

**Product Functional Specification**

**10.4 inch SVGA Color TFT LCD Module**

**Model Name: G104SN03**

**V.2**

**( u ) Preliminary Specification**

**(   ) Final Specification**

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## **II. Record of Revision**

| <b>Version and Date</b> | <b>Page</b> | <b>Old description</b> | <b>New Description</b>      | <b>Remark</b> |
|-------------------------|-------------|------------------------|-----------------------------|---------------|
| 1.0 Feb. 6, 2004        | All         | N/A                    | First Edition for Customers |               |
|                         |             |                        |                             |               |
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|                         |             |                        |                             |               |
|                         |             |                        |                             |               |

## 1.0 Handling Precautions

- 1) Since front polarizer is easily damaged, pay attention not to scratch it.
- 2) Be sure to turn off power supply when inserting or disconnection from input connector.
- 3) Wipe off water drop immediately. Long contact with water may cause discoloration or spots.
- 4) When the panel surface is soiled, wipe it with absorbent cotton or other soft cloth.
- 5) Since the panel is made of glass, it may break or crack if dropped or bumped on hard surface.
- 6) Since CMOS LSI is used in this module, take care of static electricity and insure human earth when handling.
- 7) Do not open nor modify the module Assembly.
- 8) Do not press the reflector sheet at the back of the module to any directions.
- 9) In case if a module has to be put back into the packing container slot after once it was taken out from the container, do not press the center of the CCFL Reflector edge. Instead, press at the far ends of the CFL Reflector edge softly. Otherwise the TFT module may be damaged.
- 10) At the insertion or removal of the Signal Interface Connector, be sure not to rotate nor tilt the interface Connector of the TFT module.
- 11) After installation of the TFT module into an enclosure, do not twist nor bend the TFT module even momentary. At designing the enclosure, it should be taken into consideration that no bending/twisting forces are applied to the TFT module from outside. Otherwise the TFT module may be damaged.
- 12) Cold cathode fluorescent lamp in LCD contains a small amount of mercury. Please follow local ordinances or regulations for disposal.
- 13) Small amount of materials having no flammability grade is used in the LCD module should be supplied by power complied with requirements of Limited Power Source, or be applied exemption.
- 14) The LCD module is designed so that the CFL in it is supplied by Limited Current Circuit. Do not connect the CFL in Hazardous Voltage Circuit.

## 2.0 General Description

This specification applies to the 10.4 inch color TFT LCD module G104SN03 V.2.

This module is designed for General Display.

The screen format is intended to support the SVGA (800(H) x 600(V)) screen and 262k colors (RGB 6-bits data driver).

All input signals are LVDS interface compatible.

The module does not contain an inverter card for backlight.

### Features

- SVGA 800(H) x600(V) resolution
- 1 CCFL(Cold cathode Fluorescent Lamp)
- High contrast ratio, High transmittance ratio
- Wide viewing angle
- High speed response
- Low power consumption
- LVDS interface

### Applications

Information Appliance

Industrial Application

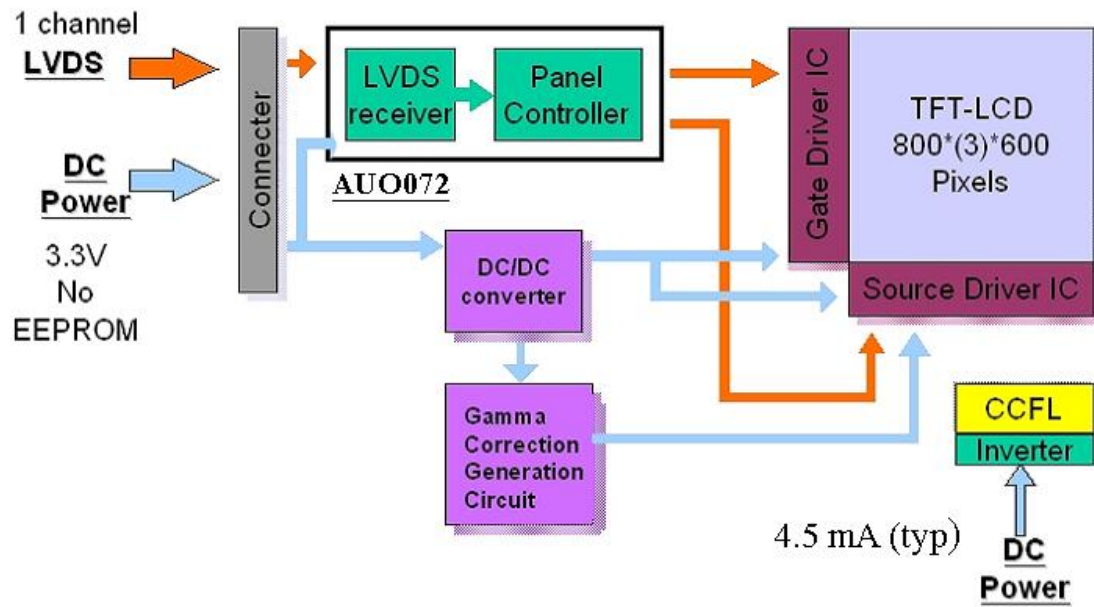
## 2.1 Display Characteristics

The following items are characteristics summary on the table under 25°C condition :

| Items                                               | Unit                 | Specifications                        |
|-----------------------------------------------------|----------------------|---------------------------------------|
| Screen Diagonal                                     | [inch]               | 10.4"                                 |
| Outline dimension                                   | [mm]                 | 236.0(W) x 174.3(H) x 7.4(D)          |
| Active Area                                         | [mm]                 | 211.2(H) x 158.4(V)                   |
| Resolution H x V                                    |                      | 800(R, G,B x3) x 600                  |
| Pixel Pitch                                         | [mm]                 | 0.264(H) x 0.264(V)                   |
| Pixel Arrangement                                   |                      | R.G.B. Vertical Stripe                |
| Display Mode                                        |                      | TN mode, Normally White               |
| Typical White Luminance (ICFL=4.5 mA)               | [cd/m <sup>2</sup> ] | 180 Typ. (center)                     |
| Contrast Ratio                                      |                      | 500 : 1 Typ.                          |
| Optical Rise Time/Fall Time                         | [msec]               | 10/25 Typ.                            |
| Viewing angle (CR ≥ 10)                             |                      | 60/60/35/65 (L/R/U/D)                 |
| Nominal Input Voltage VDD                           | [Volt]               | +3.3 Typ.                             |
| Typical Power Consumption<br>(VDD line + VCFL line) | [Watt]               | 3.3 Typ                               |
| Weight                                              | [Grams]              | 400 Typ ± 10                          |
| Surface treatment                                   |                      | Anti-glare,hard coating 3H            |
| Electrical Interface                                |                      | 1 channel LVDS                        |
| Support Color                                       |                      | Native 262K colors (RGB 6-bit driver) |
| Temperature Range                                   |                      |                                       |
| Operating                                           | [°C]                 | 0 to +50                              |
| Storage(Shipping)                                   | [°C]                 | -20 to +60                            |

## 2.2 Functional Block Diagram

The following diagram shows the functional block of the 10.4 inches Color TFT LCD Module :



### 3.0 Absolute Maximum Ratings

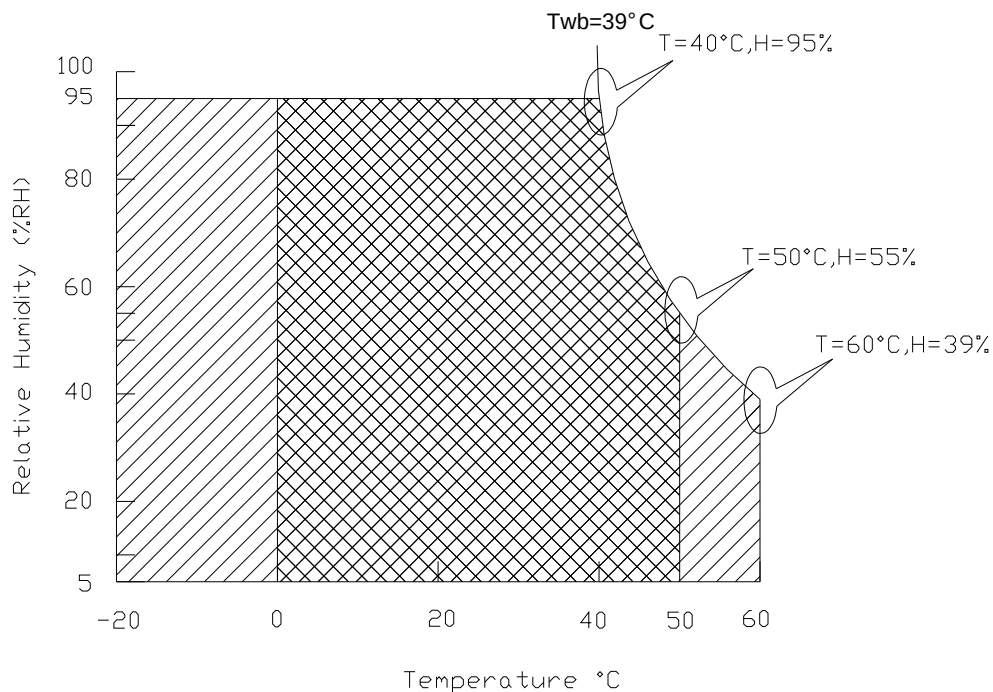
(GND = 0 V)

| Parameter             | Symbol   | Values |              | Unit    | Remark         |
|-----------------------|----------|--------|--------------|---------|----------------|
|                       |          | Min.   | Max.         |         |                |
| Power voltage         | $V_{DD}$ | -0.3   | 4            | [Volt]  | At 25°C        |
| Input signal voltage  | $V_{in}$ | -0.3   | $V_{DD}+0.3$ | [Volt]  | At 25°C        |
| CCFL current          | ICFL     | 3.0    | 5.5          | [mA]rms |                |
| CCFL starting Voltage | $V_s$    | -      | 800          | [Vrms]  | AT 25°C        |
| Operating temperature | $T_{op}$ | 0      | +50          | [°C]    | Note 1         |
| Operating Humidity    | $H_{OP}$ | 8      | 90           | [%RH]   | Note 1         |
| Storage temperature   | $T_{ST}$ | -20    | +60          | [°C]    | Note 1         |
| Storage Humidity      | $H_{ST}$ | 5      | 90           | [%RH]   | Note 1         |
| Vibration             |          |        | 1.5,10~200~1 | [G,HZ]  |                |
| Shock                 |          |        | 200,2        | [G,ms]  | Half sine wave |

Note 1: The relative humidity must not exceed 90% non-condensing at temperatures of 40 °C or less. At temperatures greater than 40 °C, the wet bulb temperature must not exceed 39 °C. When operate at low temperatures, the brightness of CCFL will drop and the life time of CCFL will be reduced.

Note 2: The unit should not be exposed to corrosive chemicals.

#### Wet bulb temperature chart



Operating Range 

Storage Range  + 



## 4.0 Optical Characteristics (Note 1, Note 2)

| Item                          | Symbol                         | Condition          | Specification        |                      |                  | Unit | Remark       |
|-------------------------------|--------------------------------|--------------------|----------------------|----------------------|------------------|------|--------------|
|                               |                                |                    | Min.                 | Typ.                 | Max.             |      |              |
| Response time                 |                                |                    |                      |                      |                  |      |              |
| Rising time                   | Tr                             | $\theta = 0^\circ$ | -                    | 10                   | 20               | ms   | Note 4       |
| Falling time                  | Tf                             |                    | -                    | 25                   | 30               |      |              |
| Contrast ratio                | CR                             | $\theta = 0^\circ$ | 400                  | 500                  | -                |      | Note 3,5     |
| Viewing angle                 | Top<br>Bottom<br>Left<br>Right | $CR \geq 10$       | 30<br>60<br>60<br>60 | 35<br>65<br>60<br>60 | -<br>-<br>-<br>- | deg. | Note 3,6     |
| White Luminance (ICFL=4.5 mA) | [cd/m <sup>2</sup> ]           | $\theta = 0^\circ$ | 160                  | 180                  | -                | nit  | Note 3,7,8,9 |
| Color chromaticity(CIE)       | Wx                             | $\theta = 0^\circ$ | 0.280                | 0.320                | 0.340            |      | Note 3,8,9   |
|                               | Wy                             |                    | 0.300                | 0.330                | 0.360            |      |              |
|                               | Rx                             |                    | 0.540                | 0.570                | 0.600            |      |              |
|                               | Ry                             |                    | 0.290                | 0.320                | 0.350            |      |              |
|                               | Gx                             |                    | 0.270                | 0.300                | 0.330            |      |              |
|                               | Gy                             |                    | 0.530                | 0.560                | 0.590            |      |              |
|                               | Bx                             |                    | 0.115                | 0.145                | 0.175            |      |              |
|                               | By                             |                    | 0.100                | 0.130                | 0.160            |      |              |
| White uniformity              | $\delta_w$                     | 13 Points          | -                    | -                    | 1.33             |      | Note 3,9,10  |

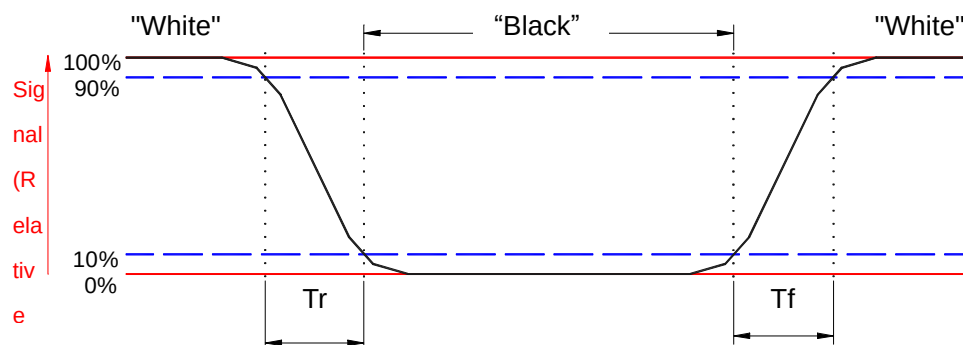
Note 1: Ambient temperature = 25°C.

Note 2: To be measured in dark room after backlight warm up 30 minutes.

Note 3: To be measured with a viewing cone of 1° by Topcon luminance meter BM-5A.

Note 4: Definition of response time:

The output signals of BM-7 are measured when the input signals are changed from "Black" to "White" (falling time) and from "White" to "Black" (rising time), respectively. The response time means the interval between the 10% and 90% of amplitudes. Refer to figure as below.

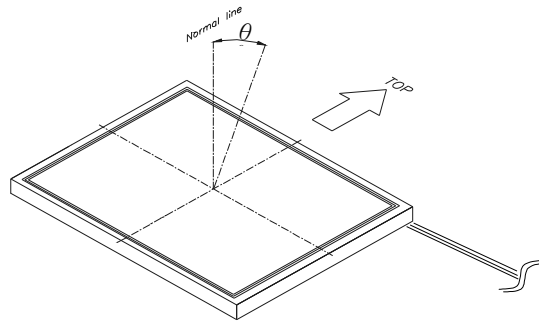


Note 5. Definition of contrast ratio:

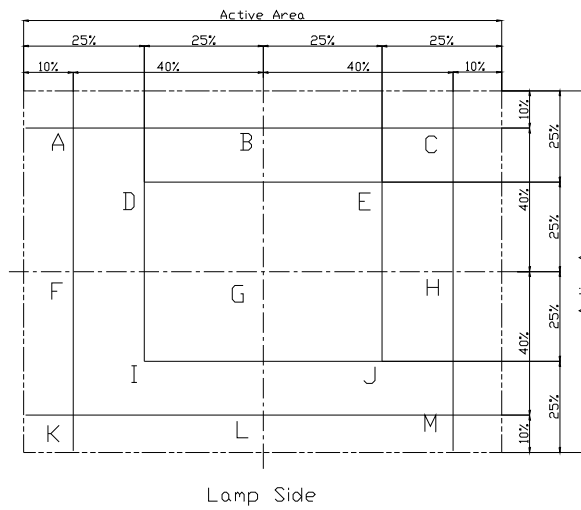
Contrast ratio is calculated with the following formula.

$$\text{Contrast ratio (CR)} = \frac{\text{Luminance on the white raster}}{\text{Luminance on the black raster}}$$

Note 6: Definition of viewing angle:



Note 7: Definition of the 13 points (from A to M) on panel, refer to figure as below



Note 8: Definition of brightness: the luminance of center points (G).

Note 9: Driving conditions for CCFL :  $I_L=4.5$  mA, 60KHz Frequency

Note 10: Definition of white uniformity:

$$\delta_w = \frac{\text{Maximum Luminance of thirteen points (brightness)}}{\text{Minimum Luminance of thirteen points (brightness)}}$$

## 5.0 Signal Interface

### 5.1 Connectors

Physical interface is described as for the connector on module.

These connectors are capable of accommodating the following signals and will be following components.

|                                       |                               |
|---------------------------------------|-------------------------------|
| <b>Connector Name / Designation</b>   | For Signal Connector          |
| <b>Manufacturer</b>                   | HIROSE                        |
| <b>Type / Part Number</b>             | HRS DF 19K-20P-1H             |
| <b>Mating Connector / Part Number</b> | HRS DF19G-20S-1C (WIRE TYPE)) |
| <b>Mating Connector / Part Number</b> | HRS DF19-20S-1F (FPC TYPE)    |

|                                       |                    |
|---------------------------------------|--------------------|
| <b>Connector Name / Designation</b>   | For Lamp Connector |
| <b>Manufacturer</b>                   | JST                |
| <b>Type / Part Number</b>             | BHSR-02VS-1        |
| <b>Mating Connector / Part Number</b> | SM02B-BHSS-1-TB    |

### 5.2 Signal Pin

Pin assignment

(1)Input signal interface

| Pin no | Symbol          | Function                       | Etc. |
|--------|-----------------|--------------------------------|------|
| 1      | V <sub>CC</sub> | +3.3 V power supply            |      |
| 2      | V <sub>CC</sub> | +3.3 V power supply            |      |
| 3      | GND             | Ground                         |      |
| 4      | GND             | Ground                         |      |
| 5      | RxIN0-          | LVDS receiver signal channel 0 |      |
| 6      | RxIN0+          |                                |      |
| 7      | GND             | Ground                         |      |
| 8      | RxIN1-          | LVDS receiver signal channel 1 |      |
| 9      | RxIN1+          |                                |      |
| 10     | GND             | Ground                         |      |
| 11     | RxIN2-          | LVDS receiver signal channel 2 |      |
| 12     | RxIN2+          |                                |      |
| 13     | GND             | Ground                         |      |
| 14     | CKIN-           | LVDS receiver signal clock     |      |
| 15     | CKIN+           |                                |      |
| 16     | GND             | Ground                         |      |
| 17     | NC              | No Connection                  |      |
| 18     | NC              | No Connection                  |      |
| 19     | GND             | Ground                         |      |
| 20     | GND             | Ground                         |      |

(2) LVDS transmitter/receiver signal mapping

|         | Symbol | Function         |                          |
|---------|--------|------------------|--------------------------|
| TxIN0   | R0     | Red data (LSB)   | 6 bit red display data   |
| TxIN1   | R1     | Red data         |                          |
| TxIN2   | R2     | Red data         |                          |
| TxIN3   | R3     | Red data         |                          |
| TxIN4   | R4     | Red data         |                          |
| TxIN5   | R5     | Red data (MSB)   |                          |
| TxIN6   | G0     | Green data (LSB) | 6 bit green display data |
| TxIN7   | G1     | Green data       |                          |
| TxIN8   | G2     | Green data       |                          |
| TxIN9   | G3     | Green data       |                          |
| TxIN10  | G4     | Green data       |                          |
| TxIN11  | G5     | Green data (MSB) |                          |
| TxIN12  | B0     | Blue data (LSB)  | 6 bits blue display data |
| TxIN13  | B1     | Blue data        |                          |
| TxIN14  | B2     | Blue data        |                          |
| TxIN15  | B3     | Blue data        |                          |
| TxIN16  | B4     | Blue data        |                          |
| TxIN17  | B5     | Blue data (MSB)  |                          |
| TxIN18  | Hs     | Horizontal sync. |                          |
| TxIN19  | Vs     | Vertical sync.   |                          |
| TxIN20  | DE     | Data enable      |                          |
| TxCLKIN | CLK    | Clock            | Dot clock                |

## 5.3 Signal Description

The module using a LVDS receiver. LVDS is a differential signal technology for LCD interface and high speed data transfer device. Transmitter shall be SN75LVDS84 (negative edge sampling) or compatible.

**Note** : Input signals shall be low or Hi-Z state when VDD is off.

| Signal Name    | Description                                                  |
|----------------|--------------------------------------------------------------|
| RxIN0-, RxIN0+ | LVDS differential data input (Red0-Red5, Green0)             |
| RxIN1-, RxIN1+ | LVDS differential data input (Green1-Green5, Blue0-Blue1)    |
| RxIN2-, RxIN2+ | LVDS differential data input (Blue2-Blue5, Hsync, Vsync, DE) |
| CKIN-, CKIN+   | LVDS differential clock input                                |
| VDD            | +3.3V Power Supply                                           |
| GND            | Ground                                                       |
| NC             | No Connection                                                |

| Signal Name                                                    | Description                                                                                                                  |                                                                                                                                                                           |
|----------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| +RED5<br>+RED4<br>+RED3<br>+RED2<br>+RED1<br>+RED0             | Red Data 5 (MSB)<br>Red Data 4<br>Red Data 3<br>Red Data 2<br>Red Data 1<br>Red Data 0 (LSB)<br>Red-pixel Data               | Red-pixel Data<br>Each red pixel's brightness data consists of these 6 bits pixel data.                                                                                   |
| +GREEN5<br>+GREEN4<br>+GREEN3<br>+GREEN2<br>+GREEN1<br>+GREEN0 | Green Data 5 (MSB)<br>Green Data 4<br>Green Data 3<br>Green Data 2<br>Green Data 1<br>Green Data 0 (LSB)<br>Green-pixel Data | Green-pixel Data<br>Each green pixel's brightness data consists of these 6 bits pixel data.                                                                               |
| +BLUE5<br>+BLUE4<br>+BLUE3<br>+BLUE2<br>+BLUE1<br>+BLUE0       | Blue Data 5 (MSB)<br>Blue Data 4<br>Blue Data 3<br>Blue Data 2<br>Blue Data 1<br>Blue Data 0 (LSB)<br>Blue-pixel Data        | Blue-pixel Data<br>Each blue pixel's brightness data consists of these 6 bits pixel data.                                                                                 |
| CLK                                                            | Data Clock                                                                                                                   | The typical frequency is 40MHz. The signal is used to strobe the pixel data and DE signals. All pixel data shall be valid at the falling edge when the DE signal is high. |
| DE                                                             | Display Timing                                                                                                               | This signal is strobed at the falling edge of CLK. When the signal is high, the pixel data shall be valid to be displayed.                                                |
| VSYNC                                                          | Vertical Sync                                                                                                                | The signal is synchronized to CLK.                                                                                                                                        |
| HSYNC                                                          | Horizontal Sync                                                                                                              | The signal is synchronized to CLK.                                                                                                                                        |

**Note** : Output signals from any system shall be low or Hi-Z state when VDD is off.

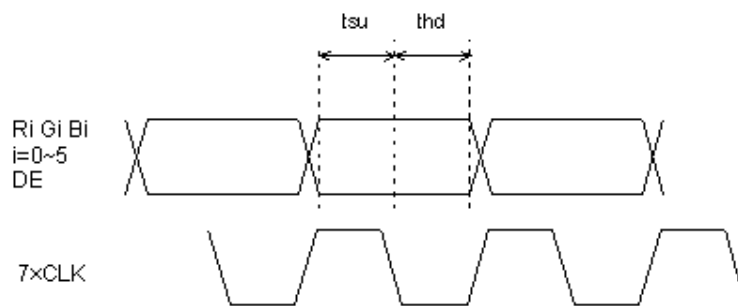
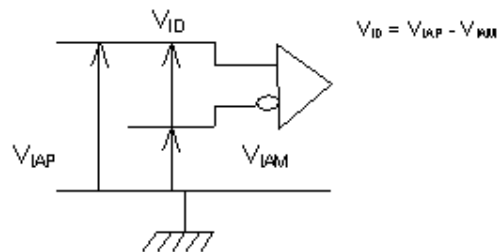
## 5.4 Signal Electrical Characteristics

Input signals shall be low or Hi-Z state when VDD is off.

It is recommended to refer the specifications of SN75LVDS86(Texas Instruments) in detail.

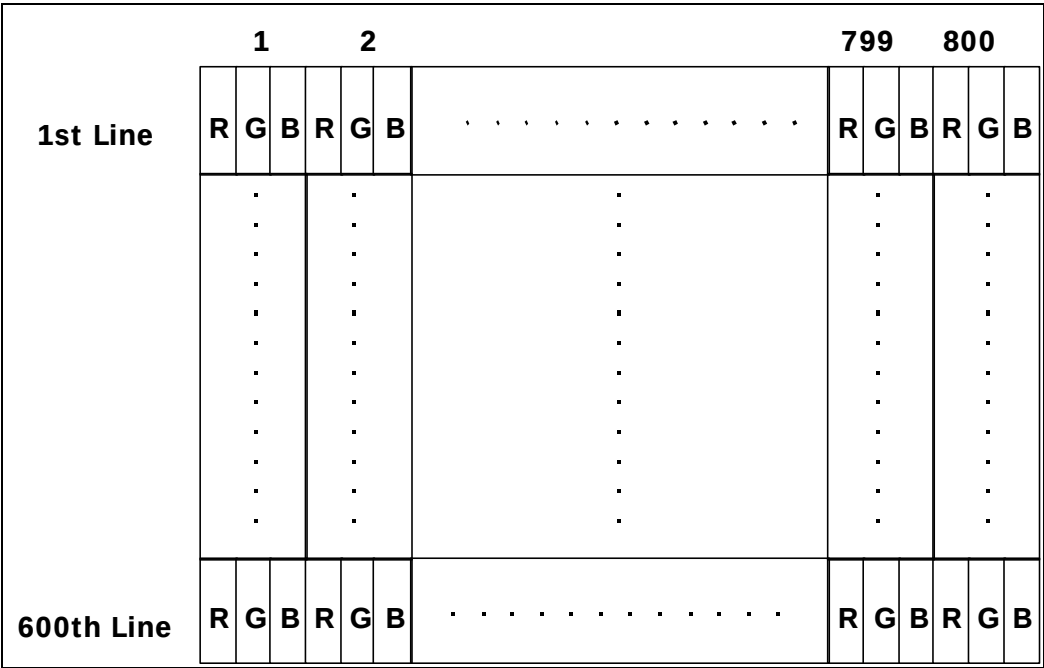
Signal electrical characteristics are as follows :

| Item                          | Symbol     | Min.                 | Typ. | Max.                       | Unit |
|-------------------------------|------------|----------------------|------|----------------------------|------|
| The differential level        | $ V_{ID} $ | 0.1                  | -    | 0.6                        | V    |
| The common mode input voltage | $V_{IC}$   | $\frac{ V_{ID} }{2}$ | -    | $2.4 - \frac{ V_{ID} }{2}$ | V    |
| The input setup time          | $t_{su}$   | 0.5                  | -    | -                          | ns   |
| The input hold time           | $t_{hd}$   | 0.5                  | -    | -                          | ns   |
| High-level input voltage      | $V_{IAP}$  | 2.0                  |      |                            | V    |
| Low-level input voltage       | $V_{IAM}$  |                      |      | 0.8                        | V    |
| Clock frequency               | CLK        | 31                   |      | 68                         | MHz  |



# 6.0 Pixel Format Image

Following figure shows the relationship of the input signals and LCD pixel format :

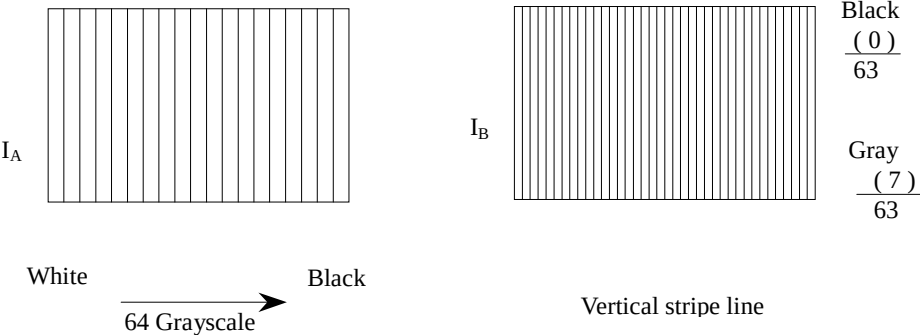


# 7.0 Power Consumption

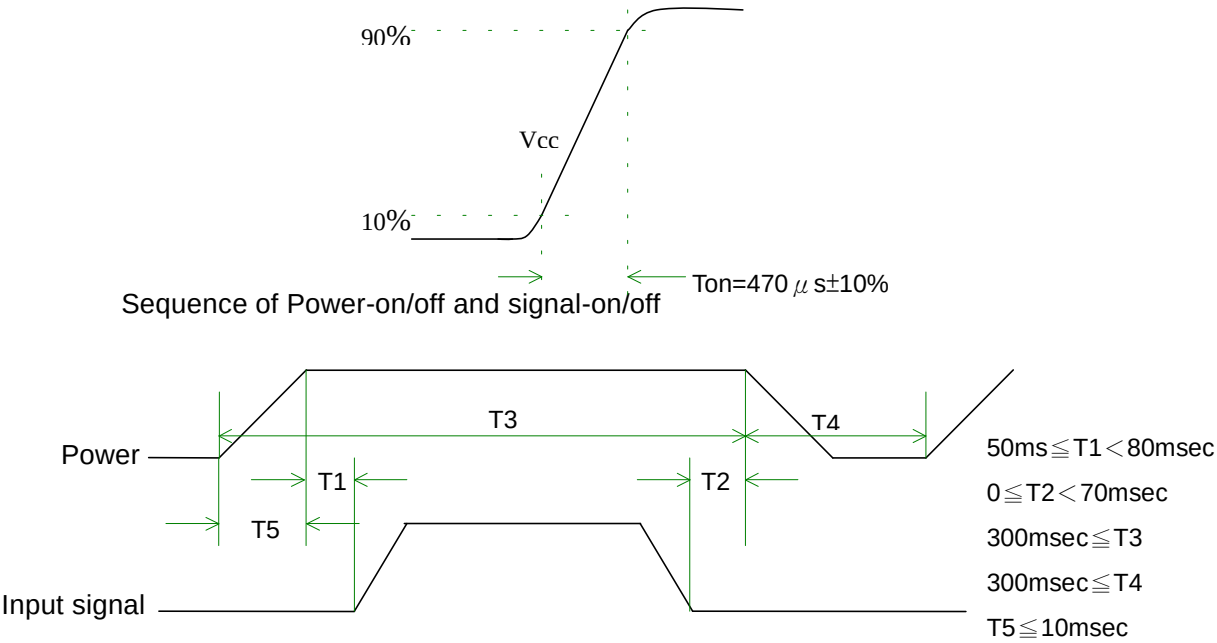
Input power specifications are as follows :

| Item                        |                     | Symbol     | Min.        | Typ. | Max.         | Unit   | Remark |
|-----------------------------|---------------------|------------|-------------|------|--------------|--------|--------|
| Power supply voltage        | Input voltage       | $V_{CC}$   | 3.0         | 3.3  | 3.6          | V      |        |
|                             | Current consumption | $I_A$      |             | 230  |              | mArms  | Note 1 |
|                             |                     | $I_B$      |             | 260  | 310          | mArms  |        |
|                             | Inrush current      | $I_{RUSH}$ | -           | -    | 1500         | mApeak | Note 2 |
| Internal logic              | Low voltage         | $V_{IL}$   | 0           | -    | $0.3 V_{CC}$ |        |        |
|                             | High voltage        | $V_{IH}$   | $0.7V_{CC}$ | -    | $V_{CC}$     |        |        |
| Power ripple voltage        |                     | $V_{RP}$   | -           | -    | 100          | mVp-p  |        |
| LCD Drive power consumption |                     | $P_{DD}$   |             | 0.76 |              | [Watt] |        |

Note 1:Effective value (mArms) at  $V_{CC} = 3.3\text{ V}/25^{\circ}\text{C}$ .



Note 2: Refer to the following power-on condition.





Apply the lamp voltage within the LCD operating range. When the backlight turns on before the LCD operation or the LCD turns off before the backlight turns off, the display may momentarily become abnormal.

**Caution**

The above on/off sequence should be applied to avoid abnormal function in the display.

In case of handling:

Make sure to turn off the power when you plug the cable into the input connector or pull the cable out of the connector.

## 8.0 Interface Timings

### 8.1 Display color v.s. input data signals:

| Display colors  |         | Data signal (0 : Low level, 1: High level) |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
|-----------------|---------|--------------------------------------------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
|                 |         | R5                                         | R4 | R3 | R2 | R1 | R0 | G5 | G4 | G3 | G2 | G1 | G0 | B5 | B4 | B3 | B2 | B1 | B0 |
| Basic colors    | Black   | 0                                          | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                 | Blue    | 0                                          | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  |
|                 | Red     | 1                                          | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                 | Magenta | 1                                          | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  |
|                 | Green   | 0                                          | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  |
|                 | Cyan    | 0                                          | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  |
|                 | 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 grayscale   | Black   | 0                                          | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                 | Dark    | 0                                          | 0  | 0  | 0  | 0  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                 | ↑       |                                            |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
|                 | ↓       |                                            |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
|                 | bright  | 1                                          | 1  | 1  | 1  | 0  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                 | Red     | 1                                          | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
| Green grayscale | Black   | 0                                          | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                 | Dark    | 0                                          | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                 | ↑       |                                            |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
|                 | ↓       |                                            |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
|                 | bright  | 0                                          | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 0  | 1  | 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 grayscale  | Black   | 0                                          | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                 | Dark    | 0                                          | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 0  |
|                 | ↑       |                                            |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
|                 | ↓       |                                            |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
|                 | bright  | 0                                          | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 0  | 1  |
|                 | Blue    | 0                                          | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  |

Note : Each basic color can be displayed in 64 gray scales using the 6 bit data signals. By combining the 18-bit data signals(R, G, B), the 262, 144 colors can be achieved on the display.

## 8.2. Input signal timing

### (1). Timing characteristics of input signals

#### (a) DE mode

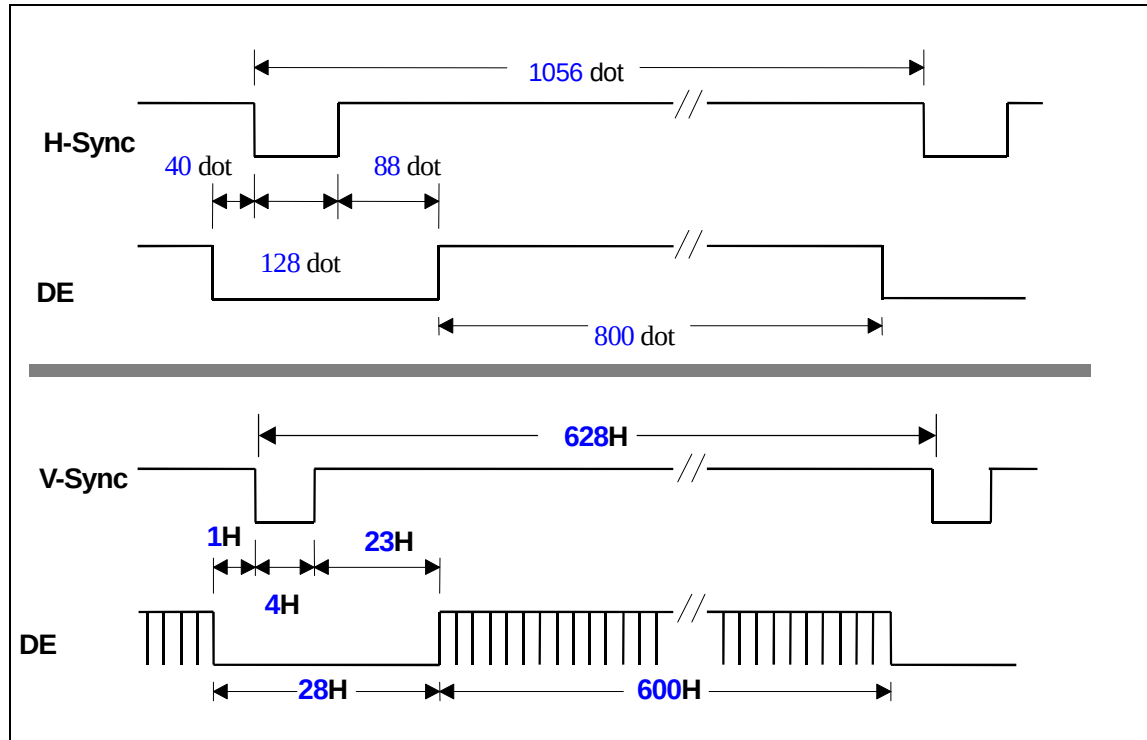
| Item                | Symbol | Min. | Typ. | Max. | Unit | Remark |
|---------------------|--------|------|------|------|------|--------|
| Clock frequency     | Fck    | 36   | 40   | 50   | MHz  |        |
| Horizontal blanking | Thb1   | 18   | 256  | 624  | Clk  |        |
| Vertical blanking   | Tvb1   | 3    | 28   | 184  | Th   |        |

#### (b) HV mode

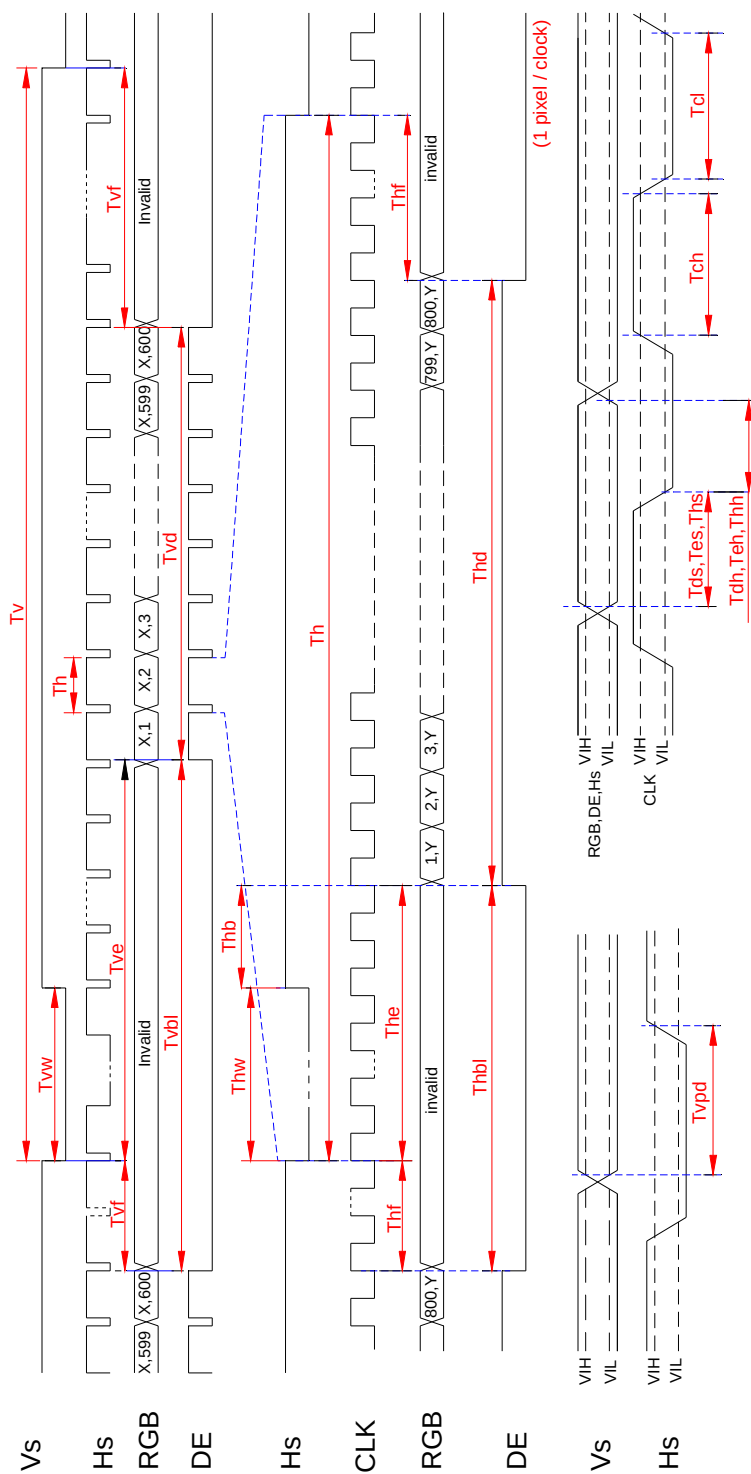
| Item                    | Symbol | Min. | Typ. | Max. | Unit | Remark |
|-------------------------|--------|------|------|------|------|--------|
| Clock frequency         | Fck    | 36   | 40   | 50   | MHz  |        |
| Hsync period            | Th     | 818  | 1056 | 1424 | Clk  |        |
| Hsync pulse width       | Thw    | 2    | 128  | -    | Clk  |        |
| Hsync front porch       | Thf    | 8    | 40   | -    | Clk  |        |
| Hsync back porch        | Thb    | 4    | 88   | -    | Clk  |        |
| Hsync blanking          | Thb1   | 18   | 256  | 624  | Clk  |        |
| Vsync period            | Tv     | 603  | 628  | 784  | Th   |        |
| Vsync pulse width       | Tvw    | 1    | 4    | -    | Th   |        |
| Vsync front porch       | Tvf    | 0    | 1    | -    | Th   |        |
| Vsync blanking          | Tvb1   | 3    | 28   | 184  | Th   |        |
| Hsync/Vsync phase shift | Tvpd   | 2    | 320  | -    | Clk  |        |

| Item                     | Symbo | Value | Unit | Description                                                                                  |
|--------------------------|-------|-------|------|----------------------------------------------------------------------------------------------|
| Horizontal display start | The   | 218   | Clk  | After falling edge of Hsync, counting 218clk, then getting valid data from 219th clk's data. |
| Vertical display start   | Tve   | 25    | Th   | After falling edge of Vsync, counting 25th, then getting 26th Th's data.                     |

(2). Timing Definition:



(3)Timing Chart:



## Timing chart

### 8.3. Display position

|            |            |       |            |       |              |              |
|------------|------------|-------|------------|-------|--------------|--------------|
| D( 1,1 )   | D( 2,1 )   | ..... | D( X,1 )   | ..... | D( 799,1 )   | D( 800,1 )   |
| D( 1,2 )   | D( 2,2 )   | ..... | D( X,2 )   | ..... | D( 799,2 )   | D( 800,2 )   |
| ⋮          |            | ..... | ⋮          | ..... | ⋮            | ⋮            |
| D( 1,Y )   | D( 2,Y )   | ..... | D( X,Y )   | ..... | D( 799,Y )   | D( 800,Y )   |
| ⋮          |            | ..... | ⋮          | ..... | ⋮            | ⋮            |
| D( 1,599 ) | D( 2,599 ) | ..... | D( X,599 ) | ..... | D( 799,599 ) | D( 800,599 ) |
| D( 1,600 ) | D( 2,600 ) | ..... | D( X,600 ) | ..... | D( 799,600 ) | D( 800,600 ) |

## 9.0 Backlight Characteristic

Backlight driving conditions

| Parameter             | Symbol | Min.  | Typ.  | Max. | Unit              | Remark    |
|-----------------------|--------|-------|-------|------|-------------------|-----------|
| Lamp voltage          | $V_L$  | 510   | 560   | 610  | Vrms              | Note 1    |
| Lamp current          | $I_L$  | 3.0   | 4.5   | 5.5  | mA <sub>rms</sub> | Note 1    |
| Power consumption     | $P_L$  | -     | 2.52  | -    | W                 | Note 2    |
| Lamp starting voltage | $V_S$  | -     | -     | 1050 | Vrms              | T=0°C     |
|                       |        | -     | -     | 800  |                   | T=25°C    |
| Frequency             | $F_L$  | -     | 60    | -    | KHz               | Note 3    |
| Lamp life time        | $L_L$  | 10000 | 20000 | -    | Hr                | Note 1, 4 |

Note 1: T= 25°C,  $I_L$  = 4.5mA

Note 2: Inverter should be designed with the characteristic of lamp. When you are designing the inverter, the output voltage of the inverter should comply with the following conditions.

- (1). The area under the positive and negative cycles of the waveform of the lamp current and lamp voltage should be area symmetric(the symmetric ratio should be larger than 90%).
- (2). There should not be any spikes in the waveform.
- (3). The waveform should be sine wave as possible.
- (4). Lamp current should not exceed the maximum value within the operating Temperature (It is prohibited to over the maximum lamp current even if operated in The non-guaranteed temperature). When lamp current over the maximum value for a long time, it may cause fire. Therefore, it is recommend that the inverter should have the current limited circuit.

Note 3: Lamp frequency may produce interference with horizontal synchronous frequency and this may cause line flow on the display. Therefore lamp frequency shall be detached from the horizontal synchronous frequency and its harmonics as far as possible in order to avoid interference.

Note 4: Brightness ( $I_L=4.5mA$ ) to be decrease to the 50% of the initial value.

### Signal for Lamp connector

| Pin no. | Symbol | Function                | Remark             |
|---------|--------|-------------------------|--------------------|
| 1       | H      | CCFL power supply(H.V.) | Cable color: Pink  |
| 2       | L      | CCFL power supply(GND)  | Cable color: White |

## 10.0 Touch Panel Specification

### 10.1 Operating condition

| Item              | Min. | Typ. | Max. | Unit            | Remark |
|-------------------|------|------|------|-----------------|--------|
| Operating voltage | -    | 5    | -    | V <sub>DC</sub> |        |

### 10.2 Electrical characteristic

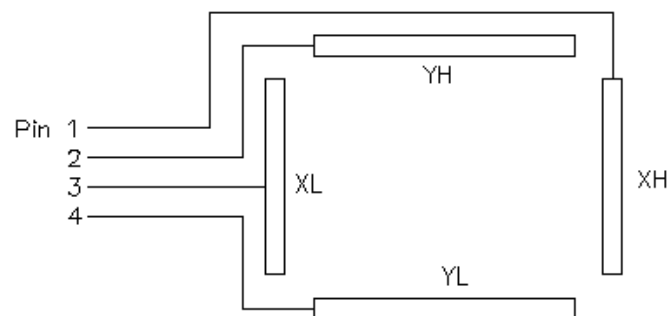
| Item                  |       | Min. | Typ. | Max. | Unit |
|-----------------------|-------|------|------|------|------|
| Terminal Resistance   | XH-XL | 200  | 500  | 800  | Ω    |
|                       | YH-YL | 200  | 500  | 800  | Ω    |
| Insulation resistance | X-Y   | 20   | -    | -    | MΩ   |
| Linearity             | X     | -    | -    | 1.5  | %    |
|                       | Y     | -    | -    | 1.5  | %    |

### 10.3 Mechanical characteristic

| Item                      | Min. | Typ. | Max. | Unit |
|---------------------------|------|------|------|------|
| Pen/Finger input pressure | -    | -    | 120  | g    |
| Surface hardness          | -    | 3    | -    | H    |

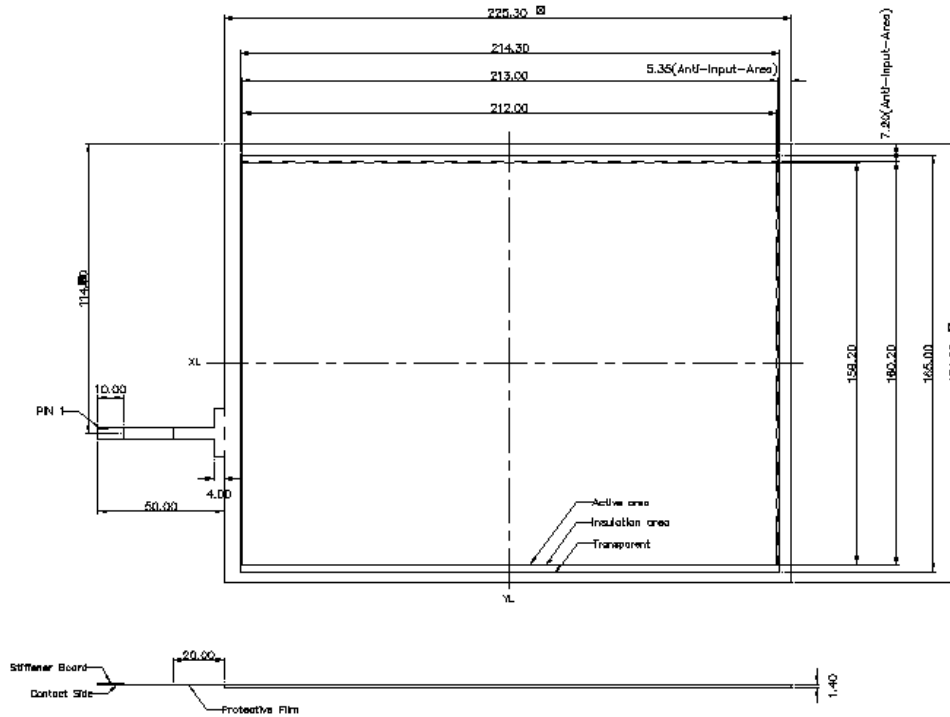
CN3: FFC tail

| Pin. No. | Symbol | Description                        |
|----------|--------|------------------------------------|
| 1        | XH     | High voltage terminal along X-axis |
| 2        | YH     | High voltage terminal along Y-axis |
| 3        | XL     | Low voltage terminal along X-axis  |
| 4        | YL     | Low voltage terminal along Y-axis  |



Connection Description

## 10.4 Touch Panel Outline Dimension





## 11.0 Reliability test items

| Test tem                                   | Test Condition                                                                | Remark        |
|--------------------------------------------|-------------------------------------------------------------------------------|---------------|
| High temperature storage                   | 70℃ , 300Hrs                                                                  | Note 1, 2 , 3 |
| Low temperature storage                    | -20℃ , 300Hrs                                                                 | Note 1, 2 , 3 |
| High temperature & high humidity operation | 40℃ , 90%RH, 300Hrs<br>(No condensation)                                      | Note 1, 2 , 3 |
| High temperature operation                 | 50℃ , 300Hrs                                                                  | Note 1, 2 , 3 |
| Low temperature operation                  | 0℃ , 300Hrs                                                                   | Note 1, 2 , 3 |
| Temperature cycling<br>(non-operation)     | -20℃~60℃<br>1H, 10mins, 1H, 5cycles                                           | Note 1, 2 , 3 |
| Electrostatic discharge<br>(non-operation) | 150 pF,150Ω,10kV,1 second, 8<br>position on the panel, 10 times each<br>place | Note 3        |
| Vibration<br>(non-operation)               | Sweep:1.5G, 10Hz~ 200Hz~ 10Hz<br>/2.5min<br>X, Y, Z, 3 directions             | Note 1, 2 , 3 |
| Mechanical shock<br>(non-operation)        | 50G/18ms, 200G/2ms, ±X, ±Y, ±Z<br>once for each direction                     | Note 1, 2 , 3 |

Note 1: Evaluation should be tested after storage at room temperature for one hour.

Note 2: There should be no change which might affect the practical display function when the display quality test is conducted under normal operating condition.

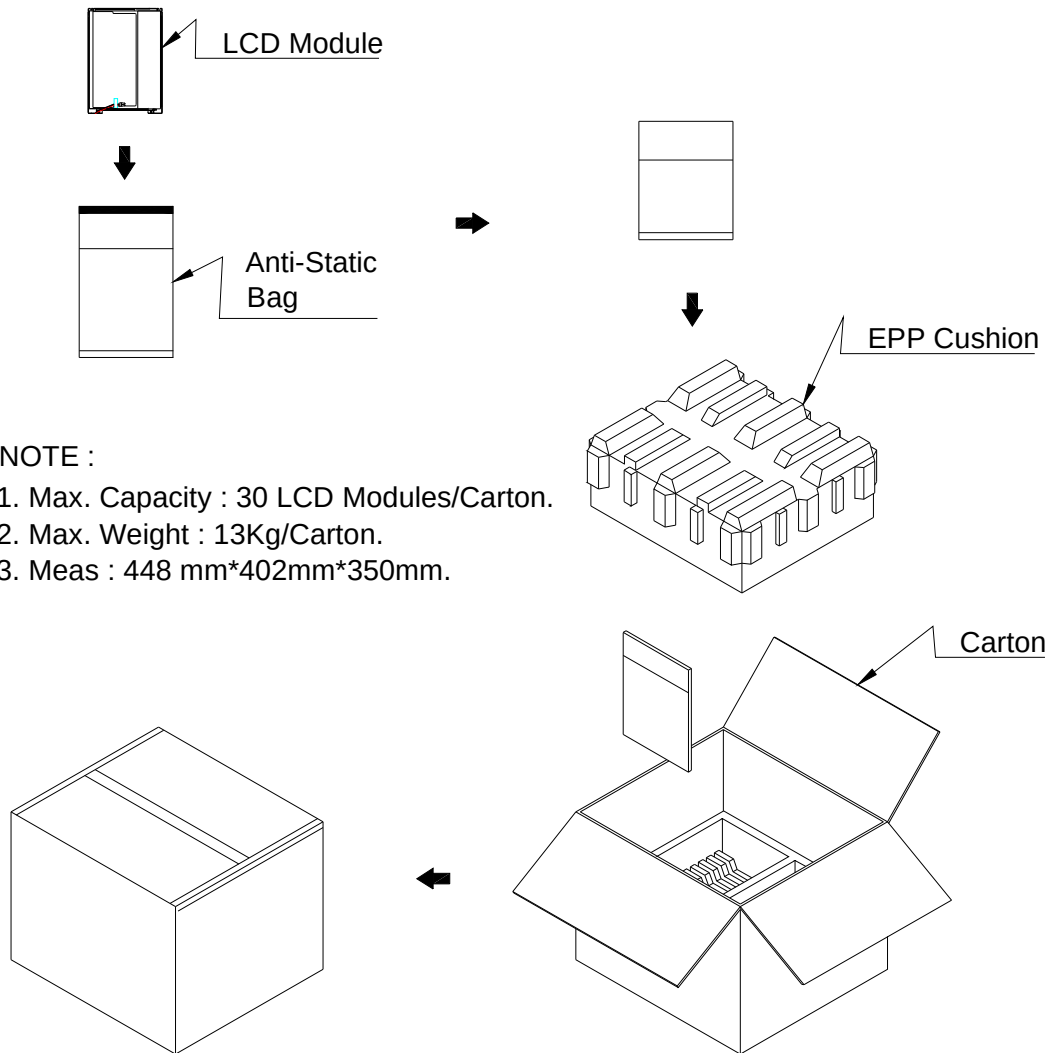
Note 3: Judgment:1. Function OK

2. No serious image quality degradation

## 12.0 Display quality

The display quality of the color TFT-LCD module should be in compliance with the AUO's OQC inspection standard.

## 13.0 Packing Dimension:



## 14.0 Mechanical Characteristic

### LCM outline dimensions

