

Display Elektronik GmbH

DATA SHEET

LCD MODULE

DEM 1024768C VMH-PW-N

10,4" TFT

Product Specification

Ver.:3

25.09.2019

Revise Records

| Rev. | Date | Contents | Written | Approved | | | | | | | | | | | | | | | | | | | | | | |
|-------------------------------|------------|--|--|----------|-------------------------------|---------|-------|--|-------|-------|-------|----|-------|----|-------|-------|-------|-------------------------------|-------|----|--|--------|--------|--------|----|-------|
| 0 | 15.02.2019 | Preliminary Specification | CL | MHO | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 29.05.2019 | Modify Power Supply Current for LCM ICC TYP TBD->320mA , Max. TBD->360mA | CL | MHO | | | | | | | | | | | | | | | | | | | | | | |
| | | Modify Power Supply Current (LED Driver) ILED TYP TBD->550mA , Max. TBD->650mA | | | | | | | | | | | | | | | | | | | | | | | | |
| | | Modify Color Chromaticity <table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <tr> <td rowspan="2">Color Chromaticity (CIE 1931)</td> <td rowspan="2">White</td> <td>Wx</td> <td rowspan="2">$\theta=0^\circ$ Normal Viewing Angle</td> <td>(TBD)</td> <td>(TBD)</td> <td>(TBD)</td> <td rowspan="2">--</td> <td rowspan="2">BM-7A</td> </tr> <tr> <td>Wy</td> <td>(TBD)</td> <td>(TBD)</td> <td>(TBD)</td> </tr> </table> <table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <tr> <td rowspan="2">Color Chromaticity (CIE 1931)</td> <td rowspan="2">White</td> <td>Wx</td> <td rowspan="2">$\theta=0^\circ$ Normal Viewing Angle</td> <td>(0.28)</td> <td>(0.33)</td> <td>(0.38)</td> <td rowspan="2">--</td> <td rowspan="2">BM-7A</td> </tr> <tr> <td>Wy</td> <td>(0.348)</td> <td>(0.398)</td> <td>(0.448)</td> </tr> </table> | | | Color Chromaticity (CIE 1931) | White | Wx | $\theta=0^\circ$ Normal Viewing Angle | (TBD) | (TBD) | (TBD) | -- | BM-7A | Wy | (TBD) | (TBD) | (TBD) | Color Chromaticity (CIE 1931) | White | Wx | $\theta=0^\circ$ Normal Viewing Angle | (0.28) | (0.33) | (0.38) | -- | BM-7A |
| Color Chromaticity (CIE 1931) | White | Wx | $\theta=0^\circ$ Normal Viewing Angle | (TBD) | | | (TBD) | | (TBD) | -- | BM-7A | | | | | | | | | | | | | | | |
| | | Wy | | (TBD) | (TBD) | (TBD) | | | | | | | | | | | | | | | | | | | | |
| Color Chromaticity (CIE 1931) | White | Wx | $\theta=0^\circ$ Normal Viewing Angle | (0.28) | (0.33) | (0.38) | -- | BM-7A | | | | | | | | | | | | | | | | | | |
| | | Wy | | (0.348) | (0.398) | (0.448) | | | | | | | | | | | | | | | | | | | | |
| 2 | 31.05.2019 | Modify 1.1 Features from MVA Mode to IPS Mode Modify 1.1 Features LEDs from 42 to 30 | CL | MHO | | | | | | | | | | | | | | | | | | | | | | |
| 3 | 25.09.2019 | Add IIS | CL | MHO | | | | | | | | | | | | | | | | | | | | | | |
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1. General Description and Features

This TFT is a transmissive type color active matrix TFT (Thin Film Transistor) liquid crystal display (LCD) that uses amorphous silicon TFT as a switching device. This model is composed of a TFT-LCD module, a receiver circuit, and a back-light unit. Graphics and texts can be displayed on a HD 1024 (W) x 3 x 768 (H) dots (4:3 aspect ratio) with 262K/16.2M colors by supplying 18/24 bits data signal (8bits/each color). The following table described the features of this TFT.

1.1 Features

- Transmissive and back-light with 30 LEDs are available.
- IPS mode.
- LVDS Receiver 24 bit Interface.

1.2 LCD Module

| Item | Specification | Unit |
|--------------------|-----------------------------------|----------|
| Screen Size | 10.4 inches | Diagonal |
| Display Resolution | 1024 x 768 | Pixel |
| Active Area | 211.20 x 158.40 | mm |
| Outline Dimension | 243.00 x 185.60 x 7.30 | mm |
| Display Mode | Normally Black mode/ Transmissive | -- |
| Surface Treatment | Anti-Glare(AG) | -- |
| Pixel Arrangement | R,G,B Vertical Stripe | -- |
| Pixel Size | 206.25 x 206.25 | um |
| Display Color | 262K/16.2M | -- |
| Viewing Direction | Full View | -- |
| Input Interface | LVDS Receiver 24 bit Interface | -- |

2. Mechanical Information

| Item | Min. | Typ. | Max. | Unit | Note |
|-------------|----------------|-------|---------|------|------|
| Module Size | Horizontal (H) | -- | (243) | -- | mm |
| | Vertical (V) | -- | (185.6) | -- | mm |
| | Thickness (T) | -- | (7.3) | -- | mm |
| Weight | -- | (TBD) | -- | g | -- |

Note (1) Not Include Component. Refer to the Outline Dimension Drawing as attached.

3. Electrical Specifications

3.1 Absolute Max. Ratings

3.1.1 Absolute Ratings of Environment

If the operating condition exceeds the following absolute maximum ratings, the TFT LCD module may be damaged permanently.

(Ta=25±2°C, GND=0)

| Item | Symbol | Min. | Max. | Unit | Note |
|-----------------------|------------------|------|------|------|---------|
| Storage Temperature | T _{STG} | -30 | 80 | °C | (1) |
| Operating Temperature | T _{OPR} | -20 | 70 | °C | (1,2,3) |

Note (1) 95 % RH Max. (40 °C ≥ Ta). Maximum wet-bulb temperature at 39 °C or less. (Ta > 40 °C) No condensation.

Note (2) In case of below 0°, the response time of liquid crystal (LC) becomes slower and the color of panel becomes darker than normal one. Level of retardation depends on temperature, because of LC's character

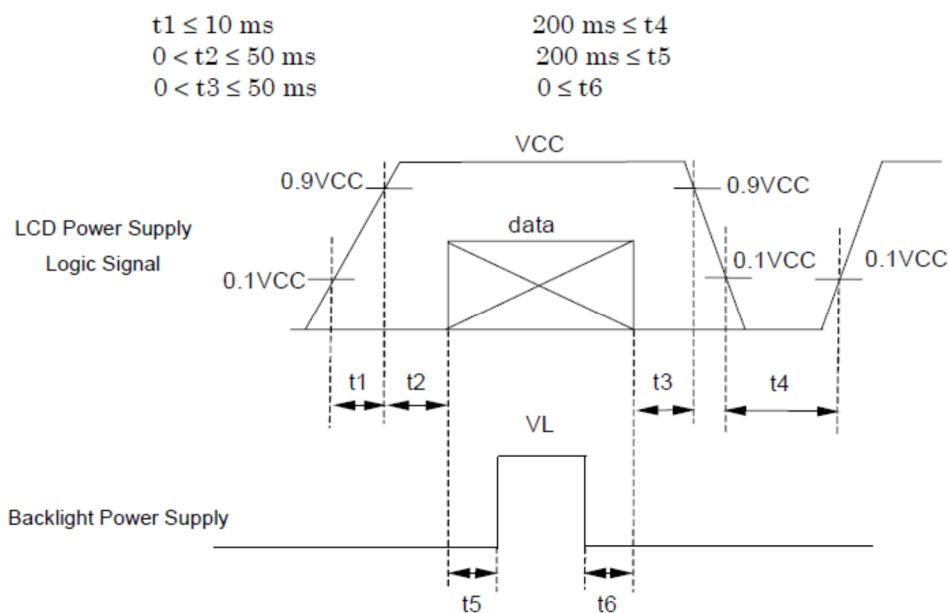
Note (3) Only operation is guaranteed at operating temperature. Contrast, response time, another display quality are evaluated at +25°C.

3.1.2 Electrical Absolute Maximum Ratings

(V_{SS}=GND=0)

| Parameter | Symbol | Min. | Max. | Unit | Remark |
|---------------------------------|-----------------|------|------|-------|----------|
| Power Supply Logic Voltage | VCC | -0.3 | 4.0 | V | |
| Power Supply LED Voltage | VLED | -0.3 | 18 | V | |
| Permissive Input Ripple Voltage | V _{RF} | -- | 100 | mVp-p | VCC=3.3V |

Display On/Off Sequence:

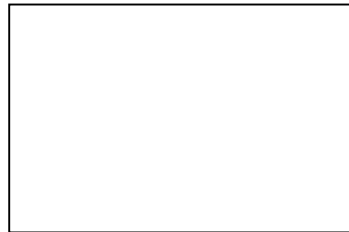


3.1.3 DC Electrical Characteristics of the TFT LCD

(Ta=25±2°C, GND=0)

| Item | | Symbol | Min. | Typ. | Max. | Unit | Remark |
|-----------------------------------|---------|--------|---------|-------|---------|------|----------|
| Power Supply Logic Voltage | | VCC | 3.0 | 3.3 | 3.6 | V | |
| Power Supply LED Voltage | | VLED | - | 12 | - | V | |
| Input Voltage for Logic | H Level | VIH | 0.7xVDD | - | VDD | V | |
| | L Level | VIL | 0 | - | 0.3xVDD | V | |
| Power Supply Current for LCM | | ICC | - | (320) | (360) | mA | Note 1 |
| Power Supply Current (LED Driver) | | ILED | - | (550) | (650) | mA | VLED=12V |
| LED Lifetime | | - | (50000) | - | - | Hrs | Note 2 |

Note1: White Pattern & 60Hz



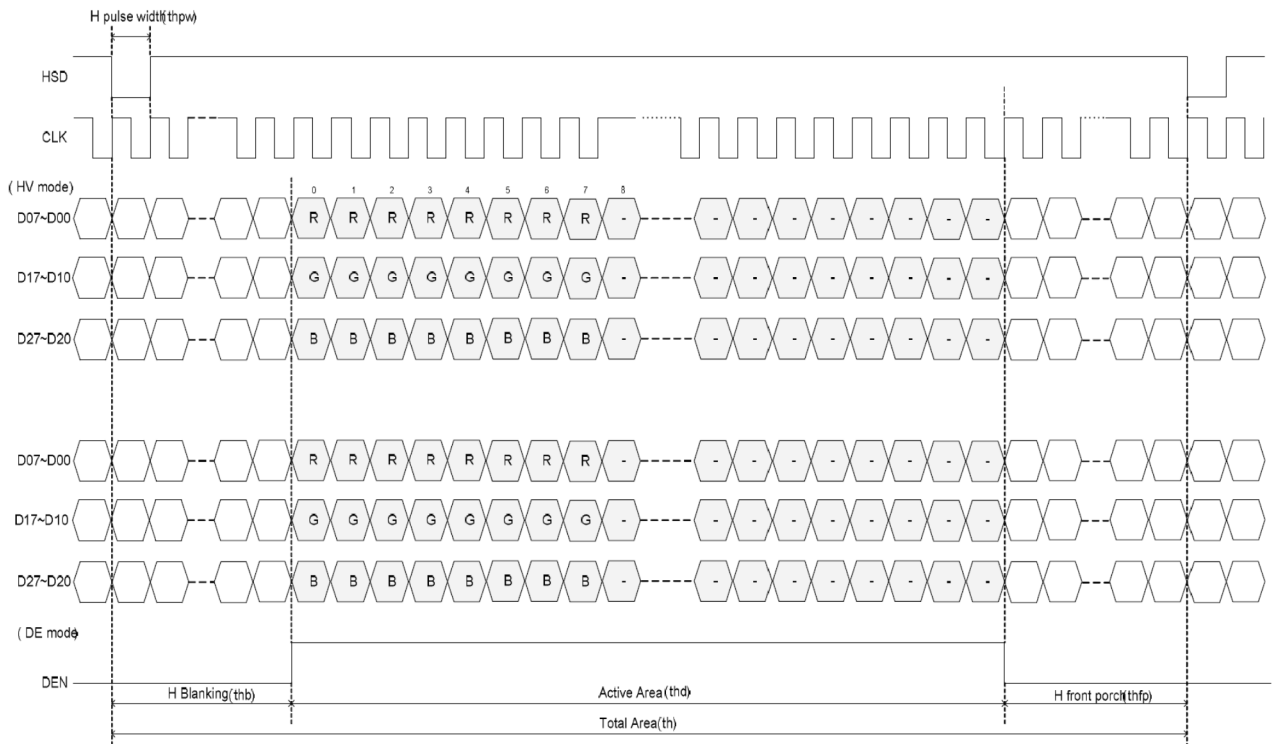
Note2: The environmental conducted under ambient air flow, at Ta=25±2°C, 60%RH±5%

3.1.4 AC Timing Condition

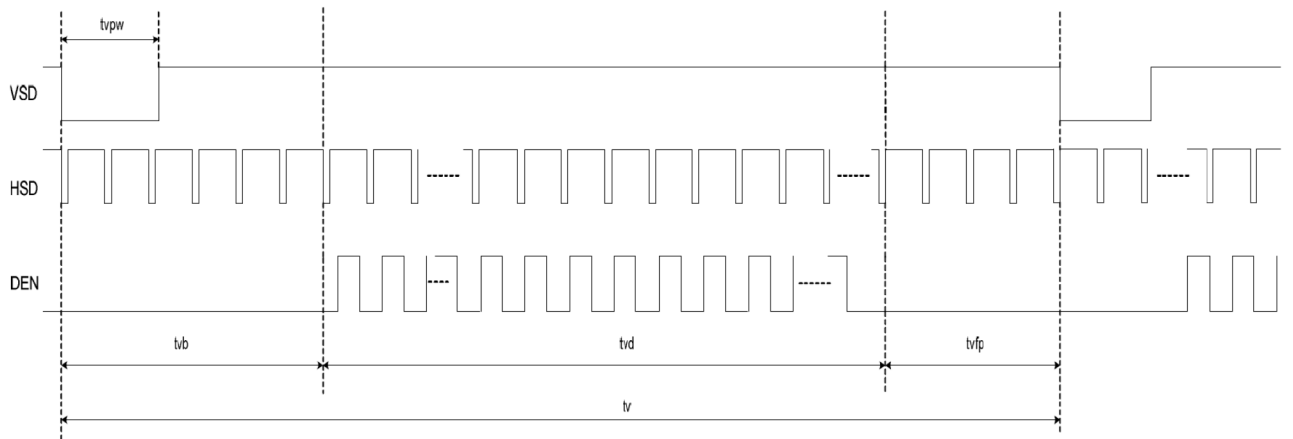
| Signal | Parameter | Symbol | Min. | Typ. | Max. | Unit. | Remark |
|-------------------|-------------------------|----------|------|------|------|-------|--------|
| DCLK | CLK frequency | fclk | 52 | 65 | 71 | MHz | |
| Horizontal Timing | Horizontal display area | Thd | 1024 | | | DCLK | |
| | HSYNC period time | Th | 1114 | 1344 | 1400 | DCLK | |
| | HSYNC Blanking | thb+thfp | 90 | 320 | 376 | DCLK | |
| Vertical Timing | Vertical display area | Tvd | 768 | | | TH | |
| | VSYNC Period time | Tv | 778 | 806 | 845 | TH | |
| | VSYNC Blanking | Tvb+tvfp | 10 | 38 | 77 | TH | |

3.1.5 Timing Characteristic

3.1.5.1 Horizontal Timing



3.1.5.2 Vertical Timing



4. Optical Characteristics

4.1 Optical characteristic of the LCD

The following items are measured under stable conditions. The optical characteristics should be measured in a dark room or equivalent state with the methods.

Measuring equipment: BM-7A

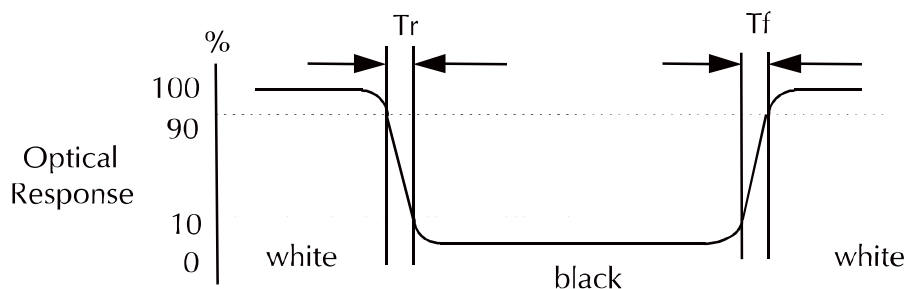
| Item | Symbol | Condition | Min | Type | Max | Unit | Note | |
|-------------------------------|--------------------------------|----------------------------|---------------------------|---------|---------|-------------------|--------|-------|
| Brightness | B | | (1000) | (1200) | -- | cd/m ² | | |
| Response Time | T _r +T _f | θ=0° | - | 30 | 40 | ms | . | |
| Contrast Ratio | CR | At optimized viewing angle | (600) | (900) | -- | -- | | |
| Luminance Uniformity | ΔL | | 70 | 75 | | % | | |
| Color Chromaticity (CIE 1931) | White | W _x | θ=0° Normal Viewing Angle | (0.28) | (0.33) | (0.38) | -- | BM-7A |
| | | W _y | | (0.348) | (0.398) | (0.448) | | |
| Viewing Angle | Hor. | θ _R | CR≥10 | 80 | 85 | -- | Degree | |
| | | θ _L | | 80 | 85 | -- | | |
| | Ver. | θ _U | | 80 | 85 | -- | | |
| | | θ _D | | 80 | 85 | -- | | |

a. Test equipment setup

After stabilizing and leaving the panel alone shall be warmed up for the stable operation of LCM, the measurement should be executed. Measurement should be executed in a stable, windless, and dark room. Optical specifications are measured by Topcon BM-7A(fast) with a viewing angle of 2° at a distance of 50cm and normal direction.

b. Definition of response time: Tr and Tf

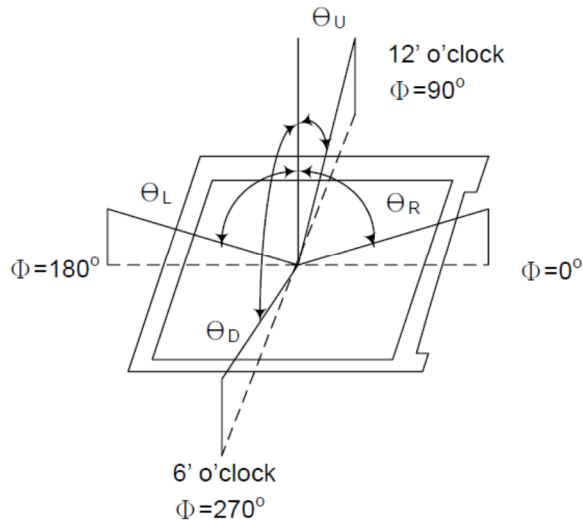
The response time is defined as the following figure and shall be measured by switching the input signal for "black" and "white".



c. Definition of contrast ratio:

$$\text{Contrast Ratio (CR)} = \frac{\text{Brightness measured when LCD is at "white state"}}{\text{Brightness measured when LCD is at "black state"}}$$

- d. Measured at the center area of the panel when all the input terminals of LCD panel are electrically opened.
- e. View Angle



- f. Definition of Luminance of White: Luminance of white at the center points

| | |
|---------------------------------|----------|
| Light Source of Back-Light Unit | LED Type |
|---------------------------------|----------|

- g. Definition of White Uniformity

$$\text{White Uniformity} = \frac{\text{Min. luminance of white among 9-points}}{\text{Max. luminance of white among 9-points}} \times 100\%$$

5. I/O Terminal

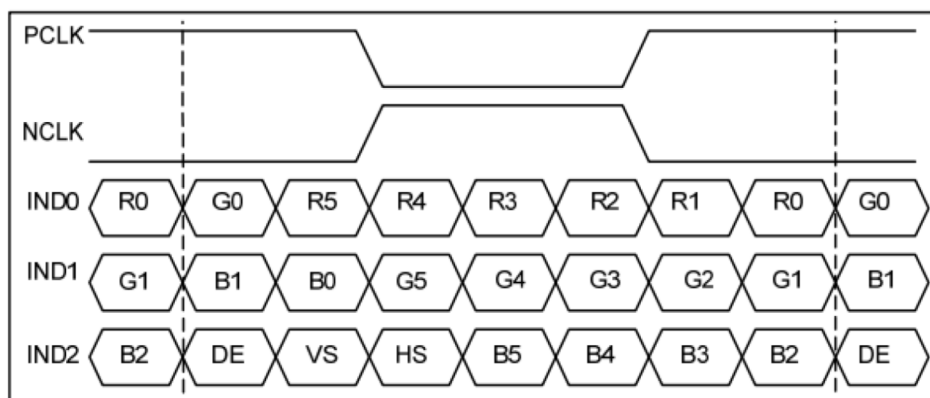
5.1 Pin Assignment (MSB24013P20A or equivalent.)

| Pin No. | Symbol | I/O | Function | Remark |
|---------|---------|-----|---|--------|
| 1 | VCC | P | Power Supply for LCM | |
| 2 | VCC | P | Power Supply for LCM | |
| 3 | SELB | I | 6bit/8bit mode select | Note 1 |
| 4 | GND | P | Ground | |
| 5 | RXI0- | I | Negative LVDS differential data 0 input | |
| 6 | RXI0+ | I | Positive LVDS differential data 0 input | |
| 7 | GND | P | Ground | |
| 8 | RXI1- | I | Negative LVDS differential data 1 input | |
| 9 | RXI1+ | I | Positive LVDS differential data 1 input | |
| 10 | GND | P | Ground | |
| 11 | RXI2- | I | Negative LVDS differential data 2 input | |
| 12 | RXI2+ | I | Positive LVDS differential data 2 input | |
| 13 | GND | P | Ground | |
| 14 | RXICLK- | I | Negative LVDS differential CLK input | |
| 15 | RXICLK+ | I | Positive LVDS differential CLK input | |
| 16 | GND | P | Ground | |
| 17 | RXI3- | I | Negative LVDS differential data 3 input | |
| 18 | RXI3+ | I | Positive LVDS differential data 3 input | |
| 19 | GND | P | Ground | |
| 20 | GND | P | Ground | |

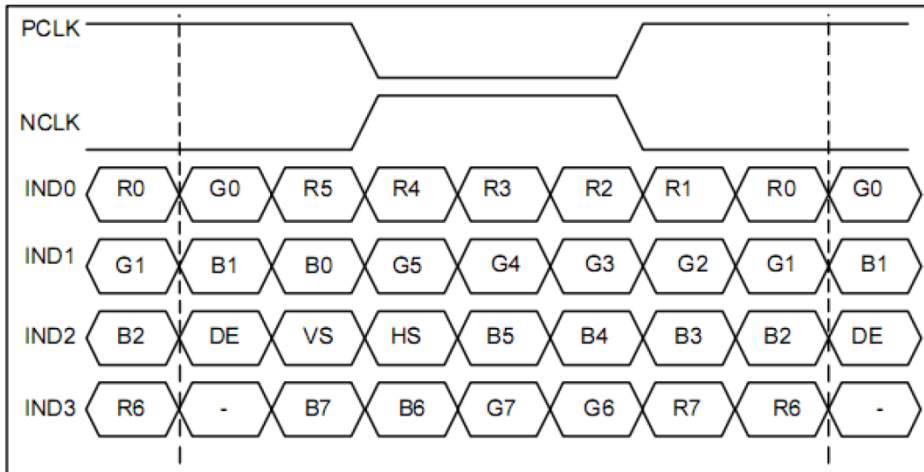
I: Input, O: Output, P: Power

Note 1: LVDS Input

6 bit LVDS Input

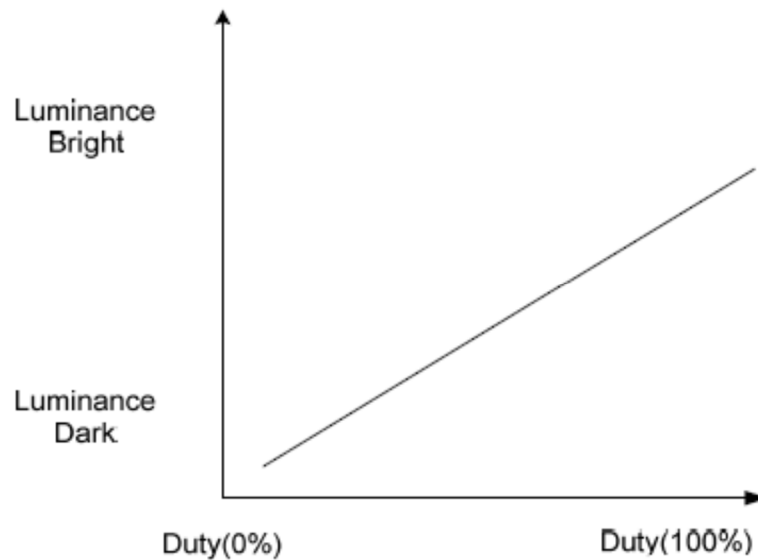


8 bit LVDS Input

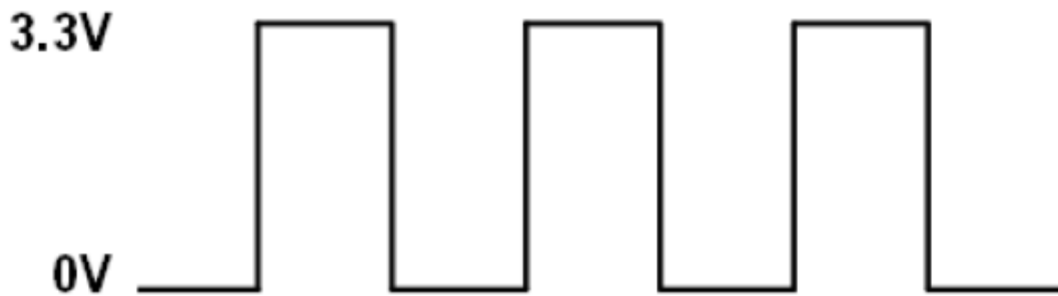


5.2 Backlight (CN2:ENTERY 3808K-F05N-03L or Equivalent)

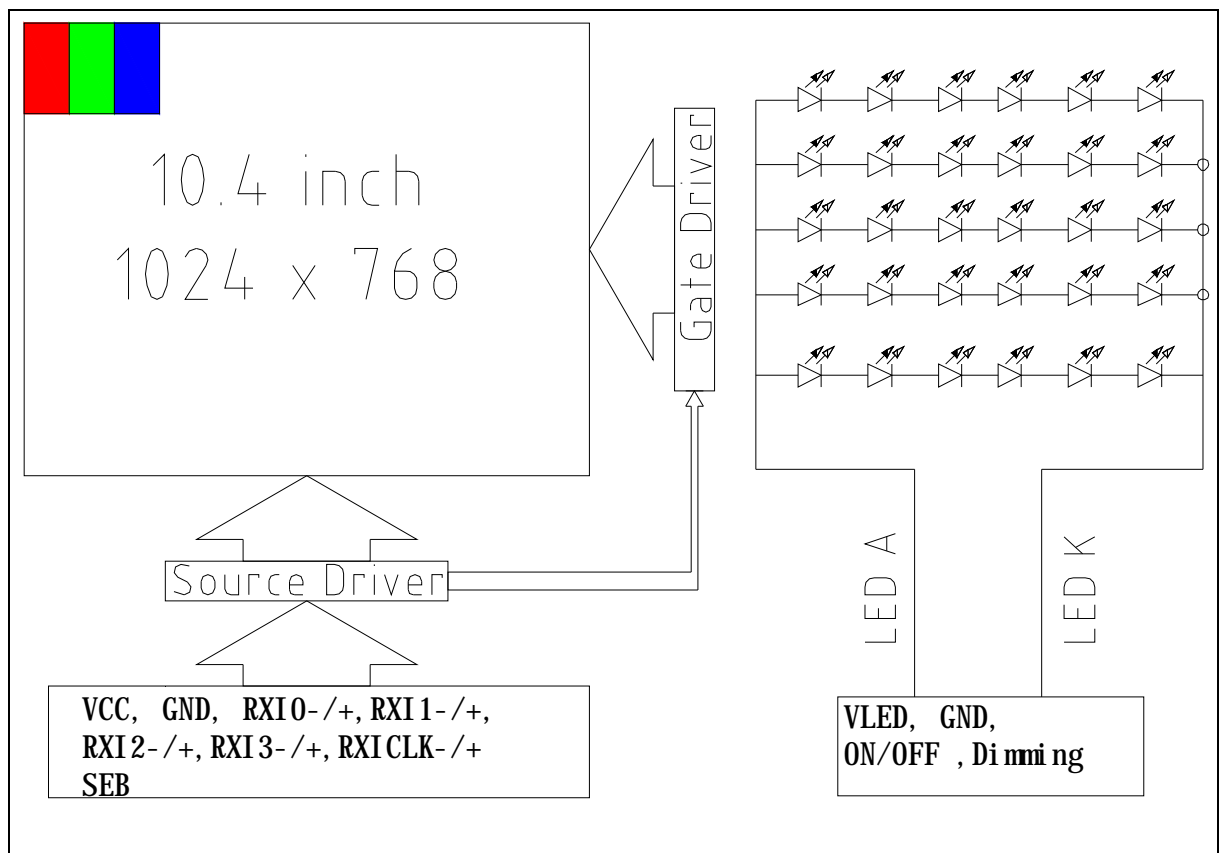
| Pin No. | Symbol | I/O | Function | Remark |
|---------|---------|-----|------------------------------------|--------|
| 1 | VLED | P | Power Supply voltage for Backlight | |
| 2 | GND | P | Ground | |
| 3 | ON/OFF | I | Backlight ON/OFF | |
| 4 | Dimming | I | Adjust brightness | Note 2 |
| 5 | GND | P | Ground | |



Note 2: Diming signal=0~3.3V, Operating frequency: 100Hz~1KHz



5.3 Block Diagram



6. Displayed Color and Input Data

| | Color & Gray Scale | Data Signal | | | | | | | | | | | | | | | | | |
|-------------|--------------------|-------------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| | | R5 | R4 | R3 | R2 | R1 | R0 | G5 | G4 | G3 | G2 | G1 | G0 | B5 | B4 | B3 | B2 | B1 | B0 |
| Basic Color | Black | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Red(0) | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Green(0) | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Blue(0) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Cyan | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Magenta | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Yellow | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| | White | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Red | Black | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Red(62) | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Red(61) | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| | Red(31) | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| | Red(1) | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Red(0) | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Green | Black | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Green(62) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Green(61) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| | Green(31) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| | Green(1) | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Green(0) | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Blue | Black | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Blue(62) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| | Blue(61) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| | Blue(31) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 |
| | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| | Blue(1) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 0 |
| | Blue(0) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 |

0 : Low level voltage, 1 :High level voltage

Each basic color can be displayed in 64 gray scales from 6 bit data signals. With the combination of total 18 bit data signals, the 262,144-color display can be achieved on the screen.

7. Reliability Condition

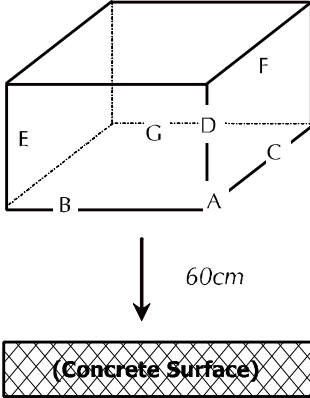
No change on display and in operation under the following test condition.

Condition: Unless otherwise specified, tests will be conducted under the following condition.

Temperature: 20±5°C.

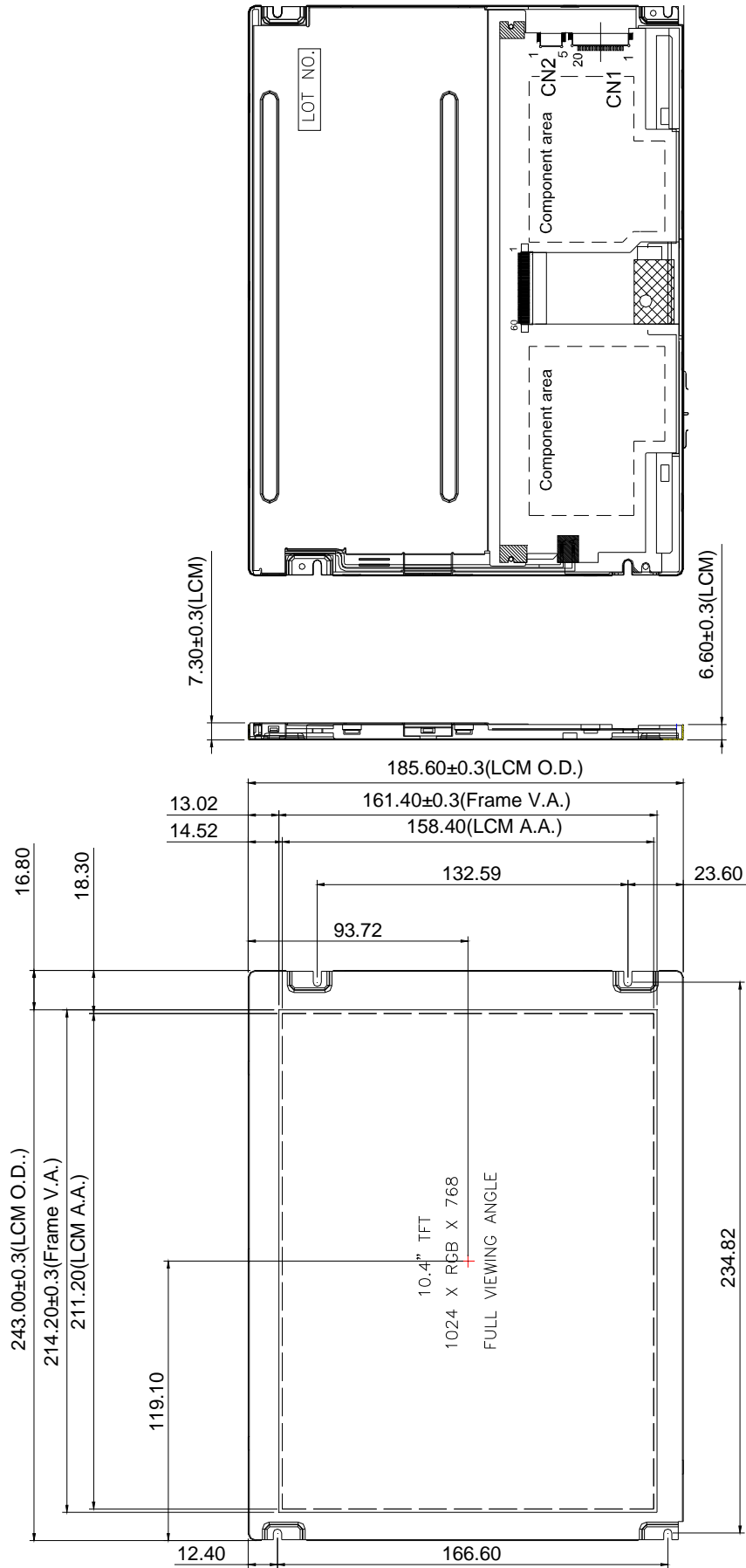
Humidity: 65±5%RH.

Tests will be not conducted under functioning state.

| No. | Parameter | Condition | Notes |
|-----|---|--|-------|
| 1 | High Temperature Operating | 70°C±2°C, 240hrs (Operation state). | |
| 2 | Low Temperature Operating | -20°C±2°C, 240hrs (Operation state). | 1 |
| 3 | High Temperature Storage | 80°C±2°C, 240hrs. | 2 |
| 4 | Low Temperature Storage | -30°C±2°C, 240hrs. | 1,2 |
| 5 | High Temperature and High Humidity Operation Test | 60°C±2°C, 90%, 240hrs. | 1,2 |
| 6 | Vibration Test | Total fixed amplitude: 1.5mm. Vibration Frequency: 10~55Hz. One cycle 60 seconds to 3 direction of Random each 15 minutes. | 3 |
| 7. | Drop Test | To be measured after dropping from 60cm high on the concrete surface in packing state.  <p><i>Dropping method corner dropping:</i></p> <p><i>A corner: Once edge dropping.</i></p> <p><i>B, C, D edge: Once face dropping.</i></p> <p><i>E, F, G face: Once.</i></p> | |

- Notes:
1. No dew condensation to be observed.
 2. The function test shall be conducted after 4 hours storage at the normal temperature and humidity after removed from the test chamber.
 3. Vibration test will be conducted to the product itself without putting I in a container.

8. Dimensional Outlines

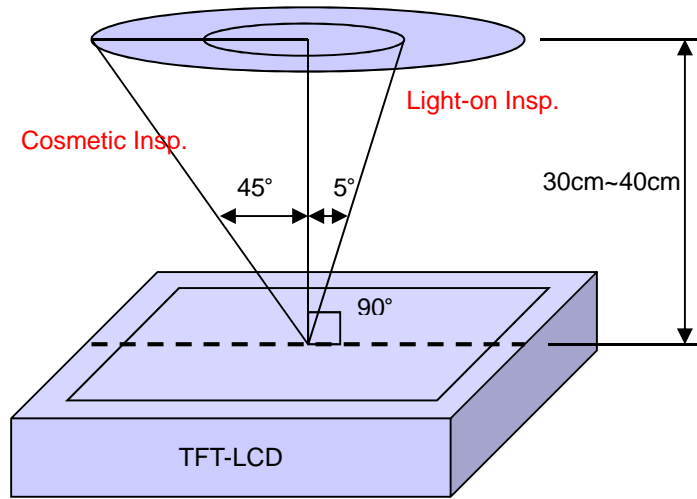


9. Incoming Inspection Standards

9.1 Inspection and Environment Conditions

9.1.1 Inspection Conditions:

- (1) Inspection Distance: 35 cm±5cm
- (2) View Angle : Light-on Inspection Angle : ±5°
Cosmetic Inspection Angle : ±45°



(perpendicular to LCD panel surface)

9.1.2 Environment Conditions:

| | | |
|----------------------|-----------------------|-------------------|
| Ambient Temperature | | 23°C±5°C |
| Ambient Humidity | | 55±10%RH |
| Ambient Illumination | Cosmetic Inspection | more than 600 Lux |
| | Functional Inspection | 300~500 Lux |

9.1.3 Sampling Conditions:

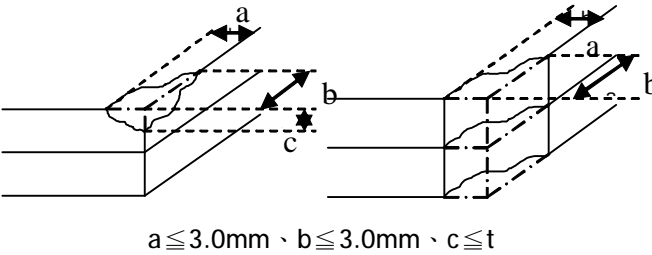
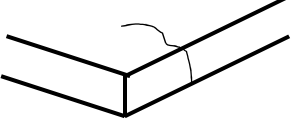
- (1) Lot Size: Quantity of shipment lot per model
- (2) Sampling Method:

| | | |
|---------------|--------------|------------------------------------|
| Sampling Plan | | MIL-STD-105E |
| | | Normal Inspection, Single Sampling |
| | | Level II |
| AQL | Major Defect | 1.0% |
| | Minor Defect | 1.5% |

- (3) The classification of Major(MA) and Minor(MI) defects is shown as 3. Inspection Criteria.

9.1.4 Inspection Criteria

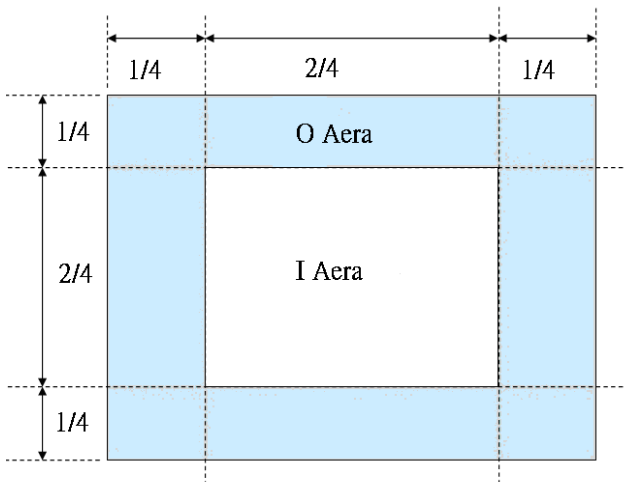
9.1.4.1 Cosmetic Inspection(Panel):

| Item | Judgment Criteria | Classification |
|---------------------------------------|---|----------------|
| Chipping on Panel |  <p>$a \leq 3.0\text{mm}$、$b \leq 3.0\text{mm}$、$c \leq t$ (Bottom glass thickness)</p> | MA |
| Scratch on Panel *Note-2 | <p>$W \leq 0.05\text{mm}$ or $L < 5\text{mm}$: Ignored $0.05\text{mm} < W \leq 0.1\text{mm}$ and $L \leq 5\text{mm}$: $N \leq 5$ $W > 0.1\text{mm}$ or $L > 5\text{mm}$: Not allowed</p> | MI |
| Bubble or Dent on Panel *Note-3 | <p>$D \leq 0.2\text{mm}$: Ignored $0.2\text{mm} < D \leq 0.5\text{mm}$: $N \leq 5$ $D > 0.5\text{mm}$: Not allowed</p> | MI |
| Panel Crack |  <p>Not Allowed crack</p> | MA |
| Bezel Deformation | Obvious deformation is not allowed. | MI |
| Bezel Oxidation | Not allowed if it rusts continuously over 1 cm (It is out of warranty with rusted tin plate) | MI |
| Bezel Scratch | $L \leq 20\text{mm}$, $W \leq 0.2$, $N \leq 3$ | MI |
| Metal Squash Dent /Flange(Front Side) | $D(W) \leq 1, L \leq 3, N \leq 3;$ | MI |
| B/L High Voltage Wire Denudation | Not allowed | MA |
| Polarizer Flaw or Leak out Resin | Defect is defined as the active area. | MI |
| Outline Dimension | Must in Spec, refer to related product spec. | MI |

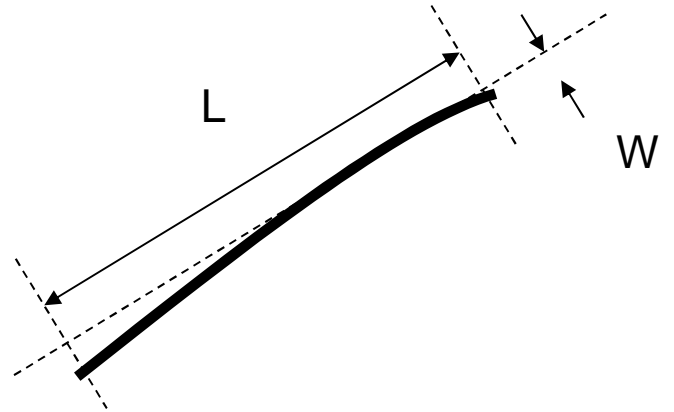
9.1.4.2 Functional Inspection:

| Item | Judgment Criteria | | | Classification |
|--|--|--|---------------------|----------------|
| | Area(Note1) | I | O | |
| Point Defect | Bright dot | Random | 2 | |
| | | 2 dots adjacent | 0 | 0 |
| | | 3 dots adjacent or more | 0 | 0 |
| | Dark dot | Random | 3 | |
| | | 2 dots adjacent | 0 | |
| | | 3 dots adjacent or more | 0 | 0 |
| | Total Dot Defect | | 5 | |
| | Distance | Distance between Bright and Bright dot | $L \geq 5\text{mm}$ | |
| | | Distance between Bright and Dark dot | $L \geq 5\text{mm}$ | |
| | | Distance between Dark dot | $L \geq 5\text{mm}$ | |
| (1) It is defined as Point Defect if defect area > 0.5dot (2) It is ignored if defect area ≤ 0.5dot (3) Weak point defect will be defined as Bright Dot if it can be observed through ND filter 5% (Full Screen Black Inspection) | | | | |
| Line Defect | Obvious vertical or horizontal line defect is not allowed. | | | MA |
| Mura | Not allowed if it can be observed through ND Filter 5 % | | | MI |
| Foreign Material in Spot Shape *Note-3 | $D \leq 0.2\text{mm}$: Ignored $0.2\text{mm} < D \leq 0.5\text{mm}$: $N \leq 8$ $D > 0.5\text{mm}$: Not allowed | | | MI |
| Foreign Material in Line or Spiral Shape *Note-4 | $W \leq 0.05\text{mm}$ or $L \leq 5\text{mm}$: Ignored $0.05\text{mm} < W \leq 0.2\text{mm}$ and $L 1.0\text{mm} \leq 5\text{mm}$: $N \leq 8$ $W > 0.2\text{mm}$ or $L > 5\text{mm}$: Not allowed | | | MI |
| Display Function Abnormal | No Malfunction can be allowed | | | MA |

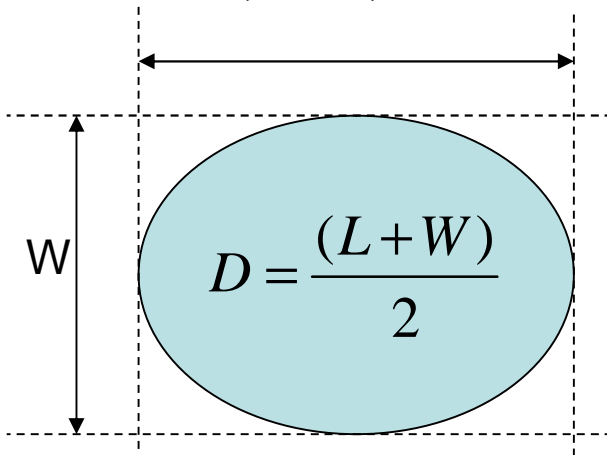
Note-1 : I/O Area Definition



Note-2 : Polarizer Scratch



Note-3 : Spot Foreign Material
($W \geq L / 4$)



Note-4 : Line or Spiral Foreign Material
($W < L / 4$)

