TO: **TOSHIBA CORPORATION**

DATE: **'08.06.12**

# Specification of 15.4" TFT/LCD
# MODEL: LP154WX4 (TLC9)

| 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 |
|---|---|---|---|---|---|---|
| 08'.06.12 | 1.0 | All | | | | Final Draft |
| | | | | | | |

## 1. Scope

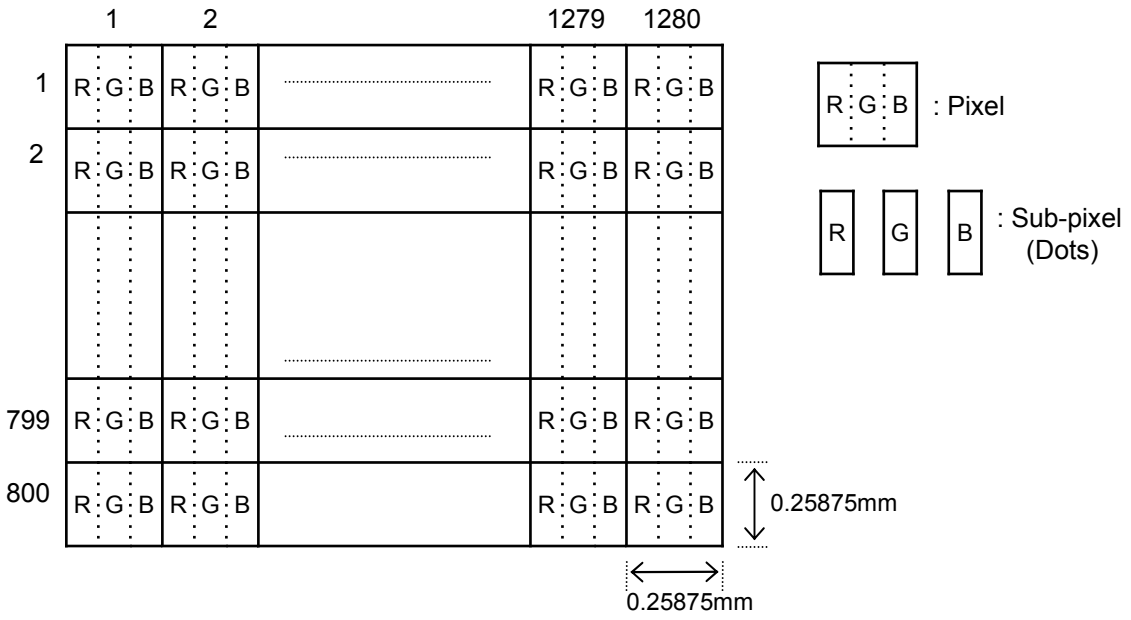
This specification is applicable to LCD manufacturer's 15.4" diagonal size TFT-LCD module "LP154WX4(TLC9)" designed for Personal Computer.

## 2. General Specification

### 2.1. Features

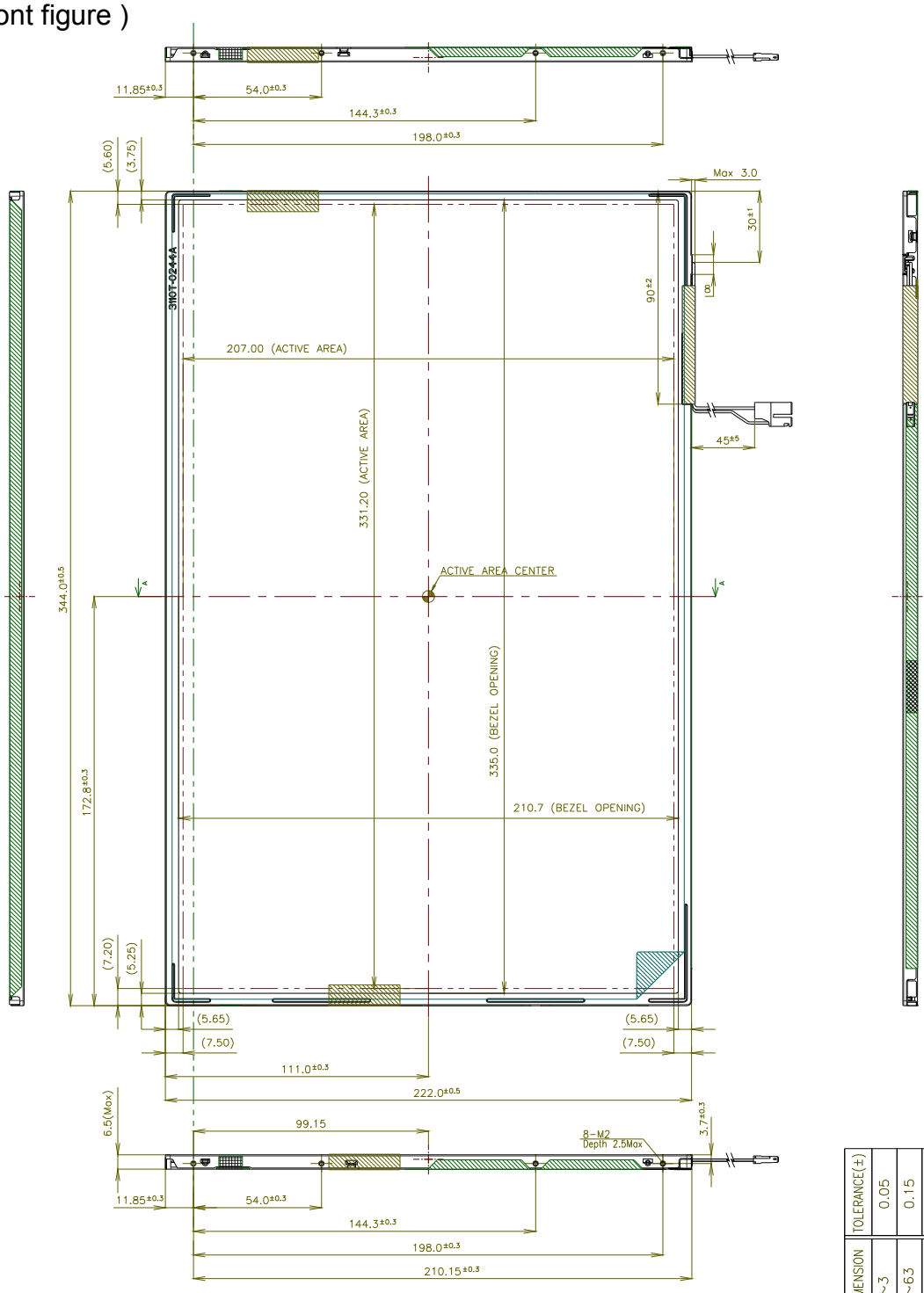
| Item | Specifications |
|---|---|
| Display area ( Active area) | 331.2 (W) × 207.0 (H) (mm) ( 15.4 " diagonal ) |
| Driving Method | TFT active matrix |
| Number of Pixels | 1280 (W) × 800 (H) × R,G,B (WXGA) (pixels) 1) |
| Pixel pitch | 0.25875 (H) × 0.25875 (V) (mm) 1) |
| Pixel Arrangement | RGB vertical stripes 1) |
| Display color | 262,144 (colors) |
| Display Mode | Transmissive mode, Normally white |
| Viewing Direction | 6 o'clock (in direction of maximum contrast) |
| Surface Treatment | Glare treatment of the front polarizer |
| Interface | LVDS |
| Backlight | Single cold-cathode fluorescent lamp for side-lighting |
| Dimensional Outline | 344.0±0.5 (W) × 222.0±0.5 (H) / 6.5(Max) (D) (mm) |
| Bezel Opening | 335.0±0.5 (W) × 210.7±0.5 (H) (mm) |
| Weight | 560g(Typ.) 575g(Max.) |

Note 1)



## 2.2. Dimensional Outline

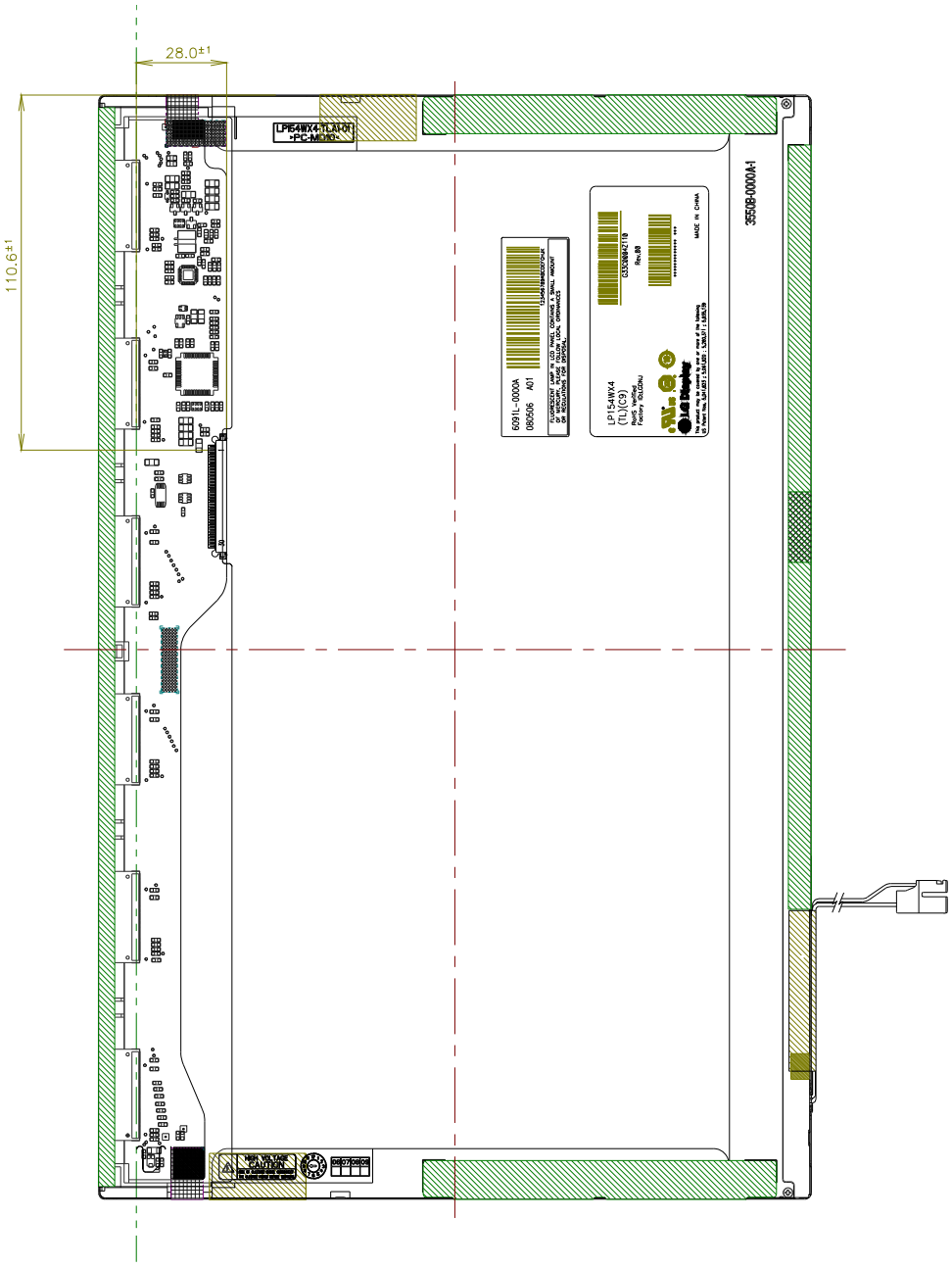
( Front figure )



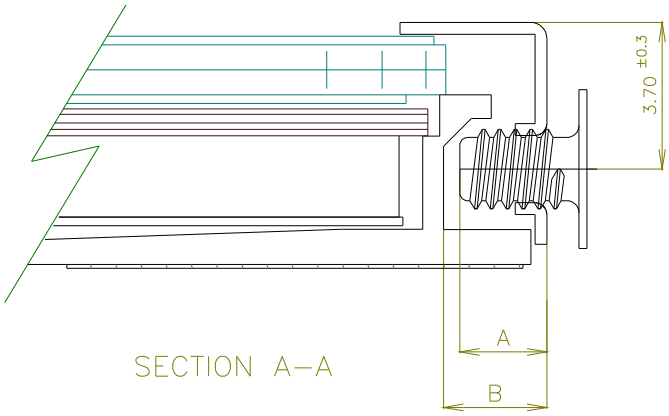

| DIMENSION | TOLERANCE(±) |
|---|---|
| 0~3 | 0.05 |
| 3~63 | 0.15 |
| 63~200 | 0.3 |
| 200~500 | 0.5 |

* The size that related with metal bezel includes tape thickness (0.05mm)

( Back figure )



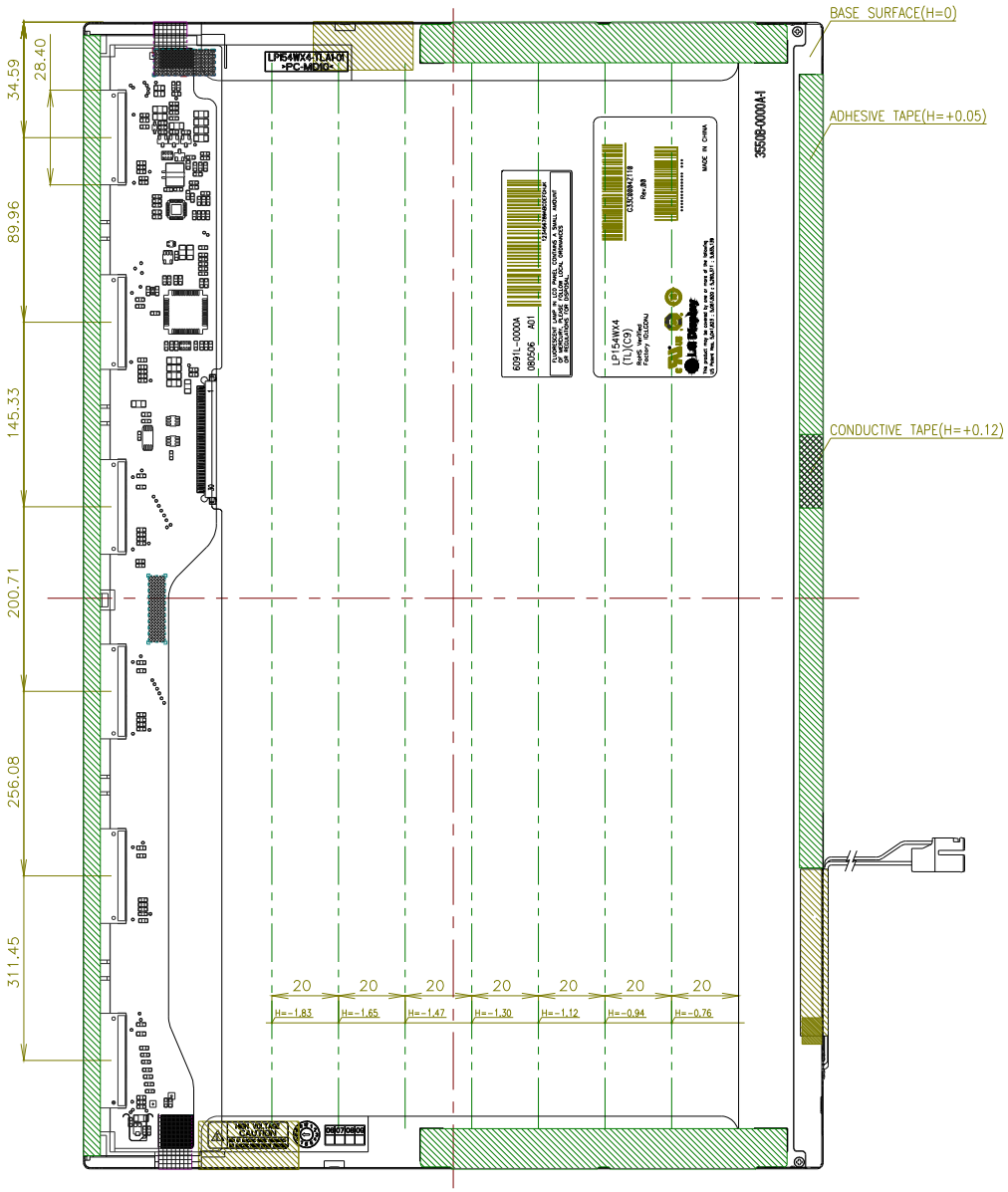
( Detail description of side mounting screw )




* Mounting Screw Length (A)
  = 2.0(Min) / 2.5(Max)
* Mounting Screw Hole Depth (B)
  = 2.5(Min)
* Mounting hole location : 3.7(typ.)
* Torque : 2.5 kgf.cm(Max)
  (Measurement gauge : torque meter)

Notes : 1. Screw plated through the method of non-electrolytic nickel plating is preferred to reduce possibility that results in vertical and/or horizontal line defect due to the conductive particles from screw surface.

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

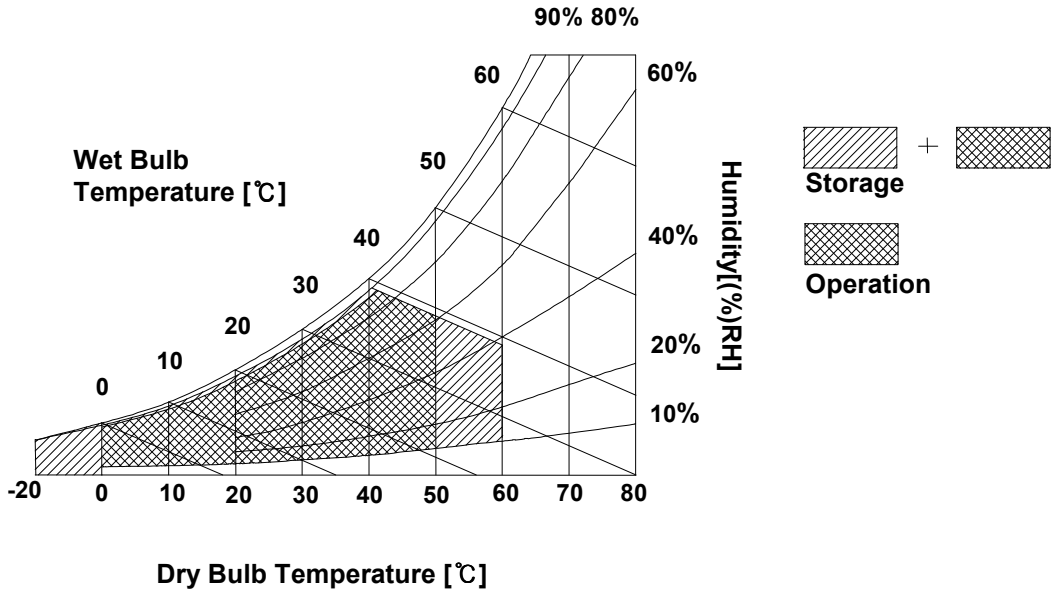


## 3. Absolute Maximum Ratings

### 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 | +50 | °C | (2) |
| Storage Temperature | TSTG | -20 | +60 | °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

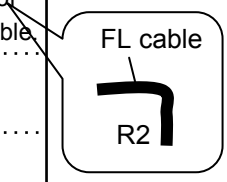
| Item | Symbol | Min | Max | Unit | Note |
|---|---|---|---|---|---|
| Power Supply Voltage | $V_{DD}$ | -0.3 | +4.0 | V | at 25 ± 5°C |
| Logic Input Voltage | $V_{IN}$ | -0.3 | VDD+0.3 | V | LVDS interface |

(2) Back Light Unit

| Item | Symbol | Min | Max | Unit | Note |
|---|---|---|---|---|---|
| Lamp Voltage | $V_L$ | | 5000 | $V_{RMS}$ | Broken lamp Max Voltage |
| Lamp Current | $I_L$ | 3.0 | 6.8 | $mA_{RMS}$ | |
| Lamp Frequency | $F_L$ | 45 | 80 | kHz | |

## 3.3. Mechanical Ratings

| Test Item | Test Conditions | | Note |
|---|---|---|---|
| Mechanical Vibration | Frequency Range 5 - 500 Hz, 14.7m/s$^2$ 1.5G) constant, 0.5Hrs each axis (X, Y, Z direction). | | Non Operation |
| | Frequency Range 5 - 500 Hz, 4.9m/s$^2$ ( 0.5G) constant, 0.5Hrs each axis (X, Y, Z direction). | | Operation |
| Mechanical Shock<br><br>LCD fix condition<br>-> See 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/s$^2$ (10G), Pulse width 11 ms, Sine Wave, ±X, ±Y, ±Z direction. | | Operation |
| Pressure Resistanace<br><br>-> See 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<br>Fig 1-1<br>Fig 1-2<br>Fig 1-3 |
| | 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. | | Non Operation |
| | Back light connector : With 50 times of connector trial there must be no damage to the shape and functionaly. | | |
| Assured torque value at side-mout part | M2 : Max 2.5 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.

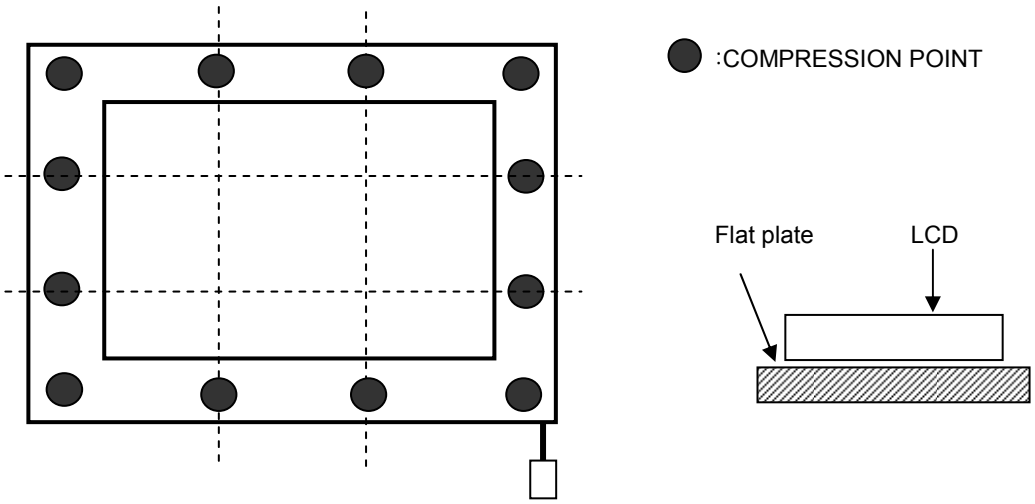
(4) Luminance should be larger than the minimum value specified in optical specification.

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)

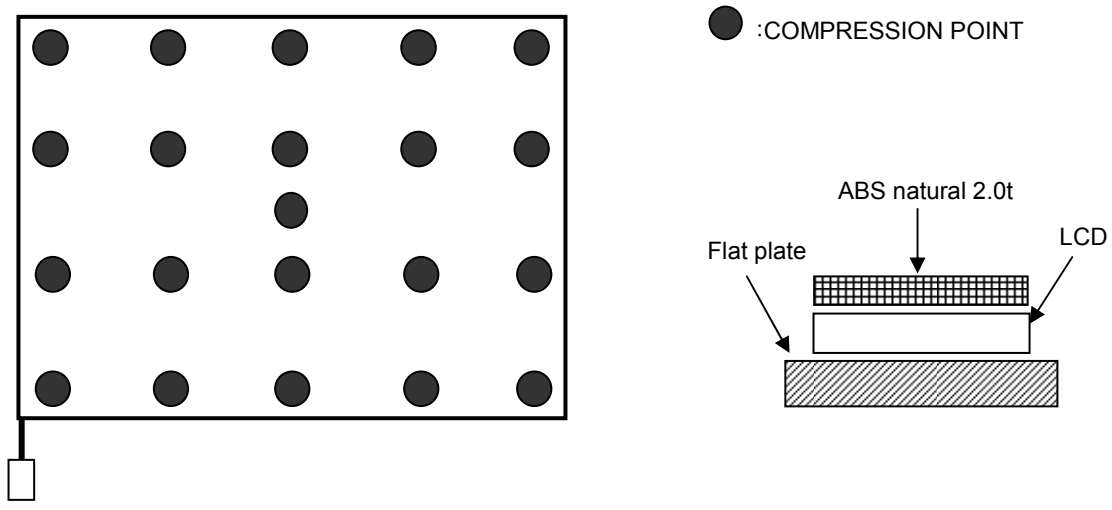



[ Fig 1-1 ]

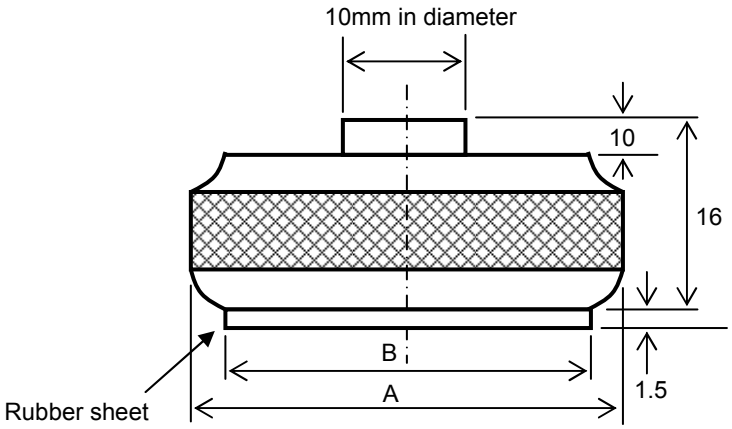
(2) The compression condition of rear side

(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 ]



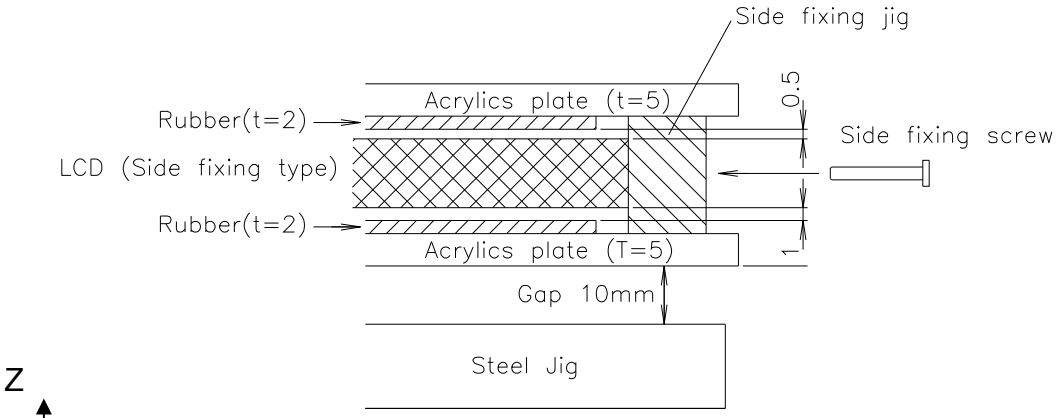

[ Fig 1-3 ]

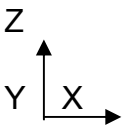
(3) Dimension of the compression jig

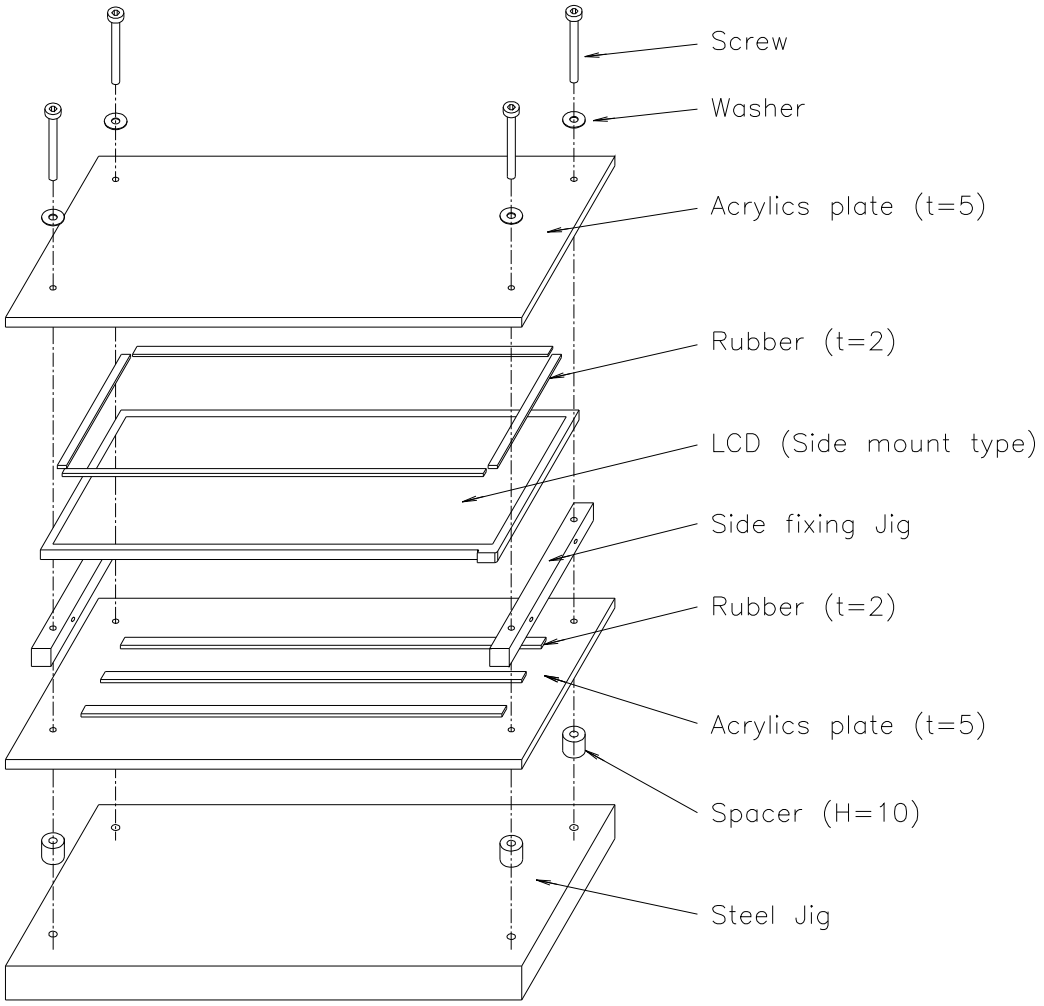
(a) compression jig for front side A = 16 mm in diameter
B = 16 mm in diameter

(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 : $V_{DD}$ 3.3V
Input Signal : According to typical value in "Electrical Characteristics"
FL Input Current : $I_L$ = 6.0$mA_{RMS}$
FL Driving Frequency : $f_{LF}$ = ( 60±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 (Center 1 Point) | | CR | θ=0°, ϕ=0° Viewing normal angle | | 400 | 600 | - | - | (2), (6) |
| Response Time | | $t_{ON}$ | | | - | 5 | 8 | ms | (3) |
| | | $t_{OFF}$ | | | - | 11 | 17 | ms | |
| Average luminance (5 Point Average) | | $Y_L$ | | | 170 | 200 | - | cd/m² | *$I_{FL}$=6.0$mA_{RMS}$ $F_L$=60±5kHz Gray Scale Level = L63 (White) |
| Cross Modulation | | $D_{SHA}$ | | | - | - | 2.0 | % | (5) |
| Luminance Uniformity Chromaticity | Red | Rx | | | 0.564 | 0.594 | 0.624 | - | (1), (6) PR650 Only for Color Coordinate (Color Coordinate of the R,G,B is based on LGD's equipment, and Color Coordinate of the W is based on LGD's equipment) |
| | | Ry | | | 0.319 | 0.349 | 0.379 | | |
| | Green | Gx | | | 0.295 | 0.325 | 0.355 | | |
| | | Gy | | | 0.513 | 0.543 | 0.573 | | |
| | Blue | Bx | | | 0.127 | 0.157 | 0.187 | | |
| | | By | | | 0.109 | 0.139 | 0.169 | | |
| | 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. | |
| | | $\theta_R$ | | 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° | 15 | 20 | - | | |
| | | $\theta_{Low}$ | | ϕ = -90° | 35 | 40 | - | | |
| 13 Points White Variation | | δ W | θ=0°, ϕ=0° Viewing normal angle | | - | - | 1.6 | | (7) |
| 13 Points CR Variation | | $\delta C_R$ | | | - | - | 2.0 | | (7) |
| White Variation | | dL | | | - | - | 2.0 | | (8) |

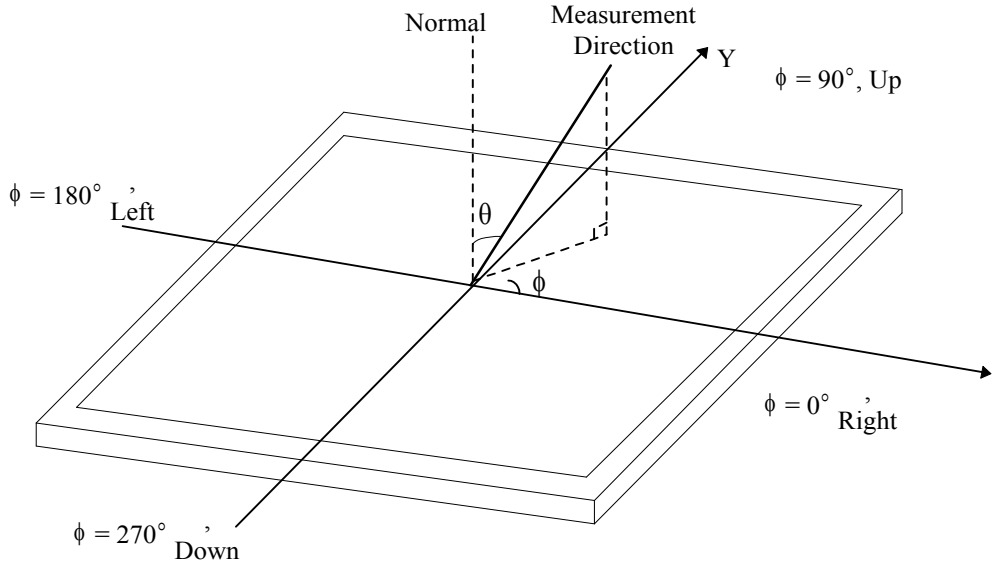
Attach the Lamp current – Luminance characteristics. The range of lamp current is shown in 3.2 (2)

A. Present CR Variation(13Point) Spec is based on PR-880 Equipment and can be changed by the measuring equipment.

| 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 | | 60.5 | 77.1 | 87.0 | | |
| | 47 | | 38.5 | 53.6 | 66.5 | | |
| | 39 | | 22.6 | 34.2 | 48.3 | | |
| | 31 | | 11.5 | 20.3 | 33.2 | | |
| | 23 | | 3.00 | 12.1 | 21.4 | | |
| | 15 | | 0.50 | 5.76 | 12.7 | | |
| | 7 | | 0.10 | 1.55 | 5.80 | | |
| | 0 | | 0.00 | 0.09 | 1.20 | | |

At normal viewing direction, during displaying the L0-L63 gray scale bar, luminance intensity inversion can not be seen.

Note 1) Definition of viewing angle θ and ϕ




Note 2) LCD fixing condition for z direction.

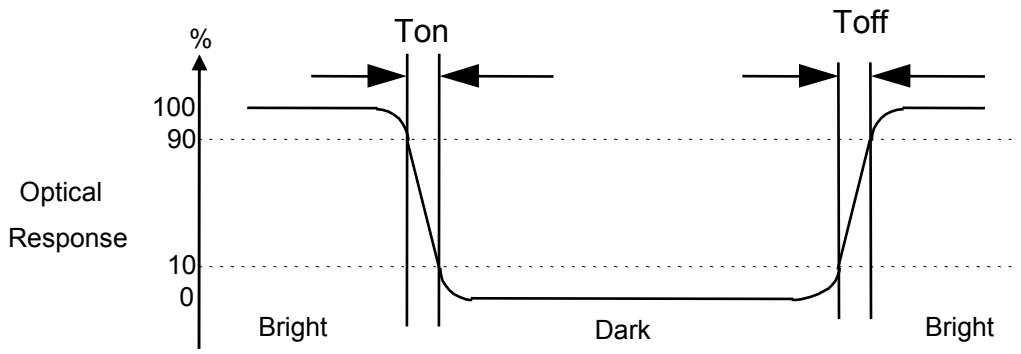
The contrast ratio can be calculated by the following expression.

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 $Y_L$

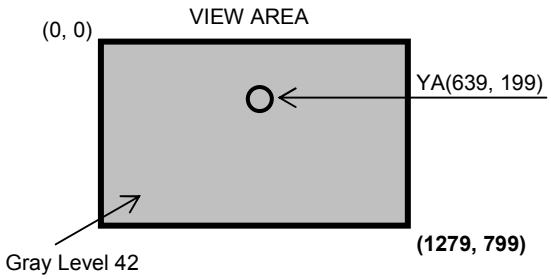
Note 5) Definition of Cross Modulation ($D_{SHA}$)

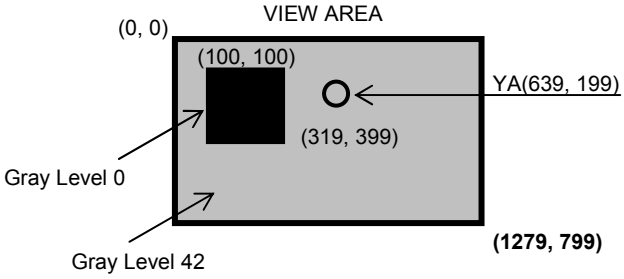
$$D_{SHA} = | Y_B - Y_A | / Y_A \times 100 \ (\%)$$

Where:

$Y_A$ = Luminance of measured location without darkest gray pattern (cd/m$^2$)

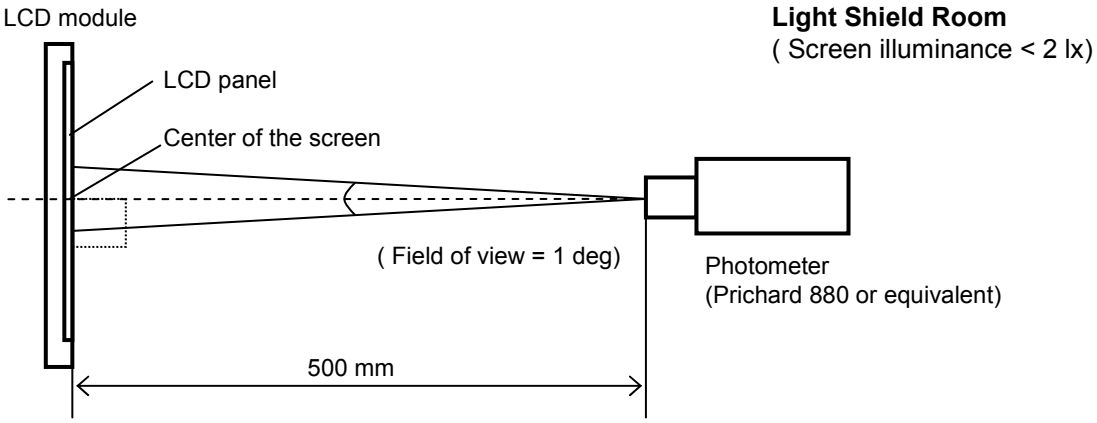
$Y_B$ = Luminance of measured location with darkest gray pattern (cd/m$^2$)



Note 6) Measuring setup

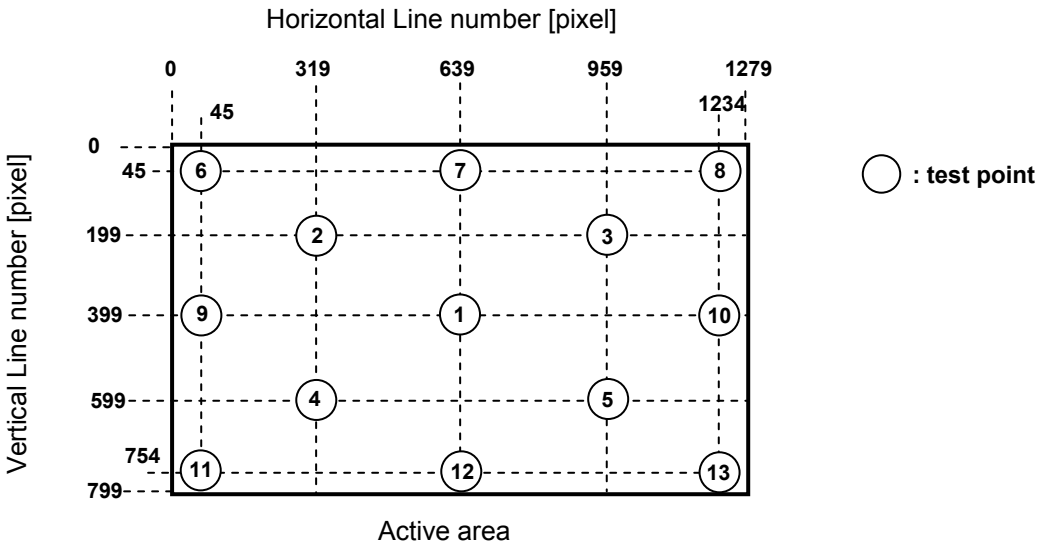
The measurement suppose to be executed after stabilized the panel at given temperature during 30 min. The measurement shall be executed 30 minutes after lighting at rating. The luminance of white should be typical luminance ( Typical Condition IL=6.0mA ). In order to stable the luminance, LCD s hall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




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

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

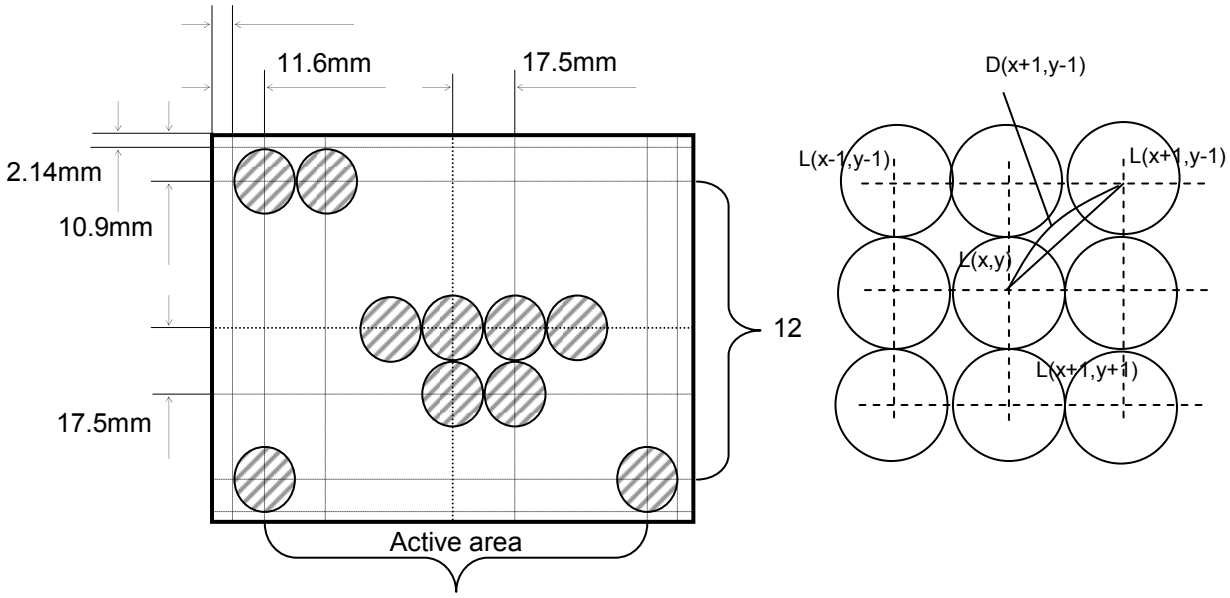
$\delta C_R$ = Maximum CR 13 points / Minimum CR of 13 points



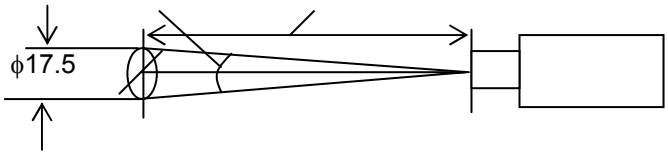
Note 8) Definition of White Variation dL : measure the luminance of white at 13 ×11 points.

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

where $2 \le x \le 15$, $2 \le y \le 11$, $I = \pm 1$, $j = \pm 1$




Measuring Spot 16
( Field of View : 2deg. Measuring Distance : 500 mm )



## 5. Electrical Characteristics

### 5.1. TFT LCD module

| Item | | Symbol | Min. | Typ. | Max. | Unit | Note |
|---|---|---|---|---|---|---|---|
| Power Supply Voltage | | $V_{DD}$ | 3.0 | 3.3 | 3.6 | V | |
| Differential Input Threshold Voltage | High | Vth | | - | +100 | mV | |
| | Low | Vtl | -100 | - | - | mV | |
| Rush Current | | $I_{RUSH}$ | - | - | 2.0 | A | (5) |
| Power Supply Current | White(L63) | $I_{DD}$ | 240 | 280 | 320 | mA | (3), (4) (a) |
| | Mosaic | | 300 | 350 | 400 | | (3), (4) (b) |
| | Max. Pattern | | 340 | 400 | 460 | | (3), (4) (c) |

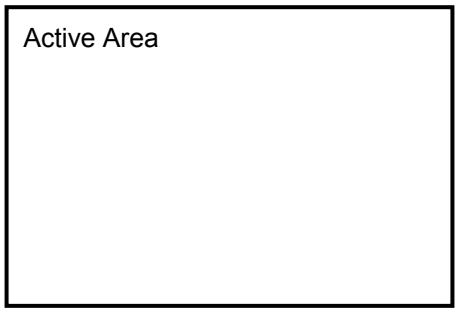
Note 1) The module should be always operated within these ranges. The "Typ." shows the recommedable value.

Note 2) Recommended LVDS transmitter : SN75LVDS84 (made by TI ).
LVDS receiver included in this module is SW0611A_M.( 1 chip)

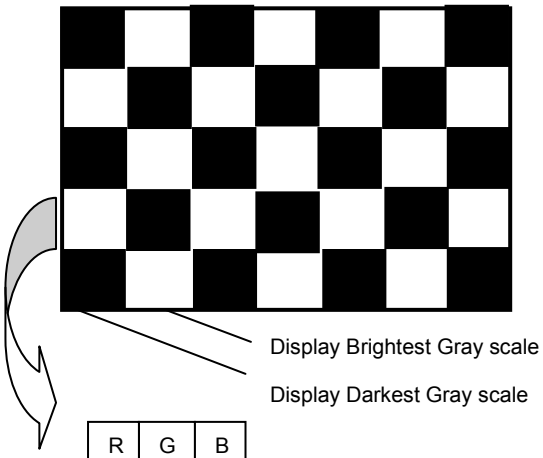
Note 3) Typical condition as follows. : fV= 60Hz, fDCLK = 69.3 MHz, $V_{DD}$= 3.3V, DC current.

Note 4) Power dissipation check pattern.

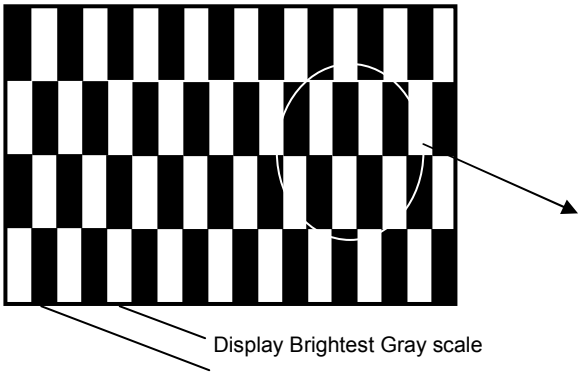
(a) White pattern



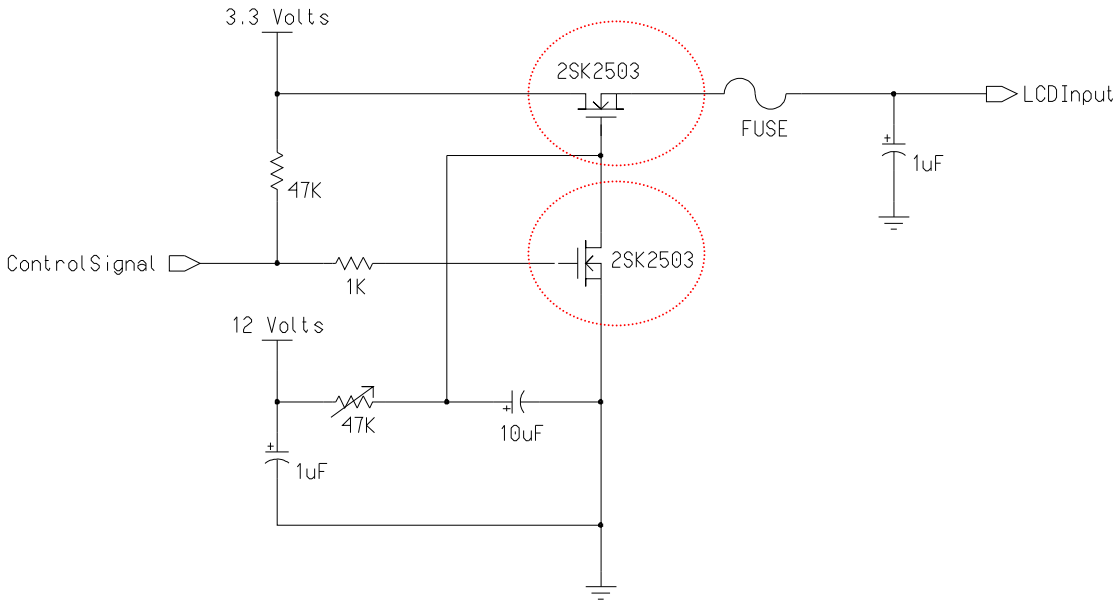

(b) Mosaic pattern



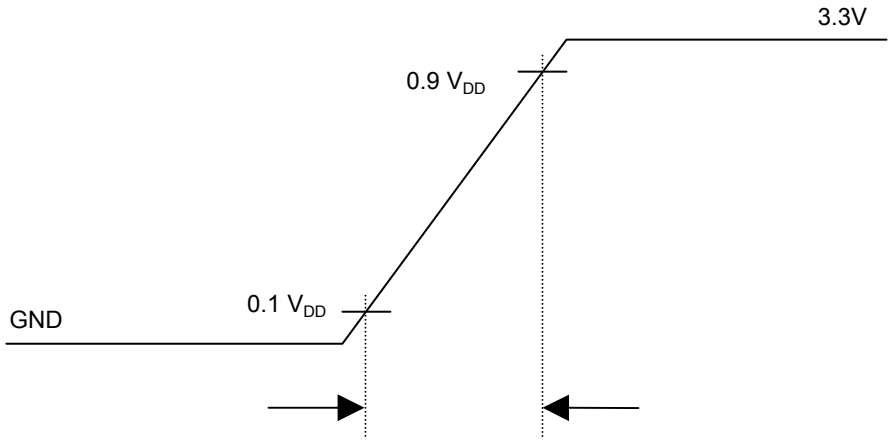

(C) Max. pattern



Note 5) Measuring condition of rush current.



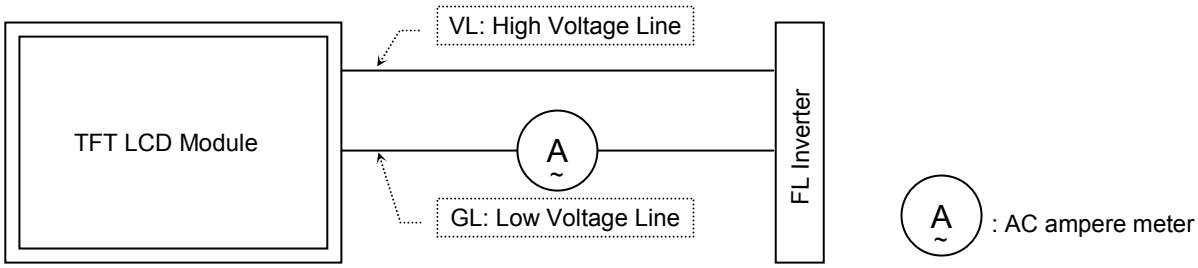

$V_{DD}$ rising time is 470us



## 5.2. Backlignt Unit

| Item | Symbol | Min. | Typ. | Max. | Unit | Note |
|---|---|---|---|---|---|---|
| Lamp Current | $I_L$ | 3.0 | 6.0 | 6.8 | $mA_{RMS}$ | (1) |
| Lamp Voltage | $V_L$ | 665 | 690 | 830 | $V_{RMS}$ | |
| Power Consumption | $P_L$ | - | 4.2 | 4.6 | W | (2) |
| Frequency | $f_{FL}$ | 45 | 60 | 80 | kHz | |
| Operating Life Time | Hr | 15,000 | - | - | Hour | (3) |
| Ignition Voltage at 0°C | $V_{IV}$ | - | - | 1500 | $V_{RMS}$ | (5) |
| | | - | - | - | | (4) |
| Ignition Voltage at 25°C | $V_{IV}$ | - | - | 1200 | | (5) |
| | | - | - | - | | (4) |
| 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) Refer to $I_L$ X $V_L$ to calculate.

Note 3) 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.

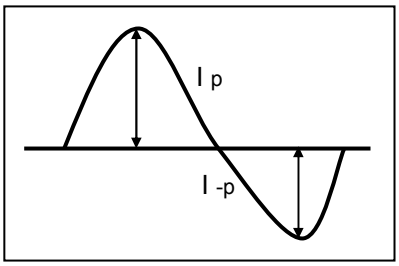
( Effective ignition length is defined as an area that has less than 70% brightness compared to the brightness in the center point.)

Note 4) 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 5) 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)

*** 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 increase the lamp lifetime and reduce leakage current.

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:

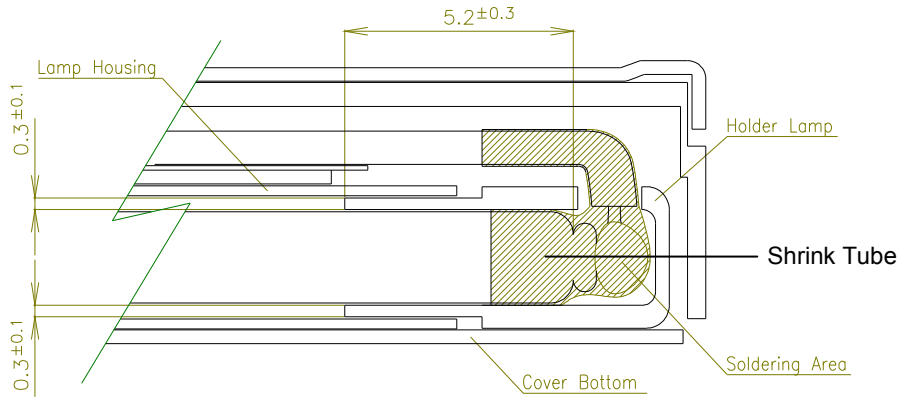
$| I_p - I_{-p} | / I_{rms} * 100\%$

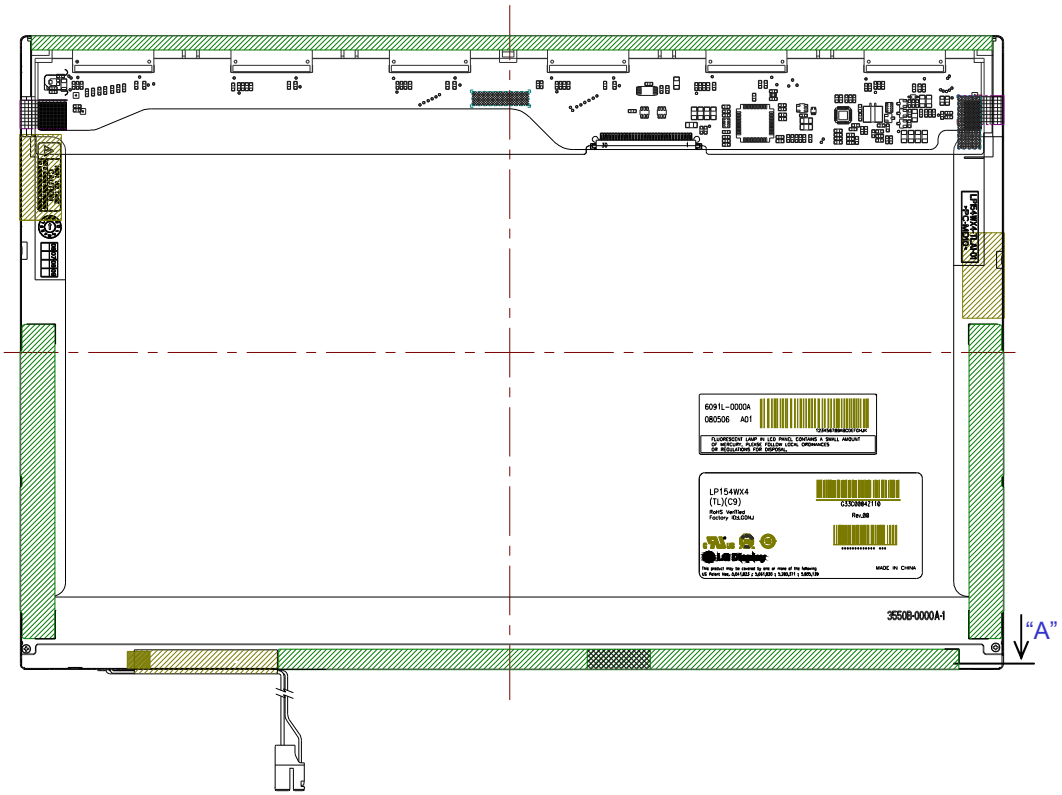
* Distortion rate

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

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

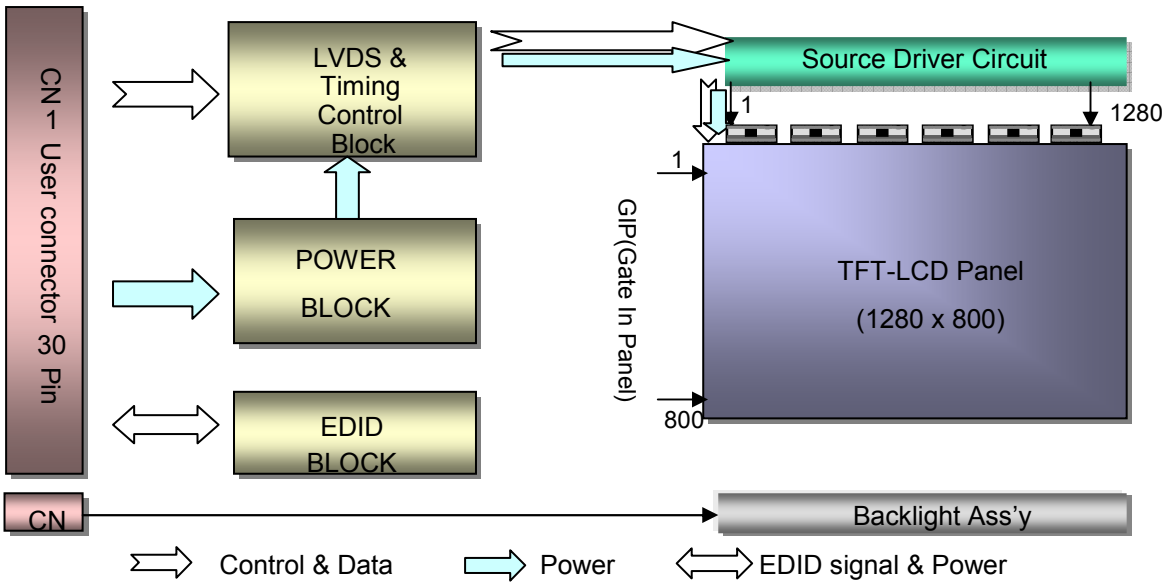
(2) Safety Regulations (Only LCD)

IEC 60950
UL 60950

(3) Material list concerning

| Item | | Silk | Product | Rating | Maker |
|---|---|---|---|---|---|
| TCON | TCON OUTPUT (Data Output) | R4,5,6,7,8,9,10 | Resistor | 100Ω | |
| | Power $V_{cc}$(2.5V) | UC1 | TCON | 2.5V | Siliconworks |
| DC/DC | Control IC for Power supply | US1 | RT9928 | PE26, 40PIN, QFN-40, R/TP, LEVEL SHIFTER+BOOST+OP-AMP, PB FREE)<br>DC/DC Switching frequency (Min.:1.0㎒ , Typ.:1.2㎒ , Max.:1.4㎒ ) | RICHTEK |
| | Switching Diode | D2,D3,D4 | BAV99 | | DIODES |
| | Schottky Barrier Diode | D1 | BAT750 | 0.75A | DIODES |
| | 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 wire color (Harison) : Blue(H) & Green (L)**
**Lamp Maker & P/No : Harison-Toshiba Lighting, MBTK2J( )X337NWLFH/C, 0.277/0.249**

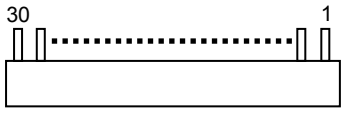
## 7. Input Terminal Pin Assignment

### 7.1. TFT LCD module

| Pin | Symbol | Description | Notes |
|---|---|---|---|
| 1 | GND | Ground | |
| 2 | VCC | Power Supply, 3.3V Typ. | |
| 3 | VCC | Power Supply, 3.3V Typ. | |
| 4 | V EEDID | DDC 3.3V power | |
| 5 | NC | Reserved for supplier test point | |
| 6 | Clk EEDID | DDC Clock | |
| 7 | DATA EEDID | DDC Data | |
| 8 | $R_{IN}$ 0- | Negative LVDS differential data input | |
| 9 | $R_{IN}$ 0+ | Positive LVDS differential data input | |
| 10 | GND | Ground | |
| 11 | $R_{IN}$ 1- | Negative LVDS differential data input | |
| 12 | $R_{IN}$ 1+ | Positive LVDS differential data input | |
| 13 | GND | Ground | |
| 14 | $R_{IN}$ 2- | Negative LVDS differential data input | |
| 15 | $R_{IN}$ 2+ | Positive LVDS differential data input | |
| 16 | GND | Ground | |
| 17 | CLKIN- | Negative LVDS differential clock input | |
| 18 | CLKIN+ | Positive LVDS differential clock input | |
| 19 | GND | Ground | |
| 20 | NC | No Connect | |
| 21 | NC | No Connect | |
| 22 | GND | Ground | |
| 23 | NC | No Connect | |
| 24 | NC | No Connect | |
| 25 | GND | Ground | |
| 26 | NC | No Connect | |
| 27 | NC | No Connect | |
| 28 | GND | Ground | |
| 29 | NC | No Connect | |
| 30 | NC | No Connect | |

1, Interface chips
1.1 LCD : SW, SW0611 (LCD Controller) including LVDS Receiver
* Pin to Pin compatible with LVDS

2. Connector
2.1 LCD :IS100-C30R-C15 ,UJU Elec. GT101-30S-HR11,LS Cable its compatibles
2.2 Mating : FI-X30M or equivalent.
2.3 Connector pin arrangement




[LCD Module Rear View]

### 7.2. Backlight Unit

Using Connector : BHTR-02VS (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 | Blue | High Voltage |
| 2 | GL | Green | Low Voltage |

## 7.3. LVDS Transmitter

LVDS Transmitter : SN75LVDS84 (made by TI ) or compatible.

| Pin # | Pin Name | Require Signals | Pin # | Pin Name | Require Signals |
|---|---|---|---|---|---|
| 1 | D4 | R4 | 48 | D3 | R3 |
| 2 | Vcc | Vcc | 47 | D2 | R2 |
| 3 | D5 | R5 | 46 | GND | GND |
| 4 | D6 | G0 | 45 | D1 | R1 |
| 5 | DND | GND | 44 | D0 | R0 |
| 6 | D7 | G1 | 43 | NC | NC |
| 7 | D8 | G2 | 42 | LVDS GND | LVDS GND |
| 8 | Vcc | Vcc | 41 | Y0M | A0M |
| 9 | D9 | G3 | 40 | Y0P | A0P |
| 10 | D10 | G4 | 39 | Y1M | A1M |
| 11 | GND | GND | 38 | Y1P | A1P |
| 12 | D11 | G5 | 37 | LVDS Vcc | LVDS Vcc |
| 13 | D12 | B0 | 36 | LVDS GND | LVDS GND |
| 14 | NC | NC | 35 | Y2M | A2M |
| 15 | D13 | B1 | 34 | Y2P | A2P |
| 16 | D14 | B2 | 33 | CLKOUTM | CLKM |
| 17 | GND | GND | 32 | CLKOUTP | CLKP |
| 18 | D15 | B3 | 31 | LVDS GND | LVDS GND |
| 19 | D16 | B4 | 30 | PLL GND | PLL GND |
| 20 | D17 | B5 | 29 | PLL Vcc | PLL Vcc |
| 21 | Vcc | Vcc | 28 | PLL GND | PLL GND |
| 22 | D18 | HSYNC | 27 | SHDN | SHDN |
| 23 | D19 | VSYNC | 26 | CLKIN | Dclk |
| 24 | GND | GND | 25 | D20 | DE(Data Enable) |

## 7.4. Timing Diagrams of LVDS Transmission

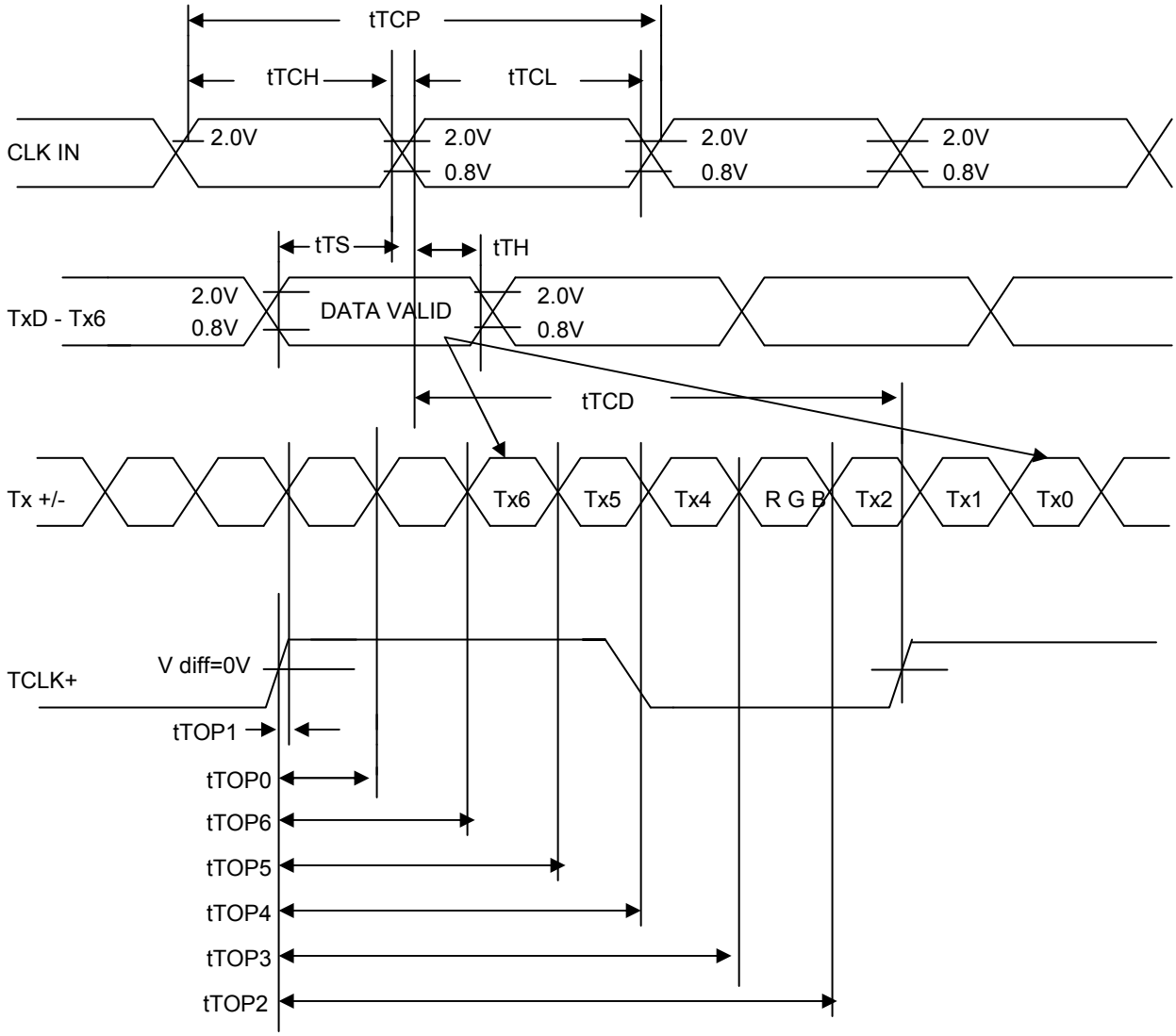
Switching Characteristic

VCC = 3.0 ~ 3.6V, Ta = -10 ~ +70℃

Transmitter

| Symbol | Parameter | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|
| tTCIT | CLK IN Transition Time | - | - | 5 | ns |
| tTCP | CLK IN Period | 14.7 | T | 32.4 | ns |
| tTCH | CLK IN High Time | 0.4T | 0.5T | 0.6T | ns |
| tTCL | CLK IN Low Time | 0.4T | 0.5T | 0.6T | ns |
| tTCD | CLK IN to TCLK +/- Delay | - | 14.2 | - | ns |
| tTS | TTL Data Setup to CLK IN | 3.0 | - | - | ns |
| tTH | TTL Data Hold from CLK IN | 1.5 | - | - | ns |
| tLVT | LVDS Transition Time | 0.26 | 0.7 | 1.5 | ns |
| tTOP1 | Output Data Position 0 (T= 15.38ns) | -0.2 | 0 | 0.2 | ns |
| tTOP0 | Output Data Position 1 (T= 15.38ns) | T/7 - 0.2 | T/7 | T/7 + 0.2 | ns |
| tTOP2 | Output Data Position 2 (T= 15.38ns) | 2T/7 - 0.2 | 2T/7 | 2T/7 + 0.2 | ns |
| tTOP3 | Output Data Position 3 (T= 15.38ns) | 3T/7 - 0.2 | 3T/7 | 3T/7 + 0.2 | ns |
| tTOP4 | Output Data Position 4 (T= 15.38ns) | 4T/7 - 0.2 | 4T/7 | 4T/7 + 0.2 | ns |
| tTOP5 | Output Data Position 5 (T= 15.38ns) | 5T/7 - 0.2 | 5T/7 | 5T/7 + 0.2 | ns |
| tTOP6 | Output Data Position 6 (T= 15.38ns) | 6T/7 - 0.2 | 6T/7 | 6T/7 + 0.2 | ns |
| tTPLL | Phase Lock Loop Set | - | - | 10 | ns |

AC Timing Diagrams
Transmitter Device



## 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 | RED (00) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | RED (01) | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | … | | | … | | | | | | … | | | | | | … | | | |
| | RED (62) | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | RED (63) | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| GREEN | GREEN (00) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | GREEN (01) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| | ... | | | ... | | | | | | ... | | | | | | ... | | | |
| | GREEN (62) | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | GREEN (63) | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| BLUE | BLUE (00) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | BLUE (01) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| | … | | | … | | | | | | … | | | | | | … | | | |
| | BLUE (62) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 0 |
| | BLUE (63) | 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

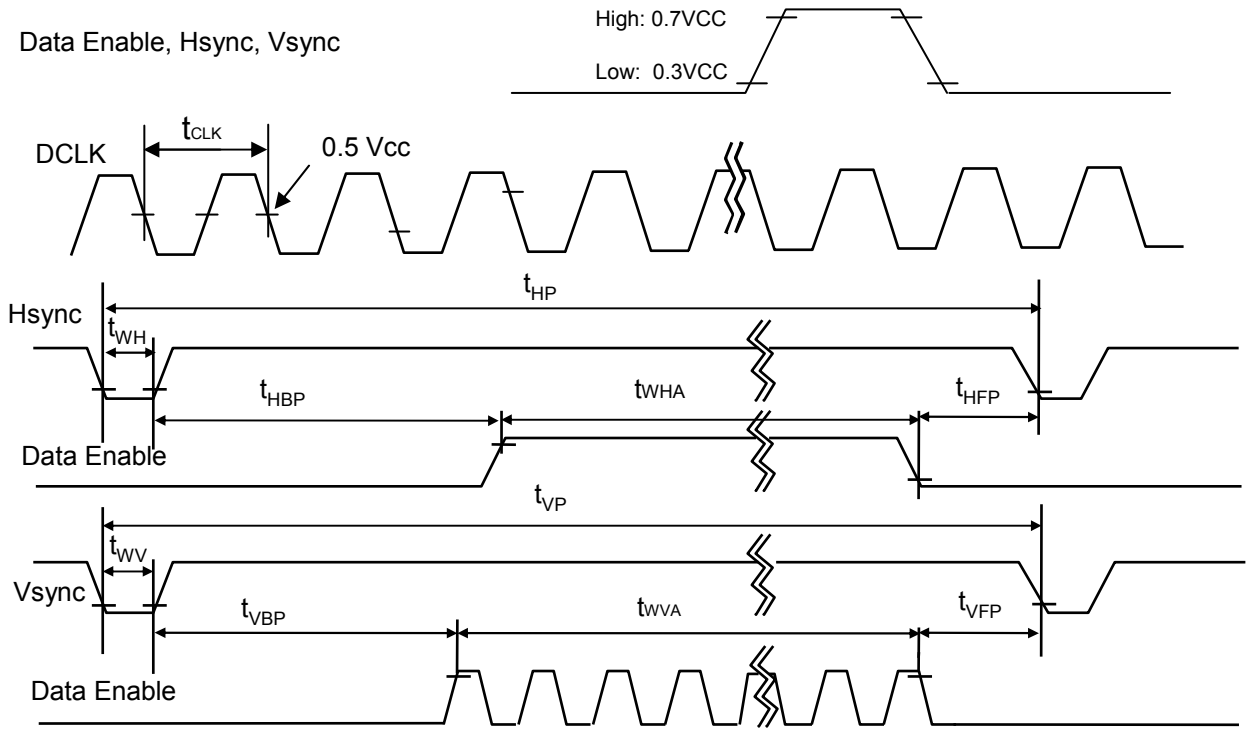
### 8.1. Timing Parameters

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.

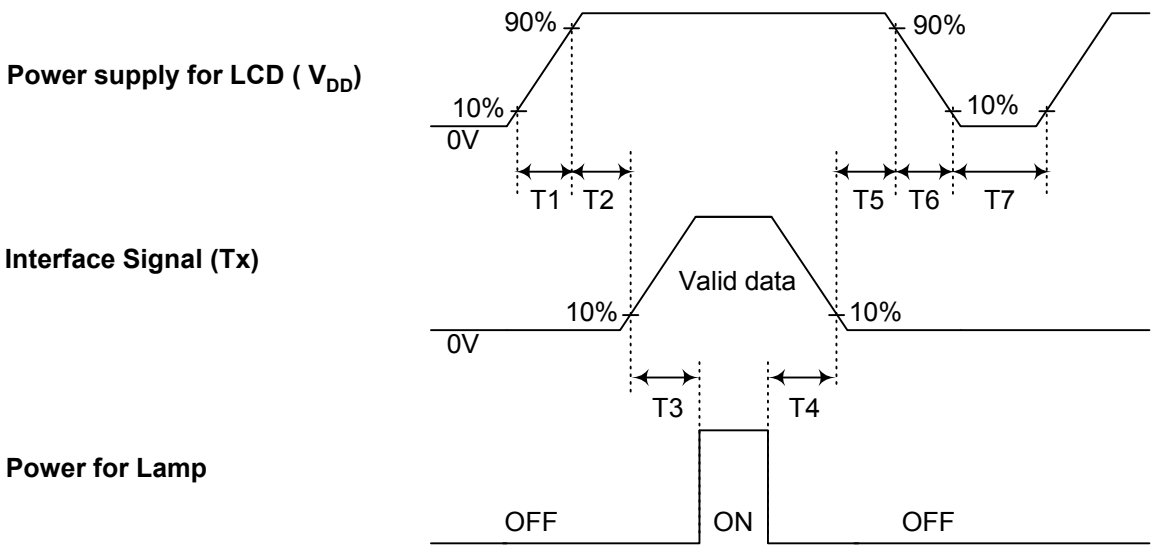
| ITEM | Symbol | | Min | Typ | Max | Unit | Note |
|---|---|---|---|---|---|---|---|
| DCLK | Frequency | $f_{CLK}$ | 65.5 | 69.3 | 76.0 | MHz | |
| Hsync | Period | Thp | 1350 | 1416 | 1480 | tCLK | |
| | Width | $t_{WH}$ | 16 | 24 | 48 | | |
| | Width-Active | $t_{WHA}$ | 1280 | 1280 | 1280 | | |
| Vsync | Period | $t_{VP}$ | 809 | 816 | 860 | tHP | |
| | Width | $t_{WV}$ | 2 | 6 | 10 | | |
| | Width-Active | $t_{WVA}$ | 800 | 800 | 800 | | |
| Data Enable | Horizontal back porch | $t_{HBP}$ | 40 | 64 | 96 | tCLK | |
| | Horizontal front porch | $t_{HFP}$ | 14 | 48 | 56 | | |
| | Vertical back porch | $t_{VBP}$ | 6 | 7 | 32 | tHP | |
| | Vertical front porch | $t_{VFP}$ | 1 | 3 | 18 | | |

### 8.2. Timing Diagrams of LVDS Transmission

Condition : VCC =3.3V



## 8.3. Power On/Off Sequence




| Parameter | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|
| $T_1$ | 0 | - | 10 | (ms) |
| $T_2$ | 0 | - | 50 | (ms) |
| $T_3$ | 200 | - | - | (ms) |
| $T_4$ | 200 | - | - | (ms) |
| $T_5$ | 0 | - | 50 | (ms) |
| $T_6$ | 0 | - | 10 | (ms) |
| $T_7$ | 200 | - | - | (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

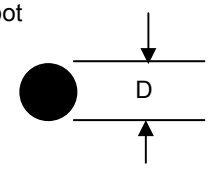
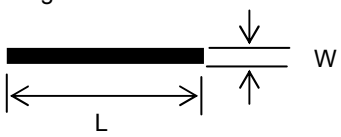
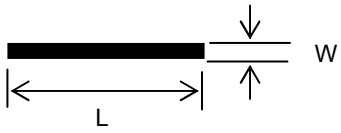
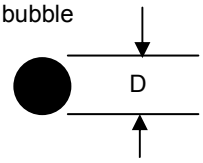
### 9.3. Defect modes

| 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; line 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

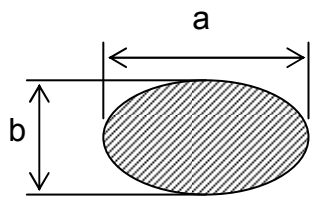
## 9.5. Visual Inspection

| 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 ≤ 0.1<br>0.3 < L ≤ 3.0<br>N ≤ 3 | W > 0.1<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)

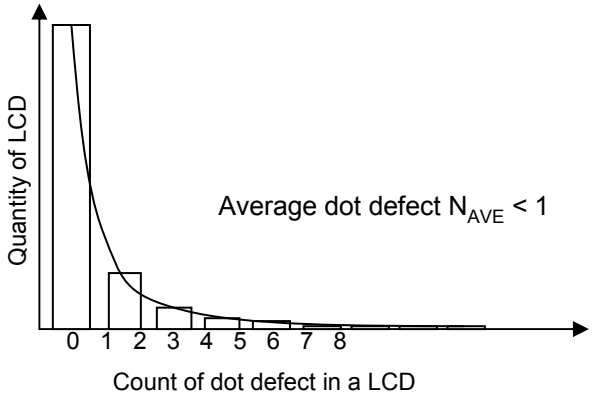


## 9.6. Electrical Inspection

(1) Dot defect

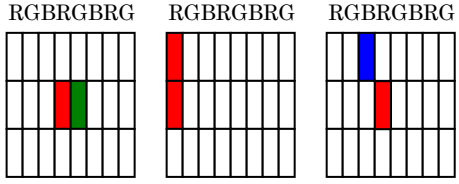
| Defect type | | Count | Reject |
|---|---|---|---|
| Bright dots | Random | N ≤ 2 | N > 3 |
| | Two adjacent | Not allowed | |
| | Three or more adjacent | Not allowed | |
| Dark dots | Random | N ≤ 4 | N > 5 |
| | Two adjacent | N ≤ 1 | N > 2 |
| | Three or more adjacent | Not allowed | |
| Maximum allowable number of dot defect | | N ≤ 5 | N > 6 |
| Maximum distance between defects | Bright - to - bright dot | L ≤ 15mm | L>15.1mm |
| | Dark - to - dark dot | L ≤ 10mm | L>10.1mm |

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




Required distribution of dot defect

4) The definition of 2 adjacent dots.

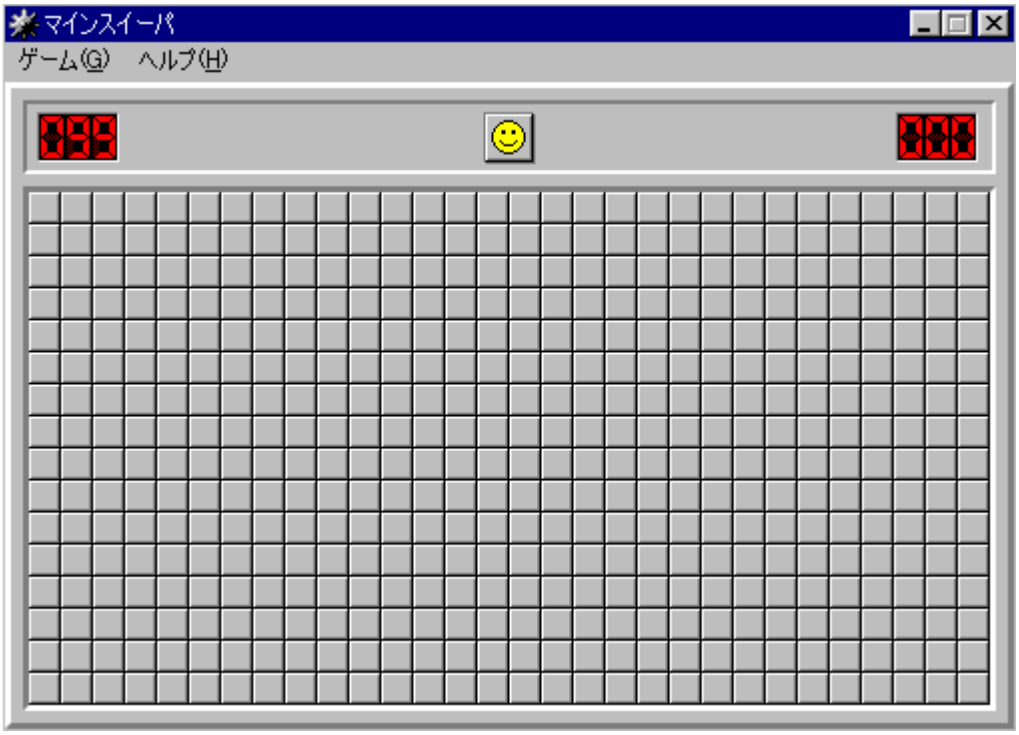


(2) Light leakage

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

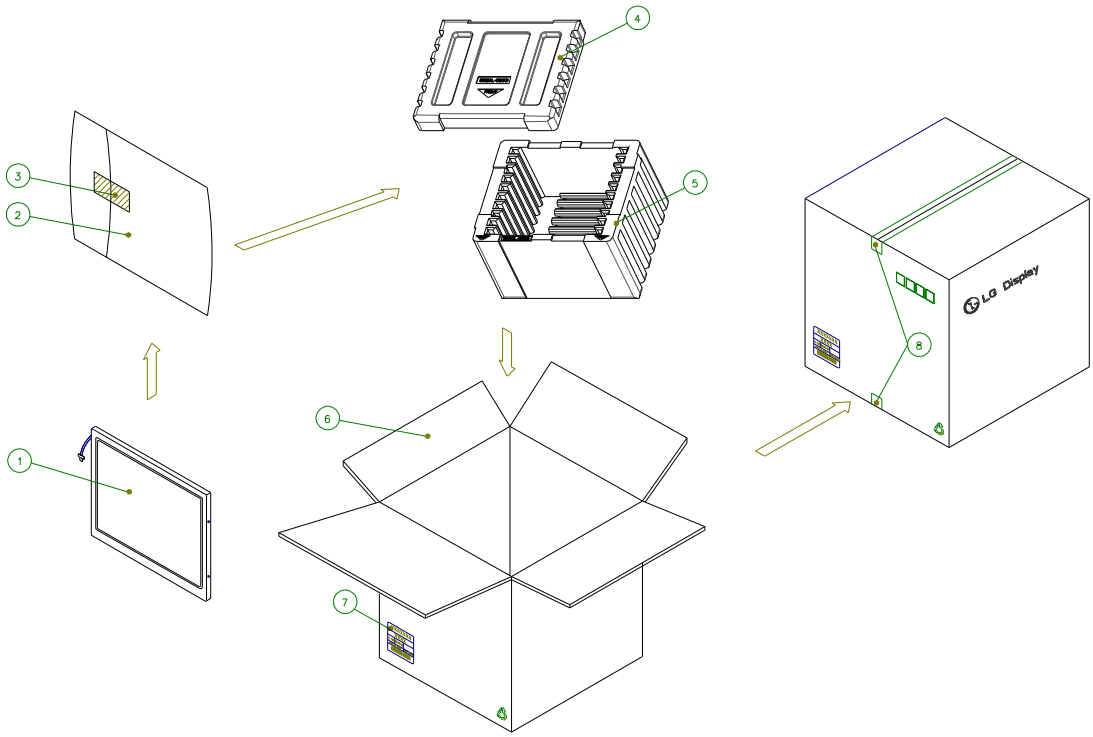
### 10.1. Carton

(1) Packing Form

Corrugated cardboard box and EPS Packing

(2) Packing Method

Packing Material : EPS (Expanded Polystyrene)
Packing Weight: : 1.3Kg
(1Box/20Module)
Packing weight, 20 pcs modules included :12.3kg




| NO. | Description | Material |
|---|---|---|
| 1 | Module | LP154WX4-TLC9 |
| 2 | Bag | PE 240x400 |
| 3 | Tape | Masking 20mmx100M |
| 4 | Packing Bottom | EPS(Gravity0.0185) |
| 5 | Packing Top | EPS(Gravity0.0185) |
| 6 | Box | SWR4 431x363x330 |
| 7 | Label | Art paper 80g |
| 8 | Tape | OPP 70mmx300M |

(3) Packing Specification

| Item | Conditions |
|---|---|
| Packing Vibration | Random=1.50Grms, Non-Operating LCM, To driving way / 1hr |
| Packing Drop Test | Refer to below table |

Vibration frequency

| Hz | $G^2$/Hz(PSD) |
|---|---|
| 3 | 0.0001 |
| 10 | 0.0024 |
| 18 | 0.0024 |
| 27 | 0.02 |
| 54 | 0.02 |
| 100 | 0.0015 |
| 150 | 0.0015 |
| 200 | 0.01 |
| 250 | 0.01 |
| 300 | 0.01 |

| | |
|---|---|
| Bottom side | drop test, repeat 3x.<br>Drop height according table. |
| Left side | drop test from 0.30 m |
| Front side | drop test from 0.30 m |
| Right side | drop test from 0.30 m |
| Rear side | drop test from 0.30 m |
| Top side | drop test from 0.30 m |

Drop Height

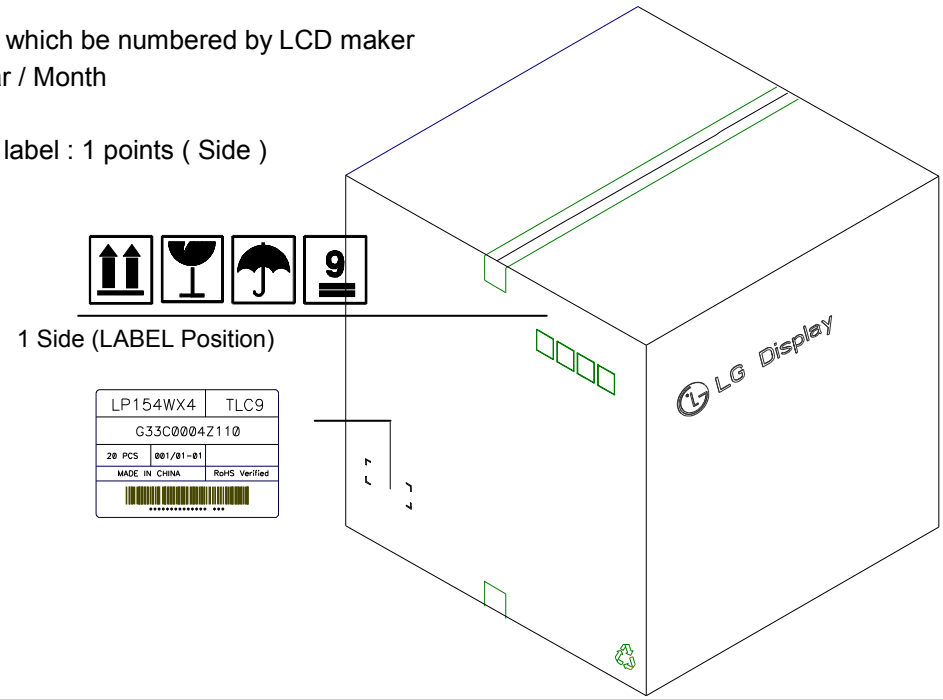
| Mass [kg] | Height [cm] | Mass [kg] | Height [cm] |
|---|---|---|---|
| 1 | 70 | 15 | 43 |
| 2 | 70 | 16 | 42 |
| 3 | 67 | 17 | 41 |
| 4 | 63 | 18 | 40 |
| 5 | 60 | 19 | 39 |
| 6 | 57 | 20 | 38 |
| 7 | 55 | 21 | 38 |
| 8 | 53 | 22 | 37 |
| 9 | 51 | 23 | 37 |
| 10 | 49 | 24 | 36 |
| 11 | 48 | 25 | 36 |
| 12 | 46 | 26 | 36 |
| 13 | 45 | 27 | 36 |
| 14 | 44 | 28 – 50 | 35 |

(4) Package Label

Package label should be at least shown the following information.

a) TOSHIBA code name(G33C0004Z110) 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 : 1 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 (G33C0004Z110) 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 : SIZE(INCH)
D : YEAR
E : MONTH
F ~ M : SERIAL NO.

Note

1. YEAR

| Year | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 |
|---|---|---|---|---|---|---|---|---|---|---|
| Mark | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 |

2. MONTH

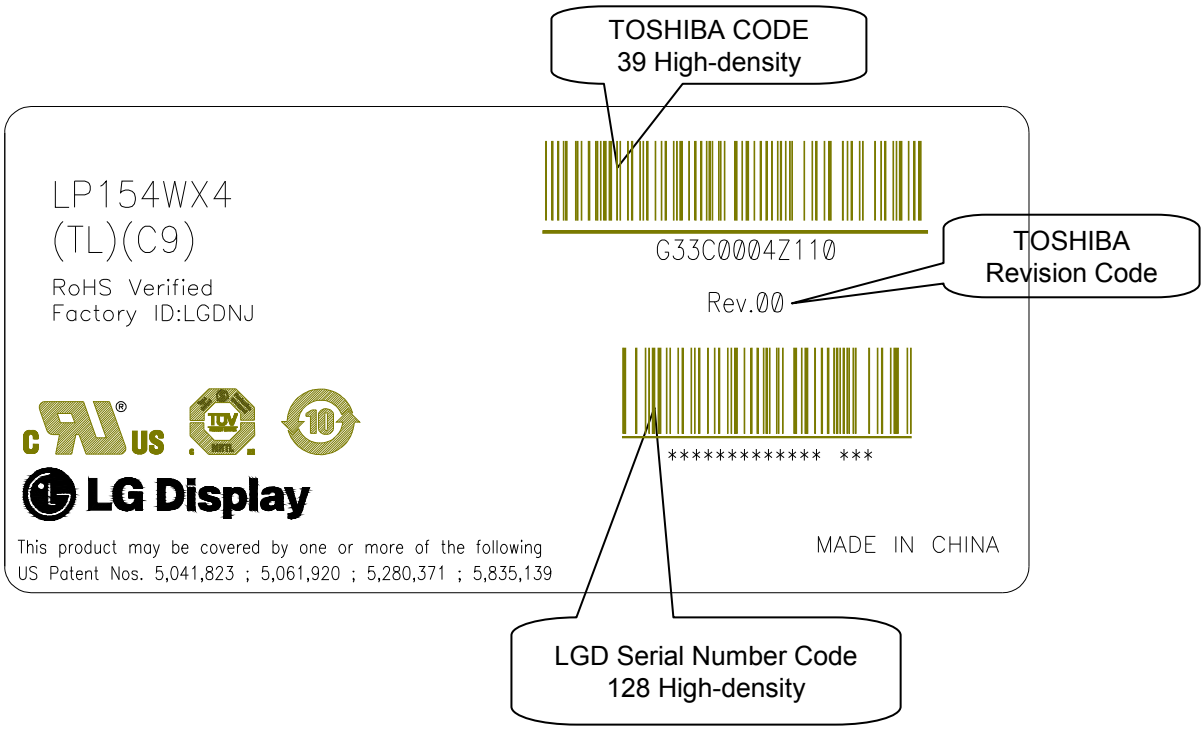
| Month | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mark | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | A | B | C |

b) Location of Lot Mark

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.

Example >

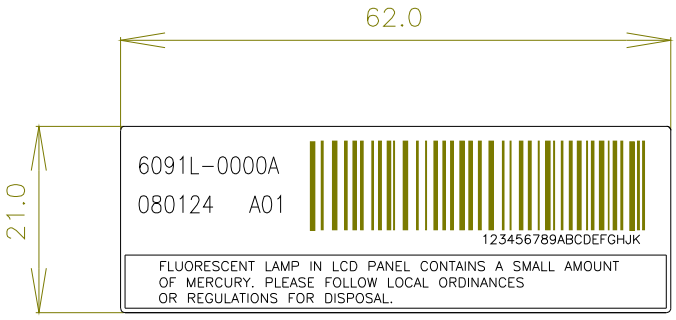
LABEL : 78mm X 37mm



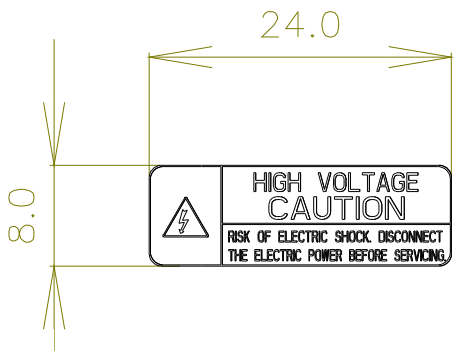

The revision code is inserted in the label by Toshiba request. If the contents of the specification need to be change under mass-production, the code can be revised after Toshiba's approval. Although there is not items in the contents of the specification, Toshiba can requests LGD to change the revision code.

## 11.2. Caution Texture and Labels on LCD

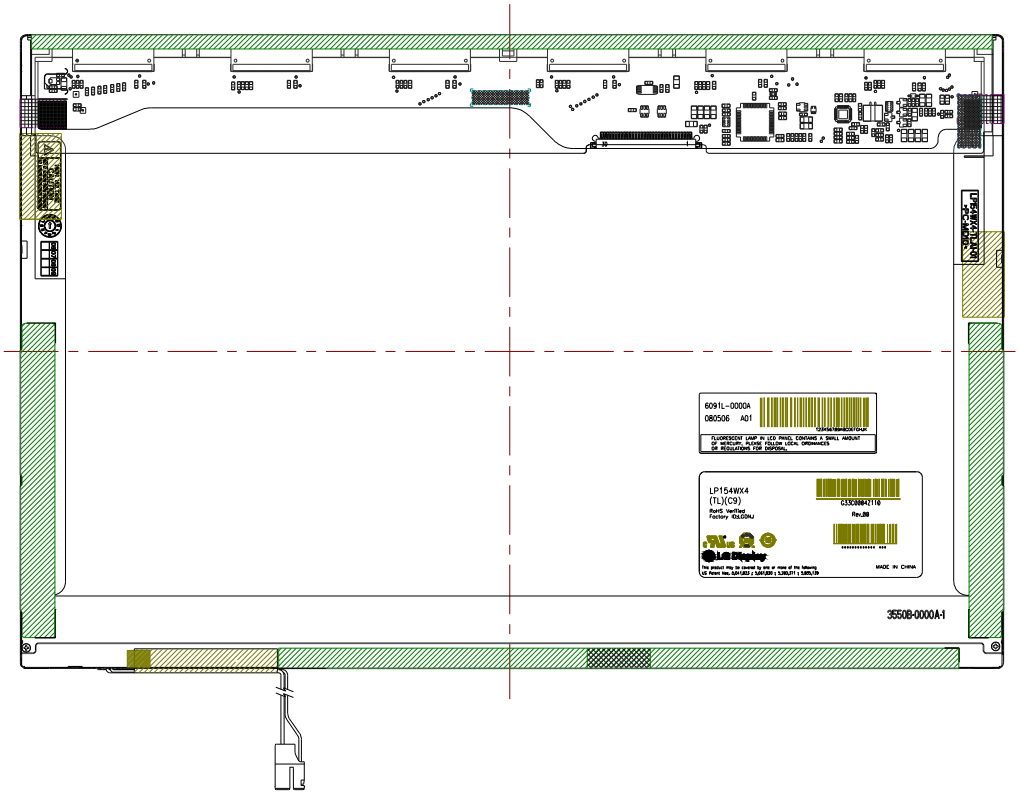
[Disposal of CCFL]




[High Voltage]



## 11.3. Label Locations on LCD



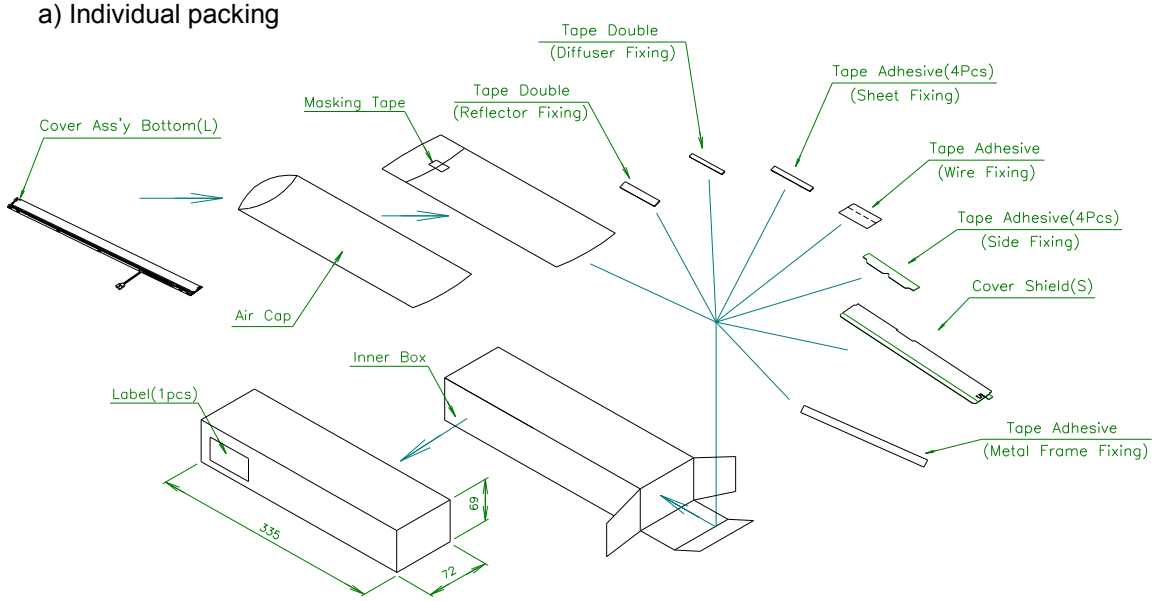

## 11.4. Others

(1) Backlight repair parts kit : 6913L-0379K (G33C0004Z110001)

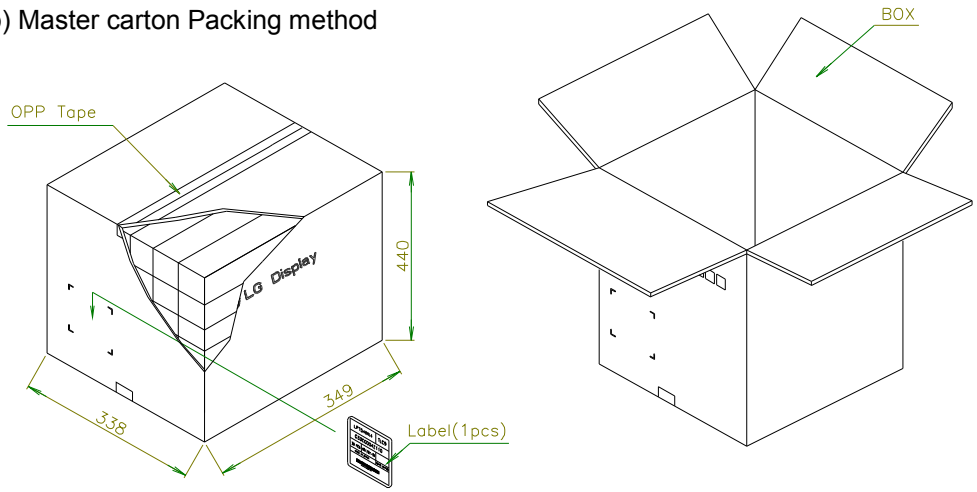
| No. | Part | Product Code | Maker | Qt'y | Note |
|---|---|---|---|---|---|
| 1 | Cover Ass'y Bottom | 3550B-0252A | Sung an/Han sung | 1 | |
| 2 | Cover Shield(S) | 3550S-0615A | Geo rim | 1 | |
| 3 | Tape Adhesive | 7250L-0116B | Geo rim | 1 | |
| 4 | Tape Adhesive | 7250L-0080G | Geo rim | 2 | |
| 5 | Tape Adhesive | 7250L-0077A | Geo rim | 1 | |
| 6 | Tape Adhesive | 7250L-0082C | Hwa sung | 2 | |
| 7 | Lamp | 6912L-0153E | HTL | 1 | |

(2) Package specification of Backlight repair parts kit

a) Individual packing

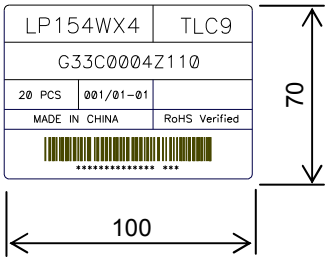



b) Master carton Packing method




[6(V) X 5(H) = 30 Boxes Inner]

c) Label



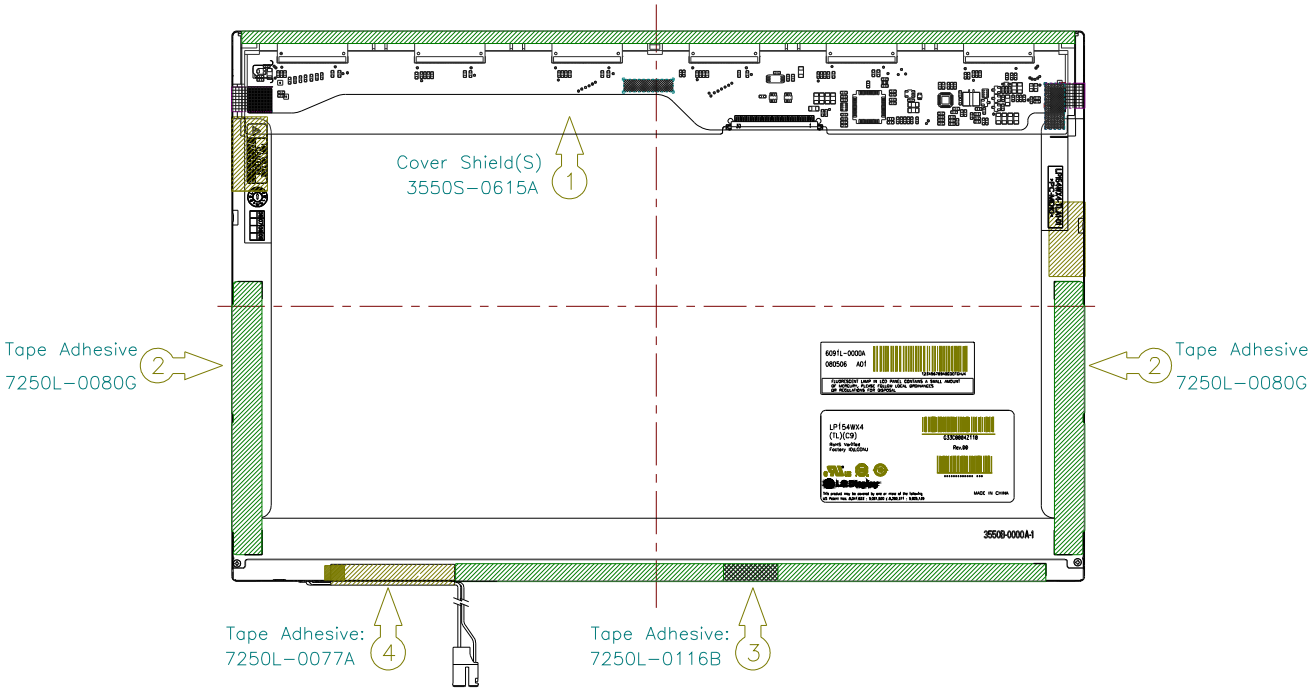
## 11.5. Instruction of changing the Lamp parts - Lamp Ass'y Exchange process

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

(1) ① Disassembly of 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 Disassembly of Tape Adhesive used for Top case fixing.(2Pcs)
Caution: Pressure or stress should not be given on Top case during this process.

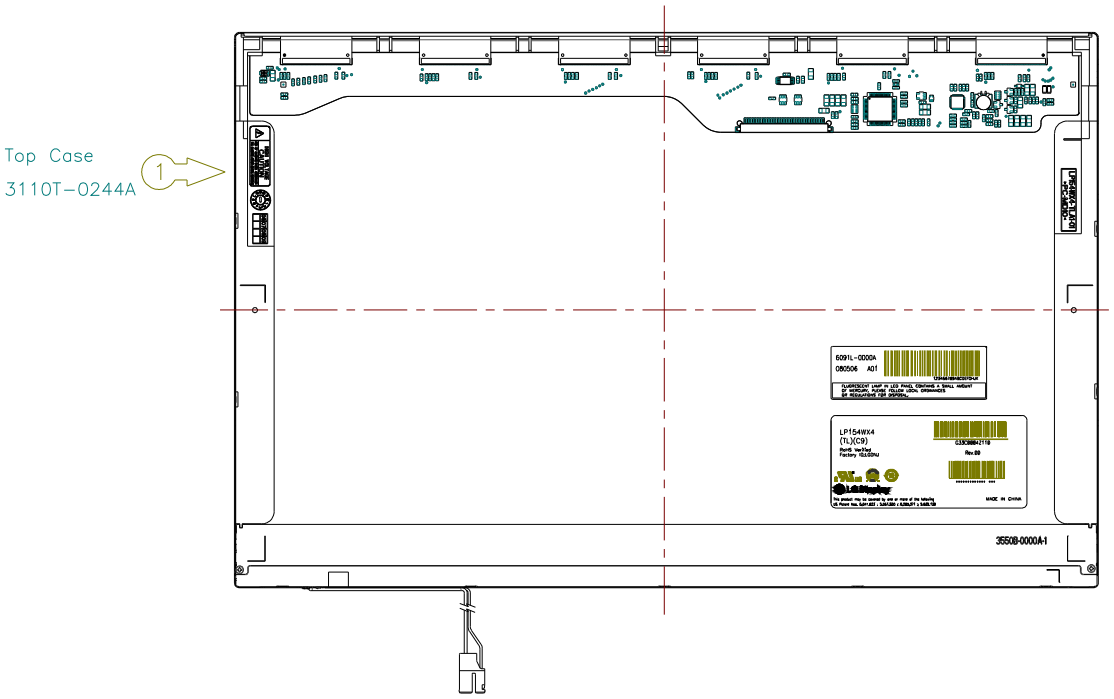
(3) ③ Disassembly of Tape Adhesive used for Top case fixing.
④ Disassembly of Tape Adhesive used for B/L Wire fixing.
Caution: Pressure or stress should not be given on Top case during this process.



11.5.2. Disassembly of Top Case

(1) ① Disassembly of Top Case

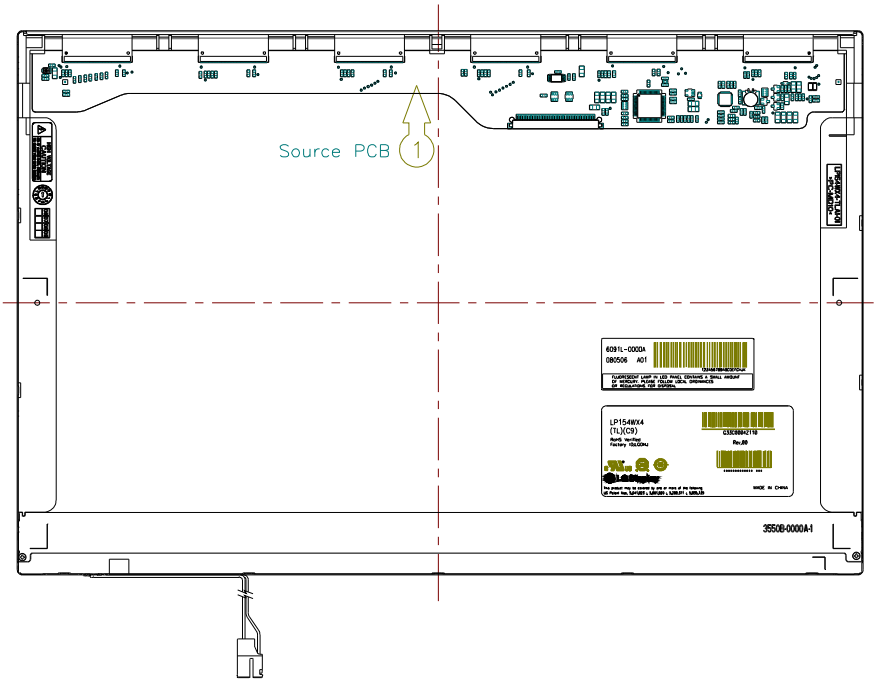
Caution: Pressure or stress should not be given on Source COF.



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 Case top, Board Ass'y, Tape Adhesive, Light guide, Cover Ass'y

(1) ① Disassembly of Case top

(2) ② 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.

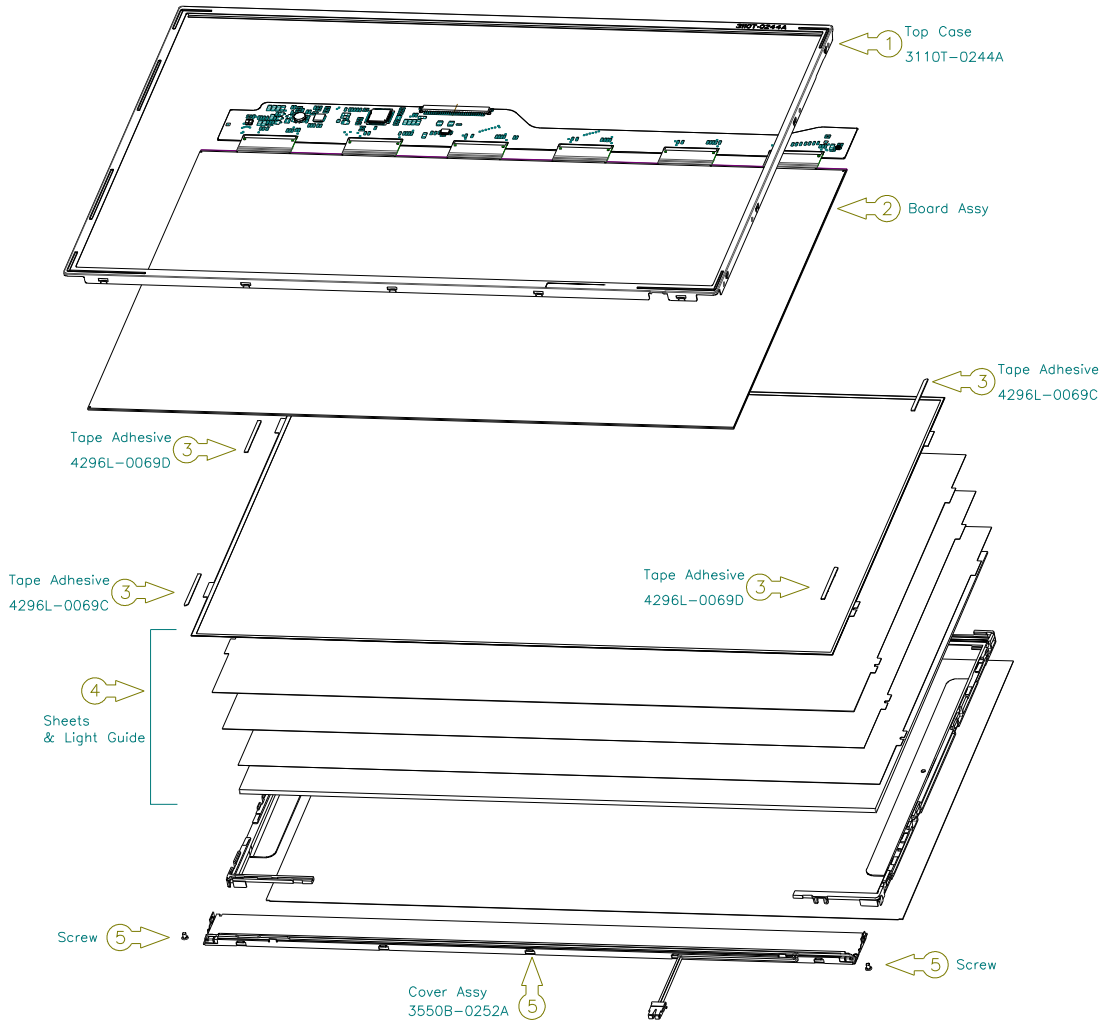
(3) ③ Disassembly of Tape Adhesive used for Sheets fixing (4Point).

(4) ④ Disassembly of Sheets, Light guide.

Caution: No penetration of foreign body is indispensable with no scratch on the surface of each Sheets.

(5) ⑤ Disassembly of Screw(2Point) and Cover Ass'y

Caution: Maximum value of torque with Screw should be below 1.5kg.



11.5.5. Assembly of Cover Ass'y, Sheets, Light guide, Tape Adhesive, Board Ass'y and Case top.

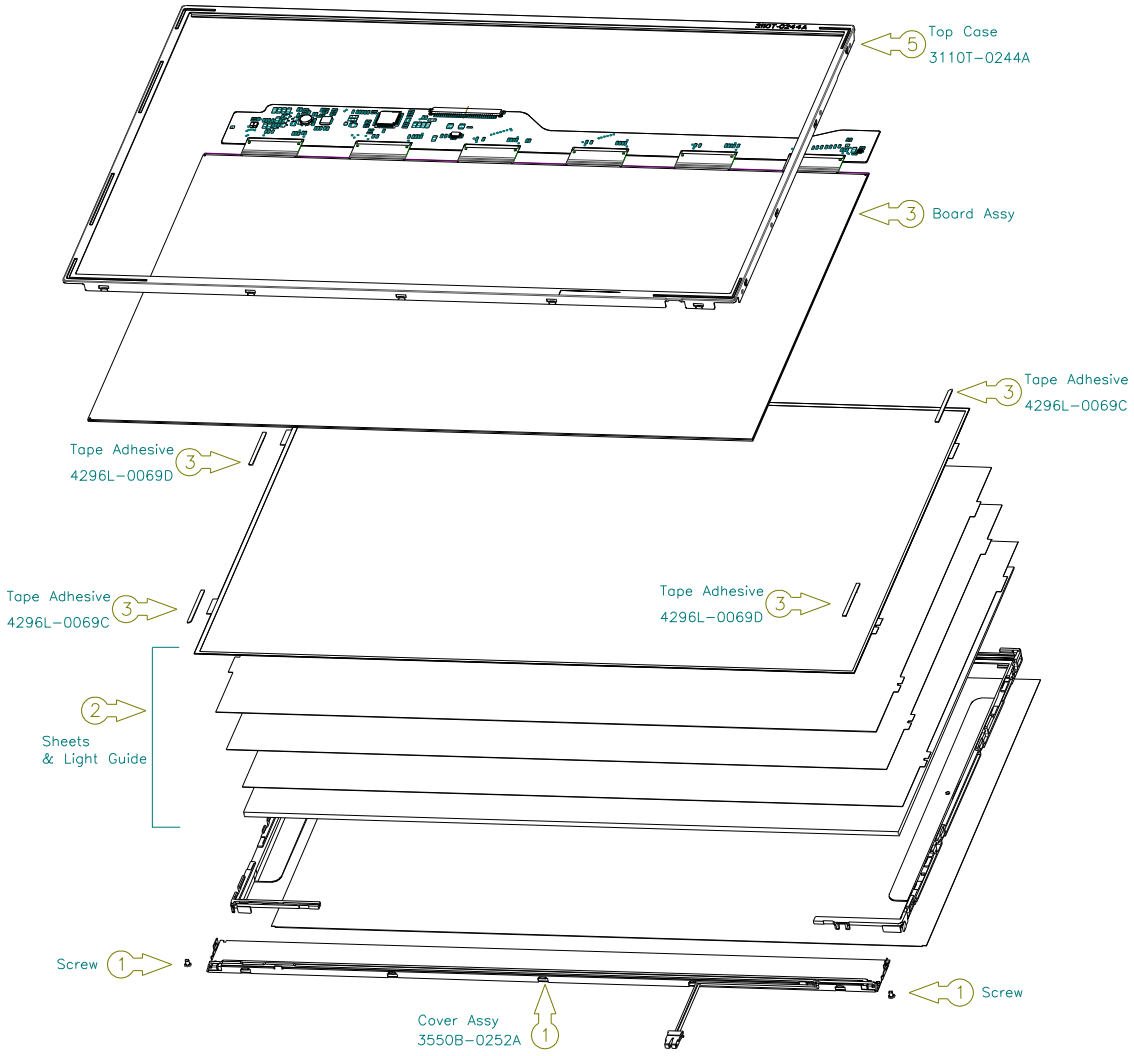
(1) ① Assembly of Cover Ass'y and Screw(2Point).
Caution: Maximum value of torque with Screw should be below 2.0kgf.cm

(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.

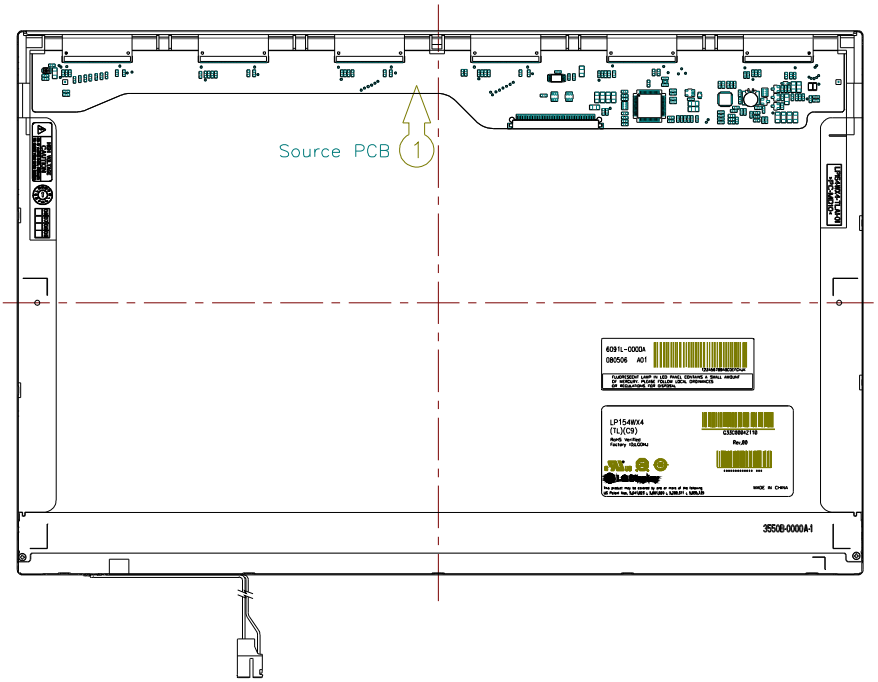
(5) ⑤ Assembly of Case top



11.5.6. Assembly of Source PCB

(1) ① Assembly of Source PCB.

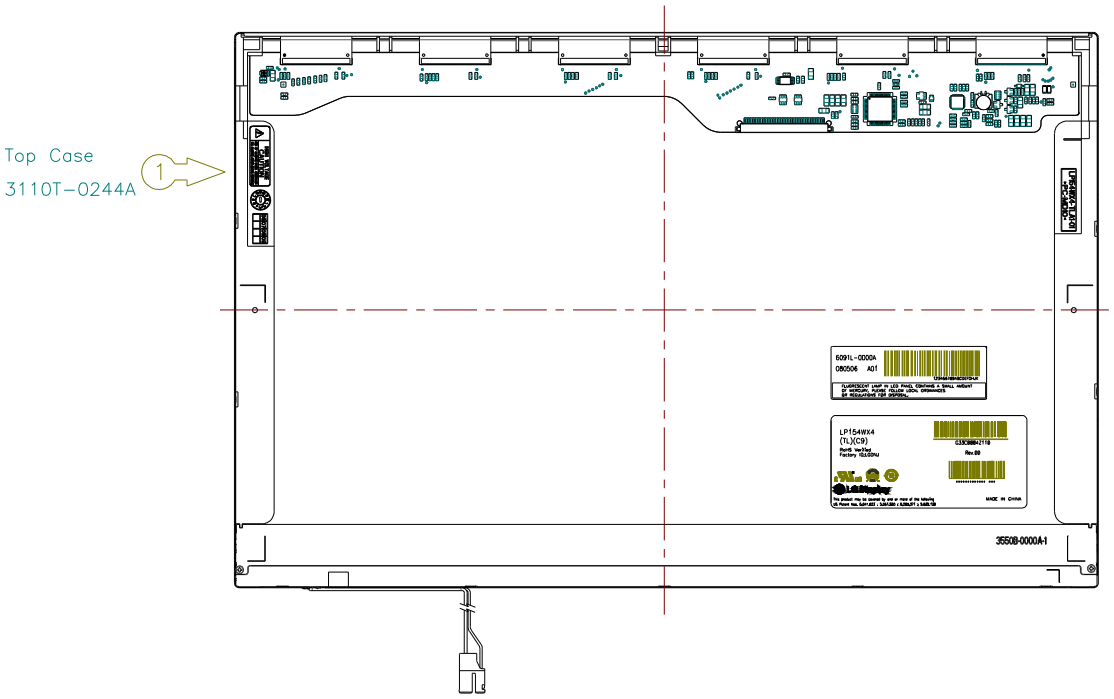
Caution: Stress should not be given on COF.



11.5.7. Assembly of Top Case

(1) ① Assembly of Top Case.

Caution: Pressure should not be given on Source COF.



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.

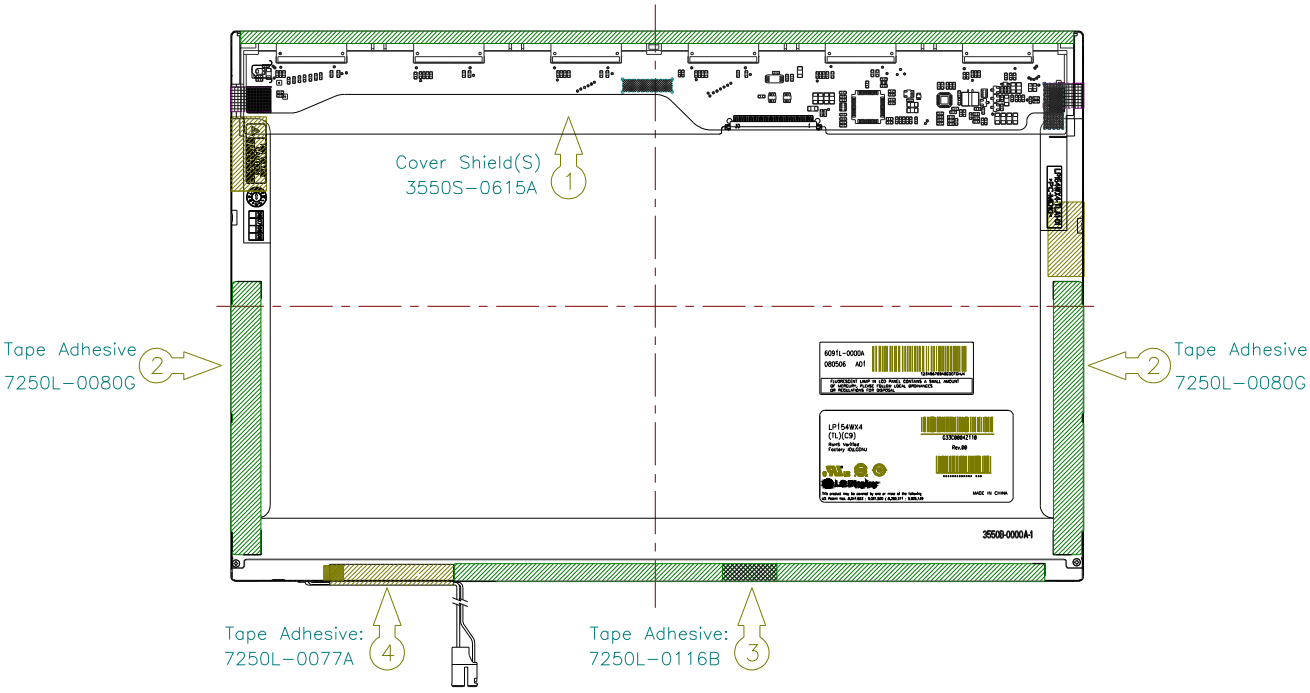
(2) ② Assembly of Tape Adhesive used for Top case fixing.

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

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

④ Assembly of Tape Adhesive used for B/L Wire fixing

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



## 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 polarlizer 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 A. Enhanced Extended Display Identification Data (EEDID™) 1/3

## EDID Data for LP154WX4-TLC9

| | Byte (Dec) | Byte (Hex) | Field Name and Comments | Value (Hex) |
|---|---|---|---|---|
| *Header* | 0 | 00 | Header | 00 |
| | 1 | 01 | Header | FF |
| | 2 | 02 | Header | FF |
| | 3 | 03 | Header | FF |
| | 4 | 04 | Header | FF |
| | 5 | 05 | Header | FF |
| | 6 | 06 | Header | FF |
| | 7 | 07 | Header | 00 |
| *Vendor / Product Version EDID* | 8 | 08 | EISA manufacture code ( 3 Character ID ) LPL | 32 |
| | 9 | 09 | EISA manufacture code (Compressed ASCII ) | 0C |
| | 10 | 0A | Panel Supplier Reserved - Product Code AB00h | 00 |
| | 11 | 0B | ( Hex. LSB first ) | AB |
| | 12 | 0C | LCD Module Serial No - Preferred but Optional ("0" If not used) | 00 |
| | 13 | 0D | LCD Module Serial No - Preferred but Optional ("0" If not used) | 00 |
| | 14 | 0E | LCD Module Serial No - Preferred but Optional ("0" If not used) | 00 |
| | 15 | 0F | LCD Module Serial No - Preferred but Optional ("0" If not used) | 00 |
| | 16 | 10 | Week of Manufacture 0 weeks | 00 |
| | 17 | 11 | Year of Manufacture 2008years | 12 |
| | 18 | 12 | EDID structure version # = 1 | 01 |
| | 19 | 13 | EDID revision # = 3 | 03 |
| *Display Parameters* | 20 | 14 | Video input Definition = Digital signal | 80 |
| | 21 | 15 | Max H image size (Rounded cm) = 33 cm | 21 |
| | 22 | 16 | Max V image size (Rounded cm) = 21 cm | 15 |
| | 23 | 17 | Display gamma = (gamma*100)-100 = Example:(2.2*100)-100=120 = 2.2 Gamma | 78 |
| | 24 | 18 | Feature Support (no_DPMS, no_Active Off/Very Low Power, RGB color display, Timing BLK 1,no_ GTF) | 0A |
| *Panel Color Coordinates* | 25 | 19 | Red/Green Low Bits (RxRy/GxGy) | 14 |
| | 26 | 1A | Blue/White Low Bits (BxBy/WxWy) | 65 |
| | 27 | 1B | Red X Rx = 0.594 | 98 |
| | 28 | 1C | Red Y Ry =0.349 | 59 |
| | 29 | 1D | Green X Gx = 0.325 | 53 |
| | 30 | 1E | Green Y Gy =0.543 | 8B |
| | 31 | 1F | Blue X Bx = 0.157 | 28 |
| | 32 | 20 | Blue Y By = 0.139 | 23 |
| | 33 | 21 | White X Wx =0.313 | 50 |
| | 34 | 22 | White Y Wy =0.329 | 54 |
| *Established Timings* | 35 | 23 | Established timing 1 (00h if not used) | 00 |
| | 36 | 24 | Established timing 2 (00h if not used) | 00 |
| | 37 | 25 | Manufacturer's timings (00h if not used) | 00 |
| *Standard Timing ID* | 38 | 26 | Standard timing ID1 (01h if not used) | 01 |
| | 39 | 27 | Standard timing ID1 (01h if not used) | 01 |
| | 40 | 28 | Standard timing ID2 (01h if not used) | 01 |
| | 41 | 29 | Standard timing ID2 (01h if not used) | 01 |
| | 42 | 2A | Standard timing ID3 (01h if not used) | 01 |
| | 43 | 2B | Standard timing ID3 (01h if not used) | 01 |
| | 44 | 2C | Standard timing ID4 (01h if not used) | 01 |
| | 45 | 2D | Standard timing ID4 (01h if not used) | 01 |
| | 46 | 2E | Standard timing ID5 (01h if not used) | 01 |
| | 47 | 2F | Standard timing ID5 (01h if not used) | 01 |
| | 48 | 30 | Standard timing ID6 (01h if not used) | 01 |
| | 49 | 31 | Standard timing ID6 (01h if not used) | 01 |
| | 50 | 32 | Standard timing ID7 (01h if not used) | 01 |
| | 51 | 33 | Standard timing ID7 (01h if not used) | 01 |
| | 52 | 34 | Standard timing ID8 (01h if not used) | 01 |
| | 53 | 35 | Standard timing ID8 (01h if not used) | 01 |

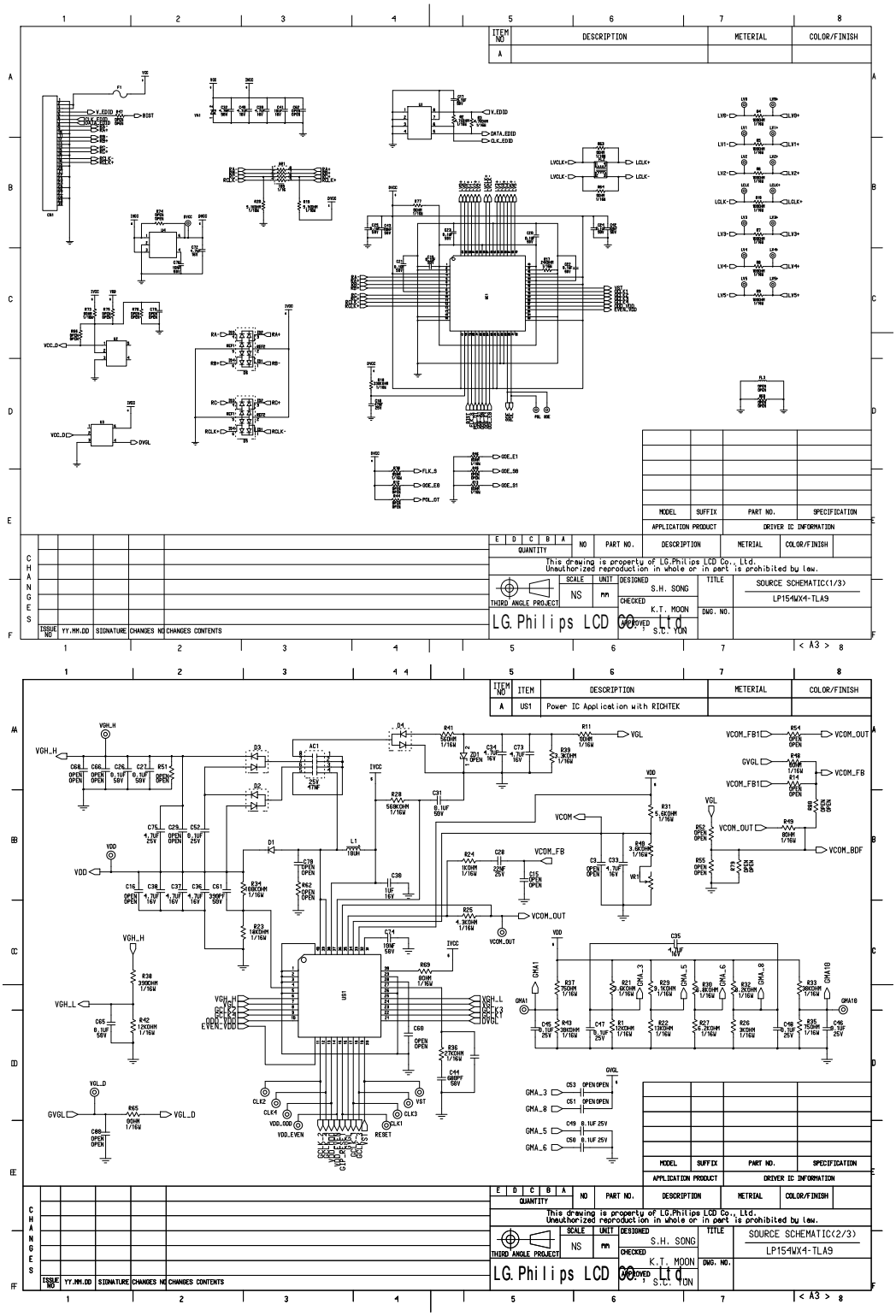
# APPENDIX A. Enhanced Extended Display Identification Data (EEDID™) 2/3

| | | | | |
|---|---|---|---|---|
| *Timing Descriptor #1* | 54 | **36** | Pixel Clock/10,000 (LSB) 69.3 MHz @ 59.98Hz | **12** |
| | 55 | **37** | Pixel Clock/10,000 (MSB) | **1B** |
| | 56 | **38** | Horizontal Active (lower 8 bits) 1280 Pixels | **00** |
| | 57 | **39** | Horizontal Blanking(Thp-HA) (lower 8 bits) 136 Pixels | **88** |
| | 58 | **3A** | Horizontal Active / Horizontal Blanking(Thp-HA) (upper 4:4bits) | **50** |
| | 59 | **3B** | Vertical Avtive 800 Lines | **20** |
| | 60 | **3C** | Vertical Blanking (Tvp-HA) (DE Blanking typ.for DE only panels) 16 Lines | **10** |
| | 61 | **3D** | Vertical Active : Vertical Blanking (Tvp-HA) (upper 4:4bits) | **30** |
| | 62 | **3E** | Horizontal Sync. Offset (Thfp) 48 Pixels | **30** |
| | 63 | **3F** | Horizontal Sync Pulse Width (HSPW) 24 Pixels | **18** |
| | 64 | **40** | Vertical Sync Offset(Tvfp) : Sync Width (VSPW) 3 Lines : 6 Lines | **36** |
| | 65 | **41** | Horizontal Vertical Sync Offset/Width (upper 2bits) | **00** |
| | 66 | **42** | Horizontal Image Size (mm) 331 mm | **4B** |
| | 67 | **43** | Vertical Image Size (mm) 207 mm | **CF** |
| | 68 | **44** | Horizontal Image Size / Vertical Image Size | **10** |
| | 69 | **45** | Horizontal Border = 0 (Zero for Notebook LCD) | **00** |
| | 70 | **46** | Vertical Border = 0 (Zero for Notebook LCD) | **00** |
| | 71 | **47** | Non-Interlace, Normal display, no stereo, Digital Separate ( Vsync_NEG, Hsync_NEG ), DE only note : LSB is set to '1' if panel is DE-timing only. H/V can be ignored. | **19** |
| *Timing Descriptor #2* | 72 | **48** | Flag | **00** |
| | 73 | **49** | Flag | **00** |
| | 74 | **4A** | Flag | **00** |
| | 75 | **4B** | Data Type Tag (Monitor Name, stored as ASCII ) | **FC** |
| | 76 | **4C** | Flag | **00** |
| | 77 | **4D** | Panel supplier P/N #1 = L | **4C** |
| | 78 | **4E** | Panel supplier P/N #2 = P | **50** |
| | 79 | **4F** | Panel supplier P/N #3 = 1 | **31** |
| | 80 | **50** | Panel supplier P/N #4 = 5 | **35** |
| | 81 | **51** | Panel supplier P/N #5 = 4 | **34** |
| | 82 | **52** | Panel supplier P/N #6 = W | **57** |
| | 83 | **53** | Panel supplier P/N #7 = X | **58** |
| | 84 | **54** | Panel supplier P/N #8 = 4 | **34** |
| | 85 | **55** | Panel supplier P/N #9 = - | **2D** |
| | 86 | **56** | Panel supplier P/N #10 = T | **54** |
| | 87 | **57** | Panel supplier P/N #11 = L | **4C** |
| | 88 | **58** | Panel supplier P/N #12 = C | **43** |
| | 89 | **59** | Panel supplier P/N #13 = 9 | **39** |
| *Timing Descriptor #3* | 90 | **5A** | Flag | **00** |
| | 91 | **5B** | Flag | **00** |
| | 92 | **5C** | Flag | **00** |
| | 93 | **5D** | Data Type Tag ( Monitor Range limits, Binary coded ) | **FD** |
| | 94 | **5E** | Flag | **00** |
| | 95 | **5F** | Min. Vertical (for interlace this refers to field rate) Binary coded rate in Hz., interger only = 54.45 Hz | **36** |
| | 96 | **60** | Max. Vertical (for interlace this refers to field rate) Binary coded rate in Hz., interger only = 62.99 Hz | **3E** |
| | 97 | **61** | Min. Horizontal in KHz., integer only, binary coded = 46.82 KHz | **2F** |
| | 98 | **62** | Max. Horizontal in KHz., integer only, binary coded = 50.96 KHz | **32** |
| | 99 | **63** | Max. Supported Pixel Clock(Manufacturer's defn.) Binary coded clock rate in MHz/10 e.g. 130MHz is 0Dh = 76 MHz | **07** |
| | 100 | **64** | VESA GTF Reserved, set = 00h if unused for GTF | **00** |
| | 101 | **65** | VESA GTF Reserved, set = 0Ah if unused for GTF | **0A** |
| | 102 | **66** | VESA GTF Reserved, set = 20h if unused for GTF | **20** |
| | 103 | **67** | VESA GTF Reserved, set = 20h if unused for GTF | **20** |
| | 104 | **68** | VESA GTF Reserved, set = 20h if unused for GTF | **20** |
| | 105 | **69** | VESA GTF Reserved, set = 20h if unused for GTF | **20** |
| | 106 | **6A** | VESA GTF Reserved, set = 20h if unused for GTF | **20** |
| | 107 | **6B** | VESA GTF Reserved, set = 20h if unused for GTF | **20** |

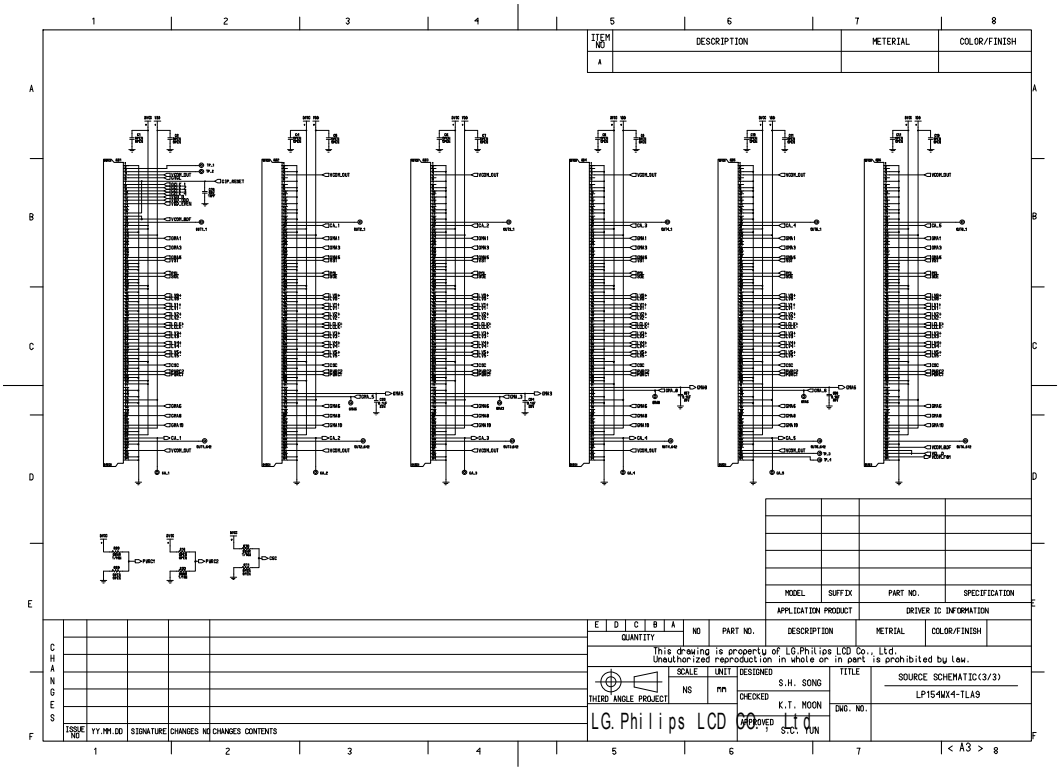
## APPENDIX A. Enhanced Extended Display Identification Data (EEDID™) 3/3

| | | | | | |
|---|---|---|---|---|---|
| *Timing Descriptor #4* | 108 | **6C** | Flag | | **00** |
| | 109 | **6D** | Flag | | **00** |
| | 110 | **6E** | Flag | | **00** |
| | 111 | **6F** | Data Type Tag ( ASCII String ) | | **FE** |
| | 112 | **70** | Flag | | **00** |
| | 113 | **71** | Panel supplier P/N #1 = | L | **4C** |
| | 114 | **72** | Panel supplier P/N #2 = | P | **50** |
| | 115 | **73** | Panel supplier P/N #3 = | 1 | **31** |
| | 116 | **74** | Panel supplier P/N #4 = | 5 | **35** |
| | 117 | **75** | Panel supplier P/N #5 = | 4 | **34** |
| | 118 | **76** | Panel supplier P/N #6 = | W | **57** |
| | 119 | **77** | Panel supplier P/N #7 = | X | **58** |
| | 120 | **78** | Panel supplier P/N #8 = | 4 | **34** |
| | 121 | **79** | Panel supplier P/N #9 = | - | **2D** |
| | 122 | **7A** | Panel supplier P/N #10 = | T | **54** |
| | 123 | **7B** | Panel supplier P/N #11 = | L | **4C** |
| | 124 | **7C** | Panel supplier P/N #12 = | C | **43** |
| | 125 | **7D** | Panel supplier P/N #13 = | 9 | **39** |
| *Chec* | 126 | **7E** | Extension flag (# of optional 128 panel ID extension block to follow, Typ = 0) | | **00** |
| | 127 | **7F** | Check Sum (The 1-byte sum of all 128 bytes in this panel ID block shall = 0) | | **01** |

## APPENDIX B. Schematics of Circuit 1/2

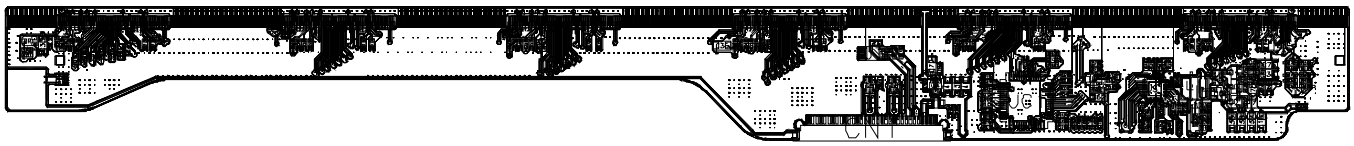


## APPENDIX B. Schematics of Circuit 2/2

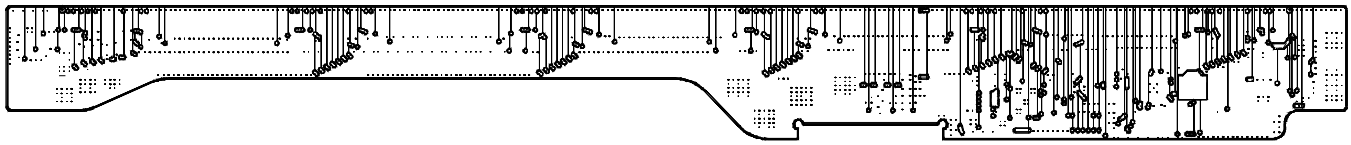


**APPENDIX C. PCB layout of Circuit**

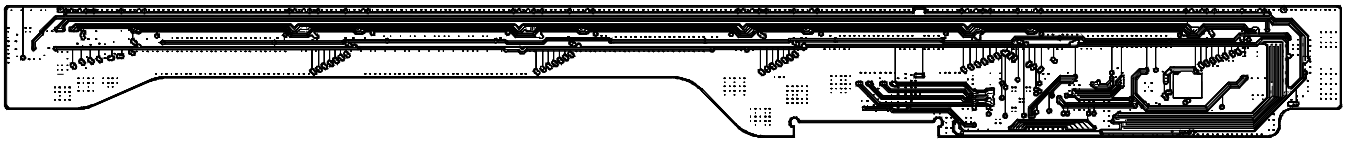
-1 Layer



-2 Layer



-3 Layer



-4 Layer