



DATA IMAGE CORPORATION

LCD Module Specification

ITEM NO.: **GM322404FFSWBG02**

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Customer Companies	R&D Dept.	Q.C. Dept.	Eng. Dept.	Prod. Dept.
	JACK	ERIC	KEN	HUANG
Approved by	Version:	Issued Date:	Sheet Code:	Total Pages:
	C	2008/1/24		21

3. GENERAL SPECIFICATION

Display Format : 320 (W) × 240 (H) dots
 Dots Size : 0.33 (W) × 0.33 (H) mm
 View Area : 122 (W) × 92 (H) mm
 Outline Dimensions : 167 (W) × 109 (H) × 11.5 (T) mm Max.

Weight : 250g max.

LCD Type & Background Color:
 STN Blue Gray
 STN Yellow
 FSTN Dark Gray

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 : NT7086

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

Pixel Color: Dark Blue, with temp. compensation.

REMARK:

Our components and processes are compliant to RoHS standard

4. ABSOLUTE MAXIMUM RATINGS

4.1 ELECTRICAL ABSOLUTE MAXIMUM RATINGS

 $V_{SS} = 0V, T_a = 25^{\circ}C$

Item	Symbol	Min.	Max.	Unit
Supply Voltage (Logic)	VDD-VSS	-0.3	7	V
Supply Voltage (LCD Driver)	VDD-V _O	0	30	V
Input Voltage	V _I	-0.3	VDD+0.3	V
Operating Temperature	T _{OP}	-20	70	°C
Storage Temperature	T _{STG}	-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 ²	--	19.6M/S ²	XYZ Direction
Shock	--	29.4M/S ²	--	490M/S ²	XYZ Direction

Note(1) $T_a = 0^{\circ}C$: 50Hr Max.

Note(2) $T_a \leq 40^{\circ}C$: 90% RH Max.

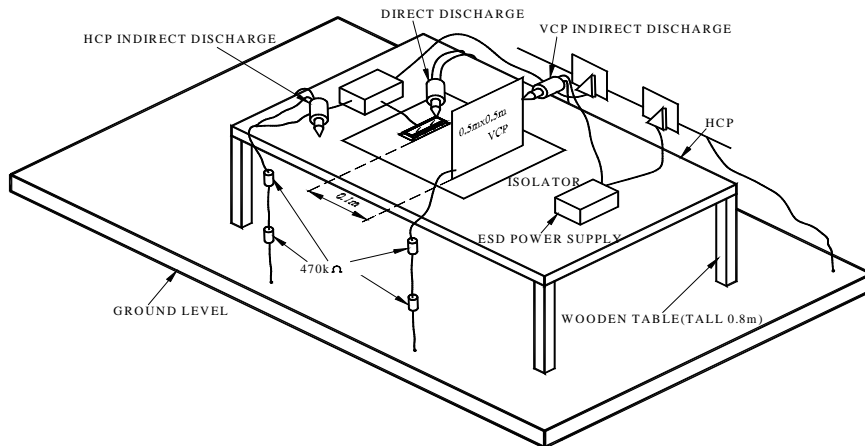
$T_a \geq 40^{\circ}C$: Absolute humidity must be lower than the humidity of 90% RH at 40°C.

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: Noise Ken, 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	

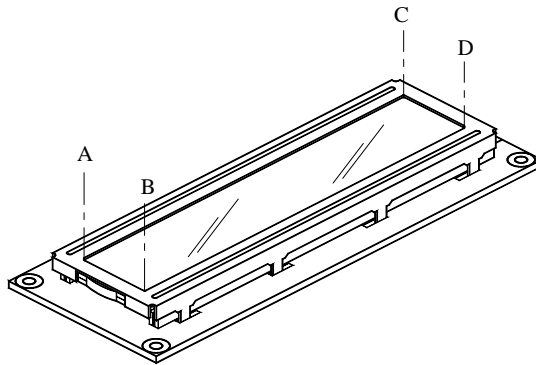
FIG 1 ESD TESTING EQUIPMENT



(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-VSS}	--	4.5	5.0	5.5	V
Supply Voltage (LCD)	V _{DD-Vo}	-20°C	21.0	21.6	22.2	V
		-10	20.8	21.5	22.1	
		0	20.7	21.4	22.0	
		25°C	20.7	21.4	22.0	
		50	19.9	20.6	21.2	
		70°C	18.6	19.3	19.9	
Input Voltage	V _{IH}	--	0.8*V _{DD}	--	V _{DD}	V
	V _{IL}	--	V _{SS}	--	0.2*V _{DD}	
Logic Supply Current	I _{DD}	V _{DD} =5V	--	49	60	mA
	I _{Vo}	V _{OP} =21.4V V _R =10K	--	0.56	--	

6. ELECTRO-OPTICAL CHARACTERISTICS

ITEM	Symbol	Condition	Min.	Typ.	Max.	Unit	Ref.
Rise Time	Tr	-20°C	--	--	15000	ms	Note (1)
		25°C		--	350		
Fall Time	Tf	-20°C	--	--	15000	ms	
		25°C		--	350		
Contrast	CR	25°C	3	--	--		Note (3)
View Angle	θ _{1-θ2} ∅ _{1, ∅2}	25°C & CR≥2	-20~30			deg	Note (2)
			-30~30				
Frame Frequency	Ff	25°C	32	64	200	Hz	

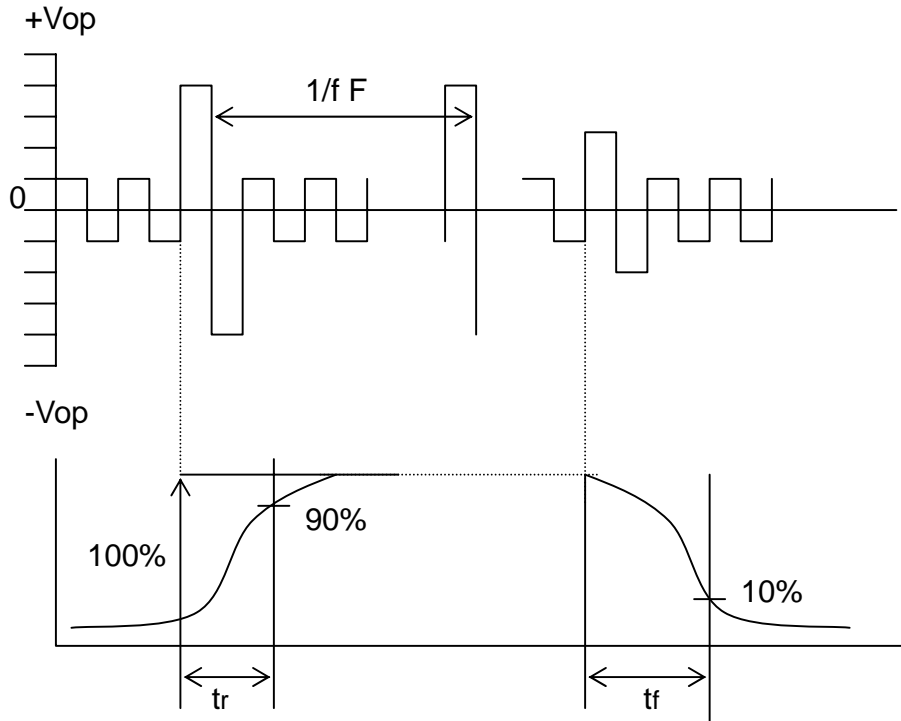
Note (1) & (2) : See next page

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 --- 21.4V

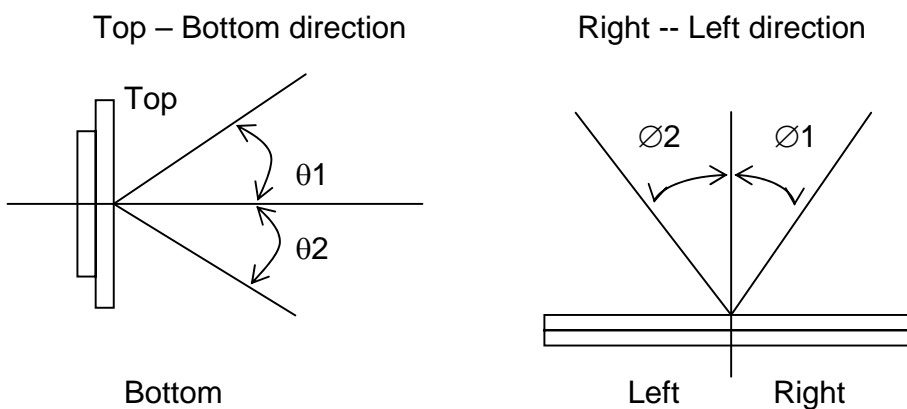
Note (1) Response time is measured as the shortest period of time possible between the change in state of an LCD segment as demonstrated below:



Condition:

- (a). Temperature ----- 25°C
- (b). Frame frequency ----- 64Hz
- (c). View Angle ----- $\theta = 0^{\circ}$, $\phi = 0^{\circ}$
- (d). Operating voltage ----- 21.4V

Note (2) Definition of View Angle



6.1 LED ELECTRO-OPTICAL CHARACTERISTIC

 $T_a = 25^{\circ}\text{C}$

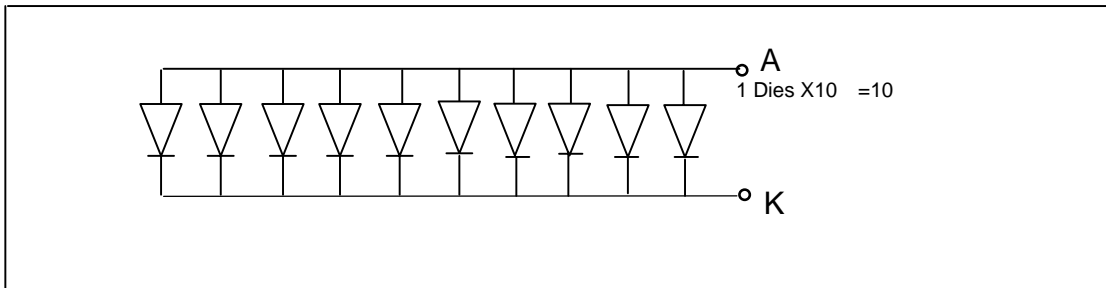
Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Forward Voltage	V_F	$I_F = 200\text{mA}$ White	3.0	3.4	3.8	V
Luminous Intensity	I_v	$I_F = 200\text{mA}$ White	400	--	--	cd/m^2
Uniformity		$I_F = 200\text{mA}$ White	80	--	--	%
Chromaticity	X	$I_F = 200\text{mA}$ White	0.26	0.30	0.33	nm
	Y		0.26	0.30	0.33	

Note : Measured at the bared LED backlight unit.

6.2 LED MAXIMUM OPERATING RANGE

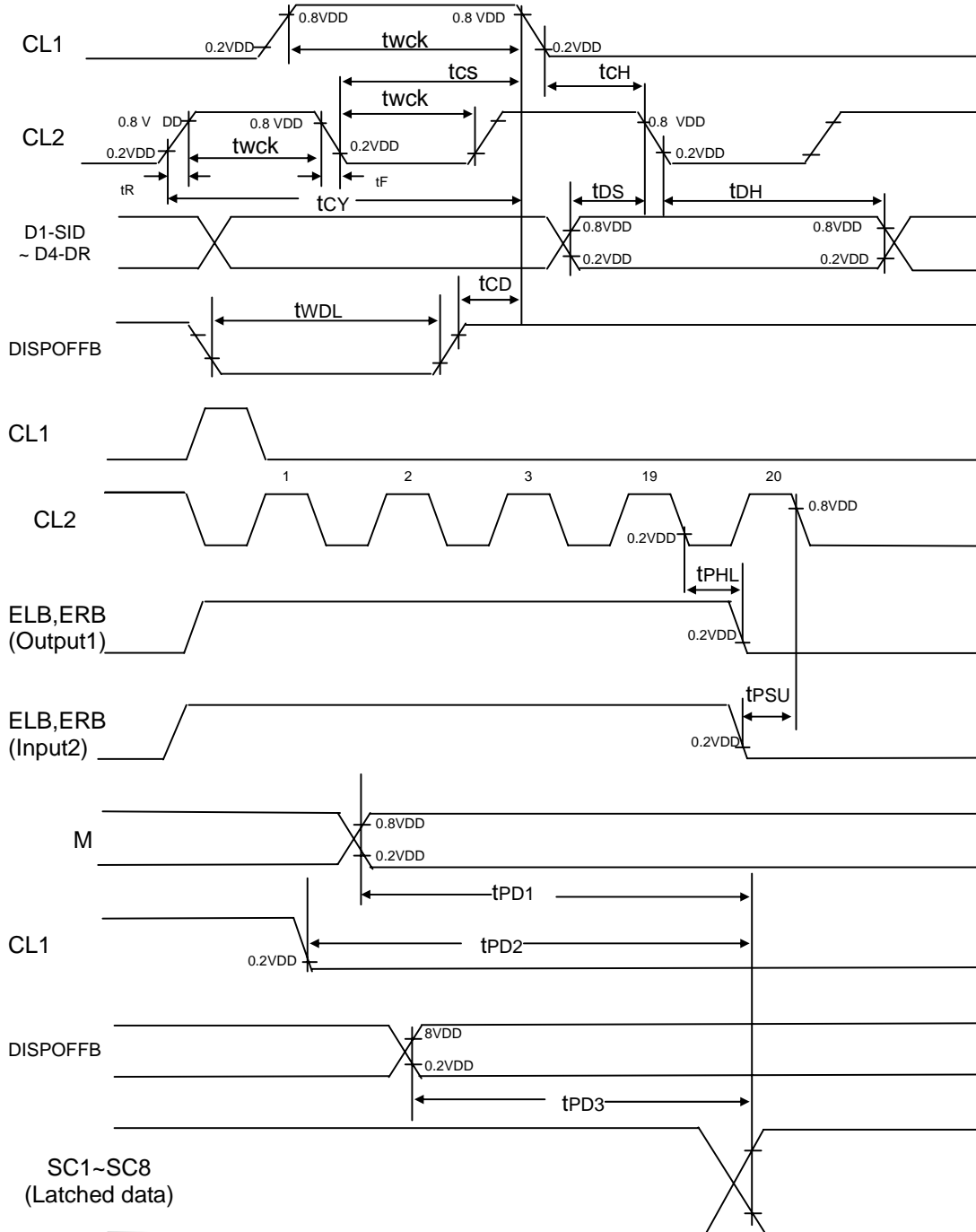
Item	Symbol	White	Unit
Power Dissipation	PAD	680	mW
Forward Current	I_{AF}	200	mA
Reverse Voltage	VR	5	V

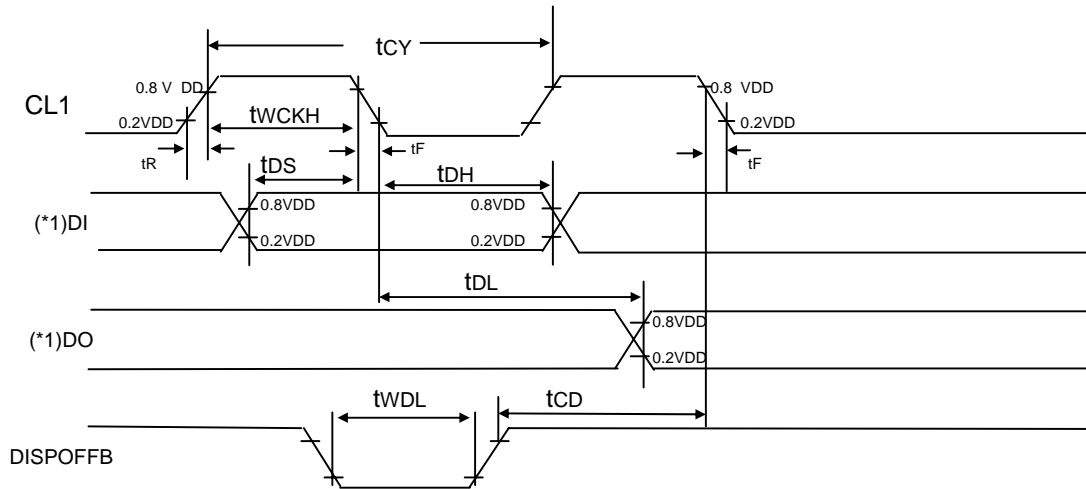
6.2.1 LED ARRAY BLOCK DIAGRAM



7. TIMING CHARACTERISTIC

(1) SEGMENT DRIVER APPLICATION TIMING



(2)COMMON DRIVER APPLICATION TIMING


(*1) When in single-type interface mode
 DI⇒D2-DL(SHL="L"),D4-DR(SHL="H")
 DO⇒D4-DR(SHL="L"),D2-DL(SHL="H")
 When in dual-type interface mode
 DI⇒D2-DL and D3-DM(SHL="L"),D4-DR and D3-DM (SHL="H")
 DO⇒D4-DR (SHL="L"),D2-DL (SHL="H")

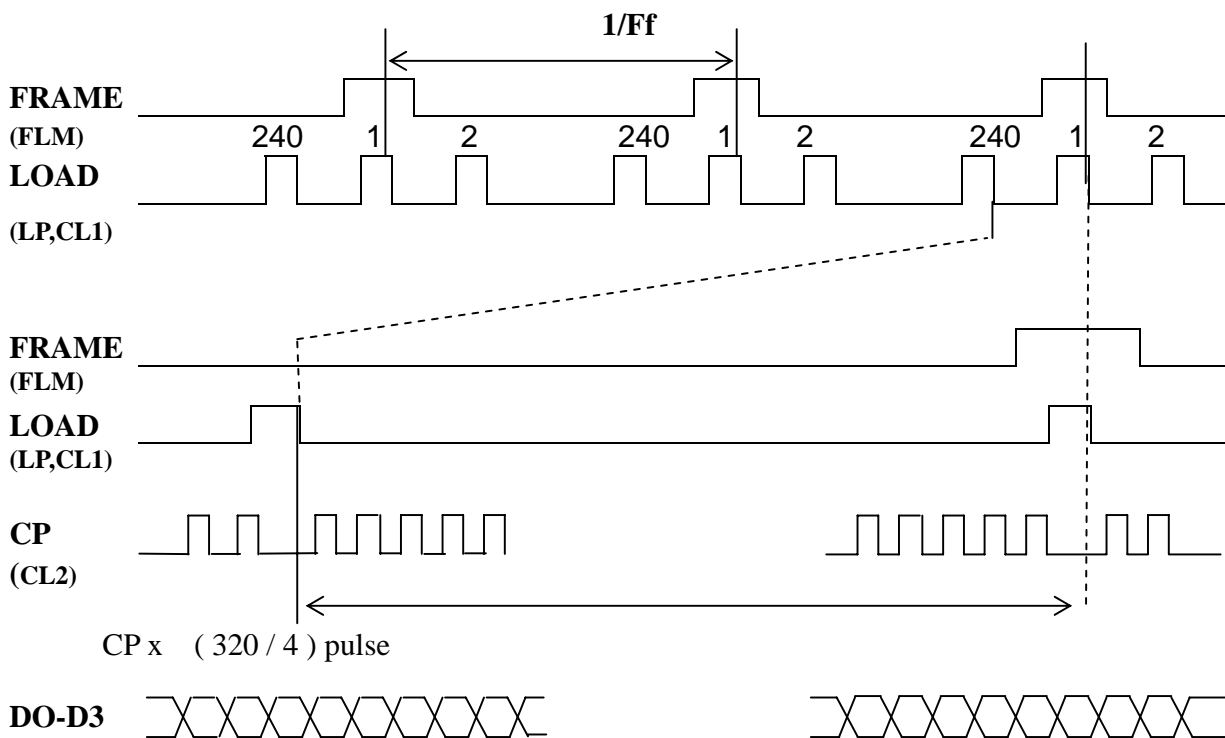
AC Characteristics
(1)SEGMENTDRIVERAPPLICATION

(VSS= 0 V, Ta=-30~ +85)

Characteristics	Symbol	Test Condition	(1)VDD=5V±10%			(2)VDD=3V±10%			Unit
			Min.	Typ.	Max.	Min.	Typ.	Max.	
Clock cycle time	t_{CY}	Duty=50%	125	-	-	250	-	-	ns
Clock pulse width	t_{WCK}		45	-	-	95	-	-	
Clock rise/fall time	t_R/t_F		-	-	-	-	-	30	
Data set-up time	t_{DS}		30	-	-	65	-	-	
Data hold time	t_{DH}		30	-	-	65	-	-	
Clock Set-up time	t_{CS}		80	-	-	120	-	-	
Clock hold time	t_{CH}		80	-	-	120	-	-	
Propagation delay time	t_{PHL}	ELB Output	-	-	60	-	-	125	
		ERB Output	-	-	60	-	-	125	
ELB,ERB Set-up time	t_{PSU}	ELB Input	30	-	-	65	-	-	
		ERB Input	30	-	-	65	-	-	
DISPOFFB low pulse width	t_{WDL}		1.2	-	-	1.2	-	-	μs
DISPOFFB clear time	t_{CD}		100	-	-	100	-	-	ns
M-OUT propagation delay time	t_{PD1}	CL=15 pF	-	-	1.0	-	-	1.2	μs
CI1-OUT propagation delay time	t_{PD2}		-	-	1.0	-	-	1.2	
DISPOFFB-OUT propagation delay time	t_{PD3}		-	-	1.0	-	-	-	

AC Characteristics
(2)COMMON DRIVER APPLICATION
(VSS= 0 V, Ta=-30~ +85)

Characteristics	Symbol	Test Condition	(1)VDD=5V±10%			(2)VDD=3V±10%			Unit
			Min.	Typ.	Max.	Min.	Typ.	Max.	
Clock cycle time	t_{CY}	Duty=50%	250	-	-	500	-	-	ns
Clock pulse width	t_{WCK}		45	-	-	95	-	-	
Clock rise/fall time	t_R/t_F		-	-	50	-	-	50	
Data set-up time	t_{DS}		30	-	-	65	-	-	
Data hold time	t_{DH}		30	-	-	65	-	-	
DISPOFFB low pulse width	t_{WDL}		1.2	-	-	1.2	-	-	μs
DISPOFFB clear time	t_{CD}		100	-	-	100	-	-	ns
Output delay time	t_{DL}		-	-	200	-	-	250	
M-OUT propagation delay time	t_{PD1}	CL=15 pF	-	-	1.0	-	-	1.2	μs
CI1-OUT propagation delay time	t_{PD2}		-	-	1.0	-	-	1.2	
DISPOFFB-OUT propagation delay time	t_{PD3}		-	-	1.0	-	-	1.2	

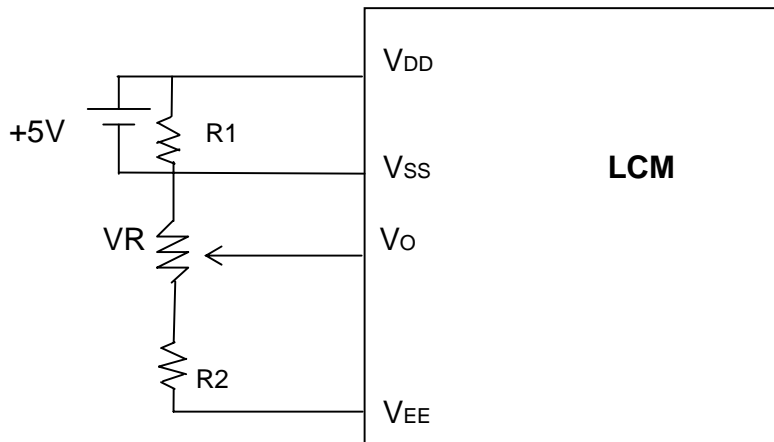
7.1 TIMING CHART


8. PIN CONNECTIONS

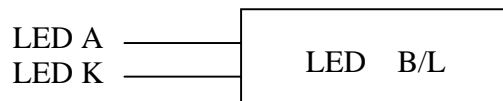
CN1

No.	Symbol	Function
1	D0	Data bus line 0
2	D1	Data bus line 1
3	D2	Data bus line 2
4	D3	Data bus line 3
5	/DISPOFF	Display on/off control, High= ON Low= OFF
6	FLM	First Line Mark
7	N.C	NO Connection
8	CL1	Data Latch Pulse
9	CL2	Data Shift Pulse
10	VDD	Power Supply For Logic
11	VSS	GND
12	VEE	Negative voltage output
13	VO	Input voltage for LCD contrast adjustment
14	FGND	Frame Ground

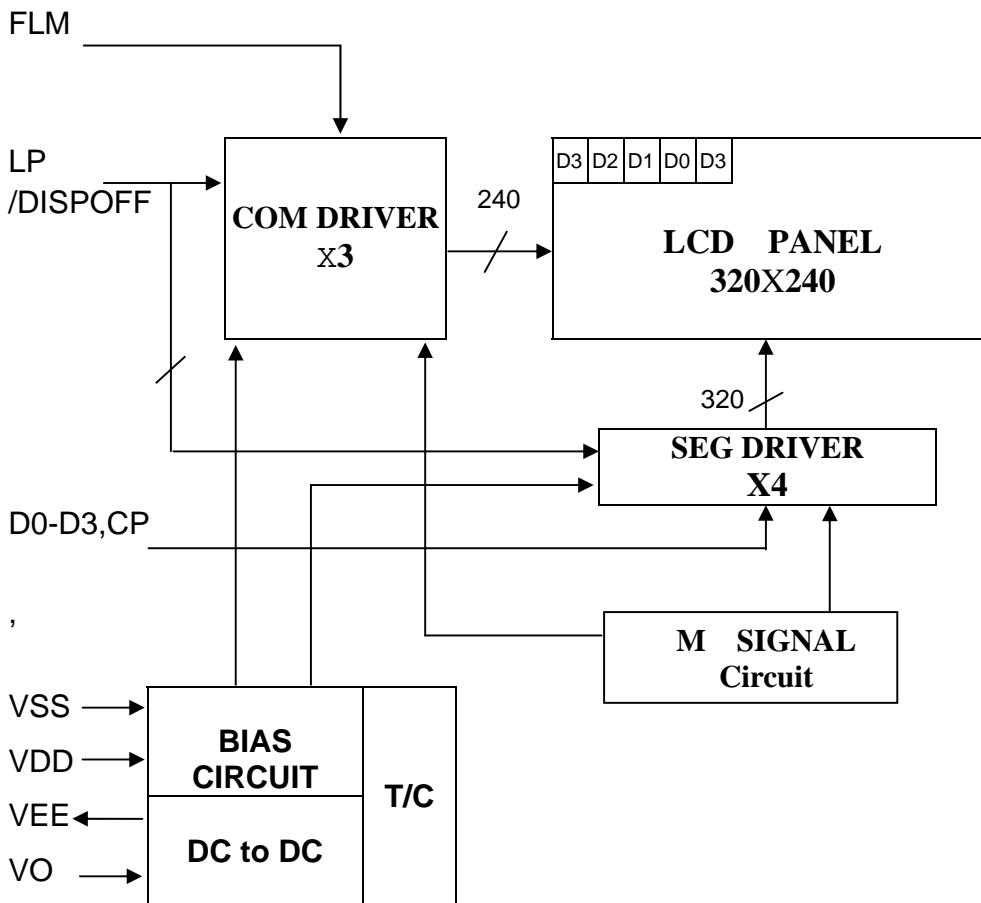
9. POWER SUPPLY



VR=250K OHM
 R1=1M OHM
 R2=5.1K OHM



10. BLOCK DI AGRAM



11. QUALITY ASSURANCE

11.1 Test Condition

11.1.1 Temperature and Humidity(Ambient Temperature)

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

11.1.3 Operation

Unless specified otherwise, test will be conducted under function state.

11.1.4 Container

Unless specified otherwise, vibration test will be conducted to the product itself without putting it in a container.

11.1.5 Test Frequency

In case of related to deterioration such as shock test. It will be conducted only once.

11.1.6 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.

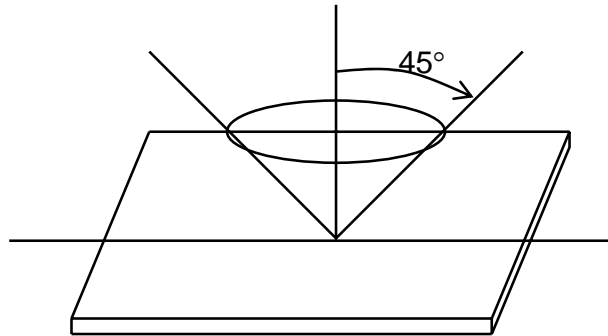
Note 2: No dew condensation to be observed.

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

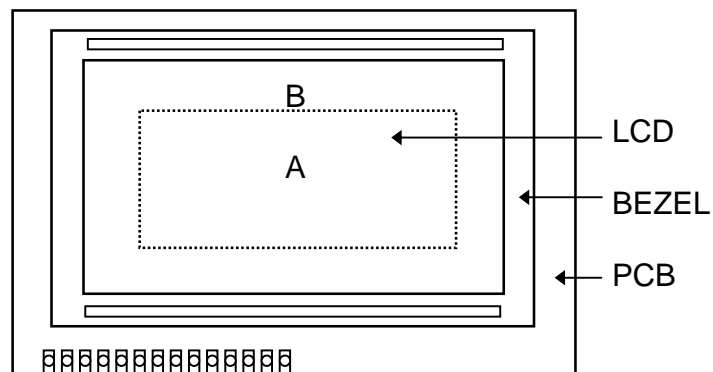
11.2 Inspection condition

11.2.1 Inspection conditions

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

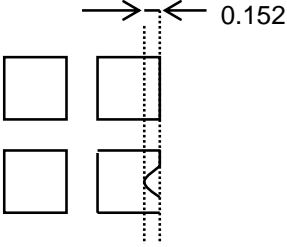


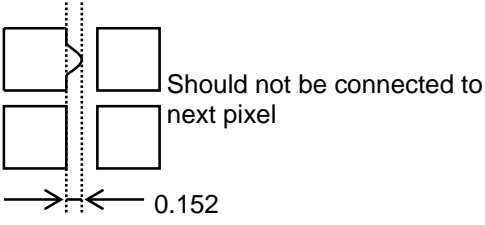
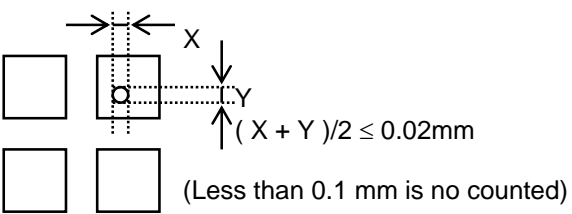
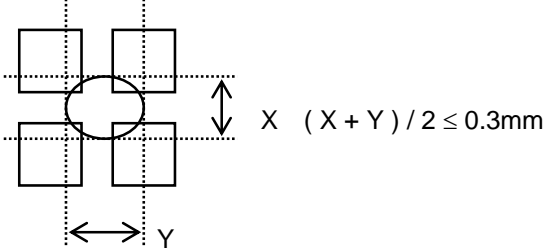
11.2.2 Definition of applicable Zones



A : Display Area
B : Non-Display Area

11.2.3 Inspection Parameters

No.	Parameter	Criteria																												
1	Black or White spots	<table border="1"> <thead> <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> </thead> <tbody> <tr> <td>$D < 0.15$</td> <td>*</td> <td>*</td> <td rowspan="4">Minor</td> <td rowspan="4">2.5</td> </tr> <tr> <td>$0.15 \leq D < 0.2$</td> <td>4</td> <td>4</td> </tr> <tr> <td>$0.2 \leq D \leq 0.25$</td> <td>2</td> <td>2</td> </tr> <tr> <td>$D \leq 0.3$</td> <td>0</td> <td>1</td> </tr> </tbody> </table> <p style="text-align: center;">$D = (\text{Long} + \text{Short}) / 2$ * : Disregard</p>	Zone Dimension	Acceptable number		Class Of Defects	AQL Level	A	B	$D < 0.15$	*	*	Minor	2.5	$0.15 \leq D < 0.2$	4	4	$0.2 \leq D \leq 0.25$	2	2	$D \leq 0.3$	0	1							
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2	Scratch, Substances	<table border="1"> <thead> <tr> <th colspan="2">Zone</th> <th colspan="2">Acceptable number</th> <th rowspan="2">Class Of Defects</th> <th rowspan="2">AQL Level</th> </tr> <tr> <th>X (mm)</th> <th>Y (mm)</th> <th>A</th> <th>B</th> </tr> </thead> <tbody> <tr> <td>*</td> <td>$0.04 \geq W$</td> <td>*</td> <td>*</td> <td rowspan="4">Minor</td> <td rowspan="4">2.5</td> </tr> <tr> <td>$3.0 \geq L$</td> <td>$0.06 \geq W$</td> <td>4</td> <td>4</td> </tr> <tr> <td>$2.0 \geq L$</td> <td>$0.08 \geq W$</td> <td>2</td> <td>3</td> </tr> <tr> <td>—</td> <td>$0.1 < W$</td> <td>0</td> <td>1</td> </tr> </tbody> </table> <p>X : Length Y : Width * : Disregard Total defects should not exceed 4/module</p>	Zone		Acceptable number		Class Of Defects	AQL Level	X (mm)	Y (mm)	A	B	*	$0.04 \geq W$	*	*	Minor	2.5	$3.0 \geq L$	$0.06 \geq W$	4	4	$2.0 \geq L$	$0.08 \geq W$	2	3	—	$0.1 < W$	0	1
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$2.0 \geq L$	$0.08 \geq W$	2	3																											
—	$0.1 < W$	0	1																											
3	Air Bubbles (between glass & polarizer)	<table border="1"> <thead> <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> </thead> <tbody> <tr> <td>$D \leq 0.15$</td> <td>*</td> <td>*</td> <td rowspan="3">Minor</td> <td rowspan="3">2.5</td> </tr> <tr> <td>$0.15 < D \leq 0.25$</td> <td>2</td> <td>*</td> </tr> <tr> <td>$0.25 < D$</td> <td>0</td> <td>1</td> </tr> </tbody> </table> <p>* : Disregard Total defects shall not excess 3/module.</p>	Zone Dimension	Acceptable number		Class of Defects	AQL Level	A	B	$D \leq 0.15$	*	*	Minor	2.5	$0.15 < D \leq 0.25$	2	*	$0.25 < D$	0	1										
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$0.25 < D$	0	1																												
4	Uniformity of Pixel	<p>(1) Pixel shape (with Dent)</p> 																												

4	Uniformity of Pixel	(2) Pixel shape (with Projection) 	
		(3) Pin hole 	
		(4) Deformation 	
		Total acceptable number : 1/pixel, 5/cell	
Class of defects	Major	AQL 0.65%	Definition It is a defect that is likely to result in failure or to reduce materially the usability of the product for the intended function.
		AQL 1.00%	It is a defect that is likely to assembly size and not result in functioning problem.
	Minor	AQL 2.5%	It is a defect that will not result in functioning problem with deviation classified.

11.3 Sampling Condition

Unless otherwise agree in written, the sampling inspection shall be applied to the incoming inspection of customer.

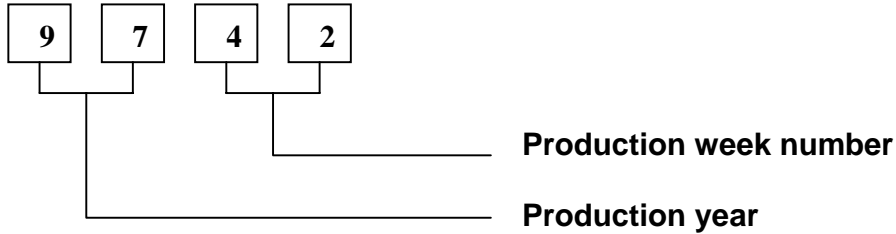
Lot size: Quantity of shipment lot per model.

Sampling type: normal inspection, single sampling

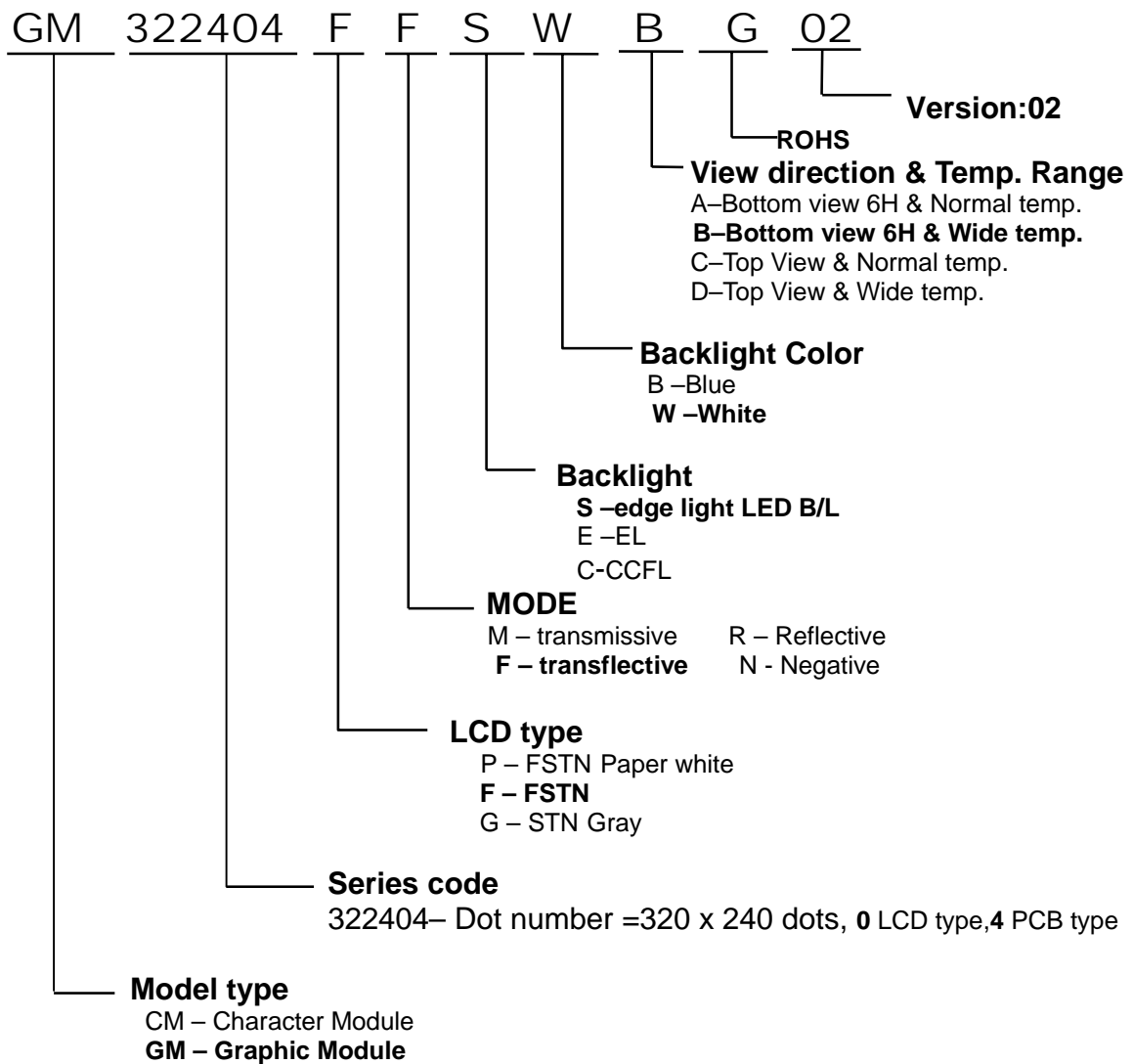
Sampling table: MIL-STD-105E

Inspection level: Level II

12. LOT NUMBERING SYSTEM



13. LCM NUMBERING SYSTEM



14. PRECAUTIONS IN USE 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 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 : $280^{\circ}\text{C} \pm 10^{\circ}\text{C}$
- (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 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

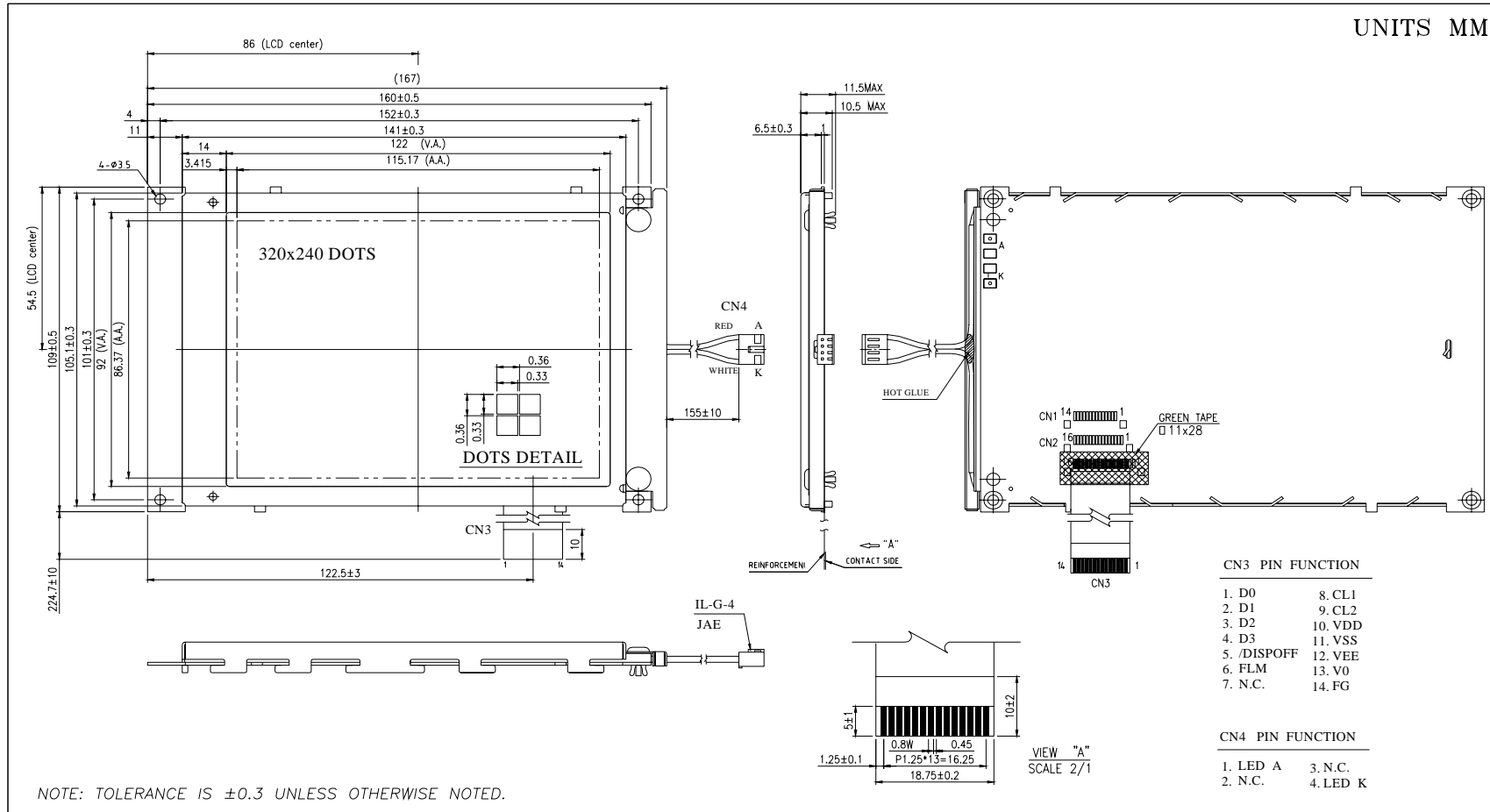
If any fluid leaks out of a damaged glass cell, wash off any human part that comes into contact with soap and water. Never swallow the fluid. The toxicity is extremely low but caution should be exercised at all the time.

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.

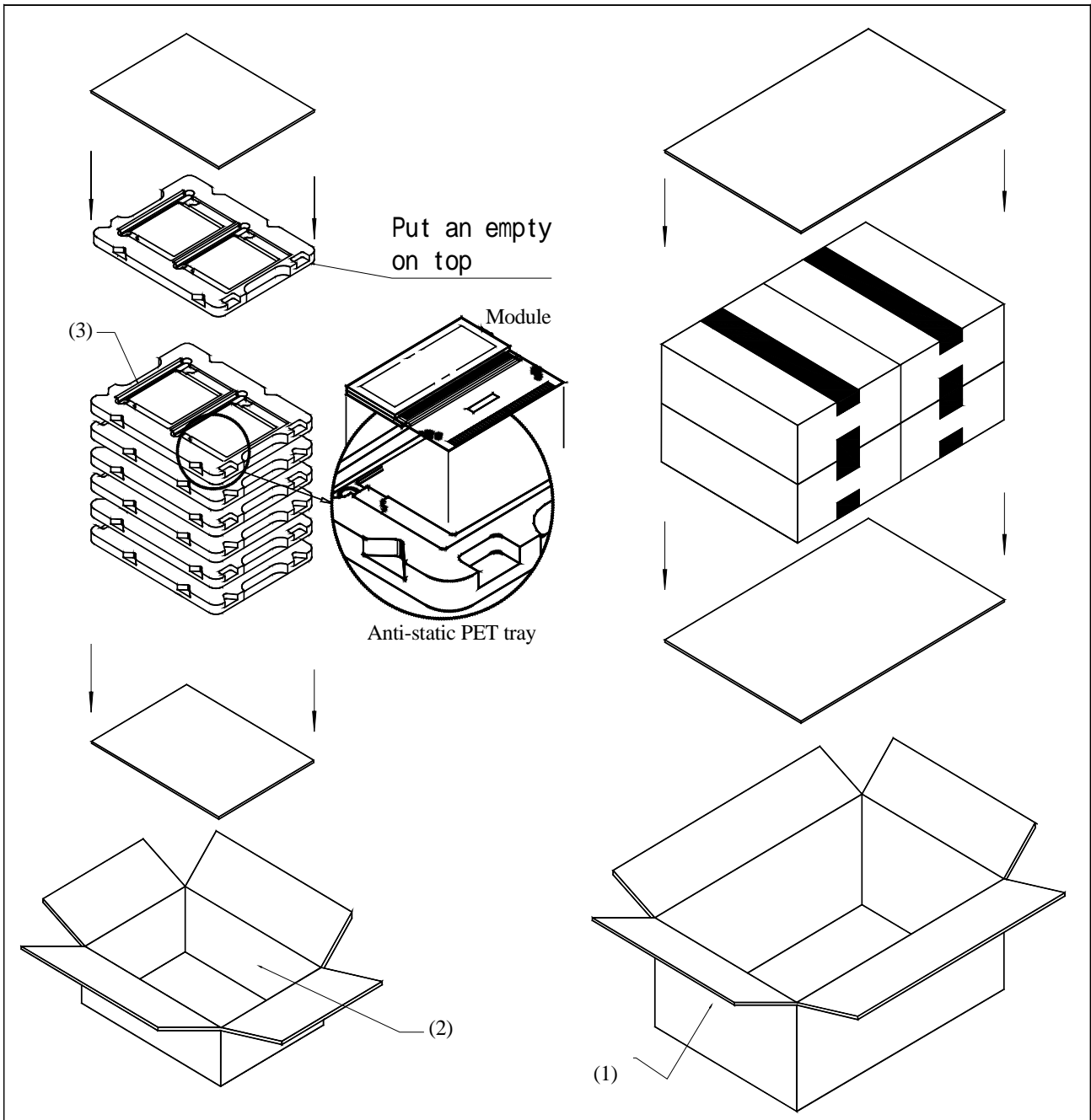
Confidential Document
15. OUTLINE DRAWING

UNITS MM



				DATE:	12/27/04'	DATA IMAGE Corporation		
				DRAWN:				TITLE: LCM OUTLINE DIMENSION
				CHECK:		A4	ISSUE DATE:	
				APPROVE:			DWG. NO. GM322404S-01	REV. A
△	Change <<GM322404S-01>> from REV: 1 to REV: A.	02/09/06'						SCALE : NULL
AUTH	DESCRIPTION	DATE	APPROVED					⊗
REVISIONS								SHEET 1 OF 1

16. PACKAGE INFORMATION



Item	Size(L*W*H)	Quantity	Note
1.Master Carton	482*282*279	1	
2.Inner Carton	267*224*115	4	
Quantity Per Inner Carton	12	Quantity per Master Carton	48
N . W	12 (kg)	G . W	12 (kg)