

**EASTTOP DISPLAY CO., LTD.****PRODUCT SPECIFICATION**

**MONO LCD MODULE**  
**MODEL: G0904A2SHN2G-A0 Ver:1.0**

< ◇ > Preliminary Specification

< ◆ > Finally Specification

CUSTOMER'S APPROVAL	
CUSTOMER :	
SIGNATURE:	DATE:

APPROVED BY	PM REVIEWED	PD REVIEWED	PREPARED BY



## Table of Contents

No.	Contents	Page
1.	FEATURES .....	4
2.	MECHANICAL SPECIFICATIONS.....	4
3.	ELECTRICAL SPECIFICATIONS.....	4
4.	TERMINAL FUNCTIONS AND BLOCK DIAGRAM .....	5
5.	TIMING CHARACTERISTICS.....	6
6.	INSTRUCTION SET.....	7
7.	QUALITY SPECIFICATIONS.....	9
8.	RELIABILITY .....	14
9.	HANDLING PRECAUTION .....	15
10.	OUTLINE DIMENSION .....	16

## 1. Features

The features of LCD are as follows

- \* Display mode : STN/Gray/ Reflective/Positive
- \* Drive IC : ST7549Ti-G2
- \* Display format : 96x40 dots
- \* Interface Input Data : I<sup>2</sup>C interface
- \* Driving Method : 1/68 Duty, 1/9 Bias
- \* Viewing Direction : 12 O'clock
- \* Backlight : Without
- \* Sample NO. : G0904A2SHN2G-A0\_01/20090206

## 2. MECHANICAL SPECIFICATIONS

Item	Specification	Unit
Module Size	45(W) x 36.2(H) x 1.98MAX(T)	mm
Number of Dots	96 x 40 dots	
View display area	40(W) x 23(H)	Mm
Activity Display Area	35.217(W) x 18.225(H)	mm
Dot Size	0.352(W) x 0.441(H)	mm
Dot Pitch	0.367 (W) x 0.456 (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 <sub>DD</sub> -V <sub>SS</sub>	-0.3	-	3.6	V
Supply Voltage For LCD Drive	V <sub>LCD</sub>	-0.3	-	13.5	V
Input Voltage	V <sub>in</sub>	-0.5	-	5	V
Operating Temp.	T <sub>op</sub>	0	-	+50	°C
Storage Temp.	T <sub>st</sub>	-10	-	+60	°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. ELECTICAL CHARACTERISTICS

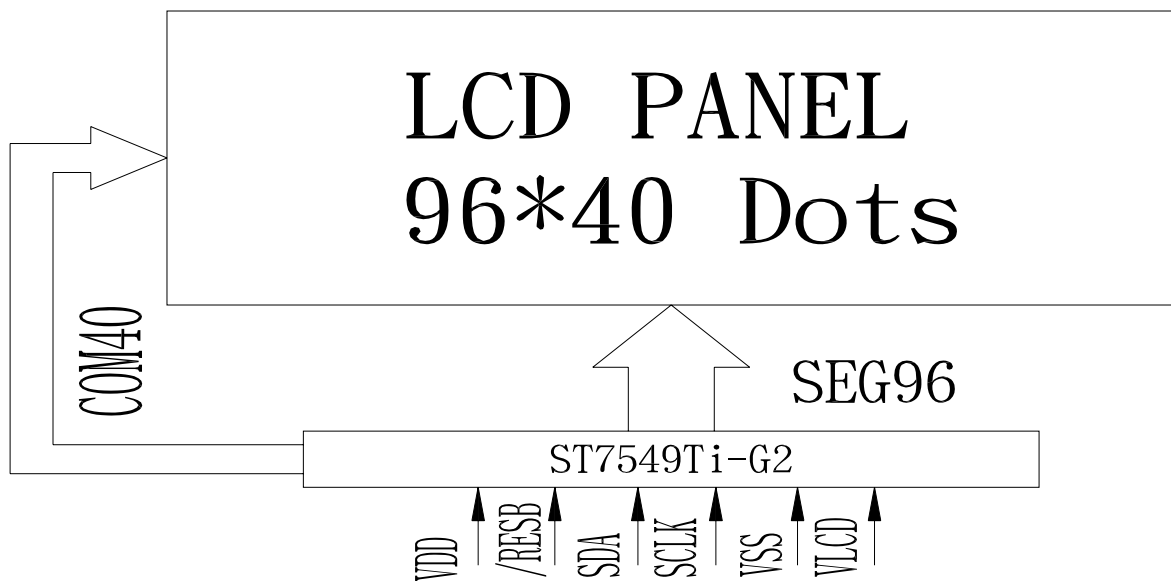
Item	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Logic supply Voltage	V <sub>DD</sub> -V <sub>SS</sub>	Ta = 25 °C V <sub>DD</sub> =3.0	2.8	3.0	3.2	V
LCD Drive	V <sub>LCD</sub>		-	9		V
Input Voltage	"H" Level V <sub>IH</sub>		0.7V <sub>DD</sub>		V <sub>DD</sub>	V
	"L" Level V <sub>IL</sub>		V <sub>SS</sub>		0.3V <sub>DD</sub>	V

## 4. TERMINAL FUNCTIONS AND BLOCK DIAGRAM

### 4-1. INTERFACE PIN FUNCTION DESCRIPTION

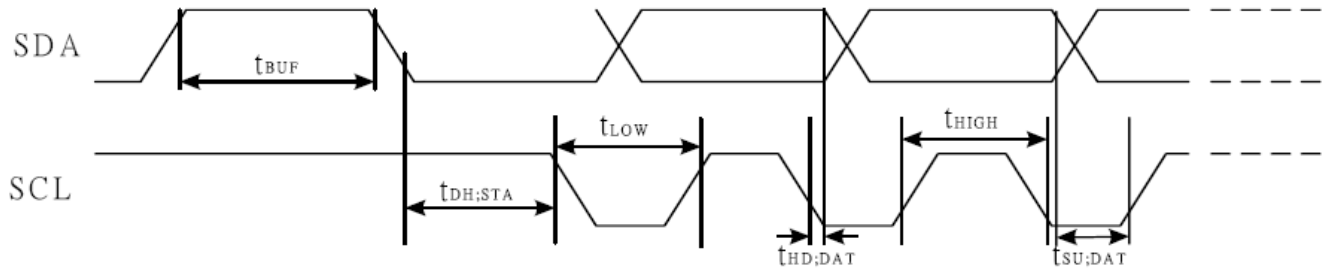
PIN NO.	SYMBOL	FUNCTIONS
1	VDD	Supply voltage for logical circuit
2	/RESB	Reset input pin
3	SDA	Serial data input
4	SCLK	Serial clock input
5	VSS	Ground
6	VLCD	Supply voltage for LCD driving

### 4-2. BLOCK DIAGRAM



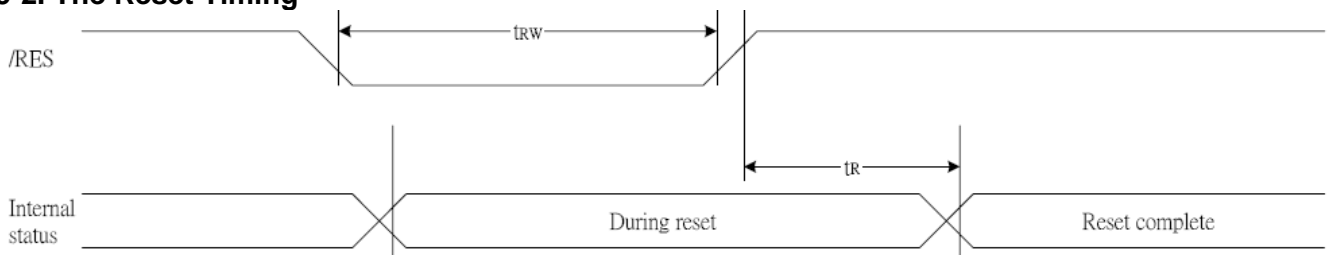
## 5. TIMING CHARACTERISTICS

### 5-1. The serial interface



Item	Signal	Symbol	Condition	Rating		Units
				Min.	Max.	
SCL clock frequency	SCL	FSCLK		-	400	KHZ
SCL clock low period	SCL	TLOW		1.3	-	us
SCL clock high period	SCL	THIGH		0.6	-	us
Data set-up time	SI	TSU;Data		100	-	ns
Data hold time	SI	THD;Data		0	0.9	us
SCL,SDA rise time	SCL	TR		20+0.1Cb	300	ns
SCL,SDA fall time	SCL	TF		20+0.1Cb	300	ns
Capacitive load represented by each bus line		Cb		-	400	pF
Setup time for a repeated START condition	SI	TSU;SUA		0.6	-	us
Start condition hold time	SI	THD;STA		0.6	-	us
Setup time for STOP condition		TSU;STO		0.6	-	us
Tolerable spike width on bus		TSW		-	50	ns
BUS free time between a STOP and START condition	SCL	TBUF		1.3		us

### 5-2. The Reset Timing



Item	Signal	Symbol	Condition	Rating			Units
				Min.	Typ.	Max.	
Reset time		tR		—	—	1	us
Reset "L" pulse width	RESB	tRW		1	—	—	us

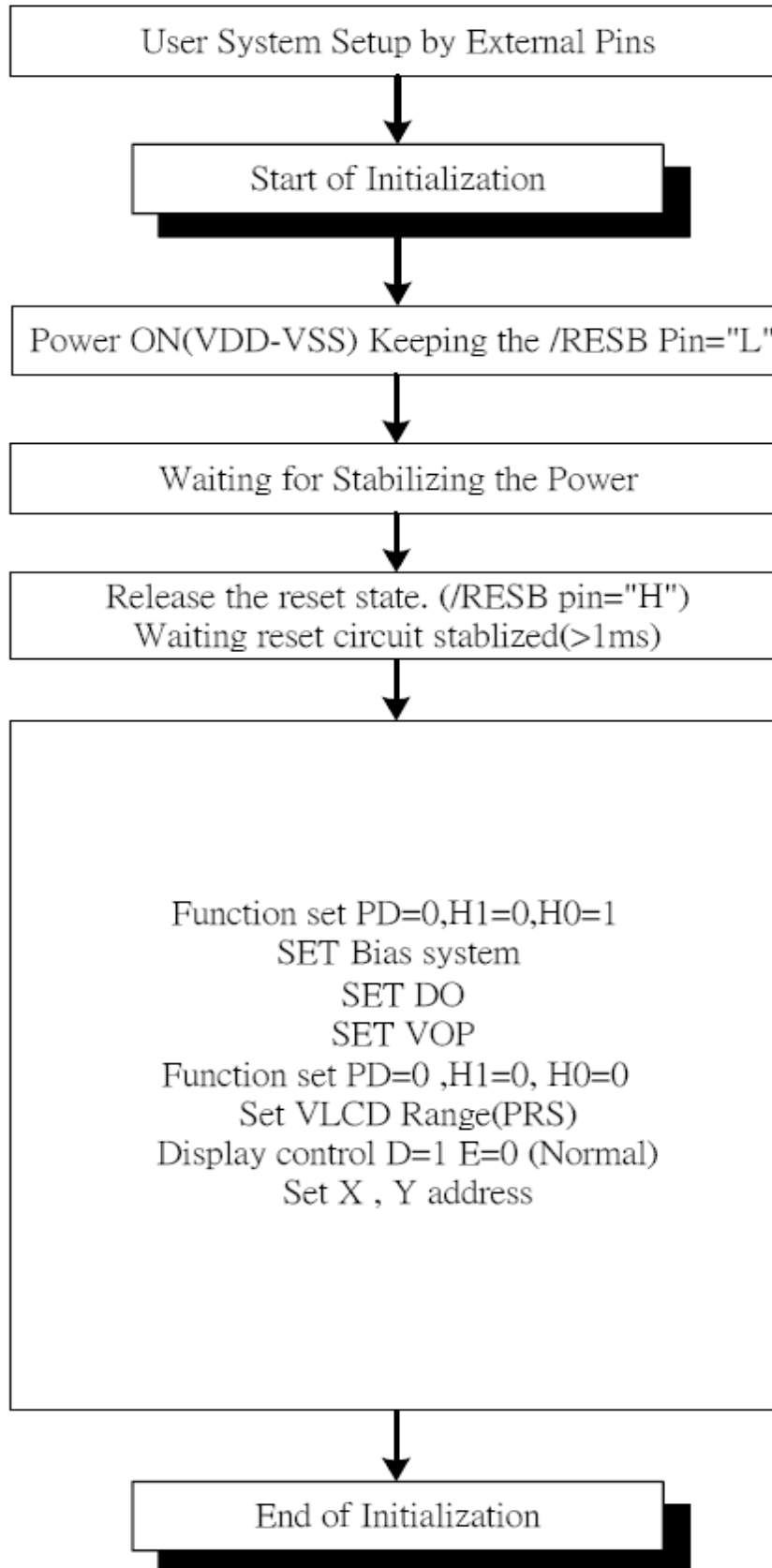
## 6. INSTRUCTION SET

### 6-1. command

INSTRUCTION	A0	WR (R/W)	COMMAND BYTE								DESCRIPTION	
			D7	D6	D5	D4	D3	D2	D1	D0		
<b>H independent instruction</b>												
NOP	0	0	0	0	0	0	0	0	0	0	0	No operation
Reserved	0	0	0	0	0	0	0	0	0	0	1	Do not use
Function set	0	0	0	0	1	MX	MY	PD	H1	H0		Power-down; entry mode; Extended instruction control
Read status byte	0	1	PD	0	0	D	E	MX	MY	DO		Read status byte
Read data	1	1	D <sub>7</sub>	D <sub>6</sub>	D <sub>5</sub>	D <sub>4</sub>	D <sub>3</sub>	D <sub>2</sub>	D <sub>1</sub>	D <sub>0</sub>		Read data to RAM
Write data	1	0	D <sub>7</sub>	D <sub>6</sub>	D <sub>5</sub>	D <sub>4</sub>	D <sub>3</sub>	D <sub>2</sub>	D <sub>1</sub>	D <sub>0</sub>		Write data to RAM

INSTRUCTION	A0	WR (R/W)	COMMAND BYTE								DESCRIPTION	
			D7	D6	D5	D4	D3	D2	D1	D0		
<b>H[1:0]=[0:0]</b>												
Reserved	0	0	0	0	0	0	0	0	0	1	X	Do not use
Set V <sub>LCD</sub> range	0	0	0	0	0	0	0	0	1	0	PRS	V <sub>LCD</sub> range L/H select
END	0	0	0	0	0	0	0	0	1	1	0	Release read/modify/write
Read/modify/write	0	0	0	0	0	0	0	0	1	1	1	RAM address at R:+0 , W:+1
Display control	0	0	0	0	0	0	0	1	D	0	E	Sets display configuration
Reserved	0	0	0	0	0	0	1	0	0	X	X	Do not use
Set Y address of RAM	0	0	0	1	0	0	Y <sub>3</sub>	Y <sub>2</sub>	Y <sub>1</sub>	Y <sub>0</sub>		Sets Y address of RAM 0 ≤ Y ≤ 9
Set X address of RAM	0	0	1	X <sub>6</sub>	X <sub>5</sub>	X <sub>4</sub>	X <sub>3</sub>	X <sub>2</sub>	X <sub>1</sub>	X <sub>0</sub>		Sets X address of RAM 0 ≤ X ≤ 101
<b>H[1:0]=[0:1]</b>												
Reserved	0	0	0	0	0	0	0	0	0	1	X	Do not use
Display configuration	0	0	0	0	0	0	0	1	DO	X	X	Top/bottom row mode set data order
Bias system	0	0	0	0	0	0	1	0	BS <sub>2</sub>	BS <sub>1</sub>	BS <sub>0</sub>	Sets bias system (BSx)
Set Start line	0	0	0	1	S5	S4	S3	S2	S1	S0		Specify the initial display line to realize vertical scrolling
Set V <sub>OP</sub>	0	0	1	V <sub>OP6</sub>	V <sub>OP5</sub>	V <sub>OP4</sub>	V <sub>OP3</sub>	V <sub>OP2</sub>	V <sub>OP1</sub>	V <sub>OP0</sub>		Write V <sub>OP</sub> to register

INSTRUCTION	A0	WR (R/W)	COMMAND BYTE								DESCRIPTION	
			D7	D6	D5	D4	D3	D2	D1	D0		
<b>H[1:0]=[1:0]</b>												
Reserved	0	0	0	0	0	0	0	0	0	1	X	Do not use
Partial screen mode	0	0	0	0	0	0	0	0	1	0	PS	Partial screen enable
Partial screen size	0	0	0	0	0	0	0	1	0	0	WS	Set partial screen size
Display part	0	0	0	0	0	0	1	0	DP2	DP1	DP0	Set display part for partial screen mode
<b>H[1:0]=[1:1]</b>												
RESET	0	0	0	0	0	0	0	0	0	1	1	Software reset
Display control	0	0	0	0	0	0	0	1	FR2	FR1	FR0	Frame rate control
N line inversion	0	0	0	1	0	NL4	NL3	NL2	NL1	NL0		Sets N line inversion
Booster Efficiency &Booster Stage	0	0	1	0	0	1	BE1	BE0	PC1	PC0		Booster Efficiency Set
Reserved	0	0	1	X	X	X	X	X	X	X	X	Do not use

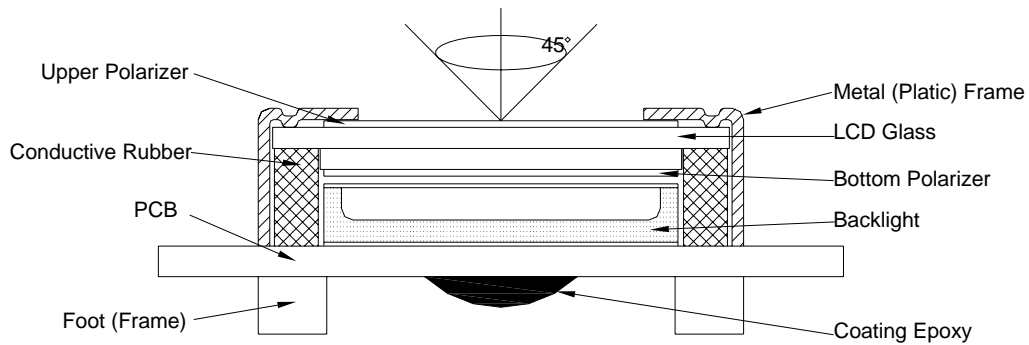
**6-2. Initialization Sequence**



## 7. QUALITY SPECIFICATIONS

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

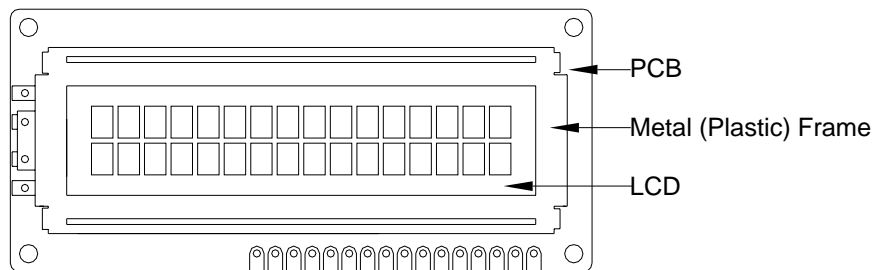
1. Inspection will be done by placing LCM 30cm away from inspector's eyeballs under normal illumination.



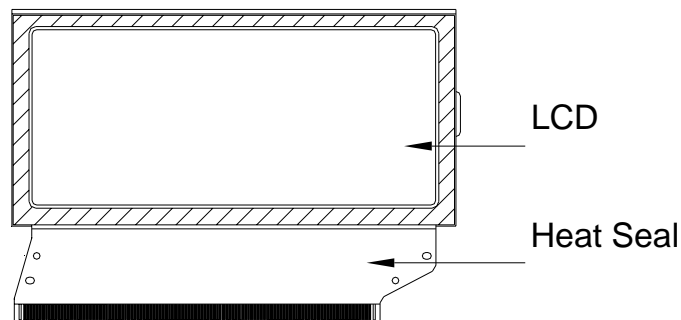
2. View Angle: with in 45° around perpendicular line.

### 7-2. Definition

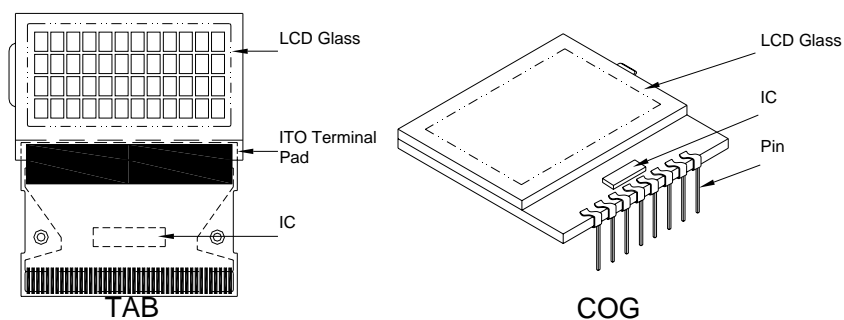
#### 1. COB



#### 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

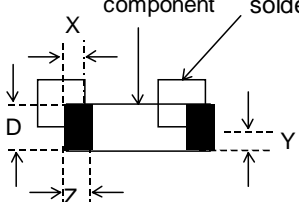
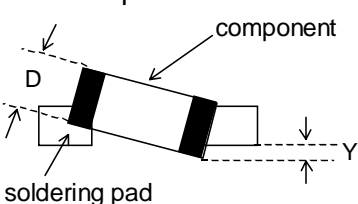
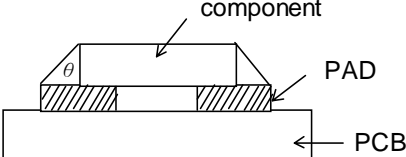
Major defect: AQL = 0.65%

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

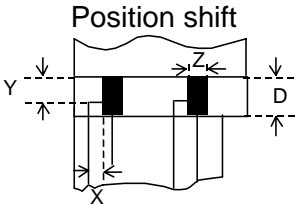
**2. SMT**

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	Component position shift 	$X < 3/4Z$ $Y > 1/3D$	Reject Reject
Minor	Component tilt 	$Y > 1/3D$	Reject
Minor	Insufficient solder 	$\theta \leq 20^\circ$	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		

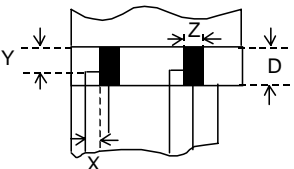
**4. Flexible Film Connector (FFC)**

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

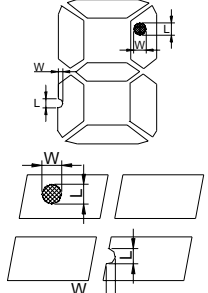
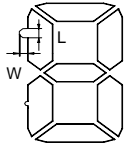
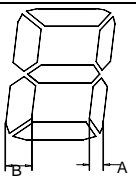
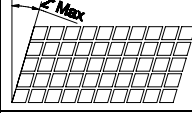
**7. LED Backing Protective Film and Others**

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	50°C , 96Hrs	No defect in cosmetic and operational function allowable.
2	Low Temperature Operating	0°C , 96Hrs	
3	High Humidity	50°C , 90%RH, 96Hrs	
4	High Temperature Storage	60°C , 96Hrs	
5	Low Temperature Storage	-10°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	0°C to 25°C to 50°C (60Min) (5Min) (60Min) 16Cycles	
8	ESD Testing	Contract Discharge Voltage: +1 ~ 5kV and -1 ~ -5kV	There will be discharged ten times at every discharging voltage cycle. The voltage gap is 1kV.
		Air Discharge Voltage: +1 ~ 8kV and -1 ~ -8kV	

Note: 1) Above conditions are suitable for EASTTOP 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 trifloro thane

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

