

# **TFT LCD Module**

## **Product Specification**

**DT070BTFT**

**7.0" (1024(RGB) x 600 DOTS) TFT Module**

June 11, 2015

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**Revision Record**

| <b>REV</b>                    | <b>CHANGES</b> | <b>DATE</b>  |
|-------------------------------|----------------|--------------|
| 0.0<br>(Ref. 1.1<br>20140630) | First release  | Jun 11, 2015 |
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## Table of Content

|                                                     |           |
|-----------------------------------------------------|-----------|
| <b>Revision Record .....</b>                        | <b>0</b>  |
| <b>1. Scope.....</b>                                | <b>3</b>  |
| <b>2. Application .....</b>                         | <b>3</b>  |
| <b>3. General Information.....</b>                  | <b>3</b>  |
| <b>4. Outline Drawing .....</b>                     | <b>4</b>  |
| <b>5. Interface Signals .....</b>                   | <b>5</b>  |
| <b>6. Absolute Maximum Ratings .....</b>            | <b>6</b>  |
| 6.1 Electrical absolute maximum ratings.....        | 6         |
| 6.2 Environment conditions .....                    | 6         |
| <b>7. Electrical Specifications.....</b>            | <b>6</b>  |
| 7.1 Electrical characteristics .....                | 6         |
| 7.2 LED backlight.....                              | 6         |
| <b>8. Command / AC Timing.....</b>                  | <b>7</b>  |
| 8.1 Timing Characteristics of Input Signals .....   | 7         |
| 8.2 Timing Sequence (Timing Chart).....             | 7         |
| 8.3 Power ON/Off Sequence .....                     | 9         |
| <b>9. Optical Specification.....</b>                | <b>10</b> |
| <b>10. Environmental / Reliability Tests .....</b>  | <b>12</b> |
| <b>11. Precautions for Use of LCD Modules .....</b> | <b>13</b> |
| 11.1 Safety .....                                   | 13        |
| 11.2 Handling .....                                 | 13        |
| 11.3 Static electricity .....                       | 13        |
| 11.4 Storage .....                                  | 13        |
| 11.5 Cleaning.....                                  | 13        |
| 11.6 Cautions for installing and assembling.....    | 13        |

## 1. Scope

This data sheet is to introduce the specification of DT070BTFT, active matrix TFT module. It is composed of a color TFT-LCD panel, driver ICs, FPC and a backlight unit. The 7.0" display area contains 1024x3 (RGB) x 600 pixels.

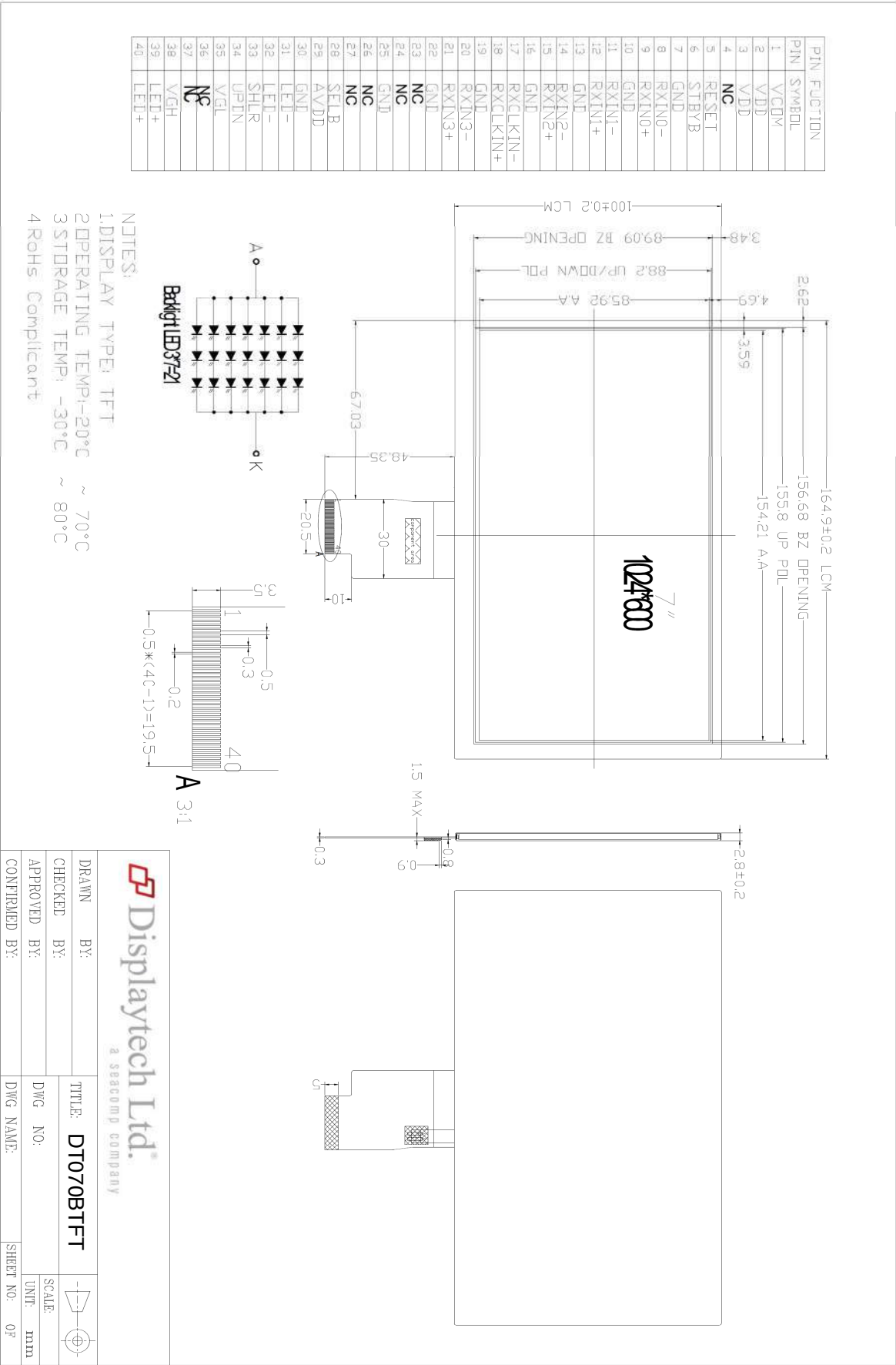
## 2. Application

Digital equipment which need color display, mobile navigator/video systems.

## 3. General Information

| Item                          | Contents                | Unit |
|-------------------------------|-------------------------|------|
| Size                          | 7.0                     | inch |
| Resolution                    | 1024x3(RGB) x 600       | /    |
| Interface                     | LVDS                    | /    |
| Technology Type               | IPS TFT                 | /    |
| Pixel Configuration           | R.G.B. Stripe           |      |
| Outline Dimension (W x H x D) | 164.9 x 100.0 x 2.8     | mm   |
| Active Area                   | 154.21 x 85.92          | mm   |
| Backlight Type                | LED                     | /    |
| Controller/ driver            | EK79001DCGB/EK73217ACGA |      |

4. Outline Drawing



## 5. Interface Signals

| No | Symbol   | Description                                                                             | Remark |
|----|----------|-----------------------------------------------------------------------------------------|--------|
| 1  | VCOM     | Common voltage                                                                          |        |
| 2  | VDD      | Power supply                                                                            |        |
| 3  | VDD      | Power supply                                                                            |        |
| 4  | NC       | No connection                                                                           |        |
| 5  | RESET    | Global reset pin                                                                        |        |
| 6  | STBYB    | Standby mode                                                                            |        |
| 7  | GND      | Power Ground                                                                            |        |
| 8  | RXIN0-   | Differential Data Input, CH0 (Negative)                                                 |        |
| 9  | RXIN0+   | Differential Data Input, CH0 (Positive)                                                 |        |
| 10 | GND      | Power Ground                                                                            |        |
| 11 | RXIN1-   | Differential Data Input, CH1 (Negative)                                                 |        |
| 12 | RXIN1+   | Differential Data Input, CH1 (Positive)                                                 |        |
| 13 | GND      | Power Ground                                                                            |        |
| 14 | RXIN2-   | Differential Data Input, CH2 (Negative)                                                 |        |
| 15 | RXIN2+   | Differential Data Input, CH2 (Positive)                                                 |        |
| 16 | GND      | Power Ground                                                                            |        |
| 17 | RXCLKIN- | Differential Clock Input (Negative)                                                     |        |
| 18 | RXCLKIN+ | Differential Clock Input (Positive)                                                     |        |
| 19 | GND      | Power Ground                                                                            |        |
| 20 | RXIN3-   | Differential Data Input, CH3 (Negative)                                                 |        |
| 21 | RXIN3+   | Differential Data Input, CH3 (Positive)                                                 |        |
| 22 | GND      | Power Ground                                                                            |        |
| 23 | NC       | No connection                                                                           |        |
| 24 | NC       | No connection                                                                           |        |
| 25 | GND      | Power Ground                                                                            |        |
| 26 | NC       | No connection                                                                           |        |
| 27 | NC       | No connection                                                                           |        |
| 28 | SELB     | In LVDS interface connected HSD to FPC for Pin Setting<br>HSD="L":8 bit ; HSD="H":6 bit |        |
| 29 | AVDD     | Power supply for analog circuits                                                        |        |
| 30 | GND      | Power Ground                                                                            |        |
| 31 | LED-     | Power for LED backlight (Cathode)                                                       |        |
| 32 | LED-     | Power for LED backlight (Cathode)                                                       |        |
| 33 | SHLR     | Source Right or Left sequence control. Normally pull high.                              | Note   |
| 34 | UPDN     | Gate Up or Down scan control. Normally pull low                                         | Note   |
| 35 | VGL      | Gate OFF Voltage                                                                        |        |
| 36 | NC       | No connection                                                                           |        |
| 37 | NC       | No connection                                                                           |        |
| 38 | VGH      | Gate ON Voltage                                                                         |        |
| 39 | LED+     | Power for LED backlight (Cathode)                                                       |        |
| 40 | LED+     | Power for LED backlight (Cathode)                                                       |        |

Note:

| UPDN | SHLR | Function                                   |
|------|------|--------------------------------------------|
| 0    | 1    | Normal Display                             |
| 0    | 0    | Inverse Left and Right                     |
| 1    | 1    | Inverse Up and Down                        |
| 1    | 0    | Inverse Left and Right Inverse Up and Down |

## 6. Absolute Maximum Ratings

### 6.1 Electrical absolute maximum ratings

| Parameter                           | Symbol             | MIN  | MAX     | Unit | Remark |
|-------------------------------------|--------------------|------|---------|------|--------|
| Power Supply Voltage                | VDD                | -0.3 | 5.0     | V    |        |
|                                     | AVDD               | -0.5 | 15.0    | V    |        |
|                                     | VGH                | -0.3 | 40.0    | V    |        |
|                                     | VGL                | -20  | 0.3     | V    |        |
| Logic Signal Input / Output Voltage | V <sub>IOVCC</sub> | -0.3 | VDD+0.5 | V    |        |
| Current of LED                      | I <sub>LED</sub>   | 0    | 175     | mA   |        |

Notes:

1. If the module is above these absolute maximum ratings. It may become permanently damaged. Using the module within the following electrical characteristic conditions are also exceeded, the module will malfunction and cause poor reliability.
2. Please be sure users are grounded when handing LCD Module.

### 6.2 Environment conditions

| Parameter             | Symbol | MIN | MAX | Unit | Remark |
|-----------------------|--------|-----|-----|------|--------|
| Operating Temperature | TOPR   | -20 | +70 | °C   |        |
| Storage Temperature   | TSTG   | -30 | +80 | °C   |        |

Notes:

1. The response time will become lower when operated at low temperature.
2. Background color changes slightly depending on ambient temperature.  
The phenomenon is reversible.
3. Ta≤40°C :85%RH MAX.  
Ta>40°C :Absolute humidity must be lower than the humidity of 85%RH at 40°C.

## 7. Electrical Specifications

### 7.1 Electrical characteristics

GND=0V, Ta=25°C

| Item                | Symbol            | MIN             | TYP    | MAX  | Unit   | Remark   |
|---------------------|-------------------|-----------------|--------|------|--------|----------|
| Power Supply        | VDD               | 2.6             | 3.3    | 3.6  | V      |          |
|                     | VCOM              | 2.85            |        | 3.45 | V      |          |
|                     | AVDD              | 9.4             | 9.6    | 9.8  | V      |          |
|                     | VGH               | 17              | 18     | 19   | V      |          |
|                     | VGL               | -6.6            | -6.0   | -5.4 | V      |          |
| Input Voltage       | H                 | V <sub>IH</sub> | 0.8VDD | ---  | VDD    | VDD=2.8V |
|                     | L                 | V <sub>IL</sub> | 0      | ---  | 0.2VDD |          |
| Current Consumption | I <sub>VDD</sub>  | ---             | 30     | 45   | mA     |          |
|                     | I <sub>AVDD</sub> | ---             | 35     | 45   | mA     |          |

### 7.2 LED backlight

Ta=25°C

| Item            | Symbol | MIN | TYP    | MAX | Unit | Remark |
|-----------------|--------|-----|--------|-----|------|--------|
| Forward current | IL     | --- | 140    | --- | mA   |        |
| Forward voltage | VL     | --- | 9.6    | --- | V    | Note 1 |
| LED life time   | ---    | --- | 25,000 | --- | Hr   | Note 2 |

Note 1: The LED Supply Voltage is defined by the number of LED at Ta=25°C and IL=140mA.

Note 2: The "LED life time" is defined as the module brightness decrease to 50% original brightness at Ta=25°C and IL=140mA. The LED lifetime could be decreased if operation IL is larger than 140mA.

Note 3: LED power consumption is around 0.297W.

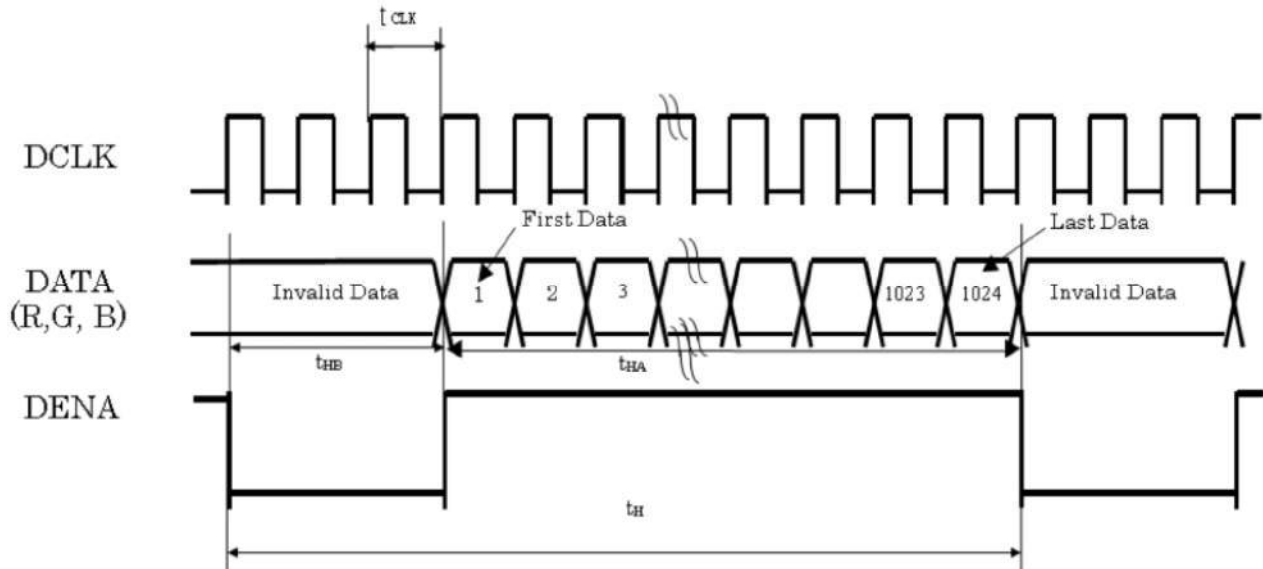
## 8. Command / AC Timing

### 8.1 Timing Characteristics of Input Signals

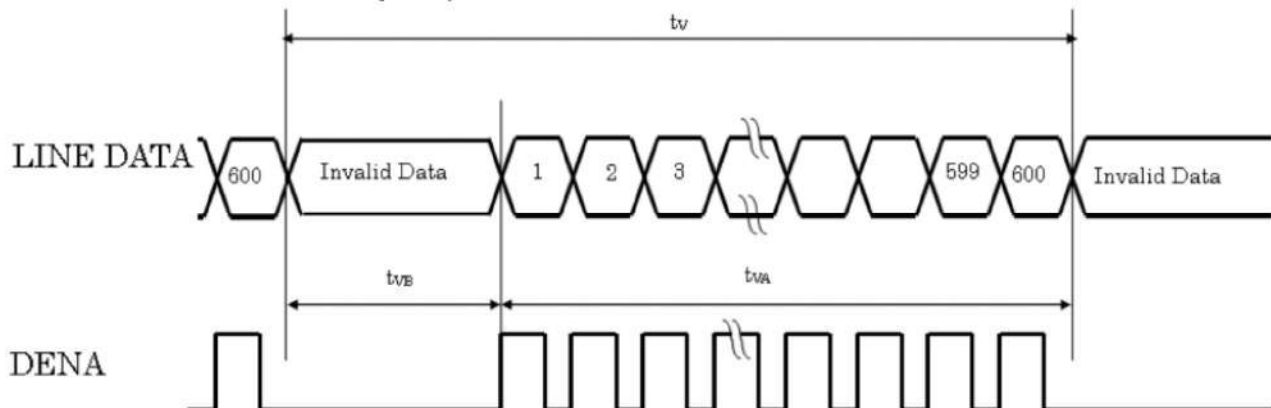
| ITEM                                                    |               |            |                           | SYMBOL          | MIN  | TYP  | MAX  | UNIT           |
|---------------------------------------------------------|---------------|------------|---------------------------|-----------------|------|------|------|----------------|
| LVDS Input Signal Sequence                              | CLK Frequency |            |                           | tclk            | 45   | 51.2 | 57   | MHz            |
| LCD Input Signal Sequence<br>( Input LVDS Transmitter ) | DENA          | Horizontal | Horizontal Total Time     | t <sub>H</sub>  | 1324 | 1344 | 1364 | tCLK           |
|                                                         |               |            | Horizontal Effective Time | t <sub>HA</sub> | 1024 |      |      | tCLK           |
|                                                         |               |            | Horizontal Blank Time     | t <sub>HB</sub> | 300  | 320  | 340  | tCLK           |
|                                                         |               | Vertical   | Vertical Total Time       | t <sub>V</sub>  | 625  | 635  | 645  | t <sub>H</sub> |
|                                                         |               |            | Vertical Effective Time   | t <sub>VA</sub> | 600  |      |      | t <sub>H</sub> |
|                                                         |               |            | Vertical Blank Time       | t <sub>VB</sub> | 25   | 35   | 45   | t <sub>H</sub> |

### 8.2 Timing Sequence (Timing Chart)

#### 8.2.1. Horizontal Timing Sequence

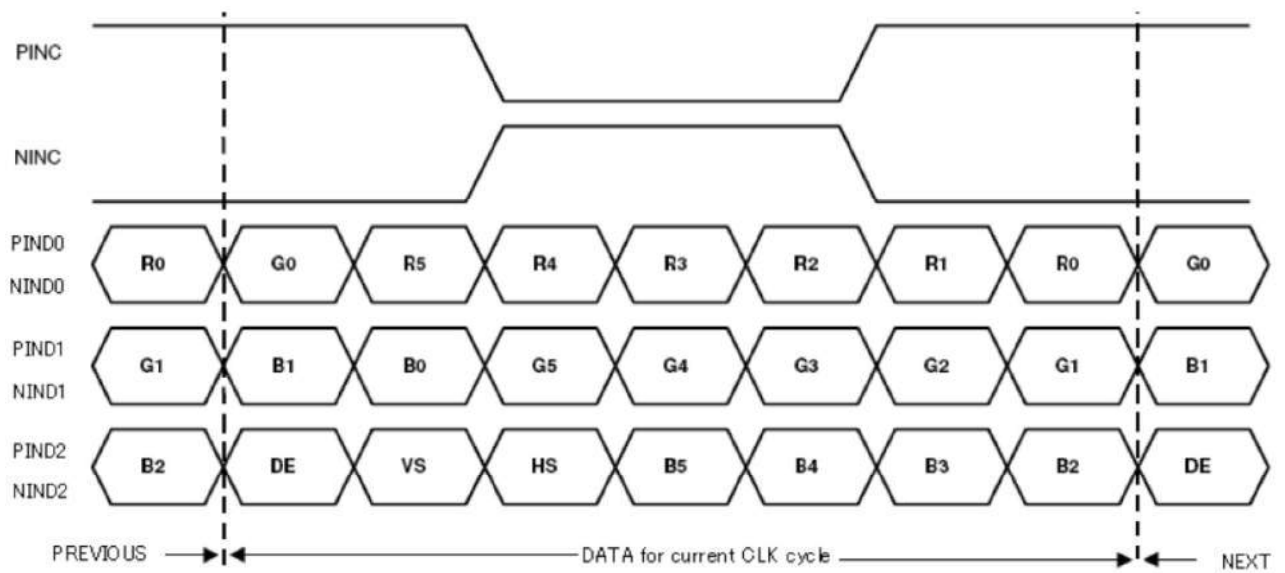


#### 8.2.2 Vertical Timing Sequence

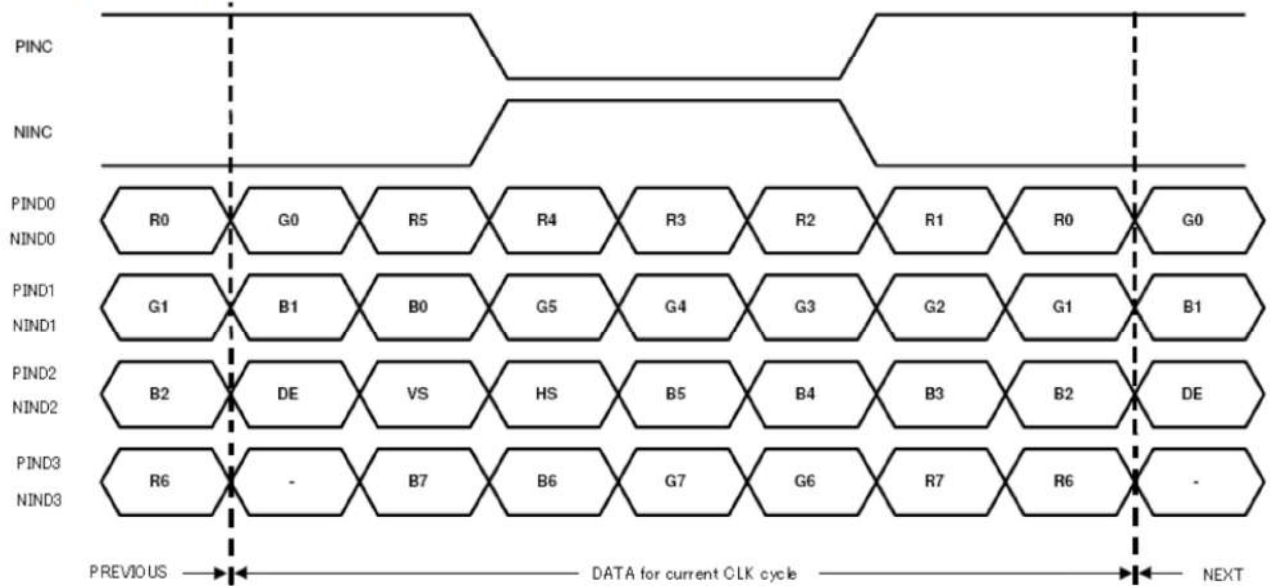


### 8.2.3 LVDS Input Data Mapping

#### 6bits LVDS Input



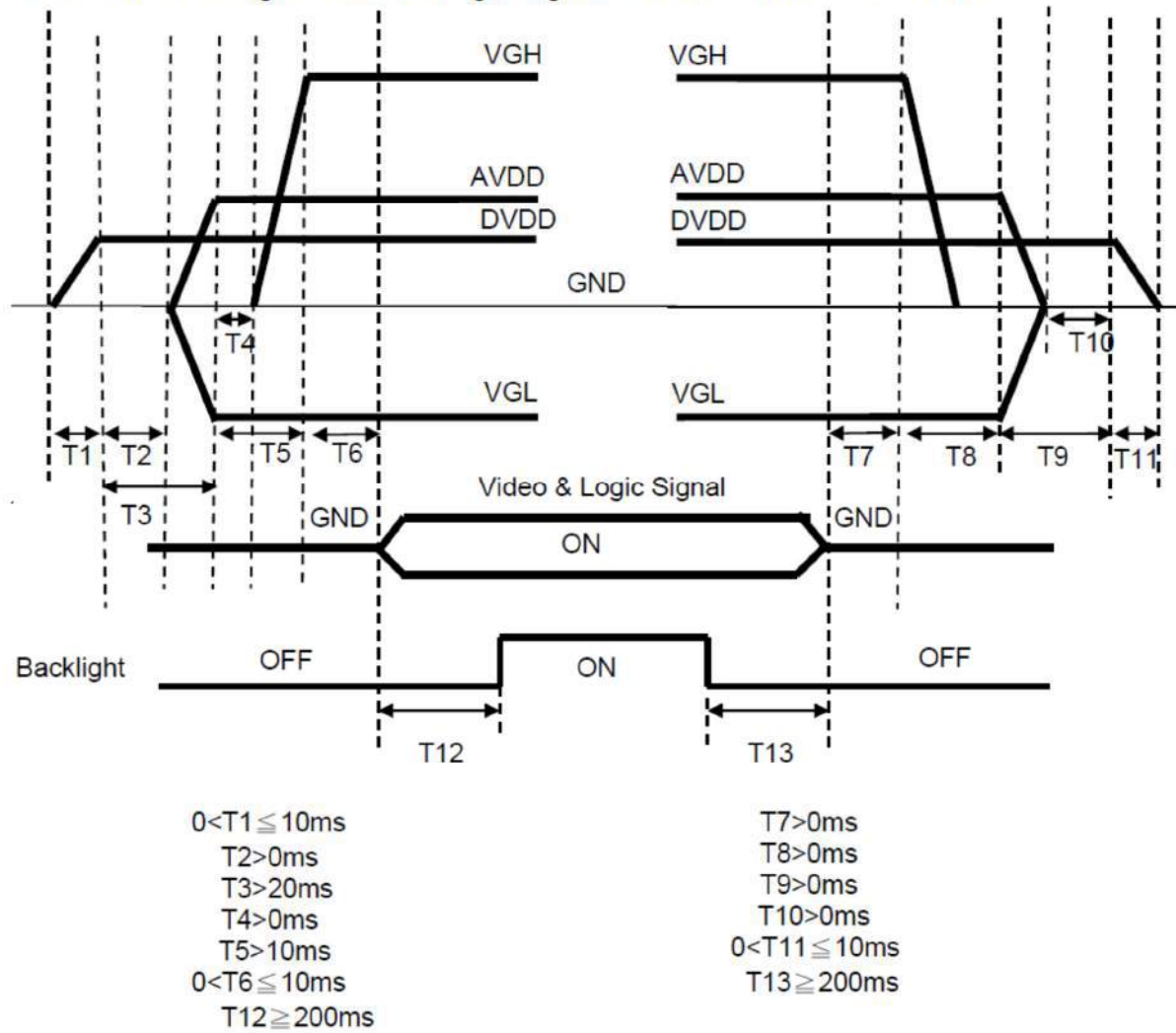
#### 8bits LVDS Input



### 8.3 Power ON/Off Sequence

Power On : DVDD→AVDD/VGL →VGH →Video & Logic Signal→Backlight

Power Off : Backlight→Video & Logic Signal→ VGH→AVDD/VGL→DVDD



## 9. Optical Specification

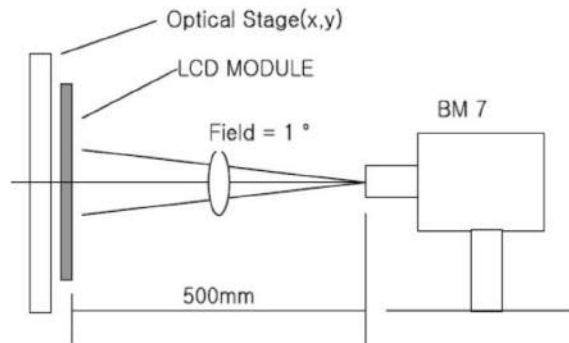
Ta=25°C

| Item           | Symbol     | Condition        | MIN        | TYP   | MAX        | Unit              | Remark    |
|----------------|------------|------------------|------------|-------|------------|-------------------|-----------|
| Contrast ratio | CR         | $\theta=0^\circ$ | ---        | 800   | ---        |                   | Note 1, 2 |
| Response time  | Tr+Tf      | 25°C             | ---        | 25    | ---        | ms                | Note 1, 3 |
| View angles    | $\theta T$ | $CR \geq 10$     | 80         | 85    | ---        | Degree            | Note 4    |
|                | $\theta B$ |                  | 80         | 85    | ---        |                   |           |
|                | $\theta L$ |                  | 80         | 85    | ---        |                   |           |
|                | $\theta R$ |                  | 80         | 85    | ---        |                   |           |
| Chromaticity   | White      | x                | Typ - 0.03 | 0.290 | Typ + 0.03 |                   | Note 1, 5 |
|                |            | y                |            | 0.331 |            |                   |           |
|                | Red        | x                |            | 0.632 |            |                   |           |
|                |            | y                |            | 0.311 |            |                   |           |
|                | Green      | x                |            | 0.297 |            |                   |           |
|                |            | y                |            | 0.536 |            |                   |           |
|                | Blue       | x                |            | 0.140 |            |                   |           |
|                |            | y                |            | 0.154 |            |                   |           |
| Luminance      | L          |                  | 220        | 250   | ---        | cd/m <sup>2</sup> | Note 1, 6 |
| Uniformity     | U          |                  | 80         | 90    | ---        | %                 | Note 1, 7 |

Note 1: Definition of optical measurement system.

Temperature = 25°C (±3°C)

LED back-light: ON, Environment brightness < 150 lx

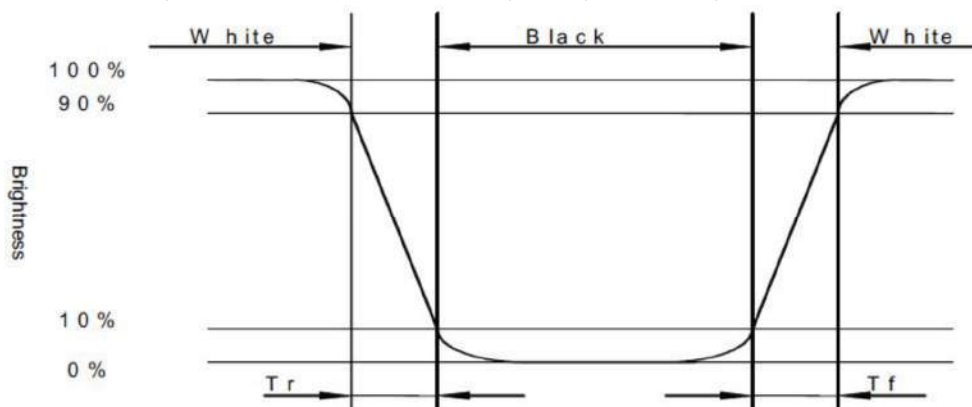


Note 2: Contrast ratio is defined as follow:

$$\text{Contrast Ratio} = \frac{\text{Surface Luminance with all white pixels}}{\text{Surface Luminance with all black pixels}}$$

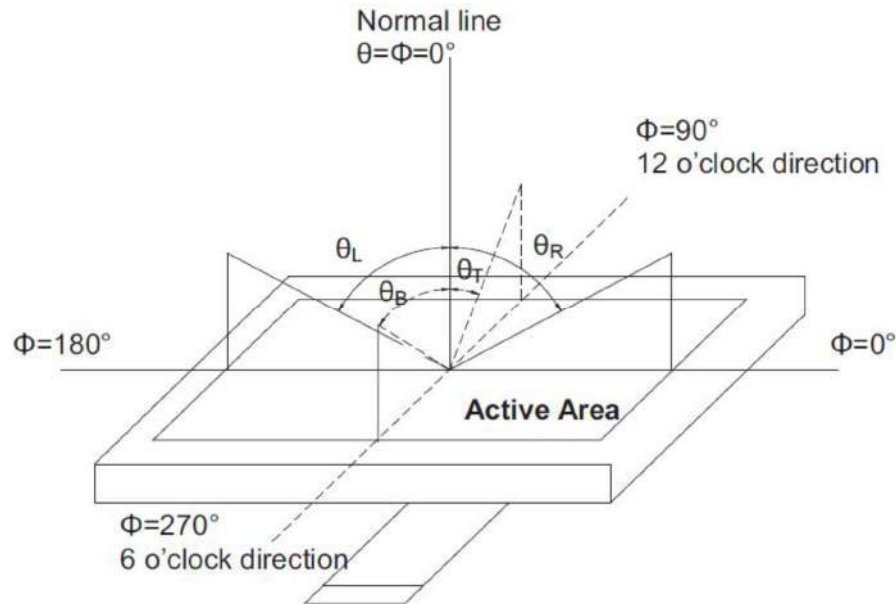
Note 3: Response time is defined as follow:

Response time is the time required for the display to transition from black to white (Rise time, Tr) and from white to black (Decay Time, Tf).



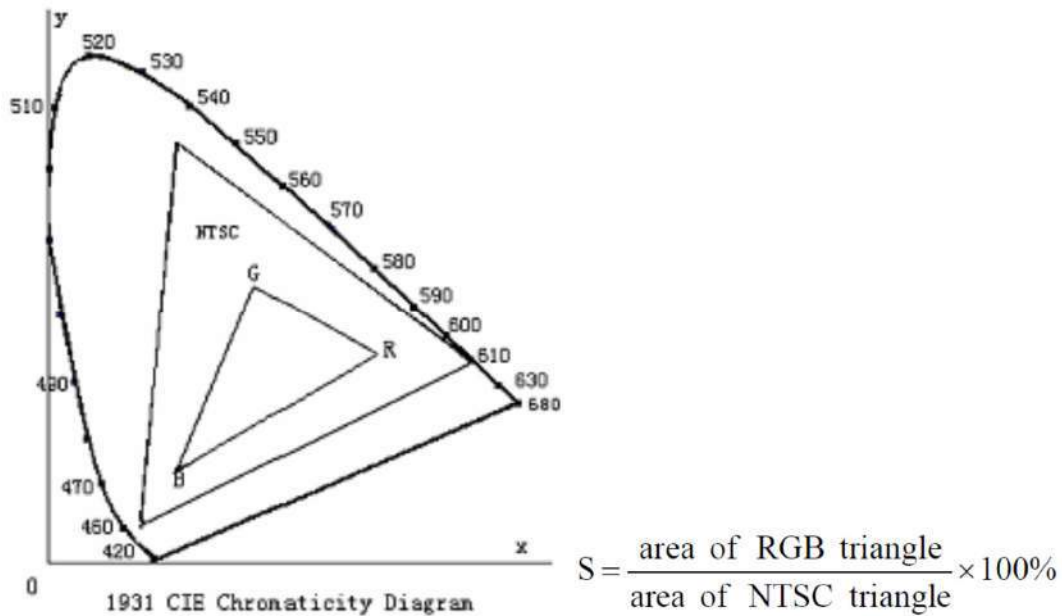
Note 4: Viewing angle range is defined as follow:

Viewing angle is measured at the center point of the LCD.



Note 5: Color chromaticity is defined as follow (CIE1931)

Color coordinates measured at center point of LCD.



Note 6: Luminance is defined as follow:

Luminance is defined as the brightness of all pixels “White” at the center of display area on optimum contrast.

Note 7: Luminance Uniformity is defined as follow:

Active area is divided into 9 measuring areas (Refer Fig.2). Every measuring point is placed at the center of each measuring area.

$$\text{Uniformity (U)} = \frac{\text{Minimum Luminance( brightness ) in 9 points}}{\text{Maximum Luminance( brightness ) in 9 points}}$$

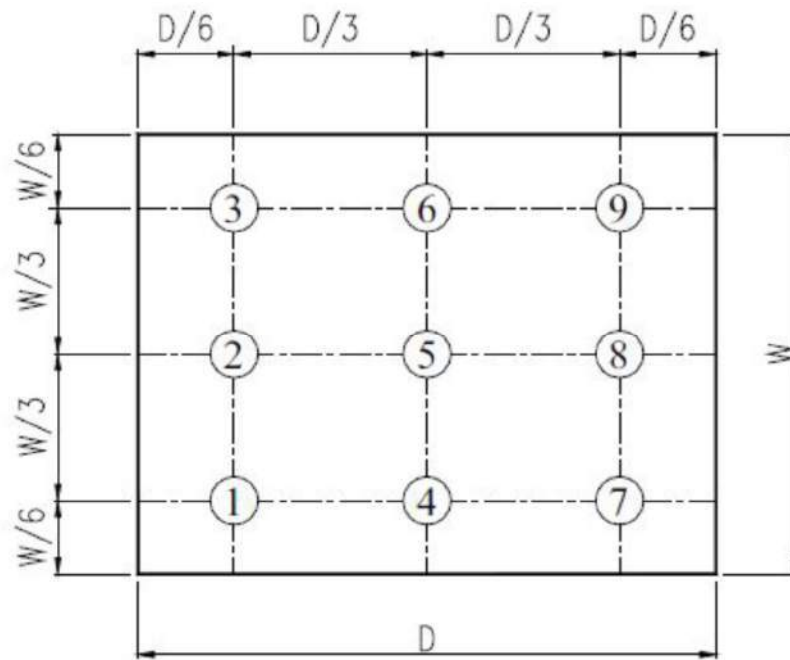


Fig. 2 Definition of uniformity

## 10. Environmental / Reliability Tests

| No | Test Item                         | Condition                                                 | Judgment Criteria                                     |
|----|-----------------------------------|-----------------------------------------------------------|-------------------------------------------------------|
| 1  | High Temp Operation               | Ta=+70°C, 96hrs                                           | Per table below                                       |
| 2  | Low Temp Operation                | Ta=-20°C, 96hrs                                           | Per table below                                       |
| 3  | High Temp Storage                 | Ta=+80°C, 96hrs                                           | Per table below                                       |
| 4  | Low Temp Storage                  | Ta=-30°C, 96hrs                                           | Per table below                                       |
| 5  | High Temp & High Humidity Storage | Ta=+60°C, 90% RH, 96hrs                                   | Per table below (polarizer discoloration is excluded) |
| 6  | Thermal Shock (Non-operation)     | -30°C 30 min ~ +80°C 30 min, Change time: 5 min, 5 cycles | Per table below                                       |
| 7  | ESD (Operation)                   | Air discharge: ±8KV, Contact discharge: ±4KV              | Per table below                                       |
| 8  | Vibration (Non-operation)         | 10Hz~150Hz, 100m/s <sup>2</sup> , 120min                  | Per table below                                       |
| 9  | Shock (Non-operation)             | Half- sine wave, 300m/s <sup>2</sup> , 11ms               | Per table below                                       |
| 10 | Package Drop Test                 | Height: 80cm, 1 corner, 3 edges, 6 surfaces               | Per table below                                       |

| Inspection             | Criterion (after test)                                                              |
|------------------------|-------------------------------------------------------------------------------------|
| Appearance             | No crack on the FPC, on the LCD panel                                               |
| Alignment of LCD panel | No bubbles in the LCD panel<br>No other defects of alignment in active area         |
| Electrical current     | Within device specifications                                                        |
| Function / Display     | No broken circuit, no short circuit or no black line<br>No other defects of display |

## 11. Precautions for Use of LCD Modules

### 11.1 Safety

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

### 11.2 Handling

- The LCD and touch panel is made of plate glass. Do not subject the panel to mechanical shock or to excessive force on its surface.
- Do not handle the product by holding the flexible pattern portion in order to assure the reliability.
- Transparency is an important factor for the touch panel. Please wear clear finger sacks, gloves and mask to protect the touch panel from finger print or stain and also hold the portion outside the view area when handling the touch panel.
- Provide a space so that the panel does not come into contact with other components.
- To protect the product from external force, put a covering lens (acrylic board or similar board) and keep an appropriate gap between them.
- Transparent electrodes may be disconnected if the panel is used under environmental conditions where dew condensation occurs.
- Property of semiconductor devices may be affected when they are exposed to light, possibly resulting in IC malfunctions.
- To prevent such IC malfunctions, your design and mounting layout shall be done in the way that the IC is not exposed to light in actual use.

### 11.3 Static electricity

- Ground soldering iron tips, tools and testers when they are in operation.
- Ground your body when handling the products.
- Power on the LCD module before applying the voltage to the input terminals.
- Do not apply voltage which exceeds the absolute maximum rating.
- Store the products in an anti-electrostatic bag or container.

### 11.4 Storage

- Store the products in a dark place at  $+25^{\circ}\text{C} \pm 10^{\circ}\text{C}$  with low humidity (40% RH to 60% RH). Don't expose to sunlight or fluorescent light.
- Storage in a clean environment, free from dust, active gas, and solvent.

### 11.5 Cleaning

- Do not wipe the touch panel with dry cloth, as it may cause scratch.
- Wipe off the stain on the product by using soft cloth moistened with ethanol. Do not allow ethanol to get in between the upper film and the bottom glass. It may cause peeling issue or defective operation. Do not use any organic solvent or detergent other than ethanol.

### 11.6 Cautions for installing and assembling

Bezel edge must be positioned in the area between the Active area and View area. The bezel may press the touch screen and cause activation if the edge touches the active area. A gap of approximately 0.5mm is needed between the bezel and the top electrode. It may cause unexpected activation if the gap is too narrow. There is a tolerance of 0.2 to 0.3mm for the outside dimensions of the touch panel and tail. A gap must be made to absorb the tolerance in the case and connector.

