

Product Specification

# SPECIFICATION FOR APPROVAL

(    ) Preliminary Specification  
( ◆ ) Final Specification

|       |                      |
|-------|----------------------|
| Title | 15.4" WSXGA+ TFT LCD |
|-------|----------------------|

|       |         |
|-------|---------|
| BUYER | General |
| MODEL |         |

|          |                          |
|----------|--------------------------|
| SUPPLIER | LG.Philips LCD CO., Ltd. |
| *MODEL   | LP154W02                 |
| SUFFIX   | TL06                     |

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

| SIGNATURE     | DATE  |
|---------------|-------|
| _____ / _____ | _____ |
| _____ / _____ | _____ |
| _____ / _____ | _____ |

Please return 1 copy for your confirmation with your signature and comments.

| APPROVED BY                 | DATE  |
|-----------------------------|-------|
| _____ J. H. Lee / S.Manager | _____ |
| <b>REVIEWED BY</b>          |       |
| _____ K.K. Jang / Manager   | _____ |
| <b>PREPARED BY</b>          |       |
| _____ J.Y. Park /Engineer   | _____ |

**Product Engineering Dept.**  
**LG. Philips LCD Co., Ltd**

**Product Specification**

| <b>NO.</b> | <b>ITEM</b>                  | <b>Page</b> |
|------------|------------------------------|-------------|
| -          | COVER                        | 1           |
| -          | CONTENTS                     | 2           |
| -          | RECORD OF REVISIONS          | 3           |
| 1          | GENERAL DESCRIPTION          | 4           |
| 2          | ABSOLUTE MAXIMUM RATINGS     | 5           |
| 3          | ELECTRICAL SPECIFICATIONS    |             |
| 3-1        | ELECTRICAL CHARACTERISTICS   | 6           |
| 3-2        | INTERFACE CONNECTIONS        | 8           |
| 3-3        | SIGNAL TIMING SPECIFICATIONS | 10          |
| 3-4        | SIGNAL TIMING WAVEFORMS      | 11          |
| 3-5        | COLOR INPUT DATA REFERENCE   | 12          |
| 3-6        | POWER SEQUENCE               | 13          |
| 4          | OPTICAL SPECIFICATIONS       | 14          |
| 5          | MECHANICAL CHARACTERISTICS   | 18          |
| 6          | RELIABILITY                  | 22          |
| 7          | INTERNATIONAL STANDARDS      |             |
| 7-1        | SAFETY                       | 23          |
| 7-2        | EMC                          | 23          |
| 8          | PACKING                      |             |
| 8-1        | DESIGNATION OF LOT MARK      | 24          |
| 8-2        | PACKING FORM                 | 24          |
| 8-3        | LABEL INFORMATION            | 25          |
| 9          | PRECAUTIONS                  | 26          |

| Product Specification |  |
|-----------------------|--|
|-----------------------|--|

### RECORDS OF REVISIONS

[illegible]

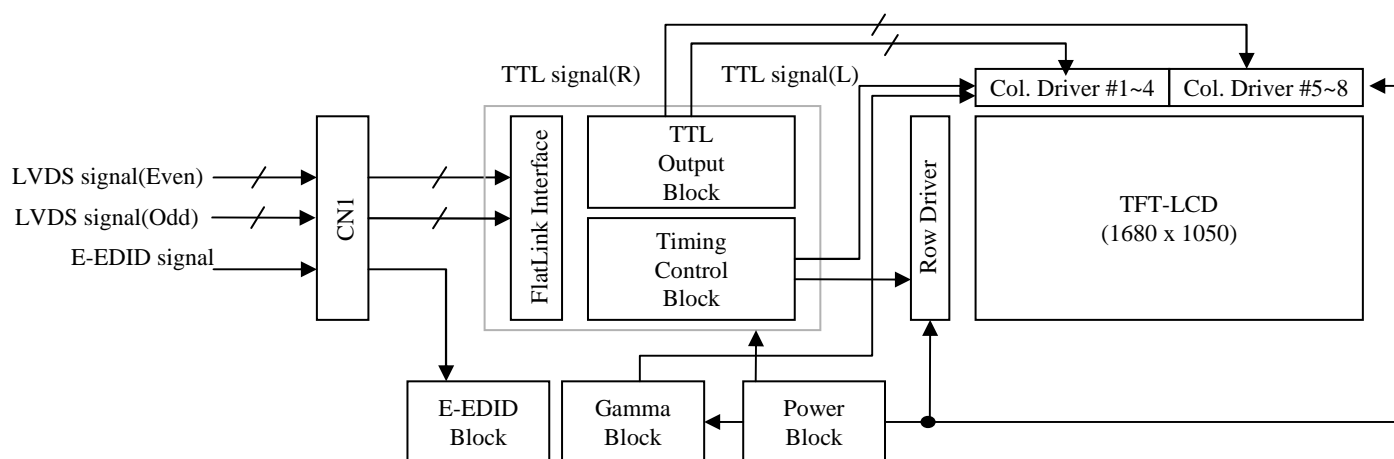
## Product Specification

### 1. General Description

The LP154W02(TL06) 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 type display operating in the normally white mode. This TFT-LCD has 15.4 inches diagonally measured active display area with WSXGA+ resolution(1680 vertical by 1050 horizontal pixel array) Each pixel is divided into Red, Green and Blue sub-pixels or dots which are arranged in vertical stripes. Gray scale or the brightness of the sub-pixel color is determined with a 6-bit gray scale signal for each dot, thus, presenting a palette of more than 262,144 colors.

The LP154W02(TL06) has been designed to apply the interface method that enables low power, high speed, low EMI. Flat Link must be used as a LVDS(Low Voltage Differential Signaling) chip.

The LP154W02(TL06) is intended to support applications where thin thickness, low power are critical factors and graphic display are important. In combination with the vertical arrangement of the sub-pixels, the LP154W02(TL06) characteristics provide an excellent flat display for office automation products such as Notebook PC.



### General Features

|                        |   |
|------------------------|---|
| Active screen size     | 15.4 inches diagonal  |
| Outline Dimension      | 344.0(H)[typ.] x 222.0(V)[typ.] x 6.5(D) mm[Max.]   |
| Pixel Pitch            | 0.19725 mm x 0.19725mm  |
| Pixel format           | 1680 horiz. By 1050 vert. Pixels RGB stripes arrangement  |
| Color depth            | 6-bit, 262,144 colors   |
| Luminance, white       | 200nit(Center 1point)   |
| Power Consumption      | 5.92W (Typ.)  |
| Weight                 | 550g (Typ), 565(Max)  |
| Display operating mode | Transmissive mode, normally white   |
| Surface treatments     | Hard coating 2H, Anti-glare, Anti-reflection, Anti-electrostatic treatment of the front polarizer (Nitto Denko AG ARC 150T) |
| RoHS Comply panel      | Yes   |

## Product Specification

### 2. Absolute Maximum Ratings

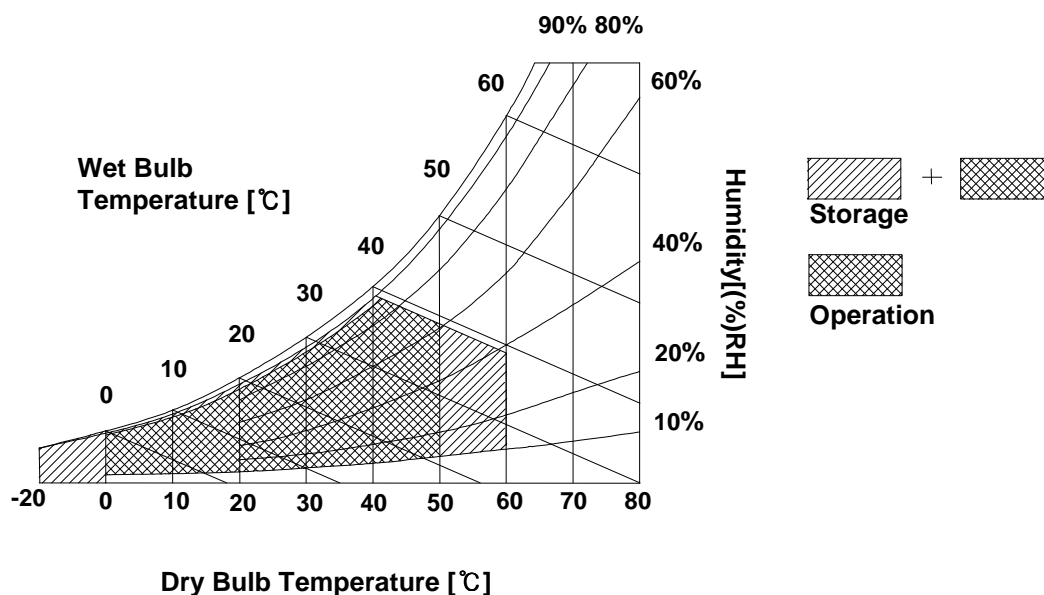
The following are maximum values which, if exceeded, may cause operation or damage to the unit.

**Table 1. ABSOLUTE MAXIMUM RATINGS**

| Parameter                  | symbol   | Values |      | Units              | Notes                         |
|----------------------------|----------|--------|------|--------------------|-------------------------------|
|                            |          | Min.   | Max. |                    |                               |
| Power Input Voltage        | $V_{CC}$ | -0.3   | 4.0  | Vdc                | At $25 \pm 5^{\circ}\text{C}$ |
| Operating Temperature      | $T_{OP}$ | 0      | 50   | $^{\circ}\text{C}$ | 1                             |
| Storage Temperature        | $T_{ST}$ | -20    | 60   | $^{\circ}\text{C}$ | 1                             |
| Operating Ambient Humidity | $H_{OP}$ | 10     | 90   | %RH                | 1                             |
| Storage Humidity           | $H_{ST}$ | 10     | 90   | %RH                | 1                             |

Note : 1. Temperature and relative humidity range are shown in the figure below.

Wet bulb temperature should be  $39^{\circ}\text{C}$  Max, and no condensation of water.



## Product Specification

### 3. Electrical Specifications

#### 3-1. Electrical Characteristics

The LP154W02(TL06) requires two power inputs. One is employed to power the LCD electronics and to drive the TFT array and liquid crystal. The second input which powers the CCFL, is typically generated by an inverter. The inverter is an external unit to the LCD.

**Table 2. ELECTRICAL CHARACTERISTICS**

| Parameter                    | Symbol          | Values |      |      | Units            | Notes |
|------------------------------|-----------------|--------|------|------|------------------|-------|
|                              |                 | Min.   | Typ. | Max. |                  |       |
| MODULE                       |                 |        |      |      |                  |       |
| Power Supply Input Voltage   | V <sub>CC</sub> | 3.0    | 3.3  | 3.6  | V <sub>dc</sub>  |       |
| Power Supply Input Current   | I <sub>CC</sub> | -      | 530  | 610  | mA               | 1     |
| Differential Impedance       | Z <sub>m</sub>  | 90     | 100  | 110  | ohm              | 2     |
| Power Consumption            | P <sub>C</sub>  |        | 1.75 | 2.01 | Watts            | 1     |
| LAMP                         |                 |        |      |      |                  |       |
| Operating Voltage            | V <sub>BL</sub> | 680    | 695  | 835  | V <sub>RMS</sub> | 3     |
| Operating Current            | I <sub>BL</sub> | 3.0    | 6.0  | 6.5  | mA               |       |
| Established Starting Voltage | V <sub>S</sub>  |        |      |      |                  | 4     |
| at 25 °C                     |                 | -      | -    | 1170 | V <sub>RMS</sub> |       |
| at 0 °C                      |                 | -      | -    | 1400 | V <sub>RMS</sub> |       |
| Operating Frequency          | f <sub>BL</sub> | 40     | 60   | 80   | kHz              | 5     |
| Discharge Stabilization Time | T <sub>S</sub>  |        |      | 3    | Minutes          | 6     |
| Power Consumption            | P <sub>BL</sub> | -      | 4.17 | 4.42 | Watts            | 7     |
| Life Time                    |                 | 12,000 | -    | -    | Hrs              | 8     |

**Note : The design of the inverter must have specification for the lamp in LCD Assembly.**

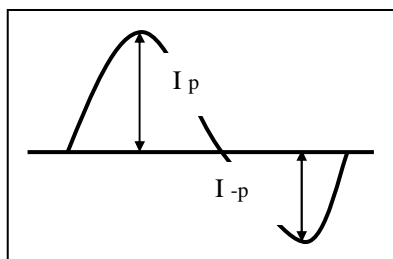
The performance of the Lamp in LCM, for example life time or brightness, is extremely influenced by the characteristics of the DC-AC inverter. So all the parameters of an inverter should be carefully designed so as not to produce too much leakage current from high-voltage output of the inverter.

When you design or order the inverter, please make sure unwanted lighting caused by the mismatch of the lamp and the inverter(no lighting, flicker, etc) never occurs. When you confirm it, the LCD Assembly should be operated in the same condition as installed in you instrument.

1. The specified typical current and power consumption are under the  $V_{CC}=3.3V$ ,  $25^{\circ}C$ ,  $f_v=60Hz$  condition whereas window XP Bliss pattern is displayed and  $f_v$  is the frame frequency.
2. This impedance value is needed to proper display and measured from LVDS  $T_x$  to the mating connector.
3. The variance of the voltage is  $\pm 10\%$ .
4. The voltage above  $V_S$  should be applied to the lamps for more than 1 second for start-up. Otherwise, the lamps may not be turned on.

## Product Specification

5. The output of the inverter must have symmetrical(negative and positive) voltage waveform and symmetrical current waveform.(Asymmetrical ratio is less than 10%) Please do not use the inverter which has asymmetrical voltage and asymmetrical current and spike wave.  
Lamp frequency may produce interface with horizontal synchronous frequency and as a result this may cause beat on the display. Therefore lamp frequency shall be as away possible from the horizontal synchronous frequency and from its harmonics in order to prevent interference.
  6. It is defined the brightness of the lamp after being lighted for 5 minutes as 100%.  
 $T_s$  is the time required for the brightness of the center of the lamp to be not less than 95%.
  7. The lamp power consumption shown above does not include loss of external inverter.  
The used lamp current is the lamp typical current.
  8. The life is determined as the time at which brightness of the lamp is 50% compared to that of initial value at the typical lamp current on condition of continuous operating at  $25 \pm 2^\circ\text{C}$ .
  9. Do not attach a conducting tape to lamp connecting wire.  
If the lamp wire attach to a conducting tape, TFT-LCD Module has a low luminance and the inverter has abnormal action. Because leakage current is occurred between lamp wire and conducting tape.
  10. Requirements for a system inverter design, which is intended to have a better display performance, a better power efficiency and a more reliable lamp, are following.  
It shall help increase the lamp lifetime and reduce leakage current.
    - a. The asymmetry rate of the inverter waveform should be less than 10%.
    - b. The distortion rate of the waveform should be within  $\sqrt{2} \pm 10\%$ .
- \* Inverter output waveform had better be more similar to ideal sine wave.



\* Asymmetry rate:

$$|I_p - I_{-p}| / I_{rms} * 100\%$$

\* Distortion rate

$$I_p \text{ (or } I_{-p}) / I_{rms}$$

**Product Specification**

### 3-2. Interface Connections

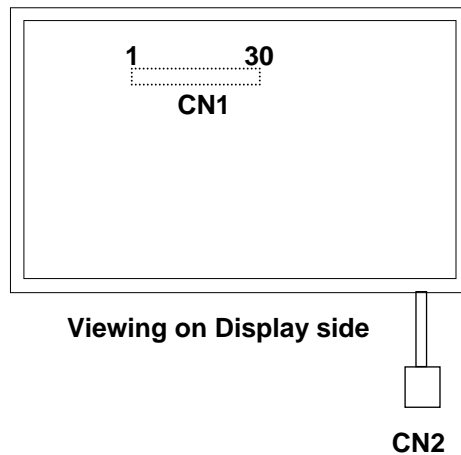
Interface chip must be used FlatLink, part No. THC63LVDF823A(Transmitter made by Thine Inc or equivalence.)

This LCD employs two interface connections, a 30-pin-connector is used for the module electronics and the other connector is used for the integral backlight system.

The electronics interface connector is a model FI-XB30SR-HF11 manufactured by JAE.

The pin configuration for the connector is shown in the table below.

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

| Pin | Symbol    | Description         | Notes   |
|-----|-----------|---------------------|---|
| 1   | GND       | Ground              | <p>1. Interface chips<br/> 1.1 LCD : KZ4E053G11(LCD Controller) including LVDS Receiver<br/> 1.2 System : THC63LVD823 or equivalent<br/> *Pin to Pin compatible with TI LVDS</p> <p>2. Connector<br/> 2.1 LCD : FI-XB30SR-HF11,JAE<br/> 2.2 Mating : FI-X30M or equivalent.<br/> 2.3 Connector pin arrangement</p> <div data-bbox="853 1115 1316 1568">  </div> |
| 2   | Vcc       | Power(3.3V)         |   |
| 3   | Vcc       | Power(3.3V)         |   |
| 4   | VEDID     | DDC 3.3V Power      |   |
| 5   | NC        | No connect          |   |
| 6   | CLKEDID   | DDC clock           |   |
| 7   | DATAEDID  | DDC data            |   |
| 8   | Odd_A1M   | Differential Signal |   |
| 9   | Odd_A1P   | Differential Signal |   |
| 10  | GND       | Ground              |   |
| 11  | Odd_A2M   | Differential Signal |   |
| 12  | Odd_A2P   | Differential Signal |   |
| 13  | GND       | Ground              |   |
| 14  | Odd_A3M   | Differential Signal |   |
| 15  | Odd_A3P   | Differential Signal |   |
| 16  | GND       | Ground              |   |
| 17  | Odd_CLKM  | Differential Signal |   |
| 18  | Odd_CLKP  | Differential Signal |   |
| 19  | GND       | Ground              |   |
| 20  | Even_A1M  | Differential Signal |   |
| 21  | Even_A1P  | Differential Signal |   |
| 22  | GND       | Ground              |   |
| 23  | Even_A2M  | Differential Signal |   |
| 24  | Even_A2P  | Differential Signal |   |
| 25  | GND       | Ground              |   |
| 26  | Even_A3M  | Differential Signal |   |
| 27  | Even_A3P  | Differential Signal |   |
| 28  | GND       | Ground              |   |
| 29  | Even_CLKM | Differential Signal |   |
| 30  | Even_CLKP | Differential Signal |   |



## Product Specification

The backlight interface connector is a model BHSR-02VS-1, manufactured by JST or equivalent.

The mating connector part number is SM02B-BHSS-1 or equivalent.

The pin configuration for the connector is shown in the table below.

**Table 4. BACKLIGHT CONNECTOR PIN CONFIGURATION**

| Pin | Symbol | Description                                  | Notes |
|-----|--------|--|-------|
| 1   | HV     | Power supply for lamp<br>(High voltage side) | 1     |
| 2   | LV     | Power supply for lamp<br>(Low voltage side)  | 1     |

Notes : 1. The high voltage side terminal is colored White. The low voltage side terminal is Yellow.

Product Specification

### 3-3. Signal Timing Specifications

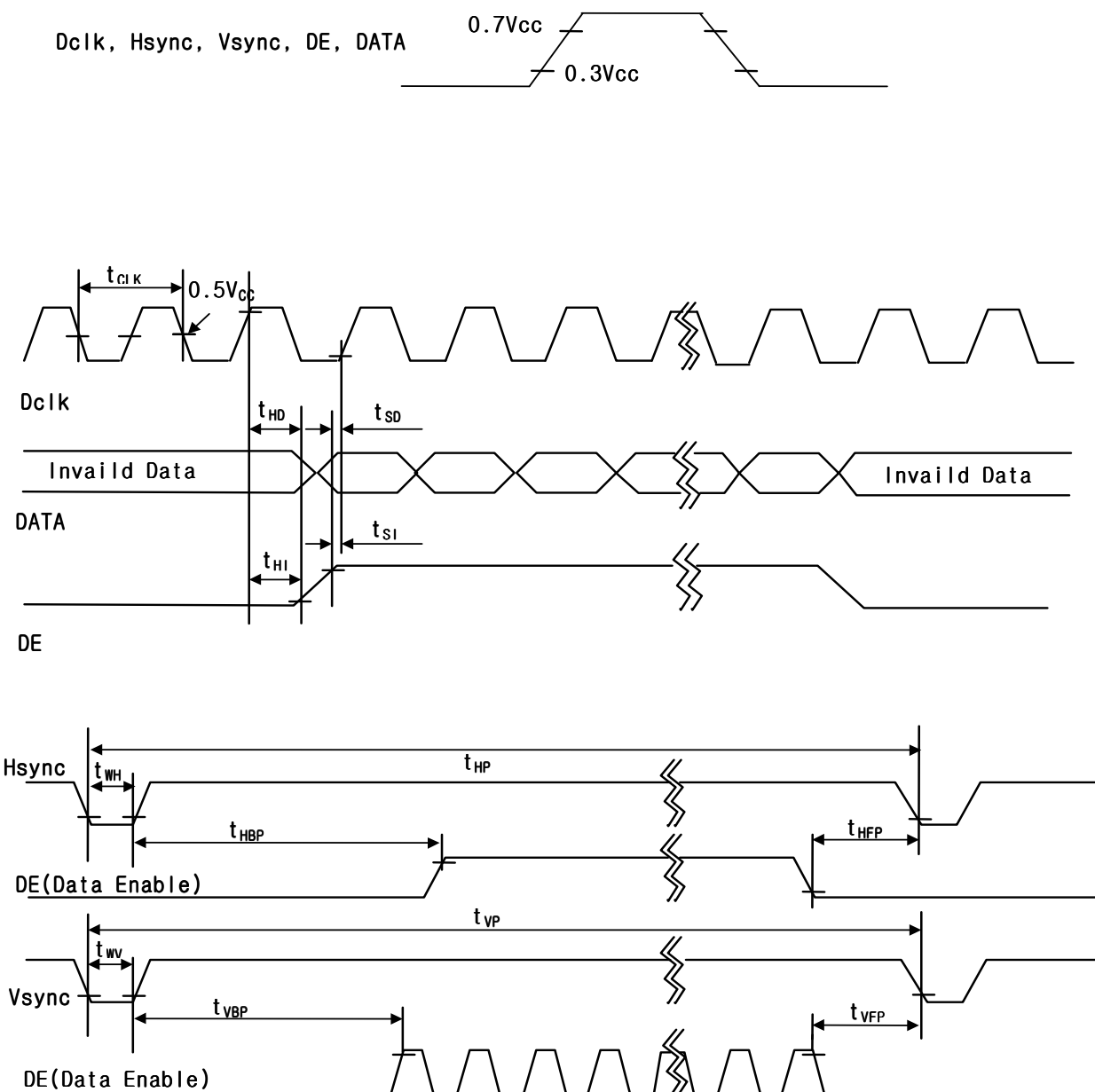
This is the signal timing required at the input of the LVDS Transmitter. All of the interface signal timing should be satisfied with the following specifications for its proper operation.

Table 6. Timing Table

| ITEM          |                        | SYMBOL    | MIN    | TYP. | MAX.   | UNIT      | NOTES                    |
|---------------|------------------------|-----------|--------|------|--------|-----------|--------------------------|
| Dclk          | Frequency              | $f_{CLK}$ | 55     | 61   | 67     | MHz       |                          |
|               | Width-Low              | $t_{WCL}$ | 3      | -    | -      | ns        |                          |
|               | Width-High             | $t_{WCH}$ | 3      | -    | -      | ns        |                          |
|               | Duty                   | D         | 0.4    | 0.5  | 0.6    |           | $D = t_{CLKH} / t_{CLK}$ |
| Hsync         | Period                 | $t_{HP}$  | 864    | 952  | 1288   | $t_{CLK}$ |                          |
|               | Width                  | $t_{WH}$  | 8      | -    | -      | $t_{CLK}$ |                          |
| Vsync         | Period                 | $t_{VP}$  | 1057   | 1066 | 1082   | $t_{HP}$  |                          |
|               | Width active           | $t_{WV}$  | 1      | -    | -      | $t_{HP}$  |                          |
| DE            | Set up Time            | $t_{SI}$  | 3      | -    | -      | ns        | For Dclk                 |
|               | Hold Time              | $t_{HI}$  | 3      | -    | -      |           |                          |
|               | Horizontal Back Porch  | $t_{HBP}$ | 8      | -    | -      | $t_{CLK}$ |                          |
|               | Horizontal Front Porch | $t_{HFP}$ | 8      | -    | -      |           |                          |
|               | Vertical Back Porch    | $t_{VBP}$ | 5      | -    | -      | $t_{HP}$  |                          |
|               | Vertical Front Porch   | $t_{VFP}$ | 1      | -    | -      |           |                          |
| DATA          | Set up Time            | $t_{SD}$  | 3      | -    | -      | ns        | For Dclk                 |
|               | Hold Time              | $t_{HD}$  | 3      | -    | -      |           |                          |
| Input Voltage | High                   | $t_{IH}$  | 0.7Vcc |      |        |           |                          |
|               | Low                    | $t_{IL}$  |        |      | 0.3Vcc |           |                          |

Product Specification

### 3-4. Signal Timing Waveforms



**Product Specification**
**3-5. Color Input Data Reference**

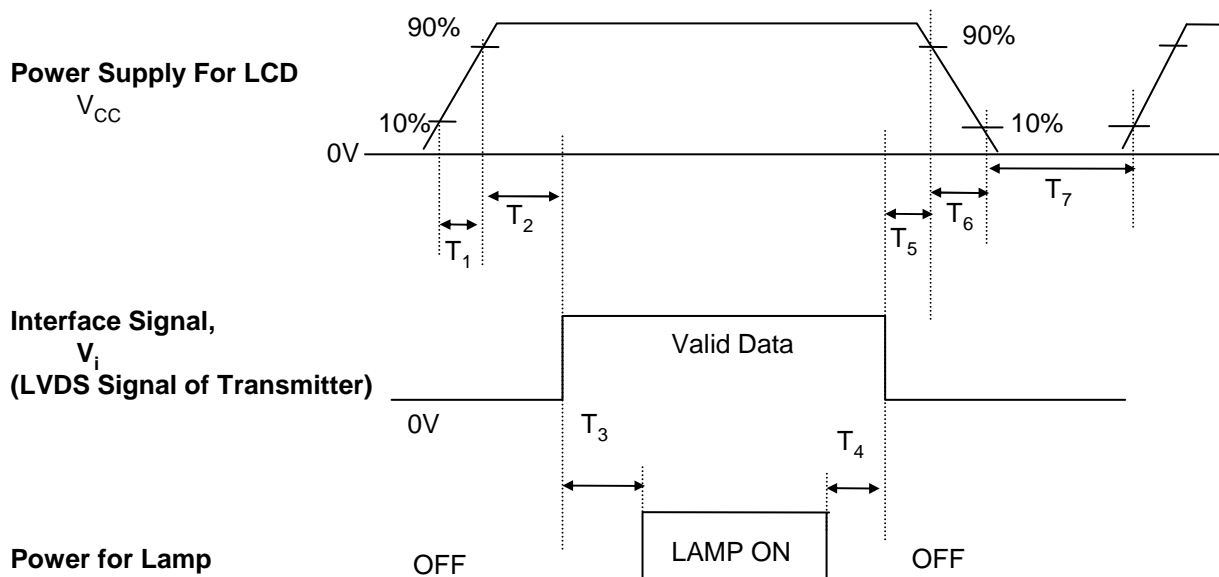
The brightness of each primary color(red,green and blue) is based on the 6-bit gray scale data input for the color ; the higher the binary input, the brighter the color. The table below provides a reference for color versus data input.

**Table 7. COLOR DATA REFERENCE**

| Color        |                 | Input Color Data |    |    |     |    |    |       |    |    |     |    |    |      |    |    |     |    |    |
|--------------|-----------------|------------------|----|----|-----|----|----|-------|----|----|-----|----|----|------|----|----|-----|----|----|
|              |                 | Red              |    |    |     |    |    | Green |    |    |     |    |    | Blue |    |    |     |    |    |
|              |                 | MSB              |    |    | LSB |    |    | MSB   |    |    | LSB |    |    | MSB  |    |    | LSB |    |    |
|              |                 | 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) Dark    | 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  |
|              | :               | :                | :  | :  | :   | :  | :  | :     | :  | :  | :   | :  | :  | :    | :  | :  | :   | :  | :  |
|              | 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) Bright  | 1                | 1  | 1  | 1   | 1  | 1  | 0     | 0  | 0  | 0   | 0  | 0  | 0    | 0  | 0  | 0   | 0  | 0  |
| Green        | Green(00)Dark   | 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  |
|              | :               | :                | :  | :  | :   | :  | :  | :     | :  | :  | :   | :  | :  | :    | :  | :  | :   | :  | :  |
|              | 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)Bright | 0                | 0  | 0  | 0   | 0  | 0  | 1     | 1  | 1  | 1   | 1  | 1  | 0    | 0  | 0  | 0   | 0  | 0  |
| Blue         | Blue(00) Dark   | 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  |
|              | :               | :                | :  | :  | :   | :  | :  | :     | :  | :  | :   | :  | :  | :    | :  | :  | :   | :  | :  |
|              | 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) Bright | 0                | 0  | 0  | 0   | 0  | 0  | 0     | 0  | 0  | 0   | 0  | 0  | 1    | 1  | 1  | 1   | 1  | 1  |

Product Specification

### 3-6. Power Sequence



| Parameter      | Values |      |      | Units |
|----------------|--------|------|------|-------|
|                | Min.   | Typ. | Max. |       |
| T <sub>1</sub> | -      | -    | 10   | ms    |
| T <sub>2</sub> | 0      | -    | 50   | ms    |
| T <sub>3</sub> | 200    | -    | -    | ms    |
| T <sub>4</sub> | 0      | -    | -    | ms    |
| T <sub>5</sub> | 0      | -    | 50   | ms    |
| T <sub>6</sub> | -      | -    | 10   | ms    |
| T <sub>7</sub> | 150    | -    | -    | ms    |

- Notes :**
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 for LCD  $V_{CC}$  to 0V.
  3. Lamp power must be turn on after power supply for LCD and interface signal are valid.

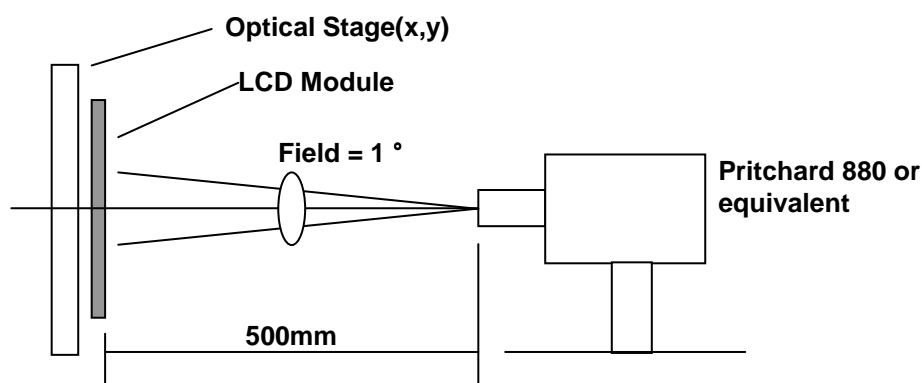
## Product Specification

### 4. Optical Specification

Optical characteristics are determined after the unit has been 'ON' and stable for approximately 30 minutes in a dark environment at 25 °C. The values specified are at an approximate distance 50cm from the LCD surface at a viewing angle of  $\Phi$  and  $\theta$  equal to 0 °.

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

**FIG. 1 Optical Characteristic Measurement Equipment and Method**



(Ta=25 °C, V<sub>CC</sub>=3.3V, f<sub>V</sub>=60Hz  
Dclk=60.9MHz, I<sub>BL</sub>=6.0mA)

**Table 8. OPTICAL CHARACTERISTICS**

| Parameter                         | Symbol                           | Values |       |       | Units             | Notes  |
|-----------------------------------|----------------------------------|--------|-------|-------|-------------------|--------|
|                                   |                                  | Min.   | Typ.  | Max.  |                   |        |
| Contrast Ratio                    | CR                               | 300    | 500   | -     |                   | 1      |
| Surface Luminance, white          | L <sub>WH</sub>                  | 170    | 200   |       | cd/m <sup>2</sup> | 2      |
| Luminance % uniformity            | $\delta_{\text{WHITE}}$          | 50     | 55    | -     | %                 | 3      |
| Response Time                     | Tr                               |        |       |       |                   | 4      |
| Rise Time + Decay Time            | Tr <sub>R</sub> +Tr <sub>D</sub> | -      | 25    | 40    | ms                |        |
| CIE Color Coordinates             |                                  |        |       |       |                   |        |
| Red                               | XR                               | 0.559  | 0.589 | 0.619 |                   | ±0.03  |
|                                   | YR                               | 0.315  | 0.345 | 0.375 |                   | ±0.03  |
| Green                             | XG                               | 0.297  | 0.327 | 0.357 |                   | ±0.03  |
|                                   | YG                               | 0.514  | 0.544 | 0.574 |                   | ±0.03  |
| Blue                              | XB                               | 0.127  | 0.157 | 0.187 |                   | ±0.03  |
|                                   | YB                               | 0.111  | 0.141 | 0.171 |                   | ±0.03  |
| White                             | XW                               | 0.285  | 0.313 | 0.341 |                   | ±0.028 |
|                                   | YW                               | 0.309  | 0.329 | 0.349 |                   | ±0.020 |
| Viewing Angle                     |                                  |        |       |       |                   |        |
| x axis, right( $\phi=0^\circ$ )   | $\theta_r$                       | 60     | 65    |       | degree            | 5      |
| x axis, left ( $\phi=180^\circ$ ) | $\theta_l$                       | 60     | 65    |       |                   |        |
| y axis, up ( $\phi=90^\circ$ )    | $\theta_u$                       | 40     | 50    |       |                   |        |
| y axis, down ( $\phi=270^\circ$ ) | $\theta_d$                       | 50     | 50    |       |                   |        |
| Gray Scale                        | -                                | -      | 2.2   | -     |                   | 6      |

## Product Specification

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

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

2. Surface luminance is the center point across the LCD surface 50cm from the surface with all pixels displaying white. For more information see FIG 2.

When  $I_{BL} = 6.0\text{mA}$ ,

3. Luminance % uniformity is measured for 13 point For more information see FIG 2.  
 $\delta \text{ WHITE} = (\text{Minimum}(\text{LN1}, \text{LN2}, \dots, \text{LN13}) \div \text{Maximum}(\text{LN1}, \text{LN2}, \dots, \text{LN13})) \times 100\%$

4. Response time is the time required for the display to transition from white to black(Rise Time,  $\text{Tr}_R$ ) and from black to white(Decay Time,  $\text{Tr}_D$ ). For additional information see FIG 3.

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 surface. For more information see FIG 4.

6. Gray scale specification

\*  $f_V = 60\text{Hz}$

| Gray Level | Luminance(%)<br>(Typ.) |
|------------|------------------------|
| L0         | 0.0                    |
| L7         | 1.0                    |
| L15        | 5.0                    |
| L23        | 12.0                   |
| L31        | 21.0                   |
| L39        | 35.0                   |
| L47        | 52.0                   |
| L55        | 74.0                   |
| L63        | 100                    |

Product Specification

FIG. 2 Luminance

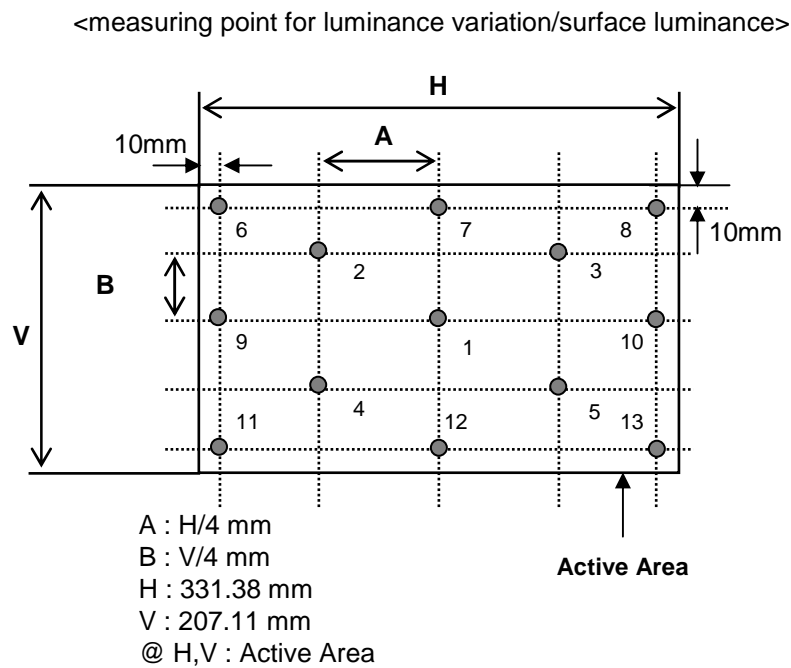
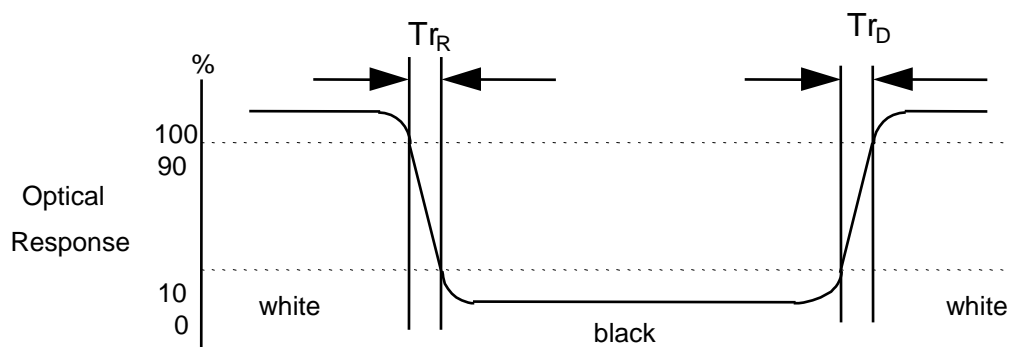


FIG. 3 Response Time

The response time is defined as the following figure and shall be measured by switching the input signal for "black" and "white".

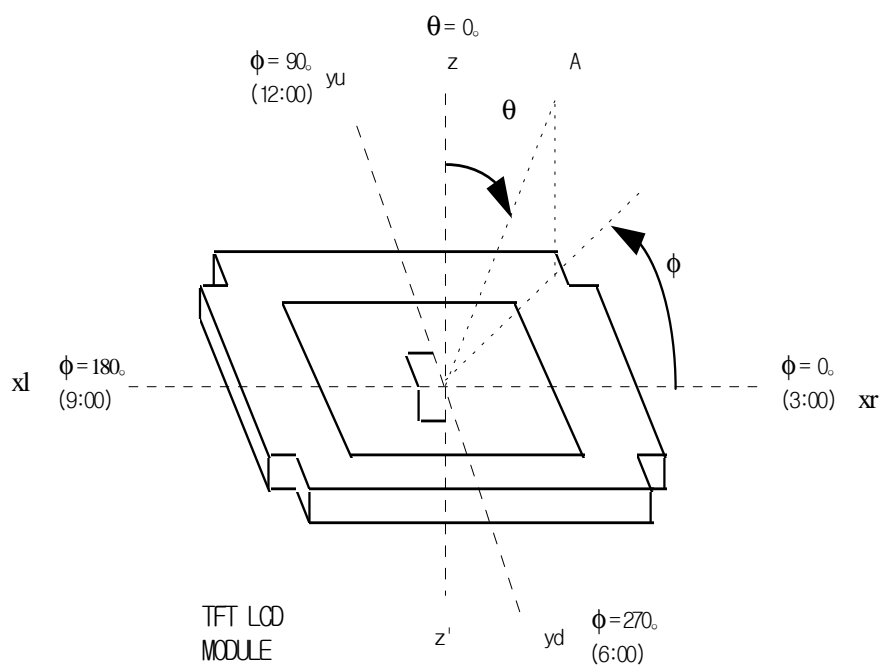




Product Specification

**FIG. 4 Viewing angle**

<dimension of viewing angle range>



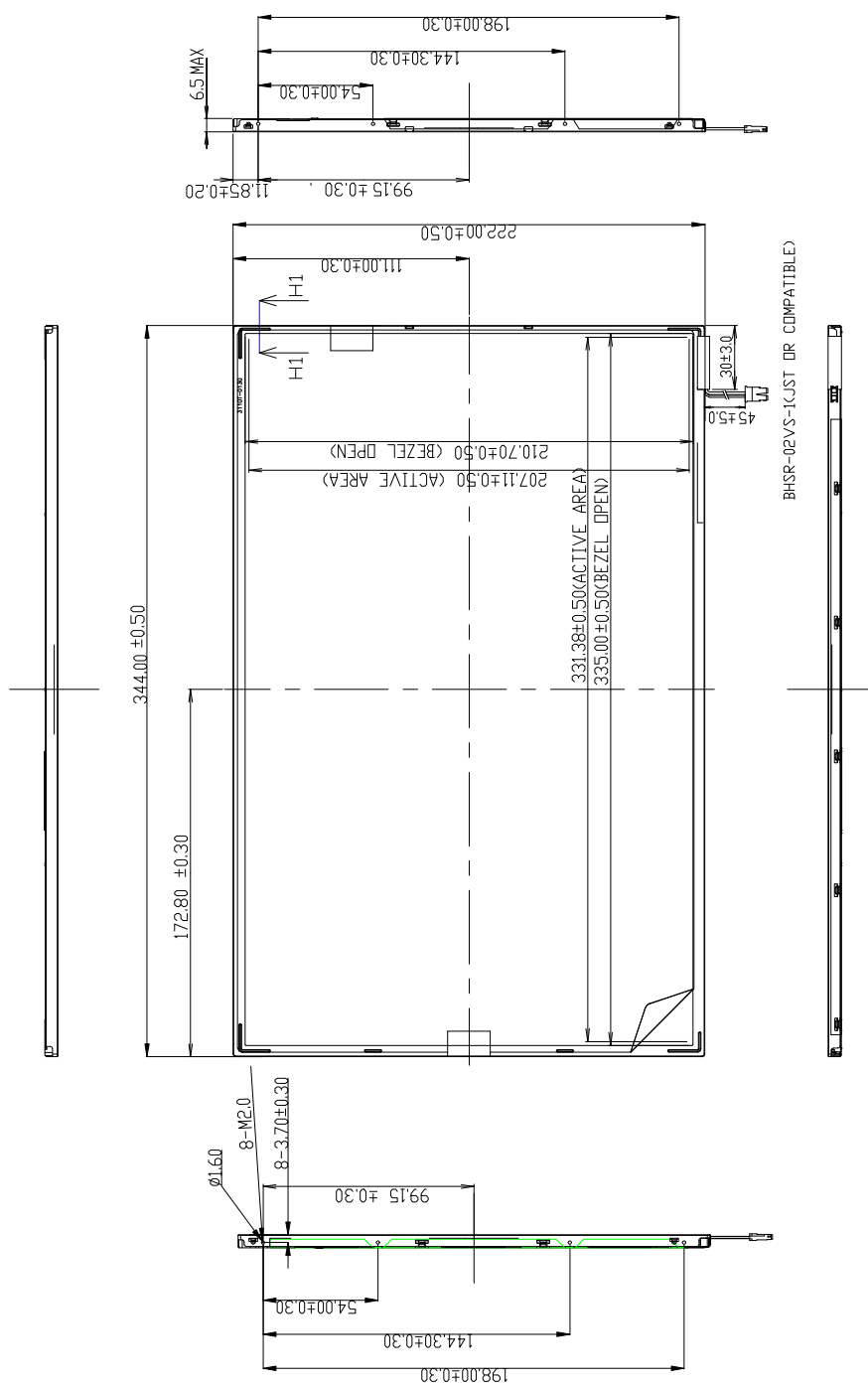
**Product Specification**

## 5. Mechanical Characteristics

The contents provide general mechanical characteristics for the model LP154W02(TL06). In addition the figures in the next page are detailed mechanical drawing of the LCD.

|                     |   |                        |
|---------------------|---|------------------------|
| Outside dimensions  | Horizontal  | 344.0 ± 0.5mm          |
|                     | Vertical  | 222.0 ± 0.5mm          |
|                     | Depth   | 6.2mm(Typ), 6.5mm(Max) |
| Bezel area          | Horizontal  | 335.0 ± 0.5mm          |
|                     | Vertical  | 210.7 ± 0.5mm          |
| Active display area | Horizontal  | 331.38mm               |
|                     | Vertical  | 207.11mm               |
| Weight(approximate) | 565g(Max)   |                        |
| Surface Treatment   | Hard coating 2H, Anti-glare, Anti-reflection,<br>Anti-electrostatic treatment of the front polarizer<br>(Nitto Denko AG ARC 150T) |                        |

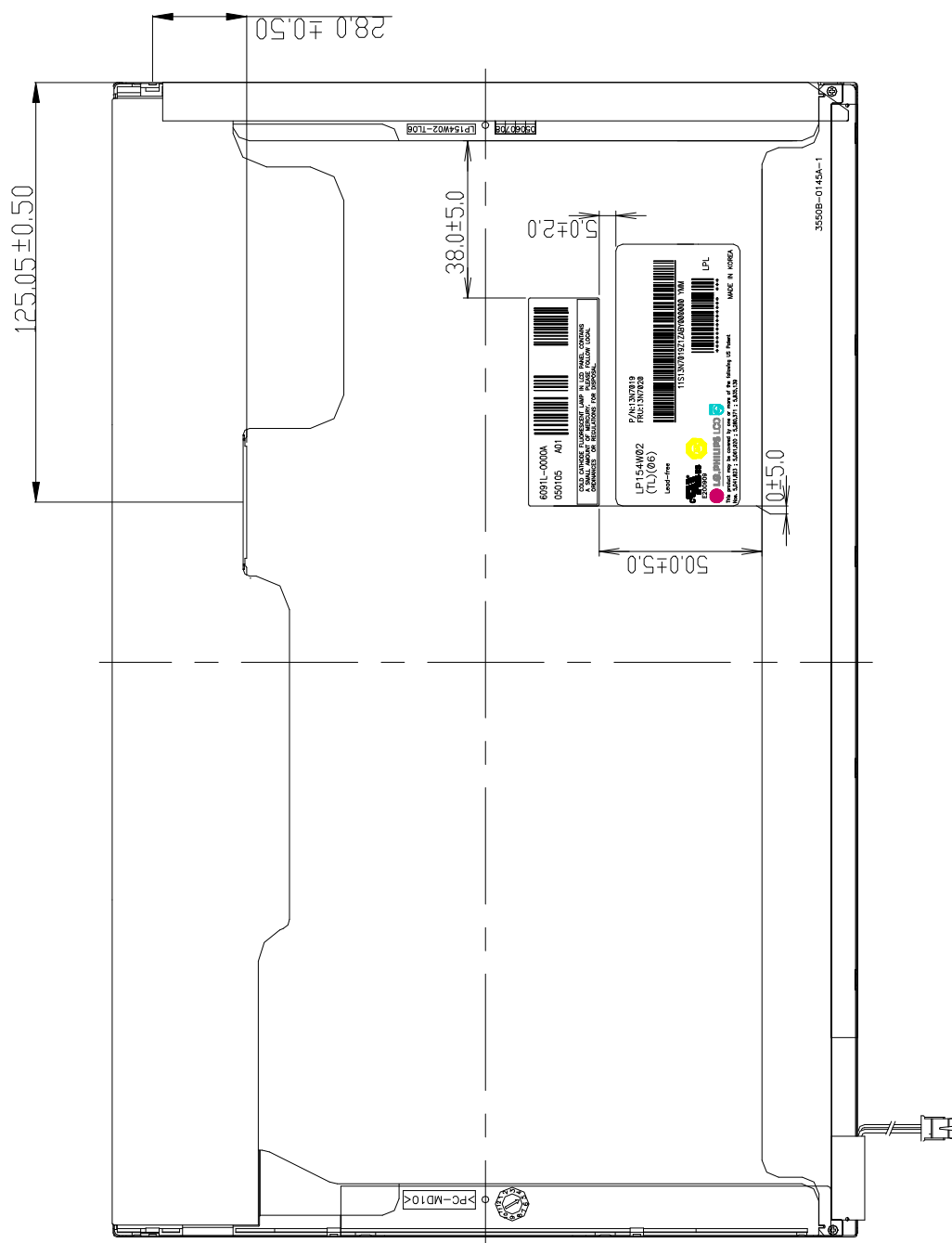
<FRONT VIEW>



Note. unspecified dimensional tolerance are  $\pm 0.5\text{mm}$

Product Specification

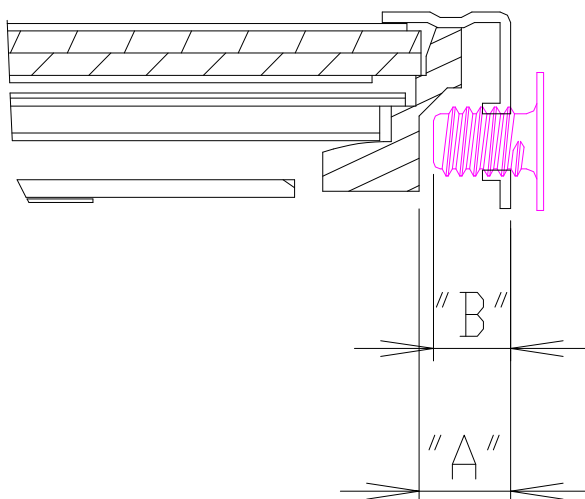
<REAR VIEW>



Note. unspecified dimensional tolerance are +/-0.5mm

**Product Specification**

<DETAIL DESCRIPTION OF SIDE MOUNTING SCREW>



SECTION H1-H1

- \*SCREW(8EA) TORQUE : 2.5kgf.cm max
- \*Screw Hole Depth ("A"): min 2.5mm
- \*Screw Length("B") : max 2.5, min2.3 (LPL CAN'T CONTROL THIS DIMENSION.)

Note. unspecified dimensional tolerance are +/-0.5mm

## Product Specification

### 6. Reliability

Environment test condition

| No. | Test Item                                   | Conditions  |
|-----|---|---|
| 1   | High temperature storage test               | Ta= 60°C, 240h  |
| 2   | Low temperature storage test                | Ta= -20°C, 240h   |
| 3   | High temperature operation test             | Ta= 50°C, 50%RH, 240h   |
| 4   | Low temperature operation test              | Ta= 0°C, 240h   |
| 5   | Vibration test (non-operating)              | Sine wave, 5 ~ 150Hz, 1.5G, 0.37oct/min<br>3 axis, 30min/axis   |
| 6   | Shock test (non-operating)                  | - No functional or cosmetic defects following a shock to all 6 sides delivering at least 180 G in a half sine pulse no longer than 2 ms to the display module<br>- No functional defects following a shock delivering at least 200 g in a half sine pulse no longer than 2 ms to each of 6 sides. Each of the 6 sides will be shock tested with one each display, for a total of 6 displays |
| 7   | Altitude<br>operating<br>storage / shipment | 0 ~ 10,000 feet (3,048m) 24Hr<br>0 ~ 40,000 feet (12,192m) 24Hr   |

{ Result Evaluation Criteria }

There should be no change which might affect the practical display function when the display quality test is conducted under normal operating condition.

**Product Specification****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

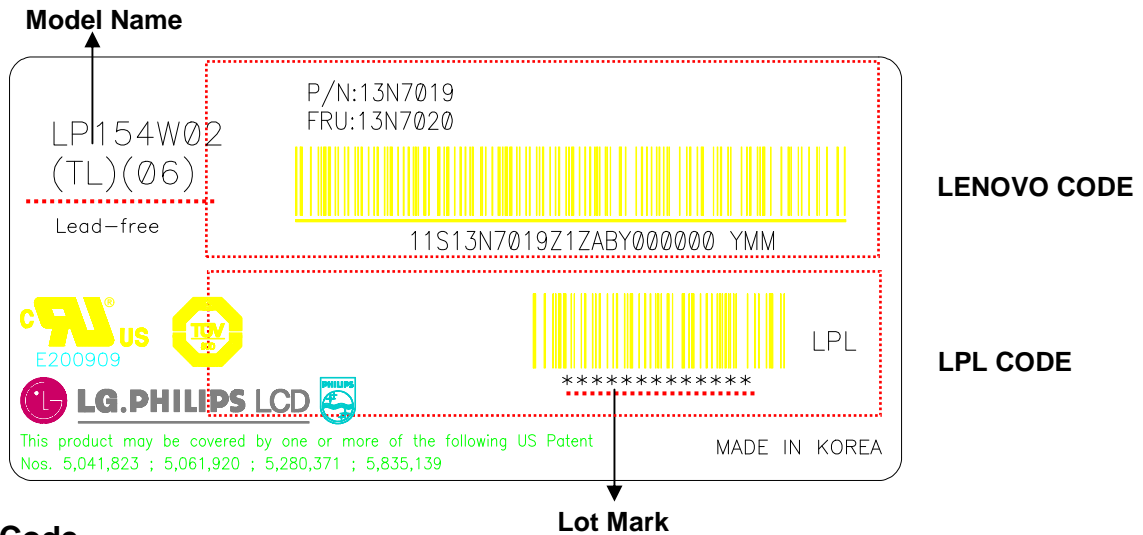
a) Package quantity in one box : 10 pcs

b) Box Size : 441mm × 373mm × 348mm

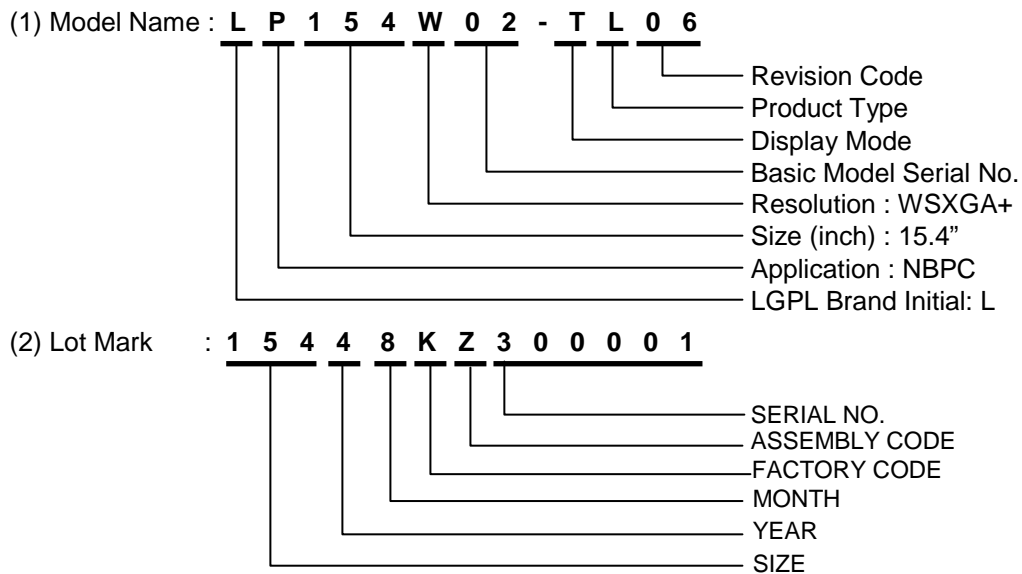


**Product Specification**

**8-3. Label Description**



**LPL Code**



**LENOVO Code**

- 1) LENOVO P/N : 13N7019
- 2) FRU P/N : 13N7020

## Product Specification

## 9. PRECAUTIONS

Please pay attention to the following 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 a 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 described 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 determined to the polarizer.)
- (7) When the surface becomes dusty, please wipe gently with absorbent cotton or other soft materials like chamois soaked 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 minimize the interference.

## Product Specification

**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) 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) The protection film is attached to the polarizer with a small amount of glue. If some stress is applied to rub the protection film against the polarizer during the time you peel off the film, the glue is apt to remain on the polarizer.  
Please carefully peel off the protection film without rubbing it against the polarizer.
- (3) 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 polarizer after the protection film is peeled off.
- (4) You can remove the glue easily. When the glue remains on the polarizer 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 A. Enhanced Extended Display Identification Data (EEDID™) 1/3

|                    |                |  | LG LP154W02-TL06 |                   |         |  |                           |
|--------------------|----------------|--|------------------|-------------------|---------|--|---------------------------|
| Byte#<br>(decimal) | Byte#<br>(HEX) | Field Name and Comments                            | Value<br>(HEX)   | Value<br>(binary) | Data    |  |                           |
| 0                  | 00             | Header   | 0 0              | 0000 0000         |         |  | Header                    |
| 1                  | 01             | Header   | F F              | 1111 1111         |         |  |                           |
| 2                  | 02             | Header   | F F              | 1111 1111         |         |  |                           |
| 3                  | 03             | Header   | F F              | 1111 1111         |         |  |                           |
| 4                  | 04             | Header   | F F              | 1111 1111         |         |  |                           |
| 5                  | 05             | Header   | F F              | 1111 1111         |         |  |                           |
| 6                  | 06             | Header   | F F              | 1111 1111         |         |  |                           |
| 7                  | 07             | Header   | 0 0              | 0000 0000         |         |  |                           |
| 8                  | 08             | ID system Manufacturer Name                        | 2 4              | 0010 0100         | IBM     |  | Vender/<br>Product ID     |
| 9                  | 09             | Compressed ASCII                                   | 4 D              | 0100 1101         |         |  |                           |
| 10                 | 0A             | ID Product Code                                    | 8 7              | 1000 0111         | #WSXGA+ |  |                           |
| 11                 | 0B             | ID Product Code                                    | 2 8              | 0010 1000         |         |  |                           |
| 12                 | 0C             | LCD Module Serial No. = 0 (If not used)            | 0 0              | 0000 0000         |         |  |                           |
| 13                 | 0D             | LCD Module Serial No. = 0 (If not used)            | 0 0              | 0000 0000         |         |  |                           |
| 14                 | 0E             | LCD Module Serial No. = 0 (If not used)            | 0 0              | 0000 0000         |         |  |                           |
| 15                 | 0F             | LCD Module Serial No. = 0 (If not used)            | 0 0              | 0000 0000         |         |  |                           |
| 16                 | 10             | Week of Manufacture                                | 0 0              | 0000 0000         | 00      |  |                           |
| 17                 | 11             | Year of Manufacture                                | 0 F              | 0000 1111         | 2005    |  |                           |
| 18                 | 12             | EDID Structure version                             | 0 1              | 0000 0001         | 1       |  | EDID Version/<br>Revision |
| 19                 | 13             | EDID Revision                                      | 0 3              | 0000 0011         | 3       |  |                           |
| 20                 | 14             | Video Input Definition = Digital I/P,non TMDS CRGB | 8 0              | 1000 0000         |         |  | Display<br>Parameter      |
| 21                 | 15             | Max H image size(cm) = 33.12cm                     | 2 1              | 0010 0001         | 33      |  |                           |
| 22                 | 16             | Max V image size(cm) = 20.70cm                     | 1 5              | 0001 0101         | 21      |  |                           |
| 23                 | 17             | Display gamma                                      | 7 8              | 0111 1000         | 2.2     |  |                           |
| 24                 | 18             | Feature support(DPMS) = Active off, RGB Color      | 0 A              | 0000 1010         |         |  | Color<br>Characteristic   |
| 25                 | 19             | Red/Green low Bits                                 | B C              | 1011 1100         |         |  |                           |
| 26                 | 1A             | Blue/White Low Bits                                | A 5              | 1010 0101         |         |  |                           |
| 27                 | 1B             | Red X  | 9 8              | 1001 1000         | 0.595   |  |                           |
| 28                 | 1C             | Red Y  | 5 8              | 0101 1000         | 0.345   |  |                           |
| 29                 | 1D             | Green X  | 5 5              | 0101 0101         | 0.332   |  |                           |
| 30                 | 1E             | Green Y  | 8 8              | 1000 1011         | 0.544   |  |                           |
| 31                 | 1F             | Blue X   | 2 8              | 0010 1000         | 0.157   |  |                           |
| 32                 | 20             | Blue Y   | 2 4              | 0010 0100         | 0.141   |  |                           |
| 33                 | 21             | White X  | 5 0              | 0101 0000         | 0.313   |  |                           |
| 34                 | 22             | White Y  | 5 4              | 0101 0100         | 0.329   |  |                           |
| 35                 | 23             | Established Timing I = 00h(If not used)            | 0 0              | 0000 0000         |         |  | Established<br>Timings    |
| 36                 | 24             | Established Timing II = 00h(If not used)           | 0 0              | 0000 0000         |         |  |                           |
| 37                 | 25             | Manufacturer's Timings = 00h(If not used)          | 0 0              | 0000 0000         |         |  |                           |
| 38                 | 26             | Standard Timing Identification 1 was not used      | 0 1              | 0000 0001         |         |  | Standard<br>Timing ID     |
| 39                 | 27             | Standard Timing Identification 1 was not used      | 0 1              | 0000 0001         |         |  |                           |
| 40                 | 28             | Standard Timing Identification 2 was not used      | 0 1              | 0000 0001         |         |  |                           |
| 41                 | 29             | Standard Timing Identification 2 was not used      | 0 1              | 0000 0001         |         |  |                           |
| 42                 | 2A             | Standard Timing Identification 3 was not used      | 0 1              | 0000 0001         |         |  |                           |
| 43                 | 2B             | Standard Timing Identification 3 was not used      | 0 1              | 0000 0001         |         |  |                           |
| 44                 | 2C             | Standard Timing Identification 4 was not used      | 0 1              | 0000 0001         |         |  |                           |
| 45                 | 2D             | Standard Timing Identification 4 was not used      | 0 1              | 0000 0001         |         |  |                           |
| 46                 | 2E             | Standard Timing Identification 5 was not used      | 0 1              | 0000 0001         |         |  |                           |
| 47                 | 2F             | Standard Timing Identification 5 was not used      | 0 1              | 0000 0001         |         |  |                           |
| 48                 | 30             | Standard Timing Identification 6 was not used      | 0 1              | 0000 0001         |         |  |                           |
| 49                 | 31             | Standard Timing Identification 6 was not used      | 0 1              | 0000 0001         |         |  |                           |
| 50                 | 32             | Standard Timing Identification 7 was not used      | 0 1              | 0000 0001         |         |  |                           |
| 51                 | 33             | Standard Timing Identification 7 was not used      | 0 1              | 0000 0001         |         |  |                           |
| 52                 | 34             | Standard Timing Identification 8 was not used      | 0 1              | 0000 0001         |         |  |                           |
| 53                 | 35             | Standard Timing Identification 8 was not used      | 0 1              | 0000 0001         |         |  |                           |

**Product Specification**
**APPENDIX A. Enhanced Extended Display Identification Data (EEDID™) 2/3**

|     |    |   |   |   |           |             |                             |
|-----|----|---|---|---|-----------|-------------|-----------------------------|
| 54  | 36 | Pixel Clock/ 10,000 (LSB)   | A | 8 | 1010 1000 | 122MHz      | Timing<br>Descriptor<br>#1  |
| 55  | 37 | Pixel Clock/ 10,000 (MSB) /   | 2 | F | 0010 1111 |             |                             |
| 56  | 38 | Horizontal Active   | 9 | 0 | 1001 0000 | 1680 pixels |                             |
| 57  | 39 | Horizontal Blanking   | E | 0 | 1110 0000 | 224 pixels  |                             |
| 58  | 3A | Horizontal Active : Horizontal Blanking   | 6 | 0 | 0110 0000 |             |                             |
| 59  | 3B | Vertical Active   | 1 | A | 0001 1010 | 1050 lines  |                             |
| 60  | 3C | Vertical Blanking   | 1 | 0 | 0001 0000 | 16 lines    |                             |
| 61  | 3D | Vertical Active : Vertical Blanking   | 4 | 0 | 0100 0000 |             |                             |
| 62  | 3E | Horizontal Sync. Offset   | 2 | 0 | 0010 0000 | 32 pixels   |                             |
| 63  | 3F | Horizontal Sync Pulse Width   | 4 | 0 | 0100 0000 | 64 pixels   |                             |
| 64  | 40 | Vertical Sync Offset : Sync Width   | 1 | 3 | 0001 0011 | 1/3 lines   |                             |
| 65  | 41 | Horizontal Vertical Sync Offset/Width upper 2bits = 0                               | 0 | 0 | 0000 0000 | 0           |                             |
| 66  | 42 | Horizontal Image Size = 331.2 mm  | 4 | B | 0010 0001 | 331         |                             |
| 67  | 43 | Vertical Image Size = 207.0mm   | C | F | 0001 0101 | 207         |                             |
| 68  | 44 | Horizontal & Vertical Image Size  | 1 | 0 | 0001 0000 |             | Timing<br>Description<br>#2 |
| 69  | 45 | Horizontal Border = 0   | 0 | 0 | 0000 0000 |             |                             |
| 70  | 46 | Vertical Border = 0   | 0 | 0 | 0000 0000 |             |                             |
| 71  | 47 | Non-interlaced, Normal display, no stereo, Digital separate sync, H/V pol negatives | 1 | 9 | 0001 1001 |             |                             |
| 72  | 48 | Pixel Clock/ 10,000 (LSB) 50-hz   | B | 7 | 1011 0111 | 101.67MHz   |                             |
| 73  | 49 | Pixel Clock/ 10,000 (MSB) / 50-hz   | 2 | 7 | 0010 0111 |             |                             |
| 74  | 4A | Horizontal Active   | 9 | 0 | 1001 0000 | 1680 pixels |                             |
| 75  | 4B | Horizontal Blanking   | E | 0 | 1110 0000 | 224 pixels  |                             |
| 76  | 4C | Horizontal Active : Horizontal Blanking   | 6 | 0 | 0110 0000 |             |                             |
| 77  | 4D | Vertical Active   | 1 | A | 0001 1010 | 1050 lines  |                             |
| 78  | 4E | Vertical Blanking   | 1 | 0 | 0001 0000 | 16 lines    |                             |
| 79  | 4F | Vertical Active : Vertical Blanking   | 4 | 0 | 0100 0000 |             |                             |
| 80  | 50 | Horizontal Sync. Offset   | 2 | 0 | 0010 0000 | 32 pixels   | Timing<br>Description<br>#3 |
| 81  | 51 | Horizontal Sync Pulse Width   | 4 | 0 | 0100 0000 | 64 pixels   |                             |
| 82  | 52 | Vertical Sync Offset : Sync Width   | 1 | 3 | 0001 0011 | 1/3 lines   |                             |
| 83  | 53 | Horizontal Vertical Sync Offset/Width upper 2bits = 0                               | 0 | 0 | 0000 0000 | 0           |                             |
| 84  | 54 | Horizontal Image Size = 331.2 mm  | 4 | B | 0010 0001 | 331         |                             |
| 85  | 55 | Vertical Image Size = 207.0mm   | C | F | 0001 0101 | 207         |                             |
| 86  | 56 | Horizontal & Vertical Image Size  | 1 | 0 | 0001 0000 |             |                             |
| 87  | 57 | Horizontal Border = 0   | 0 | 0 | 0000 0000 |             |                             |
| 88  | 58 | Vertical Border = 0   | 0 | 0 | 0000 0000 |             |                             |
| 89  | 59 | Non-interlaced, Normal display, no stereo, Digital separate sync, H/V pol negatives | 1 | 9 | 0001 1001 |             |                             |
| 90  | 5A | Detailed Timing Descriptor #3   | 0 | 0 | 0000 0000 | 0           |                             |
| 91  | 5B |   | 0 | 0 | 0000 0000 | 0           |                             |
| 92  | 5C |   | 0 | 0 | 0000 0000 | 0           |                             |
| 93  | 5D |   | 0 | F | 0000 1111 | 15          |                             |
| 94  | 5E |   | 0 | 0 | 0000 0000 | 0           | Timing<br>Description<br>#3 |
| 95  | 5F | (Horizontal active pixel /8) -31  | B | 3 | 1011 0011 | 179         |                             |
| 96  | 60 | Image Aspect Ratio(16:10)   | 0 | A | 0000 1010 | 16 : 10     |                             |
| 97  | 61 | Low Refresh Rate #1(50Hz)   | 3 | 2 | 0011 0010 | 50          |                             |
| 98  | 62 | (Horizontal active pixel /8) -31  | B | 3 | 1011 0011 | 179         |                             |
| 99  | 63 | Image Aspect Ratio(16:10)   | 0 | A | 0000 1010 | 16 : 10     |                             |
| 100 | 64 | Low Refresh Rate #2(40Hz)   | 2 | 8 | 0010 1000 | 40          |                             |
| 101 | 65 | Brightness(1/10nit)   | 1 | 4 | 0001 0100 | 20          |                             |
| 102 | 66 | Feature flag(TN mode)   | 0 | 1 | 0000 0001 | 1           |                             |
| 103 | 67 | Reserved 00h  | 0 | 0 | 0000 0000 | 0           |                             |
| 104 | 68 | EISA manufacturer code(3 Character ID)  | 3 | 2 | 0011 0010 |             |                             |
| 105 | 69 | Compressed ASCII  | 0 | C | 0000 1100 | LPL         |                             |
| 106 | 6A | Panel Supplier Reserved – Product code  | 0 | 0 | 0000 0000 |             |                             |
| 107 | 6B | (Hex, LSB first)  | 0 | 0 | 0000 0000 |             |                             |

Product Specification

APPENDIX A. Enhanced Extended Display Identification Data (EEDID™) 3/3

|     |    |                               |   |   |           |   |  |                |
|-----|----|-------------------------------|---|---|-----------|---|--|----------------|
| 108 | 6C | Detailed Timing Descriptor #4 | 0 | 0 | 0000 0000 |   |  |                |
| 109 | 6D |                               | 0 | 0 | 0000 0000 |   |  |                |
| 110 | 6E |                               | 0 | 0 | 0000 0000 |   |  |                |
| 111 | 6F |                               | F | E | 1111 1110 |   |  |                |
| 112 | 70 |                               | 0 | 0 | 0000 0000 |   |  |                |
| 113 | 71 | (Supplier S/N)                | 4 | C | 0100 1100 | L |  |                |
| 114 | 72 | (Supplier S/N)                | 5 | 0 | 0101 0000 | P |  |                |
| 115 | 73 | (Supplier S/N)                | 3 | 1 | 0011 0001 | 1 |  |                |
| 116 | 74 | (Supplier S/N)                | 3 | 5 | 0011 0101 | 5 |  |                |
| 117 | 75 | (Supplier S/N)                | 3 | 4 | 0011 0100 | 4 |  |                |
| 118 | 76 | (Supplier S/N)                | 5 | 7 | 0101 0111 | W |  |                |
| 119 | 77 | (Supplier S/N)                | 3 | 0 | 0011 0000 | 0 |  |                |
| 120 | 78 | (Supplier S/N)                | 3 | 2 | 0011 0010 | 2 |  |                |
| 121 | 79 | (Supplier S/N)                | 2 | D | 0010 1101 | - |  |                |
| 122 | 7A | (Supplier S/N)                | 5 | 4 | 0101 0100 | T |  |                |
| 123 | 7B | (Supplier S/N)                | 4 | C | 0100 1100 | L |  |                |
| 124 | 7C | (Supplier S/N)                | 3 | 0 | 0011 0000 | 0 |  |                |
| 125 | 7D | (Supplier S/N)                | 3 | 6 | 0011 0110 | 6 |  |                |
| 126 | 7E | Extension flag = 00           | 0 | 0 | 0000 0000 |   |  | Extension Flag |
| 127 | 7F | Checksum                      | 7 | F | 0111 1111 |   |  | Checksum       |

## Product Specification

### APPENDIX B. Special Statements for LP154W02 of Lenovo's Notebook

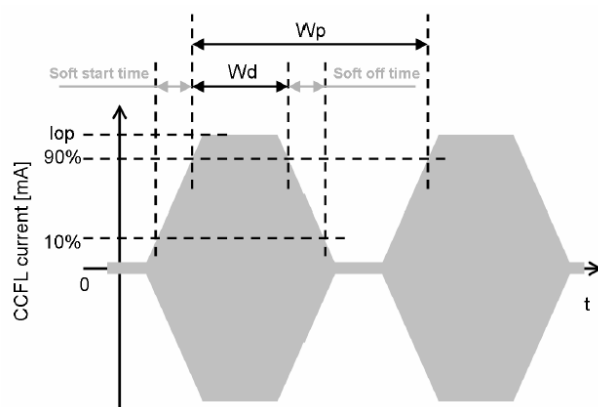
#### 1.Maximum Leakage Current of CCFL

The lamp leakage current is measured by the current difference between input and output current, whereas the output current is set at 6.0 mA.

| Parameter               | Symbol | Values |     |     | Unit | Notes |
|-------------------------|--------|--------|-----|-----|------|-------|
|                         |        | Min    | Typ | Max |      |       |
| Maximum Leakage Current | $I_L$  |        | 1.2 | 1.7 | mA   |       |

#### 2.Minimum CCFL Current

In case of inverter using PWM (Pulse Width Modulation) dimming control method, the duty ratio will be varied from 100%(maximum brightness) to 15%(minimum brightness). CCFL will work from 15% to 100% duty ratio without any problems including specified CCFL reliability when any requirements for CCFL are observed at the whole specified range of duty ratio. The duty ratio is defined as follows,



$$15\% \leq \text{Duty ratio} \leq 100\%$$

$$\text{Duty ratio}[\%] = W_d [\text{msec}] / W_p [\text{msec}] \times 100$$

Duty ratio does not include soft start time / soft off time.

Where:

$W_d$  : Duty time [msec]

$W_p$  : Width of PWM frequency [msec]

$I_{op}$  : Peak current at maximum brightness [mA]

#### 3.Refresh Rate for Power Saving Mode

In this documentation, all reliabilities are specified for timing specification based on refresh rate of 60Hz. However, LP154W02 has a good actual performance even at lower refresh rate( eg. 40Hz or 50Hz) for power saving mode, whereas LP154W02 is secured only for function under lower refresh rate. 60Hz at Normal mode, 50Hz, 40 Hz at Power save mode. Don't care Flicker level (power save mode).

#### 4. Power Sequence for T4 and T7

In this documentation, power sequence is specified differently compared with LPL's standard power sequence. LP154W02 is believed that there is no problem for current power sequence specification. However, LG.Philips LCD always recommends standard power sequence for more stable operation, specially, Min. 200[msec] for T4 and Min. 400[msec] for T7.

#### 5. White Color Shift

White Color shift at 12,000 hours lifetime should be within +0.04 for both x and y from the initial value.