

TIAN-MA
MICROELECTRONICS CO., LTD

DEVICE SPECIFICATION FOR LCD MODULE

Model No. TM320240ABA

Prepared by: 朱燕林	Date: 14/7-98
Checked by: 王彩荣	Date: 30/7-98
Verified by: 许雅荣	Date: 31/7-98
Approved by:	Date:

To: _____

CUSTOMER'S APPROVAL

DATE _____

By: _____

Presented

By: _____

Sell and Market Dep.

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REVISION RECORD

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

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1 Display Specifications

1.1 Display type: STN

1.2 Display color*:

Display color: Blue-Black

Background color: Yellow-Green

1.3 Polarizer mode: Reflective/Positive

1.4 Viewing Angle: 6:00

1.5 Driving Duty: 1/240

1.6 Backlight: None

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

2 Mechanical Specifications

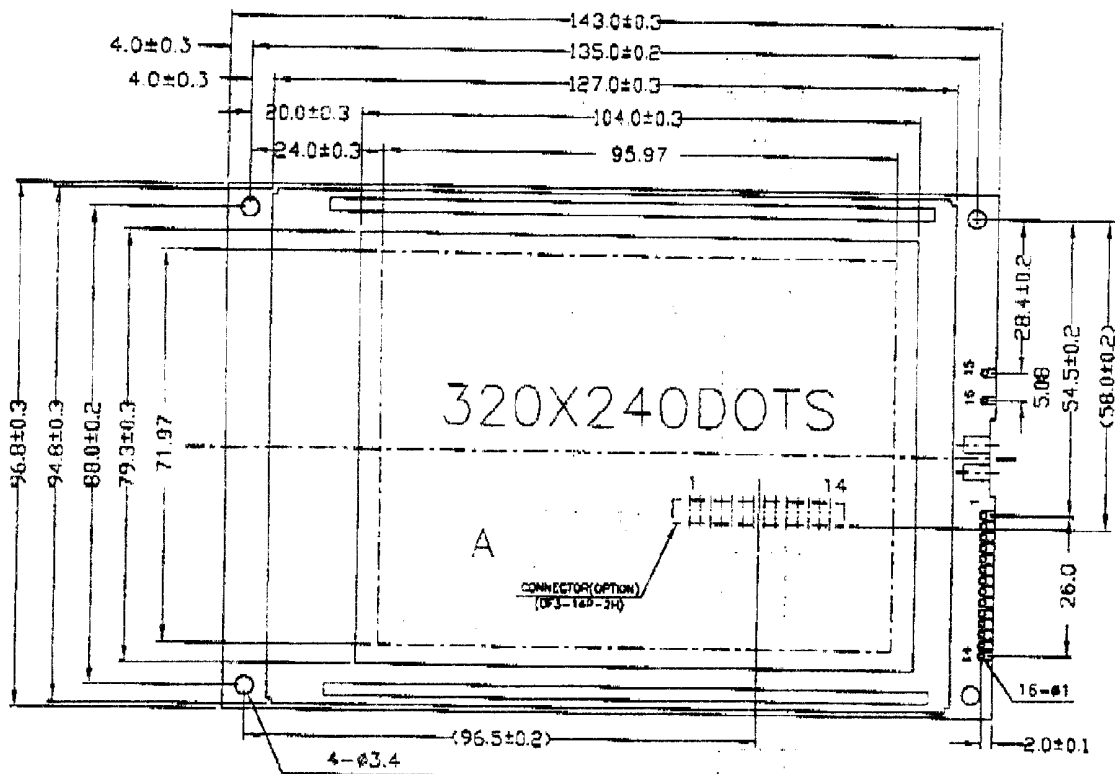
2.1 Outline Dimensions: Refer to outline drawing on page: 2

2.2 Dot Matrix: 320 × 240

2.3 Dot size: 0.27 × 0.27(mm)

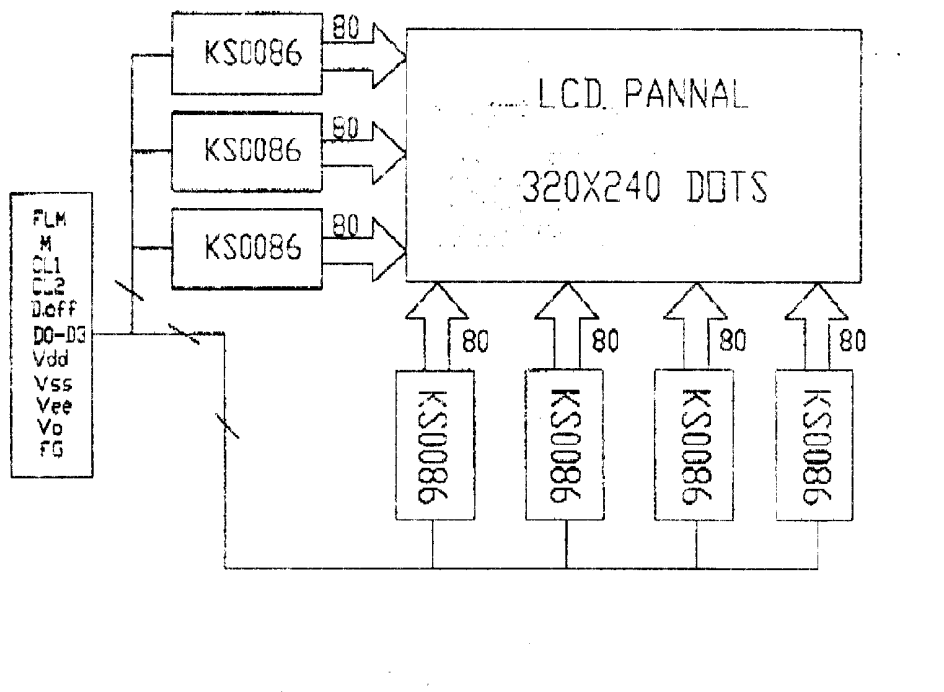
2.4 Dot pitch: 0.3 × 0.3(mm)

2.5 Weight: 152 g



1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
FLM	M	CL1	CL2	D.0??	DO	D1	D2	D3	Vdd	Vss	Vee	Vo	FG	NC	NC

3 Circuit Block Diagram



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4 Absolute Maximum Ratings

Item	Symbol	Min.	Max.	Unit	Remark
Power Supply Voltage	$V_{DD} - V_{SS}$	0	5.5	V	
LCD Driving Voltage	V_{LCD}	-	28.0		
Operating Temperature Range	T_{OP}	0	50	°C	No Condensation
Storage Temperature Range	T_{ST}	-20	60		

5 Electrical Specifications and Instruction Code

5.1 Electrical characteristics

Item	Symbol	Min.	Typ.	Max.	Unit	Remark
Supply Voltage (Logic)	$V_{DD} - V_{SS}$	4.75	5.0	5.25	V	
Supply Voltage (LCD Drive)	$V_{SS} - V_o$	-	20.4	-	V	
Input Signal Voltage	'H'Level	V_{IH}	0.8Vdd	-	Vdd+0.3	V
	'L'Level	V_{IL}	0	-	0.2Vdd	V
Supply current (Logic)	I_{DD}	-	35.0	-	mA	
Supply current (LCD Drive)	I_{EE}	-	5.0	-	mA	

5.2 Interface Signals

Pin No.	Symbol	Level	Description
1	FLM	H	indicate the beginning of each frame
2	M	H/L	Control signal for AC driving
3	CL1	H→L	Data latch clock
4	CL2	H→L	Data shift clock
5	D.off	H/L	Display off(" H " =on, " L " =off)
6	DB0	H/L	Data bit0
7	DB1	H/L	Data bit1
8	DB2	H/L	Data bit2
9	DB3	H/L	Data bit3
10	Vdd	5.0V	Power supply voltage for logic and LCD(+)
11	Vss	0V	Ground
12	Vee	-25.0V	Power supply voltage for LCD
13	Vo	-20.4V	Operating voltage for LCD drive(-)Variable
14	FG	L	Frame ground

5.3 Interface Timing Chart:

(1) Segment driver application

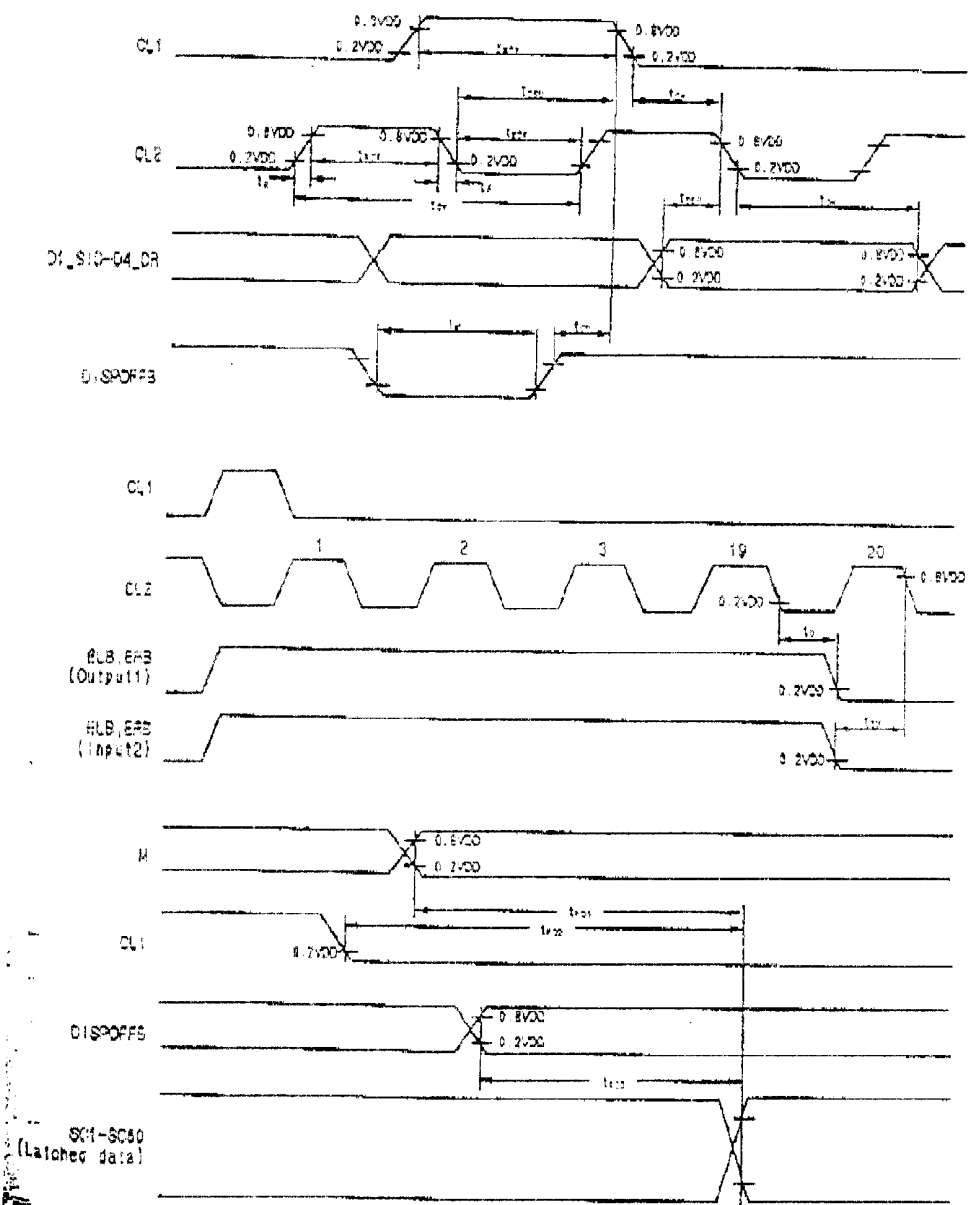
AC Characteristics

(1) SEGMENT DRIVER APPLICATION

(V_{SS} = 0V, T_a = -30 ~ +35°C)

Characteristics	Symbol	Conditions	VDD=5V ± 10%			VDD=3V ± 10%			Unit	
			MIN	TYP	MAX	MIN	TYP	MAX		
Clock Cycle Time	t _{cl}	Duty = 50%	125	-	-	250	-	-	ns	
Clock Pulse Width	t _{clk}	-	45	-	-	95	-	-		
Clock Rise/Fall Time	t _{clr}	-	-	-	30	-	-	30		
Data Set-Up Time	t _{seu}	-	30	-	-	65	-	-		
Data Hold Time	t _{sh}	-	30	-	-	65	-	-		
Clock Set-Up Time	t _{csu}	-	80	-	-	120	-	-		
Clock Hold Time	t _{ch}	-	80	-	-	120	-	-		
Propagation Delay Time	t _p	ELB Output	-	-	60	-	-	125		
		ERB Output	-	-	60	-	-	125		
ELB, ERB Set-Up Time	t _{su}	ELB Input	30	-	-	65	-	-		
		ERB Input	30	-	-	65	-	-		
DISPOFFB Low Pulse Time	t _l	-	1.2	-	-	1.2	-	-		μs
DISPOFFB Clear Time	t _c	-	100	-	-	100	-	-		ns
W-OUT Propagation Delay Time	t _{out}	C _L = 15pF	-	-	1.0	-	-	1.2	μs	
CL1-OUT Propagation Delay Time	t _{out}		-	-	1.0	-	-	1.2		
DISPOFFB ₁ -OUT Propagation Delay Time	t _{out}		-	-	1.0	-	-	1.2		

AC Characteristics (continued)
 (3) SEGMENT DRIVER APPLICATION TIMING



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(2) Common driver application

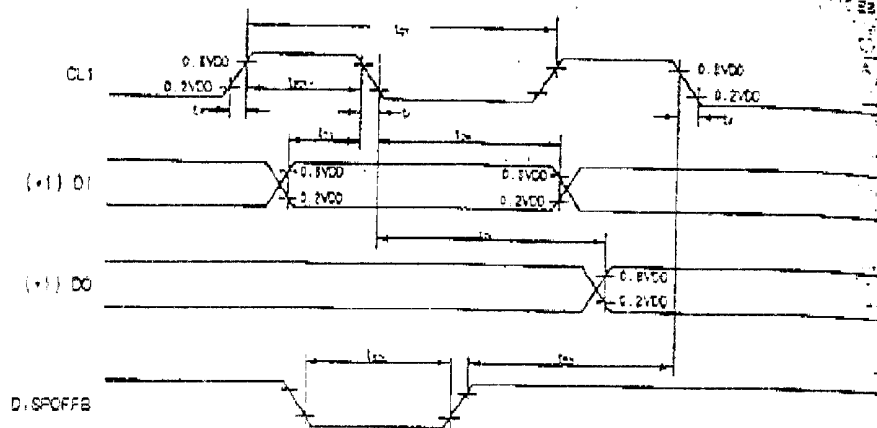
AC Characteristics (continued)

(2) COMMON DRIVER APPLICATION

(VSS = 0V, Ta = -30 ~ +85°C)

Characteristics	Symbol	Conditions	VDD=5V ± 10%			VDD=3V ± 10%			Unit
			MIN	TYP	MAX	MIN	TYP	MAX	
Clock Cycle Time	t _{cy}	Duty = 50%	250	-	-	500	-	-	ns
Clock Pulse Width	t _{wclk}	-	45	-	-	95	-	-	
Clock Rise/Fall Time	t _{r/f}	-	-	-	50	-	-	50	
Data Set-Up Time	t _{su}	-	30	-	-	65	-	-	
Data Hold Time	t _h	-	30	-	-	65	-	-	
DISPOFFB Low Pulse Width	t _{wl}	-	1.2	-	-	1.2	-	-	μs
DISPOFFB Clear Time	t _{cp}	-	100	-	-	100	-	-	ns
Output Delay Time	t _{ou}	C _L = 15pF	-	-	200	-	-	250	ns
M-OUT	t _{out1}		-	-	1.0	-	-	1.2	
Propagation Delay Time	t _{pd1}		-	-	1.0	-	-	1.2	
DISPOFFB-OUT	t _{out2}		-	-	1.0	-	-	1.2	
Propagation Delay Time	t _{pd2}		-	-	1.0	-	-	1.2	

(4) COMMON DRIVER APPLICATION TIMING



(*) When single-type interface mode

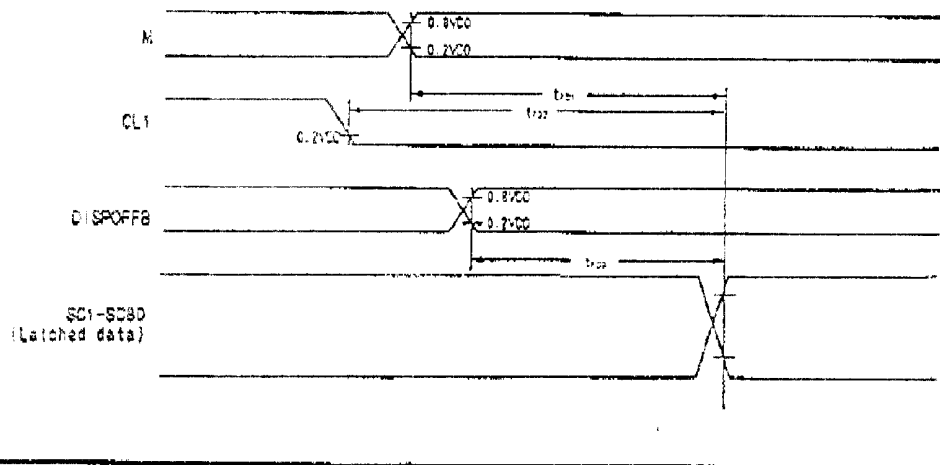
DI => D2_DL(SHL='L'), D4_DR(SHL='H')

DO => D4_DR(SHL='L'), D2_DL(SHL='H')

When dual-type interface mode:

DI => D2_DL and D2_DH(SHL='L'), D4_DR and D3_DH(SHL='H')

DO => D4_DR(SHL='L'), D2_DL(SHL='H')



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6. Optical Characteristics

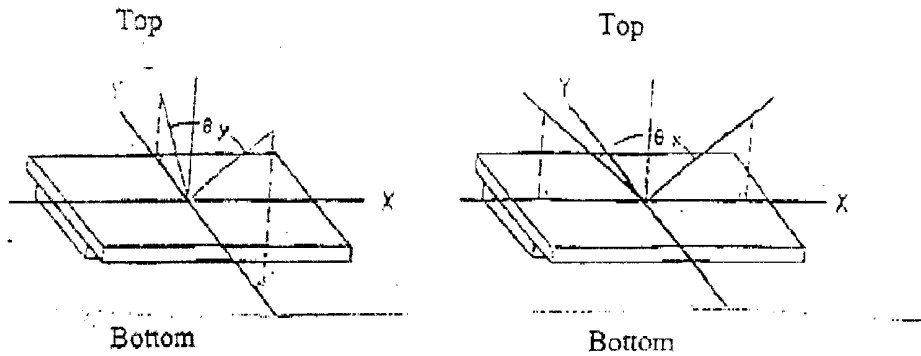
6.1 Optical Characteristics

$T_{OP}=25\text{ }^{\circ}\text{C}$

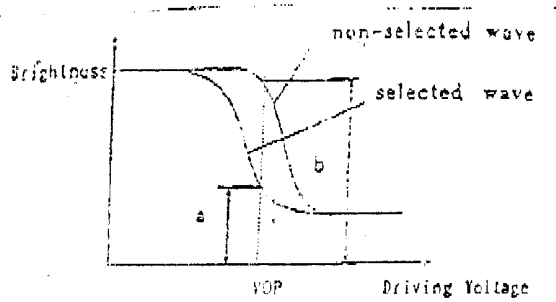
Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Remark	
Viewing Angle	θ_x	$Cr \geq 2$	$\theta_y=0^{\circ}$	-30	--	30	Deg	
	θ_y		$\theta_x=0^{\circ}$	-20	--	30		
Contrast Ratio	Cr	$\theta_x=0^{\circ}$ $\theta_y=0^{\circ}$	3.0					
Response Time	Turn on	T_{on}			350	ms		
	Turn off	T_{off}			350			

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)

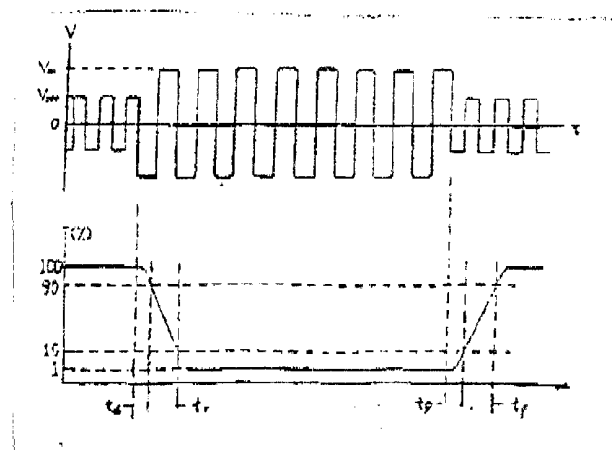


$$\text{Contrast Ratio} = b / a = \frac{\text{non-selected state brightness}}{\text{selected state brightness}}$$

Measuring Conditions:

- 1) Ambient Temperature: 25 °C ;
- 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: $t_{off} = t_d + t_r$

Measuring Condition:

- 1) Operating Voltage: 25.4V ;
- 2) Frame frequency: 64Hz

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7. Reliability

7.1 Content of Reliability Test

($T_{OP}=25\text{ }^{\circ}\text{C}$)

No.	Test Item	Content of Test	Test condition
1	High Temperature Storage	Endurance test applying the high storage temperature for a long time	60 °C 96H
2	Low Temperature Storage	Endurance test applying the low storage temperature for a long time	-20 °C 96H
3	High Temperature Operation	Endurance test applying the electric stress (voltage & current) and the thermal stress to the element for a long time	50 °C 96H
4	Low Temperature Operation	Endurance test applying the electric stress under low temperature for a long time	0 °C 96H
5	High Temperature /Humidity Storage	Endurance test applying the high temperature and high humidity storage for a long time	40 °C 90%RH 96H
6	Temperature Cycle	Endurance test applying the low and high temperature cycle $\begin{array}{ccccccc} -20\text{ }^{\circ}\text{C} & \xrightarrow{30\text{min}} & 25\text{ }^{\circ}\text{C} & \xrightarrow{5\text{min}} & 60\text{ }^{\circ}\text{C} & \xrightarrow{30\text{min}} & -20\text{ }^{\circ}\text{C} \\ & & & & & & \xrightarrow{5\text{min}} \end{array}$ <p style="text-align: center;">1 cycle</p>	-20 °C/60 °C 10 cycles
7	Vibration Test (package state)	Endurance test applying the vibration during transportation	10Hz~150Hz, 50m/s ² , 40min
8	Shock Test (package state)	Endurance test applying the shock during transportation	Half-sinewave, 100m/s ² , 11ms
9	Atmospheric Pressure Test	Endurance test applying the atmospheric pressure during transportation by air	40kPa 16H

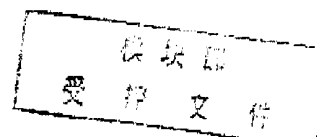
7.2 Failure Judgment Criterion

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. Especially, do not attempt to peel off the heat seal.
- 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 environment.
- 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.



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 : $0^{\circ}\text{C} \sim 40^{\circ}\text{C}$

relatively humidity: $\leq 80\%$

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.

