

# PRODUCT SPECIFICATION

## MONO LCD MODULE MODEL: G2406B0SAN1B-A0 Ver:1.2

< ◇ > Preliminary Specification

< ◆ > Finally Specification

CUSTOMER'S APPROVAL	
CUSTOMER :	
SIGNATURE:	DATE:

APPROVED BY	PM REVIEWED	PD REVIEWED	PREPARED By



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## 1. Features

The features of LCD are as follows

- \* Display mode : STN/Y-G, Positive, Reflective
- \* Drive IC : T6963C,SDN8080G
- \* Display format : 240 X 64Dots
- \* Interface Input Data : 8-Bit
- \* Driving Method : 1/64Duty, 1/9 Bias
- \* Viewing Direction : 6 O'clock
- \* Backlight : Without
- \* With Touch Panel
- \*Sample NO. :

## 2. MECHANICAL SPECIFICATIONS

Item	Specification	Unit
Module Size	125(W) x60(H)x13(T)	mm
Number of Dots	240x64 Dots	
Viewing Area	111 (W) x37 (H)	mm
Activity Area	105.57(W)x31.97 (H)	-
Dot Size	0.41(W) x 0.47(H)	mm
Dot Pitch	0.44(W) x0.50 (H)	mm

## 3. ELECTRICAL SPECIFICATIONS

### 3-1 ABSOLUTR MAZIMUM RATINGS (Ta = 25 °C)

Item	Symbol	Standard Value			Unit
		Min.	Typ.	Max.	
Supply Voltage For Logic	$V_{DD} - V_{SS}$	-0.3	-	7	V
Supply Voltage For LCD Drive	$V_{OP} = V_{DD} - V_{EE}$	6	-	28	V
Input Voltage	$V_{in}$	-0.3	-	$V_{DD} + 0.3$	V
Operating Temp.	$T_{op}$	-10	-	+60	°C
Storage Temp.	$T_{st}$	-20	-	+70	°C

\*. NOTE: The response time will be extremely slow when the operating temperature is around -10°C, and the back ground will become darker at high temperature operating.

## 3-2 ELECTRICAL CHARACTERISTICS

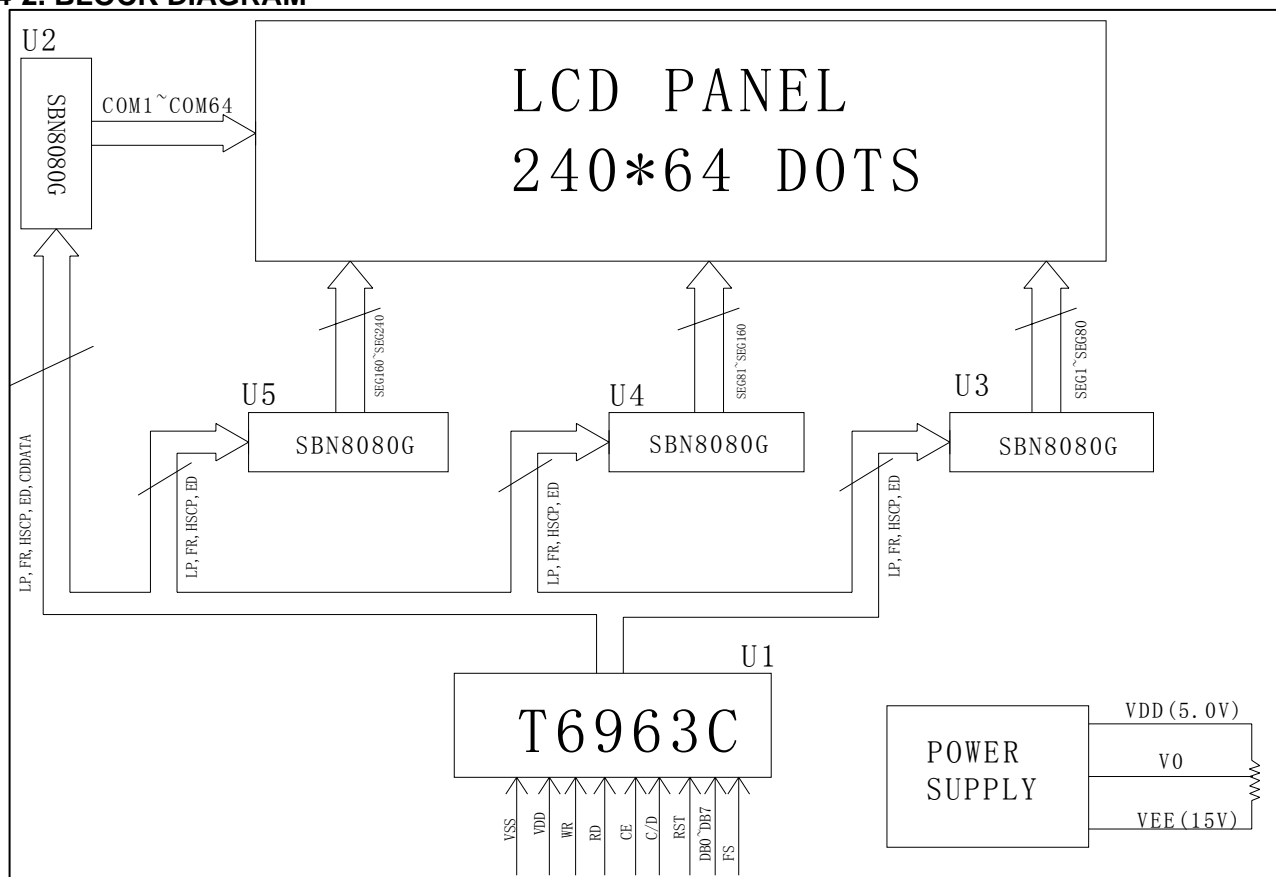
Item	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Logic supply Voltage	$V_{DD} - V_{SS}$	$T_a = 25\text{ }^\circ\text{C}$	4.5	5	5.5	V
LCD Drive	$V_{OP} = V_{DD} - V_{EE}$		-	12	-	V
Input Voltage	"H" Level	$V_{DD} = 5V \pm 10\%$	$V_{DD} - 2.2$	-	$V_{DD}$	V
	"L" Level		0	-	$0.8V_{DD}$	V
Frame Frequency	$f_{FLM}$	$V_{DD} = 5V$	-	-	-	Hz
Current Consumption	$I_{DD}$	$V_{DD} = 5V$	-	14	-	mA

## 4. TERMINAL FUNCTIONS AND BLOCK DIAGRAM

### 4-1. INTERFACE PIN FUNCTION DESCRIPTION

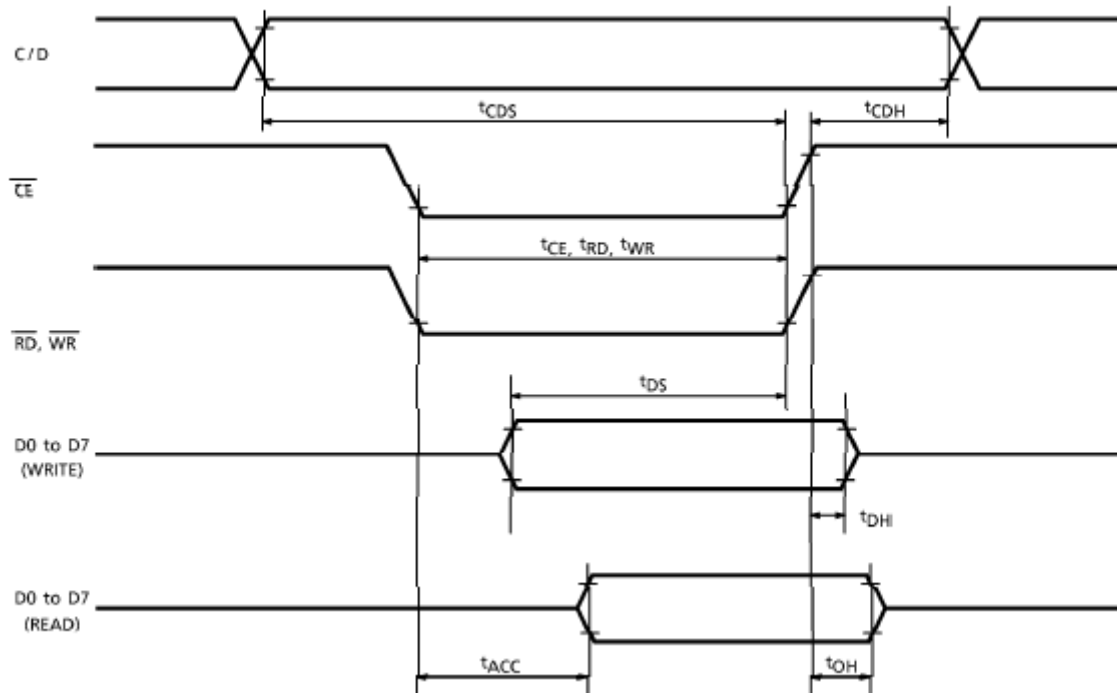
No.	Symbol	Function
1	FG	Bezel GND
2	VSS	Power GND
3	VDD	For internal logics circuit
4	V0	<b>Bias voltage terminals to drive LCD</b>
5	WR	Data Write
6	RD	Data Read
7	CE	Chip enable
8	C/D	Data or instruction
9	NC	Nop pin
10	RST	Reset signal.
11~18	DB0~DB7	Data I/O pin between CPU and T6963C
19	FS	Pin for selection of font
20	VEE	Power for LCD drive voltage

### 4-2. BLOCK DIAGRAM



## 5. System bus read/write characteristics

### Bus Timing



TEST CONDITIONS (Unless otherwise noted,  $V_{DD} = 5.0V \pm 10\%$ ,  $V_{SS} = 0V$ ,  $T_a = -20$  to  $75^\circ C$ )

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

**6. INSTRUCTION SET**

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

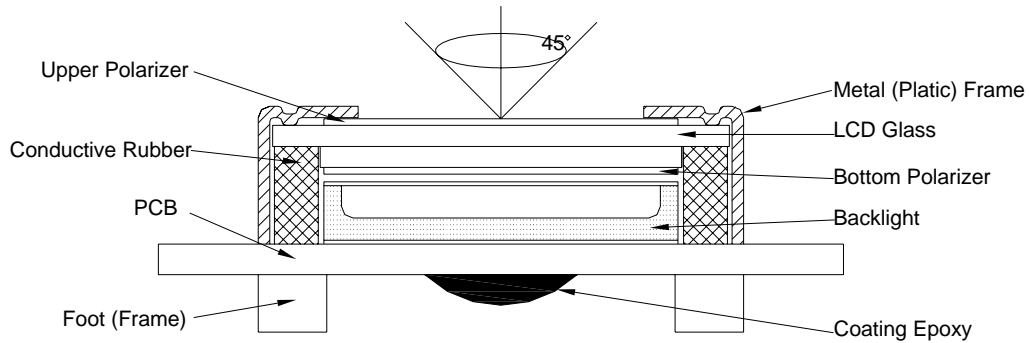
COMMAND	CODE	D1	D2	FUNCTION
BIT SET / RESET	11110XXX	—	—	Bit Reset
	11111XXX	—	—	Bit Set
	1111X000	—	—	Bit 0 (LSB)
	1111X001	—	—	Bit 1
	1111X010	—	—	Bit 2
	1111X011	—	—	Bit 3
	1111X100	—	—	Bit 4
	1111X101	—	—	Bit 5
	1111X110	—	—	Bit 6
	1111X111	—	—	Bit 7 (MSB)



## 7. QUALITY SPECIFICATIONS

### 7-1. LCM Appearance and Electric inspection Condition

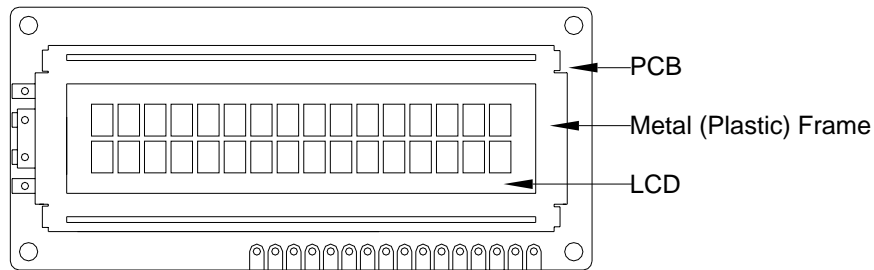
1. Inspection will be done by placing LCM 30cm away from inspector's eyeballs under normal illumination.



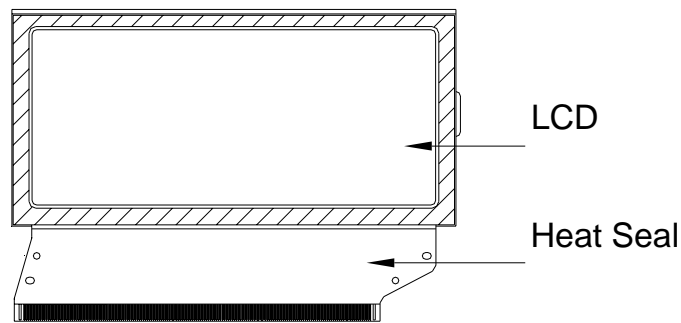
2. View Angle: with in 45° around perpendicular line.

### 7-2. Definition

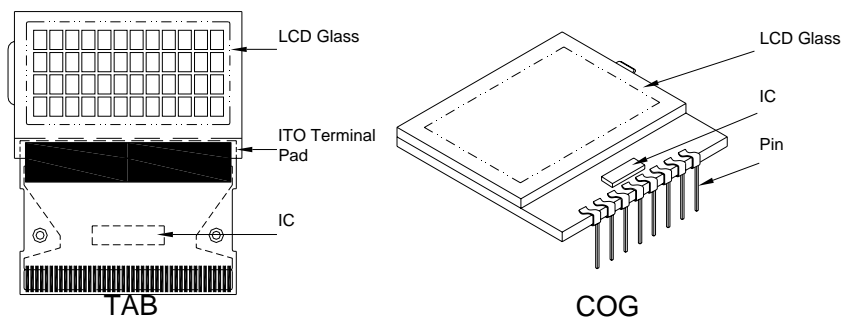
#### 1. COB



#### 2. Heat Seal



#### 3. TAB and COG



**7-3. Sampling Plan and Acceptance**

1. Sampling Plan

MIL - STD - 105E ( || ) ordinary single inspection is used.

2. Acceptance

Major defect: AQL = 0.65%

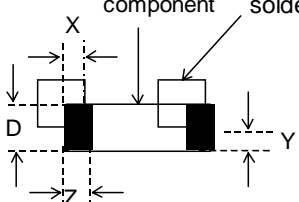
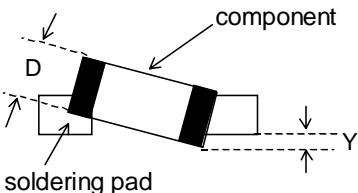
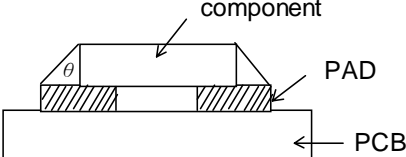
Minor defect: AQL = 1.5%

**7-4. Criteria**

**1. COB**

Defect	Inspection Item	Inspection Standards	
Major	PCB copper flakes peeling off	Any copper flake in viewing Area should be greater than 1.0mm <sup>2</sup>	Reject
Major	Height of coating epoxy	Exceed the dimension of drawing	Reject
Major	Void or hole of coating epoxy	Expose bonding wire or IC	Reject
Major	PCB cutting defect	Exceed the dimension of drawing	Reject

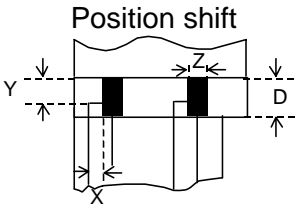
**2. SMT**

Defect	Inspection Item	Inspection Standards	
Minor	Component marking not readable		Reject
Minor	Component height	Exceed the dimension Of drawing	Reject
Major	Component solder defect (missing , extra, wrong component or wrong orientation)		Reject
Minor	<p>Component position shift</p> 	$X < 3/4Z$ $Y > 1/3D$	Reject Reject
Minor	<p>Component tilt</p> 	$Y > 1/3D$	Reject
Minor	<p>Insufficient solder</p> 	$\theta \leq 20^\circ$	Reject

**3. Metal (Plastic) Frame**

Defect	Inspection Item	Inspection Standards		
Major	Crack / breakage	Anywhere		
			Reject	
Minor	Frame Scratch	W	L	Acceptable of Scratch
		$w < 0.1\text{mm}$	Any	Ignore
		$0.1 \leq w < 0.2\text{mm}$	$L \leq 5.0\text{mm}$	2
		$0.2 \leq w < 0.3\text{mm}$	$L \leq 3.0\text{mm}$	1
		$w \geq 0.3\text{mm}$	Any	0
		Note : 1. Above criteria applicable to scratch lines with distance greater than 5mm. 2. Scratch on the back side of frame (not visible) can be ignored .		
Minor	Frame Dent , Prick $\Phi = \frac{L + W}{2}$		Acceptable of Dents / Pricks	
		$\Phi \leq 1.0\text{mm}$	2	
		$1.0 < \Phi \leq 1.5\text{mm}$	1	
		$1.5\text{mm} < \Phi$	0	
Note : 1. Above criteria applicable to any two dents / pricks with distance greater than 5mm 2. Dent / prick on the back side of frame (not visible) can be ignored				
Minor	Frame Deformation	Exceed the dimension of drawing		
Minor	Metal Frame Oxidation	Any rust		

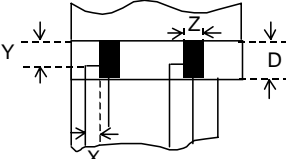
**4. Flexible Film Connector (FFC)**

Defect	Inspection Item	Inspection Standards	
Minor	Tilted soldering	Within the angle $+5^\circ$	Acceptable
Minor	Uneven solder joint /bump		Reject
Minor	Hole $\Phi = \frac{L + W}{2}$	Expose the conductive line	Reject
		$\Phi > 1.0\text{mm}$	Reject
Minor		$Y > 1/3D$	Reject
		$X > 1/2Z$	Reject

**5. Screw**

Defect	Inspection Item	Inspection Standards	
Major	Screw missing/loosen		Reject
Minor	Screw oxidation	Any rust	Reject
Minor	Screw deformation	Difficult to accept screw driver	Reject

**6. Heatseal 、TCP 、FPC**

Defect	Inspection Item	Inspection Standards	
Major	Scratch expose conductive layer		Reject
Minor	HS Hole $\Phi = \frac{L+W}{2}$	$\Phi > 0.5\text{mm}$	Reject
Major	Adhesion strength	Less than the specification	Reject
Minor	Position shift 	$Y > 1/3D$	Reject
		$X > 1/2Z$	Reject
Major	Conductive line break		Reject

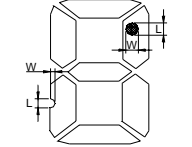
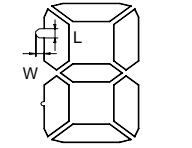
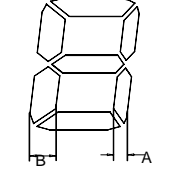
**7. LED Backing Protective Film and Others**

Defect	Inspection Item	Inspection Standards	
Minor	LED dirty, prick	Acceptable number of units	
		$\Phi \leq 0.10\text{mm}$	Ignore
		$0.10 < \Phi \leq 0.15\text{mm}$	2
		$0.15 < \Phi \leq 0.2\text{mm}$	1
		$\Phi > 0.2\text{mm}$	0
The distance between any two spots should be $\geq 5\text{mm}$ Any spot/dot/void outside of viewing area is acceptable			
Minor	Protective film tilt	Not fully cover LCD	Reject
Major	COG coating	Not fully cover ITO circuit	Reject

**8. Electric Inspection**

Defect	Inspection Item	Inspection Standards	
Major	Short		Reject
Major	Open		Reject

## 9. Inspection Specification of LCD

Defect	Inspect Item	Inspection Standards				
		W	$W \leq 0.03$	$0.03 < W \leq 0.05$	$W > 0.05$	
Minor	Linear Defect * Glass Scratch * Polarizer Scratch * Fiber and Linear material	L	$L < 5$	$L < 3$	Any	
		ACC. NO.	1	1	Reject	
		Note	L is the length and W is the width of the defect			
Minor	Black Spot and Polarizer Pricked * Foreign material between glass and polarizer or glass and glass * Polarizer hole or protuberance by external force	$\Phi$	$\Phi \leq 0.1$	$0.1 < \Phi \leq 0.15$	$0.15 < \Phi \leq 0.2$	$\Phi > 0.2$
		ACC. NO.	3EA / 100mm <sup>2</sup>	2	1	0
		Note	$\Phi$ is the average diameter of the defect. Distance between two defects > 10mm.			
Minor	White Spot and Bubble in polarizer * Unobvious transparent foreign material between glass and glass or glass and polarizer * Air protuberance between polarizer and glass	$\Phi$	$\Phi \leq 0.3$	$0.3 < \Phi \leq 0.5$	$0.5 < \Phi$	
		ACC. NO.	3EA / 100mm <sup>2</sup>	1	0	
		Note	$\Phi$ is the average diameter of the defect. Distance between two defects > 10mm.			
Minor	Segment Defect 	$\Phi$	$\Phi \leq 0.10$	$0.10 < \Phi \leq 0.20$	$0.20 < \Phi \leq 0.25$	$\Phi > 0.25$
		ACC. NO.	3EA / 100mm <sup>2</sup>	2	1	0
		Note	W is more than 1/2 segment width			Reject
			$\Phi = \frac{L + W}{2}$ Distance between two defect is 10mm			
Minor	Protuberant Segment  $\Phi = (L + W) / 2$	$\Phi$	$\Phi \leq 0.10$	$0.10 < \Phi \leq 0.20$	$0.20 < \Phi \leq 0.25$	$\Phi > 0.25$
		W	Glue	$W \leq 1/2$ Seg $W \leq 0.2$	$W \leq 1/2$ Seg $W \leq 0.2$	Ignore
		ACC. NO.	3EA / 100mm <sup>2</sup>	2	1	0
Minor	Assembly Mis-alignment 	1. Segment				
		B	$B \leq 0.4\text{mm}$	$0.4 < B \leq 1.0\text{mm}$	$B > 1.0\text{mm}$	
		B-A	$B-A < 1/2B$	$B-A < 0.2$	$B-A < 0.25$	
		Judge	Acceptable	Acceptable	Acceptable	
		2. Dot Matrix				
			Deformation > 2°			Reject
Minor	Stain on LCD Panel Surface	Accept when stains can be wiped lightly with a soft cloth or a similar one. Otherwise, judged according to the above items: "Black spot" and "White Spot"				

**8. RELIABILITY**

NO.	Item	Condition	Criterion
1	High Temperature Operating	60°C , 96Hrs	No defect in cosmetic and operational function allowable.
2	Low Temperature Operating	-10°C , 96Hrs	
3	High Humidity	50°C , 90%RH, 96Hrs	
4	High Temperature Storage	70°C , 96Hrs	
5	Low Temperature Storage	-20°C , 96Hrs	
6	Vibration	Random wave 10 ~ 100Hz Acceleration: 2g 2 Hrs per direction(X,Y,Z)	Total current Consumption should be below double of initial value.
7	Thermal Shock	-20°C to 55°C to 70°C (60Min) (5Min) (60Min) 16Cycles	
8	ESD Testing	Contract Discharge Voltage: +1 ~ 5kV and -1 ~ -5kV  Air Discharge Voltage: +1 ~ 8kV and -1 ~ -8kV	There will be discharged ten times at every discharging voltage cycle. The voltage gap is 1kV.

Note: 1) Above conditions are suitable for EASSTOP DISPLAY standard products.  
2) For restrict products, the test conditions listed as above must be revised.

## 9. HANDLING PRECAUTION

### (1) Mounting Method

The panel of the LCD Module consists of two thin glass plates with polarizers which easily get damaged since the Module is fixed by utilizing fitting holes in the printed circuit board. Extreme care should be taken when handling the LCD Modules.

### (2) Caution of LCD handling & cleaning

When cleaning the display surface, use soft cloth with solvent (recommended below) and wipe lightly.

- Isopropyl alcohol
- Ethyl alcohol
- Trichloro triflurothane

Do not wipe the display surface with dry or hard materials that will damage the polarizer surface.

Do not use the following solvent:

- Water- Ketone- Aromatics

### (3) Caution against static charge

The LCD Module use C-MOS LSI drivers, so we recommend that you connect any unused input terminal to VDD or VSS, do not input any signals before power is turned on. And ground your body, Work/assembly table. And assembly equipment to protect against static electricity.

### (4) Packaging

- Modules use LCD elements, and must be treated as such. Avoid intense shock and falls from a height.
- To prevent modules from degradation. Do not operate or store them exposed directly to sunshine or high temperature/humidity.

### (5) Caution for operation

- It is indispensable to drive LCD's within the specified voltage limit since the higher voltage than the limit shorten LCD life. An electrochemical reaction due to direct current causes LCD deterioration, Avoid the use of direct current drive.
- Response time will be extremely delayed at lower temperature than the operating temperature range and on the other hand at higher temperature LCD's show dark color in them. However those phenomena do not mean malfunction or out of order with LCD's. Which will come back in the specified operating temperature range.
- If the display area is pushed hard during operation, some font will be abnormally displayed but it resumes normal condition after turning off once.
- A slight dew depositing on terminals is a cause for electro-chemical reaction resulting in terminal open circuit.

Usage under the relative condition of 40°C, 50%RH or less is reequired.

### (6) Storage

In the case of storing for a long period of time (for instance.) For years) for the purpose or replacement use, The following ways are recommended.

- Storage in a polyethylene bag with sealed so as not to enter fresh air outside in it, And with no desiccant.
- Placing in a dark place where neither exposure to direct sunlight nor light is. Keeping temperature in the specified storage temperature range.
- Storing with no touch on polarizer surface by the anything else. (It is recommended to store them as they have been contained in the inner container at the time of delivery)

### (7) Safety

- It is recommendable to crash damaged or unnecessary LCD into pieces and wash off liquid crystal by using solvents such as acetone and ethanol.

Which should be burned up later.

- When any liquid crystal leaked out of a damaged glass cell comes in contac with your hands, please wash it off well with soap and wate

# 10. OUTLINE DIMENSION

