



**SPECIFICATION  
FOR  
LCD MODULE**

**MODULE NO: AFK240320A1-2.4INTM**

**REVISION NO: V02**

Customer's Approval:

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|                           | SIGNATURE | DATE |
|---------------------------|-----------|------|
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| CHECKED BY                |           |      |
| APPROVED BY               |           |      |

# Records of Revision

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# 1. Introduction

## 1.1 Scope of application

This specification applies to the positive type TFT transmissive dot matrix LCD module.

LCD resolution: Dots 240xRGBx320.

As to basic specification of the driver IC, refer to the IC (ILI9341V ) specification and data sheet.

## 1.2 Structure:

Module Structure: TFT Panel+Polarizer+IC+FPC+BL;

Full 262K/65K Color 2.4 inch TFT Panel;

One bare chip with gold bump (COG) TECH;

Support 80 MCU 8/9/16/18-bit bus interface I;

White LED back light;

## 1.3 TFT features:

Transmissive Type LCD, normally black;

240 dot-source and 320 dot-gate outputs;

All viewing direction;

## 1.4 Applications:

Mobile phone

PSP

PDA

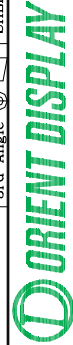
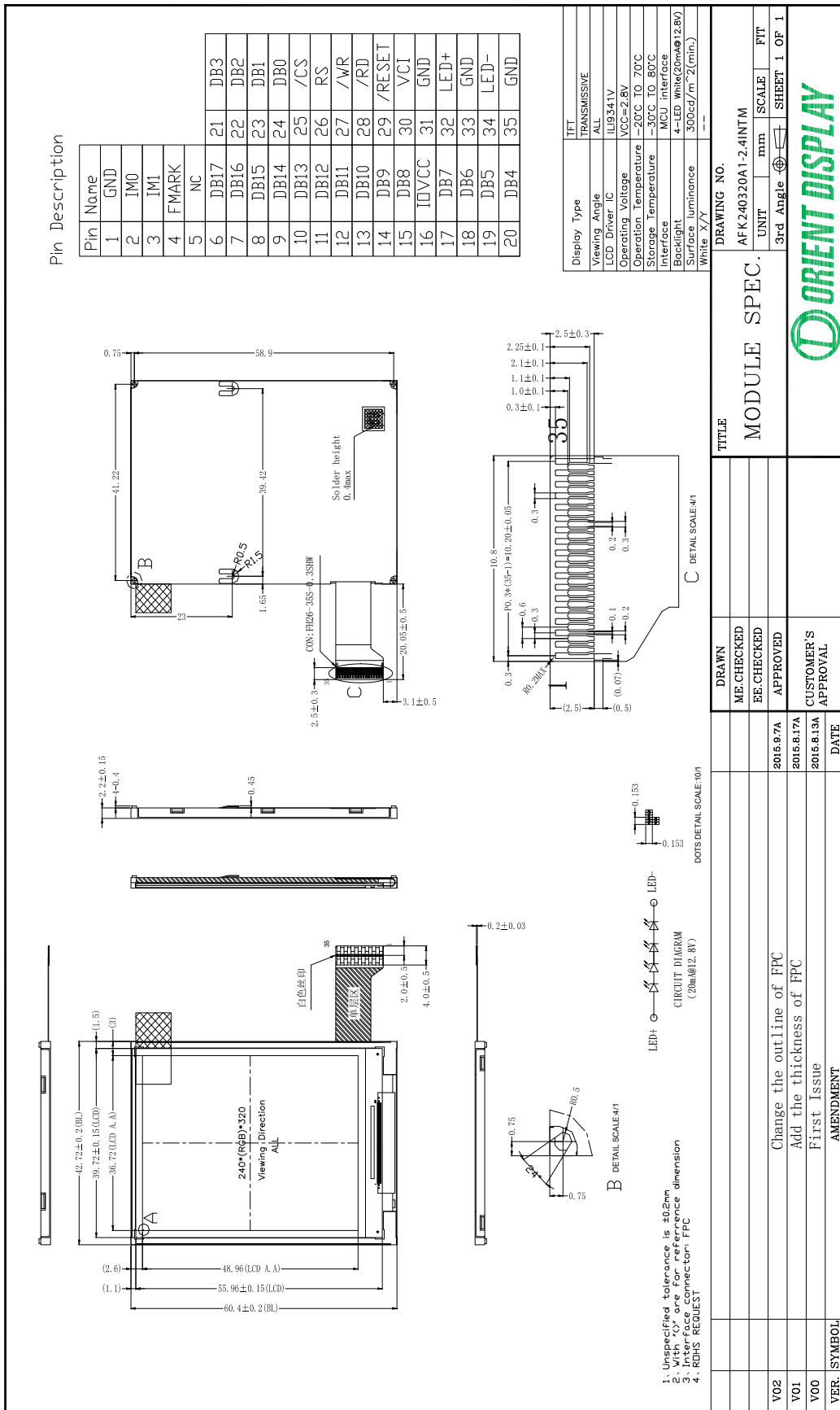
GPS

Etc...

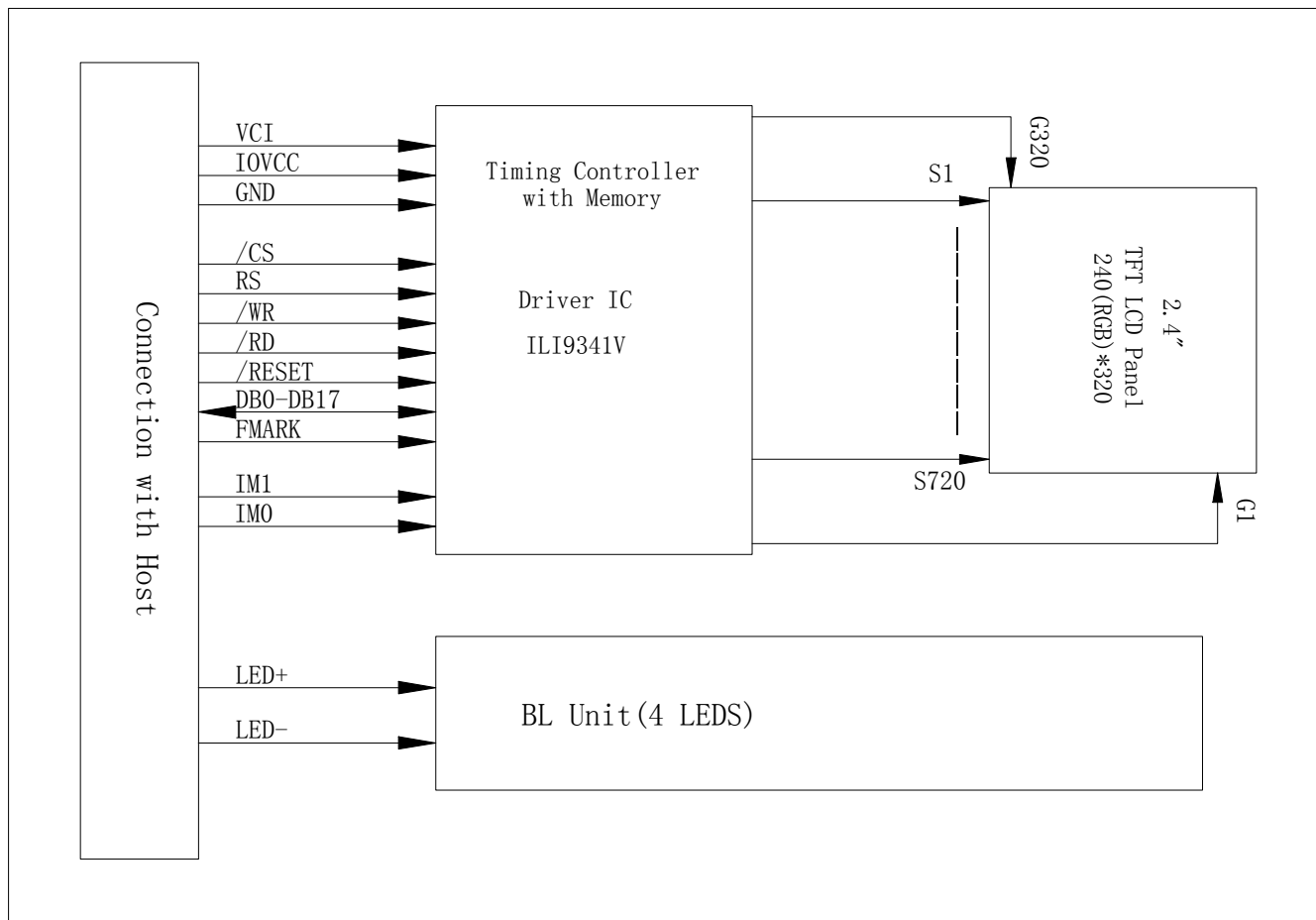
## 2. General specification

| ITEM                | Standard value               | UNIT |
|---------------------|------------------------------|------|
| Display Mode        | Transmissive, Normally black | ---  |
| Driver Method       | TFT Active matrix            |      |
| Number of Dots      | 240 (RGB)*320                | Dots |
| Pixel Arrangement   | RGB Vertical Stripe          |      |
| Active Area         | 36.72*48.96                  | mm   |
| Viewing Direction   | All                          |      |
| Driver IC           | ILI9341V                     |      |
| Module Size (W*H*T) | 42.72*60.4*2.2               | mm   |
| Approx. Weight      | TBD                          | g    |
| Back Light          | 4-Dies White LED series      |      |
| System interface    | I80 MCU 8/9/16/18-bit        |      |

### 3. Mechanical Drawing



## 4. BLOCK DIAGRAM



## 5. Interface Pin Function

| Pin No. | Symbol | Description  |
|---------|--------|--|
| 1       | GND    | Power ground   |
| 2       | IM0    | Select the MCU interface mode  |
| 3       | IM1    |  |
| 4       | FMARK  | Tearing effect output pin to synchronize MPU to frame writing, activated by S/W command. When this pin is not activated, this pin is low.<br>If not used, open this pin. |
| 5       | NC     | No connection  |
| 6       | DB17   | Data bus.  |
| 7       | DB16   |  |
| 8       | DB15   |  |
| 9       | DB14   |  |
| 10      | DB13   |  |
| 11      | DB12   |  |
| 12      | DB11   |  |
| 13      | DB10   |  |
| 14      | DB9    |  |
| 15      | DB8    |  |
| 16      | IOVCC  | Power supply for interface logic circuits (1.8V/2.8V).   |
| 17      | DB7    | Data bus.  |
| 18      | DB6    |  |
| 19      | DB5    |  |
| 20      | DB4    |  |
| 21      | DB3    |  |
| 22      | DB2    |  |
| 23      | DB1    |  |
| 24      | DB0    |  |
| 25      | /CS    | Chip selection pin<br>Low enable; High disable.  |
| 26      | RS     | This pin is used to select “Data or Command” in the parallel interface.<br>When RS= 1, data is selected.<br>When RS= 0, command is selected.                             |
| 27      | WR     | Serves as a write signal and writes data at the rising edge.   |
| 28      | RD     | Serves as a read signal and MCU read data at the rising edge.  |
| 29      | /RESET | This signal will reset the device and must be applied to properly initialize the chip.<br>Signal is active low.  |



|    |      |                          |
|----|------|--------------------------|
| 30 | VCI  | Power voltage(2.8V)      |
| 31 | GND  | Power ground             |
| 32 | LED+ | Anode of LED backlight   |
| 33 | GND  | Power ground             |
| 34 | LED- | Cathode of LED backlight |
| 35 | GND  | Power ground             |

**Note:** Select the MCU interface mode

| IM1 | IM0 | MCU-Interface Mode            | DB Pin in use |
|-----|-----|-------------------------------|---------------|
| 0   | 0   | 80 MCU 8-bit bus interface I  | DB[7:0]       |
| 0   | 1   | 80 MCU 16-bit bus interface I | DB[15:0]      |
| 1   | 0   | 80 MCU 9-bit bus interface I  | DB[8:0]       |
| 1   | 1   | 80 MCU 18-bit bus interface I | DB[17:0]      |

## 6. ABSOLUTE MAXIMUM RATINGS

| Parameter                 | Symbol           | Min  | Max     | Unit |
|---------------------------|------------------|------|---------|------|
| Supply voltage for logic  | IOVCC            | -0.3 | 4.6     | V    |
| Supply voltage for Analog | VCI              | -0.3 | 4.6     | V    |
| Input voltage             | VIN              | -0.3 | VCI+0.3 | V    |
| Supply current (One LED)  | I <sub>LED</sub> |      | 30      | mA   |
| Operating temperature     | T <sub>OP</sub>  | -20  | +70     | °C   |
| Storage temperature       | T <sub>ST</sub>  | -30  | +80     | °C   |

## 7. ELECTRICAL CHARACTERISTICS

For IC

| Item                      | Symbol           | Min    | Typ | Max    | Unit | Applicable terminal |
|---------------------------|------------------|--------|-----|--------|------|---------------------|
| Supply voltage for logic  | IOVCC            | 1.65   | 2.8 | 3.3    | V    |                     |
| Supply voltage for Analog | VCI              | 2.5    | 2.8 | 3.3    | V    |                     |
| Input voltage             | VIL              | VSS    | -   | 0.3VCI | V    |                     |
|                           | VIH              | 0.7VCI | -   | VCI    | V    |                     |
| Input leakage current     | I <sub>LKG</sub> | -0.1   |     | +0.1   | μA   |                     |

For backlight

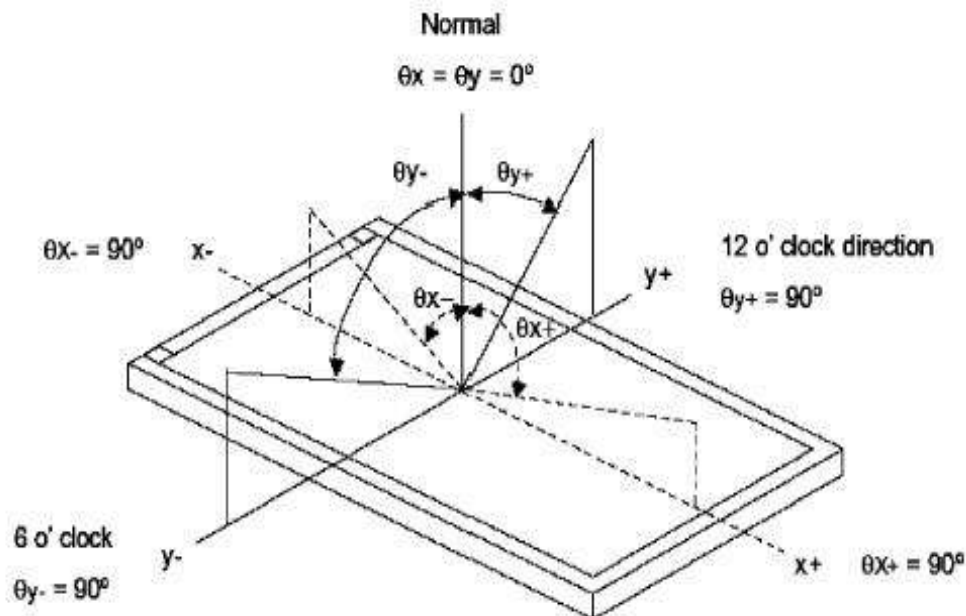
| Item              | Symbol           | Min  | Typ   | Max  | Unit  | Condition |
|-------------------|------------------|------|-------|------|-------|-----------|
| Supply Current    | I                |      | 20    |      | mA    |           |
| Forward Voltage   | V <sub>LED</sub> | 12.0 | 12.8  | 13.6 | V     | I=20mA    |
| Power Consumption | P                |      | 256   |      | mW    |           |
| Life Time         |                  |      | 50000 |      | Hours | Note      |

**Note:** Brightness to be decreased to 50% of the initial value at ambient temperature TA=25°C

## 8. OPTICAL CHARACTERISTICS

| ITEM                 | SYMBOL         | CONDITIONS           | SPECIFICATIONS |       |       | UNIT              | NOTE |  |
|----------------------|----------------|----------------------|----------------|-------|-------|-------------------|------|--|
|                      |                |                      | MIN.           | TYP.  | MAX   |                   |      |  |
| Brightness           | B              | Viewing normal angle | 300            | ---   | -     | Cd/m <sup>2</sup> |      |  |
| Contrast Ratio       | CR             |                      |                | 800   | ---   | ---               |      |  |
| Response Time        | Tr+Tf          |                      |                | 35    | 45    | ms                |      |  |
| CIE Color coordinate | Red            |                      | X <sub>R</sub> | ---   |       |                   |      |  |
|                      |                |                      | Y <sub>R</sub> |       |       |                   |      |  |
|                      | Green          |                      | X <sub>G</sub> | ---   |       |                   |      |  |
|                      |                |                      | Y <sub>G</sub> |       |       |                   |      |  |
|                      | Blue           |                      | X <sub>B</sub> | ---   |       |                   |      |  |
|                      |                |                      | Y <sub>B</sub> |       |       |                   |      |  |
| White                | X <sub>w</sub> |                      | 0.260          | 0.280 | 0.300 |                   |      |  |
|                      | Y <sub>w</sub> | 0.289                | 0.309          | 0.329 |       |                   |      |  |
| Viewing Angle        | Hor.           | $\theta_{x+}$        |                | 80    | ---   | Deg.              |      |  |
|                      |                | $\theta_{x-}$        |                | 80    | ---   |                   |      |  |
|                      | Ver.           | $\theta_{y+}$        |                | 80    | ---   |                   |      |  |
|                      |                | $\theta_{y-}$        |                | 80    |       |                   |      |  |
| Uniformity           | Un             |                      | 80             |       | %     |                   |      |  |

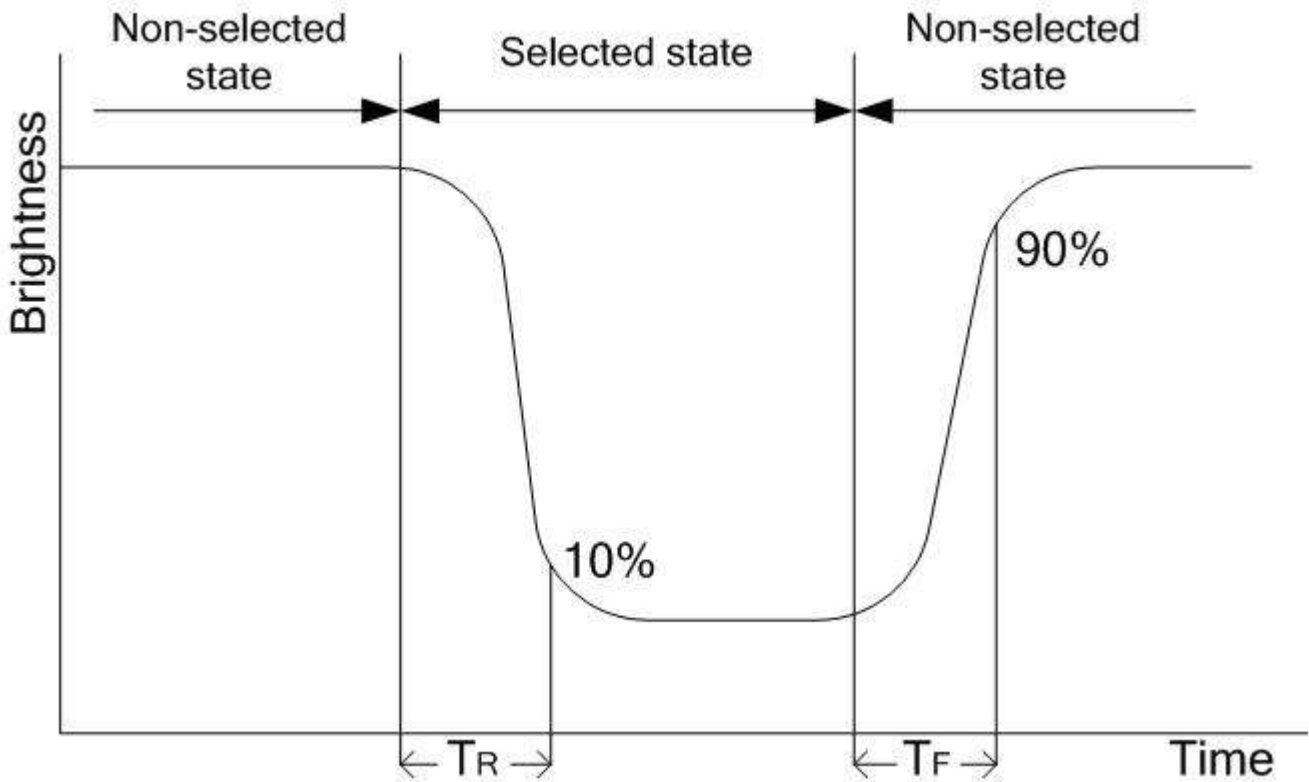
**Note 1 : Definition of Viewing Angle  $\theta_x$  and  $\theta_y$  :**



Note 2: Definition of contrast ratio CR:

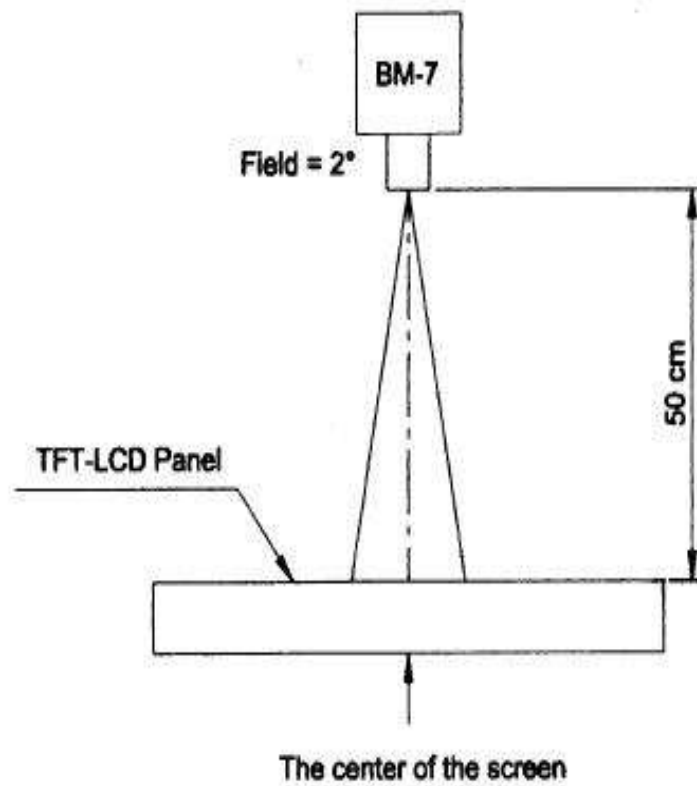
$$CR = \frac{\text{Brightness of non-selected dots (white)}}{\text{Brightness of selected dots (black)}}$$

Note 3: Definition of response time ( $T_R$ ,  $T_F$ )

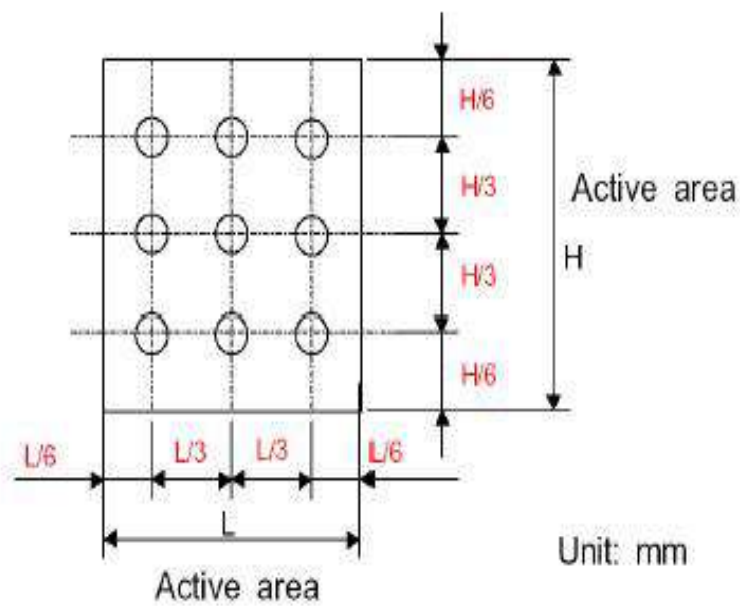


**The brightness test equipment setup**

20mA Field=2° (As measuring "black" image, field=2° is the best testing condition)

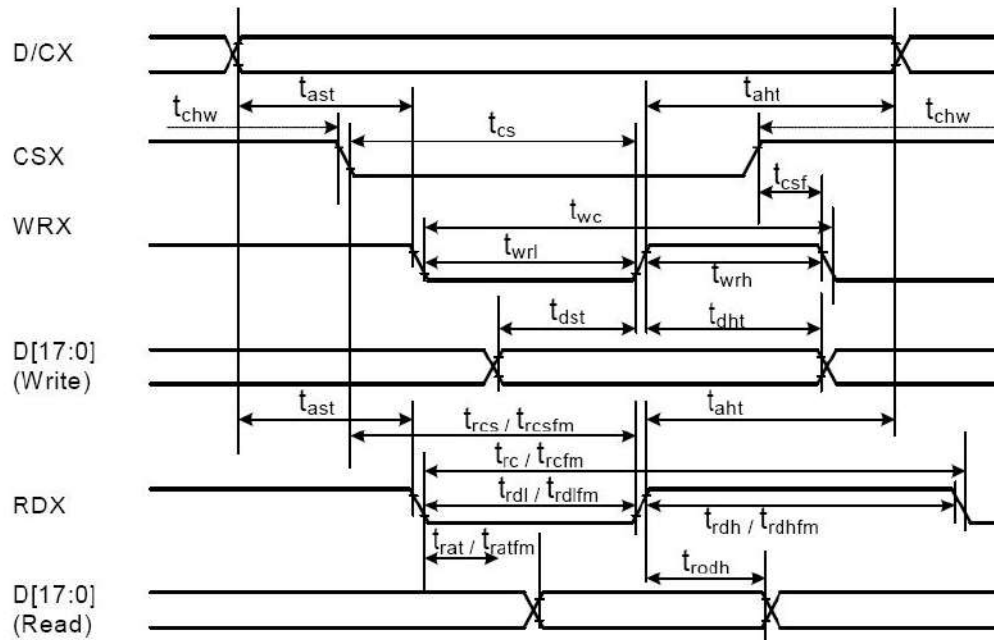


**Note 4 :**



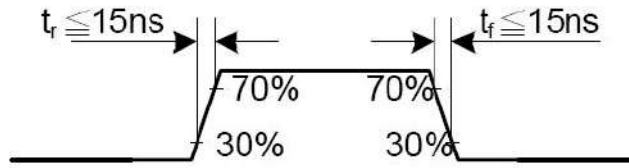
## 9. Timing characteristics

### 9.1 80 series MCU Parallel Interface Characteristics:18/16/9/8-bit Bus

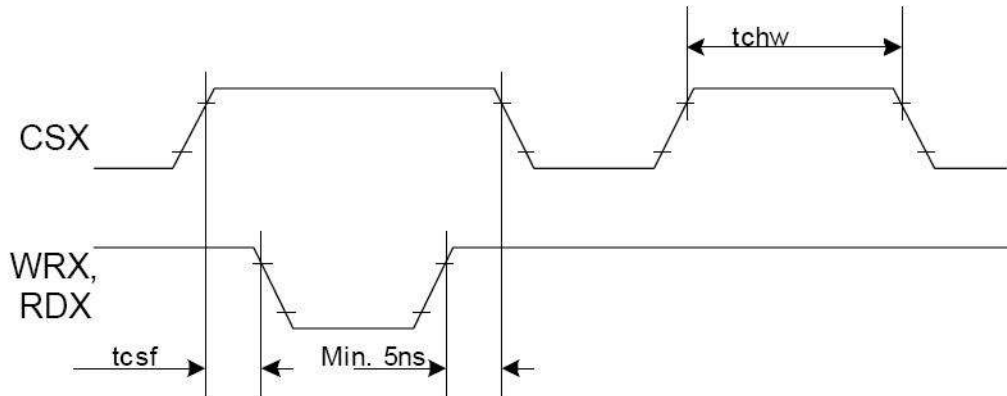


| Signal                                    | Symbol             | Parameter                          | min | max | Unit | Description                               |
|---|--------------------|------------------------------------|-----|-----|------|---|
| DCX                                       | t <sub>ast</sub>   | Address setup time                 | 0   | -   | ns   |   |
|   | t <sub>ah</sub>    | Address hold time (Write/Read)     | 0   | -   | ns   |   |
| CSX                                       | t <sub>chw</sub>   | CSX "H" pulse width                | 0   | -   | ns   |   |
|   | t <sub>cs</sub>    | Chip Select setup time (Write)     | 15  | -   | ns   |   |
|   | t <sub>rcs</sub>   | Chip Select setup time (Read ID)   | 45  | -   | ns   |   |
|   | t <sub>rcsfm</sub> | Chip Select setup time (Read FM)   | 355 | -   | ns   |   |
|   | t <sub>csf</sub>   | Chip Select Wait time (Write/Read) | 10  | -   | ns   |   |
| WRX                                       | t <sub>wc</sub>    | Write cycle                        | 66  | -   | ns   |   |
|   | t <sub>wrh</sub>   | Write Control pulse H duration     | 15  | -   | ns   |   |
|   | t <sub>wrl</sub>   | Write Control pulse L duration     | 15  | -   | ns   |   |
| RDX (FM)                                  | t <sub>rcfm</sub>  | Read Cycle (FM)                    | 450 | -   | ns   |   |
|   | t <sub>rdhfm</sub> | Read Control H duration (FM)       | 90  | -   | ns   |   |
|   | t <sub>rdlfm</sub> | Read Control L duration (FM)       | 355 | -   | ns   |   |
| RDX (ID)                                  | t <sub>rc</sub>    | Read cycle (ID)                    | 160 | -   | ns   |   |
|   | t <sub>rdh</sub>   | Read Control pulse H duration      | 90  | -   | ns   |   |
|   | t <sub>rdl</sub>   | Read Control pulse L duration      | 45  | -   | ns   |   |
| D[17:0],<br>D[15:0],<br>D[8:0],<br>D[7:0] | t <sub>dst</sub>   | Write data setup time              | 10  | -   | ns   | For maximum CL=30pF<br>For minimum CL=8pF |
|   | t <sub>dht</sub>   | Write data hold time               | 10  | -   | ns   |   |
|   | t <sub>rat</sub>   | Read access time                   | -   | 40  | ns   |   |
|   | t <sub>ratfm</sub> | Read access time                   | -   | 340 | ns   |   |
|   | t <sub>rod</sub>   | Read output disable time           | 20  | 80  | ns   |   |

Note: Ta=-30 to 70°C, IOVCC=1.65V to 3.3V, VCI=2.5V to 3.3V, VSS=0V

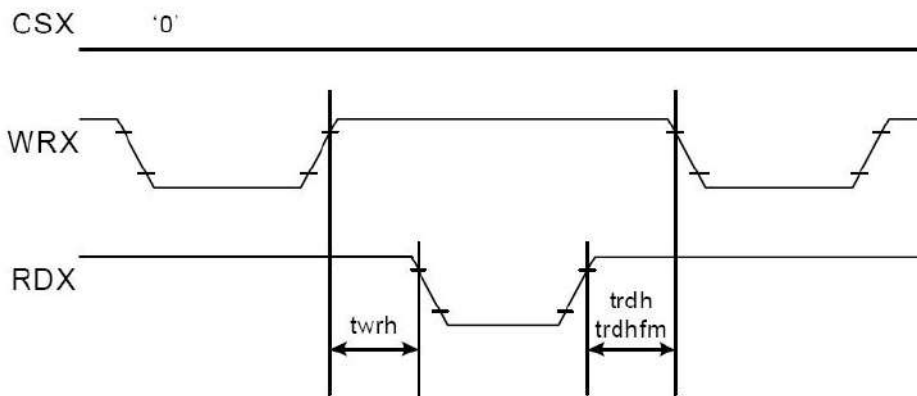


CS timings:



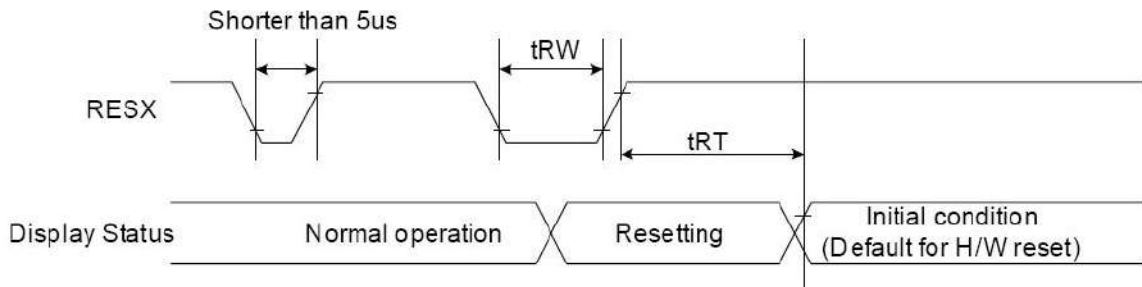
Note: Logic high and low levels are specified as 30% and 70% of IOVCC for Input signals.

Write to read or read to write timings:



Note: Logic high and low levels are specified as 30% and 70% of IOVCC for Input signals.

## 9.2 Reset Timing



| Signal | Symbol | Parameter            | Min | Max                 | Unit |
|--------|--------|----------------------|-----|---------------------|------|
| RESX   | tRW    | Reset pulse duration | 10  |                     | uS   |
|        | tRT    | Reset cancel         |     | 5<br>(note 1,5)     | mS   |
|        |        |                      |     | 120<br>(note 1,6,7) | mS   |

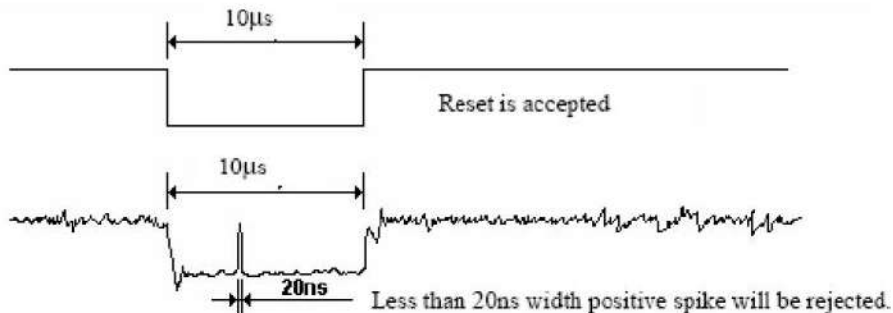
Note 1: The reset cancel includes also required time for loading ID bytes, VCOM setting and other settings from NV memory to registers. This loading is done every time when there is HW reset cancel time (tRT) within 5 ms after a rising edge of RESX.

Note 2: Spike due to an electrostatic discharge on RESX line does not cause irregular system reset according to the table below: -

| RESX Pulse           | Action         |
|----------------------|----------------|
| Shorter than 5us     | Reset Rejected |
| Longer than 10us     | Reset          |
| Between 5us and 10us | Reset starts   |

Note 3: During the Resetting period, the display will be blanked (The display is entering blanking sequence, which maximum time is 120 ms, when Reset Starts in Sleep Out –mode. The display remains the blank state in Sleep In -mode.) And then return to Default condition for Hardware Reset.

Note 4: Spike Rejection also applies during a valid reset pulse as shown below:



Note 5: When Reset applied during Sleep In Mode.

Note 6: When Reset applied during Sleep Out Mode.

Note 7: It is necessary to wait 5msec after releasing RESX before sending commands. Also Sleep Out command cannot be sent for 120msec.



# 10. Standard Specification for Reliability :

## 10-1. Standard Specifications for Reliability of LCD Module

| No | Item                        | Description   |
|----|-----------------------------|---|
| 01 | High temperature operation  | The sample should be allowed to stand at 70 °C for 240 hours under driving condition and then returning it to normal temperature condition, and allowing it stand for 2 hours.                      |
| 02 | Low temperature operation   | The sample should be allowed to stand at -20 °C for 240 hours under driving condition and then returning it to normal temperature condition, and allowing it stand for 2 hours.                     |
| 03 | High temperature storage    | The sample should be allowed to stand at 80°C for 240 hours under no-load condition, and then returning it to normal temperature condition, and allowing it stand for 2 hours.                      |
| 04 | Low temperature storage     | The sample should be allowed to stand at -30°C for 240 hours under no-load condition, then returning it to normal temperature condition, and allowing it stand for 2 hours.                         |
| 05 | Moisture storage            | The sample should be allowed to stand at 60°C,90%RH MAX for 240 hours under no-load condition, then taking it out and drying it at normal temperature for 2 hours.                                  |
| 06 | Thermal shock storage       | The sample should be allowed to stand the following 10 cycles :<br>-30°C for 30 minutes → normal temperature for 5 minutes → +80°C for 30 minutes → normal temperature for 5 minutes, as one cycle. |
| 07 | Packing vibration           | Frequency range : 10Hz ~ 55Hz<br>Amplitude of vibration : 1.5mm Sweep time: 12 min<br>X,Y,Z 2 hours for each direction.   |
| 08 | Packing drop test           | According to ISTA 1A 2001.  |
| 09 | Electrical Static Discharge | Air: ±4KV 150pF/330Ω 5 times  |
|    |                             | Contact: ±2KV 150pF/330Ω 5 time   |

\*Sample size for each test item is 3~5pcs

## 10 - 2. Testing Conditions and Inspection Criteria

For the final test the testing sample must be stored at room temperature for 24 hours, after the tests listed in Table 12.2, Standard specifications for Reliability have been executed in order to ensure stability.

| No | Item                | Test Model             | In section Criteria  |
|----|---------------------|------------------------|--|
| 01 | Current Consumption | Refer To Specification | The current consumption should conform to the product specification.   |
| 02 | Contrast            | Refer To Specification | After the tests have been executed, the contrast must be larger than half of its initial value prior to the tests. |
| 03 | Appearance          | Visual inspection      | Defect free.   |

## 10- 3. MTBF

|      |  |
|------|--|
| MTBF | Functions, performance, appearance, etc. shall be free from remarkable deterioration within 10,000 hours under ordinary operating and storage conditions room temperature ( $25 \pm 5^\circ\text{C}$ ), normal humidity ( $50 \pm 10\% \text{ RH}$ ), and in area not exposed to direct sun light. |
|------|--|

# 11. Specification of Quality Assurance:

## 11-1. Purpose

This standard for Quality Assurance should affirm the quality of LCD module products to supply to purchaser by Orient Display.

## 11-2. Standard for Quality Test

### a. Inspection:

Before delivering, the supplier should take the following tests, and affirm the quality of product.

### b. Electro-Optical Characteristics:

According to the individual specification to test the product.

### c. Test of Appearance Characteristics:

According to the individual specification to test the product.

### d. Test of Reliability Characteristics:

According to the definition of reliability on the specification for testing products.

### e. Delivery Test:

Before delivering, the supplier should take the delivery test.

(i) Test method: According to MIL-STD105E. General Inspection Level II take a single time.

(ii) The defects classify of AQL as following:

Major defect: AQL = 0.65

Minor defect: AQL = 2.5

Total defects: AQL = 2.5

## 11-3. Non- conforming Analysis & Deal With Manners

### a. Non- conforming Analysis:

(i) Purchaser should supply the detail data of non- conforming sample and the non- conforming.

(ii) After accepting the detail data from purchaser, the analysis of non- conforming should be finished in two weeks.

(iii) If supplier can not finish analysis on time, must announce purchaser before 3 days.

### b. Disposition of non- conforming:

(i) If find any product defect of supplier during assembly time, supplier must change the good product for every defect after recognition.

(ii) Both supplier and customer should analyze the reason and discuss the disposition of non- conforming when the reason of nonconforming is not sure.

## 11-4. Agreement items

Both sides should discuss together when the following problems happen.

a. There is any problem of standard of quality assurance, and both sides should think that must be modified.

b. There is any argument item which does not record in the standard of quality assurance.

c. Any other special problem.

11-5. Standard of The Product Appearance Test

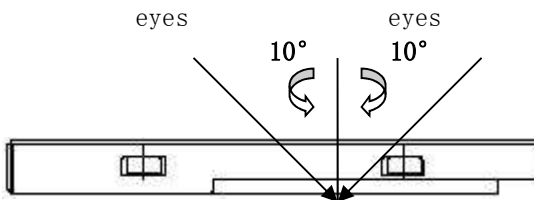
a. Manner of appearance test:

(i) The test must be under 20W × 2 or 40W fluorescent light, and the distance of view must be at  $30 \pm 5$ cm.

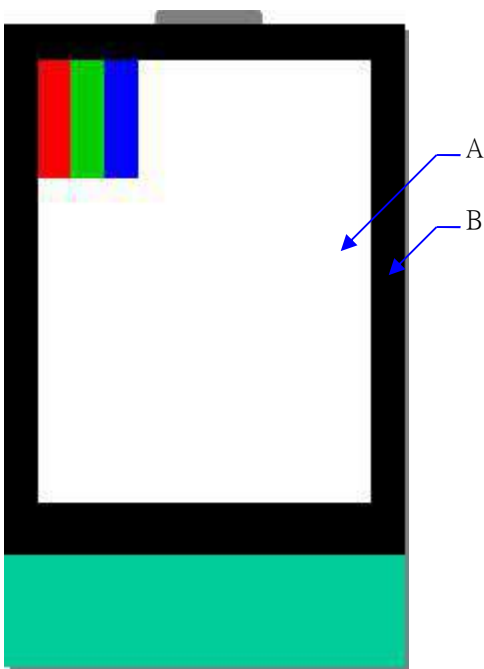
(ii) When test the model of transmissive product must add the reflective plate.

(iii) The test direction is base on around  $10^\circ$  of vertical line.

(iiii) Temperature:  $25 \pm 5^\circ\text{C}$  Humidity:  $60 \pm 10\% \text{RH}$



(iv) Definition of area:



A. Area: Viewing area.

B. Area: Out of viewing area.

(Outside viewing area)

b. Basic principle:

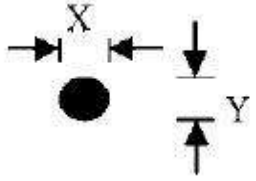
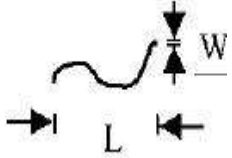
(i) It will accord to the AQL when the standard can not be described.

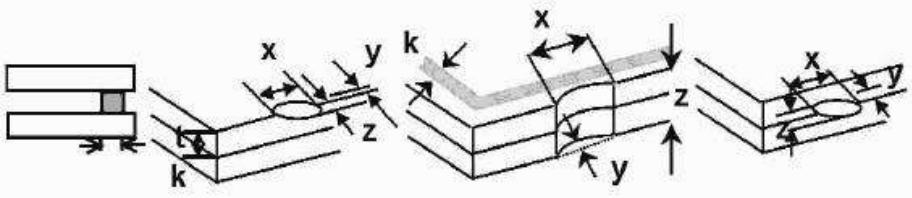
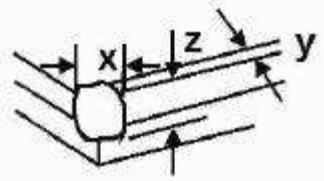
(ii) The sample of the lowest acceptable quality level must be discussed by both supplier and customer when any dispute happened.

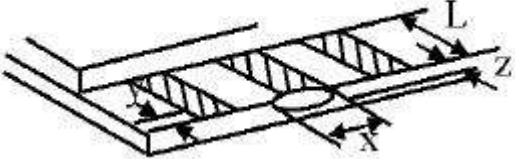
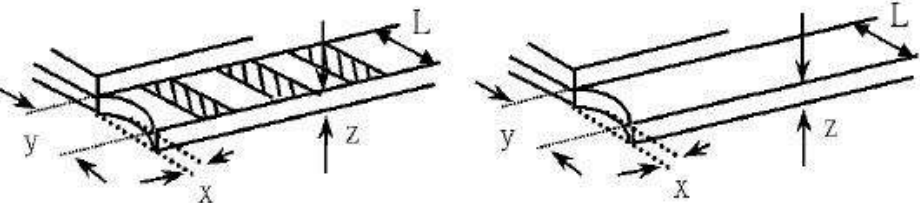
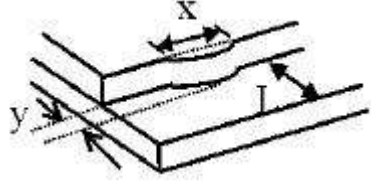
(iii) Must add new item on time when it is necessary.

c. Standard of inspection: (Unit: mm)

11-6. Inspection specification

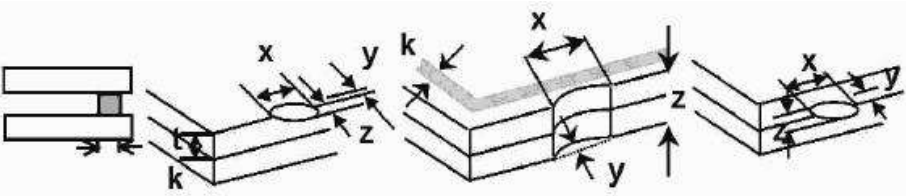
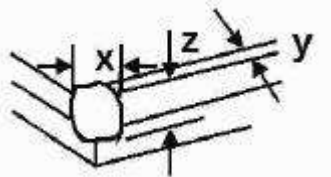
| NO                      | Item  | Criterion   | AQL      |                  |                  |                 |                         |   |                         |   |                         |   |               |   |           |           |                  |     |               |                 |              |                      |   |              |                      |     |            |           |     |
|-------------------------|---|---|----------|------------------|------------------|-----------------|-------------------------|---|-------------------------|---|-------------------------|---|---------------|---|-----------|-----------|------------------|-----|---------------|-----------------|--------------|----------------------|---|--------------|----------------------|-----|------------|-----------|-----|
| 01                      | Electrical Testing  | 1.1 Missing vertical, horizontal segment, segment contrast defect.<br>1.2 Missing character, dot or icon.<br>1.3 Display malfunction.<br>1.4 No function or no display.<br>1.5 Current consumption exceeds product specifications.<br>1.6 LCD viewing angle defect.<br>1.7 Mixed product types.<br>1.8 Flicker  | 0.65     |                  |                  |                 |                         |   |                         |   |                         |   |               |   |           |           |                  |     |               |                 |              |                      |   |              |                      |     |            |           |     |
| 02                      | Black or White spots or Bright spots or Color spots on LCD (Display only)   | 2.1 White and black or color spots on display $\leq 0.25\text{mm}$ , no more than Five spots.<br>2.2 Densely spaced: No more than three spots within 3mm.   | 2.5      |                  |                  |                 |                         |   |                         |   |                         |   |               |   |           |           |                  |     |               |                 |              |                      |   |              |                      |     |            |           |     |
| 03                      | LCD and Touch Panel black spots, white spots, contamination (non - display) | <p>3.1 Round type: As following drawing<br/> <math>\Phi = (X+Y) / 2</math></p>  <table border="1" data-bbox="833 1003 1366 1218"> <thead> <tr> <th>Size(mm)</th> <th>Acceptable Q' ty</th> </tr> </thead> <tbody> <tr> <td><math>\Phi \leq 0.10</math></td> <td>Accept no dense</td> </tr> <tr> <td><math>0.10 &lt; \Phi \leq 0.20</math></td> <td>2</td> </tr> <tr> <td><math>0.20 &lt; \Phi \leq 0.25</math></td> <td>2</td> </tr> <tr> <td><math>0.25 &lt; \Phi \leq 0.30</math></td> <td>1</td> </tr> <tr> <td><math>0.30 &lt; \Phi</math></td> <td>0</td> </tr> </tbody> </table> <p>* Densely spaced: No more than two spots within 3mm.</p> <p>3.2 Line type: (As following drawing)</p>  <table border="1" data-bbox="737 1355 1366 1570"> <thead> <tr> <th>Length(m)</th> <th>Width(mm)</th> <th>Acceptable Q' ty</th> </tr> </thead> <tbody> <tr> <td>---</td> <td><math>W \leq 0.02</math></td> <td>Accept no dense</td> </tr> <tr> <td><math>L \leq 3.0</math></td> <td><math>0.02 &lt; W \leq 0.05</math></td> <td rowspan="2">2</td> </tr> <tr> <td><math>L \leq 2.5</math></td> <td><math>0.03 &lt; W \leq 0.08</math></td> </tr> <tr> <td>---</td> <td><math>0.08 &lt; W</math></td> <td>Rejection</td> </tr> </tbody> </table> <p>* Densely spaced: No more than two lines within 3mm.</p> | Size(mm) | Acceptable Q' ty | $\Phi \leq 0.10$ | Accept no dense | $0.10 < \Phi \leq 0.20$ | 2 | $0.20 < \Phi \leq 0.25$ | 2 | $0.25 < \Phi \leq 0.30$ | 1 | $0.30 < \Phi$ | 0 | Length(m) | Width(mm) | Acceptable Q' ty | --- | $W \leq 0.02$ | Accept no dense | $L \leq 3.0$ | $0.02 < W \leq 0.05$ | 2 | $L \leq 2.5$ | $0.03 < W \leq 0.08$ | --- | $0.08 < W$ | Rejection | 2.5 |
| Size(mm)                | Acceptable Q' ty  |   |          |                  |                  |                 |                         |   |                         |   |                         |   |               |   |           |           |                  |     |               |                 |              |                      |   |              |                      |     |            |           |     |
| $\Phi \leq 0.10$        | Accept no dense   |   |          |                  |                  |                 |                         |   |                         |   |                         |   |               |   |           |           |                  |     |               |                 |              |                      |   |              |                      |     |            |           |     |
| $0.10 < \Phi \leq 0.20$ | 2   |   |          |                  |                  |                 |                         |   |                         |   |                         |   |               |   |           |           |                  |     |               |                 |              |                      |   |              |                      |     |            |           |     |
| $0.20 < \Phi \leq 0.25$ | 2   |   |          |                  |                  |                 |                         |   |                         |   |                         |   |               |   |           |           |                  |     |               |                 |              |                      |   |              |                      |     |            |           |     |
| $0.25 < \Phi \leq 0.30$ | 1   |   |          |                  |                  |                 |                         |   |                         |   |                         |   |               |   |           |           |                  |     |               |                 |              |                      |   |              |                      |     |            |           |     |
| $0.30 < \Phi$           | 0   |   |          |                  |                  |                 |                         |   |                         |   |                         |   |               |   |           |           |                  |     |               |                 |              |                      |   |              |                      |     |            |           |     |
| Length(m)               | Width(mm)   | Acceptable Q' ty  |          |                  |                  |                 |                         |   |                         |   |                         |   |               |   |           |           |                  |     |               |                 |              |                      |   |              |                      |     |            |           |     |
| ---                     | $W \leq 0.02$   | Accept no dense   |          |                  |                  |                 |                         |   |                         |   |                         |   |               |   |           |           |                  |     |               |                 |              |                      |   |              |                      |     |            |           |     |
| $L \leq 3.0$            | $0.02 < W \leq 0.05$  | 2   |          |                  |                  |                 |                         |   |                         |   |                         |   |               |   |           |           |                  |     |               |                 |              |                      |   |              |                      |     |            |           |     |
| $L \leq 2.5$            | $0.03 < W \leq 0.08$  |   |          |                  |                  |                 |                         |   |                         |   |                         |   |               |   |           |           |                  |     |               |                 |              |                      |   |              |                      |     |            |           |     |
| ---                     | $0.08 < W$  | Rejection   |          |                  |                  |                 |                         |   |                         |   |                         |   |               |   |           |           |                  |     |               |                 |              |                      |   |              |                      |     |            |           |     |

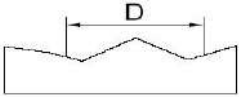
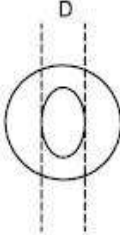
| NO                      | Item                  | Criterion  | AQL               |                  |                  |                 |                         |               |                         |                 |               |                   |               |                |               |                       |               |                    |                 |               |     |
|-------------------------|-----------------------|--|-------------------|------------------|------------------|-----------------|-------------------------|---------------|-------------------------|-----------------|---------------|-------------------|---------------|----------------|---------------|-----------------------|---------------|--------------------|-----------------|---------------|-----|
| 04                      | Polarizer bubbles     | If bubbles are visible, judge using black spot specifications, not easy to find, must check in specify direction <table border="1" data-bbox="858 371 1353 584" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Size <math>\Phi</math> (mm)</th> <th>Acceptable Q' ty</th> </tr> </thead> <tbody> <tr> <td><math>\Phi \leq 0.20</math></td> <td>Accept no dense</td> </tr> <tr> <td><math>0.20 &lt; \Phi \leq 0.50</math></td> <td>3</td> </tr> <tr> <td><math>0.50 &lt; \Phi \leq 1.00</math></td> <td>2</td> </tr> <tr> <td><math>1.00 &lt; \Phi</math></td> <td>0</td> </tr> <tr> <td>Total Q' ty</td> <td>3</td> </tr> </tbody> </table>  | Size $\Phi$ (mm)  | Acceptable Q' ty | $\Phi \leq 0.20$ | Accept no dense | $0.20 < \Phi \leq 0.50$ | 3             | $0.50 < \Phi \leq 1.00$ | 2               | $1.00 < \Phi$ | 0                 | Total Q' ty   | 3              | 2.5           |                       |               |                    |                 |               |     |
| Size $\Phi$ (mm)        | Acceptable Q' ty      |  |                   |                  |                  |                 |                         |               |                         |                 |               |                   |               |                |               |                       |               |                    |                 |               |     |
| $\Phi \leq 0.20$        | Accept no dense       |  |                   |                  |                  |                 |                         |               |                         |                 |               |                   |               |                |               |                       |               |                    |                 |               |     |
| $0.20 < \Phi \leq 0.50$ | 3                     |  |                   |                  |                  |                 |                         |               |                         |                 |               |                   |               |                |               |                       |               |                    |                 |               |     |
| $0.50 < \Phi \leq 1.00$ | 2                     |  |                   |                  |                  |                 |                         |               |                         |                 |               |                   |               |                |               |                       |               |                    |                 |               |     |
| $1.00 < \Phi$           | 0                     |  |                   |                  |                  |                 |                         |               |                         |                 |               |                   |               |                |               |                       |               |                    |                 |               |     |
| Total Q' ty             | 3                     |  |                   |                  |                  |                 |                         |               |                         |                 |               |                   |               |                |               |                       |               |                    |                 |               |     |
| 05                      | Scratches             | Follow NO.3 -2 Line Type.  |                   |                  |                  |                 |                         |               |                         |                 |               |                   |               |                |               |                       |               |                    |                 |               |     |
| 06                      | Chipped glass         | Symbols:<br>x: Chip length      y: Chip width      z: Chip thickness<br>k: Seal width      t: Glass thickness      a: LCD side length<br>L: Electrode pad length<br>6.1 General glass chip:<br>6.1.1 Chip on panel surface and crack between panels:<br> <table border="1" data-bbox="419 1088 1238 1200" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>z: Chip thickness</th> <th>y: Chip width</th> <th>x: Chip length</th> </tr> </thead> <tbody> <tr> <td><math>Z \leq 1/2t</math></td> <td>Not over viewing area</td> <td><math>x \leq 1/8a</math></td> </tr> <tr> <td><math>1/2t &lt; z \leq 2t</math></td> <td>Not exceed 1/3k</td> <td><math>x \leq 1/8a</math></td> </tr> </tbody> </table> <p>⊙ Unit: mm<br/>           ⊙ If there are 2 or more chips, x is the total length of each chip</p> 6.1.2 Corner crack:<br> <table border="1" data-bbox="419 1581 1238 1693" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>z: Chip thickness</th> <th>y: Chip width</th> <th>x: Chip length</th> </tr> </thead> <tbody> <tr> <td><math>Z \leq 1/2t</math></td> <td>Not over viewing area</td> <td><math>x \leq 1/8a</math></td> </tr> <tr> <td><math>1/2t &lt; z \leq 2t</math></td> <td>Not exceed 1/3k</td> <td><math>x \leq 1/8a</math></td> </tr> </tbody> </table> <p>⊙ Unit: mm<br/>           ⊙ If there are 2 or more chips, x is the total length of each chip</p> | z: Chip thickness | y: Chip width    | x: Chip length   | $Z \leq 1/2t$   | Not over viewing area   | $x \leq 1/8a$ | $1/2t < z \leq 2t$      | Not exceed 1/3k | $x \leq 1/8a$ | z: Chip thickness | y: Chip width | x: Chip length | $Z \leq 1/2t$ | Not over viewing area | $x \leq 1/8a$ | $1/2t < z \leq 2t$ | Not exceed 1/3k | $x \leq 1/8a$ | 2.5 |
| z: Chip thickness       | y: Chip width         | x: Chip length   |                   |                  |                  |                 |                         |               |                         |                 |               |                   |               |                |               |                       |               |                    |                 |               |     |
| $Z \leq 1/2t$           | Not over viewing area | $x \leq 1/8a$  |                   |                  |                  |                 |                         |               |                         |                 |               |                   |               |                |               |                       |               |                    |                 |               |     |
| $1/2t < z \leq 2t$      | Not exceed 1/3k       | $x \leq 1/8a$  |                   |                  |                  |                 |                         |               |                         |                 |               |                   |               |                |               |                       |               |                    |                 |               |     |
| z: Chip thickness       | y: Chip width         | x: Chip length   |                   |                  |                  |                 |                         |               |                         |                 |               |                   |               |                |               |                       |               |                    |                 |               |     |
| $Z \leq 1/2t$           | Not over viewing area | $x \leq 1/8a$  |                   |                  |                  |                 |                         |               |                         |                 |               |                   |               |                |               |                       |               |                    |                 |               |     |
| $1/2t < z \leq 2t$      | Not exceed 1/3k       | $x \leq 1/8a$  |                   |                  |                  |                 |                         |               |                         |                 |               |                   |               |                |               |                       |               |                    |                 |               |     |

| NO                    | Item           | Criterion  | AQL           |                |                   |                       |               |                |               |                |                   |            |               |                |          |           |               |            |     |
|-----------------------|----------------|--|---------------|----------------|-------------------|-----------------------|---------------|----------------|---------------|----------------|-------------------|------------|---------------|----------------|----------|-----------|---------------|------------|-----|
| 07                    | Glass crack    | <p>Symbols:<br/> x: Chip length      y: Chip width      z: Chip thickness<br/> k: Seal width      t: Glass thickness    a: LCD side length<br/> L: Electrode pad length</p> <p>7.2 Protrusion over terminal:<br/> 7.2.1 Chip on electrode pad:</p>  <table border="1" data-bbox="547 757 1233 913"> <tr> <td>y: Chip width</td> <td>x: Chip length</td> <td>z: Chip thickness</td> </tr> <tr> <td><math>y \leq 0.5\text{mm}</math></td> <td><math>x \leq 1/8a</math></td> <td><math>0 &lt; z \leq t</math></td> </tr> </table> <p>7.2.2 Non-conductive portion:</p>  <table border="1" data-bbox="547 1256 1233 1413"> <tr> <td>y: Chip width</td> <td>x: Chip length</td> <td>z: Chip thickness</td> </tr> <tr> <td><math>y \leq L</math></td> <td><math>x \leq 1/8a</math></td> <td><math>0 &lt; z \leq t</math></td> </tr> </table> <p>⊙ If there chipped area touches the ITO terminal, over 2/3 of the ITO must remain and be inspected according to electrode terminal specifications.<br/> ⊙ If the product will be heat sealed by the customer, the alignment mark must not be damaged.</p> <p>7.2.3 Substrate protuberance and internal crack</p>  <table border="1" data-bbox="874 1697 1318 1854"> <tr> <td>y: width</td> <td>x: length</td> </tr> <tr> <td><math>y \leq 1/3L</math></td> <td><math>X \leq a</math></td> </tr> </table> | y: Chip width | x: Chip length | z: Chip thickness | $y \leq 0.5\text{mm}$ | $x \leq 1/8a$ | $0 < z \leq t$ | y: Chip width | x: Chip length | z: Chip thickness | $y \leq L$ | $x \leq 1/8a$ | $0 < z \leq t$ | y: width | x: length | $y \leq 1/3L$ | $X \leq a$ | 2.5 |
| y: Chip width         | x: Chip length | z: Chip thickness  |               |                |                   |                       |               |                |               |                |                   |            |               |                |          |           |               |            |     |
| $y \leq 0.5\text{mm}$ | $x \leq 1/8a$  | $0 < z \leq t$   |               |                |                   |                       |               |                |               |                |                   |            |               |                |          |           |               |            |     |
| y: Chip width         | x: Chip length | z: Chip thickness  |               |                |                   |                       |               |                |               |                |                   |            |               |                |          |           |               |            |     |
| $y \leq L$            | $x \leq 1/8a$  | $0 < z \leq t$   |               |                |                   |                       |               |                |               |                |                   |            |               |                |          |           |               |            |     |
| y: width              | x: length      |  |               |                |                   |                       |               |                |               |                |                   |            |               |                |          |           |               |            |     |
| $y \leq 1/3L$         | $X \leq a$     |  |               |                |                   |                       |               |                |               |                |                   |            |               |                |          |           |               |            |     |

| NO | Item               | Criterion  | AQL                                      |
|----|--------------------|--|--|
| 08 | Cracked glass      | The LCD with extensive crack is not acceptable.  | 2.5                                      |
| 09 | Backlight elements | 9.1 Illumination source flickers when lit.<br>9.2 Spots or scratches that appear when lit must be judged. Using LCD spot, lines and contamination standards.<br>9.3 Backlight doesn't light or color is wrong.   | 2.5<br>2.5<br>0.65                       |
| 10 | Bezel              | Bezel must comply with product specifications.   | 2.5                                      |
| 11 | PCB、COB            | 11.1 COB seal may not have pinholes larger than 0.2mm or contamination.<br>11.2 COB seal surface may not have pinholes through to the IC.<br>11.3 The height of the COB should not exceed the height indicated in the assembly diagram.<br>11.4 There may not be more than 2mm of sealant outside the seal area on PCB. And there should be no more than three places.<br>11.5 Parts on PCB must be the same as on the production characteristic chart, There should be no wrong parts, missing parts or excess parts.<br>11.6 The jumper on the PCB should conform to the product characteristic chart. | 2.5<br>2.5<br>2.5<br>2.5<br>0.65<br>0.65 |
| 12 | FPC                | 12.1 FPC terminal damage $\leq$ 1/2 FPC terminal width and can not affect the function , we judge accept.<br>12.2 FPC alignment hole damage $\leq$ 1/2 alignment area and can not affect the function , we judge accept.   | 2.5<br>2.5                               |
| 13 | Soldering          | 13.1 No cold solder joints, missing solder connections, oxidation or icicle.<br>13.2 No short circuits in components on PCB or FPC.  | 2.5<br>0.65                              |



| NO                | Item                                   | Criterion   | AQL               |               |                |            |  |               |                   |               |                |            |  |               |     |
|-------------------|--|---|-------------------|---------------|----------------|------------|--|---------------|-------------------|---------------|----------------|------------|--|---------------|-----|
| 14                | Touch Panel<br>Chipped<br>glass        | <p>Symbols:<br/> x: Chip length      y: Chip width      z: Chip thickness<br/> k: Seal width      t: Touch Panel Total thickness    a: LCD side length<br/> L: Electrode pad length</p> <p>14.1 General glass chip:<br/> 14.1.1 Chip on panel surface and crack between panels:</p>  <table border="1" data-bbox="395 842 1211 1057"> <tr> <td>z: Chip thickness</td> <td>y: Chip width</td> <td>x: Chip length</td> </tr> <tr> <td><math>z \leq t</math></td> <td><math>\leq 1/2 k</math> and not over viewing area</td> <td><math>x \leq 1/8a</math></td> </tr> </table> <p>⊙ Unit: mm<br/> ⊙ If there are 2 or more chips, x is the total length of each chip</p> <p>14.1.2 Corner crack:</p>  <table border="1" data-bbox="395 1404 1211 1619"> <tr> <td>z: Chip thickness</td> <td>y: Chip width</td> <td>x: Chip length</td> </tr> <tr> <td><math>z \leq t</math></td> <td><math>\leq 1/2 k</math> and not over viewing area</td> <td><math>x \leq 1/8a</math></td> </tr> </table> <p>⊙ Unit: mm<br/> ⊙ If there are 2 or more chips, x is the total length of each chip</p> | z: Chip thickness | y: Chip width | x: Chip length | $z \leq t$ | $\leq 1/2 k$ and not over viewing area | $x \leq 1/8a$ | z: Chip thickness | y: Chip width | x: Chip length | $z \leq t$ | $\leq 1/2 k$ and not over viewing area | $x \leq 1/8a$ | 2.5 |
| z: Chip thickness | y: Chip width                          | x: Chip length  |                   |               |                |            |  |               |                   |               |                |            |  |               |     |
| $z \leq t$        | $\leq 1/2 k$ and not over viewing area | $x \leq 1/8a$   |                   |               |                |            |  |               |                   |               |                |            |  |               |     |
| z: Chip thickness | y: Chip width                          | x: Chip length  |                   |               |                |            |  |               |                   |               |                |            |  |               |     |
| $z \leq t$        | $\leq 1/2 k$ and not over viewing area | $x \leq 1/8a$   |                   |               |                |            |  |               |                   |               |                |            |  |               |     |

| NO                 | Item  | Criterion   | AQL   |                  |                 |                 |                    |   |                    |   |           |   |     |
|--------------------|---|---|---|------------------|-----------------|-----------------|--------------------|---|--------------------|---|-----------|---|-----|
| 15                 | Touch Panel (Fish eye, dent and bubble on film) | <table border="1" data-bbox="421 353 954 535"> <thead> <tr> <th>SIZE (mm)</th> <th>Acceptable Q' ty</th> </tr> </thead> <tbody> <tr> <td><math>\Phi \leq 0.2</math></td> <td>Accept no dense</td> </tr> <tr> <td><math>0.2 &lt; D \leq 0.4</math></td> <td>5</td> </tr> <tr> <td><math>0.4 &lt; D \leq 0.5</math></td> <td>2</td> </tr> <tr> <td><math>0.5 &lt; D</math></td> <td>0</td> </tr> </tbody> </table>   | SIZE (mm)                                       | Acceptable Q' ty | $\Phi \leq 0.2$ | Accept no dense | $0.2 < D \leq 0.4$ | 5 | $0.4 < D \leq 0.5$ | 2 | $0.5 < D$ | 0 | 2.5 |
| SIZE (mm)          | Acceptable Q' ty                                |   |   |                  |                 |                 |                    |   |                    |   |           |   |     |
| $\Phi \leq 0.2$    | Accept no dense                                 |   |   |                  |                 |                 |                    |   |                    |   |           |   |     |
| $0.2 < D \leq 0.4$ | 5   |   |   |                  |                 |                 |                    |   |                    |   |           |   |     |
| $0.4 < D \leq 0.5$ | 2   |   |   |                  |                 |                 |                    |   |                    |   |           |   |     |
| $0.5 < D$          | 0   |   |   |                  |                 |                 |                    |   |                    |   |           |   |     |
| 16                 | Touch Panel Newton ring                         | Newton ring dimension $\leq 1/2$ touch panel area and not affect font and line distortion ( $\leq 2.5\%$ ), it is acceptable.   | 2.5   |                  |                 |                 |                    |   |                    |   |           |   |     |
| 17                 | Touch Panel Linearity                           | Less than 2.5% is acceptable.   | 2.5   |                  |                 |                 |                    |   |                    |   |           |   |     |
| 18                 | LCD Ripple                                      | Touch the touch panel, can not see the LCD ripple.<br>Pen: R 1.0mm silicon rubber.<br>Operation Force: 80g  | 2.5   |                  |                 |                 |                    |   |                    |   |           |   |     |
| 19                 | General appearance                              | <p>19.1 Pin type must match type in specification sheet.</p> <p>19.2 LCD pin loose or missing pins.</p> <p>19.3 Product packaging must the same as specified on packaging specification sheet.</p> <p>19.4 Product dimension and structure must conform to product specification sheet.</p>   | <p>0.65</p> <p>0.65</p> <p>0.65</p> <p>0.65</p> |                  |                 |                 |                    |   |                    |   |           |   |     |

## 12. Handling Precaution:

### 12-1 Handling of LCM

- Don't give external shock.
- Don't apply excessive force on the surface.
- Liquid in LCD is hazardous substance. Must not lick and swallow.  
when the liquid is attach to your hand, skin, cloth etc.  
Wash it out thoroughly and immediately.
- Don't operate it above the absolute maximum rating.
- Don't disassemble the LCM.
- The operators should be grounded whenever he/she comes into contact with the module. Never touch any of the conductive parts such as the LSI pads, the copper leads on the PCB and the interface terminals with any parts of the human body.
- The modules should be kept in antistatic bags or other containers resistant to static for storage.
- The module is coated with a film to protect the display surface. Be care when peeling off this protective film since static electricity may be generated.

### 12-2 Storage

- Store in an ambient temperature of  $25\pm 10^{\circ}\text{C}$ , and in a relative humidity of  $50\pm 10\%RH$ . Don't expose to sunlight or fluorescent light.
- Storage in a clean environment, free from dust, active gas, and solvent.
- Store in anti-static electricity container.
- Store without any physical load.

### 12-3 Soldering

- Use only soldering irons with proper grounding and no leakage.
- Iron: No higher than  $280\pm 10^{\circ}\text{C}$  and less than 3 sec during Hand soldering.
- Rewiring: no more than 2 times.

## 13 Packing method

-----TBD