DATA IMAGE CORPORATION

LCD Module Specification

ITEM NO.: **GM12321AS1LY-J1**

Table of Contents

1. COVER & CONTENTS ····· 1
2. RECORD OF REVISION ····· 2
3. GENERAL SPECIFICATIONS ····· 3
4. ABSOLUTE MAXIMUM RATINGS ····· 4
5. ELECTRICAL CHARACTERISTICS ····· 5
6. ELECTRO-OPTICAL CHARACTERISTIC ····· 5
7. TIMING CHARACTERISTICS ····· 8
8. PIN CONNECTIONS ····· 10
9. POWER SUPPLY ····· 10
10. BLOCK DIAGRAM ····· 11
11. QUALITY ASSURANCE ····· 14
12. LOT NUMBERING SYSTEM ····· 18
13. LCM NUMBERING SYSTEM ····· 18
14. PRECAUTIONS IN USE LCM ····· 19
15 OUTLINE DRAWING ····· 20

Approved by	Checked by QC. Div	Checked by Pro. Div	Checked by R&D. Div.	Drawn by
	Final Revision:	Sheet Code:	Issued Date: 1999/5/26	Total Page: 20

2. RECORD OF REVISION

Rev	Date	Item	Page	Comment

3. GENERAL SPECIFICATION

Display Format :	122dots (W)	×	32dots (H)		
Dot Size :	0.4 (W)	×	0.45 (H)		mm
View Area :	62.2 (W)	×	17.9 (H)		mm
General Dimensions :	84 (W)	×	44 (H)	× 15 (T)	mm Max.

Weight : 40 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 ☐ Amber ☐ Blue Green

☐ White ☐ Others

Controller / Driver : SED1520DAA

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

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	¢ J
Storage Temperature	T_{STG}	-20	70	¢ J

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.

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_{EE}	0°C	6.5	7.2	7.7	V
		25°C	5.8	6.4	6.9	
		50°C	5.4	5.8	6.5--	
Input Voltage	V_{IH}	--	$V_{SS+2.0}$	--	V_{DD}	V
	V_{IL}		V_{SS}	--	$V_{SS+0.8}$	
Logic Supply Current	I_{DD}	V_{DD}-V_{SS}=5V	--	3	5	mA

6. ELECTRO-OPTICAL CHARACTERISTICS

ITEM	Symbol	Condition	Min.	Typ.	Max.	Unit	Ref.
Rise Time	Tr	0°C	--	--	--	ms	Note (1)
		25°C		120	240		
Fall Time	Tf	0°C	--	--	--	ms	
		25°C		200	350		
Contrast	CR	25°C	3	4	--		Note (3)
View Angle	θ1~θ2 ∅1, ∅2	25°C & CR≥1.5	--	--	80		Note (2)
			-30	--	30		
Frame Frequency	Ff	25°C	--	64	--	Hz	

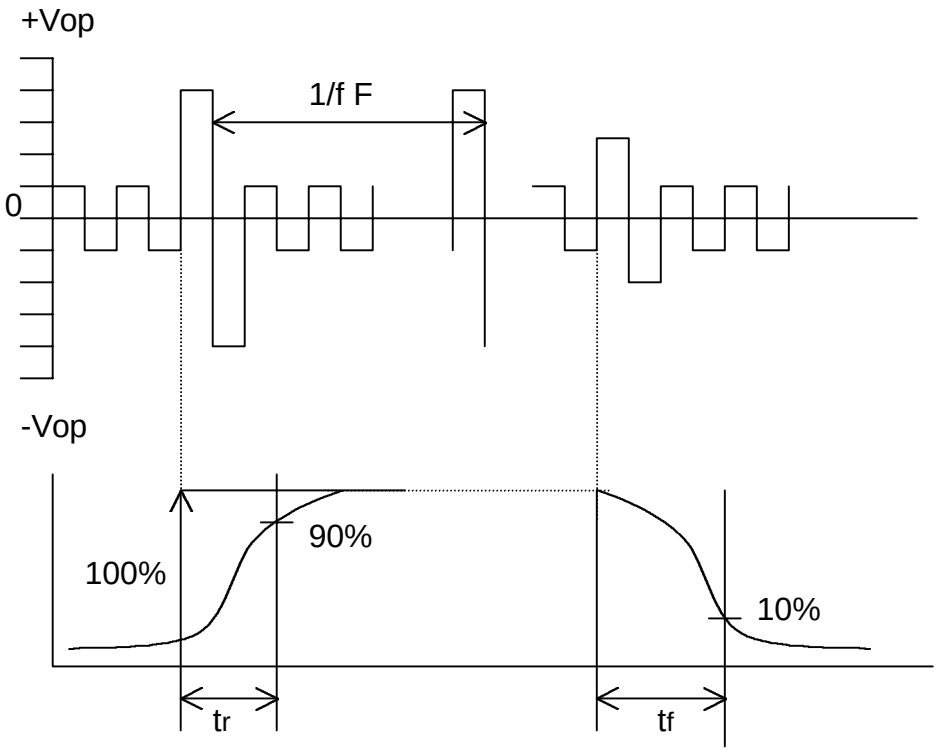
Note (1) & (2) : See next page

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°, ∅ = 0°
(d). Operating voltage --- 6.4V

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:

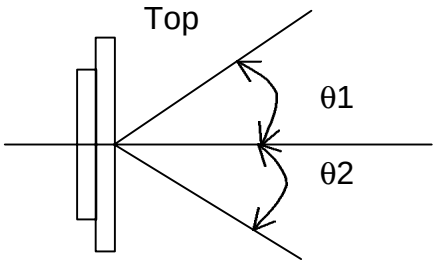


Condition:

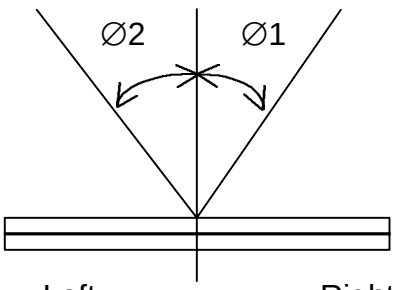
(a) . Temperature ----------25°C
(b) . Frame frequency --------- 64Hz
(c) . View Angle ---------- θ = 0°, ∅=0°
(d) . Operating voltage -------- 6.4V

Note (2) Definition of View Angle

Top – Bottom direction



Right -- Left direction



6.1 LED ELECTRO-OPTICAL CHARACTERISTIC

Ta = 25°C

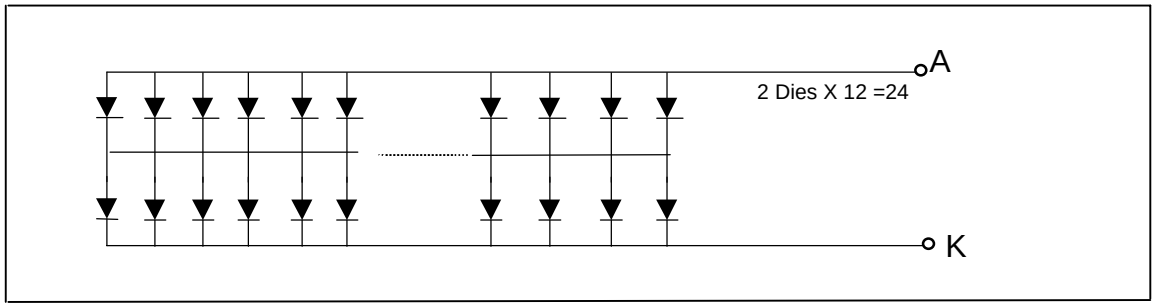
Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Forward Voltage	V_F	IF =200mA Yellow Green	--	4.2	4.6	V
Luminous Intensity	I_V	IF = 200mA Yellow Green	--	160	--	cd/m^2
Peak Emission	λP	IF = 200mA Yellow Green	--	573	575	nm
Spectrum Radiation	$\Delta\lambda$	IF = 200mA Yellow Green	--	30	--	nm
Reverse Current	IR	VR = 8V Yellow Green	--	--	0.2	mA

Note : Measured at the bard LED backlight unit.

6.2 LED MAXIMUM OPERATING RANGE

Item	Symbol	Yellow Green	Unit
Power Dissipation	P_{AD}	0.85	W
Forward Current	I_{AF}	300	mA
Reverse Voltage	VR	8	V

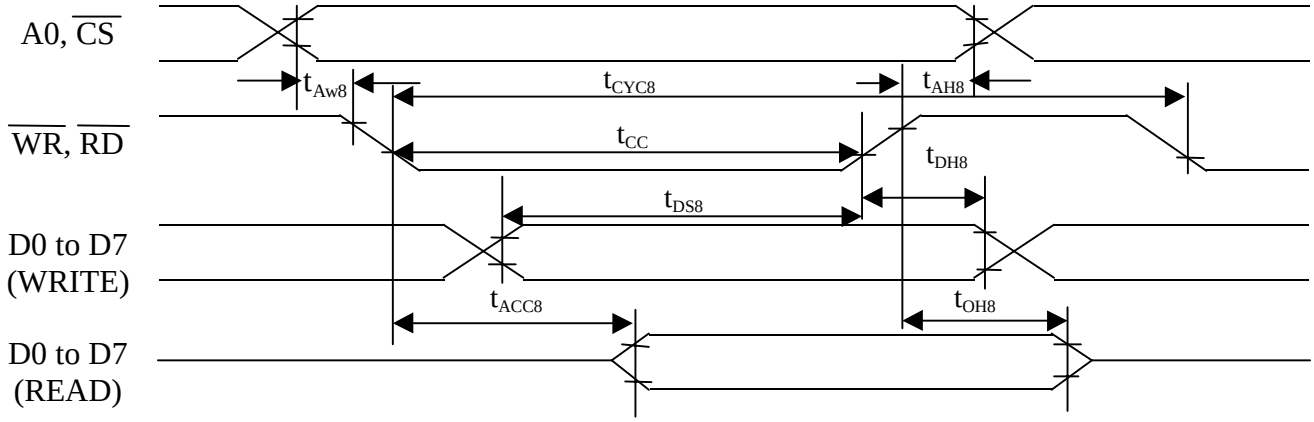
6.2.1 LED ARRAY BLOCK DIAGRAM



7. TIMING CHARACTERISTICS

AC Characteristics

MPU Bus Read/Write I (80 – family MPU)



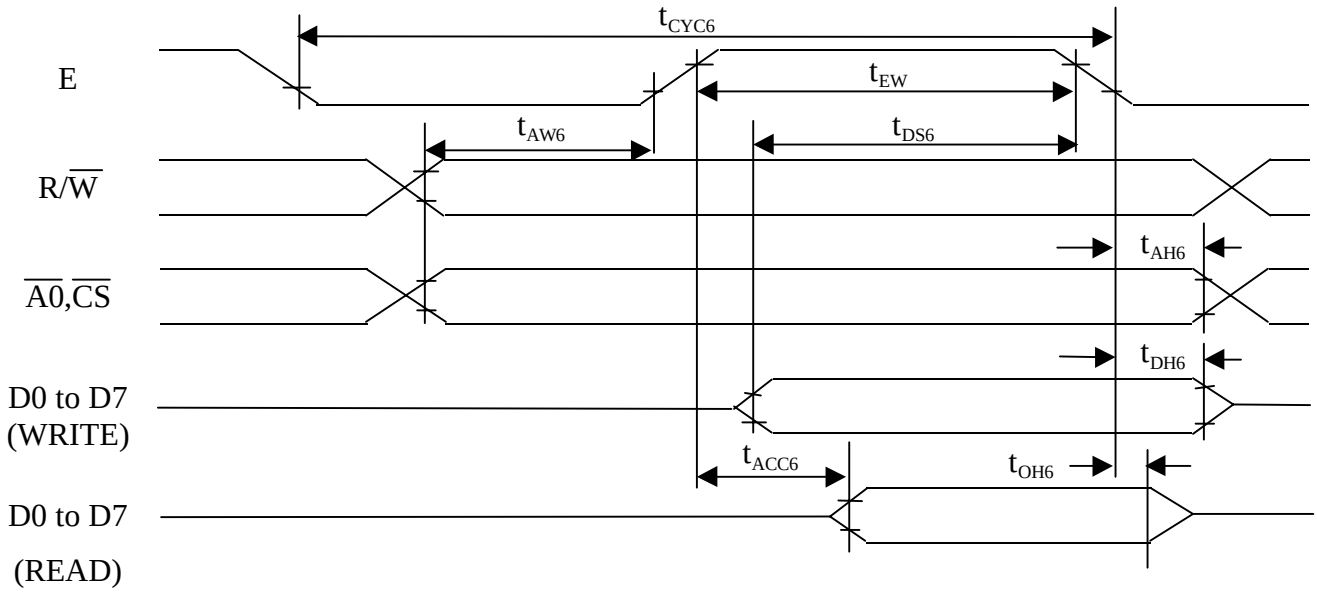
Ta = -20 to 75 deg. C, VSS = -5.0V ± 10% unless stated otherwise

Parameter	Symbol	Condition	Rating		Unit	Signal
			min	max		
Address hold time	t_{AH8}		10	--	ns	A0,$\overline{CS}$
Address setup time	t_{AW8}		20	--	ns	
System cycle time	t_{CYC8}		1000	--	ns	$\overline{WR}$,$\overline{RD}$
Control pulsewidth	t_{CC}		200	--	ns	
Data setup time	t_{DS8}		80	--	ns	D0 to D7
Data hold time	t_{DH8}		10	--	ns	
RD access time	t_{ACC8}	CL = 100 PF	--	90	ns	
Output disable time	t_{CH8}		10	60	ns	

Notes : 1. Increase parameter values by 200% when Vss = -3.0V.

2. All inputs must have a rise and fall time of less than 15 ns.

MPU Bus Read/Write II (68 – family MPU)



Ta = -20 to 75 deg. C, VSS = -5.0V ± 10% unless stated otherwise

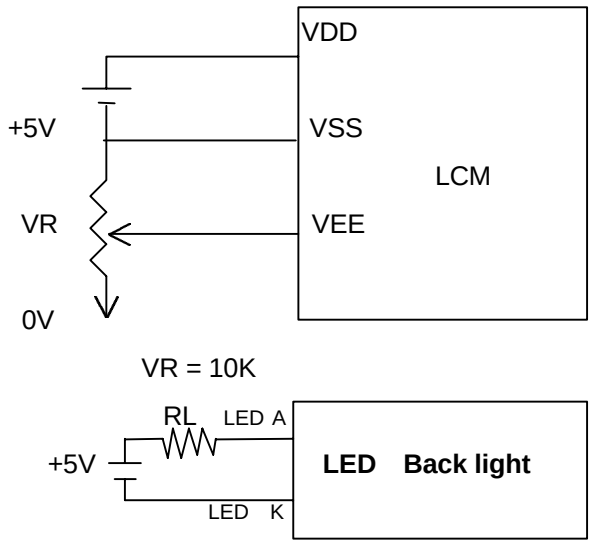
Parameter		Symbol	Condition	Rating		Unit	Signal
				min	max		
System cycle time		t_{CYC6}		1000	--	ns	A0,$\overline{CS}$,R/$\overline{W}$
Address setup time		t_{AW6}		20	--	ns	
Address hold time		t_{AH6}		00	--	ns	
Data setup time		t_{DS6}		80	--	ns	D0 to D7
Data hold time		t_{DH6}		10	--	ns	
Output disable time		t_{OH6}	CL = 100 PF	10	60	ns	
Access time		t_{ACC6}		--	90	ns	
Enable pulsewidth	Read	t_{EW}		100	--	ns	E
	Write			8	--	ns	

Notes : 1. t_{CYC6} is the cycle time of $\overline{CS}$. E = H, not the cycle time of E.
2. Increase parameter values by 200% when Vss = -3.0V.
3. All inputs must have a rise and fall time of less than 15 ns.

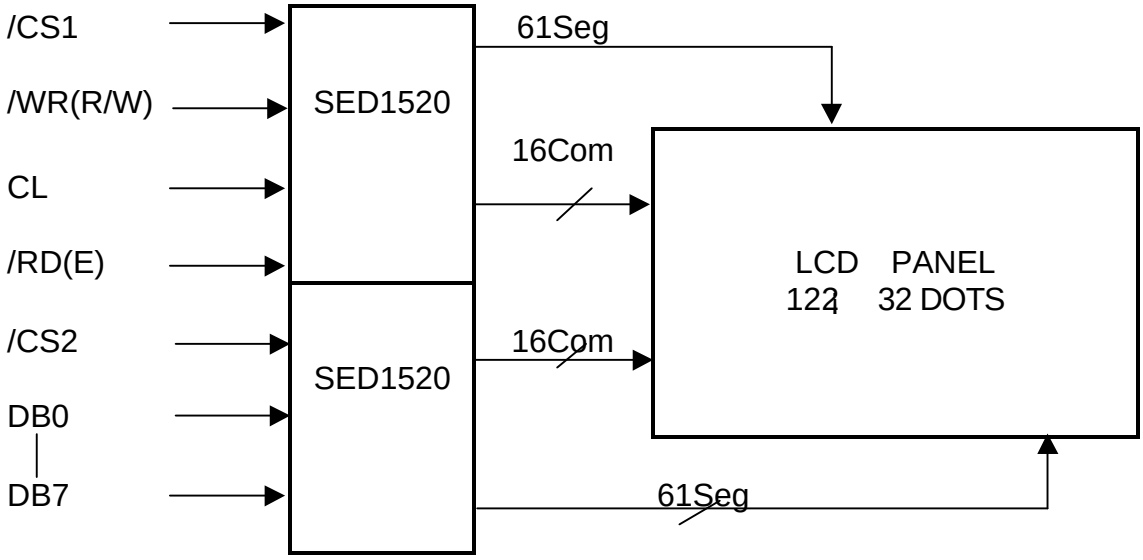
8. PIN CONNECTIONS

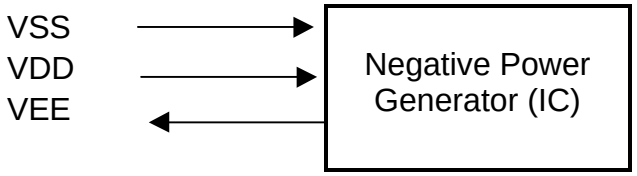
No.	Symbol	Function
1	VSS	Ground (0V)
2	VDD	+5V
3	VEE	LCD contrast control voltage input
4	A0	L→ Instructions H→ Data
5	/CS1	Chip Enable Active “L”
6	/CS2	Chip Enable Active “L”
7	CL	External Clock Input (2K Hz)
8	/RD (E)	/RD for 80 series, E for 68 series
9	/WR (R/W)	/WR for 80 series, R/W for 68 series
10	DB0	Data Bus Line
11	DB1	
12	DB2	
13	DB3	
14	DB4	
15	DB5	
16	DB6	
17	DB7	
18	Res	Reset Signal, H→80 series, L→68 series
19	LED A	Power Supply for LED Backlight
20	LED K	

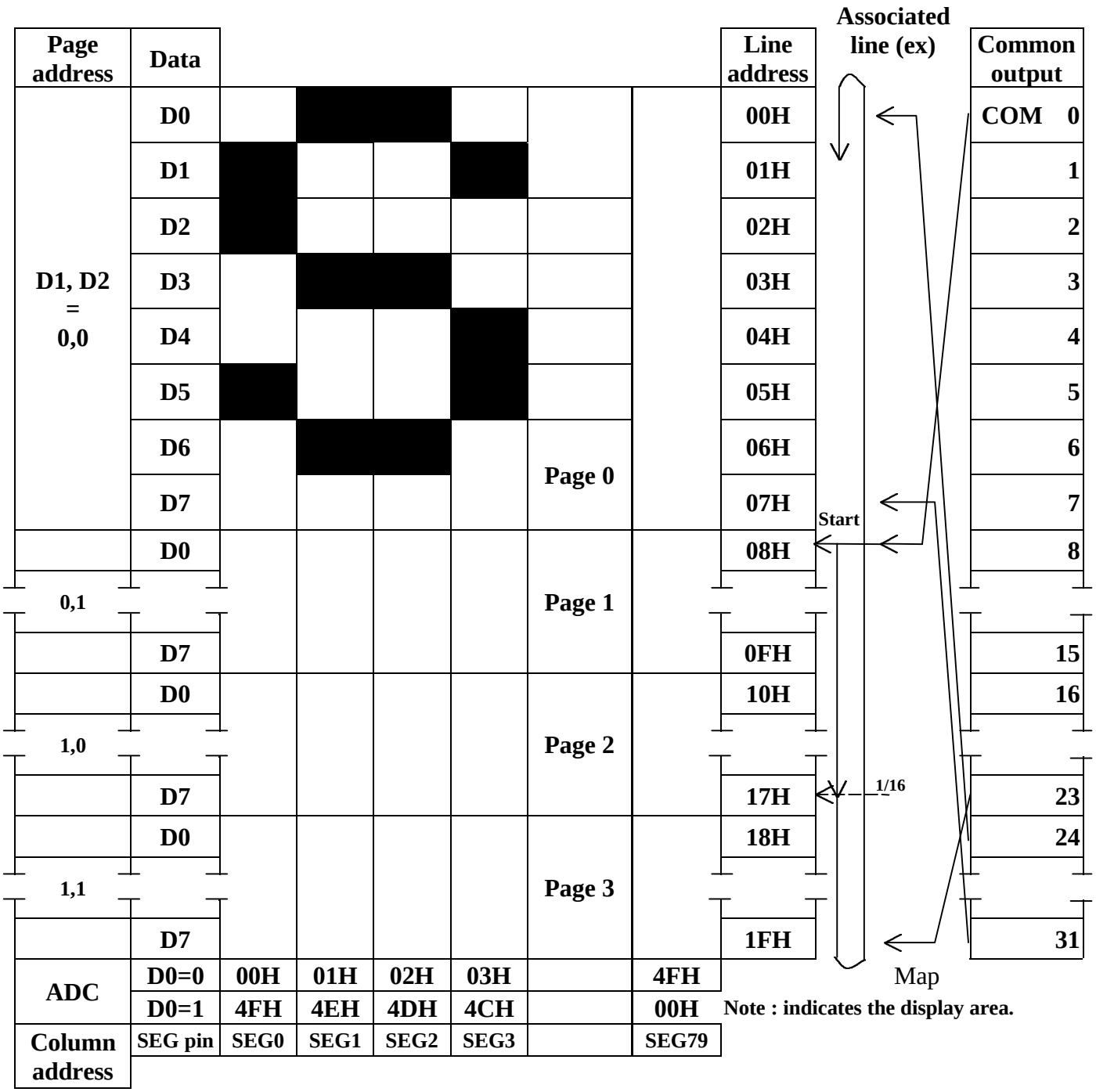
9. POWER SUPPLY



10. BLOCK DIAGRAM







Display Data RAM Addressing

COMMANDS

Summary

Command	Code											Function	
	A0	RD	WR	D7	D6	D5	D4	D3	D2	D1	D0		
Display ON/OFF	0	1	0	1	0	1	0	1	1	1	0/1	Turns display on or off. 1 : ON, 0 : OFF	
Display start line	0	1	0	1	1	0	Display start address (0 to 31)					Specifies RAM line corresponding to top line of display.	
Set page address	0	1	0	1	0	1	1	1	0	Page (0 to 3)		Sets display RAM page in page address register.	
Set column (segment) address	0	1	0	0	Column address (0 to 72)							Sets display RAM column address in column address register.	
Read status	0	0	1	Busy	ADC	ON/OFF	Reset	0	0	0	0	Reads the following status:	
												BUSY	1 : Busy 0 : Ready
												ADC	1 : CW output 0 : CCW output
												ON/OFF	1 : Display off 0 : Display on
												RESET	1 : Being reset 0 : Normal
Write display data	1	1	0	Write data								Writes data from data bus into display RAM.	
Read display data	1	0	1	Read data								Reads data from display RAM onto data bus.	
Select ADC	0	1	0	1	0	1	0	0	0	0	0/1	0 : CW output 1 : CCW output	
Static drive ON/OFF	0	1	0	1	0	1	0	0	1	0	0/1	Selets static driving operation. 1 : Static drive 0 : Normal driving	
Select duty	0	1	0	1	0	1	0	1	0	0	0/1	Selets LCD duty cycle 1 : 1/32 0 : 1/16	
Read – Modify - Write	0	1	0	1	1	1	0	0	0	0	0	Read – modify – write ON	
End	0	1	0	1	1	1	0	1	1	1	0	Read – modify – write OFF	
Reset	0	1	0	1	1	1	0	0	0	1	0	Software reset	

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

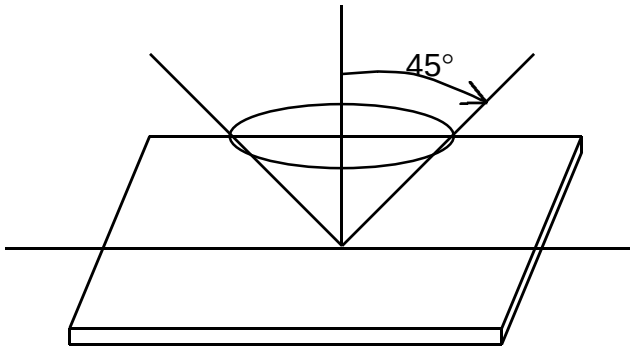
No.	Parameter	Conditions	Regulations
1	High Temperature Operating	50 ± 2 °C	Note 3
2	Low Temperature Operating	0 ± 2 °C	Note 3
3	High Temperature Storage	70 ± 2 °C	Note 3
4	Low Temperature Storage	-20 ± 2 °C	Note 3
5	Vibration Test (Non-operation state)	Total fixed amplitude : 1.5mm Vibration Frequency : 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

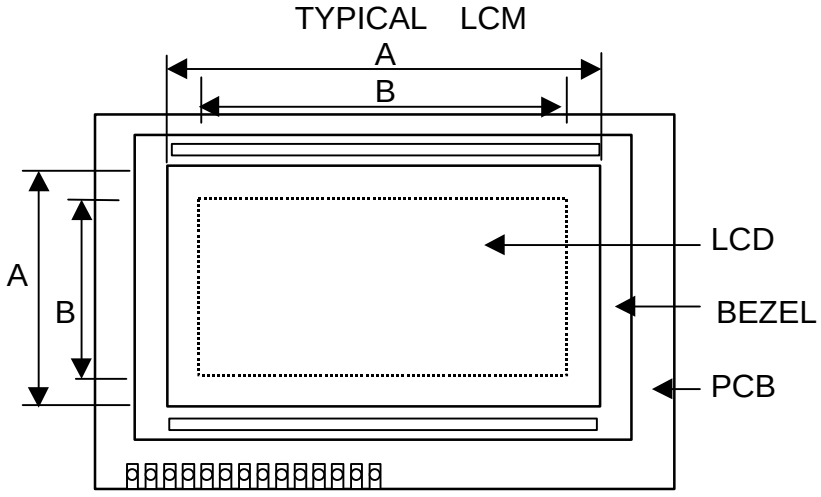
11.2 Inspection condition

11.2.1 Inspection conditions

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



11.2.2 Definition of applicable Zones



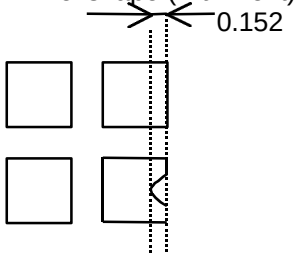
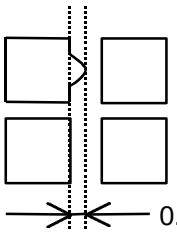
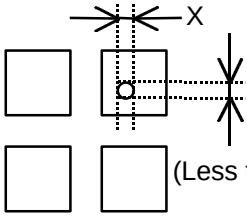
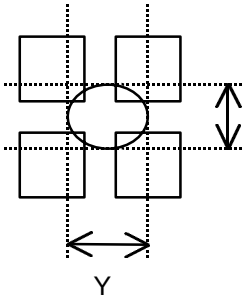
A : Viewing area
B : Active area

11.2.3 Inspection Parameters

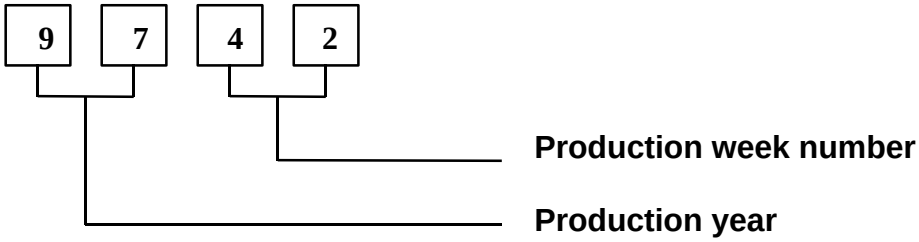
<table>
<tr><th>No.</th><th>Parameter</th><th>Criteria</th></tr>
<tr><td>1</td><td>Foreign Substances
(Spots)</td><td>(1) Round Shape
<table>
<tr><th rowspan="2">Zone
Dimension</th><th colspan="3">Acceptable number</th><th rowspan="2">Class Of Defects</th><th rowspan="2">Acceptable level</th></tr>
<tr><th>A</th><th>B</th><th>C</th></tr>
<tr><td>D ≤ 0.2</td><td>*</td><td>*</td><td>*</td><td rowspan="4">Minor</td><td rowspan="4">2.5</td></tr>
<tr><td>0.2≤ D ≤ 0.3</td><td>3</td><td>4</td><td>*</td></tr>
<tr><td>0.3 ≤ D ≤ 0.4</td><td>2</td><td>3</td><td>*</td></tr>
<tr><td>D < 0.3</td><td>0</td><td>1</td><td>*</td></tr>
</table>
D = (Long + Short) / 2 * : Disregard
<table>
<tr><th rowspan="2">Zone
X (mm) Y(mm)</th><th colspan="3">Acceptable number</th><th rowspan="2">Class Of Defects</th><th rowspan="2">Accept-able level</th></tr>
<tr><th>A</th><th>B</th><th>C</th></tr>
<tr><td>*</td><td>0.03 ≥ W</td><td>*</td><td>*</td><td>*</td><td rowspan="4">Minor</td><td rowspan="4">2.5</td></tr>
<tr><td>3.0 ≥ L</td><td>0.05 ≥ W</td><td>3</td><td>4</td><td></td></tr>
<tr><td>1.0 ≥ L</td><td>0.1 ≥ W</td><td>3</td><td>3</td><td></td></tr>
<tr><td>—</td><td>0.1 < W</td><td></td><td></td><td></td></tr>
</table>
X : Length Y : Width * : Disregard

Total defects should not exceed 4/module</td></tr>
<tr><td>2</td><td>Air Bubbles
(between glass
& polarizer)</td><td>
<table>
<tr><th rowspan="2">Zone
Dimension</th><th colspan="3">Acceptable number</th><th rowspan="2">Class of Defects</th><th rowspan="2">Acceptable Level</th></tr>
<tr><th>A</th><th>B</th><th>C</th></tr>
<tr><td>D ≤ 0.3</td><td>*</td><td>*</td><td>*</td><td rowspan="4">Minor</td><td rowspan="4">2.5</td></tr>
<tr><td>0.3 < D ≤ 0.4</td><td>3</td><td>*</td><td>*</td></tr>
<tr><td>0.4 < D ≤ 0.6</td><td>2</td><td>3</td><td>*</td></tr>
<tr><td>0.6 < D</td><td>0</td><td>0</td><td>*</td></tr>
</table>
* : Disregard

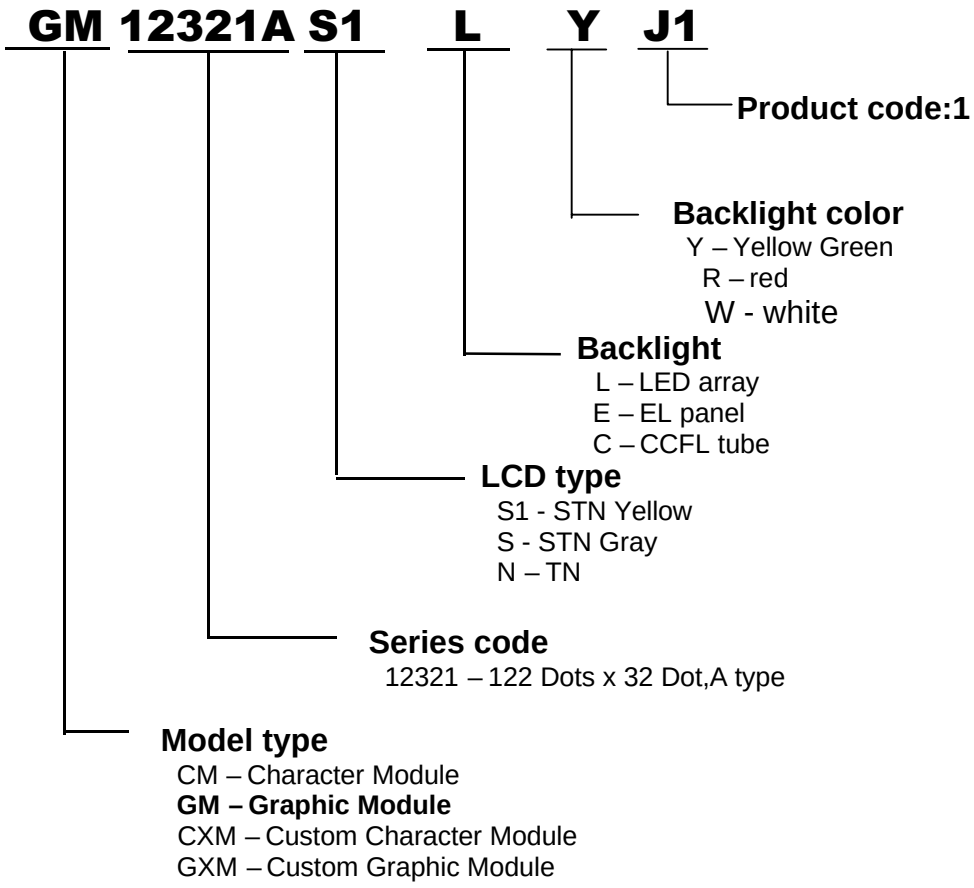
Total defects shall not excess 3/module.</td></tr>
</table>

3	Uniformity of Pixel	(1) Pixel shape (with Dent)  (2) Pixel shape (with Projection)  Should not be connected to next pixel 0.152 (3) Pin hole  (X + Y)/2 ≤ 0.02mm (Less than 0.1 mm is no counted) (4) Deformation  (X + Y) / 2 ≤ 0.3mm Total acceptable number : 1/pixel, 5/cell

12. LOT NUMBERING SYSTEM



13. LCM NUMBERING SYSTEM



14. 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 statics, a relative humidity of 50-60% is recommended.

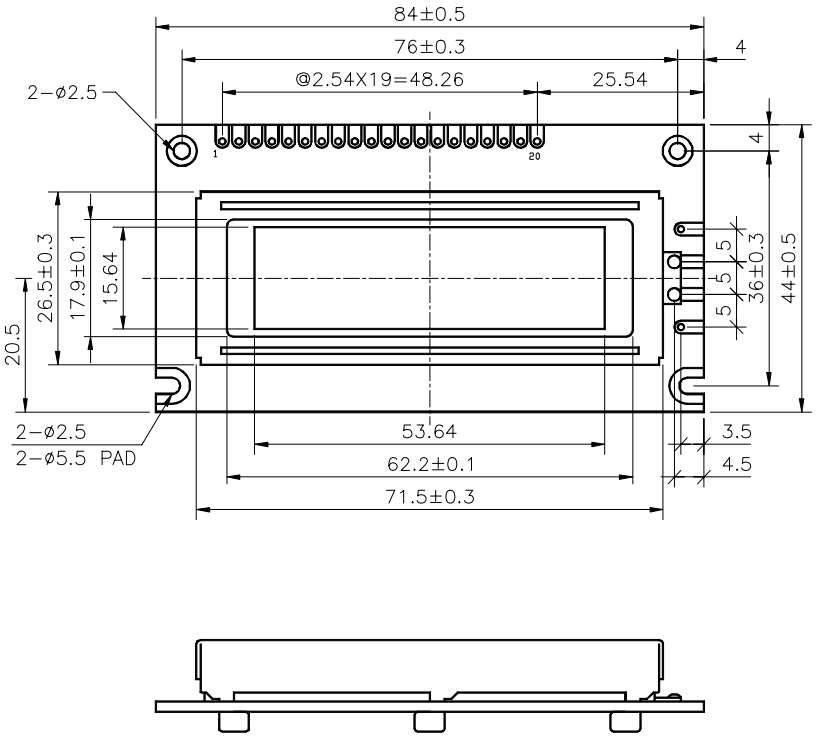
2.3 Soldering
(1). Solder only to the I/O terminals.
(2). Use only soldering irons with proper grounding and no leakage.
(3). Soldering temperature : 280°C ± 10°C
(4). Soldering time: 3 to 4 sec.
(5). Use eutectic solder with resin flux fill.
(6). If flux is used, the LCD surface should be covered to avoid flux spatters. Flux residue should be removed after wards.

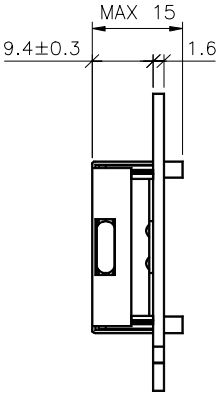
2.4 Operation
(1). The viewing angle can be adjusted by varying the LCD driving voltage V0.
(2). Driving voltage should be kept within specified range; excess voltage shortens display life.
(3). Response time increases with decrease in temperature.
(4). Display may turn black or dark blue at temperatures 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".

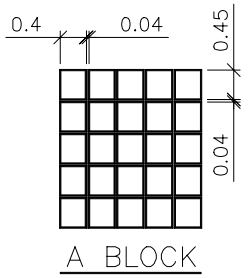
2.5 Storage
If any fluid leaks out of a damaged glass cell, wash off any human part that comes into contact with soap and water. Never swallow the fluid. The toxicity is extremely low but caution should be exercised at all the time.

2.6 Limited Warranty
Unless otherwise agreed between DATA IMAGE and customer, DATA IMAGE will replace or repair any of its LCD and LCM which is found to be defective electrically and visually when inspected in accordance with DATA IMAGE acceptance standards, for a period on one year from date of shipment. Confirmation of such date shall be based on freight documents. The warranty liability of DATA IMAGE is limited to repair and/or replacement on the terms set forth above. DATA IMAGE will not responsible for any subsequent or consequential events.

15 OUTLINE DRAWING







PIN FUNCTIONS

1.	VSS	11.	DB1
2.	VDD	12.	DB2
3.	VEE	13.	DB3
4.	AO	14.	DB4
5.	/CS1	15.	DB5
6.	/CS2	16.	DB6
7.	CL	17.	DB7
8.	/RD(E)	18.	RES
9.	/WR(R/W)	19.	LEDA
10.	DB0	20.	LEDK