# SPECIFICATION
# FOR
# LCD Module
# YXM024TS-1

| | |
|---|---|
| **MODULE:** | YXM024TS-1 |
| **CUSTOMER:** | |

| REV | DESCRIPTION | DATE |
|---|---|---|
| 1 | FIRST ISSUE | 2011.4. 6 |
| | | |

| TZD | INITIAL | DATE |
|---|---|---|
| PREPARED BY | | 2010.4.6 |
| CHECKED BY | | |
| APPROVED BY | | |

| CUSTOMER | INITIAL | DATE |
|---|---|---|
| APPROVED BY | | |

## Revision History

| Data | Rev. No. | Page | Summary |
|---|---|---|---|
| 2011.4. 6 | 1 | | FIRST ISSUE |

## Contents

# General Description

## * Description

YXM024TS-1is a color active matrix TFT (Thin Film Transistor) LCD (liquid crystal display) that uses amorphous silicon TFT as a switching device. This model is composed of a Transmissive type TFT-LCD Panel, driver circuit, back-light unit. The resolution of a 2.4" TFT-LCD contains 240 x 320 pixels, and can display up to 262K colors.

## * Features

-Low Input Voltage: VCC: 2.5~3.3V; IOVCC: 1.65~3.3V
-Display Colors of TFT LCD: 262K colors
-CPU Interface: 8080 parallel 8/9/16/18 bit
-Internal Power Supply Circuit.

| General Information Items | Specification | Unit | Note |
|---|---|---|---|
| | Main Panel | | |
| Display area(AA) | 36. 72(H) *48.96(V) (2. 4 inch ) | mm | - |
| Driver element | a-Si TFT active matrix | - | - |
| Display colors | 262K | colors | - |
| Number of pixels | 240(RGB) *320 | dots | - |
| Pixel arrangement | RGB vertical stripe | - | - |
| Pixel pitch | 0.153(H) *0.153(V) | mm | - |
| Viewing angle | 12 | o'clock | - |
| Drive IC | HX8347G | - | - |
| Display mode | Transmissive/ Normally White | - | - |
| Operating temperature | -20～+70 | ℃ | - |
| Storage temperature | -30～+80 | ℃ | - |

## * Mechanical Information

| Item | | Min. | Typ. | Max. | Unit | Note |
|---|---|---|---|---|---|---|
| Module size | Horizontal(H) | - | 42.32 | - | mm | - |
| | Vertical(V) | - | 60.92 | - | mm | - |
| | Depth(D) | - | 2.25 | | mm | - |
| Weight | | - | TBD | - | g | - |

# 1. Optical Characteristics

The test of Optical specifications shall be measured in a dark room (ambient luminance ≤ 1 lux and temperature = 25±2℃) with the equipment of Luminance meter system (Goniometer system and TOPCON BM-5) and test unit shall be located at an approximate distance 50cm from the LCD surface at a viewing angle of θ and Φ equal to 0°. We refer to θØ=0 (=θ3 ) as the 3 o'clock direction (the "right"), θØ=90 (= θ12 ) as the 12 o'clock direction ("upward"), θØ=180 (= θ9 ) as the 9 o'clock direction ("left") and θØ=270(= θ6 ) as the 6 o'clock direction ("bottom"). While scanning θand/or Ø, the center of the measuring spot on the Display surface shall stay fixed.
Optimum viewing angle direction is 6 'clock.

| Parameter | | Symbol | Condition | Min. | Typ. | Max. | Unit | Remark |
|---|---|---|---|---|---|---|---|---|
| Viewing Angle range | Horizontal | $\Theta_3$ | CR > 10 | | 45 | - | Deg. | Normal Pol Note 1 |
| | | $\Theta_9$ | | | 45 | - | Deg. | |
| | Vertical | $\Theta_{12}$ | | | 20 | - | Deg. | |
| | | $\Theta_6$ | | | 50 | - | Deg. | |
| Luminance Contrast ratio | | CR | Θ = 0° | 350 | 500 | | | Note 2 |
| Transmittance | | T(%) | Θ = 0° | | 5.1 | - | % | Base on C light Note 3 |
| White Chromaticity | | $x_w$ | Θ = 0° | | | | | Note 4 CF Glass |
| | | $y_w$ | | | | | | |
| Reproduction of color | Red | $x_R$ | Θ = 0° | 0.669 | 0.654 | 0.639 | | |
| | | $y_R$ | | 0.330 | 0.315 | 0.300 | | |
| | Green | $x_G$ | | 0.302 | 0.287 | 0.272 | | |
| | | $y_G$ | | 0.559 | 0.544 | 0.529 | | |
| | Blue | $x_B$ | | 0.153 | 0.138 | 0.123 | | |
| | | $y_B$ | | 0.136 | 0.121 | 0.106 | | |
| Threshold Voltage | | Vsat | | | 2.5 | | V | Figure 3 |
| | | Vth | | | 1.45 | | V | |
| Response Time (Rising + Falling) | | $T_{RT}$ | Ta= 25° C Θ = 0° | - | 25 | | ms | Note 5 |

Notes : 1. Viewing angle is the angle at which the contrast ratio is greater than 10. The viewing angles are determined for the horizontal or 3, 9 o'clock direction and the vertical or 6, 12 o'clock direction with respect to the optical axis which is normal to the LCD surface (see Figure 4 shown in Appendix).

2. Contrast measurements shall be made at viewing angle of Θ= 0 and at the center of the LCD surface. Luminance shall be measured with all pixels in the view field set first to white, then to the dark (black) state.
(see Figure 4) Luminance Contrast Ratio (CR) is defined mathematically.

$$CR = \frac{\text{Luminance when displaying a white raster}}{\text{Luminance when displaying a black raster}}$$

3. Transmittance is the Value with Polarizer

4. The color chromaticity coordinates specified in Table 4 shall be calculated from the spectral data measured with all pixels first in red, green, blue and white. Measurements shall be made at the center of the panel.
Measurement condition is C- light Source & Halogen Lampe

5. The electro-optical response time measurements shall be made as Figure 5 by switching the "data" input signal ON and OFF. The times needed for the transmittance to change from 10% to 90% is Tr, and 90% to 10% is Td.

Figure 3. The Definition of Vth & Vsat

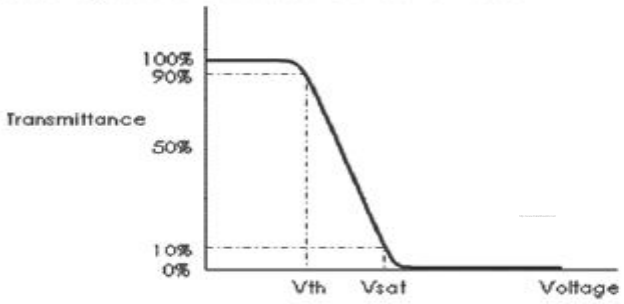



Figure 4. Measurement Set Up

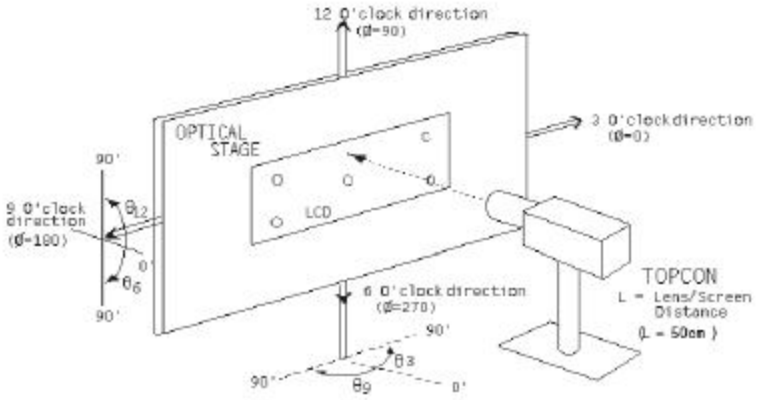
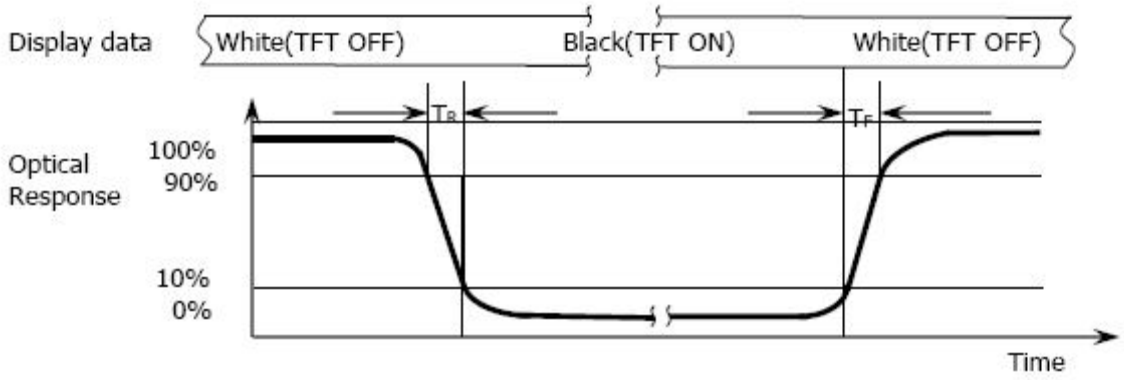


Figure 5. Response Time Testing




## 2. Electrical Characteristics

### 2.1 Absolute Maximum Rating (Ta=25 VSS=0V)

| Characteristics | Symbol | Min. | Typ. | Max. | Unit | Note |
|---|---|---|---|---|---|---|
| System voltage | VCC | -0.3 | 2.8 | +4.6 | V | - |
| Supply voltage (Digital) | IOVCC | -0.3 | - | +4.6 | V | - |
| Supply voltage (Logic) | IOVCC | -0.3 | - | +4.6 | V | - |
| Operating temperature | $T_{OP}$ | -20 | - | +70 | ℃ | 1, |
| Storage temperature | $T_{ST}$ | -30 | - | +80 | ℃ | 2 |

Note1: Background color changes slightly depending on ambient temperature. This phenomenon is reversible. Ta70℃: 75%RH max

Ta>70℃: absolute humidity must be lower than the humidity of 75%RH at 70℃

Note2: Ta at -30℃will be <48hrs, at 80℃ will be <120hrs

## 2.2 DC Electrical Characteristics

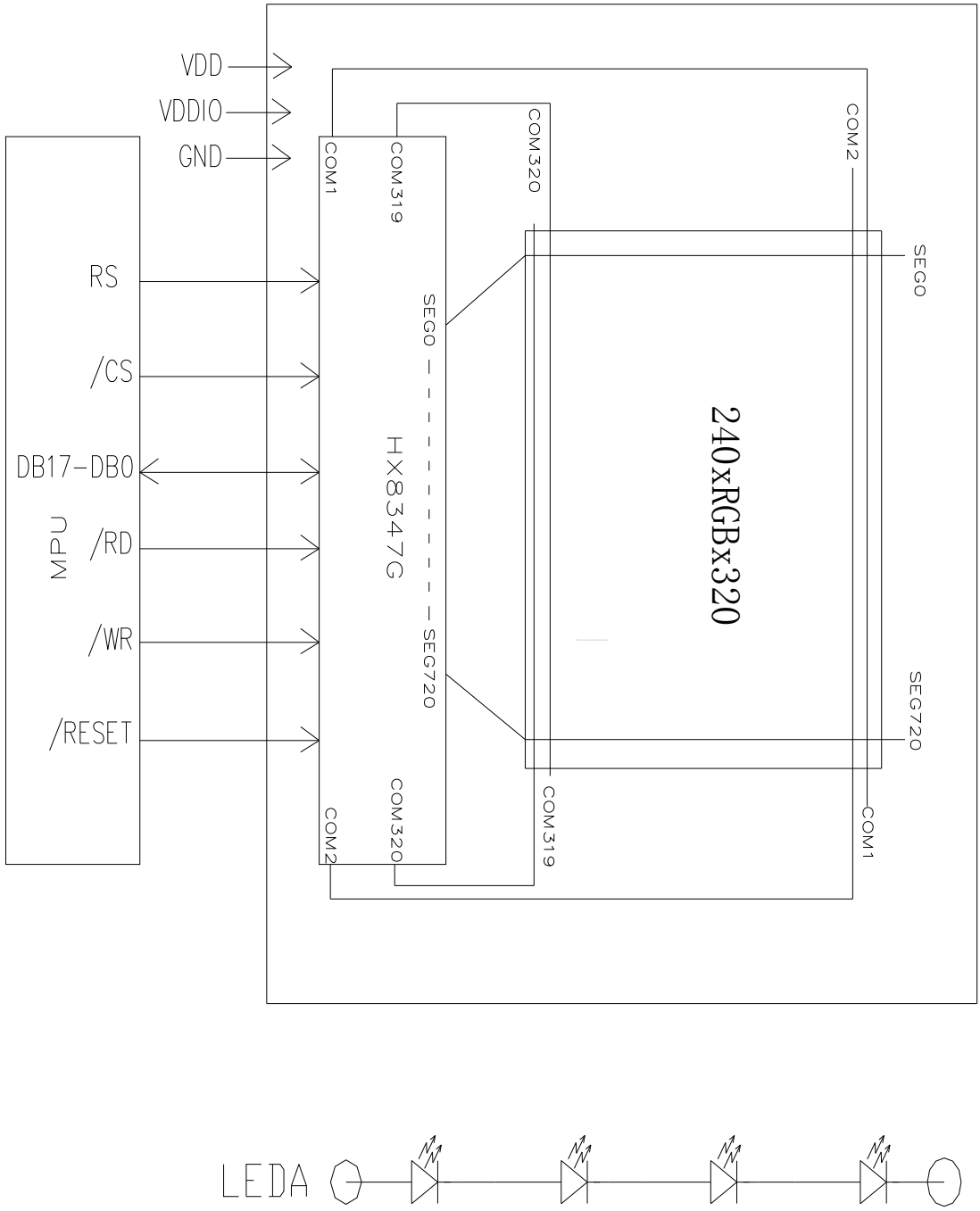
| Characteristics | Symbol | Min. | Typ. | Max. | Unit | Note |
|---|---|---|---|---|---|---|
| System voltage | VCC | 2.5 | 2.8 | 3.3 | V | - |
| Digital & Logic operation Supply voltage | IOVCC | 1.65 | 1.8 | 3.3 | V | - |
| Normal mode Current consumption | $VCC_I$ | - | 8 | - | mA | - |
| Sleep-in mode Current consumption | $VCC_I$ | - | 100 | - | uA | - |
| Level input voltage | $V_{IH}$ | 0.8 IOVCC | - | IOVCC | V | - |
| | $V_{IL}$ | GND | - | 0.2 IOVCC | V | - |
| Level output voltage | $V_{OH}$ | 0.8 IOVCC | - | IOVCC | V | - |
| | $V_{OL}$ | GND | - | 0.2 IOVCC | V | - |

## 2.3 LED Backlight Characteristics

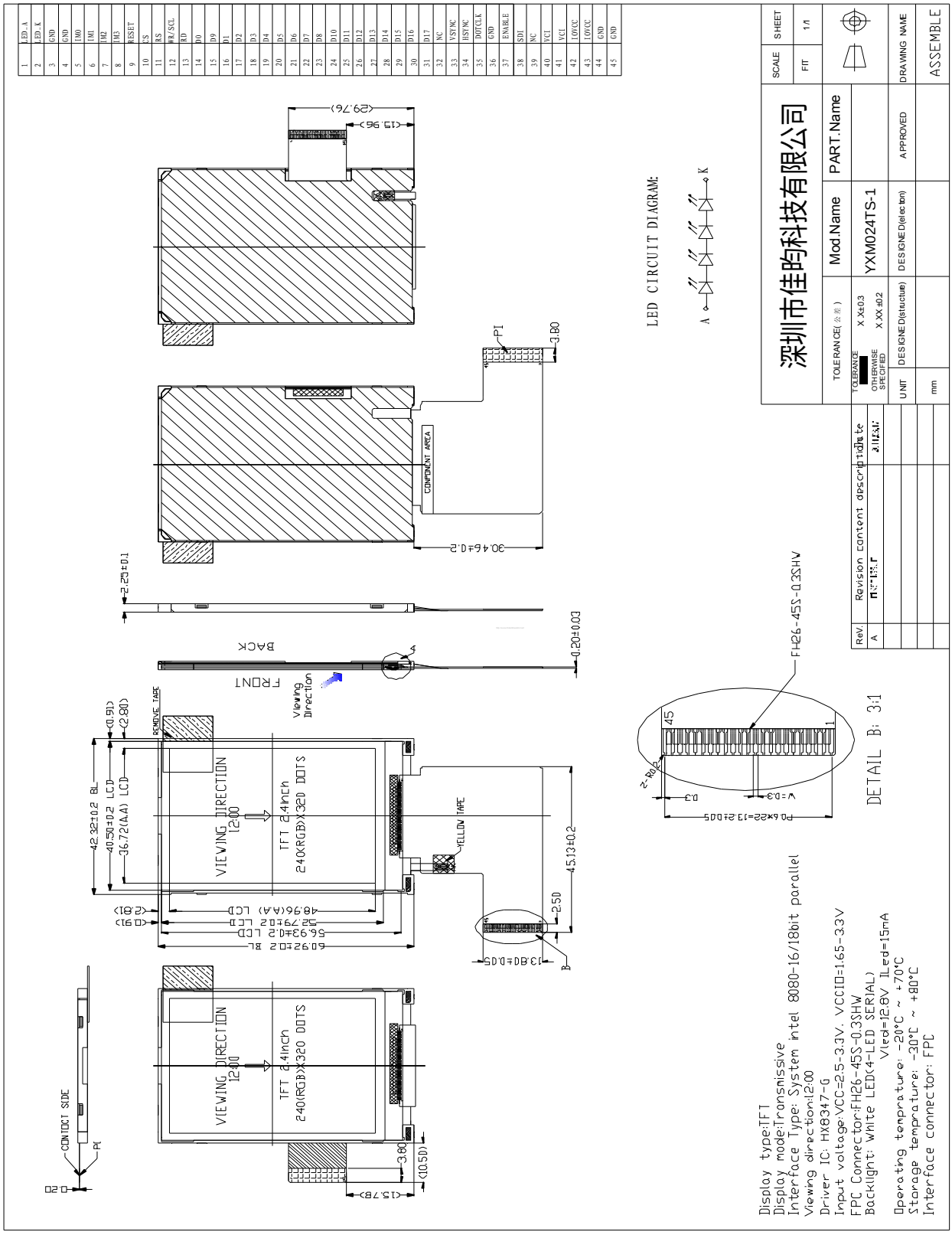
The back-light system is edge-lighting type with 4chips White Serial

| Item | Symbol | Min. | Typ. | Max. | Unit | Note |
|---|---|---|---|---|---|---|
| Forward Current | $I_F$ | - | 15 | - | mA | - |
| Forward Voltage | $V_F$ | - | 12.8 | - | V | - |
| LCM Luminance | $L_V$ | 200 | | - | cd/m2 | $I_B$=15mA |
| Uniformity | AVg | 80 | - | - | % | - |

## 3. Block Diagram



# 4. Outline dimension



## 5. Input terminal Pin Assignment

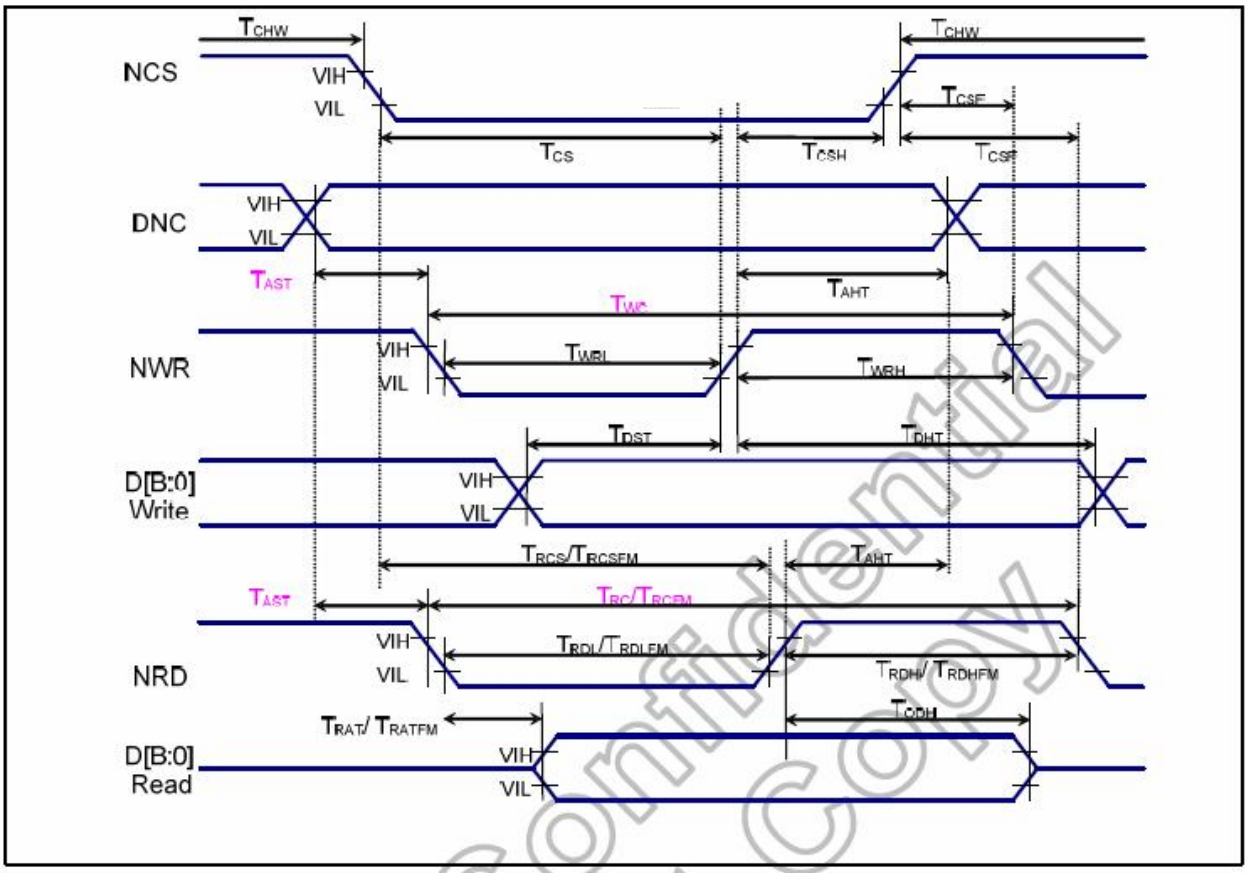
| Pin NO. | Symbol | Level | Function |
|---|---|---|---|
| 1 | LEDA | H | Backlight+ |
| 2 | LEDK | L | Backlight- |
| 3 | GND | L | Ground |
| | GND | L | Ground |
| 4 | IM0 | H/L | System interface select |
| 6 | IM1 | H/L | System interface select. |
| 7 | IM2 | H/L | System interface select. |
| 8 | IM3 | H/L | System interface select. |
| 9 | RESET | H/L | Hardware reset pin |
| 10 | CS | H/L | Chip select input pin |
| 11 | RS | H/L | A register select signal |
| 12 | WR | H/L | Write enable clock input pin |
| 13 | RD | H/L | Read enable clock input pin |
| 14 | DB0 | H/L | DATA BUS DB0 |
| 15 | DB9 | H/L | DATA BUS DB9 |
| 16-23 | DB1-DB8 | H/L | DATA BUS DB1-DB8 |
| 24-31 | DB10-DB17 | H/L | DATA BUS DB10-DB17 |
| 32 | NC | | No connection |
| 33 | VSYNC | H/L | Vertical synchronizing signal in RGB interface. |
| 34 | HSYNC | H/L | Horizontal synchronizing signal in RGB interface. |
| 35 | DOTCLK | H/L | Data enable signal in RGB interface. |
| 36 | GND | L | Ground |
| 37 | ENABLE | H/L | A data ENABLE signal in RGB I/F mode. |
| 38 | SDI | H/L | Serial data input pin and output pin(SDA) in serial bus |
| 39 | NC | | No connection |
| 40-41 | VCI | H | Power supply(2.5-3.3V) |
| 42-43 | IOVCC | H | Power supply(1.65-3.3V) |
| 44-45 | GND | L | Ground |

| IM3 | IM2 | IM1 | IM0 | Interface mode |
|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 8080 MCU 16-bits Parallel type I |
| 0 | 0 | 0 | 1 | 8080 MCU 8-bits Parallel type I |
| 0 | 0 | 1 | 0 | 8080 MCU 16-bits Parallel type II |
| 0 | 0 | 1 | 1 | 8080 MCU 8-bits Paralle type II |
| 1 | 0 | 0 | 0 | 8080 MCU 18-bits Parallel type I |
| 1 | 0 | 0 | 1 | 8080 MCU 9-bits Parallel type I |
| 1 | 0 | 1 | 0 | 8080 MCU 18-bits Parallel type II |
| 1 | 0 | 1 | 1 | 8080 MCU 9-bits Parallel type II |

## 6. Operating Principle & Methods

Please refer to HX8347G datasheet for more details.

**Timing Characteristics**



(VSSA=0V, IOVCC=1.65V to 3.3V, VCI=2.3V to 3.3V, $T_A$ = -30 to 70° C)

| Signal | Symbol | Parameter | Spec. Min. | Spec. Typ | Spec. Max. | Unit | Description |
|---|---|---|---|---|---|---|---|
| DNC_SCL | tAST | Address setup time | 10 | - | - | ns | - |
| | tAHT | Address hold time (Write/Read) | 10 | - | - | | |
| NCS | tCHW | Chip select "H" pulse width | 0 | - | - | ns | - |
| | tCS | Chip select setup time (Write) | 15 | - | - | | |
| | tRCS | Chip select setup time (Read ID) | 45 | - | - | | |
| | tRCSFM | Chip select setup time (Read FM) | 355 | - | - | | |
| | tCSF | Chip select wait time (Write/Read) | 10 | - | - | | |
| | tCSH | Chip select hold time | 10 | - | - | | |
| NWR_SCL | tWC | Write cycle( 1pixel for one write) | 100 | - | - | ns | - |
| | tWC | Write cycle (1 pixel for 2 or 3 write) | 50 | | | | |
| | tWRH | Control pulse "H" duration | 15 | - | - | | |
| | tWRL | Control pulse "L" duration | 15 | - | - | | |
| NRD(ID) | tRC | Read cycle (ID) | 160 | - | - | ns | When read ID data |
| | tRDH | Control pulse "H" duration (ID) | 90 | - | - | | |
| | tRDL | Control pulse "L" duration (ID) | 45 | - | - | | |
| NRD(FM) | tRCFM | Read cycle (FM) ( 1pixel for one read) | 600 | - | - | ns | When read from frame memory |
| | tRCFM | Read cycle (FM) (1 pixel for 2 or 3 read) | 400 | - | - | | |
| | tRDHFM | Control pulse "H" duration (FM) | 90 | - | - | | |
| | tRDLFM | Control pulse "L" duration (FM) | 355 | - | - | | |
| DB17 to DB0 | tDST | Data setup time | 10 | - | - | ns | For maximum CL=30pF For minimum CL=8pF |
| | tDHT | Data hold time | 10 | - | - | | |
| | tRAT | Read access time (ID) | - | - | 100 | | |
| | tRATFM | Read access time (FM) | - | - | 340 | | |
| | tODH | Output disable time | 20 | | 80 | | |

**Note:** The input signal rise time and fall time (tr, tf) is specified at 15 ns or less.
Logic high and low levels are specified as 30% and 70% of IOVCC for Input signals.

## 7. Display ON/OFF Sequence

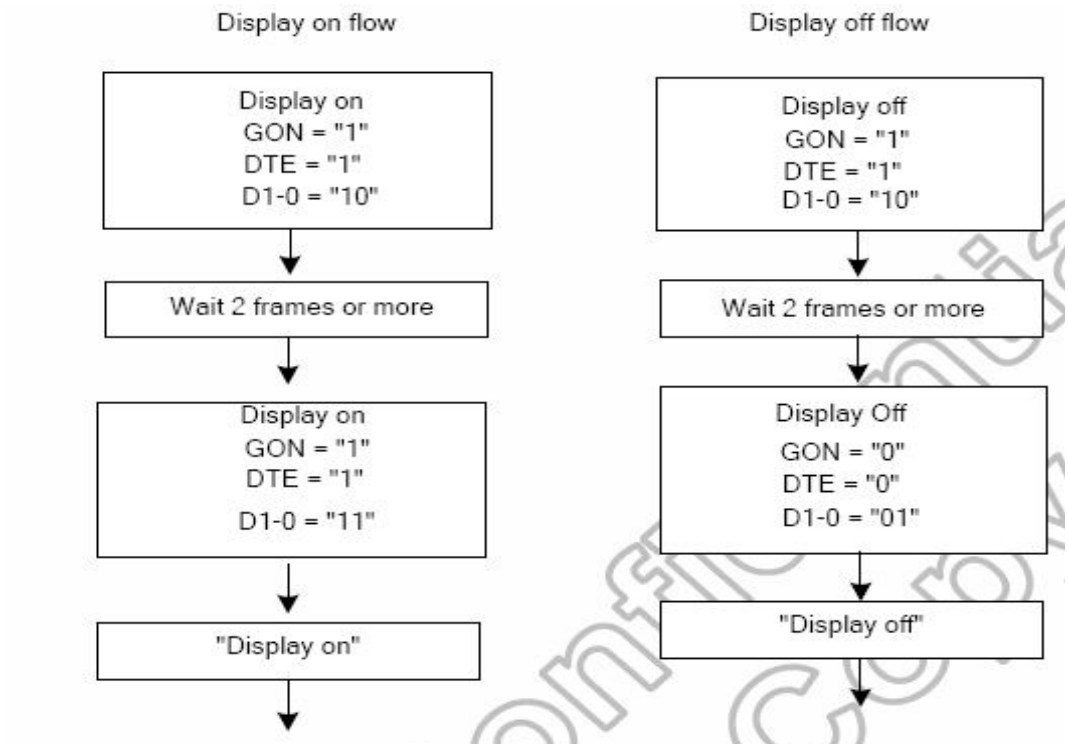



**Figure 5.37: Display on/off set flow**

# 8. Reliability Test Result

## 8.1 Condition

| Item | Condition | Sample Size | Test Result | Note |
|---|---|---|---|---|
| Low Temperature Operating Life test | -20℃, 96HR | 3ea | pass | - |
| Thermal Humidity Operating Life test | 40℃, 90%RH, 96HR | 3ea | pass | - |
| Temperature Cycle ON/OFF test | -20℃ ↔ 70℃, ON/OFF, 20CYC | 3ea | pass | (1) |
| High Temperature Storage test | 80℃, 96HR | 3ea | pass | - |
| Low Temperature Storage test | －30℃, 96HR | 3ea | pass | - |
| Thermal Shock Resistance | The sample should be allowed to stand the following 5 cycles of operation: TSTL for 30 minutes -> normal temperature for 5 minutes -> TSTH for 30 minutes -> normal temperature for 5 minutes, as one cycle, then taking it out and drying it at normal temperature, and allowing it stand for 24 hours | 3ea | pass | |
| Box Drop Test | 1 Corner 3 Edges 6 faces, 66cm(MEDIUM BOX) | 1box | pass | - |

Note (1) ON Time over 10 seconds, OFF Time under 10 seconds

# 9. Packing

TBD

# 10. Cautions and Handling Precautions

## 10.1 Handling and Operating the Module

(1) When the module is assembled, it should be attached to the system firmly. Do not warp or twist the module during assembly work.
(2) Protect the module from physical shock or any force. In addition to damage, this may cause improper operation or damage to the module and back-light unit.
(3) Note that polarizer is very fragile and could be easily damaged. Do not press or scratch the surface.
(4) Do not allow drops of water or chemicals to remain on the display surface. If you have the droplets for a long time, staining and discoloration may occur.
(5) If the surface of the polarizer is dirty, clean it using some absorbent cotton or soft cloth.
(6) The desirable cleaners are water, IPA (Isopropyl Alcohol) or Hexane. Do not use ketone type materials (ex. Acetone), Ethyl alcohol, Toluene, Ethyl acid or Methyl chloride. It might permanent damage to the polarizer due to chemical reaction.
(7) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contact with hands, legs, or clothes, it must be washed away thoroughly with soap.
(8) Protect the module from static; it may cause damage to the CMOS ICs.
(9) Use finger-stalls with soft gloves in order to keep display clean during the incoming inspection and assembly process.
(10) Do not disassemble the module.
(11) Protection film for polarizer on the module shall be slowly peeled off just before use so that the electrostatic charge can be minimized.
(12) Pins of I/F connector shall not be touched directly with bare hands.
(13) Do not connect, disconnect the module in the “Power ON” condition.
(14) Power supply should always be turned on/off by the item 6.1 Power On Sequence &6.2 Power Off Sequence

## 10.2 Storage and Transportation.

(1) Do not leave the panel in high temperature, and high humidity for a long time.
It is highly recommended to store the module with temperature from 0 to 35 ℃ and relative humidity of less than 70%
(2) Do not store the TFT-LCD module in direct sunlight.
(3) The module shall be stored in a dark place. When storing the modules for a long time, be sure to adopt effective measures for protecting the modules from strong ultraviolet radiation, sunlight, or fluorescent light.
(4) It is recommended that the modules should be stored under a condition where no condensation is allowed. Formation of dewdrops may cause an abnormal operation or a failure of the module. In particular, the greatest possible care should be taken to prevent any module from being operated where condensation

has occurred inside.

(5) This panel has its circuitry FPC on the bottom side and should be handled carefully in order not to be stressed.

# 11. LCD Module Out-Going Quality Level

## 11. LCD Module Out-Going Quality Level

(1.0) Purpose

The LCD specification provides outgoing provision and its expected quality level based on our outgoing inspection of LCD.

(2.0) Applicable Scope

The LCD specification is applicable to the arrangement in regard to outgoing Inspection and quality assurance after it.

(3.0) Quality Specification

(3.1) Quality Level

The quality level of BHL&BMDT are based on GB/T2828.1, Apply Level II, normal inspection by single sampling.

| Rank | Item | AQL | Note |
|---|---|---|---|
| Major(MA) | Segment Short | 0.65 | |
| | Segment Missing | | |
| | Solder Bridging | | |
| | Outside Dimension | | |
| | Cold Solder | | |
| Minor (MI) | Black Spots, Foreign Substance, White Spots, Pinhole, Segment Deformation Air Bubbles between Glass & Polarizer, Scratchs(Glass & Polarizer), Color Variation, Solder Ball, Misalignment | 1.0 | |

Note) AQL- Acceptable Quality Level

(3.2) Appearance Standards

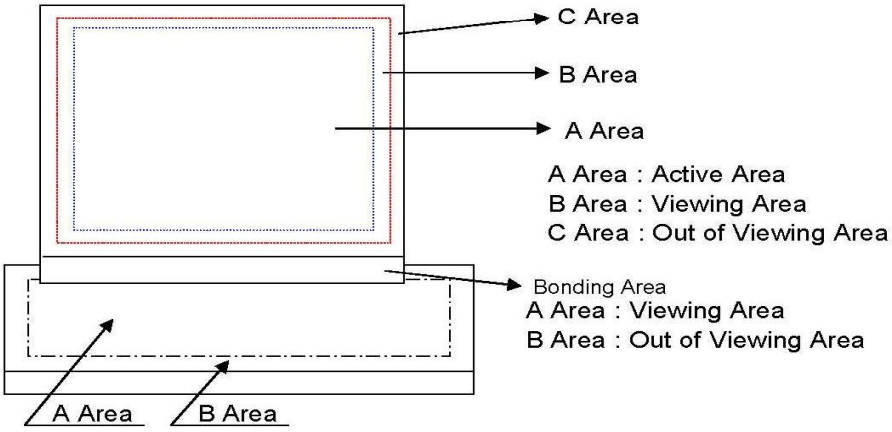
1) Inspection Conditions

The LCD shall be inspected under 20W white fluorescent lamp light.

The distance between the eyes and the sample shall be 30cm.

All directions for inspecting the sample should be within 3C° to perpendicular line.

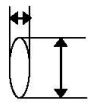
2) Definition of the Area



(3.3) Apperance Spec

Y

X

| No | Item | Criteria | Rank | Remark |
|---|---|---|---|---|
| 1 | Segment Short<br>Segment Missing | Not allowed | MA | |
| 2 | Solder Bridging | Any bridging between components,<br>except common circuit, is not allowed. | MA | |
| 3 | Outside Dimension | Drawing & specification must be within<br>permitable tolerance. | MA | |
| 4 | Cold Solder | Cold solder is not allowed. | MA | |
| 5 | Black(White)<br>Spots, Foreign<br>Substances | 1) Round Type<br>2) Liner Type<br>At (1) & (2) total defect q'ty is must not exceed 5 pieces. | MI |  <br>** : Mean Diameter (X + Y)/2 |
| 6 | OC Spot | | MI | |
| 7 | Air Bubles<br>Between Glass &<br>Polarizer<br>(Polarizer Defects) | | MI | |

1) Round Type

| Area Dimension** | Acceptable Q'ty | | Remark |
|---|---|---|---|
| | A Area | B Area | |
| ≤ 0.1 | Ignore | | |
| ≤ 0.2 | 2 | Ignore | |
| ≤ 0.3 | 1 | Ignore | |
| 0.3 < | 0 | Ignore | |

2) Liner Type

| Dimension | | Acceptable Q'ty | | Remark |
|---|---|---|---|---|
| Length | Width | A Area | B Area | |
| - | ≤ 0.025 | Ignore | | |
| ≤ 2.5 | ≤ 0.05 | 3 | Ignore | |
| ≤ 1.5 | ≤0.075 | 2 | Ignore | |
| | 0.075 < | Follow round type | | |

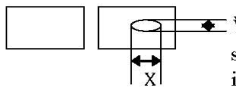
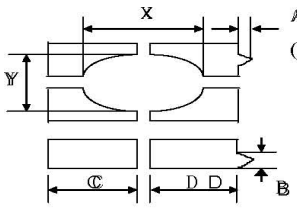
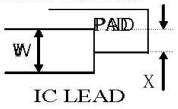
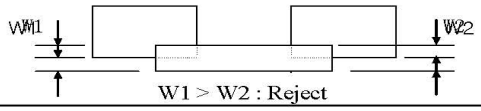
A Area B Area

At (1) & (2) total defect q'ty is must not exceed 5 pieces.

| Area Dimension** | Acceptable Q'ty | | Remark |
|---|---|---|---|
| | A Area | B Area | |
| ≤ 0.2 | Ignore | | |
| ≤ 0.8 | 3 | Ignore | |
| ≤ 1.0 | 1 | Ignore | |

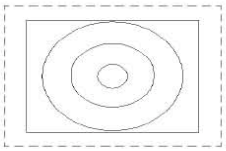
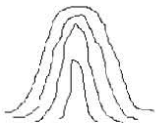
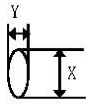
| Area Dimension** | Acceptable Q'ty | | Remark |
|---|---|---|---|
| | A Area | B Area | |
| ≤ 0.15 | Ignore | | |
| ≤ 0.3 | 3 | Ignore | |
| ≤ 0.5 | 2 | Ignore | |
| ≤ 0.7 | 1 | Ignore | |
| Total | 5 | Ignore | |

(3.3) Appearance Spec

| No | Item | Criteria | Rank | Remark |
|---|---|---|---|---|
| 8 | Pin hole<br>(On Segment) |  <br>(X+Y)/2 ≤ 0.2㎜<br>Within 1 per one segment ( Less than 0.1㎜ is not counted)<br>Total defects q'ty is must not exceed 5 pieces. | MI | |
| 9 | Segment<br>Deformation |  <br>(X+Y)/2 ≤ 0.2㎜<br>A ≤ 0.2㎜<br>B ≤ 0.2㎜<br>(C-D) ≤ 0.2㎜<br>Acceptable Q'ty<br>Dot, Segment: 1<br>LCD: 5<br>≤ 0.1: Ignore all defect<br>Each visible dot must be more than half effective dot area | MI | (X + Y)/2 ≤ 0.2㎜ |
| 10 | Color Variation | Within the three colors, except LCD Standard color is acceptable. | MI | |
| 11 | Glass & Polarizer Scratch | Follow NO.5(2) condition | MI | |
| 12 | Solder Ball | 1)Acceptable if the size of void is less than 0.18㎜<br>2)Acceptable if a solder ball is not movable<br>3)Rejectable if the solder ball exceed 5EA in 2.54 × 2.54㎜ area. | MI | |
| 13 | Miss Alignment | 1)Acceptable if it dose not exceed 50% of the lead width IC.<br>  <br>X ≤ W/2 : Accept<br>X > W/2 : Reject<br>2)Rejectable, provided that it does exceed 50% of the component termination width.<br>  <br>W1 > W2 : Reject | | |

Note : A limitation sample is given top priority

(3.3) Appearance Spec

<table>
<tr><th>No</th><th>Item</th><th>Criteria</th><th>Rank</th><th>Remark</th></tr>
<tr><td>14</td><td>Touch Panel</td><td>
1) Round Type、Foreign Substances
<table>
<tr><th rowspan="2">Area<br>Dimension**</th><th colspan="2">Acceptable Q'ty</th><th rowspan="2">Remark</th></tr>
<tr><th>A Area</th><th>B Area</th></tr>
<tr><td>≤ 0.1</td><td colspan="2">Ignore</td><td rowspan="4"></td></tr>
<tr><td>≤ 0.2</td><td>2</td><td>Ignore</td></tr>
<tr><td>≤ 0.3</td><td>1</td><td>Ignore</td></tr>
<tr><td>0.3 <</td><td>0</td><td>Ignore</td></tr>
</table>
2) Liner Type & Scratch
<table>
<tr><th colspan="2">Dimension</th><th colspan="2">Acceptable Q'ty</th><th>Remark</th></tr>
<tr><th>Length</th><th>Width</th><th>A Area</th><th>B Area</th><th></th></tr>
<tr><td>-</td><td>W≤0.025</td><td colspan="2">Ignore</td><td rowspan="4">Ignore</td></tr>
<tr><td>L≤3.0</td><td rowspan="2">W≤0.05</td><td colspan="2">Ignore</td></tr>
<tr><td>3.0<L≤5.0</td><td colspan="2">2</td></tr>
<tr><td>≤ 7</td><td>W≤0.1</td><td colspan="2">1</td></tr>
<tr><td>-</td><td>W>0.1</td><td colspan="2">Follow round type</td><td></td></tr>
</table>
4) Newton Ring<br>
a)Regular<br>
 <br>
The area of the Newton ring is more than 1/3area of the touch panel It's NG.<br>
The area of the Newton ring is less than 1/3 area of the touch panel It's OK.<br><br>
b)None-regularity<br>
 <br>
The area of the Newton ring is more than 1/2area of the touch panel It's NG.<br>
The area of the Newton ring is less than 1/2 area of the touch panel It's OK.
</td><td>MI</td><td>


** : Mean Diameter (X + Y)/2
</td></tr>
</table>

# 12. BHL&BMDT Customer Quality Service Process

## 12. BHL&BMDT Customer Quality Service Process

In order to provide better service to Customer, BHL&BMDT shall apply the after-sales product quality service process as below:

1. According to the P/O from Customer, BHL&BMDT should deliver required product to the place appointed by Customer.
2. Customer will do IQC for the incoming procuct.
3. Inspection standard should be provided by BHL&BMDT, and it will be valid after confirmed by Customer.Inspection and Defects determination should be carried out according to the standard agreed by both Parties.
4. In order to guarantee in-time communication of product quality information and effective service, QA staff on Customer side should send Weekly Quality Report to the appointed CS staff in BHL&BMDT.
5. After BHL&BMDT get related information, both sides should arrange time and place to determin the defects found by Customer.
6. BHL&BMDT should cooperate with Customer for special quality requirement.
7. After confirmed by both side, BHL&BMDT should be responsible for the defect products which caused by its quality problem. BHL&BMDT should take back the confirmed defect product and return the good product to the place required by customer.
8. BHL&BMDT agree to provide related training of LCD product technology and usage.
9. Customer should use the LCD product according to the instruction. BHL&BMDT will not be responsible for the defect product caused by violation of Users' Instruction.
10. Both parties should deal with the quality problem with friendly cooperative policy. And both parties should negotiate to deal with the defect products of which the responsibility is not very clear.

## 13. LCD Module Operation Instruction

13. **LCD Module Operation Instruction**

**BHL&BMDT**

**Part I. How to use the LCD Module**

1. Don't hit the LCD Panel in any way because the LCD is made of glass.
2. Don't clean the surface of LCD with hard things. Please clean LCD with Air-gun or very soft cloth when necessary. The protective film on the POL can be removed just before assembly, otherwise, dust, spit or other foreign matter may attached on the LCD under the protective film. After the protective film is removed, only air-gun can be used to remove any dust or foreign matter. Fingure or cloth MUST NOT be used in such cases.
3. No chemical liquid is allowed to clean the LCD, such as alcohol, acetone and IPA. All of these can damage the LCD. Water on the LCD must be cleaned as soon as possible, for it will cause POL color change or other defect.
4. Please move and assemble LCD very carefully during assembly, and don't push or twist it.
5. Don't damage the FPC of LCD module. It will cause permanent defect.
6. Don't disassemble LCD module. It will cause permanent defect.
7. Don't expose LCD module under sunshine, strong fluorescence or ultraviolet radiation.
8. Please make sure that operators wear static-protective bands effectively and working tables are effectively earthing during operation.
9. Please place LCD module on the tray provided by BHL&BMDT while moving it, in order to avoid mechanical damage. Hold the module's side frames to avoide damage during moving.
10. Don't twist, disassemble, squeeze or hit the PCB. It will damage the circuit or component on PCB and cause functional defect.
11. Please use the connector according to the instruction provided by BHL&BMDT.
12. Please place dual module with the sub-panel upward. Trays should be placed in contrary direction. An empty tray should be placed on the top.
13. Sealing operation on PCB must be very careful to avoid short or cut the original circuit on PCB. Otherwise, it will cause permenant damage to the LCD.
14. Don't add direct DC or high voltage to LCD panel. It will cause functional damage to the LCD or shorten the life of LCD product.
15. LCD may respond slowly or display abnormally in extrem temperature (lower than -20℃ or higher than 50℃). But this doesn't mean LCD functional defect. LCD will display normally in regular temperature. Therefore, don't use LCD product in extrem temperature.
16. Don't push the display area of LCD panel, it will cause abnormal display. This doesn't mean LCD functional defect, neither. LCD will display normally in regular temperature.
17. Electrical test of LCD product is made by using mobile phone provided by Customer. We can use special test equipment to do the test, also.
18. The black band on IC on LCD product is used to protect the IC from light. Please do NOT remove it.
19. Please take great care to use connector. Customer should be responsible for connector defect caused by operation on Customer side.

## Part II Storage

1. Physical status of liquid crystal will change in extrem temperature, and it can not be resumed when the temperature returns to be normal. So LCD module should be stored in required temperature.
2. LCD module should be stored in required humidity. Low hymidity may add static, while high humidity may corrode the ITO circuit of LCD product. The suitable storage environment is: temperature: 22±5℃, humidity: 55%±10%.
3. Don't expose LCD module under sunshine, strong fluorescence or ultraviolet radiation for a long time. It should be stored in dark area.
4. LCD should be stored in static-protective polythene bag. Don't expose it in the air for a long time.