# LITEMAX

## DLD1047-N
## Sunlight Readable 10.4" LED B/L LCD

## User Manual

| Approved by | Checked by | Prepared by |
|---|---|---|
| | | |

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**Record of Revision**

| Version and Date | Page | Old Description | New Description | Remark |
|---|---|---|---|---|
| June/26/2024 | all | | Initial release | |
| | | | | |
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| | | | | |

# Contents

# 1 General Description

The DLD1047-N is a 10.4 inch industrial grade sunlight readable LCD, with high brightness 1400 nits, it produces sharp images, crisp text and lifelike colors. The Durapixel LED backlight technology ensures high reliability and low power consumption, suitable for outdoor application, kiosk, factory automation, military, transportation and gaming application.

## 1.1 Features

- 10.4" sunlight readable, high brightness
- Resolutions: 800x600
- Aspect ratio of 4:3
- Wide temperature (-30°C~85°C)
- Low power consumption
- BL MTBF: 100,000 hours

## 1.2 General Specifications

| Model Name | DLD1047-N |
|---|---|
| Description | 10.4" TFT LCD, 1400nits LED Backlight, 800x600 |
| Screen Size | 10.4" |
| Display Area (mm) | 211.2 (H) x 158.4(V) mm |
| Brightness | 1400 cd/m$^2$ |
| Resolution | 800x600 |
| Aspect Ratio | 4:3 |
| Contrast Ratio | 1000 : 1 |
| Pixel Pitch (mm) | 0.264(H) x 0.264(V) |
| Pixel Pre Inch (PPI) | 96 |
| Viewing Angle | 176°(H),176°(V) |
| Color Saturation (NTSC) | 79% |
| Display Colors | 16.7M |
| Response Time (Typical) | 25ms |
| Panel Interface | LVDS |
| Input Interface | VGA,DVI-D,HDMI |
| Input Power | DC 12V |
| Power Consumption | 9.5W |
| OSD Key | 4 Keys (Power Switch, Menu, +, -) |
| OSD Control | Brightness, Color, Contrast, H/V Position…etc |
| Dimensions (mm) | 248.2x189.3x45.5 |
| Bezel Size(U/B/L/R) | 19.2/11.7/20.3/16.7 mm |
| Mounting | 75 x 75 mm |
| Weight (Net) | 1.53 kg |
| Operating Temperature | -30°C ~ 85°C |
| Storage Temperature | -30°C ~ 85°C |

DLD= Panel+ LED Driving Board + AD Control Board + Housing

## 1.3 Absolute Maximum Ratings

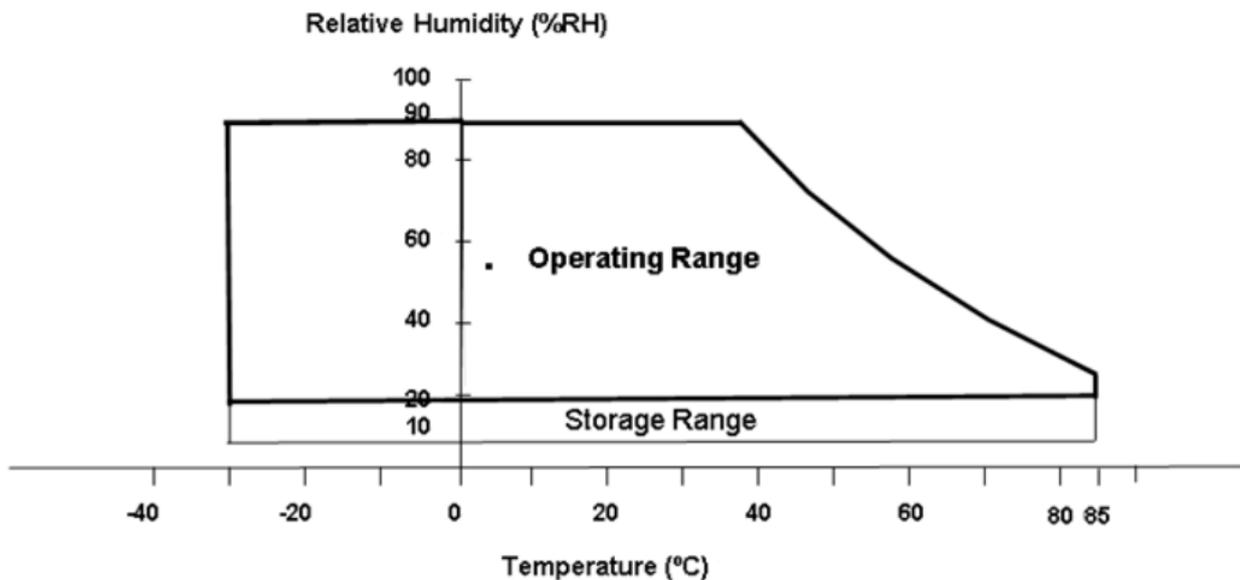Permanent damage may occur if exceeding the following maximum rating.

| Item | Symbol | Value | | Unit | Note |
|------|--------|-------|------|------|------|
| | | Min. | Max. | | |
| Operating Ambient Temperature | $T_{OP}$ | -30 | +85 | ℃ | (1)(2) |
| Storage Temperature | $T_{ST}$ | -30 | +85 | ℃ | |

Note (1)

(a) 90 %RH Max.

(b) Wet-bulb temperature should be 39 ºC Max.

(c) No condensation.

Note (2) Panel surface temperature should be 0℃ min. and 65℃ max under Vcc=5.0V, fr =60Hz, typical

LED string current, 25℃ ambient temperature, and no humidity control . Any condition of ambient

operating temperature ,the surface of active area should be keeping not higher than 85℃ (Panel

sureface temperature).



## 1.4 Absolute Electrical Ratings

**TFT LCD Module**

| Item | Symbol | Value | | Unit | Note |
|------|--------|-------|------|------|------|
| | | Min. | Max. | | |
| Power Supply Voltage | VCC | -0.3 | 5.5 | V | (1) |
| Logic Input Voltage | $V_{IN}$ | -0.3 | 3.6 | V | |

Note (1) Permanent damage to the device may occur if maximum values are exceeded. Function
operation should be restricted to the conditions described under Normal Operating Conditions.

## 2    Electrical Specifications

### 2.1    Electrical Characteristics

Ta = 25 ± 2 ℃

| Parameter | | Symbol | Value | | | Unit | Note |
|---|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | | |
| Power Supply Voltage | | $V_{CC}$ | 4.5 | 5 | 5.5 | V | - |
| Ripple Voltage | | $V_{RP}$ | - | - | (300) | mVp-p | |
| Inrush Current | | $I_{INRUSH}$ | - | - | (2.5) | A | (2) |
| Power Supply Current | White | Icc | - | (120) | (135) | mA | (3)a |
| | Black | | - | (115) | (130) | mA | (3)b |
| LVDS differential input voltage | | $V_{id}$ | 200 | - | 600 | mV | (5) |
| LVDS common input voltage | | $V_{ic}$ | 1.0 | 1.2 | 1.4 | V | (5) |
| Differential Input Voltage for LVDS Receiver Threshold | "H" Level | $V_{IH}$ | - | - | 100 | mV | - |
| | "L" Level | $V_{IL}$ | -100 | - | - | mV | - |
| Terminating Resistor | | $R_T$ | - | 100 | - | Ohm | - |

Note (1)The assembly should be always operated within above ranges.

Note (2)Measurement Conditions:
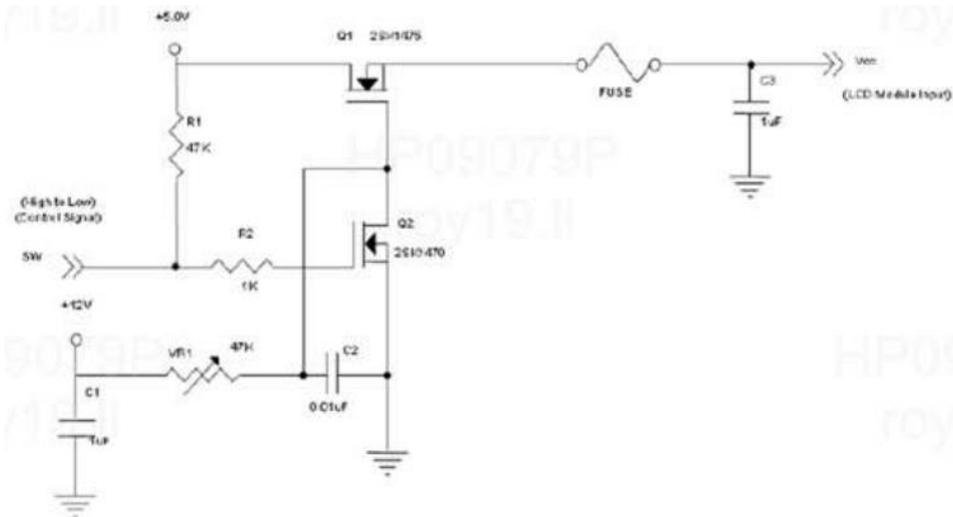
## VCC rising time is 470 $\mu$s
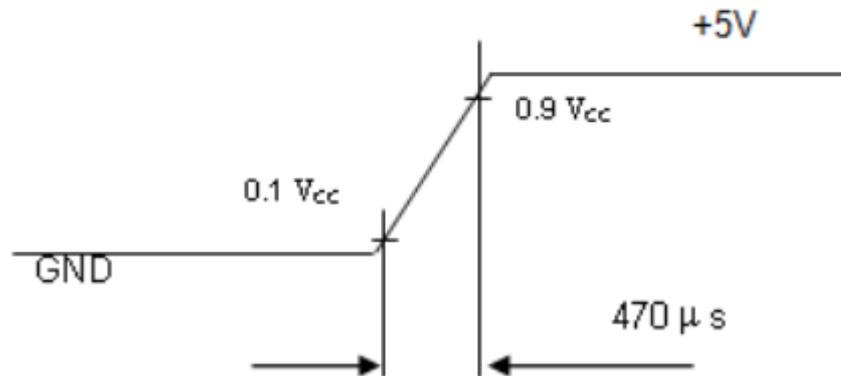


Note (3) The specified power supply current is under the conditions at VDD =5V, Ta = 25 ± 2 ℃, DC Currentand fv = 60 Hz, whereas a power dissipation check pattern below is displayed.

a. White Pattern



Active Area

b. Black Pattern



Active Area

## 2.2 Input Terminal Pin Assignment

TFT LCD MODULE

| Pin No. | Symbol | Function | Polarity | Note |
|---|---|---|---|---|
| 1 | RXO0- | Negative LVDS differential data input. Channel O0 | Negative | |
| 2 | RXO0+ | Positive LVDS differential data input. Channel O0 | Positive | |
| 3 | RXO1- | Negative LVDS differential data input. Channel O1 | Negative | |
| 4 | RXO1+ | Positive LVDS differential data input. Channel O1 | Positive | |
| 5 | RXO2- | Negative LVDS differential data input. Channel O2 | Negative | |
| 6 | RXO2+ | Positive LVDS differential data input. Channel O2 | Positive | |
| 7 | GND | Ground | | |
| 8 | RXOC- | Negative LVDS differential clock input. | Negative | |
| 9 | RXOC+ | Positive LVDS differential clock input. | Positive | |
| 10 | RXO3- | Negative LVDS differential data input. Channel O3 | Negative | |
| 11 | RXO3+ | Positive LVDS differential data input. Channel O3 | Positive | |
| 12 | GND | Ground | | |
| 13 | NC | Not connection, this pin should be open | | |
| 14 | LED_PWM | Backlight Adjust (PWM Dimming 190-210Hz,H: 3.3VDC, L: 0VDC) | | |
| 15 | LED_EN | Enable pin 3.3V | | |
| 16 | LED_GND | Converter ground | | |
| 17 | LED_GND | Converter ground | | |
| 18 | LED_GND | Converter ground | | |
| 19 | NC | Not connection, this pin should be open | | |
| 20 | LED_VCC | Converter input voltage 12V | | |
| 21 | LED_VCC | Converter input voltage 12V | | |
| 22 | LED_VCC | Converter input voltage 12V | | |
| 23 | NC | Not connection, this pin should be open | | |
| 24 | NC | Not connection, this pin should be open | | |
| 25 | SEL68 | LVDS 6/8 bit select function control, Low → 6 bit Input Mode. High → 8bit Input Mode | | (3)(4) |
| 26 | NC | Not connection, this pin should be open | | |
| 27 | NC | Not connection, this pin should be open | | |
| 28 | UD/LR | Reverse Scan Control, Low → Normal Mode. High → Reverse Scan | | (3)(4) |
| 29 | VCC | Power supply 5V | | |
| 30 | VCC | Power supply 5V | | |

Note (1) Connector Part No.: STM MSAK24025P30MB(Exterior silver) or I-PEX 20455-030E-76(Exterior gold) or equivalent.

Note (2) User's connector Part No.: I-PE X20453-030T-03 or equivalent.

Note (3) "Low" stands for 0V. "High" stands for 3.3V.

Note (4)Interface optional pin has internal scheme as following diagram, Customer should keep the interface voltage level requirement which including panel board loading as below

Note (5) Pin1 location is RXO0- to comply with mechanical characterics

RPFI pin:
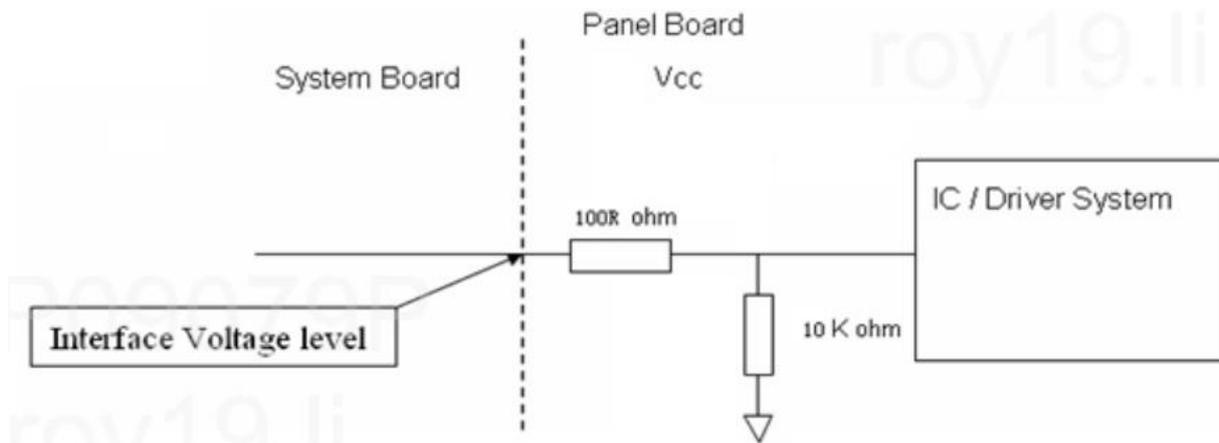


## 2.3 Color Data Input Assignment

The brightness of each primary color (red, green and blue) is based on the 8-bit gray scale data input for the color. The higher the binary input, the brighter the color. The table below provides the assignment of color.

| Color | | Data Signal | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Red | | | | | | | | Green | | | | | | | | Blue | | | | | | | |
| | | R7 | R6 | R5 | R4 | R3 | R2 | R1 | R0 | G7 | G6 | G5 | G4 | G3 | G2 | G1 | G0 | B7 | B6 | B5 | B4 | B3 | B2 | B1 | B0 |
| Basic Colors | 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 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Green | 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 | 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 |
| Gray Scale Of Red | Red(0) / Dark | 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 |
| Gray Scale Of Green | Green(0)/Dark | 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 |
| Gray Scale Of Blue | Blue(0) / Dark | 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)0: Low Level Voltage, 1: High Level Voltage
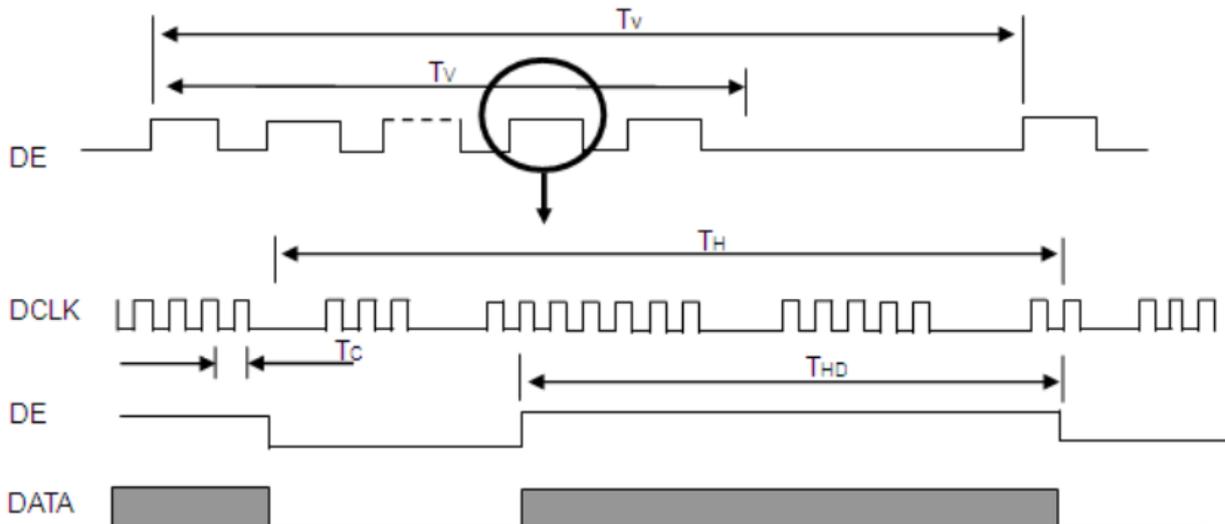
## 2.4 Input Signal Timing Specifications

The input signal timing specifications are shown as the following table and timing diagram.

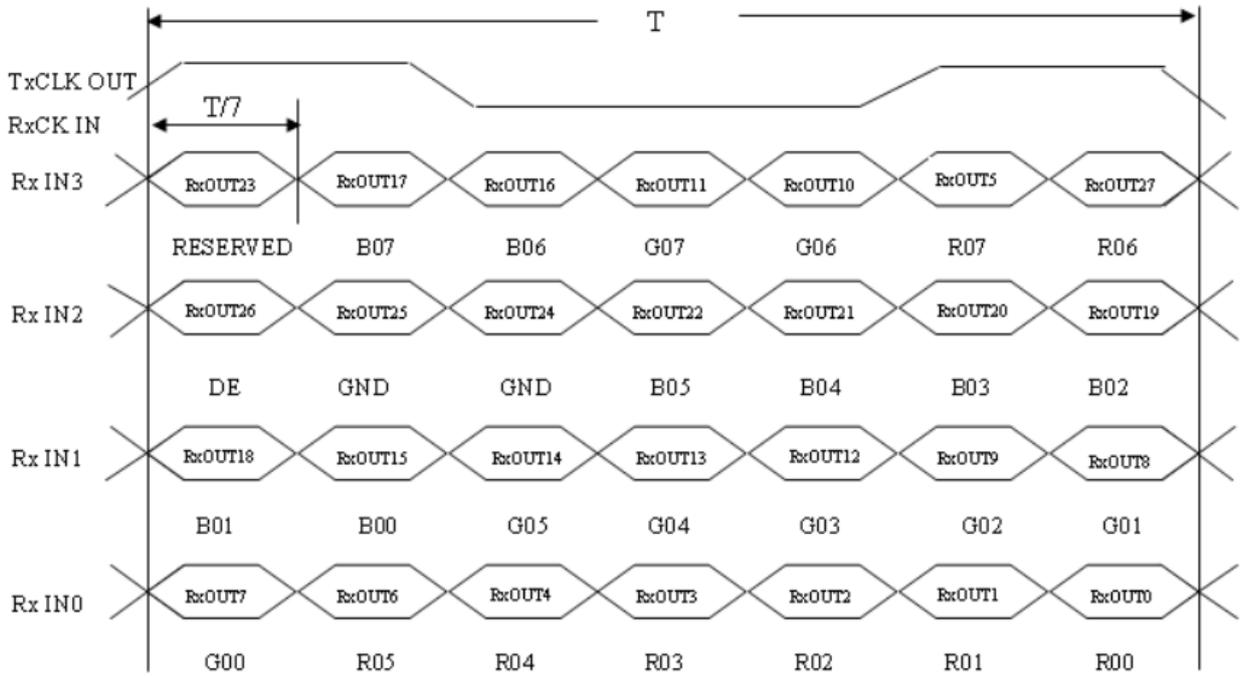| Signal | Item | Symbol | Min. | Typ. | Max. | Unit | Note |
|---|---|---|---|---|---|---|---|
| LVDS Clock | Frequency | $F_r$ | (35) | 40 | (48) | MHz | - |
| | Period | $T_c$ | (20.8) | 25 | (28.6) | ns | |
| | Input Clock to data skew | TLVCCS | - | - | 0.25 | UI | (a) |
| | Spread spectrum modulation range | $F_{clkin\_mod}$ | -1.5 | | 1.5 | % | (b) |
| | Spread spectrum modulation frequency | $F_{SSM}$ | 25 | - | 90 | KHz | |
| Vertical Display Term | Frame Rate | $F_r$ | 60 | 60 | 60 | Hz | - |
| | Total | $T_v$ | (610) | 628 | (790) | $T_h$ | $Tv=T_{vd}+T_{vb}$ |
| | Active Display | $T_{vd}$ | 600 | 600 | 600 | $T_h$ | - |
| | Blank | $T_{vb}$ | $T_v-T_{vd}$ | 28 | $T_v-T_{vd}$ | $T_h$ | - |
| Horizontal Display Term | Total | $T_h$ | (960) | 1056 | (1060) | $T_c$ | $T_h=T_{hd}+T_{hb}$ |
| | Active Display | $T_{hd}$ | 800 | 800 | 800 | $T_c$ | - |
| | Blank | $T_{hb}$ | $T_h-T_{hd}$ | 256 | $T_h-T_{hd}$ | $T_c$ | - |

Note (1) Because this module is operated by DE only mode, Hsync and Vsync input signals should be set to low logic level or ground. Otherwise, this module would operate abnormally.

Note (2) The Tv(Tvd+Tvb) must be integer, otherwise, the module would operate abnormally.

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## INPUT SIGNAL TIMING DIAGRAM

## TIMING DIAGRAM of LVDS

| | | | | | | |
|---|---|---|---|---|---|---|
| TxCLK OUT | | | | | | |
| RxCK IN | T/7 | | | | | |
| Rx IN3 | RxOUT23 | RxOUT17 | RxOUT16 | RxOUT11 | RxOUT10 | RxOUT5 | RxOUT27 |
| | RESERVED | B07 | B06 | G07 | G06 | R07 | R06 |
| Rx IN2 | RxOUT26 | RxOUT25 | RxOUT24 | RxOUT22 | RxOUT21 | RxOUT20 | RxOUT19 |
| | DE | GND | GND | B05 | B04 | B03 | B02 |
| Rx IN1 | RxOUT18 | RxOUT15 | RxOUT14 | RxOUT13 | RxOUT12 | RxOUT9 | RxOUT8 |
| | B01 | B00 | G05 | G04 | G03 | G02 | G01 |
| Rx IN0 | RxOUT7 | RxOUT6 | RxOUT4 | RxOUT3 | RxOUT2 | RxOUT1 | RxOUT0 |
| | G00 | R05 | R04 | R03 | R02 | R01 | R00 |

Note (a) The input clock cycle-to-cycle jitter is defined as below figures. $Trcl = I\ T1 - TI$
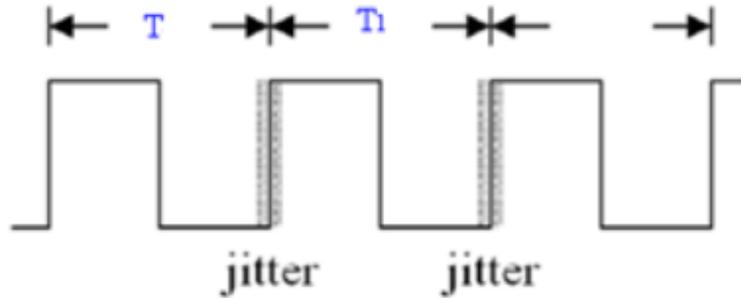
Note (b) Input Clock to data skew is defined as below figures.
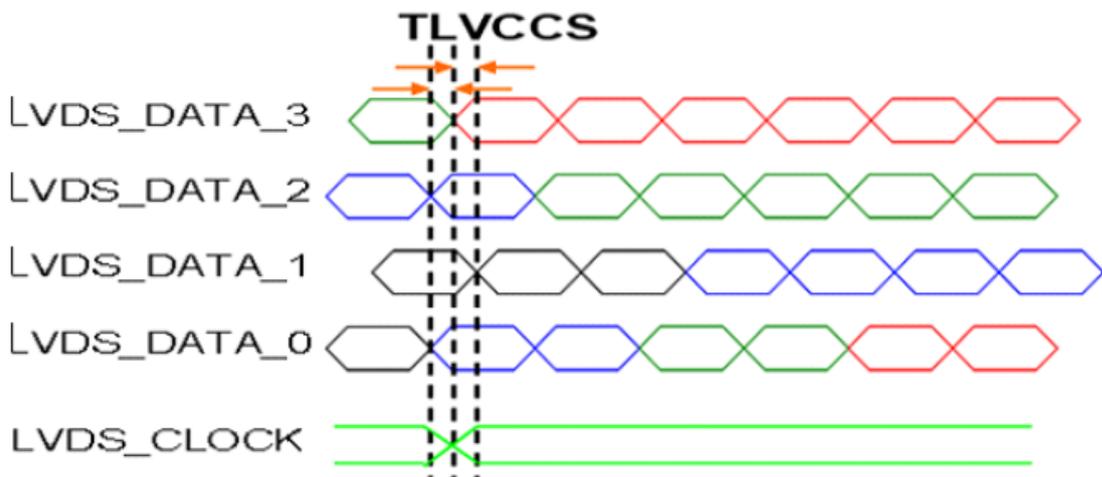
Note (c) The SSCG (Spread spectrum clock generator) is defined as below figures.
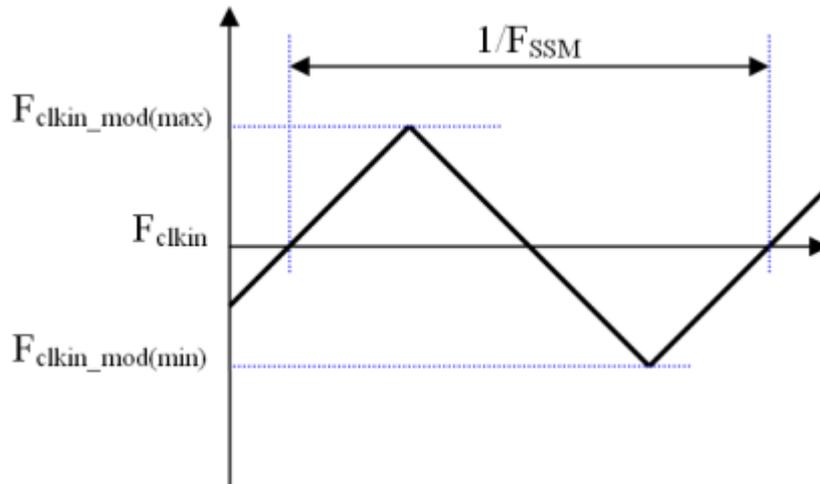


## 2.5 Power ON/OFF Sequence

To prevent a latch-up or DC operation of LCD assembly, the power on/off sequence should be as the diagram below.
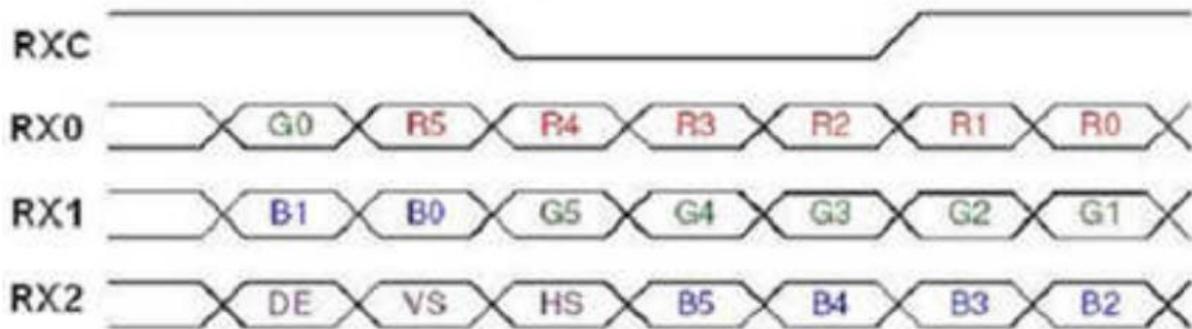
**Power ON/OFF sequence**
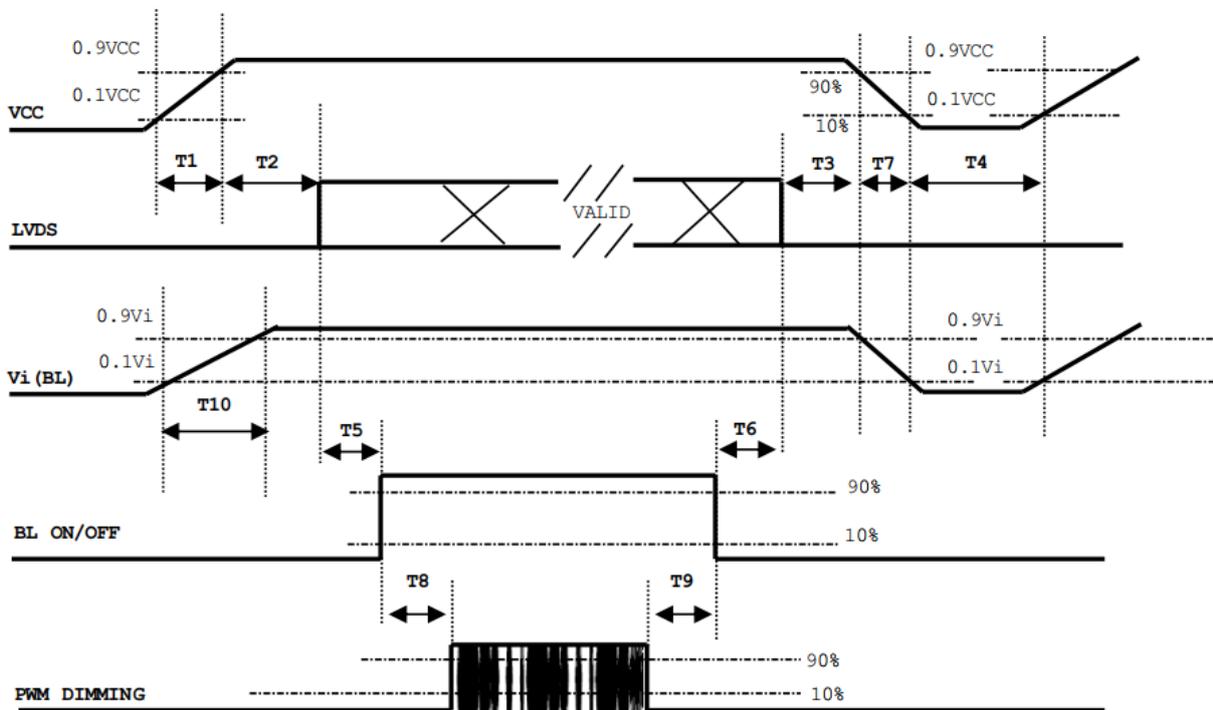
| Parameter | Value | | | Units |
| --- | --- | --- | --- | --- |
| | Min | Typ | Max | |
| T1 | 0.5 | --- | 10 | ms |
| T2 | 0 | --- | 50 | ms |
| T3 | 0 | --- | 50 | ms |
| T4 | 500 | --- | --- | ms |
| T5 | 450 | --- | --- | ms |
| T6 | 200 | --- | --- | ms |
| T7 | 10 | --- | 100 | ms |
| T8 | 10 | --- | --- | ms |
| T9 | 10 | --- | --- | ms |
| T10 | 20 | --- | 50 | ms |

Note:

(1)The supply voltage of the external system for the module input should be the same as the definition of Vcc.

(2)When the backlight turns on before the LCD operation of the LCD turns off, the display may momentarily become abnormal screen.

(3)In case of VCC = off level, please keep the level of input signals on the low or keep a high impedance.

(4)T4 should be measured after the module has been fully discharged between power off and on period.

(5)Interface signal shall not be kept at high impedance when the power is on.

(6)INX won't take any responsibility for the products which are damaged by the customers not following the Power Sequence.

(7)There might be slight electronic noise when LCD is turned off (even backlight unit is also off). To avoid this symptom, we suggest "Vcc falling timing" to follow "T7 spec".

## 2.6 Input Data Format

### SEL 6/8="Low" for 6 Bits LVDS

| RXC | | | | | | | |
|-----|----|----|----|----|----|----|----|
| RX0 | G0 | R5 | R4 | R3 | R2 | R1 | R0 |
| RX1 | B1 | B0 | G5 | G4 | G3 | G2 | G1 |
| RX2 | DE | VS | HS | B5 | B4 | B3 | B2 |

### SEL 6/8="High" for 8 Bits LVDS

| RXC | | | | | | | |
|-----|-----|----|----|----|----|----|----|
| RX0 | G0 | R5 | R4 | R3 | R2 | R1 | R0 |
| RX1 | B1 | B0 | G5 | G4 | G3 | G2 | G1 |
| RX2 | DE | VS | HS | B5 | B4 | B3 | B2 |
| RX3 | RSV | B7 | B6 | G7 | G6 | R7 | R6 |
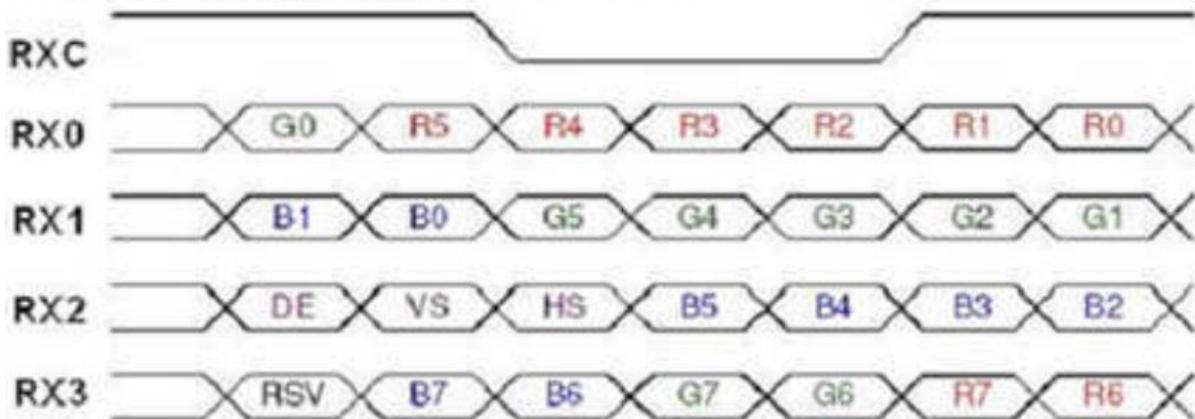
Note (1) R/G/B data 7: MSB, R/G/B data 0: LSB
Note (2) Please follow PSWG

| Signal Name | Description | Remark |
|---|---|---|
| R7 | Red Data 7 (MSB) | Red-pixel Data |
| R6 | Red Data 6 | Each red pixel's brightness data consists of these |
| R5 | Red Data 5 | 8 bits pixel data. |
| R4 | Red Data 4 | |
| R3 | Red Data 3 | |
| R2 | Red Data 2 | |
| R1 | Red Data 1 | |
| R0 | Red Data 0 (LSB) | |
| G7 | Green Data 7 (MSB) | Green-pixel Data |
| G6 | GreenData 6 | Each green pixel's brightness data consists of these |
| G5 | GreenData 5 | 8 bits pixel data. |
| G4 | GreenData 4 | |
| G3 | GreenData 3 | |
| G2 | GreenData 2 | |
| G1 | GreenData 1 | |
| G0 | GreenData 0 (LSB) | |
| B7 | Blue Data 7 (MSB) | Blue-pixel Data |
| B6 | Blue Data 6 | Each blue pixel's brightness data consists of these |
| B5 | Blue Data 5 | 8 bits pixel data. |
| B4 | Blue Data 4 | |
| B3 | Blue Data 3 | |
| B2 | Blue Data 2 | |
| B1 | Blue Data 1 | |
| B0 | Blue Data 0 (LSB) | |
| RXCLKIN+ RXCLKIN- | LVDS Clock Input | |
| DE | Display Enable | |
| VS | Vertical Sync | |
| HS | Horizontal Sync | |

## 2.7 Scanning Direction

The following figures show the image see from the front view. The arrow indicates the direction of scan.



**Fig.1 Normal Scan**

**Fig.2 Reverse Scan**

Fig. 1  Normal scan (pin 28, UD/LR = Low )

Fig. 2  Reverse scan (pin 28, UD/LR = Hight )

## 3    Optical Specification

| Item | | Symbol | Condition | Min. | Typ. | Max. | Unit | Note |
|---|---|---|---|---|---|---|---|---|
| Color chromaticity | Red | Rx | θx=0 θy=0 CA-410 | 0.615 | 0.645 | 0.675 | - | Test Mode: (2) (3) |
| | | Ry | | 0.310 | 0.340 | 0.370 | - | |
| | Green | Gx | | 0.281 | 0.311 | 0.341 | - | |
| | | Gy | | 0.590 | 0.620 | 0.650 | - | |
| | Blue | Bx | | 0.116 | 0.146 | 0.176 | - | |
| | | By | | 0.012 | 0.042 | 0.072 | - | |
| | White | Wx | | 0.279 | 0.309 | 0.339 | - | |
| | | Wy | | 0.309 | 0.339 | 0.369 | - | |
| Center Luminance of White | | Lc | θx=0 θy=0 CA-410 | 1260 | 1400 | 1820 | cd/m$^2$ | |
| Uniform | | Lu | | | 89 | | % | |
| Contrast Ratio | | CR | θx=0 θy=0 Klein K-10 | 900:1 | 1000:1 | | - | Test Mode: (4) |
| Color Saturation | | NTSC | | | 79 | | % | |
| Viewing Angle | Horizontal | θx+ | CR ≥ 10 | | 88 | | Deg | Test Mode: (1) |
| | | θx- | | | 88 | | | |
| | Vertical | θy+ | | | 88 | | | |
| | | θy- | | | 88 | | | |

**Test Mode：**
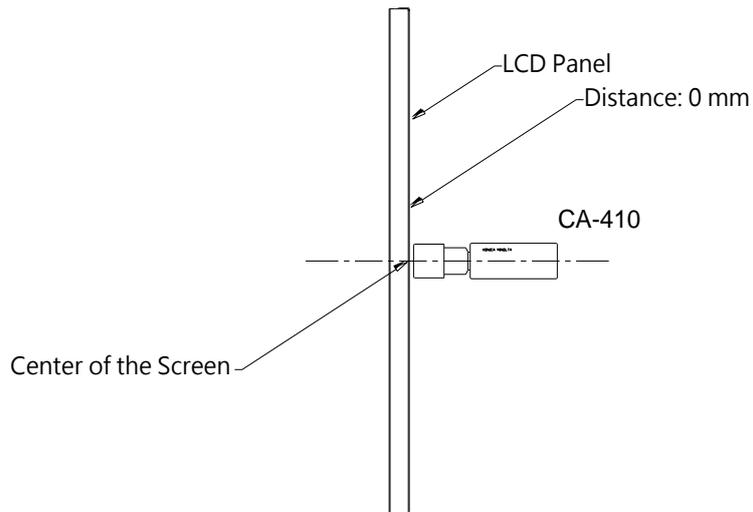
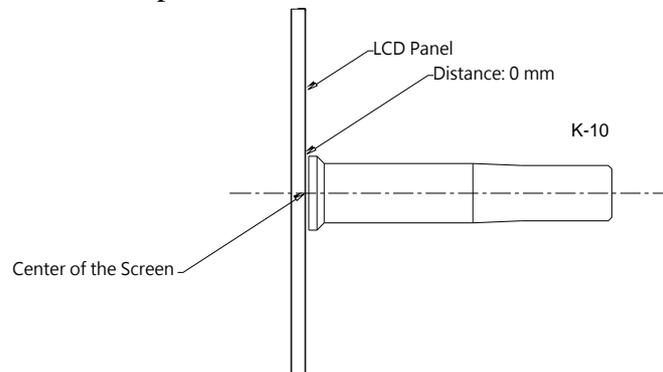(1) Definition of Viewing Angle (θx , θy):
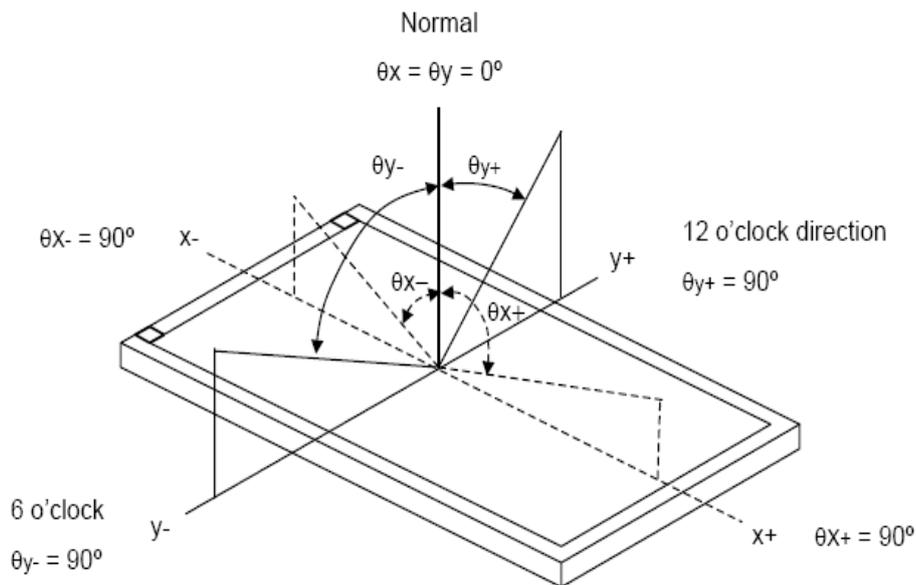
(2) Definition of Test Point:



Active Area
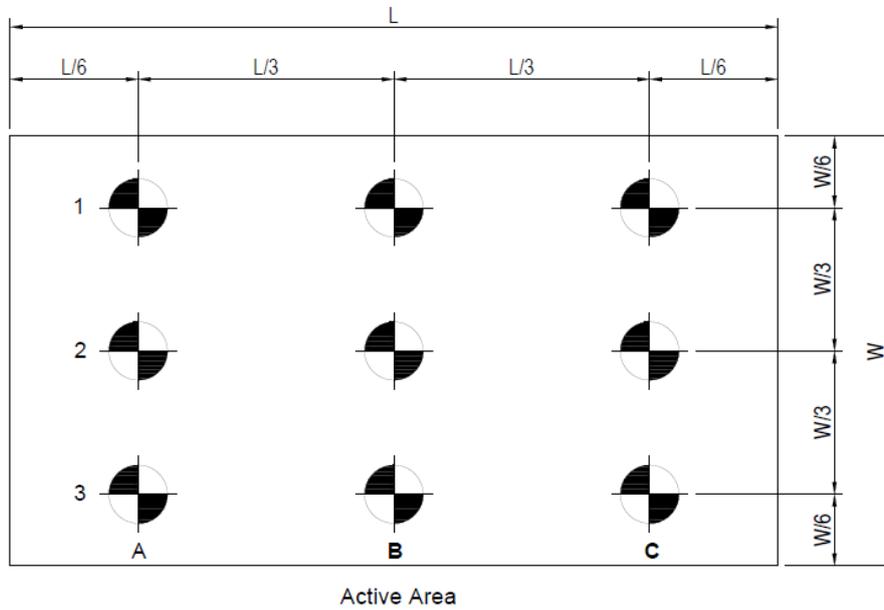
(3) CA-410 Measurement Setup:



(4) Klein K-10 Measurement Setup:

# 4 LED Driving Board Specifications

This specification is applied to LED converter unit for LED backlight.

## 4.1 Operating Characteristics

| Item | Symbol | Condition | MIN. | TYP. | MAX. | Unit | Remark |
|------|--------|-----------|------|------|------|------|--------|
| Input Voltage | Vin | | 10.0 | 12.0 | 14.0 | V | |
| Input Current (High Brightness) | IinH | Brightness = 100% | 0.71 | 0.59 | 0.50 | A | (1) |
| LED Current (High Brightness) | IoutH | Brightness = 100% | ----- | 0.23 | ----- | A | |
| Working Frequency | W_Freq | Brightness = 100% | ----- | 400 | ----- | KHZ | |
| Input Power consumption | Pin | Brightness = 100% | ----- | 7.08 | ----- | W | |
| Brightness Control | | DC mode | | | | | |
| | Vadj | Connection of Voltage | 0.2 | ----- | 5.0 | V | (2) |
| | | PWM mode | | | | | |
| | PWM | Connect to PWM | 0 | ----- | 100 | % | (3) |
| | Freq | | ----- | 200 | ----- | Hz | (4) |
| ON/OFF Control | Von | Normal Operation | 2 | ----- | 5 | V | |
| | Voff | | 0 | ----- | 0.8 | V | |
| Output Voltage | Vout | Brightness = 100% | ----- | 27.85 | 27.90 | V | |
| Efficiency | η | Brightness = 100% | ----- | 90.4 | ----- | % | (5) |

Remark:
   (1) this data is based on the testing result of practical input voltage, Iin is measured by related Vin(min, typ, max) . If the voltage is increased, the current will decrease. If the voltage is decrease, the current will increase
   (2) Max brightness at Vadj=0.2V. Min brightness at Vadj=4.8V.
   (3) Max dimming ratio = 1:100.
   (4) Frequency can be adjusted in accordance with demand(120Hz minimum, or lights will be flickering)
   (5) ηmax = Vout(max)*IoutH(max)/Vin(max)*IinH(min)
   $\eta$ min = Vout(min)*IoutH (min)/Vin(min)*IinH(max)

### 4.2 Connector Socket

**Input Connector: J3(JST S9B-PH-SM3-TB or Compatible)**

| PIN No | Symbol | Description |
|--------|--------|-------------|
| 1 | Vin | DC+ |
| 2 | Vin | DC+ |
| 3 | Vin | DC+ |
| 4 | GND | Ground |
| 5 | GND | Ground |
| 6 | GND | Ground |
| 7 | Brightness | Brightness Control |
| 8 | Control | ON/OFF Control |
| 9 | CL | PWM or DC selection (Low → DC , Hi → PWM) |

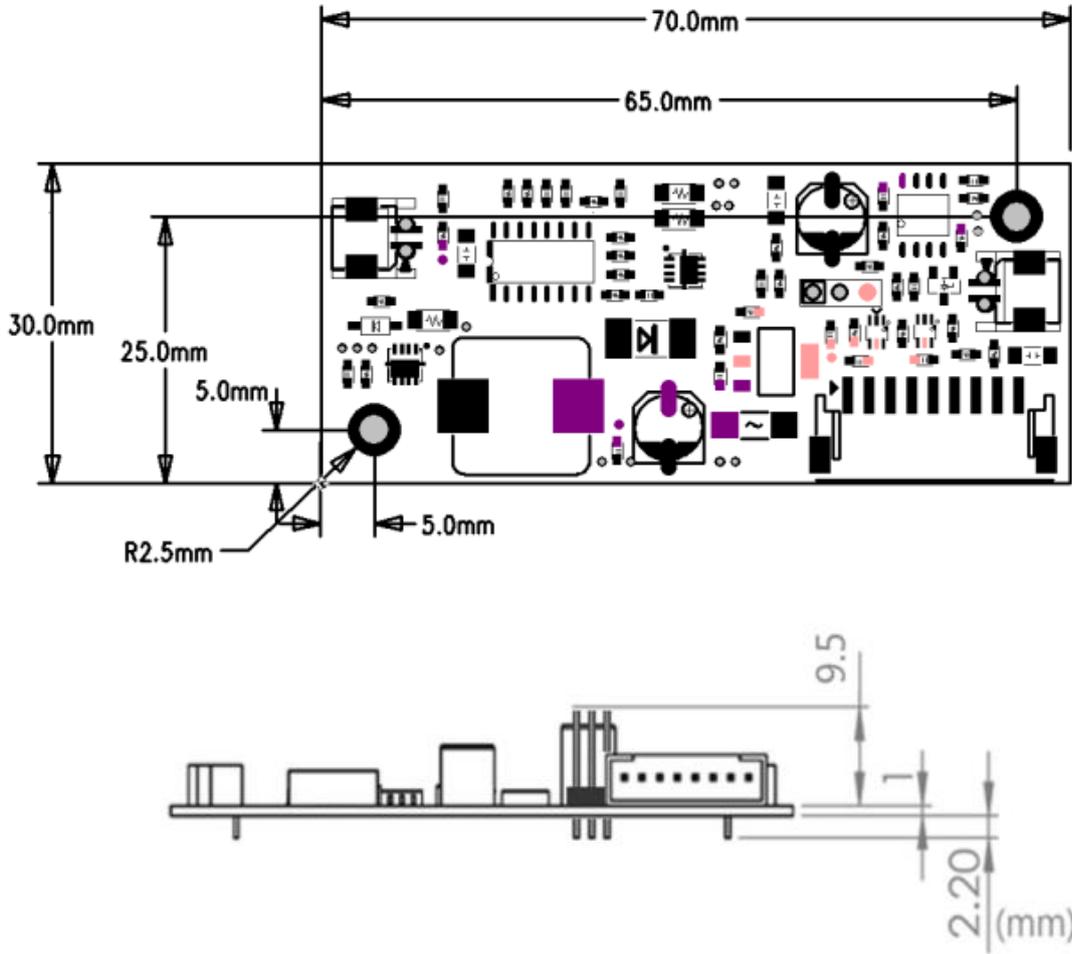**Output Connector :J1,J2(JST S2B-ZR-SM4A-TF or Compatible)**

| PIN NO | Symbol | Description |
|--------|--------|-------------|
| 1 | Output | LED High Voltage( + ) |
| 2 | Output | LED Low Voltage ( - ) |

**DC or PWM Connector :J4**

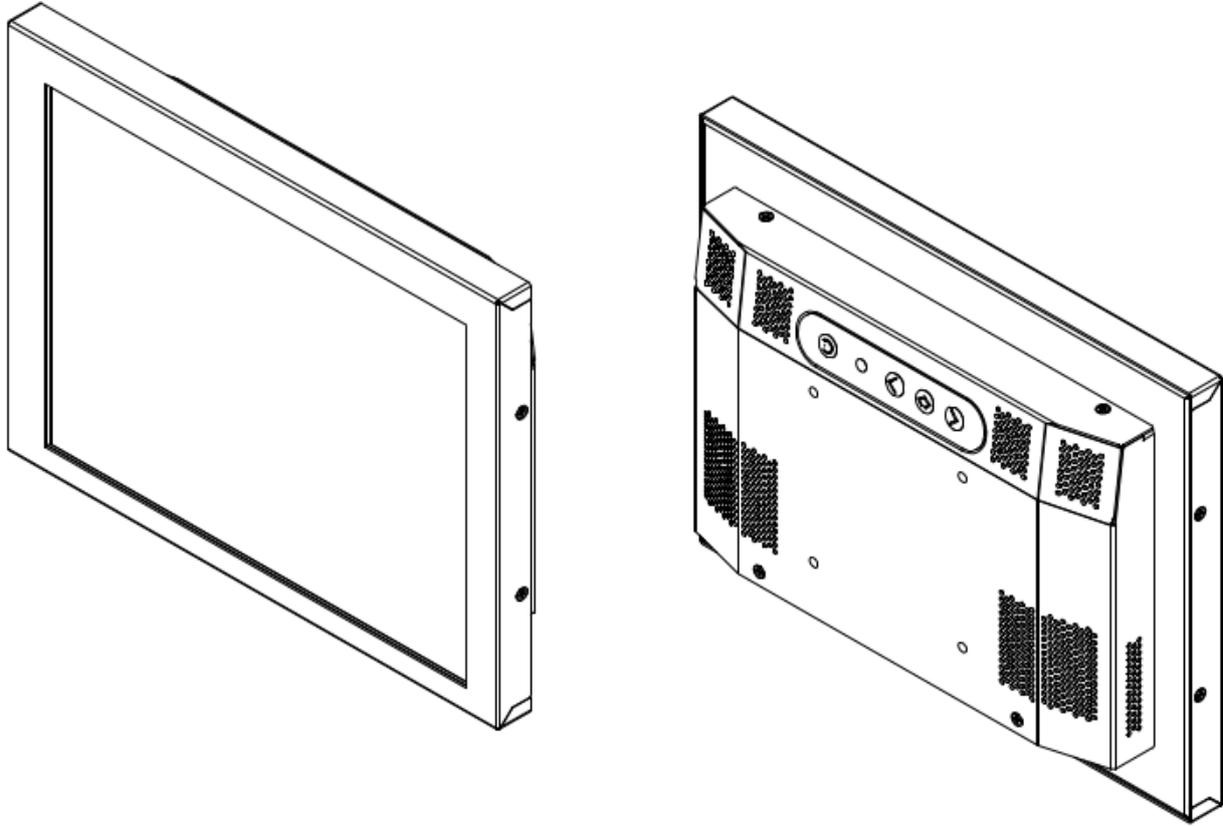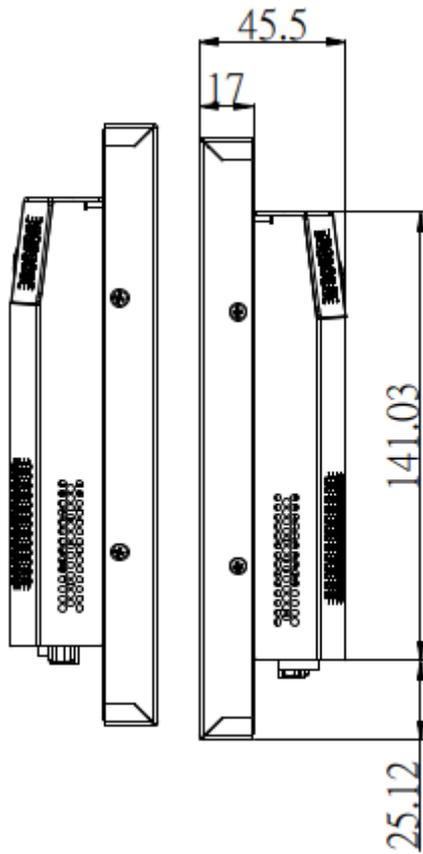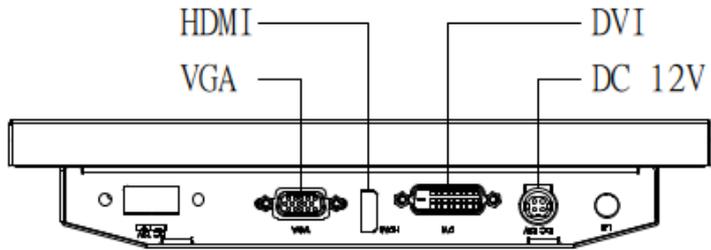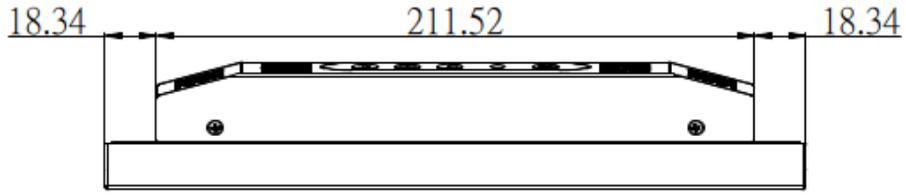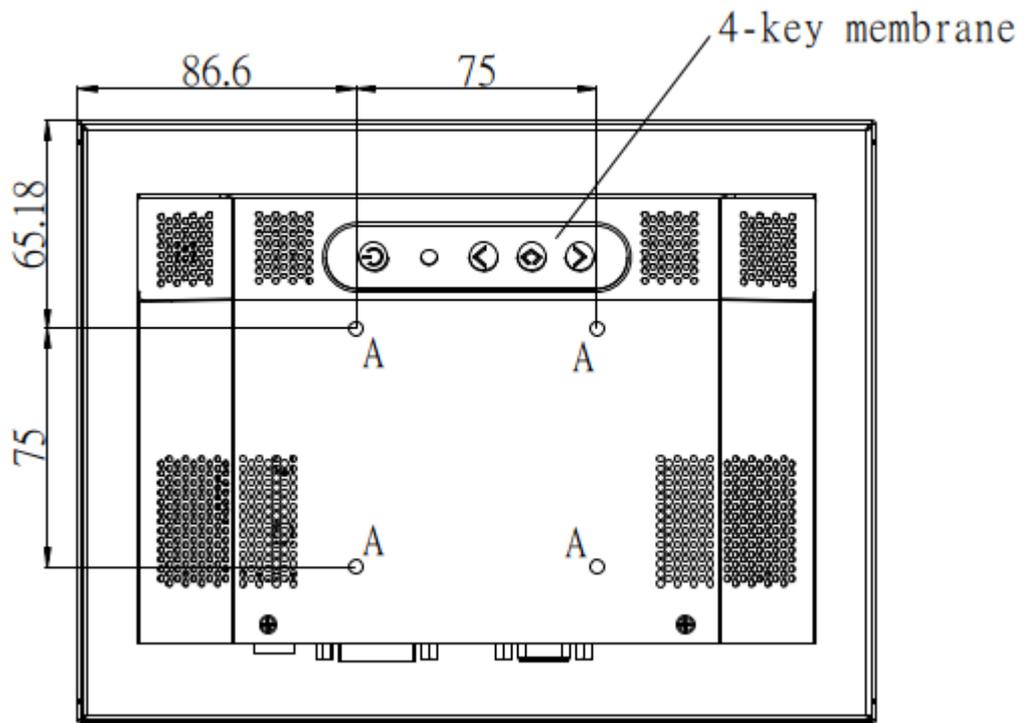| PIN NO | Symbol | Description |
|--------|--------|-------------|
| 1 | DC | JUMP pin 1,2 |
| 2 | GND | LED driver is DC input |
| | | JUMP pin 2,3 |
| 3 | PWM | LED driver is PWM input |

## 4.3　Mechanical Characteristics

Dimension:　70mm*30mm*10.5mm

## 5 Mechanical Drawing

O.D.=248.2

19.55  B.O.=212.7  15.95

20.3  A.A.=211.2  16.7

19.2

18.1

A.A.=158.4

B.O.=160

O.D.=189.3

11.7

11.2

18.34    211.52    18.34

HDMI ———————————    ——————— DVI
VGA ——————————    ——————— DC 12V

45.5

17

141.03

25.12
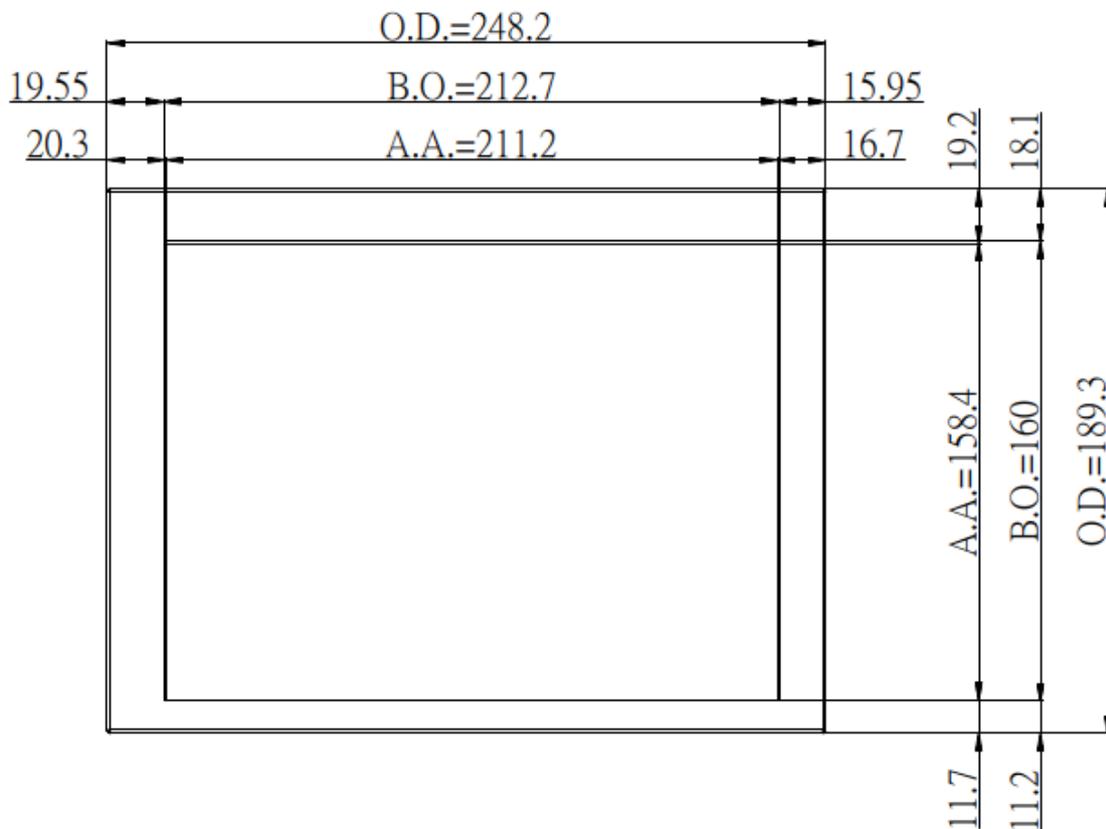
Note：
O.D. : OUTLINE DIMENSION
B.O. : BEZEL OPENING
A.A. : ACTIVE AREA
A : 4 - M4_USER HOLE_MAX Depth = 6mm

## 6    AD8891GDH Board & OSD Functions

We developed this A/D board to support industrial high brightness and commercial applications. This A/D board has many functions. It has a VGA and DVI-D and HDMI input. Rev.1 is European RoHS compliant.

**General Description**
- ◼ **Max resolution up to Full HD**
- ◼ **Analog RGB input up to 205MHz**
- ◼ **Ultra-reliable DVI-I input**
- ◼ **HDMI input (HDMI 1.3)**
- ◼ **Dual/single LVDS interface**
- ◼ **Inverter analog or PWM dimming control.**
- ◼ **Support panel DC 5V or 12V,3.3V output**
- ◼ **OSD control**
- ◼ **External RS232 control (optional)**
- ◼ **Input Power 24V or 12V DC**
- ◼ **Audio out (optional)**
- ◼ **\*External Digital light sensor brightness control (optional)**
- ◼ **\*External light sensor brightness control (optional)**
- ◼ **Support output voltage 12V(1A) and 5V(1A)**
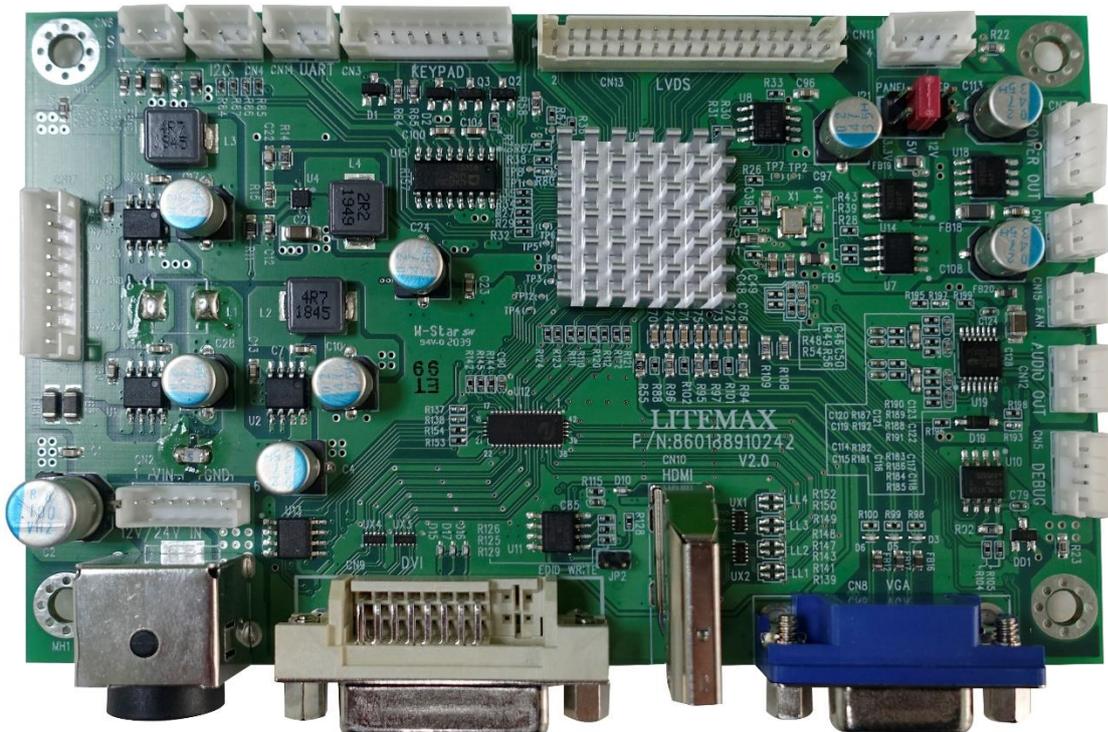
## Outline Dimensions

### AD8891GDH 130mmX80mm
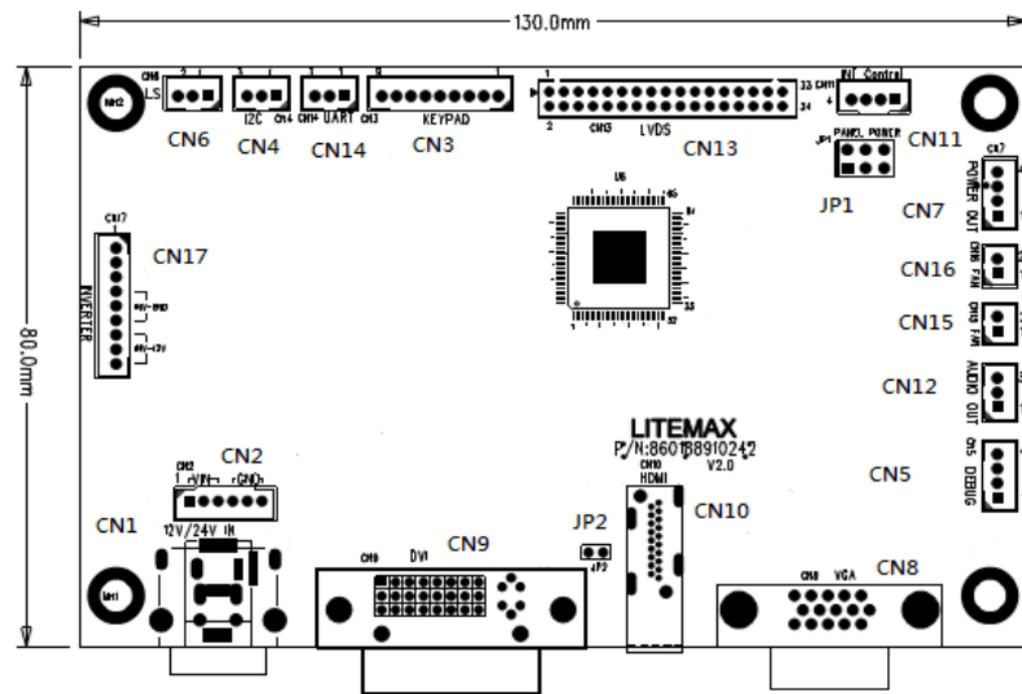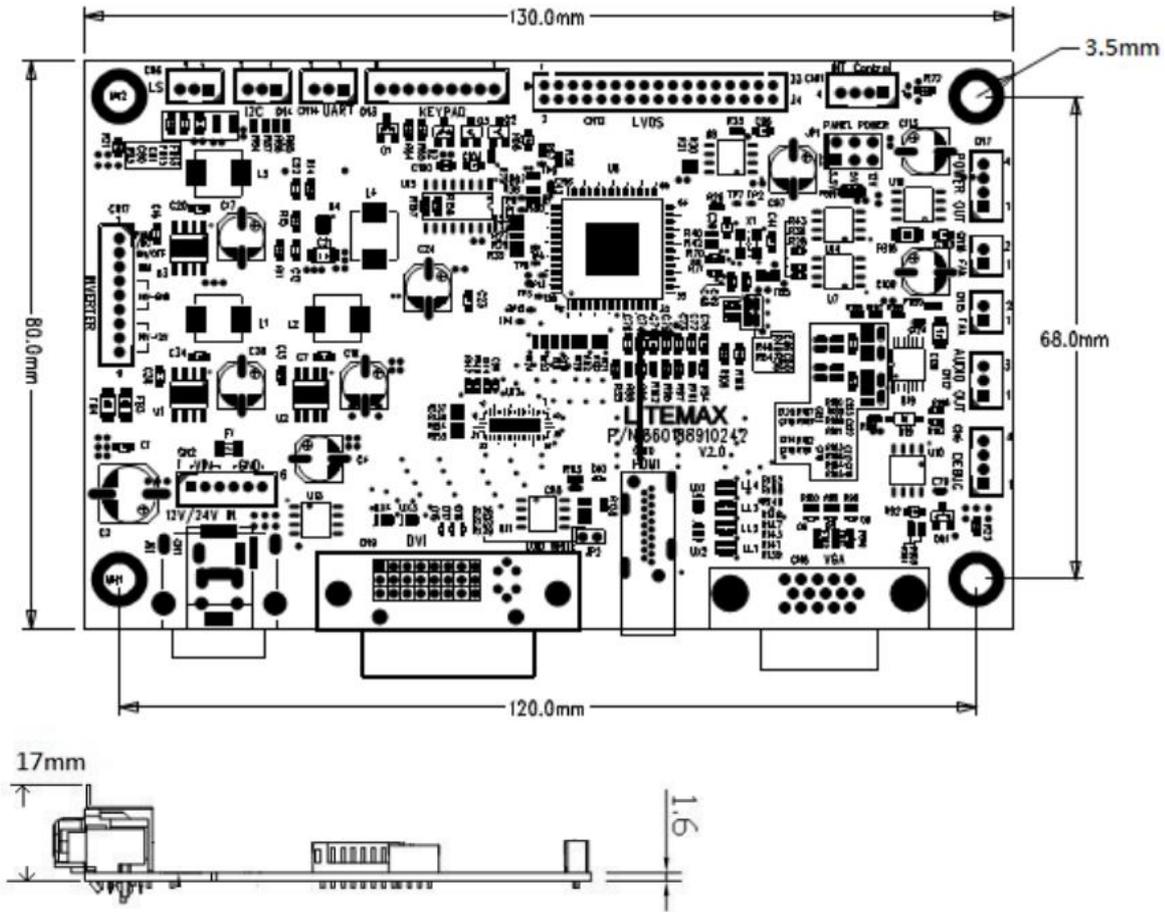
**AD8891GDH Board Pin Define**

**CN13: Panel LVDS connector**

| Pin No. | Function | Pin No. | Function |
|---------|----------|---------|----------|
| 1 | RxO0- | 18 | RxE1+ |
| 2 | RxO0+ | 19 | RxE2- |
| 3 | RxO1- | 20 | RxE2+ |
| 4 | RxO1+ | 21 | RxEC- |
| 5 | RxO2- | 22 | RxEC+ |
| 6 | RxO2+ | 23 | RxE3- |
| 7 | RxOC- | 24 | RxE3+ |
| 8 | RxOC+ | 25 | NC |
| 9 | RxO3- | 26 | NC |
| 10 | RxO3+ | 27 | GND |
| 11 | NC | 28 | GND |
| 12 | NC | 29 | Pull Height |
| 13 | GND | 30 | Pull Low |
| 14 | GND | 31 | VLCD |
| 15 | RxE0- | 32 | VLCD |
| 16 | RxE0+ | 33 | VLCD |
| 17 | RXE1- | 34 | VLCD |

**CN9: DVI-D Input Connector**

| Pin No. | Function | Pin No. | Function | Pin No. | Function |
|---------|----------|---------|----------|---------|----------|
| 1 | T.M.D.S. Data2- | 9 | T.M.D.S. Data1- | 17 | T.M.D.S. Data0- |
| 2 | T.M.D.S. Data2+ | 10 | T.M.D.S. Data1+ | 18 | T.M.D.S. Data0+ |
| 3 | T.M.D.S. Data2/4 Shield | 11 | DET_DVI | 19 | T.M.D.S. Data0/5 Shield |
| 4 | NC | 12 | NC | 20 | NC |
| 5 | NC | 13 | NC | 21 | NC |
| 6 | DDC Clock | 14 | +5V Power | 22 | T.M.D.S. Clock Shield |
| 7 | DDC Data | 15 | Ground (for +5V) | 23 | T.M.D.S. Clock+ |
| 8 | NC | 16 | Hot Plug Detect | 24 | T.M.D.S. Clock- |

### CN8: Analog RGB Input connector (D-SUB 15Pin)

| Pin | Symbol | Description | Pin No. | Symbol | Description |
|---|---|---|---|---|---|
| 1 | RED | Analog Red | 9 | +5V | +5VDDC |
| 2 | GREEN | Analog Green | 10 | SGND | Sync GND |
| 3 | BLUE | Analog Blue | 11 | NCD | Reserved |
| 4 | GND | Reserved | 12 | SDA | DDC Serial Data |
| 5 | GND | DET_VGA | 13 | HSYNC | Horizontal Sync |
| 6 | RED_RTN | Red Return | 14 | VSYNC | Vertical Sync |
| 7 | GREEN_RTN | Green Return | 15 | SCL | DDC Data Clock |
| 8 | BLUE_RTN | Blue Return | | | |

### CN10: HDMI Input connector (HDMI 19Pin)

| Pin No. | Function | Pin No. | Function | Pin No. | Function |
|---|---|---|---|---|---|
| 1 | T.M.D.S. Data2+ | 9 | T.M.D.S. Data0- | 17 | GND |
| 2 | Shield | 10 | T.M.D.S. Clock+ | 18 | HDMI 5V |
| 3 | T.M.D.S. Data2- | 11 | Shield | 19 | Hot Plug Detect |
| 4 | T.M.D.S. Data1+ | 12 | T.M.D.S. Clock- | | |
| 5 | Shield | 13 | CEC | | |
| 6 | T.M.D.S. Data1- | 14 | NC | | |
| 7 | T.M.D.S. Data0+ | 15 | HDMI_SCL | | |
| 8 | Shield | 16 | HDMI_SDA | | |

### CN1: Power DIN (12V)

| Pin No. | Function | Pin No. | Function |
|---|---|---|---|
| 1 | 24V/12V | 2 | 24V/12V |
| 3 | GND | 4 | GND |

### CN1: Power Jack (12V)

| Pin No. | Function | Pin No. | Function |
|---|---|---|---|
| 1 | 24V/12V | 2 | GND |
| 3 | GND | | |

## CN2: Power connector (12V) (6PIN 2.0mm)

| Pin No. | Function | Pin No. | Function |
|---------|----------|---------|----------|
| 1 | 24V/12V | 2 | 24V/12V |
| 3 | 24V/12V | 4 | GND |
| 5 | GND | 6 | GND |

## CN7: Touch Power connector

| Pin No. | Function | Pin No. | Function |
|---------|----------|---------|----------|
| 1 | 5V | 2 | GND |
| 3 | 12V | 4 | GND |

## CN15, CN16: Fan control (2PIN 2.0mm)

| Pin No. | Function | Pin No. | Function |
|---------|----------|---------|----------|
| 1 | 12V | 2 | GND |

## CN3: Key Pad (9PIN 2.0mm)

| Pin No. | Function | Pin No. | Function |
|---------|-----------|---------|----------|
| 1 | POWER KEY | 6 | MENU KEY |
| 2 | GREEN LED | 7 | AUTO KEY |
| 3 | RED LED | 8 | GND |
| 4 | DOWN KEY | 9 | NC |
| 5 | UP KEY | | |

## JP1: Panel Power

| Pin No. | Function | Pin No. | Function |
|---------|----------|---------|----------|
| 1-2 | 3.3V | 5-6 | 12V |
| 3-4 | 5V | | |

## CN14: RS232 Connector (3PIN 2.0mm)

| Pin No. | Function | Pin No. | Function |
|---------|----------|---------|----------|
| 1 | UART TX | 2 | UART RX |
| 3 | GND | | |

### CN11: INT Control (4PIN 2.0mm)

| Pin No. | Function | Pin No. | Function |
|---------|----------|---------|----------|
| 1 | 5V | 2 | INT |
| 3 | GPIO | 4 | GND |

Reserve for some control

### CN6: Ambient (2PIN 2.0mm)/VR (3PIN 2.0mm)

| Pin No. | Function | Pin No. | Function |
|---------|----------|---------|----------|
| 1 | 3.3V/5V | 2 | Sensor Out |
| 3 | GND | | |

### CN12: Audio out connector (3PIN 2.0mm)

| Pin No. | Function | Pin No. | Function |
|---------|----------|---------|----------|
| 1 | Audio R out | 2 | Audio L out |
| 3 | GND | | |

For audio connect to another Audio AMP

### CN4: I2C Connector (3PIN 2.0mm)

| Pin No. | Function | Pin No. | Function |
|---------|----------|---------|----------|
| 1 | I2C_SDA | 2 | I2C_SCL |
| 3 | GND | | |

For digital LS

### JP2: EDID Jumper (2PIN 2.0mm)

| Pin No. | Function | Pin No. | Function |
|---------|----------|---------|----------|
| 1 | Pull High | 2 | GND |

When EDID want to update it must be short .

### CN5: Debug Connector (4PIN 2.0mm)

| Pin No. | Function | Pin No. | Function |
|---------|----------|---------|----------|
| 1 | 3.3V | 2 | DDCA_SCL |
| 3 | DDCA_SDA | 4 | GND |

For F/W debug

## CN17: Inverter Connector (9PIN 2.0mm)

| Pin No. | Function | Pin No. | Function |
|---------|----------|---------|----------|
| 1 | PWM/DC SEL | 6 | GND |
| 2 | Backlight ON/OFF | 7 | 24V/12V |
| 3 | Dimming adjust | 8 | 24V/12V |
| 4 | GND | 9 | 24V/12V |
| 5 | GND | | |

## 6.1　OSD Function

**MEMBRANE CONTROL BUTTOM**
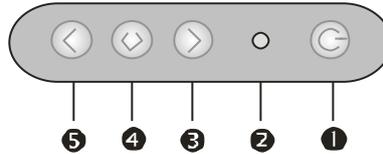


❶**POWER SWITCH:** Pushing the power switch will turn the monitor on.　Pushing it again to turn the monitor off.

❷**Power LED:** Power ON-Green / Power off-No.

❸**Up Key >:** Increase item number or value of the selected item.

❹**Menu Key:** Enter to the OSD adjustment menu.　It also used for go back to previous menu for sub-menu, and the change data don't save to memory.

❺**Down Key <:** Decrease item number or item value when OSD is on.

**Screen Adjustment Operation Procedure**

1. **Entering the screen adjustment**

   The setting switches are normally at stand-by.　Push the **Menu Key** once to display the main menu of the screen adjustment.　The adjustable items will be displayed in the main menu.

2. **Entering the settings**

   Use the **Down Key <** and **Up Key >** buttons to select the desired setting icon and push the SELECT button to enter sub-menu.

3. **Change the settings**

   After the sub-menu appears, use the **Down Key <** and **Up Key >** buttons to change the setting values.

4. **Save**

   After finishing the adjustment, push the SELECT button to memorize the setting.

5. **Return & Exit the main menu**

   Exit the screen adjustment; push the "MENU" button.　When no operation is done around 10 sec (default OSD timeout), it goes back to the stand-by mode and no more switching is accepted except MENU to restart the setting.

## 6.2  OSD Menu

Here are some instructions for you to use the OSD (On Screen Display). By pressing the "menu", you will see the below picture.
Timing shows resolution and V-frequency of the panel. This 2 information is not changeable by user.
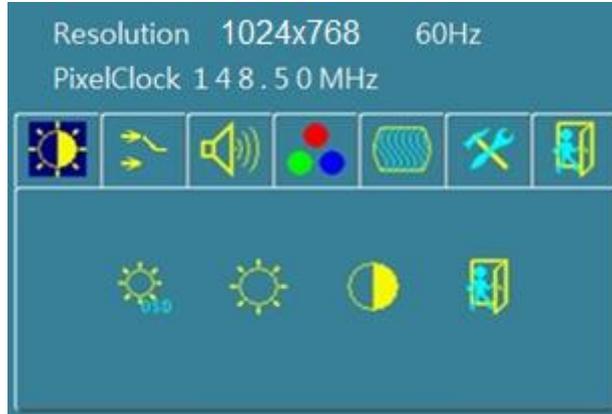


There are 7 sub menus within the OSD user interface:
Brightness, Signal Select, Sound, Color, Image, Tools, and Exit.

When you press the "menu" button, you enter the "Brightness" sub directory. In this directory, you will see 4 selections:

press "menu" once, you can go into the **Ambient light sensor**.

**Ambient light sensor:**
press this Icon,must to accompany with Litemax ambient light sensor to auto dimming.**(OPTION)**

**OSD Brightness**：

Press the "menu" once, to adjust the brightness. Press "left" to dim down the brightness to "0", press "right" to increase the brightness to "100"

**Contrast**：

Press "Menu" once, you can adjust the contrast from "0" to "100" by pressing the "Left" and "Right".

**Exit:** back to the beginning menu.
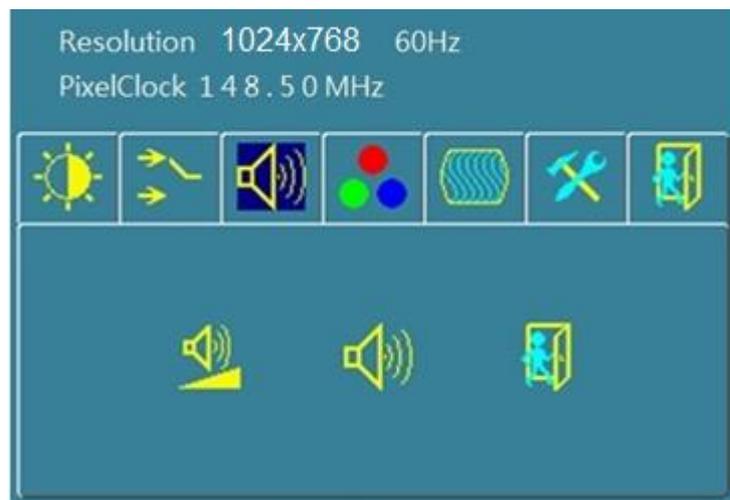
 **Analog:** RGB/VGA input
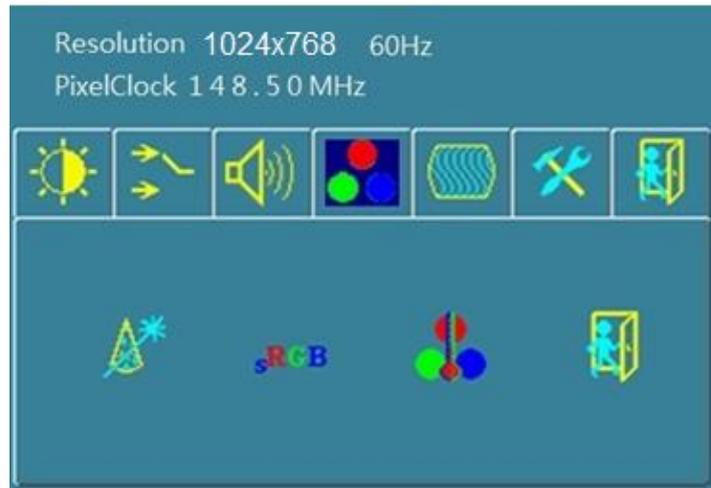
 **Digital:** DVI input

 **HDMI:** HDMI input

 **Exit:** back to the beginning menu.



 **Audio Volume:** Audio volume adjustment.

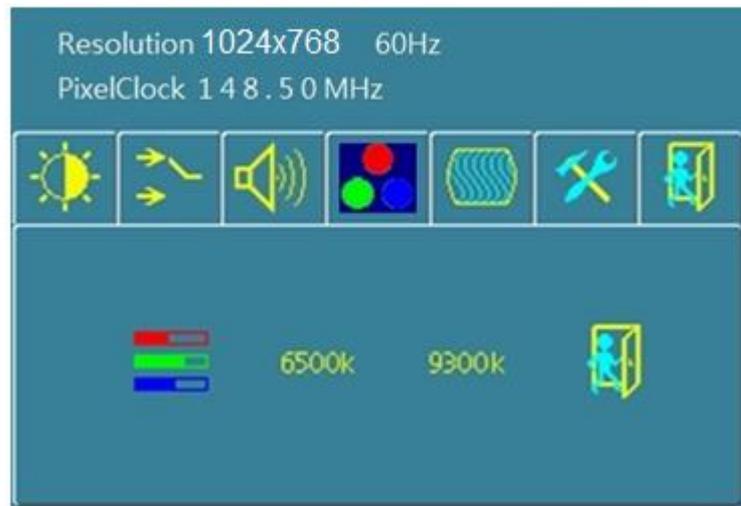 **UnMute/Mute:** You can mute the speaker by pressing this option.

 **Exit:** back to the beginning menu.

LITEMAX Electronics Inc.                                                                 Page 33

**Auto Color**：By navigating over to the "Auto Color" option, optimal color performance is invoked.


**SRGB:** Windows standard color setting




**Color Temperature:** You have 4 options in this selection
.


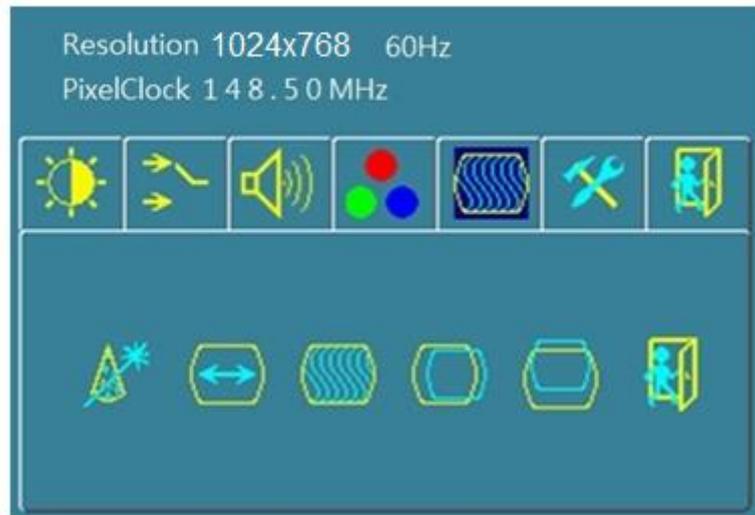**Color Temperature User Define:** Default is 100 for "R", "G", and "B".


**Color Tempture_6500K:** Warm color scheme


**Color Tempture_9300K:** Cold color scheme


**Exit:** back to the beginning menu.

**Auto Adjust:**

Choose this option and the AD8891 will adjust to the optimal horizontal and vertical frequency.

**Clock:** If you are not satisfied with the Auto tune result, you can adjust manually by pressing "Clock". Using this will make the image wider.

**Phase:** If "double images" appear around the characters, choose "Phase" to remove them..
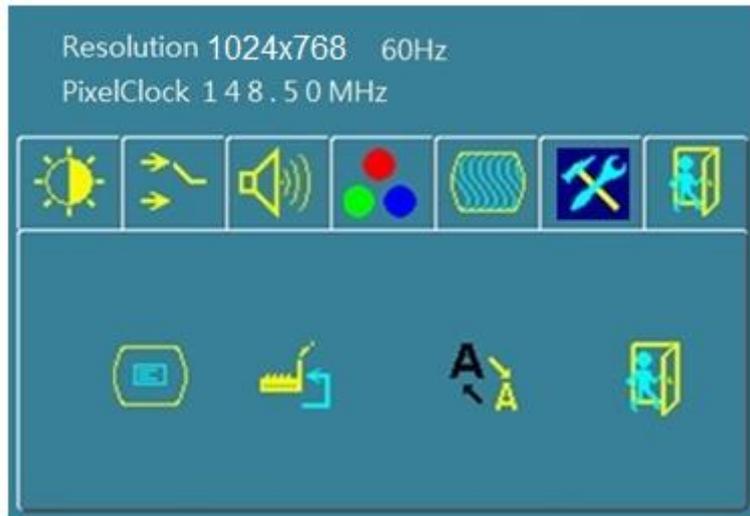
**HPos:** You can shift the screen horizontally using this function.

**VPos:** You can shift the screen vertically using this function.

**Exit:** back to the beginning menu.

**OSD Control:** Selecting this option, brings you to 4 more options:



**OSD_time:** Select time for the OSD user interface to stay on screen, for 2 sec. to 16 sec. Default is 10 sec.

**OSD_HPos:** Moves the OSD user interface horizontally on screen.

**OSD_VPos:** Moves the OSD user interface vertically on screen.

**Exit:** You can exit this sub menu back to the beginning

**Factory_Reset:** By pressing this, the screen will revert to factory settings, and the previous settings will be deleted.

**Sharpness:** Sharpen characters.

**Exit:** back to the normal screen

**OSD Lock Function：**

It is possible to lock all the OSD buttons to prevent unauthorized changes to occur by pressing "**right >**" and "Menu" buttons simultaneously. You will see the "lock" icon below on the center of the screen for 8 ~ 9 seconds. If any button is pushed after the lock function is initiated, the below icon will appear on the screen.'

Keypad Lock

To release the OSD lock, press and "**right >**" and "Menu". The below icon will appear on the center of the screen for 8 ~ 9 seconds. Now all OSD keys are active again.

Keypad Unlock

# 7 Precautions

## 7.1 Handling and Mounting Precautions

(1) The module should be assembled into the system firmly by using every mounting hole. Do not apply rough force such as bending or twisting to the LCD during assembly.

(2) You should consider the mounting structure so that uneven force (ex. Twisted stress, Concentrated stress) is not applied to the module. And the case on which a module is mounted should have sufficient strength so that external force is not transmitted directly to the LCD module.

(3) While assembling or installing LCD modules, it can only be in the clean area. The dust and oil may cause electrical short or damage the polarizer.

(4) Use fingerstalls or soft gloves in order to keep display clean during the incoming inspection and assembly process.

(5) Do not press or scratch the surface harder than a HB pencil lead on the panel because the polarizer is very soft and easily be scratched.

(6) Please attach the surface transparent protection film to the surface in order to protect the polarizer. Transparent protection film should have sufficient strength in order to the resist external force.

(7) When the transparent protection film is peeled off, static electricity is generated between the film and polarizer. This should be peeled off slowly and carefully by people who are electrically grounded and with well ion-blown equipment or in such a condition, etc.

(8) If the surface of the polarizer is dirty, please clean it by some absorbent cotton or soft cloth. Do not use Ketone type materials (ex. Acetone), Ethyl alcohol, Toluene, Ethyl acid or Methyl chloride. It might permanently damage the polarizer due to chemical reaction.

(9) Wipe off water droplets or oil immediately. Staining and discoloration may occur if they left on panel for a long time.

(10) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contacting with hands, legs or clothes, it must be washed away thoroughly with soap.

(11) Protect the LCD module from static electricity, it may cause damage to the C-MOS Gate Array IC.

(12) Do not disassemble the module.

(13) Do not pull or fold the lamp wire.

(14) Pins of I/F connector should not be touched directly with bare hands.

## 7.2 Storage Precautions

(1) High temperature or humidity may reduce the performance of LCD module. Please store LCD module within the specified storage conditions.

(2) If possible store them in a dark place. Do not expose the module to sunlight or fluorescent light. Keep the temperature between 5℃ and 35℃ at normal humidity.

(3) It is dangerous that moisture come into or contacted the LCD module, because the moisture may damage LCD module when it is operating.

(4) The polarizer surface should not come in contact with any other object. It is recommended that they be stored in the container in which they were shipped.

## 7.3    Operation Precautions

(1)    Do not pull the I/F connector in or out while the LCD module is operating.
(2)    Always follow the correct power on/off sequence when LCD module is connecting and operating. This can prevent the CMOS LSI chips from damage during latch-up.
(3)    Response time depends on the temperature. (In lower temperature, it becomes longer.)
(4)    Brightness depends on the temperature. (In lower temperature, it becomes lower.)
(5)    Be careful for condensation at sudden temperature change. Condensation makes damage to polarizer or electrical contacted parts. And after fading condensation, smear or spot will occur.
(6)    Module has high frequency circuits. Sufficient suppression to the electromagnetic interference shall be done by system manufacturers. Grounding and shielding methods are very important to minimize the interference.
(7)    Please do not give any mechanical and/or acoustical impact to module. Otherwise, module can't be operated its full characteristics perfectly.
(8)    Since a module is composed of electronic circuits, it is not strong to electrostatic discharge. Make certain that treatment persons are connected to ground through wrist band etc. And don't touch interface pin directly.
(9)    Do not display the fixed pattern for a long time because it may cause image sticking.
(10)    In order to prevent image sticking, periodical power-off or screen save is needed after fixed pattern long time display.
(11)    Black image or moving image is strongly recommended as a screen save.
(12)    Static information display recommended to use with moving image. Cycling display between 10 minutes' information (static) display and 10 seconds' moving image.
(13)    Background and character (image) color change is recommended. Use different colors for background and character, respectively. And change colors themselves periodically.
(14)    LCD system is required to place in well-ventilated environment. Adapting active cooling system is highly recommended.
(15)    Product reliability and functions are only guaranteed when the product is used under right operation usages.
(16)    If product will be used in extreme conditions, such as high temperature/ humidity, shock and vibration it is strongly recommended to contact Litemax for filed application engineering advice. Otherwise, its reliability and function may not be guaranteed. Extreme conditions are commonly found at airports, transit stations, taxi-top, in vehicle and controlling systems.

## 8    Disclaimer

All information in this document are subject to change, please constant LiteMax for any new design.