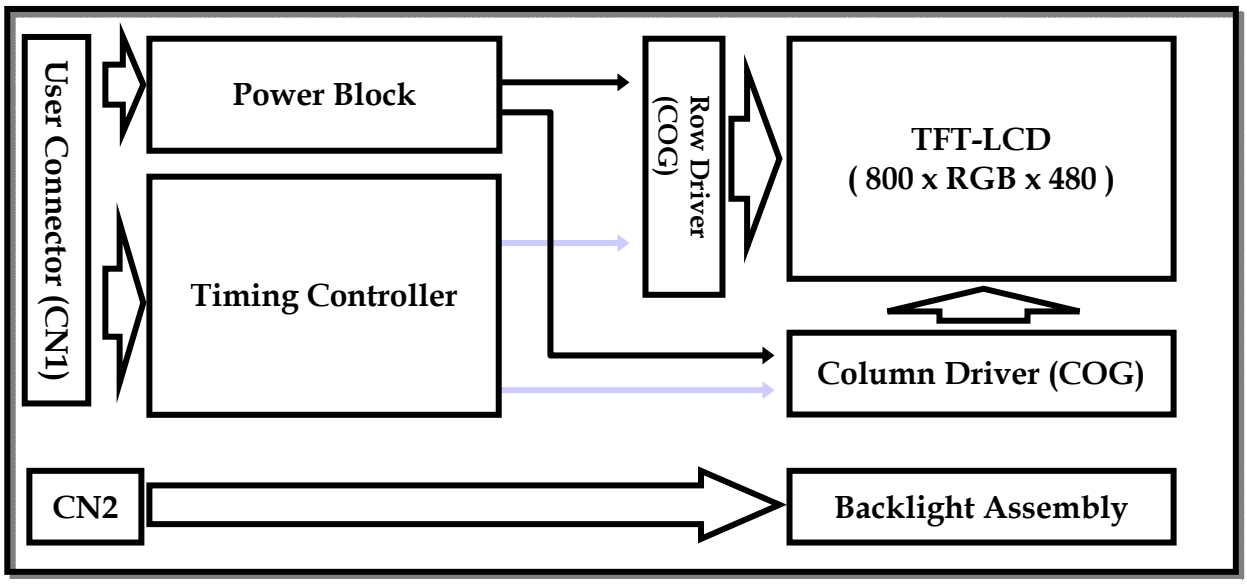
Revision No	Revision Date	Page	Description
0.0	Jan.22,2005	-	First Draft

1. General Description

The LB070WV1 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 7.0 inches diagonally measured active display area with WVGA resolution(800 horizontal by 480 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 LB070WV1 has been designed to apply the interface method that enables low power, high speed, low EMI.

The LB070WV1 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 LB070WV1 characteristics provide an excellent flat display.



General Features

Active Screen Size	7.0 inches diagonal
Outline Dimension	170.0 (H) × 109.6 (V) × 17.0(D) mm (Typ.)
Pixel Pitch	0.1905 mm × 0.1905 mm
Pixel Format	800 horiz. by 480 vert. Pixels RGB strip arrangement
Color Depth	6-bit, 262,144 colors
Luminance, White	600 cd/m^2(Min.) / TBD cd/m^2(Typ.)
Power Consumption	Total 8.11 Watt(Typ.) [LCM circuit 0.79 Watt(Typ.)+B/L input 7.32 Watt(Typ.)]
Weight	280g(Typ.) 290g (Max.)
Display Operating Mode	Transmissive mode, normally white
Surface Treatment	Anti-glare/Anti-reflection treatment of the front polarizer

2. Absolute Maximum Ratings

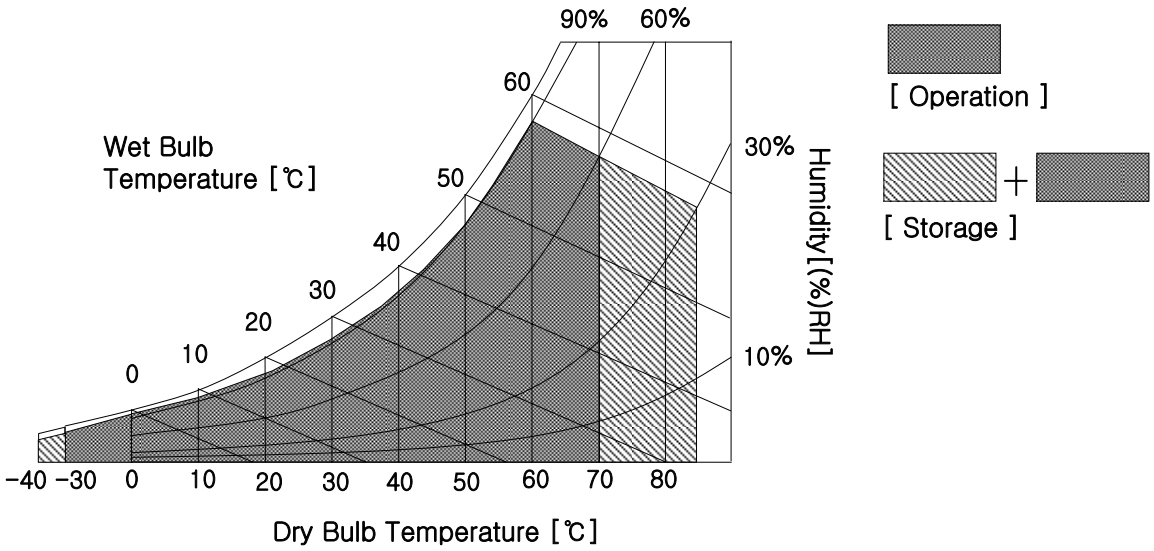
The following are maximum values which, if exceeded, may cause faulty operation or damage to the unit.

Table 1. ABSOLUTE MAXIMUM RATINGS

Parameter		Symbol	Values		Units	Notes
			Min	Max		
Power Input Voltage		VCC	0.0	3.6	Vdc	at 25 ± 5°C
Storage Temperature		HST	-40	85	°C	1
Operating Temperature	Surface Of Panel	TP	-30	85	°C	1,2
	Ambient	TA	-30	70	°C	1,2,3

Notes :

1. Maximum wet-bulb temperature is 58℃. Condensation of dew must be avoided, because it may cause electrical current leakage, and deterioration of performance and quality.
2. The operating temperature means that LCD Module guarantees operation of the circuit. All the contents of Electro-optical specifications are guaranteed under the room temperature condition.
3. This temperature is ambient temperature with regard to the heat which is generated under operation of circuit and backlight on.(reference value)



3. Electrical Specifications

3-1. Electrical Characteristics

The LB070WV1 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

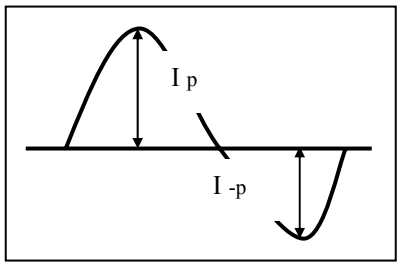
Parameter	Symbol	Values			Unit	Notes
		Min	Typ	Max		
MODULE :						
Power Supply Input Voltage	VCC	3.0	3.3	3.6	V_{DC}	
Power Supply Input Current	I_{CC}	204	240	276	mA	1
Power Consumption	Pc	-	0.79	0.91	Watt	1
LAMP :						
Operating Voltage	V_{BL}	580 (7mA)	610 (6mA)	730 (3mA)	V_{RMS}	2
Operating Current	I_{BL}	3.0	6.0	7.0	mA_{RMS}	3
Power Consumption	P_{BL}	-	7.32	8.12		8
Operating Frequency	f_{BL}	40	60	80	kHz	6
Discharge Stabilization Time	Ts	-	-	3	Min	4
Life Time		20,000	-	-	Hrs	5
Established Starting Voltage at 25℃ at -30 ℃	Vs			 1540 1840	 V_{RMS} V_{RMS}	7

Note)

1. The specified current and power consumption are under the Vcc = 3.3V , 25℃, fv = 60Hz condition whereas Mosaic pattern is displayed and fv is the frame frequency.
2. The variance of the voltage is ± 10%.
3. The typical operating current is for the typical surface luminance (L_{WH}) in optical characteristics.
4. 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%.
5. 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.
6. 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.
7. 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.
8. The lamp power consumption shown above does not include loss of external inverter.
   The applied lamp current is a typical one.

Note)

9. 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 $\sqrt{2} \pm 10\%$.
      * Inverter output waveform had better be more similar to ideal sine wave.



* Asymmetry rate:

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

* Distortion rate

$$I_p \text{ (or } I_{-p}) / I_{rms}$$

※ 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.
The electronics interface connector is a model 9617S-40C-T, manufactured by IRISO Electronics Co.,Ltd.

Table 3. MODULE CONNECTOR PIN CONFIGURATION (CN1)

Pin No.	Symbol	Description
1	GND	Ground
2	CLK	Clock
3	GND	Ground
4	R0	Red Data Signal 0 (LSB)
5	R1	Red Data Signal 1
6	R2	Red Data Signal 2
7	R3	Red Data Signal 3
8	R4	Red Data Signal 4
9	R5	Red Data Signal 5 (MSB)
10	GND	Ground
11	G0	Green Data Signal 0 (LSB)
12	G1	Green Data Signal 1
13	G2	Green Data Signal 2
14	G3	Green Data Signal 3
15	G4	Green Data Signal 4
16	G5	Green Data Signal 5 (MSB)
17	GND	Ground
18	B0	Blue Data Signal 0 (LSB)
19	B1	Blue Data Signal 1
20	B2	Blue Data Signal 2

Pin No.	Symbol	Description
21	B3	Blue Data Signal 3
22	B4	Blue Data Signal 4
23	B5	Blue Data Signal 5 (MSB)
24	GND	Ground
25	Hsync	Horizontal Sync
26	DE	Data Enable
27	Vsync	Vertical Sync
28	GND	Ground
29	GND	Ground
30	NC	No Connection
31	BRT+	Brightness Sensor Pos
32	BRT-	Brightness Sensor Neg
33	GND	Ground
34	HVR	Horizontally and Vertically Inverted
35	NC	No Connection
36	VCC	+3.3 [V] (Power Supply)
37	VCC	+3.3 [V] (Power Supply)
38	VCC	+3.3 [V] (Power Supply)
39	GND	Ground
40	NTC	Thermal Sensor Pin

[Note 1]
• Hsync = “Negative”
• Vsync = “Negative”

[Note 2]
• HVR=“HIGH” → Regular Video
• HVR=“LOW → Horizontally and Vertically Inverted Video

The backlight interface connector is a model BHR-05VS-1, manufactured by JST or Compatible.
The mating connector part number is SM04(9-E2)B-BHS-1-TB or equivalent.

Table 4. BACKLIGHT CONNECTOR PIN CONFIGURATION (CN2)

Pin	Symbol	Description	Notes
1	LV	Power supply for lamp (Low voltage side)	1
2	LV	Power supply for lamp (Low voltage side)	1
3	NC	Non Connection	-
4	HV	Power supply for lamp (High voltage side)	1
5	HV	Power supply for lamp (High voltage side)	1

Notes : 1. The high voltage side terminal is colored pink and the low voltage side terminal is gray.

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 for its proper operation.

Table 5-1. TIMING TABLE

*** 50Hz Framerate ***

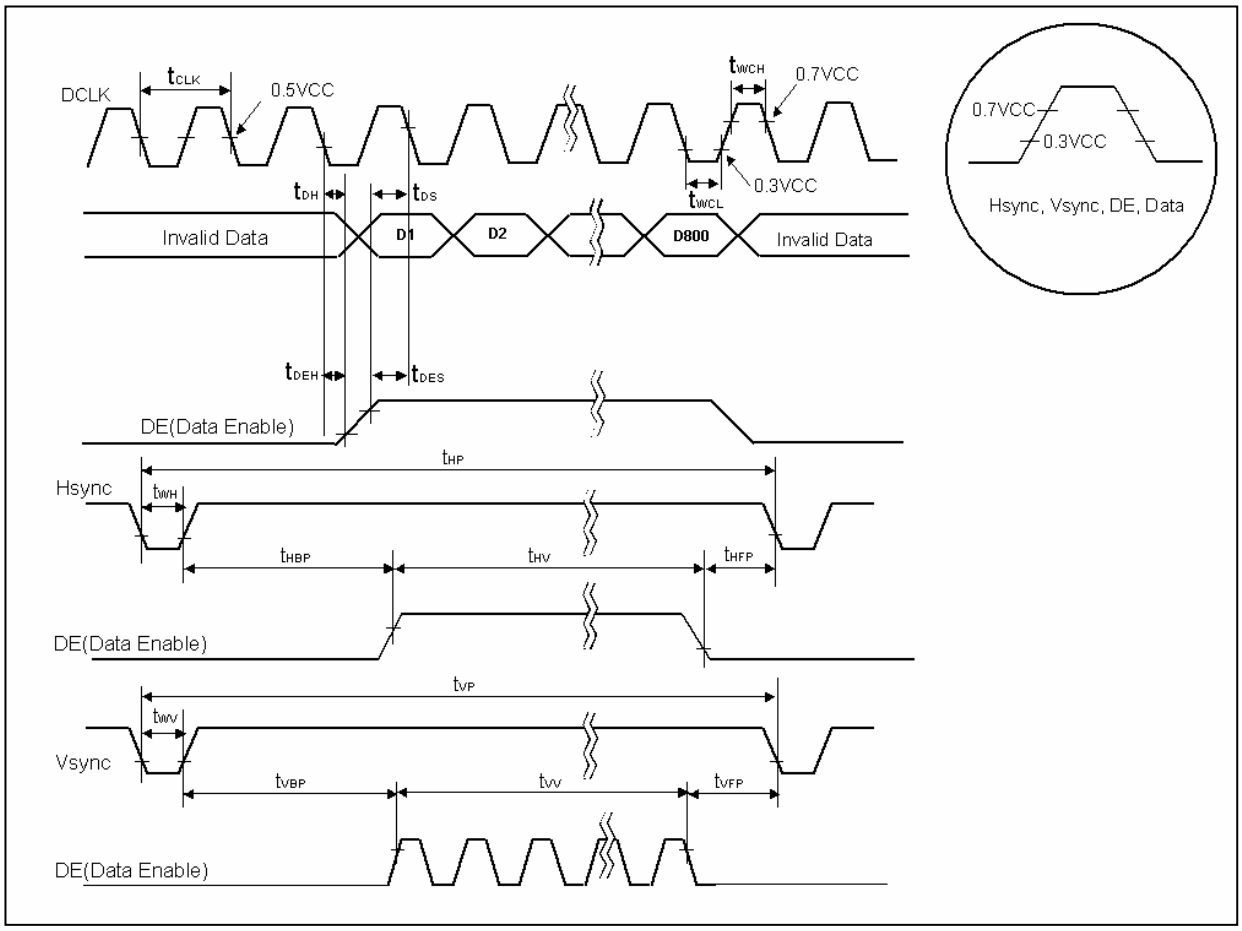
Item		Symbol	Min.	Typ.	Max.	Unit	Remarks
DCLK	Frequency	f_{CLK}	26.62	33.00	34.54	MHz	
	Period	t_{CLK}	28.95	30.30	37.56	ns	
	High Level Width	t_{WCH}	6	-	-	ns	
	Low Level Width	t_{WCL}	6	-	-	ns	
DATA	Setup Time	t_{DS}	4	-	-	ns	
	Hold Time	t_{DH}	4	-	-	ns	
DE	Setup Time	t_{DES}	5	-	-	ns	
	Hold Time	t_{DEH}	5	-	-	ns	
Hsync	Period	t_{HP}	1024	1056	1088	t_{CLK}	
	Width	t_{WH}	-	128	-		
	Horizontal Valid	t_{HV}	800	800	800		
	Horizontal Back Porch	t_{HBP}	10	-	-		
	Horizontal Front Porch	t_{HFP}	10	-	-		
Vsync	Period	t_{VP}	520	625	635	t_{HP}	
	Width	t_{WV}	-	2	-		
	Vertical Valid	t_{VV}	480	480	480		
	Vertical Back Porch	t_{VBP}	6	-	-		
	Vertical Front Porch	t_{VFP}	2	-	-		

Table 5-2. TIMING TABLE

*** 60Hz Framerate ***

Item		Symbol	Min.	Typ.	Max.	Unit	Remarks
DCLK	Frequency	f_{CLK}	31.95	33.26	34.60	MHz	
	Period	t_{CLK}	28.90	30.06	31.30	ns	
	High Level Width	t_{WCH}	6	-	-	ns	
	Low Level Width	t_{WCL}	6	-	-	ns	
DATA	Setup Time	t_{DS}	4	-	-	ns	
	Hold Time	t_{DH}	4	-	-	ns	
DE	Setup Time	t_{DES}	5	-	-	ns	
	Hold Time	t_{DEH}	5	-	-	ns	
Hsync	Period	t_{HP}	1024	1056	1088	t_{CLK}	
	Width	t_{WH}	-	128	-		
	Horizontal Valid	t_{HV}	800	800	800		
	Horizontal Back Porch	t_{HBP}	10	-	-		
	Horizontal Front Porch	t_{HFP}	10	-	-		
Vsync	Period	t_{VP}	520	525	530	t_{HP}	
	Width	t_{WV}	-	2	-		
	Vertical Valid	t_{VV}	480	480	480		
	Vertical Back Porch	t_{VBP}	6	-	-		
	Vertical Front Porch	t_{VFP}	2	-	-		

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 6. 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 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

3-6. Power Sequence

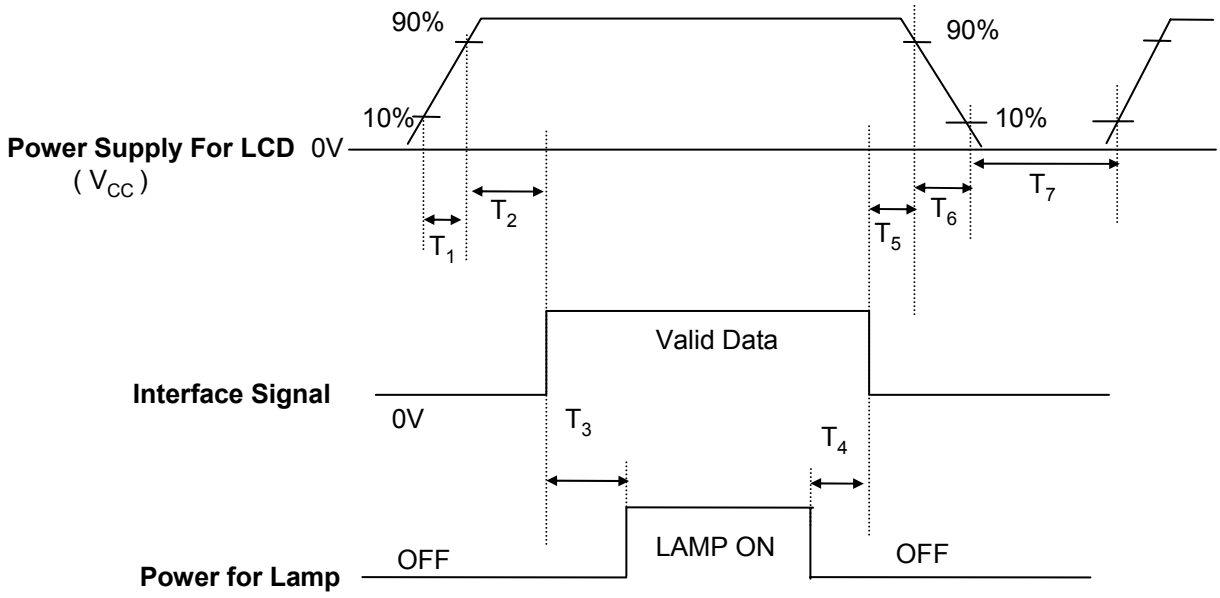


Table 7. POWER SEQUENCE TABLE

Parameter	Value			Units
	Min.	Typ.	Max.	
T_1	0.5	-	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	400	-	-	(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.

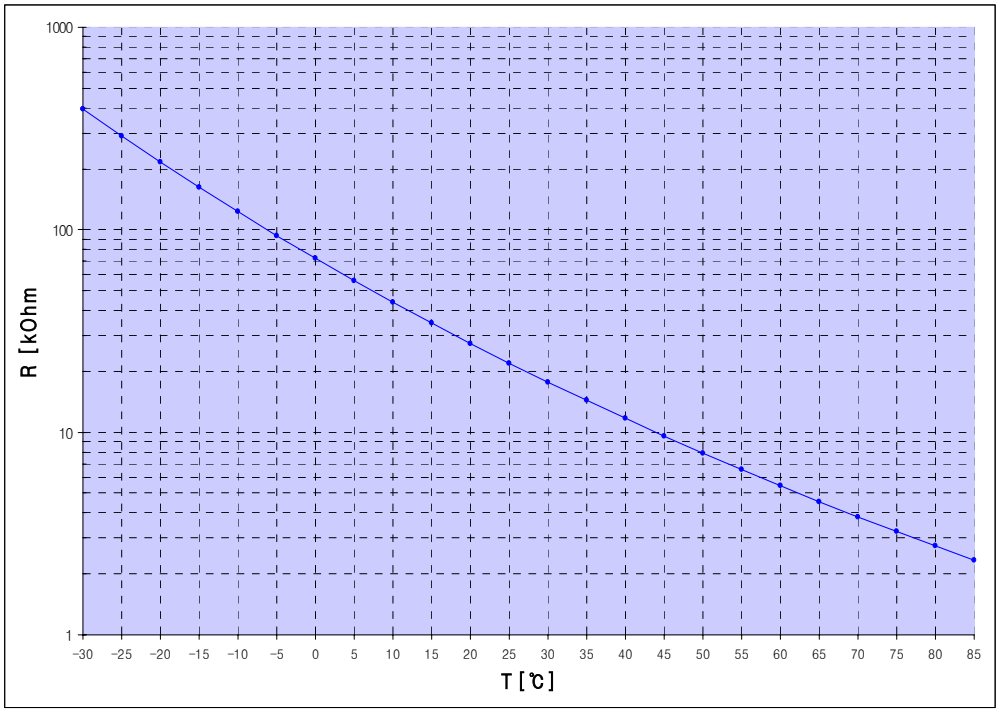
3-7. Thermistor

*NCP18XW223E03RB made by Murata Manufacturing Co., Ltd

- Resistance : 22k ohm ±3%
- B-Constant : 3950K ±3%

Temp. (℃)	$R_{TYP.}$ (kohm)
-30	396.07
-25	291.02
-20	216.01
-15	161.98
-10	122.64
-5	93.70
0	72.19
+5	56.09
+10	43.91
+15	34.63
+20	27.51
+25	22.00

Temp. (℃)	$R_{TYP.}$ (kohm)
+30	17.71
+35	14.34
+40	11.69
+45	9.58
+50	7.89
+55	6.54
+60	5.45
+65	4.56
+70	3.83
+75	3.24
+80	2.75
+85	2.34



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

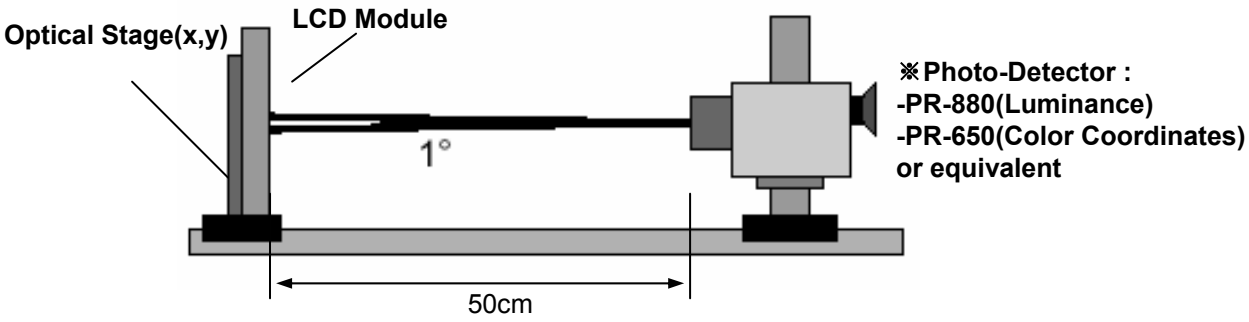


Table 9. OPTICAL CHARACTERISTICS

With LCF or Without LCF

Ta=25°C, VCC=3.3V, fv=60Hz, f_{CLK}= 33.26MHz, I_{BL} = 6.0mA_{RMS}

Parameter		Symbol	Values			Units	Notes
			Min	Typ	Max		
Contrast Ratio		CR	TBD	-	-		1
Surface Luminance, white		L_{WH}	TBD	-	-	cd/m^2	2
Luminance Variation		δ_{WHITE}	-	1.4	1.6		3
Response Time							4
	Rise Time	Tr_R	-	10	20	ms	
	Decay Time	Tr_D	-	40	50	ms	
Color Coordinates							2
	RED	RX	TBD	TBD	TBD		
		RY	TBD	TBD	TBD		
	GREEN	GX	TBD	TBD	TBD		
		GY	TBD	TBD	TBD		
	BLUE	BX	TBD	TBD	TBD		
		BY	TBD	TBD	TBD		
	WHITE	WX	0.283	0.313	0.343		
		WY	0.299	0.329	0.359		
Viewing Angle							5
	x axis, right(Φ=0°)	Θr	65	70	-	degree	
	x axis, left (Φ=180°)	Θl	65	70	-	degree	
	y axis, up (Φ=90°)	Θu	45	50	-	degree	
	y axis, down (Φ=270°)	Θd	55	60	-	degree	
Gray Scale							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 measured at the center point(L_1) of the LCD with all pixels displaying white at the distance of 50cm by PR-880. Color Coordinates are measured at the center point(L_1) of the LCD with all pixels displaying red, green, blue and white at the distance of 50cm by PR-650. For more information, refer to the FIG 1 and FIG 2.

3. Luminance % uniformity is measured for 9 point For more information see FIG 2.
   δ WHITE = Maximum(L1,L2, ….. L9) ÷ Minimum(L1,L2, ….. L9)

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.

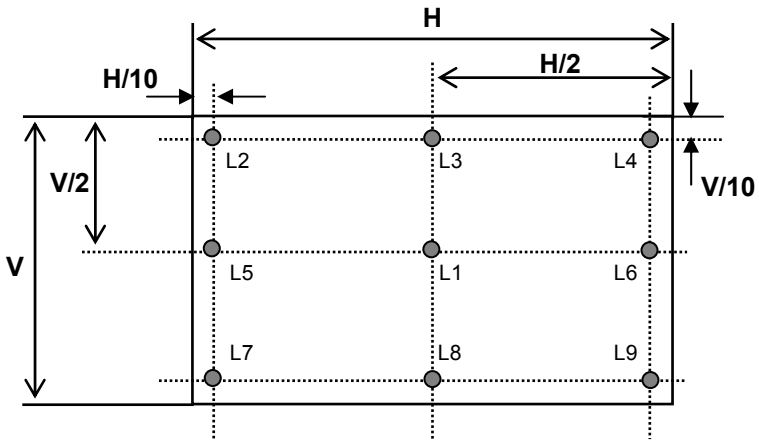
5. Viewing angle is the angle at which the contrast ratio is greater than 10. The angles are determined for the horizontal or x axis and the vertical or y axis with respect to the z axis which is normal to the LCD surface. For more information see FIG 4.

6. Gray scale specification

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

FIG. 2 Luminance

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



***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”.

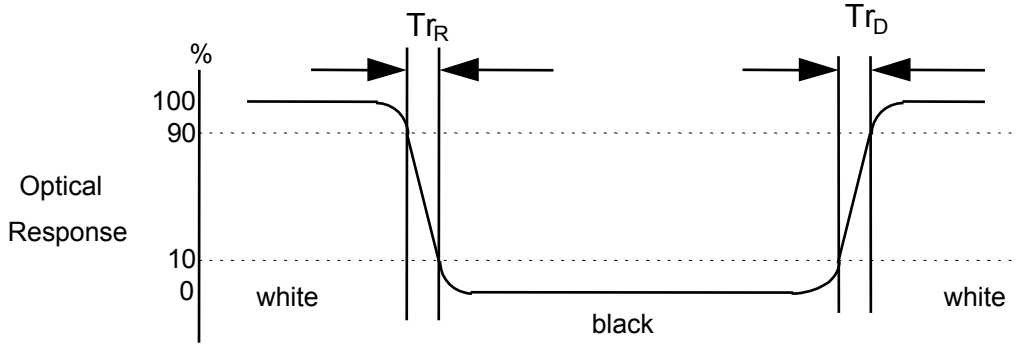
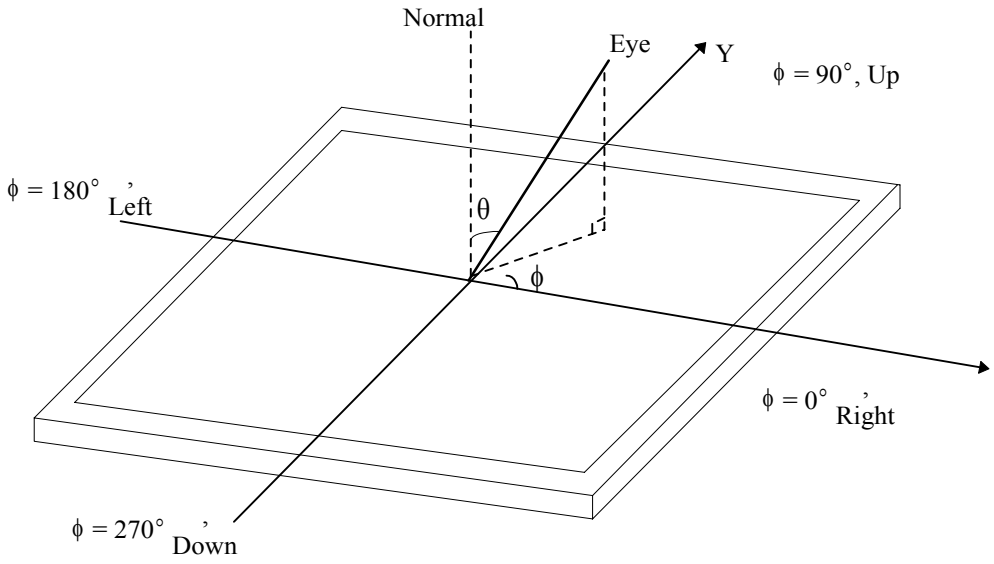


FIG. 4 Viewing angle

<Dimension of viewing angle range>



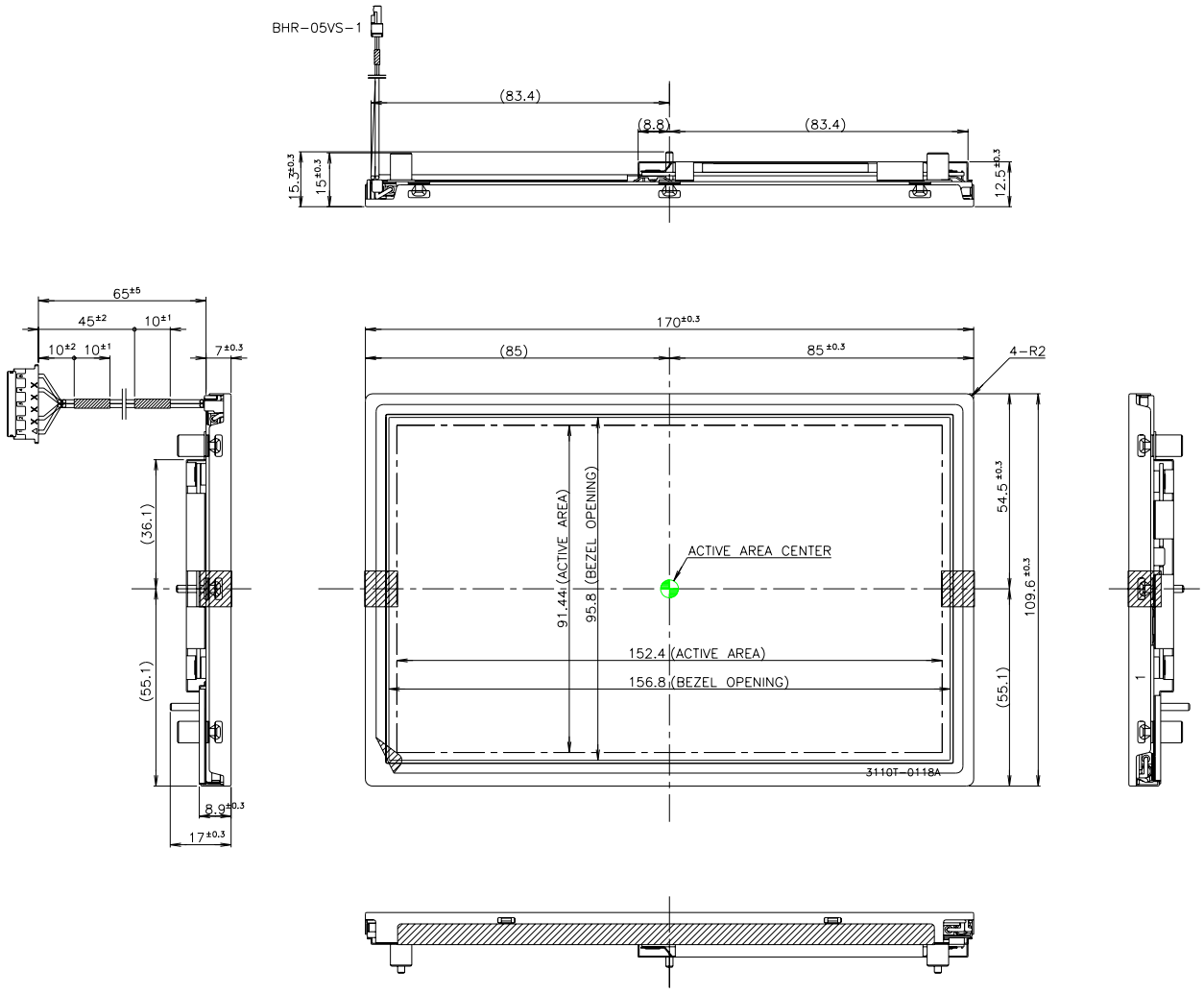
5. Mechanical Characteristics

The contents provide general mechanical characteristics for the model LB070WV1. In addition the figures in the next page are detailed mechanical drawing of the LCD.

Outline Dimension	Horizontal	170.0 mm (Typ.)
	Vertical	109.6 mm (Typ.)
	Depth	17.0 mm (Typ.)
Bezel Area	Horizontal	156.8 mm (Typ.)
	Vertical	95.8 mm (Typ.)
Active Display Area	Horizontal	152.40 mm (Typ.)
	Vertical	91.44 mm (Typ.)
Weight	280g(Typ.) / 290g (Max.)	
Surface Treatment	Anti-glare/Anti-Reflection treatment of the front polarizer	

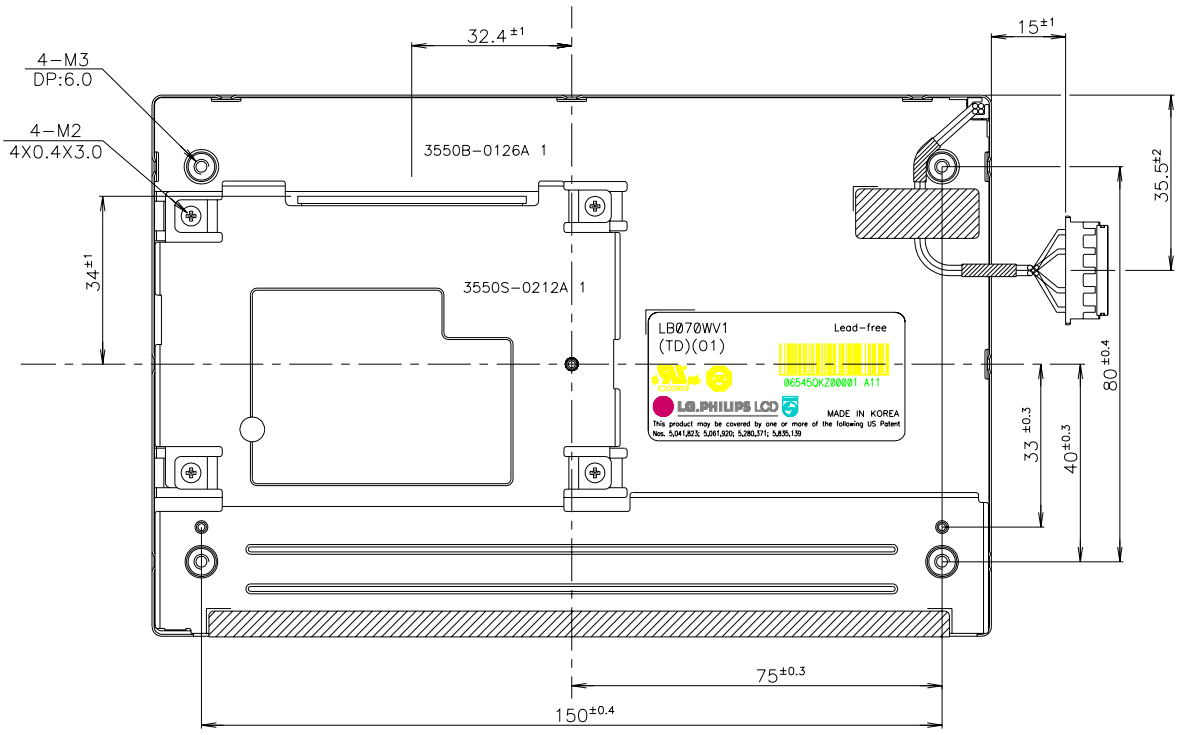
<FRONT VIEW>

Note) Unit:[mm], General tolerance: ± 0.3mm



<REAR VIEW>

Note) Unit:[mm], General tolerance: ± 0.3mm



6. Reliability

Environment test condition

No.	Test Item	Conditions
1	High Temperature Storage Test	Ta=+85℃ 240h
2	Low Temperature Storage Test	Ta=-40℃ 240h
3	High Temperature Operation Test	Tp=+85℃ 240h
4	Low Temperature Operation Test	Ta=-30℃ 240h
5	High Temperature and High Humidity Operation Test	Tp=+60℃ 90%RH 240h
6	Vibration test (non-operating)	Sine wave, 10 ~ 500 ~ 10Hz, 1.5G, 0.37oct/min 3 axis, 1hour/axis
7	Shock test (non-operating)	Half sine wave, 80G, 11ms 3 times shock of each six faces
8	Thermal Shock Test (non-operating)	Ta=-40℃(0.5h) ~ +85℃(0.5h) / 100 cycles

※ Ta= Ambient Temperature, Tp= Panel Temperature

{ 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. 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	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 : (TBD) pcs

b) Box Size : (TBD)mm × (TBD)mm × (TBD)mm

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.