

# SPECIFICATION FOR APPROVAL

- ( ) Preliminary Specification
- ( ) Final Specification

|       |                     |
|-------|---------------------|
| Title | 47.0" WUXGA TFT LCD |
|-------|---------------------|

|       |        |
|-------|--------|
| BUYER | Xoceco |
| MODEL |        |

|          |                          |
|----------|--------------------------|
| SUPPLIER | LG.Philips LCD Co., Ltd. |
| *MODEL   | LC470WU1                 |
| SUFFIX   | SL01                     |

\*When you obtain standard approval, please use the above model name without suffix

| APPROVED BY | SIGNATURE DATE |
|-------------|----------------|
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| /           |                |
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Please return 1 copy for your confirmation with your signature and comments.

**TV Product Development Dept.  
LG. Philips LCD Co., Ltd**

Product Specification

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**RECORD OF REVISIONS**

| Revision No. | Revision Date  | Page       | Description   |
|--------------|----------------|------------|---|
| 0.0          | Feb.17, 2005   | -          | Preliminary Specification(First Draft)                        |
| 0.1          | Mar. 16. 2005  | 6,7        | Fill in the Power Consumptions & Rush Current                 |
| 0.1          | Mar. 16. 2005  | 8          | Change of the Pin Map (Pin No. 26,27,42,43,47)                |
| 0.2          | May. 03. 2005  | 4,16       | Change of the Luminance & Contrast Ratio                      |
| 0.3          | June. 01. 2005 | 4,14,15,16 | Change of the Luminance & Timing Chart                        |
| 0.4          | June. 13. 2005 | 21,22      | Addition of panel Gap & Tolerance                             |
| 0.5          | June. 23. 2005 | 11         | Addition of Interface Timing Value(Min.)                      |
| 0.6          | July 22. 2005  | 11,24      | Change of Timing Chart & International Standards              |
| 0.7          | July 28. 2005  | 28,29,30   | Addition of Packing Spec.(Appendix)                           |
| 0.8          | Aug. 25. 2005  | 4,6,7      | Fill in the Power Consumptions, Change of Burst On Duty Ratio |
| 0.9          | Aug. 31. 2005  | 12         | Addition of the Timing Table(PAL)                             |
| 1.0          | Sep. 21. 2005  | 5,7,17,18  | Fill in the Color coordinates & Gray spec.                    |
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Free Datasheet <http://www.datasheet4u.com/>

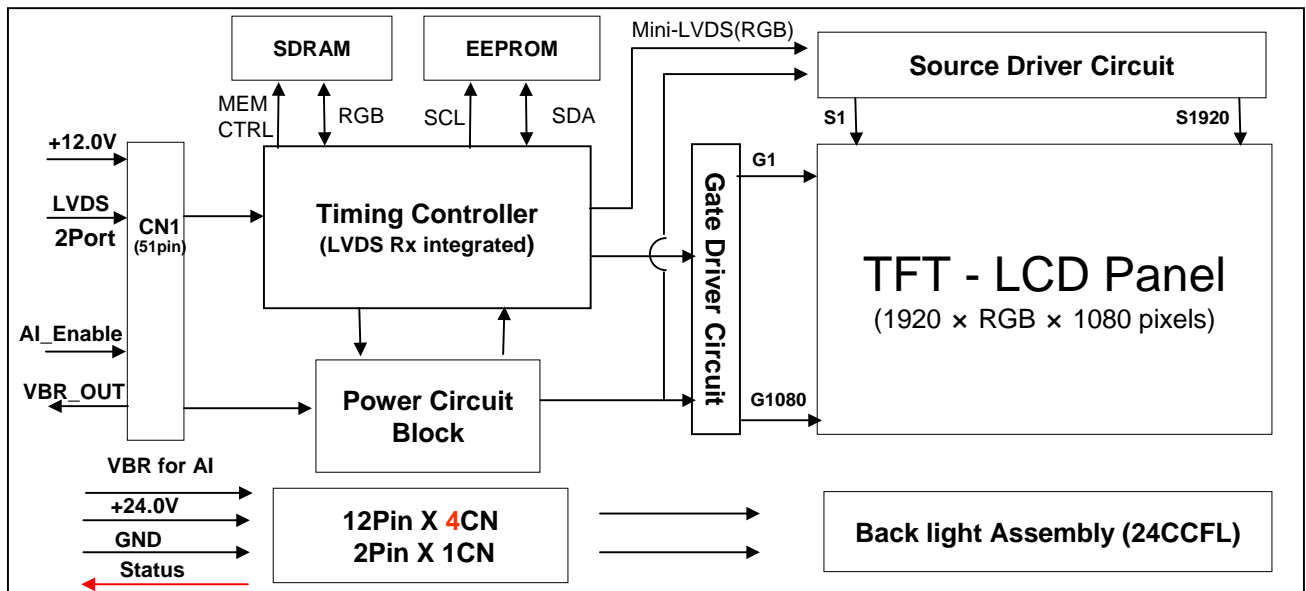
Product Specification

### 1. General Description

The LC470WU1 is a Color Active Matrix Liquid Crystal Display with an integral Cold Cathode Fluorescent Lamp(CCFL) backlight system. The matrix employs a-Si Thin Film Transistor as the active element. It is a transmissive display type which is operating in the normally black mode. It has a **46.96 inch** diagonally measured active display area with WUXGA resolution (1080 vertical by 1920 horizontal pixel array). Each pixel is divided into Red, Green and Blue sub-pixels or dots which are arrayed in vertical stripes. Gray scale or the luminance of the sub-pixel color is determined with a 8-bit gray scale signal for each dot. Therefore, it can present a palette of more than 16.7M(true) colors.

It has been designed to apply the 8-bit 2-port LVDS interface.

It is intended to support LCD TV, PCTV where high brightness, super wide viewing angle, high color gamut, high color depth and fast response time are important.



### General Features

|                       |   |
|-----------------------|---|
| Active Screen Size    | 46.96 inch (1192.87mm) diagonal   |
| Outline Dimension     | 1096.0(H) x 640.0 (V) x 48.1 mm(D) (Typ.)                               |
| Pixel Pitch           | 0.5415 mm x 0.5415 mm   |
| Pixel Format          | 1920 horiz. by 1080 vert. Pixels, RGB stripe arrangement                |
| Color Depth           | 8-bit, 16.7 M colors  |
| Luminance, White      | 550 cd/m <sup>2</sup> (Center 1point ,Typ.)                             |
| Viewing Angle (CR>10) | Viewing angle free ( R/L 178 (Typ.), U/D 178 (Typ.))                    |
| Power Consumption     | Total 231W (Typ.) (Logic=8.4W, Inverter=223 W [I <sub>BL</sub> = 5.8] ) |
| Weight                | 20.0K g (Typ.)  |
| Display Mode          | Transmissive mode, Normally black                                       |
| Surface Treatment     | Hard coating(3H), Anti-glare treatment of the front polarizer           |

Product Specification

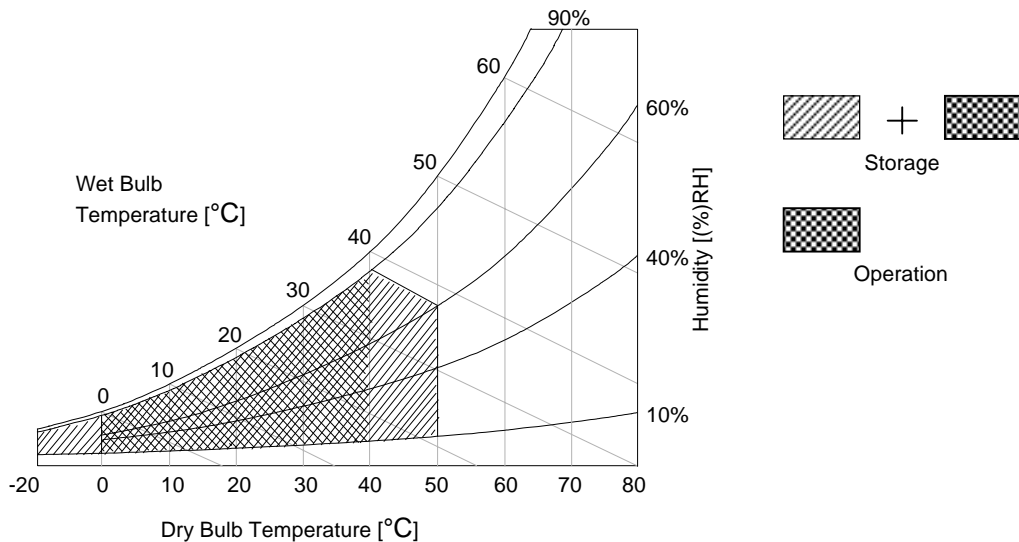
2. Absolute Maximum Ratings

The following items are maximum values which, if exceeded, may cause faulty operation or damage to the LCD module.

Table 1. ABSOLUTE MAXIMUM RATINGS

| Parameter                  |                    | Symbol              | Value |       | Unit            | Remark       |
|----------------------------|--------------------|---------------------|-------|-------|-----------------|--------------|
|                            |                    |                     | Min   | Max   |                 |              |
| Power Input Voltage        | LCM                | V <sub>LCD</sub>    | -0.3  | +14.0 | V <sub>DC</sub> | at 25 ± 2 °C |
|                            | Backlight inverter | V <sub>BL</sub>     | 21.6  | +27.0 | V <sub>DC</sub> |              |
| ON/OFF Control Voltage     |                    | V <sub>ON/OFF</sub> | -0.3  | +5.25 | V <sub>DC</sub> |              |
| Brightness Control Voltage |                    | V <sub>Br</sub>     | 0     | +5.0  | V <sub>DC</sub> |              |
| Operating Temperature      |                    | T <sub>OP</sub>     | 0     | +40   | °C              | Note 1       |
| Storage Temperature        |                    | T <sub>ST</sub>     | -20   | +50   | °C              |              |
| Operating Ambient Humidity |                    | H <sub>OP</sub>     | 10    | 90    | %RH             |              |
| Storage Humidity           |                    | H <sub>ST</sub>     | 10    | 90    | %RH             |              |

Note : 1. Temperature and relative humidity range are shown in the figure below.  
Wet bulb temperature should be 39 °C Max. and no condensation of water.



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### 3. Electrical Specifications

#### 3-1. Electrical Characteristics

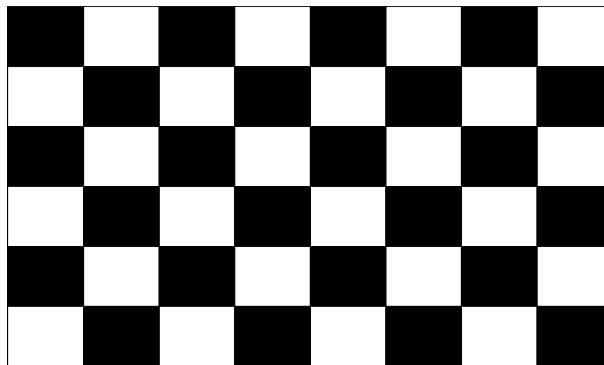
It requires two power inputs. One is employed to power for the LCD circuit. The other is used for the CCFL backlight and inverter circuit.

**Table 2. ELECTRICAL CHARACTERISTICS**

| Parameter           | Symbol            | Value |            |            | Unit            | Note |
|---------------------|-------------------|-------|------------|------------|-----------------|------|
|                     |                   | Min   | Typ        | Max        |                 |      |
| Circuit :           |                   |       |            |            |                 |      |
| Power Input Voltage | V <sub>LCD</sub>  | 11.4  | 12.0       | 12.6       | V <sub>dc</sub> |      |
| Power Input Current | I <sub>LCD</sub>  | -     | 700        | 800        | mA              | 1    |
|                     |                   | -     | 980        | 1100       | mA              | 2    |
| Power Consumption   | P <sub>LCD</sub>  | -     | <b>8.4</b> | <b>9.6</b> | Watt            | 1    |
| Rush current        | I <sub>RUSH</sub> | -     | -          | <b>5</b>   | A               | 3    |

- Note :
1. The specified current and power consumption are under the  $V_{LCD}=12.0V$ ,  $25 \pm 2^{\circ}C$ ,  $f_V=60Hz$  condition whereas mosaic pattern(8 x 6) is displayed and  $f_V$  is the frame frequency.
  2. The current is specified at the maximum current pattern.
  3. The duration of rush current is about 2ms and rising time of power input is 1ms (min.).

White : 255Gray  
Black : 0Gray



Mosaic Pattern(8 x 6)

Product Specification

**Table 2. ELECTRICAL CHARACTERISTICS (Continue)**

| Parameter                                | Symbol            | Value  |       |            | Unit | Note |     |
|--|-------------------|--------|-------|------------|------|------|-----|
|  |                   | Min    | Typ   | Max        |      |      |     |
| Inverter :                               |                   |        |       |            |      |      |     |
| Power Input Voltage                      | VBL               | 22.8   | 24.0  | 25.2       | VDC  | 1    |     |
| Power Supply Input Voltage Ripple        |                   | -0.2   |       | <b>0.2</b> | Vp-p |      |     |
| Power Input Current                      | operating         | IBL    | -     | 9.3        | 10.0 |      | A   |
|  | Turn on           | IBL    |       | 12         | 13.2 |      | A   |
| Power Consumption                        | PBL               | -      | 223   | 240        | W    |      |     |
| Input Voltage for Control System Signals | Brightness Adjust | VBR    | 0     |            | 3.3  | VDC  | 2   |
|  | On/Off            | On     | V on  | <b>3.0</b> |      | 5.0  | VDC |
|  |                   | Off    | V off | -0.3       | 0.0  | 0.5  | VDC |
| Lamp :                                   |                   |        |       |            |      |      |     |
| Life Time                                |                   | 50,000 |       |            | Hrs  | 3    |     |

Notes :

- Electrical characteristics are determined after the unit has been 'ON' and stable for approximately 120 minutes at  $25 \pm 2^\circ\text{C}$   
The specified current and power consumption are under the typical supply Input voltage, it is total power consumption.  
The ripple voltage of the power supply input voltage is under 0.2 Vp-p.  
LPL recommend Input Voltage is  $24.0\text{V} \pm 5\%$ .
- Brightness Control.  
This VBR Voltage control brightness.

| VBR Voltage | Function                               |
|-------------|--|
| 3.3V        | Maximum Brightness (100%)              |
| 0V          | Minimum Brightness.(Burst On Duty 40%) |

- The life is determined as the time at which luminance of the lamp is 50% compared to that of initial value at the typical lamp current on condition of continuous operating at  $25 \pm 2^\circ\text{C}$ .  
Specified value is when lamp is aligned horizontally.

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### 3-2. Interface Connections

This LCD module employs two kinds of interface connection, a 51-pin connector is used for the module electronics and **four** 12-pin connectors are used for the integral backlight system.

#### 3-2-1. LCD Module

- LCD Connector(CN1): FI-R51S-HF(manufactured by JAE)
- Mating Connector : **FI-RE51HL**(manufactured by JAE)

**Table 3. MODULE CONNECTOR(CN1) PIN CONFIGURATION**

| No | Symbol        | Description                     | No | Symbol           | Description             |
|----|---------------|---------------------------------|----|------------------|-------------------------|
| 1  | GND           | Ground                          | 27 | Reserved (NC)    | No connection or Ground |
| 2  | MSDA          | Serial Data for AI & OD         | 28 | RE0N             | SECOND CHANNEL 0-       |
| 3  | M_SCL         | Serial Clock for AI & OD        | 29 | RE0P             | SECOND CHANNEL 0+       |
| 4  | VSDA          | Serial Data for P-Vcom          | 30 | RE1N             | SECOND CHANNEL 1-       |
| 5  | VSCL          | Serial Clock for P-Vcom         | 31 | RE1P             | SECOND CHANNEL 1+       |
| 6  | WP            | Data Write Protection           | 32 | RE2N             | SECOND CHANNEL 2-       |
| 7  | LVDS Select   | Logic 'L' Level : LG(NS) Format | 33 | RE2P             | SECOND CHANNEL 2+       |
| 8  | VBR_EXT       | External VBR Input              | 34 | GND              | Ground                  |
| 9  | VBR_OUT       | VBR Output                      | 35 | RECLKN           | SECOND CLOCK CHANNEL C- |
| 10 | AI Enable     | Logic 'L' Level : Disable       | 36 | RECLKP           | SECOND CLOCK CHANNEL C+ |
| 11 | GND           | Ground                          | 37 | GND              | Ground                  |
| 12 | RO0N          | FIRST CHANNEL 0-                | 38 | RE3N             | SECOND CHANNEL 3-       |
| 13 | RO0P          | FIRST CHANNEL 0+                | 39 | RE3P             | SECOND CHANNEL 3+       |
| 14 | RO1N          | FIRST CHANNEL 1-                | 40 | Reserved (NC)    | No connection           |
| 15 | RO1P          | FIRST CHANNEL 1+                | 41 | Reserved (NC)    | No connection           |
| 16 | RO2N          | FIRST CHANNEL 2-                | 42 | Reserved (NC)    | No connection or Ground |
| 17 | RO2P          | FIRST CHANNEL 2+                | 43 | Reserved (NC)    | No connection or Ground |
| 18 | GND           | Ground                          | 44 | GND              | Ground                  |
| 19 | ROCLKN        | FIRST CLOCK CHANNEL C-          | 45 | GND              | Ground                  |
| 20 | ROCLKP        | FIRST CLOCK CHANNEL C+          | 46 | GND              | Ground                  |
| 21 | GND           | Ground                          | 47 | <b>NC</b>        | No connection           |
| 22 | RO3N          | FIRST CHANNEL 3-                | 48 | V <sub>LCD</sub> | Power Supply +12.0V     |
| 23 | RO3P          | FIRST CHANNEL 3+                | 49 | V <sub>LCD</sub> | Power Supply +12.0V     |
| 24 | Reserved (NC) | No connection                   | 50 | V <sub>LCD</sub> | Power Supply +12.0V     |
| 25 | Reserved (NC) | No connection                   | 51 | V <sub>LCD</sub> | Power Supply +12.0V     |
| 26 | Reserved (NC) | No connection or Ground         | -  | -                | -                       |

- Note :
1. All GND(ground) pins should be connected together to the LCD module's metal frame.
  2. All V<sub>LCD</sub> (power input) pins should be connected together.
  3. All Input levels of LVDS signals are based on the IEA 664 Standard.
  4. Specific pins(pin No. #1~#10) are used for internal data process of the LCD module.  
If not used, these pins are no connection.



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**Table 4. Required signal assignment for Flat Link (NS:DS90C387) Transmitter**

| Pin | Pin Name | Require Signal             | Pin | Pin Name  | Require Signal                          |
|-----|----------|----------------------------|-----|-----------|---|
| 1   | VCC      | Power Supply for TTL Input | 29  | GND       | Ground pin for TTL                      |
| 2   | D5       | TTL Input(R7)              | 30  | D26       | TTL Input(DE)                           |
| 3   | D6       | TTL Input(R5)              | 31  | TxCLKIN   | TTL Level clock Input                   |
| 4   | D7       | TTL Input(G0)              | 32  | PWR DWN   | Power Down Input                        |
| 5   | GND      | Ground pin for TTL         | 33  | PLL GND   | Ground pin for PLL                      |
| 6   | D8       | TTL Input(G1)              | 34  | PLL VCC   | Power Supply for PLL                    |
| 7   | D9       | TTL Input(G2)              | 35  | PLL GND   | Ground pin for PLL                      |
| 8   | D10      | TTL Input(G6)              | 36  | LVDS GND  | Ground pin for LVDS                     |
| 9   | VCC      | Power Supply for TTL Input | 37  | TxOUT3+   | Positive LVDS differential data output3 |
| 10  | D11      | TTL Input(G7)              | 38  | TxOUT3-   | Negative LVDS differential data output3 |
| 11  | D12      | TTL Input(G3)              | 39  | TxCLKOUT+ | Positive LVDS differential clock output |
| 12  | D13      | TTL Input(G4)              | 40  | TxCLKOUT- | Negative LVDS differential clock output |
| 13  | GND      | Ground pin for TTL         | 41  | TxOUT2+   | Positive LVDS differential data output2 |
| 14  | D14      | TTL Input(G5)              | 42  | TxOUT2-   | Negative LVDS differential data output2 |
| 15  | D15      | TTL Input(B0)              | 43  | LVDS GND  | Ground pin for LVDS                     |
| 16  | D16      | TTL Input(B6)              | 44  | LVDS VCC  | Power Supply for LVDS                   |
| 17  | VCC      | Power Supply for TTL Input | 45  | TxOUT1+   | Positive LVDS differential data output1 |
| 18  | D17      | TTL Input(B7)              | 46  | TxOUT1-   | Negative LVDS differential data output1 |
| 19  | D18      | TTL Input(B1)              | 47  | TxOUT0+   | Positive LVDS differential data output0 |
| 20  | D19      | TTL Input(B2)              | 48  | TxOUT0-   | Negative LVDS differential data output0 |
| 21  | GND      | Ground pin for TTL Input   | 49  | LVDS GND  | Ground pin for TTL                      |
| 22  | D20      | TTL Input(B3)              | 50  | D27       | TTL Input(R6)                           |
| 23  | D21      | TTL Input(B4)              | 51  | D0        | TTL Input(R0)                           |
| 24  | D22      | TTL Input(B5)              | 52  | D1        | TTL Input(R1)                           |
| 25  | D23      | TTL Input(RSVD)            | 53  | GND       | Ground pin for TTL                      |
| 26  | VCC      | Power Supply for TTL Input | 54  | D2        | TTL Input(R2)                           |
| 27  | D24      | TTL Input(HSYNC)           | 55  | D3        | TTL Input(R3)                           |
| 28  | D25      | TTL Input(VSYNC)           | 56  | D4        | TTL Input(R4)                           |

Notes : 1. Refer to LVDS Transmitter Data Sheet for detail descriptions.  
2. 7 means MSB and 0 means LSB at R,G,B pixel data

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**3-2-2. Backlight Inverter**

Input Connector

-Inverter Connector : S12B-PH-SM3(manufactured by JST) or Equivalent

-Mating Connector : PHR-12 or Equivalent

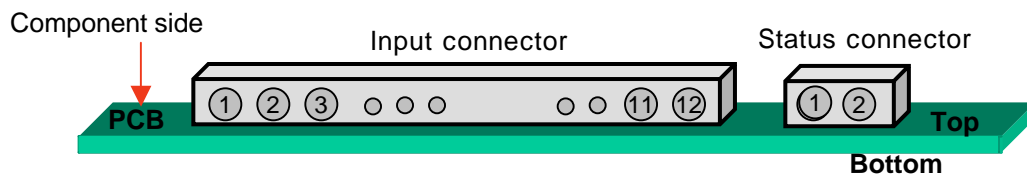
Status Connector

-Inverter Connector : 20022WR-02A00(manufactured by Yeon Ho co., Korea)

-Mating Connector : 20022HR-02S00(manufactured by Yeon Ho co., Korea)

**Table 5. INVERTER CONNECTOR PIN CONFIGURATION**

| Pin No                                 | Symbol | Description                                 | Master | Slave      | Note |
|--|--------|---|--------|------------|------|
| 1                                      | VBL    | Power Supply +24.0V                         | VBL    | VBL        |      |
| 2                                      | VBL    | Power Supply +24.0V                         | VBL    | VBL        |      |
| 3                                      | VBL    | Power Supply +24.0V                         | VBL    | VBL        |      |
| 4                                      | VBL    | Power Supply +24.0V                         | VBL    | VBL        |      |
| 5                                      | VBL    | Power Supply +24.0V                         | VBL    | VBL        |      |
| 6                                      | GND    | POWER GND                                   | GND    | GND        |      |
| 7                                      | GND    | POWER GND                                   | GND    | GND        |      |
| 8                                      | GND    | POWER GND                                   | GND    | GND        | 1    |
| 9                                      | GND    | POWER GND                                   | GND    | GND        |      |
| 10                                     | GND    | POWER GND                                   | GND    | GND        |      |
| 11                                     | VBR    | 0V ~ 3.3V                                   | VBR    | Don't care | 2    |
| 12                                     | On/Off | 0V ~ 5.0V                                   | On/Off | Don't care | 3    |
| Option Pin(Lamp Open Status Detection) |        |   |        |            |      |
| 1                                      | GND    | POWER GND                                   | GND    |            |      |
| 2                                      | Status | Upper 3.0V(Normal),<br>Under 0.7V(Abnormal) | Status |            |      |



Note : 1. GND should be connected to the LCD module's metal frame.

2. Minimum Brightness : VBR = 0.0V  
Maximum Brightness : VBR = 3.3V

3. VON : 3.0 ~ 5.0V  
VOFF : -0.3 ~ 0.5V

## Product Specification

### 3-3. Signal Timing Specifications

Table 6 shows the signal timing required at the input of the LVDS transmitter. All of the interface signal timing should be satisfied with the following specification for normal operation.

**Table 6. TIMING TABLE for NTSC (DE Only Mode)**

| ITEM       |                | Symbol   | Min  | Typ  | Max  | Unit  | Note   |
|------------|----------------|----------|------|------|------|-------|--------|
| Horizontal | Display Period | $t_{HV}$ | -    | 960  | -    | clock |        |
|            | Blank          | $t_{HB}$ | 100  | 140  | 320  | clock |        |
|            | Total          | $t_{HP}$ | 1060 | 1100 | 1280 | clock | 2200/2 |
| Vertical   | Display Period | $t_{VV}$ | -    | 1080 | -    | Lines |        |
|            | Blank          | $t_{VB}$ | 11   | 45   | 69   | Lines |        |
|            | Total          | $t_{VP}$ | 1091 | 1125 | 1149 | Lines |        |

| ITEM      |            | Symbol    | Min  | Typ   | Max  | Unit | Note    |
|-----------|------------|-----------|------|-------|------|------|---------|
| Frequency | DCLK       | $f_{CLK}$ | 70   | 74.25 | 77   | MHz  | 148.5/2 |
|           | Horizontal | $f_H$     | 65.5 | 67.5  | 68.9 | KHz  |         |
|           | Vertical   | $f_V$     | 57   | 60    | 63   | Hz   |         |

Note : The Input of HSYNC & VSYNC signal does not have an effect on normal operation(DE Only Mode).

The performance of the electro-optical characteristics may be influenced by variance of the vertical refresh rate.

## Product Specification

Table 7 shows the signal timing required at the input of the LVDS transmitter. All of the interface signal timing should be satisfied with the following specification for normal operation.

**Table 7. TIMING TABLE for PAL (DE Only Mode)**

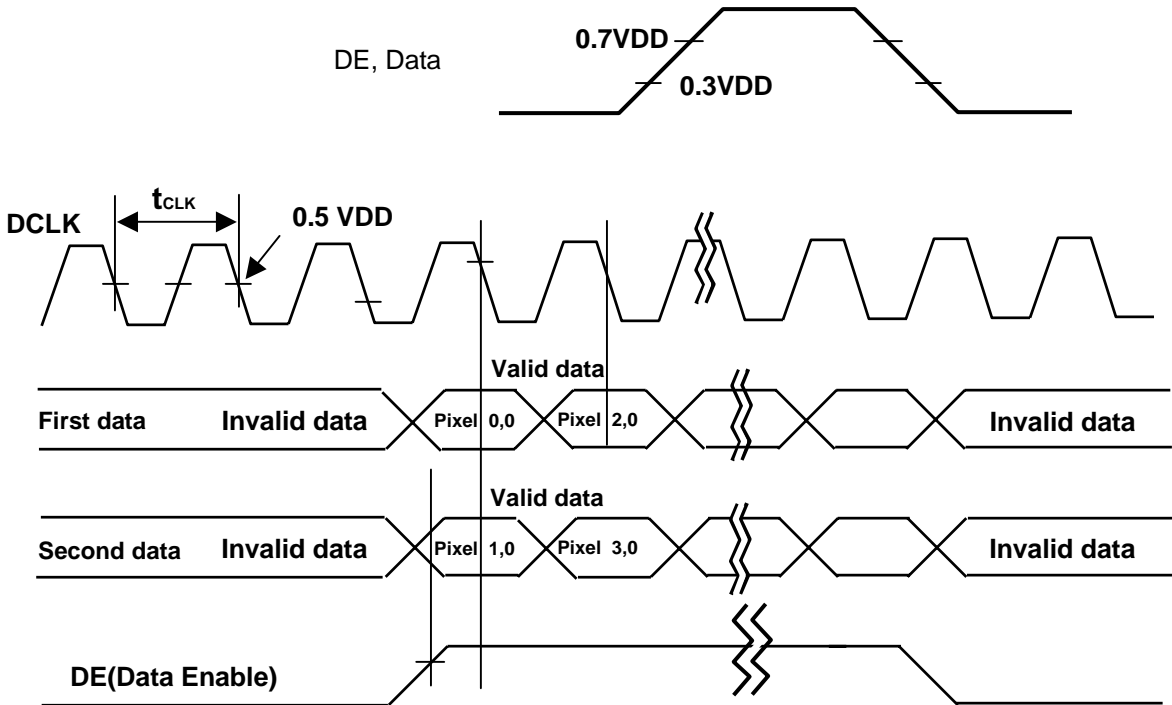
| ITEM       |                | Symbol   | Min  | Typ  | Max  | Unit  | Note   |
|------------|----------------|----------|------|------|------|-------|--------|
| Horizontal | Display Period | $t_{HV}$ | -    | 960  | -    | clock |        |
|            | Blank          | $t_{HB}$ | 100  | 140  | 240  | clock |        |
|            | Total          | $t_{HP}$ | 1060 | 1100 | 1200 | clock | 2200/2 |
| Vertical   | Display Period | $t_{VV}$ | -    | 1080 | -    | Lines |        |
|            | Blank          | $t_{VB}$ | 25   | 45   | 65   | Lines |        |
|            | Total          | $t_{VP}$ | 1105 | 1125 | 1145 | Lines |        |

| ITEM      |            | Symbol    | Min   | Typ   | Max   | Unit | Note     |
|-----------|------------|-----------|-------|-------|-------|------|----------|
| Frequency | DCLK       | $f_{CLK}$ | 59.63 | 61.88 | 67.5  | MHz  | 123.75/2 |
|           | Horizontal | $f_H$     | 55.25 | 56.25 | 57.25 | KHz  |          |
|           | Vertical   | $f_V$     | 47    | 50    | 53    | Hz   |          |

Note : The Input of HSYNC & VSYNC signal does not have an effect on normal operation(DE Only Mode).

The performance of the electro-optical characteristics may be influenced by variance of the vertical refresh rate.

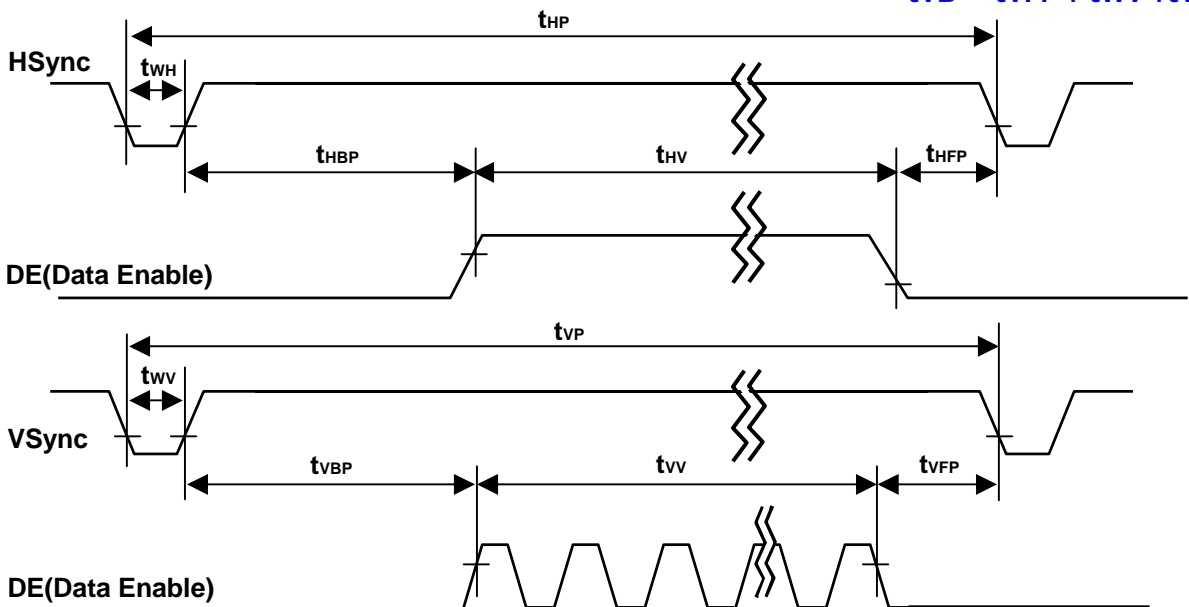
### 3-4. Signal Timing Waveforms



#### \* Reference : Sync. Relation

\*  $t_{HB} = t_{HFP} + t_{WH} + t_{HBP}$

\*  $t_{VB} = t_{VFP} + t_{WV} + t_{VBP}$



Product Specification

### 3-5. Color Data Reference

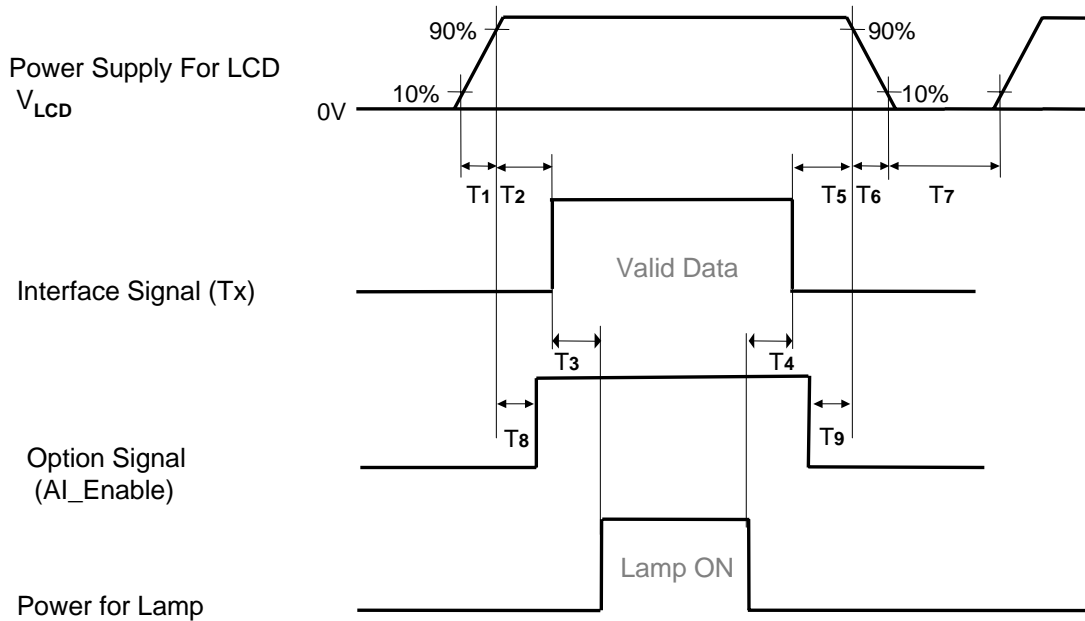
The brightness of each primary color(red,green,blue) is based on the 8-bit gray scale data input for the color. The higher binary input, the brighter the color. Table 8 provides a reference for color versus data input.

**Table8. COLOR DATA REFERENCE**

| Color       |                  | Input Color Data |     |    |    |    |    |    |     |       |    |    |    |    |    |     |     |      |    |    |    |    |    |    |    |
|-------------|------------------|------------------|-----|----|----|----|----|----|-----|-------|----|----|----|----|----|-----|-----|------|----|----|----|----|----|----|----|
|             |                  | RED              |     |    |    |    |    |    |     | GREEN |    |    |    |    |    |     |     | BLUE |    |    |    |    |    |    |    |
|             |                  | MSB              | LSB |    |    |    |    |    | MSB | LSB   |    |    |    |    |    | MSB | LSB |      |    |    |    |    |    |    |    |
|             |                  | R7               | R6  | R5 | R4 | R3 | R2 | R1 | R0  | G7    | G6 | G5 | G4 | G3 | G2 | G1  | G0  | B7   | B6 | B5 | B4 | B3 | B2 | B1 | B0 |
| Basic Color | Black            | 0                | 0   | 0  | 0  | 0  | 0  | 0  | 0   | 0     | 0  | 0  | 0  | 0  | 0  | 0   | 0   | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|             | Red (255)        | 1                | 1   | 1  | 1  | 1  | 1  | 1  | 1   | 0     | 0  | 0  | 0  | 0  | 0  | 0   | 0   | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|             | Green (255)      | 0                | 0   | 0  | 0  | 0  | 0  | 0  | 0   | 1     | 1  | 1  | 1  | 1  | 1  | 1   | 1   | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|             | Blue (255)       | 0                | 0   | 0  | 0  | 0  | 0  | 0  | 0   | 0     | 0  | 0  | 0  | 0  | 0  | 0   | 0   | 1    | 1  | 1  | 1  | 1  | 1  | 1  | 1  |
|             | Cyan             | 0                | 0   | 0  | 0  | 0  | 0  | 0  | 0   | 1     | 1  | 1  | 1  | 1  | 1  | 1   | 1   | 1    | 1  | 1  | 1  | 1  | 1  | 1  | 1  |
|             | Magenta          | 1                | 1   | 1  | 1  | 1  | 1  | 1  | 1   | 0     | 0  | 0  | 0  | 0  | 0  | 0   | 0   | 1    | 1  | 1  | 1  | 1  | 1  | 1  | 1  |
|             | Yellow           | 1                | 1   | 1  | 1  | 1  | 1  | 1  | 1   | 1     | 1  | 1  | 1  | 1  | 1  | 1   | 1   | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|             | White            | 1                | 1   | 1  | 1  | 1  | 1  | 1  | 1   | 1     | 1  | 1  | 1  | 1  | 1  | 1   | 1   | 1    | 1  | 1  | 1  | 1  | 1  | 1  | 1  |
| RED         | RED (000) Dark   | 0                | 0   | 0  | 0  | 0  | 0  | 0  | 0   | 0     | 0  | 0  | 0  | 0  | 0  | 0   | 0   | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|             | RED (001)        | 0                | 0   | 0  | 0  | 0  | 0  | 0  | 1   | 0     | 0  | 0  | 0  | 0  | 0  | 0   | 0   | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|             | ...              | ...              |     |    |    |    |    |    |     | ...   |    |    |    |    |    |     |     | ...  |    |    |    |    |    |    |    |
|             | RED (254)        | 1                | 1   | 1  | 1  | 1  | 1  | 1  | 0   | 0     | 0  | 0  | 0  | 0  | 0  | 0   | 0   | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|             | RED (255)        | 1                | 1   | 1  | 1  | 1  | 1  | 1  | 1   | 0     | 0  | 0  | 0  | 0  | 0  | 0   | 0   | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
| GREEN       | GREEN (000) Dark | 0                | 0   | 0  | 0  | 0  | 0  | 0  | 0   | 0     | 0  | 0  | 0  | 0  | 0  | 0   | 0   | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|             | GREEN (001)      | 0                | 0   | 0  | 0  | 0  | 0  | 0  | 0   | 0     | 0  | 0  | 0  | 0  | 0  | 0   | 1   | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|             | ...              | ...              |     |    |    |    |    |    |     | ...   |    |    |    |    |    |     |     | ...  |    |    |    |    |    |    |    |
|             | GREEN (254)      | 0                | 0   | 0  | 0  | 0  | 0  | 0  | 0   | 1     | 1  | 1  | 1  | 1  | 1  | 1   | 0   | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|             | GREEN (255)      | 0                | 0   | 0  | 0  | 0  | 0  | 0  | 0   | 1     | 1  | 1  | 1  | 1  | 1  | 1   | 1   | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
| BLUE        | BLUE (000) Dark  | 0                | 0   | 0  | 0  | 0  | 0  | 0  | 0   | 0     | 0  | 0  | 0  | 0  | 0  | 0   | 0   | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|             | BLUE (001)       | 0                | 0   | 0  | 0  | 0  | 0  | 0  | 0   | 0     | 0  | 0  | 0  | 0  | 0  | 0   | 0   | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 1  |
|             | ...              | ...              |     |    |    |    |    |    |     | ...   |    |    |    |    |    |     |     | ...  |    |    |    |    |    |    |    |
|             | BLUE (254)       | 0                | 0   | 0  | 0  | 0  | 0  | 0  | 0   | 0     | 0  | 0  | 0  | 0  | 0  | 0   | 0   | 1    | 1  | 1  | 1  | 1  | 1  | 1  | 0  |
|             | BLUE (255)       | 0                | 0   | 0  | 0  | 0  | 0  | 0  | 0   | 0     | 0  | 0  | 0  | 0  | 0  | 0   | 0   | 1    | 1  | 1  | 1  | 1  | 1  | 1  | 1  |

### 3-6. Power Sequence

#### 3-6-1. LCD Driving circuit



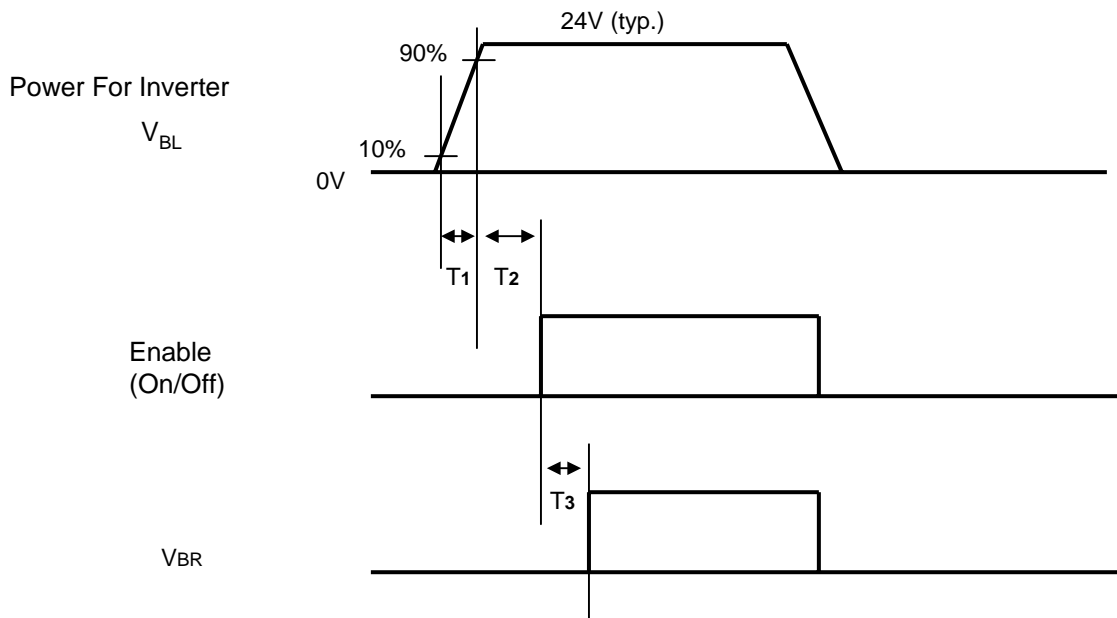
**Table 9. POWER SEQUENCE**

| Parameter | Value       |     |     | Unit |
|-----------|-------------|-----|-----|------|
|           | Min         | Typ | Max |      |
| T1        | 0.5         | -   | 20  | ms   |
| T2        | 0.5         | -   | 50  | ms   |
| T3        | 200         | -   | -   | ms   |
| T4        | 200         | -   | -   | ms   |
| T5        | 0.5         | -   | 50  | ms   |
| T6        | -           | -   | 300 | ms   |
| T7        | 1.0         | -   | -   | s    |
| T8        | 0 < T8 < T2 |     |     | ms   |
| T9        | 0 < T9 < T5 |     |     | ms   |

- Note :
1. Please avoid floating state of interface signal at invalid period.
  2. When the interface signal is invalid, be sure to pull down the power supply  $V_{LCD}$  to 0V.
  3. Flicker would come out when power on-off(T7=under 2s) is tested over several ten-times.
  4. The case when the T2/T5 exceed maximum specification, it operates protection pattern(Black pattern) till valid signal inputted. There is no reliability problem.
  5. The T3/T4 is recommended value, the case when failed to meet a minimum specification, abnormal display would be shown. There is no reliability problem.

Product Specification

3-6-2. On/Off for Inverter



3-6-3. Deep condition for Inverter

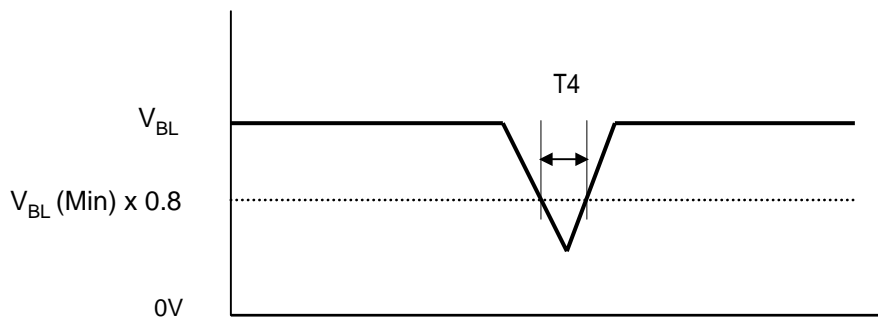


Table 10. POWER SEQUENCE FOR INVERTER

| Parameter | Value |     |     | Unit | Remark                          |
|-----------|-------|-----|-----|------|---------------------------------|
|           | Min   | Typ | Max |      |                                 |
| T1        | 20    | -   | -   | ms   | After Inverter's connected      |
| T2        | 500   | -   | -   | ms   |                                 |
| T3        | 0     | -   | -   | ms   |                                 |
| T4        | -     | -   | 10  | ms   | $V_{BL}(\text{Min}) \times 0.8$ |



Product Specification

### 4. Optical Specification

Optical characteristics are determined after the unit has been 'ON' and stable for approximately 2 Hrs in a dark environment at  $25 \pm 2^\circ\text{C}$ . The specified optical values are measured at an approximate 50cm distance from the LCD surface on condition that viewing angle of  $\Phi$  and  $\theta$  equal to  $0^\circ$ .

FIG. 1 shows additional information concerning the measurement equipment and method.

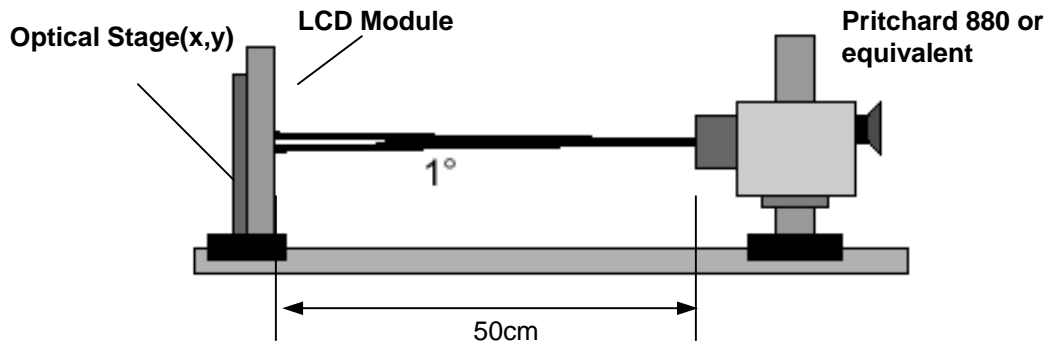


FIG. 1 Optical Characteristic Measurement Equipment and Method

Table 11. OPTICAL CHARACTERISTICS

$T_a = 25 \pm 2^\circ\text{C}$ ,  $V_{LCD} = 12.0\text{V}$ ,  $f_v = 60\text{Hz}$ ,  $D_{clk} = 148.5\text{MHz}$   $VBR = 3.3V$

| Parameter                    | Symbol                            | Value      |              |              | Unit            | Note   |   |
|------------------------------|-----------------------------------|------------|--------------|--------------|-----------------|--------|---|
|                              |                                   | Min        | Typ          | Max          |                 |        |   |
| Contrast Ratio               | CR                                | TBD        | <b>800</b>   | -            |                 | 1      |   |
|                              | CR with AI                        | TBD        | <b>1600</b>  | -            |                 |        |   |
| Surface Luminance, white     | $L_{WH}$                          | TBD        | <b>550</b>   |              | $\text{cd/m}^2$ | 2      |   |
| Luminance Variation          | $\delta_{WHITE}$ 5P               |            |              | 1.3          |                 | 3      |   |
| Response Time (Gray-to-Gray) | $T_{R}, T_{D}$                    |            | 8            | 16           | ms              | 4      |   |
| Color Coordinates [CIE1931]  | RED                               | Rx         | Typ<br>-0.03 | <b>0.638</b> | Typ<br>+0.03    |        |   |
|                              |                                   | Ry         |              | <b>0.340</b> |                 |        |   |
|                              | GREEN                             | Gx         |              | <b>0.279</b> |                 |        |   |
|                              |                                   | Gy         |              | <b>0.611</b> |                 |        |   |
|                              | BLUE                              | Bx         |              | <b>0.146</b> |                 |        |   |
|                              |                                   | By         |              | <b>0.062</b> |                 |        |   |
|                              | WHITE                             | Wx         |              | 0.272        |                 |        |   |
|                              | Wy                                | 0.278      |              |              |                 |        |   |
| Viewing Angle (CR>10)        |                                   |            |              |              |                 |        |   |
|                              | x axis, right( $\phi=0^\circ$ )   | $\theta_r$ | 85           | 89           | -               | degree | 5 |
|                              | x axis, left ( $\phi=180^\circ$ ) | $\theta_l$ | 85           | 89           | -               |        |   |
|                              | y axis, up ( $\phi=90^\circ$ )    | $\theta_u$ | 85           | 89           | -               |        |   |
|                              | y axis, down ( $\phi=270^\circ$ ) | $\theta_d$ | 85           | 89           | -               |        |   |
| Gray Scale                   | Without AI                        |            |              |              |                 | 6      |   |
|                              | With AI                           |            |              |              |                 |        |   |

Product Specification

Note :

1. Contrast Ratio(CR) is defined mathematically as :

$$\text{Contrast Ratio} = \frac{\text{Surface Luminance with all white pixels}}{\text{Surface Luminance with all black pixels}}$$

Measure Position : Center 1-point.

2. Surface Luminance( $L_{WH}$ ) is the luminance value measured at an approximate 50cm distance from the center 1-point of LCD surface as all pixels displaying white. See FIG. 2 for more information.
3. The variation of surface luminance ,  $\delta$  WHITE is defined as :

$$\delta \text{ WHITE}(5P) = \text{Maximum}(L_{on1}, L_{on2}, L_{on3}, L_{on4}, L_{on5}) / \text{Minimum}(L_{on1}, L_{on2}, L_{on3}, L_{on4}, L_{on5})$$

Where  $L_{on1}$  to  $L_{on5}$  are the luminance with all pixels displaying white at 5 locations .  
For more information, see the FIG. 2.

4. Response time is defined as the required time for the transition from G(N) to G(M) (Rise Time,  $Tr_R$ ) and from G(M) to G(N) (Decay Time,  $Tr_D$ ). For additional information see the FIG. 3. (N<M)
5. Viewing angle is the angle at which the contrast ratio is greater than 10. The angles are determined for the horizontal or x axis and the vertical or y axis with respect to the z axis which is normal to the LCD module surface. For more information, see the FIG. 4.
6. See Table 12 for gray scale specification

**Table 12. GRAY SCALE SPECIFICATION**

| Gray Level | Luminance [%] (Typ.) | Luminance [%] (Typ.) with AI |
|------------|----------------------|------------------------------|
| L0         | 0.16                 | 0.06                         |
| L15        | 0.33                 | 0.13                         |
| L31        | 0.96                 | 0.64                         |
| L47        | 2.36                 | 1.8                          |
| L63        | 4.67                 | 3.56                         |
| L79        | 7.95                 | 6.2                          |
| L95        | 12.21                | 10.3                         |
| L111       | 17.19                | 14.2                         |
| L127       | 22.5                 | 19.5                         |
| L143       | 28.86                | 25.5                         |
| L159       | 36.48                | 32.6                         |
| L175       | 44.1                 | 40.8                         |
| L191       | 54.26                | 50.4                         |
| L207       | 64.42                | 60.2                         |
| L223       | 75.32                | 72.4                         |
| L239       | 87.3                 | 85.0                         |
| L255       | 100                  | 100                          |

Product Specification

Measuring point for surface luminance & measuring point for luminance variation.

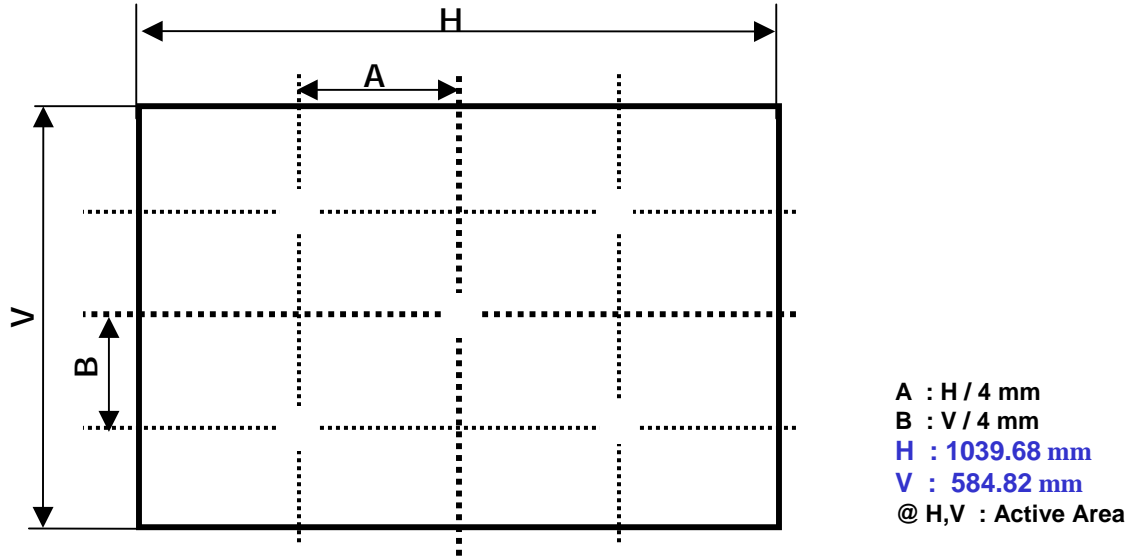


FIG. 2 5 Points for Luminance Measure

Response time is defined as the following figure and shall be measured by switching the input signal for "Gray(N)" and "Gray(M)".

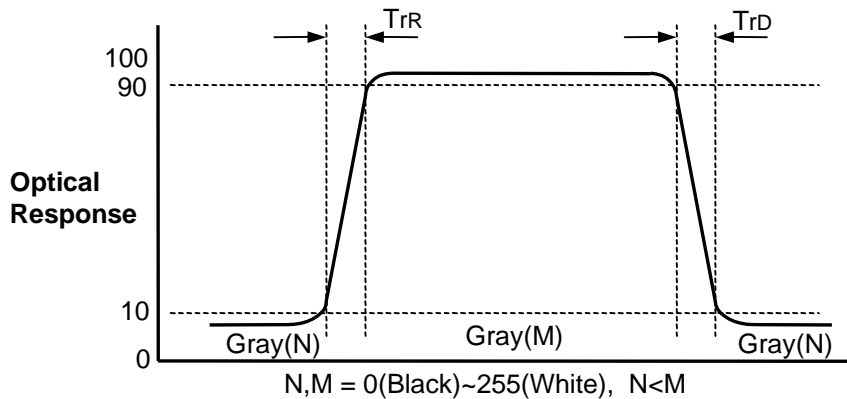


FIG. 3 Response Time

Product Specification

Dimension of viewing angle range

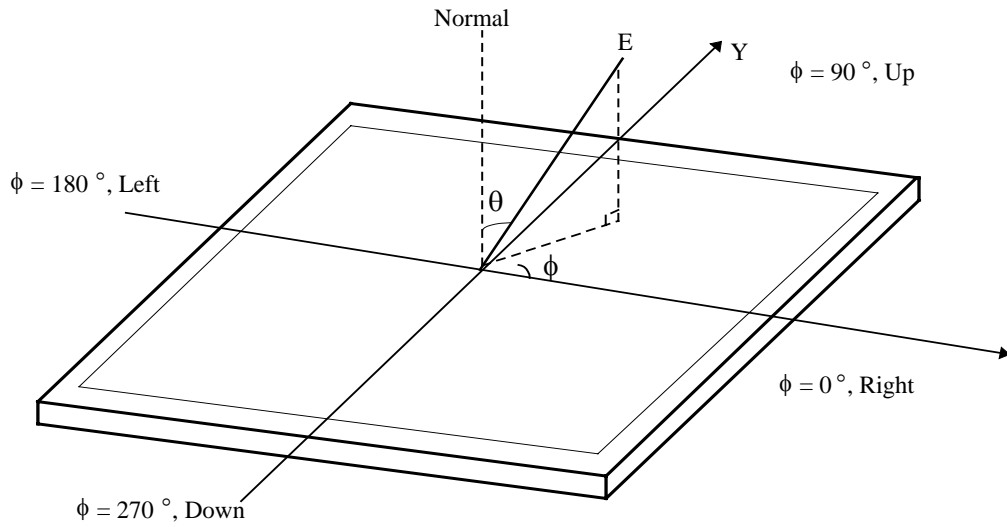


FIG. 4 Viewing Angle

## 5. Mechanical Characteristics

Table 13 provides general mechanical characteristics.

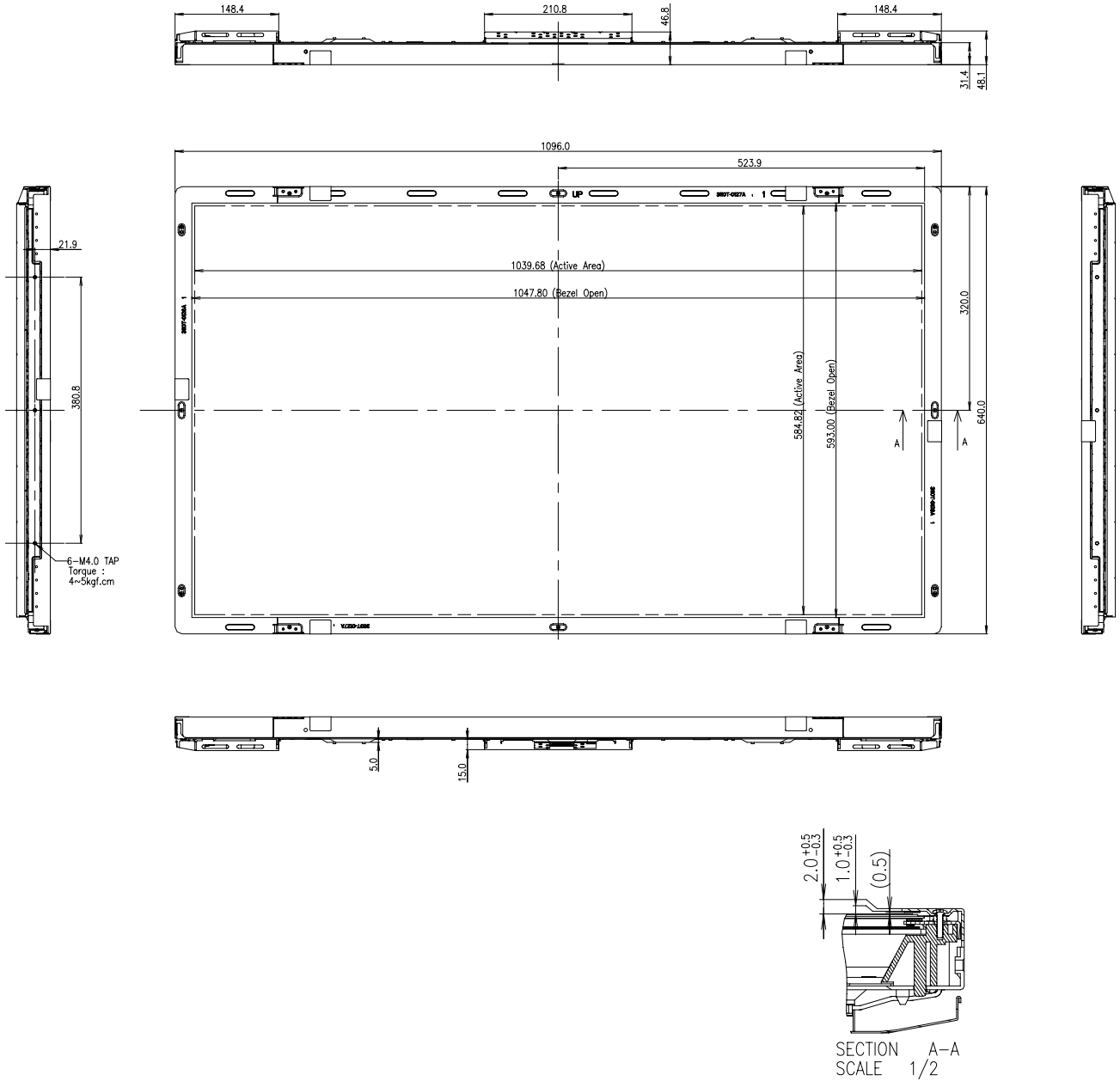
**Table 13. MECHANICAL CHARACTERISTICS**

| Item                | Value   |            |
|---------------------|---|------------|
| Outline Dimension   | Horizontal  | 1096.0 mm  |
|                     | Vertical  | 640.0 mm   |
|                     | Depth   | 48.1 mm    |
| Bezel Area          | Horizontal  | 1047.8 mm  |
|                     | Vertical  | 593.0 mm   |
| Active Display Area | Horizontal  | 1039.68 mm |
|                     | Vertical  | 584.82 mm  |
| Weight              | 20.0 Kg (Typ.)  |            |
| Surface Treatment   | Hard coating(3H)<br>Anti-glare treatment of the front polarizer |            |

Note : Please refer to page21 and 22 for mechanic drawings in terms of tolerance.

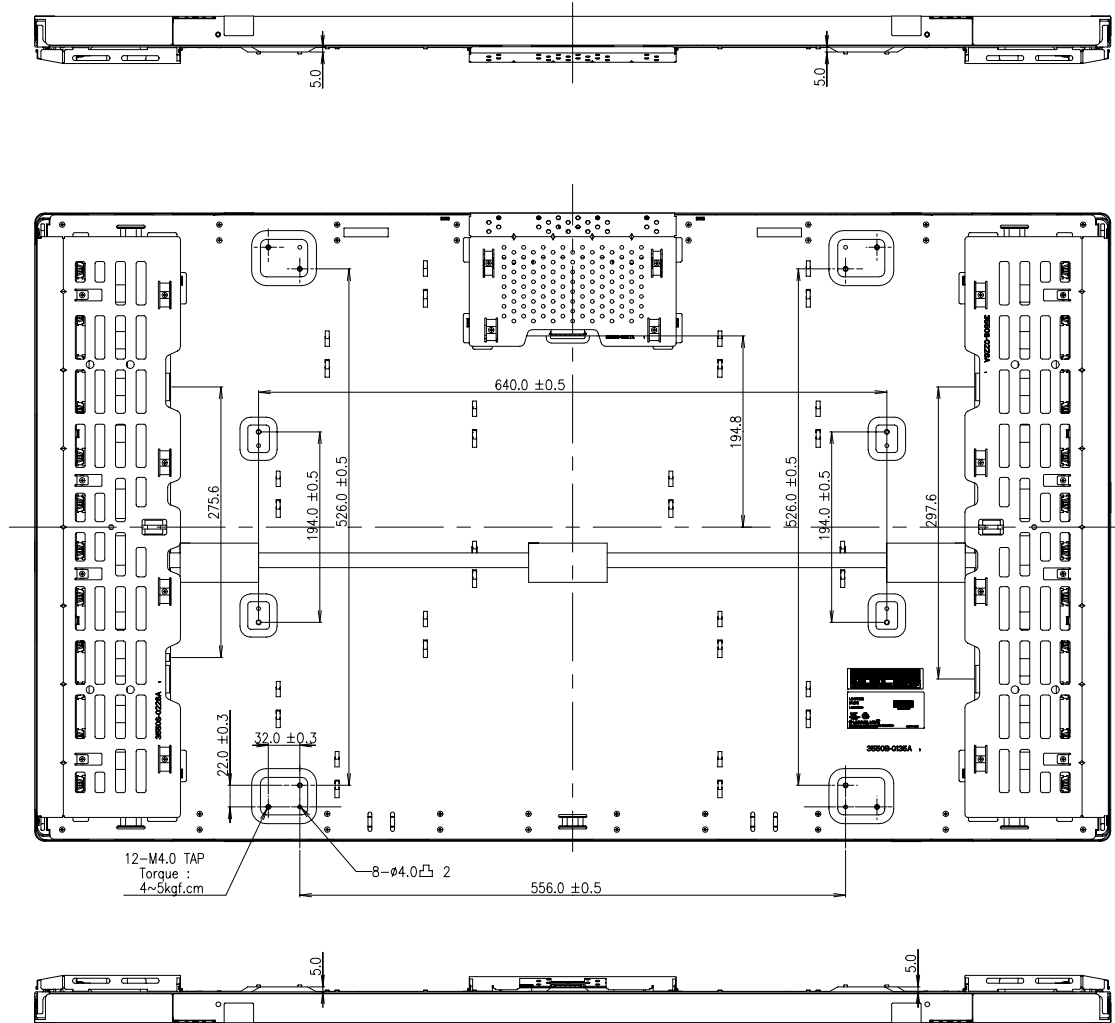
Product Specification

<FRONT VIEW>



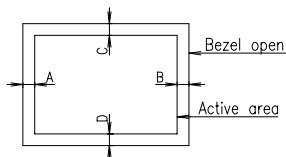
Product Specification

<REAR VIEW>



NOTES

1. Unspecified tolerances are to be  $\pm 1.0\text{mm}$ .
2. The length of mounting screw is MAX 5.5mm.
3. Tilt and partial disposition tolerance of display area are as following.
  - (1) X-Direction : IA-BI  $\leq 1.5\text{mm}$
  - (2) Y-Direction : IC-DI  $\leq 1.5\text{mm}$



Product Specification

## 6. Reliability

**Table 14. ENVIRONMENT TEST CONDITION**

| No. | Test Item                                | Condition   |
|-----|--|---|
| 1   | High temperature storage test            | Ta= 50°C 240h   |
| 2   | Low temperature storage test             | Ta= -20°C 240h  |
| 3   | High temperature operation test          | Ta= 40°C 50%RH 240h   |
| 4   | Low temperature operation test           | Ta= 0°C 240h  |
| 5   | Vibration test<br>(non-operating)        | Wave form : random<br>Vibration level : 1.0G RMS<br>Bandwidth : 10-300Hz<br>Duration : 30 min for X,Y,Z axis<br>One time each direction |
| 6   | Shock test<br>(non-operating)            | Shock level :50G(X,Y axis) , 35G(Z axis)<br>Waveform : half sine wave, 11ms<br>Direction : ± X, ± Y, ± Z<br>One time each direction     |
| 7   | Humidity condition Operation             | Ta= 40 °C, 90%RH  |
| 8   | Altitude operating<br>storage / shipment | 0 - 14,000 feet(4267.2m)<br>0 - 40,000 feet(12192m)   |



## 7. International Standards

### 7-1. Safety

- a) UL 60950-1:2003, First Edition, Underwriters Laboratories, Inc., Standard for Safety of Information Technology Equipment.
- b) CAN/CSA C22.2, No. 60950-1-03 1<sup>st</sup> Ed. April 1, 2003, Canadian Standards Association, Standard for Safety of Information Technology Equipment.
- c) EN 60950-1:2001, First Edition, European Committee for Electrotechnical Standardization(CENELEC) European Standard for Safety of Information Technology Equipment.

### 7-2. EMC

- a) ANSI C63.4 "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electrical Equipment in the Range of 9kHz to 40GHz. "American National Standards Institute(ANSI), 1992
- b) C.I.S.P.R. "Limits and Methods of Measurement of Radio Interface Characteristics of Information Technology Equipment." International Special Committee on Radio Interference.
- c) EN 55022 "Limits and Methods of Measurement of Radio Interface Characteristics of Information Technology Equipment." European Committee for Electrotechnical Standardization.(CENELEC), 1998 ( Including A1: 2000 )

Product Specification

## 8. Packing

### 8-1. Designation of Lot Mark

a) Lot Mark

|   |   |   |   |   |   |   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | B | C | D | E | F | G | H | I | J | K | L | M |
|---|---|---|---|---|---|---|---|---|---|---|---|---|

A,B,C : SIZE(INCH)

E : MONTH

G : ASSEMBLY CODE

D : YEAR

F : FACTORY CODE

H, I, J, K, L, M : SERIAL NO.

Note

1. YEAR

|      |      |      |      |      |      |      |      |      |      |      |
|------|------|------|------|------|------|------|------|------|------|------|
| Year | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 |
| Mark | 1    | 2    | 3    | 4    | 5    | 6    | 7    | 8    | 9    | 0    |

2. MONTH

|       |     |     |     |     |     |     |     |     |     |     |     |     |
|-------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Month | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
| Mark  | 1   | 2   | 3   | 4   | 5   | 6   | 7   | 8   | 9   | A   | B   | C   |

3. FACTORY CODE

|              |          |             |         |
|--------------|----------|-------------|---------|
| Factory Code | LPL Gumi | LPL Nanjing | HEESUNG |
| Mark         | K        | C           | D       |

4. SERIAL NO.

|      |   |
|------|---|
| Mark | 100001~199999, 200001~299999, 300001~399999, ....., A00001~A99999, ....., Z00001~Z99999 |
|------|---|

b) Location of Lot Mark

Serial No. is printed on the label. The label is attached to the backside of the LCD module.  
This is subject to change without prior notice.

### 8-2. Packing Form

a) Package quantity in one pallet : 10 pcs

b) Pallet Size : 1220mm X 1140mm X 860mm

## 9. Precautions

Please pay attention to the followings when you use this TFT LCD module.

### 9-1. Mounting Precautions

- (1) You must mount a module using holes arranged in four corners or four sides.
- (2) You should consider the mounting structure so that uneven force (ex. Twisted stress) is not applied to the module. And the case on which a module is mounted should have sufficient strength so that external force is not transmitted directly to the module.
- (3) Please attach the surface transparent protective plate to the surface in order to protect the polarizer. Transparent protective plate should have sufficient strength in order to resist external force.
- (4) You should adopt radiation structure to satisfy the temperature specification.
- (5) Acetic acid type and chlorine type materials for the cover case are not desirable because the former generates corrosive gas of attacking the polarizer at high temperature and the latter causes circuit break by electro-chemical reaction.
- (6) Do not touch, push or rub the exposed polarizers with glass, tweezers or anything harder than HB pencil lead. And please do not rub with dust clothes with chemical treatment. Do not touch the surface of polarizer for bare hand or greasy cloth.(Some cosmetics are detrimental to the polarizer.)
- (7) When the surface becomes dusty, please wipe gently with absorbent cotton or other soft materials like chamois soaks with petroleum benzene. Normal-hexane is recommended for cleaning the adhesives used to attach front / rear polarizers. Do not use acetone, toluene and alcohol because they cause chemical damage to the polarizer.
- (8) Wipe off saliva or water drops as soon as possible. Their long time contact with polarizer causes deformations and color fading.
- (9) Do not open the case because inside circuits do not have sufficient strength.

### 9-2. Operating Precautions

- (1) The spike noise causes the mis-operation of circuits. It should be lower than following voltage :  
 $V = \pm 200\text{mV}$ (Over and under shoot voltage)
- (2) Response time depends on the temperature.(In lower temperature, it becomes longer.)
- (3) Brightness depends on the temperature. (In lower temperature, it becomes lower.)  
And in lower temperature, response time(required time that brightness is stable after turned on) becomes longer.
- (4) Be careful for condensation at sudden temperature change. Condensation makes damage to polarizer or electrical contacted parts. And after fading condensation, smear or spot will occur.
- (5) When fixed patterns are displayed for a long time, remnant image is likely to occur.
- (6) Module has high frequency circuits. Sufficient suppression to the electromagnetic interference shall be done by system manufacturers. Grounding and shielding methods may be important to minimized the interference.
- (7) Please do not give any mechanical and/or acoustical impact to LCM. Otherwise, LCM can't be operated its full characteristics perfectly.
- (8) A screw which is fastened up the steels should be a machine screw.  
(if not, it causes metallic foreign material and deal LCM a fatal blow)
- (9) Please do not set LCD on its edge.

### 9-3. Electrostatic Discharge Control

Since a module is composed of electronic circuits, it is not strong to electrostatic discharge. Make certain that treatment persons are connected to ground through wrist band etc. And don't touch interface pin directly.

### 9-4. Precautions for Strong Light Exposure

Strong light exposure causes degradation of polarizer and color filter.

### 9-5. Storage

When storing modules as spares for a long time, the following precautions are necessary.

- (1) Store them in a dark place. Do not expose the module to sunlight or fluorescent light. Keep the temperature between 5°C and 35°C at normal humidity.
- (2) The polarizer surface should not come in contact with any other object.  
It is recommended that they be stored in the container in which they were shipped.

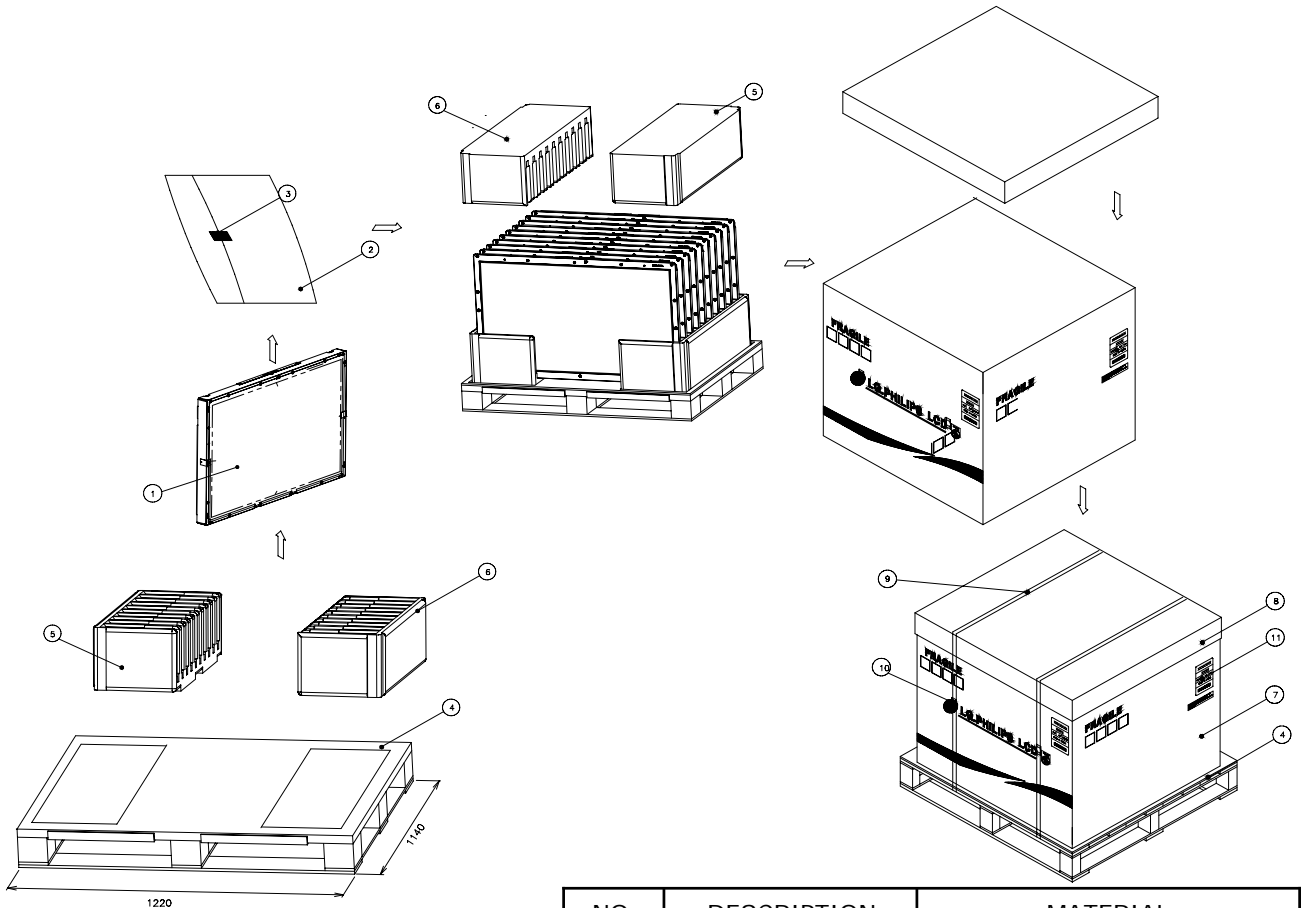
### 9-6. Handling Precautions for Protection Film

- (1) The protection film is attached to the bezel with a small masking tape.  
When the protection film is peeled off, static electricity is generated between the film and polarizer.  
This should be peeled off slowly and carefully by people who are electrically grounded and with well ion-blown equipment or in such a condition, etc.
- (2) When the module with protection film attached is stored for a long time, sometimes there remains a very small amount of glue still on the bezel after the protection film is peeled off.
- (3) You can remove the glue easily. When the glue remains on the bezel surface or its vestige is recognized, please wipe them off with absorbent cotton waste or other soft material like chamois soaked with normal-hexane.

Product Specification

# APPENDIX-

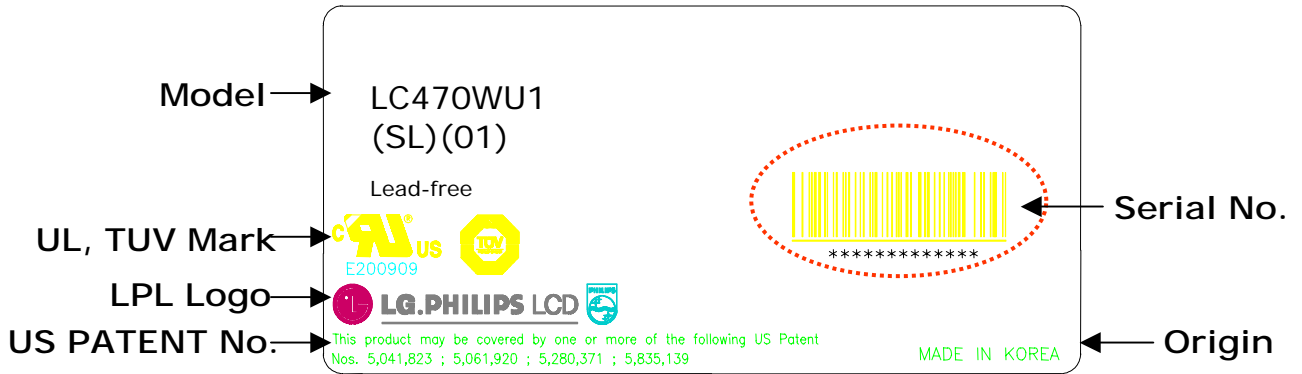
LC470WU1-SL01 Pallet Ass'y



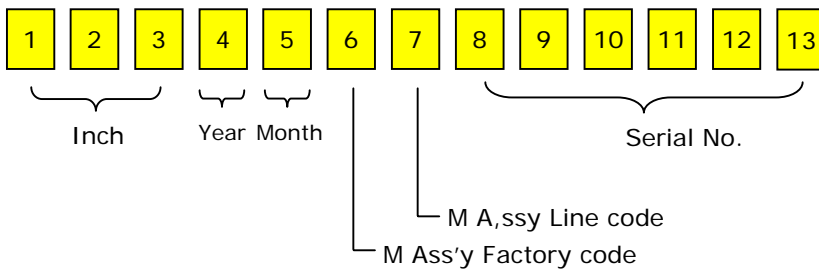
| NO. | DESCRIPTION   | MATERIAL               |
|-----|---------------|------------------------|
| 1   | LCD Module    |                        |
| 2   | BAG           | 47INCH                 |
| 3   | TAPE          | MASKING 20MM X 50M     |
| 4   | PALLET        | PAPER 1220X1140X138MM  |
| 5   | PACKING       | EPS                    |
| 6   | PACKING       | EPS                    |
| 7   | ANGLE PACKING | PAPER                  |
| 8   | ANGLE COVER   | PAPER                  |
| 9   | BAND,CLIP     | STEEL                  |
| 10  | BAND          | PP                     |
| 11  | LABEL         | YUPO PAPER 80G 100X100 |

# APPENDIX-

LCM Label




Serial No. (See CAS 25page for more information)



# APPENDIX-

Pallet Label

|   |           |
|---|-----------|
| <h1>LC470WU1</h1>   |           |
| <h2>SL01</h2>   |           |
| 10 PCS  | 001/01-01 |
| REMARK  |           |
| MADE IN KOREA   | Lead-free |
| <br>***** ** |           |