

## Product Specification

# SPECIFICATION FOR APPROVAL

( ◆ ) Preliminary Specification

(   ) Final Specification

|       |                  |
|-------|------------------|
| Title | 9.7" XGA TFT LCD |
|-------|------------------|

|          |  |
|----------|--|
| Customer |  |
| MODEL    |  |

|          |                      |
|----------|----------------------|
| SUPPLIER | LG Display Co., Ltd. |
| *MODEL   | LP097X02             |
| Suffix   | SLA2                 |

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

| APPROVED BY | SIGNATURE |
|-------------|-----------|
| /           |           |
| /           |           |
| /           |           |

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

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LG Display Co., Ltd**

## Product Specification

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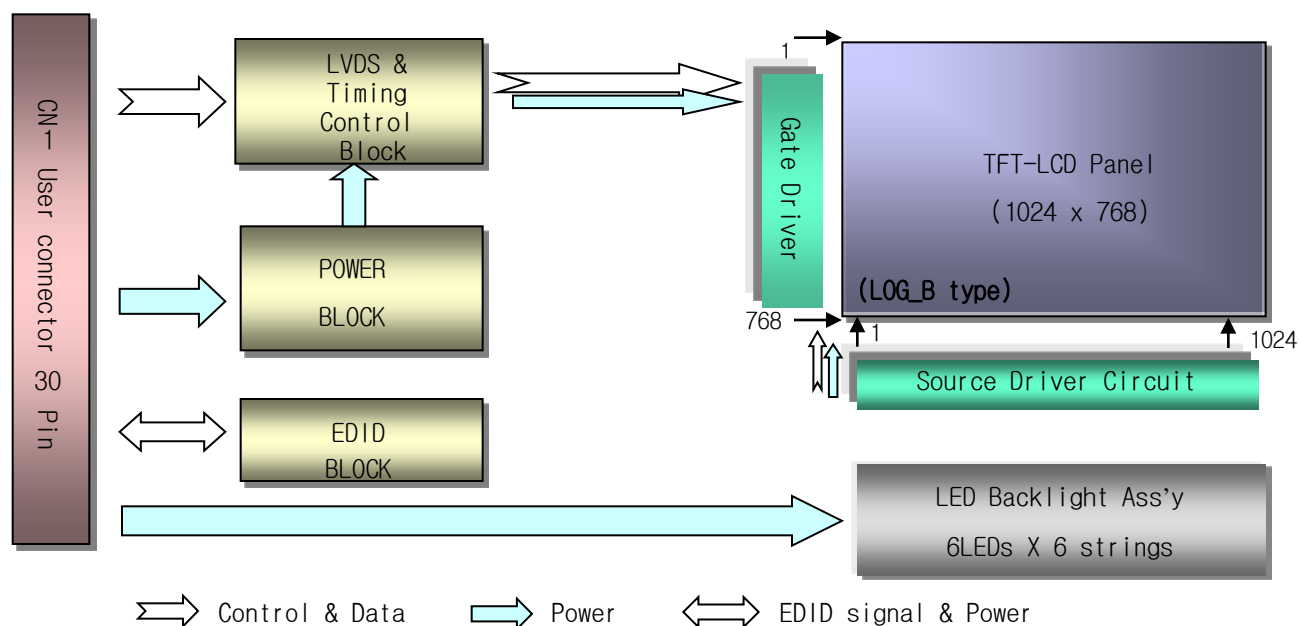
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### 1. General Description

The LP097X02 is a Color Active Matrix Liquid Crystal Display with an integral LED backlight system. The matrix employs a-Si Thin Film Transistor as the active element. It is a transmissive type display operating in the normally Black mode. This TFT-LCD has 9.7 inches diagonally measured active display area with XGA resolution(1024 horizontal by 768 vertical 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 LP097X02 has been designed to apply the interface method that enables low power, high speed, low EMI.

The LP097X02 is intended to support applications where thin thickness, low power are critical factors and graphic displays are important. In combination with the vertical arrangement of the sub-pixels, the LP097X02 characteristics provide an excellent flat display for office automation products such as Notebook PC.



### General Features

|                        |  |
|------------------------|--|
| Active Screen Size     | 9.7 inches diagonal  |
| Outline Dimension      | 210.53(H) × 166.53 (V) × 3.55(D, Max.) mm ※ PCB area : 5.82(Max.)            |
| Pixel Pitch            | 0.192 mm × 0.192 mm  |
| Pixel Format           | 1024 horiz. by 768 vert. Pixels RGB strip arrangement                        |
| Color Depth            | 6-bit, 262,144 colors  |
| Luminance, White       | 400 cd/m <sup>2</sup> (Typ., @ I <sub>LED</sub> =20mA)                       |
| Power Consumption      | Logic : 0.8W(typ.@Mosaic), Back Light : 2.1W (typ.@ I <sub>LED</sub> = 20mA) |
| Weight                 | 160g (Max.)  |
| Display Operating Mode | Transmissive mode, normally Black  |
| Surface Treatment      | Glare, Anti-reflective treatment of the front polarizer, 3H                  |

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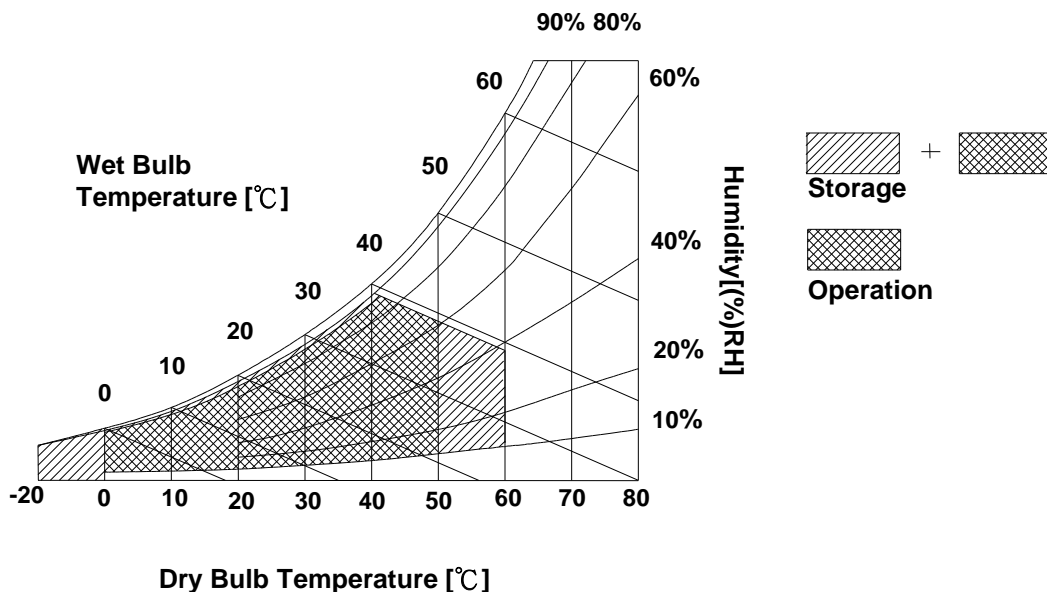
### 2. Absolute Maximum Ratings

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

**Table 1. ABSOLUTE MAXIMUM RATINGS**

| Parameter                  | Symbol | Values |     | Units | Notes       |
|----------------------------|--------|--------|-----|-------|-------------|
|                            |        | Min    | Max |       |             |
| Power Input Voltage        | VCC    | -0.3   | 4.0 | Vdc   | at 25 ± 5°C |
| Operating Temperature      | TOP    | 0      | 50  | °C    | 1           |
| Storage Temperature        | HST    | -20    | 60  | °C    | 1           |
| Operating Ambient Humidity | HOP    | 10     | 90  | %RH   | 1           |
| Storage Humidity           | HST    | 10     | 90  | %RH   | 1           |

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

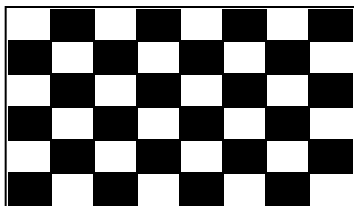
The LP097X02 requires two power inputs. One is employed to power the LCD electronics and to drive the TFT array and liquid crystal. The second input which powers the LED BL.

**Table 2. ELECTRICAL CHARACTERISTICS**

| Parameter                               | Symbol                   | Values |     |      | Unit            | Notes |
|---|--------------------------|--------|-----|------|-----------------|-------|
|   |                          | Min    | Typ | Max  |                 |       |
| MODULE :                                |                          |        |     |      |                 |       |
| Power Supply Input Voltage              | VCC                      | 3.0    | 3.3 | 3.6  | V <sub>DC</sub> |       |
| Power Supply Input Current              | I <sub>CC</sub>   Mosaic | -      | 240 | 280  | mA              | 1     |
| Power Consumption                       | P <sub>c</sub>           | -      | 0.8 | 0.92 | Watt            | 1     |
| Differential Impedance                  | Z <sub>m</sub>           | 90     | 100 | 110  | Ohm             | 2     |
| LED Backlight :<br>(Without LED Driver) |                          |        |     |      |                 |       |
| LED Driver input Volatge<br>(on system) | VLED                     |        |     | 12   | V               | 3     |
| Operating Current per string            | I <sub>LED</sub>         | 5      | 20  | 25   | mA              | 4     |
| Power Consumption                       | P <sub>BL</sub>          |        | 2.1 | 2.6  | Watt            | 5     |
| Life Time                               |                          | 10,000 | -   | -    | Hrs             | 6     |

Note)

1. The specified current and power consumption are under the Vcc = 3.3V , 25°C , fv = 60Hz condition whereas Mosaic pattern is displayed and fv is the frame frequency.



2. This impedance value is needed to proper display and measured form LVDS Tx to the mating connector.
3. **LED input voltage must be input below than 12V to operate normally for LED Driver.**
4. The typical operating current is for the typical surface luminance (L<sub>WH</sub>) in optical characteristics.
5. The LED power consumption shown above does not include power of external LED driver circuit for typical current condition.
6. The life time is determined as the time at which brightness of lamp is 50% compare to that of initial value at the typical lamp current.

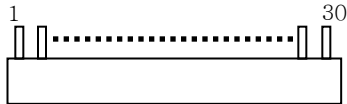
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### 3-2. Interface Connections

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

The electronics interface connector is a model 20474-030E-12 manufactured by I-PEX.

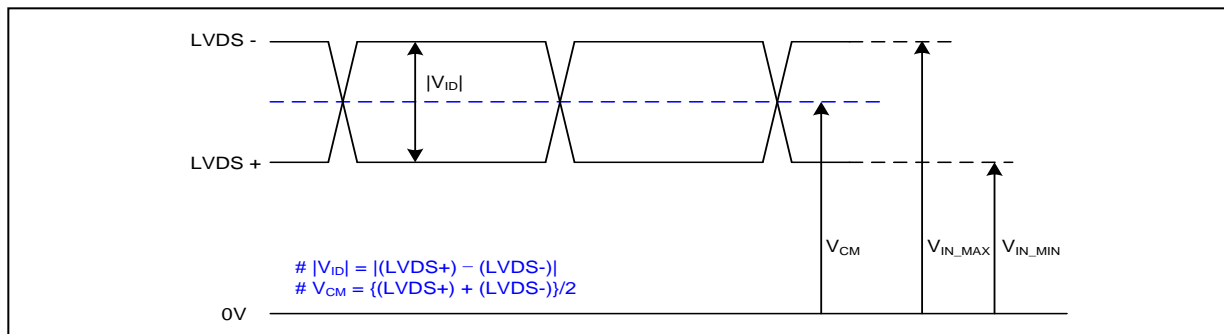
**Table 3. MODULE CONNECTOR PIN CONFIGURATION (CN1)**

| Pin | Symbol             | Description                            | Notes  |
|-----|--------------------|--|--|
| 1   | GND                | Ground                                 | [LVDS Receiver]<br>SiliconWorks, SW0627B   |
| 2   | VCC                | Power Supply, 3.3V Typ.                |  |
| 3   | VCC                | Power Supply, 3.3V Typ.                | [Connector]<br>I-PEX 20474-030E-1#   |
| 4   | V EEDID            | DDC 3.3V power                         |  |
| 5   | GSP                | GSP                                    | [Mating Connector]<br>I-PEX 20472-030T-10 series<br>or equivalent (micro-coax type)  |
| 6   | Clk EEDID          | DDC Clock                              |  |
| 7   | DATA EEDID         | DDC Data                               | [Connector pin arrangement]<br>LCD front view<br> |
| 8   | R <sub>IN</sub> 0- | Negative LVDS differential data input  |  |
| 9   | R <sub>IN</sub> 0+ | Positive LVDS differential data input  |  |
| 10  | GND                | Ground                                 |  |
| 11  | R <sub>IN</sub> 1- | Negative LVDS differential data input  |  |
| 12  | R <sub>IN</sub> 1+ | Positive LVDS differential data input  |  |
| 13  | GND                | Ground                                 |  |
| 14  | R <sub>IN</sub> 2- | Negative LVDS differential data input  |  |
| 15  | R <sub>IN</sub> 2+ | Positive LVDS differential data input  |  |
| 16  | GND                | Ground                                 |  |
| 17  | CLKIN-             | Negative LVDS differential clock input |  |
| 18  | CLKIN+             | Positive LVDS differential clock input |  |
| 19  | GND                | Ground                                 |  |
| 20  | NC                 | No Connection                          |  |
| 21  | Vdc                | LED Anode (Positive)                   |  |
| 22  | Vdc                | LED Anode (Positive)                   |  |
| 23  | NC                 | No Connection                          |  |
| 24  | Vdc1               | LED Cathode (Negative)                 |  |
| 25  | Vdc2               | LED Cathode (Negative)                 |  |
| 26  | Vdc3               | LED Cathode (Negative)                 |  |
| 27  | Vdc4               | LED Cathode (Negative)                 |  |
| 28  | Vdc5               | LED Cathode (Negative)                 |  |
| 29  | Vdc6               | LED Cathode (Negative)                 |  |
| 30  | NC                 | No Connection                          |  |

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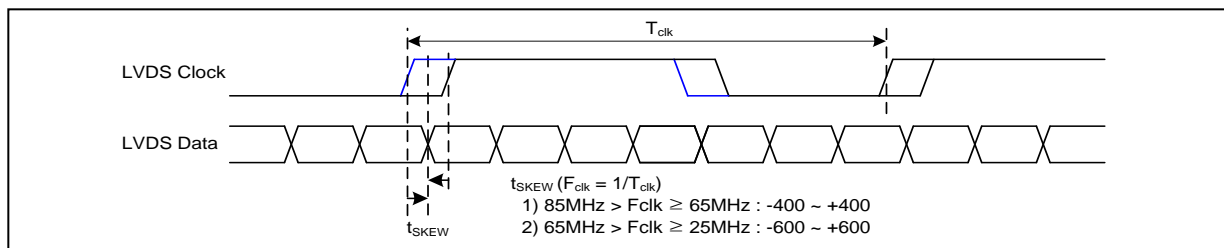
### 3-3. LVDS Signal Timing Specifications

#### 3-3-1. DC Specification



| Description               | Symbol     | Min | Max | Unit | Notes |
|---------------------------|------------|-----|-----|------|-------|
| LVDS Differential Voltage | $ V_{ID} $ | 100 | 600 | mV   | -     |
| LVDS Common mode Voltage  | $V_{CM}$   | 0.6 | 1.8 | V    | -     |
| LVDS Input Voltage Range  | $V_{IN}$   | 0.3 | 2.1 | V    | -     |

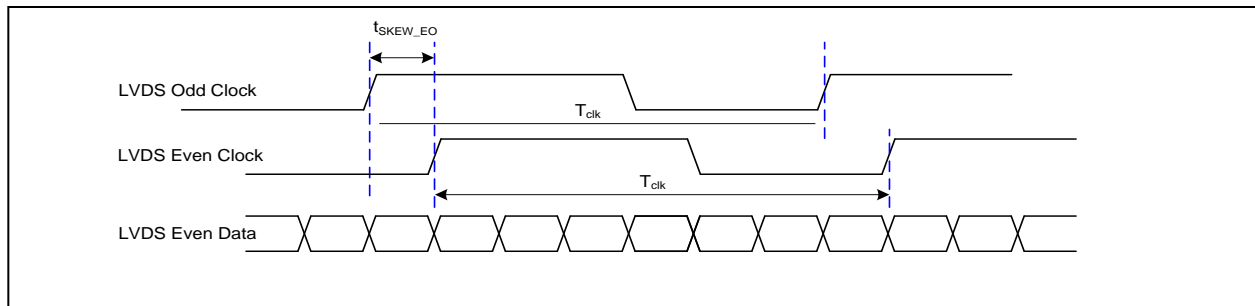
#### 3-3-2. AC Specification



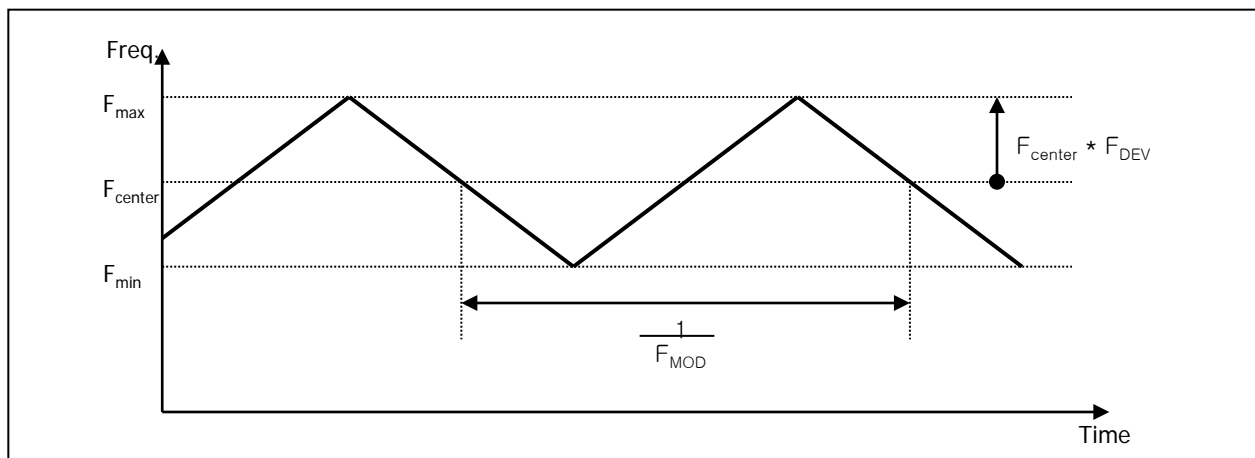
| Description  | Symbol         | Min   | Max   | Unit      | Notes                |
|--|----------------|-------|-------|-----------|----------------------|
| LVDS Clock to Data Skew Margin                         | $t_{SKEW}$     | - 400 | + 400 | ps        | 85MHz > Fclk ≥ 65MHz |
|  | $t_{SKEW}$     | - 600 | + 600 | ps        | 65MHz > Fclk ≥ 25MHz |
| LVDS Clock to Clock Skew Margin (Even to Odd)          | $t_{SKEW\_EO}$ | - 1/7 | + 1/7 | $T_{clk}$ | -                    |
| Maximum deviation of input clock frequency during SSC  | $F_{DEV}$      | -     | ± 3   | %         | -                    |
| Maximum modulation frequency of input clock during SSC | $F_{MOD}$      | -     | 200   | KHz       | -                    |



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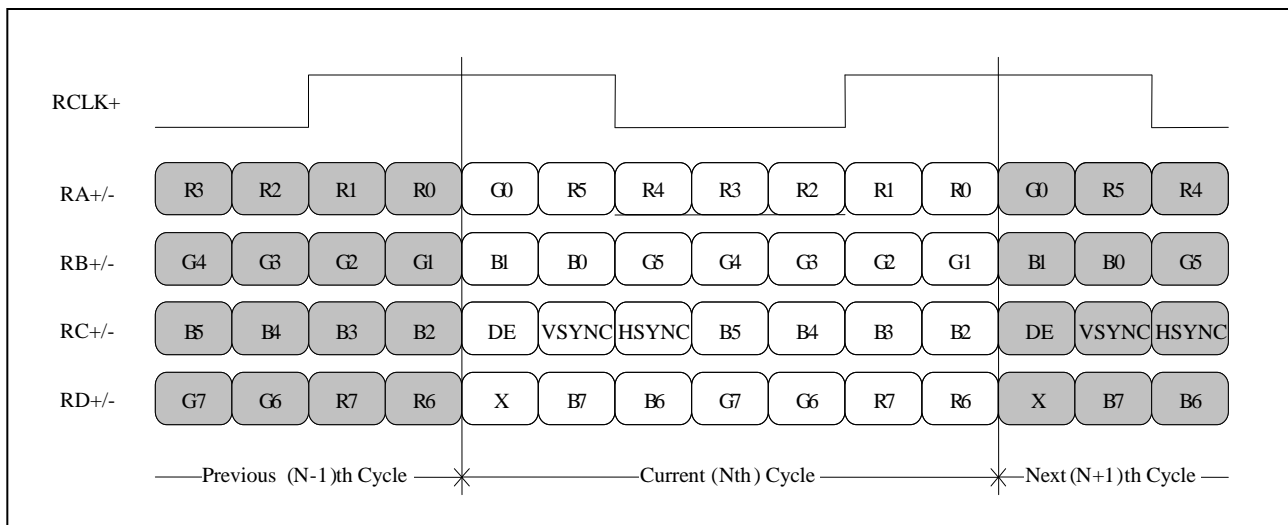
< Clock skew margin between channel >



< Spread Spectrum >

### 3-3-3. Data Format

-. LVDS 1 Port



< LVDS Data Format >

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### 3-4. Signal Timing Specifications

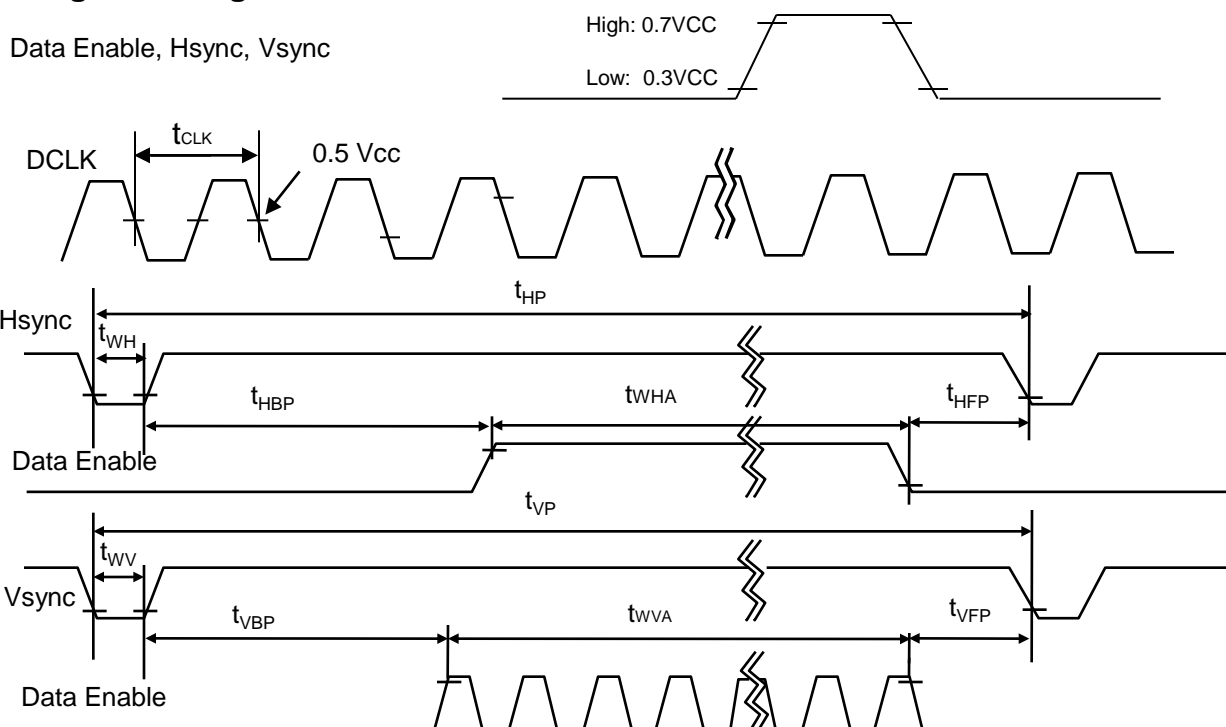
This is the signal timing required at the input of the User connector. All of the interface signal timing should be satisfied with the following specifications and specifications of LVDS Tx/Rx for its proper operation.

**Table 6. TIMING TABLE**

| ITEM        | Symbol                 |           | Min  | Typ    | Max  | Unit | Note |
|-------------|------------------------|-----------|------|--------|------|------|------|
| DCLK        | Frequency              | $f_{CLK}$ | 97   | 100.03 | 103  | MHz  |      |
| Hsync       | Active                 | $t_{HP}$  | 1024 | 1024   | 1024 | Tclk |      |
|             | Period                 | $t_{WH}$  | 1960 | 2084   | 2223 |      |      |
|             | Width-Active           | $t_{WHA}$ | 240  | 320    | 400  |      |      |
| Vsync       | Active                 | $t_{VP}$  | 768  | 768    | 768  | tHP  |      |
|             | Period                 | $t_{WV}$  | 776  | 800    | 824  |      |      |
|             | Width-Active           | $t_{WVA}$ | 3    | 10     | 17   |      |      |
| Data Enable | Horizontal back porch  | $t_{HBP}$ | 400  | 480    | 560  | tCLK |      |
|             | Horizontal front porch | $t_{HFP}$ | 180  | 260    | 320  |      |      |
|             | Vertical back porch    | $t_{VBP}$ | 4    | 6      | 12   | tHP  |      |
|             | Vertical front porch   | $t_{VFP}$ | 1    | 16     | 32   |      |      |

### 3-5. Signal Timing Waveforms

Condition : VCC = 3.3V



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### 3-6. Color Input Data Reference

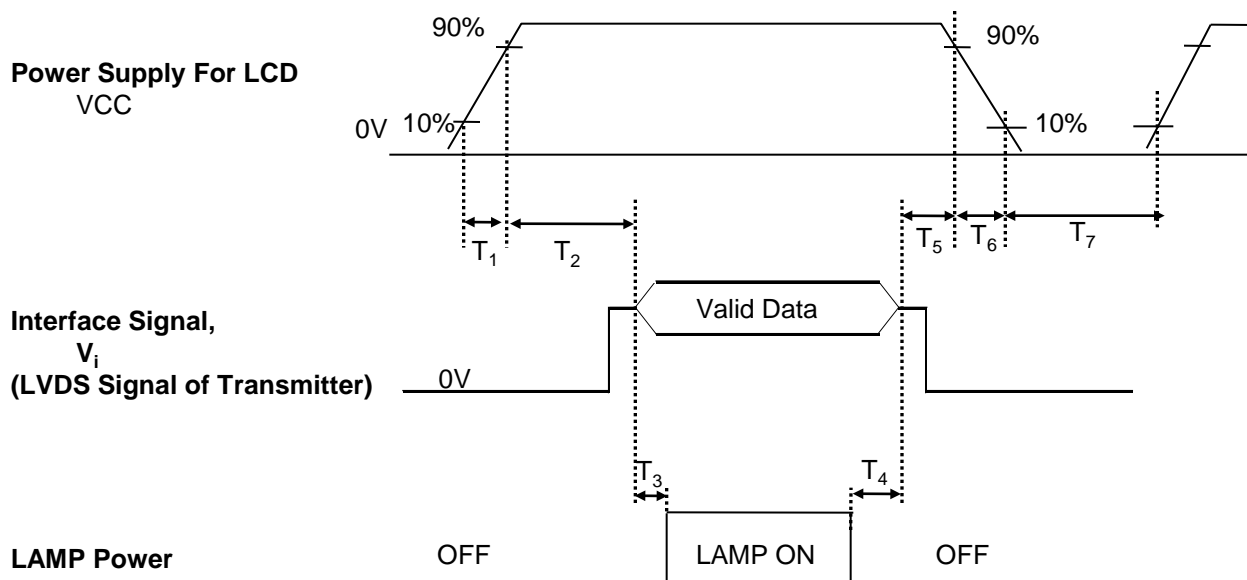
The brightness of each primary color (red, green and blue) is based on the 6-bit gray scale data input for the color ; the higher the binary input, the brighter the color. The table below provides a reference for color versus data input.

**Table 7. COLOR DATA REFERENCE**

| Color       |            | Input Color Data |     |     |     |     |     |       |     |     |     |     |     |      |     |     |     |     |     |
|-------------|------------|------------------|-----|-----|-----|-----|-----|-------|-----|-----|-----|-----|-----|------|-----|-----|-----|-----|-----|
|             |            | RED              |     |     |     |     |     | GREEN |     |     |     |     |     | BLUE |     |     |     |     |     |
|             |            | MSB              |     |     | LSB |     |     | MSB   |     |     | LSB |     |     | MSB  |     |     | LSB |     |     |
|             |            | R 5              | R 4 | R 3 | R 2 | R 1 | R 0 | G 5   | G 4 | G 3 | G 2 | G 1 | G 0 | B 5  | B 4 | B 3 | B 2 | B 1 | B 0 |
| Basic Color | Black      | 0                | 0   | 0   | 0   | 0   | 0   | 0     | 0   | 0   | 0   | 0   | 0   | 0    | 0   | 0   | 0   | 0   | 0   |
|             | Red        | 1                | 1   | 1   | 1   | 1   | 1   | 0     | 0   | 0   | 0   | 0   | 0   | 0    | 0   | 0   | 0   | 0   | 0   |
|             | Green      | 0                | 0   | 0   | 0   | 0   | 0   | 1     | 1   | 1   | 1   | 1   | 1   | 0    | 0   | 0   | 0   | 0   | 0   |
|             | Blue       | 0                | 0   | 0   | 0   | 0   | 0   | 0     | 0   | 0   | 0   | 0   | 0   | 1    | 1   | 1   | 1   | 1   | 1   |
|             | Cyan       | 0                | 0   | 0   | 0   | 0   | 0   | 1     | 1   | 1   | 1   | 1   | 1   | 1    | 1   | 1   | 1   | 1   | 1   |
|             | Magenta    | 1                | 1   | 1   | 1   | 1   | 1   | 0     | 0   | 0   | 0   | 0   | 0   | 1    | 1   | 1   | 1   | 1   | 1   |
|             | Yellow     | 1                | 1   | 1   | 1   | 1   | 1   | 1     | 1   | 1   | 1   | 1   | 1   | 0    | 0   | 0   | 0   | 0   | 0   |
|             | White      | 1                | 1   | 1   | 1   | 1   | 1   | 1     | 1   | 1   | 1   | 1   | 1   | 1    | 1   | 1   | 1   | 1   | 1   |
| RED         | RED (00)   | 0                | 0   | 0   | 0   | 0   | 0   | 0     | 0   | 0   | 0   | 0   | 0   | 0    | 0   | 0   | 0   | 0   | 0   |
|             | RED (01)   | 0                | 0   | 0   | 0   | 0   | 1   | 0     | 0   | 0   | 0   | 0   | 0   | 0    | 0   | 0   | 0   | 0   | 0   |
|             | ...        |                  |     |     |     |     |     |       |     |     |     |     |     |      |     |     |     |     |     |
|             | RED (62)   | 1                | 1   | 1   | 1   | 1   | 0   | 0     | 0   | 0   | 0   | 0   | 0   | 0    | 0   | 0   | 0   | 0   | 0   |
|             | RED (63)   | 1                | 1   | 1   | 1   | 1   | 1   | 0     | 0   | 0   | 0   | 0   | 0   | 0    | 0   | 0   | 0   | 0   | 0   |
| GREEN       | GREEN (00) | 0                | 0   | 0   | 0   | 0   | 0   | 0     | 0   | 0   | 0   | 0   | 0   | 0    | 0   | 0   | 0   | 0   | 0   |
|             | GREEN (01) | 0                | 0   | 0   | 0   | 0   | 0   | 0     | 0   | 0   | 0   | 0   | 1   | 0    | 0   | 0   | 0   | 0   | 0   |
|             | ...        |                  |     |     |     |     |     |       |     |     |     |     |     |      |     |     |     |     |     |
|             | GREEN (62) | 0                | 0   | 0   | 0   | 0   | 0   | 1     | 1   | 1   | 1   | 1   | 0   | 0    | 0   | 0   | 0   | 0   | 0   |
|             | GREEN (63) | 0                | 0   | 0   | 0   | 0   | 0   | 1     | 1   | 1   | 1   | 1   | 1   | 0    | 0   | 0   | 0   | 0   | 0   |
| BLUE        | BLUE (00)  | 0                | 0   | 0   | 0   | 0   | 0   | 0     | 0   | 0   | 0   | 0   | 0   | 0    | 0   | 0   | 0   | 0   | 0   |
|             | BLUE (01)  | 0                | 0   | 0   | 0   | 0   | 0   | 0     | 0   | 0   | 0   | 0   | 0   | 0    | 0   | 0   | 0   | 0   | 1   |
|             | ...        |                  |     |     |     |     |     |       |     |     |     |     |     |      |     |     |     |     |     |
|             | BLUE (62)  | 0                | 0   | 0   | 0   | 0   | 0   | 0     | 0   | 0   | 0   | 0   | 0   | 1    | 1   | 1   | 1   | 1   | 0   |
|             | BLUE (63)  | 0                | 0   | 0   | 0   | 0   | 0   | 0     | 0   | 0   | 0   | 0   | 0   | 1    | 1   | 1   | 1   | 1   | 1   |

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### 3-7. Power Sequence



**Table 8. POWER SEQUENCE TABLE**

| Parameter      | Value |      |      | Units |
|----------------|-------|------|------|-------|
|                | Min.  | Typ. | Max. |       |
| T <sub>1</sub> | 0.5   | -    | 10   | (ms)  |
| T <sub>2</sub> | 0     | -    | 50   | (ms)  |
| T <sub>3</sub> | 200   | -    | -    | (ms)  |
| T <sub>4</sub> | 200   | -    | -    | (ms)  |
| T <sub>5</sub> | 0     | -    | 50   | (ms)  |
| T <sub>6</sub> | 0     | -    | 10   | (ms)  |
| T <sub>7</sub> | 400   | -    | -    | (ms)  |

Note)

1. Valid Data is Data to meet "3-3. LVDS Signal Timing Specifications"
2. Please avoid floating state of interface signal at invalid period.
3. When the interface signal is invalid, be sure to pull down the power supply for LCD VCC to 0V.
4. Lamp power must be turn on after power supply for LCD and interface signal are valid.

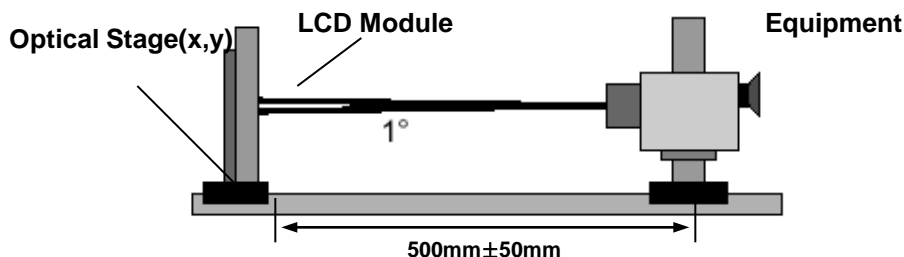
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### 4. Optical Specification

Optical characteristics are determined after the unit has been 'ON' and stable for approximately 20 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**



**Table 9. OPTICAL CHARACTERISTICS**

$T_a=25^{\circ}\text{C}$ ,  $V_{CC}=3.3\text{V}$ ,  $f_v=60\text{Hz}$ ,  $f_{CLK}=100.03\text{MHz}$ ,  $I_{LED}=20\text{mA}$

| Parameter           |            | Symbol             | Condition                | Min       | Typ   | Max   | Units             | Notes |
|---------------------|------------|--------------------|--------------------------|-----------|-------|-------|-------------------|-------|
| Average Luminance   |            | L <sub>AVE</sub>   | 5 Points<br>(ILED= 20mA) | 340       | 400   | -     | cd/m <sup>2</sup> | 2     |
| Luminance variation |            | δ <sub>WHITE</sub> | 13 points                | -         | 1.4   | 1.6   | %                 | 3     |
| C/R                 |            | -                  | Center 1 Point           | 500       | 600   | -     | -                 | 1     |
| Response time       |            |                    | -                        | -         | 30    | 50    | ms                | 4     |
| Viewing angle       | Horizontal | Θ                  | φx(Left,Right)           | ±80       | ±89   | -     | °                 | 5     |
|                     | Vertical   | Θ                  | φyu(Up)                  | 80        | 89    | -     |                   |       |
|                     |            | Θ                  | φyd(Down)                | 80        | 89    | -     |                   |       |
| Color Coordinates   |            | RED                | RX                       | 0.574     | 0.604 | 0.634 |                   |       |
|                     |            |                    | RY                       | 0.321     | 0.351 | 0.381 |                   |       |
|                     |            | GREEN              | GX                       | 0.291     | 0.321 | 0.351 |                   |       |
|                     |            |                    | GY                       | 0.522     | 0.552 | 0.582 |                   |       |
|                     |            | BLUE               | BX                       | 0.122     | 0.152 | 0.182 |                   |       |
|                     |            |                    | BY                       | 0.103     | 0.133 | 0.163 |                   |       |
|                     |            | WHITE              | WX                       | 0.283     | 0.313 | 0.343 |                   |       |
|                     |            |                    | WY                       | 0.299     | 0.329 | 0.359 |                   |       |
| Cross Talk          |            | DSHA               | -                        | -         | -     | 4.0   | %                 | Fig.5 |
| Gray Scale          |            | -                  | -                        | Gamma 2.2 |       |       |                   | 6     |

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Note)

1. Contrast Ratio(CR) is defined mathematically as

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

2. Surface luminance is the average of 5 point across the LCD surface 50cm from the surface with all pixels displaying white. For more information see FIG 1.

$$L_{WH} = \text{Average}(L_1, L_2, \dots L_5)$$

3. The variation in surface luminance , The panel total variation ( $\delta_{WHITE}$ ) is determined by measuring  $L_N$  at each test position 1 through 13 and then defined as followed numerical formula.  
For more information see FIG 2.

$$\delta_{WHITE} = \frac{\text{Maximum}(L_1, L_2, \dots L_{13})}{\text{Minimum}(L_1, L_2, \dots L_{13})}$$

4. Response time is the time required for the display to transition from white to black (rise time,  $Tr_R$ ) and from black to white(Decay Time,  $Tr_D$ ). 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 [%] (Typ) |
|------------|---------------------|
| L0         | 0.12                |
| L7         | 1.00                |
| L15        | 4.30                |
| L23        | 9.80                |
| L31        | 19.2                |
| L39        | 34.2                |
| L47        | 53.5                |
| L55        | 74.5                |
| L63        | 100                 |

Product Specification

FIG. 2 Luminance

<Measuring point for Average Luminance & measuring point for Luminance variation>

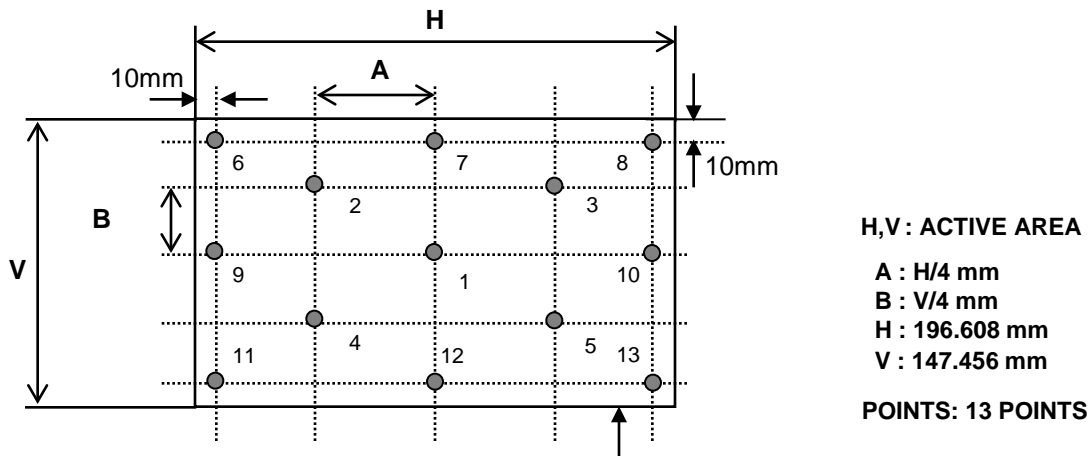


FIG. 3 Response Time

Active Area

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

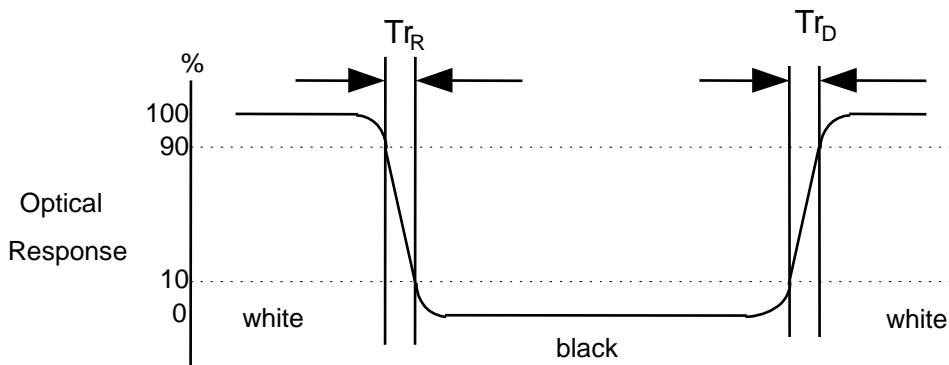
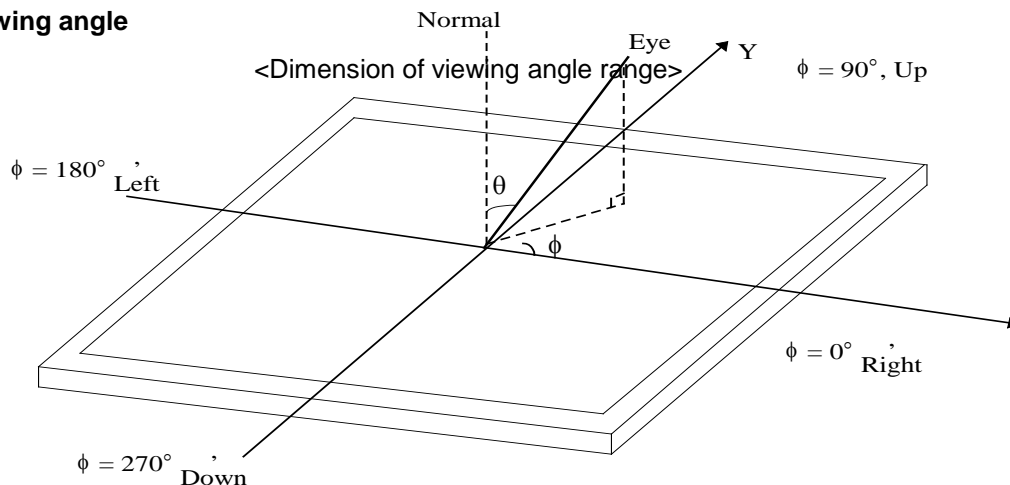


FIG. 4 Viewing angle



## Product Specification

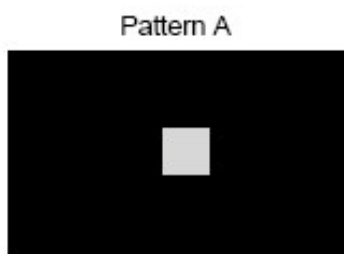
**FIG. 5 Cross talk**

No visual cross-talk will be allowed. Two luminance values are measured at center spot with 50 x 50 pixels. The cross-talk,  $D_{SHA}$ , is defined as,

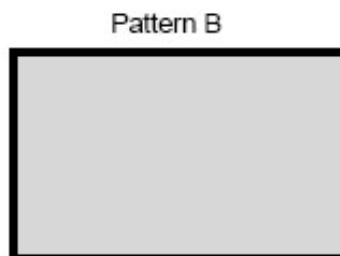
$$D_{SHA} = (L_B - L_A) / L_B \cdot 100\%,$$

Where,  $L_A$  = Luminance in Pattern A

$L_B$  = Luminance in Pattern B.



Pattern A  
Gray Scale = 31 in center  
Black in surrounding area



Pattern B  
Gray Scale = 31 full screen

## 5. Mechanical Characteristics

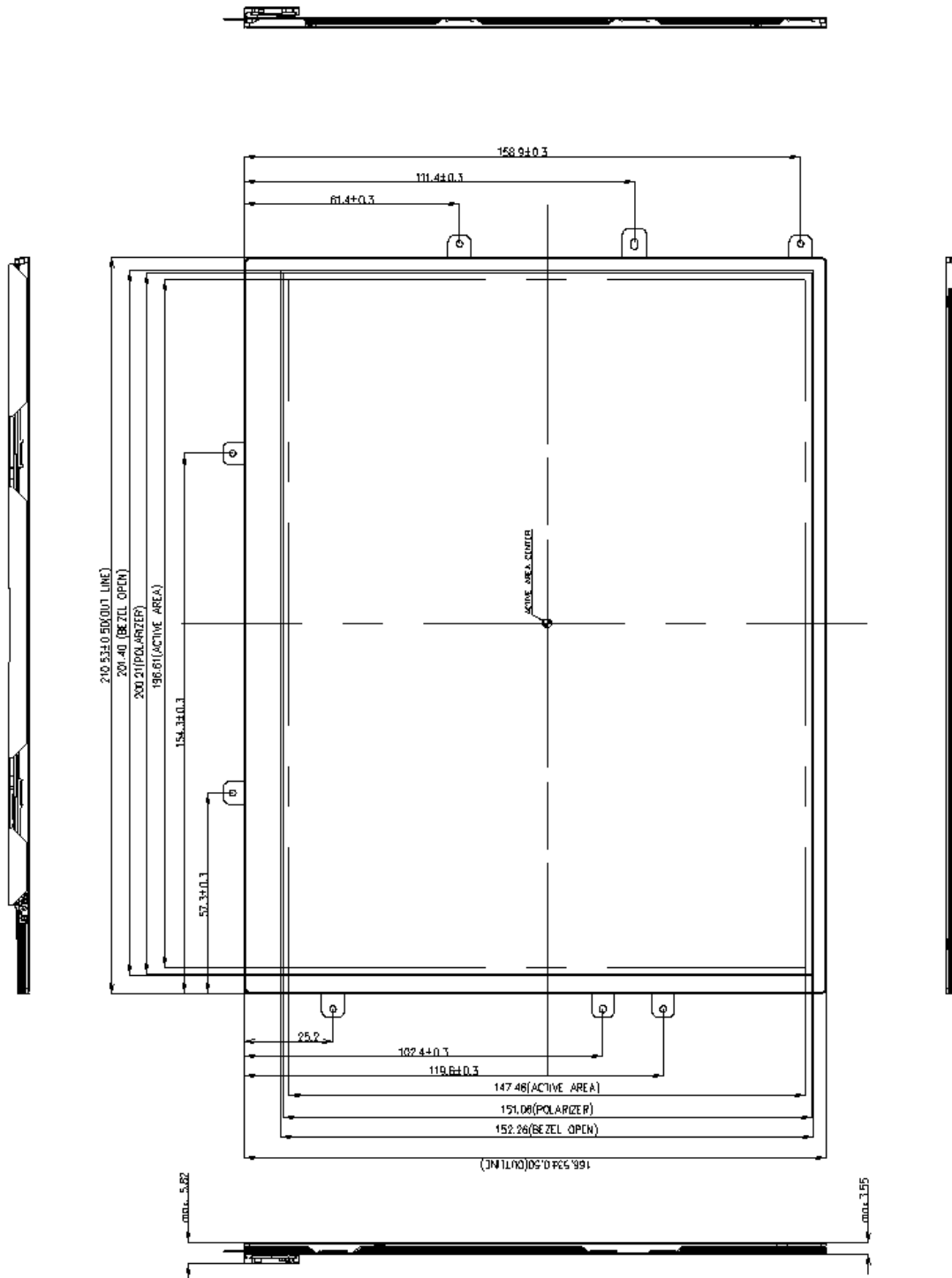
The contents provide general mechanical characteristics for the model LP097X02. In addition the figures in the next page are detailed mechanical drawing of the LCD.

|                     |  |  |
|---------------------|--|--|
| Outline Dimension   | Horizontal   | 210.53 ± 0.50mm (without bracket length) |
|                     | Vertical   | 166.53 ± 0.50mm (without bracket length) |
|                     | Thickness  | 3.55mm(Max.) ※ PCB area : 5.82(Max.)     |
| Bezel Area          | Horizontal   | 201.40mm                                 |
|                     | Vertical   | 152.26mm                                 |
| Active Display Area | Horizontal   | 196.608mm                                |
|                     | Vertical   | 147.456mm                                |
| Weight              | 160g (Max.)  |  |
| Surface Treatment   | Hard coating(3H), Glare treatment of the front Polarizer (Haze 0%) |  |



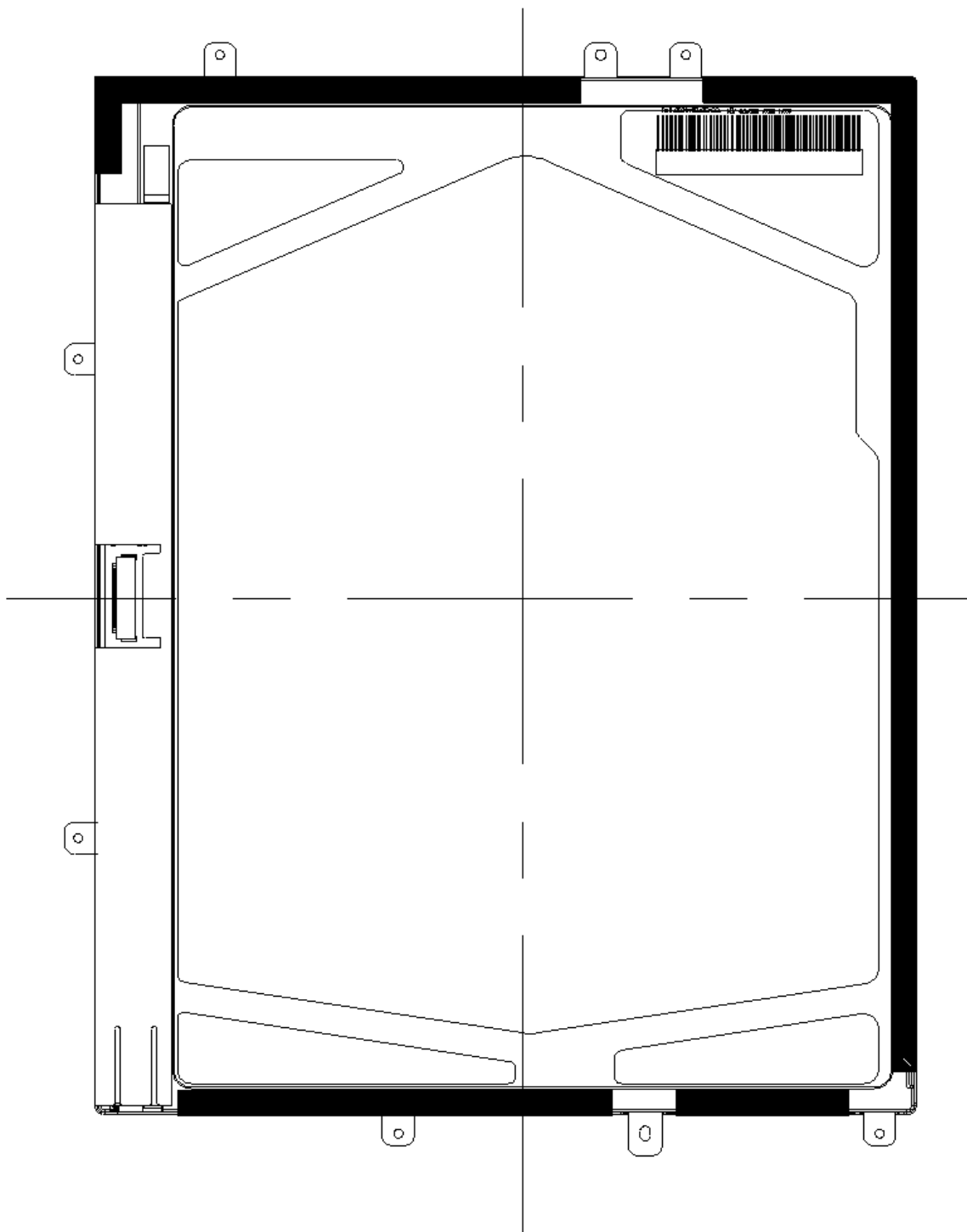
Product Specification

<FRONT VIEW>



Product Specification

<REAR VIEW>



## 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, 10 ~ 500 ~ 10Hz, 1.5G, 0.37oct/min<br>3 axis, 1hour/axis                              |
| 6   | Shock test (non-operating)                  | Half sine wave, 180G, 2ms<br>one shock of each six faces(I.e. run 180G 6ms<br>for all six faces) |
| 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.

## 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

D : YEAR

F ~ 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   |

#### 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 : 40 pcs

b) Box Size : 365mm × 478mm × 328mm

## 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 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

| Byte#<br>(decimal) | Byte#<br>(HEX) | Field Name and Comments   | Value<br>(HEX) | Value<br>(binary) |                           |
|--------------------|----------------|---|----------------|-------------------|---------------------------|
| 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             | EISA manufacture code ( 3 Character ID )  | 0 6            | 0000 0110         | Vender/<br>Product ID     |
| 9                  | 09             | EISA manufacture code (Compressed ASCII)  | 1 0            | 0001 0000         |                           |
| 10                 | 0A             | Panel Supplier Reserved - Product Code = K48(0x9cb3)  | B 3            | 1011 0011         |                           |
| 11                 | 0B             | ( Hex. LSB first )  | 9 C            | 1001 1100         |                           |
| 12                 | 0C             | LCD Module Serial No - Preferred but Optional ("0" If not used)                                 | 0 0            | 0000 0000         |                           |
| 13                 | 0D             | LCD Module Serial No - Preferred but Optional ("0" If not used)                                 | 0 0            | 0000 0000         |                           |
| 14                 | 0E             | LCD Module Serial No - Preferred but Optional ("0" If not used)                                 | 0 0            | 0000 0000         |                           |
| 15                 | 0F             | LCD Module Serial No - Preferred but Optional ("0" If not used)                                 | 0 0            | 0000 0000         |                           |
| 16                 | 10             | Week of Manufacture 00 weeks  | 0 0            | 0000 0000         |                           |
| 17                 | 11             | Year of Manufacture 2009 years  | 1 3            | 0001 0011         |                           |
| 18                 | 12             | EDID structure version # = 1  | 0 1            | 0000 0001         | EDID Version/<br>Revision |
| 19                 | 13             | EDID revision # = 3   | 0 3            | 0000 0011         |                           |
| 20                 | 14             | Video input Definition = Digital signal   | 8 0            | 1000 0000         | Display<br>Parameter      |
| 21                 | 15             | Max H image size (Rounded cm) =   | 1 4            | 0001 0100         |                           |
| 22                 | 16             | Max V image size (Rounded cm) =   | 0 F            | 0000 1111         |                           |
| 23                 | 17             | Display gamma = (gamma*100)-100 = Example: (2.2*100)-100=120                                    | 7 8            | 0111 1000         |                           |
| 24                 | 18             | Feature Support (no_DPMS, no_Active Off/Very Low Power, RGB color display, Timing BLK1, no_GTF) | 0 A            | 0000 1010         | Color<br>Characteristic   |
| 25                 | 19             | Red/Green Low Bits (RxBV/GxGv)  | 0 0            | 0000 0000         |                           |
| 26                 | 1A             | Blue/White Low Bits (BxBv/WxWv)   | 0 5            | 0000 0101         |                           |
| 27                 | 1B             | Red X Rx = 00   | 0 0            | 0000 0000         |                           |
| 28                 | 1C             | Red Y Ry = 00   | 0 0            | 0000 0000         |                           |
| 29                 | 1D             | Green X Gx = 00   | 0 0            | 0000 0000         |                           |
| 30                 | 1E             | Green Y Gy = 00   | 0 0            | 0000 0000         |                           |
| 31                 | 1F             | Blue X Bx = 00  | 0 0            | 0000 0000         |                           |
| 32                 | 20             | Blue Y By = 00  | 0 0            | 0000 0000         |                           |
| 33                 | 21             | White X Wx = 0.313  | 5 0            | 0101 0000         |                           |
| 34                 | 22             | White Y Wy = 0.329  | 5 4            | 0101 0100         |                           |
| 35                 | 23             | Established timing 1 (00h if not used)  | 0 0            | 0000 0000         | Established<br>Timings    |
| 36                 | 24             | Established timing 2 (00h if not used)  | 0 0            | 0000 0000         |                           |
| 37                 | 25             | Manufacturer's timings (00h if not used)  | 0 0            | 0000 0000         |                           |
| 38                 | 26             | <b>SMPL_MP</b>  | A 0            | 1010 0000         | Standard<br>Timing ID     |
| 39                 | 27             | Panel Vendor ID 0x97  | 9 7            | 1001 0111         |                           |
| 40                 | 28             | Low Order bits of Project ID_Auto-boot support(1)_Low Order 3 bits of Device Vendor ID          | 6 9            | 0110 1001         |                           |
| 41                 | 29             | High Order bits of Project ID_LCD Native Color_Black(1)_High Order 3 bits of Device Vendor ID   | 0 9            | 0000 1001         |                           |
| 42                 | 2A             | 0x00  | 0 0            | 0000 0000         |                           |
| 43                 | 2B             | 0x00  | 0 0            | 0000 0000         |                           |
| 44                 | 2C             | 0x00  | 0 0            | 0000 0000         |                           |
| 45                 | 2D             | 0x00  | 0 0            | 0000 0000         |                           |
| 46                 | 2E             | 0x00  | 0 0            | 0000 0000         |                           |
| 47                 | 2F             | 0x00  | 0 0            | 0000 0000         |                           |
| 48                 | 30             | 0x00  | 0 0            | 0000 0000         |                           |
| 49                 | 31             | 0x00  | 0 0            | 0000 0000         |                           |
| 50                 | 32             | Operating frequency setting (54Mhz =0x36, 100Mhz =0x64)   | 6 4            | 0110 0100         |                           |
| 51                 | 33             | B/L Configuration(DY:0x, ROE:1x, HS:2x)(TG:x0, Nichia:x1)                                       | 1 0            | 0001 0000         |                           |
| 52                 | 34             | 0x00  | 0 0            | 0000 0000         |                           |
| 53                 | 35             | 0x00  | 0 0            | 0000 0000         |                           |



## Product Specification

## APPENDIX A. Enhanced Extended Display Identification Data (EEDID™) 2/3

| Byte#<br>(decimal) | Byte#<br>(HEX) | Field Name and Comments   | Value<br>(HEX) | Value<br>(binary) |                             |
|--------------------|----------------|---|----------------|-------------------|-----------------------------|
| 54                 | 36             | Pixel Clock/10,000 (LSB) : 100Mhz   | 1 3            | 0001 0011         | Timing<br>Descriptor<br>#1  |
| 55                 | 37             | Pixel Clock/10,000 (MSB)  | 2 7            | 0010 0111         |                             |
| 56                 | 38             | Horizontal Active (lower 8 bits) 1024pixel  | 0 0            | 0000 0000         |                             |
| 57                 | 39             | Horizontal Blanking(Thp+HA) (lower 8 bits) 1060pixel                                      | 2 4            | 0010 0100         |                             |
| 58                 | 3A             | Horizontal Active / Horizontal Blanking(Thp+HA) (upper 4:4bits)                           | 4 4            | 0100 0100         |                             |
| 59                 | 3B             | Vertical Active 768line   | 0 0            | 0000 0000         |                             |
| 60                 | 3C             | Vertical Blanking (Tvp+HA) (DE Blanking typ. for DE only panels) 32line                   | 2 0            | 0010 0000         |                             |
| 61                 | 3D             | Vertical Active : Vertical Blanking (Tvp+HA) (upper 4:4bits)                              | 3 0            | 0011 0000         |                             |
| 62                 | 3E             | Horizontal Sync. Offset (Thfp) 260pixel   | 0 4            | 0000 0100         |                             |
| 63                 | 3F             | Horizontal Sync Pulse Width (HSPW) 320pixel   | 4 0            | 0100 0000         |                             |
| 64                 | 40             | Vertical Sync Offset (Tvp) : Sync Width (VSPW) 16line/10line                              | 0 A            | 0000 1010         |                             |
| 65                 | 41             | Horizontal Vertical Sync Offset/Width (upper 2bits)                                       | 5 4            | 0101 0100         |                             |
| 66                 | 42             | Horizontal Image Size (mm)  | C 5            | 1100 0101         |                             |
| 67                 | 43             | Vertical Image Size (mm)  | 9 4            | 1001 0100         |                             |
| 68                 | 44             | Horizontal Image Size / Vertical Image Size   | 0 0            | 0000 0000         | Timing<br>Description<br>#2 |
| 69                 | 45             | Horizontal Border = 0 (Zero for Notebook LCD)   | 0 0            | 0000 0000         |                             |
| 70                 | 46             | Vertical Border = 0 (Zero for Notebook LCD)   | 0 0            | 0000 0000         |                             |
| 71                 | 47             | Non-Interlace, Normal display, no stereo, Digital Separate (Vsync_NEG, Hsync_NEG)         | 1 8            | 0001 1000         |                             |
| 72                 | 48             | Flag  | 0 0            | 0000 0000         |                             |
| 73                 | 49             | Flag  | 0 0            | 0000 0000         |                             |
| 74                 | 4A             | Flag  | 0 0            | 0000 0000         |                             |
| 75                 | 4B             | Data Type Tag (Descriptor Defined by manufacturer)  | 0 1            | 0000 0001         |                             |
| 76                 | 4C             | Flag  | 0 0            | 0000 0000         |                             |
| 77                 | 4D             | Descriptor Defined by manufacturer (Apple EDID signature)                                 | 0 6            | 0000 0110         |                             |
| 78                 | 4E             | Descriptor Defined by manufacturer (Apple EDID signature)                                 | 1 0            | 0001 0000         |                             |
| 79                 | 4F             | Descriptor Defined by manufacturer (Link Type)  | 3 0            | 0011 0000         |                             |
| 80                 | 50             | Descriptor Defined by manufacturer (Pixel and link component format_6bit panel interface) | 0 0            | 0000 0000         |                             |
| 81                 | 51             | Descriptor Defined by manufacturer (Panel feature_Inverter NA, no Inverter)               | 0 0            | 0000 0000         |                             |
| 82                 | 52             | Descriptor Defined by manufacturer  | 0 0            | 0000 0000         | Timing<br>Description<br>#3 |
| 83                 | 53             | Descriptor Defined by manufacturer  | 0 0            | 0000 0000         |                             |
| 84                 | 54             | Descriptor Defined by manufacturer  | 0 0            | 0000 0000         |                             |
| 85                 | 55             | Descriptor Defined by manufacturer  | 0 0            | 0000 0000         |                             |
| 86                 | 56             | Descriptor Defined by manufacturer  | 0 0            | 0000 0000         |                             |
| 87                 | 57             | Descriptor Defined by manufacturer  | 0 0            | 0000 0000         |                             |
| 88                 | 58             | (If<13 char--> 0Ah, then terminate with ASCII code 0Ah,set remaining char = 20h)          | 0 A            | 0000 1010         |                             |
| 89                 | 59             | (If<13 char--> 0Ah, then terminate with ASCII code 0Ah,set remaining char = 20h)          | 2 0            | 0010 0000         |                             |
| 90                 | 5A             | Flag  | 0 0            | 0000 0000         |                             |
| 91                 | 5B             | Flag  | 0 0            | 0000 0000         |                             |
| 92                 | 5C             | Flag  | 0 0            | 0000 0000         |                             |
| 93                 | 5D             | Data Type Tag ( ASCII String )  | F E            | 1111 1110         |                             |
| 94                 | 5E             | Flag  | 0 0            | 0000 0000         |                             |
| 95                 | 5F             | L   | 4 C            | 0100 1100         | Timing<br>Description<br>#3 |
| 96                 | 60             | P   | 5 0            | 0101 0000         |                             |
| 97                 | 61             | 0   | 3 0            | 0011 0000         |                             |
| 98                 | 62             | 9   | 3 9            | 0011 1001         |                             |
| 99                 | 63             | 7   | 3 7            | 0011 0111         |                             |
| 100                | 64             | X   | 5 8            | 0101 1000         |                             |
| 101                | 65             | 0   | 3 0            | 0011 0000         |                             |
| 102                | 66             | 2   | 3 2            | 0011 0010         |                             |
| 103                | 67             | -   | 2 D            | 0010 1101         |                             |
| 104                | 68             | S   | 5 3            | 0101 0011         |                             |
| 105                | 69             | L   | 4 C            | 0100 1100         |                             |
| 106                | 6A             | A   | 4 1            | 0100 0001         |                             |
| 107                | 6B             | 2   | 3 2            | 0011 0010         |                             |

## Product Specification

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

| Byte#<br>(decimal) | Byte#<br>(HEX) | Field Name and Comments  | Value<br>(HEX) | Value<br>(binary) |                             |
|--------------------|----------------|--|----------------|-------------------|-----------------------------|
| 108                | 6C             | Flag   | 0 0            | 0000 0000         | Timing<br>Description<br>#4 |
| 109                | 6D             | Flag   | 0 0            | 0000 0000         |                             |
| 110                | 6E             | Flag   | 0 0            | 0000 0000         |                             |
| 111                | 6F             | Data Type Tag ( ASCII String )   | F E            | 1111 1110         |                             |
| 112                | 70             | Flag   | 0 0            | 0000 0000         |                             |
| 113                | 71             | C  | 4 3            | 0100 0011         |                             |
| 114                | 72             | o  | 6 F            | 0110 1111         |                             |
| 115                | 73             | l  | 6 C            | 0110 1100         |                             |
| 116                | 74             | o  | 6 F            | 0110 1111         |                             |
| 117                | 75             | r  | 7 2            | 0111 0010         |                             |
| 118                | 76             | SPACE  | 2 0            | 0010 0000         |                             |
| 119                | 77             | L  | 4 C            | 0100 1100         |                             |
| 120                | 78             | C  | 4 3            | 0100 0011         |                             |
| 121                | 79             | D  | 4 4            | 0100 0100         |                             |
| 122                | 7A             | LE   | 0 A            | 0000 1010         |                             |
| 123                | 7B             | SPACE  | 2 0            | 0010 0000         |                             |
| 124                | 7C             | SPACE  | 2 0            | 0010 0000         |                             |
| 125                | 7D             | SPACE  | 2 0            | 0010 0000         |                             |
| 126                | 7E             | Extension flag (# of optional 128 panel ID extension block to follow, Typ = 0) | 0 0            | 0000 0000         | Extension Flag              |
| 127                | 7F             | Check Sum (The 1-byte sum of all 128 bytes in this panel ID block shall = 0)   | 9 C            | 1001 1100         | Checksum                    |