# Product Specification

Part Name: 10.40 inch TFT Display Module

TLET1040F4A-IH

| Customer: |
| --- |
| Approved by |

| From: |
| --- |
| Approved by |

# Revision History

| Rev. | Date | Contents | Written | Approved |
|---|---|---|---|---|
| A | 2021/04/19 | Preliminary Specification | MA | YUAN |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

Special Notes

| | |
|---|---|
| Note1. | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |

# Contents

# 1. General Specifications

| No. | Item | Specification | Remark |
|---|---|---|---|
| 1 | LCD size | 10.4 inch | |
| 2 | Driver element | a-Si TFT active matrix | |
| 3 | Resolution | 1024(W) RGB x768(H) | |
| 4 | Display mode | Normally Black, Transmissive | |
| 5 | Dot pitch | 0.2054(W) x 0.2054(H) | |
| 6 | Active area | 210.43(W) x 157.82(H) mm | |
| 7 | Module size | 238.6(W) ×175.8(H) ×6.5(D) mm | |
| 8 | View direction | ALL | O ‘clock |
| 9 | Surface treatment | AG | |
| 10 | Color arrangement | RGB-stripe | |
| 11 | Interface | LVDS | |
| 12 | Lcm power consumption | 6.7W | TYP. |
| 13 | Drive IC | TBD | |

Note 1: Refer to Assembly Drawing.

# 2. Pin Assignment

## 2.1. Absolute Maximum Ratings

FPC Connector is used for the module electronics interface.
The recommended model is P-two 187098-30091 or equivalent

| Pin No | Symbol | I/O | Function | Remark |
|---|---|---|---|---|
| 1 | NC | - | No Connection | |
| 2 | GND | P | Ground | |
| 3 | RIN3+ | I | +LVDS Differential Data Input | |
| 4 | RIN3- | I | -LVDS Differential Data Input | |
| 5 | GND | P | Ground | |
| 6 | CLK+ | I | +LVDS Differential Clock Input | |
| 7 | CLK- | I | -LVDS Differential Clock Input | |
| 8 | GND | P | Ground | |
| 9 | RIN2+ | I | +LVDS Differential Data Input | |
| 10 | RIN2- | I | -LVDS Differential Data Input | |
| 11 | GND | P | Ground | |
| 12 | RIN1+ | I | +LVDS Differential Data Input | |
| 13 | RIN1- | I | -LVDS Differential Data Input | |
| 14 | GND | P | Ground | |
| 15 | RIN0+ | I | +LVDS Differential Data Input | |
| 16 | RIN0- | I | -LVDS Differential Data Input | |
| 17 | GND | P | Ground | |
| 18 | NC | - | No Connection | |
| 19 | GND | P | Ground | |
| 20 | SEL6/8 | I | Selection for 6 bits/8bit LVDS data input<br>Low or NC : 8 bit input mode<br>High : 6 bit input mode | Note 1 |
| 21 | NC | - | No Connection | |
| 22 | NC | - | No Connection | |
| 23 | NC | - | No Connection | |
| 24 | RESERSE | I | Reverse panel function (Display rotation) | Note 2 |
| 25 | GND | P | Ground | |
| 26 | GND | P | Ground | |

| | | | | |
|---|---|---|---|---|
| 27 | GND | P | Ground | |
| 28 | VDD | P | Power supply: + 3.3V | |
| 29 | VDD | P | Power supply: + 3.3V | |
| 30 | VDD | P | Power supply: + 3.3V | |

Note I: input; O: output; P: Power or Ground(0V).

Note 1:SEL6/8 is used for selecting 6bit/8bit LVDS data input, L or NC: 8bit; High:6bit.

Note 2:Reverse pin is used for selecting scanning direction.

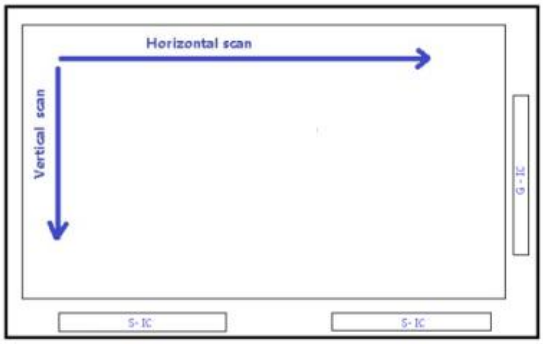



Fig. 1 Normal scan (Pin24, Reverse = Low or NC)

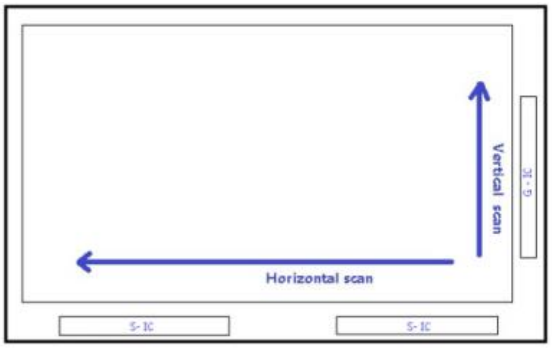



Fig. 2 Reverse scan (Pin24, Reverse = High)

## 2.2. Connector 2: Cillux,CI4205M2HRD-NH

5-pin connector is used for input power & control signals for BL converter power IC

| Pin No | Symbol | I/O | Function | Remark |
|---|---|---|---|---|
| 1 | VLED | P | 12V input | |
| 2 | VLED | P | 12V input | |
| 3 | GND | P | Ground | |
| 4 | LED_PWM | I | PWM Signal | |
| 5 | LED_EN | I | Converter power IC Enable<br>(Active High) | |

# 3. Operation Specifications

## 3.1.Absolute Maximum Ratings

**Test condition: GND=0V, $T_A$=25 °C**

Note1

| Item | Symbol | Values | | | Unit | Remark |
|---|---|---|---|---|---|---|
| | | Min. | Typ. | Max. | | |
| Power voltage | VDD | 3.0 | 3.3 | 3.6 | V | |
| Input logic high voltage | $V_{IH}$ | 0.9 VDD | - | VDD | V | |
| Input logic low voltage | $V_{IL}$ | GND | - | 0.1 VDD | V | |

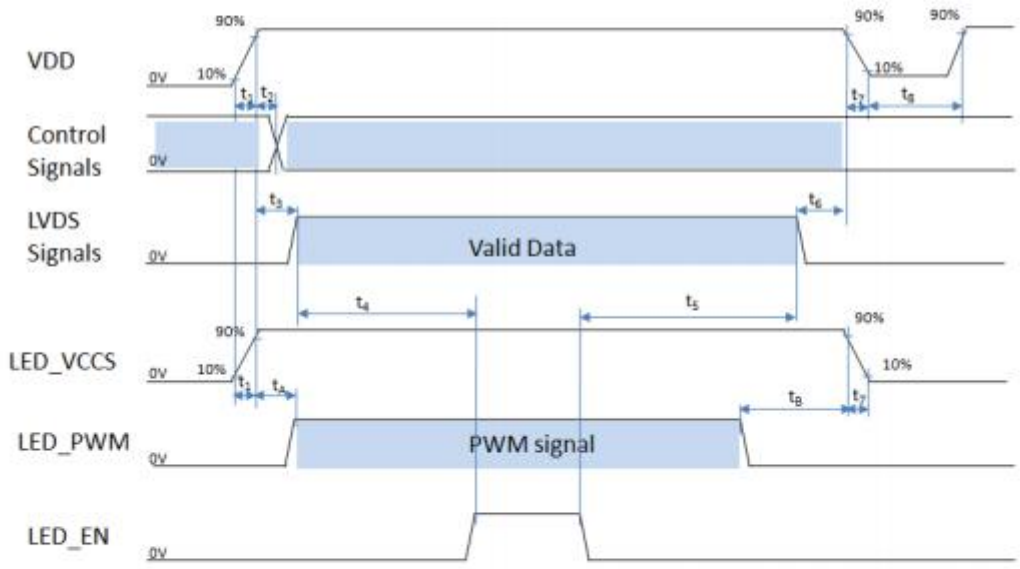
### 3.1.1. Current for LED Driver

| Symabol | Parameter | | Values | | | Unit | Remark |
|---|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | | |
| VLED | Input Voltage | | 11 | 12 | 13 | [Volt] | |
| $I_{VLED}$ | Input Current | | - | 520 | - | [mA] | 100%Brightness (VLED=12V) |
| LED_EN | EN Control level | BL On | 3.0 | 3.3 | 5 | [Volt] | |
| | | BL Off | 0 | - | 0.3 | | |
| $P_{VLED}$ | Power Consumption | | - | 6.24 | - | [Watt] | 100%Brightness (VLED=12V) |
| $F_{PWM}$ | PWM Freqquency | | 1K | - | 20K | [HZ] | PWM Dimming |
| LED_PWM | PWM High level | | 3.0 | 3.3 | 5.5 | [Volt] | |
| | PWM Low level | | 0 | - | 0.3 | | |
| Operation Life | | | 20,000 | - | - | Hrs | (Ta=25℃),Note 1 IF=160mA |

## 3.2. Power, Signal sequence

The power sequence specifications are shown as the following table and diagram.

| Symbol | Value | | Unit |
|---|---|---|---|
| | Min. | Max. | |
| $t_1$ | 1 | 20 | ms |
| $t_2$ | 1 | 5 | ms |
| $t_3$ | 10 | 50 | ms |
| $t_4$ | 200 | 500 | ms |
| $t_5$ | 200 | 500 | ms |
| $t_6$ | 50 | 200 | ms |
| $t_7$ | 0 | 20 | ms |
| $t_8$ | 500 | - | ms |
| $t_A$ | 0 | 50 | ms |
| $t_B$ | 0 | 50 | ms |




Note 1: Please don't plug the interface cable of on when system is turned on.

Note 2: Please avoid floating state of the interface signal during signal invalid period.

Note 3: It is recommended that the backlight power must be turned on after the power supply for LCD and the interface signal is valid.

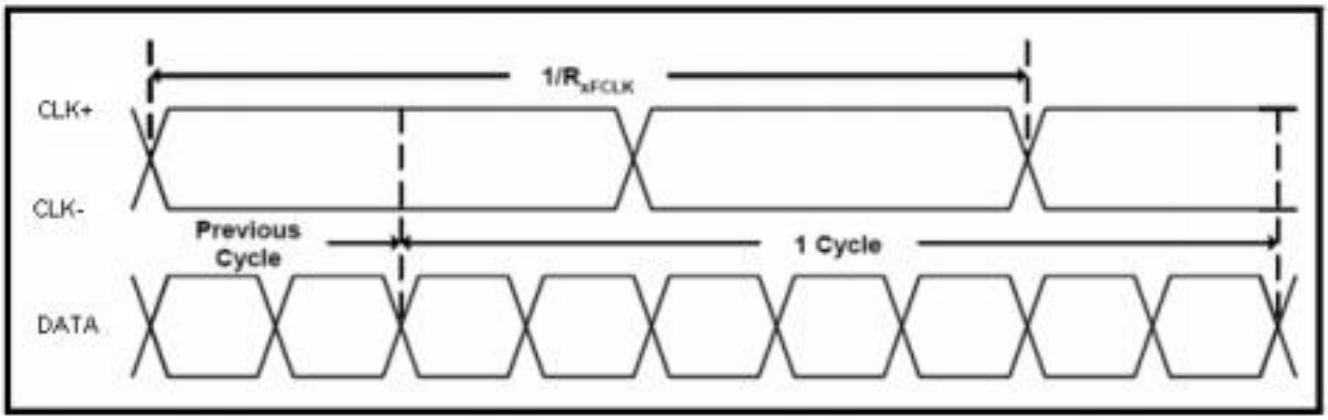
Note 4: Control signals include SEL6/8 & Reverse.

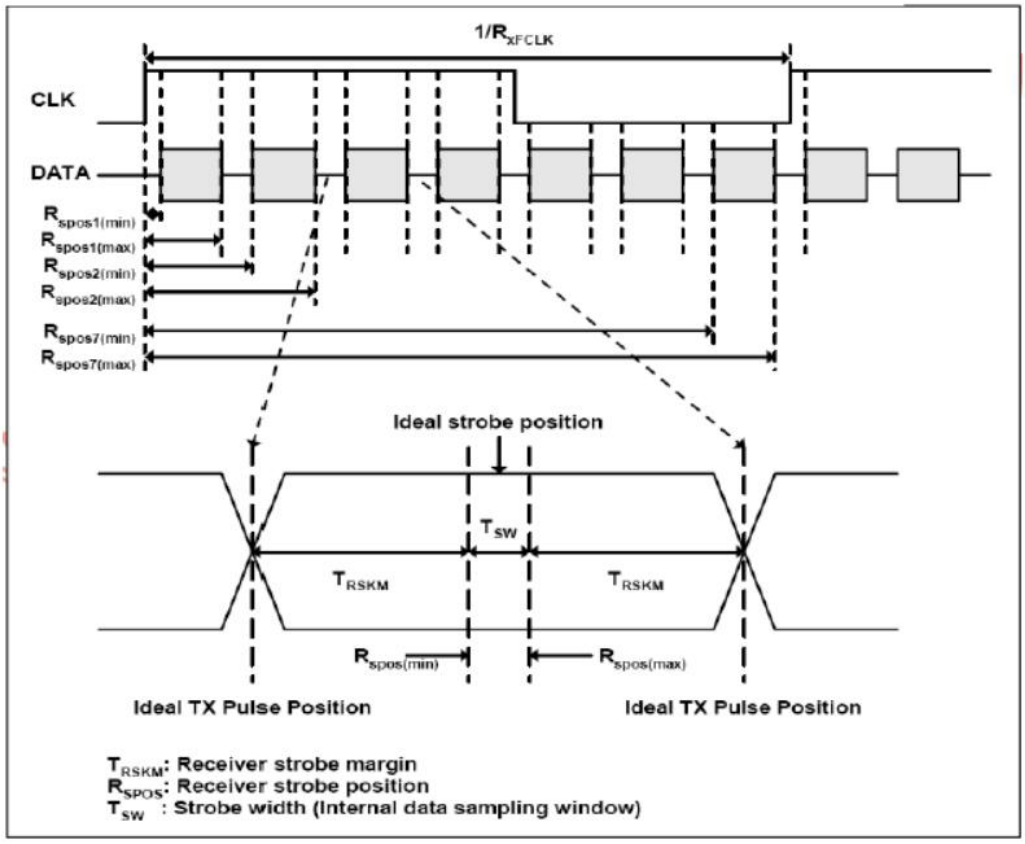
# 3.3. LVDS Signal timing characteristics

### AC Electrical characteristics

| Parameter | Symbol | Min | Typ | Max | Units | Condition |
|---|---|---|---|---|---|---|
| Clock frequency | RxFCLK | 26.2 | 51.2 | 71 | MHz | |
| Input data skew margin | TRSKM | 500 | 500 | 1/(2*RxFCLK) | ps | Typical value for 1024*600 resolution |
| Clock high time | TLVCH | | 4/(7xRxFCLK) | | ns | \|VID\|=400mv RxVCM=1.2V RxFCLK=71MHz VDD_LVDS=3.3V |
| Clock low time | TLVCL | | 3/(7xRxFCLK) | | ns | |
| VSD setup time | TenPLL | 0 | TenPLL | 150 | us | |

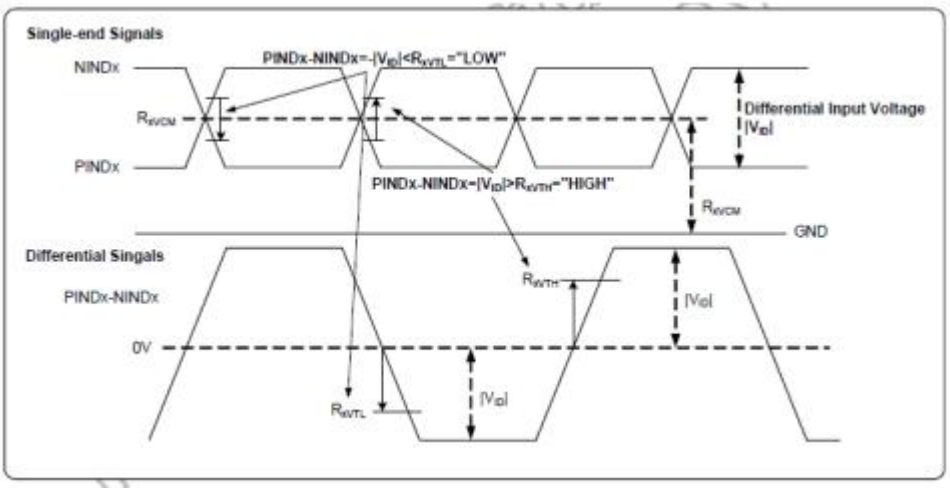
### Input clock and data timing diagram






## DC electrical characteristics

| Parameter | Symbol | Values | | | Unit | Remark |
|---|---|---|---|---|---|---|
| | | Min. | Typ. | Max. | | |
| LVDS Differential input high Threshold voltage | $R_{xVTH}$ | - | - | +100 | mV | $R_{xVCM}$=1.2V |
| LVDS Differential input low Threshold voltage | $R_{xVTL}$ | -100 | - | - | mV | |
| Input Voltage range (Singled-end) | $R_{xVIN}$ | 0 | - | VDD-1.2+ $\lvert V_{ID}\rvert/2$ | V | |
| LVDS Differential input common mode voltage | $R_{xVCM}$ | $\lvert V_{ID}\rvert/2$ | - | VDD-1.2 | V | |
| LVDS Differential voltage | $\lvert V_{ID}\rvert$ | 0.2 | - | 0.6 | V | |

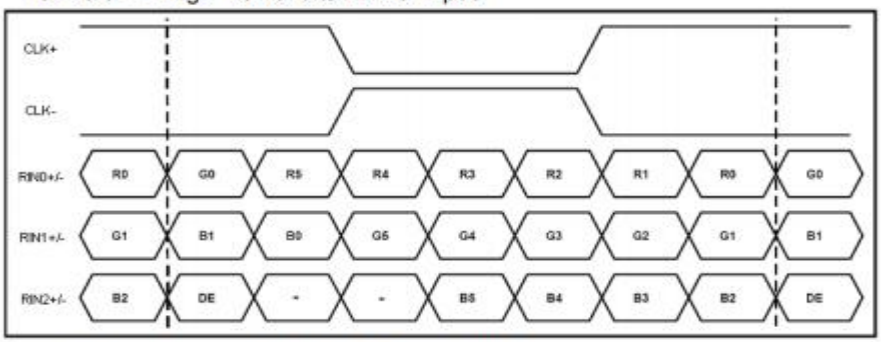



## data timing

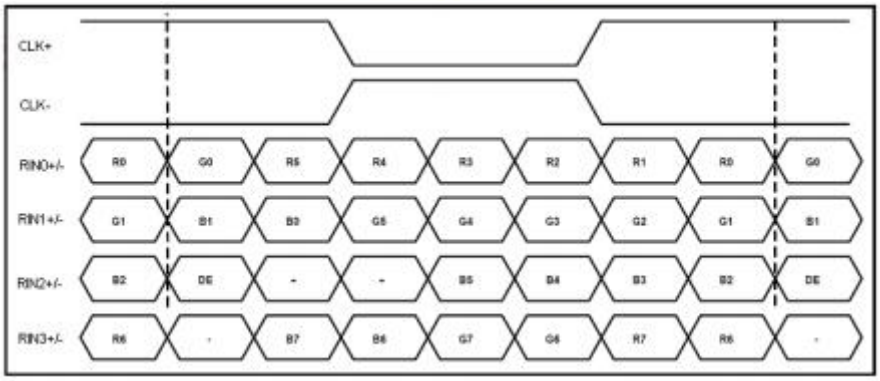
| Parameter | Symbol | Spec. | | | Unit |
|---|---|---|---|---|---|
| | | Min. | Typ. | Max. | |
| DCLK frequency | fclk | 52 | 65 | 71 | MHz |
| Horizontal display area | thd | | 1024 | | DCLK |
| HSD period | th | 1114 | 1344 | 1400 | DCLK |
| HSD blanking | thb+thfp | 90 | 320 | 376 | DCLK |
| Vertical display area | tvd | | 768 | | $T_H$ |
| VSD period | tv | 778 | 806 | 845 | $T_H$ |
| VSD blanking | tvbp+tvfp | 10 | 38 | 77 | $T_H$ |

## LVDS data input format

SEL6/8 = "High" for 6 bits LVDS Input




SEL6/8 = "Low" or "NC" for 8 bits LVDS Input



# 4. Optical Specifications

| Item | Symbol | Condition | Values | | | Unit | Remark |
|---|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | | |
| Viewing angle (CR≥ 10) | $\theta_L$ | Φ=180°(9 o'clock) | 80 | - | - | degree | Note 1 |
| | $\theta_R$ | Φ=0°(3 o'clock) | 80 | - | - | | |
| | $\theta_T$ | Φ=90°(12 o'clock) | 80 | - | - | | |
| | $\theta_B$ | Φ=270°(6 o'clock) | 80 | - | - | | |
| Response time | $T_{ON+}$ $T_{OFF}$ | Normal θ=Φ=0° | - | 25 | 35 | msec | Note 3 |
| Contrast ratio | CR | | 800 | 1000 | - | - | 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 | | 500 | 600 | - | cd/m² | Note 6 |
| Luminance uniformity | $Y_U$ | | 70 | 75 | - | % | Note 7 |
| Color Gamut | NTSC | CIE1931 | 55 | 62 | - | % | |

The test systems refer to Note 2.

Note 1: Definition of viewing angle range

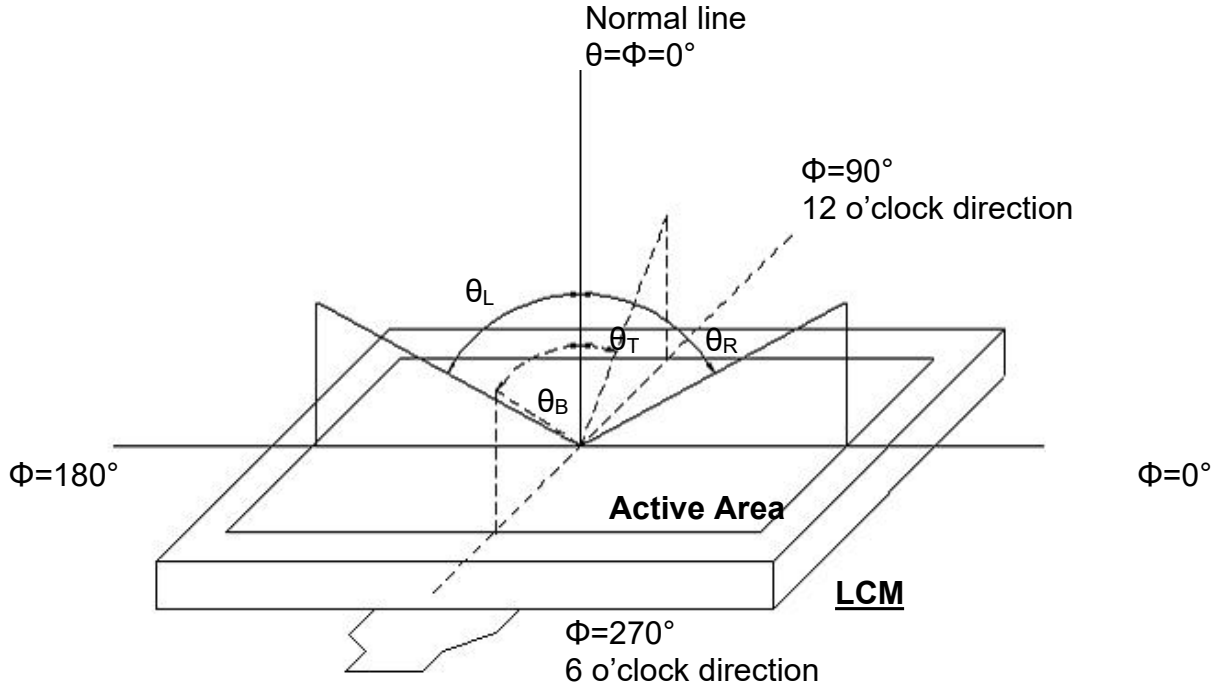



Fig. 4-1 Definition of viewing angle

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. (Viewing angle is measured by ELDIM-EZ contrast/Height :1.2mm, Response time is measured by Photo detector TOPCON BM-7, other items are measured by BM-5A/ Field of view: 1° /Height: 500mm.) or CA-210.

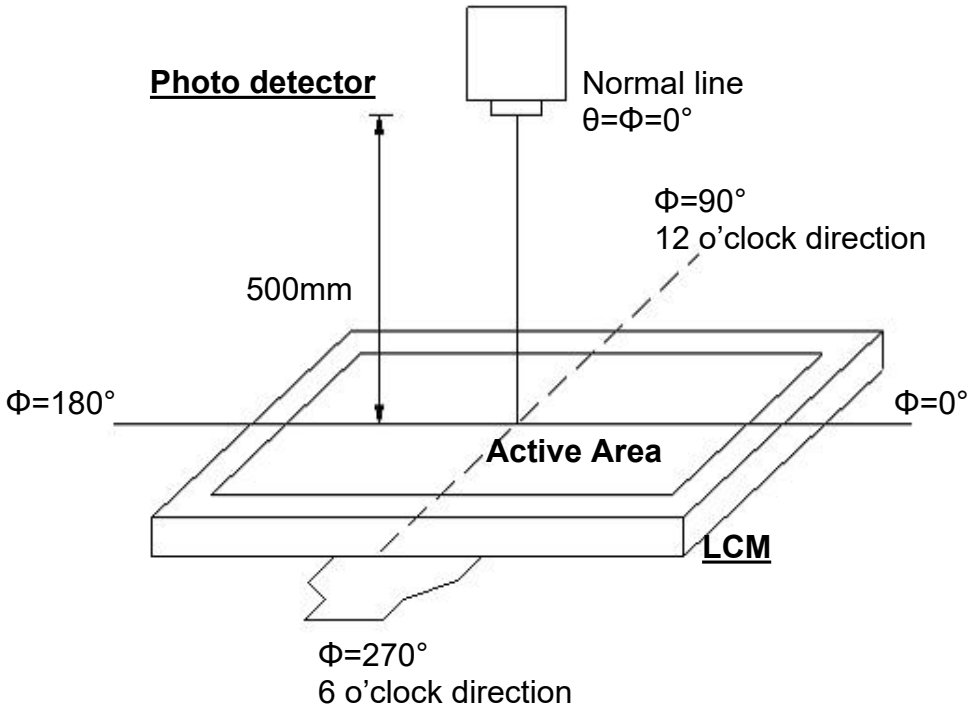



Fig. 4-2 Optical measurement system setup

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%.

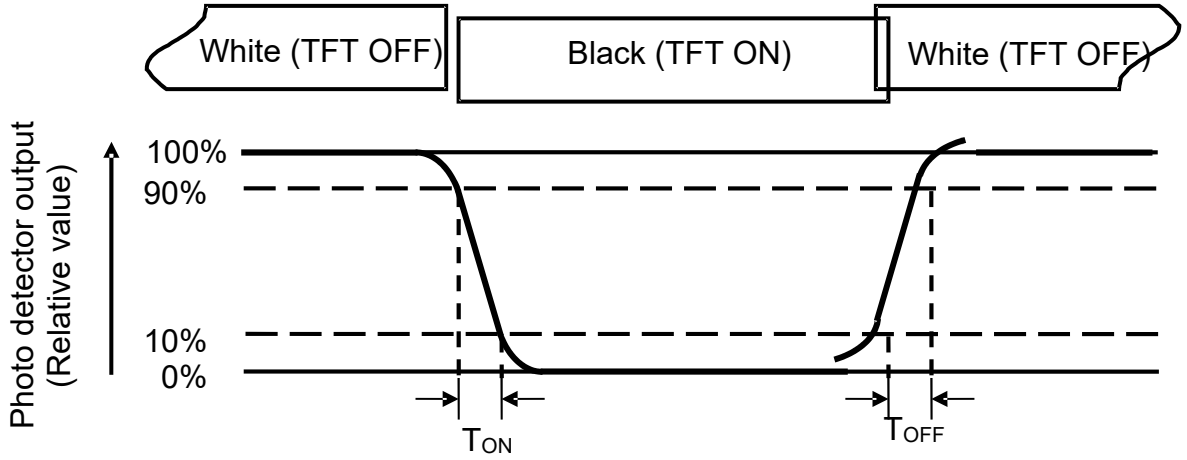



Fig. 4- 3 Definition of response time

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: All input terminals LCD panel must be ground while measuring the center area of the panel. The LED driving condition is $I_L$=520mA .

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

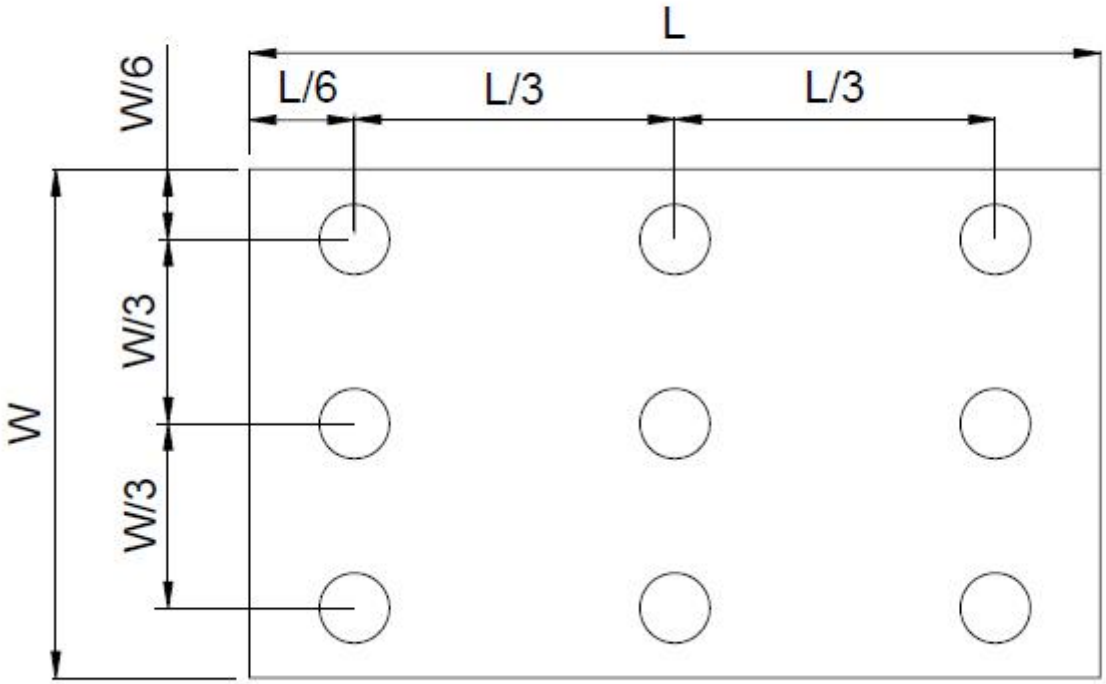



Fig. 4-4 Definition of measuring points

$B_{MAX}$: The measured maximum luminance of all measurement position.
$B_{MIN}$: The measured minimum luminance of all measurement position.

# 5. Reliability Test

| Item | Test Conditions | Criterion |
|---|---|---|
| High Temperature Storage | Ta = 80℃ 240hrs | Note 1，Note3，Note 4 ,Note5 |
| Low Temperature Storage | Ta = -30℃ 240hrs | Note 1，Note3，Note 4 |
| High Temperature Operation | Ts = 70℃ 240hrs | Note 2，Note3，Note 4 , Note5 |
| Low Temperature Operation | Ta =-20℃ 240hrs | Note 1，Note3，Note 4 |
| Operate at High Temperature and Humidity | +60℃, 90%RH 240hrs | Note3，Note 4 Note5 |
| Thermal Shock(non operation) | -30℃/30 min ~ +80℃/30 min for a total 100 cycles, Start with cold temperature and end with high temperature. | Note3，Note 4 Note5 |
| Vibration Test | Sweep:10Hz~55Hz~10Hz 2G<br>2 hours for each direction of X. Y. Z.<br>(6 hours for total) | |
| Package Vibration Test | Random Vibration :<br>0.015G*G/Hz from 5-200HZ, -6dB/Octave from 200-500HZ<br>2 hours for each direction of X. Y. Z.<br>(6 hours for total) | |
| Package Drop Test | Height:60 cm<br>1 corner, 3 edges, 6 surfaces | |
| Electro Static Discharge | Contact=+/-4KV,<br>Air=+/-8KV,(R=330R,C=150pF), 1 sec,9point,10times/point; | |

※Criterion:

Note 1: Ta is the ambient temperature of samples.

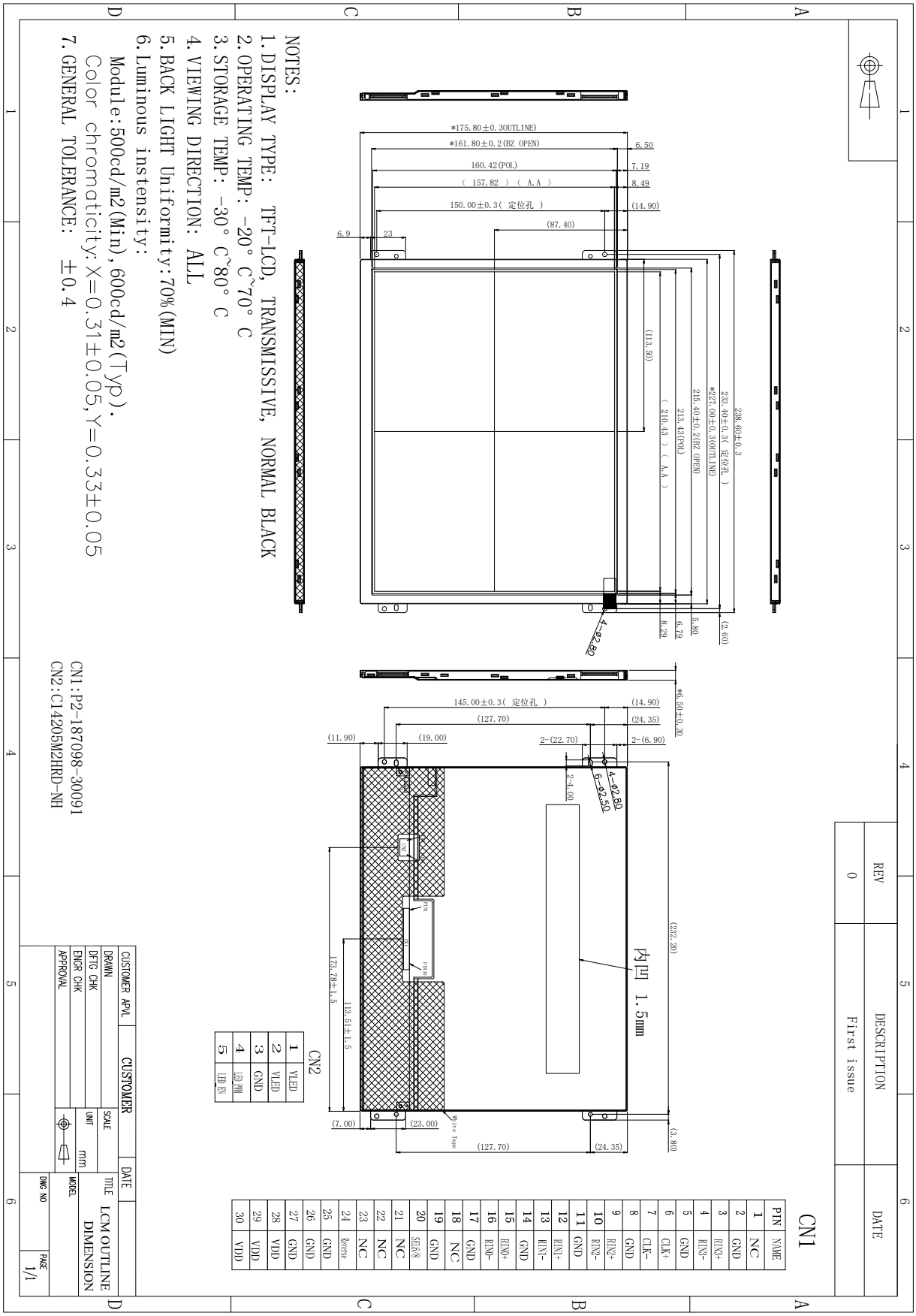
Note 2: Ts is the temperature of panel’s surface.

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.

Note 5: A certain level of Mura (non-uniformity) of dark / black image will happen several days after high temperature testing (H.T.T.). There is a slowly part recovery over a long time (several months). Such a long exposure time like in H.T.T. will normally not happen in a real application. Therefore the test H.T.T. was introduced to simulate cycles with normal conditions in-between but with the same total exposure time what show a significant reduced Mura.
The root cause is related to tension generated due to different amount of shrinking in the stack of layers in the polarizer sheet. The effect is more significant on larger displays like this size. An investigation into alternative polarizer material showed that there is no better alternative currently available.

# 6. Mechanical Drawing



# 7. Package Drawing

## TBD

# 8. General Precautions

## 8.1. 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.

## 8.2. 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.

## 8.3. 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.

## 8.4. 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.

## 8.5. 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.