

Version :0.1

TECHNICAL SPECIFICATION

MODEL NO : PD050VL1

☐ Customer's Confirmation

Customer

Date

By

☐ PVI's Confirmation

| Dep | FAE | Panel Design | Electronic Design | Mechanical Design | Product Verification | Prepared by |
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TECHNICAL SPECIFICATION

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1. Application

This product applies computer peripheral, industrial meter, image communication and multi-media. If you must use in severe reliability environment, please don't extend over PVI's reliability test conditions.

2. Features

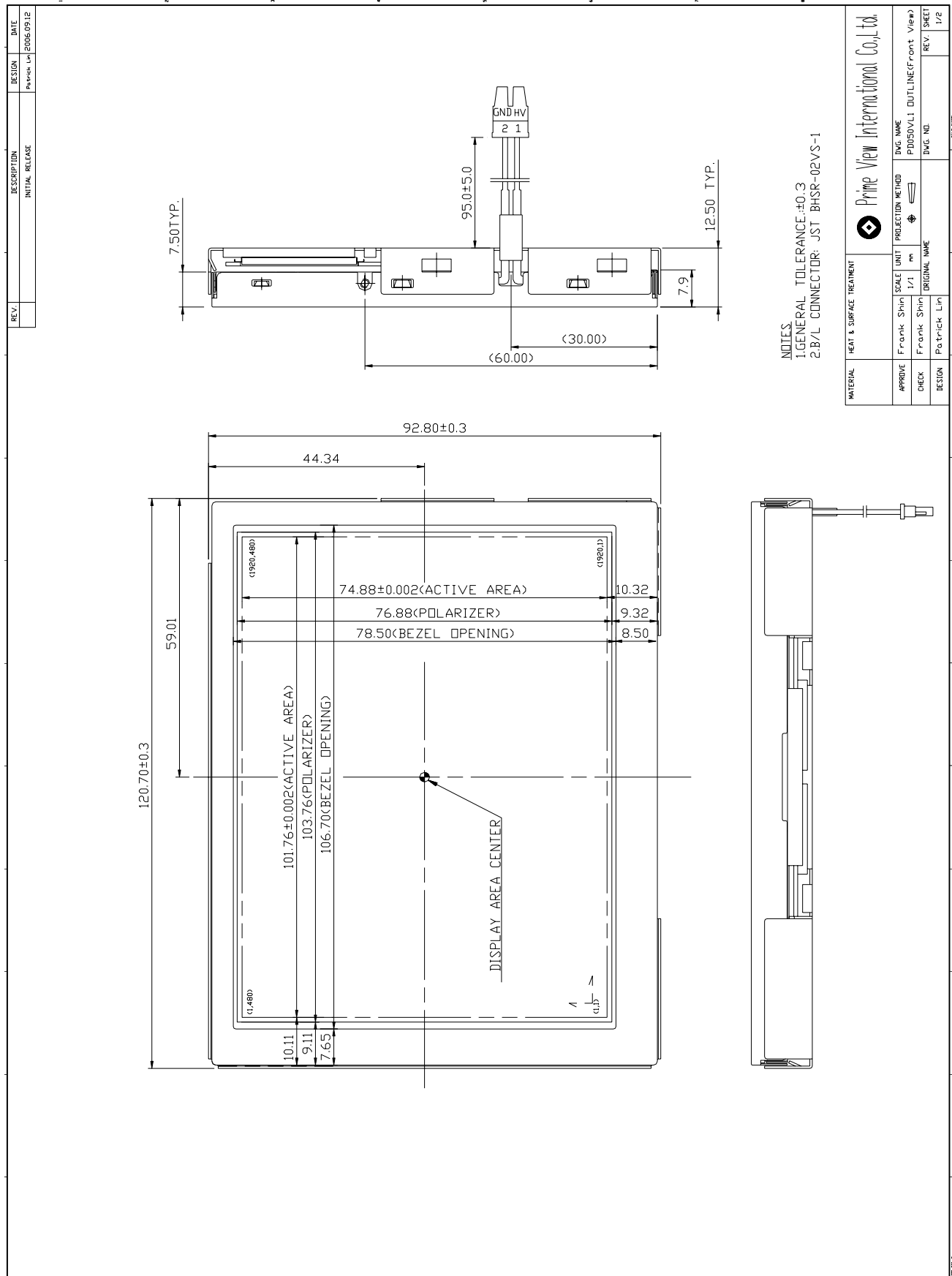
- . Support the DENB mode, Sync mode (Hsync+Vsync)
- . Pixel in stripe configuration
- . Slim and compact
- . Display Colors : 262,144 colors
- . Image Reversion : Up/Down and Left/Right
- . Viewing Direction : 6 o'clock
- . Amorphous silicon TFT LCD panel with LED B/L
- . LVDS transmission interface

3. Mechanical Specifications

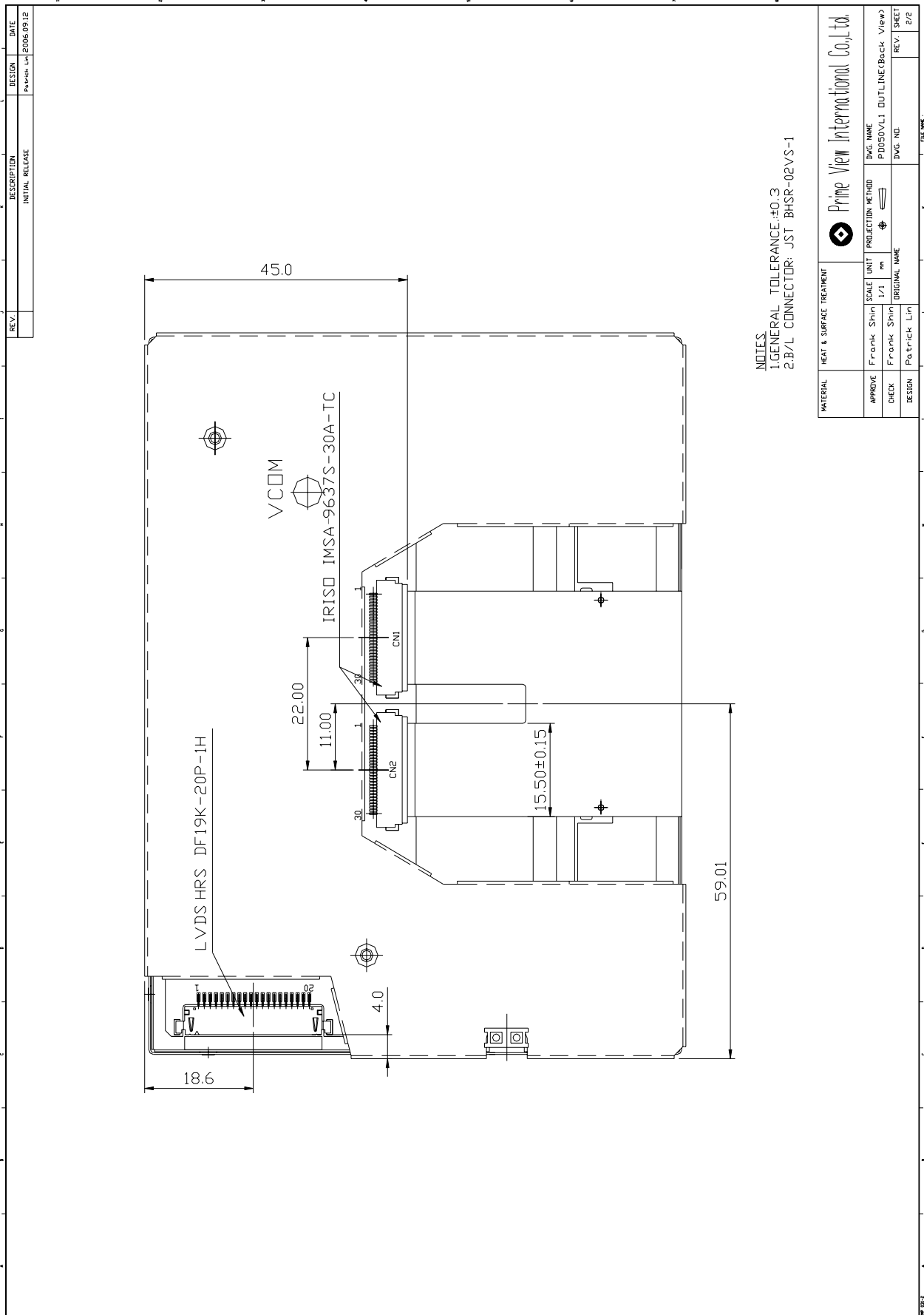
| Parameter | Specifications | Unit |
|---------------------|---------------------------------|------|
| Screen Size | 5(diagonal) | inch |
| Display Format | 640×(R,G,B)×480 | dot |
| Active Area | 101.76 (H)×74.88(V) | mm |
| Pixel Pitch | 0.159(H)×0.156(V) | mm |
| Pixel Configuration | Stripe | |
| Outline Dimension | 120.7(H)×92.8(V)×12.5(D) (Typ.) | mm |
| Weight | TBD | g |

4. Mechanical Drawing of TFT-LCD Module

Outline Drawing : Front View (unit mm)



Outline Drawing : Rear View (unit mm)



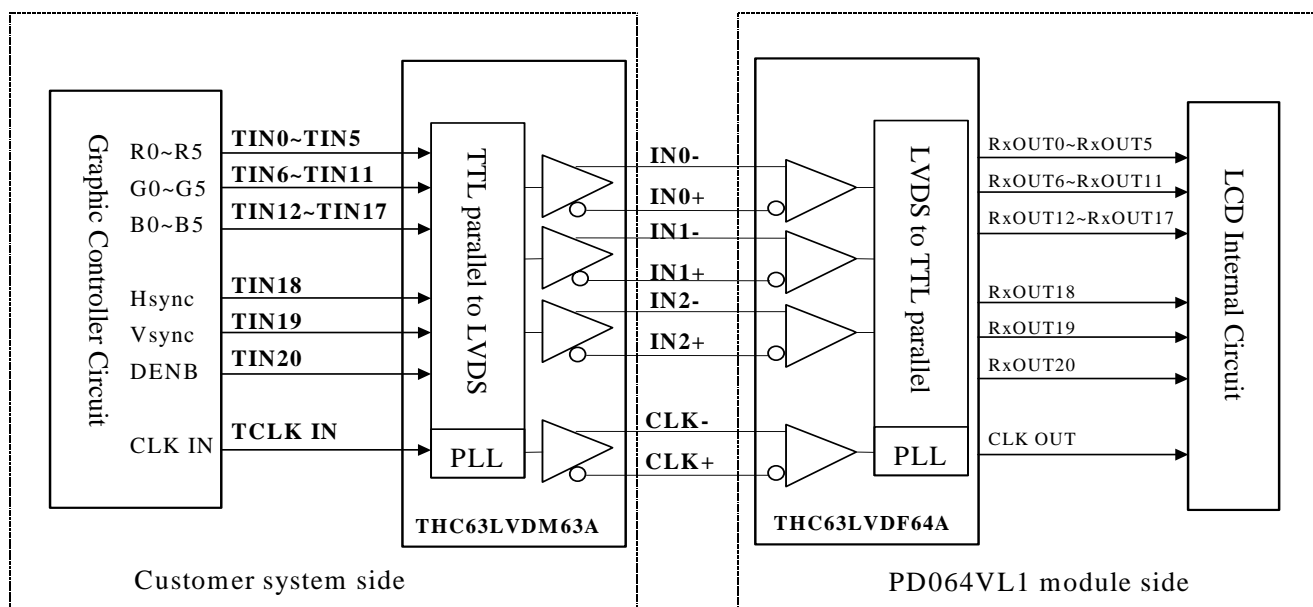
5. Input Terminals

5-1) TFT-LCD Panel Driving

Connector type: DFL19K-20P-1H(HRS)

| Pin No. | Symbol | Function | Remark |
|---------|--------|--------------------------------|--------|
| 1 | Vcc | +3.3V Power Supply | |
| 2 | Vcc | +3.3V Power Supply | |
| 3 | GND | Ground | |
| 4 | GND | Ground | |
| 5 | INO- | LVDS receiver signal channel 0 | |
| 6 | INO+ | LVDS receiver signal channel 0 | |
| 7 | GND | Ground | |
| 8 | IN1- | LVDS receiver signal channel 1 | |
| 9 | IN1+ | LVDS receiver signal channel 1 | |
| 10 | GND | Ground | |
| 11 | IN2- | LVDS receiver signal channel 2 | |
| 12 | IN2+ | LVDS receiver signal channel 2 | |
| 13 | GND | Ground | |
| 14 | CLK- | LVDS receiver signal clock | |
| 15 | CLK+ | LVDS receiver signal clock | |
| 16 | GND | Ground | |
| 17 | NC | No connection | |
| 18 | NC | No connection | |
| 19 | GND | Ground | |
| 20 | GND | Ground | |

LVDS Interface Block Diagram

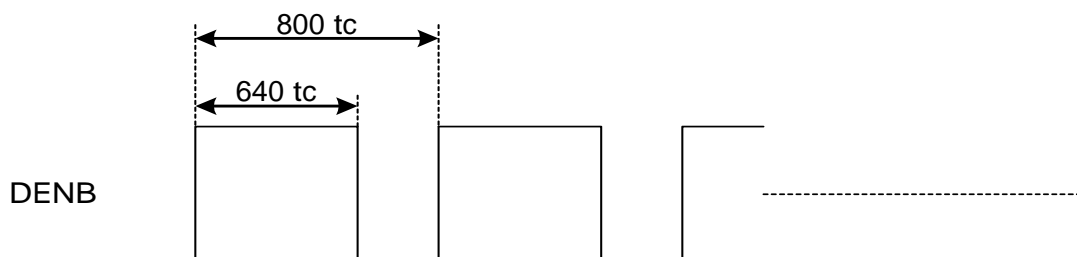


Recommended Transmitter (THC63LVDM63A Thane) to PD050VL1 interface Assignment:

| Input terminal of THC63LVDM63A | | Graphic controller output signal | | Output signal symbol | To PM070WL1 interface terminal (Symbol) |
|--------------------------------|-----|----------------------------------|---------------------------------|------------------------|---|
| Symbol | No. | Symbol | Function | | |
| TIN0 | 44 | R0 | Red pixel data (LSB) | Tout0- Tout0+ | No.5 : IN0- No.6 : IN0+ |
| TIN1 | 45 | R1 | Red pixel data | | |
| TIN2 | 47 | R2 | Red pixel data | | |
| TIN3 | 48 | R3 | Red pixel data | | |
| TIN4 | 1 | R4 | Red pixel data | | |
| TIN5 | 3 | R5 | Red pixel data(MSB) | | |
| TIN6 | 4 | G0 | Green pixel data (LSB) | Tout1- Tout1+ | No.8 : IN1- No.9 : IN1+ |
| TIN7 | 6 | G1 | Green pixel data | | |
| TIN8 | 7 | G2 | Green pixel data | | |
| TIN9 | 9 | G3 | Green pixel data | | |
| TIN10 | 10 | G4 | Green pixel data | | |
| TIN11 | 12 | G5 | Green pixel data(MSB) | | |
| TIN12 | 13 | B0 | Blue pixel data(LSB) | Tout2- Tout2+ | No.11 : IN2- No.12 : IN2+ |
| TIN13 | 15 | B1 | Blue pixel data | | |
| TIN14 | 16 | B2 | Blue pixel data | | |
| TIN15 | 18 | B3 | Blue pixel data | | |
| TIN16 | 19 | B4 | Blue pixel data | | |
| TIN17 | 20 | B5 | Blue pixel data(MSB) | | |
| TIN18 | 22 | Hsync | Horizontal Synchronous Signal | TCLK out- TCLK out+ | No.14 : CLK - No.15 : CLK + |
| TIN19 | 23 | Vsync | Vertical Synchronous Signal | | |
| TIN20 | 25 | DENB | Compound Synchronization signal | | |
| CLK in | 26 | CLK | Data sampling clock | | |

DENB input signal.

If customer wanted to off the DENB mode , you must keep the DENB always High or Low.



(tc: the period of sampling clock)

6. Absolute Maximum Ratings :

The followings are maximum values, which if exceeded, may cause faulty operation or damage to the unit.

GND=0V, Ta=25

| Parameters | Symbol | MIN. | MAX. | Unit | Remark |
|-----------------------|------------------|------|----------------------|------|----------|
| Supply Voltage | V _{CC} | -0.3 | +7.0 | V | |
| Input Signals Voltage | V _{sig} | -0.3 | V _{CC} +0.3 | V | Note 6-1 |

Note 6-1 : Input signals include CLK , Hsync , Vsync , DENB , R[0:5] , G[0:5] and B[0:5].

7. Electrical Characteristics
7-1) Recommended Operating Conditions:

GND = 0V , Ta = 25

| Item | Symbol | Min. | Typ. | Max. | Unit | Remark |
|--|-----------------|------|------|------|------|----------|
| Supply Voltage | V _{CC} | 3.0 | 3.3 | 3.6 | V | |
| Current Dissipation | I _{CC} | - | TBD | - | mA | Note 7-1 |
| LVDS Differential input high threshold | V _{TH} | - | TBD | - | mV | Note7-2 |
| LVDS Differential input low threshold | V _{TL} | - | - | - | | |

Note 7-1 : To test the current dissipation of VCC using the “color bars” testing pattern shown as below

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|

1. White
2. Yellow
3. Cyan
4. Green
5. Magenta
6. Red
7. Blue
8. Black

Idd current dissipation testing pattern

Note7-2 : Please refers to THC63LVDF64A specification by THINE Corporation.
This LCD module conforms to LVDS standard.

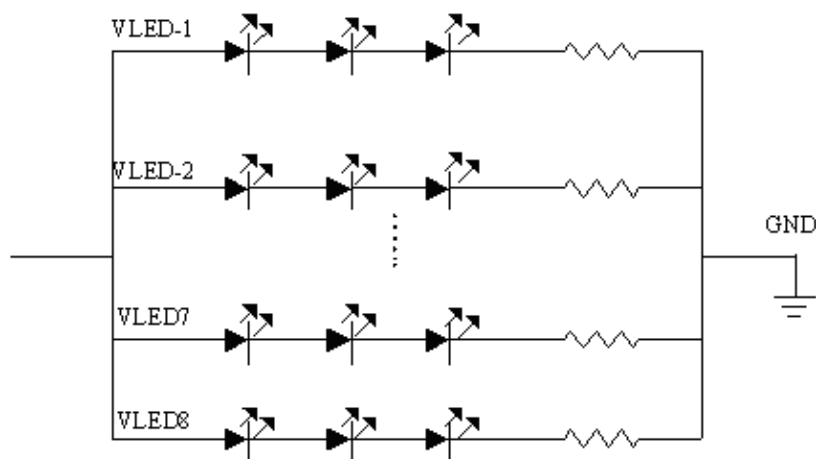
7-2) Recommended driving condition for LED backlight

GND = 0V , Ta = 25

| Parameter | Symbol | Min | TYP | MAX | Unit | Remark |
|---------------------------------|------------|-----|-----|-----|------|----------------------|
| Supply voltage of LED backlight | V_{LED} | 9.0 | 9.9 | 12 | V | $I_L = 20\text{ mA}$ |
| Supply current of LED backlight | I_{LED1} | - | 20 | - | mA | Note 7-3 |
| | I_{LED2} | | | | | |
| Backlight Power Consumption | P_{LED} | TBD | TBD | TBD | mW | Note 7-4 |

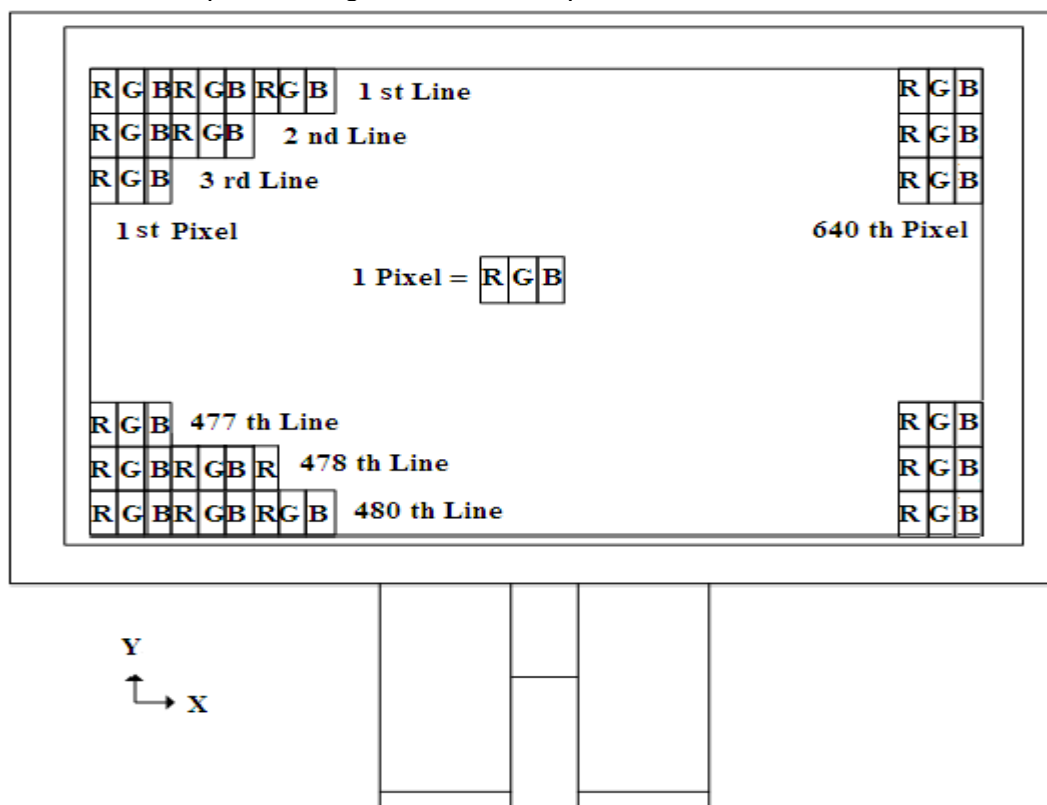
Note 7-3: LED B/L applied information , please refer to the appendix at the end .

Note 7-4: $P_{LED} = V_{LED1} * I_{LED1} + V_{LED2} * I_{LED2} \dots + V_{LED7} * I_{LED7} + V_{LED8} * I_{LED8}$



8. Pixel Arrangement

The LCD module pixel arrangement is the stripe.

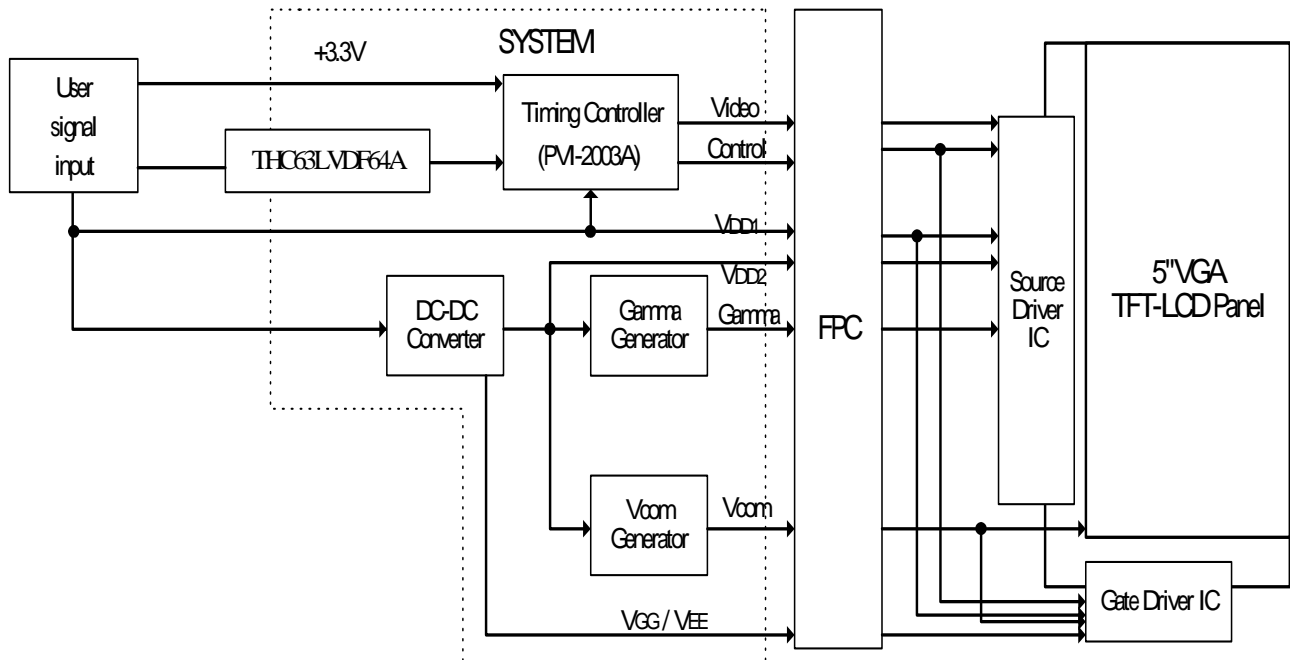


9. Display Color and Gray Scale Reference

| 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

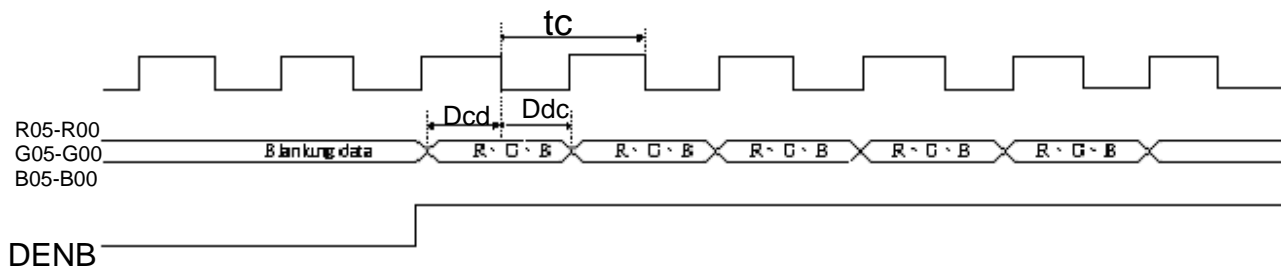


11. Interface Timing
11-1) Timing Parameters

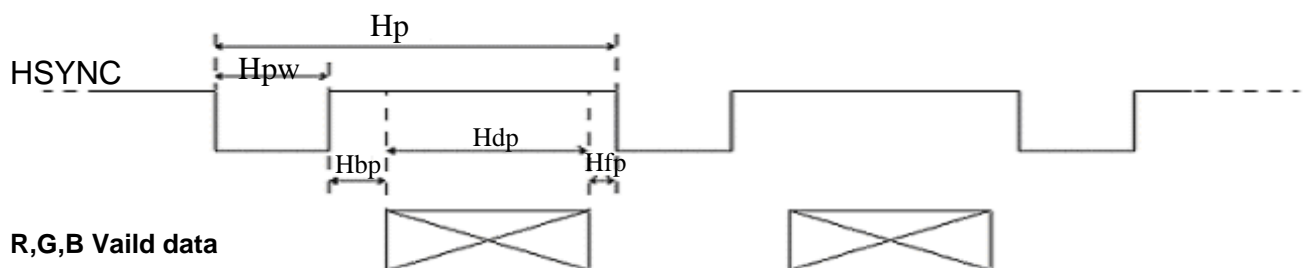
| | | Symbol | Min. | Typ. | Max. | Unit |
|----------------------------------|----------------------------------|-----------------|-------------|-------------|-------------|-------------|
| Power supply | | VCC | 3.0 | 3.3 | 3.6 | V |
| CLK | Frequency | 1/tc | - | 25 | - | MHz |
| | | tc | - | 40 | - | ns |
| HSYNC | Period | Hp | - | 32 | - | us |
| | | | - | 800 | - | tc |
| | Display period | Hdp | - | 640 | - | tc |
| | Pulse width | Hp _w | - | 96 | - | tc |
| | Back-porch | Hb _p | - | 46 | - | tc |
| | Front-porch | Hf _p | - | 18 | - | tc |
| | Hp _w +Hb _p | | - | 142 | - | tc |
| | Hsync-CLK | Hh _c | 10 | - | Tc-10 | ns |
| Vsync-Hsync | | Hv _h | 0 | 0 | 200 | tc |
| VSYNC | Period | Vp | - | 16.8 | - | ms |
| | | | - | 525 | - | Hp |
| | Display period | Vd _p | - | 480 | - | Hp |
| | Pulse width | Vp _w | - | 2 | - | Hp |
| | Back-porch | Vb _p | - | 33 | - | Hp |
| | Front-porch | Vf _p | - | 10 | - | Hp |
| Vp _w +Vb _p | | | - | 35 | - | Hp |
| DENB | Horizontal scanning period | T1 | - | 800 | - | tc |
| | Horizontal display period | T2 | - | 640 | - | tc |
| | Vertical display period | T3 | - | 480 | - | T1 |
| | Frame cycling period | T4 | 520 | 525 | 800 | T1 |
| R,G,B | CLK-DATA | Dcd | 10 | - | - | ns |
| | DATA-CLK | Ddc | 8 | - | - | ns |

11-2) The Timing Diagram

a.1 Input signal range



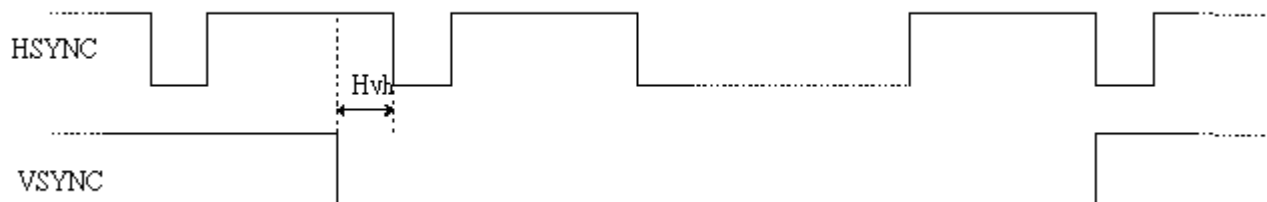
a.2 HSYNC timing



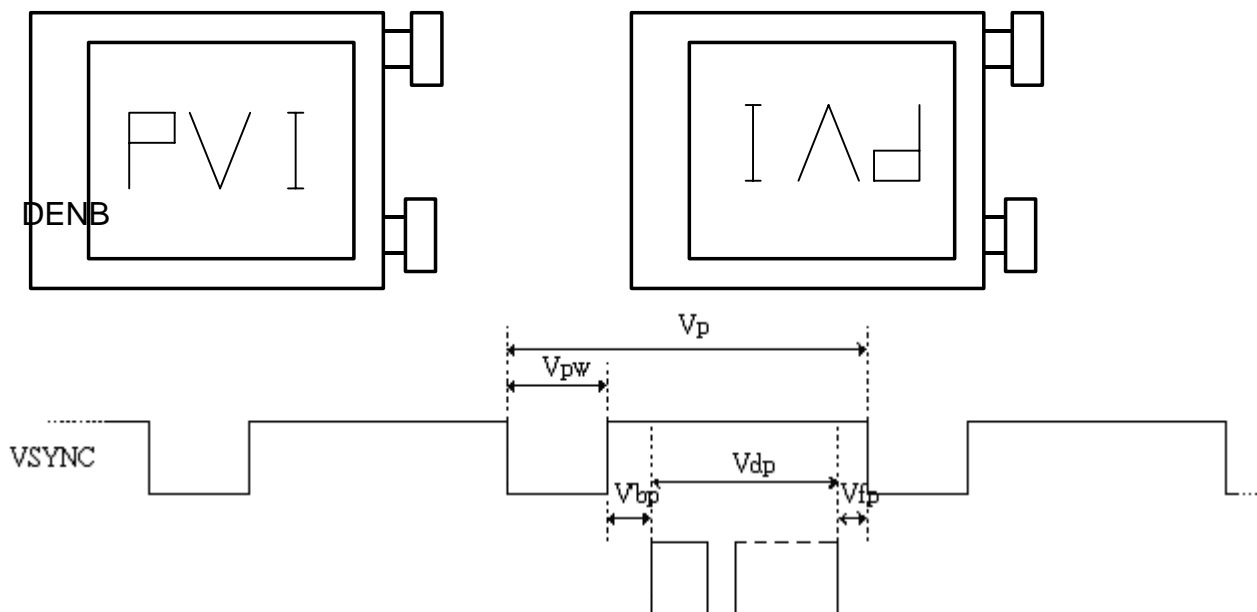
a.3 CLK, HSYNC relationship



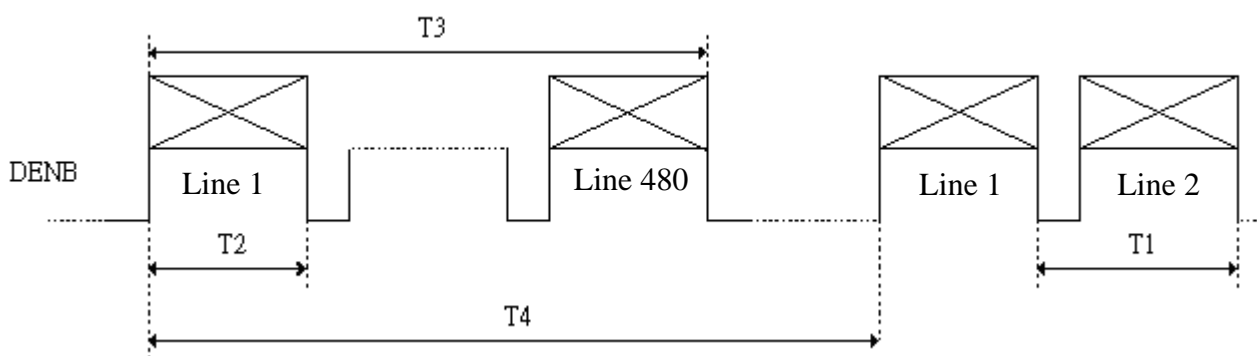
a.4 HSYNC, VSYNC relationship



a.5 VSYNC timing



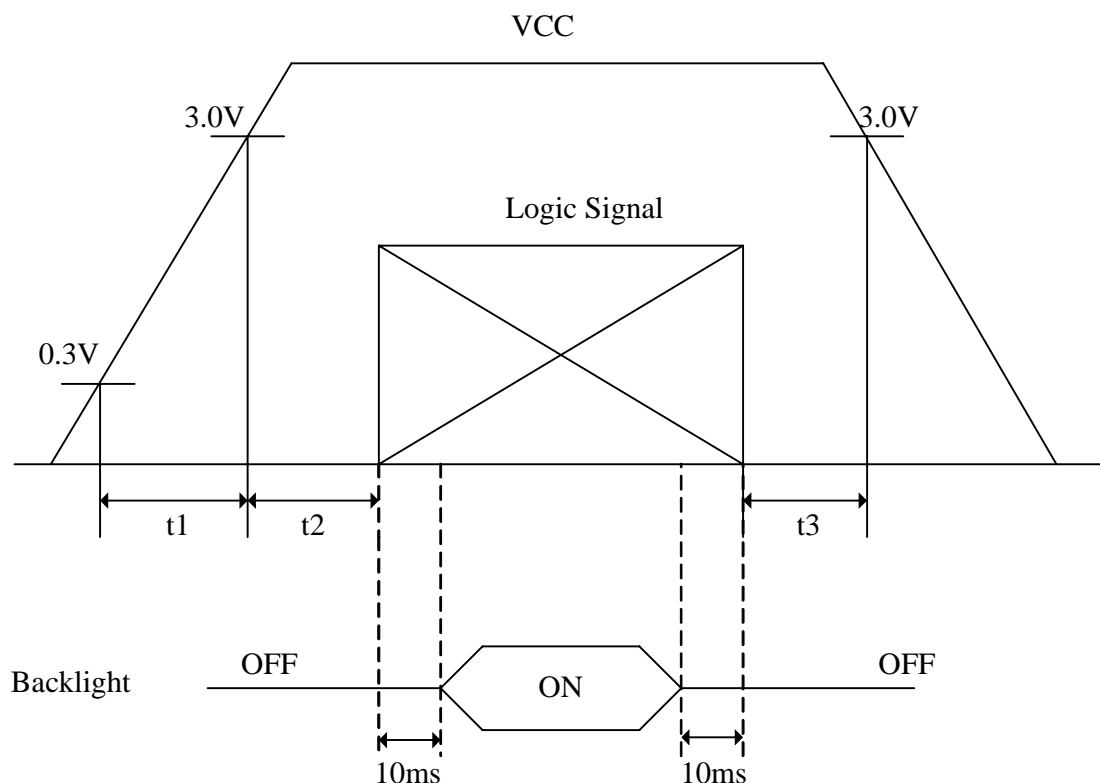
a.6 DENB timing



11-3) Control Board Dip Switch Format

TBD

12. Power On Sequence



1. $0 < t_1 \leq 20\text{ms}$
2. $0 < t_2 \leq 50\text{ms}$
3. $0 < t_3 \leq 1\text{s}$

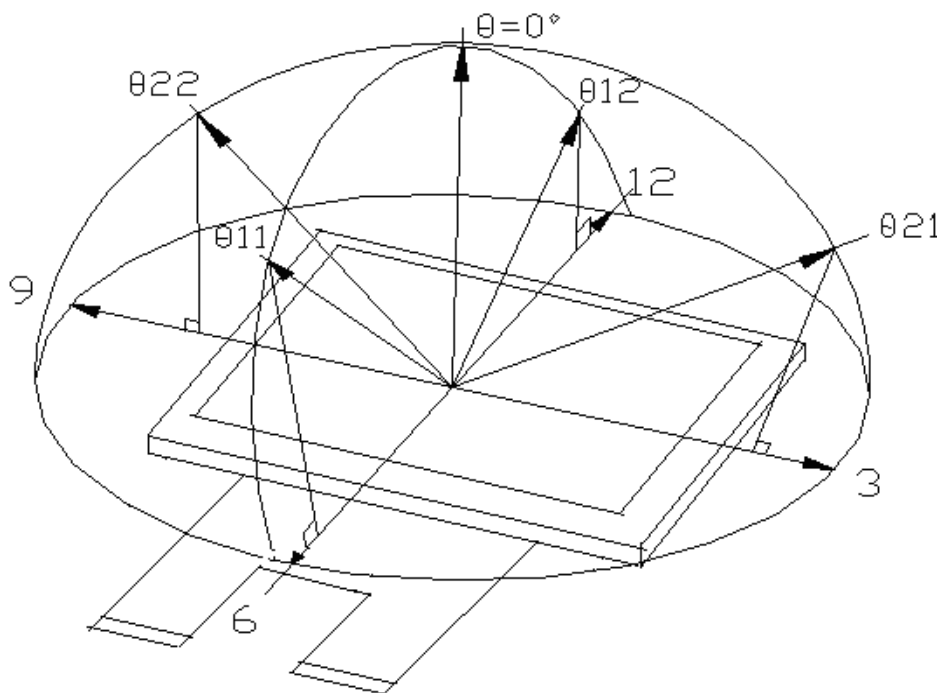
13. Optical Characteristics

13-1) Specification:

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

| Parameter | | Symbol | Condition | MIN. | TYP. | MAX. | Unit | Remarks |
|--------------------|------------|--------|----------------------------|--------|--------|------|-------------------|-----------|
| Viewing Angle | Horizontal | 21, 22 | CR > 10 | 55 | 60 | - | deg | Note 13-1 |
| | Vertical | 12 | | 35 | 40 | - | deg | |
| | | 11 | | 50 | 55 | - | deg | |
| Contrast Ratio | | CR | At optimized Viewing angle | - | TBD | - | - | Note 13-2 |
| Response time | Rise | Tr | =0° | - | 15 | 30 | ms | Note 13-4 |
| | Fall | Tf | | - | 25 | 50 | ms | |
| Brightness | | L | =0° | 450 | 500 | - | cd/m ² | Note 13-3 |
| Uniformity | | U | | 70 | 75 | - | % | Note 13-5 |
| Cross Talk | | - | =0° | - | - | 3.5 | % | Note 13-6 |
| White Chromaticity | | x | =0° | - | TBD | - | - | Note 13-3 |
| | | y | | - | TBD | - | - | |
| LED Life Time | | | +25 | 20,000 | 30,000 | - | hrs | |

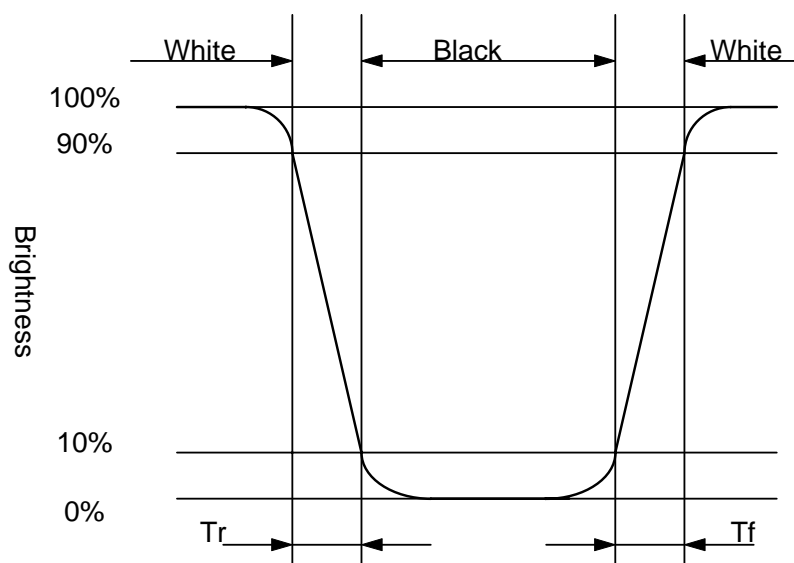
Note 13-1 : The definitions of viewing angle diagrams :



Note 13-2: $CR = \frac{\text{Luminance when LCD is White}}{\text{Luminance when LCD is Black}}$
 Contrast Ratio is measured in optimum common electrode voltage.

Note 13-3 : Topcon BM-7 (fast) luminance meter 1°field of view is used in the testing (after 20~30 minutes operation).

Note 13-4 : The definitions of response time T_r and T_f :



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

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

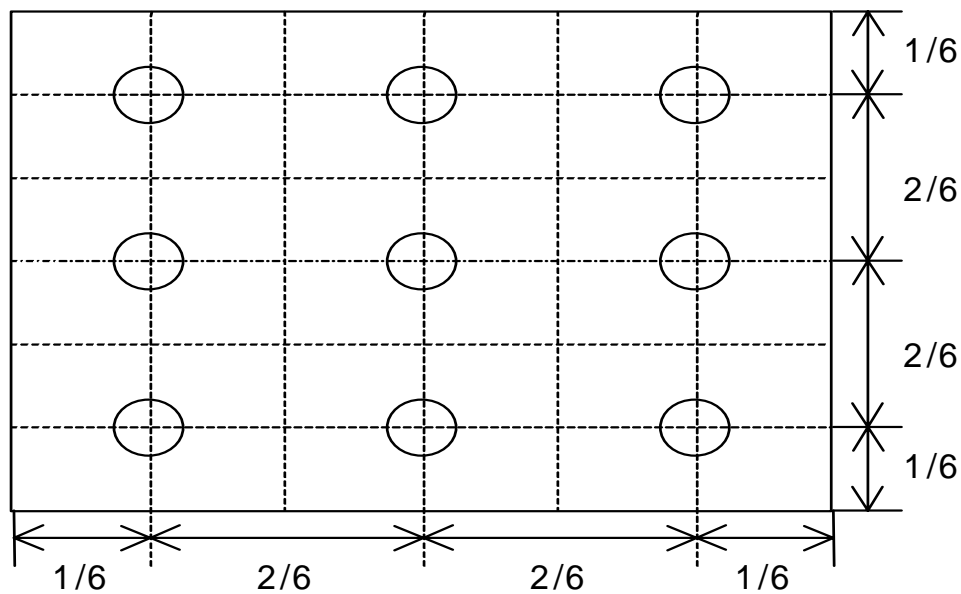
Luminance meter : BM-5A or BM-7 fast (TOPCON)

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

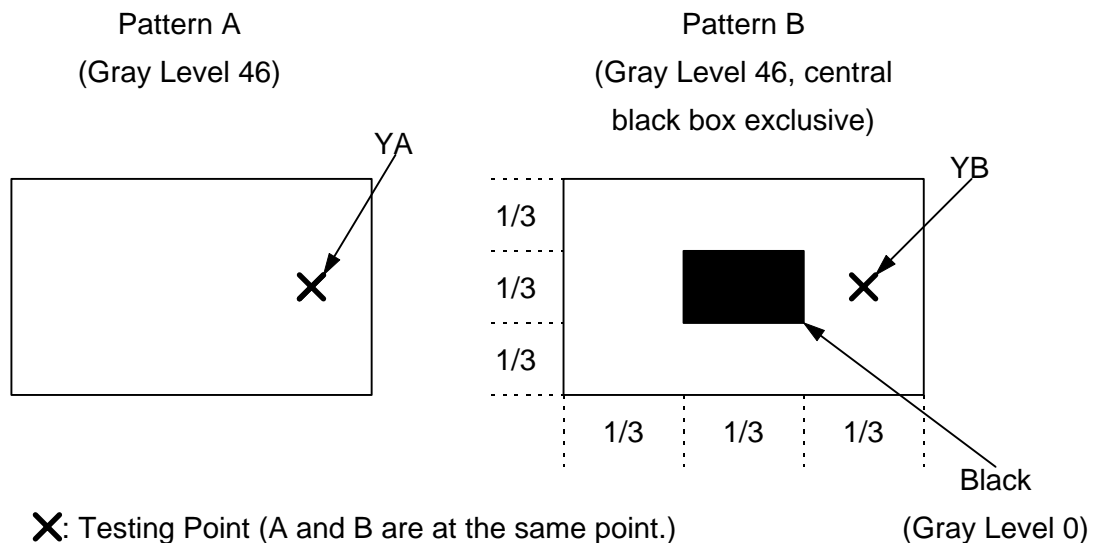
YB: Brightness of Pattern B

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



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.

15. Reliability Test

| No | Test Item | Test Condition |
|----|---|--|
| 1 | High Temperature Storage Test | Ta = +90 , 240 hrs |
| 2 | Low Temperature Storage Test | Ta = -40 , 240 hrs |
| 3 | High Temperature Operation Test | Ta = +80 , 240 hrs |
| 4 | Low Temperature Operation Test | Ta = -30 , 240 hrs |
| 5 | High Temperature & High Humidity Operation Test | Ta = +60 , 90%RH, 240 hrs |
| 6 | Thermal Cycling Test (non-operating) | -30 +80 , 200 Cycles 30 min 30 min |
| 7 | Vibration Test (non-operating) | Frequency : 10 ~ 55 Hz Amplitude : 1 mm Sweep time: 11 mins 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) | 150pF, 330 Air : ±15KV ; Contact : ±8KV 10 times/point , 9 points/panel face |

Ta: ambient temperature

[Criteria]

1. Main LCD should normally work under the normally condition no defect of function, screen quality and appearance (including : mura ,line defect ,no image).
2. After the vibration and shock test , can't be find chip broken.

16. Packing Diagram

TBD

Revision History

| Rev. | Issued Date | Revised | Contents |
|------|--------------|---------|-------------|
| 0.1 | Sep.12 ,2006 | | Preliminary |