TIANMA
MICROELECTRONICS CO., LTD

DEVICE SPECIFICATION FOR LCD MODULE

Model No. TM122ADCW6

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To: _____

☐**CUSTOMER'S APPROVAL**

DATE _____

By: _____ **By:** _____

Presented

Sell and Market Dep.

TIANMA MICRO ELECTRONICS CO., LTD

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REVISION RECORD

Date	Ref. Page	Revision No.	Revision Items	Check & Approval

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受 控 文 件

1 Display Specifications

1.1 Display type: STN

1.2 Display color*:

Display color: Blue-Black

Background color: Gray

1.3 Polarizer mode: Transflective/Positive

1.4 Viewing Angle: 6:00

1.5 Driving Duty: 1/16

1.6 Backlight: LED

* Color tone is slightly changed by temperature and driving voltage.

2 Mechanical Specifications

2.1 Outline Dimensions: Refer to outline drawing on page: 2

2.2 Display Format: 12 Characters X 2 Lines

2.3 Display Fonts: 5 X 7 dots+Cursor

2.4 Character Size: 2.65 X5.5 (mm)

2.5 Dot Size: 0.45X0.60(mm)

2.6 Dot Pitch: 0.55X0.70(mm)

2.7 Weight: 25g

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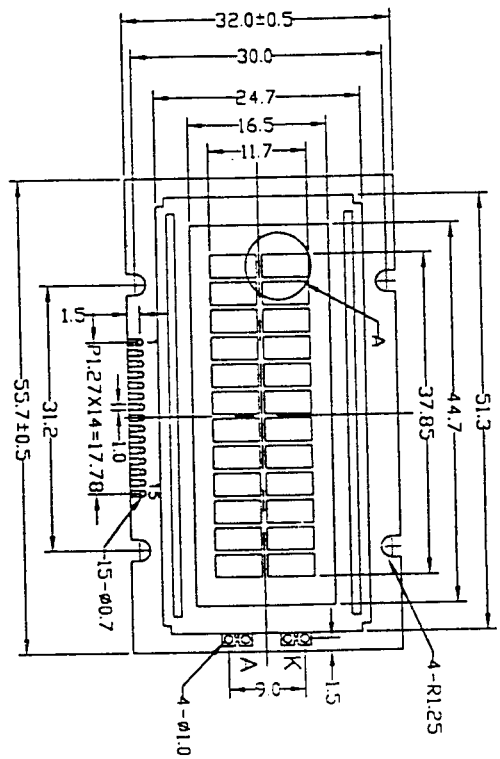
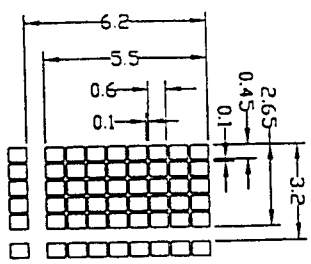
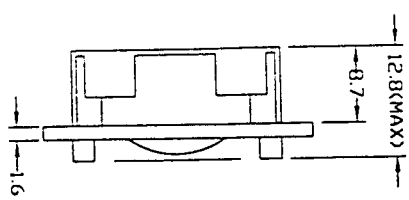
参阅文件

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
VSS/K	VDD	VO	RS	R/W	E	DB0	DB1	DB2	DB3	DB4	DB5	DB6	DB7	A



DETAIL A:





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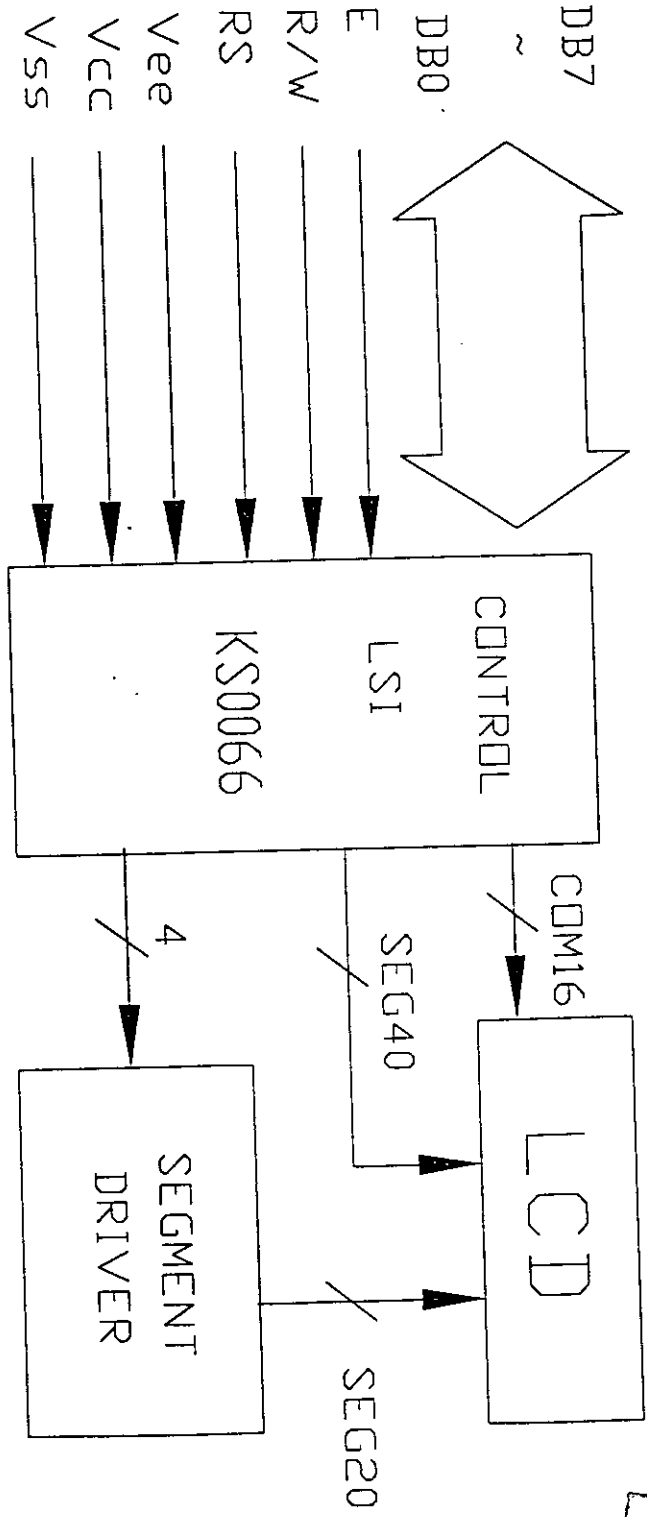
3 Circuit Block Diagram



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4 Absolute Maximum Ratings

Item	Symbol	Min.	Max.	Unit	Remark
Power Supply Voltage	V_{DD}– Vss	-0.3	7.0	V	
LCD Driving Voltage	V_{DD}–V_{EE}	-0.3	13.0		
Operating Temperature Range	T_{OP}	-20	+70	℃	No Condensation
Storage Temperature Range	T_{ST}	-30	+80		

5 Electrical Specifications and Instruction Code

5.1 Electrical characteristics

Item		Symbol	Min.	Typ.	Max.	Unit	Remark
Supply Voltage (Logic)		V_{DD}–Vss	4.5	5.0	5.5	V	
Supply Voltage (LCD Drive)		V_{DD}–V_{EE}	-	4.5	-	V	
Input Signal Voltage	'H'Level	V_{IH}	$0.7V_{DD}$	-	V_{DD}+0.3	V	
	'L'Level	V_{IL}	-0.3	-	0.2 V_{DD}	V	
Supply current (Logic)		I_{DD}	-	-	1.1	mA	
Supply current (LCD Drive)		I_{EE}	-	-	0.37	mA	
Supply Current (LED)		**I_{LED}**	-	-	**110.6**	**mA**	

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5.2 Interface Signals

Pin No.	Symbol	Level	Description
1	Vss/K	0V	Ground
2	V_{DD}	5.0V	Power supply voltage for logic and LCD(+)
3	Vo	0.5V	Power supply voltage for LCD(-)
4	RS	H/L	Selects registers
5	R/W	H/L	Selects read or write
6	E	H/L	Starts data read/write
7	DB0	H/L	Data bit0
8	DB1	H/L	Data bit1
9	DB2	H/L	Data bit2
10	DB3	H/L	Data bit3
11	DB4	H/L	Data bit4
12	DB5	H/L	Data bit5
13	DB6	H/L	Data bit6
14	DB7	H/L	Data bit7
15	A	4.2V	The positive electrode of LED backlight

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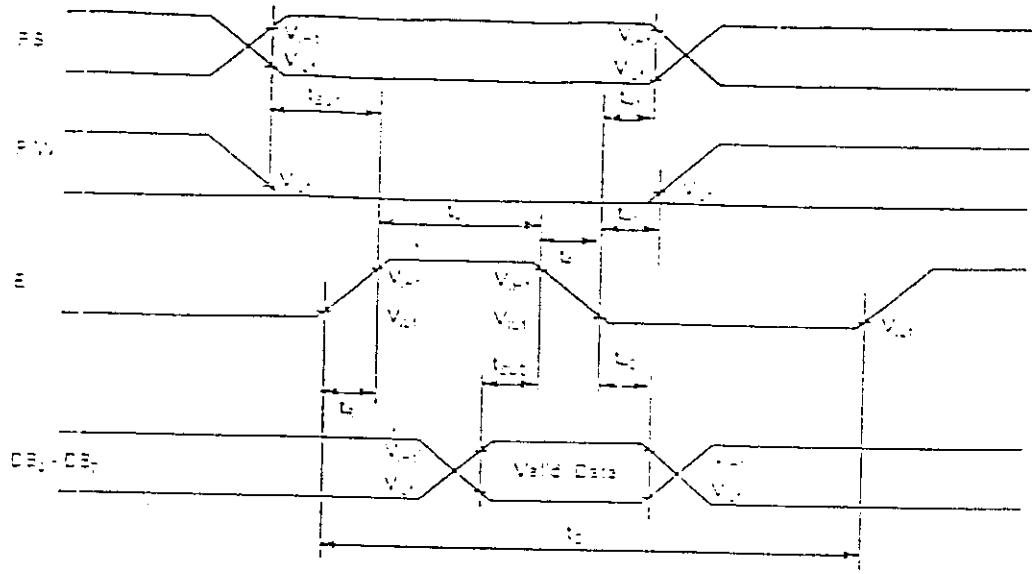
5.3 Interface Timing Chart:

AC Characteristics (V_{DD}=5V ± 10%, V_{SS}=0V Ta=-20 ~ +75°C)

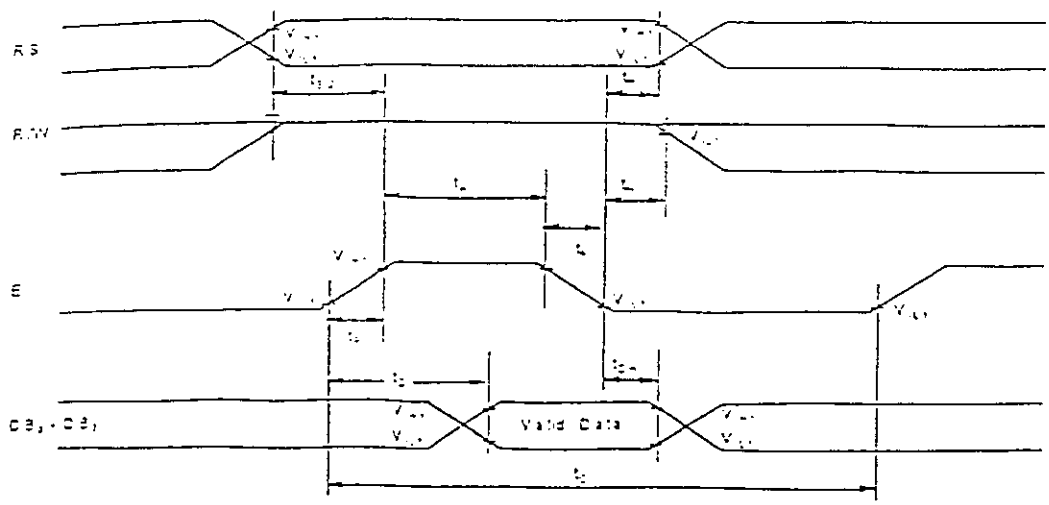
(1) Write mode (Writing data from Mcom to KS0066)

Characteristic	Symbol	Min	Typ	Max	Unit	Test pin
E Cycle Time	t_C	500	-	-	ns	E
E Rise Time	t_R	-	-	25	ns	E
E Fall Time	t_F	-	-	25	ns	E
E Pulse Width (High, Low)	t_W	220	-	-	ns	E
R/W and RS Setup Time	t_{SU1}	40	-	-	ns	R/W, RS
R/W and RS Hold Time	t_{H1}	10	-	-	ns	R/W, RS
Data Setup Time	t_{SU2}	60	-	-	ns	DB_0~DB_7
Data Hold Time	t_{H2}	10	-	-	ns	DB_0~DB_7



(2) Read mode (Reading data from KS0066 to Mcom)

Characteristic	Symbol	Min	Typ	Max	Unit	Test pin
E Cycle Time	t_C	500	-	-	ns	E
E Rise Time	t_R	-	-	25	ns	E
E Fall Time	t_F	-	-	25	ns	E
E Pulse Width (High, Low)	t_W	220	-	-	ns	E
R/W and RS Setup Time	t_{SU1}	40	-	-	ns	R/W, RS
R/W and RS Hold Time	t_{H1}	10	-	-	ns	R/W, RS
Data Output Delay Time	t_D	-	-	100	ns	DB_0~DB_7
Data Hold Time	t_{DH}	20	-	-	ns	DB_0~DB_7



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5.4 Instruction Code

CONTROL and DISPLAY COMMAND

Command	RS	R/W	DB_7	DB_6	DB_5	DB_4	DB_3	DB_2	DB_1	DB_0	Excution time (fosc=250KHz)	Remark
DISPLAY CLEAR	L	L	L	L	L	L	L	L	L	H	1.64ms	
RETURN HOME	L	L	L	L	L	L	L	L	H	X	1.64ms	cursor move to first digit
ENTRY MODE SET	L	L	L	L	L	L	L	H	I/D	SH	40μs	•I/D: set cursor move direction I/D: H Increase; L Decrease •SH: Specifies shift of display SH: H display is shifted; L display is not shifted
DISPLAY ON/OFF	L	L	L	L	L	L	H	D	C	B	40μs	•Display D: H Display on; L Display off •Cursor C: H Cursor on; L Cursor off •Blinking B: H Blinking on; L Blinking off
SHIFT	L	L	L	L	L	H	S/C	R/L	X	X	40μs	S/C: H Display shift; L Cursor move R/L: H Right shift; L Left shift
SET FUNCTION	L	L	L	L	H	DL	N	F	X	X	40μs	DL: H 8 bits interface; L 4 bits interface N: H 2 line display; L 1 line display F: H 5 × 10 dots; L 5 × 7 dots

Command	RS	R/W	DB_7	DB_6	DB_5	DB_4	DB_3	DB_2	DB_1	DB_0	Exputtion time (fosc=250KHz)	Remark
SET CG RAM ADDRESS	L	L	L	H	CG RAM address (corresponds to cursor address)						40μs	CG RAM Data is sent and received after this setting
SET DD RAM ADDRESS	L	L	H	DD RAM address							40μs	DD RAM Data is sent and received after this setting
READ BUSY FLAG & ADDRESS	L	H	BF	Address Counter used for Both DD & CG RAM address							0μs	BF: H Busy; L Ready - Reads BF indication internal operating is being performed. - reads address counter contents
WRITE DATA	H	L	Write Data								46μs	Write data into DD or CG RAM
READ DATA	H	H	Read Data								46μs	Read data from DD or CGRAM

X: Don't care

5.5Character generator ROM(KS0066U-00)

Upper 4bit / Lower 4bit	LLLL	LLLH	LLHL	LLHH	LHLL	LHLH	LHHL	LHHH	HLLL	HLLH	HLHL	HLHH	HHLL	HHLH	HHHL	HHHH
LLLL	CG RAM (1)															
LLLH	(2)															
LLHL	(3)															
LLHH	(4)															
LHLL	(5)															
LHLH	(6)															
LHHL	(7)															
LHHH	(8)															
HLLL	(1)															
HLLH	(2)															
HLHL	(3)															
HLHH	(4)															
HHLL	(5)															
HHLH	(6)															
HHHL	(7)															
HHHH	(8)															

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6.Optical Characteristics

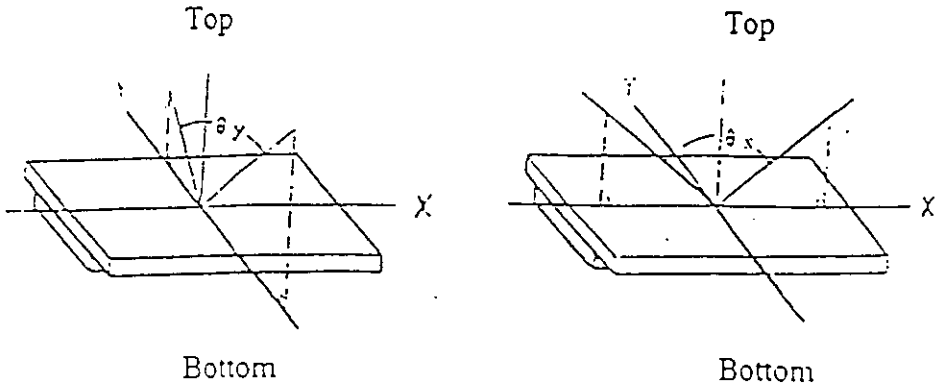
6.1 Optical Characteristics

Top=25℃

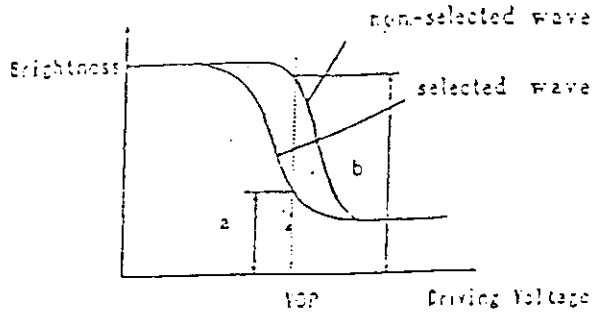
Item		Symbol	Condition		Min.	Typ.	Max.	Unit	Remark
Viewing Angle		θ_x	Cr>2	$\theta_y=0°$	-30	--	30	Deg	
		θ_y		$\theta_x=90°$	-35	--	20		
Contrast Ratio		Cr	$\theta_x=0°$ $\theta_y=0°$		4.0				
Response Time	Turn on	Ton	$\theta_x=0°$ $\theta_y=0°$				250	ms	
	Turn off	Toff					250		

6.2 Definition of optical characteristics

6.2.1 Definition of viewing Angle(see fig. as follow)



6.2.2 Definition of Contrast Ratio(see fig. as follow)

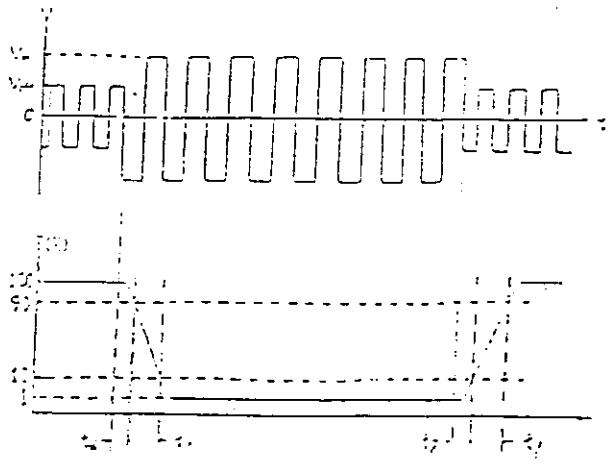


$$\text{Contrast Ratio} = b / a = \frac{\text{non-selected state brightness}}{\text{selected state brightness}}$$

Measuring Conditions:

1) Ambient Temperature: 25 ℃ ; 2) Frame frequency: 64Hz

6.2.3 Definition of Response time(see fig. as follow)



Turn-on time: $t_{on}=t_d+t_r$

Turn-off time: $t_{off}=t_d+t_f$

Measuring Condition:

1) Operating Voltage: 4.5 V ; 2) Frame frequency: 64Hz

7. Reliability

7.1 Content of Reliablity Test (T_{OP}=25℃)

No.	Test Item	Content of Test	Test condition
1	High Temperature Storage	Endurance test applying the high storage temperature for a long time	80℃ 240H
2	Low Temperature Storage	Endurance test applying the low storage temperature for a long time	-30℃ 240H
3	High Temperature Operation	Endurance test applying the electric stress (voltage & current) and the thermal stress to the element for a long time	70℃ 240H
4	Low Temperature Operation	Endurance test applying the electric stress under low temperature for a long time	-20℃ 240H
5	High Temperature /Humidity Storage	Endurance test applying the high temperature and high humidity storage for a long time	60℃ 95%RH 240H
6	Temperature Cycle	Endurance test applying the low and high temperature cycle -30℃←→25℃←→80℃←→25℃ 30min 5min 30min 5min ←——————→ 1 cycle	-30℃/80℃ 10 cycles
7	Vibration Test (package state)	Endurance test applying the vibration during transportation	10Hz~500Hz, 100m/s^2, 120min
8	Shock Test (package state)	Endurance test applying the shock during transportation	Half-sinewave, 300m/s^2, 18ms
9	Atmospheric Pressure Test	Endurance test applying the atmospheric pressure during transportation by air	25kPa 16H

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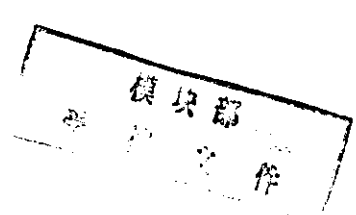
7.2 Failure Judgment Criterion

Criterion Item	Test Item No.									Failure Judgement Criterion
	1	2	3	4	5	6	7	8	9	
Basic Specification	0	0	0	0	0	0	0	0	0	Out of the basic Specification
Electrical specification	0	0	0	0	0					Out of the electrical specification
Mechanical Specification							0	0		Out of the mechanical specification
Optical Characteristic	0	0	0	0	0	0			0	Out of the optical specification
Remark	Basic specification = Optical specification + Mechanical specification									



8 Precautions for use of LCD Modules

8.1 Handling Precautions

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

8.1.2 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.

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

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

8.1.5 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

8.1.6 Do not attempt to disassemble the LCD Module.

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

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

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

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

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

d. 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.

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8.2 Storage precautions

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

8.2.2 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:

temperature : 0℃ ～ 40℃

relatively humidity: ≤80%

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

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