



**Samsung Secret**

**Product Information**

**DATE : 15. Jul. 2011**

**SAMSUNG TFT-LCD**

**MODEL : LTA460HJ15**

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

**LCD Business**

**Samsung Electronics Co . , LTD.**

|              |                   |                |                          |             |               |
|--------------|-------------------|----------------|--------------------------|-------------|---------------|
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**Revision History**

| Date             | Rev. No | Page | Summary      |
|------------------|---------|------|--------------|
| 15. Jul.<br>2011 | 000     | all  | First issued |

## General Description

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### Description

**LTA460HJ15** 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 46.0" is 1920 x 1080 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 an 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 ratio & aperture ratio with wide color gamut
- SPVA(Super Patterned Vertical Align) mode
- Wide viewing angle ( $\pm 178^\circ$ )
- High speed response
- FHD resolution (16:9)
- Low Power consumption
- Edge Type LED (Light Emitted Diode) BLU
- DE (Data Enable) mode
- 4ch LVDS (Low Voltage Differential Signaling) interface (4 pixel/clock)

## General Information

| Items               | Specification                                         | Unit              | Note               |
|---------------------|-------------------------------------------------------|-------------------|--------------------|
| Module Size         | 1055.5(H <sub>TYP</sub> ) x 610.8 (V <sub>TYP</sub> ) | mm                | $\pm 1.0\text{mm}$ |
|                     | 31.1 (D <sub>TYP</sub> )                              |                   |                    |
| Weight              | 11,800 (Max.)                                         | g                 |                    |
| Pixel Pitch         | 0.53025(H) x 0.17675(W) * 3                           | mm                |                    |
| Active Display Area | 1018.08(H) x 572.67(V)                                | mm                |                    |
| Surface Treatment   | Haze 7%                                               | -                 | Anti-Glare         |
| Display Colors      | 8bit – 16.7M                                          | Colors            |                    |
| Number of Pixels    | 1920 x 1080                                           | Pixel             |                    |
| Pixel Arrangement   | RGB vertical stripe                                   | -                 |                    |
| Display Mode        | Normally Black                                        | -                 |                    |
| Luminance of White  | 400 (Typ.)                                            | cd/m <sup>2</sup> |                    |

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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-0.3 | 16.5 | V    | (1)  |
| Storage temperature           | $T_{STG}$ | -20     | 60   | °C   | (2)  |
| Operation temperature         | $T_{OPR}$ | 0       | 50   | °C   |      |
| Surface temperature           | $T_{SUR}$ | 0       | 60   | °C   | -    |
| Shock ( non - operating )     | $S_{nop}$ | -       | 30   | G    | (3)  |
| Vibration ( non - operating ) | $V_{nop}$ | -       | 1.5  | G    | (4)  |

Note (1)  $T_a = 25 \pm 2$  °C

(2) Temperature and relative humidity range are shown in the figure below.

a. 90 % RH Max. ( $T_a \leq 39$  °C)

b. Relative Humidity is 90% or less. ( $T_a > 39$

c. No condensation

(3) 11ms, sine wave, one time for  $\pm X$ ,

(4) 10-300 Hz, Sweep rate 10min, 30min for X,Y,Z axis

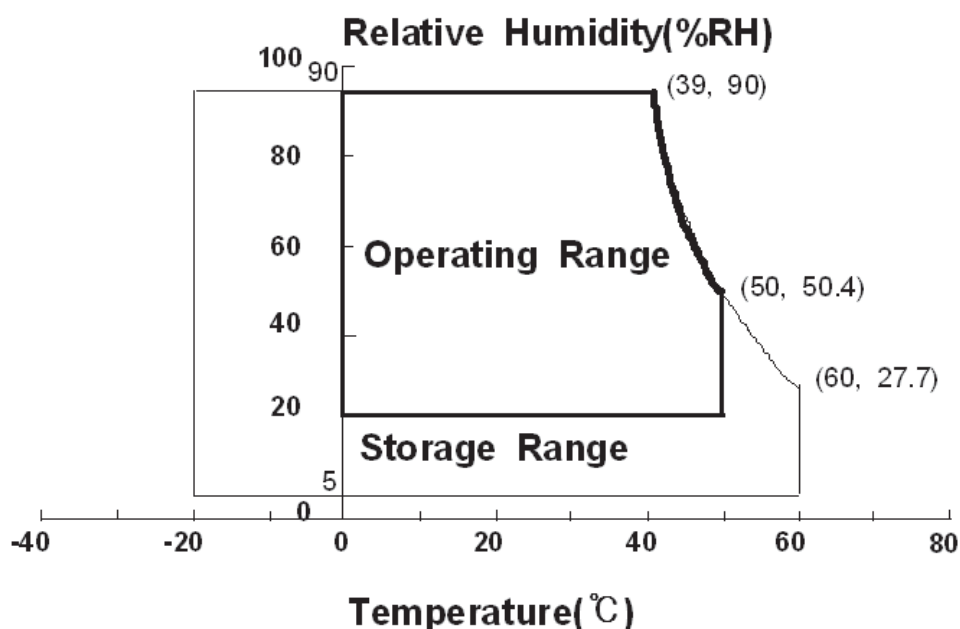


Fig. Temperature and Relative humidity range

## 2. Optical Characteristics

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The optical characteristics should be measured in a dark room or equivalent.

Measuring equipment : TOPCON RD-80S, TOPCON SR-3, ELDIM EZ-Contrast

(Ta = 25 ± 2 °C, VDD=12.0V, fv=120Hz, f<sub>DCLK</sub>=297MHz, Dimming Duty = Max)

| Item                                     |        | Symbol           | Condition                                                           | Min.          | Typ.   | Max.  | Unit              | Note                     |
|------------------------------------------|--------|------------------|---------------------------------------------------------------------|---------------|--------|-------|-------------------|--------------------------|
| Contrast Ratio<br>(Center of screen)     |        | C/R              | Normal<br>$\theta_{L,R}=0$<br>$\theta_{U,D}=0$<br><br>Viewing Angle | 3,000         | 4,000  | -     |                   | (1)<br>SR-3              |
| Response Time                            | G-to-G | Tg               |                                                                     | -             | 8      | -     | msec              | (3)<br>RD-80S<br>BM-7    |
| Luminance of White<br>(Center of screen) |        | Y <sub>L</sub>   |                                                                     | 300           | 400    | -     | cd/m <sup>2</sup> | (4)<br>SR-3              |
| Color Chromaticity<br>(CIE 1931)         | Red    | Rx               |                                                                     | TYP.<br>-0.03 | 0.653  | +0.03 |                   | (5),(6)<br>SR-3<br>PR650 |
|                                          |        | Ry               |                                                                     |               | 0.330  |       |                   |                          |
|                                          | Green  | Gx               |                                                                     |               | 0.310  |       |                   |                          |
|                                          |        | Gy               |                                                                     |               | 0.600  |       |                   |                          |
|                                          | Blue   | Bx               |                                                                     |               | 0.150  |       |                   |                          |
|                                          |        | By               |                                                                     |               | 0.058  |       |                   |                          |
|                                          | White  | Wx               |                                                                     |               | 0.280  |       |                   |                          |
|                                          |        | Wy               | 0.290                                                               |               |        |       |                   |                          |
| Color Gamut                              |        | -                |                                                                     | -             | 72     | -     | %                 | (5)<br>SR-3              |
| Color Temperature                        |        | CCT              |                                                                     | -             | 10,000 | -     | K                 |                          |
| Viewing Angle                            | Hor.   | $\theta_L$       | C/R≥10                                                              | 75            | 89     | -     | Degree            | (6)<br>EZ-Contrast       |
|                                          |        | $\theta_R$       |                                                                     | 75            | 89     | -     |                   |                          |
|                                          | Ver.   | $\theta_U$       |                                                                     | 75            | 89     | -     |                   |                          |
|                                          |        | $\theta_D$       |                                                                     | 75            | 89     | -     |                   |                          |
| Brightness Uniformity<br>(9 Points)      |        | B <sub>uni</sub> |                                                                     | -             | -      | 25    | %                 | (2)<br>SR-3              |

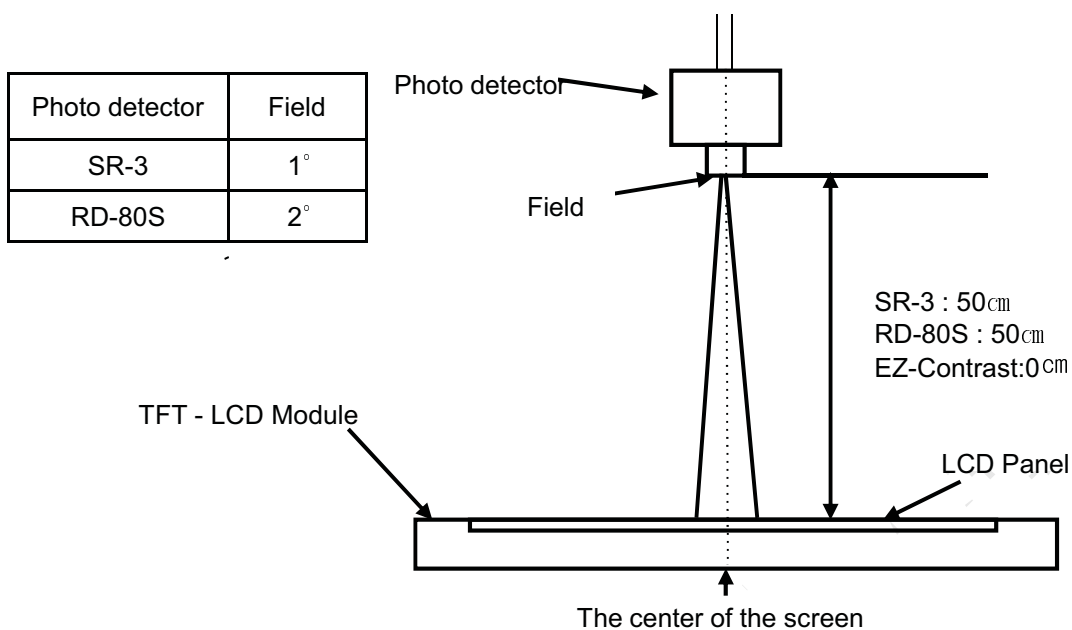
### - Test Equipment Setup

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.

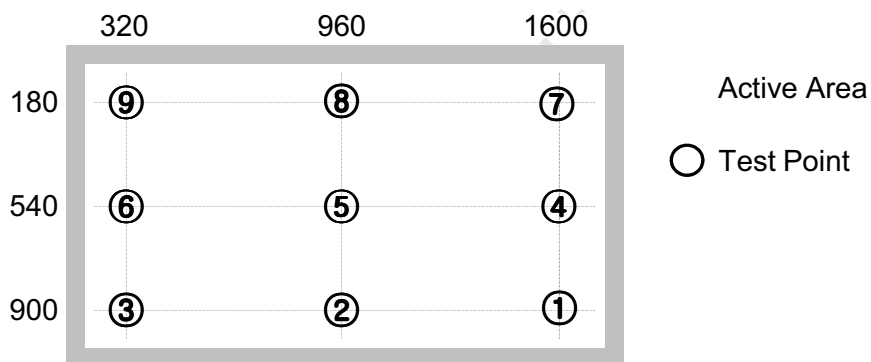
. Dimming Duty = 100%

. Environment condition : Ta = 25 ± 2 °C

|       |            |         |                   |      |        |
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- Definition of 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

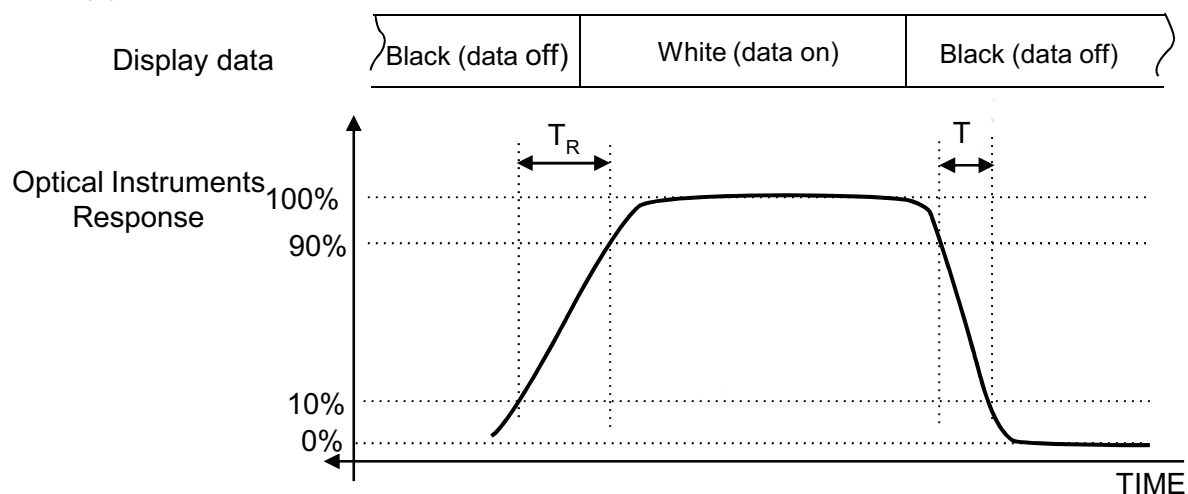
Note (2) Definition of 9 points brightness uniformity (Test pattern : Full White)

$$B_{uni} = 100 * \frac{(B_{max} - B_{min})}{B_{max}}$$

Bmax : Maximum brightness

Bmin : Minimum brightness

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



※ G- to- G : Average response time between Gray to Gray (Scale)

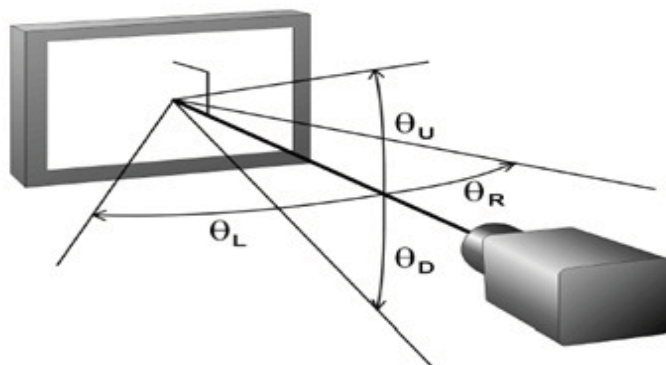
Note (4) Definition of Luminance of White : Luminance of white at center point ⑤

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)





### 3. Electrical Characteristics

#### 3.1 TFT LCD Module

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

$T_a = 25^{\circ}\text{C} \pm 2^{\circ}\text{C}$

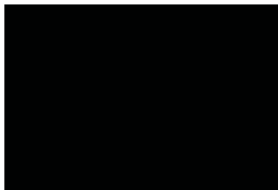
| Item                    |               | Symbol            | Min. | Typ. | Max. | Unit | Note    |
|-------------------------|---------------|-------------------|------|------|------|------|---------|
| Voltage of Power Supply |               | V <sub>DD</sub>   | 10.8 | 12.0 | 13.2 | V    | (1)     |
| Current of Power Supply | (a) Black     | I <sub>DD</sub>   | -    | 720  | 950  | mA   | (2),(3) |
|                         | (b) White     |                   | -    | 1280 | 1500 | mA   |         |
|                         | (c) N-pattern |                   | -    | 1280 | 1500 | mA   |         |
| Vsync Frequency         |               | f <sub>V</sub>    | 100  | 120  | 125  | Hz   |         |
| Hsync Frequency         |               | f <sub>H</sub>    | 120  | 135  | 140  | kHz  |         |
| Main Frequency          |               | Fdclk             | 260  | 297  | 310  | MHz  |         |
| Rush Current            |               | I <sub>RUSH</sub> | -    | 5    | 7    | A    | (4)     |

Note (1) The ripple voltage should be controlled under 10% of  $V_{DD}$

(2)  $f_V=120\text{Hz}$ ,  $f_{DCLK}=297\text{MHz}$ ,  $V_{DD}=12.0\text{V}$ , DC Current.

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

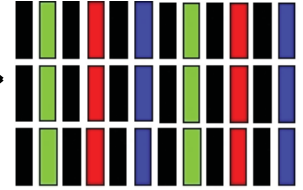
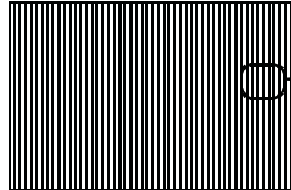
a) Black Pattern



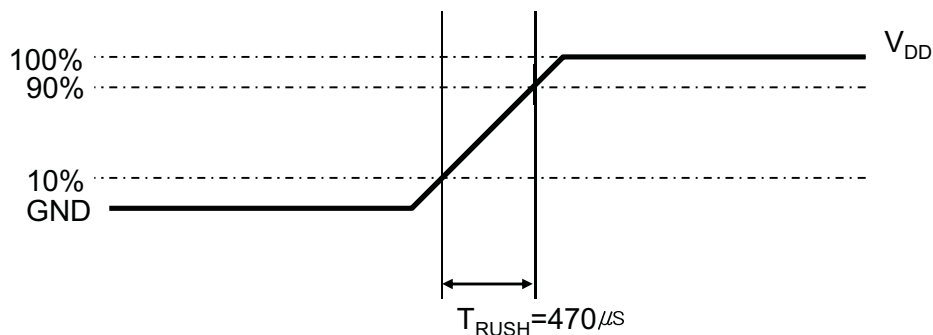
b) White Pattern



c) N Pattern



(4) Measurement Conditions

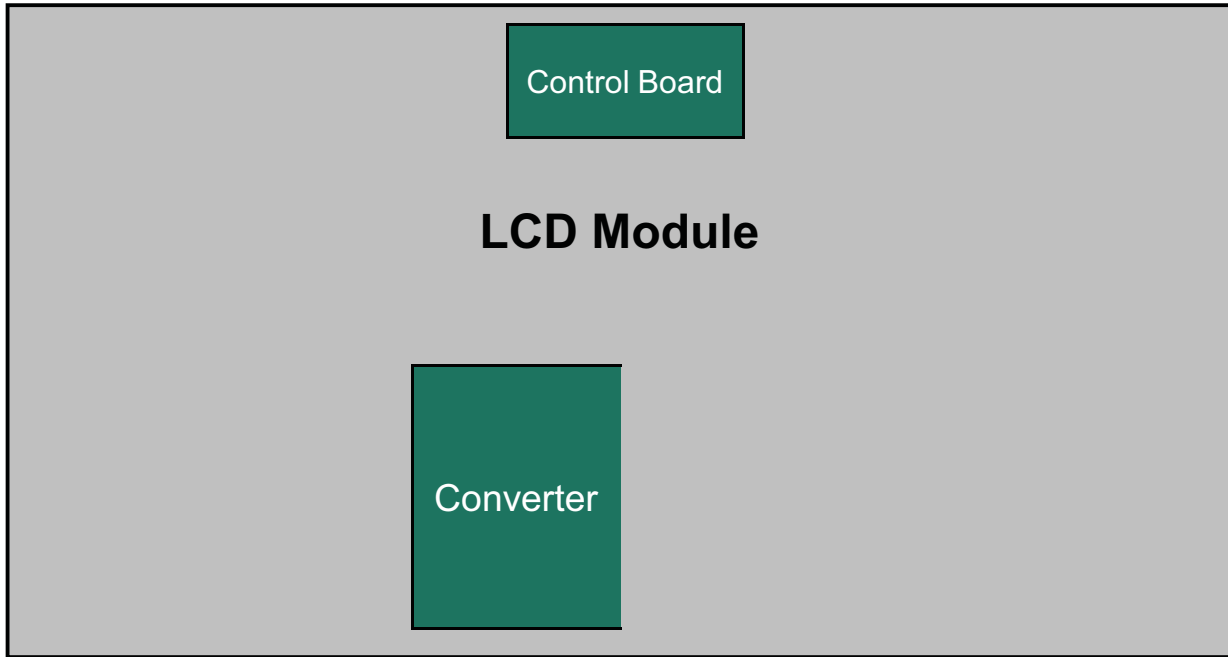


Rush Current  $I_{RUSH}$  can be measured when  $T_{RUSH}$  is  $470\mu\text{s}$ .

### 3.2 Back Light Unit

The back light unit contains Edge type White LEDs (Light Emitting Diode)

$T_a = 25 \pm 2^\circ\text{C}$



| Item                | Symbol | Min.   | Typ. | Max. | Unit | Note |
|---------------------|--------|--------|------|------|------|------|
| Operating Life Time | Hr     | 30,000 | -    | -    | Hour | (1)  |

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

[Operating condition :  $T_a = 25 \pm 2^\circ\text{C}$ , For single LED only. ]

### 3.3 Converter Input Condition & Specification

| Items                            | Symbol              | Conditions                  | Specifications |      |      | Unit  | Note                       |
|----------------------------------|---------------------|-----------------------------|----------------|------|------|-------|----------------------------|
|                                  |                     |                             | Min.           | Typ. | Max. |       |                            |
| Input Voltage                    | V <sub>in</sub>     | -                           | 22             | 24   | 26   | V     | Ta=25± 2 °C                |
| Input Current                    | I <sub>RUSH</sub>   | Vin=24.0V<br>Vdim =3.3V     | -              | -    | 3.8  | A     | 2D Mode                    |
|                                  |                     |                             | -              | -    | TBD  | A     | 3D Mode                    |
| Output Current                   | I <sub>O,MAX</sub>  | Vin = 24.0V<br>V dim =3.3 V | -              | 140  | -    | mArms | 2D Mode                    |
|                                  |                     |                             | -              | TBD  | -    | mArms | 3D Mode                    |
| Backlight On/Off                 | ON                  | Vin=24.0 V                  | 2.4            | -    | 5.25 | V     |                            |
|                                  | OFF                 | Vin=24.0 V                  | 0              | -    | 0.8  |       |                            |
| Dimming Range                    | V <sub>DIM</sub>    | Vin :22~26V                 | 0              | -    | 3.3  | V     |                            |
| Dimming Frequency                | F <sub>PWM</sub>    | Vin=24.0 V                  | -              | 170  | -    | Hz    |                            |
| External Dimming Duty Range      | EX_Dim              | Min                         | 1              | -    | 100  | %     |                            |
| External Dimming Frequency Range | F <sub>EX_PWM</sub> | Vin=22.0~26.0 V             | 120            | -    | 180  | Hz    | Dim Pin(#13)<br>: Floating |
| External Dimming Signal Level    | V <sub>PWM</sub>    | High (ON)                   | 2.4            | -    | 5.25 | V     |                            |
|                                  |                     | Low (Off)                   | 0              | -    | 0.8  |       |                            |

Note) Power Consumption is measured when 400 [cd/m ] of luminance which is the typical luminance.

(1) All data is measured after 120min warm-up.

- Additional Appendix for Supply Current & Power consumption

| ITEM          | SYMBOL          | CONDITION        | SPECIFICATION |     |     | UNIT | NOTE                               |
|---------------|-----------------|------------------|---------------|-----|-----|------|------------------------------------|
|               |                 |                  | MIN           | TYP | MAX |      |                                    |
| Input Current | lovershoot, 2D  | Vin=24V, dim=max | -             | TBD | TBD | Adc  | Maximum current after turn-on      |
|               | Isaturation, 2D |                  | -             | TBD | TBD | Adc  | Saturation current after 1hr aging |
|               | lovershoot, 3D  |                  | -             | TBD | TBD | Adc  | Maximum current after turn-on      |
|               | Isaturation, 3D |                  | -             | TBD | TBD | Adc  | Saturation current after 1hr aging |

## 4. Input Terminal Pin Assignment

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### 4.1.1 Input Signal & Power

Connector : FI-RE41S-HF (JAE/UJU)

| Pin | Description        |         | Pin | Symbol             | Description   |
|-----|--------------------|---------|-----|--------------------|---------------|
| 1   | Vdd(12V)           |         | 21  | ODD LVDS<br>SIGNAL | Rx1[3]P       |
| 2   | Vdd(12V)           |         | 22  |                    | No Connection |
| 3   | Vdd(12V)           |         | 23  |                    | No Connection |
| 4   | Vdd(12V)           |         | 24  |                    | GND           |
| 5   | Vdd(12V)           |         | 25  |                    | Rx3[0]N       |
| 6   | No Connection      |         | 26  |                    | Rx3[0]P       |
| 7   | GND                |         | 27  |                    | Rx3[1]N       |
| 8   | GND                |         | 28  |                    | Rx3[1]P       |
| 9   | GND                |         | 29  |                    | Rx3[2]N       |
| 10  | ODD LVDS<br>SIGNAL | Rx1[0]N | 30  |                    | Rx3[2]P       |
| 11  |                    | Rx1[0]P | 31  |                    | GND           |
| 12  |                    | Rx1[1]N | 32  |                    | Rx3CLK-       |
| 13  |                    | Rx1[1]P | 33  |                    | Rx3CLK+       |
| 14  |                    | Rx1[2]N | 34  |                    | GND           |
| 15  |                    | Rx1[2]P | 35  |                    | Rx3[3]N       |
| 16  |                    | GND     | 36  |                    | Rx3[3]P       |
| 17  |                    | Rx1CLK- | 37  |                    | No Connection |
| 18  |                    | Rx1CLK+ | 38  |                    | No Connection |
| 19  |                    | GND     | 39  | GND                |               |
| 20  |                    | Rx1[3]N | 40  | No Connection      |               |
|     |                    |         | 41  | No Connection      |               |

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

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#### 4.1.2 Input Signal & Power

Connector : FI-RE51S-HF (JAE/UJU)

| Pin | Description      |               | Pin | Description      |                                          |
|-----|------------------|---------------|-----|------------------|------------------------------------------|
| 1   | Vdd(12V)         |               | 26  | EVEN LVDS SIGNAL | Rx4[0]P                                  |
| 2   | Vdd(12V)         |               | 27  |                  | Rx4[1]N                                  |
| 3   | Vdd(12V)         |               | 28  |                  | Rx4[1]P                                  |
| 4   | Vdd(12V)         |               | 29  |                  | Rx4[2]N                                  |
| 5   | Vdd(12V)         |               | 30  |                  | Rx4[2]P                                  |
| 6   | No Connection    |               | 31  |                  | GND                                      |
| 7   | GND              |               | 32  |                  | Rx4CLK-                                  |
| 8   | GND              |               | 33  |                  | Rx4CLK+                                  |
| 9   | GND              |               | 34  |                  | GND                                      |
| 10  | EVEN LVDS SIGNAL | Rx2[0]N       | 35  |                  | Rx4[3]N                                  |
| 11  |                  | Rx2[0]P       | 36  |                  | Rx4[3]P                                  |
| 12  |                  | Rx2[1]N       | 37  |                  | No Connection                            |
| 13  |                  | Rx2[1]P       | 38  |                  | No Connection                            |
| 14  |                  | Rx2[2]N       | 39  | GND              |                                          |
| 15  |                  | Rx2[2]P       | 40  | No Connection    |                                          |
| 16  |                  | GND           | 41  | No Connection    |                                          |
| 17  |                  | Rx2CLK-       | 42  | 3D_EM            | 3D_EN signal (Note 2)                    |
| 18  |                  | Rx2CLK+       | 43  | No Connection    |                                          |
| 19  |                  | GND           | 44  | No Connection    |                                          |
| 20  |                  | Rx2[3]N       | 45  | No Connection    |                                          |
| 21  |                  | Rx2[3]P       | 46  | No Connection    |                                          |
| 22  |                  | No Connection | 47  | No Connection    |                                          |
| 23  |                  | No Connection | 48  | 3D_SYNC_I        | Shutter glass Sync Input signal (Note 3) |
| 24  |                  | GND           | 49  | 3D_SYNC_O        | Shutter glass Sync Signal                |
| 25  |                  | Rx4[0]N       | 50  | No Connection    |                                          |
|     |                  |               | 51  | No Connection    |                                          |

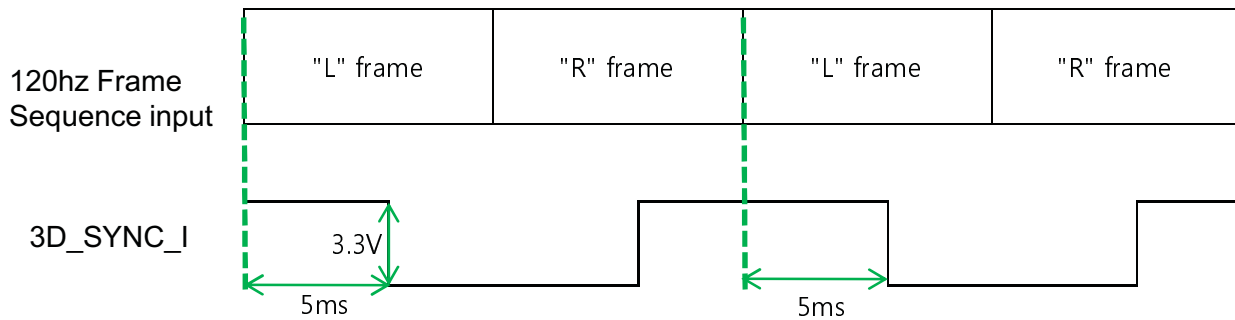
Note (1) No Connection: These PINS are used only for SAMSUNG. (DO NOT CONNECT)

Note (2) 3D Enable signal voltage level

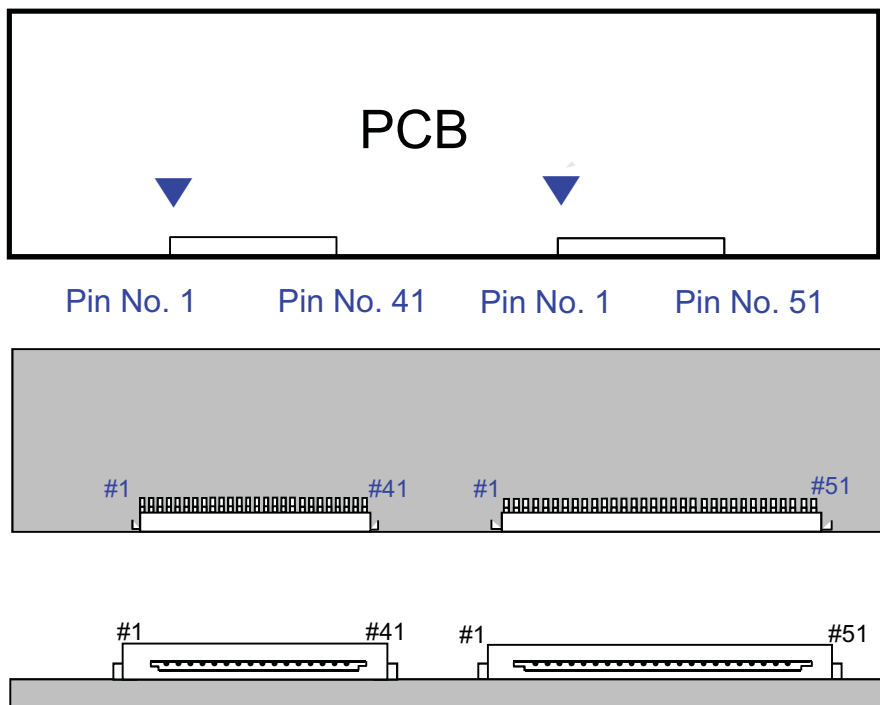
High : Min 2.7V, Max 3.3V      Low : Min 0 V, Max 0.4V

Note3) Recommend timing for 3D\_SYNC\_I Signal .

- Guide Signal to Separate L frame and R frame
- Shutter glass signal & Operation timing also depend on this signal
- To operate 3D function, need this signal from Set A/D board.  
(In Order for using it in 2D mode, change the input condition into High)



Note4) Pin number starts from Left side



**Fig. Connector diagram**

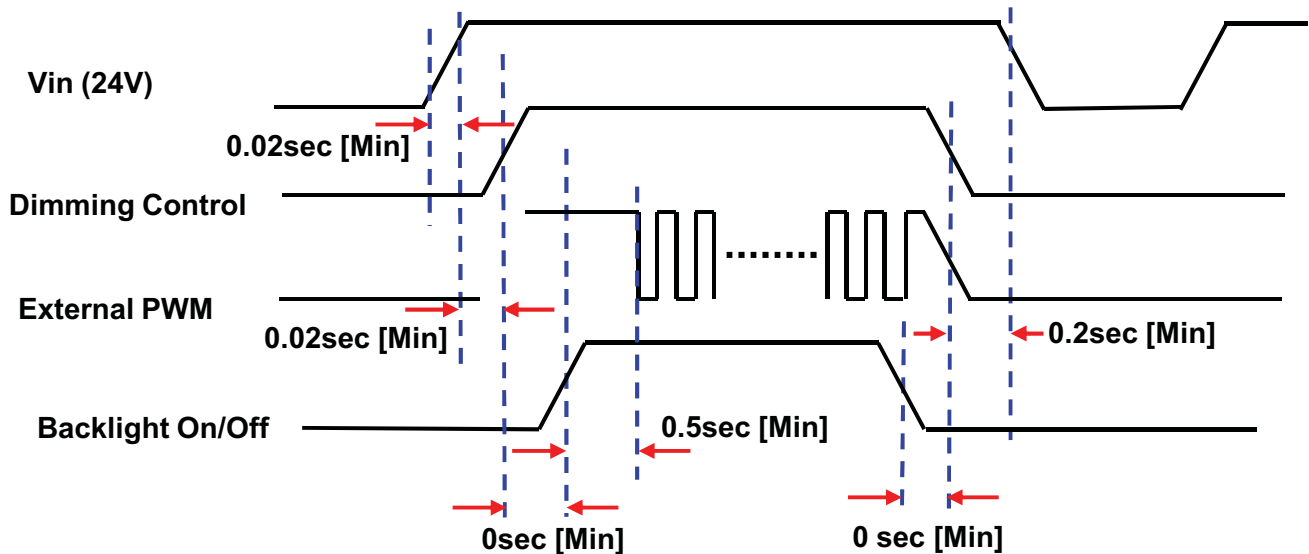
- All GND pins should be connected together and also be connected to the LCD's metal chassis.
- All power input pins should be connected together.
- All NC pins should be separated from other signal or power.

## 4.2 Converter Input Pin Configuration

Connector : Yeon-ho, 20022WR-14B1

| Pin No. | Pin Configuration(FUNCTION)                         |
|---------|-----------------------------------------------------|
|         | Master                                              |
| 1 ~ 5   | 24 V                                                |
| 6 ~ 10  | GND                                                 |
| 11      | No Connection (DO NOT CONNECT)                      |
| 12      | Backlight On /Off [ON:2.4 – 5.25 V, OFF: 0 - 0.8 V] |
| 13      | Dimming Control [0V:Min, 3.3V:Max]                  |
| 14      | No Connection (DO NOT CONNECT)                      |

## 4.3. Converter Input Power Sequence



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

#### 4.4 LVDS Interface

- LVDS Receiver : T-con (merged)
- Data Format (JEIDA Only)

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



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

| COLOR                        | DISPLAY<br>(8bit) | DATA SIGNAL |    |    |    |    |    |    |    |    |       |    |    |    |    |    |    |    |    |      |    |    |    |    |    |              |       | GRAY<br>SCALE<br>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<br>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<br>SCALE<br>OF<br>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<br>↑         | 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~<br>R 252 |       |                        |  |
|                              |                   | :           | :  | :  | :  | :  | :  |    |    | :  | :     | :  | :  | :  | :  |    |    | :  | :  | :    | :  | :  | :  |    |    |              |       |                        |  |
|                              | ↓<br>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  | 0            | R 253 |                        |  |
|                              |                   | 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            | R 254 |                        |  |
|                              | 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  | 0            | R255  |                        |  |
| GRAY<br>SCALE<br>OF<br>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<br>↑         | 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            | 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  | 0            | G2    |                        |  |
|                              |                   | :           | :  | :  | :  | :  | :  |    |    | :  | :     | :  | :  | :  | :  |    |    | :  | :  | :    | :  | :  | :  |    |    | G3~<br>G252  |       |                        |  |
|                              |                   | :           | :  | :  | :  | :  | :  |    |    | :  | :     | :  | :  | :  | :  |    |    | :  | :  | :    | :  | :  | :  |    |    |              |       |                        |  |
|                              | ↓<br>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  | 0            | G253  |                        |  |
|                              |                   | 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            | G254  |                        |  |
|                              | 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  | 0            | G255  |                        |  |
| GRAY<br>SCALE<br>OF<br>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<br>↑         | 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            | 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  | 0            | B2    |                        |  |
|                              |                   | :           | :  | :  | :  | :  | :  |    |    | :  | :     | :  | :  | :  | :  |    |    | :  | :  | :    | :  | :  | :  |    |    | B3~<br>B252  |       |                        |  |
|                              |                   | :           | :  | :  | :  | :  | :  |    |    | :  | :     | :  | :  | :  | :  |    |    | :  | :  | :    | :  | :  | :  |    |    |              |       |                        |  |
|                              | ↓<br>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  | 1            | B253  |                        |  |
|                              |                   | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1    | 1  | 1  | 1  | 1  | 1  | 1            | B254  |                        |  |
|                              | 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  | 1            | B255  |                        |  |

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

## 5. Interface Timing

**Samsung Secret**

### 5.1 Timing Parameters ( DE mode )

| SIGNAL                  | ITEM                  | SYMBOL   | MIN. | TYP. | MAX. | Unit   | NOTE |
|-------------------------|-----------------------|----------|------|------|------|--------|------|
| Clock                   | Frequency             | $1/T_C$  | 260  | 297  | 305  | MHz    | -    |
| Hsync                   |                       | $F_H$    | 120  | 135  | 140  | KHz    | -    |
| Vsync                   |                       | $F_V$    | 100  | 120  | 125  | Hz     | -    |
| Vertical Display Term   | Active Display Period | $T_{VD}$ | -    | 1080 | -    | Lines  | -    |
|                         | Vertical Total        | $T_V$    | 1092 | 1125 | 1380 | Lines  | -    |
| Horizontal Display Term | Active Display Period | $T_{HD}$ | -    | 1920 | -    | Clocks | -    |
|                         | Horizontal Total      | $T_H$    | 2092 | 2200 | 2348 | 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  $V_{DD} = 3.3\text{ V}$

(3) Spread spectrum

- Modulation rate (max) : 1.5 %

- Modulation Frequency : under 100 KHz

### 5.2 LVDS Input Data Characteristics

| ITEM                       |                            | SYMBOL     | Min. | Typ. | Max. | UNIT | NOTE |
|----------------------------|----------------------------|------------|------|------|------|------|------|
| Input Data Position        | F                          | $t_{RSRM}$ | -    | -    | 400  | ps   | -    |
|                            | $F = 78\text{MHz}$         |            | -    | -    | 450  | ps   |      |
|                            | $F_{IN} = 74.25\text{MHz}$ |            | -    | -    | 500  | ps   |      |
| Input Data Position        | $F_{IN} = 85\text{MHz}$    | $t_{RSLM}$ | -400 | -    | -    | ps   |      |
|                            | $F_{IN} = 78\text{MHz}$    |            | -450 | -    | -    | ps   |      |
|                            | $F_{IN} = 74.25\text{MHz}$ |            | -500 | -    | -    | ps   |      |
| Input common mode voltage  |                            | $V_{CM}$   | 0.3  | -    | 1.8  | V    | -    |
| Differential Input Voltage |                            | $ V_{ID} $ | 200  | 350  | 600  | mV   | -    |

Note) When the skew is measured the Spread Spectrum should be 0%

**MODEL**

**LTA460HJ15**

**Doc. No**

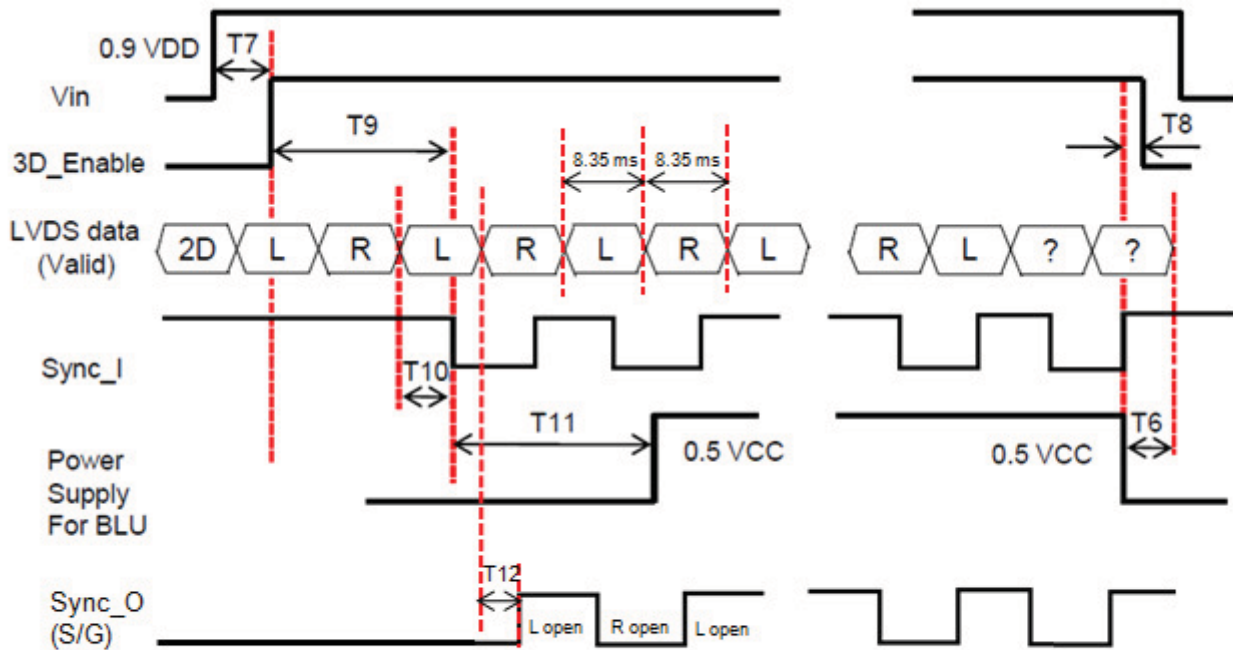
**06-000-G-20110715**

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## 5.3 3D mode Sequence

### 5.3.1 3D Sequence



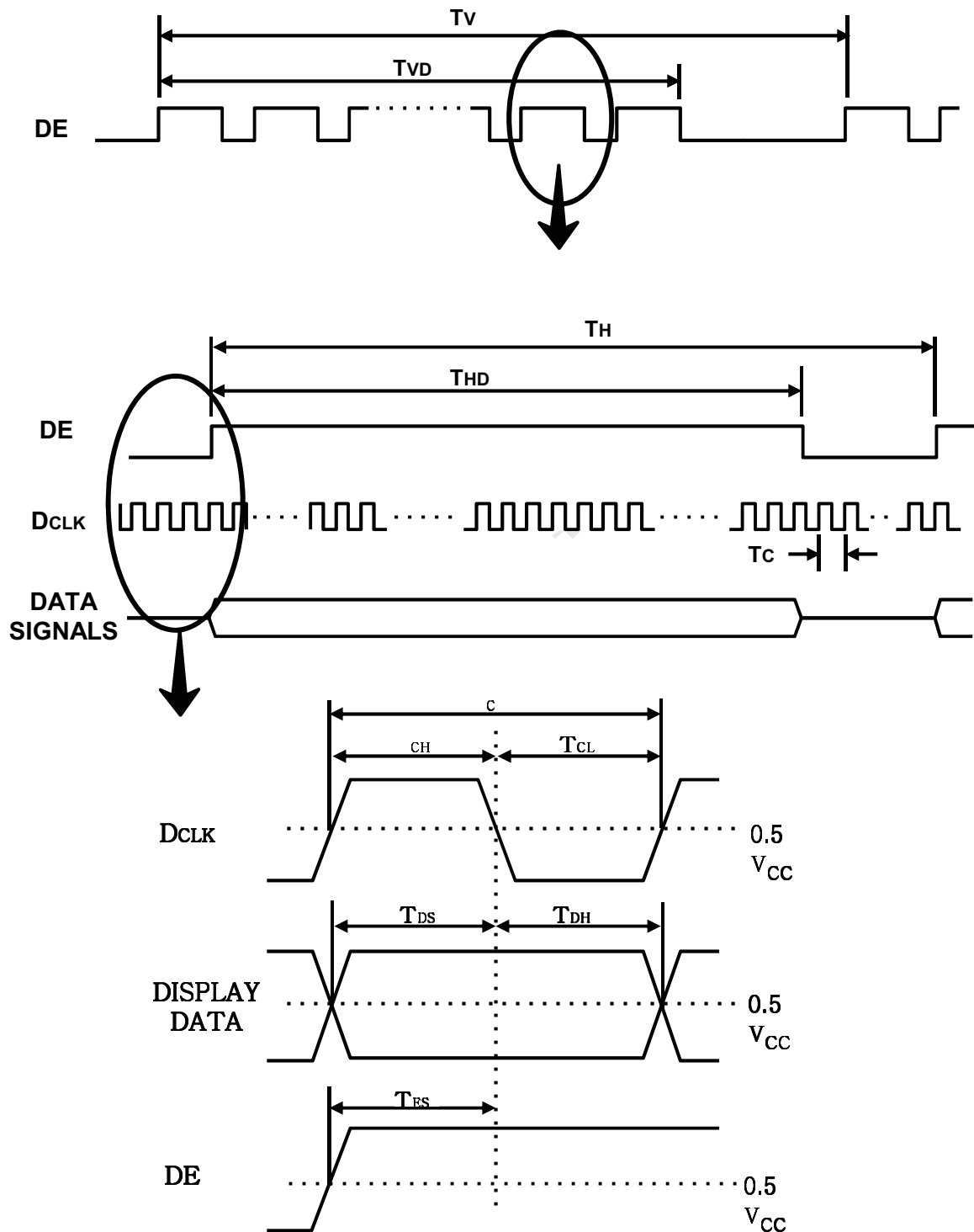
|     | spec             | Measure | Result |     | spec        | Measure | Result |
|-----|------------------|---------|--------|-----|-------------|---------|--------|
| T5  | $\geq 1000$ msec |         |        | T8  | $> 0$ msec  |         |        |
| T6  | $\geq 100$ msec  |         |        | T9  | $> 0$ msec  |         |        |
| T7  | $\geq 2$ sec     |         |        | T10 | Typ. 5 msec |         |        |
| T12 | Typ. 4.5msec     |         |        |     |             |         |        |

※ T10 :  $Sync\_I$  is checked with Valid Active L frame

### 5.3.2 Level of 3D Control signal

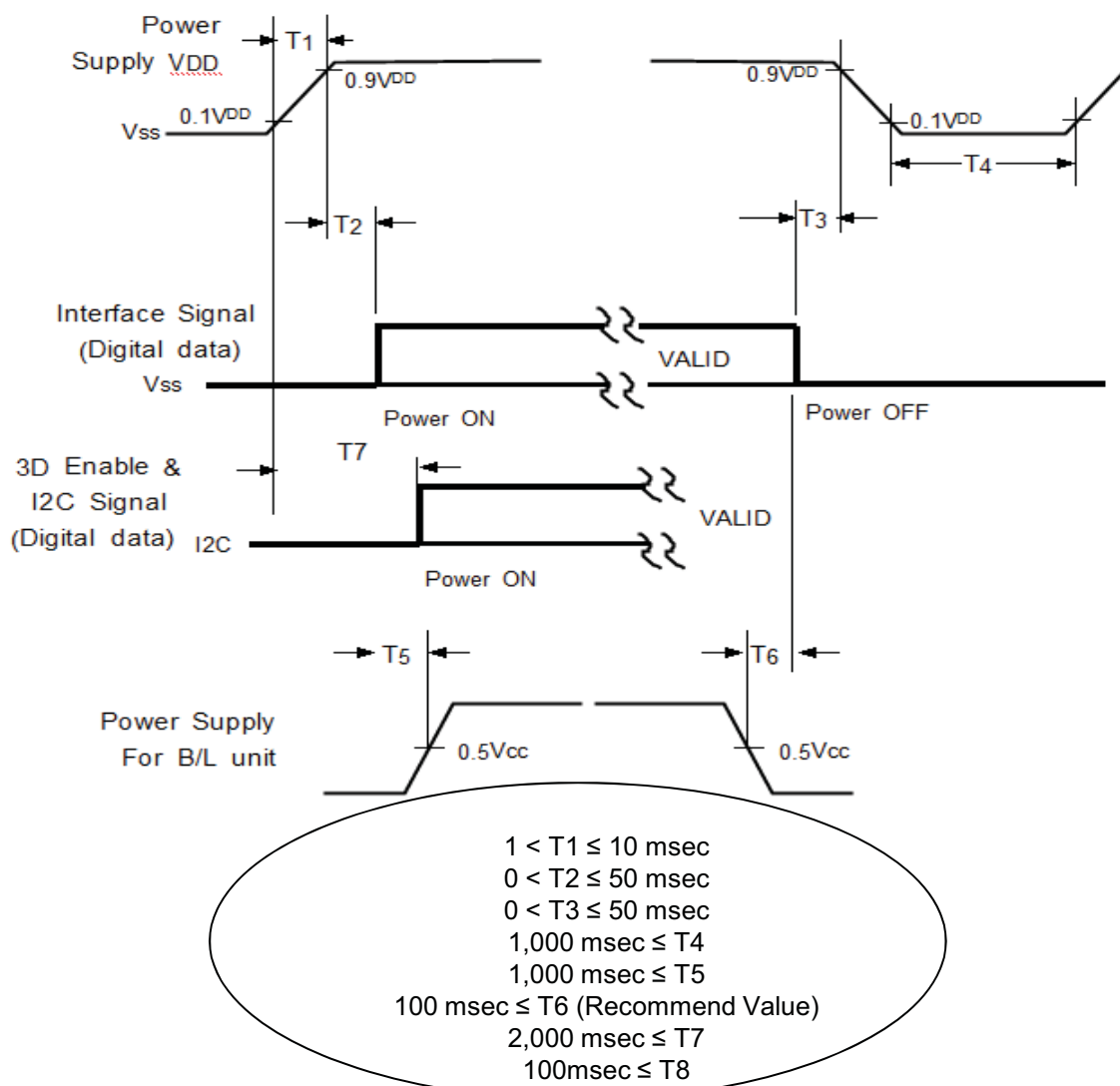
| Test Items      | Test Condition                           |      | Spec |     |
|-----------------|------------------------------------------|------|------|-----|
|                 |                                          |      | Min  | Max |
| 3D Enable Level | C-PBA Input Level<br>(Change to 3D mode) | High | 2.7  | 3.3 |
|                 |                                          | Low  | 0.0  | 0.4 |
| 3D_SYNC_I       | C-PBA Input Level<br>(L/R Sync)          | High | 2.7  | 3.3 |
|                 |                                          | Low  | 0.0  | 0.4 |
| 3D_SYNC_O       | Shutter Glasses Sync<br>Level            | High | 2.7  | 3.3 |
|                 |                                          | Low  | 0.0  | 0.4 |

# 5.4 Timing diagrams of interface signal ( DE mode )



## 5.5 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.



The supply voltage of the external system for the Module input should be the same as the definition of  $V_{DD}$ .

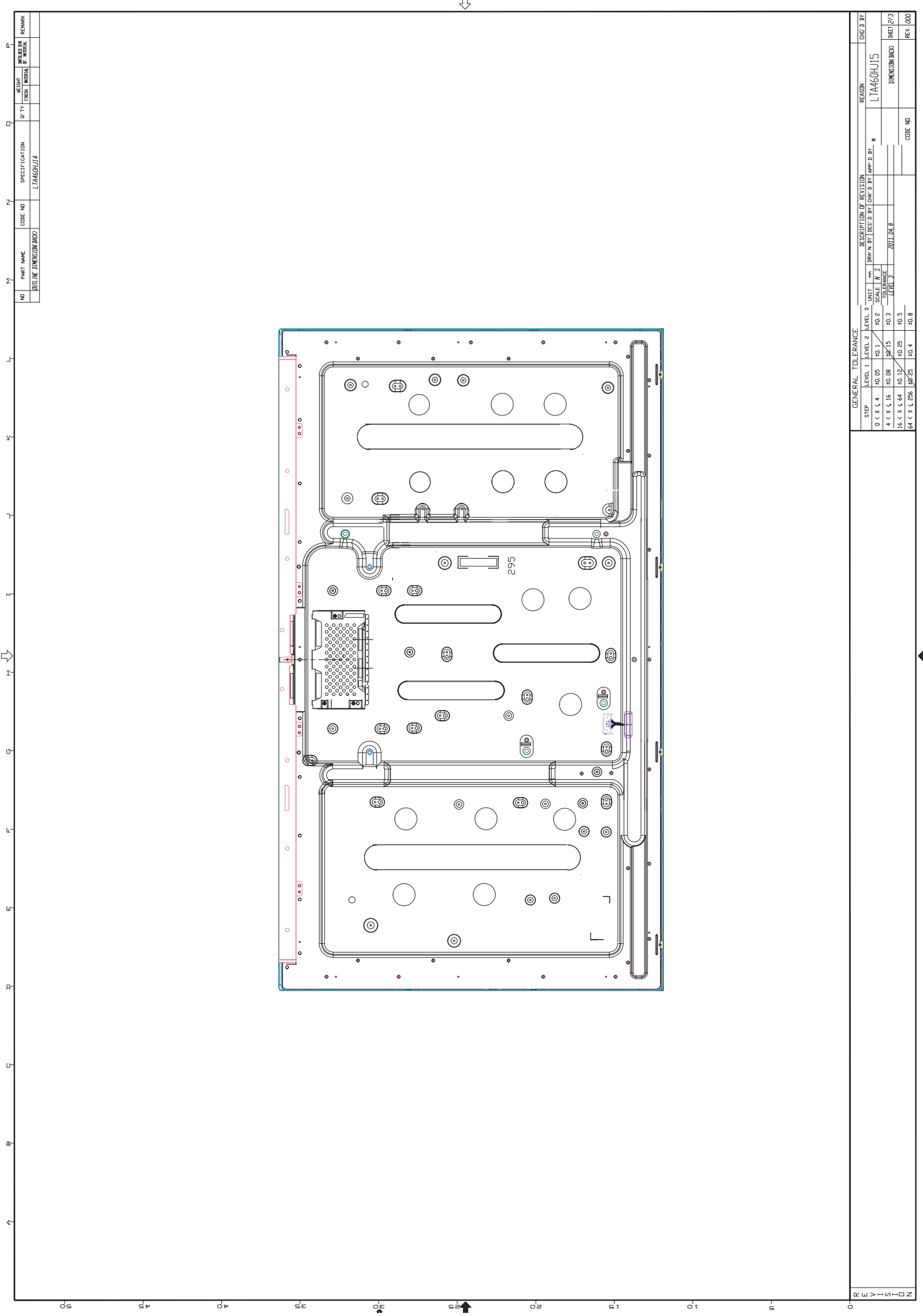
Apply the LED voltage within the LCD operation range. When the back light turns on before the LCD operation or the LCD turns off before the back light turns off, the display may momentarily show abnormal screen.

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.





## 7. PACKING

### 8.1 CARTON (Internal Package)

#### (1) Packing Form

Corrugated fiberboard box and corrugated cardboard as shock absorber

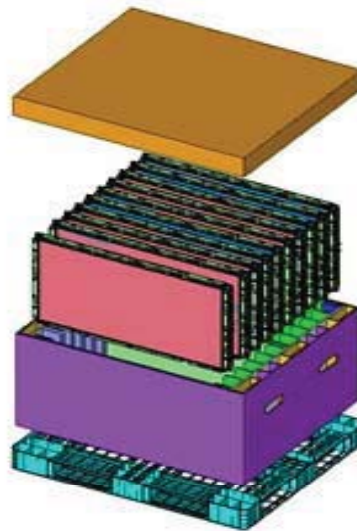
#### (2) Packing Method

**Packing  
-Pallet Box**

**LCD Module**

**Packing  
-Pallet Box**

**Pallet-Plastic**



### 8.2 Packing Specification

| Item                | Specification                   | Remark                                                                                                                          |
|---------------------|---------------------------------|---------------------------------------------------------------------------------------------------------------------------------|
| LCD Packing         | 16 ea /<br>(Packing-Pallet Box) | 1. 10.5 kg / LCD (16ea)<br>2. 12 Kg / Cushion-pallet (2ea)<br>3. 8 Kg / Packing-Pallet Box (1ea)<br>4. Packing Material : Paper |
| Pallet              | 1Box / Pallet                   | 1. Pallet weight = 8.8 kg                                                                                                       |
| Packing Direction   | Vertical                        |                                                                                                                                 |
| Total Pallet Size   | H x V x height                  | 1270mm(H) x 1150mm(V) x 844mm(height)                                                                                           |
| Total Pallet Weight | 196.8kg                         | Pallet(8.8kg) + Module (10.5 * 16=168kg) +<br>Cushion (up + bottom =12kg) + Pallet-BOX(8kg)                                     |



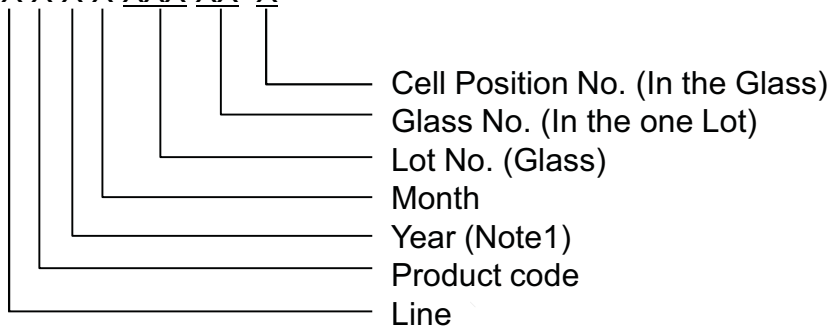
## 8. MARKING & OTHERS

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

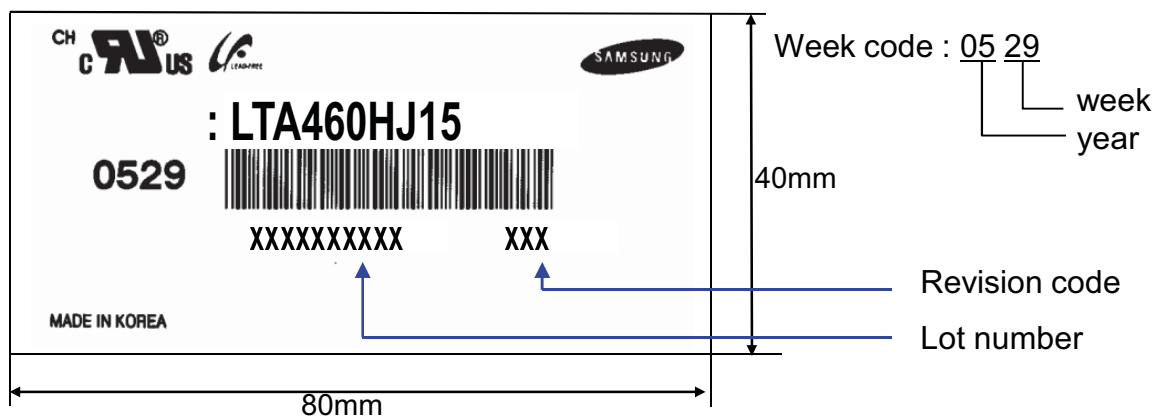
(1) Part number : **LTA460HJ15**

(2) Revision: Three letters

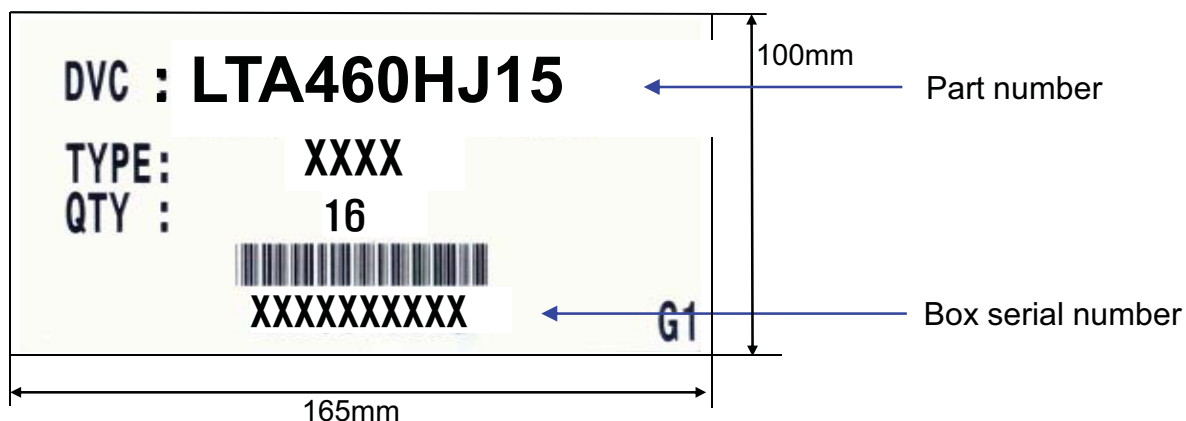
(3) Lot number : X X X X XXX XX X



(4) Nameplate Indication



(5) Packing box attach



(6) Others

1. After service part

LEDs cannot be replaced because of the narrow bezel structure.

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

## 9. General Precautions

### 9.1 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 converter 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 LED 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 Electrostatic discharge. Otherwise the ASIC IC or Semiconductor 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 disassemble shield case of converter & LVDS board.
- (m) Do not connect N.C pins. (Samsung internal use only)
- (n) Protection film for polarizer on the Module should be slowly peeled off just before use so that the electrostatic charge can be minimized. Must put on antistatic glove while handle a module
- (o) Pins of I/F connector should not be touched directly with bare hands.

## 9.2 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 5 to 40 °C 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.
- (d) Storage period is recommended not to excess 1 year.

## 9.3 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 converter power supply should be connected directly with a minimized length. A longer cable between the back light and the converter may cause lower luminance of LED and may require higher startup voltage (Vs).

## 9.4 Operation Condition Guide

- (a) The LCD product should be operated under normal conditions.  
Normal condition is defined as below;
  - Temperature : 20 ~ 15 °C
  - Humidity : 55 ~ 20%
  - 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.

**Revision History**

| Date             | Rev. No | Page | Summary      |
|------------------|---------|------|--------------|
| 15. Jul.<br>2011 | 000     | all  | First issued |