SAMSUNG ELECTRONICS

**ISSUED DATE : 2006-05-13**

**SAMSUNG TFT-LCD PRODUCT INFORMATION**

# MODEL : LTM300M1 - P01

Note : This is Product Information is subject to change after 3 months of issuing date.

LCD Application Engineering 2, TCS Team

Samsung Electronics Co . , LTD.

wise view™ SAMSUNG TFT-LCD

## Contents

# General Description

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LTM300M1-P01 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 30.0” is 2560 x 1600 and this model can display up to 16.7 millions colors.

## Features

- High contrast ratio & high aperture structure
- High speed response
- WQXGA (2560 x 1600 pixels) resolution
- S-PVA (Super Patterned Vertical Alignment) mode
- Direct BLU Structure (Cold Cathod Fluorescent Tube)
- Sync & DE(Data Enable) mode
- Dual Link TMDS serial interface (4pixel/clock)
- RoHS compliance
- Pb-free compliance

## Applications

- Workstation & desktop monitors
- Display terminals for AV application products
- Monitors for industrial machine
- HDTV, medical machine

  * If the module is used to other applications besides the above, please contact SEC in advance.

# General Information

| Items | Specification | Unit | Note |
|---|---|---|---|
| Pixel Pitch | 0.2505(H) x 0.2505(W) | mm | |
| Active Display Area | 641.28(H) x 400.8(V) | mm | |
| Surface Treatment | Haze 44% , Hard-coating (3H) | | |
| Display Colors | 8 bit - 16.7M | colors | |
| Number of Pixels | 2,560 x 1,600 | pixel | |
| Pixel Arrangement | RGB vertical stripe | | |
| Display Mode | Normally Black | | |
| Luminance of White | 400 | cd/㎡ | typ |

**Mechanical Information**

| Item | | Min. | Typ. | Max. | Unit | Note |
|---|---|---|---|---|---|---|
| Module size | Horizontal (H) | - | 677.3 | - | mm | w/o inverter ass'y |
| | Vertical (V) | - | 436.8 | - | mm | |
| | Depth (D) | - | - | 42.3 | mm | w/ inverter ass'y |
| Weight | | - | - | - | kg | LCD module only |
| | | - | - | 4.9 | Kg | w/ Inverter assembly |

Note (1) Mechanical tolerance is ± 0.5mm unless there is a special comment.

## 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 | 21.0 | V | |
| Storage temperature | $T_{STG}$ | -25 | 60 | ℃ | (1) |
| Glass surface temperature (Operation) | $T_{OPR}$ | 0 | 50 | ℃ | |
| Shock ( non - operating ) | $S_{nop}$ | - | 50 | G | (2) |
| Vibration ( non - operating ) | $V_{nop}$ | - | 1.5 | G | (3) |

Note (1) Ta= 25 ± 2 °C

(1) Temperature and relative humidity range are shown in the figure below.
   a. 90 % RH Max.  (Ta ≤ 39 °C)
   b. Maximum wet-bulb temperature at 39 °C or less. (Ta ≤ 39 °C)
   c. No condensation
(2) 11ms, sine wave, one time for  ±X, ±Y, ±Z axis
(3) 10-300 Hz, Sweep rate 10min, 30min for X,Y,Z axis

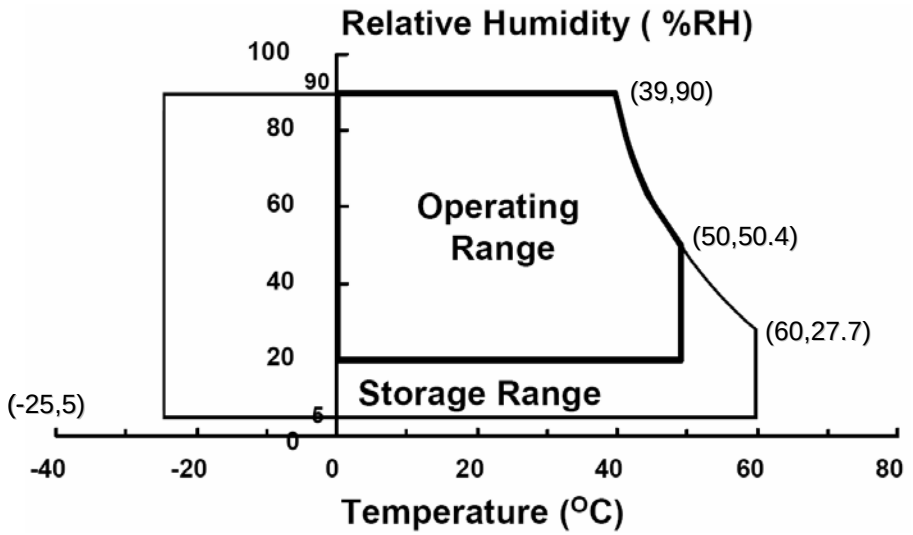



**Fig.  Temperature and  Relative humidity range**

## 2. Optical Characteristics

The optical characteristics should be measured in a dark room or equivalent.
Measuring equipment : TOPCON BM-7,SPECTRORADIOMETER SR-3

(Ta = 25 ± 2°C, VDD=18V, fv= 60Hz, fDCLK=134.25MHz, IL = 6.0mArms)

| Item | | Symbol | Condition | Min. | Typ. | Max. | Unit | Note |
|---|---|---|---|---|---|---|---|---|
| Contrast Ratio (Center of screen) | | C/R | Normal $\theta_{L,R}=0$ $\theta_{U,D}=0$ Viewing Angle | 500 | 900 | - | | (3) SR-3 |
| Response Time | On/Off | Tr + Tf | | - | 12 | 18 | msec | (5) BM-7 |
| | **G-To-G** | $T_{G-G,AVG}$ | | - | 6 | - | msec | BM-7 |
| Luminance of White (Center of screen) | | $Y_L$ | | 350 | 400 | - | cd/m2 | (6) SR-3 |
| Color Chromaticity (CIE 1931) | Red | Rx | | - | 0.640 | - | | (7),(8) SR-3 |
| | | Ry | | - | 0.330 | - | | |
| | Green | Gx | | - | 0.300 | - | | |
| | | Gy | | - | 0.608 | - | | |
| | Blue | Bx | | - | 0.150 | - | | |
| | | By | | - | 0.060 | - | | |
| | White | Wx | | - | 0.313 | - | | |
| | | Wy | | | 0.329 | | | |
| Color Chromaticity (CIE 1976) | Red | Ru' | | - | 0.459 | - | | |
| | | Rv' | | - | 0.525 | - | | |
| | Green | Gu' | | - | 0.125 | - | | |
| | | Gv' | | - | 0.563 | - | | |
| | Blue | Bu' | | - | 0.164 | - | | |
| | | Bv' | | - | 0.197 | - | | |
| | White | Wu' | | - | 0.198 | - | | |
| | | Wv' | | - | 0.468 | - | | |
| C.G.L | White | △u'v' | | - | - | 0.02 | | (9) |

* C.G.L : Color Grayscale Linearity

(continue to the next page)

| Item | | Symbol | Condition | Min. | Typ. | Max. | Unit | Note |
|---|---|---|---|---|---|---|---|---|
| Color Gamut | | - | | - | 72 | - | % | |
| Color Temperature | | - | | - | 6500 | - | K | |
| Viewing Angle | Hor. | $\theta_L$ | CR≥10 | 80 | 89 | - | Degrees | (8) SR-3 |
| | | $\theta_R$ | | 80 | 89 | - | | |
| | Ver. | $\theta_U$ | | 80 | 89 | - | | |
| | | $\theta_D$ | | 80 | 89 | - | | |
| Viewing Angle | Hor. | $\theta_L$ | CR≥100 | - | 75 | - | Degrees | (8) SR-3 |
| | | $\theta_R$ | | - | 75 | - | | |
| | Ver. | $\theta_U$ | | - | 65 | - | | |
| | | $\theta_D$ | | - | 65 | - | | |
| Brightness Uniformity (13 Points) | | $B_{uni}$ | | - | - | 25 | % | (4) SR-3 |

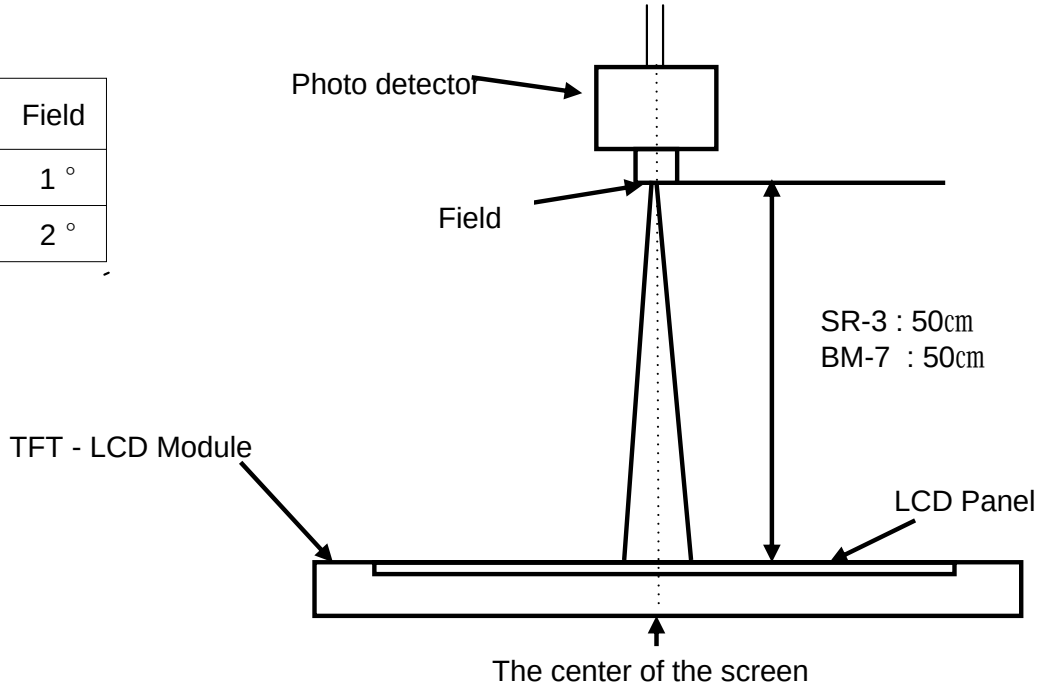
Note (1) Test Equipment Setup

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

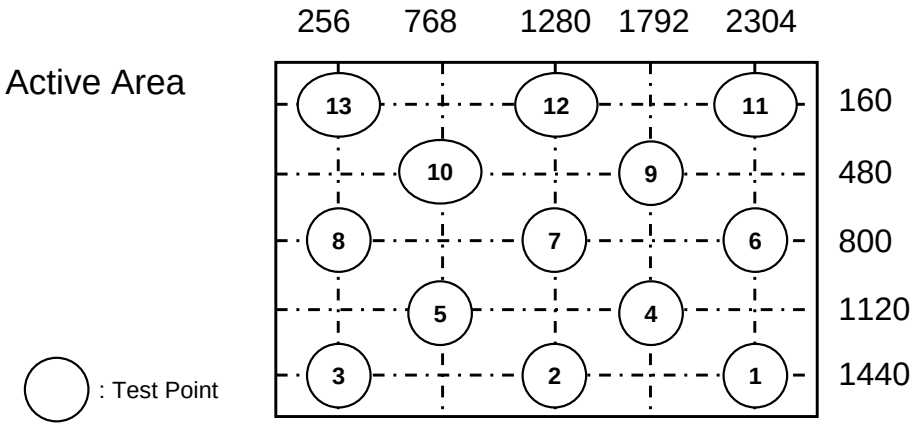
Single lamp current : 6.0mA

Environment condition : Ta = 25 ± 2 °C

| Photo detector | Field |
|---|---|
| SR-3 | 1 ° |
| BM-7 | 2 ° |



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 point⑦ 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 13 points brightness uniformity(100% White)

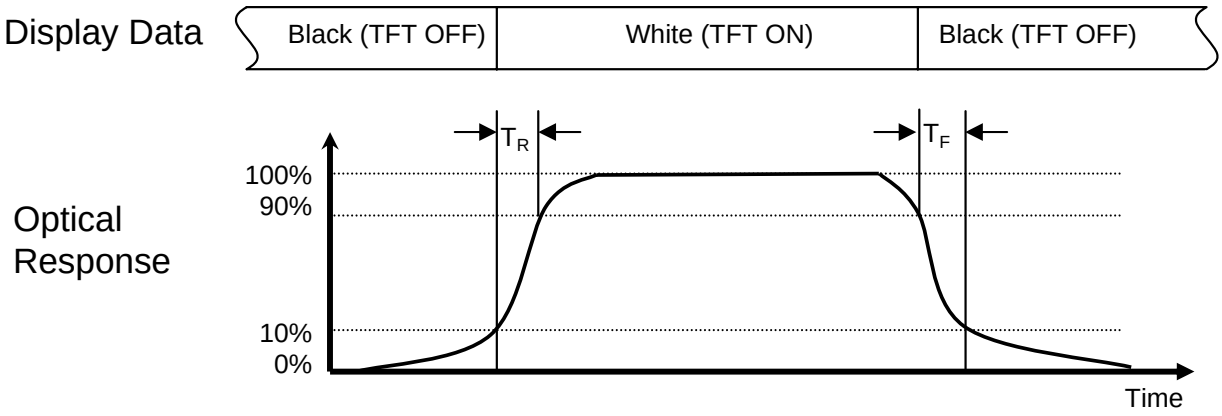
$$Buni = 100 \times \frac{(B\max - B\min)}{B\max}$$

Bmax : Maximum brightness

Bmin : Minimum brightness

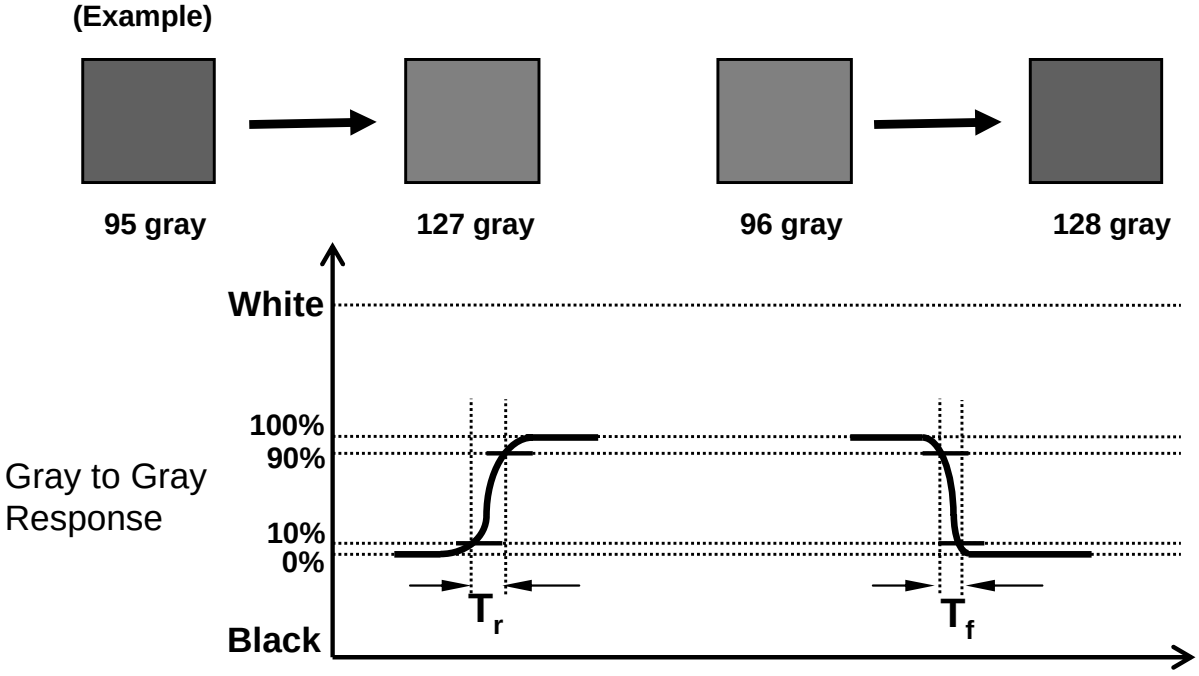
Note (5) Definition of Response time

a. On/Off response time : Sum of Tr, Tf




b. Gray to Gray Response Time

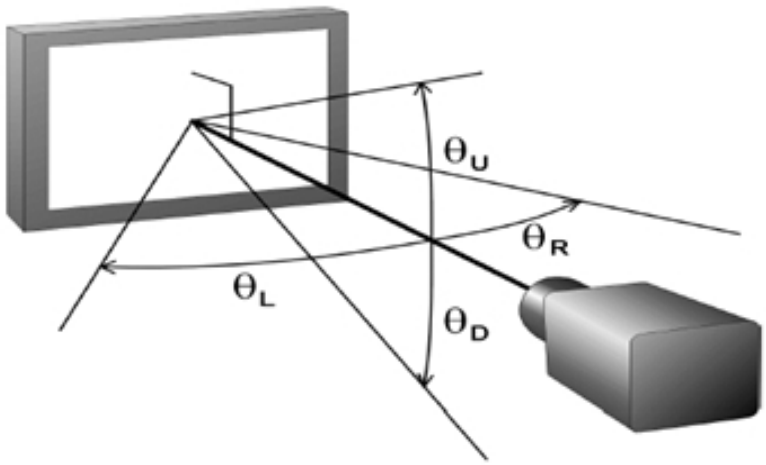
- Measuring gray : 31 → 63, 63 →95,95 → 127, 127 → 159, 159 → 191, 191 → 223 grays and vice versa
- $T_{G\text{-}G,\ avg}$ : Average response time of ones between above grays



Note (6) Definition of Luminance of White : Luminance of white at center point⑤

Note (7) Definition of Color Chromaticity (CIE 1931, CIE1976)
Color coordinate of Red, Green, Blue & White at center point⑤

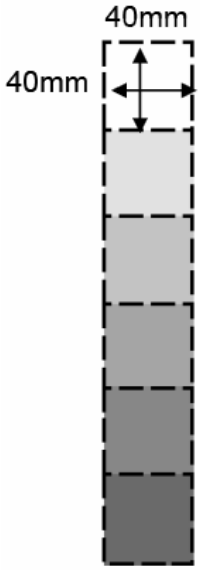
Note (8) Definition of Viewing Angle
: Viewing angle range (CR ≥10, CR ≥100)



Note (9) Color Grayscale Linearity

a. Test image : 100% full white pattern with a test pattern as below

b. Test pattern : Squares, 40mm by 40mm in size, filled with 255, 225, 195, 165, 135 and 105 grays steps should be arranged at the center⑤ of the screen.




c. Test method

-1st gray step : move a square of 255 gray level should be moved into the center of the screen and measure luminance and u' and v' coordinates.

- Next gray step : Move a 225 gray square into the center and measure both luminance and coordinates, too.

d. Test evaluation

$$\Delta u'v' = \sqrt{(u'_A - u'_B)^2 + (v'_A - v'_B)^2}$$

Where A, B : 2 gray levels found to have the largest color differences between them

i.e. get the largest Δu' and Δv' of each 6 pair of u' and v' and calculate the Δu'v'.

# 3. Electrical Characteristics

## 3.1 TFT LCD Module

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

Ta = 25°C

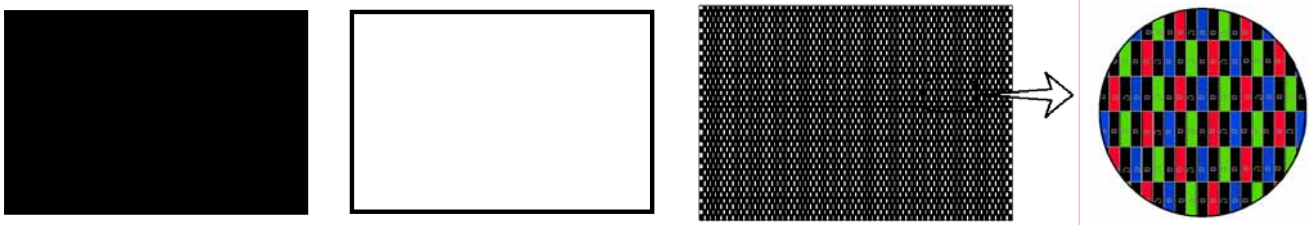
| Item | | Symbol | Min. | Typ. | Max. | Unit | Note |
|---|---|---|---|---|---|---|---|
| Voltage of Power Supply | | $V_{DD}$ | 17 | 18 | 19 | V | (1) |
| Interface Type | | Dual Link TMDS | TMDS (Sil178 or Sil170 TX) | | | | |
| Current of Power Supply | (a) Black | $I_{DD}$ | - | 750 | 900 | mA | (2) |
| | (b) White | | - | 1,000 | 1,200 | mA | |
| | (c) Dot | | - | 1,150 | 1,250 | mA | |
| Vsync Frequency | | $f_V$ | - | 59.97 | - | Hz | 2pxl/clk |
| Hsync Frequency | | $f_H$ | - | 98.713 | - | kHz | |
| Main Frequency | | $f_{DCLK}$ | - | 134.25 | - | MHz | |
| Vsync Frequency | | $f_V$ | - | 59.91 | - | Hz | 1pxl/clk |
| Hsync Frequency | | $f_H$ | - | 49.31 | - | kHz | |
| Main Frequency | | $f_{DCLK}$ | - | 71.0 | - | MHz | |
| Rush Current | | $I_{RUSH}$ | - | - | 3.0 | A | (3) |

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

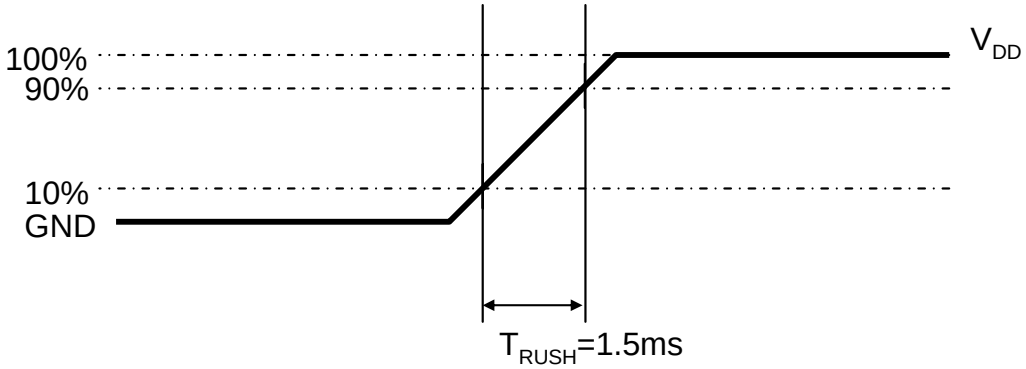
(1) fV=60Hz, fDCLK =134.25MHz, VDD = 18.0V, DC Current.

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

a) Black Pattern b) White Pattern c) Dot Pattern



(3) Measurement Condition




Rush Current $I_{RUSH}$ can be measured when $T_{RUSH}$. is 1.5ms.

## 3.2 Back Light Unit

The back light unit is a direct type 16 CCFTs ( Cold Cathode Fluorescent Tube )
The characteristics of lamps are shown in the following tables.

Ta=25 ± 2°C

| Item | Symbol | Min. | Typ. | Max. | Unit | Note |
|---|---|---|---|---|---|---|
| Lamp Current | $I_L$ | 4.0 | 6.0 | 7.5 | mArms | (1) |
| Lamp Voltage | $V_L$ | - | 1120 | - | Vrms | |
| Lamp Frequency | $f_L$ | 40 | - | 60 | kHz | (2) |
| Operating Life Time | Hr | 50,000 | - | - | Hour | (3) |
| Startup Voltage | Vs | - | 0°C : 1,850<br>25°C: 1,700 | | Vrms | (5) |

Note (1) Specified values are for a single lamp.
Lamp current is measured with current meter for high frequency as shown below.
Refer to the following block diagram of the back light unit for more information.

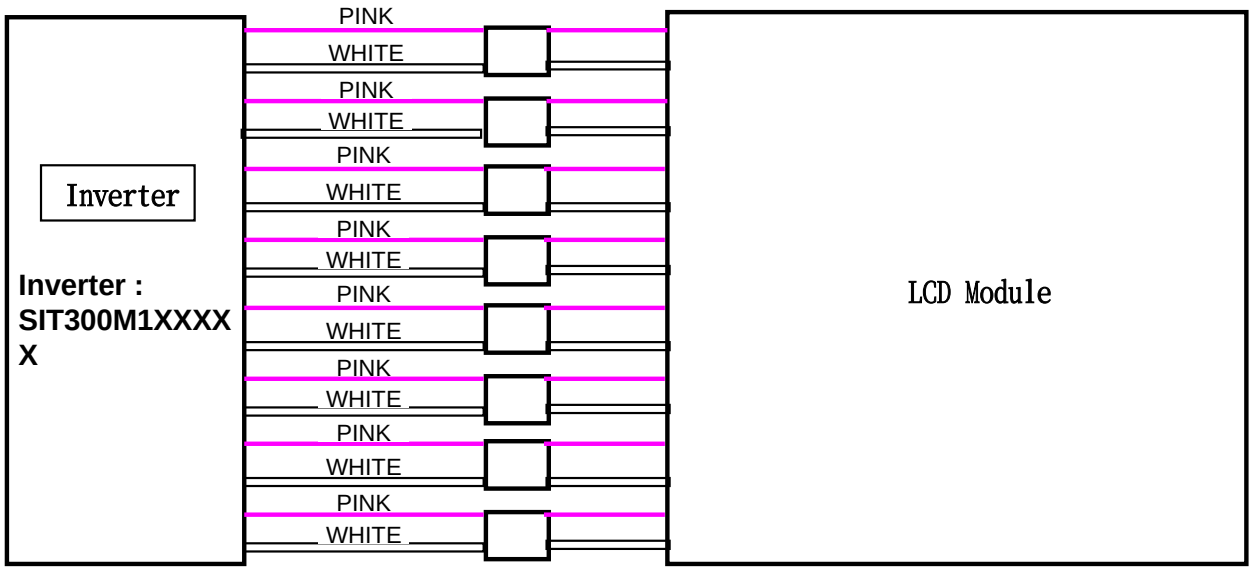



**Fig. Measurement point of Lamp Current**

(2) Lamp frequency which may produce interference with horizontal synchronous frequency 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) Life time (Hr) is defined as the time when brightness of a lamp unit itself becomes 50% or less than its original value at the condition of Ta = 25±2°C and $I_L$ = 6.0mArms

(4) If an inverter has shutdown function, it should keep its output for over 1 second even if the lamp connector is open. Otherwise the lamps may not be turned on.

## 3.3 Inverter Specification

| No. | Item | SYM | Condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|
| 1 | Input Voltage | $V_{IN}$ | - | 21.6 | 24.0 | 26.4 | V |
| 2 | Input Current | $I_{IN}$ | Vin=24V, $V_{ADIM}$=2.8V | | | 7 | A |
| | | | After 1 Hour Aging | | 3.5 | | |
| 3 | Output Current | $I_{OMAX}$ | Vin=24V, $V_{ADIM}$ : 2.8V | 5.5 | 6.0 | 6.5 | mArms |
| | | $I_{0MIN}$ | Vin=24V, $V_{ADIM}$ : 0.0V | 3.0 | 3.5 | 4.0 | |
| 4 | Lamp Frequency | $f_0$ | $V_{IN}$=24V | 55 | 60 | 65 | KHz |
| 5 | Backlight ON/OFF Control | ON | - | 2.4 | | 5.25 | V |
| | | OFF | - | 0 | | 0.8 | |
| 6 | Analog Mode Signal | $V_{ADIM}$ | $V_{IN}$=24V | 0 | | 2.8 | V |
| 7 | Open Lamp Voltage | $V_{OPEN}$ | $V_{IN}$=24V,PWM Duty=100% Each Transformer Output | 1850 | | | Vrms |
| 8 | PWM Frequency | $f_{PWM}$ | $V_{IN}$=24V | 140 | 150 | 160 | Hz |
| 9 | Shutdown time | $T_{SD}$ | $V_{IN}$=24V | 1.0 | 1.5 | 2.0 | sec |

(Note)

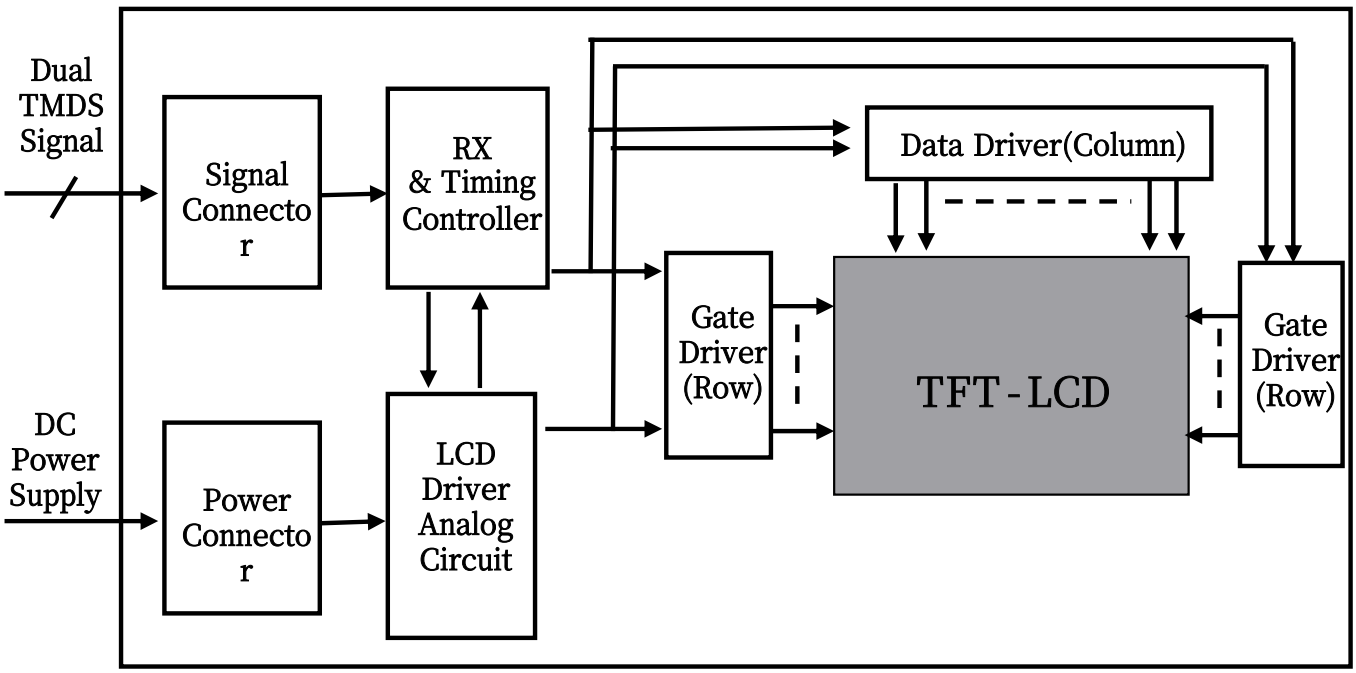
● Open Lamp voltage measurement

- Vopen : All output connectors open, then two voltage probe touch on one lamp output terminals simultaneously
- One wire open voltage : One wire of lamp open, then two voltage probes touch on one lamp output terminals simultaneously

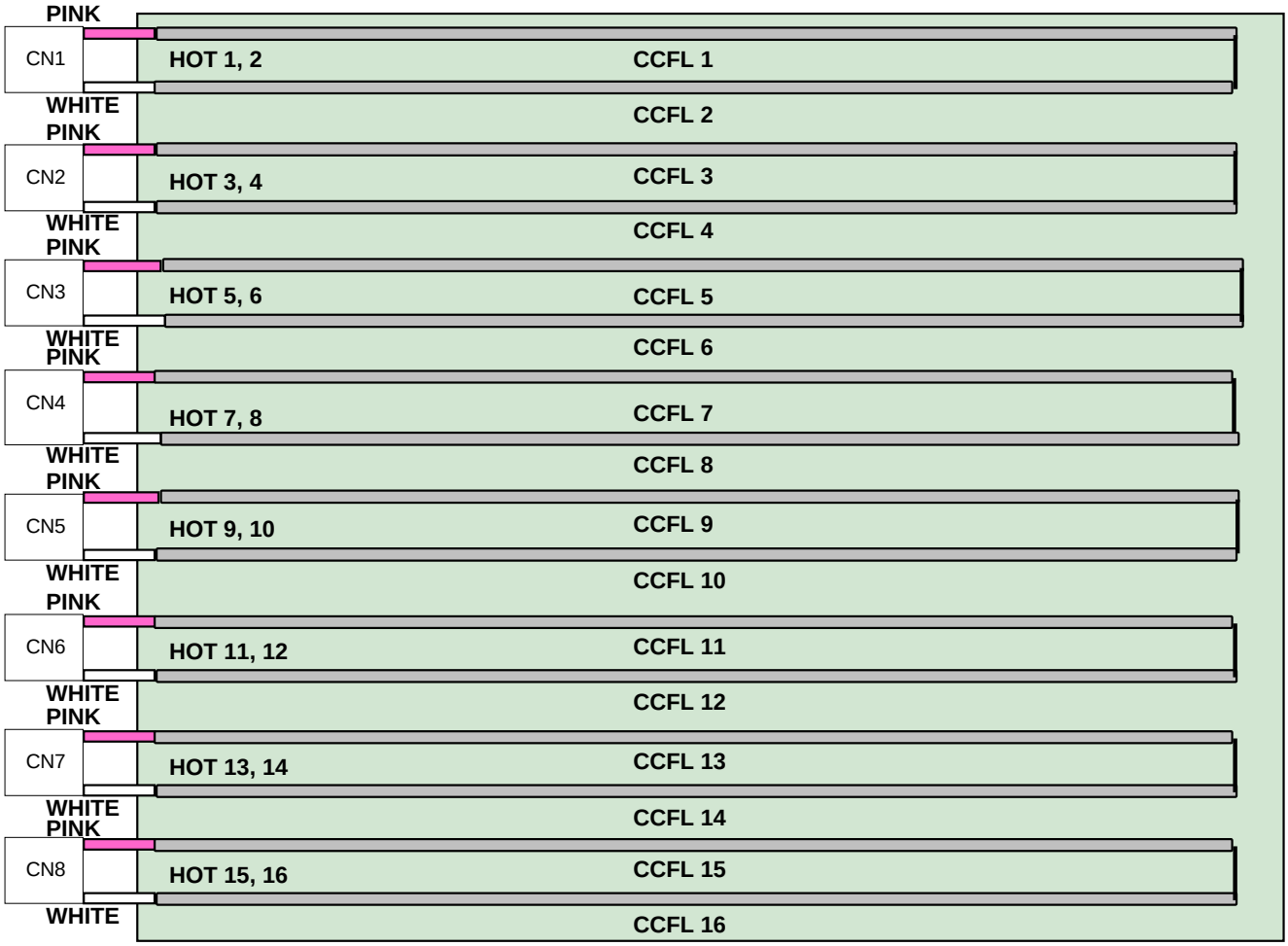
※ The open lamp voltage indicates the secondary voltage of Transformer.
in case of open lamp voltage-measurement, They must be tested simultaneously.

# 4. BLOCK DIAGRAM

## 4.1 TFT LCD Module




## 4.2 Back Light Unit



# 5. Input Terminal Pin Assignment

## 5.1.1 Input Signal ( Connector : IS100-L30O-C23 or Compatible )

| PIN No | Symbol | Description | PIN No | Symbol | Description |
|---|---|---|---|---|---|
| 1 | NC | CTL (Internal Only) | 16 | RxC+ | TMDS Negative differential output (channel C) |
| 2 | NC | CE (Internal Only) | 17 | SHLD5 | Shield for TMDS Channel 5 |
| 3 | NC | NC | 18 | Rx5+ | TMDS Positive differential output (channel 5) |
| 4 | NC | NC | 19 | Rx5- | TMDS Negative differential output (channel 5) |
| 5 | SHLD2 | Shield for TMDS Channel 2 | 20 | SHLD4 | Shield for TMDS Channel 4 |
| 6 | Rx2+ | TMDS Positive differential output (channel 2) | 21 | Rx4+ | TMDS Positive differential output (channel 4) |
| 7 | Rx2- | TMDS Negative differential output (channel 2) | 22 | Rx4- | TMDS Negative differential output (channel 4) |
| 8 | SHLD1 | Shield for TMDS Channel 1 | 23 | SHLD3 | Shield for TMDS Channel 3 |
| 9 | Rx1+ | TMDS Positive differential output (channel 1) | 24 | Rx3+ | TMDS Positive differential output (channel 3) |
| 10 | Rx1- | TMDS Negative differential output (channel 1) | 25 | Rx3- | TMDS Negative differential output (channel 3) |
| 11 | SHLD0 | Shield for TMDS Channel 0 | 26 | NC | NC |
| 12 | Rx0+ | TMDS Positive differential output (channel 0) | 27 | NC | NC |
| 13 | Rx0- | TMDS Negative differential output (channel 0) | 28 | NC | NC |
| 14 | SHLDC | Shield for TMDS Channel C | 29 | NC | NC |
| 15 | RxC+ | TMDS Positive differential output (channel C) | 30 | NC | NC |

* If the system already uses the 1, 2 pins, it should keep under GND level
The voltage applied to those pins should not exceed -200mV.

## 5.1.2. Input Power

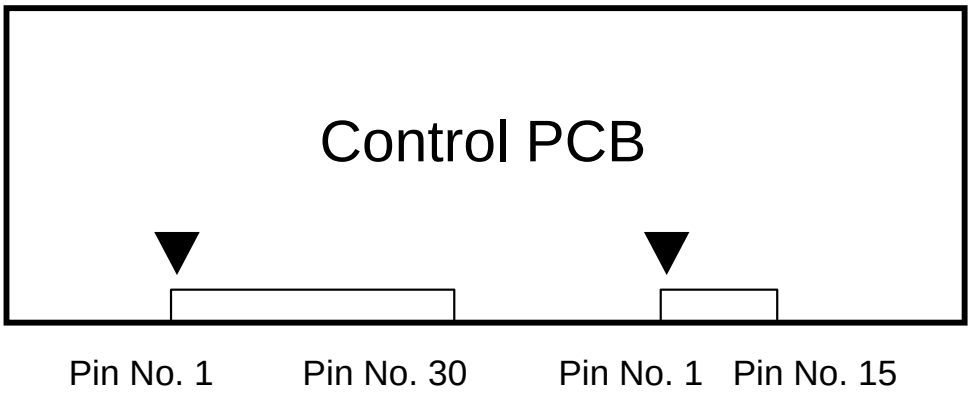
1) Connector (Receptacle) : 53261 (Molex) of Equivalent.
2) Mating Connector (Plug) : 51021 or its equivalent.

| PIN No | Symbol | Description | Notes |
|---|---|---|---|
| 1 | SDA | Sil1169 HDCP program Mode Data | Pull Up 3.3V |
| 2 | SCL | Sil1169 HDCP program Mode CLK | Pull Up 3.3V |
| 3 | PWR_ON | LCM On Control signal input | Pull Up 3.3V |
| 4 | GND | Ground | |
| 5 | Vlcd | LCM Power supply, +18V ±5% | |
| 6 | Vlcd | LCM Power supply, +18V ±5% | |
| 7 | Vlcd | LCM Power supply, +18V ±5% | |
| 8 | Vlcd | LCM Power supply, +18V ±5% | |
| 9 | GND | Ground | |
| 10 | HDCP_CLK | HDCP_Clock | Reserved |
| 11 | HDCP_DAT | HDCP_Data | Reserved |
| 12 | AGP | Auto generate pattern | Pull Up 3.3V |
| 13 | HS_OUT | Hsync Output | |
| 14 | VS_OUT | Vsync Output | |
| 15 | GND | Ground | |

5.1.3. Inverter Input Connector : S14B-PHA-SM (JST) or Compatible.

| Pin | Symbol | Description | Notes |
|---|---|---|---|
| 1 | $V_{BL}$ | Power Supply, +24V | |
| 2 | $V_{BL}$ | Power Supply, +24V | |
| 3 | $V_{BL}$ | Power Supply, +24V | |
| 4 | $V_{BL}$ | Power Supply, +24V | |
| 5 | $V_{BL}$ | Power Supply, +24V | |
| 6 | GND | Power Ground | |
| 7 | GND | Power Ground | |
| 8 | GND | Power Ground | |
| 9 | GND | Power Ground | |
| 10 | GND | Power Ground | |
| 11 | VS | No connection | |
| 12 | $V_{ON}$ | BL On/Off Control signal | ON : 2.4V~5.25V<br>OFF : 0.0~0.8V |
| 13 | $V_{BR}$ | PWM Dimming Control Signal | **Max2.8V / Min(0.0)V** |
| 14 | Status | Lamp Operating Status | Normal =0~0.8V<br>Abnormal=**3.0~5.0V** |

Note) Pin number starts from Right side



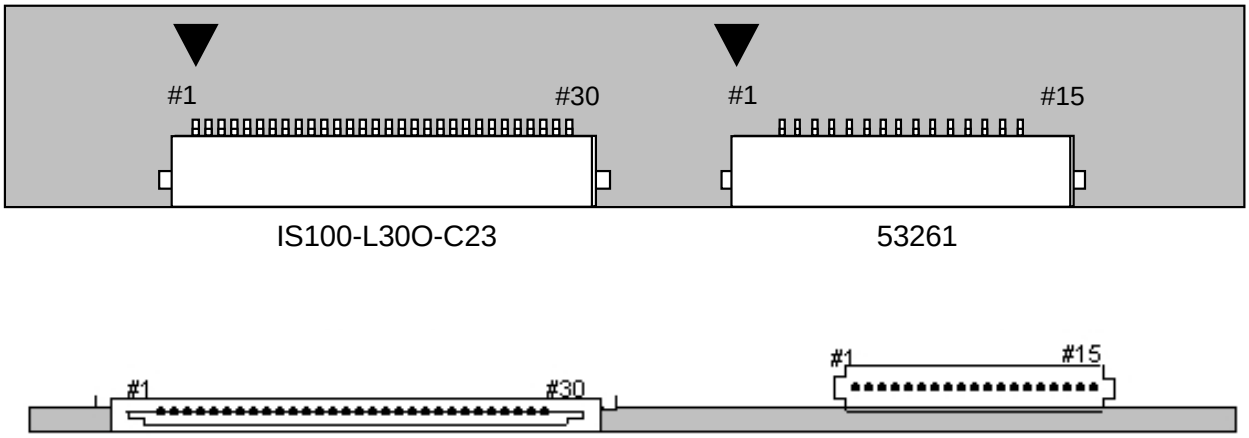




**Fig. Connector diagram**

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

## 5.2 Back Light Unit

| Pin No. | Input | Color | Function |
|---|---|---|---|
| 1-1 | HOT | PINK | High Voltage |
| 1-2 | HOT | WHITE | High Voltage |
| 2-1 | HOT | PINK | High Voltage |
| 2-2 | HOT | WHITE | High Voltage |
| 3-1 | HOT | PINK | High Voltage |
| 3-2 | HOT | WHITE | High Voltage |
| 4-1 | HOT | PINK | High Voltage |
| 4-2 | HOT | WHITE | High Voltage |
| 5-1 | HOT | PINK | High Voltage |
| 5-2 | HOT | WHITE | High Voltage |
| 6-1 | HOT | PINK | High Voltage |
| 6-2 | HOT | WHITE | High Voltage |
| 7-1 | HOT | PINK | High Voltage |
| 7-2 | HOT | WHITE | High Voltage |
| 8-1 | HOT | PINK | High Voltage |
| 8-2 | HOT | WHITE | High Voltage |
| Connector Part No. | 20022WR-14(L)(Yeonho) or Compatible. | | |

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

| COLOR | DISPLAY (8bit) | DATA SIGNAL | | | | | | | | | | | | | | | | | | | | | | | | GRAY SCALE LEVEL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | RED | | | | | | | | GREEN | | | | | | | | BLUE | | | | | | | | |
| | | R0 | R1 | R2 | R3 | R4 | R5 | R6 | R7 | G0 | G1 | G2 | G3 | G4 | G5 | G6 | G7 | B0 | B1 | B2 | B3 | B4 | B5 | B6 | B7 | |
| BASIC COLOR | BLACK | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | - |
| | BLUE | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | - |
| | GREEN | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | - |
| | CYAN | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | - |
| | RED | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | - |
| | MAGENTA | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | - |
| | YELLOW | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | - |
| | WHITE | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | - |
| GRAY SCALE OF RED | BLACK | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | R0 |
| | DARK ↑ | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | R1 |
| | | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | R2 |
| | | : | : | : | : | : | : | | | : | : | : | : | : | : | | | : | : | : | : | : | : | | | R3~ R252 |
| | ↓ LIGHT | : | : | : | : | : | : | | | : | : | : | : | : | : | | | : | : | : | : | : | : | | | |
| | | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | R253 |
| | | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 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 |
| | DARK ↑ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | G1 |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | G2 |
| | | : | : | : | : | : | : | | | : | : | : | : | : | : | | | : | : | : | : | : | : | | | G3~ G252 |
| | ↓ LIGHT | : | : | : | : | : | : | | | : | : | : | : | : | : | | | : | : | : | : | : | : | | | |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 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 | 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 |
| | DARK ↑ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | B1 |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | B2 |
| | | : | : | : | : | : | : | | | : | : | : | : | : | : | | | : | : | : | : | : | : | | | B3~ B252 |
| | ↓ LIGHT | : | : | : | : | : | : | | | : | : | : | : | : | : | | | : | : | : | : | : | : | | | |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 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 | 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 (1) 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

# 6. Interface Timing

## 6.1 Timing Parameters ( Dual Mode : 2,560*1,600 )

**2pxl/clk**

| SIGNAL | ITEM | SYMBOL | MIN. | TYP. | MAX. | UNIT | NOTE |
|---|---|---|---|---|---|---|---|
| Clock | Frequency | $1/T_C$ | 134.25 | 134.25 | 134.25 | MHz | (1),(2) |
| | High Time | $T_{CH}$ | 3.725 | 3.725 | 3.725 | nsec | |
| | Low Time | $T_{CL}$ | 3.725 | 3.725 | 3.725 | nsec | |
| Data Enable | Setup Time | $T_{ES}$ | - | - | - | nsec | |
| Frame Frequency | Cycle | $T_V$ | 16.7 | 16.7 | 16.7 | msec | |
| | | | 1646 | 1646 | 1646 | lines | |
| One Line Scanning Time | Cycle | $T_H$ | 2720 | 2720 | 2720 | clocks | |
| Vertical Active Display Term | Display Period | $T_{VD}$ | 1600 | 1600 | 1600 | lines | |
| | VSync Width | $T_{VW}$ | 6 | 6 | 6 | lines | ① |
| | Vertical Front Porch | $T_{VFP}$ | 3 | 3 | 3 | lines | ② |
| | Vertical Back Porch | $T_{VBP}$ | 37 | 37 | 37 | lines | ③ |
| | Vertical Blank Period | $T_{VB}$ | 46 | 46 | 46 | lines | ①+②+③ |
| Horizontal Active Display Term | Display Period | $T_{HD}$ | 1280 | 1280 | 1280 | clocks | 2pixel/clock (3) |
| | | | 2560 | 2560 | 2560 | pixels | |
| | HSync Width | $T_{HW}$ | 32 | 32 | 32 | pixels | ④ |
| | Horizontal Front Porch | $T_{HBP}$ | 48 | 48 | 48 | pixels | ⑤ |
| | Horizontal Back Porch | $T_{HFP}$ | 80 | 80 | 80 | pixels | ⑥ |
| | Horizontal Blank Period | $T_{HBP}$ | 160 | 160 | 160 | pixels | ④+⑤+⑥ |

Note 1) Test Point : TTL control signal and CLK at TMDS Tx input terminal in system
Note 2) Internal VCC 3.3 V
Note 3) DE Signal should have a same period.
Note 4) VESA CVT SPEC (Reduced Blanking)
Note 5) VESA CVT Name : 4.10MA-R

## 6.2 Timing Parameters ( Single Mode : 1,280*800 )

**1pxl/clk**

| SIGNAL | ITEM | SYMBOL | MIN. | TYP. | MAX. | UNIT | NOTE |
|---|---|---|---|---|---|---|---|
| Clock | Frequency | $1/T_C$ | 71 | 71 | 71 | MHz | (1),(2) |
| | High Time | $T_{CH}$ | 7.04 | 7.04 | 7.04 | nsec | |
| | Low Time | $T_{CL}$ | 7.04 | 7.04 | 7.04 | nsec | |
| Data Enable | Setup Time | $T_{ES}$ | - | - | - | nsec | |
| Frame Frequency | Cycle | $T_V$ | 16.7 | 16.7 | 16.7 | msec | |
| | | | 823 | 823 | 823 | lines | |
| One Line Scanning Time | Cycle | $T_H$ | 1440 | 1440 | 1440 | clocks | |
| Vertical Active Display Term | Display Period | $T_{VD}$ | 800 | 800 | 800 | lines | |
| | VSync Width | $T_{VW}$ | 6 | 6 | 6 | lines | ① |
| | Vertical Front Porch | $T_{VFP}$ | 3 | 3 | 3 | lines | ② |
| | Vertical Back Porch | $T_{VBP}$ | 14 | 14 | 14 | lines | ③ |
| | Vertical Blank Period | $T_{VB}$ | 23 | 23 | 23 | lines | ①+②+③ |
| Horizontal Active Display Term | Display Period | $T_{HD}$ | 1280 | 1280 | 1280 | clocks | 1pixel/clock (3) |
| | | | 1280 | 1280 | 1280 | pixels | |
| | HSync Width | $T_{HW}$ | 32 | 32 | 32 | pixels | ④ |
| | Horizontal Front Porch | $T_{HFP}$ | 48 | 48 | 48 | pixels | ⑤ |
| | Horizontal Back Porch | $T_{HBP}$ | 80 | 80 | 80 | pixels | ⑥ |
| | Horizontal Blank Period | $T_{HBP}$ | 160 | 160 | 160 | pixels | ④+⑤+⑥ |

Note 1) Test Point : TTL control signal and CLK at TMDS Tx input terminal in system

Note 2) Internal VCC 3.3 V

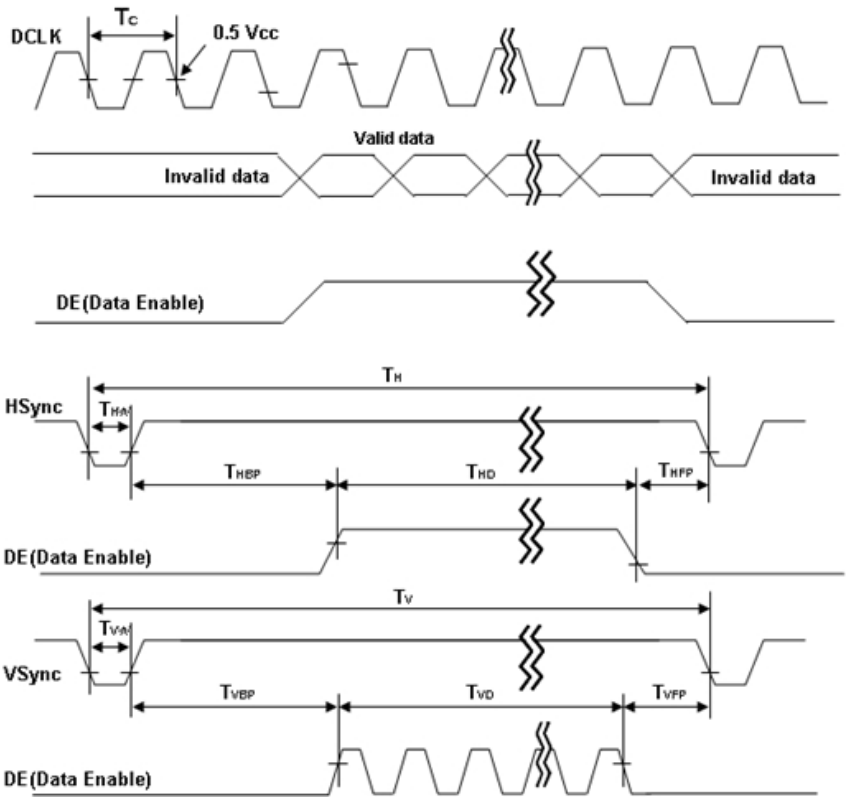
Note 3) DE Signal should have a same period.

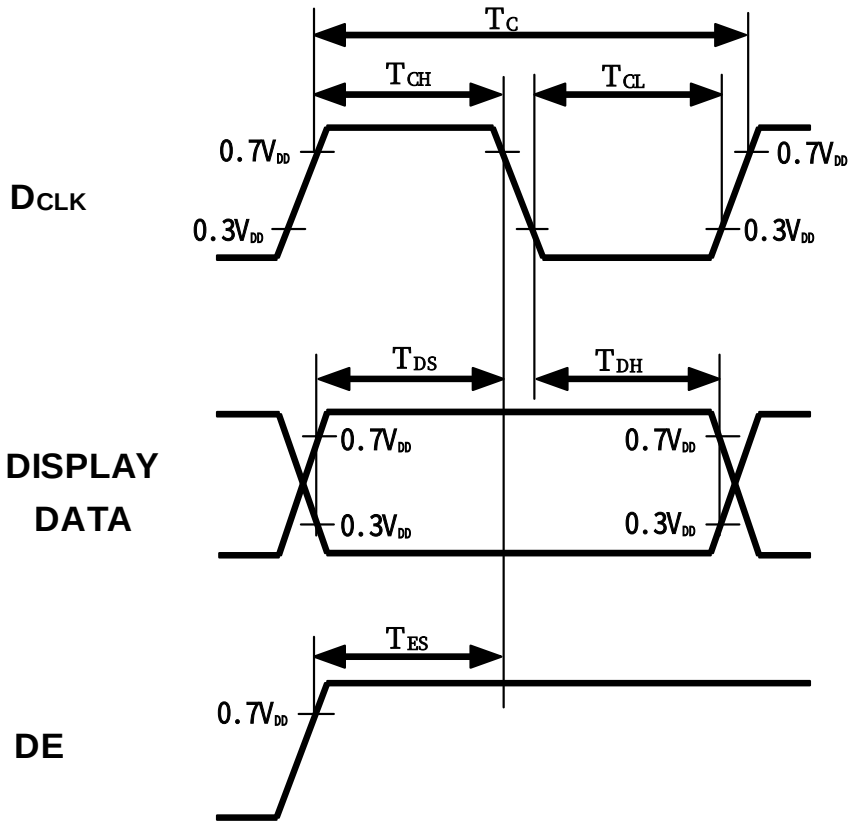
Note 4) VESA CVT SPEC (Reduced Blanking)

Note 5) VESA CVT Name : 1.02MA-R

Note 6) To operate single mode, sil1169 should be programmed.

## 6.3 Timing diagrams of interface signal ( DE only mode )



## 6.4 TMDS Interface Timing Setting

| Device | Pin Name | First Clock Edge | Second Clock Edge |
|---|---|---|---|
| Master SiI 178 | D11 | G0[3] | R0[7] |
| | D10 | G0[2] | R0[6] |
| | D9 | G0[1] | R0[5] |
| | D8 | G0[0] | R0[4] |
| | D7 | B0[7] | R0[3] |
| | D6 | B0[6] | R0[2] |
| | D5 | B0[5] | R0[1] |
| | D4 | B0[4] | R0[0] |
| | D3 | B0[3] | G0[7] |
| | D2 | B0[2] | G0[6] |
| | D1 | B0[1] | G0[5] |
| | D0 | B0[0] | G0[4] |
| Slave SiI 178 | D11 | G1[3] | R1[7] |
| | D10 | G1[2] | R1[6] |
| | D9 | G1[1] | R1[5] |
| | D8 | G1[0] | R1[4] |
| | D7 | B1[7] | R1[3] |
| | D6 | B1[6] | R1[2] |
| | D5 | B1[5] | R1[1] |
| | D4 | B1[4] | R1[0] |
| | D3 | B1[3] | G1[7] |
| | D2 | B1[2] | G1[6] |
| | D1 | B1[1] | G1[5] |
| | D0 | B1[0] | G1[4] |

Notes
1. Color Pixel Components: R = RED, G = GREEN, B = BLUE
2. Bit significance within a color: [7:0] = [Msb:Lsb]

## 6.5 TMDS Rx(Sil1169) Programming Mode Data

| SiI 1169 Address | Master | Slave |
|---|---|---|
| 09 | 07 | 07 |
| 0A | 32 | 32 |
| 0B | 08 | 08 |
| 0C | 00 | 00 |
| 0D | 05 | 45 |
| 0E | 02 | 02 |
| 0F | 5B | 53 |

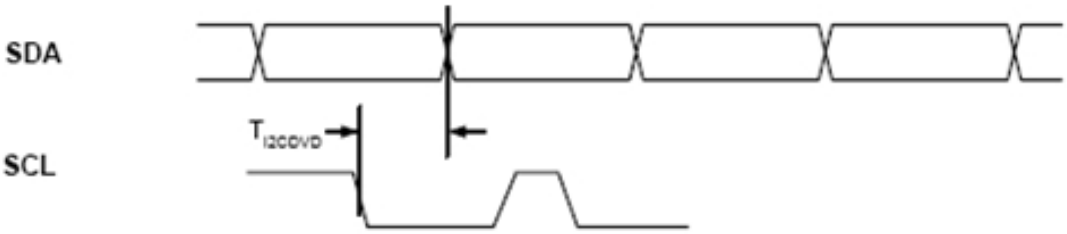
Note 1) For the Normal operating, LCM TMDS Rx(Sil1169) should be programmed using the above programming mode data

Note 2) TMDS Rx should be re-programmed each power on/off status.

Note 3) The above programming mode is recommended value.
if the different data is programmed, it may cause abnormal display or No Display.

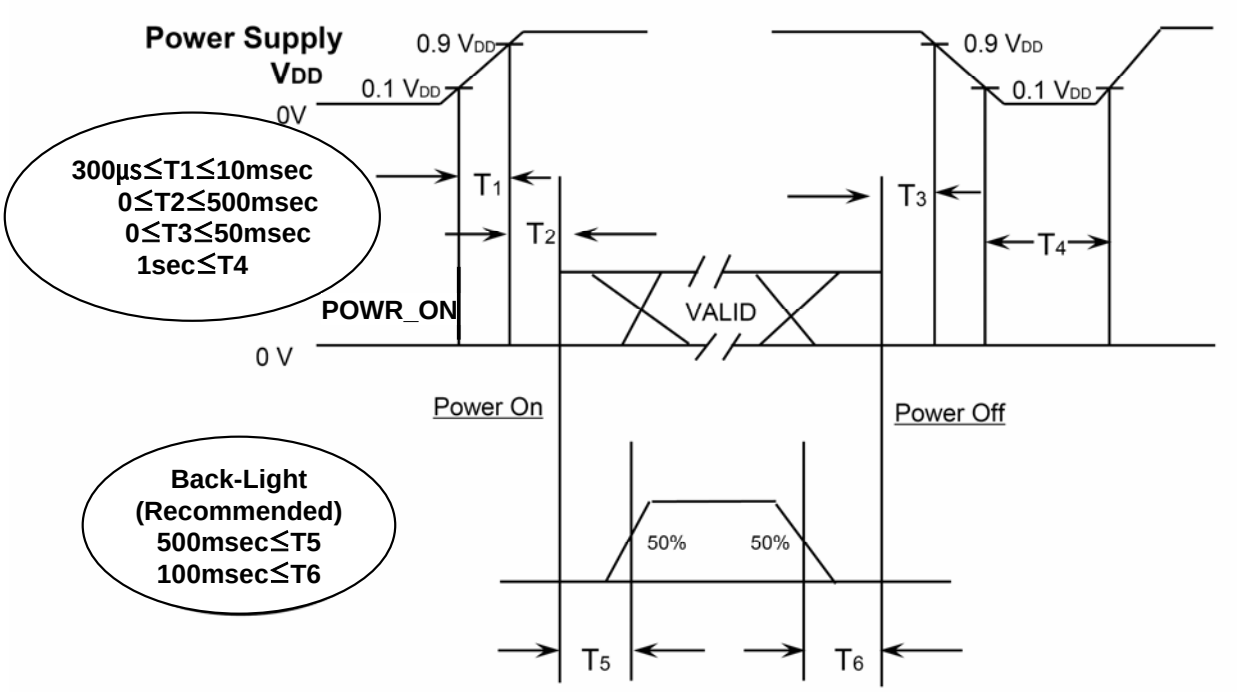
6.6 TMDS Rx(Sil1169) Input Skew : Tccs = Max 4nS


6.7 TMDS Rx(SiI1169) I2C Data Valid Delay : Ti2cdvd = MAX 700nS



## 6.8 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.

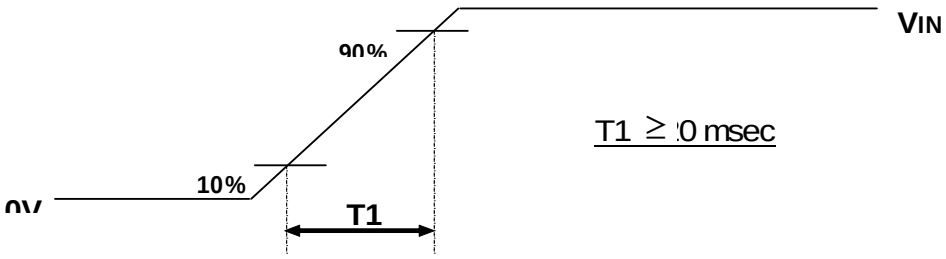



T1 : $V_{DD}$ rising time from 10% to 90%
T2 : The time from $V_{DD}$ to valid data at power ON.
T3 : The time from valid data off to $V_{DD}$ off at power Off.
T4 : $V_{DD}$ off time for Windows restart
T5 : The time from valid data to B/L enable at power ON.
T6 : The time from valid data off to B/L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

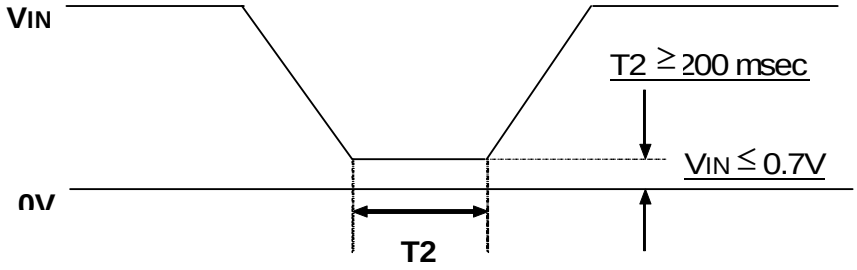
- The supply voltage of the external system for the Module input should be the same as the definition of $V_{DD}$.
- Apply the lamp voltage within the LCD operation range. When the back light turns on before the LCD operation or the LCD turns off before the back light turns off, the display may momentarily show abnormal screen.
- In case of $V_{DD}$ = off level, please keep the level of input signals low or keep a high impedance.
- T4 should be measured after the Module has been fully discharged between power off and on period.
- Interface signal should not be kept at high impedance when the power is on.

## 6.9 Inverter Power Sequence

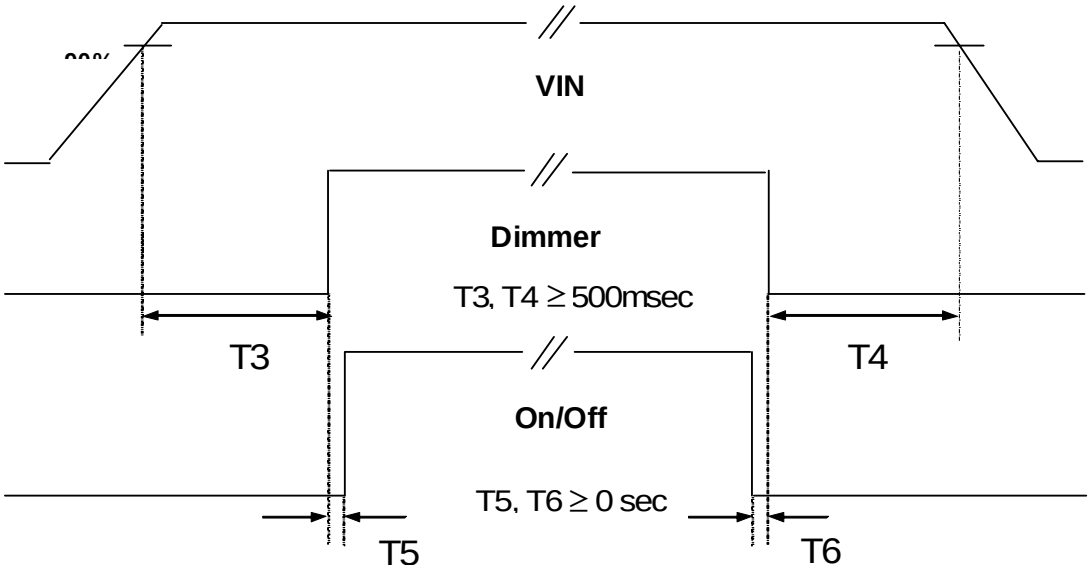
**1) Rising Time of $V_{IN}$**



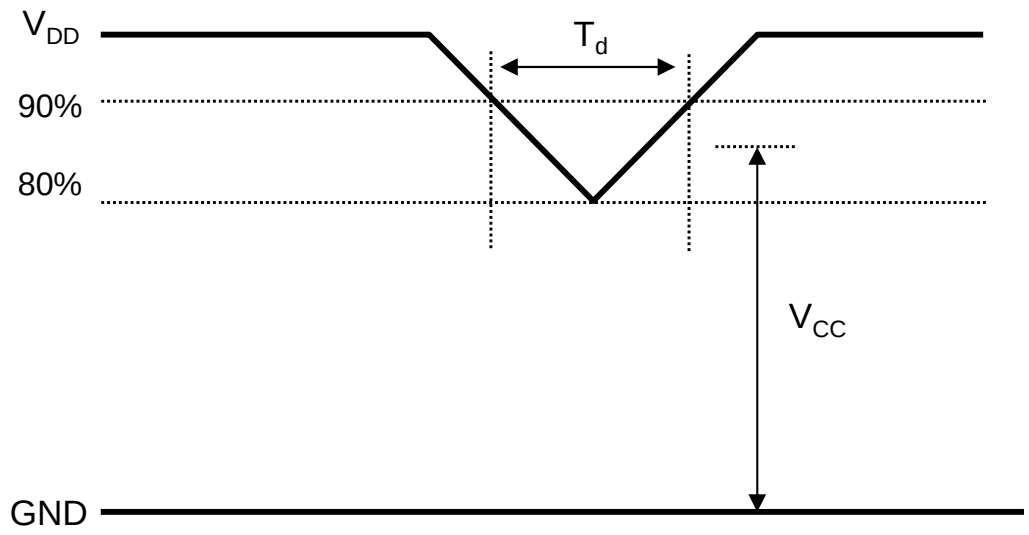

**2) On/Off Sequence of $V_{IN}$**




**3) Power Sequence**



## 6.10 VDD Power Dip Condition




$17V \leq V_{DD} \leq 19V$
If $V_{DD}$(typ.) x 80% $\leq V_{CC} \leq V_{DD}$(typ) x 90%
Then, 0<Td ≤20msec

Note (1) The above conditions are for the glitch of the input voltage.

(2) For stable operation of an LCD Module power, please follow them.

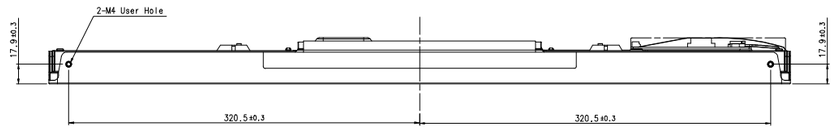
i.e., if typ VDD x 80% ≤ Vcc ≤ typ VDD x 90%, then $T_d$ should be less than 20ms.

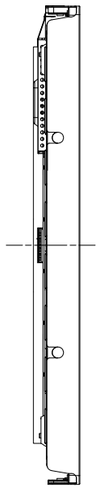
## 7. Outline Dimension

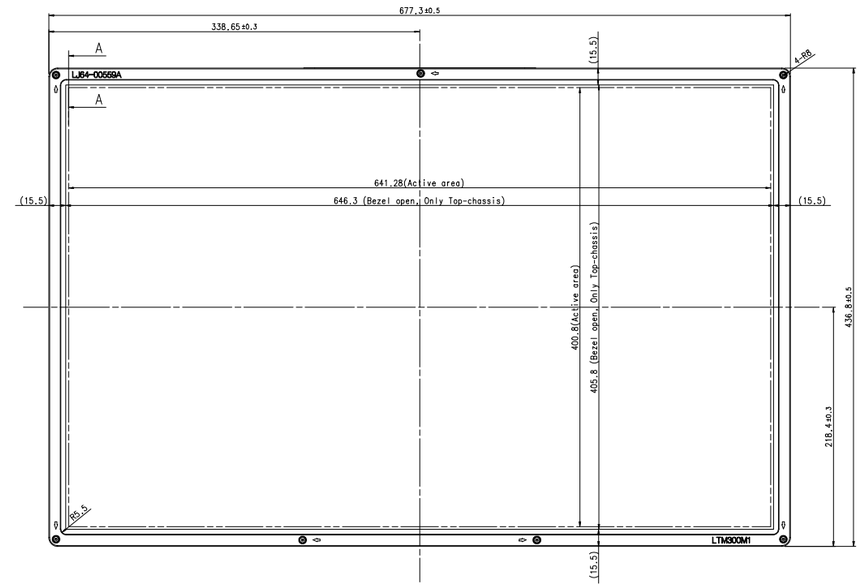
[ Refer to the next page ]

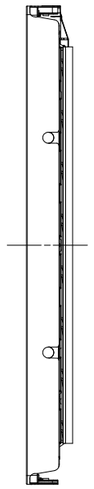
FILE NO.

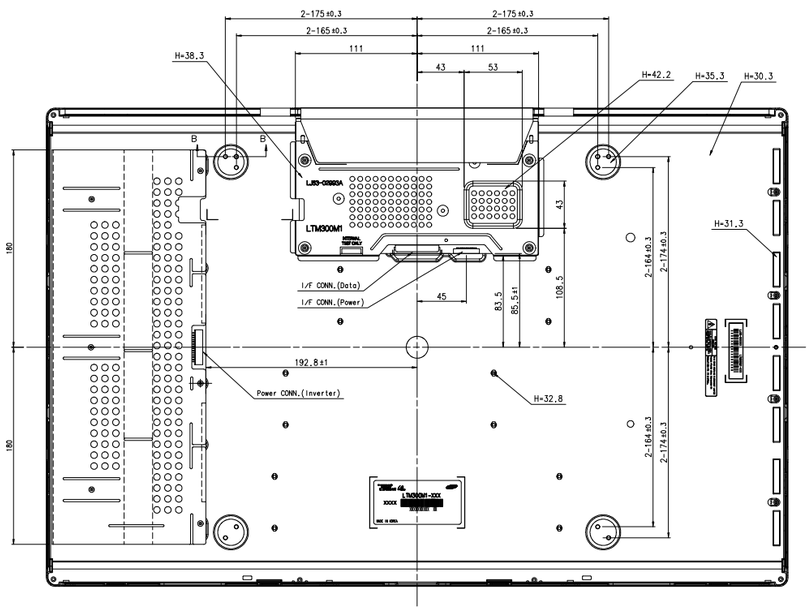
| NO | PART NAME | CODE NO | SPECIFICATION | Q'TY | WEIGHT FINISH | WEIGHT MATERIAL | EMBOSED DW. NO. MATERIAL | REMARK |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |

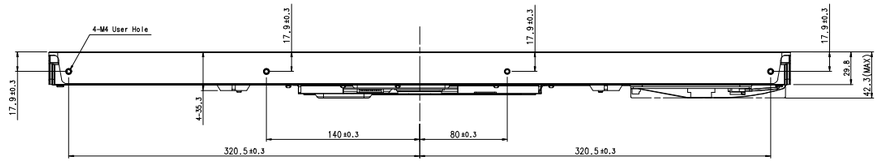


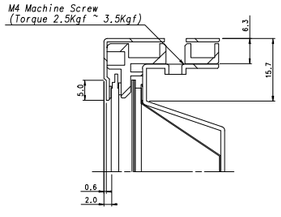





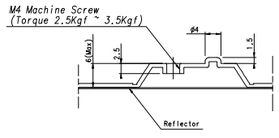






SECTION A-A
SCALE 2:1

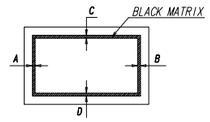



SECTION B-B
SCALE 2:1

*** NOTES**

1. BACKLIGHT : 16 COLD CATHODE FLUORESCENT LAMPS.
2. I/F CONNECTOR SPEC.
   - Data : MAKER;UJU, PART NO;IS100-L300-C23
   - Power: MAKER;Molex, PART NO;53261
   - Power(Inverter): MAKER;JST, PART NO;S14B-PH-SM3
3. UNSPECIFIED TORLERANCE TO BE ±0.5.
4. GAP BETWEEN TOP CHASSIS AND GLASS IS 1.2 mm MAX
5. WEIGHT : Typ. 4,600g (Max 4,900g)
6. *BLACK MATRIX SPEC*

- $|A - B| \leq 2.0$ mm
- $|C - D| \leq 2.0$ mm




" PRELIMINARY "

| GENERAL TOLERANCE | | | |
|---|---|---|---|
| STEP | LEVEL 1 | LEVEL 2 | LEVEL 3 |
| 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 |

| REV | DATE | DESCRIPTION OF REVISION | DRA'N BY | DES'D BY | CHK'D BY | APP'D BY |
|---|---|---|---|---|---|---|
| | | | | | | |

UNIT : mm
SCALE : /
TOLERANCE
SAMSUNG ELECTRONICS

| REASON | CHG'D BY |
|---|---|
| | |

| | |
|---|---|
| MODEL NAME | LTM300M1-P01 |
| PART/SHEET NAME | OUTLINE-DIM. |
| SHEET | 1/1 |
| SPEC. NO. | |
| CODE NO. | |
| VER. | 00 |

# 8. General Precautions

## 8.1 Handling

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

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

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

(d) Note that polarizer films are very fragile and could be damaged 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 cause permanent damage to the polarizer due to chemical reaction.

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

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

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

(k) Do not disassemble the Module.

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

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

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

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

## 8.2 Storage

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

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

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

## 8.3 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 item 6.3 "Power on/off sequence"

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

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

## 8.4 Operation Condition Guide

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

## 8.5 Others

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

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

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

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

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

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