PHOENIX DISPLAY
INTERNATIONAL, INC.

# PHOENIX DISPLAY INTERNATIONAL, INC

# SPECIFICATION FOR LCD MODULE

| | |
|---|---|
| **CUSTOMER** | |
| **PART NUMBER** | PDIS133MWU03HG |
| **DESCRIPTION** | 13.3" 1920 (RGB) x 1080 Dots |
| **VERSION** | 1.0 |
| **ISSUE DATE** | 12-Oct-19 |

**COMPANY ADDRESS:**
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## 1. Record of Revision

| Rev | Issued Date | Description | Editor |
|---|---|---|---|
| 1.0 | 2019/10/12 | First Release | Yigui.Han |
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## 2. General Specifications

| Feature | | Spec |
|---|---|---|
| Characteristics | Size | 13.3 inch |
| | Resolution | 1920(horizontal)*1080(Vertical) |
| | Interface | EDP |
| | Connect type | Connector |
| | Display Colors | 16.7M |
| | Technology type | a-Si |
| | Pixel pitch (mm) | 0.153*0.153 |
| | Pixel Configuration | R.G.B.-Stripe |
| | Display Mode | Normally Black |
| | LCD Driver IC | TBD |
| | Viewing Direction | ALL |
| Mechanical | LCM (W x H x D) (mm) | 307.6*183.05*5.5 |
| | Active Area(mm) | 293.76 *165.24 |
| | Weight (g) | TBD |
| | LED Numbers | 51 |

Note 1: Requirements on Environmental Protection: RoHs
Note 2: LCM weight tolerance: +/- 5%

# 3. Input/Output Terminals

| | | |
|---|---|---|
| 1 | NC | Not Connect |
| 2 | GND | Power ground |
| 3 | EDP_D1- | Complement Signal Link Lane 1 |
| 4 | EDP_D1+ | True Signal Line 1 |
| 5 | GND | Power ground |
| 6 | EDP_D0- | Complement Signal Link Lane 0 |
| 7 | EDP_D0+ | True Signal Line 0 |
| 8 | GND | Power ground |
| 9 | ETX_AUX+ | True Signal Auxiliary Ch. |
| 10 | ETX_AUX- | Complement Signal Auxiliary Ch. |
| 11 | GND | Power ground |
| 12 | VDD3.3 | Power Supply +3.3V |
| 13 | VDD3.3 | Power Supply +3.3V |
| 14 | NC | Not Connect |
| 15 | GND | Power ground |
| 16 | GND | Power ground |
| 17 | HPD | HPD Signal Pin |
| 18-30 | NC | Not Connect |

## BL/PIN

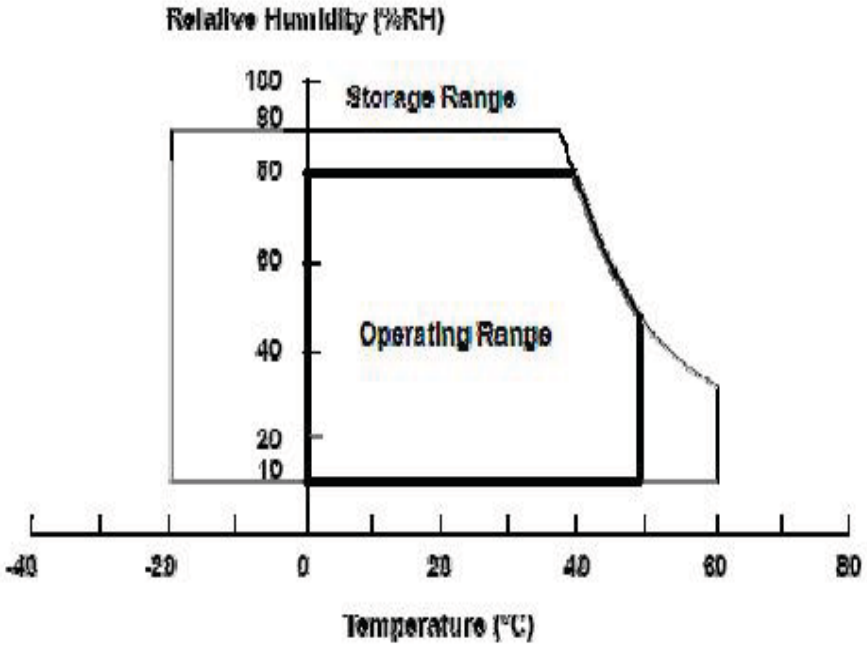
| | | |
|---|---|---|
| 1 | LEDA | Backlight LED Anode. |
| 2 | LEDK | Backlight LED Cathode |

# 4.Absolute Maximum Rating

| Item | Symbol | Min. | Max. | Unit | Conditions |
|---|---|---|---|---|---|
| Supply Voltage | $V_{DD}$ | -0.3 | 4.0 | V | - |
| Input Signal | $V_S$ | -0.3 | 2.4 | V | eDP Signals |
| Operating Temperature | TOP | 0 | 50 | ℃ | Note |
| Operating Humidity | HOP | 10 | 80 | %RH | Note |
| Storage Temperature | TST | -20 | 60 | ℃ | Note |
| Storage Humidity | HST | 10 | 90 | %RH | Note |

Note : (A)Maximum Wet-Bulb temperature should be 39℃ and no condensation of water.
(B)When you apply the LCD module for OA system. Please make sure to keep the temperature of LCD module under 60℃.
(C)Storage /Operating temperature & humidity:

**Figure 2 Absolute Ratings of Environment of the LCD Module**



# 5.Electrical Characteristics

## 5.1 Driving TFT LCD Panel

| Item | | Symbol | MIN | TYP | MAX | Unit | Remark |
|---|---|---|---|---|---|---|---|
| Supply Voltage | | VDD | 3.0 | 3.3 | 3.6 | V | |
| Input Signal Voltage | Low Leve | VIL | GND | - | 0.3x VDD | V | |
| | High Level | VIH | 0.7x VDD | - | VDD | V | |
| Output Signal Voltage | Low Leve | VIL | - | - | VSS+0.4 | V | |
| | High Level | VIH | VDD-0.4 | - | - | V | |
| (Panel+LSI) Power Consumption | | Black Mode (60Hz) | - | - | | nW | |
| | | Standby | - | - | - | uW | |

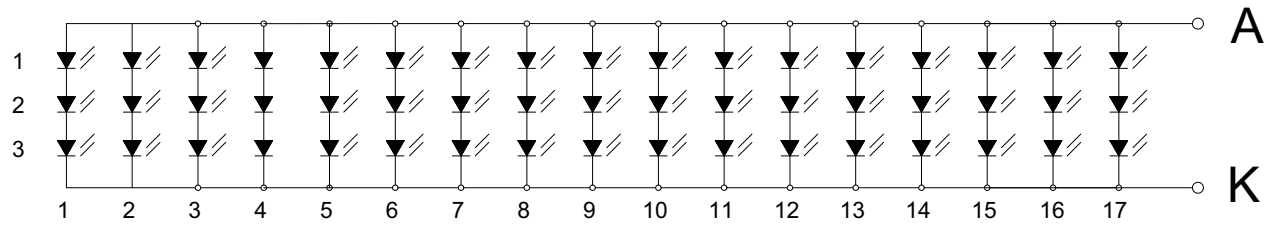
## 5.2 LED Driving Conditions

| Item | Symbol | MIN | TYP | MAX | Unit | Remark |
|---|---|---|---|---|---|---|
| Forward Current | **I F** | **-** | **680** | **-** | **mA** | |
| Forward Voltage | **V F** | **7.8** | **9.6** | **11.4** | **V** | |
| Backlight Power consumption | **W BL** | **-** | **6.528** | **-** | **W** | |
| LED Lifetime | | **-** | **30000** | **-** | **Hrs** | |

Note A: Calculator value for LED chip specification.

Note B: The LED life time define as the estimated time to 50% degradation of initial luminous.

Note C: I LED =40 mA (Per LED)

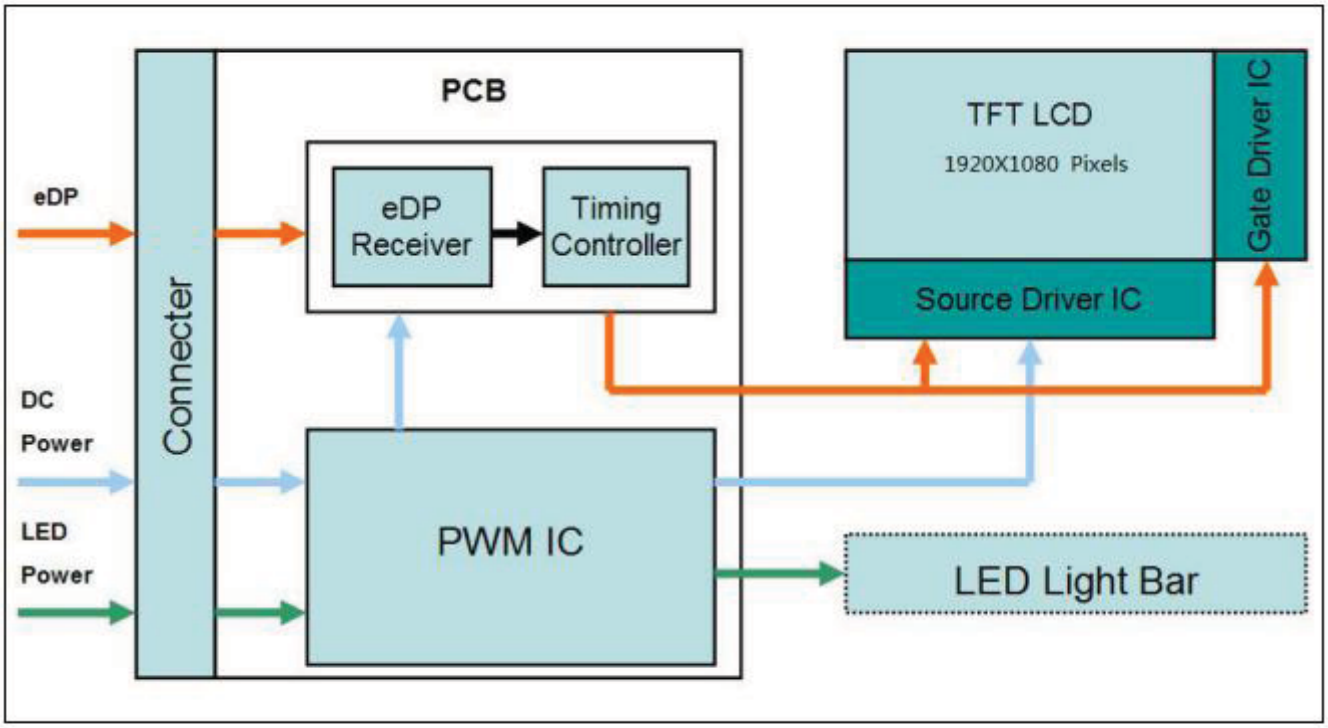



CIRCUIT DIAGRAM

## 5.2 Functional Block Diagram

Figure 1 Shows the functional block diagram of the LCD panel.

**Figure 1 Block Diagram**



# 6.Interface Timing

## 6.1 Timing Characteristics

Basically,interface timings should match the 1920 x 1080 /60Hz manufacturing guide line timing.

| Parameter | Symbol | Unit | Min. | Typ. | Max. |
|---|---|---|---|---|---|
| Signal Clock Frequency | $f_{dck}$ | MHz | 132 | 138.5 | 140 |
| H Total Time | $T_{hp}$ | clocks | 2020 | 2080 | 2400 |
| H Active Time | HA | clocks | | 1920 | |
| H Blanking | $T_{hfp}$ | clocks | - | 160 | - |
| H Frequency | $f_h$ | kHz | 65 | 66 | 72 |
| V Total Time | $T_{vp}$ | lines | 1090 | 1111 | 1200 |
| V Active Time | VA | lines | | 1080 | |
| V Blanking | $T_{vfp}$ | lines | - | 31 | - |
| V Frequency | $f_v$ | Hz | 55 | 60 | 65 |

## 6.2 Signal Electrical Characteristics

Input signals shall be low or High-impedance state when VDD is off.

It is recommended to refer the specifications of VESA Display Port Standard V1.2 in detail.

**Table 8 Display Port Main Link**

| Parameter | Description | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|
| $V_{CM}$ | Differentia Common Mode Voltage | 0 | - | 2.0 | V |
| $V_{Diff\ P-P}$ Level 1 | Differential Peak to Peak Voltage Level 1 | 0.34 | 0.40 | 0.46 | V |
| $V_{Diff\ P-P}$ Level 2 | Differential Peak to Peak Voltage Level 2 | 0.51 | 0.60 | 0.68 | V |
| $V_{Diff\ P-P}$ Level 3 | Differential Peak to Peak Voltage Level 3 | 0.69 | 0.80 | 0.92 | V |
| $V_{Diff\ P-P}$ Level 4 | Differential Peak to Peak Voltage Level 4 | 1.02 | 1.20 | 1.38 | V |

Note: Fallow as VESA display port standard V1.2 at both 1.62 and 2.7Gbps link rates.

**Figure 8 Display Port Main Link Signal**

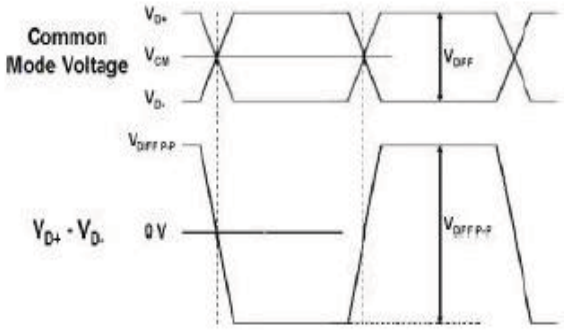



**Figure 9 Display Port AUX_CH Signal**

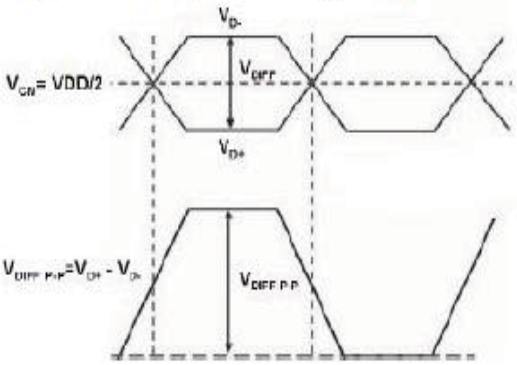



**Table 9 Display Port AUX_CH**

| Parameter | Description | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|
| $V_{CM}$ | Differentia Common Mode Voltage | 0 | VDD/2 | 2 | V |
| $V_{Diff\ P-P}$ | Differential Peak to Peak Voltage | 0.39 | - | 1.38 | V |

Note: Fallow as VESA display port standard V1.2.

**Table 10 Display Port $V_{HPD}$**

| Parameter | Description | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|
| $V_{HPD}$ | HPD Voltage | 2.25 | - | 3.60 | V |

Note: Fallow as VESA display port standard V1.2.

**Figure 10 Display Port Interface Power Up/Down Sequence, Normal System Operation**

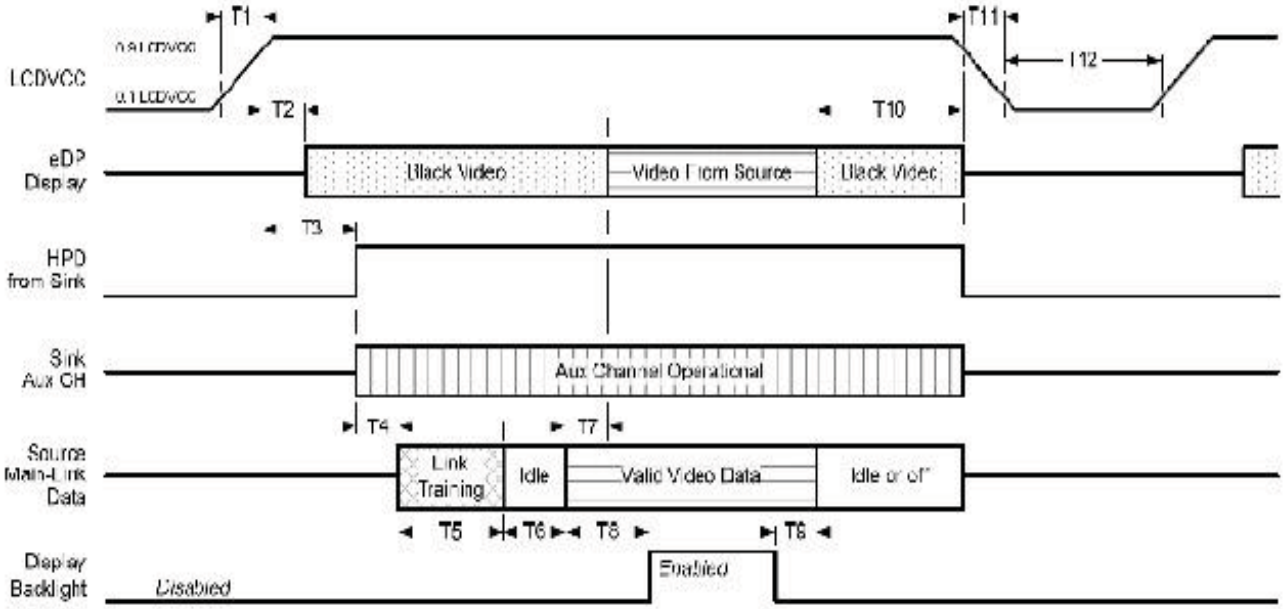
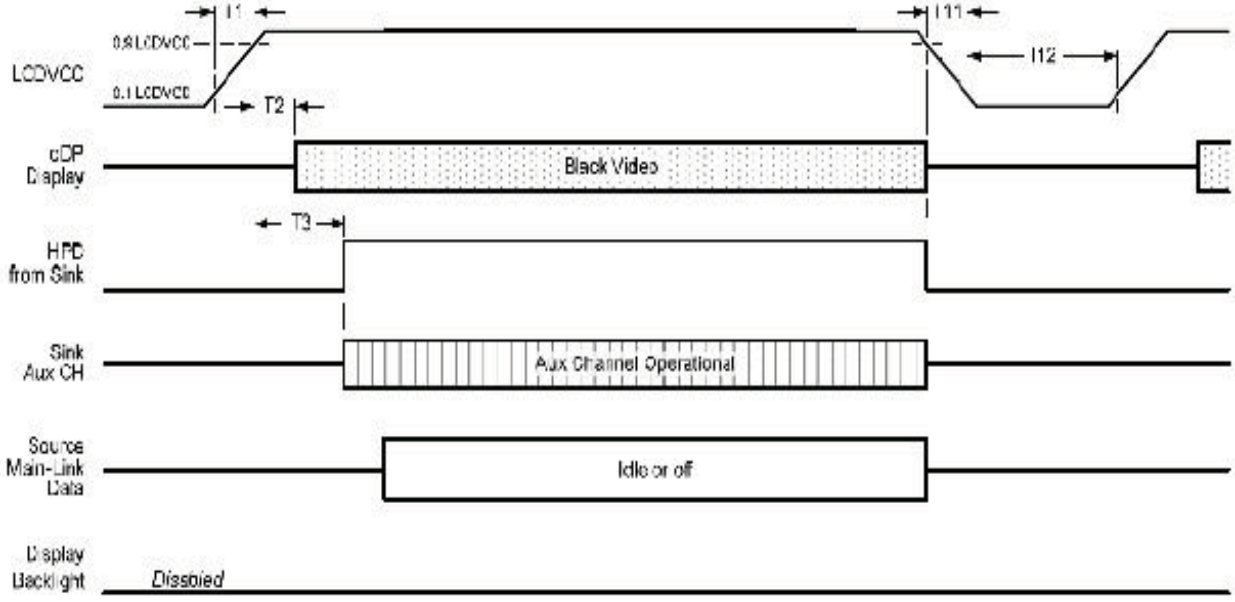



**Figure 11 Display Port Interface Power Up/Down Sequence, Aux Channel Transaction Only**



## 6.3 eDP Panel Power Sequence Timing Parameters

| Timing Parameter | Description | Reqd. By | Limits | | Notes |
|---|---|---|---|---|---|
| | | | Min. | Max. | |
| T1 | Power rail rise time, 10% to 90% | Source | 0.5ms | 10ms | - |
| T2 | Delay from LCD VCC to black video generation | Sink | 0ms | 200ms | Prevents display noise until valid video data is received from the Source.(see note 1 below) |
| T3 | Delay from LCD VCC to HPD high | Sink | 0ms | 200ms | Sink Aux Channel must be operational upon HPD high. |
| T4 | Delay from HPD high to link training initialization | Source | - | - | Allows for Source to read Link capability and initialize. |
| T5 | Link training duration | Source | - | - | Dependant on Source link training protocol. |
| T6 | Link idle | Source | - | - | Min accounts for required BS-Idle pattern.<br>Max allows for Source frame synchronization. |
| T7 | Delay from valid video data from Source to video on display | Sink | 0ms | 50ms | Max allows Sink validate video data and timing. |
| T8 | Delay from valid video from Source to backlight enable | Source | - | - | Source must assure display video is stable. |
| T9 | Delay from backlight disable to end of valid video data | Source | - | - | Source must assure backlight is no longer illuminated.(see note 1 below) |
| T10 | Delay from end of valid video data from Source to power off | Source | 0ms | 500ms | - |
| T11 | Power rail fall time, 90% to 10% | Source | - | 10ms | - |
| T12 | Power off time | Source | 500ms | - | - |

## 6.4 Power Consumption

Input power specifications are as follows.

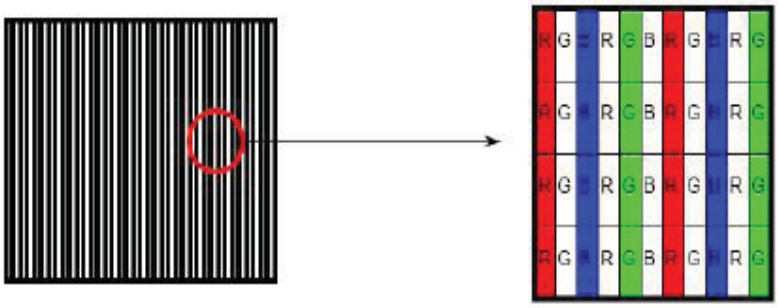
The power specification are measured under 25℃ and frame frequency under 60Hz.

| Symbol | Parameter | Min. | Typ. | Max. | Units | Condition |
|---|---|---|---|---|---|---|
| VDD | Logic/LCD Drive Voltage | 3.0 | 3.3 | 3.6 | V | - |
| IDD | VDD Current | - | 180 | 260 | mA | Note A, |
| $IDD_{MAX}$ | VDD Current | - | - | 260 | mA | Note B, C |
| PDD | VDD Power | - | 0.594 | 0.858 | W | Note A, B, C |
| IRush | Inrush Current | - | - | 2 | A | Note D, E |
| VDDrp | Allowable Logic/LCD Drive Ripple Voltage | - | - | 100 | mV | Vp-p |

Note A : $IDD_{Black}$ measurement condition $f_{dck}$=138.5 MHz, $f_v$=60Hz, VDD=3.3V, Normal pattern.

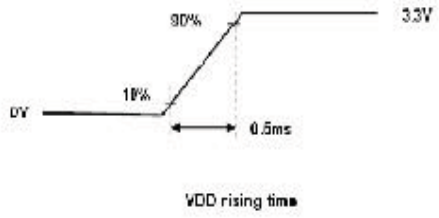
Note B : $IDD_{MAX}$ measurement condition $f_{dck}$=138.5 MHz, $f_v$=60Hz, VDD=3.3V, V-Stripe pattern.

Note C : Description of the V-Stripe pattern.



Note D : Measure Condition Figure 12.

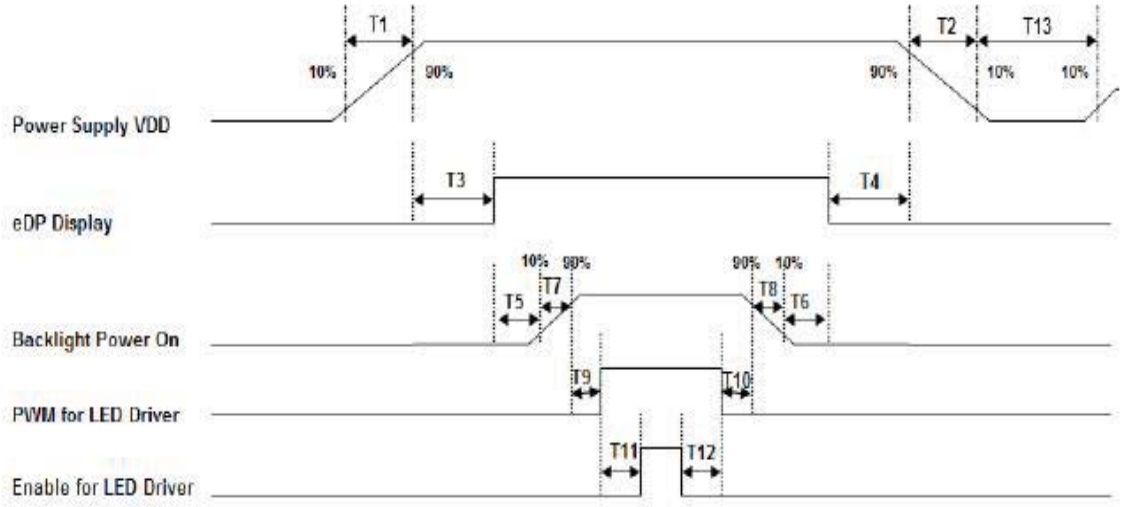
**Figure 12 VDD Rising Time**




Note E : When the IRush Measure Condition at VDD rising time=1.5ms, the value of IRush(Typ.)= 1A.

## 6.5 Power ON/OFF Sequence

VDD power on/off sequence is as follows. Interface signals are also shown in the chart. Signals from any system shall be Hi-Z state or low level when VDD is off.




| Parameter | Unit | Min. | Max. |
|---|---|---|---|
| T1 | ms | 0.5 | 10 |
| T2 | ms | 0 | 10 |
| T3 | ms | 0 | 200 |
| T4 | ms | 0 | 50 |
| T5 | ms | 300 | - |
| T6 | ms | 200 | - |
| T7 | ms | 0.5 | 10 |
| T8 | ms | 0 | 10 |
| T9 | ms | 10 | - |
| T10 | ms | 10 | - |
| T11 | ms | 10 | - |
| T12 | ms | 0 | - |
| T13 | ms | 500 | - |

# 7. Optical Characteristics

| Items | | Symbol | Condition | Min. | Typ. | Max. | Unit | Remark | Note |
|---|---|---|---|---|---|---|---|---|---|
| Response time | | Tr+Tf | - | - | 25 | 30 | ms | FIG.1 | Note4 |
| Contrast Ratio | | CR | | 700 | 1000 | - | - | FIG.2 | Note1 |
| Surface luminance | | LV | θ =0° | 400 | 500 | - | cd/m2 | FIG.2 | Note2 |
| Luminance uniformity | | Yu | θ =0° | 70 | 75 | - | % | FIG.2 | Note3 |
| NTSC | | - | θ =0° | 65 | 70 | - | % | FIG.2 | Note5 |
| Viewing angle | | $\theta_T$ | Center CR≥10 | - | 80 | - | deg | FIG.3 | Note6 |
| | | $\theta_B$ | | - | 80 | - | deg | FIG.3 | |
| | | $\theta_L$ | | - | 80 | - | deg | FIG.3 | |
| | | $\theta_R$ | | - | 80 | - | deg | FIG.3 | |
| Chromaticity | Red | $R_X$ | θ =0° ∅=0° Ta=25° | 0.612 | 0.642 | 0.672 | - | FIG.2 CIE1931 | Note5 |
| | | $R_Y$ | | 0.303 | 0.333 | 0.363 | - | | |
| | Green | $G_X$ | | 0.271 | 0.301 | 0.331 | - | | |
| | | $G_Y$ | | 0.591 | 0.621 | 0.651 | - | | |
| | Blue | $B_X$ | | 0.123 | 0.153 | 0.183 | - | | |
| | | $B_Y$ | | 0.025 | 0.055 | 0.085 | - | | |
| | White | $W_X$ | | 0.283 | 0.313 | 0.343 | - | | |
| | | $W_Y$ | | 0.299 | 0.329 | 0.359 | - | | |

**Note1. Definition of contrast ratio**

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

$$\text{Contrast ratio} = \frac{\text{Luminance measured when LCD on the “White” state}}{\text{Luminance measured when LCD on the “Black” state}}$$

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 (Tr) is the time between photo detector output intensity changed from 90% to 10%. And fall time (Tf) 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**

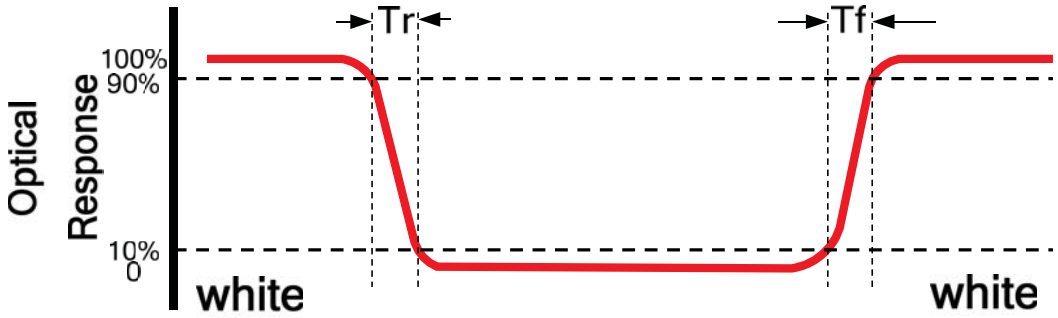



**FIG.2. Measuring method for contrast ratio, surface luminance, luminance uniformity, CIE (x,y) chromaticity**

Size : S≤5”(see Figure a) A : 5 mm B : 5 mm
H,V : Active area
Light spot size ∅=5mm(BM-5) or ∅=7.7mm (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).

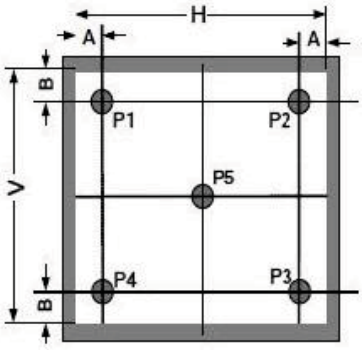


Figure a

Size : 5"＜S≤12.3"(see Figure b) H,V : Active area

Light spot size ∅=5mm(BM-5) or ∅=7.7mm (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).

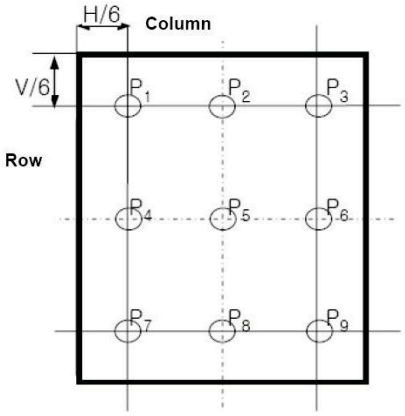



Figure b

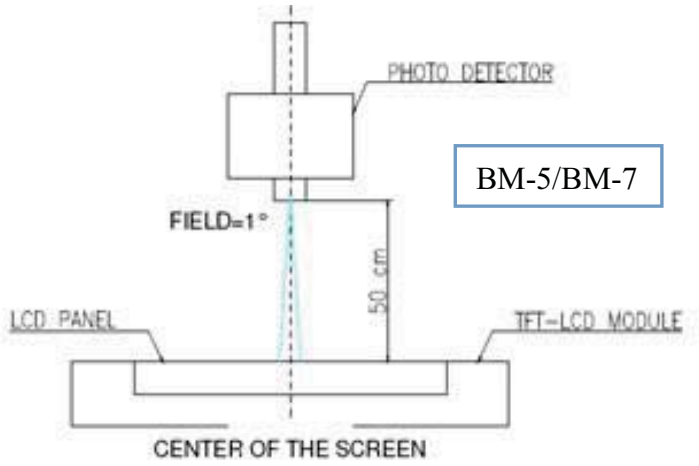
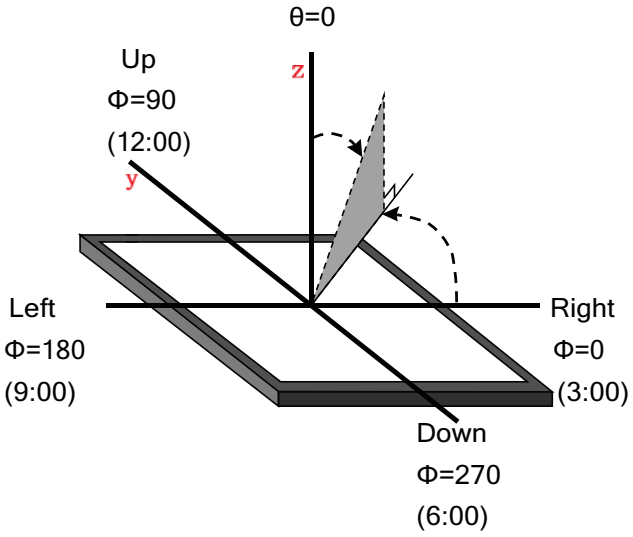



Figure c

**FIG.3.The definition of viewing angle**

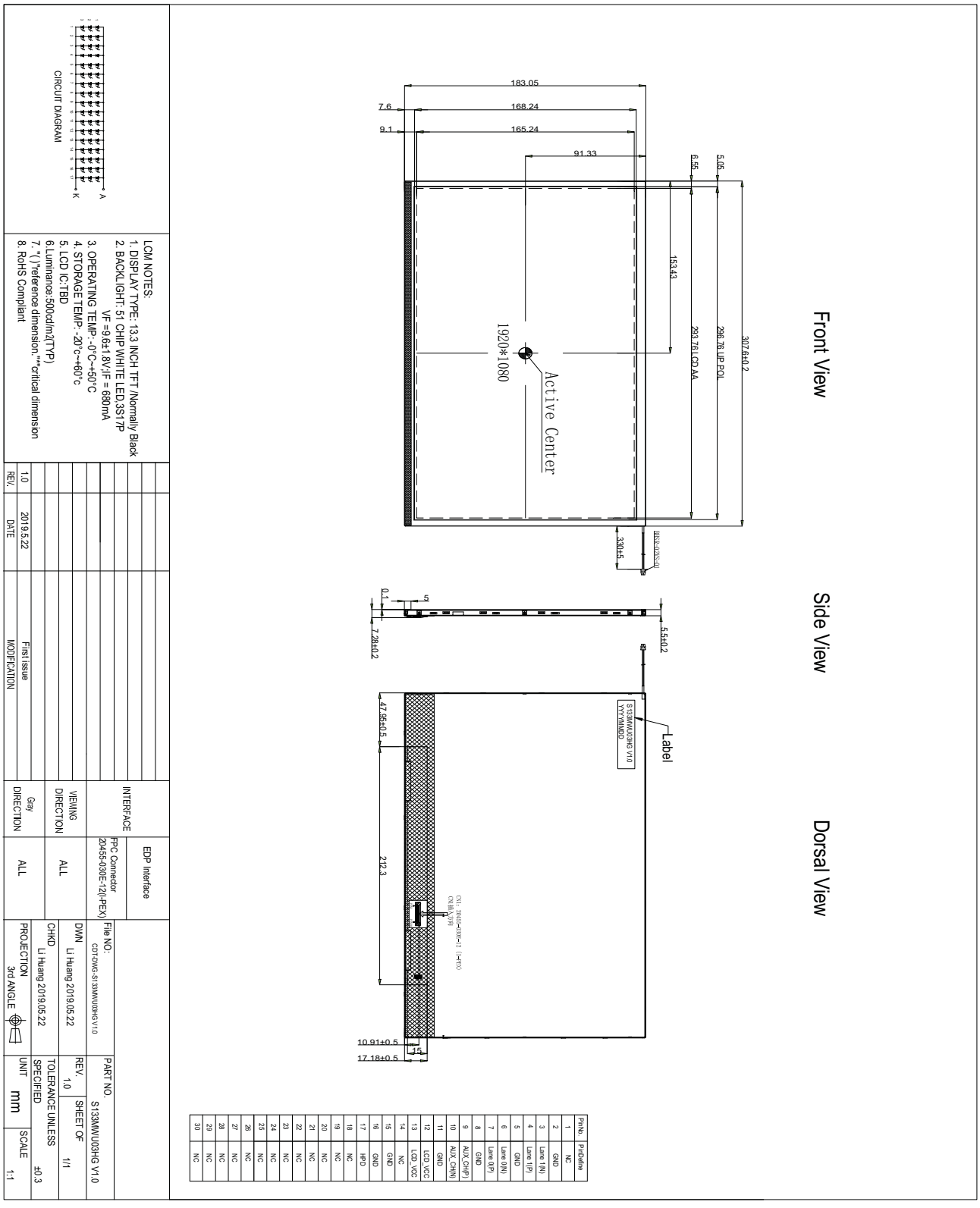


# 8. Environmental / Reliability Tests

| No | Test Item | Condition | Remarks |
|---|---|---|---|
| 1 | High Temperature Operation | Ts= +50℃, 96hrs | Note 1 IEC60068-2-2, GB2423. 2-89 |
| 2 | Low Temperature Operation | Ta= -0℃, 96hrs | Note 2 IEC60068-2-1 GB2423.1-89 |
| 3 | High Temperature Storage | Ta= +60℃, 96hrs | IEC60068-2-2 GB2423. 2-89 |
| 4 | Low Temperature Storage | Ta= -20℃, 96hrs | IEC60068-2-1 GB/T2423.1-89 |
| 5 | High Temperature & Humidity Storage | Ta= +60℃, 90% RH max,96 hours | IEC60068-2-3 GB/T2423.3-2006 |
| 6 | Thermal Shock (Non-operation) | -40℃ 20 min ~ +60℃ 30 min Change time: 5min, 30 Cycle | Start with cold temperature, end with high temperature IEC60068-2-14, GB2423.22-87 |
| 7 | Electro Static Discharge (Operation) | C=150pF, R=330 Ω, 5 points/panel Air:±8KV, 5 times; Contact: ±4KV, 5 times; (Environment: 15℃ ~ 35℃, 30% ~ 60%, 86Kpa ~ 106Kpa) | IEC61000-4-2 GB/T17626.2-1998 |
| 8 | Vibration (Non-operation) | Frequency range: 10~55Hz, Stroke: 1.mm Sweep: 10Hz~55Hz~10Hz 2 hours for each direction of X .Y. Z. (package condition) | IEC60068-2-6 GB/T2423.5-1995 |
| 9 | Shock (Non-operation) | 60G 6ms, ± X, ±Y , ± Z 3 times for each direction | IEC60068-2-27 GB/T2423.5-1995 |
| 10 | Package Drop Test | Height: 80 cm, 1 corner, 3 edges, 6 surfaces | IEC60068-2-32 GB/T2423.8-1995 |

Note: 1. Ts is the temperature of panel's surface.
2. Ta is the ambient temperature of sample.
3. The size of sample is 5pcs.

# 9. Mechanical Drawing



# 10.Packing

**Packing Method**

TBD

# 11.TFT-LCD Module Inspection Criteria

## 11.1 Scope

The incoming inspection standards shall be applied to TFT －LCD Modules (hereinafter Called "Modules") that supplied by CDTech Technology LTD.

## 11.2 Incoming Inspection

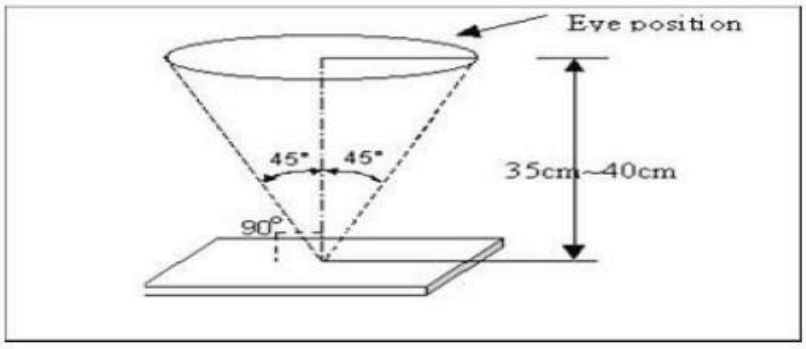
The customer shall inspect the modules within twenty calendar days of the delivery date（the “inspection period）at its own cost. The result of the inspection（acceptance or rejection）shall be recorded in writing, and a copy of this writing will be promptly sent to The seller, If the results of the inspecting 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

## 11.3 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

## 11.4 Inspection Conditions

4.1 Ambient conditions:
a. Temperature: Room temperature 25±5℃
b. Humidity: (60±10) ％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±5 ㎝.
4.3 Viewing Angle
U/D: 45 ° /45°, L/R: 45° /45°



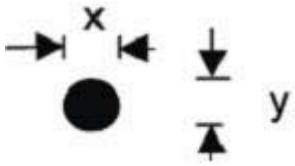

## 11.5 Inspection Criteria

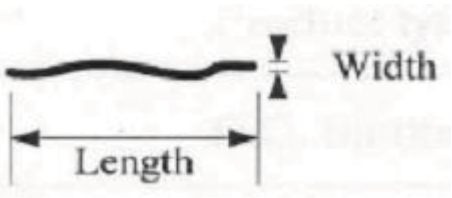
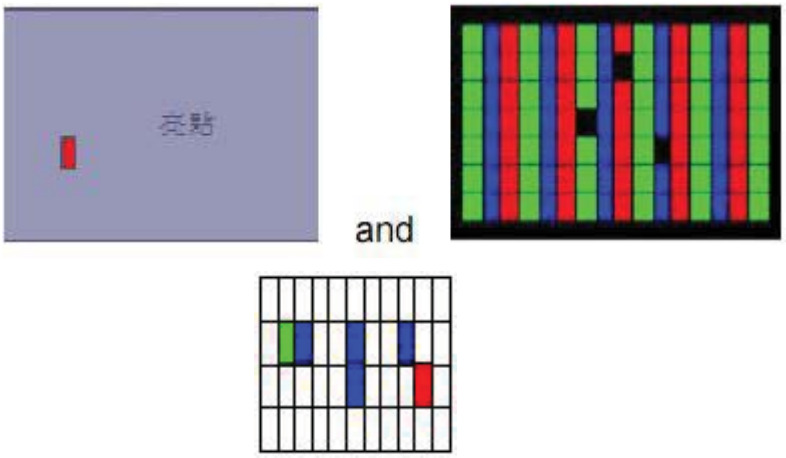
Defects are classified as major defects and minor defects according to the degree of Defectiveness defined herein.

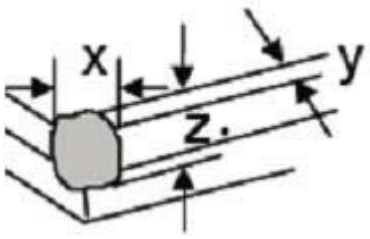
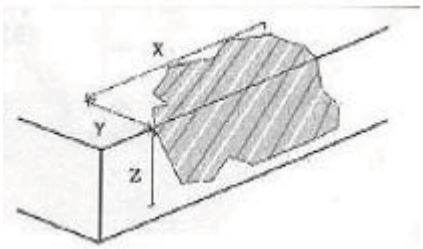
### 11.5.1 Major defect

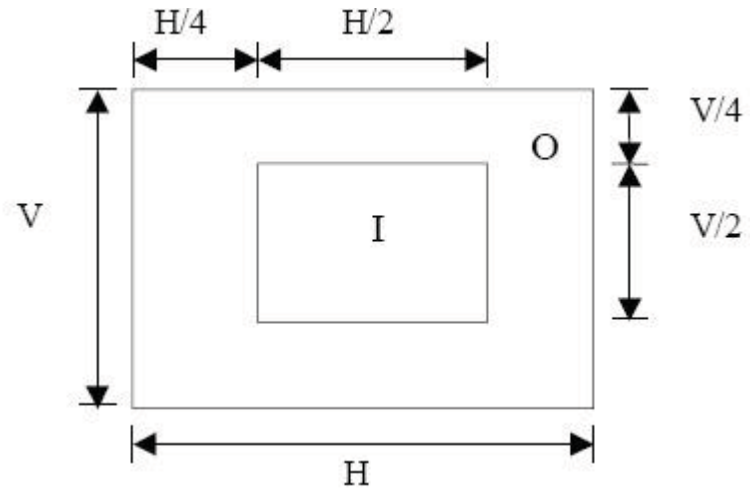
| Item No | Items to be inspected | Inspection Standard |
|---|---|---|
| 5.1.1 | All functional defects | 1) No display<br>2) Display abnormally<br>3) Short circuit<br>4) line defect |
| `5.1.2 | Missing | Missing function component |
| 5.1.3 | Crack | Glass Crack |

### 11.5.2 Minor defect

| Item No | Items to be inspected | Inspection standard | |
|---|---|---|---|
| 5.2.1 | Spot Defect Including Black spot White spot Pinhole Foreign particle Polarizer dirt | For dark/white spot is defined<br>$\varphi = (x+y) / 2$<br> | |
| | | Size φ(mm) | Acceptable Quantity |
| | | Φ<0.2 | Ignore |
| | | 0.2 ≤Φ≤0.5 | N≤4 |
| | | Φ>0.5 | Not allowed |

<table>
<tr><td rowspan="4">5.2.2</td><td rowspan="4">Line Defect<br>Including Black line<br>White line Scratch</td><td colspan="2">Define:<br>
</td></tr>
<tr><td>Width(mm)<br>Length(mm)</td><td>Acceptable Quantity</td></tr>
<tr><td>W<0.05</td><td>Ignore</td></tr>
<tr><td>0.05≤W≤0.1<br>0.3≤L≤3.0</td><td>N≤5</td></tr>
<tr><td>5.2.3</td><td>Polarizer<br>Dent/Bubble</td><td>L>3.0</td><td>Not allowed</td></tr>
<tr><td rowspan="4">5.2.3</td><td rowspan="4">Polarizer<br>Dent/Bubble</td><td>Sizeφ(mm)</td><td>Acceptable Quantity</td></tr>
<tr><td>Φ<0.2</td><td>Ignore</td></tr>
<tr><td>0.2 ≤Φ≤0.5</td><td>N≤4</td></tr>
<tr><td>Φ>0.5</td><td>Not allowed</td></tr>
<tr><td rowspan="6">5.2.4</td><td rowspan="6">Electrical Dot<br>Defect</td><td colspan="2">Bright and Black dot define:<br>
<br>Two Adjacent Dot</td></tr>
<tr><td colspan="2">Inspection pattern: Full white、Full black、Red、green and blue screens</td></tr>
<tr><td rowspan="2">Item</td><td colspan="3">Acceptable Quantity</td></tr>
<tr><td>Single Dot</td><td>Adjacent 2dots</td><td>Note</td></tr>
<tr><td>Black dot defect</td><td>5</td><td>1</td><td>5</td></tr>
<tr><td>Bright dot defect</td><td>4</td><td>0</td><td>4</td></tr>
<tr><td>Total Dot</td><td colspan="2"></td><td>7</td></tr>
</table>

<table>
<tr><td rowspan="6">5.2.5</td><td rowspan="6">Glass defect</td><td colspan="2">1.Corner Fragment:<br></td></tr>
<tr><td>Size(mm)</td><td>Acceptable Quantity</td></tr>
<tr><td>X≤3mm<br>Y≤1mm<br>Z≤T</td><td>Ignore<br>T：Glass thickness<br>X: Length<br>Y: Width<br>Z: thickness</td></tr>
<tr><td colspan="2">2. Side Fragment:<br></td></tr>
<tr><td>Size(mm)</td><td>Acceptable Quantity</td></tr>
<tr><td>X≤5.0mm<br>Y ≤1mm<br>Z≤T</td><td>T：Glass thickness<br>X: Length<br>Y: Width<br>Z: thickness</td></tr>
</table>




**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.

## 11.6 Mechanics specification

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

# 12.Precautions for Use of LCD modules

## 12.1 Handling Precautions

12.1.1. The display panel is made of glass. Do not subject it to a mechanical shock by dropping it from a high place, etc.

12.1.2. 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.

12.1.3. Do not apply excessive force to the display surface or the adjoining areas since this may cause the color tone to vary.

12.1.4. The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarizer carefully.

12.1.5. 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 alcohol

Solvents other than those mentioned above may damage the polarizer. Especially, do not use the following:

- Water
- Ketene
- Aromatic solvents

12.1.6. Do not attempt to disassemble the LCD Module.

12.1.7. If the logic circuit power is off, do not apply the input signals.

12.1.8. To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.

12.1.8.1. Be sure to ground the body when handling the LCD Modules.

12.1.8.2. Tools required for assembly, such as soldering irons, must be properly ground.

12.1.8.3. To reduce the amount of static electricity generated, do not conduct assembly and other work under dry conditions.

12.1.8.4. 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.

## 12.2 Storage Precautions

12.2.1. When storing the LCD modules, avoid exposure to direct sunlight or to the light of fluorescent lamps.

12.2.2. 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%

12.2.3. The LCD modules should be stored in the room without acid, alkali and harmful gas.

## 12.3 Transportation Precautions

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