

|                  |            |                  |            |
|------------------|------------|------------------|------------|
| MDT0350D3ISC-RGB | 320 x 240  | RGB Interface    | TFT Module |
| Specification    |            |                  |            |
| Version: 2       |            | Date: 02/07/2021 |            |
| Revision         |            |                  |            |
| 1                | 01/01/2021 | First issue      |            |
| 2                | 02/07/2021 | Pin table update |            |

| Display Features      |                        |  |                  |
|-----------------------|------------------------|-------------------------------------------------------------------------------------|------------------|
| Display Size          | 3.5"                   |                                                                                     |                  |
| Resolution            | 320 x 240              |                                                                                     |                  |
| Orientation           | Landscape              |                                                                                     |                  |
| Appearance            | RGB                    |                                                                                     |                  |
| Logic Voltage         | 3.3V                   |                                                                                     |                  |
| Interface             | RGB                    |                                                                                     |                  |
| Brightness            | 400 cd/m <sup>2</sup>  |                                                                                     |                  |
| Touchscreen           | CTP                    |                                                                                     |                  |
| Module Size           | 76.90 x 63.90 x 4.89mm |                                                                                     |                  |
| Operating Temperature | -20°C ~ +70°C          |                                                                                     |                  |
| Pinout                | 54 way FFC             |                                                                                     |                  |
| Pitch                 | 0.5mm                  | Box Quantity                                                                        | Weight / Display |
|                       |                        | ---                                                                                 | ---              |

\* - For full design functionality, please use this specification in conjunction with the ST7272A specification.(Provided Separately)

| Display Accessories |             |
|---------------------|-------------|
| Part Number         | Description |
|                     |             |
|                     |             |
|                     |             |

| Optional Variants |         |
|-------------------|---------|
| Appearances       | Voltage |
|                   |         |
|                   |         |
|                   |         |



## General Specifications

| Feature         |                      | Spec                          |
|-----------------|----------------------|-------------------------------|
| Characteristics | Size                 | 3.5 inch                      |
|                 | Resolution           | 320(horizontal)*240(Vertical) |
|                 | Interface            | 24bit-RGB                     |
|                 | Connect type         | Connector                     |
|                 | Color Depth          | 16.7M                         |
|                 | Technology type      | a-Si                          |
|                 | Pixel pitch (mm)     | 0.219*0.219                   |
|                 | Pixel Configuration  | R.G.B.Stripe                  |
|                 | Display Mode         | Normally Black                |
|                 | CTP Driver IC        | GT911                         |
|                 | Driver IC            | ST7272A                       |
|                 | Viewing Direction    | Full view                     |
| Mechanical      | LCM (W x H x D) (mm) | 76.90*63.90*4.89              |
|                 | Active Area(mm)      | 70.08*52.56                   |
|                 | Weight (g)           | TBD                           |
|                 | LED Numbers          | 6 LEDs                        |

Note 1: Requirements on Environmental Protection: RoHs

Note 2: LCM weight tolerance: +/- 5%

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## Input/Output Terminals

| No.   | Symbol   | Description                                                        |
|-------|----------|--------------------------------------------------------------------|
| 1-2   | VBL-     | Backlight LED Cathode                                              |
| 3-4   | VBL+     | Backlight LED Anode.                                               |
| 5     | Y1(NC)   | Touch panel up side (NC)                                           |
| 6     | X1(NC)   | Touch panel right side (NC)                                        |
| 7     | NC       | -                                                                  |
| 8     | RESET    | System reset pin - Connect to VDD (pull high) in normal operation. |
| 9     | SPENB    | Chip Select - Leave pin OPEN when not used                         |
| 10    | SPCK     | Serial Clock - Leave pin OPEN when not used                        |
| 11    | SPDA     | Serial Data - Leave pin OPEN when not used                         |
| 12-19 | B0~B7    | Data bus                                                           |
| 20-27 | G0~G7    | Data bus                                                           |
| 28-35 | R0~R7    | Data bus                                                           |
| 36    | HSYNC    | Line Synchronous Signal                                            |
| 37    | VSYNC    | Frame Synchronous Signal                                           |
| 38    | DOTCLK   | Dot-clock signal and oscillator source                             |
| 39-40 | NC       | -                                                                  |
| 41-42 | VDD      | Power supply for logic operation                                   |
| 43    | Y2(NC)   | Touch panel bottom side (NC)                                       |
| 44    | X2(NC)   | Touch panel left side (NC)                                         |
| 45-47 | NC       | -                                                                  |
| 48    | IF2 (NC) | Control the input data format (NC)                                 |
| 49    | IF1 (NC) | Control the input data format (NC)                                 |
| 50    | IF0 (NC) | Control the input data format (NC)                                 |
| 51    | NC       | -                                                                  |
| 52    | DEN      | Display enable signal                                              |
| 53-54 | GND      | System Ground                                                      |

## CTP PIN-MAP

| Pin | Signal | Description                   |
|-----|--------|-------------------------------|
| 1   | GND    | Ground                        |
| 2   | VDD    | Power supply                  |
| 3   | INT    | Interrupt request to the host |
| 4   | SDA    | I2C data input and output     |
| 5   | SCL    | I2C clock input               |
| 6   | REST   | Reset Pin for CTP             |



## Absolute Maximum Rating

| Item                  | Symbol    | MIN  | Typ | MAX | Unit | Remark |
|-----------------------|-----------|------|-----|-----|------|--------|
| Supply Voltage        | $V_{DD}$  | -0.5 | -   | 5.0 | V    | -      |
| Operating Temperature | $T_{OPR}$ | -20  | -   | 70  | °C   | -      |
| Storage Temperature   | $T_{STG}$ | -30  | -   | 80  | °C   |        |

## Timing characteristics

### 1. ELECTRICAL CHARACTERISTICS

| Item                  |            | Symbol   | MIN      | TYP | MAX      | Unit | Remark |
|-----------------------|------------|----------|----------|-----|----------|------|--------|
| Supply Voltage        |            | $V_{CC}$ | 3.0      | 3.3 | 3.6      | V    |        |
|                       |            | IOVCC    | 1.65     | 3.0 | 3.3      |      |        |
| Input Signal Voltage  | Low Level  | $V_{IL}$ | GND      | -   | 0.1x VDD | V    |        |
|                       | High Level | $V_{IH}$ | 0.8x VDD | -   | VDD      | V    |        |
| Output Signal Voltage | Low Level  | $V_{OL}$ | 0        | -   | 0.2*VDD  | V    |        |
|                       | High Level | $V_{OH}$ | 0.8*VDD  | -   | VDD      | V    |        |

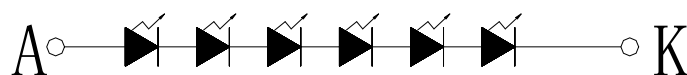
### 2. LED Driving Conditions

| Item                        | Symbol   | MIN  | TYP   | MAX  | Unit | Remark |
|-----------------------------|----------|------|-------|------|------|--------|
| Forward Current             | $I_F$    | -    | 20    | -    | mA   |        |
| Forward Voltage             | $V_F$    | 16.2 | 19.2  | 20.4 | V    |        |
| Backlight Power consumption | $W_{BL}$ | -    | 0.384 | -    | W    |        |
| LED Lifetime                |          | -    | 30000 | -    | Hrs  |        |

Note 1: Each LED:  $I_F = 20\text{ mA}$ ,  $V_F = 2.8 \sim 3.4\text{V}$ .

Note 2: Optical performance should be evaluated at  $T_a = 25^\circ\text{C}$  only.

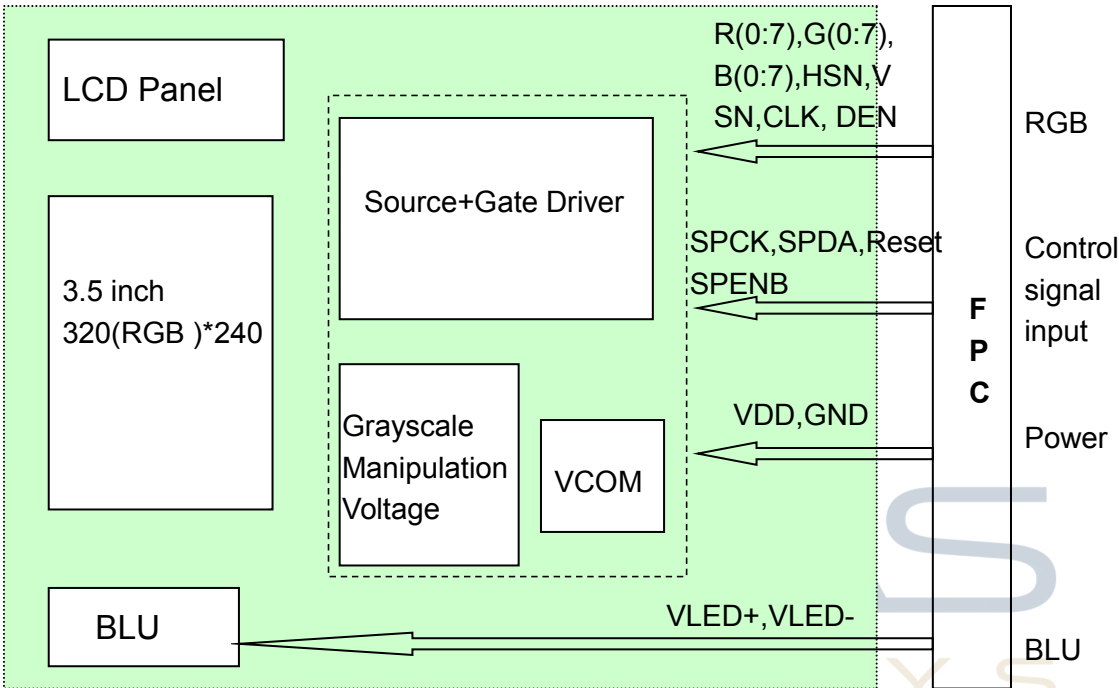
Note 3: If LED is driven by high current, high ambient temperature & humidity condition. The life Time of LED will be reduced. Operating life means brightness goes down to 50% initial brightness. Typical operating life time is estimated data.



CURRENT  $I_F = 20\text{mA}$

Figure: LED connection of backlight(Constant Current)

3. Block Diagram



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# Interface Timing

## 1. AC Electrical Characteristics

Test Condition: (VDD=VDDP=3.3V, VDDA=5.0V, GND=GNDA=GNDA=0V, TA= 25°C)

| Parameter                                           | Symbol                      | Min.     | Typ.  | Max. | Unit  | Conditions                                                                                 |
|-----------------------------------------------------|-----------------------------|----------|-------|------|-------|--------------------------------------------------------------------------------------------|
| <b>System Operation Timing</b>                      |                             |          |       |      |       |                                                                                            |
| VDD power source slew time                          | T <sub>POR</sub>            |          |       | 1000 | us    | From 0V to 90% VDD                                                                         |
| RSTB active pulse width                             | T <sub>RSTB</sub>           | 40       |       |      | us    | VDD = 3.3V                                                                                 |
| <b>Input Output Timing</b>                          |                             |          |       |      |       |                                                                                            |
| CLKIN clock time                                    | T <sub>clk</sub>            | 33.3/125 | -     | -    | ns    | Please refer to timing table(p.32)                                                         |
| HSD to CLKIN                                        | T <sub>hc</sub>             | -        | -     | 1    | CLKIN |                                                                                            |
| HSD width                                           | T <sub>hwh</sub>            | 1        | -     | -    | CLKIN |                                                                                            |
| VSD width                                           | T <sub>vwh</sub>            | 1        | -     | -    | Th    |                                                                                            |
| HSD period time                                     | T <sub>h</sub>              | 60       | 63.56 | 67   | us    |                                                                                            |
| VSD setup time                                      | T <sub>vst</sub>            | 8        | -     | -    | ns    |                                                                                            |
| VSD hold time                                       | T <sub>vhd</sub>            | 10       | -     | -    | ns    |                                                                                            |
| HSD setup time                                      | T <sub>hst</sub>            | 8        | -     | -    | ns    |                                                                                            |
| HSD hold time                                       | T <sub>hhd</sub>            | 10       | -     | -    | ns    |                                                                                            |
| Data set-up time                                    | T <sub>dsu</sub>            | 8        | -     | -    | ns    | DIN[23:0] to CLKIN                                                                         |
| Data hold time                                      | T <sub>dhd</sub>            | 10       | -     | -    | ns    | DIN[23:0] to CLKIN                                                                         |
| DEN setup time                                      | T <sub>esd</sub>            | 12       | -     | -    | ns    | DEN to CLKIN                                                                               |
| Time that VSD to 1 <sup>st</sup> line data input    | T <sub>vs</sub>             | 2        | 13    | 127  | Th    | @CCIR601 / 8bit RGB HV mode<br>Control by HDLY[6:0] setting<br>T <sub>vs</sub> = HDLY[6:0] |
| Time that CCIR_V to 1 <sup>st</sup> line data input | T <sub>vs</sub>             | 12       | 20    | 28   | Th    | @CCIR656 NTSC mode<br>Control by HDLY[6:0] setting<br>T <sub>vs</sub> = HDLY[6:0]          |
| Time that CCIR_V to 1 <sup>st</sup> line data input | T <sub>vs</sub> 17 25 33 Th |          |       |      |       | @CCIR656 PAL mode<br>Control by HDLY[6:0] setting<br>T <sub>vs</sub> = HDLY[6:0]           |
| Time that VSD to 1 <sup>st</sup> line data input    | T <sub>vs</sub>             | 2        | 13    | 127  | Th    | @24bit RGB HV mode<br>Control by HDLY[6:0] setting<br>T <sub>vs</sub> = HDLY[6:0]          |
| Source output stable time 1                         | T <sub>st</sub>             | -        | 25    | 30   | us    | 96% final, CL=30pF, RL=2K                                                                  |
| Gate output stable time                             | T <sub>gst</sub>            | -        | 500   | 1000 | ns    | 96% final, CL=40pF                                                                         |
| VCOMOUT output stable time                          | T <sub>cst</sub>            | -        | 4     | 8    | us    | 96% final, CL=33nF, RL=100ohm                                                              |
| <b>3-wire serial communication AC timing</b>        |                             |          |       |      |       |                                                                                            |
| Serial clock                                        | T <sub>spck</sub>           | 320      | -     | -    | ns    |                                                                                            |
| SPCK pulse duty                                     |                             | 40       | 50    | 60   | %     | T <sub>ckh</sub> / T <sub>spck</sub>                                                       |
| Serial data setup time                              | T <sub>isu</sub>            | 120      | -     | -    | ns    |                                                                                            |
| Serial data hold time                               | T <sub>ihd</sub>            | 120      | -     | -    | ns    |                                                                                            |
| Serial clock high/low                               | T <sub>ckh/l</sub>          | 120      | -     | -    | ns    |                                                                                            |
| Chip select distinguish                             | T <sub>cd</sub>             | 1        | -     | -    | us    |                                                                                            |
| SPENB to VSD                                        | T <sub>cv</sub>             | 1        | -     | -    | us    |                                                                                            |
| SPENB input setup time                              | T <sub>eck</sub>            | 150      | -     | -    | ns    |                                                                                            |
| SPENB input hold time                               | T <sub>cke</sub>            | 150      | -     | -    | ns    |                                                                                            |

## 2. DC Electrical Characteristics

### Recommended Operating Range

| Item                       | Symbol | Min. | Typ. | Max. | Unit | Conditions |
|----------------------------|--------|------|------|------|------|------------|
| Supply Voltage             | VDD    | 3.0  | 3.3  | 3.6  | V    |            |
| IO Supply Voltage          | VDDI   | 3.0  | -    | 3.6  | V    |            |
| Charge Pump Supply Voltage | PVDD   | 3.0  | 3.3  | 3.6  | V    |            |

### DC Characteristics for Digital Circuit

| Item                      | Symbol | Min.     | Typ. | Max.     | Unit | Conditions |
|---------------------------|--------|----------|------|----------|------|------------|
| Logic-High Input Voltage  | Vih    | 0.7VDDI  | -    | VDDI     | V    |            |
| Logic-Low Input Voltage   | Vil    | DGND     | -    | 0.3VDDI  | V    |            |
| Logic-High Output Voltage | Voh    | VDDI-0.4 | -    | VDDI     | V    |            |
| Logic-Low Output Voltage  | Vol    | DGND     | -    | DGND+0.4 | V    |            |

### DC Characteristics for Analog Circuit

| Item                        | Symbol | Min. | Typ. | Max. | Unit | Conditions          |
|-----------------------------|--------|------|------|------|------|---------------------|
| Positive High-Voltage Power | VGH    | 13   | 15   | 16.5 | V    | No Load@<br>FR=60Hz |
| Negative High-Voltage Power | VGL    | -7   | -10  | -11  | V    |                     |
| Output Voltage Deviation    | Vod    | -    | ±35  | ±45  | mV   |                     |
| Standby Current             | Isc    | -    |      | 50   | uA   |                     |
| Operation Current           | Ioc    | -    | 20   |      | mA   |                     |

### 3. 24 Bit RGB Mode

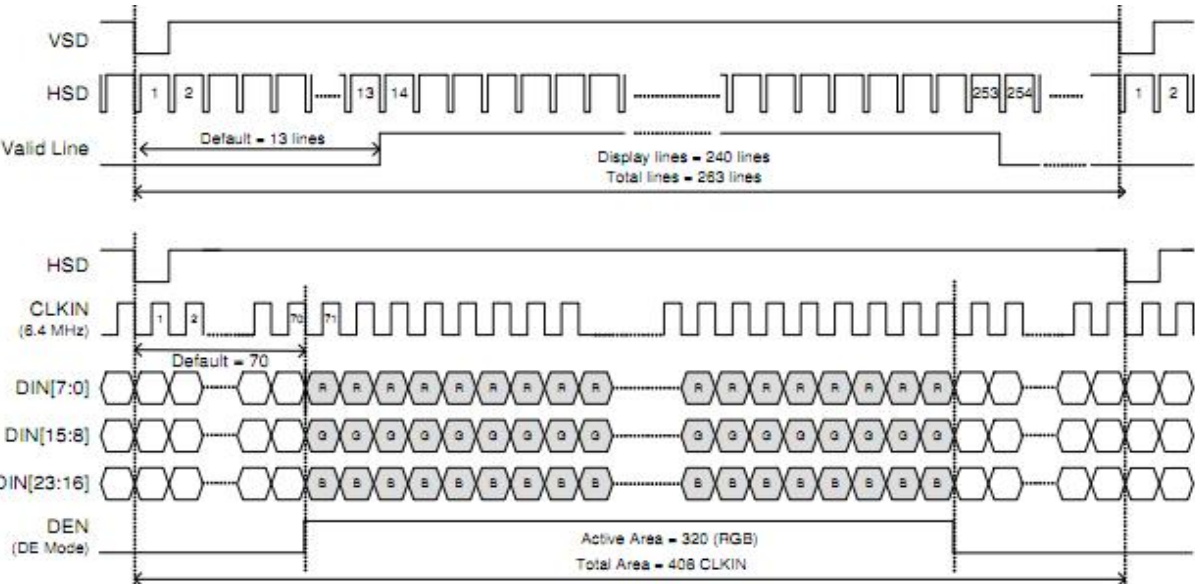
Parallel 24-bit RGB Input Timing (PVDD=VDD=VDDI= 3.3V, AGND= 0V, TA=25°C)

| Parallel 24-bit RGB Input Timing Table |                |        |      |      |      |                                                                                              |
|----------------------------------------|----------------|--------|------|------|------|----------------------------------------------------------------------------------------------|
| Item                                   | Symbol         | Min.   | Typ. | Max. | Unit | Note                                                                                         |
| DCLK Frequency                         | Fclk           | 5      | 6    | 8    | MHz  |                                                                                              |
| DCLK Period                            | Tclk           | 125    | 167  | 200  | ns   |                                                                                              |
| HSYNC                                  | Period Time    | Th     | 325  | 371  | 438  | DCLK                                                                                         |
|                                        | Display Period | Thdisp |      | 320  |      | DCLK                                                                                         |
|                                        | Back Porch     | Thbp   | 3    | 43   | 43   | DCLK<br>SYNC mode back porch control<br>by H_BLANKING[7:0] setting<br>Thbp= H_BLANKING[7:0]  |
|                                        | Front Porch    | Thfp   | 2    | 8    | 75   | DCLK                                                                                         |
|                                        | Pulse Width    | Thw    | 2    | 4    | 43   | DCLK                                                                                         |
| VSYNC                                  | Period Time    | Tv     | 244  | 260  | 289  | HSYNC                                                                                        |
|                                        | Display Period | Tvdisp |      | 240  |      | HSYNC                                                                                        |
|                                        | Back Porch     | Tvbp   | 2    | 12   | 12   | HSYNC<br>SYNC mode back porch control<br>by V_BLANKING[7:0] setting<br>Tvbp= V_BLANKING[7:0] |
|                                        | Front Porch    | Tvfp   | 2    | 8    | 37   | HSYNC                                                                                        |
|                                        | Pulse Width    | Tvw    | 2    | 4    | 12   | HSYNC                                                                                        |

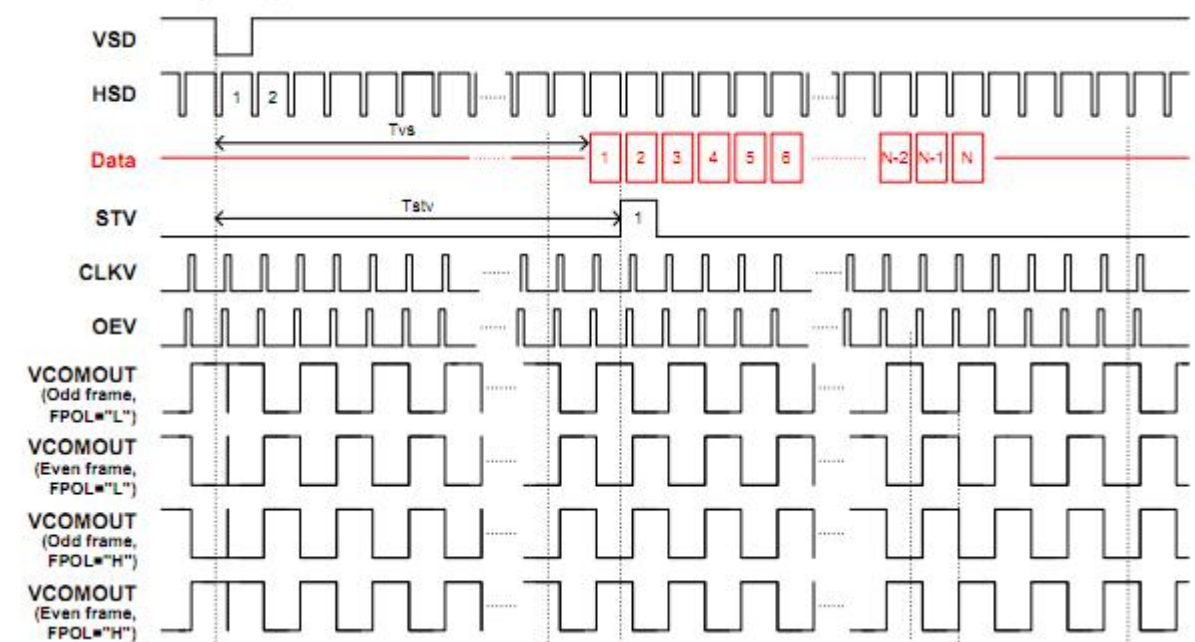
Note: It is necessary to keep Tvbp =12 and Thbp =43 in sync mode. DE mode is unnecessary to keep it.



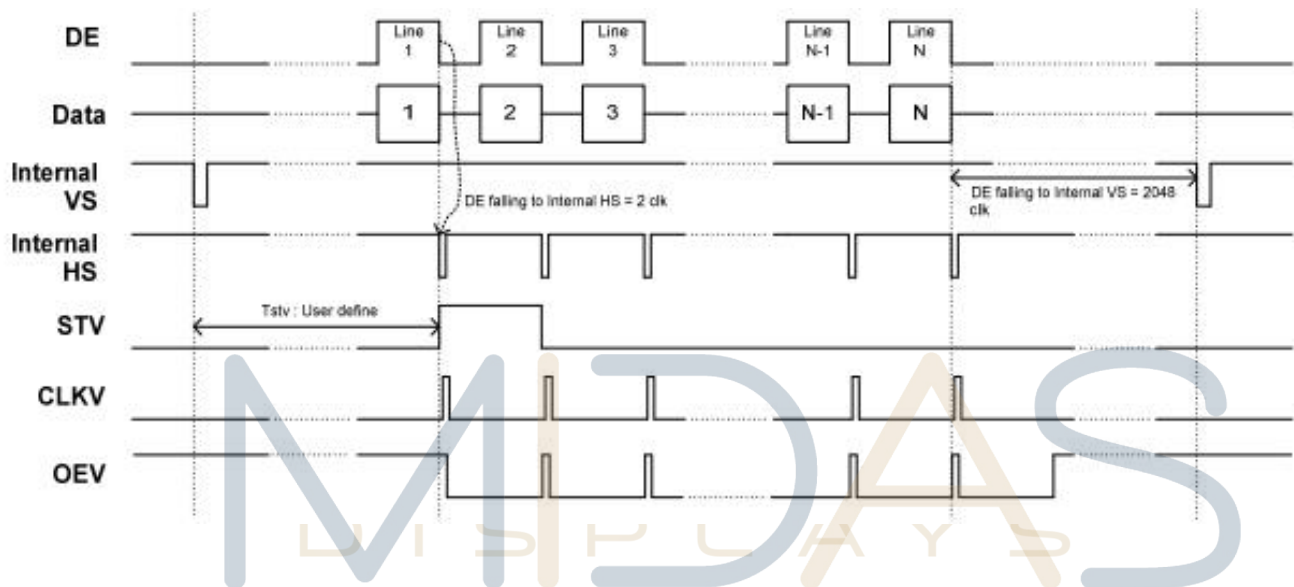
#### 4. Input Data Timing



#### 5. Vertical Timing Diagram (HV Mode)



## 6. Vertical Timing Diagram (DE Mode)



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## Optical Characteristics

| Items                |       | Symbol            | Condition                                    | Min. | Typ. | Max. | Unit  | Remark           | Note  |
|----------------------|-------|-------------------|----------------------------------------------|------|------|------|-------|------------------|-------|
| Response time        |       | Tr+Tf             | -                                            | -    | 50   | 80   | ms    | FIG.1            | Note4 |
| Contrast Ratio       |       | CR                |                                              | -    | 600  | -    | -     | FIG.2            | Note1 |
| Surface luminance    |       | LV                | $\theta=0^\circ$                             | 350  | 400  | -    | cd/m2 | FIG.2            | Note2 |
| Luminance uniformity |       | Yu                | $\theta=0^\circ$                             | 75   | 80   | -    | %     | FIG.2            | Note3 |
| NTSC                 |       | -                 | $\theta=0^\circ$                             | -    | 50   | -    | %     | FIG.2            | Note5 |
| Viewing angle        |       | $\theta$<br>Cr>10 | $\phi=90^\circ$                              | -    | 80   | -    | deg   | FIG.3            | Note6 |
|                      |       |                   | $\phi=270^\circ$                             | -    | 80   | -    | deg   | FIG.3            |       |
|                      |       |                   | $\phi=0^\circ$                               | -    | 80   | -    | deg   | FIG.3            |       |
|                      |       |                   | $\phi=180^\circ$                             | -    | 80   | -    | deg   | FIG.3            |       |
| Chromaticity         | Red   | R <sub>x</sub>    | $\theta=0^\circ$<br>$\phi=0^\circ$<br>Ta=25° | TBD  | TBD  | TBD  | -     | FIG.2<br>CIE1931 | Note5 |
|                      |       | R <sub>y</sub>    |                                              | TBD  | TBD  | TBD  | -     |                  |       |
|                      | Green | G <sub>x</sub>    |                                              | TBD  | TBD  | TBD  | -     |                  |       |
|                      |       | G <sub>y</sub>    |                                              | TBD  | TBD  | TBD  | -     |                  |       |
|                      | Blue  | B <sub>x</sub>    |                                              | TBD  | TBD  | TBD  | -     |                  |       |
|                      |       | B <sub>y</sub>    |                                              | TBD  | TBD  | TBD  | -     |                  |       |
|                      | White | W <sub>x</sub>    |                                              | TBD  | TBD  | TBD  | -     |                  |       |
|                      |       | W <sub>y</sub>    |                                              | TBD  | TBD  | TBD  | -     |                  |       |

### Note1. Definition of contrast ratio

Contrast ratio(Cr) is defined mathematically by the following formula. For more information see FIG.2.

$$\text{Contrast ratio} = \frac{\text{Luminance with all pixels white}}{\text{Luminance with all pixels black}}$$

For contrast ratio, Surface Luminance, Luminance uniformity and CIE,the testing data is base on TOPCON's BM-5 or BM-7 photo detector or compatible.

### Note2. Definition of surface luminance.

Surface luminance is the luminance with all pixels displaying white. For more information see FIG.2.

Lv = Average Surface Luminance with all white pixels(P1,P2,P3, .....,Pn)

### Note3. Definition of luminance uniformity



The luminance uniformity in surface luminance is determined by measuring luminance at each test position 1 through n, and then dividing the maximum luminance of n points luminance by minimum luminance of n points luminance. For more information see FIG.2.

$$YU = \frac{\text{Minimum surface luminance with all white pixels (P1,P2,P3,.....,Pn)}}{\text{Maximum surface luminance with all white pixels (P1,P2,P3,.....,Pn)}}$$

#### Note4. Definition of response time

The response time is defined as the LCD optical switching time interval between “White” state and “Black” state. Rise time ( $T_r$ ) is the time between photo detector output intensity changed from 90% to 10%. And fall time ( $T_f$ ) is the time between photo detector output intensity changed from 10% to 90%. For additional information see FIG1.

#### Note5. Definition of color chromaticity (CIE1931)

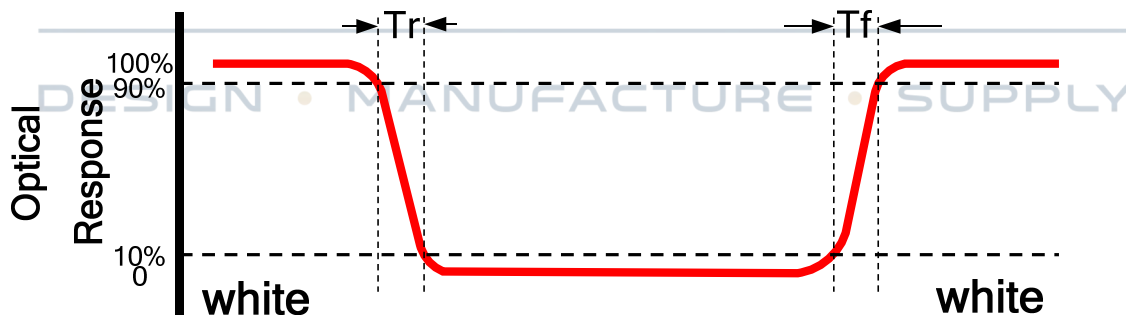
CIE (x,y) chromaticity, The x,y value is determined by screen active area center position P5. For more information see FIG.2.

#### Note6. Definition of viewing angle

Viewing angle is the angle at which the contrast ratio is greater than 10. Angles are determined for the horizontal or x axis and the vertical or y axis with respect to the z axis which is normal to the LCD surface. For more information see FIG.3.

For viewing angle and response time testing, the testing data is base on Autronic-Melchers’s ConoScope or DMS series Instruments or compatible.

**FIG.1. The definition of response Time**



**FIG.2. Measuring method for contrast ratio, surface luminance,**

#### **luminance uniformity, CIE (x,y) chromaticity**

Size :  $S \leq 5''$  (see Figure a) A : 5 mm B : 5 mm

H,V : Active area

Light spot size  $\varnothing = 5\text{mm}$  (BM-5) or  $\varnothing = 7.7\text{mm}$  (BM-7) 50cm distance or compatible distance from the LCD surface to detector lens.

test spot position : see Figure a.

measurement instrument : TOPCON’s luminance meter BM-5 or BM-7 or compatible (see Figure c).

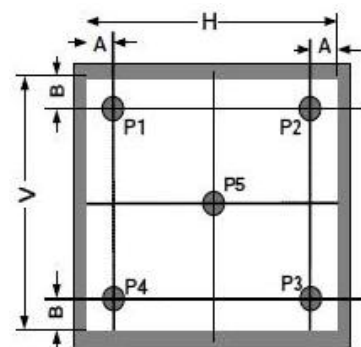


Figure a

Size :  $5'' < S \leq 12.3''$  (see Figure b) H,V : Active area

Light spot size  $\varnothing = 5\text{mm}$  (BM-5) or  $\varnothing = 7.7\text{mm}$  (BM-7) 50cm distance or compatible distance from the LCD surface to detector lens.

test spot position : see Figure b.

measurement instrument : TOPCON's luminance meter BM-5 or BM-7 or compatible (see Figure c).

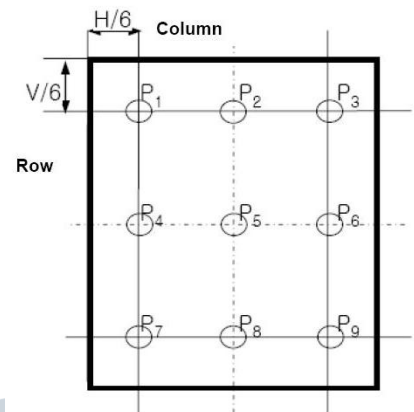


Figure b

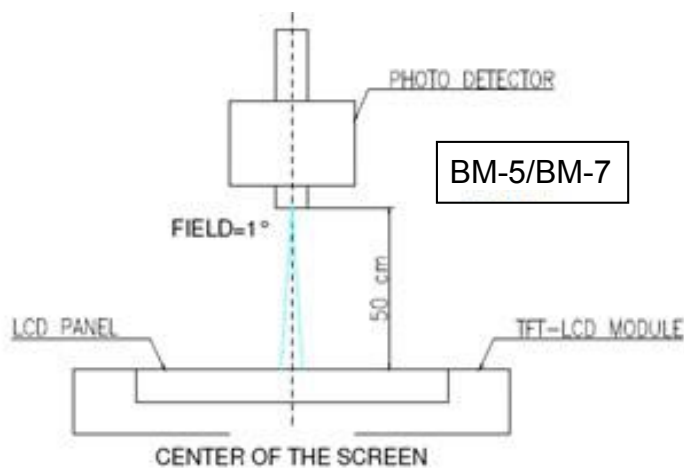
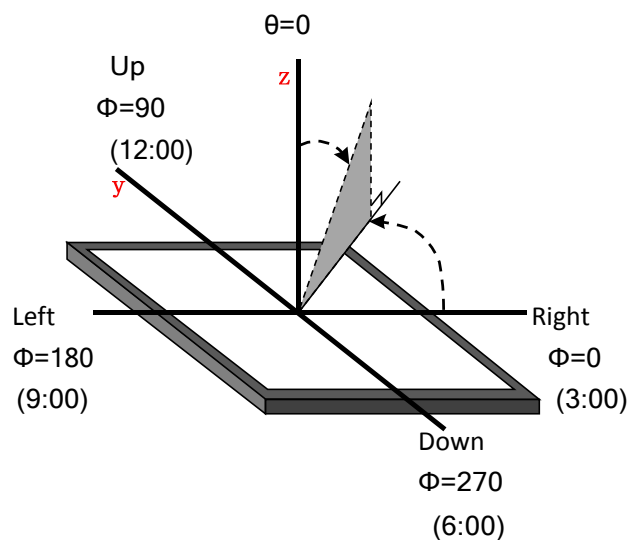


Figure c

FIG.3.The definition of viewing angle



## Environmental / Reliability Tests

| No | Test Item                             | Condition                                                                                                                                   | Remarks                                                                                            |
|----|---------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------|
| 1  | High Temperature Operation            | Ts= +85℃, 96hrs                                                                                                                             | IEC60068-2-1:2007<br>GB2423. 2-2008                                                                |
| 2  | Low Temperature Operation             | Ta= -30℃, 96hrs                                                                                                                             | IEC60068-2-1:2007<br>GB2423.1-2008                                                                 |
| 3  | High Temperature Storage              | Ta= +85℃, 96hrs                                                                                                                             | IEC60068-2-1:2007<br>GB2423. 2-2008                                                                |
| 4  | Low Temperature Storage               | Ta= -30℃, 96hrs                                                                                                                             | IEC60068-2-1:2007<br>GB2423.1-2008                                                                 |
| 5  | High Temperature & Humidity Operation | Ta= +60℃, 90% RH max, 96 hours                                                                                                              | IIEC60068-2-78:2001<br>GB/T2423.3-2006                                                             |
| 6  | Thermal Shock (Non-operation)         | -30℃ 30 min ~ +80℃ 30 min<br>Change time: 5min, 20 Cycle                                                                                    | Start with cold temperature,<br>end with high temperature<br>IEC60068-2-14:1984,<br>GB2423.22-2002 |
| 7  | ESD                                   | C=150pF, R=330 Ω,<br>5 points/panel ,<br>Air:±8KV, 5 times<br>Contact: ±4KV, 5 times<br>(Environment: 15℃ ~ 35℃, 30% ~ 60%, 86Kpa ~ 106Kpa) | IEC61000-4-2:2001<br>GB/T17626.2-2006                                                              |
| 8  | Vibration (Non-operation)             | Frequency range: 10~55Hz,<br>Stroke: 1.5mm ,<br>Sweep: 10Hz~55Hz~10Hz<br>2 hours for each direction of X .Y. Z.<br>(6 hours for total)      | IEC60068-2-6:1982<br>GB/T2423.10-1995                                                              |
| 9  | Mechanical Shock (Non-operation)      | Half Sine Wave<br>60G ,6ms,±X,±Y,±Z<br>3times for each direction                                                                            | IEC60068-2-27:1987<br>GB/T2423.5—1995                                                              |
| 10 | Package Drop Test                     | Height: 60 cm,<br>1 corner, 3 edges, 6 surfaces                                                                                             | IEC60068-2-32:1990<br>GB/T2423.8-1995                                                              |



Notes:

1. The test result shall be evaluated after the sample has been left at room temperature and humidity for 2 hours without load. No condensation shall be accepted. The sample will not be accepted if appear these defects:

1).Air bubble in the LCD;

2).Seal leak

3).Non-display

4).missing segments

5).Glass crack

6).CR reduction >40%

7).IDD increase >100%

8).Brightness reduction >50%

9).Color coordinate tolerance >0.05

2.≤7.0 inch: The size of sample is 5pcs;

>7.0 inch: The size of sample is 2pcs;

3. One test sample must complete each test item;

4.In case of malfunction defect caused by ESD damage, if it would be recovered to normal state after resetting, it would be judge as a good part.

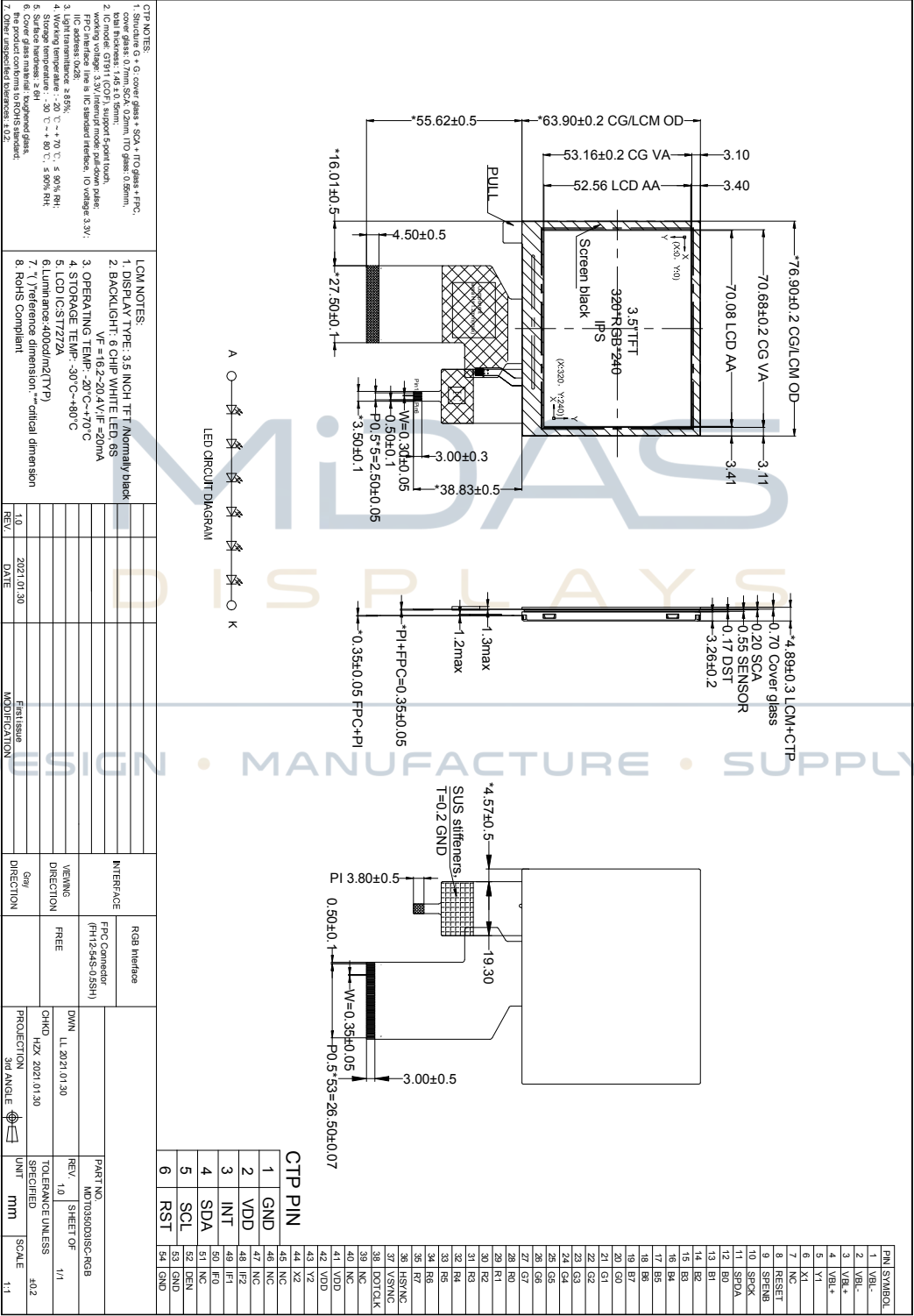
5.In the test of High Temperature Operation and High Temperature & Humidity Operation ,the operation temperature is the surface temperature of module.

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# TFT-LCD Module Inspection Criteria

## 1. Scope

The incoming inspection standards shall be applied to TFT –LCD Modules (hereinafter Called "Modules") that supplied by Midas Displays.

## 2. Incoming Inspection

The customer shall inspect the modules within twenty calendar days of the delivery date (the "inspection period") at its own cost. The result of the inspection (acceptance or rejection) shall be recorded in writing, and a copy of this writing will be promptly sent to The seller, If the results of the inspecting from buyer does not send to the seller within twenty Calendar days of the delivery date. The modules shall be regards as acceptance. Should the customer fail to notify the seller within the inspection period, the buyers Right to reject the modules shall be lapsed and the modules shall be deemed to have Been accepted by the buyer

## 3. Inspection Sampling

- 3.1. Lot size: Quantity per shipment lot per model
- 3.2. Sampling type: Normal inspection, Single sampling
- 3.3. Inspection level: II
- 3.4. Sampling table: MIL-STD-105E
- 3.5. Acceptable quality level (AQL )  
Major defect: AQL=0.65 Minor defect: AQL=1.00

## 4. Inspection Conditions

### 4.1 Ambient conditions:

- a. Temperature: Room temperature  $25 \pm 5^{\circ}\text{C}$
- b. Humidity:  $(60 \pm 10) \% \text{RH}$
- c. Illumination: Single fluorescent lamp non-directive (300 to 700 Lux)

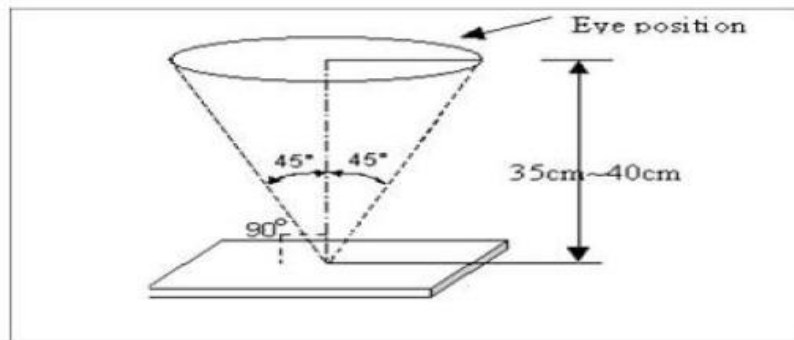
### 4.2 Viewing distance

The distance between the LCD and the inspector's eyes shall be at least  $35 \pm 5 \text{ cm}$ .

### 4.3 Viewing Angle

U/D:  $45^{\circ}/45^{\circ}$ , L/R:  $45^{\circ}/45^{\circ}$





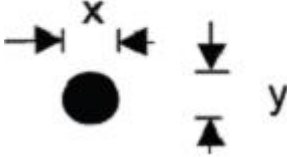
## 5. Inspection Criteria

Defects are classified as major defects and minor defects according to the degree of Defectiveness defined herein.

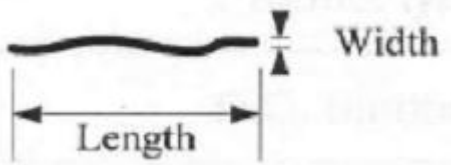
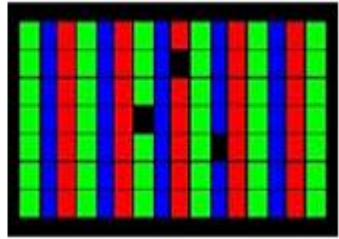
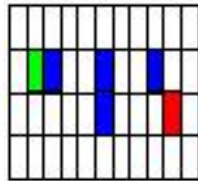
### 5.1 Major defect

| Item No | Items to be inspected  | Inspection Standard                                                          |
|---------|------------------------|------------------------------------------------------------------------------|
| 5.1.1   | All functional defects | 1) No display<br>2) Display abnormally<br>3) Short circuit<br>4) line defect |
| 5.1.2   | Missing                | Missing function component                                                   |
| 5.1.3   | Crack                  | Glass Crack                                                                  |

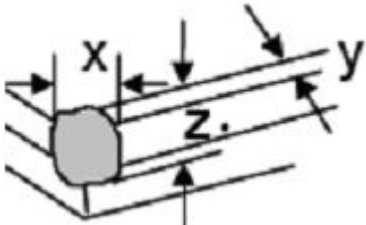
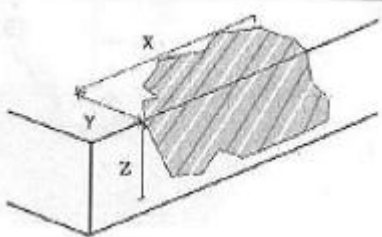
### 5.2 Minor defect

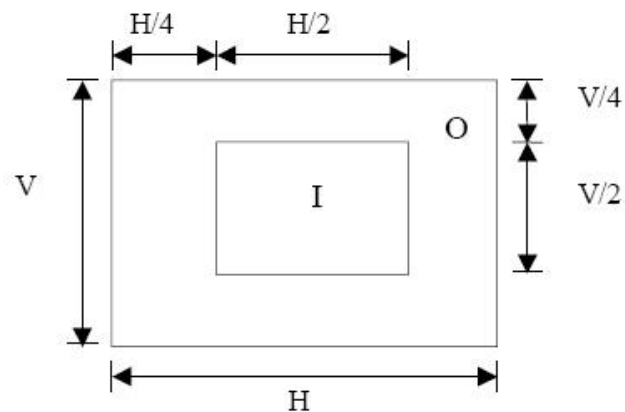
| Item No | Items to be inspected                                                                     | Inspection standard                                                                                                                      |                     |
|---------|-------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------|---------------------|
| 5.2.1   | Spot Defect<br>Including Black spot White spot<br>Pinhole Foreign particle Polarizer dirt | For dark/white spot is defined<br>$\phi = (x+y) / 2$  |                     |
|         |                                                                                           | Size $\phi$ (mm)                                                                                                                         | Acceptable Quantity |
|         |                                                                                           | $\phi \leq 0.05$                                                                                                                         | Ignore              |
|         |                                                                                           | $0.05 < \phi \leq 0.15$                                                                                                                  | 2                   |
|         |                                                                                           | $0.15 < \phi$                                                                                                                            | Not allowed         |



|       |                                                     |                                                                                                                                                                                                                                                                                                                           |  |                     |   |                |
|-------|-----------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|---------------------|---|----------------|
| 5.2.2 | Polarizer dirt, particle                            | Size $\phi$ (mm)                                                                                                                                                                                                                                                                                                          |  | Acceptable Quantity |   |                |
|       |                                                     | $\phi \leq 0.15$                                                                                                                                                                                                                                                                                                          |  | 1                   |   |                |
|       |                                                     | $\Phi > 0.15$                                                                                                                                                                                                                                                                                                             |  | Not allowed         |   |                |
| 5.2.3 | Line Defect Including Black line White line Scratch | Define:<br>                                                                                                                                                                                                                             |  |                     |   |                |
|       |                                                     | Width(mm) Length(mm)                                                                                                                                                                                                                                                                                                      |  | Acceptable Quantity |   |                |
|       |                                                     | $W \leq 0.05$                                                                                                                                                                                                                                                                                                             |  | Ignore              |   |                |
|       |                                                     | $0.05 < W \leq 0.1$<br>$L \leq 1.5$                                                                                                                                                                                                                                                                                       |  | 1                   |   |                |
|       |                                                     | $0.1 < W$ , or $L > 1.5$                                                                                                                                                                                                                                                                                                  |  | Not allowed         |   |                |
| 5.2.4 | Polarizer Dent/Bubble                               | Not allowed                                                                                                                                                                                                                                                                                                               |  |                     |   |                |
| 5.2.5 | Electrical Dot Defect                               | Bright and Black dot define:<br> and <br><br>Two Adjacent Dot |  |                     |   |                |
|       |                                                     | Inspection pattern: Full white、Full black、Red、green and blue screens                                                                                                                                                                                                                                                      |  |                     |   |                |
|       |                                                     | Item                                                                                                                                                                                                                                                                                                                      |  | Acceptable Quantity |   |                |
|       |                                                     |                                                                                                                                                                                                                                                                                                                           |  | I                   | O | Note           |
|       |                                                     | Black dot defect                                                                                                                                                                                                                                                                                                          |  | 1                   |   | (5mm≤Distance) |
|       |                                                     | Bright dot defect                                                                                                                                                                                                                                                                                                         |  | 1                   |   |                |



|                          |                                                             |                                                                                      |                                                                       |
|--------------------------|-------------------------------------------------------------|--------------------------------------------------------------------------------------|-----------------------------------------------------------------------|
|                          |                                                             | Two Adjacent Dot                                                                     | Not allow                                                             |
| 5.2.6                    | Glass defect                                                |    |                                                                       |
|                          |                                                             | 1. Corner Fragment:                                                                  |                                                                       |
|                          |                                                             | Size(mm)                                                                             | Acceptable Quantity                                                   |
|                          |                                                             | X≤2mm<br>Y≤1mm<br>Z≤T                                                                | Ignore<br>T: Glass thickness<br>X: Length<br>Y: Width<br>Z: thickness |
|                          |                                                             | 2. Side Fragment:                                                                    |                                                                       |
|                          |                                                             |  |                                                                       |
| Size(mm)                 | Acceptable Quantity                                         |                                                                                      |                                                                       |
| X≤5.0mm<br>Y ≤1mm<br>Z≤T | T: Glass thickness<br>X: Length<br>Y: Width<br>Z: thickness |                                                                                      |                                                                       |



I area & O area

- Note:
- 1). Dot defect is defined as the defective area of the dot area is larger than 50% of the dot area.
  - 2). The distance between two bright dot defects (red, green, blue, and white) should be larger than 15mm.
  - 3). The distance between black dot defects or black and bright dot defects should be more than 5mm apart.
  - 4). Polarizer bubble is defined as the bubble appears on active display area. The defect of polarizer bubble shall be ignored if the polarizer bubble appears on the outside of active display area.

## 6. Mechanics specification

As for the outside dimension, weight of the modules, please refer to product specification  
For more details



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# Precautions for Use of LCD modules

## 1. Handling Precautions

- 1.1. The display panel is made of glass. Do not subject it to a mechanical shock by dropping it from a high place, etc.
- 1.2. If the display panel is damaged and the liquid crystal substance inside it leaks out, be sure not to get any in your mouth, if the substance comes into contact with your skin or clothes, promptly wash it off using soap and water.
- 1.3. Do not apply excessive force to the display surface or the adjoining areas since this may cause the color tone to vary.
- 1.4. The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarizer carefully.
- 1.5. If the display surface is contaminated, breathe on the surface and gently wipe it with a soft dry cloth. If still not completely clear, moisten cloth with one of the following solvents:
  - Isopropyl alcohol
  - Ethyl alcoholSolvents other than those mentioned above may damage the polarizer. Especially, do not use the following:
  - Water
  - Ketene
  - Aromatic solvents
- 1.6. Do not attempt to disassemble the LCD Module.
- 1.7. If the logic circuit power is off, do not apply the input signals.
- 1.8. To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.
  - 1.8.1. Be sure to ground the body when handling the LCD Modules.
  - 1.8.2. Tools required for assembly, such as soldering irons, must be properly ground.
  - 1.8.3. To reduce the amount of static electricity generated, do not conduct assembly and other work under dry conditions.
  - 1.8.4. The LCD 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.

## 2. Storage Precautions

- 2.1. When storing the LCD modules, avoid exposure to direct sunlight or to the light of fluorescent lamps.
- 2.2. The LCD modules should be stored under the storage temperature range. If the LCD modules will be stored for a long time, the recommend condition is:  
Temperature : 0℃ ~ 40℃ Relatively humidity: ≤80%
- 2.3. The LCD modules should be stored in the room without acid, alkali and harmful gas.

## 3. Transportation Precautions

The LCD modules should be no falling and violent shocking during transportation, and also should avoid excessive press, water, damp and sunshine.

