# *INNOLUX* DISPLAY CORPORATION
## LCD MODULE
# SPECIFICATION

**Customer:** _____

**Model Name:** P070BAG-CM1

**Date:** 2015/04/20

**Version:** 01

☐ **Preliminary Specification**
■ **Final Specification**

**For Customer's Acceptance**

| Approved by | Comment |
|---|---|
|  |  |

| Approved by | Reviewed by | Prepared by |
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| Henry.Chien<br>Cs.Chang<br>2015/04/20 | Sunny.Sun<br>Cc01.Chen<br>Wenguo.Deng<br>2015/04/20 | Xinyi.Yuan<br>Yvan.Yan<br>2015/04/20 |

# Record of Revision

| Version | Revise Date | Page | Content |
|---|---|---|---|
| Pre-SPEC.V01 | 2014/4/15 | ALL | Initial Release. |
| Pre-SPEC.V02 | 2014/12/23 | 1 | Update Backlight power consumption& Panel power consumption& Weight |
| | | 5 | Update Operation Specifications |
| | | 6 | Update Input signal voltage |
| | | 7 | Update Current Consumption& Backlight Driving Conditions |
| | | 13 | Update Optical Specifications |
| | | 20 | Update Packaging Material Table |
| Pre-SPEC.V03 | 2015/1/9 | 7 | Update Current Consumption |
| | | 18 | Update Safety |
| | | 19 | Modify Mechanical Drawing |
| | | 21 | Modify Package Drawing |
| Final-SPEC | | | First Final Release. |
| | 2015/4/20 | 19 | Modify Mechanical Drawing |

# Contents

# INNOLUX

# 1. General Specifications

| No. | Item | Specification | Remark |
|---|---|---|---|
| 1 | LCD size | 7.0 inch(Diagonal) | |
| 2 | Driver element | a-Si TFT active matrix | |
| 3 | Resolution | 1024 × 3(RGB) × 600 | |
| 4 | Display mode | Normally White, Transmissive | |
| 5 | Pixel pitch | 0.1506(W) × 0.1432(H) mm | |
| 6 | Active area | 154.2144(W) × 85.92(H) mm | |
| 7 | Module size | 164.9(W) ×100(H) ×4.8(D) mm | Note 1 |
| 8 | Surface treatment | Hard Coating | |
| 9 | Color arrangement | RGB-stripe | |
| 10 | Interface | LVDS | |
| 11 | View direction(Gray Inversion) | 6 O'Clock | |
| 12 | Backlight power consumption | 2.62 W   (Typ.) | |
| 13 | Panel power consumption | 0.4 W   (Typ.) | |
| 14 | Weight | 140g   (Typ.) | |

Note 1: Refer to Mechanical Drawing.

# INNOLUX

## 2. Pin Assignment

FPC Connector is used for the module electronics interface. The recommended model is FH12A-40S-0.5SH manufactured by Hirose.

| Pin No. | Symbol | I/O | Function | Remark |
|---------|--------|-----|----------|--------|
| 1 | VCOM | P | Common Voltage | |
| 2 | VDD | P | Power Voltage for digital circuit | |
| 3 | VDD | P | Power Voltage for digital circuit | |
| 4 | NC | --- | No connection | |
| 5 | Reset | I | Global reset pin | |
| 6 | STBYB | I | Standby mode, Normally pulled high STBYB = "1", normal operation STBYB = "0", timing controller, source driver will turn off, all output are High-Z | |
| 7 | GND | P | Ground | |
| 8 | RXIN0- | I | - LVDS differential data input | |
| 9 | RXIN0+ | I | + LVDS differential data input | |
| 10 | GND | P | Ground | |
| 11 | RXIN1- | I | - LVDS differential data input | |
| 12 | RXIN1+ | I | + LVDS differential data input | |
| 13 | GND | P | Ground | |
| 14 | RXIN2- | I | - LVDS differential data input | |
| 15 | RXIN2+ | I | + LVDS differential data input | |
| 16 | GND | P | Ground | |
| 17 | RXCLKIN- | I | - LVDS differential clock input | |
| 18 | RXCLKIN+ | I | + LVDS differential clock input | |
| 19 | GND | P | Ground | |
| 20 | RXIN3- | I | - LVDS differential data input | |
| 21 | RXIN3+ | I | + LVDS differential data input | |
| 22 | GND | P | Ground | |
| 23 | NC | --- | No connection | |
| 24 | NC | --- | No connection | |
| 25 | GND | P | Ground | |
| 26 | NC | --- | No connection | |

| 27 | DIMO | O | Backlight CABC controller signal output | |
| 28 | SELB | I | 6bit/8bit mode select | Note1 |
| 29 | AVDD | P | Power for Analog Circuit | |
| 30 | GND | P | Ground | |
| 31 | LED- | P | LED Cathode | |
| 32 | LED- | P | LED Cathode | |
| 33 | L/R | I | Horizontal inversion | Note3 |
| 34 | U/D | I | Vertical inversion | Note3 |
| 35 | VGL | P | Gate OFF Voltage | |
| 36 | CABCEN1 | I | CABC H/W enable | Note2 |
| 37 | CABCEN0 | I | CABC H/W enable | Note2 |
| 38 | VGH | P | Gate ON Voltage | |
| 39 | LED+ | P | LED Anode | |
| 40 | LED+ | P | LED Anode | |

I: input, O: output, P: Power

Note1: If LVDS input data is 6 bits ,SELB must be set to High;

If LVDS input data is 8 bits ,SELB must be set to Low.

Note2: When CABC_EN="00", CABC OFF.

When CABC_EN="01", user interface image.

When CABC_EN="10", still picture.

When CABC_EN="11", moving image.

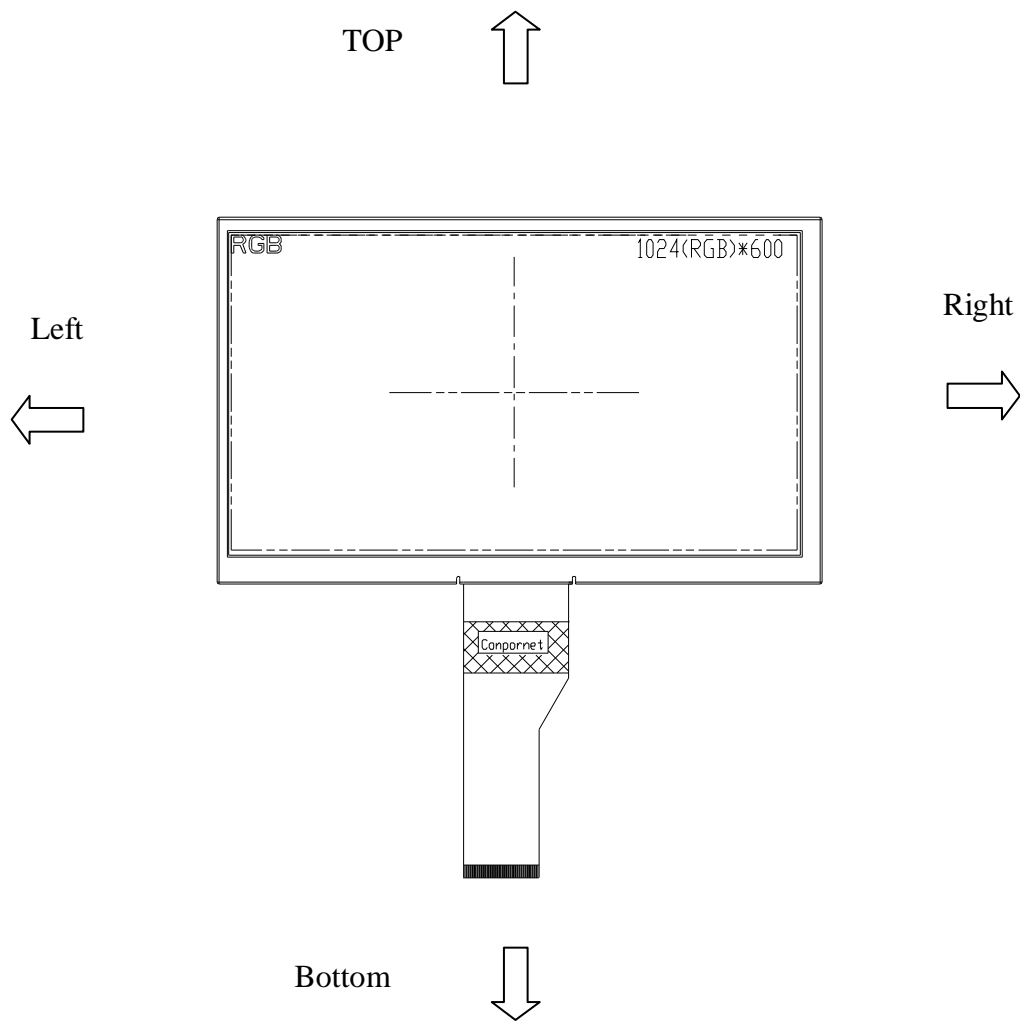When CABC off, don't connect DIMO, else connect it to backlight.

Note3: When L/R="0", set right to left scan direction.

When L/R="1", set left to right scan direction.

When U/D="0", set top to bottom scan direction.

When U/D="1", set bottom to top scan direction.

Note: Definition of scanning direction.
Refer to the figure as below:

TOP

Left

Right

RGB                    1024(RGB)*600

Conpornet

Bottom

# INNOLUX
# 3. Operation Specifications

## 3.1.　Absolute Maximum Ratings

(Note 1)

| Item | Symbol | Values | | Unit | Remark |
|---|---|---|---|---|---|
| | | Min. | Max. | | |
| Power voltage | $DV_{DD}$ | -0.3 | 5.0 | V | |
| | $AV_{DD}$ | 6.5 | 13.5 | V | |
| | $V_{GH}$ | -0.3 | 42.0 | V | |
| | $V_{GL}$ | -20.0 | 0.3 | V | |
| | $V_{GH}\text{-}V_{GL}$ | - | 40.0 | V | |
| Operation Temperature | $T_{OP}$ | -20 | 70 | ℃ | |
| Storage Temperature | $T_{ST}$ | -30 | 80 | ℃ | |
| LED Reverse Voltage | $V_R$ | - | 5 | V | Each LED |
| LED Forward Current | $I_F$ | - | 60 | mA | Each LED |

Note 1: The absolute maximum rating values of this product are not allowed to be exceeded
　　　　at any times. Should a module be used with any of the absolute maximum ratings
　　　　exceeded, the characteristics of the module may not be recovered, or in an extreme
　　　　case, the module may be permanently destroyed.

### 3.1.1.  Typical Operation Conditions

( Note 1)

| Item | Symbol | Values | | | Unit | Remark |
|---|---|---|---|---|---|---|
| | | **Min.** | **Typ.** | **Max.** | | |
| Power voltage | $DV_{DD}$ | 3.0 | 3.3 | 3.6 | V | Note 2 |
| | $AV_{DD}$ | 10.8 | 11 | 11.2 | V | |
| | $V_{GH}$ | 19.7 | 20 | 20.3 | V | |
| | $V_{GL}$ | -6.5 | -6.8 | -7.1 | V | |
| Input signal voltage | $V_{COM}$ | 3.3 | 3.8 | 4.3 | V | Note 4 |
| Input logic high voltage | $V_{IH}$ | 0.7 $DV_{DD}$ | - | $DV_{DD}$ | V | Note 3 |
| Input logic low voltage | $V_{IL}$ | 0 | - | 0.3 $DV_{DD}$ | V | |

Note 1: Be sure to apply $DV_{DD}$ and $V_{GL}$ to the LCD first, and then apply $V_{GH}$.

Note 2: $DV_{DD}$ setting should match the signals output voltage (refer to Note 3) of customer's system board.

Note 3: LVDS, Reset.

Note 4: Typ. $V_{COM}$ is only a reference value, it must be optimized according to each LCM. Be sure to use VR;
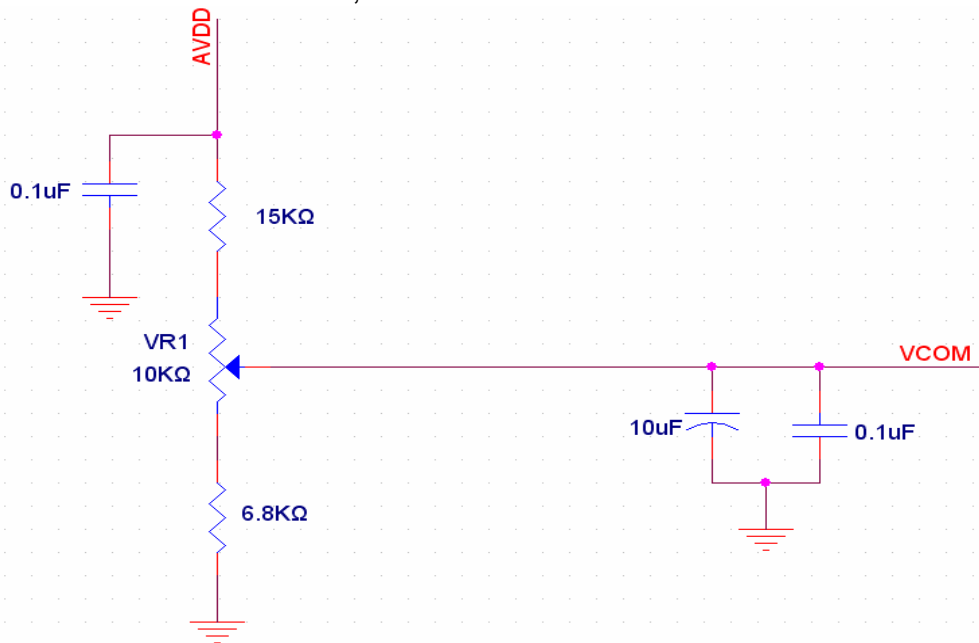
### 3.1.2.   Current Consumption

| Item | Symbol | Values | | | Unit | Remark |
|---|---|---|---|---|---|---|
| | | **Min.** | **Typ.** | **Max.** | | |
| Current for Driver | $I_{GH}$ | - | 0.26 | 1 | mA | $V_{GH}$ =20V |
| | $I_{GL}$ | - | 0.26 | 1 | mA | $V_{GL}$ = -6.8V |
| | $IDV_{DD}$ | - | 35 | 60 | mA | $DV_{DD}$ =3.3V |
| | $IAV_{DD}$ | - | 20 | 30 | mA | $AV_{DD}$ =11V |

### 3.1.3.   Backlight Driving Conditions

| Item | Symbol | Values | | | Unit | Remark |
|---|---|---|---|---|---|---|
| | | **Min.** | **Typ.** | **Max.** | | |
| Voltage for LED backlight | $V_L$ | 8.4 | 9.9 | 10.2 | V | Note 1 |
| Current for LED backlight | $I_L$ | -- | 265 | -- | mA | |
| LED life time | - | - | 15,000 | - | Hr | Note 2 |

Note 1: The LED Supply Voltage is defined by the number of LED at Ta=25℃ and $I_L$ =265mA.
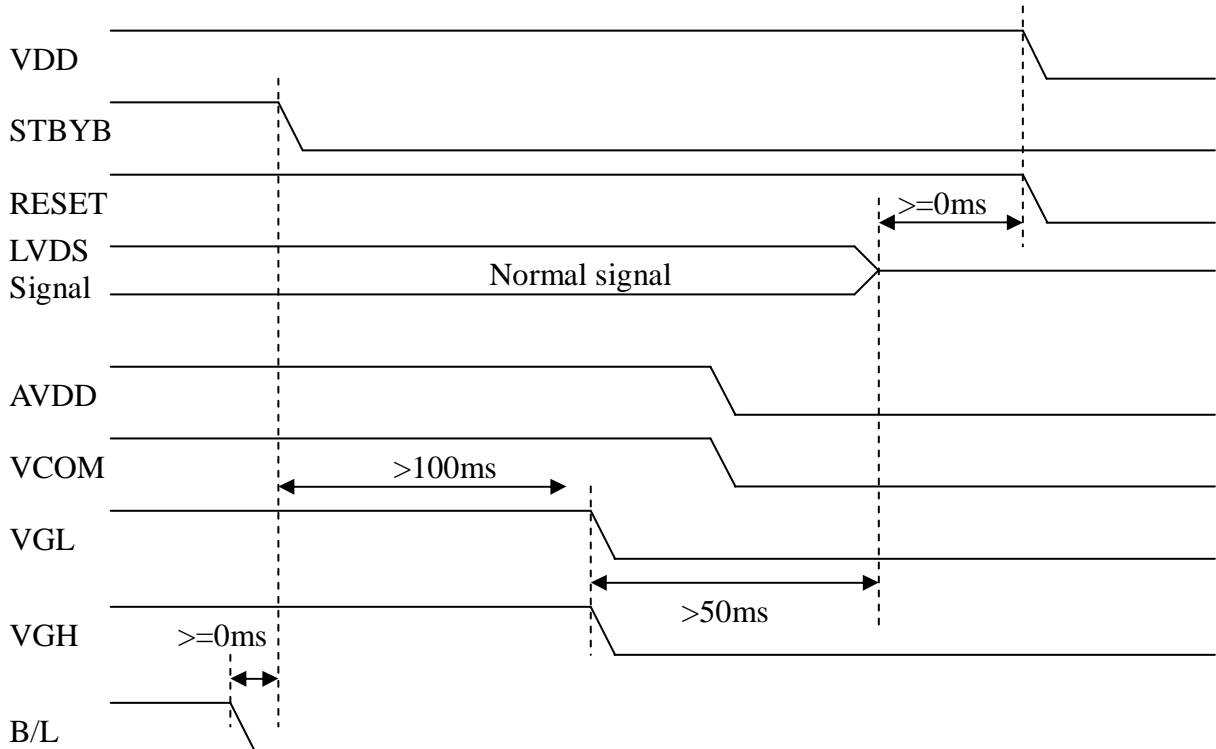
Note 2: The "LED life time" is defined as the module brightness decrease to 50% original brightness at Ta=25℃ and $I_L$ =265mA. The LED lifetime could be decreased if operating $I_L$ is lager than 265mA.

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## 3.2. Power Sequence

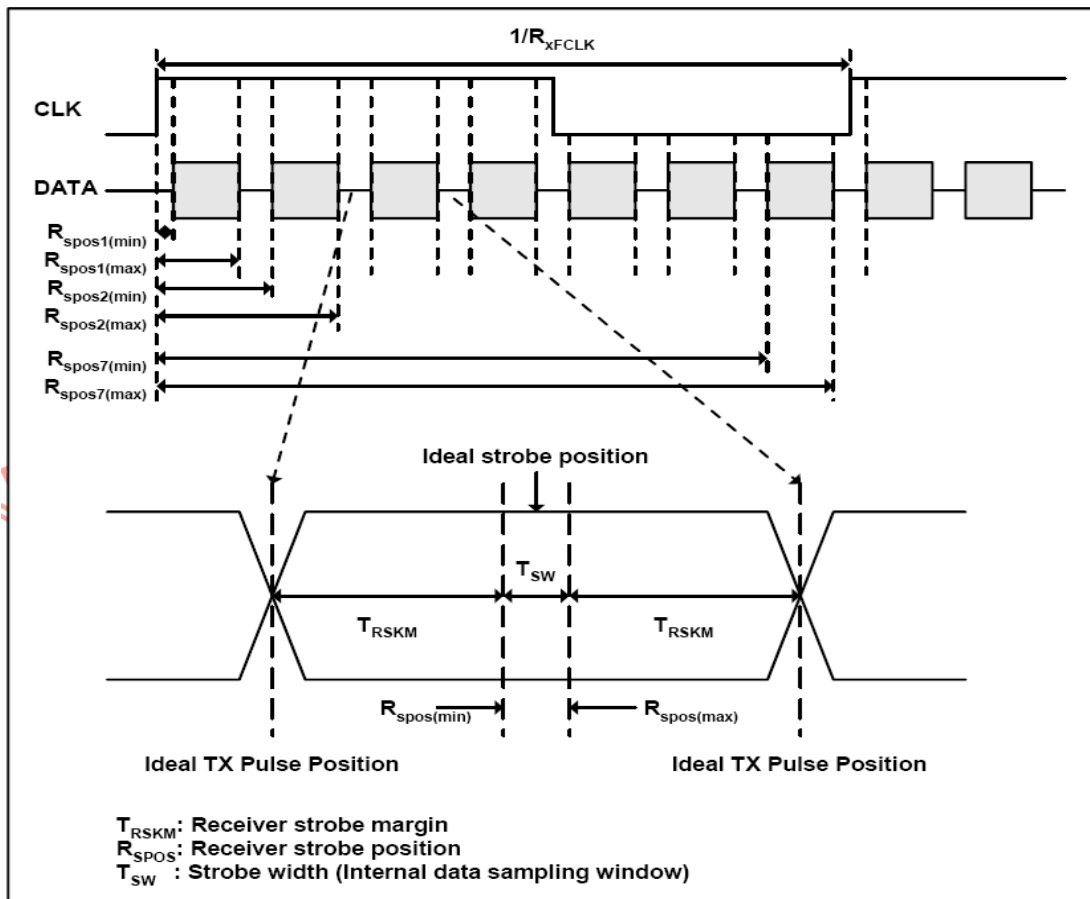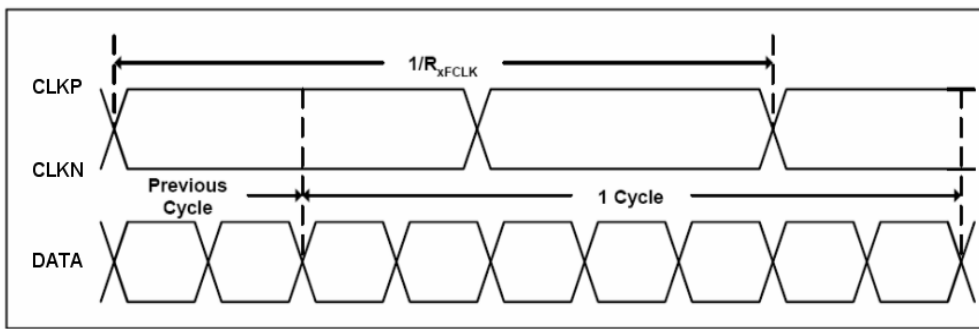**a. Power on:**
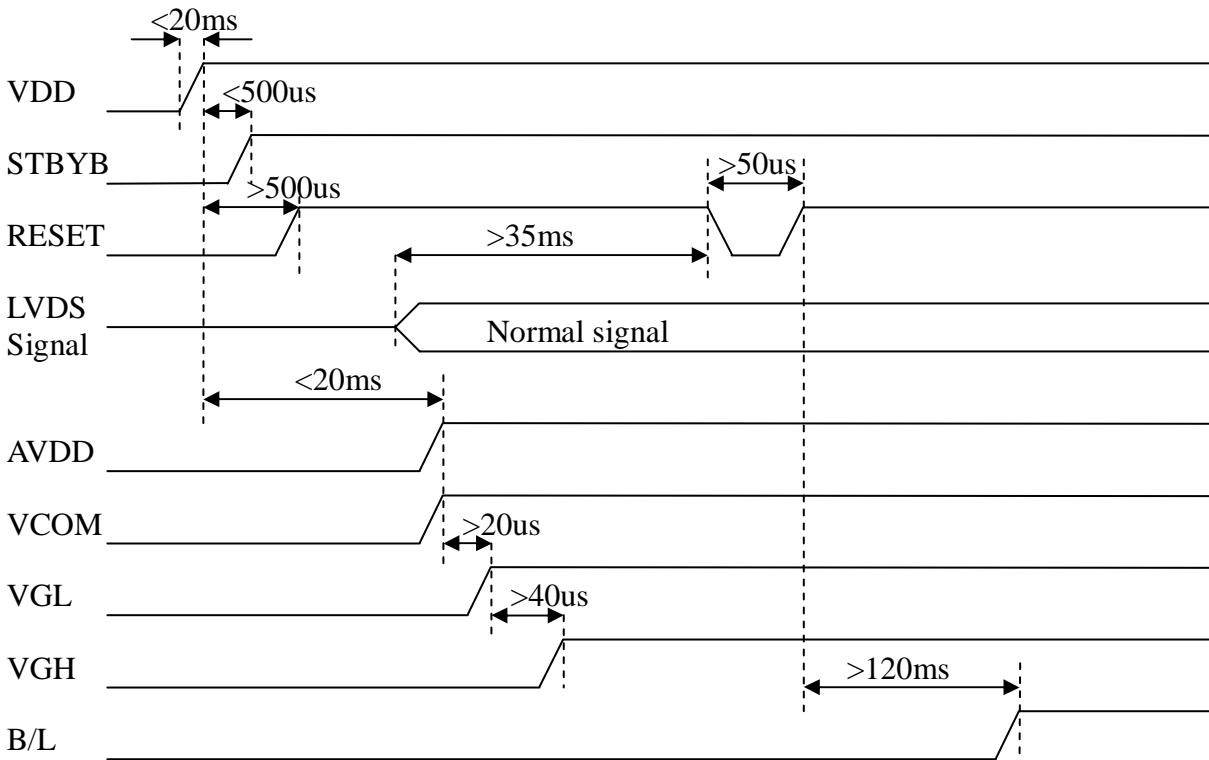


**b. Power off:**

# 3.3. Timing Characteristics

### 3.3.1. AC Electrical Characteristics

| Parameter | Symbol | Values | | | Unit | Remark |
|---|---|---|---|---|---|---|
| | | Min. | Typ. | Max. | | |
| Clock frequency | $R_{xFCLK}$ | 40.8 | 51.2 | 67.2 | MHz | |
| Input data skew margin | $T_{RSKM}$ | 500 | - | - | ps | |
| Clock high time | $T_{LVCH}$ | - | $4/(7* R_{xFCLK})$ | - | ns | |
| Clock low time | $T_{LVCL}$ | - | $3/(7* R_{xFCLK})$ | - | ns | |

### 3.3.2. Input Clock and Data Timing Diagram



$T_{RSKM}$: Receiver strobe margin
$R_{SPOS}$: Receiver strobe position
$T_{SW}$ : Strobe width (Internal data sampling window)

### 3.3.3. DC Electrical Characteristics

| Parameter | Symbol | Values | | | Unit | Remark |
|---|---|---|---|---|---|---|
| | | Min. | Typ. | Max. | | |
| Differential input high Threshold voltage | $R_{xVTH}$ | - | - | +0.1 | V | $R_{XVCM}$=1.2V |
| Differential input low Threshold voltage | $R_{xVTL}$ | -0.1 | - | - | V | |
| Input voltage range (singled-end) | $R_{xVIN}$ | 0 | - | 2.4 | V | |
| Differential input common mode voltage | $R_{xVCM}$ | $\|V_{ID}\|/2$ | - | $2.4-\|V_{ID}\|/2$ | V | |
| Differential voltage | $\|V_{ID}\|$ | 0.2 | - | 0.6 | V | |
| Differential input leakage current | $RV_{xliz}$ | -10 | - | +10 | uA | |
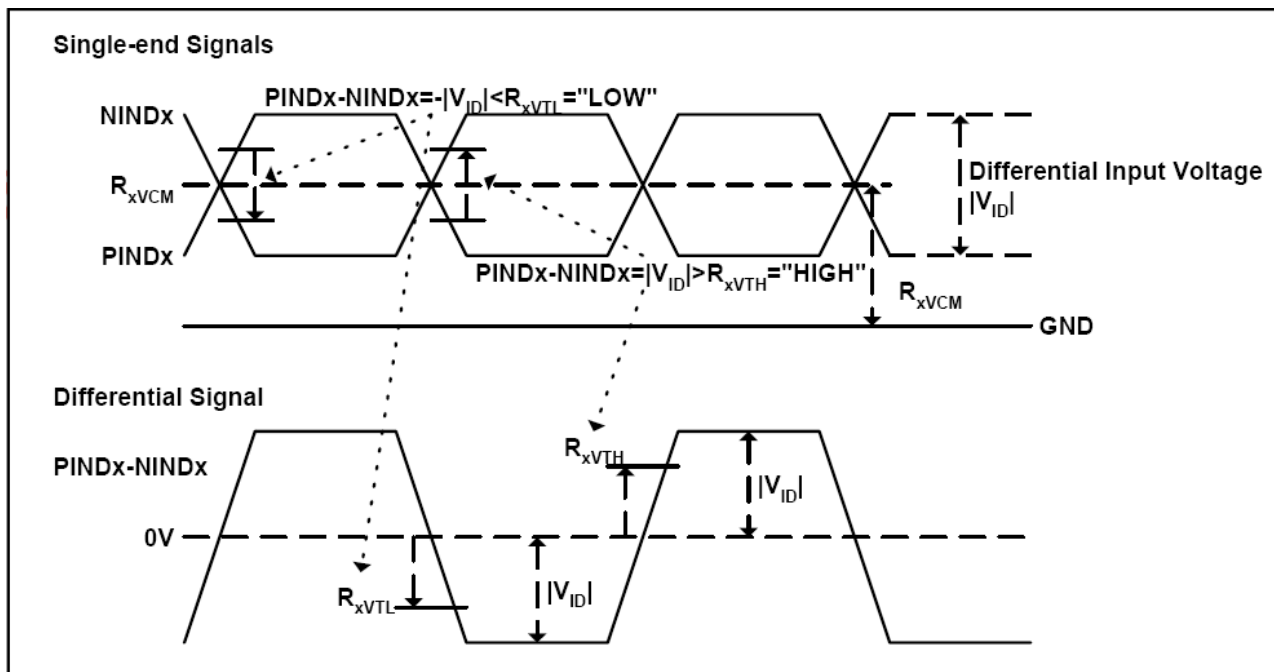
### 3.3.4.  Timing

| Item | Symbol | Values | | | Unit | Remark |
|------|--------|--------|------|------|------|--------|
| | | Min. | Typ. | Max. | | |
| Clock Frequency | fclk | 40.8 | 51.2 | 67.2 | MHz | Frame rate =60Hz |
| Horizontal display area | thd | | 1024 | | DCLK | |
| HS period time | th | 1114 | 1344 | 1400 | DCLK | |
| HS Blanking | thb | 90 | 320 | 376 | DCLK | |
| Vertical display area | tvd | | 600 | | H | |
| VS period time | tv | 610 | 635 | 800 | H | |
| VS Blanking | thb | 10 | 35 | 200 | H | |

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### 3.3.5. Data Input Format

**6bit LVDS input**

| PINC | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| NINC | | | | | | | | | |
| IND0 | R0 | G0 | R5 | R4 | R3 | R2 | R1 | R0 | G0 |
| IND1 | G1 | B1 | B0 | G5 | G4 | G3 | G2 | G1 | B1 |
| IND2 | B2 | DE | - | - | B5 | B4 | B3 | B2 | DE |

**8bit LVDS input**

| PINC | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| NINC | | | | | | | | | |
| IND0 | R0 | G0 | R5 | R4 | R3 | R2 | R1 | R0 | G0 |
| IND1 | G1 | B1 | B0 | G5 | G4 | G3 | G2 | G1 | B1 |
| IND2 | B2 | DE | - | - | B5 | B4 | B3 | B2 | DE |
| IND3 | R6 | - | B7 | B6 | G7 | G6 | R7 | R6 | - |
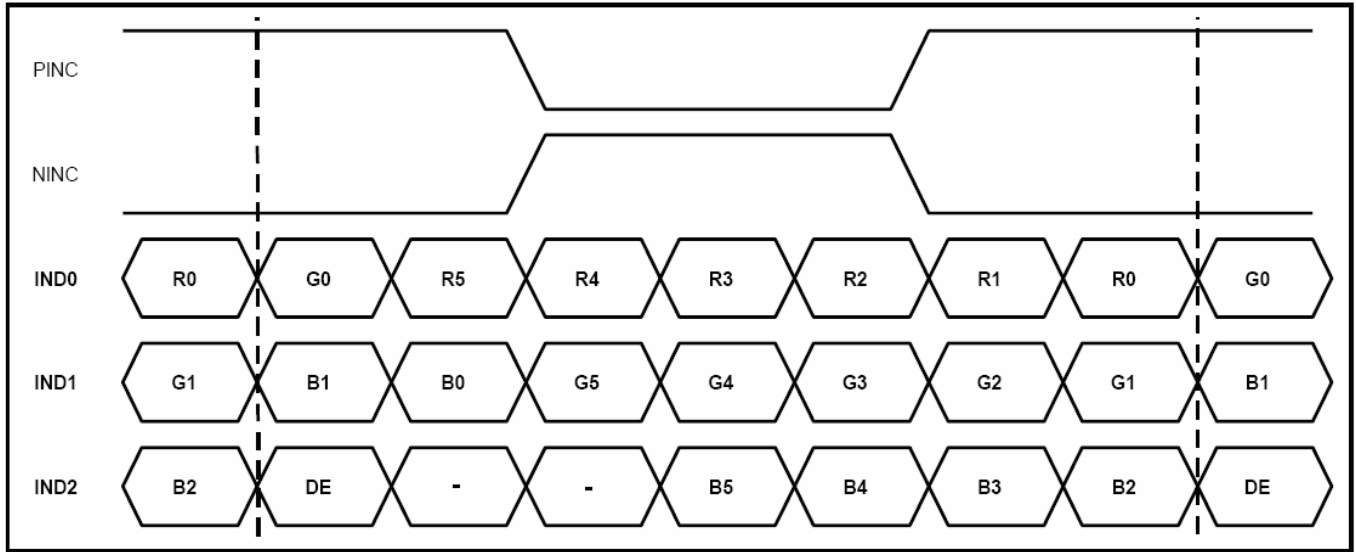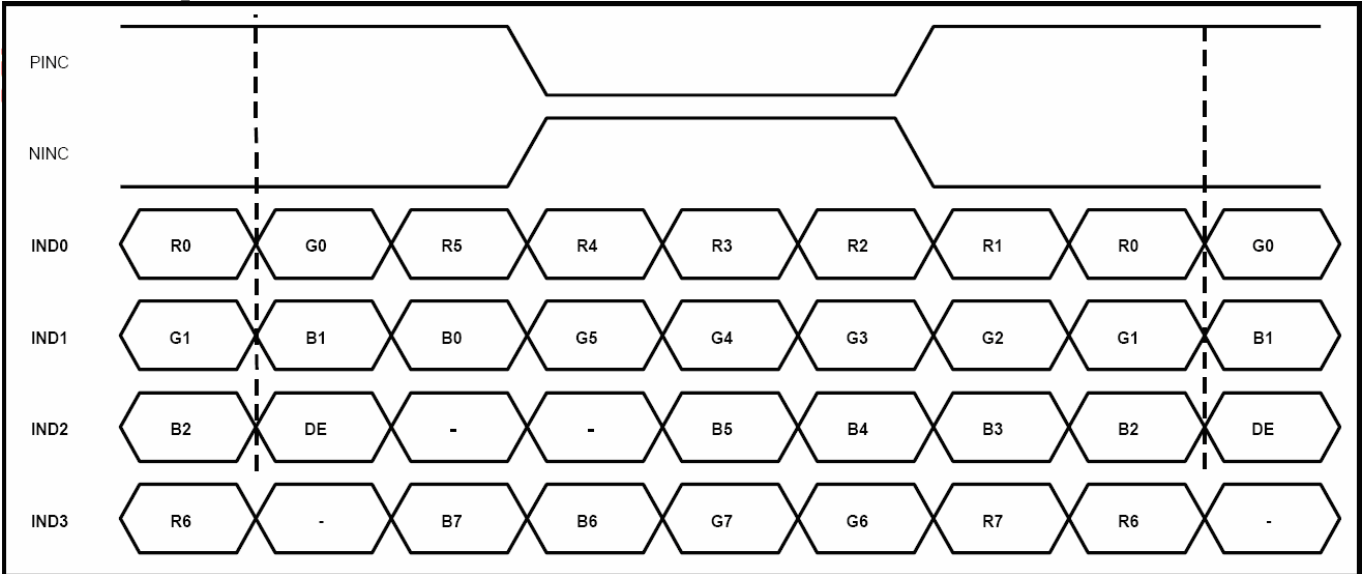
Note: Support DE timing mode only, SYNC mode not supported.

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# 4. Optical Specifications

| Item | Symbol | Condition | Values | | | Unit | Remark |
|------|--------|-----------|--------|--------|--------|------|--------|
| | | | Min. | Typ. | Max. | | |
| Viewing angle (CR≥ 10) | $\theta_L$ | Φ=180°(9 o'clock) | 65 | 75 | - | degree | Note 1 |
| | $\theta_R$ | Φ=0°(3 o'clock) | 65 | 75 | - | | |
| | $\theta_T$ | Φ=90°(12 o'clock) | 60 | 70 | - | | |
| | $\theta_B$ | Φ=270°(6 o'clock) | 65 | 75 | - | | |
| Response time | $T_{ON}$ | Normal θ=Φ=0° | - | 10 | 20 | msec | Note 3 |
| | $T_{OFF}$ | | - | 15 | 30 | msec | Note 3 |
| Contrast ratio | CR | | 500 | 800 | - | - | Note 4 |
| Color chromaticity | $W_X$ | | 0.26 | 0.31 | 0.36 | - | Note 2 Note 5 Note 6 |
| | $W_Y$ | | 0.28 | 0.33 | 0.38 | - | |
| Luminance | L | | 400 | 500 | - | cd/m² | Note 6 |
| Luminance uniformity | $Y_U$ | | 70 | 75 | - | % | Note 7 |

Test Conditions:
1. $DV_{DD}$=3.1V, $I_L$=265mA (Backlight current), the ambient temperature is 25℃.
2. The test systems refer to Note 2.

Note 1: Definition of viewing angle range



Normal line
θ=Φ=0°

Φ=90°
12 o'clock direction

θ_L

θ_T

θ_R

θ_B

Φ=180°

**Active Area**

Φ=0°

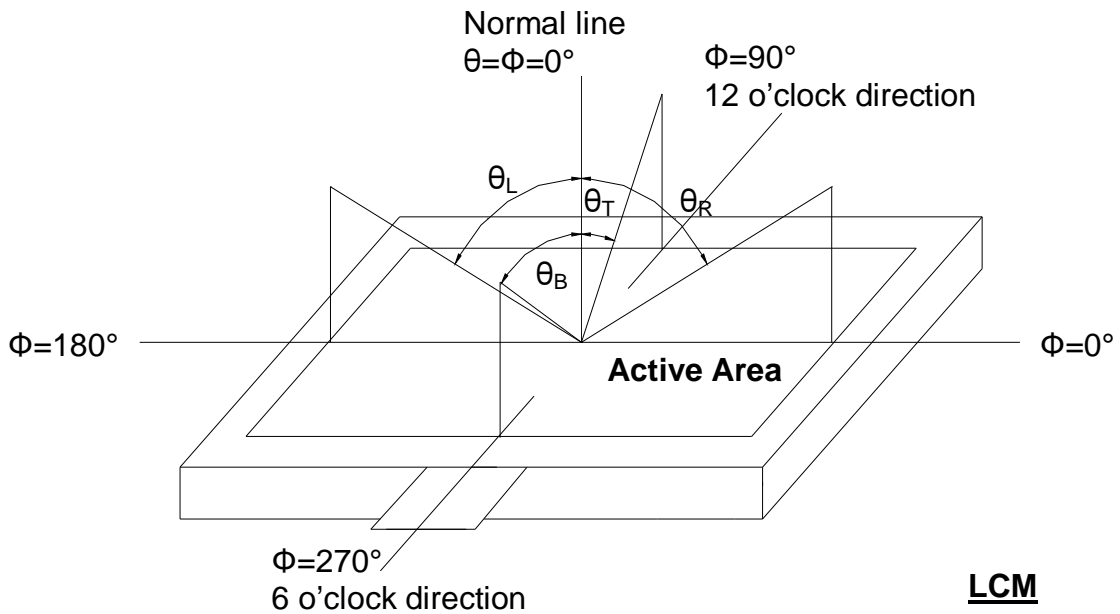Φ=270°
6 o'clock direction

**LCM**

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°/Heig ht: 500mm.)



**Photo detector**

Normal line
θ=Φ=0°

Φ=90°
12 o'clock direction

500mm

Φ=180°

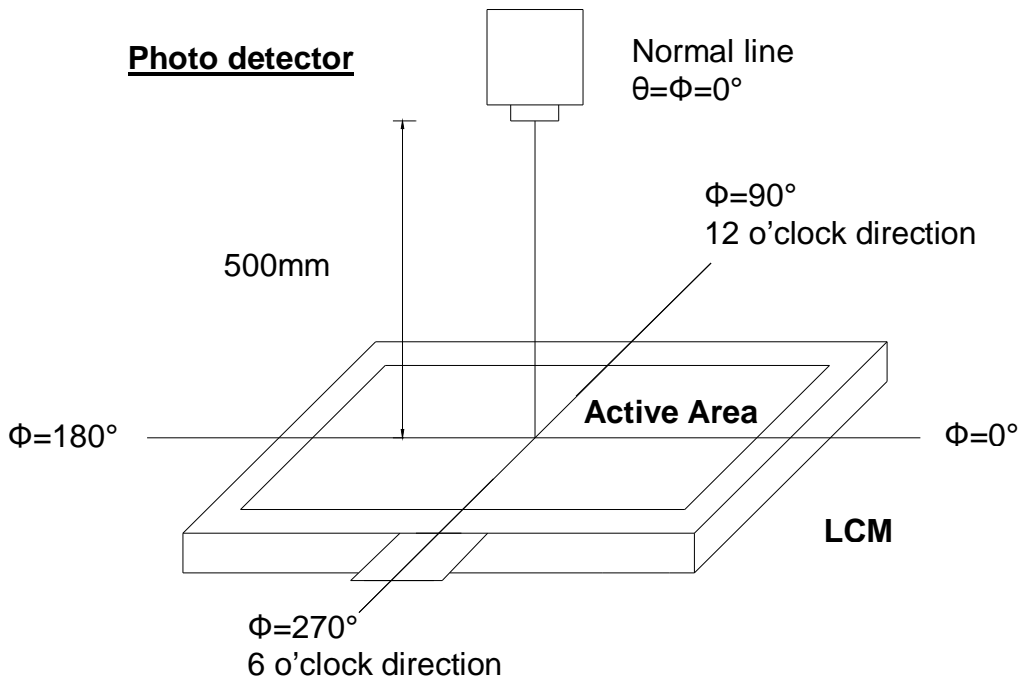**Active Area**

Φ=0°

**LCM**

Φ=270°
6 o'clock direction

Fig. 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%.
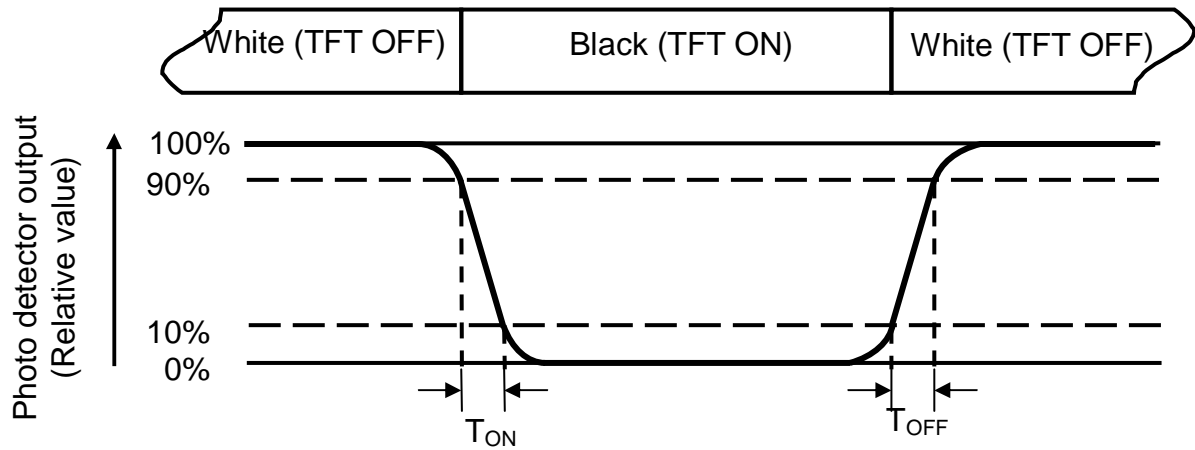


Fig. 4-3 Definition of response time

Note 4: Definition of contrast ratio

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

Note 5: Definition of color chromaticity (CIE1931)
Color coordinates measured at center point of LCD.

Note 6: Definition of luminance:
Measured at the center area of the panel when LCD panel is driven at "white" state. The LED driving condition is $I_L=265mA$ .

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.

$$Luminance\ \ Uniformity\ (Yu) = \frac{B_{min}}{B_{max}}$$
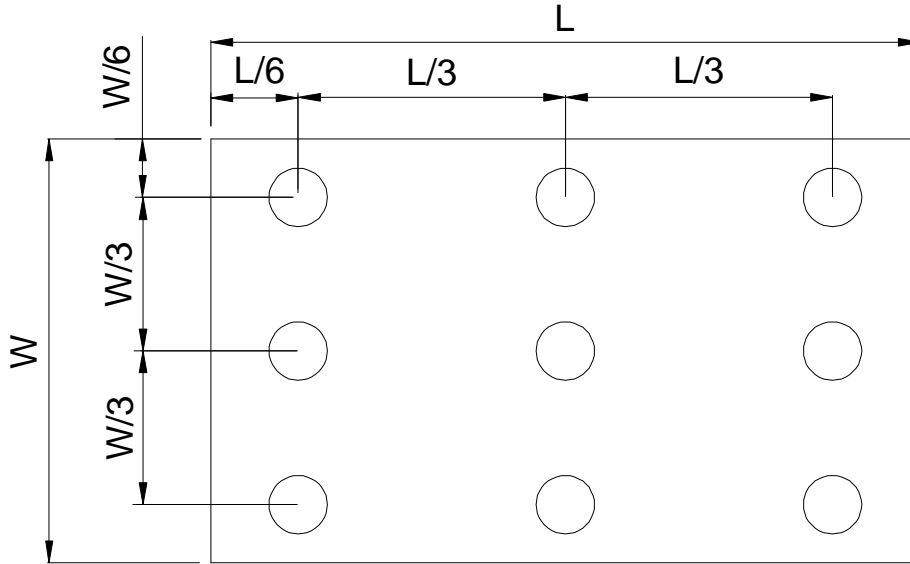
L-------Active area length      W----- Active area width



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.

# 5. Reliability Test Items

(Note3)

| Item | Test Conditions | Remark |
|---|---|---|
| High Temperature Storage | Ta = 80℃                              240hrs | Note 1，Note 4 |
| Low Temperature Storage | Ta = -30℃                             240hrs | Note 1，Note 4 |
| High Temperature Operation | Ts = 70℃                              240hrs | Note 2，Note 4 |
| Low Temperature Operation | Ta = -20℃                             240hrs | Note 1，Note 4 |
| Operate at High Temperature and Humidity | +60℃, 90%RH                     240hrs | Note 4 |
| Thermal Shock | [(-30℃ 30min)→(80℃ 30min)]/cycle，(Ramp ≧20℃/min), 100cycles | Note 4 |
| Vibration Test | (1)1.5G / 10-500Hz, 30min/cycle, 1cycle for each X, Y, Z | |
| Mechanical Shock | (1) 220G, half sine 2ms, 6sides (function& cosmetic defects) | |
| Package Vibration Test | Random Vibration : ISTA-3A 1Hz~200Hz,Grms=0.53 Half hours for direction of Z | |
| Package Drop Test | 72cm(weight≦10kg), 60cm(weight＞10kg);1 times for 6-faces, 3-edges and 1-corner | |
| Electro Static Discharge | Contact mode：150pf，330Ω，±2KV Air mode：150pf，330Ω，±2KV | |

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.

# 6. General Precautions

## 6.1.    Safety

1.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.
2.The temperature for use is no more than 80 C, otherwise, only promise the function is OK, but the quality may be changed.

## 6.2.    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.

## 6.3.    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.

## 6.4.    Storage

1. Store the module in a dark room where must keep at 25±10℃ 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.

## 6.5.    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.

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# 7. Mechanical Drawing

# INNOLUX
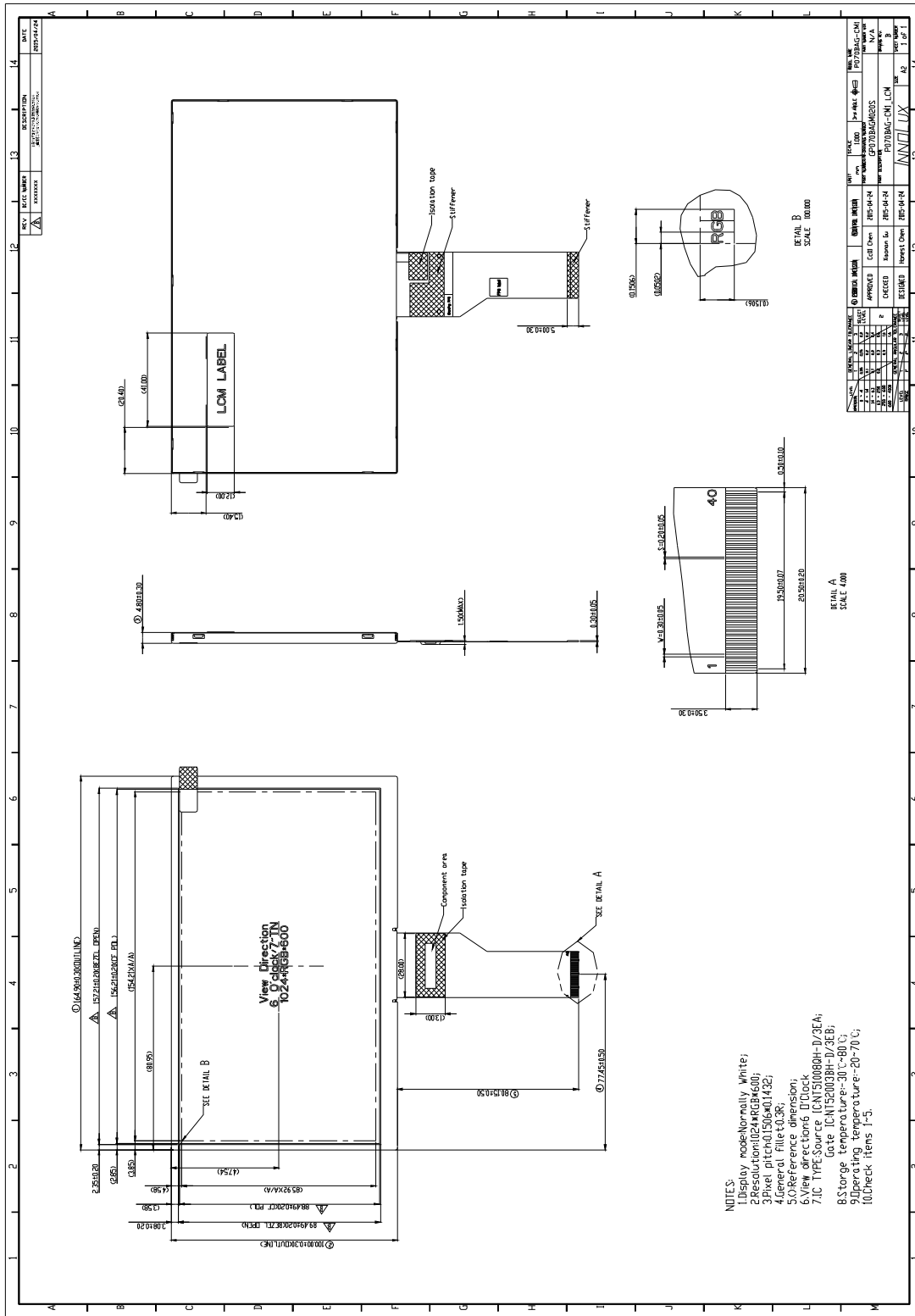
# 8. Package Drawing

## 8.1. Packaging Material Table

| No. | Item | Model (Material) | Dimensions(mm) | Unit Weight (kg) | Quantity（PCS） | Remark |
|---|---|---|---|---|---|---|
| 1 | LCM | P070BAG-CM1 | 164.90x100x4.8 | 0.140 | 50 | |
| 2 | Dust-Proof Bag | PE | 700 x 530x0.05 | 0.048 | 1 | |
| 3 | CrepePaper _Tape | 四維CM35 | 30x10x0.1 | 0.001 | 50 | |
| 4 | Corrugated Bar | BC Corrugated paper | 510x122 | 0.046 | 4 | |
| 5 | Partition | BC Corrugated paper | 512 × 349 × 226 | 1.466 | 1 | |
| 6 | A/S Bag | PE | 178*160*0.06 | 0.004 | 50 | |
| 7 | Carton | Corrugated paper | 525 × 362 × 250 | 0.950 | 1 | |
| 8 | Total weight | 10.12± 5%Kg | | | | |

## 8.2. Packaging Quantity

Total LCM quantity in Carton: no. of  Partition  2 Rows × quantity per Row  25 = 50

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## 8.3. Packaging Drawing

LCM

A/S Bag

Crepe Paper Tape

1. Bend FPC and LED Light Bar wire to LCM backside.
2. Put LCM into A/S BAG .
3. Fix with crepe paper tape .

Partition

Corrugated Bar*2

Corrugated Bar*2

DUST-PROOF-BAG

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