# SPECIFICATION

# **Product Model:** PV101WX-HIC4003

| DESIGNED | CHECKED | Approved |
|---|---|---|
| 研发部<br>2023.12.7<br>Well | 研发部<br>2023.12.7<br>Tom | 研发部<br>2023.12.7<br>Mike |

## For Customer's Acceptance：

| Comments: | Approved by： |
|---|---|
|  |  |

# Revision Record

| Rev NO. | Rev Date | Contents | Note |
|---------|----------|----------|------|
| V0 | 2023.12.7 | New Issue | |
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# Table of Contents

# 1. Scope

This specification defines general provisions as well as inspection standards for TFT module supplied by Kingtech Group Co.,Ltd.

If the event of unforeseen problem or unspecified items may occur, naturally shall negotiate and agree to solution.

# 2. General Information

| Item | Standard Values | Unit |
|---|---|---|
| LCD type | 10.1" TFT | |
| Dot arrangement | 1280×R.G.B.×800 | dots |
| Color filter array | RGB vertical stripe | |
| Display mode | Normally Black | |
| Module size | 229.46(W)×149.1(H)×4.8(T) | mm |
| Active area | 216.96(W)×135.60(H) | mm |
| Interface | LVDS 8bit | |
| Operating temperature | -20 ~ +70 | °C |
| Storage temperature | -30 ~ +80 | °C |
| Weight | TBD | g |

## 3. External Dimensions

## 4.Pin Assignment

| PIN | PIN NAME | DESCRIPTION | Remark |
|---|---|---|---|
| 1 | VCOM(NC) | Common Voltage, NC | |
| 2 | VDD | Power Supply | |
| 3 | VDD | | |
| 4 | NC | No connection | |
| 5 | NC | | |
| 6 | NC | | |
| 7 | GND | Ground | |
| 8 | Rxin0- | -LVDS Differential Data Input | R0~R5,G0 |
| 9 | Rxin0+ | +LVDS Differential Data Input | |
| 10 | GND | Ground | |
| 11 | Rxin1- | -LVDS Differential Data Input | G1~G5,B0, B1 |
| 12 | Rxin1+ | +LVDS Differential Data Input | |
| 13 | GND | Ground | |
| 14 | Rxin2- | -LVDS Differential Data Input | B2~B5,HS, VS,DE |
| 15 | Rxin2+ | +LVDS Differential Data Input | |
| 16 | GND | Ground | |
| 17 | RxCLK- | -LVDS Differential Clock Input | LVDS CLK |
| 18 | RxCLK+ | +LVDS Differential Clock Input | |
| 19 | GND | Ground | |
| 20 | Rxin3- | -LVDS Differential Data Input | R6,R7,G6,G7, B6,B7 |
| 21 | Rxin3+ | +LVDS Differential Data Input | |
| 22 | GND | Ground | |
| 23 | NC | No connection | |
| 24 | NC | | |
| 25 | GND | Ground | |
| 26 | NC | No connection | |
| 27 | NC | No connection | |
| 28 | NC | No connection | |
| 29 | AVDD(NC) | Power for Analog Circuit, NC | |
| 30 | GND | Ground | |
| 31 | LEDK | LED Cathode | |
| 32 | LEDK | LED Cathode | |
| 33 | NC | No connection | |
| 34 | NC | | |
| 35 | VGL(NC) | Gate OFF Voltage, NC | |
| 36 | NC | No connection | |
| 37 | NC | No connection | |
| 38 | VGH(NC) | Gate ON Voltage, NC | |
| 39 | LEDA | LED Anode | |
| 40 | LEDA | LED Anode | |

# 5. Absolute Maximum Ratings

| Item | Symbol | Min. | Max. | Unit | Remark |
|---|---|---|---|---|---|
| Supply Voltage | VDD | -0.3 | 5.0 | V | |

# 6. DC Characteristics

| Item | Symbol | Min. | Typ. | Max. | Unit | Remark |
|---|---|---|---|---|---|---|
| Power Voltage | VDD | 3.0 | 3.3 | 3.6 | V | |
| Input logic high voltage | $V_{IH}$ | 0.8*VDD | - | VDD | V | |
| Input logic low voltage | $V_{IL}$ | GND | - | 0.2*VDD | V | |
| Current for Power | $I_{DD}$ | - | 250 | 400 | mA | VDD=3.3V |

# 7. Timing Characteristics
## 7.1 Power On and Power Off Timing
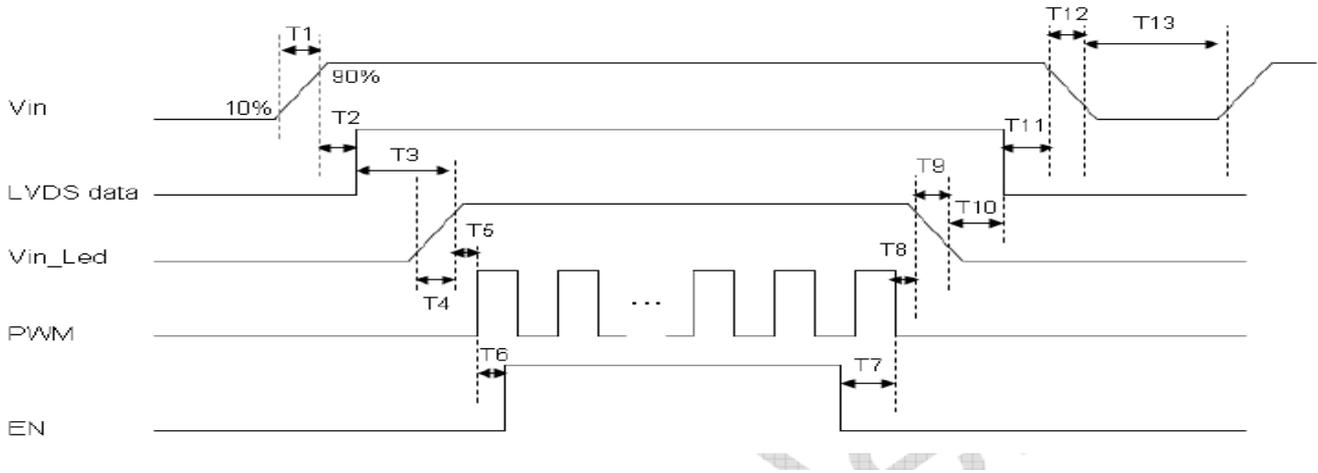


| Parameter | Symbol | Min. | Typ | Max. | Unit |
|---|---|---|---|---|---|
| Vin rise time | T1 | 0.5 | - | 10 | ms |
| Vin good to signal valid | T2 | 30 | - | 90 | ms |
| Signal valid to backlight on | T3 | 200 | - | - | ms |
| Backlight power on time | T4 | 0.5 | - | - | ms |
| Backlight VDD good to system PWM on | T5 | 10 | - | - | ms |
| System PWM on to backlight enable on | T6 | 10 | - | - | ms |
| Backlight enable of to system PWM off | T7 | 0 | - | - | ms |
| System PWM off to B/L power disable | T8 | 10 | - | - | ms |
| Backlight power off time | T9 | 0.5 | 10 | 30 | ms |
| Backlight off to signal disable | T10 | 200 | - | - | ms |
| Signal disable to power down | T11 | 0 | - | 50 | ms |
| VIN fall time | T12 | 0.5 | 10 | 30 | ms |
| Power off | T13 | 500 | - | - | ms |

## 7.2 LVDS Signal Timing Characteristics

### 7.2.1 LVDS DC electrical characteristics
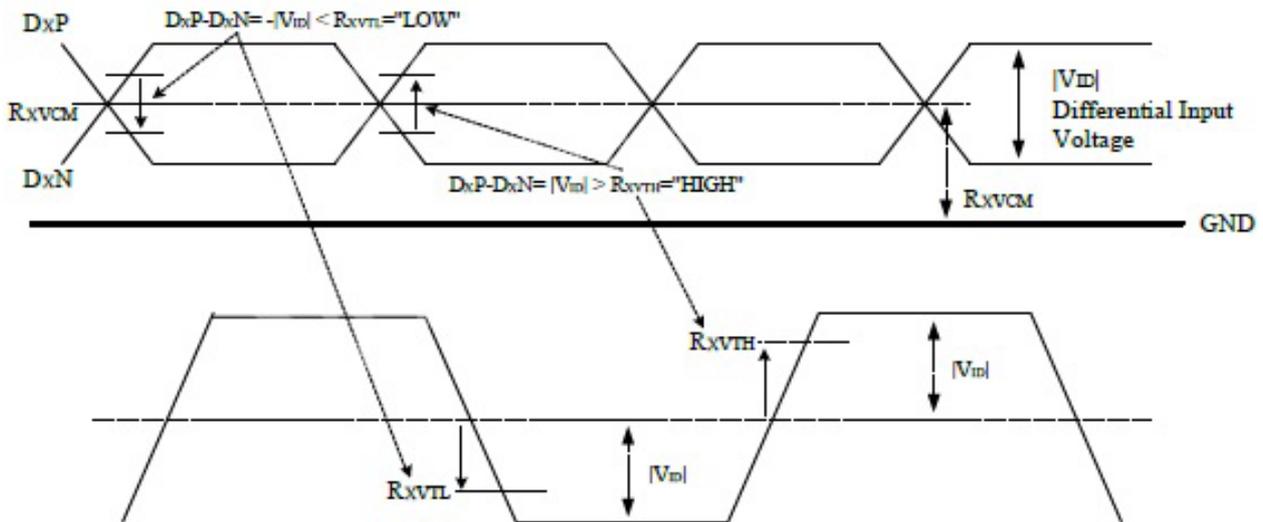


| Parameter | Symbol | Min. | Typ. | Max. | Unit | Condition |
|---|---|---|---|---|---|---|
| Differential input high threshold voltage | $R_{XVTH}$ | - | - | +0.1 | V | RXVCM=1.2V |
| Differential input low threshold voltage | $R_{XVTL}$ | -0.1 | - | - | V | |
| Input voltage range (singled-end) | $R_{XVIN}$ | 0.7 | - | 1.7 | V | |
| Differential input common mode voltage | $R_{XVCM}$ | 1 | 1.2 | 1.4 | V | \|VID\|=0.2 |
| Differential input impedance | ZID | 80 | 100 | 125 | ohm | |
| Differential input voltage | \|VID\| | 0.2 | - | 0.6 | V | |
| Differential input leakage current | ILCLVDS | -10 | - | +10 | uA | |
| LVDS Digital Operating Current | IVDD | - | 15 | 20 | mA | FDCLK=80MHz,VDD=3.3V, Input pattern: 55h->Aah->55h->Aah |
| LVDS Digital Stand-by Current | IST | - | - | 250 | uA | Clock & all Functions are stopped |

## 7.2.2 LVDS mode AC electrical characteristics
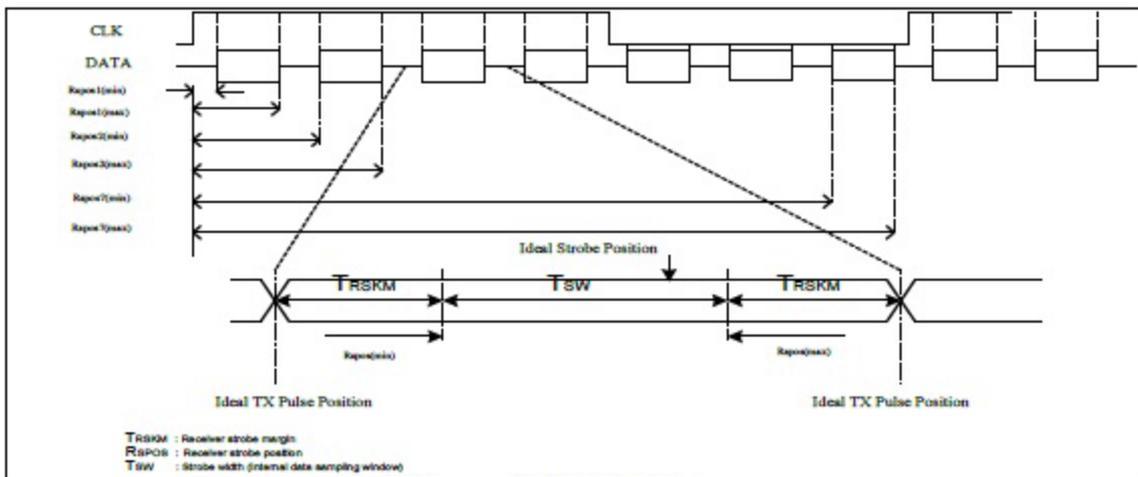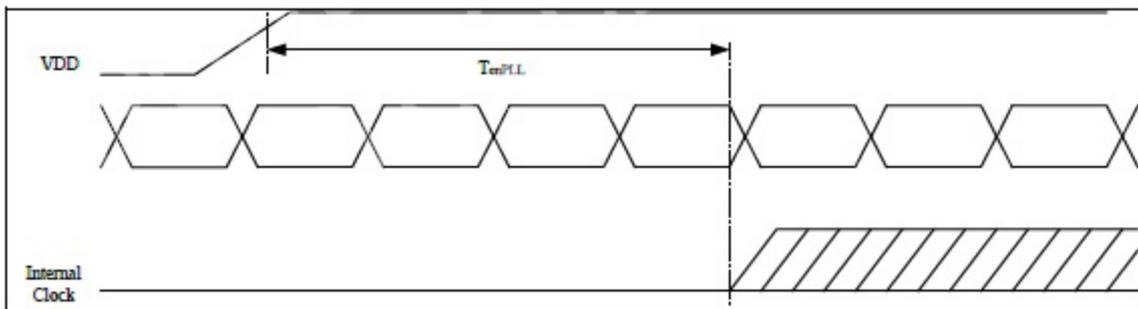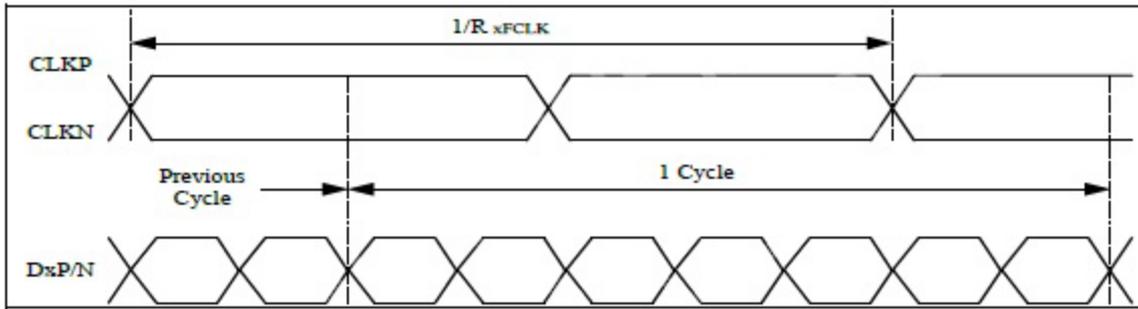


| Parameter | Symbol | Spec. | | | Unit | Condition |
|-----------|--------|-------|------|------|------|-----------|
| | | Min. | Typ. | Max. | | |
| Clock frequency | RxFCLK | 30 | - | - | MHz | Refer to input timing table for each display resolution |
| Input data skew margin | TRSKM | 500 | - | - | ps | \|VID\| = 200mV RxVCM = 1.2V RxFCLK = 81MHz |
| Clock high time | TLVCH | - | 4/(7* RxFCLK) | - | ns | |
| Clock low time | TLVCL | - | 3/(7* RxFCLK) | - | ns | |
| PLL wake-up time | TenPLL | - | - | 150 | us | |

## 7.2.3 Interface Timings

| Parameter | Symbol | Min. | Typ | Max. | Unit |
|---|---|---|---|---|---|
| DCLK frequency @Frame rate=60Hz | $F_{DCLK}$ | 66.3 | 72.4 | 78.9 | MHz |
| HSYNC period time | $T_H$ | 1380 | 1440 | 1500 | DCLK |
| Horizontal display area | $T_{HD}$ | | 1280 | | DCLK |
| HSYNC period width | $T_{HPW}$ | 2 | - | 40 | DCLK |
| HSYNC back porch (with pulse width) | $T_{HBP}$ | 88 | 88 | 88 | DCLK |
| HSYNC front porch | $T_{HFP}$ | 12 | 72 | 132 | DCLK |
| VSYNC period time | $T_V$ | 824 | 838 | 872 | H |
| Vertical display area | $T_{VD}$ | | 800 | | H |
| VSYNC period width | $T_{VPW}$ | 2 | - | 20 | H |
| VSYNC back porch (with pulse width) | $T_{VBP}$ | 23 | 23 | 23 | H |
| VSYNC front porch | $T_{VFP}$ | 1 | 15 | 49 | H |

## 7.2.4 LVDS Data Mapping
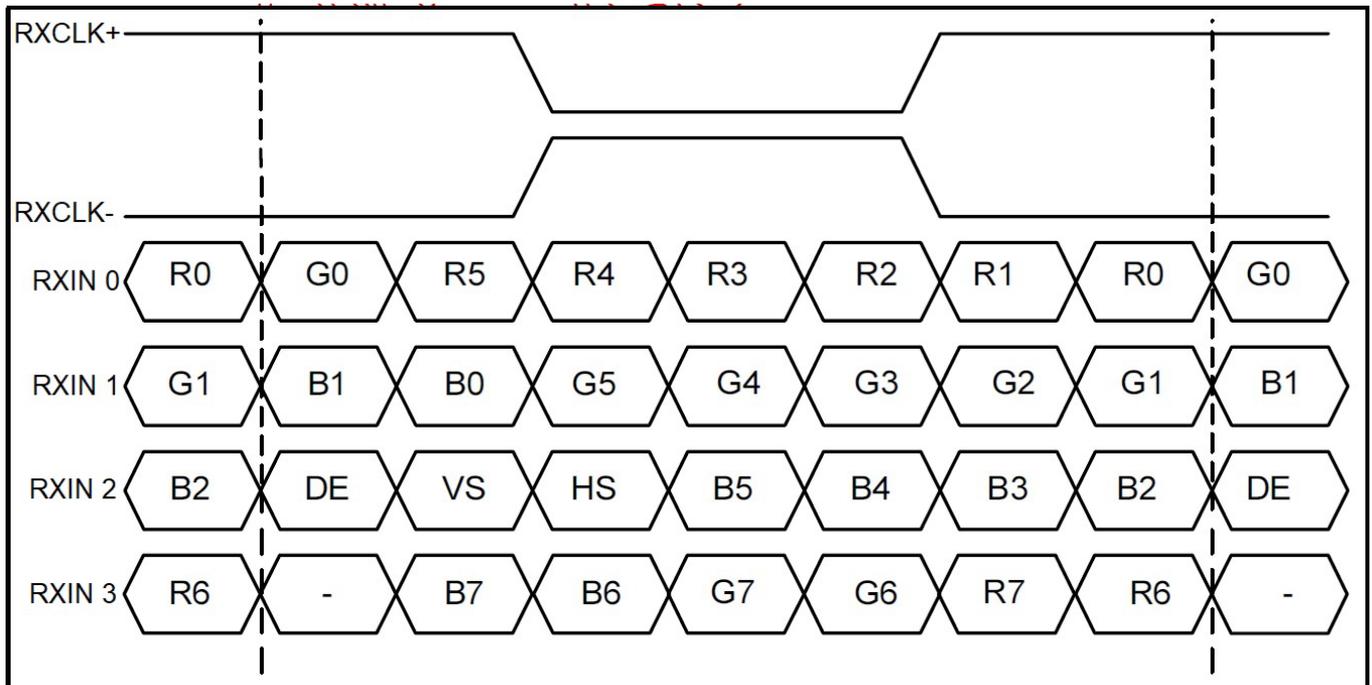


8-bit LVDS input (LVBIT = H)

# 8. Backlight Characteristic
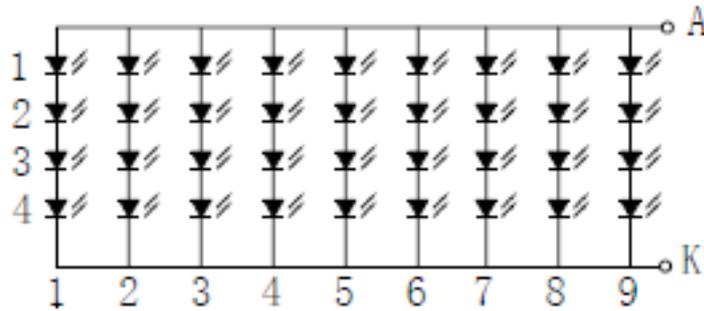


| Item | Symbol | Min | Typ | Max | Unit | Remark |
|---|---|---|---|---|---|---|
| Supply Voltage | Vf | 10.8 | 13.6 | 15.4 | V | If=360mA |
| Supply Current | If | - | 360 | - | mA | |
| Luminous Intensity for LCM | - | 800 | 1000 | - | cd/m2 | If=360mA |
| Luminance uniformity | - | 70 | - | - | % | If=360mA |
| Life Time | - | 50000 | - | - | Hr | If=360mA |
| Color | White | | | | | |

Note: Measure using TOPCON BM7-7AC

# 9. Optical Characteristics

| Item | Conditions | | Min. | Typ. | Max. | Unit | Note |
|---|---|---|---|---|---|---|---|
| Viewing Angle (CR>10) | Horizontal | θL | 80 | 85 | - | degree | (1) (4) |
| | | θR | 80 | 85 | - | | |
| | Vertical | θT | 80 | 85 | - | | |
| | | θB | 80 | 85 | - | | |
| Contrast Ratio | Center | | 800 | 1000 | - | - | (1) (2) (4) (6) |
| Response Time | Tr + Tf | | - | 25 | 35 | ms | (3) (4) (6) |
| CF Color Chromaticity (CIE1931) | Red x | | - | - | - | - | (4) (5) (6) |
| | Red y | | - | - | - | - | |
| | Green x | | - | - | - | - | |
| | Green y | | - | - | - | - | |
| | Blue x | | - | - | - | - | |
| | Blue y | | - | - | - | - | |
| | White x | | 0.26 | 0.31 | 0.36 | - | |
| | White y | | 0.28 | 0.33 | 0.38 | - | |
| Color Gamut | CIE 1931 | | - | 53 | - | % | (4) (5) (6) |

Note:
1.  Definition of Viewing Angle:
    Viewing angles are measured by TOPCON BM7-7AC
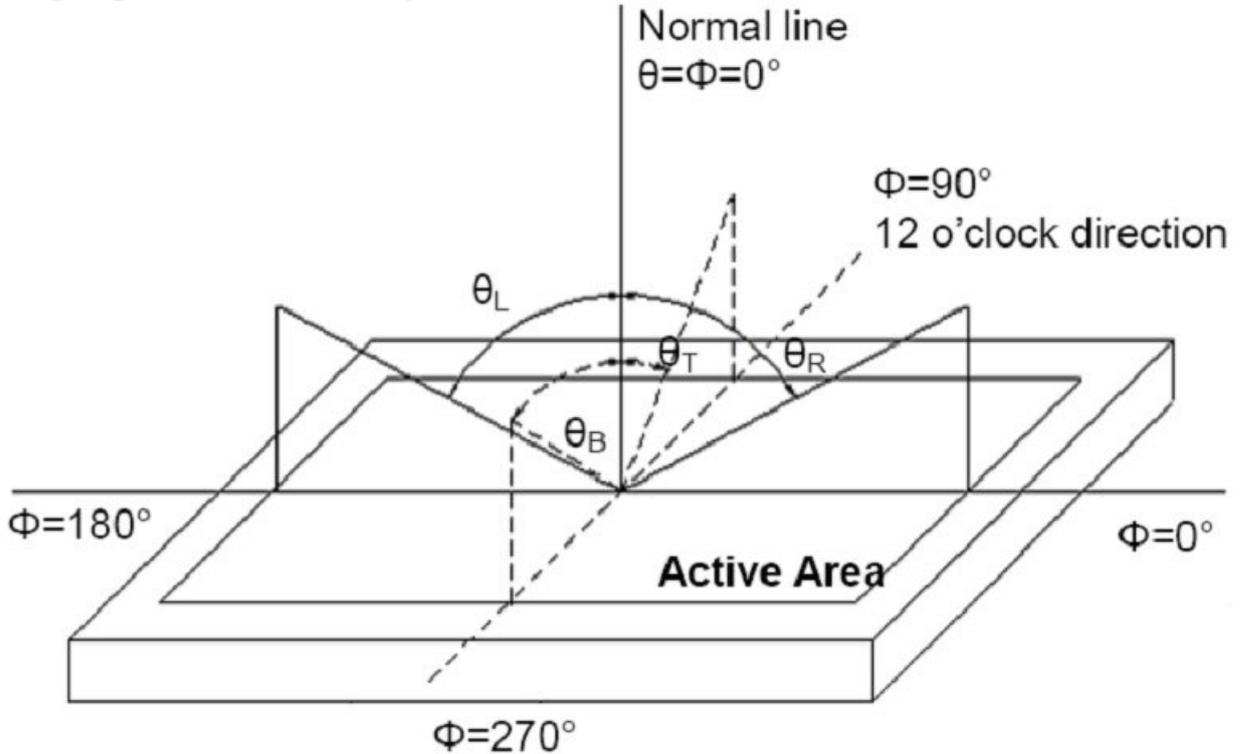


2.  Definition of Contrast Ratio (CR):
    The contrast ratio can be calculated by the following expression
    Contrast Ratio (CR) = L63 / L0
    L63: Luminance of gray level 63, L0: Luminance of gray level 0
3.  Definition of Response Time (TR, TF):
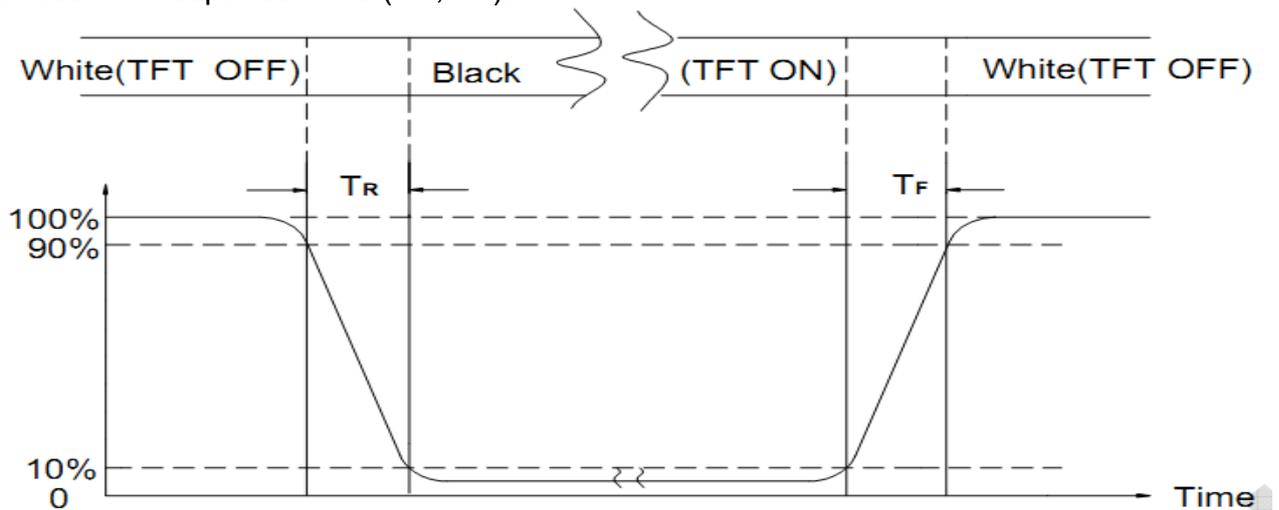
4.  Measurement Setup:
    The LCD assembly should be stabilized at given temperature for 30 minutes to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 30 minutes in a windless room.
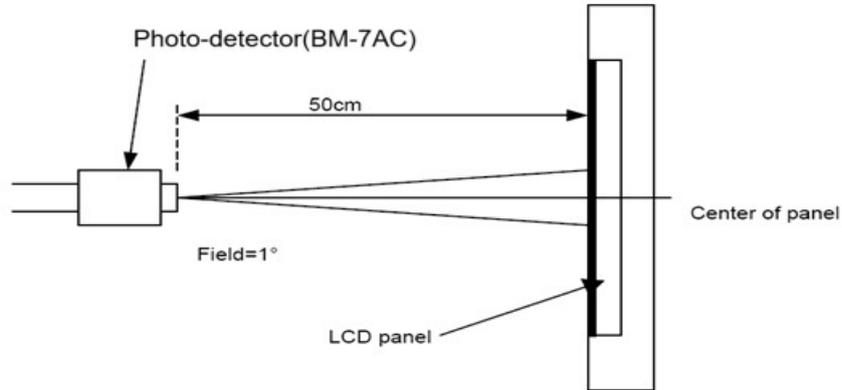


5.  Definition of brightness uniformity
    Brightness uniformity=(Min Luminance of 9 points)/(Max Luminance of 9 points)×100%
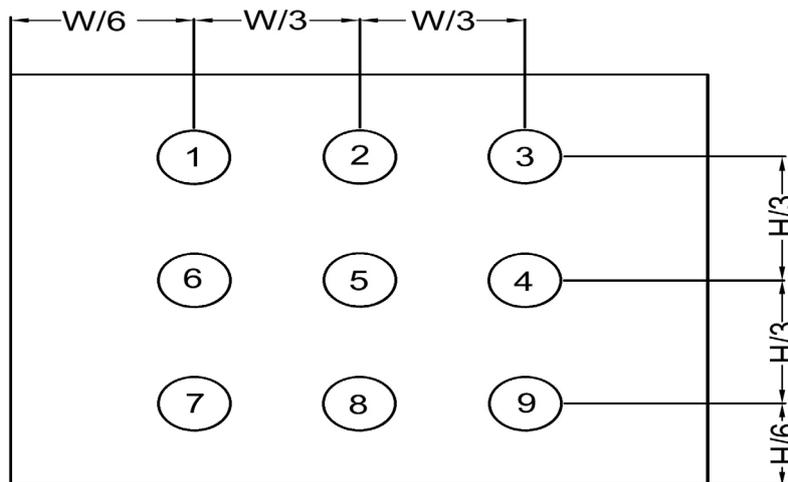


6.  Definition of color chromaticity (CIE1931)
    Color coordinates measured at the center point of LCD

# 10. Reliability Test Conditions and Methods

| NO. | Test Items | Test Condition |
|---|---|---|
| ① | High Temperature Storage | Keep in 80°C±2°C 240Hrs<br>Surrounding temperature, then storage at normal condition 4hrs. |
| ② | Low Temperature Storage | Keep in -30°C±2°C 240Hrs<br>Surrounding temperature, then storage at normal condition 4hrs. |
| ③ | High Temperature Operating | 70°C±2°C×240Hrs |
| ④ | Low Temperature Operating | -20°C±2°C×240Hrs |
| ⑤ | High Temperature / High Humidity Storage Test | Keep in 60°C / 90% R.H duration for 240hrs<br>Surrounding temperature, then storage at normal condition 4hrs. |
| ⑥ | Temperature Cycling Storage Test | -30°C → +25°C → 80°C → +25°C<br>(30mins)  (5mins)  (30mins)  (5mins)<br>◄——————— 30 Cycle ———————►<br>Surrounding temperature, then storage at normal condition 4hrs. |
| ⑦ | ESD Test | Air Discharge:<br>Apply 8 KV with 5 times<br>Discharge for each polarity +/-  \|  Contact Discharge:<br>Apply 250 V with 5 times<br>discharge for each polarity +/-<br><br>1. Temperature ambiance : 15°C～35°C<br>2. Humidity relative : 30%～60%<br>3. Energy Storage Capacitance (Cs + Cd): 150pF±10%<br>4. Discharge Resistance (Rd): 330Ω±10%<br>5. Discharge, mode of operation:<br>Single Discharge (time between successive discharges at least 1 sec)    (Tolerance if the output voltage indication : ±5%) |
| ⑧ | Vibration Test (Packaged) | 1. Sine wave 10～55 Hz frequency (1 min/sweep)<br>2. The amplitude of vibration :1.5 mm<br>3. Each direction (X、Y、Z) duration for 2 Hrs |
| ⑨ | Drop Test (Packaged) | (see table below) |

| Packing Weight (Kg) | Drop Height (cm) |
|---|---|
| 0 ~ 45 | 122 |
| 45.4 ~ 90.8 | 76 |
| 90.8 ~ 454 | 61 |
| Over 454 | 46 |

Drop Direction: ※1 corner / 3 edges / 6 sides each 1time

# 11. Inspection Standard

## 11.1. Quality:

The quality of goods supplied to purchaser shall come up to the following standard.

### 11.1.1. The method of preserving goods.

After delivery of goods from KINGTECH to purchaser. Purchaser shall control the LCM AT -10 TO 40, and it might be desirable to keep at the normal room temperature and until incoming inspection or throwing into process line.

### 11.1.2.Incoming inspection

(A) The method of inspection.

If purchaser make an incoming inspection, a sampling plan shall be applied on the condition that quality of one delivery shall be regarded as one lot.

(B) The standard of quality.

ISO-2859-1 (SAME AS MIL-STD-105E), LEVEL: II

| Class | AQL (%) |
| --- | --- |
| Critical | 0.4 % |
| Major | 0.65 % |
| Minor | 1.5 % |

Every item shall be inspected according to the class.

(C) Measure

If as the result of above receiving inspection, a lot out is discovered. Purchaser shall be informed seller of it within seven days. But first shipment within fourteen days.

### 11.1.3. Warranty policy

KINGTECH will provide one-year warranty for the products only if under specification operating conditions. KINGTECH will replace new products for these defect products which under warranty period and belong to the responsibility of KINGTECH.

## 11.2. Checking condition:

**11.2.1.** Checking direction shall be in the 45 degree area to face the sample.

**11.2.2.** Checker shall see over 300±25 mm. With bare eyes far from sample.

## 11.3. Inspection Plan:

| Class | Item | Judgement | Class |
|---|---|---|---|
| Packing & Indicate | 1. Outside and inside package | "Model On.", "Lot No." and "Quantity" Should indicate on the package. | Minor |
| | 2. Model mixed and quantity | Other model mixed.......rejected<br>Quantity short or over……..rejected | Critical |
| | 3. Product indication | "Model On." Should indicate on the product | Major |
| Assembly | 4. Dimension, LCD glass scratch and scribe defect. | According to specification or drawing. | Major |
| Appearance | 5. Viewing area | Polarizer edge or LCD's sealing line is visible in the viewing area……..rejected | Minor |
| | 6. Blemish, Black spot, White spot in the LCD and LCD glass cracks | According to standard of visual inspection(inside viewing area) | Minor |
| | 7. Blemish, Black spot, White spot and scratch on the polarizer | According to standard of visual inspection (inside viewing area) | Minor |
| | 8. Bubble in polarizer | According to standard of visual inspection (inside viewing area) | Minor |
| | 9. LCD's rainbow color | Strong deviation color (or newton ring) of LCD……..rejected.<br>Or according to limited sample (if needed, and inside viewing area) | Minor |
| Electrical | 10. Electrical and optical characteristics (contrast, VOP, chromaticity…ETC) | According to specification or drawing. (Inside viewing area) | Critical |
| | 11. Missing line | Missing dot, line, character……..rejected | Critical |
| | 12. Short circuit wrong pattern display | No display, Wrong pattern display, Current consumption out of specification……..rejected | Critical |
| | 13. Dot defect (for color and TFT) | According to standard or visual inspection | Minor |

## 11.4. Standard of visual inspection

| NO | CLASS | ITEM | JUDGEMENT | | |
|---|---|---|---|---|---|
| 11.4.1 | Minor | Black and white spot foreign materiel dust in the cell blemish scratch. | (A) Round type: unit: mm <br><br> Diameter (mm) / Acceptable Q'ty: <br> Ø ≦ 0.2 — Distances ≧ 1mm <br> 0.2 < Ø ≦ 0.3 — 4(Distance ≧ 15mm) <br> 0.3 < Ø ≦ 0.4 — 3(Distance ≧ 15mm) <br> 0.4 < Ø — 0 <br> Note: Ø=(Length*Width)/2 <br><br> (B) Linear type: unit: mm <br> Length / Width / Acceptable Q'ty: <br> - / W ≦ 0.03 / Distances ≧ 1mm <br> L ≦4.0 / 0.03 < W ≦ 0.05 / 3(Distance ≧ 15mm) <br> - / 0.05 < W / Follow round type <br> Note: Ø=(Length*Width)/2 | | |
| 11.4.2 | Minor | Bubble in polarizer dent on polarizer. | unit: mm <br> Diameter (mm) / Acceptable Q'ty: <br> Ø ≦ 0.2 — Distances ≧ 1mm <br> 0.2 < Ø ≦ 0.3 — 4(Distance ≧ 15mm) <br> 0.3 < Ø ≦ 0.5 — 2(Distance ≧ 15mm) <br> 0.5 < Ø — 0 | | |
| 11.4.3 | Minor | Dot Defect | Items / ACC. Q'TY: <br> Bright dot — N ≦ 2 (Distance ≧ 15mm) <br> Dark dot — N ≦ 4 (Distance ≧ 15mm) <br><br> Pixel Define: <br><br>  <br><br> Note 1: The definition of dot: The size of a defective dot over 1/2 of whole dot is regarded as one defective dot. Definition: <1/2dot and visible by 5% ND filter N ≦ 5 <br> Note 2: Bright dot: Dots appear bright and unchanged in size in which LCD panel is displaying under black pattern. <br> Note 3: Dark dot: Dots appear dark and unchanged in size in which LCD panel is displaying under pure red, green, blue pattern. | | |
| 11.4.4 | Minor | Mura | Not visible through 5% ND filter in 50% gray or judge by limit sample if necessary. | | |
| 11.4.5 | Minor | LCD glass chipping |  X ≧ 3mm  Y > S | | |

| 11.4.6 | Minor | LCD glass chipping |  | $X$ or $Y > S$ |
|---|---|---|---|---|
| 11.4.7 | Minor | LCD glass<br>Glass crack |  | Continuous<br>burst NG |
| 11.4.8 | Minor | LCD glass<br>Scribe defect |  | According to<br>dimension |
| 11.4.9 | Minor | LCD glass<br>Chipping(on the<br>terminal area) |  | $Y < 1/2Z$<br>$Y \geqq 0.5mm$<br>$X \geqq 3mm$ |
| 11.4.10 | Minor | LCD glass<br>Chipping(on the<br>terminal surface) |  | $Y < 1/2Z$<br>$Y \geqq 0.5mm$<br>$X \geqq 3mm$ |
| 11.4.11 | Minor | LCD glass chipping | <br>If touch the electrode lines, the need to retain the two-thirds electrode lines. | $X \geqq 3mm$<br>$X \geqq T$ |
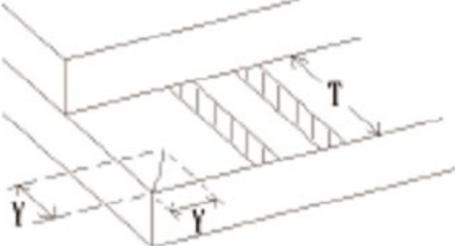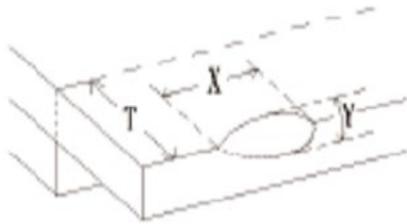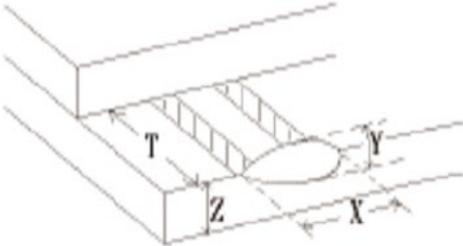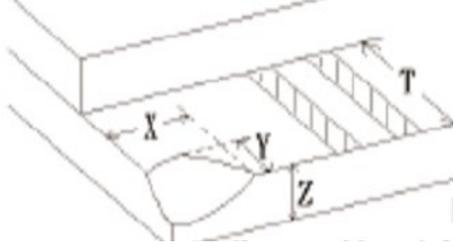
# 12. Handling Precautions
## 12.1 Mounting method

The LCD panel consists of two thin glass plates with polarizes which easily be damaged. And since the module in so constructed as to be fixed by utilizing fitting holes in the printed circuit board. Extreme care should be needed when handling the LCD modules.

## 12.2 Caution of LCD handling and cleaning

When cleaning the display surface, Use soft cloth with solvent [Recommended below] and wipe lightly
- Isopropyl alcohol
- Ethyl alcohol

Do not wipe the display surface with dry or hard materials that will damage the polarizer surface.

Do not use the following solvent:
- Water
- Aromatics

Do not wipe ITO pad area with the dry or hard materials that will damage the ITO patterns
Do not use the following solvent on the pad or prevent it from being contaminated:
- Soldering flux
- Chlorine (CI), Sulfur (S)

If goods were sent without being silicon coated on the pad, ITO patterns could be damaged due to the corrosion as time goes on.

If ITO corrosion happens by miss-handling or using some materials such as Chlorine (CI), Sulfur (S) from customer, Responsibility is on customer.

## 12.3 Caution against static charge

The LCD module use C-MOS LSI drivers, so we recommended that you:
Connect any unused input terminal to Power or Ground, do not input any signals before power is turned on, and ground your body, work/assembly areas, and assembly equipment to protect against static electricity.

## 12.4 packing

- Module employs LCD elements and must be treated as such.
- Avoid intense shock and falls from a height.
- To prevent modules from degradation, do not operate or store them exposed direct to sunshine or high temperature/humidity

## 12.5 Caution for operation

- It is an indispensable condition to drive LCD's within the specified voltage limit since the higher voltage then the limit cause the shorter LCD life.
- An electrochemical reaction due to direct current causes LCD's undesirable deterioration, so that the use of direct current drive should be avoided.
- Response time will be extremely delayed at lower temperature then the operating temperature range and on the other hand at higher temperature LCD's how dark color in them. However, those phenomena do not mean malfunction or out of order with LCD's, which will come back in the specified operation temperature.
- If the display area is pushed hard during operation, some font will be abnormally displayed but it resumes normal condition after turning off once.
- Slight dew depositing on terminals is a cause for electro-chemical reaction resulting in terminal open circuit.
  Usage under the maximum operating temperature, 50%Rh or less is required.

## 12.6 storing

In the case of storing for a long period of time for instance, for years for the purpose or

replacement use, the following ways are recommended.

- Storage in a polyethylene bag with the opening sealed so as not to enter fresh air outside in it. And with no desiccant.
- Placing in a dark place where neither exposure to direct sunlight nor light's keeping the storage temperature range.
- Storing with no touch on polarizer surface by the anything else.
  [It is recommended to store them as they have been contained in the inner container at the time of delivery from us.

## 12.7 Safety

- It is recommendable to crash damaged or unnecessary LCD's into pieces and wash off liquid crystal by either of solvents such as acetone and ethanol, which should be burned up later.
- When any liquid leaked out of a damaged glass cell comes in contact with your hands, please wash it off well with soap and water.

# 13. Precaution for Use

## 13.1

A limit sample should be provided by the both parties on an occasion when the both parties agreed its necessity. Judgment by a limit sample shall take effect after the limit sample has been established and confirmed by the both parties.

## 13.2

On the following occasions, the handing of problem should be decided through discussion and agreement between responsible of the both parties.

- When a question is arisen in this specification.
- When a new problem is arisen which is not specified in these specifications.
- When inspection specifications change or operating condition change in customer is reported to KINGTECH TFT, and some problem is arisen in this specification due to the change.
- When a new problem is arisen at the customer's operating set for sample evaluation in the customer site.

# 14. Packing Method

**TBD**