

KOE

JDI Group

TENTATIVE

Kaohsiung Opto-Electronics Inc.

FOR MESSRS : _____

DATE : Sep 17th ,2012

TECHNICAL DATA

TX26D24VC0AAA

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PROPOSED BY: Dan Cheng

2. RECORD OF REVISION

| DATE | SHEET No. | SUMMARY |
|------|-----------|---------|
| | | |

3. GENERAL DATA

3.1 DISPLAY FEATURES

This module is a 10.1" WXGA of 16:9 format amorphous silicon TFT. The pixel format is vertical stripe and sub pixels are arranged as R(red), G(green), B(blue) sequentially. This display is RoHS compliant, and COG (chip on glass) technology and LED backlight are applied on this display.

| | |
|-------------------------|---|
| Part Name | TX26D24VC0AAA |
| Module Dimensions | 229.46(W) mm x 149.1(H) mm x 2.4(D) mm |
| LCD Active Area | 216.96(W) mm x 135.6(H) mm |
| Dot Pitch | 0.0565(W) mm x 3(R, G, B)(W) x 0.1695(H) mm |
| Resolution | 1280 x 3(RGB)(W) x 800(H) dots |
| Color Pixel Arrangement | R, G, B Vertical stripe |
| LCD Type | Transmissive Color TFT; Normally Black |
| Display Type | Active Matrix |
| Number of Colors | 16.7M Colors (8-bit RGB) |
| Weight | 146 g (typ.) |
| Interface | 1ch-LVDS/Receiver ; 40 pins |
| Power Supply Voltage | 3.3V for LCD ; 5.0V for Backlight |
| Power Consumption | (0.9W) for LCD; (3.0W) for Backlight |

4. ABSOLUTE MAXIMUM RATINGS

| Item | Symbol | Min. | Max. | Unit | Remarks |
|-------------------------|------------------|------|------|------|------------------------------|
| Supply Voltage | V _{DD} | -0.3 | 5.0 | V | V _{SS} =0V, TA=25°C |
| Input Voltage of Logic | V _{IH} | -0.3 | 5.0 | V | Note 1 |
| Operating Temperature | T _{OP} | 0 | 50 | °C | Note 2 |
| Storage Temperature | T _{ST} | -20 | 60 | °C | Note 2 |
| Backlight Input Voltage | V _{LED} | -0.3 | 6.5 | V | - |

Note 1: It shall be applied to pixel data signal and clock signal.

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

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

5. ELECTRICAL CHARACTERISTICS

5.1 LCD CHARACTERISTICS

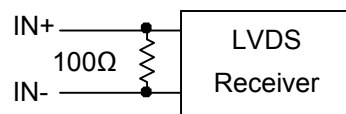
$T_a = 25\text{ }^\circ\text{C}$, $V_{SS} = 0\text{V}$

| Item | Symbol | Condition | Min. | Typ. | Max. | Unit | Remarks |
|--|------------|--------------------------|------|-------|------|------|---------|
| Power Supply Voltage | V_{DD} | - | 3.0 | 3.3 | 3.6 | V | - |
| Differential Input Voltage for LVDS Receiver Threshold | V_I | "H" level | - | - | +100 | mV | Note 1 |
| | | "L" level | -100 | - | - | | |
| Differential Input Voltage for LVDS Common mode | VCM | - | 0.7 | - | 1.6 | V | - |
| LVDS Differential Voltage | $ V_{ID} $ | - | 250 | - | 600 | mV | - |
| Input Voltage for Logic | V_{IH} | - | 3.0 | - | 3.6 | V | |
| | V_{IL} | - | 0 | - | 0.5 | | |
| Power Supply Current | I_{DD} | $V_{DD}-V_{SS}$ =3.3V | - | (270) | TBD | mA | Note 2 |
| Vsync Frequency | f_v | - | - | 60.0 | - | Hz | Note 3 |
| Hsync Frequency | f_H | - | - | 49.4 | - | KHz | |
| DCLK Frequency | f_{CLK} | - | - | 71.1 | - | MHz | |

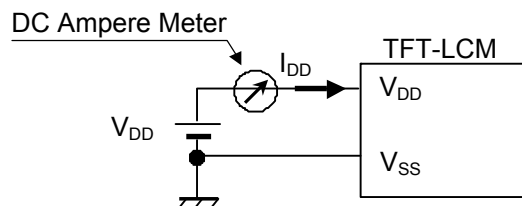
Note 1: VCM=+1.2V

VCM is common mode voltage of LVDS transmitter/receiver.

The input terminal of LVDS transmitter is terminated with 100Ω.



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



Note 3: For LVDS transmitter input.

5.2 BACKLIGHT CHARACTERISTICS

| Item | Symbol | Condition | Min. | Typ. | Max. | Unit | Remarks |
|-----------------------|-----------|----------------|------|-------|------|------|---------|
| LED Input Voltage | V_{LED} | Backlight Unit | 4.8 | 5.0 | 6.2 | V | - |
| LED Forward Current | I_{LED} | Backlight Unit | - | (600) | TBD | mA | - |
| PWM Control Level | PWM | "H" level | 3.0 | - | 3.6 | V | - |
| | | "L" level | - | - | 0.4 | V | - |
| PWM Control Frequency | f_{PWM} | - | 1K | - | 20K | Hz | |

Note 1: Fig. 5.1 shows the LED backlight circuit. The circuit has 36 LEDs in total.

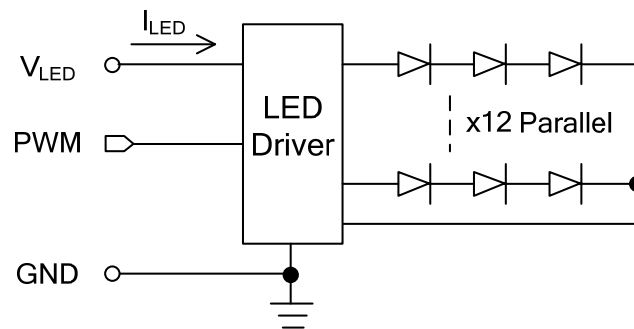


Fig. 5.1

6. OPTICAL CHARACTERISTICS

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

- Supplying the signals and voltages defined in the section of electrical characteristics.
- The backlight unit needs to be turned on for 30 minutes.
- The ambient temperature is 25 °C .
- In the dark room around 500~1000 lx, the equipment has been set for the measurements as shown in Fig 6.1.

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

| Item | Symbol | Condition | Min. | Typ. | Max. | Unit | Remarks |
|-----------------------|---------------|--|------|-------|------|-------------------|---------|
| Brightness of White | - | $\phi = 0^\circ, \theta = 0^\circ,$ $I_{LED} = 240\text{ mA}$ | 300 | 350 | - | cd/m ² | Note 1 |
| Brightness Uniformity | - | | 70 | 75 | - | % | Note 2 |
| Contrast Ratio | CR | | 600 | 800 | - | - | Note 3 |
| Response Time | T_{R+Tf} | $\phi = 0^\circ, \theta = 0^\circ$ | - | 25 | 50 | ms | Note 4 |
| NTSC Ratio | - | $\phi = 0^\circ, \theta = 0^\circ$ | - | (TBD) | - | % | - |
| Viewing Angle | θ_x | $\phi = 0^\circ, CR \geq 10$ | 75 | 85 | - | Degree | Note 5 |
| | $\theta_{x'}$ | $\phi = 180^\circ, CR \geq 10$ | 75 | 85 | - | | |
| | θ_y | $\phi = 90^\circ, CR \geq 10$ | 75 | 85 | - | | |
| | $\theta_{y'}$ | $\phi = 270^\circ, CR \geq 10$ | 75 | 85 | - | | |
| Color Chromaticity | White | X | 0.26 | 0.31 | 0.36 | | Note 6 |
| | | Y | 0.28 | 0.33 | 0.38 | | |

Note 1: The brightness is measured from 9 point of the panel, P1~P9 in Fig. 6.2, for the average value.

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

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

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

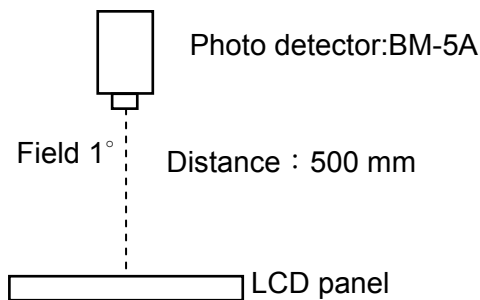


Fig. 6.1

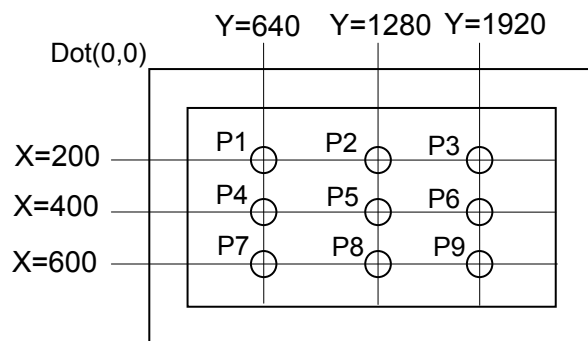


Fig. 6.2

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

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

Note 4: The definition of response time is shown in Fig. 6.3. The rising time is the period from 10% brightness to 90% brightness when the data is from white to black. Oppositely, Falling time is the period from 90% brightness rising to 10% brightness.

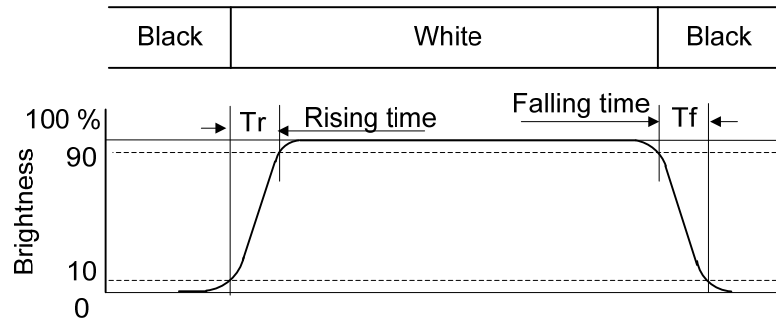


Fig. 6.3

Note 5: The definition of viewing angle is shown in Fig. 6.4. Angle ϕ is used to represent viewing directions, for instance, $\phi = 270^\circ$ means 6 o'clock, and $\phi = 0^\circ$ means 3 o'clock. Moreover, angle θ is used to represent viewing angles from axis Z toward plane XY.

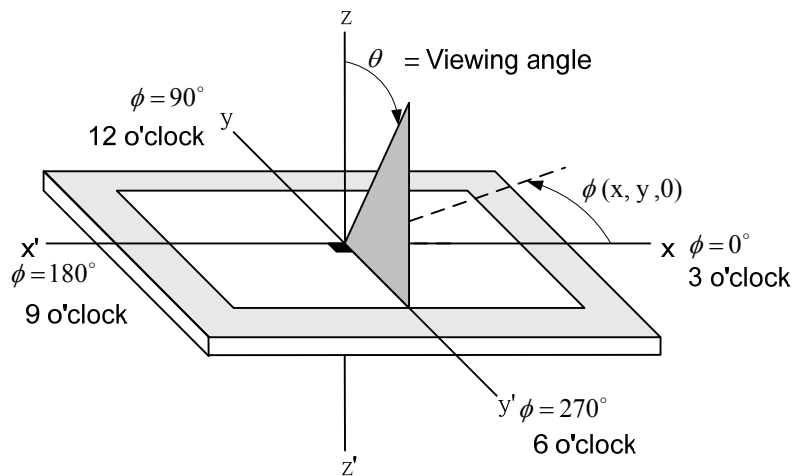
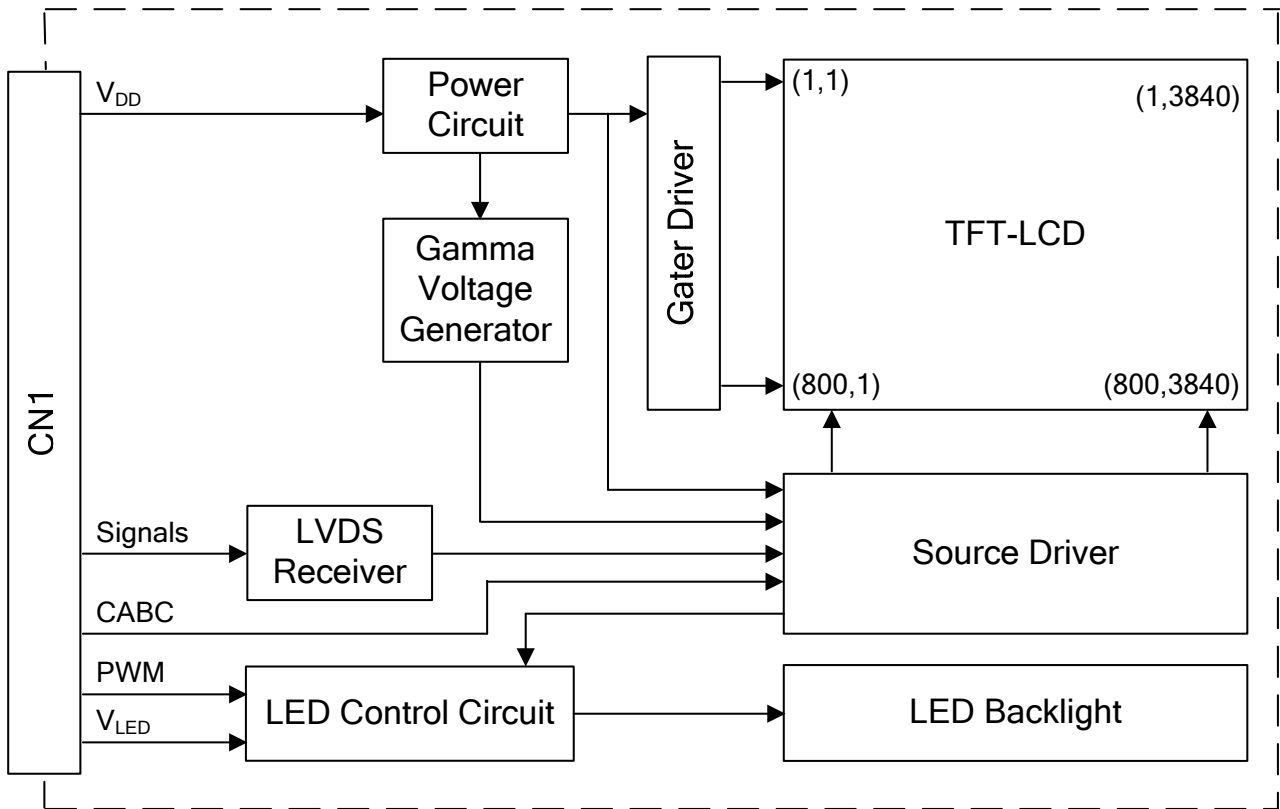


Fig. 6.4

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

7. BLOCK DIAGRAM



8. LCD INTERFACE

8.1 INTERFACE PIN CONNECTIONS

The display interface connector is F62240-H1210A made by Vigorconn and more details of the connector are shown in the section of outline dimension.

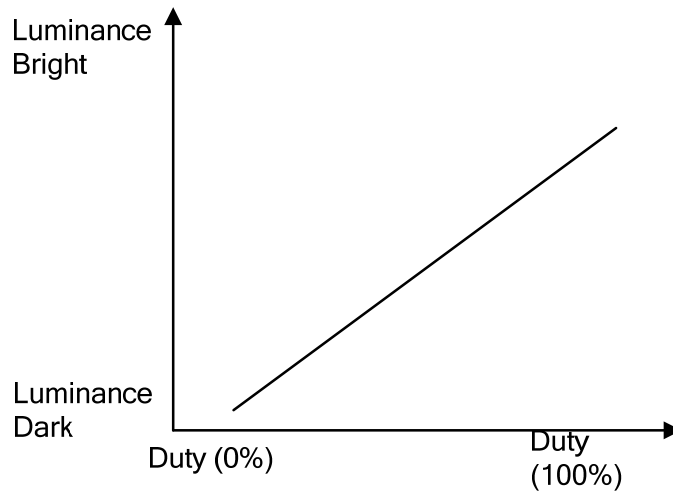
Pin assignment of LCD interface is as below:

| Pin No. | Symbol | Function | Remark |
|---------|------------------|-------------------------------------|------------------------|
| 1 | NC | No connection | |
| 2 | V _{DD} | Power Supply | |
| 3 | V _{DD} | Power Supply | |
| 4 | NC | No connection | |
| 5 | NC | No connection | |
| 6 | NC | No connection | |
| 7 | NC | No connection | |
| 8 | In0- | -LVDS Differential Data Input | R0-R5, G0 |
| 9 | In0+ | +LVDS Differential Data Input | |
| 10 | V _{SS} | Ground | |
| 11 | In1- | -LVDS Differential Data Input | G1~G5, B0,B1 |
| 12 | In1+ | +LVDS Differential Data Input | |
| 13 | V _{SS} | Ground | |
| 14 | In2- | -LVDS Differential Data Input | B2-B5,HS,VS, DE |
| 15 | In2+ | +LVDS Differential Data Input | |
| 16 | V _{SS} | Ground | |
| 17 | CLK- | -LVDS Differential Clock Input | LVDS CLK |
| 18 | CLK+ | +LVDS Differential Clock Input | |
| 19 | V _{SS} | Ground | |
| 20 | In3- | -LVDS Differential Data Input | R6, R7, G6, G7, B6, B7 |
| 21 | In3+ | +LVDS Differential Data Input | |
| 22 | V _{SS} | Ground | |
| 23 | GND | LED Ground | |
| 24 | GND | LED Ground | |
| 25 | GND | LED Ground | |
| 26 | NC | No connection | |
| 27 | PWM | PWM Control Signal of LED Converter | Note 2 |
| 28 | NC | No connection | |
| 29 | CABC | CABC Enable Input | Note 1 |
| 30 | NC | No connection | |
| 31 | V _{LED} | LED Power | |
| 32 | V _{LED} | LED Power | |
| 33 | V _{LED} | LED Power | |
| 34 | NC | No connection | |
| 35 | NC | No connection | |
| 36 | NC | No connection | |
| 37 | NC | No connection | |
| 38 | NC | No connection | |
| 39 | NC | No connection | |
| 40 | NC | No connection | |

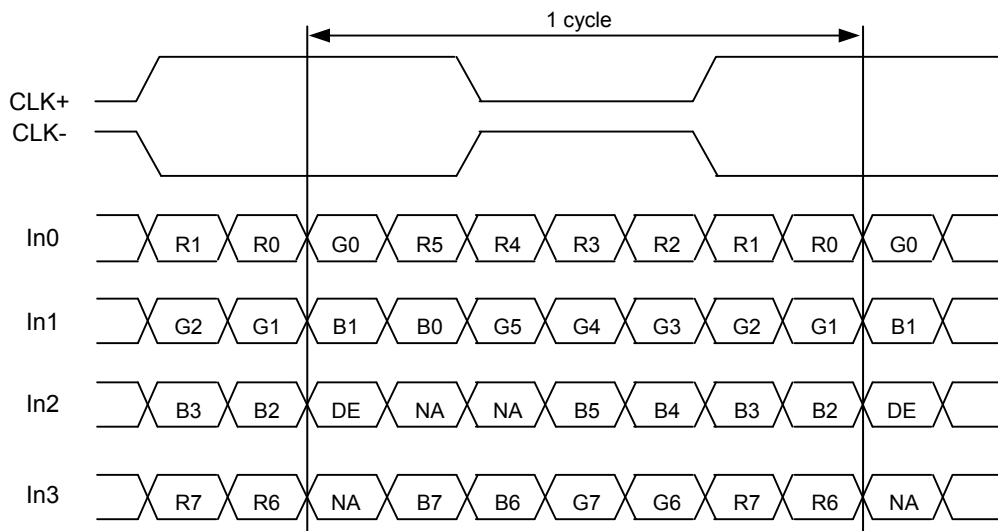
Note 1: The setting of CABC function are as follows.

| Pin | Enable | Disable |
|------|--------------|---------------------|
| CABC | High Voltage | Low Voltage or open |

Note 2: PWM is used to adjust backlight brightness.



8.2 LVDS DATA FORMAT



DE: Display Enable

NA: Not Available

8.3 TIMING CHART

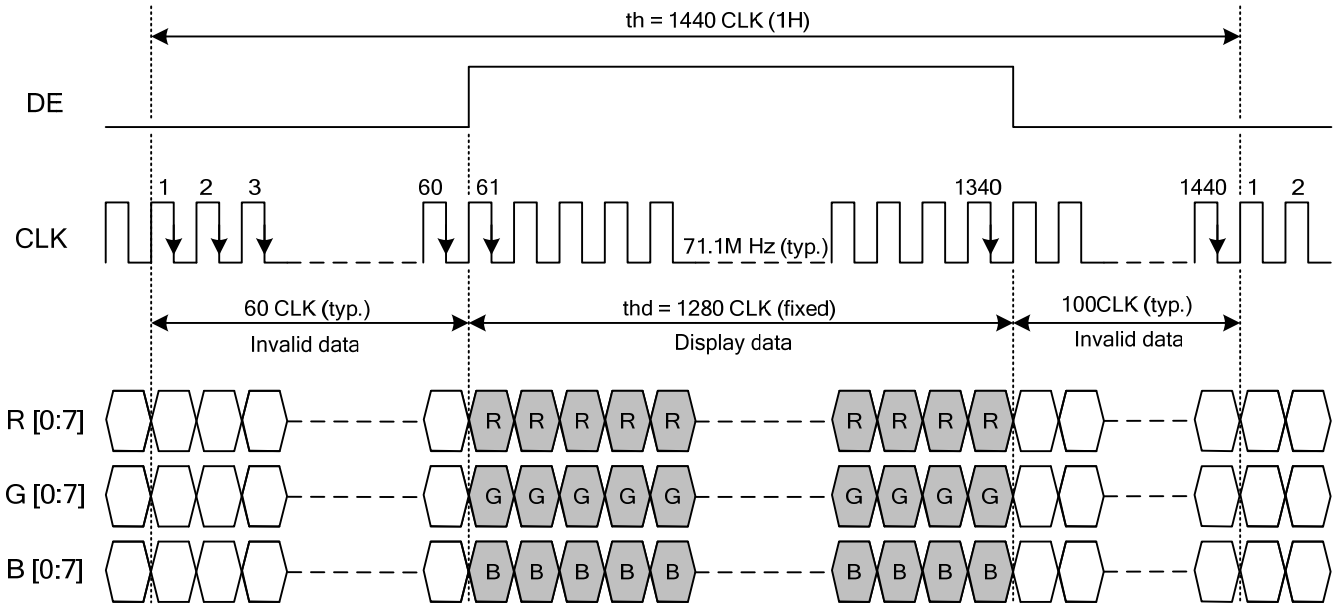


Fig. 8.1 Horizontal Timing

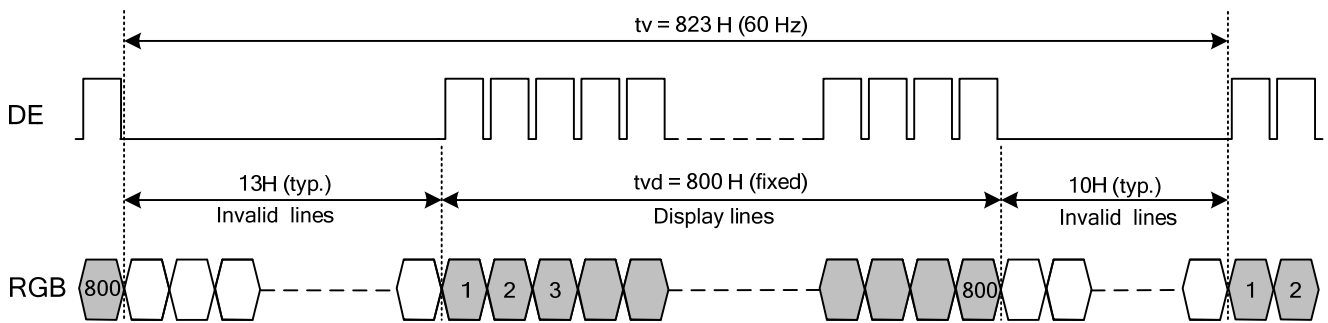


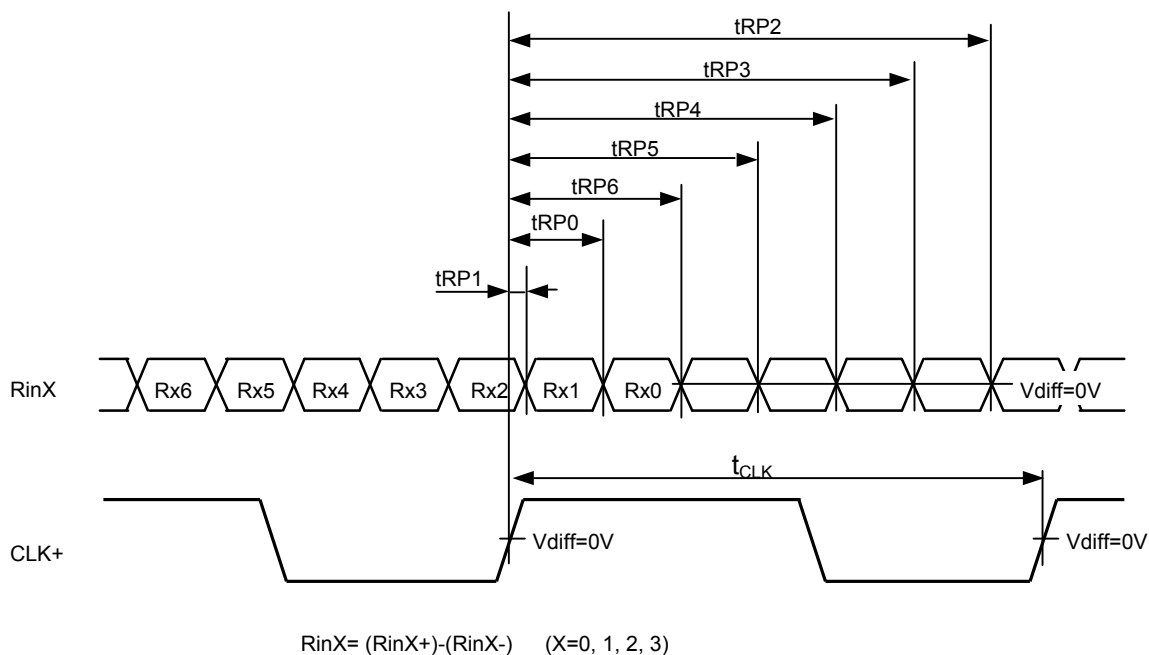
Fig. 8.2 Vertical Timing

8.4 TIME TABLE

The column of timing sets including minimum, typical, and maximum as below are based on the best optical performance, frame frequency (Vsync) = 60 Hz to define. If 60 Hz is not the aim to set, 57~63 Hz for Vsync is recommended to apply for better performance by other parameter combination as the definitions in section 5.1.

| Item | | Symbol | Min. | Typ. | Max. | Unit |
|------------|---------------|------------------|--------|------|--------|------|
| Horizontal | CLK Frequency | f_{CLK} | (68.9) | 71.1 | (73.4) | MHz |
| | Display Data | thd | 1280 | | | CLK |
| | Cycle Time | th | (1410) | 1440 | (1470) | |
| Vertical | Display Data | tvd | 600 | | | H |
| | Cycle Time | tv | (815) | 823 | (833) | |

8.5 LVDS RECEIVER TIMING



| | Item | Symbol | Min. | Typ. | Max. | Unit | Remarks |
|---------------------|-------------------|--------|------|----------|------|------|---------|
| CLK | Cycle frequency | 1/tCLK | - | 71.1 | - | MHz | |
| RinX (X=0,1,2,3) | 0 data position | tRP0 | - | 1/7*tCLK | - | ns | |
| | 1st data position | tRP1 | - | 0 | - | | |
| | 2nd data position | tRP2 | - | 6/7*tCLK | - | | |
| | 3rd data position | tRP3 | - | 5/7*tCLK | - | | |
| | 4th data position | tRP4 | - | 4/7*tCLK | - | | |
| | 5th data position | tRP5 | - | 3/7*tCLK | - | | |
| | 6th data position | tRP6 | - | 2/7*tCLK | - | | |

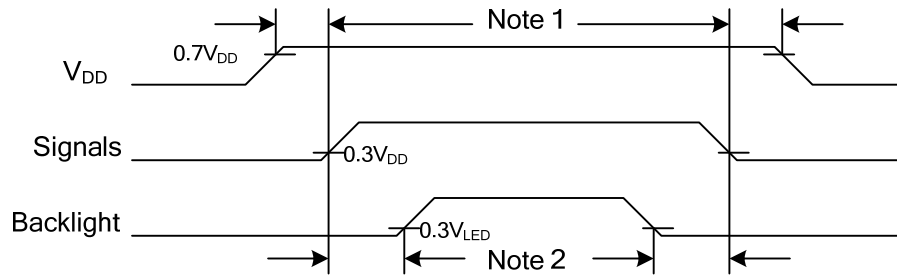
8.6 DATA INPUT for DISPLAY COLOR

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

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

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

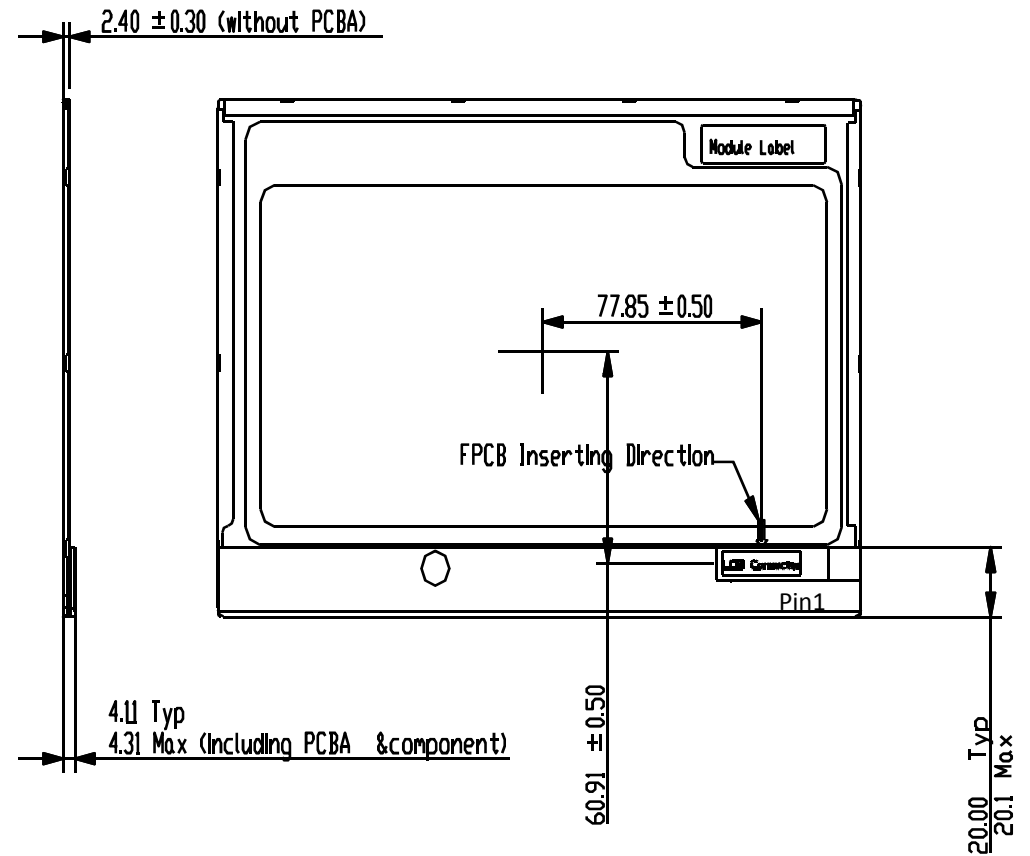
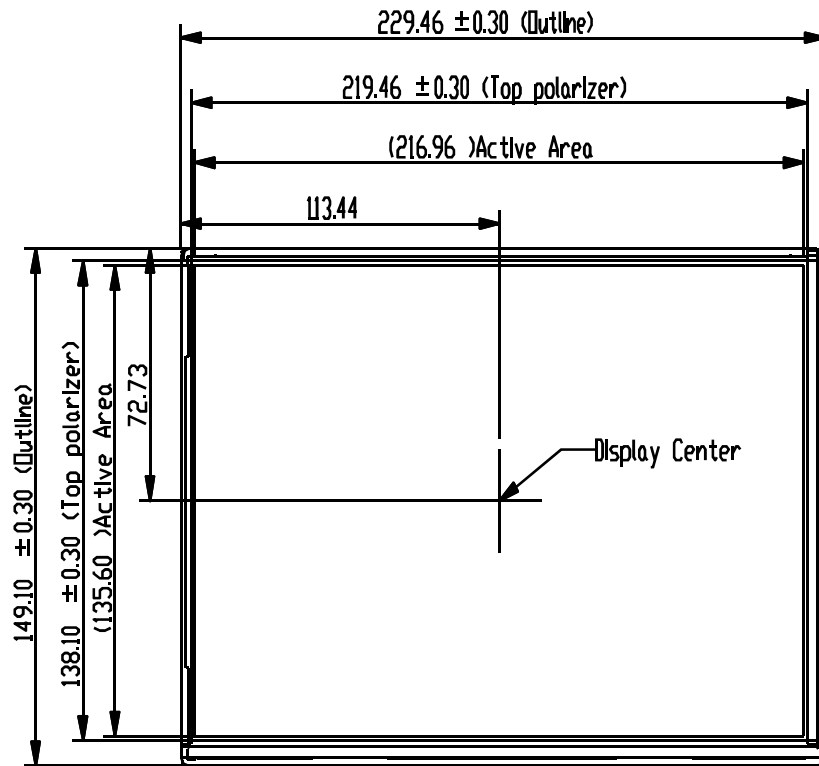
8.7 POWER SEQUENCE



Note 1: In order to avoid any damages, V_{DD} has to be applied before all other signals. The opposite is true for power off where V_{DD} has to be remained on until all other signals have been switch off. The recommended time period is 1 second. Hot plugging might cause display damage due to incorrect power sequence, please pay attention on interface connecting before power on.

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

9. OUTLINE DIMENSIONS



Note :

1. General Tolerance ±0.30mm.

Unit : mm
Scale : NTS