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Customer Acceptance Specifications

Model : **HSD140PHW1**
-A

相關文件：

| | |
|---|------|
| Accepted by: | |
| Signature | Date |
| Proposed by: Technical Service Division | |
| Signature | Date |

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Record of Revisions

| Rev. | Date | Sub-Model | Description of change |
|------|------|-----------|--|
| 1.0 | -- | A | Formal Product Specification was first issued. |

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1.0 GENERAL DESCRIPTION

1.1 Introduction

HannStar Display model HSD140PHW1-A 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 14 (16:9) inch diagonally measured active display area with HD (1366 horizontal by 768 vertical pixel) resolution.

1.2 Features

- 14 (16:9 diagonal) inch configuration
- One channel LVDS interface
- 262K color by 6 bit R.G.B signal input
- RoHS Compliance
- Halogen Free

1.3 General information

| Item | | Specification | Unit |
|-------------------|--------------|-----------------------------------|--------|
| Outline Dimension | | 323.5(Typ) x 192(Typ) x 5.2 (Max) | mm |
| Display area | | 309.40(H) x 173.95(V) | mm |
| Number of Pixel | | 1366 RGB (H) x 768(V) | pixels |
| Pixel pitch | | 0.2265(H) x 0.2265(V) | mm |
| Pixel arrangement | | RGB Vertical stripe | |
| Display mode | | Normally white | |
| NTSC | | 60 | % |
| Surface treatment | | Glare, Hard-Coating (3H) | |
| Weight | | 350 (Typ.) | g |
| Back-light | | White LED | |
| Power Consumption | Logic System | 1.2 (Max.) | W |
| | B/L System | 3.6 (Max.) | W |

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1.4 Mechanical Information

| | Item | Min. | Typ. | Max. | Unit |
|-------------|----------------|-------|-------|-------|------|
| Module Size | Horizontal (H) | 323 | 323.5 | 324 | mm |
| | Vertical (V) | 191.5 | 192 | 192.5 | mm |
| | Depth (D) | — | — | 5.2 | mm |
| Weight | | — | 350 | 360 | g |

2.0 ABSOLUTE MAXIMUM RATINGS

2.1 Electrical Absolute Rating

2.1.1 TFT LCD Module

| Item | Symbol | Min. | Max. | Unit | Note |
|----------------------|----------|------|------|------|------|
| Logic Supply voltage | V_{DD} | -0.3 | 4.0 | V | |

2.1.2 Environment Absolute Rating

| Item | Symbol | Min. | Max. | Unit | Note |
|-----------------------|-----------|------|------|------|------|
| Operating Temperature | T_{opa} | 0 | 50 | °C | |
| Storage Temperature | T_{stg} | -20 | 60 | °C | |

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3.0 OPTICAL CHARACTERISTICS

3.1 Optical specification

| Item | | Symbol | Condition | Min. | Typ. | Max. | Unit | Note |
|------------------------------|---------|------------------|------------------------------------|-------|-------|-------|-------------------|-------------------------------------|
| Contrast | | CR | $\Theta=0$ Normal viewing angle | 400 | 500 | — | | (1)(2)(4) |
| Response time | Rising | Tr | | — | 2 | 4 | msec | (1)(3) |
| | Falling | Tf | | — | 6 | 12 | | |
| White luminance (5 point) | | Y _L | | 176 | 220 | — | cd/m ² | (1)(4)(5) (I _L =20mA) |
| Color chromaticity (CIE1931) | Red | R _x | | 0.589 | 0.619 | 0.649 | | |
| | | R _Y | | 0.309 | 0.339 | 0.369 | | |
| | Green | G _x | | 0.310 | 0.340 | 0.370 | | |
| | | G _Y | | 0.582 | 0.612 | 0.642 | | |
| | Blue | B _x | | 0.119 | 0.149 | 0.179 | | |
| | | B _Y | | 0.041 | 0.071 | 0.101 | | |
| | White | W _x | | 0.283 | 0.313 | 0.343 | | |
| | | W _y | | 0.299 | 0.329 | 0.359 | | |
| Viewing angle | Hor. | Θ _L | CR>10 | 40 | 45 | — | | (1)(4) |
| | | Θ _R | | 40 | 45 | — | | |
| | Ver. | Θ _U | | 10 | 15 | — | | |
| | | Θ _D | | 30 | 35 | — | | |
| Brightness uniformity | | B _{UNI} | Θ=0 (5point) | 80 | — | — | % | (6) |
| Brightness Uniformity | | B _{UNI} | Θ=0 (13 points) | 70 | — | — | % | (6) |

3.2 Measuring Condition

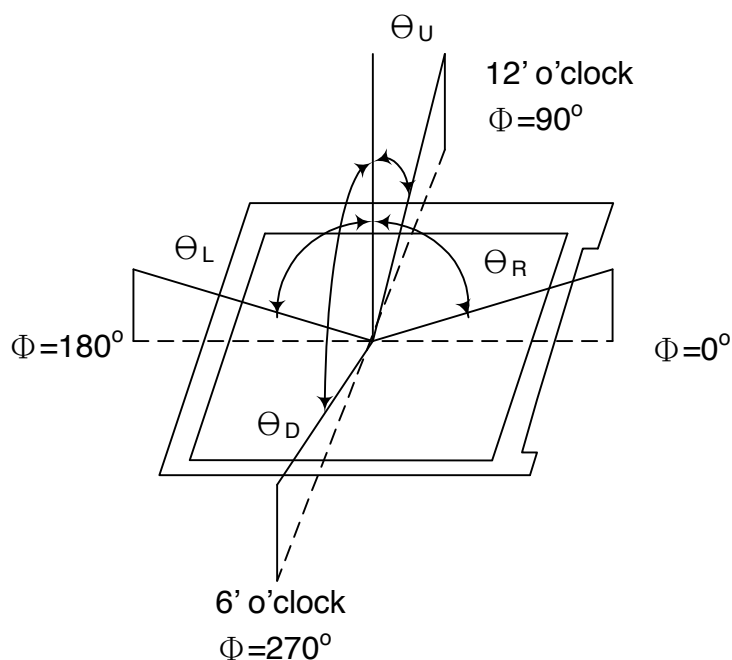
- Measuring surrounding : dark room
- LED current I_L : 20mA / single LED
- Ambient temperature : $25\pm 2^\circ\text{C}$
- 15min. warm-up time.

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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

Note (1) Definition of Viewing Angle:

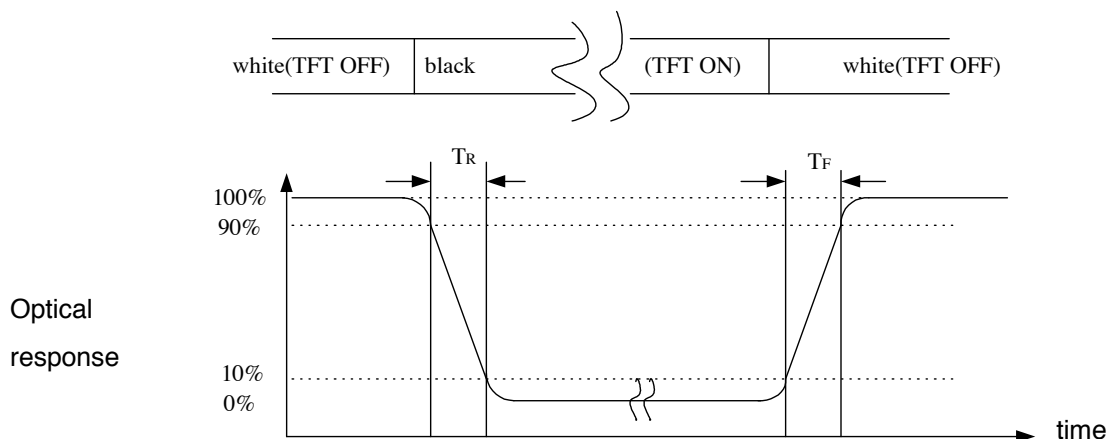


Note (2) Definition of Contrast Ratio (CR) :
measured at the center point of panel

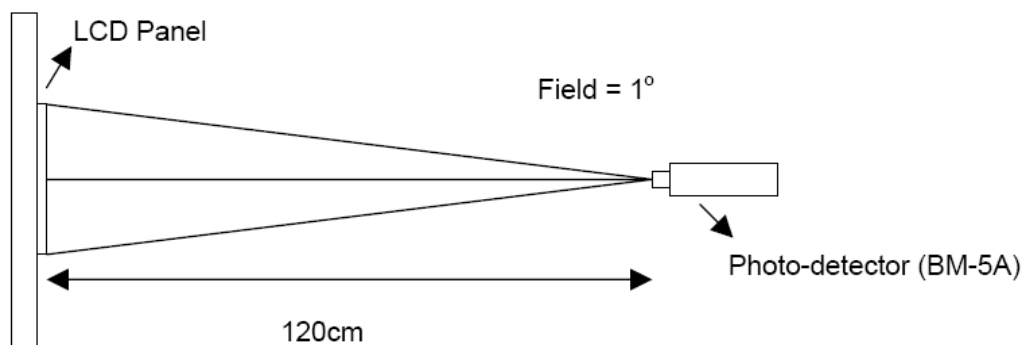
$$CR = \frac{\text{Luminance with all pixels white}}{\text{Luminance with all pixels black}}$$

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



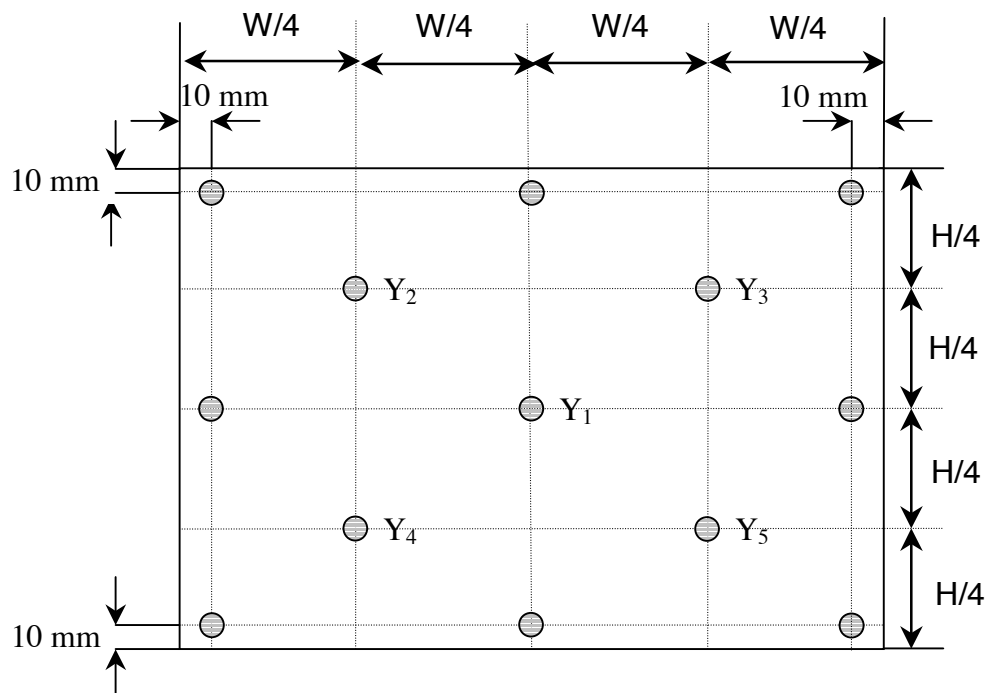
Note (4) Definition of optical measurement setup



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Note (5) Definition of Average Luminance Uniformity of White (5 Point)

$$\text{Average Luminance Uniformity} = \frac{Y_1 + Y_2 + Y_3 + Y_4 + Y_5}{5}$$



Note (6) Definition of brightness uniformity

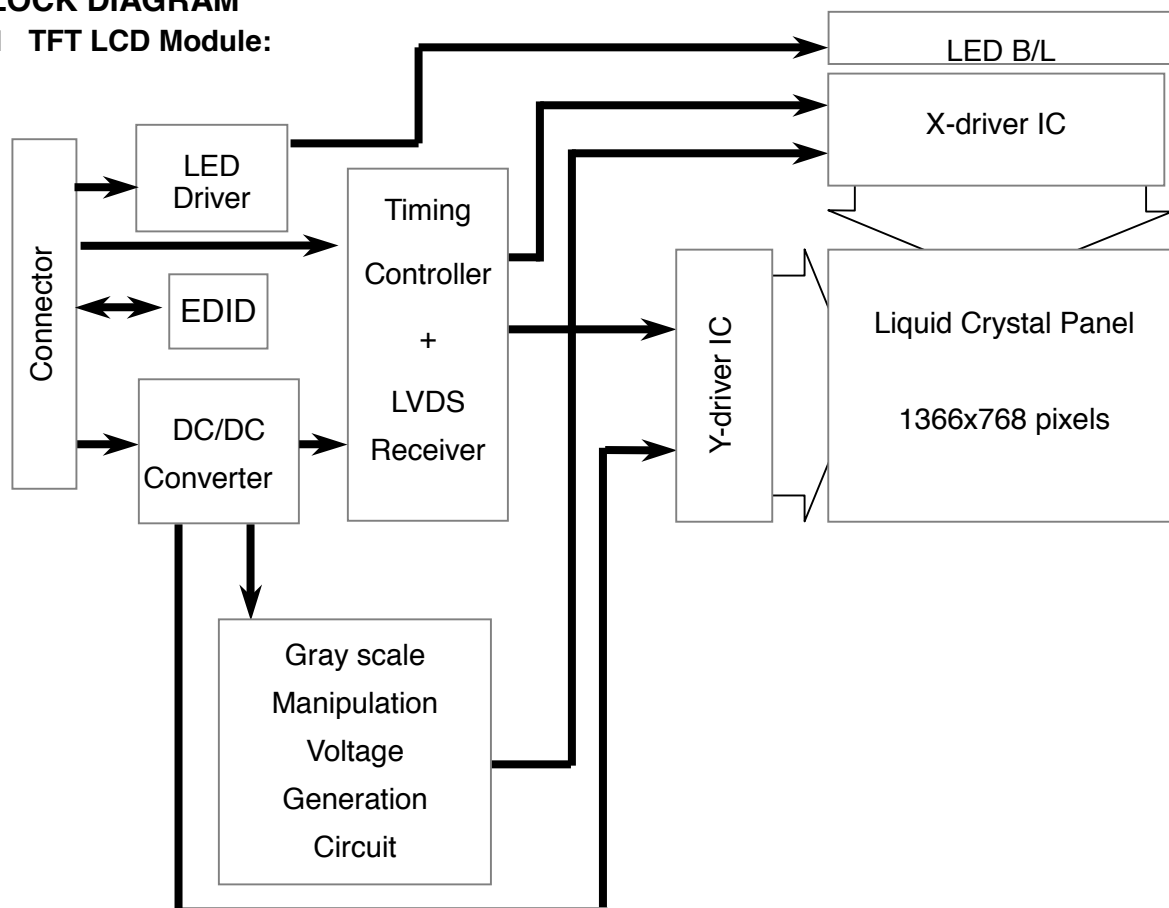
$$\text{Luminance uniformity(5 points)} = \frac{(\text{Min Luminance of 5 points})}{(\text{Max Luminance of 5 points})} \times 100\%$$

$$\text{Luminance uniformity(13 points)} = \frac{(\text{Min Luminance of 13 points})}{(\text{Max Luminance of 13 points})} \times 100\%$$

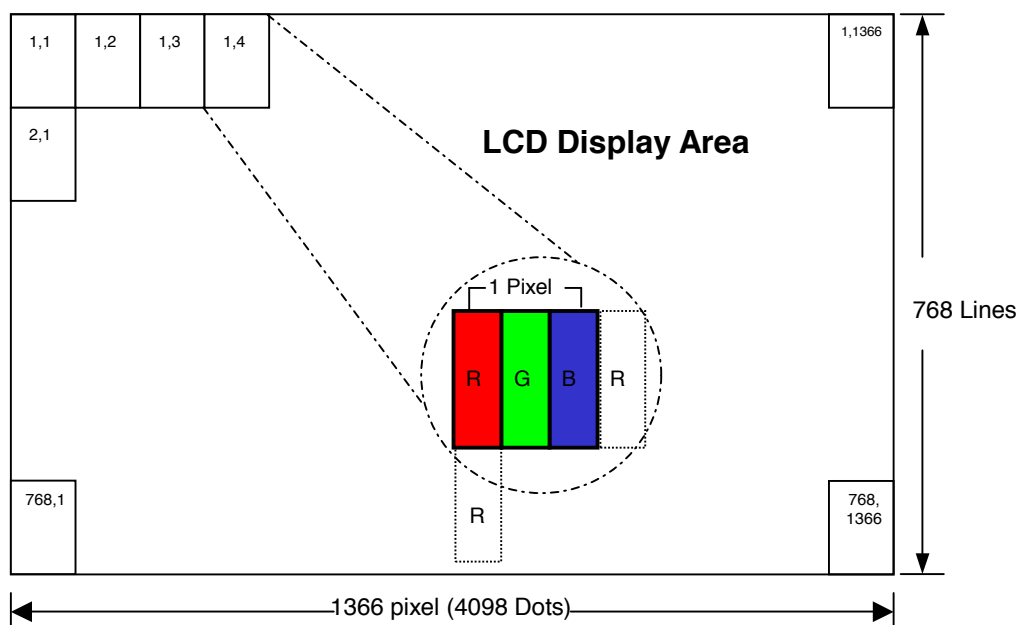
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4.0 BLOCK DIAGRAM

4.1 TFT LCD Module:



4.2 Pixel Format



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4.3 Relationship Between Displayed Color and Input

| | | MSB | | | | | | LSB | | | | | | MSB | | | | | | LSB | | | | | | Gray scale level |
|-----------------------------|-------------------------|-----|----|----|----|----|----|-----|----|----|----|----|----|-----|----|----|----|----|----|-----------|-----|--|--|--|--|------------------|
| | Display | R5 | R4 | R3 | R2 | R1 | R0 | G5 | G4 | G3 | G2 | G1 | G0 | B5 | B4 | B3 | B2 | B1 | B0 | | | | | | | |
| Basic color | Black | L | L | L | L | L | L | L | L | L | L | L | L | L | L | L | L | L | L | - | | | | | | |
| | Blue | L | L | L | L | L | L | L | L | L | L | L | L | H | H | H | H | H | H | - | | | | | | |
| | Green | L | L | L | L | L | L | H | H | H | H | H | H | L | L | L | L | L | L | - | | | | | | |
| | Light Blue | L | L | L | L | L | L | H | H | H | H | H | H | H | H | H | H | H | H | - | | | | | | |
| | Red | H | H | H | H | H | H | L | L | L | L | L | L | L | L | L | L | L | L | - | | | | | | |
| | Purple | H | H | H | H | H | H | L | L | L | L | L | L | H | H | H | H | H | H | - | | | | | | |
| | Yellow | H | H | H | H | H | H | H | H | H | H | H | H | L | L | L | L | L | L | - | | | | | | |
| | White | H | H | H | H | H | H | H | H | H | H | H | H | H | H | H | H | H | H | - | | | | | | |
| Gray scale of Red | Black | L | L | L | L | L | L | L | L | L | L | L | L | L | L | L | L | L | L | L0 | | | | | | |
| | Dark ↑ ↓ Light | L | L | L | L | L | H | L | L | L | L | L | L | L | L | L | L | L | L | L1 | | | | | | |
| | | L | L | L | L | L | H | L | L | L | L | L | L | L | L | L | L | L | L | L2 | | | | | | |
| | | ⋮ | | | | | | ⋮ | | | | | | ⋮ | | | | | | L3...L60 | | | | | | |
| | | H | H | H | H | L | H | L | L | L | L | L | L | L | L | L | L | L | L | L61 | | | | | | |
| | | H | H | H | H | H | L | L | L | L | L | L | L | L | L | L | L | L | L | L | L62 | | | | | |
| | Red | H | H | H | H | H | H | L | L | L | L | L | L | L | L | L | L | L | L | Red L63 | | | | | | |
| Gray scale of Green | Black | L | L | L | L | L | L | L | L | L | L | L | L | L | L | L | L | L | L | L0 | | | | | | |
| | Dark ↑ ↓ Light | L | L | L | L | L | L | L | L | L | L | L | H | L | L | L | L | L | L | L1 | | | | | | |
| | | L | L | L | L | L | L | L | L | L | L | H | L | L | L | L | L | L | L | L2 | | | | | | |
| | | ⋮ | | | | | | ⋮ | | | | | | ⋮ | | | | | | L3...L60 | | | | | | |
| | | L | L | L | L | L | L | H | H | H | H | L | H | L | L | L | L | L | L | L61 | | | | | | |
| | | L | L | L | L | L | L | H | H | H | H | H | L | L | L | L | L | L | L | L | L62 | | | | | |
| | Green | L | L | L | L | L | L | H | H | H | H | H | H | L | L | L | L | L | L | Green L63 | | | | | | |
| Gray scale of Blue | Black | L | L | L | L | L | L | L | L | L | L | L | L | L | L | L | L | L | L | L0 | | | | | | |
| | Dark ↑ ↓ Light | L | L | L | L | L | L | L | L | L | L | L | L | L | L | L | L | L | H | L1 | | | | | | |
| | | L | L | L | L | L | L | L | L | L | L | L | L | L | L | L | L | H | L | L2 | | | | | | |
| | | ⋮ | | | | | | ⋮ | | | | | | ⋮ | | | | | | L3...L60 | | | | | | |
| | | L | L | L | L | L | L | L | L | L | L | L | L | H | H | H | H | L | H | L61 | | | | | | |
| | | L | L | L | L | L | L | L | L | L | L | L | L | H | H | H | H | H | L | L | L62 | | | | | |
| | Blue | L | L | L | L | L | L | L | L | L | L | L | L | H | H | H | H | H | H | Blue L63 | | | | | | |
| Gray scale of White & Black | Black | L | L | L | L | L | L | L | L | L | L | L | L | L | L | L | L | L | L | L0 | | | | | | |
| | Dark ↑ ↓ Light | L | L | L | L | L | H | L | L | L | L | L | H | L | L | L | L | L | H | L1 | | | | | | |
| | | L | L | L | L | L | H | L | L | L | L | H | L | L | L | L | L | H | L | L2 | | | | | | |
| | | ⋮ | | | | | | ⋮ | | | | | | ⋮ | | | | | | L3...L60 | | | | | | |
| | | H | H | H | H | L | H | H | H | H | L | H | H | H | H | H | L | H | L | L61 | | | | | | |
| | | H | H | H | H | H | L | H | H | H | H | H | L | H | H | H | H | H | L | L | L62 | | | | | |
| | White | H | H | H | H | H | H | H | H | H | H | H | H | H | H | H | H | H | H | White L63 | | | | | | |

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5.0 INTERFACE PIN CONNECTION

5.1 TFT LCD Module : CN1 (Input signal): IPEX 20455-040E-12 (IPEX or equivalent)

| Pin No. | Signal | Description |
|---------|----------|---|
| 1 | NC | Not connection |
| 2 | AVDD | Power Supply, 3.3V (typical) |
| 3 | AVDD | Power Supply, 3.3V (typical) |
| 4 | DVDD | DDC 3.3V power |
| 5 | NC | No Connection |
| 6 | SCL | EDID Clock |
| 7 | SDA | EDID Data |
| 8 | Rin0- | - LVDS differential data input (R0-R5,G0) |
| 9 | Rin0+ | +LVDS differential data input (R0-R5,G0) |
| 10 | GND | Ground |
| 11 | Rin1- | - LVDS differential data input(G1-G5,B0-B1) |
| 12 | Rin1+ | +LVDS differential data input (G1-G5,B0-B1) |
| 13 | GND | Ground |
| 14 | Rin2- | - LVDS differential data input (B2-B5,HS,VS,DE) |
| 15 | Rin2+ | +LVDS differential data input (B2-B5,HS,VS,DE) |
| 16 | GND | Ground |
| 17 | CIKIN- | -LVDS differential clock input |
| 18 | CIKIN+ | +LVDS differential clock input |
| 19 | GND | Ground |
| 20 | NC | No Connection |
| 21 | NC | No Connection |
| 22 | GND | Ground-Shield |
| 23 | NC | No Connection |
| 24 | NC | No Connection |
| 25 | GND | Ground-Shield |
| 26 | NC | No Connection |
| 27 | NC | No Connection |
| 28 | GND | Ground-Shield |
| 29 | NC | No Connection |
| 30 | NC | No Connection |
| 31 | VLED_GND | LED Ground |
| 32 | VLED_GND | LED Ground |
| 33 | VLED_GND | LED Ground |
| 34 | NC | No Connection |
| 35 | PWM | PWM Signal for LED dimming control |
| 36 | LED_EN | LED Enable Pin (+3V Input) |
| 37 | NC | No Connection |
| 38 | VLED | LED Power Supply 7-21V |
| 39 | VLED | LED Power Supply 7-21V |
| 40 | VLED | LED Power Supply 7-21V |

Note : The brightness of LCD panel could be changed by adjusting PWM

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6.0 ELECTRICAL CHARACTERISTICS

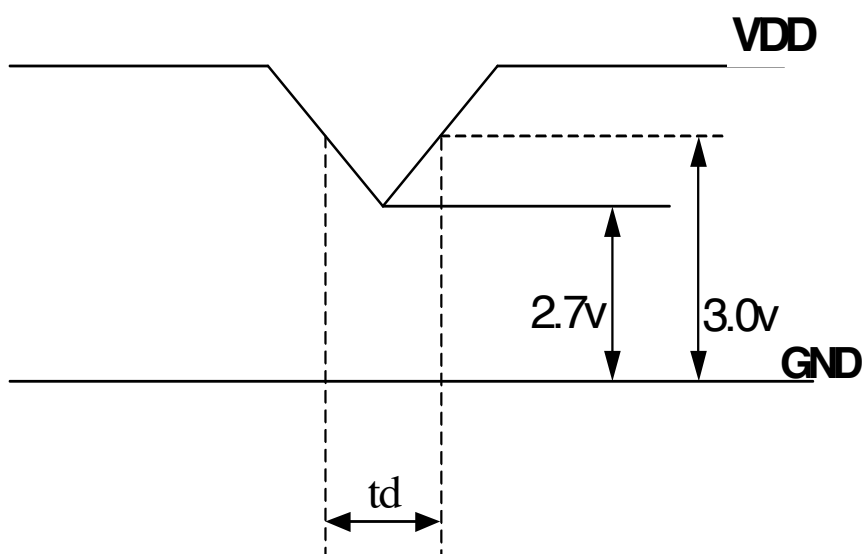
6.1 TFT LCD Module

| Item | Symbol | Min. | Typ. | Max. | Unit | Note |
|-------------------------|------------|------|------|------|------|---------------------------------------|
| Supply Voltage | V_{DD} | 3.0 | 3.3 | 3.6 | V | Note (1) |
| Current of power supply | I_{DD} | - | 0.3 | - | A | $V_{DD}=3.3V$ 、 Black pattern (L0) |
| Inrush current | I_{RUSH} | - | - | 1.50 | A | Note (2) |

Note (1): V_{DD} -dip condition:

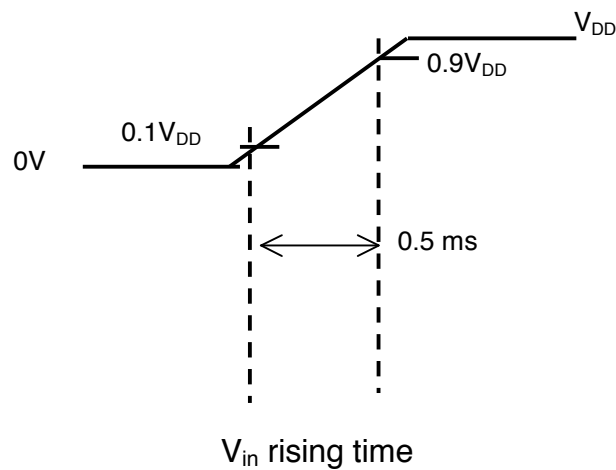
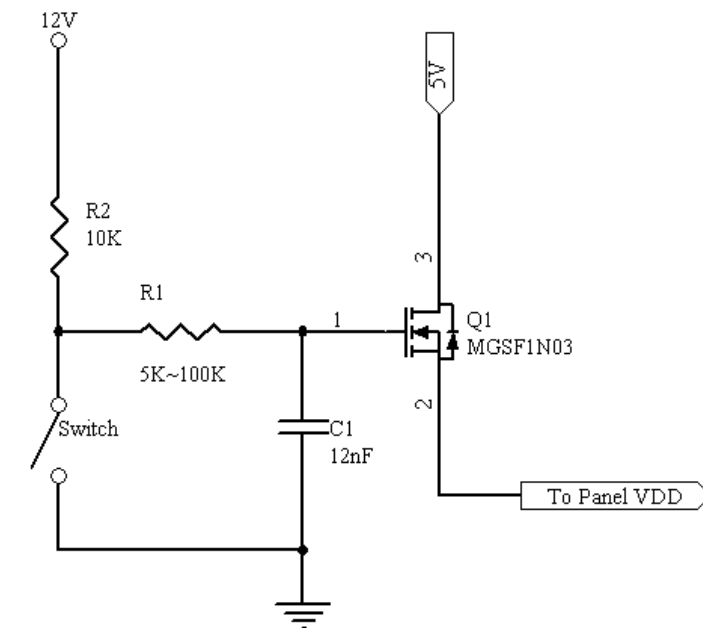
When V_{DD} operating within $2.7V \leq V_{DD} < 3.0V$, $t_d \leq 10ms$, the display may momentarily become abnormal.

$V_{DD} < 2.7V$, V_{DD} dip condition should also follow the power on/off conditions for supply voltage.



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Note : (2) Power on Inrush current test circuit

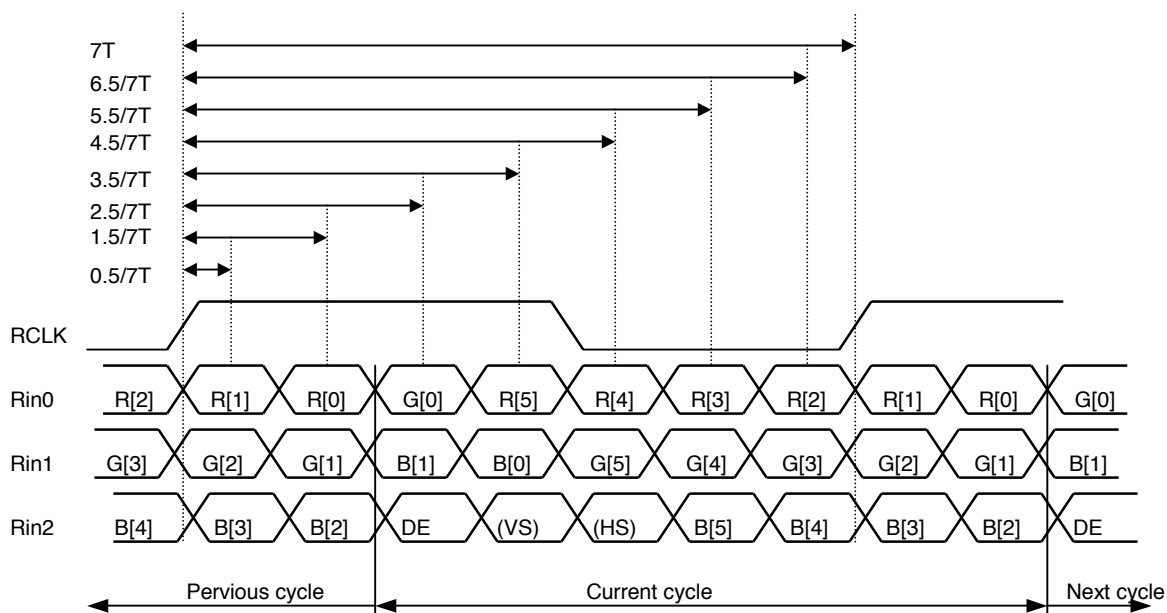


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6.2 Switching Characteristics for LVDS Receiver

| Item | Symbol | Min. | Typ. | Max. | Unit | Conditions |
|-----------------------------------|------------|----------------|------|------------------------|---------|---------------|
| Differential Input High Threshold | V_{th} | — | — | 100 | mV | $V_{CM}=1.2V$ |
| Differential Input Low Threshold | V_{tl} | -100 | — | — | mV | |
| Input Current | I_{IN} | -10 | — | +10 | μA | |
| Differential input Voltage | $ V_{ID} $ | 0.1 | — | 0.6 | V | |
| Common Mode Voltage Offset | V_{CM} | $(V_{ID} /2)$ | 1.25 | $1.8-0.4-(V_{ID} /2)$ | V | |

6.3 Bit Mapping & Interface Definition



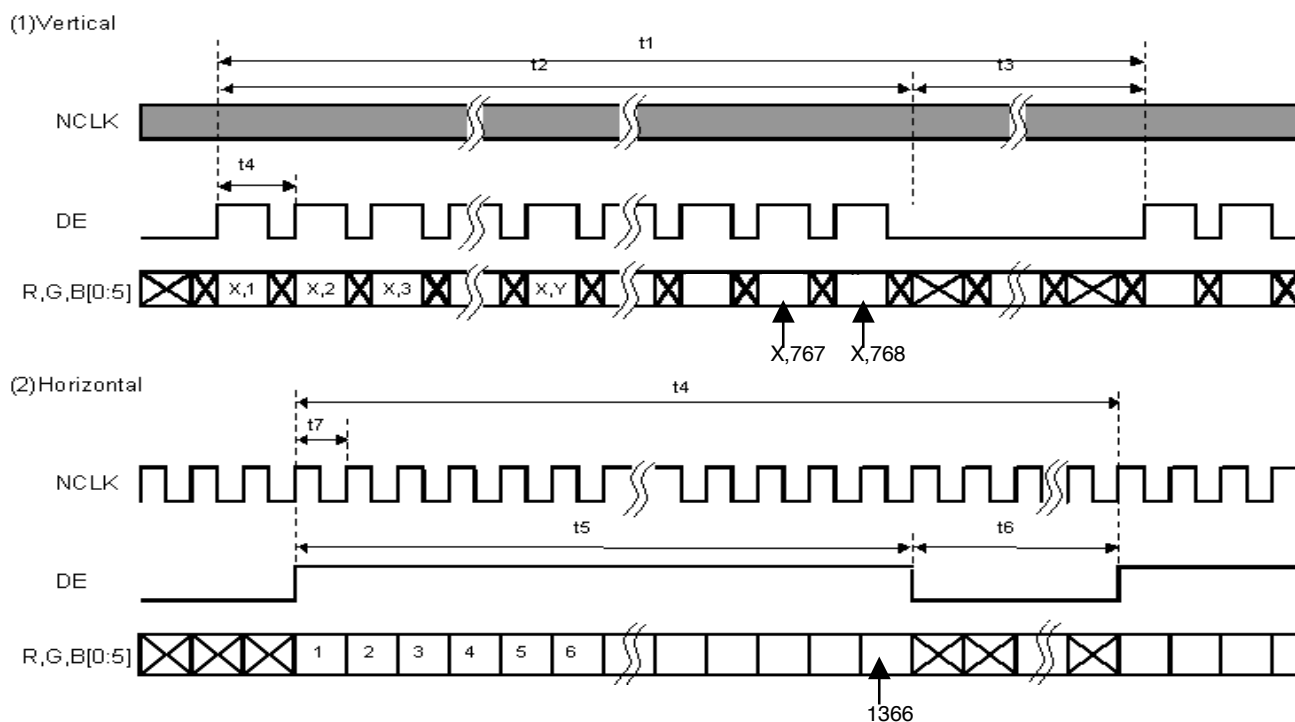
LVDS Receiver Input Timing Definition
for 6bits LVDS input

| | | | |
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6.4 Interface Timing (DE mode)

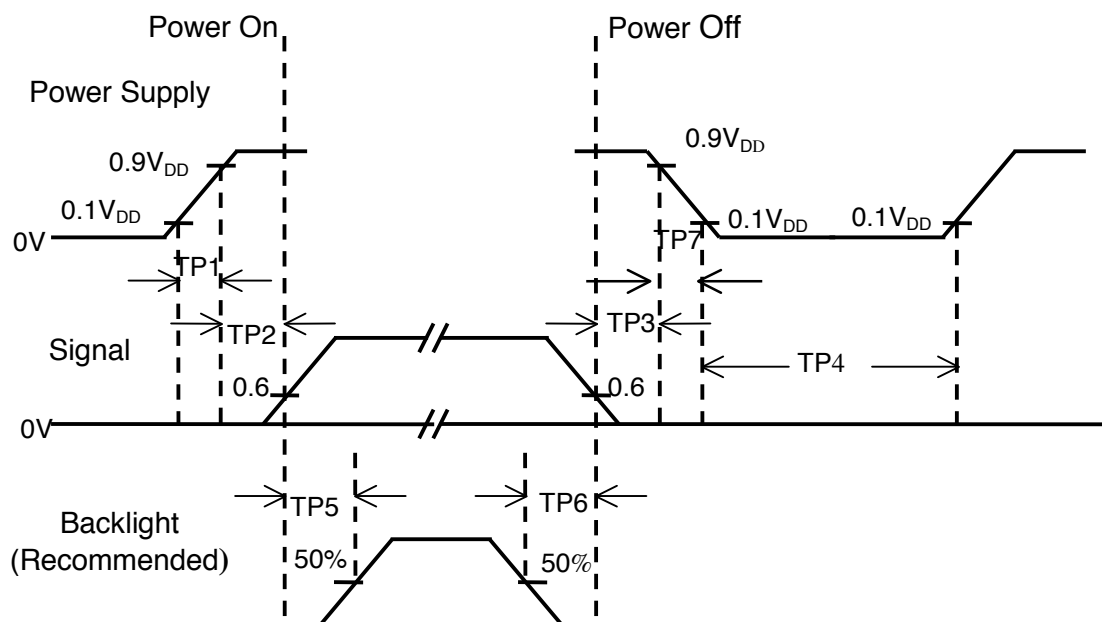
| Item | Symbol | Min. | Typ. | Max. | Unit |
|--------------------------|--------|------|------|------|-------|
| Frame Rate | -- | 55 | 60 | 65 | Hz |
| Frame Period | t1 | 776 | 806 | 1023 | line |
| Vertical Display Time | t2 | 768 | 768 | 768 | line |
| Vertical Blanking Time | t3 | 8 | 40 | 255 | line |
| 1 Line Scanning Time | t4 | 1396 | 1552 | 2047 | clock |
| Horizontal Display Time | t5 | 1366 | 1366 | 1366 | clock |
| Horizontal Blanking Time | t6 | 30 | 186 | 681 | clock |
| Clock Rate | t7 | 65 | 75 | 85 | MHz |

Timing Diagram of Interface Signal (DE mode)



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6.5 Power On / Off Sequence



| Item | Min. | Typ. | Max. | Unit | Remark |
|------|------|------|------|------|--------|
| TP1 | 0.5 | -- | 10 | msec | |
| TP2 | 0 | -- | 50 | msec | |
| TP3 | 0 | -- | 50 | msec | |
| TP4 | 1000 | -- | -- | msec | |
| TP5 | 200 | -- | -- | msec | |
| TP6 | 200 | -- | -- | msec | |
| TP7 | 1 | -- | 10 | msec | |

- Note :**
- (1) The supply voltage of the external system for the module input should be the same as the definition of V_{DD}.
 - (2) Apply the lamp voltage within the LCD operation range. When the back-light turns on before the LCD operation or the LCD turns off before the back-light turns off, the display may momentarily become white.
 - (3) In case of V_{DD} = off level, please keep the level of input signal on the low or keep a high impedance.
 - (4) TP4 should be measured after the module has been fully discharged between power off and on period.
 - (5) Interface signal shall not be kept at high impedance when the power is on.

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6.6 Backlight Unit

| Parameter | Symbol | Min | Typ | Max | Units | Condition |
|-----------------------|-----------|--------|------|------|-------|-----------------------------------|
| LED Current | I_F | -- | 20 | 21 | mA | Ta=25°C |
| LED Voltage | V_F | 3.0 | 3.2 | 3.4 | Volt | Ta=25°C |
| LED Power consumption | P_{LED} | -- | 3.07 | 3.36 | Watt | Ta=25°C Note (1) |
| LED Life-Time | N/A | 10,000 | -- | -- | Hour | Ta=25°C $I_F=20mA$ Note (2) |

Note (1): Calculator value for reference $P=I_F \times V_F \times N$ (LED Qty')

Note (2): The LED lifetime defines as the estimated time to 50% degradation of final luminous.

6.7 LED Driver

6.7.1 Absolute Maximum Ratings

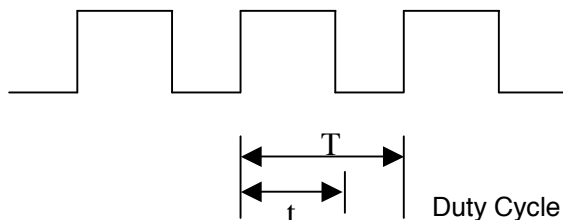
| Item | Symbol | Min. | Max. | Unit | Note |
|--------------------------|-------------------|------|------|------|------|
| LED Power Supply voltage | V_{LED} | -0.3 | 24 | Volt | |
| LED_EN, PWM pin Voltage | V_{EN}, V_{PWM} | -- | 5.5 | Volt | |

6.7.2 DC Electrical Characteristics

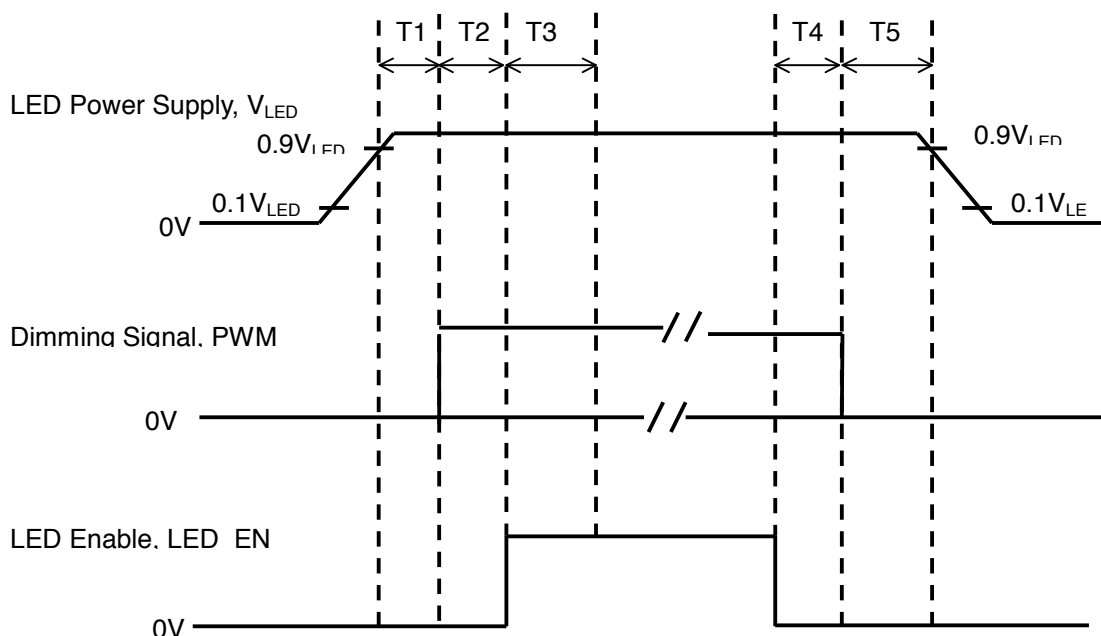
| Parameter | Symbol | Min | Typ | Max | Units | Note |
|--------------------------|------------|-----|-----|------|-------|----------|
| LED Power Supply Voltage | V_{LED} | 7.0 | -- | 20.0 | Volt | |
| LED_EN High Threshold | V_{ENH} | 2.0 | -- | -- | Volt | |
| LED_EN Low Threshold | V_{ENL} | -- | -- | 0.3 | Volt | |
| PWM High Threshold | V_{PWMH} | 3.0 | -- | -- | Volt | |
| PWM Low Threshold | V_{PWML} | -- | -- | 0.2 | Volt | |
| PWM Frequency | F_{PWM} | 200 | -- | 275 | Hz | |
| PWM Duty Cycle | T_D | 10 | -- | 100 | % | Note (1) |

| | | | |
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Note(1)



6.7.3 LED Power on/off sequence



| Symbol | Value | | | Unit |
|--------|-------|-----|-----|------|
| | Min | Typ | Max | |
| T1 | 10 | -- | -- | ms |
| T2 | 10 | -- | -- | |
| T3 | 50 | -- | -- | |
| T4 | 0 | -- | -- | |
| T5 | 10 | -- | -- | |

Note (1): The duty of LED dimming signal should be more than 20% in T2 and T3

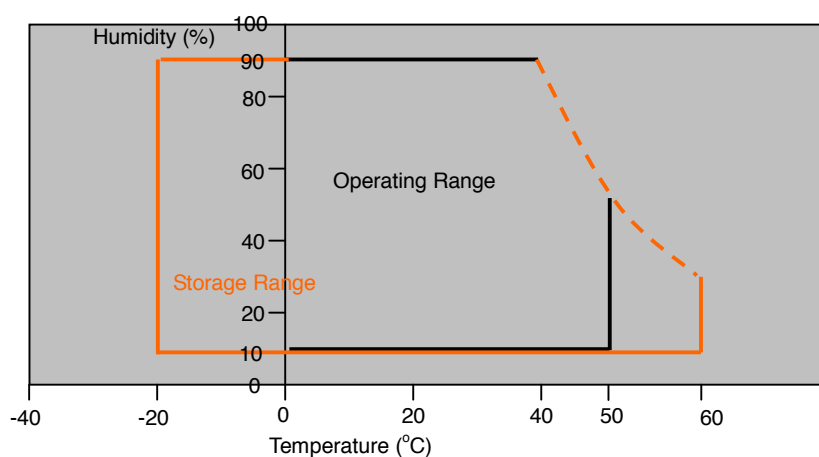
Note (2): PWM can adjust brightness to control Pin. Pulse duty the bigger the brighter.

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7.0 Reliability test items

| No. | Item | Conditions | Remark |
|-----|--------------------------------------|---|--------|
| 1 | High Temperature Storage | Ta=+60°C, 240hrs | |
| 2 | Low Temperature Storage | Ta=-20°C, 240hrs | |
| 3 | High Temperature Operation | Ta=+50°C, 500hrs | |
| 4 | Low Temperature Operation | Ta=0°C, 500hrs | |
| 5 | Thermal Cycling Test (non operation) | -20°C(30min)→+60°C(30min), 100 cycles | |
| 6 | Vibration | Sine Wave 1.5G, 5~500Hz, XYZ 30min/each direction | |
| 7 | Shock | Half-Sine, 200G, 2ms, ±XYZ, 1time | |

Storage / Operating temperature



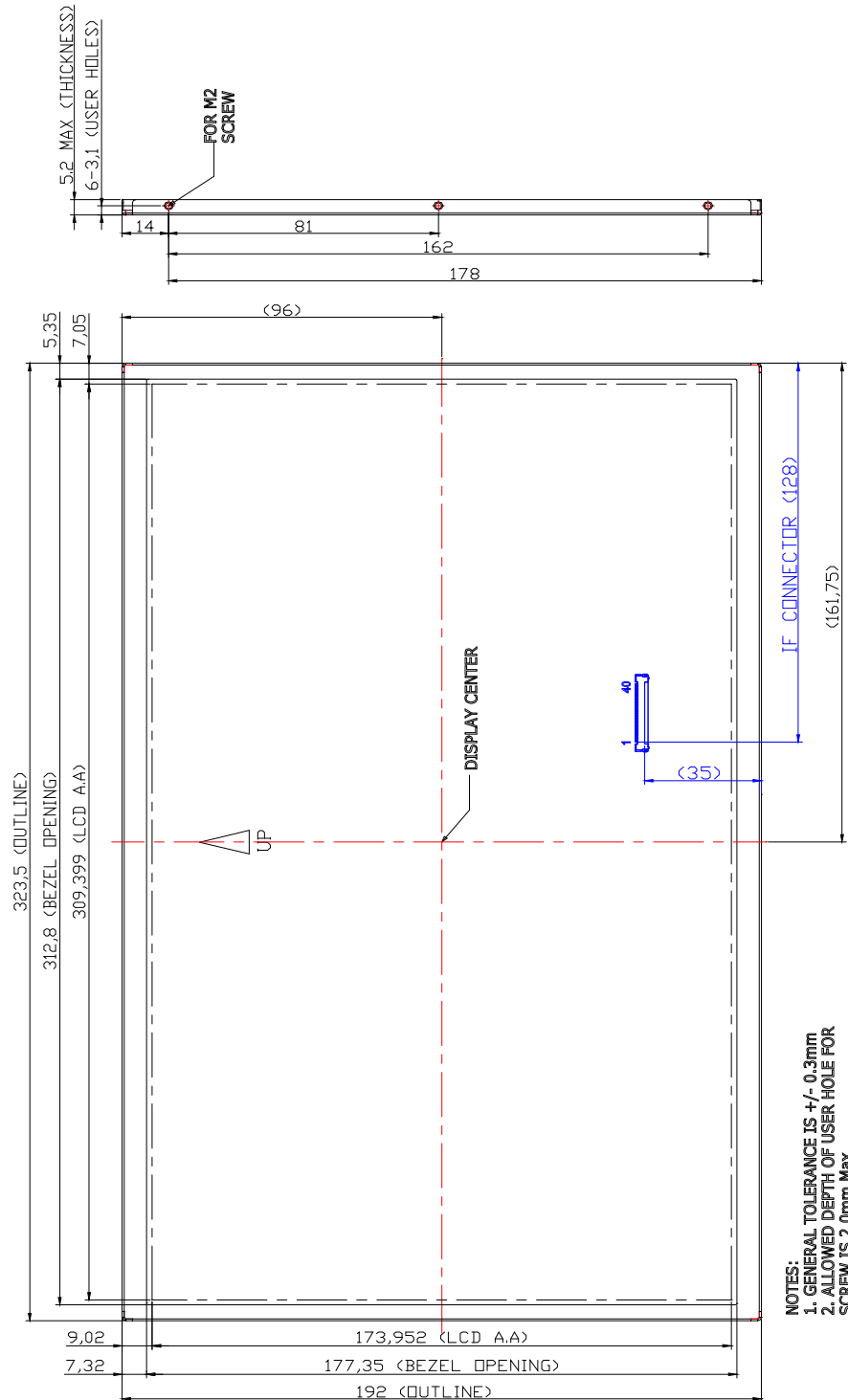
Note .Max wet bulb temp.=39°C

| | | | |
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8.0 OUTLINE DIMENSION

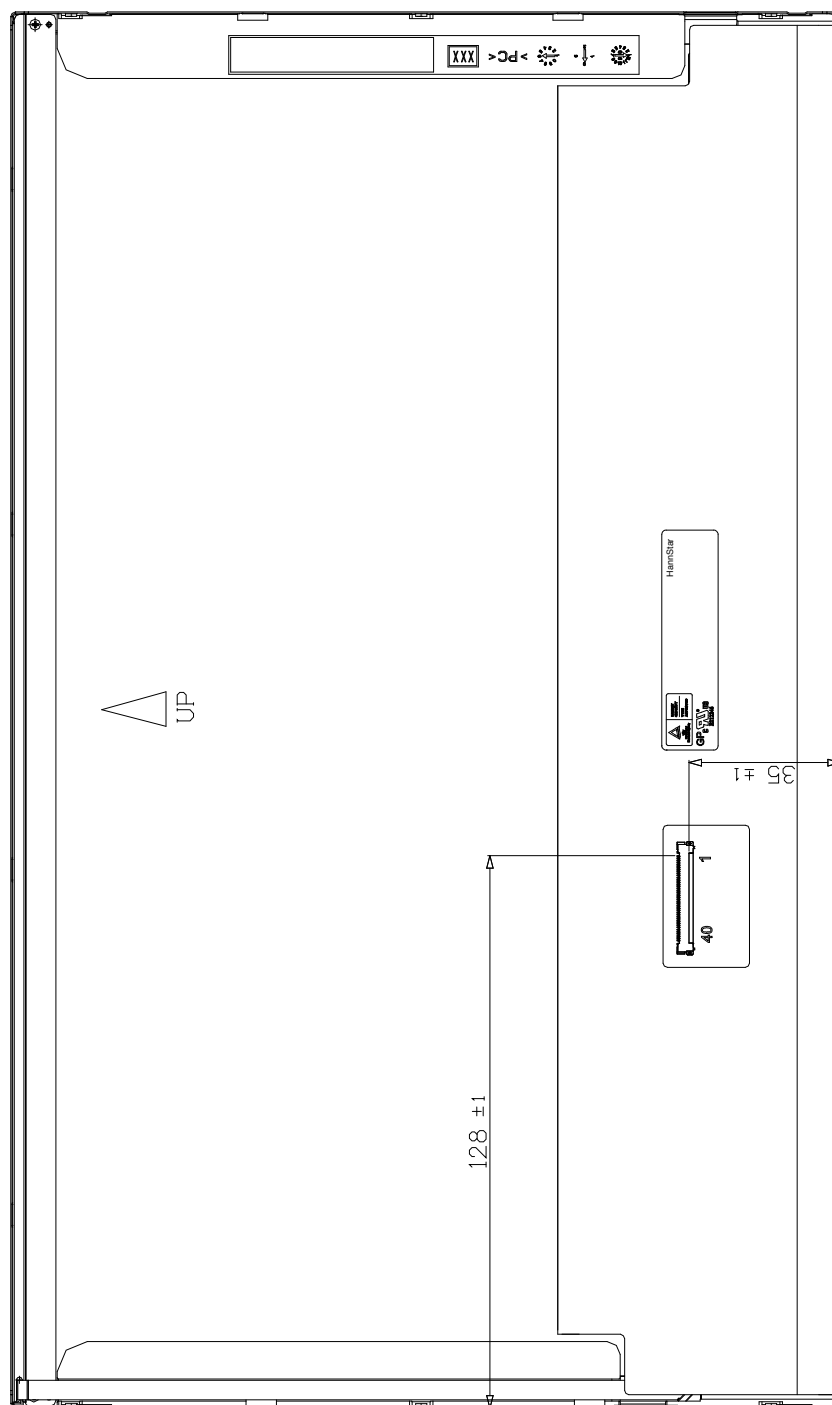
8.1 Front View Outline Dimension

Unit : mm



| | | | |
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8.2 Back View Outline Dimension



| | | | |
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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

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

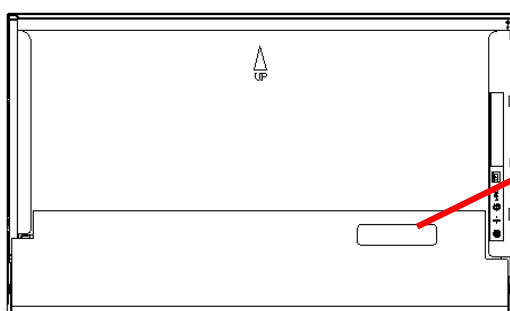
Note (2) Production Month

| | | | | | | | | | | | | |
|-------|------|------|------|------|------|------|------|------|------|------|------|------|
| 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 Location of Lot Mark

(1) The label is attached to the backside of the LCD module.

(2) This is subject to change without prior notice.



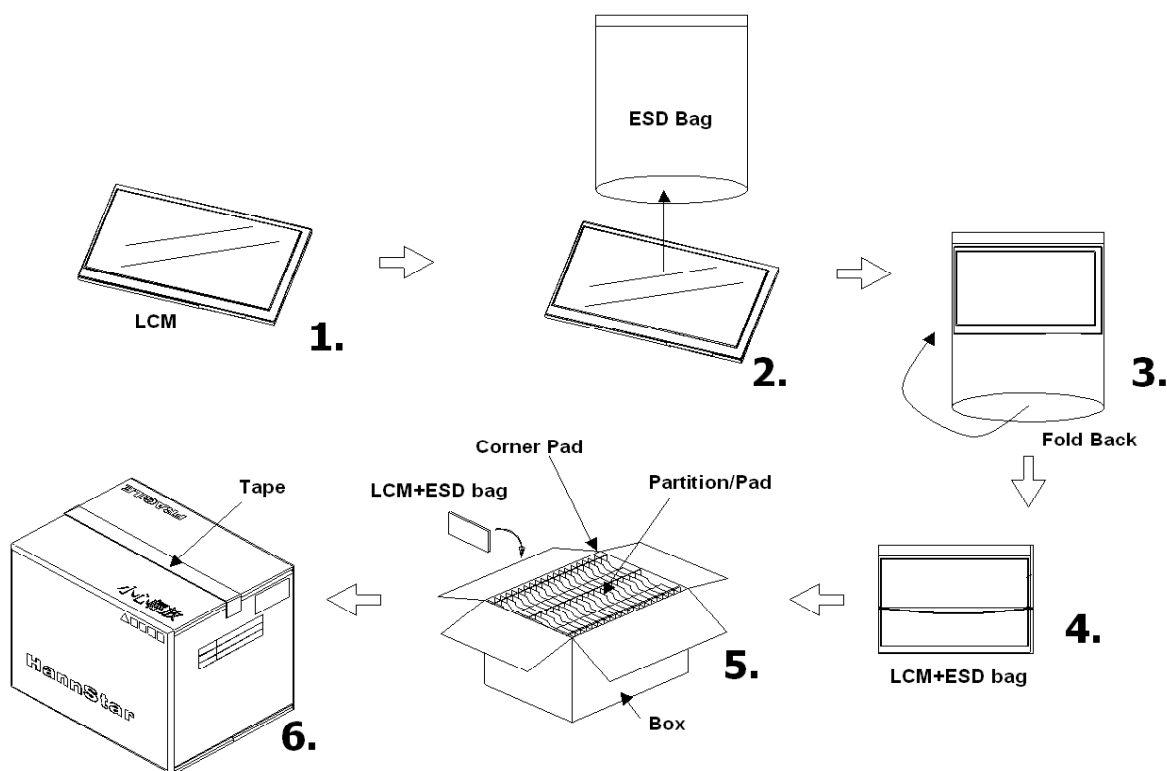
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10.0 PACKAGE SPECIFICATION

10.1 Packing form

| LCM Model | LCM Qty. in the box | Inner Box Size (mm) | Notice |
|--------------|---------------------|------------------------------|--------|
| HSD140PHW1-A | 30 pcs/box | 466 x 280 x 424 ^H | |

10.2 Packing assembly drawings



| HSD140PHW1-A | 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 mounting 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.