

**PRODUCTION SPECIFICATION  
OF LCD MODULE  
MODULE NO.: L024HVV04-B1387A**

<b>Customer Name:</b>			
<b>Customer Part Number:</b>			
<b>Approved By:</b>		<b>Date:</b>	

<b>Prepared By</b>	<b>Checked By</b>	<b>Approved By</b>

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## Revision History

Rev	Issued Date	Description	Page	Editor
1.0	Aug.20, 2019	First release	All	

## 1 General Specifications

	Feature	Specifications
<b>Display Spec.</b>	LCD type	2.4 inch
	Resolution (H*V)	320(RGB)×480
	Technology Type	a-Si TFT
	Pixel Configuration	R.G.B. Vertical Stripe
	Display Mode	Transmissive / Normally Black
	Surface Treatment	Glare
	Viewing Direction	ALL
<b>Mechanical Characteristics</b>	OutlineDimensions (W x H x T) (mm)	38.9*61.3*2.1
	Active Area(mm)	32.8*49.68
	With /Without Touch screen	Without CTP
	Match Connector	0.5pitch, 30pin
	Backlight Type	White LED
	Weight (g)	TBD
<b>Electrical Characteristics</b>	Interface	MIPI
	Number of color	16.7M
	Driver IC	ST7701S

## 2 Pin Assignment

NO.	PIN NAME	Description
1	LEDA	LED anode
2	LEDK1	LED Cathode
3	LEDK2	LED Cathode
4	VCI	Power Supply 2.8V
5	IOVCC	Power Supply 1.8V-2.8V
6	RESET	LCM reset signals
7	TE	Tearing effect output
8	PWM	The PWM frequency output for LCD driver control.
9	GND	Ground
10	D0P	DSI-D0+ data signals
11	D0N	DSI-D0- data signals
12	GND	Ground
13	D1P	DSI-D1+ data signals
14	D1N	DSI-D1- data signals
15	GND	Ground
16	CLKP	DSI-Clock+
17	CLKN	DSI-Clock-
18	GND	Ground
19	NC	
20	NC	
21	GND	Ground
22	NC	
23	NC	
24	GND	Ground
25	TP_INT	Touch Interrupt
26	TP_SDA	Touch IIC Data signal
27	TP_SCL	Touch IIC Clock signal
28	TP_RESET	Touch Reset Signal
29	TP_VCI	Touch Power supply
30	TP_IOVCC	Touch Power supply

### 3 Absolute Maximum Ratings

GND=0V, Ta= 25°C

Item	Symbol	Value	Unit
Power supply voltage for logic	V <sub>DD</sub>	0.3~3.6	V
Input voltage	V <sub>in</sub>	V <sub>DD</sub> +0.3	V
Operating temperature	T <sub>opr</sub>	-20 to 70	°C
Storage temperature	T <sub>stg</sub>	-30 to 80	°C

### 4 Electrical Characteristics

#### 4.1 Driving TFT LCD Panel

GND=0V, Ta=25°C

Item	Symbol	Min	Type	Max	Unit	Test condition
Operating voltage	V <sub>DD</sub>	2.6	2.8	3.6	V	-
Supply current	I <sub>DD</sub>	-		50	mA	V <sub>DD</sub> =2.8V, Ta=25°C
Input voltage	V <sub>IH</sub>	0.8V <sub>DD</sub>	-	V <sub>DD</sub>	V	-
	V <sub>IL</sub>	0	-	0.2V <sub>DD</sub>	V	
Input leakage current	I <sub>IL</sub>	-1.0	-	1.0	μA	V <sub>IN</sub> =V <sub>DD</sub> or V <sub>SS</sub>

Note: Voltage greater than above may damage the module.

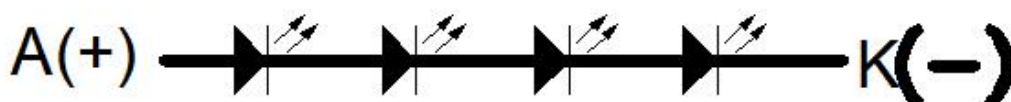
All voltages are specified relative to V<sub>SS</sub>=0V.

#### 4.2 Driving Backlight

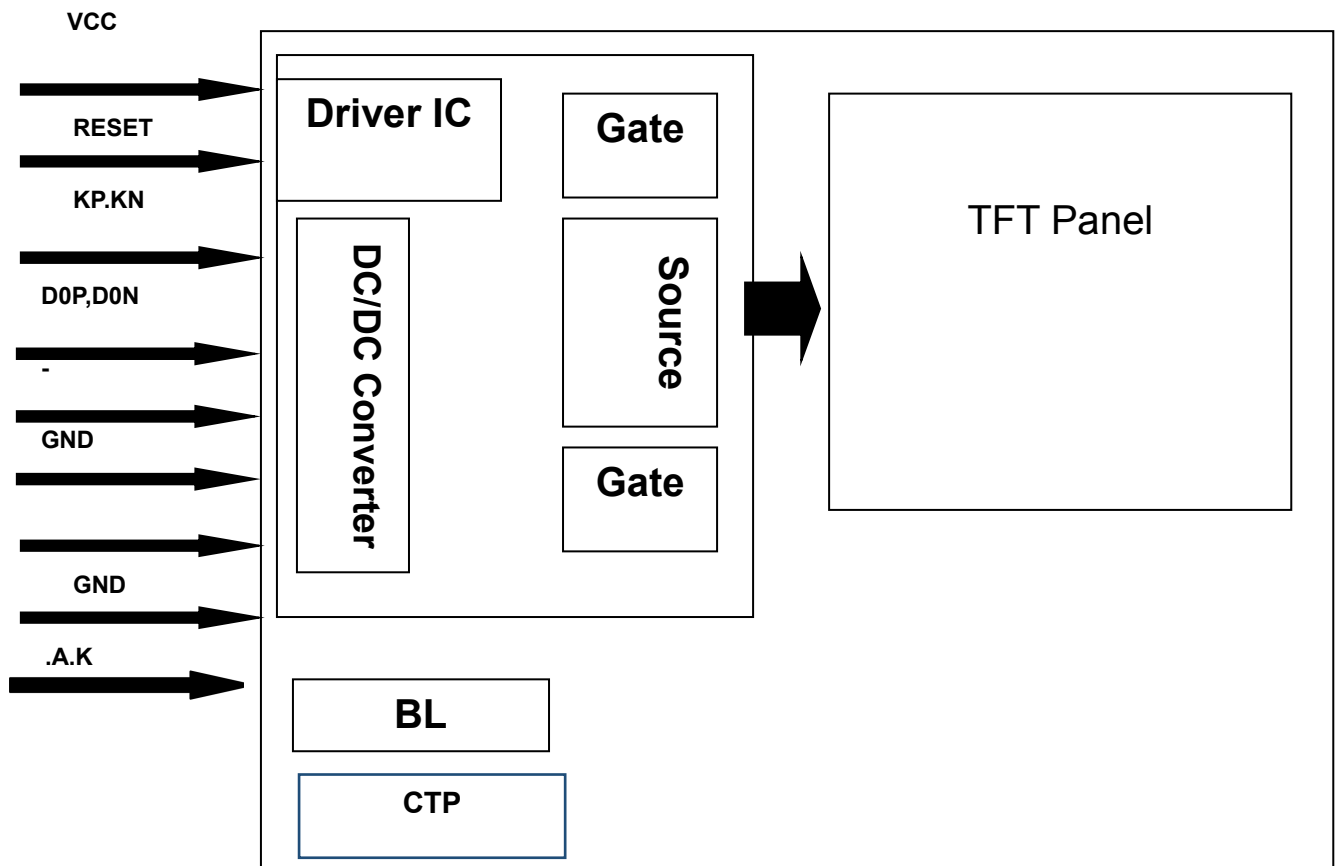
Ta=25°C

Item	Symbol	Min	Typ	Max	Unit	Remark
Forward Current	I <sub>F</sub>	--	20	22	mA	
Forward Voltage	V <sub>F</sub>	-	12.8	-	V	
Connection mode	P	--	4Series	--		
LED number	/		4		pcs	

Note1: Optical performance should be evaluated at Ta=25°C only .If LED is driven by high current, high ambient temperature & humidity condition. The life time of LED will be reduced. Operating life means brightness goes down to 50% initial brightness. Typical operating life time is estimated data.



### 4.3 Block Diagram



## 5 INTERFACE TIMING

### 5.1 System Bus Read/Write Characteristics.

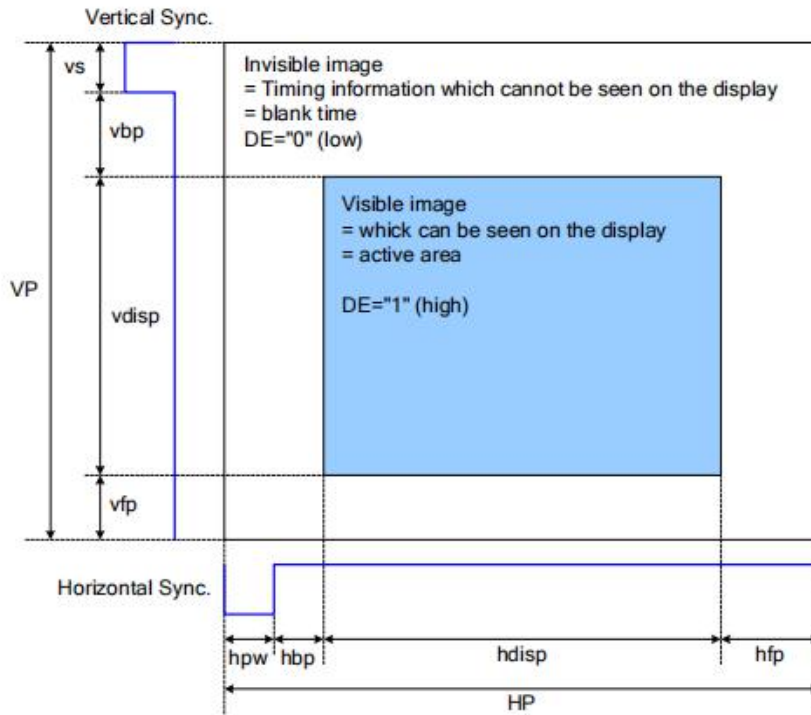


Figure 22 Access Area by RGB Interface

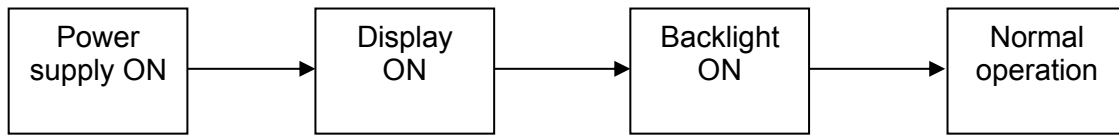
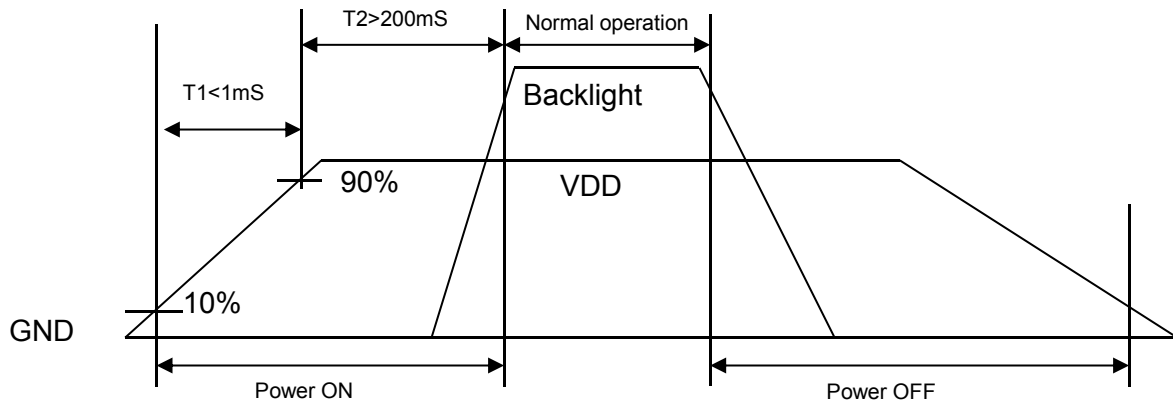
Please refer to the following table for the setting limitation of RGB interface signals.

Parameter	Symbol	Min.	Typ.	Max.	Unit
Horizontal Sync. Width	hbw	1	-	255	Clock
Horizontal Sync. Back Porch	hbp	1	--	255	Clock
Horizontal Sync. Front Porch	hfp	1	--	-	Clock
Vertical Sync. Width	vs	1	--	254	Line
Vertical Sync. Back Porch	vbp	1	--	254	Line
Vertical Sync. Front Porch	vfp	2	--	--	Line

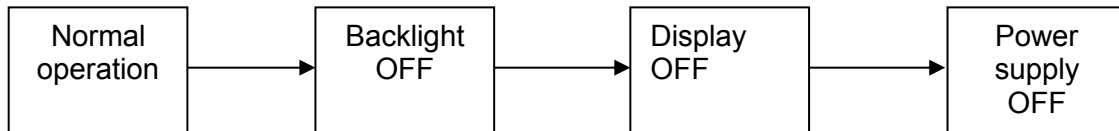
Note:

1. Typical value are related to the setting frame rate is 60Hz.

**5.2 Power ON/OFF Timing**



Power ON sequence



Power OFF sequence

## 6 Optical Characteristics

Ta=25°C

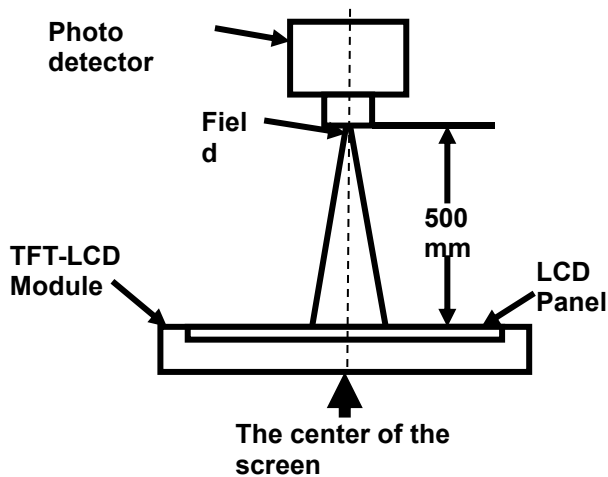
Item	Symbol	Condition	Min	Typ	Max	Unit	Remark
View Angles	$\theta T$	$CR \geq 10$	-	80	-	Degree	Note 2
	$\theta B$		-	80	-		
	$\theta L$		-	80	-		
	$\theta R$		-	80	-		
Contrast Ratio	CR	$\theta=0^\circ$	1000	1500	-	-	Note1 Note3
Response Time	$T_{ON}$	25°C	-	30	40	ms	Note1 Note4
	$T_{OFF}$						
Uniformity	U	-	80	85	-	%	Note1 Note6
NTSC	-	-	-	70	-	%	Note 5
Luminance	L		280	350	-	cd/m <sup>2</sup>	Note1 Note7

Test Conditions:

1.  $V_F=12.8V$ ,  $I_F=20mA$ , the ambient temperature is 25°C.
2. The test systems refer to Note 1 and Note 2.

**Note 1: Definition of optical measurement system.**

The optical characteristics should be measured in dark room. After 5 minutes operation, the optical properties are measured at the center point of the LCD screen. All input terminals LCD panel must be ground when measuring the center area of the panel.



Item	Photo detector	Field
Contrast Ratio	SR-3A	1°
Luminance		
Chromaticity		
Lum Uniformity	BM-7A	2°
Response Time		

**Note 2: Definition of viewing angle range and measurement system.**

viewing angle is measured at the center point of the LCD by CONOSCOPE(ergo-80).

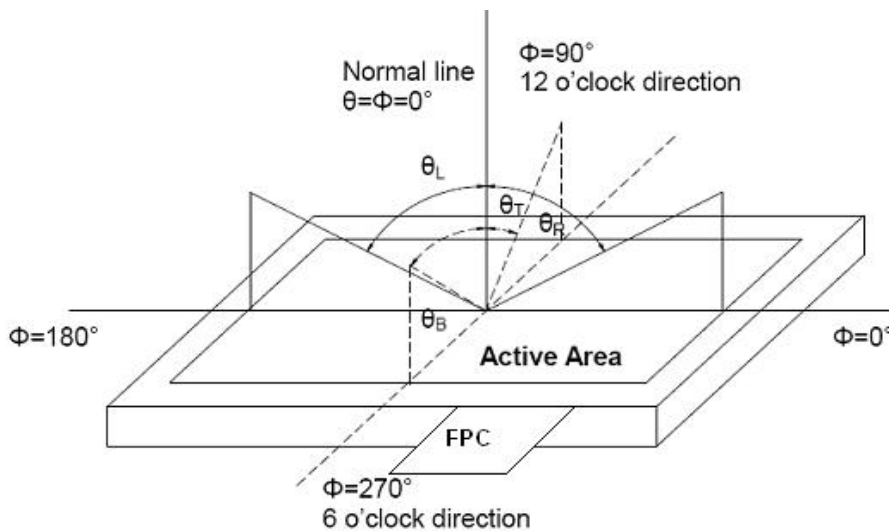


Fig. 1 Definition of viewing angle

**Note 3: Definition of contrast ratio**

$$\text{Contrast ratio (CR)} = \frac{\text{Luminance measured when LCD is on the "White" state}}{\text{Luminance measured when LCD is on the "Black" state}}$$

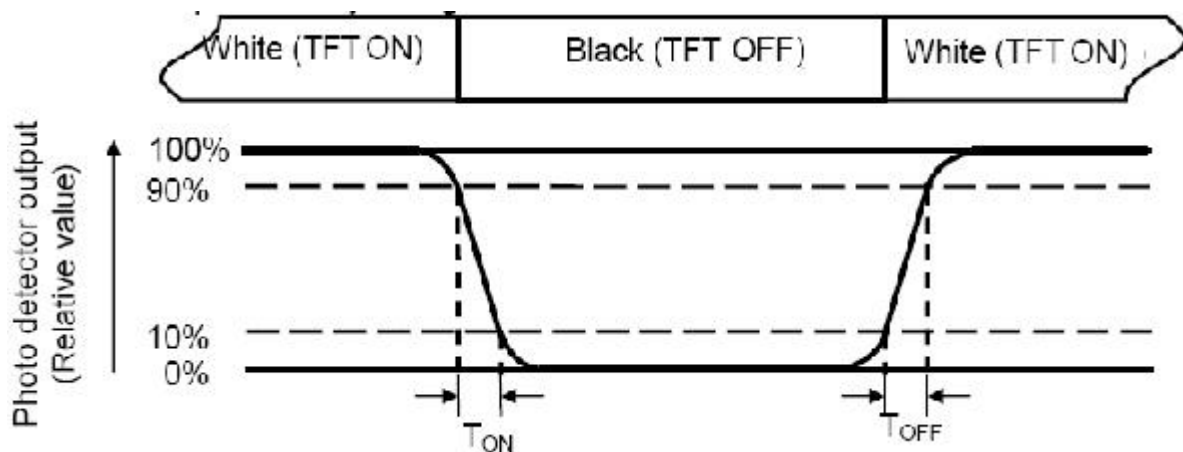
“White state “:The state is that the LCD should be driven by  $V_{\text{white}}$ .

“Black state”: The state is that the LCD should be driven by  $V_{\text{black}}$ .

$V_{\text{white}}$ : To be determined     $V_{\text{black}}$ : To be determined.

**Note 4: Definition of Response time**

The response time is defined as the LCD optical switching time interval between “White” state and “Black” state. Rise time ( $T_{\text{ON}}$ ) is the time between photo detector output intensity changed from 90% to 10%. And fall time ( $T_{\text{OFF}}$ ) is the time between photo detector output intensity changed from 10% to 90%.

**Note 5: Definition of color chromaticity (CIE1931)**

Color coordinates measured at center point of LCD.

**Note 6: Definition of Luminance Uniformity**

Active area is divided into 9 measuring areas (Refer Fig. 2). Every measuring point is placed at the center of each measuring area.

Luminance Uniformity (U) =  $L_{min} / L_{max}$

L-----Active area length W----- Active area width

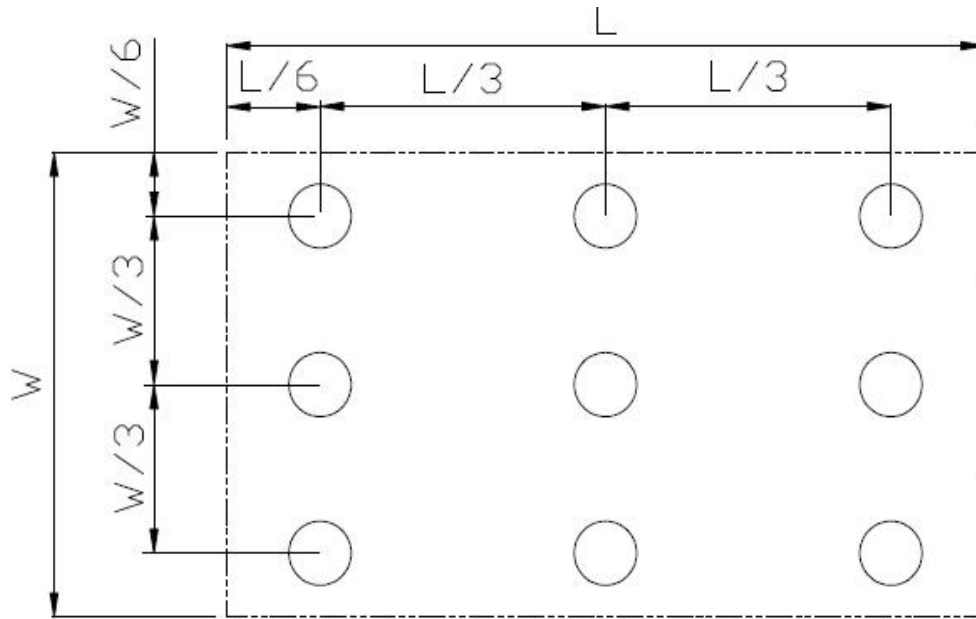


Fig. 2 Definition of uniformity

$L_{max}$ : The measured maximum luminance of all measurement position.

$L_{min}$ : The measured minimum luminance of all measurement position.

**Note 7: Definition of Luminance:**

Measure the luminance of white state at center point.

## 7 Environmental / Reliability Test

Item	Condition	Time (hrs)	Assessment
High temp. Storage	80°C	120	No abnormalities in functions and appearance
High temp. Operating	70°C	120	
Low temp. Storage	-30°C	120	
Low temp. Operating	-20°C	120	
Humidity	40°C/ 90%RH	120	
Thermal Shock(Non-operation)	-20°C ← 25°C →70°C (0.5 hour ← 5 min → 0.5 hour)	10cycles	

Remark:

- 1.The test samples should be applied to only one test item.
- 2.Sample size for each test item is 1~10pcs.
- 3.In case of malfunction defect caused by ESD damage, if it would be recovered to normal state after resetting, it would be judged as a good part.



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## 9 Precautions For Use of LCD Modules

### 9.1 Handling Precautions

9.1.1.1 The display panel is made of glass. Do not subject it to a mechanical shock by dropping it from a high place, etc.

9.1.1.2 If the display panel is damaged and the liquid crystal substance inside it leaks out, be sure not to get any in your mouth, if the substance comes into contact with your skin or clothes, promptly wash it off using soap and water.

9.1.1.3 Do not apply excessive force to the display surface or the adjoining areas since this may cause the color tone to vary.

9.1.1.4 The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarizer carefully.

9.1.1.5 If the display surface is contaminated, breathe on the surface and gently wipe it with a soft dry cloth. If still not completely clear, moisten cloth with one of the following solvents:

- Isopropyl alcohol
- Ethyl alcohol

Solvents other than those mentioned above may damage the polarizer. Especially, do not use the following:

- Water
- Ketone
- Aromatic solvents

9.1.1.6 Do not attempt to disassemble the LCD Module.

9.1.1.7 If the logic circuit power is off, do not apply the input signals.

9.1.1.8 To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.

9.1.1.9 Be sure to ground the body when handling the LCD Modules.

9.1.1.10 Tools required for assembly, such as soldering irons, must be properly ground.

9.1.1.11 To reduce the amount of static electricity generated, do not conduct assembly and other work under dry conditions.

9.1.1.12 The LCD Module is coated with a film to protect the display surface. Be care when peeling off this protective film since static electricity may be generated.

9.1.1.13 Storage precautions

9.1.1.14 When storing the LCD modules, avoid exposure to direct sunlight or to the light of fluorescent lamps.

9.1.1.15 The LCD modules should be stored under the storage temperature range. If the LCD modules will be stored for a long time, the recommend condition is:

9.1.1.16 The LCD modules should be stored in the room without acid, alkali and harmful gas.

### 9.2 Transportation Precautions

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