



PHOENIX DISPLAY INTERNATIONAL, INC.

PHOENIX DISPLAY INTERNATIONAL, INC SPECIFICATION FOR LCD MODULE

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|--------------------|--------------------|
| CUSTOMER | |
| PART NUMBER | PDI500MZNI-01P |
| DESCRIPTION | 5.0" TFT 480 x 272 |
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1. General Specification

| No. | Item | Specification | Remark |
|-----|-----------------------------|----------------------------------|--------|
| 1 | LCD size | 5.0 inch(Diagonal) | |
| 2 | Driver element | a-Si TFT active matrix | |
| 3 | Resolution | 480 X 3(RGB) X 272 | |
| 4 | Display mode | Normally White, Transmissive | |
| 5 | Active area | 110.88(W) X 62.83(H) mm | |
| 6 | Module size | 120.70(W) X 75.80(H) X 4.3(D) mm | Note1 |
| 7 | Surface treatment | Anti-Glare | |
| 8 | Color arrangement | RGB-stripe | |
| 9 | Interface | 24Bit RGB | |
| 10 | Backlight power consumption | 640mW | |
| 11 | Weight | TBD | |

Note 1: Refer to Mechanical Drawing.

2. Pin Assignment

2.1 TFT LCD Panel Driving Section

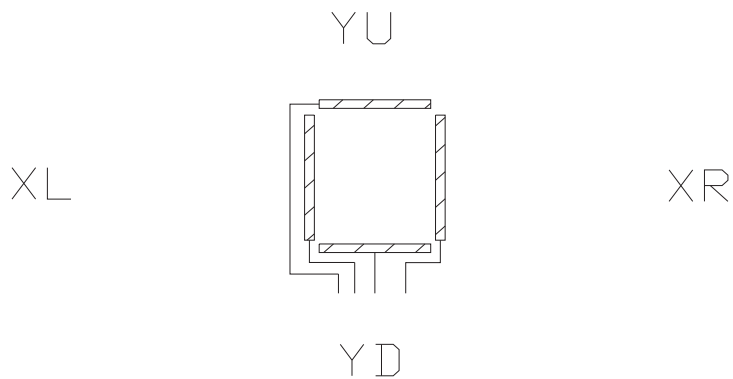
| Pin No. | Symbol | I/O | Function | Remark |
|---------|--------|-----|-----------------------------------|--------|
| 1 | VLED- | P | Power for LED backlight (Cathode) | |
| 2 | VLED+ | P | Power for LED backlight (Anode) | |
| 3 | GND | P | Power ground | |
| 4 | VDD | P | Power supply | |
| 5 | R0 | I | Data bus | |
| 6 | R1 | I | Data bus | |
| 7 | R2 | I | Data bus | |
| 8 | R3 | I | Data bus | |
| 9 | R4 | I | Data bus | |
| 10 | R5 | I | Data bus | |
| 11 | R6 | I | Data bus | |
| 12 | R7 | I | Data bus | |
| 13 | G0 | I | Data bus | |
| 14 | G1 | I | Data bus | |
| 15 | G2 | I | Data bus | |
| 16 | G3 | I | Data bus | |
| 17 | G4 | I | Data bus | |
| 18 | G5 | I | Data bus | |
| 19 | G6 | I | Data bus | |
| 20 | G7 | I | Data bus | |
| 21 | B0 | I | Data bus | |
| 22 | B1 | I | Data bus | |
| 23 | B2 | I | Data bus | |
| 24 | B3 | I | Data bus | |
| 25 | B4 | I | Data bus | |
| 26 | B5 | I | Data bus | |
| 27 | B6 | I | Data bus | |
| 28 | B7 | I | Data bus | |
| 29 | GND | P | Power ground | |

| | | | | |
|----|-------|---|-----------------------|--|
| 30 | DCLK | I | Dot clock | |
| 31 | DISP | I | Display on/off | |
| 32 | HSYN | I | Horizontal signal YNC | |
| 33 | VSYNC | I | Vertical signal YNC | |
| 34 | DE | I | Data enable | |
| 35 | NC | - | No connect | |
| 36 | GND | P | Power Ground | |
| 37 | XR | I | TP pin | |
| 38 | YD | I | TP pin | |
| 39 | XL | I | TP pin | |
| 40 | YU | I | TP pin | |

2.2. Touch Screen Panel Section

| Symbol | I/O | Function | Remark |
|--------|--------|--|--------|
| YU | Top | Top electrode – differential analog | |
| XL | Left | Left electrode – differential analog | |
| YD | Bottom | Bottom electrode – differential analog | |
| XR | Right | Right electrode – differential analog | |

Note: Touch screen panel block



3. Operation Specifications

3.1. Absolute Maximum Ratings

| Parameter | Symbol | Min | Max | Unit |
|--------------------------|-----------|------|----------------|------|
| Supply voltage for logic | V_{cc} | -0.3 | 3.6 | V |
| Input voltage for logic | V_{IN} | -0.5 | $V_{cc} + 0.3$ | V |
| Supply current (One LED) | I_{LED} | | 30 | mA |
| Operating temperature | T_{OP} | -20 | +70 | °C |
| Storage temperature | T_{ST} | -30 | +80 | °C |

3.1.1. Typical Operation Conditions

| Item | Symbol | Min | Typ | Max | Unit | Applicable terminal |
|--------------------------|-----------|--------------|-----|--------------|------|---------------------|
| Supply voltage for logic | V_{cc} | 3 | 3.3 | 3.6 | V | V_{DD} |
| Input voltage | V_{IL} | -0.3 | - | $0.2 V_{DD}$ | V | |
| | V_{IH} | $0.8 V_{cc}$ | - | V_{cc} | V | |
| Input leakage current | I_{LKG} | | | | μA | |
| LED Forward voltage | V_f | 3.0 | 3.2 | 3.4 | V | With One LED |
| Input backlight current | I_{LED} | - | 20 | 25 | mA | With One LED |

3.1.2. Backlight Driving Conditions

| Item | Symbol | Values | | | Unit | Remark |
|---------------------------|--------|--------|------|------|------|--------|
| | | Min. | Typ. | Max. | | |
| Voltage for LED backlight | V_L | 15 | 16 | 17 | V | Note 1 |
| Current for LED backlight | I_L | - | 40 | 40 | mA | |
| LED life time | - | 20,000 | - | - | Hr | Note 2 |

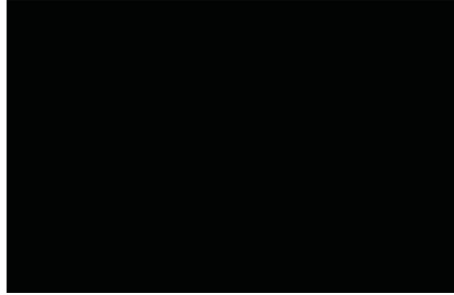
Note 1: The LED Supply Voltage is defined by the number of LED at $T_a=25^{\circ}\text{C}$ and $I_L=40\text{mA}$.

Note 2: The “LED life time” is defined as the module brightness decrease to 50% original brightness at $T_a=25^{\circ}\text{C}$ and $I_L=40\text{mA}$. The LED lifetime could be decreased if operating I_L is larger than 40 mA.

Note 3: Typ.specification: Gray-level test pattern; Max.specification: Black-level test pattern.



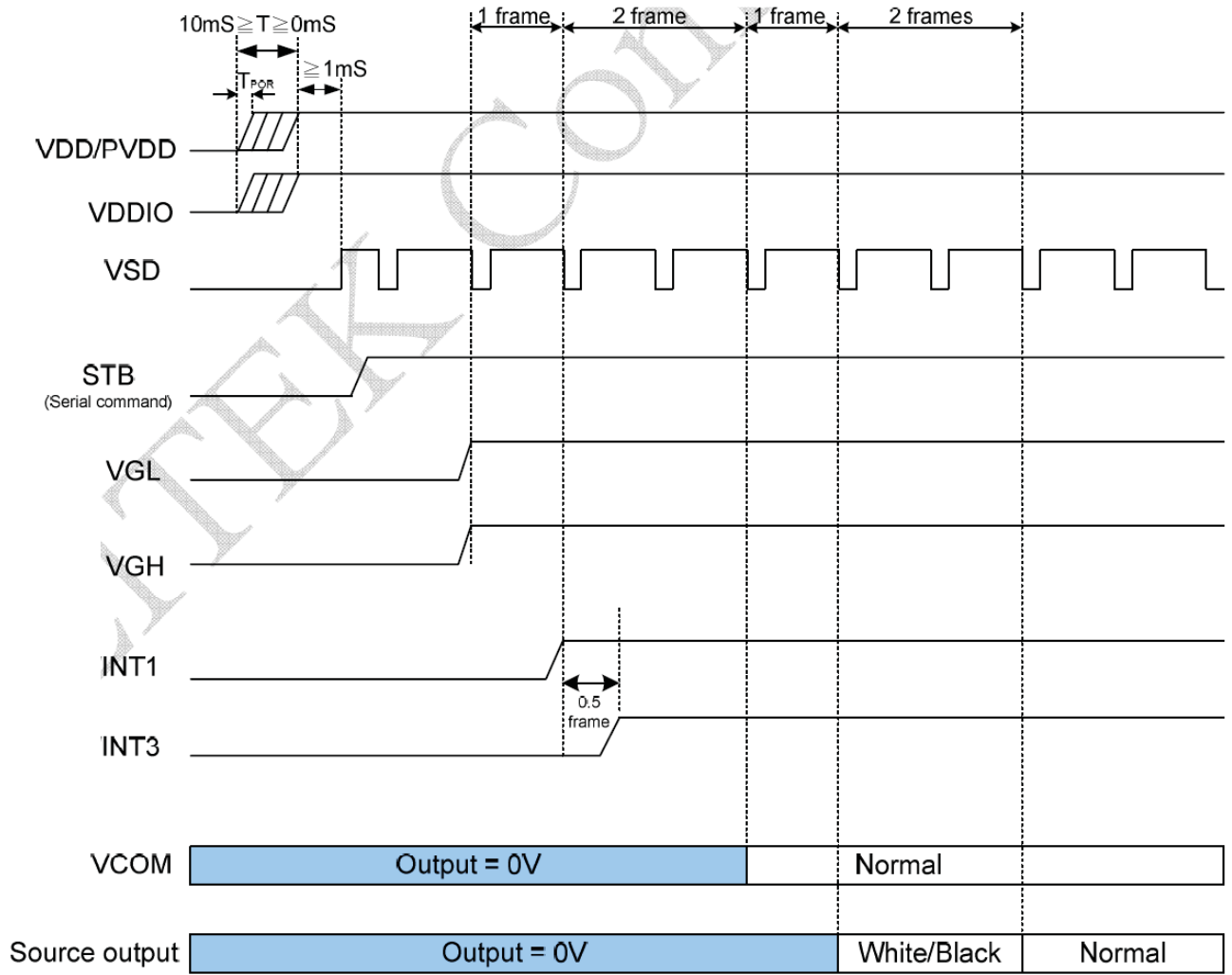
(a) Gray-level test pattern



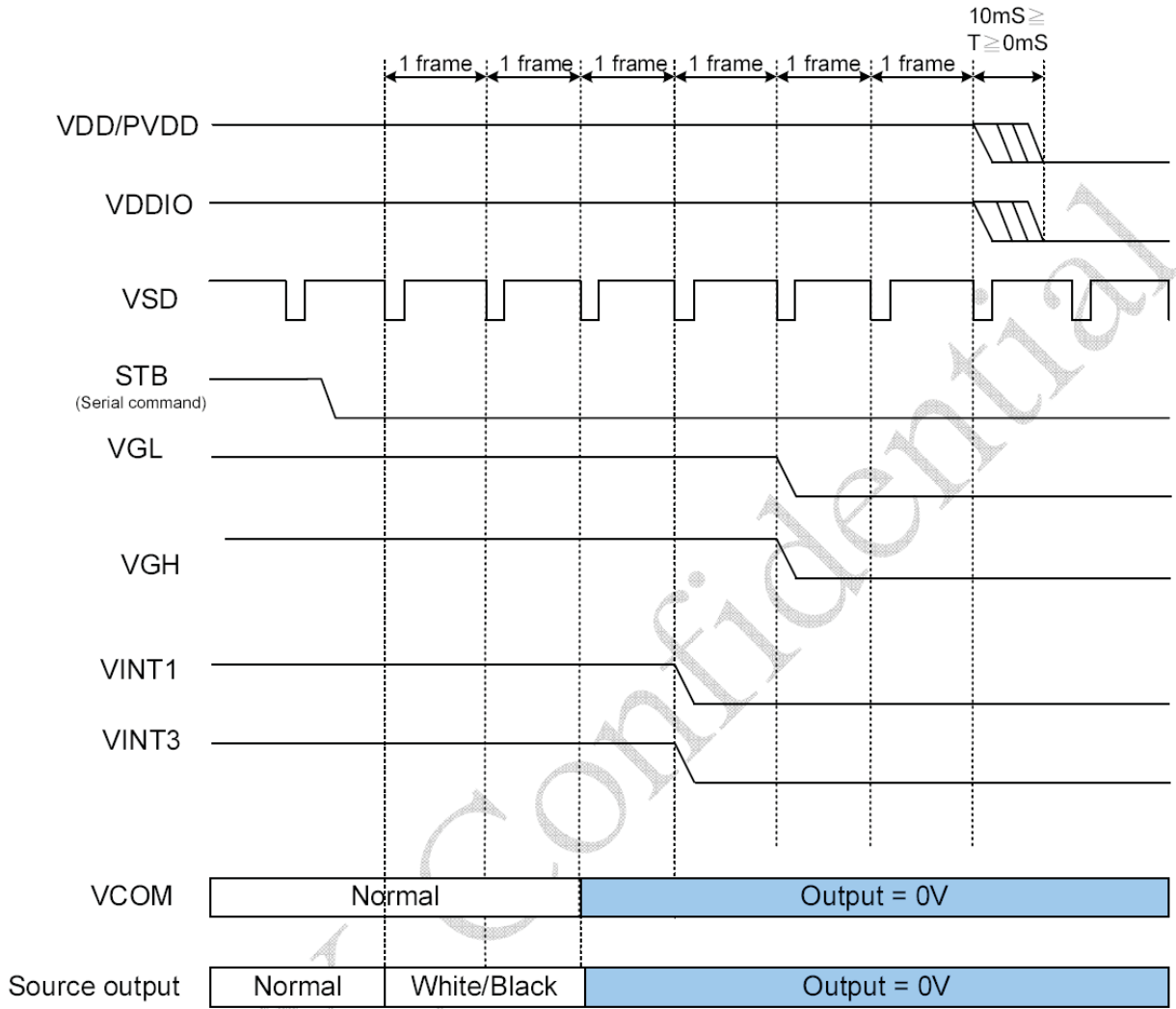
(b) Black-level test pattern

3.2. Power Sequence

Power on:



Power off:



3.3. Timing Characteristics

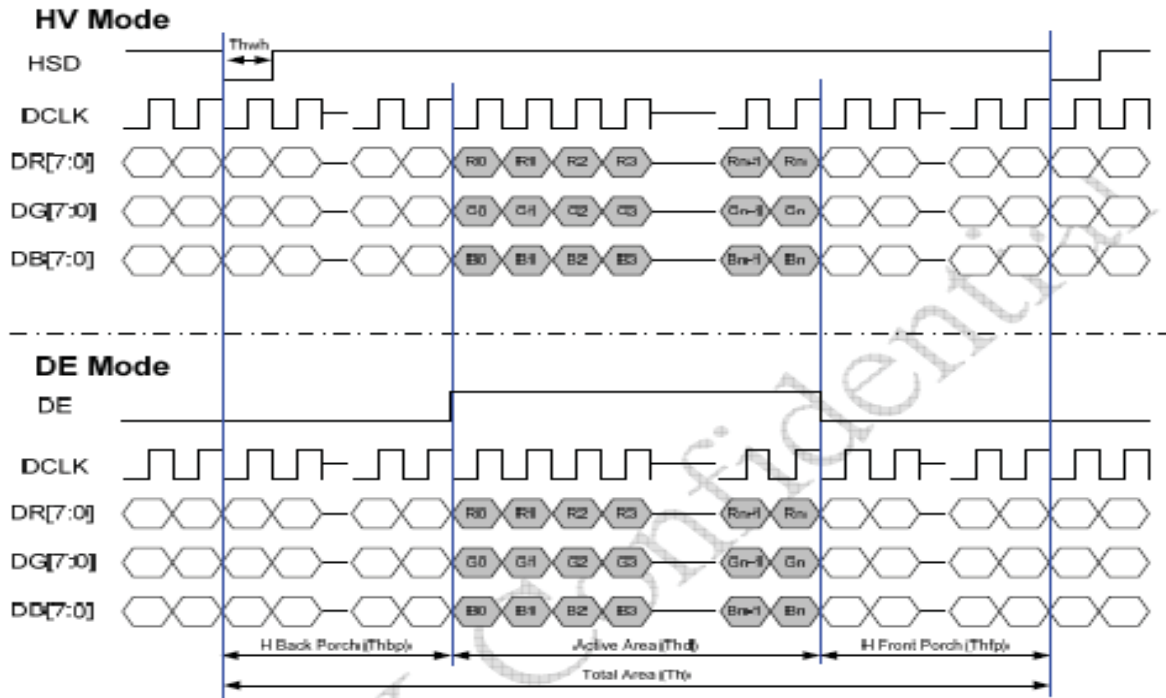
Parallel RGB input timign table

| Parameter | Symbol | Value | | | Unit |
|------------------|--------|-------|------|------|------|
| | | Min. | Typ. | Max. | |
| DCLK frequency | fclk | 5 | 9 | 12 | MHz |
| VSD period time | Tv | 277 | 288 | 400 | H |
| VSD display area | Tvd | 272 | | | H |
| VSD back porch | Tvb | 3 | 8 | 31 | H |
| VSD front porch | Tvfp | 2 | 8 | 97 | H |
| HSD period time | Th | 520 | 525 | 800 | DCLK |
| HSD display area | Thd | 480 | | | DCLK |
| HSD back porch | Thbp | 36 | 40 | 255 | DCLK |
| HSD front porch | Thfp | 4 | 5 | 65 | DCLK |

| Parameters | Symbol | Min. | Typ. | Max. | Unit | Conditions |
|----------------------------------|--------|------|------|------|------|------------|
| DCLK frequency | Fclk | 24 | 27 | 30 | MHz | |
| DCLK cycle time | Tclk | 83 | 110 | 200 | ns | |
| DCLK pulse duty | Tcwh | 40 | 50 | 60 | % | |
| Time from HSD to source output | Thso | - | 13 | - | DCLK | |
| Time from HSD to gate output | Thgo | - | 27 | - | DCLK | |
| Time from HSD to gate output off | Thgz | - | 3 | - | DCLK | |
| Time from HSD to VCOM | Thvc | - | 12 | - | DCLK | |

Data Input Format

Parallel RGB mode data format



4. Touch Screen Panel Specifications

4.1. Electrical Characteristics

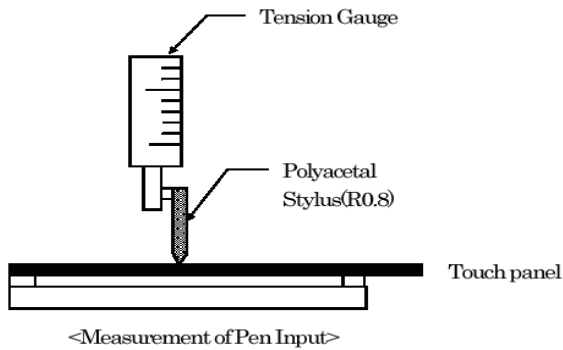
| Item | Value | | | Unit | Remark |
|-----------------------|-------|------|------|------------|---------------------------|
| | Min. | Typ. | Max. | | |
| Linearity | -- | -- | 1.5 | % | Analog X and Y directions |
| Terminal Resistance | 400 | - | 1050 | Ω | X(Film side) |
| | 100 | - | 450 | Ω | Y(Glass side) |
| Insulation resistance | 25 | - | - | M Ω | DC 25V |
| Voltage | - | - | 10 | V | DC |
| Chattering | - | - | 10 | ms | 100k Ω pull-up |
| Transparency | 80 | - | - | % | |

4.2. Mechanical & Reliability Characteristics

| Item | Value | | | Unit | Remark |
|-------------------------------|------------------|------|------|------------|--------|
| | Min. | Typ. | Max. | | |
| Active force | 10 | - | 100 | g | Note 1 |
| Durability-surface scratching | Write 100,000 | - | - | characters | Note 2 |
| Durability-surface pitting | 1,000,000 | - | - | touches | Note 3 |
| Surface hardness | 3 | - | - | H | |

Note 1: Active force test condition

- (1) Input DC 5V on X direction, Drop off Polyacetal Stylus (R0.8), until output voltage stabilize ,then get the activation force.
- (2) R8.0mm Silicon rubber for finger Activation force test
- (3) Test point: 9 points



Note 2: Measurement for surface area.

- Scratch 100,000 times straight line on the film with a stylus change every 20,000 times.

- Force: 250gf.

- Speed: 60mm/sec.

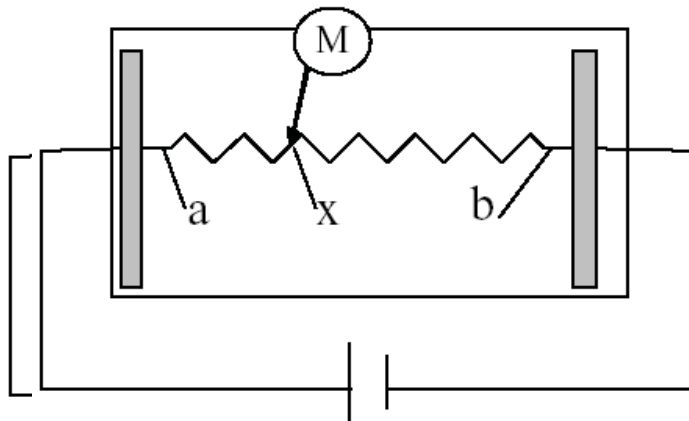
- Stylus: R0.8 polyacetal tip.

Note 3: Pit 1,000,000 times on the film with a R0.8 silicon rubber.

- Force: 250gf.

- Speed: 2times/sec.

4.3. Linearity Definition

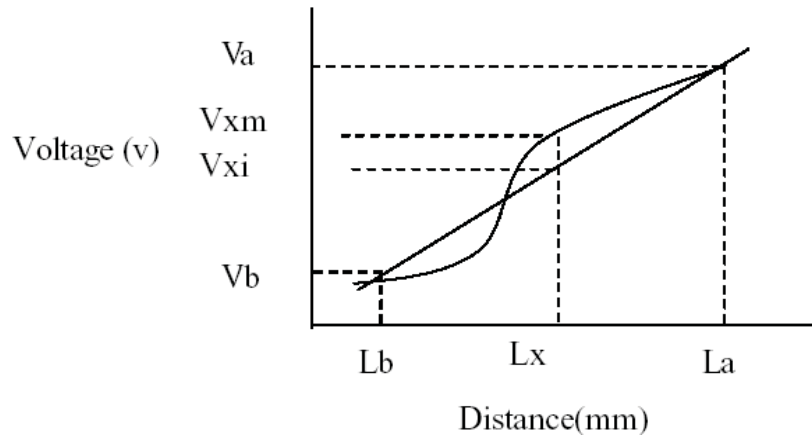


V_a : maximum voltage in the active area of touch panel

V_b : minimum voltage in the active area of touch panel
 X : random measuring point

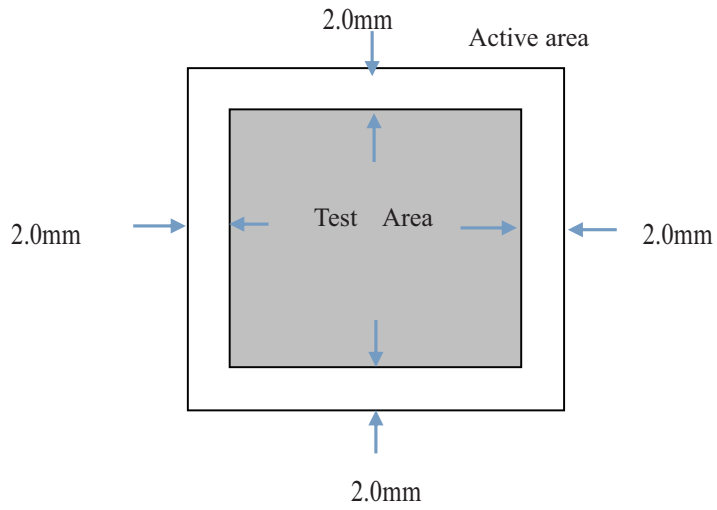
V_{xm} : actual voltage of L_x point

V_{xi} : theoretical voltage of L_x point



$$\text{Linearity} = \frac{|V_{xi} - V_{xm}|}{(V_a - V_b)} * 100\%$$

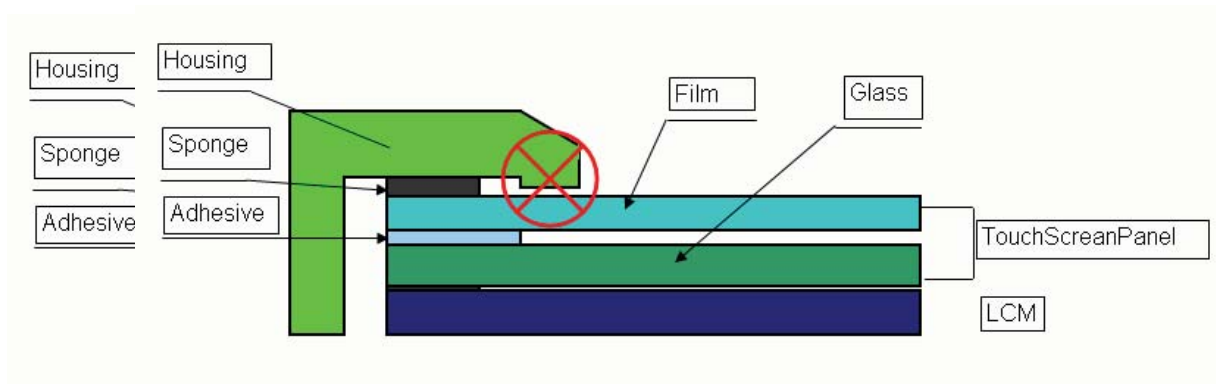
Note: Test area is as follows and operation force is 150gf



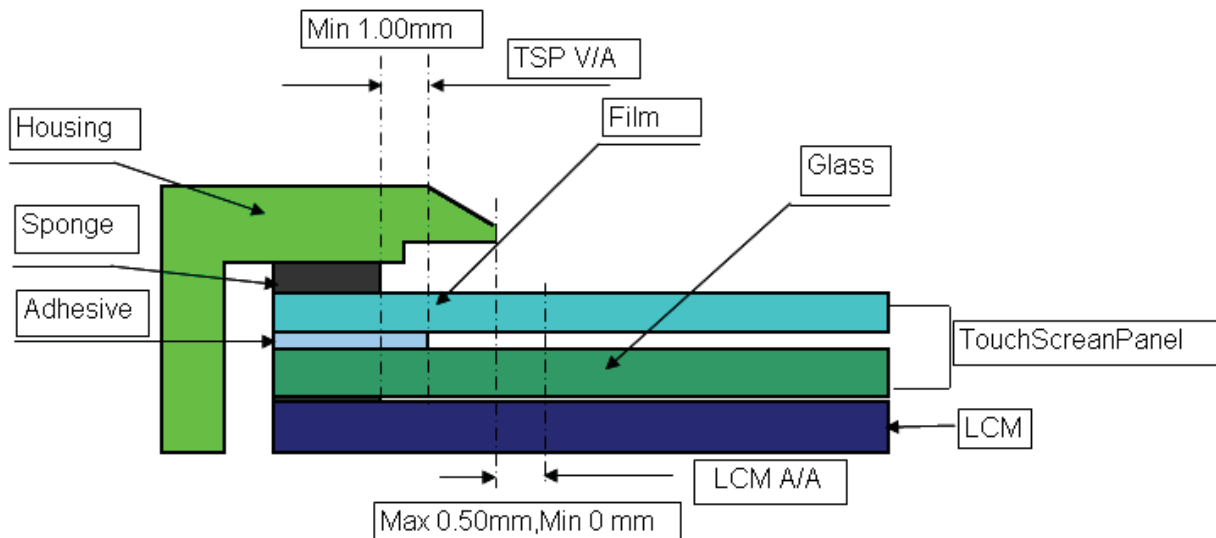
4.4. Housing Design Guide

Housing design follow as below.

- 1) Avoid the design that housing overlap and press on the active area of the LCM.
- 2) Give enough gap(over 0.5mm at compressed) between the housing and TSP to protect wrong operating.



- 3) Use a buffer material(Gasket) between the TSP and housing to protect damage and wrong operating.area.overlap and press on the inside of TSP view



5. Optical Specifications

| ITEM | SYMBOL | CONDITIONS | SPECIFICATIONS | | | UNIT | NOTE | |
|----------------------|--------|----------------------|----------------|-------|-------|-------------------|--|--|
| | | | MIN. | TYP. | MAX | | | |
| Brightness | B | Viewing normal angle | - | 200 | - | Cd/m ² | All left side data are based on CPT's product reference only | |
| Contrast Ratio | CR | | 350 | 500 | -- | -- | | |
| Response Time | Tr+Tf | | -- | 30 | | ms | | |
| CIE Color coordinate | Red | | XR | -- | 0.608 | | | |
| | | | YR | | 0.316 | | | |
| | Green | | XG | -- | 0.305 | | | |
| | | | YG | | 0.556 | | | |
| | Blue | | XB | -- | 0.135 | | | |
| | | | YB | | 0.137 | | | |
| White | XW | | -- | 0.300 | | | | |
| | YW | | 0.340 | | | | | |
| Viewing Angle | Hor. | θ_{X+} | 55 | 65 | -- | Deg. | | |
| | | θ_{X-} | 55 | 65 | -- | | | |
| | Ver. | θ_{Y+} | 45 | 55 | -- | | | |
| | | θ_{Y-} | 45 | 55 | | | | |
| Uniformity | Un | | 80 | 85 | | % | | |

Note 1: Definition of viewing angle range

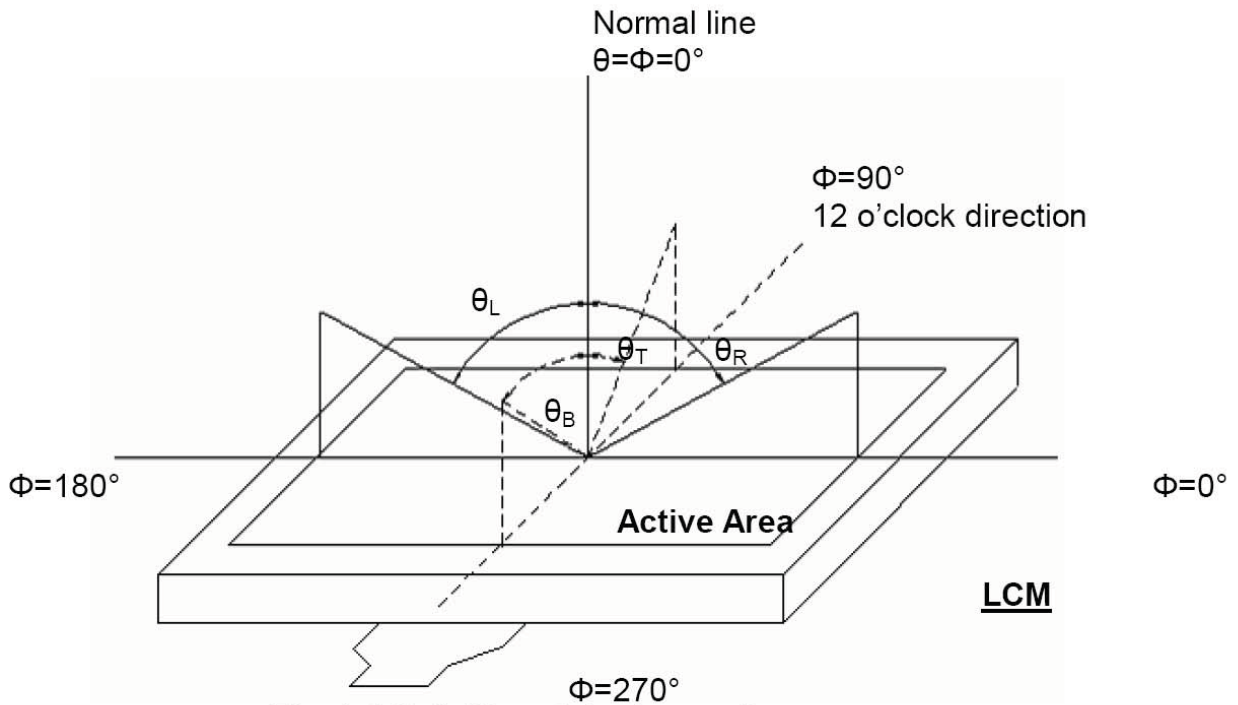


Fig. 4-1 Definition of viewing angle

Note 2: Definition of optical measurement system.

The optical characteristics should be measured in dark room. After 30 minutes operation, the optical properties are measured at the center point of the LCD screen. (Response time is measured by Photo detector TOPCON BM-7, other items are measured by BM-5A/Field of view: 1° /Height: 500mm.)

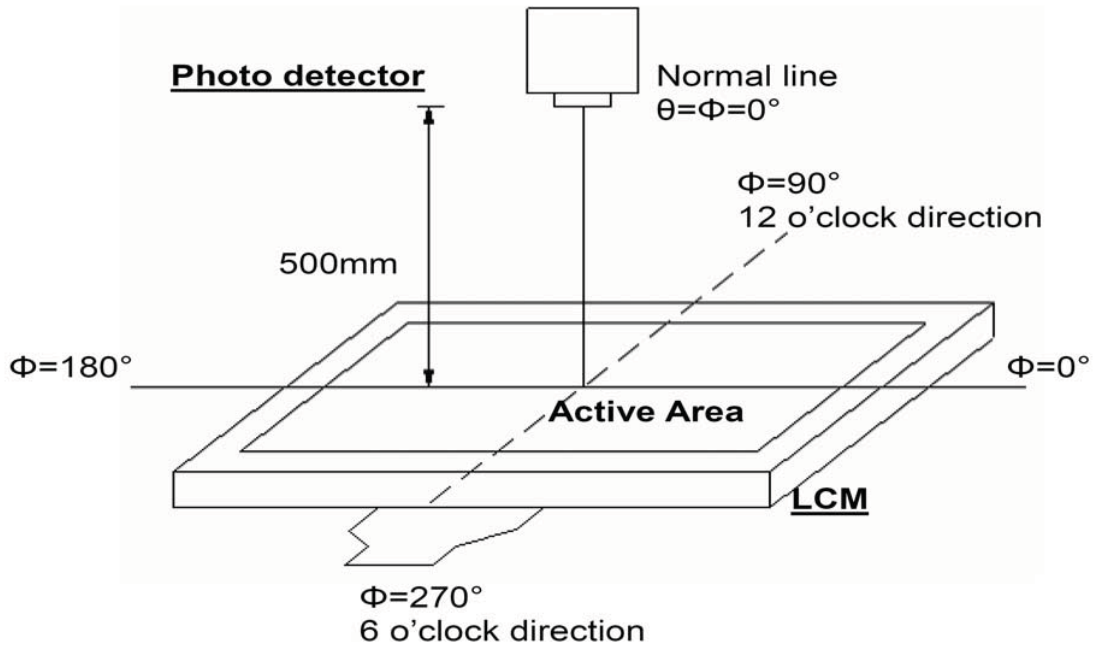


Figure 4-2 Optical measurement system setup

Note 3: Definition of Response time

The response time is defined as the LCD optical switching time interval between “White” state and “Black” state. Rise time (T_{ON}) is the time between photo detector output intensity changed from 90% to 10%. And fall time (T_{OFF}) is the time between photo detector output intensity changed from 10% to 90%.

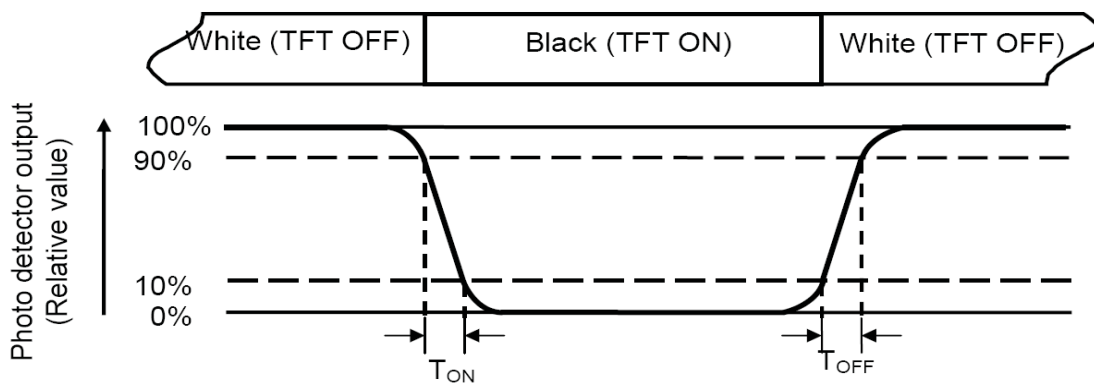


Figure 4-3 Definition of response time

Note 4: Definition of contrast ratio

$$\text{Contrast ratio (CR)} = \frac{\text{state White" " the on LCD when measured Luminance}}{\text{Luminance measured when LCD on the "Black" state}}$$

Note 5: Definition of color chromaticity (CIE1931)

Color coordinates measured at center point of LCD.

Note 6: All input terminals LCD panel must be ground while measuring the center area of the panel. The LED driving condition is $I_L=180\text{mA}$.

Note 7: Definition of Luminance Uniformity

Active area is divided into 9 measuring areas (Refer to Fig. 4-4).

Every measuring point is placed at the center of each measuring area.

$$\text{Luminance Uniformity (YU)} = \frac{B_{\min}}{B_{\max}}$$

L =Active area length W =Active area width

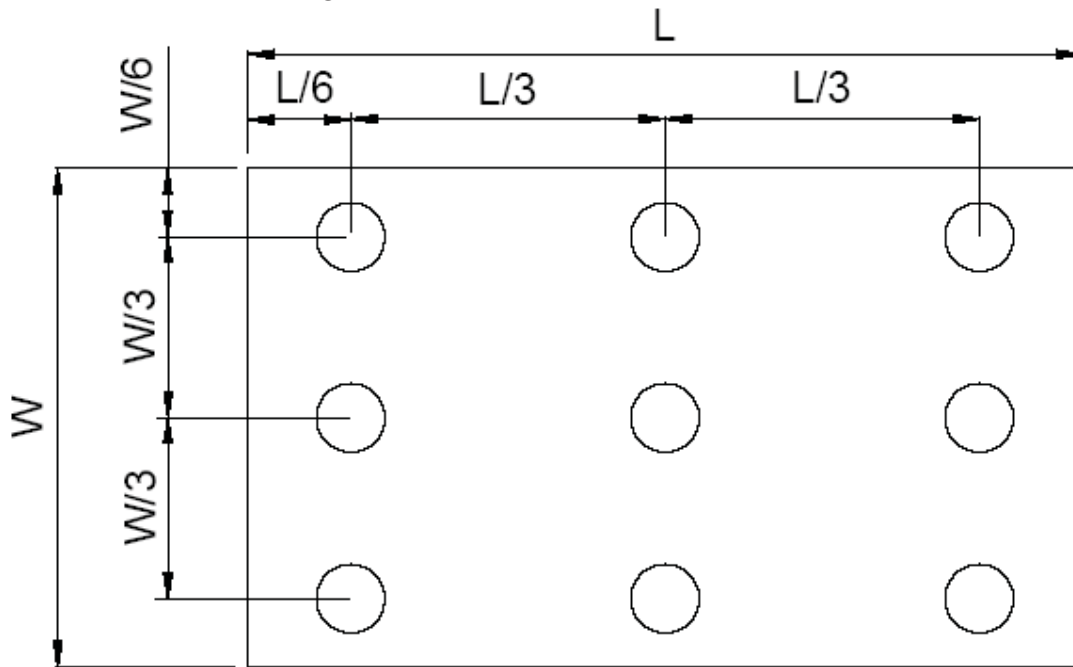


Fig. 4-4 Definition of measuring points

B_{\max} : The measured maximum luminance of all measurement position.

B_{\min} : The measured minimum luminance of all measurement position.

6. Reliability Test Items

(NOTE 3)

| Item | Test Conditions | Remark |
|--|--|------------------|
| High temperature storage | Ta=80°C 240hrs | NOTE1 , NOTE4 |
| Low temperature storage | Ta=-30°C 240hrs | NOTE1 , NOTE4 |
| High temperature operation | Ta=70°C 240hrs | NOTE2 , NOTE4 |
| Low temperature operation | Ta=-20°C 240hrs | NOTE2 , NOTE4 |
| Operate at high temperature and humidity | +60°C, 90%RH 240hrs | NOTE4 |
| Thermal Shock | -30°C/30min~+80°C/30min for a total 100 cycles ,start with cold temperature and end with high temperature . | NOTE4 |
| Vibration Test | Frequency range:10~55HZ Stroke:1.5mm Swap:10HZ~55HZ~10HZ 2 hours of each direction of X.Y. Z (6 hours for total) | |
| Mechanical shock | 100G 6ms, ± X, ± Y, ± Z 3 times for each direction | |
| Package vibration test | Random vibration :0.15G*G/HZ from 5-200 HZ,-6dB/Octave from 200-500HZ of each direction of X.Y. Z (6 hours for total) | |
| Low temperature storage | Height:60cm 1 corner ,3 edges ,6 surfaces | |
| Low temperature storage | ± 2KV ,Human Body Mode, 100pF/1500 Ω | |

Note 1: Ta is the ambient temperature of samples.

Note 2: Ts is the temperature of panel' s surface.

Note 3: In the standard condition, there shall be no practical problem that may affect the display function. After the reliability test, the product only guarantees operation, but don' t guarantee all of the cosmetic specification.

Note 4: Before cosmetic and function test, the product must have enough recovery time, at least 2 hours at room temperature.

7. General Precautions

7.1. Safety

Liquid crystal is poisonous. Do not put it in your mouth. If liquid crystal touches your skin or clothes, wash it off immediately by using soap and water.

7.2. 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 easily damaged. Please handle it carefully to avoid scratch or other damages.

3. To avoid contamination on the display surface, do not touch the module surface with bare hands.

4. Keep a space so that the LCD panels do not touch other components.

5. Put cover board such as acrylic board on the surface of LCD panel to protect panel from damages.

6. Transparent electrodes may be disconnected if you use the LCD panel under environmental conditions where the condensation of dew occurs.

7. Do not leave module in direct sunlight to avoid malfunction of the ICs.

7.3. Static Electricity

1. Be sure to ground module before turning on power or operating module.

2. Do not apply voltage which exceeds the absolute maximum rating value.

7.4. Storage

1. Store the module in a dark room where must keep at $25\pm 10^{\circ}\text{C}$ and 65%RH or less.

2. Do not store the module in surroundings containing organic solvent or corrosive gas.

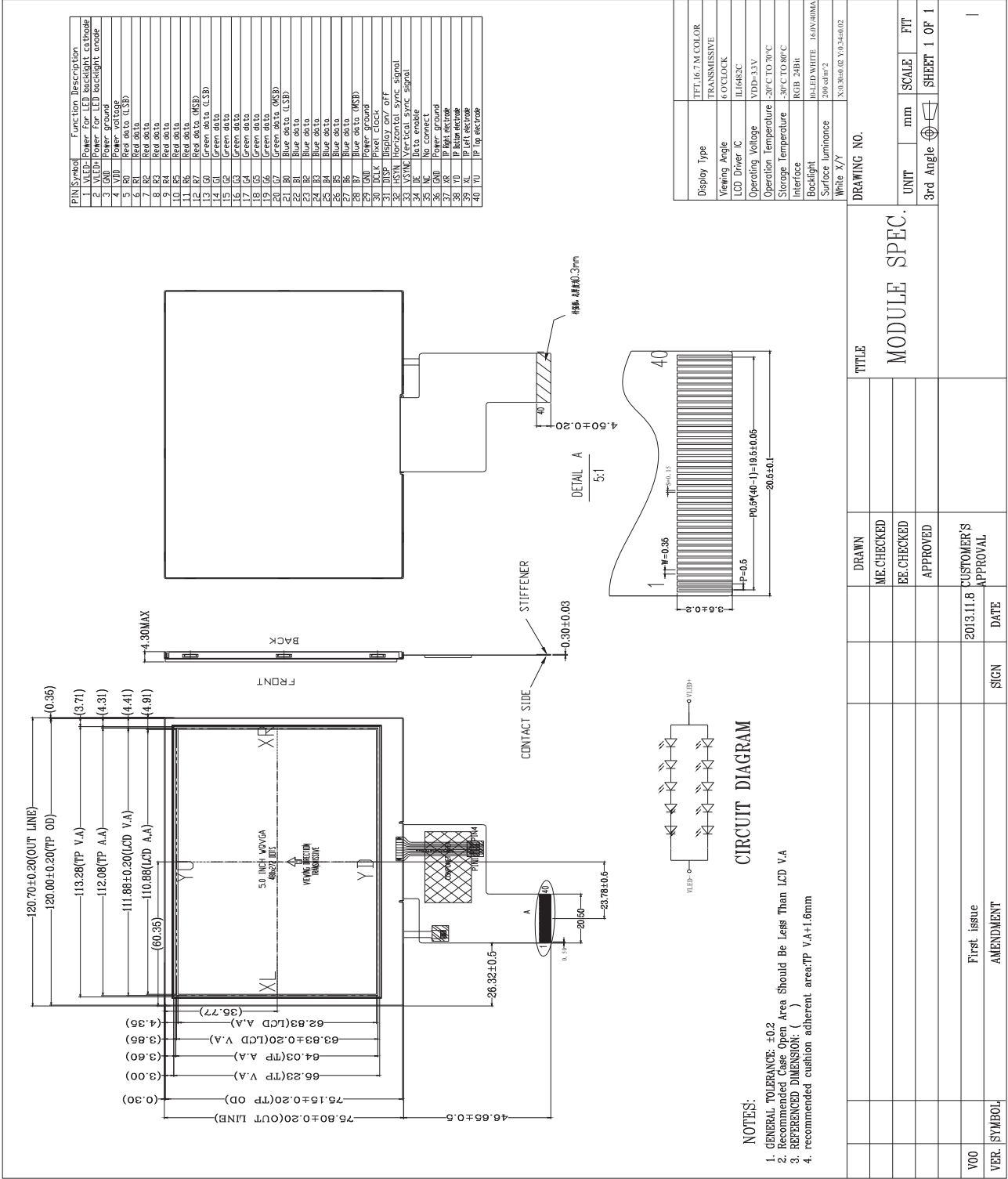
3. Store the module in an anti-electrostatic container or bag.

7.5. Cleaning

1. Do not wipe the polarizer with dry cloth. It might cause scratch.

2. Only use a soft sloth with IPA to wipe the polarizer, other chemicals might permanent damage to the polarizer .

8. Mechanical Drawing



| PIN Symbol | Function Description |
|------------|-----------------------------------|
| 1 VLED+ | Power for Backlight (Anode) |
| 2 VLED- | Power for LED Backlight (Cathode) |
| 3 GND | Power Ground |
| 4 VDD | Power Voltage |
| 5 R0 | Res data (LSB) |
| 6 R1 | Res data |
| 7 R2 | Res data |
| 8 R3 | Res data |
| 9 R4 | Res data |
| 10 R5 | Res data |
| 11 R6 | Res data |
| 12 R7 | Res data (MSB) |
| 13 G0 | Green data (LSB) |
| 14 G1 | Green data |
| 15 G2 | Green data |
| 16 G3 | Green data |
| 17 G4 | Green data |
| 18 G5 | Green data |
| 19 G6 | Green data |
| 20 G7 | Green data (MSB) |
| 21 B0 | Blue data (LSB) |
| 22 B1 | Blue data |
| 23 B2 | Blue data |
| 24 B3 | Blue data |
| 25 B4 | Blue data |
| 26 B5 | Blue data |
| 27 B6 | Blue data |
| 28 B7 | Blue data (MSB) |
| 29 GND | Power Ground |
| 30 DCLK | Pixel Clock |
| 31 HSPD | Horizontal Sync |
| 32 VSYNC | Vertical Sync Signal |
| 33 VSYNC | Vertical Sync Signal |
| 34 IE | Data enable |
| 35 NC | No connect |
| 36 VDD | Power Voltage |
| 37 TP | TP Pad (Electro) |
| 38 TP | TP Pad (Electro) |
| 39 XL | IP Left Electrode |
| 40 XU | IP Top Electrode |

| | |
|-----------------------|--------------------------|
| Display Type | TFT 16.7M COLOR |
| Viewing Angle | TRANSMISSIVE |
| LCM Driver IC | 6-CLOCK |
| Operating Voltage | EL1682C |
| Storage Temperature | VDD=3.3V |
| Operating Temperature | -20°C TO 70°C |
| Storage Temperature | -30°C TO 80°C |
| Interface | RGB, 24Bit |
| Backlight | 3-LED WHITE 16.0V/30MA |
| Surface Luminance | 200 cd/m ² |
| White X/Y | X:0.314, Y:0.344, Z:0.02 |

| DRAWING NO. | | TITLE | |
|---------------------|-----------|--------------|--------------|
| UNIT | mm | SCALE | P/T |
| 3rd Angle | | | SHEET 1 OF 1 |
| DRAWN | | MODULE SPEC. | |
| ME-CHECKED | | | |
| BE-CHECKED | | | |
| APPROVED | | | |
| VER. | 100 | First issue | |
| SYMBOL | | AMENDMENT | |
| CUSTOMER'S APPROVAL | 2013.11.8 | SIGN | DATE |
| | | | |