

LCD Module Specification


Model No.: AT070TN01

Date : May 2003

7 inch TFT

FUDA ELECTRONICS

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1. General specifications

| NO. | Item | Specification | Remark |
|-----|-------------------|---|--------|
| 1 | LCD size | 7.0 inch | |
| 2 | Driver Element | a-Si TFT active matrix | |
| 3 | Display contents | 480 pixels X 234 pixels | |
| 4 | Display Mode | Normally white, Transmissive with Backlight | |
| 5 | Dot pitch | 0.107(W) X 0.370(H) mm | |
| 6 | Active area | 154.08(W) X 86.58(H) mm | |
| 7 | Module Size | 164.9 X 100 X 5.7 mm | |
| 8 | Surface Treatment | AG | |
| 9 | Weight | 160 g Typical | |

2. Electrical characteristics**(1). Absolute maximum ratings**

| Item | Symbol | Condition | Values | | Unit | Remark |
|---------------------------------|-------------------|-------------|--------|---------------|------|--------|
| | | | Min. | Max. | | |
| Power voltage | V_{CC} | GND=0 | (-0.3) | (7) | V | |
| | AV_{DD} | $AV_{SS}=0$ | (-0.3) | (7) | V | |
| | V_{GH} | GND=0 | (-0.3) | (18) | V | |
| | V_{GL} | | (-15) | (0.3) | V | |
| | $V_{GH} - V_{GL}$ | | - | (33) | V | |
| Input signal voltage | V_i | | (-0.3) | $AV_{DD}+0.3$ | V | Note 1 |
| | V_I | | (-0.3) | $V_{CC}+0.3$ | V | Note 2 |
| | VCOM | | (-2.9) | (5.2) | V | |
| Operation Temperature (Ambient) | Top | | -10 | 60 | °C | |
| Storage Temperature (Ambient) | Tst | | -20 | 70 | °C | |

Note:

- VR, VG, VB.
- STHL, STHR, OEH, L/R, CPH1~CPH3, STVR, STVL, OEV, CKV, U/D.

(2). Pin assignment**(a). TFT LCD panel diving section**

| Pin no | Symbol | IO | Function | Remark |
|--------|----------|----|---|--------|
| 1 | GND | - | Ground for logic circuit | |
| 2 | V_{CC} | I | Supply voltage of logic control circuit for scan driver | |
| 3 | V_{GL} | I | Negative power for scan driver | |

| | | | | |
|----|-----------|-----|---|----------|
| 4 | V_{GH} | I | Positive power for scan driver | |
| 5 | STVR | I/O | Vertical start pulse | Note 1 |
| 6 | STVL | I/O | Vertical start pulse | Note 1 |
| 7 | CKV | I | Shift clock input for scan driver | |
| 8 | U/D | I | UP/DOWN scan control input | Note 1,2 |
| 9 | OEV | I | Output enable control for scan driver | |
| 10 | VCOM | I | Common electrode driving signal | |
| 11 | VCOM | I | Common electrode driving signal | |
| 12 | L/R | I | LEFT/RIGHT scan control | Note 1,2 |
| 13 | MOD | I | Sequential sampling and simultaneous sampling setting | Note 3 |
| 14 | OEH | I | Output enable control for data driver | |
| 15 | STHL | I/O | Start pulse for horizontal scan line | Note 1 |
| 16 | STHR | I/O | Start pulse for horizontal scan line | Note 1 |
| 17 | CPH3 | I | Sampling and shifting clock pulse for data driver | |
| 18 | CPH2 | I | Sampling and shifting clock pulse for data driver | |
| 19 | CPH1 | I | Sampling and shifting clock pulse for data driver | |
| 20 | V_{CC} | I | Supply voltage of logic control circuit for data driver | |
| 21 | GND | - | Ground for logic circuit | |
| 22 | VR | I | Alternated video signal (Red) | |
| 23 | VG | I | Alternated video signal (Green) | |
| 24 | VB | I | Alternated video signal (Blue) | |
| 25 | AV_{DD} | I | Supply voltage for analog circuit | |
| 26 | AV_{SS} | - | Ground for analog circuit | |

Note:

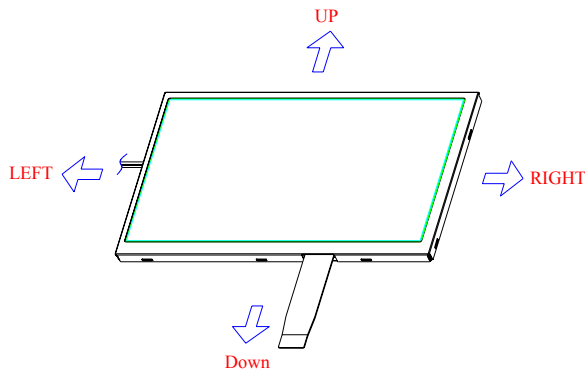
1. Selection of scanning mode (please refer to the following table)

| Setting of scan control input | | IN/OUT state for start pulse | | | | Scanning direction |
|-------------------------------|----------|------------------------------|------|------|------|---------------------------|
| U/D | L/R | STVR | STVL | STHR | STHL | |
| GND | V_{CC} | O | I | O | I | Up to down, left to right |
| V_{CC} | GND | I | O | I | O | Down to up, right to left |
| GND | GND | O | I | I | O | Up to down, right to left |
| V_{CC} | V_{CC} | I | O | O | I | Down to up, left to right |

I: input, O: output

2. Definition of Scanning Direction.

Refer to figure as below:



3. MOD=H: Simultaneous sampling.

MOD=L: Sequential sampling.

Please set CPH2 and CPH3 to GND when MOD=H,

(b). Backlight unit

| Pin no | Symbol | Function | Remark |
|--------|--------|--|--------|
| 1 | HI | Power supply for backlight unit (high voltage) | Pink |
| 2 | GND | Ground for backlight unit | White |

(3). Electrical characteristics

(a). Typical operating conditions (GND=AV_{SS}=0V, Note 4)

| Item | Symbol | Values | | | Unit | Remark |
|-------------------------------------|------------------|-----------------|---------------------|-----------------------|--------------------|--------------|
| | | Min. | Typ. | Max. | | |
| Power supply | V _{CC} | 3 | 5 | 5.2 | V | |
| | AV _{DD} | 4.8 | 5 | 5.2 | V | |
| | V _{GH} | 14.3 | 15 | 15.7 | V | |
| | V _{GL} | -10.5 | -10 | -9.5 | V | |
| Video signal amplitude (VR, VG, VB) | V _{iA} | 0.4 | - | AV _{DD} -0.4 | V | Note1 |
| | V _{iAC} | - | 3 | - | V | AC component |
| | V _{iDC} | - | AV _{DD} /2 | - | V | DC component |
| VCOM | V _{CAC} | 3.5 | 5.6 | 6.5 | V | Note2 |
| | V _{CDC} | 1.7 | 2.0 | 2.3 | V | DC component |
| Input signal Voltage | H level | V _{IH} | 0.8V _{CC} | - | V _{CC} | Note3 |
| | L level | V _{IL} | 0 | - | 0.2V _{CC} | |

Note:

1. Refer to Fig.3-(a).
2. The brightness of LCD panel could be changed by adjusting the AC component of VCOM.
3. SRHL, STHR, OEHL, L/R, CPH1~CPH3, STVR, STVL, OEV, CKV, U/D
4. Be sure to apply GND, V_{CC}, and V_{GL}, to the LCD first, and then apply V_{GH}

(b). Current consumption (GND=AV_{SS}=0V)

| Parameter | Symbol | Condition | Values | | | Unit | Remark |
|--------------------|-----------------|-----------------------|--------|------|------|------|--------|
| | | | Min. | Typ. | Max. | | |
| Current for Driver | I _{GH} | V _{GH} =15V | | 0.2 | 0.5 | mA | |
| | I _{GL} | V _{GL} =-10V | | 0.8 | 1.5 | mA | |
| | I _{CC} | V _{CC} =5V | | 3.0 | 6.0 | mA | |
| | I _{DD} | AV _{DD} =5V | | 17 | 30 | mA | |

(c). Backlight driving conditions

| Item | Symbol | Values | | | Unit | Remark |
|-----------------------|----------------|--------|------|-------|-------|----------|
| | | Min. | Typ. | Max. | | |
| Lamp voltage | V _L | - | 560 | 620 | Vrms | |
| Lamp Current | I _L | - | 6 | 7 | mArms | |
| Frequency | F _L | - | 60 | 80 | kHz | Note 4 |
| Lamp starting voltage | V _S | - | - | 900 | Vrms | Note 1,5 |
| | | - | - | - | Vrms | Note 2,5 |
| | | - | - | 1,100 | Vrms | Note 3,5 |
| Lamp life time | | 10,000 | - | - | Hr | Note 6 |

Note:

1. Ta=25°C
2. Ta=0°C
3. Ta=-20°C
4. The lamp frequency should be selected as different as possible from display horizontal synchronous signal to avoid interference
5. For starting the backlight unit, the output voltage of DC/AC's transformer should be larger than the maximum lamp starting voltage.
6. The "lamp life time" is defined as the module brightness decrease to 50% original brightness at Ta=25°C, I_L=6mA

(4). AC timing

(a). Timing conditions (sequential mode)

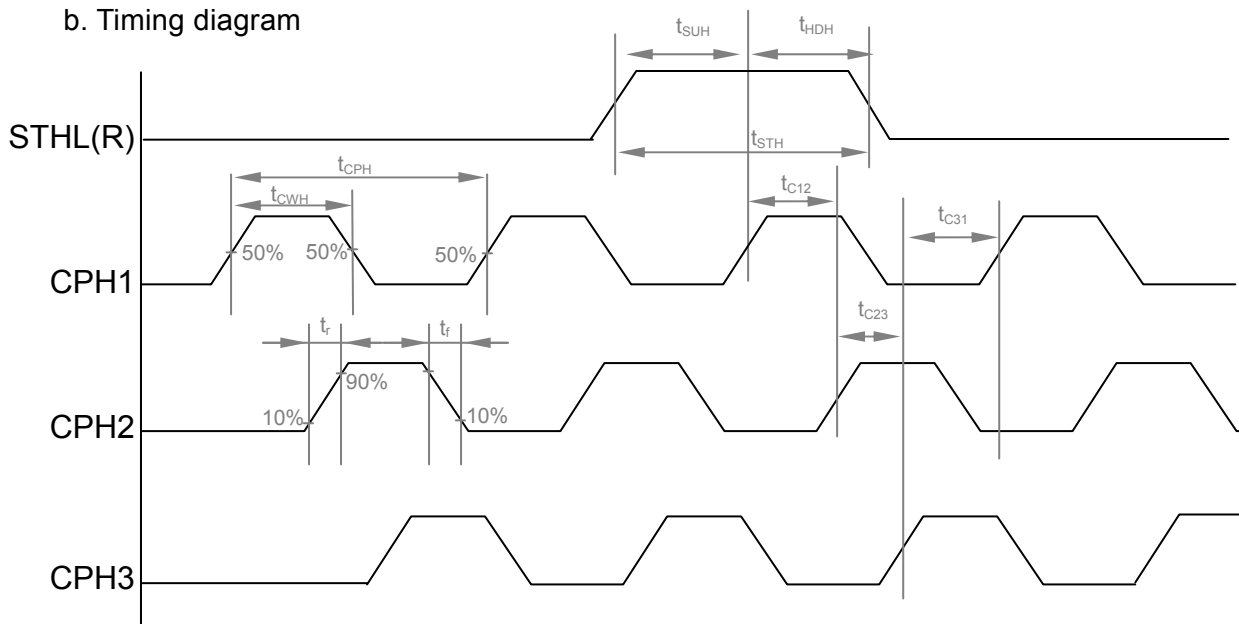
| Item | Symbol | Values | | | Unit | Remark |
|--------------------------------|--|--------|---------------------|---------------------|------|-----------|
| | | Min. | Typ. | Max. | | |
| Rising time | t _r | - | - | 10 | ns | Note 1 |
| Falling time | t _f | - | - | 10 | ns | Note 1 |
| High and low level pulse width | t _{CPH} | 99 | 103 | 107 | ns | CPH1~CPH3 |
| CPH pulse duty | t _{CWH} | 40 | 50 | 60 | % | CPH1~CPH3 |
| CPH pulse delay | t _{C12} t _{C23} t _{C31} | 30 | t _{CPH} /3 | t _{CPH} /2 | ns | CPH1~CPH3 |

| | | | | | | |
|---------------------------------|------------|------|------|------|-------------|------------|
| STH setup time | t_{SUH} | 20 | - | - | ns | STHR, STHL |
| STH hold time | t_{HDH} | 20 | - | - | ns | STHR, STHL |
| STH pulse width | t_{STH} | - | 1 | - | t_{CPH} | STHR, STHL |
| STH period | t_H | 61.5 | 63.5 | 65.5 | μs | STHR, STHL |
| OEH pulse width | t_{OEH} | - | 1.22 | - | μs | |
| Sample and hold disable time | t_{DIS1} | - | 8.28 | -- | μs | |
| OEV pulse width | t_{OEV} | - | 5.40 | | μs | |
| CKV pulse width | t_{CKV} | - | 4.18 | - | μs | |
| Clean enable time | t_{DIS2} | - | 3.74 | -- | μs | |
| Horizontal display start | t_{SH} | - | 0 | - | $t_{CPH}/3$ | |
| Horizontal display timing range | t_{DH} | - | 1440 | - | $t_{CPH}/3$ | |
| STV setup time | t_{SUV} | 400 | - | - | ns | STVL, STVR |
| STV hold time | t_{HDV} | 400 | - | - | ns | STVL, STVR |
| STV pulse width | t_{STV} | - | - | 1 | t_H | STVL, STVR |
| Horizontal lines per field | t_V | 256 | 262 | 268 | t_H | Note 2 |
| Vertical display start | t_{SV} | | 3 | - | t_H | |
| Vertical display timing range | t_{DV} | | 234 | - | t_H | |
| VCOM rising time | t_{rCOM} | | - | 5 | μs | |
| VCOM falling time | t_{fCOM} | | - | 5 | μs | |
| VCOM delay time | t_{DCOM} | | - | 3 | μs | |
| RGB delay time | t_{DRGB} | | - | 1 | μs | |

Note:

1. For all of the logic signals
2. Please don't use odd horizontal lines to drive LCD panel for both odd and even field simultaneously.

b. Timing diagram



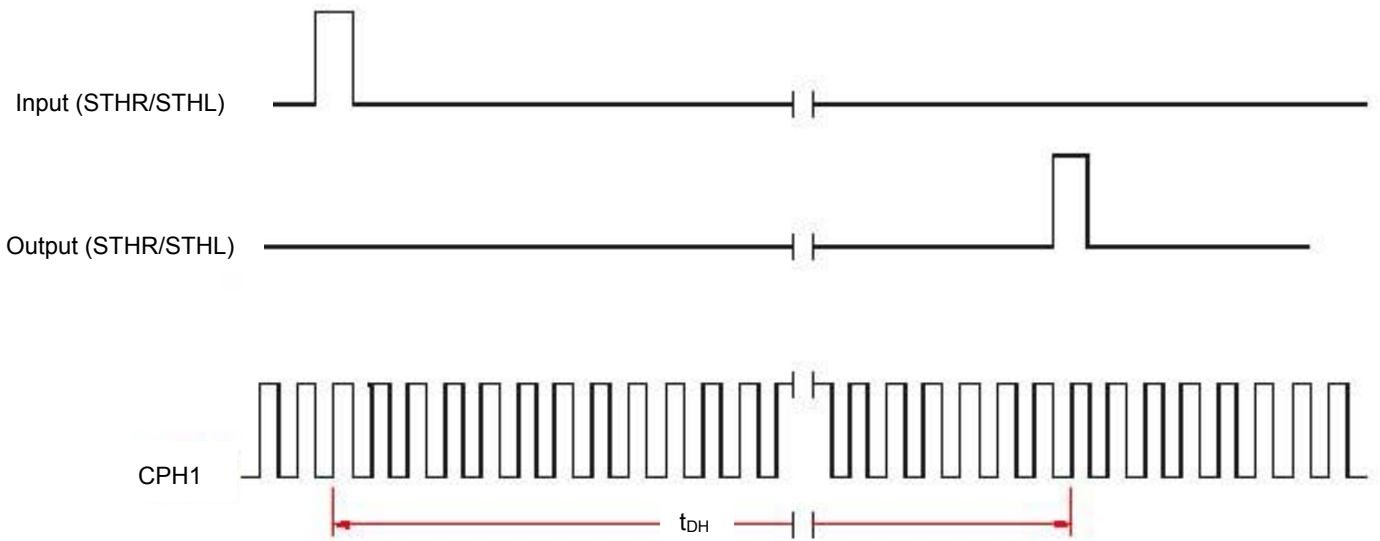


Fig.2 Sampling clock timing

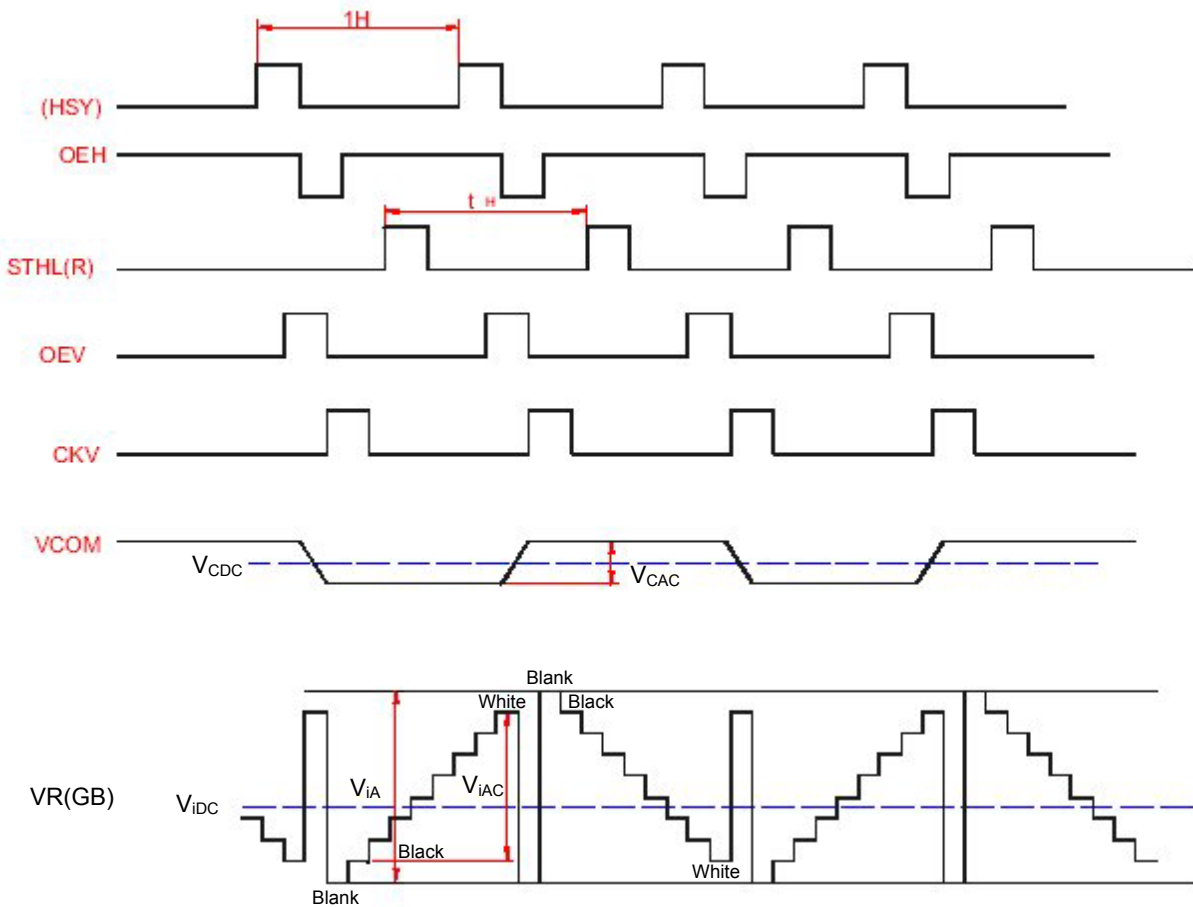
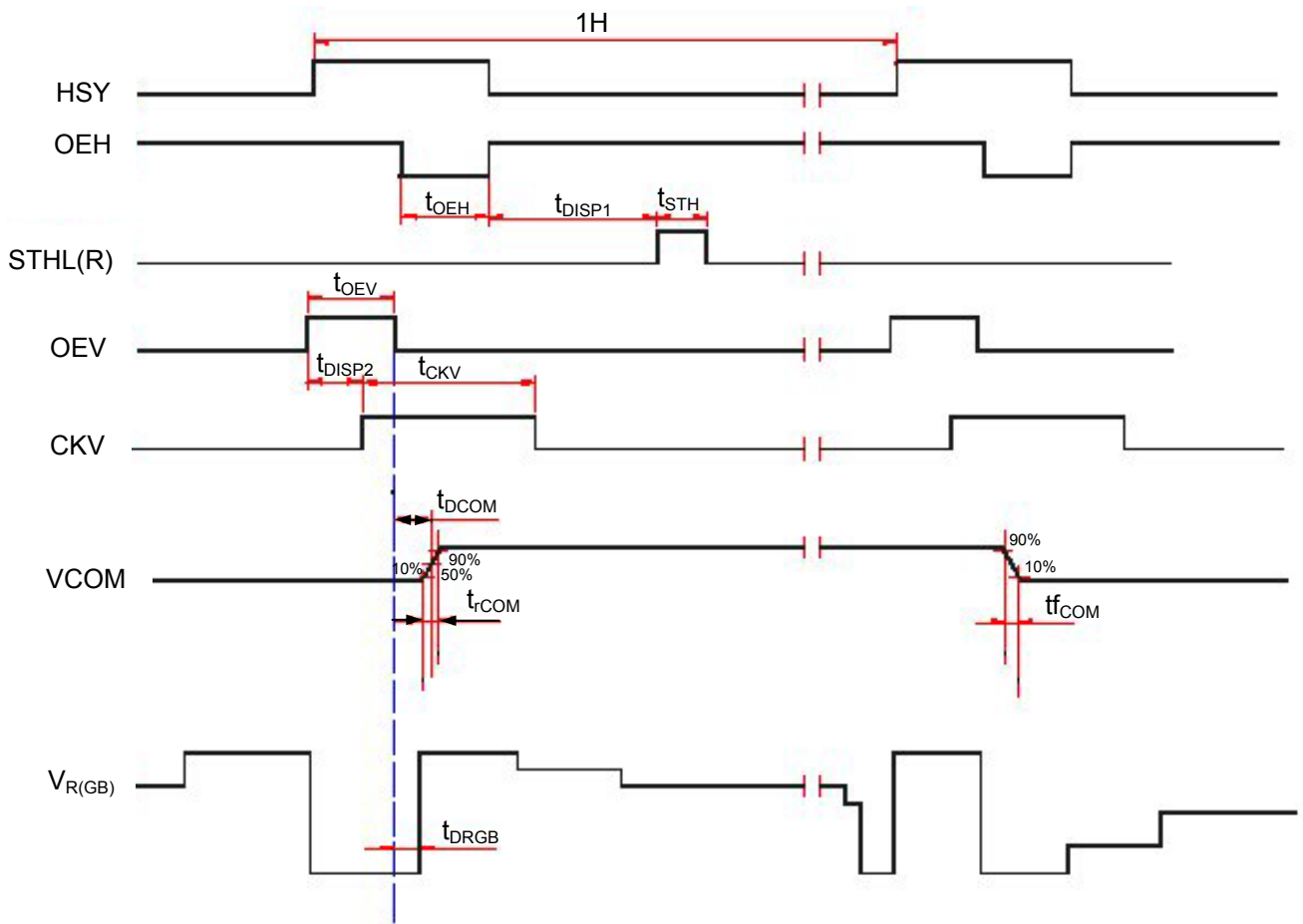


Fig.3-(a) Horizontal timing



Note: The falling edge of OEV should be synchronized with the falling edge of OEH

Fig.3-(b) Detail horizontal timing

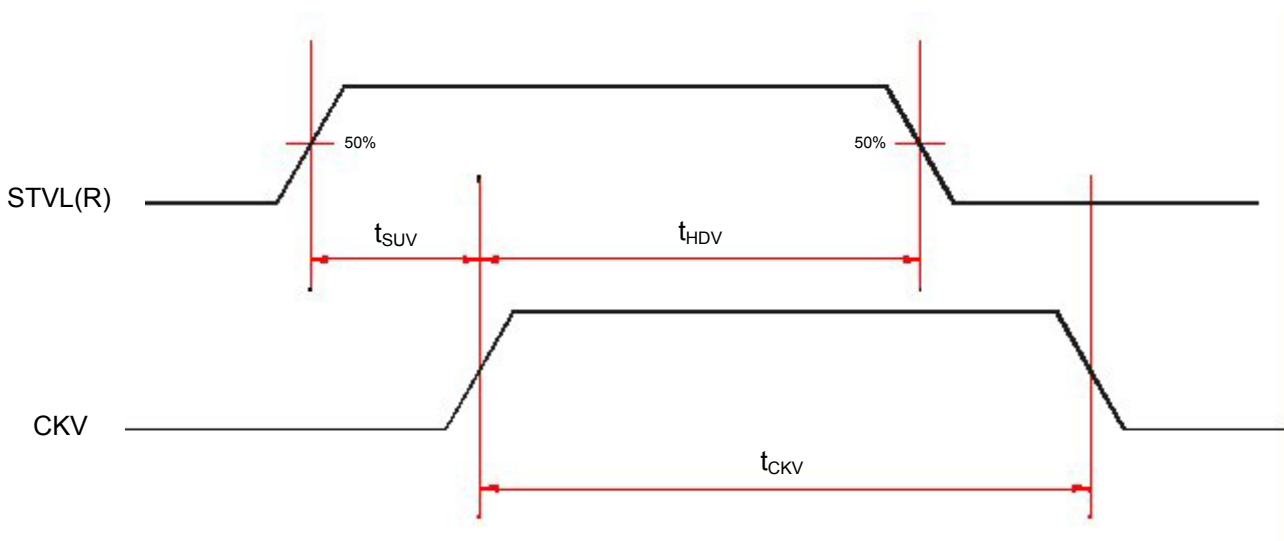


Fig.4 Vertical shift clock timing

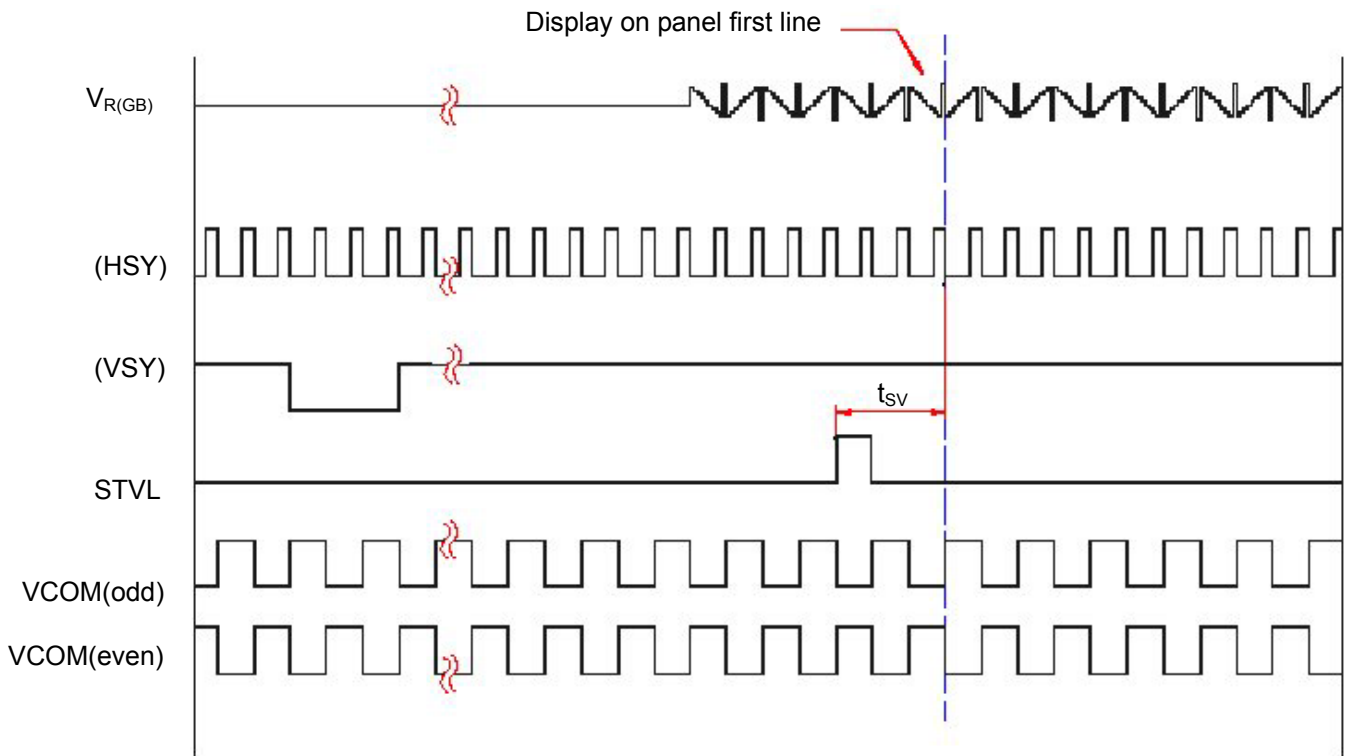


Fig.5-(a) Vertical timing (from up to down)

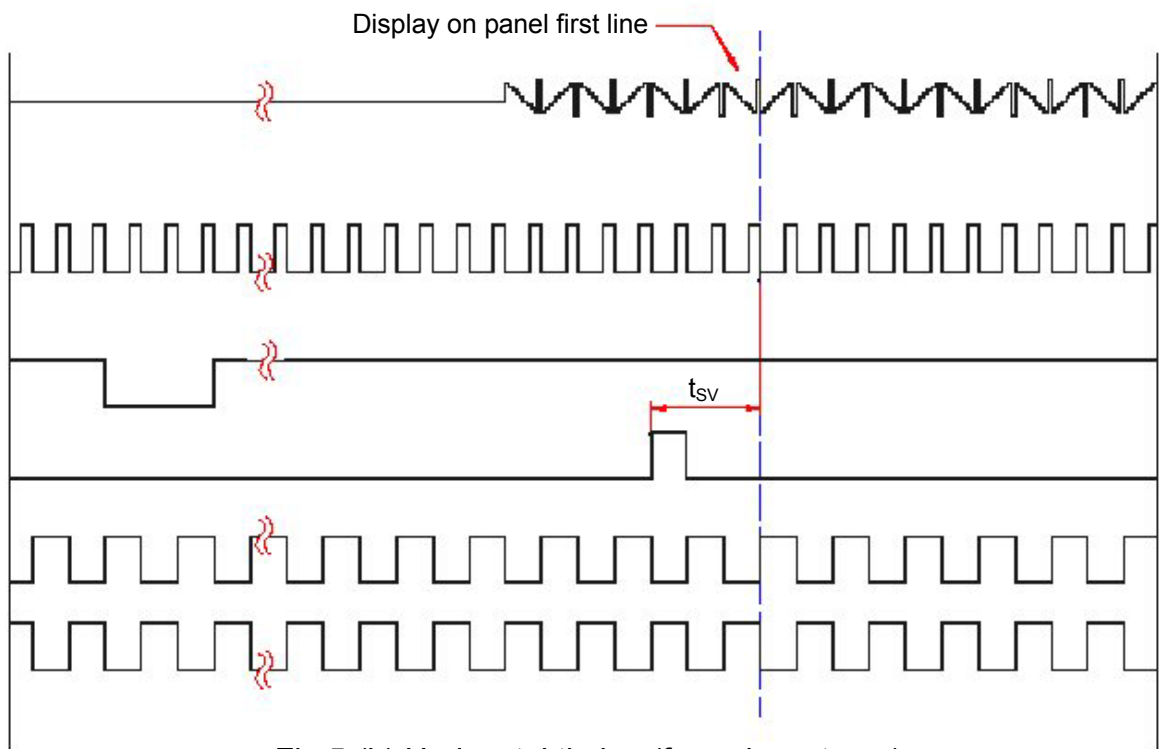
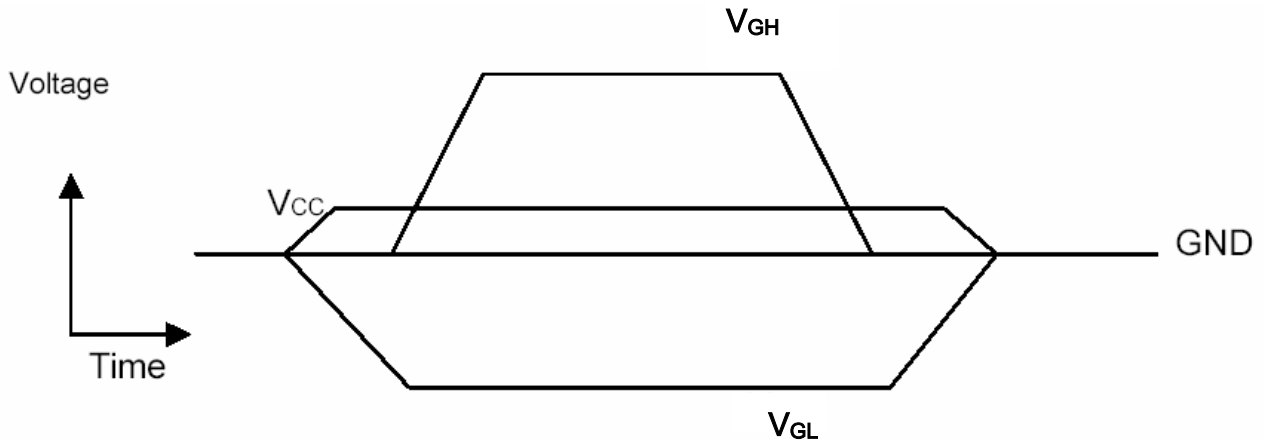


Fig.5-(b) Horizontal timing (from down to up)

(5) Power sequence

This module adopts high voltage driver IC, so it may be damaged by a large current flow if a wrong power on/off sequence is used! The recommend power sequence is to connect V_{CC} first, then connect power to driver gate power, V_{GL} and V_{GH} . When shutting off the power, shut off the driver gate power, V_{GL} and V_{GH} , then shut off the logic power, V_{CC} , or shut off the power simultaneously!



3. Optical specifications

The following items are measured under stable conditions. The optical characteristics should be measured in dark room or equivalent state with the methods shown in Note 1.

Ta=25±2°C, I_L=6mA

| Item | | Symbol | Condition | Min | Typ | Max | Unit | Remark |
|--------------------|-------|----------------|----------------------------|------|------|------|-------------------|--------|
| Response time | | T _R | Θ=0 | - | 10 | 50 | ms | Note2 |
| | | T _F | | - | 20 | 60 | ms | |
| Contrast ratio | | CR | At optimized viewing angle | 200 | 300 | | | Note3 |
| Brightness | | Y _L | Θ=0 | 150 | 200 | | Cd/m ² | Note4 |
| Color Chromaticity | White | W _x | Θ=0 | 0.26 | 0.31 | 0.36 | | Note4 |
| | | W _y | | 0.28 | 0.33 | 0.38 | | |
| Viewing Angle | Hor. | Θ _R | CR≥10 | 50 | 60 | | Degree | Note5 |
| | | Θ _L | | 50 | 60 | | | |
| | Ver. | Φ _H | | 30 | 40 | | | |
| | | Φ _L | | 50 | 60 | | | |

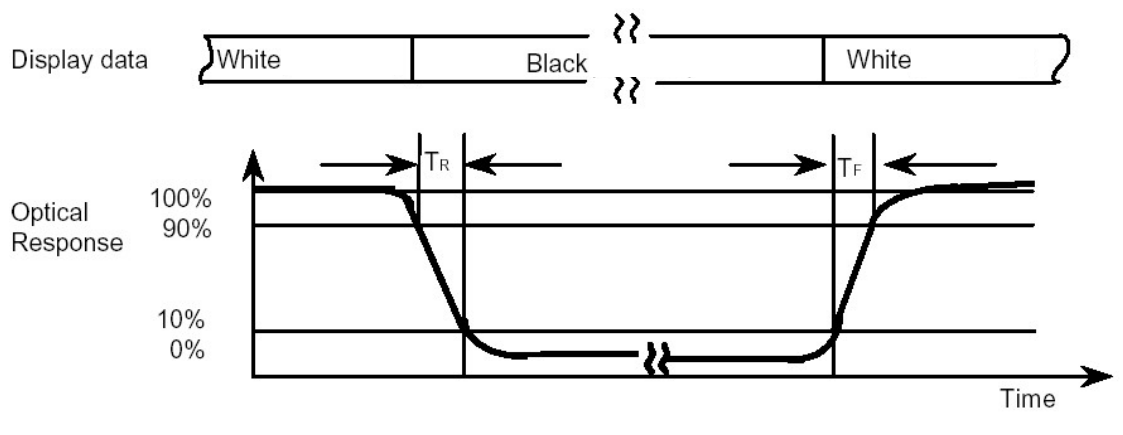
Note:

1. Test equipment setup

After stabilizing and leaving the panel alone at a given temperature for 30 minutes, the measurement should be executed. Measurement should be executed in a stable, windless, and dark room. Optical specifications are measured by Topcon BM-5A with a viewing angle of 1° at a distance of 50cm and normal direction.

2. Definition of response time: T_R and T_F

The figure below is the output signal of the photo detector.



3. Definition of contrast ratio:

$$\text{Contrast ratio (CR)} = \frac{\text{Brightness measured when LCD is at "white" state}}{\text{Brightness measured when LCD is at "black" state}}$$

White $V_i = V_{i50\%} \pm 1.5 \text{ V}$

Black $V_i = V_{i50\%} \mp 2.0 \text{ V}$

“ \pm ” means that the analog input signal swings in phase with V_{COM} signal.

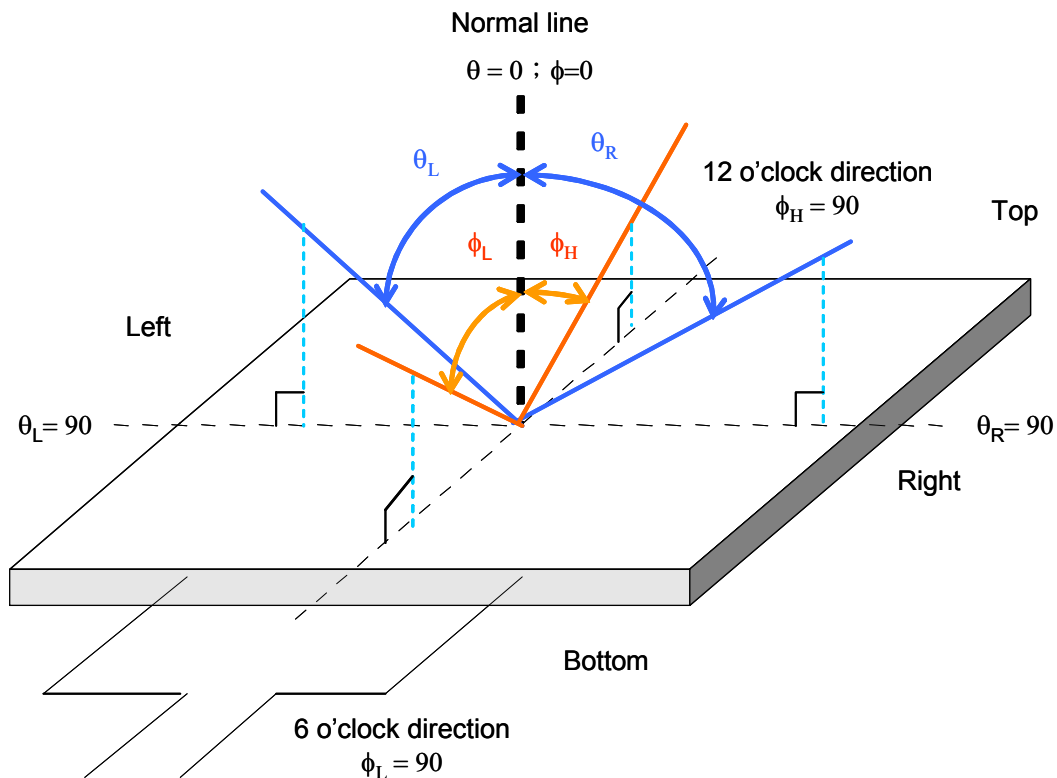
“ \mp ” means that the analog input signal swings out of phase with V_{COM} signal.

$V_{i50\%}$: The analog input voltage when transmission is 50%

The 100% transmission is defined as the transmission of LCD panel when all the input terminals of module are electrically opened.

4. Measured at the center area of the panel when all the input terminal of LCD panel are electrically opened.

5. Definition of viewing angle:



4. Reliability test items

(1). Reliability levels in mass production are as below:

| Test Items | Test Conditions |
|--|--|
| High temperature storage | +70°C±3°C, Dry(30%RH max.) For 240 hours |
| Low temperature storage | -20°C±3°C for 240 hours |
| High temperature operation | +60°C±3°C, Dry(30%RH max.) for 240 hours |
| Low temperature operation | -10°C±3°C for 240 hours |
| Operation at high temperature and humidity | +40°C±3°C,90%±3%RH max. for 240 hours |
| Thermal shock | -20degree/0.5h ~ +70 degree/0.5h for a total 20 cycles |
| Mechanical shock | Drop onto the tilted floor from 60cm heights, 1 corner, 3 edges, 6 faces. Apply shipping package to this test |
| Vibration test | Sweep at 10Hz to 55Hz to 10Hz, amplitude 0.75mm for 20cycles each in X,Y and Z directions. Apply shipping package to this test. |

Note1: High temp storage & High temp/High humidity Op the polarizer is out of subject

Note 2: the test sample has recovery time 2 hours at room temp before function check

5. Handling precautions

1 Safety

The liquid crystal in the LCD is poisonous. **DO NOT** put it in your mouth. If the liquid crystal touches your skin or clothes, wash it off immediately using soap and water.

2 Handling

- 1) The LCD panel is plate glass. **DO NOT** subject the panel to mechanical shock or to excessive force on its surface.
- 2) The polarizer attached to the display is very easy to damage, handle it with careful attention.
- 3) To avoid contamination on the display surface, **DO NOT** touch the display surface with bare hands.
- 4) Provide a space so that the LCD panel does not come into contact with other components.
- 5) To protect the LCD panel from external pressure, put covering glass (acrylic board or similar board) keeping appropriate gap between them.
- 6) Transparent electrodes may be disconnected if you use the LCD panel under environmental conditions where dew condensation occurs.
- 7) Property of semiconductor devices may be affected when they are exposed to light, possibly resulting in malfunctioning of the ICs.
- 8)To prevent such malfunctioning of the ICs, your design and mounting layout done are so that the IC is not exposed to light in actual use.

3 Static electricity

- 1) Ground soldering iron tips, tools and testers when you operate.
- 2) Ground your body when handling the products.
- 3) **DO NOT** apply voltage to the input terminal without applying power supply.
- 4) **DO NOT** apply voltage which exceeds the absolute maximum rating.
- 5) Store the products in an anti-electrostatic container.

4 Storage

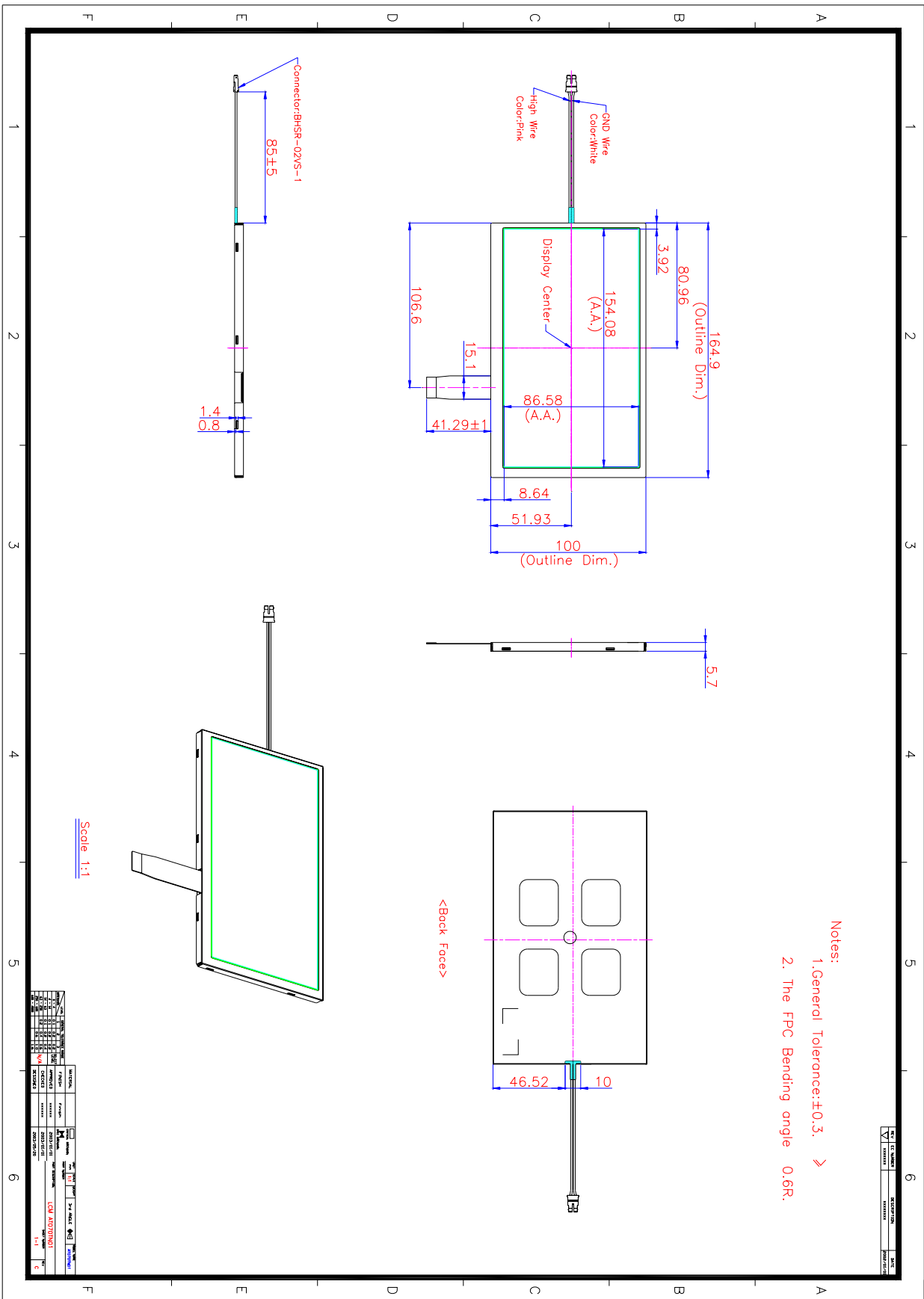
- 1) Store the products in a dark place at $+25^{\circ}\text{C} \pm 10^{\circ}\text{C}$, low humidity (65%RH or less).
- 2) **DO NOT** store the products in an atmosphere containing organic solvents or corrosive gases.

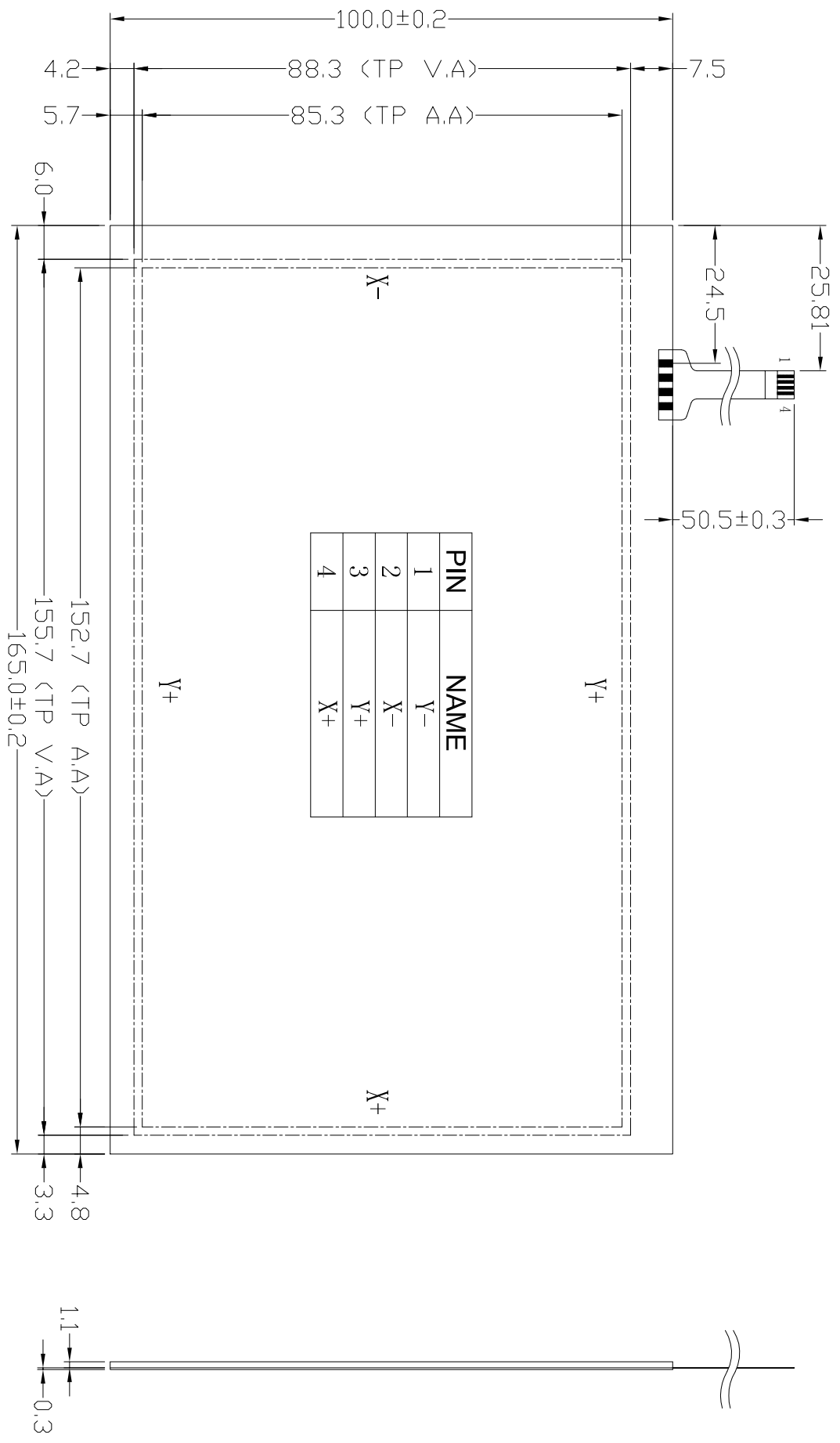
5 Cleaning

- 1) **DO NOT** wipe the polarizer with dry cloth, as it might cause scratch.
- 2) Wipe the polarizer with a soft cloth soaked with petroleum IPA, other chemical might damage.

6. Mechanical dimensions


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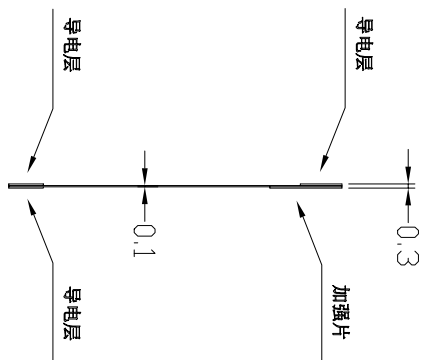
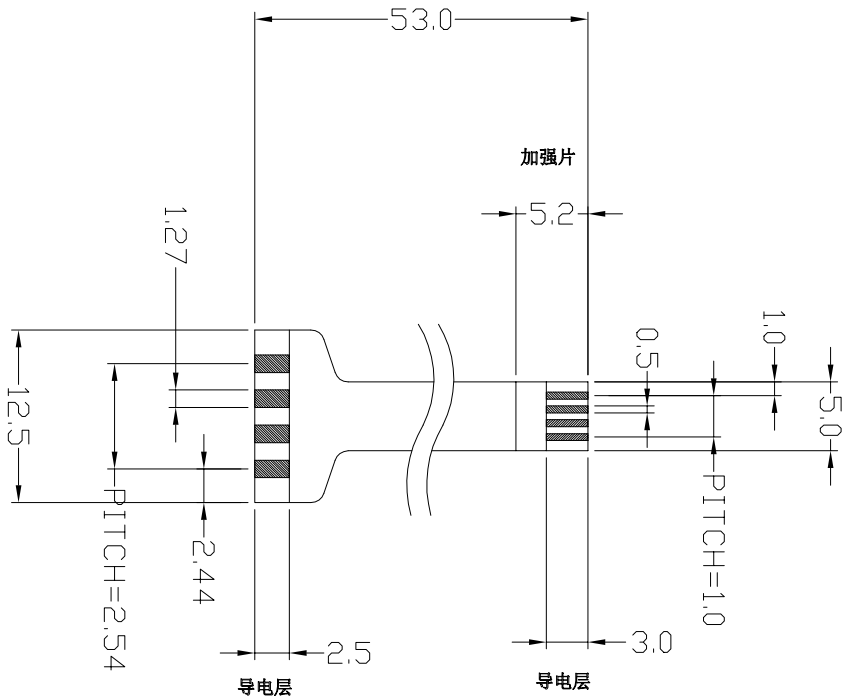




REMARK:

1. OPERATION TEMP : 0°C TD +60°C
2. STORAGE TEMP : -10°C TD +70°C
3. TAIL TYPE: FPC BY GOLD PLATED

| | | | |
|---|------------------------|-------------------|--|
| FUDA ELECTRONICS | | | |
|  | Model NO | TSA-0127 REV.B | |
| UNIT : mm | Designed by : Cai Le | Date : 2007/08/20 | |
| General tol: 0.1mm | Approved by : Chen Y B | Date : 2007/08/20 | |
| Scale : DD NDT SCALE DRAWING | | Sheet : 1 of 2 | |



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Model NO

TSA-0127 FPC

UNIT : mm

Designed by : Cai Le

Date : 2007/08/19

General tol: 0.1mm

Approved by : Chen Y B

Date : 2007/08/19

Scale : DD NDT SCALE DRAWING

Sheet : 1 of 1

REMARK:

1. OPERATION TEMP : 0°C TO +60°C
2. STORAGE TEMP : -10°C TO +70°C
3. TAIL TYPE: FPC BY GOLD PLATED

7. Packing specifications

(1). Packaging material table

Per carton

| No | Item | Model (Material) | Dimensions (mm) | Unit Weight (Kg) | Quantity | Remark |
|----|--------------|------------------|-----------------|------------------|----------|-------------|
| 1 | LCM module | AT070TN01 | 164.9*100*5.7 | 0.160 | 30 | |
| 2 | EPP tray | EPP | 516*384*6.5 | 0.07 | 7 | Anti-static |
| 3 | Carton | Carton | 530*355*255 | 1.06 | 1 | |
| 4 | Total weight | 6.5 Kg \pm 5% | | | | |

(2). Packaging quantity

| | | |
|--|------------------------|--------|
| (1) LCM quantity per tray: no. of the row | 5 x no. the column | 6 = 30 |
| (2) Total LCM quantity in Carton: no. of EPP trays | 30 x quantity per tray | 7 = 30 |

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