# SPECIFICATION
# FOR
# APPROVAL

(◆) **Preliminary Specification**

( **Final Specification**

| Title | 13.3” WXGA TFT LCD |
|---|---|

| Customer | APPLE |
|---|---|
| MODEL | K84 |

| SUPPLIER | LG. Display Co., Ltd. |
|---|---|
| *MODEL | LP133WX2 |
| Suffix | TLC7 |

*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.

| APPROVED BY | SIGNATURE |
|---|---|
| **J. K. Kim / S.Manager** | |
| **REVIEWED BY** | |
| **K. T. Moon/ Manager** | |
| **PREPARED BY** | |
| **H.H. Lee/ Engineer** | |

**Product Engineering Dept.**
**LG. Display Co., Ltd**

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# RECORD OF REVISIONS

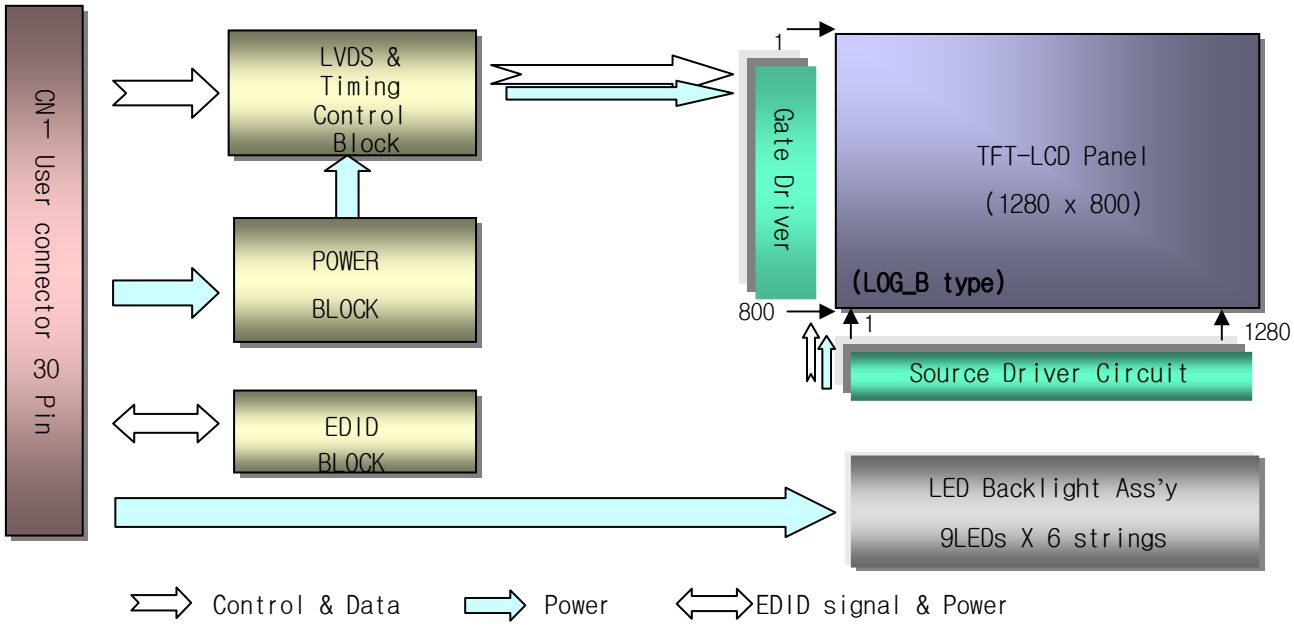
| Revision No | Revision Date | Page | Description | EDID ver |
|---|---|---|---|---|
| 0.0 | 08. May. 2009 | - | First Draft | 0.0 |

## 1. General Description

The LP133WX2 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 white mode. This TFT-LCD has 13.3 inches diagonally measured active display area with WXGA resolution(1280 horizontal by 800 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 LP133WX2 has been designed to apply the interface method that enables low power, high speed, low EMI.

The LP133WX2 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 LP133WX2 characteristics provide an excellent flat display for office automation products such as Notebook PC.




## General Features

| | |
|---|---|
| Active Screen Size | 13.3 inches diagonal |
| Outline Dimension | 297.15 (H) × 192.15 (V) × 3.68(D, Max.) mm |
| Pixel Pitch | 0.2235 mm × 0.2235 mm |
| Pixel Format | 1280 horiz. by 800 vert. Pixels RGB strip arrangement |
| Color Depth | 6-bit, 262,144 colors |
| Luminance, White | 275 cd/m$^2$(Typ., @$I_{LED}$=19mA) |
| Power Consumption | Logic : 0.76W(typ.@Mosaic), Back Light : 3.2W(typ.@ $I_{LED}$= 19mA) |
| Weight | 310(Max.) |
| Display Operating Mode | Transmissive mode, normally white |
| Surface Treatment | Hard Coating(Glare), Anti reflection treatment of the front Polarizer (Haze 0%) |

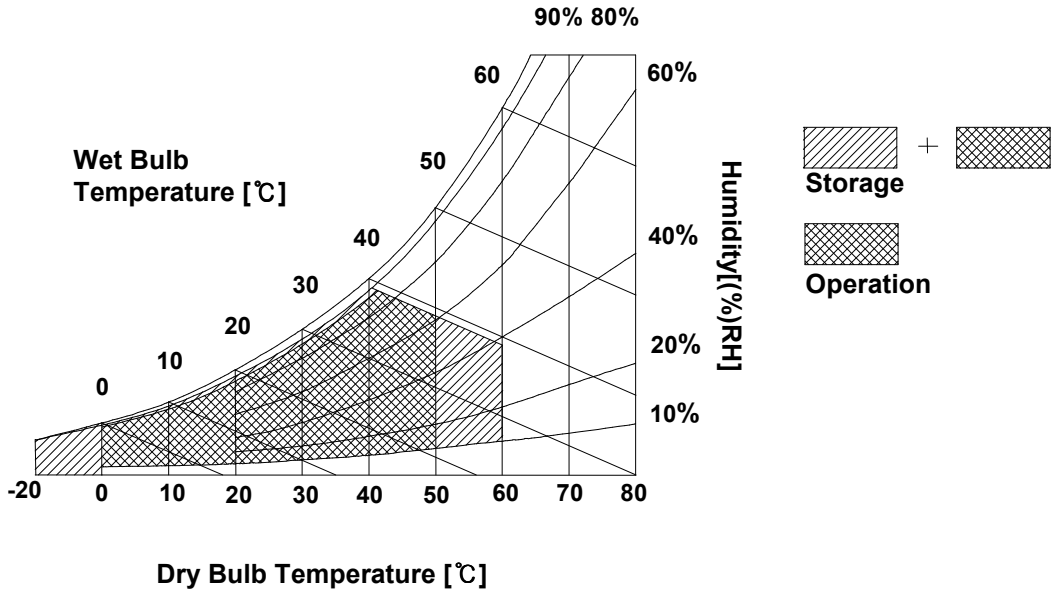
## 2. Absolute Maximum Ratings

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.



# 3. Electrical Specifications

## 3-1. Electrical Characteristics

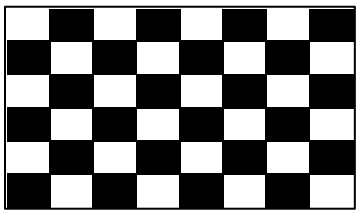
The LP133WX2 requires two power inputs. One is employed to power the LCD electronics and to drive the TFT array and liquid crystal. The second input which powers the LED BL.

**Table 2. ELECTRICAL CHARACTERISTICS**

| Parameter | Symbol | Values | | | Unit | Notes |
|---|---|---|---|---|---|---|
| | | Min | Typ | Max | | |
| MODULE : | | | | | | |
| Power Supply Input Voltage | VCC | 3.0 | 3.3 | 3.6 | $V_{DC}$ | |
| Power Supply Input Current | $I_{CC}$ Mosaic | - | 230 | 265 | mA | 1 |
| Power Consumption | Pc | - | 0.76 | 0.875 | Watt | 1 |
| Differential Impedance | Zm | 90 | 100 | 110 | Ohm | 2 |
| LED Backlight : | | | | | | |
| Operating Current per string | $I_{LED}$ | 5 | 19 | 20 | mA | 3 |
| Power Consumption | $P_{BL}$ | - | 3.2 | 3.5 | Watt | 4 |
| Life Time | | 10,000 | - | - | Hrs | 5 |

Note)

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

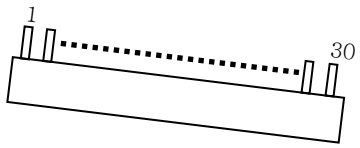


2. This impedance value is needed to proper display and measured form LVDS Tx to the mating connector.
3. The typical operating current is for the typical surface luminance ($L_{WH}$) in optical characteristics.
4. Define the brightness of the lamp after being lighted for 5 minutes as 100%, Ts is the time required for the brightness of the center of the lamp to be not less than 95%.
5. The life time is determined as the time at which brightness of LED is 50% compare to that of initial value at the typical LED current.

## 3-2. Interface Connections

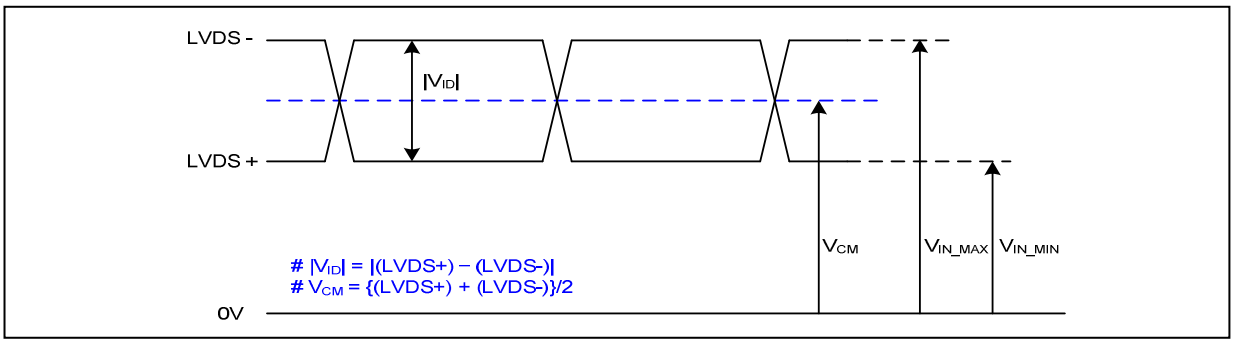
This LCD employs two interface connections, a 30 pin connector is used for the module electronics interface and the other connector is used for the integral backlight system.
The electronics interface connector is a model 20474-030E-1# manufactured by I-PEX.

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

| Pin | Symbol | Description | Notes |
|---|---|---|---|
| 1 | GND | Ground | [LVDS Receiver]<br>SiliconWorks, SW0618V<br><br>[Connector]<br>I-PEX 20474-030E–1#<br><br>[Mating Connector]<br>I-PEX 20472-030T-10 series<br>or equivalent (micro-coax type)<br><br>[Connector pin arrangement]<br>LCD front view<br>  <br> |
| 2 | VCC | Power Supply, 3.3V Typ. | |
| 3 | VCC | Power Supply, 3.3V Typ. | |
| 4 | V EEDID | DDC 3.3V power | |
| 5 | GSP | GSP | |
| 6 | Clk EEDID | DDC Clock | |
| 7 | DATA EEDID | DDC Data | |
| 8 | $R_{IN}$ 0− | Negative LVDS differential data input | |
| 9 | $R_{IN}$ 0+ | Positive LVDS differential data input | |
| 10 | GND | Ground | |
| 11 | $R_{IN}$ 1− | Negative LVDS differential data input | |
| 12 | $R_{IN}$ 1+ | Positive LVDS differential data input | |
| 13 | GND | Ground | |
| 14 | $R_{IN}$ 2− | Negative LVDS differential data input | |
| 15 | $R_{IN}$ 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 | |

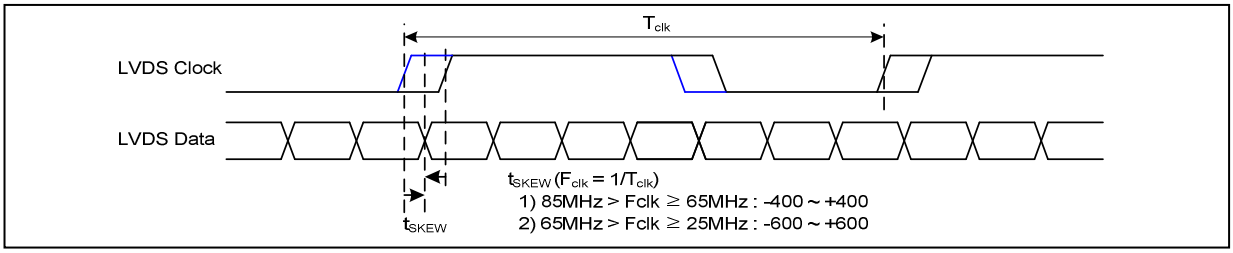
## 3-3. LVDS Signal Timing Specifications

### 3-3-1. DC Specification

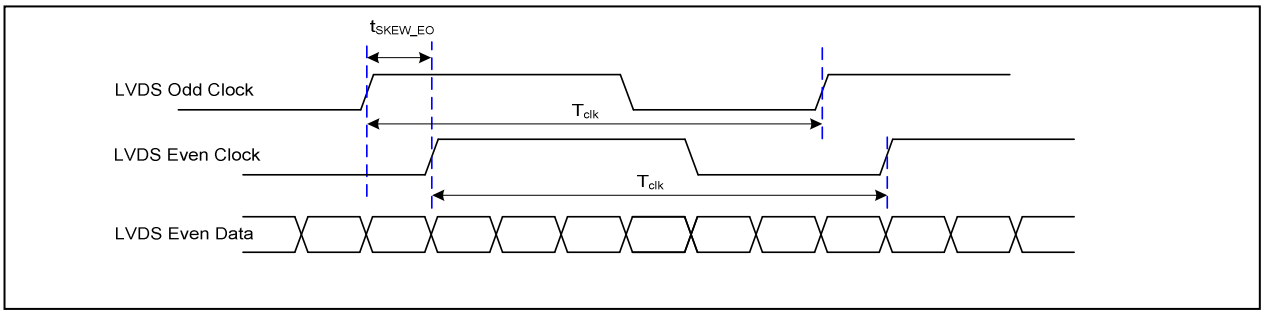



| Description | Symbol | Min | Max | Unit | Notes |
|---|---|---|---|---|---|
| LVDS Differential Voltage | $\|V_{ID}\|$ | 100 | 600 | mV | - |
| LVDS Common mode Voltage | $V_{CM}$ | 0.6 | 1.8 | V | - |
| LVDS Input Voltage Range | $V_{IN}$ | 0.3 | 2.1 | V | - |

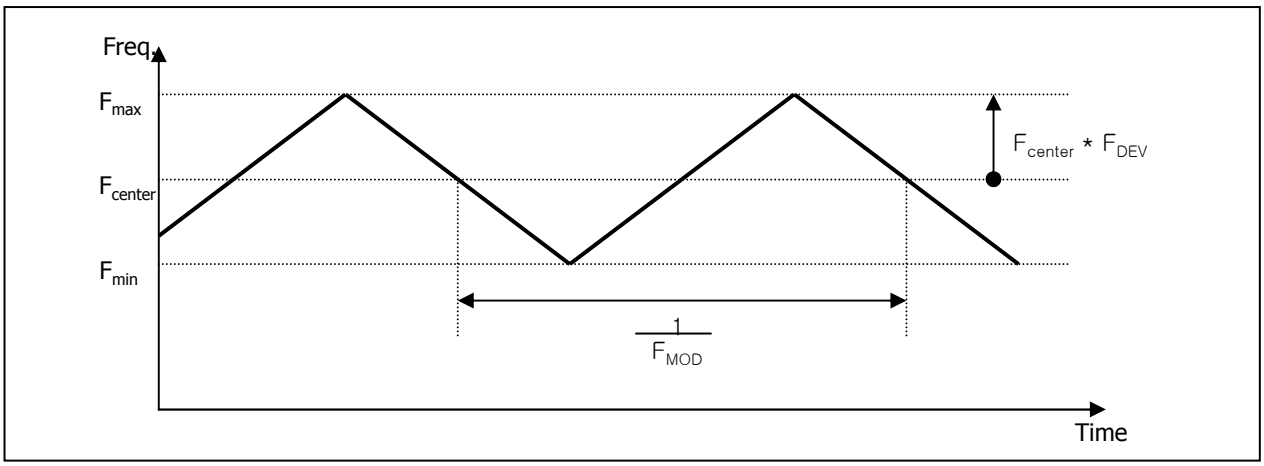
### 3-3-2. AC Specification




| 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 | - |



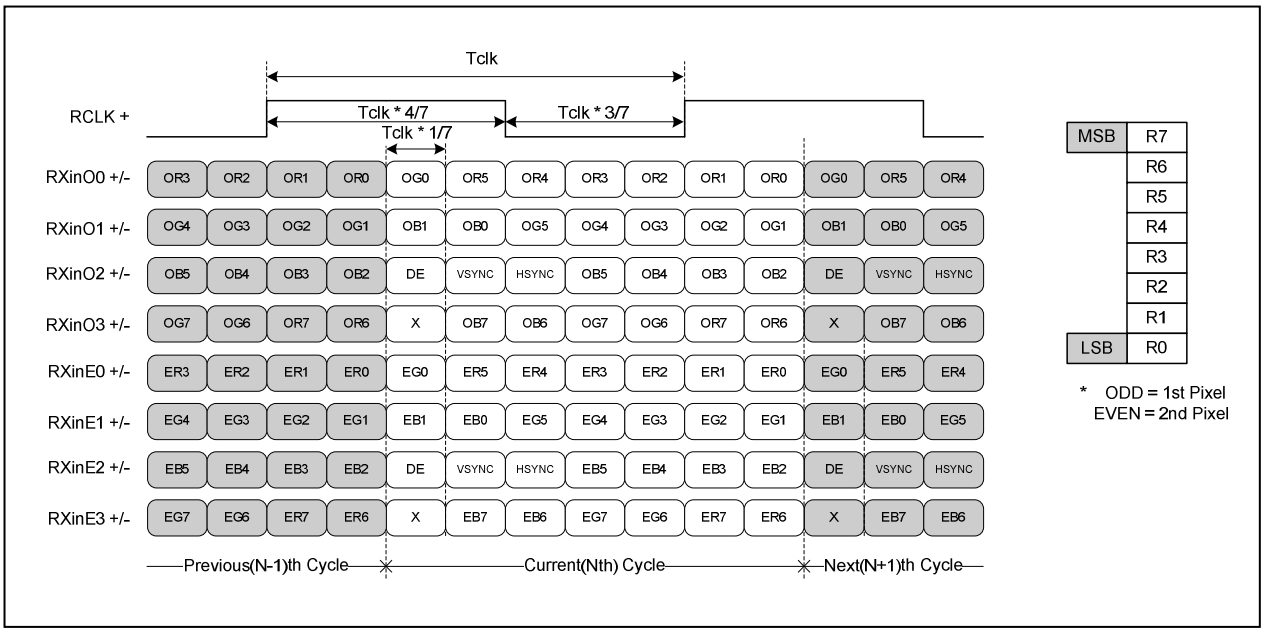

< Clock skew margin between channel >




< Spread Spectrum >

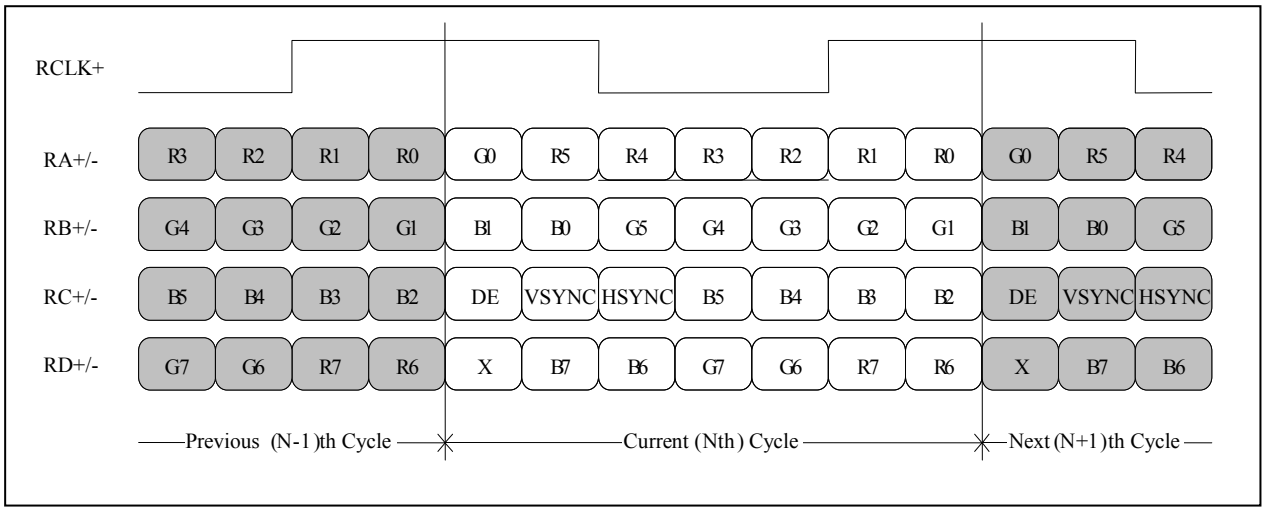
### 3-3-3. Data Format

1) LVDS 2 Port




< LVDS Data Format >

2) LVDS 1 Port


RCLK+
RA+/-
R3 R2 R1 R0 G0 R5 R4 R3 R2 R1 R0 G0 R5 R4
RB+/-
G4 G3 G2 G1 B1 B0 G5 G4 G3 G2 G1 B1 B0 G5
RC+/-
B5 B4 B3 B2 DE VSYNC HSYNC B5 B4 B3 B2 DE VSYNC HSYNC
RD+/-
G7 G6 R7 R6 X B7 B6 G7 G6 R7 R6 X B7 B6
Previous (N-1)th Cycle
Current (Nth) Cycle
Next (N+1)th Cycle

## 3-4. Signal Timing Specifications

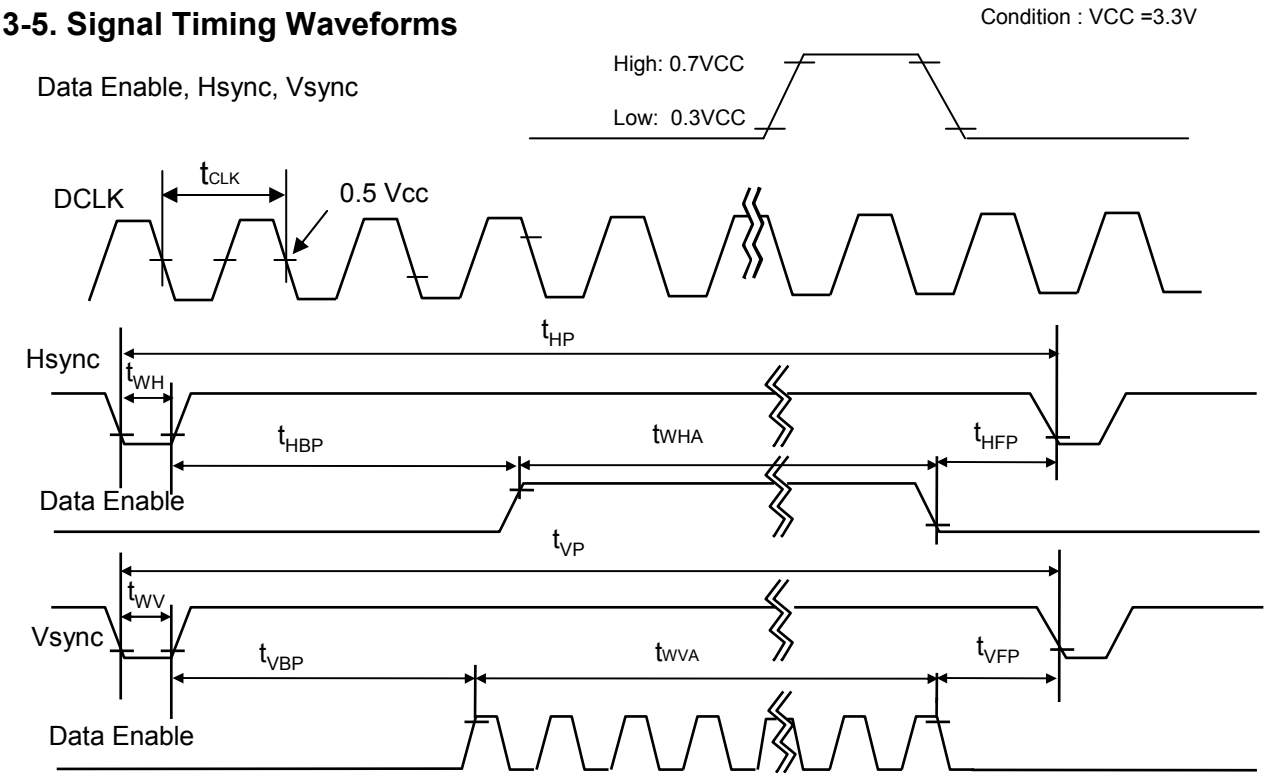
This is the signal timing required at the input of the User connector. All of the interface signal timing should be satisfied with the following specifications and specifications of LVDS Tx/Rx for its proper operation.

**Table 6. TIMING TABLE**

| ITEM | Symbol | | Min | Typ | Max | Unit | Note |
|---|---|---|---|---|---|---|---|
| DCLK | Frequency | $f_{CLK}$ | | 72.5 | | MHz | |
| Hsync | Period | Thp | 1280 | 1280 | 1280 | Tclk | |
| | Width | $t_{WH}$ | 1420 | 1423 | 1460 | | |
| | Width-Active | $t_{WHA}$ | 16 | 32 | 48 | | |
| Vsync | Period | $t_{VP}$ | 800 | 800 | 800 | tHP | |
| | Width | $t_{WV}$ | 811 | 846 | 847 | | |
| | Width-Active | $t_{WVA}$ | 3 | 6 | 9 | | |
| Data Enable | Horizontal back porch | $t_{HBP}$ | 54 | 63 | 98 | tCLK | |
| | Horizontal front porch | $t_{HFP}$ | 16 | 48 | 62 | | |
| | Vertical back porch | $t_{VBP}$ | 5 | 37 | 35 | tHP | |
| | Vertical front porch | $t_{VFP}$ | 3 | 3 | 3 | | |

## 3-5. Signal Timing Waveforms

Condition : VCC =3.3V



## 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 |
| | | R5 | R4 | R3 | R2 | R1 | R0 | G5 | G4 | G3 | G2 | G1 | G0 | B5 | B4 | B3 | B2 | B1 | B0 |
| Basic Color | Black | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 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 |

## 3-7. Power Sequence

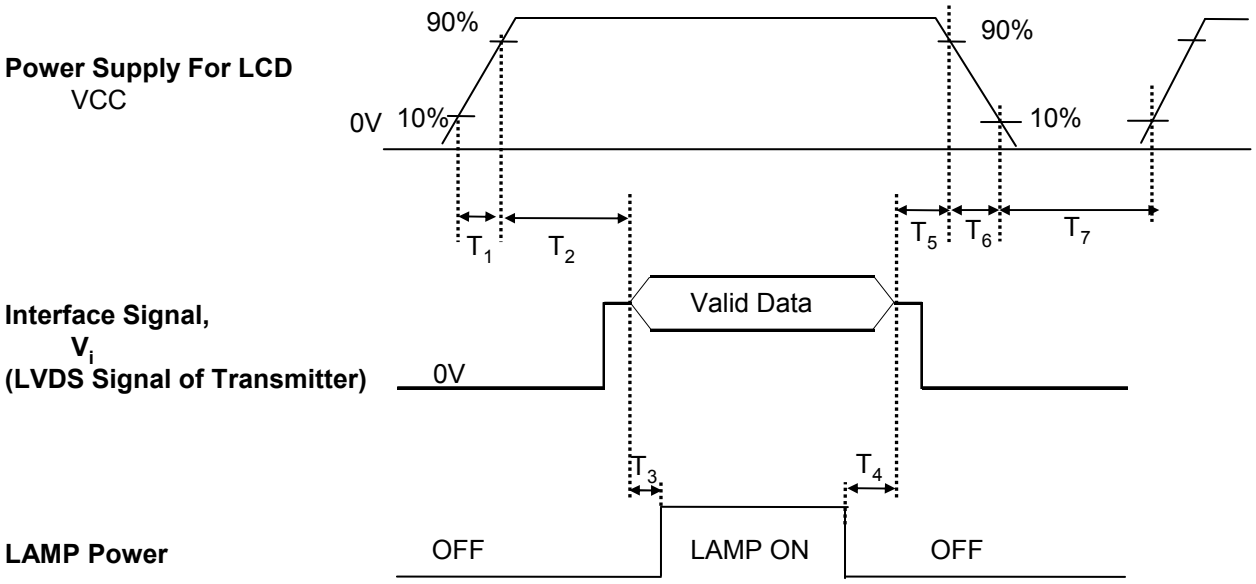



**Table 8. POWER SEQUENCE TABLE**

| Parameter | Value | | | Units |
|---|---|---|---|---|
| | Min. | Typ. | Max. | |
| $T_1$ | 0 | - | 10 | (ms) |
| $T_2$ | 0 | - | 50 | (ms) |
| $T_3$ | 200 | - | - | (ms) |
| $T_4$ | 200 | - | - | (ms) |
| $T_5$ | 0 | - | 50 | (ms) |
| $T_6$ | 0 | - | 10 | (ms) |
| $T_7$ | 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.

## 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 Φ and Θ equal to 0°.
FIG. 1 presents additional information concerning the measurement equipment and method.

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

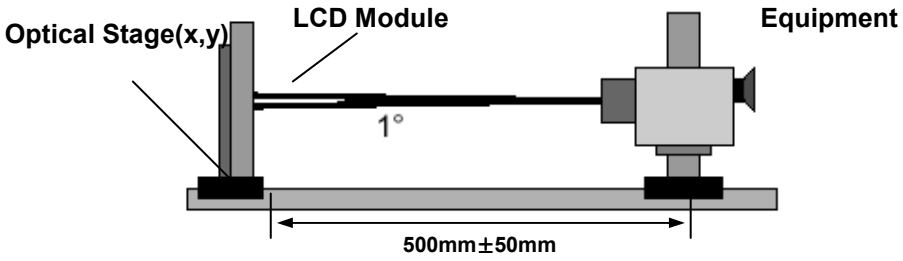



**Table 9. OPTICAL CHARACTERISTICS** Ta=25°C, VCC=3.3V, fv=60Hz, $f_{CLK}$= 72.5MHz, ILED = 19mA

| Parameter | | Symbol | Condition | Min | Typ | Max | Units | Notes |
|---|---|---|---|---|---|---|---|---|
| Average Luminance | | LAVE | 160 Points (ILED= 19mA) | 235 | 275 | - | cd/㎡ | Fig 2 |
| Luminance variation | | % | 160 points | 60 | 70 | - | - | Fig 2 |
| C/R | | - | Center 1 Point | 450 | 600 | - | - | |
| Response time | | TrR + TrD | - | - | 16 | 25 | ms | Fig 3 |
| Viewing angle | Horizontal | Θ | ϕx(Left,Right) | | ±70 | - | ° | Fig 4 |
| | Vertical | Θ | ϕyu(Up) | | 60 | - | | |
| | | Θ | ϕyd(Down) | | 60 | - | | |
| Worst neighbor Brightness uniformity | | % | | 70 | | | | |
| White chromaticity deviation (W.R.T center) | | | d u'v' | - | - | 0.0075 | | |
| White chromaticity deviation (Over panel) | | | d u'v' | - | - | 0.0125 | | |
| White chromaticity deviation (Worst neighbor) | | | d u'v' | - | - | 0.0025 | | |
| Cross Talk | | DSHA | - | - | - | 4.0 | % | Fig 5 |
| Gray Scale | | - | - | Gamma 2.2 | | | | |

**Table 10. RGB Color Chromaticity**

| | White | | Red | | Green | | Blue | |
|---|---|---|---|---|---|---|---|---|
| | Wx | Wy | Rx | Ry | Gx | Gy | Bx | By |
| Max. | 0.338 | 0.354 | 0.615 | 0.365 | 0.350 | 0.595 | 0.180 | 0.155 |
| Typ. | 0.313 | 0.329 | 0.590 | 0.340 | 0.325 | 0.570 | 0.155 | 0.130 |
| Min. | 0.288 | 0.304 | 0.565 | 0.315 | 0.300 | 0.545 | 0.130 | 0.105 |

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. 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.

3. 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.

4. Gray scale specification * $f_V$=60Hz

| Gray Level | Luminance [%] (Typ) |
|---|---|
| L0 | 0.10 |
| L7 | 0.71 |
| L15 | 3.43 |
| L23 | 8.90 |
| L31 | 19.2 |
| L39 | 31.9 |
| L47 | 47.2 |
| L55 | 71.2 |
| L63 | 100 |

5. Average Luminance

Ave. = SUM(L1:L160) / 160

where L1 to L160 are the luminance values measured at point #1 to #160.

6. Luminance Uniformity

Luminance Uniformity:

U = 100% - (Lmax-Lmin)/Lmax

where, Lmax = max {Luminance values at 160 points},

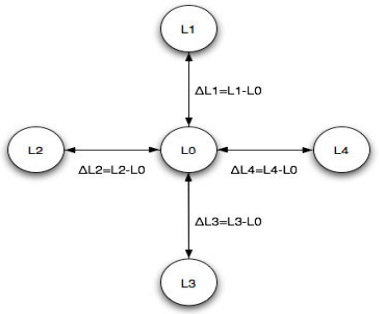
Lmin = min {Luminance values at 160 points}

7. Worst neighbor Luminance Uniformity

Worst Neighbor Luminance Uniformity (The 4 points that are closest to the test point)

WNU=100%-Max(∆L1, ∆L2, ∆L3, ∆L4)/L0

Global WNU = min (WNU1, …WNU160)




8. White chromaticity deviation – with respect to center

Center color coordinate is defined as the Average of points: 72, 73, 88, 89.

9. White chromaticity deviation – over panel

Maximum delta u'v' between any two measured points over the 160 points

10. White chromaticity deviation – worst neighbor

Maximum delta u'v' between any two neighboring points on the panel

11. White Chromaticity

Average (72, 73, 88, 89 Points)

12. RGB Chromaticity

Center Point

**FIG. 2 Luminance**

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

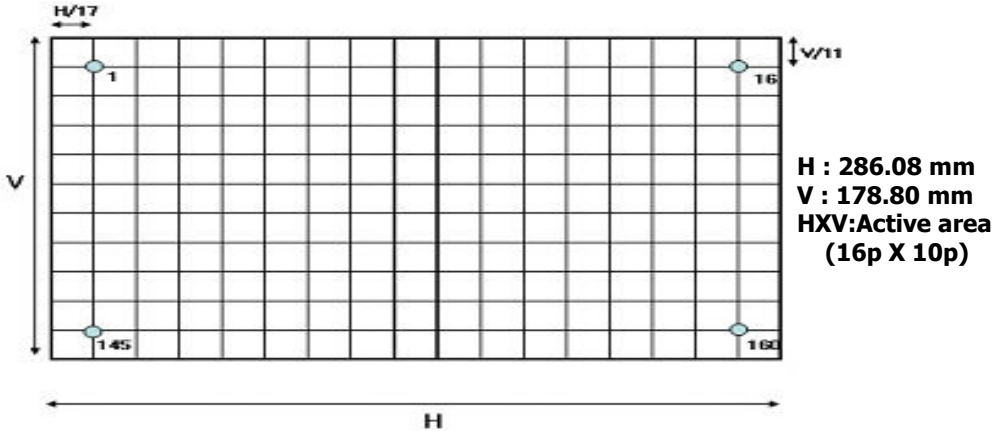



**FIG. 3 Response Time**

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

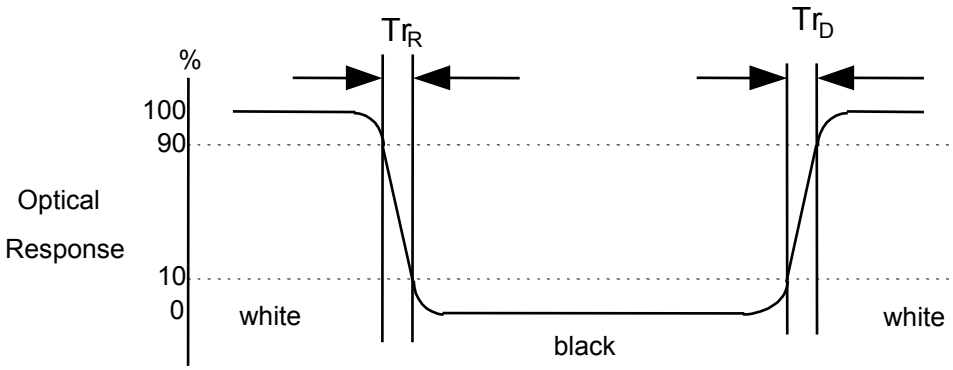



**FIG. 4 Viewing angle**

<Dimension of viewing angle range>

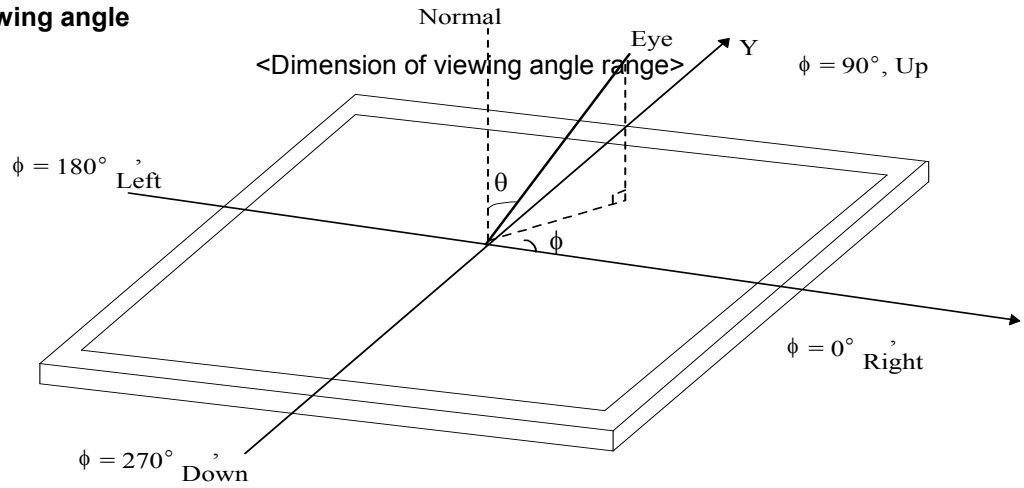


**FIG. 5 Cross talk**

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

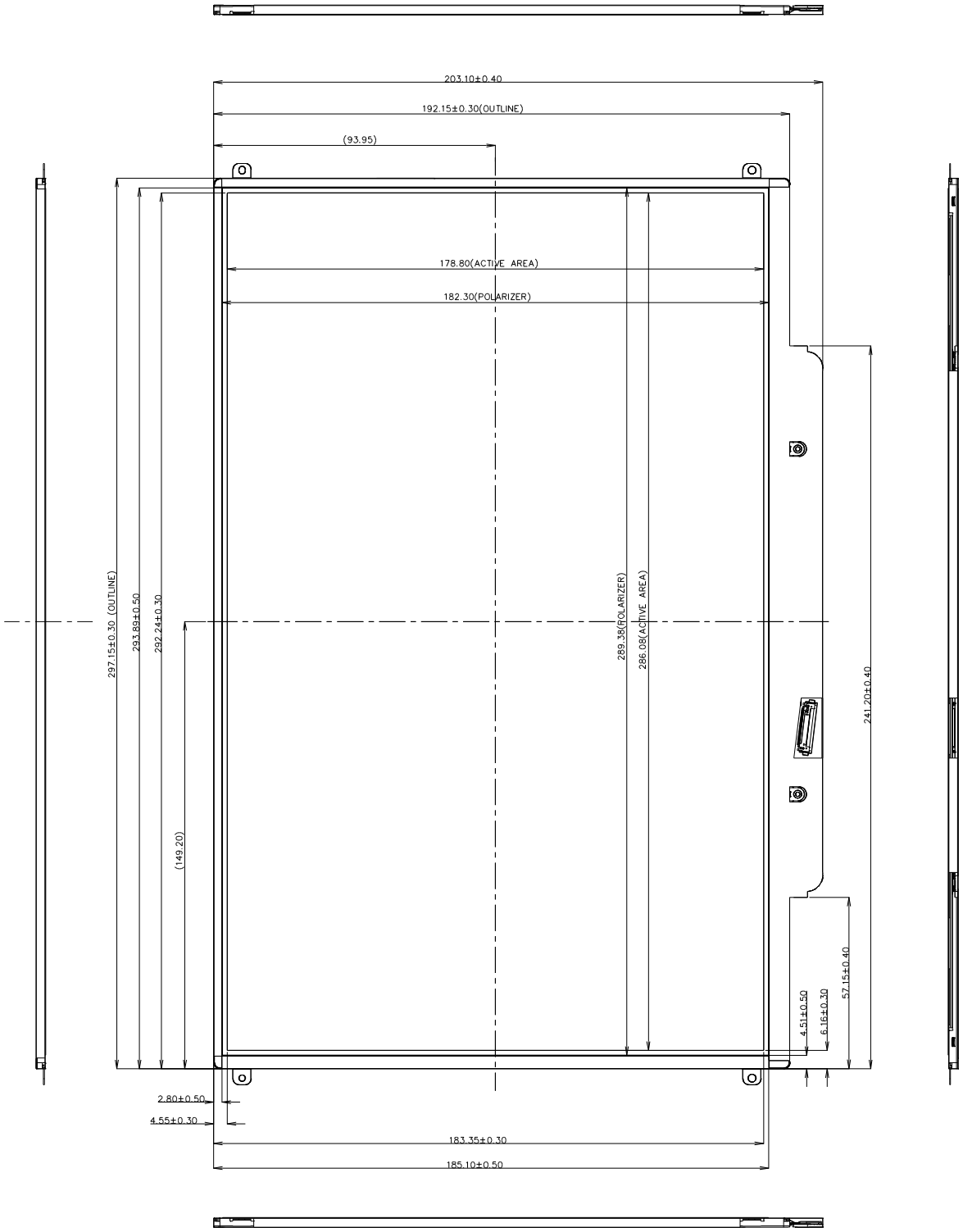
$L_B$ = Luminance in Pattern B.

## 5. Mechanical Characteristics

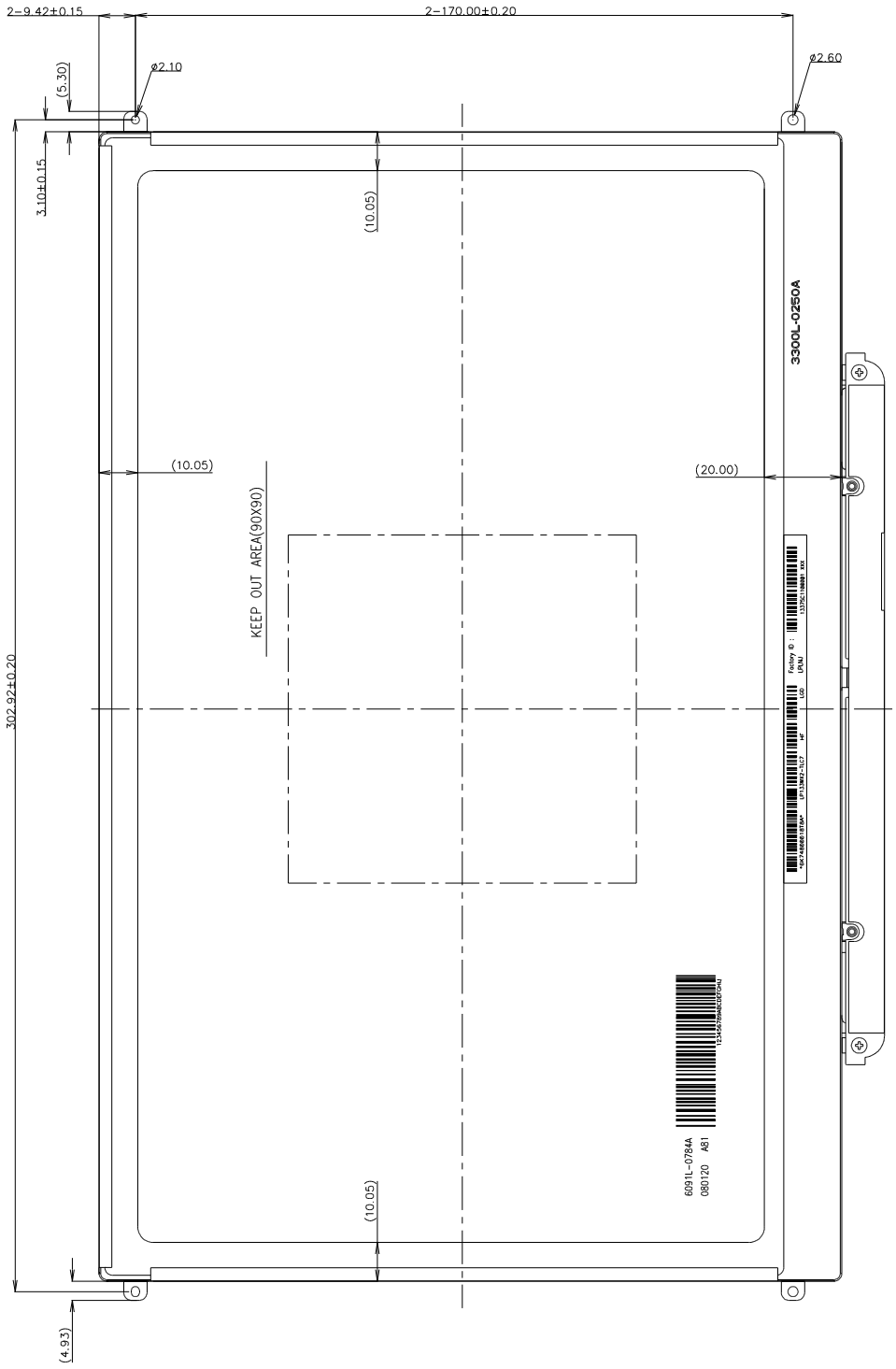
The contents provide general mechanical characteristics for the model LP133WX2. In addition the figures in the next page are detailed mechanical drawing of the LCD.

| | | |
|---|---|---|
| Outline Dimension | Horizontal | 297.15 ± 0.30mm |
| | Vertical | 192.15 ± 0.30mm |
| | Thickness | 3.68mm(Max.) |
| Bezel Area | Horizontal | 289.38 mm |
| | Vertical | 182.5mm |
| Active Display Area | Horizontal | 286.08mm |
| | Vertical | 178.80 mm |
| Weight | 310g (Max.) | |
| Surface Treatment | Hard coating(2H), Glare treatment of the front Polarizer (Haze 0%) | |

<FRONT VIEW>


203.10±0.40
192.15±0.30(OUTLINE)
(93.95)
178.80(ACTIVE AREA)
182.30(POLARIZER)
297.15±0.30 (OUTLINE)
293.89±0.50
292.24±0.30
(149.20)
289.38(POLARIZER)
286.08(ACTIVE AREA)
241.20±0.40
57.15±0.40
6.16±0.30
4.51±0.50
2.80±0.50
4.55±0.30
183.35±0.30
185.10±0.50

<REAR VIEW>


2-9.42±0.15
2-170.00±0.20
ø2.10
ø2.60
(5.30)
3.10±0.15
(10.05)
(10.05)
(20.00)
KEEP OUT AREA(90X90)
302.92±0.20
(10.05)
(4.93)
3300L-0250A
6091L-0784A
080120 A01

## 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 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 1st 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 )

# 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)
D : YEAR
E : MONTH
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 : 20 pcs

b) Box Size : 422mm × 340mm × 257mm

# 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 the resist external force.
(4) You should adopt radiation structure to satisfy the temperature specification.
(5) Acetic acid type and chlorine type materials for the cover case are not desirable because the former generates corrosive gas of attacking the polarizer at high temperature and the latter causes circuit break by electro-chemical reaction.
(6) Do not touch, push or rub the exposed polarizers with glass, tweezers or anything harder than HB pencil lead. And please do not rub with dust clothes with chemical treatment.
Do not touch the surface of polarizer for bare hand or greasy cloth.(Some cosmetics are detrimental to the polarizer.)
(7) When the surface becomes dusty, please wipe gently with absorbent cotton or other soft materials like chamois soaks with petroleum benzene. Normal-hexane is recommended for cleaning the adhesives used to attach front / rear polarizers. Do not use acetone, toluene and alcohol because they cause chemical damage to the polarizer.
(8) Wipe off saliva or water drops as soon as possible. Their long time contact with polarizer causes deformations and color fading.
(9) Do not open the case because inside circuits do not have sufficient strength.

## 9-2. OPERATING PRECAUTIONS

(1) The spike noise causes the mis-operation of circuits. It should be lower than following voltage :
V=± 200mV(Over and under shoot voltage)

(2) Response time depends on the temperature.(In lower temperature, it becomes longer.)
(3) Brightness depends on the temperature. (In lower temperature, it becomes lower.)
And in lower temperature, response time(required time that brightness is stable after turned on) becomes longer.
(4) Be careful for condensation at sudden temperature change. Condensation makes damage to polarizer or electrical contacted parts. And after fading condensation, smear or spot will occur.
(5) When fixed patterns are displayed for a long time, remnant image is likely to occur.
(6) Module has high frequency circuits. Sufficient suppression to the electromagnetic interference shall be done by system manufacturers. Grounding and shielding methods may be important to minimized the interference.

## 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.

# APPENDIX A. Enhanced Extended Display Identification Data (EEDID™) 1/3

| Byte# (decimal) | Byte# (HEX) | Field Name and Comments | Value (HEX) | | Value (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 manufacturer code(3 Character ID) = APP | 0 | 6 | 0000 0110 | Vender/ Product ID |
| 9 | 09 | Compressed ASCII | 1 | 0 | 0001 0000 | |
| 10 | 0A | Product code(Refer to Apple's request) = K84(0x9cbe) | B | E | 1011 1110 | |
| 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 = April 3th 17weeks | 1 | 1 | 0001 0001 | |
| 17 | 11 | Year of Manufacture = 2009 | 1 | 3 | 0001 0011 | |
| 18 | 12 | EDID Structure version # = 1 | 0 | 1 | 0000 0001 | EDID Version/ Revision |
| 19 | 13 | EDID Revision # = 3 | 0 | 3 | 0000 0011 | |
| 20 | 14 | Video Input Definition = Digital I/P,non TMDS CRGB | 8 | 0 | 1000 0000 | Display Parameter |
| 21 | 15 | Max H image size(㎝)=28.608cm(29) | 1 | D | 0001 1101 | |
| 22 | 16 | Max V image size(㎝)=17.880cm(18) | 1 | 2 | 0001 0010 | |
| 23 | 17 | Display gamma =2.2 | 7 | 8 | 0111 1000 | |
| 24 | 18 | Feature support(DPMS) = Active off, RGB Color | 0 | A | 0000 1010 | |
| 25 | 19 | Red/Green low Bits | D | A | 1101 1010 | Color Characteristic |
| 26 | 1A | Blue/White Low Bits | E | 0 | 1110 0000 | |
| 27 | 1B | Red X = 0.597 | 9 | 8 | 1001 1000 | |
| 28 | 1C | Red Y = 0.349 | 5 | 9 | 0101 1001 | |
| 29 | 1D | Green X = 0.319 | 5 | 1 | 0101 0001 | |
| 30 | 1E | Green Y = 0.549 | 8 | C | 1000 1100 | |
| 31 | 1F | Blue X = 0.144 | 2 | 4 | 0010 0100 | |
| 32 | 20 | Blue Y = 0.135 | 2 | 2 | 0010 0010 | |
| 33 | 21 | White X = 0.313 | 5 | 0 | 0101 0000 | |
| 34 | 22 | White Y = 0.329 | 5 | 4 | 0101 0100 | |
| 35 | 23 | Established Timing I = 00h(If not used) | 0 | 0 | 0000 0000 | Established 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 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 | |

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

| Byte# (decimal) | Byte# (HEX) | Field Name and Comments | Value (HEX) | | Value (binary) | |
|---|---|---|---|---|---|---|
| 54 | 36 | Pixel Clock/10,000 (LSB) 72.5 MHz @ 60.2Hz | 5 | 2 | 0101 0010 | Timing Descriptor #1 |
| 55 | 37 | Pixel Clock/10,000 (MSB) | 1 | C | 0001 1100 | |
| 56 | 38 | Horizontal Active (lower 8 bits) 1280 Pixels | 0 | 0 | 0000 0000 | |
| 57 | 39 | Horizontal Blanking(Thp-HA) (lower 8 bits) 143 Pixels | 8 | F | 1000 1111 | |
| 58 | 3A | Horizontal Active / Horizontal Blanking(Thp-HA) (upper 4:4bits) | 5 | 0 | 0101 0000 | |
| 59 | 3B | Vertical Avtive 800 Lines | 2 | 0 | 0010 0000 | |
| 60 | 3C | Vertical Blanking (Tvp-HA) (DE Blanking typ.for DE only panels) 46 Lines | 2 | E | 0010 1110 | |
| 61 | 3D | Vertical Active : Vertical Blanking (Tvp-HA) (upper 4:4bits) | 3 | 0 | 0011 0000 | |
| 62 | 3E | Horizontal Sync. Offset (Thfp) 48 Pixels | 3 | 0 | 0011 0000 | |
| 63 | 3F | Horizontal Sync Pulse Width (HSPW) 32 Pixels | 2 | 0 | 0010 0000 | |
| 64 | 40 | Vertical Sync Offset(Tvfp) : Sync Width (VSPW) 3 Lines : 6 Lines | 3 | 6 | 0011 0110 | |
| 65 | 41 | Horizontal Vertical Sync Offset/Width (upper 2bits) | 0 | 0 | 0000 0000 | |
| 66 | 42 | Horizontal Image Size = 286.08mm(286) | 1 | E | 0001 1110 | |
| 67 | 43 | Vertical Image Size = 178.80cm(179) | B | 3 | 1011 0011 | |
| 68 | 44 | Horizontal & Vertical Image Size | 1 | 0 | 0001 0000 | |
| 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 | 8 | 0001 1000 | |
| 72 | 48 | Detailed Timing Descriptor #2 | 0 | 0 | 0000 0000 | Timing Description #2 |
| 73 | 49 | | 0 | 0 | 0000 0000 | |
| 74 | 4A | | 0 | 0 | 0000 0000 | |
| 75 | 4B | | 0 | 1 | 0000 0001 | |
| 76 | 4C | Version | 0 | 0 | 0000 0000 | |
| 77 | 4D | Apple edid signature | 0 | 6 | 0000 0110 | |
| 78 | 4E | Apple edid signature | 1 | 0 | 0001 0000 | |
| 79 | 4F | Link Type | 2 | 0 | 0010 0000 | |
| 80 | 50 | Pixel and link component format(6-bit panel interface) | 0 | 0 | 0000 0000 | |
| 81 | 51 | Panel features(Inverter NA, no inverter) | 0 | 0 | 0000 0000 | |
| 82 | 52 | | 0 | 0 | 0000 0000 | |
| 83 | 53 | | 0 | 0 | 0000 0000 | |
| 84 | 54 | | 0 | 0 | 0000 0000 | |
| 85 | 55 | | 0 | 0 | 0000 0000 | |
| 86 | 56 | | 0 | 0 | 0000 0000 | |
| 87 | 57 | | 0 | 0 | 0000 0000 | |
| 88 | 58 | | 0 | A | 0000 1010 | |
| 89 | 59 | | 2 | 0 | 0010 0000 | |
| 90 | 5A | Detailed Timing Descriptor #3 | 0 | 0 | 0000 0000 | Timing Description #3 |
| 91 | 5B | | 0 | 0 | 0000 0000 | |
| 92 | 5C | | 0 | 0 | 0000 0000 | |
| 93 | 5D | | F | E | 1111 1110 | |
| 94 | 5E | | 0 | 0 | 0000 0000 | |
| 95 | 5F | L | 4 | C | 0100 1100 | |
| 96 | 60 | P | 5 | 0 | 0101 0000 | |
| 97 | 61 | 1 | 3 | 1 | 0011 0001 | |
| 98 | 62 | 3 | 3 | 3 | 0011 0011 | |
| 99 | 63 | 3 | 3 | 3 | 0011 0011 | |
| 100 | 64 | W | 5 | 7 | 0101 0111 | |
| 101 | 65 | X | 5 | 8 | 0101 1000 | |
| 102 | 66 | 2 | 3 | 2 | 0011 0010 | |
| 103 | 67 | - | 2 | D | 0010 1101 | |
| 104 | 68 | T | 5 | 4 | 0101 0100 | |
| 105 | 69 | L | 4 | C | 0100 1100 | |
| 106 | 6A | C | 4 | 3 | 0100 0011 | |
| 107 | 6B | 7 | 3 | 7 | 0011 0111 | |

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

| Byte# (decimal) | Byte# (HEX) | Field Name and Comments | Value (HEX) | | Value (binary) | |
|---|---|---|---|---|---|---|
| 108 | 6C | Detailed Timing Descriptor #4 | 0 | 0 | 0000 0000 | Timing Description #4 |
| 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 | 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 | LF | 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 = 00 | 0 | 0 | 0000 0000 | Extension Flag |
| 127 | 7F | Checksum | 5 | D | 0101 1101 | Checksum |