



晶采光電科技股份有限公司  
**AMPIRE CO., LTD.**

## **SPECIFICATIONS FOR LCD MODULE**

|                          |                               |
|--------------------------|-------------------------------|
| <b>CUSTOMER</b>          |                               |
| <b>CUSTOMER PART NO.</b> |                               |
| <b>AMPIRE PART NO.</b>   | <b>AO-12864TFIQW-00H-A(R)</b> |
| <b>APPROVED BY</b>       |                               |
| <b>DATE</b>              |                               |

☐ **Approved For Specifications**

☐ **Approved For Specifications & Sample**

**AMPIRE CO., LTD.**

**TOWER A, 4F, No.114, Sec. 1, HSIN-TAI 5th RD., HIS-CHIH,  
TAIPEI HSIEN, TAIWAN(R.O.C.)**

**台北縣汐止鎮新台五路一段114號4樓(東方科學園區A棟)**

**TEL:886-2-26967269, FAX:886-2-26967196 or 886-2-26967270**

|                    |                   |                     |
|--------------------|-------------------|---------------------|
| <b>APPROVED BY</b> | <b>CHECKED BY</b> | <b>ORGANIZED BY</b> |
|                    |                   |                     |

## RECORD OF REVISION

| Revision Date | Page | Contents    | Editor |
|---------------|------|-------------|--------|
| 2007/5/3      | --   | New Release | Tony   |

## 1 FEATURES

- (1) Display format : 128×64 dots, 1/64 duty, 1/9 bias.
- (2) Construction : LCD panel , COG and FPC, White LED Back-light.
- (3) Display type : FSTN, Transflective, 6 o'clock view
- (4) Controller : ST7565
- (5) Extend temperature type.
- (6) ROHS compliant.

## 2 MECHANICAL DATA

| Parameter    | Stand Value                | Unit |
|--------------|----------------------------|------|
| Dot size     | 0.355(W) × 0.355(H)        | mm   |
| Dot pitch    | 0.38(W) × 0.38(H)          | mm   |
| Active area  | 48.615(W) × 24.295 (H)     | mm   |
| Viewing area | 52.6 (W) × 27.5 (H)        | mm   |
| Module size  | 59.0(W) × 65.4(H) × 7.2(T) | mm   |

## 3 ABSOLUTE MAXIMUM RATINGS

| Parameter                    | Symbol  | Min   | Max     | Unit |
|------------------------------|---------|-------|---------|------|
| Logic Circuit Supply Voltage | VDD-VSS | -0.3  | +7.0    | V    |
| LCD Driving Voltage          | VLCD    | -18.0 | +0.3    | V    |
| Input Voltage                | Vi      | -0.3  | VDD+0.3 | V    |
| Operating Temp.              | TOP     | -20   | 70      | °C   |
| Storage Temp.                | TSTG    | -30   | 80      | °C   |

## 4 ELECTRO-OPTICAL CHARACTERISTICS

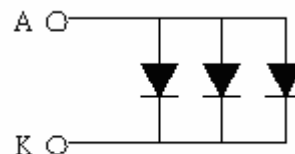
| Parameter                                        | Symbol  | Condition   | Min    | Typ  | Max     | Unit              | Note                                 |
|--------------------------------------------------|---------|-------------|--------|------|---------|-------------------|--------------------------------------|
| ----- Electronic Characteristics -----           |         |             |        |      |         |                   |                                      |
| Logic Circuit Supply Voltage                     | VDD-VSS | --          | --     | 3.3  | --      | V                 |                                      |
| LCD Driving Voltage (STN )                       | VLCD    | -20 °C      | 10.2   | 11.2 | 12.2    | V                 |                                      |
|                                                  |         | 25 °C       | 9.9    | 10.9 | 11.9    |                   |                                      |
|                                                  |         | 70 °C       | 9.6    | 10.6 | 11.6    |                   |                                      |
| Input Voltage                                    | VIH     | --          | 0.8VDD | --   | VDD     | V                 |                                      |
|                                                  | VIL     | --          | -0     | --   | 0.2 VDD | V                 |                                      |
| Logic Supply Current                             | IDD     | VDD=3.3V    | --     | 0.3  | 0.5     | mA                |                                      |
| ----- Optical Characteristics ( FSTN ) -----     |         |             |        |      |         |                   |                                      |
| Contrast                                         | CR      | --          | 2      | 5    |         |                   | Note 1                               |
| Rise Time                                        | tr      | 25°C        | --     | 305  | 450     | ms                | Note 2                               |
| Fall Time                                        | tf      | 25°C        | --     | 120  | 180     | ms                |                                      |
| Viewing Angle Range                              | θ f     | 25°C & CR≥2 | --     | 40   | --      | Deg.              | Note 3                               |
|                                                  | θ b     |             | --     | 35   | --      |                   |                                      |
|                                                  | θ l     |             | --     | 35   | --      |                   |                                      |
|                                                  | θ r     |             | --     | 35   | --      |                   |                                      |
| Frame Frequency                                  | fF      | 25°C        | --     | 64   | --      | Hz                |                                      |
| ----- White LED Back-light Characteristics ----- |         |             |        |      |         |                   |                                      |
| Parameter                                        | Symbol  | Condition   | Min    | Typ  | Max     | Unit              | Note                                 |
| Forward Voltage                                  | VF      | IF=45mA     | --     | 3.2  | 3.5     | V                 | Supply Voltage between A&K<br>Note 5 |
| Forward Current                                  | IF      | --          | --     | 45   | 60      | mA                | Note 4                               |
| LCM Luminous intensity                           |         | IF=45mA     | --     | 18   | --      | cd/m <sup>2</sup> | Note 4                               |
| LED C.I.E                                        | X       | IF=45mA     | 0.26   | 0.30 | 0.34    |                   | Note 6                               |
|                                                  | Y       | IF=45mA     | 0.27   | 0.31 | 0.35    |                   |                                      |

(NOTE 4) Luminous intensity is decided from forward current of the White LED.

(NOTE 5) The Luminous Intensity depends on IF

(NOTE 6) White LEDs are with color tolerance

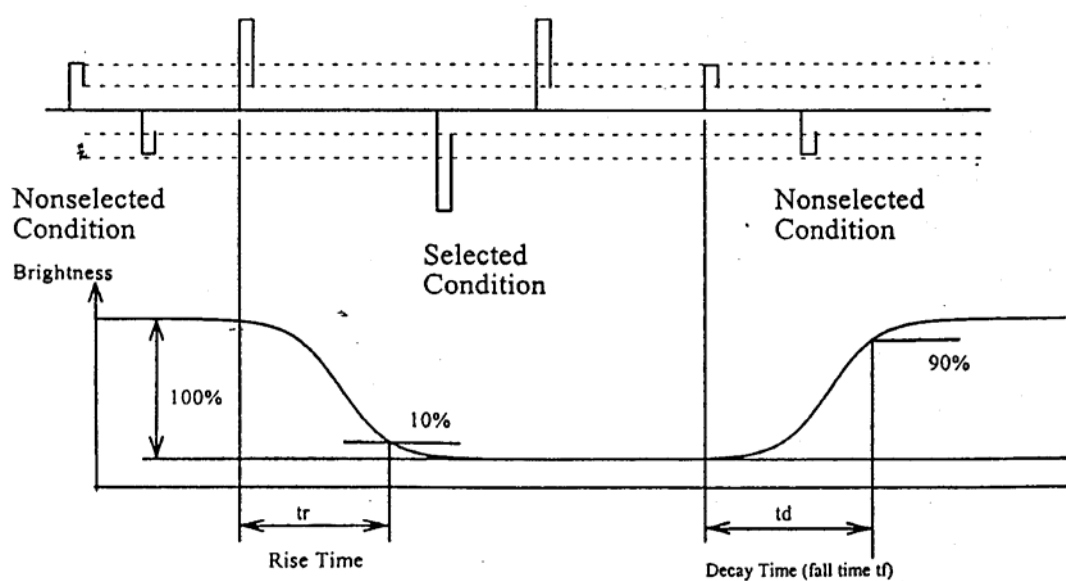
\* LED Dice number = 3



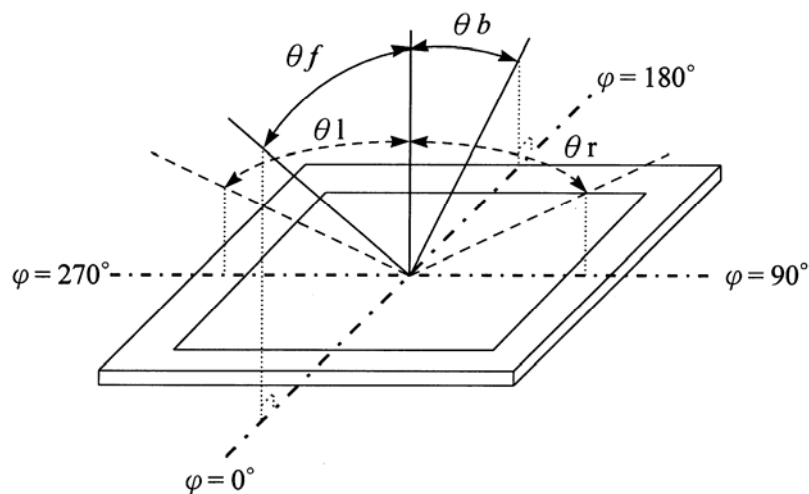
(NOTE 1) Contrast ratio :

$$CR = (\text{Brightness in OFF state}) / (\text{Brightness in ON state})$$

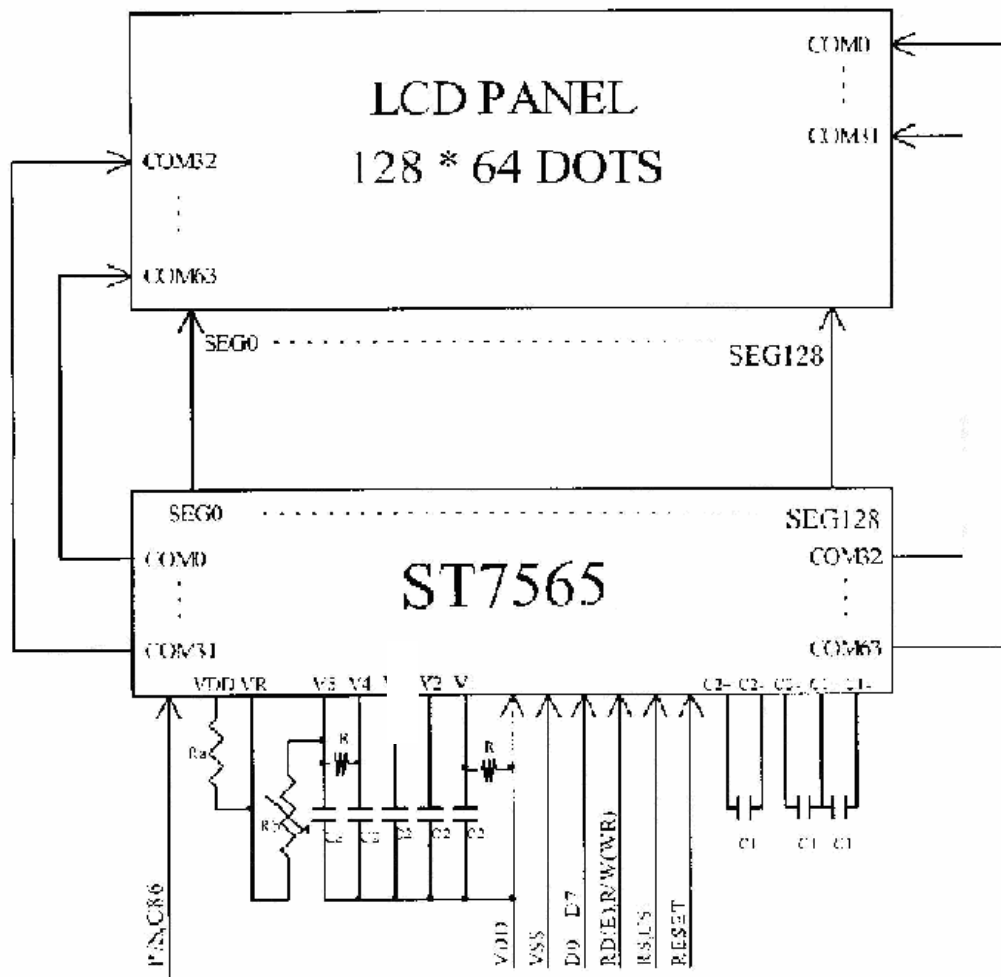
( NOTE 2 ) Response time :



(NOTE 3) Viewing angle

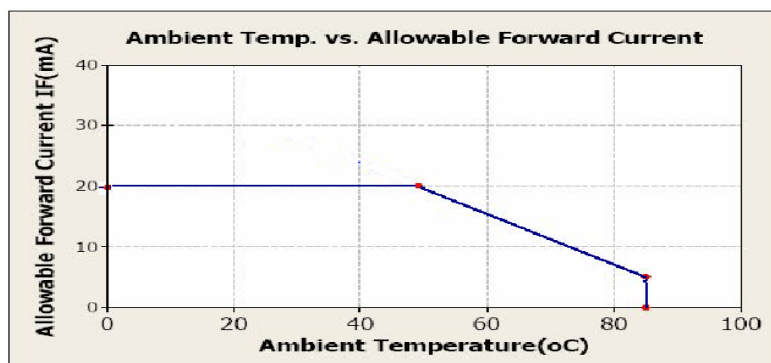


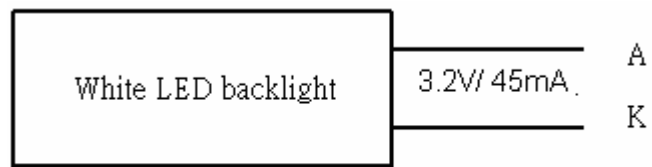
## 5 BLOCK DIAGRAM & POWER SUPPLY



R : 100KΩ~150KΩ  
 C1 : 1.0uf  
 C2 : 0.1uf~0.47uf  
 Ra , Rb : 1MΩ ~ 5MΩ

One LED





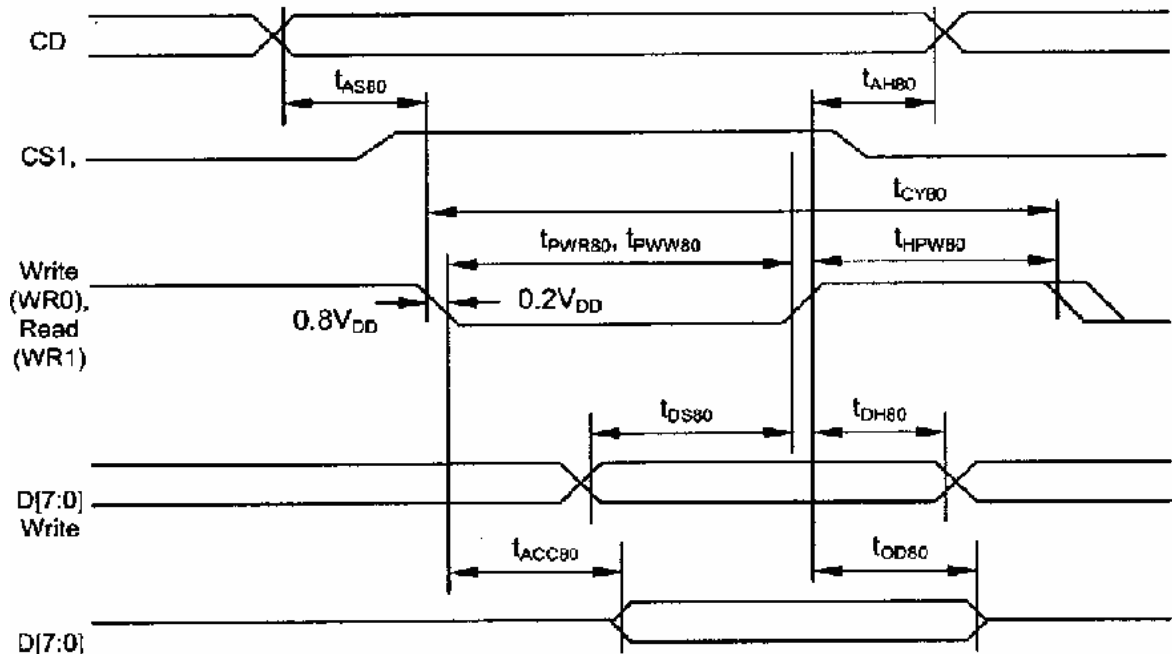
## 6 INTERFACE

| No. | Symbol  | Function                                                                                                                                               |                                                                           |
|-----|---------|--------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------|
| 1   | P/S     | Serial or interface selection terminal                                                                                                                 |                                                                           |
| 2   | C86     | MPU interface type selection terminal.                                                                                                                 |                                                                           |
| 3   | VDD     | Power supply for logic (VDD=+3v)                                                                                                                       |                                                                           |
| 4   | VR      | Voltage adjust terminal.                                                                                                                               |                                                                           |
| 5   | V5      | LCD driver supply voltage<br>VDD (=V0) ≥ V1 ≥ V2 ≥ V3 ≥ V4 ≥ V5                                                                                        |                                                                           |
| 6   | V4      |                                                                                                                                                        |                                                                           |
| 7   | V3      |                                                                                                                                                        |                                                                           |
| 8   | V2      |                                                                                                                                                        |                                                                           |
| 9   | V1      |                                                                                                                                                        |                                                                           |
| 10  | C2+     | Used to voltage booster according to the boosting ratio.                                                                                               |                                                                           |
| 11  | C2-     |                                                                                                                                                        |                                                                           |
| 12  | C1-     |                                                                                                                                                        |                                                                           |
| 13  | C1+     |                                                                                                                                                        |                                                                           |
| 14  | C3-     |                                                                                                                                                        |                                                                           |
| 15  | VOUT    | Voltage converter output                                                                                                                               |                                                                           |
| 16  | VSS     | Ground (0V)                                                                                                                                            |                                                                           |
| 17  | VDD     | Power supply for logic (VDD=+3v)                                                                                                                       |                                                                           |
| 18  | D7      | 8-bit data bus                                                                                                                                         | Serial input data (SDA)                                                   |
| 19  | D6      |                                                                                                                                                        | Serial input clock (SCK)                                                  |
| 20  | D5      |                                                                                                                                                        | When the serial interface selected (P/S="L"),<br>DB0~DB5 : high impedance |
| 21  | D4      |                                                                                                                                                        |                                                                           |
| 22  | D3      |                                                                                                                                                        |                                                                           |
| 23  | D2      |                                                                                                                                                        |                                                                           |
| 24  | D1      |                                                                                                                                                        |                                                                           |
| 25  | D0      |                                                                                                                                                        |                                                                           |
| 26  | RD(E)   | 68 Type : Enable signal of 68 type MPU input terminal.<br>80 Type : D0 to D7 terminals are output                                                      |                                                                           |
| 27  | WR(R/W) | 68 Type : read/write control signal of 68 type MPU input terminal.<br>80 Type : Data on the data bus input synchronizing the rise edge of this signal. |                                                                           |
| 28  | A0      | Connector to the address bus of MPU.                                                                                                                   |                                                                           |
| 29  | RES     | Reset terminal.                                                                                                                                        |                                                                           |
| 30  | CS1     | Chip select terminal.                                                                                                                                  |                                                                           |



## .7 TIMING CHARACTERISTICS

### 8080-SYSTEM



| Parameter                         | Symbol | Min. | Typ. | Max. | Unit |
|-----------------------------------|--------|------|------|------|------|
| <b>8080 Series(VDD=2.7~ 4.5V)</b> |        |      |      |      |      |
| Address Hold Time(A0)             | tAH8   | 0    |      | -    | ns   |
| Address Setup Time(A0)            | tAW8   | 0    |      | -    | ns   |
| System Cycle Time((A0)            | Tcyc8  | 300  |      |      | ns   |
| Control L Pulse Width(/WR)        | tCCLW  | 60   |      |      | ns   |
| Control L Pulse Width(/RD)        | tCCLR  | 120  |      |      | ns   |
| Control H Pulse Width(/WR)        | tCCHW  | 60   |      |      | ns   |
| Control H Pulse Width(/RD)        | tCCHR  | 60   |      |      | ns   |
| Data Setup Time(D0~7)             | tDS8   | 40   |      |      | ns   |
| Address Hold Time                 | tDH8   | 15   |      |      | ns   |
| /RD access time                   | tACC8  | -    |      | 140  | ns   |
| Output Disable Time               | tOH8   | 10   |      | 100  | ns   |

## **8. QUALITY AND RELIABILITY**

### **8.1 TEST CONDITIONS**

Tests should be conducted under the following conditions :

Ambient temperature :  $25 \pm 5^{\circ}\text{C}$

Humidity :  $60 \pm 25\% \text{ RH}$ .

### **8.2 SAMPLING PLAN**

Sampling method shall be in accordance with MIL-STD-105E , level II, normal single sampling plan .

### **8.3 ACCEPTABLE QUALITY LEVEL**

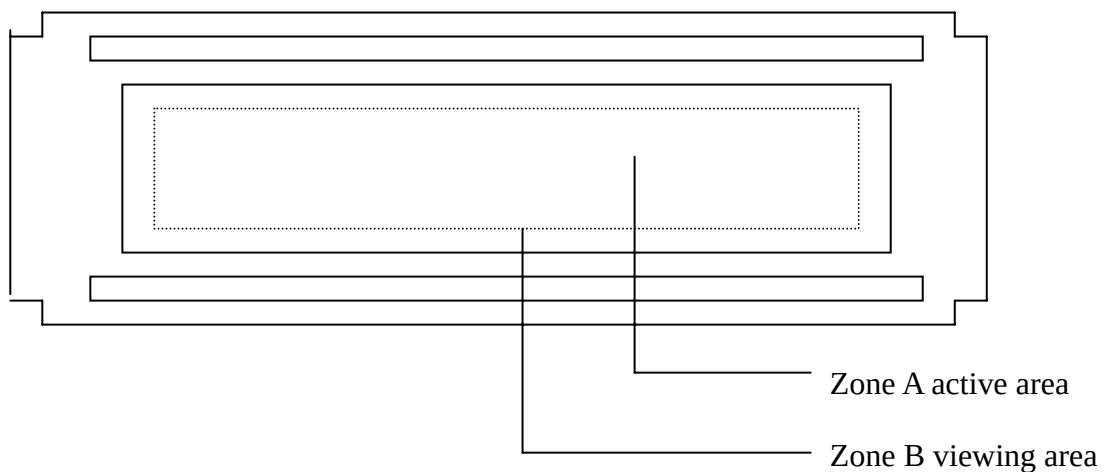
A major defect is defined as one that could cause failure to or materially reduce the usability of the unit for its intended purpose. A minor defect is one that does not materially reduce the usability of the unit for its intended purpose or is an infringement from established standards and has no significant bearing on its effective use or operation.

### **8.4 APPEARANCE**

An appearance test should be conducted by human sight at approximately 30 cm distance from the LCD module under fluorescent light. The inspection area of LCD panel shall be within the range of following limits.

## 9. INSPECTION QUALITY CRITERIA

| Item                 | Description of defects                                               |           |           | Class of Defects | Acceptable level (%) |     |
|----------------------|----------------------------------------------------------------------|-----------|-----------|------------------|----------------------|-----|
| Function             | Short circuit or Pattern cut                                         |           |           | Major            | 0.65                 |     |
| Dimension            | Deviation from drawings                                              |           |           | Major            | 1.5                  |     |
| Black spots          | Ave . dia . D                                                        | area A    | area B    | Minor            | 2.5                  |     |
|                      | D≤0.2                                                                | Disregard |           |                  |                      |     |
|                      | 0.2<D≤0.3                                                            | 3         | 4         |                  |                      |     |
|                      | 0.3<D≤0.4                                                            | 2         | 3         |                  |                      |     |
|                      | 0.4<D                                                                | 0         | 1         |                  |                      |     |
| Black lines          | Width W, Length L                                                    |           | A         | B                | Minor                | 2.5 |
|                      | W≤0.03                                                               |           | disregard |                  |                      |     |
|                      | 0.03<W≤0.05                                                          |           | 3         | 4                |                      |     |
|                      | 0.05<W≤0.07 , L≤3.0                                                  |           | 1         | 1                |                      |     |
|                      | See line criteria                                                    |           |           |                  |                      |     |
| Bubbles in polarizer | Average diameter D 0.2 < D < 0.5 mm<br>for N = 4 , D > 0.5 for N = 1 |           |           | Minor            | 2.5                  |     |
| Color uniformity     | Rainbow color or newton ring.                                        |           |           | Minor            | 2.5                  |     |
| Glass Scratches      | Obvious visible damage.                                              |           |           | Minor            | 2.5                  |     |
| Contrast ratio       | See note 1                                                           |           |           | Minor            | 2.5                  |     |
| Response time        | See note 2                                                           |           |           | Minor            | 2.5                  |     |
| Viewing angle        | See note 3                                                           |           |           | Minor            | 2.5                  |     |



## 10 RELIABILITY

| Test Item                  | Test Conditions                                                                                                             | Note |
|----------------------------|-----------------------------------------------------------------------------------------------------------------------------|------|
|                            | Extend Temp. type                                                                                                           |      |
| High Temperature Operation | 70±3°C , t=96 hrs                                                                                                           |      |
| Low Temperature Operation  | -20±3°C , t=96 hrs                                                                                                          |      |
| High Temperature Storage   | 80±3°C , t=96 hrs                                                                                                           | 1,2  |
| Low Temperature Storage    | -30±3°C , t=96 hrs                                                                                                          | 1,2  |
| Thermal Shock Test         | -30°C ~ 25°C ~ 80°C<br>30 m in. 5 min. 30 min. ( 1 cycle )<br>Total 5 cycle                                                 | 1,2  |
| Humidity Test              | 40 °C, Humidity 90%, 96 hrs                                                                                                 | 1,2  |
| Vibration Test (Packing)   | Sweep frequency : 10 ~ 55 ~ 10 Hz/1min<br>Amplitude : 0.75mm<br>Test direction : X.Y.Z/3 axis<br>Duration : 30min/each axis | 2    |

Note 1 : Condensation of water is not permitted on the module.

Note 2 : The module should be inspected after 1 hour storage in normal conditions  
(15-35°C , 45-65%RH).

Definitions of life end point :

- Current drain should be smaller than the specific value.
- Function of the module should be maintained.
- Appearance and display quality should not have degraded noticeably.
- Contrast ratio should be greater than 50% of the initial value.

## **11 HANDLING PRECAUTIONS**

- (1) A LCD module is a fragile item and should not be subjected to strong mechanical shocks.
- (2) Avoid applying pressure to the module surface. This will distort the glass and cause a change in color.
- (3) Under no circumstances should the position of the bezel tabs or their shape be modified.
- (4) Do not modify the display PCB in either shape or positioning of components.
- (5) Do not modify or move location of the zebra or heat seal connectors.
- (6) The device should only be soldered to during interfacing. Modification to other areas of the board should not be carried out.
- (7) In the event of LCD breakage and resultant leakage of fluid do not inhale, ingest or make contact with the skin. If contact is made rinse immediately.
- (8) When cleaning the module use a soft damp cloth with a mild solvent, such as Isopropyl or Ethyl alcohol. The use of water, ketone or aromatic is not permitted.
- (9) Prior to initial power up input signals should not be applied.
- (10) Protect the module against static electricity and observe appropriate anti-static precautions.

## **12 OUTLINE DIMENSION**

