TO: **TOSHIBA CORPORATION**

DATE: **'04.04.06.**

# Specification of 15.0" TFT/LCD
# MODEL: LP150E06(B3K3)

| Prepared | Checked | Approved | |
|---|---|---|---|
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**NOTICE of RECEIPT**

We accepted this specification. **OME Operations, TOSHIBA Corp.**

| | | | |
|---|---|---|---|
| Purchasing Dept. | Eng. | Senr. Eng. | Senr. Mgr |
| | | | |
| PC Hardware Dept. | Eng. | Senr. Eng. | Senr. Mgr |
| | | | |

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## Record of Revision

| Date | Rev. No. | Sheet(New) | Item | Old | New | Reason |
|---|---|---|---|---|---|---|
| 04.04.06 | 0.1 | All | | | | First Edition |

## 1. Scope

This specification is applicable to LCD manufacturer's 38.1cm (15.0") diagonal size TFT-LCD module "LP150E06(B3K3)" designed for Personal Computer.

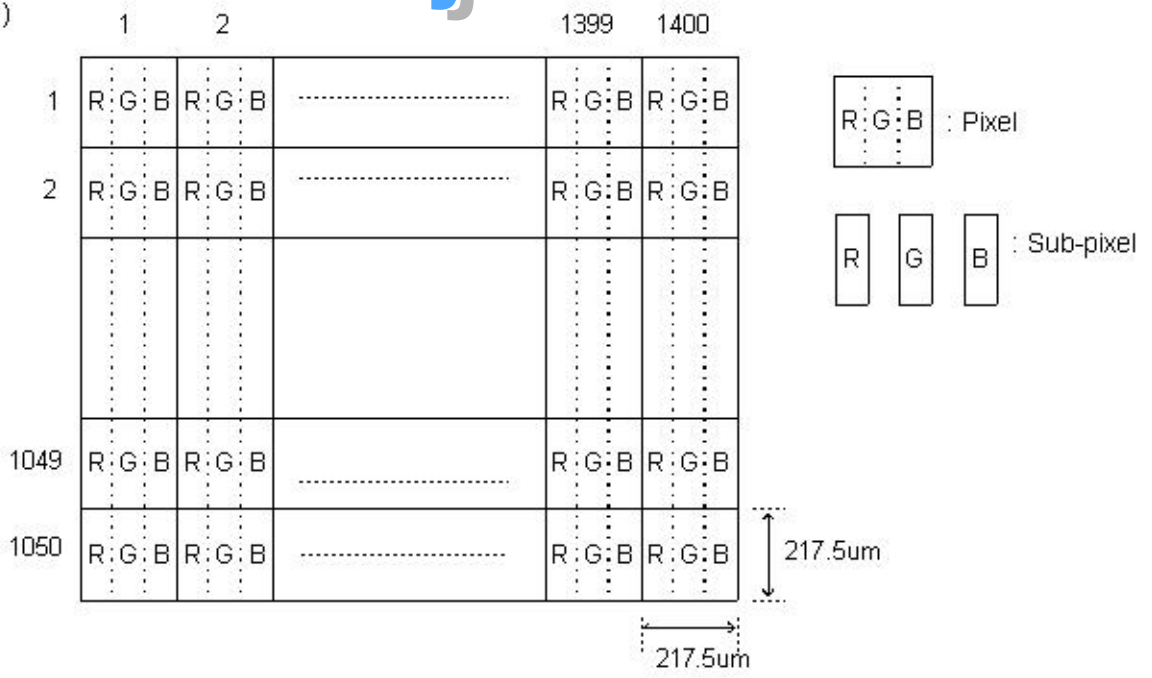
## 2. General Specification

### 2.1. Features

| Item | Specifications |
|---|---|
| Display area (Active area) | 304.5 (H) × 228.38 (V) (mm) (15.0 " diagonal) |
| Driving Method | TFT active matrix |
| Number of Pixels | 1400 (W) × 1050 (H) × R,G,B (XGA) (pixels) |
| Pixel pitch | 217.5 (H) × 217.5 (V) (um) |
| Pixel Arrangement | RGB vertical stripes |
| Display color | 262,144 (colors) |
| Display Mode | Transmissible type, Normally white |
| Viewing Direction | 6 o'clock (in direction of maximum contrast) |
| Surface Treatment | Anti – glare & hard coating 3H,HAZE(25%) |
| Interface | LVDS 2Port |
| Backlight | Single cold-cathode fluorescent lamp |
| Dimensional Outline | 317.2 (H) × 241.4 (V) / 6.0(Max)(D) mm |
| Bezel Opening | 307.5 (W) × 231.4 (H) (mm) |
| Weight | 515g(Typ) 530g(Max) |

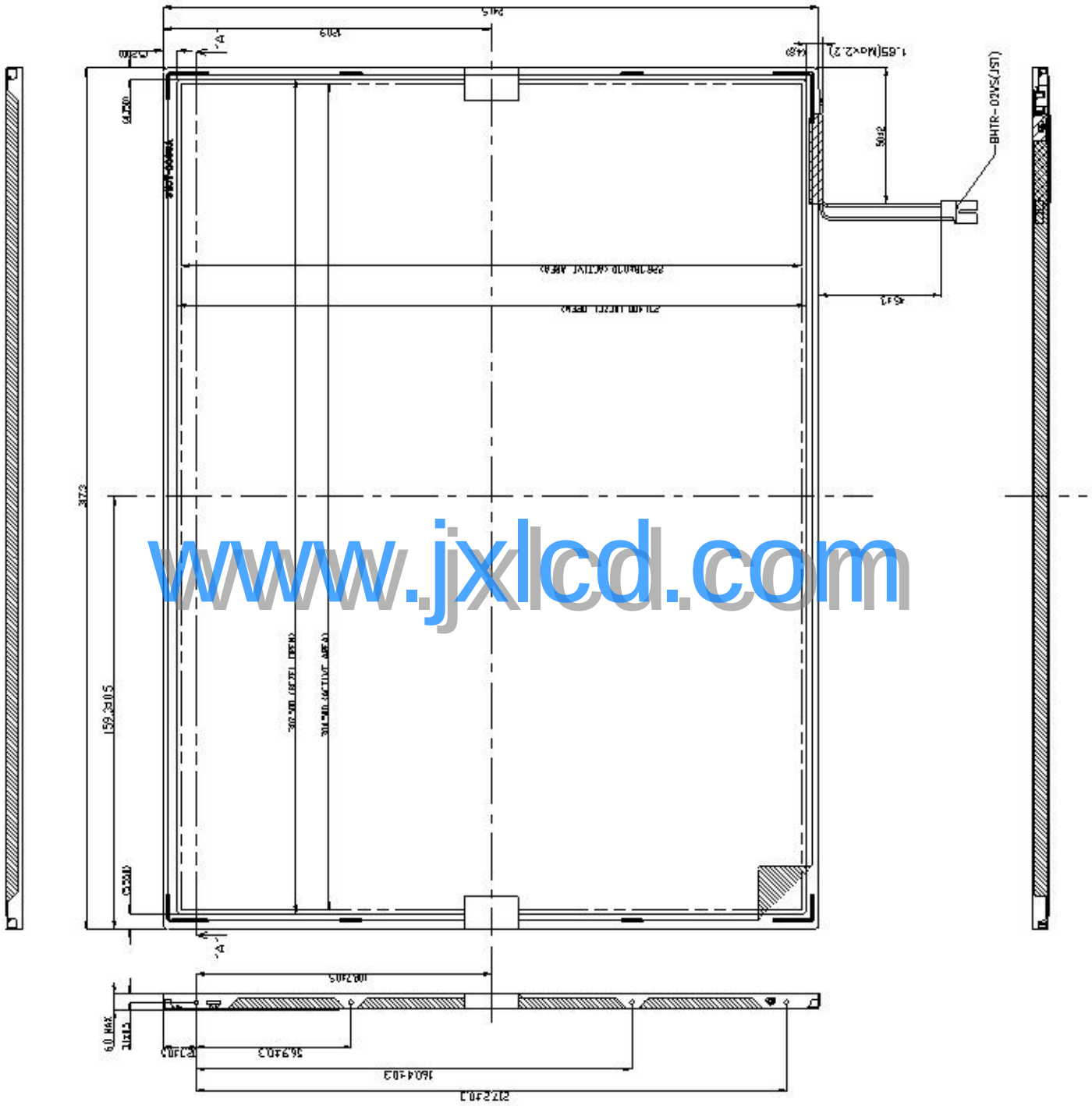


Note 1)

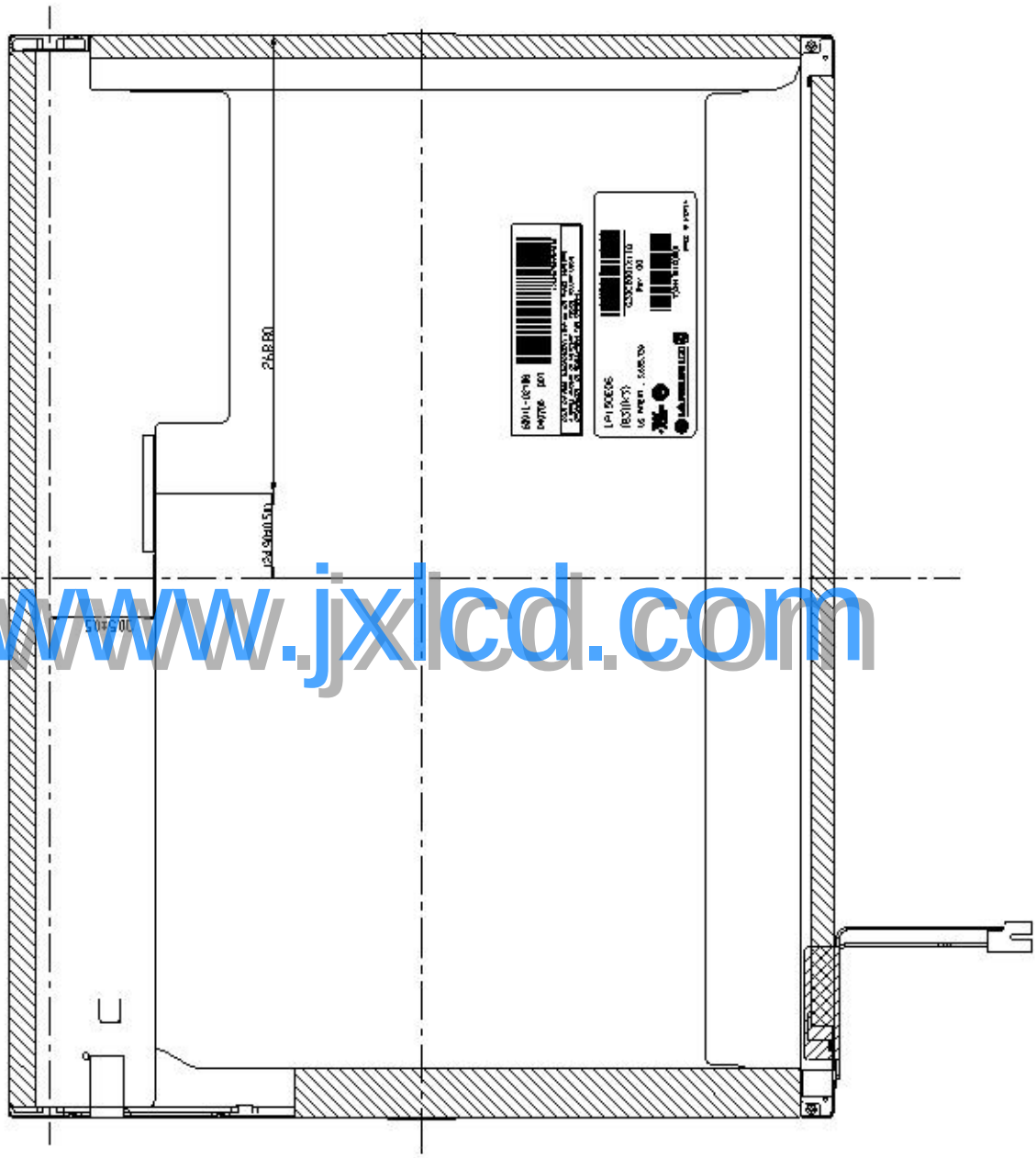


## 2.2. Dimensional Outline

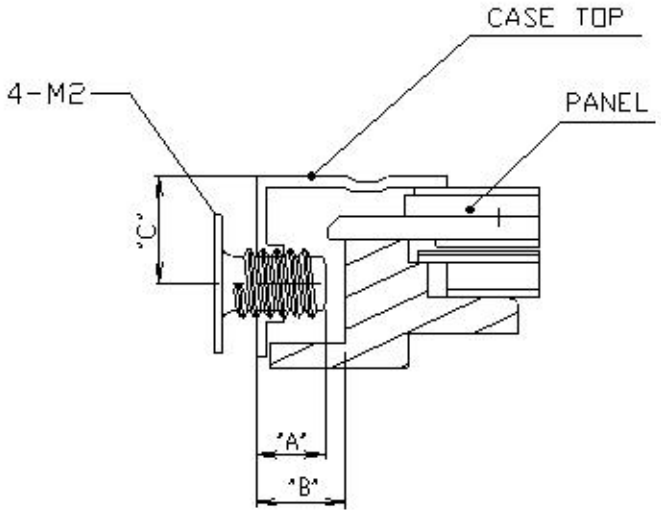
( Front figure )



( Back figure )



( Detail description of side mounting screw )

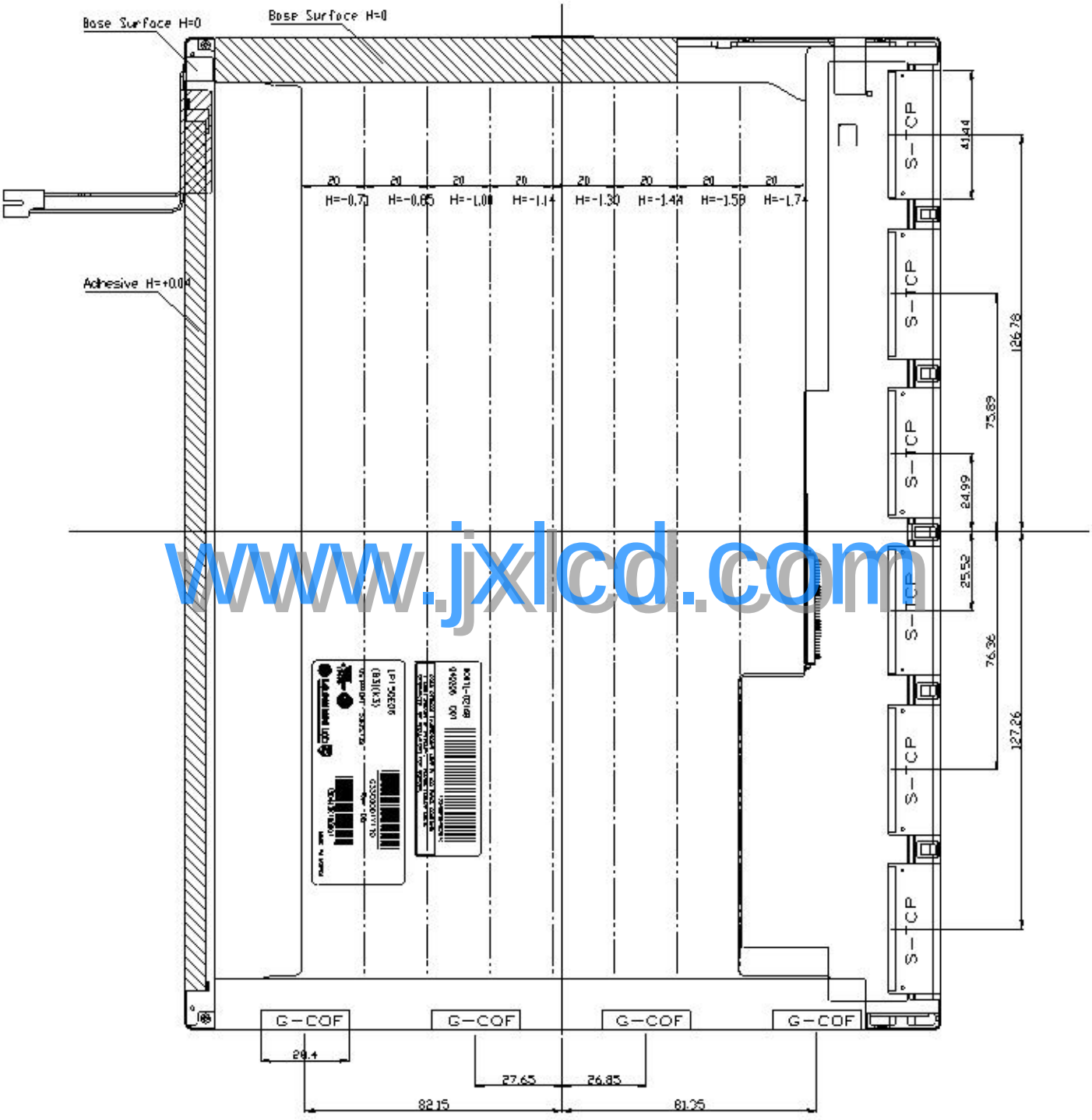



SCREW TORQUE : 2.3~2.5kgf cm
(Measurement gauge : torque meter)



* Mounting Screw depth
  depth Min. : "A" =2.0
  depth Max : "B" =2.5
* Mounting hole location : "C" = 3.1(typ.)

( Detail description of height of LCM back side & TAB Zone)

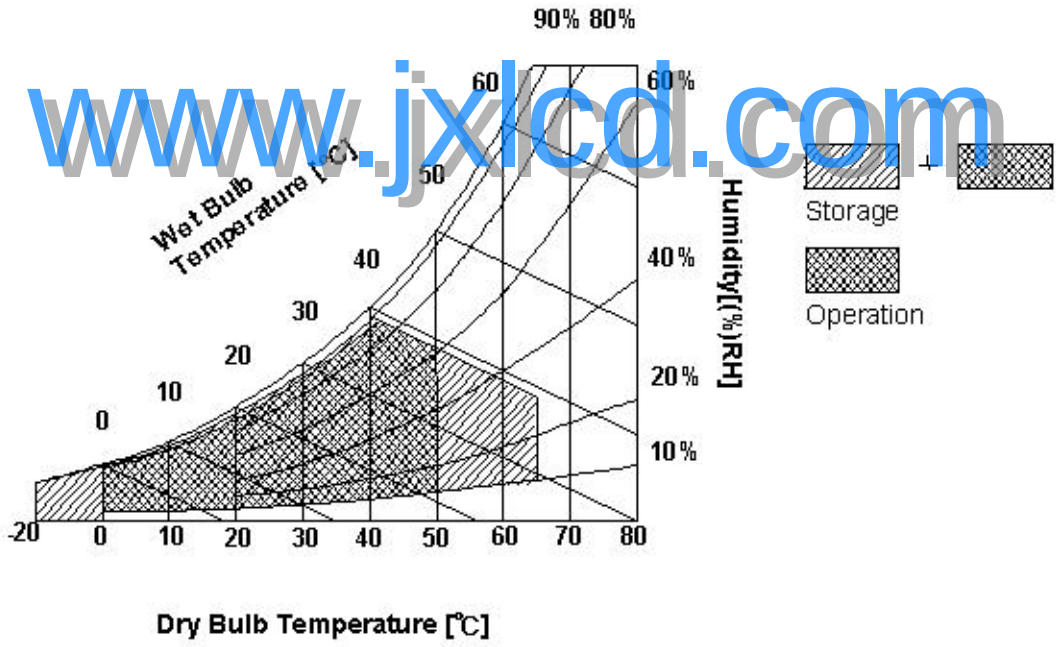


## 3. Absolute Maximum Ratings

### 3.1. Absolute Ratings of Environment

| Item | Symbol | Min | Max | Unit | Note |
|---|---|---|---|---|---|
| Operating Ambient Temperature | TOP | 0 | +50 | °C | (1) |
| Operating Temperature for Panel | - | 0 | +60 | °C | (2) |
| Storage Temperature | TSTG | -20 | +65 | °C | (1) |
| Operating Ambient Humidity | HOP | 10 | 90 | %RH | (1) |
| Storage Humidity | HSTG | 10 | 90 | %RH | (1) |
| Air Pressure | - | 57 | 101.3 | kPa | Operation |
| Air Pressure | - | 12 | 101.3 | kPa | Non-operation |
| Altitude | - | - | 3 | Km | Operation |
| Altitude | - | - | 12 | Km | Non-operation |

Note 1) Temperature and relative humidity range are shown in the figure below.
Wet bulb temperature should be 39°C Max, and no condensation of water.






Note 2) The surface temperature caused by self heat radiation of cell itself is specified on this item.

## 3.2. Electrical Absolute Maximum

(1) TFT LCD Module

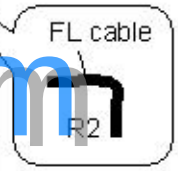
| Item | Symbol | Min | Max | Unit | Note |
|---|---|---|---|---|---|
| Power Supply Voltage | $V_{CC}$ | -0.3 | +4.0 | V | at 25 ± 5°C |
| Logic Input Voltage | $V_{IN}$ | -0.3 | V cc+0.3 | V | LVDS interface |

(2) Back Light Unit

| Item | Symbol | Min | Max | Unit | Note |
|---|---|---|---|---|---|
| Lamp Voltage | $V_L$ | - | 5000 | $V_{RMS}$ | Broken lamp Max Voltage |
| Lamp Current | $I_L$ | 2.0 | 6.3 | $mA_{RMS}$ | |
| Lamp Frequency | $F_L$ | 50 | 80 | KHz | |

## 3.3. Mechanical Ratings

| Test Item | Test Conditions | | Note |
|---|---|---|---|
| Mechanical Vibration | Frequency Range 5 - 500 Hz, 14.7m/s² 1.5G) constant, 0.5Hrs each axis (X, Y, Z direction). | | Non Operation |
| | Frequency Range 5 - 500 Hz, 4.9m/s² ( 0.5G) constant, 0.5Hrs each axis (X, Y, Z direction). | | Operation |
| Mechanical Shock<br><br>LCD fix condition<br>-> Note 2) | * 240G, Pulse width 2 ms, Sine Wave, ±X, ±Y, ±Z direction.<br>70G, Pulse width 11ms, Sine Wave ±X, ±Y, ±Z direction.<br>* Note) Normal function is only checking points. | | Non Operation |
| | 98 m/s²(10G), Pulse width 11 ms, Sine Wave, ±X, ±Y, ±Z direction. | | Operation |
| Pressure Resistanace<br><br>-> Note 1) | No Destruction with the force 196 N (20 kgf, 16 mm in diameter) to the display surface at the vertical direction. | | Non Operation |
| | No Destruction with the force 294.2 N (30 kgf, 30 mm in diameter) to the back of the display surface at the vertical direction.<br>Only the breakage of below items will not happen after test.<br>( Glass.Lamp & Circuit parts) | | |
| Strength of FL Cable | Strength of Rotation force | Cable : No disconnection of cable to the 5 trial of 360 degree rotation. See a bended state of cable. | Non Operation |
| | | Connector : No disconnection of cable to 10 trial of 180 degree rotation. See a bended state of cable. | |
| | Lead Pull Test | Soldering portion 29.4N(3.0kgf) 10mins<br>*1.08mm Wire applied | |
| | | Connector : 12.9N (1.32kgf) 1 sec<br>*1.08mm Wire applied | |






| | | |
|---|---|---|
| Connector tension test | Input connector : With 50 times of connector trial there must be no damage to the shape and functionaly.<br>Back light connector : With 50 times of connector trial there must be no damage to the shape and functionaly. | Non Operation |
| Assured torque value at side-mout part | M2 : Max 3.0 kgf | Non Operation |
| Rescrewed test | 15 times under Max. torque | Non Operation |
| Tapping test | Tapping area : All bezel(Metal cover) side,<br>LCD: Full-screen gray (L32).<br>"Ripple (Pooling )" can not be seen in Active Area<br>Tapping Force: Max 3kgf.cm | Operation |

Definitions of failure for judgment shall be as follows:

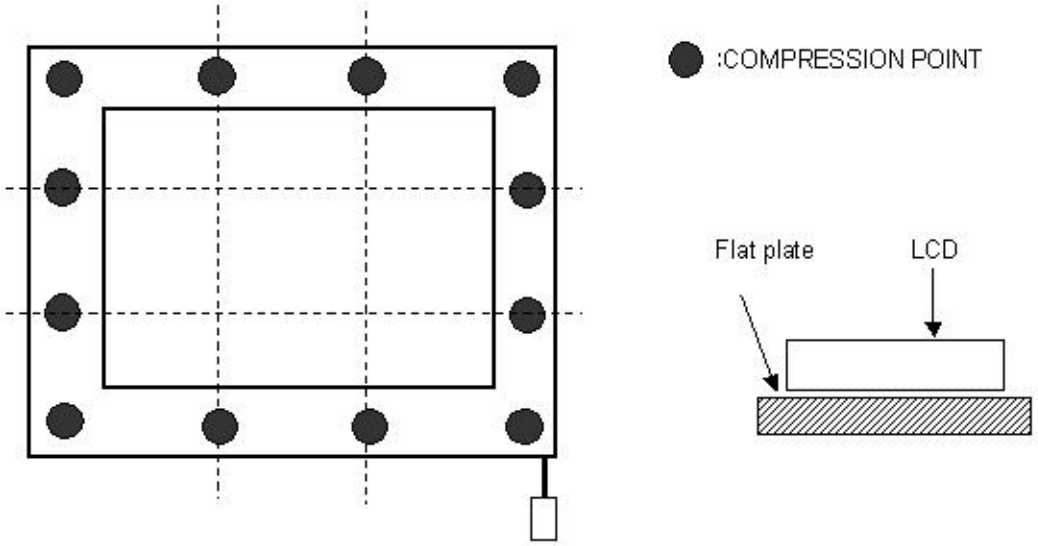
(1) Function of the module should be maintained.
(2) Current consumption should be smaller than the specified value.
(3) Appearance and display quality should not have distinguished degradation.
(4) Luminance should be larger than the minimum value specified in optical specification.

Note 1)

(1) The compression condition of front side

(a) Compression point : 12 points ( refer to Fig 1-1)

(b) Compression condition: 20kgf, 3 sec, Tool diameter: 16 mm in diameter (refer to Fig 1-3)



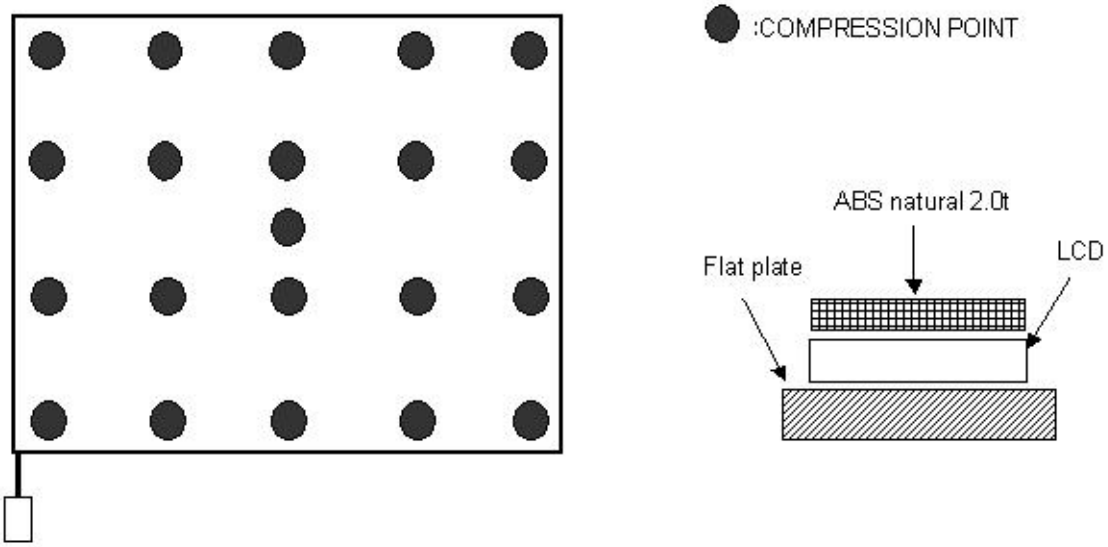

[ Fig 1-1 ]



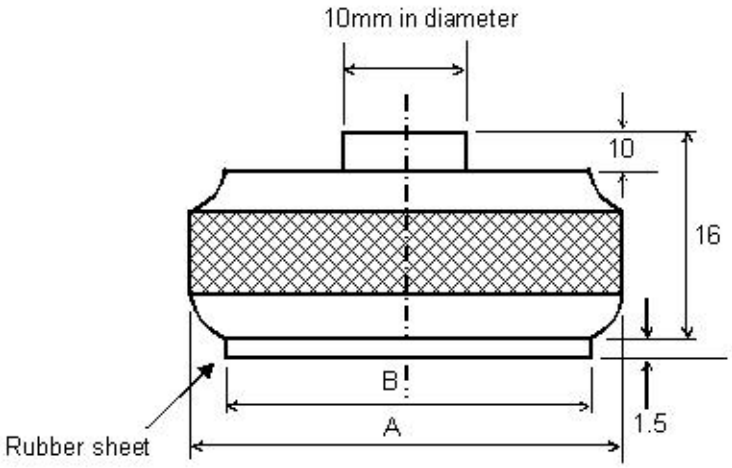
(2) The compression condition of rear side

(a) Compression point : 21 points ( refer to Fig 1-2 )

(b) Compression condition : 30kgf, 3 sec, Tool radius: 30 mm in diameter ( refer to Fig 1-3)




[ Fig 1-2 ]



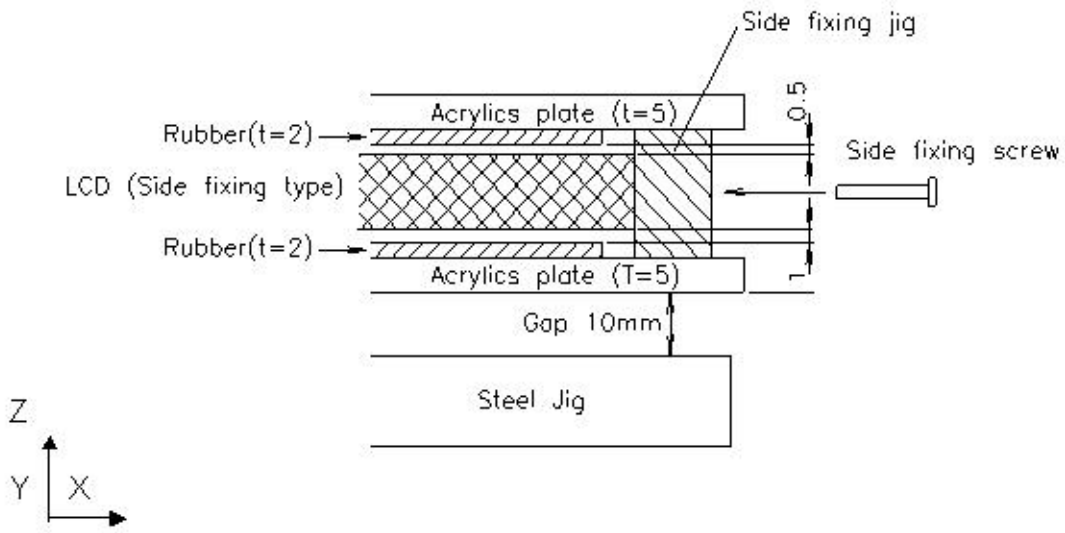

[ Fig 1-3 ]

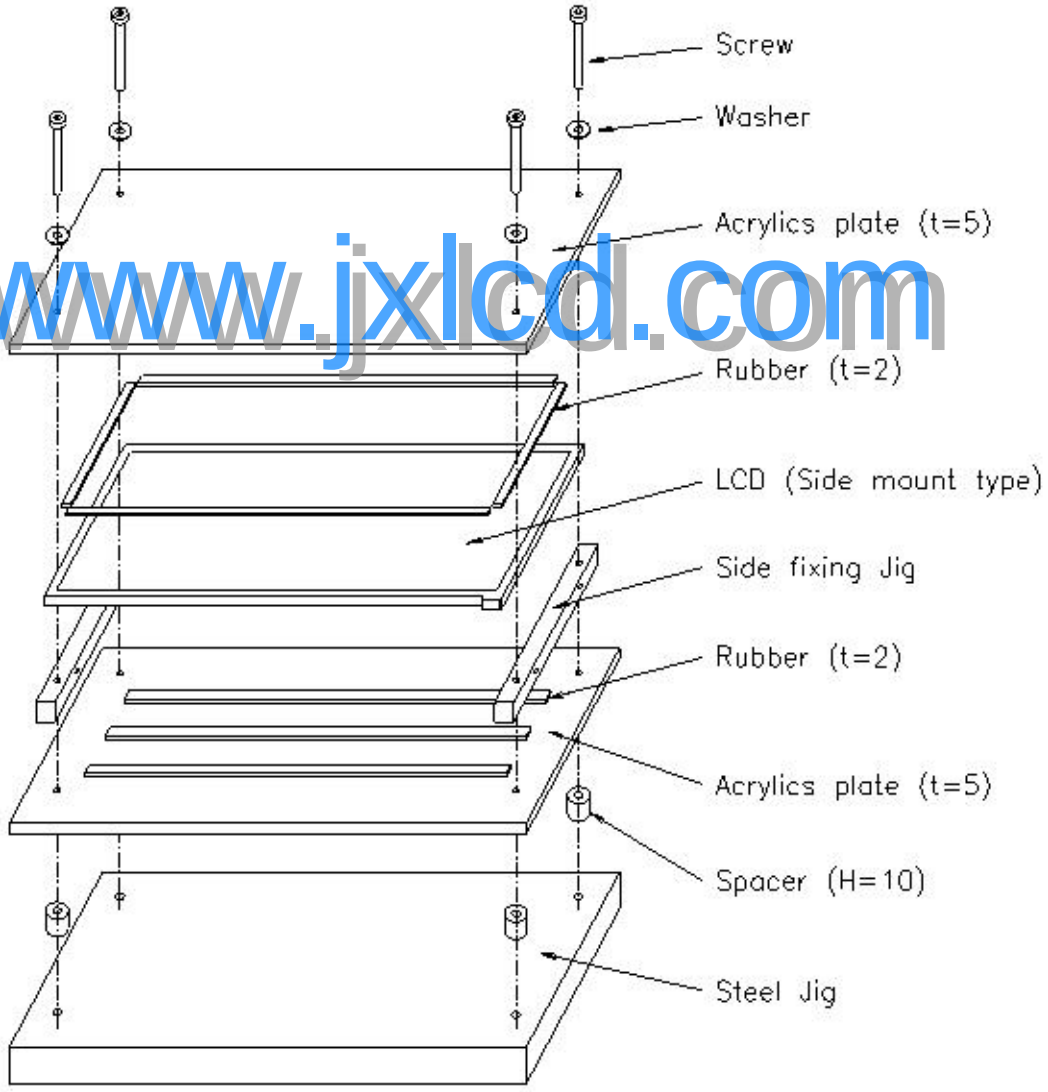
(3) Dimension of the compression jig

(a) compression jig for front side A = 16 mm in diameter
B = 16 mm in diameter

(b) compression jig for rear side A = 30 mm in diameter
B = 28 mm in diameter

Note 2) LCD fixing condition for z direction.



## 3.4. The Others

(1) Static electricity pressure resistance

| Item | Testing conditions | Operation | Non Operation |
|---|---|---|---|
| Contact discharge | 150pF, 330 ohm | ±8KV | ± 10 kV |
| Air discharge | 150pF, 330 ohm | ±15KV | ±20 KV |

(2) Sound noise

There should be no uncomfortable noise.

Being used under whatever surrounds, when power on/off, the panel should not generate uncomfortable noise. And regarding specified values are negotiated if it is needed.

(3) Open / Short

No smoke, no fiery at any open/ short test

(4) MTBF : 50,000 Hr (except for backlight lamp)

## 4. Optical Characteristics

### 4.1. Test Conditions

Ambient Temperature : $T_a$ 25 ± 5 °C
Ambient Humidity : $H_a$ 65 ± 20 %RH
Supply Voltage : $V_{CC}$ = 3.3V
Input Signal : According to typical value in "Electrical Characteristics"
FL Input Current : $I_L$ = 6.0$mA_{RMS}$
FL Driving Frequency : $f_{LF}$ = 65±5 kHz
FL Inverter : LG Inverter (6632Z-1301A)

The measuring method is shown in 4.2. The following items are measured under stable conditions. The optical characteristics should be measured in a dark room ( Screen illuminance < 2 lx ) or equivalent state with the methods shown in Note (6).

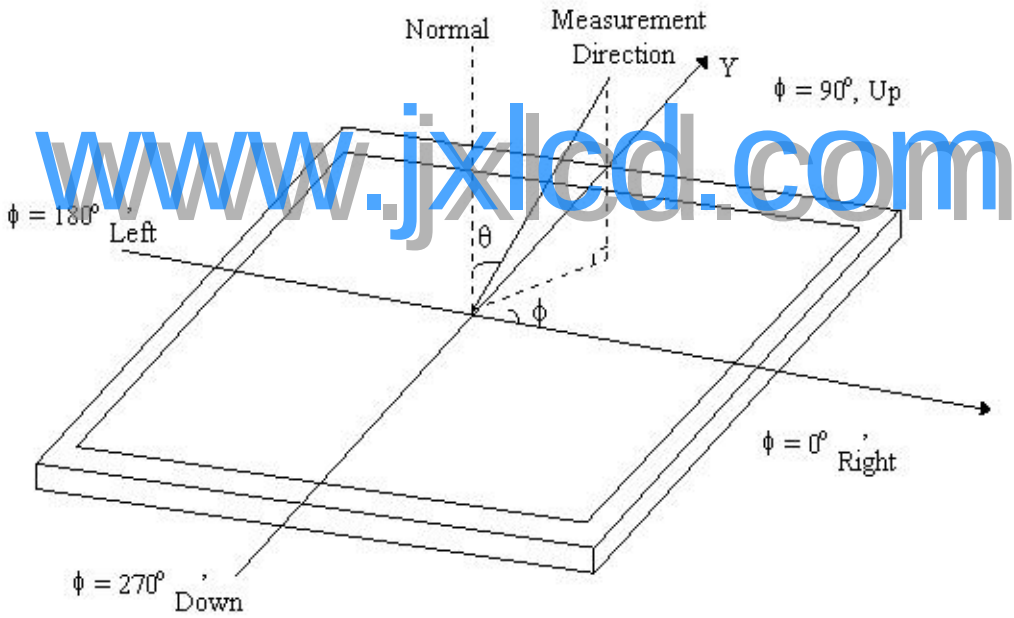
### 4.2. Optical Specifications

| Item | | Symbol | Conditions | | Min. | Typ. | Max. | Unit | Note |
|---|---|---|---|---|---|---|---|---|---|
| Contrast Ratio ( 1 Point, Center ) | | CR | θ = 0°, ϕ = 0° Viewing normal angle | | 150 | 300 | - | - | (2), (6) |
| Response Time | | $t_{ON}$ | | | - | 10 | 20 | ms | (3) |
| | | $t_{OFF}$ | | | - | 20 | 30 | ms | |
| Average luminance ( 5point Average, White ) | | $Y_L$ | | | 165 | 200 | - | cd/m² | (7) |
| Cross Modulation | | $D_{CHA}$ | | | - | - | 2.0 | % | (5) |
| Luminance Uniformity Chromaticity | Red | Rx | | | 0.560 | 0.590 | 0.620 | | (1), (6) PR650 |
| | | Ry | | | 0.313 | 0.343 | 0.373 | | |
| | Green | Gx | | | 0.290 | 0.320 | 0.350 | - | |
| | | Gy | | | 0.510 | 0.540 | 0.570 | | |
| | Blue | Bx | | | 0.125 | 0.155 | 0.185 | | |
| | | By | | | 0.103 | 0.133 | 0.163 | | |
| | White | Wx | | | 0.283 | 0.313 | 0.343 | | |
| | | Wy | | | 0.299 | 0.329 | 0.359 | | |
| Viewing Angle | Hor. | $\theta_L$ | CR ≥ 10 | ϕ = 180 | 40 | 45 | - | deg. | (1), (6) |
| | | $\theta_R$ | | ϕ = 0° | 40 | 45 | - | | |
| | Ver. | $\theta_{up}$ | | ϕ = 90° | 10 | 15 | - | | |
| | | $\theta_{Low}$ | | ϕ = -90° | 30 | 35 | - | | |
| | Hor. | $\theta_L$ | CR ≥ 5 | ϕ = 180 | 45 | 50 | - | | |
| | | $\theta_R$ | | ϕ = 0° | 45 | 50 | - | | |
| | Ver. | $\theta_{up}$ | | ϕ = 90° | 20 | 25 | - | | |
| | | $\theta_{Low}$ | | ϕ = -90° | 35 | 40 | - | | |
| 13 Points White Variation | | δW | θ = 0°, ϕ = 0° Viewing normal angle | | - | - | 2.0 | | (7) |
| 13 Points CR Variation | | $\delta C_R$ | | | - | - | 2.0 | | (7), A |
| White Variation | | dL | | | - | - | 2.0 | | (8) |

* Gray scale specifications.

| Item | Gray level | Conditions | Min. | Typ. | Max. | Unit | Note |
|---|---|---|---|---|---|---|---|
| Normalized luminance at each gray level | 63 | θ=0°, ϕ=0° Viewing normal angle | 100 | 100 | 100 | % | (1), (6) (Center 1 Point) |
| | 55 | | 60.0 | 75.0 | 90.0 | | |
| | 47 | | 30.0 | 48.0 | 66.0 | | |
| | 39 | | 15.5 | 31.0 | 46.5 | | |
| | 31 | | 8.0 | 19.0 | 30.0 | | |
| | 23 | | 3.0 | 9.50 | 16.0 | | |
| | 15 | | 0.73 | 3.93 | 7.13 | | |
| | 7 | | 0.00 | 0.83 | 2.20 | | |
| | 0 | | 0.00 | 0.33 | 0.66 | | |

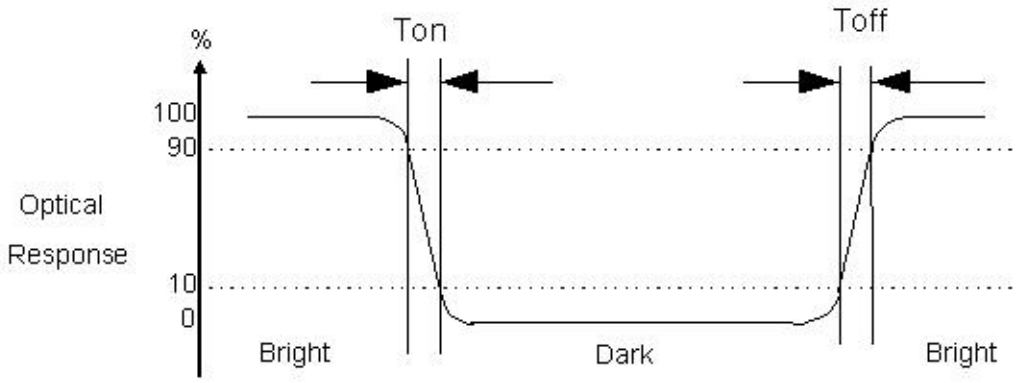
Note 1) Definition of viewing angle θ and ϕ






Note 2) LCD fixing condition for z direction.
The contrast ratio can be calculated by the following expression.
Contrast Ratio (CR) = L63 / L0
L63 : Luminance on the white raster (gray scale level L63)
L 0 : Luminance on the black raster (gray scale level L0)

Note 3) Definition of response time




Note 4) Definition of surface luminance of white

Measure the luminance of white at Center point. Surface luminance of white $Y_L$

Note 5) Definition of Cross Modulation ($D_{SHA}$)

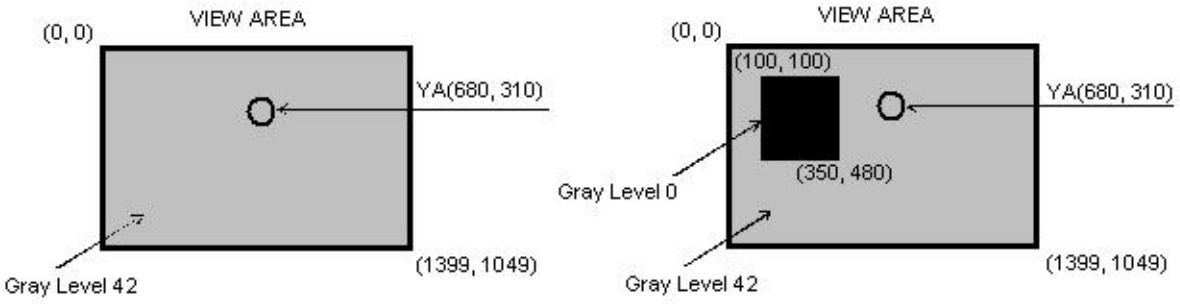
$D_{SHA} = | Y_B - Y_A | / Y_A \times 100 (\%)$

Where:

$Y_A$ = Luminance of measured location without darkest gray pattern (cd/m²)

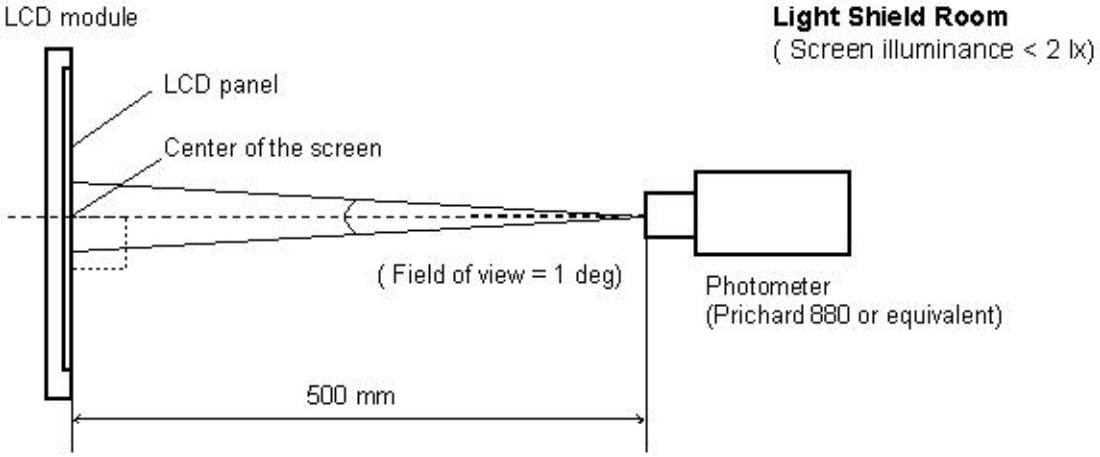
$Y_B$ = Luminance of measured location with darkest gray pattern (cd/m²)





Note 6) Measuring setup

The measurement suppose to be executed after stabilized the panel at given temperature during 30 min. The measurement shall be executed 30 minutes after lighting at rating. The luminance of white should be typical luminance ( **Typical Condition IL=6.0mA** ). In order to stable the luminance, LCD shall not be got winds.



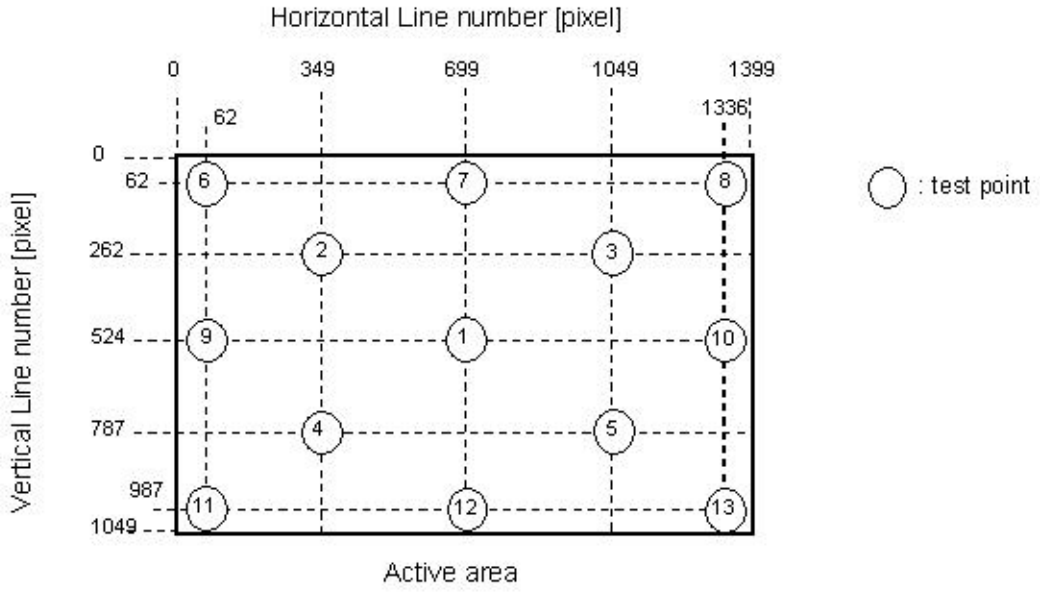



Note 7) Definition of 13 points white variation $\delta W$, CR variation $\delta C_R$ and average luminance $Y_L$

$\delta W$ = Maximum luminance of 13 points / Minimum luminance of 13 points

$\delta C_R$ = Maximum CR 13 points / Minimum CR of 13 points

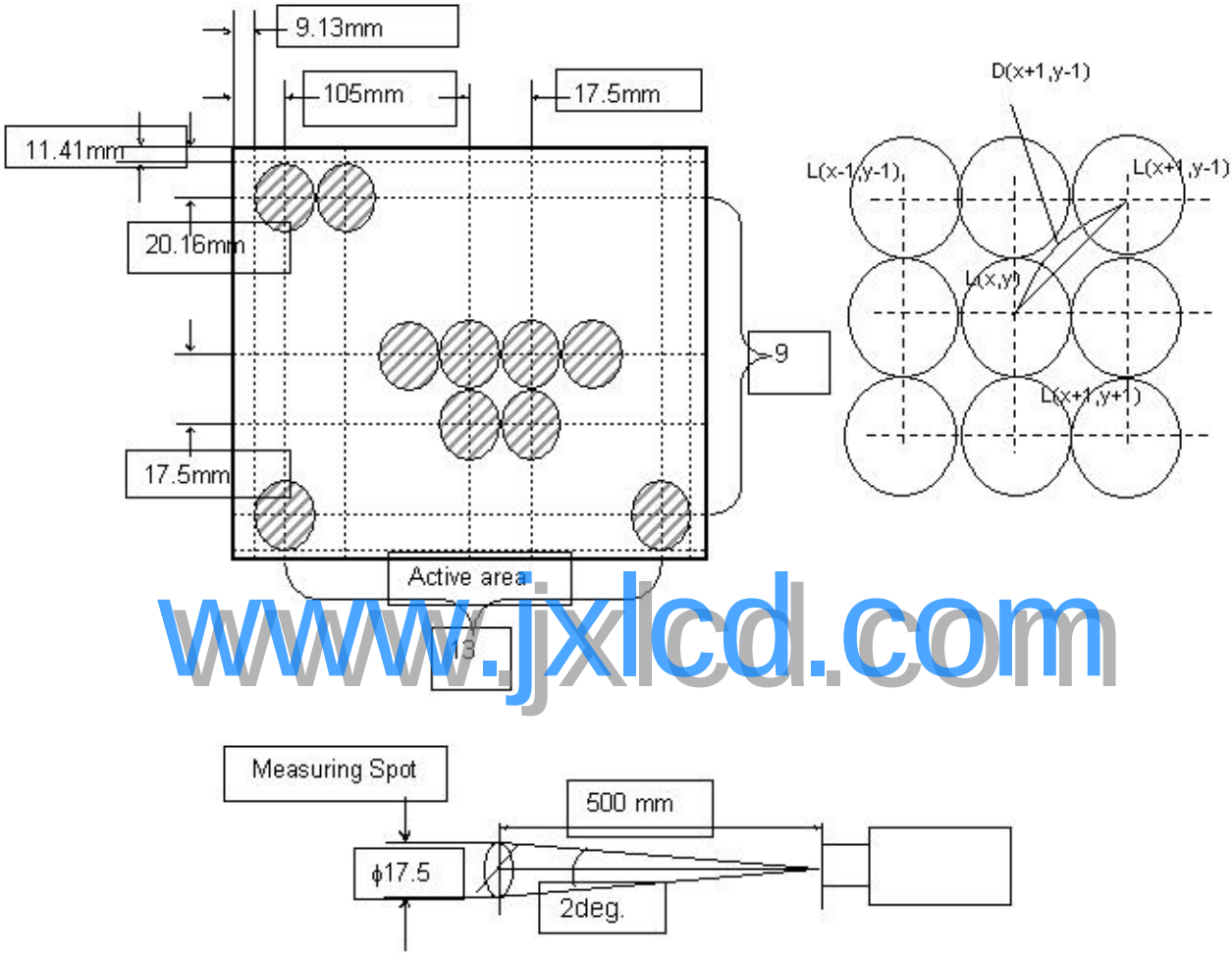
$Y_L$ = Luminance of 5 points(1~5) / 5



Note 8) Definition of White Variation dL : measure the luminance of white at 13 × 9 points.

$$dL = [\ |\ L(x,y) - L(x+i, y+j)\ |\ /\ (\ L(x,y) \times D(x+i, y+j)\ )\ ] \times 100 \quad (\%/mm)$$

where $2 \le x \le 12,\ 2 \le y \le 8,\ i = \pm 1,\ j = \pm 1$



## 5. Electrical Characteristics

### 5.1. TFT LCD module

| Item | | Symbol | Min. | Typ. | Max. | Unit | Note |
|---|---|---|---|---|---|---|---|
| Power Supply Voltage | | $V_{CC}$ | 3.0 | 3.3 | 3.6 | V | |
| Differential Input Threshold Voltage | High | Vth | - | - | +100 | mV | |
| | Low | Vtl | -100 | - | - | mV | |
| Rush Current | | $I_{RUSH}$ | - | - | 1.8 | A | (4) |
| Power Supply Current | White(L63) | $I_{DD}$ | - | 300 | 345 | mA | (2), (3) (a) |
| | Mosaic | | - | 420 | 480 | | (2), (3) (b) |
| | Max. Pattern | | - | 440 | 505 | | (2), (3) (c) |

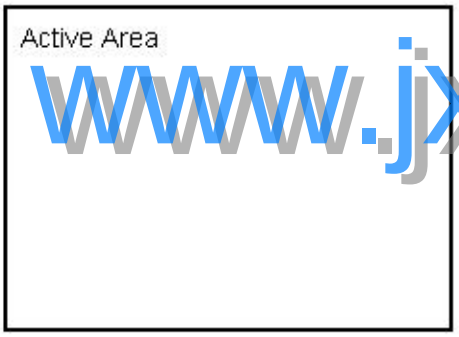
Note 1) The module should be always operated within these ranges. The "Typ." shows the recommendable value.

Note 2) Recommended LVDS transmitter : THC63LVDF823A made by Thine.
LVDS receiver included in this module is THC63LVDF824A.( 1 chip)

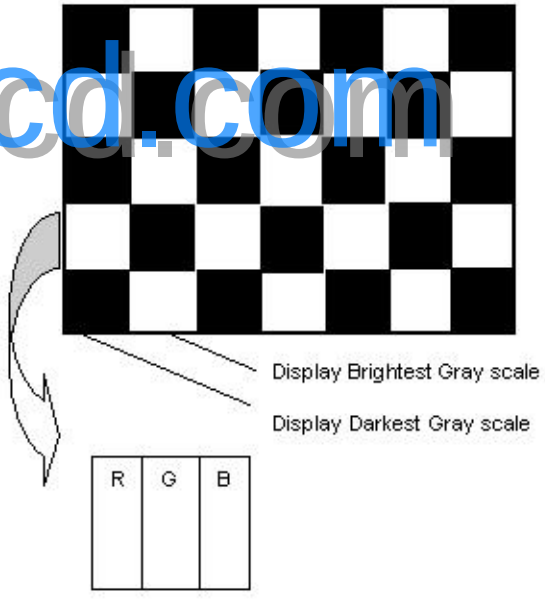
Note 3) Typical condition as follows. : fV= 60Hz, fDCLK = 54 MHz, $V_{DD}$= 3.3V, DC current.

Note 4) Power dissipation check pattern.

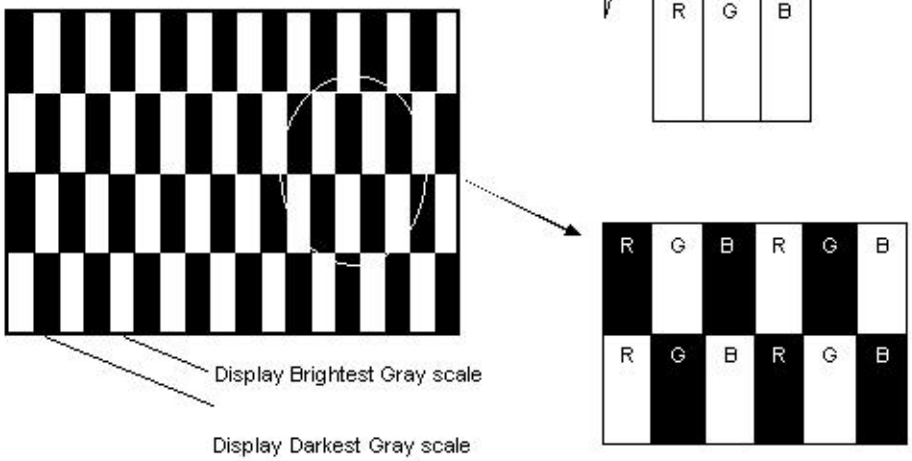
(a) White pattern



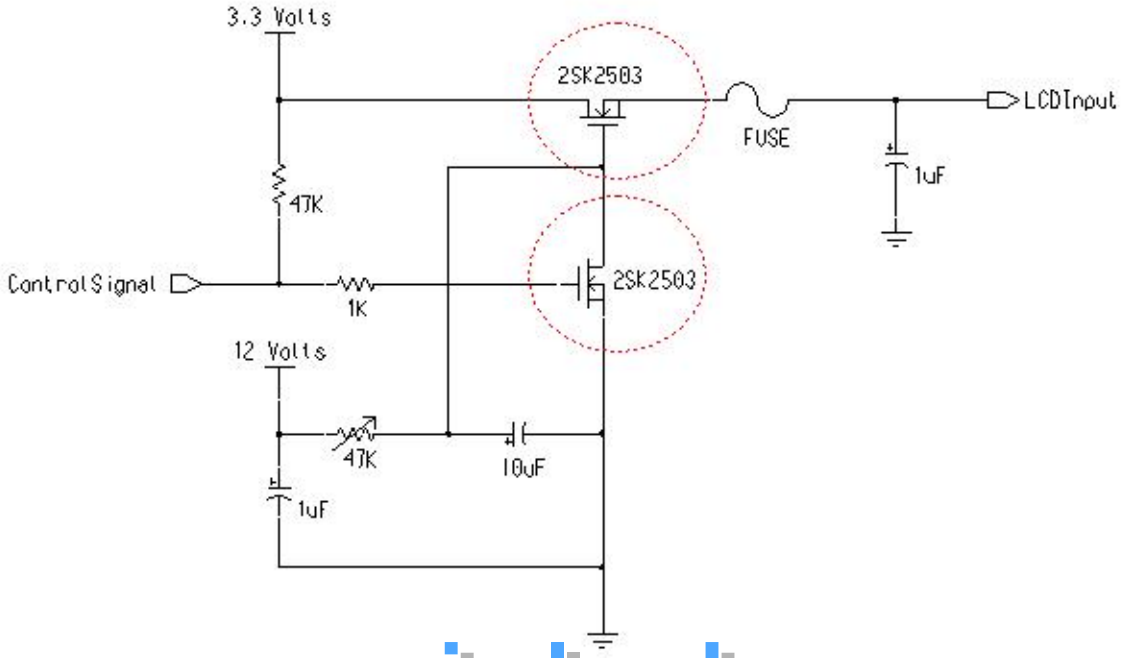

(b) Mosaic pattern




(C) Max. pattern

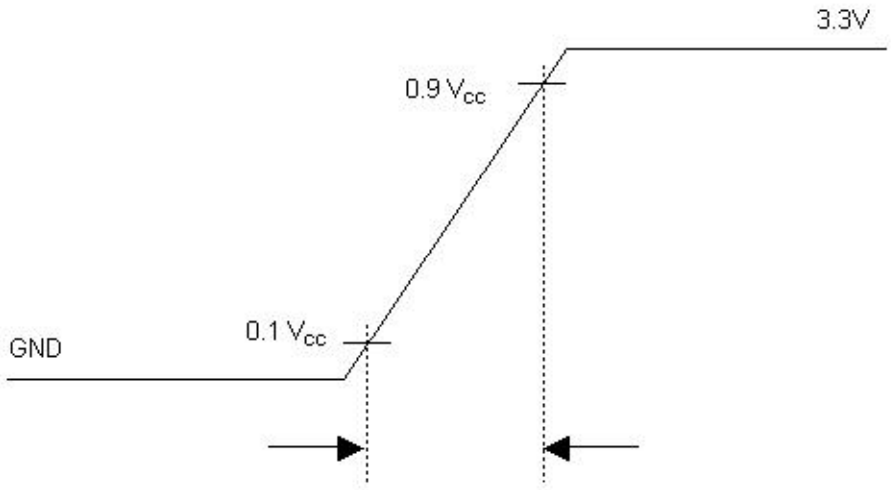


Note 4) Measuring condition of rush current.





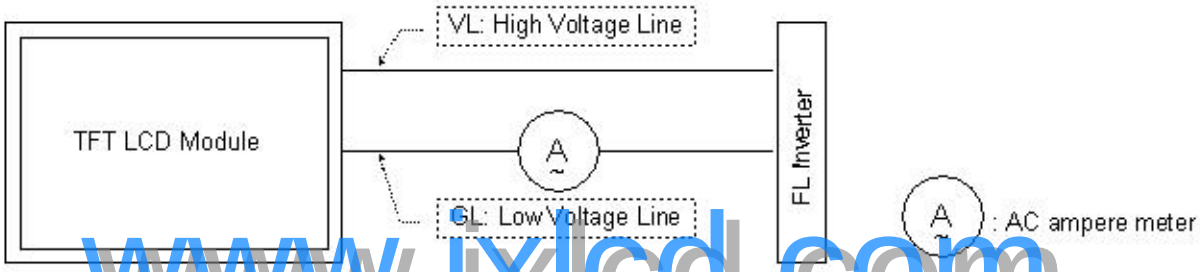

$V_{cc}$ rising time is 470us



## 5.2. Backlignt Unit

| Item | Symbol | Min. | Typ. | Max. | Unit | Note |
|---|---|---|---|---|---|---|
| Lamp Current | $I_L$ | 2.0 | 5.0 | 6.3 | $mA_{RMS}$ | (1) |
| Lamp Voltage | $V_L$ | 650 | 705 | 870 | $V_{RMS}$ | 10% Tolerance(6.0mA) |
| Power Consumption | $P_L$ | - | 3.5 | 4.1 | W | (2) |
| Frequency | $f_{FL}$ | 50 | 65 | (80) | kHz | |
| Operating Life Time | Hr | 10,000 | - | - | Hour | (3) |
| Ignition Voltage at 25°C | $V_{IN}$ | - | - | 1165 | $V_{RMS}$ | (4) |
| Ignition Voltage at 0°C | $V_{IN}$ | - | - | 1400 | | (4) |
| Creepage Distance | - | 5.15 | 5.25 | 5.35 | mm | |
| Mercury Qt'y of CCFL | - | 1.5 | - | 3.0 | mg | |

Note 1) Lamp current is measured with a high frequency current as shown below.






Note 2) The variance of the voltage is ± 10%.

Note 3) Refer to $I_L$ X $V_L$ to calculate.

Note 4) Life time of Lamp can be defined as the time in which it continues to operate under the condition T = 25°C ± 2°C and IL= 6.0 mArms until one of the following events occurs.

1. When the brightness becomes 50% or lower than it's original.
2. When the Effective ignition length becomes 80% or lower than it's original value.

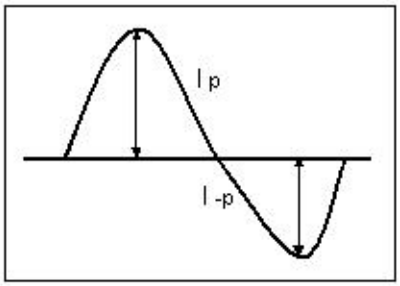
( Effective ignition length is defined as an area that has less than 70% brightness compared to the brightness in the center point.)

Note 5) The discharge shall be connected uniformly. Slide up method shall be used for voltage application. Above voltage is applied voltage to both ends of the lamp as the starting voltage.
( Above value is not out put voltage of inverter.)

Note 6) The lamp shall be lighted stably. Slide up method shall be used for voltage application. Above voltage is applied voltage to both ends of the lamp as the established starting voltage. (Above value is not out put voltage of inverter)
The voltage above $V_{IN}$ should be applied to the lamps for more than 1 second for start-up. Otherwise, the lamps may not be turned on. The used lamp current is the lamp typical current.

*** Requirements for a system inverter design, which is intended to have a better display performance, a better power efficiency and a more reliable lamp, are following.
It shall help the lamp lifetime increased and leakage current reduced.

a. The asymmetry rate of the inverter waveform should be less than 10%.
b. The distortion rate of the waveform should be within $\sqrt{2} \pm 10\%$.
* Inverter output waveform had better be more similar to ideal sine wave.




* Asymmetry rate:

$| I_p - I_{-p} | / I_{rms} * 100\%$

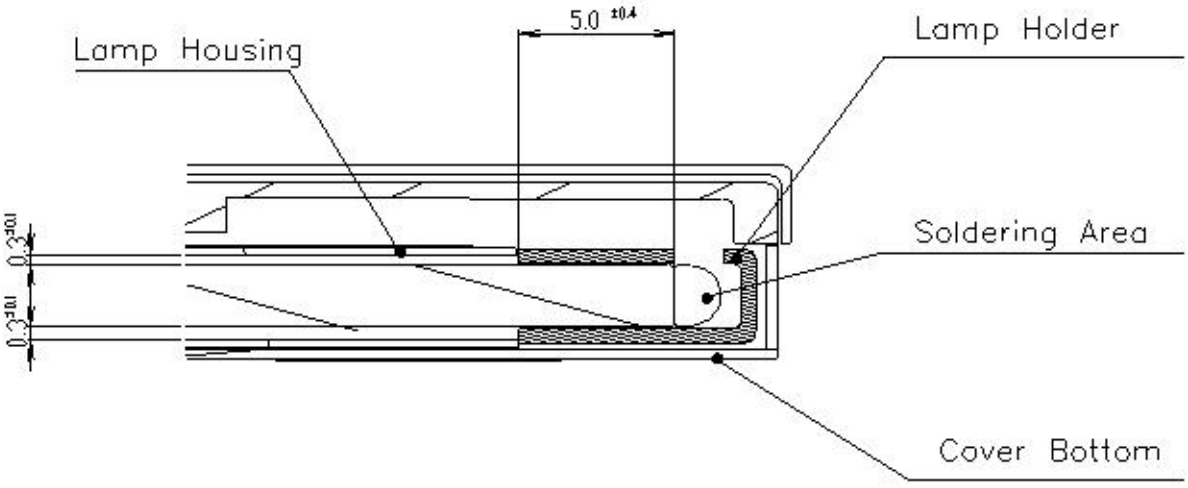
* Distortion rate

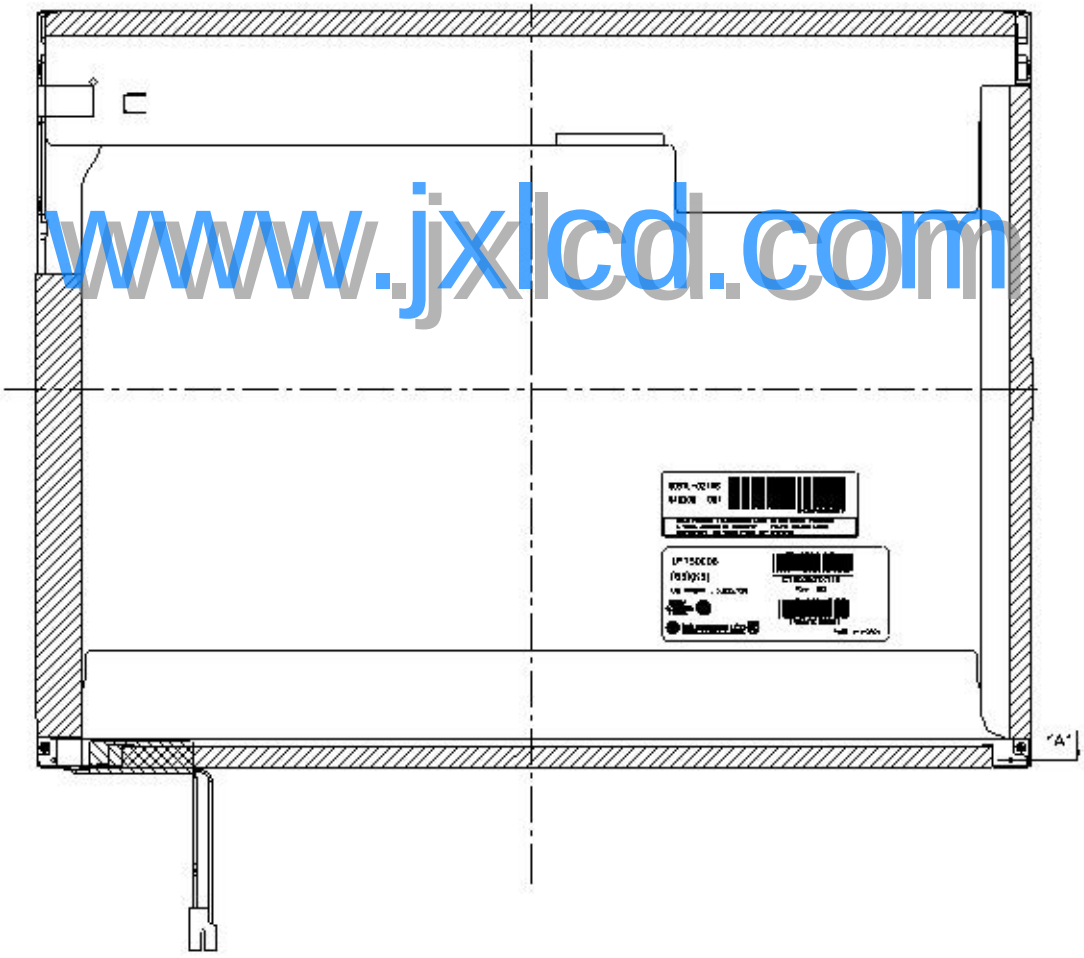
$I_p$ (or $I_{-p}$) / $I_{rms}$

※ Do not attach a conducting tape to lamp connecting wire.
If the lamp wire attach to a conducting tape, TFT-LCD Module has a low luminance and the inverter has abnormal action. Because leakage current is occurred between lamp wire and conducting tape.

Note 6) Detail description of creepage distance

[ Section 'A' ]



## 5.3. Regulation

The set (which LCD module is assembled into) should conform to the regulations below.

(1) EMI Regulations.

CISPR : Pub.22 CLASS B
FCC : PART15 CLASS B
VCCI : CLASS B

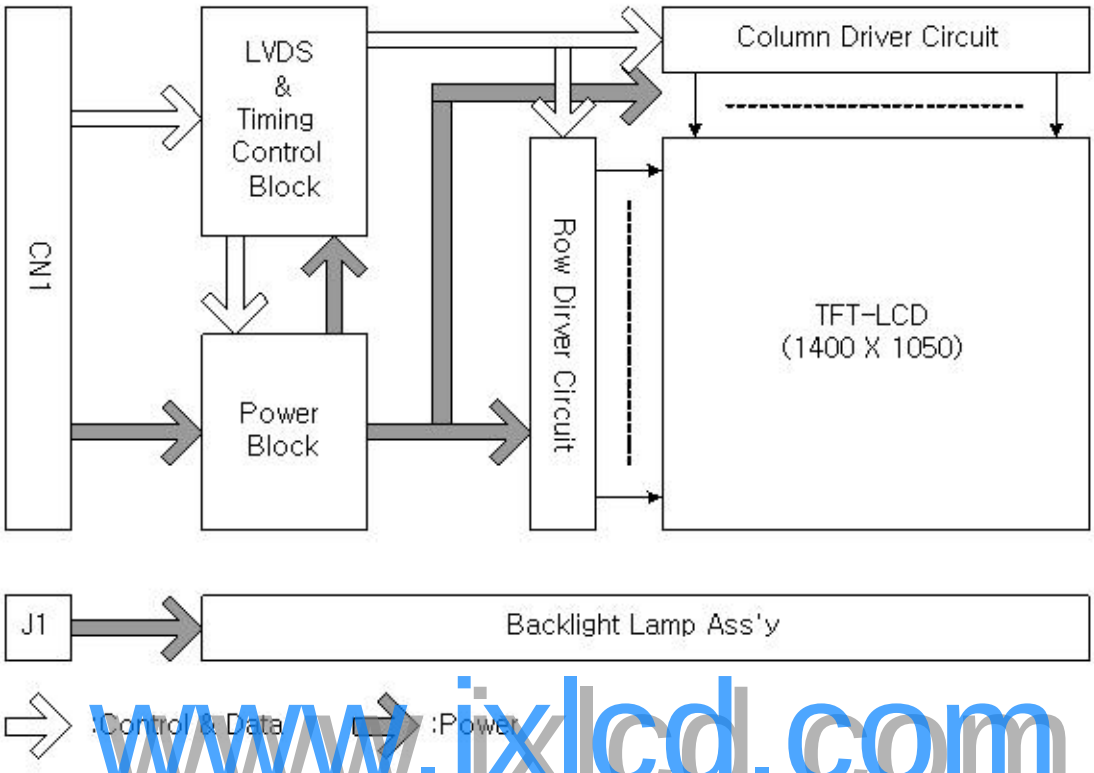
(2) Safety Regulations (Only LCD)

IEC 950
UL 1950

(3) Material list concerning

| Item | | Silk | Product | Rating | Maker |
|---|---|---|---|---|---|
| EMI Filter | ASIC (Data Output) | AR1~9 | Array Resistor | 100Ω 1/16W 5% 3216 R/TP | |
| | | C95~103 | Array Capacitor | 68pF 50V NP0 10% 3216 | |
| | ASIC (Clock Output) | FL5,6 | BLM18BD601SN | 600Ω 1608 | MURATA |
| | | C38,40 / C39,41 | Chip Capacitor | 39pF / 47pF | |
| | Power $V_{DD}$(3.3V) | - | - | - | |
| DC/DC | Control IC for Power supply | U1 | LM2622MMX | 8p, MSOP R/TP PWM | National Semicon ductor |
| | Switching Diode | D1,D2,D3,D5 | BAV99 | | DIODS |
| | Zener Diode | ZD1 | BZT52C5V6S | 5.6V | |
| | Schottky Barrier Diode | D4 | BAT750 | 0.75A | |
| | Inductor | L1 | PLN6012T-100MR80 | 10 uH± 20% (Inductance)<br>0.24Ω ±20%(DC Resistance)<br>0.9A Max(Rated DC Current) | TDK |

## 6. Block Diagram



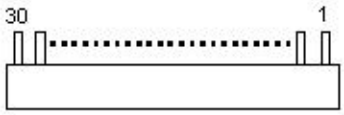



Lamp: SS18C3100N6585C2902820S (SANKEN)

1. Hot (Pink)
2. Cold (WHITE)

## 7. Input Terminal Pin Assignment

### 7.1. TFT LCD module

| Pin | Symbol | Description | Notes |
|---|---|---|---|
| 1 | VSS | Ground | [LVDS Transmitter]<br>Thine, THC63LVDF823A or equivalent<br><br>[LVDS Receiver]<br>Thine, THC63LVDF824A<br><br>[Connector]<br>LCD : GT101-30S-HR11, LG Cable<br>*** JAE FI-XB30Sx-HFxx or JAE FI-XB30S-HF or equivalent.**<br>Matching : JAE FI-X30M or equivalent<br><br>[Connector pin arrangement]<br>  <br><br>LCD rear view |
| 2 | VCC | Power Supply, 3.3V Typ. | |
| 3 | VCC | Power Supply, 3.3V Typ. | |
| 4 | $V_{EDID}$ | DDC 3.3V power | |
| 5 | NC | No Connection | |
| 6 | $Clk_{EDID}$ | DDC Clock | |
| 7 | $DATA_{EDID}$ | DDC Data | |
| 8 | Odd_$R_{IN}$0- | -LVDS differential data (odd pixels R0-R5, G0) | |
| 9 | Odd_$R_{IN}$0+ | +LVDS differential data (odd pixels R0-R5, G0 ) | |
| 10 | VSS | Ground | |
| 11 | Odd_$R_{IN}$1- | -LVDS differential data (odd pixels G1-G5, B0-B1 ) | |
| 12 | Odd_$R_{IN}$1+ | +LVDS differential data (odd pixels G1-G5, B0-B1 ) | |
| 13 | VSS | Ground | |
| 14 | Odd_$R_{IN}$2- | -LVDS differential data (odd pixels B2-B5, HS, VS, DE) | |
| 15 | Odd_$R_{IN}$2+ | +LVDS differential data (odd pixels B2-B5, HS, VS, DE) | |
| 16 | VSS | Ground | |
| 17 | Odd_$Clk_{IN}$- | -LVDS differential clock (odd pixels) | |
| 18 | Odd_$Clk_{IN}$+ | +LVDS differential clock(odd pixels) | |
| 19 | VSS | Ground | |
| 20 | Even_$R_{IN}$0- | -LVDS differential data (even pixels R0-R5, G0) | |
| 21 | Even_$R_{IN}$0+ | +LVDS differential data (even pixels R0-R5, G0 ) | |
| 22 | VSS | Ground | |
| 23 | Even_$R_{IN}$1- | -LVDS differential data (even pixels G1-G5, B0-B1 ) | |
| 24 | Even_$R_{IN}$1+ | +LVDS differential data (even pixels G1-G5, B0-B1 ) | |
| 25 | VSS | Ground | |
| 26 | Even_$R_{IN}$2- | -LVDS differential data (even pixels B2-B5, HS, VS, DE) | |
| 27 | Even_$R_{IN}$2+ | +LVDS differential data (even pixels B2-B5, HS, VS, DE) | |
| 28 | VSS | Ground | |
| 29 | Even_$Clk_{IN}$- | -LVDS differential clock (even pixels) | |
| 30 | Even_$Clk_{IN}$+ | +LVDS differential clock (even pixels) | |



### 7.2. Backlight Unit

Using Connector : BHTR-02VS-1 (Maker : JST)
(Contact Pin of VL : SBHT-002T-P0.5 (Maker :JST ))
(Contact Pin of GL : SBHT-002T-P0.5 (Maker :JST ))

| Pin | Symbol | Cable Color | Function |
|---|---|---|---|
| 1 | VL | Pink | High Voltage |
| 2 | GL | White | Low Voltage |

## 7.3. LVDS Transmitter

LVDS Transmitter : THC63LVDF823 (made by Thine ) or compatible.

| Pin Name | Pin # | Type | Description |
|---|---|---|---|
| TA1+, TA1- | 48, 49 | LVDS OUT | LVDS Data Ouputs. The 1st pixel output data when Dual-in mode. |
| TB1+, TB1- | 46, 47 | LVDS OUT | |
| TC1+, TC1- | 43, 44 | LVDS OUT | |
| TD1+, TD1- | 39, 40 | LVDS OUT | |
| TCLK1+, TCLK1- | 41, 42 | LVDS OUT | LVDS Clock Out for Tx1+/-. |
| TA2+, TA2- | 36, 37 | LVDS OUT | The 2nd LVDS Data Outputs. These pins are disabled when Single-out mode. |
| TB2+, TB2- | 34, 35 | LVDS OUT | |
| TC2+, TC2- | 31, 32 | LVDS OUT | |
| TD2+, TD2- | 27, 28 | LVDS OUT | |
| TCLK2+, TCLK2- | 29, 30 | LVDS OUT | LVDS Clock Out for Tx2+/-. |
| R17 ~ R10 | 60, 59, 58, 57, 54, 53, 52, 51 | IN | The 1st Pixel Data Inputs. |
| G17 ~ G10 | 68, 67, 66, 65, 64, 63, 62, 61 | IN | |
| B17 ~ B10 | 78, 77, 76, 75, 74, 73, 70, 69 | IN | |
| R27 ~ R20 | 86, 85, 84, 83, 82, 81, 80, 79 | IN | The 2nd Pixel Data Inputs. |
| G27 ~ G20 | 96, 95, 94, 93, 92, 91, 90, 89 | IN | |
| B27 ~ B20 | 6, 5, 2, 1, 100, 99, 98, 97 | IN | |
| DE | 9 | IN | Data Enable Input. |
| VSYNC | 8 | IN | Vsync Input. |
| HSYNC | [illegible] | IN | Hsync Input. |
| CLKIN | 10 | IN | Clock Input. |
| TEST1, TEST5 | 13, 22 | OUT | Test Pins. |
| TEST3, TEST4 | 20, 21 | IN | Test Pins, must be L for normal operation. |
| TEST2 | 14 | IN | Test Pins, must be H for normal operation. |
| /PDWN | 19 | IN | H: Normal operation,<br>L: Power down (all outputs are Hi-Z) |
| 6/8 | 18 | IN | 6bit/8bit color select.<br>H: 6bit (TDx+/- are GND), L: 8bit. |
| OE | 17 | IN | Output enable.<br>H: Output enable, L: Output disable (all outputs are Hi-Z) |
| MODE1, MODE0 | 15, 16 | IN | Pixel Data Mode.<br>MODE1 / MODE0 / Mode<br>L / L / Dual-in/Dual-out Mode<br>L / H / Dual-in/Single-out Mode<br>H / H / Single-in/Single-out Mode |
| RS | 12 | IN | LVDS swing range select.<br>H: Normal range, L: Reduced range. |
| R/F | 11 | IN | Input Clock Triggering Edge Select.<br>H: Rising edge, L: Falling edge |
| OVCC | 3 | Power | Power Supply Pin for TTL outputs. |
| OGND | 4 | Ground | Ground pin for TTL outputs. |
| VCC | 55, 71, 87 | Power | Power Supply Pins for TTL inputs and digital circuitry. |
| GND | 56, 72, 88 | Ground | Ground Pins for TTL inputs and digital circuitry. |
| LVDS VCC | 33, 45 | Power | Power Supply Pins for LVDS Outputs. |
| LVDS GND | 26, 38, 50 | Ground | Ground Pins for LVDS Outputs. |
| PLL VCC | 24 | Power | Power Supply for PLL circuitry. |
| PLL GND | 23, 25 | Ground | Ground Pin for PLL circuitry. |

## 7.4. Timing Diagrams of LVDS Transmission

Switching Characteristic

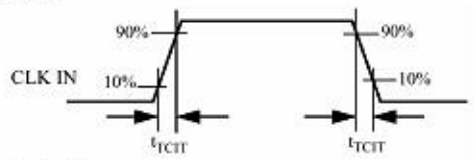
VCC = 3.0 ~ 3.6V, Ta = -10 ~ +70℃

| Symbol | Parameter | | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|---|
| $t_{TCIT}$ | CLK IN Transition time | | | | 5.0 | ns |
| $t_{TCIP}$ | CLK IN Period | | 11.76 | | 40.0 | ns |
| $t_{TCH}$ | CLK IN High Time | | $0.35t_{TCIP}$ | $0.5t_{TCIP}$ | $0.65t_{TCIP}$ | ns |
| $t_{TCL}$ | CLK IN Low Time | | $0.35t_{TCIP}$ | $0.5t_{TCIP}$ | $0.65t_{TCIP}$ | ns |
| $t_{TS}$ | TTL Data Setup to CLK IN | | 2.5 | | | ns |
| $t_{TH}$ | TTL Data Hold from CKL IN | | 0.0 | | | ns |
| $t_{TCOP}$ | CLK OUT Period | Dual-in/Dual-out | 11.76 | | 40.0 | ns |
| | | Dual-in/Single-out | 7.4 | | 20.0 | ns |
| $t_{LVT}$ | LVDS Transition Time | | | 0.5 | | ns |
| $t_{TOP1}$ | Output Data Position0 ($t_{TCOP}$ = 7.4ns) | | -0.15 | 0.0 | +0.15 | ns |
| $t_{TOP0}$ | Output Data Position1 ($t_{TCOP}$ = 7.4ns) | | $\frac{t_{TCOP}}{7} - 0.15$ | $\frac{t_{TCOP}}{7}$ | $\frac{t_{TCOP}}{7} + 0.15$ | ns |
| $t_{TOP6}$ | Output Data Position2 ($t_{TCOP}$ = 7.4ns) | | $2\frac{t_{TCOP}}{7} - 0.15$ | $2\frac{t_{TCOP}}{7}$ | $2\frac{t_{TCOP}}{7} + 0.15$ | ns |
| $t_{TOP5}$ | Output Data Position3 ($t_{TCOP}$ = 7.4ns) | | $3\frac{t_{TCOP}}{7} - 0.15$ | $3\frac{t_{TCOP}}{7}$ | $3\frac{t_{TCOP}}{7} + 0.15$ | ns |
| $t_{TOP4}$ | Output Data Position4 ($t_{TCOP}$ = 7.4ns) | | $4\frac{t_{TCOP}}{7} - 0.15$ | $4\frac{t_{TCOP}}{7}$ | $4\frac{t_{TCOP}}{7} + 0.15$ | ns |
| $t_{TOP3}$ | Output Data Position5 ($t_{TCOP}$ = 7.4ns) | | $5\frac{t_{TCOP}}{7} - 0.15$ | $5\frac{t_{TCOP}}{7}$ | $5\frac{t_{TCOP}}{7} + 0.15$ | ns |
| $t_{TOP2}$ | Output Data Position6 ($t_{TCOP}$ = 7.4ns) | | $6\frac{t_{TCOP}}{7} - 0.15$ | $6\frac{t_{TCOP}}{7}$ | $6\frac{t_{TCOP}}{7} + 0.15$ | ns |
| $t_{TPLL}$ | Phase Lock Loop Set | | | | 10.0 | ms |
| $t_{OE}$ | OE High to Data Valid | | TBD | | | ns |
| $t_{CK12}$ | Skew Time between TCLK1+ and TCLK2+ | | | | TBD | ns |

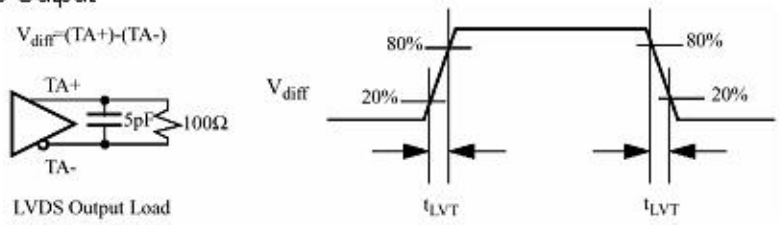


### 7.4.1. AC Timing Diagrams

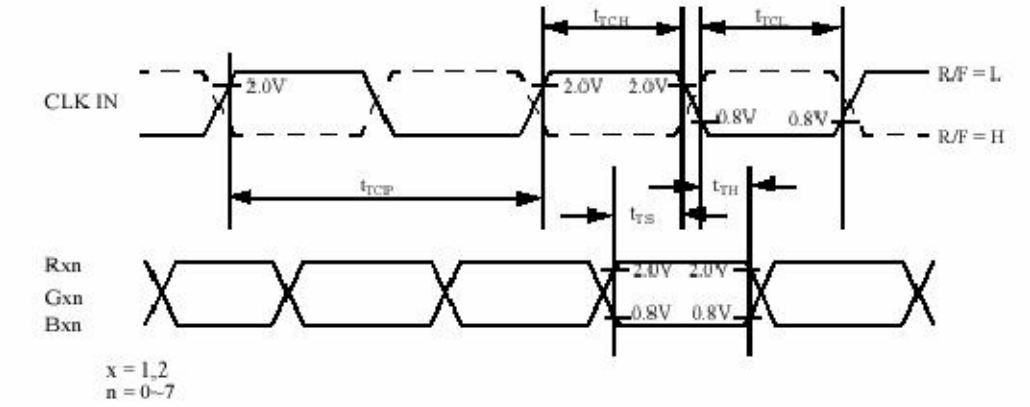
(1) TTL Input



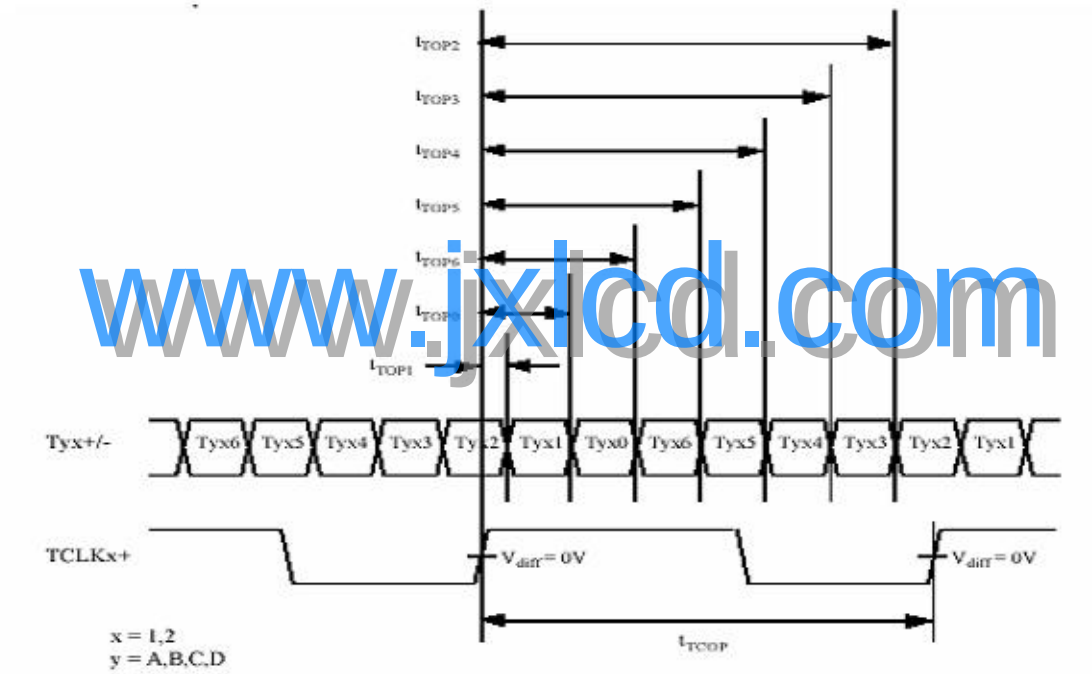

(2) LVDS Output

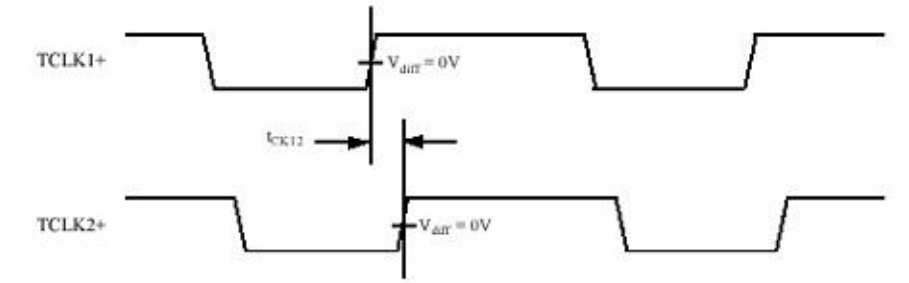


(3) TTL Intputs




(4) LVDS Outputs




Note:
$V_{diff}$ = (Tyx+) - (Tyx-) , (TCLKx+) - (TCLKx-)

## 7.5. Input Signal, Basic Display Colors and Gray Scale of each Color

| Color | | Input Color Data | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | RED | | | | | | GREEN | | | | | | BLUE | | | | | |
| | | MSB | | | | | LSB | MSB | | | | | LSB | MSB | | | | | LSB |
| | | R5 | R4 | R3 | R2 | R1 | R0 | G5 | G4 | G3 | G2 | G1 | G0 | B5 | B4 | B3 | B2 | B1 | B0 |
| Basic Color | Black | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Red | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Green | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 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 |
| | Cyan | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | 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 |
| RED | Black | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | RED(Dark) | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | ... | | | ... | | | | | | ... | | | | | | ... | | | |
| | RED(Bright) | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | RED | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| GREEN | Black | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | GREEN(Dark) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| | ... | | | ... | | | | | | ... | | | | | | ... | | | |
| | GREEN(Bright) | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | GREEN | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| BLUE | Black | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | BLUE(Dark) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| | ... | | | ... | | | | | | ... | | | | | | ... | | | |
| | BLUE(Bright) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 0 |
| | BLUE | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 |



Note 1) 0: Low level voltage, 1: High level voltage

## 8. Interface Timing

### 8.1. Timing Parameters

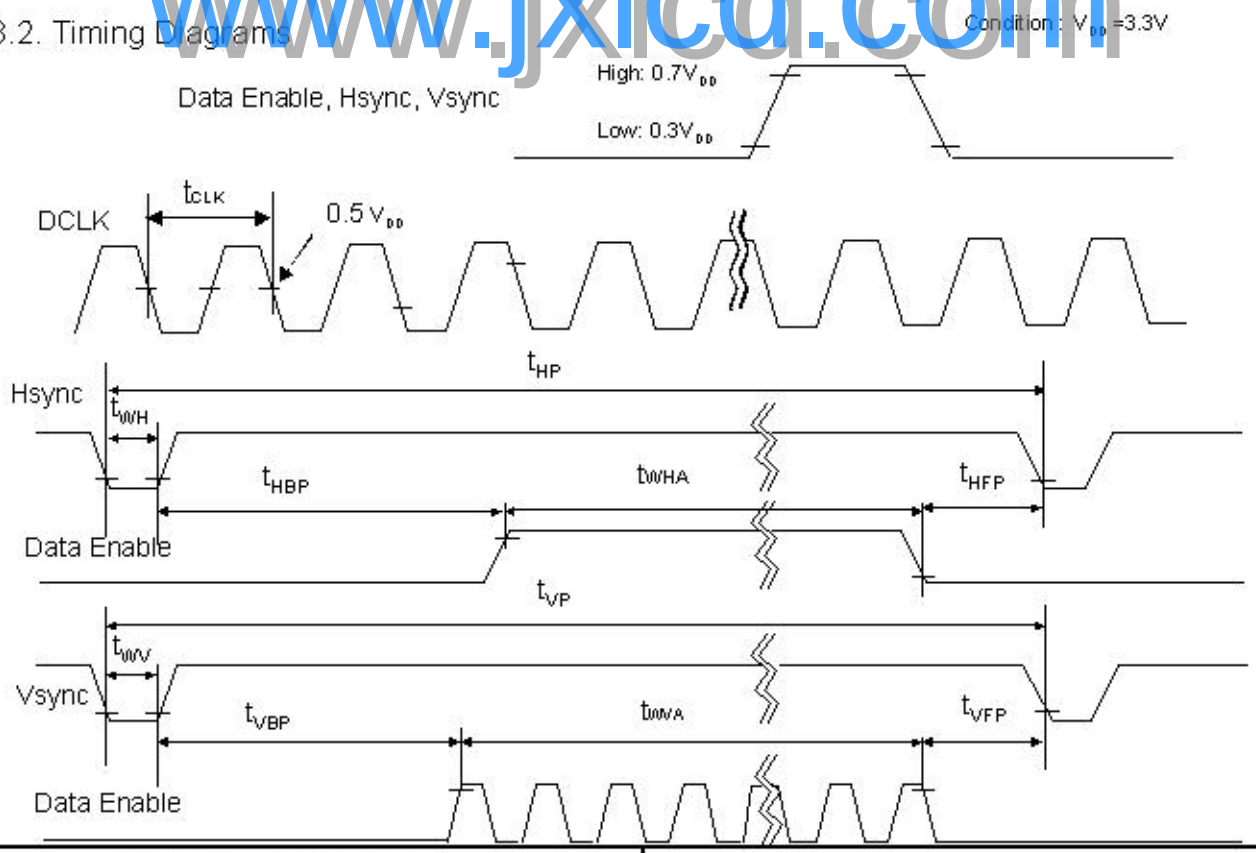
This is the signal timing required at the input of the LVDS Transmitter. All of the interface signal timing should be satisfied with the following specifications for its proper operation.

| ITEM | Symbol | | Min | Typ | Max | Unit | Note |
|---|---|---|---|---|---|---|---|
| DCLK | Frequency | $f_{CLK}$ | 53.5 | 54 | 54.5 | MHz | |
| Hsync | Period | $t_{HP}$ | 732 | 800 | 848 | $t_{CLK}$ | |
| | Width | $t_{WH}$ | 8 | - | - | | |
| Vsync | Period | $t_{VP}$ | 1060 | 1125 | 1150 | $t_{HP}$ | |
| | Width | $t_{WV}$ | 2 | - | - | | |
| Data Enable | Horizontal back porch | $t_{HBP}$ | 8 | - | - | $t_{CLK}$ | |
| | Horizontal front porch | $t_{HFP}$ | 8 | - | - | | |
| | Vertical back porch | $t_{VBP}$ | 3 | - | - | $t_{HP}$ | |
| | Vertical front porch | $t_{VFP}$ | 2 | - | - | | |

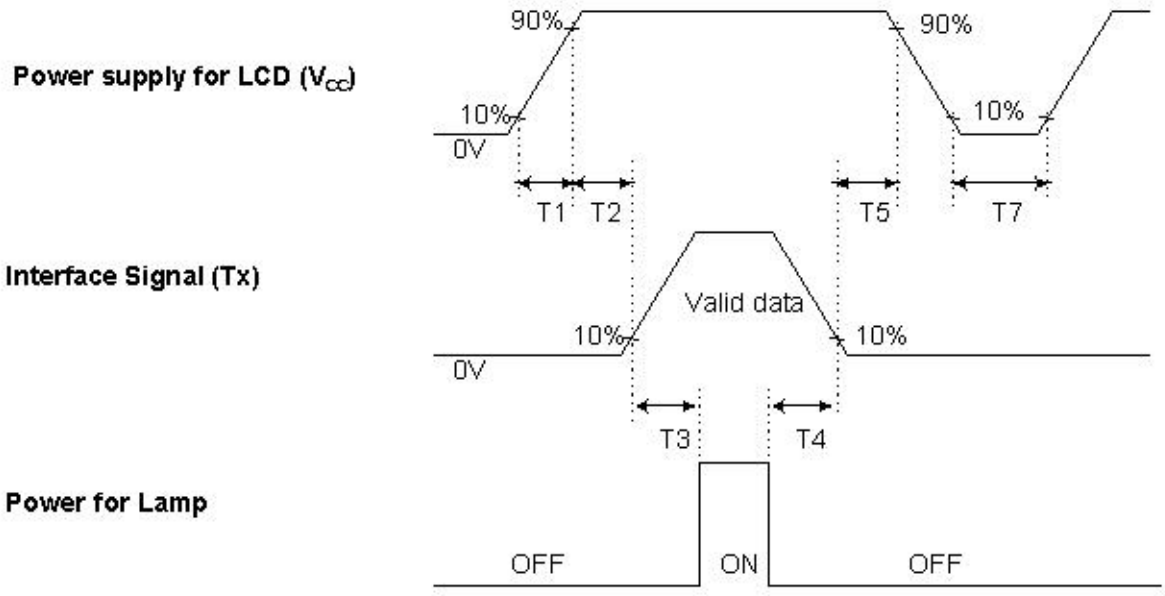
$D_{CLK}$ : Dual Port Operating



### 8.2. Timing Diagrams



## 8.3. Power On/Off Sequence




| Parameter | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|
| $T_1$ | 1 | - | 10 | (ms) |
| $T_2$ | 0 | - | 50 | (ms) |
| $T_3$ | 200 | - | - | (ms) |
| $T_4$ | 200 | - | - | (ms) |
| $T_5$ | 0 | - | 50 | (ms) |
| $T_7$ | 400 | - | - | (ms) |



Note 1) Please avoid floating state of interface signal at invalid period.
Note 2) When the interface signal is invalid, be sure to pull down the power supply for LCD $V_{CC}$ to 0V.
Note 3) Lamp power must be turn on after power supply for LCD and interface signal are valid.

## 9. Cosmetic Specification

### 9.1. Sampling

A.Q.L (Acceptable Quality Level ): MIL-STD, 105E Level II,
Major: 0.65 , Minor: 1.5

### 9.2. Conditions of Inspections

(1) Ambient Temperature : 25±5°C
(2) Ambient Humidity : 65±20%RH
(3) Illumination : 200 – 500 Lux ( nominal 350 Lux ) under the fluorescent lamp
(4) Viewing Distance: Approximately 30cm by the eyes of the inspector from the module
(5) Viewing angle : The surface of the module and the inspector's line shall be at 90 ± 45 degrees.
(6) Display pattern: Pure Red, Green, Blue, Black, White, Gray level 0 - 63

### 9.3. Defect modes

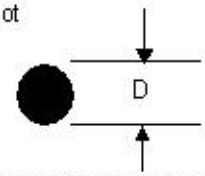
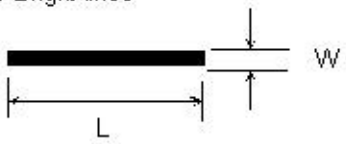
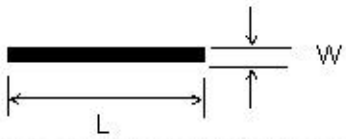
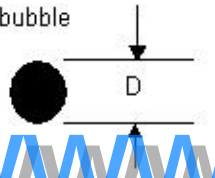
| Defect Mode | Description |
|---|---|
| Dark / Bright spots | Points on the display which appear dark / bright and remain unchanged in size |
| Dark / Bright lines | Lines on the display which appear dark / bright and remain unchanged in size |
| Polarizer scratch | When the unit is lit a light , line is seen across a darker background; lile does not vary in size |
| Polarizer dent | When the unit is lit a light, light (white) spots appear against a darker background, and do not vary in size |
| Bright / dark dot | A sub-pixel (R,G,B dot) stuck off / on |
| Rubbing line | Diagonal lines that appear gray with the display patterns dark and vary in size |
| Dim line | When the unit lights, lines in the minor (Vertical ) or major (Horizontal) axis appear dim |
| Cross line | When the unit lights, lines in the both minor and major axis do not appear |
| Interference | Interference can not be seen with any bright plane display at any viewing angle |
| Flicker | When displaying sub-pexel checker(gray level and darkest gray), flicker can not be seen |
| Ripple (Pooling ) | Tapping Test, Tapping area : All bezel(Metal cover) side, LCD: Full-screen gray (L32) "Ripple (Pooling )" can not be seen in Active Area |



### 9.4. Mechanical Inspection

(1) Light leakage: No light leakage between metal chassis (bezel) and glass
(2) No sharp edge
(3) The mounting holes: No Changed (Side fixed type)
(4) PCB Appearance: No pattern peeling snapping / No electrically short
If there are repair portions, the repair portions on PCB is covered by epoxy resign
(5) Soldering: No cold solder joint, lead move when pulled
(6) Bezel, Frame, Connectors: No distinct stain, rust or scratch, no pin bending

## 9.5. Visual Inspection

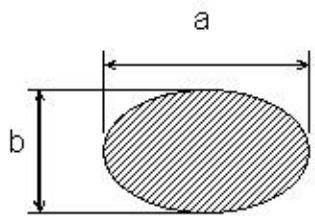
| Defect type | Count (mm) | Reject (mm) |
|---|---|---|
| Dark / bright spot   | 0.2 < D ≤ 0.5<br>N ≤ 3 | D > 0.5 |
| Dark / Bright lines   | 0.05 < W ≤ 0.07<br>0.3 < L ≤ 3.0<br>N ≤ 3 | W > 0.07<br>L > 3.0 |
| Polarizer scratch   | 0.01 < W ≤ 0.1<br>0.3 < L ≤ 0.5<br>N ≤ 3 | W > 0.1<br>L > 0.5 |
| Polarizer dent / bubble   | 0.2 ≤ D ≤ 0.5<br>N ≤ 3 | D > 0.5 |
| Maximum allowable number of defects | N ≤ 7 | N > 7 |
| Rubbing defect | Not allowed | |
| Dim line | Not allowed | |

[ D : diameter, W : width, L : length, N : count ]



Note 1) Inspection area should be within bezel opening.
Note 2) Dusts which are bigger not less than 0.10mm (0.1≤W) shall be judged by "Average Diameter".
Note 3) Scratches which are bigger not less than 0.05mm (0.05≤W) shall be judged by "Average Diameter".

Average Diameter D = (a+b)/2 (mm)



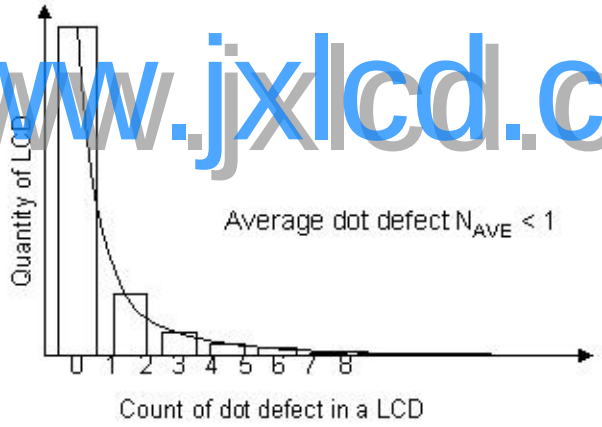
## 9.6. Electrical Inspection

(1) Dot defect

| Defect type | | Count | Reject |
|---|---|---|---|
| Bright dots | Random | N ≤ 5 ( Green ≤ 3 ) | N > 5 ( Green > 3 ) |
| | Two adjacent | N = 0 | N > 0 |
| | Three or more adjacent | Not allowed | |
| Dark dots | Random | N ≤ 5 | N > 5 |
| | Two adjacent | N = 1 | N > 1 |
| | Three or more adjacent | Not allowed | |
| Maximum allowable number of dot defect | | N ≤ 8 | N > 8 |
| Maximum distance between defects | Bright - to - bright dot | L≥15mm | L<15mm |
| | Dark - to - dark dot | L≥10mm | L<10mm |

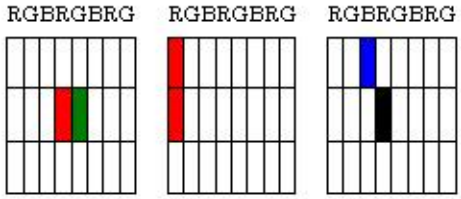
a) Inspection patterns for dot defect are Pure Red, Green, Blue, Black, and White.
b) Adjacent two dots will be counted as two dots.
c) The distribution of dot defects should be below. Average value of dot defect s should be less than 1.






Required distribution of dot defect

d) The definition of 2 adjacent dots.

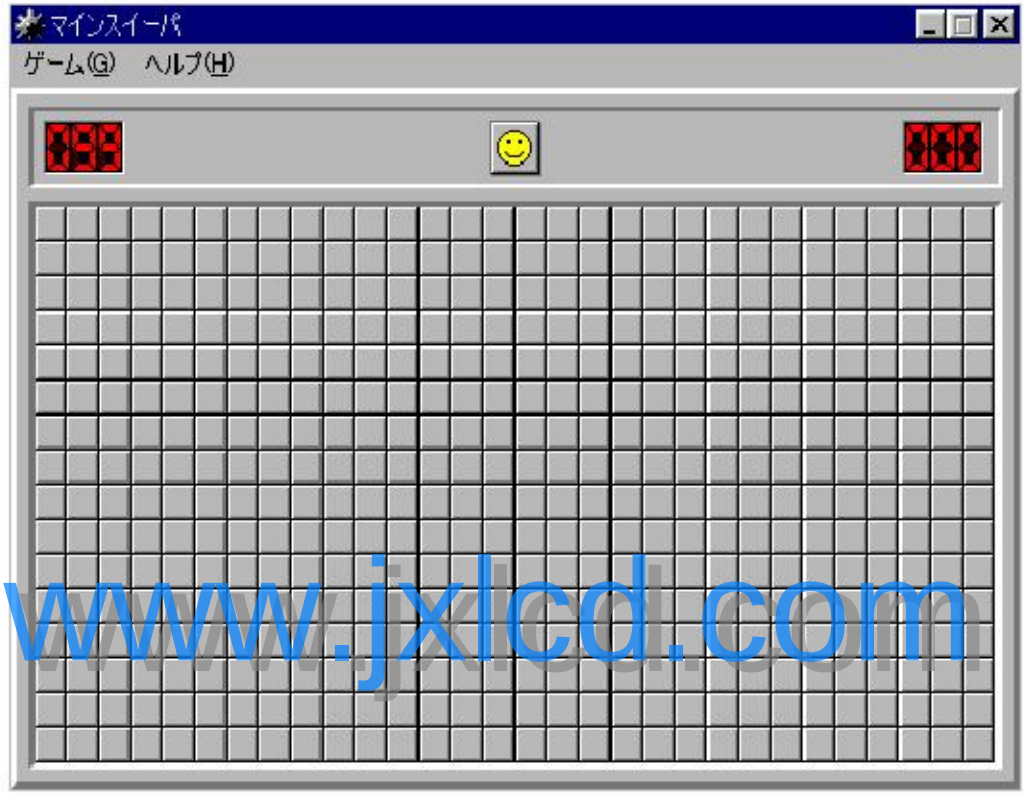


(2) Light leakage

Light leakage can not be seen between metal chassis (bezel) and glass when displaying black plane.

(3) Image sticking

Image sticking pattern shall not be to persist longer than 1second after displaying following pattern 8 hours in the room temperature condition.






(4) Glue/stain/dirt

Glue, non-removable stain and dirt which are visible in the inspection area are not acceptable.

## 10. Packing

### 10.1. Carton

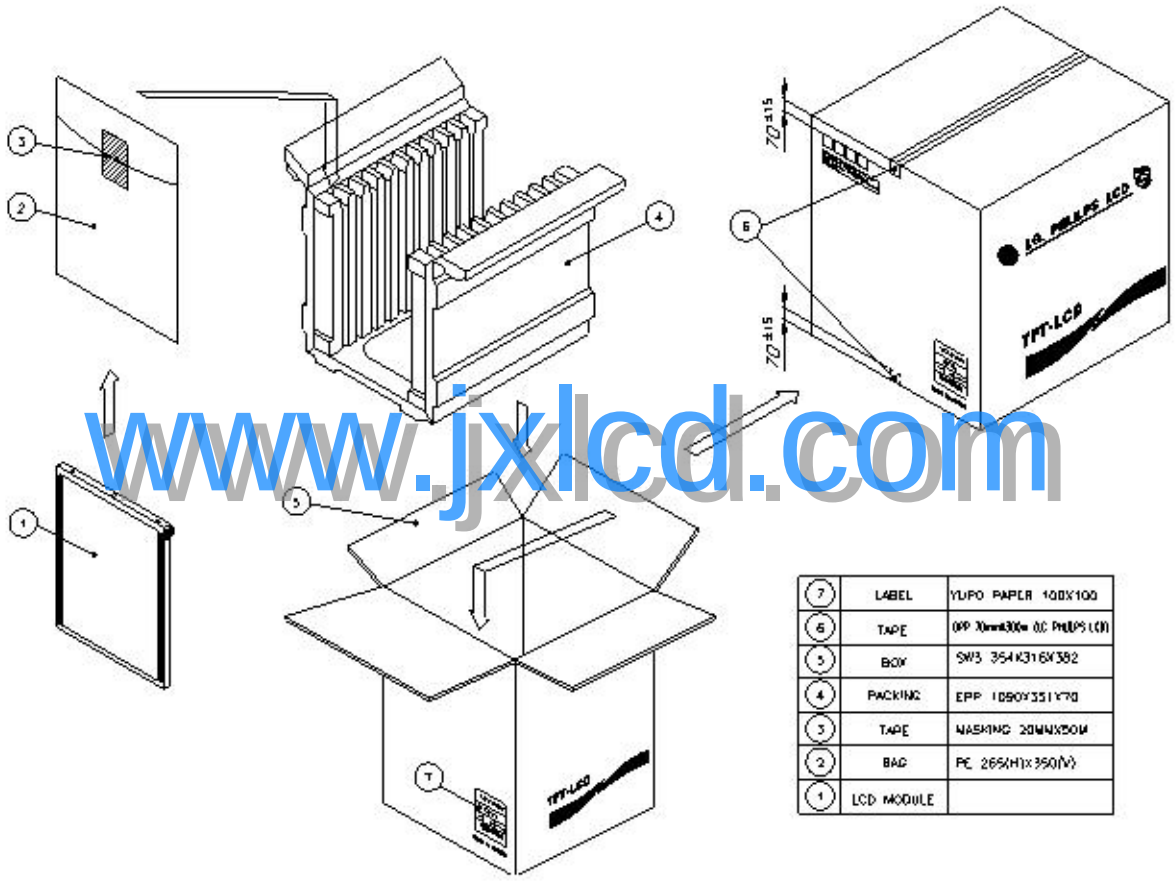
(1) Packing Form

Corrugated cardboard box and EPP

(2) Packing Method

Packing Material

Packing Weight: 262g
(1BOX/10Module)






| | | |
|---|---|---|
| 7 | LABEL | YUPO PAPER 100X100 |
| 6 | TAPE | OPP 70mmX300m OC PHILIPS LCD |
| 5 | BOX | SW3 354X316X382 |
| 4 | PACKING | EPP 1090X351X70 |
| 3 | TAPE | MASKING 20MMX50M |
| 2 | BAG | PE 265(H)X350(V) |
| 1 | LCD MODULE | |

(3) Packing Specification

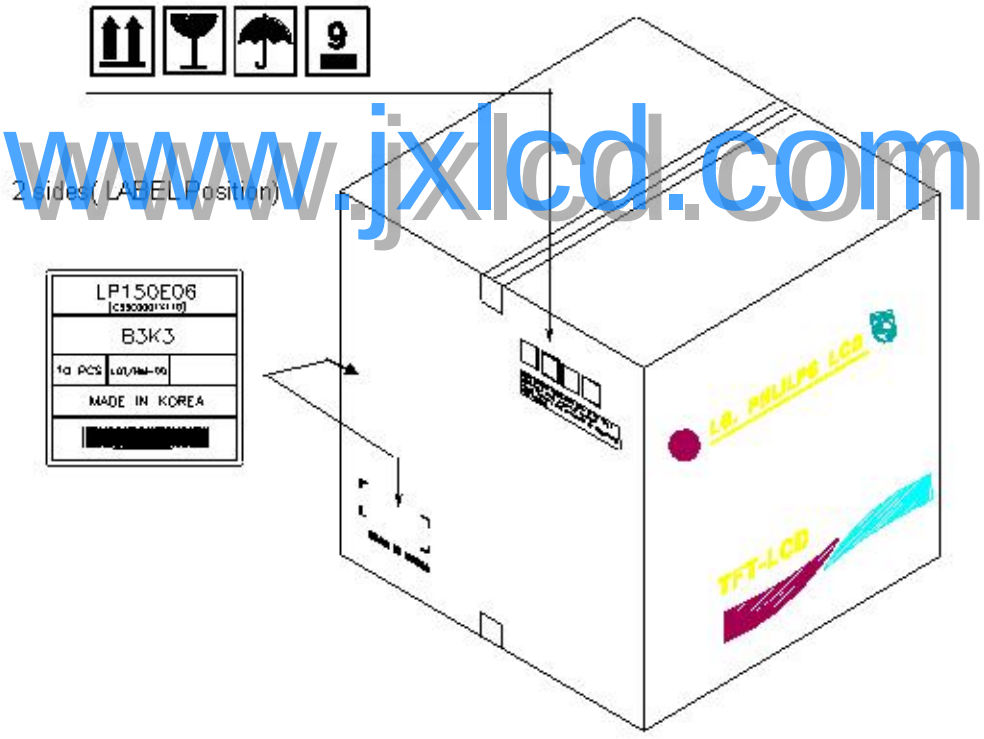
| Item | Conditions |
|---|---|
| Packing Vibration | Frequency Range : 5 - 500 - 5 Hz, Degree of acceleration 1.0G(9.8m/s²). Sweep rate 27 minutes<br>Resonance Frequency : 1.0G(9.8m/s²), 30minutes each Axis(X, Y, Z direction) : Non Operation<br>Random 1.06Grms, 30minutes each Axis(X, Y, Z direction) : Non Operation |
| Packing Drop Test | 1 Angle, 3 Edge, 6 Face, 70 cm |

(4) Package Label

Package label should be at least shown the following information.

a) TOSHIBA code name(G33C0001X110) which will be numbered by Toshiba
b) Revision number which be numbered by LCD maker
c) Quantity
d) LCD maker
e) Model number which be numbered by LCD maker
f) Production Year / Month

(5) Location of Package label : 2 points ( Side )



## 11. Labels and Lamp Ass'y Exchange

### 11.1. LCD code Label on LCD

LCD code label should be at least shown the following information.

(1) TOSHIBA code name (G33C0001X110) which will be numbered by Toshiba & Bar code
(Bar code : CODE-39 High-density )

(2) LGPL Serial number CODE ( numbered by LCD maker , less than equal 13 digits)

| A | B | C | D | E | F | G | H | I | J | K | L | M |
|---|---|---|---|---|---|---|---|---|---|---|---|---|

A,B,C : Inch
D : Year
E : Month
F : Panel Code
G : Factory Code
H : Assembly Code
I,J,K,L,M : Serial No

Note:

1. Year

| Year | 97 | 98 | 99 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Mark | 7 | 8 | 9 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

2. Month

| Month | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mark | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | A | B | C |



3. Panel Code

| Panel Code | P1 Factory | P2 Factory | P3 Factory | P4 Factory | P5 Factory | Hydis Panel |
|---|---|---|---|---|---|---|
| Mark | 1 | 2 | 3 | 4 | 5 | H |

4. Factory Code

| Factory Code | LPL Gumi | LPL Nanjing | HEESUNG |
|---|---|---|---|
| Mark | K | C | D |

5. Serial No

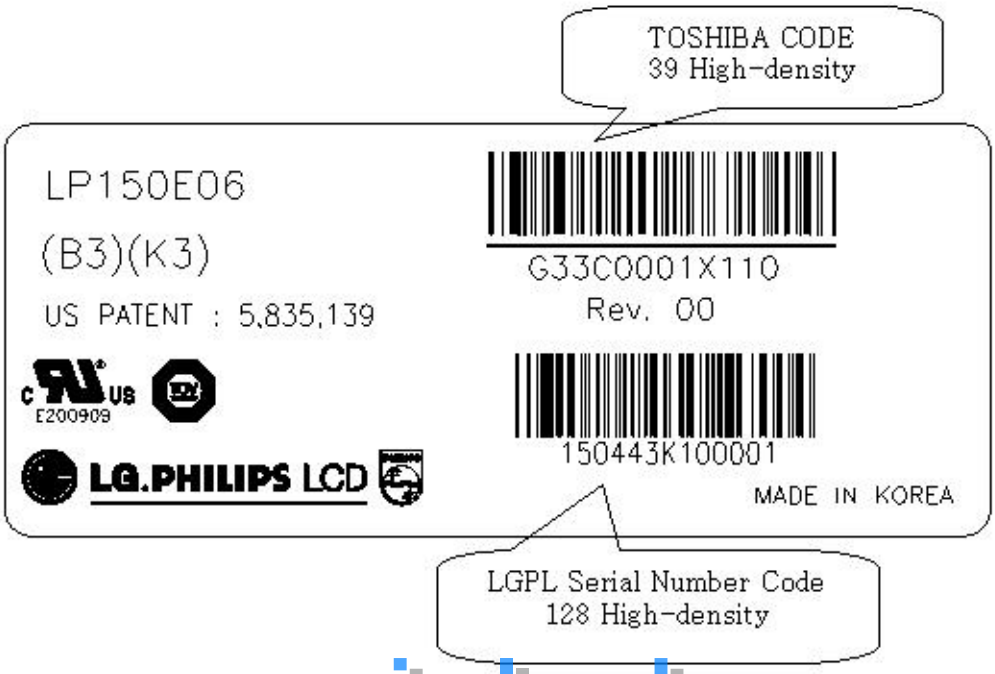
| Serial No. | 1 ~ 99,999 | 100,000 ~ |
|---|---|---|
| Mark | 00001 ~ 99999 | A0001 ~ A9999, - - - - , Z9999 |

Serial NO. Is printed on the label. The label is attached to the backside of the LCD module.
This is subject to change without prior notice.

a) Bar code of Serial number
b) Revision number (numbered by LCD maker)
c) Bar code of Revision number
d) LCD maker
e) LCD Model number ( numbered by LCD maker)
f) Production Year / Month

Example >

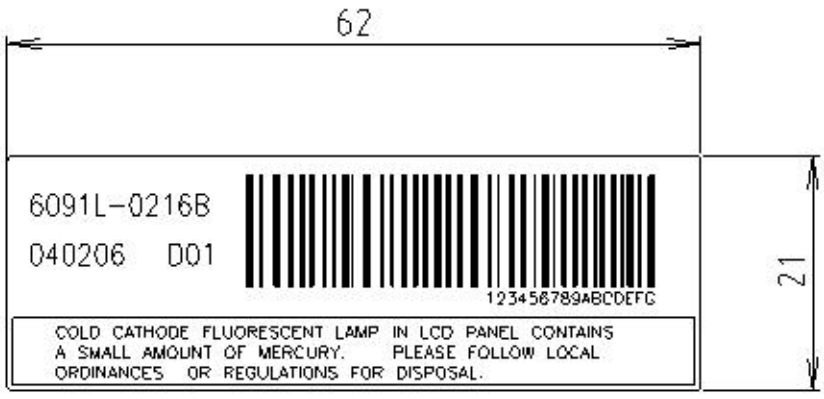
LABEL : 72mm X 30mm



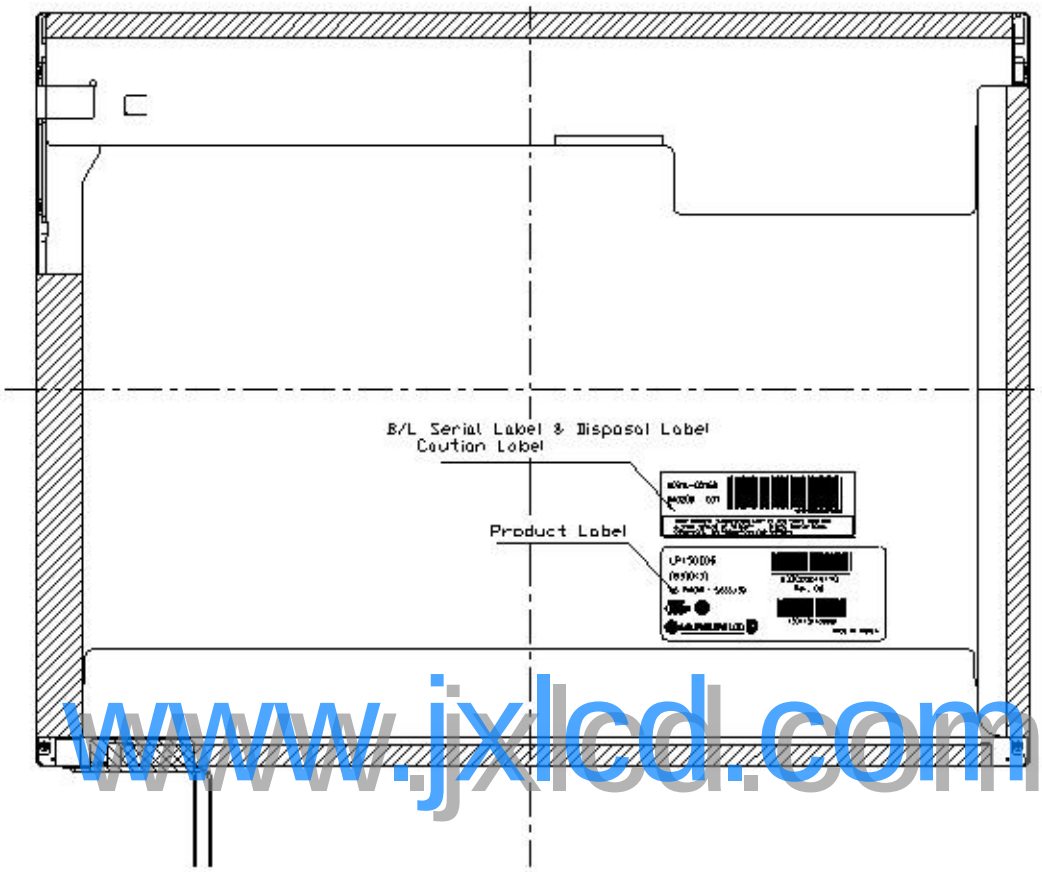



11.2. Caution Texture and Labels on LCD

[Disposal of CCFL]



## 11.3. Label Locations on LCD





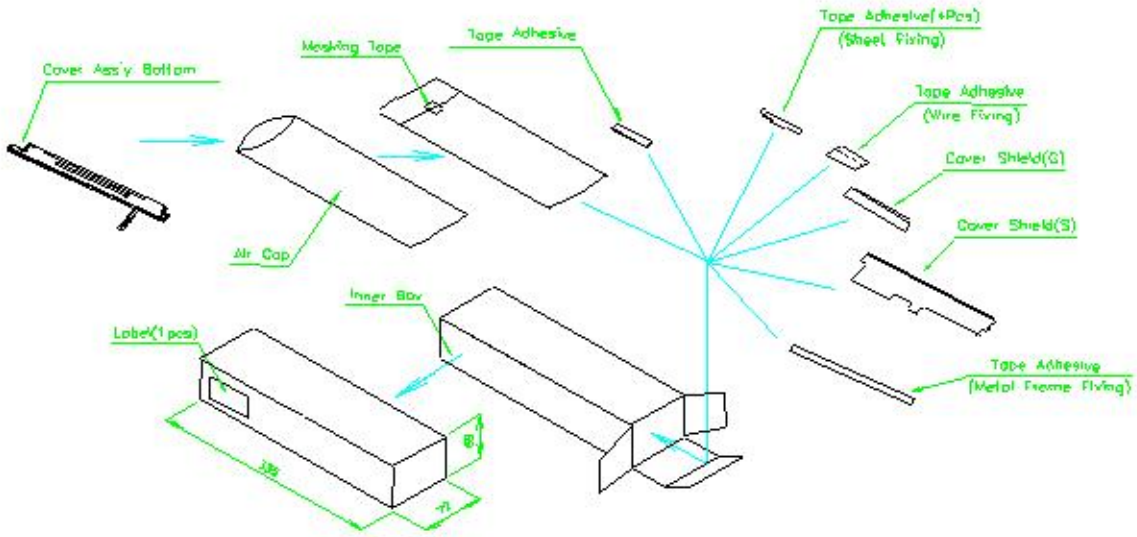

## 11.4. Others

(1) Backlight repair parts kit : 6913L-0227A(G33C0001X110001)

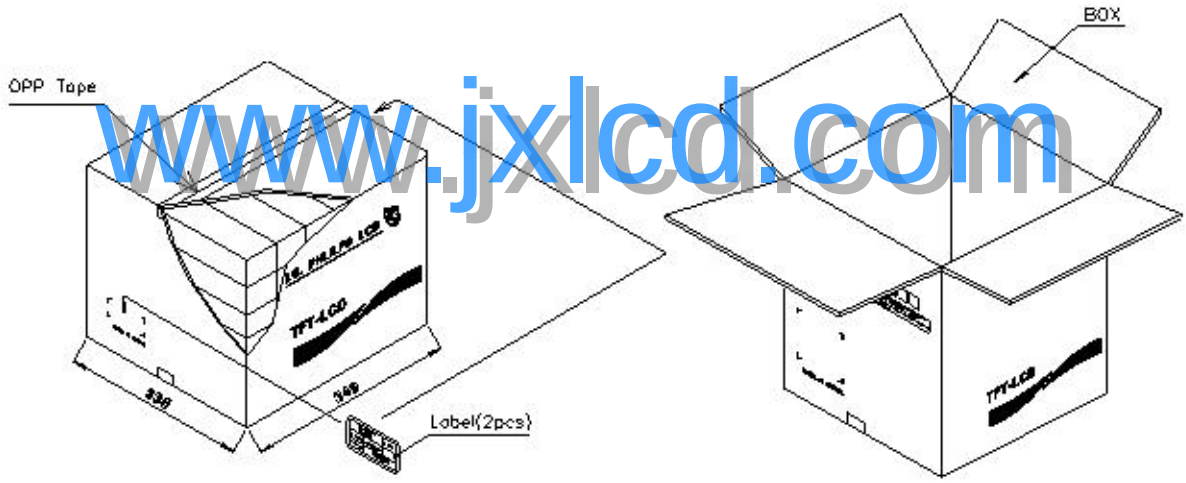
| No. | Part | Product Code | Maker | Qt'y | Note |
|---|---|---|---|---|---|
| 1 | Cover Ass'y Bottom | 3550B-0069A | Won Woo | 1 | |
| 2 | Cover Shield(S) | 3550S-0135A | Geo Rim | 1 | |
| 3 | Cover Shield(G) | 3550S-0132A | Jae Hyun | 1 | |
| 4 | Tape Adhesive | 7250L-0050K | Jae Hyun | 1 | |
| 5 | Tape Adhesive | 7250L-0080A | Jae Hyun | 1 | |
| 6 | Tape Filament | 7250L-0083A | Jae Hyun | 1 | |
| 7 | Tape Adhesive | 7250L-0087A | Tae Sung | 2 | |
| 8 | Tape Adhesive | 7250L-0087B | Tae Sung | 2 | |

(2) Package specification of Backlight repair parts kit

a) Individual packing




b) Master carton Packing method






c) Label

## 11.5. Instruction of changing the Lamp parts - Lamp Ass'y Exchange process

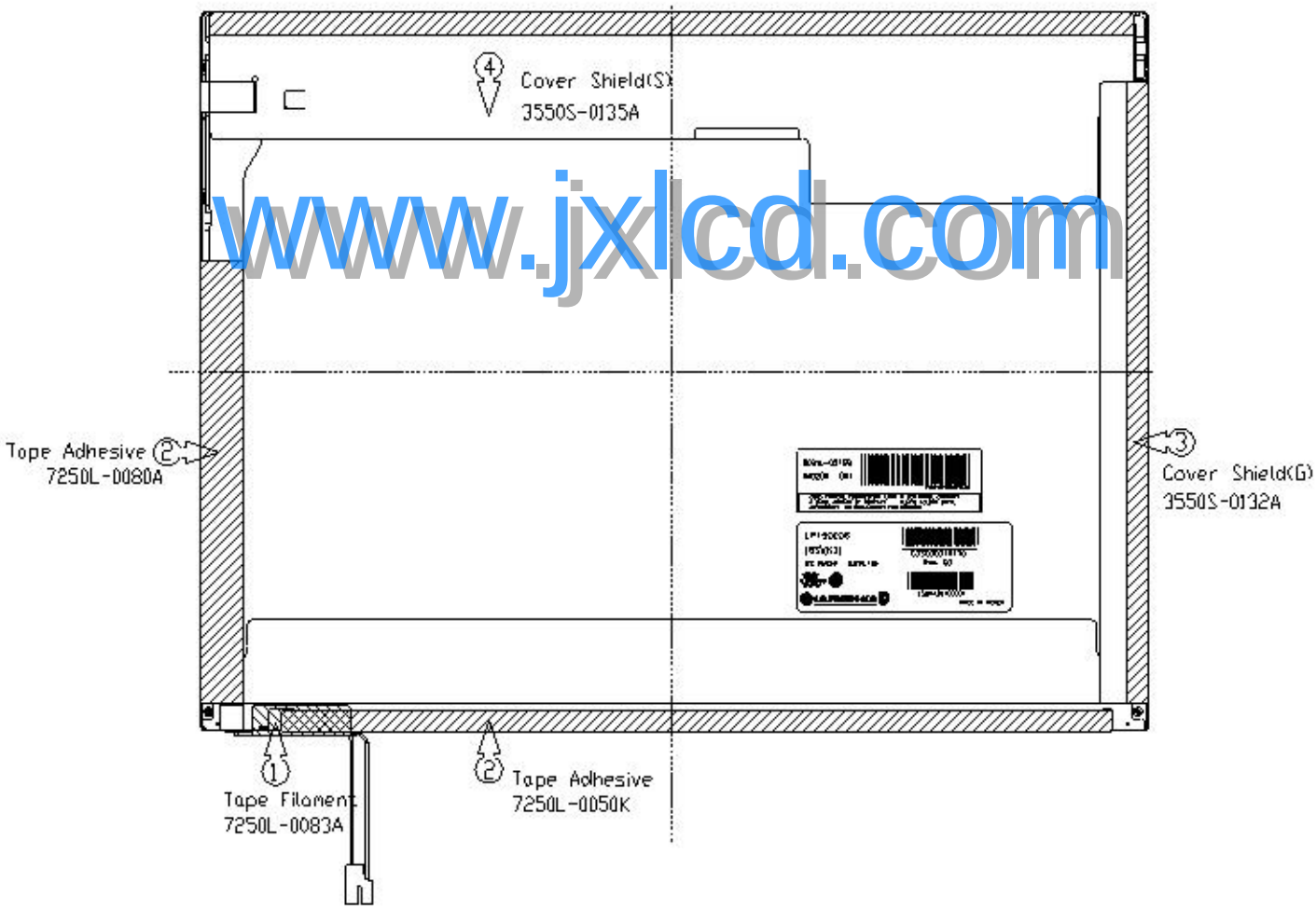
### 11.5.1. Disassembly of outside tape / Cover shield

(1) ① Disassembly of Tape Filament used for B/L Wire fixing
Caution: Pressure or stress should not be given on B/L Wire.

(2) ② Disassembly of Tape Adhesive used for Top case fixing
Caution: Pressure or stress should not be given on Top case during this process

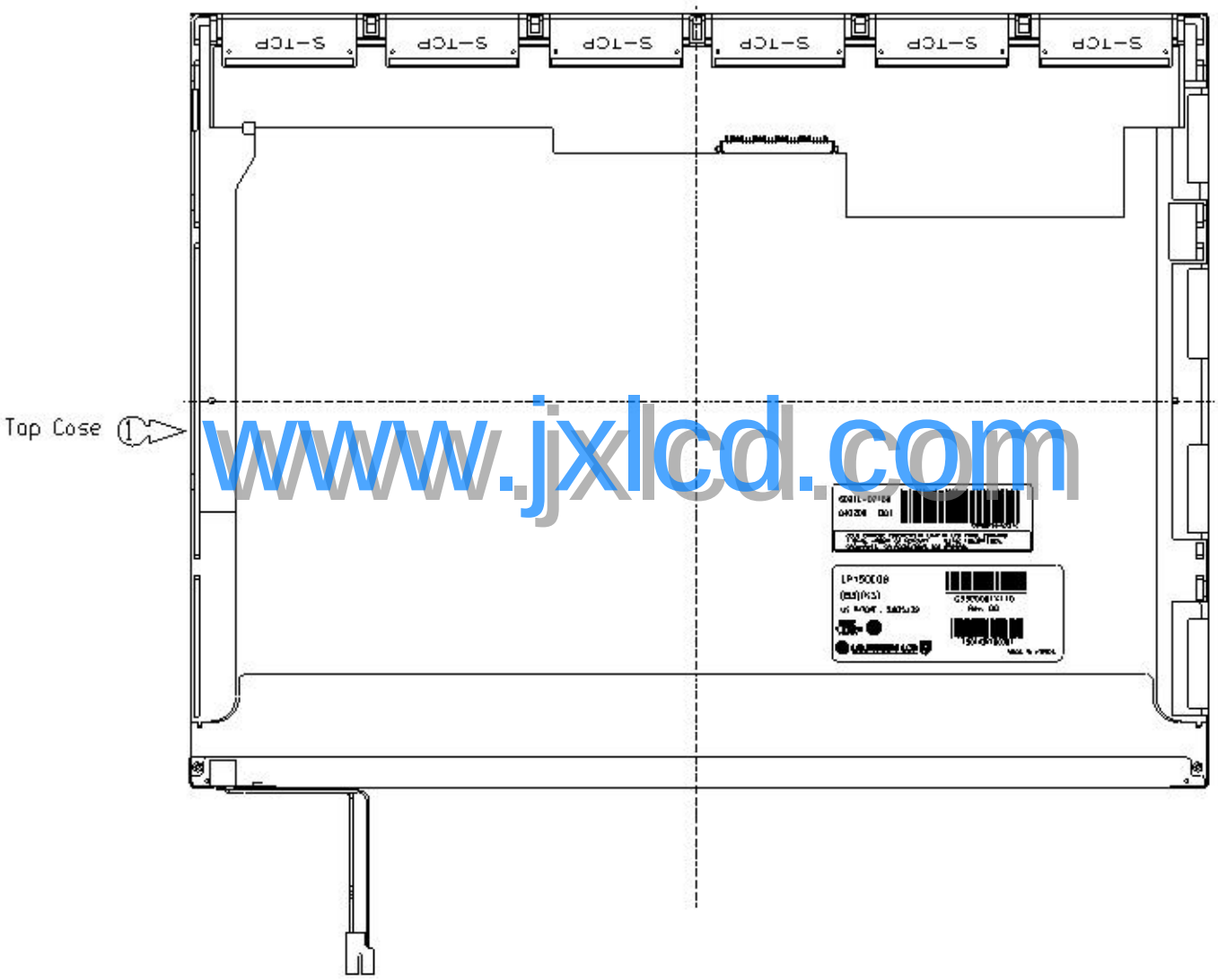
(3) ③ Disassembly of Cover shield(G)
Caution: Pressure or stress should not be given on Gate COF.

(4) ④Disassembly of Cover shield(S)
Caution: Pressure or stress should not be given on Source PCB.
Usage of gloves with anti-electric discharge coating is recommended.
To eliminate possible damage on circuits occurred by ESC.



11.5.2. Disassembly of Top Case

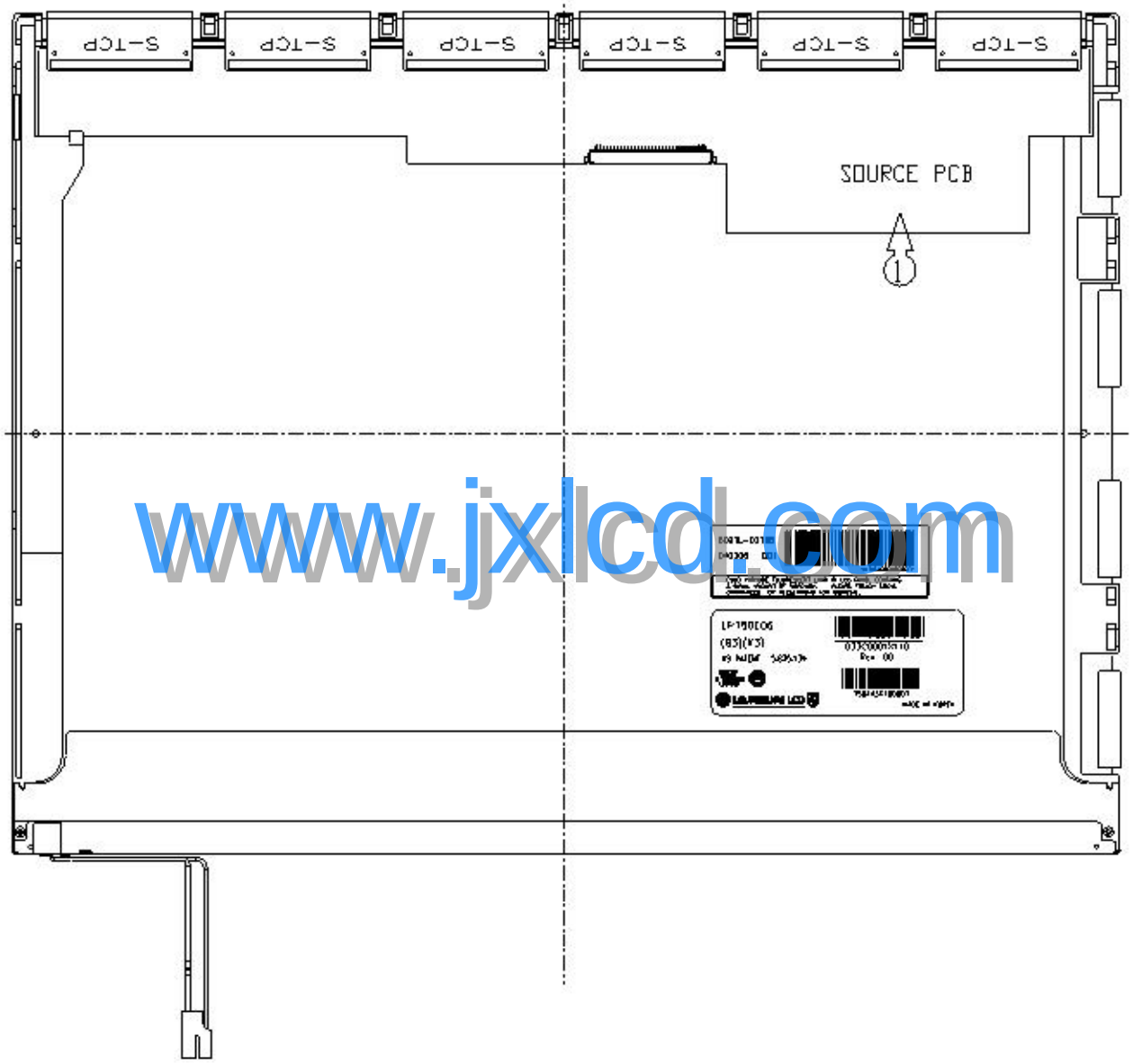
(1) ① Disassembly of Top Case
Caution: Pressure or stress should not be given on Source COF and Gate COF.



11.5.3. Disassembly of Source PCB

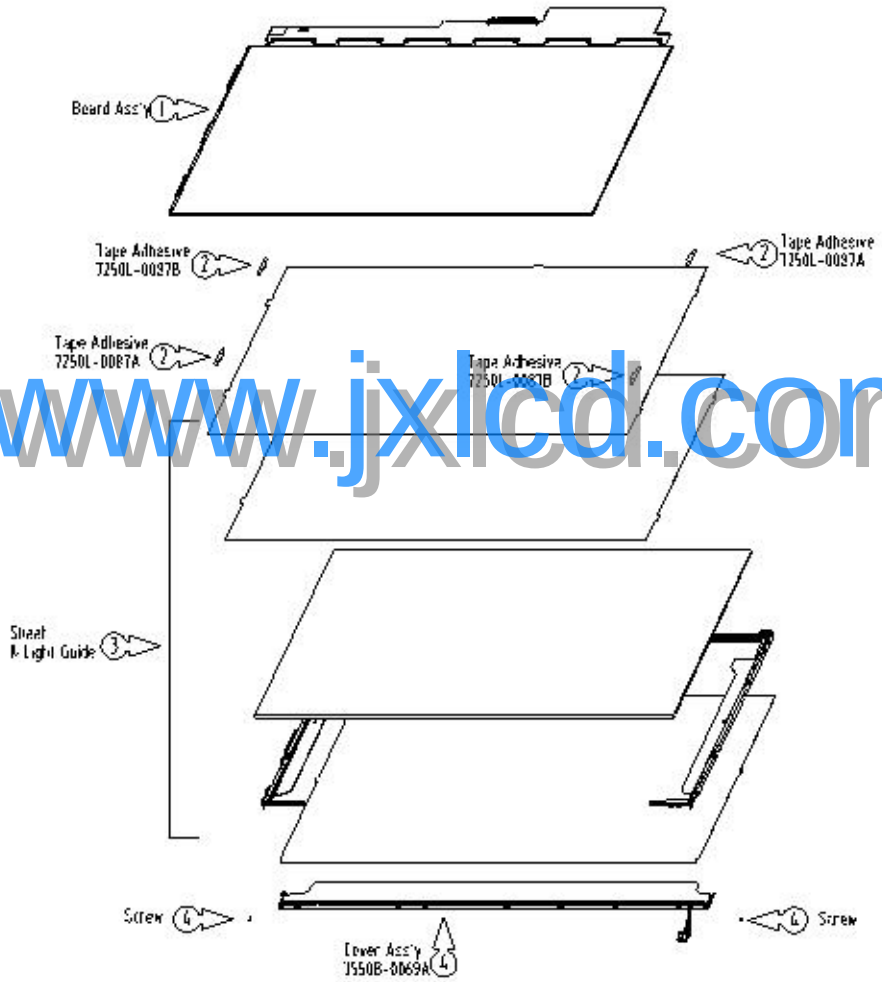
(1) ① Disassembly of Source PCB.

Caution: Pressure or stress should not be given on PCB and COF



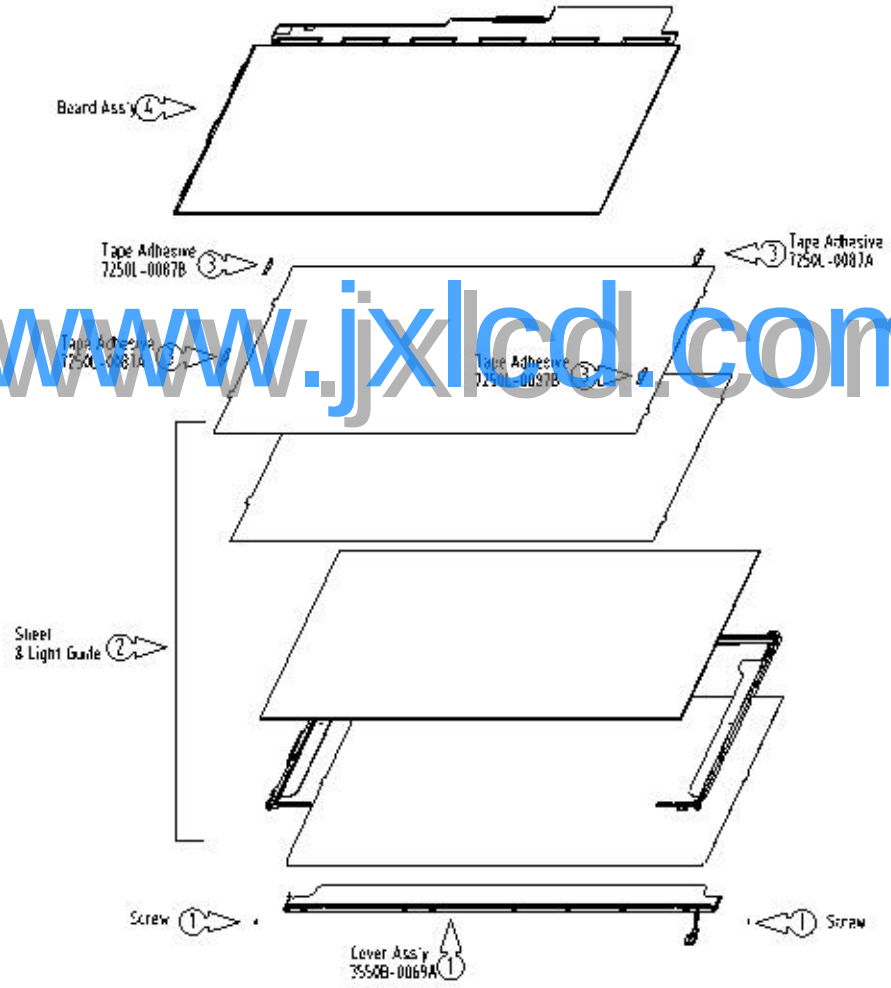
11.5.4. Disassembly of Board Ass'y, Tape Adhesive, Light guide,Cover Ass'y Bottom(L)

(1) ① Disassembly of Board Ass'y.
Caution: This process should be made in Clean room with no scratch nor particle on Polarizer and B/L Ass'y.
(2) ② Disassembly of Tape Adhesive used for Sheets fixing (4Point).
(3) ③ Disassembly of Sheets, Light guide.
Caution: No penetration of foreign body is indispensable with no scratch on the surface of each Sheets.
(4) ④ Disassembly of Screw(2Point) and Cover Ass'y Bottom
Caution: Maximum value of torque with Screw should be below 1.5kg.



11.5.5. Assembly of Cover Ass'y Bottom(L), Sheets, Light guide, Tape Adhesive and Board Ass'y.

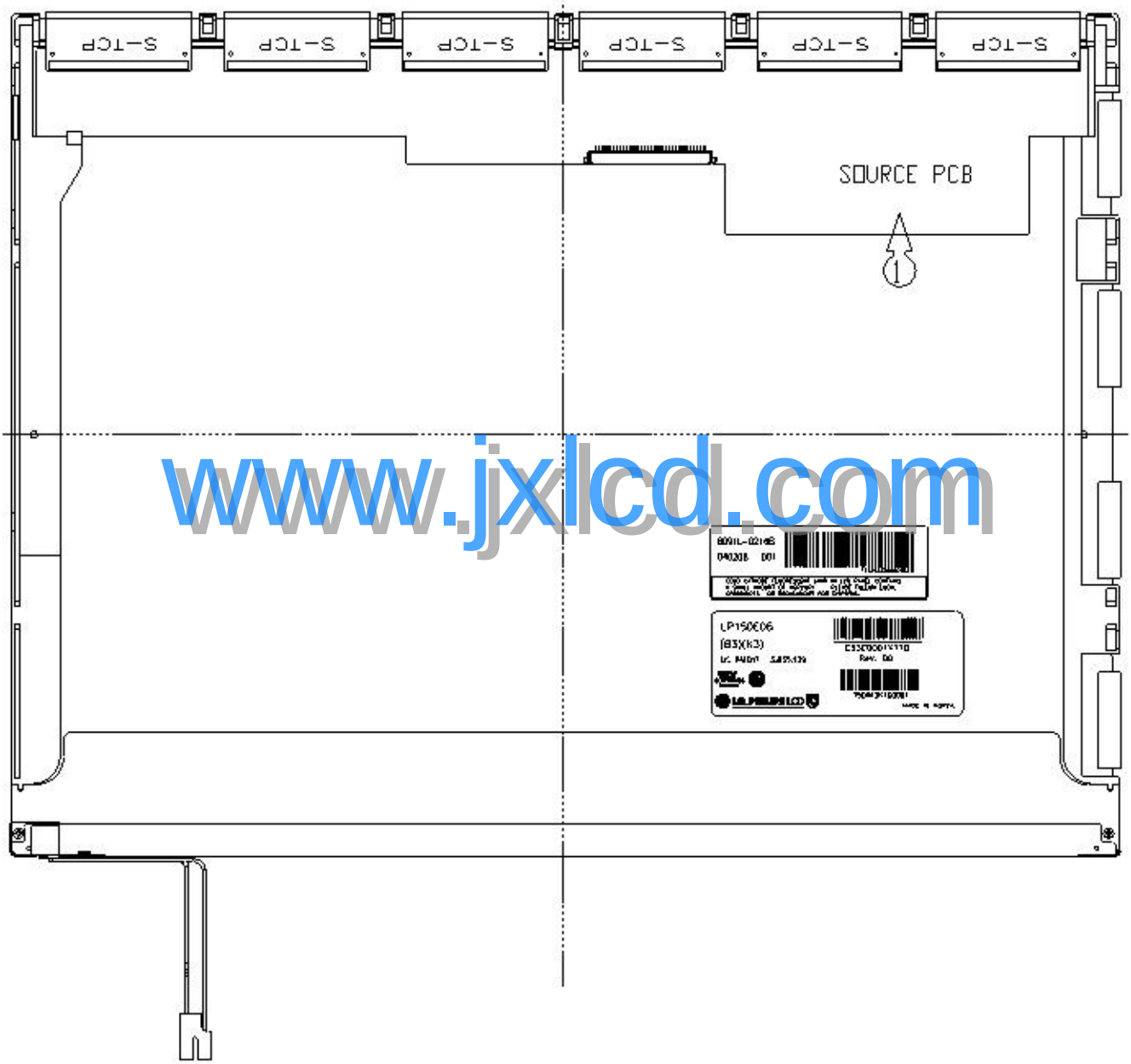
(1) ① Assembly of Cover Ass'y Bottom and Screw(2Point).
Caution: Maximum value of torque with Screw should be below 2.0kgf.cm
(2) ② Assembly of Light Guide and Sheets.(Reflector Sheet fixing with one Double Tape)
Caution: No penetration of foreign body is indispensable with no scratch on the surface of each Sheet and Light guide.
(3) ③ Assembly of Tape adhesive used for Sheets fixing(4Point)
(4) ④ Assembly of Board Ass'y.
Caution: Pressure or stress should not be given on PCB and COF.



11.5.6. Assembly of Source PCB

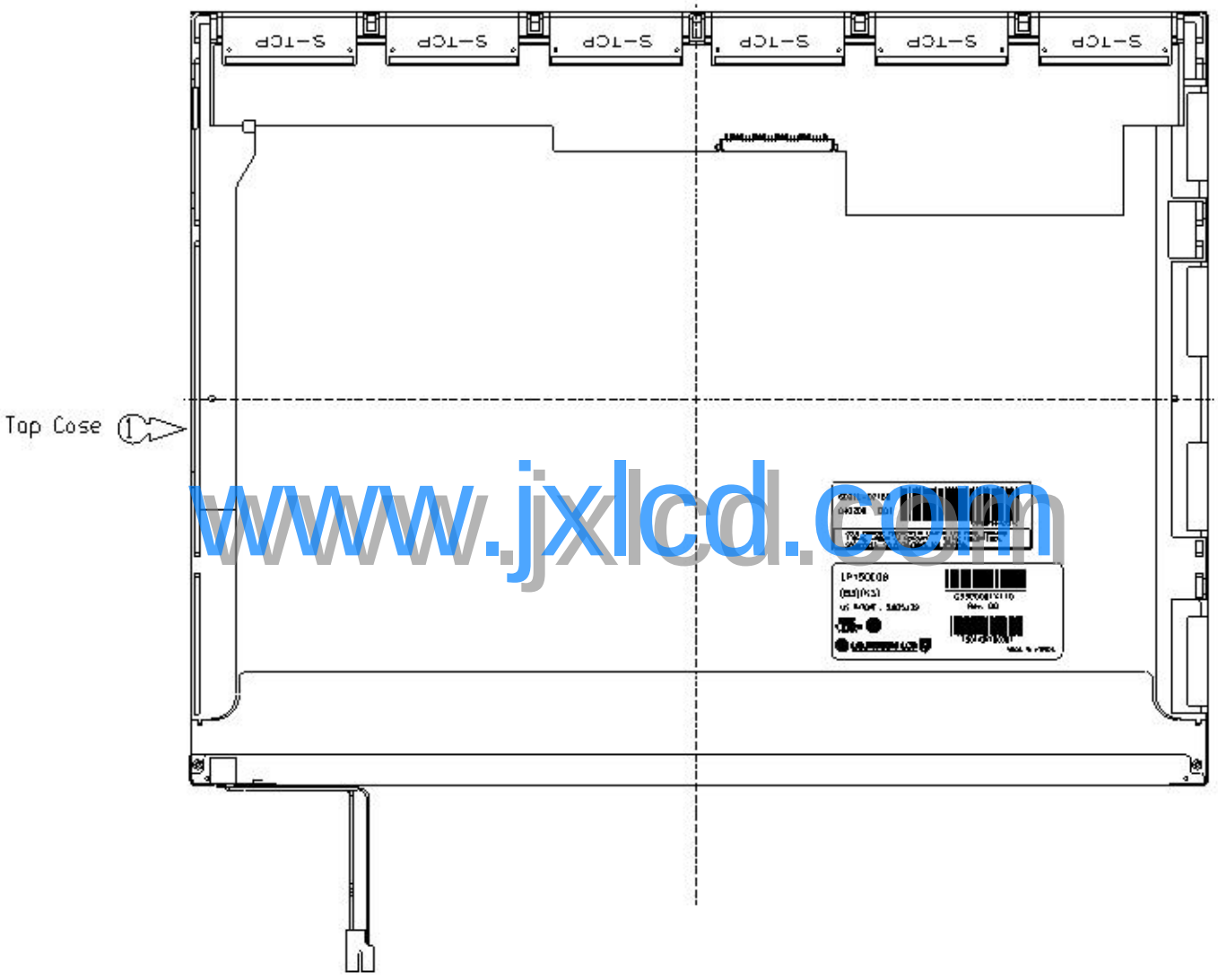
(1) ① Assembly of Source PCB.

Caution: Stress should not be given on COF



11.5.7. Assembly of Top Case

(1) ① Assembly of Top Case.
Caution: Pressure should not be given on Source COF and Gate COF.



11.5.8. Assembly of outside Tape and Cover shield

(1) ① Assembly of Cover shield(S)

Caution: Pressure or stress should not be given on Source PCB.

Usage of gloves with anti-electric discharge coating is recommended

To eliminate possible damage on circuits occurred by ESC.

(2) ② Assembly of Cover shield(G)

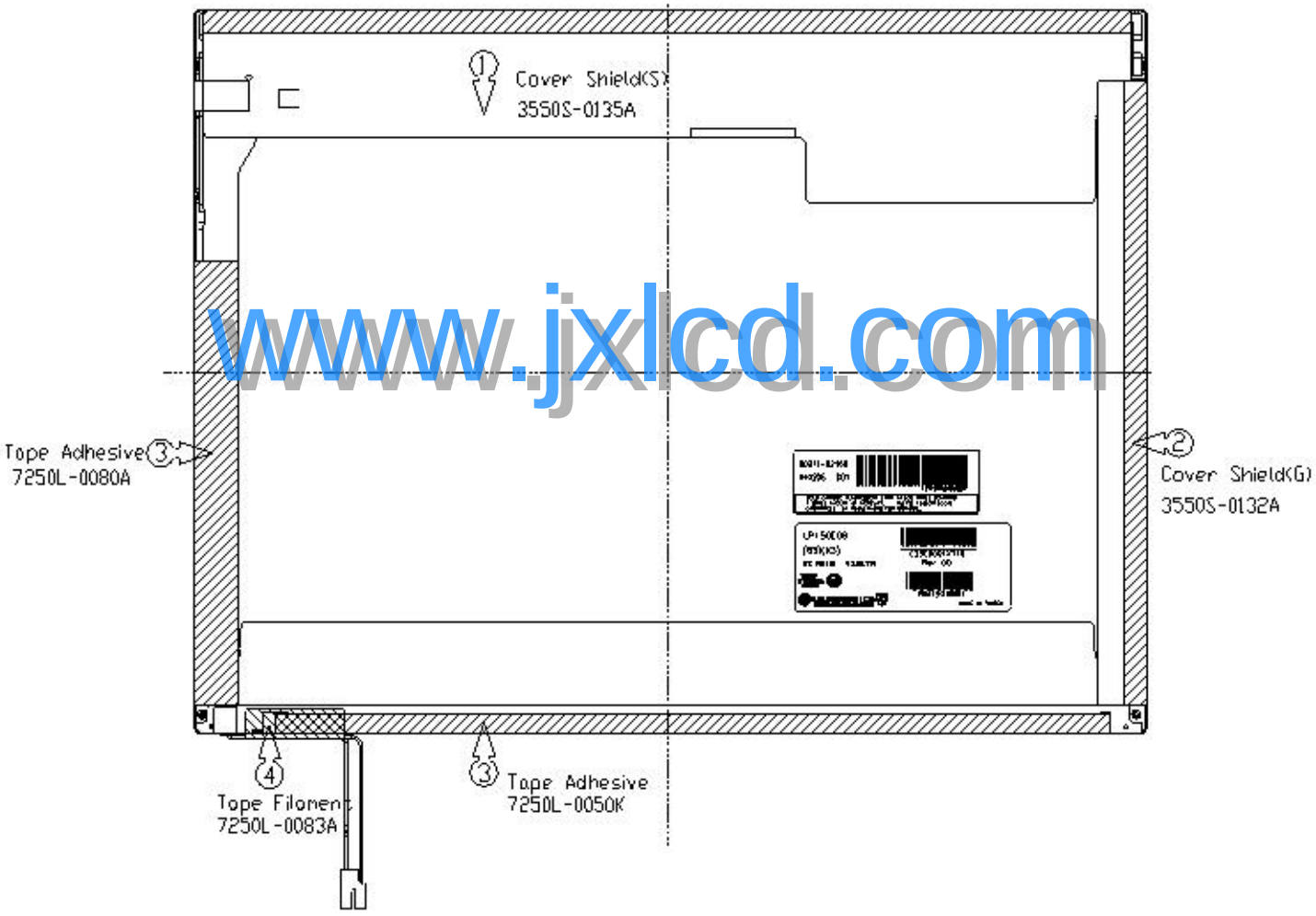
Caution: Pressure or stress should not be given on Gate COF.

(3) ③ Assembly of Tape Adhesive used for Top case fixing

Caution: Pressure or stress should not be given on Top case during this process

(4) ④ Assembly of Tape adhesive used for B/L Wire fixing

Caution: Pressure or stress should not be given on B/L Wire.



## 12. General Precaution

Please pay attention to the followings when you use this TFT LCD module.

### 12.1. Mounting Precautions

(1) You must mount a module using holes arranged in four corners or four sides.

(2) You should consider the mounting structure so that uneven force (ex. twisted stress) is not applied to the module. And the case on which a module is mounted should have sufficient strength so that external force is not transmitted directly to the module.

(3) Please attach a transparent protective plate to the surface in order to protect the polarizer. Transparent protective plate should have sufficient strength in order to resist external force.

(4) You should adopt radiation structure to satisfy the temperature specification.

(5) Acetic acid type and chlorine type materials for the cover case aren't desirable because the former generates corrosive gas of attacking the polalizer at high temperature and the latter causes circuit break by electro-chemical reaction.

(6) Do not touch, push or rub the exposed polarizers with glass, tweezers or anything harder than HB pencil lead. And please do not rub with dust clothes with chemical treatment. Do not touch the surface of polarizer for bare hand or greasy cloth. (Some cosmetics are detrimental to the polarizer.)

(7) When the surface becomes dusty, please wipe gently with absorbent cotton or other soft materials like chamois soaked with petroleum benzene. Normal-hexane is recommended for cleaning the adhesives used to attach front / rear polarizers. Do not use acetone, toluene and alcohol because they cause chemical damage to the polarizer.

(8) Wipe off saliva or water drops as soon as possible. Their long time contact with polarizer causes deformations and color fading.

(9) Do not open the case because inside circuits do not have sufficient strength.



### 12.2. Operating Precautions

(1) The spike noise causes the mis-operation of circuits. It should be lower than following voltage
: V = ± 200mV (Over and under shoot voltage).

(2) Response time depends on the temperature. (In lower temperature, it becomes longer.)

(3) Brightness depends on the temperature. (In lower temperature, it becomes lower.) And in lower temperature, response time (required time that brightness is stable after turned on ) becomes longer.

(4) Be careful for condensation at sudden temperature change. Condensation makes damage to polarizer or electrical contacted parts. And after fading condensation, smear or spot will occur.

(5) When fixed patterns are displayed for a long time, remnant image is likely to occur.

(6) A module has high frequency circuit. If you need to shield the electromagnetic noise, please co-work. When a Back-light unit is operating, it sounds. If you need to shield the noise, please co-work.

### 12.3. Electrostatic Discharge Control

Since a module is composed of electronic circuits, it is not strong to electrostatic discharge. Make certain that treatment persons are connected to ground through wrist band etc . And don't touch interface pin directly.

## 12.4. Precautions for Strong Light Exposure

Strong light exposure causes degradation of polarizer and color filter.

## 12.5. Storage

When storing modules as spares for a long time, the following precautions are necessary.

(1) Store them in a dark place. Do not expose the module to sunlight or fluorescent light. Keep the temperature between 5℃ and 35℃ at normal humidity.

(2) The polarizer surface should not come in contact with any other object. It is recommended that they be stored in the container in which they were shipped.

## 12.6. Handling Precautions for Protection Film

(1) When the protection film is peeled off, static electricity is generated between the film and polarizer. This should be peeled off slowly and carefully by people who are electrically grounded and with well ion- blown equipment or in such a condition, etc.

(2) The protection film is attached to the polarizer with a small amount of glue. If some stress is applied to rub the protection film against the polarizer during the time you peel off the film, the glue is apt to remain on the polarizer. Please carefully peel off the protection film without rubbing it against the polarizer.

(3) When the module with protection film attached is stored for a long time, sometimes there remains a very small amount of glue still on the polarizer after the protection film is peeled off.

(4) You can remove the glue easily. When the glue remains on the polarizer surface or its vestige is recognized, please wipe them off with absorbent cotton waste or other soft material like chamois soaked with normal-hexane.

**< Appendix>**