

# TFT LCD

## Specification

This module uses ROHS material

- ( ) Preliminary Specification
- (●) Final Specification

|       |               |
|-------|---------------|
| Title | 1.50" TFT LCD |
|-------|---------------|

|          |  |
|----------|--|
| Customer |  |
| MODEL    |  |

|          |                     |
|----------|---------------------|
| SUPPLIER | B&H Korea Co., Ltd. |
| MODEL    | BHT150TREA          |
| Revision | Ver 1.21            |

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

| SIGNATURE | DATE  |
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**Products Engineering Dept.**  
**B&H Korea Co., Ltd**

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**Record of Reversion**

| <b>Rev</b> | <b>Issued Date</b> | <b>Description</b>   |
|------------|--------------------|--|
| 0          | Dec 28, 2011       | New  |
| 0.1        | Jan 25, 2012       | Modify 7.2 Basic Measure Condition: Format   |
| 0.11       | Mar 05, 2012       | <ol style="list-style-type: none"><li>1. Add White Chromaticity Max in 7.1</li><li>2. Delete Backlight Life Time in 5.2</li><li>3. Add HVDD and VVDD Current</li><li>4. Add Left/Right and Up/Down Image in 3.1</li><li>5. Delete Optical System B in 7.2</li><li>6. Add 11. Packing Drawing</li></ol> |
| 0.20       | May 07, 2012       | 7.3 Cancel Vcom Measured Method  |
| 0.21       | Jun 17, 2012       | 10. Mechanical Drawing: Change FPC enhanced board length form 5.0mm to 4.0mm   |
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## Product Specification

## 1 FEATURES

The 1.5"(3.86 cm) LCD module is the active matrix color TFT LCD module. LTPS (Low Temperature Poly Silicon) TFT technology is used and vertical and horizontal drivers are built on the panel. NTSC and PAL format are compatible. Horizontal scan can be from left to right or from right to left and Vertical scan can be from up to down or from down to up.

## 2 GENERAL SPECIFICATIONS

| Item                      | Description        | Unit |
|---------------------------|--------------------|------|
| Display Size (Diagonal)   | 1.5 inch (3.86cm)  |      |
| Display Type              | Transmissive       |      |
| Active Area (HxV)         | 31.15 X 22.80      | mm   |
| Number of Dots (HxV)      | 490 x 240=117,600  | dot  |
| Dot Pitch (HxV)           | 0.0635 X 0.095     | mm   |
| Color Arrangement         | RGB Delta          |      |
| Color Numbers             | Full Color         |      |
| Outline Dimension (HxVxT) | 37.1 x 32.7 x 3.74 | mm   |
| Weight                    | 10                 | g    |
| Surface Treatment         | Anti Reflection    |      |

\* Exclude FPC and protrusions.

### 3 INPUT/OUTPUT TERMINALS

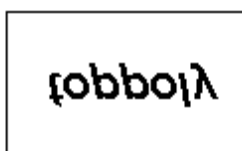
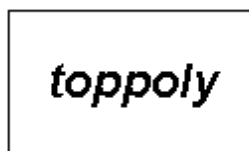
#### 3.1 TFT LCD Panel

Recommend Connector Type: HIROSE FH24S-0.5SH

| Pin | Symbol | I/O | Description                            | Remark   |
|-----|--------|-----|--|----------|
| 1   | NC     | -   | No connection (Leave this pin open)    |          |
| 2   | COM    | I   | Common voltage                         |          |
| 3   | CKV1   | I   | Vertical clock 1                       |          |
| 4   | CKV2   | I   | Vertical clock 2                       |          |
| 5   | VVDD   | I   | Power supply for vertical driver       |          |
| 6   | STV    | I   | Vertical start signal                  |          |
| 7   | XSTV   | I   | Inverted signal of STV                 |          |
| 8   | CSV    | I   | Up / Down inverse control signal       | Note 3-1 |
| 9   | ENB    | I   | Enable signal                          |          |
| 10  | XENB   | I   | Inverted signal of ENB                 |          |
| 11  | PCD    | I   | Precharge data signal                  |          |
| 12  | B      | I   | Video signal (B)                       |          |
| 13  | R      | I   | Video signal (R)                       |          |
| 14  | G      | I   | Video signal (G)                       |          |
| 15  | VSS    | I   | VSS for vertical and horizontal driver |          |
| 16  | XPCG   | I   | Inverted signal of PCG                 |          |
| 17  | PCG    | I   | Precharge gate signal                  |          |
| 18  | CSH    | I   | Right / Left inverse control signal    | Note 3-2 |
| 19  | XSTH   | I   | Inverted signal of STH                 |          |
| 20  | STH    | I   | Horizontal start signal                |          |
| 21  | CKH2   | I   | Horizontal clock 2                     |          |
| 22  | CKH1   | I   | Horizontal clock 1                     |          |
| 23  | HVDD   | I   | Power supply for horizontal driver     |          |
| 24  | NC     | -   | No connection (Leave this pin open)    |          |

Note 3-1: H: Normal scan,

L: Reverse scan



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Note 3-2: H: Normal scan,

L: Reverse scan



### 3.2 Light Source

Light Source Type: LED Backlight

Recommend Connector Type: JST-ZHR-2

| Pin | Symbol   | Description           | Remark |
|-----|----------|-----------------------|--------|
| 1   | $V_F$    | LED Input Voltage     |        |
| 2   | $V_{FS}$ | GND for LED Backlight |        |

## 4 ABSOLUTE MAXIMUM RATINGS

VSS=0V

| Item   | Symbol                                | MIN  | MAX | Unit |
|--|---------------------------------------|------|-----|------|
| Power Supply for Horizontal Driver               | HVDD                                  | -1.0 | +14 | V    |
| Power Supply for Vertical Driver                 | VVDD                                  | -1.0 | +14 | V    |
| Common Electrode Voltage                         | VCOM                                  | -1.0 | +14 | V    |
| Horizontal Driver / Precharge Data Input Voltage | STH, XSTH, CKH1, CKH2, CSH, PCG, XPCG | -1.0 | +14 | V    |
| Vertical Driver / Precharge Data Input Voltage   | STV, XSTV, CKV1, CKV2, CSV, ENB, XENB | -1.0 | +14 | V    |
| Video / Precharge Data Input Voltage             | VG, VR, VB, VPCD                      | -1.0 | +13 | V    |
| Back Light Forward Current                       | $I_F$                                 | -    | 25  | mA   |
| Operating Temperature                            | $T_{opr}$                             | -10  | +60 | °C   |
| Storage Temperature                              | $T_{stg}$                             | -30  | +80 | °C   |

## 5 ELECTRICAL CHARACTERISTICS

### 5.1 Driving TFT LCD Panel

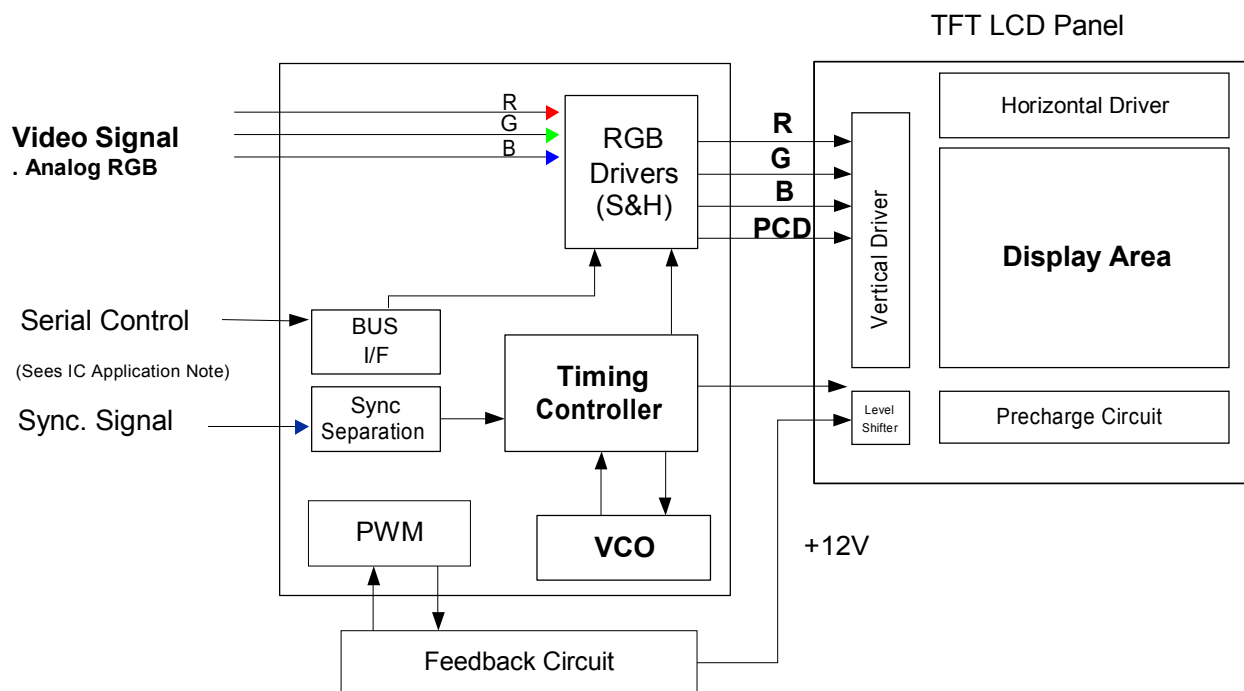
VSS=0V, Ta=25°C

| Item                               | Symbol         | MIN     | TYP     | MAX     | Unit | Remark   |  |
|------------------------------------|----------------|---------|---------|---------|------|----------|--|
| Power Supply for Vertical Driver   | VVDD           | 11.7    | 12      | 12.3    | V    |          |  |
| Power Supply for Horizontal Driver | HVDD           | 11.7    | 12      | 12.3    | V    |          |  |
| Horizontal Driver Input Voltage    | Low            | VHIL    | -0.3    | 0.0     | 0.3  | V        |  |
|                                    | High           | VHIH    | 2.5     | 3.0     | 4.0  | V        |  |
| Vertical Driver Input Voltage      | Low            | VVIL    | -0.3    | 0.0     | 0.3  | V        |  |
|                                    | High           | VVIH    | 2.5     | 3.0     | 4.0  | V        |  |
| CSH, CSV                           | Low            | VSIL    | -0.3    | 0.0     | 0.3  | V        |  |
|                                    | High           | VSIH    | 11.5    | VDD     | VDD  | V        |  |
| Video Signal Center Voltage        | VVC            | 5.0     | 5.2     | 5.4     | V    | Note 5-1 |  |
| Video Input Voltage Range          | VG, VR, VB     | VCC-3.5 | --      | VVC+3.5 | V    |          |  |
| Common Electrode Voltage           | VCOM           | --      | VVC-0.2 | --      | V    | Note 5-2 |  |
| Current of Vertical Driver         | IVDD           | --      | 0.66    | --      | mA   |          |  |
| Current of Horizontal Driver       | IHDD           | --      | 2.9     | --      | mA   |          |  |
| Panel Power Consumption            | W <sub>P</sub> | --      | 43      | --      | mW   |          |  |

Note 5-1: Video signal and precharge data signal shall be input symmetrically around VVC.

Note 5-2: Set common electrode voltage to the optimum voltage.

#### (1) Driving TFT LCD Panel Block Diagram



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5.2

Driving Backlight

Ta=25°C

| Item                        | Symbol          | MIN  | TYP     | MAX    | Unit | Remark   |
|-----------------------------|-----------------|------|---------|--------|------|----------|
| Forward Current             | I <sub>F</sub>  | --   | 15      | 20     | mA   | Note 5-3 |
| Forward Current Voltage     | V <sub>F</sub>  | 8.85 | 10.425  | 11.625 | V    |          |
| Backlight Power Consumption | W <sub>BL</sub> | --   | 156.375 | --     | mW   |          |

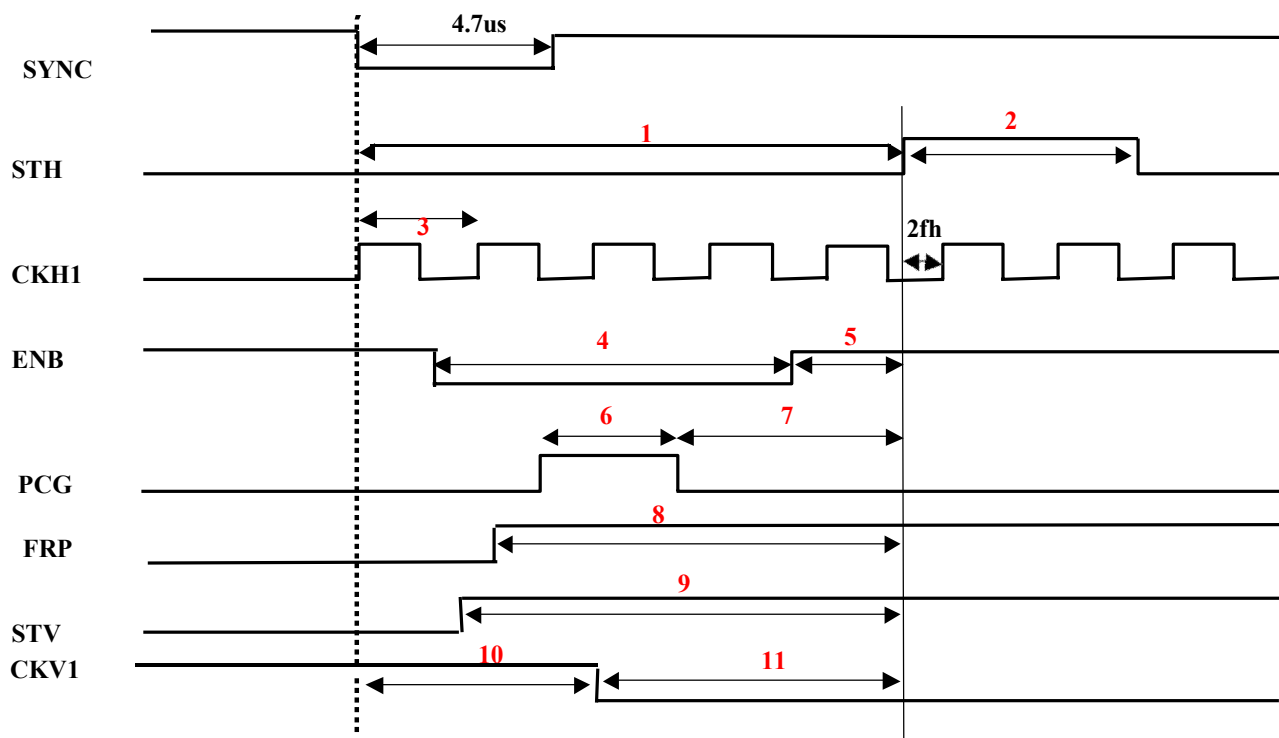
Note 5-3: Backlight driving circuit is recommend as the fix current circuit.

6 TIMING CHART

6.1 Horizontal

|              | NTSC<br>Cycle(fh)  | PAL<br>Cycle(fh)   | 1(fh) | 2(fh) | 3(fh) | 4(fh) | 5(fh) | 6(fh) | 7(fh) | 8(fh) | 9(fh) | 10(fh) | 11(fh) |
|--------------|--------------------|--------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|--------|
| Odd<br>Line  | 622<br>(t=102.2ns) | 636<br>(t=100.6ns) | 82.5  | 12    | 6     | 69    | 9.5   | 25    | 19.5  | 31.5  | 76.5  | 50     | 32.5   |
| Even<br>Line | 622<br>(t=102.2nS) | 636<br>(t=100.6nS) | 81    | 12    | 6     | 69    | 8     | 25    | 18    | 30    | 75    | 50     | 32.5   |

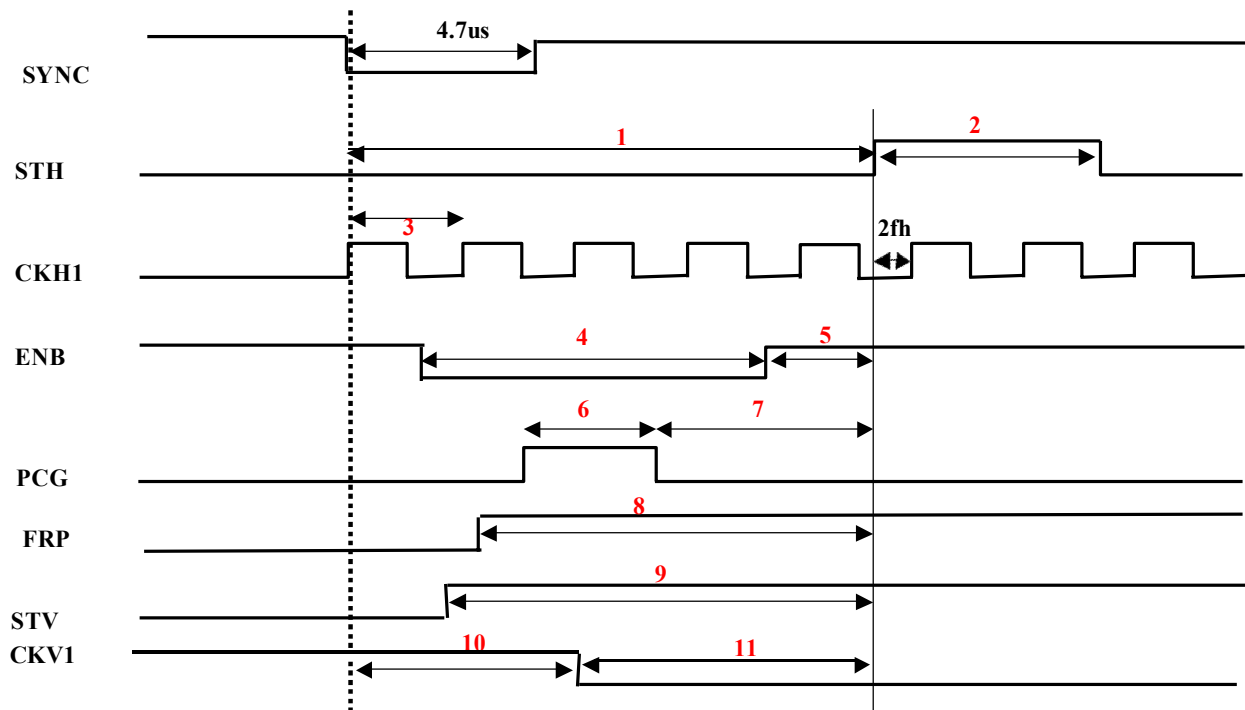
(1) Odd Line





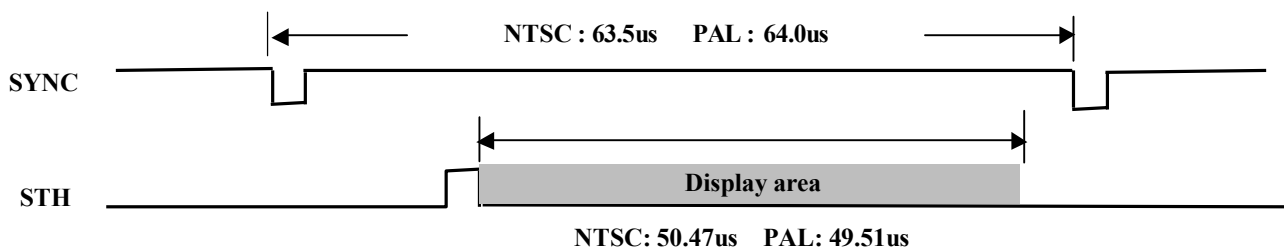
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(2) Even Line



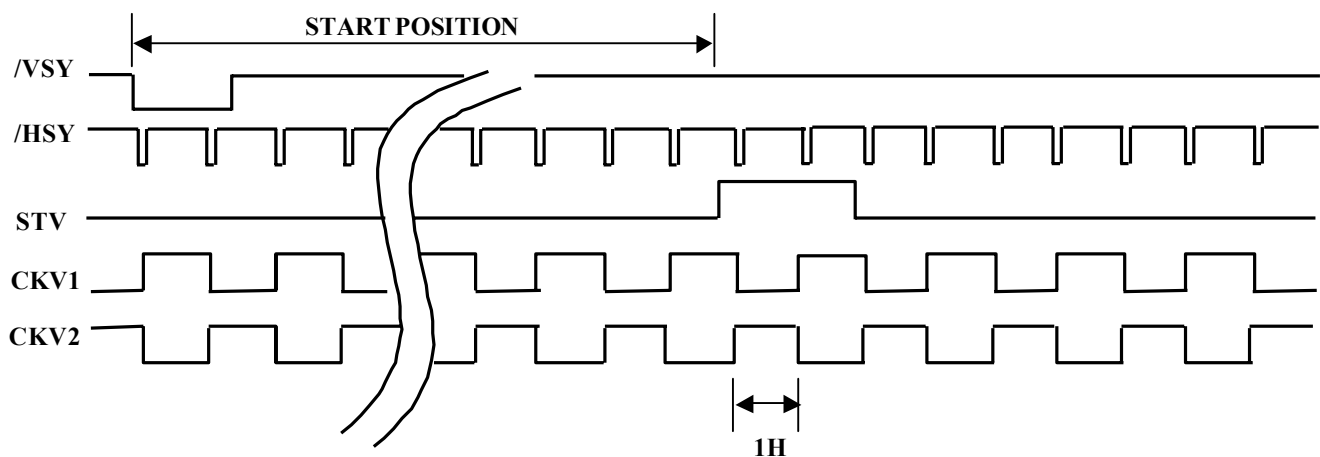
6.2 Vertical

(1) Display Area



(2) Start Position

|      | Odd Field | Even Field |
|------|-----------|------------|
| NTSC | 16        | 15         |
| PAL  | 23        | 22         |



Product Specification

**7 OPTICAL CHARACTERISTICS**

7.1 Optical Specification

Ta=25°C

| Item                             | Symbol  | Condition      | MIN | TYP   | MAX   | Unit              | Remarks  |
|----------------------------------|---------|----------------|-----|-------|-------|-------------------|----------|
| Viewing Angles                   | Θ11     | CR ≥ 10        | 35  | 40    | --    | Degree            | Note 7-1 |
|                                  | Θ12     |                | 35  | 40    | --    |                   |          |
|                                  | Θ21     |                | 15  | 20    | --    |                   |          |
|                                  | Θ22     |                | 50  | 60    | --    |                   |          |
| Contrast Ratio                   | CR      | Θ=0°           | 100 | 150   | --    |                   | Note 7-2 |
| Response Time                    | Rising  | Tr             | --  | 17    | --    | ms                | Note 7-3 |
|                                  | Falling | Tf             | --  | 30    | --    |                   |          |
| Luminance (I <sub>F</sub> =15mA) | L       |                | 220 | 260   | --    | cd/m <sup>2</sup> | Note 7-5 |
| V-T Characteristics              | V90     | VT90           | --  | 2.3   | --    | V                 | Note 7-4 |
|                                  | V10     | VT10           | --  | 1.4   | --    | V                 |          |
| Chromaticity                     | White   | x <sub>w</sub> | --  | 0.295 | 0.325 |                   | Note 7-6 |
|                                  |         | y <sub>w</sub> | --  | 0.310 | 0.360 |                   |          |

7.2 Basic Measure Condition

(1) Driving voltage

HVDD= 12.0V, VVDD=12.0V

VVC=5.2V, VCOM = Optimum common electrode voltage

(2) Ambient Temperature: Ta=25°C

(3) Testing Point: Measure in the display center point and the test angle θ=0°

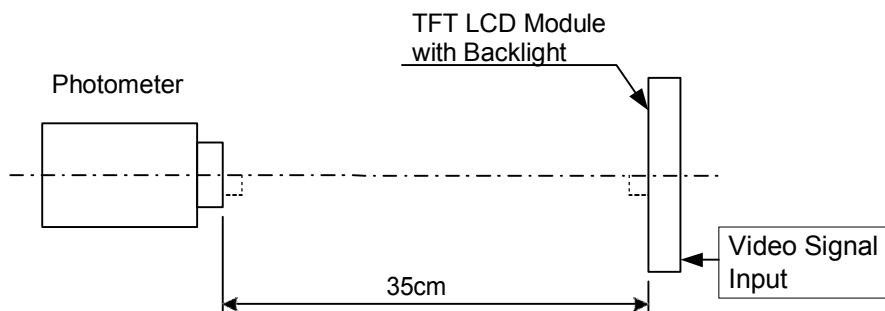
(4) R, G, B signal input voltage VG, VR, VB

VG, VR, VB=VVC ± VAC (VAC: Signal Amplitude)

(5) LED Current: I<sub>F</sub>=15mA.

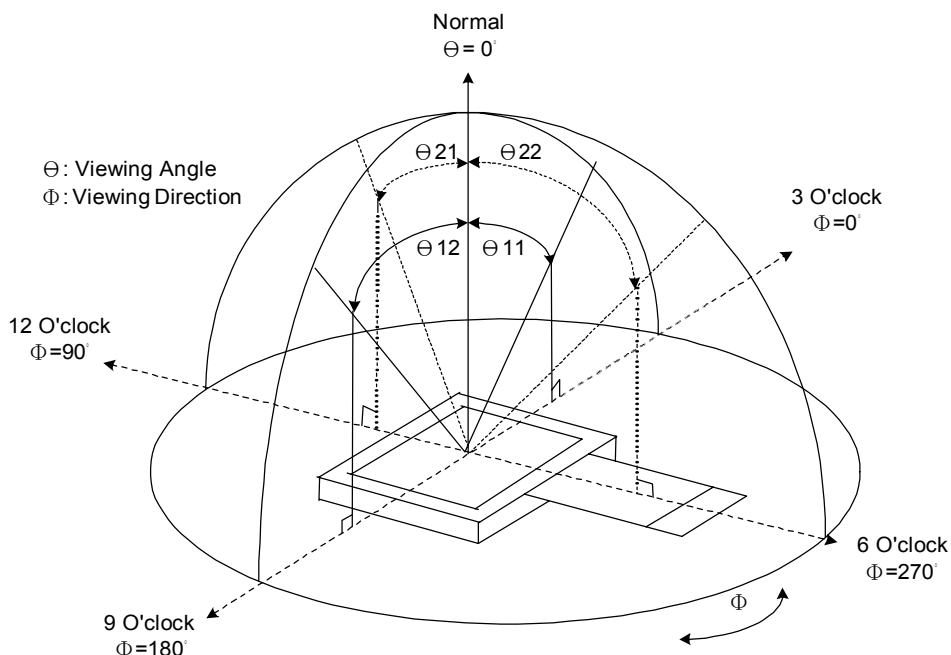
(6) Testing Facility: Topcon BM-5A

Environmental illumination: ≤ 10 Lux



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Note 7-1: Viewing angle diagrams:

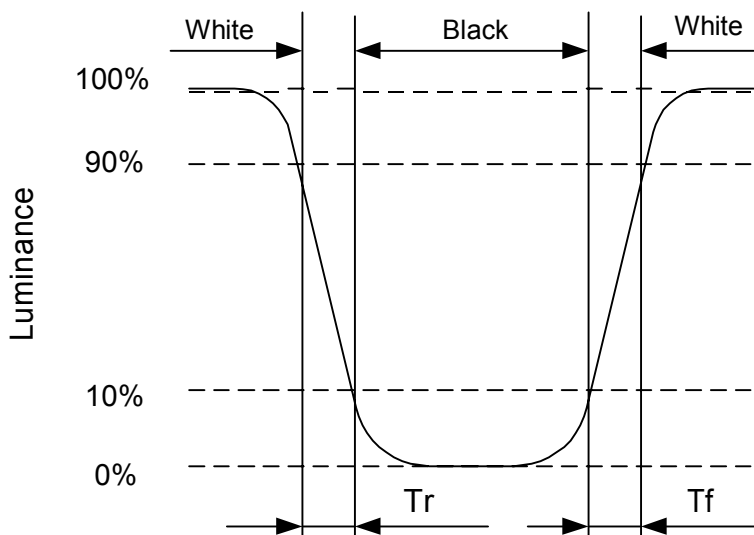


Note 7-2: Contrast Ratio:

Contrast ratio is measured in optimum common electrode voltage. The signal amplitude VAC of white image is 0.5V and black image is 3.5V.

$$CR = \frac{\text{Luminance with white image}}{\text{Luminance with black image}}$$

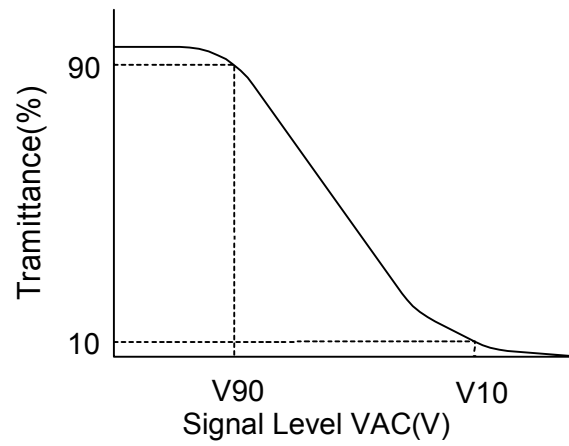
Note 7-3: Definition of response time:



Note 7-4: V-T Characteristics:

Measure the relationship between video signal amplitude and transmittance. Define the voltage of 90% transmittance is V90 and the voltage of 10% transmittance is V10

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Note 7-5: Luminance:

Test Point: Display Center

Test Circuit: See Section 7.2(5) Testing fix current circuit

Note 7-6: Chromaticity: The same test condition as Note 7-5.

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**8 REILABILITY**

| No | Test Item  | Condition   |
|----|--|---|
| 1  | High Temperature Operation                                 | Ta=+60°C, 240hrs  |
| 2  | High Temperature & High Humidity Operation                 | Ta=+40°C, 95% RH, 240hrs  |
| 3  | Low Temperature Operation                                  | Ta=-10°C, 240hrs  |
| 4  | High Temperature Storage (non-operation)                   | Ta=+80°C, 240hrs  |
| 5  | Low Temperature Storage (non-operation)                    | Ta=-30°C, 240hrs  |
| 6  | Thermal Shock (non-operation)                              | -30°C ↔ 80°C, 50 cycles<br>30 min 30 min  |
| 7  | Resistance to Static Electricity Discharge (non-operation) | C=200pF, R=0Ω;<br>Discharge: ±150V<br>3 times / Terminal  |
| 8  | Surface Discharge (non-operation)                          | C=150pF, R=330Ω;<br>Discharge: Air: ±15kV; Contact: ±8kV<br>5 times / Point; 5 Points / Panel               |
| 9  | Vibration (non-operation)                                  | Frequency: 10~55Hz; Amplitude: 1.5mm<br>Sweep Time: 11min<br>Test Time: 2 hrs for each direction of X, Y, Z |
| 10 | Shock (non-operation)                                      | Acceleration: 100G; Period: 6ms<br>Directions: ±X, ±Y, ±Z; Cycles: Twice                                    |

Ta: Ambient Temperature

## 9 HANDLING CAUTIONS

### 9.1 ESD (Electrical Static Discharge) Strategy

ESD will cause serious damage of the panel, ESD strategy is very important in handling.

Following items are the recommend ESD strategy

- (1) In handling LCD panel, please wear non-charged material gloves. And the conduction ring connect wrist to the earth and the conducting shoes to the earth is necessary.
- (2) The machine and working table for the panel should have ESD prohibition strategy.
- (3) In handling the panel, ionize flowing decrease the charge in the environment is necessary.
- (4) In the process of assembly the module, shield case should connect to the ground.

### 9.2 Environment

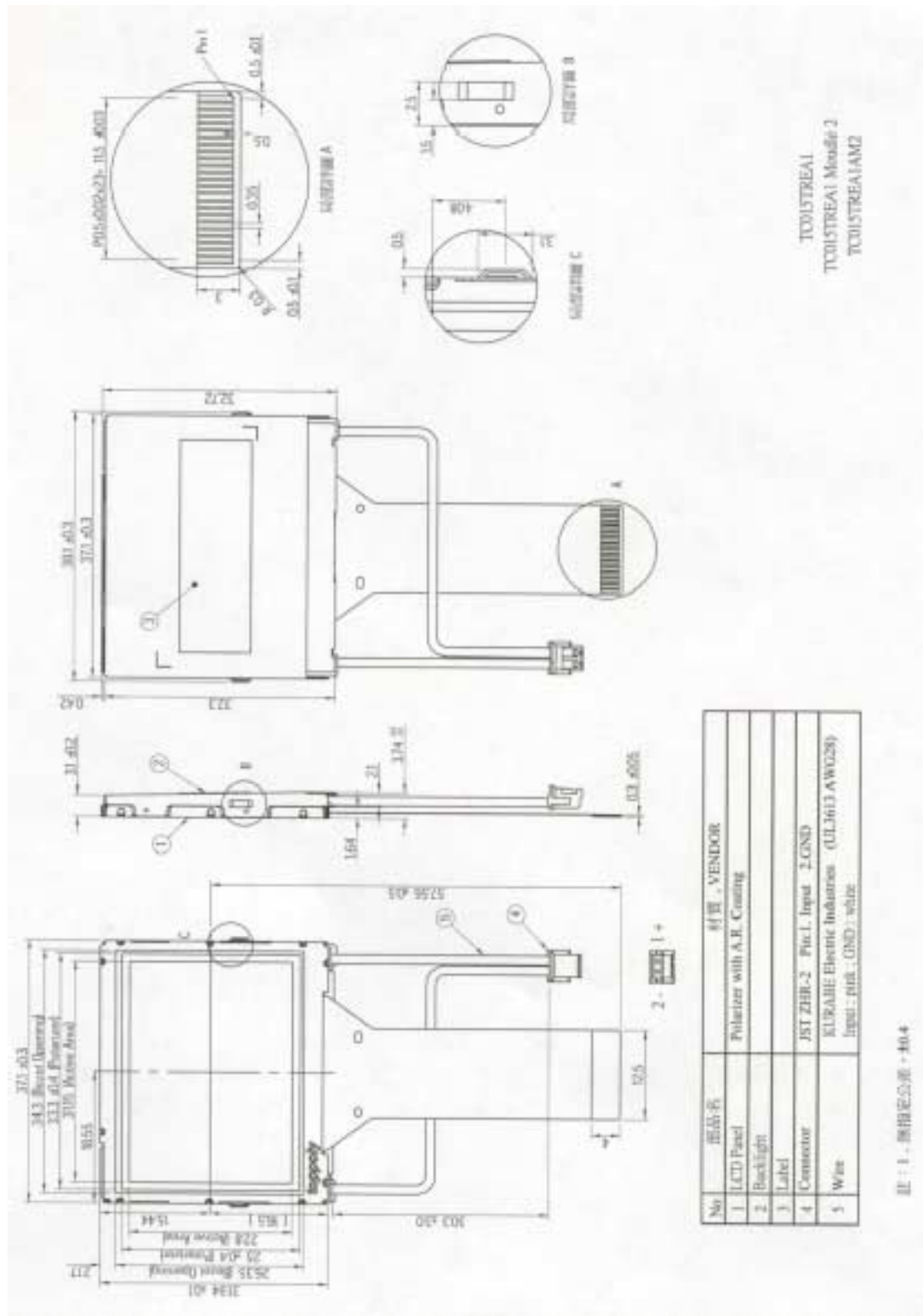
- (1) Working environment of the panel should in the clean room.
- (2) The front poliazzer is easy damaged, handle it carefully and do not scratch it by sharp material.
- (3) Panel has polarizer protective film in the surface please remove the protection film of polarizer slowly with ionized air to prevent the electrostatic discharge.

### 9.3 Others

- (1) Turn off the power supply before connecting and disconnecting signal input cable.
- (2) The connection area of FPC and panel is very weak, do not handle panel only by FPC or bend FPC.
- (3) Water drop on the surface or condensation as panel power on will corrode panel electrode.
- (4) As the packing bag open, watch out the environment of the panel storage. High temperature and high humidity environment is prohibited.
- (5) When the TFT LCD module is broken, please watch out whether liquid crystal leaks out or not. If your hand touches liquid crystal, wash your hand cleanly by water and soap as soon as possible.

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10 MECHANICAL DRAWING



11 Packing Drawing

