



Document Revision History

| Revision | Data       | Page | Description | Changed By |
|----------|------------|------|-------------|------------|
| V1.0     | 2017-03-23 | --   | First issue |            |
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## 1. LCM Specification

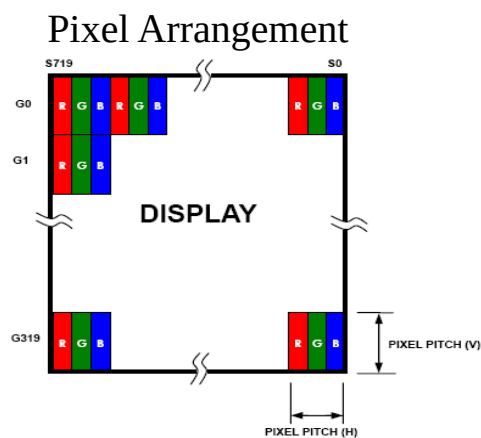
### 1.1 Description

ATM0700D38B-T is a transmissive type color active matrix liquid crystal display (LCD) which uses amorphous thin film transistor (TFT) as switching devices. This product is composed of a TFT LCD panel, a drive IC, a FPC, and a WLED-backlight unit. The active display area is 7.0 inches diagonally measured and the native resolution is 800\*RGB\*480. Features of this product are listed in the following table.

### 1.2 Functions & Features

Table1.1 Module Functions & Features

| Parameter             | Value                      | Unit              |
|-----------------------|----------------------------|-------------------|
| LCD Mode              | a-Si TFT/transmissive      | -                 |
| Color                 | 16.2M                      | -                 |
| Display Resolution    | 800*3(RGB)*480             | pixels            |
| Outline Dimension     | 164.8(W) *100.0(H) *4.9(T) | mm                |
| Active Area(A.A)      | 154.08*(W) *85.92(H)       | mm                |
| Pixel Arrangement     | RGB-stripe                 | -                 |
| Viewing Direction     | 6 O'clock                  |                   |
| Display Mode          | Normally WHITE             |                   |
| Surface Treatment     | Anti-Glare                 |                   |
| Back-light            | White LED*27CHIP           | PCS               |
| Average Brightness    | 590                        | cd/m <sup>2</sup> |
| Operation Temperature | -20~70                     | °C                |
| Storage Temperature   | -30~80                     | °C                |



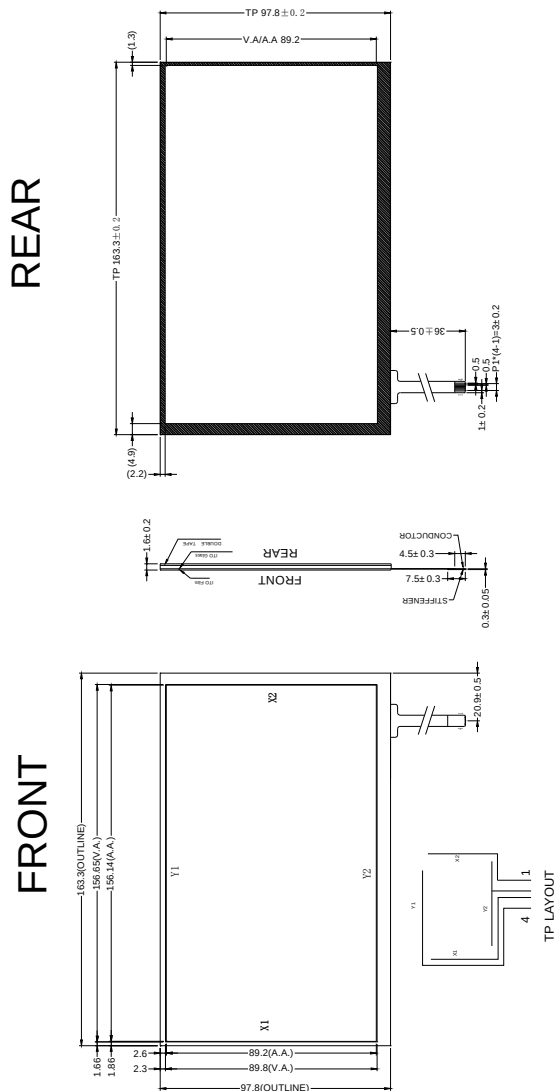


# ATM0700D38B-T(AZ DISPLAYS) TFT MODULE V1.0

## Touch Panel Section

FPC Connector is used for the module electronics interface. The recommended model is FH12-4S-1SH manufactured by Hirose.

| Pin No. | Sym<br>bol | I/O    | Function                               | Remark |
|---------|------------|--------|----------------------------------------|--------|
| 4       | Y1         | Top    | Top electrode – differential analog    |        |
| 3       | X1         | Left   | Left electrode – differential analog   |        |
| 2       | Y2         | Bottom | Bottom electrode – differential analog |        |
| 1       | X2         | Right  | Right electrode – differential analog  |        |



## Parameters:

- 1 Operating voltage: DC5V;
- 2 Operating force: 40~100g;
- 3 Linearity ≤1.5%; Insulation resistance >10M Ω (25VDC);
- 4 Working temperature: -20℃ ~ +70℃ 20% ~ 90%RH;
- 5 Storage temperature: -20℃ ~ +80℃ 20% ~ 85%RH;
- 6 Transmittance > 75%;
- 7 Structure: Film + Glass;
- 8 ITO-Film: Anti glare;
- 9 Response time <10ms;
- 10 electrode resistance: 200~900 ohms;
- 11 Unspecified tolerance: +/-0.3mm

### 3. Electrical Units

#### 3.1 Electrical Specification

<Table3. Electrical specifications>

| Item                  | Symbol | Unit | Value  |     |     | Note |
|-----------------------|--------|------|--------|-----|-----|------|
|                       |        |      | Min    | Typ | Max |      |
| Power voltage         | VCC    | V    | 3.0    | 3.3 | 3.6 |      |
| Operating Temperature | TOP    | °C   | -20 to |     | +70 |      |
| Storage Temperature   | TST    | °C   | -30 to |     | +80 |      |

Notes:

1. VCC setting should match the signals output voltage (refer to Note 3) of customer' s system board.
2. DCLK,HS,VS,DE,R0~R7,G0~G7,B0~B7.

## 3.2 Pin Descriptions

### 3.2.1 TFT LCD Panel interface FPC Pin Description

| Pin No. | Symbol | I/O | Function                                                                                                                                                                                                                       |
|---------|--------|-----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1       | Led-   | P   | Power for LED backlight (Cathode)                                                                                                                                                                                              |
| 2       | Led+   | P   | Power for LED backlight (Anode)                                                                                                                                                                                                |
| 3       | GND    | P   | Analog Ground                                                                                                                                                                                                                  |
| 4       | VCC    | P   | Power voltage                                                                                                                                                                                                                  |
| 5       | R0     | I   | Data input(LSB)                                                                                                                                                                                                                |
| 6       | R1     | I   | Data input                                                                                                                                                                                                                     |
| 7       | R2     | I   | Data input                                                                                                                                                                                                                     |
| 8       | R3     | I   | Data input                                                                                                                                                                                                                     |
| 9       | R4     | I   | Data input                                                                                                                                                                                                                     |
| 10      | R5     | I   | Data input                                                                                                                                                                                                                     |
| 11      | R6     | I   | Data input                                                                                                                                                                                                                     |
| 12      | R7     | I   | Data input(MSB)                                                                                                                                                                                                                |
| 13      | G0     | I   | Data input (LSB)                                                                                                                                                                                                               |
| 14      | G1     | I   | Data input                                                                                                                                                                                                                     |
| 15      | G2     | I   | Data input                                                                                                                                                                                                                     |
| 16      | G3     | I   | Data input                                                                                                                                                                                                                     |
| 17      | G4     | I   | Data input                                                                                                                                                                                                                     |
| 18      | G5     | I   | Data input                                                                                                                                                                                                                     |
| 19      | G6     | I   | Data input                                                                                                                                                                                                                     |
| 20      | G7     | I   | Data input(MSB)                                                                                                                                                                                                                |
| 21      | B0     | I   | Data input (LSB)                                                                                                                                                                                                               |
| 22      | B1     | I   | Data input                                                                                                                                                                                                                     |
| 23      | B2     | I   | Data input                                                                                                                                                                                                                     |
| 24      | B3     | I   | Data input                                                                                                                                                                                                                     |
| 25      | B4     | I   | Data input                                                                                                                                                                                                                     |
| 26      | B5     | I   | Data input                                                                                                                                                                                                                     |
| 27      | B6     | I   | Data input                                                                                                                                                                                                                     |
| 28      | B7     | I   | Data input (MSB)                                                                                                                                                                                                               |
| 29      | GND    | P   | Digital Ground                                                                                                                                                                                                                 |
| 30      | DCLK   | I   | Clock input                                                                                                                                                                                                                    |
| 31      | DISP   | I   | <p>Display on/off control.</p> <p>DISP="L", enter standby mode for power saving. Timing controller and source driver will turn off, all outputs are Hi-Z.</p> <p>DISP="H", normal operation.</p> <p>Note: Normal pull high</p> |
| 32      | HS     | I   | Horizontal sync input. Negative polarity                                                                                                                                                                                       |
| 33      | VS     | I   | Vertical sync input. Negative polarity                                                                                                                                                                                         |
| 34      | DE     | I   | Data enable                                                                                                                                                                                                                    |
| 35      | NC     | -   | Not connect                                                                                                                                                                                                                    |



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|    |     |     |                                                      |
|----|-----|-----|------------------------------------------------------|
| 36 | GND | P   | Digital Ground                                       |
| 37 | XR  | I/O | Right electrode - differential analog,NC by default  |
| 38 | YD  | I/O | Bottom electrode - differential analog,NC by default |
| 39 | XL  | I/O | Left electrode - differential analog,NC by default   |
| 40 | YU  | I/O | Top electrode - differential analog,NC by default    |

I/O: I: input, O: output, P: power

## 3.3.1 Electrical characteristics (Ta=25°C)

## 3.3.2 TFT-LCD Current Consumption

Table 3.2:

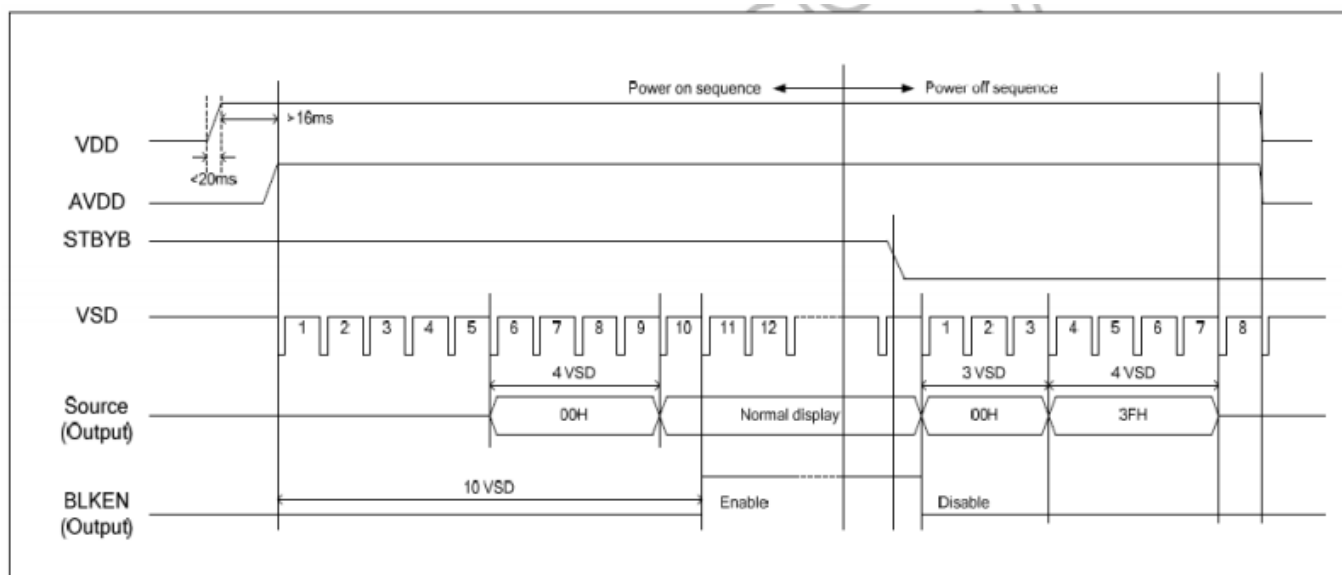
| Item                   | Symbol | Unit | Test Condition | Min | Typ. | Max | Note |
|------------------------|--------|------|----------------|-----|------|-----|------|
| Gate on power current  | IVGH   | mA   |                |     |      |     | -    |
| Gate off power current | IVGL   | mA   |                |     |      |     | -    |
| Analog power current   | IVDD   | mA   | VDD=3.3V       | -   | TBD  |     | -    |
| Analog power current   | IAVDD  | mA   |                |     |      |     |      |

## 3.3 Power Sequence

To prevent the device damage from latch up, the power sequence shown below must be followed.

Power ON: VDD, GND → AVDD, AVSS → V1 to V14

Power OFF: V1 to V14 → AVDD, AVSS → VDD, GND



### 3.4 Back-light Specification

Table 3.3 Back-light Specification

| Item                          | Symbol | Conditions                       | Min.     | Typ. | Max. | Unit  |
|-------------------------------|--------|----------------------------------|----------|------|------|-------|
| Supply Voltage                | VF     | Only<br>Backlight                | 9.0      |      | 10   | V     |
| Supply Current                | IF     |                                  | 20*9=180 |      |      | mA    |
| Average<br>Brightness(BL+LCD) | IV     | Backlight<br>Current<br>IF=180mA | 520      | 590  |      | Cd/m2 |
| CIE Color Coordinate          | X      | Backlight<br>Current<br>IF=180mA | -        |      | -    | -     |
|                               | Y      |                                  | -        |      | -    |       |
| Uniformity                    | B      | Backlight<br>Current<br>IF=180mA | 80       | -    | -S   | (%)   |
| Color                         | White  |                                  |          |      |      |       |

## 4. Timing Characteristics

### 4.1. AC Electrical Characteristics

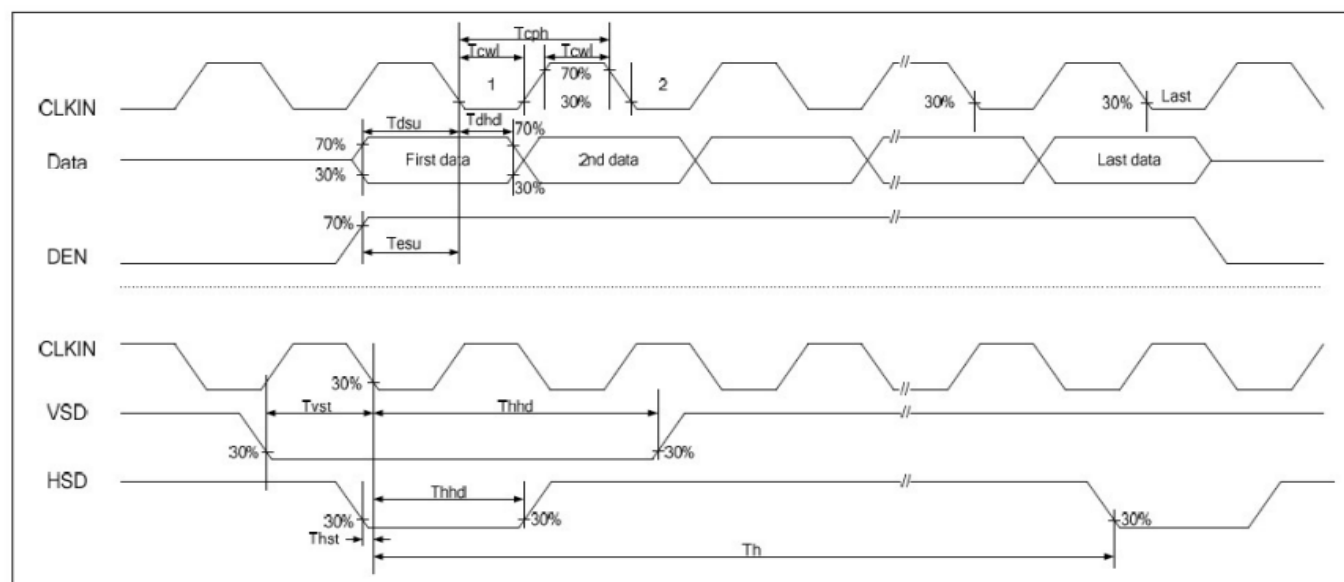
| Item                       | Symbol      | Value |     |     | Unit | Remark |
|----------------------------|-------------|-------|-----|-----|------|--------|
|                            |             | Min   | Typ | Max |      |        |
| Hs setup time              | $T_{HST}$   | 8     |     |     | ns   |        |
| Hs hold time               | $T_{HHD}$   | 8     |     |     | ns   |        |
| VS setup time              | $T_{VST}$   | 8     |     |     | ns   |        |
| VS hold time               | $T_{VHD}$   | 8     |     |     | ns   |        |
| Data setup time            | $T_{DSU}$   | 8     |     |     | ns   |        |
| Data hold time             | $T_{DHD}$   | 8     |     |     | ns   |        |
| DE setup time              | $T_{ESU}$   | 8     |     |     | ns   |        |
| DE hold time               | $T_{EHD}$   | 8     |     |     | ns   |        |
| DVDD power on slew<br>rate | $T_{POR}$   | -     |     | 20  | ms   |        |
| RESET pulse width          | $T_{RST}$   | 10    |     |     | ns   |        |
| Dot Clock                  | $L/T_{CLK}$ | 29    | 33  | 38  | MHz  |        |
| DCLK pulse duty            | $T_{CWH}$   | 40    | 50  | 60  | %    |        |

## 4.2. Timing characteristics of input signals

| Parameter         | Symbol                 | Spec |      |      | Unit |
|-------------------|------------------------|------|------|------|------|
|                   |                        | Min. | Typ. | Max. |      |
| CLK frequency     | fclk                   | -    | 33.3 | 50   | MHz  |
| DE H period       | thpw+thb+thd+thfp = th | 885  | 1000 | 1010 | DCLK |
| DE H-Display Area | thd                    | 800  |      |      | DCLK |
| DE H-Blanking     | th-thd                 | 85   | 200  | 210  | DCLK |
| DE V period       | tvpw+tvb+tvb+tvfp      | 500  | 512  | -    | DCLK |
| DE V-Display Area | tvb                    | 480  |      |      | th   |
| DE V-Blanking     | tv-tvb                 | 20   | 32   | -    | th   |

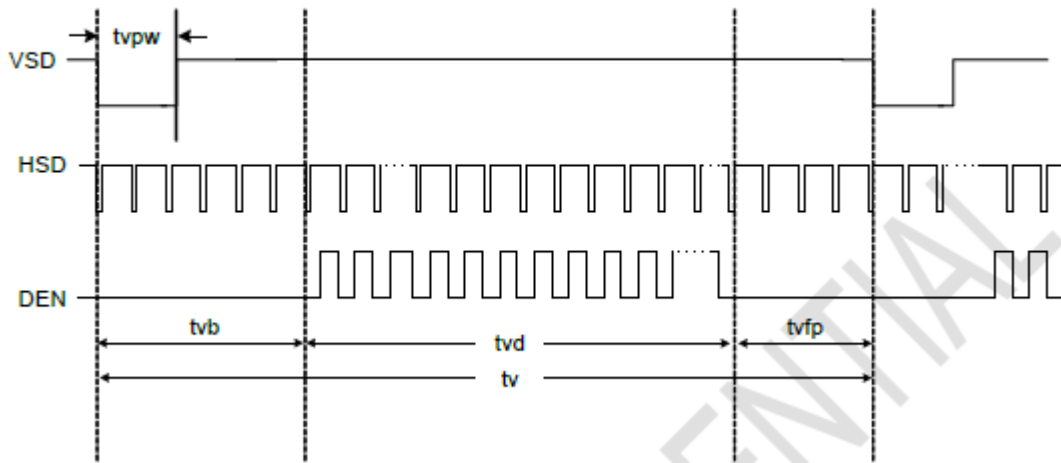
## 4.3. Timing Diagram

### 4.3.1 input Clock and Data Timing Diagram

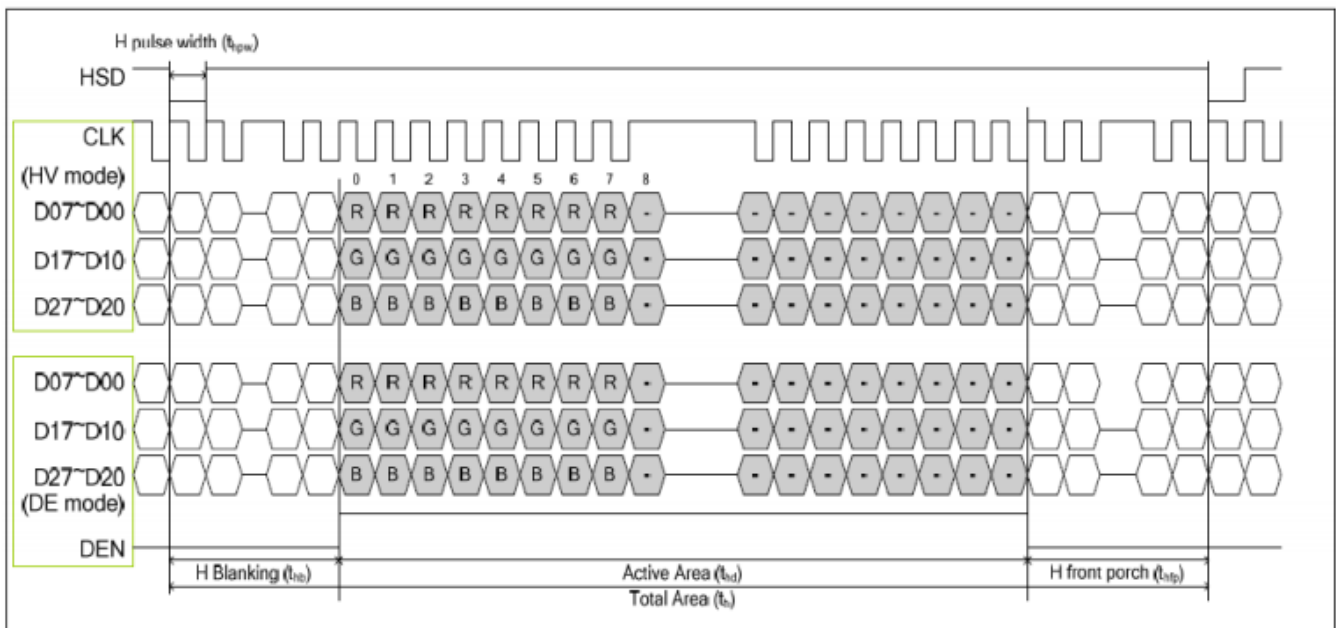


### 4.3.2 Data Input Format for TTL

#### Vertical input timing



Horizontal input timing



## 5 Optical Specifications

| Item of electro-optical characteristics | Symbol |   | Condition | Min | Typ | Max | Unit                  | Remark |
|-----------------------------------------|--------|---|-----------|-----|-----|-----|-----------------------|--------|
| Contrast ratio                          | CR     |   | Ø =0°     | 350 | 500 | --  |                       | Note1  |
| Surface Luminance                       | YL     |   | 180mA     | 490 | 550 | --  | Cd/<br>M <sup>2</sup> | Note1  |
| Color saturation                        | NTSC   |   | -         | --  | 50  | --  | %                     |        |
| Response time                           | Ton    |   | Ø =0°     | --  | 10  | 20  | ms                    | Note2  |
|                                         | Tof    |   |           | --  | 15  | 30  |                       |        |
| Viewing angle range                     | Ø =0°  |   | Top       | 50  | 60  | --  |                       | Note3  |
|                                         |        |   | Bottom    | 40  | 50  | --  |                       |        |
|                                         |        |   | Left      | 60  | 70  | --  |                       |        |
|                                         |        |   | Right     | 60  | 70  | --  |                       |        |
| Module Chromaticity<br>CIE(x,y)         | White  | x | Ø =0°     |     |     |     |                       | Note4  |
|                                         |        | y |           |     |     |     |                       |        |
|                                         | Red    | x |           | --  |     | --  |                       |        |
|                                         |        | y |           | --  |     | --  |                       |        |
|                                         | Green  | x |           | --  |     | --  |                       |        |
|                                         |        | y |           | --  |     | --  |                       |        |
|                                         | Blue   | x |           | --  |     | --  |                       |        |
|                                         |        | y |           | --  |     | --  |                       |        |
| Transmittance                           | Trans  |   | --        |     |     | --  | %                     | Note5  |
| Cross talk                              | Ct     |   | --        | --  | --  |     | %                     | Note6  |

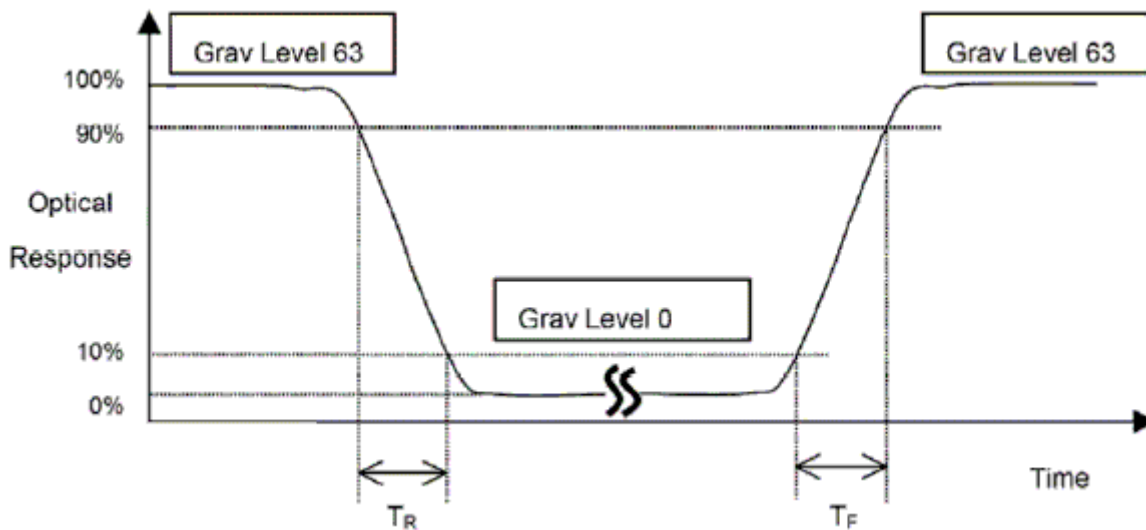
Notes(1) :1. All input terminals LCD panel must be ground while measuring the center area of the panel.

2. Contrast measurements shall be made at viewing angle of  $\varnothing = 0$  and at the center of the LCD surface. Luminance shall be measured with all pixels in the view field set first to white, then to the dark (black) state.

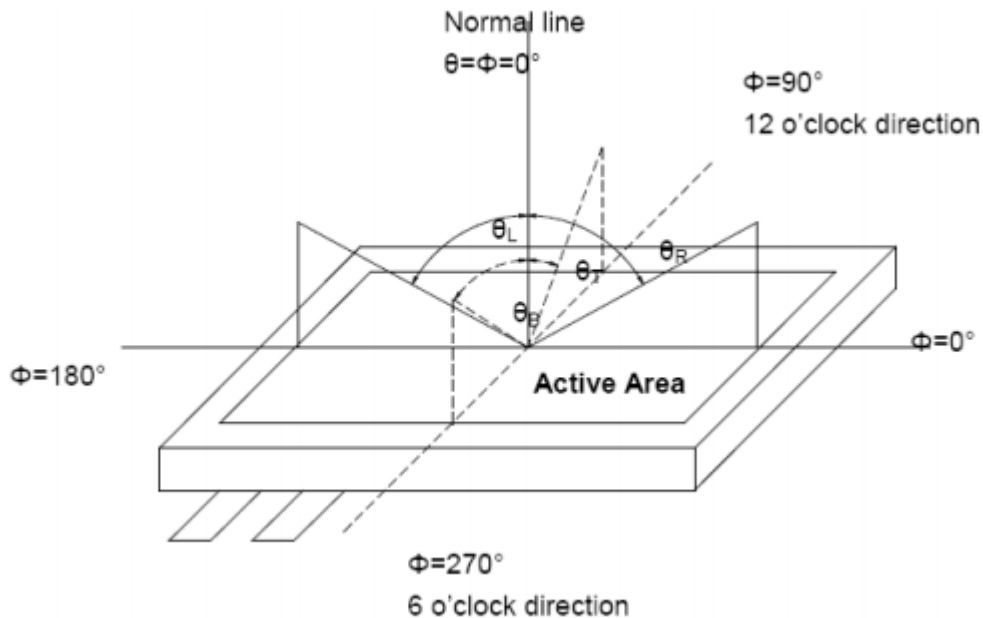
(see Figure 4) Luminance Contrast Ratio (CR) is defined mathematically

$$CR = \frac{\text{Luminance when displaying a white raster}}{\text{Luminance when displaying a black raster}}$$

Note (2) Definition of Response Time (TR, TF):



Note (3) Definition of viewing Angle:



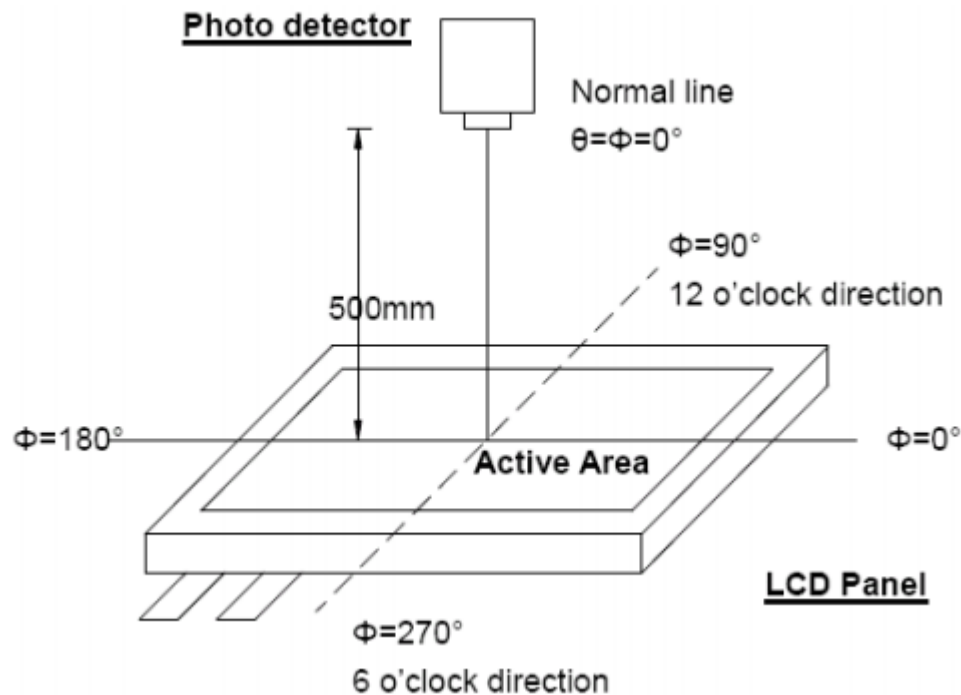
\*\*\* The above “Viewing Angle” is the measuring position with Largest Contrast Ratio; not for good image quality.

View Direction for good image quality is 6 O’clock. Module maker can increase the “Viewing Angle” by applying Wide View Film.

Note (4) Definition of optical measurement system.

The optical characteristics should be measured in dark room. 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.)





Note (5) Definition of Transmittance

Where LMOD defined as measured luminance at center point of MOD with "White" state

LBL defined as measured luminance at center point of Backlight Unit with same MOD. The

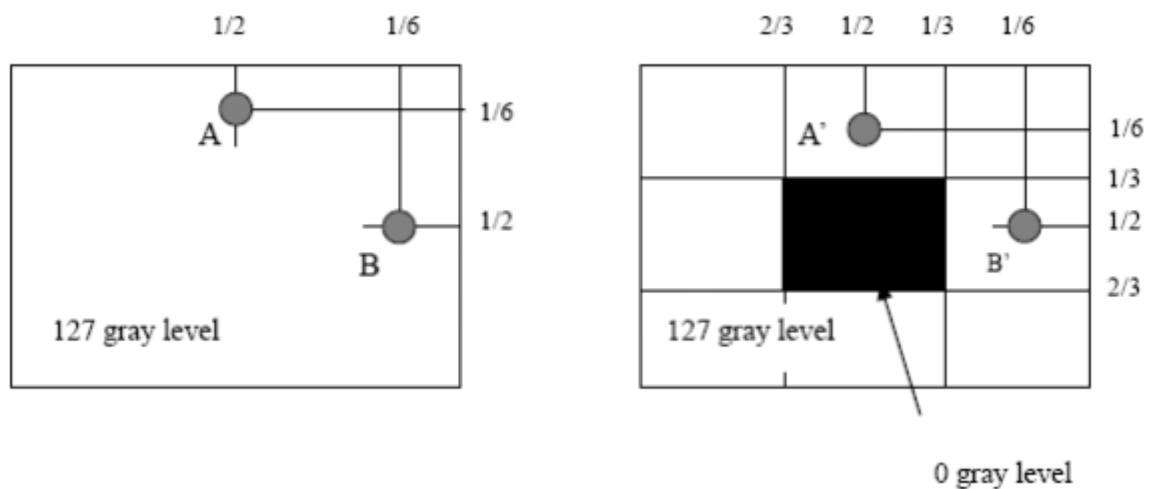
Backlight Unit has composite optical films, except "gain" characteristic optical films.

$$Tr\% = (LMOD / LBL) * 100\%$$

Note (5) Definition of crosstalk:

$|LA - LA'| / LA \times 100\% \leq 2\% \text{ max.}$ , LA and LA' are brightness at location A and A'

$|LB - LB'| / LB \times 100\% \leq 2\% \text{ max.}$ , LB and LB' are brightness at location B and B'



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## 6 Reliability Test Items

| NO. | Test Item               | Test Condition | Check Time |
|-----|-------------------------|----------------|------------|
| 1   | High temp storage       | T=80           | 240hrs     |
| 2   | Low temp storage        | T=-30          | 240hrs     |
| 3   | High temp operation     | T=70           | 240hrs     |
| 4   | Low temp operation      | T= -20         | 240hrs     |
| 5   | High temp&high humidity | T=50 H=90%     | 240hrs     |

### Reliability Test Criteria:

Display function should be no change under normal operating condition.

## 7. Handling Precautions

### 7.1 Safety

The liquid crystal in the LCD is poisonous. Keep away from your mouth and eyes. If the liquid crystal contacts with your skin, mouse or clothes, use soap to wash it off immediately.

### 7.2 Handling

- i. The LCD panel is made by thin glass. Prevent the panel from mechanical shock or putting excessive force on its surface.
- ii. The polarizer attached on the display is very easy to be damaged, handle it with special attention.
- iii. To avoid contamination on the display surface, do not touch the display surface with bare hands.
- iv. The transparent electrodes may be disconnected if you use the LCD panel under dew-condensing environment.
- v. The characteristics of the semiconductor devices may be affected when they are exposed to light, possibly resulting in malfunctioning of the ICs. To prevent such malfunctioning of the ICs, make sure the application and the mounting of the panel are designed so that the IC is not exposed to light.

### 7.3 Static Electricity

Ground soldering iron tips, tools and testers when you operate. Also ground your body when handling the products and store the products in an anti-electrostatic container.

### 7.4 Storage

Store the products in a dark place where the temperature is within the range of  $25\pm 10$  and with low humidity (65%RH or less). Do not store the LCD product in an atmosphere containing organic solvents or corrosive gases.

### 7.5 Cleaning

Do not wipe the polarizer with dry cloth, as it might cause scratching. Wipe the polarizer with a soft cloth soaked with petroleum IPA. Other chemical might damage the panel.