

SPECIFICATION FOR APPROVAL

- (●) Preliminary Specification
() Final Specification

Title	4.8" WVGA TFT LCD
-------	-------------------

Customer	
MODEL	

SUPPLIER	LG.Philips LCD Co., Ltd.
*MODEL	LB048WV1
Suffix	TL01

*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
S.D. Jung / G. Manager	_____
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Product Engineering Dept.
LG. Philips LCD Co., Ltd

Product Specification

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RECORD OF REVISIONS

Revision No	Revision Date	Page	Description
0.1	Jan. 25. 2007	-	Preliminary Specifications
0.2	May. 15. 2007	4	Update for Luminance, weight, Power consumption
		5	Update for absolute maximum ratings
		6	Update for Power consumption
		7	MODULE CONNECTOR PIN CONFIGURATION
		13	Update for C/R, Luminance
		14	Update for Grayscale spec.
		17	Update for weight
0.3	Sep.28.2007	-	Change Model Name & Suffix
		11~12	Update for TSP Spec.
0.4	Nov.19.2007	4, 13, 17	Delete ' w/o TSP ' Information
		11~12	Update for TSP Spec.
		13	Update Luminance Uniformity & Color Coordinates
		18 ~ 19	Update Dawings
0.5	Nov.26.2007	22	Update Packing Information
		19	Update Dawings(Add PCB Information)

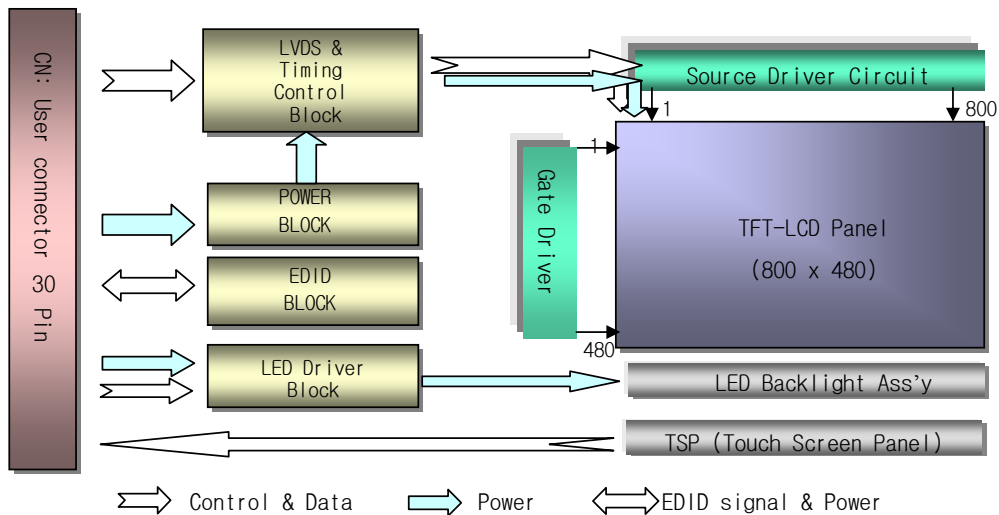
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1. General Description

The LB048WV1 is a Color Active Matrix Liquid Crystal Display with an integral LED backlight system. The matrix employs a-Si Thin Film Transistor as the active element. It is a transmissive type display operating in the normally white mode. This TFT-LCD has 4.8 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 LB048WV1 has been designed to apply the interface method that enables low power, high speed, low EMI.

The LB048WV1 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 LB048WV1 characteristics provide an excellent flat display for office automation products such as UMPC.



General Features

Active Screen Size	4.8 inches diagonal
Outline Dimension (Typ)	114.65 (H) × 74.7 (V) × 5.85(D) mm w TSP, w Comp
Pixel Pitch	0.12975mmx0.12975mm
Pixel Format	800 horiz. by 480 vert. Pixels RGB strip arrangement
Color Depth	6-bit, 262,144 colors
Luminance, White	280 cd/m ² (Typ.), 1 point, w TSP
Power Consumption	Total 1.17 Watt(Typ.) @ LCM circuit 0.4 Watt(Typ.), B/L input 0.77 Watt(Typ.)
Weight (Typ)	77g w TSP, w Component.
Display Operating Mode	Transmissive mode, normally white
Surface Treatment	Hard coating(3H) Glare treatment of the TSP.

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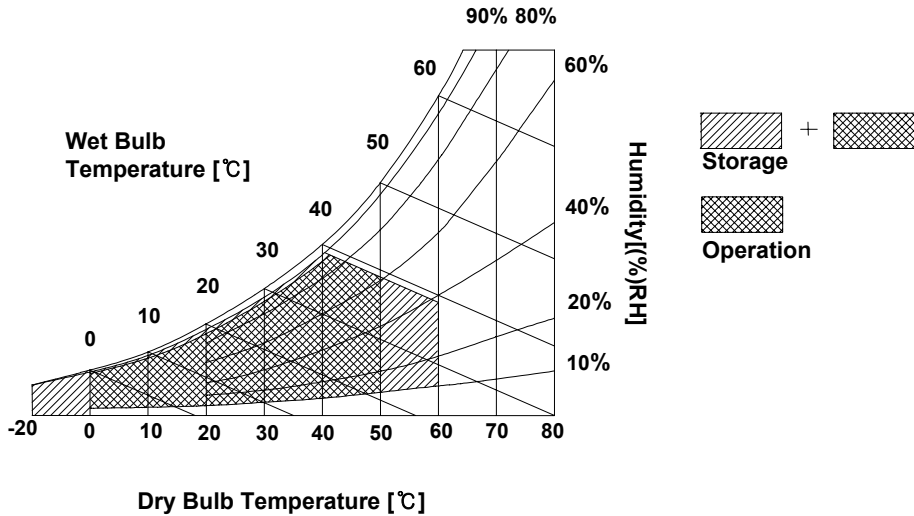
2. Absolute Maximum Ratings

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

Table 1. ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Values		Units	Notes
		Min	Max		
Power Input Voltage	VCC	-0.3	4.0	Vdc	at 25 ± 5°C
LED Driving circuit power Supply	VLD	-0.3	7.0	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.



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3. Electrical Specifications

3-1. Electrical Characteristics

The LB048WV1 requires two power inputs. One is employed to power the LCD electronics and to drive the TFT array and liquid crystal. The second input which powers the LED, is typically generated by a LED Driver. The LED Driver is an internal unit to the LCD.

Table 2. ELECTRICAL CHARACTERISTICS

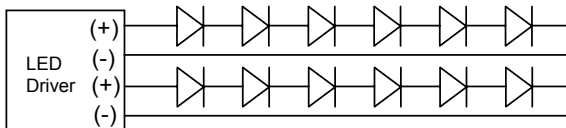
Parameter	Symbol	Values			Unit	Notes
		Min	Typ	Max		
Power Supply Input Voltage	VCC	3.0	3.3	3.6	V _{DC}	
Power Supply Input Current	I _{CC}		120	140	mA	1
Power Consumption	P _c	-	0.4	0.46	Watt	1
Differential Impedance	Z _m	90	100	110	Ohm	2
LED Driving circuit power Supply	VLD	2.5	3.3	5.5	V _{DC}	
LED Brightness Dimming	PWM_Dimming	-		30	KHz	

Note)

- The specified current and power consumption are under the Vcc = 3.3V , 25 °C , fv = 60Hz condition whereas Mosaic pattern is displayed and fv is the frame frequency.
- This impedance value is needed to proper display and measured form LVDS Tx to the mating connector.

3-2. Back Light Unit

The edge-lighting type of back light unit consists of 12 LEDs, 2 parallel strings of 6 serial LEDs.


Table 3 Electrical Characteristics Of Back Light Unit

 (T_a = 25 °C)

Parameter	Symbol	Values			Units	Notes
		Min	Typ.	Max		
LED Current	I _{LED}	-	20	25	mA	1
Power Consumption	P _{LED}	-	770	840	mW	2

Note)

- The permissible forward current of LED vary with environmental temperature.
- I_{LED} is 20mA / "1 LED"
- The LED power consumption shown above does not include loss of LED Driver Block. The efficiency of LED Driver Block is approximately 75%.

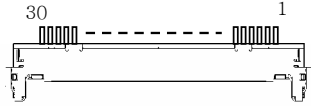
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3-3. Interface Connections

This LCD employs one interface connections, a 30 pin connector is used for the module electronics interface and the integral backlight system.

The electronics interface connector is a model FI-JH-30S manufactured by JAE.

Table 4. MODULE CONNECTOR PIN CONFIGURATION (CN)

Pin	Symbol	Description	Notes
1	GND	Ground	<p>1. Interface chips 1.1 LCD : LCD Controller including LVDS Receiver 1.2 System : THC63LVD823A or equivalent * Pin to Pin compatible with THINE LVDS</p> <p>2. Connector 2.1 LCD : FI-JH-30S, JAE 2.2 Mating : FI-JH-30C or equivalent. 2.3 Connector pin arrangement</p>  <p>[LCD Module Rear View]</p>
2	VCC	Power Supply, 3.3V Typ.	
3	VCC	Power Supply, 3.3V Typ.	
4	V EEDID	DDC 3.3V power	
5	NC	No Connection	
6	Clk EEDID	DDC Clock	
7	DATA EEDID	DDC Data	
8	Odd_R _{IN} 0-	Negative LVDS differential data input	
9	Odd_R _{IN} 0+	Positive LVDS differential data input	
10	GND	Ground	
11	Odd_R _{IN} 1-	Negative LVDS differential data input	
12	Odd_R _{IN} 1+	Positive LVDS differential data input	
13	GND	Ground	
14	Odd_R _{IN} 2-	Negative LVDS differential data input	
15	Odd_R _{IN} 2+	Positive LVDS differential data input	
16	GND	Ground	
17	Odd_CLKIN-	Negative LVDS differential clock input	
18	Odd_CLKIN+	Positive LVDS differential clock input	
19	GND	Ground	
20	GND	Ground	
21	VLD	LED Driving circuit power Supply, 3.3V Typ.	
22	VLD	LED Driving circuit power Supply, 3.3V Typ.	
23	GND	Ground	
24	EN_LED	LED On/Off Control	
25	PWM_Dimming	LED Brightness Dimming	
26	GND	Ground	
27	X1	X Right Touch Panel	
28	Y1	Y Bottom Touch Panel	
29	X2	X Left Touch Panel	
30	Y2	Y Top Touch Panel	

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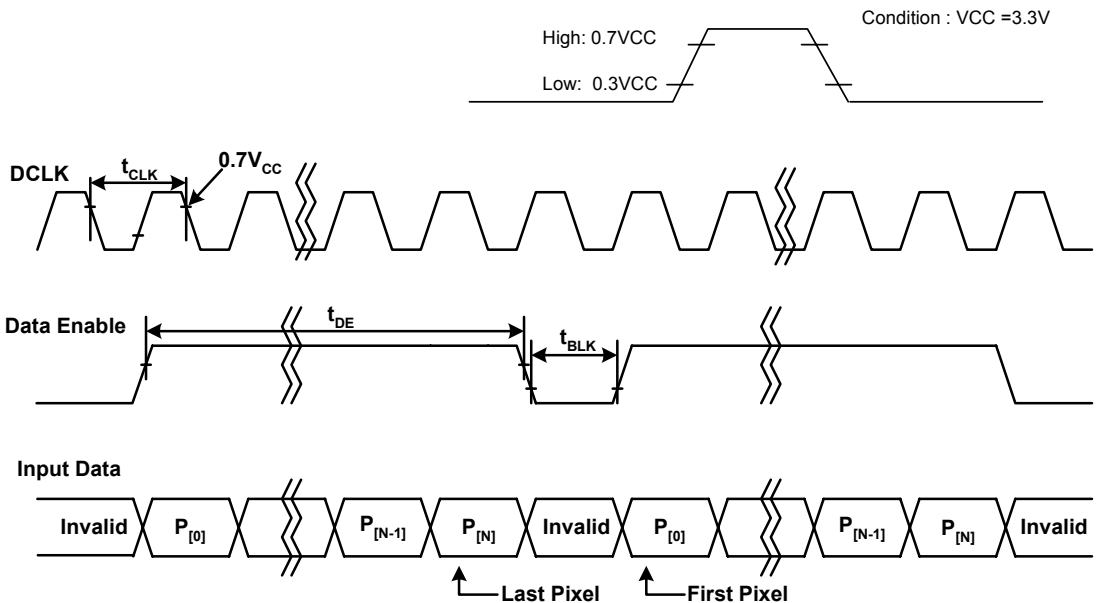
3-4. Signal Timing Specifications

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

Table 5. TIMING TABLE

ITEM	Symbol		Min	Typ	Max	Unit	Note
DCLK	Frequency	f _{CLK}	28.0	29.5	31.0	MHz	
DE (Data Enable)	Active Data	t _{DE}	800	800	800	tCLK	
Blank (Blank Period)	Blank	t _{BLK}	24	192	400	tCLK	

3-5. Signal Timing Waveforms



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3-6. Color Input Data Reference

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

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

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3-7. Power Sequence

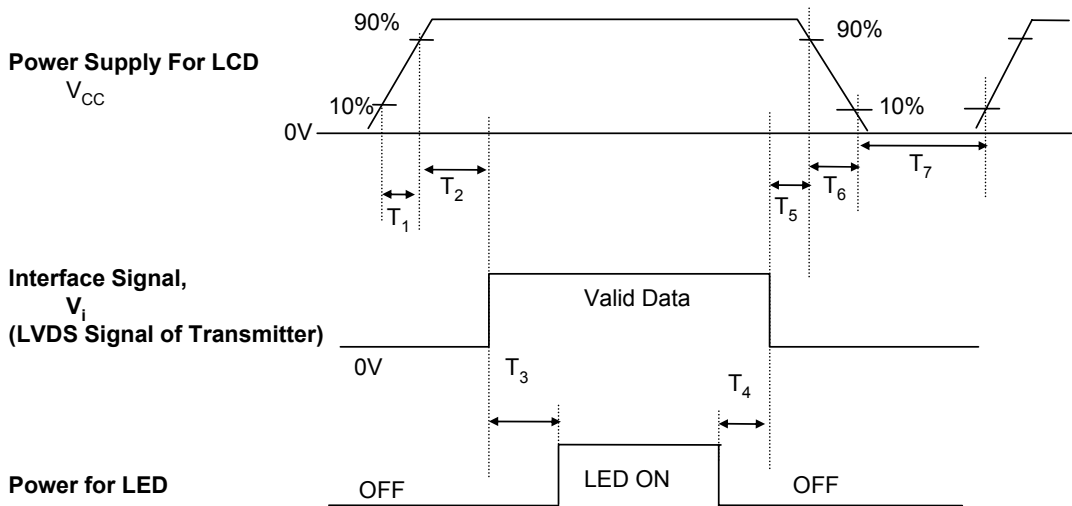


Table 7. POWER SEQUENCE TABLE

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	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 V_{CC} to 0V.
3. LED power must be turn on after power supply for LCD and interface signal are valid.

Product Specification

4. Touch Screen Panel Specifications

4-1. Electrical Characteristics

Item	Min.	Typ.	Max.	Unit	Note
Linearity	-1.5	-	+1.5	%	Each X/Y Direction
Terminal Resistance	200	-	900	Ω	X-axis
	200	-	900	Ω	Y-axis
Insulation Resistance	20	-	-	M Ω	DC 25V
Voltage	-	5	7	V	DC
Chattering	-	-	10	ms	At Connector Pin
Transparency	-	80	-	%	

4-2. Mechanical Characteristics

Item	Min.	Typ.	Max.	Unit	Note
ITO Glass	-	0.7	-	mm	
ITO Film	-	0.2	-	mm	
Input Activation Force	-	-	100	g	1
Durability (Surface scratching)	Write 100,000	-	-	Characters	2
Durability (Surface pitting)	1,000,000	-	-	times	3
Surface Hardness	3	-	-	H	Judgment.ref. JIS-K5400

[Note 1] Stylus pen Input : R0.8mm polyacetal pen or silicon rubber.

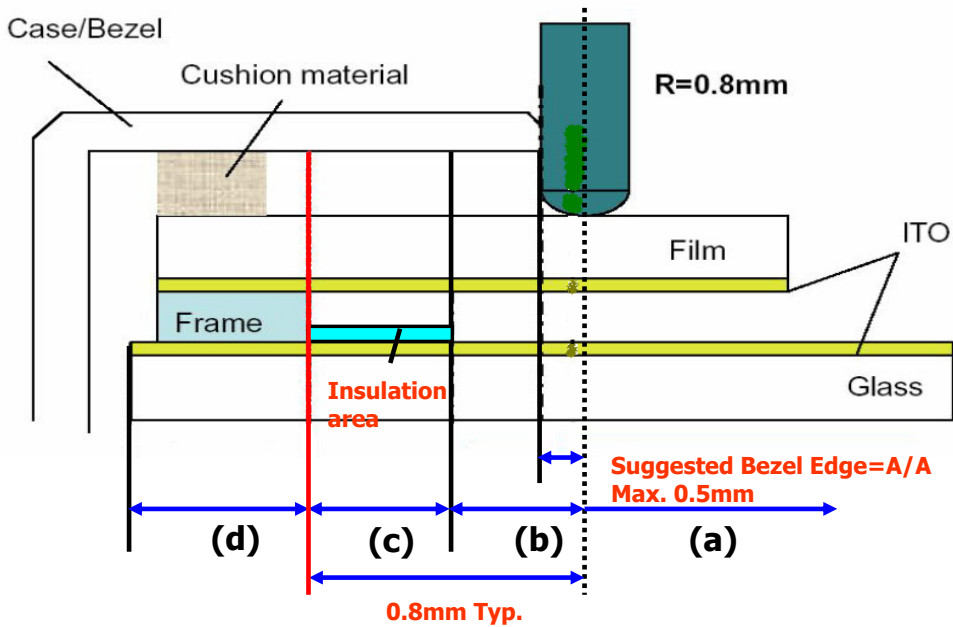
[Note 2] Measurement for Surface area

- Force : 250gf
- Speed : 60m/sec
- Stylus : R0.8 polyacetal tip
- Judgment : Terminal Resistance, Linearity (According to section 3-7-1)

[Note 3] Pit 1,000,000 times on the Film with a R8.0 silicon rubber

- Force : 250gf
- Speed : 2times/sec
- Judgment : Terminal Resistance, Linearity (According to section 3-7-1)

4-3. Precautions in use of touch screen panel.



Area(a): Active area

The active area is guaranteed the position data detectable precision, operation force and other operations. It is strongly recommended to place the operation button or menu keys within the active area. Due to structure, the active area is less durable at the edge or close to the edge.

Area(b): Operation non-guaranteed area

This area does not guarantee a touch panel operation and its function. When this area is pressed, touch panel shows degradation of its performance and durability such as a pen sliding durability becomes about one-tenth compared with the active area (Area-(a) as guaranteed area) and its operation force requires about double. About 0.5 mm outside from a boundary of the active area corresponds to this area.

Area(c): (Pressing prohibition area)

The area which forbids pressing, because an excessive load is applied to a transparent electrode (ITO) and a serious damage is given to a touch panel function by pressing.

Area(d): (Non-Active area)

The area does not activate even if pressed.

5. Optical Specification

Optical characteristics are determined after the unit has been 'ON' and stable for approximately 5 minutes in a dark environment at 25°C. The values specified are at an approximate distance 50cm from the LCD surface at a viewing angle of Φ and Θ equal to 0°.

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

FIG. 1 Optical Characteristic Measurement Equipment and Method

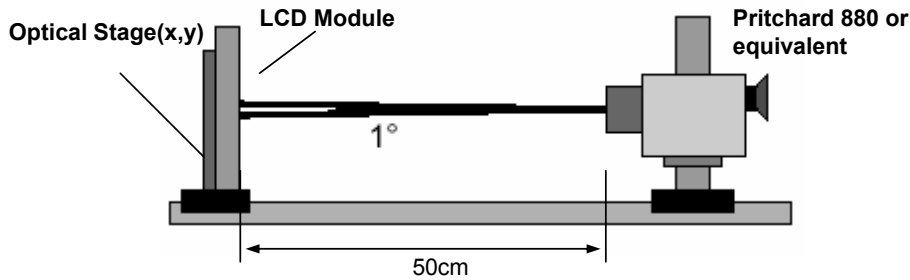


Table 8. OPTICAL CHARACTERISTICS

Ta=25°C, VCC=3.3V, fv=60Hz, fCLK= 29.5MHz, Iled= 20mA

Parameter	Symbol	Values			Units	Notes
		Min	Typ	MAx		
Contrast Ratio	CR	300	350			1
Surface Luminance, white (w TSP)	L _{WH}	240	280		cd/m ²	2
Luminance Uniformity	U	-	1.3	1.5		3
Response Time						4
Rise Time+Decay Time	Tr _R +Tr _D		16	25	ms	
Color Coordinates						±0.05
RED	RX	0.532	0.582	0.632		
	RY	0.295	0.345	0.395		
GREEN	GX	0.306	0.356	0.406		
	GY	0.527	0.577	0.627		
BLUE	BX	0.104	0.154	0.204		
	BY	0.062	0.112	0.162		
WHITE	WX	0.263	0.313	0.363		
	WY	0.279	0.329	0.379		
Viewing Angle						5
x axis, right($\Phi=0^\circ$)	Θ_r		65		degree	
x axis, left ($\Phi=180^\circ$)	Θ_l		65		degree	
y axis, up ($\Phi=90^\circ$)	Θ_u		50		degree	
y axis, down ($\Phi=270^\circ$)	Θ_d		50		degree	
Gray Scale						6

Product Specification

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 1point across the LCD surface 50cm from the surface with all pixels displaying white. For more information see FIG 2.

3. Luminance uniformity is measured for 9 point For more information see FIG 2.
Luminance Uniformity= Maximum of 9points (①~⑨) / Minimum of 9points (①~⑨)

4. Response time is the time required for the display to transition from white to black (rise time, Tr_R) and from black to white(Decay Time, Tr_D). For additional information see FIG 3.

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

6. Gray scale specification

* $f_V=60\text{Hz}$

Gray Level	Luminance [%] (Typ)
L0	0.16
L7	0.50
L15	3.05
L23	11.1
L31	21.2
L39	35.9
L47	55.2
L55	76.7
L63	100

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FIG. 2 Luminance

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

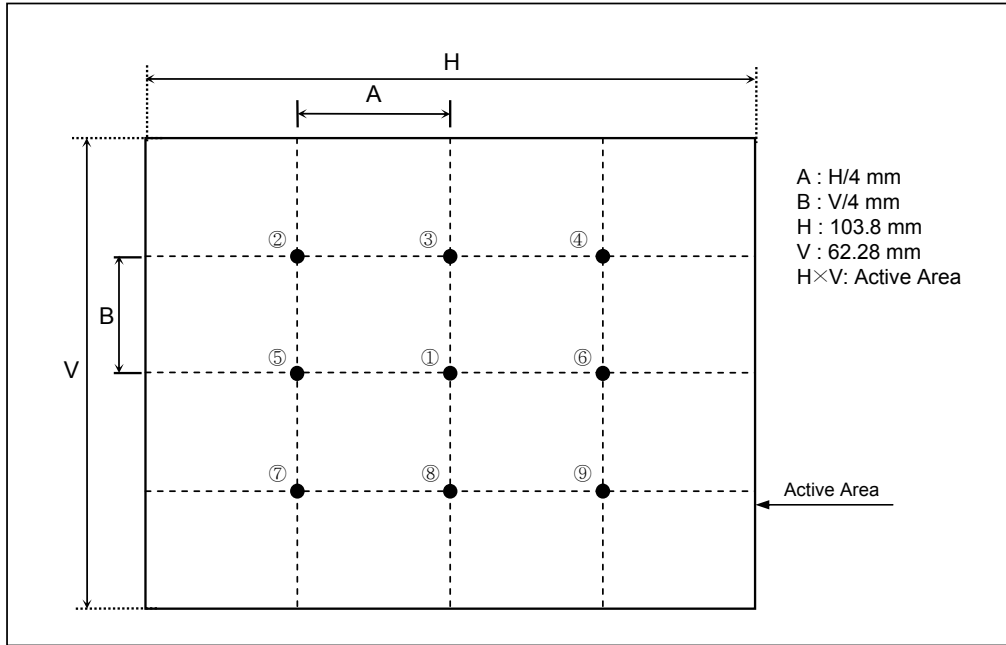
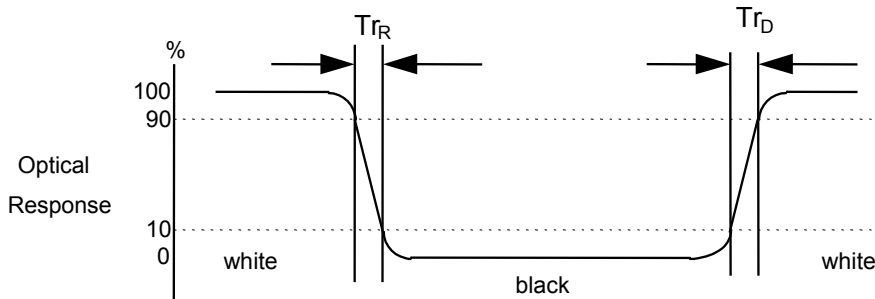


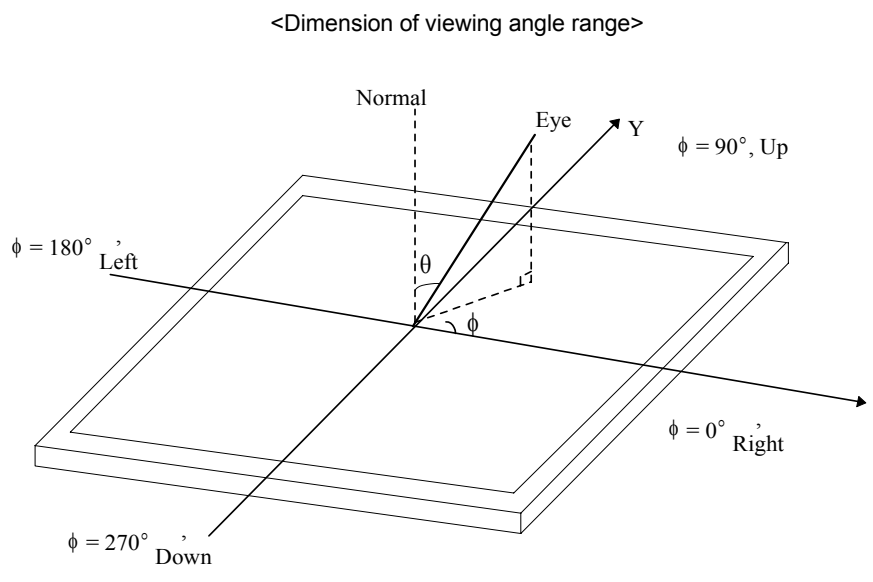
FIG. 3 Response Time

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



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FIG. 4 Viewing angle



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6. Mechanical Characteristics

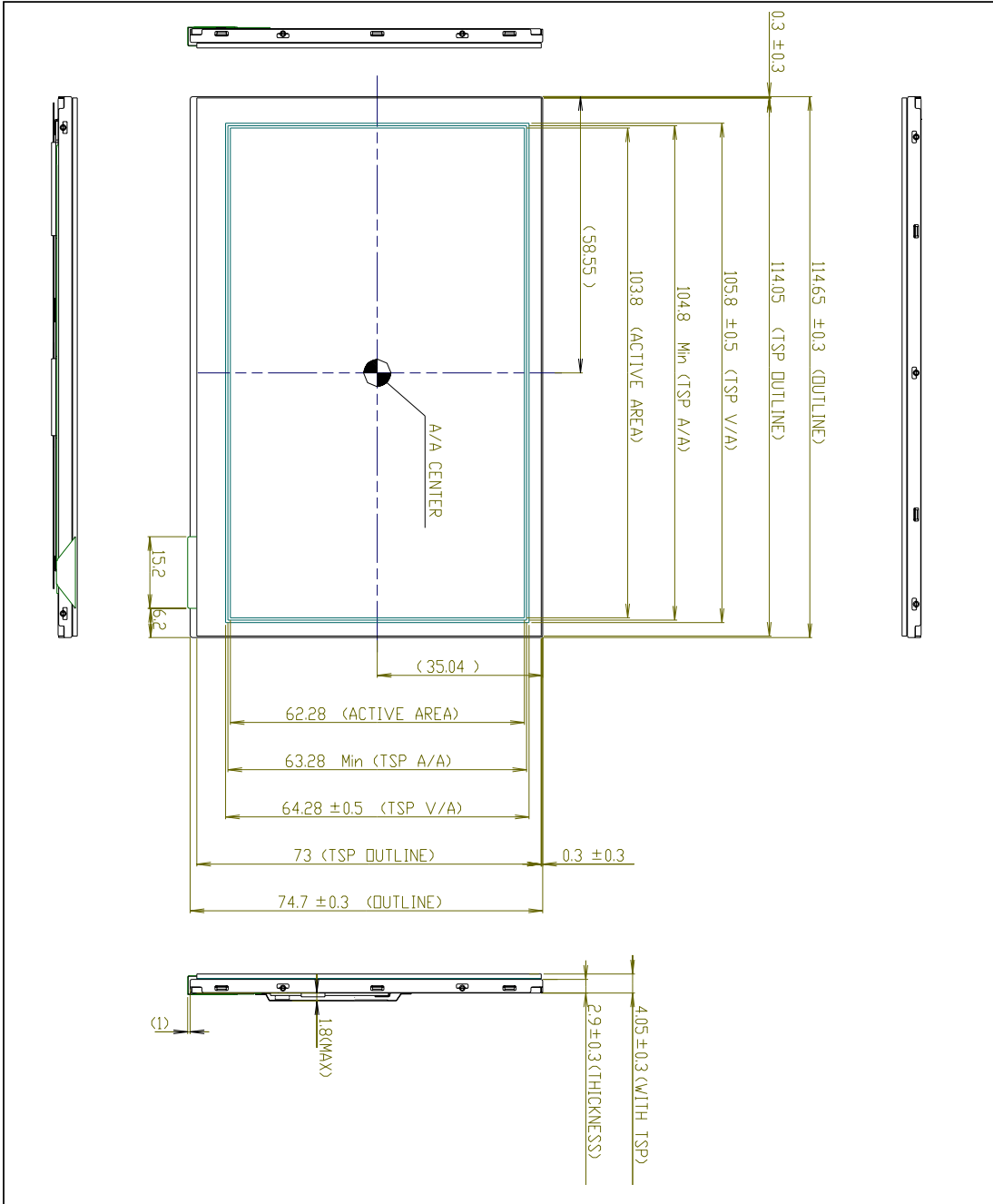
The contents provide general mechanical characteristics for the model LB048WV1.
In addition the figures in the next page are detailed mechanical drawing of the LCD.

Outline Dimension	Horizontal	114.65 ± 0.3mm
	Vertical	74.7 ± 0.3mm
	Depth	5.85± 0.3mm (w TSP, w Comp)
Bezel Area	Horizontal	106.8 ± 0.3mm
	Vertical	65.28 ± 0.3mm
Active Display Area	Horizontal	103.8 mm
	Vertical	62.28 mm
Weight	77g ± 7g w TSP	
Surface Treatment	Hard coating(3H) Glare treatment of the TSP	

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<FRONT VIEW>

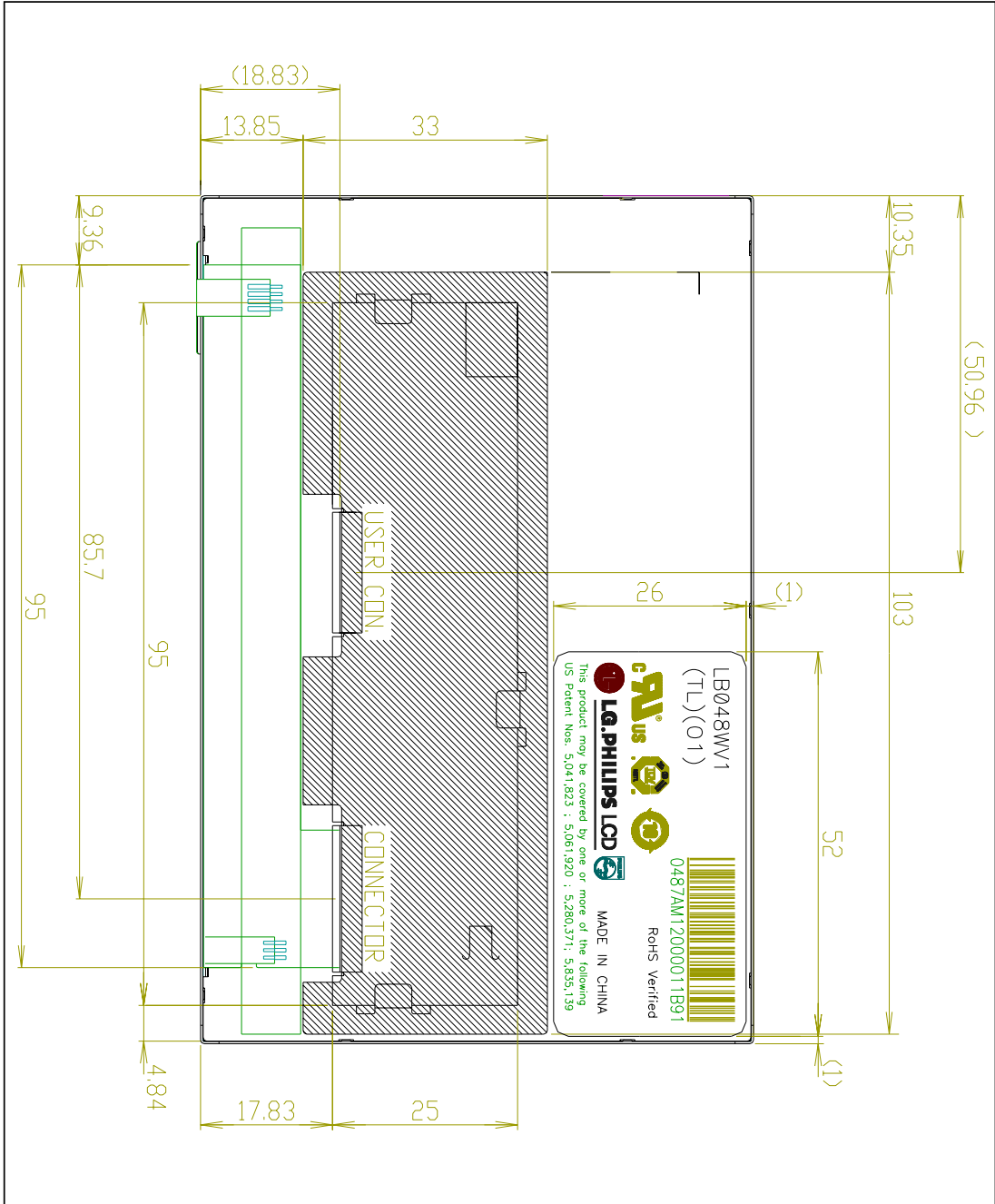
Note) Unit:[mm], General tolerance: ± 0.5 mm



Product Specification

<REAR VIEW>

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



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7. Reliability

Environment test condition

No.	Test Item	Conditions
1	High temperature storage test	Ta= 60°C, 240h
2	Low temperature storage test	Ta= -20°C, 240h
3	High temperature operation test	Ta= 50°C, 50%RH, 240h
4	Low temperature operation test	Ta= 0°C, 240h
5	Vibration test (non-operating)	Sine wave, 5 ~ 150Hz, 1.5G, 0.37oct/min 3 axis, 30min/axis
6	Shock test (non-operating)	-180G, 2msec, Half sine - ±X, ±Y, ±Z. Per 1time
7	Thermal Shock test	-30 °C (0.5h) ~ 70 °C (0.5h) , 100cycles

{ 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.

Product Specification

8. International Standards

8-1. Safety

- a) UL 1950 Third Edition, Underwriters Laboratories, Inc. Jan. 28, 1995.
Standard for Safety of Information Technology Equipment Including Electrical Business Equipment.
- b) CAN/CSA C22.2 No. 950-95 Third Edition, Canadian Standards Association, Jan. 28, 1995.
Standard for Safety of Information Technology Equipment Including Electrical Business Equipment.
- c) EN 60950 : 1992+A1: 1993+A2: 1993+A3: 1995+A1: 1997+A11: 1997
IEC 950 : 1991+A1: 1992+A2: 1993+A3: 1995+A1: 1996
European Committee for Electrotechnical Standardization(CENELEC)
EUROPEAN STANDARD for Safety of Information Technology Equipment Including Electrical Business Equipment.

8-2. 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

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9. Packing

9-1. Designation of Lot Mark

a) Lot Mark

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

A,B,C : SIZE(INCH)

E : MONTH

D : YEAR

F ~ M : SERIAL NO.

Note

1. YEAR

Year	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Mark	1	2	3	4	5	6	7	8	9	0

2. MONTH

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mark	1	2	3	4	5	6	7	8	9	A	B	C

b) Location of Lot Mark

Serial No. is printed on the label. The label is attached to the backside of the LCD module.
This is subject to change without prior notice.

9-2. Packing Form

a) Package quantity in one box : 63 pcs

b) Box Size : 475 x 348 x 175

Product Specification

10. PRECAUTIONS

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

10-1. OPERATING PRECAUTIONS

- (1) The spike noise causes the mis-operation of circuits. It should be lower than following voltage :
 $V = \pm 200\text{mV}$ (Over and under shoot voltage)
- (2) Response time depends on the temperature. (In lower temperature, it becomes longer.)
- (3) Brightness depends on the temperature. (In lower temperature, it becomes lower.)
And in lower temperature, response time (required time that brightness is stable after turned on) becomes longer.
- (4) Be careful for condensation at sudden temperature change. Condensation makes damage to polarizer or electrical contacted parts. And after fading condensation, smear or spot will occur.
- (5) When fixed patterns are displayed for a long time, remnant image is likely to occur.
- (6) Module has high frequency circuits. Sufficient suppression to the electromagnetic interference shall be done by system manufacturers. Grounding and shielding methods may be important to minimized the interference.

10-2. ELECTROSTATIC DISCHARGE CONTROL

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

10-3. PRECAUTIONS FOR STRONG LIGHT EXPOSURE

Strong light exposure causes degradation of polarizer and color filter.

10-4. STORAGE

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

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

10-5. 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.