



LMT150DNGFWD

LCD Module User Manual

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Rev.	Descriptions	Release Date
0.1	Preliminary	2012-09-10

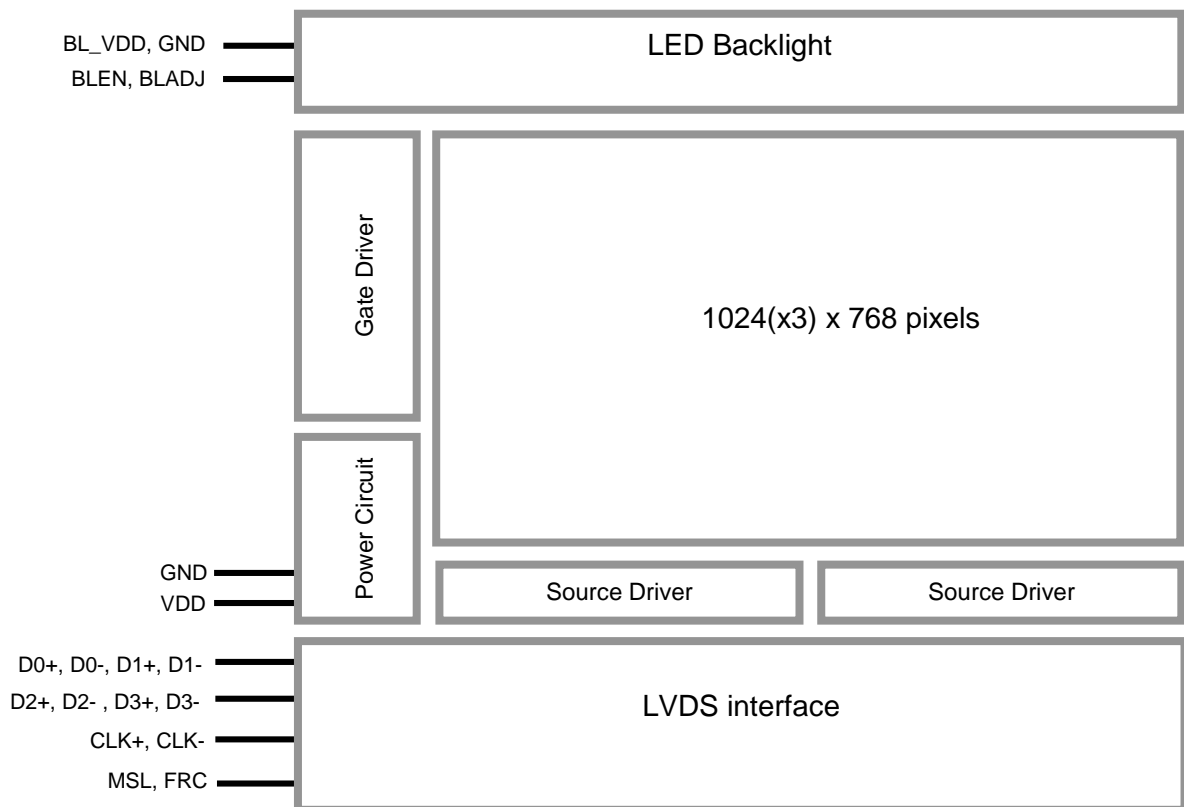
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1. General Specification

Signal Interface :	LVDS
Display Technology :	a-Si TFT active matrix
Display Mode :	Transmissive / Normal White
Color Depth:	16.7M
Screen Size :	15.0 inch (Diagonal)
Outline Dimension :	326.5x253.5x11.8 (mm) (see Outline DWG for details)
Active Area :	304.128x228.096 (mm)
Number of dots :	1024x 3 (RGB) x 768
Dot Pitch :	0.099x0.297 (mm)
Pixel Configuration :	R.G.B. Vertical Stripe
Backlight :	LEDs
Surface Treatment :	Anti-Glare
Logic Supply:	3.3V
Backlight Supply:	12.0V
Operating Temperature :	-20 ~ +70°C
Storage Temperature :	-30 ~ +80°C

2. Block Diagram



3. Input/Output Terminals

3.1 TFT Terminals

Pin No.	Pin Name	IO	Descriptions		
			24Bit LVDS(MAP A)	24Bit LVDS (MAP B)	18Bit LVDS
1	VDD	Power	Power Supply		
2					
3	GND	Power	Ground		
4					
5	D0-	Input	Pixel data	Pixel data	Pixel data
6	D0+	Input	R2~R7,G2	R0~R5,G0	R0~R5,G0
7	GND	Power	Ground		
8	D1-	Input	Pixel data	Pixel data	Pixel data
9	D1+	Input	G3~G7,B2~B3	G1~G5,B0~B1	G1~G5,B0~B1
10	GND	Power	Ground		
11	D2-	Input	Pixel data	Pixel data	Pixel data
12	D+	Input	B4~B7,DE	B2~B5,DE	B2~B5,DE
13	GND	Power	Ground		
14	CLK-	Input	Pixel clock		
15	CLK+	Input			
16	GND	Power	Ground		
17	D3-	Input	R0~R1,G0~G1,B0~B1	R6~R7,G6~G7,B6~B7	Ground
18	D3+	Input			
19	MSL	Input	MSL=1	MSL=0,or open	MSL=1
20	FRC	Input	FRC=0	FRC=0	FRC=1,or open

3.2 BackLight Terminals

Pin No.	Pin Name	IO	Descriptions
1	BL_VDD	Power	Positive Power Supply(12.0V)
2	GND	Power	Power Supply GND (0V)
3	BLEN	Input	Backlight Driver Control(*1) BLEN=Hi, Backlight Driving Booster enable BLEN=Lo, Backlight Driving Booster disable
4	BLADJ	Input	Backlight dimming control PWM may be used to adjust the output brightness
5	NC	-	No Connection

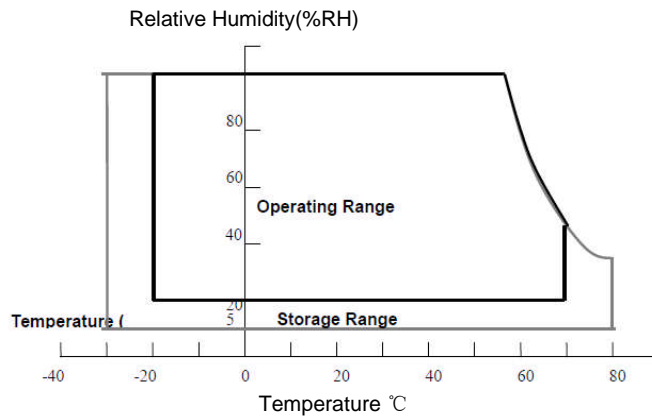
4. Absolute Maximum Ratings

GND=0V, T_{OP}=25°C

Items	Symbol	Min.	Max.	Unit	Condition
Power Voltage	VDD	-0.3	+4.0	V	GND = 0V
Input voltage	V _{IN}	-0.3	+4.0	V	GND= 0V
Operating Temperature	T _{OP}	-20	+70	°C	No Condensation
Storage Temperature	T _{ST}	-30	+80	°C	No Condensation

Note1: V_{IN} represent D0±, D1±, D2±, D3±, CLK±

Note2: Recommended Temperature/Humidity Graph as follow



5. Electrical Characteristics

5.1 Driving TFT LCD Panel

GND=0V, VDD=3.3V, T_{OP}=25°C

Items	Symbol	MIN.	TYP.	MAX.	Unit	Note
Power supply voltage	VDD	3.0	3.3	3.6	V	*1
Power supply current	IDD	-	500	550	mA	
Permissible ripple voltage	VRP	-	-	100	mV	
Differential input voltage	Vid	250	-	400	mV	
Differential input threshold voltage for LVDS receiver	VTL	-100	-	-	mV	VCM=1.25V,*2
	VTH	-	-	100	mV	
Input voltage width for LVDS receiver	V _i	0	-	1.9	V	
Terminating resistor	RT	-	100	-	Ω	
Rush current	I _{rush}	-	-	1.5	A	
Input voltage for MSL signals	High	VFH	2.0	-	VCC	V
	Low	VFL	0	-	0.4	V

*1: All black pattern

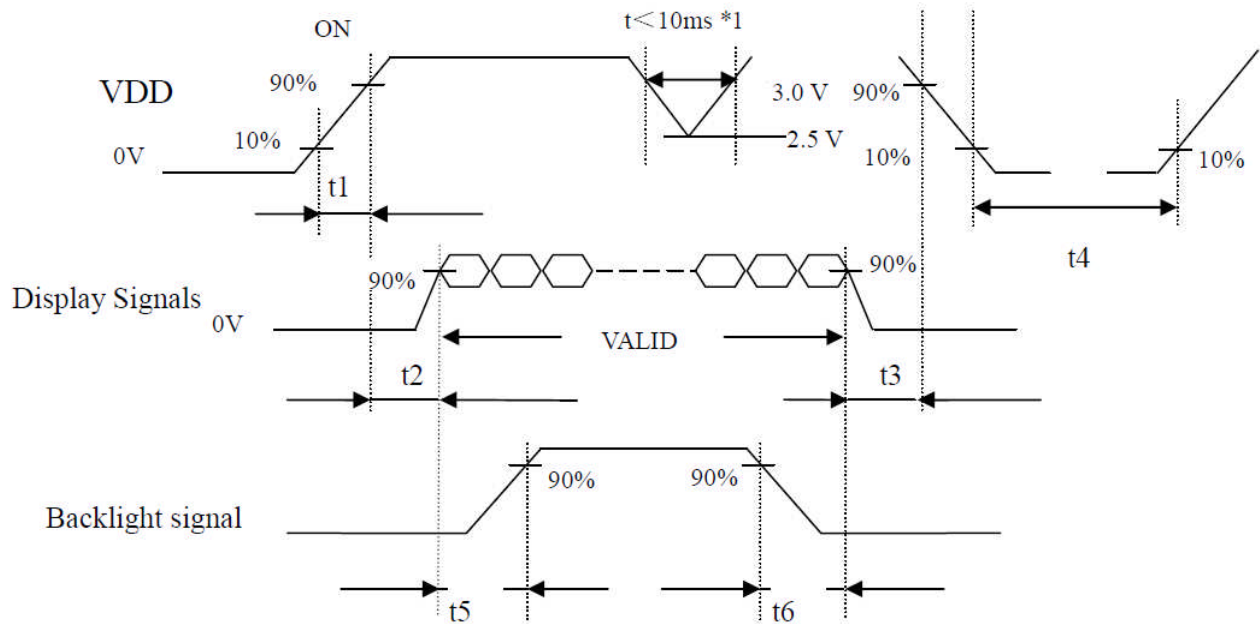
*2: Common mode voltage for LVDS receiver

5.2 LED Backlight Characteristics

Parameter	Symbol	MIN.	TYP.	MAX.	Unit	Note
Power supply voltage	BL_VDD	10.8	12.0	12.6	V	
Power supply current	BL_IDD	-	750	-	mA	
Light bar life time	Hr	50000	-	-	Hr	
Input voltage for PWM signal	High	2.0	-	5.0	V	
	Low	0	-	0.4	V	
Input voltage for BRTC signal	High	2.0	-	5.0	V	
	Low	0	-	0.4	V	
PWM frequency	Fpwm	200	-	20K	Hz	
PWM pulse width	Tpwm	10	-	-	us	

*1: The operating lifetime is mean time to half-luminance. In case the product works under low temperature environment, the lifetime becomes short.

5.3 Power supply voltage Sequence



Timing: $t_1: 0.5ms < t_1 < 10ms$; $t_2: 0.5 ms < t_2 < 50ms$; $t_3: 0ms < t_3 < 50ms$; $t_4: t_4 > 1000ms$; $t_5: t_5 > 200ms$; $t_6: t_6 > 200ms$;

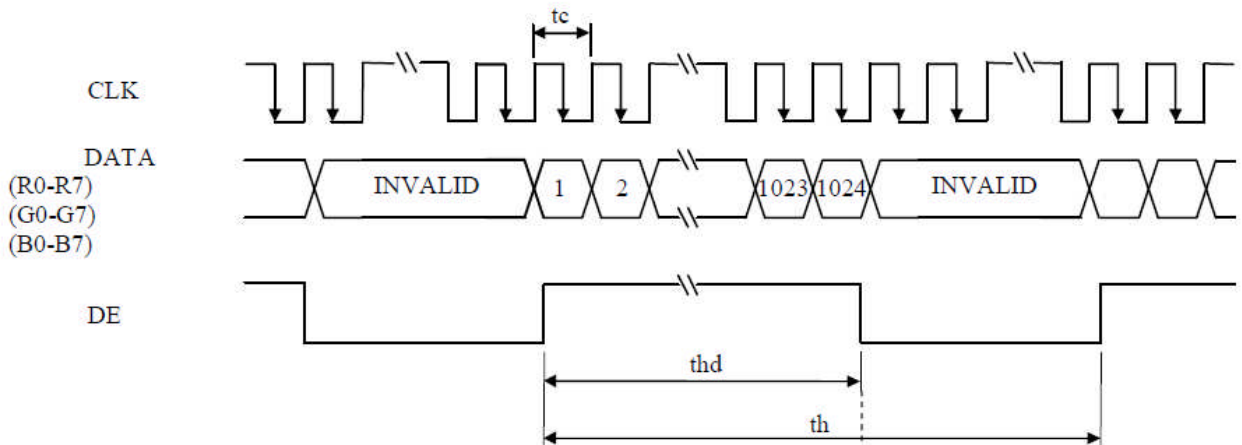
6. AC Characteristics

6.1 Timing Characteristics

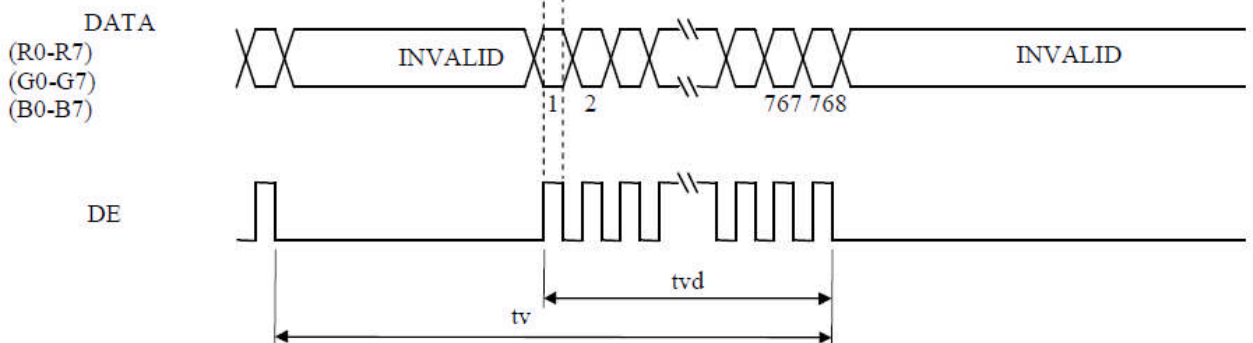
Parameter		Symbol	min.	typ.	max.	Unit	Remarks
Clock	Frequency	1/tc	50	65.0	81.25	MHz	15.384ns (typ.)
		tc	20	15.4	12.31	ns	
Horizontal signals	Cycle	th	16.54	20.68	25.77	μs	48.36kHz (typ.)
			1150	1344	1800	CLK	
	Display period	thd	1024				-
Vertical signals	Cycle	tv	13.1	16.67	20	ms	60.0Hz(typ.)
			776	806	1023	H	
	Display period	tvd	768				-

6.2 Input signal timing chart

Horizontal timing



Vertical timing



7. Optical Characteristics

Parameter Note 1		Condition	Symbol	min.	typ.	max.	Unit	Remarks
Luminance		White at center $\theta R=0^\circ, \theta L=0^\circ$ $\theta U=0^\circ, \theta D=0^\circ$	L	350	400	-	cd/ m	Note1
Contrast ratio		White/Black at center $\theta R=0^\circ, \theta L=0^\circ,$ $\theta U=0^\circ, \theta D=0^\circ$	CR	400	600	-	-	Note1,3
Luminance uniformity		White $\theta R=0^\circ, \theta L=0^\circ, \theta U=0^\circ, \theta D=0$	LU	-	1.25	1.33	-	Note1,6
Chromaticity	White	X coordinate	Wx	0.283	0.313	0.343	-	Note1,5
		Y coordinate	Wy	0.299	0.329	0.359	-	
	Red	X coordinate	Rx	0.601	0.631	0.661	-	
		Y coordinate	Ry	0.325	0.355	0.385	-	
	Green	X coordinate	Gx	0.314	0.344	0.374	-	
		Y coordinate	Gy	0.578	0.608	0.638	-	
	Blue	X coordinate	Bx	0.123	0.153	0.183	-	
		Y coordinate	By	0.057	0.087	0.117	-	
Color gamut		$\theta R=0^\circ, \theta L=0^\circ, \theta U=0, \theta D=0$ At center,against NTSC	C	50	60	-	%	
Response time		White to black	Ton	-	3	5	ms	Note4
		Black to white	Toff	-	5	7	ms	
		Ton+ Toff	-	-	8	12	ms	
Viewing angle	Right	$CR \geq 10$	θR	70	80	-	°	Note7
	Left	$CR \geq 10$	θL	70	80	-	°	
	Up	$CR \geq 10$	θU	70	80	-	°	
	Down	$CR \geq 10$	θD	70	80	-	°	

Note:

The value above are initial Characteristics Value.

Note 1:

The data are measured after LEDs are turned on for 5 minutes. LCM displays full white. The brightness is the average value of 9 measured spots. Measurement equipment SR-3A (1°)

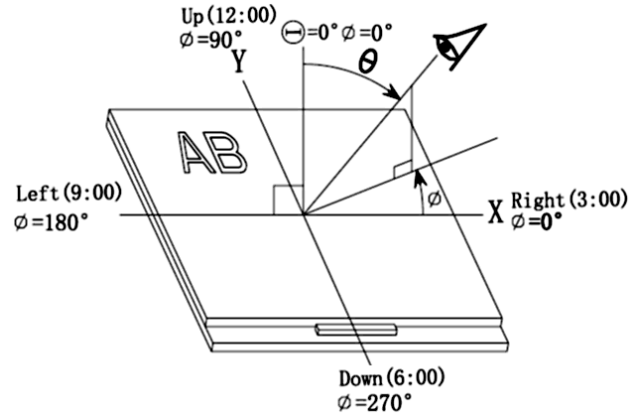
Measuring condition:

- Measuring surroundings: Dark room
- Measuring temperature: Ta=25°C.
- Adjust operating voltage to get optimum contrast at the center of the display.

Note 2:

The definition of viewing angle:

Refer to the graph below marked by θ and ϕ



Note 3:

The definition of contrast ratio (Test LCM using SR-3A (1°)):

$$\text{Contrast Ratio (CR)} = \frac{\text{Luminance When LCD is at "White" state}}{\text{Luminance When LCD is at "Black" state}}$$

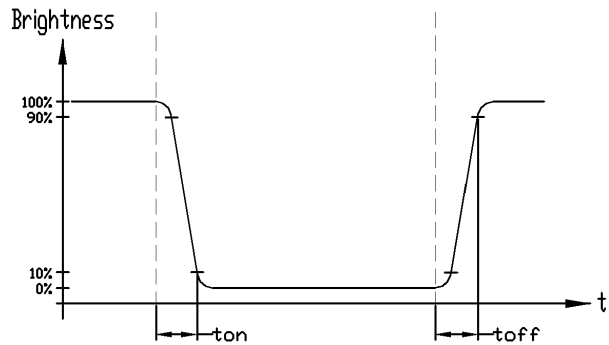
(Contrast Ratio is measured in optimum common electrode voltage)

Note 4:

Definition of Response time. (Test LCD using BM-7A(2°)):

The output signals of photo detector are measured when the input signals are changed from "black" to "white"(falling time) and from "white" to "black"(rising time), respectively.

The response time is defined as the time interval between the 10% and 90% of amplitudes. Refer to figure as below.

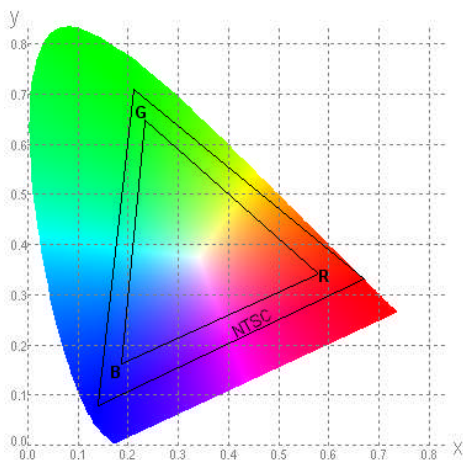


Note 5:

Definition of Color of CIE1931 Coordinate and NTSC Ratio.

Color gamut:

$$S = \frac{\text{Area of RGB triangle}}{\text{Area of NTSC triangle}} \times 100\%$$



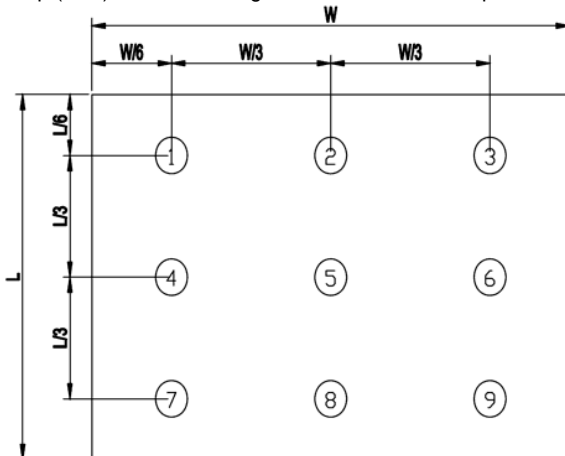
Note 6:

The luminance uniformity is calculated by using following formula.

$$\Delta Bp = Bp (\text{Min.}) / Bp (\text{Max.}) \times 100 (\%)$$

Bp (Max.) = Maximum brightness in 9 measured spots

Bp (Min.) = Minimum brightness in 9 measured spots.



Note 7:

Measured the luminance of white state at center point

8. Precautions of using LCD Modules

Mounting

- Mounting must use holes arranged in four corners or four sides.
- The mounting structure so provide even force on to LCD module. Uneven force (ex. Twisted stress) should 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.
- It is suggested to attach a transparent protective plate to the surface in order to protect the polarizer. It should have sufficient strength in order to the resist external force.
- The housing should adopt radiation structure to satisfy the temperature specification.
- 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.
- Do not touch, push or rub the exposed polarizers with glass, tweezers or anything harder than HB pencil lead. Never rub with dust clothes with chemical treatment. Do not touch the surface of polarizer for bare hand or greasy cloth.(Some cosmetics deteriorate the polarizer.)
- When the surface becomes dusty, please wipe gently with absorbent cotton or other soft materials like chamois soaks with petroleum benzine. 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.
- Wipe off saliva or water drops as soon as possible. Their long time contact with polarizer

Operating

- The spike noise causes the mis-operation of circuits. It should be within the $\pm 200\text{mV}$ level (Over and under shoot voltage)
- Response time depends on the temperature.(In lower temperature, it becomes longer.)
- 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.
- 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.
- When fixed patterns are displayed for a long time, remnant image is likely to occur.
- 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

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.

Strong Light Exposure

Strong light exposure causes degradation of polarizer and color filter.

Storage

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

- 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.
- 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.

Protection Film

- 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.
- 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.
- 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.
- 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.

Transportation

The LCD modules should be no falling and violent shocking during transportation, and also should avoid excessive press, water, damp and sunshine.