

## PRODUCT SPECIFICATION

### TFT LCD MODULE

**MODEL : KWH043ST43-F02** Version: 1.0

【    】 Preliminary Specification

【 ◆ 】 Finally Specification

| CUSTOMER'S APPROVAL |       |
|---------------------|-------|
| SIGNATURE:          | DATE: |
|                     |       |

- It signifies that you fully understand and accept all the contents of this specification if you sign and send back the first page of this specifications.

| Designed by | R&D Checked by | Quality Department by | Approved by |
|-------------|----------------|-----------------------|-------------|
| LEO         |                |                       |             |

**Prepared By :**

**FORMIKE ELECTRONIC CO.,LTD**

Address : Flat 401-403, 4th Floor, Block B, iPARK Building, DengLiang Rd.,No.26, NanShan District, ShenZhen, 518054, China

TEL:(86) 755 88306921,88306931 FAX:(86) 755 88304615

Http:// [www.wandisplay.com](http://www.wandisplay.com)

- This specification is subject to change without notice. Please contact FORMIKE or it's representative before designing your product based on this specification.

## Revision record

[illegible]

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## 1. General Description

### 1.1 Description

KWH043ST43-F02 is a Transmissive type color active matrix liquid crystal display (LCD), which uses amorphous thin film transistor (TFT) as switching devices. This product is composed of a TFT LCD panel, driver IC, FPC, backlight and touch panel unit . The following table described the features of FORMIKE KWH043ST43-F02.

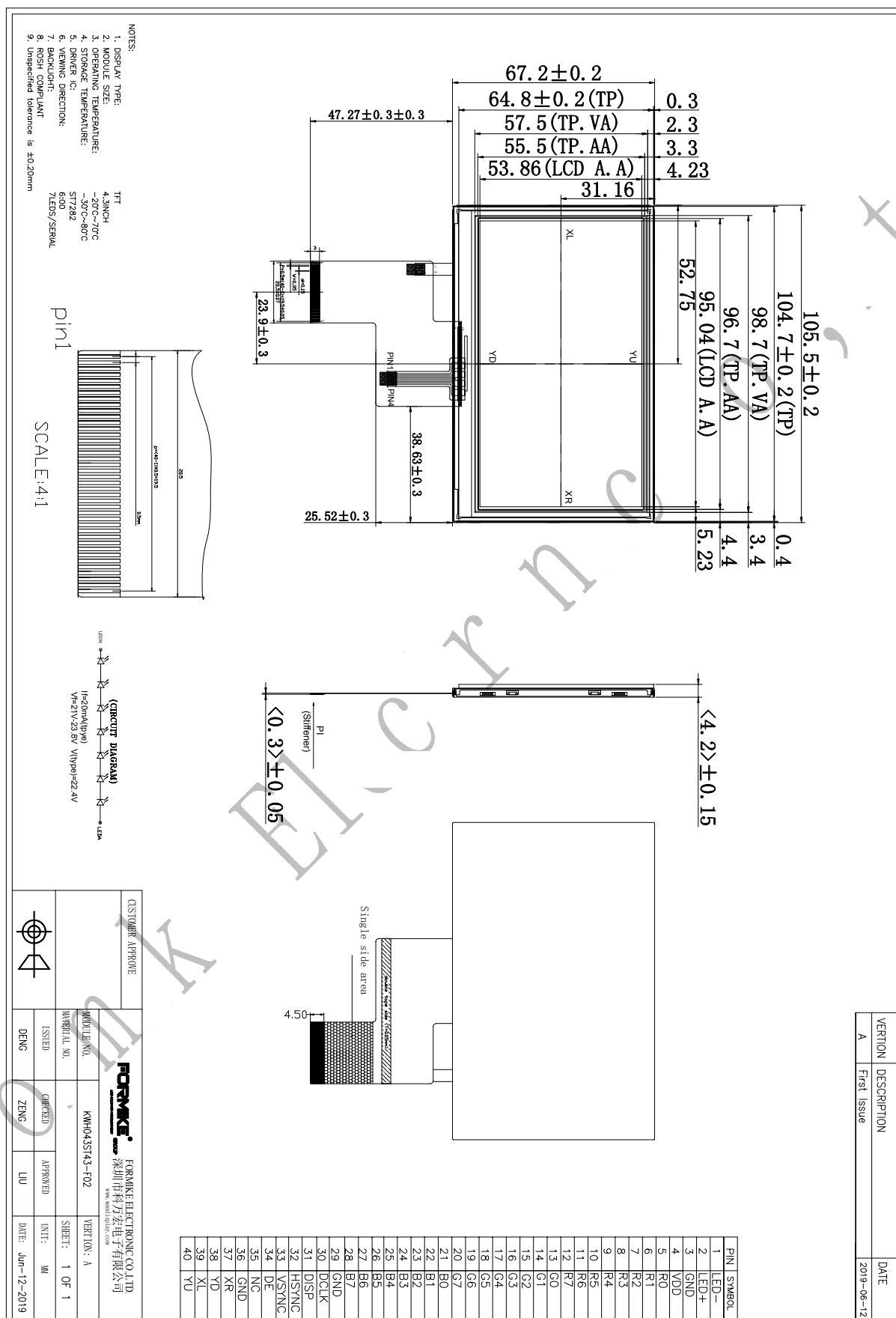
### 1.2 Application

PAD,PMP,MP4,DVB-S,GPS, Multimedia products,Portable Navigation and other electronic Products  
Etc.

### 1.3 Features:

| Features          | Description                     | UNITS |
|-------------------|---------------------------------|-------|
| LCD type          | 4.3'TFT                         | --    |
| Dot arrangement   | 480 (RGB) × 272                 | dots  |
| Driver IC         | ST7282                          | --    |
| Color Depth       | 16M                             |       |
| Interface         | RGB 24bit Interface             |       |
| View Direction    | 6 o'clock                       |       |
| Module size       | 105.50(W) × 67.20 (H) × 4.20(T) |       |
| Active area       | 95.04(W) × 53.86 (H)            | mm    |
| Dot pitch         | 0.198 (W) × 0.198 (H)           | mm    |
| Surface treatment | Anti-glare                      | --    |
| Back Light        | 7 White LEDs                    |       |
| With/Without TSP  | With TSP                        |       |
| Weight(g)         | TBD                             |       |

## 2. External Dimensions



### 3. Interface Description

FPC Connector is used for the module electronics interface. The recommended model is FH19SC-40S-0.5SH manufactured by HIROSE.

| Pin No. | Symbol | Functional                       | Remark |
|---------|--------|----------------------------------|--------|
| 1       | LED-   | Power for LED backlight cathode. |        |
| 2       | LED+   | Power for LED backlight anode.   |        |
| 3       | GND    | Power ground.                    |        |
| 4       | VDD    | Power voltage.                   |        |
| 5       | R0     | Red data(LSB).                   |        |
| 6       | R1     | Red data.                        |        |
| 7       | R2     | Red data.                        |        |
| 8       | R3     | Red data.                        |        |
| 9       | R4     | Red data.                        |        |
| 10      | R5     | Red data.                        |        |
| 11      | R6     | Red data.                        |        |
| 12      | R7     | Red data(MSB).                   |        |
| 13      | G0     | Green data(LSB).                 |        |
| 14      | G1     | Green data.                      |        |
| 15      | G2     | Green data.                      |        |
| 16      | G3     | Green data.                      |        |
| 17      | G4     | Green data.                      |        |
| 18      | G5     | Green data.                      |        |
| 19      | G6     | Green data.                      |        |
| 20      | G7     | Green data(MSB).                 |        |
| 21      | B0     | Blue data(LSB).                  |        |
| 22      | B1     | Blue data.                       |        |
| 23      | B2     | Blue data.                       |        |
| 24      | B3     | Blue data.                       |        |
| 25      | B4     | Blue data.                       |        |
| 26      | B5     | Blue data.                       |        |
| 27      | B6     | Blue data.                       |        |
| 28      | B7     | Blue data(MSB).                  |        |
| 29      | GND    | Power Ground.                    |        |
| 30      | DCLK   | Pixel clock.                     |        |
| 31      | DISP   | Display on/off.                  | NOTE1  |
| 32      | HSYNC  | No Connector.                    |        |
| 33      | VSNC   | No Connector.                    |        |
| 34      | DE     | Data Enable.                     | NOTE2  |
| 35      | NC     | No Connector.                    |        |
| 36      | GND    | Power Ground.                    |        |
| 37      | XR     | Touch panel pin for XR.          |        |
| 38      | YD     | Touch panel pin for YD.          |        |
| 39      | XL     | Touch panel pin for XL.          |        |
| 40      | YU     | Touch panel pin for YU.          |        |

Note1: During set to DISP=" H ", input data are valid. During set to DISP=" L ", input data are invalid and white display data is written to data register automatically.

Note2: DE=" H ": data can be access, DE=" L ": data cannot be access

## 4. Absolute Maximum Ratings

| Item                | Symbol | Values |         | Unit | Condition |
|---------------------|--------|--------|---------|------|-----------|
|                     |        | Min.   | Max.    |      |           |
| Power Voltage       | VDD    | 0.3    | 5.0     | V    |           |
| Logic Input Signal  | VIN    | -0.3   | VDD+0.3 | V    |           |
| Logic Output Signal | VOOUT  | -0.3   | VDD+0.3 | V    |           |

Note: Device is subject to be damaged permanently if stresses beyond those absolute maximum ratings listed above

## 5. Electrical Characteristics

### 5.1 Operating conditions:

| Item              | Symbol | Values |      |      | Unit | Remark        |
|-------------------|--------|--------|------|------|------|---------------|
|                   |        | Min.   | Typ. | Max. |      |               |
| Power Supply      | VDD    | 3.0    | 3.3  | 3.6  | V    |               |
| Operating Current | IDD    | -      | 15   | -    | mA   | Black pattern |
| Frame frequency   | Frame  | -      | 60   | 90   | Hz   |               |
| Dot Data Clock    | DCLK   | -      | 9.0  | 15   | MHz  |               |
| Power Consumption | PLCD   | -      | 49.5 | -    | mW   | Black pattern |

### 5.2 DC CHARACTERISTICS

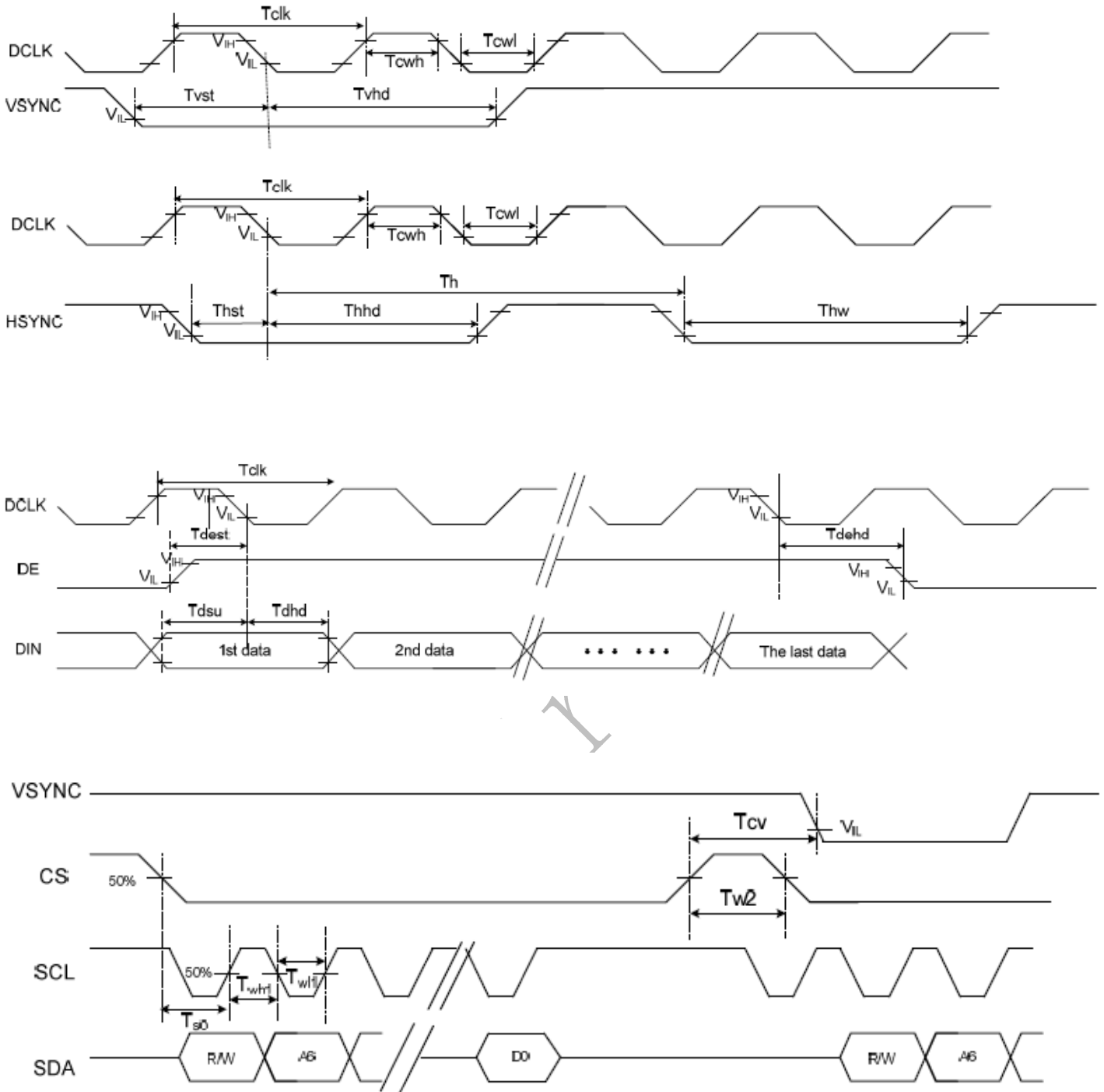
| Parameter                | Symbol          | Rating  |      |         | Unit | Condition |
|--------------------------|-----------------|---------|------|---------|------|-----------|
|                          |                 | Min.    | Typ. | Max.    |      |           |
| Low level input voltage  | V <sub>IL</sub> | 0       | -    | 0.3*VDD | V    |           |
| High level input voltage | V <sub>IH</sub> | 0.7*VDD | -    | VDD     | V    |           |

## 6. Timing Characteristics.

### 6.1 AC Timing Characteristics

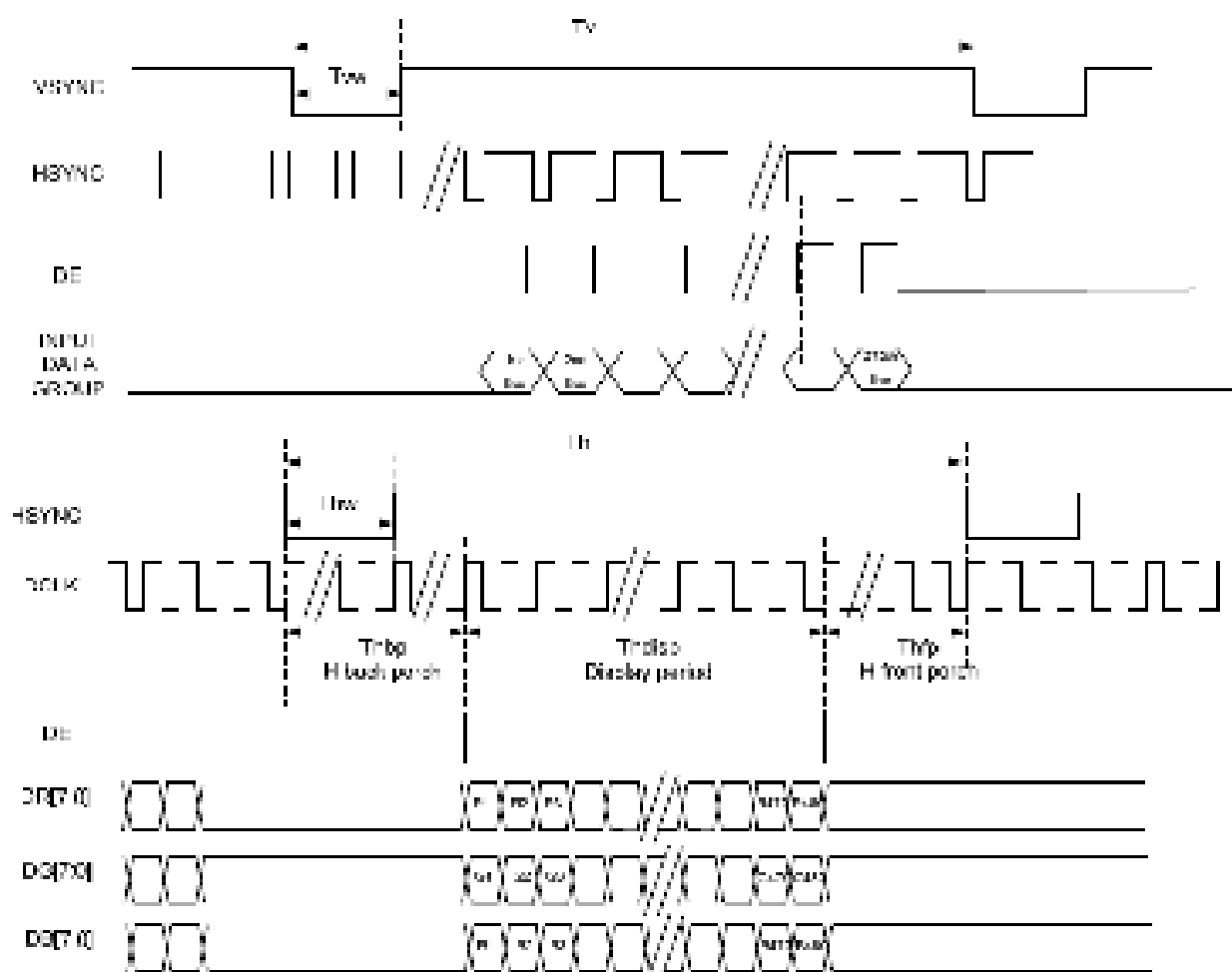
| Item                         | Symbol | Min. | Typ. | Max. | Unit | Conditions                                            |
|------------------------------|--------|------|------|------|------|-------------------------------------------------------|
| System operation timing      |        |      |      |      |      |                                                       |
| VDD power source slew time   | TPOR   | -    | -    | 20   | ms   | From 0V to 99% VDD                                    |
| GRB pulse width              | tRSTW  | 10   | 50   | -    | us   | R=10Kohm, C=1uF                                       |
| Input/ Output timing         |        |      |      |      |      |                                                       |
| CLK pulse duty               | Tcw    | 40   | 50   | 60   | %    |                                                       |
| Hsync width                  | Thw    | 2    | -    | -    | DCLK |                                                       |
| Hsync period                 | Th     | 55   | 60   | 65   | us   |                                                       |
| Vsync setup time             | Tvst   | 12   | -    | -    | ns   |                                                       |
| Vsync hold time              | Tvhd   | 12   | -    | -    | ns   |                                                       |
| Hsync setup time             | Thst   | 12   | -    | -    | ns   |                                                       |
| Hsync hold time              | Thhd   | 12   | -    | -    | ns   |                                                       |
| Data setup time              | Tdsu   | 12   | -    | -    | ns   |                                                       |
| Data hold time               | Tdhd   | 12   | -    | -    | ns   |                                                       |
| DE setup time                | Tdest  | 10   | -    | -    | ns   |                                                       |
| DE setup time                | Tdehd  | 10   | -    | -    | ns   |                                                       |
| SD output stable time        | Tst    | -    | -    | 12   | us   | Output settled within +20mV<br>Loading = 6.8k+28.2pF. |
| GD output rise and fall time | Tgst   | -    | -    | 6    | us   | Output settled (5%~95%),<br>Loading = 4.7k+29.8pF     |

|                              |     |    |  |  |    |  |
|------------------------------|-----|----|--|--|----|--|
| 3-wire serial communication  |     |    |  |  |    |  |
| Delay between CSB and VSYNC  | Tcv | 1  |  |  | us |  |
| CS input setup time          | Ts0 | 50 |  |  | ns |  |
| Serial data input setup time | Ts1 | 50 |  |  | ns |  |
| CS input hold time           | Th0 | 50 |  |  | ns |  |
| Serial data input hold time  | Th1 | 50 |  |  | ns |  |

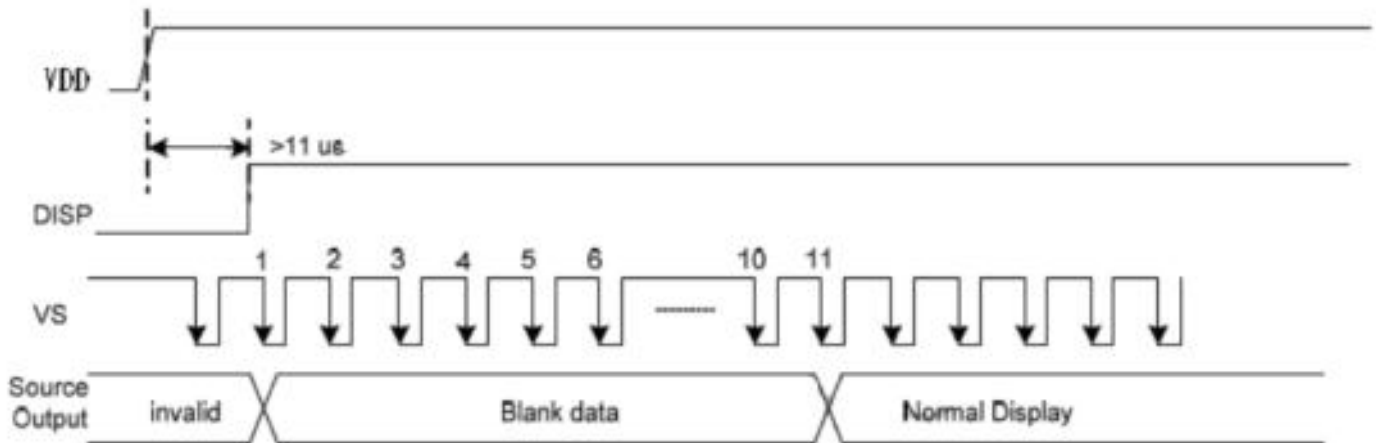


## 6.2 DC Timing Characteristics.

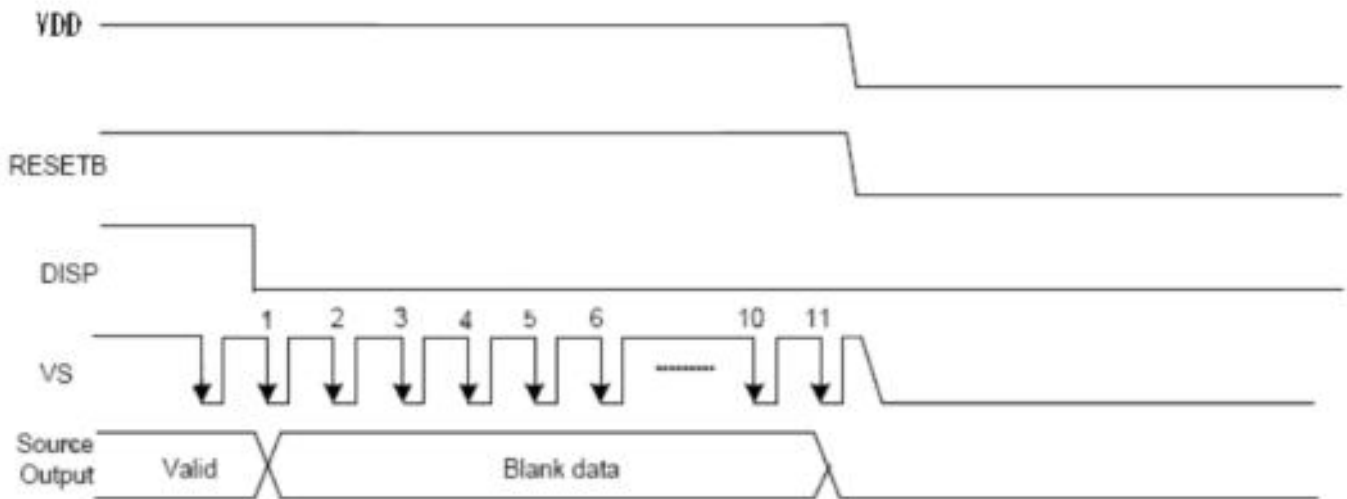
| Item           | Symbol         | Min.   | Typ. | Max. | Unit | Remark                |
|----------------|----------------|--------|------|------|------|-----------------------|
| DCLK Frequency | Fclk           | 8      | 9    | 12   | MHz  |                       |
| DCLK Period    | Tclk           | 83     | 111  | 125  | ns   |                       |
| HSYNC          | Period Time    | Th     | 485  | 531  | DCLK |                       |
|                | Display Period | Thdisp | 480  |      | DCLK |                       |
|                | Back Porch     | Thbp   | 3    | 43   | DCLK | By H_Blanking setting |
|                | Front Porch    | Thfp   | 2    | 8    | DCLK |                       |
|                | Pulse Width    | Thw    | 2    | 4    | DCLK |                       |
| VSYNC          | Period Time    | Tv     | 276  | 292  | H    |                       |
|                | Display Period | Tvdisp | 272  |      | H    |                       |
|                | Back Porch     | Tvbp   | 2    | 12   | H    | By V_Blanking setting |
|                | Front Porch    | Tvfp   | 2    | 8    | H    |                       |
|                | Pulse Width    | Tvw    | 2    | 4    | H    |                       |



### 6.3 Power sequence



**Power On Sequence**



**Power Off Sequence**

Fr

## 7. Backlight Characteristics.



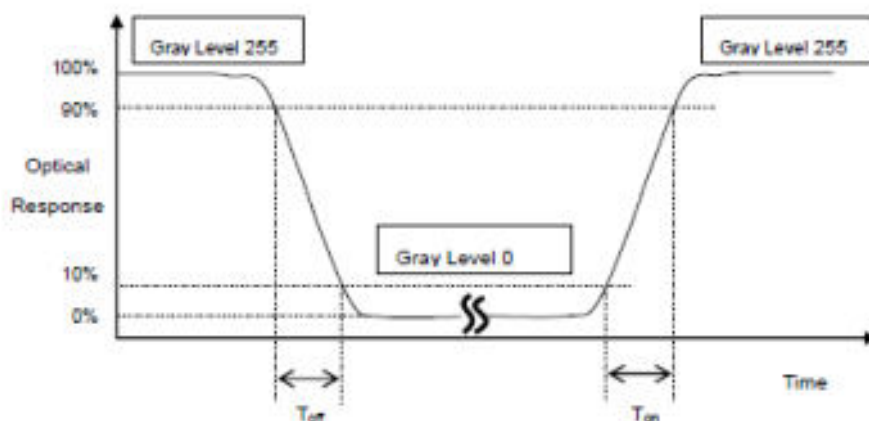
| Item                       | Sy<br>mb<br>ol | MIN         | TYP          | MAX         | UNIT         | Test<br>Condition | Note |
|----------------------------|----------------|-------------|--------------|-------------|--------------|-------------------|------|
| Supply Voltage             | <b>Vf</b>      | <b>20.0</b> | <b>22.2</b>  | <b>24.8</b> | <b>V</b>     | <b>If=20 mA</b>   | -    |
| Supply Current             | <b>If</b>      | -           | <b>20</b>    | -           | <b>mA</b>    | -                 | -    |
| Reverse Voltage            | <b>Vr</b>      | -           | -            | <b>5</b>    | <b>V</b>     | <b>10uA</b>       |      |
| Power dissipation          | <b>Pd</b>      | -           | <b>444</b>   | -           | <b>mW</b>    | -                 |      |
| Luminous Intensity for LCM |                | <b>240</b>  | <b>270</b>   | -           | <b>Cd/m2</b> | <b>If=20 mA</b>   |      |
| Uniformity for LCM         | -              | <b>80</b>   | -            | -           | <b>%</b>     | <b>If=20 mA</b>   |      |
| Life Time                  | -              | -           | <b>50000</b> | -           | <b>Hr</b>    | <b>If=20 mA</b>   | -    |
| Backlight Color            | <b>White</b>   |             |              |             |              |                   |      |

## 8.Optical Characteristics

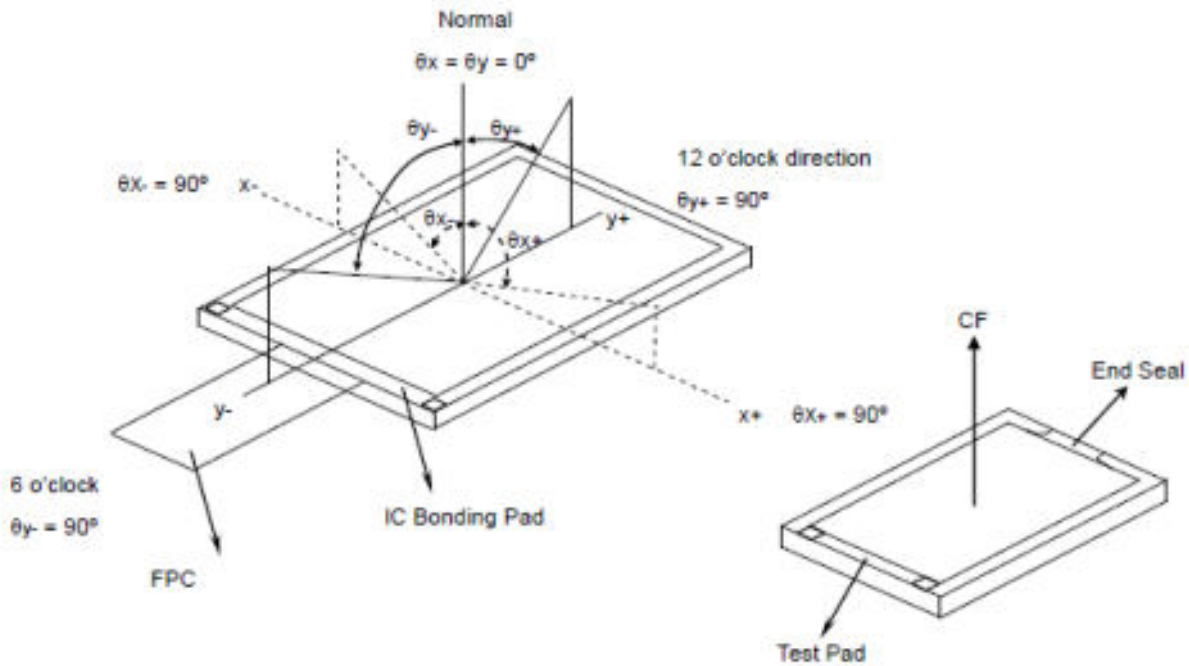
| Item                                  |             | Symbol             | Conditions                                              | Specifications |       |       | Unit | Note                                                                                                                                                                                   |
|---------------------------------------|-------------|--------------------|---------------------------------------------------------|----------------|-------|-------|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                       |             |                    |                                                         | Min.           | Typ.  | Max.  |      |                                                                                                                                                                                        |
| Transmittance (w/o APCF)              |             | T%                 | Viewing normal angle<br>$\theta_x = \theta_y = 0^\circ$ | 4.60%          | 5.41% | —     | %    | T% definition :<br>(w/o DBEF) & (w/o APCF)<br>(w/o Haze) & (w/o WPA)                                                                                                                   |
| Contrast Ratio                        |             | CR                 |                                                         | --             | 500   | --    | --   | The left side data are based on INX's following condition –<br>1.LC : TN<br>2.Light Source :C light<br>3.Polarizer :<br>4.Machine : DMS 803<br>5. VLC dark = 4.6V,<br>VLC white = 0.5V |
| Response Time                         |             | $T_{on} + T_{off}$ |                                                         | -              | 25    | 35    | ms   |                                                                                                                                                                                        |
| Viewing Angle                         | Hor.        | $\theta_{x+}$      | Center<br>CR>10                                         | --             | 70    | --    | deg. |                                                                                                                                                                                        |
|                                       |             | $\theta_{x-}$      |                                                         | --             | 70    | --    |      |                                                                                                                                                                                        |
|                                       | Ver.        | $\theta_{y+}$      |                                                         | --             | 50    | --    |      |                                                                                                                                                                                        |
|                                       |             | $\theta_{y-}$      |                                                         | --             | 70    | --    |      |                                                                                                                                                                                        |
| CF only Color Chromaticity (CIE 1931) | Red         | Rx                 | Viewing normal angle<br>$\theta_x = \theta_y = 0^\circ$ | 0.588          | 0.618 | 0.648 | -    | Light Source :C-Light                                                                                                                                                                  |
|                                       |             | Ry                 |                                                         | 0.313          | 0.343 | 0.373 | -    |                                                                                                                                                                                        |
|                                       | Green       | Gx                 |                                                         | 0.276          | 0.306 | 0.336 | -    |                                                                                                                                                                                        |
|                                       |             | Gy                 |                                                         | 0.497          | 0.527 | 0.557 | -    |                                                                                                                                                                                        |
|                                       | Blue        | Bx                 |                                                         | 0.109          | 0.139 | 0.169 | -    |                                                                                                                                                                                        |
|                                       |             | By                 |                                                         | 0.068          | 0.098 | 0.128 | -    |                                                                                                                                                                                        |
|                                       | White       | Wx                 |                                                         | 0.283          | 0.313 | 0.343 | -    |                                                                                                                                                                                        |
|                                       |             | Wy                 |                                                         | 0.293          | 0.323 | 0.353 | -    |                                                                                                                                                                                        |
|                                       | Color Gamut |                    |                                                         | --             | 52    | --    | %    |                                                                                                                                                                                        |

CR (X) is corresponding to the Contrast Ratio of the point X at Figure in Note (5).

\*Note (2) Definition of Response Time ( $T_{on}$ ,  $T_{off}$ ):

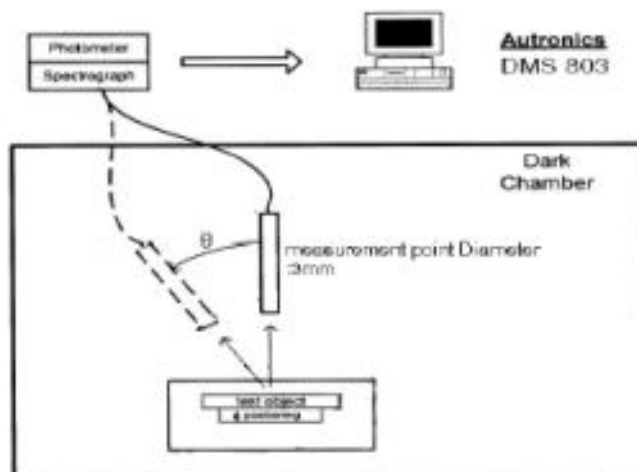


**\*Note(3) Definition of Viewing Angle**

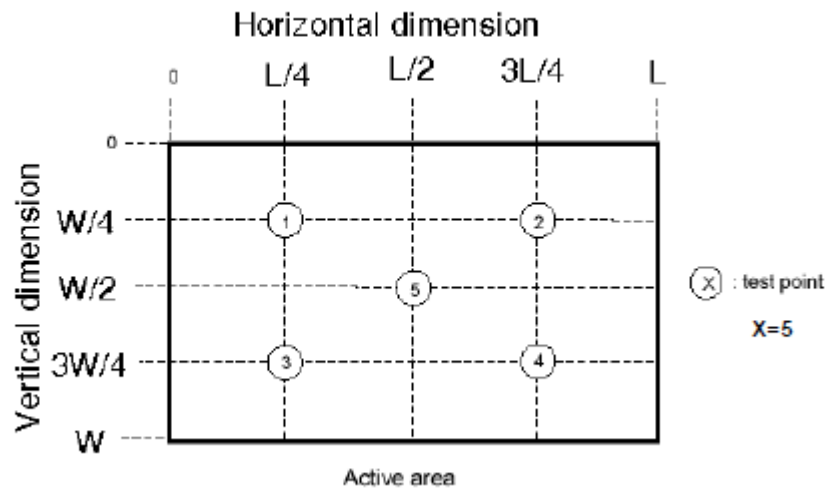


**\*Note (4) Measurement Set-Up:**

The LCD module should be stabilized at a given temperature for 20 minutes to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 20 minutes in a windless room.



\*Note (5)



## 9. RELIABILITY

| No. | Test Item                                     | Test Condition                                                                                | Remark                                                                                                  |
|-----|-----------------------------------------------|-----------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------|
| 1   | High Temperature Storage                      | +80℃± 2℃, 96 hrs                                                                              | Note                                                                                                    |
| 2   | Low Temperature Storage                       | -30℃± 2℃, 96 hrs                                                                              | Note                                                                                                    |
| 3   | High Temperature Operation                    | +70℃± 2℃, 96 hrs                                                                              | Note                                                                                                    |
| 4   | Low Temperature Operation                     | +20℃± 2℃, 96 hrs                                                                              | Note                                                                                                    |
| 5   | High Temperature & High Humidity Storage Test | +50℃± 5℃, 90%R.H, 96 hours                                                                    | Note                                                                                                    |
| 6   | Temperature Cycle ( non operation)            | -30℃ ← +25℃ → +80℃<br>(30mins ← 5mins → 30mins)<br>10 Cycles                                  | Note                                                                                                    |
| 7   | Electronic Static Discharge                   | Air Discharge: 2KV to with 5 times                                                            | Discharge for each polarity<br>Mode of Operation: Single Discharge, successive discharge at least 1 sec |
|     |                                               | Ambiance: 15℃~35℃, 30%~60%R.H<br>Resistance(Rd): 330Ω ±10%<br>Capacitance(Cs + Cd): 150pF±10% |                                                                                                         |
| 8   | Vibration (Packaged)                          | Frequency range: 10Hz ~ 55 Hz<br>Amplitude: 1.5mm<br>Direction of X.Y. Z for 3 Hrs in total   |                                                                                                         |
| 9   | Drop Test ( Packaged)                         | Height: 80cm, Time: 1<br>1 corner, 3 edged, 6 surfaces                                        |                                                                                                         |

Note : Recovery Time should be 2~4 hours at room temperature (20±8℃) and humidity ( below 60% R.H). No abnormalities in functions and appearance

## 10.INSPECTION CRITERION

### 10.1 Scope

Display Quality Evaluation

Mechanics Specification

### 10.2 Sampling Plan

MIL-STD-105E

Unless there is other agreement, the sampling plan for incoming inspection shall follow MIL-STD-105E

Lot size: Quantity per shipment as one lot (different model as different lot ).

Sampling type: Normal inspection, single sampling

Sampling level: Level II.

### 10.3 Acceptable Quality Level

| Item       | Major | Minor |
|------------|-------|-------|
| Appearance | 1.0%  | 1.5%  |
| Electrical | 0.65  | 1.0%  |

#### 10.3.1 Classification of defects:

##### 10.3.1.1 Major defect

Any defect may result in functional failure, or reduce the usability of product for its purpose. For

Example: Electrical failure, deformation and etc.

##### 10.3.1.2 Minor defect

The criteria on major or minor judgment will be according with the classification of defects.

### 10.4 Panel Inspection Condition

10.4.1 Environment:

10.4.2 Room Temperature:  $25 \pm 5^{\circ}$  C.

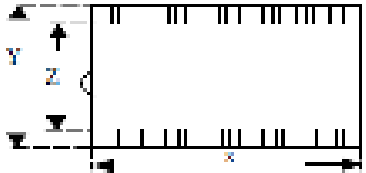
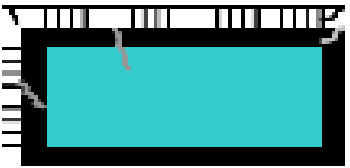
10.4.3 Humidity:  $50 \pm 20\%$  RH.

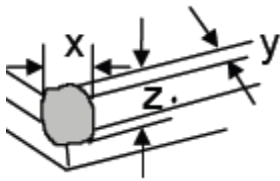
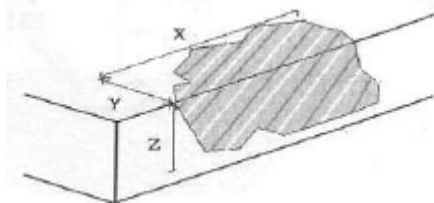
Illumination: 300 ~ 700 Lux.

10.4.4 Inspection Distance:  $35 \pm 5$  cm

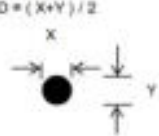
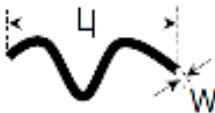
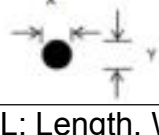
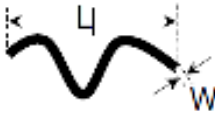
### 10.5 TFT Inspection Criteria

#### 10.5.1 Visual inspection criterion in cosmetic / appearance

| Glass defect |                   |                        |                                                                                       |
|--------------|-------------------|------------------------|---------------------------------------------------------------------------------------|
| N<br>o       | Item              | Criteria               | Remark                                                                                |
| 1            | Dimension (Minor) | By engineering diagram |   |
| 2            | Crack (Major)     | Extensive crack        |  |

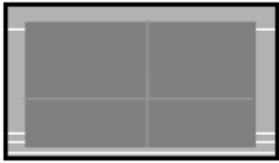
|   |                |                                                                            |                                                                                                                                                          |
|---|----------------|----------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|
| 3 | Corner (Minor) | $X \leq 3 \text{ mm}$<br>$Y \leq 3 \text{ mm}$<br>$Z \leq T$<br><br>Ignore |  <p>T: Glass thickness<br/>Z: Thickness<br/>X: Length<br/>Y: Width</p> |
| 4 | Side (Minor)   | $X \leq 5 \text{ mm}$<br>$Y \leq 3 \text{ mm}$<br>$Z \leq T$<br><br>Ignore |  <p>T: Glass thickness<br/>Z: Thickness<br/>X: Length<br/>Y: Width</p> |

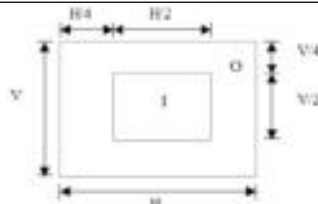
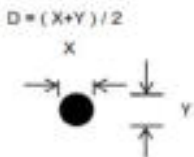
TFT defect in appearance

| No | Item                                                                                            | Criteria                                                                                                                                                                                                                                                               | Remark                                                                                                                          |
|----|-------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|
| 1  | Foreign Spot (Minor)<br>Including:<br>Black spot,<br>White spot<br>Pin hole<br>Foreign particle | $D \leq 0.15 \text{ mm}$ , Ignore<br>$0.15 \text{ mm} < D \leq 0.3 \text{ mm}$ , $N \leq 3$<br>$0.3 \text{ mm} < D$ , $N = 0$<br>Distance $\geq 5 \text{ mm}$<br>Ignore if out of Area AA                                                                              | $D = (X+Y)/2$ ,<br>X: Length, Y: Width<br> |
| 2  | Foreign Line(Minor)<br>Including:<br>Black line<br>White line<br>Bright line                    | $W \leq 0.03 \text{ mm}$ , Ignore<br>$0.03 \text{ mm} < W \leq 0.05 \text{ mm}$ , $L \leq 4 \text{ mm}$ , $N \leq 3$<br>$0.05 \text{ mm} < W \leq 0.08 \text{ mm}$ , $L \leq 4 \text{ mm}$ , $N \leq 1$<br>$W > 0.08 \text{ mm}$ , $N = 0$<br>Ignore if out of Area AA | L: Length, W: Width<br>                    |
| 3  | Polarizer Dent/Air Bubble (Minor)                                                               | $D \leq 0.2 \text{ mm}$ , Ignore<br>$0.2 \text{ mm} < D \leq 0.3 \text{ mm}$ , $N \leq 3$<br>$0.3 \text{ mm} < D \leq 0.5 \text{ mm}$ , $N \leq 1$<br>$D > 0.50 \text{ mm}$ , $N = 0$<br>Distance $\geq 5 \text{ mm}$                                                  | $D = (X+Y)/2$ ,<br>X: Length, Y: Width<br> |
| 4  | Polarizer Scratches (Minor)                                                                     | $W \leq 0.03 \text{ mm}$ , Ignore<br>$0.03 \text{ mm} < W \leq 0.05 \text{ mm}$ , $L \leq 4 \text{ mm}$ , $N \leq 3$<br>$0.05 \text{ mm} < W \leq 0.08 \text{ mm}$ , $L \leq 4 \text{ mm}$ , $N \leq 1$<br>$W > 0.08 \text{ mm}$ , $N = 0$<br>Ignore if out of Area AA | L: Length, W: Width<br>                    |

| Other defects |                   |                                                                                                                                |        |
|---------------|-------------------|--------------------------------------------------------------------------------------------------------------------------------|--------|
| No            | Item              | Criteria                                                                                                                       | Remark |
| 1             | FPC (Minor)       | Any crack or breakage which effect the function are not allowed<br>Disregard if the dirty removed                              |        |
| 2             | Backlight (Minor) | Power up is allowed.<br>Breaking off is not allowed.<br>The scratch which may causes a problem in practical use is not allowed |        |
| 3             | Bezel (Minor)     | Erasable dirt is ignore                                                                                                        |        |

#### 10.5.2 Visual inspection criterion in electrical display

| Glass defect |                                                   |                 |                                                                                       |
|--------------|---------------------------------------------------|-----------------|---------------------------------------------------------------------------------------|
| No           | Item                                              | Criteria        | Remark                                                                                |
| 1            | No display (Major)<br>Abnormally<br>Short circuit | Not allowed     |    |
| 2            | Missing line (Major)                              | Not allowed     |   |
| 3            | Darker or lighter line (Major)                    | Not allowed     |  |
| 4            | Weak line (Minor)                                 | By limit sample |                                                                                       |

| Display Inspection |                       |                                                                                                                                                                                                                                                                        |        |        |        |                                                                                                                                                                       |
|--------------------|-----------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|--------|--------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| No                 | Item                  | Criteria                                                                                                                                                                                                                                                               |        |        |        | Remark                                                                                                                                                                |
| 1                  | Bright / Dark dot     | Items                                                                                                                                                                                                                                                                  | Area I | Area O | Tota I | <br><br>1. 1sub-pixel: 1R or 1G or 1B<br>2. Point defect area $\geq$ 1/2 sub pixel |
|                    |                       | Bright                                                                                                                                                                                                                                                                 | 1      | 1      | 1      |                                                                                                                                                                       |
|                    |                       | Dark                                                                                                                                                                                                                                                                   | 1      | 3      | 3      |                                                                                                                                                                       |
|                    |                       | Bright & Dark                                                                                                                                                                                                                                                          | 2      | 3      | 4      |                                                                                                                                                                       |
|                    |                       | 2 adjacent dots                                                                                                                                                                                                                                                        | 0      | 0      | 0      |                                                                                                                                                                       |
|                    |                       | Minimum Distance $\geq$ 5mm                                                                                                                                                                                                                                            |        |        |        |                                                                                                                                                                       |
| 2                  | Tiny bright dot       | Visible through 6% ND filter<br>$D \leq 0.15\text{mm}$ , Ignore<br>$0.15\text{mm} < D \leq 0.3\text{mm}$ , $N \leq 3$<br>$0.3\text{mm} < D \leq 0.35\text{mm}$ , $N \leq 1$<br>$D > 0.35\text{mm}$ , $N = 0$<br>Distance $\geq 5\text{mm}$<br>Ignore if out of Area AA |        |        |        | $D = (X+Y)/2$ ,<br>X: Length, Y: Width<br>                                         |
| 4                  | Mura/Waving/ Hot spot | Not visible through 6% ND filter in 50% gray or judge by limit sample if necessary                                                                                                                                                                                     |        |        |        |                                                                                                                                                                       |

\* Note:

- Defect which is on the Black Matrix (outside of active area) are not considered as a defect.
- If any specific defect is not included in the above defect table, this defect should be judged by Formike.
- W: Width, L: Length D: Average Diameter N: Count.

## 11. PRECAUTION RELATING & PRODUCT HANDLING

Display is assembled and adjusted with a high degree of precision. Do not attempt to make any alteration or modification.

### 11.1 SAFETY

11.1.1 If the LCD panel breaks, be careful not to get the liquid crystal to touch your skin.

11.1.2 If the liquid crystal touches your skin or clothes, please wash it off immediately by using soap and water.

### 11.2 HANDLING

11.2.1 Avoid any strong mechanical shock which can break the glass.

11.2.2 Avoid static electricity which can damage the CMOS LSI - When working with the module, be sure to ground your body and any electrical equipment you may be using. The followings should be noted:

11.2.2.1 CMOS-LSI is used for the module circuit; therefore operators should be grounded whenever he/she comes into contact with the module.

11.2.2.2 Do not 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.

11.2.2.3 Do not touch the connection terminals of the display with bare hand; it will cause disconnection or defective insulation of terminals.

11.2.2.4 The modules should be kept in anti-static bags or other containers resistant to static for storage.

11.2.2.5 Only properly grounded soldering irons should be used.

11.2.2.6 If an electric screwdriver is used, it should be grounded and shielded to prevent sparks.

11.2.2.7 The normal static prevention measures should be observed for work clothes and working benches.

11.2.3.8 Since dry air is inductive to static, a relative humidity of 50-60% is recommended

11.2.3 Do not remove the panel or frame from the module.

11.2.4 The polarizing plate of the display is very fragile. Please handle it very carefully, do not touch, push or rub the exposed polarizing with anything harder than an HB pencil lead (glass, tweezers, etc.)

11.2.5 Do not wipe the polarizing plate with a dry cloth, as it may easily scratch the surface of plate.

11.2.6 Do not touch the display area with bare hands, this will stain the display area.

11.2.7 Do not use ketonics solvent & aromatic solvent. Use with a soft cloth soaked with a cleaning naphtha solvent.

11.2.8 To control temperature and time of soldering is  $300 \pm 10^{\circ}\text{C}$  and 3-4 sec.

To avoid liquid (include organic solvent) stained on LCD Module.

### 11.3 STORAGE

11.3.1 Store the panel or module in a dark place where the temperature is  $25^{\circ}\text{C} \pm 5^{\circ}\text{C}$  and the humidity is below 60% RH.

11.3.2 Avoid exposure to direct sunlight or to the light of fluorescent lamps.

11.3.3 Do not place the module near organic solvents or corrosive gases.

Do not crush, shake, or jolt the module.

## 11.4 LIMITED WARRANTY

11.4.1 FORMIKE modules are not consumer products, but may be incorporated by FORMIKE's customers into consumer products or components thereof, FORMIKE does not warrant that its modules and components are fit for any such particular purpose.

11.4.2 The liability of FORMIKE is limited to repair or replacement on the terms set forth below. FORMIKE will not be responsible for any subsequent or consequential events or injury or damage to any personnel or user including third party personnel and/or user. Unless otherwise agreed in writing between FORMIKE and the customer, FORMIKE will only replace or repair any of its Modules which is found defective electrically or visually when inspected in accordance with FORMIKE INSPECTION CRITERIA

11.4.3 No warranty can be granted if any of the precautions state in handling liquid crystal display has been disregarded. Broken glass, scratches on polarizer mechanical damages as well as defects that are caused accelerated environment tests are excluded from warranty.

11.4.4 In returning the modules, they must be properly packaged; there should be detailed description of the failures or defect.

## 12. OTHERS

12.1 If there is any not specified quality standard in this specification as well as RMA , please refer to < INSPECTION CRITERIA>. Contact FORMIKE to get the complete <INSPECTION CRITERIA> by the contact window or [feedback@wandisplay.com](mailto:feedback@wandisplay.com).

12.2 Special agreement of <INSPECTION CRITERIA> is recognized only in writhing between FORMIKE and the customer also indicated it before ordering.