

Version : 0.2

# TECHNICAL SPECIFICATION

MODEL NO. : PM065WX1

☐ Customer's Confirmation

Customer \_\_\_\_\_

Date \_\_\_\_\_

By \_\_\_\_\_

☐ PVI's Confirmation

| Dep  | FAE           | Panel Design  | Electronic Design | Mechanical Design | Product Verification | Prepared by   |
|------|---------------|---------------|-------------------|-------------------|----------------------|---------------|
| Sign | 劉金豐<br>7/4/09 | 劉金豐<br>7/4/09 | 金豐<br>7/4/09      | 申峰<br>7/4/09      | 張系<br>7/4/09         | 吳昌霖<br>7/4/09 |

## Revision History

| Rev. | Issued Date   | Revised Contents                                                                                                                                                                                                                                                                                                                                                |
|------|---------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0.1  | Mar. 22, 2007 | Preliminary                                                                                                                                                                                                                                                                                                                                                     |
| 0.2  | Jul. 04, 2007 | <b>3.Mechanical Specifications</b><br>add weight = (130)±10 g<br><br><b>6.Absolute Maximum Ratings</b><br>add supply voltage parameter<br><br><b>7.Electrical Characteristics</b><br>add 7-1 Recommended Operating Conditions parameter<br>add 7-3 Power Consumption parameter<br><br><b>13. Optical Characteristics</b><br>add optical specification parameter |

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## 1. Application

This data sheet applies to a color TFT LCD module, PM065WX1.

PM065WX1 module applies to OA product, portable DVD, car TV (must use Analog to Digital driving board), which requires high quality flat panel display. If you must use in severe reliability environment, please don't extend over PVI's reliability test conditions.

If you use PM065WX1, Prime View advises your systems use PVI's timing controller IC (PVI-2003A) which will generate proper timing signals to control PM065WX1.

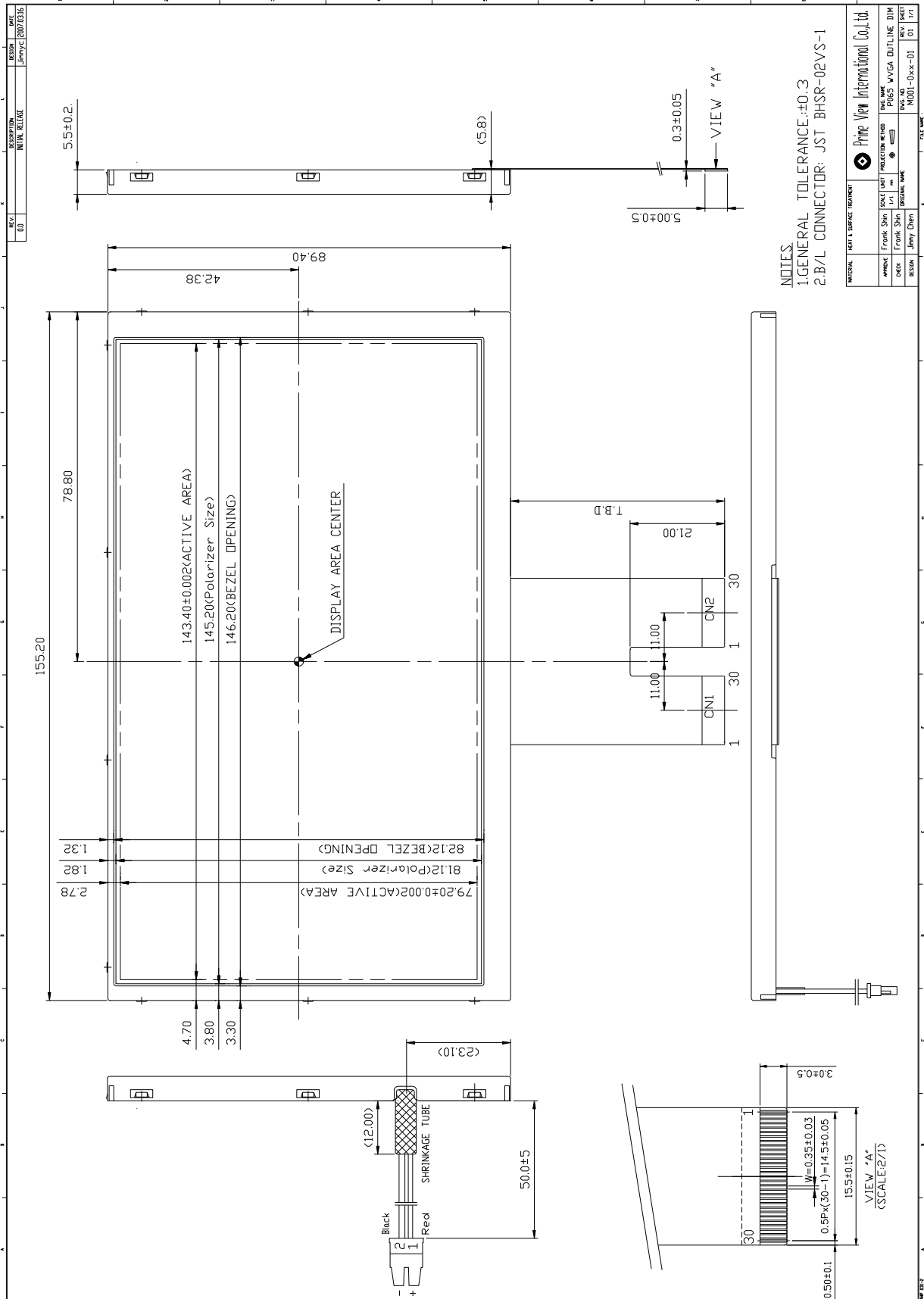
## 2. Features

- . Wide VGA (800\*480 pixels) resolution
- . Amorphous silicon TFT LCD panel with LED
- . Pixel in stripe configuration
- . Thin and light weight
- . Display Colors : 262,144 colors
- . TTL transmission interface
- . Wide viewing angle

## 3. Mechanical Specifications

| Parameter                      | Specifications                        | Unit |
|--------------------------------|---------------------------------------|------|
| Screen Size                    | 6.5 (diagonal)                        | inch |
| Display Format                 | 800 × (R, G, B) × 480                 | dot  |
| Display Colors                 | 262,144                               |      |
| Active Area                    | 143.4 (H) × 79.2 (V)                  | mm   |
| Pixel Pitch                    | 0.17925 (H) × 0.165 (V)               | mm   |
| Pixel Configuration            | Stripe                                |      |
| Outline Dimension              | 155.2 (w) × 89.4 (H) × 5.5 (typ.) (D) | mm   |
| Weight                         | (130)±10                              | g    |
| Back-light                     | LED                                   |      |
| Surface treatment              | Anti-glare and Wide View Film         |      |
| Display mode                   | Normally white                        |      |
| Gray scale inversion direction | 6 o'clock                             |      |

## 4. Mechanical Drawing of TFT-LCD Module



## 5. Input / Output Terminals

### 5-1) TFT-LCD Panel Driving

Connector type : IRISO 9637S-30Y905 30pin Pitch : 0.5mm

#### CN 1

| Pin No. | Symbol | I/O | Function                                      | Remark   |
|---------|--------|-----|-----------------------------------------------|----------|
| 1       | DIO1   | I/O | Horizontal Start Pulse Signal Input or Output | Note 5-1 |
| 2       | VSS1   | I   | Ground                                        |          |
| 3       | VDD1   | I   | Power Supply                                  |          |
| 4       | CLK    | I   | Horizontal Shift Clock                        |          |
| 5       | VSS1   | I   | Ground                                        |          |
| 6       | R/L    | I   | Right / Left selection                        | Note 5-1 |
| 7       | R0     | I   | Red Data (LSB)                                |          |
| 8       | R1     | I   | Red Data                                      |          |
| 9       | R2     | I   | Red Data                                      |          |
| 10      | R3     | I   | Red Data                                      |          |
| 11      | R4     | I   | Red Data                                      |          |
| 12      | R5     | I   | Red Data (MSB)                                |          |
| 13      | VSS1   | I   | Ground                                        |          |
| 14      | G0     | I   | Green Data (LSB)                              |          |
| 15      | G1     | I   | Green Data                                    |          |
| 16      | G2     | I   | Green Data                                    |          |
| 17      | G3     | I   | Green Data                                    |          |
| 18      | G4     | I   | Green Data                                    |          |
| 19      | G5     | I   | Green Data (MSB)                              |          |
| 20      | VSS1   | I   | Ground                                        |          |
| 21      | B0     | I   | Blue Data (LSB)                               |          |
| 22      | B1     | I   | Blue Data                                     |          |
| 23      | B2     | I   | Blue Data                                     |          |
| 24      | B3     | I   | Blue Data                                     |          |
| 25      | B4     | I   | Blue Data                                     |          |
| 26      | B5     | I   | Blue Data (MSB)                               |          |
| 27      | LD     | I   | Load output signal                            | Note 5-2 |
| 28      | REV    | I   | Data invert control                           | Note 5-3 |
| 29      | POL    | I   | Polarity selection                            | Note 5-4 |
| 30      | DIO2   | I/O | Horizontal Start Pulse Signal Input or Output | Note 5-1 |

**CN 2**

| Pin No. | Symbol | I/O | Function                                    | Remark    |
|---------|--------|-----|---------------------------------------------|-----------|
| 1       | VSS2   | I   | Ground                                      |           |
| 2       | V1     | I   | Gamma Voltage 1                             | Note 5-10 |
| 3       | V2     | I   | Gamma Voltage 2                             | Note 5-10 |
| 4       | V3     | I   | Gamma Voltage 3                             | Note 5-10 |
| 5       | V4     | I   | Gamma Voltage 4                             | Note 5-10 |
| 6       | V5     | I   | Gamma Voltage 5                             | Note 5-10 |
| 7       | V6     | I   | Gamma Voltage 6                             | Note 5-10 |
| 8       | V7     | I   | Gamma Voltage 7                             | Note 5-10 |
| 9       | VSS2   | I   | Ground                                      |           |
| 10      | V8     | I   | Gamma Voltage 8                             | Note 5-10 |
| 11      | V9     | I   | Gamma Voltage 9                             | Note 5-10 |
| 12      | V10    | I   | Gamma Voltage 10                            | Note 5-10 |
| 13      | V11    | I   | Gamma Voltage 11                            | Note 5-10 |
| 14      | V12    | I   | Gamma Voltage 12                            | Note 5-10 |
| 15      | V13    | I   | Gamma Voltage 13                            | Note 5-10 |
| 16      | V14    | I   | Gamma Voltage 14                            | Note 5-10 |
| 17      | VSS2   | I   | Ground                                      |           |
| 18      | VDD2   | I   | Voltage for analog circuit                  | Note 5-10 |
| 19      | VCOM   | I   | Common Voltage                              |           |
| 20      | XON    | I   | NC                                          |           |
| 21      | OE     | I   | Output Enable                               | Note 5-5  |
| 22      | U/D    | I   | Up / Down Selection                         | Note 5-6  |
| 23      | CKV    | I   | Vertical Shift Clock                        | Note 5-7  |
| 24      | STVU   | I/O | Vertical Shift Pulse Signal Input or Output | Note 5-6  |
| 25      | STVD   | I/O | Vertical Shift Pulse Signal Input or Output | Note 5-6  |
| 26      | VGG    | I   | Gate On Voltage                             | Note 5-8  |
| 27      | GND    | I   | Ground                                      |           |
| 28      | VCC    | I   | Voltage for logic circuit                   |           |
| 29      | GND    | I   | Ground                                      |           |
| 30      | VEE    | I   | Gate Off Voltage                            | Note 5-9  |

Note 5-1: Gate off voltage,  $V_{EE(TYP.)} = -8V$

Note 5-2: Gate on voltage,  $V_{GG(TYP.)} = +17V$

Note 5-3: Select up or down shift

| U/D | STVU  | STVD  | Shift      |
|-----|-------|-------|------------|
| 1   | Hi-Z  | Input | Down to Up |
| 0   | Input | Hi-Z  | Up to Down |

Note 5-4: Gate driver shift clock

Note 5-5: When OE is connected to high “1”, the driver outputs are disabled (Gate output =  $V_{EE}$ ). Under this condition, the operation of registers will not be affected.

Note 5-6: Select left or right shift

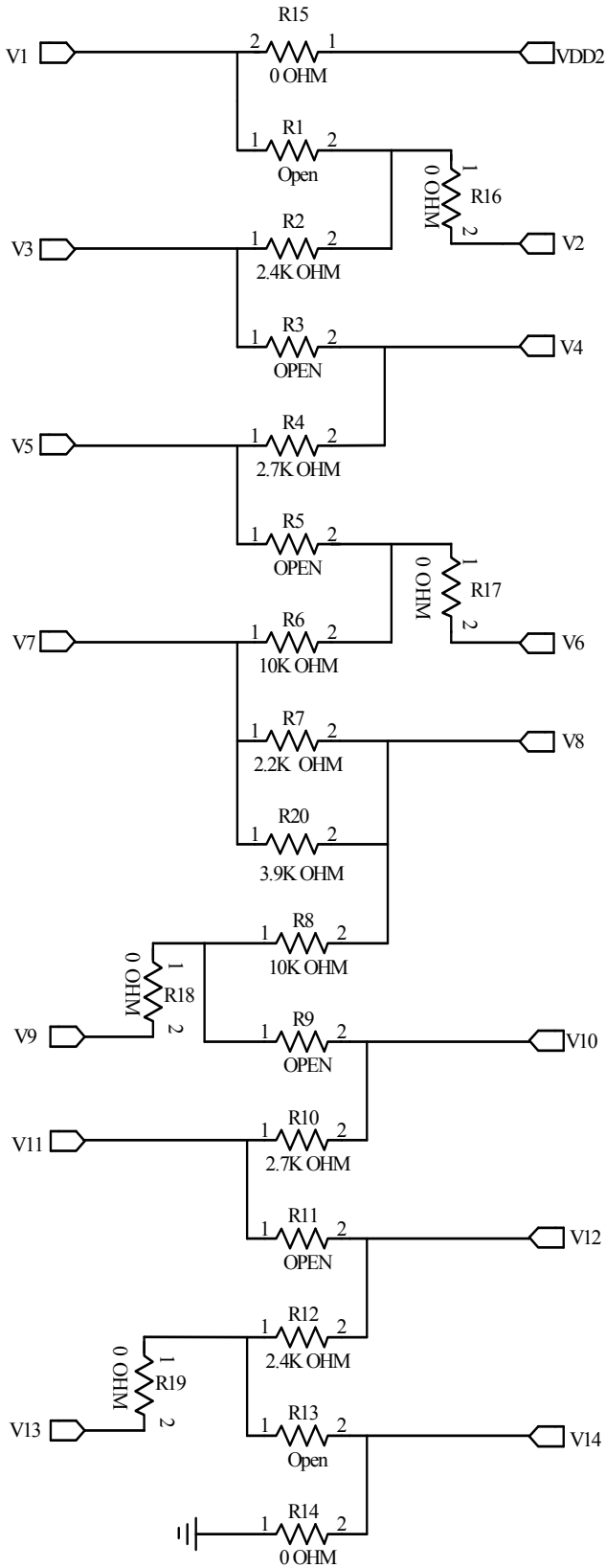
| R/L | DIO1  | DIO2  | Shift         |
|-----|-------|-------|---------------|
| 1   | Input | Hi-Z  | Left to right |
| 0   | Hi-Z  | Input | Right to left |

Note 5-7: Latch the polarity of outputs and switch the new data to outputs. At the rising edge (LD), latch the “POL” signal to control the polarity of the outputs.

Note 5-8: Control whether the Data R0~G5 are inverted or not. (PVI suggests connecting to GND) When “REV=1”, these data will be inverted.  
EX: “00”→”3F”, “07”→”38”, “15”→”2A”

Note 5-9: Polarity selector for dot-inversion control. Available at the rising edge of LD.  
When POL=1: Even outputs range from V1~V7, and Odd outputs range from V8~V14; When POL=0: Even outputs range from V8~V14, and Odd outputs range from V1~V7.

Note 5-10: Typical Application Circuit (When  $V_{DD2}$  (Typ.) = +9.5V)



**5-2) Backlight driving**

Connector type : JST BHSR-02VS-1

| Pin No | Symbol | Description                              | Remark             |
|--------|--------|------------------------------------------|--------------------|
| 1      | +      | Input terminal (Positive electrode side) | Wire color : Red   |
| 2      | -      | Input terminal (Ground side)             | Wire Color : Black |

**6.Absolute Maximum Ratings:**
 $V_{SS1}=V_{SS2}=GND=0V$ ,  $T_a=25^{\circ}C$ 

| Parameters     | Symbol          | MIN.   | MAX.   | Unit | Remark |
|----------------|-----------------|--------|--------|------|--------|
| Supply Voltage | $V_{DD1}$       | (-0.3) | (5.0)  | V    |        |
|                | $V_{CC}$        |        |        | V    |        |
|                | $V_{DD2}$       | (-0.5) | (12.0) | V    |        |
|                | $V_{GG}$        | (-0.3) | (40.0) | V    |        |
|                | $V_{GG}-V_{EE}$ | -      | (40.0) | V    |        |
|                | $V_{EE}$        | (-20)  | (0.3)  | V    |        |

**7.Electrical Characteristics**
**7-1) Recommended Operating Conditions:**
 $V_{SS1}=V_{SS2}=GND=0V$ ,  $T_a=25^{\circ}C$ 

| Item                             | Symbol    | Min.         | Typ.  | Max.         | Unit | Remark |
|----------------------------------|-----------|--------------|-------|--------------|------|--------|
| Supply Voltage for Source Driver | $V_{DD1}$ | (3.0)        | (3.3) | (3.6)        | V    |        |
|                                  | $V_{DD2}$ | (9.0)        | (9.5) | (10)         | V    |        |
| Supply Voltage for Gate Driver   | $V_{GG}$  | -            | (17)  | -            | V    |        |
|                                  | $V_{EE}$  | -            | (-8)  | -            | V    |        |
|                                  | $V_{CC}$  | (3.0)        | (3.3) | (3.6)        | V    |        |
| Digital Input Voltage            | $V_{IH}$  | $0.8V_{DD1}$ | -     | $V_{DD1}$    | V    |        |
|                                  | $V_{IL}$  | 0            | -     | $0.2V_{DD1}$ | V    |        |
| $V_{com}$ Voltage                | $V_{com}$ | -            | (3.8) | -            | V    |        |

**7-2) Recommended driving condition for LED back light**

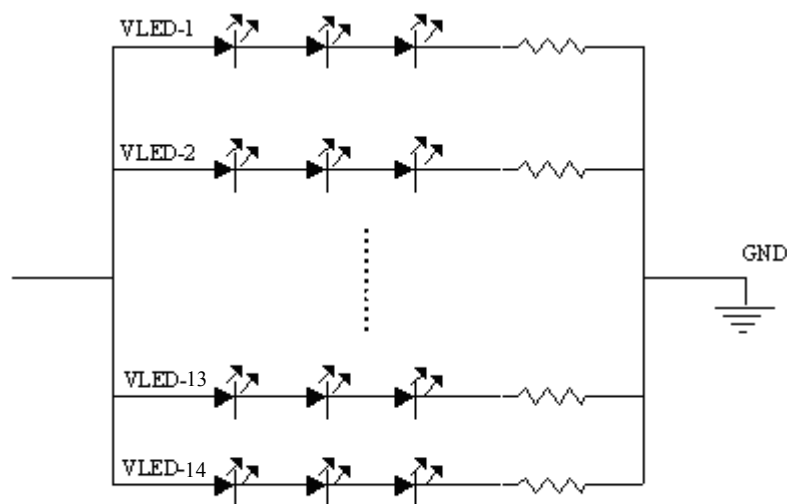
GND = 0 V , Ta = 25°C

| Parameter                       | Symbol    | Min | TYP     | MAX     | Unit | Remark                   |
|---------------------------------|-----------|-----|---------|---------|------|--------------------------|
| Supply voltage of LED backlight | $V_{LED}$ | -   | 11.0    | 11.5    | V    | $I_{LED} = 20\text{ mA}$ |
| Supply current of LED backlight | $I_{LED}$ | -   | 20      | -       | mA   | Note 7-1                 |
| Backlight Power Consumption     | $P_{LED}$ | -   | (0.308) | (0.322) | W    | Note 7-2                 |

Note 7-1 : The LED driving condition is defined for each LED module. (3 LED Serial)

Input current = 20mA \* 14 = 280mA

Note 7-2 :  $P_{LED} = V_{LED-1} * I_{LED-1} + V_{LED-2} * I_{LED-2} + \dots + V_{LED-13} * I_{LED-13} + V_{LED-14} * I_{LED-14}$

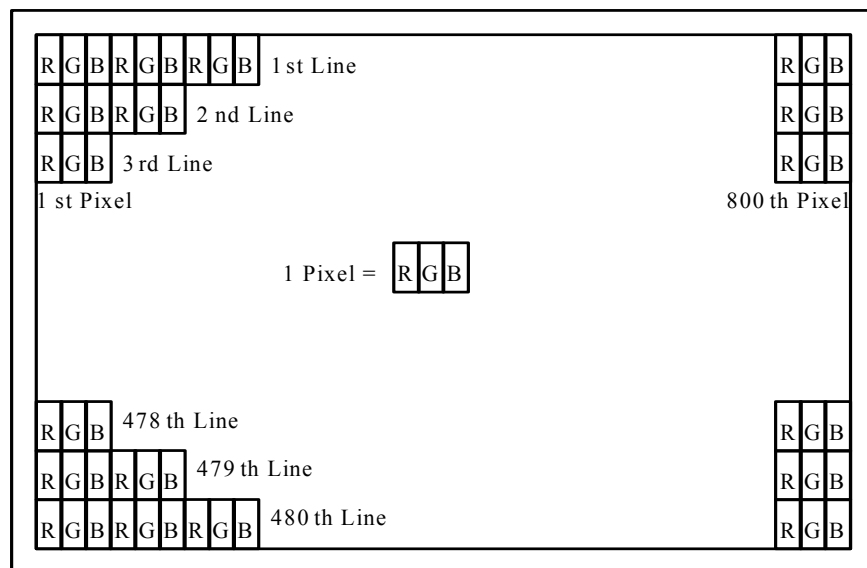

**7-3) Power Consumption**

| Parameter                                  | Symbol    | Condition        | Typ.     | Max.     | Unit | Remark   |
|--------------------------------------------|-----------|------------------|----------|----------|------|----------|
| Supply Current for Gate Driver (Hi level)  | $I_{GG}$  | $V_{GG} = +17V$  | (0.16)   | (0.48)   | mA   |          |
| Supply Current for Gate Driver (Low level) | $I_{EE}$  | $V_{EE} = -8V$   | (0.14)   | (0.42)   | mA   |          |
| Supply Current for Source Driver (Digital) | $I_{DD1}$ | $V_{DD1} = +3.3$ | (2.50)   | (5.00)   | mA   |          |
| Supply Current for Source Driver (Analog)  | $I_{DD2}$ | $V_{DD2} = +9.5$ | (20.00)  | (40.00)  | mA   |          |
| Supply Current for Gate Driver (Digital)   | $I_{CC}$  | $V_{CC} = +3.3$  | (0.10)   | (0.30)   | mA   |          |
| LCD Panel Power Consumption (W/O B/L)      |           |                  | (202.44) | (409.08) | mW   | Note 7-3 |
| Total Power Consumption                    |           |                  | (0.510)  | (0.731)  | W    |          |

Note 7-3: The power consumption for back light is not included.

## 8. Pixel Arrangement

The LCD module pixel arrangement is the stripe.

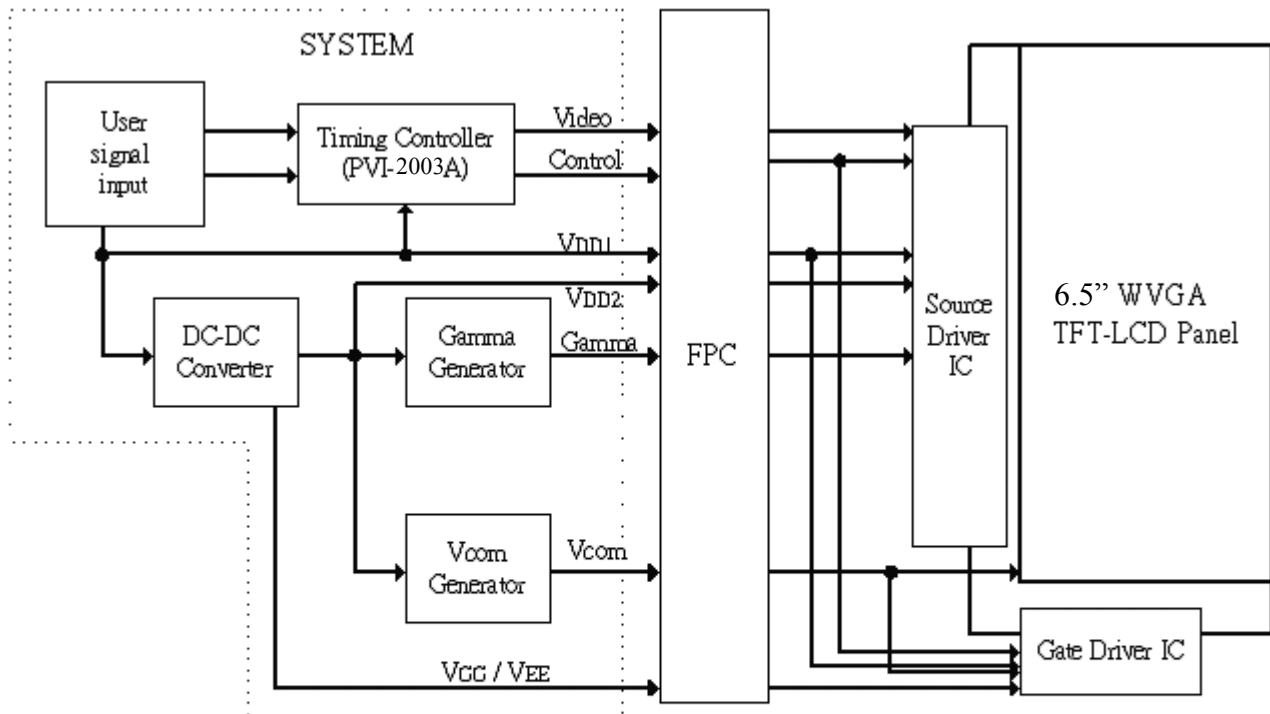


**9. Display Color and Gray Scale Reference**

| Color        |            | Input Color Data |    |    |    |    |    |       |    |    |    |    |    |      |    |    |    |    |    |
|--------------|------------|------------------|----|----|----|----|----|-------|----|----|----|----|----|------|----|----|----|----|----|
|              |            | Red              |    |    |    |    |    | Green |    |    |    |    |    | Blue |    |    |    |    |    |
|              |            | R5               | R4 | R3 | R2 | R1 | R0 | G5    | G4 | G3 | G2 | G1 | G0 | 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  |
|              | Red (63)   | 1                | 1  | 1  | 1  | 1  | 1  | 0     | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  |
|              | Green (63) | 0                | 0  | 0  | 0  | 0  | 0  | 1     | 1  | 1  | 1  | 1  | 1  | 0    | 0  | 0  | 0  | 0  | 0  |
|              | Blue (63)  | 0                | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 1    | 1  | 1  | 1  | 1  | 1  |
|              | Cyan       | 0                | 0  | 0  | 0  | 0  | 0  | 1     | 1  | 1  | 1  | 1  | 1  | 1    | 1  | 1  | 1  | 1  | 1  |
|              | Magenta    | 1                | 1  | 1  | 1  | 1  | 1  | 0     | 0  | 0  | 0  | 0  | 0  | 1    | 1  | 1  | 1  | 1  | 1  |
|              | Yellow     | 1                | 1  | 1  | 1  | 1  | 1  | 1     | 1  | 1  | 1  | 1  | 1  | 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  |
| Red          | Red (00)   | 0                | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  |
|              | Red (01)   | 0                | 0  | 0  | 0  | 0  | 1  | 0     | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  |
|              | Red (02)   | 0                | 0  | 0  | 0  | 1  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  |
|              | Darker     |                  |    |    |    |    |    |       |    |    |    |    |    |      |    |    |    |    |    |
|              | ↓          | ↓                | ↓  | ↓  | ↓  | ↓  | ↓  | ↓     | ↓  | ↓  | ↓  | ↓  | ↓  | ↓    | ↓  | ↓  | ↓  | ↓  |    |
|              | Brighter   |                  |    |    |    |    |    |       |    |    |    |    |    |      |    |    |    |    |    |
|              | Red (61)   | 1                | 1  | 1  | 1  | 0  | 1  | 0     | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  |
|              | Red (62)   | 1                | 1  | 1  | 1  | 1  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  |
|              | Red (63)   | 1                | 1  | 1  | 1  | 1  | 1  | 0     | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  |
| Green        | Green (00) | 0                | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  |
|              | Green (01) | 0                | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 1  | 0  | 0    | 0  | 0  | 0  | 0  | 0  |
|              | Green (02) | 0                | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 1  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  |
|              | Darker     |                  |    |    |    |    |    |       |    |    |    |    |    |      |    |    |    |    |    |
|              | ↓          | ↓                | ↓  | ↓  | ↓  | ↓  | ↓  | ↓     | ↓  | ↓  | ↓  | ↓  | ↓  | ↓    | ↓  | ↓  | ↓  | ↓  |    |
|              | Brighter   |                  |    |    |    |    |    |       |    |    |    |    |    |      |    |    |    |    |    |
|              | Green (61) | 0                | 0  | 0  | 0  | 0  | 0  | 1     | 1  | 1  | 1  | 0  | 1  | 0    | 0  | 0  | 0  | 0  | 0  |
|              | Green (62) | 0                | 0  | 0  | 0  | 0  | 0  | 1     | 1  | 1  | 1  | 1  | 0  | 0    | 0  | 0  | 0  | 0  | 0  |
|              | Green (63) | 0                | 0  | 0  | 0  | 0  | 0  | 1     | 1  | 1  | 1  | 1  | 1  | 0    | 0  | 0  | 0  | 0  | 0  |
| Blue         | Blue (00)  | 0                | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  |
|              | Blue (01)  | 0                | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 1  |
|              | Blue (02)  | 0                | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 1  | 0  | 0  |
|              | Darker     |                  |    |    |    |    |    |       |    |    |    |    |    |      |    |    |    |    |    |
|              | ↓          | ↓                | ↓  | ↓  | ↓  | ↓  | ↓  | ↓     | ↓  | ↓  | ↓  | ↓  | ↓  | ↓    | ↓  | ↓  | ↓  | ↓  |    |
|              | Brighter   |                  |    |    |    |    |    |       |    |    |    |    |    |      |    |    |    |    |    |
|              | Blue (61)  | 0                | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 1    | 1  | 1  | 1  | 0  | 1  |
|              | Blue (62)  | 0                | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 1    | 1  | 1  | 1  | 1  | 0  |
|              | Blue (63)  | 0                | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 1    | 1  | 1  | 1  | 1  | 1  |

## 10. Block Diagram

### 10-1) TFT-module Block Diagram



If you use PM065WX1, you can apply PVI-2003 A (Timing controller) which will generate timing signals to support PM065WX1.

## 11. Interface Timing

### 11.1) Timing Parameters

AC Electrical Characteristics ( $V_{CC}=V_{DD1}= 3.3V$ ,  $V_{DD2}=9.5V$ ,  $GND=V_{SS1}=V_{SS2}=0V$ ,  $T_a=25^{\circ}C$ )

| Parameter                      | Symbol            | Min. | Typ. | Max. | Unit            |
|--------------------------------|-------------------|------|------|------|-----------------|
| CLK Frequency                  | Fclk              | -    | 32   | 40   | MHz             |
| CLK Pulse Width                | Tcw               | 25   | -    | -    | ns              |
| Data Set-up Time               | Tsu               | 4    | -    | -    | ns              |
| Data Hold Time                 | Thd               | 2    | -    | -    | ns              |
| Propagation Delay of DIO2/1    | Tphl              | 6    | 10   | 15   | ns              |
| Time That The Last Data to LD  | Tld               | 1    | -    | -    | Tcw             |
| Pulse width of LD              | Twld              | 2    | -    | -    | Tcw             |
| Time That LD to DIO1/2         | Tlds              | 5    | -    | -    | Tcw             |
| POL Set-up Time                | Tpsu              | 6    | -    | -    | ns              |
| POL Hold Time                  | Tphd              | 6    | -    | -    | ns              |
| OE Pulse Width                 | T <sub>OE</sub> V | 1    | -    | -    | μs              |
| CKV Pulse Width                | T <sub>CKV</sub>  | 500  | -    | -    | ns              |
| STV Set-up Time                | T <sub>SUV</sub>  | 400  | -    | -    | ns              |
| STV Hold Time                  | T <sub>HDV</sub>  | 400  | -    | -    | ns              |
| Horizontal Display Period      | T <sub>HDP</sub>  | -    | 800  | -    | Tcw             |
| Horizontal Period Timing Range | T <sub>HP</sub>   | -    | 1056 | -    | Tcw             |
| Horizontal Lines Per Field     | T <sub>V</sub>    | 484  | 508  | 620  | T <sub>HP</sub> |
| Vertical Display Timing Range  | T <sub>DV</sub>   | -    | 480  | -    | T <sub>HP</sub> |

11.2) Timing Diagram

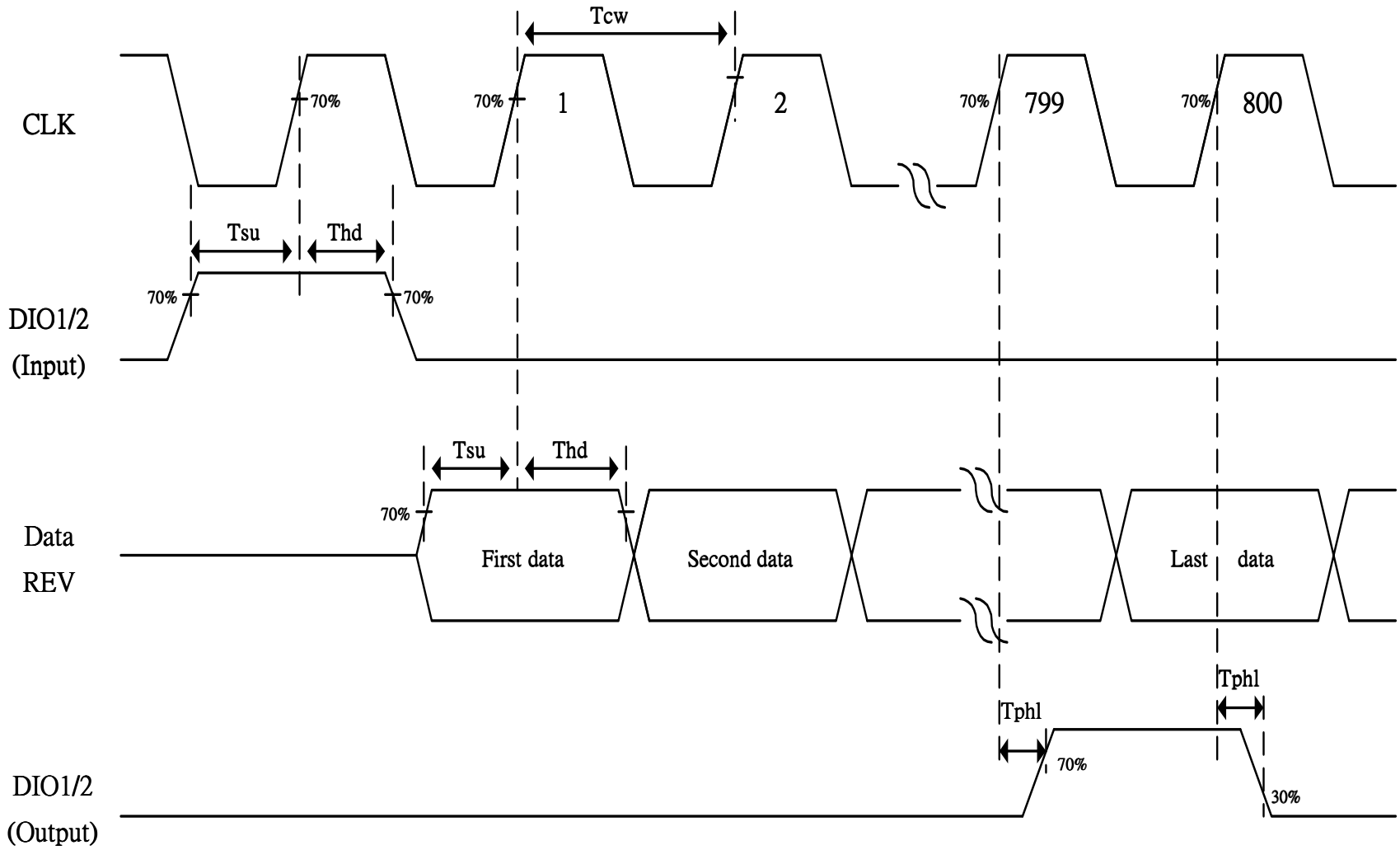


Fig. 11-1 Horizontal timing (1)

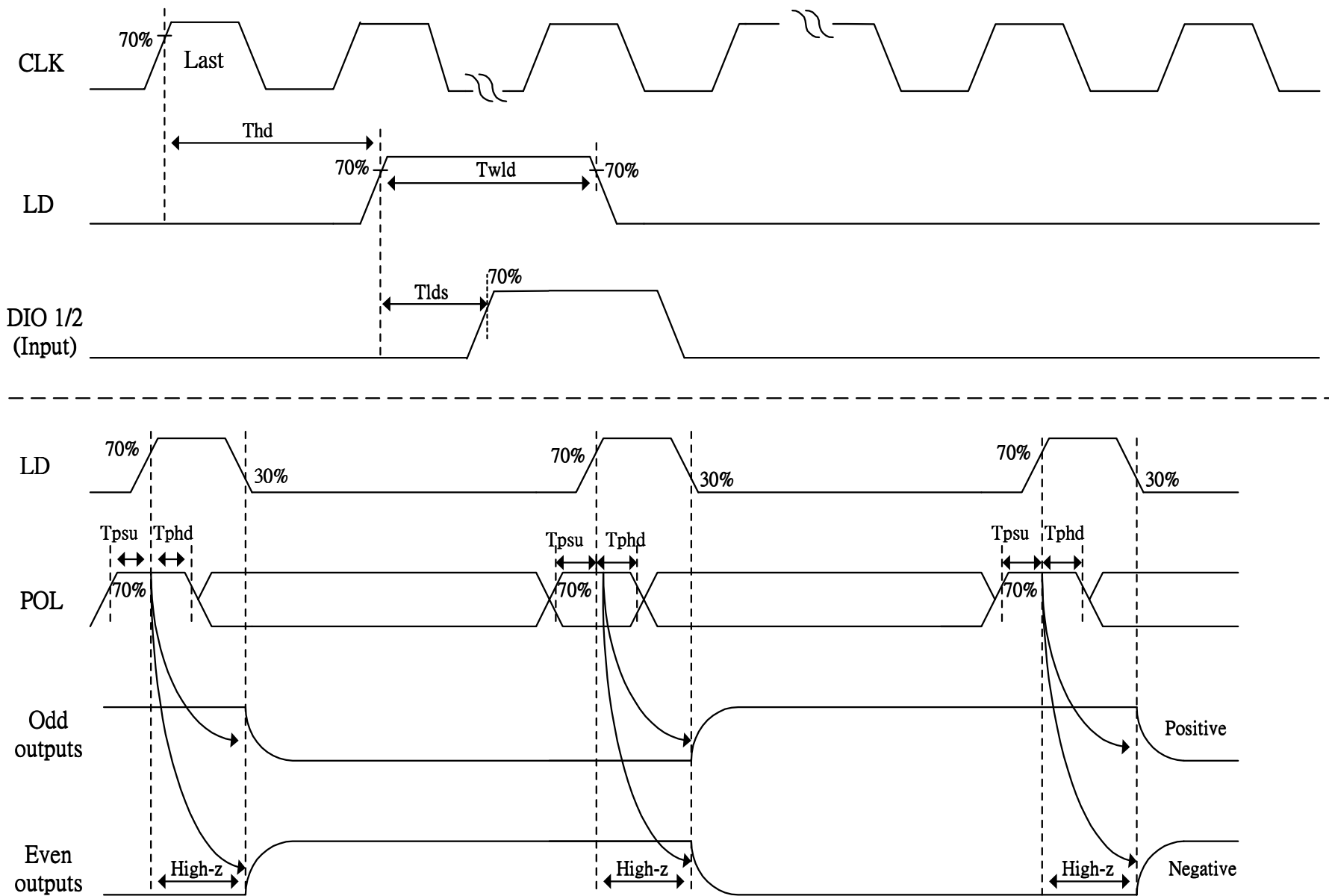


Fig. 11-2 Horizontal timing(2)

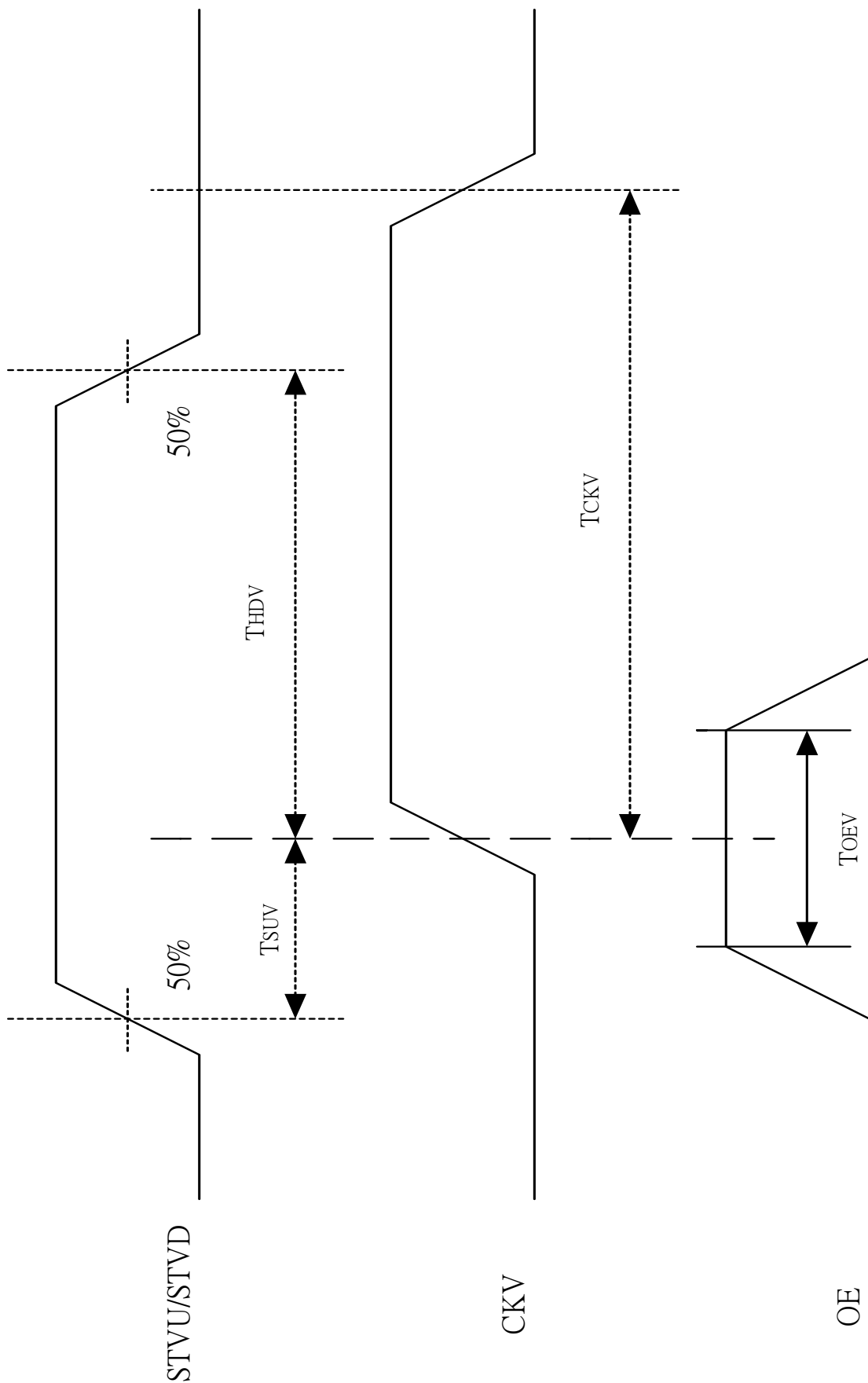


Fig. 11-3 Vertical shift clock timing

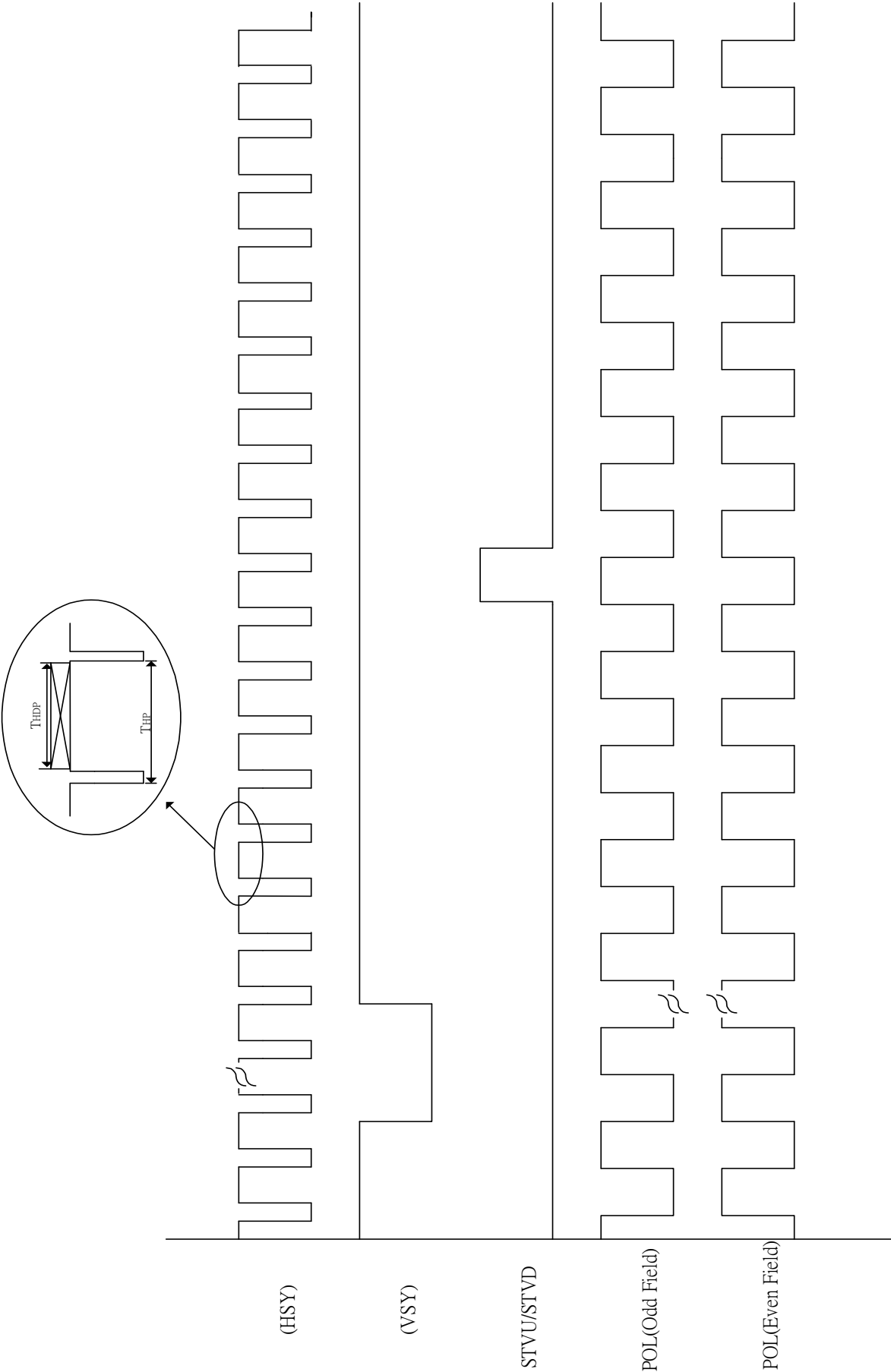
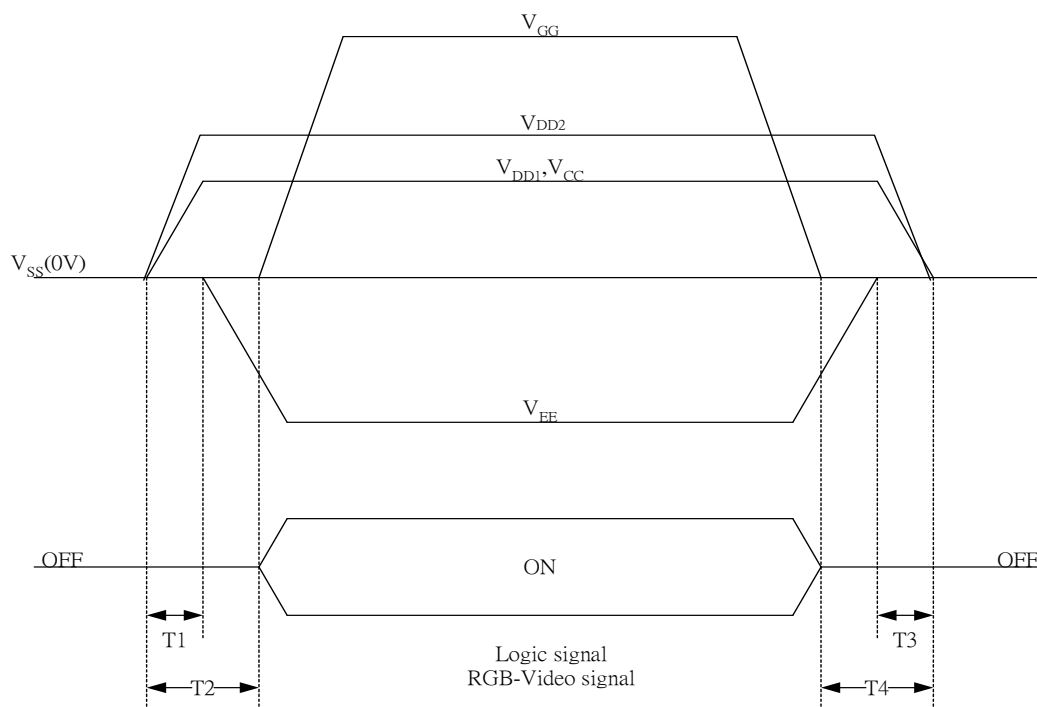


Fig. 11-4 Vertical timing

## 12. Power On Sequence



$$1.10\text{ms} \leq T1 < T2$$

$$2. 0\text{ms} < T3 \leq T4 \leq 10\text{ms}$$

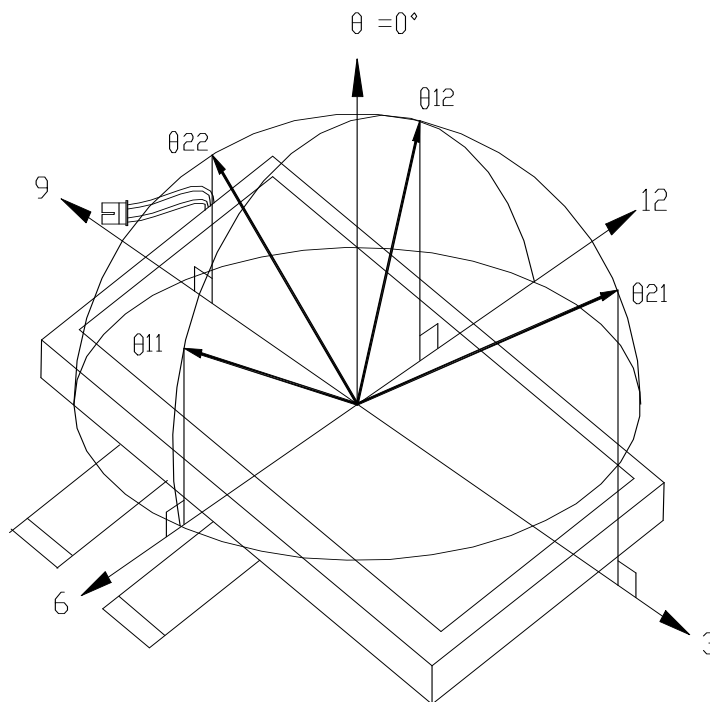
## 13. Optical Characteristics

### 13-1) Specification:

$T_a=25^\circ\text{C}$

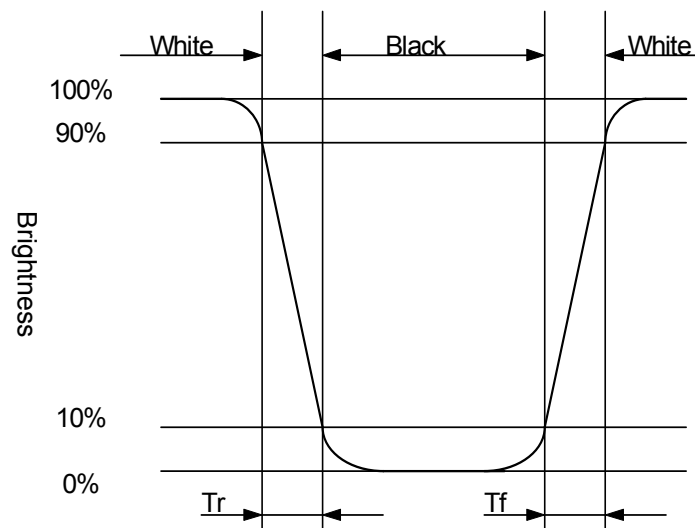
| Parameter            |            | Symbol                   | Condition                        | MIN.    | TYP.   | MAX.   | Unit              | Remarks   |
|----------------------|------------|--------------------------|----------------------------------|---------|--------|--------|-------------------|-----------|
| Viewing Angle        | Horizontal | $\theta$                 | CR > 10                          | 55      | 60     |        | deg               | Note 13-1 |
|                      | Vertical   | $\theta$ (to 12 o'clock) |                                  | 35      | 40     | -      | deg               |           |
|                      |            | $\theta$ (to 6 o'clock)  |                                  | 50      | 55     | -      | deg               |           |
| Contrast Ratio       |            | CR                       |                                  | 250     | 400    | -      | -                 | Note 13-2 |
| Response time        | Rise       | Tr                       | $\theta = 0^\circ$               | -       | 15     | 30     | ms                | Note 13-3 |
|                      | Fall       | Tf                       |                                  | -       | 25     | 50     | ms                |           |
| Brightness           |            |                          | $\theta = 0^\circ / \varphi = 0$ | (450)   | (550)  |        | cd/m <sup>2</sup> | Note 13-4 |
| Luminance Uniformity |            | U                        |                                  | 75      | 80     | -      | %                 | Note 13-5 |
| LED Life Time        |            |                          |                                  | (20000) | -      | -      | hr                |           |
| White Chromaticity   |            | x                        |                                  | (0.28)  | (0.31) | (0.34) | -                 |           |
|                      |            | y                        |                                  | (0.30)  | (0.33) | (0.37) | -                 |           |
| Cross Talk           |            |                          | $\theta = 0^\circ$               | -       | -      | 3.5    | %                 | Note 13-6 |

Note 13-1: The definitions of viewing angles are as follow

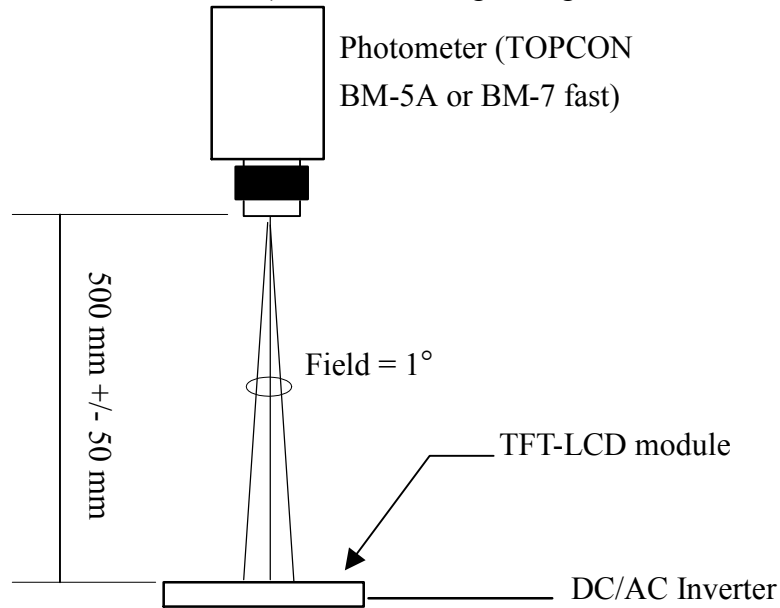


Note 13-2: The definition of contrast ratio  $CR = \frac{\text{Luminance at gray level 63}}{\text{Luminance at gray level 0}}$

Note 13-3: Definition of Response Time  $T_r$  and  $T_f$ :



Note 13-4: The optical characteristics shall be measured in dark room (ambient illumination on panel surface less than 1 Lux). The measuring configuration shows as following figure.



Optical characteristics measuring configuration

Note 13-5: The uniformity of LCD is defined as

$$U = \frac{\text{The Minimum Brightness of the 9 testing Points}}{\text{The Maximum Brightness of the 9 testing Points}}$$

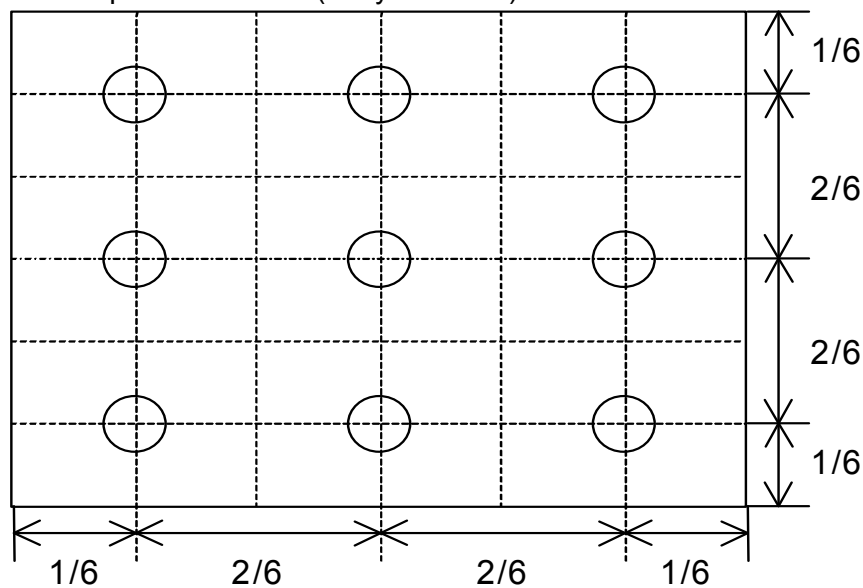
Luminance meter : BM-5A or BM-7 fast(TOPCON)

Measurement distance : 500 mm +/- 50 mm

Ambient illumination : < 1 Lux

Measuring direction : Perpendicular to the surface of module

The test pattern is white (Gray Level 63).



Note 13-6: Cross Talk (CTK) =  $\frac{|YA-YB|}{YA} \times 100\%$

YA: Brightness of Pattern A

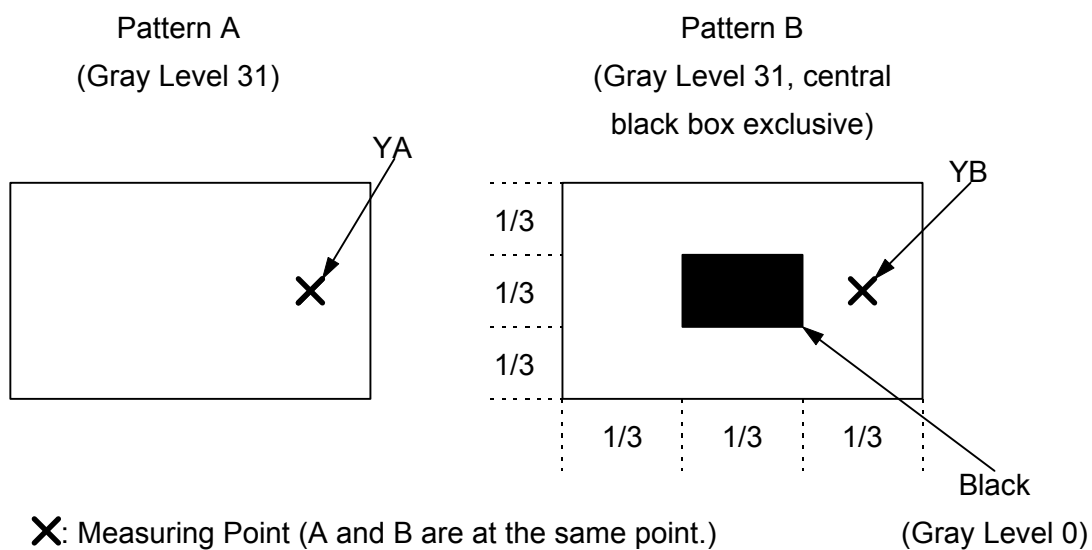
YB: Brightness of Pattern B

Luminance meter : BM 5A or BM-7 fast (TOPCON)

Measurement distance : 500 mm +/- 50 mm

Ambient illumination : < 1 Lux

Measuring direction : Perpendicular to the surface of module



Note 13-7: Topcon BM-5A or BM-7 fast luminance meter 1° field of view is used in the testing.

**14. Handling Cautions****14-1) Mounting of module**

- a) Please power off the module when you connect the input/output connector.
- b) Please connect the ground pattern of the inverter circuit surely. If the connection is not perfect, some following problems may happen possibly.
  - 1.The noise from the backlight unit will increase.
  - 2.The output from inverter circuit will be unstable.
  - 3.In some cases a part of module will heat.
- c) Polarizer which is made of soft material and susceptible to flaw must be handled carefully.
- d) Protective film (Laminator) is applied on surface to protect it against scratches and dirt. It is recommended to peel off the laminator before use and taking care of static electricity.

**14-2) Precautions in mounting**

- a) When metal part of the TFT-LCD module (shielding lid and rear case) is soiled, wipe it with soft dry cloth.
- b) Wipe off water drops or finger grease immediately. Long contact with water may cause discoloration or spots.
- c) TFT-LCD module uses glass which breaks or cracks easily if dropped or bumped on hard surface. Please handle with care.
- d) Since CMOS LSI is used in the module. So take care of static electricity and earth yourself when handling.

**14-3) Adjusting module**

- a) Adjusting volumes on the rear face of the module have been set optimally before shipment.
- b) Therefore, do not change any adjusted values. If adjusted values are changed, the specifications described may not be satisfied.

**14-4) Others**

- a) Do not expose the module to direct sunlight or intensive ultraviolet rays for many hours.
- b) Store the module at a room temperature place.
- c) The voltage of beginning electric discharge may over the normal voltage because of leakage current from approach conductor by to draw lump read lead line around.
- d) If LCD panel breaks, it is possibly that the liquid crystal escapes from the panel. Avoid putting it into eyes or mouth. When liquid crystal sticks on hands, clothes or feet. Wash it out immediately with soap.
- e) Observe all other precautionary requirements in handling general electronic components.
- f) Please adjust the voltage of common electrode as material of attachment by 1 module.

**14-5) Polarizer mark**

The polarizer mark is to describe the direction of wide view angle film how to match up with the rubbing direction.

**15. Reliability Test**

| No | Test Item                                       | Test Condition                                                                                                                | Remark |
|----|-------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|--------|
| 1  | High Temperature Storage Test                   | Ta = +95℃, 240 hrs                                                                                                            |        |
| 2  | Low Temperature Storage Test                    | Ta = -40℃, 240 hrs                                                                                                            |        |
| 3  | High Temperature Operation Test                 | Ta = +85℃, 240 hrs                                                                                                            |        |
| 4  | Low Temperature Operation Test                  | Ta = -30℃, 240 hrs                                                                                                            |        |
| 5  | High Temperature & High Humidity Operation Test | Ta = +60℃, 90%RH, 240 hrs<br>(No Condensation)                                                                                |        |
| 6  | Thermal Cycling Test<br>(non-operating)         | -30℃ → +80℃, 200 Cycles<br>30min 30min                                                                                        |        |
| 7  | Vibration Test<br>(non-operating)               | Frequency : 10 ~ 55 Hz,<br>Amplitude : 1 mm<br>Sweep time : 11 min<br>Test Period : 6 Cycles for each direction of X,<br>Y, Z |        |
| 8  | Shock Test<br>(non-operating)                   | 100G, 6ms<br>Direction: ±X, ±Y, ±Z Cycle: 3 times                                                                             |        |
| 9  | Electrostatic Discharge Test<br>(non-operating) | 200pF, 0Ω<br>±200V<br>1 time / each terminal                                                                                  |        |

Ta: ambient temperature

Note : The protective film must be removed before temperature test.

**[Criteria]**

There can be no display failures after exposure to reliability tests. (including : line defect ,no image). All the cosmetic specification is judged before the reliability stress.

**15. Packing****TBD**