Product Specification
(Preliminary)

Part Name: Monochrome LCD Display Module
Part No.: BGB240128-06 SERIES
Doc No.: SAS1-1230-A

Customer:
Approved by:

From: Blaze Display Technology Co., Ltd.
Approved by:

Blaze Display Technology Co., Ltd.

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Notes:
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2. The information contained herein is presented merely to indicate the characteristics and performance of our products. No responsibility is assumed by Blaze Display Technology Co., Ltd. for any intellectual property claims or other problems that may result application based on the module described herein.

Revised History

Part Number	Revision	Revision Content	Revised on
BGB240128-06-LW-SNMWD-1.0	1.0	New	Oct 10th, 2012

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Contents

1. Basic Specifications

1.1 Display Specifications
1) Display Type: STN-Blue/ Negative
2) Display Format: 240 × 128
3) Character Color (ON):   White
4) Background Color (ON):   Blue
   Background Color (OFF):   Blue
5) Drive Method: 1/128Duty; 1/12Bias
6) Viewing Direction: 6:00
7) Polarizer Type: Transmissive

1.2 Mechanical Specifications
1) Outline Dimensions: According to the annexed outline drawing on the next page
2) Viewing Area: 114.00 W × 64.00 H (mm)
3) Active Area: 107.97 W × 57.57H (mm)
4) Dot Pitch: 0.45W × 0.45 H (mm)
5) Dot Size: 0.40W × 0.40H (mm)
6) Weight: T.B.D.

1.3 Others
1) Driver IC: RA6963 or EQV
2) Backlight: LED, White, If = 120mA, Vf = 5.0 ± 0.2V
3) Operating Temperature: $-20°C - +70°C$
4) Storage Temperature: $-30°C - +80°C$
5) RoHS Compliant: Yes

1.4 Mechanical Drawing

INTERFACE:

1	FG
2	VSS
3	VCC(5V)
4	V0
5	WR
6	RD
7	CS
8	C/D
9	RST
10	DB0
11	DB1
12	DB2
13	DB3
14	DB4
15	DB5
16	DB6
17	DB7
18	FS
19	VEE
20	LED+(5V)

DOT SIZE

240X128 DOTS

NOTES:
01. DISPLAY TYPE: STN(BLUE)/NEGATIVE/TRANSMISSIVE RoHS
02. OPERATING VOLTAGE: VOP=18.0V,VDD=5.0V
03. OPERATING TEMPERATURE: -20°C~+70°C
04. STORAGE TEMPERATURE: -30°C~+80°C
05. DRIVE MODE: 1/128DUTY,1/12BIAS
06. VIEWING DIRECTION: 6:00
07. DRIVE IC: RA6963
08. CONNECTOR: ZEBER
09. BACKLIGHT: LED(WHITE)
10. CUSTOMER'S PART ID:

DESIGNED BY: BDT-27	BGB240128-06	VERSION:	1.0
CHECKED BY: BDT-04		PAGE 1 OF 1	
APPROVED BY: BDT-01		UNIT:	mm
Website:http://www.blazedisplay.com		DATE:	2012-09-24

| Revised Record | 1.0 | New issue | | 2012-09-24 |

PCB 154.00±0.3
140.00±0.3
133.00±0.3
V.A 114.00±0.2
A.A 107.97

PCB 84.00±0.3
80.00±0.3
78.00±0.3
V.A 64.00±0.2
A.A 57.57

2. Electrical Specification

2.1 Block Diagram
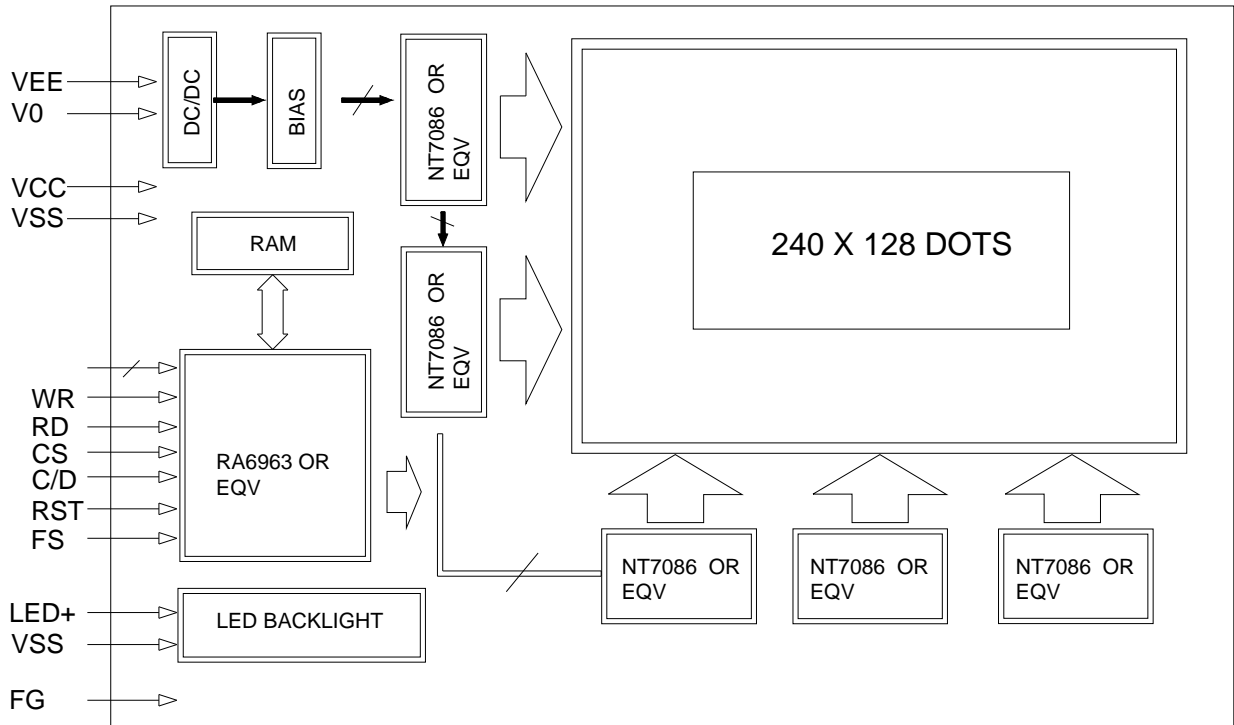
Typical appliction
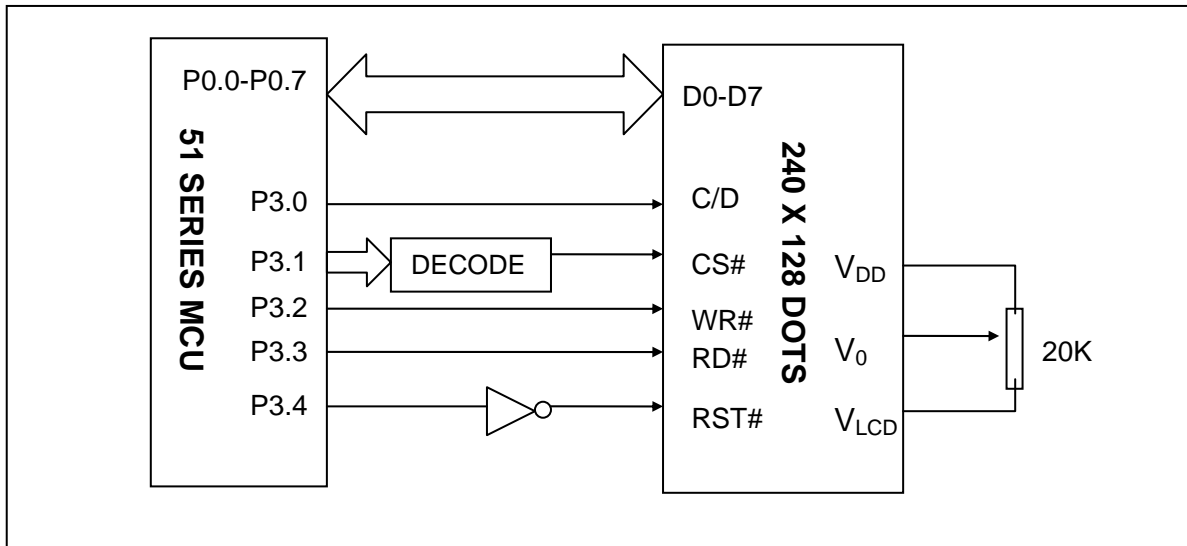
2.2 Absolute Maximum Ratings

Item	Symbol	Min.	Max.	Unit
Power Supply for Logic	Vdd	−0.3	+5.5	V
Power supply for LCD Drive	Vlcd(Vdd-V0)	-0.3	15.0	V
Input Voltage	Vin	−0.3	Vdd + 0.3	V
Operating Temperature	Topr	−20	+70	°C
Storage Temperature	Tstg	−30	+80	°C

2.3 Electrical Characteristics

HIGH-level input voltage	V_{IHC}	See note 2.	$0.8\ V_{DD}$	—	V_{DD}	V
LOW-level input voltage	V_{ILC}	See note 2.	V_{SS}	—	$0.2\ V_{DD}$	V
HIGH-level output voltage	V_{OHC}	IOH= −2.0 mA. See note 2.	$V_{DD} - 0.4$	—	—	V
LOW-level output voltage	V_{OLC}	IOH= 1.6 mA. See note 2.	—	—	VSS+ 0.4	V
Open-drain						
LOW-level output voltage	V_{OLN}	IOL= 6.0 mA.	—	—	$V_{SS} +$ 0.4V	V
Schmitt-trigger						
Rising-edge threshold voltage	V_{T+}	See note 3.	$0.5\ V_{DD}$	$0.7\ V_{DD}$	$0.8\ V_{DD}$	V
Falling-edge threshold voltage	V_{T-}	See note 3.	$0.2\ V_{DD}$	$0.3\ V_{DD}$	$0.5\ V_{DD}$	V

Notes:

1. D0 to D7, A0, ($\overline{CS}$), ($\overline{RD}$), ($\overline{WR}$), VD0 to VD7, VA0 to VA15, ($\overline{VRD}$), ($\overline{VWR}$) and ($\overline{VCE}$) are TTL-level inputs.
2. SEL1 is CMOS-level inputs. YD, XD0 to XD3, XSCL, LP, WF, YDIS are CMOS-level outputs.
3. RES is an Schmitt-trigger input. The pulse width on ($\overline{RES}$) must be at least 200us. Note that pulses of more than a few seconds will cause DC voltages to be applied to the LCD panel.
4. f_{OSC} = 10 MHz, no load (no display memory), internal character generator, 256x200 pixel display. The operating supply current can be reduced by approximately 1 mA by setting both CLO and the display OFF.
5. VD0 to VD7 and D0 to D7 have internal feedback circuits so that if the inputs become high-impedance, the input state immediately prior to that is held. Because of the feedback circuit, input current flow occurs when the inputs are in an intermediate state.
6. Because the oscillator circuit input bias current is in the order of uA, design the printed circuit board so as to reduce leakage currents.

2.4 Pin Definition

| No.	Symbol	Function
1	FG	Frame Ground
2	VSS	Ground (0V)
3	VCC	Supply Voltage for Logic (+5.0V)
4	V0	Contrast Adjustment
5	WR	Write Control or Read/Write Control
6	RD	Read Control or Enable
7	CS	Chip select
8	C/D	Command/Data Select
9	RST	Hardware Reset
10-17	BD0-DB7	Data Bus
18	FS	Pins for selection of font
19	VEE	Negative output
20	LED+	LED Power Supply + (5.0V)

3. LED Backlight

3.1 Power Supply for LED Backlight
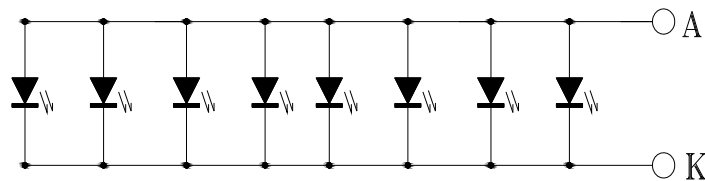
3.2 Electrical Optical Characteristics

Ta = 25°C; Vdd = 5.0V, otherwise specified

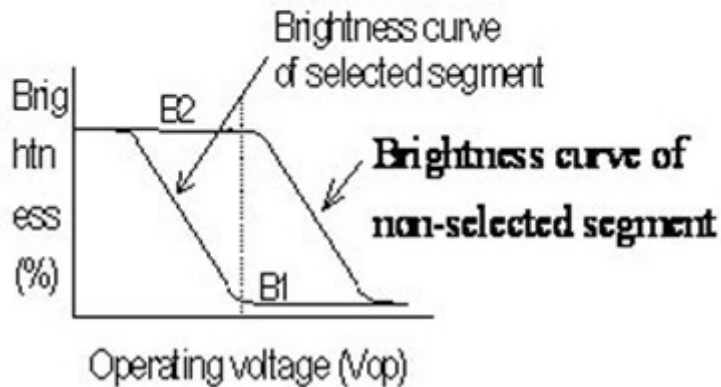| Item	Symbol	Conditions	Standard Value			Unit
			Min.	Typ.	Max.	
Forward Voltage	Vf	If = 120mA	4.9	5.0	5.1	V
Reverse Current	Ir	Vr = 5.0V	–	–	100	uA
Spectral Line Half Width	$\triangle\lambda$	IF = 120mA	–	–	–	nm
Peak Wave Length	λp	T = 25℃	–	–	–	nm
Luminance	Lv	IF =120mA	–	60	–	Cd/m^2
Uniformity	$\triangle$	Min / Max = 100%	–	–	75%	%

4. Optical Characteristics
4.1 Definition of Viewing Angle
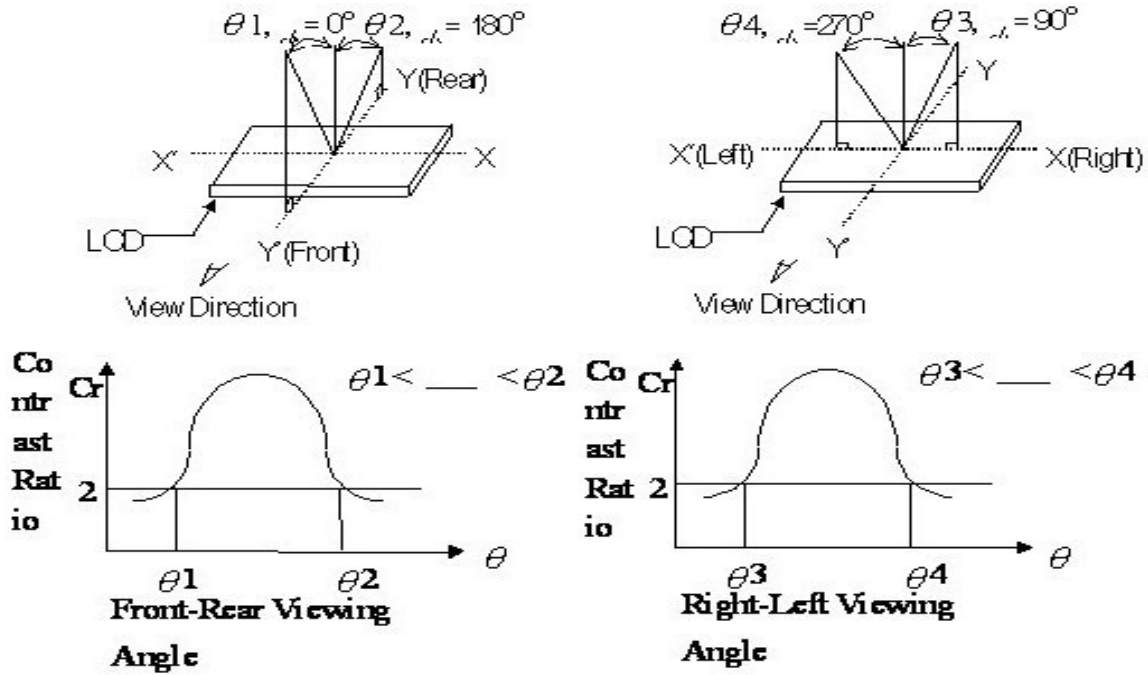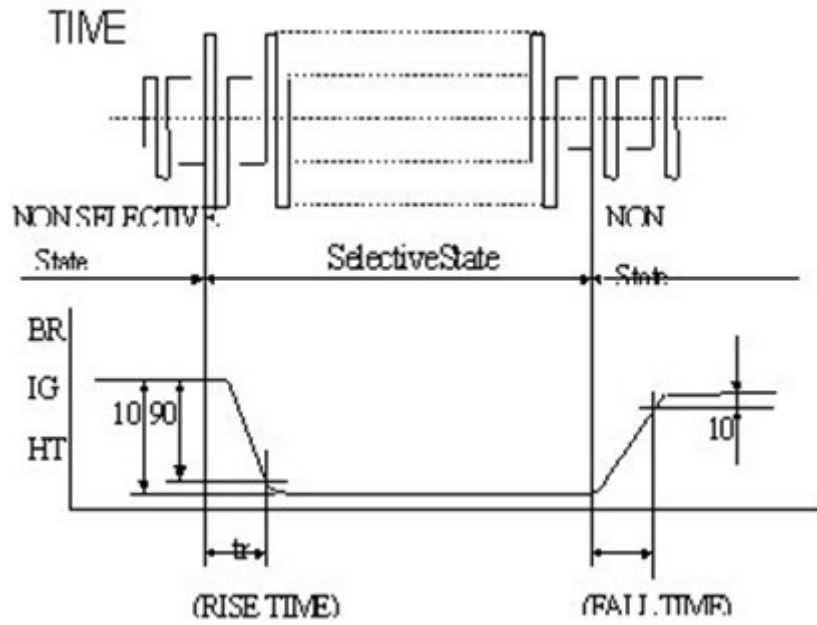

4.2 Definition of Contrast

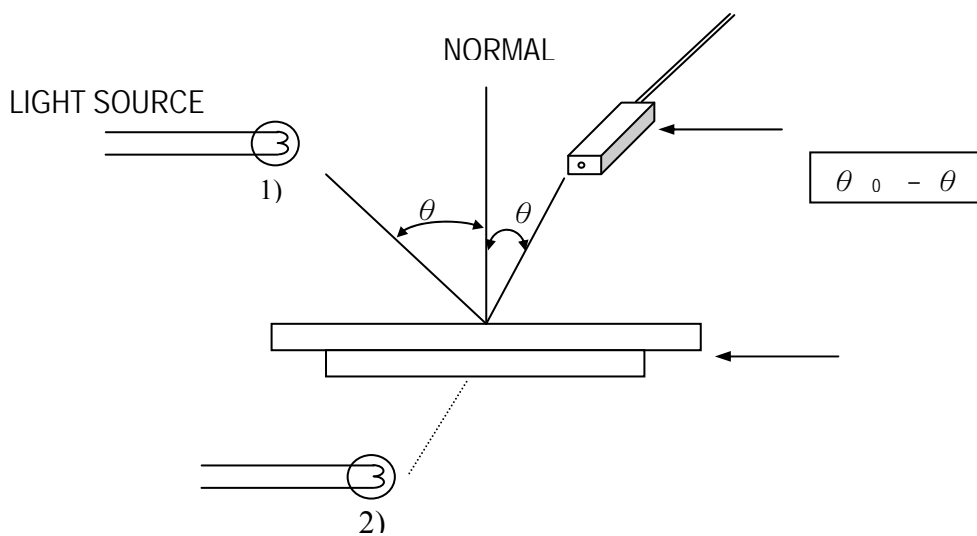$$C.R = \frac{\text{Brightness of nonselected segment (B2)}}{\text{Brightness of selected segment}}$$

4.3 Definition of Response

TIME

NON SELECTIVE State | SelectiveState | NON State

BR IG HT

10 90

tr (RISE TIME)

10

(FALL TIME)

4.4 Measuring Instruments For Electro-optical Characteristics

NORMAL

LIGHT SOURCE

1)

θ θ

$\theta_0 - \theta$

2)

* Note:
1) Light source position for measuring the reflective type of LCD panel;
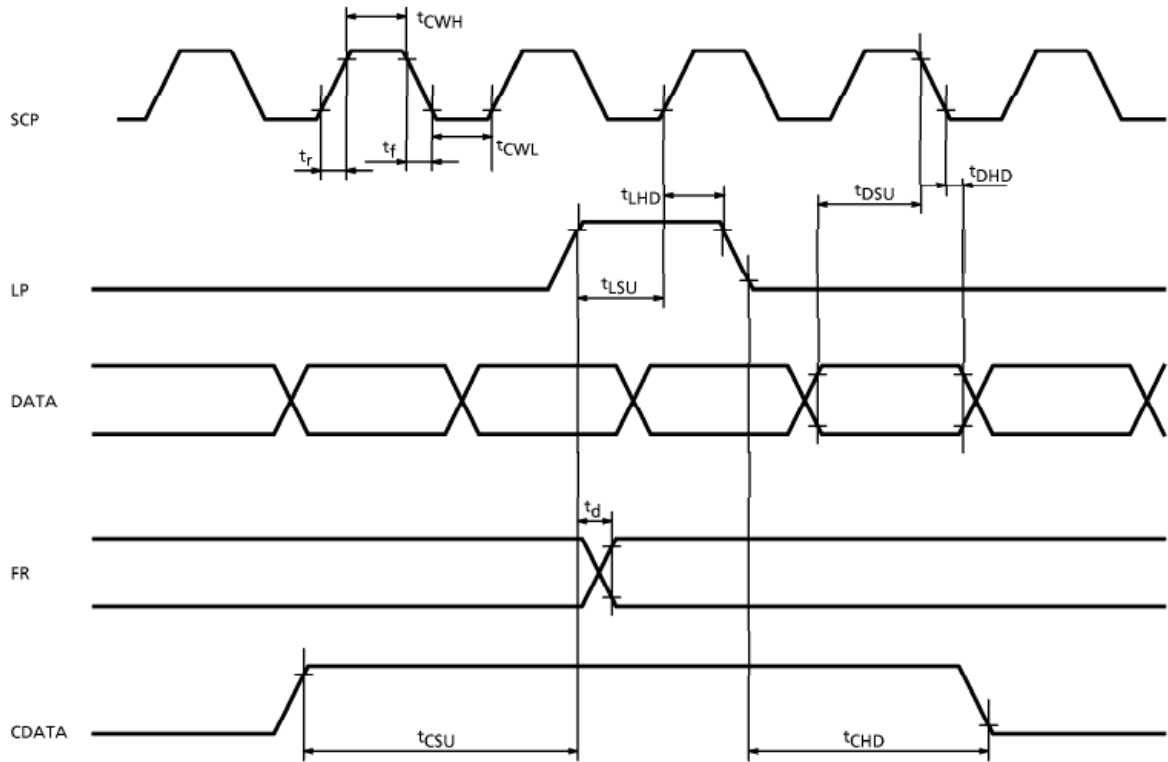2) Light source position for measuring the transflective / transmissive types of LCD panel.

5. AC Characteristics and Input Timing Characteristics

5.1 AC characteristics (Vdd=5V, Vss=0V Ta=25°C)
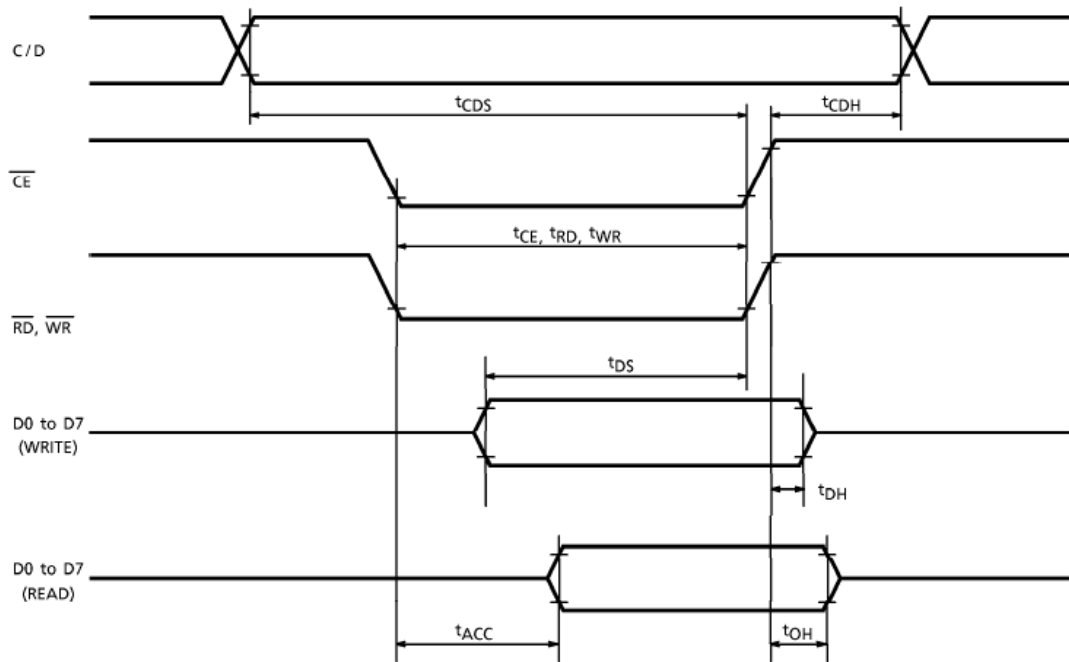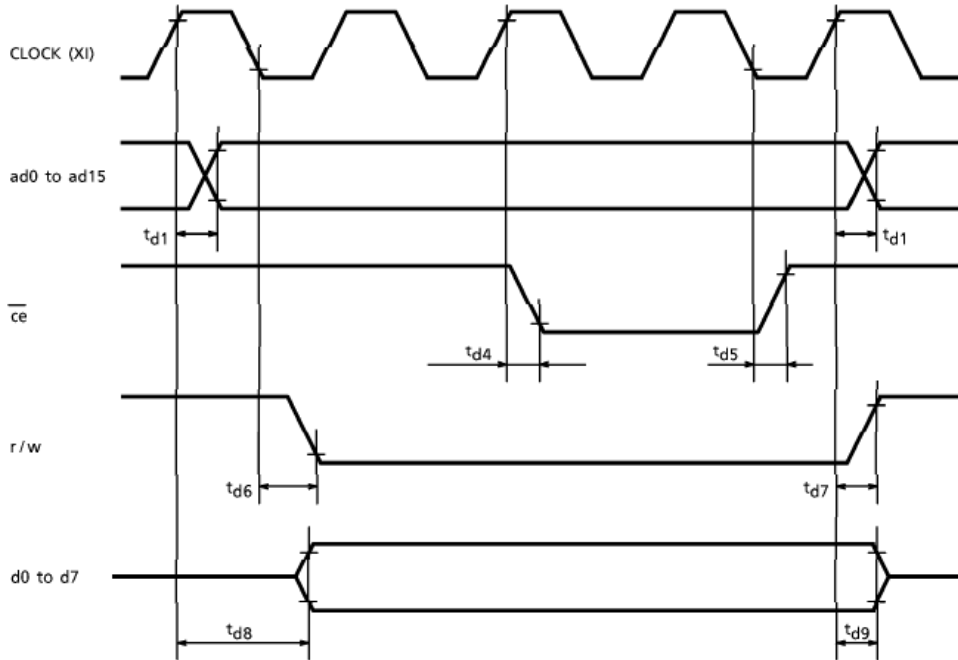
AC CHARACTERISTICS

● Switching Characteristics (1)

TEST CONDITIONS (Unless otherwise noted, $V_{DD} = 5.0V \pm 10\%$, $V_{SS} = 0V$, Ta = −20 to 70°C)

ITEM	SYMBOL	TEST CONDITIONS	MIN	MAX	UNIT
Operating Frequency	f_{scp}	Ta = −10~70°C	—	2.75	MHz
SCP Pulse Width	t_{CWH}, t_{CWL}	—	150	—	ns
SCP Rise / Fall Time	t_r, t_f	—	—	30	ns
LP Set-up Time	t_{LSU}	—	150	290	ns
LP Hold Time	t_{LHD}	—	5	40	ns
Data Set-up Time	t_{DSU}	—	170	—	ns
Data Hold Time	t_{DHD}	—	80	—	ns
FR Delay Time	t_d	—	0	90	ns
CDATA Set-up Time	t_{CSU}	—	450	850	ns
CDATA Hold Time	t_{CHD}	—	450	950	ns

- Switching Characteristics (2)

  Bus Timing

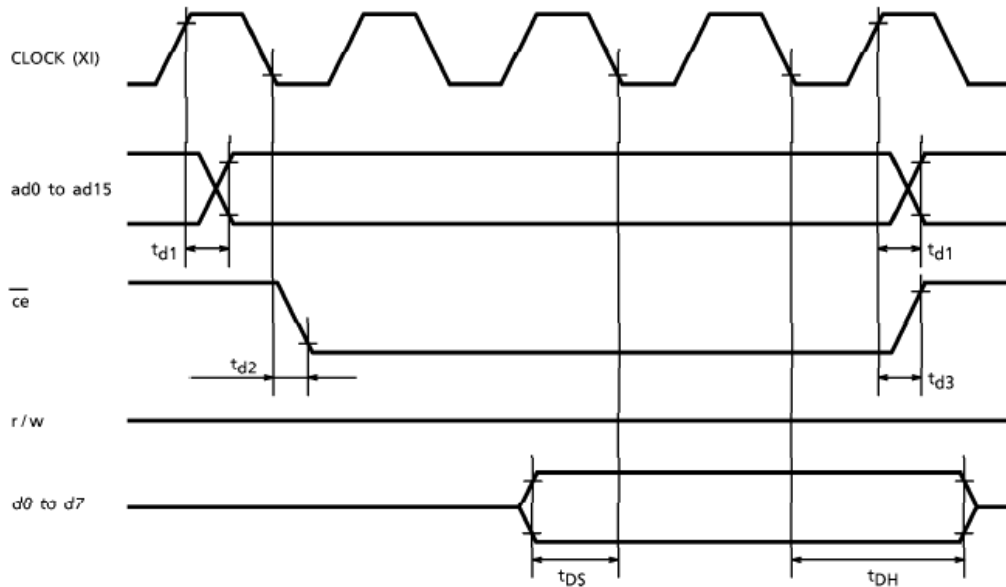TEST CONDITIONS (Unless otherwise noted, $V_{DD} = 5.0V \pm 10\%$, $V_{SS} = 0V$, Ta = − 20 to 75°C)

ITEM	SYMBOL	TEST CONDITIONS	MIN	MAX	UNIT
C/D Set-up Time	t_{CDS}	—	100	—	ns
C/D Hold Time	t_{CDH}	—	10	—	ns
$\overline{CE}$, $\overline{RD}$, $\overline{WR}$ Pulse Width	t_{CE}, t_{RD}, t_{WR}	—	80	—	ns
Data Set-up Time	t_{DS}	—	80	—	ns
Data Hold Time	t_{DH}	—	40	—	ns
Access Time	t_{ACC}	—	—	150	ns
Output Hold Time	t_{OH}	—	10	50	ns

5.2 Write/Read Mode

(2) External RAM Write mode

(1) External RAM Read mode

TEST CONDITIONS (Unless otherwise noted, $V_{DD} = 5.0V \pm 10\%$, $V_{SS} = 0V$, Ta = − 20 to 70°C)

ITEM	SYMBOL	TEST CONDITIONS	MIN	MAX	UNIT
Address Delay Time	t_{d1}	—	—	250	ns
ce Fall Delay Time (Read)	t_{d2}	—	—	180	ns
ce Rise Delay Time (Read)	t_{d3}	—	—	180	ns
Data Set-up Time	t_{DS}	—	0	—	ns
Data Hold Time	t_{DH}	—	30	—	ns
ce Fall Delay Time (Write)	t_{d4}	—	—	200	ns
ce Rise Delay Time (Write)	t_{d5}	—	—	200	ns
r/w Fall Delay Time	t_{d6}	—	—	180	ns
r/w Rise Delay Time	t_{d7}	—	—	180	ns
Data Stable Time	t_{d8}	—	—	450	ns
Data Hold Time	t_{d9}	—	—	200	ns

6. Instruction Table

COMMAND DEFINITIONS

COMMAND	CODE	D1	D2	FUNCTION
REGISTERS SETTING	00100001	X address	Y address	Set Cursor Pointer
	00100010	Data	00H	Set Offset Register
	00100100	Low address	High address	Set Address Pointer
SET CONTROL WORD	01000000	Low address	High address	Set Text Home Address
	01000001	Columns	00H	Set Text Area
	01000010	Low address	High address	Set Graphic Home Address
	01000011	Columns	00H	Set Graphic Area
MODE SET	1000X000	—	—	OR mode
	1000X001	—	—	EXOR mode
	1000X011	—	—	AND mode
	1000X100	—	—	Text Attribute mode
	10000XXX	—	—	Internal CG ROM mode
	10001XXX	—	—	External CG RAM mode
DISPLAY MODE	10010000	—	—	Display off
	1001XX10	—	—	Cursor on, blink off
	1001XX11	—	—	Cursor on, blink on
	100101XX	—	—	Text on, graphic off
	100110XX	—	—	Text off, graphic on
	100111XX	—	—	Text on, graphic on
CURSOR PATTERN SELECT	10100000	—	—	1-line cursor
	10100001	—	—	2-line cursor
	10100010	—	—	3-line cursor
	10100011	—	—	4-line cursor
	10100100	—	—	5-line cursor
	10100101	—	—	6-line cursor
	10100110	—	—	7-line cursor
	10100111	—	—	8-line cursor
DATA AUTO READ / WRITE	10110000	—	—	Set Data Auto Write
	10110001	—	—	Set Data Auto Read
	10110010	—	—	Auto Reset
DATA READ / WRITE	11000000	Data	—	Data Write and Increment ADP
	11000001	—	—	Data Read and Increment ADP
	11000010	Data	—	Data Write and Decrement ADP
	11000011	—	—	Data Read and Decrement ADP
	11000100	Data	—	Data Write and Nonvariable ADP
	11000101	—	—	Data Read and Nonvariable ADP
SCREEN PEEK	11100000	—	—	Screen Peek
SCREEN COPY	11101000			Screen Copy

X : invalid

COMMAND	CODE	D1	D2	FUNCTION
BIT SET / RESET	11110XXX	—	—	Bit Reset
	11111XXX	—	—	Bit Set
	1111X000	—	—	Bit 0 (LSB)
	1111X001	—	—	Bit 1
	1111X010	—	—	Bit 2
	1111X011	—	—	Bit 3
	1111X100	—	—	Bit 4
	1111X101	—	—	Bit 5
	1111X110	—	—	Bit 6
	1111X111	—	—	Bit 7 (MSB)

X : invalid
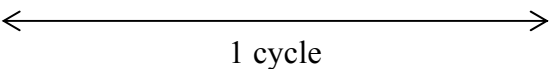
- Setting registers

CODE	HEX.	FUNCTION	D1	D2
00100001	21H	SET CURSOR POINTER	X ADRS	Y ADRS
00100010	22H	SET OFFSET REGISTER	DATA	00H
00100100	24H	SET ADDRESS POINTER	LOW ADRS	HIGH ADRS

7. Reliability Specification

7.1 Contents of Reliability Tests

No.	Test Item	Content of Test	Test Condition
1	High Temperature Storage	Endurance test applying the high storage temperature for a long time	+80°C 96H
2	Low Temperature Storage	Endurance test applying the low storage temperature for a long time	−30°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	+70°C 96H
4	Low Temperature Operation	Endurance test applying the electric stress under low temperature for a long time	−20°C 96H
5	High Temperature/ Humidity Storage	Endurance test applying the high temperature and humidity storage for a long time	40°C 90%RH 96H
6	Temperature Cycle	Endurance test applying the low and high temperature cycle −20°C ⟷ 25°C ⟷ 70°C ⟷ 25°C 30min　　5min　　30min　　5min ⟵――――――――――――――⟶ 1 cycle	−20°C/70°C 10 cycles
7	Vibration Test (Package State)	Endurance test applying the vibration during transportation	10Hz－55Hz, 50m/s,15min
8	Shock Test (Package State)	Endurance test applying the shock during transportation	Half-sinewave, 100m/s, 11ms
9	Atmospheric Pressure Test	Endurance test applying the atmospheric pressure during transportation by air	40 kPa 16 H

7.2 Life Time

Item	Description
1	Function, performance, appearance, etc. shall be free from remarkable deterioration within 50,000 hours under ordinary operating and storage conditions of room temperature (25±10°C), normal humidity (45±20% RH), and in area not exposed to direct sunlight.

* Note: Test Condition

1) Temperature and humidity: If no specification, Temperature set at 25±2°C, Humidity set at 60±5%RH;

2) Operating state: Samples subject to the tests shall be in " Operating " condition.

8. Quality Level

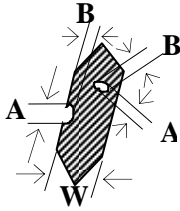### 8.1 Zone Definition
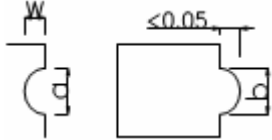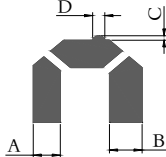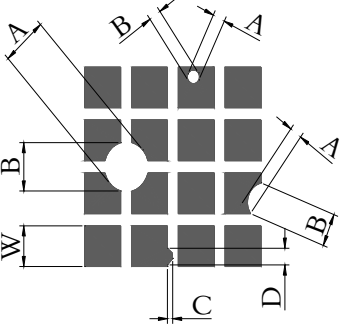

A   Viewing area

B   Outside viewing area
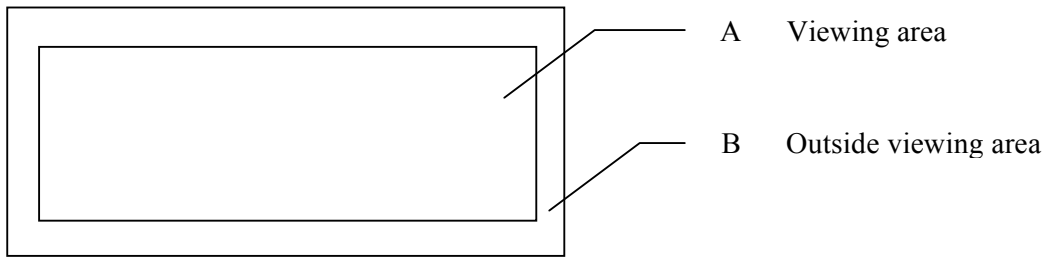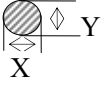
8.2 Visual Inspection

1) Inspect under 2x20W or 40W fluorescent lamp (approximately 3000 lux) leaving 25 to 30 cm between the module and the lamp and 30 cm between the module and the eye (measuring position).

2) Appearance is inspected at the best contrast voltage (best contrast is adjusted considering clearness and crosstalk on screen).

3) Inspect the module at 45° right and left, top and bottom.

4) Use the optimum viewing angle during the contrast inspection.
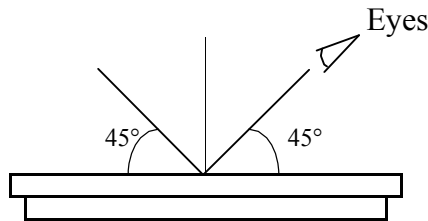
8.3 Standard of Apperance Inspection

No.	Item	Criteria
1	Black spot White spot Dust	Round type: as per following drawing $\Phi = (X+Y)/2$ **Acceptable quantity** <table><tr><td>Size</td><td>Zone A</td><td>Zone B</td></tr><tr><td>Φ<0.1</td><td>Any number</td><td rowspan=4>Any number</td></tr><tr><td>0.1<Φ<0.2</td><td>2</td></tr><tr><td>0.2<Φ<0.25</td><td>1</td></tr><tr><td>0.25<Φ</td><td>0</td></tr></table> Line type: as per following drawing **Acceptable quantity** <table><tr><td>Length</td><td>Width</td><td>Zone A</td><td>Zone B</td></tr><tr><td>—</td><td>W≤0.02</td><td>Any number</td><td rowspan=4>Any number</td></tr><tr><td>L≤3.0</td><td>0.02<W≤0.03</td><td rowspan=2>2</td></tr><tr><td>L≤2.5</td><td>0.03<W≤0.05</td></tr><tr><td>—</td><td>0.05<W</td><td>As round type</td></tr></table> Total acceptable quantity: 3

2	Polariser scratch	Scratch on protective film is permitted Scratch on polariser: same as No. 1

3	Polariser bubble	$\Phi = (X+Y)/2$

Acceptable quantity		
Size	Zone A	Zone B
$\Phi < 0.2$	Any number	
$0.2 < \Phi < 0.5$	2	Any number
$0.5 < \Phi < 1.0$	1	
$1.0 < \Phi$	0	

Total acceptable quantity: 3

4 Segment deformation

4.1 Pin hole on segmented display
W: segment width
$\Phi = (A+B)/2$

Acceptable quantity	
Width	Quantity
W≤0.4	$\Phi \leq 0.2$ and $\Phi \leq 1/2W$
W>0.4	$\Phi \leq 0.25$ and $\Phi \leq 1/3W$

Total acceptable quantity: 1 defect per segment
Pin holes with Φ under 0.10 mm are acceptable

4.2 Pin hole on dot matrix display

Acceptable quantity	
Size	
a, b<0.1	Any number
(a+b)/2≤0.1	Any number
$0.5 < \Phi < 1.0$	3

Total acceptable quantity: 7

4.3 Segments / dots with different width

Acceptable	
a≥b	a/b≤4/3
a<b	a/b>4/3

4.4 Alignment layer defect
$\Phi = (A+B)/2$

Acceptable quantity	
Size	
$\Phi \leq 0.4$	Any number
$0.4 < \Phi \leq 1.0$	5
$1.0 < \Phi \leq 1.5$	3
$1.5 < \Phi \leq 2.0$	2

Total acceptable quantity: 7

5	Colour uniformity	Level of sample for approval set as limit sample

6	Backlight	The backlight colour should correspond to the product specification Flashing and or unlit backlight is not allowed Dust larger than 0.25 mm is not allowed
7	COB	Exposed wire bond pad is not allowed Insufficient covering with resin is not allowed (wire bond line exposed) Dust or bubble on the resin are not allowed
8	PCB	No unmelted solder paste should be present on PCB Cold solder joints, missing solder connections, or oxidation are not allowed No residue or solder balls on PCB are allowed Short circuits on components are not allowed

| 9	Tray particles	Acceptable quantity		
			Size	Quantity
		On tray	$\Phi < 0.2$	Any number
			$\Phi > 0.25$	4
		On display	$\Phi \geqslant 0.25$	2
			L = 3	1

9. Package Specifications

T.B.D.

10. Percautions When Using These LCD Modules

10.1 Handling Precautions

1) Since the display panel is being made of glass, do not apply mechanical impacts such us dropping from a high position.
2) If the display panel is broken by some accident and the internal organic substance leaks out, be careful not to inhale nor lick the organic substance.
3) If pressure is applied to the display surface or its neighborhood of the LCD Module, the cell structure may be damaged and be careful not to apply pressure to these sections.
4) The polarizer covering the surface of the LCD Module is soft and easily scratched. Please be careful when handling the LCD Module.
5) When the surface of the polarizer of the LCD Module has soil, clean the surface. It takes dvantage of by using following adhesion tape.
   * Scotch Mending Tape No. 810 or an equivalent.
   Never try to breathe upon the soiled surface nor wipe the surface using cloth containing solvent such as ethyl alcohol, since the surface of the polarizer will become cloudy.
   Also, pay attention that the following liquid and solvent may spoil the polarizer:
   * Water
   * Ketone
   * Aromatic Solvents
6) Hold LCD Module very carefully when palcing LCD Module into the system housing. Do not apply excessive stress or pressure to LCD Module. And, do not over bend the film with electrode pattern layouts. These stresses will influence the display performance. Also, secure sufficient rigidity for the outer cases.
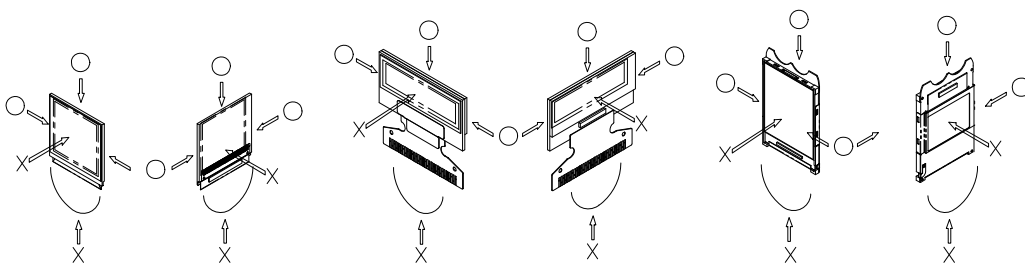
7) Do not apply stress to the LSI chips and the surrounding molded sections.
8) Do not disassemble nor modify the LCD Module.
9) Do not apply input signals while the logic power is off.
10) Pay sufficient attention to the working environments when handing LCD Modules to prevent occurrence of element breakage accidents by static electricity.
   * Be sure to make human body grounding when handling LCD Modules.
   * Be sure to ground tools to use or assembly such as soldering irons.
   * To suppress generation of static electricity, avoid carrying out assembly work under dry environments.
   * Protective film is being applied to the surface of the display panel of the LCD Module. Be careful since static electricity may be generated when exfoliating the

protective film.

* Protective film is being applied to the surface of the display panel of the LCD Module. Be careful since static electricity may be generated when exfoliating the protective film

11) Protection film is being applied to the surface of the display panel and removes the protection film before assembling it. At this time, if the LCD Module has been stored for a long period of time, residue adhesive material of the protection film may remain on the surface of the display panel after removed of the film. In such case, remove the residue material by the method introduced in the above Section 5).

12) If electric current is applied when the LCD Module is being dewed or when it is placed under high humidity environments, the electrodes may be corroded and be careful to avoid the above.

10.2 Storage Precautions

1) When storing LCD Modules, put them in static electricity preventive bags avoiding exposure to direct sun light nor to lights of fluorescent lamps. and, also, avoiding high temperature and high humidity environment or low temperature (less than 0°C) environments. (We recommend you to store these modules in the packaged state when they were shipped from Blaze Display Technology Co., Ltd.)
At that time, be careful not to let water drops adhere to the packages or bags nor let dewing occur with them.

2) If electric current is applied when water drops are adhering to the surface of the LCD Module, when the LCD Module is being dewed or when it is placed under high humidity environments, the electrodes may be corroded and be careful about the above.

10.3 Designing Precautions

1) The absolute maximum ratings are the ratings which can not be exceeded for LCD Module, and if these values are exceeded, panel damage may be happen.

2) To prevent occurrence of malfunctioning by noise, pay attention to satisfy the VIL and VIH specifications and, at the same time, to make the signal line cable as short as possible.

3) We recommend you to install excess current preventive unit (fuses, etc.) to the power circuit (VDD). (Recommend value: 0.5A)

5) Pay sufficient attention to avoid occurrence of mutual noise interference with the neighboring devices.

6) As for EMI, take necessary measures on the equipment side basically.
When fastening the LCD Module, fasten the external plastic housing section.

7) If power supply to the LCD Module is forcibly shut down by such errors as taking out the main battery while the LCD Panel is in operation, we cannot guarantee the quality of this LCD Module.

8) The electric potential to be connected to the rear face of the IC chip should be as follows:
* Connection (contact) to any other potential than the above may lead to rupture of the IC.

10.4 Precautions When Disposing of the LCD Modules

Request the qualified companies to handle industrial wastes when disposing of the LCD Modules. Or, when burning them, be sure to observe the environmental and hygienic laws and regulations.

10.5 Other Precautions

1) When a LCD Module is operated for a long of time with fixed pattern may remain as an after image or slight contrast deviation may occur.
   Nonetheless, if the operation is interrupted and left unused for a while, normal state can be restored. Also, there will be no problem in the reliability of the module

2) To protect LCD Modules from performance drops by static electricity rapture, etc., do not touch the following sections whenever possible while handling the LCD Modules.
   * Pins and electrodes
   * Pattern layouts such as the TCP & FPC

3) With this LCD Module, the LCD Module driver is being exposed. Generally speaking, semiconductor elements change their characteristics when light is radiated according to the principle of the solar battery. Consequently, if this LCD Module driver is exposed to light, malfunctioning may occur.
   * Design the product and installation method so that the LCD Module driver may be shielded from light in actual usage.
   * Design the product and installation method so that the LCD Module driver may be shielded from light during the inspection processes.

4) Although this LCD Module stores the operation state data by the commands and the indication data, when excessive external noise, etc. enters into the module, the internal status may be changed to take appropriate measures to suppress noise generation or to protect from influences of noise on the system design.

5) We recommend you to construct its software to make periodical refreshment of the operation statuses (re-setting of the commands and re-transference of the display data) to cope with catastrophic noise.