



# LITEMAX DLF/DLH0615

## Sunlight readable 6.4" LED B/L LCD

(1st Edition 8/14/2007 )

All information is subject to change without notice.

| Approved by | Checked by | Prepared by |
|-------------|------------|-------------|
| David       | Sharline   | Eric        |

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## Record of Revision

| Version and Date | Page | Old Description | New Description | Remark |
|------------------|------|-----------------|-----------------|--------|
|                  |      |                 |                 |        |
|                  |      |                 |                 |        |
|                  |      |                 |                 |        |
|                  |      |                 |                 |        |

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## Application

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This product applies computer peripheral , industrial meter , image communication and multi-media.

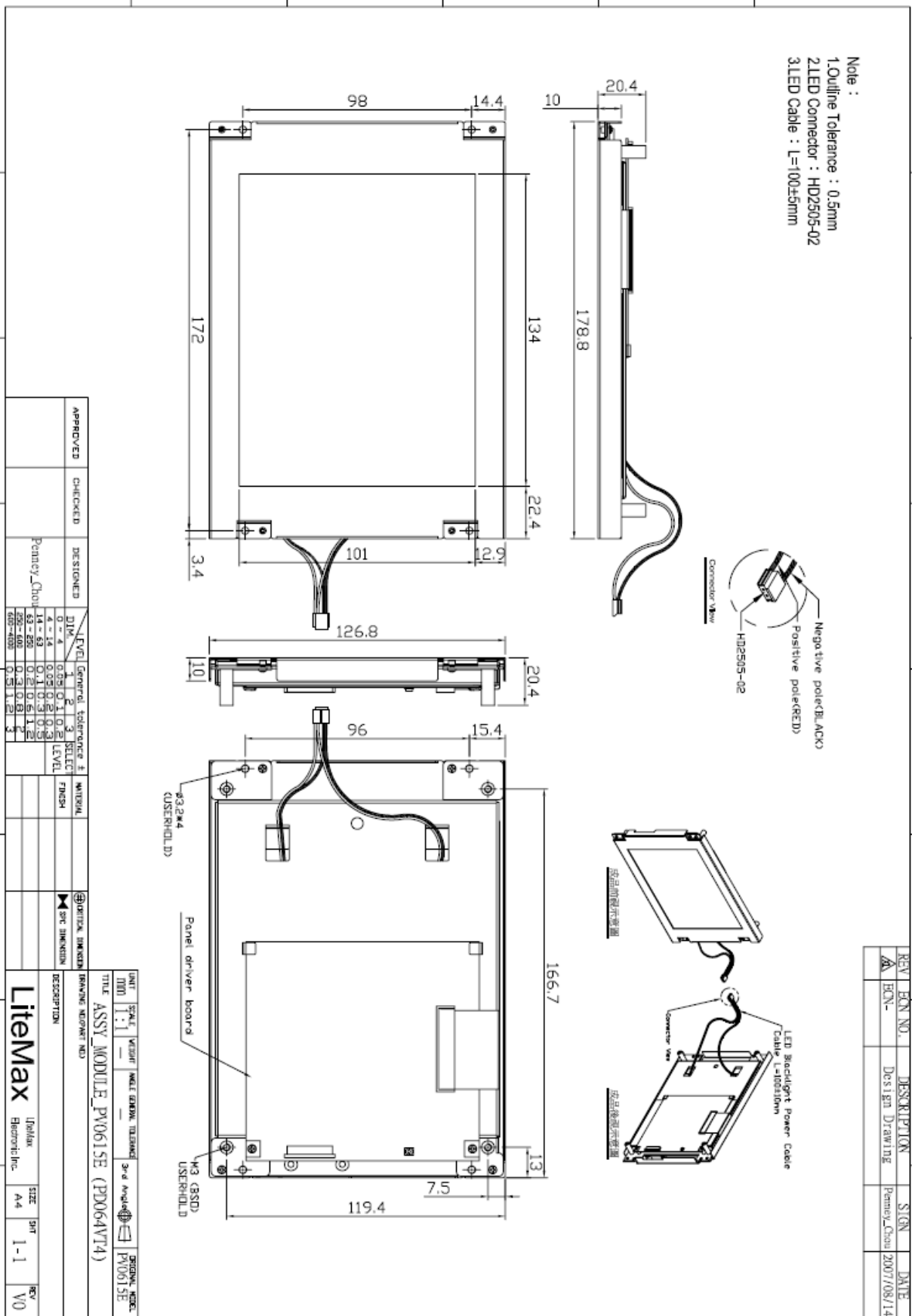
### Features

- Compatible with VGA-480 , VGA-400 , VGA-350 mode
- Support the DENB mode
- Pixel in stripe configuration
- Slim and compact
- Display Colors : 262,144 colors
- Image Reversion : Up/Down and Left/Right
- Active area / Outline area = 57.02 %
- Viewing Direction : 6 o'clock
- Backlight lamps are Replaceable

### Mechanical Specifications

| Parameter           | Specifications                     | Unit |
|---------------------|------------------------------------|------|
| Screen Size         | 6.4 (diagonal)                     | inch |
| Display Format      | 640×R, G, B×480                    | dot  |
| Active Area         | 129.6 (H)×97.4 (V)                 | mm   |
| Dot Pitch           | 0.0675 (H)×0.203 (V)               | mm   |
| Pixel Pitch         | 0.2025 (H)×0.203 (V)               | mm   |
| Pixel Configuration | Stripe                             |      |
| Outline Dimension   | 178.8(W)×126.8 (H)×20.4 (D) (Typ.) | mm   |
| Weight              | 340±10                             | g    |

# Mechanical Drawing of TFT-LCD Module



Note :  
 1.Outline Tolerance : 0.5mm  
 2.LED Connector : HD2505-02  
 3.LED Cable : L=100±5mm

|          |         |            |            |
|----------|---------|------------|------------|
| APPROVED | CHECKED | DESIGNED   | DATE       |
|          |         | Penny Chou | 2007-08-14 |

| LEVEL | General Tolerance | ±      | LEVEL | FINISH | SPRINKLING |
|-------|-------------------|--------|-------|--------|------------|
| 0     | 0.4               | 0.05   | 0.1   | 0.2    | 0.3        |
| 1     | 0.25              | 0.1    | 0.2   | 0.3    | 0.4        |
| 2     | 0.15              | 0.05   | 0.1   | 0.2    | 0.3        |
| 3     | 0.1               | 0.03   | 0.05  | 0.1    | 0.2        |
| 4     | 0.05              | 0.02   | 0.03  | 0.05   | 0.1        |
| 5     | 0.02              | 0.01   | 0.02  | 0.03   | 0.05       |
| 6     | 0.01              | 0.005  | 0.01  | 0.02   | 0.03       |
| 7     | 0.005             | 0.002  | 0.005 | 0.01   | 0.02       |
| 8     | 0.002             | 0.001  | 0.002 | 0.005  | 0.01       |
| 9     | 0.001             | 0.0005 | 0.001 | 0.002  | 0.005      |

|      |       |        |      |                   |           |                |
|------|-------|--------|------|-------------------|-----------|----------------|
| UNIT | SCALE | VISION | MAKE | GENERAL TOLERANCE | 3rd Angle | ORIGINAL MODEL |
| MM   | 1:1   |        |      |                   |           | PV0615E        |

|             |                                |
|-------------|--------------------------------|
| TITLE       | ASSY MODULE PV0615E (P0064VT4) |
| DESCRIPTION | INVADE SIGNART NO.             |

|                         |        |      |     |
|-------------------------|--------|------|-----|
| Company                 | Jobber | SIZE | 3rd |
| LiteMax Electronic Inc. |        | A4   | 1-1 |
|                         |        |      | REV |
|                         |        |      | V0  |

| REV | ECN NO. | DESCRIPTION    | SIGN       | DATE       |
|-----|---------|----------------|------------|------------|
| 1   |         | Design Drawing | Penny Chou | 2007/08/14 |

## Input / Output Terminals

TFT-LCD Panel Driving

LCD module connector (Reference)

JAE IL-FPR-30S-HF (Right angle Lower-side contact)

| Pin No. | Symbol | Function                                       | Remark               |
|---------|--------|--|----------------------|
| 1       | CLK    | Clock Signal for Sampling Image Digital Data   |                      |
| 2       | Hsync  | Horizontal Synchronous Signal                  | Note (1)             |
| 3       | Vsync  | Vertical Synchronous Signal                    |                      |
| 4       | GND    | Ground (0V)                                    |                      |
| 5       | R0     | Red Image Data Signal (LSB)                    |                      |
| 6       | R1     | Red Image Data Signal                          |                      |
| 7       | R2     | Red Image Data Signal                          |                      |
| 8       | R3     | Red Image Data Signal                          |                      |
| 9       | R4     | Red Image Data Signal                          |                      |
| 10      | R5     | Red Image Data Signal (MSB)                    |                      |
| 11      | GND    | Ground (0V)                                    |                      |
| 12      | G0     | Green Image Data Signal (LSB)                  |                      |
| 13      | G1     | Green Image Data Signal                        |                      |
| 14      | G2     | Green Image Data Signal                        |                      |
| 15      | G3     | Green Image Data Signal                        |                      |
| 16      | G4     | Green Image Data Signal                        |                      |
| 17      | G5     | Green Image Data Signal (MSB)                  |                      |
| 18      | GND    | Ground (0V)                                    |                      |
| 19      | B0     | Blue Image Data Signal (LSB)                   |                      |
| 20      | B1     | Blue Image Data Signal                         |                      |
| 21      | B2     | Blue Image Data Signal                         |                      |
| 22      | B3     | Blue Image Data Signal                         |                      |
| 23      | B4     | Blue Image Data Signal                         |                      |
| 24      | B5     | Blue Image Data Signal (MSB)                   |                      |
| 25      | GND    | Ground (0V)                                    |                      |
| 26      | DENB   | Enable   | Note (1)<br>Note (2) |
| 27      | VCC    | DC +5.0V Power Supply                          | Note (3)             |
| 28      | VCC    | DC +5.0V Power Supply                          |                      |
| 29      | R/L    | Horizontal Image Shift-direction Select Signal | Note (4)             |
| 30      | U/D    | Vertical Image Shift-direction Select Signal   | Note (5)             |

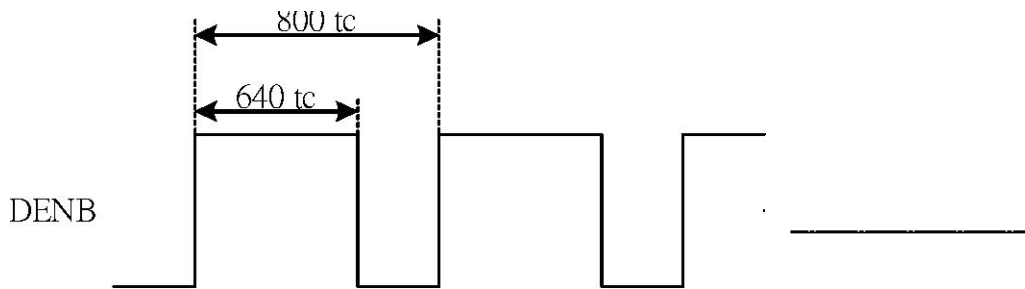
Note (1) The relationship between DENB & SYNC. Mode

1. DENB mode with the top priority.
2. When working with the SYNC. Mode, the TFT-LCD module is compatible with three kinds of VGA timing . They are VGA-480 , VGA-400 and VGA-350 mode . The polarization of Hsync and Vsync determine the timings.

|                    |            |                     |          |          |
|--------------------|------------|---------------------|----------|----------|
| Mode SYNC.         | DENB       | VGA-480             | VGA-400  | VGA-350  |
| Hsync Polarization | Don't care | Negative / Positive | Negative | Positive |
| Vsync Polarization | Don't care | Negative / Positive | Positive | Negative |

Note (2) DENB input signal.

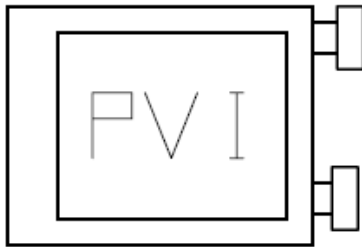
1. If customer wanted to off the DENB mode , you must keep the DENB (pin 27) always High or Low.



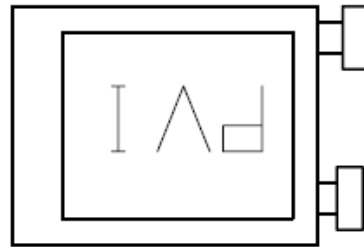
Note (3)  $V_{CC}$  TYP.=+5V

Note (4) (5) : The definitions of U/D & R/L

R/L(PIN 30)= High , U/D(PIN 31)= Low



R/L(PIN 30)= Low , U/D(PIN 31)= High





### **Absolute Maximum Ratings:**

---

The followings are maximum values , which if exceeded, may cause faulty operation or damage to the unit.  
GND=0V, Ta=25°C

| Parameters            | Symbol           | MIN. | MAX.                 | Unit | Remark   |
|-----------------------|------------------|------|----------------------|------|----------|
| +5V Supply Voltage    | V <sub>cc</sub>  | -0.3 | +7.0                 | V    |          |
| Input Signals Voltage | V <sub>sig</sub> | -0.3 | V <sub>cc</sub> +0.3 | V    | Note (1) |
| Storage Temperature   | T <sub>stg</sub> | -30  | +70                  | °C   |          |
| Operating Temperature | T <sub>opa</sub> | -20  | +70                  | °C   | Note (2) |

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

Note (2) Optical characteristics shown in Table 9-1 are measured under Ta=+25°C.

## Electrical Characteristics

Recommended Operating Condition for TFT-LCD panel : GND = 0V , Ta = 25<sup>°C</sup>

| Parameters                   | Symbol            | Min.  | Typ. | Max.  | Unit | Remark               |
|------------------------------|-------------------|-------|------|-------|------|----------------------|
| +5V Supply Voltage           | V <sub>CC</sub>   | +4.75 | +5.0 | +5.25 | V    |                      |
| Supply Input Ripple Voltage  | V <sub>CCRP</sub> |       |      | 0.1   | Vp-p | V <sub>CC</sub> =+5V |
| Input Signals Voltage (High) | V <sub>IH</sub>   | +2.6  |      |       | V    |                      |
| Input Signals Voltage (Low)  | V <sub>IL</sub>   |       |      | +0.5  | V    |                      |

### Recommended Operating Condition for backlight:

Ta = 25<sup>°C</sup>

| Item        | Symbol         | Min. | Typ. | Max. | Unit | Remark                |
|-------------|----------------|------|------|------|------|-----------------------|
| LED Current | I <sub>L</sub> | -    | 1.65 | -    | A    |                       |
| LED Voltage | V <sub>L</sub> | -    | 6.5  | -    | Vrms | I <sub>L</sub> =1.65A |

Backlight driving connector : HD2505-02 , Pin No. : 2 , Pitch : 2.54 mm

| Pin No | Symbol | Description                | Remark |
|--------|--------|----------------------------|--------|
| 1      | +      | Positive Pole(RED Cable)   |        |
| 2      | -      | Negative Pole(Black Cable) |        |

| Parameters                  | Symbol          | Typ.  | Max. | Unit | Remark   |
|-----------------------------|-----------------|-------|------|------|----------|
| +5V Current Dissipation     | I <sub>CC</sub> | 100   | 120  | mA   |          |
| LCD Panel Power Consumption |                 | 0.5   | 0.6  | W    | Note (1) |
| Backlight Power Consumption |                 | 10.73 |      | W    | Note (2) |

Note (1) The power consumption of backlight is not included.

Note (2) Backlight lamp power consumption is calculated by I<sub>L</sub>×V<sub>L</sub>.

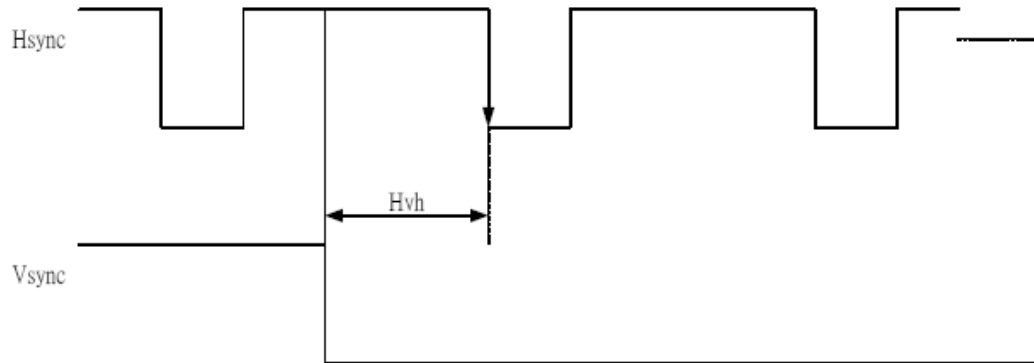
## Input / Output signal timing chart

| Parameters  |                            | Symbol      | Format | Min. | Typ.   | Max.     | Unit | Note     |  |
|-------------|----------------------------|-------------|--------|------|--------|----------|------|----------|--|
| CLK         | Frequency                  | $F_c=1/T_c$ | All    | -    | 25.175 | -        | MHz  | Note (1) |  |
|             |                            | $t_c$       | All    | -    | 40     | -        | ns   |          |  |
| Hsync       | Period                     | Hp          | All    | -    | 31.778 | -        | us   |          |  |
|             |                            |             |        | -    | 800    | -        | tc   |          |  |
|             | Display period             | Hd          | All    | -    | 640    | -        | tc   |          |  |
|             | Pulse width                | Hpw         | All    | 12   | 96     | 139      | tc   |          |  |
|             | Back-porch                 | Hbp         | All    | 12   | 48     | 139      | tc   |          |  |
|             | Front-porch                | Hfp         | All    | -    | 16     | -        | tc   |          |  |
|             | Hpw+Hbp                    |             |        | All  | 136    | 144      | 151  | tc       |  |
|             | Hsync-CLK                  | Hhc         | All    | 10   | -      | $T_c-10$ | ns   |          |  |
| Vsync-Hsync | Hvh                        | All         | 0      | 0    | 200    | tc       |      |          |  |
| Vsync       | Period                     | Vp          | 480    | -    | 16.8   | -        | ms   |          |  |
|             |                            |             |        | 515  | 525    | 800      | Hp   |          |  |
|             |                            |             |        | 400  | -      | 14.3     | -    | ms       |  |
|             |                            |             |        |      | 446    | 449      | 480  | Hp       |  |
|             |                            |             |        | 350  | -      | 14.3     | -    | ms       |  |
|             |                            |             |        |      | 447    | 449      | 510  | Hp       |  |
|             | Display period             | Vdp         | 480    | -    | 480    | -        | Hp   |          |  |
|             |                            |             |        | 400  | -      | 400      |      | -        |  |
|             |                            |             |        | 350  | -      | 350      |      | -        |  |
|             | Pulse width                | Vpw         | All    | 2    | 2      | 35       | Hp   |          |  |
|             | Back-porch                 | Vbp         | 480    | 2    | 33     | 35       | Hp   |          |  |
|             |                            |             |        | 400  | 2      | 35       |      | 38       |  |
|             |                            |             |        | 350  | 2      | 60       |      | 63       |  |
|             | Front-porch                | Vfp         | 480    | 1    | 10     | -        | Hp   |          |  |
|             |                            |             |        | 400  | 1      | 12       |      | -        |  |
|             |                            |             |        | 350  | 1      | 37       |      | -        |  |
|             | Vpw+Vbp                    |             | 480    | 31   | 35     | 38       | Hp   |          |  |
|             |                            |             |        | 400  | 33     | 37       |      | 40       |  |
| 350         |                            |             |        | 58   | 62     | 65       |      |          |  |
| Data        | CLK-DATA                   | Dcd         | All    | 10   |        | -        | ns   |          |  |
|             | DATA-CLK                   | Ddc         | All    | 10   |        | -        | ns   |          |  |
| DENB        | Horizontal scanning period | T1          | All    | 780  | 800    | 900      | tc   |          |  |
|             | Horizontal display period  | T2          | All    | -    | 640    | -        | tc   |          |  |
|             | Vertical display period    | T3          | All    | -    | 480    | -        | T1   |          |  |
|             | Frame cycling period       | T4          | All    | 515  | 525    | 800      | T1   |          |  |

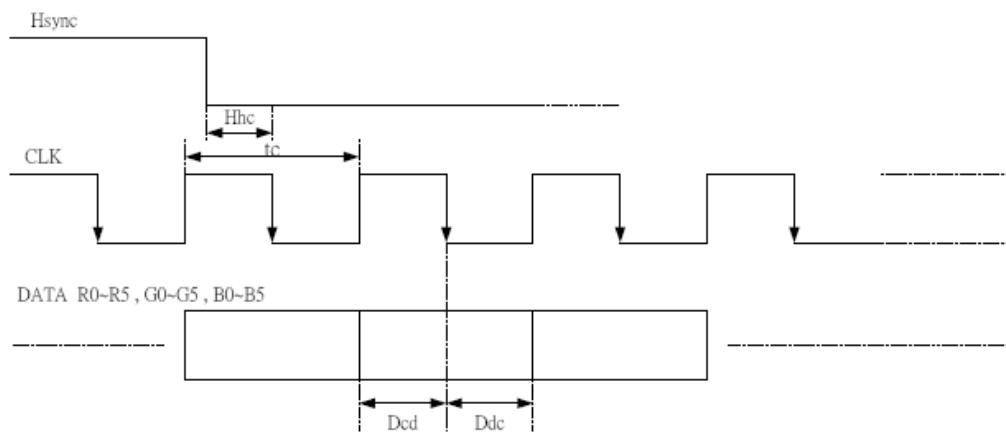
Note (1)  $T_c$  is the period of sampling clock. In case of low-frequency, the image-flicker may occur.

## Display Time Range

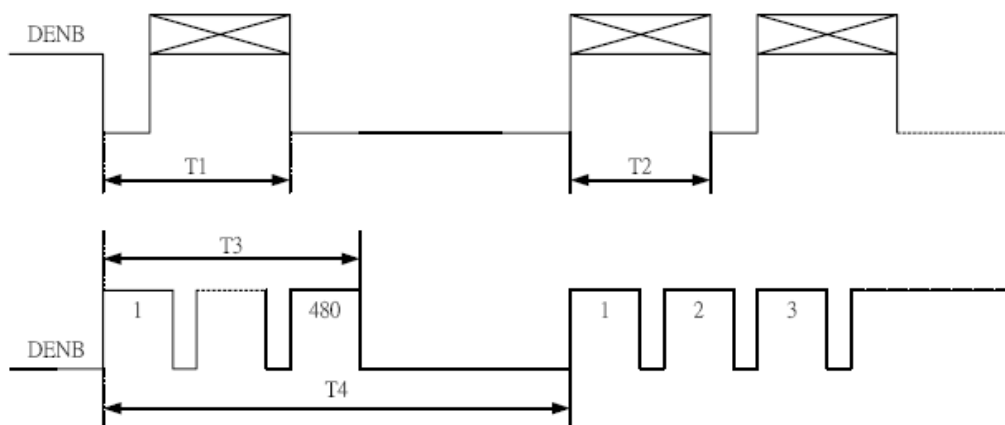
(1) Vertical Timing :



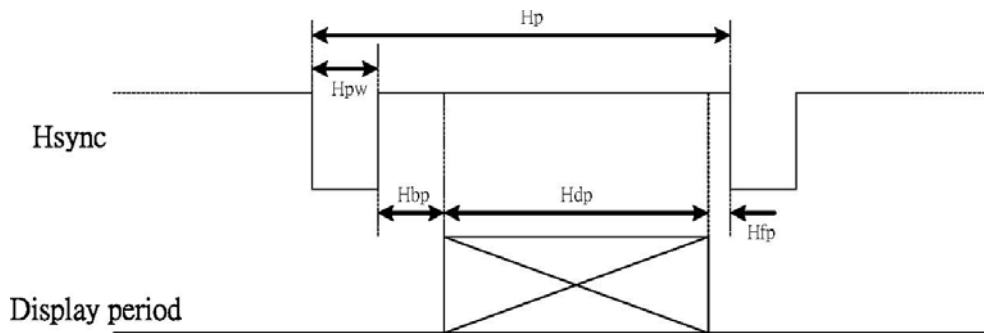
(2) Horizontal Timing :



(3) DENB Timing :



(4) Detail of Horizontal Timing :



(a) VGA-480 Mode (Hsync = Positive / Negative Polarization)

| Item | Description        | Clock Cycles | Time           |
|------|--------------------|--------------|----------------|
| A    | Horizontal Width   | 96           | 3.813 $\mu$ s  |
| B    | Horizontal B-Porch | 48           | 1.907 $\mu$ s  |
| C    | Horizontal Display | 640          | 25.422 $\mu$ s |
| D    | Horizontal F-Porch | 16           | 0.636 $\mu$ s  |
| E    | Horizontal Total   | 800          | 31.778 $\mu$ s |

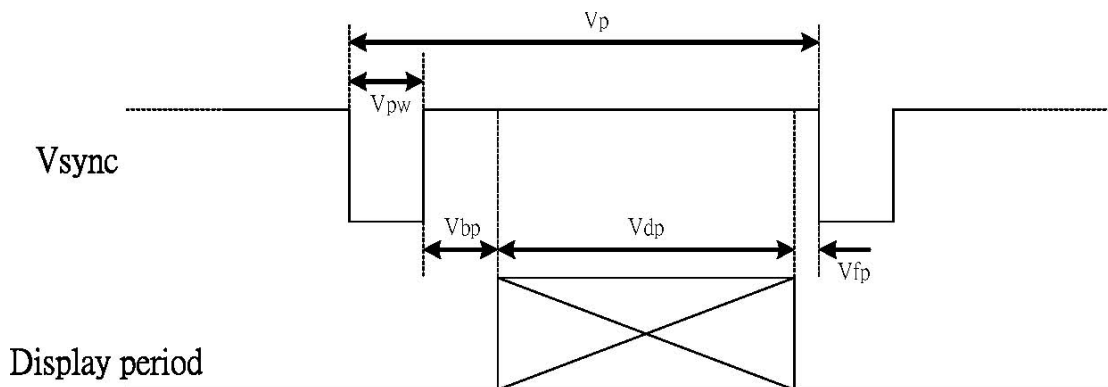
(b) VGA-400 Mode (Hsync = Negative Polarization)

| Item | Description        | Clock Cycles | Time           |
|------|--------------------|--------------|----------------|
| A    | Horizontal Width   | 96           | 3.813 $\mu$ s  |
| B    | Horizontal B-Porch | 48           | 1.907 $\mu$ s  |
| C    | Horizontal Display | 640          | 25.422 $\mu$ s |
| D    | Horizontal F-Porch | 16           | 0.636 $\mu$ s  |
| E    | Horizontal Total   | 800          | 31.778 $\mu$ s |

(c) VGA-350 Mode (Hsync = Positive Polarization)

| Item | Description        | Clock Cycles | Time           |
|------|--------------------|--------------|----------------|
| A    | Horizontal Width   | 96           | 3.813 $\mu$ s  |
| B    | Horizontal B-Porch | 48           | 1.907 $\mu$ s  |
| C    | Horizontal Display | 640          | 25.422 $\mu$ s |
| D    | Horizontal F-Porch | 16           | 0.636 $\mu$ s  |
| E    | Horizontal Total   | 800          | 31.778 $\mu$ s |

(5) Detail of Vertical Timing :



(a) VGA-480 Mode (Vsync = Positive / Negative Polarization)

| Item | Description      | Horizontal Lines | Time          |
|------|------------------|------------------|---------------|
| A    | Vertical Width   | 2                | 63.5 $\mu$ s  |
| B    | Vertical B-Porch | 33               | 1.049 ms      |
| C    | Vertical Display | 480              | 15.253 ms     |
| D    | Vertical F-Porch | 10               | 317.8 $\mu$ s |
| E    | Vertical Total   | 525              | 16.683 ms     |

(b) VGA-400 Mode (Vsync = Positive Polarization)

| Item | Description      | Horizontal Lines | Time          |
|------|------------------|------------------|---------------|
| A    | Vertical Width   | 2                | 63.5 $\mu$ s  |
| B    | Vertical B-Porch | 35               | 1.112 ms      |
| C    | Vertical Display | 400              | 12.711 ms     |
| D    | Vertical F-Porch | 12               | 381.0 $\mu$ s |
| E    | Vertical Total   | 449              | 14.268 ms     |

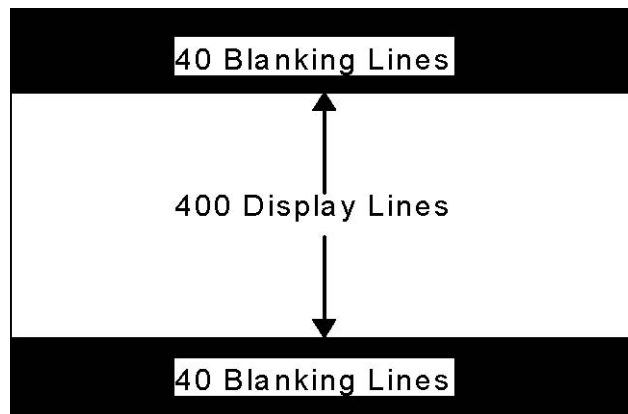
(c) VGA-350 Mode (Vsync = Negative Polarization)

| Item | Description      | Horizontal Lines | Time          |
|------|------------------|------------------|---------------|
| A    | Vertical Width   | 2                | 63.5 $\mu$ s  |
| B    | Vertical B-Porch | 60               | 1.907 ms      |
| C    | Vertical Display | 350              | 11.122 ms     |
| D    | Vertical F-Porch | 37               | 1.176 $\mu$ s |
| E    | Vertical Total   | 449              | 14.268 ms     |

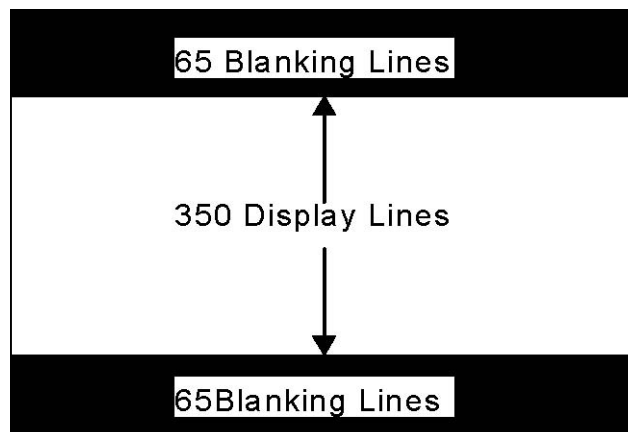
## Vertical Display Position

| Mode    | Hsync               | Vsync               | V-Start Position | V-Display | Remark |
|---------|---------------------|---------------------|------------------|-----------|--------|
| VGA-480 | Positive / Negative | Positive / Negative | 34               | 480 lines |        |
| VGA-400 | Negative            | Positive            | 17               | 400 lines | Note 8 |
| VGA-350 | Positive            | Negative            | 30               | 350 lines | Note 9 |

Note (3) As the format is VGA-400 (Hsync = Negative , Vsync = Positive) , LCD module will adjust the display area to the center of display . At this time , both of the upper and lower display areas have 40 blanking lines (the display color is black) . The actual display area is center 400 lines .



Note (4) As the format is VGA-350 (Hsync = Positive, Vsync = Negative) , LCD module will adjust the display area to the center of display . At this time , both of the upper and lower display areas have 65 blanking lines (the display color is black) . The actual display area is center 350 lines .



## 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  |    |



## Control Board Dip Switch Format

### SW1

| Item   | Symbol | Condition                 | Remark        |
|--------|--------|---------------------------|---------------|
| SW 1-1 | -      | No connection             | Default (OFF) |
| SW 1-2 | HP3    | Horizontal Shift (8 Line) | Default (ON)  |
| SW 1-3 | HP2    | Horizontal Shift (4 Line) | Default (OFF) |
| SW 1-4 | HP1    | Horizontal Shift (2 Line) | Default (OFF) |
| SW 1-5 | HP0    | Horizontal Shift (1 Line) | Default (ON)  |
| SW 1-6 | VP2    | Vertical Shift (4 Line)   | Default (OFF) |
| SW 1-7 | VP1    | Vertical Shift (2 Line)   | Default (ON)  |
| SW 1-8 | VP0    | Vertical Shift (1Line)    | Default (ON)  |

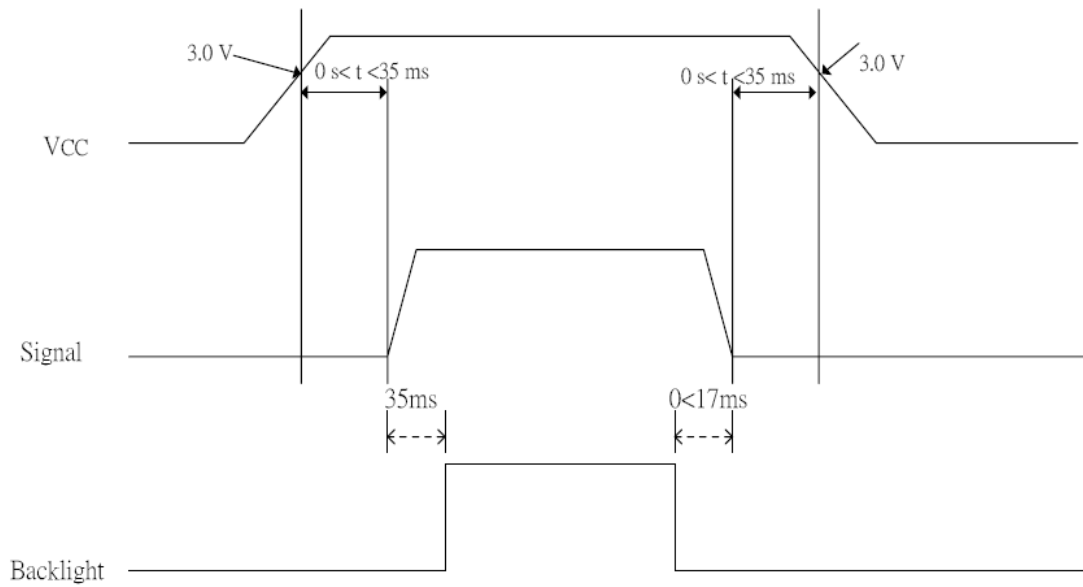
1. The default state is base on SYNC. mode (VGA-480)
2. Total horizontal shift line are 15 lines (HP0~HP3 on)  
Total vertical shift line are 7 lines (VP0~VP2 on)

### SW2

| Item   | Symbol | Condition                               | Remark       |
|--------|--------|---|--------------|
| SW 2-1 | UD     | Vertical Image Shift-direction Select   | Default (ON) |
| SW 2-2 | RL     | Horizontal Image Shift-direction Select | Default (ON) |

## Power n Sequence

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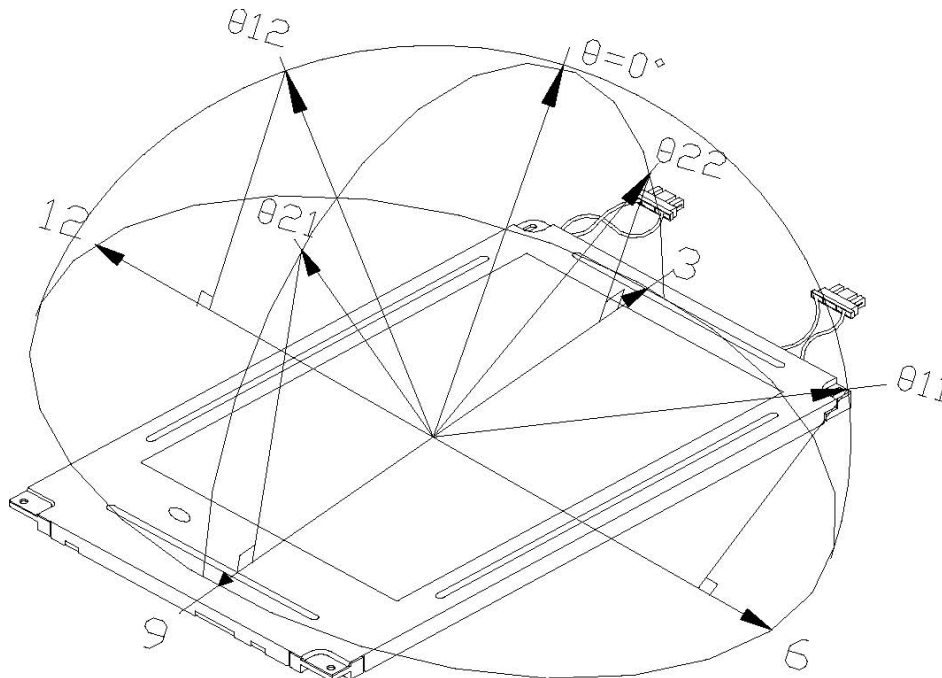
1. The supply voltage for input signals should be same as Vcc.
2. When the power is off , please keep whole signals (Hsync, Vsync, CLK, Data) low level or high impedance

## Optical Characteristics Specification:

Ta=25°C

| Parameter          |            | Symbol                           | Condition                  | MIN.  | TYP.   | MAX.  | Unit              | Remarks  |
|--------------------|------------|----------------------------------|----------------------------|-------|--------|-------|-------------------|----------|
| Viewing Angle      | Horizontal | $\theta_{21}$ ,<br>$\theta_{22}$ | CR > 10                    | -     | ±60    | -     | deg               | Note 9-1 |
|                    | Vertical   | $\theta_{12}$                    |                            | -     | 40     | -     | deg               |          |
|                    |            | $\theta_{11}$                    |                            | -     | 55     | -     | deg               |          |
| Contrast Ratio     |            | CR                               | At optimized Viewing angle | -     | 400    | -     | -                 | Note 9-2 |
| Response time      | Rise       | Tr                               | $\theta = 0^\circ$         | -     | 15     | 30    | ms                | Note 9-4 |
|                    | Fall       | Tf                               |                            | -     | 25     | 50    | ms                |          |
| Brightness         |            |                                  | $\theta = 0^\circ$         | -     | 1000   | -     | cd/m <sup>2</sup> | Note 9-3 |
| Uniformity         |            | U                                |                            | -     | 80     | -     | %                 | Note 9-5 |
| Cross Talk         |            |                                  | $\theta = 0^\circ$         | -     | -      | 3     | %                 | Note 9-6 |
| White Chromaticity |            | x                                | $\theta = 0^\circ$         | 0.264 | 0.294  | 0.324 | -                 | Note 9-3 |
|                    |            | y                                |                            | 0.278 | 0.308  | 0.338 | -                 |          |
| Lamp Life Time     |            |                                  |                            | -     | 50,000 | -     | hr                |          |

Note (1) The definitions of viewing angle diagrams :



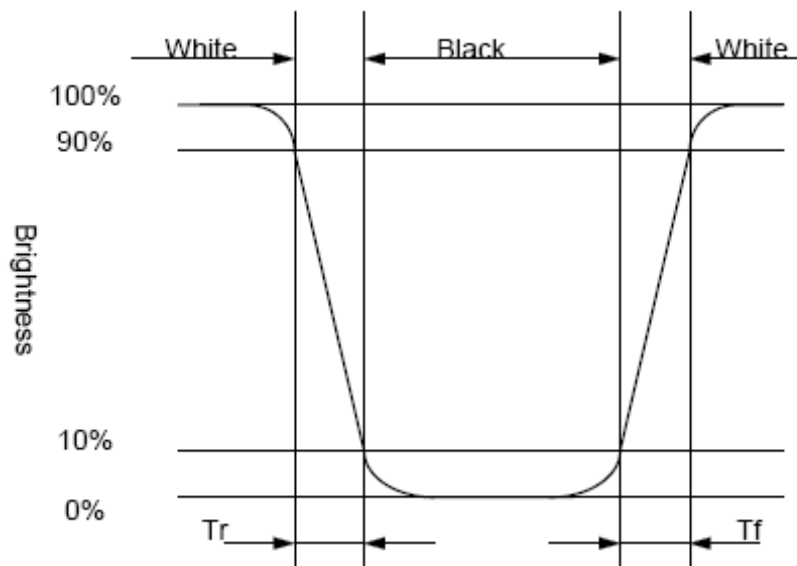
Note (2)

$$CR = \frac{\text{Luminance when LCD is White}}{\text{Luminance when LCD is Black}}$$

Contrast Ratio is measured in optimum common electrode voltage.

- Note (3)
1. Topcon BM-7 (fast) luminance meter 1° field of view is used in the testing ( after 20~30 minutes operation).
  2. Lamp current : 6 mA
  3. Inverter model : TDK-347.

Note (4) The definitions of response time



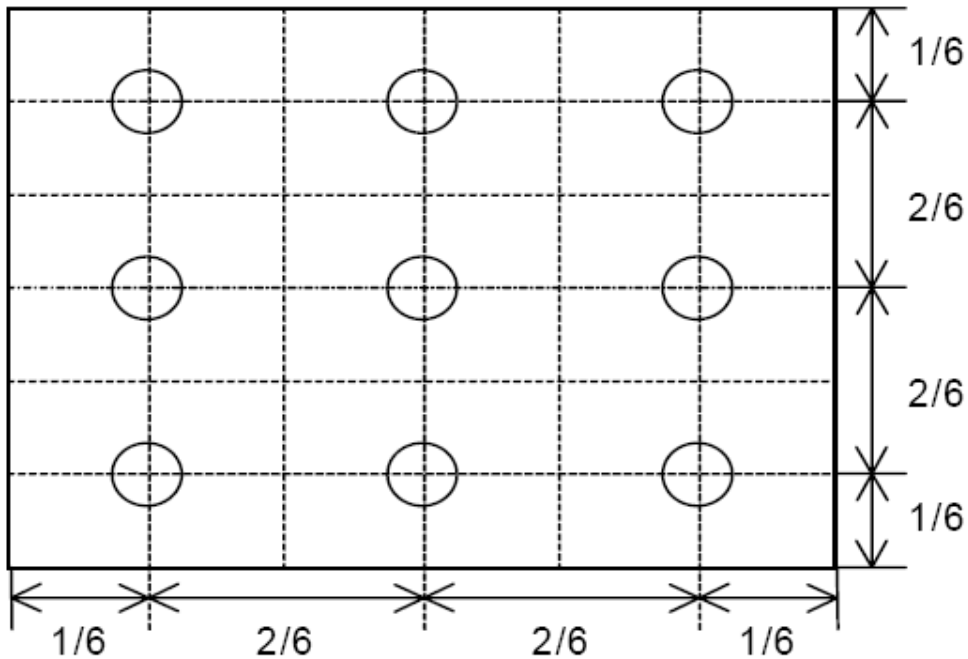
Note (5) The uniformity of LCD is defined as

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

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

Measurement distance : 500 mm +/- 50 mm

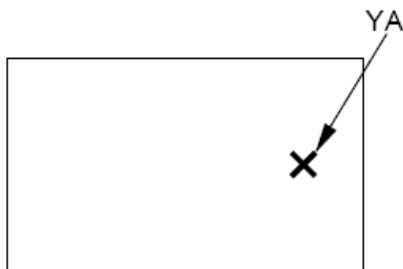
Ambient illumination : < 1 Lux Measuring direction : Perpendicular to the surface of module



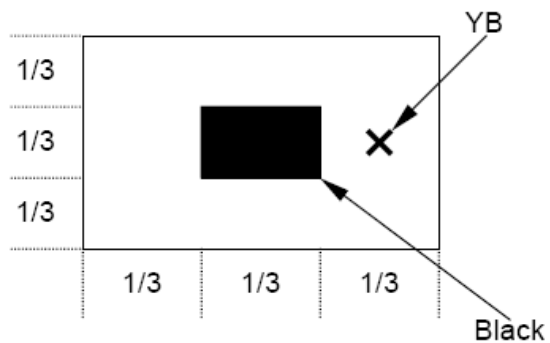
Note (6) Cross Talk (CTK) =  $\frac{YA - YB}{YA} \times 100\%$

YA : Brightness of Pattern A  
 YB : Brightness of Pattern B

Pattern A  
 (Gray Level 31)



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



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

(Gray Level 0)

## Handling Cautions

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### 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.

### 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.

### 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.

### 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.

### Polarizer mark

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

## Reliability Test

| No | Test Item                                       | Test Condition  |
|----|---|---|
| 1  | Low Temperature Storage Test                    | Ta = -30 °C, 240 hrs  |
| 2  | High Temperature Operation Test                 | Ta = +70 °C, 240 hrs  |
| 3  | Low Temperature Operation Test                  | Ta = -20 °C, 240 hrs  |
| 4  | High Temperature & High Humidity Operation Test | Ta = +60 °C, 90%RH, 240 hrs   |
| 5  | Thermal Cycling Test (non-operating)            | -25°C → +70°C, 200 Cycles      30 min    30 min   |
| 6  | Vibration Test (non-operating)                  | 2 Frequency : 10 ~ 57 Hz/Vibration Width :0.075mm<br>58-500 H/ / Gravity :9.8m/s Sweep time: 11 minutes<br>Test period: 3 hrs for each direction of X, Y, Z |
| 7  | Shock Test (non-operating)                      | Gravity :490m/s Direction: ±X, ±Y, ±Z Pulse<br>Width :11ms, half sine wave  |
| 8  | Electrostatic Discharge Test (non-operating)    | 2150pF, 330Ω Air : ±15KV ; Contact : ±8KV 10<br>times/point , 9 points/panel face   |

Ta: ambient temperature

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

[Judgement Criteria]

Under the display quality test conditions with normal operation state , there should be no change which may affect practical display function.

# Block Diagram

