

Product Specification

SPECIFICATION FOR APPROVAL

- () Preliminary Specification
() Final Specification

Title	8.4" SVGA (800 x RGB x 600) TFT LCD
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BUYER	
MODEL	

SUPPLIER	LG.Philips LCD Co., Ltd.
MODEL	LB084S02
Suffix	TD01

SIGNATURE	DATE
/	_____
/	_____
/	_____

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

SIGNATURE	DATE
S.D. JUNG / G.Manager _____	_____
REVIEWED BY	
J.Y. KIM / Manager _____	_____
PREPARED BY	
O.J. KWON / Engineer _____	_____

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

Product Specification

Contents

No	ITEM	Page
	COVER	1
	CONTENTS	2
	RECORD OF REVISIONS	3
1	GENERAL DESCRIPTION	4
2	ABSOLUTE MAXIMUM RATINGS	5
3	ELECTRICAL SPECIFICATIONS	
3-1	ELECTRICAL CHARACTREISTICS	6
3-2	INTERFACE (INPUT TERMINAL)	8
3-3	SIGNAL TIMING SPECIFICATIONS	10
3-4	TIMING DIAGRAM	11
3-5	DETAIL DESCRIPTION OF PIN FUNCTION	13
3-6	RECOMMENDED GAMMA CORRECTION VOLTAGE	13
4	OPTICAL SFECIFICATIONS	14
5	MECHANICAL CHARACTERISTICS	18
6	RELIABLITY	21
7	INTERNATIONAL STANDARDS	
7-1	SAFETY	22
7-2	EMC	22
8	PACKING	
8-1	DESIGNATION OF LOT MARK	23
8-2	PACKING FORM	23
9	PRECAUTIONS	24

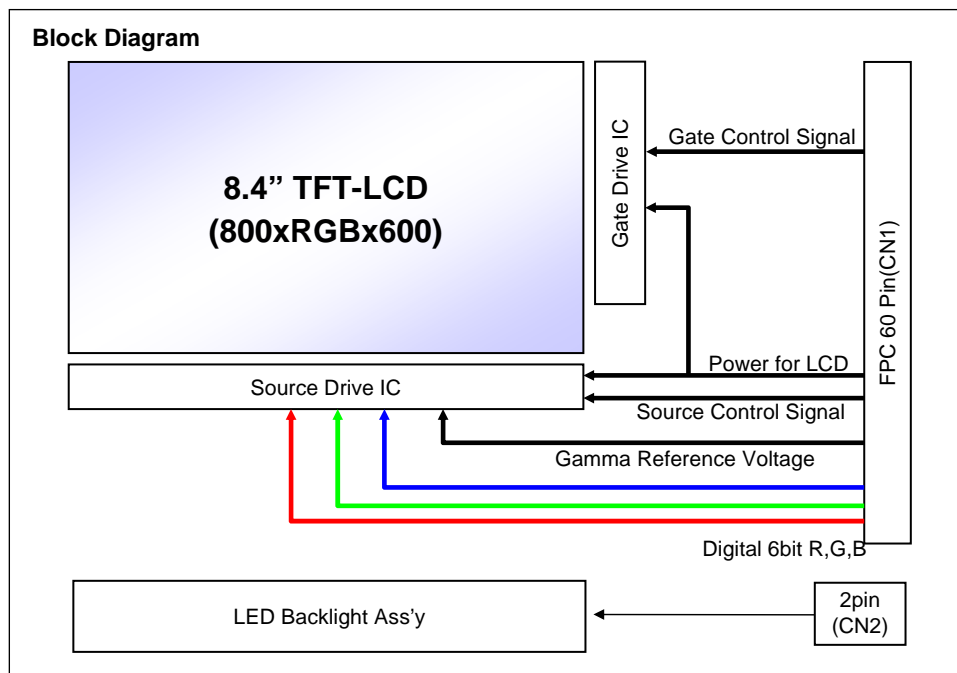
Product Specification

1. General Description

The LB084S02 is a Color Active Matrix Liquid Crystal Display with an integral Light Emitting Diode(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 8.4 inches diagonally measured active display area with SVGA resolution(800 horizontal by 600 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 LB084S02 has been designed to apply the interface method that enables low power, high speed, low EMI.

The LB084S02 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 LB084S02 characteristics provide an excellent flat display.



General Features

Active Screen Size	8.4 inches diagonal
Outline Dimension	189.75x149.4x6.3mm
Pixel Pitch	0.071mm × 0.213mm
Pixel Format	800 horiz. by 600 vert. Pixels RGB strip arrangement
Color Depth	6-bit, 262,144 colors
Luminance, White	250 cd/m ² (Typ.)
Power Consumption	LCD(TBD)
Weight	300g(Typ.)
Display Operating Mode	Transmitting type, normally white
Surface Treatment	Anti-glare treatment of the front polarizer

Product Specification

2. Absolute Maximum Ratings

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

Table 1. ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Condition	Min	Max	Unit	Remark
Logic Voltage	VCC	T _a =25	-0.3	5.0	V	
Source Driver Voltage	AVDD	T _a =25	-0.5	15.0	V	
Digital Input Signals	V _{I1}	T _a =25	-0.3	5.0	V	[Note 2-1]
Analog Input Signals	V _{I2}	T _a =25	-0.5	15.0	V	[Note 2-2]
Gate Driver Voltage	VGH	T _a =25	-0.3	42	V	
	VGL	T _a =25	-20	0.3	V	
	VGH-VGL	T _a =25	-0.3	40	V	
Operating Temperature (Ambient Temperature)	T _{op}	-	-10	60		[Note 2-3,4,5,6]
Storage Temperature	T _{st}	-	-20	70		[Note 2-3,4]

[Note 2-1] POL, STVD, OEV, CKV, STVU, EDGSL, U/D, STHL, REV, DCLK, STHR, LD, R0-5/G0-5/B0-5, R/L

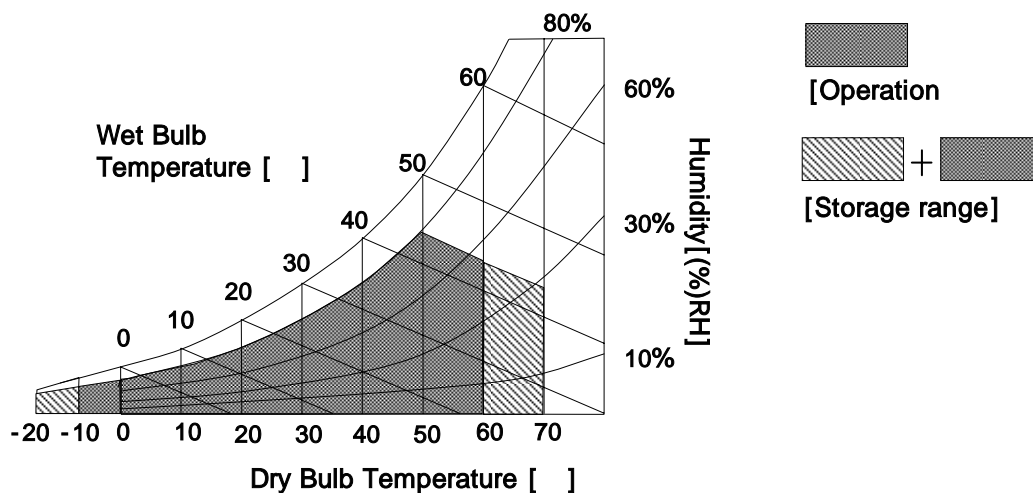
[Note 2-2] V1/2/3/4/5/6/7/8/9/10/11/12/13/14

[Note 2-3] This rating applies to all parts of the module and should not be exceeded.

[Note 2-4] Maximum wet-bulb temperature is 46 . Condensation of dew must be avoided as electrical current leaks will occur, causing a degradation of performance specifications.

[Note 2-5] The operating temperature only guarantees operation of the circuit and doesn't guarantee all the contents of Electro-optical specification.

[Note 2-6] Ambient temperature when the backlight is lit (reference value).



Product Specification

3. Electrical Specifications

3-1. Electrical Characteristics

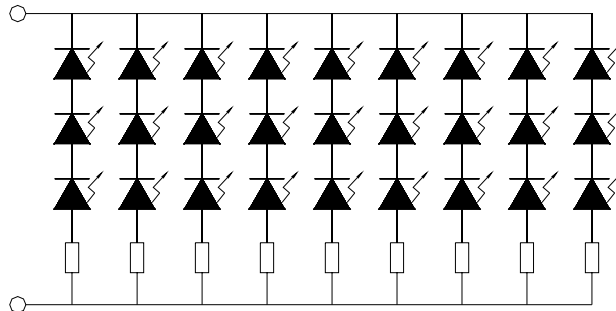
The LB084S02 requires two power inputs. One is employed to power the LCD electronics and to drive the TFT array and liquid crystal. The second input which powers the **LED**, is typically generated by an LED Driver. **The LED Driver is an external unit to the LCD.**

Table 2. ELECTRICAL CHARACTERISTICS(LED Unit) ($T_a = 25^{\circ}C$)

ITEMS	SYM BOL	SPEC.			UNIT	REMARK
		Min	Typ	Max		
LED current	IL		20	TBD	mA	ta=25 ,per chain
LED voltage	VL		9.9	TBD	V	ta=25 ($\pm 10\%$)
LED power	PL		1.78	TBD	W	ta=25 -

*** The permissible forward current of LED vary with environmental temperature.

[LED Array Structure]



Product Specification
Table 3. ELECTRICAL CHARACTERISTICS(TFT-LCD PANEL DRIVING SECTION)
 $T_a=25$

Parameter		Symbol	Min	Typ	Max	Unit	Remark
Logic Supply Voltage		VCC	3.0	3.3	3.6	V	
Digital Input Signal	High Level	V_{IH}	0.7VCC	-	VCC	V	
	Low Level	V_{IL}	0	-	0.3VCC	V	
Source Driver Supply Voltage		VDD	TBD	(10.0)	TBD	V	
Gate Driver	TFT	Hi	VGH	TBD	(19.5)	TBD	V
		Lo	VGL	TBD	(-4.5)	TBD	V
Gamma Correction Voltage		DC	V1 ~ V7	0.4AVDD	-	AVDD-0.1	V
			V8 ~ V14	0.1	-	0.6VDD	
Color Filter Substrate Voltage		DC	VCOM	TBD	(4.12)	TBD	V
Source Driver Supply Current		IDD	-	(37.50)	TBD	mA	VDD = 12V
Logic Supply Current		ICC	-	(3.58)	TBD	mA	VCC = 3.3V
Gate Driver High Supply Current		IGH	-	(0.26)	TBD	mA	VGH = 19.5V
Gate Driver Low Supply Current		IGL	-	(0.39)	TBD	mA	VGL = -4.5V

***** Cautionary Matter : When applying or disconnecting power, please be sure that such action is sequentially carried out for all power supplies. In addition, apply input signals only after power has been turned on.

[Power Sequence]
-Source Driver :

Power on sequence : Case.1) VCC > Logic input > AVDD > V1 to V14.

Case.2) VCC > AVDD > V1 to V14 > Logic input.

Power off sequence is reverse turn of this.

-Gate Driver :

Power on sequence : VCC > VGL > Input signal > VGH.

Power off sequence is reverse turn of this.

Product Specification

3-2. Interface (Input Terminal)

This LCD employs two interface connections, a 60 pin connector is used for the module electronics interface and the other connector is used for the integral backlight system.

Table 4. TFT-LCD Panel Driving Part

Pin No.	Symbol	Description	Pin No.	Symbol	Description
1	POL	Polarity selection	31	GND	Power ground
2	STVD	Vertical start pulse input when U/D=H	32	G5	Green data(MSB)
3	OEV	Output enable	33	G4	Green data
4	CKV	Vertical clock	34	G3	Green data
5	STVU	Vertical start pulse input when U/D=L	35	G2	Green data
6	GND	Power ground	36	G1	Green data
7	EDGSL	Select rising edge or falling edge	37	G0	Green data(LSB)
8	VCC	Power supply for digital circuit	38	STHL	Horizontal start pulse input when R/L=L
9	V9	Gamma voltage level 9	39	REV	Control signal are inverted or not
10	VGL	Gate OFF voltage	40	GND	Power ground
11	V2	Gamma voltage level 2	41	DCLK	Sample clock
12	VGH	Gate ON voltage	42	VCC	Power supply for digital circuit
13	V6	Gamma voltage level 6	43	STHR	Horizontal start pulse input when R/L=H
14	U/D	Up/down selection	44	LD	Latch the polarity of outputs and switches the new data to outputs
15	VCOM	Common voltage	45	B5	Blue data(MSB)
16	GND	Power ground	46	B4	Blue data
17	AVDD	Power supply for analog circuit	47	B3	Blue data
18	V14	Gamma voltage level 14	48	B2	Blue data
19	V11	Gamma voltage level 11	49	B1	Blue data
20	V8	Gamma voltage level 8	50	B0	Blue data(LSB)
21	V5	Gamma voltage level 5	51	R/L	Right/Left selection
22	V3	Gamma voltage level 3	52	V1	Gamma voltage level 1
23	GND	Power gorund	53	V4	Gamma voltage level 4
24	R5	Red data(MSB)	54	V7	Gamma voltage level 7
25	R4	Red data	55	V10	Gamma voltage level 10
26	R3	Red data	56	V12	Gamma voltage level 12
27	R2	Red data	57	V13	Gamma voltage level 13
28	R1	Red data	58	AVDD	Power supply for analog circuit
29	R0	Red data(LSB)	59	GND	Power ground
30	GND	Power ground	60	VCOM	Common voltage

**The matching connector part number is FH19SC-30S-0.5SH(Bottom Contact Type, 0.5mm-Pitch) manufactured by Hirose or equivalent.

Product Specification

The backlight interface connector is a model BHSR-02VS-1, manufactured by JST or Compatible.
The mating connector part number is SM02(8.0)B-BHSS-1-TB or equivalent.

Table 5. BACKLIGHT CONNECTOR PIN CONFIGURATION (CN2)

Pin	Symbol	Description	Remark
1	A	Power Supply For LED [Anode]	[Note 3-1]
2	K	Power Supply For LED [Cathode]	

[Note 3-1] The Anode side terminal is colored red and the Cathode side terminal is black.

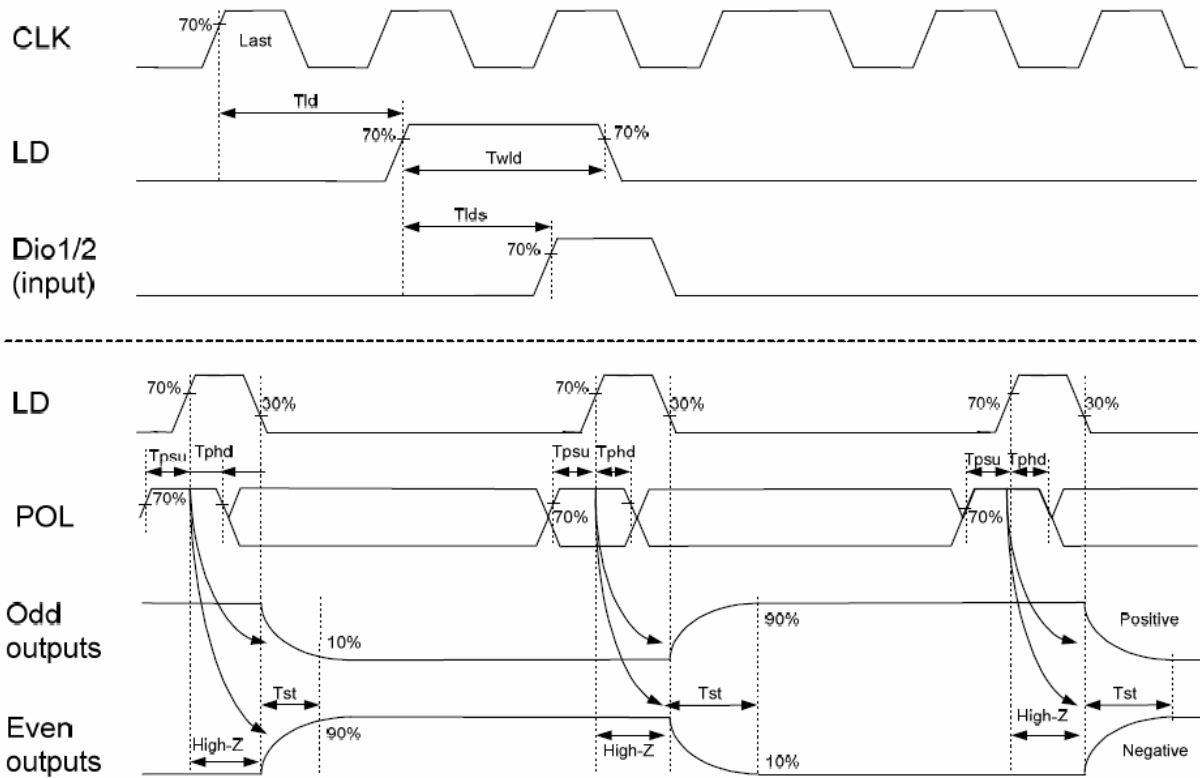
Product Specification
3-3. Signal Timing Specifications
Table 6. Timing Characteristics of input signals

Parameter		Symbol	Min	Typ	Max	Unit	condition
S O U R C E	CLK Frequency	fclk	-	50	55	MHz	EDGSL='0'
		fclk	-	25	27.5	MHz	EDGSL='1'
	CLK pulse width	Tcw	40%	-	60%	Tcph	
	Data set-up time	Tsu	4	-	-	ns	
	Data hold time	Thd	2	-	-	ns	
	Propagation delay of DIO2/1	Tphl	6	10	15	ns	CL=25pF (Output)
	Time that the last data to LD	Tld	1	-	-	Tcph	
	Pulse width of LD	Twld	2	-	-	Tcph	
	Time that LD to DIO 1/2	Tlds	5	-	-	Tcph	
	POL Set-up time	Tpsu	6	-	-	ns	POL to LD
	POL hold time	Tphd	6	-	-	ns	POL to LD
	Output stable time	Tst	-	-	9	ns	
	Repair output delay stable time	Tst1	-	-	20	us	
G A T E	GSC Frequency	fclk	-	-	200	KHz	
	GSC Rise Time	trck	-	-	100	ns	
	GSC Falling Time	tfck	-	-	100	ns	
	GSC Pulse Width	pwclk	500	-	-	ns	
	GSP1/2 Setup Time	tsu	200	-	-	ns	
	GSP1/2 Hold Time	thd	300	-	-	ns	
	GOE Pulse Width	twcl	1	-	-	us	

Product Specification

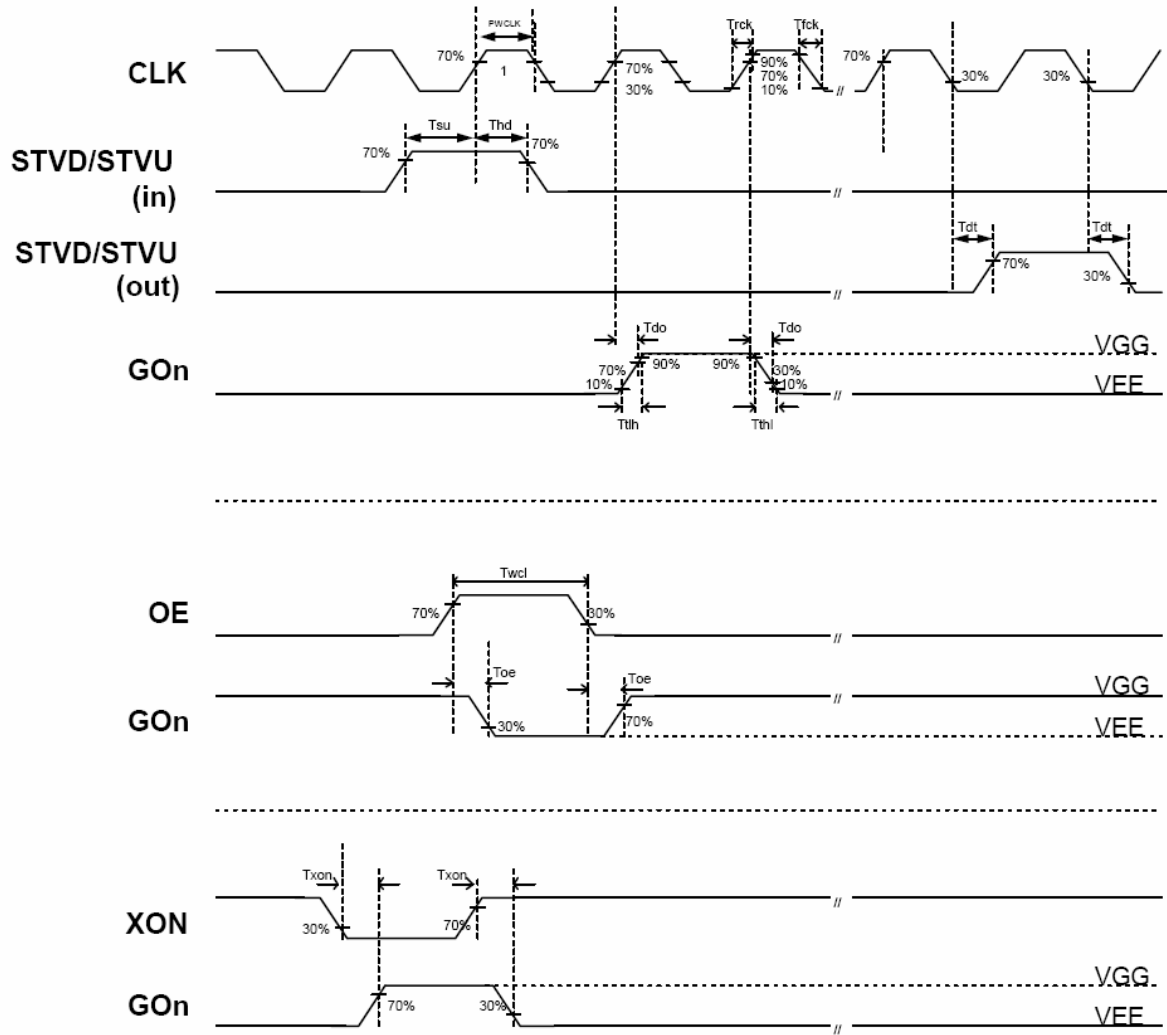
3-4. Timing Diagram

Source D-IC Timing Diagram



Product Specification

Gate D-IC Timing Diagram



Product Specification

3-5. Detail Description of Pin Functions

1. U_D is used as input pin for selecting the shifting direction of bi-directional shift register.

U_D	Output Shift	STV Input Pin
H	Up to Down	STVD
L	Down to Up	STVU

2. R_L is used as input pin for the horizontal scanning direction. If R_L is H, STHR is the Input Pin for the Source Start Pulse(STH=SSP). Otherwise(If R_L is L), STHL is the Input Pin for the SSP.

R_L	Scanning Direction	STH Input Pin
H	Form Left to Right	STHR
L	From Right to Left	STHL

3-6. Recommended Gamma Correction Voltage [V1 to V14]

(VDD=10V)

Symbol	Values(Typ)	Unit	Remark
V1	(9.05)	V	[Note 3-3]
V2	(8.53)		
V3	(7.41)		
V4	(6.79)		
V5	(6.52)		
V6	(6.00)		
V7	(5.29)		
V8	(4.86)		
V9	(4.02)		
V10	(3.49)		
V11	(3.21)		
V12	(2.62)		
V13	(1.51)		
V14	(1.01)		

[Note 3-3] Be sure to maintain the voltage relationships of
 $AVDD > V1 > V2 > V3 > V4 > V5 > V6 > V7 ; V8 > V9 > V10 > V11 > V12 > V13 > V14 > GND+0.1V$

Product Specification

4. Optical Specifications

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

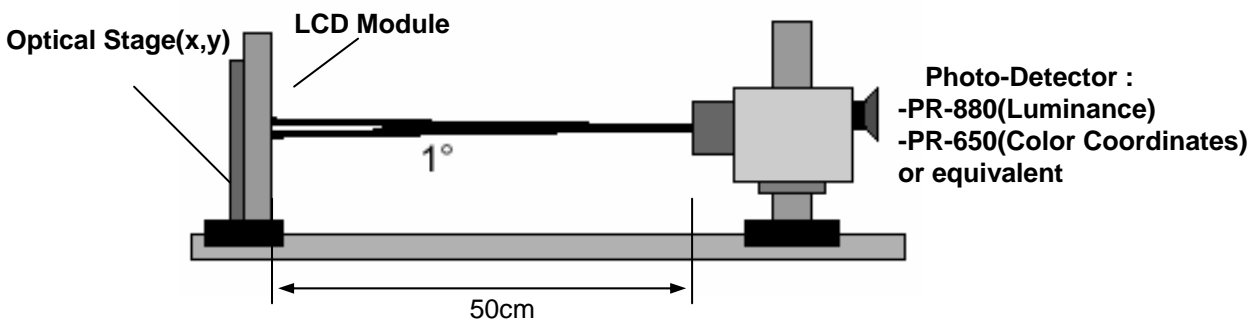


Table 9. OPTICAL CHARACTERISTICS

Ta=25°C, VCC=3.3V, fv=60Hz, fCLK= 33.26MHz, IBL = 5.5mA_{RMS}

Parameter	Symbol	Values			Units	Remark
		Min	Typ	Max		
Contrast Ratio	CR	TBD	500	-		[Note 4-1]
Surface Luminance, white	L _{WH}	200	250	-	cd/m ²	[Note 4-2]
Luminance Variation	δ_{WHITE}	-	1.25	1.4		[Note 4-3]
Response Time						[Note 4-4]
: Rise Time	T _{rR}	-	10	20	ms	
: Decay Time	T _{rD}	-	15	30	ms	
Color Coordinates						[Note 4-2]
: WHITE	WX	0.26	0.31	0.36		
	WY	0.28	0.33	0.38		
Viewing Angle						[Note 4-5]
: x axis, right($\Phi=0^\circ$)	Θ_r	60	65	-	degree	
: x axis, left ($\Phi=180^\circ$)	Θ_l	60	65	-	degree	
: y axis, up ($\Phi=90^\circ$)	Θ_u	40	45	-	degree	
: y axis, down ($\Phi=270^\circ$)	Θ_d	55	60	-	degree	

Product Specification

[Note 4-1] Contrast Ratio(CR) is defined mathematically as

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

[Note 4-2] Surface luminance is measured at the center point(L₁) of the LCD with all pixels displaying white at the distance of 50cm by PR-880. Color Coordinates are measured at the center point(L₁) 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.

[Note 4-3] Luminance % uniformity is measured for 9 point For more information see FIG 2.
WHITE = Maximum(L₁,L₂, L₉) ÷ Minimum(L₁,L₂, L₉)

[Note 4-4] 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.

[Note 4-5] 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.

Product Specification

FIG. 2 Luminance

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

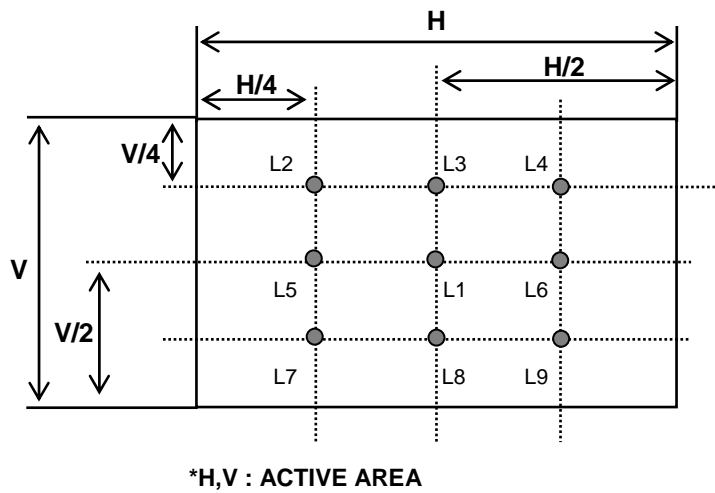
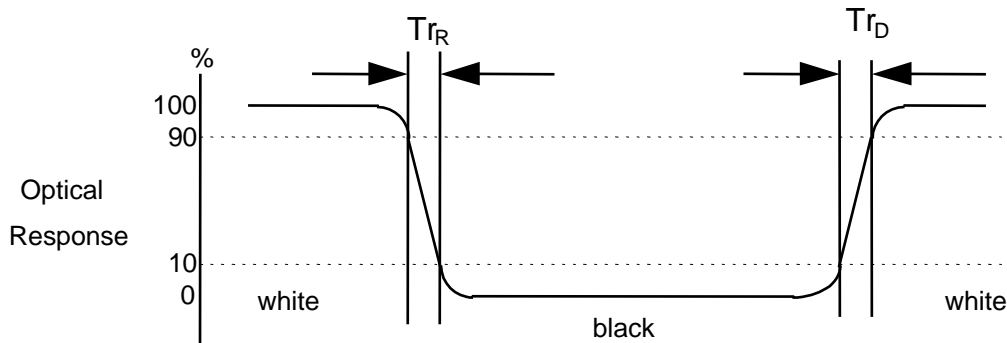


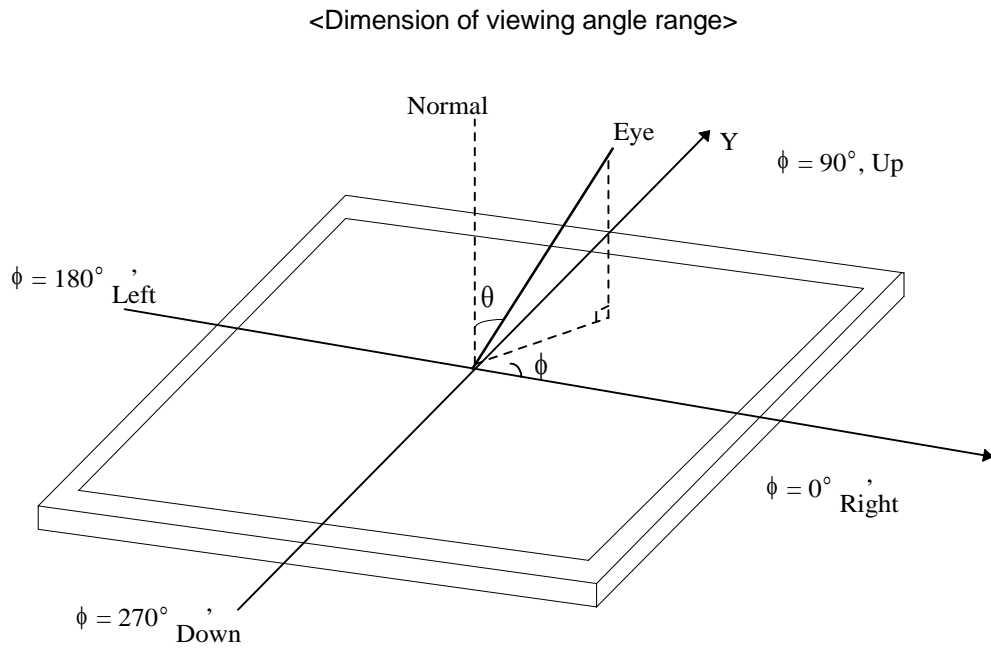
FIG. 3 Response Time

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



Product Specification

FIG. 4 Viewing angle



Product Specification
5. Mechanical Characteristics

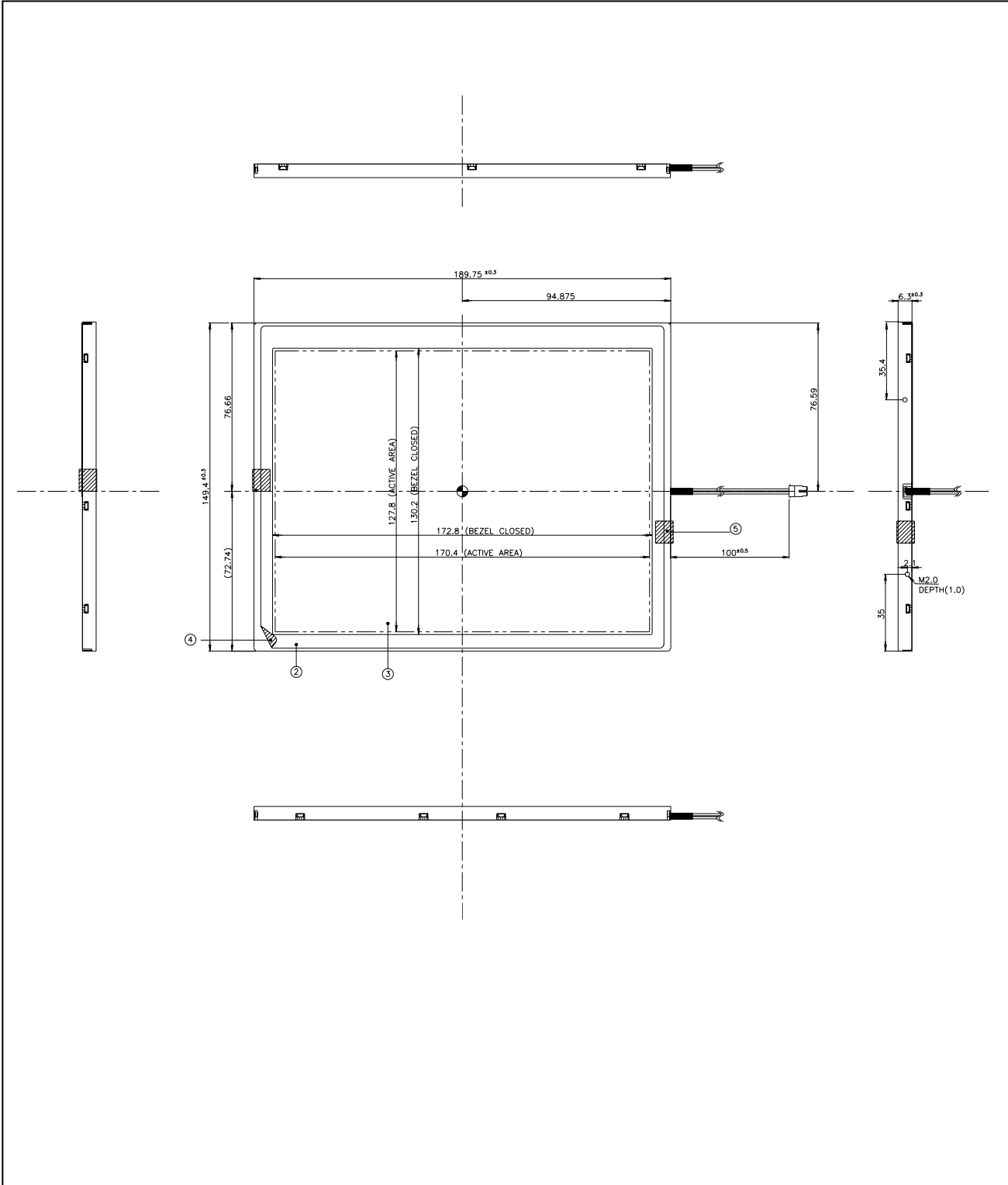
The contents provide general mechanical characteristics for the model LB084S02. In addition the figures in the next page are detailed mechanical drawing of the LCD.

Outline Dimension	Horizontal	189.75 mm(Typ)
	Vertical	149.4 mm(Typ)
	Depth	6.3 mm (Typ.)
Bezel Area	Horizontal	172.8 mm (Typ.)
	Vertical	130.2mm (Typ.)
Active Display Area	Horizontal	170.4 mm (Typ.)
	Vertical	127.8 mm (Typ.)
Weight	300g(Typ.) / 305g (Max.)	
Surface Treatment	Anti-glare treatment of the front polarizer	

Product Specification

<FRONT VIEW>

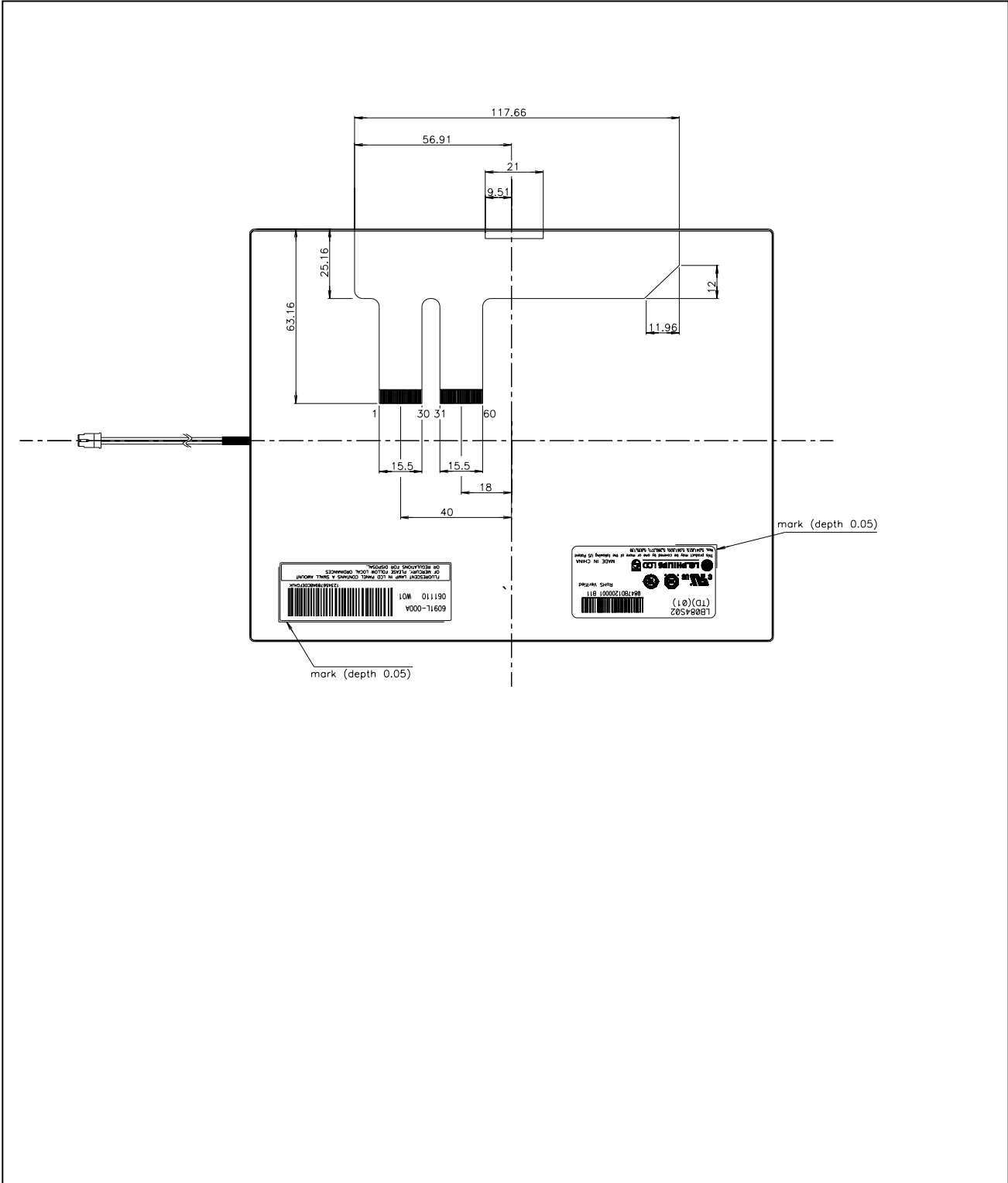
Unit:[mm], General tolerance: $\pm 0.3\text{mm}$



Product Specification

<REAR VIEW>

Unit:[mm], General tolerance: $\pm 0.3\text{mm}$



Product Specification

6. Reliability

No.	Test Items	Test Condition	Remark
1	High Temperature Storage Test	T _a =70 240h	[Note 6-1,2,3]
2	Low Temperature Storage Test	T _a =-20 240h	[Note 6-1,2,3]
3	High Temperature Operation Test	T _a =60 240h	[Note 6-1,2,3]
4	Low Temperature Operation Test	T _a =-10 240h	[Note 6-1,2,3]
5	High Temperature and High Humidity Operation Test	T _a =50 80%RH 240h	[Note 6-1,2,3]
6	Electro Static Discharge Test	-Panel Surface/Top_Case : 150pF, 150 (Air : ±15kV , Contact : ±8kV) -FPC input terminal : 100pF ±200V 0	
7	Shock Test (non-operating)	Half sine wave, 80G, 11ms 3 times shock of each six faces	
8	Vibration Test (non-operating)	Sine wave, 10 ~ 500 ~ 10Hz, 1.5G, 0.37oct/min 3 axis, 1hour/axis	
9	Thermal Shock Test	-10 (0.5h) ~ 60 (0.5h) / 100 cycles	

[Note 6-1] T_a = Ambient Temperature

[Note 6-2] In the Reliability Test, Confirm performance after leaving in room temp.

[Note 6-3] In the standard condition, there shall be no practical problems that may affect the display function. **After the reliability test, we can guarantee the product only when the corrosion is causing its malfunction. The corrosion causing no functional defect can not be guaranteed.**

T_a= Ambient 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.

Product Specification

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)

Product Specification

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)
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.

8-2. Packing Form

a) Package quantity in one box : 22 pcs

b) Box Size(mm) : 475*262*228

Product Specification

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 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 :
 $V = \pm 200\text{mV}$ (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.

Product Specification

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.