SPECIFICATION
FOR
APPROVAL

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

Title	10.4” SVGA (800 x RGB x 600) TFT LCD

BUYER	
MODEL	

SUPPLIER	LG Display
MODEL	LB104S02
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	
A.R. CHO / Engineer	

Products Engineering Dept.
LG Display

Contents

RECORD OF REVISIONS

Revision No	Revision Date	Page	Description
1.0	Feb. 21. 2008	-	Final
1.1	Apr.08.2008	-	Change Company LOGO
		14	Change Up/Down viewing angle[typ.50/55→ 55/50,min.40/45→45/40]
		17	Indicate the FPC side
		19	Indicate the main viewing angle direction
		20	Indicate the main viewing angle direction

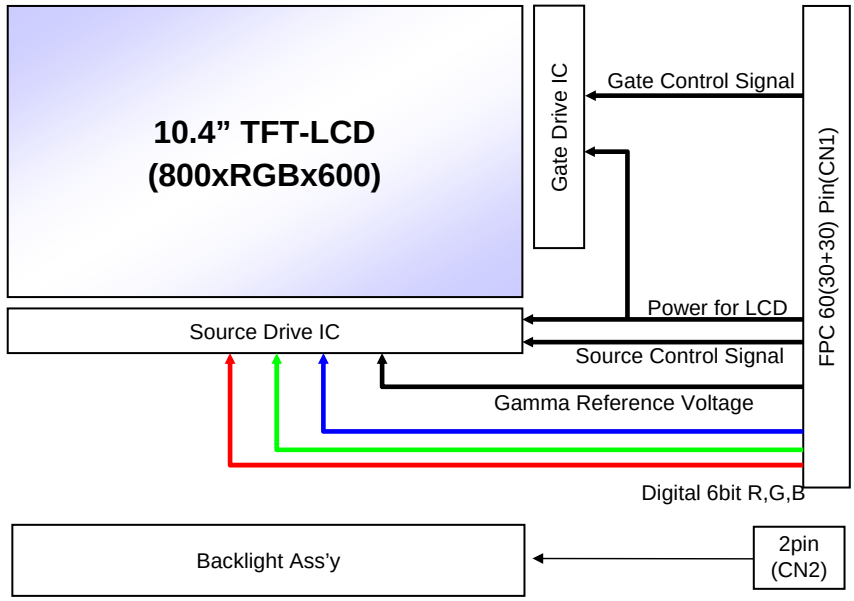
1. General Description

The LB104S02 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 10.4 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 LB104S02 has been designed to apply the interface method that enables low power, high speed, low EMI.

The LB104S02 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 LB104S02 characteristics provide an excellent flat display.

Block Diagram



General Features

Active Screen Size	10.4 inches diagonal
Outline Dimension	234.7x178.6x6.8mm
Pixel Pitch	0.088x0.264 mm
Pixel Format	800 horiz. by 600 vert. Pixels RGB strip arrangement
Color Depth	6-bit, 262,144 colors
Luminance, White	250 cd/m2 (Typ.)
Weight	420 g(Typ.)
Display Operating Mode	Transmitting type, normally white
Surface Treatment	Anti-glare treatment of the front polarizer

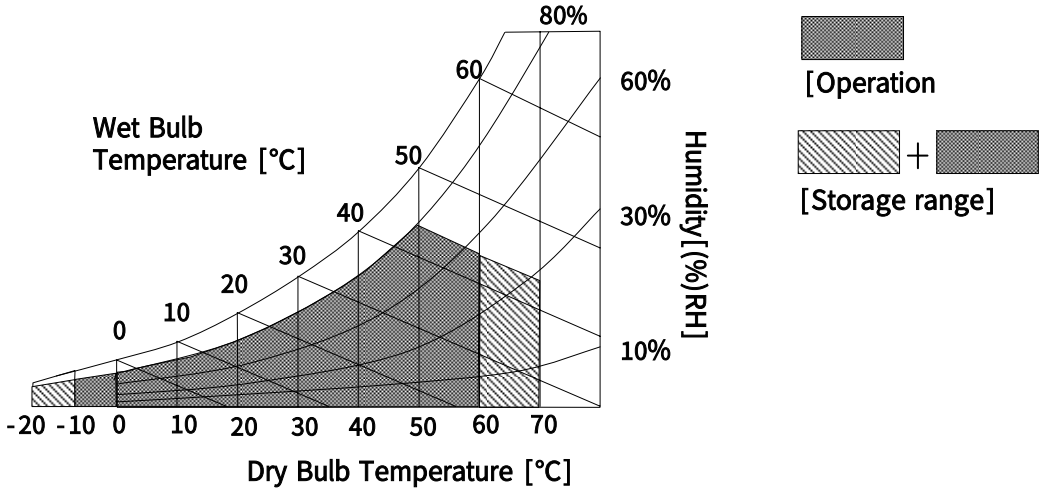
2. Absolute Maximum Ratings

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 functional specification and doesn't guarantee all the contents of Electro-optical specification.
[Note 2-6] Ambient temperature when the backlight is lit (reference value).



3. Electrical Specifications

3-1. Electrical Characteristics

The LB104S02 requires two power inputs. CN1 is employed to power the LCD electronics and to drive the TFT array and liquid crystal. CN2 input which powers the CCFL, is typically generated by one inverter. The inverters are external unit to the LCD.

Table 2. ELECTRICAL CHARACTERISTICS(TFT-LCD PANEL DRIVING SECTION)

$(T_a = 25^{\circ}C)$

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			AVDD	8.32	9.32	10.32	V	
Gate Driver	TFT	Hi	VGH	16.55	17.55	18.55	V	
		Lo	VGL		-4.99		V	
Gamma Correction Voltage		DC	V1 ~ V7	0.4AVDD	-	AVDD-0.1	V	
			V8 ~ V14	0.1	-	0.6AVDD		
Color Filter Substrate Voltage		DC	VCOM	3.6	3.9	4.1	V	
Source Driver Supply Current			IDD	-	38	50.0	mA	AVDD =9.32V
Logic Supply Current			ICC	-	5	20.0	mA	VCC = 3.3V
Gate Driver High Supply Current			IGH	-	0.80	2	mA	VGH = 17.55V
Gate Driver Low Supply Current			IGL	-	0.32	1	mA	VGL =-4.99V

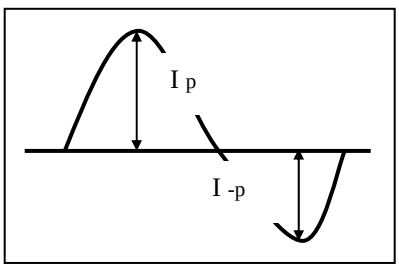
***** Cautionary Matter : When applying or disconnecting power, please be sure that such action is sequentially carried out for all power supplies. In addition, apply input signals only after power has been turned on.

[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.

Table 3. ELECTRICAL CHARACTERISTICS(CCFL DRIVING SECTION) T_a=25℃

Parameter		Symbol	Values			Unit	Notes
			Min	Typ	Max		
Operating Voltage		V_{BL}	720	800	880	V_{RMS}	1
Operating Current		I_{BL}	6.0	6.5	7.0	mA_{RMS}	2
Power Consumption		P_{BL}	-	5.2	5.8	W	3
Operating Frequency		f_{BL}	40	60	80	kHz	4
Discharge Stabilization Time		Ts	-	-	3	Min	5
Life Time			20,000	-	-	Hrs	6
Established Starting Voltage	at 25℃	Vs	-	-	1,500	V_{RMS}	7
	at -10 ℃		-	-	2,200	V_{RMS}	

1. The used lamp current is the lamp typical current.
2. The typical operating current is 6.5 mArms for the typical surface luminance (L_{WH}) in optical characteristics.
3. The lamp power consumption shown above does not include loss of external inverter.
   The used lamp current is the lamp typical current.($P_{BL} = V_{BL} \times I_{BL}$)
4. 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.
5. 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%.
6. 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
7. The voltage above Vs should be applied to the lamp for more than 1 second for start-up, Otherwise, the lamp may not be turned on, The used lamp current is the lamp typical current.
8. 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 (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 (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
1	POL	Polarity selection
2	STVD	Vertical start pulse input when U/D=H
3	OEV	Output enable
4	CKV	Vertical clock
5	STVU	Vertical start pulse input when U/D=L
6	GND	Power ground
7	EDGSL	Select rising edge or falling edge
8	VCC	Power supply for digital circuit
9	V9	Gamma voltage level 9
10	VGL	Gate OFF voltage
11	V2	Gamma voltage level 2
12	VGH	Gate ON voltage
13	V6	Gamma voltage level 6
14	U/D	Up/down selection
15	VCOM	Common voltage
16	GND	Power ground
17	AVDD	Power supply for analog circuit
18	V14	Gamma voltage level 14
19	V11	Gamma voltage level 11
20	V8	Gamma voltage level 8
21	V5	Gamma voltage level 5
22	V3	Gamma voltage level 3
23	GND	Power ground
24	R5	Red data(MSB)
25	R4	Red data
26	R3	Red data
27	R2	Red data
28	R1	Red data
29	R0	Red data(LSB)
30	GND	Power ground

Pin No.	Symbol	Description
31	GND	Power ground
32	G5	Green data(MSB)
33	G4	Green data
34	G3	Green data
35	G2	Green data
36	G1	Green data
37	G0	Green data(LSB)
38	STHL	Horizontal start pulse input when R/L=L
39	REV	Control signal are inverted or not
40	GND	Power ground
41	DCLK	Sample clock
42	VCC	Power supply for digital circuit
43	STHR	Horizontal start pulse input when R/L=H
44	LD	Latch the polarity of outputs and switches the new data to outputs
45	B5	Blue data(MSB)
46	B4	Blue data
47	B3	Blue data
48	B2	Blue data
49	B1	Blue data
50	B0	Blue data(LSB)
51	R/L	Right/Left selection
52	V1	Gamma voltage level 1
53	V4	Gamma voltage level 4
54	V7	Gamma voltage level 7
55	V10	Gamma voltage level 10
56	V12	Gamma voltage level 12
57	V13	Gamma voltage level 13
58	AVDD	Power supply for analog circuit
59	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.

The backlight interface connector is a model BHSR-02VS-1, manufactured by JST or Compatible.
The mating connector part number is SM02B-BHSS-1 or equivalent.

Table 5. BACKLIGHT CONNECTOR PIN CONFIGURATION (CN2)

Pin	Symbol	Description	Wire Color
1	HV	Power supply for lamp (High voltage side)	Pink
2	LV	Power supply for lamp (Low voltage side)	White

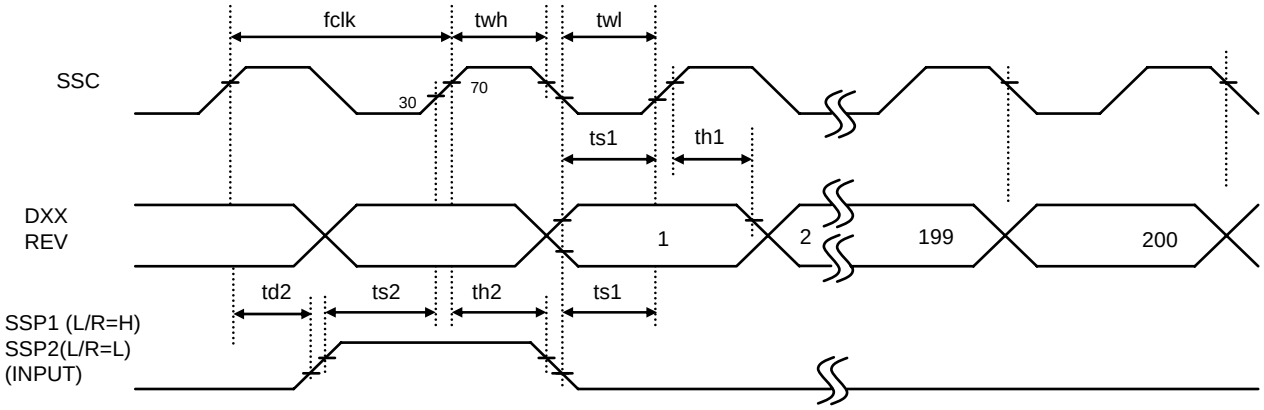
3-3. Signal Timing Specifications

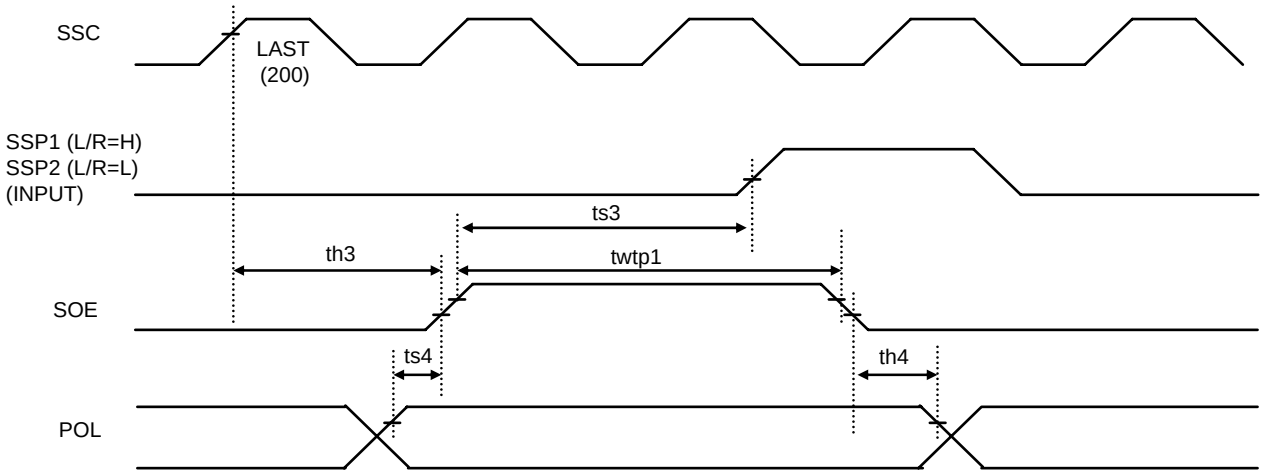
Table 6. Timing Characteristics of input signals

Parameter		Symbol	Min	Typ	Max	Unit	condition
SOURCE	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	
GATE	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	

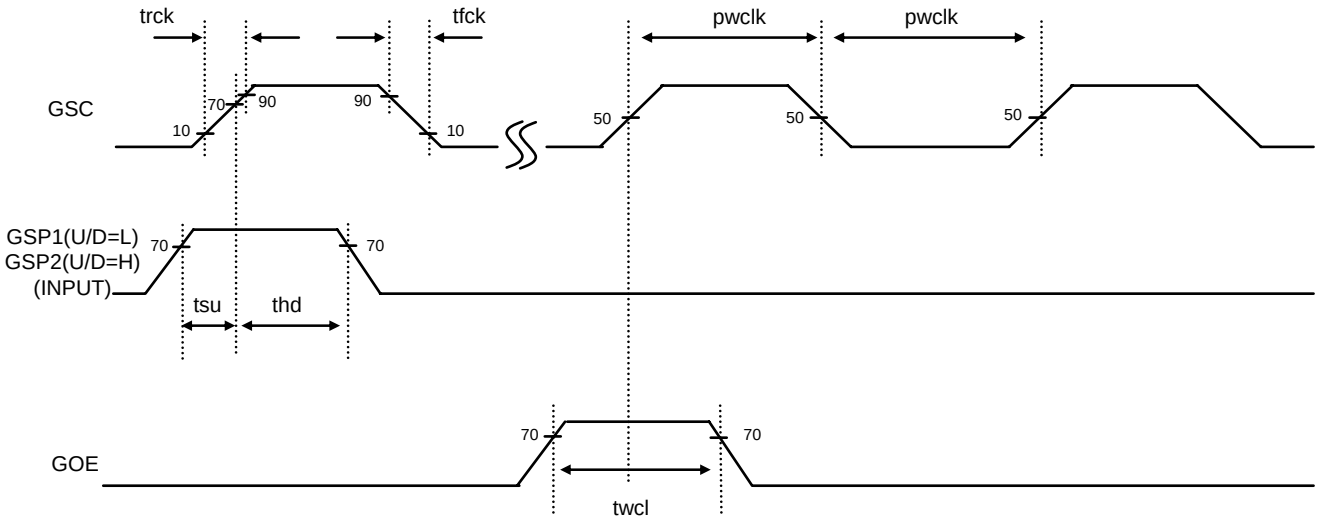
3-4. Timing Diagram

① Source D-IC Timing Diagram





② Gate D-IC Timing Diagram



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 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]

(AVDD=9.32V)

Symbol	Values(Typ)	Unit	Remark
V1	(8.35)	V	[Note 3-3]
V2	(Open)		
V3	(Open)		
V4	(6.59)		
V5	(Open)		
V6	(Open)		
V7	(5.32)		
V8	(3.60)		
V9	(Open)		
V10	(Open)		
V11	(2.37)		
V12	(Open)		
V13	(Open)		
V14	(0.63)		

[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

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

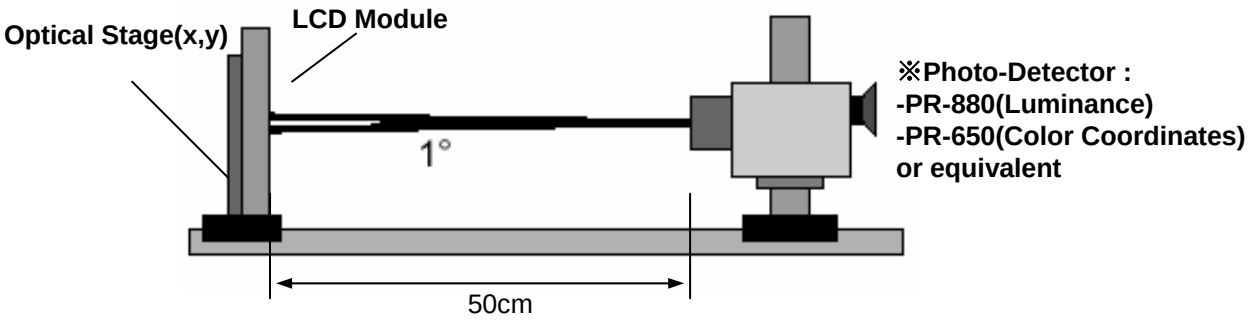


Table 9. OPTICAL CHARACTERISTICS

Ta=25°C, VCC=3.3V, fv=60Hz, f_{CLK}= 50MHz, I_{BL} = 6.5 mA_{RMS}

Parameter		Symbol	Values			Units	Remark
			Min	Typ	Max		
Contrast Ratio		CR	300	400	-		[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	Tr_R	-	6	20	ms	
	Decay Time	Tr_D	-	19	30	ms	
Color Coordinates							[Note 4-2]
	RED	Rx	0.571	0.601	0.631		Reference
		Ry	0.301	0.331	0.361		
	GREEN	Gx	0.277	0.307	0.337		
		Gy	0.551	0.581	0.601		
	BLUE	Bx	0.119	0.149	0.179		
		By	0.093	0.123	0.153		
	WHITE	Wx	0.270	0.300	0.330		
		Wy	0.300	0.330	0.360		
Viewing Angle							[Note 4-5]
	x axis, right(Φ=0°)	Θr	55	65	-	degree	
	x axis, left (Φ=180°)	Θl	55	65	-	degree	
	y axis, up (Φ=90°)	Θu	45	55	-	degree	
	y axis, down (Φ=270°)	Θd	40	50	-	degree	

[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(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.

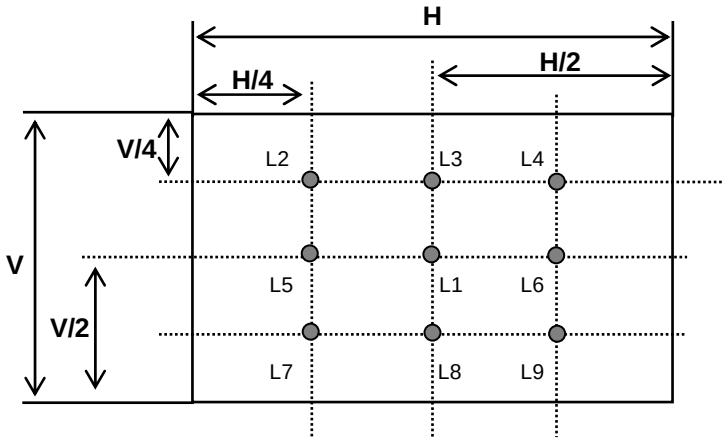
[Note 4-3] Luminance % uniformity is measured for 9 point For more information see FIG 2.
δ WHITE = Maximum(L1,L2, ….. L9) ÷ Minimum(L1,L2, ….. L9)

[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.

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”.

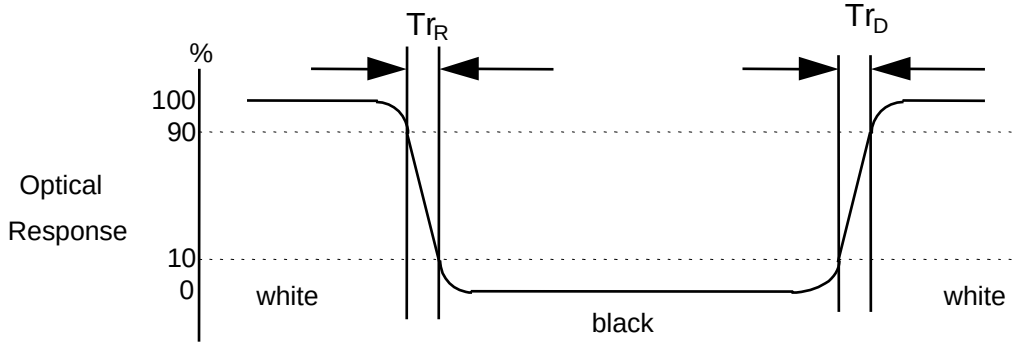
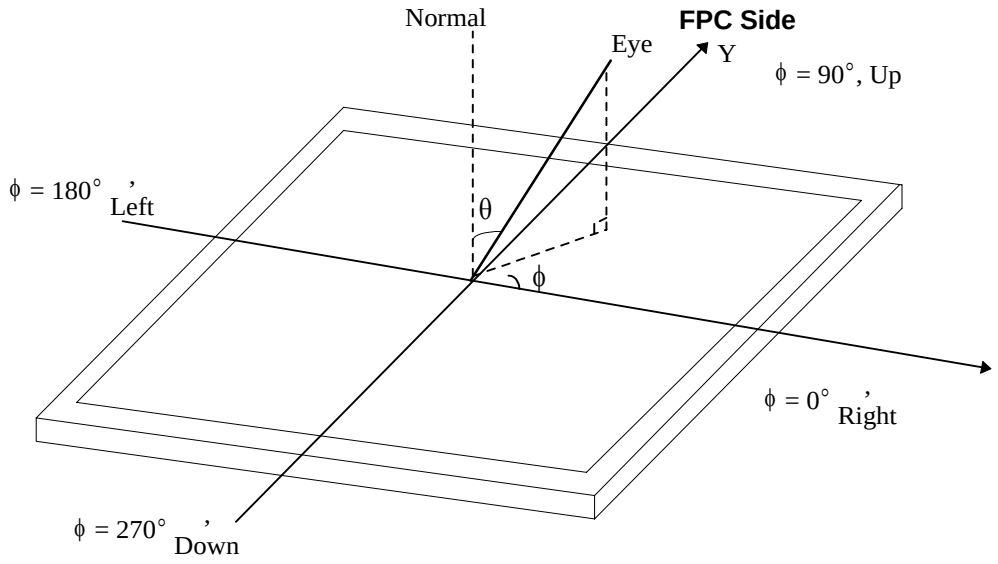


FIG. 4 Viewing angle

<Dimension of viewing angle range>



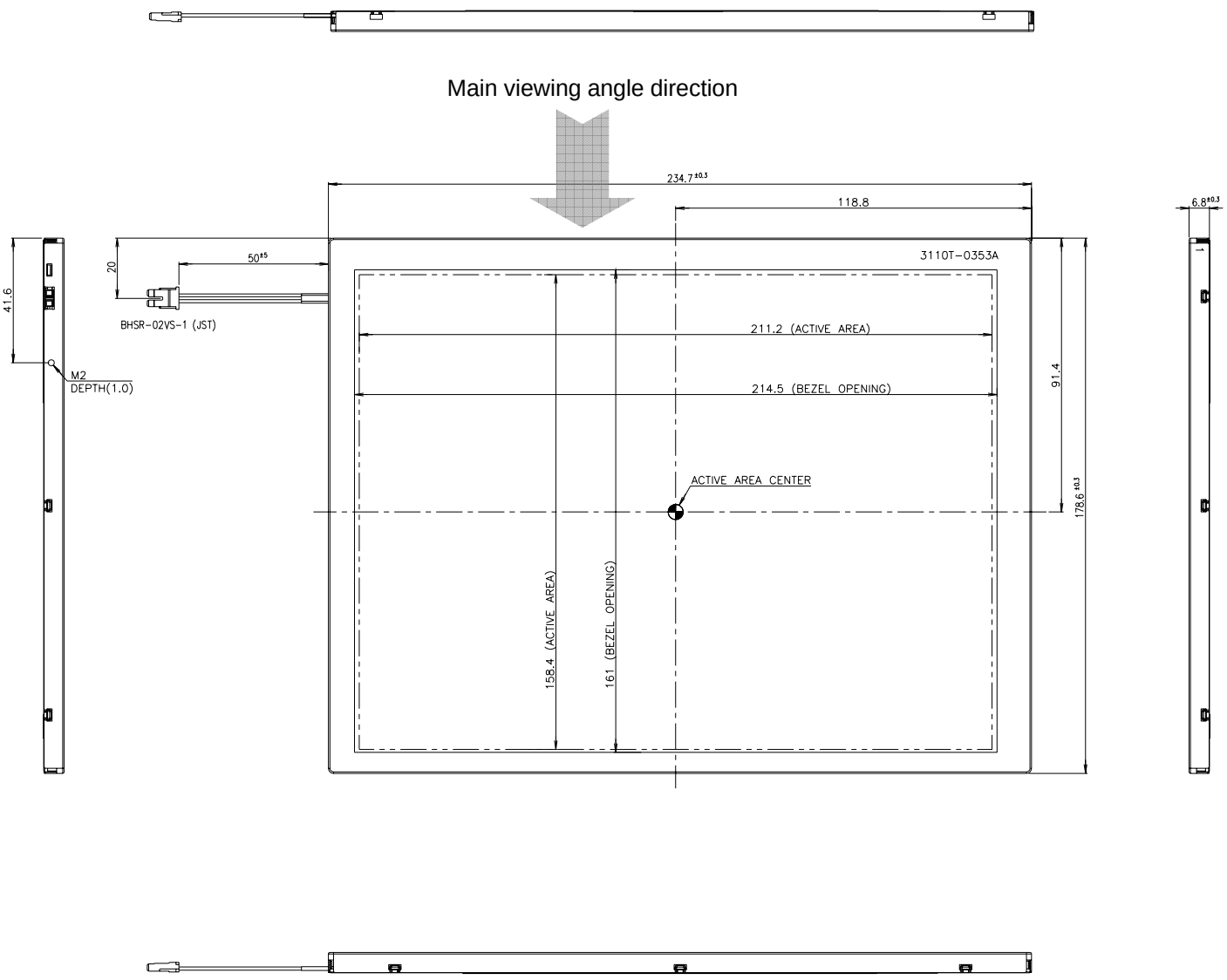
5. Mechanical Characteristics

The contents provide general mechanical characteristics for the model LB104S02. In addition the figures in the next page are detailed mechanical drawing of the LCD.

Outline Dimension	Horizontal	234.7 mm(Typ)
	Vertical	178.6 mm(Typ)
	Depth	6.8 mm (Typ.)
Bezel Area	Horizontal	214.5 mm (Typ.)
	Vertical	161 mm (Typ.)
Active Display Area	Horizontal	211.2 mm (Typ.)
	Vertical	158.4 mm (Typ.)
Weight	420 g(Typ.) / 450 g (Max.)	
Surface Treatment	Anti-glare treatment of the front polarizer	

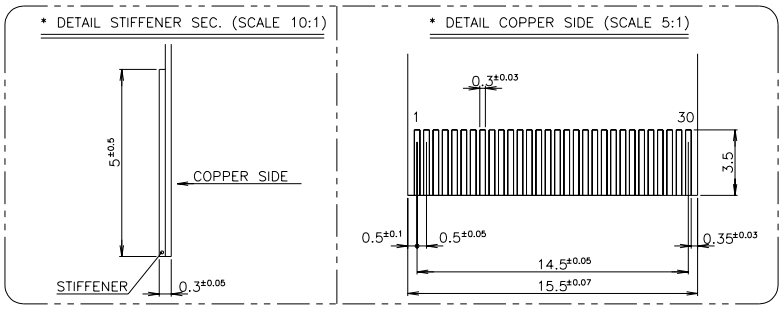
<FRONT VIEW>

Unit:[mm], General tolerance: ± 0.3mm

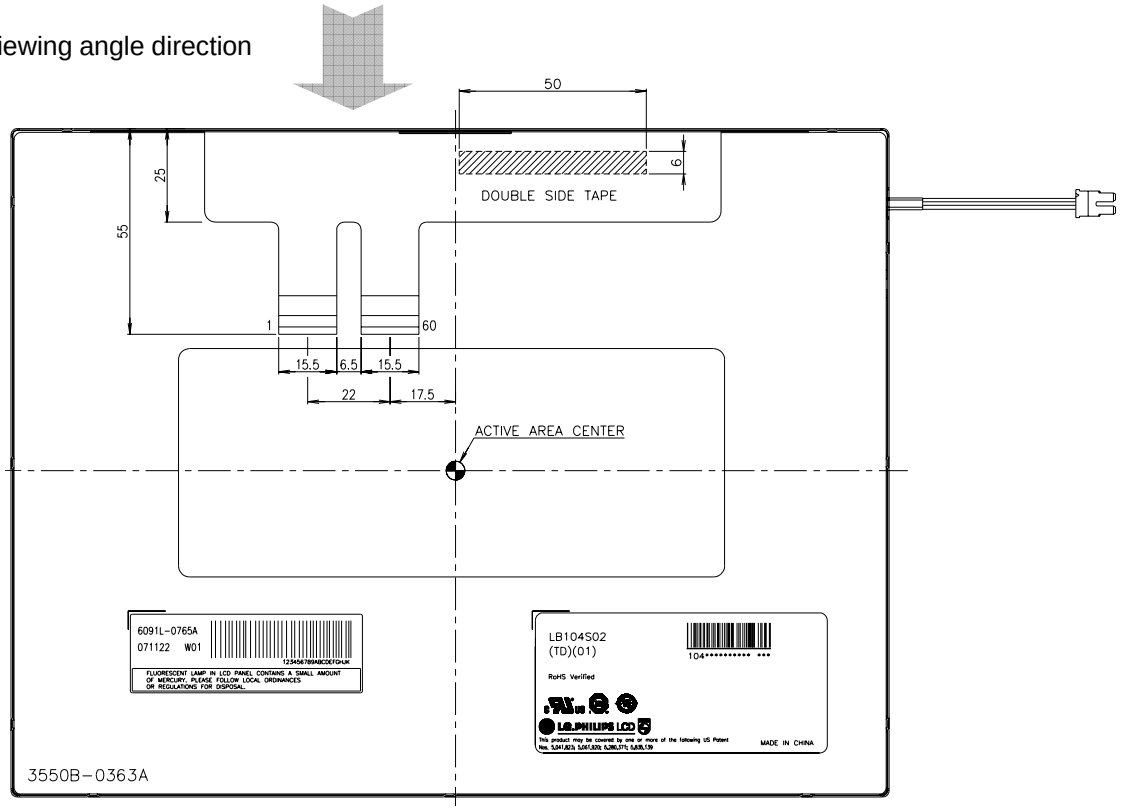


<REAR VIEW>

Unit:[mm], General tolerance: ± 0.3mm



Main viewing angle direction



6. Reliability

No.	Test Items	Test Condition	Remark
1	High Temperature Storage Test	Ta=70℃ 240h	[Note 6-1,2,3]
2	Low Temperature Storage Test	Ta=-20℃ 240h	[Note 6-1,2,3]
3	High Temperature Operation Test	Tp=60℃ 240h	[Note 6-1,2,3]
4	Low Temperature Operation Test	Ta =-10℃ 240h	[Note 6-1,2,3]
5	High Temperature and High Humidity Operation Test	Ta=50℃ 80%RH 240h	[Note 6-1,2,3]
6	Electro Static Discharge Test	-Panel Surface/Top_Case : 150pF, 150Ω (Air : ±15kV , Contact : ±8kV) -FPC input terminal : 100pF ±200V 0Ω	
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, T_p = Panel Surface 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.

{ Result Evaluation Criteria }
1. Evaluation should be tested after storage at room temperature for 24 hours.
2. There should be no change which might affect the practical display function when the display test 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 ~ 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 : 20 pcs

b) Box Size(mm) : 425x246x310

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.
(7) This module is not designed to attach TSP(touch screen panels). If TSP is applied, LPL can't guarantee the 'Ripple' related problems.

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.