**AUO**

# Product Specification

# 7.0" COLOR TFT-LCD MODULE

## MODEL NAME: A070VW02 V0

<◆>Preliminary Specification

<　>Final Specification

Note: The content of this specification is subject to change.

# Record of Revision

| Version | Revise Date | Page | Content |
|---------|-------------|------|---------|
| 0.0 | 2006/04/07 | | First draft. |
| 0.1 | 2006/05/03 | 5 | Modify thickness to 6.7mm. |
| 0.2 | 2006/05/10 | 5 | Revise weight |
| | | 6 | Update mechanical drawing |
| | | 17 | Revise optical specifications |
| 0.3 | 2006/05/17 | 13 | Add VS timing diagram for HV mode timing |
| 0.4 | 2006/05/19 | 21 | Add packing form |
| 0.5 | 2006/06/05 | 14 | Remove power on/off sequence |
| | | 19 | Revise heat shock condition |
| 0.6 | 2006/08/05 | 5 | Modify surface treatment description |
| | | 7 | Modify the outline drawing for rear side |
| | | 9 | Define IDD value |
| | | 15-18 | Revise touch panel specifications |
| | | 19 | Revise the note of RA test |
| 0.7 | 2006/08/15 | 13-14 | Update timming value |
| 0.8 | 2006/10/26 | 9 | Update absolute maximum rating |
| | | 9 | Define LED lifetime |
| 0.9 | 2006/10/30 | 8 | Revise the pin assignment, EDID pins are reserved but not connect |
| 1.0 | 2007/01/17 | 7 | Make the outline drawing be clear |
| 1.1 | 2007/03/06 | 7 | PCBA outline modify |
| | | | |
| | | | |

## Contents:

## A. General Description

A070VW02 V0 is a transmissive type color active amorphous Silicon TFT (Thin Film Transistor) LCD (Liquid crystal Display). This model is composed of a TFT-LCD module, a backlight unit, a driving board and a touch panel

## B. Features

- 7-inch display size
- WVGA resolution with stripe dot arrangement
- Single 3.3V power supply for LCD, 6.6V/200mA for LED backlight
- SYNC + DE Mode
- Low power consumption
- LVDS 6-bit input interface
- Wide viewing angle
- Green design

## C. Functional Block Diagram
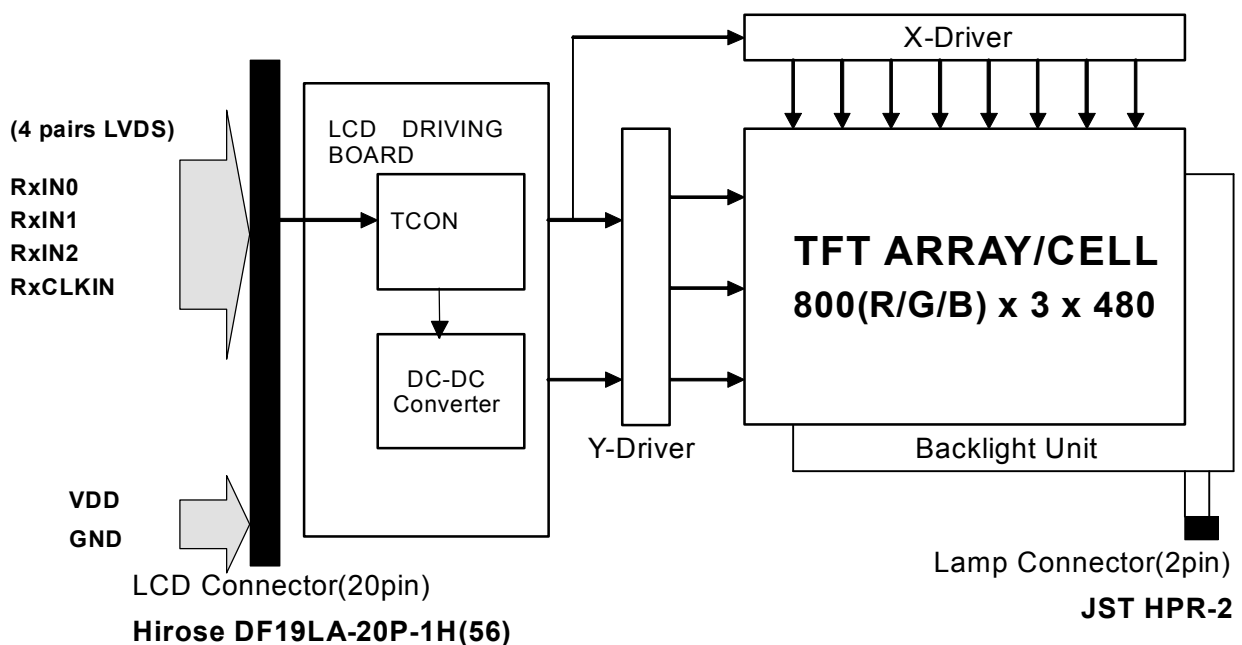
## D. Physical specifications

| NO. | Item | Unit | Specification | Remark |
|-----|------|------|---------------|--------|
| 1 | Display Resolution | dot | 800RGB(H)×480(V) | |
| 2 | Active Area | mm | 152.40(H)×91.44(V) | |
| 3 | Screen Size | inch | 7.0(Diagonal) | |
| 4 | Pixel Pitch | mm | 0.1905(H)×0.1905(V) | |
| 5 | Color Configuration | -- | R. G. B. Stripe | Note 1 |
| 6 | Color Depth | -- | 262K Colors | Note 2 |
| 7 | Overall Dimension | mm | 165(H) × 106(V) × 6.7(T) | Note 3 |
| 8 | Weight | g | 165+/-10% | |
| 9 | Surface treatment | -- | Anti-Glare(8% haze value) | |
| 10 | Display Mode | -- | Normally White | |

Note 1: Below figure shows the dot stripe arrangement.
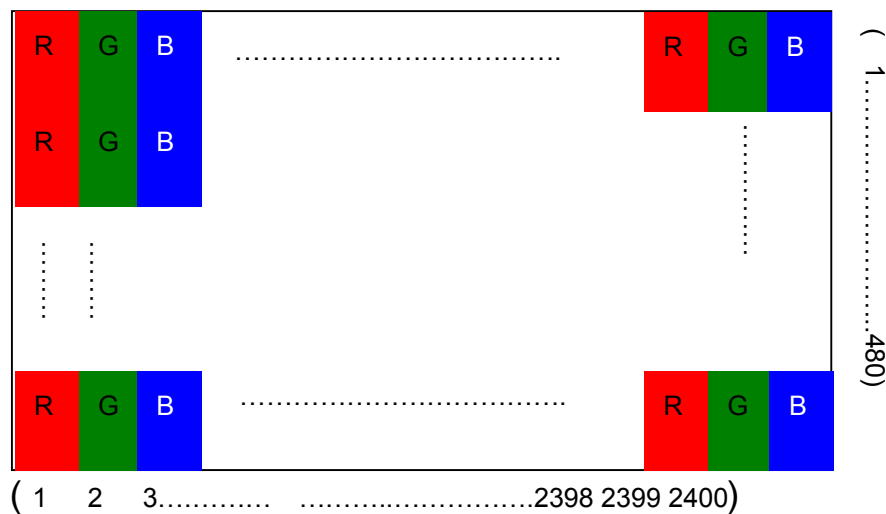


Note 2: The 262K color display depends on 6-bit data signal input.

Note 3: Not including the backlight cable and screw height. Refer to next page for further information

# E. Outline Dimension

## 1. TFT-LCD Module – Front View



General Tolerance : ±0.3

165
164 (T/P)
154.6 (Bezel Opening)
153.4 (T/P Active Area)
152.4 (Active Area)

0.5
7
7.6±1
8.1

70±5

Cathode (-)
Anode (+)
JST PHR-2

6.2
6.9
6.7

106 (T/P)
100 (Bezel Opening)
93.64 (Bezel Opening)
92.44 (T/P Active Area)
91.44 (Active Area)

0.94
5.6
6.2±1
6.7

3.06±1
49.06±1

8 (Stiffner)

15

78.2±1

5±0.2
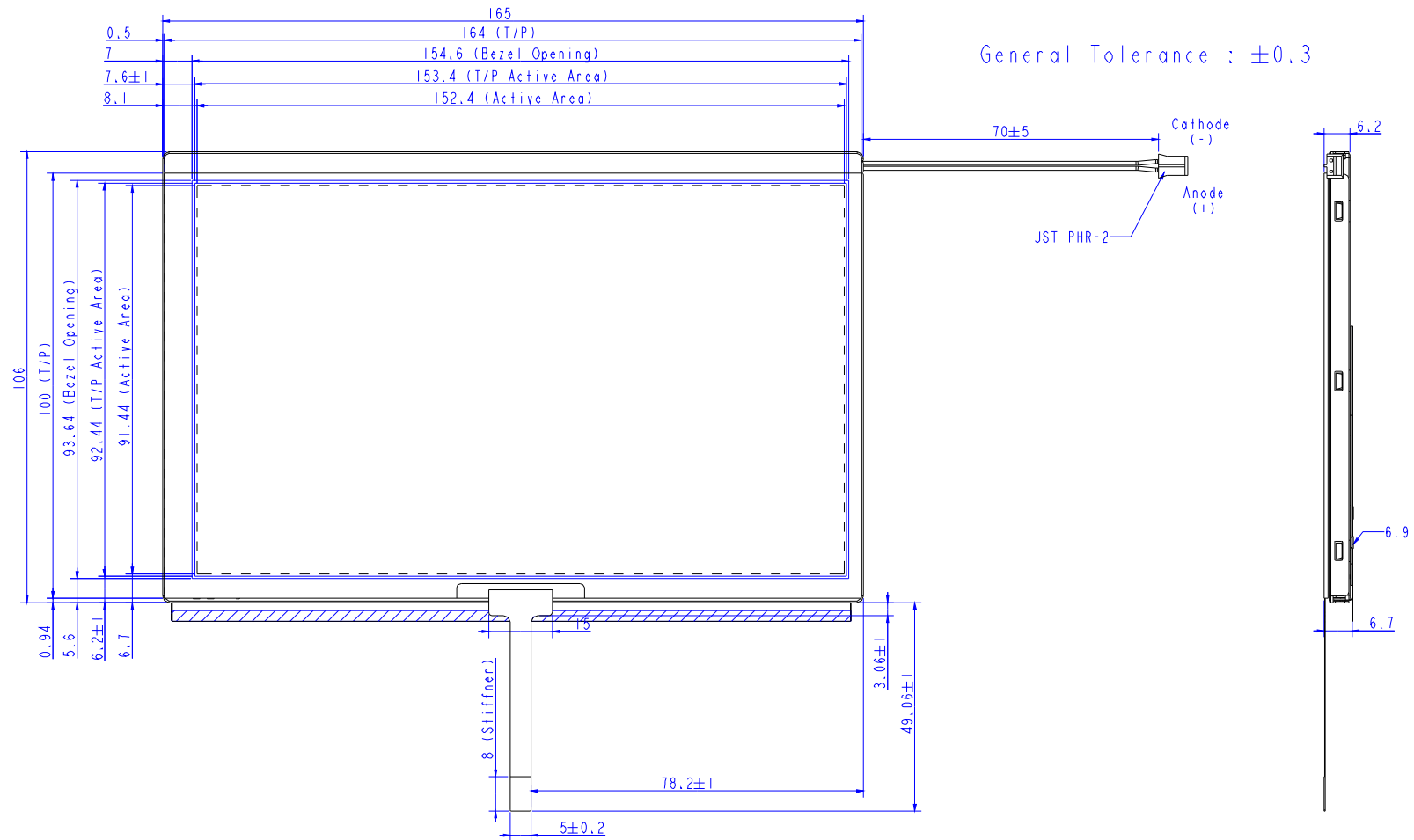
## 2. TFT-LCD Module – Rear View

BAR CODE LABEL

160.9

(30.4)

PIN 1    PIN 20    (4.7)

(23.55)

HIROSE
DF19LA-20P-1H(56)

55

(44)

PIN 1    PIN 4

4±1

1±0.2

P1.0*3=3±0.15  W=0.6±0.1

DETAIL A
SCALE 3/1

SEE DETAIL A
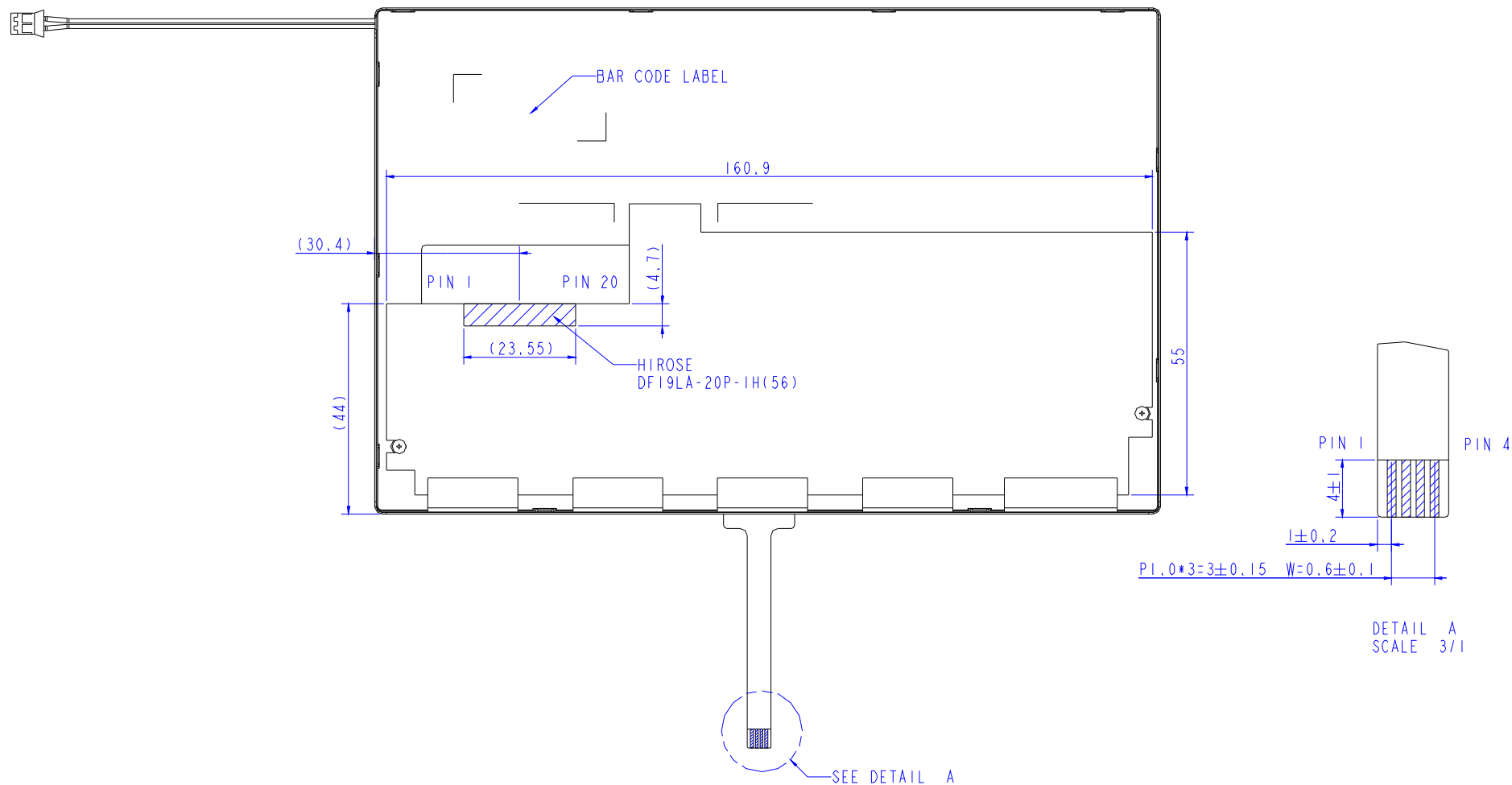
## F. Electrical Specifications

### 1. LVDS Connector Pin Assignment

| Pin No | Symbol | I/O | Function |
|--------|--------|-----|----------|
| 1 | GND | G | Ground |
| 2 | VDD | P | Power supply 3.3V (typical) |
| 3 | VDD | P | Power supply 3.3V (typical) |
| 4 | NC | -- | Reserved – Do not connect |
| 5 | NC | -- | Reserved – Do not connect |
| 6 | NC | -- | Reserved – Do not connect |
| 7 | NC | -- | Reserved – Do not connect |
| 8 | RxIN0N | I | -LVDS differential data input (R0~R5, G0) |
| 9 | RxIN0P | I | +LVDS differential data input (R0~R5, G0) |
| 10 | GND | G | Ground |
| 11 | RxIN1N | I | -LVDS differential data input (G1~G5, B0~B1) |
| 12 | RxIN1P | I | +LVDS differential data input (G1~G5, B0~B1) |
| 13 | GND | G | |
| 14 | RxIN2N | I | -LVDS differential data input (B2~B5, $H_{sync}$, $V_{sync}$, DE) |
| 15 | RxIN2P | I | +LVDS differential data input (B2~B5, $H_{sync}$, $V_{sync}$, DE) |
| 16 | GND | G | Ground |
| 17 | RxCLKINN | I | -LVDS differential clock input |
| 18 | RxCLKINP | I | +LVDS differential clock input |
| 19 | GND | G | Ground |
| 20 | GND | G | Ground |

I: Input pin; P: Power pin; G: Ground pin
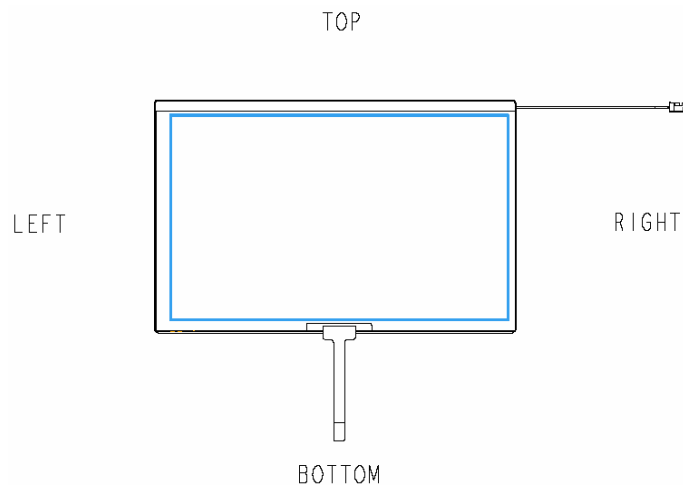
## 2. Absolute Maximum Ratings

| Items | Symbol | Product Specification | | | Unit |
|---|---|---|---|---|---|
| | | Min. | Typ. | Max. | |
| Power Voltage | VDD | -0.3 | | 4 | V |
| Operation Temperature | Topa | 0 | | 60 | ℃ |
| Storage Temperature | Tstg | -20 | | 65 | ℃ |

# G. Electrical Characteristics

The following items are measured under a stable condition and suggested application circuit.

## 1. TFT-LCD Typical Operation Condition

| Items | Symbol | Product Specification | | | Unit |
|---|---|---|---|---|---|
| | | Min. | Typ. | Max. | |
| Power Voltage | VDD | 3.0 | 3.3 | 3.6 | V |
| IDD Current | IDD | -- | 190 | 210 | mA |

Note: Above every operation range is based on stable operation.

## 2. Backlight Driving Condition

| Parameter | Symbol | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|
| Voltage for LED | VLED | -- | 6.6 | -- | V |
| Current for LED | ILED | -- | 200 | 240 | mA |
| LED lifetime | | 10,000 | | | Hrs |

Note 1: Panel surface temperature should be kept less than content of "Absolute maximum ratings"

Note 2: The "LED life time" is defined as the module brightness decrease to 50% original brightness at Ta=25℃, IL=200mA

## 3. Signal Electrical Characteristics

### a. Signal Operation Condition

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

It is recommended to refer to the specifications of SN75LVDS86DGG(Texas Instruments) in detail.

Signal electrical characteristics are as follows

| Parameter | Condition | Min | Max | Unit |
|---|---|---|---|---|
| Vth | Differential Input High Threshold (Vcm=+1.2V) | | 100 | [mV] |
| Vtl | Differential Input Low Threshold (Vcm=+1.2V) | -100 | | [mV] |

Note: LVDS Signal Waveform:

VtH

Vtl

*Vcm*

*VSS*
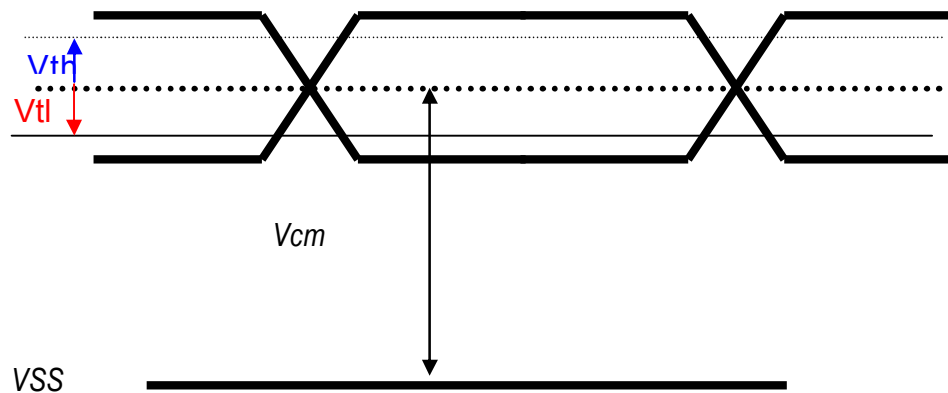
The module uses a 100ohm resistor between positive and negative data lines of each receiver input.

**Signal Input**

LVDS Receiver

Pin No.

8  **RxIN0-**

R

9  **RxIN0+**

11 **RxIN1-**

R

12 **RxIN1+**

14 **RxIN2-**

R

15 **RxIN2+**

17 **RxCLKIN-**

R

18 **RxCLKIN+**

### b. Input Data Format
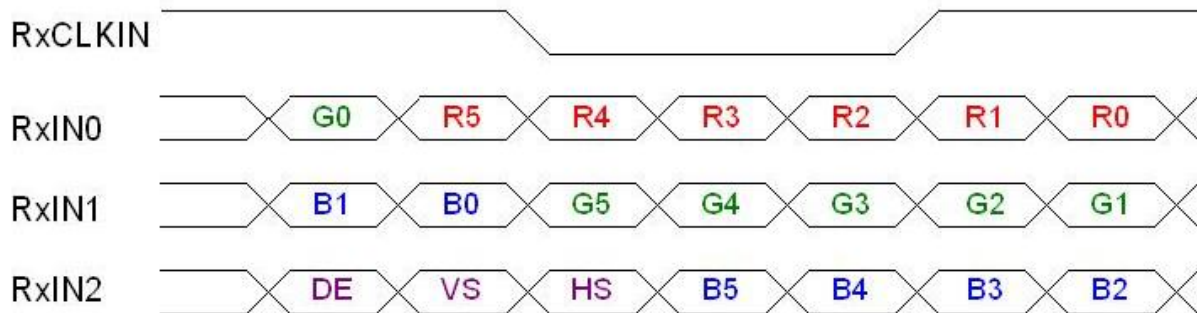


| Signal Name | Description | |
|---|---|---|
| RED5 | Red Data 5 (MSB) | Red-pixel Data |
| RED4 | Red Data 4 | Each red pixel's brightness data consists of these 6 |
| RED3 | Red Data 3 | bits pixel data. |
| RED2 | Red Data 2 | |
| RED1 | Red Data 1 | |
| RED0 | Red Data 0 (LSB) | |
| | Red-pixel Data | |
| GREEN 5 | Green Data 5 (MSB) | Green-pixel Data |
| GREEN 4 | Green Data 4 | Each green pixel's brightness data consists of these 6 |
| GREEN 3 | Green Data 3 | bits pixel data. |
| GREEN 2 | Green Data 2 | |
| GREEN 1 | Green Data 1 | |
| GREEN 0 | Green Data 0 (LSB) | |
| | Green-pixel Data | |
| BLUE 5 | Blue Data 5 (MSB) | Blue-pixel Data |
| BLUE 4 | Blue Data 4 | Each blue pixel's brightness data consists of these 6 |
| BLUE 3 | Blue Data 3 | bits pixel data. |
| BLUE 2 | Blue Data 2 | |
| BLUE 1 | Blue Data 1 | |
| BLUE 0 | Blue Data 0 (LSB) | |
| | Blue-pixel Data | |

| DTCLK | Data Clock | The signal is used to strobe the pixel data and DSPTMG signals. All pixel data shall be valid at the falling edge when the DSPTMG signal is high. |
|---|---|---|
| DSPTMG | Display Timing | This signal is strobed at the falling edge of -DTCLK. When the signal is high, the pixel data shall be valid to be displayed. |
| VSYNC | Vertical Sync | The signal is synchronized to -DTCLK . |
| HSYNC | Horizontal Sync | The signal is synchronized to -DTCLK . |

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

### c. Signal Description

The LVDS receiver equipped in this LCD module is compatible with SN75LVDS86 standard. LVDS is a differential signal technology for LCD interface and high speed data transfer device. Transmitter shall be SN75LVDS84 (negative edge sampling) or compatible.

| Signal Name | Description |
|---|---|
| RxIN0N, RxIN0P | LVDS differential data input (Red0-Red5, Green0) |
| RxIN1N, RxIN1P | LVDS differential data input (Green1-Green5, Blue0-Blue1) |
| RxIN2N, RxIN2P | LVDS differential data input (Blue2-Blue5, Hsync, Vsync, DSPTMG) |
| RxCLKINN, RxCLKIN0P | LVDS differential clock input |
| VDD | +3.3V Power Supply |
| GND | Ground |

Note 1: Start from right side

Note 2: Please follow VESA

## 4. AC Timing

### a. HV Mode

### (a-1)Timing Diagram
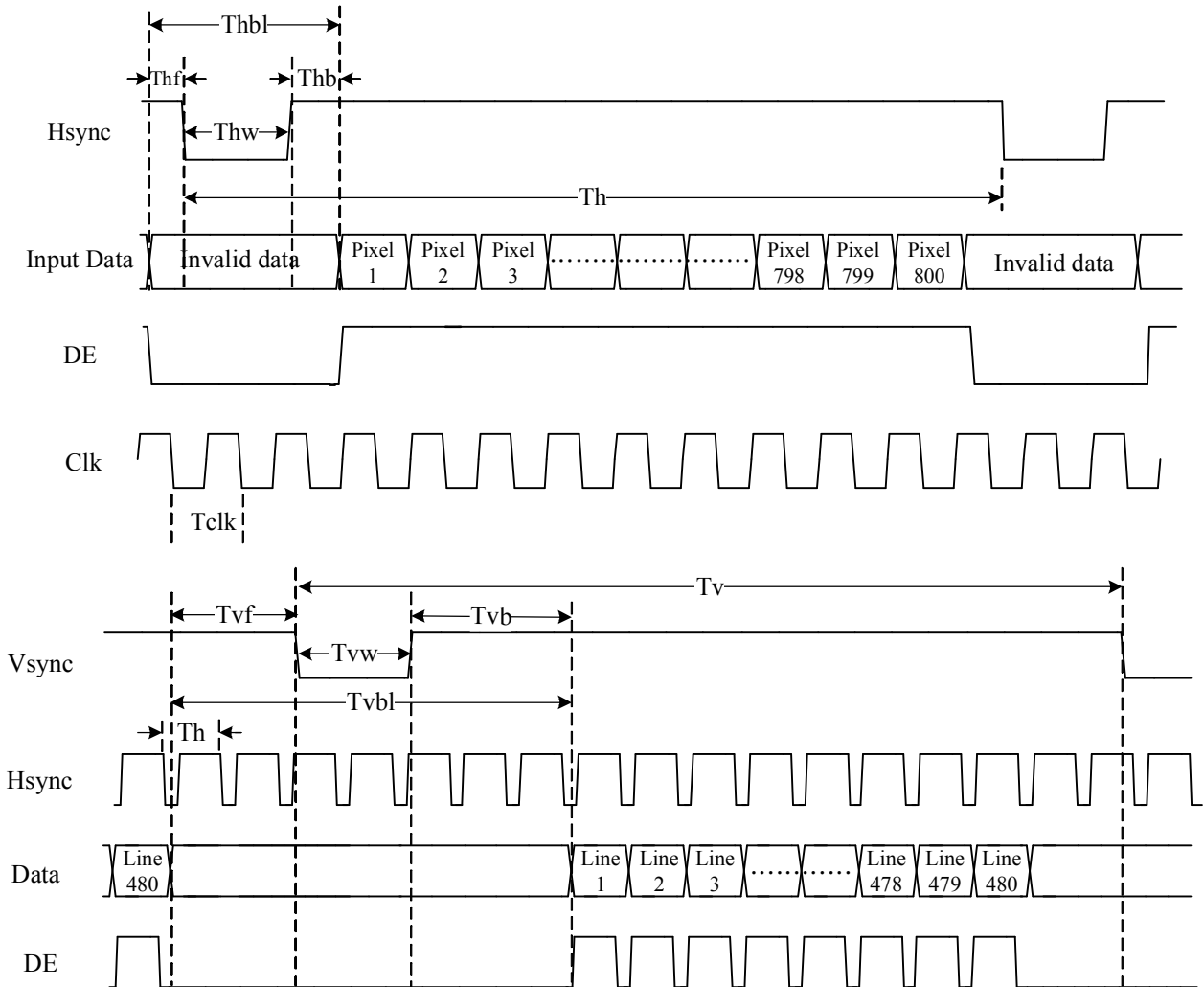


### (a-2) Timing Condition

| Item | Symbol | Min | Typ | Max | Unit | Remark |
|---|---|---|---|---|---|---|
| Frame Rate | | | 60 | -- | Hz | |
| Clock frequency | 1/Tck | 29.58 | 33.26 | 39.82 | MHZ | |
| Hsync period | Th | 992 | 1056 | 1088 | Clk | |
| Hsync pulse width | Thw | 40 | 80 | 120 | Clk | |
| Hsync back porch | Thb | 56 | 96 | 136 | Clk | |
| Hsync width + back porch | Thw+Thb | -- | 176 | -- | Clk | |
| Hsync front porch | Thf | 16 | 80 | 112 | Clk | |
| Hsync blanking | Thbl | 192 | 256 | 288 | Clk | |
| Vsync period | Tv | 497 | 525 | 610 | Th | |

| Vsync pulse width | Tvw | 1 | 3 | 5 | Th | |
| --- | --- | --- | --- | --- | --- | --- |
| Vsync back porch | Tvb | 11 | 13 | 15 | Th | |
| Vsync width + back porch | Tvb+Tvw | -- | 16 | -- | Th | |
| Vsync front porch | Tvf | 1 | 29 | 114 | Th | |
| Vsync blanking | Tvbl | 17 | 45 | 130 | Th | |

### b. DE Mode

### (b-1) Timing Diagram
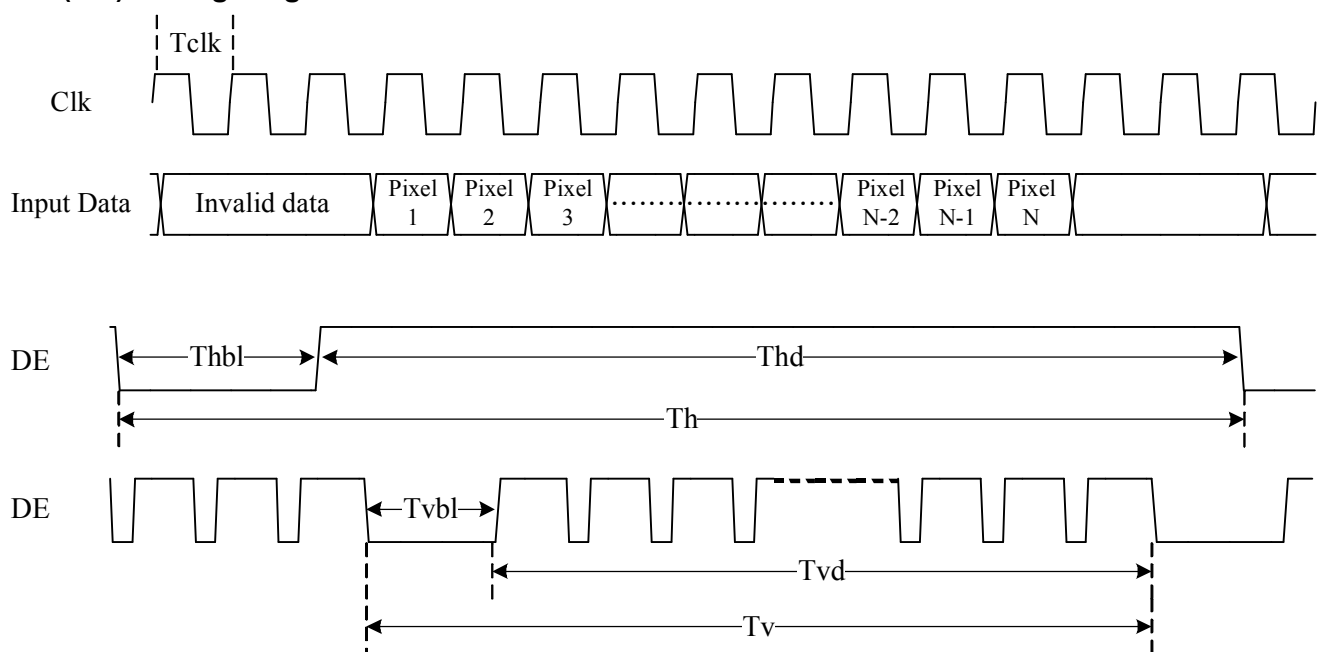


### (b-2) Timing Condition

| Item | Symbol | Min | Typ | Max | Unit | Remark |
| --- | --- | --- | --- | --- | --- | --- |
| Clock frequency | 1/Tck | 29.58 | 33.26 | 39.82 | MHz | |
| Horizontal blanking | Thbl | 192 | 256 | 288 | Clk | |
| Horizontal period | Th | 992 | 1056 | 1088 | Clk | |
| Horizontal active | Thd | | 800 | | Clk | |
| Vertical blanking | Tvbl | 17 | 45 | 130 | Th | |
| Vertical period | Tv | 497 | 525 | 610 | Th | |
| Vertical display area | Tvd | | 480 | | Th | |

## H. Touch Panel Specifications

### 1. FPC Pin Assignment

| Pin No. | Symbol | I/O |
|---------|--------|-----|
| 1 | Right | O |
| 2 | Down | O |
| 3 | Left | O |
| 4 | Up | O |

### 2. Electrical Characteristics

| Item | | Min. | Max. | Unit | Remark |
|------|---|------|------|------|--------|
| Operating Voltage / DC | | -- | 7 | V | Standard 5V |
| Contact Current | | -- | 1 | mA | |
| Operating Current | Film | -- | 20 | mA | |
| | Glass | -- | 20 | mA | |
| Terminal Resistance | X –axis | 200 | 1200 | Ω | At connector |
| | Y –axis | 200 | 900 | | |
| Linearity | | -1.5% | 1.5% | -- | Note 1 |
| Insulation Resistance | | 20M | -- | Ω | DC 25V |
| Response Time | | -- | 10 | ms | |
| Voltage Endurance Test | | 60 | -- | Ms | DC 25V |

Note 1: Measurement condition of Linearity: difference between actual voltage & theoretical voltage is an

error at any points. Linearity is the value max. error voltage divided by voltage difference on active area.
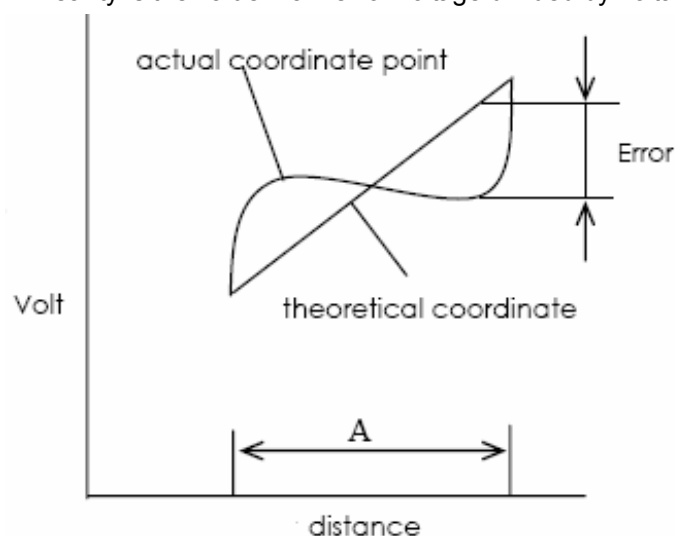
## 3. Mechanical Characteristics

| Item | SPEC | | Unit | Remark |
|---|---|---|---|---|
| Outline Dimension | 164.0x100.0x1.2 | | mm | |
| Viewing Area | 154.6x93.64 | | mm | |
| Active Area | 153.4x92.44 | | mm | |
| Item | Min. | Max. | Unit | Remark |
| Hardness of Surface | 3 | -- | H | JIS K-5600 |
| Operation Force (Pen or Finger) | -- | 100 | g | Note 1 |

Note 1: Within "guaranteed active area", but not on the edge and dot-spacer.

## 4. Durability Test

| Item | Min. | Max. | Unit | Remark |
|---|---|---|---|---|
| Touch Test | 1000K | | Times | Note 1 |
| Handwriting Friction Test | 100K | | Times | Note 2, 3 |

Note 1: By using Φ12mm/R8.0mm silicon rubber, under the loading of 250g to impact the surface of touch

　　　panel under the speed of 2 time/second, after repeat knocking 1000k times, goods must fulfill:

　　　　　Terminal Resistance: as defined in H.2

　　　　　Linearity Error: as defined in H.2

　　　　　Insulation Resistance: as defined in H.2

Note 2: By using Φ3.0mm/R0.8mm/POM pen with 2.45N (250g) loading under 70mm/sec moving speed,

　　　within the touch panel 35mm linear contact range and repeat 100K times(one direction moving as

　　　test one time), goods must fulfil:

　　　　　Terminal Resistance: as defined in H.2

　　　　　Linearity Error: as defined in H.2

　　　　　Insulation Resistance: as defined in H.2

Note 3: Test area - Along the diagonals of active area of the touch panel, and the friction center is the same

　　　as the center of active area. It means that the distance is 17.5mm extended both at the friction

　　　center two sides along the diagonals of active area of the touch panel and proceeding handwriting

　　　friction test.

## 5. Structure and Area Definition

Below figure illustrates the recommended bezel and cushion design. In order to prevent unusual performance degradation and malfunction of the touch panel, please carry out the set case designing and a touch panel assembling method after surely considering the definition of each area illustrated in below figure.
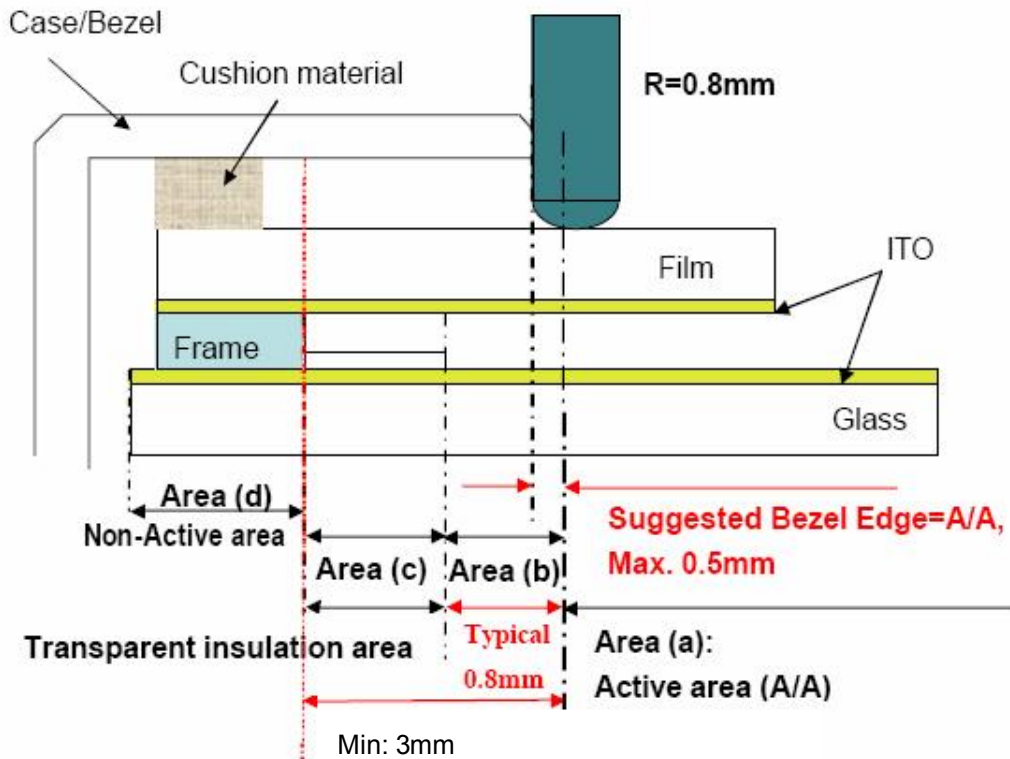


Area (a): Active area

The active area is guaranteed the position data detectable precision, operation force and other operations. It's strongly recommended to place the operation button or menu keys within the active area.

Area (b): Operating non-guaranteed area

The area doesn't guarantee a touch panel operation and its function. When this area is pressed, touch panel shows degradation of its performance and durability.

Area (c): Pressing prohibition area

The area which forbids pressing.

Area (d): Non-active area

The area doesn't activate even if pressed.

## 6. Attention

Please pay attention for below matters at mounting design of touch panel of LCD module.

1) Do not design enclosure pressing the view area to prevent from miss input.

2) Enclosure support must not touch with view area.

3) Do not put a heavy force along the edge of the active area.

4) Cushion material: Use elastic or non-conductive material to enclosure touch panel.

5) Do not bond film of touch panel with enclosure.

6) The touch panel edge is conductive. Do not touch it with any conductive part after mounting.

   If user wants to cleaning touch panel by air gun, pressure $2kg/cm^2$ below is suggested. Not to blow glass from FPC site to prevent FPC peeled off

7) Do not put a heavy shock or stress on touch panel and film surface. Ex. Don't lift the panel by film face with vacuum.

8) Do not lift LCD module by FPC.

9) Please use dry cloth or soft cloth with neutral detergent (after wring dry) or one with ethanol at cleaning. Do not use any organic solvent, acid or alkali liquor.

10) Do not pile touch panel. Do not put heavy goods on touch panel.

## I.  Optical Specifications

| Item | Symbol | Condition | Min. | Typ. | Max. | Unit | Remark |
|---|---|---|---|---|---|---|---|
| Response Time<br>Rise<br>Fall | <br>Tr<br>Tf | θ=0° | | <br>12<br>18 | <br>50<br>60 | <br>ms<br>ms | Note 4 |
| Contrast ratio | CR | At optimized viewing angle | 140 | 240 | - | | Note 5, 6 |
| Viewing Angle<br>Top<br>Bottom<br>Left<br>Right | | CR≧10 | 30<br>50<br>50<br>50 | 40<br>60<br>60<br>60 | -<br>-<br>-<br>- | deg. | |
| Brightness | $Y_L$ | θ=0° | 140 | 180 | - | cd/m² | |
| White Chromaticity | X | θ=0° | 0.26 | 0.31 | 0.36 | | |
| | y | θ=0° | 0.28 | 0.33 | 0.38 | | |

Note 1: Ambient temperature =25℃. To be measured in the dark room.

Note 2: To be measured on the center area of panel with a viewing cone of 1° by Topcon luminance meter BM-5, after 15 minutes operation.

Note 3: Definition of response time:

The output signals of photo detector 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 is defined as the time interval between the 10% and 90% of amplitudes. Refer to the figure below:
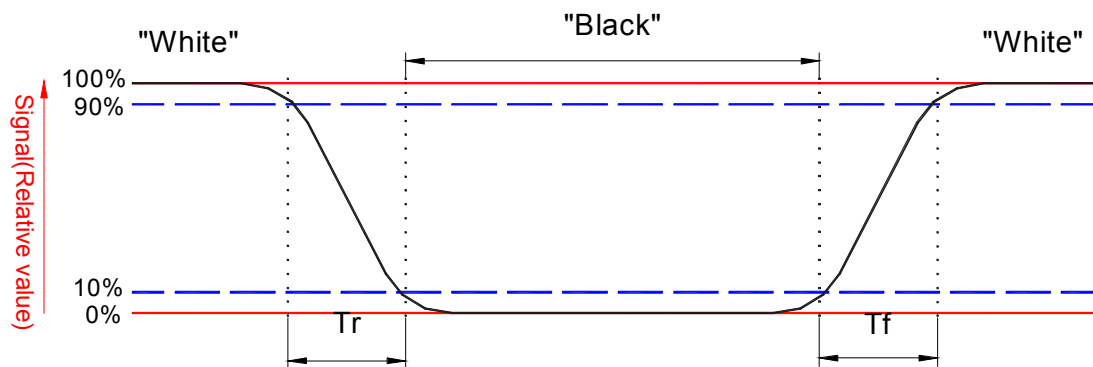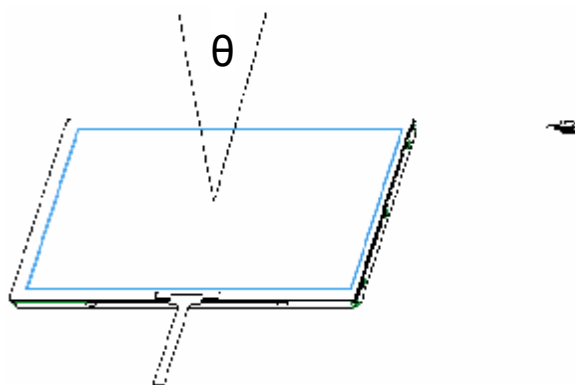


Note 4. Definition of contrast ratio:

Contrast ratio is calculated with the following formula.

$$\text{Contrast ratio (CR)} = \frac{\text{Photo detector output when LCD is at "White" state}}{\text{Photo detector output when LCD is at "Black" state}}$$

Note 5. inition of viewing angle, Refer to figure as below.



Note 6. Measured at the center area of the panel when all the input terminals of LCD panel are electrically opened

## J.  Reliability Test Items

| No. | Test items | Conditions | | Remark |
|---|---|---|---|---|
| 1 | High Temperature Storage | Ta= 65℃ | 240Hrs | |
| 2 | Low Temperature Storage | Ta= -20℃ | 240Hrs | |
| 3 | High Temperature Operation | Ta= 60℃ | 240Hrs | |
| 4 | Low Temperature Operation | Ta= 0℃ | 240Hrs | |
| 5 | High Temperature & Humidity | Ta= 50℃. 80% RH | 240Hrs | Operation |
| 6 | Heat Shock | -20℃~60℃ , 50 cycle,   2Hrs/cycle | | Non-operation |
| 7 | Electrostatic Discharge | ±200V,200pF(0Ω), once for each terminal | | Non-operation |
| 8 | Vibration | Frequency    : 10~55Hz<br>Stoke    : 1.5mm<br>Sweep    : 10 ~ 55 ~ 10Hz<br>2 hours for each direction of X,Y,Z<br>(6 hours for total) | | JIS C7021,<br>A-10<br>condition A |
| 9 | Mechanical Shock | 100G. 6ms, ±X,±Y,±Z<br>3 times for each direction | | Non-operation<br>JIS C7021,A-7<br>Condition C |
| 10 | Vibration (With Carton) | Random vibration:<br>0.015G$^2$/Hz from 5~200Hz | | IEC 68-34 |
| 11 | Drop (With Carton) | Height: 60cm<br>1 corner, 3 edges, 6 surfaces | | |

Note 1: Ta: Ambient Temperature

Note 2: In the standard conditions, there is not display function NG issue occurred. All the cosmetic specification is judged before the reliability stress.

## K. Handling Precautions

1. Since the touch panel is easily damaged, pay attention not to scratch it.

2. Be sure to turn off power supply when inserting or disconnecting 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. At the insertion or removal of the Signal Interface Connector, be sure not to rotate nor tilt the Interface Connector of the TFT Module.

10. After installation of the TFT Module into a system 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.

## L. Packing Form
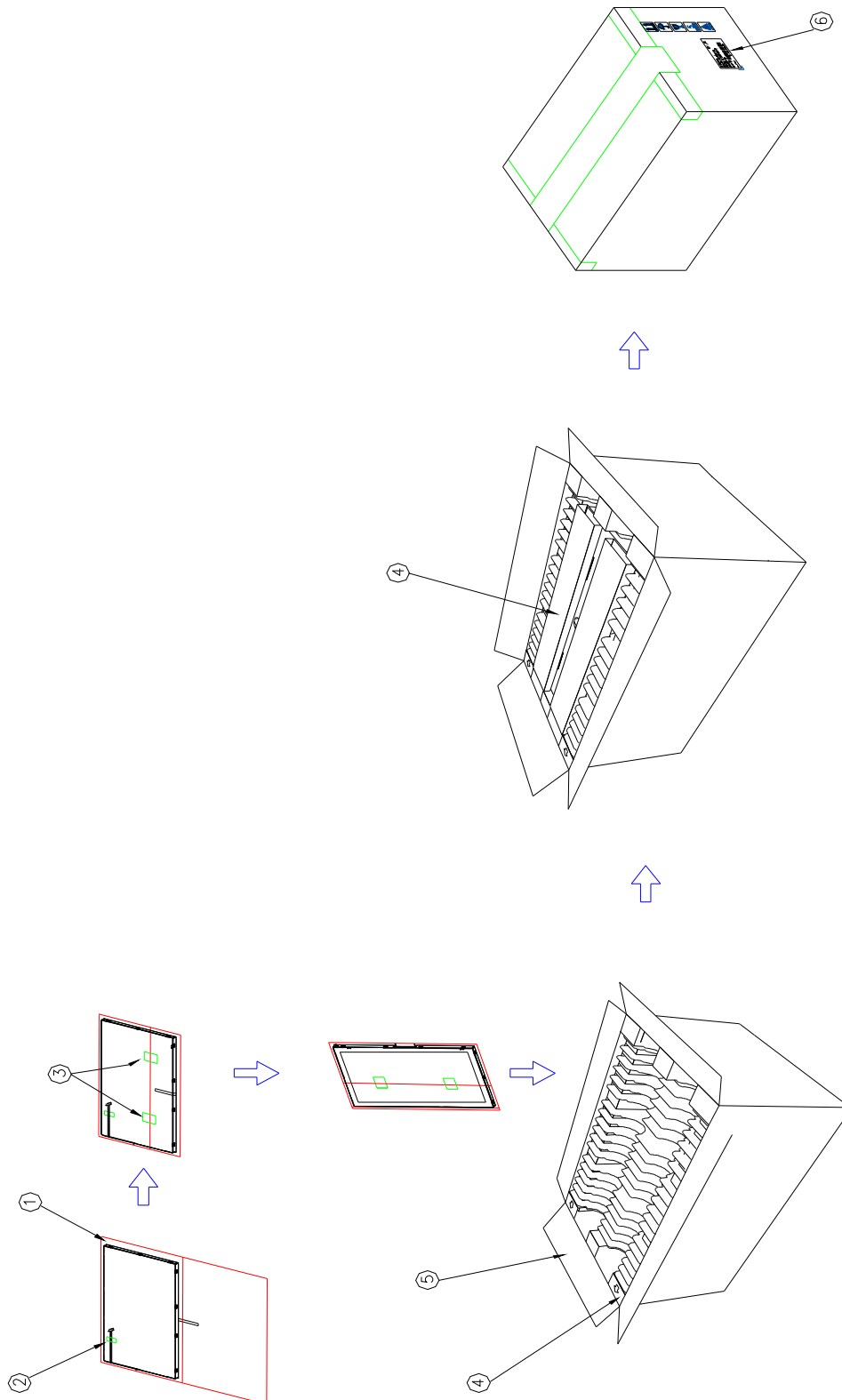
Max. capacity: 30 modules
Carton outline : 520 x 340 x 250 mm