**SAMSUNG**

**ELECTRONICS**

TO : Sambo Computer

DATE : June,25 2002

*SAMSUNG TFT-LCD*

# MODEL NO. : LTN121XF-L01

APPROVED BY :

CHECKED BY :

Notes :

<u>Any Modification of Spec is not allowed without SEC' permission</u>

APPROVED BY : *K. H. Shin*

PREPARED BY : **Application Engineering Team**

## SAMSUNG ELECTRONICS CO., LTD.

wise view™

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|------|---------|------|---------|---|---|
| Oct.10 ,2001 | 000 | All | Approval Specification | | |
| | | | | | |

# GENERAL DESCRIPTION

## DESCRIPTION

LTN121XF-L01 is a color active matrix TFT (Thin Film Transistor) liquid crystal display (LCD) that uses amorphous silicon TFT 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  12.1″ contains 1024 x 768 pixels and can display up to  262,144colors.  6  o'clock direction is the optimum viewing angle.

## FEATURES

- Ultra Thin and light weight
- High contrast ratio
- XGA (1024x768 pixels) resolution
- Low  power consumption
- DE (Data enable) only mode.
- 3.3V LVDS  Interface with  1 pixel / clock

## APPLICATIONS

- Notebook  PC  and desktop monitors
- Display terminals for AV application products
- Monitors for Industrial  machine
- 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 | 245.76(H) x 184.32(V)  (12.1″ diagonal ) | mm | |
| Driver element | a-Si TFT active matrix | | |
| Display colors | 262,144 | Color | |
| Number of pixel | 1024  x  768 (XGA) | pixel | |
| Pixel arrangement | RGB vertical stripe | | |
| Pixel pitch | 0.240(H) x 0.240(V) (TYP.) | mm | |
| Display Mode | Normally white | | |
| Surface treatment | HAZE 25,  HARD-COATING 3H | | |

MECHANICAL INFORMATION

| ITEM | | MIN. | TYP. | MAX. | NOTE |
|---|---|---|---|---|---|
| Module size | Horizontal (H) | 260.5 | 261.0 | 261.5 | |
| | Vertical (V) | 198.5 | 199.0 | 199.5 | |
| | Depth (D) | 4.4 | 4.7 | 5.0 | (1), (3) |
| | Depth (D′) | - | - | 5.2 | (3) |
| Weight | | - | 310 | 320 | g |

Note (1) Measurement condition of outline dimension
. Equipment : Vernier Calipers
. Push Force : 500g·f (minimum)
(2) User Hole Torque : 2.0±0.3 kg·f·cm, 5 times
(3) Depth D = Module Thickness , Depth D′ = Thickness of PCB ( at T-Con.)

# 1. ABSOLUTE MAXIMUM RATINGS

## 1.1 ABSOLUTE RATINGS OF ENVIRONMENT

| ITEM | SYMBOL | MIN. | MAX. | UNIT | NOTE |
|---|---|---|---|---|---|
| Storage temperature | $T_{STG}$ | -25 | 60 | %°C | (1) |
| Operating temperature (Temperature of glass surface) | $T_{OPR}$ | 0 | 50 | %°C | (1) |
| Shock ( non-operating ) | Snop | - | 220 | G | (2),(4) |
| Vibration (non-operating) | Vnop | - | 1. 5 | G | (3),(4) |

Note (1) Temperature and relative humidity range are shown in the figure below.
90 % RH Max. ( 40 °C ≥ Ta)
Maximum wet - bulb temperature at 39 °C or less. (Ta > 40%°C ) No condensation.
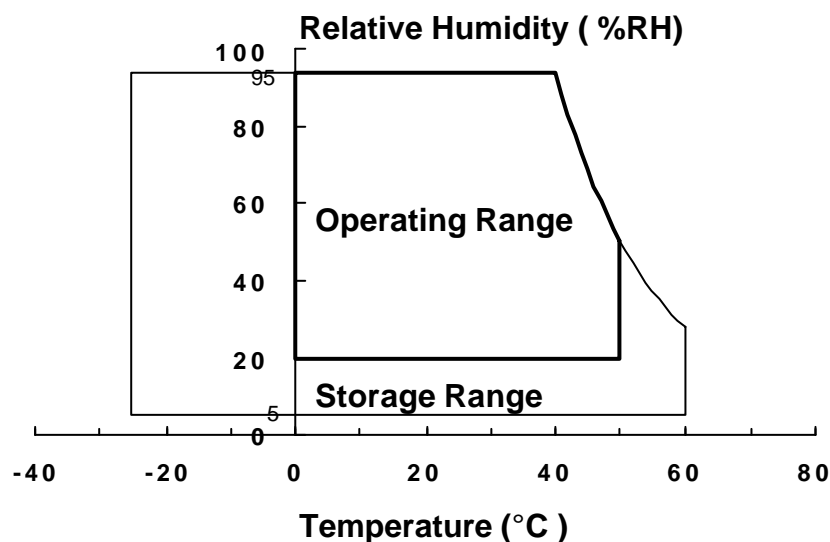


(2) 2ms, half sine wave, one time for ± X, ± Y, ± Z.
(3) 10 - 300 Hz, Sweep rate 10 min, 30min for X,Y,Z.
(4) At testing Vibration and Shock, the fixture in holding the Module to be tested have to be hard and rigid enough so that the Module would not be twisted or bent by the fixture.

## 1.2 ELECTRICAL ABSOLUTE RATINGS

### (1) TFT LCD MODULE

( Vss = GND = 0  V)

| ITEM | SYMBOL | MIN. | MAX. | UNIT | NOTE |
|---|---|---|---|---|---|
| Power Supply Voltage | VDD | Vss -0.3 | VDD+0.3 | V | ( 1 ) |
| Logic Input Voltage | $V_{IN}$ | Vss -0.3 | VDD+0.3 | V | ( 1 ) |

NOTE (1)  Within Ta = 25 $\pm$ 2 °C

### (2) BACK-LIGHT UNIT

Ta = 25 $\pm$ 2 °C

| ITEM | SYMBOL | MIN. | MAX. | UNIT. | NOTE |
|---|---|---|---|---|---|
| Lamp  current | $I_L$ | 3.0 | 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
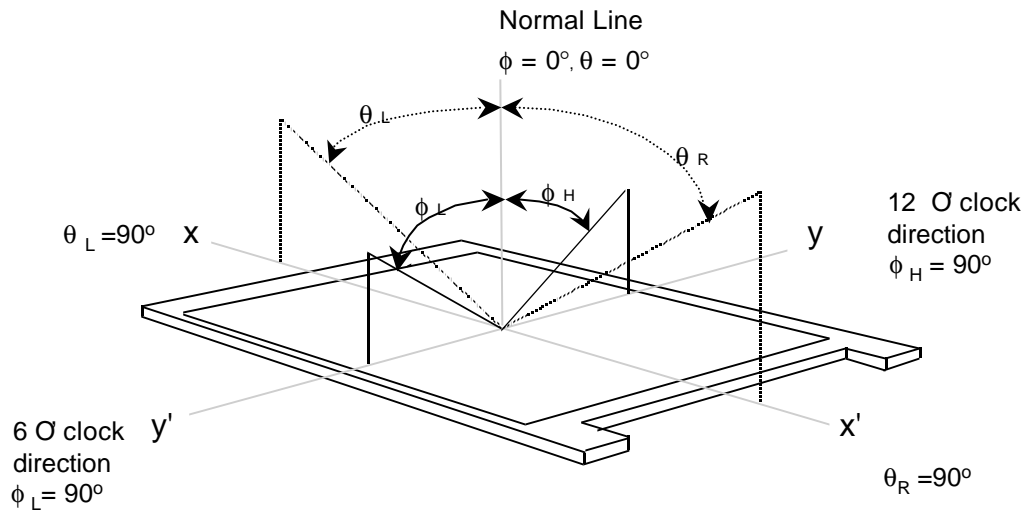Conditions.

## 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 BM-5A , PR650

* $Ta = 25 \pm 2°C$ , $V_{DD}$=3.3V,  fv= 60Hz,  $f_{DCLK}$=65MHz, $I_L$ = 6.0 mA

| ITEM | | SYMBOL | CONDITION | MIN. | TYP. | MAX. | UNIT | NOTE |
|---|---|---|---|---|---|---|---|---|
| Contrast Ratio (5 Points) | | CR | φ = 0, θ = 0 Normal Viewing Angle | 180 | | - | | (1), (2), (5) |
| Response Time at Ta | Rising | $T_R$ | | - | 10 | 20 | msec | (1), (3) |
| | Falling | $T_F$ | | - | 30 | 50 | | |
| Average Luminance of White (5 Points) | | $Y_{L,AVE}$ | | 110 | 140 | - | cd/m² | (1), (4) |
| Color Chromaticity ( CIE ) | Red | $R_X$ | | 0.579 | 0.599 | 0.619 | | Measured by PR 650 (1), (5) |
| | | $R_Y$ | | 0.325 | 0.345 | 0.365 | | |
| | Green | $G_X$ | | 0.296 | 0.316 | 0.336 | | |
| | | $G_Y$ | | 0.518 | 0.538 | 0.558 | | |
| | Blue | $B_X$ | | 0.135 | 0.155 | 0.175 | | |
| | | $B_Y$ | | 0.122 | 0.142 | 0.162 | | |
| | White | $W_X$ | | 0.295 | 0.315 | 0.335 | | |
| | | $W_Y$ | | 0.310 | 0.330 | 0.350 | | |
| Viewing Angle | Hor. | $θ_L$ | CR( at center point) ≥ 10 | 40 | - | - | Degrees | |
| | | $θ_R$ | | 40 | - | - | | |
| | Ver. | $φ_H$ | | 10 | - | - | | |
| | | $φ_L$ | | 50 | - | - | | |
| 13 Points White Variation | | $δL$ | | - | - | 1.75 | | (6) |

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

Normal Line

$\phi = 0°, \theta = 0°$

$\theta_L$

$\theta_R$

$\phi_L$

$\phi_H$

$\theta_L = 90°$    x

12 O'clock direction
$\phi_H = 90°$

y

6 O'clock direction
$\phi_L = 90°$

y'

x'

$\theta_R = 90°$

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 FIGURE OF NOTE 6)

Note 3) Definition of Response time :

Display data   | White(TFT OFF) | Black(TFT ON) | White(TFT OFF) |

Optical Response

$T_R$     $T_F$

100 %
90 %

10 %
0 %

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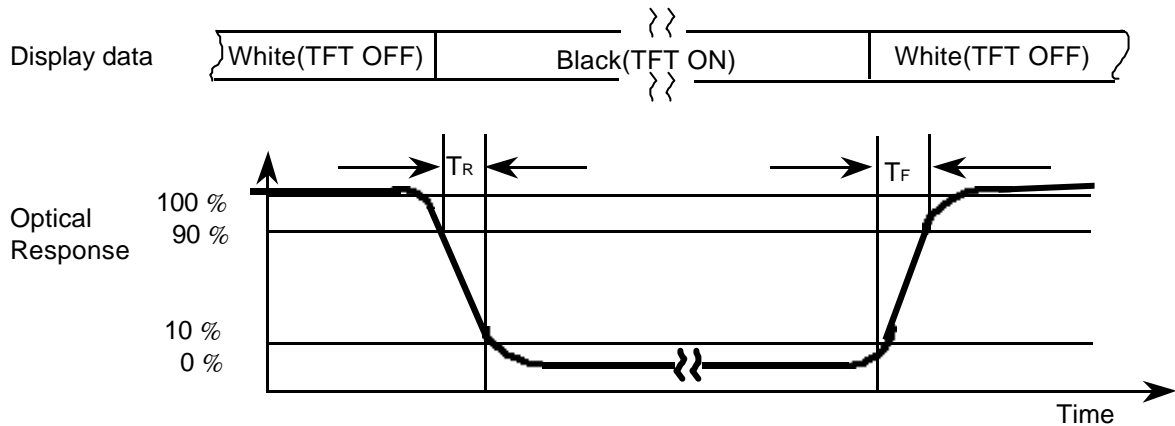
Note 4) Definition of Average Luminance of White : measure the luminance of white at 5 points.

256    512    768

Average Luminance of White ( $Y_{L,AVE}$ )

$$Y_{L,AVE} = \frac{Y_{L4} + Y_{L5} + Y_{L7} + Y_{L9} + Y_{L10}}{5}$$

VIEW AREA

(10)    (9)     192

(7)    384

(5)    (4)    576 lines

◯  : test point

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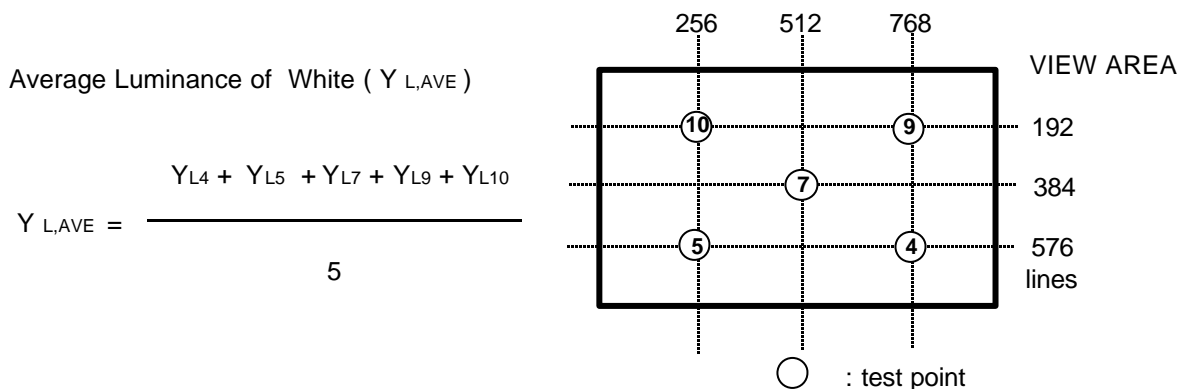
Note  5)  After stabilizing and leaving the panel alone at a given temperature for 30 minutes, the measurement
should be executed.  Measurement should be executed in a stable, windless,and dark room.
30 minutes after lighting the back-light. This should be measured in the center of screen.
Lamp current : 6.0 mA
Environment condition : Ta = 25 ± 2 ℃

Photo detector
( TOPCON BM-5A
or PR650 )

Field = 2°

40 cm (BM-5A)
50 cm (PR-650)

TFT-LCD module

LCD panel

Center of the screen
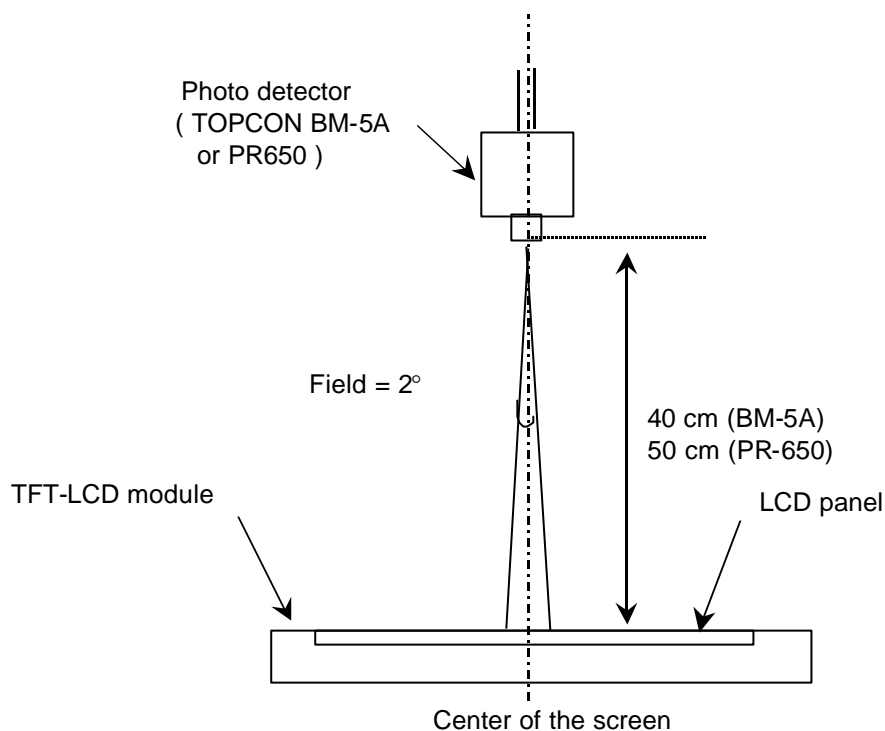
Optical characteristics measurement setup

Note 6)  Definition of 13 points white variation ( δ w ),  CR  variation( Cᴠᴇʀ )  [  ① ~ ⑬ ]

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



| 10mm | | 256 | 512 | 768 | 10mm |

10mm

13    12    11
   10       9          192

8    7    6    384    ◯ : test point

5    4    576
(lines)

3    2    1

10mm
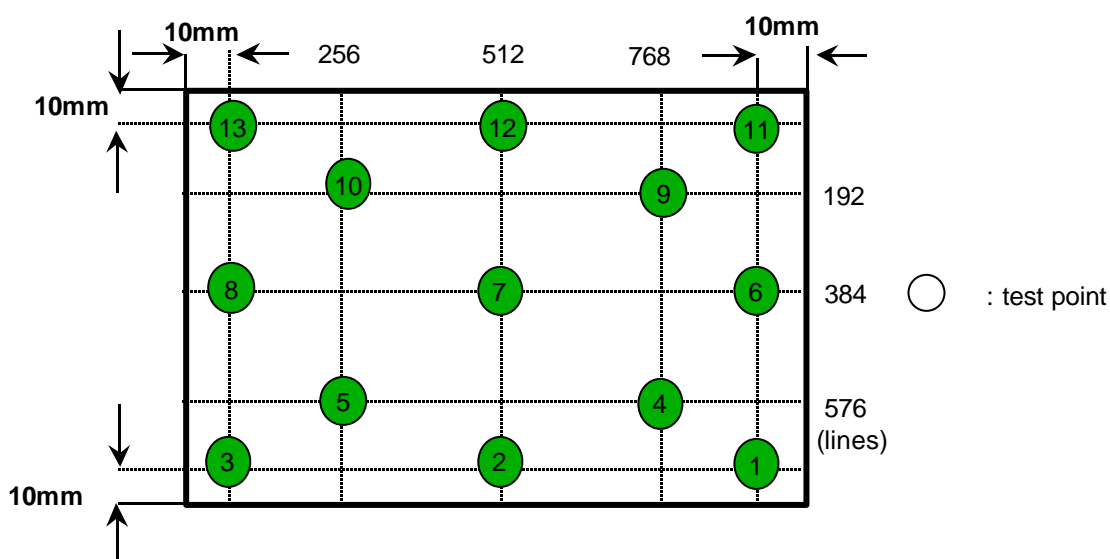
# 3. ELECTRICAL CHARACTERISTICS

## 3.1 TFT LCD MODULE

Ta = 25 $\pm$ 2%°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 | (1) |
| | Low | $V_{IL}$ | -100 | - | - | mV | |
| Vsync Frequency | | $f_V$ | - | 60 | - | Hz | |
| Hsync Frequency | | $f_H$ | - | 48.2 | - | KHz | |
| Main Frequency | | $f_{DCLK}$ | - | 65 | - | MHz | |
| Rush Current | | $I_{RUSH}$ | - | - | 1.5 | A | (4) |
| Current of Power Supply | White | $I_{DD}$ | - | 260 | - | mA | (2),(3) |
| | Mosaic | | - | 275 | - | mA | (2),(3) |
| | Max. | | - | 330 | 380 | mA | (2),(3) |

Note  (1)  Condition : $V_{CM}$=+1.2V(Common mode Voltage)

(2)  $f_V$=60Hz,  $f_{DCLK}$ =65MHZ,   Vdd = 3.3V , DC Current.

(3)  Power dissipation check pattern

*a) White Pattern                                    *b)Mosaic Pattern

VIEW AREA

Display Brightest Gray Level

Display Darkest Gray Level
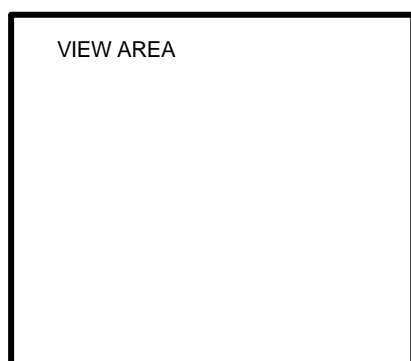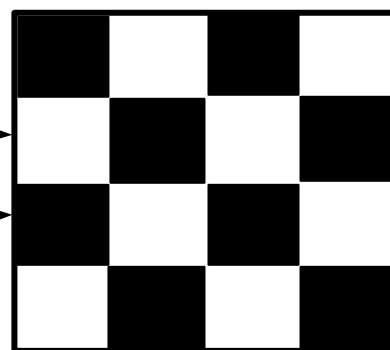
*c) 1 dot pattern(Max current pattern)
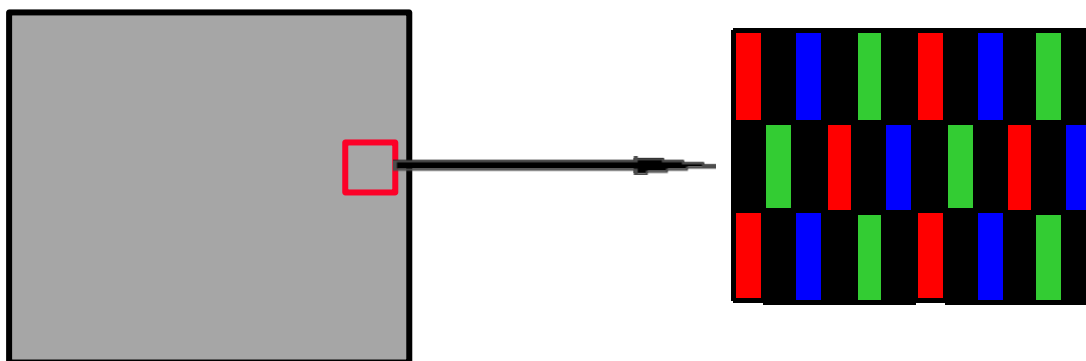


4) Rush current measurement condition



3.3V

M1
2SK1059

R1
47K

FUSE

C1
1uF

$V_{DD}$ ( LCD  INPUT)

CONTROL SIGNAL
(HIGH to LOW)

R2
1K

M2
2SK1399

12V

R3
47K

C2
10000pF

C3
1uF

$V_{DD}$ rising time is 470us

0.9$V_{DD}$

3.3V

0.1$V_{DD}$

GND

470us

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|---|---|---|---|---|---|
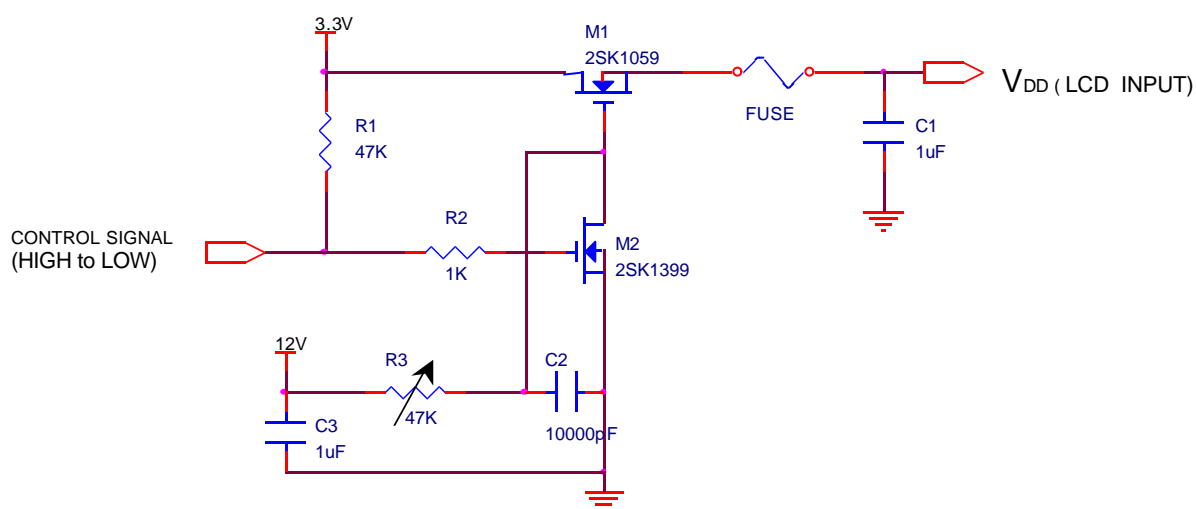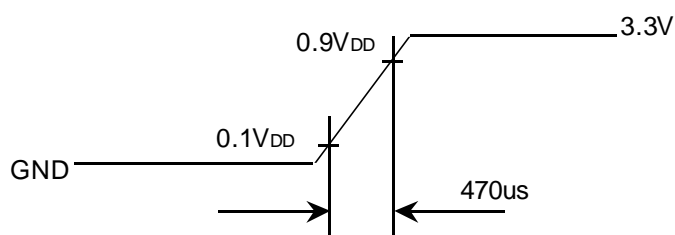
## 3.2  BACKLIGHT UNIT

The back-light system is an edge - lighting type with a single CCFT ( Cold Cathode Fluorescent Tube ).
The characteristics of a single lamp are shown in the following tables.

INVERTER : SEM SIC-130T                                                                                         Ta = 25 ± 2°C

| ITEM | SYMBOL | MIN | TYP | MAX | UNIT | NOTE |
|------|--------|-----|-----|-----|------|------|
| Lamp Current | $I_L$ | 3.0 | 6.0 | 6.5 | mArms | (1) |
| Lamp Voltage | $V_L$ | - | 595 | - | Vrms | $I_L$=5.0mA |
| Frequency | $f_L$ | 50 | 60 | 65 | KHz | (2) |
| Power Consumption | $P_L$ | - | 3.0 | - | W | (3) $I_L$=5.0mA |
| Operating Life Time | Hr | 10,000 | - | - | Hour | (4) |
| Startup Voltage | $V_S$ | - | - | 1100 (25°C) / 1300 (0°C) | Vrms | (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 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 a high frequency current meter as shown below.



No 2 Pin is $V_{LOW}$.

SEM SIC-130T
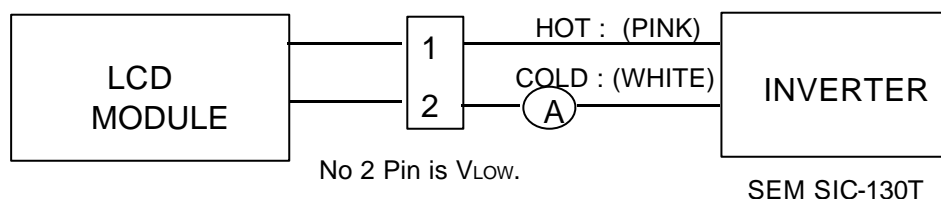
(2)  Lamp frequency may produce interference with horizontal synchronous frequency  and this
      may cause line flow on the display. Therefore lamp frequency should be detached  from the
horizontal synchronous frequency and its harmonics as far as possible in order to avoid interference.

(3) refer to $I_L$ X $V_L$ 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 $I_L$ = 6.0 mArms until one of  the following  event  occurs.
      1. When the brightness becomes 50% or lower than it́s original.
      2. When the Effective ignition length becomes 80% or lower than it́s  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 voltage above this value should be applied  to the  lamp for more than 0.8 second to startup
      Otherwise the lamp may not  be turned on.

# 4. BLOCK DIAGRAM

## 4.1 TFT LCD MODULE

Connector : HIROSE DF-19L20P-1H

**User Connector**

DF-19L-20P -1H

**LVDS + G/A Integrated Timing Controller (LXD91810)**

**Source Drive IC**

**12.1 XGA TFT-LCD (MB. Panel)**

**DC-DC Converter**

**Gamma Generator**

**VCOM Generator**

→ Video Signal
→ Control Signal
→ VCOM
→ Gamma
→ DVDD
→ AVDD
→ Von/Voff

**Gate Drive IC**

**Source PCB**

## 4.2 BACKLIGHT UNIT

Connector : JST BHSR-02VS-01

Reflector

LAMP

1 HOT (PINK)

2 COLD(WHITE)
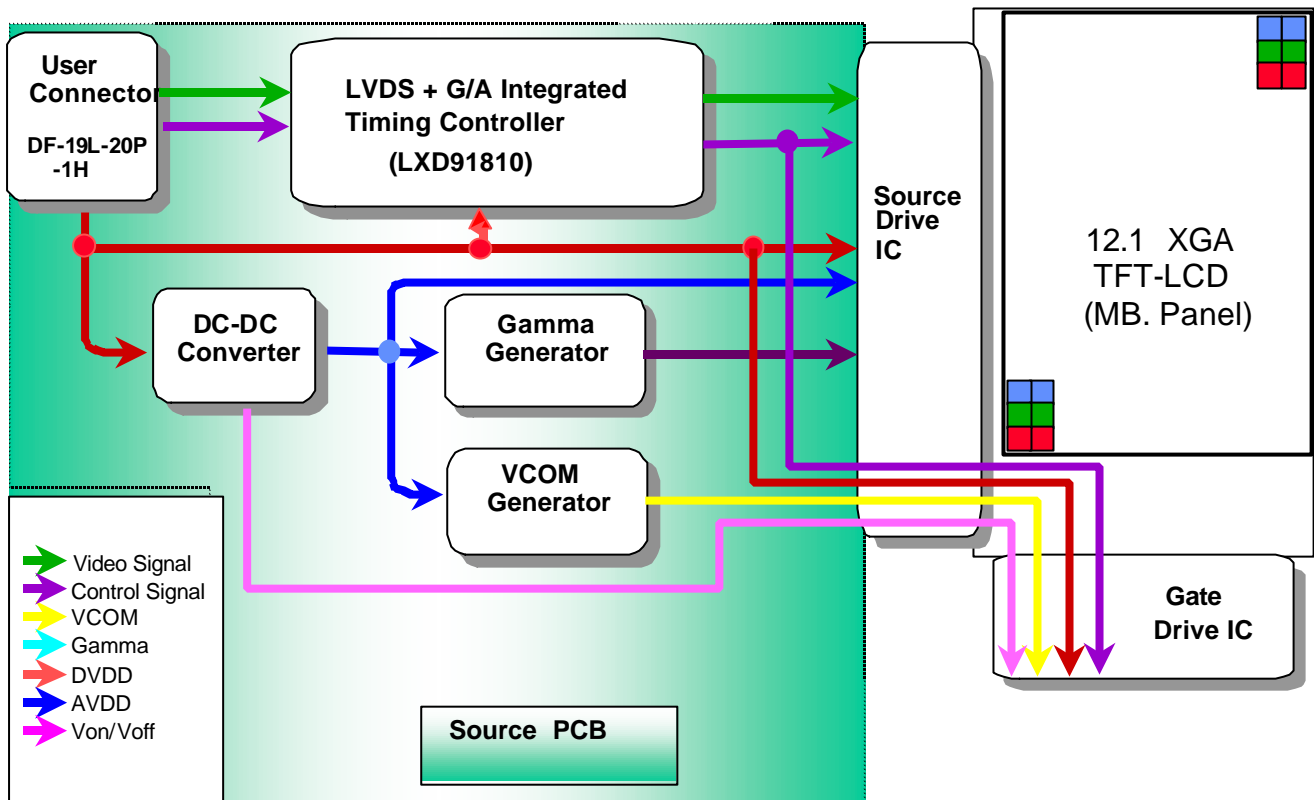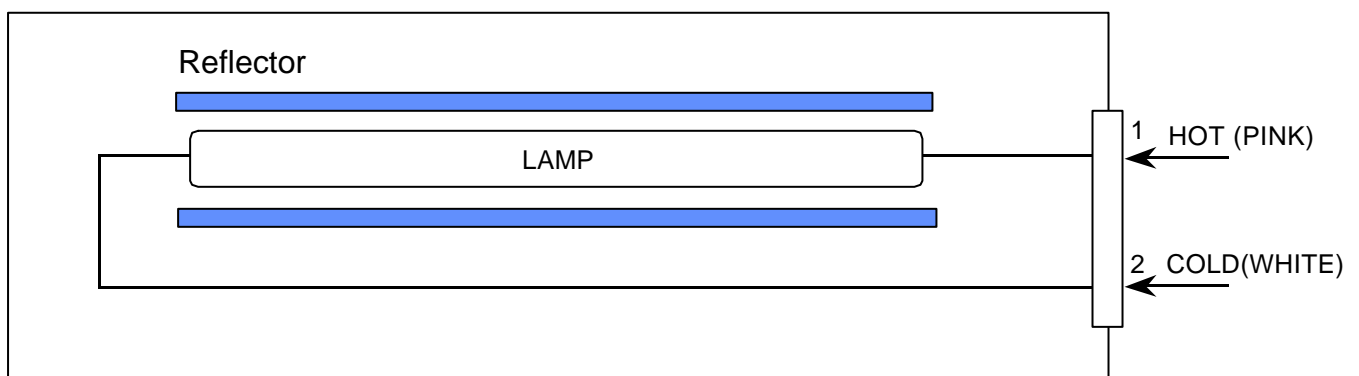
Note) The output of the inverter may change according to the material of the reflector.

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# 5. INPUT TERMINAL PIN ASSIGNMENT

## 5.1. Input Signal & Power (LVDS, Connector : HIROSE DF-19L-20P-1H

| PIN NO | SYMBOL | FUNCTION | POLARITY | REMARK |
|--------|--------|----------|----------|--------|
| 1 | VDD | POWER SUPPLY +3.3V | | |
| 2 | VDD | POWER SUPPLY +3.3V | | |
| 3 | GND | GROUND | | |
| 4 | GND | GROUND | | |
| 5 | RxIN0- | LVDS Differential Data INPUT | Negative | R0~R5 G0 |
| 6 | RxIN0+ | LVDS Differential Data INPUT | Positive | |
| 7 | GND | GROUND | | |
| 8 | RxIN1- | LVDS Differential Data INPUT | Negative | G1~G5 B0~B1 |
| 9 | RxIN1+ | LVDS Differential Data INPUT | Positive | |
| 10 | GND | GROUND | | |
| 11 | RxIN2- | LVDS Differential Data INPUT | Negative | B2~B5,DE Hsync,Vsync |
| 12 | RxIN2+ | LVDS Differential Data INPUT | Positive | |
| 13 | GND | GROUND | | |
| 14 | RxCLKIN- | LVDS Differential Clock INPUT | Negative | |
| 15 | RxCLKIN+ | LVDS Differential Clock INPUT | Positive | |
| 16 | GND | GROUND | | |
| 17 | NC | No Connection | | |
| 18 | NC | No Connection | | |
| 19 | GND | GROUND | | |
| 20 | GND | GROUND | | |

## 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 |

## FLAT LINK INTERFACE



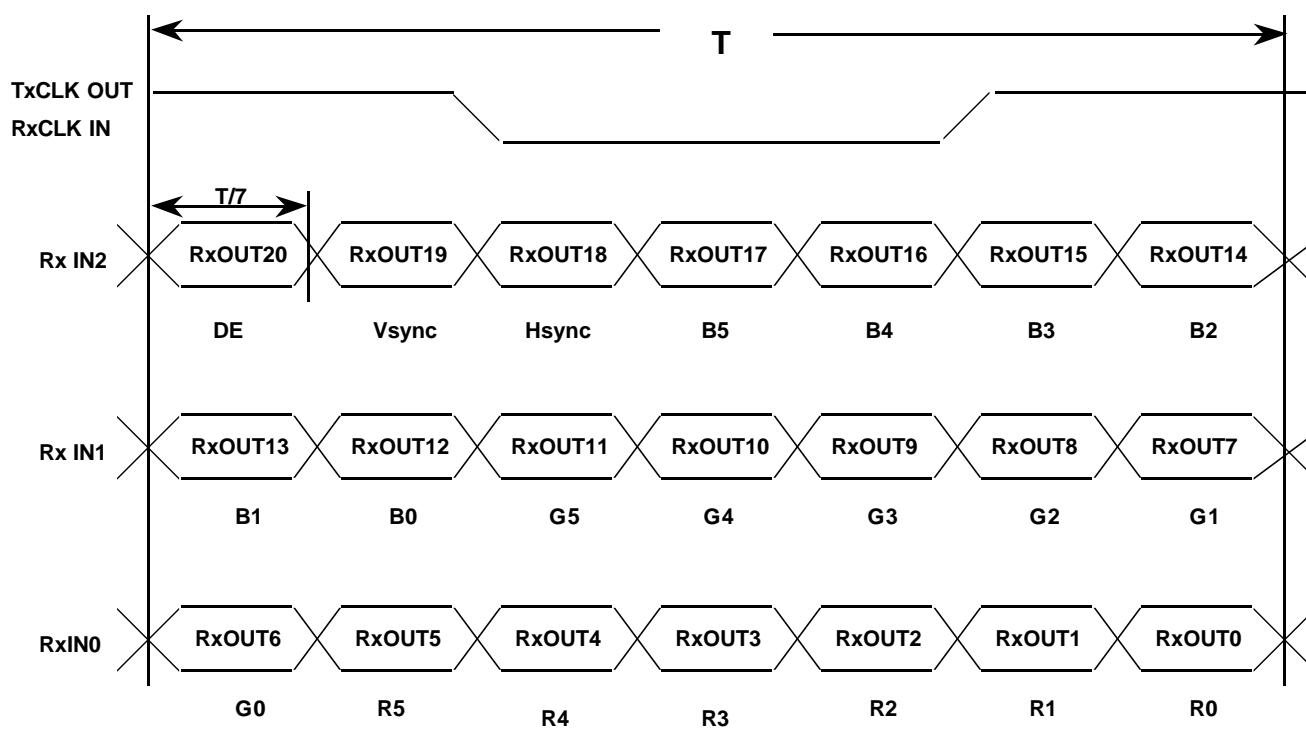| Doc.No. | LTN121XF-L01 | Rev.No | 04 - 000 - G - 020625 | Page | 15/26 |
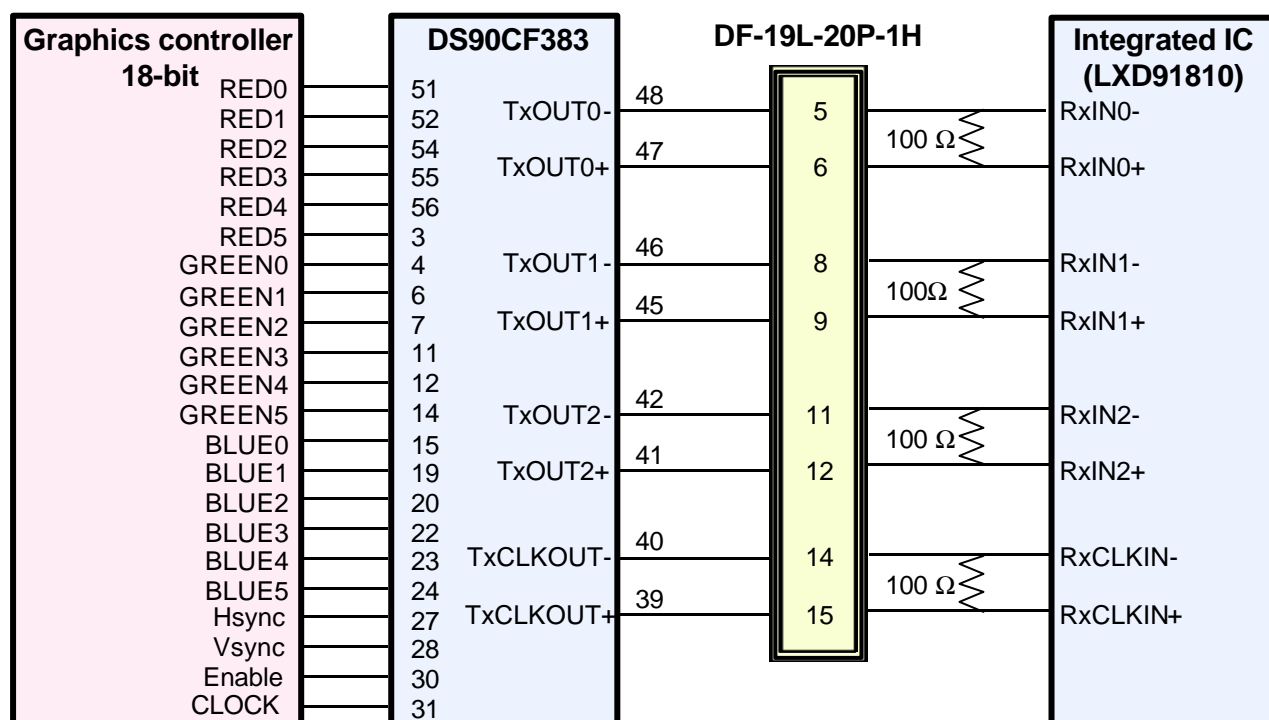
## 5.3 BACK LIGHT UNIT

Connector : JST BHSR - 02VS -1
Mating Connector : JST SM02B-BHSS-1

| Pin NO. | Symbol | Color | Function |
|---------|--------|-------|----------|
| 1 | HOT | PINK | High Voltage |
| 2 | COLD | WHITE | Low Voltage |

## 5.4 Timing Diagrams of LVDS For Transmission

LVDS Receiver : LXD91810(including I/F IC)

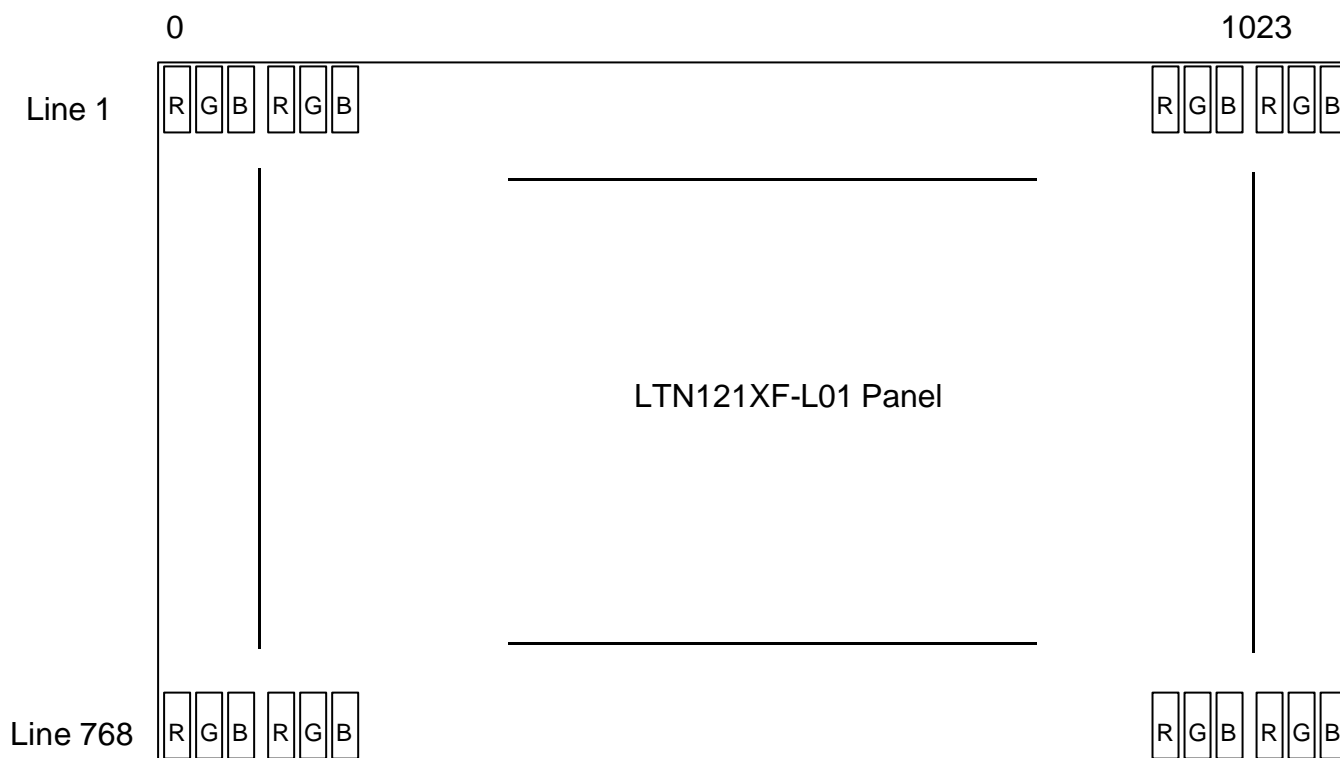## 5.5 Input Signal, Basic Display Colors and Gray Scale of Each Colors

| 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 | B5 | |
| BASIC COLOR | BLACK | 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 | 1 | 1 | 1 | 1 | 1 | 1 | - |
| | GREEN | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | - |
| | CYAN | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 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 | 0 | - |
| | MAGENTA | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | - |
| | YELLOW | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 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 | - |
| GRAY SCALE OF RED | BLACK | 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 | R1 |
| | | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | R2 |
| | | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | R3~R60 |
| | | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | |
| | ↓ LIGHT | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | R61 |
| | | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 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 | 0 | R63 |
| GRAY SCALE OF GREEN | BLACK | 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 | 1 | 0 | 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 | 0 | G2 |
| | | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | G3~G60 |
| | | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | |
| | ↓ LIGHT | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | G61 |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | G62 |
| | GREEN | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 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 | 0 | B0 |
| | DARK ↑ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | B1 |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | B2 |
| | | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | B3~B60 |
| | | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | |
| | ↓ LIGHT | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 1 | B61 |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | B62 |
| | BLUE | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | B63 |

Note

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

(2) Input Signal :  0 = Low level voltage,  1 = High level voltage

## 5.6 PIXEL FORMAT

0                                                                                    1023

Line 1    R G B  R G B                                    R G B  R G B

LTN121XF-L01 Panel

Line 768  R G B  R G B                                    R G B  R G B

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# 6. INTERFACE TIMING

## 6.1 Timing Parameters

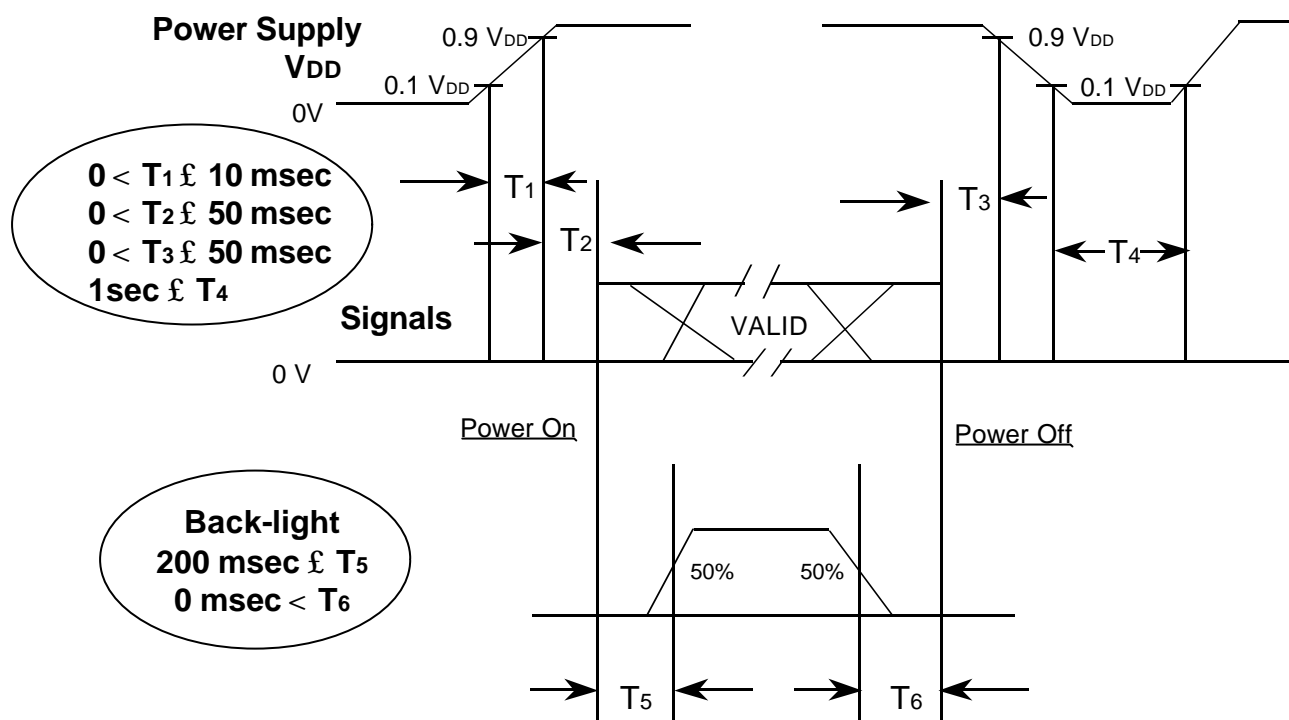| Signal | Item | Symbol | MIN | TYP | MAX | Unit | Note |
|---|---|---|---|---|---|---|---|
| Frame Frequency | Cycle | $T_V$ | | 806 | | lines | |
| Vertical Active Display Term | Display Period | $T_{VD}$ | - | 768 | - | lines | |
| One Line Scanning Time | Cycle | $T_H$ | | 1344 | | clocks | |
| Horizontal Active Display Term | Display Period | $T_{HD}$ | - | 1024 | - | clocks | |

## 6.2 Timing diagrams of interface signal
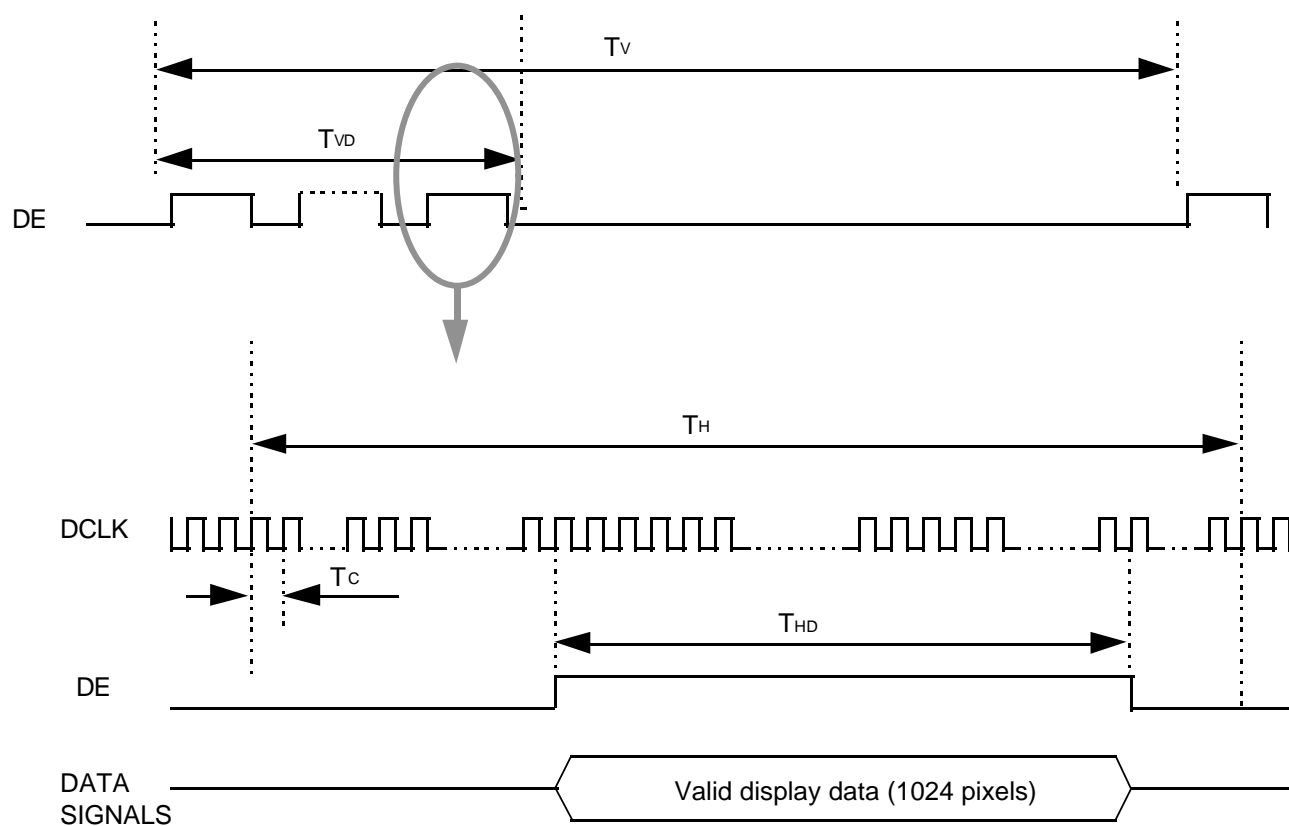


Note (1) All input condition(level&timing) for LXD91810 are the same with those of NS DS90CF364 or compatible.

### 6.3 Power ON/OFF Sequence

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



**Power Supply V$_{DD}$**

0.9 V$_{DD}$    0.9 V$_{DD}$
0.1 V$_{DD}$    0.1 V$_{DD}$
0V

$0 < T_1 \pounds 10$ msec
$0 < T_2 \pounds 50$ msec
$0 < T_3 \pounds 50$ msec
$1sec \pounds T_4$

$T_1$    $T_3$
$T_2$    $T_4$

**Signals**

VALID

0 V

Power On    Power Off

**Back-light**
$200$ msec $\pounds T_5$
$0$ msec $< T_6$

50%    50%

$T_5$    $T_6$

## Power ON/OFF Sequence

T1 : Vdd rising time from 10% to 90%

T2 : The time from Vdd to valid data at power ON.

T3 : The time from valid data off to Vdd off at power Off.

T4 : Vdd 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.

NOTE.

(1) The supply voltage of the external system for the module input should be the same as the definition of V$_{DD}$.

(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$_{DD}$ = 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.

# 8. GENERAL PRECAUTIONS

1. Handling

  (a) When the module is assembled, It should be attached to the system firmly
     using every 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 CCFT back-light.

  (c) Note that polarizers are very fragile and could 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 some absorbent cotton or soft cloth.

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

  (g) 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 thoroughly
     with soap.

  (h) Protect the module from static , it may cause damage to the C-MOS Gate Array IC.

  (i) Use fingerstalls with soft gloves in order to keep display clean during the incoming
     inspection and assembly process.

  (j) Do not disassemble the module.

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

  (l) Do not adjust the variable resistor which is located on the back side.

  (m) Protection film for polarizer on the module shall be slowly peeled off just before use so
     that the electrostatic charge can be minimized.

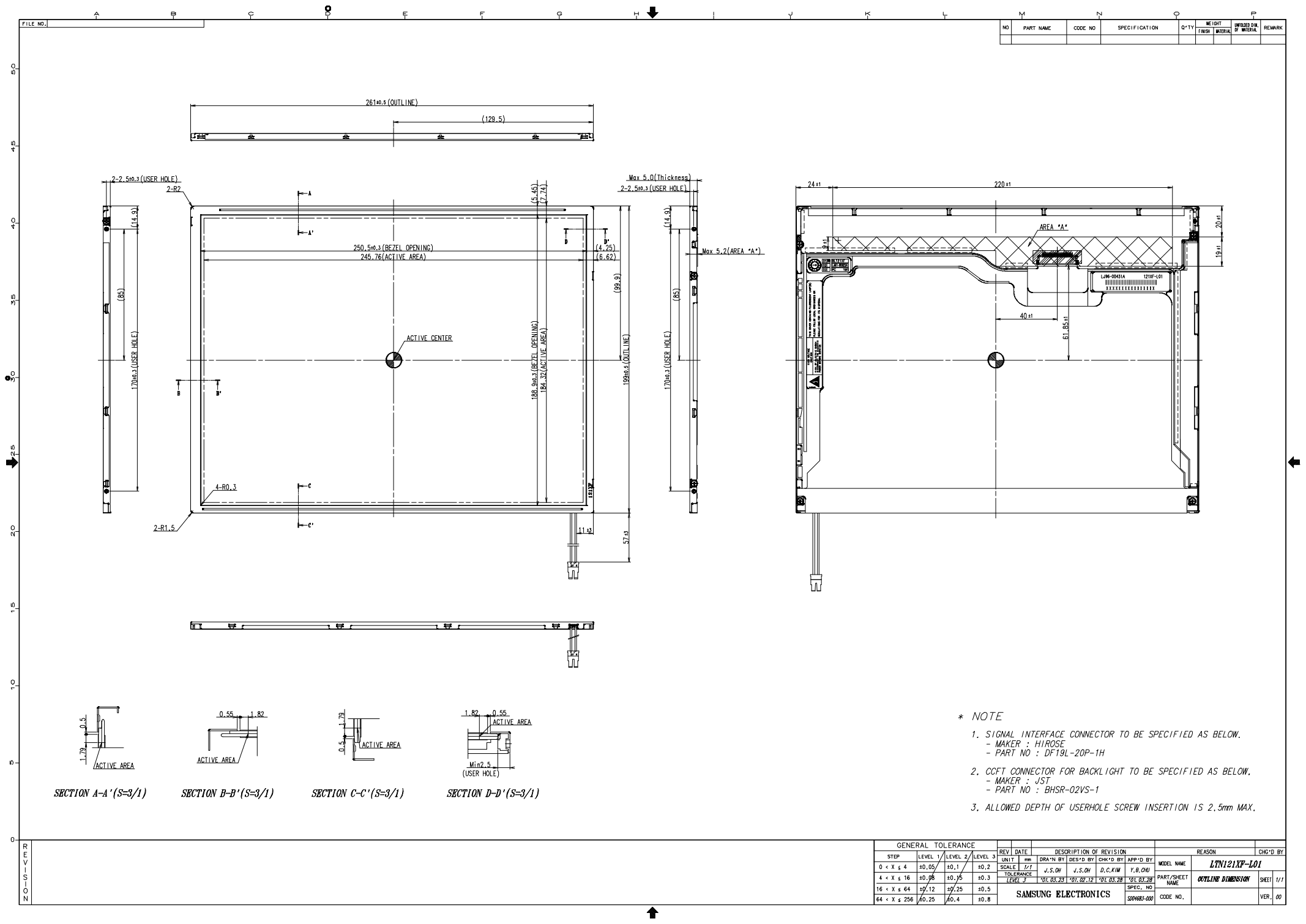  (n) Pins of I/F connector shall not be touched directly with bare hands.

## 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 °C and
relative humidity of less than 70%.

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

  (c) The module shall be stored in a dark place. It is prohibited to apply sunlight or fluorescent
light  during the store.

## 3. OPERATION

  (a)  Do not connect,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)  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 shall be a
minimized length and 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).

## 4. 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. ( the supply voltage variation, input
voltage variation, variation in part  contents and environmental temperature, so on)
Otherwise the module may be damaged.

  (d) If the module displays the same pattern continuously for a long period of time,it can be
the situation when the image "sticks" to the screen.

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

**SECTION A-A'(S=3/1)**

**SECTION B-B'(S=3/1)**

**SECTION C-C'(S=3/1)**

**SECTION D-D'(S=3/1)**

* NOTE

1. SIGNAL INTERFACE CONNECTOR TO BE SPECIFIED AS BELOW.
   - MAKER : HIROSE
   - PART NO : DF19L-20P-1H

2. CCFT CONNECTOR FOR BACKLIGHT TO BE SPECIFIED AS BELOW.
   - MAKER : JST
   - PART NO : BHSR-02VS-1

3. ALLOWED DEPTH OF USERHOLE SCREW INSERTION IS 2.5mm MAX.

| NO | PART NAME | CODE NO | SPECIFICATION | Q'TY | WEIGHT FINISH MATERIAL | UNFOLDED DIM. OF MATERIAL | REMARK |
|----|-----------|---------|---------------|------|------------------------|---------------------------|--------|

| GENERAL TOLERANCE | | | | REV | DATE | DESCRIPTION OF REVISION | | | | REASON | CHG'D BY |
|-------------------|--|--|--|-----|------|-------------------------|--|--|--|--------|----------|

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 |

| UNIT | mm |
| SCALE | 1/1 |
| TOLERANCE LEVEL 3 |

| | DRA'N BY | DES'D BY | CHK'D BY | APP'D BY |
|--|----------|----------|----------|----------|
| | J.S.OH | J.S.OH | D.C.KIM | Y.B.CHU |
| | '01.03.23 | '01.02.12 | '01.03.28 | '01.03.28 |

SAMSUNG ELECTRONICS

| MODEL NAME | LTN121XF-L01 |
| PART/SHEET NAME | OUTLINE DIMENSION | SHEET 1/1 |
| SPEC. NO S004683-000 | | |
| CODE NO. | VER. 00 |