# TITLE : HT18E22-300
# Product Specification

Rev.0

Hyundai Display Technology, Inc.

# REVISION HISTORY

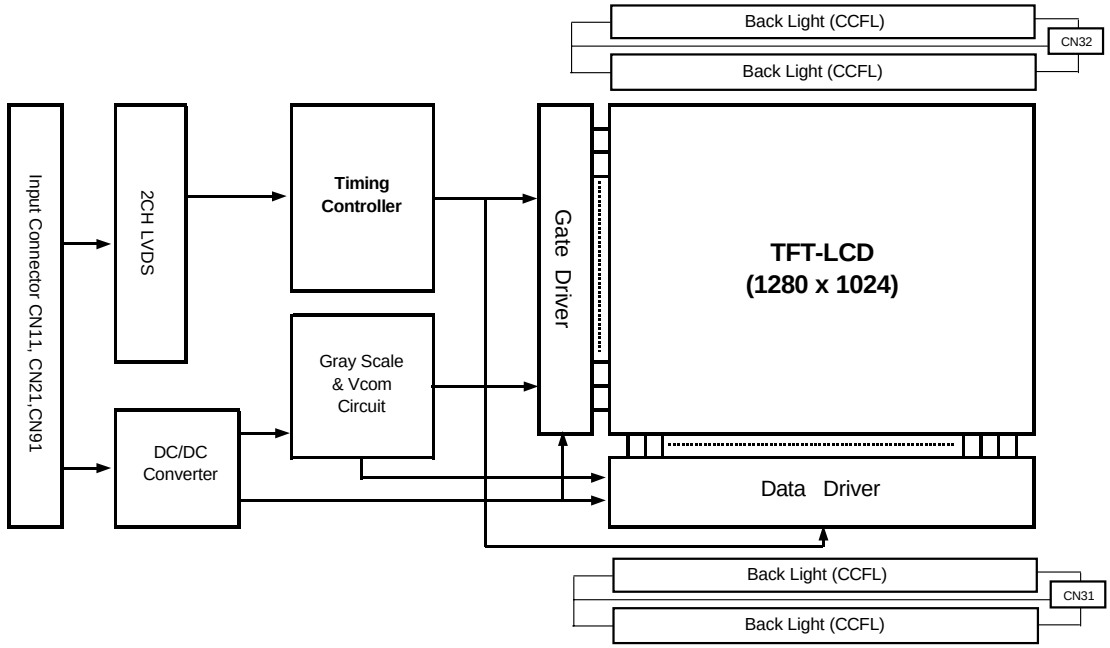
| REV. | ECN NO. | DESCRIPTION OF CHANGES | DATE | PREPARED |
|---|---|---|---|---|
| 0 | | Initial Release | 2003/01/10 | S.Y.Kim |

# Contents

## 1.0 GENERAL DESCRIPTIONS

### 1.1 Introduction

HT18E22-300 is a color active matrix TFT LCD module using amorphous silicon TFT's (Thin Film Transistors) as an active switching devices. This module has a 18.1 inch diagonally measured active area with SXGA resolutions (1280 horizontal by 1024 vertical pixel array). Each pixel is divided into RED, GREEN, BLUE dots which are arranged in vertical stripe and this module can display 16,777,216 colors. The TFT-LCD panel used for this module is a low reflection and higher color type. Therefore, this module is suitable for desk-top type of PC.




### 1.2 Features

- UFFS (Ultra Fringe Field Switching) Mode
- High speed response
- 256 Gray Scale (8 bits)
- Incorporated edge type back-light (4 lamps)
- High luminance and Low reflection & wide viewing angle (Using Ultra FFS Tech.)
- DE (Data Enable) only Mode
- 2CH LVDS Interface
- Monitor for Workstation & Desktop PC use
- Display terminals for control system
- Monitors for process controller

1.4 General Specifications

The following are general specifications at the model HT18E22-300. (listed in Table 1)

<Table 1. General Specifications>

| Parameter | Specification | Unit | Remarks |
|---|---|---|---|
| Active area | 359.040 (H) X 287.232 (V) | mm | |
| Number of pixels | 1280 (H) X 1024 (V) | pixels | |
| Pixel pitch | 0.2805 (H) X 0.2805 (V) | mm | |
| Pixel arrangement | RGB Vertical stripe | | |
| Display colors | 16,777,216 | colors | |
| Display mode | Normally Black | | |
| Outline dimension | 414.0(H) X 335.0(V) X 18.6(D) | mm | Note 1 |
| Weight | 2600 Typ | g | Note 2 |
| Back-light | Top/Bottom edge side 4-CCFL type | | Note 3 |

Notes : 1. General tolerance : H & V = ±0.5mm / D = ±0.3mm
2. 2700 Max.
3. CCFL (Cold Cathode fluorescent lamp)

## 2.0 ABSOLUTE MAXIMUM RATINGS

The followings are maximum values which, if exceed, may cause faulty operation or damage to the unit. The operational and non-operational maximum voltage and current values are listed in Table 2.

< Table 2. Absolute Maximum Ratings>

| Parameter | Symbol | Min. | Max. | Unit | Remarks |
|---|---|---|---|---|---|
| Power Input Voltage | $V_{AA}$ | -0.3 | 13.0 | V | |
| Back-light lamp Current | $I_L$ | 3.0 | 8.0 | mArms | |
| Operating Temperature<br>(Humidity) | $T_{OP}$<br>RH | 10 | +40<br>75 | °C<br>% | ≤40°C |
| Storage Temperature<br>(Humidity) | $T_{ST}$<br>RH | -20 | +60<br>95 | °C<br>% | ≤40°C |

## 3.0 ELECTRICAL SPECIFICATIONS

### 3.1 Electrical Characteristics

< Table 3. Electrical specifications > (Ta = 25°C)

| Parameter | Symbol | Min. | Typ. | Max. | Unit | Remark |
|---|---|---|---|---|---|---|
| Power Input Voltage | $V_{AA}$ | 11.5 | 12.0 | 12.5 | V | |
| Power Input Current | $I_{AA}$ | - | 340 | 560 | mA | Note 1 |
| "H" level Differential input | $V_{IL}$ | 100 | | | mV | Note 2 |
| "L" level Differential input | $V_{IH}$ | | | -100 | mV | |
| Back-light lamp Voltage | $V_{BL}$ | | 800 | | Vrms | |
| Back-light lamp Current | $I_{BL}$ | | 6 | | mArms | Per CCFL |
| Back-light Lamp Operating Frequency | $F_L$ | | 50 | | KHz | Note |
| Lamp Start Voltage | $V_S$ | | 1200 | 1550 (0°C) | Vrms | Note 4 |
| | | | 900 | 1100 (25°C) | Vrms | |
| Lamp Life | Hr | - | 30,000 | | Hours | |
| Power Consumption | $P_{AA}$ | - | 4.08 | - | W | |
| | $P_{BL}$ | - | 19.2 | - | W | Note5 |
| | $P_{total}$ | - | 23.28 | - | W | |

Notes :

1. Test Pattern of power supply current
   - Typ : Vertical color bar
   - Max : Vertical 2 line skip (@L255)

2. LVDS Receiver common mode voltage, $V_{CM}$ = 1.2V
3. The lamp frequency should be selected as different as possible from the horizontal synchronous frequency and its harmonics to avoid interference which may cause line flow on the display.
4. The voltage shown above should be applied to the lamps for more than 1 second to startup. Otherwise the lamps may not to be turned on.
5. Calculated value for reference ($V_{BL}$ X $I_{BL}$) X 4 excluding inverter loss.

## 4.0 OPTICAL SPECIFICATIONS

### 4.1 Overview

The test of Optical specifications shall be measured in a dark room (ambient luminance ≤ 1 lux and temperature = 25±2°C) with the equipment of Luminance meter system (Goniometer system and TOPCON BM-5) and test unit shall be located at an approximate distance 50cm from the LCD surface at a viewing angle of θ and Φ equal to 0°. We refer to $\theta_{Ø=0}$ (=$\theta_3$) as the 3 o'clock direction (the "right"), $\theta_{Ø=90}$ (=$\theta_{12}$) as the 12 o'clock direction ("upward"), $\theta_{Ø=180}$ (=$\theta_9$) as the 9 o'clock direction ("left") and $\theta_{Ø=270}$(=$\theta_6$) as the 6 o'clock direction ("bottom"). While scanning θ and/or Ø, the center of the measuring spot on the Display surface shall stay fixed. The measurement shall be executed 30 minutes after lighting at rating with the back-light CCFL being run at a 6 mArms current after 30 minutes warm-up period. Optimum viewing angle direction is 6 o'clock.

### 4.2 Optical Specifications

<Table 4. Optical Specifications>

| Parameter | | Symbol | Condition | Min. | Typ. | Max. | Unit | Remark |
|---|---|---|---|---|---|---|---|---|
| Viewing Angle range | Horizontal | $\theta_3$ | CR > 10 | 80 | | | Deg. | Note 1 |
| | | $\theta_9$ | | 80 | | | Deg. | |
| | Vertical | $\theta_{12}$ | | 80 | | | Deg. | |
| | | $\theta_6$ | | 80 | | | Deg. | |
| Contrast ratio | | CR | θ = 0° | | 300 | | | Note 2 |
| Average Luminance of White | | $Y_w$ | θ = 0° | 190 | 210 | | cd/m$^2$ | Note 3 |
| White luminance uniformity | | ΔY | $I_{BL}$ = 6.0mA | | | 1.45 | | Note 4 |
| Reproduction Of color | White | $X_W$ | θ = 0° | 0.301 | 0.321 | 0.341 | | Note 5 |
| | | $Y_W$ | | 0.321 | 0.341 | 0.361 | | |
| | Red | $X_R$ | | 0.626 | 0.646 | 0.666 | | |
| | | $Y_R$ | | 0.322 | 0.342 | 0.362 | | |
| | Green | $X_G$ | | 0.271 | 0.291 | 0.311 | | |
| | | $Y_G$ | | 0.590 | 0.610 | 0.630 | | |
| | Blue | $X_B$ | | 0.124 | 0.144 | 0.164 | | |
| | | $Y_B$ | | 0.088 | 0.108 | 0.128 | | |
| Response Time (Rise + Decay) | | Ttotal | | - | 27 | 31 | ms | Note 6 |
| Cross Talk | | CT | | | | 4.0 | % | Note 7 |

Notes :

1. Viewing angle is the angle at which the contrast ratio is greater than 10. The viewing angles are determined for the horizontal or 3, 9 o'clock direction and the vertical or 6, 12 o'clock direction with respect to the optical axis which is normal to the LCD surface (see FIGURE 1 shown in Appendix).
2. Contrast measurements shall be made at viewing angle of $\theta = 0°$ and at the center of the LCD surface. Luminance shall be measured with all pixels in the view field set first to white, then to the dark (black) state . (see FIGURE 1 shown in Appendix) Luminance Contrast Ratio (CR) is defined mathematically

$$CR = \frac{\text{Luminance when displaying a white raster}}{\text{Luminance when displaying a black raster}}$$

3. Average Luminance of white is defined as arithmetic mean of five measurement points across the LCD surface. Luminance shall be measured with all pixels in the view field set first to white. This measurement shall be taken at the locations shown in FIGURE 2 for a total of the measurements per display.
4. The White luminance uniformity on LCD surface is then expressed as : $\Delta Y$ = Maximum Luminance of five points / Minimum Luminance of five points (see FIGURE 2 shown in Appendix).
5. The color chromaticity coordinates specified in Table 4. shall be calculated from the spectral data measured with all pixels first in red, green, blue, and white. Measurements shall be made at the center of the panel.
6. The electro-optical response time measurements shall be made as FIGURE 3 shown in Appendix by switching the "data" input signal ON and OFF. The times needed for the luminance to change from 10% to 90% is Tr and 90% to 10% is Td.
7. Cross-Talk of one area of the LCD surface by another shall be measured by comparing the luminance ($Y_A$) of a 25mm diameter area, with all display pixels set to a gray level, to the luminance ($Y_B$) of that same area when any adjacent area is driven dark. (See FIGURE 4 shown in Appendix).

## 5.0 INTERFACE CONNECTION

5.1 Electrical Interface Connection

The module-side connector : FI - SEB20P – HF (JAE) or Equivalent

The user-side connector : FI – SE20M/FI – S20S (JAE) or Equivalent

<Table 5. Pin Assignment for Receiver Interface Connection>

CN11 Pin Assignment

| Pin No. | Symbol | Description |
|---|---|---|
| 20 | NC | N.C. |
| 19 | NC | |
| 18 | Vss | GND |
| 17 | Vss | 1) |
| 16 | RAIN0- | Odd Pixel Data |
| 15 | RAIN0+ | 2) |
| 14 | Vss | GND |
| 13 | RAIN1- | Odd Pixel Data |
| 12 | RAIN1+ | |
| 11 | Vss | GND |
| 10 | RAIN2- | Odd Pixel Data |
| 9 | RAIN2+ | |
| 8 | Vss | GND |
| 7 | RACLKIN- | Odd Pixel CLK |
| 6 | RACLKIN+ | |
| 5 | Vss | GND |
| 4 | RAIN3- | Odd Pixel Data |
| 3 | RAIN3+ | |
| 2 | Vss | GND |
| 1 | RSVD | N.C. |

CN21 Pin Assignment

| Pin No. | Symbol | Description |
|---|---|---|
| 20 | NC | N.C. |
| 19 | NC | |
| 18 | Vss | GND |
| 17 | Vss | 1) |
| 16 | RBIN0- | Even Pixel Data |
| 15 | RBIN0+ | 2) |
| 14 | Vss | GND |
| 13 | RBIN1- | Even Pixel Data |
| 12 | RBIN1+ | |
| 11 | Vss | GND |
| 10 | RBIN2- | Evev Pixel Data |
| 9 | RBIN2+ | |
| 8 | Vss | GND |
| 7 | RBCLKIN- | Even Pixel CLK |
| 6 | RBCLKIN+ | |
| 5 | Vss | GND |
| 4 | RBIN3- | Even Pixel Data |
| 3 | RBIN3+ | |
| 2 | Vss | GND |
| 1 | RSVD | N.C. |

CN91 Pin Assignment

The module-side connector : 53261-0890 (Molex)

The user-side connector : 51021-0800 (Molex) or Equivalent

| Pin No. | Symbol | Description |
|---|---|---|
| 1 | N.C | No Connection |
| 2, 3, 4 | Vss | GND |
| 5, 6, 7, 8 | VAA | 12.0V |

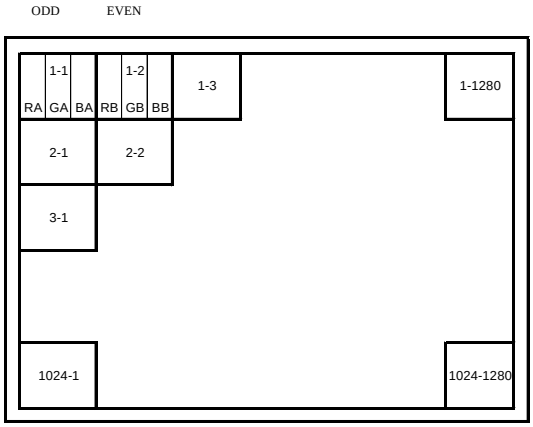
Notes 1) All Vss pins should be grounded. Shield Case is internally connected to Vss.

2) RnINm+ and RnINm- (n = A,B, m = 0,1,2,3) should be wired by twist – pairs or side by side FPC patterns, respectively

5.2 2CH LVDS(Rx : THC63LVDF84A) Interface

| | INPUT SIGNAL | TRANSMITTER Pin No. | TRANSMITTER INPUT | INTERFACE SYSTEM | INTERFACE TFT-LCD | RECEIVER Pin No. | RECEIVER OUTPUT | OUTPUT SIGNAL |
|---|---|---|---|---|---|---|---|---|
| | RA2 | 51 | TAIN0 | | | 27 | RAOUT0 | RA |
| | RA3 | 52 | TAIN1 | | | 29 | RAOUT1 | RA3 |
| | RA4 | 54 | TAIN2 | TAOUT0+ | RAIN0+ | 30 | RAOUT2 | RA4 |
| | RA5 | 55 | TAIN3 | | | 32 | RAOUT3 | RA5 |
| | RA6 | 56 | TAIN4 | TAOUT0- | RAIN0- | 33 | RAOUT4 | RA6 |
| | RA7 | 3 | TAIN6 | | | 35 | RAOUT6 | RA7 |
| | GA2 | 4 | TAIN7 | | | 37 | RAOUT7 | GA2 |
| | GA3 | 6 | TAIN8 | | | 38 | RAOUT8 | GA3 |
| L | GA4 | 7 | TAIN9 | | | 39 | RAOUT9 | GA4 |
| | GA5 | 11 | TAIN12 | | | 43 | RAOUT12 | GA5 |
| V | GA6 | 12 | TAIN13 | TAOUT1+ | RAIN1+ | 45 | RAOUT13 | GA6 |
| | GA7 | 14 | TAIN14 | | | 46 | RAOUT14 | GA7 |
| D | BA2 | 15 | TAIN15 | TAOUT1- | RAIN1- | 47 | RAOUT15 | BA2 |
| | BA3 | 19 | TAIN18 | | | 51 | RAOUT18 | BA3 |
| S | BA4 | 20 | TAIN19 | | | 53 | RAOUT19 | BA4 |
| | BA5 | 22 | TAIN20 | | | 54 | RAOUT20 | BA5 |
| | BA6 | 23 | TAIN21 | | | 55 | RAOUT21 | BA6 |
| O | BA7 | 24 | TAIN22 | TAOUT2+ | RAIN2+ | 1 | RAOUT22 | BA7 |
| | HSYNC | 27 | TAIN24 | | | 3 | RAOUT24 | HSYNC |
| D | VSYNC | 28 | TAIN25 | TAOUT2- | RAIN2- | 5 | RAOUT25 | VSYNC |
| | DE | 30 | TAIN26 | | | 6 | RAOUT26 | DE |
| D | RA0 | 50 | TAIN27 | | | 7 | RAOUT27 | RA0 |
| | RA1 | 2 | TAIN5 | | | 34 | RAOUT5 | RA1 |
| | GA0 | 8 | TAIN10 | | | 41 | RAOUT10 | GA0 |
| | GA1 | 10 | TAIN11 | TAOUT3+ | RAIN3+ | 42 | RAOUT11 | GA1 |
| | BA0 | 16 | TAIN16 | | | 49 | RAOUT16 | BA0 |
| | BA1 | 18 | TAIN17 | TAOUT3- | RAIN3- | 50 | RAOUT17 | BA1 |
| | RSVD | 25 | TAIN23 | | | 2 | RAOUT23 | RSVD |
| | MCLK | 31 | TCLKAIN | TCLKAOUT+ | RCLKAIN+ | 26 | RCLKAOUT | MCLK |
| | | | | TCLKAOUT- | RCLKAIN- | | | |
| | RB2 | 51 | TBIN0 | | | 27 | RBOUT0 | RB2 |
| | RB3 | 52 | TBIN1 | | | 29 | RBOUT1 | RB3 |
| | RB4 | 54 | TBIN2 | TBOUT0+ | RBIN0+ | 30 | RBOUT2 | RB4 |
| | RB5 | 55 | TBIN3 | | | 32 | RBOUT3 | RB5 |
| | RB6 | 56 | TBIN4 | TBOUT0- | RBIN0- | 33 | RBOUT4 | RB6 |
| | RB7 | 3 | TBIN6 | | | 35 | RBOUT6 | RB7 |
| | GB2 | 4 | TBIN7 | | | 37 | RBOUT7 | GB2 |
| | GB3 | 6 | TBIN8 | | | 38 | RBOUT8 | GB3 |
| | GB4 | 7 | TBIN9 | | | 39 | RBOUT9 | GB4 |
| L | GB5 | 11 | TBIN12 | | | 43 | RBOUT12 | GB5 |
| | GB6 | 12 | TBIN13 | TBOUT1+ | RBIN1+ | 45 | RBOUT13 | GB6 |
| V | GB7 | 14 | TBIN14 | | | 46 | RBOUT14 | GB7 |
| | BB2 | 15 | TBIN15 | TBOUT1- | RBIN1- | 47 | RBOUT15 | BB2 |
| D | BB3 | 19 | TBIN18 | | | 51 | RBOUT18 | BB3 |
| S | BB4 | 20 | TBIN19 | | | 53 | RBOUT19 | BB4 |
| | BB5 | 22 | TBIN20 | | | 54 | RBOUT20 | BB5 |
| | BB6 | 23 | TBIN21 | | | 55 | RBOUT21 | BB6 |
| | BB7 | 24 | TBIN22 | TBOUT2+ | RBIN2+ | 1 | RBOUT22 | BB7 |
| E | RSVD | 27 | TBIN24 | | | 3 | RBOUT24 | RSVD |
| | RSVD | 28 | TBIN25 | TBOUT2- | RBIN2- | 5 | RBOUT25 | RSVD |
| V | RSVD | 30 | TBIN26 | | | 6 | RBOUT26 | RSVD |
| E | RB0 | 50 | TBIN27 | | | 7 | RBOUT27 | RB0 |
| | RB1 | 2 | TBIN5 | | | 34 | RBOUT5 | RB1 |
| N | GB0 | 8 | TBIN10 | | | 41 | RBOUT10 | GB0 |
| | GB1 | 10 | TBIN11 | TBOUT3+ | RBIN3+ | 42 | RBOUT11 | GB1 |
| | BB0 | 16 | TBIN16 | | | 49 | RBOUT16 | BB0 |
| | BB1 | 18 | TBIN17 | TBOUT3- | RBIN3- | 50 | RBOUT17 | BB1 |
| | RSVD | 25 | TBIN23 | | | 2 | RBOUT23 | RSVD |
| | MCLK | 31 | TCLKAIN | TCLKBOUT+ | RCLKBIN+ | 26 | RCLKAOUT | MCLK |
| | | | | TCLKBOUT- | RCLKBIN- | | | |

5.3 Data Input Format




Display Position of Input Data(V-H)

5.4 Back-light Interface

5.4.1 The connector interface pin assignments (CN31,CN32)

The Back-light interface connector is a model BHR-04VS-1 manufactured by JST or equivalent. Connector pin assignment is listed in Table 6.

<Table 6. Back-light Electrical Interface>

| Pin No. | INPUT | Color | Function |
|---|---|---|---|
| 1 | HOT 1 | Pink | High Voltage |
| 2 | HOT 2 | Pink | High Voltage |
| 3 | N.C | - | No Connection |
| 4 | COLD | White | GND |

## 6.0 SIGNAL TIMING SPECIFICATIONS

The specification of the signal timing parameter is listed in Table 7.

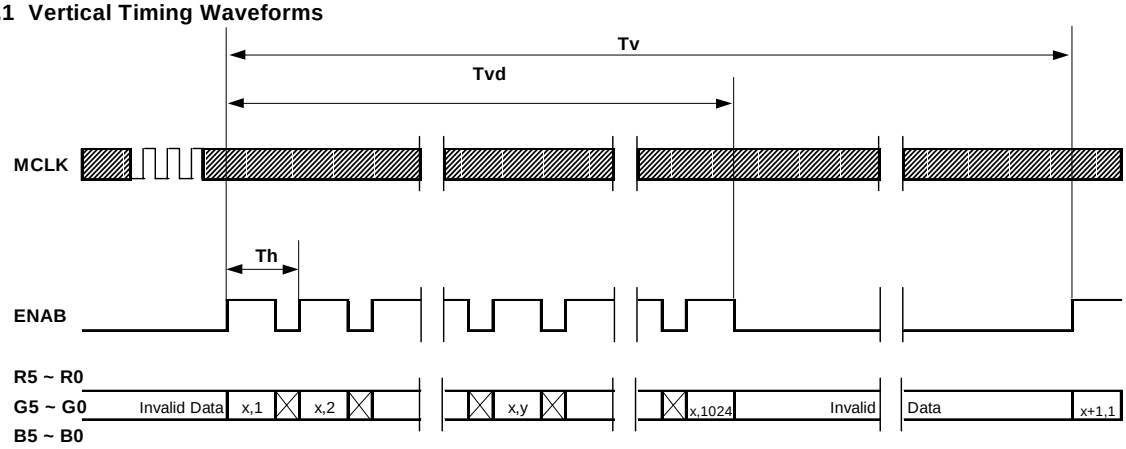
The HT18E22-300 is operated by DE only mode

<Table 7. Signal Timing Specifications>

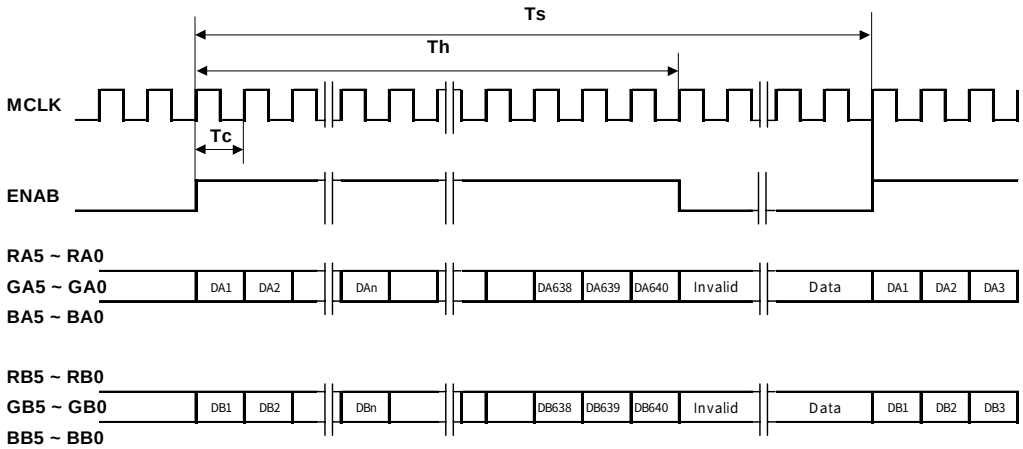
| ITEM | | Symbol | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Clock | Frequency | 1/Tc | 42.5 | 54 | 54 | MHz |
| | High time | Tch | 5 | - | - | ns |
| | Low time | Tcl | 5 | - | - | ns |
| Data | Setup time | Tds | 4 | - | - | ns |
| | Hold time | Tdh | 4 | - | - | ns |
| Data Enable setup time | | Tes | 4 | - | - | ns |
| Frame period | | Tv | 1032 | 1066 | 1066 | Lines |
| Vertical display period | | Tvd | 1024 | 1024 | 1024 | Lines |
| One line scanning period | | Th | 665 | 844 | 844 | Clocks |
| Horizontal display period | | Thd | 640 | 640 | 640 | Clocks |

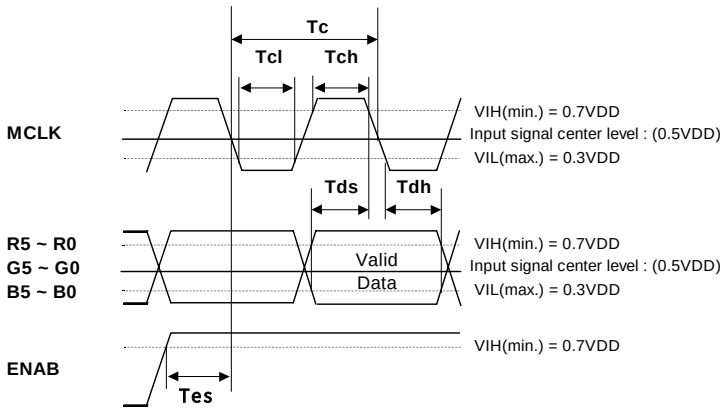
## 7.0 SIGNAL TIMING WAVEFORMS

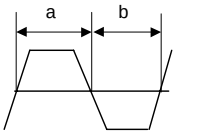
### 7.1 Vertical Timing Waveforms




### 7.2 Horizontal Timing Waveforms




Duty(a,b) = 50%±10%

## 8.0 INPUT SIGNALS, BASIC DISPLAY COLORS & GRAY SCALE OF COLORS

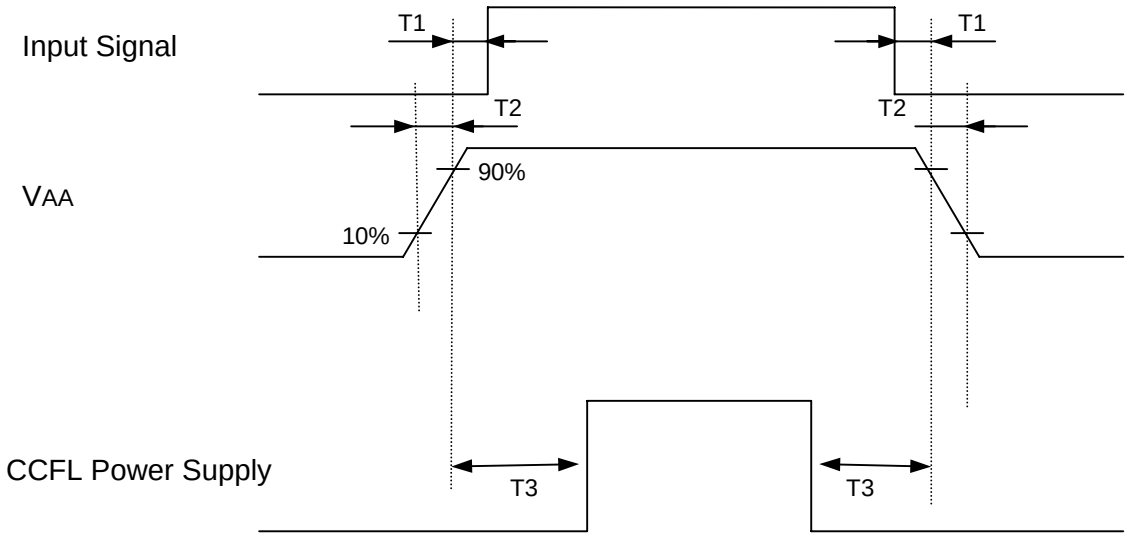
Each color is displayed in 16.7 Million gray scales from 8bit data signal inputs. Table 8 shows the 8bit input signals for basic display colors and gray scale.

<Table 8. 8 Bit Input signals, basic display colors and gray scale for each color>

| | | Data Signal | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ODD | RA7 | RA6 | RA5 | RA4 | RA3 | RA2 | RA1 | RA0 | GA7 | GA6 | GA5 | GA4 | GA3 | GA2 | GA1 | GA0 | BA7 | BA6 | BA5 | BA4 | BA3 | BA2 | BA1 | BA0 |
| | EVEN | RB7 | RB6 | RB5 | RB4 | RB3 | RB2 | RB1 | RB0 | GB7 | GB6 | GB5 | GB4 | GB3 | GB2 | GB1 | GB0 | BB7 | BB6 | BB5 | BB4 | BB3 | BB2 | BB1 | BB0 |
| Basic Colors | Black | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Blue | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Green | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Light Blue | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Red | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Purple | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Yellow | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | White | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Gray Scale Of Red | Black | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | △ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Darker | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | △ | ↓ | | | | | | | | ↓ | | | | | | | | ↓ | | | | | | | |
| | ▽ | | | | | | | | | | | | | | | | | | | | | | | | |
| | Brighter | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | ▽ | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Red | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Gray Scale Of Green | Black | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | △ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Darker | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | △ | ↓ | | | | | | | | ↓ | | | | | | | | ↓ | | | | | | | |
| | ▽ | | | | | | | | | | | | | | | | | | | | | | | | |
| | Brighter | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | ▽ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Green | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Gray Scale Of Blue | Black | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | △ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| | Darker | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| | △ | ↓ | | | | | | | | ↓ | | | | | | | | ↓ | | | | | | | |
| | ▽ | | | | | | | | | | | | | | | | | | | | | | | | |
| | Brighter | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 |
| | ▽ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 |
| | Blue | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Gray Scale Of White | Black | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | △ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| | Darker | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| | △ | ↓ | | | | | | | | ↓ | | | | | | | | ↓ | | | | | | | |
| | ▽ | | | | | | | | | | | | | | | | | | | | | | | | |
| | Brighter | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 |
| | ▽ | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 |
| | White | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

## 9.0 POWER SEQUENCE

To prevent a latch-up or DC operation of the LCD module, the power on/off sequence should be as shown in below




- T1 ≤ 50 (ms)
- T2 ≤ 30 (ms)
- 100 ≤ T3 ≤ 200 (ms)

Note : Do not keep the interface signal high-impedance when power is on.

## 10.0 MECHANICAL CHARACTERISTICS

10.1 Dimensional Requirements

FIGURE 5 & 6, shown in Appendix, shows mechanical outlines for the model HT18E22-300 . Other parameters are shown in Table 10.

<Table 10. Dimensional Parameters>

| Parameter | Specification | Unit | Remark |
|---|---|---|---|
| Active area | 359.04 (H) X 287.23 (V) | mm | |
| Number of pixels | 1280 (H) X 1024 (V) | pixels | |
| | (1 pixel = R + G + B dots) | | |
| Pixel pitch | 0.2805 (H) X 0.2805 (V) | mm | |
| Pixel arrangement | RGB Vertical stripe | | |
| Display colors | 16,777,216 | colors | |
| Display mode | Normally Black | | |
| Outline dimension | 414.0 (H) X 335.0 (V) X 18.6(D) | mm | 1) |
| Weight | 2600 Typ. | gram | 2) |
| Back-light | Top/Bottom edge side 4-CCFL type | | |

1). General tolerance : H & V = ±0.5mm / D = ±0.3mm
2). 2700 Max.

10.2 Mounting

See FIGURE 5 & 6, shown in Appendix

10.3 Anti-Glare and Polarizer Hardness.

The surface of the LCD has an anti-glare coating to minimize reflection and a coating to reduce scratching.

10.4 Light Leakage

There shall not be visible light from the back-lighting system around the edges of the screen as seen from a distance 50 cm from the screen with an overhead light level of 300lux.

## 11.0 RELIABILITY TEST

The Reliability test items and its conditions are shown in below.

<Table 11. Reliability test>

| No. | Test Items | Conditions |
|---|---|---|
| 1 | High temperature storage test | Ta = 60 °C, 240 hrs |
| 2 | Low temperature storage test | Ta = -20 °C, 240 hrs |
| 3 | High temperature & high humidity | Ta = 40 °C, 75 %RH, 240 hrs |
| 4 | High temperature operation test | Ta = 40 °C, 240 hrs |
| 5 | Low temperature operation test | Ta = 10 °C, 240 hrs |
| 6 | Thermal shock | Ta = 0 °C ↔ 50 °C (0.5 hr), 100 cycle |
| 7 | Vibration test<br>(non-operating) | Frequency : 10 ~ 300 Hz, SW10min<br>Gravity/AMP : 1.0G<br>Period : X,Y,Z 2hrs |
| 8 | Shock test<br>(non-operating) | Gravity : 100G<br>Pulse width : 6 ms, half sine wave<br>Direction : ±X, ±Y, ±Z<br>once for each direction |
| 9 | Electrostatic discharge test | Contact : 150 pF, 330Ω , 8KV 5 times<br>Air : 150 pF, 330Ω , 15KV 5 times |

## 12.0 HANDLING & CAUTIONS

(1) Cautions when taking out the module

- Pick the pouch only, when taking out module from a shipping package.

(2) Cautions for handling the module

- As the electrostatic discharges may break the LCD module, handle the LCD module with care. Peel a protection sheet off from the LCD panel surface as slowly as possible.
- As the LCD panel and back-light element are made from fragile glass material, impulse and pressure to the LCD module should be avoided.
- As the surface of the polarizer is very soft and easily scratched, use a soft dry cloth without chemicals for cleaning.
- Do not pull the interface connector in or out while the LCD module is operating.
- Put the module display side down on a flat horizontal plane.
- Handle connectors and cables with care.

(3) Cautions for the operation

- When the module is operating, do not lose MCLK, DE signals. If any one of these signals is lost, the LCD panel would be damaged.
- Obey the supply voltage sequence. If wrong sequence is applied, the module would be damaged.

(4) Cautions for the atmosphere

- Dew drop atmosphere should be avoided.
- Do not store and/or operate the LCD module in a high temperature and/or humidity atmosphere. Storage in an electro-conductive polymer packing pouch and under relatively low temperature atmosphere is recommended.

(5) Cautions for the module characteristics

- Do not apply fixed pattern data signal to the LCD module at product aging.
- Applying fixed pattern for a long time may cause image sticking.

(6) Other cautions

- Do not disassemble and/or re-assemble LCD module.
- Do not re-adjust variable resistor or switch etc.
- When returning the module for repair or etc., Please pack the module not to be broken. We recommend to use the original shipping packages.

## 13.0 APPENDIX

**Figure 1. Measurement Set Up**

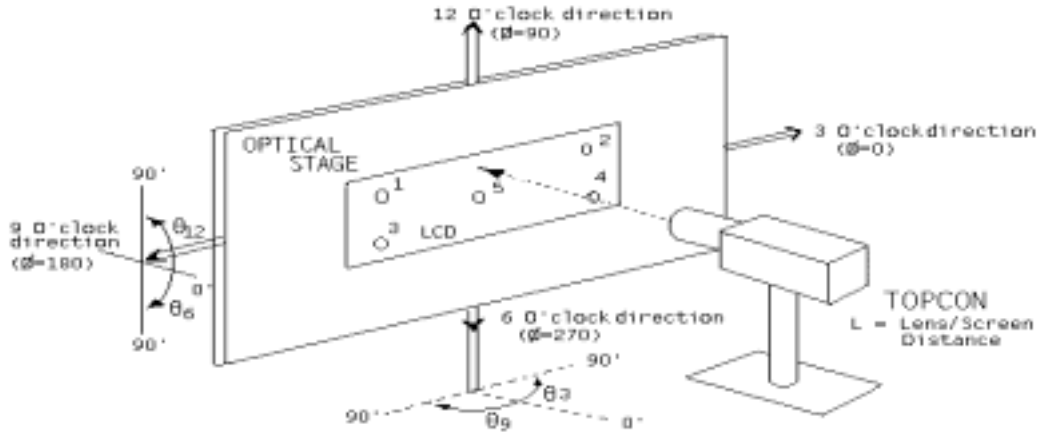


**Figure 2. Average Luminance & Uniformity Measurement Locations**

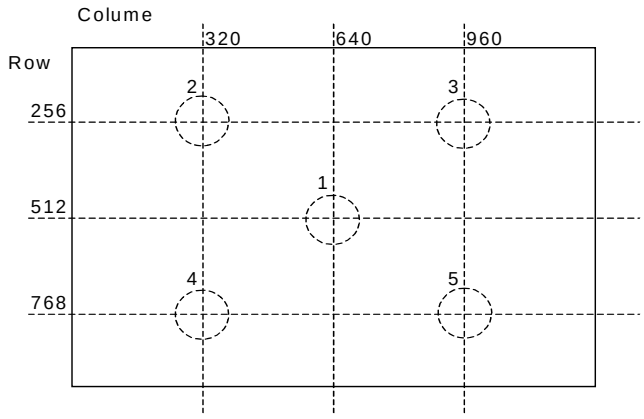



**Figure 3. Response Time Testing**

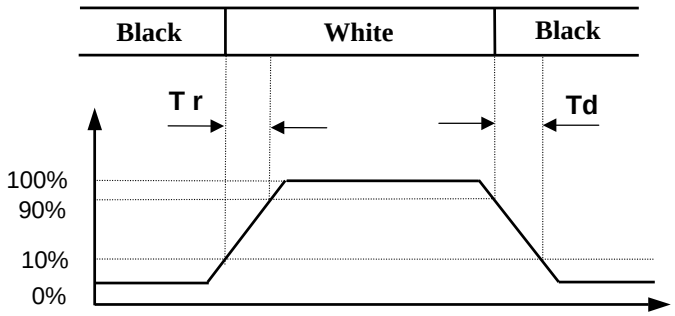
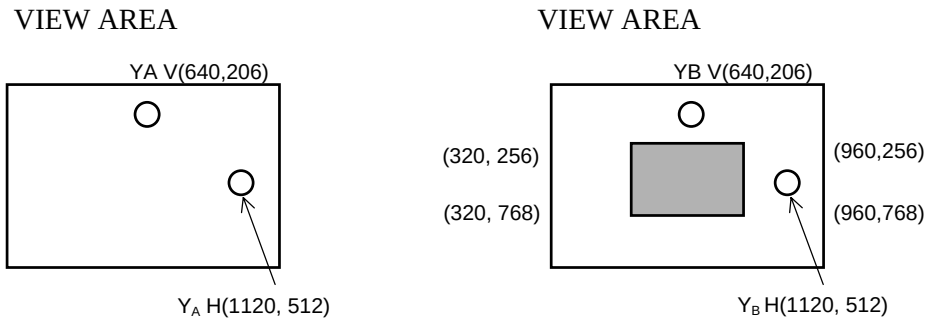



**Figure 4. Cross Modulation Test Description**




$$\text{Cross-Talk (\%)} = \left| \frac{Y_B - Y_A}{Y_A} \right| \times 100$$

Where:

$Y_A$ = Initial luminance of measured area ($cd/m^2$)

$Y_B$ = Subsequent luminance of measured area ($cd/m^2$)

The location measured will be exactly the same in both patterns

**Figure 5. TFT-LCD Module Outline Dimensions (Front view)**

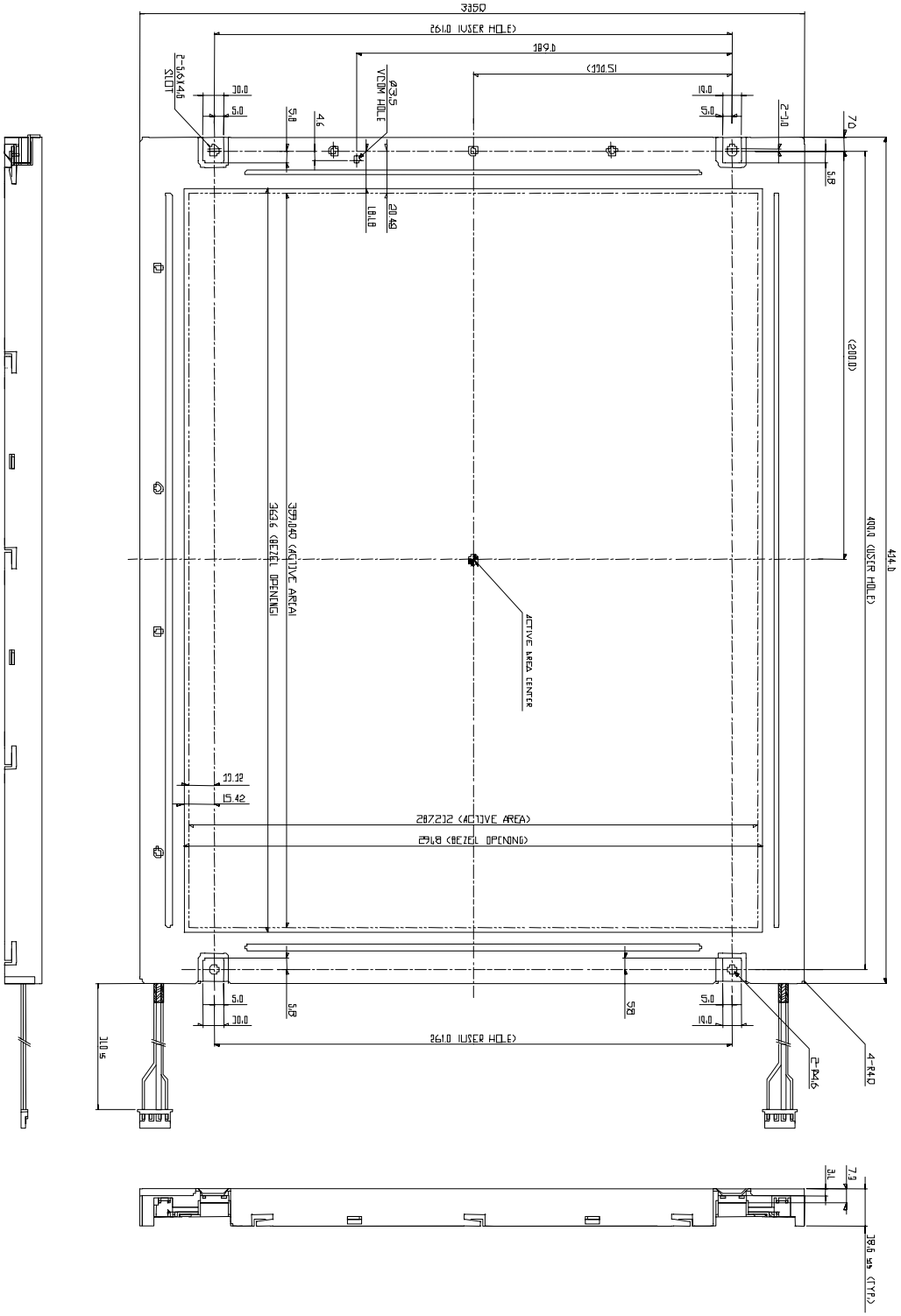


**Figure 6. TFT-LCD Module Outline Dimensions (Back view)**