

TFT-Display Datenblatt

Modell PM070WX1

Kurzdaten

| | |
|------------|-----------------------------|
| Hersteller | PrimeView |
| Diagonale | 7,0" / 17,8cm |
| Format | 15:9 |
| Auflösung | 800x480 |
| Backlight | 1xCCFL/400cd/m ² |
| Temperatur | -30...+85°C (Betrieb) |

Version : 10.0



Inselkammerstr. 10
82008 Unterhaching
Tel: +49 89 614 503 40
www.hy-line.de/computer

TECHNICAL SPECIFICATION
MODEL NO : PM070WX1

The content of this information is subject to be changed without notice.
Please contact PVI or its agent for further information.


Customer's Confirmation


Customer _____

Date _____

By _____

PVI's Confirmation


Confirmed By _____


Prepared By _____

Revision History

| Rev. | Issued Date | Revised Contents |
|------|--------------|---|
| 0.0 | 10 Nov. 2003 | New |
| 0.1 | 17 Mar. 2004 | Modify Page 4 : 4.Mechanical Drawing of TFT-LCD Module Outline Drawing : Front View (unit mm) Page 16 : 13.Optical Characteristics, 13-1) Specification: Luminance Uniformity (U) from "Min : 55, Typ : 80" to "Min : 70, Typ : 75" |
| 1.0 | 12 May.2004 | Modify Page 3 : 3.Mechanical Specifications Page 11 : 6.Absolute Maximum Ratings: 7-2) Recommended Driving Condition for Back Light Page 12 : 7-3) Power Consumption Page 16 : 13. Optical Characteristics, 13-1) Specification: Page 22 : 17. Packing Diagram |
| 1.1 | 03 Aug .2004 | Modify Page 6 : 5.Input / Output Terminals Page 8 : Note 5-5 Page 12 : 6.Absolute Maximum Ratings 7-1) Recommended Operating Conditions Page 13 : 7-3) Power Consumption Page 16 : 11.1) Timing Parameters Page 17 : 11.2) Timing Diagram Page 21 : 12. Power On Sequence Page 21 : 13. Optical Characteristics Add Page11 : Note5-10 3)Typical Application Circuit (When VDD2 = +9.5V) |
| 1.2 | 06 Oct.2004 | Add Page 12 : Note 7-3 ,3. The Kick-off times \geq 1sec |
| 1.3 | 12 Jan.2005 | Modify Page 13 : 7-3) Power Consumption Add Page 26 : 15. Reliability Test, Note Del Page 26 : 16. Indication of Lot Number Label |
| 1.4 | 09 July,2005 | Modify: Page 11: 5-2) Backlight driving From: Connector type: JST BHR-02VS-1, PIN No 2 pin, pitch=3.5mm Modify: Connector type: JST BHSR-02VS-1, PIN No 2 pin, pitch=3.5mm |
| 1.5 | 07 Feb ,2006 | 1- Modify Page 9. Note 5-10 Gamma circuitry 2.Page 8. Note5-2 V _{GG} =+27 modify to V _{GG} =+17V Page 10 7-1 Recommend Operation Conditions Supply Voltage for gate driver V _{GG} =+27 modify to V _{GG} =+17V |

| Rev. | Issued Date | Revised Contents |
|------|---------------|---|
| 1.5 | 07 Feb ,2006 | 7-2 Recommended Driving Condition for Back Light modify starting Voltage 25°C starting Voltage Max. from 820 (Vrms) to 1090(Vrms) 0°C starting Voltage Max. from 970 (Vrms) to 1420(Vrms) |
| 1.6 | 27 Apr, 2006 | 15. Reliability Test 變更前： High Temperature Storage Test , Ta = +80°C , 240 hrs Low Temperature Storage Test , Ta = -30°C , 240 hrs 變更後： High Temperature Storage Test , Ta = +85°C , 240 hrs Low Temperature Storage Test , Ta = -40°C , 240 hrs |
| 8.0 | 02 Aug,2006 | 15. Reliability Test High Temperature operation Test , Ta = +80°C , 240 hrs Low Temperature operation Test , Ta = -20°C , 240 hrs 變更後： High Temperature operation Test , Ta = +85°C , 240 hrs Low Temperature operation Test , Ta = -30°C , 240 hrs |
| 9.0 | 23,Oct,2006 | 1.Page9 note5-10: Typical Application Circuit: from R1= 0ohm,R13=0ohm modify to, R1=open .R13=open 2.Page10 7.Electrical Characteristics VEE voltage from -10V(Typ.), modify to -8V(typ) Vcom voltage from 3.6V(Typ.), modify to 3.1V(typ) |
| 10.0 | Apr.01 , 2008 | Page 8 5. Input / Output Terminals Modify Note Page 26 Add 14. Handling Cautions e)Please following the tear off direction as figure 14-1 to remove the protective film as slowly as possible, so that electrostatic charge can be minimized. |

TECHNICAL SPECIFICATION**CONTENTS**

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1.Application

This data sheet applies to a color TFT LCD module, PM070WX1.

PM070WX1 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 PM070WX1, Prime View advises your systems use PVI's timing controller IC (PVI-2003A) which will generate proper timing signals to control PM070WX1.

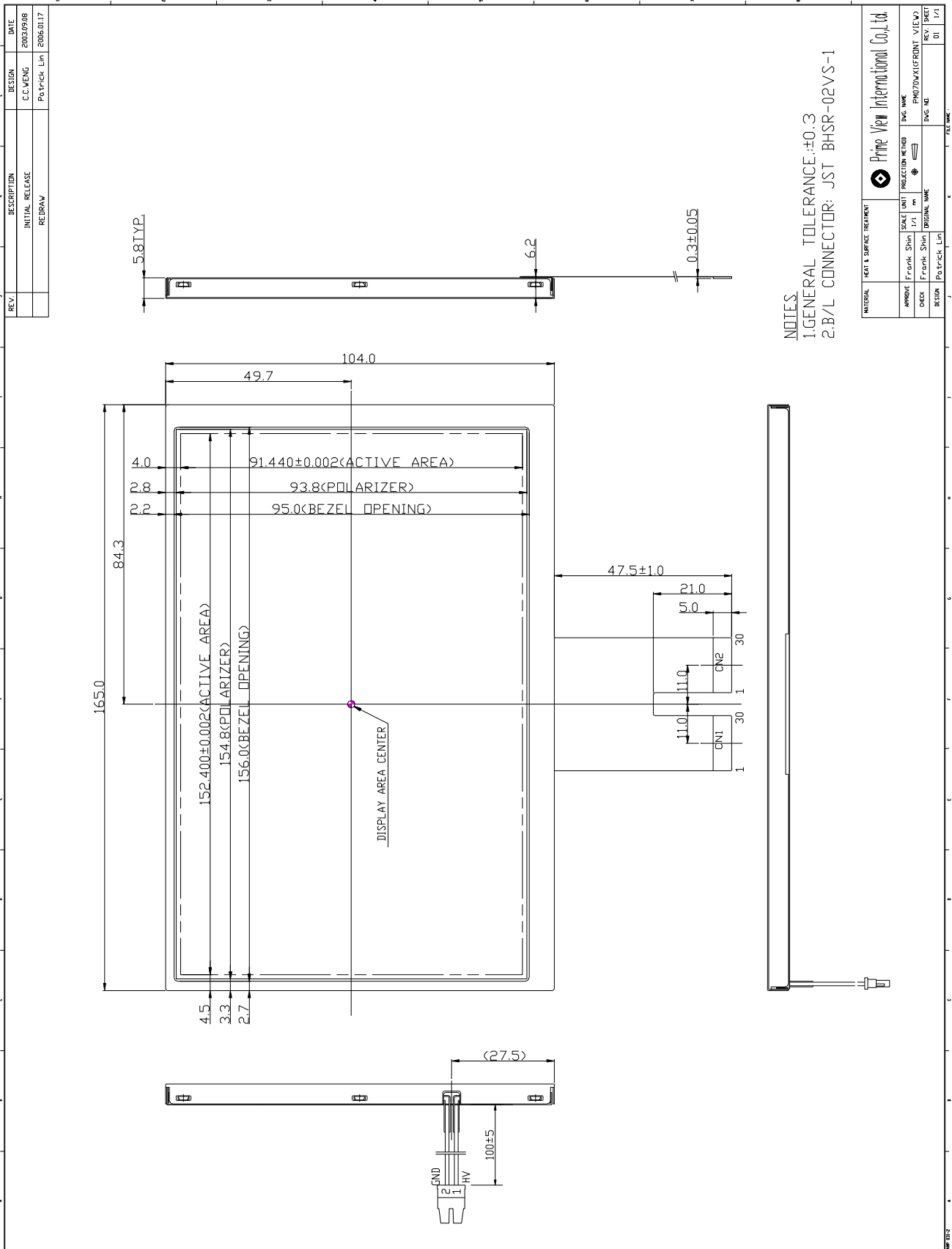
2. Features

- . Wide VGA (800*480 pixels) resolution
- . Amorphous silicon TFT LCD panel with back-light unit
- . Pixel in stripe configuration
- . Thin and light weight
- . Display Colors : 262,144 colors
- . Optimum Viewing Direction : 6 o'clock
- . TTL transmission interface
- . Wide viewing angle

3.Mechanical Specifications

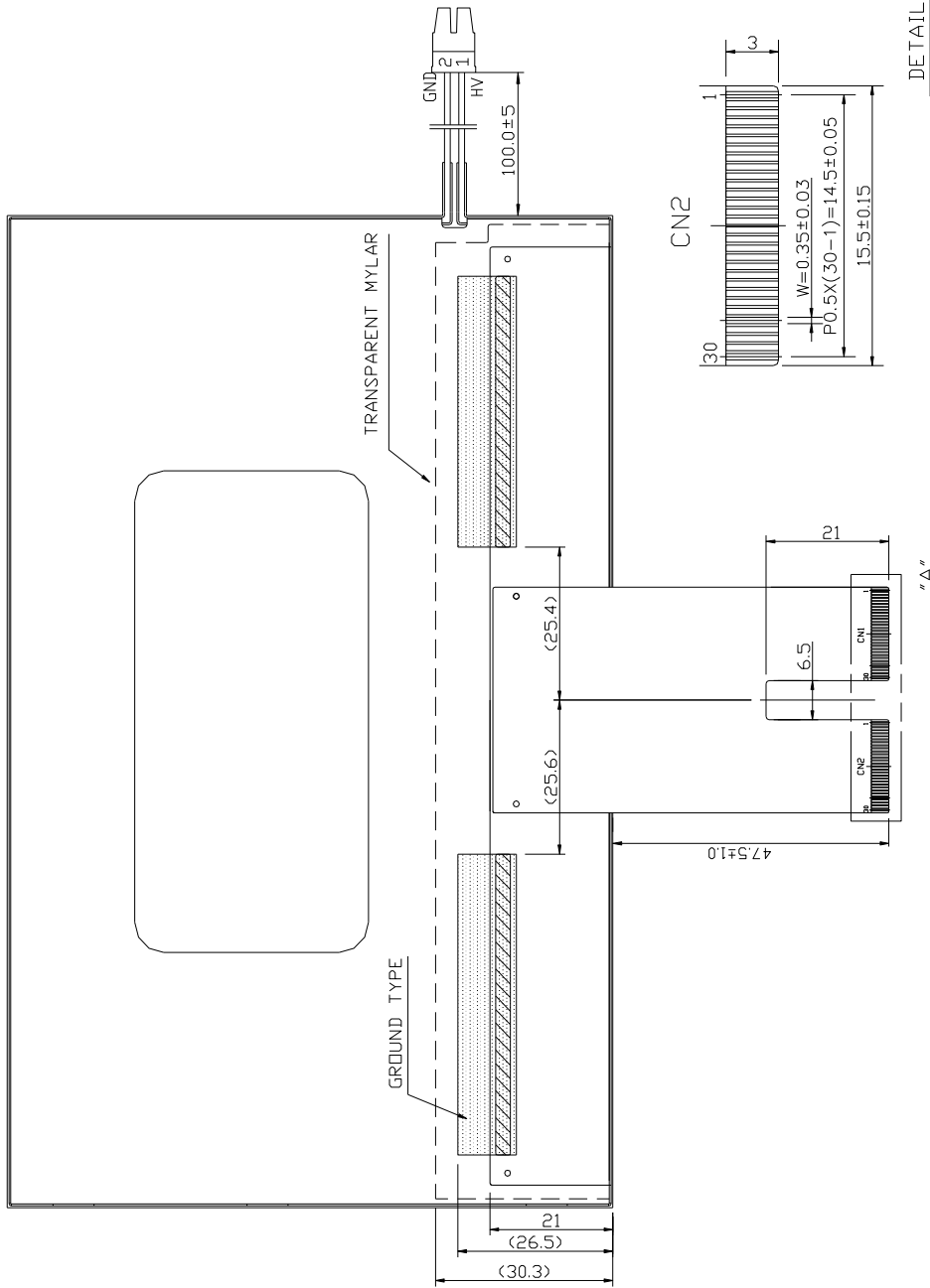
| Parameter | Specifications | Unit |
|--------------------------------|-----------------------------------|------|
| Screen Size | 7.0(diagonal) | inch |
| Display Format | 800×(R, G, B)×480 | dot |
| Display Colors | 262,144 | |
| Active Area | 152.4(H)×91.44(V) | mm |
| Pixel Pitch | 0.1905(H)×0.1905(V) | mm |
| Pixel Configuration | Stripe | |
| Outline Dimension | 165.0(w)×104.0 (H)×6.2 (typ.) (D) | mm |
| Weight | 175 | g |
| Back-light | CCFL, 1 tube | |
| Surface treatment | Anti-glare and Wide View Film | |
| Display mode | Normally white | |
| Gray scale inversion direction | 6 o'clock [ref to Note 13-1] | |

4. Mechanical Drawing of TFT-LCD Module



PM070WX1

| REV. | DESCRIPTION | DESIGN | DATE |
|------|-----------------|-------------|------------|
| | INITIAL RELEASE | C.C.WENG | 2003/09/16 |
| | REDRAW | Patrick Lin | 2006.01.17 |



DETAIL "A"
(S: 3/1)

| MATERIAL | HEAT & SURFACE TREATMENT | APPROVAL | DATE | DESIGN NO. | REV. |
|----------|--------------------------|-------------|------|--------------------|------|
| | | Frank Shin | 1/1 | PM070WX1/BACK VIEW | 01 |
| | | Patrick Lin | 1/1 | | 01 |

Prime View International Co., Ltd.

NOTES:
 1. GENERAL TOLERANCE: ±0.3
 2. B/L CONNECTOR: JST BHSR-02VS-1

5. Input / Output Terminals

5-1) TFT-LCD Panel Driving

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 | Note 5-11 |
| 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: 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 5-2: 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 5-3: 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 5-4: 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 5-5: 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 up or down shift

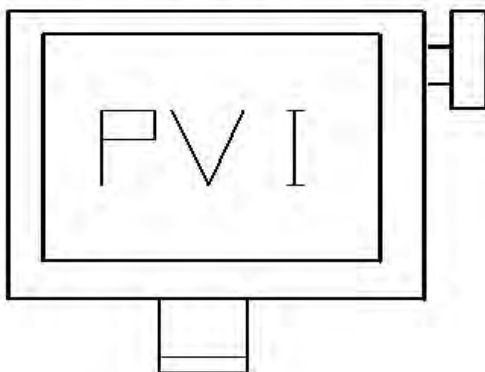
| U/D | STVU | STVD | Shift |
|-----|-------|-------|------------|
| 1 | Hi-Z | Input | Down to Up |
| 0 | Input | Hi-Z | Up to Down |

Note 5-7: Gate driver shift clock

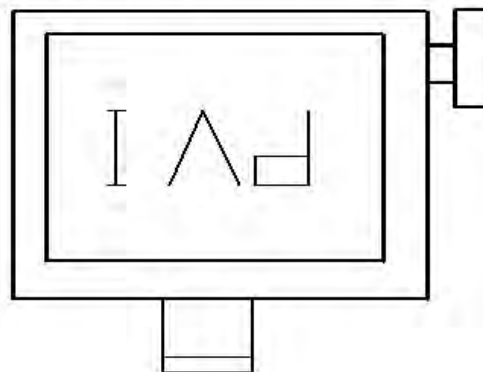
Note 5-8: Gate on voltage, $V_{GG}=+17$ V.

Note 5-9: Gate off voltage, $V_{EE}=-8$ V.

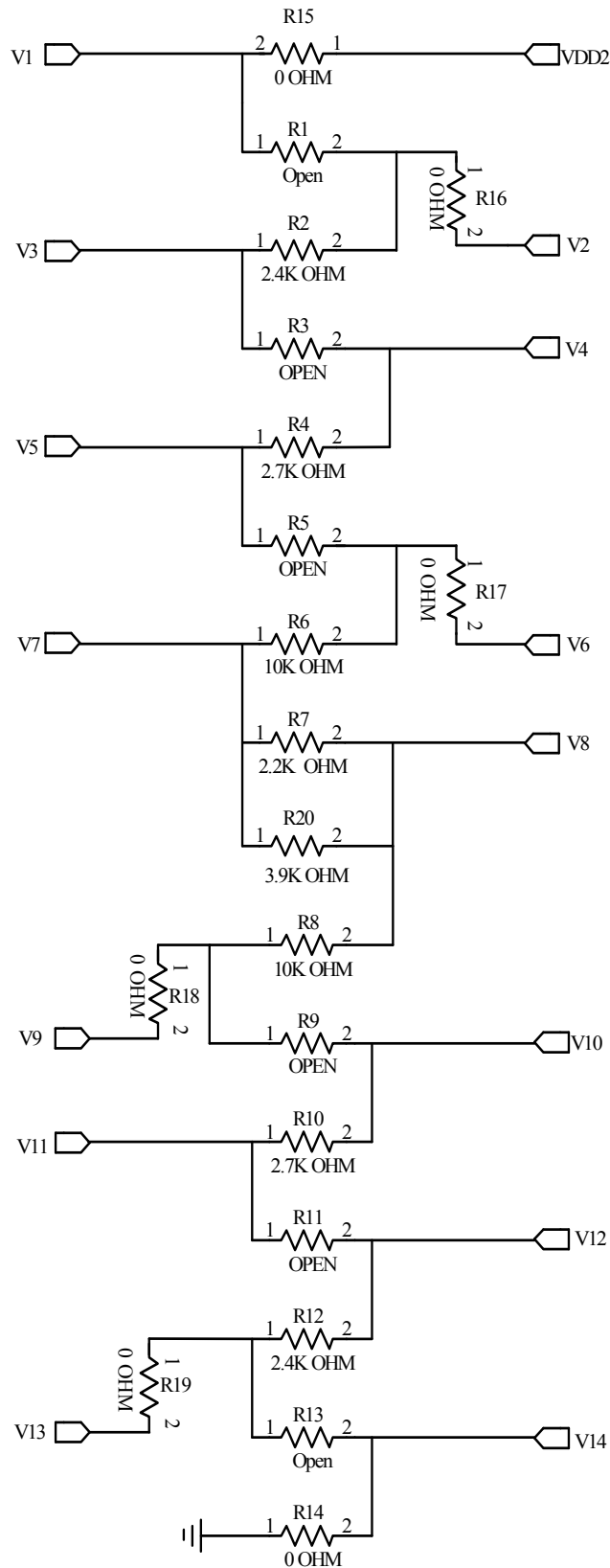
U/D(PIN22)=0 R/L(PIN6)=1



U/D(PIN22)=1 R/L(PIN6)=0



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



Note 5-11 :This pin is NC or must connect VDD1

5-2) Backlight driving

Connector type: JST BHSR-02VS-1, 2 pins, pitch=3.5mm

| Pin No | Symbol | Description | Remark |
|--------|--------|-----------------------------------|-------------------------------|
| 1 | VL1 | Input terminal (Hi voltage side) | Wire color : Pink |
| 2 | VL2 | Input terminal (Low voltage side) | Wire Color : White ,Note 5-12 |

Note 5-12 : Low voltage side of backlight inverter connects with ground of inverter circuits.

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 | 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 | 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} | - | 3.1 | - | V | |

7-2) Recommended Driving Condition for Back Light

$T_a=25^{\circ}C$

| Parameter | Symbol | Min. | Typ. | Max. | Unit | Remark |
|---|--------|------|------|------|------|-----------|
| Lamp Voltage | V_L | 520 | 580 | 638 | V | $I_L=6mA$ |
| Lamp Current | I_L | 4 | 6 | 7 | mA | Note 7-1 |
| Lamp Frequency | P_L | 45 | 60 | 80 | KHz | Note 7-2 |
| Starting Voltage ($25^{\circ}C$) (Reference Value) | V_s | - | - | 1090 | Vrms | Note 7-3 |
| Starting Voltage ($0^{\circ}C$) (Reference Value) | V_s | - | - | 1420 | Vrms | Note 7-3 |

Note 7-1: In order to satisfy the quality of B/L, no matter use what kind of inverter, the output lamp current must between Min. and Max. to avoid the abnormal display image caused by B/L.

Note 7-2: The waveform of lamp driving voltage should be as closed to a perfect sine wave as possible.

Note 7-3: The "Max of starting voltage" means the minimum voltage of inverter to turn on the CCFL. and it should be applied to the lamp for more than 1 second to start up. Otherwise the lamp may not be turned on.
PVI strongly recommend that the minimum voltage of inverter could be designed for 0°C condition.

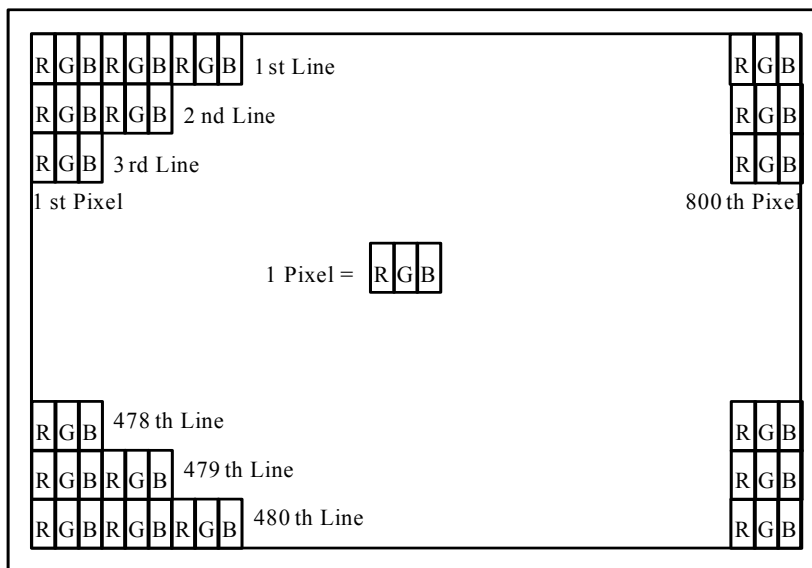
7-3) Power Consumption

| Parameter | Symbol | Condition | Typ. | Max. | Unit | Remark |
|--|------------------|-------------------------|--------|--------|------|----------|
| Supply Current for Gate Driver (Hi level) | I _{GG} | V _{GG} =+17V | 0.32 | 0.41 | mA | |
| Supply Current for Gate Driver (Low level) | I _{EE} | V _{EE} =-8V | 3.35 | 4.19 | mA | |
| Supply Current for Source Driver (Digital) | I _{DD1} | V _{DD1} =+3.3V | 6 | 10 | mA | |
| Supply Current for Source Driver (Analog) | I _{DD2} | V _{DD2} =+9.5V | 20 | 27.5 | mA | |
| Supply Current for Gate Driver (Digital) | I _{CC} | V _{CC} =+3.3V | 0.01 | 0.013 | mA | |
| LCD Panel Power Consumption(W/O B/L) | - | - | 251.97 | 347.26 | mW | |
| Back Light Lamp Power Consumption | - | - | 3.48 | - | W | Note 7-4 |

Note 7-4: Back light lamp power consumption is calculated by I_L×V_L.

8. Pixel Arrangement

The LCD module pixel arrangement is the stripe.

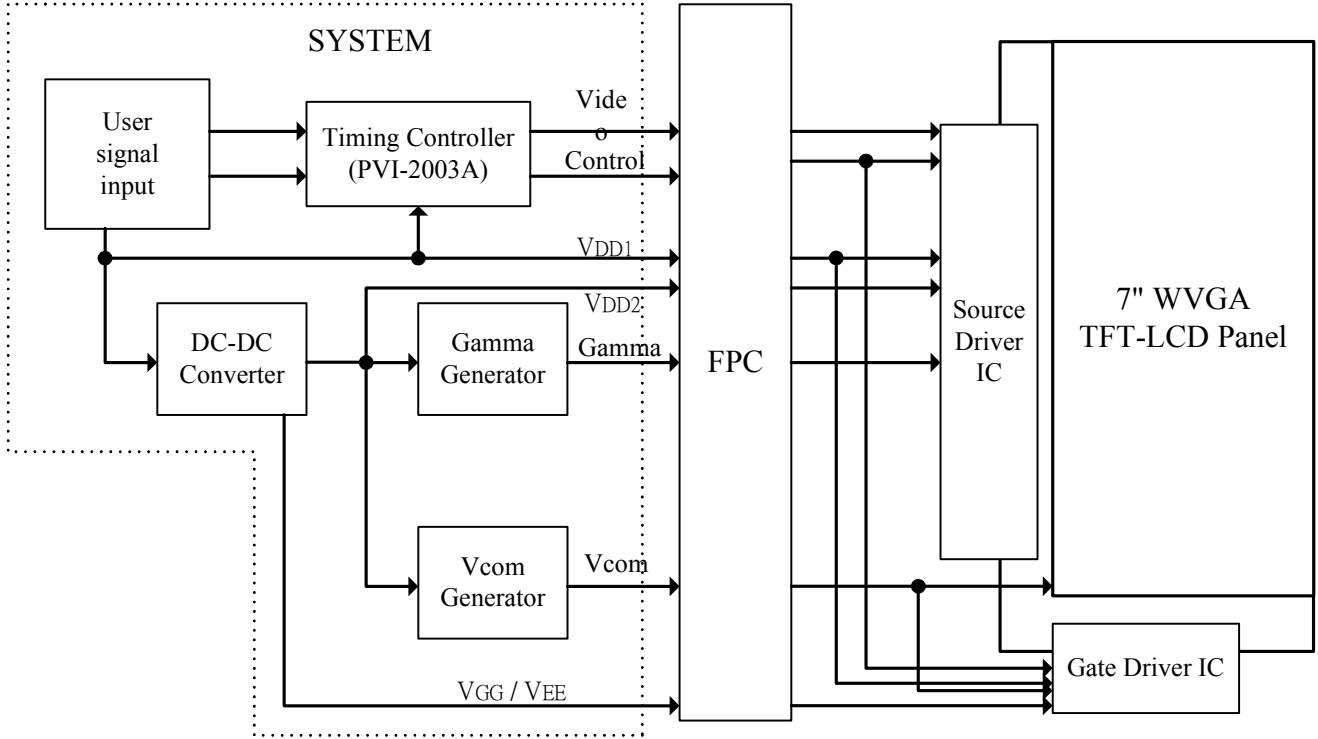


9. Display Color and Gray Scale Reference

| 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 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Green (02) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 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 | 0 | 1 | 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 PM070WX1, you can apply PVI-2003A(Timing controller) which will generate timing signals to support PM070WX1.

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 _{OE} V | 1 | - | - | μs |
| CKV Pulse Width | T _{CKV} | 500 | - | - | ns |
| STV Set-up Time | T _{SUV} | 400 | - | - | ns |
| STV Hold Time | T _{HDV} | 400 | - | - | ns |
| Horizontal Display Period | T _{HDP} | - | 800 | - | Tcw |
| Horizontal Period Timing Range | T _{HP} | - | 1056 | - | Tcw |
| Horizontal Lines Per Field | T _V | 484 | 508 | 620 | T _{HP} |
| Vertical Display Timing Range | T _{DV} | - | 480 | - | T _{HP} |

11.2) Timing Diagram

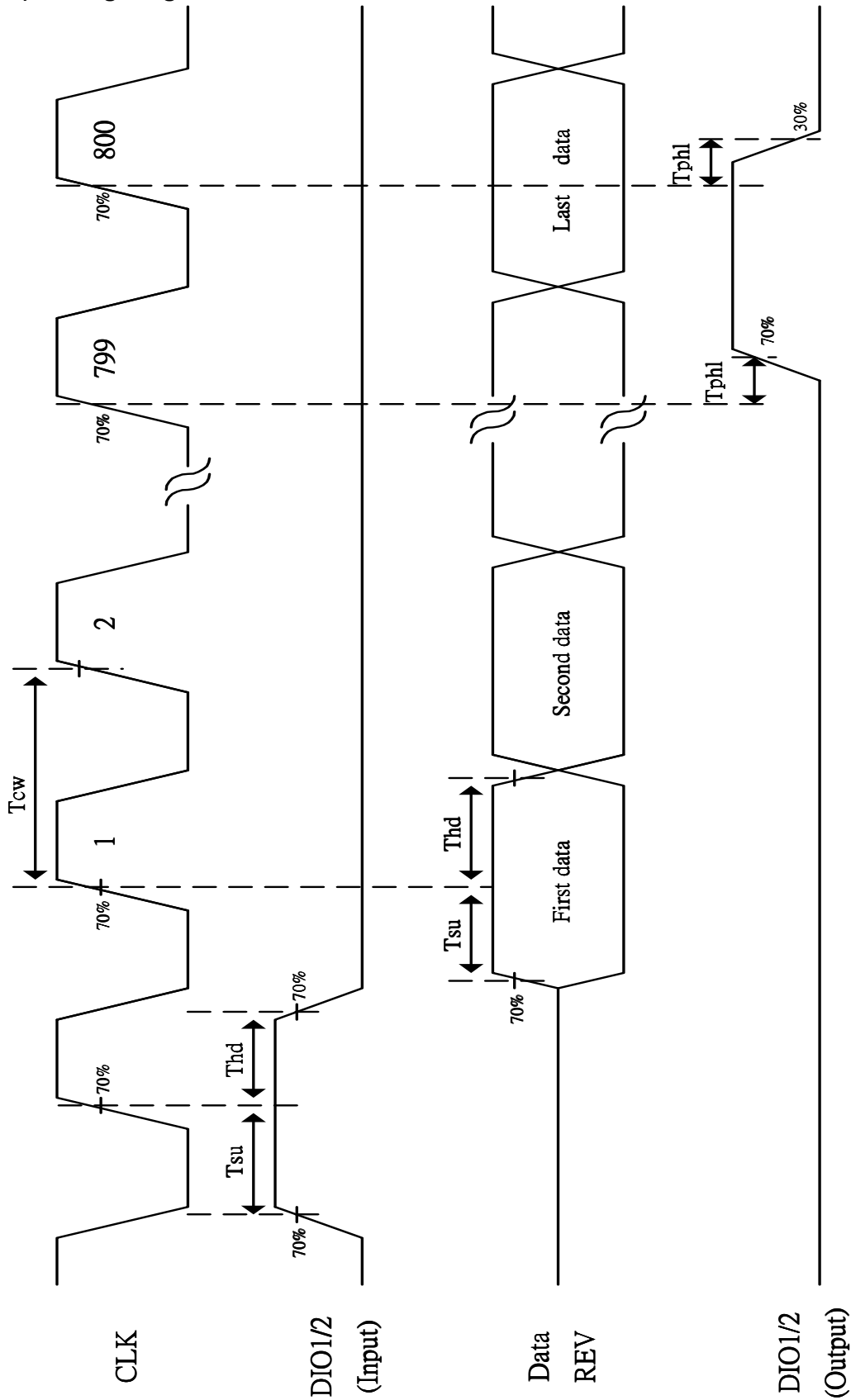


Fig. 11-1 Horizontal timing (1)

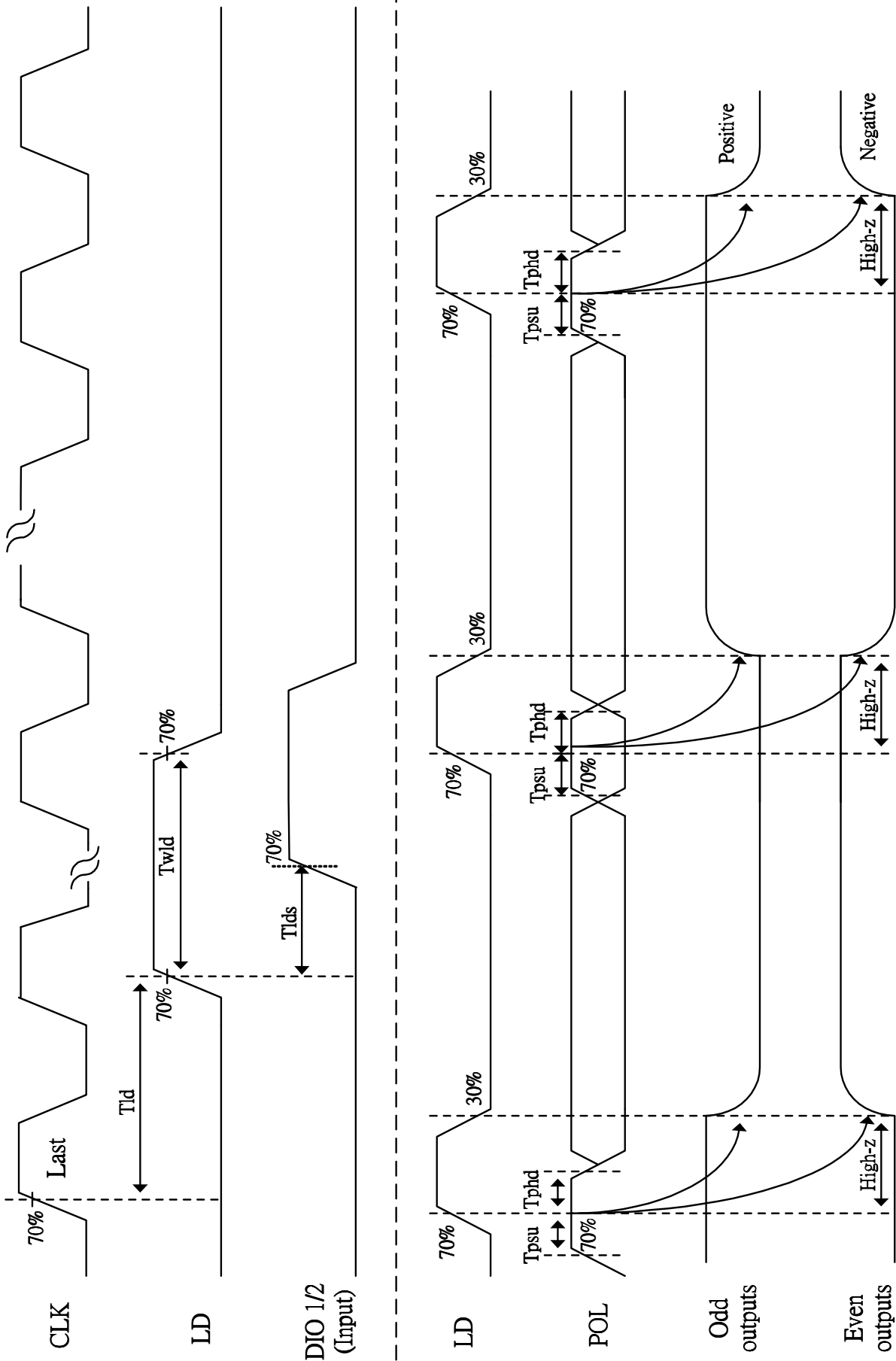


Fig. 11-2 Horizontal timing(2)

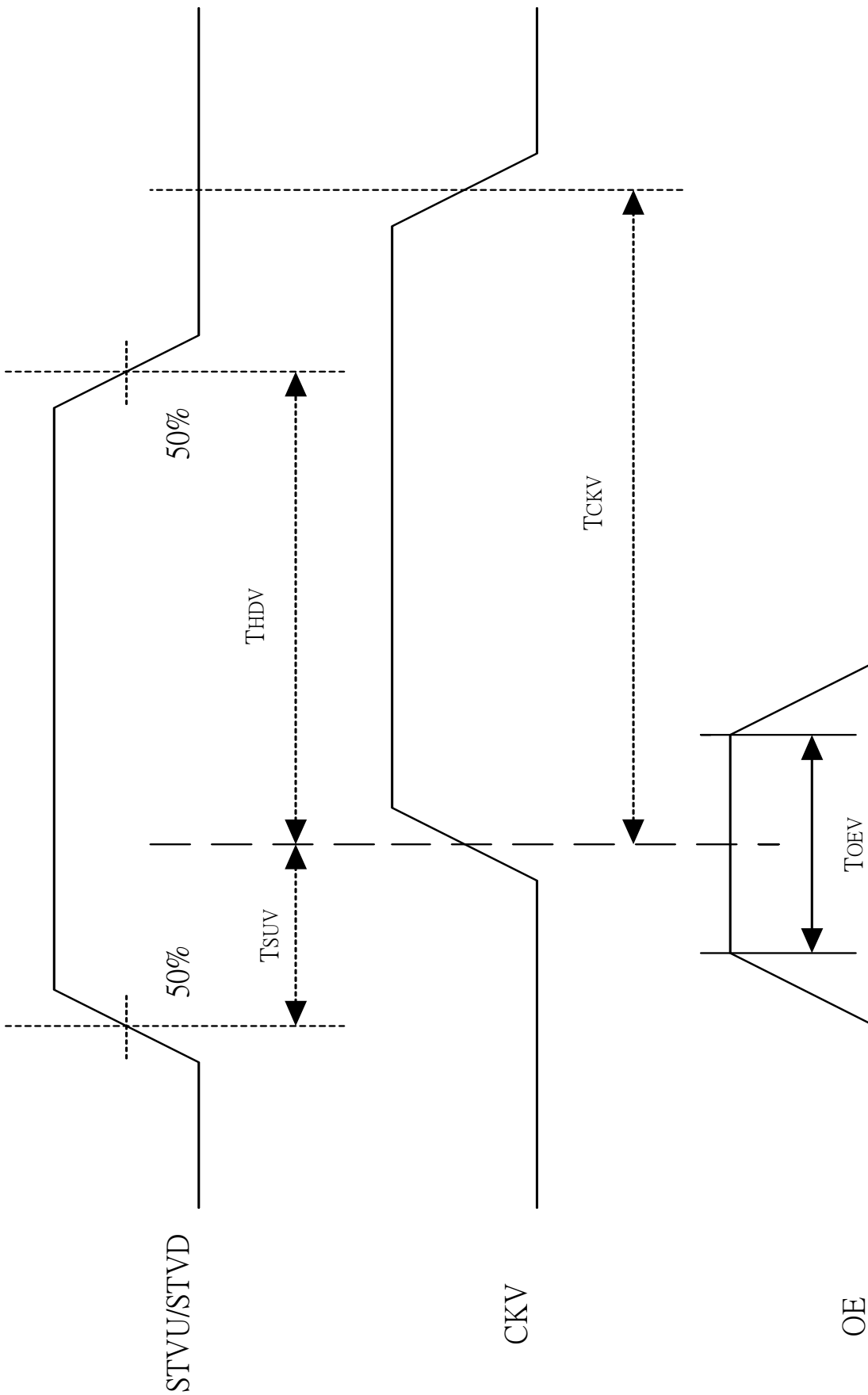


Fig. 11-3 Vertical shift clock timing

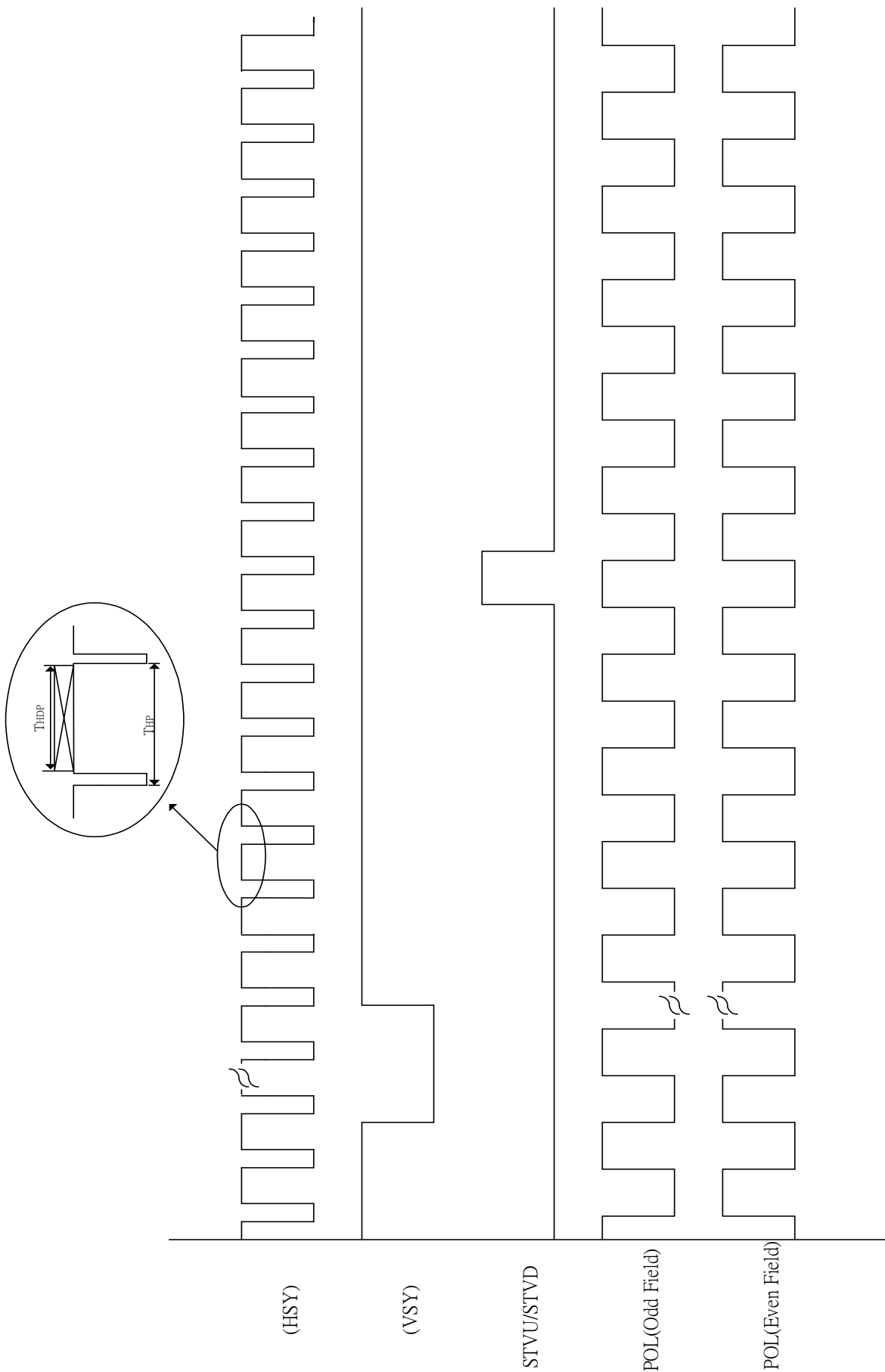
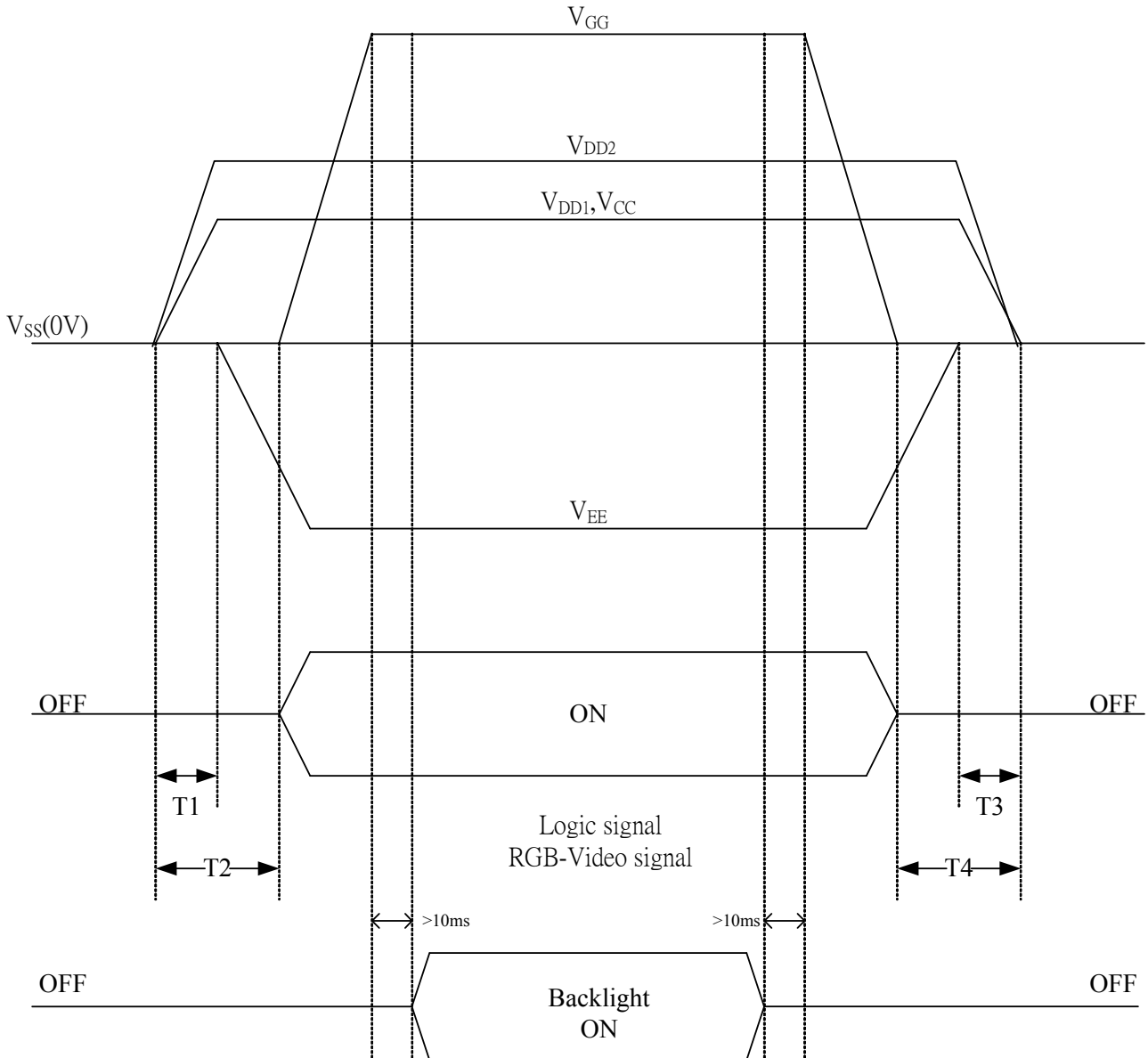


Fig. 11-4 Vertical timing

12. Power On Sequence



1. $1.10\text{ms} \leq T1 < T2$

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

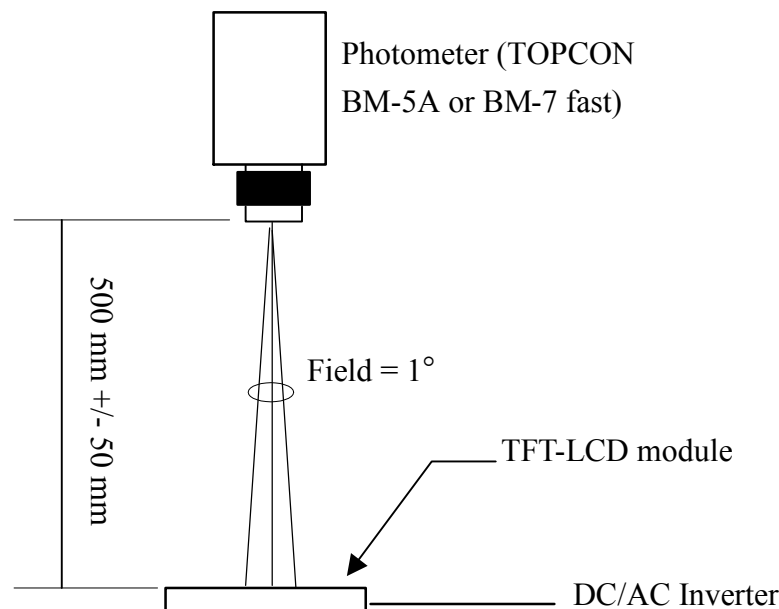
13. Optical Characteristics

13-1) Specification:

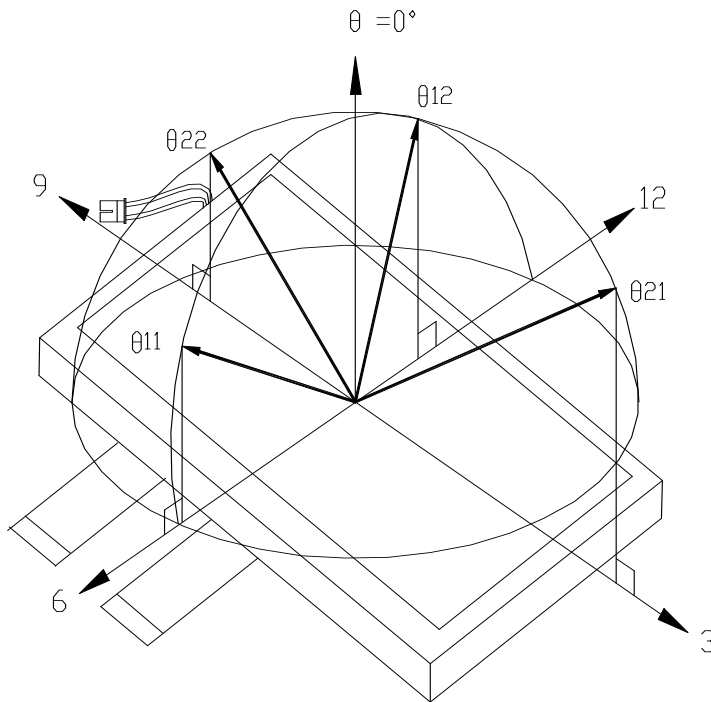
Ta=25°C

| Parameter | Symbol | Condition | MIN. | TYP. | MAX. | Unit | Remarks |
|----------------------|------------|----------------------------------|----------|----------|-------|-------------------|---------------|
| Viewing Angle | Horizontal | θ 21.22 | ± 55 | ± 60 | - | deg | Note 13-1 |
| | Vertical | θ 12 | 35 | 40 | - | deg | to 12 o'clock |
| | | θ 11 | 50 | 55 | - | deg | to 6 o'clock |
| Contrast Ratio | CR | At optimized Viewing angle | 250 | 400 | - | - | Note 13-2 |
| Response time | Rise | Tr | - | 15 | 30 | ms | Note 13-3 |
| | Fall | Tf | - | 25 | 50 | ms | |
| Brightness | L | $\theta = 0^\circ / \varphi = 0$ | 350 | 400 | - | cd/m ² | |
| Luminance Uniformity | U | | 70 | 75 | - | % | Note 13-4 |
| Lamp Life Time | - | - | 25000 | - | - | hr | At 6mA |
| White Chromaticity | x | $\theta = 0^\circ / \varphi = 0$ | 0.27 | 0.3 | 0.33 | - | |
| | y | | 0.297 | 0.327 | 0.357 | - | |
| Cross Talk | - | $\theta = 0^\circ$ | - | - | 3.5 | % | Note 13-5 |

All the optical measurement shall be executed 30 minutes after backlight being turn-on. 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.

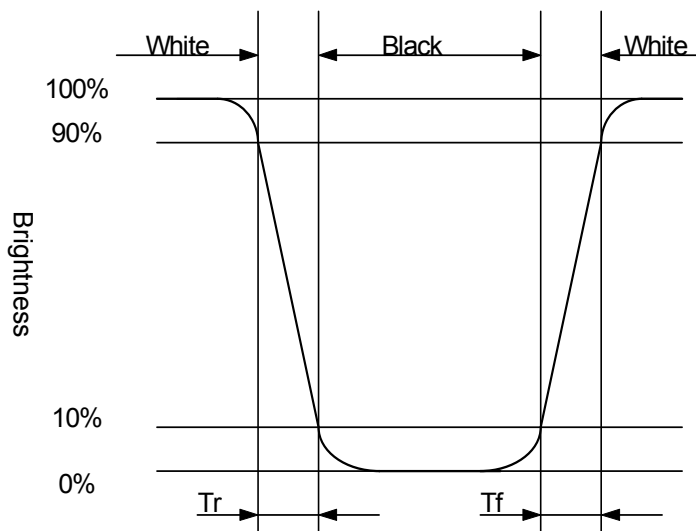


Note 13-1: The definitions of viewing angles are as follow



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 uniformity of LCD is defined as

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

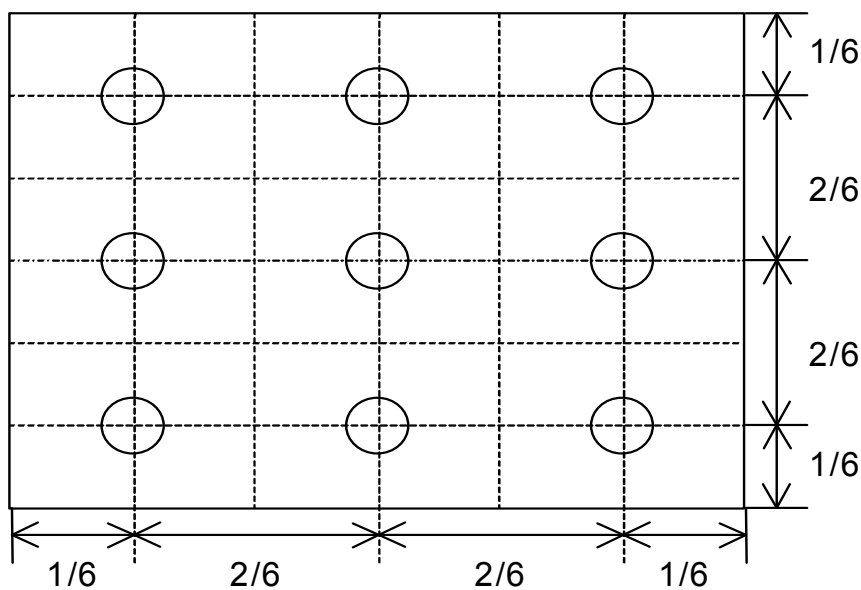
Luminance meter : BM-5A or BM-7 fast(TOPCON)

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 13-5: Cross Talk (CTK) = $\frac{|YA-YB|}{YA} \times 100\%$

YA: Brightness of Pattern A

YB: Brightness of Pattern B

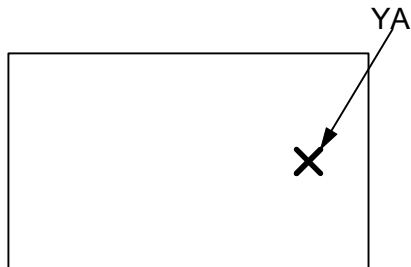
Luminance meter : BM 5A or BM-7 fast (TOPCON)

Measurement distance : 500 mm +/- 50 mm

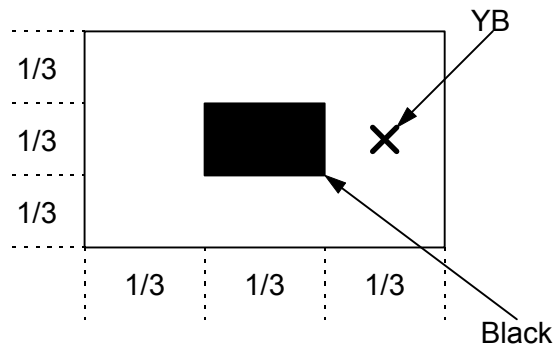
Ambient illumination : < 1 Lux

Measuring direction : Perpendicular to the surface of module

Pattern A
(Gray Level 31)



Pattern B
(Gray Level 31, central
black box exclusive)



X: Measuring Point (A and B are at the same point.)

Black
(Gray Level 0)

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.
- e) Please following the tear off direction as figure 14-1 to remove the protective film as slowly as possible, so that electrostatic charge can be minimized.

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 mach up with the rubbing direction.

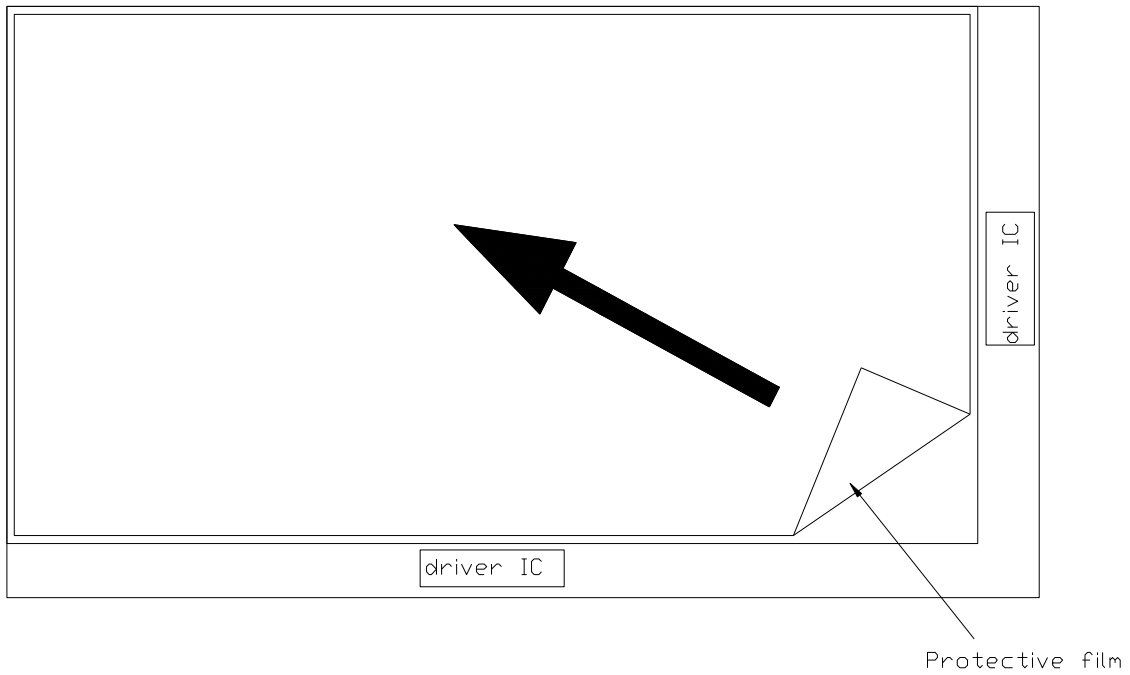


Figure 14-1 the way to peel off protective film

15. Reliability Test

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

Ta: ambient temperature

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

[Criteria]

In the standard conditions, there is not display function NG issue occurred. (including : line defect ,no image), All the cosmetic specification is judged before the reliability stress.

16. Packing Diagram

