

**Display Elektronik GmbH**

# DATA SHEET

**TFT MODULE**

**DEM 320240I TMH-PW-N**

**(C1-TOUCH)**

**5,7“ TFT + PCT**

*Product Specification*

*Ver.: 0*

**25.11.2016**

Revise Records

Revise Records

| Rev. | Date       | Contents                  | Written | Approved |
|------|------------|---------------------------|---------|----------|
| 0    | 25.11.2016 | Preliminary Specification | MH      | MH       |
|      |            |                           |         |          |
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Special Notes

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**1. General Description and Features**

This 5,7" TFT is a transmissive type color active matrix TFT (Thin Film Transistor) liquid crystal display (LCD) that uses amorphous silicon TFT as a switching device. This model is composed of a TFT-LCD module, a driver circuit and a back-light unit. Graphics and texts can be displayed on a QVGA 320 (W) x 3 x 240 (H) dots with 16.7M colors by supplying 24 bits data signal (8bits/each color). The following table described the features:

**1.1 Features**

- Transmissive and Backlight with 450cd/m2.
- TN (Twisted Nematic) Mode.
- 8-Bits-MCU 8080-System Interface
- Projected Capacitive Touch Panel.
- RoHS Compliance

**1.2 LCD Module**

| Item               | Specification                                  | Unit     |
|--------------------|--|----------|
| Screen Size        | 5.7 Inches                                     | Diagonal |
| Display Resolution | 320 x RGB x 240                                | Pixel    |
| Active Area        | 115.20 x 86.40                                 | mm       |
| Display Mode       | Normally White Mode / Transmissive / Wide view | --       |
| Pixel Arrangement  | R,G,B Vertical Tripe                           | --       |
| Pixel Size         | 0.120 x 0.360                                  | Mm       |
| TFT Control IC     | SSD1963  | --       |
| Viewing Direction  | 12 o'clock                                     | --       |
| Input Interface    | 8-Bit-MCU i80-System Interface                 | --       |

**2. Mechanical Information**

| Item        | Min.           | Typ.  | Max.   | Unit | Note       |
|-------------|----------------|-------|--------|------|------------|
| Module Size | Horizontal (H) | --    | 144.00 | --   | mm (1,2,3) |
|             | Vertical (V)   | --    | 104.60 | --   | mm (2)     |
|             | Thickness (T)  | --    | 14.90  | --   | mm (1,3)   |
| Weight      | --             | (152) | --     | g    | --         |

Note (1) Not include FPC. Refer to the Outline Dimension Drawing as attached.

(2) Backlight unit is included.

(3) Excluding backlight cables.

3. Electrical Specifications

3.1 Absolute Max. Ratings

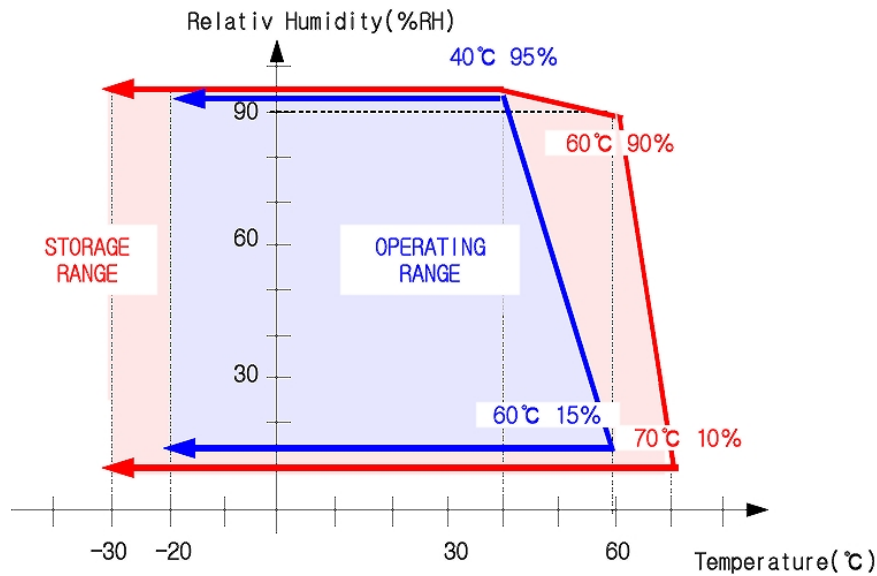
3.1.1 Absolute Ratings of Environment

If the operating condition exceeds the following absolute maximum ratings, the TFT LCD module may be damaged permanently.

(Ta=25±2°C, Vss=GND=0)

| Item                  | Symbol           | Min. | Max. | Unit | Note    |
|-----------------------|------------------|------|------|------|---------|
| Storage Temperature   | T <sub>STG</sub> | -30  | 80   | °C   | (1)     |
| Operating Temperature | T <sub>OPR</sub> | -20  | 70   | °C   | (1,2,3) |

Note (1) 95 % RH Max. ( 40°C ≥ Ta ). Maximum wet-bulb temperature at 39 °C or less.  
 (Ta > 40°C) No condensation.



Note (2) In case of below 0°C, the response time of liquid crystal (LC) becomes slower and the color of panel becomes darker than normal one. Level of retardation depends on temperature, because of LC's character

Note (3) Only operation is guaranteed at operating temperature. Contrast, response time, another display quality are evaluated at +25°C.

3.1.2 Electrical Absolute Maximum Ratings

(Vss=GND=0)

| Parameter            | Symbol          | Min. | Max. | Unit | Remark |
|----------------------|-----------------|------|------|------|--------|
| Power Supply Voltage | V <sub>CC</sub> | -0.3 | 5.0  | V    |        |

**3.2 Electrical Characteristics**

3.2.1 DC Electrical Characteristics of the TFT LCD

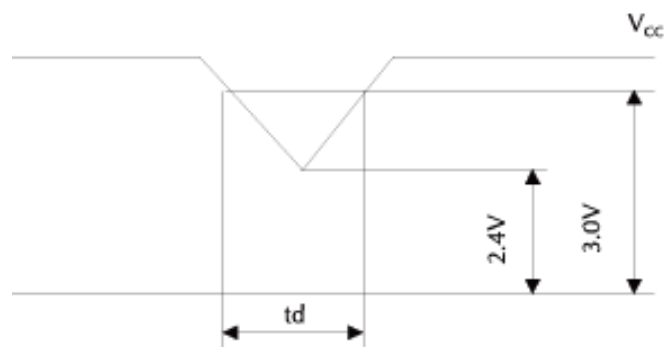
(Ta=25±2°C, Vss=GND=0)

| Item                    | Symbol  | Min.   | Typ. | Max.   | Unit | Remark |
|-------------------------|---------|--------|------|--------|------|--------|
| Power Supply            | VCC     | 3.0    | 3.3  | 3.6    | V    | Note 1 |
| Input Voltage for Logic | H Level | 0.7VCC | -    | VCC    | V    |        |
|                         | L Level | 0      | -    | 0.3VCC | V    |        |
| Power Supply Current    | ICC     |        | 120  | 160    | mA   | Note 2 |

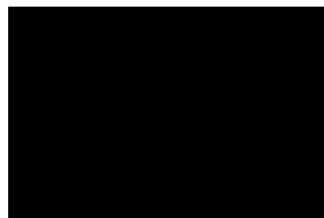
Note1: Vcc-dip conditions

Vcc-dip conditions should also follow the Vcc-turn-on conditions

Td ≤ 10ms



Note2: fv =60Hz, Ta=25°C, Display pattern : Black pattern



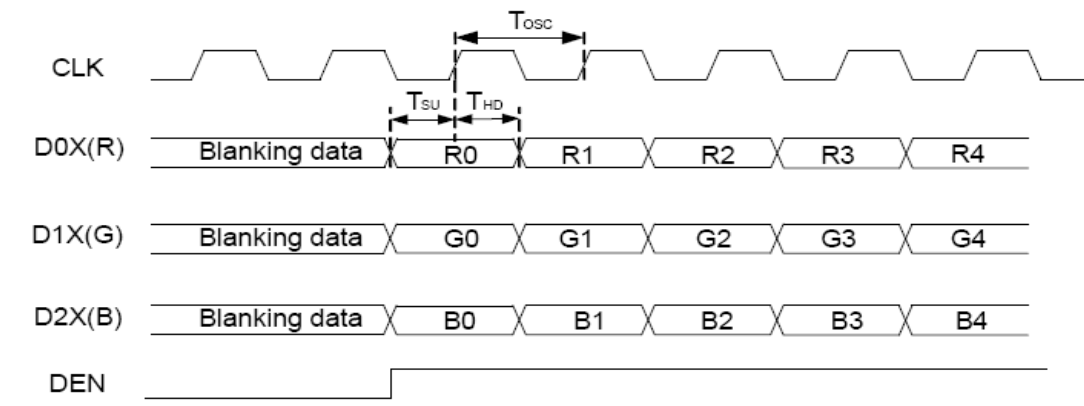
**3.3 AC Timing Characteristic**

## 3.3.1 Timing Condition

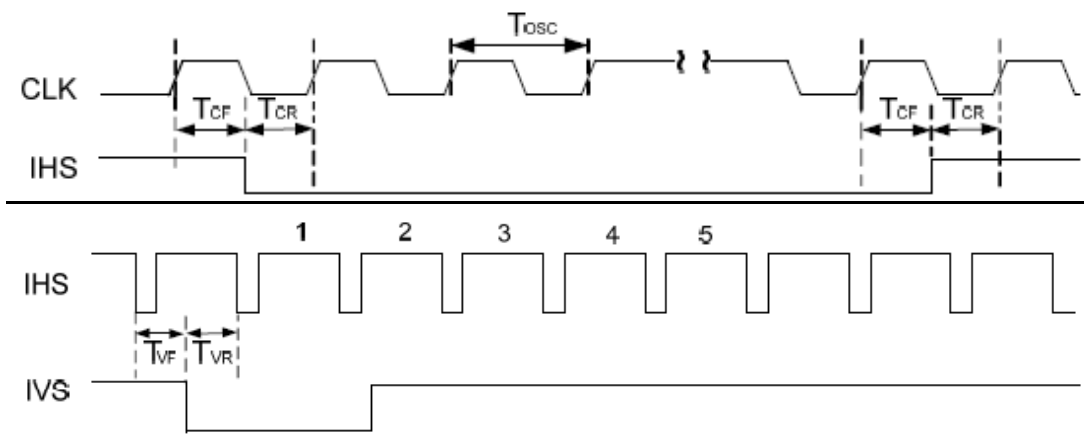
| Signal   | Parameter  | Symbol | Min. | Typ. | Max. | Unit. | Remark |  |
|--|--|--------|------|------|------|-------|--------|--|
| DCLK   | DCLK period                                      | TOSC   | -    | 156  | -    | ns    |        |  |
|  | Frequency  | FOSC   | -    | 6.4  | -    | MHz   |        |  |
| RGB DATA   | Data setup time                                  | TSU    | 12   | -    | -    | ns    |        |  |
|  | Data hold time                                   | THD    | 12   | -    | -    | ns    |        |  |
| Hsync  | Hsync period                                     | TH     | -    | 408  | -    | TOSC  |        |  |
|  | Hsync pulse width                                | THS    | 5    | 30   | -    | TOSC  |        |  |
|  | Back-Porch                                       | THB    |      | 38   |      | TOSC  |        |  |
|  | Front-Porch                                      | THF    |      | 20   |      | TOSC  |        |  |
|  | Hsync rising time(Setup)                         | TCr    | 12   | -    | -    | ns    |        |  |
|  | Hsync falling time(Hold)                         | TCf    | 12   | -    | -    | ns    |        |  |
| Vsync  | Vsync period                                     | NTSC   | -    | 262  | -    | TH    |        |  |
|  |  | PAL    | -    | 312  | -    | TH    |        |  |
|  | Vsync pulse width                                | TVS    | 1    | 3    | 5    | TH    |        |  |
|  | Back-Porch                                       | NTSC   | TVB  |      | 15   |       | TH     |  |
|  |  | PAL    |      |      | 23   |       | TH     |  |
|  | Display Period                                   | TVD    |      | 240  |      | TH    |        |  |
|  | Front Porch                                      | NTSC   | TVF  |      | 5    |       | TH     |  |
|  |  | PAL    |      |      | 46   |       | TH     |  |
|  | Vsync rising time(Setup)                         | TVr    | 12   | -    | -    | ns    |        |  |
|  | Vsync falling time(Hold)                         | TVf    | 12   | -    | -    | ns    |        |  |
|  | Vsync falling to Hsync rising time for odd field | THVO   | 1    | -    | -    | TOSC  |        |  |
| Vsync falling to Hsync falling time for even field | THVE   | 1      | -    | -    | TOSC |       |        |  |
| DEN  | Vsync-DEN time                                   | NTSC   | -    | 18   | -    | TH    |        |  |
|  |  | PAL    | -    | 26   | -    | TH    |        |  |
|  | Hsync-DEN time                                   | THE    | 36   | 68   | 88   | TOSC  |        |  |
|  | DEN plus width                                   | TEP    | -    | 320  | -    | TOSC  |        |  |

Note : If DEN is fixed to low, the SYNC mode is used. Otherwise DE mode is used. When SYNC mode is used, 1st data start from 68th CLK after H-sync falling

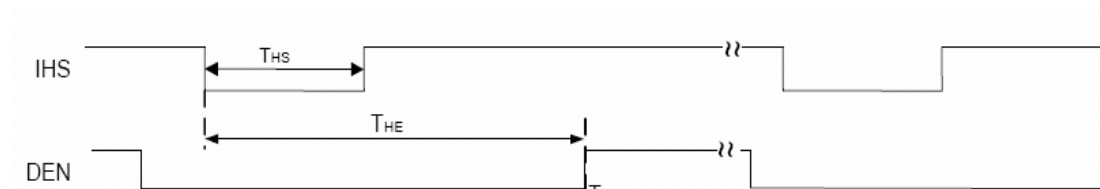
3.3.2 Clock and Data Waveform



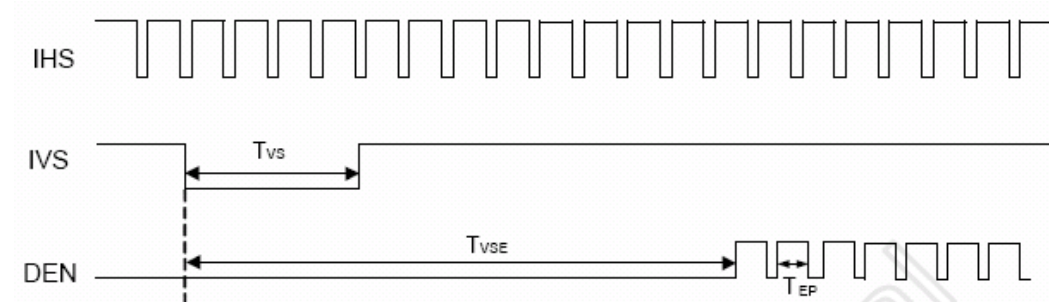
3.3.3 Clock and Sync waveforms



3.3.4 HS and horizontal control timing waveforms



3.3.5 HS and vertical control timing waveforms





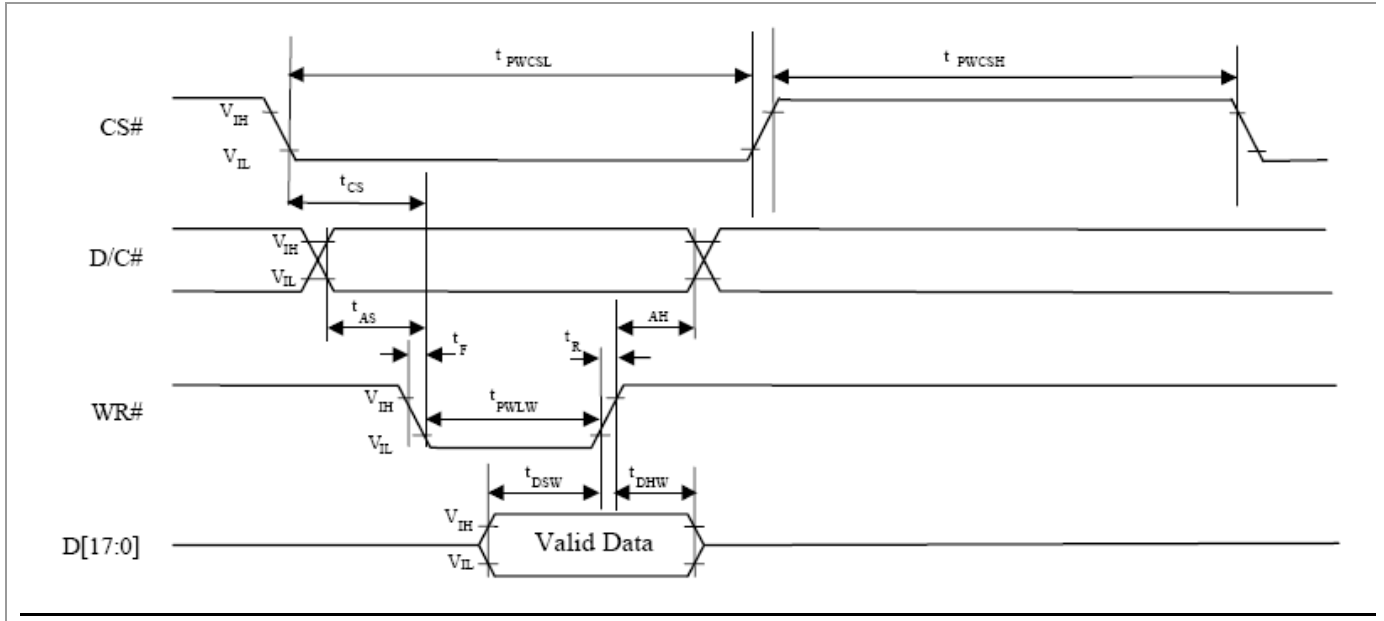
## 3.3.6 8080-series Interface Timing Condition

| Parameter                                       | Symbol | Min.     | Typ.          | Max. | Unit. | Remark |
|---|--------|----------|---------------|------|-------|--------|
| System Clock Frequency                          | fMCLK  | 1        | -             | 110  | MHz   | Note   |
| System Clock Period                             | tMCLK  | 1/ fMCLK | -             | -    | ns    | Note   |
| Control Pulse High Width Write                  | tpwchl | 13       | 1.5*<br>tMCLK | -    | ns    |        |
| Control Pulse High Width Read                   | tpwchl | 30       | 3.5*<br>tMCLK | -    | ns    |        |
| Control Pulse Low Width Write(next write cycle) | tpwchl | 13       | 1.5*<br>tMCLK | -    | ns    |        |
| Control Pulse Low Width Write(next read cycle)  | tpwchl | 80       | 9*<br>tMCLK   | -    | ns    |        |
| Control Pulse Low Width Read                    | tpwchl | 80       | 9*<br>tMCLK   | -    | ns    |        |
| Address Setup Time                              | tas    | 1        | -             | -    | ns    |        |
| Address Hold Time                               | tah    | 2        |               |      | ns    |        |
| Write Data Setup Time                           | tdsw   | 4        | -             | -    | ns    |        |
| Write Data Hold Time                            | tdhw   | 1        | -             | -    | ns    |        |
| Write Low Time                                  | tpwlw  | 12       | -             | -    | ns    |        |
| Read Data Hold Time                             | tdhr   | 1        | -             | -    | ns    |        |
| Address Time                                    | tacc   | 32       | -             | -    | ns    |        |
| Read Low Time                                   | tpelr  | 36       | -             | -    | ns    |        |
| Rise Time                                       | tr     | -        | -             | 0.5  | ns    |        |
| Fall Time                                       | tf     | -        | -             | 0.5  | ns    |        |
| Chip select setup time                          | tcs    | 2        | -             | -    | ns    |        |
| Chip select hold time to read signal            | tchsh  | 3        | -             | -    | ns    |        |

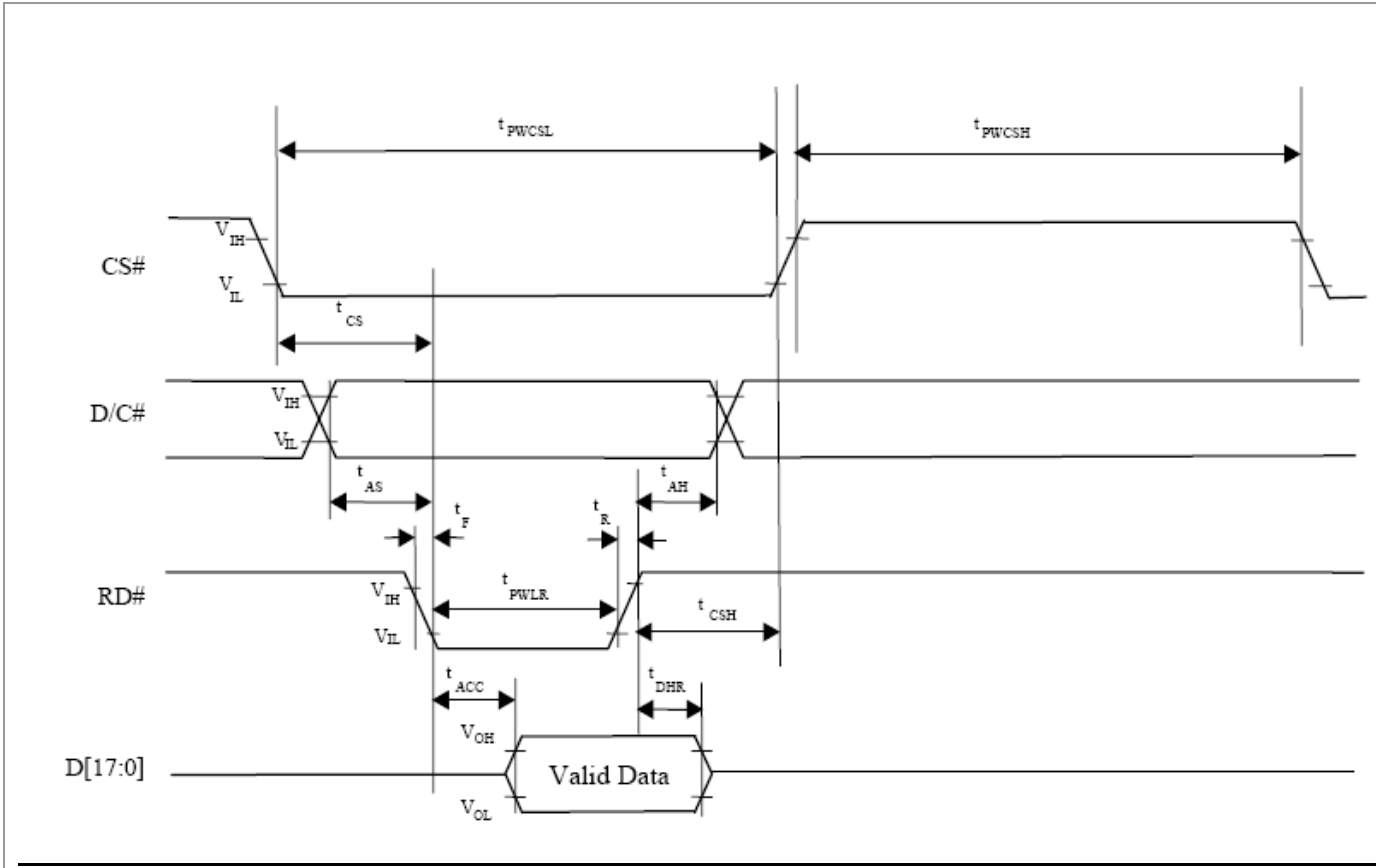
Note : System Clock Denotes external input clock(PLL-bypass) or internal generated clock(PLL-enabled)  
Reference input clock=10MHz.

About Command setting , Please refer to [SSD1963](#).

3.3.7 Parallel 8080-series Interface Timing Diagram(Write Cycle)



3.3.8 Parallel 8080-series Interface Timing Diagram(Read Cycle)



3.3.9 Mapping for writing an Pixel Data

| Interface | Cycle           | D[7] | D[6] | D[5] | D[4] | D[3] | D[2] | D[1] | D[0] |
|-----------|-----------------|------|------|------|------|------|------|------|------|
| 8 bits    | 1 <sup>st</sup> | R7   | R6   | R5   | R4   | R3   | R2   | R1   | R0   |
|           | 2 <sup>nd</sup> | G7   | G6   | G5   | G4   | G3   | G2   | G1   | G0   |
|           | 3 <sup>rd</sup> | B7   | B6   | B5   | B4   | B3   | B2   | B1   | B0   |

**3.4 Backlight Unit**

The Backlight system is an edge-lighting type with 21 white LED(Light Emitting Diode)s. The characteristics of 21white LEDs are shown in the following tables.

(Ta= Room Temp)

| Characteristics           |      | Symbol   | Min.    | Typ.   | Max.     | Unit | Note |
|---------------------------|------|----------|---------|--------|----------|------|------|
| Current of Backlight Unit |      | $I_B$    | -       | 60     | 75       | mA   | (1)  |
| Voltage of Backlight Unit |      | $V_B$    | -       | (23.1) | (24.5)   | V    |      |
| Power Consumption         |      | $P_{BL}$ | -       | (1386) | (1837.5) | mW   | (2)  |
| LED Lifetime              | 25°C | -        | (50000) | -      | -        | hr   | (3)  |

Note (1) LEDS in 7 series x 3 parallel type.

(2) Where  $I_B = 60\text{mA}$ ,  $V_B = 23.1$ ,  $P_{BL} = V_B \times I_B$

(3) The environmental conducted under ambient air flow, at  $T_a=25\pm 2^\circ\text{C}$ ,  $60\%\text{RH}\pm 5\%$

4. Optical Characteristics

4.1 Optical characteristic of the LCD

The following items are measured under stable conditions. The optical characteristics should be measured in a dark room or equivalent state with the methods shown in Note (1).

Measuring equipment: BM-5A, BM-7

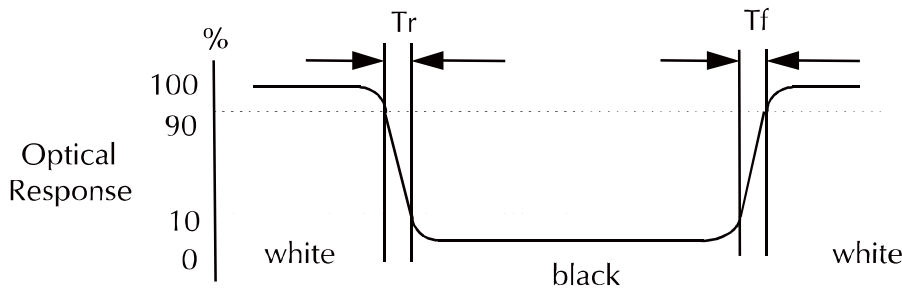
| Item                          | Symbol         | Condition                  | Min                       | Type  | Max   | Unit              | Note   |
|-------------------------------|----------------|----------------------------|---------------------------|-------|-------|-------------------|--------|
| Brightness                    |                |                            | 360                       | (450) | --    | cd/m <sup>2</sup> |        |
| Response Time                 | T <sub>r</sub> | θ=0°                       | -                         | 15    | 20    | ms                | .      |
|                               | T <sub>f</sub> |                            | --                        | 25    | 35    | ms                |        |
| Contrast Ratio                | CR             | At optimized viewing angle | 300                       | (450) | --    | --                |        |
| Color Gamut                   | NTSC %         | --                         | --                        | 50    | --    | %                 |        |
| Color Chromaticity (CIE 1931) | Red            | R <sub>x</sub>             | θ=0° Normal Viewing Angle | 0.610 | 0.640 | 0.670             | --     |
|                               |                | R <sub>y</sub>             |                           | 0.314 | 0.344 | 0.374             |        |
|                               | Green          | G <sub>x</sub>             |                           | 0.268 | 0.298 | 0.328             | --     |
|                               |                | G <sub>y</sub>             |                           | 0.553 | 0.583 | 0.613             |        |
|                               | Blue           | B <sub>x</sub>             |                           | 0.107 | 0.137 | 0.167             | --     |
|                               |                | B <sub>y</sub>             |                           | 0.139 | 0.159 | 0.179             |        |
|                               | White          | W <sub>x</sub>             |                           | 0.282 | 0.312 | 0.342             | --     |
|                               |                | W <sub>y</sub>             |                           | 0.309 | 0.339 | 0.369             |        |
| Viewing Angle (12H)           | Hor.           | θ <sub>R</sub>             | CR≥10                     | 55    | 65    | --                | Degree |
|                               |                | θ <sub>L</sub>             |                           | 55    | 65    | --                |        |
|                               | Ver.           | φ <sub>H</sub>             |                           | 55    | 65    | --                |        |
|                               |                | φ <sub>L</sub>             |                           | 40    | 50    | --                |        |

a. Test equipment setup

After stabilizing and leaving the panel alone shall be warmed up for the stable operation of LCM, the measurement should be executed. Measurement should be executed in a stable, windless, and dark room. Optical specifications are measured by Topcon BM-7(fast) with a viewing angle of 2° at a distance of 50cm and normal direction.

b. Definition of response time: Tr and Tf

The response time is defined as the following figure and shall be measured by switching the input signal for "black" and "white".

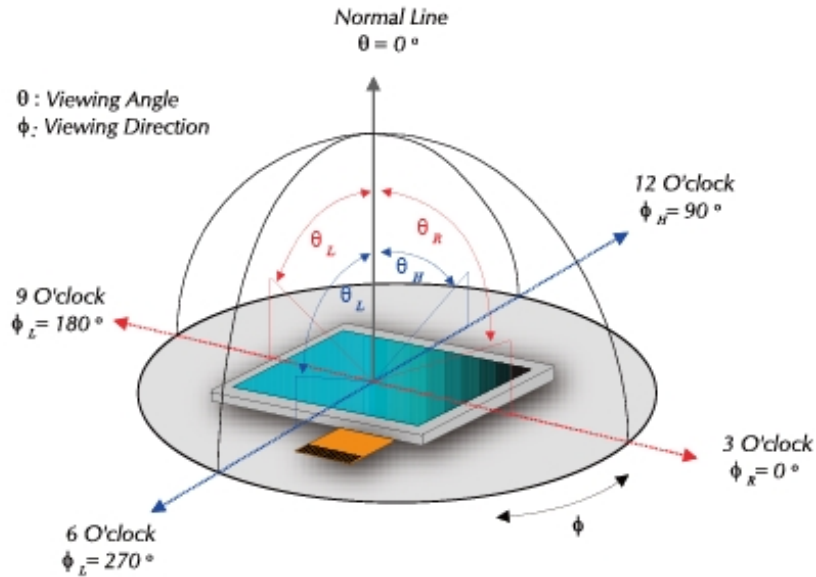


c. Definition of contrast ratio:

$$\text{Contrast Ratio (CR)} = \frac{\text{Brightness measured when LCD is at "white state"}}{\text{Brightness measured when LCD is at "black state"}}$$

d. Measured at the center area of the panel when all the input terminals of LCD panel are electrically opened.

e. View Angle



f. Definition of Luminance of White: Luminance of white at the center points

|                                 |          |
|---------------------------------|----------|
| Light Source of Back-Light Unit | LED Type |
|---------------------------------|----------|

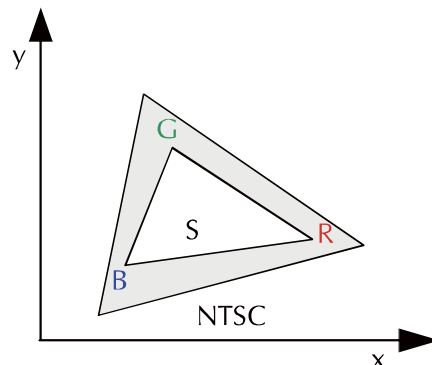
g. Definition of White Uniformity

$$\text{White Uniformity} = \frac{\text{Min. luminance of white among 9-points}}{\text{Max. luminance of white among 9-points}}$$

h. The definition of Color Gamut -Color Chromaticity CIE 1931

Color coordinate of white & red, green, blue at center point.

$$\text{Color Gamut : NTSC(\%)} = (\text{RGB Triangle Area} / \text{NTSC Triangle Area}) \times 100$$

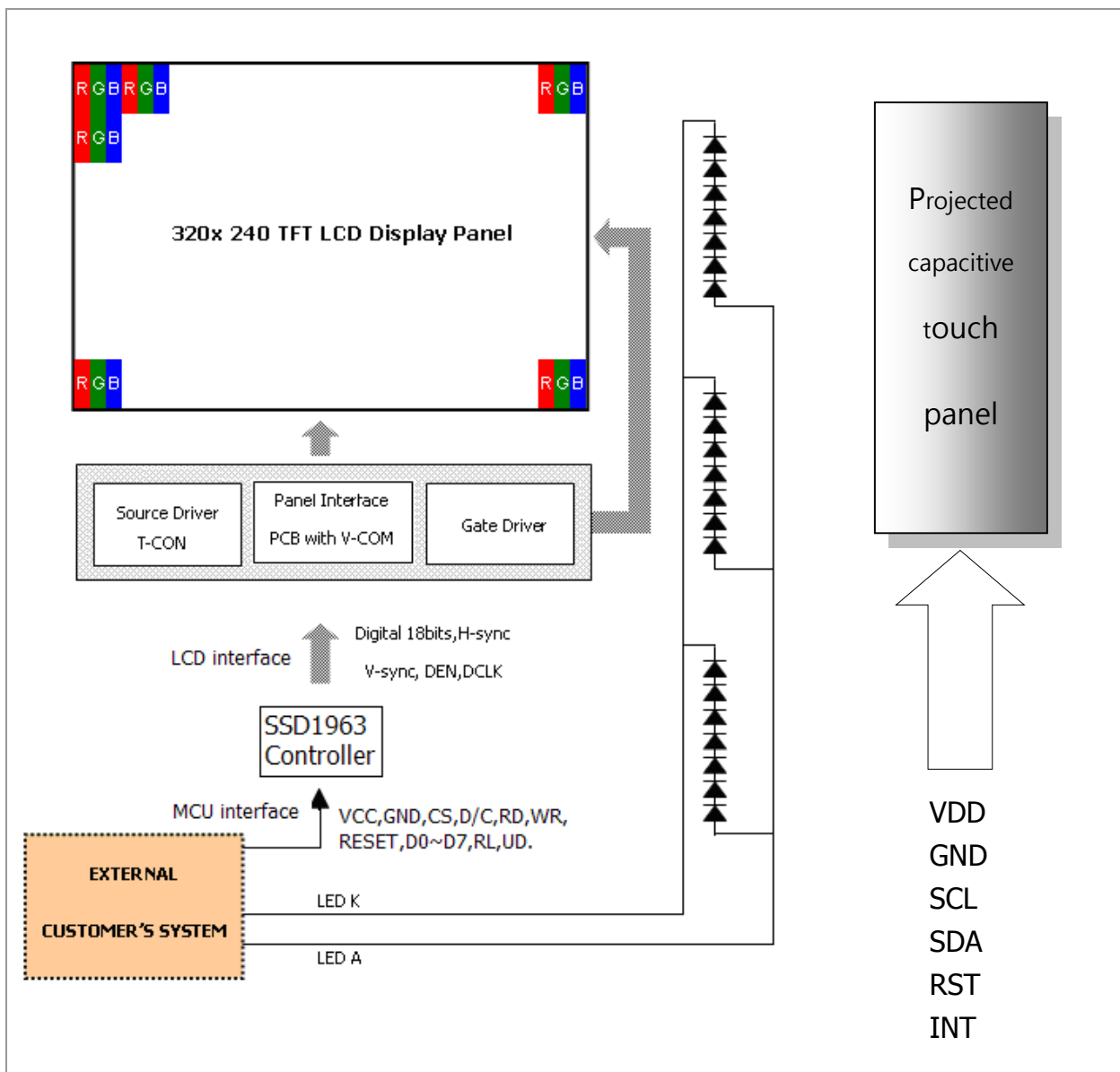


## 5. I/O Terminal

## 5.1 Pin Assignment

| Pin No. | Symbol | I/O | Function   | Remark  |
|---------|--------|-----|--|---------|
| 1       | GND    | P   | GND  |         |
| 2       | VCC    | P   | Power supply   |         |
| 3       | NC     | -   | Not Connection   |         |
| 4       | D/C    | I   | Data/Command select  |         |
| 5       | WR     | I   | 8080 mode :write signal  |         |
| 6       | RD     | I   | 8080 mode :read signal   |         |
| 7       | D0     | I   | Data bus   |         |
| 8       | D1     | I   | Data bus   |         |
| 9       | D2     | I   | Data bus   |         |
| 10      | D3     | I   | Data bus   |         |
| 11      | D4     | I   | Data bus   |         |
| 12      | D5     | I   | Data bus   |         |
| 13      | D6     | I   | Data bus   |         |
| 14      | D7     | I   | Data bus   |         |
| 15      | CS     | I   | Chip select  |         |
| 16      | RES    | I   | Hardware Reset   |         |
| 17      | NC     | -   | Not Connection   |         |
| 18      | R/L    | I   | Horizontal display mode select signal<br>L: Normal<br>H: Left / Right reverse mode | Note5-1 |
| 19      | U/D    | I   | Vertical display mode select signal<br>H: Normal<br>L: Up / Down reverse mode      | Note5-1 |
| 20      | NC     | -   | Not Connection   |         |

5.2 Block Diagram



5.3 Backlight Unit (BLU)

| Pin No. | Symbol | Function                       | Remark |
|---------|--------|--------------------------------|--------|
| 1       | LEDA   | Power Supply for LED backlight | Red    |
| 2       | LEDK   | GND for LED backlight          | Black  |

Connector: JST BHSR-02VS-1

5.4 Basic Display Color and Gray Scale

|             | Color & Gray Scale | Data Signal |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
|-------------|--------------------|-------------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
|             |                    | R7          | R6 | R5 | R4 | R3 | R2 | R1 | R0 | G7 | G6 | G5 | G4 | G3 | G2 | G1 | G0 | B7 | B6 | B5 | B4 | B3 | B2 | B1 | B0 |
| Basic Color | Black              | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |    |
|             | Red(0)             | 1           | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |    |
|             | Green(0)           | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |    |
|             | Blue(0)            | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 1  |    |
|             | Cyan               | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  |    |
|             | Magenta            | 1           | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 1  |    |
|             | Yellow             | 1           | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |    |
|             | White              | 1           | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  |    |
| Red         | Black              | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |    |    |
|             | Red(1)             | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |    |    |
|             | Red(2)             | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |    |    |
|             | :                  | :           | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  |    |    |
|             | Red(31)            | 0           | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |    |    |
|             | :                  | :           | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  |    |
|             | Red(62)            | 1           | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |    |    |
| Red(63)     | 1                  | 1           | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |    |    |    |
| Green       | Black              | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |    |    |
|             | Green(1)           | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 0  | 0  | 0  | 0  | 0  | 0  |    |    |
|             | Green(2)           | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |    |    |
|             | :                  | :           | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  |    |    |
|             | Green(31)          | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  |    |    |
|             | :                  | :           | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  |    |    |
|             | Green(62)          | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |    |    |
| Green(63)   | 0                  | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  |    |    |    |
| Blue        | Black              | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |    |    |
|             | Blue(1)            | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  |    |    |
|             | Blue(2)            | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  |    |    |
|             | :                  | :           | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  |    |    |
|             | Blue(31)           | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  |    |    |
|             | :                  | :           | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  |    |    |
|             | Blue(62)           | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  |    |    |
| Blue(63)    | 0                  | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  |    |    |    |

Each basic color can be displayed in 256 gray scales from 8 bit data signals. With the combination of total 24 bit data signals, the 16.7M-color display can be achieved on the screen.



## 6. Projected capacitive touch Screen Panel Specifications

## 6.1 Touch Panel

| Item                        | Specification                                     | Unit     |
|-----------------------------|---|----------|
| Screen Size                 | 5.7inches   | Diagonal |
| Type                        | Transparent Type Projected Capacitive Touch Panel | --       |
| Input Mode                  | Human's Finger                                    | --       |
| Sensor Active Area          | 117.2 (W) × 88.4 (H)                              | mm       |
| Interface                   | I2C   | --       |
| Cover Glass Pencil-Hardness | 6H(min) by JIS K5400                              | --       |
| Digital Power Supply        | 2.8 ~ 3.6   | V        |
| Power Consumption           | TBD   | mA       |
| IC solution                 | IC : ILI2117                                      |          |

## 6.2 Electrical Characteristics

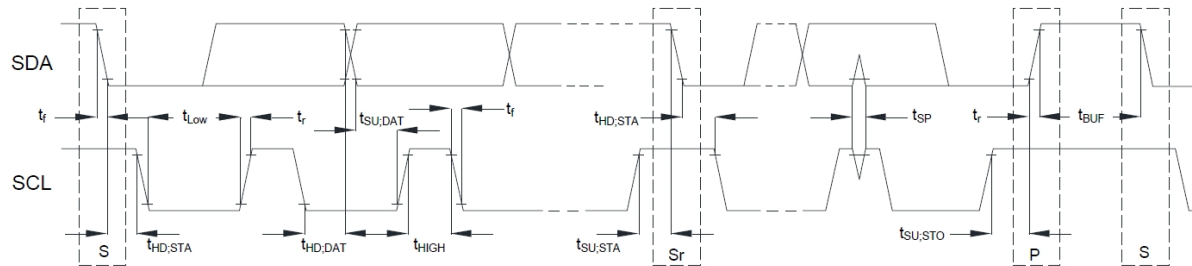
| Item                                     | Symbol              | Min.      | Typ. | Max.      | Unit | Remark                 |
|--|---------------------|-----------|------|-----------|------|------------------------|
| Power Supply Logic Voltage               | VDD                 | 2.8       | 3.3  | 3.6       | V    |                        |
| Charge Pump Power Supply Voltage         | VDD3                | 2.8       | 3.3  | 3.6       | V    |                        |
| System I/O Power Supply Voltage          | VDDIO               | 1.8       | 3.3  | 3.6       | V    |                        |
| $\overline{RSTN}$ Slew Rate              | V/T <sub>slew</sub> | 10        |      |           | V/mS |                        |
| Input High Voltage                       | V <sub>IH</sub>     | 0.7*VDDIO | -    | VDDIO     | V    |                        |
| Input Low Voltage                        | V <sub>IL</sub>     | -0.3      | -    | 0.3*VDDIO | V    |                        |
| Output High Voltage                      | V <sub>OH</sub>     | 2.8       | 3.3  | 3.6       | V    | VDDIO=VDD              |
|  |                     | 1.65      | 1.8  | 1.95      | V    | VDDIO=1.8V or Floating |
| Output Low Voltage                       | V <sub>OL</sub>     | 0         | -    | 0.3       | V    |                        |
| Input Leakage Current                    | I <sub>I</sub>      | -         | 1    | -         | μA   |                        |
| I <sup>2</sup> C Pull-High/Low Impedance | R <sub>po</sub>     | 1.425K    | 4.7K | 7.875K    | Ω    | Standerd mode (*1)     |
|  |                     | 1.425K    | 1.5K | 1.575K    | Ω    | Fast mode(*1)          |
| Operation Mode Current                   | I <sub>OP</sub>     | -         | TBD  | -         | mA   | (*2)                   |
| Standby Current                          | I <sub>Idle</sub>   | -         | TBD  | -         | mA   | (*2)                   |
| Sleeping Current                         | I <sub>Sleep</sub>  | -         | 100  | -         | μA   |                        |

Note 1: The pull high/low impedance was defined under C<sub>b</sub> (total capacitance load for each SDA/SCL lines)400pF for standard mode and 300pF for fast mode. If C<sub>b</sub> smaller than 400pF/300pF, I2C circuit can chose higher impedance for saving sink power. The minimum impedance was defined under I<sub>d</sub> (sink current) of 3mA. All the above condition was defined with internal pull high impendence of 4.7k to 5.3k.

Note 2: The power consumption depends on sensor loading condition.

**6.3 Pin Assignments and Definitions** (Connector Part No: "FH34SJ-6S-1.0SH" or equivalent.)

| Item | Name | I/O | Unit                          |
|------|------|-----|-------------------------------|
| 1    | GND  | P   | Ground                        |
| 2    | SDA  | I/O | I2C Data                      |
| 3    | SCL  | I   | I2C Clock                     |
| 4    | VDD  | P   | Power                         |
| 5    | INT  | I   | Interrupt request to the host |
| 6    | RST  | I   | External Reset, active low    |

**6.4 FUNCTIONAL DESCRIPTION**6.4.1 AC Characteristics of the SDA and SCL on I<sup>2</sup>C interface

## 6.4.2 Characteristics of the SDA and SCL bus lines

| Symbol       | Parameter   | 100KHz |      |         | 400KHz |     |         |
|--------------|---|--------|------|---------|--------|-----|---------|
|              |   | Min    | Max  | Unit    | Min    | Max | Unit    |
| $f_{SCL}$    | SCL clock frequency   | 0      | 100  | kHz     | 0      | 400 | KHz     |
| $t_{HD,STA}$ | Hold time (repeated) START condition. After this period, the first clock pulse is generated | 4.0    | –    | $\mu$ s | 0.6    | –   | $\mu$ s |
| $t_{LOW}$    | LOW period of the SCL clock   | 4.7    | –    | $\mu$ s | 1.3    | –   | $\mu$ s |
| $t_{HIGH}$   | HIGH period of the SCL clock  | 4.0    | –    | $\mu$ s | 0.6    | –   | $\mu$ s |
| $t_{SU,STA}$ | Set-up time for a repeated START condition  | 4.7    | –    | $\mu$ s | 0.6    | –   | $\mu$ s |
| $t_{HD,DAT}$ | Data hold time  | 0      | 3.45 | $\mu$ s | 0      | 0.9 | $\mu$ s |
| $t_{SU,DAT}$ | Data set-up time  | 250    | –    | ns      | 100    | –   | ns      |
| $t_r$        | Rise time of both SDA and SCL signals   | –      | 1000 | ns      | –      | 300 | ns      |
| $t_f$        | Fall time of both SDA and SCL signals   | –      | 300  | ns      | –      | 300 | ns      |
| $t_{SU,STO}$ | Set-up time for STOP condition  | 4.0    | –    | $\mu$ s | 0.6    | –   | $\mu$ s |
| $t_{BUF}$    | Bus free time between a STOP and START condition  | 4.7    | –    | $\mu$ s | 1.3    | –   | $\mu$ s |

**7. Reliability Condition**

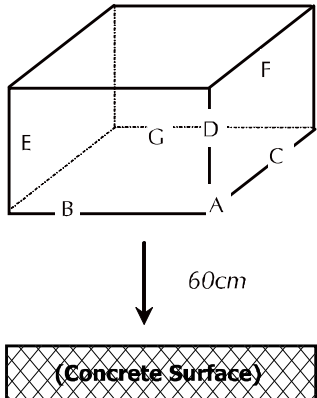
No change on display and in operation under the following test condition.

Condition: Unless otherwise specified, tests will be conducted under the following condition.

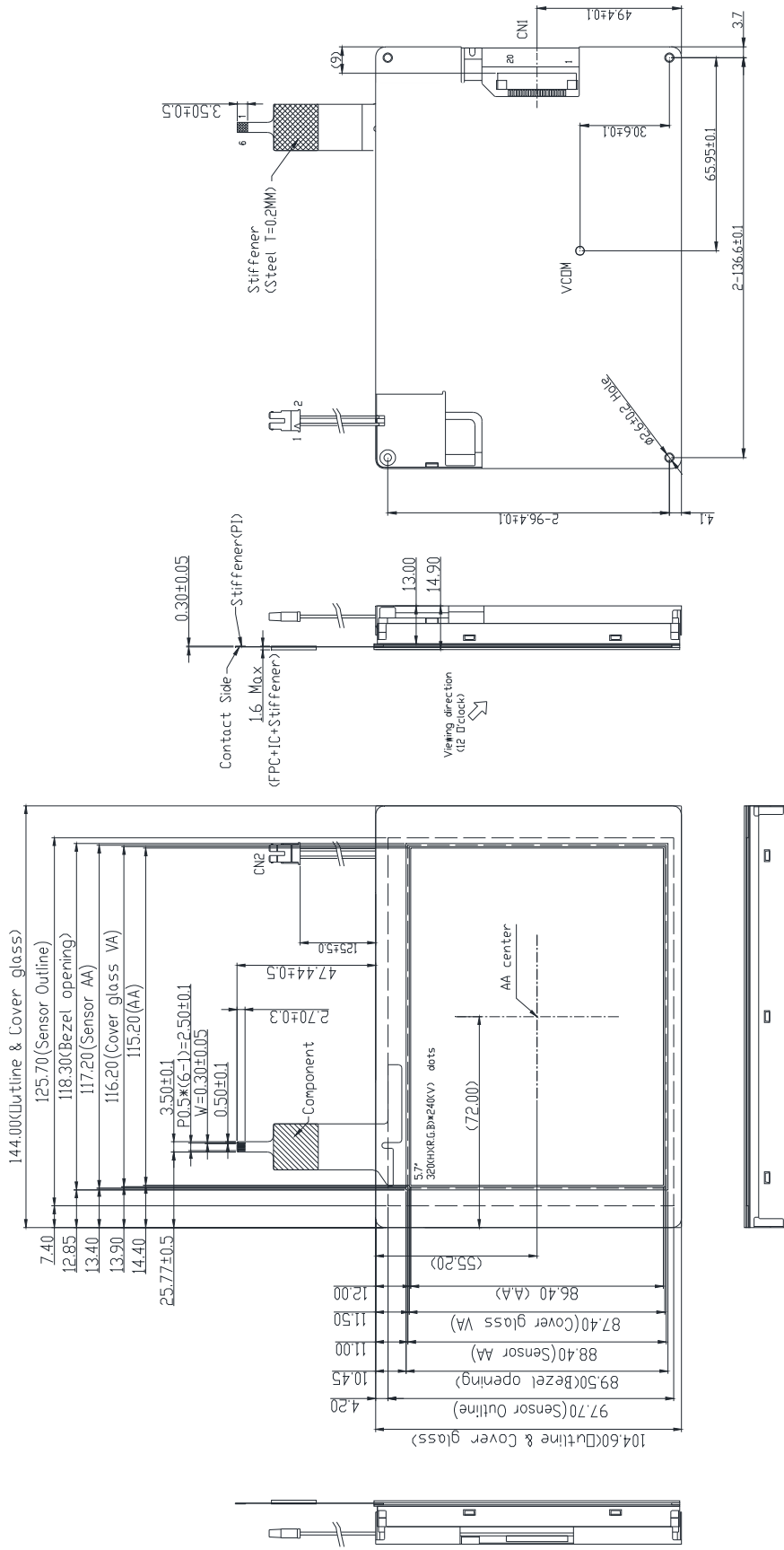
Temperature: 20±5°C.

Humidity: 65±5%RH.

Tests will be not conducted under functioning state.

| No. | Parameter   | Condition  | Notes |
|-----|---|--|-------|
| 1   | High Temperature Operating                        | 70°C±2°C, 240hrs (Operation state).  | -     |
| 2   | Low Temperature Operating                         | -20°C±2°C, 240hrs (Operation state).   | -     |
| 3   | High Temperature Storage                          | 80°C±2°C, 240hrs.  | -     |
| 4   | Low Temperature Storage                           | -30°C±2°C, 240hrs.   | -     |
| 5   | High Temperature and High Humidity Operation Test | 60°C±2°C, 90%, 240hrs.   | -     |
| 6   | Vibration Test                                    | Total fixed amplitude: 1.5mm.<br>Vibration Frequency: 10~55Hz.<br>One cycle 60 seconds to 3 direction of X, Y, Z each 15 minutes.  | -     |
| 7.  | Drop Test   | To be measured after dropping from 60cm high on the concrete surface in packing state.<br><br> <p><i>Dropping method corner dropping:</i></p> <p><i>A corner: Once edge dropping.</i></p> <p><i>B, C, D edge: Once face dropping.</i></p> <p><i>E, F, G face: Once.</i></p> | -     |

8. Dimensional Outlines



PIN ASSIGNMENT:

| PIN | DEFINITION |
|-----|------------|
| 1   | GND        |
| 2   | SDA        |
| 3   | SCL        |
| 4   | VDD        |
| 5   | INT        |
| 6   | RST        |

- 11:D4
- 12:D5
- 13:D6
- 14:D7
- 15:CS
- 16:RES
- 17:DC
- 18:R/L
- 19:U/D
- 20:NC

CTP connector: Hirose FH34SJ-6S-05SH or equivalent

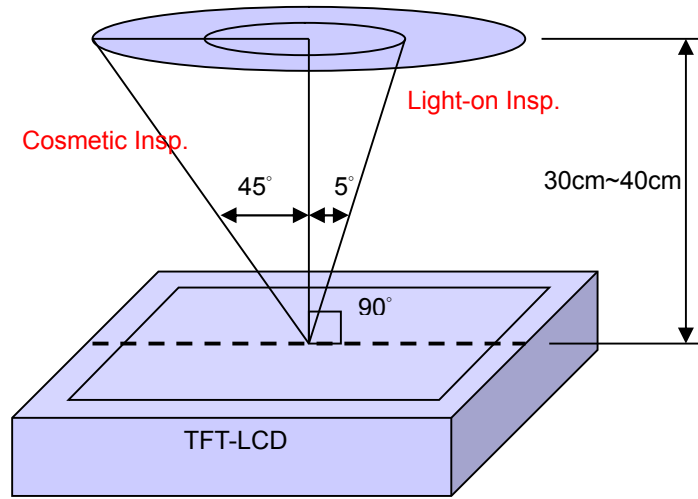
CNI: 5F2.2435E-12621120  
or equivalent  
(Bottom Contact/1.0Pitch)  
CN2: BHSF-02VS-(JST)  
or equivalent

9. Incoming Inspection Standards

9.1 Inspection and Environment Conditions

9.1.1 Inspection Conditions:

- (1) Inspection Distance: 35 cm±5cm
- (2) View Angle : Light-on Inspection Angle : ±5°  
Cosmetic Inspection Angle : ±45°



( perpendicular to LCD panel surface)

9.1.2 Environment Conditions:

|                      |                       |                   |
|----------------------|-----------------------|-------------------|
| Ambient Temperature  |                       | 23°C ±5°C         |
| Ambient Humidity     |                       | 55±10%RH          |
| Ambient Illumination | Cosmetic Inspection   | more than 600 Lux |
|                      | Functional Inspection | 300~500 Lux       |

9.1.3 Sampling Conditions:

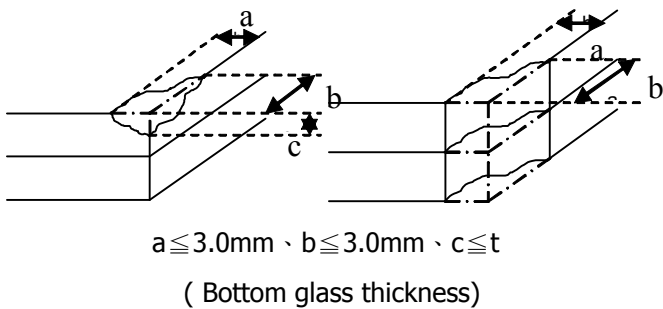
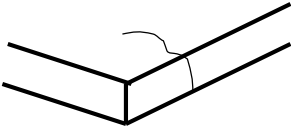
- (1) Lot Size: Quantity of shipment lot per model
- (2) Sampling Method:

|               |              |                                    |
|---------------|--------------|------------------------------------|
| Sampling Plan |              | MIL-STD-105E                       |
|               |              | Normal Inspection, Single Sampling |
|               |              | Level II                           |
| AQL           | Major Defect | 1.0%                               |
|               | Minor Defect | 1.5%                               |

(3) The classification of Major(MA) and Minor(MI) defects is shown as 3. Inspection Criteria.

9.1.4 Inspection Criteria

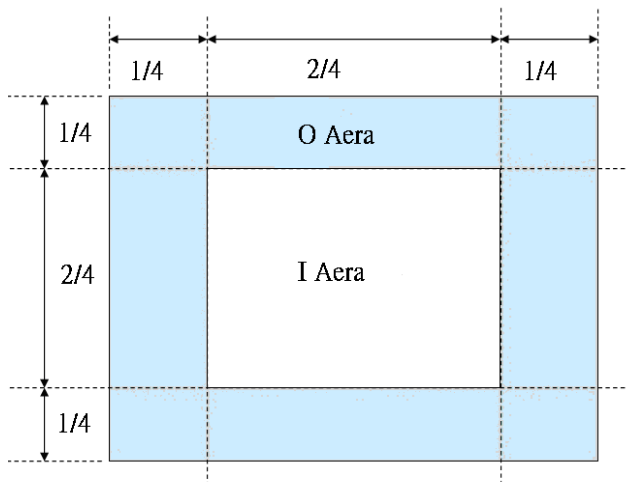
9.1.4.1 Cosmetic Inspection(Panel):

| Item                                  | Judgment Criteria   | Classification |
|---------------------------------------|---|----------------|
| Chipping on Panel                     |  <p><math>a \leq 3.0\text{mm} \cdot b \leq 3.0\text{mm} \cdot c \leq t</math><br/>( Bottom glass thickness)</p>   | MA             |
| Scratch on Panel<br>*Note-2           | <p><math>W \leq 0.05\text{mm}</math> or <math>L &lt; 5\text{mm}</math>: Ignored<br/> <math>0.05\text{mm} &lt; W \leq 0.1\text{mm}</math> and <math>L \leq 5\text{mm}</math>: <math>N \leq 5</math><br/> <math>W &gt; 0.1\text{mm}</math> or <math>L &gt; 5\text{mm}</math>: Not allowed</p> | MI             |
| Bubble or Dent on Panel<br>*Note-3    | <p><math>D \leq 0.2\text{mm}</math>: Ignored<br/> <math>0.2\text{mm} &lt; D \leq 0.3\text{mm}</math>: <math>N \leq 5</math><br/> <math>D &gt; 0.3\text{mm}</math>: Not allowed</p>  | MI             |
| Panel Crack                           |  <p>Not Allowed crack</p>   | MA             |
| Bezel Deformation                     | Obvious deformation is not allowed.   | MI             |
| Bezel Oxidation                       | Not allowed if it rusts continuously over 1 cm (It is out of warranty with rusted tin plate)  | MI             |
| Bezel Scratch                         | $L \leq 20\text{mm}$ , $W \leq 0.2$ , $N \leq 3$  | MI             |
| Metal Squash Dent /Flange(Front Side) | $D(W) \leq 1, L \leq 3, N \leq 3;$  | MI             |
| B/L High Voltage Wire Denudation      | Not allowed   | MA             |
| Polarizer flaw or leak out resin      | Defect is defined as the active area.   | MI             |
| Outline Dimension                     | Must in Spec, refer to related product spec.  | MI             |

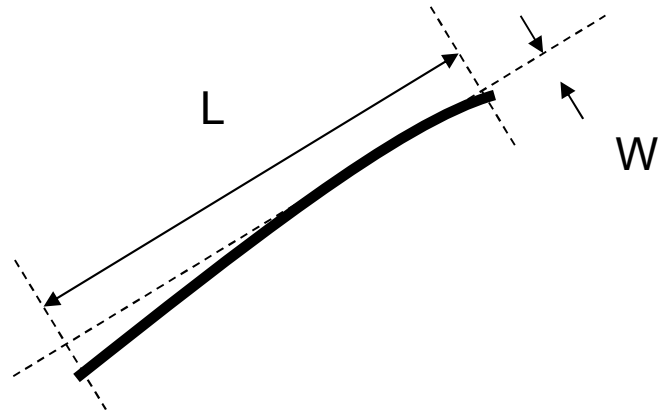
9.1.4.2 Functional Inspection:

| Item  | Judgment Criteria  |  |                     | Classification |    |
|---|--|--|---------------------|----------------|----|
|   | Area(Note1)  | I                                      | O                   |                |    |
| Point Defect  | Bright dot   | Random                                 | 2                   |                | MI |
|   |  | 2 dots adjacent                        | 0                   | 0              |    |
|   |  | 3 dots adjacent or more                | 0                   | 0              |    |
|   | Dark dot   | Random                                 | 3                   |                |    |
|   |  | 2 dots adjacent                        | 0                   |                |    |
|   |  | 3 dots adjacent or more                | 0                   | 0              |    |
|   | Total Dot Defect   |  | 5                   |                |    |
|   | Distance   | Distance between Bright and Bright dot | $L \geq 5\text{mm}$ |                |    |
|   |  | Distance between Bright and Dark dot   | $L \geq 5\text{mm}$ |                |    |
|   |  | Distance between Dark dot              | $L \geq 5\text{mm}$ |                |    |
| (1) It is defined as Point Defect if defect area > 0.5dot<br>(2) It is ignored if defect area $\leq 0.5\text{dot}$<br>(3) Weak point defect will be defined as Bright Dot if it can be observed through ND filter 5%( Full Screen Black Inspection) |  |  |                     |                |    |
| Line Defect   | Obvious vertical or horizontal line defect is not allowed.   |  |                     | MA             |    |
| Mura  | Not allowed if it can be observed through ND Filter 5 %  |  |                     | MI             |    |
| Foreign Material in spot shape<br>*Note-3   | $D \leq 0.2\text{mm}$ : Ignored<br>$0.2\text{mm} < D \leq 0.5\text{mm}$ : $N \leq 8$<br>$D > 0.5\text{mm}$ : Not allowed   |  |                     | MI             |    |
| Foreign Material in line or spiral shape<br>*Note-4   | $W \leq 0.05\text{mm}$ or $L \leq 5\text{mm}$ : Ignored<br>$0.05\text{mm} < W \leq 0.2\text{mm}$ and $L 1.0\text{mm} \leq 5\text{mm}$ : $N \leq 8$<br>$W > 0.2\text{mm}$ or $L > 5\text{mm}$ : Not allowed |  |                     | MI             |    |
| Display Function Abnormal   | No Malfunction can be allowed  |  |                     | MA             |    |

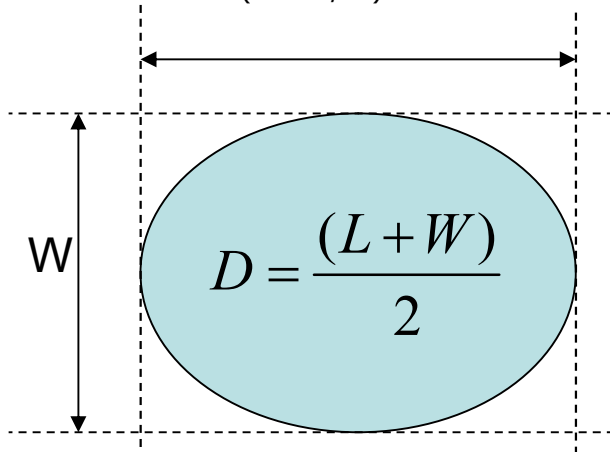
Note-1 : I/O Area Definition



Note-2 : Polarizer Scratch



Note-3 : Spot Foreign Material  
( $W \geq L / 4$ )



Note-4 : Line or Spiral Foreign Material  
( $W < L / 4$ )

