KOE

JDI Group

Kaohsiung Opto-Electronics Inc.

FOR MESSRS : _____ DATE : Apr. 28th ,2017

# CUSTOMER'S ACCEPTANCE SPECIFICATIONS

# TX26D202VM0BAA

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ACCEPTED BY: _____ PROPOSED BY: Johin Chou

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<tr><td>Brightness Uniformity</td></tr>
<tr><td>Contrast Ratio</td></tr>
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<tr><td>1) Stains<br>2) Foreign Materials<br>3) Dark Spot</td><td>$0.2 \leqq D \leqq 0.6$</td></tr>
</table>
↓
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<table>
<tr><th colspan="2">Item</th><th>Symbol</th><th>Min.</th><th>Typ.</th><th>Max.</th></tr>
<tr><td rowspan="8">Color<br>Chromaticity</td><td rowspan="2">Red</td><td>X</td><td>0.58</td><td>0.63</td><td>0.68</td></tr>
<tr><td>Y</td><td>0.27</td><td>0.32</td><td>0.37</td></tr>
<tr><td rowspan="2">Green</td><td>X</td><td>0.30</td><td>0.35</td><td>0.40</td></tr>
<tr><td>Y</td><td>0.52</td><td>0.57</td><td>0.62</td></tr>
<tr><td rowspan="2">Blue</td><td>X</td><td>0.10</td><td>0.15</td><td>0.20</td></tr>
<tr><td>Y</td><td>0.08</td><td>0.13</td><td>0.18</td></tr>
<tr><td rowspan="2">White</td><td>X</td><td>0.26</td><td>0.31</td><td>0.36</td></tr>
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<tr><td>Y</td><td>0.56</td><td>0.61</td><td>0.66</td></tr>
<tr><td rowspan="2">Blue</td><td>X</td><td>0.10</td><td>0.15</td><td>0.20</td></tr>
<tr><td>Y</td><td>0.04</td><td>0.09</td><td>0.14</td></tr>
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<tr><td>B</td><td>Color Filter Consolidation</td><td>PCN0978</td></tr>
</table></td></tr>
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</table>

# 3. GENERAL DATA

## 3.1 DISPLAY FEATURES

This module is a 10.1” WUXGA of 16:10 format amorphous silicon TFT. The pixel format is vertical stripe and sub pixels are arranged as R (red), G (green), B (blue) sequentially. This display is RoHS compliant, COG (chip on glass) technology and LED backlight are applied on this display.

| | |
|---|---|
| Part Name | TX26D202VM0BAA |
| Module Dimensions | 232.1(W) x 153.2(H) x 4.7(D) mm.(Expect PCB Area) |
| LCD Active Area | 217.44(W) mm x 135.9(H) mm |
| Pixel Pitch | 0.11325(W) mm x 0.11325 (H) mm |
| Resolution | 1920 x 3(RGB)(W) x 1200(H) Dots |
| Color Pixel Arrangement | R, G, B Vertical Stripe |
| LCD Type | Transmissive Color TFT; Normally Black |
| Display Type | Active Matrix |
| Number of Colors | 16.7M Colors (8-bit RGB) |
| Backlight | Light Emitting Diode (LED) |
| Weight | 284 g |
| Interface | 2ch-LVDS; 50 pins |
| Power Supply Voltage | 3.3V for LCD; 12V for Backlight |
| Power Consumption | 2.21W for LCD; 7.68W for Backlight |
| Viewing Direction | Super Wide Version (In-Plane Switching) |

# 4. ABSOLUTE MAXIMUM RATINGS

| Item | Symbol | Min. | Max. | Unit | Remarks |
|---|---|---|---|---|---|
| Supply Voltage | $V_{DD}$ | -0.3 | 5 | V | - |
| Input Voltage of Logic | $V_I$ | -0.3 | $V_{DD}$+0.3 | V | Note 1 |
| Operating Temperature | Top | -30 | 80 | ˚C | Note 2 |
| Storage Temperature | Tst | -30 | 80 | ˚C | Note 2 |
| Backlight Input Voltage | $V_{LED}$ | - | 20 | V | - |

Note 1: The rating is defined for the signal voltages of the interface such as CLK and pixel data pairs.

Note 2: The maximum rating is defined as above based on the panel surface temperature, which might be different from ambient temperature after assembling the panel into the application. Moreover, some temperature-related phenomenon as below needed to be noticed:

- Background color, contrast and response time would be different in temperatures other than 25˚C.
- Operating under high temperature will shorten LED lifetime.

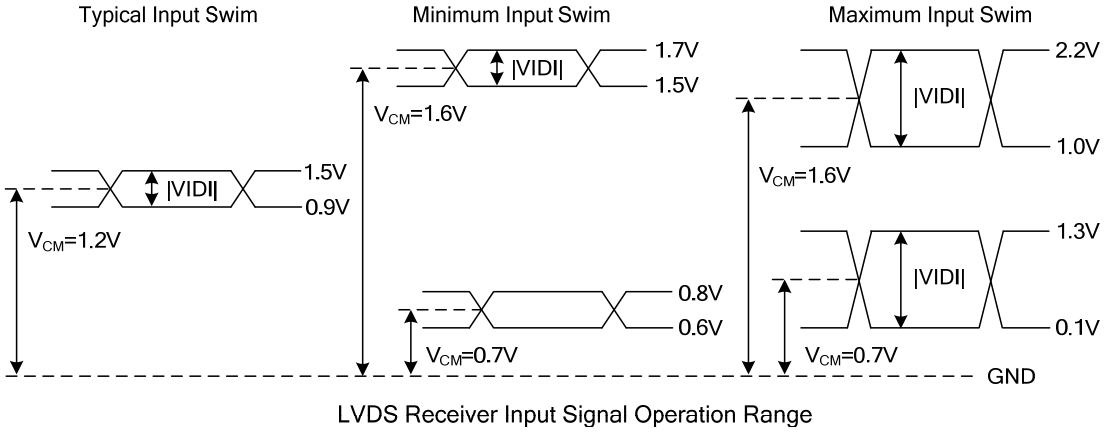
# 5. ELECTRICAL CHARACTERISTICS

## 5.1 LCD CHARACTERISTICS

$T_a = 25\ ^{\circ}C,\ V_{SS} = 0V$

| Item | Symbol | Condition | Min. | Typ. | Max. | Unit | Remarks |
|---|---|---|---|---|---|---|---|
| Power Supply Voltage | $V_{DD}$ | - | 3.0 | 3.3 | 3.6 | V | - |
| Differential Input Voltage for LVDS Receiver Threshold | $V_I$ | "H" level | - | - | +100 | mV | Note 1 |
| | | "L" level | -100 | - | - | | |
| Power Supply Current | $I_{DD}$ | $V_{DD}$=3.3V | - | 670 | 800 | mA | Note 2 |
| Frame Frequency | $f_{Frame}$ | - | 60 | | | Hz | Note 3 |
| CLK Frequency | $f_{CLK}$ | - | 75.91 | 78.36 | 79.89 | MHz | |

Note 1: VCM 1.2V is common mode voltage of LVDS transmitter and receiver.




LVDS Receiver Input Signal Operation Range

Note 2: An all white check pattern is used when measuring $I_{DD}$. $f_{Frame}$ is set to 60 Hz.

Note 3: For LVDS transmitter input.

Note 4: 2A fuse is applied in the module for $I_{DD}$. For display activation and protection purpose, power supply is recommended larger than 5A to start the display and break fuse once any short circuit occurred.

## 5.2 BACKLIGHT CHARACTERISTICS

$T_a = 25\ ^\circ C$

| Item | Symbol | Condition | Min. | Typ. | Max. | Unit | Remarks |
|---|---|---|---|---|---|---|---|
| Input Voltage | $V_{LED}$ | $I_{LED}$= 640 mA | 11 | 12 | 13 | V | Note1 |
| Input current | $I_{LED}$ | 0% duty | - | 10 | - | mA | Note 2 |
| | | 100% duty | - | 640 | 760 | | |
| LED lifetime | - | $I_{LED}$= 640 mA | - | 40K | - | hrs | Note 3 |

Note 1: As Fig. 5.1 shown, LED current is constant, 640 mA, controlled by the LED driver when applying 12V.

Note 2: Dimming function can be obtained by applying PWM signal from the display interface CN1. The recommended PWM signal is 1K ~ 10K Hz with 3.3V amplitude.

Note 3: The estimated lifetime is specified as the time to reduce 50% brightness by applying 640 mA at 25°C.

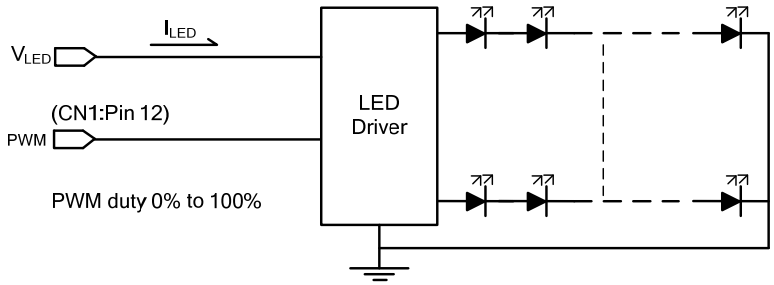



Fig 5.1

# 6. OPTICAL CHARACTERISTICS

The optical characteristics are measured based on the conditions as below:

- Supplying the signals and voltages defined in the section of electrical characteristics.
- The backlight unit needs to be turned on for 30 minutes.
- The ambient temperature is 25°C.
- In the dark room less than 100 lx, the equipment has been set for the measurements as shown in Fig 6.1.

$T_a = 25\ ^\circ C$, $f_{Frame} = 60$ Hz, $V_{DD} = 3.3V$

| Item | | Symbol | Condition | Min. | Typ. | Max. | Unit | Remarks |
|---|---|---|---|---|---|---|---|---|
| Brightness of White | | - | $\phi = 0^\circ, \theta = 0^\circ$, $I_{LED}$= 640 mA | 640 | 800 | - | $cd/m^2$ | Note 1 |
| Brightness Uniformity | | - | | 70 | - | - | % | Note 2 |
| Contrast Ratio | | CR | | 400 | 800 | - | - | Note 3 |
| Response Time | | $T_r + T_f$ | $\phi = 0^\circ, \theta = 0^\circ$ | - | 25 | - | ms | Note 4 |
| Viewing Angle | | $\theta$ x | $\phi = 0^\circ$, CR ≥ 10 | - | 85 | - | Degree | Note 5 |
| | | $\theta$ x′ | $\phi = 180^\circ$, CR ≥ 10 | - | 85 | - | | |
| | | $\theta$ y | $\phi = 90^\circ$, CR ≥ 10 | - | 85 | - | | |
| | | $\theta$ y′ | $\phi = 270^\circ$, CR ≥ 10 | - | 85 | - | | |
| Color Chromaticity | Red | X | $\phi = 0^\circ, \theta = 0^\circ$ | 0.52 | 0.57 | 0.62 | - | Note 6 |
| | | Y | | 0.27 | 0.32 | 0.37 | | |
| | Green | X | | 0.28 | 0.33 | 0.38 | | |
| | | Y | | 0.56 | 0.61 | 0.66 | | |
| | Blue | X | | 0.10 | 0.15 | 0.20 | | |
| | | Y | | 0.04 | 0.09 | 0.14 | | |
| | White | X | | 0.25 | 0.30 | 0.35 | | |
| | | Y | | 0.26 | 0.31 | 0.36 | | |

Note 1: The brightness is measured from the panel center point, P5 in Fig. 6.2, for the typical value.

Note 2: The brightness uniformity is calculated by the equation as below:

$$\text{Brightness uniformity} = \frac{\text{Min. Brightness}}{\text{Max. Brightness}} \times 100\%$$

which is based on the brightness values of the 9 points measured by BM-5 as shown in Fig. 6.2.

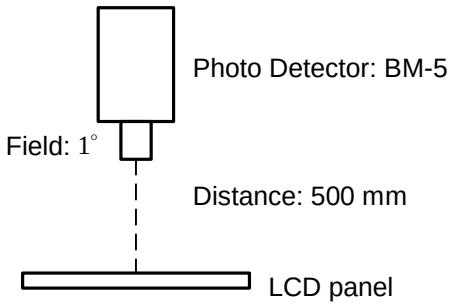



Fig. 6.1

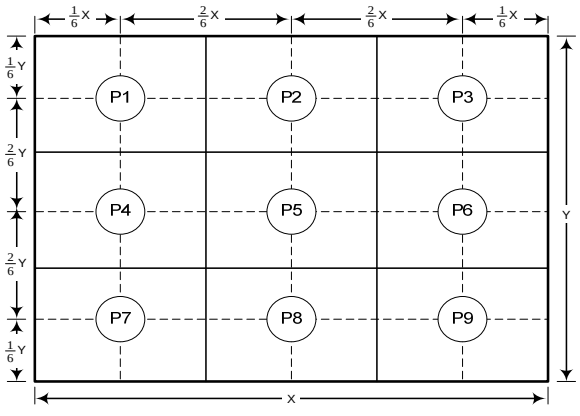



Fig. 6.2

Note 3: The Contrast Ratio is measured from the center point of the panel, P5, and defined as the following equation:

$$CR = \frac{\text{Brightness of White}}{\text{Brightness of Black}}$$

Note 4: The definition of response time is shown in Fig. 6.4. The rising time is the period from 10% brightness to 90% brightness when the data is from black to white. Oppositely, Falling time is the period from 90% brightness falling to 10% brightness.

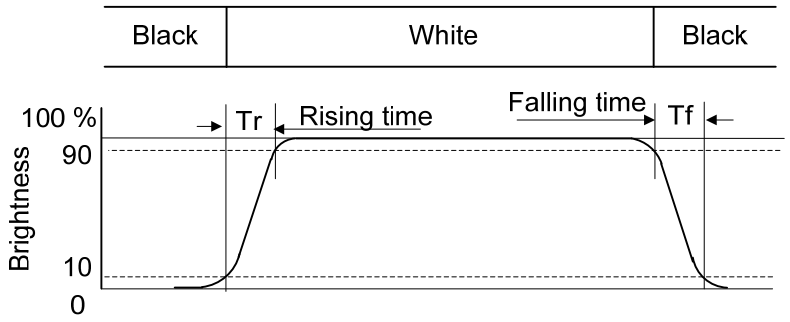



Fig.6.4

Note 5: The definition of viewing angle is shown in Fig. 6.5. Angle $\phi$ is used to represent viewing directions, for instance, $\phi = 270^\circ$ means 6 o'clock, and $\phi = 0^\circ$ means 3 o'clock. Moreover, angle $\theta$ is used to represent viewing angles from axis Z toward plane XY.

The display is super wide viewing angle version, so that the best optical performance can be obtained from every viewing direction.

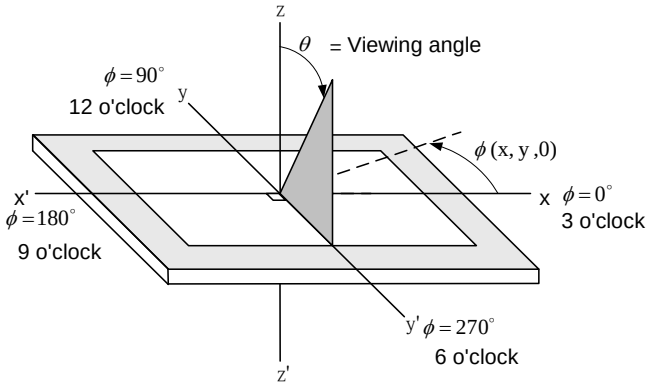
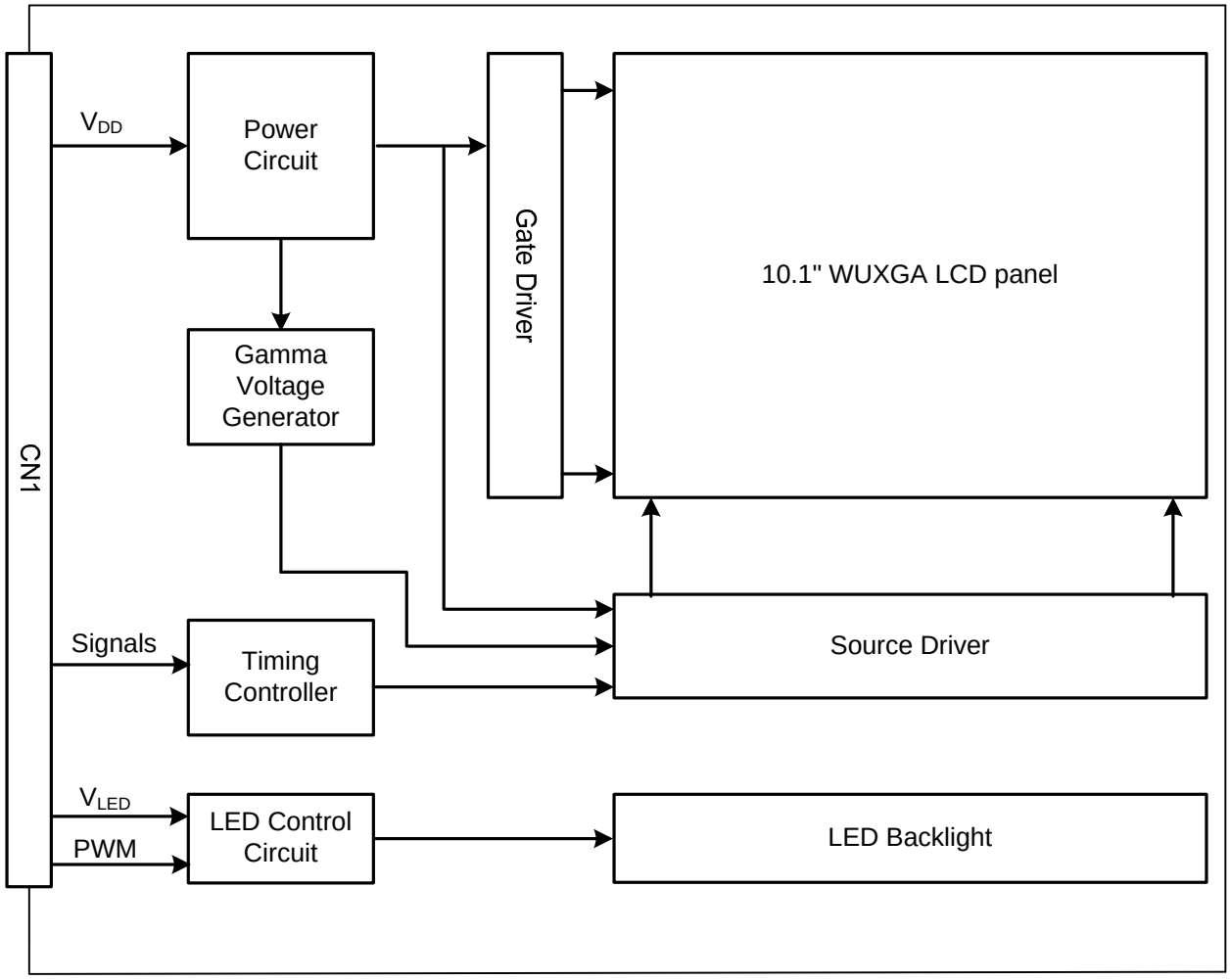



Fig 6.5

Note 6: The color chromaticity is measured from the center point of the panel, P5, as shown in Fig. 6.2.

# 7. BLOCK DIAGRAM




Note 1: Signals are CLK and pixel data pairs.

# 8. RELIABILITY TESTS

| Test Item | Condition | |
|---|---|---|
| High Temperature | 1) Operating<br>2) 80°C | 240 hrs |
| Low Temperature | 1) Operating<br>2) -30°C | 240 hrs |
| High Temperature | 1) Storage<br>2) 80°C | 240 hrs |
| Low Temperature | 1) Storage<br>2) -30°C | 240 hrs |
| Heat Cycle | 1) Operating<br>2) –20°C ~70°C<br>3) 3hrs~1hr~3hrs | 240 hrs |
| Thermal Shock | 1) Non-Operating<br>2) -35°C ↔ 85°C<br>3) 0.5 hr ↔ 0.5 hr | 240 hrs |
| High Temperature & Humidity | 1) Operating<br>2) 40°C & 85%RH<br>3) Without condensation | 240 hrs<br>(Note 3) |
| Vibration | 1) Non-Operating<br>2) 20～200 Hz<br>3) 2G<br>4) X, Y, and Z directions | 1 hr for each direction |
| Mechanical Shock | 1) Non-Operating<br>2) 10 ms<br>3) 50G<br>4) ±X, ±Y and ±Z directions | Once for each direction |
| ESD | 1) Operating<br>2) Tip: 150 pF, 330Ω<br>3) Air discharge for glass: ± 8KV<br>4) Contact discharge for metal frame: ± 8KV | 1) Glass: 9 points<br>2) Metal frame: 8 points<br>(Note 4) |

Note 1: Display functionalities are inspected under the conditions defined in the specification after the reliability tests.

Note 2: The display is not guaranteed for use in corrosive gas environments.

Note 3: Under the condition of high temperature & humidity, if the temperature is higher than 40℃, the humidity needs to be reduced as Fig. 8.1 shown.

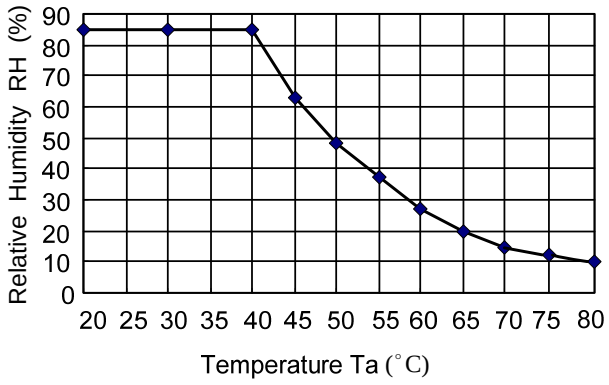



Fig. 8.1

Note 4: All pins of LCD interface (CN1) have been tested by ±100V contact discharge of ESD under non-operating condition.

# 9. LCD INTERFACE

## 9.1 INTERFACE PIN CONNECTIONS

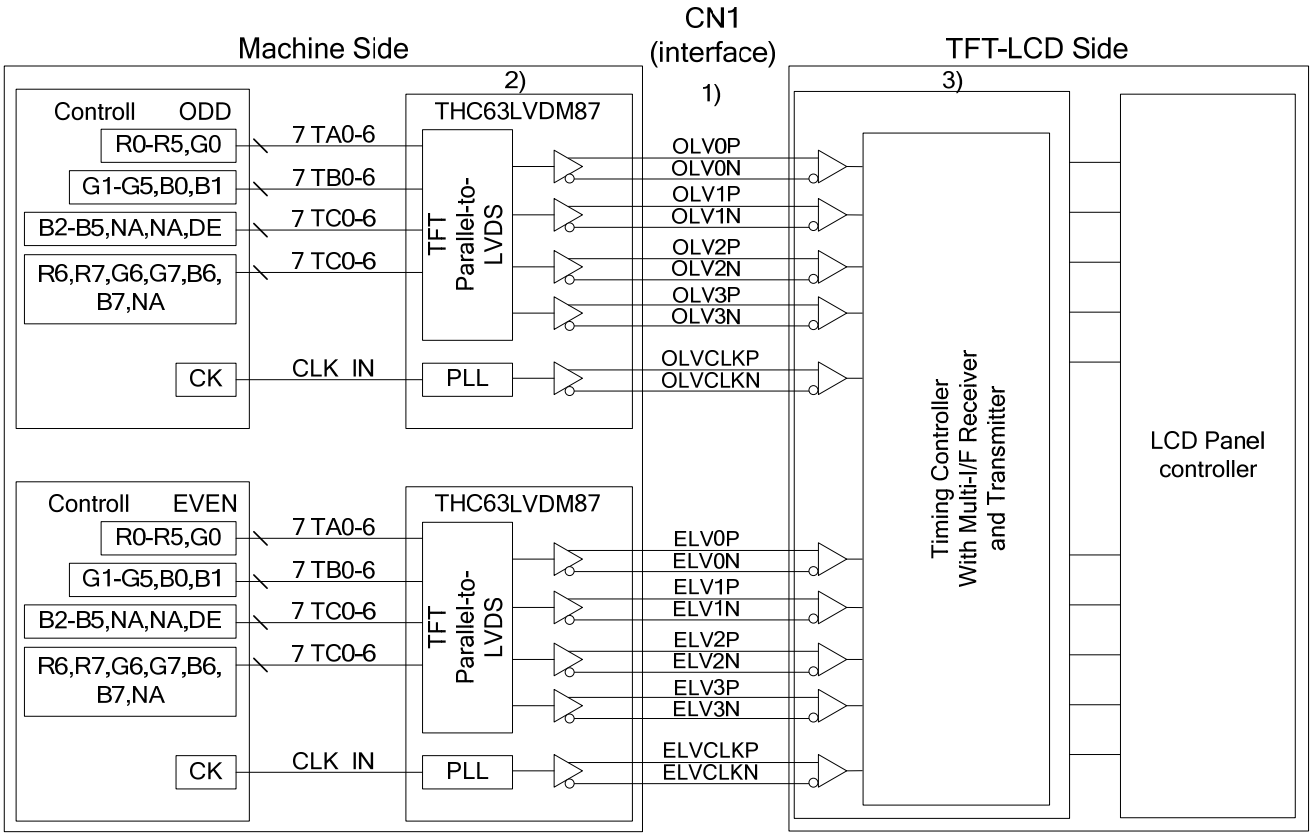
The display interface connector CN1 is 51296-5094 made by MOLEX and pin assignment is as below:

| Pin No. | Symbol | Signal | Pin No. | Symbol | Signal |
|---|---|---|---|---|---|
| 1 | GND | Ground | 26 | OLV3N | Odd pixel LVDS data pair 3N |
| 2 | GND | Ground | 27 | OLV3P | Odd pixel LVDS data pair 3P |
| 3 | $V_{DD}$ | Power Supply 3.3V | 28 | GND | Ground |
| 4 | $V_{DD}$ | Power Supply 3.3V | 29 | ELVON | Even pixel LVDS data pair 0N |
| 5 | $V_{DD}$ | Power Supply 3.3V | 30 | ELVOP | Even pixel LVDS data pair 0P |
| 6 | GND | Ground | 31 | GND | Ground |
| 7 | GND | Ground | 32 | ELV1N | Even pixel LVDS data pair 1N |
| 8 | NC | No Connection | 33 | ELV1P | Even pixel LVDS data pair 1P |
| 9 | NC | No Connection | 34 | GND | Ground |
| 10 | NC | No Connection | 35 | ELV2N | Even pixel LVDS data pair 2N |
| 11 | GND | Ground | 36 | ELV2P | Even pixel LVDS data pair 2P |
| 12 | PWM | BL Control Input | 37 | GND | Ground |
| 13 | GND | Ground | 38 | ELVCLKN | Even pixel LVDS clock pair N |
| 14 | OLV0N | Odd pixel LVDS data pair 0N | 39 | ELVCLKP | Even pixel LVDS clock pair P |
| 15 | OLV0P | Odd pixel LVDS data pair 0P | 40 | GND | Ground |
| 16 | GND | Ground | 41 | ELV3N | Even pixel LVDS data pair 3N |
| 17 | OLV1N | Odd pixel LVDS data pair 1N | 42 | ELV3P | Even pixel LVDS data pair 3P |
| 18 | OLV1P | Odd pixel LVDS data pair 1P | 43 | GND | Ground |
| 19 | GND | Ground | 44 | GND | Ground |
| 20 | OLV2N | Odd pixel LVDS data pair 2N | 45 | $V_{LED}$ | Power Supply for LED 12V |
| 21 | OLV2P | Odd pixel LVDS data pair 2P | 46 | $V_{LED}$ | Power Supply for LED 12V |
| 22 | GND | Ground | 47 | $V_{LED}$ | Power Supply for LED 12V |
| 23 | OLVCLKN | Odd pixel LVDS clock pair N | 48 | $V_{LED}$ | Power Supply for LED 12V |
| 24 | OLVCLKP | Odd pixel LVDS clock pair P | 49 | GND | Ground |
| 25 | GND | Ground | 50 | GND | Ground |

Note 1: OVLnN/ELVnN and OVLnP/ELVnP (n=0, 1, 2, 3), OLVCLKN/ELVCLKN and OLVCLKP/ELVCLKP should be wired by twist-pairs or side-by-side FPC patterns, respectively.

Note 2: Normal brightness: 100% PWM duty; Brightness control: 0% to 100% PWM duty.

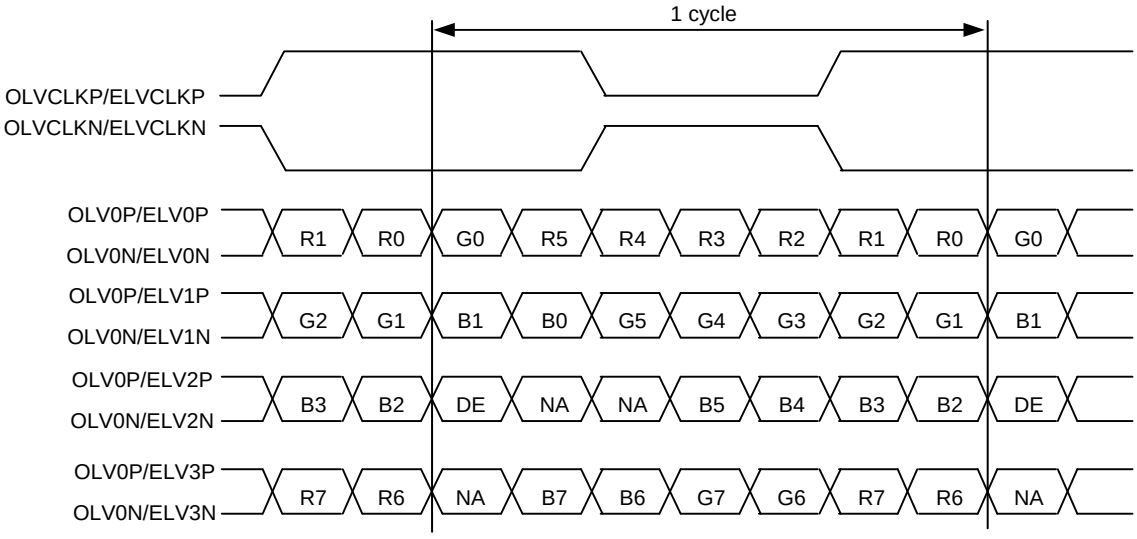
## 9.2 LVDS INTERFACE




Note 1: LVDS cable impedance should be 100 ohms per signal line when each 2-lines (P, N) is used in differential mode.

Note 2: The recommended transmitter, THC63LVDM87, is made by Thine or equivalent, which is not contained in the module.

## 9.3 LVDS DATA FORMAT




DE: Display Enable

NA: Not Available

## 9.4 TIMING CHART

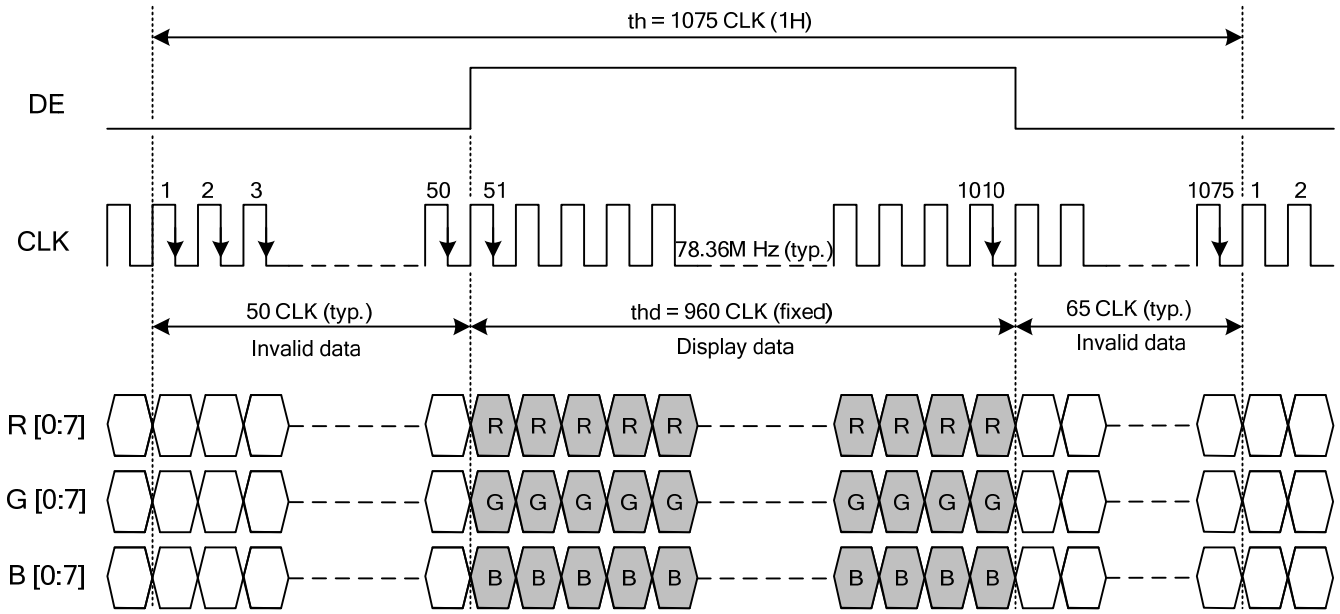



Fig. 9.1 Horizontal Timing

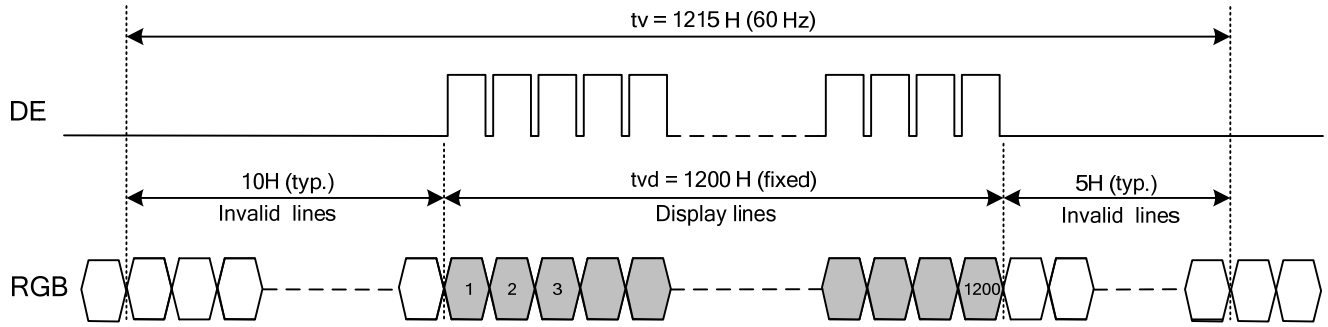



Fig. 9.2 Vertical Timing

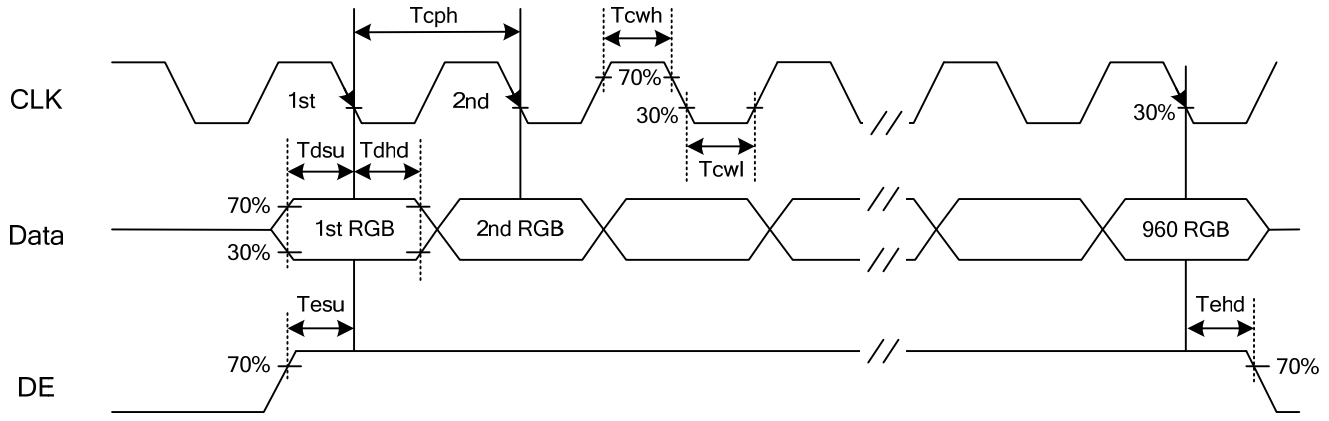



Fig. 9.3 Setup & Hold Time

## 9.5 TIMING TABLE

The column of timing sets including minimum, typical, and maximum as below are based on the best optical performance, frame frequency ( $f_{Frame}$ ) = 60Hz to define.

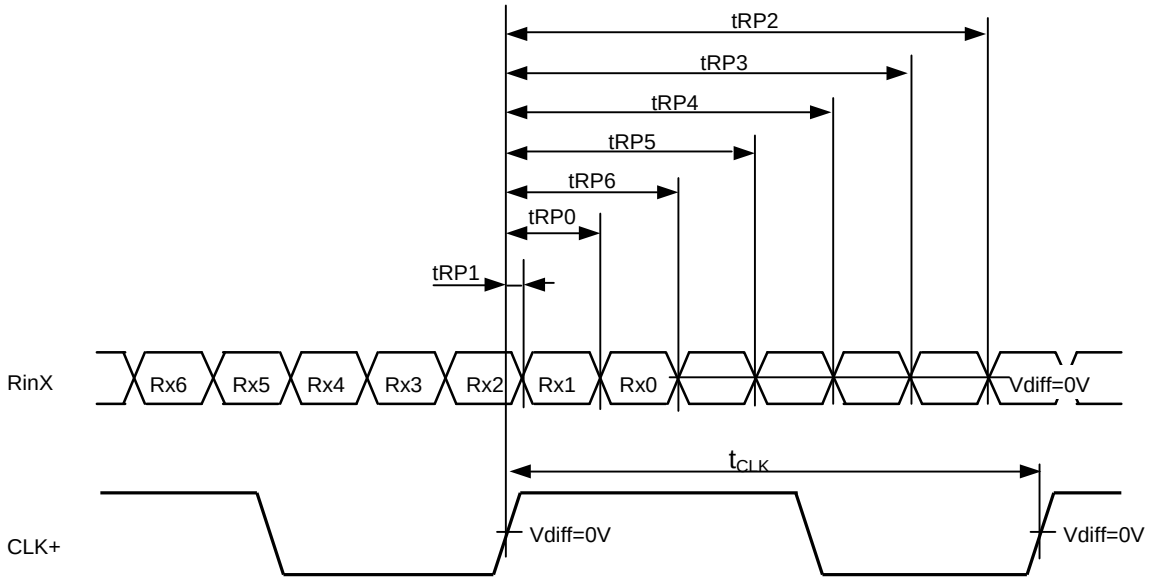
A. DE MODE

| Item | | Symbol | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| CLK Frequency | | fclk | 75.91 | 78.36 | 79.89 | MHz |
| Horizontal | Display Data | thd | | 960 | | CLK |
| | Cycle Time | th | 1050 | 1075 | 1087 | |
| Vertical | Display Line | tvd | | 1200 | | H |
| | Cycle Time | tv | 1210 | 1215 | 1225 | |

B. CLOCK AND DATA INPUT TIMING

| Item | | Symbol | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| CLK | Duty | Tcwh | 47.5 | 50 | 52.5 | % |
| | Cycle Time | Tcph | - | 12.76 | - | ns |
| Data | Setup Time | Tdsu | 1 | - | - | |
| | Hold Time | Tdhd | 1 | - | - | |
| DE | Setup Time | Tesu | 1 | - | - | |
| | Hold Time | Tehd | 1 | - | - | |

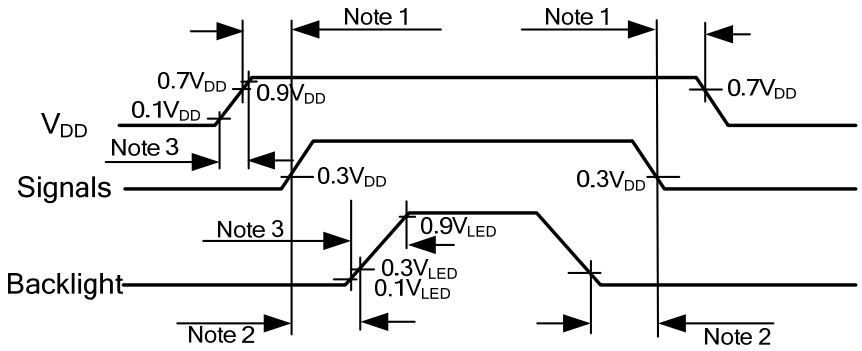
## 9.6 LVDS RECEIVER TIMING




RinX= (RinX+)-(RinX-)  (X=0, 1, 2, 3)

| Item | | Symbol | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| CLK | Cycle frequency | 1/tcLK | 75.91 | 78.36 | 79.89 | MHz |
| RinX (X=0,1,2,3) | 0 data position | tRP0 | 1/7* $t_{CLK}$ -0.91 | 1/7* $t_{CLK}$ | 1/7* $t_{CLK}$ +0.91 | ns |
| | 1st data position | tRP1 | -0.91 | 0 | +0.91 | |
| | 2nd data position | tRP2 | 6/7* $t_{CLK}$ -0.91 | 6/7* $t_{CLK}$ | 6/7* $t_{CLK}$ +0.91 | |
| | 3rd data position | tRP3 | 5/7* $t_{CLK}$ -0.91 | 5/7* $t_{CLK}$ | 5/7* $t_{CLK}$ +0.91 | |
| | 4th data position | tRP4 | 4/7* $t_{CLK}$ -0.91 | 4/7* $t_{CLK}$ | 4/7* $t_{CLK}$ +0.91 | |
| | 5th data position | tRP5 | 3/7* $t_{CLK}$ -0.91 | 3/7* $t_{CLK}$ | 3/7* $t_{CLK}$ +0.91 | |
| | 6th data position | tRP6 | 2/7* $t_{CLK}$ -0.91 | 2/7* $t_{CLK}$ | 2/7* $t_{CLK}$ +0.91 | |

## 9.7 POWER SEQUENCE




Note 1: In order to avoid any damages, $V_{DD}$ has to be applied before all other signals. The opposite is true for power off where $V_{DD}$ has to be remained on until all other signals have been switch off. The recommended time period is 1 second.

Note 2: In order to avoid showing uncompleted patterns in transient state. It is recommended that switching the backlight on is delayed for 1 second after the signals have been applied. The opposite is true for power off where the backlight has to be switched off 1 second before the signals are removed.

Note 3: In order to avoid high Inrush current, $V_{DD}$ & $V_{LED}$ rising time need to set at

$0.5ms < V_{DD}$ & $V_{LED} < 10ms$.

## 9.8 DATA INPUT for DISPLAY COLOR

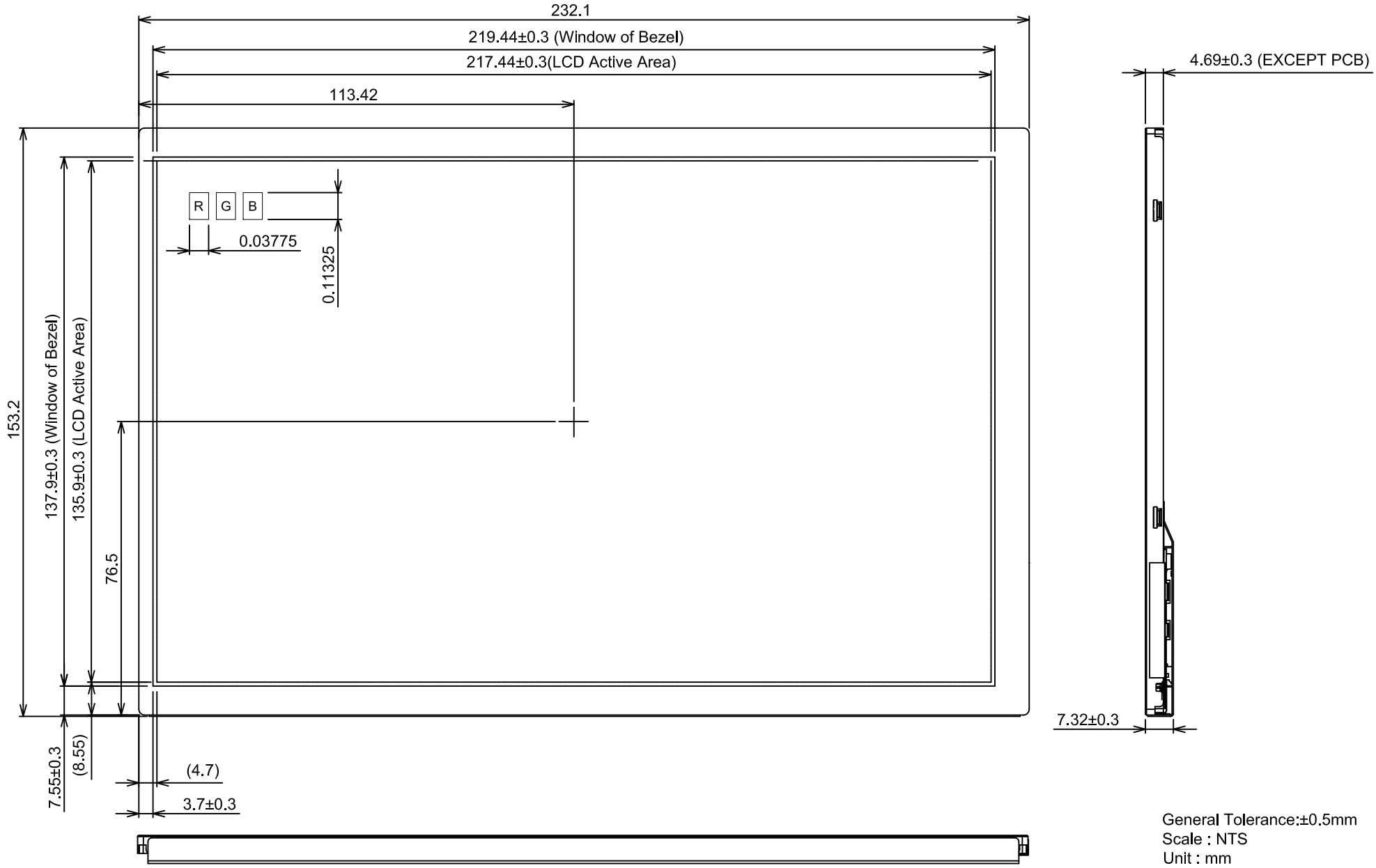
| Input color | | Red Data | | | | | | | | Green Data | | | | | | | | Blue Data | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | R7 | R6 | R5 | R4 | R3 | R2 | R1 | R0 | G7 | G6 | G5 | G4 | G3 | G2 | G1 | G0 | B7 | B6 | B5 | B4 | B3 | B2 | B1 | B0 |
| | | MSB | | | | | | | LSB | MSB | | | | | | | LSB | MSB | | | | | | | LSB |
| Basic Color | Black | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Red(255) | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Green(255) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Blue(255) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Cyan | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Magenta | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Yellow | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 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 | 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 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Red(1) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Red(2) | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| | Red(253) | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Red(254) | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Red(255) | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 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 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Green(1) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Green(2) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| | Green(253) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Green(254) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Green(255) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 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 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Blue(1) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| | Blue(2) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| | Blue(253) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 |
| | Blue(254) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 |
| | Blue(255) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

Note 1: Definition of gray scale : Color(n) Number in parenthesis indicates gray scale level. Larger number corresponds to brighter level.

Note 2: Data Signal : 1 : High, 0 : Low

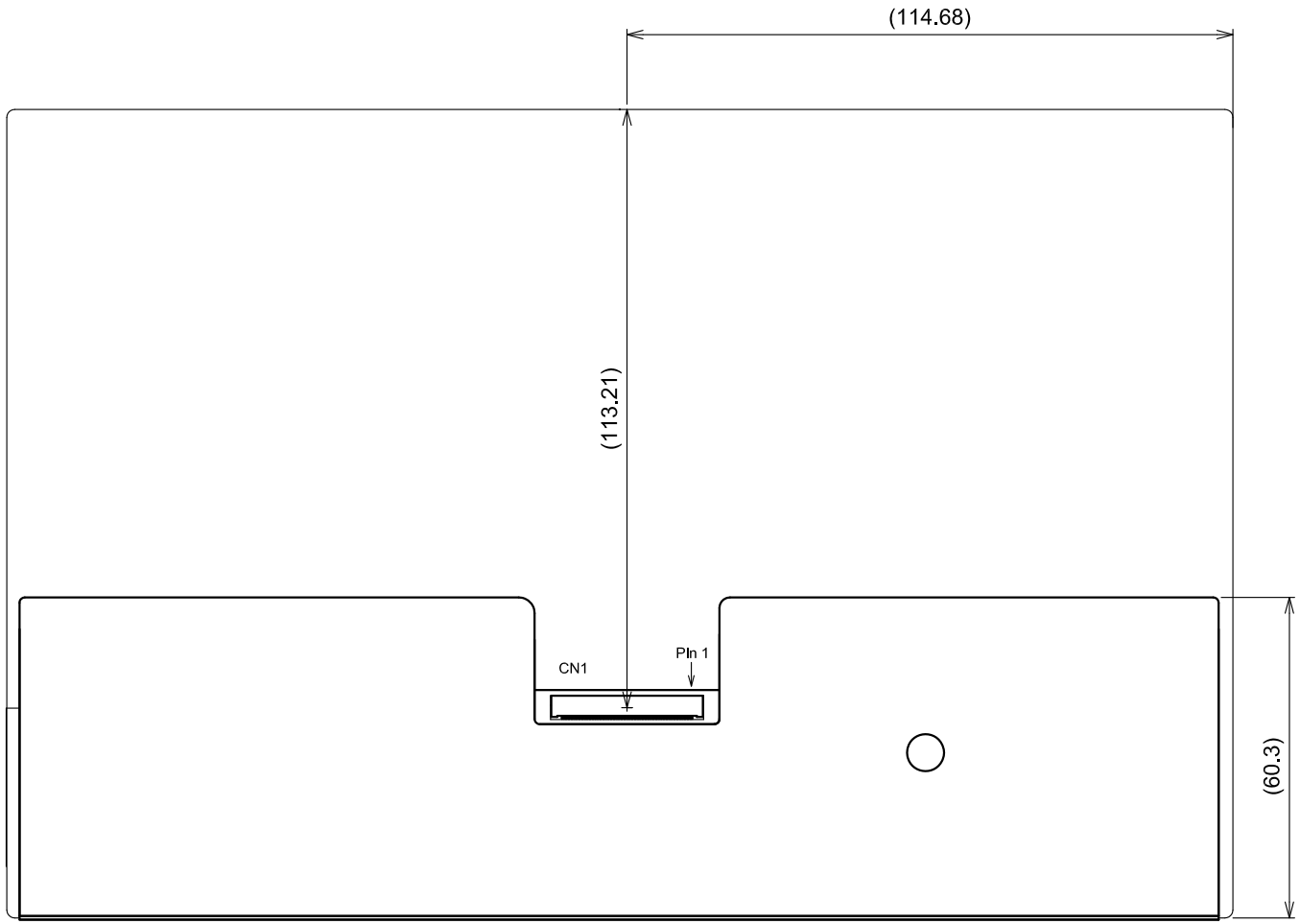
# 10. OUTLINE DIMENSIONS

## 10.1 FRONT VIEW




General Tolerance:±0.5mm
Scale : NTS
Unit : mm

## 10.2 REAR VIEW




General Tolerance:±0.5mm
Scale : NTS
Unit : mm

| KAOHSIUNG OPTO-ELECTRONICS INC. | SHEET No. | 7B64PS 2710-TX26D202VM0BAA-4 | PAGE | 10-2/2 |
|---|---|---|---|---|

# 11. APPEARANCE STANDARD

The appearance inspection is performed in a dark room around 500~1000 lx based on the conditions as below:

- The distance between inspector's eyes and display is 30 cm.
- The viewing zone is defined with angle $\theta$ shown in Fig. 11.1 The inspection should be performed within 45° when display is shut down. The inspection should be performed within 5° when display is power on.

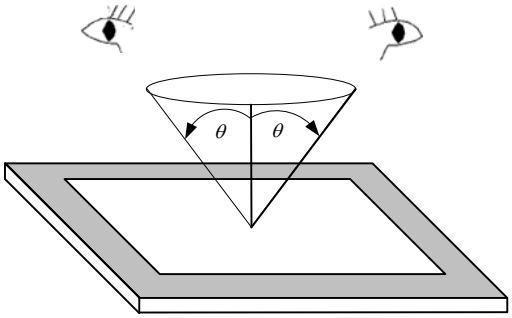



Fig. 11.1

## 11.1 THE DEFINITION OF LCD ZONE

LCD panel is divided into 2 areas as shown in Fig.11.2 for appearance specification in next section. A zone is the LCD active area (dot area); B zone is the area between A zone and metal frame.

In terms of housing design, B zone is the recommended window area customers' housing should be located in.

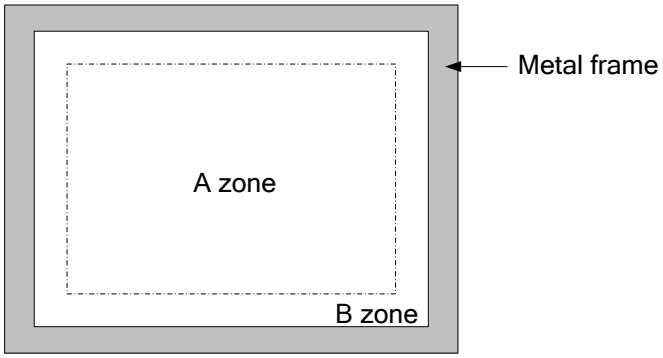



Fig. 11.2

## 11.2 LCD APPEARANCE SPECIFICATION

The specification as below is defined as the amount of unexpected phenomenon or material in different zones of LCD panel. The definitions of length, width and average diameter using in the table are shown in Fig. 11.4 and Fig. 11.5.

| Item | Criteria | | | | Applied zone |
|---|---|---|---|---|---|
| Scratches | Length (mm) | Width (mm) | Maximum number | Minimum space | A |
| | L≦15 | W≦0.02 | Ignored | - | |
| | L≦15 | 0.02＜W≦0.1 | 5 | - | |
| | L＞15 | 0.1＜W | 0 | - | |
| Dent | Serious one is not allowed | | | | A |
| Wrinkles in polarizer | Serious one is not allowed | | | | A |
| Bubbles on polarizer | Average diameter (mm) | | Maximum number | | A |
| | D＜0.3 | | Ignored | | |
| | 0.3≦D≦0.6 | | 4 | | |
| | 0.6＜D | | 0 | | |
| 1) Stains<br>2) Foreign Materials<br>3) Dark Spot | Filamentous (Line shape) | | | | A |
| | Length (mm) | Width (mm) | Maximum number | | |
| | L≦2.0 | W≦0.15 | 5 | | |
| | L＞2.0 | 0.15＜W | 0 | | |
| | Round (Dot shape) | | | | A |
| | Average diameter (mm) | Maximum number | Minimum Space | | |
| | D≦0.2 | Ignored | - | | |
| | 0.2＜D≦0.6 | 4 | - | | |
| | 0.6＜D | 0 | - | | |
| | Those wiped out easily are acceptable | | | | |
| Dot-Defect | | Area① | Area② | Maximum number | A<br>(Note 1) |
| | Bright dot-defect | 0 dot | 2 dot | 2 dot | |
| | Dark dot-defect | 2 dot | 3 dot | 3 dot | |
| | Bright + Dark point | 2 dot | 3 dot | 4 dot | |

Note 1: The Dot-Defect inspection within A zone (active area) would be divided into area ①, ② as Fig. 11.3 shown.

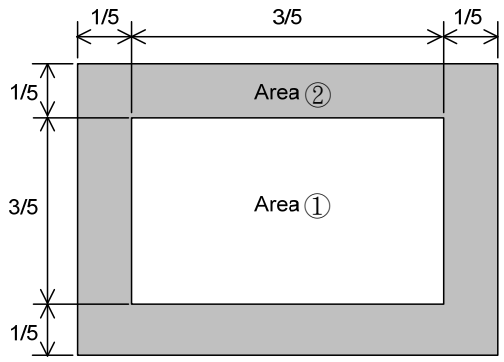



Fig. 11.3

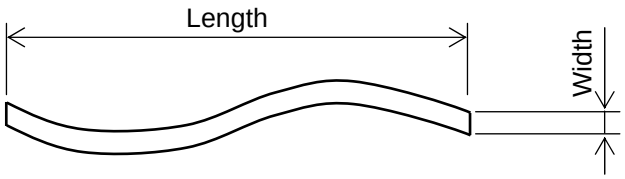
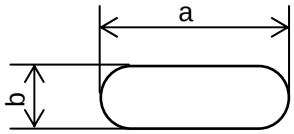



Fig 11.4




Average diameter = $\frac{a+b}{2}$

Fig 11.5

Note 2: The definitions of dot defect are as below:

- The defect area of the dot must be bigger than half of a dot.
- For bright dot-defect, showing black pattern, the dot's brightness must be over 30% brighter than others.
- For dark dot-defect, showing white pattern, the dot's brightness must be under 70% darker than others.
- The definition of 1-dot-defect is the defect-dot, which is isolated and no adjacent defect-dot.
- The definition of adjacent dot is shown as Fig. 11.5.
- The Density of dot defect is defined in the area within diameter $\phi$ =20mm.

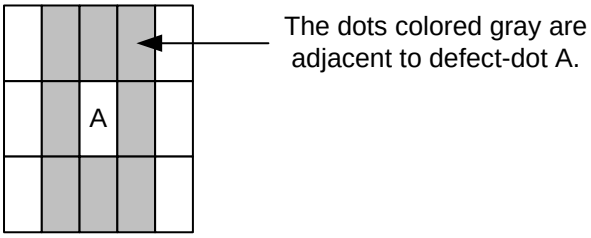



Fig. 11.5

# 12. PRECAUTIONS

## 12.1 PRECAUTIONS of ESD

1) Before handling the display, please ensure your body has been connected to ground to avoid any damages by ESD. Also, do not touch display's interface directly when assembling.

2) Please remove the protection film very slowly before turning on the display to avoid generating ESD.

## 12.2 PRECAUTIONS of HANDLING

1) In order to keep the appearance of display in good condition; please do not rub any surfaces of the displays by sharp tools harder than 3H, especially touch panel, metal frame and polarizer.

2) Please do not pile the displays in order to avoid any scars leaving on the display. In order to avoid any injuries, please pay more attention for the edges of glasses and metal frame, and wear finger cots to protect yourself and the display before working on it.

3) Touching the display area or the terminal pins with bare hand is prohibited. This is because it will stain the display area and cause poor insulation between terminal pins, and might affect display's electrical characteristics furthermore.

4) Do not use any harmful chemicals such as acetone, toluene, and isopropyl alcohol to clean display's surfaces.

5) Please use soft cloth or absorbent cotton with ethanol to clean the display by gently wiping. Moreover, when wiping the display, please wipe it by horizontal or vertical direction instead of circling to prevent leaving scars on the display's surface, especially polarizer.

6) Please wipe any unknown liquids immediately such as saliva, water or dew on the display to avoid color fading or any permanently damages.

7) Maximum pressure to the surface of the display must be less than $1{,}96 \times 10^4$ Pa. If the area of adding pressure is less than $1\,cm^2$, the maximum pressure must be less than 1.96N.

## 12.3 PRECAUTIONS OF OPERATING

1) Please input signals and voltages to the displays according to the values defined in the section of electrical characteristics to obtain the best performance. Any voltages over than absolute maximum rating will cause permanent damages to this display. Also, any timing of the signals out of this specification would cause unexpected performance.

2) When the display is operating at significant low temperature, the response time will be slower than it at $25\,C^\circ$. In high temperature, the color will be slightly dark and blue compared to original pattern. However, these are temperature-related phenomenon of LCD and it will not cause permanent damages to the display when used within the operating temperature.

3) The use of screen saver or sleep mode is recommended when static images are likely for long periods of time. This is to avoid the possibility of image sticking.

4) Spike noise can cause malfunction of the circuit. The recommended limitation of spike noise is no bigger than $\pm 100$ mV.

## 12.4 PRECAUTIONS of STORAGE

If the displays are going to be stored for years, please be aware the following notices.

1) Please store the displays in a dark room to avoid any damages from sunlight and other sources of UV light.
2) The recommended long-term storage temperature is between 10℃~35℃ and 55%~75% humidity to avoid causing bubbles between polarizer and LCD glasses, and polarizer peeling from LCD glasses.
3) It would be better to keep the displays in the container, which is shipped from KOE, and do not unpack it.
4) Please do not stick any labels on the display surface for a long time, especially on the polarizer.

# 13. DESIGNATION of LOT MARK

1) The lot mark is showing in Fig.13.1. First 4 digits are used to represent production lot, T represented made in Taiwan, and the last 6 digits are the serial number.

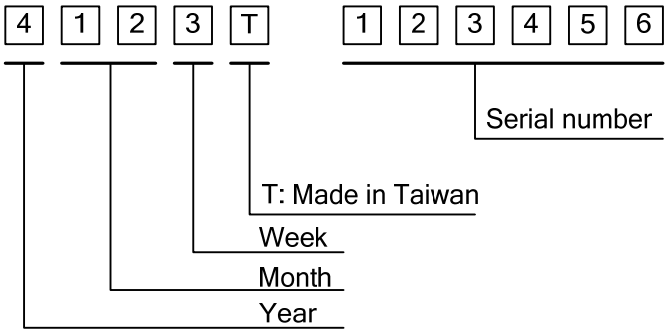



Fig. 13.1

2) The tables as below are showing what the first 4 digits of lot mark are shorted for.

| Year | Lot Mark |
|---|---|
| 2015 | 5 |
| 2016 | 6 |
| 2017 | 7 |
| 2018 | 8 |
| 2019 | 9 |

| Month | Lot Mark | Month | Lot Mark |
|---|---|---|---|
| Jan. | 01 | Jul. | 07 |
| Feb. | 02 | Aug. | 08 |
| Mar. | 03 | Sep. | 09 |
| Apr. | 04 | Oct. | 10 |
| May | 05 | Nov. | 11 |
| Jun. | 06 | Dec. | 12 |

| Week | Lot Mark |
|---|---|
| 1~7 days | 1 |
| 8~14 days | 2 |
| 15~21 days | 3 |
| 22~28 days | 4 |
| 29~31 days | 5 |

3) Except letters I and O, revision number will be shown on lot mark and following letters A to Z.

| REV No. | ITEM | REMARKS |
|---|---|---|
| A | - | - |
| B | Color Filter Consolidation | PCN0978 |

4) The location of the lot mark is on the back of the display shown in Fig. 13.2.

Label example:

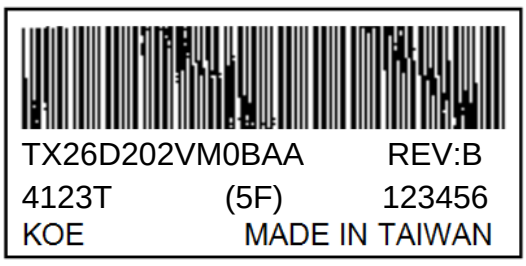



Fig. 13.2