

# INDUSTRIAL STRENGTH... Start Your Application From YOURITECH

Integration support

Obsolescence Management

PCAP

Embedded Systems

Human Machine Interface

Touch Solutions

Software

Quality Management

Open Frame Monitors

LCD Controller

Research & Development

Firmware

EMC tests

on-site service

Optical Bonding

In-house Manufacturing

Cover glass

System solutions

OEM Solutions

Custom Display

Production Custom designs Installation

Mechanical design



**MODEL NO : ET040HD02-T**

**MODEL VERSION: 01**

**SPEC VERSION : 1.0**

**ISSUED DATE: 2021-04-03**

☐ Preliminary Specification

☒ Final Product Specification

**Customer :** \_\_\_\_\_

| Approved by | Notes |
|-------------|-------|
|             |       |

**Youri Confirmation**

| Prepared by | Reviewed by | Approved by |
|-------------|-------------|-------------|
| John        | Johnny      | Wang        |

## **1. Introduction**

### **1.1 Scope of application**

LCD specification: Dots 720xRGBx720

As to basic specification of the driver IC, refer to the IC (NV3052CGRB) specification and data book.

All material & processing of the LCD module should be Lead Free.

### **1.2 TFT features:**

Structure: TFT PANNEL+IC +FPC+BL;

ALL Viewing Type LCD

720 dot-segment and 720 dot-common outputs;

16.7M Color can be selected by software;

White LED back light;

24bit RGB interface

### **1.3 Applications:**

## 2. LCM General specification

| ITEM              | Standard value               | Unit |
|-------------------|------------------------------|------|
| LCD Type          | Normally Black               | --   |
| Drive element     | TFT active matrix            | --   |
| Number of pixels  | 720*3RGB(H)X720(V)           | Dots |
| Pixel arrangement | RGB Vertical Stripe          | --   |
| Pixel Pitch (W*H) | 0.141H) X 0.141(V)           | mm   |
| Active area       | 101.52(H) x 101.52(V)        | mm   |
| Viewing direction | ALL O'CLOCK                  | -    |
| TFT Driver IC     | NV3052CGRB                   |      |
| TFT interface     | 24bit RGB                    | -    |
| Approx. Weight    | TBD                          | g    |
| LCM Size(W*H*T)   | 105.6(W) ×109.87(H) ×2.03(T) | mm   |
| Touch structure   | --                           |      |
| Touch Driver IC   | --                           | -    |
| Touch Interface   | --                           |      |



### 3. Absolute Maximum Rating

| Characteristics           | Symbol           | Min. | Max. | Unit |
|---------------------------|------------------|------|------|------|
| LCM Operating Temperature | T <sub>OPR</sub> | -20  | +60  | °C   |
| LCM Storage Temperature   | T <sub>STG</sub> | -30  | +70  | °C   |
| Humidity                  | RH               | -    | 90   | %    |

### 4. Electrical Characteristics

#### 4.1 TFT DC Characteristics

| Characteristics           | Symbol                | Min. | Typ. | Max. | Unit |
|---------------------------|-----------------------|------|------|------|------|
| Supply Voltage for I/O    | VDDIO                 | 1.65 | 1.8  | 3.3  | V    |
| Supply Voltage for(DC/DC) | VDD                   | 2.7  | 3.3  | 3.6  | V    |
| Current Consumption       | I <sub>DD</sub>       | --   | 100  | --   | mA   |
|                           | I <sub>DD-SLEEP</sub> | --   | 150  | --   | uA   |

#### 4.2 Back-Light Unit Characeristics

The back-light system is an edge-lighting type with 6 white LEDs. The characteristics of the back-light are shown in the following tables.

|                     |                |      |        |      |                   |        |
|---------------------|----------------|------|--------|------|-------------------|--------|
| Forward Voltage     | V <sub>F</sub> | 16.8 | --     | 19.2 | V                 | -      |
| Forward current     | I <sub>F</sub> | --   | 20     | -    | mA                | -      |
| Luminance(With LCD) | L <sub>V</sub> | TBD  |        | --   | cd/m <sup>2</sup> | -      |
| LED life time       | N/A            | ---- | 30,000 | --   | Hr                | Note 1 |
| Forward Voltage     | V <sub>F</sub> | 16.8 | --     | 19.2 | V                 | -      |

Note:

- (1) The “LED life time” is defined as the module brightness decrease to 50% of original brightness at I<sub>L</sub>=20mA/LED. The LED life time could be decreased if operating I<sub>L</sub> is larger than 25mA/LED.

Backlight circuit diagram shown in below:



## 5. Module Function Description

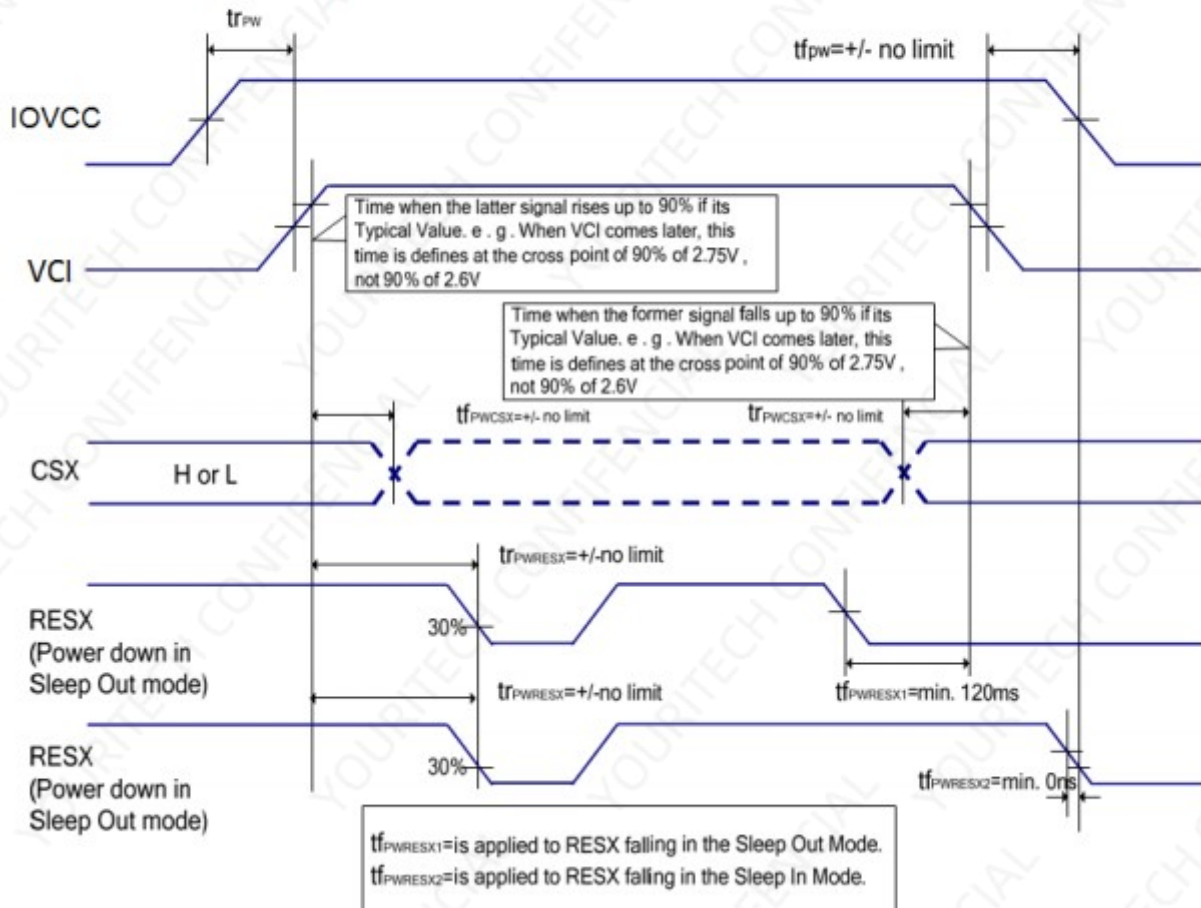
| Pin No. | Symbol    | LCM Functional                                        | Notes |
|---------|-----------|-------------------------------------------------------|-------|
| 1       | LEDA      | Power supply for backlight anode input terminal.      |       |
| 2       | LEDK      | Power supply for backlight cathode input terminal.    |       |
| 3       | VCC(3.3V) | Power Supply For LCD.                                 |       |
| 4       | GND       | Power Ground                                          |       |
| 5       | GND       | Power Ground                                          |       |
| 6       | DEN       | Data enable signal for RGB interface operation.       |       |
| 7       | VSYNC     | Frame synchronous signal for RGB interface operation. |       |
| 8       | HSYNC     | Line synchronous signal for RGB interface operation.  |       |
| 9       | CLK       | MIPI-DSI CLOCK differential signal input pins         |       |
| 10~17   | B7~B0     | Blue data                                             |       |
| 18~25   | G7~G0     | Green data                                            |       |
| 26~33   | R7~R0     | Red data                                              |       |
| 34      | RESET     | Reset pin. Setting either pin low initializes the LSI |       |
| 35      | CS        | Chip selection signal.                                |       |
| 36      | SCL       | Serial clock signal pin.                              |       |
| 37      | SDA       | Serial data input/output pin.                         |       |
| 38      | GND       | Power Ground                                          |       |
| 39      | VCC(3.3V) | Power Supply For LCD.                                 |       |
| 40      | GND       | Power Ground                                          |       |

## 6. Timing Characteristics

### Power On/Off Sequence

#### Case 1 – RESX line is held high or unstable by host at power on

If RESX line is held High or unstable by the host during Power On, then a Hardware Reset must be applied after both VCI and IOVCC have been applied – otherwise correct functionality is not guaranteed. There is no timing restriction upon this hardware reset.



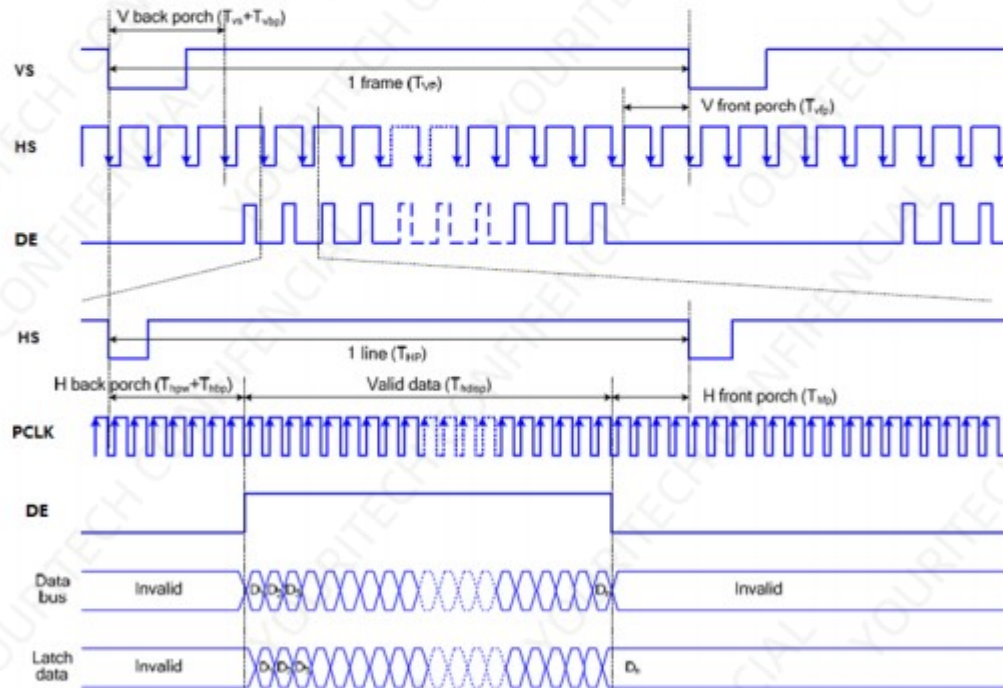
### 6.1.2 RGB Interface Mode Selection

NV3052CGRB supports two kinds of RGB interface, DE mode and SYNC mode. The table shown below uses command 23h to select RGB interface mode.

| sync_mode[1:0] | RGB Mode     |
|----------------|--------------|
| 00             | SYNC+DE mode |
| 01             | SYNC mode    |
| 10             | DE mode      |
| 11             | SYNC+DE mode |

### 6.1.3 RGB Interface Timing

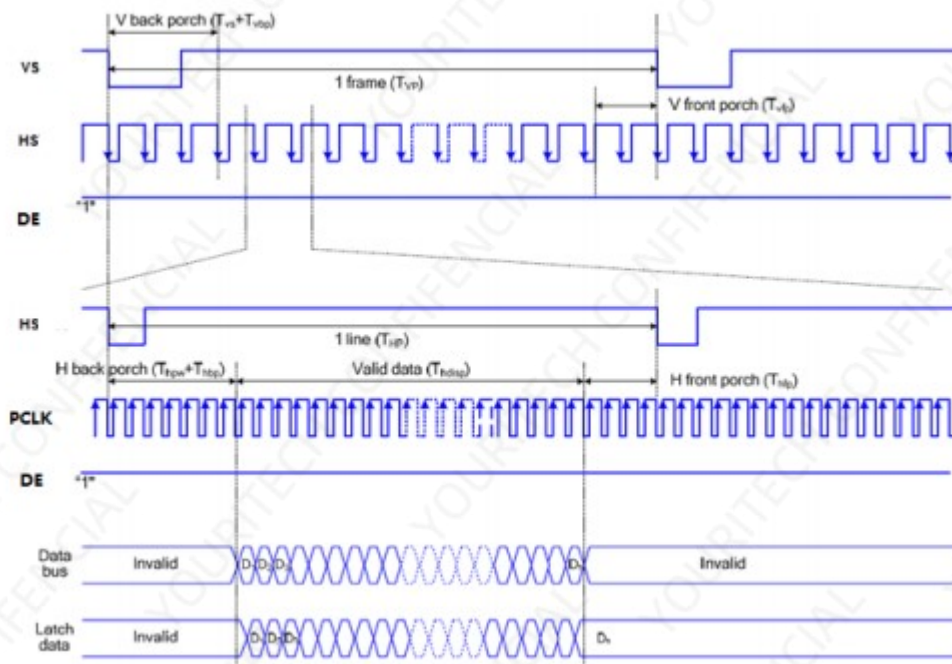
The timing chart of RGB interface DE mode is shown as follows.



Timing Chart of Signals in RGB Interface DE Mode

Note: The setting of front porch and back porch in host must match that in IC as this mode.

The timing chart of RGB interface SYNC mode is shown as follows.



Timing chart of RGB interface SYNC mode

Below Table provide the timing parameter by external Vertical-cycle

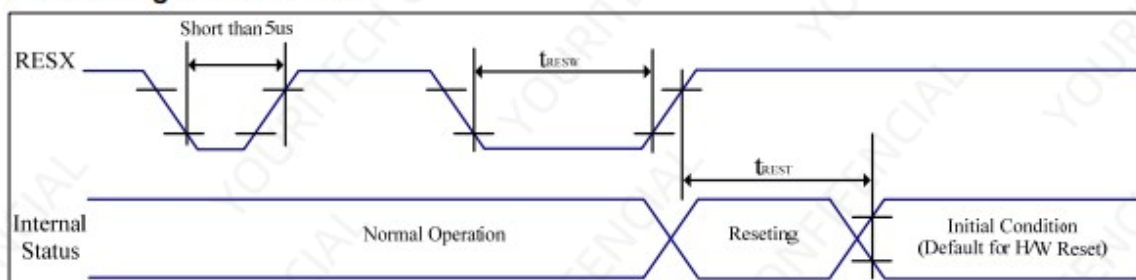
(Resolution for 720/640 horizontal x 1280 vertical display with Frame-Rate of 60Hz)

| Parameters                        | Symbols | Min. | Typ      | Max.   | Unit |
|-----------------------------------|---------|------|----------|--------|------|
| Horizontal Synchronization        | hpw     | -    | 2        | -      | PCLK |
| Horizontal Back Porch             | hbp     | -    | 42       | -      | PCLK |
| Horizontal Front Porch            | hfp     | -    | 44       | -      | PCLK |
| Hsync+ HBP+ HFP                   | -       | -    | 88*Note1 | -      | PCLK |
| Horizontal Address (Display area) | hdisp   | -    | 720      | -      | PCLK |
| Horizontal cycle                  | -       | -    | 12.703   | -      | us   |
| Vertical Synchronization          | VS      | -    | 2        | -      | Line |
| Vertical Back Porch               | vbp     | -    | 14       | -      | Line |
| Vertical Front Porch              | vfp     | -    | 16       | -      | Line |
| Vsync+ VBP+ VFP                   | -       | -    | 32       | -      | Line |
| Vertical Address (Display area)   | vdisp   | -    | 1280     | -      | Line |
| Vertical cycle                    | -       | -    | 16.66    | 16.181 | ms   |
| Frame-Rate                        | -       | -    | 60       | 61.8   | Hz   |

"-" means no limit.

Note : 1. If using Image Process Algorithm, Type value for H-blanking is minimum requirement.

### Reset timing characteristics



VSS=0V, IOVCC=1.65V to 3.6V, VCI=2.5V to 6.0V,  $T_a = -30^{\circ}\text{C}$  to  $70^{\circ}\text{C}$

| Symbol     | Parameter                 | Related Pins | MIN | TYP | MAX | Note                                     | Unit |
|------------|---------------------------|--------------|-----|-----|-----|------------------------------------------|------|
| $T_{resw}$ | *1) Reset low pulse width | RESX         | 10  | -   | -   | -                                        | us   |
| $T_{rest}$ | *2) Reset complete time   | -            | -   | -   | 5   | When reset applied during Sleep in mode  | ms   |
|            |                           | -            | -   | -   | 120 | When reset applied during Sleep out mode | ms   |

Table: Reset input timing

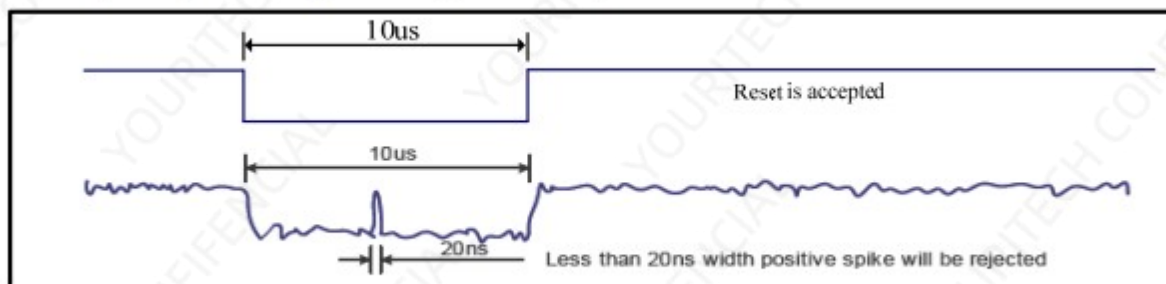
Note 1: Due to an electrostatic discharge on RESX line, spike does not cause irregular system reset according to the table below.

| RESX Pulse           | Action                                                             |
|----------------------|--------------------------------------------------------------------|
| Shorter than 5us     | Reset Rejected                                                     |
| Longer than 10us     | Reset                                                              |
| Between 5us and 10us | Reset starts<br>(It depends on voltage and temperature condition.) |

Note 2: During the resetting period, the display will be blanked (The display is entering blanking sequence, which maximum time is 120ms, when Reset Starts in Sleep Out mode. The display remains the blank state in Sleep In mode), then return to default condition for H/W reset.

Note 3: During Reset Complete Time, ID1/ID2/ID3 and VCOM value in OTP will be latched to internal register. After a rising edge of RESX, there is a H/W reset complete time ( $T_{rest}$ ) which lasted 5ms. The loading operation will be done every time during this reset.

Note 4: Spike Rejection also applies during a valid reset pulse as shown below:



Note 5: It is necessary to wait 5msec after releasing RESX before sending commands. Also Sleep Out command cannot be sent for 120 msec.

## 7. Optical Characteristics

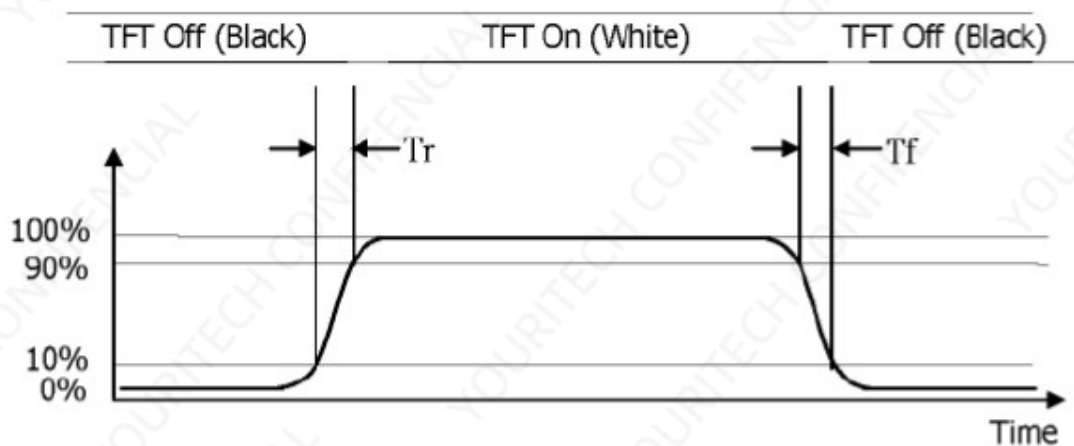
| Parameter                        |            | Symbol        | Condition                                                    | Min.  | Typ.  | Max.  | Unit | Remark                                         |
|----------------------------------|------------|---------------|--------------------------------------------------------------|-------|-------|-------|------|------------------------------------------------|
| Viewing Angle range              | Horizontal | $\Theta_3$    | CR > 10                                                      | 80    | 85    | -     | Deg. | Note 1                                         |
|                                  |            | $\Theta_9$    |                                                              | 80    | 85    | -     | Deg. |                                                |
|                                  | Vertical   | $\Theta_{12}$ |                                                              | 80    | 85    | -     | Deg. |                                                |
|                                  |            | $\Theta_6$    |                                                              | 80    | 85    | -     | Deg. |                                                |
| Luminance Contrast ratio         |            | CR            | $\Theta = 0^\circ$<br>(Center)<br>Normal<br>Viewing<br>Angle | 1000  | 1200  | -     |      | Note 2                                         |
| Transmittance (pol)              |            | T(%)          |                                                              | 4.55  | 5.35  | -     | %    | @Silicate<br>BLU<br>POL:HC+<br>Clear<br>Note 3 |
| White luminance uniformity       |            | $\Delta Y$    |                                                              |       |       |       | %    |                                                |
| White Chromaticity               |            | $x_w$         |                                                              | 0.262 | 0.292 | 0.322 |      | CF<br>@C Light<br>Note 4                       |
|                                  |            | $y_w$         |                                                              | 0.307 | 0.337 | 0.367 |      |                                                |
| Reproduction of color            | Red        | $x_R$         |                                                              | 0.620 | 0.650 | 0.680 |      |                                                |
|                                  |            | $y_R$         |                                                              | 0.292 | 0.322 | 0.352 |      |                                                |
|                                  | Green      | $x_G$         |                                                              | 0.250 | 0.280 | 0.310 |      |                                                |
|                                  |            | $y_G$         |                                                              | 0.533 | 0.563 | 0.593 |      |                                                |
|                                  | Blue       | $x_B$         |                                                              | 0.105 | 0.135 | 0.165 |      |                                                |
|                                  |            | $y_B$         |                                                              | 0.111 | 0.141 | 0.171 |      |                                                |
| Response Time (Rising + Falling) |            | $T_{RT}$      | Ta= 25° C<br>$\Theta = 0^\circ$                              | -     | 30    | 35    | ms   | Note 5                                         |

**Note :**

1. Viewing angle is the angle at which the contrast ratio is greater than 10. The viewing are determined for the horizontal or 3, 9 o'clock direction and the vertical or 6, 12 o'clock direction with respect to the optical axis which is normal to the LCD surface.
2. Contrast measurements shall be made at viewing angle of  $\theta = 0^\circ$  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 1 shown in Appendix) Luminance Contrast Ratio (CR) is defined mathematically.

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

3. Transmittance is the Value with Polarizer(HC+Clear) & silicate BLU (Film structure is on Table 4.1)
4. The color chromaticity coordinates specified in the above Table shall be calculated from the spectral data measured with all pixels first in red, green, blue and white. Measurements shall be made at the center of the panel.
5. The electro-optical response time measurements shall be made as **FIGURE 1** shown in Appendix. The times needed for the luminance to change from 10% to 90% is  $T_r$ , and 90% to 10% is  $T_f$ .



**Figure1 Response Time Testing**

## 8. Reliability Test Item

| No. | Test Item                              | Test Condition                                           | Notes                                                                                                                                                                                                                                   |
|-----|----------------------------------------|----------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1   | High Temp. Storage                     | +70°C / 96H                                              | 1. Functional test is OK.<br>Missing Segment, short,<br>unclear segment<br>non-display, display abnormally<br>and liquid crystal leakage<br>un-allowed.<br>2. No low<br>temperature bubbles, end seal<br>loose and fall, frame rainbow. |
| 2   | Low Temp. Storage                      | -30°C / 96H                                              |                                                                                                                                                                                                                                         |
| 3   | High Temp. Operating                   | +60°C / 96H                                              |                                                                                                                                                                                                                                         |
| 4   | Low Temp. Operating                    | -20°C / 96H                                              |                                                                                                                                                                                                                                         |
| 5   | High Temperature<br>/ Humidity storage | 50°C x 90%RH / 96H                                       |                                                                                                                                                                                                                                         |
| 6   | Thermal and cold shock                 | Static state, -20°C (30min) ~ 60°C<br>(30min), 50 cycles |                                                                                                                                                                                                                                         |

## 9. Packing Method----TBD

- END -