



ELECTRONICS

Approval



TO :  
DATE : Dec.5. 2008

**SAMSUNG TFT-LCD**  
**MODEL NO : LTN156AT01-D**

NOTE : Extension code [ -D ]  
          → LTN156AT01-D  
          Surface type [ Glare ]

*The information described in this SPEC is preliminary and can be changed without prior notice.*

APPROVED BY :           K. H. Shin          

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|                |              |               |                 |             |        |
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## GENERAL DESCRIPTION

### DESCRIPTION

LTN156AT01-D is a color active matrix TFT (Thin Film Transistor) liquid crystal display (LCD) that uses amorphous silicon TFT as switching devices. This model is composed of a TFT LCD panel, a driver circuit and a backlight system. The resolution of a 15.6" contains 1366 x 768 pixels and can display up to 262,144 colors. 6 O'clock direction is the Optimum viewing angle.

### FEATURES

- Thin and light weight
- High contrast ratio, high aperture structure
- 1366 x 768 pixels resolution (16:9)
- Fast Response Time
- Low power consumption
- DE (Data enable) only mode
- 3.3V LVDS Interface
- On board EDID chip
- Pb-free product
- RoHS compliance

### APPLICATIONS

- Notebook PC
- If the usage of this product is not for PC application, but for others, please contact SEC

## GENERAL INFORMATION

| Item              | Specification                             | Unit  | Note   |
|-------------------|---|-------|--------|
| Display area      | 344.232 (H) x 193.536 (V) (15.6"diagonal) | mm    |        |
| Driver element    | a-Si TFT active matrix                    |       |        |
| Display colors    | 262,144                                   |       |        |
| Number of pixel   | 1366 x 768                                | pixel | 16 : 9 |
| Pixel arrangement | RGB vertical stripe                       |       |        |
| Pixel pitch       | 0.252 (H) x 0.252 (V) (TYP.)              | mm    |        |
| Display Mode      | Normally white                            |       |        |
| Surface treatment | Haze 0, Hardness 3H                       |       | Glare  |

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## Mechanical Information

| Item        |                | Min.  | Typ.  | Max.  | Unit | Note |
|-------------|----------------|-------|-------|-------|------|------|
| Module size | Horizontal (H) | 358.8 | 359.3 | 359.8 | mm   |      |
|             | Vertical (V)   | 209.0 | 209.5 | 210   | mm   |      |
|             | Depth (D)      | -     | -     | 6.2   | mm   | (1)  |
| Weight      |                | -     | 500   | 520   | g    |      |

Note (1) Measurement condition of outline dimension

- . Equipment : Vernier Calipers
- . Push Force : 500g · f (minimum)

## 1. ABSOLUTE MAXIMUM RATINGS

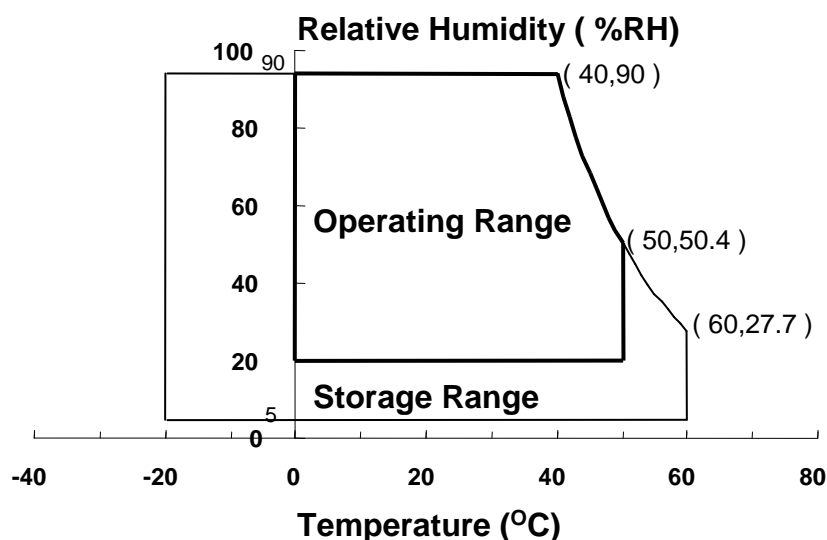
### 1.1 ENVIRONMENTAL ABSOLUTE RATINGS

| Item  | Symbol | Min. | Max. | Unit | Note     |
|---|--------|------|------|------|----------|
| Storage temperate                                     | TSTG   | -20  | 60   | °C   | (1), (5) |
| Operating temperate<br>(Temperature of glass surface) | TOPR   | 0    | 50   | °C   | (1), (5) |
| Shock ( non-operating )                               | Snop   | -    | 240  | G    | (2), (4) |
| Vibration (non-operating)                             | Vnop   | -    | 2.41 | G    | (3), (4) |

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

95 % RH Max. ( $40\text{ °C} \geq T_a$ )

Maximum wet - bulb temperature at  $39\text{ °C}$  or less. ( $T_a > 40\text{ °C}$ ) No condensation



(2) 2ms, half sine wave, one time for  $\pm X$ ,  $\pm Y$ ,  $\pm Z$ .

(3) 5 - 500 Hz, random vibration, 30min for X, Y, Z.

(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.

(5) If product is used for extended time excessively or exposed to high temperatures for extended time, there is a possibility of wide viewing angle film damage which could affect visual characteristics.

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## 1.2 ELECTRICAL ABSOLUTE RATINGS

## (1) TFT LCD MODULE

 $V_{DD} = 3.3V, V_{SS} = GND = 0V$ 

| Item                 | Symbol   | Min.           | Max.           | Unit | Note |
|----------------------|----------|----------------|----------------|------|------|
| Power Supply Voltage | $V_{DD}$ | $V_{DD} - 0.3$ | $V_{DD} + 0.3$ | V    | (1)  |
| Logic Input Voltage  | $V_{DD}$ | $V_{DD} - 0.3$ | $V_{DD} + 0.3$ | V    | (1)  |

Note (1) Within  $T_a$  ( $25 \pm 2 \text{ }^\circ\text{C}$ )

## (2) BACK-LIGHT UNIT

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

| Item           | Symbol | Min. | Max. | Unit  | Note |
|----------------|--------|------|------|-------|------|
| Lamp Current   | $I_L$  | 2.0  | 6.5  | mArms | (1)  |
| Lamp frequency | $F_L$  | 50   | 80   | kHz   | (1)  |

Note 1) Permanent damage to the device may occur if maximum values are exceeded  
 Functional operation should be restricted to the conditions described under normal operating conditions.

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## 2. OPTICAL CHARACTERISTICS

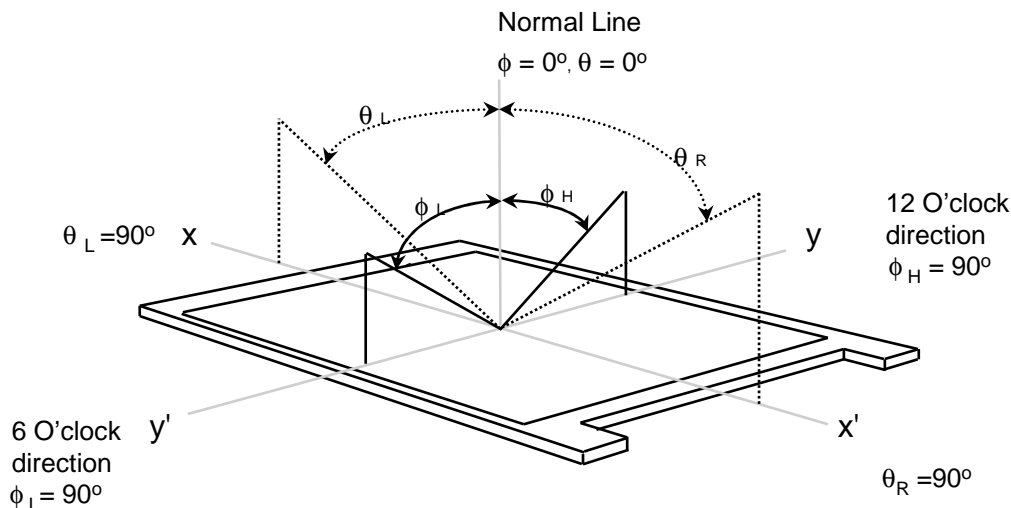
The following items are measured under stable conditions. The optical characteristics should be measured in a dark room or equivalent state with the methods shown in Note (5).  
Measuring equipment : TOPCON SR-3

\* Ta = 25 ± 2 °C, V<sub>DD</sub>=3.3V, f<sub>V</sub>= 60Hz, f<sub>DCLK</sub>= 72.33 MHz, I<sub>L</sub> = 6.5 mA

| Item  |       | Symbol             | Condition                                    | Min.  | Typ.  | Max   | Unit              | Note                               |
|---|-------|--------------------|--|-------|-------|-------|-------------------|------------------------------------|
| Contrast Ratio<br>(5 Points)                |       | CR                 | Normal<br>Viewing<br>Angle<br>φ = 0<br>θ = 0 | 500   | 600   | -     | -                 | (1), (2),<br>(5)                   |
| Response Time at Ta<br>( Rising + Falling ) |       | T <sub>RT</sub>    |  | -     | 25    | 35    | msec              | (1), (3)                           |
| Average Luminance<br>of White (5 Points)    |       | Y <sub>L,AVE</sub> |  | 200   | 220   | -     | cd/m <sup>2</sup> | I <sub>L</sub> =6.0 mA<br>(1), (4) |
| Color<br>Chromaticity<br>( CIE )            | Red   | R <sub>X</sub>     |  | 0.609 | 0.629 | 0.649 | -                 |                                    |
|   |       | R <sub>Y</sub>     |  | 0.313 | 0.333 | 0.353 |                   |                                    |
|   | Green | G <sub>X</sub>     |  | 0.272 | 0.292 | 0.312 |                   |                                    |
|   |       | G <sub>Y</sub>     |  | 0.560 | 0.580 | 0.600 |                   |                                    |
|   | Blue  | B <sub>X</sub>     |  | 0.140 | 0.160 | 0.180 |                   |                                    |
|   |       | B <sub>Y</sub>     |  | 0.076 | 0.096 | 0.116 |                   |                                    |
|   | White | W <sub>X</sub>     |  | 0.293 | 0.313 | 0.333 |                   |                                    |
|   |       | W <sub>Y</sub>     | 0.309  | 0.329 | 0.349 |       |                   |                                    |
| Viewing<br>Angle                            | Hor.  | θ <sub>L</sub>     | CR ≥ 10                                      | 40    | -     | -     | Degrees           | (1), (5)<br>SR-3                   |
|   |       | θ <sub>R</sub>     |  | 40    | -     | -     |                   |                                    |
|   | Ver.  | φ <sub>H</sub>     |  | 15    | -     | -     |                   |                                    |
|   |       | φ <sub>L</sub>     |  | 30    | -     | -     |                   |                                    |
| Color Gamut                                 |       |                    |  | -     | 60    | -     | %                 |                                    |
| 13 Points<br>White Variation                |       | Δ <sub>L</sub>     |  | -     | -     | 1.7   | -                 | (6)                                |

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Note 1) Definition of Viewing Angle : Viewing angle range( $10 \leq C/R$ )

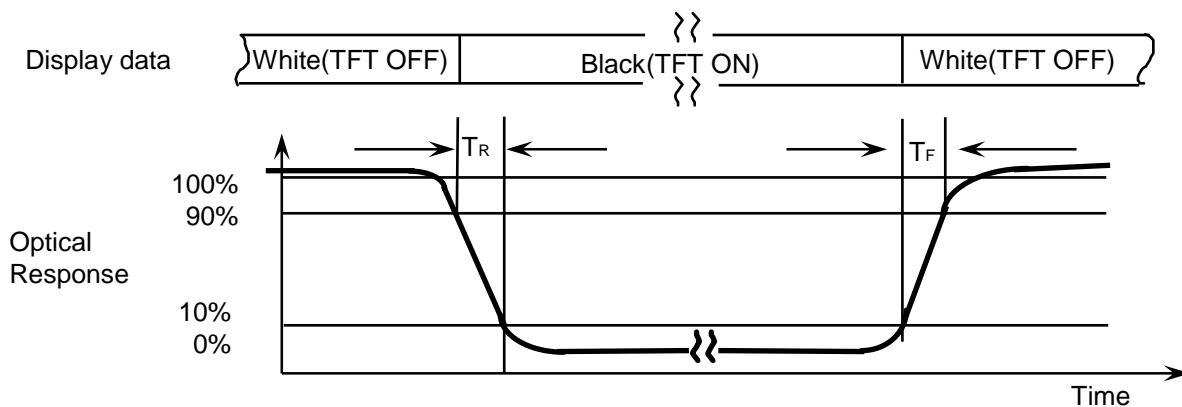


Note 2) Definition of Contrast Ratio (CR) : Ratio of gray max (Gmax) ,gray min (Gmin) at 5 points(4, 5, 7, 9, 10)

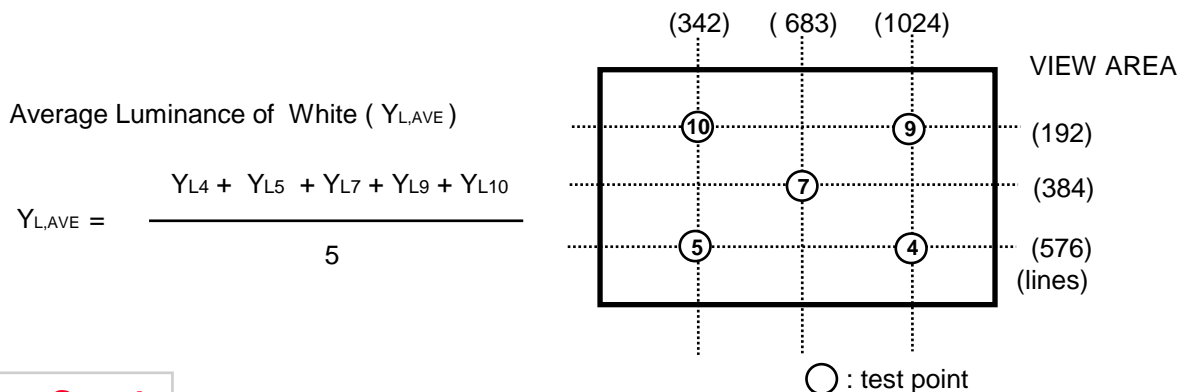
$$CR = \frac{CR(4) + CR(5) + CR(7) + CR(9) + CR(10)}{5}$$

Points : (4) , (5) , (7) , (9) , (10) at the figure of Note (6).

Note 3) Definition of Response time :

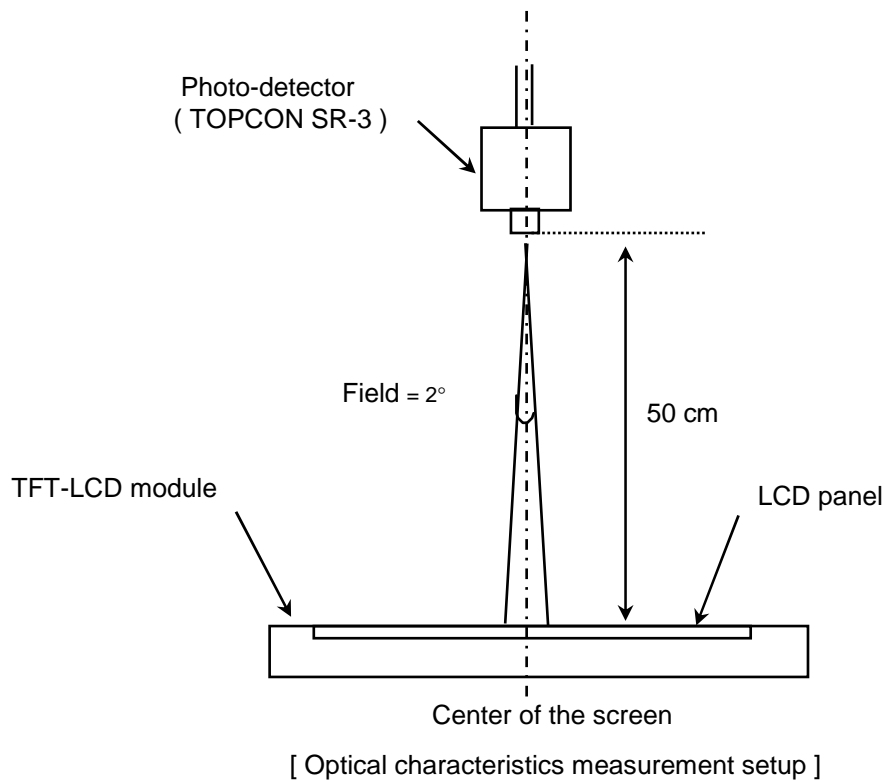


Note 4) Definition of Average Luminance of White : measure the luminance of white at 5 points.



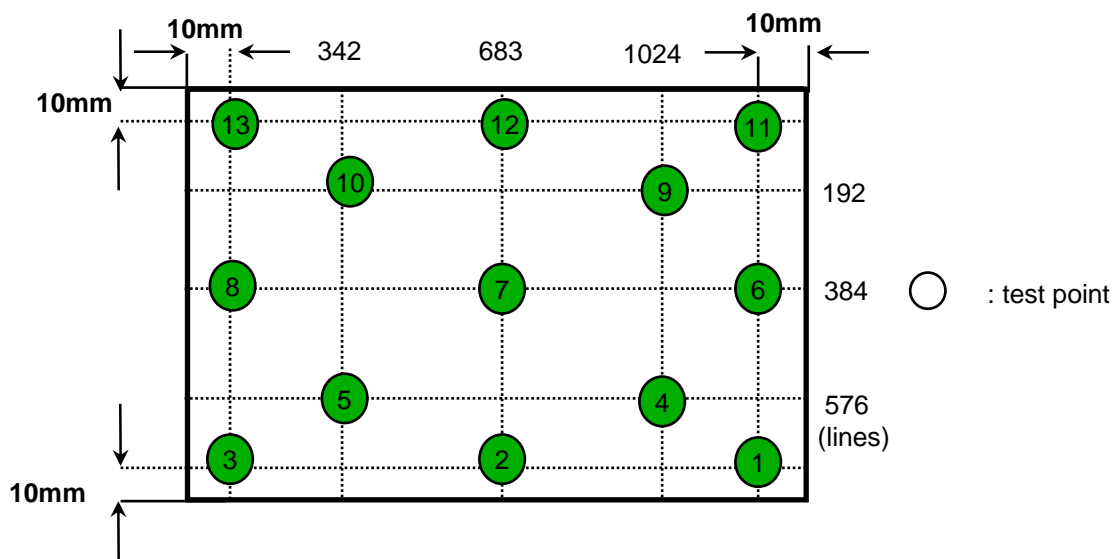
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Note 5) After stabilizing and leaving the panel alone at a given temperature for 30 min , the measurement should be executed. Measurement should be executed in a stable, windless, and dark room. 30 min after lighting the backlight. This should be measured in the center of screen.  
 Lamp current : 6.5 mA (Inverter : S11700)  
 Environment condition :  $T_a = 25 \pm 2 \text{ }^\circ\text{C}$



Note 6) Definition of 13 points white variation ( $\delta L$ ), [ ① ~ ⑬ ]

$$\delta L = \frac{\text{Maximum luminance of 13 points}}{\text{Minimum luminance of 13 points}}$$



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### 3. ELECTRICAL CHARACTERISTICS

#### 3.1 TFT LCD MODULE

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

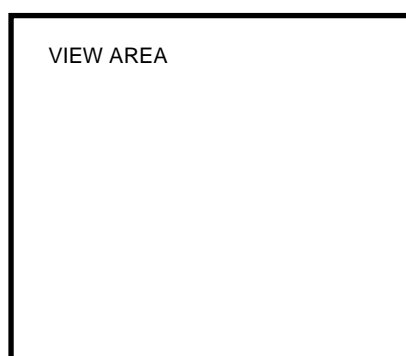
| Item   | Symbol     | Min.     | Typ.  | Max. | Unit | Note |                  |
|--|------------|----------|-------|------|------|------|------------------|
| Voltage of Power Supply                                | $V_{DD}$   | 3.0      | 3.3   | 3.6  | V    |      |                  |
| Differential Input Voltage for LVDS Receiver Threshold | High       | $V_{IH}$ | -     | -    | +100 | mV   | $V_{CM} = +1.2V$ |
|  | Low        | $V_{IL}$ | -100  | -    | -    | mV   |                  |
| Vsync Frequency  | $f_V$      | -        | 60    | -    | Hz   |      |                  |
| Hsync Frequency  | $f_H$      | -        | 47.4  | -    | KHz  |      |                  |
| Main Frequency   | $f_{DCLK}$ | 67.5     | 72.33 | 80   | MHz  |      |                  |
| Rush Current   | $I_{RUSH}$ | -        | -     | 1.5  | A    | (4)  |                  |
| Current of Power Supply                                | White      | $I_{DD}$ | -     | 360  | -    | mA   | (2),(3)*a        |
|  | Mosaic     |          | -     | 420  | -    | mA   | (2),(3)*b        |
|  | V. Stripe  |          | -     | 530  | 600  | mA   | (2),(3)*c        |

Note (1) Display data pins and timing signal pins should be connected. ( GND = 0V )

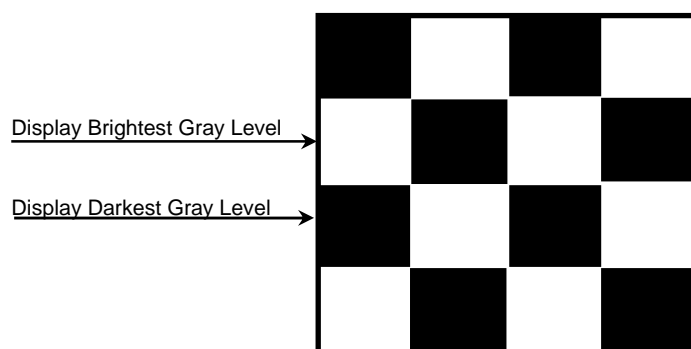
(2)  $f_V = 60\text{Hz}$ ,  $f_{DCLK} = 72.33\text{ MHz}$ ,  $V_{DD} = 3.3V$ , DC Current.

(3) Power dissipation pattern

\*a) White Pattern



\*b) Mosaic Pattern



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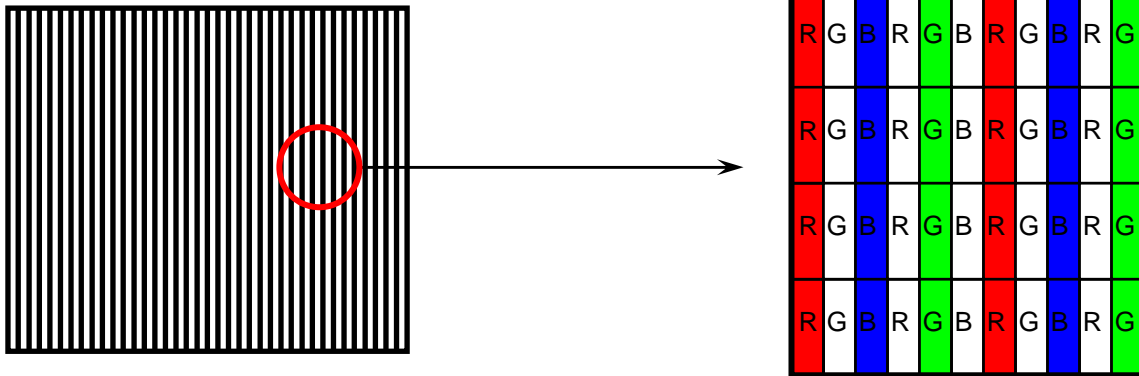
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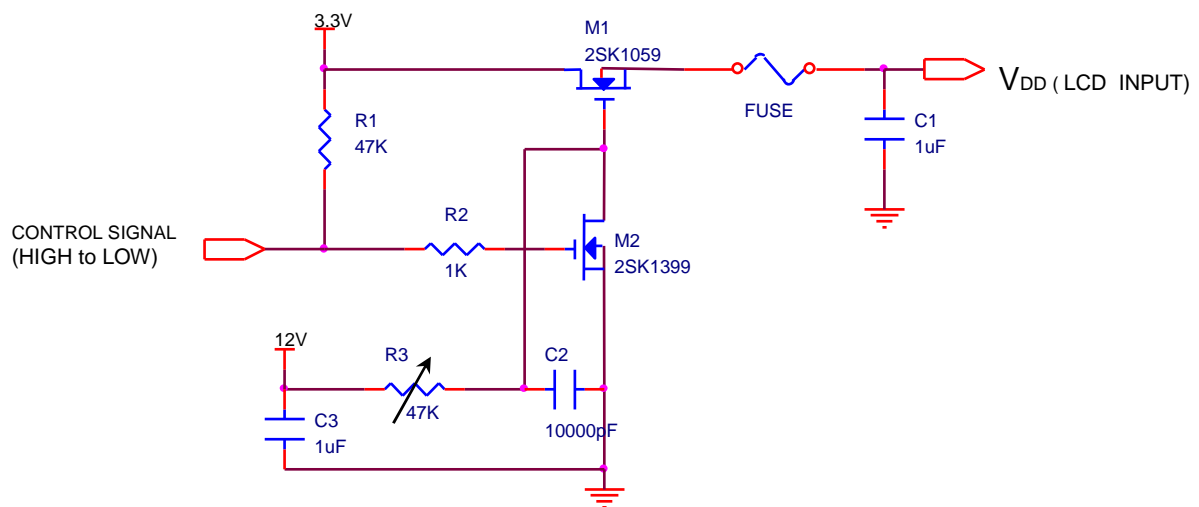
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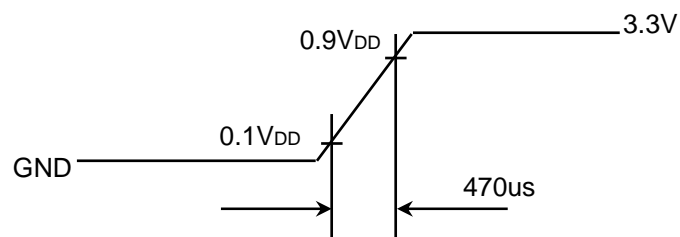
\*c) 1dot Vertical stripe pattern



4) Rush current measurement condition



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



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### 3.2 BACK-LIGHT UNIT

The backlight system is an edge-lighting type with a CCFL ( Cold Cathode Fluorescent Lamp ).  
The characteristics of a single lamp are shown in the following tables.

- INVERTER : (SEM SI 1700)

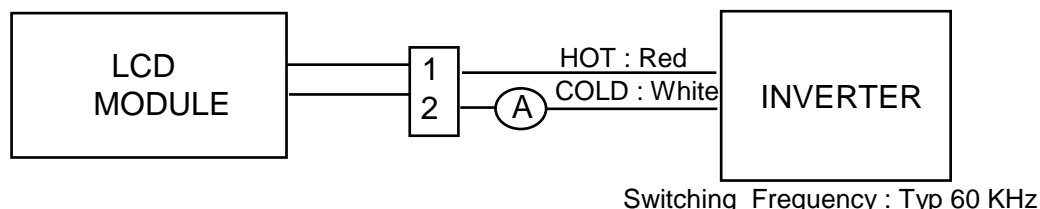
Ta= 25 ± 2 °C

| Item                | Symbol         | Min.   | Typ. | Max. | Unit  | Note                         |
|---------------------|----------------|--------|------|------|-------|------------------------------|
| Lamp Current        | I <sub>L</sub> | 3.0    | 6.0  | 6.5  | mArms | (1)                          |
| Lamp Voltage        | V <sub>L</sub> | -      | 705  | -    | Vrms  | I <sub>L</sub> =6.0mA        |
| Frequency           | f <sub>L</sub> | 48     | 60   | 65   | KHz   | (2)                          |
| Power Consumption   | P <sub>L</sub> | -      | 4.5  | -    | W     | (3)<br>I <sub>L</sub> =6.0mA |
| Operating Life Time | Hr             | 15,000 | -    | -    | Hour  | (4)                          |
| Startup Voltage     | V <sub>s</sub> | -      | -    | 1300 | Vrms  | 25°C, (5)                    |
|                     |                |        |      | 1480 | Vrms  | 0°C, (5)                     |
| Lamp startup time   |                | -      | -    | 1.0  | sec   | (5)                          |

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.

The performance of the backlight, 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 backlight 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 a high frequency current meter as shown below.



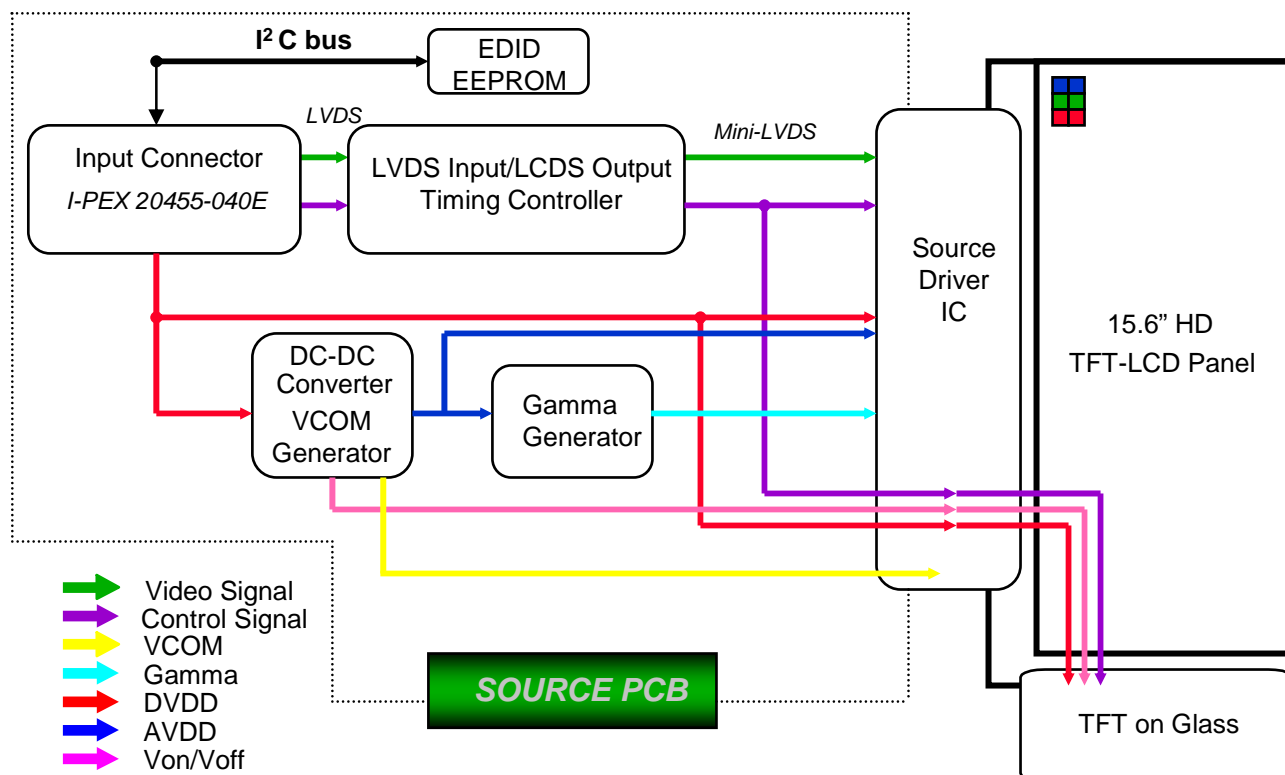
- (2) Lamp frequency may produce interference with horizontal synchronous frequency and this may cause line flow on the display. Therefore lamp frequency should be detached from the horizontal synchronous frequency and its harmonics as far as possible in order to avoid interference.
- (3) Refer to I<sub>L</sub> × V<sub>L</sub> to calculate.
- (4) Life time (Hr) of a lamp can be defined as the time in which it continues to operate under the condition Ta= 25 ± 2 °C and I<sub>L</sub> = 6.5 mArms until one of the following event occurs.
  1. When the brightness becomes 50% or lower than the original.
  2. When the Effective ignition length becomes 80% or lower than the original value.  
(Effective ignition length is defined as an area that has less than 70% brightness compared to the brightness in the center point.)
- (5) The inverter open voltage - this voltage should be measured after ballast capacitor- have to be larger than the lamp startup voltage, otherwise backlight may has blinking for a moment after turns on or not be turned on.  
If an inverter has shutdown function it should keep its open voltage for longer than 1 second even if lamp connector open.

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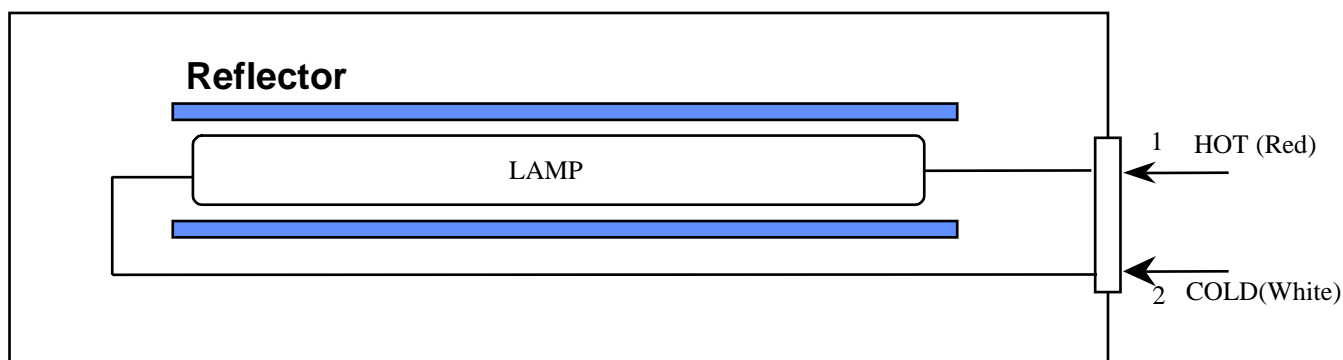
|         |              |        |                 |      |         |
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## 4. BLOCK DIAGRAM

### 4.1 TFT LCD Module



### 4.2 BACK-LIGHT UNIT



Note) The output of the inverter may change according to the material of the reflector.

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## 5. INPUT TERMINAL PIN ASSIGNMENT

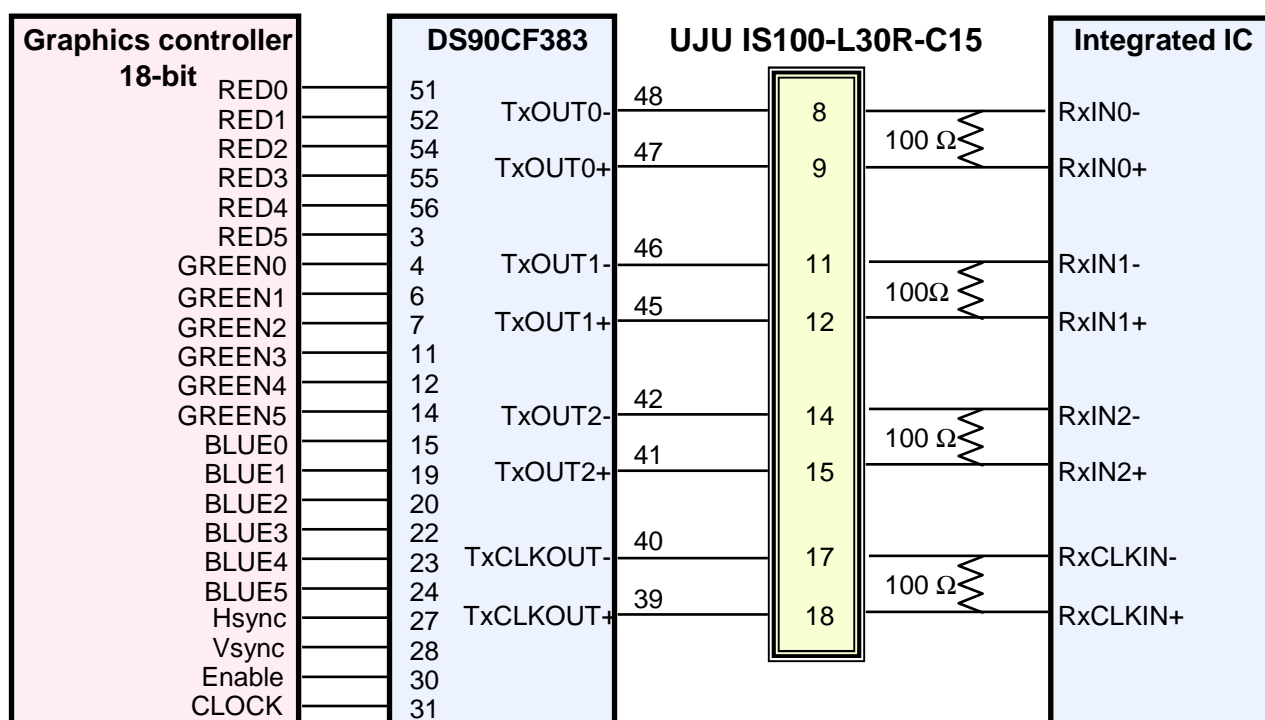
5.1. Input Signal & Power (LVDS, Connector : UJU IS100-L30R-C15 or compatible)  
Mating Connector : JAE FI-X30M or compatible)

| PIN NO | SYMBOL   | FUNCTION                                     | POLARITY | REMARK |
|--------|----------|--|----------|--------|
| 1      | VSS      | Ground                                       |          |        |
| 2      | VDD      | POWER SUPPLY +3.3V                           |          |        |
| 3      | VDD      | POWER SUPPLY +3.3V                           |          |        |
| 4      | VEEDID   | DDC 3.3V Power                               |          |        |
| 5      | TEST     | Panel Self Test                              |          |        |
| 6      | CLKEDID  | DDC Clock                                    |          |        |
| 7      | DATAEDID | DDC data                                     |          |        |
| 8      | RxIN0-   | LVDS Differential Data INPUT (R0-R5,G0)      | Negative |        |
| 9      | RxIN0+   | LVDS Differential Data INPUT (R0-R5,G0)      | Positive |        |
| 10     | VSS      | Ground                                       |          |        |
| 11     | RxIN1-   | LVDS Differential Data INPUT (G1-G5,B0-B1)   | Negative |        |
| 12     | RxIN1+   | LVDS Differential Data INPUT (G1-G5,B0-B1)   | Positive |        |
| 13     | VSS      | Ground                                       |          |        |
| 14     | RxIN2-   | LVDS Differential Data INPUT (B2-B5,Sync,DE) | Negative |        |
| 15     | RxIN2+   | LVDS Differential Data INPUT (B2-B5,Sync,DE) | Positive |        |
| 16     | VSS      | Ground                                       |          |        |
| 17     | RxCLK-   | LVDS Differential Data INPUT (Clock)         | Negative |        |
| 18     | RxCLK+   | LVDS Differential Data INPUT (Clock)         | Positive |        |
| 19     | VSS      | Ground                                       |          |        |
| 20     | NC       | No Connection                                |          |        |
| 21     | NC       | No Connection                                |          |        |
| 22     | NC       | No Connection                                |          |        |
| 23     | NC       | No Connection                                |          |        |
| 24     | NC       | No Connection                                |          |        |
| 25     | NC       | No Connection                                |          |        |
| 26     | NC       | No Connection                                |          |        |
| 27     | NC       | No Connection                                |          |        |
| 28     | NC       | No Connection                                |          |        |
| 29     | NC       | No Connection                                |          |        |
| 30     | NC       | No Connection                                |          |        |

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## 5.2 LVDS Interface : Transmitter DS90CF363 or Compatible

| Pin No. | Name   | RGB Signal | Pin No. | Name    | RGB Signal |
|---------|--------|------------|---------|---------|------------|
| 51      | TxIN0  | R0         | 14      | TxIN14  | G5         |
| 52      | TxIN1  | R1         | 15      | TxIN15  | B0         |
| 54      | TxIN2  | R2         | 19      | TxIN18  | B1         |
| 55      | TxIN3  | R3         | 20      | TxIN19  | B2         |
| 56      | TxIN4  | R4         | 22      | TxIN20  | B3         |
| 3       | TxIN6  | R5         | 23      | TxIN21  | B4         |
| 4       | TxIN7  | G0         | 24      | TxIN22  | B5         |
| 6       | TxIN8  | G1         | 27      | TxIN24  | Hsync      |
| 7       | TxIN9  | G2         | 28      | TxIN25  | Vsync      |
| 11      | TxIN12 | G3         | 30      | TxIN26  | DE         |
| 12      | TxIN13 | G4         | 31      | TxCLKIN | Clock      |

**LVDS INTERFACE**

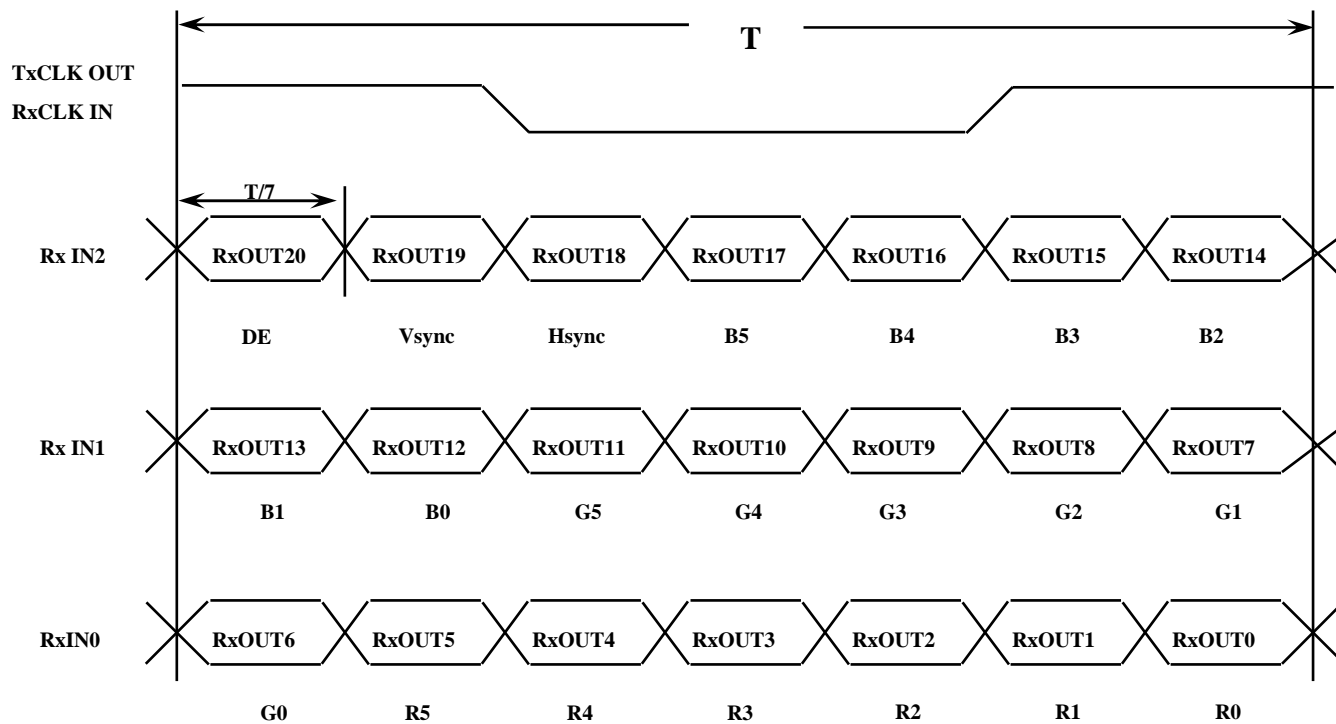
Note : The LCD Module uses a 100ohm resistor between positive and negative lines of each receiver input.

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## 5.3 Timing Diagrams of LVDS For Transmission

## LVDS Receiver : Integrated T-CON



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## 5.4 Input Signals, 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    | G0 | G1 | G2 | G3 | G4   | G5 | B0 | B1 | B2 | B3 |                  | B4     |
| Basic Colors        | Black   | 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  | 1  | 1  | 1  | 1  | 1                | -      |
|                     | Green   | 0           | 0  | 0  | 0  | 0  | 0     | 1  | 1  | 1  | 1  | 1    | 1  | 0  | 0  | 0  | 0  | 0                | -      |
|                     | Cyan    | 0           | 0  | 0  | 0  | 0  | 0     | 1  | 1  | 1  | 1  | 1    | 1  | 1  | 1  | 1  | 1  | 1                | -      |
|                     | Red     | 1           | 1  | 1  | 1  | 1  | 1     | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0                | -      |
|                     | Magenta | 1           | 1  | 1  | 1  | 1  | 1     | 0  | 0  | 0  | 0  | 0    | 0  | 1  | 1  | 1  | 1  | 1                | -      |
|                     | Yellow  | 1           | 1  | 1  | 1  | 1  | 1     | 1  | 1  | 1  | 1  | 1    | 1  | 0  | 0  | 0  | 0  | 0                | -      |
|                     | White   | 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                | R0     |
|                     | Dark    | 1           | 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                | R3~R60 |
|                     | :       | :           | :  | :  | :  | :  | :     | :  | :  | :  | :  | :    | :  | :  | :  | :  | :  | :                |        |
|                     | :       | :           | :  | :  | :  | :  | :     | :  | :  | :  | :  | :    | :  | :  | :  | :  | :  | :                |        |
|                     | ↓       | 1           | 0  | 1  | 1  | 1  | 1     | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0                | R61    |
|                     | Light   | 0           | 1  | 1  | 1  | 1  | 1     | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0                | R62    |
|                     | Red     | 1           | 1  | 1  | 1  | 1  | 1     | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0                | R63    |
| Gray Scale Of Green | Black   | 0           | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0                | G0     |
|                     | Dark    | 0           | 0  | 0  | 0  | 0  | 0     | 1  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0                | G1     |
|                     | ↑       | 0           | 0  | 0  | 0  | 0  | 0     | 0  | 1  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0                | G3~G60 |
|                     | :       | :           | :  | :  | :  | :  | :     | :  | :  | :  | :  | :    | :  | :  | :  | :  | :  | :                |        |
|                     | :       | :           | :  | :  | :  | :  | :     | :  | :  | :  | :  | :    | :  | :  | :  | :  | :  | :                |        |
|                     | ↓       | 0           | 0  | 0  | 0  | 0  | 0     | 1  | 0  | 1  | 1  | 1    | 1  | 0  | 0  | 0  | 0  | 0                | G61    |
|                     | Light   | 0           | 0  | 0  | 0  | 0  | 0     | 0  | 1  | 1  | 1  | 1    | 1  | 0  | 0  | 0  | 0  | 0                | G62    |
|                     | Green   | 0           | 0  | 0  | 0  | 0  | 0     | 1  | 1  | 1  | 1  | 1    | 1  | 0  | 0  | 0  | 0  | 0                | G63    |
| Gray Scale Of Blue  | Black   | 0           | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0                | B0     |
|                     | Dark    | 0           | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0    | 0  | 1  | 0  | 0  | 0  | 0                | B1     |
|                     | ↑       | 0           | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 1  | 0  | 0  | 0                | B3~B60 |
|                     | :       | :           | :  | :  | :  | :  | :     | :  | :  | :  | :  | :    | :  | :  | :  | :  | :  | :                |        |
|                     | :       | :           | :  | :  | :  | :  | :     | :  | :  | :  | :  | :    | :  | :  | :  | :  | :  | :                |        |
|                     | ↓       | 0           | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0    | 0  | 1  | 0  | 1  | 1  | 1                | B61    |
|                     | Light   | 0           | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 1  | 1  | 1  | 1                | B62    |
|                     | Blue    | 0           | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0    | 0  | 1  | 1  | 1  | 1  | 1                | B63    |

Note 1) Definition of gray :

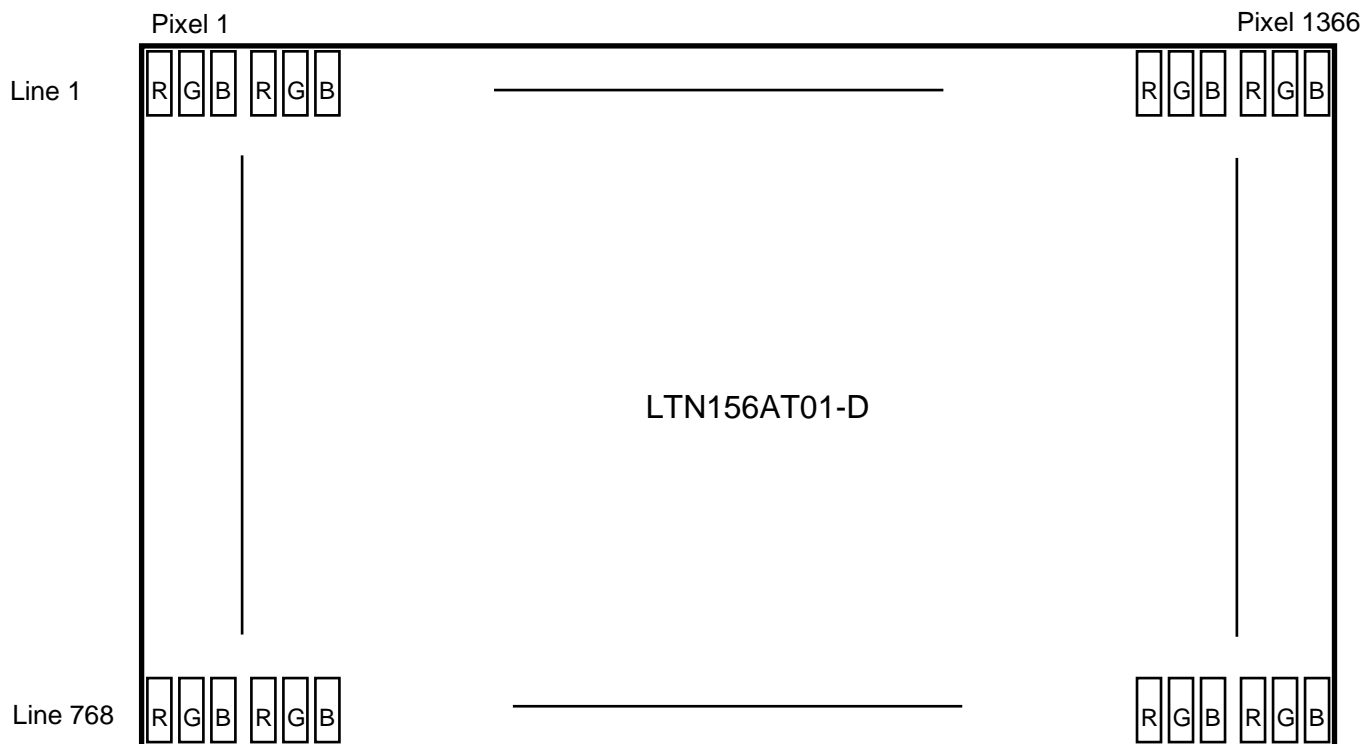
Rn: Red gray, Gn: Green gray, Bn: Blue gray (n=gray level)

Note 2) Input signal: 0 =Low level voltage, 1=High level voltage

**Samsung Secret**



### 5.5 Pixel Format in the display



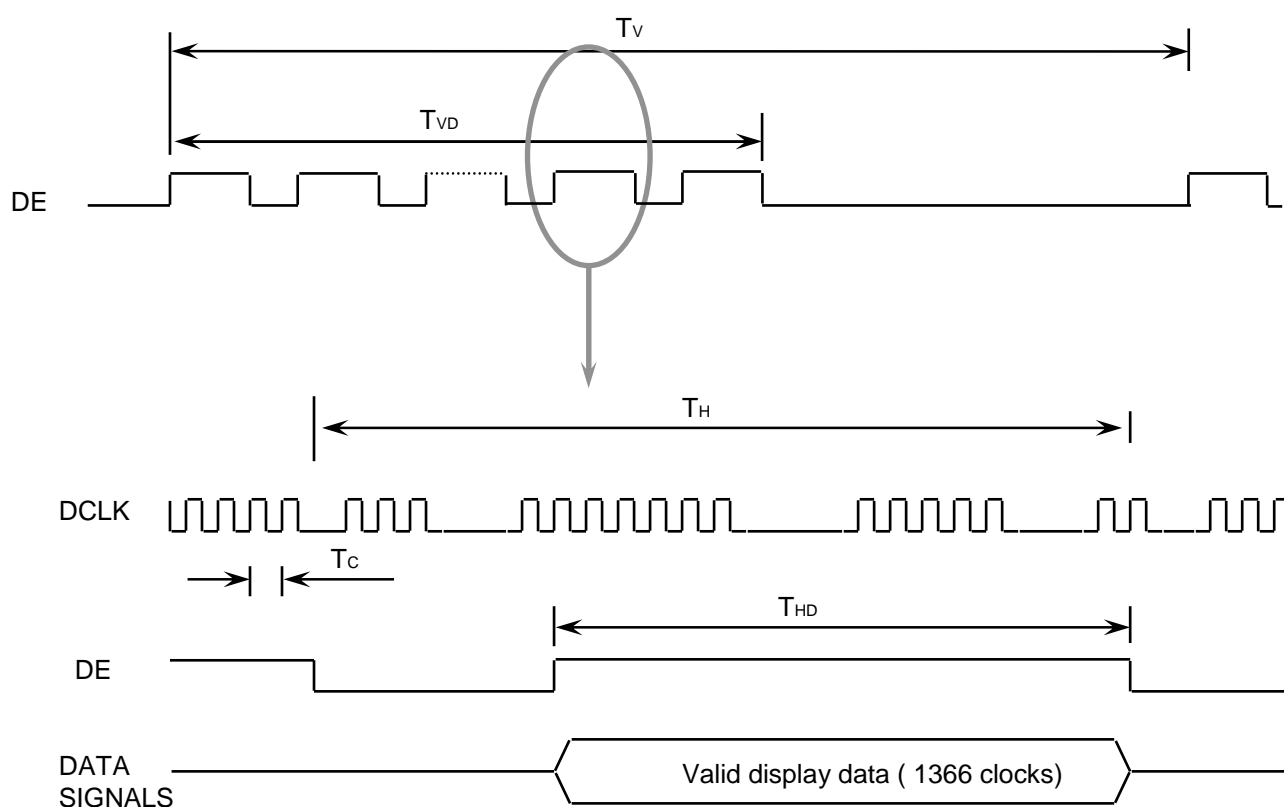
**Samsung Secret**

## 6. INTERFACE TIMING

### 6.1 Timing Parameters

| Signal                         | Item           | Symbol | Min. | Typ. | Max. | Unit   | Note |
|--------------------------------|----------------|--------|------|------|------|--------|------|
| Frame Frequency                | Cycle          | TV     | 773  | 790  | 1000 | Lines  | -    |
| Vertical Active Display Term   | Display Period | TVD    | -    | 768  | -    | Lines  | -    |
| One Line Scanning Time         | Cycle          | TH     | 1406 | 1526 | 1750 | Clocks | -    |
| Horizontal Active Display Term | Display Period | THD    | -    | 1366 | -    | Clocks | -    |

### 6.2 Timing diagrams of interface signal

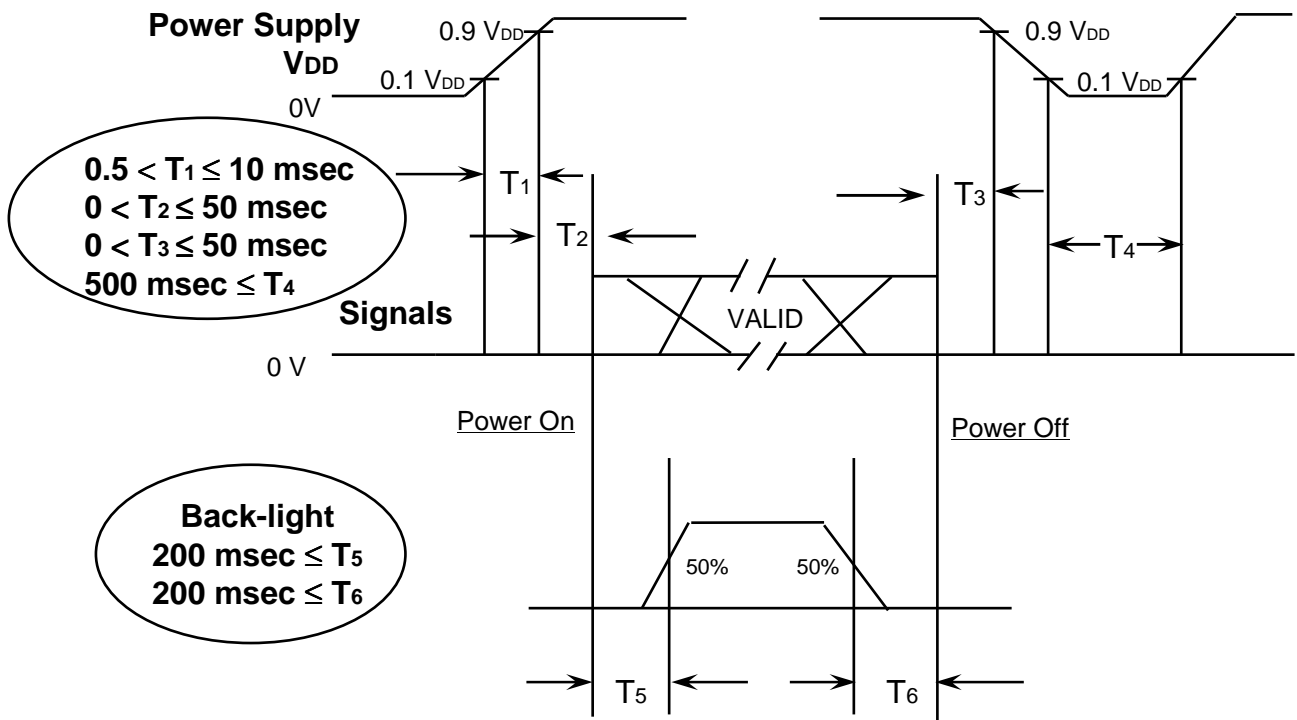


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### 6.3 Power ON/OFF Sequence

Approval

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



**Power ON/OFF Sequence**

- T<sub>1</sub> : V<sub>DD</sub> rising time from 10% to 90%
- T<sub>2</sub> : The time from V<sub>DD</sub> to valid data at power ON.
- T<sub>3</sub> : The time from valid data off to V<sub>DD</sub> off at power Off.
- T<sub>4</sub> : V<sub>DD</sub> off time for Windows restart
- T<sub>5</sub> : The time from valid data to B/L enable at power ON.
- T<sub>6</sub> : The time from valid data off to B/L disable at power Off.

**NOTE.**

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

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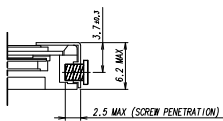
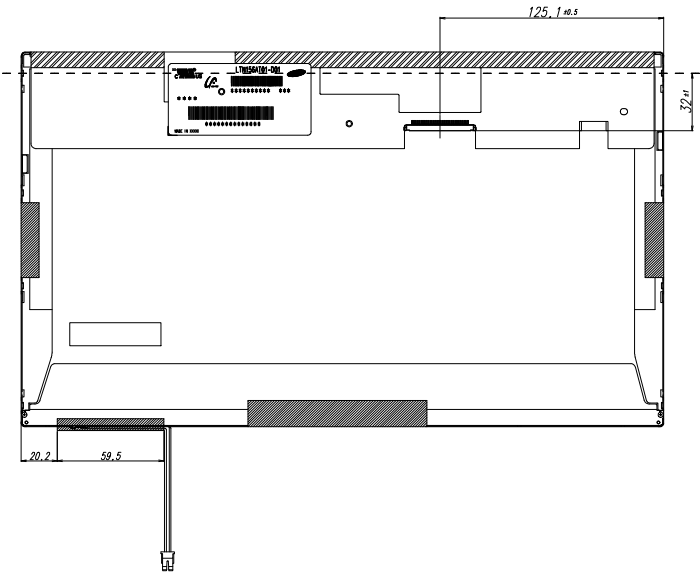
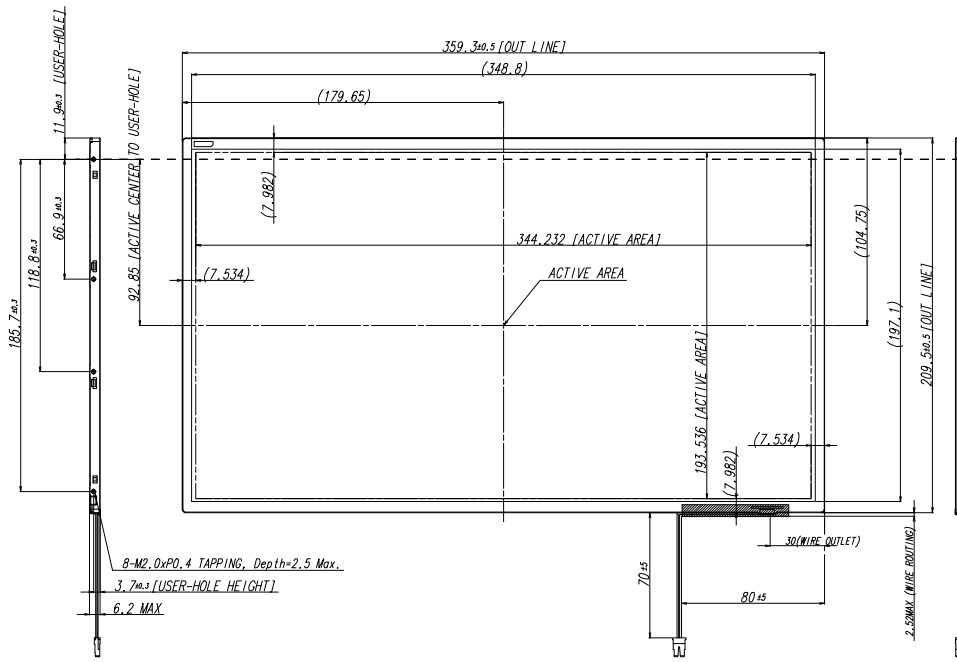
## 7. MECHANICAL OUTLINE DIMENSION

Approval

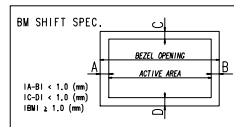
Please refer to the next page.

**Samsung Secret**

|                |              |               |                 |             |         |
|----------------|--------------|---------------|-----------------|-------------|---------|
| <b>Doc.No.</b> | LTN156AT01-D | <b>Rev.No</b> | 04-A00-S-081125 | <b>Page</b> | 21 / 30 |
|----------------|--------------|---------------|-----------------|-------------|---------|



<USER HOLE SCREW PENETRATION DEPTH>



\* NOTE

1. SIGNAL INTERFACE CONNECTOR TO BE SPECIFIED AS BELOW.
  - MAKER : UJU OR COMPATIBLE
  - INPUT CONNECTOR : UJU IS100-L30R-L15
2. LAMP CONNECTOR FOR BACKLIGHT TO BE SPECIFIED AS BELOW.
  - MAKER : JST (TBD)
  - PART NO : BHSR-02VS-1 (TBD)
  - LAMP DIAMETER :  $\phi 2.0$
3. ALLOWED DEPTH OF USERHOLE SCREW INSERTION IS MAX 2.5mm
4. TORQUE SPEC : MAX 2.5 Kgf-cm (5TIMES)
5. CALIFERS MEASURING FORCE : 750 150 gf
6. WEIGHT : TYP 500, MAX 520 g (TBD)

Approval

| REV | DATE       | DESCRIPTION OF REVISION | REASON | CHG'D BY |
|-----|------------|-------------------------|--------|----------|
| 001 | 11.08.2008 | INITIAL DESIGN          |        |          |
| 002 | 11.08.2008 | DESIGN CHANGE           |        |          |
| 003 | 11.08.2008 | DESIGN CHANGE           |        |          |
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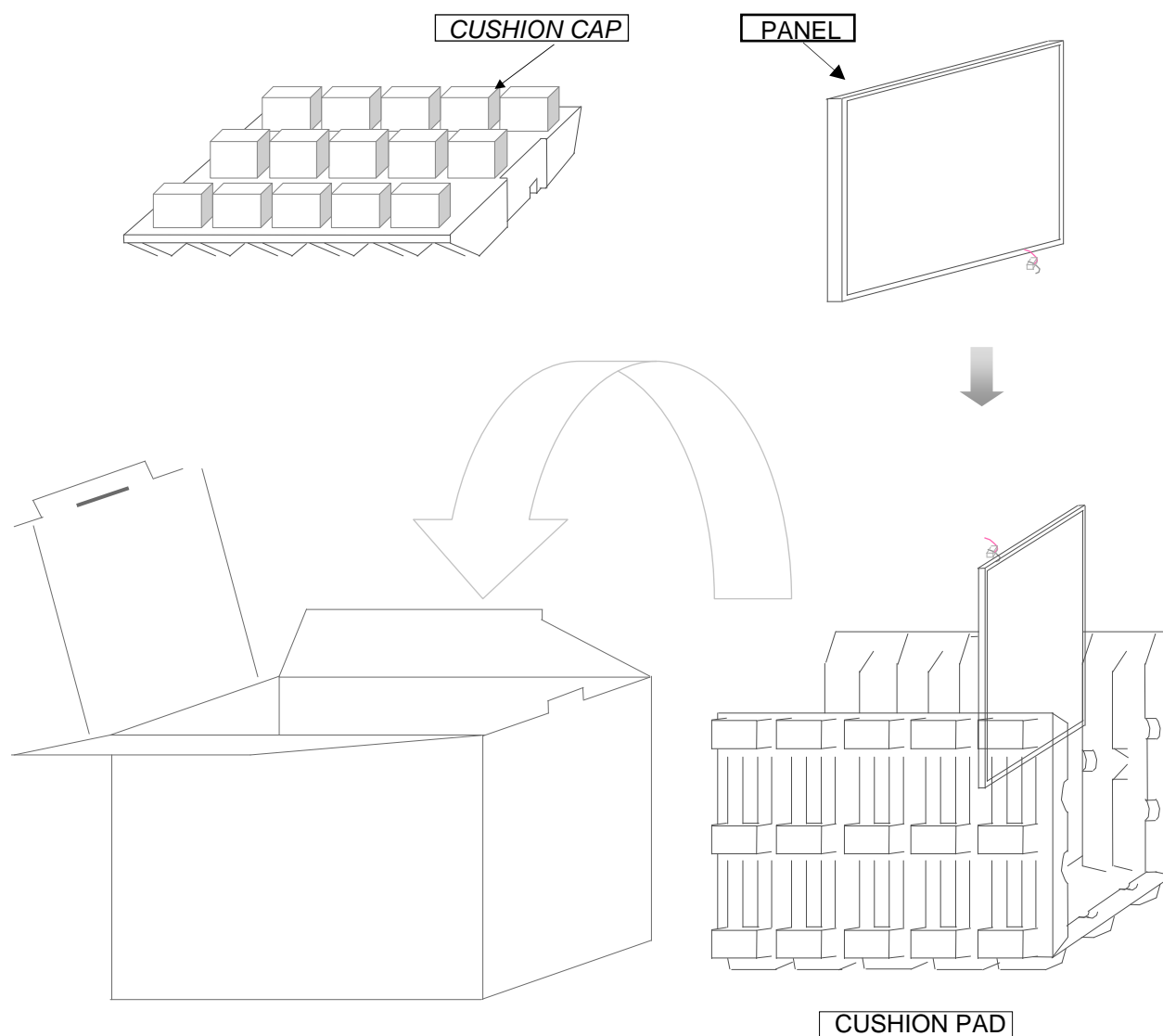
## 8. PACKING

### 1. CARTON(Internal Package)

#### (1) Packing Form

Corrugated Cardboard box and Corrupad form as shock absorber

#### (2) Packing Method



Note 1) Total Weight : Approximately 10 kg

2) Acceptance number of piling : 20 sets

3) Carton size : 344(W) x 432(D) x 329(H)

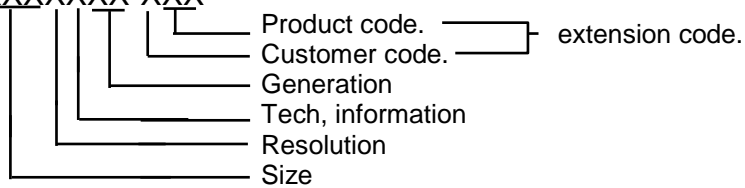
**Samsung Secret**

| No | Part name   | Quantity |
|----|---|----------|
| 1  | Static electric protective sack                     | 20       |
| 2  | Packing case (Inner box)<br>included shock absorber | 1 set    |
| 3  | Pictorial marking                                   | 2 pcs    |
| 4  | Carton  | 1 set    |

**9. MARKINGS & OTHERS**

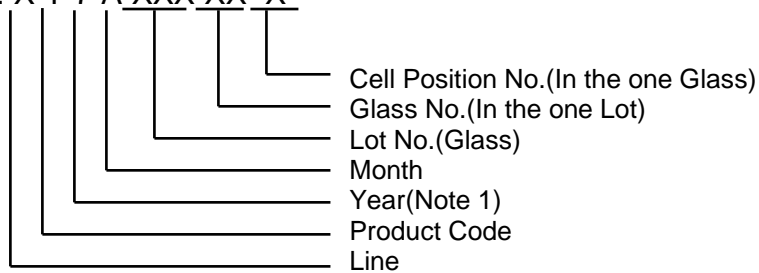
A nameplate bearing followed by is affixed to a shipped product at the specified location on each product.

(1) Parts number : LTNXXXXXXXX-XXX



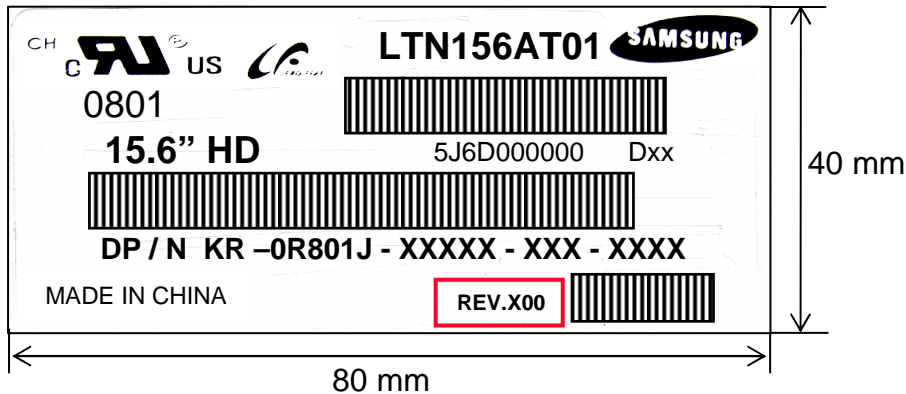
(2) Revision : Three letters

(3) Lot number : X Y 7 A XXX XX X



NOTE 1). This code indicating year is omitted in the products of KIHEUNG site.

(5) Nameplate Indication( Following example is only for reference )



Parts name : LTN156AT01-D  
Lot number : 5J6D000000  
Inspected work week : 0801 Number ("0R801J" is for 156AT01-D)  
DP/N : Part Number for other customer  
REV.X00 : Product Revision Code

**Samsung Secret**