



LC320DXY

Product Specification

# SPECIFICATION FOR APPROVAL

- ( ● ) Preliminary Specification  
(   ) Final Specification

|       |                    |          |                      |
|-------|--------------------|----------|----------------------|
| Title | 32.0" WXGA TFT LCD |          |                      |
| BUYER |                    | SUPPLIER | LG.Display Co., Ltd. |
| MODEL |                    | *MODEL   | LC320DXY             |
|       |                    | SUFFIX   | SHAA (RoHS Verified) |

| APPROVED BY | SIGNATURE | DATE |
|-------------|-----------|------|
| /           |           |      |
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| /           |           |      |

Please return 1 copy for your confirmation with your signature and comments.

| APPROVED BY                       | SIGNATURE | DATE |
|-----------------------------------|-----------|------|
| Jinho KIM / Team Leader           |           |      |
| <b>REVIEWED BY</b>                |           |      |
| ByungHoon Kim<br>/ Project Leader |           |      |
| <b>PREPARED BY</b>                |           |      |
| Sucheol Lee / Engineer            |           |      |

**TV Products Development Dept.  
LG. Display LCD Co., Ltd**

## Product Specification

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## RECORD OF REVISIONS

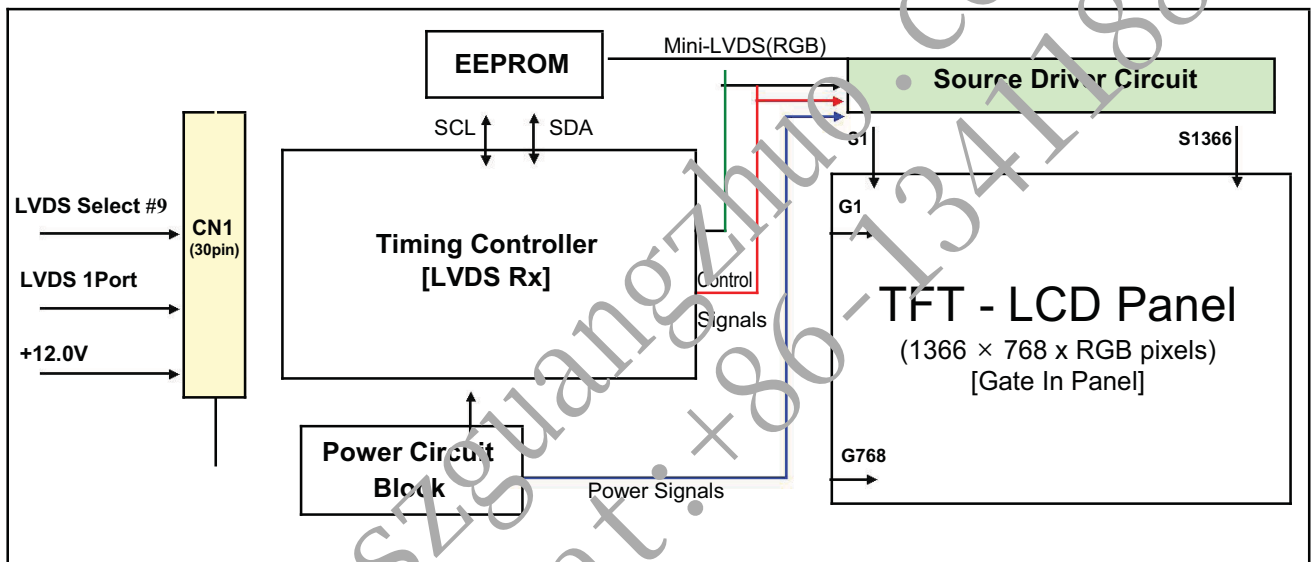
[illegible]

## Product Specification

## 1. General Description

The LC320DDXY is a Color Active Matrix Liquid Crystal Display with an integral the Source PCB and Gate implanted on Panel (GIP). The matrix employs a-Si Thin Film Transistor as the active element. It is a transmissive type display operating in the normally black mode. It has a 31.51 inch diagonally measured active display area with W XGA resolution (768 vertical by 1366 horizontal pixel array). Each pixel is divided into Red, Green and Blue sub-pixels or dots which are arranged in vertical stripes. Gray scale of the luminance of the sub-pixel color is determined with a 8-bit gray scale signal for each dot. Therefore, it can present a palette of more than 16.7M(6bit + FRC) colors.

It is intended to support LCD TV, PCTV where high brightness, super wide viewing angle, high color gamut, high color depth and fast response time are important.



## General Features

|                          |                                                                                                          |
|--------------------------|----------------------------------------------------------------------------------------------------------|
| Active Screen Size       | 31.51 inches(800.4mm) diagonal                                                                           |
| Outline Dimension        | 715.0(H) x 411.0 (V) x 1.3 mm(D) (Typ.)                                                                  |
| Pixel Pitch              | 170.25 $\mu\text{m}$ x 510.75 $\mu\text{m}$ x RGB                                                        |
| Pixel Format             | 1366 horiz. by 768 vert. Pixels, RGB stripe arrangement                                                  |
| Color Depth              | 8-bit (D), 16.7 M colors                                                                                 |
| Drive IC Data Interface  | Source D-IC : 6-bit mini-LVDS, gamma reference voltage, and control signals<br>Gate D-IC : Gate In Panel |
| Transmittance (With POL) | 6.45 % (Typ.)                                                                                            |
| Viewing Angle (CR>10)    | Viewing angle free ( R/L 178 (Min.), U/D 178 (Min.))                                                     |
| Weight                   | 0.86 Kg (Typ.)                                                                                           |
| Display Mode             | Transmissive mode, Normally black                                                                        |
| Surface Treatment (Top)  | Hard coating(2H), Anti-glare low reflection treatment of the front polarizer (Haze 3%(Typ.))             |

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## 2. Absolute Maximum Ratings

The following items are maximum values which, if exceeded, may cause faulty operation or permanent damage to the LCD module.

**Table 1. ABSOLUTE MAXIMUM RATINGS**

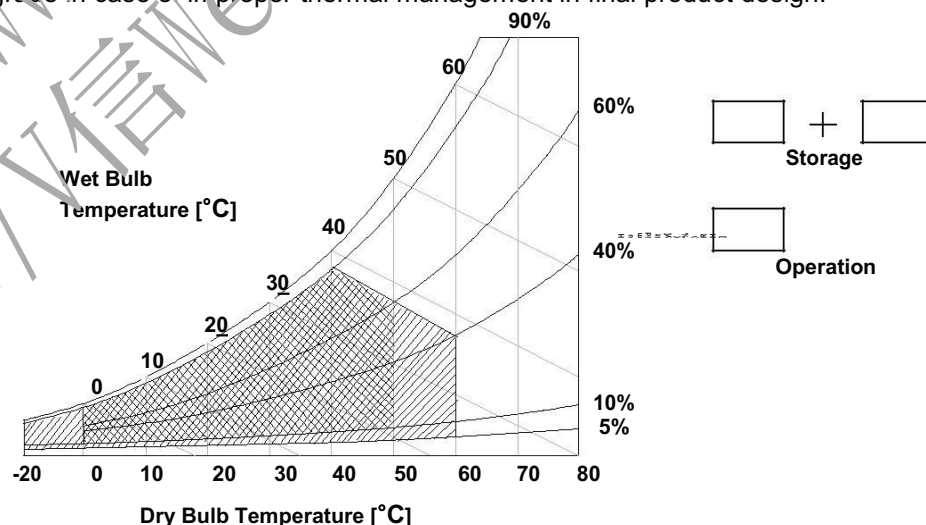
| Parameter                            |             | Symbol             | Value |       | Unit            | Note |
|--------------------------------------|-------------|--------------------|-------|-------|-----------------|------|
|                                      |             |                    | Min   | Max   |                 |      |
| Power Input Voltage                  | LCD Circuit | V <sub>LCD</sub>   | -0.3  | +14.0 | V <sub>DC</sub> | 1    |
| T-Con Option Selection Voltage       |             | V <sub>LOGIC</sub> | -0.3  | +4.0  | V <sub>DC</sub> |      |
| Operating Temperature                |             | T <sub>OP</sub>    | 0     | +50   | °C              | 2,3  |
| Storage Temperature(without packing) |             | T <sub>ST</sub>    | -20   | +60   | °C              |      |
| Panel Front Temperature              |             | T <sub>SUR</sub>   | -     | +60   | °C              | 4    |
| Operating Ambient Humidity           |             | H <sub>OP</sub>    | 10    | 90    | %RH             | 2,3  |
| Storage Humidity                     |             | H <sub>ST</sub>    | 5     | 90    | %RH             |      |

notes: 1. Ambient temperature condition (T<sub>a</sub> = 25 ± 2 °C)

2. Temperature and relative humidity range are shown in the figure below. Wet bulb temperature should be Max 30 °C and no condensation of water.

3. Gravity mura can be guaranteed below 40°C condition.

4. The maximum operating temperature is based on the test condition that the surface temperature of display area is less than or equal to 60 °C with LCD module alone in a temperature controlled chamber. Thermal management should be considered in final product design to prevent the surface temperature of display area from being over 68 °C. The range of operating temperature may degrade in case of improper thermal management in final product design.



## Product Specification

## 3. Electrical Specifications

## 3-1. Electrical Characteristics

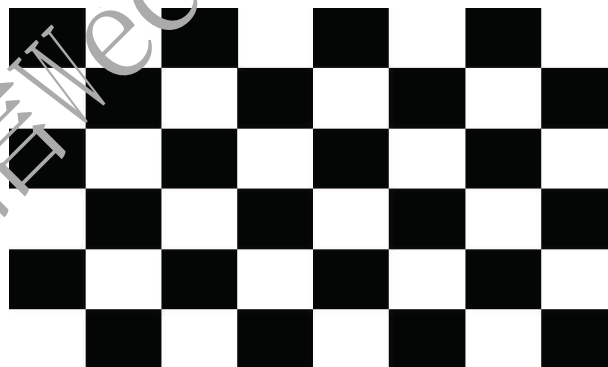
Table 2. ELECTRICAL CHARACTERISTICS

| Parameter           |                    | Symbol            | Value |      |      | Unit            | Note |
|---------------------|--------------------|-------------------|-------|------|------|-----------------|------|
|                     |                    |                   | Min   | Typ  | Max  |                 |      |
| Circuit :           |                    |                   |       |      |      |                 |      |
| Power Input Voltage |                    | V <sub>LCD</sub>  | 10.8  | 12.0 | 13.2 | V <sub>DC</sub> | 5    |
| Power Input Current |                    | I <sub>LCD</sub>  | -     | 240  | 273  | mA              | 1    |
|                     |                    |                   | -     | 250  | 225  | mA              | 2    |
| T-CON Option        | Input High Voltage | V <sub>IH</sub>   | 2.7   | -    | 3.6  | VDC             |      |
| Selection Voltage   | Input Low Voltage  | V <sub>IL</sub>   | 0     | -    | 0.7  | VDC             |      |
| Power Consumption   |                    | P <sub>LCD</sub>  |       | 2.5  | 3.3  | Watt            | 1    |
| Rush current        |                    | I <sub>RUSH</sub> | -     | -    | 4.0  | A               | 3    |

Note 1. The specified current and power consumption are under the V<sub>LCD</sub>=12.0V, Ta=25 ± 2°C, f<sub>v</sub>=60Hz condition, and mosaic pattern(6 x 6) is displayed and f<sub>v</sub> is the frame frequency.

2. The current is specified at the maximum current pattern.
3. The duration of rush current is about 2ms and rising time of power input is 0.5ms (min.).
4. Ripple voltage level is recommended under ± 5% of typical voltage
5. Maximum of Power Input Voltage is included with ripple.

White : 255 Gray  
Black : 0 Gray



Mosaic Pattern(8 x 6)

## Product Specification

## 3-2. Interface Connections

## 3-2-1. LCD Module

- LCD Connector(CN1) : FI-X30SSL-HF (Manufactured by JAE) or IS100-L30B-C23 (Manufactured by UJU)
- Mating Connector : FI-X30C2L (Manufactured by JAE) or Equivalent

Table 3. MODULE CONNECTOR(CN1) PIN CONFIGURATION

| Pin No. | Symbol      | Description                    | Note             |
|---------|-------------|--------------------------------|------------------|
| 1       | VLCD        | Power Supply +12.0V            | Appendix IV<br>4 |
| 2       | VLCD        | Power Supply +12.0V            |                  |
| 3       | VLCD        | Power Supply +12.0V            |                  |
| 4       | VLCD        | Power Supply +12.0V            |                  |
| 5       | GND         | Ground                         |                  |
| 6       | GND         | Ground                         |                  |
| 7       | GND         | Ground                         |                  |
| 8       | GND         | Ground                         |                  |
| 9       | LVDS Select | 'H' = JEIDA , 'L' or NC = VESA |                  |
| 10      | NC          | No Connection                  |                  |
| 11      | GND         | Ground                         |                  |
| 12      | RA-         | LVDS Receiver Signal(-)        |                  |
| 13      | RA+         | LVDS Receiver Signal(+)        |                  |
| 14      | GND         | Ground                         |                  |
| 15      | RB-         | LVDS Receiver Signal(-)        |                  |
| 16      | RB+         | LVDS Receiver Signal(+)        |                  |
| 17      | GND         | Ground                         |                  |
| 18      | RC-         | LVDS Receiver Signal(-)        |                  |
| 19      | RC+         | LVDS Receiver Signal(+)        |                  |
| 20      | GND         | Ground                         |                  |
| 21      | RCLK-       | LVDS Receiver Clock Signal(-)  |                  |
| 22      | RCLK+       | LVDS Receiver Clock Signal(+)  |                  |
| 23      | GND         | Ground                         |                  |
| 24      | RD-         | LVDS Receiver Signal(-)        |                  |
| 25      | RD+         | LVDS Receiver Signal(+)        |                  |
| 26      | GND         | Ground                         |                  |
| 27      | NC          | No Connection (Note 4)         | 4                |
| 28      | NC          | No Connection (Note 4)         | 4                |
| 29      | NC          | No Connection (Note 4)         | 4                |
| 30      | GND         | Ground                         |                  |

## Notes :

1. All GND (Ground) pins should be connected together to the LCD module's metal frame.
2. All V<sub>CD</sub> (power input) pins should be connected together.
3. All Input levels of LVDS signals are based on the EIA 644 Standard.
4. These pins are used only for LGD (Do not connect)
5. Specific pin No. #30 is used for "No signal detection" of system signal interface.  
It should be GND for NSB (No Signal Black) while the system interface signal is not.  
If this pin is "H", LCD Module displays AGP (Auto Generation Pattern).

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## 3-3. Signal Timing Specifications

Table 6 shows the signal timing required at the input of the LVDS transmitter. All of the interface signal timings should be satisfied with the following specification for normal operation.

Table 4. TIMING TABLE (DE Only Mode)

| ITEM       |                | Symbol          | Min          | Typ          | Max            | Unit             | Note |
|------------|----------------|-----------------|--------------|--------------|----------------|------------------|------|
| Horizontal | Display Period | t <sub>HV</sub> | -            | 1366         | -              | t <sub>clk</sub> |      |
|            | Blank          | t <sub>HB</sub> | 90           | 162          | 410            | t <sub>clk</sub> |      |
|            | Total          | t <sub>HP</sub> | 1456         | 1528         | 1776           | t <sub>clk</sub> |      |
| Vertical   | Display Period | t <sub>VV</sub> | -            | 768          | -              | t <sub>HP</sub>  |      |
|            | Blank          | t <sub>VB</sub> | 20<br>(126)  | 22<br>(180)  | (235)          | t <sub>HP</sub>  | 1    |
|            | Total          | t <sub>VP</sub> | 788<br>(894) | 790<br>(948) | 1008<br>(1063) | t <sub>HP</sub>  |      |

| ITEM      |            | Symbol           | Min        | Typ        | Max        | Unit | Note                                      |
|-----------|------------|------------------|------------|------------|------------|------|-------------------------------------------|
| Frequency | DCLK       | f <sub>CLK</sub> | 63.0       | 72.4       | 80.0       | MHz  |                                           |
|           | Horizontal | f <sub>H</sub>   | 45         | 47.4       | 55         | KHz  | 2                                         |
|           | Vertical   | f <sub>V</sub>   | 57<br>(47) | 60<br>(50) | 63<br>(53) | Hz   | 2<br>NTSC :<br>57~63Hz<br>(PAL : 47~53Hz) |

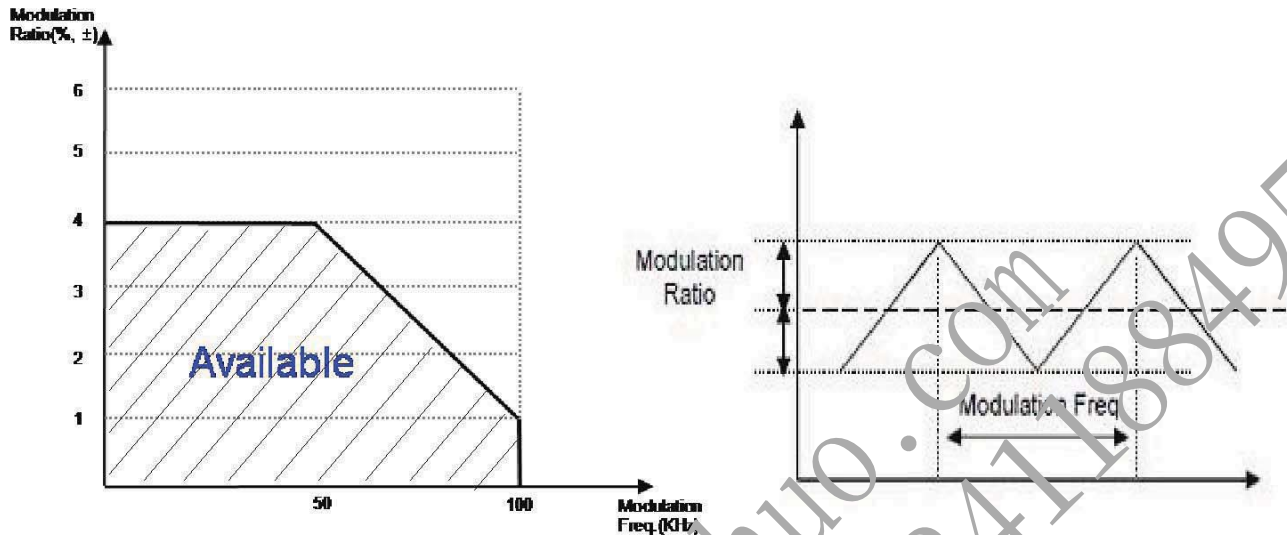
Note: 1. The input of H<sub>SYNC</sub> & V<sub>SYNC</sub> signal does not have an effect on normal operation (DE Only Mode).  
If you use spread spectrum of EMI, add some additional clock to minimum value for clock margin.

2. The performance of the electro-optical characteristics may be influenced by variance of the vertical refresh rate and the horizontal frequency

※ Timing should be set based on clock frequency.



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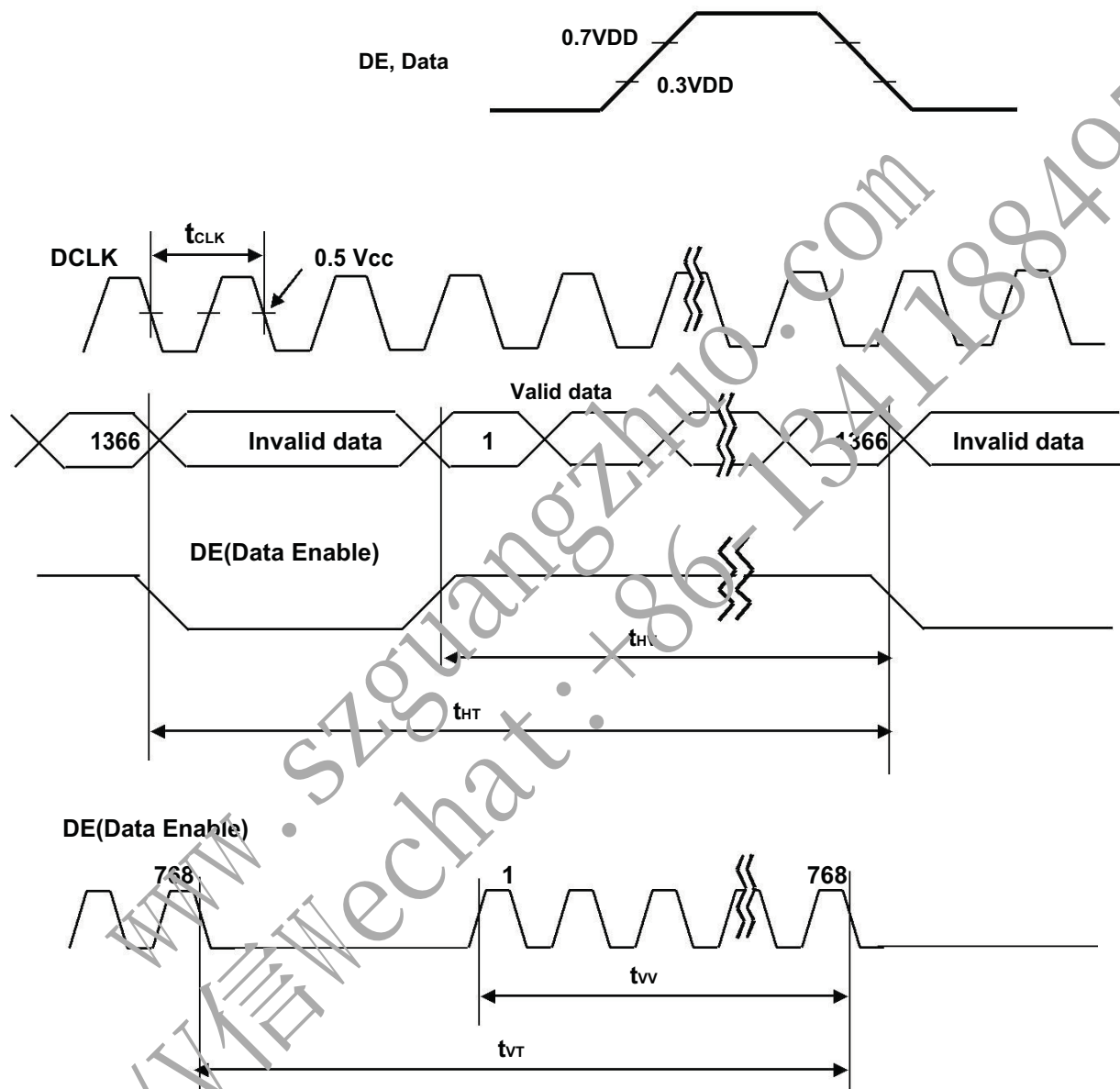
※ Please pay attention to the followings when you set Spread Spectrum Rate(SSR) and Modulation Frequency(FMOD)

1. Please set proper Spread Spectrum Rate(SSR) and Modulation Frequency (FMOD) of TV system LVDS output.
2. Please check FOS after you set Spread Spectrum Rate(SSR) and Modulation Frequency(FMOD) to avoid abnormal display. Especially, harmonic noise can appear when you use Spread Spectrum under FMOD 30 KHz.

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### 3-4. LVDS Signal Specification

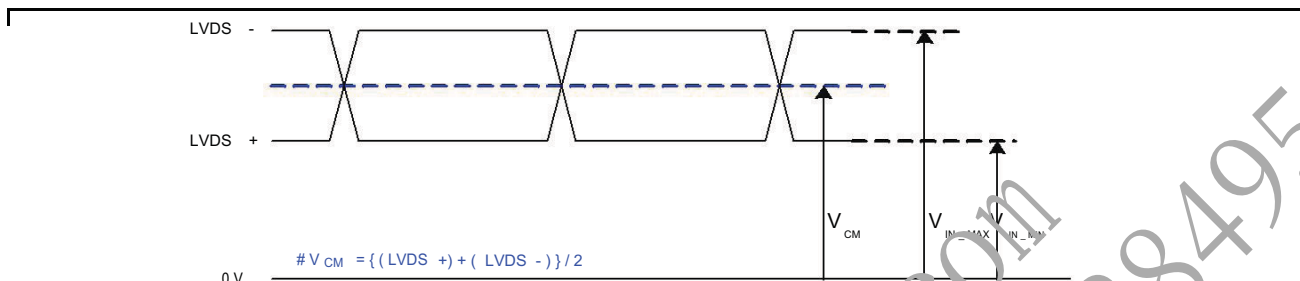
#### 3-4-1. LVDS Input Signal Timing Diagram



## Product Specification

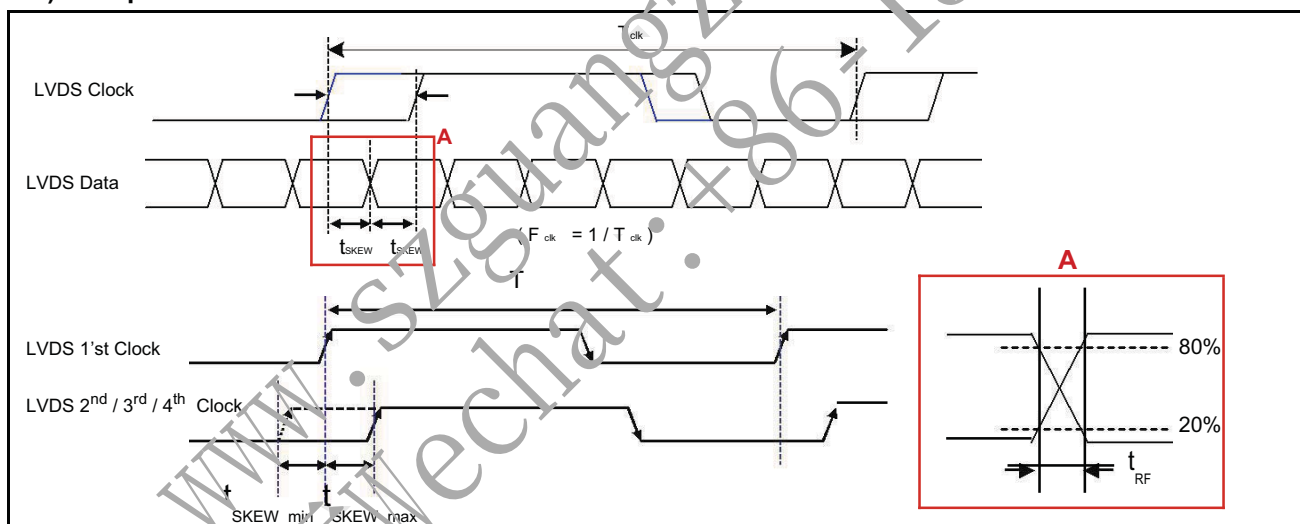
## 3-4-2. LVDS Input Signal Characteristics

## 1) DC Specification



| Description                   | Symbol   | Min | Max | Unit | Note |
|-------------------------------|----------|-----|-----|------|------|
| LVDS Common mode Voltage      | $V_{CM}$ | 1.0 | 1.5 | V    |      |
| LVDS Input Voltage Range      | $V_{IN}$ | 0.7 | 1.8 | V    |      |
| Change in common mode Voltage | VCM      | -   | 250 | mV   | -    |

## 2) AC Specification



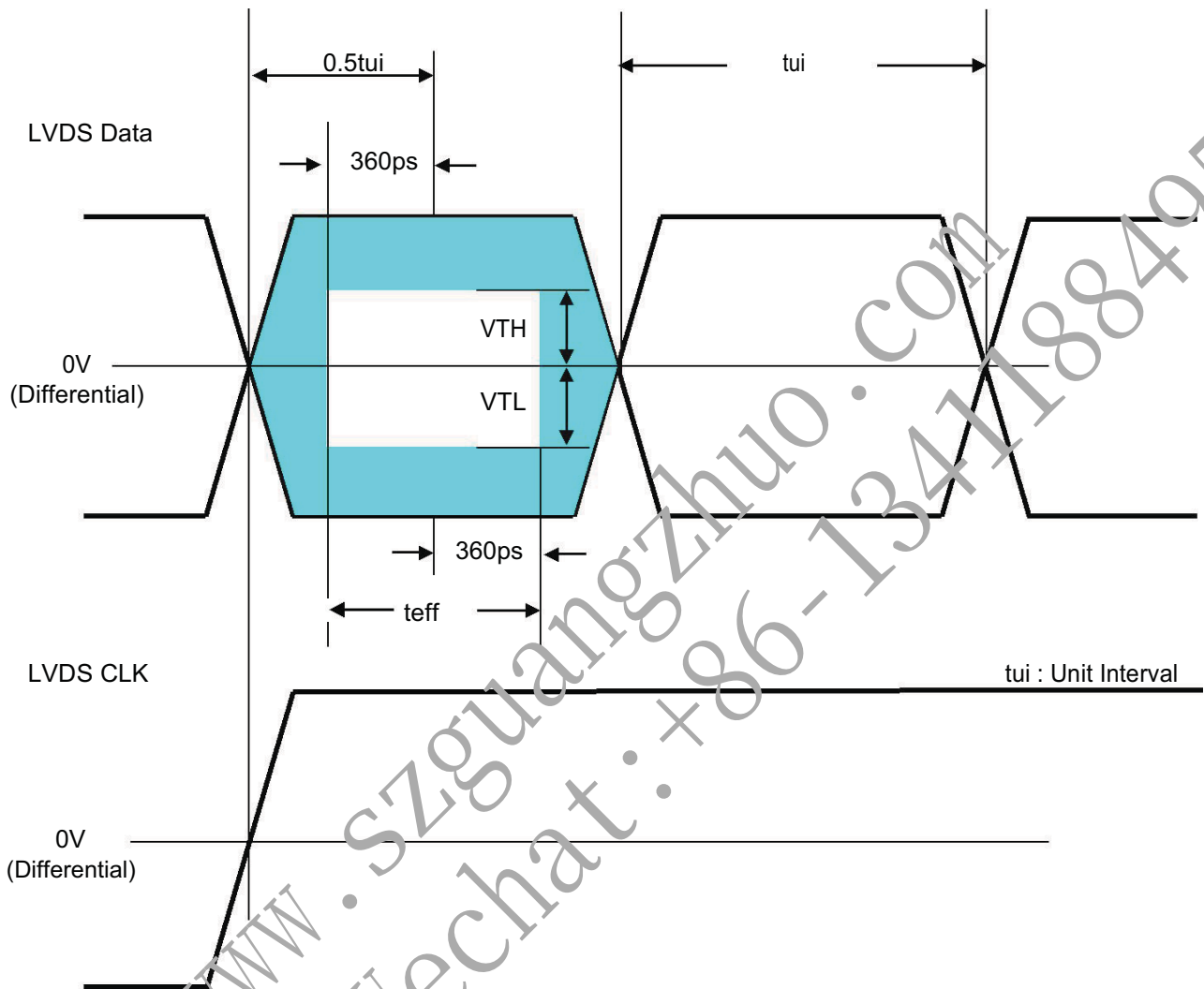
| Description                            | Symbol         | Min         | Max                        | Unit | Note                                |
|----------------------------------------|----------------|-------------|----------------------------|------|-------------------------------------|
| LVDS Differential Voltage              | $V_{TH}$       | 100         | 600                        | mV   | Tested with Differential Probe<br>3 |
|                                        | $V_{TL}$       | -600        | -100                       | mV   |                                     |
| LVDS Clock to Data Skew                | $t_{SKEW}$     | -           | $ (0.20 \cdot T_{clk})/7 $ | ps   | -                                   |
| LVDS Clock/DATA Rising/Falling time    | $t_{RF}$       | 260         | $ (0.3 \cdot T_{clk})/7 $  | ps   | 2                                   |
| Effective time of LVDS                 | $t_{eff}$      | $ \pm 360 $ | -                          | ps   | -                                   |
| LVDS Clock to Clock Skew (Even to Odd) | $t_{SKEW\_EO}$ | -           | $ 1/7 \cdot T_{clk} $      | ps   | -                                   |

notes 1. All Input levels of LVDS signals are based on the EIA 644 Standard.

2. If  $t_{RF}$  isn't enough,  $t_{eff}$  should be meet the range.

3. LVDS Differential Voltage is defined within  $t_{eff}$

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\* This accumulated waveform is tested with differential probe

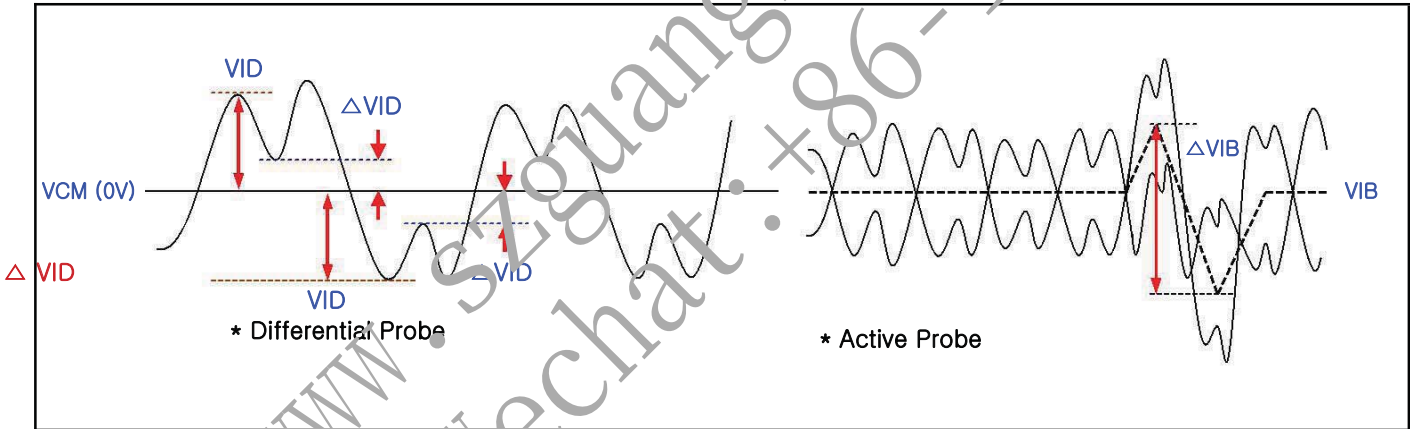
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3-5. Intra interface Signal Specification

3-5-1. Mini-LVDS Signal Specification

Table 5. ELECTRICAL CHARACTERISTICS

| Parameter                                   | Symbol          | Condition                 | MIN             | TYP | MAX                 | Unit | notes |
|---------------------------------------------|-----------------|---------------------------|-----------------|-----|---------------------|------|-------|
| Mini-LVDS Clock frequency                   | CLK             | $3.0V \leq VCC \leq 3.6V$ |                 | -   | 290                 | MHz  |       |
| mini-LVDS input Voltage (Center)            | $V_{IB}$        | Mini-LVDS Clock and Data  | $0.7 + (VID/2)$ | -   | $(VCC-1.2) - VID/2$ | V    |       |
| mini-LVDS input Voltage Distortion (Center) | $\Delta V_{IB}$ |                           | -               | -   | 0.8                 | V    |       |
| mini-LVDS differential Voltage range        | $V_{ID}$        |                           | 200             | -   | 800                 | mV   |       |
| mini-LVDS differential Voltage range Dip    | $\Delta V_{ID}$ |                           | 25              | -   | 800                 | mV   |       |



Differential Probe

FIG. 1 Description of VID, ΔVIB, ΔVID

\* Source PCB

Active Probe

Measurement of VID, ΔVIB, ΔVID

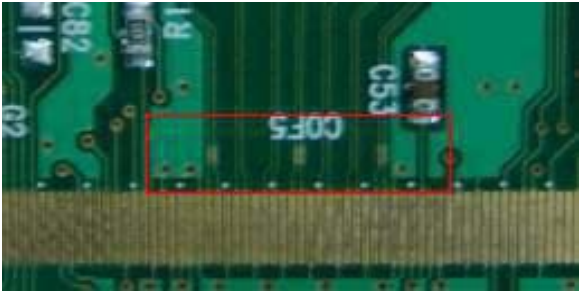


FIG. 2 Measure point  
FIG. 3 Measure point

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## 3-6. Color Data Reference

The brightness of each primary color(red,green,blue) is based on the 8bit gray scale data input for the color. The higher binary input, the brighter the color. Table 7 provides a reference for color versus data input.

Table 6. COLOR DATA REFERENCE

| Color       |             | Input Color Data |    |    |    |     |    |    |    |       |    |     |    |      |    |     |    |    |    |    |    |    |    |    |    |
|-------------|-------------|------------------|----|----|----|-----|----|----|----|-------|----|-----|----|------|----|-----|----|----|----|----|----|----|----|----|----|
|             |             | RED              |    |    |    |     |    |    |    | GREEN |    |     |    | BLUE |    |     |    |    |    |    |    |    |    |    |    |
|             |             | MSB              |    |    |    | LSB |    |    |    | MSB   |    | LSB |    | MSB  |    | LSB |    |    |    |    |    |    |    |    |    |
|             |             | R7               | R6 | R5 | R4 | R3  | R2 | R1 | R0 | G7    | G6 | G5  | G4 | G3   | G2 | G1  | G0 | B7 | B6 | 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  | 0  | 0  | 0  | 0  | 0  | 0  |
|             | Red (255)   | 1                | 1  | 1  | 1  | 1   | 1  | 1  | 1  | 0     | 0  | 0   | 0  | 0    | 0  | 0   | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|             | Green (255) | 0                | 0  | 0  | 0  | 0   | 0  | 0  | 0  | 1     | 1  | 1   | 1  | 1    | 1  | 1   | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|             | Blue (255)  | 0                | 0  | 0  | 0  | 0   | 0  | 0  | 0  | 0     | 0  | 0   | 0  | 0    | 0  | 0   | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  |
|             | Cyan        | 0                | 0  | 0  | 0  | 0   | 0  | 0  | 0  | 1     | 1  | 1   | 1  | 1    | 1  | 1   | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  |
|             | Magenta     | 1                | 1  | 1  | 1  | 1   | 1  | 1  | 1  | 0     | 0  | 0   | 0  | 0    | 0  | 0   | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  |
|             | Yellow      | 1                | 1  | 1  | 1  | 1   | 1  | 1  | 1  | 1     | 1  | 1   | 1  | 1    | 1  | 1   | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|             | White       | 1                | 1  | 1  | 1  | 1   | 1  | 1  | 1  | 1     | 1  | 1   | 1  | 1    | 1  | 1   | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  |
| RED         | RED (000)   | 0                | 0  | 0  | 0  | 0   | 0  | 0  | 0  | 0     | 0  | 0   | 0  | 0    | 0  | 0   | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|             | RED (001)   | 0                | 0  | 0  | 0  | 0   | 0  | 0  | 1  | 0     | 0  | 0   | 0  | 0    | 0  | 0   | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|             | ...         | ...              |    |    |    |     |    |    |    | ...   |    |     |    | ...  |    |     |    |    |    |    |    |    |    |    |    |
|             | RED (254)   | 1                | 1  | 1  | 1  | 1   | 1  | 1  | 0  | 0     | 0  | 0   | 0  | 0    | 0  | 0   | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|             | RED (255)   | 1                | 1  | 1  | 1  | 1   | 1  | 1  | 1  | 0     | 0  | 0   | 0  | 0    | 0  | 0   | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
| GREEN       | GREEN (000) | 0                | 0  | 0  | 0  | 0   | 0  | 0  | 0  | 0     | 0  | 0   | 0  | 0    | 0  | 0   | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|             | GREEN (001) | 0                | 0  | 0  | 0  | 0   | 0  | 0  | 0  | 0     | 0  | 0   | 0  | 0    | 0  | 0   | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|             | ...         | ...              |    |    |    |     |    |    |    | ...   |    |     |    | ...  |    |     |    |    |    |    |    |    |    |    |    |
|             | GREEN (254) | 0                | 0  | 0  | 0  | 0   | 0  | 0  | 0  | 1     | 1  | 1   | 1  | 1    | 1  | 1   | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|             | GREEN (255) | 0                | 0  | 0  | 0  | 0   | 0  | 0  | 0  | 1     | 1  | 1   | 1  | 1    | 1  | 1   | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
| BLUE        | BLUE (000)  | 0                | 0  | 0  | 0  | 0   | 0  | 0  | 0  | 0     | 0  | 0   | 0  | 0    | 0  | 0   | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|             | BLUE (001)  | 0                | 0  | 0  | 0  | 0   | 0  | 0  | 0  | 0     | 0  | 0   | 0  | 0    | 0  | 0   | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 0  |
|             | ...         | ...              |    |    |    |     |    |    |    | ...   |    |     |    | ...  |    |     |    |    |    |    |    |    |    |    |    |
|             | BLUE (254)  | 0                | 0  | 0  | 0  | 0   | 0  | 0  | 0  | 0     | 0  | 0   | 0  | 0    | 0  | 0   | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0  |
|             | BLUE (255)  | 0                | 0  | 0  | 0  | 0   | 0  | 0  | 0  | 0     | 0  | 0   | 0  | 0    | 0  | 0   | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  |

## Product Specification

## 3-7. Power Sequence

## 3-6-1. LCD Driving circuit

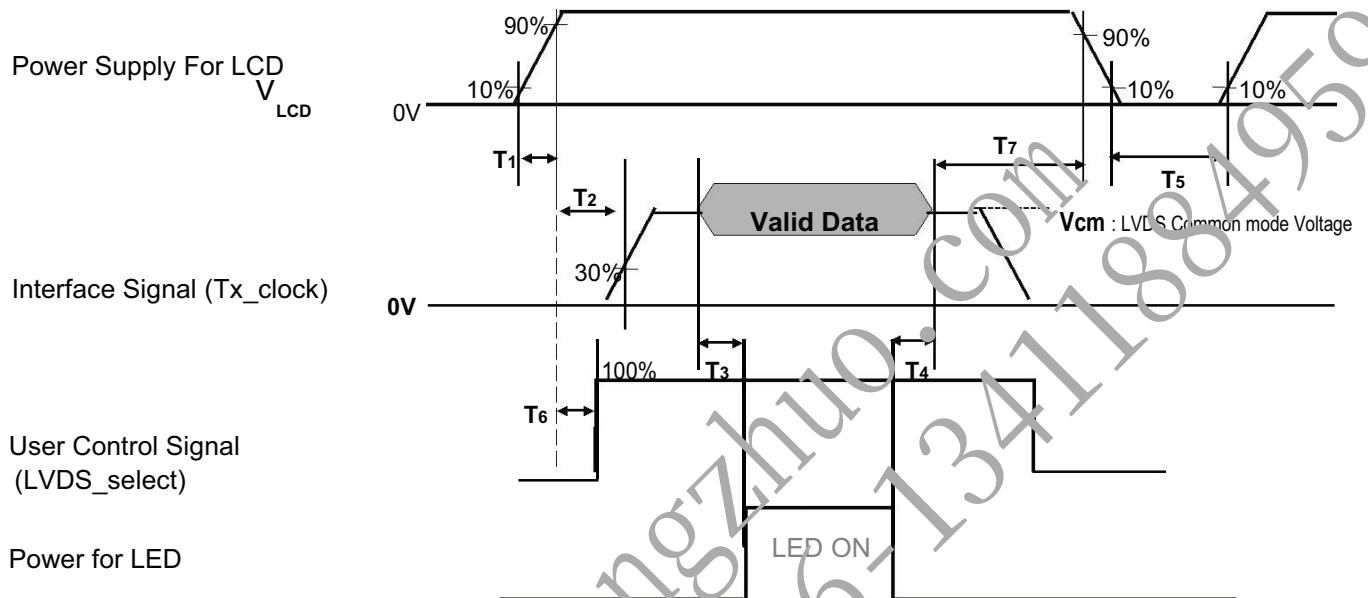


Table 8. POWER SEQUENCE

| Parameter | Value |     |     | Unit | Note |
|-----------|-------|-----|-----|------|------|
|           | Min   | Typ | Max |      |      |
| T1        | 0.5   | -   | 20  | ms   | 1    |
| T2        | 0     | -   | -   | ms   | 2    |
| T3        | 400   | -   | -   | ms   | 3    |
| T4        | 200   | -   | -   | ms   | 3    |
| T5        | 1.0   | -   | -   | s    | 4    |
| T6        | 0     | -   | T2  | ms   | 5    |
| T7        | 0     | -   | -   | ms   | 6    |

- Note :
1. Even though T1 is over the specified value, there is no problem if I2T spec of fuse is satisfied.
  2. If T2 is satisfied with specification after removing LVDS Cable, there is no problem.
  3. The T3 / T4 is recommended value, the case when failed to meet a minimum specification, abnormal display would be shown. There is no reliability problem.
  4. T5 should be measured after the Module has been fully discharged between power off and on period.
  5. If the on time of signals (Interface signal and user control signals) precedes the on time of Power ( $V_{LCD}$ ), it will be happened abnormal display. When T6 is NC status, T6 doesn't need to be measured.
  6. It is recommendation specification that T7 has to be 0ms as a minimum value.
- ※ Please avoid floating state of interface signal at invalid period.  
 ※ When the power supply for LCD ( $V_{LCD}$ ) is off, be sure to pull down the valid and invalid data to 0V.

## Product Specification

#### 4. Optical Specification

Optical characteristics are determined after the unit has been 'ON' and stable in a dark environment at  $25 \pm 2^\circ\text{C}$ . The values are specified at distance 50cm from the LCD surface at a viewing angle of  $\Phi$  and  $\theta$  equal to  $0^\circ$ . FIG. 6 shows additional information concerning the measurement equipment and method.

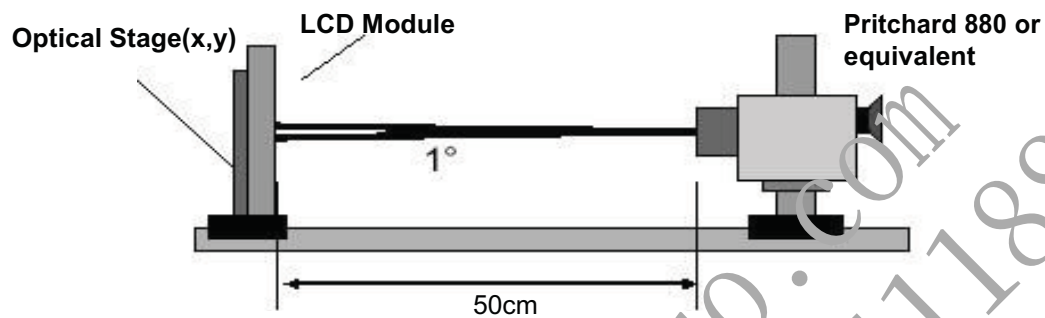


FIG. 3 Optical Characteristic Measurement Equipment and Method

$T_a = 25 \pm 2^\circ\text{C}$ ,  $V_{CD} = 12.0\text{V}$ ,  $f_v = 60\text{Hz}$ ,  $D_{clk} = 72.4\text{MHz}$ ,  
Light source : D65 Standard

Table 6. OPTICAL CHARACTERISTICS

| Parameter                      |                                   | Symbol          | Value        |       |              | Unit   | Note |
|--------------------------------|-----------------------------------|-----------------|--------------|-------|--------------|--------|------|
|                                |                                   |                 | Min          | Typ   | Max          |        |      |
| Contrast Ratio                 |                                   | CR              | 850          | 1200  | -            |        | 1    |
| Response Time                  | Variation                         | C to G $\sigma$ | -            | 7     | 10           |        | 3    |
|                                | Gray to Gray (BW)                 | G to G BW       | -            | 9     | 13           | ms     | 2    |
| Transmittance                  |                                   | T               | 5.88         | 6.45  |              | %      | 4    |
| Color Coordinates<br>[CIE1931] | RED                               | R <sub>x</sub>  | Typ<br>-0.03 | 0.663 | Typ<br>+0.03 |        | 5    |
|                                |                                   | R <sub>y</sub>  |              | 0.326 |              |        |      |
|                                | GREEN                             | G <sub>x</sub>  |              | 0.286 |              |        |      |
|                                |                                   | G <sub>y</sub>  |              | 0.583 |              |        |      |
|                                | BLUE                              | B <sub>x</sub>  |              | 0.134 |              |        |      |
|                                |                                   | B <sub>y</sub>  |              | 0.132 |              |        |      |
| Viewing Angle (CR>10)          |                                   |                 |              |       |              |        |      |
|                                | x axis, right( $\phi=0^\circ$ )   | $\theta_r$      | 89           | -     | -            | degree | 6    |
|                                | x axis, left ( $\phi=180^\circ$ ) | $\theta_l$      | 89           | -     | -            |        |      |
|                                | y axis, up ( $\phi=90^\circ$ )    | $\theta_u$      | 89           | -     | -            |        |      |
|                                | y axis, down ( $\phi=270^\circ$ ) | $\theta_d$      | 89           | -     | -            |        |      |
| Gray Scale                     |                                   |                 | -            | -     | -            |        | 7    |



## Product Specification

Note : 1. Contrast Ratio(CR) is defined mathematically as :

CR(Contrast Ratio) = Maximum CR<sub>n</sub> (n=1, 2, 3, 4, 5)

CR<sub>n</sub> =  $\frac{\text{Surface Luminance at position n with all white pixels}}{\text{Surface Luminance at position n with all black pixels}}$

n = the Position number(1, 2, 3, 4, 5). For more information, see FIG 2

The value of CR should be extracted using the LGD sheet structure (Diffuser/Prism/Prism)

2. Response time is the time required for the display to transit from any gray to white (Rise Time, T<sub>RP</sub>) and from any gray to black (Decay time, T<sub>RD</sub>). For additional information see the FIG. 3.

※ G to G<sub>BW</sub> Spec stands for average value of all measured points.

Photo Detector : RD-80S / Field : 2 °

The response time is valued with operating condition of LGD's standard RLJ

3. G to G<sub>σ</sub> is Variation of Gray to Gray response time composing a picture

$$\sqrt{\frac{\sum (X_i - u)^2}{n}}$$

X<sub>i</sub> = Individual Data  
u = Data average

G to G (σ) =

4. The value of transmittance should be extracted using the LGD standard sheet structure (Diffuser/Diffuser)

5. The value of color coordinates should be extracted using the standard light source of D65

6. Viewing angle is the angle at which the contrast ratio is greater than 10. The angles are determined for the horizontal or x axis and the vertical or y axis with respect to the z axis which is normal to the LCD module surface. For more information, see the FIG. 4.

7. Gray scale specification

Gamma Value is approximately 2.2. For more information, see the Table 9.

Table 9. GRAY SCALE SPECIFICATION

| Gray Level | Luminance [%] (Typ) |
|------------|---------------------|
| L0         | 0.07                |
| L15        | 0.27                |
| L31        | 1.04                |
| L47        | 2.49                |
| L63        | 4.68                |
| L79        | 7.66                |
| L95        | 11.5                |
| L111       | 16.1                |
| L127       | 21.6                |
| L143       | 28.1                |
| L159       | 35.4                |
| L175       | 43.7                |
| L191       | 53.0                |
| L207       | 63.2                |
| L223       | 74.5                |
| L239       | 86.7                |
| L255       | 100                 |

Product Specification

Measuring point for Contrast Ratio

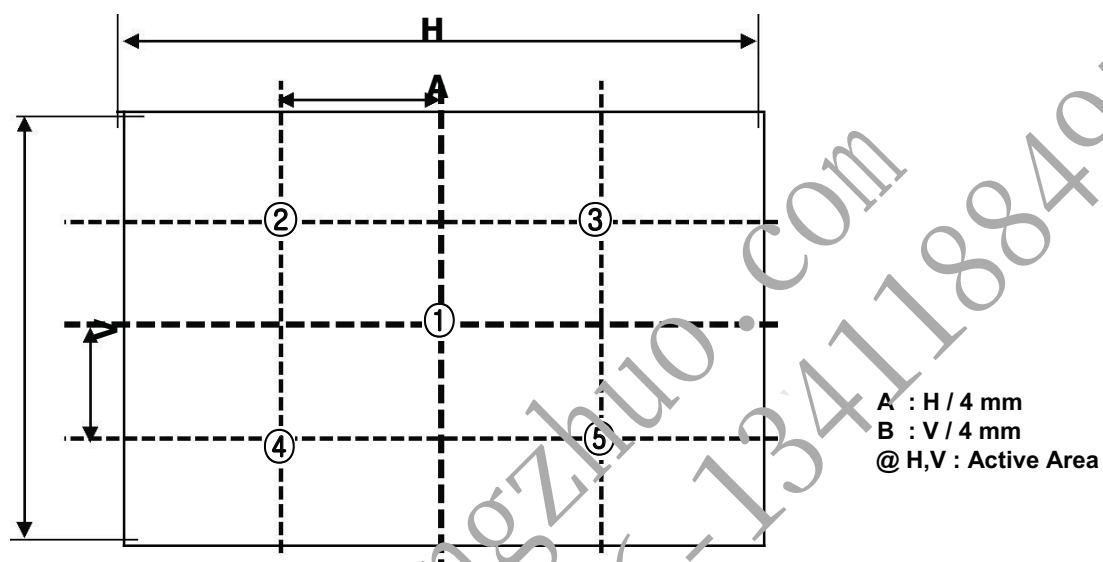


FIG. 2 1 Points for Contrast Ratio

Response time is defined as the following figure and shall be measured by switching the input signal for "Gray(N)" and "Black or White".

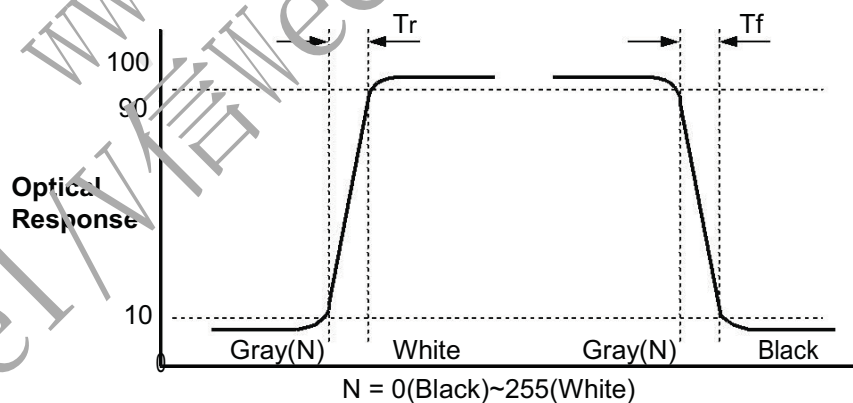


FIG. 3 Response Time

Product Specification

Dimension of viewing angle range

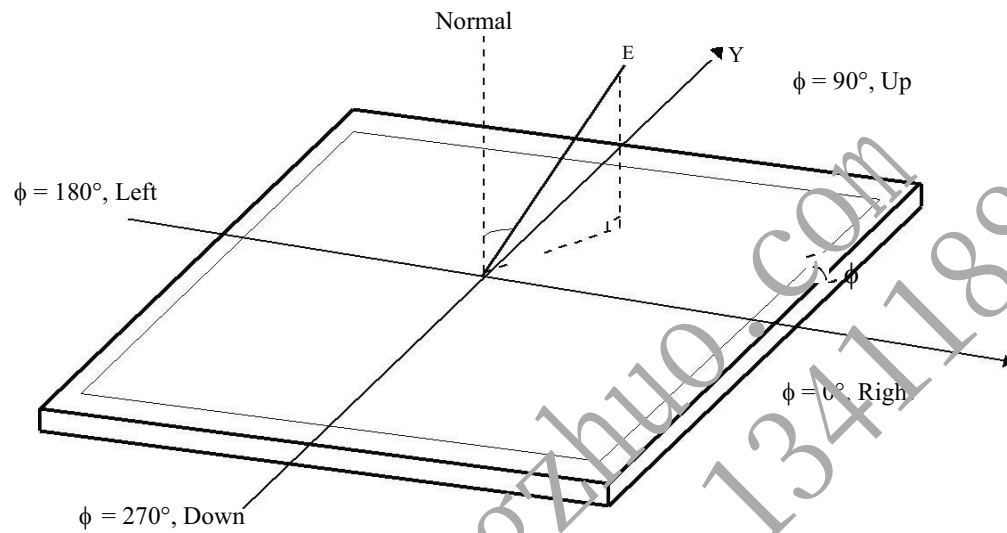


FIG. 4 Viewing Angle

## Product Specification

**5. Mechanical Characteristics**

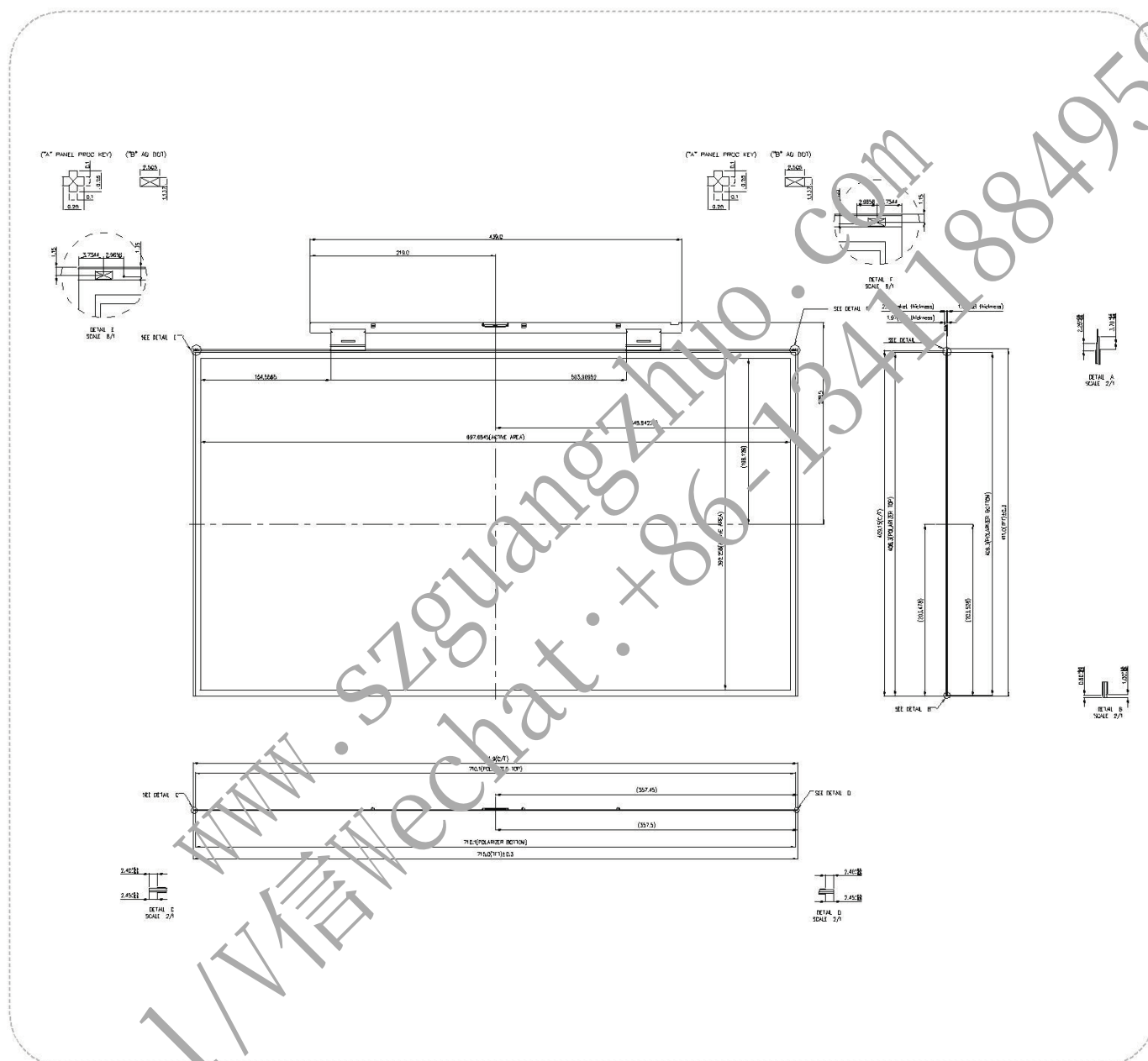
Table 8 provides general mechanical characteristics.

**Table 8. MECHANICAL CHARACTERISTICS**

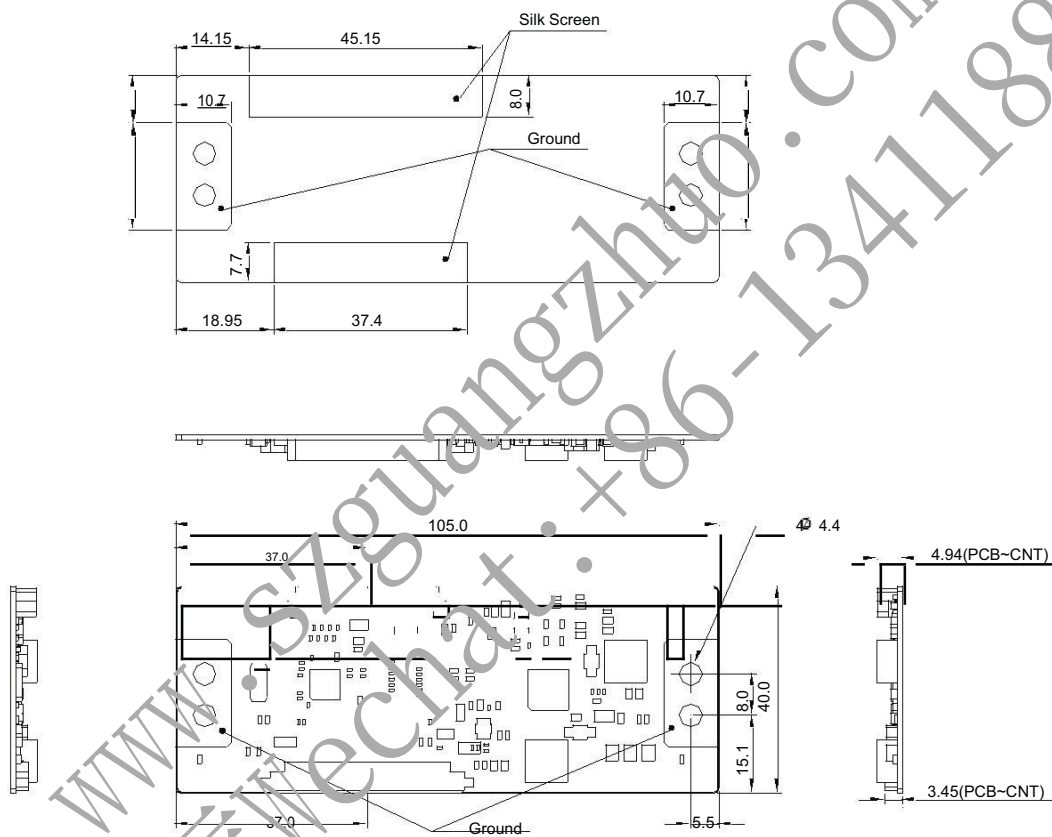
| Item                              | Value                                                                                            |            |
|-----------------------------------|--------------------------------------------------------------------------------------------------|------------|
| Outline Dimension<br>(Only Glass) | Horizontal                                                                                       | 745.0mm    |
|                                   | Vertical                                                                                         | 411.0mm    |
|                                   | Thickness                                                                                        | 1.3 mm     |
| Active Display Area               | Horizontal                                                                                       | 697.6345mm |
|                                   | Vertical                                                                                         | 392.256mm  |
| Weight                            | 0.86kg (typ.) 0.94kg (max.)                                                                      |            |
| Surface Treatment                 | Hard coating(2H), Anti-glare low reflection treatment of the front polarizer<br>(Haze: 3%(Typ.)) |            |

notes : Please refer to a mechanic drawing in terms of tolerance at the next page.

**[ FRONT VIEW ]**



## 6-2. Control Board Assembly Dimension



## Product Specification

**6. Reliability****Table 9. ENVIRONMENT TEST CONDITION**

| No. | Test Item                                | Condition                      |
|-----|------------------------------------------|--------------------------------|
| 1   | High temperature storage test            | Ta= 60°C 90% 240h              |
| 2   | Low temperature storage test             | Ta= -20°C 240h                 |
| 3   | High temperature operation test          | Ta= 50°C 50%RH 500h            |
| 4   | Low temperature operation test           | Ta= 0°C 500h                   |
| 5   | Humidity condition Operation             | Ta= 40 °C ,90%RH               |
| 6   | Altitude operating<br>storage / shipment | 0 - 16,400 ft<br>0 - 40,000 ft |

notes : Before and after Reliability test, Board ass'y should be operated with normal function.

Product Specification

## 7. International Standards

### 7-1. Safety

- a) UL 60065, Underwriters Laboratories Inc.  
Audio, Video and Similar Electronic Apparatus - Safety Requirements.
- b) CAN/CSA C22.2 No.60065:03, Canadian Standards Association. Audio,  
Video and Similar Electronic Apparatus - Safety Requirements.
- c) IEC 60065, The International Electrotechnical Commission (IEC).  
Audio, Video and Similar Electronic Apparatus - Safety Requirements.

### 7-2. Environment

- a) RoHS, Directive **2011/65/EU** of the European Parliament and of the council of **8 June 2011**



Product Specification

## 8. Packing

### 8-1. Packing Form

- a) Package quantity in one Pallet :272pcs
- b) Pallet Size :1140 mm(L) X 990 mm(W) X 1110mm(H)

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## Product Specification

### 9. Precautions

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

#### 9-1. Handling Precautions

- (1) Please attach the surface transparent protective film to the surface in order to protect the polarizer.  
Transparent protective plate should have sufficient strength in order to resist external force.
- (2) Acetic acid type and chlorine type materials for the cover case are not desirable because the former generates corrosive gas of attacking the polarizer at high temperature and the latter causes circuit break by electro-chemical reaction.
- (3) 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.)
- (4) After removing the protective film, when the surface becomes dusty, please wipe gently with absorbent cotton or other soft materials like chamois soaked with petroleum benzine.  
Do not use acetone, toluene and alcohol because they cause chemical damage to the polarizer.
- (5) Wipe off saliva or water drops as soon as possible. Their long time contact with polarizer causes deformations and color fading.
- (6) 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. Panel ground path should be connected to metal ground.
- (7) Please make sure to avoid external forces applied to the Source PCB and D-IC during the process of handling or assembling the TV set. If not, it causes panel damage or malfunction.
- (8) Panel and BLU should be protected from the static electricity. If not, it causes IC damage.
- (9) Do not pull or fold the source D-IC which connect the source PCB and the panel.
- (10) Panel (board ass'y) should be put on the BLU structure precisely to avoid mechanical impact.
- (11) FFC Cable should be connected between System board and Source PCB correctly.
- (12) Mechanical structure for backlight system should be designed for sustaining board ass'y safely.
- (13) Surface temperature of the Source D-IC should be controlled under 100°C with TV Set status.  
If not, problems such as IC damage or decrease of lifetime could occur.

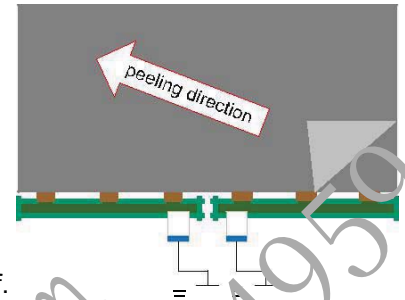
#### 9-2. Operating Precautions

- (1) Response time depends on the temperature. (In lower temperature, it becomes longer.)
- (2) Brightness depends on the temperature. (In lower temperature, it becomes lower.)  
And in lower temperature, Stable time (required time that brightness is stable after turned on) becomes longer.
- (3) 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.
- (4) When fixed patterns are displayed for a long time, remnant image is likely to occur.
- (5) Module has high frequency circuits. Sufficient suppression to the electromagnetic interference shall be done by system manufacturers. Grounding and shielding methods may be important to minimize the interference.

## Product Specification

### 9-3. Protection Film

- (1) Please keep attaching the protection film before assembly.
- (2) Please peel off the protection film slowly.
- (3) Please peel off the protection film just like shown in the Fig.11
- (4) Ionized air should be blown over during the peeling.
- (5) Source PCB should be connected to the ground when peel off the protection film.
- (6) The protection film should not be contacted to the source D-IC during peeling it off.



< Fig. 11 >

### 9-4. Storage Precautions

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

- (1) Temperature : 5 ~ 40 °C
- (2) Humidity : 35 ~ 75 %RH
- (3) Period : 6 months
- (4) Control of ventilation and temperature is necessary.
- (5) Please make sure to protect the product from strong light exposure, water or moisture. Be careful for condensation.
- (6) Please keep the modules at a circumstance shown below Fig.12.



< Fig.12 >

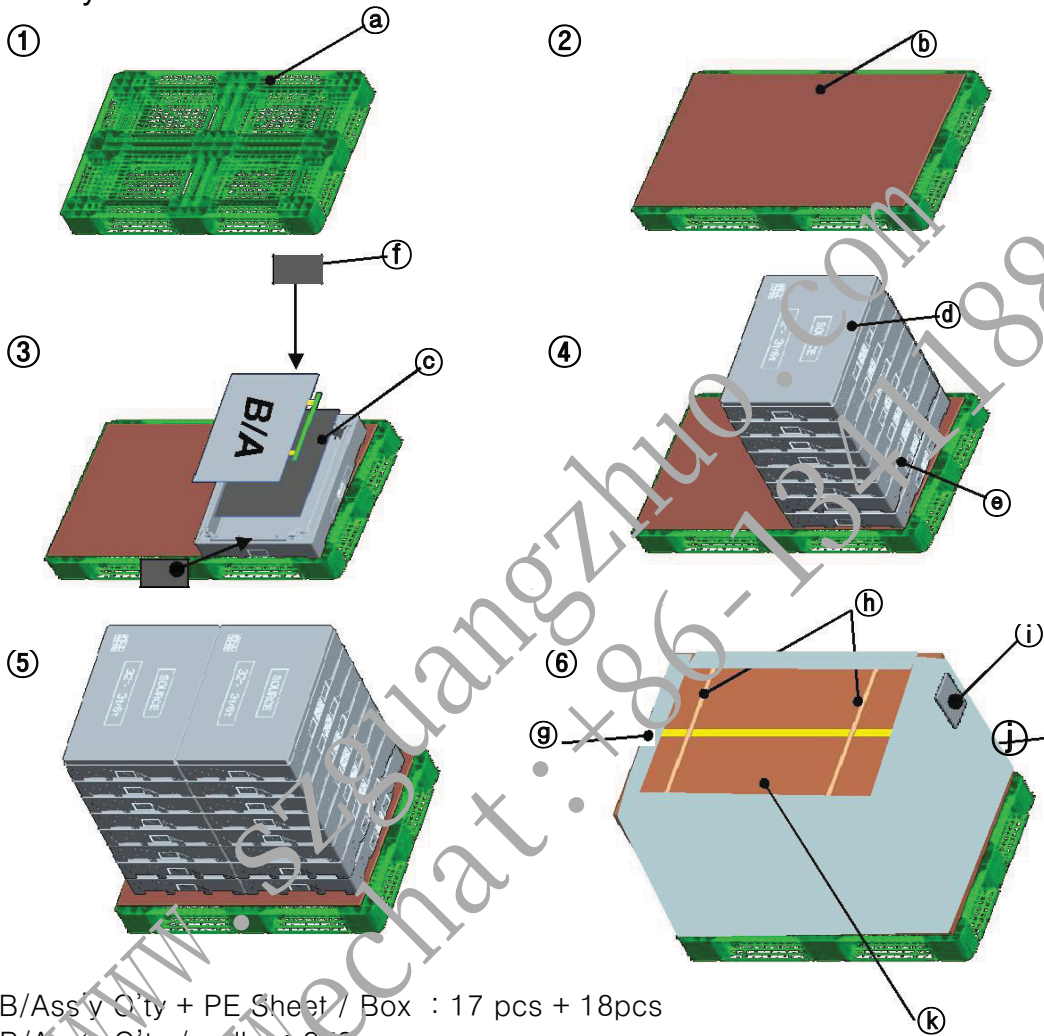
### 9-5. Packing Precautions

Product assembled into module should be stored in the Al-bag(cover case).

Product Specification

# APPENDIX-I-1

■ Pallet Ass'y



- a) B/Ass'y Q'ty + PE Sheet / Box : 17 pcs + 18pcs  
b) B/Ass'y Q'ty / pallet : 272 pcs  
c) Box Q'ty / pallet : 16 box  
d) Pallet Size : 1140 mm(L) X 990 mm(W) X 1115 mm(H)

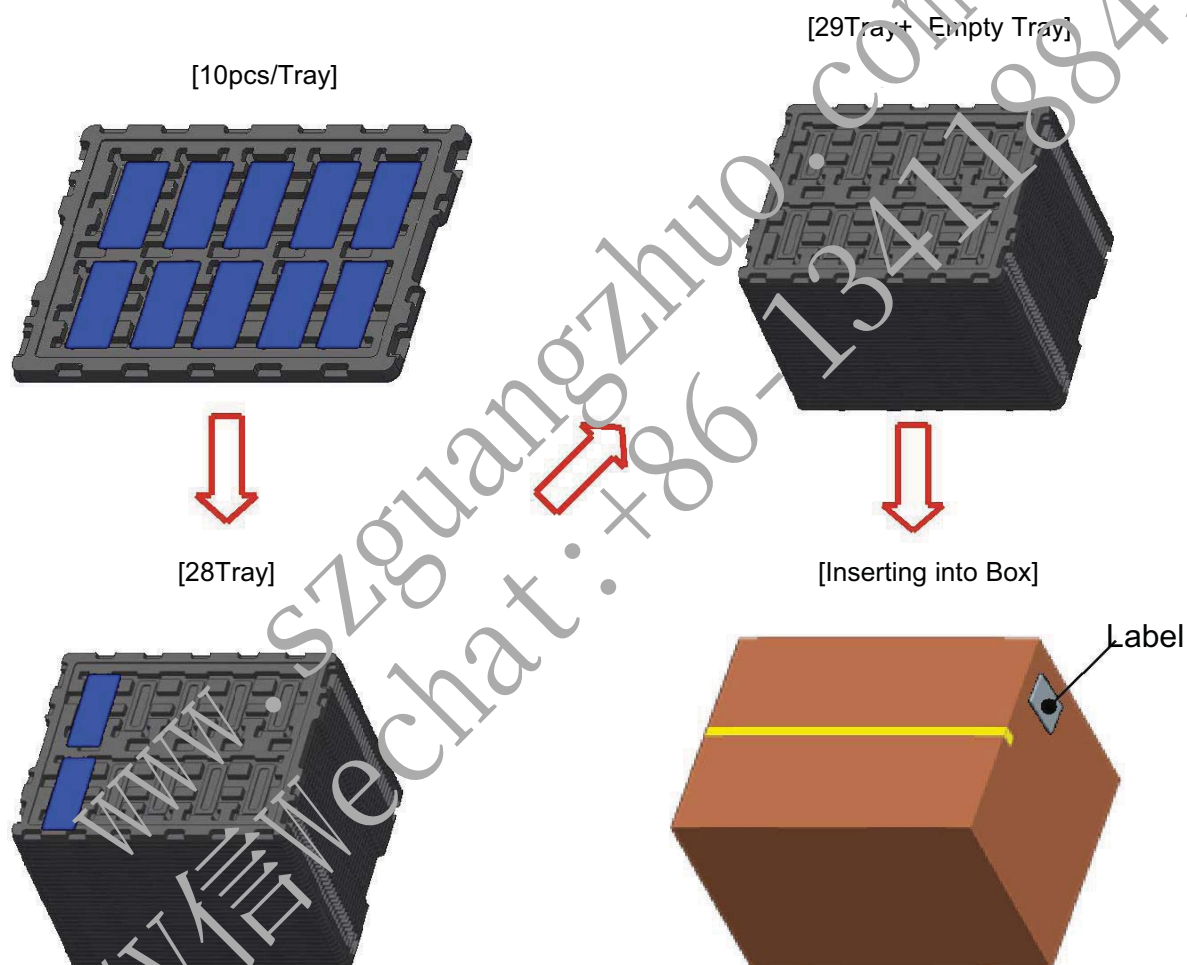
| No. | Description    | Material  | No. | Description   | Material          |
|-----|----------------|-----------|-----|---------------|-------------------|
| (a) | Pallet         | Plastic   | (g) | Tape          | OPP               |
| (b) | Carton Plate   | Paper, SW | (h) | Band          | PP                |
| (c) | PE Sheet       | PE        | (i) | Label         | BOX, YUPO, 100X70 |
| (d) | Top Packing    | EPS       | (j) | wrap          | LLDPE             |
| (e) | Bottom Packing | EPS       | (k) | Angle Packing | Paper, SW         |
| (f) | Desiccant      | Power dry |     |               |                   |

## Product Specification

## # APPENDIX-I-2

## ■ Control PCB Packing Ass'y

- a) Control PCB Qty / Box : 272 pcs  
 b) Tray Qty / Box : 29Tray(Upperst Tray Is empty)  
 c) Tray Size : 466 X 353 X 16  
 d) Box size : 468 X 355 X 301

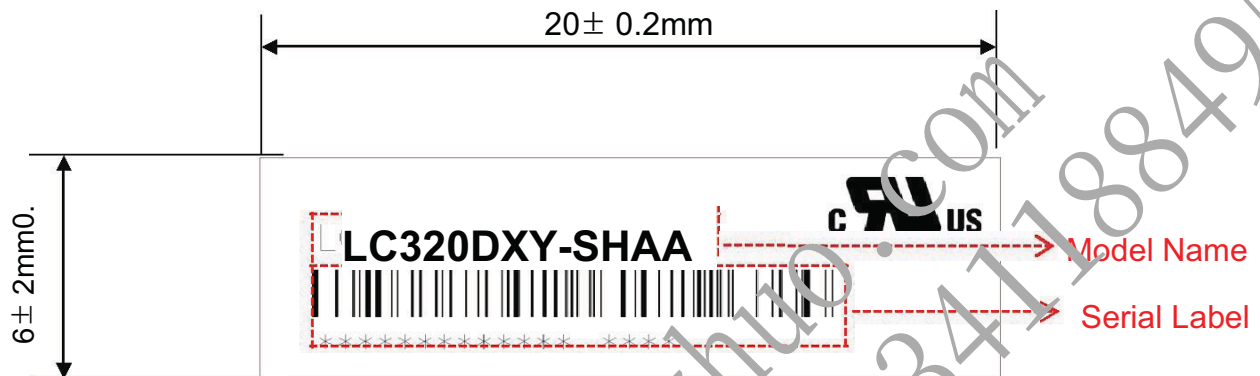


| NO. | DESCRIPTION       | MATERIAL          |
|-----|-------------------|-------------------|
| 1   | PCB Packing A,ssy | -                 |
| 2   | Tray              | PET               |
| 3   | Box               | SW                |
| 4   | Label             | BOX, YUPO, 100X70 |

Product Specification

# APPENDIX- II-1

■ Board Ass'y ID Label

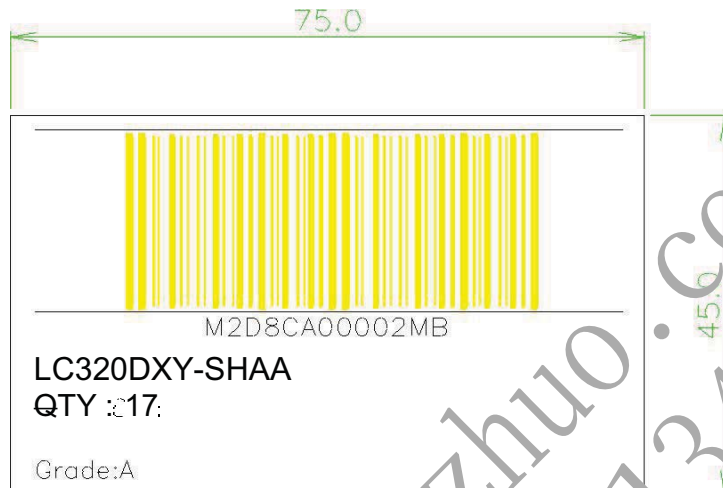


LC320DXY

Product Specification

# APPENDIX- II-2

■ BOX Label



■ Pallet Label

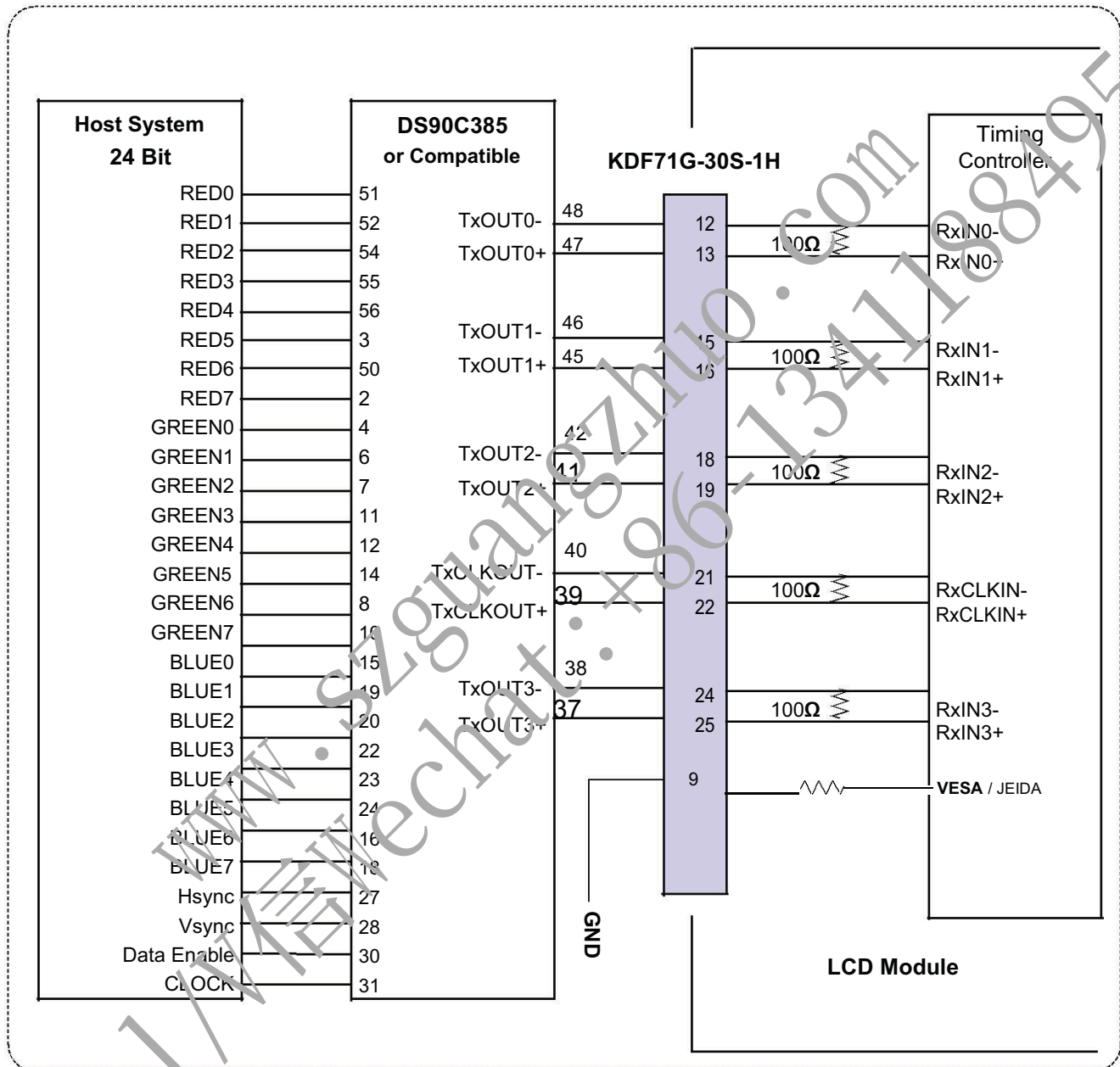




## Product Specification

## # APPENDIX- III-1

■ Required signal assignment for Flat Link (Thine : THC63LVD103) Transmitter(Pin7= "L" or "NC")



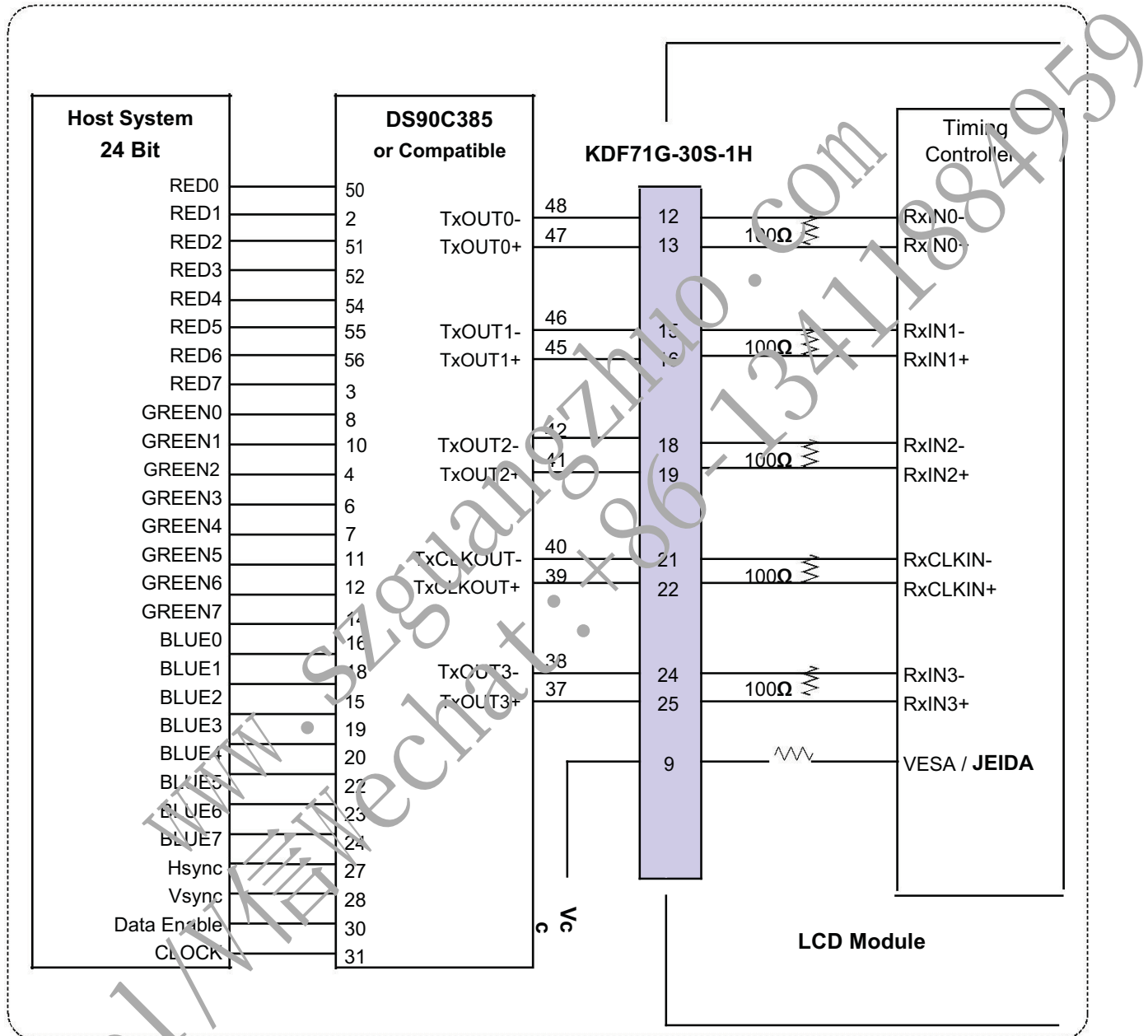
- Note: 1. The LCD module uses a 100 Ohm[Ω] resistor between positive and negative lines of each receiver input.  
 2. Refer to LVDS Transmitter Data Sheet for detail descriptions. (THC63LVD103 or Compatible)  
 3. '7' means MSB and '0' means LSB at R,G,B pixel data.



## Product Specification

## # APPENDIX- III-2

■ Required signal assignment for Flat Link (Thine : THC63LVD103) Transmitter(Pin7= "H" )



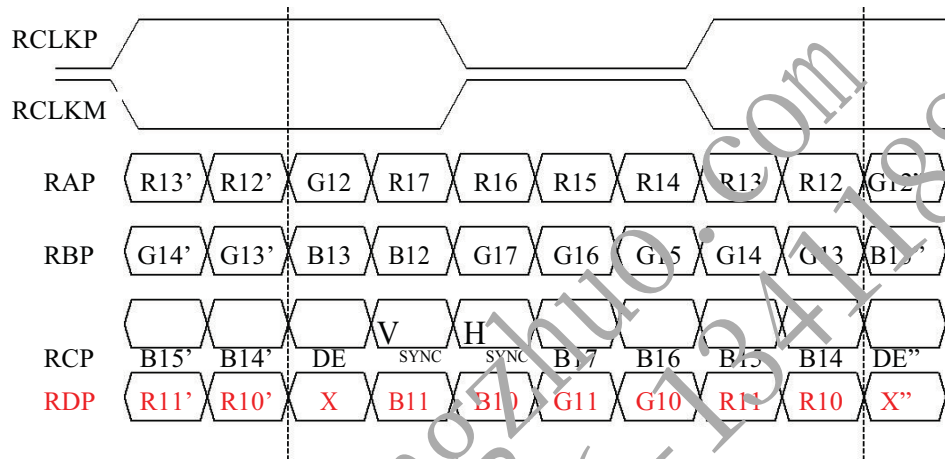
- Note :1. The LCD module uses a 100 Ohm[Ω] resistor between positive and negative lines of each receiver input.  
 2. Refer to LVDS Transmitter Data Sheet for detail descriptions. (THC63LVD103 or Compatible)  
 3. '7' means MSB and '0' means LSB at R,G,B pixel data.

## Product Specification

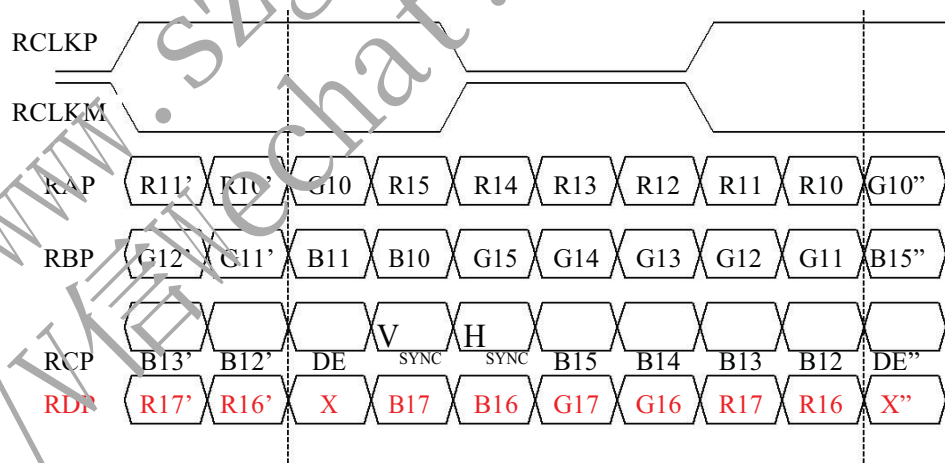
## # APPENDIX- IV

## ■ LVDS Data-Mapping Information (8 Bit )

## 1) LVDS Select : "H" Data-Mapping (JEIDA format)



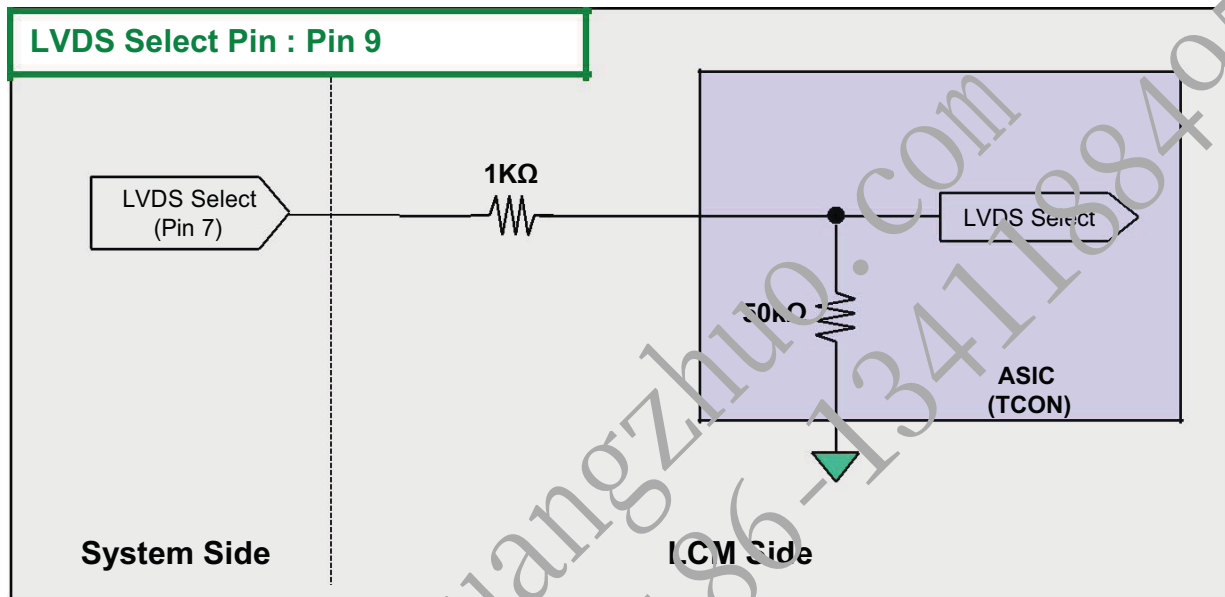
## 2) LVDS Select : "L" Data-Mapping (VESA format)



## # APPENDIX- V

### ■ Option Pin Circuit Block Diagram

1) Circuit Block Diagram of **LVDS Format** Selection pin



## Product Specification

## # APPENDIX- VI-1

## ■ Flicker Adjustment

| Parameter                   | Unit | Min                                   | Typ | Max | Note |
|-----------------------------|------|---------------------------------------|-----|-----|------|
| Inversion Method            | -    | H2-Dot Inversion                      |     |     |      |
| Adjust Pattern / Gray Level | -    | G H2-Dot Full Flicker, 127 Gray, 60Hz |     |     | 60Hz |
| Position                    | -    | Center                                |     |     |      |
| Voltage range               | V    | 5.4                                   | 6.4 | 7.4 |      |

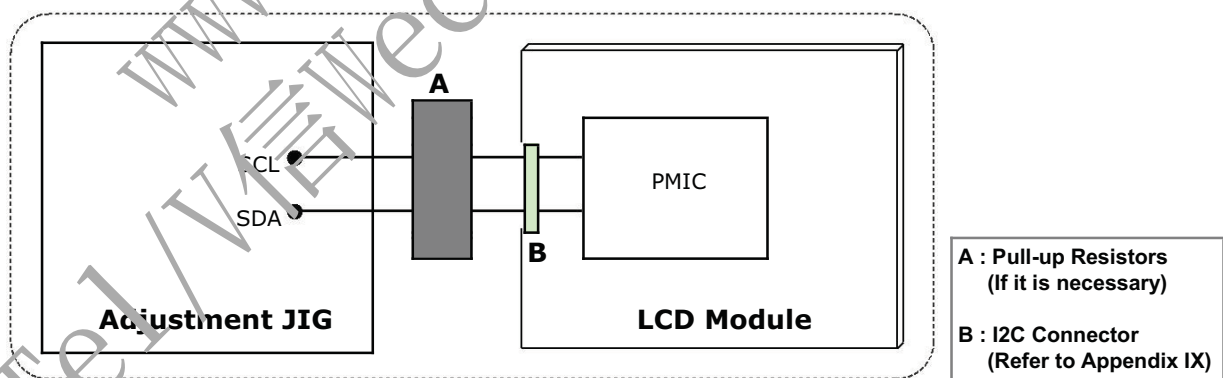


FIG.7 VCOM Adjustment Pattern &amp; Block Diagram

## Product Specification

## # APPENDIX- VI-2

**Vcom Adjustment****MODULE 30 Pin CNT(CN1) PIN CONFIGURATION**

| Pin No | Description | Note |
|--------|-------------|------|
| 1~26   | -           |      |
| 27     | SDA         |      |
| 28     | SCL         |      |
| 29~30  | -           |      |

LC320DXY-SHAA Control PCB Assembly uses TI PWM IC(TPS65175).  
PWM IC (Slave) Address is 40h (1000000), Vcon. Register address is 15h & 16h.

If you need detailed information, Please refer to TI PWM IC(TPS65175) Data Sheet or contact with TI company.

Product Specification

# APPENDIX-VII

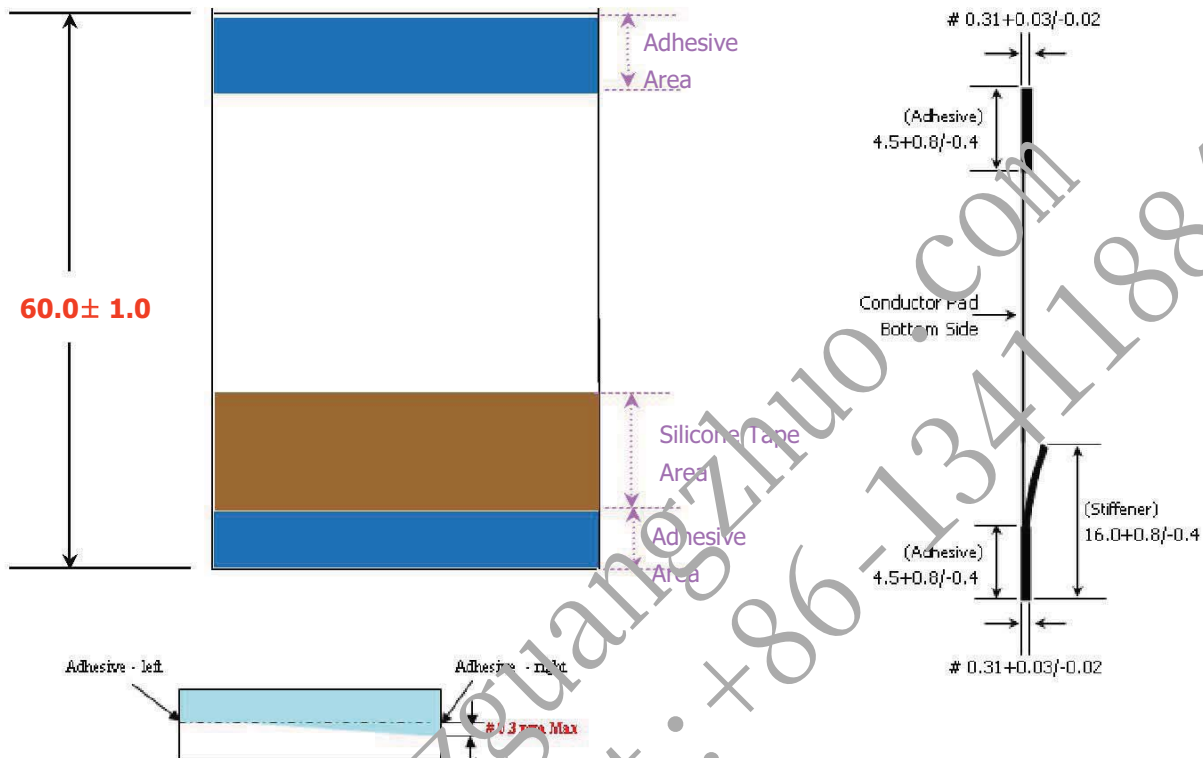
■ The reference method of BL burst dimming

It is recommended to use synchronous V-sync frequency to prevent waterfall ( $V_{sync} * 2 = \text{Burst Frequency}$ )

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## Product Specification

## # APPENDIX-VIII



## - Material List

| APPLICATION                | STANDARD                    | MATERIAL                                                                                                             | REFERENCE                                                                                                                                                                                                                     |
|----------------------------|-----------------------------|----------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. CONDUCTOR               | GOLD PLATED<br>COPPER WIRE  | 1. 99.99% COPPER<br>2. GOLD PLATED                                                                                   | 1. Tolerance<br>- THICKNESS: $\pm 0.01$<br>- WIDTH: $\pm 0.04$ -0.02<br>2. ELONGATION(%)<br>10 MORE THAN<br>3. TENSION:<br>(KGF) 0.2 MORE THAN<br>4. GOLD THICKNESS: 0.05 $\mu$ m MIN<br>*MAKER: DOSOL<br>Processing: EunSung |
| 2. INSULATION              | POLYESTER FILM<br>(PET/PET) | 1. POLYESTER<br>BASE FILM : 0.025 mm<br>2. POLYESTER HOTMELT<br>ADHESIVE : 0.035 mm<br>TOTAL : 0.060 mm<br>THICKNESS | UL VW-1 FLAME<br>Width : 120mm<br>Length : 500M<br>UNIT : ROLL<br>*MAKER:<br>COSMOAMT/<br>SHINCHANG HOTMELT                                                                                                                   |
| 3. SUPPORTING TAPE         | POLYESTER FILM              | 1. POLYESTER<br>BASE FILM : 0.188 mm<br>2. POLYESTER HOTMELT<br>ADHESIVE : 0.027 mm<br>TOTAL THICKNESS : 0.215 mm    | Width : 20.5mm<br>Length : 250M<br>Unit : ROLL<br>*MAKER :<br>SUNGSHIN Trading/<br>COSMOAMT                                                                                                                                   |
| 4. SILICON TAPE<br>(BROWN) |                             | TOTAL<br>THICKNESS : 0.065 mm                                                                                        | *MAKER: DAEHYUN ST                                                                                                                                                                                                            |

## ◆ Note

- Layer : Single Side
- Pad : GOLD Plating
- # e dimension : Cpk 1.0 more
- ## dimension : Cpk 1.33 more
- Stiffener Color : Sky Blue
- H-F
- Dimension Unit : mm
- Connector : Hirose(TF06L-50S-0.5SH)  
LSM(GF05G-50S-E2000)  
UJU(PF050-L50B-C21)