3. GENERAL SPECIFICATION

Display Format :	128 (W) ·	64 (H)	Dots
Dot Size :	0.4 (W) ·	0.56 (H)	mm
View Area :	62.0 (W) ·	44.0 (H)	mm
General Dimensions :	78 (W) ·	70 (H) ·	13 (T) mm Max.
Weight :	g max.		

LCD Type : ☐ STN Gray ☐ STN Yellow ☑ FSTN

Polarizer mode : ☐ Reflective ☑ Transflective

☐ Transmissive ☐ Negative

View Angle : ☑ 6 O'clock ☐ 12 O'clock ☐ Others ____

Backlight : ☑ LED ☐ EL ☐ CCFL

Backlight Color : ☑ Yellow Green ☑ Blue ☑ Black

☐ White ☑ Gray

Controller / Driver : KS0107/KS0108

Temperature Range : ☐ Normal ☑ Wide Temperature

Operating	0 to 50°C	Operating	-20 to 70°C
Storage	-20 to 70°C	Storage	-30 to 80°C

Remark:

4. ABSOLUTE MAXIMUM RATINGS

4.1 ELECTRICAL ABSOLUTE MAXIMUM RATINGS

V_{SS}= 0V, Ta = 25°C

Item	Symbol	Min.	Max.	Unit
Supply Voltage (Logic)	V_{DD}-V_{SS}	0	8	V
Supply Voltage (LCD Driver)	V_{DD}-V_{EE}	0	16.5	V
Input Voltage	V_I	V_{SS}-0.3	V_{DD}+0.3	V
Operating Temperature	T_{OP}	0	50	°C
Storage Temperature	T_{STG}	-20	70	°C

4.2 ENVIRONMENTAL ABSOLUTE MAXIMUM RATINGS

Item	Operating		Storage		Comment
	(Min.)	Max.)	(Min.)	(Max.)	
Ambient Temp	0	50	-20	70	Note (1)
Humidity	Note (2)		Note(2)		Without Condensation
Vibration	--	4.9M/S^2	--	19.6M/S^2	XYZ Direction
Shock	--	29.4M/S^2	--	490M/S^2	XYZ Direction

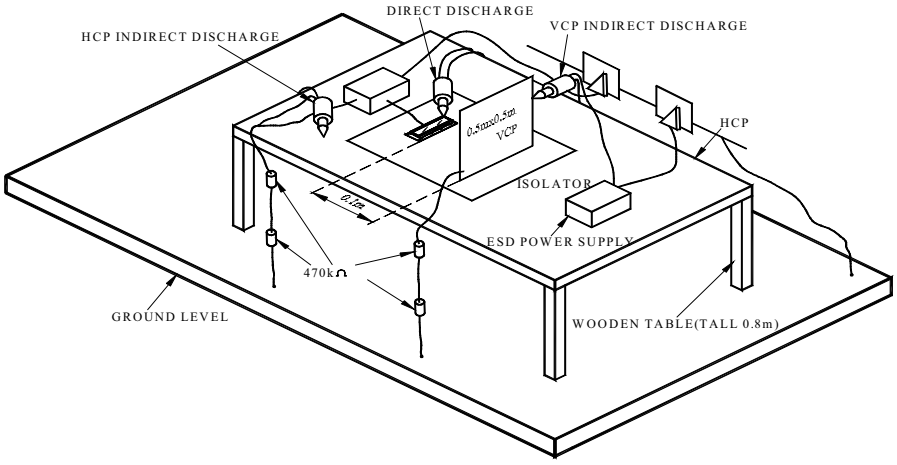
Note(1) Ta = 0°C : 50Hr Max.
Note(2) Ta ≤ 40°C : 90% RH Max.
Ta ≥ 40°C : Absolute humidity must be lower than the humidity of 90% RH at 40°C.

4.3 Electronic Static Discharge maximum rating

ESD test method : IEC1000-4-2

Item	Description	
Testing environment	Ambient temperature :15°C to 35 °C Humidity: 30% to 60 % LCM (E.U.T) : Power up	
Testing equipment	Manufacture: NoiseKen, Model No. ESD-100L	
Testing condition	See drawing 1	
Direct discharge	0 to ± 6 KV	Discharge point, see drawing 2
Indirect discharge	0 to ± 12KV	Discharge point, see drawing 1
Pass condition	No malfunction of unit. Temporary malfunction of unit which can be recovered by system reset	
Fail condition	Non. Recoverable malfunction of LCM or system	

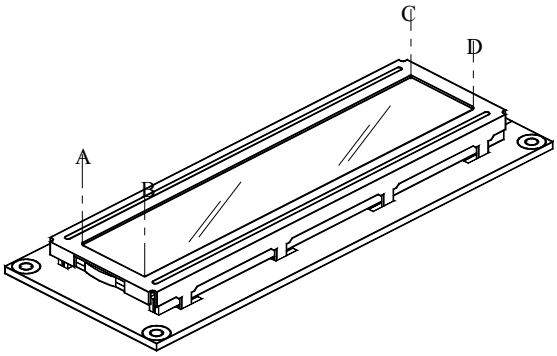
FIG 1 ESD TESTING EQUIPMENT



(1)

DIRECT CONTACT DISCHARGE

CONTACT POINT : A.B.C.D



(2)

5. ELECTRICAL CHARACTERISTICS

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Supply Voltage (Logic)	V_{DD}-V_{SS}		4.5	5.0	5.5	V
Supply Voltage (LCD)	V_{DD}-V_O	0°C	9.5	10	10.85	V
		25°C	9.0	9.5	10.2	
		50°C	8.4	8.9	9.6	
Input Voltage	V_{IH}	--	0.7V_{DD}	--	V_{DD}	V
	V_{IL}		V_{SS}	--	0.3V_{DD}	
Logic Supply Current	I_{DD}	V_{DD}-V_{SS}=5V	--	4	--	mA

6. ELECTRO-OPTICAL CHARACTERISTICS

ITEM	Symbol	Condition	Min.	Typ.	Max.	Unit	Ref.
Rise Time	Tr	0°C	--	400	600	ms	Note (1)
		25°C		110	170		
Fall Time	Tf	0°C	--	500	800	ms	
		25°C		110	170		
Contrast	CR	25°C	--	3	--		Note (3)
View Angle	$\theta 1$~$\theta 2$ $\varnothing 1$, $\varnothing 2$	25°C & CR≧1.5	40	--	--		Note (2)
			35	--	--		
Frame Frequency	Ff	25°C	--	64	--	Hz	

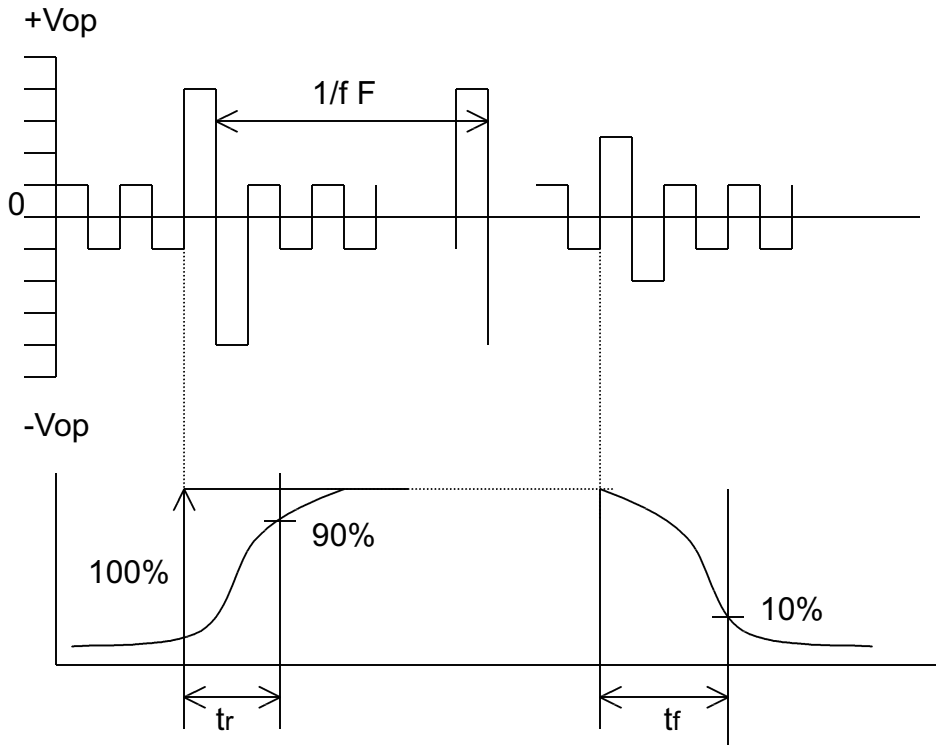
Note (1) & (2) : See next page

Note (3) : Contrast ratio is defined under the following condition:

$$CR = \frac{\text{Brightness of non-selected condition}}{\text{Brightness of selected condition}}$$

(a). Temperature ---------- 25°C
(b). Frame frequency ---- 64Hz
(c). Viewing angle -------- θ= 0°, $\varnothing$ = 0°
(d). Operating voltage --- 9.5V

Note (1) Response time is measured as the shortest period of time possible between the change in state of an LCD segment as demonstrated below:

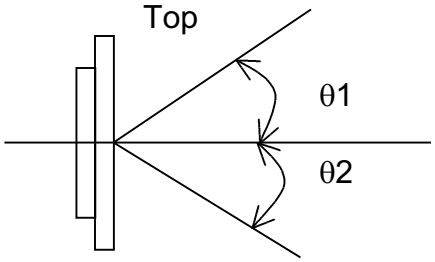


Condition:

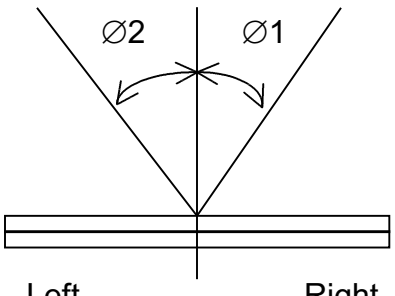
(a) . Temperature ----------25℃
(b) . Frame frequency --------- 64Hz
(c) . View Angle ---------- θ = 0°, ∅=0°
(d) . Operating voltage -------- 9.5V

Note (2) Definition of View Angle

Top – Bottom direction



Right -- Left direction



6.1 LED ELECTRO-OPTICAL CHARACTERISTIC

Ta = 25°C

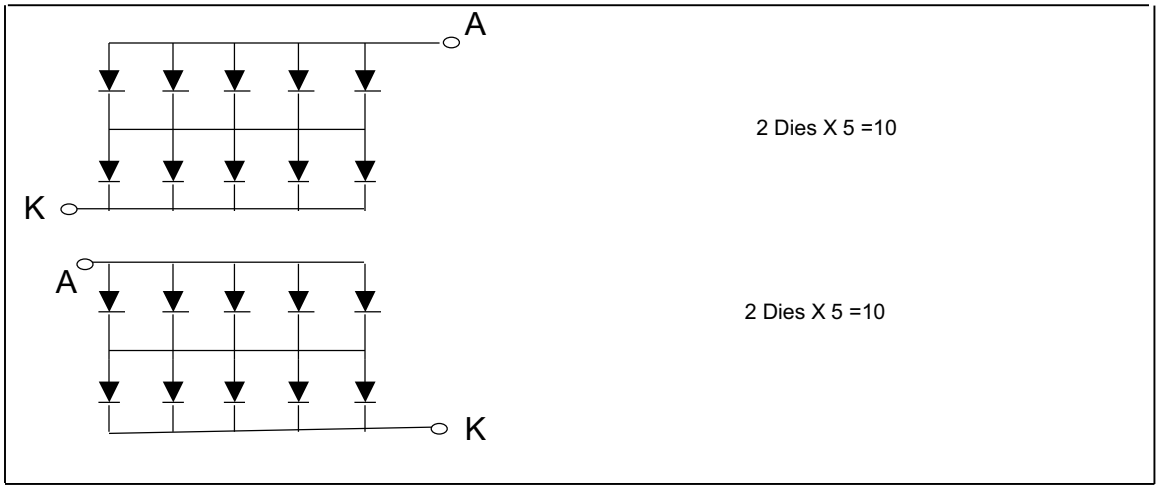
Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Forward Voltage	V_F	IF =100mA Blue	--	6.2	--	V
Luminous Intensity	I_V	IF =100mA Blue		27	--	cd/m^2
Peak Emission	λP	IF = 100mA Blue	--	470	--	nm
Spectrum Radiation	$\Delta\lambda$	IF = 100mA Blue	--	65	--	nm
Reverse Current	IR	VR = 8V Blue	--	--	0.2	mA

Note : Measured at the bared LED backlight unit.

6.1.2 LED MAXIMUM OPERATING RANGE

Item	Symbol	Blue	Unit
Power Dissipation	P_{AD}	1.85	W
Forward Current	I_{AF}	250	mA
Reverse Voltage	VR	8	V

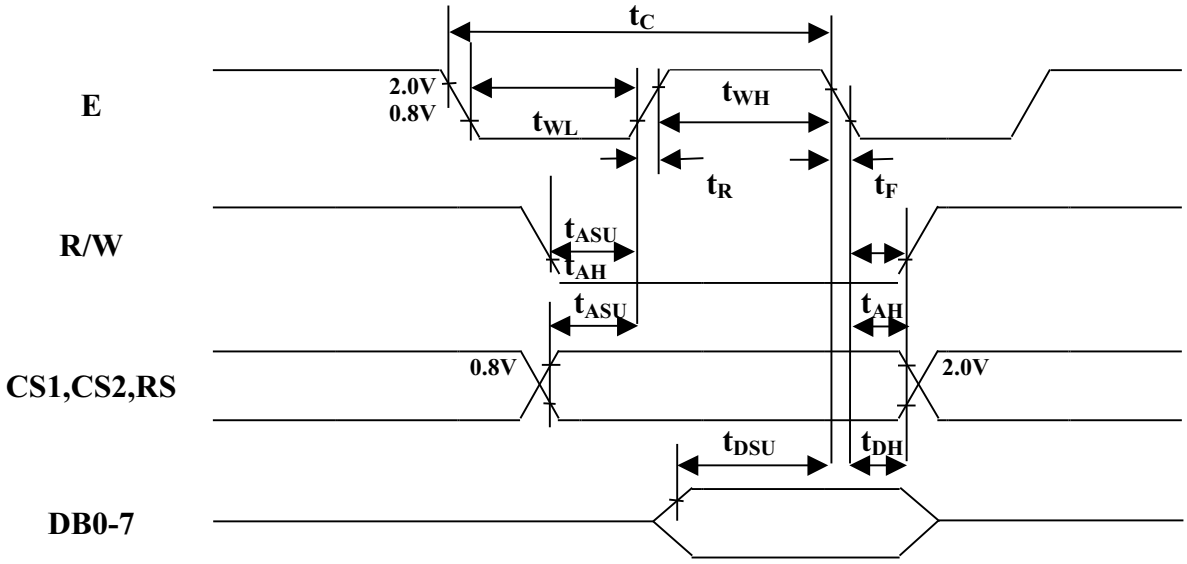
6.1.3 LED BLOCK DIAGRAM



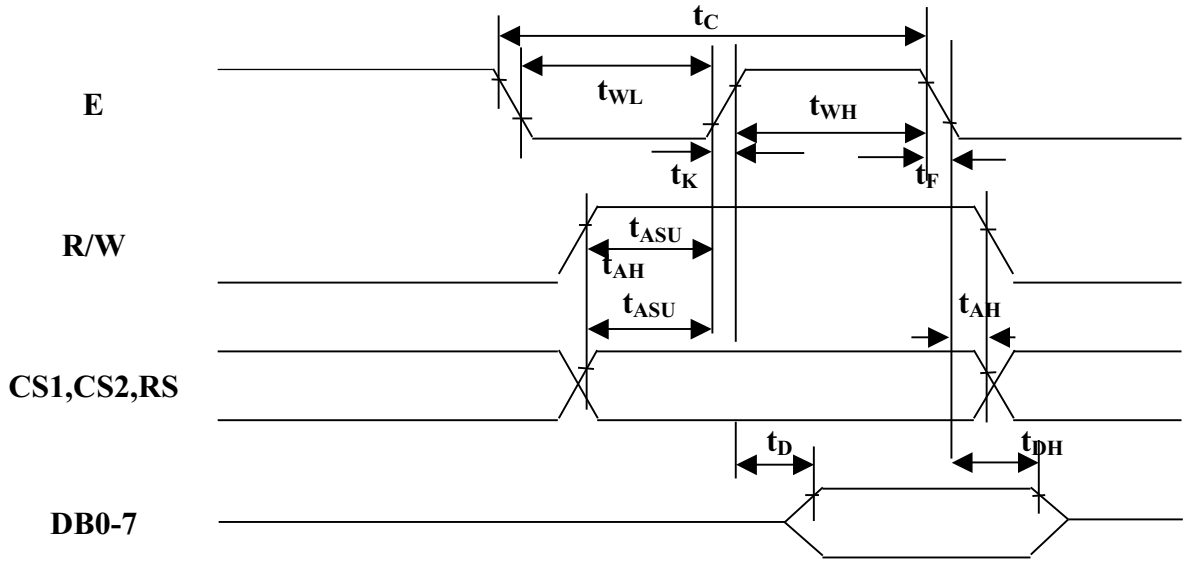
7. TIMING CHARACTERISTICS

MPU Interface

Characteristic	Symbol	Min	Typ	Max	Unit
E Cycle	t_C	1000	--	--	ns
E High Level Width	t_{WH}	450	--	--	ns
E Low Level Width	t_{WL}	450	--	--	ns
E Rise Time	t_R	--	--	25	ns
E Fall Time	t_F	--	--	25	ns
Address Set-Up Time	t_{ASU}	140	--	--	ns
Address Hold Time	t_{AH}	10	--	--	ns
Data Set-Up Time	t_{SU}	200	--	--	ns
Data Delay Time	t_D	--	--	320	ns
Data Hold Time (Write)	t_{DHW}	10	--	--	ns
Data Hold Time (Read)	t_{DHR}	20	--	--	ns



MPU write timing

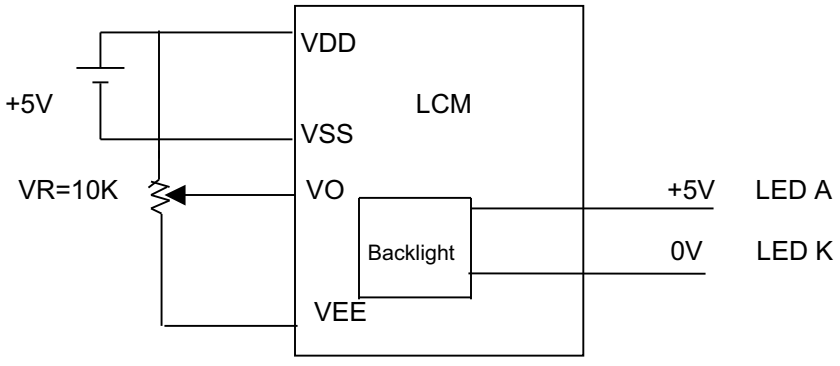


MPU read timing

8. PIN CONNECTIONS

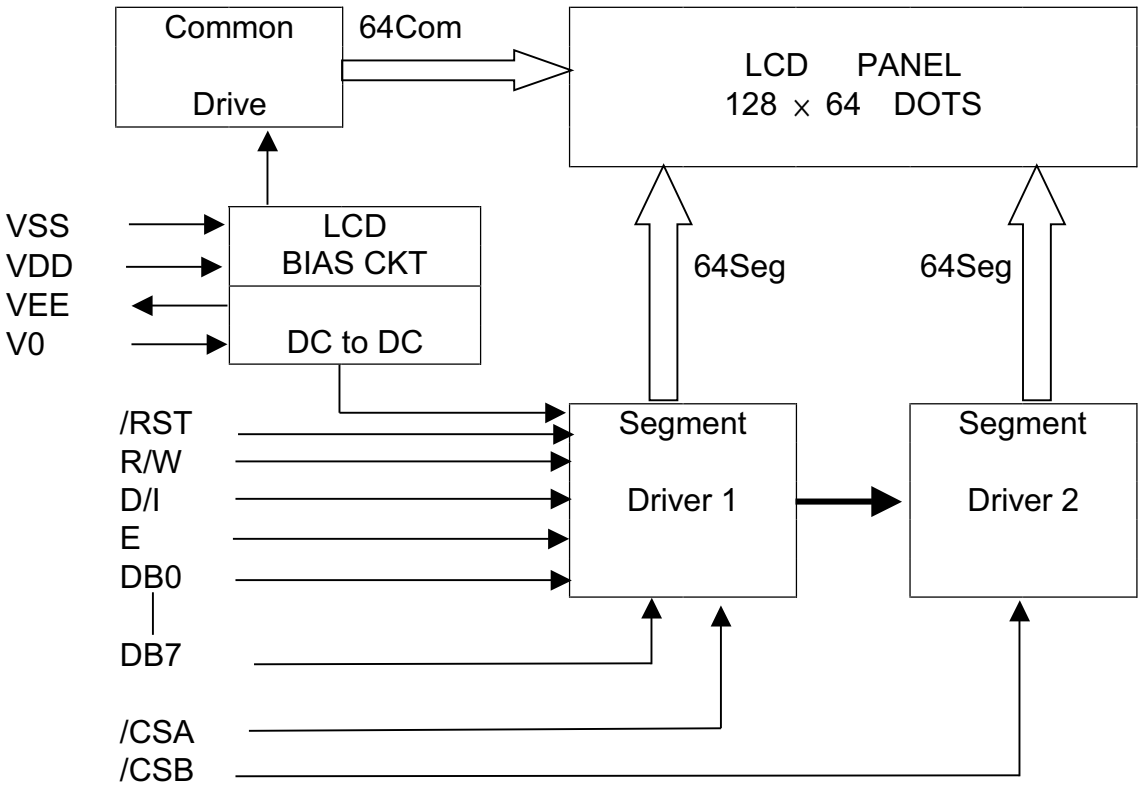
No.	Symbol	Function
1	/CSA	Chip select for IC1, Active LOW
2	/CSB	Chip select for IC2, Active LOW
3	V_{SS}	Ground (0V)
4	V_{DD}	+5V
5	V_0	Power Supply For LCD Drive
6	D/I	L→ Instructions H→ Data
7	R/W	H→ Data Read (LCD → MPU) L→ Data Write (LCD ← MPU)
8	E	Enable Signal
9	DB0	Data Bus Line
10	DB1	
11	DB2	
12	DB3	
13	DB4	
14	DB5	
15	DB6	
16	DB7	
17	/RST	Reset, Active LOW
18	V_{EE}	Negative Voltage output
19	LEDA	LED Anode. Power Supply +
20	LEDK	LED Cathode. Power Supply -

9. POWER SUPPLY



-

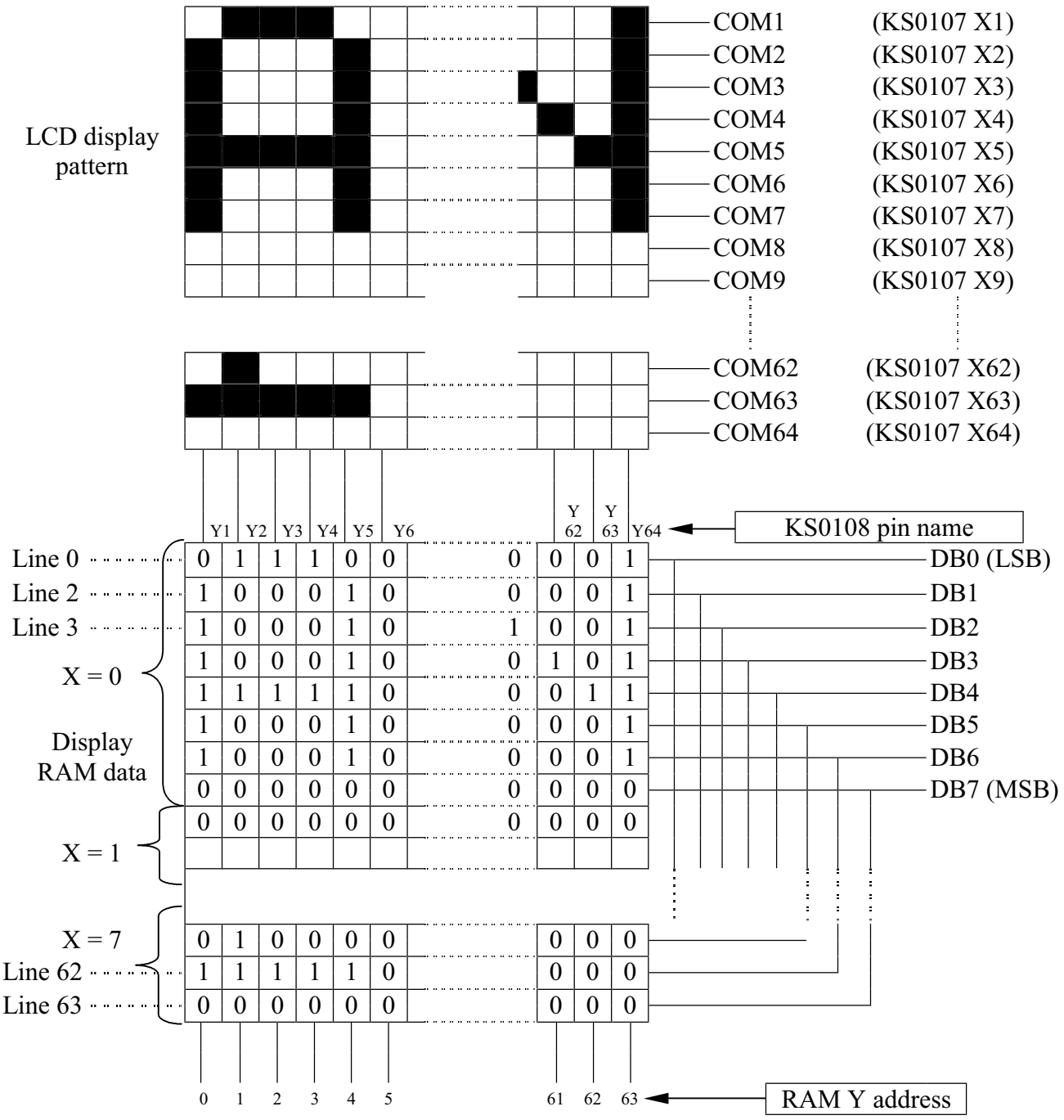
10. BLOCK DIAGRAM



DISPLAY CONTROL INSTRUCTION

The display control instructions control the internal state of the KS0108B . Instruction is received from MPU to KS0108B for the display control. The following table shows various instructions.

Instruction	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	Function
Display ON/OFF	L	L	L	L	H	H	H	H	H	L/H	Controls the display on or off. Internal status and display RAM data is not affected. L : OFF, H : ON
Set Address	L	L	L	H	Y address (0-63)						Sets the Y address in the Y address counter.
Set Page (X address)	L	L	H	L	H	H	H	Page (0-7)			Sets the X address at the X address counter.
Display Start Line	L	L	H	H	Display start line (0-63)						Indicates the display data RAM displayed at the top of the screen
Status Read	L	H	BUSY	L	ON / OFF	RESET	L	L	L	L	Read status. BUSY L: Ready H: In operation ON/OFF L: Display ON H: Display OFF RESET L: Normal H: Reset
Write Display Data	H	L	Write Data								Writes data (DB0:7)into display data RAM. After writing instruction, Y address is increased by 1 automatically.
Read Display Data	H	H	Read Data								Read data (DB0:7) from display data RAM to the data bus.



ADC = 1 (connected to V_{CC})

Relation between RAM Data ant Display

11. QUALITY ASSURANCE

11.1 Test Condition

11.1.1 Temperature and Humidity(Ambient Temperature)
Temperature : 20 ± 5°C
Humidity : 65 ± 5%

11.1.2 Operation
Unless specified otherwise, test will be conducted with LCM in operation.

11.1.3 Container
Unless specified otherwise, vibration test will be conducted on module only.

11.1.4 Test Frequency
Single cycle.

11.1.5 Test Method

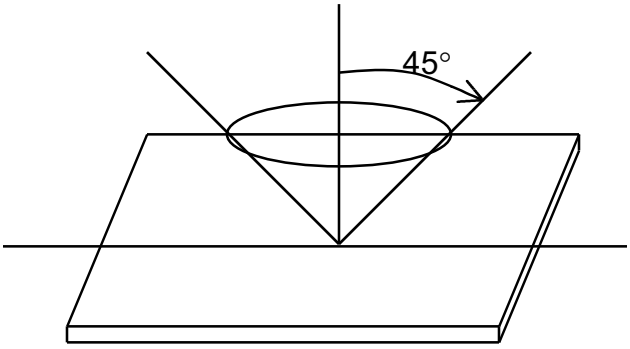
No.	Parameter	Conditions	Regulations
1	High Temperature Operating	50 ± 2 °C	Note 3
2	Low Temperature Operating	0 ± 2 °C	Note 3
3	High Temperature Storage	70 ± 2 °C	Note 3
4	Low Temperature Storage	-20 ± 2 °C	Note 3
5	Vibration Test (Non-operation state)	Total fixed amplitude : 1.5mm Vibration Frequency : 10 ~ 55Hz One cycle 60 seconds to 3 directions of X.Y.Z. for each 15 minutes	Note 3
6	Damp Proof Test (Non-operation state)	40°C ± 2°C, 90~95%RH, 96h	Note 1,2
7	Shock Test (Non-operation state)	To be measured after dropping from 60cm high once concrete surface in packing state	Note 3

Note 1: Returned under normal temperature and humidity for 4 hrs.
Note 2: No dew condensation to be observed.
Note 3: No change on display and in operation under the test condition

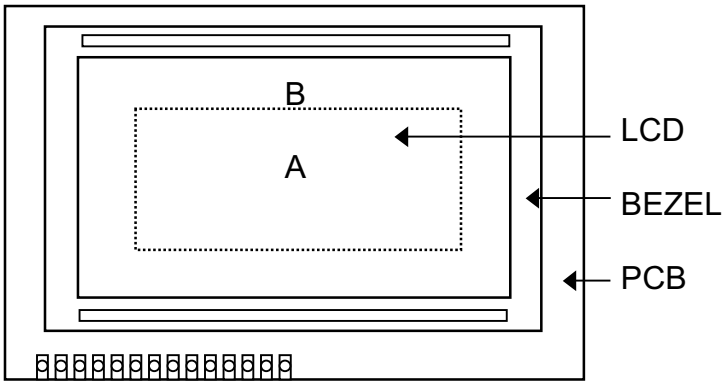
11.2 Inspection condition

11.2.1 Inspection conditions

The LCD shall be inspected under 40W white fluorescent light.



11.2.2 Definition of applicable Zones



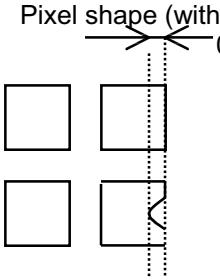
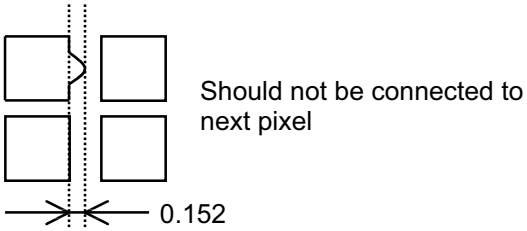
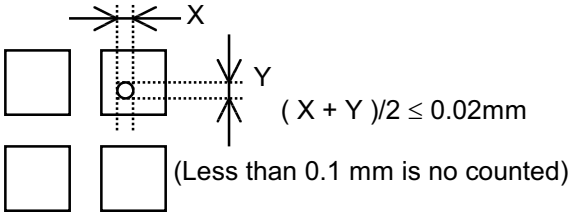
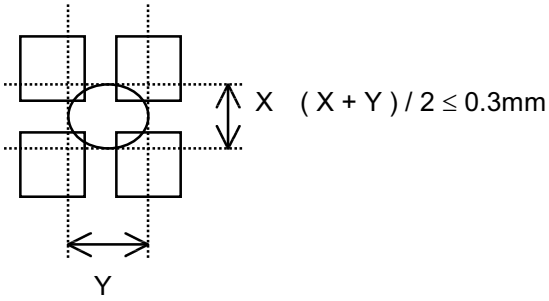
A : Display Area
B : Non-Display Area

11.2.3 Inspection Parameters

<table>
<tr><th>No.</th><th>Parameter</th><th>Criteria</th></tr>
<tr><td>1</td><td>Black or White spots</td><td>
<table>
<tr><th rowspan="2">Zone / Dimension</th><th colspan="2">Acceptable number</th><th rowspan="2">Class Of Defects</th><th rowspan="2">AQL Level</th></tr>
<tr><th>A</th><th>B</th></tr>
<tr><td>D < 0.15</td><td>*</td><td>*</td><td rowspan="4">Minor</td><td rowspan="4">2.5</td></tr>
<tr><td>0.15≤ D< 0.2</td><td>4</td><td>4</td></tr>
<tr><td>0.2 ≤ D ≤ 0.25</td><td>2</td><td>2</td></tr>
<tr><td>D ≤ 0.3</td><td>0</td><td>1</td></tr>
</table>
D = (Long + Short) / 2 * : Disregard
</td></tr>
<tr><td>2</td><td>Scratch, Substances</td><td>
<table>
<tr><th rowspan="2">Zone / X (mm) / Y(mm)</th><th colspan="2">Acceptable number</th><th rowspan="2">Class Of Defects</th><th rowspan="2">AQL Level</th></tr>
<tr><th>A</th><th>B</th></tr>
<tr><td>*</td><td>0.04 ≥ W</td><td>*</td><td>*</td><td rowspan="4">Minor</td><td rowspan="4">2.5</td></tr>
<tr><td>3.0 ≥ L</td><td>0.06 ≥ W</td><td>4</td><td>4</td></tr>
<tr><td>2.0 ≥ L</td><td>0.08 ≥ W</td><td>2</td><td>3</td></tr>
<tr><td>—</td><td>0.1 < W</td><td>0</td><td>1</td></tr>
</table>
X : Length Y : Width * : Disregard

Total defects should not exceed 4/module
</td></tr>
<tr><td>3</td><td>Air Bubbles
(between glass
& polarizer)</td><td>
<table>
<tr><th rowspan="2">Zone / Dimension</th><th colspan="2">Acceptable number</th><th rowspan="2">Class of Defects</th><th rowspan="2">AQL Level</th></tr>
<tr><th>A</th><th>B</th></tr>
<tr><td>D ≤ 0.15</td><td>*</td><td>*</td><td rowspan="3">Minor</td><td rowspan="3">2.5</td></tr>
<tr><td>0.15 < D ≤ 0.25</td><td>2</td><td>*</td></tr>
<tr><td>0.25 < D</td><td>0</td><td>1</td></tr>
</table>
* : Disregard

Total defects shall not excess 3/module.
</td></tr>
</table>

3	Uniformity of Pixel	(1) Pixel shape (with Dent)  (2) Pixel shape (with Projection)  (3) Pin hole  (4) Deformation  Total acceptable number : 1/pixel, 5/cell

12. PRECAUTION FOR USING LCM

1. LIQUID CRYSTAL DISPLAY (LCD)

LCD is made up of glass, organic sealant, organic fluid, and polymer based polarizers. The following precautions should be taken when handing:

(1). Keep the temperature within range of use and storage. Excessive temperature and humidity could cause polarization degredation, polarizer peel off or bubble.

(2). Do not contact the exposed polarizers with anything harder than an HB pencil lead. To clean dust off the display surface, wipe gently with cotton, chamois or other soft material soaked in petroleum benzin.

(3). Wipe off saliva or water drops immediately. Contact with water over a long period of time may cause polarizer deformation or color fading, while an active LCD with water condensation on its surface will cause corrosion of ITO electrodes.

(4). Glass can be easily chipped or cracked from rough handling, especially at corners and edges.

(5). Do not drive LCD with DC voltage.

2. Liquid Crystal Display Modules

2.1 Mechanical Considerations

LCM are assembled and adjusted with a high degree of precision. Avoid excessive shocks and do not make any alterations or modifications. The following should be noted:

(1). Do not tamper in any way with the tabs on the metal frame.

(2). Do not modify the PCB by drilling extra holes, changing its outline, moving its components or modifying its pattern.

(3). Do not touch the elastomer connector, especially insert an backlight panel (for example, EL).

(4). When mounting a LCM make sure that the PCB is not under any stress such as bending or twisting . Elastomer contacts are very delicate and missing pixels could result from slight dislocation of any of the elements.

(5). Avoid pressing on the metal bezel, otherwise the elastomer connector could be deformed and lose contact, resulting in missing pixels.

2.2. Static Electricity

LCM contains CMOS LSI's and the same precaution for such devices should apply, namely:

(1). The operator should be grounded whenever he/she comes into contact with the module. Never touch any of the conductive parts such as the LSI pads, the copper leads on the PCB and the interface terminals with any parts of the human body.

(2). The modules should be kept in antistatic bags or other containers resistant to static for storage.

(3). Only properly grounded soldering irons should be used.

(4). If an electric screwdriver is used, it should be well grounded and shielded from commutator sparks.

(5). The normal static prevention measures should be observed for work clothes and working benches; for the latter conductive (rubber) mat is recommended.

(6). Since dry air is inductive to static, a relative humidity of 50-60% is recommended.

2.3 Soldering

(1). Solder only to the I/O terminals.

(2). Use only soldering irons with proper grounding and no leakage.

(3). Soldering temperature: 280°C ± 10°C

(4). Soldering time: 3 to 4 sec.

(5). Use eutectic solder with resin flux fill.

(6). If flux is used, the LCD surface should be covered to avoid flux spatters. Flux residue should be removed after wards.

2.4 Operation

(1). The viewing angle can be adjusted by varying the LCD driving voltage V0.

(2). Driving voltage should be kept within specified range; excess voltage shortens display life.

(3). Response time increases with decrease in temperature.

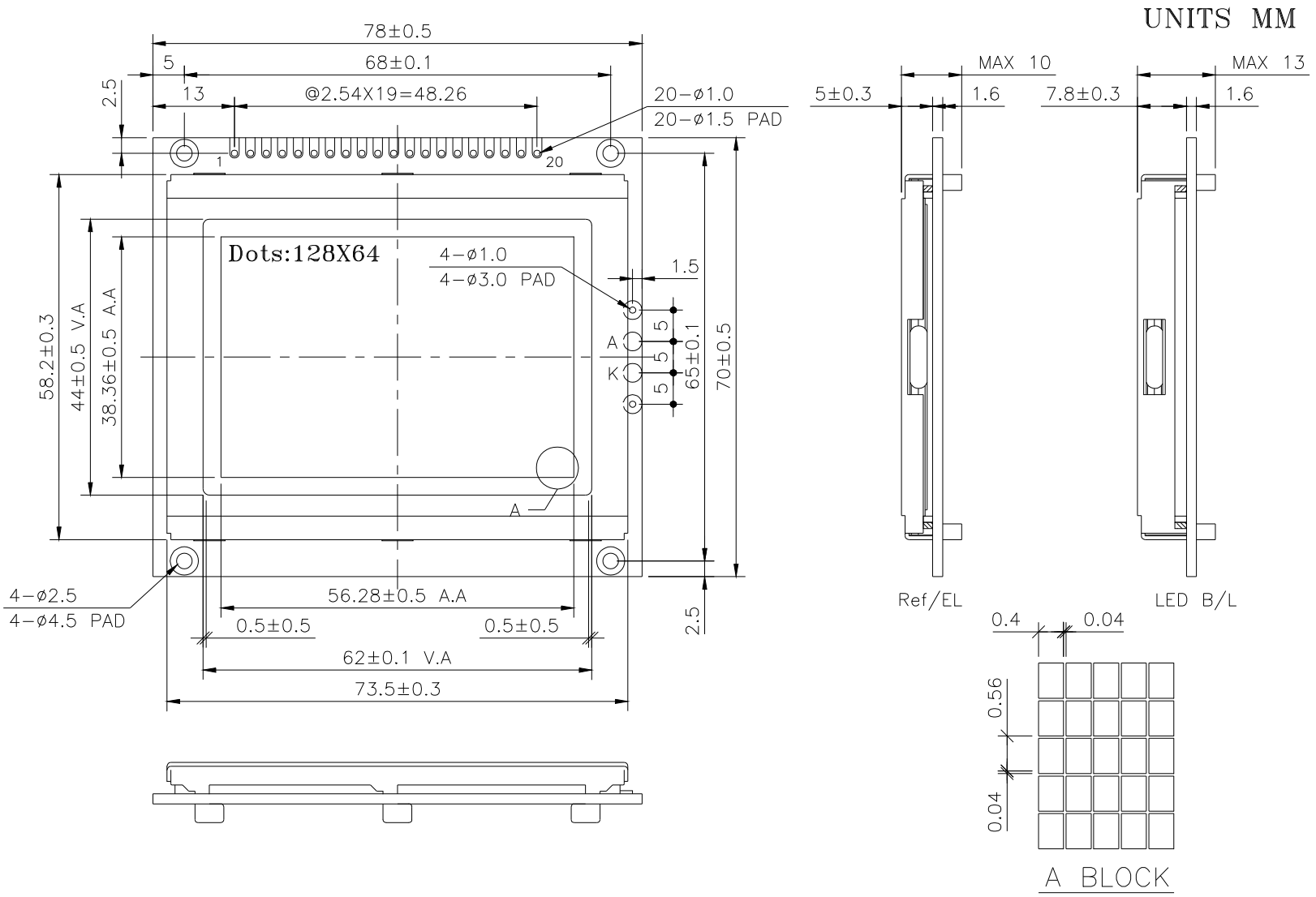
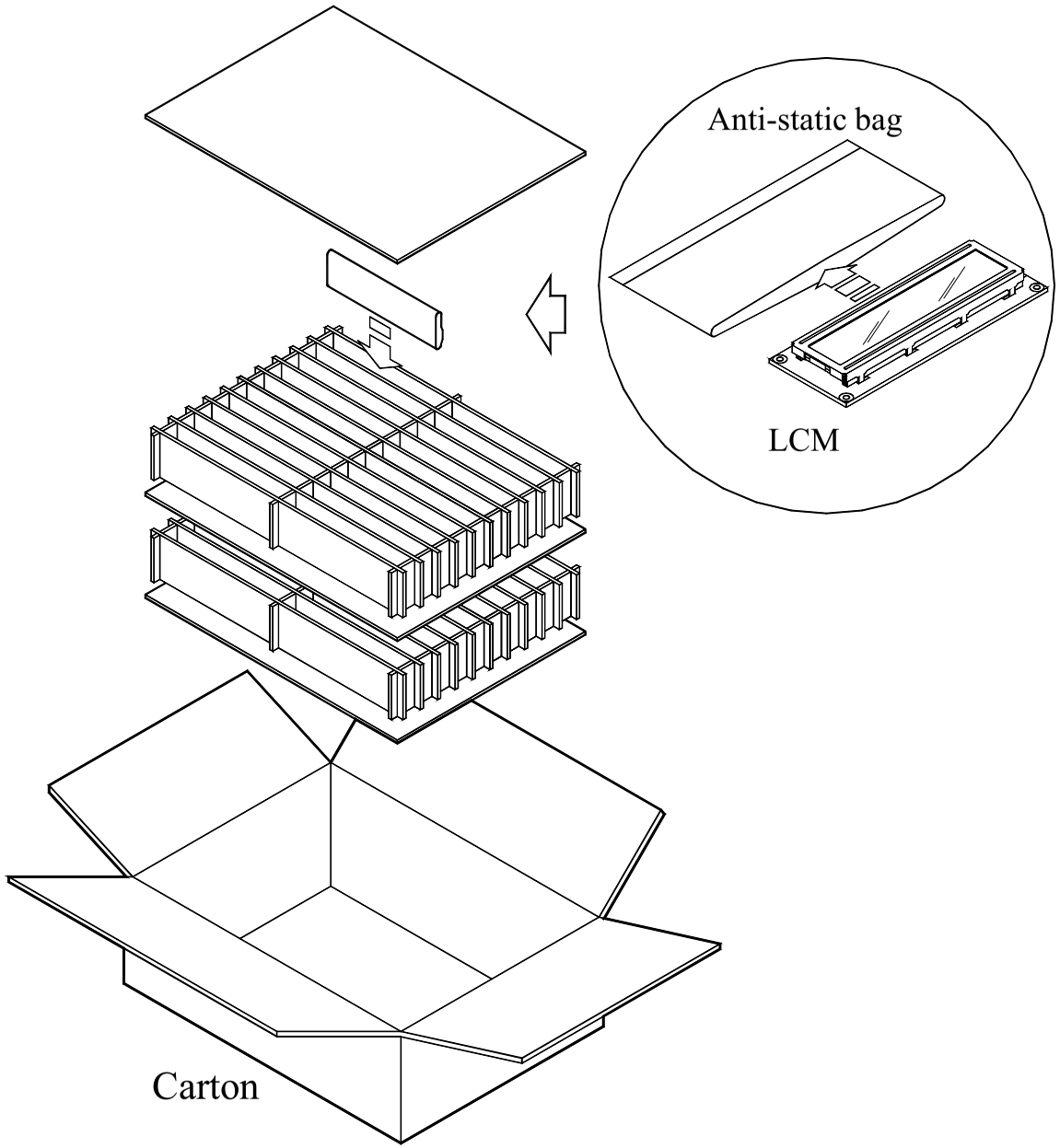
(4). Display may turn black or dark blue at temperatures above its operational range; this is (however not pressing on the viewing area) may cause the segments to appear "fractured".

(5). Mechanical disturbance during operation (such as pressing on the viewing area) may cause the segments to appear "fractured".

2.5 Storage

If any fluid leaks out of a damaged glass cell, wash off any human part that comes into contact with soap and water. Never swallow the fluid. The toxicity is extremely low but caution should be exercised at all the time.

13. OUTLINE DRAWING



14 . PACKAGE INFORMATION