Product Information

**Customer : TOSHIBA**          **DATE : 28. May. 2009**

*SAMSUNG TFT-LCD*

MODEL : LTA320AP08

*The Information Described in this Specification is Preliminary and can be changed without prior notice*

| APPROVAED BY | DATE | PREPARED BY | DATE |
|---|---|---|---|
| | 28.May.2009 | | 28.May.2009 |

LCD Business

Samsung Electronics Co . , LTD.

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## * Revision History

| Date | Rev. No | Page | Summary |
|------|---------|------|---------|
| May 21, 2009 | 000 | all | First issued |
| May 28, 2009 | 001 | 5 | Surface temperature update |
| | | 6 | Optical charateristics update |
| | | 9,19 | Vsync frequency update |
| | | 11 | Inverter input current update |

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# General Description

## Description

 LTA320AP08 is a color active matrix liquid crystal display (LCD) that uses amorphous silicon TFT(Thin Film Transistor) as switching components. This model is composed of a TFT LCD panel, a driver circuit and a back light unit. The resolution of a 32.0" is 1366 x 768 and this model can display up to 16.7 million colors with wide viewing angle of 89° or higher in all directions. This panel is intended to support applications to provide a excellent performance for Flat Panel Display such as Home-alone Multimedia TFT-LCD TV and High Definition TV.

## Features

- RoHS compliance (Pb-free)
- High contrast & aperture ratio with wide color gamut
- PVA (Patterned Vertical Align) mode
- Wide viewing angle ($\pm$178°)
- High speed response
- HD resolution (16:9)
- Low Power consumption
- U-Type 4 CCFLs (Cold Cathode Fluorescent Lamp)
- DE (Data Enable) mode
- LVDS (Low Voltage Differential Signaling) interface (1pixel/clock)

# General Information

| Items | Specification | Unit | Note |
|---|---|---|---|
| Module Size | 760.0(H) x 450.0(V) x 50.2 (D) [Max] | mm | $\pm$1.0mm |
| Weight | 6,500 | g | |
| Pixel Pitch | 0. 51075(H) x 0.51075(V) | mm | |
| Active Display Area | 697.6845(H) x 392.256(V) | mm | |
| Surface Treatment | Haze 7% , Hard-coating (3H) | | |
| Display Colors | 8 bit - 16.7M | colors | |
| Number of Pixels | 1366 x 768 | pixel | |
| Pixel Arrangement | RGB Horizontal stripe | | |
| Display Mode | Normally Black | | |
| Luminance of  White | 450nit (Typ.) | cd/m$^2$ | |

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# 1. Absolute Maximum Ratings

If the condition exceeds maximum ratings, it can cause malfunction or unrecoverable damage to the device.

| Item | Symbol | Min. | Max. | Unit | Note |
|------|--------|------|------|------|------|
| Power Supply Voltage | $V_{DD}$ | GND-0.5 | 13.2 | V | (1) |
| Dimming control | Max. Lum | - | 5 | V | (1) |
| Storage temperature | $T_{STG}$ | -20 | 60 | ℃ | (2) |
| Surface temperature | $T_{SUR}$ | 0 | **65** | ℃ | (3) |
| Operation temperature | $T_{OPR}$ | 0 | 50 | ℃ | (2) |
| Shock ( non - operating ) | $S_{nop}$ | - | 50 | G | (4) |
| Vibration ( non - operating ) | $V_{nop}$ | - | 1.5 | G | (5) |

Note (1) Ta= 25 $\pm$ 2 °C
(2) Temperature and relative humidity range are shown in the figure below.
   a. 90 % RH Max.  (Ta ≤ 39 °C)
   b. Relative Humidity is 90% or less. (Ta > 39 °C)
   c. No condensation
(3) Although abnormal visual problems can be occurred in Tsur range,
   the polarizer is not damaged in this range.
(4) 11ms, sine wave, one time for $\pm$X, $\pm$Y, $\pm$Z axis
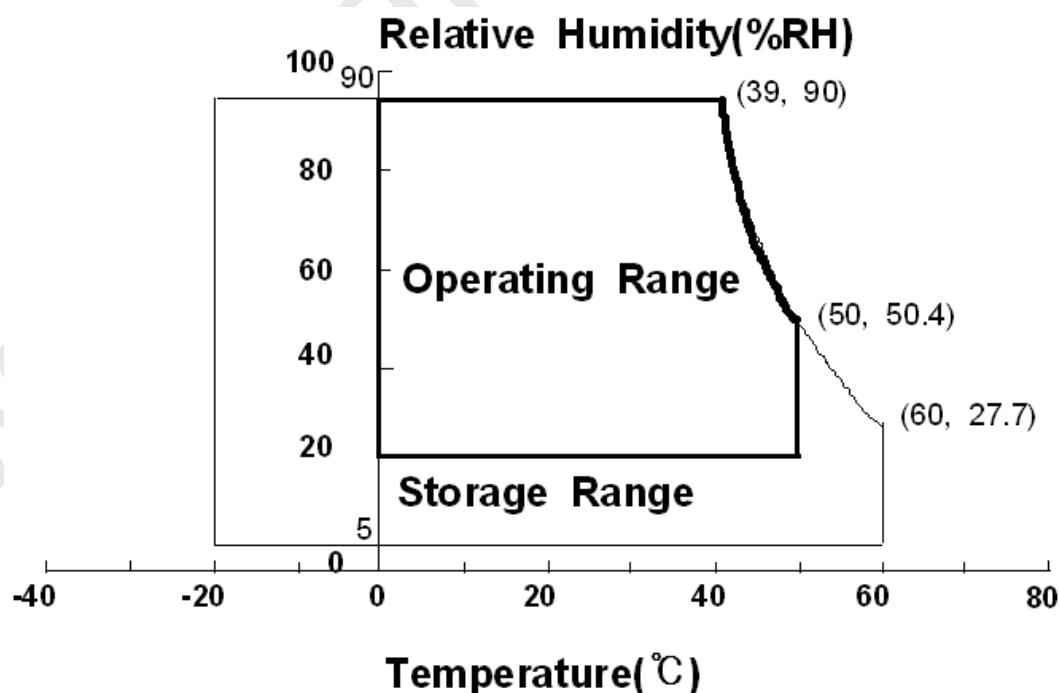(5) 10-300 Hz, Sweep rate 10min, 30min for X,Y,Z axis



Fig.  Temperature and  Relative humidity range

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# 2. Optical Characteristics

The optical characteristics should be measured in a dark room or equivalent.
Measuring equipment  : TOPCON RD-80S, TOPCON SR-3,ELDIM EZCONTRAST

(Ta = 25 $\pm$ 2°C,  VDD=12.0V,   fv= 60Hz,  $f_{DCLK}$=75 MHz, Duty 100% )

| Item | | Symbol | Condition | Min. | Typ. | Max. | Unit | Note |
|---|---|---|---|---|---|---|---|---|
| Contrast Ratio (Center of screen) | | C/R | | **2500** | **4000** | - | | (1) SR-3 |
| Response Time | G-to-G | Tg | | - | 8 | 16 | msec | (3) RD-80S |
| Luminance of White (Center of screen) | | $Y_L$ | | 400 | 450 | - | cd/m$^2$ | (4) SR-3 |
| Color Chromaticity (CIE 1931) | Red | Rx | Normal θ**L,R**=0 θ**U,D**=0 Viewing Angle | TYP. -0.03 | (0.637) | TYP. +0.03 | | (5),(6) SR-3 |
| | | Ry | | | (0.333) | | | |
| | Green | Gx | | | (0.282) | | | |
| | | Gy | | | (0.607) | | | |
| | Blue | Bx | | | (0.146) | | | |
| | | By | | | (0.060) | | | |
| | White | Wx | | | (0.280) | | | |
| | | Wy | | | (0.290) | | | |
| Color Gamut | | - | | - | 72 | - | % | (5) SR-3 |
| Color Temperature | | - | | - | 10,000 | - | K | (5) SR-3 |
| Viewing Angle | Hor. | θ$_L$ | C/R≥10 | 75 | 89 | - | Degree | (6) EZ-Contrast |
| | | θ$_R$ | | 75 | 89 | - | | |
| | Ver. | θ$_U$ | | 75 | 89 | - | | |
| | | θ$_D$ | | 75 | 89 | - | | |
| Brightness Uniformity (9 Points) | | B$_{uni}$ | | - | - | 25 | % | (2) SR-3 |

- Test Equipment Setup
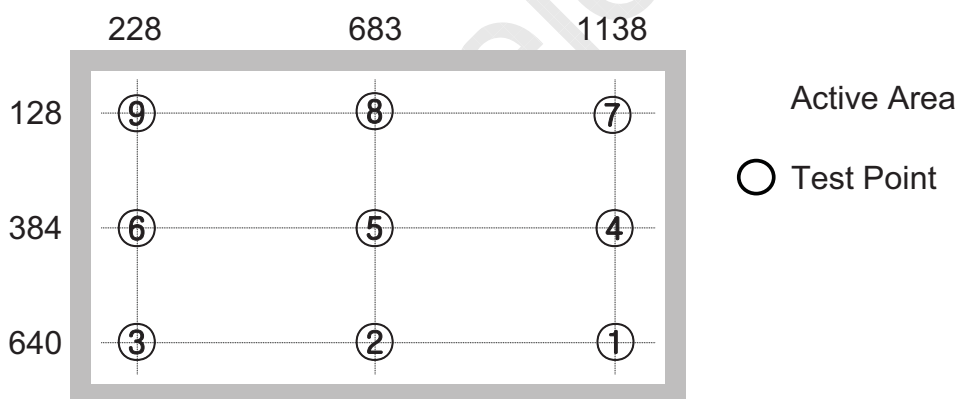
   The measurement should be executed in a stable, windless and dark room between
   40min and 60min after lighting the back light at the given temperature for stabilization
   of the back light. This should be measured in the center of screen.

   Environment condition : Ta  = 25 $\pm$ 2 °C

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|---|---|---|---|---|---|

| Photo detector | Field |
|---|---|
| SR-3 | 1° |
| RD-80S | 2° |

Photo detector

Field

SR-3 : 50cm
RD-80S : 50cm
EZ-Contrast : 0cm

TFT - LCD Module

LCD Panel

The center of the screen
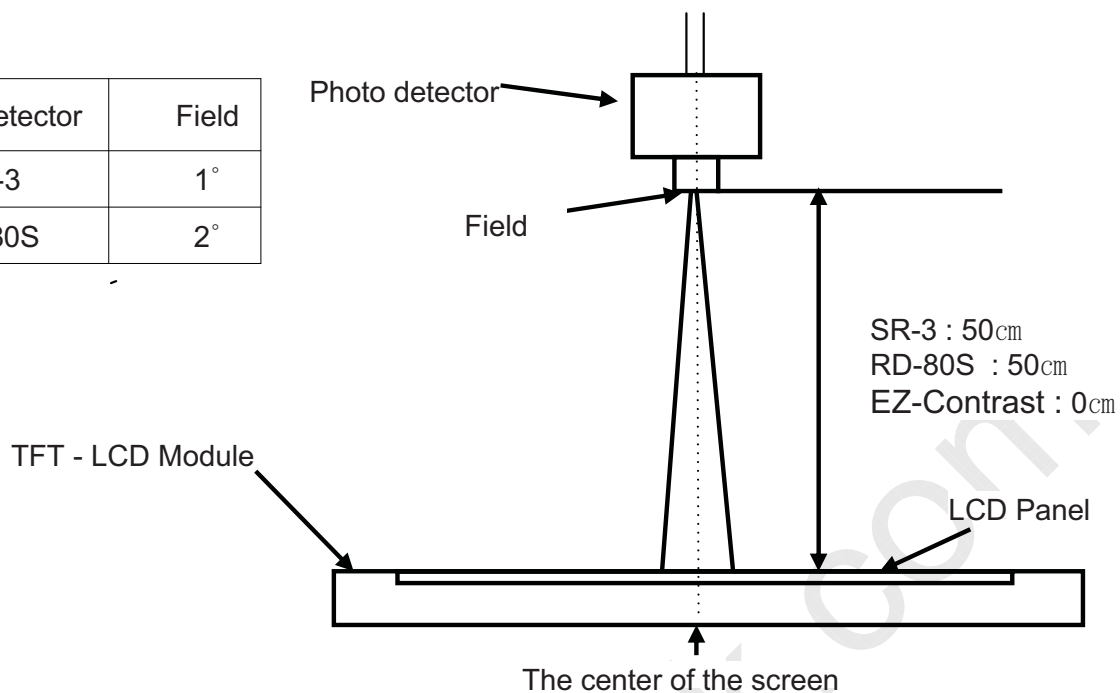
- Definition of test point



Active Area

○ Test Point

Note (1) Definition of Contrast Ratio (C/R)
 : Ratio of gray max (Gmax) & gray min (Gmin) at the center point ⑤ of the panel

$$C/R = \frac{G\max}{G\min}$$

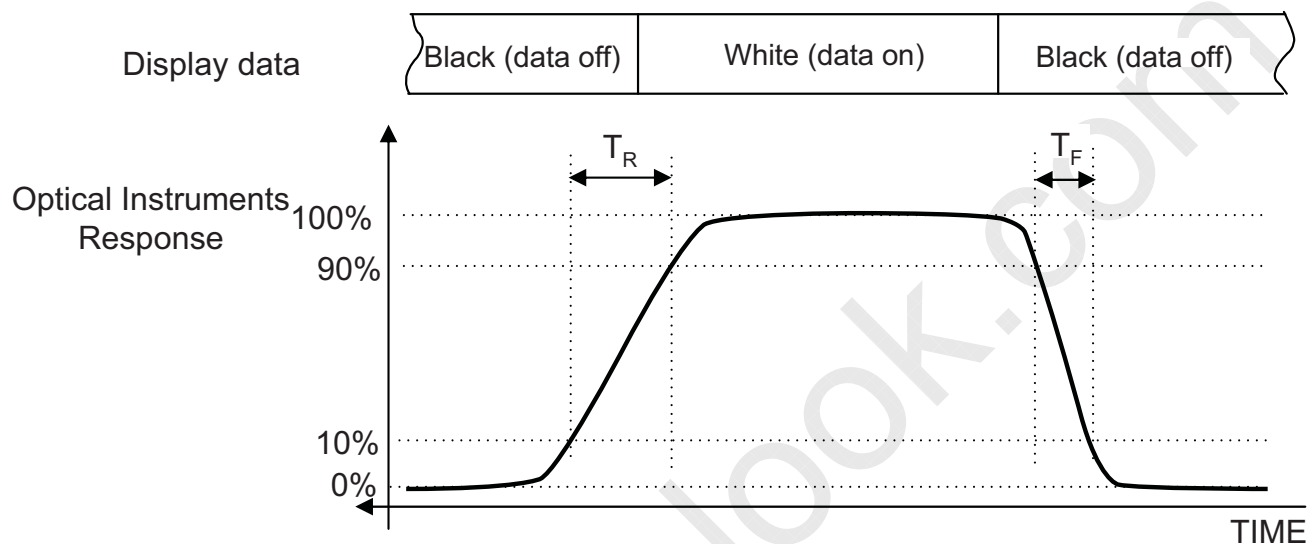Gmax : Luminance with all pixels white
Gmin : Luminance with all pixels black

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Note (2) Definition of 9 points brightness uniformity ( Test Pattern : Full White )

$$Buni = 100 * \frac{(B\max - B\min)}{B\max}$$

Bmax : Maximum brightness
Bmin : Minimum brightness

Note (3) Definition of Response time : Sum of Tr, Tf

Display data

| Black (data off) | White (data on) | Black (data off) |

Optical Instruments Response

$T_R$          $T_F$

100%
90%

10%
0%

TIME

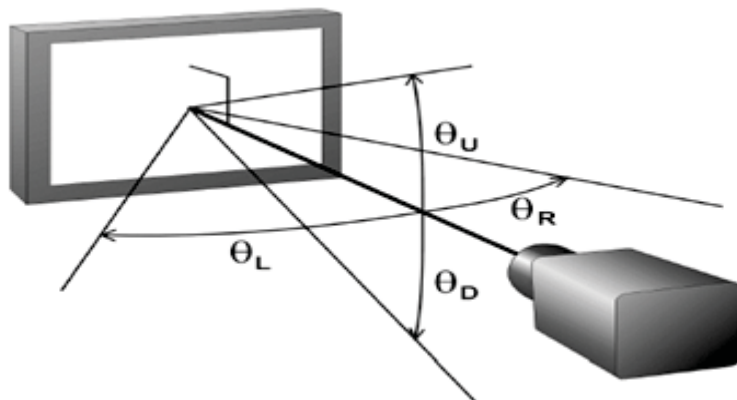Note (4) Definition of Luminance of White : Luminance of white at center point ⑤

Note (5) Definition of Color Chromaticity (CIE 1931)
Color coordinate of Red, Green, Blue & White at center point ⑤

Note (6) Definition of Viewing Angle
: Viewing angle range (C/R ≥ 10)

$\Theta_U$
$\Theta_R$
$\Theta_L$
$\Theta_D$

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| --- | --- | --- | --- | --- | --- |

## 3. Electrical Characteristics

### 3.1 TFT LCD Module

The connector for display data & timing signal should be connected.

Ta = 25°C ± 2 °C

| Item | | Symbol | Min. | Typ. | Max. | Unit | Note |
|---|---|---|---|---|---|---|---|
| Voltage of Power Supply | | $V_{DD}$ | 11 | 12 | 13 | V | (1) |
| Current of Power Supply | (a) Black | $I_{DD}$ | - | 450 | - | mA | (2),(3) |
| | (b) White | | - | 450 | - | mA | |
| | (c) N-Pattern | | - | 450 | 950 | mA | |
| Vsync Frequency | | $f_V$ | **48** | 60 | 66 | Hz | |
| Hsync Frequency | | $f_H$ | 44 | 48 | 53 | kHz | |
| Main Frequency | | $f_{DCLK}$ | 65 | 78 | 82 | MHz | |
| Rush Current | | $I_{RUSH}$ | - | - | 4 | A | (4) |

Note (1) The ripple voltage should be controlled under 10% of $V_{DD}$.
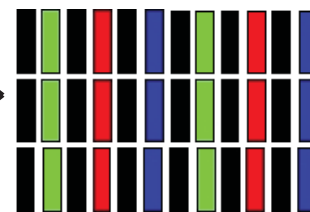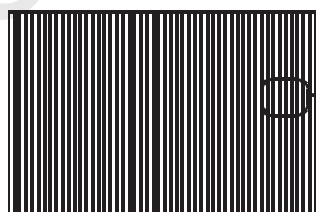
(2) fv=60Hz,  fDCLK = 75 MHz,   $V_{DD}$ = 12.0V,  DC Current.

(3) Power dissipation check pattern (LCD Module only)

a) Black Pattern      b) White Pattern      c) N-Pattern

(4) Measurement Conditions

$T_{RUSH}$=470$\mu$s
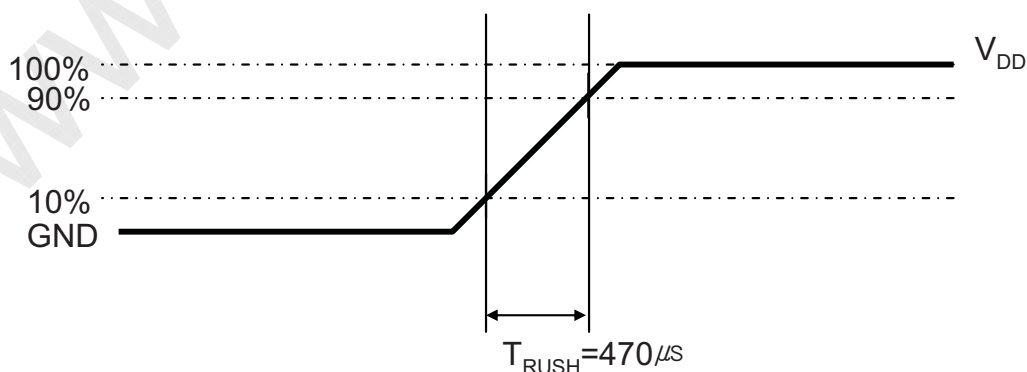
Rush Current $I_{RUSH}$ can be measured when  $T_{RUSH}$. is 470$\mu$s.

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## 3.2  Back Light Unit

The back light unit contains 4 U-type CCFLs ( Cold Cathode  Fluorescent Lamp ).

Ta=25 $\pm$ 2°C
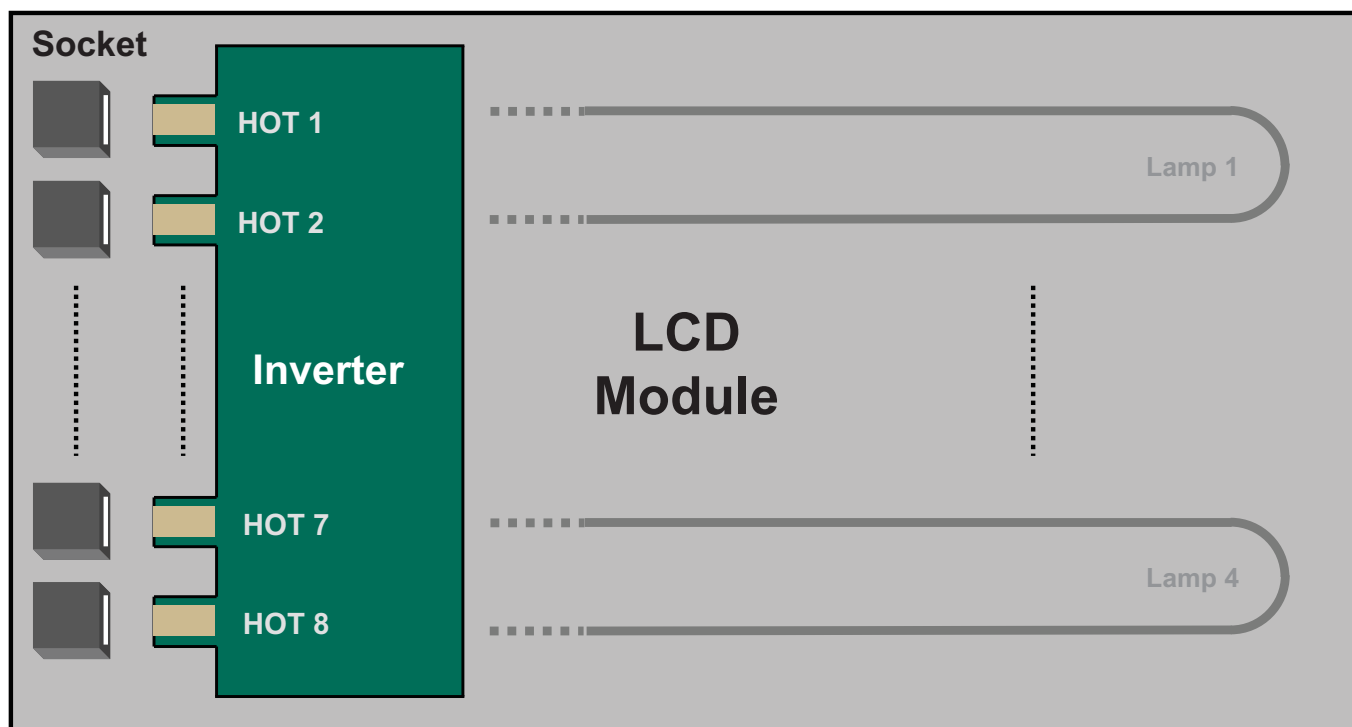


| Item | Symbol | Min. | Typ. | Max. | Unit | Note |
|---|---|---|---|---|---|---|
| Lamp Voltage | $V_L$ | - | 1,615 | - | Vrms | |
| Operating Life Time | Hr | 50,000 | - | - | Hour | (1) |
| Startup Voltage | Vs | - | - | 0℃ : 2,670<br>25℃ :2,140 | Vrms | |

Note (1)  It is defined as the time to take until the brightness reduces to 50% of its original value.

[Operating condition : Ta = 25$\pm$2℃, For single lamp only. ]

## 3.3 Inverter Input Condition & Specification

| Items | Symbol | Conditions | Specifications | | | Unit | Note |
|---|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | | |
| Input Voltage | Vin | - | 22 | 24 | 26 | V | Ta=25±2 ℃ |
| Input Current | Iin | Vin=24.0V Vdim=3.3V Ta=25℃ | - | **2.2** | **2.45** | A | (1) |
| | | | - | **2.1** | **2.31** | | (2) |
| Lamp Current | $I_{O\_Max}$ | Vdim=3.3V | 7.7 | 8.2 | 8.7 | mA | (2) |
| Frequency | $F_{LAMP}$ | Vin=24.0 V | 55 | 57.5 | 60 | kHz | - |
| Backlight On/Off | ON | Vin=24.0 V | 2.4 | - | 5.25 | V | - |
| | OFF | Vin=24.0 V | 0 | - | 0.8 | | - |
| Dimming Control | $V_{DIM}$ | Max Lum | 3.3 | - | 5.0 | V | - |
| | | Min. Lum | - | - | 0 | | - |

Note) Power Consumption is measured when 450[cd/m²] of luminance which is the typical luminance.

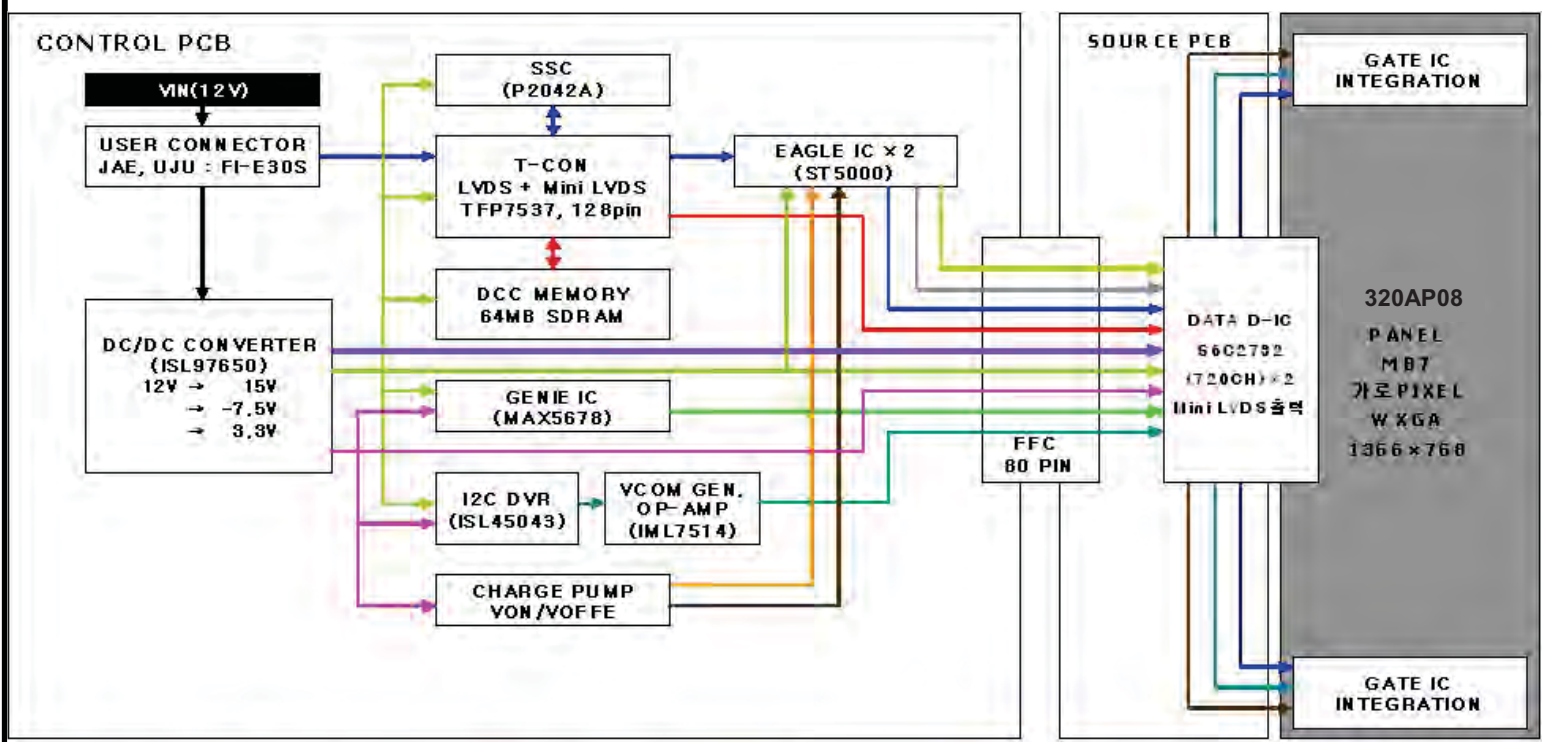Lamp Current is measured at the point before Lamp.

(1) Max Value of the Power Consumption is measured during initial turn-on time* of the backlight.

(2) Max Value of the Power Consumption is measured after 60 min warm-up.

 * Initial turn-on time : From 0sec to 60min after turn-on

# 4. Block Diagram

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# 5.  Input Terminal Pin Assignment

## 5.1. Input Signal & Power                                          Connector : FI-E30S (JAE)

| PIN No. | Description | PIN No. | Description |
|---|---|---|---|
| 1 | No Connection | 16 | GND |
| 2 | No Connection | 17 | RxIN3- |
| 3 | No Connection | 18 | RxIN3+ |
| 4 | GND | 19 | GND |
| 5 | RxIN0- | 20 | No Connection |
| 6 | RxIN0+ | 21 | LVDS OPTION (Note 2) |
| 7 | GND | 22 | No Connection |
| 8 | RxIN1- | 23 | GND |
| 9 | RxIN1+ | 24 | GND |
| 10 | GND | 25 | No Connection (Redommend) |
| 11 | RxIN2- | 26 | Vin |
| 12 | RxIN2+ | 27 | Vin |
| 13 | GND | 28 | Vin |
| 14 | RxCLK- | 29 | Vin |
| 15 | RxCLK+ | 30 | Vin |

Note)(1) No Connection: This PINS are only used for SAMSUNG internal using.

(2)  LVDS OPTION : If this PIN : HIGH (3.3 V) →  Normal LVDS format

: LOW (GND) or Open →  JEIDA  LVDS format

SEQUENCE     : On  = $V_{DD}$(T1) $\geq$ LVDS Option $\geq$ Interface Signal(T2)

OFF =  Interface Signal(T3) $\geq$ LVDS Option $\geq$ $V_{DD}$

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Note(3) Pin number starts from Right side
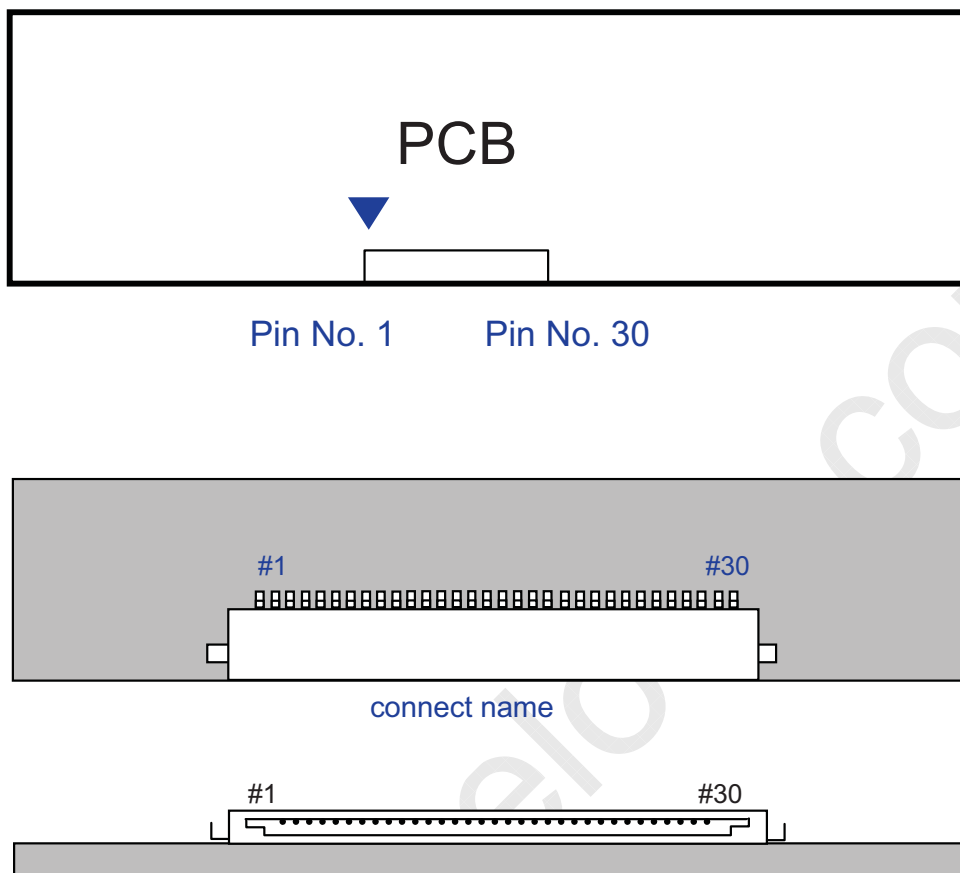


**Fig. Connector diagram**

a. All GND pins should be connected together and also be connected to the LCD's metal chassis.
b. All power input pins should be connected together.
c. All NC pins should be separated from other signal or power.

## 5.2. Inverter Input Pin Configuration

Connector : 2002WR-14B1[Yeonho]

| Pin No. | Pin Configuration(FUNCTION) |
|---------|------------------------------|
| 1 | 24 V |
| 2 | 24 V |
| 3 | 24 V |
| 4 | 24 V |
| 5 | 24 V |
| 6 | GND |
| 7 | GND |
| 8 | GND |
| 9 | GND |
| 10 | GND |
| 11 | Error Out [ Normal : GND, Abnormal : Open Collector] |
| 12 | Backlight On /Off |
| 13 | Dimming Control [0V:Min, 3.3V:Max] |
| 14 | No connection |

## 5.3. Inverter Input Power Sequence
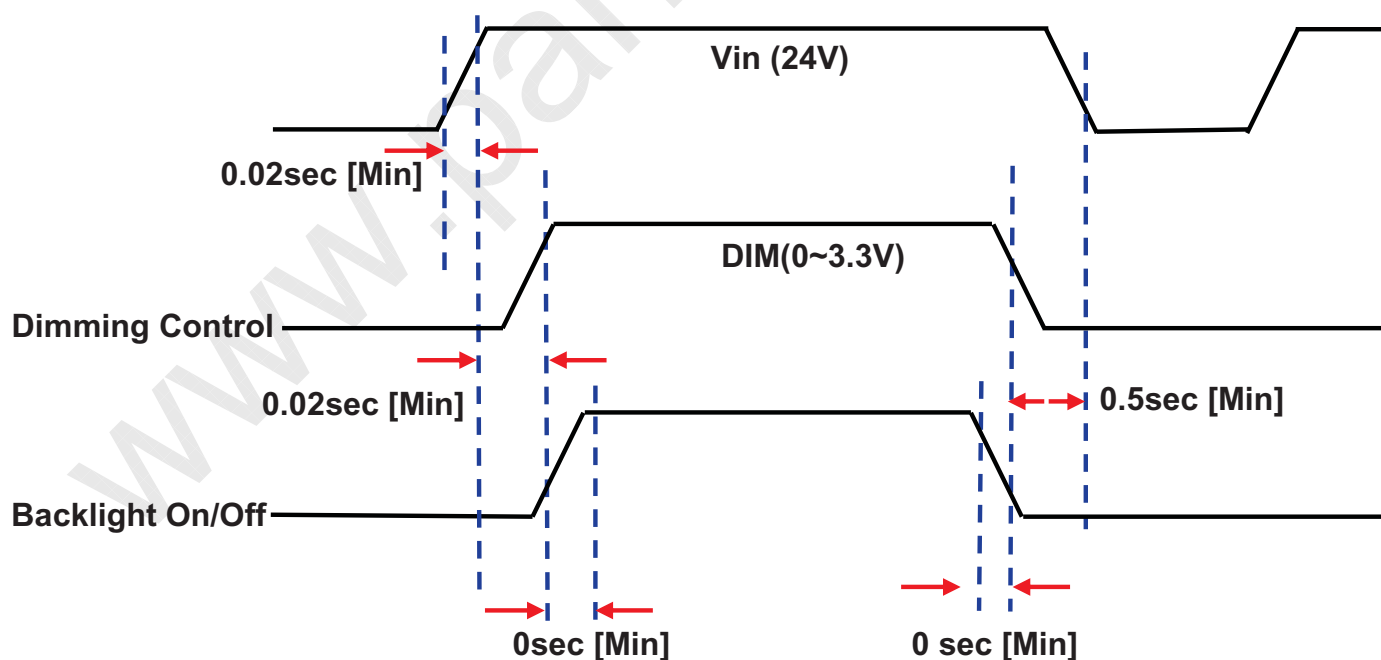


Note)     SEQUENCE :    On  = Vin(24V) > Dimming Control≥ Backlight On/off
                    OFF =  Backlight On/Off ≥ Dimming Control > Vin(24V)

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## 5.4  LVDS  Interface
### - LVDS Receiver : Tcon (merged)
### - Data Format (JEIDA & Normal)

| | LVDS pin | JEIDA -DATA | Normal -DATA |
|---|---|---|---|
| TxOUT/RxIN0 | TxIN/RxOUT0 | R2 | R0 |
| | TxIN/RxOUT1 | R3 | R1 |
| | TxIN/RxOUT2 | R4 | R2 |
| | TxIN/RxOUT3 | R5 | R3 |
| | TxIN/RxOUT4 | R6 | R4 |
| | TxIN/RxOUT6 | R7 | R5 |
| | TxIN/RxOUT7 | G2 | G0 |
| TxOUT/RxIN1 | TxIN/RxOUT8 | G3 | G1 |
| | TxIN/RxOUT9 | G4 | G2 |
| | TxIN/RxOUT12 | G5 | G3 |
| | TxIN/RxOUT13 | G6 | G4 |
| | TxIN/RxOUT14 | G7 | G5 |
| | TxIN/RxOUT15 | B2 | B0 |
| | TxIN/RxOUT18 | B3 | B1 |
| TxOUT/RxIN2 | TxIN/RxOUT19 | B4 | B2 |
| | TxIN/RxOUT20 | B5 | B3 |
| | TxIN/RxOUT21 | B6 | B4 |
| | TxIN/RxOUT22 | B7 | B5 |
| | TxIN/RxOUT24 | HSYNC | HSYNC |
| | TxIN/RxOUT25 | VSYNC | VSYNC |
| | TxIN/RxOUT26 | DEN | DEN |
| TxOUT/RxIN3 | TxIN/RxOUT27 | R0 | R6 |
| | TxIN/RxOUT5 | R1 | R7 |
| | TxIN/RxOUT10 | G0 | G6 |
| | TxIN/RxOUT11 | G1 | G7 |
| | TxIN/RxOUT16 | B0 | B6 |
| | TxIN/RxOUT17 | B1 | B7 |
| | TxIN/RxOUT23 | RESERVED | RESERVED |

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## 5.5 Input Signals, Basic Display Colors and Gray Scale of Each Color

| COLOR | DISPLAY (8bit) | DATA SIGNAL | | | | | | | | | | | | | | | | | | | | | | | GRAY SCALE LEVEL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | RED | | | | | | | | GREEN | | | | | | | | BLUE | | | | | | | | |
| | | R0 | R1 | R2 | R3 | R4 | R5 | R6 | R7 | G0 | G1 | G2 | G3 | G4 | G5 | G6 | G7 | B0 | B1 | B2 | B3 | B4 | B5 | B6 | B7 | |
| BASIC COLOR | 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 | - |
| | CYAN | 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 | - |
| | MAGENTA | 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 | R0 |
| | DARK ↑ | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | R1 |
| | | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | R2 |
| | | : | : | : | : | : | | | : | : | : | : | : | : | : | | | : | : | : | : | : | : | | | R3~ R252 |
| | | : | : | : | : | : | | | : | : | : | : | : | : | : | | | : | : | : | : | : | : | | | |
| | ↓ LIGHT | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | R252 |
| | | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | R252 |
| | 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 | R252 |
| 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 | G0 |
| | DARK ↑ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | G1 |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | G2 |
| | | : | : | : | : | : | | | : | : | : | : | : | : | : | | | : | : | : | : | : | : | | | G3~ G252 |
| | | : | : | : | : | : | | | : | : | : | : | : | : | : | | | : | : | : | : | : | : | | | |
| | ↓ LIGHT | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | G252 |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | G252 |
| | 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 | G252 |
| 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 | B0 |
| | DARK ↑ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | B1 |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | B2 |
| | | : | : | : | : | : | | | : | : | : | : | : | : | : | | | : | : | : | : | : | : | | | B3~ B252 |
| | | : | : | : | : | : | | | : | : | : | : | : | : | : | | | : | : | : | : | : | : | | | |
| | ↓ LIGHT | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | B252 |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | B252 |
| | 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 | B252 |

Note) Definition of Gray :

   Rn : Red Gray,  Gn : Green Gray,  Bn : Blue Gray (n = Gray level)

   Input Signal :  0 = Low level voltage,  1 = High level voltage

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|---|---|---|---|---|---|

# 6. Interface Timing

## 6.1 Timing Parameters  ( DE only mode )

| SIGNAL | ITEM | SYMBOL | MIN. | TYP. | MAX. | Unit | NOTE |
|---|---|---|---|---|---|---|---|
| Clock | Frequency | $1/T_C$ | 65 | 78 | 82 | MHz | - |
| Hsync | | $F_H$ | 44 | 48 | 53 | KHz | - |
| Vsync | | $F_V$ | **48** | 60 | 66 | Hz | - |
| Vertical Display Term | Active Display Period | $T_{VD}$ | - | 768 | - | Lines | - |
| | Vertical Total | $T_{VB}$ | 773 | 838 | 1200 | Lines | - |
| Horizontal Display Term | Active Display Period | $T_{HD}$ | - | 1366 | - | Clocks | - |
| | Horizontal Total | $T_H$ | 1460 | 1600 | 2000 | clocks | - |

Note) This product is DE only mode. The input of Hsync & Vsync signal does
     not have an effect on normal operation.
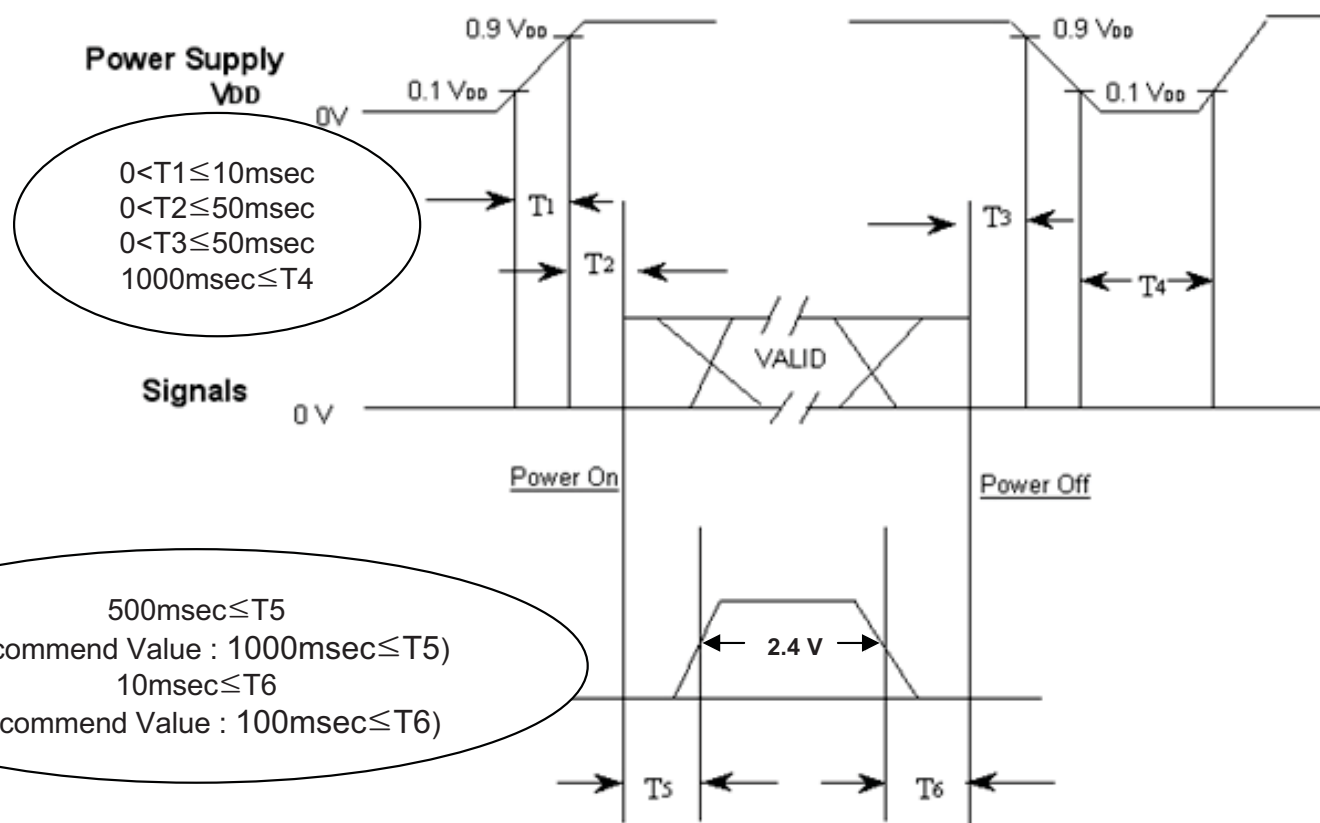   (1) Test Point : TTL control signal and CLK at LVDS Tx input terminal in system
   (2) Internal $V_{DD}$ = 3.3V

## 6.2 Timing diagrams of interface signal ( DE only mode )
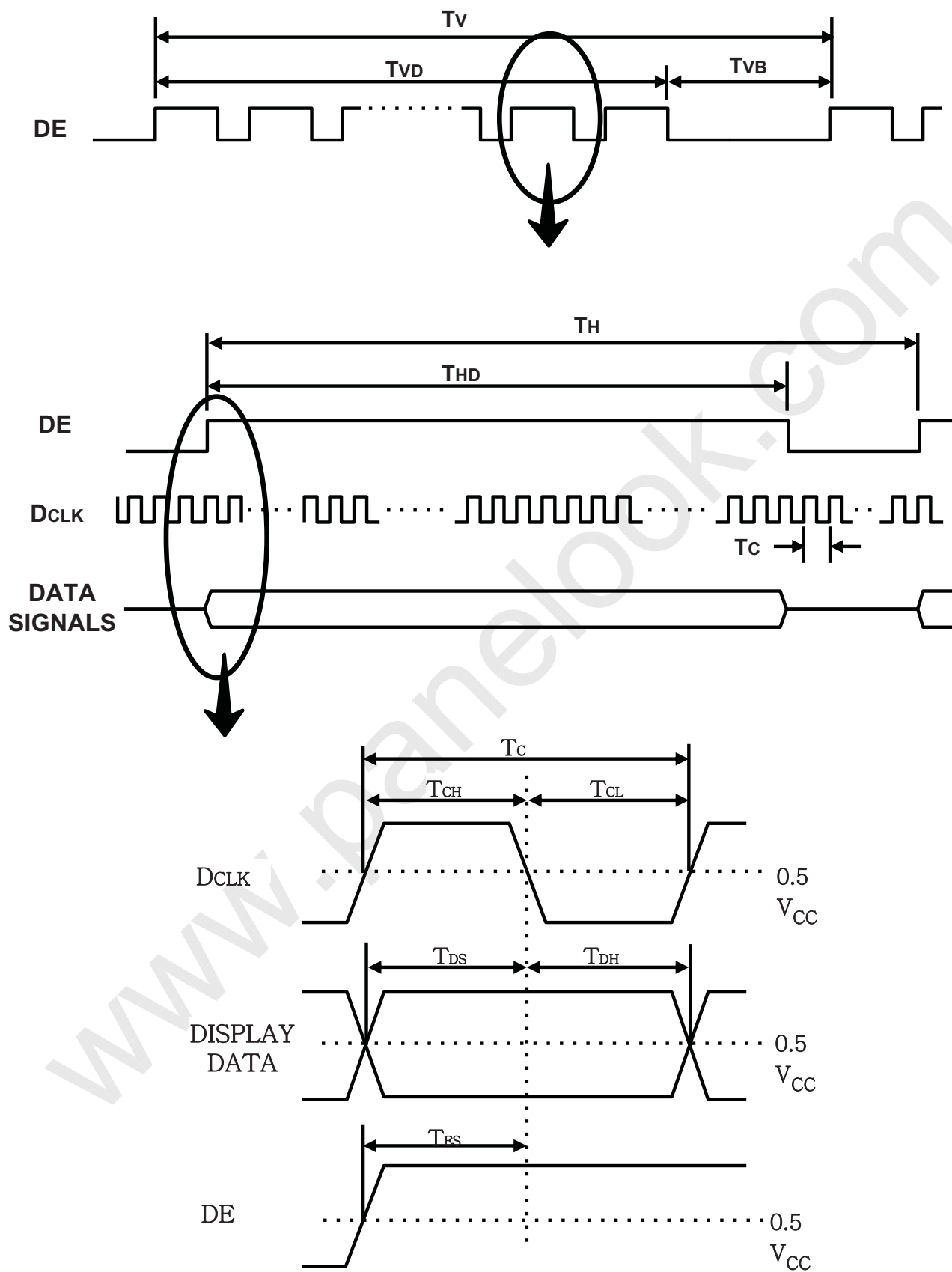
## 6.3  Power ON/OFF Sequence

To prevent a latch-up or DC operation of the LCD Module, the power on/off sequence  should be as the diagram below.



Power Supply $V_{DD}$ — 0.9 $V_{DD}$, 0.1 $V_{DD}$, 0V

$0 < T1 \leq 10msec$
$0 < T2 \leq 50msec$
$0 < T3 \leq 50msec$
$1000msec \leq T4$

Signals — 0 V

$500msec \leq T5$
(Recommend Value : $1000msec \leq T5$)
$10msec \leq T6$
(Recommend Value : $100msec \leq T6$)

Power On          Power Off          VALID          2.4 V

T1 : $V_{DD}$ rising time from 10% to 90%
T2 : The time from $V_{DD}$ to valid data at power ON.
T3 : The time from valid data off to $V_{DD}$ off at power Off.
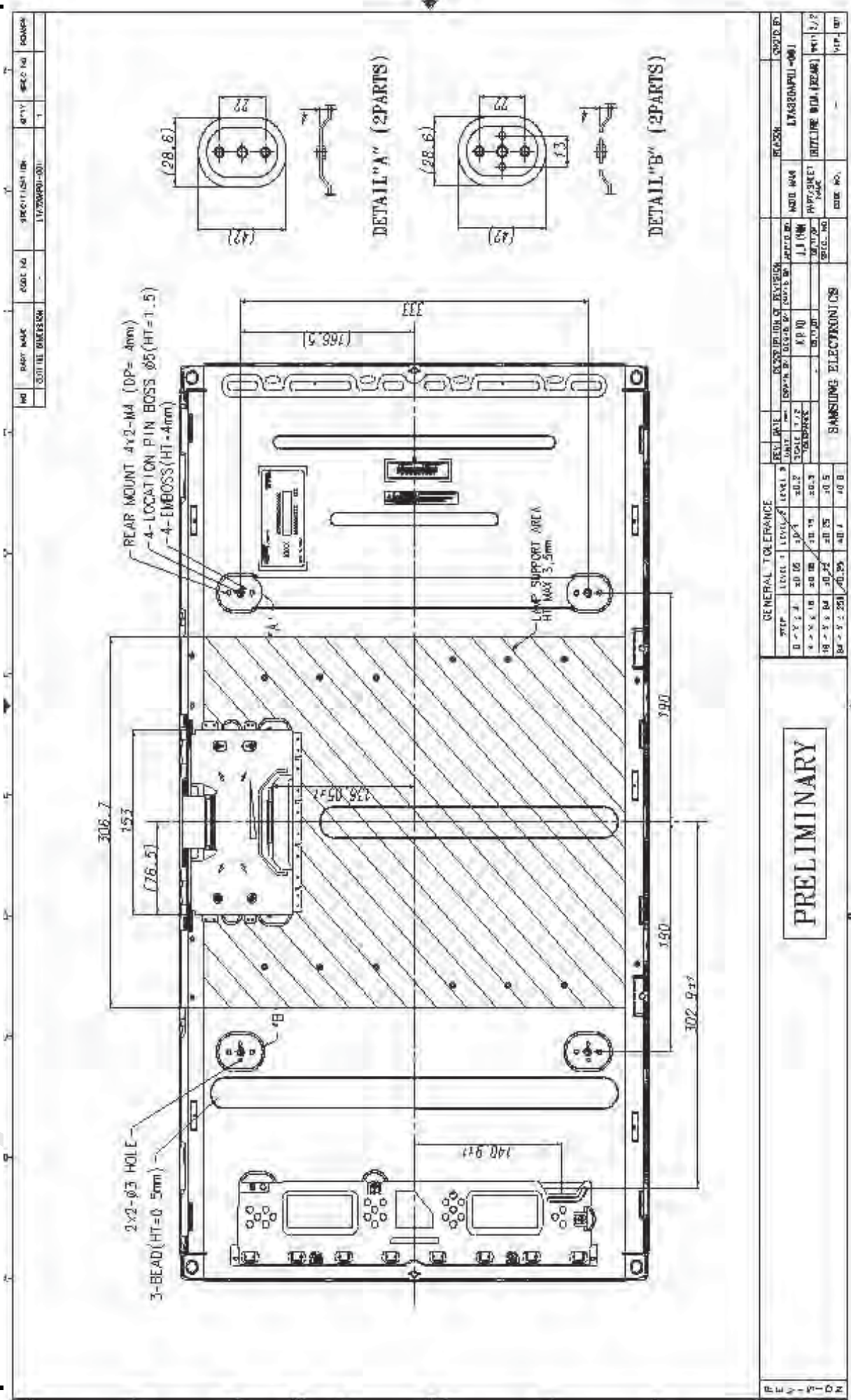T4 : $V_{DD}$ off time for Windows restart
T5 : The time from valid data to B/L enable at power ON.
T6 : The time from valid data off to B/L disable at power Off.

- The supply voltage of the external system for the Module input should be the same as the definition of $V_{DD}$.
- 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 show abnormal screen.
- In case of $V_{DD}$ = off level, please keep the level of input signals low or keep a high impedance.
- T4 should be measured after the Module has been fully discharged between power off and on period.
- Interface signal should not be kept at high impedance when the power is on.
- In case T5 is less than 1000msec and T6 is less than 100msec, Garbage Display can be seen.( It is not related to electrical function issue, Just for recommendation to prevent Garbage Display )

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# 7.Outline dimension



SECTION B-B'

SECTION A-A'

SECTION C-C'

PRELIMINARY

DETAIL "A" (2PARTS)

DETAIL "B" (2PARTS)

PRELIMINARY

SAMSUNG ELECTRONICS

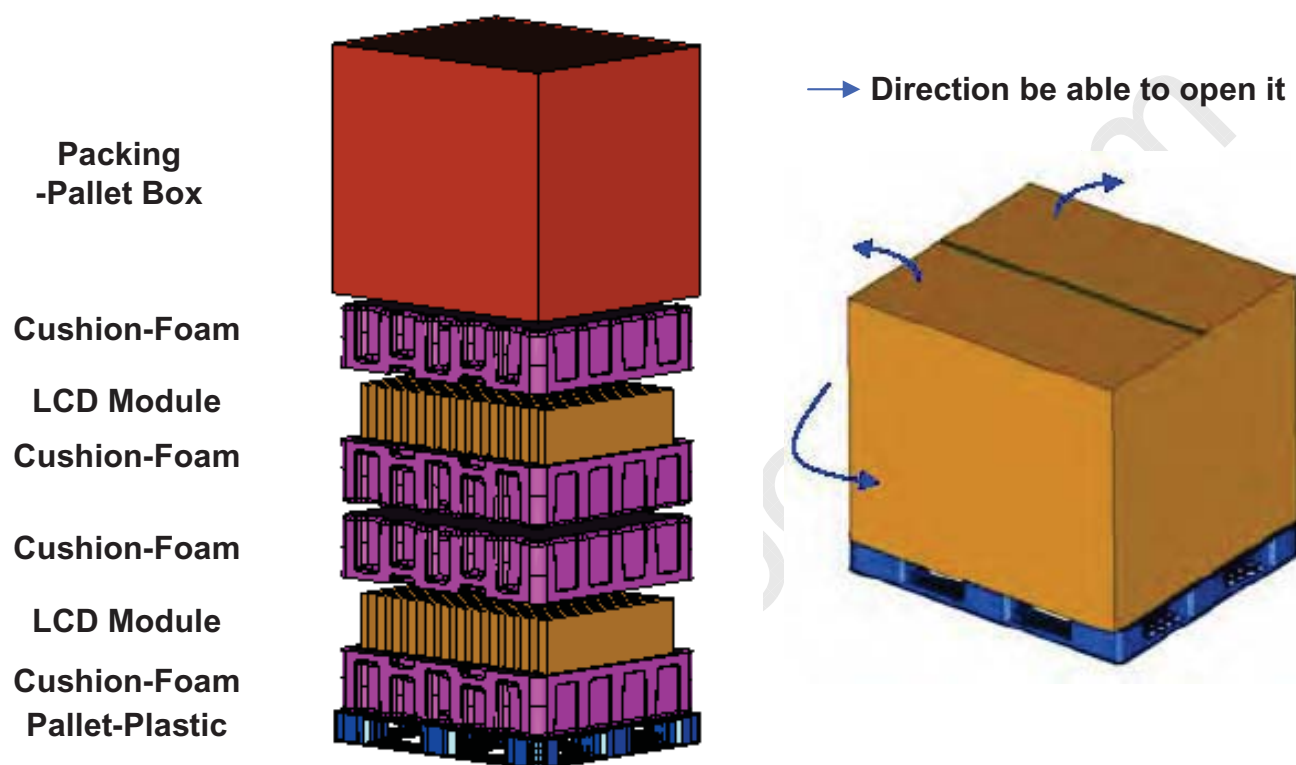| MODEL | LTA320AP08 | Doc. No | 09-001-G-090528 | Page | 22 / 27 |

# 8. PACKING

## 8.1  CARTON (Internal Package)
(1) Packing Form
　　Corrugated fiberboard box and corrugated cardboard as shock absorber
(2) Packing Method



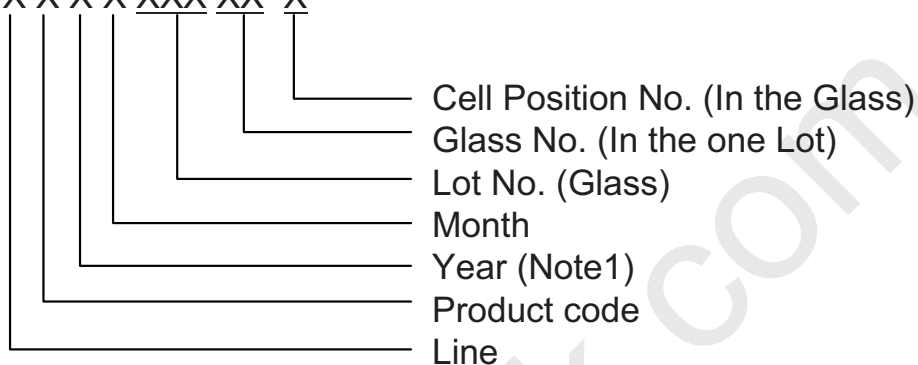→ **Direction be able to open it**

**Packing -Pallet Box**

**Cushion-Foam**

**LCD Module**

**Cushion-Foam**

**Cushion-Foam**

**LCD Module**

**Cushion-Foam**
**Pallet-Plastic**

## 8.2 Packing Specification

| Item | Specification | Remark |
|---|---|---|
| LCD Packing | 24ea / (Packing-Pallet Box) | 1. 7 Kg / LCD (24ea)<br>2. 3.5 Kg / Cushion-pallet (4ea)<br>3. 8.8 Kg / Packing-Pallet Box (1ea)<br>4. Cushion-pallet Material : EPS<br>5. Packing-Pallet Box Material : DW4 |
| Pallet | 1Box / Pallet | 1. Pallet weight = 8kg |
| Packing Direction | Vertical | |
| Total Pallet Size | H x V x height | 1150mm(H) x 985mm(V) x 1611mm(height) |
| Total Pallet Weight | 199 kg | Pallet(8kg) + Module(7*24=168Kg) + Cushion (up*2+botton*2=14kg) + Pallet-BOX (8.8kg) |

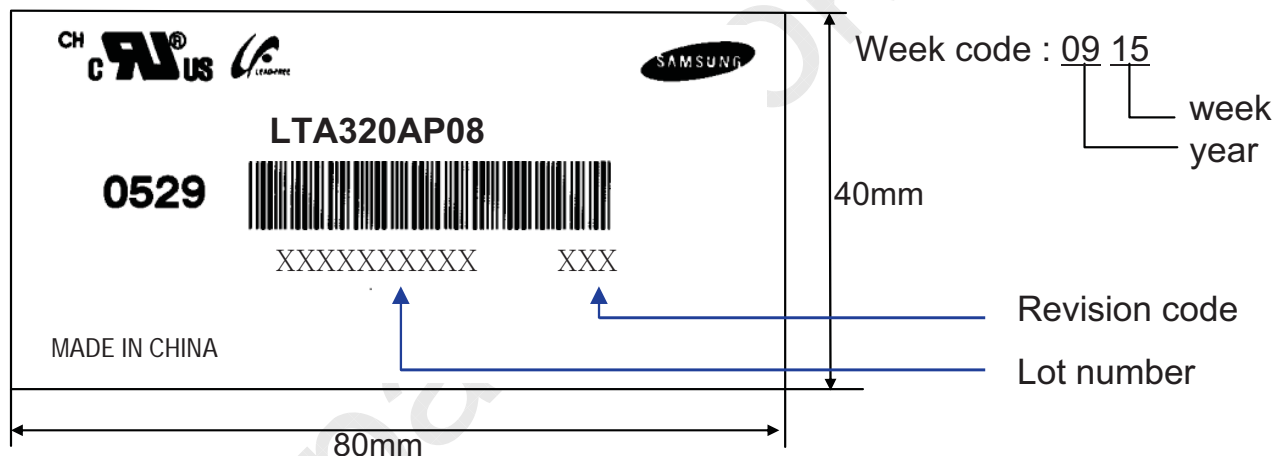| MODEL | LTA320AP08 | Doc. No | 09-001-G-090528 | Page | 23 / 27 |
|---|---|---|---|---|---|

## 9. MARKING & OTHERS

A nameplate bearing followed by is affixed to a shipped product at the specified location on each product.

(1) Part number : LTA320AP08
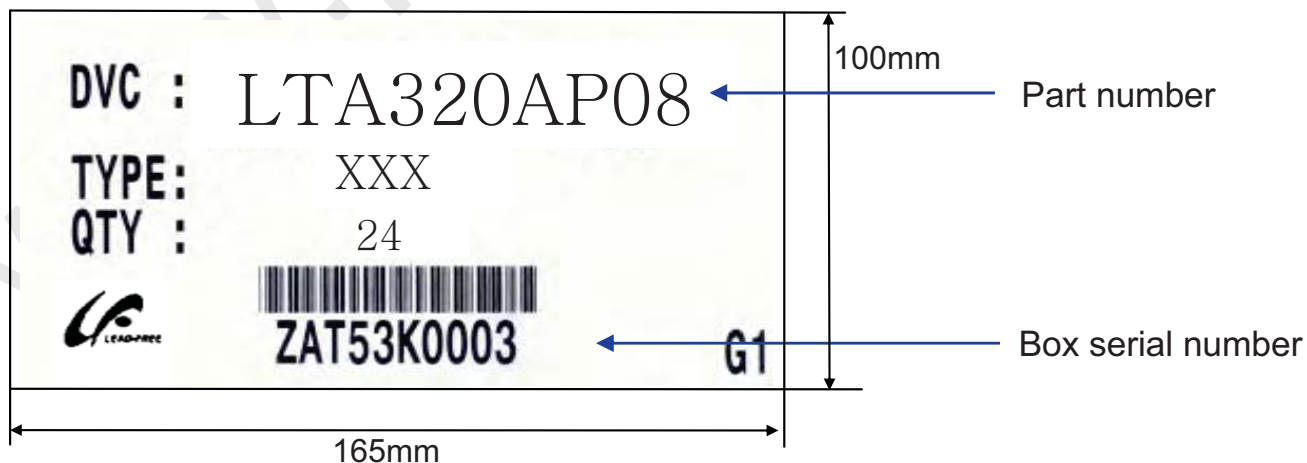(2) Revision: Three letters
(3) Lot number : X X X X XXX XX  X

- Cell Position No. (In the Glass)
- Glass No. (In the one Lot)
- Lot No. (Glass)
- Month
- Year (Note1)
- Product code
- Line

(4) Nameplate Indication

LTA320AP08

0529

XXXXXXXXXX   XXX

MADE IN CHINA

40mm

80mm

Week code : 09 15
- week
- year

Revision code

Lot number

(5) Packing box attach

DVC : LTA320AP08
TYPE: XXX
QTY : 24
ZAT53K0003    G1

100mm

165mm

Part number

Box serial number

(6) Others
1. After service part
Lamps cannot be replaced because of the narrow bezel structure.

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|-------|-----------|---------|-----------------|------|---------|

# 10. General Precautions

## 10.1 Handling

(a) When the Module is assembled, it should be attached to the system firmly using all mounting holes. Be careful not to twist and bend the Module.

(b) Because the inverter use high voltage, it should be disconnected from power before it is assembled or disassembled.

(c) Refrain from strong mechanical shock and / or any force to the Module. In addition to damage, this may cause improper operation or damage to the Module and CCFT back light.

(d) Note that polarizers are very fragile and could be damage easily. Do not press or scratch the surface harder than a HB pencil lead.

(e) Wipe off water droplets or oil immediately. If you leave the droplets for a long time, staining or discoloration may occur.

(f) If the surface of the polarizer is dirty, clean it using absorbent cotton or soft cloth.

(g) Desirable cleaners are water, IPA(Isopropyl Alcohol) or Hexane. Do not use Ketone type materials(ex. Acetone), Ethyl alcohol, Toluene, Ethyl acid or Methyl chloride. It might permanent damage to the polarizer due to chemical reaction.

(h) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth . In case of contact with hands, legs or clothes, it must be washed away with soap thoroughly.

(i) Protect the Module from static, or the CMOS Gate Array IC would be damaged.

(j) Use finger-stalls with soft gloves in order to keep display clean during the incoming inspection and assembly process.

(k) Do not disassemble the Module.

(l) Do not pull or fold the lamp wire.

(m) Do not adjust the variable resistor located on the Module.

(n) Protection film for polarizer on the Module should be slowly peeled off just before use so that the electrostatic charge can be minimized.

(o) Pins of I/F connector should not be touched directly with bare hands.

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|-------|------------|---------|-----------------|------|---------|

## 10.2 Storage

(a) Do not leave the Module in high temperature, and high humidity for a long time. It is highly recommended to store the Module with temperature from 0 to 35℃ and relative humidity of less than 70%.

(b) Do not store the TFT-LCD Module in direct sunlight.

(c) The Module should be stored in a dark place. It is prohibited to apply sunlight or fluorescent light in storing.

## 10.3 Operation

(a) Do not connect or disconnect the Module in the "Power On" condition.

(b) Power supply should always be turned on/off  by the "Power on/off sequence"

(c) Module has high frequency circuits. Sufficient suppression to the electromagnetic interference should be done by system manufacturers. Grounding and shielding methods may be important to minimize the interference.

(d) The cable between the back light connector and its inverter power supply should be connected directly with a minimized length. A longer cable between the back light and the inverter may cause lower luminance of lamp(CCFT) and may require higher startup voltage(Vs).

## 10.4 Operation Condition Guide

(a) The LCD product should be operated under normal conditions.
Normal condition is defined as below;
- Temperature : $20\pm15$℃
- Humidity : $55\pm20\%$
- Display pattern : continually changing pattern (Not stationary)

(b) If the product will be used in extreme conditions such as high temperature, humidity, display patterns or operation time etc.., It is strongly recommended to contact SEC for Application engineering advice. Otherwise, its reliability and function may not be guaranteed. Extreme conditions are commonly found at Airports, Transit Stations, Banks, Stock market, and Controlling systems.

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## 10.5 Others

(a) Ultra-violet ray filter is necessary for outdoor operation.

(b) Avoid condensation of water. It may result in improper operation or disconnection
of electrode.

(c) Do not exceed the absolute maximum rating value. ( supply voltage variation,
input voltage variation, variation in part contents and environmental temperature,
and so on)
Otherwise the Module may be damaged.

(d) If the Module keeps displaying the same pattern for a long period of time,
the image may be "sticked" to the screen.
To avoid image sticking, it is recommended to use a screen saver.

(e) This Module has its circuitry PCB's on the rear side and should be handled
carefully in order not to be stressed.

(f) Please contact SEC in advance when you display the same pattern for a long time.

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