

# DATA IMAGE CORPORATION

## LCD Module Specification

ITEM NO.: GM24122S1RH-J6

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Approved by	Checked by QC. Div	Checked by Pro. Div	Checked by R&D. Div.	Drawn by
	Final Revision: B	Sheet Code:	Issued Date: 1999/3/10	Total Page: 16

## 2. RECORD OF REVISION

Rev	Date	Item	Page	Comment
B	10/MAR/99	7,10,15	7,10,11,12,13 14,15,22	<ol style="list-style-type: none"><li>1. Change R9 resistor value from 2.2K to 1.1K.</li><li>2. Remove LCD controller and RAM IC from PCB.</li><li>3. Add female connector for JP2.</li><li>4. Respecify pin assignment, Block diagram and Timing chart.</li></ol>

### 3. GENERAL SPECIFICATION

Display Format : 240 (W) × 128 (H) dots  
Dots Size : 0.50 (W) × 0.50 (H) mm  
View Area : 148.0 (W) × 75.0 (H) mm  
General Dimensions : 180 (W) × 120 (H) × 16 (T) mm Max.  
Weight : g max.

LCD Type :  STN Blue  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

Driver : SANYO LC7940, LC7942

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<sub>SS</sub>= 0V, Ta = 25°C

Item	Symbol	Min.	Max.	Unit
Supply Voltage (Logic)	V <sub>DD</sub> -V <sub>SS</sub>	0	7	V
Supply Voltage (LCD Driver)	V <sub>DD</sub> -V <sub>EE</sub>	0	25	V
Input Voltage	V <sub>I</sub>	V <sub>SS</sub>	V <sub>DD</sub>	V
Operating Temperature	T <sub>OP</sub>	-20	70	°C
Storage Temperature	T <sub>STG</sub>	-30	80	°C

### 4.2 ENVIRONMENTAL ABSOLUTE MAXIMUM RATINGS

Item	Operating		Storage		Comment
	(Min.)	Max.)	(Min.)	(Max.)	
Ambient Temp	-20	70	-30	80	Note (1)
Humidity	Note (2)		Note(2)		Without Condensation
Vibration	--	4.9M/S <sup>2</sup>	--	19.6M/S <sup>2</sup>	XYZ Direction
Shock	--	29.4M/S <sup>2</sup>	--	490M/S <sup>2</sup>	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 <sub>DD</sub> -V <sub>SS</sub>		4.5	5.0	5.5	V
Supply Voltage (LCD)	V <sub>DD</sub> -V <sub>O</sub>	-20°C	18.2	19.2	20.4	V
		25°C	16.1	17.3	19.3	
		70°C	15.8	16.2	17.3	
Input Voltage	V <sub>IH</sub>	--	V <sub>SS</sub> -2.2	--	V <sub>DD</sub>	V
	V <sub>IL</sub>		0	--	0.8	
Logic Supply Current	I <sub>DD</sub>	V <sub>DD</sub> -V <sub>SS</sub> =5V	--	5	--	mA
	I <sub>EE</sub>		--	1.71	--	mA

## 6. ELECTRO-OPTICAL CHARACTERISTICS

ITEM	Symbol	Condition	Min.	Typ.	Max.	Unit	Ref.
Rise Time	Tr	-20°C	--	2400	4800	ms	Note (1)
		25°C		180	360		
Fall Time	Tf	-20°C	--	1500	3000	ms	
		25°C		90	180		
Contrast	CR	25°C	4.5	8.0	--		Note (3)
View Angle	θ <sub>1</sub> ~θ <sub>2</sub> ∅ <sub>1</sub> , ∅ <sub>2</sub>	25°C & CR≥3	50	--	--		Note (2)
			-30	--	30		
Frame Frequency	Ff	25°C	--	70	--	Hz	

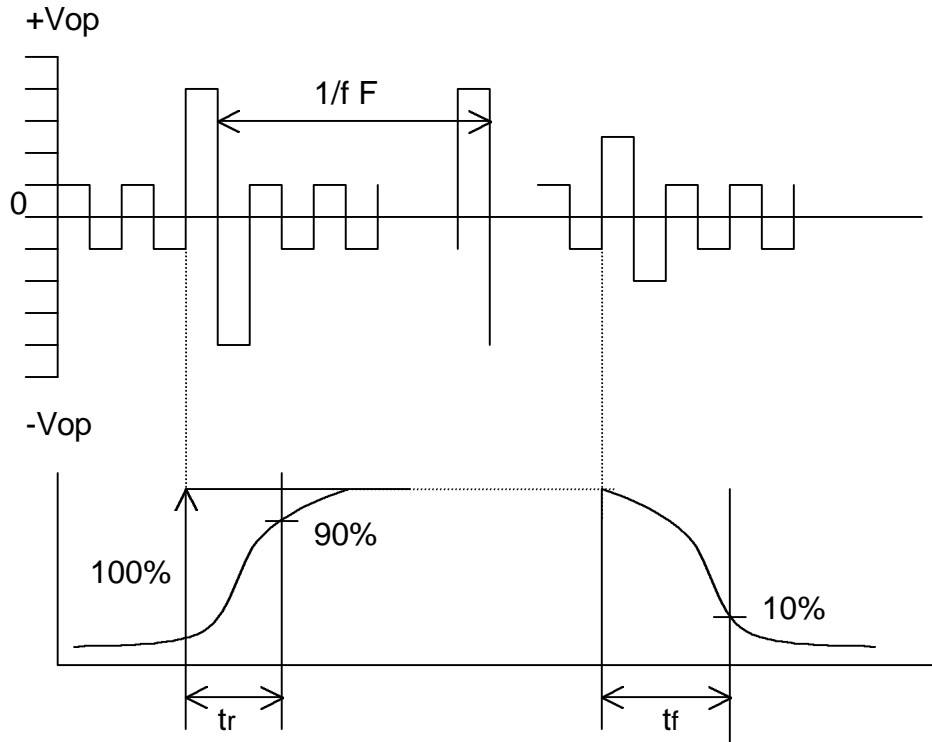
Note (1) & (2) : See next page

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 ---- 70Hz
- ( c ). Viewing angle ----- θ= 0°, ∅ = 0°
- ( d ). Operating voltage --- 17.3V

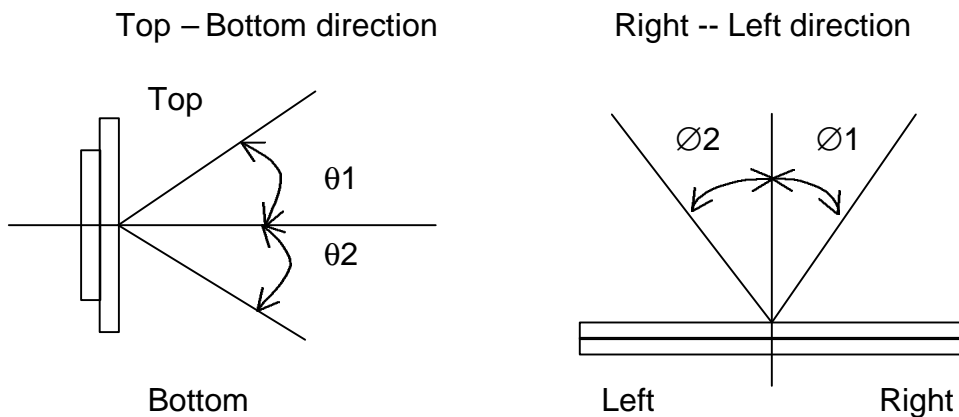
Note (1) Response time is measured as the shortest period of time possible between the change in state of an LCD segment as demonstrated below:



Condition:

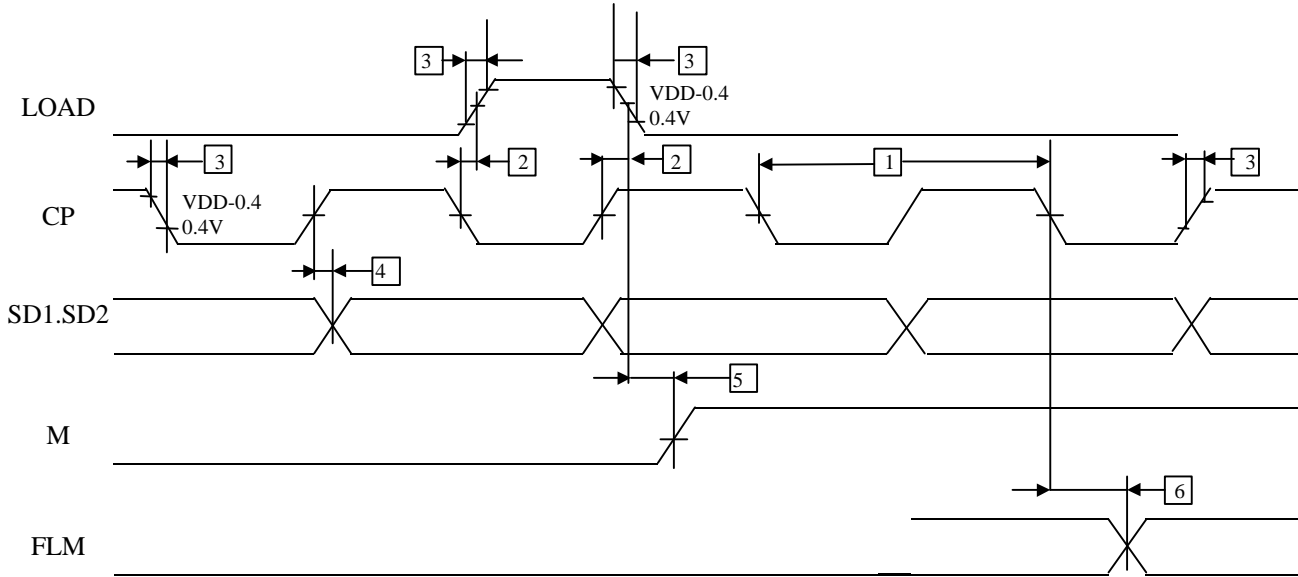
- (a) . Temperature -----25°C
- (b) . Frame frequency ----- 70Hz
- (c) . View Angle -----  $\theta = 0^\circ, \varnothing=0^\circ$
- (d) . Operating voltage ----- 17.3V

Note (2) Definition of View Angle



# 7. TIMING CHARACTERISTICS

Interface with the driver LSI



Ta = -20 to 75°C, V<sub>DD</sub> = 5.0V±5%, GND = 0V

ITEM	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNIT
Clock Cycle Time	t <sub>cyc</sub>	--	400	--	--	ns
Clock Phase Difference	t <sub>DCL</sub>	--	--	--	100	ns
Clock Rise/Fall Time	t <sub>CRF</sub>	--	--	--	30	ns
SD1,SD2 Phase Difference	t <sub>DD</sub>	--	--	--	100	ns
M Phase Difference	t <sub>DMA</sub>	--	--	--	200	ns
FLM Phase Difference	t <sub>DFM</sub>	--	--	--	200	ns

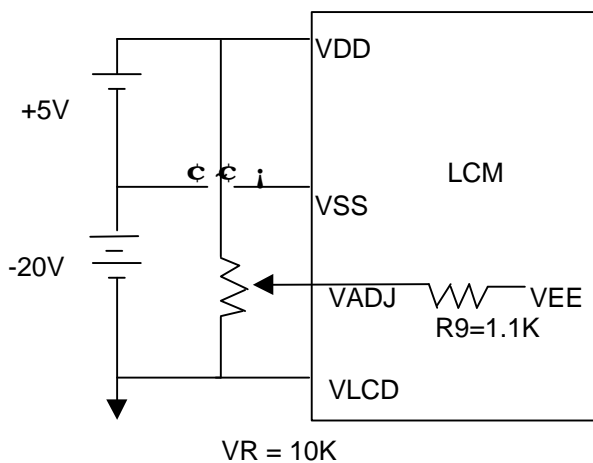
Notes: (1) All output terminals are under no load.

(2) All measurement points other than those specified are at 0.5V<sub>DD</sub>.

## 8. PIN CONNECTIONS

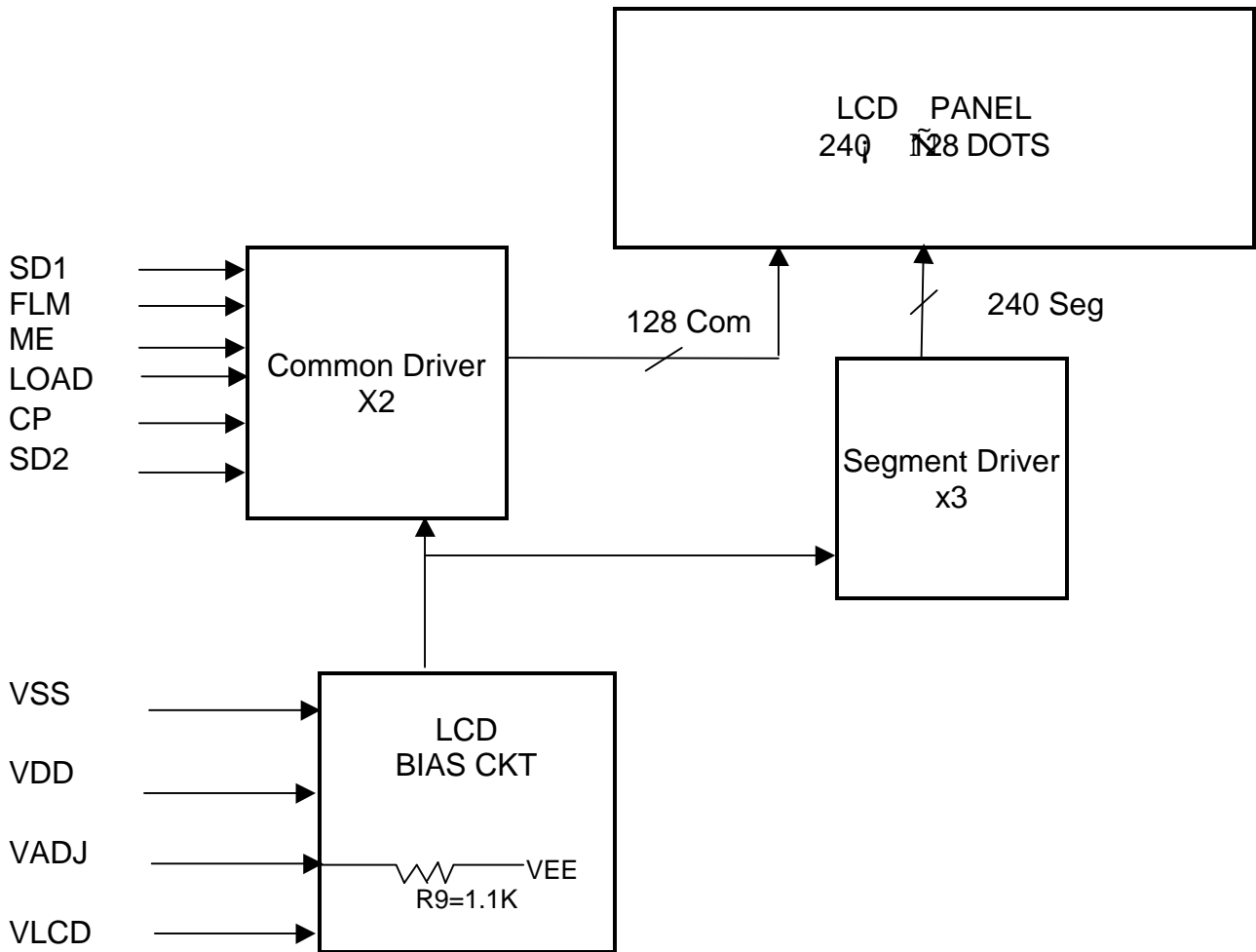
Pin	Symbol	Function
B1	SD1	Display data serial output for the upper screen
B2	FLM	Frame signal.
B3	ME(M)	Alternate signal For LCD driver
B4	LOAD	Display data latch signal
B5	CP	Data shift pulse
B6	SD2	Display data serial output for the lower screen
B7	V <sub>DD</sub> (+5V)	Power Supply for (Logic)
B8	V <sub>SS</sub>	Ground
B9	VLCD	Power Supply input for LCD drive
B10	VADJ	LCD contrast adjustment

## 9. POWER SUPPLY





## 10. BLOCK DIAGRAM



## 11. QUALITY ASSURANCE

### 11.1 Test Condition

#### 11.1.1 Temperature and Humidity(Ambient Temperature)

Temperature :  $20 \pm 5^{\circ}\text{C}$   
Humidity :  $65 \pm 5\%$

#### 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	$70 \pm 2^{\circ}\text{C}$	Note 3
2	Low Temperature Operating	$-20 \pm 2^{\circ}\text{C}$	Note 3
3	High Temperature Storage	$80 \pm 2^{\circ}\text{C}$	Note 3
4	Low Temperature Storage	$-30 \pm 2^{\circ}\text{C}$	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)	$40^{\circ}\text{C} \pm 2^{\circ}\text{C}$ , 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.

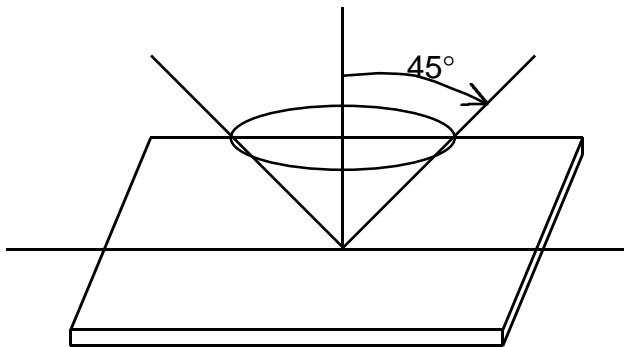
Note 2: No dew condensation to be observed.

Note 3: No change on display and in operation under the test condition

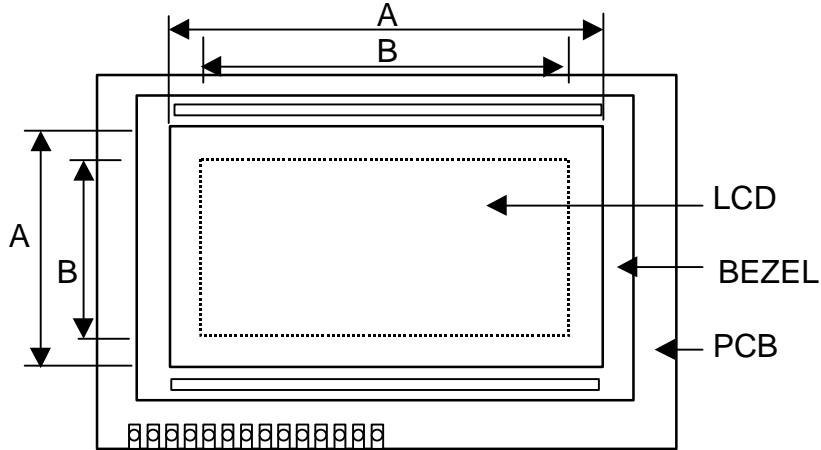
## 11.2 Inspection condition

### 11.2.1 Inspection conditions

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



### 11.2.2 Definition of applicable Zones Typical LCM



A : Viewing area  
B : Active area

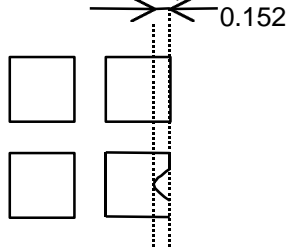
### 11.2.3 Inspection Parameters

No.	Parameter	Criteria																																																													
1	Foreign Substances (Spots)	<p>(1) Round Shape</p> <table border="1"> <thead> <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> </thead> <tbody> <tr> <td><math>D \leq 0.2</math></td> <td>*</td> <td>*</td> <td>*</td> <td rowspan="4">Minor</td> <td rowspan="4">2.5</td> </tr> <tr> <td><math>0.2 \leq D \leq 0.3</math></td> <td>3</td> <td>4</td> <td>*</td> </tr> <tr> <td><math>0.3 \leq D \leq 0.4</math></td> <td>2</td> <td>3</td> <td>*</td> </tr> <tr> <td><math>D &lt; 0.3</math></td> <td>0</td> <td>1</td> <td>*</td> </tr> </tbody> </table> <p><math>D = (\text{Long} + \text{Short}) / 2</math> * : Disregard</p> <table border="1"> <thead> <tr> <th colspan="2">Zone</th> <th colspan="3">Acceptable number</th> <th rowspan="2">Class Of Defects</th> <th rowspan="2">Acceptable level</th> </tr> <tr> <th>X (mm)</th> <th>Y (mm)</th> <th>A</th> <th>B</th> <th>C</th> </tr> </thead> <tbody> <tr> <td>*</td> <td><math>0.03 \geq W</math></td> <td>*</td> <td>*</td> <td>*</td> <td rowspan="4">Minor</td> <td rowspan="4">2.5</td> </tr> <tr> <td><math>3.0 \geq L</math></td> <td><math>0.05 \geq W</math></td> <td>3</td> <td>4</td> <td></td> </tr> <tr> <td><math>1.0 \geq L</math></td> <td><math>0.1 \geq W</math></td> <td>3</td> <td>3</td> <td></td> </tr> <tr> <td>—</td> <td><math>0.1 &lt; W</math></td> <td></td> <td></td> <td></td> </tr> </tbody> </table> <p>X : Length Y : Width * : Disregard</p> <p>Total defects should not exceed 4/module</p>	Zone Dimension	Acceptable number			Class Of Defects	Acceptable level	A	B	C	$D \leq 0.2$	*	*	*	Minor	2.5	$0.2 \leq D \leq 0.3$	3	4	*	$0.3 \leq D \leq 0.4$	2	3	*	$D < 0.3$	0	1	*	Zone		Acceptable number			Class Of Defects	Acceptable level	X (mm)	Y (mm)	A	B	C	*	$0.03 \geq W$	*	*	*	Minor	2.5	$3.0 \geq L$	$0.05 \geq W$	3	4		$1.0 \geq L$	$0.1 \geq W$	3	3		—	$0.1 < W$			
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2	Air Bubbles (between glass & polarizer)	<table border="1"> <thead> <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> </thead> <tbody> <tr> <td><math>D \leq 0.3</math></td> <td>*</td> <td>*</td> <td>*</td> <td rowspan="4">Minor</td> <td rowspan="4">2.5</td> </tr> <tr> <td><math>0.3 &lt; D \leq 0.4</math></td> <td>3</td> <td>*</td> <td>*</td> </tr> <tr> <td><math>0.4 &lt; D \leq 0.6</math></td> <td>2</td> <td>3</td> <td>*</td> </tr> <tr> <td><math>0.6 &lt; D</math></td> <td>0</td> <td>0</td> <td>*</td> </tr> </tbody> </table> <p>* : Disregard</p> <p>Total defects shall not excess 3/module.</p>	Zone Dimension	Acceptable number			Class of Defects	Acceptable Level	A	B	C	$D \leq 0.3$	*	*	*	Minor	2.5	$0.3 < D \leq 0.4$	3	*	*	$0.4 < D \leq 0.6$	2	3	*	$0.6 < D$	0	0	*																																		
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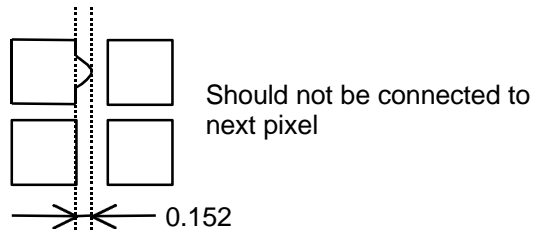
3

Uniformity of Pixel

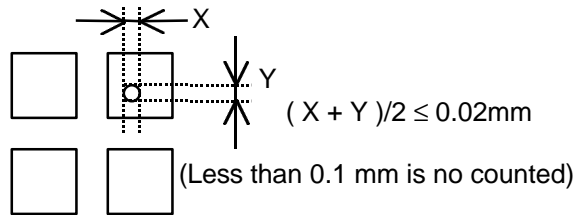
(1) Pixel shape (with Dent)



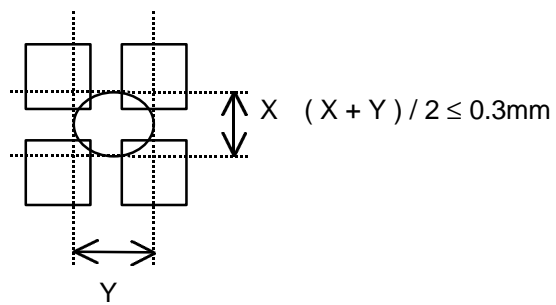
(2) Pixel shape (with Projection)



(3) Pin hole

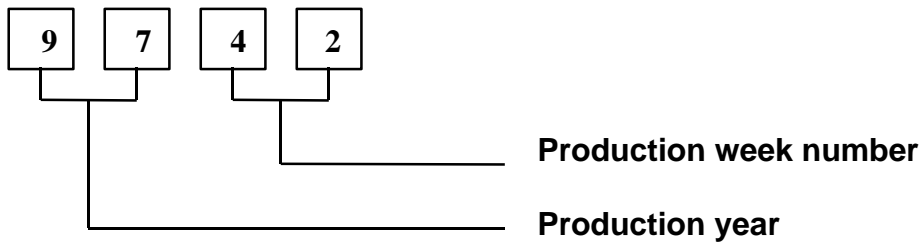


(4) Deformation

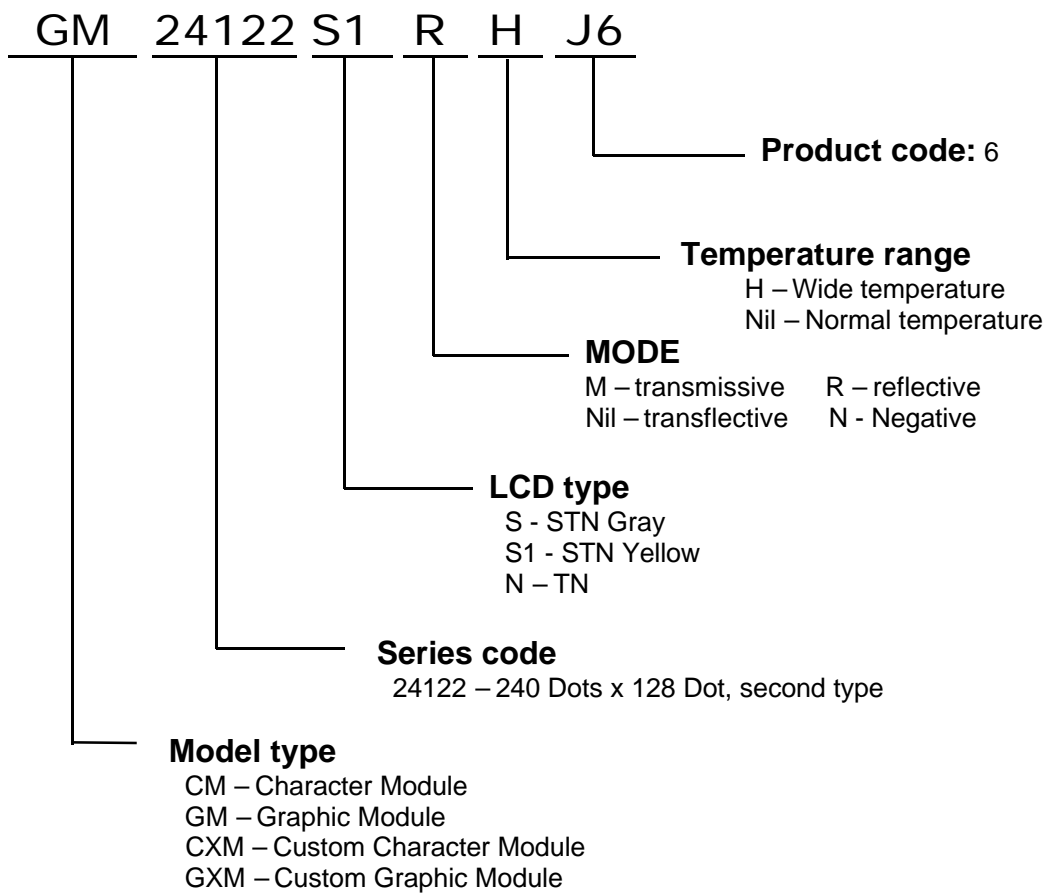


Total acceptable number : 1/pixel, 5/cell

## 12. 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 handling,

- (1). Keep the temperature within range of use and storage. Excessive temperature and humidity could cause polarization degradation, 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 benzine.
- (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 :  $280^{\circ}\text{C} \pm 10^{\circ}\text{C}$
- (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  $V_0$ .
- (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

