# SPECIFICATION
# FOR
# APPROVAL

( • ) **Preliminary Specification**
( ) **Final Specification**

| Title | 10.4” VGA TFT LCD |
|---|---|

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

| SUPPLIER | LG.Philips LCD Co., Ltd. |
|---|---|
| *MODEL | LP104V2 |
| SUFFIX | B1 |

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

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

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

| SIGNATURE | DATE |
|---|---|
| I.H.AHN / G.Manager | |
| **REVIEWED BY** | |
| H.W. KIM / Manager | |
| **PREPARED BY** | |
| C.S. SO / Engineer | |

**New Product Development Team.**
**LG. Philips LCD Co., Ltd**

# Contents

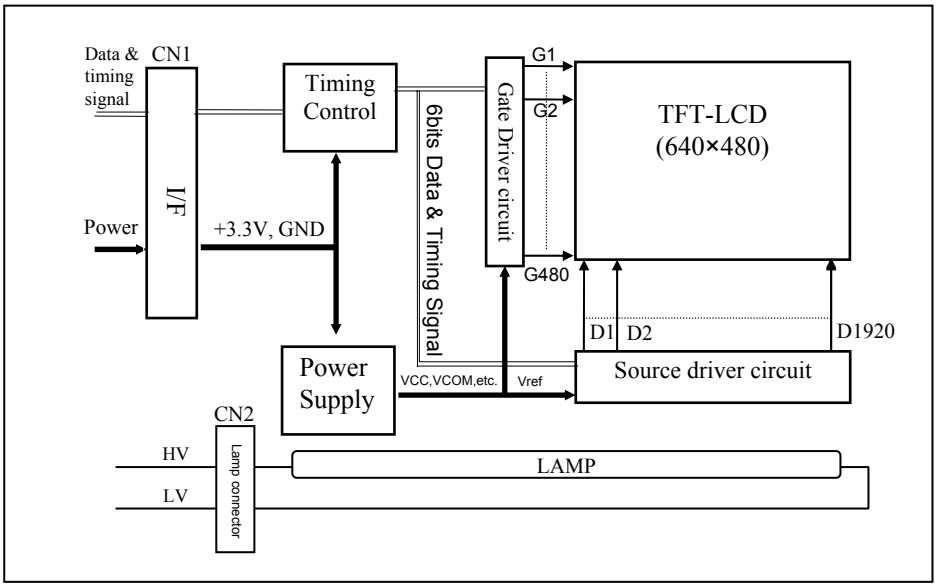
# RECORD OF REVISIONS

| Revision No | Revision Date | Page | DESCRIPTION |
|---|---|---|---|
| 0.0 | July 10, 2002 | - | First Draft |

## 1. General Description

The LG Philips LCD Co., Ltd. model LP104V2 LCD is a Color Active Matrix Liquid Crystal Display with an integral Cold Cathode Fluorescent Tube(CCFT) back light 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 a 10.4 inch diagonally measured active display area with VGA resolution(480 vertical by 640 horizontal pixel array). Each pixel is divided into Red, Green and Blue sub-pixels or dots which are arranged in vertical stripes. Gray scale or the brightness of the sub-pixel color is determined with a 6-bit gray scale signal for each dot, thus, presenting a palette of more than 262,144 colors.

The LP104V2 LCD 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 LP104V2 characteristics provide an excellent flat panel display for office automation products such as Notebook PC.




## General Features

| | |
|---|---|
| Active Screen Size | 10.4 inches(26.42cm) diagonal |
| Outline Dimension | 246.5(H) x 179.4(V) x 8.0(D) mm(Typ.) |
| Pixel Pitch | 0.33 mm x 0.33 mm |
| Pixel Format | 640 horiz. By 480 vert. Pixels RGB strip arrangement |
| Color Depth | 6-bit, 262,144 colors |
| Luminance, White | 280 cd/m$^2$(Typ.) |
| Power Consumption | Total 3.5 Watt(Typ.) |
| Weight | 380 g (typ.) |
| Display Operating Mode | Transmissive mode, normally white |
| Surface Treatment | Hard coating(3H)<br>Anti-glare treatment of the front polarizer, |

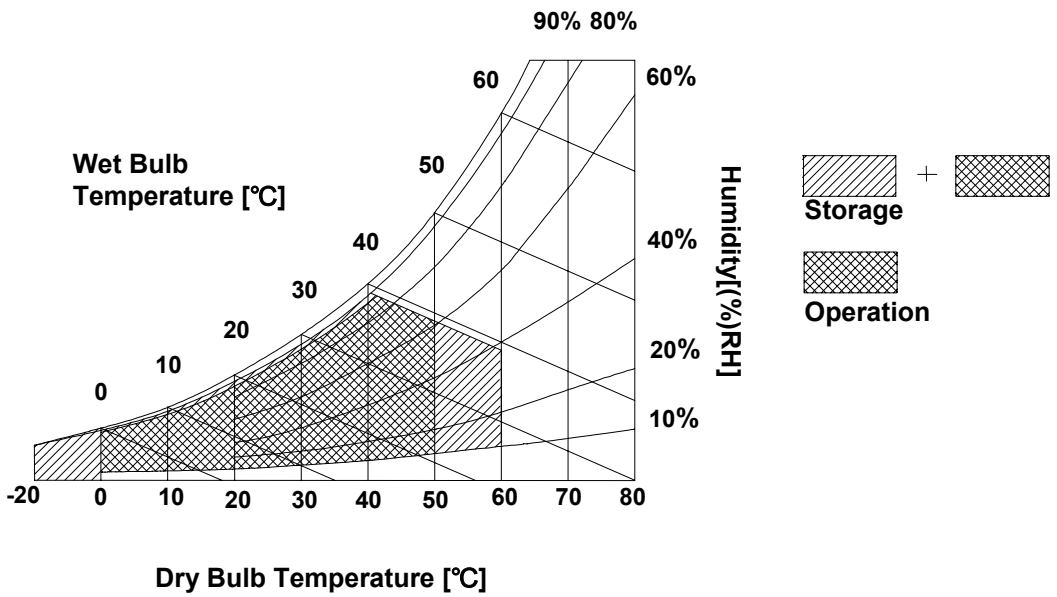
## 2. Absolute Maximum Ratings

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 | 3.6 | Vdc | at 25 ± 3°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 LP104V2 requires two power inputs. One is employed to power the LCD electronics and to drive the TFT array and liquid crystal. The second input which powers the CCFL, is typically generated by an inverter. The inverter is an external unit to the LCD.

**Table 2. ELECTRICAL CHARACTERISTICS**

| Parameter | Symbol | Values | | | Unit | Notes |
|---|---|---|---|---|---|---|
| | | Min | Typ | Max | | |
| MODULE : | | | | | | |
| Power Supply Input Voltage | Vcc | 3.0 | 3.3 | 3.6 | Vdc | |
| Power Supply Input Current | Icc | 230 | 270 | 311 | mA | 1 |
| Power Consumption | Pc | - | 0.89 | 1.02 | Watt | 1 |
| | | | | | | |
| LAMP : | | | | | | |
| Operating Voltage | $V_{BL}$ | | 515 | 630 | VRMS | 2 |
| Operating Current | $I_{BL}$ | 2.0 | 5.0 | 6.0 | mA | |
| Established Starting Voltage | Vs | | | | | 3 |
| at 25 °C | | | | 845 | VRMS | |
| at 0 °C | | | | 1015 | VRMS | |
| Operating Frequency | $f_{BL}$ | 40 | 60 | 80 | kHz | 2 |
| Discharge Stabilization Time | Ts | | | 3 | Min | 3 |
| Power Consumption | $P_{BL}$ | | 2.6 | 3.0 | Watt | 4 |
| Life Time | | 20,000 | | | Hrs | 5 |

Note : The design of the inverter must have specifications for the lamp in LCD Assembly.
The performance of the Lamp in LCM, for example life time or brightness, is extremely influenced by the characteristics of the DC-AC inverter. So all the parameters of an inverter should be carefully designed so as not to produce too much leakage current from high-voltage output of the inverter. When you design or order the inverter, please make sure unwanted lighting caused by the mismatch of the lamp and the inverter(no lighting, flicker, etc) never occurs. When you confirm it, the LCD – Assembly should be operated in the same condition as installed in you instrument.
1. The specified current and power consumption are under the $V_{CC}$=3.3V, 25°C,$f_V$=60Hz condition whereas full black pattern is displayed and $f_V$ is the frame frequency.
2. The variance of the voltage is ± 10%.
3. The voltage above $V_S$ should be applied to the lamps for more than 1 second for start-up.
Otherwise, the lamps may not be turned on. The used lamp current is the lamp typical current.

4. The output of the inverter must have symmetrical(negative and positive) voltage waveform and symmetrical current waveform.(Unsymmetrical ratio is less than 10%) Please do not use the inverter which has unsymmetrical voltage and unsymmetrical current and spike wave.
Lamp frequency may produce interface with horizontal synchronous frequency and as a result this may cause beat on the display. Therefore lamp frequency shall be as away possible from the horizontal synchronous frequency and from its harmonics in order to prevent interference.

5. Let's define the brightness of the lamp after being lighted for 5 minutes as 100%.
$T_S$ is the time required for the brightness of the center of the lamp to be not less than 95%.

6. The lamp power consumption shown above does not include loss of external inverter.
The used lamp current is the lamp typical current.

7. The life is determined as the time at which brightness of the lamp is 50% compared to that of initial value at the typical lamp current on condition of continuous operating at 25 ± 3°C.

※ Do not attach a conducting tape to lamp connecting wire.
If the lamp wire attach to a conducting tape, TFT-LCD Module has a low luminance and the inverter has abnormal action. Because leakage current is occurred between lamp wire and conducting tape.

## 3-2. Interface Connections

This LCD employs two interface connections, a 31 pin connector is used for the module electronics and the other connector is used for the integral backlight system.

The electronics interface connector is a model DF9B-31P-1V manufactured by HIROSE. The pin configuration for the connector is shown in the table below.

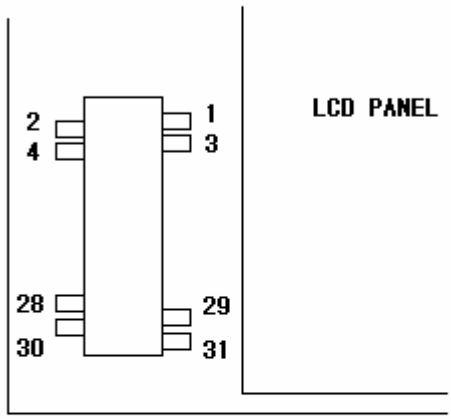
<<LCD Connector :DF9B-31P-1V(HIROSE), Mating Connector : DF9B-31S-1V(HIROSE)>>

**Table 3. MODULE CONNECTOR PIN CONFIGURATION**

| Pin | Symbol | Description |
|---|---|---|
| 1 | GND | Ground |
| 2 | CLK | Data clock |
| 3 | Hsync | Horizontal sync. |
| 4 | Vsync | Vertical sync. |
| 5 | GND | Red data(LSB) |
| 6 | R0 | Red data |
| 7 | R1 | Red data |
| 8 | R2 | Red data |
| 9 | R3 | Red data |
| 10 | R4 | Red data |
| 11 | R5 | Red data(MSB) |
| 12 | GND | Ground |
| 13 | G0 | Green data(LSB) |
| 14 | G1 | Green data |
| 15 | G2 | Green data |
| 16 | G3 | Green data |
| 17 | G4 | Green data |
| 18 | G5 | Green data(MSB) |
| 19 | GND | Ground |
| 20 | B0 | Blue data(LSB) |
| 21 | B1 | Blue data |
| 22 | B2 | Blue data |
| 23 | B3 | Blue data |
| 24 | B4 | Blue data |
| 25 | B5 | Blue data(MSB) |
| 26 | GND | Ground |
| 27 | DTMG | Data timing signal |
| 28 | VCC | Power supply +3.3V |
| 29 | VCC | Power supply +3.3V |
| 30 | NC | No connection |
| 31 | NC | No connection |

Notes

I/F PIN ARRANGEMENT
(Transparent view) 3




TOP VIEW

* NC (30, 31pin) should be electrically opened during operation.
* The metal top case is connected to GND.
* All GND(ground) pins should be connected together and to Vss which also be connected to the LCD's metal frame.
* All VCC(power input) pins should be connected together.

The backlight interface connector is a model BHR-03VS-1, manufactured by JST. The mating connector part number is SM02(8.0)B-BHS-1-TB or equivalent.
The pin configuration for the connector is shown in the table below.

**Table 4. BACKLIGHT CONNECTOR PIN CONFIGURATION(CN2)**

| Pin | Symbol | Description | Notes |
|---|---|---|---|
| 1 | HV | Power supply for lamp (High voltage side) | 1 |
| 2 | NC | No Connection | |
| 3 | LV | Power supply for lamp (Low voltage side) | 1 |

Notes : 1. The high voltage side terminal is colored pink and the low voltage side terminal is white

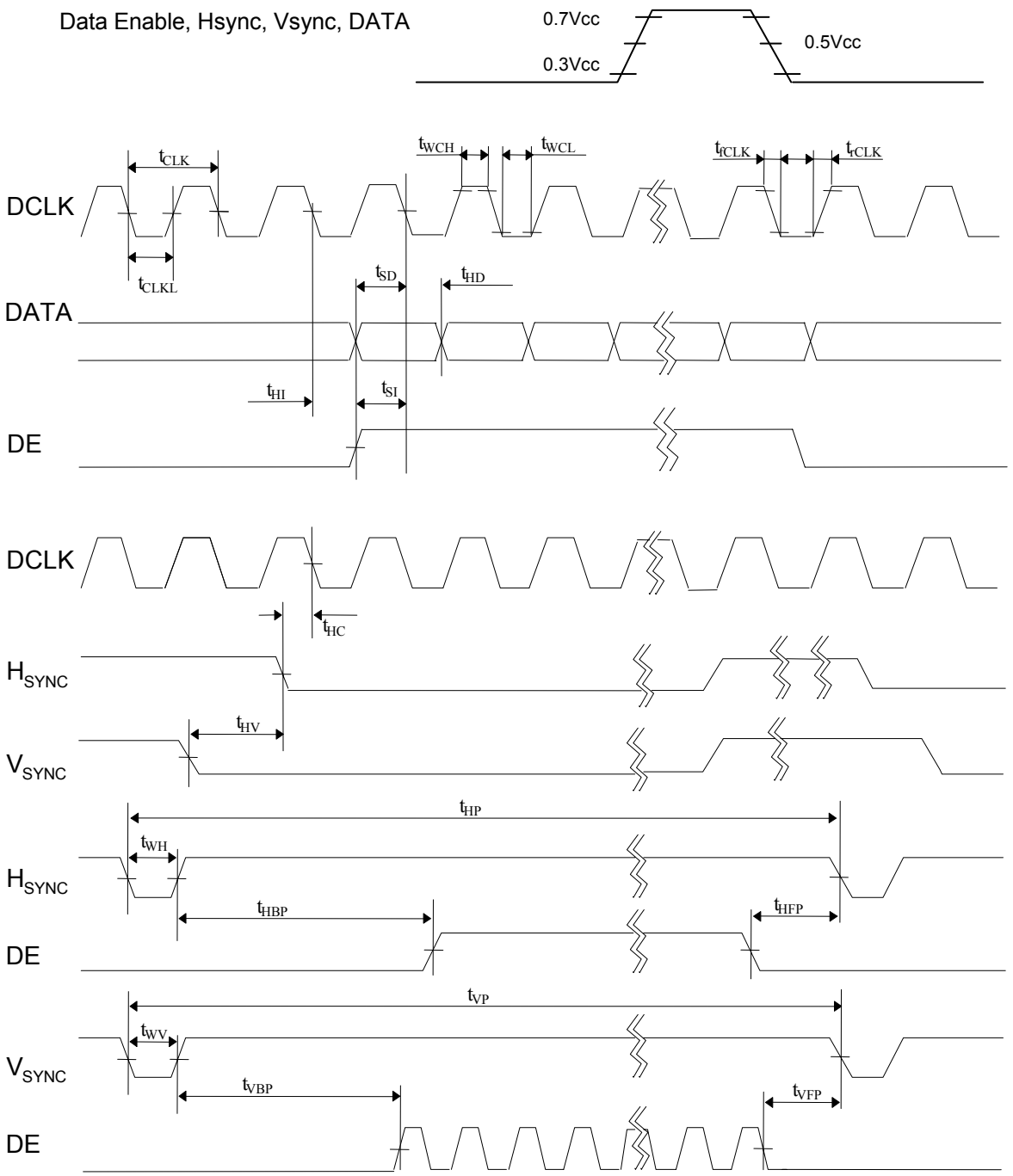
## 3-3. Signal Timing Specifications

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 for it's proper operation.

**Table 5. Timing Table**

| ITEM | Symbol | | Min | Typ | Max | Unit | Note |
|---|---|---|---|---|---|---|---|
| DCLK | Frequency | $f_{CLK}$ | 21 | 25 | 32 | MHz | |
| | Width-High | $t_{WCL}$ | 7 | - | - | ns | |
| | Width-Low | $t_{WCH}$ | 7 | - | - | ns | |
| | Duty | D | 0.45 | 0.5 | 0.55 | | D=$t_{CLKH}/t_{CLK}$ |
| Hsync | Period | $t_{HP}$ | 770 | 800 | 900 | $t_{CLK}$ | |
| | Width-Active | $t_{WH}$ | 9 | - | 128 | | |
| Vsync | Frequency | $t_{VSY}$ | 60 | 60 | 60 | Hz | |
| | Period | $t_{VP}$ | 515 | 525 | 560 | $t_{HP}$ | |
| | Width-Active | $t_{WV}$ | 1 | - | 15 | | |
| Data Enable | Set-up time | $t_{SI}$ | 0 | - | - | ns | for DCLK |
| | Hold time | $t_{HI}$ | 15 | - | - | | |
| | Horizontal back porch | $t_{HBP}$ | 12 | - | - | $t_{CLK}$ | |
| | Horizontal front porch | $t_{HFP}$ | 10 | - | - | | |
| | Vertical back porch | $t_{VBP}$ | 34 | - | - | $t_{HP}$ | |
| | Vertical front porch | $t_{VFP}$ | 1 | - | - | | |
| Data | Set-up time | $t_{SD}$ | 0 | - | - | ns | for DCLK |
| | Hold time | $t_{HD}$ | 15 | - | - | | |

## 3-4. Signal Timing Waveforms



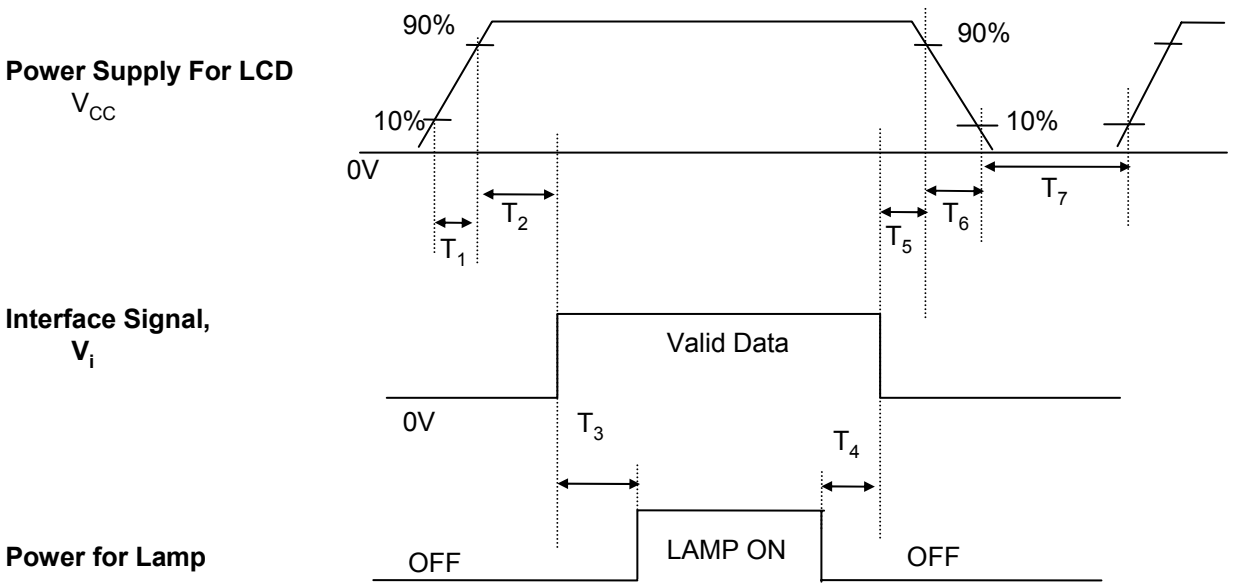
## 3-5. Color Input Data Reference

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

**Table 6. COLOR DATA REFERENCE**

| Color | | Input Color Data | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Red | | | | | | Green | | | | | | Blue | | | | | |
| | | MSB | | | | | LSB | MSB | | | | | LSB | MSB | | | | | LSB |
| | | R5 | R4 | R3 | R2 | R1 | R0 | G5 | G4 | G3 | G2 | G1 | G0 | B5 | B4 | B3 | B2 | B1 | B0 |
| Basic Colors | Black | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Red(63) | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Green(63) | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Blue(63) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Cyan | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Magenta | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Yellow | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| | White | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Red | Red(00) Dark | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Red(01) | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Red(02) | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| | Red(61) | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Red(62) | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Red(63) Bright | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Green | Green(00)Dark | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Green(01) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Green(02) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| | Green(61) | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Green(62) | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Green(63)Bright | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Blue | Blue(00) Dark | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Blue(01) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| | Blue(02) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| | Blue(61) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 1 |
| | Blue(62) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 0 |
| | Blue(63) Bright | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 |

## 3-6. Power Sequence




| Parameter | Values | | | Units |
|---|---|---|---|---|
| | Min. | Typ. | Max. | |
| $T_1$ | - | - | 50 | ms |
| $T_2$ | 0.5 | - | 50 | ms |
| $T_3$ | 200 | - | - | ms |
| $T_4$ | 200 | - | - | ms |
| $T_5$ | 0.5 | - | 50 | ms |
| $T_6$ | - | - | 10 | ms |
| $T_7$ | 400 | - | - | ms |

Notes : 1. Please avoid floating state of interface signal at invalid period.
2. When the interface signal is invalid, be sure to pull down the power supply for LCD $V_{CC}$ to 0V.
3. Lamp power must be turn on after power supply for LCD an interface signal are valid.

## 4. Optical Specification

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

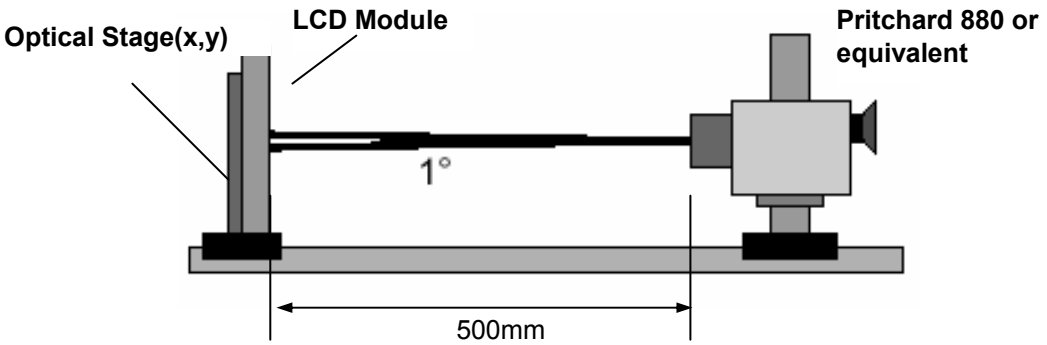



**Table 7. OPTICAL CHARACTERISTICS**

Ta=25 °C, $V_{CC}$=3.3V, fv=60Hz
Dclk=25MHz, $I_{BL}$=5mA

| Parameter | Symbol | Values | | | Units | Notes |
|---|---|---|---|---|---|---|
| | | Min | Typ | MAx | | |
| Contrast Ratio | CR | 140 | 200 | - | | 1 |
| Surface Luminance, white | $L_{WH}$ | 240 | 280 | - | cd/m$^2$ | 2 |
| Luminance Variation | $\delta_{WHITE}$ | - | 1.2 | 1.4 | % | 3 |
| Response Time | Tr | | | | Ms | 4 |
| Rise Time | $Tr_R$ | - | 10 | 20 | | |
| Decay Time | $Tr_D$ | - | 35 | 50 | | |
| Color Coordinates | | | | | | |
| RED | RX | 0.523 | 0.543 | 0.563 | | |
| | RY | 0.308 | 0.328 | 0.348 | | |
| GREEN | GX | 0.295 | 0.315 | 0.335 | | |
| | GY | 0.479 | 0.499 | 0.519 | | |
| BLUE | BX | 0.138 | 0.158 | 0.178 | | |
| | BY | 0.129 | 0.149 | 0.169 | | |
| WHITE | WX | 0.297 | 0.317 | 0.337 | | |
| | WY | 0.311 | 0.331 | 0.351 | | |
| Viewing Angle | | | | | | |
| x axis, right(ϕ=0°) | θr | - | 45 | - | degree | 5 |
| x axis, left (ϕ=180°) | θl | - | 45 | - | | |
| y axis, up (ϕ=90°) | θu | - | 15 | - | | |
| y axis, down (ϕ=270°) | θd | - | 35 | - | | |
| Gray Scale | | | | | | 6 |

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

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

2. Surface luminance is the center point across the LCD surface 50cm from the surface with all pixels displaying white. For more information see FIG 2.
When $I_{BL}$=5mA, $L_{WH}$= 240cd/m$^2$(Min.) 280cd/m$^2$(Typ.)

3. The variation in surface luminance , $\delta$ WHITE is determined by measuring $L_{ON}$ at each test position 1 through 9, and then dividing the maximum $L_{ON}$ of 9 points luminance by minimum $L_{ON}$ of 9 points luminance. For more information see FIG 2.

$$\delta \text{ WHITE} = \text{Maximum}(L_{ON1}, L_{ON2}, \ldots L_{ON9}) \div \text{Minimum}(L_{ON1}, L_{ON2}, \ldots L_{ON9})$$

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.

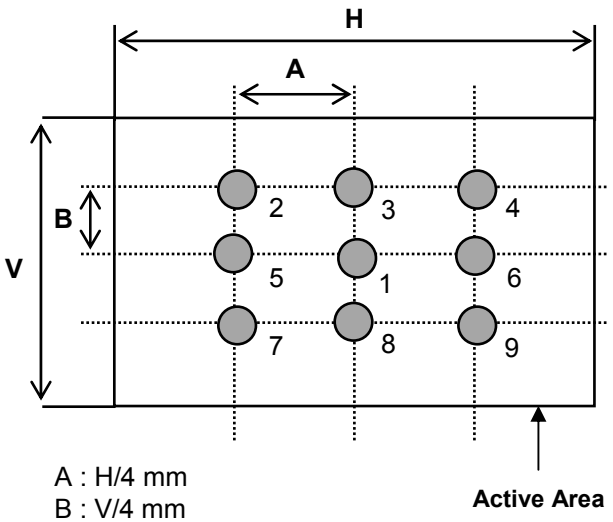
5. Viewing angle is the angle at which the contrast ratio is greater than 10. The angles are determined for the horizontal or x axis and the vertical or y axis with respect to the z axis which is normal to the LCD surface. For more information see FIG 4.

6. Gray scale specification

| Gray Level | Luminance [%] (Typ) |
|---|---|
| L0 | 0.37 |
| L7 | 0.80 |
| L15 | 3.08 |
| L23 | 8.30 |
| L31 | 19.20 |
| L39 | 32.30 |
| L47 | 49.30 |
| L55 | 70.00 |
| L63 | 100.00 |

**FIG. 2 Luminance**

<measuring point for luminance variation>




A : H/4 mm
B : V/4 mm
@ H,V : Active Area

<measuring point for surface luminance>

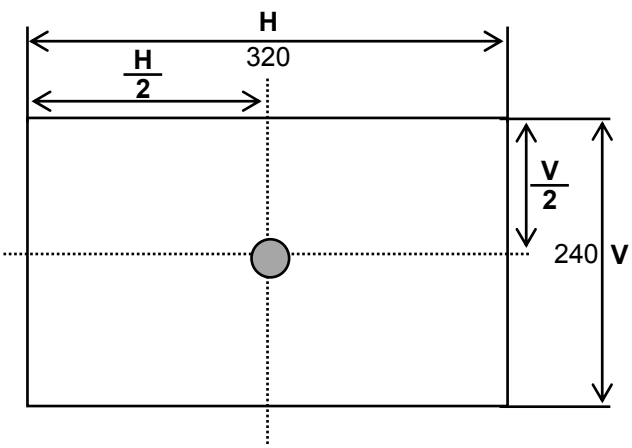



**FIG. 3 Response Time**

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

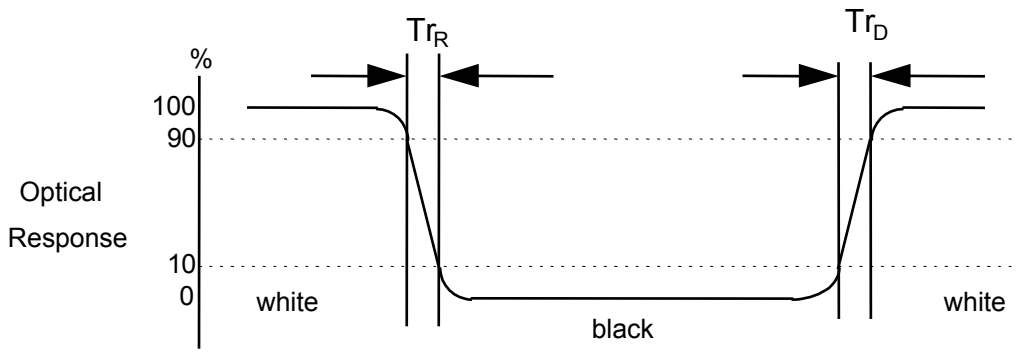
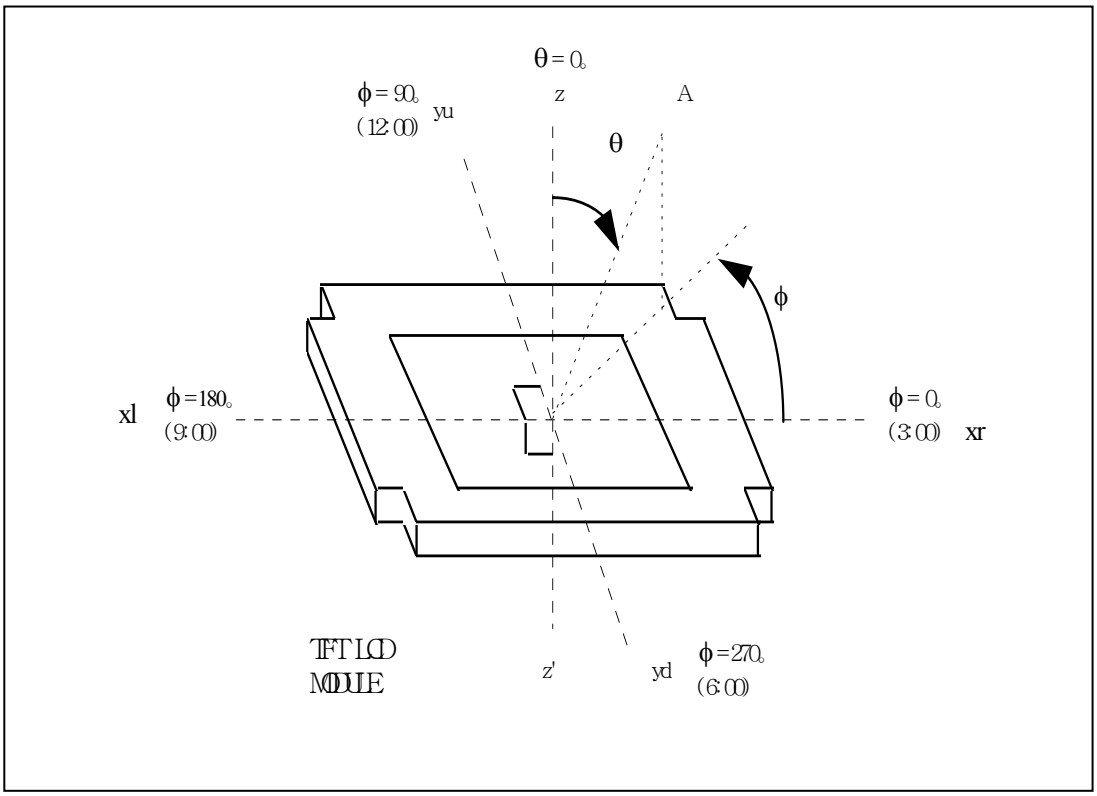


**FIG. 4 Viewing angle**

<Dimension of viewing angle range>

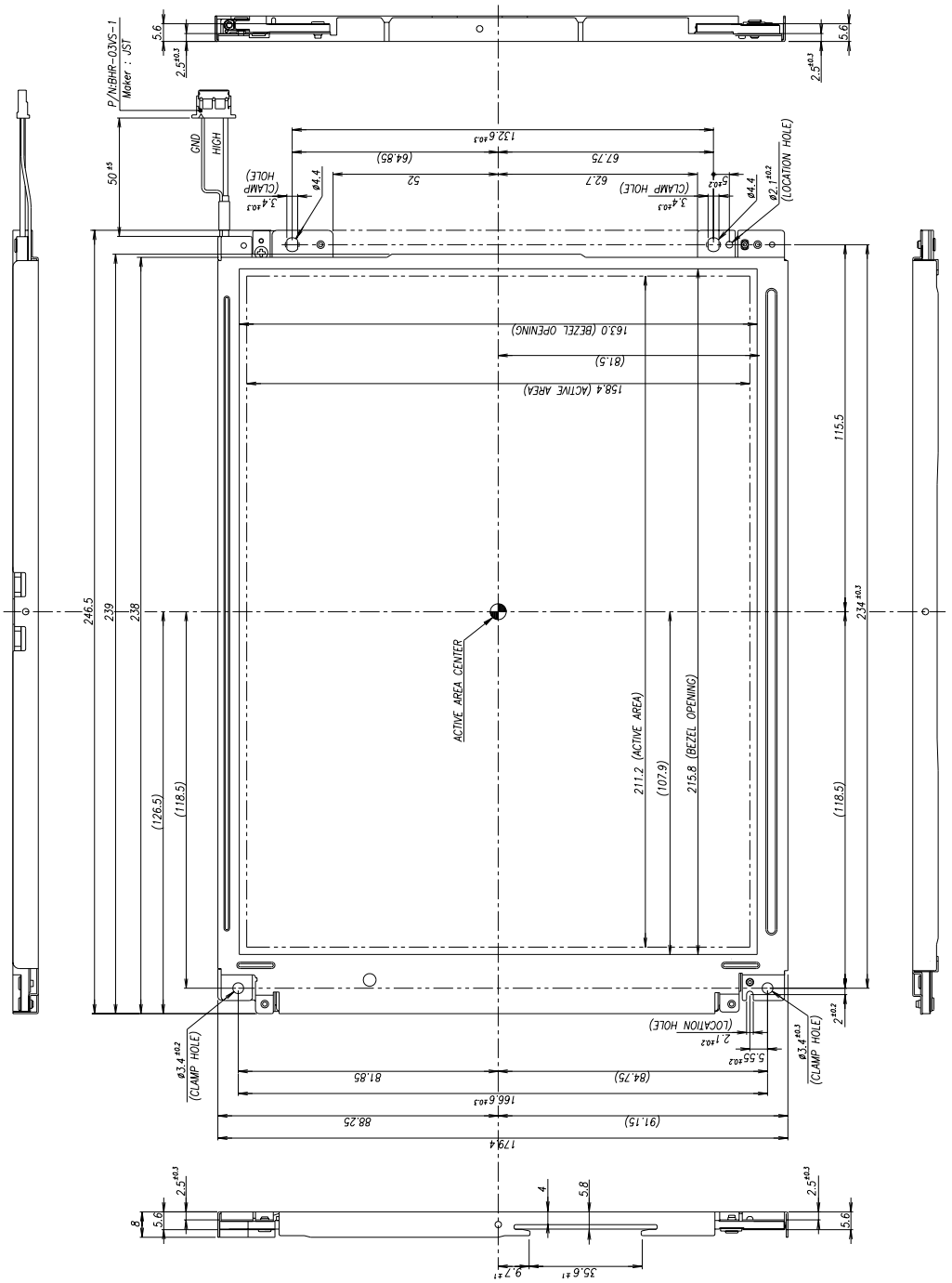


## 5. Mechanical Characteristics

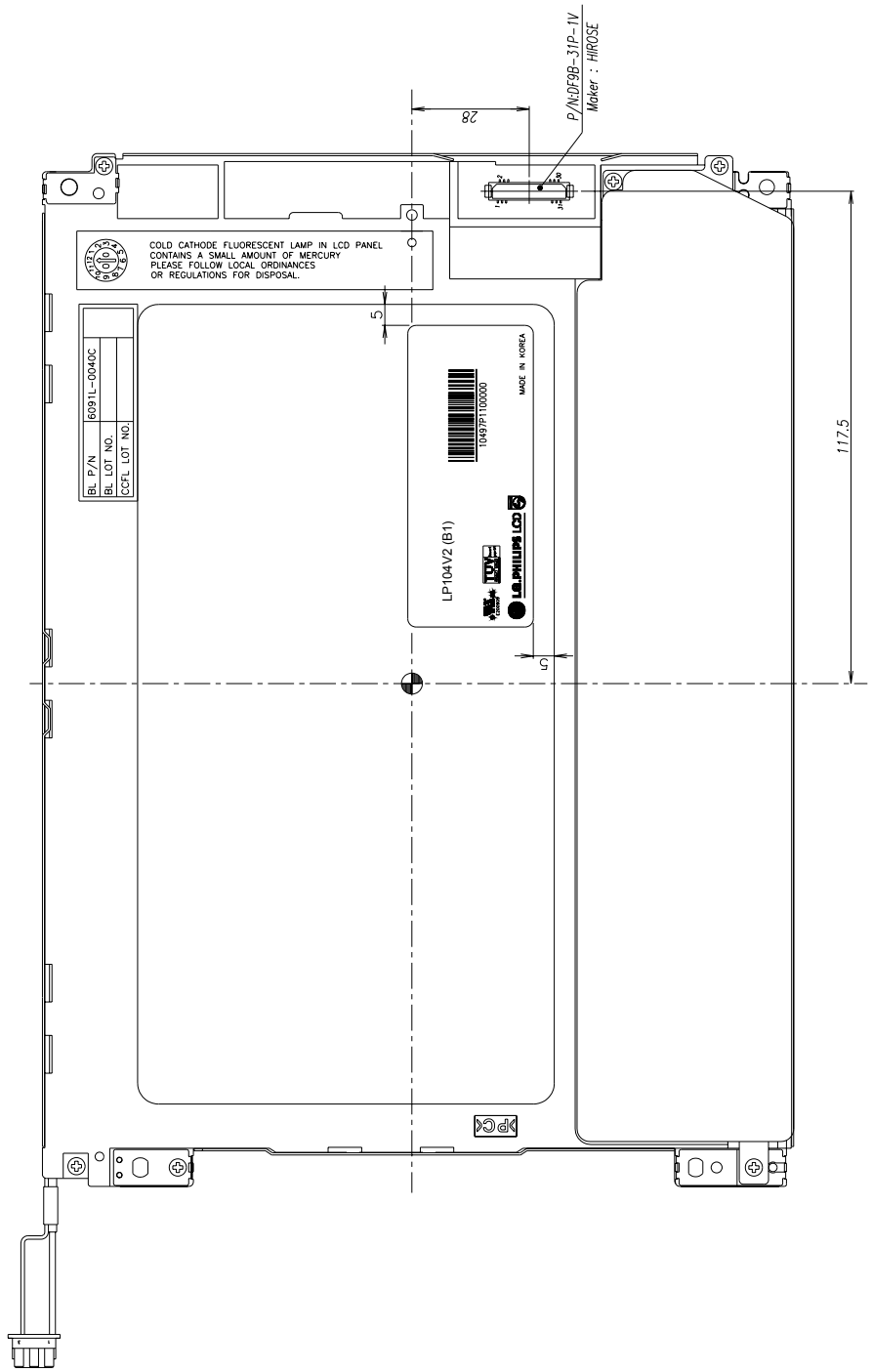
The contents provide general mechanical characteristics for the model LP104V2. In addition the figures in the next page are detailed mechanical drawing of the LCD.

| | | |
|---|---|---|
| Outline Dimension | Horizontal | 246.5 ± 0.5mm |
| | Vertical | 179.4 ± 0.5mm |
| | Depth | 8.0 ± 0.5mm |
| Bezel Area | Horizontal | 215.8 ± 0.5mm |
| | Vertical | 163.0 ± 0.5mm |
| Active Display Area | Horizontal | 211.2mm |
| | Vertical | 158.4mm |
| Weight | 380g (Typ.) | 400g (Max.) |
| Surface Treatment | Hard coating(3H)<br>Anti-glare treatment of the front polarizer | |

<FRONT VIEW>


P/N:BHR-03VS-1
Maker : JST
GND
HIGH
(CLAMP HOLE)
(CLAMP HOLE)
(LOCATION HOLE)
(64.85)
67.75
62.7
52
132.6
163.0 (BEZEL OPENING)
(81.5)
158.4 (ACTIVE AREA)
115.5
246.5
239
238
234
(126.5)
(118.5)
(118.5)
ACTIVE AREA CENTER
211.2 (ACTIVE AREA)
(107.9)
215.8 (BEZEL OPENING)
(LOCATION HOLE)
(CLAMP HOLE)
(CLAMP HOLE)
81.85
(84.75)
166.6
88.25
(91.15)
179.4
5.6
2.5
5.8
4
8
9.7
35.6

<REAR VIEW>


P/N:DF9B-31P-1V
Maker : HIROSE
28
COLD CATHODE FLUORESCENT LAMP IN LCD PANEL
CONTAINS A SMALL AMOUNT OF MERCURY
PLEASE FOLLOW LOCAL ORDINANCES
OR REGULATIONS FOR DISPOSAL.
BL P/N
BL LOT NO.
CCFL LOT NO.
6091L-0040C
MADE IN KOREA
LP104V2 (B1)
LG.PHILIPS LCD
117.5
5
5

## 6. Reliability

Environment test condition

| No | Test Item | Condition |
|---|---|---|
| 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<br>(non-operating) | Wave form : random<br>Vibration level : 1.0G RMS<br>Bandwidth : 10-500Hz<br>Duration : X,Y,Z, 20 min<br>One time each direction |
| 6 | Shock test<br>(non-operating) | Shock level : 120G<br>Waveform : half sine wave, 2ms<br>Direction : ±X, ±Y, ±Z<br>One time each direction |
| | Altitude<br>operating<br>storage / shipment | 0 - 10,000 feet(3048m)<br>0 - 40,000 feet(12,192m) |

{ 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 1950 Third Edition, Underwriters Laboratories, Inc. Jan. 28, 1995.
Standard for Safety of Information Technology Equipment Including Electrical Business Equipment.
b) CAN/CSA C22.2 No. 950-95 Third Edition, Canadian Standards Association, Jan. 28, 1995.
Standard for Safety of Information Technology Equipment Including Electrical Business Equipment.
c) EN 60950 : 1992+A1: 1993+A2: 1993+A3: 1995+A4: 1997+A11: 1997
IEC 950 : 1991+A1: 1992+A2: 1993+A3: 1995+A4: 1996
European Committee for Electrotechnical Standardization(CENELEC)
EUROPEAN STANDARD for Safety of Information Technology Equipment Including Electrical Business Equipment.

# 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
D : YEAR
E : MONTH
F,G : PANEL CODE
H : ASSEMBLY CODE
I,J,K,L,M : SERIAL NO.

Note

1. YEAR

| Year | 97 | 98 | 99 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Mark | 7 | 8 | 9 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

2. MONTH

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

3. Serial No.

| Year | 1 ~ 99999 | 100000 ~ |
|---|---|---|
| Mark | 00001 ~ 99999 | A0001 ~ A9999, ..... , Z9999 |

b) Location of Lot Mark

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

## 8-2. Packing Form

a) Package quantity in one box : 10 pcs

b) Box Size : 321mm × 260mm × 329mm

## 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.