LITEMAX
Sunlight Readable LCD!

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DURApixel™ LED B/L LCD

RoHS·WEEE LITEMAX COMPLIANT

# LITEMAX

## DLD5500-I

## Sunlight Readable 55” 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 |
|---|---|---|---|---|
| Oct/30/2025 | all | | Initial release | |
| | | | | |
| | | | | |
| | | | | |

## Contents

# 1 General Description

The DLD5500-I is a 55 inch industrial grade sunlight readable LCD, with high brightness 2500 nits, it produce 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

- High Brightness 2500 nits
- Sunlight Readable
- Wide Operation Temperature (-30 ˚C ~ 70 ˚C)
- LCD Blackening Defect Free (H-Tni 110 ˚C)
- Surface Treatment (Haze 25%)
- Low Power Consumption
- BL MTBF: 100,000 hours

## 1.2 General Specifications

| Model Name | DLD5500-I |
|---|---|
| **Description** | 55” TFT LCD, 2500 nits LED Backlight, 3840x2160 |
| **Screen Size** | 55” |
| **Display Area (mm)** | 1209.6(H) x 680.4(V) |
| **Brightness** | 2500 cd/m$^2$ |
| **Resolution** | 3840x2160 |
| **Aspect Ratio** | 16 : 9 |
| **Contrast Ratio** | 6000 : 1 |
| **Pixel Pitch (mm)** | 0.315(H) x 0.315(V) |
| **Pixel Per Inch (PPI)** | 80 |
| **Viewing Angle** | 178°(H),178°(V) |
| **Color Saturation (NTSC)** | 83% |
| **Display Colors** | 1.07G |
| **Response Time (Typical)** | 9.5ms |
| **Panel Interface** | V-by-One |
| **Input Interface** | DVI-I, HDMI, DP |
| **Input Power** | AC100~240V |
| **Power Consumption** | 280W |
| **OSD Key** | 5 Keys (Power Switch, Menu, +, -, Exit) |
| **OSD Control** | Brightness, Color, Contrast, Auto Turing, H/V Position…etc |
| **Dimensions (mm)** | 1240.1 x 711.1 x 107.5 mm |
| **Bezel Size(U/B/L/R)** | 15.35/15.35/15.25/15.25 mm |
| **Mounting** | 400x200, 400x300 |
| **Weight (Net)** | 27 kg |
| **Operating Temperature** | -30 ˚C ~ 70 ˚C |
| **Storage Temperature** | -30 ˚C ~ 70 ˚C |

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

## 1.3 Absolute Maximum Ratings

Permanent damage may occur if exceeding the following maximum rating.

| Item | Symbol | Value | | Unit | Note |
|---|---|---|---|---|---|
| | | Min. | Max. | | |
| Storage Temperature | $T_{ST}$ | -30 | +70 | ℃ | (1), (3), (4) |
| Operating Ambient Temperature | $T_{OP}$ | -30 | +70 | ℃ | (1), (2), (3), (4) |
| Panel Surface Temperature | $P_{ST}$ | | +80 | ℃ | (2) |

Note (1) Temperature and relative humidity range is shown in the figure below:

(a) 90 %RH Max. (Ta <=40℃)

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

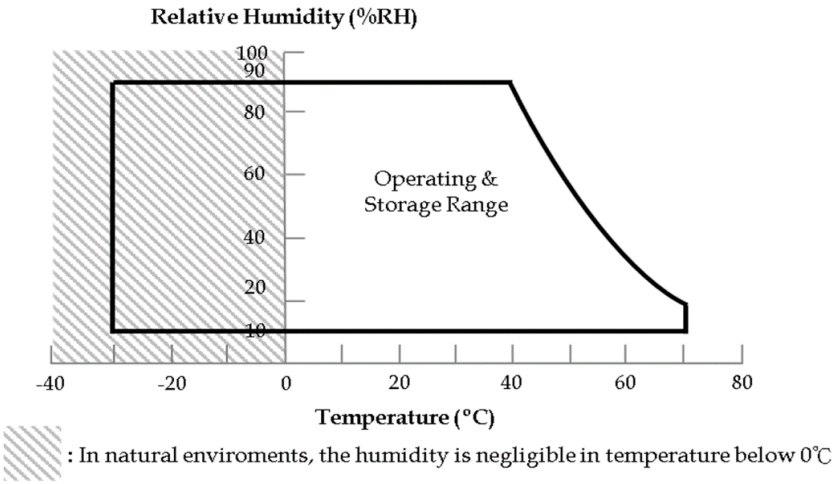
(c) No condensation.

Note (2) (a)Thermal management should be considered in final product design to prevent the surface temperature of display area from being over 80 ºC. The range of operating temperature may degrade in case of improper thermal management in final product design.

(b) Surface temperature is measured at 70℃ Dry condition.

Note (3) The rating of environment is based on LCD module. Leave LCD cell alone, this environment condition can't be guaranteed. Except LCD cell, the customer has to consider the ability of other parts of LCD module and LCD module process.

Note (4) Low temperature start can only be performed when the ambient temperature is greater than -20℃. Response time depends on the temperature. (In lower temperature, it becomes longer.)



## 2 Electrical Absolute Ratings

### 2.1 TFT LCD Module

| Item | Symbol | Value | | Unit | Note |
|---|---|---|---|---|---|
| | | Min. | Max. | | |
| Power Supply Voltage | VCC | -0.3 | 13.5 | V | (1) |
| Logic Input Voltage | VIN | -0.3 | 3.6 | V | |
| Source Driver Temperature | - | - | 125 | ℃ | (2) |
| Component Temperature | - | - | 100 | ℃ | |

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) The surface temperature of Source Driver should be controlled under 125℃, operating over thermal spec will cause the damage or decrease of lifetime.

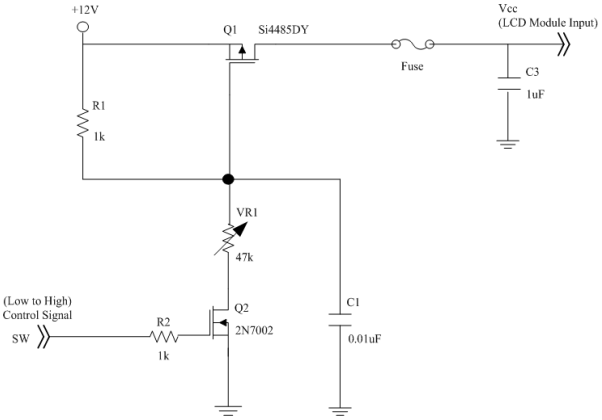
## 2.2 Electrical Characteristics

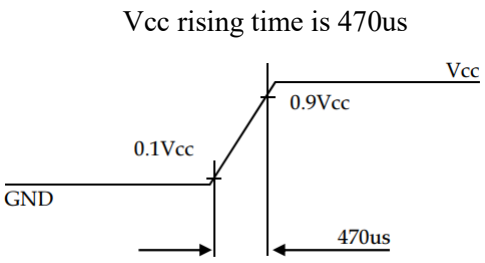
(Ta = 25 ± 2 ºC)

| Parameter | | Symbol | Value | | | Unit | Note |
|---|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | | |
| Power Supply Voltage | | $V_{CC}$ | 10.8 | 12 | 13.2 | V | (1) |
| Rush Current | | $I_{RUSH}$ | — | — | (4.03) | A | (2) |
| Power consumption | White Pattern | PT | — | (19.706) | (21.677) | W | (3) |
| | Black Pattern | PT | — | (8.911) | (9.802) | | |
| | Heavy Loading pattern EX：Horizontal Stripe | PT | — | (18.975) | (20.873) | | |
| Power Supply Current | White Pattern | — | — | (1.714) | (2.045) | A | |
| | Black Pattern | — | — | (0.767) | (0.909) | | |
| | Heavy Loading pattern EX：Horizontal Stripe | — | — | (1.643) | (1.975) | | |
| VbyOne HS | Differential Input High Threshold Voltage | VLVTH | — | — | +50 | mV | |
| | Differential Input Low Threshold Voltage | VLVTL | -50 | — | — | mV | |
| | Differential Input Resistor | RRIN | 80 | 100 | 120 | ohm | |
| CMOS interface | Input High Threshold Voltage | $V_{IH}$ | 2.7 | — | 3.6 | V | |
| | Input Low Threshold Voltage | $V_{IL}$ | 0 | — | 0.7 | V | |

Note (1)The module should be always operated within above ranges. The ripple voltage should be controlled under 10% of Vcc (Typ.)

Note (2)Measurement Conditions:



Note (3) The specified power consumption and power supply current is under the conditions at Vcc = 12 V, Ta = 25 ± 2 ºC, fr =50/60Hz, whereas a power dissipation check pattern below is displayed.

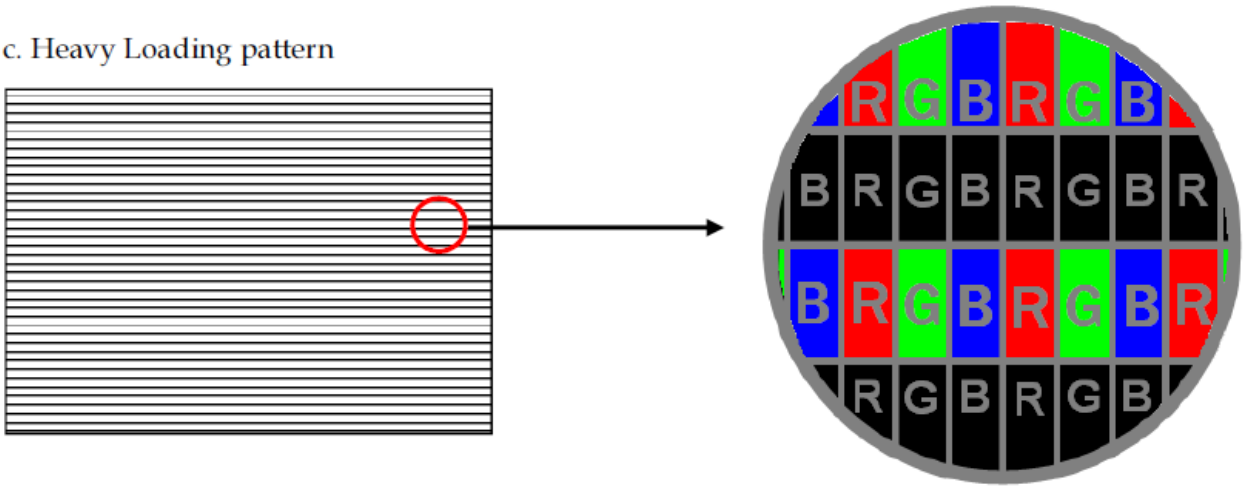
a. White Pattern

Active Area

b. Black Pattern

Active Area

c. Heavy Loading pattern



## 2.3 Input Terminal Pin Assignment

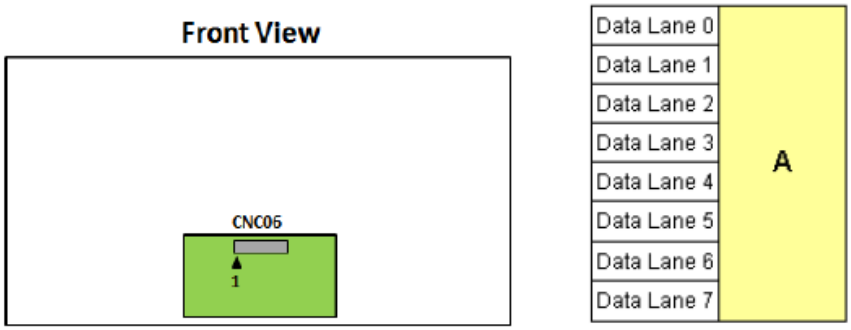
CNC04 Connector Pin Assignment: [FF01-42T-5131(FCN), 0-51162217-5(XDYT), FFSKL05011N51C(STM)

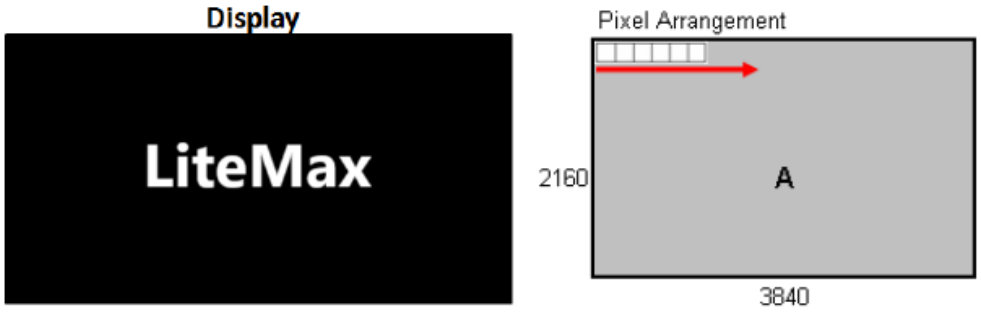
| Pin | Name | Description | Note |
|---|---|---|---|
| 1 | Vin | Power input (+12V) | (5) |
| 2 | Vin | Power input (+12V) | |
| 3 | Vin | Power input (+12V) | |
| 4 | Vin | Power input (+12V) | |
| 5 | Vin | Power input (+12V) | |
| 6 | Vin | Power input (+12V) | |
| 7 | Vin | Power input (+12V) | |
| 8 | Vin | Power input (+12V) | |
| 9 | N.C. | No Connection | |
| 10 | GND | Ground | |
| 11 | GND | Ground | |
| 12 | GND | Ground | |
| 13 | GND | Ground | |
| 14 | GND | Ground | |
| 15 | N.C. | No Connection | (4) |
| 16 | N.C. | No Connection | |
| 17 | N.C. | No Connection | |
| 18 | SDA | I2C Data signal ,(open drain) | (8) |
| 19 | SCL | I2C Clock signal,(open drain) | |
| 20 | N.C. | No Connection | (4) |
| 21 | N.C. | No Connection | |
| 22 | N.C. | No Connection | (4) |
| 23 | N.C. | No Connection | (4) |
| 24 | N.C. | No Connection | |
| 25 | HTPDN | No Connection or ground | (9) |
| 26 | LOCKN | Lock detect output, Open drain. | |
| 27 | GND | Ground | |
| 28 | RX0N | 1ST Pixel Negative VbyOne differential data input in area A. Lan 0 | (1) |
| 29 | RX0P | 1ST Pixel Positive VbyOne differential data input in area A. Lan 0 | |
| 30 | GND | Ground | |
| 31 | RX1N | 2ND Pixel Negative VbyOne differential data input in area A. Lan 1 | (1) |
| 32 | RX1P | 2ND Pixel Positive VbyOne differential data input in area A. Lan 1 | |
| 33 | GND | Ground | |
| 34 | RX2N | 3RD Pixel Negative VbyOne differential data input in area A. Lan 2 | (1) |
| 35 | RX2P | 3RD Pixel Positive VbyOne differential data input in area A. Lan 2 | |
| 36 | GND | Ground | |
| 37 | RX3N | 4TH Pixel Negative VbyOne differential data input in area A. Lan 3 | (1) |
| 38 | RX3P | 4TH Pixel Positive VbyOne differential data input in area A. Lan 3 | |

| | | | |
|---|---|---|---|
| 39 | GND | Ground | |
| 40 | RX4N | 5TH Pixel Negative VbyOne differential data input in area A. Lan 4 | (1) |
| 41 | RX4P | 5TH Pixel Positive VbyOne differential data input in area A. Lan 4 | |
| 42 | GND | Ground | |
| 43 | RX5N | 6TH Pixel Negative VbyOne differential data input in area A. Lan 5 | (1) |
| 44 | RX5P | 6TH Pixel Positive VbyOne differential data input in area A. Lan 5 | |
| 45 | GND | Ground | |
| 46 | RX6N | 7TH Pixel Negative VbyOne differential data input in area A. Lan 6 | (1) |
| 47 | RX6P | 7TH Pixel Positive VbyOne differential data input in area A. Lan 6 | |
| 48 | GND | Ground | |
| 49 | RX7N | 8TH Pixel Negative VbyOne differential data input in area A. Lan 7 | (1) |
| 50 | RX7P | 8TH Pixel Positive VbyOne differential data input in area A. Lan 7 | |
| 51 | GND | Ground | |

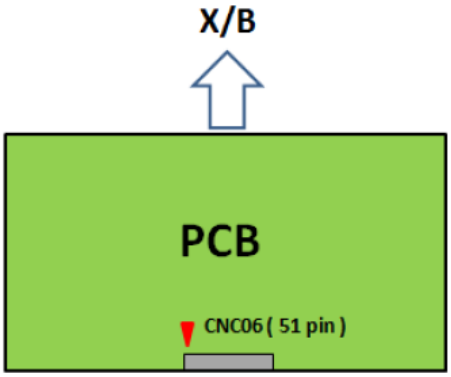
Note (1) V-by-One® HS Data Mapping

| Area | Lane | Data Stream |
|---|---|---|
| A | Lane 0 | 1, 9, 17, ....., 3825, 3833 |
| | Lane 1 | 2, 10, 18, ....., 3826, 3834 |
| | Lane 2 | 3, 11, 19, ....., 3827, 3835 |
| | Lane 3 | 4, 12, 20, ....., 3828, 3836 |
| | Lane 4 | 5, 13, 21, .....,3829, 3837 |
| | Lane 5 | 6, 14, 22, ....., 3830, 3838 |
| | Lane 6 | 7, 15, 23, ....., 3831, 3839 |
| | Lane7 | 8, 16, 24, ....., 3832, 3840 |



Note (2) V-by-One HS connector pin order defined as follows

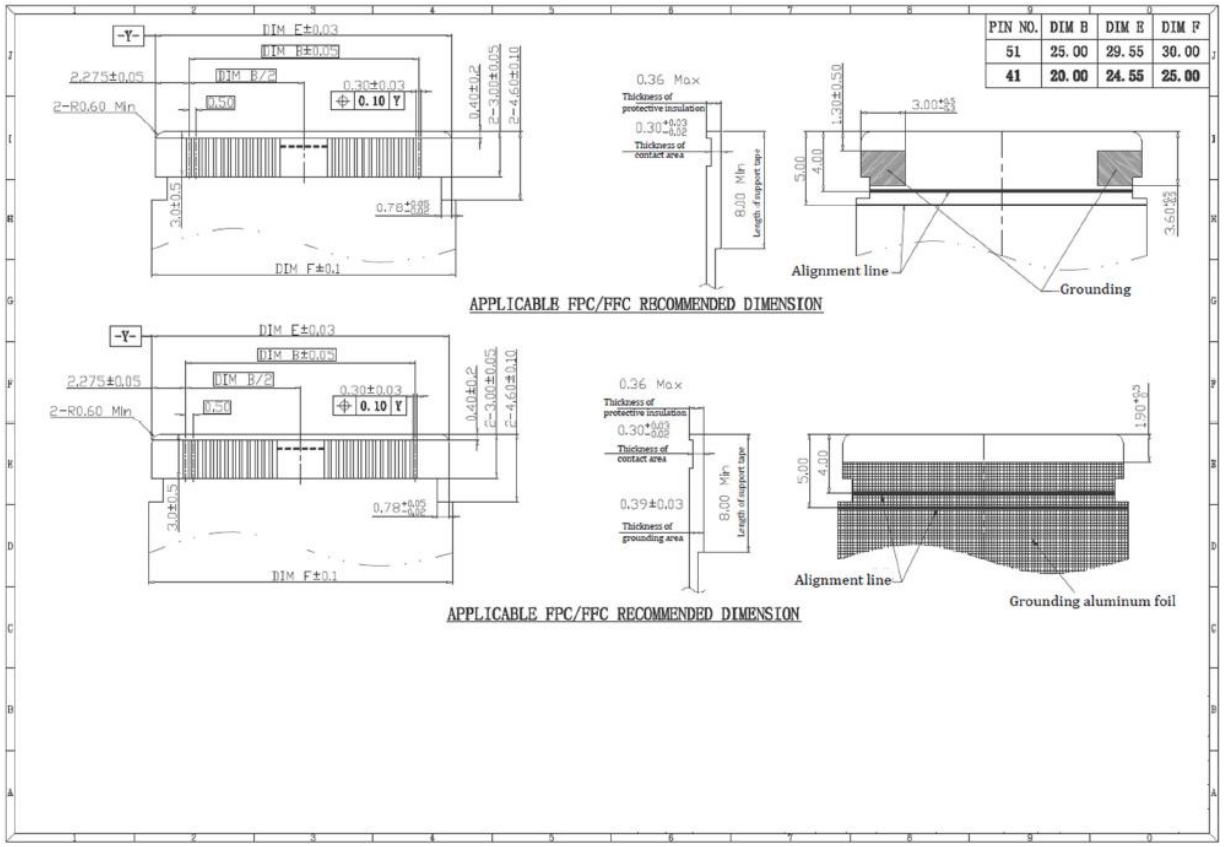



Note (4) Reserved for internal use. Please leave it open.

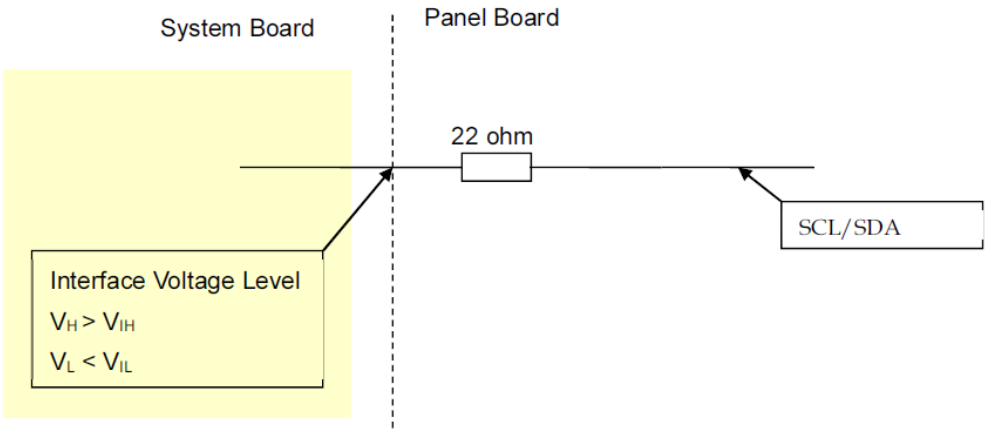
Note (5) Power input (+12V), Please check the current rating of FFC cable to meet the power consumption requirement.

Note (6) This pin connect to ground internal, but it could be open

Note (7) V-by-One connector Recommend Mating FFC drawing as below.



Note (8) I2C pin has internal scheme as following diagram. Customer should use additional pull-high resistor to keep the interface voltage level requirement which including Panel board loading as below.




Note (9) This pin connect to ground internal, but it could be open.

## 2.4 Color Data Input Assignment

The brightness of each primary color (red, green and blue) is based on the 10-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 versus data input.

| Color | | Data Signal | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Red | | | | | | | | | | Green | | | | | | | | | | Blue | | | | | | | | | |
| | | R9 | R8 | R7 | R6 | R5 | R4 | R3 | R2 | R1 | R0 | G9 | G8 | G7 | G6 | G5 | G4 | G3 | G2 | G1 | G0 | B9 | B8 | 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 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Red | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 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 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 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 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Cyan | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 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 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 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 | 1 | 1 | 1 | 1 | 0 | 0 | 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 | 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 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Red (1) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Red (2) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | : | | | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| | : | | | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| | Red (1021) | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Red (1022) | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Red (1023) | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 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 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Green (1) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Green (2) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| | Green (1021) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Green (1022) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Green (1023) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 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 | 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 | 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 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| | Blue (1021) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 |
| | Blue (1022) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 |
| | Blue (1023) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

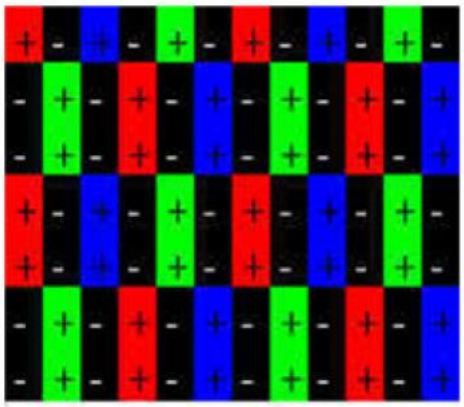
Note (1) 0: Low Level Voltage , 1: High Level Voltage

## 2.5 Flicker ( Vcom) Adjustment

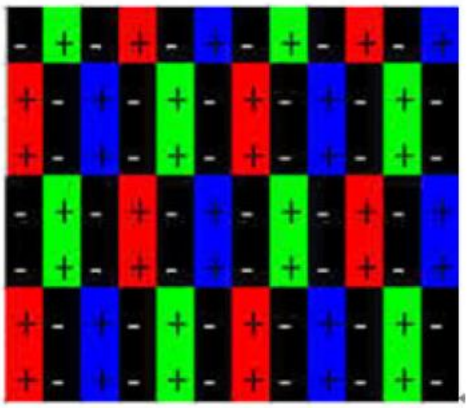
(1) Adjustment Pattern:

1+2N- Sub-pixel pattern was shown as below. If customer need below pattern, please directly contact with Account FAE.

Frame N



Frame N+1



(2) Adjustment method: (Digital V-com)

Programmable memory IC is used for Digital V-com adjustment in this model. Litemax provide Auto Vcom tools to adjust Digital V-com.The detail connection and setting instruction, please directly contact with Account FAE or refer Litemax Auto V-com adjustment OI. Below items is suggested to be ready before Digital V-com adjustment in customer LCM line.

a. USB Sensor Board.

b. Programmable software

## 2.6 Input Signal Timing Specifications

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

(Ta = 25 ± 2 ºC)

| Signal | Item | Symbol | Min. | Typ. | Max. | Unit | Note |
|---|---|---|---|---|---|---|---|
| Frequency | Data Clock | 1/Tc | 70 | 74.25 | 80 | MHZ | (1) |
| V-by-One Receiver | Intra-Pair skew | | -0.3 | — | 0.3 | UI | (2) |
| | Inter-pair skew | | -5 | — | 5 | UI | (3) |
| | Spread spectrum modulation range | Fclkin_mod | 1/Tc-0.5% | — | 1/Tc+0.5% | MHz | (4) |
| | Spread spectrum modulation frequency | $F_{SSM}$ | — | — | 30 | KHz | |

Timing Spec For QFHD Frame Rate = 50Hz

| Signal | Item | | Symbol | Min. | Typ. | Max. | Unit | Note |
|---|---|---|---|---|---|---|---|---|
| Frame rate | 2D mode | | Fr | 47 | 50 | 53 | Hz | (5),(6) |
| Horizontal Frequency | | | Fh | 122.8 | 135 | 140 | KHz | |
| Vertical Active Display Term (8 Lane,3840X2160 Active Area) | 2D Mode | Total | Tv | 2200 | 2700 | 2790 | Th | Tv=Tvd+Tvb |
| | | Display | Tvd | 2160 | | | Th | |
| | | Blank | Tvb | 40 | 540 | 630 | Th | |
| Horizontal Active Display Term (8 Lane,3840X2160 Active Area) | 2D Mode | Total | Th | 530 | 550 | 570 | Tc | Th=Thd+Thb |
| | | Display | Thd | 480 | | | Tc | |
| | | Blank | Thb | 50 | 70 | 90 | Tc | |

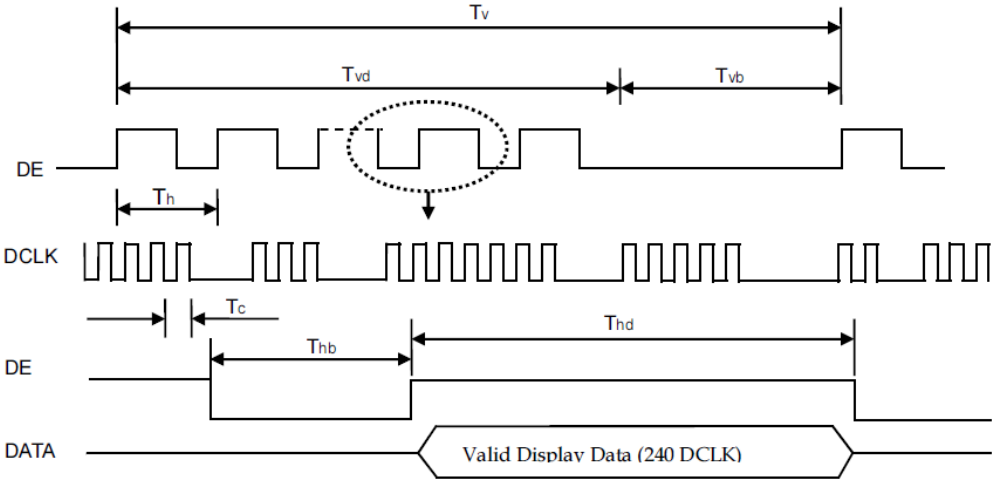
Timing Spec For QFHD Frame Rate = 60Hz

| Signal | Item | | Symbol | Min. | Typ. | Max. | Unit | Note |
|---|---|---|---|---|---|---|---|---|
| rame Rate | 2D Mode | | $F_r$ | 57 | 60 | 63 | Hz | (5),(6) |
| Horizontal Frequency | | | Fh | 122.8 | 135 | 140 | KHz | |
| Vertical Active Display Term (8 Lane,3840X2160 Active Area) | 2D Mode | Total | Tv | 2200 | 2250 | 2790 | Th | Tv=Tvd+Tvb |
| | | Display | Tvd | 2160 | | | Th | |
| | | Blank | Tvb | 40 | 90 | 630 | Th | |
| Horizontal Active Display Term (8 Lane,3840X2160 Active Area) | 2D Mode | Total | Th | 530 | 550 | 570 | Tc | Th=Thd+Thb |
| | | Display | Thd | 480 | | | Tc | |
| | | Blank | Thb | 50 | 70 | 90 | Tc | |

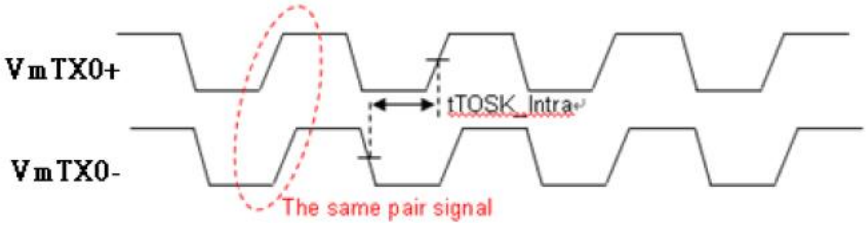
Note (1) Please make sure the range of pixel clock has follow the below equation：

Fclkin(max) ≧ Fr × Tv × Th

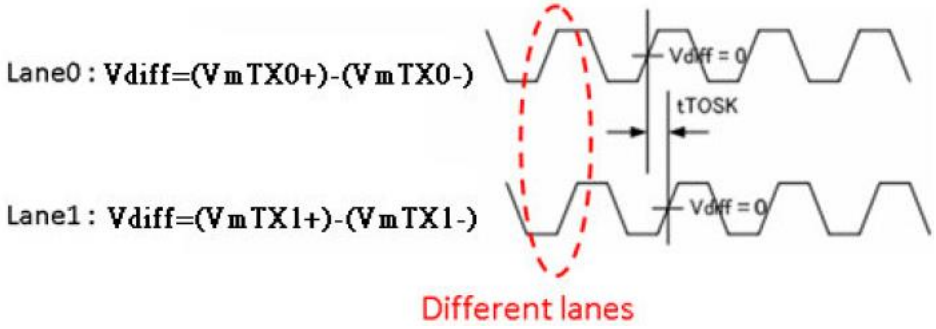
Fr × Tv × Th ≧ Fclkin (min)



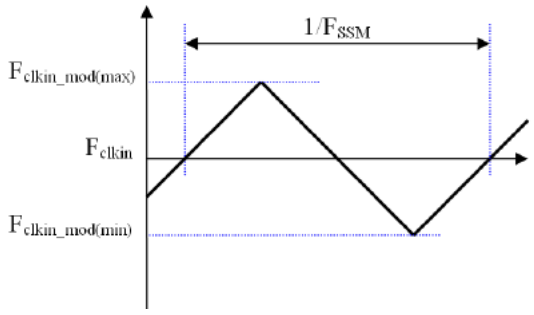

Note (2) VbyOne HS Intra-pair skew




Note (3) VbyOne HS Inter-pair skew.

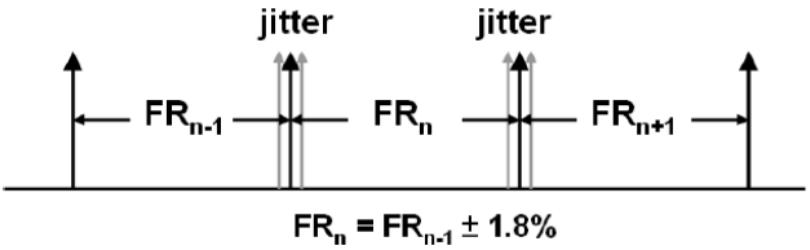



Note (4) The SSCG (Spread spectrum clock generator) is defined as below figures.



Note (5) For converter reference signals, the frame-to-frame jitter of the input frame rate is defined as the above figures. FRn = FRn-1 ± 1.8%

Note (6) For converter reference signals, The setup of the frame rate jitter > 1.8% may result in the cosmetic LED backlight symptom.




## 2.7 Timing Diagram

### V By One Signal Timing Diagram

The eye diagram is measured by the oscilloscope and receiver CDR characteristic must be emulated.

PLL bandwidth : 40MHz

Damping factor : 1.4

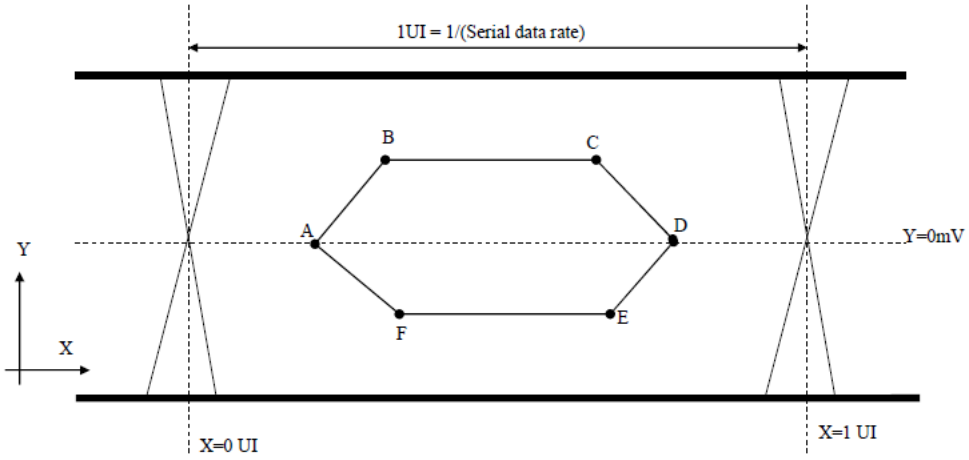



Table 1 Eye Mask Specification

| | X [UI] | Y [mV] | Note |
|---|---|---|---|
| A | 0.25 | 0 | (1) |
| B | 0.3 | 50 | (1) |
| C | 0.7 | 50 | (1) |
| D | 0.75 | 0 | (1) |
| E | 0.7 | -50 | (1) |
| F | 0.3 | -50 | (1) |

Note (1) Input levels of V-by-One HS signals are comes from "V-by-One HS Stander Ver.1.4"

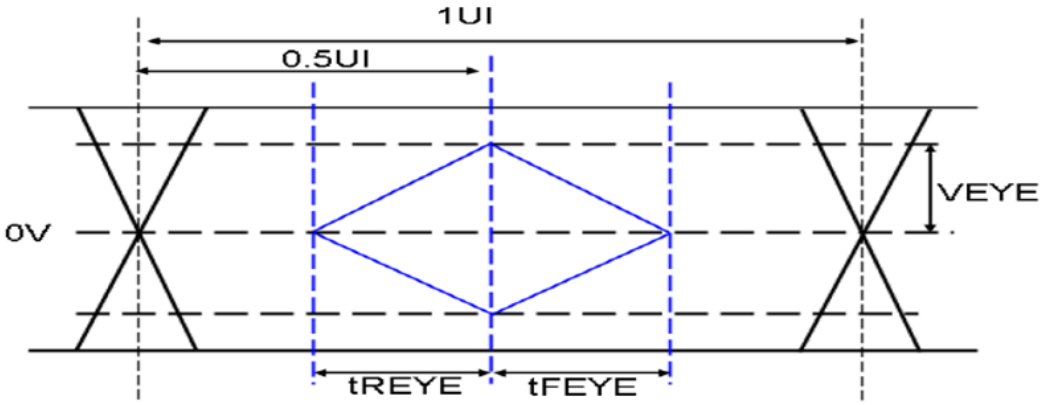
## CMPI Signal Timing Diagram

CMPI AC Electrical Characteristics

| Parameter | Symbol | Min. | Typ. | Max. | Unit | Condition |
|---|---|---|---|---|---|---|
| Effective Veye Rising Time | tREYE | 0.20 | - | - | UI | |
| Effective Veye Falling Time | tFEYE | 0.20 | - | - | UI | |
| Effective Veye Level | VEYE | 75 | - | - | mV | |
| CMPI Clock | 1UI | | 0.644 | | ns | |

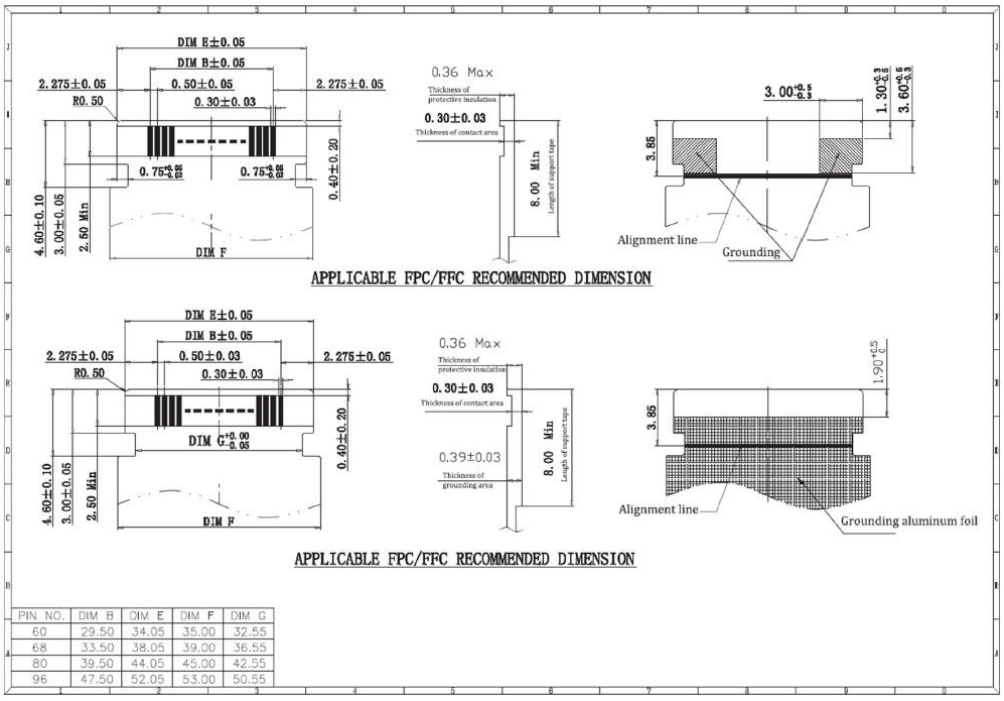
Note (1) CMPI EYE diagram must be in above spec within any pattern. If your application is not in our spec., Litemax can not guarantee display and function normal.

Note (2) Eye timing diagram




Note (3) Measure point: C0_X P/N

Note (4) Recommended FFC drawing



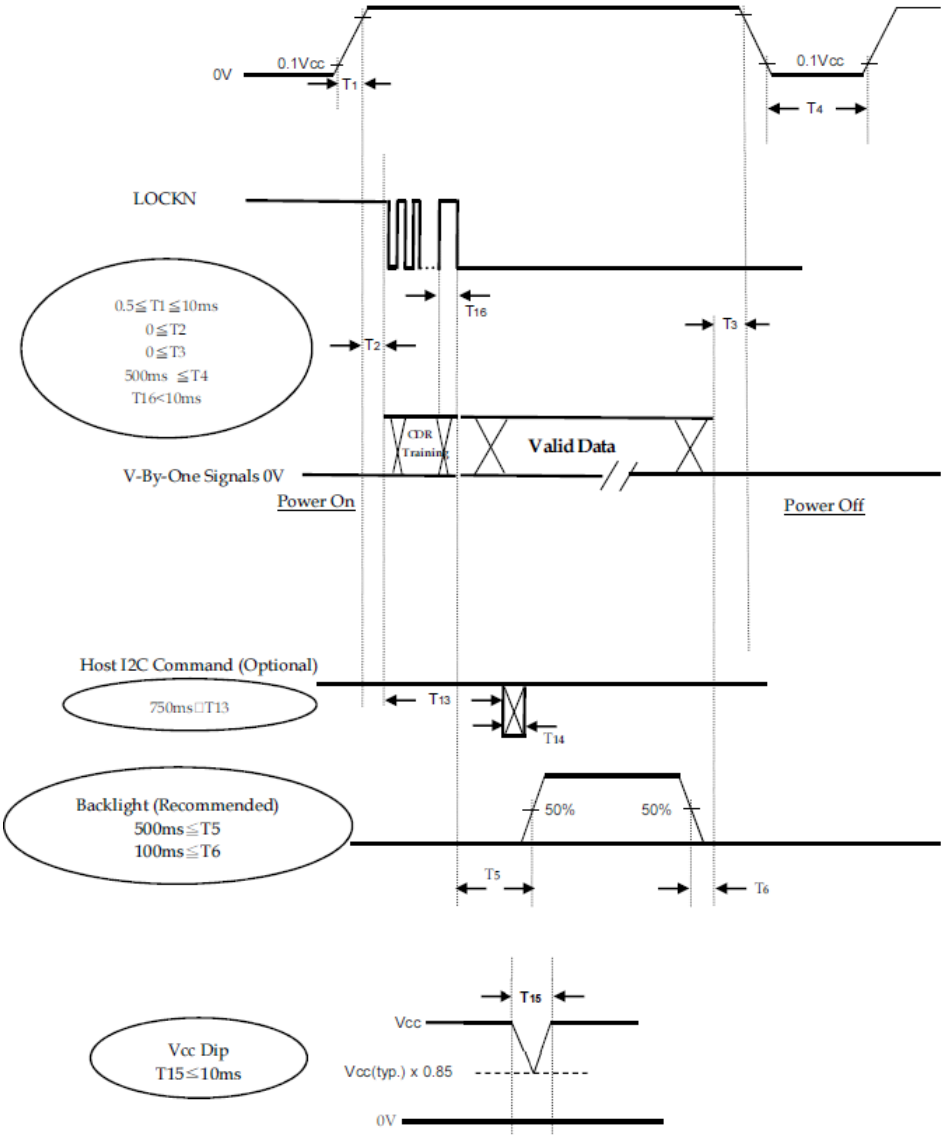

| PIN NO. | DIM B | DIM E | DIM F | DIM G |
|---|---|---|---|---|
| 60 | 29.50 | 34.05 | 35.00 | 32.55 |
| 68 | 33.50 | 38.05 | 39.00 | 36.55 |
| 80 | 39.50 | 44.05 | 45.00 | 42.55 |
| 96 | 47.50 | 52.05 | 53.00 | 50.55 |

## Byte Length And Color Mapping Of V-By-One HS

| Packer input & Unpacker output | | 30bpp RGB (10bit) |
|---|---|---|
| Byte 0 | D[0] | R[2] |
| | D[1] | R[3] |
| | D[2] | R[4] |
| | D[3] | R[5] |
| | D[4] | R[6] |
| | D[5] | R[7] |
| | D[6] | R[8] |
| | D[7] | R[9] |
| Byte 1 | D[8] | G[2] |
| | D[9] | G[3] |
| | D[10] | G[4] |
| | D[11] | G[5] |
| | D[12] | G[6] |
| | D[13] | G[7] |
| | D[14] | G[8] |
| | D[15] | G[9] |
| Byte 2 | D[16] | B[2] |
| | D[17] | B[3] |
| | D[18] | B[4] |
| | D[19] | B[5] |
| | D[20] | B[6] |
| | D[21] | B[7] |
| | D[22] | B[8] |
| | D[23] | B[9] |
| Byte 3 | D[24] | X |
| | D[25] | X |
| | D[26] | B[0] |
| | D[27] | B[1] |
| | D[28] | G[0] |
| | D[29] | G[1] |
| | D[30] | R[0] |
| | D[31] | R[1] |

## 2.8 Power On/Off Sequence

To prevent a latch-up or DC operation of LCD module, the power on/off sequence should be as the diagram below. (Ta = 25 ± 2 ºC)




Note (1) The supply voltage of the external system for the module input should follow the definition of Vcc.

Note (2) Apply the LED voltage within the LCD operation range. When the backlight turns on before the LCD operation or the LCD turns off before the backlight turns off, the display may momentarily become abnormal screen.

Note (3) In case of Vcc is in off level, please keep the level of input signals on the low or high impedance besides LOCKN . If T2<0, that maybe cause electrical overstress failure.

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

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

Note (6) Vcc have to be decayed smoothly when power-off.

Note (7) When the I2C Command is after backlight turns on, the display may momentarily become abnormal screen.

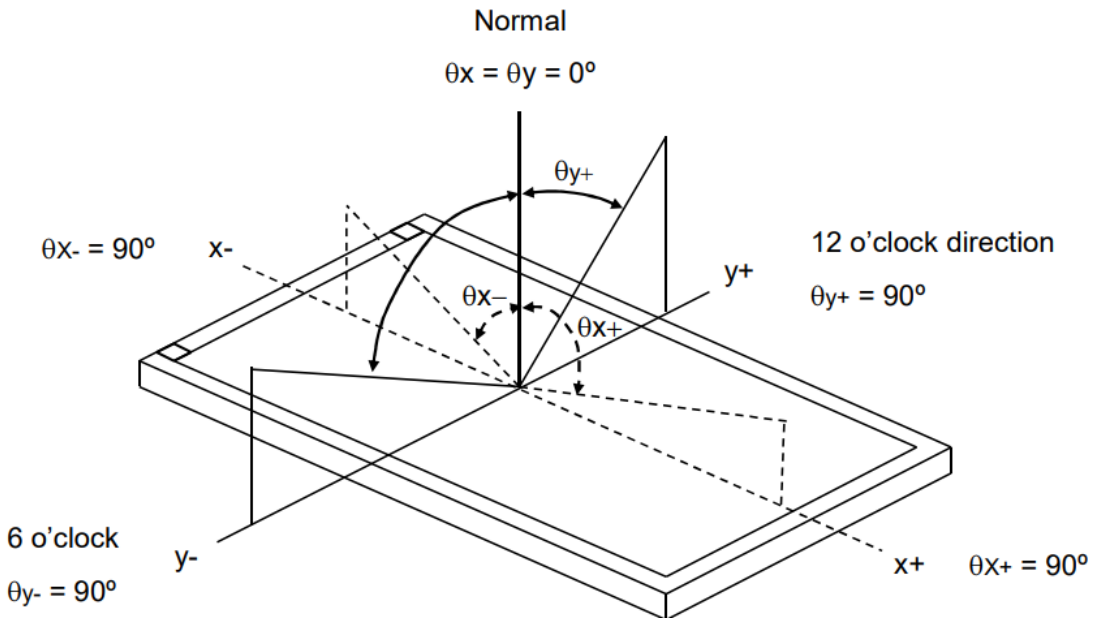
Note (8) T16 , V-by-One signals shall be stabilized and follows timing specification which defined by section 2.6 & 2.7

## 3 Optical Specification

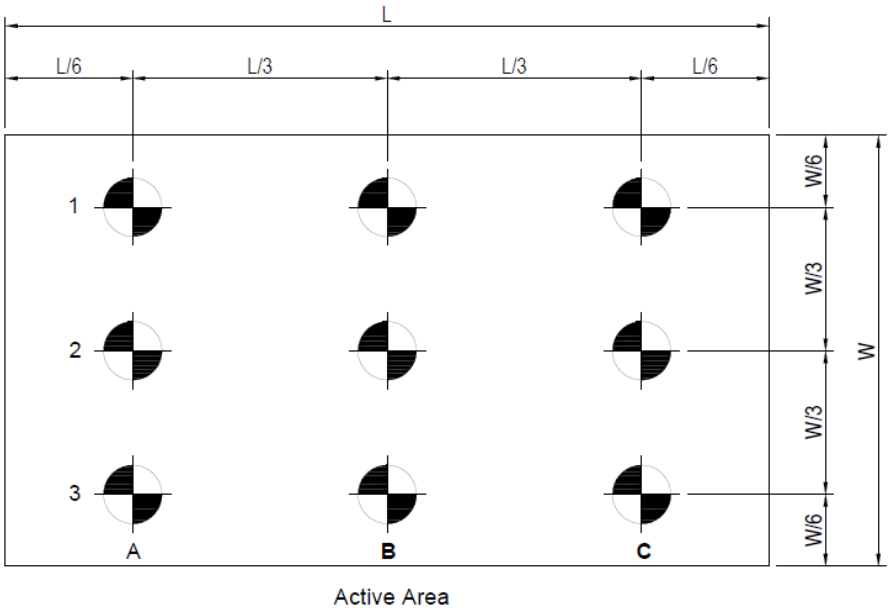
| Item | | Symbol | Condition | Min. | Typ. | Max. | Unit | Note |
|---|---|---|---|---|---|---|---|---|
| Color chromaticity | Red | Rx | θx=0 θy=0 CA-410 | 0.623 | 0.653 | 0.683 | - | Test Mode: (2) (3) |
| | | Ry | | 0.303 | 0.333 | 0.363 | - | |
| | Green | Gx | | 0.283 | 0.313 | 0.343 | - | |
| | | Gy | | 0.577 | 0.607 | 0.637 | - | |
| | Blue | Bx | | 0.115 | 0.145 | 0.175 | - | |
| | | By | | 0.025 | 0.055 | 0.085 | - | |
| | White | Wx | | 0.255 | 0.285 | 0.315 | - | |
| | | Wy | | 0.263 | 0.293 | 0.323 | - | |
| Center Luminance of White | | Lc | θx=0 θy=0 CA-410 | 2250 | 2500 | 3250 | cd/m$^2$ | |
| Uniformity | | Lu | | | 86 | | % | |
| Contrast Ratio | | CR | θx=0 θy=0 Klein K-10 | 5400:1 | 6000:1 | | - | Test Mode: (4) |
| Color Saturation | | NTSC | | | 83 | | % | |
| Viewing Angle | Horizontal | θx+ | CR ≥ 10 | | 89 | | Deg | Test Mode: (1) |
| | | θx- | | | 89 | | | |
| | Vertical | θy+ | | | 89 | | | |
| | | θy- | | | 89 | | | |

**Test Mode：**

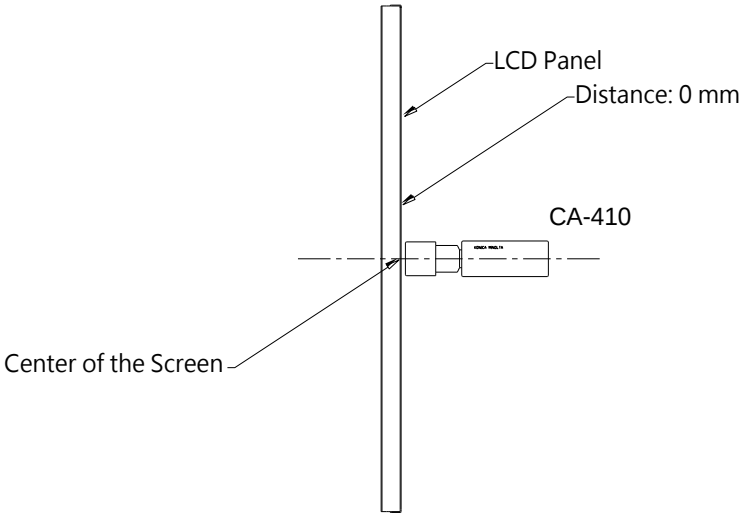
(1) Definition of Viewing Angle (θx , θy):



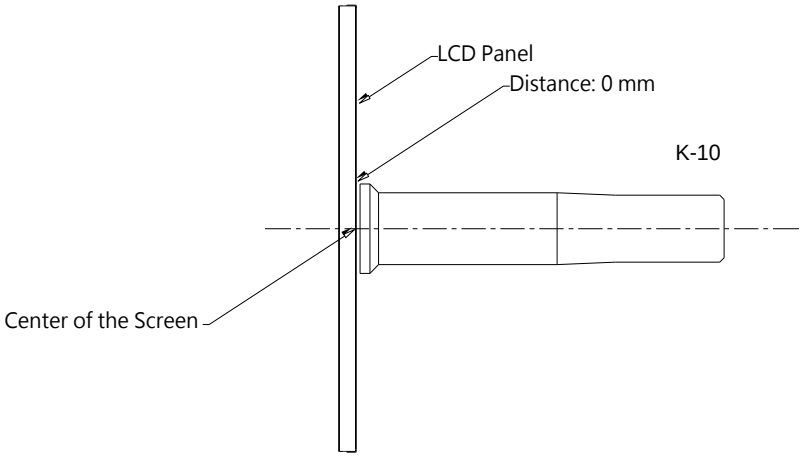
(2) Definition of Test Point:




(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 5500-I 2500nits LED backlight.

## 4.1 Operating Characteristics

| Item | Symbol | Condition | MIN. | TYP. | MAX. | Unit | Remark |
|---|---|---|---|---|---|---|---|
| Input Voltage | Vin | | 22.0 | 24.0 | 26.0 | V | |
| Input Current (High Brightness) | IinH | Brightness = 100% | 5.54 | 5.07 | 4.68 | A | (1) |
| Input Power Consumption | Pin | Brightness = 100% | ----- | 121.6 | ----- | W | |
| LED Current (High Brightness) | IoutH | Brightness = 100% | ----- | 1.09 | ----- | A | J2 |
| | | | ----- | 2.19 | ----- | A | J7、J8 |
| Working Frequency | W_Freq | Brightness = 100% | ----- | 400 | ----- | KHZ | |
| Brightness Control | DC mode | | | | | | |
| | Vadj | Connection of Voltage | 0.2 | ----- | 4.8 | 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% | ----- | 33.44 | 33.49 | V | J2 |
| | | | ----- | 33.44 | 33.49 | V | J7、J8 |
| Efficiency | η | Brightness = 100% | ----- | 90.1 | ----- | % | (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) $\eta_{max} = V_{out(max)} * I_{outH(max)} / V_{in(max)} * I_{inH(min)}$

$\eta_{min} = V_{out(min)} * I_{outH\ (min)} / V_{in(min)} * I_{inH(max)}$

## 4.2 Connector Socket

**Input Connector: CN1** (JST B10B-PH-K-S or Compatible)

| PIN No | Symbol | Description |
|---|---|---|
| 1 | Vin | DC+ |
| 2 | Vin | DC+ |
| 3 | Vin | DC+ |
| 4 | Vin | DC+ |
| 5 | Vin | DC+ |
| 6 | GND | Ground |
| 7 | GND | Ground |
| 8 | GND | Ground |
| 9 | GND | Ground |
| 10 | GND | Ground |

**DC or PWM Connector :CN2**

| PIN NO | Symbol | Description |
|---|---|---|
| 1 | DC | Clsoe pin 1,2<br>LED driver is DC dimming |
| 2 | GND | |
| 3 | PWM | Close pin 2,3<br>LED driver is PWM dimming |

Note: If you use CN2 to set DC/PWM, please NC the pin1 of CN3.

**Input Connector :CN3** (JST B3B-PH-K-S or Compatible)

| PIN No | Symbol | Description |
|---|---|---|
| 1 | CL | PWM or DC selection |
| 2 | Control | ON/OFF Control |
| 3 | Brightness | Brightness Control |
| 4 | GND | Ground |

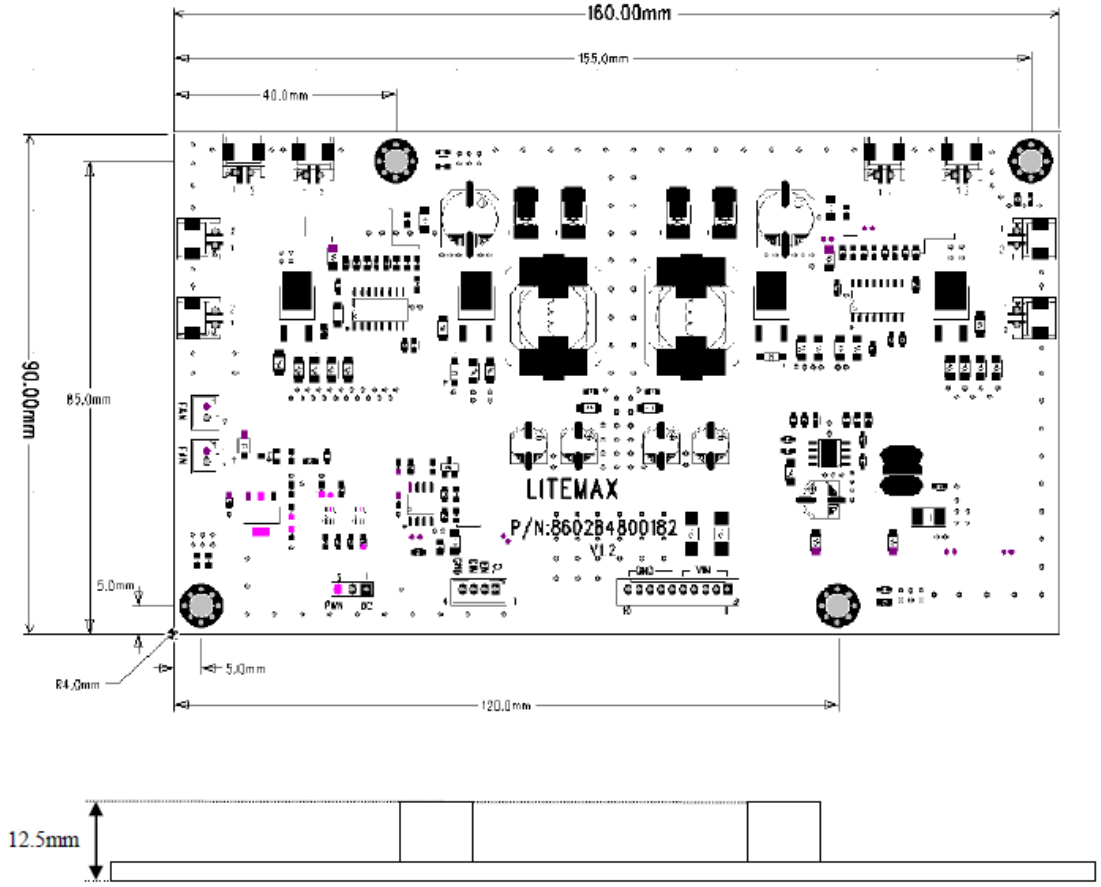
Note: Pin1 is dimming method control pin, Low → DC dimming, High → PWM dimming.
If pin1 is be used, please NC CN2.

**Output Connector : J1,J2, J7,J8**(JST S2B-EH or Compatible)

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

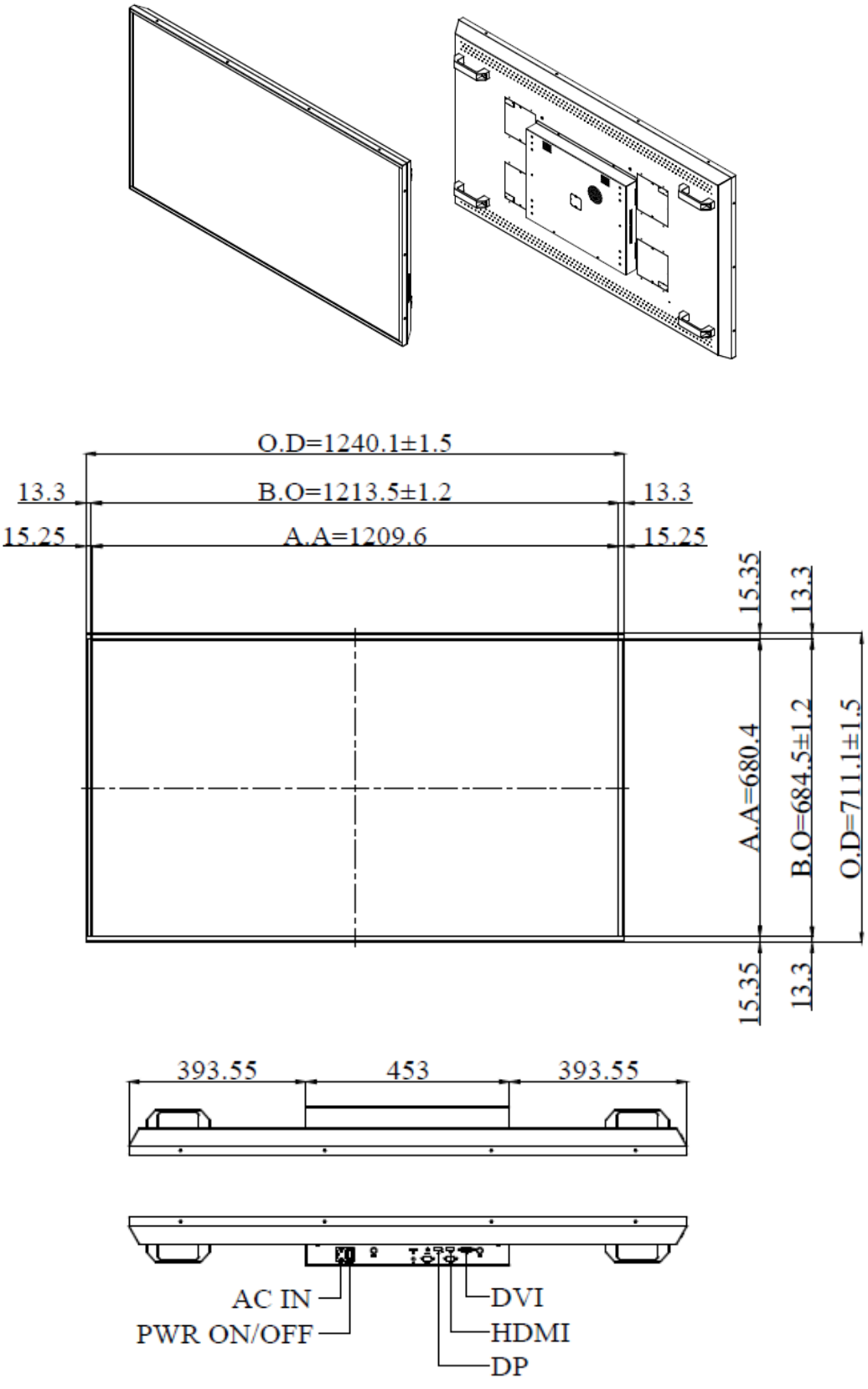
## 4.3 Mechanical Characteristics

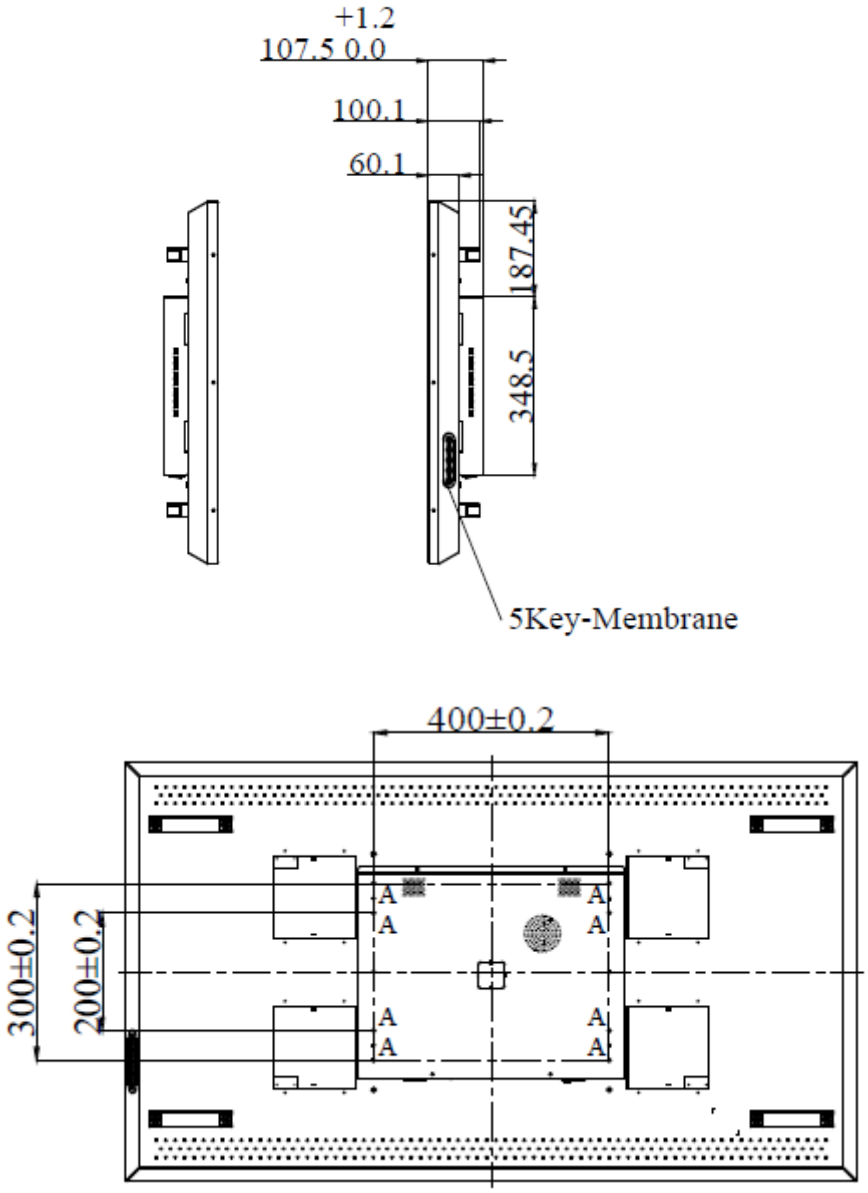
Dimension: 160 x 90 x 12.5mm



## 5 Mechanical Drawing

Unit:mm






NOTE：

O.D. : OUTLINE DIMENSION

B.O. : BEZEL OPENING

A.A. : ACTIVE AREA

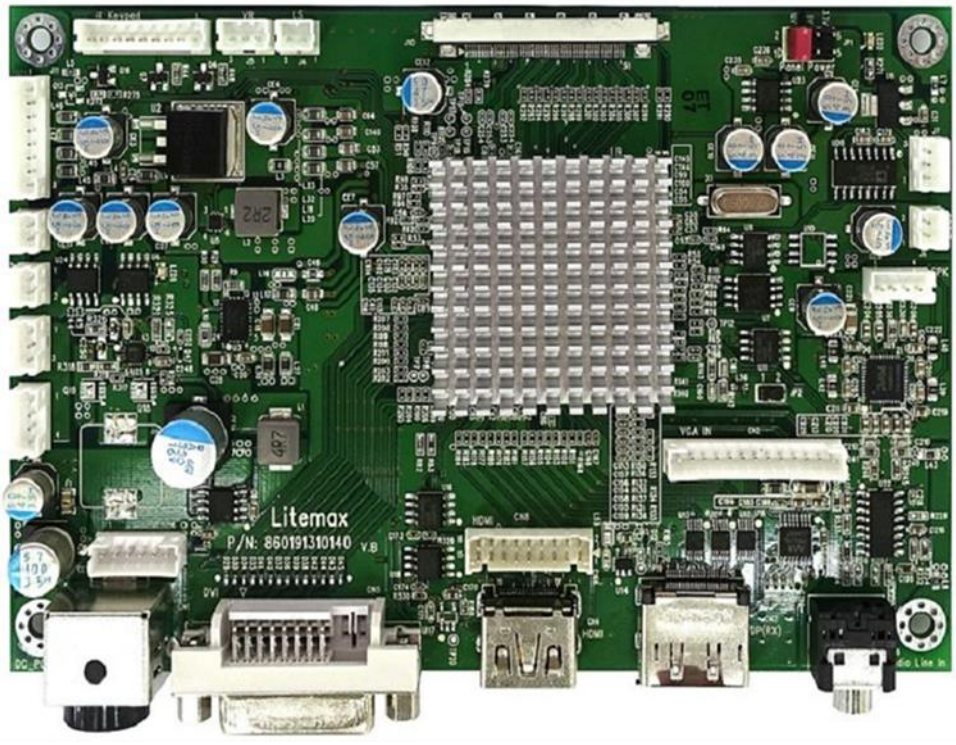
A:8-M6_USER HOLE_MAX Depth=12mm

# 6 AD9131DHP 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 an external luminance sensor as an option, or optional VR button to control brightness, fan rotation and RS232. Rev.2 is European RoHS compliant.

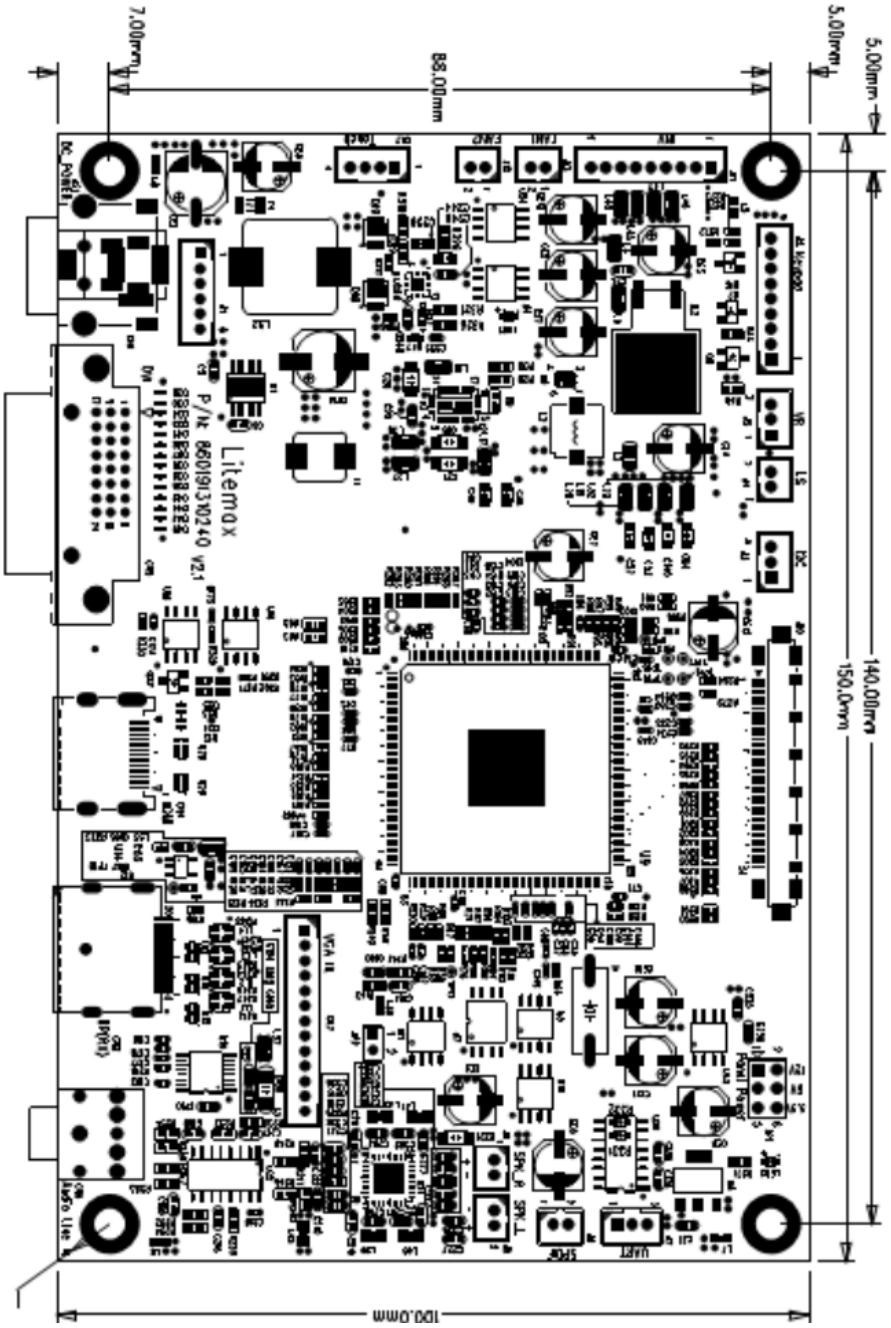
## 6.1 General Description

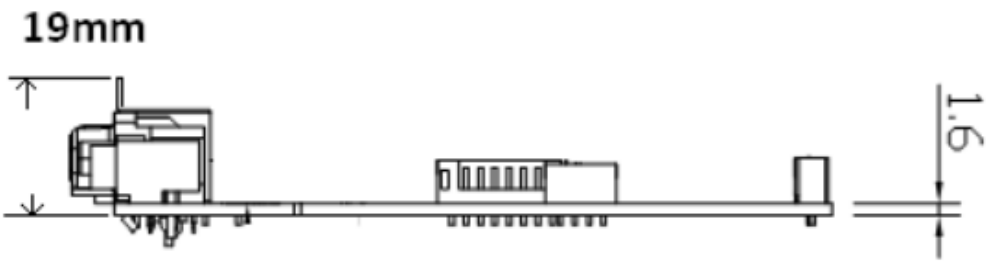
- **Max resolution up to UHD (4096x2160)**
- **Support V-By-one or e-DP panel**
- **DVI operates up to165M Hz**
- **One ultra-reliable dual-link DVI input(4K2K@30Hz)**
- **One HDMI(HDMI 2.0) input(4K2K@60Hz)**
- **One display port input (DP 1.2a) (4K2K@60Hz)**
- **V-by-One or e-DP interface**
- **Support panel DC5V or 3.3V, 12V output**
- **External fan control by software**
- **OSD control**
- **Inverter analog or PWM dimming control**
- **External V.R. brightness control (Optional)**
- **External light sensor brightness control (Optional)**
- **External RS232 control (Optional)**
- **Input power 24V DC or 12V DC (24V DC power input is optional)**



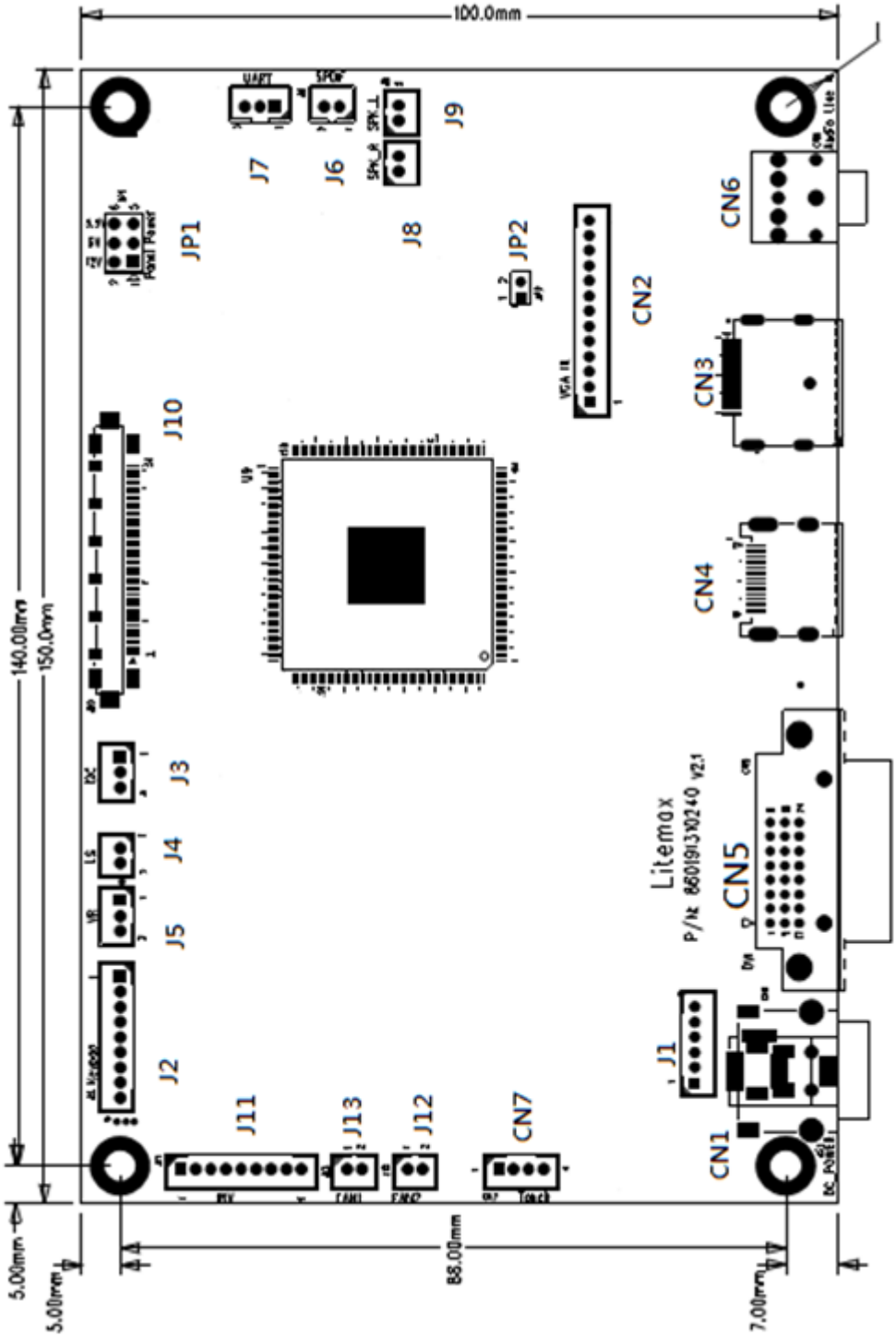
## 6.2 Outline Dimensions

**AD9131 150mm x 100mm**



## 6.3 AD9131DHP Board Pin Define



## J10: Panel (V-By-one or e-DP) connector

| Pin No. | Function | Pin No. | Function |
|---|---|---|---|
| 1 | PANEL-VCC | 27 | GND |
| 2 | PANEL-VCC | 28 | RX0N |
| 3 | PANEL-VCC | 29 | RX0P |
| 4 | PANEL-VCC | 30 | GND |
| 5 | PANEL-VCC | 31 | RX1N |
| 6 | PANEL-VCC | 32 | RX1P |
| 7 | PANEL-VCC | 33 | GND |
| 8 | PANEL-VCC | 34 | RX2N |
| 9 | NC | 35 | RX2P |
| 10 | GND | 36 | GND |
| 11 | GND | 37 | RX3N |
| 12 | GND | 38 | RX3P |
| 13 | GND | 39 | GND |
| 14 | GND | 40 | RX4N |
| 15 | eDP_HPD1 | 41 | RX4P |
| 16 | AUXTX_P1 | 42 | GND |
| 17 | AUXTX_N1 | 43 | RX5N |
| 18 | P_SDA | 44 | RX5P |
| 19 | P_SCL | 45 | GND |
| 20 | NC | 46 | RX6N |
| 21 | eDP_HPD0 | 47 | RX6P |
| 22 | LD_EN | 48 | GND |
| 23 | AUXTX_P0 | 49 | RX7N |
| 24 | AUXTX_N0 | 50 | RX7P |
| 25 | HTPDN | 51 | GND |
| 26 | LOCKN | | |

## CN5: DVI-D Input Connector (24pin )

| 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 | T.M.D.S Data1/3 Shield | 19 | T.M.D.S. Data0/5 Shield |
| 4 | T.M.D.S. Data4- | 12 | T.M.D.S. Data3- | 20 | T.M.D.S. Data5- |
| 5 | T.M.D.S. Data4+ | 13 | T.M.D.S. Data3+ | 21 | T.M.D.S. Data5+ |

| | | | | | |
|---|---|---|---|---|---|
| 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 | Vertical SYNC. | 16 | Hot Plug Detect | 24 | T.M.D.S. Clock- |

**CN4: HDMI Connector (19pin HDMI)**

| 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 | | |

**CN3: DISPLAY PORT Connector (20pin DP)**

| Pin No. | Function | Pin No. | Function |
|---|---|---|---|
| 1 | LAN_C_D3N | 11 | GND |
| 2 | GND | 12 | ML_LANE0_P |
| 3 | LAN_C_D3P | 13 | GND |
| 4 | ML_LANE2_N | 14 | GND |
| 5 | GND | 15 | AUX _CH_P |
| 6 | ML_LANE2_P | 16 | GND |
| 7 | ML_LANE1_N | 17 | AUX _CH_N |
| 8 | GND | 18 | Hot plug detect |
| 9 | ML_LANE1_P | 19 | GND |
| 10 | ML_LANE0_N | 20 | DP +5V |

**CN6: Audio Jack in**

| Pin No. | Function | Pin No. | Function |
|---|---|---|---|
| 1 | GND | 2 | LINE IN R |
| 3 | GND | 4 | GND |
| 5 | LINE IN L | | |

**CN1: Power DIN(24V or 12V)**

| Pin No. | Function | Pin No. | Function |
|---|---|---|---|
| 1 | DC24V or DC12V (Note 1) | 2 | DC24V or DC12V (Note 1) |
| 3 | GND | 4 | GND |

**CN1: Power Jack (24V or 12V)**

| Pin No. | Function | Pin No. | Function |
|---|---|---|---|
| 1 | DC24V or DC12V (Note 1) | 2 | GND |
| 3 | GND | | |

**J1: Power input connector (6 pin 2.0mm)**

| Pin No. | Function | Pin No. | Function |
|---|---|---|---|
| 1 | DC24V or DC12V (Note 1) | 2 | DC24V or DC12V (Note 1) |
| 3 | DC24V or DC12V (Note 1) | 4 | GND |
| 5 | GND | 6 | GND |

Note 1:Power input has tow different versions,12V power input version and 24V input version don't mistake.

**CN7: Power out connector (5V/12V)(4PIN 2.0mm)**

| Pin No. | Function | Pin No. | Function |
|---|---|---|---|
| 1 | DC5V | 2 | GND |
| 3 | DC12V | 4 | GND |

**J11: Inverter Connector (8PIN 2.0mm)**

| Pin No. | Symbol | Description | Pin No. | Symbol | Description |
|---|---|---|---|---|---|
| 1 | DC/PWM | DC/PWM SEL | 5 | GND | GND |
| 2 | ON/OFF | Backlight ON/OFF | 6 | GND | GND |
| 3 | BRIGHT | Dimming adjust | 7 | DC12V | Input DC12V |
| 4 | GND | GND | 8 | DC12V | Input DC12V |
| 9 | DC12V | Input DC12V | | | |

**J13,J12: FAN (2PIN 2.0mm)**

| Pin No. | Function | Pin No. | Function |
|---|---|---|---|
| 1 | FAN(+) | 2 | GND |

**J2: 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 | GND |
| 5 | UP KEY | | |

**J5: VR connector (3PIN 2.0mm)**

| Pin No. | Function | Pin No. | Function |
|---|---|---|---|
| 1 | DC 3.3V | 2 | VR OUT |
| 3 | GND | | |

**J4: Ambient (2PIN 2.0mm)**

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

**JP1: PANEL VCC (3PIN 2.54mm)**

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

**J8& J9: Speaker Connector (2PIN 2.0mm)**

| Pin No. | Function | Pin No. | Function |
|---|---|---|---|
| 1 | SPK+ | 2 | SPK- |

**J7: UART Connector (RS232 IN) (3PIN 2.0mm)**

| Pin No. | Function | Pin No. | Function |
|---|---|---|---|
| 1 | TXD | 2 | RXD |
| 3 | GND | | |

### J3: I2C Connector (3PIN 2.0mm)

| Pin No. | Function | Pin No. | Function |
|---|---|---|---|
| 1 | SDA | 2 | SCL |
| 3 | GND | | |

### J6: SPDIF (2PIN 2.0mm)

| Pin No. | Function | Pin No. | Function |
|---|---|---|---|
| 1 | SPDIF_OUT | 2 | GND |

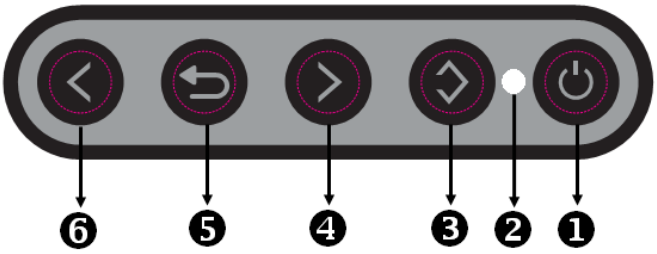
### JP2: EDID (2PIN 2.0mm)

| Pin No. | Function | Pin No. | Function |
|---|---|---|---|
| 1 | EEROM Write protect | 2 | GND |

When need to rewrite EEROM EDID , short two pin .

## 6.4 OSD Function

**MEMBRANE CONTROL BUTTOM**




❶ **Key:** (Power) function key

Press the power switch will turn the monitor on.

Press it again to turn the monitor off.

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

❸ **Key:** (Menu + Selection Right + Enter) function key

Press this button to the OSD “main menu”. And then press this button go to the “Selection Right” function, and press again this button to “Enter”.

❹ **Key:** (Menu + Selection Up + Increase) function key

Press this button to the OSD “main menu”. And then press this button go to the “Selection Up” function, and press again this button to adjustment value “Increase”.

❺ **Key:** (Menu + Exit) function key

Enter to the OSD adjustment menu. It also used for go back to previous menu for sub-menu.

❻ **Key:** (Menu + Selection Down + Decrease) function key

Press this button to the OSD “main menu”. And then press this button go to the “Selection Down” function, and press again this button to adjustment value “Decrease”.

**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 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 30 sec (default OSD timeout), it goes back to the stand-by mode and no more switching is accepted except MENU to restart the setting.

## 6.5 OSD Menu

By pressing the “menu” button, you will see the below picture. Across from timing you will see resolution, frequency, and V-frequency of the panel. These cannot be altered by the user.

# 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.