

### 1. Features:

The features of LCD are as follows:

- Display mode : STN /BLUE, POSITIVE, TRANSMISSIVE
- Colour : Display dot :WHITE  
Background: BLUE
- Display Format : 320 × 240 Dots
- \* IC : RA8835
- Interface Input Data : MCU 8 Bit / 4 Bit
- Driving Method : 1/240 Duty, 1/17 Bias
- Viewing Direction: 6 O'clock
- Backlight : LED (WHITE)

### 2. Mechanical Specifications:

Item	Specification	Unit
Module Size	160.00(W) X107.2(H) X12.0MAX(T)	mm
Viewing Area	122.00(W) X 92.00(H)	mm
Effective Display Area	115.17(W) X 86.37(H)	mm
Number of Dots	320X240 Dots	-
Dot Size	0.33(W) X 0.36(H)	mm
Dot Pitch	0.33(W) X 0.36(H)	mm

### 3. Electrical Specifications:

#### 1. Absolute Maximum Ratings (V<sub>SS</sub> = 0V)

Item	Symbol	Standard Value			Unit
		Min.	Typ.	Max.	
Supply Voltage For Logic	V <sub>DD</sub>	-0.3	-	7.0	V
Supply Voltage For LCD Drive	V <sub>0</sub> , V <sub>OUT</sub>	-24.2	-24.6	-24.8	V
Operating Temp.	T <sub>OP</sub>	-20	-	+70	°C
Storage Temp.	T <sub>ST</sub>	-30	-	+80	°C
Static Electricity	Be sure that you are ground when handing LCM				

#### 2. Electrical Characteristics:

Item		Symbol	Test Condition	Min.	Typ.	Max.	Unit
Supply Voltage For Logic		V <sub>DD</sub> – V <sub>SS</sub>	T <sub>a</sub> =25°C	4.8	5.0	5.2	V
Supply Voltage For LCD		V <sub>DD</sub> – V <sub>0</sub>	T <sub>a</sub> =25°C	-24.2	-24.6	-24.8	V
Input Voltage	“H” Level	V <sub>IH</sub>	T <sub>a</sub> =25°C	0.8V <sub>DD</sub>	-	V <sub>DD</sub>	V
	“L” Level	V <sub>IL</sub>		V <sub>SS</sub>	-	0.2V <sub>DD</sub>	V
Output Voltage	“H” Level	V <sub>OH</sub>	I <sub>OUT</sub> = -0.5mA	0.8V <sub>DD</sub>	-	V <sub>DD</sub>	V
	“L” Level	V <sub>OL</sub>	I <sub>OUT</sub> = 0.5mA	V <sub>SS</sub>	-	0.2V <sub>DD</sub>	V
Current Consumption		I <sub>DD</sub>	V <sub>IN</sub> = V <sub>DD</sub>	-	-	1.0	mA

NOTE: 1) Duty ratio=1/65, Bias=1/9  
2) Measured in Dots ON-state

**3. BACKLIGHT:**

**3.1 Absolute Maximum Ratings:**

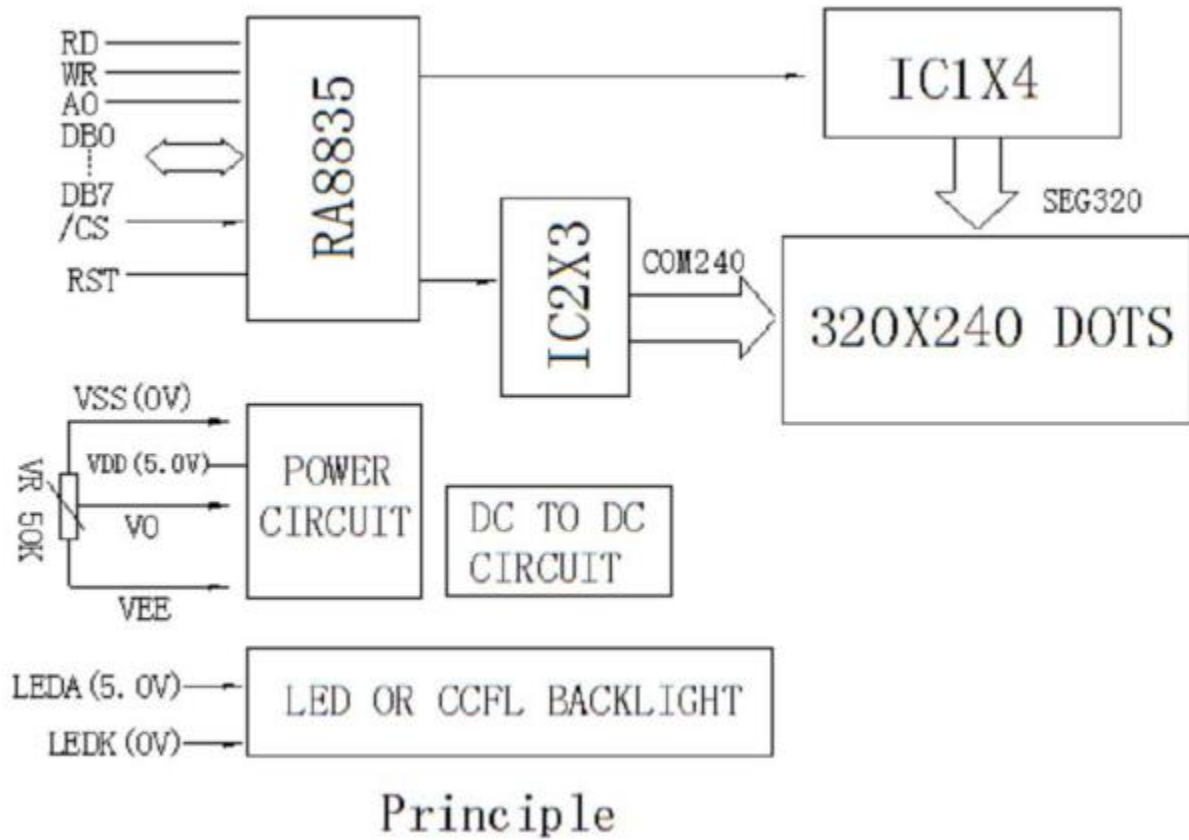
Item	Symbol	Condition	Min.	Typ.	Max	Unit
Forward Current	IF	Ta= 25°C	-	-	20	mA
Reverse Voltage	VR		-	-	5	V
Power Dissipation	PD	Ta= 25°C	-	-	100	mW

**3.2 Opto-electronic Characteristics:**

Item	Symbol	Condition	Min.	Typ.	Max	Unit
Forward Voltage	VF	Ta= 25°C IF= 130mA	4.8	5.0	5.2	V
Luminous	-		100	150	-	cd/m <sup>2</sup>

*\* The brightness is measured without LCD panel*

**4. Schematic Design:**



### 5. Interface Pin Function:

Pin No.	Pin Out	Description
1	VSS	GND (0V)
2	VDD	Logic supply voltage (5.0V)
3	VO	Operating Voltage for LCD Driving
4	WR	VRAM write signal, 8080 family : Write signal 6800 family : R/W signal
5	RD	VRAM read signal, 8080 family : Read signal 6800 family : Enable clock
6	CS	Chip Select, This active-LOW input enables the RA8835. It is usually connected to the output of an address decoder device that maps the RA8835 into the memory space of the controlling microprocessor.
7	A0	VRAM address bus
8	RES	Reset, This active-LOW input performs hardware reset on the RA8835. It is a Schmitt-trigger input for enhanced noise immunity; however, care should be taken to ensure that it is not triggered if the supply voltage is lowered.
9-16	D0-D7	Display data
17	LED+	LED Backlight +.(5.0V)
18	VEE	Power Supply for LCD Drive
19	LED+	LED Backlight +.(5.0V)
20	LED-	LED Backlight -. (0V)

<b>Pin No.</b>	<b>Pin Out</b>	<b>Description</b>
1-4	D0-D3	Display data
5	DISPOFF	Display control signal H: Display on L: Display off
6	FLM	Fist line marker
7	N/C	-
8	LP	Data latch signal
9	CP	Clock signal for shifting data
10	VDD	Logic supply voltage (5.0V)
11	VSS	GND (0V)
12	VEE	Power supply for LCD drive
13	V0	Voltage level for LCD contrast adjustment
14	FGND	Frame Ground
15	LED+	LED Backlight +.(5.0V)
16	LED-	LED Backlight -. (0V)

## 6. Command List:

**Table-1: Command Set**

Class	Command	Code												Hex	Command Description	Command Read Parameters	
		RD	WR	A0	D7	D6	D5	D4	D3	D2	D1	D0	No. of Bytes			Section	
System Control	<b>SYSTEM SET</b>	1	0	1	0	1	0	0	0	0	0	0	0	40	Initialize device and display	8	6-2-1
	<b>SLEEP IN</b>	1	0	1	0	1	0	1	0	0	1	1	53	Enter standby mode	0	6-2-2	
Display Control	<b>DISPLAY ON/OFF</b>	1	0	1	0	1	0	1	1	0	0	D	58, 59	Enable and disable display and display flashing	1	6-3-1	
	<b>SCROLL</b>	1	0	1	0	1	0	0	0	1	0	0	44	Set display start address and display regions	10	6-3-2	
	<b>CSRFORM</b>	1	0	1	0	1	0	1	1	1	0	1	5D	Set cursor type	2	6-3-3	
	<b>CGRAM ADR</b>	1	0	1	0	1	0	1	1	1	0	0	5C	Set start address of character generator RAM	2	6-3-6	
	<b>CSRDIR</b>	1	0	1	0	1	0	0	1	1	CD 1	CD 0	4C to 4F	Set direction of cursor movement	0	6-3-4	
	<b>HDOT SCR</b>	1	0	1	0	1	0	1	1	0	1	0	5A	Set horizontal scroll position	1	6-3-7	
	<b>OVLAY</b>	1	0	1	0	1	0	1	1	0	1	1	5B	Set display overlay format	1	6-3-5	
Drawing Control	<b>CSRW</b>	1	0	1	0	1	0	0	0	1	1	0	46	Set cursor address	2	6-4-1	
	<b>CSRR</b>	1	0	1	0	1	0	0	0	1	1	1	47	Read cursor address	2	6-4-2	
Memory Control	<b>MWRITE</b>	1	0	1	0	1	0	0	0	0	1	0	42	Write to display memory	—	6-5-1	
	<b>MREAD</b>	1	0	1	0	1	0	0	0	0	1	1	43	Read from display memory	—	6-5-2	

**Notes:**

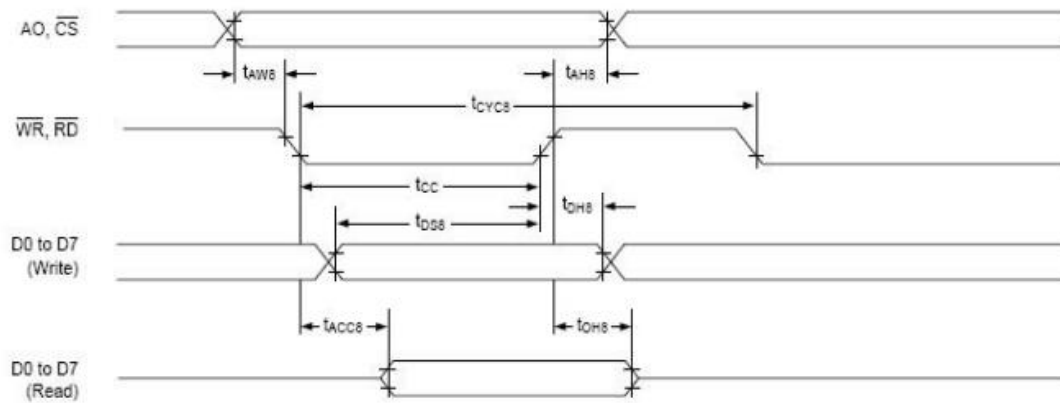
1. In general, the internal registers of the RA8835 series are modified as each command parameter is input. However, the microprocessor does not have to set all the parameters of a command and may send a new command before all parameters have been input. The internal registers for the parameters that have been input will have been changed but the remaining parameter registers are unchanged. 2-byte parameters (where two bytes are treated as 1 data item) are handled as follows:

- a. CSRW, CSRR: Each byte is processed individually. The microprocessor may read or write just the low byte of the cursor address.
- b. SYSTEM SET, SCROLL, CGRAM ADR: Both parameter bytes are processed together. If the command is changed after half of the parameter has been input, the single byte is ignored.

2. APL and APH are 2-byte parameters, but are treated as two 1-byte parameters.

## 7. Timing Characteristics (Continued):

### 8080 family interface timing



T<sub>a</sub> = -20 to 75°C

Signal	Symbol	Parameter	VDD = 4.5 to 5.5V		VDD = 2.7 to 4.5V		Unit	Condition
			min	max	min	max		
A0, $\overline{CS}$	t <sub>AH8</sub>	Address hold time	10	—	10	—	ns	CL = 100pF
	t <sub>AW8</sub>	Address setup time	0	—	0	—	ns	
$\overline{WR}$ , $\overline{RD}$	t <sub>CYC8</sub>	System cycle time	See note.	—	See note.	—	ns	
	t <sub>CC</sub>	Strobe pulsewidth	120	—	150	—	ns	
D0 to D7	t <sub>DS8</sub>	Data setup time	120	—	120	—	ns	
	t <sub>DH8</sub>	Data hold time	5	—	5	—	ns	
	t <sub>ACC8</sub>	$\overline{RD}$ access time	—	50	—	80	ns	
	t <sub>OHS</sub>	Output disable time	10	50	10	55	ns	

**Note:** For memory control and system control commands:

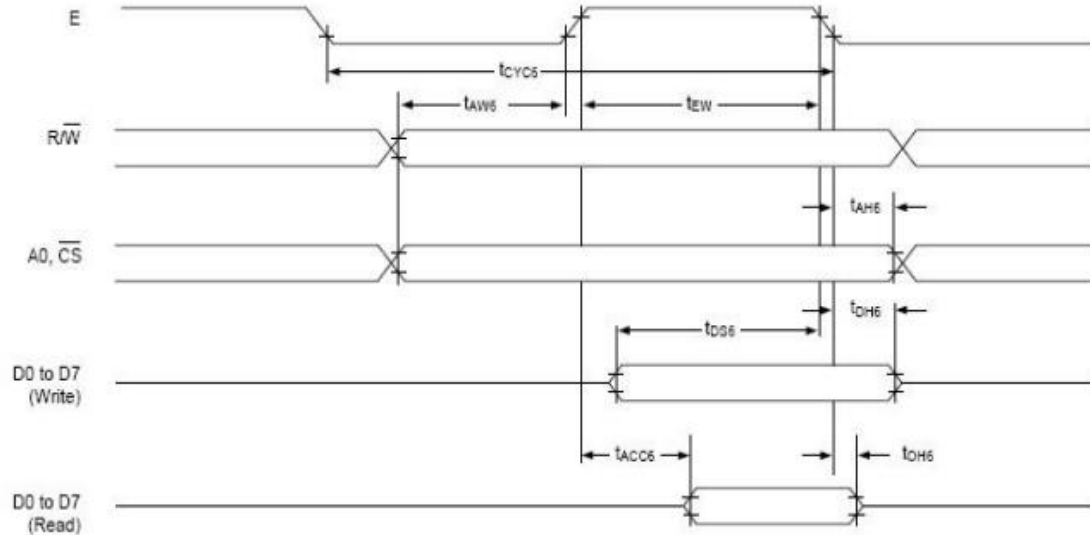
$$t_{CYC8} = 2t_C + t_{CC} + t_{CEA} + 75 > t_{ACV} + 245$$

For all other commands:

$$t_{CYC8} = 4t_C + t_{CC} + 30$$



**6800 family interface timing**



Note:  $t_{CYC6}$  indicates the interval during which CS is LOW and E is HIGH.

$T_a = -20$  to  $75^\circ\text{C}$

Signal	Symbol	Parameter	VDD = 4.5 to 5.5V		VDD = 2.7 to 4.5V		Unit	Condition
			min	max	min	max		
A0, CS, R/W	$t_{CYC6}$	System cycle time	See note.	—	See note.	—	ns	CL = 100 pF
	$t_{AW6}$	Address setup time	0	—	10	—	ns	
	$t_{AH6}$	Address hold time	0	—	0	—	ns	
D0 to D7	$t_{DS6}$	Data setup time	100	—	120	—	ns	
	$t_{DH6}$	Data hold time	0	—	0	—	ns	
	$t_{OH6}$	Output disable time	10	50	10	75	ns	
	$t_{ACC6}$	Access time	—	85	—	130	ns	
E	$t_{EW}$	Enable pulsewidth	120	—	150	—	ns	

Note: For memory control and system control commands:

$$t_{CYC6} = 2t_C + t_{EW} + t_{CEA} + 75 > t_{ACV} + 245$$

For all other commands:

$$t_{CYC6} = 4t_C + t_{EW} + 30$$

## 8. Quality Specification (Continued):

### 8-3. Sampling Plan and Acceptance

#### 1. Sampling Plan

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

#### 2. Acceptance

Major defect:                      AQL = 0.25%

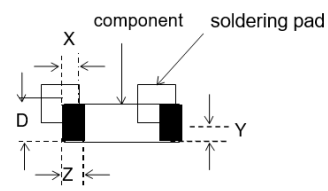
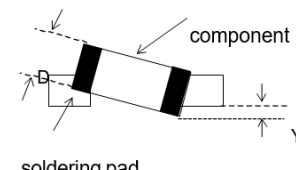
Minor defect:                      AQL = 0.65%

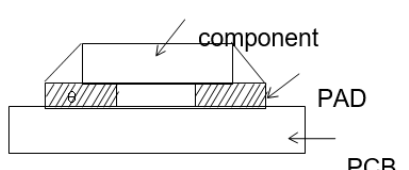
### 8-4. Criteria

#### a) 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

#### b) SMT

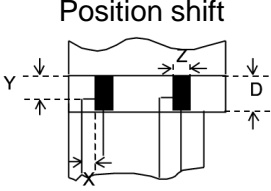
Defect	Inspection Item	Inspection Standards	
Minor	Component marking not readable		Reject
Minor	Component height	Exceed the dimension Of drawing	Reject
Major	Component solder defect (missing , extra, wrong component or wrong orientation		Reject
Minor	 <p>Component position shift</p>	$X < 3/4Z$ $Y > 1/3D$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

Minor	<p>Insufficient solder</p> 	$\theta \leq 20^\circ$	Reject
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**c) Metal (Plastic) Frame**

Defect	Inspection Item	Inspection Standards		
Major	Crack / breakage	Anywhere		
		Reject		
Minor	Frame Scratch	W	L	Acceptable of Scratch
		$w < 0.03\text{mm}$	Any	Ignore
		$0.03\text{mm} \leq w < 0.05\text{mm}$	$L \leq 5.0\text{mm}$	2
		$0.05\text{mm} < w < 0.1\text{mm}$	$L < 3.0\text{mm}$	1
		$w > 0.1\text{mm}$	Any	0
<p>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.</p>				
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
<p>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</p>				
Minor	Frame Deformation	Exceed the dimension of drawing		
Minor	Metal Frame Oxidation	Any rust		

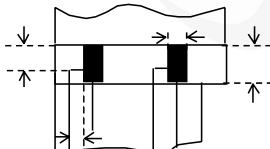
**d) Flexible Film Connector (FFC)**

Defect	Inspection Item		Inspection Standards	
Minor	Tilted soldering		Within the angle $\pm 3^\circ$	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	Position shift 		$Y > 1/3D$	Reject
			$X > 1/2Z$	Reject

**e) 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

**f) Heat seal , TCP , FPC**

Defect	Inspection Item		Inspection Standards	
Major	Scratch expose conductive layer			Reject
Minor	HS Hole	$\Phi = \frac{L + W}{2}$	$\Phi > 0.2\text{mm}$	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

**g) 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 $\geq 10\text{mm}$ 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

**h) Electric Inspection**

Defect	Inspection Item	Inspection Standards	
Major	Short		Reject
Major	Open		Reject

**i) Inspection Specification of LCD**

Defect	Inspect Item	Inspection Standards					
		W	W<0.03	0.03<W<0.05	W>0.05		
Minor	Linear Defect	* Glass Scratch	L	L<5	L<3	Any	
		* Polarizer Scratch	ACC. NO.	1	1	Reject	
		* Fiber and Linear material	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	Φ	Φ≤0.1	0.1<Φ≤0.15	0.15<Φ≤0.2	Φ>0.2
		* Polarizer hole or protuberance by external force	ACC. NO.	3EA/1PC	2	1	0
			Note	Φ 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	Φ	Φ≤0.1	0.1<Φ≤0.15	0.15<Φ≤0.2	Φ>0.2
		* Air protuberance between polarizer and glass	ACC. NO.	3EA / 1PC	2	1	0
			Note	Φ is the average diameter of the defect. Distance between two defects > 10mm.			
Minor	Segment Defect		Φ	Φ≤0.10	0.10<Φ≤0.20	Φ>0.2	
			ACC. NO.	3EA / 1PC	2	0	
					W is more than 1/2 segment width	Reject	
			Note	$\Phi = \frac{L + W}{2}$ Distance between two defect is 10mm			
Minor	Protuberant Segment	<p style="text-align: center;"><math>\Phi = (L + W) / 2</math></p>	Φ	Φ≤0.10	0.10<Φ≤0.20	Φ>0.2	
			W	Glue	W≤1/2 Seg , W≤0.2	Ignore	
			ACC. NO.	3EA / 1PC	2	0	
Minor	Assembly Misalignment		1. Segment				
			B	B≤0.4mm	0.4<B≤1.0mm	B>1.0mm	
			B-A	B-A<1/2B	B-A<0.2	B-A<0.25	
			Judge	Acceptable	Acceptable	Acceptable	
		2. Dot Matrix					
		Deformation>0.35mm			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"
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## 9. Reliability:

NO.	Item	Condition	Criterion
1	High Temperature Operating	70°C, 96Hrs	No defect in cosmetic and operational function allowable.
2	Low Temperature Operating	-20°C, 96Hrs	
3	High Humidity	40°C, 90%RH, 96Hrs	
4	High Temperature Storage	80°C, 96Hrs	
5	Low Temperature Storage	-30°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	-10°C to 25°C to 60°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 xinnuoya standard products.  
2) For restrict products, the test conditions listed as above must be revised.

## **10. 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
- Trichlorotrifluoroethane

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.



### Handling Precaution (Continued):

- 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 darkcolor 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 60°C, 90%RH or less is required.

#### (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 contact with your hands, please wash it off well with soap and water.

11. Outline Dimensions:

