TO :

Date : Apr, 30, 2009

# HannStar Product Specification

## (Formal)

## 7” Color TFT-LCD Module

Model: HSD070IDW1-E**

Note: 1.Please contact HannStar Display Corp. before designing your product based on this module specification.

2.The information contained herein is presented merely to indicate the characteristics and performance of our products. No responsibility is assumed by HannStar for any intellectual property claims or other problems that may result from application based on the module described herein.

3.The mark “ ** ” of Model means sub-model code.

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# Record of Revisions

| Rev. | Date | Sub-Model | Description of change |
|---|---|---|---|
| 1.0 | Apr, 30, 2009 | - | Formal Product Specification was first issued. |

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# 1.0 GENERAL DESCRIPTION

## 1.1 Introduction

HannStar Display model HSD070IDW1-E is a color active matrix thin film transistor (TFT) liquid crystal display (LCD) that uses amorphous silicon TFT as a switching device. This model is composed of a TFT LCD panel, a driving circuit and a back-light system. This TFT LCD has a 7.0 (16:9) inch diagonally measured active display area with WVGA (800 horizontal by 480 vertical pixel) resolution.

## 1.2 Features

- 7 (16:9 diagonal) inch configuration
- 6 bits + FRC driver with 1channel TTL interface
- LED Backlight
- Up/Down, Left/Right reversion selection
- RoHS/ Halogen Free Compliance

## 1.3 Applications

- Automotive
- Mobile NB
- Digital Photo frame
- Multimedia applications and Others AV system

## 1.4 General information

| Item | | Specification | Unit |
|---|---|---|---|
| Outline Dimension | | 164.9 x 100.0 x 5.7 (Typ.) | mm |
| Display area | | 153.6(H) x 86.64(V) | mm |
| Number of Pixel | | 800 RGB(H) x 480(V) | pixels |
| Pixel pitch | | 0.192(H) x 0.1805(V) | mm |
| Pixel arrangement | | RGB Vertical stripe | |
| Display mode | | Normally white | |
| Surface treatment | | Antiglare, Hard-Coating(3H) with EWV film | |
| Weight | | 170 (Typ.) | g |
| Back-light | | Single LED (Side-Light type) | |
| Power Consumption | B/L System | 2.16(Max.) | W |

## 1.5 Mechanical Information

| Item | | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|
| Module Size | Horizontal(H) | 164.6 | 164.9 | 165.2 | mm |
| | Vertical(V) | 99.7 | 100.0 | 100.3 | mm |
| | Depth(D) | 5.4 | 5.7 | 6.0 | mm |
| Weight (Without inverter) | | — | 170 | — | g |

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# 2.0 ABSOLUTE MAXIMUM RATINGS

## 2.1 Electrical Absolute Rating

### 2.1.1 TFT LCD Module

| Item | Symbol | Min. | Max. | Unit | Note |
|---|---|---|---|---|---|
| Power supply voltage | Vcc | -0.3 | 6.0 | V | GND=0 |
| | $V_{GH}$ | 0.3 | 40 | V | GND=0 |
| | $V_{GL}$ | -20 | 0.3 | V | GND=0 |
| | $AV_{DD}$ | 0.5 | 15 | V | AGND=0 |
| | $V_{COM}$ | 0 | 6 | V | |
| Logic Signal Input Level | $V_I$ | -0.3 | Vcc +0.3 | V | |

### 2.1.2 Back-Light Unit

| Item | Symbol | Typ. | Max. | Unit | Note |
|---|---|---|---|---|---|
| LED current | $I_L$ | 180 | — | mA | (1) (2)(3) |
| LED voltage | $V_L$ | 10.5 | — | V | (1) (2)(3) |

Note

(1) Permanent damage may occur to the LCD module if beyond this specification. Functional operation should be restricted to the conditions described under normal operating conditions.

(2) Ta =25±2℃

(3) Test Condition: LED current 180 mA. The LED lifetime could be decreased if operating IL is larger than 180mA.

## 2.2 Environment Absolute Rating

| Item | Symbol | Min. | Max. | Unit | Note |
|---|---|---|---|---|---|
| Operating Temperature | $T_{opa}$ | -20 | 70 | ℃ | |
| Storage Temperature | $T_{stg}$ | -30 | 80 | ℃ | |

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## 3.0 OPTICAL CHARACTERISTICS

### 3.1 Optical specification

| Item | | Symbol | Condition | Min. | Typ. | Max. | Unit | Note |
|---|---|---|---|---|---|---|---|---|
| Contrast | | CR | Θ=0 Normal viewing angle | 400 | 500 | — | | (1)(2) |
| Response time | Rising | $T_R$ | | — | 5 | 7 | msec | (1)(3) |
| | Falling | $T_F$ | | — | 20 | 28 | | |
| White luminance (Center) | | $Y_L$ | | 360 | 450 | — | $cd/m^2$ | (1)(4) ($I_L$=140mA) |
| Color chromaticity (CIE1931) | White | $W_x$ | | 0.260 | 0.310 | 0.360 | | (1)(4) |
| | | $W_y$ | | 0.280 | 0.330 | 0.380 | | |
| Viewing angle | Hor. | $\Theta_L$ | CR>10 | 60 | 75 | — | | |
| | | $\Theta_R$ | | 60 | 75 | — | | |
| | Ver. | $\Theta_U$ | | 40 | 60 | — | | |
| | | $\Theta_D$ | | 50 | 70 | — | | |
| Brightness uniformity | | $B_{UNI}$ | Θ=0 | 70 | - | — | % | (5)(7) |
| Optima View Direction | | 6 O' clock | | | | | | (6) |

### 3.2 Measuring Condition

- Measuring surrounding: dark room
- LED current $I_L$: 180mA
- Ambient temperature: 25±2°C
- 15min. warm-up time.

### 3.3 Measuring Equipment

- FPM520 of Westar Display technologies, INC., which utilized SR-3 for Chromaticity and BM-5A for other optical characteristics.
- Measuring spot size: 20 ~ 21 mm

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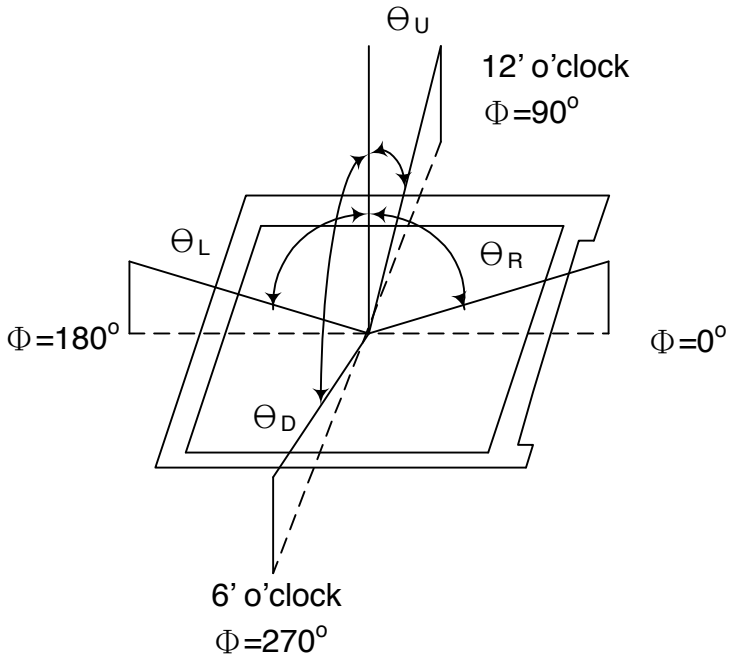
**Note (1)** Definition of Viewing Angle:




**Note (2)** Definition of Contrast Ratio(CR) :
measured at the center point of panel

$$CR = \frac{\text{Luminance with all pixels white}}{\text{Luminance with all pixels black}}$$

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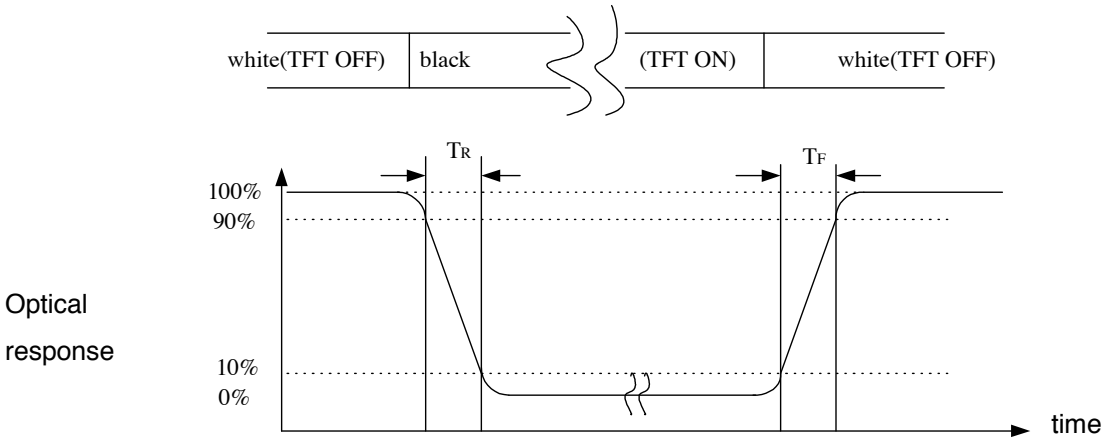
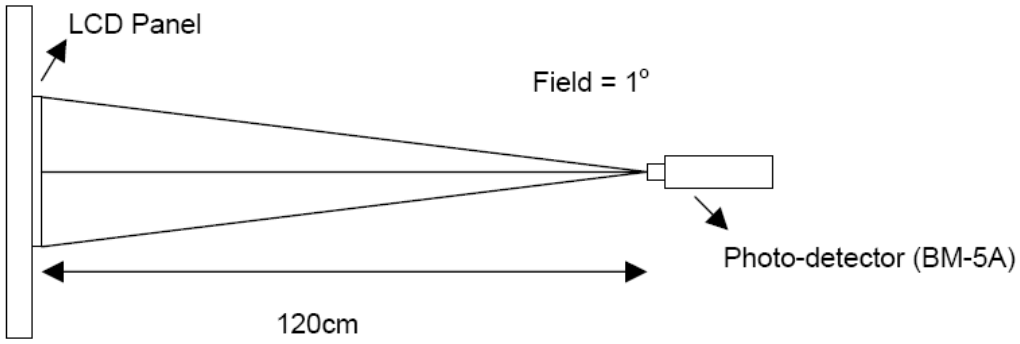
**Note (3)** Definition of Response Time: Sum of $T_R$ and $T_F$




**Note (4)** Definition of optical measurement setup

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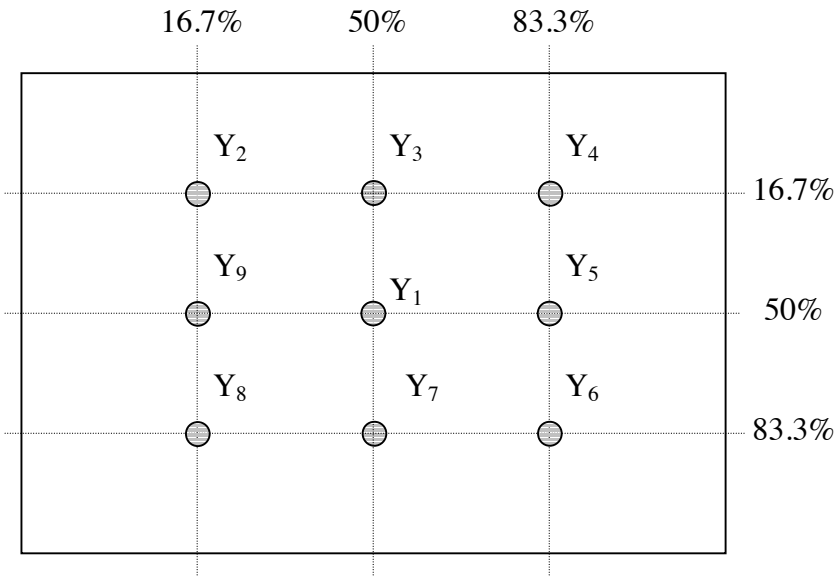
**Note (5)** Definition of brightness uniformity




$$\text{Luminance uniformity} = \frac{\text{(Min Luminance of 9 points)}}{\text{(Max Luminance of 9 points)}} \times 100\%$$

**Note (6)** Rubbing Direction (The different Rubbing Direction will cause the different optimal view direction.

**Note (7)** Measured at the brightness of the panel when all terminals of LCD panel are electrically open.

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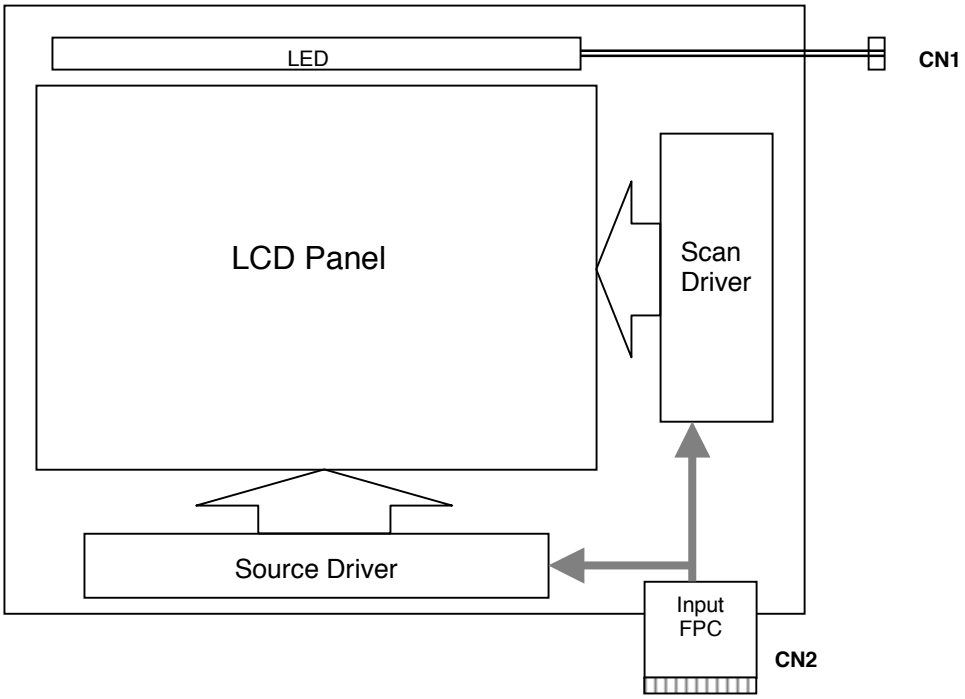
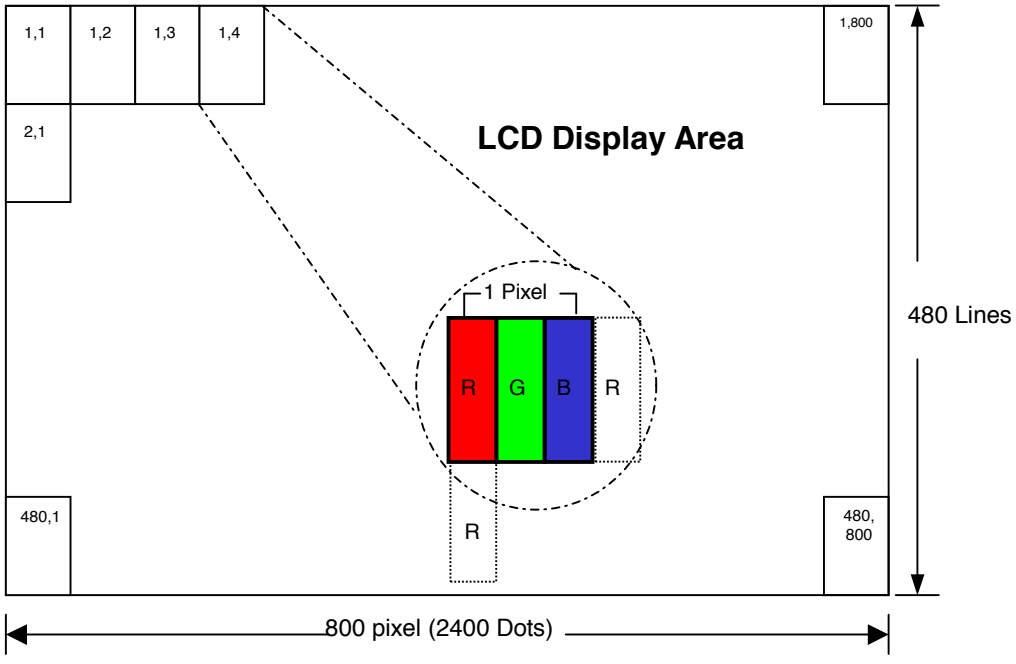
# 4.0 BLOCK DIAGRAM

## 4.1 TFT LCD Module




## 4.2 Pixel Format

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# 5.0 INTERFACE PIN CONNECTION

## 5.1 TFT LCD Module

CN2 (Input signal): FPC Down Connector, (FH28-60S-0.5SH (HIROSE), 60pin,pitch = 0.5mm)

| Terminal no. | Symbol | I/O | Function |
|---|---|---|---|
| 1 | AGND | P | Analog Ground |
| 2 | AVDD | P | Analog Power |
| 3 | VCC | P | Digital Power |
| 4 | R0 | I | Data Input(LSB) |
| 5 | R1 | I | Data Input |
| 6 | R2 | I | Data Input |
| 7 | R3 | I | Data Input |
| 8 | R4 | I | Data Input |
| 9 | R5 | I | Data Input |
| 10 | R6 | I | Data Input |
| 11 | R7 | I | Data Input(MSB) |
| 12 | G0 | I | Data Input(LSB) |
| 13 | G1 | I | Data Input |
| 14 | G2 | I | Data Input |
| 15 | G3 | I | Data Input |
| 16 | G4 | I | Data Input |
| 17 | G5 | I | Data Input |
| 18 | G6 | I | Data Input |
| 19 | G7 | I | Data Input(MSB) |
| 20 | B0 | I | Data Input(LSB) |
| 21 | B1 | I | Data Input |
| 22 | B2 | I | Data Input |
| 23 | B3 | I | Data Input |
| 24 | B4 | I | Data Input |
| 25 | B5 | I | Data Input |
| 26 | B6 | I | Data Input |
| 27 | B7 | I | Data Input(MSB) |
| 28 | DCLK | I | Clock input |
| 29 | DE | I | Data Enable signal |
| 30 | HSD | I | Horizontal sync input.Negative polarity |
| 31 | VSD | I | Vertical sync input.Negative polarity |
| 32 | MODE3 | I | DE/SYNC mode select .normally pull high H:DE mode.L:HSD/VSD mode |
| 33 | RSTB | I | global reset pin.Active low to enter reset state.suggest to connecting with an RC reset circuit for stability .normally pull high. |
| 34 | STBYB | I | standby mode,normally pull high STBYB="1",normal operation STBYB="0",timming control ,soruce driver will turn off,all output are high-Z |
| 35 | SHLR | I | Source right or left sequence control.SHLR="L",shift left:last data=S1<-S2…S1200=first data SHLR="H",shift right:first data=S1->SS2…S1200=last data |

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| Terminal no. | Symbol | I/O | Function |
|---|---|---|---|
| 36 | VCC | P | Digital Power |
| 37 | UPDN | I | gate up or down scan control. UPDN="L" , DOWN shift : G1->G2…->G480 ; UPDN="H", up shift: G1<-G2…<-G480 |
| 38 | GND | P | Digital Ground |
| 39 | AGND | P | Analog Ground |
| 40 | AVDD | P | Analog Power |
| 41 | VCOMin | I | For external VCOM DC input(Optional) |
| 42 | DITH | I | Dithering setting: DITH="H" 6bit resolution (last 2 bits of input data truncated) (default setting) DITH="L" 8bit resolution |
| 43 | NC | - | Not connect |
| 44 | NC | - | Not connect |
| 45 | V10 | P | Gamma correction voltage reference |
| 46 | V9 | P | Gamma correction voltage reference |
| 47 | V8 | P | Gamma correction voltage reference |
| 48 | V7 | P | Gamma correction voltage reference |
| 49 | V6 | P | Gamma correction voltage reference |
| 50 | V5 | P | Gamma correction voltage reference |
| 51 | V4 | P | Gamma correction voltage reference |
| 52 | V3 | P | Gamma correction voltage reference |
| 53 | V2 | P | Gamma correction voltage reference |
| 54 | V1 | P | Gamma correction voltage reference |
| 55 | NC | - | Not connect |
| 56 | VGH | P | Positive Power for TFT |
| 57 | VCC | P | Digital Power |
| 58 | VGL | P | Negative Power for TFT |
| 59 | GND | P | Digital Ground |
| 60 | NC | - | Not connect |

## 5.2 Back-Light Unit

**CN1** LED Power Source (**BHSR-02VS-1**) or equivalent

Mating Connector: (**SBHT-002T-P0.5**) or equivalent

| Terminal no. | Symbol | Function |
|---|---|---|
| 1 | VL | LED power supply (high voltage) |
| 2 | GL | LED power supply (low voltage) |

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# 6.0 ELECTRICAL CHARACTERISTICS

## 6.1 TFT LCD Module

| Item | Symbol | Min. | Typ. | Max. | Unit | Note |
|---|---|---|---|---|---|---|
| Supply Voltage | Vcc | 2.7 | 3.0 | 3.5 | V | |
| | $V_{GH}$ | 14.5 | 15 | 20 | V | |
| | $V_{GL}$ | -10 | -7 | -6.5 | V | |
| | $AV_{DD}$ | 9.85 | 10 | 10.15 | V | |
| VCOM | $V_{COMin}$ | - | 3.9 | - | V | |
| Input signal voltage | $V_{iH}$ | 0.7 Vcc | - | Vcc | V | Note (1) |
| | $V_{iL}$ | 0 | - | 0.3 Vcc | V | |
| Current of power supply | $I_{DD}$ | - | 5.426 | - | mA | Vcc =3.0V |
| | $I_{ADD}$ | - | 24.1 | - | mA | $AV_{DD}$=10 V (Black) |
| | $I_{GH}$ | - | 0.128 | - | mA | $V_{GH}$=15V |
| | $I_{GL}$ | - | 0.344 | - | mA | $V_{GL}$= -7V |
| Input level of V1~V5 | Vx | AVDD/2- | | AVDD-0.1- | V | |
| Input level of V6~V10 | Vx | 0.1- | | AVDD/2- | V | |

Note (1): HSYNC, VSYNC, DE, Digital Data

Note (2): Be sure to apply the power voltage as the power sequence spec.

Note (3): DGND=AGND=0V,)

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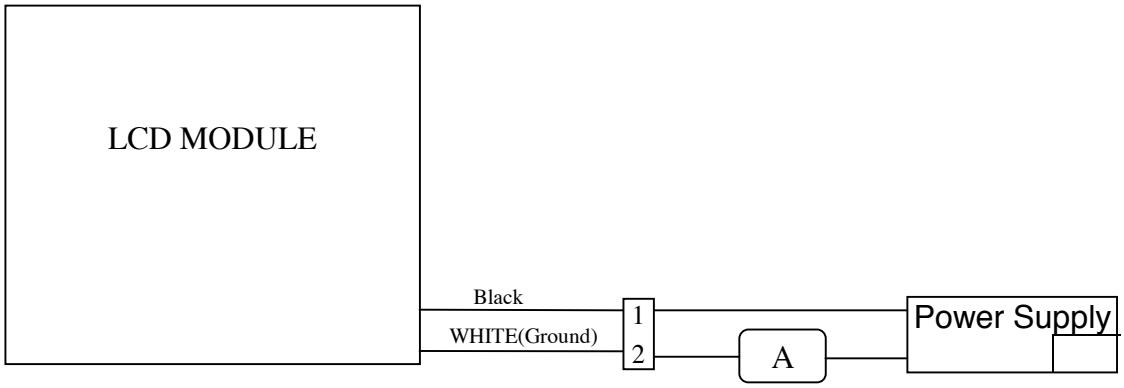
## 6.2 Back-Light Unit

The backlight system is an edge-lighting type with 27 LED.

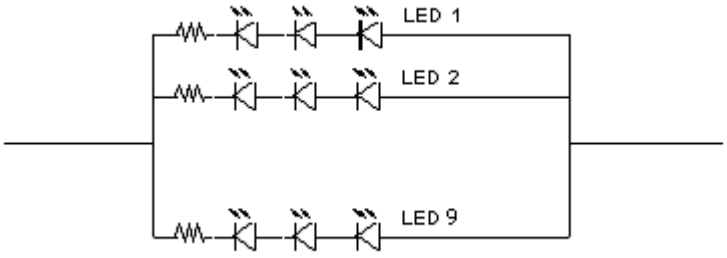
The characteristic of the LED is shown in the following tables.

| Item | Symbol | Min. | Typ. | Max. | Unit | Note |
|---|---|---|---|---|---|---|
| LED current | IL | — | 180 | — | mA | (2) |
| LED voltage | VL | — | 10.5 | — | V | |
| Operating LED life time | Hr | 20,000 | — | — | Hour | (1)(2) |




Note (1) LED life time (Hr) can be defined as the time in which it continues to operate under the condition: Ta=25±3°C, typical IL value indicated in the above table until the brightness becomes less than 50%.

Note (2) The "LED life time" is defined as the module brightness decrease to 50% original brightness at Ta=25℃ and IL=180mA. The LED lifetime could be decreased if operating IL is larger than 180mA. The constant current driving method is suggested.




**LED Light Bar Circuit**

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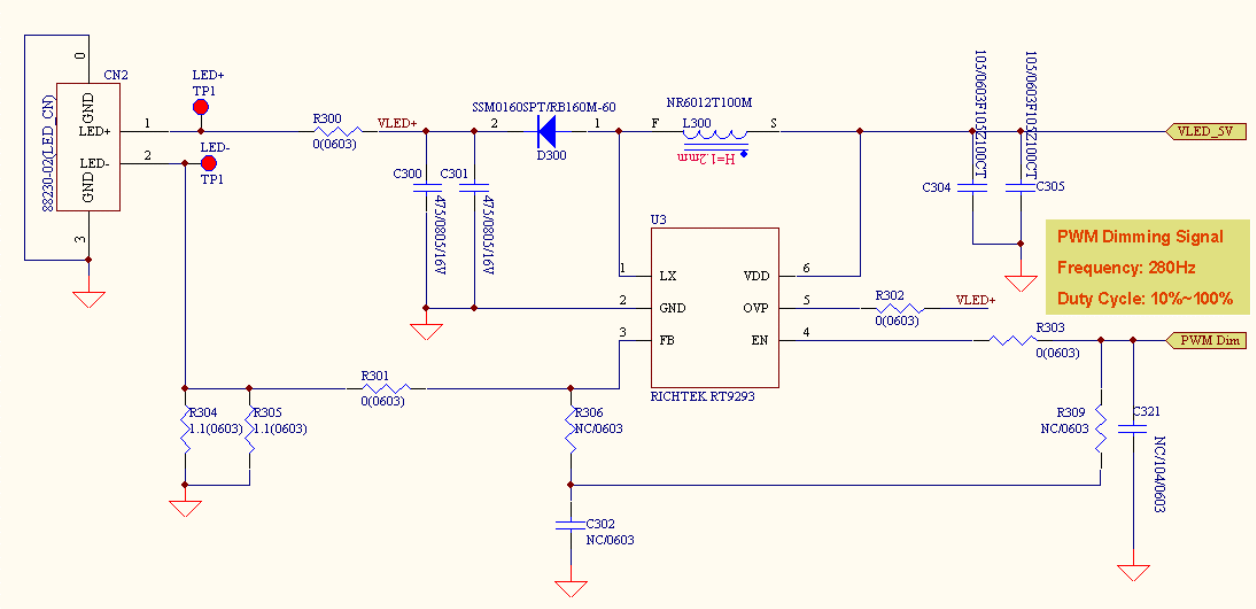
Note (3) Suggested Schematic of LED Back-Light Driver




**Suggested Schematic of LED Back-Light Driver**

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### 6.3 AC Characteristics

| Item | Symbol | Min. | Typ. | Max. | Unit | Note |
|---|---|---|---|---|---|---|
| DCLK cycle time | Tcph | 25 | | | ns | |
| DCLK frequency | fclk | | 30 | 40 | MHz | |
| DCLK pulse duty | Tcwh | 40 | 50 | 60 | % | |
| VSD setup time | Tvst | 8 | | | ns | |
| VSD hold time | Tvhd | 8 | | | ns | |
| HSD setup time | Thst | 8 | | | ns | |
| HSD hold time | Thhd | 8 | | | ns | |
| Data setup time | Tdsu | 8 | | | ns | |
| Data hold time | Tdhd | 8 | | | ns | |
| DE setup time | Tesu | 8 | | | ns | |
| DE hold time | Tehd | 8 | | | ns | |
| Horizontal display area | thd | | 800 | | Tcph | |
| HSD period time | th | | 928 | | Tcph | |
| HSD pulse width | thpw | 1 | 48 | | Tcph | |
| HSD back porch | thb | | 40 | | Tcph | |
| HSD front porch | thfp | | 40 | | Tcph | |
| Vertical display area | tvd | | 480 | | th | |
| VSD period time | tv | | 525 | | th | |
| VSD pulse width | tvpw | | 3 | | th | |
| VSD back porch | tvb | | 29 | | th | |
| VSD front porch | tvfp | | 13 | | th | |

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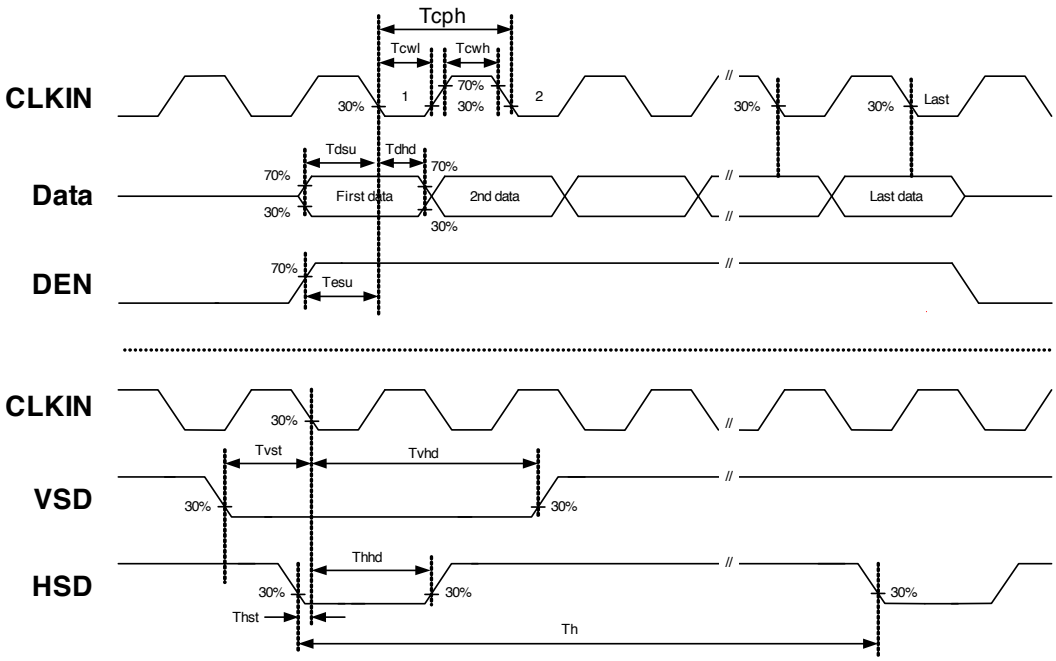
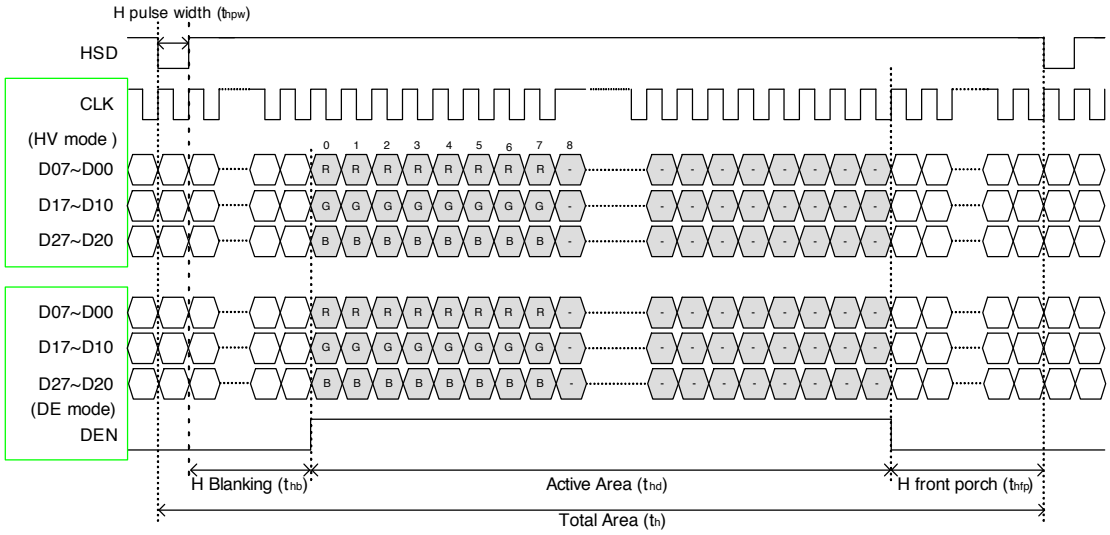
## 6.4 Timing Diagram of Interface Signal




**Sampling clock timing**




**Horizontal display timing range**

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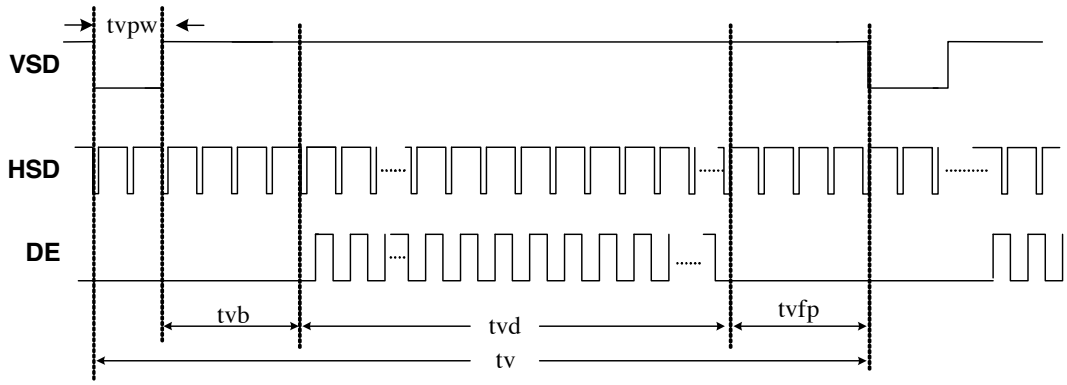


**Vertical timing**

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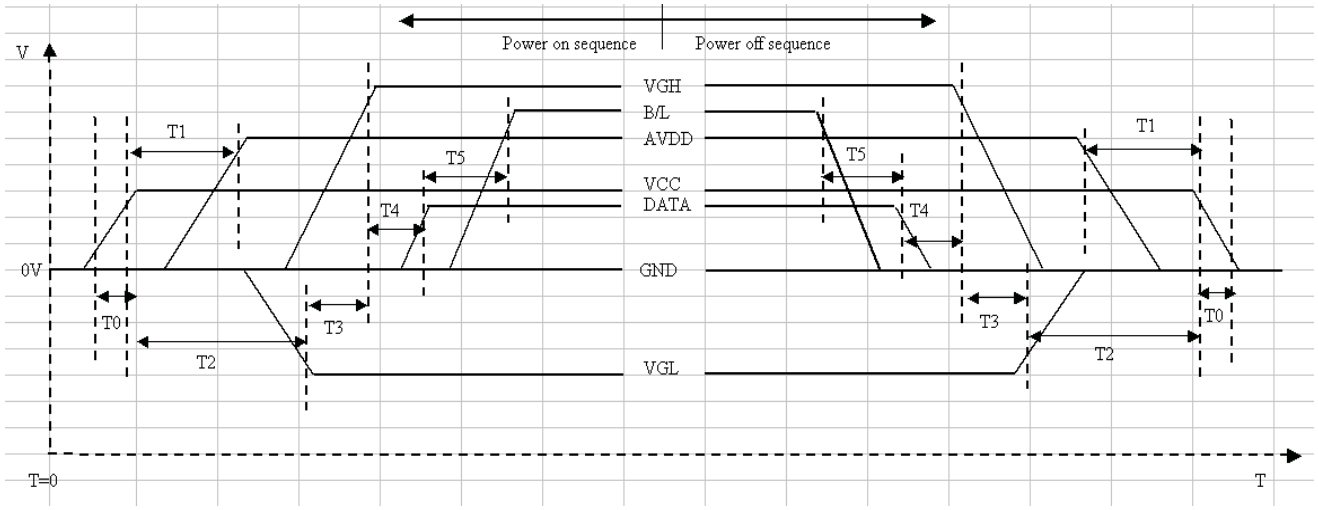
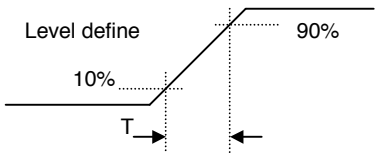
## 6.5 Power Sequence




| Item | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|
| T0 | 0.5 | -- | 20 | msec |
| T1 | 16 | | | msec |
| T2 | 20 | | | msec |
| T3 | 10 | | | msec |
| T4 | 10 | | 50 | msec |
| T5 | 50 | | | msec |




Power On Sequence: VCC-> AVDD -> VGL -> VGH -> Data -> B/L

Power Off Sequence: B/L-> Data -> VGH -> VGL -> AVDD -> VCC

Notes: Data include R0~R7, G0~G7, B0~B7, HSD, VSD, DCLK, SHLR, UPDN, DE MODE, RSTB, STBYB, SHLR, UPDN, DITH

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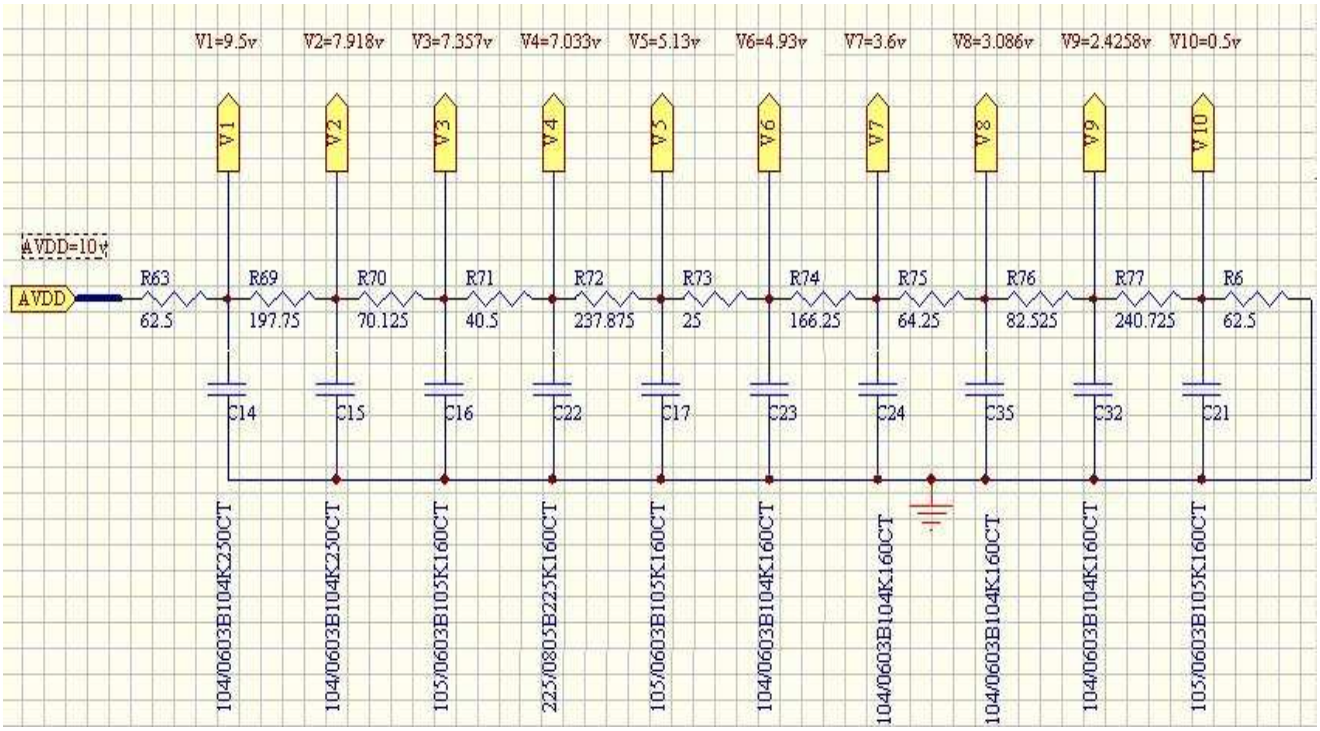
### 6.6 Gamma circuit




** Suggested Gamma Circuit. **

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## 7.0 Reliability test items

| No. | Item | Conditions | Remark |
|---|---|---|---|
| 1 | High Temperature Storage | Ta=+80°C, 240hrs | |
| 2 | Low Temperature Storage | Ta=-30°C, 240hrs | |
| 3 | High Temperature Operation | Ta=+70°C, 240hrs | |
| 4 | Low Temperature Operation | Ta=-20°C, 240hrs | |
| 5 | High Temperature and High Humidity (operation) | Ta=+60°C, 90%RH, 240hrs | |
| 6 | Thermal Cycling Test (non operation) | -30°C(30min) → +80°C(30min), 200cycles | |
| 7 | Electrostatic Discharge | ±200V,200pF(0Ω) 1 time/each terminal | |
| 8 | Vibration | 1.Random:<br>1.04Grms, 5~500Hz, X/Y/Z,<br>30min/each direction<br>2. Sine:<br>Freq. Range: 8~33.3Hz<br>Stoke: 1.3mm<br>Sweep: 2.9G, 33.3~400Hz<br>X/Z: 2hr, Y: 4hr, cyc: 15min | |
| 9 | Shock | 100G, 6ms, ±X, ±Y, ±Z<br>3 time for each direction | JIS C7021, A-10<br>(Condition A) |
| 10 | Vibration (with carton) | Random: 0.015G^2/Hz, 5~200Hz<br>-6dB/Octave, 200~400Hz<br>XYZ each direction: 2hr | |
| 11 | Drop (with carton) | Height: 60cm<br>1 corner, 3 edges, 6 surfaces | JIS Z0202 |

Note: There is no display function NG issue occurred, all the cosmetic specification is judged before the reliability stress.

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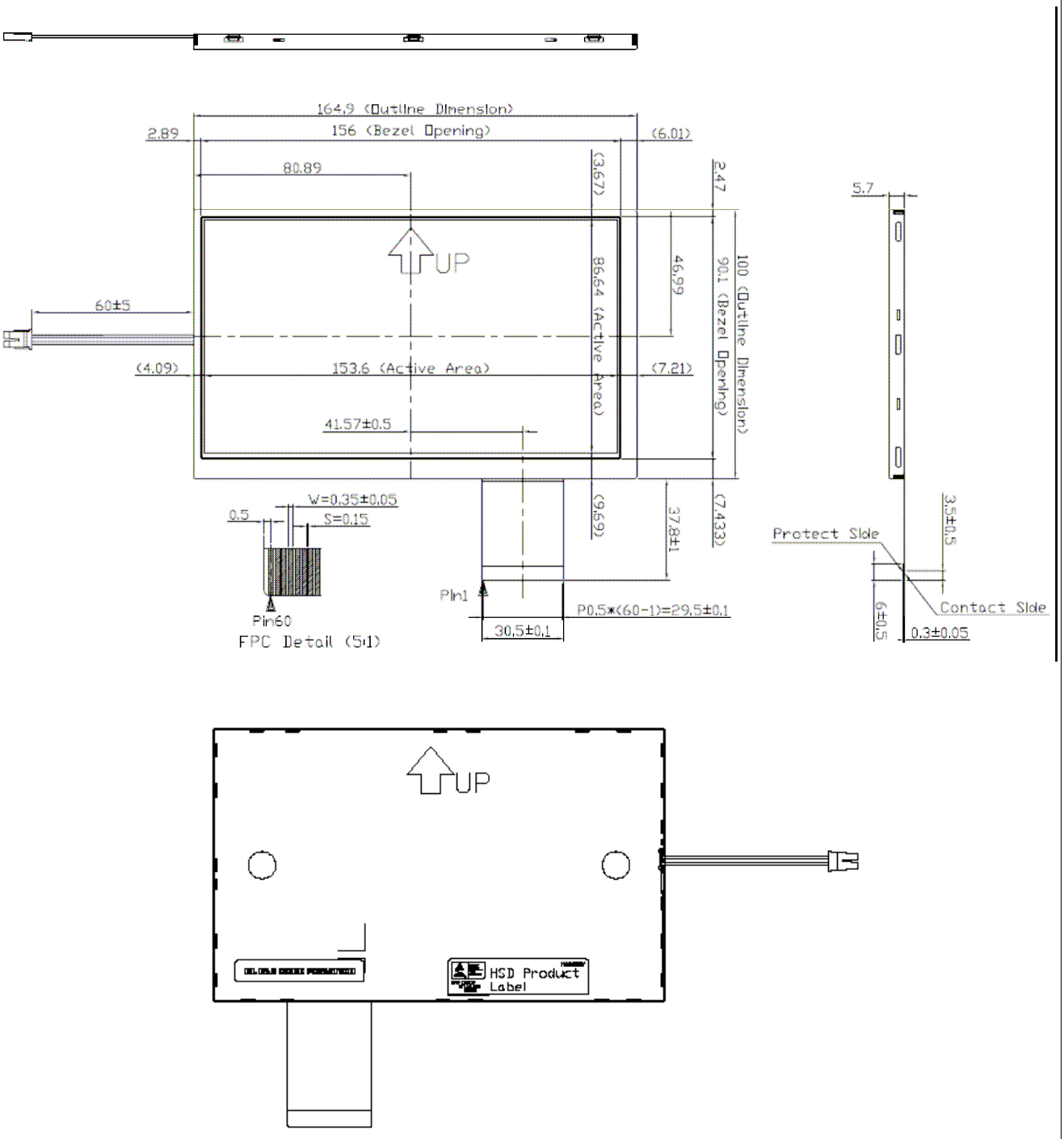
## 8.0 OUTLINE DIMENSION

### 8.1 Outline Dimension

**Unit : mm**

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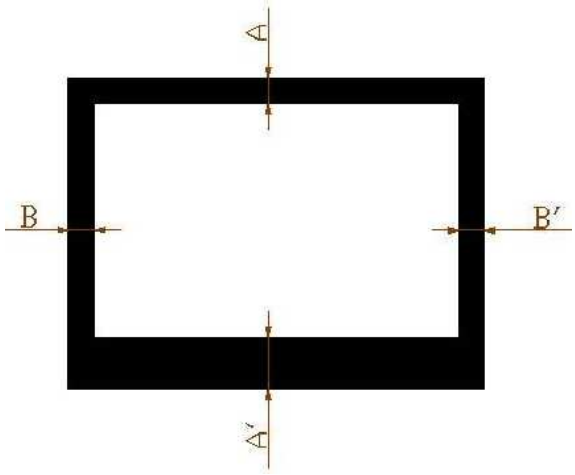


BM Assembly Tolerance

$0 \leqq (A'-A) \leqq 2\ (mm)$

$|B'-B| \leqq 1\ (mm)$

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# 9.0 LOT MARK

## 9.1 Lot Mark

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

Code 1,2,3,4,5,6: HannStar internal flow control code.
Code 7: production location.
Code 8: production year.
Code 9: production month.
Code 10,11,12,13,14,15: serial number.

Note (1) Production Year: Code 8 is defined by the last number of the year, for example

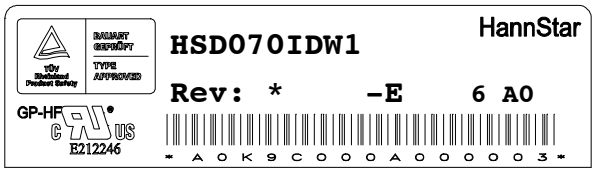
| Year | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 |
|---|---|---|---|---|---|---|---|---|---|---|
| Mark | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 |

Note (2) Production 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 |

## 9.2 Detail of Lot Mark

(1) Below label is attached on the backside of the LCD module. See Section 8.0: Outline Dimension.
(2) The detail of Lot Mark is attached as below.
(3) This is subject to change without prior notice.

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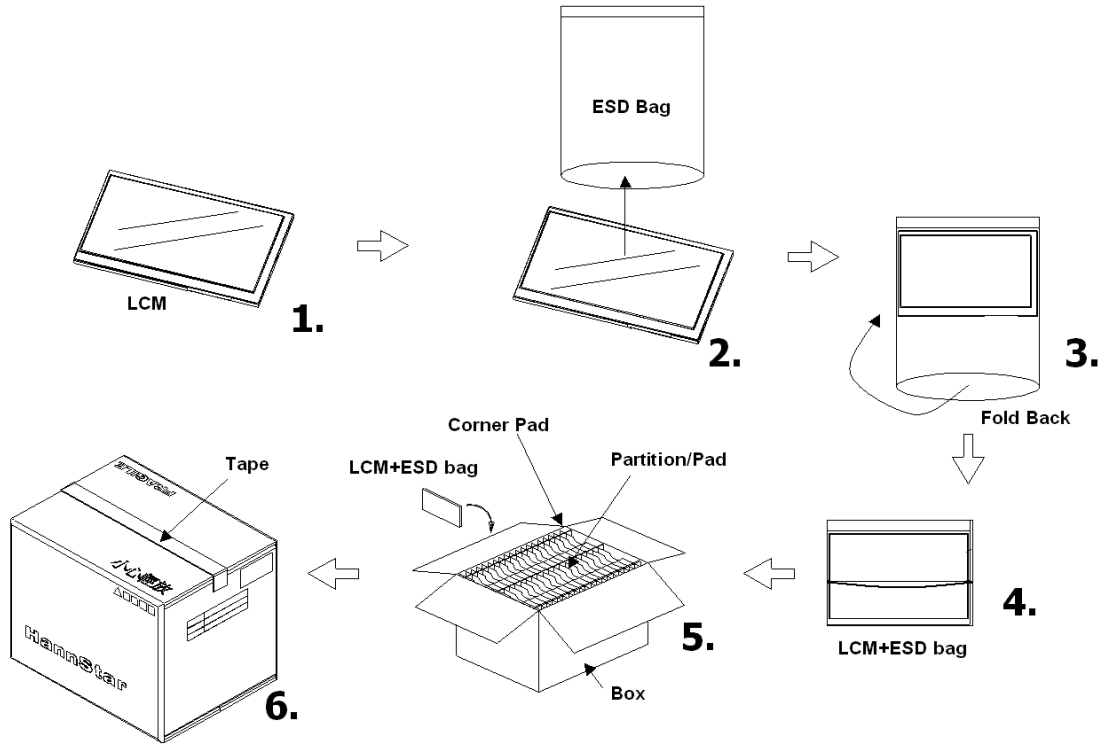
# 10.0 PACKAGE SPECIFICATION

## 10.1 Packing form

(1) Package quantity in one carton: 80 pieces.

(2) Carton size: 451mm×375mm×284mm.

## 10.2 Packing assembly drawings




| | Material | Notice |
|---|---|---|
| Box | Corrugated Paper Board | (AB Flute) |
| Partition/Pad | Corrugated Paper Board | (B Flute) |
| Corner Pad | Corrugated Paper Board | (AB Flute) |
| ESD bag | PE | |

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# 11.0 GENERAL PRECAUTION

## 11.1 Use Restriction

This product is not authorized for use in life supporting systems, aircraft navigation control systems, military systems and any other application where performance failure could be life threatening or otherwise catastrophic.

## 11.2 Disassembling or Modification

Do not disassemble or modify the module. It may damage sensitive parts inside LCD module, and may cause scratches or dust on the display. HannStar does not warrant the module, if customers disassemble or modify the module.

## 11.3 Breakage of LCD Panel

11.3.1.If LCD panel is broken and liquid crystal spills out, do not ingest or inhale liquid crystal, and do not contact liquid crystal with skin.

11.3.2. If liquid crystal contacts mouth or eyes, rinse out with water immediately.

11.3.3. If liquid crystal contacts skin or cloths, wash it off immediately with alcohol and rinse thoroughly with water.

11.3.4. Handle carefully with chips of glass that may cause injury, when the glass is broken.

## 11.4 Electric Shock

11.4.1. Disconnect power supply before handling LCD module.

11.4.2. Do not pull or fold the LED cable.

11.4.3. Do not touch the parts inside LCD modules and the fluorescent LED's connector or cables in order to prevent electric shock.

## 11.5 Absolute Maximum Ratings and Power Protection Circuit

11.5.1. Do not exceed the absolute maximum rating values, such as the supply voltage variation, input voltage variation, variation in parts' parameters, environmental temperature, etc., otherwise LCD module may be damaged.

11.5.2. Please do not leave LCD module in the environment of high humidity and high temperature for a long time.

11.5.3. It's recommended to employ protection circuit for power supply.

## 11.6 Operation

11.6.1 Do not touch, push or rub the polarizer with anything harder than HB pencil lead.

11.6.2 Use fingerstalls of soft gloves in order to keep clean display quality, when persons handle the LCD module for incoming inspection or assembly.

11.6.3 When the surface is dusty, please wipe gently with absorbent cotton or other soft material.

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11.6.4 Wipe off saliva or water drops as soon as possible. If saliva or water drops contact with polarizer for a long time, they may causes deformation or color fading.

11.6.5 When cleaning the adhesives, please use absorbent cotton wetted with a little petroleum benzine or other adequate solvent.

### 11.7 Mechanism

Please mount LCD module by using mouting holes arranged in four corners tightly.

### 11.8 Static Electricity

11.8.1 Protection film must remove very slowly from the surface of LCD module to prevent from electrostatic occurrence.

11.8.2. Because LCD module use CMOS-IC on circuit board and TFT-LCD panel, it is very weak to electrostatic discharge. Please be careful with electrostatic discharge. Persons who handle the module should be grounded through adequate methods.

### 11.9 Strong Light Exposure

The module shall not be exposed under strong light such as direct sunlight. Otherwise, display characteristics may be changed.

### 11.10 Disposal

When disposing LCD module, obey the local environmental regulations.

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