



ELECTRONICS

Approval

Customer :

Issued Date : Sept. 16, 2005

**SAMSUNG TFT-LCD**

**MODEL NO. : LTA460WS-L03**

Note : \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

*Any Modification of Spec is not allowed without SEC's permission.*

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**Samsung Electronics Co . , LTD.**



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Revision History

| Date          | Revision No. | Page | Summary                                   |
|---------------|--------------|------|-------------------------------------------|
| Sept.16, 2005 | 000          | All  | LTA460WS-L03 Model spec was issued first. |

## General Description

### \* Description

LTA460WS-L03 is a color active matrix TFT (Thin Film Transistor) liquid crystal display (LCD) that uses amorphous silicon TFTs as a switching devices. This model is composed of a TFT LCD panel, a driver circuit and a back-light system. The resolution of a 46.0" contains 1366 x 768 pixels and can display up to 16.7 million colors with wide viewing angle of 89° or higher in all directions.

### \* Features

- High contrast ratio, high aperture structure
- SPVA(Super Patterned Vertical Align) mode
- Wide viewing angle( $\pm 178^\circ$ )
- High speed response
- WXGA (1366 x 768 pixels) resolution (16:9)
- Low Power consumption
- Direct Type 24 CCFTs(Cold Cathode Fluorescent Tube)
- LVDS (Low Voltage Differential Signal) interface. (1pixel/clock)

### \* Applications

Home-alone Multimedia TFT-LCD TV  
 Display terminals for AV application products  
 High Definition TV (HDTV)

### \* General information

| Items             | Specification              | Unit   | Note                             |
|-------------------|----------------------------|--------|----------------------------------|
| Display area      | 1018.353(H) × 572.544(V)   | mm     | -                                |
| Driver element    | a-Si TFT active matrix     |        | -                                |
| Display colors    | 16.7M(8bits-true)          | colors | -                                |
| Number of pixels  | 1366 x 768                 | pixel  | 16:9                             |
| Pixel pitch       | 0.7455(H) × 0.7455(V)      | mm     | R,G,B Vertical Strip = 0.2485(H) |
| Display mode      | Normally Black             |        | -                                |
| Surface treatment | Haze 44%, Hard Coating(3H) |        | Anti-Glare                       |

## \* Mechanical information

| Item        |               | Min. | Typ.   | Max.   | Note |
|-------------|---------------|------|--------|--------|------|
| Module size | Horizontal(H) | -    | 1083.0 | 1084.0 | mm   |
|             | Vertical(V)   | -    | 627.0  | 628.0  | mm   |
|             | Depth(D)      | -    | 56.5   | 57.5   | mm   |
| Weight      |               | -    | 16,000 | 16,500 | g    |

## 1. Absolute Maximum Ratings

## 1.1 Absolute ratings of environment

| Item                          | Symbol           | Min. | Max. | Unit | Note    |
|-------------------------------|------------------|------|------|------|---------|
| Storage temperature           | T <sub>STG</sub> | -20  | 60   | ℃    | (1)     |
| Operating temperature         | T <sub>OPR</sub> | 0    | 50   | ℃    | (1)     |
| Shock ( non - operating )     | Snop             | -    | 50   | G    | (2),(4) |
|                               |                  |      | 30   |      |         |
| Vibration ( Non - operating ) | Vnop             | -    | 1.5  | G    | (3),(4) |

Note (1) Temperature and relative humidity range are shown in the figure below.

93.8 % RH Max. ( 40 °C ≥ Ta )

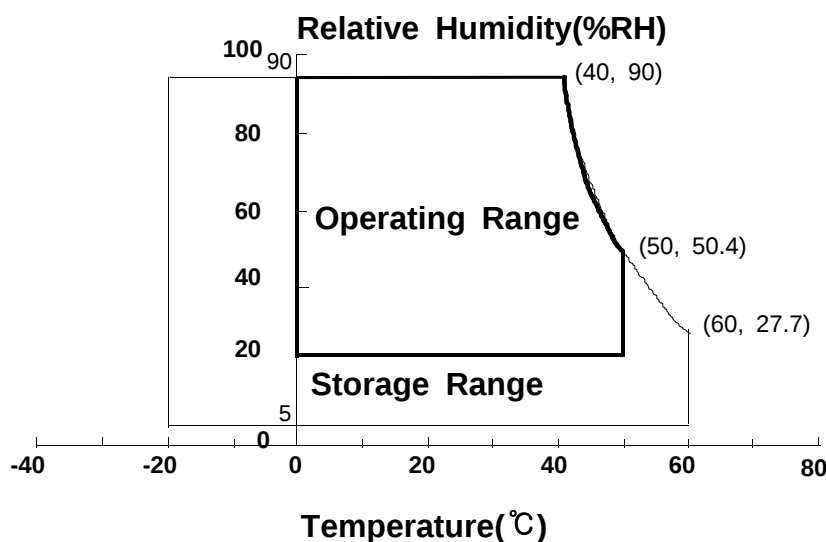
Maximum wet-bulb temperature at 39 °C or less.

(Ta > 40 °C) No condensation.

(2) 11ms, sine wave, 1 time for ±X, ±Y, ±Z axis

(3) 10~300Hz/1.5G (10min/cycle, 30min for X,Y,Z axis)

(4) At testing Vibration and Shock, the fixture in holding the Module to be tested have to be hard and rigid enough so that the Module would not be twisted or bent by the fixture.



## 1.2 ELECTRICAL ABSOLUTE RATINGS

### (1) TFT LCD MODULE

| Item                 |            | Symbol | Min.    | Max. | Unit | Note |
|----------------------|------------|--------|---------|------|------|------|
| Power Supply Voltage | LCD Module | VDD    | Vss-0.5 | 5.5  | V    | (1)  |

(Vss = GND = 0 V)

NOTE (1) Within Ta ( 25 ± 2 °C)

## 2. Optical Characteristics

The following items are measured under stable conditions. The optical characteristics

|          |              |          |                 |      |        |
|----------|--------------|----------|-----------------|------|--------|
| Doc . No | LTA460WS-L03 | Rev. No. | 01-000-G-050916 | Page | 6 / 30 |
|----------|--------------|----------|-----------------|------|--------|

should be measured in a dark room or equivalent state with the methods shown in Note (1).

◆ Measuring equipment : SR-3, BM-7

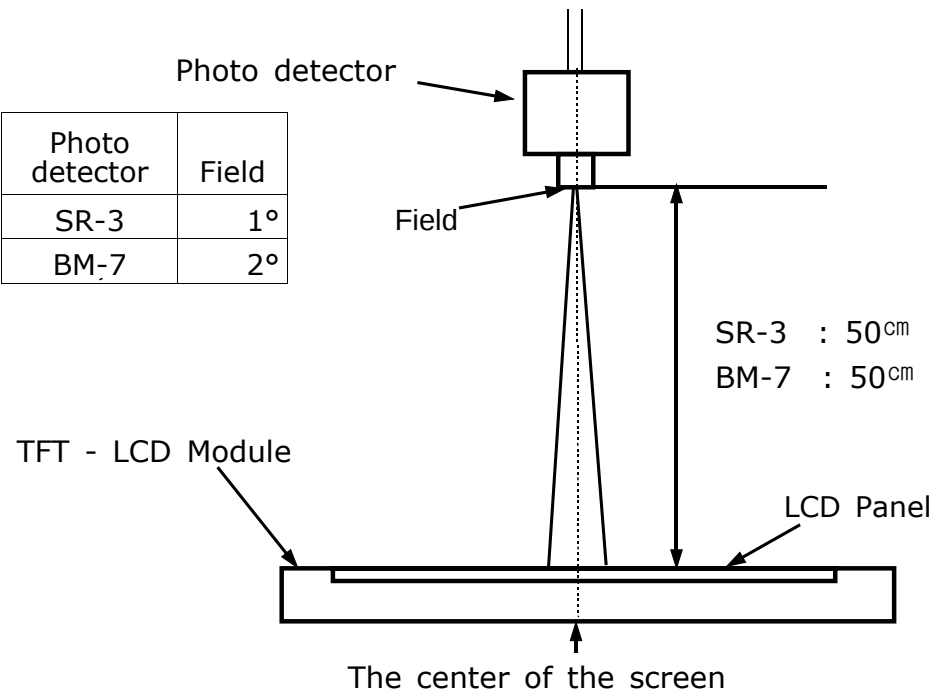
\*  $T_a = 25 \pm 2^\circ\text{C}$ ,  $V_{DD} = 5\text{V}$ ,  $f_v = 60\text{Hz}$ ,  $f_{DCLK} = 80\text{MHz}$ ,  $I_L = 6.0\text{mA}$

| Item                                     |         | Symbol     | Condition                                      | Min.          | Typ.  | Max.          | Unit              | Note        |
|------------------------------------------|---------|------------|------------------------------------------------|---------------|-------|---------------|-------------------|-------------|
| Contrast Ratio<br>(Center of screen)     |         | C/R        | Normal<br>$\theta_{L,R}=0$<br>$\theta_{U,D}=0$ | 800           | 1000  | -             |                   | (3)<br>SR-3 |
| Response<br>Time                         | Rising  | Tr         |                                                | -             | 10    | 13            | msec              | (4)<br>BM-7 |
|                                          | Falling | Tf         |                                                | -             | 6     | 7             |                   |             |
| Luminance of White<br>(Center of screen) |         | YL         |                                                | 400           | 500   | -             | cd/m <sup>2</sup> | (5)<br>SR-3 |
| Color<br>Chromaticity<br>(CIE 1931)      | Red     | Rx         | Viewing<br>Angle                               | TYP.<br>-0.03 | 0.648 | TYP.<br>+0.03 |                   | (6)<br>SR-3 |
|                                          |         | Ry         |                                                |               | 0.333 |               |                   |             |
|                                          | Green   | Gx         |                                                |               | 0.271 |               |                   |             |
|                                          |         | Gy         |                                                |               | 0.592 |               |                   |             |
|                                          | Blue    | Bx         |                                                |               | 0.141 |               |                   |             |
|                                          |         | By         |                                                |               | 0.066 |               |                   |             |
|                                          | White   | Wx         |                                                |               | 0.280 |               |                   |             |
|                                          |         | Wy         |                                                |               | 0.290 |               |                   |             |
| Color Temperature                        |         | k          | -                                              | 10000         | -     |               |                   |             |
| Color Gamut                              |         | -          | -                                              | 72            | -     | %             |                   |             |
| Viewing<br>Angle                         | Hor.    | $\theta_L$ | C/R $\geq 10$                                  | 75            | 89    | -             | Degrees           | (7)<br>SR-3 |
|                                          |         | $\theta_R$ |                                                | 75            | 89    | -             |                   |             |
|                                          | Ver.    | $\theta_U$ |                                                | 75            | 89    | -             |                   |             |
|                                          |         | $\theta_D$ |                                                | 75            | 89    | -             |                   |             |
| Brightness<br>Uniformity<br>(9 points)   |         | Buni       | -                                              | -             | 25    | %             | (8)<br>SR-3       |             |

Note 1) Test Equipment Setup

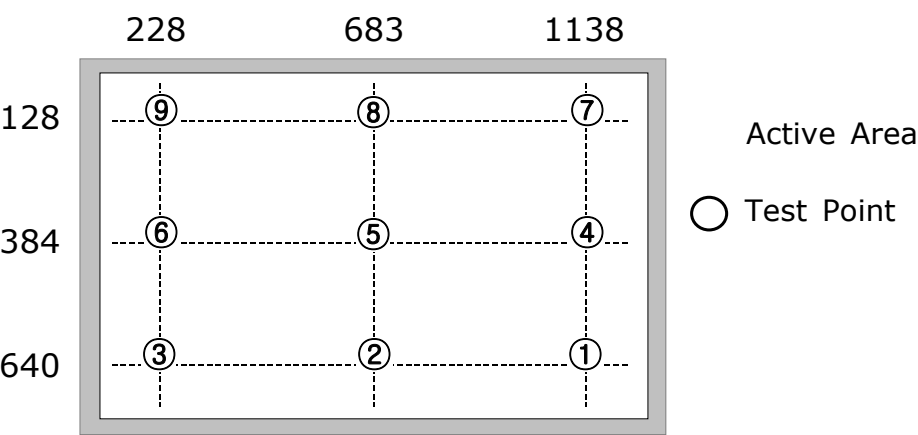
The measurement should be executed in a stable, windless and dark room between 30min and 40min after lighting the back-light at the given temperature for stabilization of the back-light. This should be measured in the center of screen.

A single lamp current : 6.0 mA  
Environment condition : Ta = 25 ± 2 °C



Optical Measuring Equipment Setup

Note 2) Definition of test point

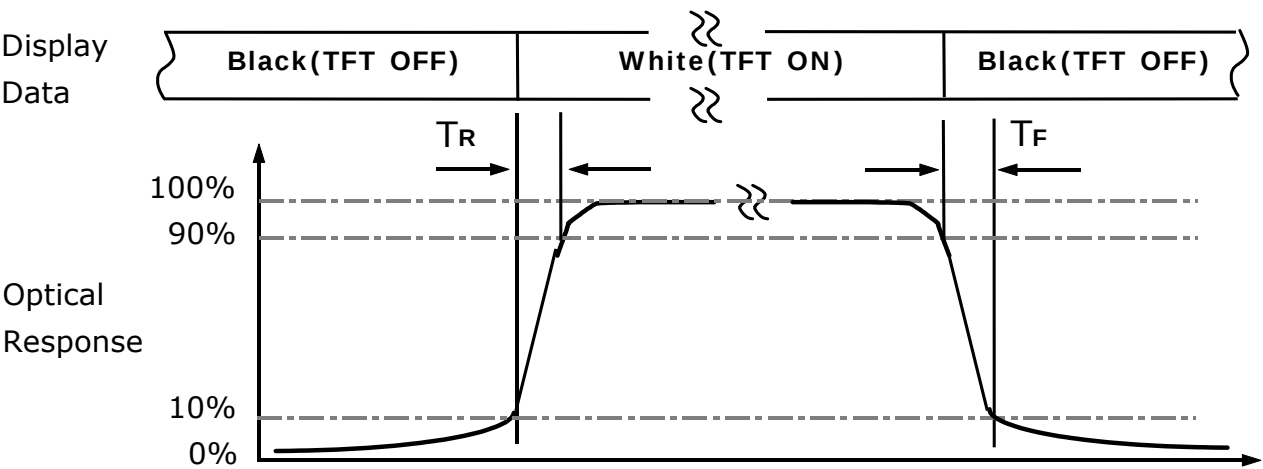


Note 3) Definition of Contrast Ratio (C/R) : Ratio of gray max (Gmax) & gray min (Gmin) at the center point(5) of the panel

$$CR = \frac{G_{max}}{G_{min}}$$

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

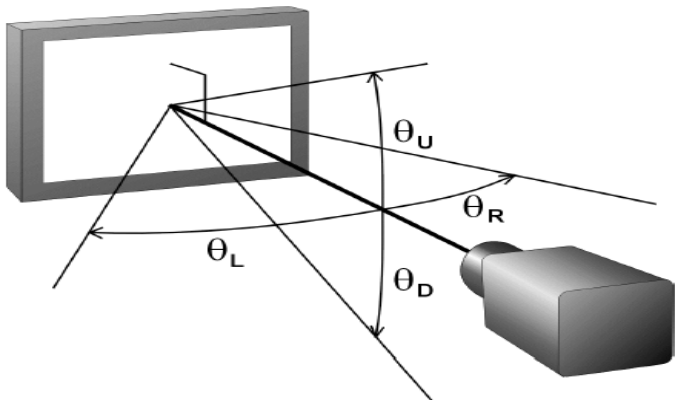
Note 4) Definition of Response time : Sum of TR ,TF



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

Note 6) Definition of Color Chromaticity (CIE 1931)  
Color coordinate of Red , Green , Blue & White at center point(5).

Note 7) Definition of Viewing Angle : Viewing angle range (CR≥10 )



Note 8) Definition of 9 points brightness uniformity

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

Bmax : Maximum brightness  
Bmin : Minimum brightness

### 3. Electrical Characteristics

#### 3.1 TFT LCD MODULE

Ta = 25°C

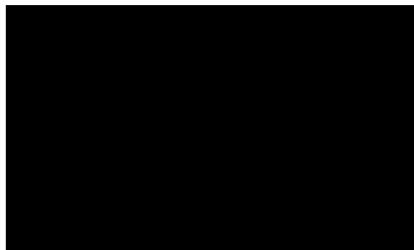
| Item                    |              | Symbol            | Min. | Typ.  | Max. | Unit | Note    |
|-------------------------|--------------|-------------------|------|-------|------|------|---------|
| Voltage of Power Supply |              | V <sub>DD</sub>   | 4.5  | 5.0   | 5.5  | V    | (1)     |
| Power Consumption       | (a)Black     | I <sub>DD</sub>   | -    | 1750  | -    | mA   | (2),(3) |
|                         | (b)White     |                   | -    | 2000  | -    | mA   |         |
|                         | (c)N-Pattern |                   | -    | 2300  | 2600 | mA   |         |
| Vsync Frequency         |              | f <sub>V</sub>    | -    | 60    | -    | Hz   |         |
| Hsync Frequency         |              | f <sub>H</sub>    | 46.3 | 50.18 | -    | kHz  |         |
| Main Frequency          |              | f <sub>DCLK</sub> | 65   | 80    | 90   | MHz  |         |
| Rush Current            |              | I <sub>RUSH</sub> | -    | 4.5   | 6    | A    | (4)     |

Note (1) Main pixel clock frequency is the value which is measured at the input of LVDS transmitter.

(2) f<sub>V</sub>=60Hz, f<sub>DCLK</sub> =80MHz, V<sub>DD</sub> = 5.0V, DC Current.

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

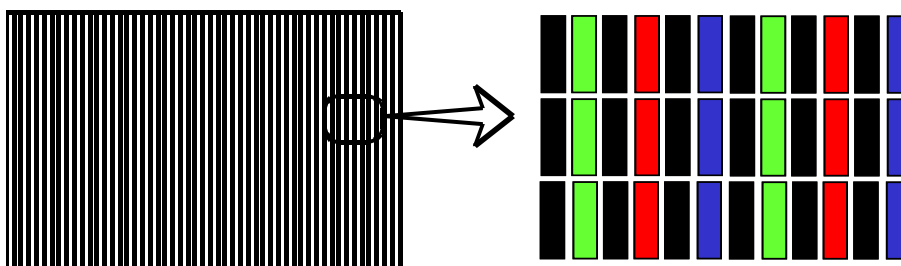
(a) Black Pattern



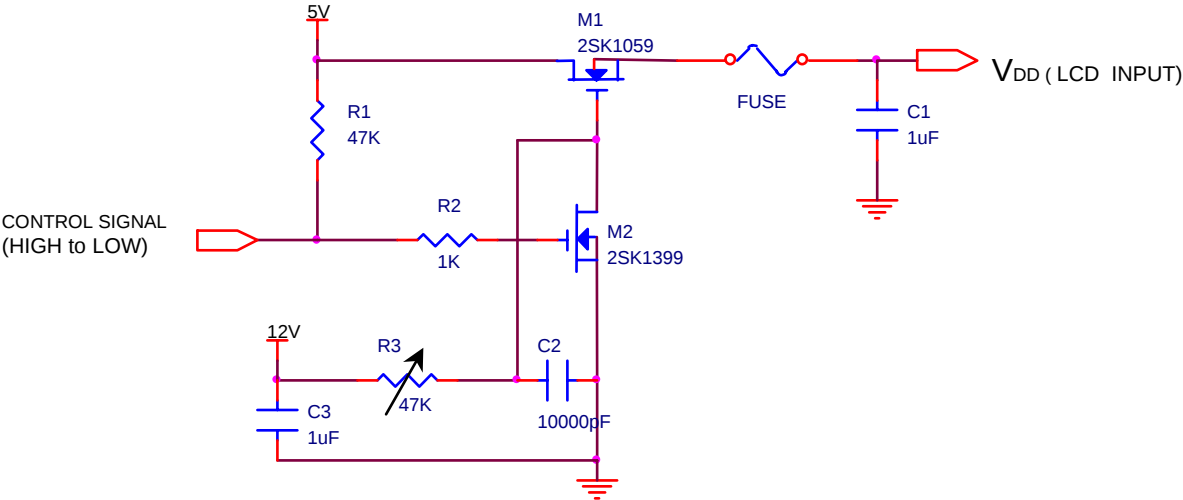
(b) White Pattern



(C) N-pattern

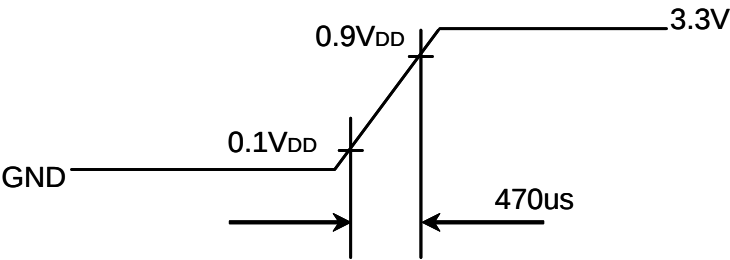


(4) Measurement Conditions



Note : Control Signal : High(+5V) -->Low(Ground)  
All Signal lines to panel except for power 5V : Ground  
The rising time of supplied voltage is controlled to 470us by R and C value.

V<sub>DD</sub> rising time is 470us



3.2 BACK-LIGHT UNIT

The back-light system contains 24 direct-lighting type CCFTs (Cold Cathode Fluorescent Tube). Life time (Hr) of a lamp, 50,000 hours, is defined as the time in which it continues to operate under the condition of Ta = 25±2°C and typical luminance for a lamp until the brightness becomes 50% or lower than it's original value.

| Parameter           | SYMBOL | MIN.   | TYP. | MAX.      | UNIT              | NOTE |
|---------------------|--------|--------|------|-----------|-------------------|------|
| Lamp Current        | IL     | 3.0    | 5.5  | 7.0       | mA <sub>rms</sub> | (1)  |
| Lamp Voltage        | VL     | 1700   | 1780 | 1940      | V <sub>rms</sub>  | (1)  |
| Lamp Frequency      | fL     | 40     | -    | 80        | kHz               | (2)  |
| Operating Life Time | Hr     | 50,000 | -    | -         | Hour              | (3)  |
| Start Up Voltage    | Vs     | -      | -    | 0°C:2500  | V <sub>rms</sub>  | (4)  |
|                     |        |        |      | 25°C:1990 |                   |      |

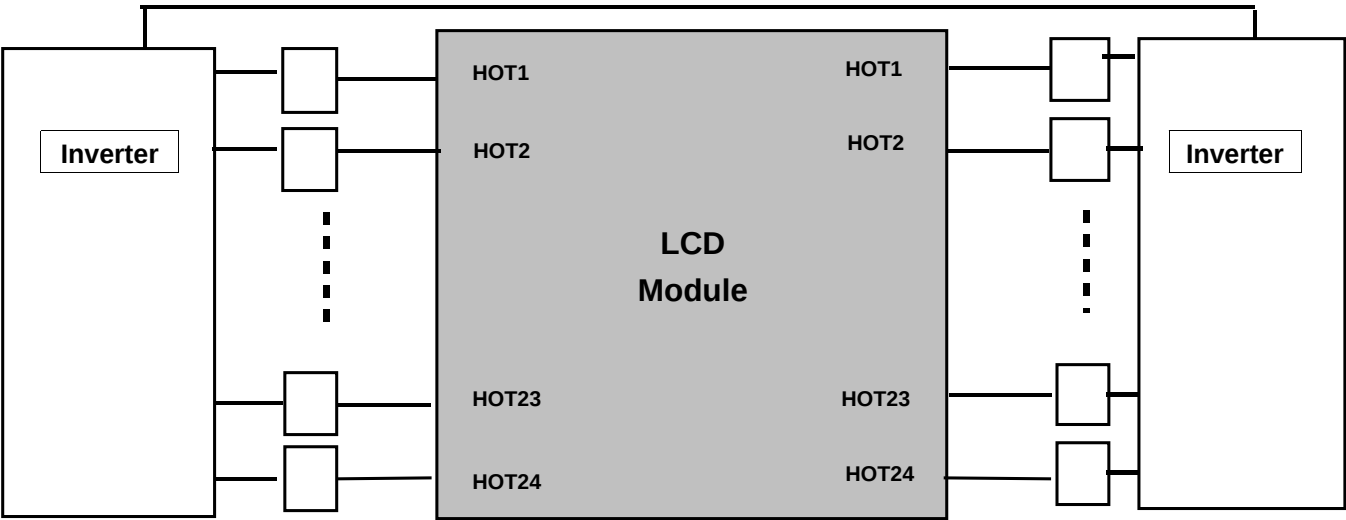
**Note)** The waveform of the inverter output voltage must be area symmetric and the design of the inverter must have specifications for the modularized lamp. Specified values are for a single lamp.

The performance of the back-light, for example life time or brightness, is much influenced by the characteristics of the DC-AC inverter for the lamp. So all the parameters of an inverter should be carefully designed so as not to produce too much leakage current from high-voltage output of the inverter.

When you design or order the inverter, please make sure that a poor lighting caused by the mismatch of the back-light and the inverter(miss lighting, flicker, etc.) never occur. When you confirm it, the module should be operated in the same condition as it is installed in your instrument.

Note (1) lamp current is measured with current meter.

Refer to the following block diagram of the back-light unit for more information.



- (2) Lamp frequency may produce interference with horizontal synchronous frequency and this may cause line flow on the display. Therefore We synchronized the lamp frequency to horizontal frequency.
- (3) Life time (Hr) of a lamp is defined as the time in which it continues to operate under the condition of  $T_a = 25 \pm 2^\circ\text{C}$  and  $I_L = 7.0 \text{ mArms}(\text{max})$  for a lamp until the brightness becomes 50% or lower than it's original value.
- (4) If an inverter has shutdown function it should keep its output for more than 1 second even if the lamp connector open. Otherwise the lamps may not to be turned on.

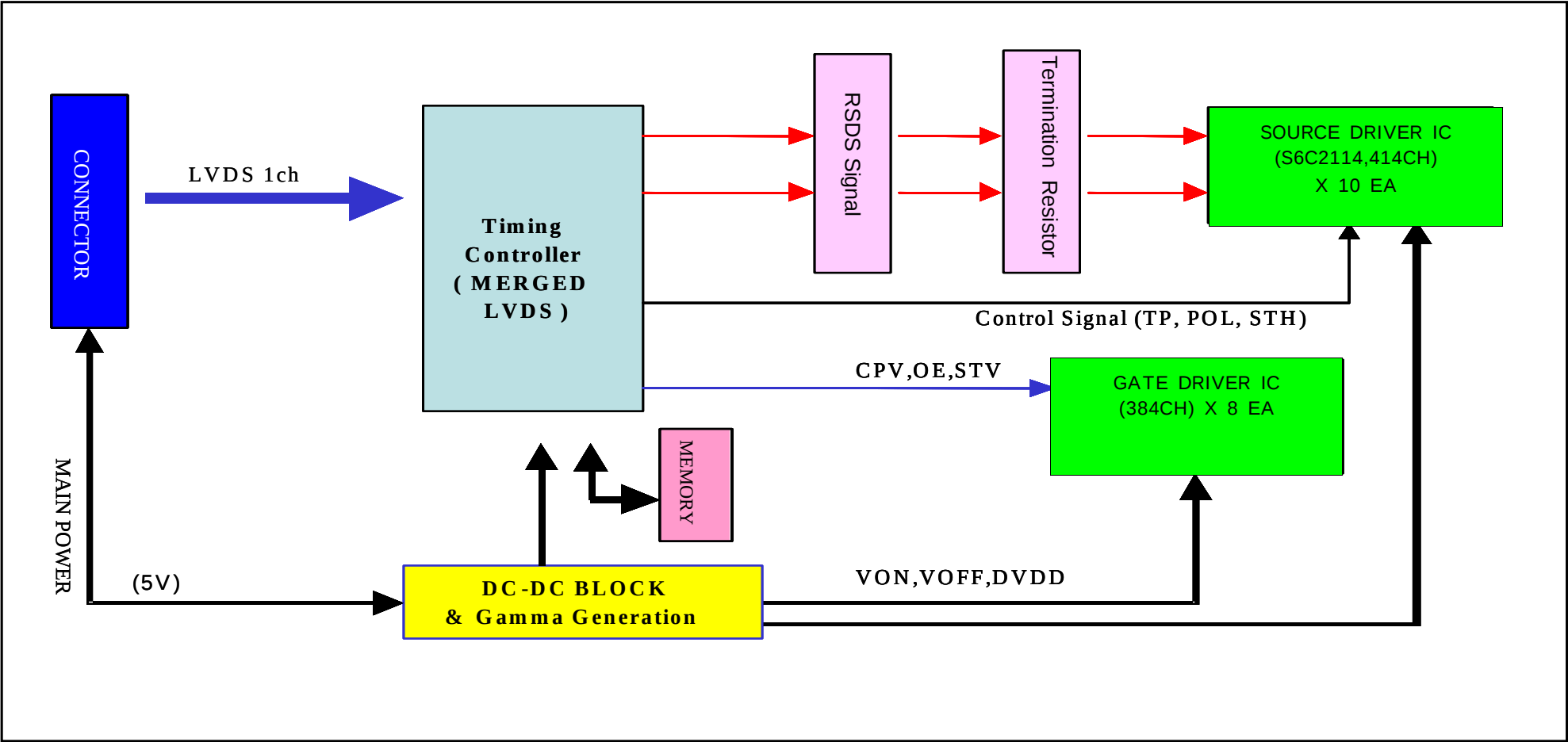
### 3.3 Inverter Input Condition & Specification

| Items            | Symbol   | Conditions               | Specifications |      |      | Unit  | Note                                         |
|------------------|----------|--------------------------|----------------|------|------|-------|----------------------------------------------|
|                  |          |                          | Min.           | Typ. | Max. |       |                                              |
| Input Voltage    | Vin      | -                        | 23             | 24   | 25   | V     | $T_a = 25^\circ\text{C}$                     |
| Input Current    | Iin      | Vin=24.0V,<br>Vdim=3.3 V | 7.65           | 8.5  | 9.35 | Adc   | After 120 min<br>Warm-up<br>@ Vin=24V<br>(1) |
| Lamp Current     | Io,max   | Vdim=3.3 V               | 5.0            | 5.5  | 6.0  | mArms |                                              |
|                  | Io,typ   | dim=2.5V                 | 73.5           | 83.5 | 88.5 | %     |                                              |
|                  | Io,min   | Vdim= 0 V                | 25             | 30   | 35   | %     |                                              |
| Frequency        | FL       | Vin=24 V<br>Adim=3.3V    | 65             | 67.5 | 70   | kHz   |                                              |
| Backlight On/Off | ON       | Vin=24                   | 2.4            | -    | 5.25 | V     |                                              |
|                  | OFF      | Vin=24                   | 0              | -    | 0.8  |       |                                              |
| Dimming Control  | Max Lum  | Vdim                     | -              | 3.3  | -    | V     | DC input                                     |
|                  | Min. Lum | Vdim                     | -              | 0    | -    |       |                                              |

Note (1) Power Consumption is measured when  $500[\text{cd}/\text{m}^2]$  of luminance which is the typ. luminance. Max Value of the Power Consumption is measured at initial turn on of the backlight.

4. Block Diagram

4.1 TFT LCD MODULE



## 5. Input Terminal Pin Assignment

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

| No. | Signal          | No. | Signal          |
|-----|-----------------|-----|-----------------|
| 1   | Do not connect* | 16  | GND             |
| 2   | Do not connect* | 17  | Rx3-            |
| 3   | Do not connect* | 18  | Rx3+            |
| 4   | GND             | 19  | GND             |
| 5   | Rx0-            | 20  | Do not connect* |
| 6   | Rx0+            | 21  | LVDS OPTION **  |
| 7   | GND             | 22  | Do not connect* |
| 8   | Rx1-            | 23  | GND             |
| 9   | Rx1+            | 24  | GND             |
| 10  | GND             | 25  | GND             |
| 11  | Rx2-            | 26  | VDD (+5V DC)    |
| 12  | Rx2+            | 27  | VDD (+5V DC)    |
| 13  | GND             | 28  | VDD (+5V DC)    |
| 14  | RxCLK-          | 29  | VDD (+5V DC)    |
| 15  | RxCLK+          | 30  | VDD (+5V DC)    |

\* NOT CONNECTED : THIS PINS ARE ONLY USED FOR SEC INTERNAL OPERATIONS.

\*\* LVDS OPTION : IF THIS PIN : HIGH (3.3 V) → NORMAL NS LVDS FORMAT  
OTHERWISE : LOW (GND) OR OPEN(NC) → JEIDA LVDS FORMAT

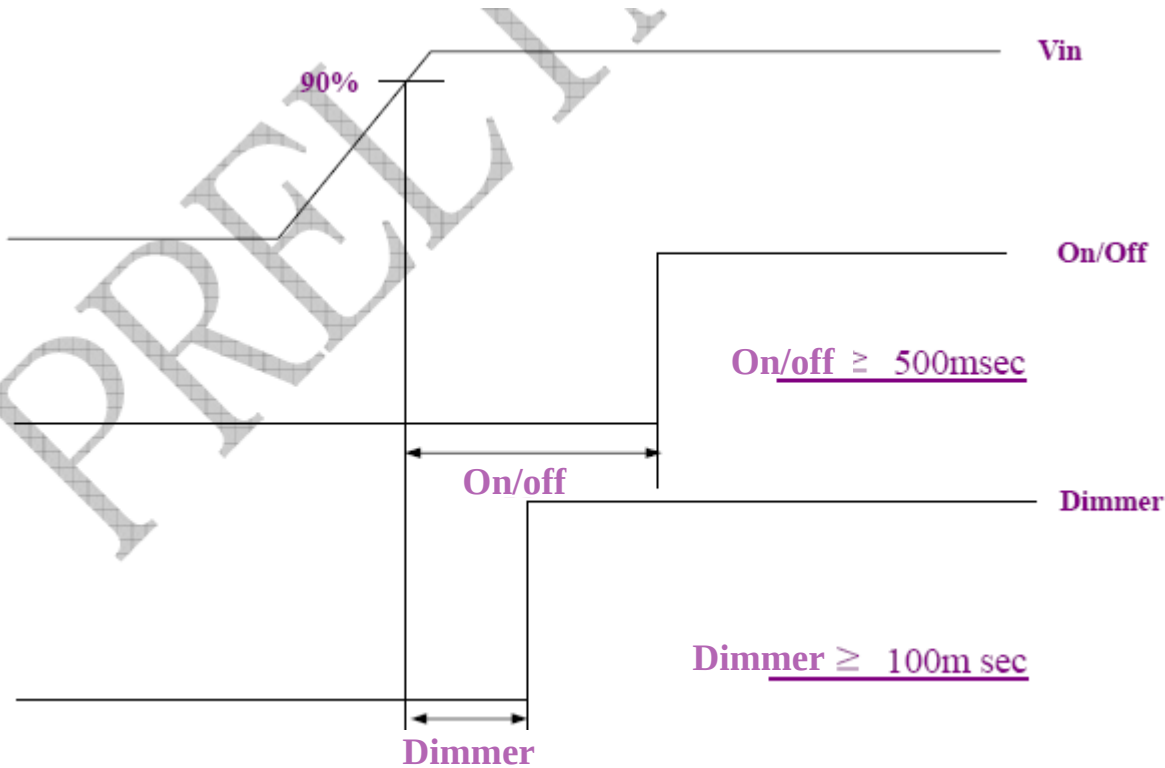
\*\*\* Sequence : On =  $V_{dd}(T1) \geq \text{LVDS Option} \geq \text{Interface Signal}(T2)$   
OFF =  $\text{Interface Signal}(T3) \geq \text{LVDS Option} \geq V_{dd}$

5.2. Inverter Input Pin Configuration

Connector : S14B-PH-SM3-TB(JST)

| 1  | DC 24V                                                   |
|----|----------------------------------------------------------|
| 2  | DC 24V                                                   |
| 3  | DC 24V                                                   |
| 4  | DC 24V                                                   |
| 5  | DC 24V                                                   |
| 6  | GND                                                      |
| 7  | GND                                                      |
| 8  | GND                                                      |
| 9  | GND                                                      |
| 10 | GND                                                      |
| 11 | Fail Detection*(normal: GND, abnormal : float)           |
| 12 | Inverter Enable (DC-0.3 to 0.8V off, DC 2.4 to 5.25V on) |
| 13 | Brightness(DC 0V : Vbr=min, DC 3.3V : Vbr=Max)           |
| 14 | No connection                                            |

5.3 Inverter Input Power Sequence



## 5.4 LVDS Interface

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

|             | LVDS pin     | JEIDA -DATA | VESA -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   |

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

| COLOR               | DISPLAY | 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      |  |                  |
|                     | ↑       | 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 |  |                  |
|                     |         | :           | :  | :  | :  | :  | :  | :  | :  | :  | :     | :  | :  | :  | :  | :  | :  | :  | :  | :    | :  | :  | :  | :  | :  |         |  |                  |
|                     | ↓       | 1           | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | R253    |  |                  |
|                     |         | LIGHT       | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | R254    |  |                  |
|                     | 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  | R255    |  |                  |
| 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      |  |                  |
|                     | ↑       | 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 |  |                  |
|                     |         | :           | :  | :  | :  | :  | :  | :  | :  | :  | :     | :  | :  | :  | :  | :  | :  | :  | :  | :    | :  | :  | :  | :  | :  |         |  |                  |
|                     | ↓       | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 0     | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | G253    |  |                  |
|                     |         | LIGHT       | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1     | 1  | 1  | 1  | 1  | 1  | 1  | 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  | G255    |  |                  |
| 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      |  |                  |
|                     | ↑       | 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 |  |                  |
|                     |         | :           | :  | :  | :  | :  | :  | :  | :  | :  | :     | :  | :  | :  | :  | :  | :  | :  | :  | :    | :  | :  | :  | :  | :  |         |  |                  |
|                     | ↓       | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 0  | 1    | 1  | 1  | 1  | 1  | 1  | B253    |  |                  |
|                     |         | LIGHT       | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 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  | B255    |  |                  |

Note) Definition of Gray :

R<sub>n</sub> : Red Gray, G<sub>n</sub> : Green Gray, B<sub>n</sub> : Blue Gray (n = Gray level)

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

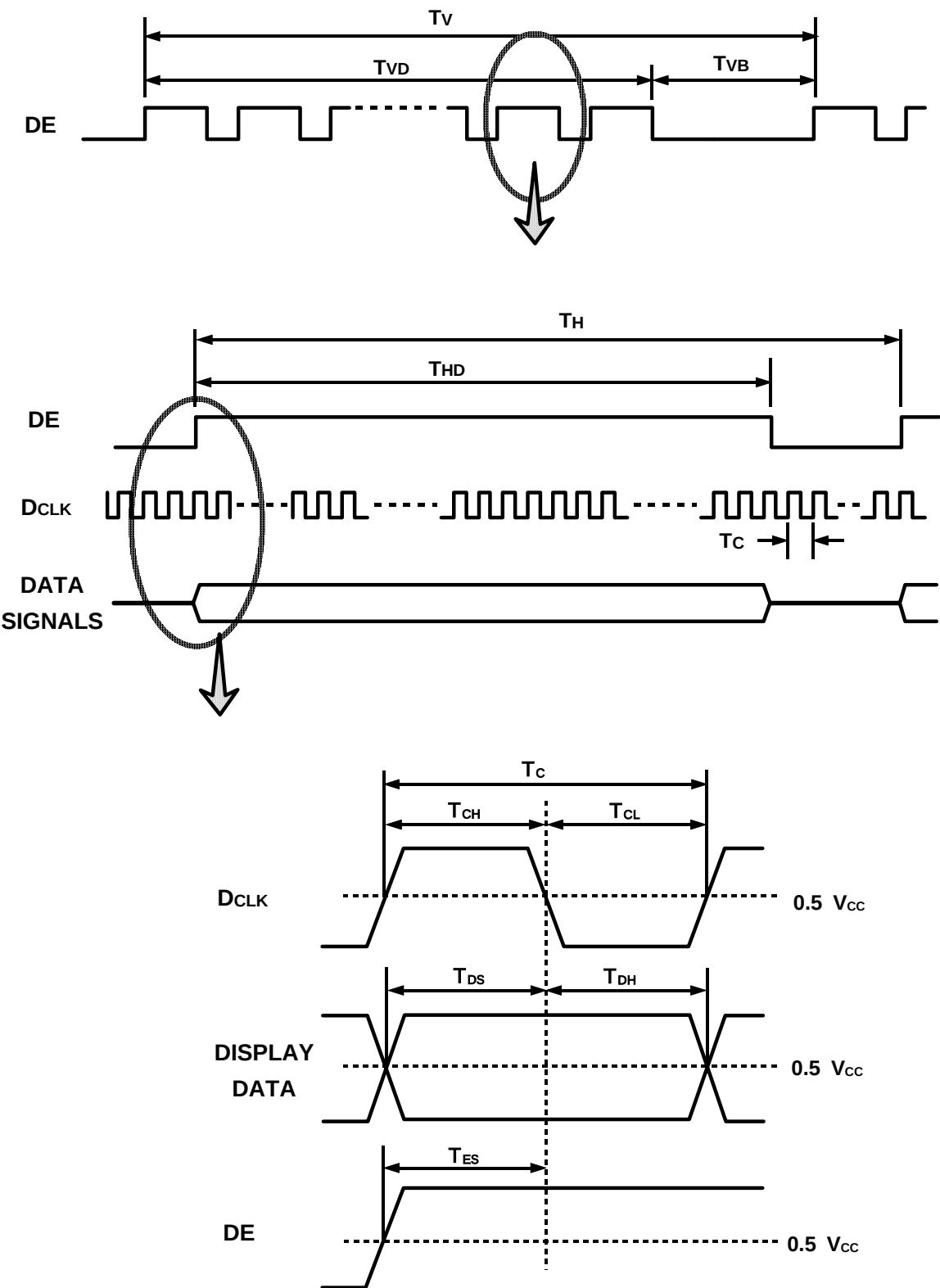
## 6. Interface Timing

### 6.1 Timing Parameters ( DE only mode )

| SIGNAL                               | ITEM                | SYMBOL | MIN. | TYP.  | MAX. | UNIT   | NOTE |
|--------------------------------------|---------------------|--------|------|-------|------|--------|------|
| Clock                                | Frequency           | 1/Tc   | 65   | 80    | 90   | MHz    | -    |
| Hsync                                |                     | Fh     | 46.3 | 50.18 | -    | KHz    | -    |
| Vsync                                |                     | Fv     | -    | 60    | -    | Hz     | -    |
| Vertical<br>Active<br>Display Term   | Display<br>Period   | TVD    | -    | 768   | -    | lines  | -    |
|                                      | Vertical<br>Total   | TVB    | 773  | 838   | -    | lines  | -    |
| Horizontal<br>Active<br>Display Term | Display<br>Period   | THD    | -    | 1366  | -    | clocks | -    |
|                                      | Horizontal<br>Total | TH     | 1570 | 1600  | 1700 | clocks | -    |

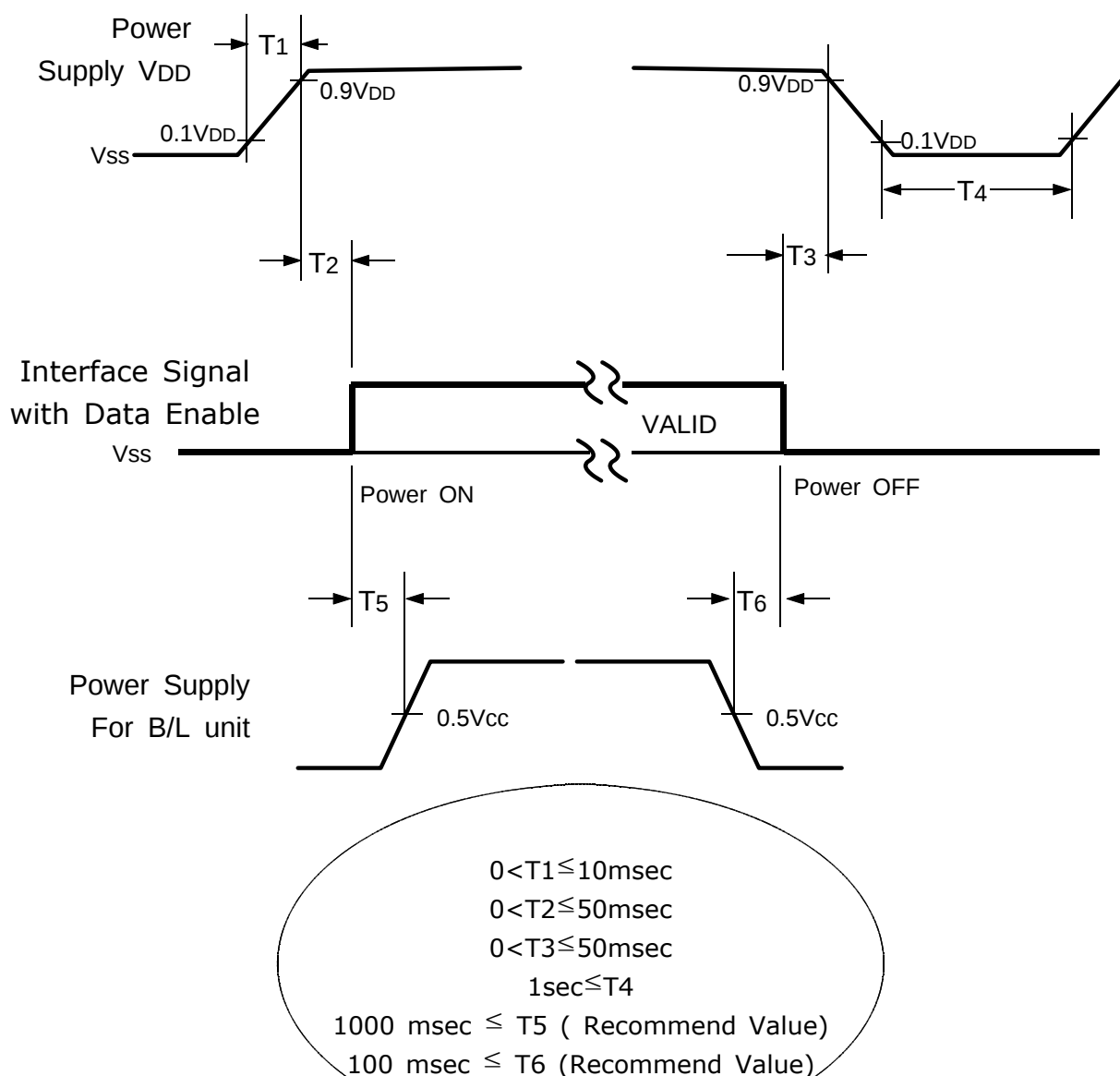
Note) This product is DE only mode. The input of Hsync & Vsync signal does not have an effect on normal operation.

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.

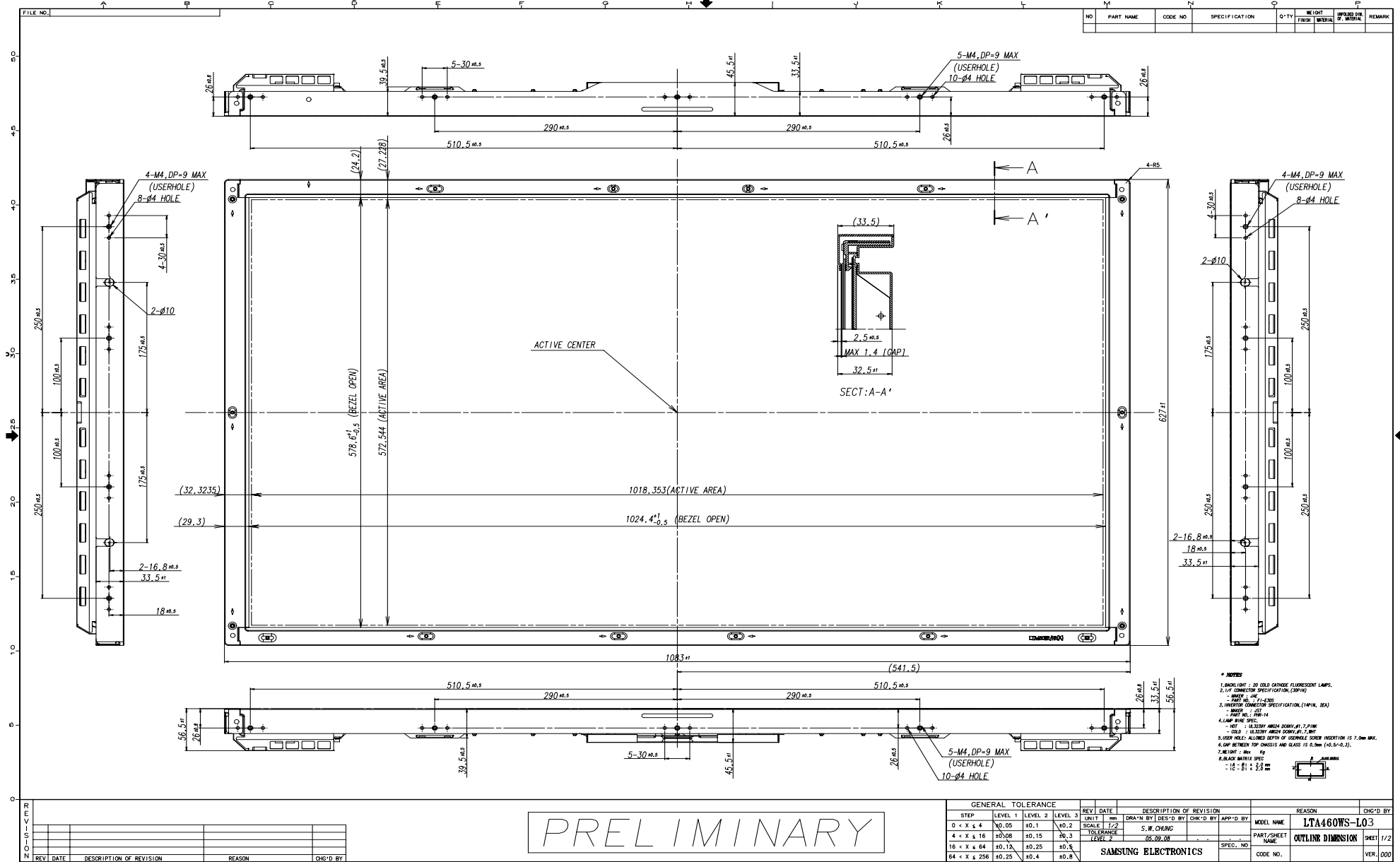


#### NOTE.

- (1) The supply voltage of the external system for the module input should be the same as the definition of VDD.
- (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 abnormal screen.
- (3) In case of VDD = off level, please keep the level of input signals on the low or keep a high impedance.
- (4) T4 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.

## 7. Outline Dimension (Front View)

Approval



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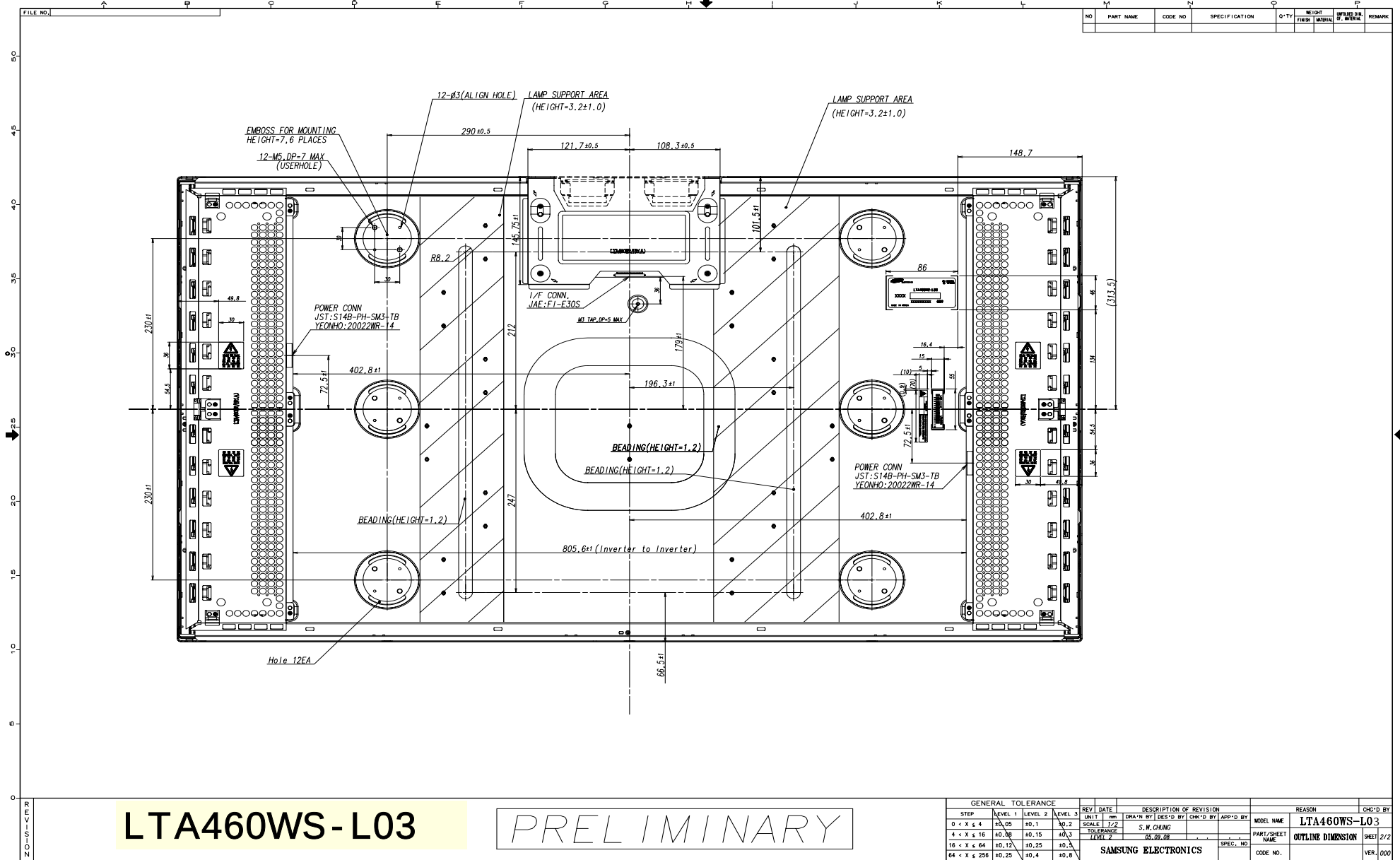
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PRELIMINARY

## 7. Outline Dimension (Rear View)

Approval



LTA460WS-L03

PRELIMINARY

| STEP         | LEVEL 1 | LEVEL 2 | LEVEL 3 | REV | DATE | DESCRIPTION OF REVISION | REASON | CHK'D BY |
|--------------|---------|---------|---------|-----|------|-------------------------|--------|----------|
| 0 < X ≤ 4    | ±0.05   | ±0.1    | ±0.2    |     |      |                         |        |          |
| 4 < X ≤ 16   | ±0.08   | ±0.15   | ±0.3    |     |      |                         |        |          |
| 16 < X ≤ 64  | ±0.12   | ±0.25   | ±0.5    |     |      |                         |        |          |
| 64 < X ≤ 256 | ±0.25   | ±0.4    | ±0.8    |     |      |                         |        |          |

| UNIT | mm | SCALE | 1/2 | TOLERANCE | LEVEL 2 | DATE | DESIGNED BY | CHK'D BY |
|------|----|-------|-----|-----------|---------|------|-------------|----------|
|      |    |       |     |           |         |      |             |          |

| MODEL NAME   | PART/SHEET NAME | OUTLINE DIMENSION | SHEET 2/2 |
|--------------|-----------------|-------------------|-----------|
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## 8. Reliability test

| Item                    | Test condition                                                                                             | Quantity      | Remark |
|-------------------------|------------------------------------------------------------------------------------------------------------|---------------|--------|
| Temperature Step Stress | -20 ~ 60℃, 10Cycle (80hr determination)                                                                    | 4EA           | OK     |
| HTOL                    | 50℃, 1000HR (500hr determination)                                                                          | 8EA           | OK     |
| LTOL                    | 0℃, 1000HR (500hr determination)                                                                           | 4EA           | OK     |
| HTS                     | 70℃, 1000HR (500hr determination)                                                                          | 4EA           | OK     |
| LTS                     | -30℃, 1000HR (500hr determination)                                                                         | 4EA           | OK     |
| THB                     | 40℃ / 95%RH, 1000HR (500hr determination)                                                                  | 4EA           | OK     |
| WHTS                    | 60℃ / 75%RH, 1000HR (500hr determination)                                                                  | 4EA           | OK     |
| T/C                     | -20 ℃ ~ 60 ℃, 200Cycle (100cycle determination)                                                            | 4EA           | OK     |
| ESD (non-operation)     | C D M : ±10 kV,150pF/330 Ω,9Point,3times/Point                                                             | 3EA           | OK     |
| ESD(operation)          | contact : ±8 kV ,150pF/330Ω,100Point,1 time/Point<br>non-contact : ±15 kV,200pF/100Ω,100Point,1 time/Point | 6EA           | OK     |
| Input Con. ESD          | contact : ±2kV,150pF/330,Input Con.Pin,3 times/Pin                                                         | 3EA           | OK     |
| POWER ON/OFF            | 30sec (on) / 30sec(off) : 12,000 times                                                                     | 4EA           | OK     |
| Vibration               | 10~300Hz/1.5G/10minSR, XYZ, 30min/axis                                                                     | 3EA           | OK     |
| Shock                   | 11msec, 30G for ±Z 1time/axis , 50G for ±XY 1time/axis                                                     | 3EA           | OK     |
| PALLET vibration        | 1.146 Grms, Random, Z axis 1Hr                                                                             | 1PALLET(12EA) | OK     |
| PALLET Drop             | 20cm, 2Edge(Front, Back), 1Face(Bottom)                                                                    | 1PALLET(12EA) | OK     |

### [ Result Evaluation Criteria]

Under the display quality test conditions with normal operation state, these shall

be no change which may affect practical display function.

\* HTOL/ LTOL : High/Low Temperature Operating Life,

\*\* THB : Temperature Humidity Bias

\*\*\* HTS/LTS : High/Low Temperature Storage

\*\*\*\* WHTS : Wet High Temperature Storage

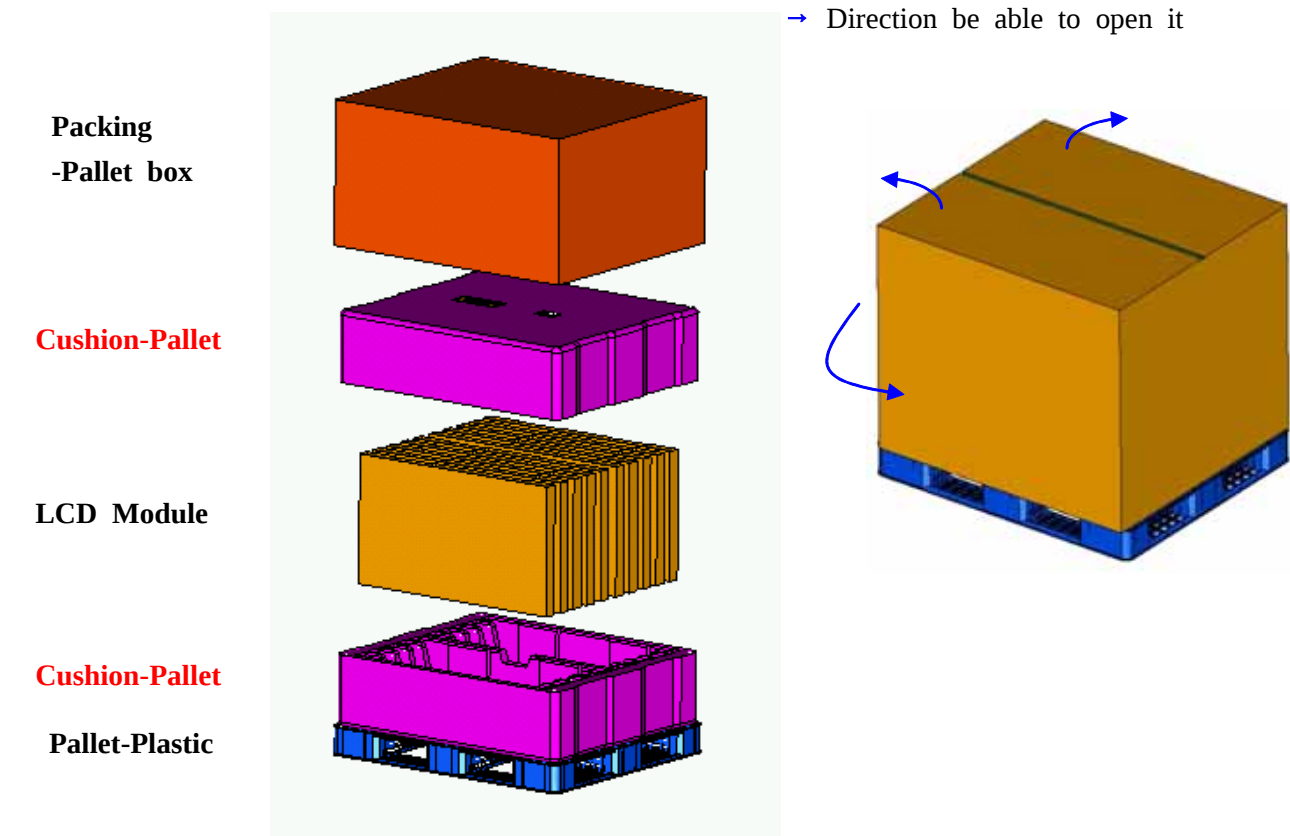
9. PACKING

9.1 Carton

1) Packing Form

Corrugated fiberboard box and EPS cushion as shock absorber

2) Packing Method



9.2 Packing Specification

12.2. Packing Specification

| ITEM                  | Specification               | Remark                                                                                                                                                                                   |
|-----------------------|-----------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| LCD Packing           | 10ea / (Packing-Pallet Box) | 1. 160Kg / LCD (10ea)<br>2. 10 Kg / <b>Cushion-Pallet</b> (2ea)<br>3. 8 Kg / Packing-Pallet Box (1ea)<br>3. <b>Cushion-Pallet Material</b> : EPS<br>4. Packing-Pallet Box Material : DW4 |
| <b>Pallet-Plastic</b> | 1Box / Pallet               | 1. Pallet weight = 8.8kg<br>2. 8.8 Kg / Pallet                                                                                                                                           |
| Packing Direction     | Vertical                    |                                                                                                                                                                                          |
| Total Pallet size     | H x V x height              | 1270mm(H) x 1150mm(V) x 844mm(height)                                                                                                                                                    |
| Total Pallet weight   | 187kg                       | Pallet(8.8kg) + Module(16*10=160) + Cushion(up+botton=10kg) + PALLET-BOX(8kg)                                                                                                            |

10. MARKING & OTHERS

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

(1) Parts number : LTA460WS-L03-00R7

1      2    3 4 5   6   7 8 9

(2) Lot number    :   7    I   5   F   020   79   E

1    2    3    4    5    6    7

7 : Line

I : Device

5 : Year

F : Month

020 : LOT No.

79 : GLASS No.

E : CELL No.

LTA : AV model

460 : Panel Size

W : WXGA

S : Generation

L : LVDS

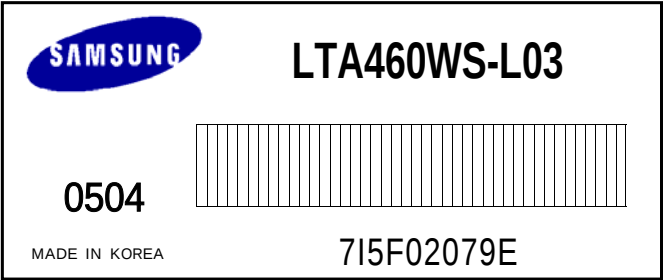
03 : Derivation No.

0 : Customer Code

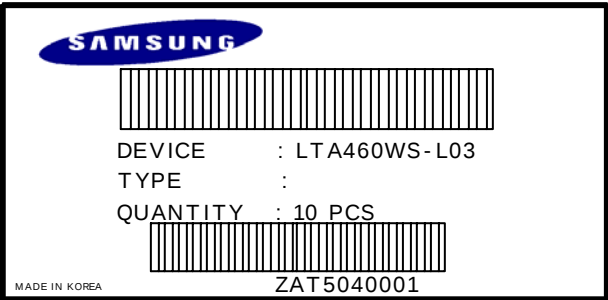
0R : Revision No.

7 : Line

(3) Nameplate    Indication



(4) Packing Pallet Label



Z A T 5 0 4 0 0 0 1

1 2 3 4 5      6

Z : PALLET

A : LINE

T : CITE CODE

5 : YEAR

04 : WEEK

0001 : SERIAL No.

## 11. General Precautions

### 11.1 Handling

- (a) When the module is assembled into a system, it should be attached firmly using all mounting holes. Be careful not to twist and bend the modules.
- (b) 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 CCFL back-light.
- (c) Note that polarizers are very fragile and can be easily damaged. Do not press or scratch the surface harder than a HB pencil lead.
- (d) Wipe off water droplets or oil immediately. If you leave the droplets for a long time, Staining and discoloration may occur.
- (e) If the surface of the polarizer is dirty, clean it using absorbent cotton or soft cloth.
- (f) The 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 may cause permanent polarizer damage due to the chemical reaction.
- (g) If the liquid crystal material leaks from the panel, it should be kept away from the eyes and mouth. In case of contact with skin or clothes, thoroughly wash it away with soap and water.
- (h) Protect the module from static electricity. It may cause damage to the C-MOS Gate Array IC.
- (i) Use finger-stalls with soft gloves to keep display clean during the incoming inspection and the assembly process.
- (j) Do not disassemble the module.
- (k) Do not pull or fold the lamp wire.
- (l) Do not adjust the variable resistor located on the back side.
- (m) I/F connector pins should not be touched directly with bare hands.

## 11.2 Storage

- (a) Do not expose the module in high temperature, and/or high humidity for a long time. It is highly recommended to store the module within the temperature from 0 to 35°C and relative humidity of less than 70%.
- (b) Do not store the TFT-LCD module in direct sunlight. The module shall be stored in a dark place. Prolonged exposure to sunlight or fluorescent light during the storage will damage the module.

## 11.3 Operation

- (a) Do not connect or disconnect the module in the "Power On" condition.
- (b) Power supply should always be turned on/off by following item 6.3 " Power on/off sequence ".
- (c) The Module has high frequency circuits. Sufficient suppression to the electromagnetic interference shall 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 at the minimum length possible to be connected directly. The longer cable between the back-light and the inverter may cause lower luminance of lamp(CCFT) and may require higher startup voltage(Vs).

## 11.4 Operation Condition Guide

- (a) The LCD product should be operated under normal conditions.  
Normal condition is defined as below;
  - Temperature : 20±15°C
  - Humidity : 65±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.

## 11.5 Others

- (a) Use Ultra-violet light filters if outdoor operation is necessary.
- (b) Avoid water condensation. Moisture may penetrate sensitive electrical connections resulting in improper operation.
- (c) Do not exceed the absolute maximum rating values. (supply voltage variation, input voltage variation, variation in part contents and environmental temperature, etc..) Otherwise, the module may be damaged.
- (d) If the module displays the same pattern continuously for a long period of time, it can result in the situation where the image "sticks" (remains) on the screen. We recommend that you should discuss SEC when you want the module to be operated in displaying the same pattern for a long time.
- (e) The module has sensitive PCB circuitry on the back side and should be handled carefully in order prevent stress and possible failure.