

Display Elektronik GmbH

DATA SHEET

**TFT- MODULE**

**DEM 800480B TMH-PW-N**

**7,0" TFT**

06.01.2011



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## 1. General Description and Features

DEM 800480B TMH-PW-N 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 receiver circuit and a back-light unit. Graphics and texts can be displayed on a WVGA 800 (W) x RGB x 480 (H) dots (16:9 aspect ratio) with 262,144 colors. The following table described the features of DEM 800480B TMH-PW-N.

### 1.1 Features

- Transmissive and back-light with 30 LEDs are available.
- TN (Twisted Nematic) mode.
- LVDS Receiver 18 bit Interface.
- ROHS Compliance

### 1.2 LCD Module

| Item               | Specification                     | Unit     |
|--------------------|-----------------------------------|----------|
| Screen Size        | 7.0 inches                        | Diagonal |
| Display Resolution | 800 (H) x 480 (V)                 | Pixel    |
| Active Area        | 152.4 (H) x 91.44 (V)             | mm       |
| Outline Dimension  | 166.6 (H) x 109.4 (V) x 10.0 (T)  | mm       |
| Display Mode       | Normally white mode/ Transmissive | --       |
| Pixel Arrangement  | R,G,B Vertical Stripe             | --       |
| Pixel Size         | 0.1905 x 0.1905                   | mm       |
| Surface Treatment  | Anti-Glare and Hard Coating(3H)   |          |
| Display Color      | 262K                              | --       |
| Viewing Direction  | 6 o'clock                         | --       |
| Input Interface    | LVDS Receiver 18 bit Interface    | --       |

## 2. Mechanical Information

| Item        | Min.           | Typ.  | Max.  | Unit | Note |
|-------------|----------------|-------|-------|------|------|
| Module Size | Horizontal (H) | --    | 166.6 | --   | mm   |
|             | Vertical (V)   | --    | 109.4 | --   | mm   |
|             | Thickness (T)  | --    | 10.0  | --   | mm   |
| Weight      | --             | (165) | --    | g    | --   |

Note (1) Not Include Component. Refer to the Outline Dimension Drawing as attached.

### 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.

( $T_a=25\pm 2^\circ\text{C}$ ,  $V_{SS}=\text{GND}=0$ )

| Item                  | Symbol    | Min. | Max. | Unit             | Note    |
|-----------------------|-----------|------|------|------------------|---------|
| Storage temperature   | $T_{STG}$ | -30  | 80   | $^\circ\text{C}$ | (1)     |
| Operating temperature | $T_{OPR}$ | -20  | 70   | $^\circ\text{C}$ | (1,2,3) |

Note (1) 95 % RH Max. (  $40^\circ\text{C} \geq T_a$  ). Maximum wet-bulb temperature at  $39^\circ\text{C}$  or less. ( $T_a > 40^\circ\text{C}$ ) No condensation.

Note (2) In case of below  $0^\circ$ , 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  $+25^\circ\text{C}$ .

#### 3.1.2 Electrical Absolute Maximum Ratings

##### 3.1.2.1 TFT-LCD Module

( $V_{SS}=\text{GND}=0$ )

| Parameter            | Symbol   | Min. | Max.         | Unit | Remark |
|----------------------|----------|------|--------------|------|--------|
| Power supply voltage | $V_{CC}$ | -0.3 | 4.0          | V    |        |
| input voltage        | $V_I$    | -0.3 | $V_{CC}+0.3$ | V    | --     |

##### 3.1.2.2 Backlight Unit

( $V_{SS}=\text{GND}=0$ )

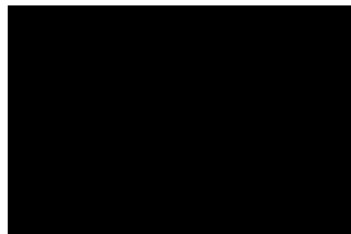
| Parameter                 | Symbol | Min. | Max. | Unit | Remark |
|---------------------------|--------|------|------|------|--------|
| Current of Backlight Unit | IB     | --   | 250  | mA   |        |
| Voltage of Backlight Unit | VB     | --   | 15   | V    |        |

**3.1.3 DC Electrical Characteristics of the TFT LCD**

(Ta=25±2°C, V<sub>SS</sub>=GND=0)

| Item                    | Symbol                                   | Min. | Typ.  | Max. | Unit | Remark |
|-------------------------|--|------|-------|------|------|--------|
| Power supply            | VCC                                      | 3.0  | 3.3   | 3.6  | V    |        |
| Input Voltage for logic | Differential Input High Threshold<br>VTH |      |       | +100 | mA   |        |
|                         | Differential Input Low Threshold<br>VTL  | -100 |       |      | mA   |        |
| Power Supply current    | ICC                                      | -    | (215) | TBD  | mA   | Note 1 |

Note1: fv =60Hz , Ta=25°C , Display pattern : Black pattern



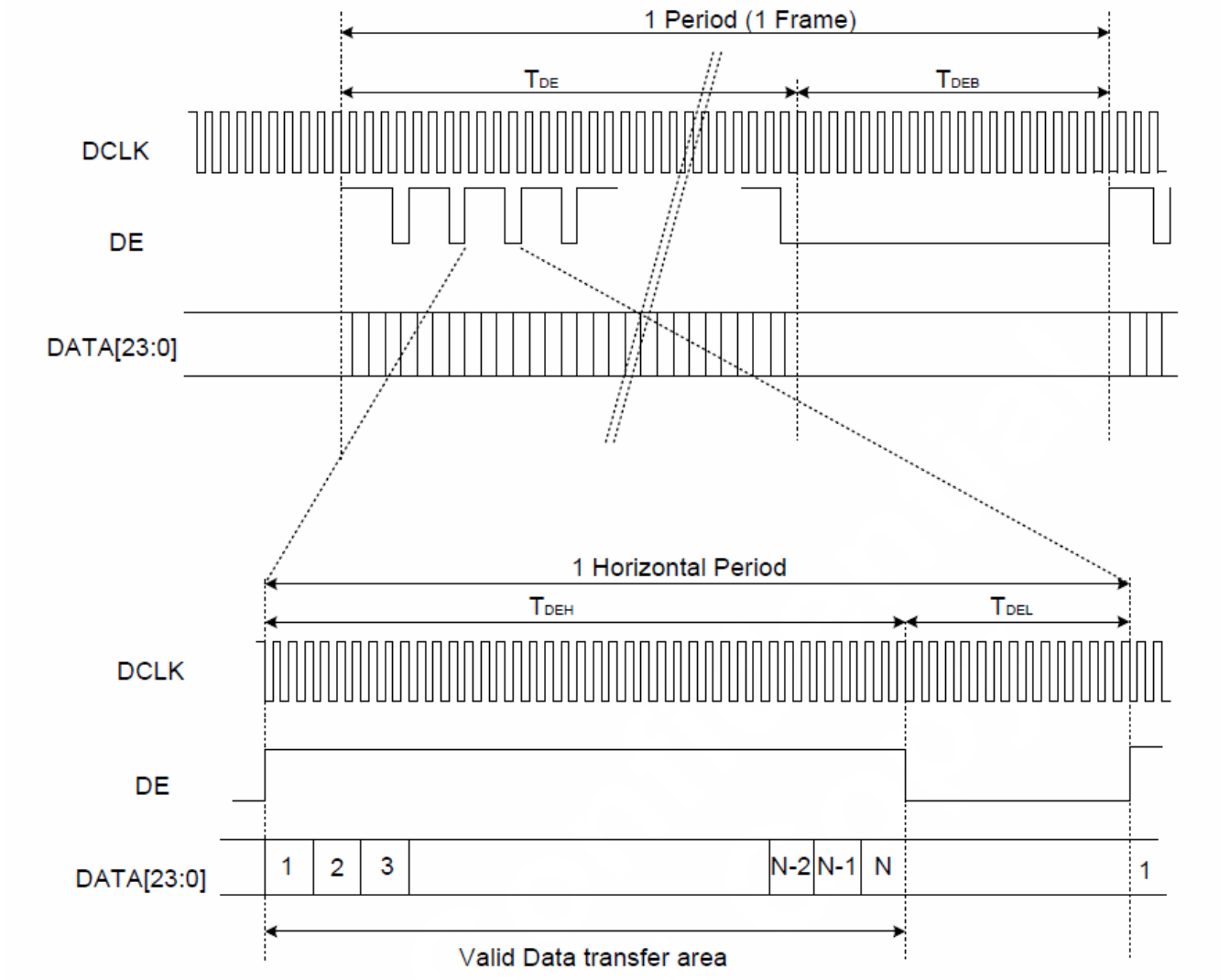
**3.2 AC Timing Characteristic of The LCD**

**3.2.1 Timing Condition (DE only mode)**

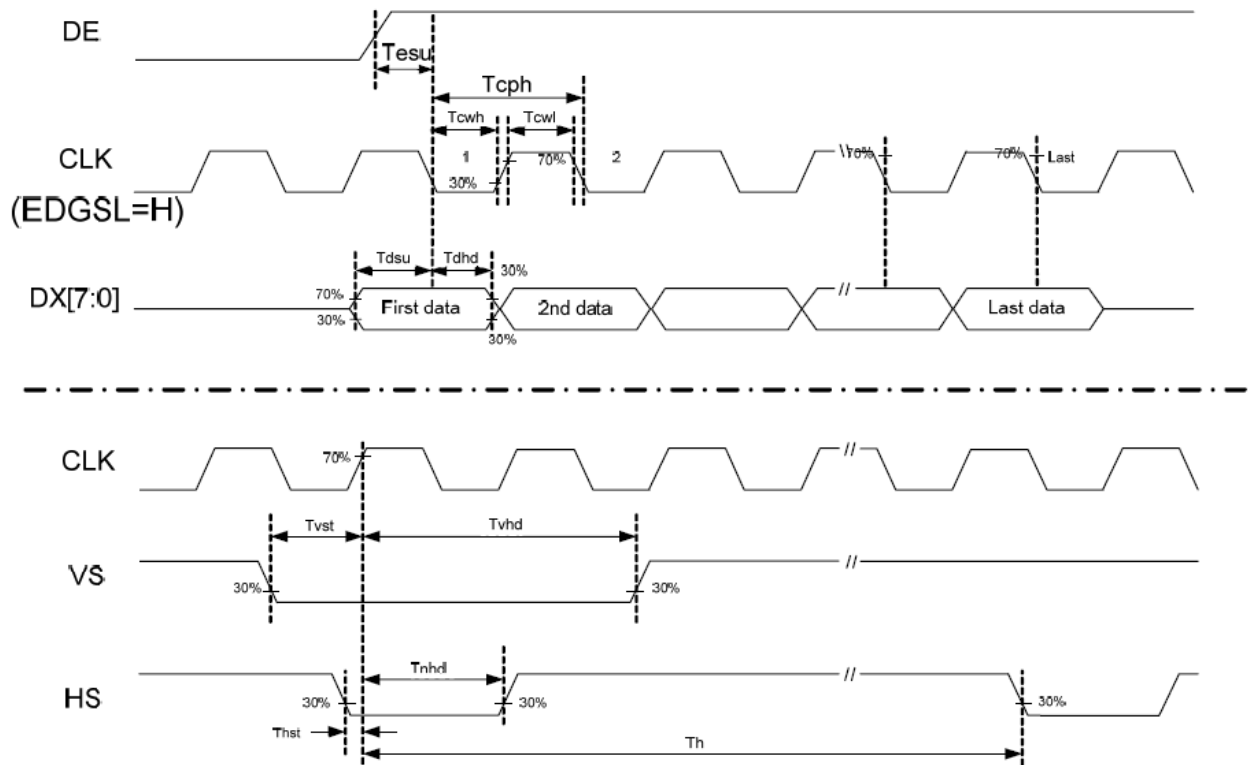
| Signal | Parameter         | Symbol                             | Min. | Typ.  | Max.  | Unit.                              | Remark |
|--------|-------------------|------------------------------------|------|-------|-------|------------------------------------|--------|
| DCLK   | CLK frequency     | F <sub>CPH</sub>                   | 29.4 | 33.26 | 42.48 | MHz                                |        |
|        | CLK period        | T <sub>CPH</sub>                   | -    | 30.06 | -     | ns                                 |        |
|        | CLK pulse duty    | T <sub>CWH</sub>                   | 40   | 50    | 60    | %                                  |        |
| DE     | DE period         | T <sub>DEH</sub> +T <sub>DEL</sub> | 1000 | 1056  | 1200  | T <sub>CPH</sub>                   |        |
|        | DE pulse width    | T <sub>DEH</sub>                   | -    | 800   | -     | T <sub>CPH</sub>                   |        |
|        | DE frame blanking | T <sub>DEB</sub>                   | 10   | 45    | 110   | T <sub>DEH</sub> +T <sub>DEL</sub> |        |
|        | DE frame width    | T <sub>DE</sub>                    | -    | 480   | -     | T <sub>DEH</sub> +T <sub>DEL</sub> |        |
|        | DE setup time     | T <sub>esu</sub>                   | 6    | -     | -     | ns                                 |        |
| Data   | Data setup time   | T <sub>dsu</sub>                   | 6    | -     | -     | ns                                 |        |
|        | Data hold time    | T <sub>dhd</sub>                   | 6    | -     | -     | ns                                 |        |

3.2.2 Timing Characteristic

3.2.2.1 DE and RGB Data Input Timing



3.2.2.2 Clock and Data input waveforms



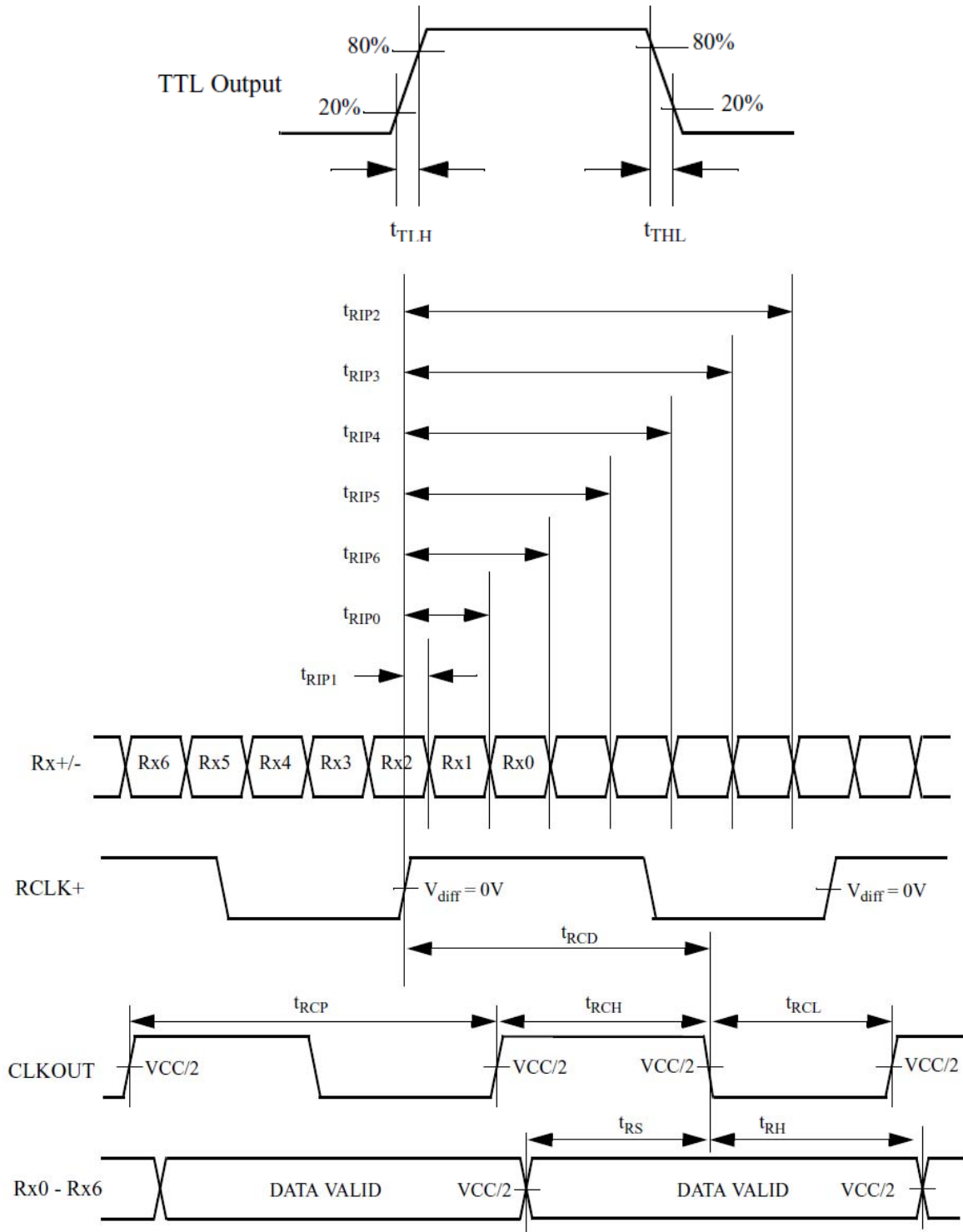
3.3 LVDS Switching Characteristics

3.3.1 LVDS Timing Condition

| Symbol | Parameter                          |                  | Min.      | Typ. | Max.     | Unit. | Note |
|--------|------------------------------------|------------------|-----------|------|----------|-------|------|
| tRCP   | CLK OUT Period                     | VCC = 3.0 - 3.6V | 11.76     | T    | 50.0     | ns    |      |
|        |                                    | VCC = 2.5 - 3.6V | 14.28     | T    | 50.0     | ns    |      |
| tRCH   | CLK OUT High Time                  |                  | -         | 4T/7 | -        | ns    |      |
| tRCL   | CLK OUT Low Time                   |                  | -         | 3T/7 | -        | ns    |      |
| tRCD   | RCLK +/- to CLK OUT Delay          |                  | -         | 5T/7 | -        | ns    |      |
| tRS    | TTL Data Setup to CLK OUT          |                  | 0.35T-0.3 | -    | -        | ns    |      |
| tRH    | TTL Data Hold from CKL OUT         |                  | 0.45T-1.6 | -    | -        | ns    |      |
| tTLH   | TTL Low to High Transition Time    |                  | -         | 2.0  | 3.0      | ns    |      |
| tTHL   | TTL High to Low Transition Time    |                  | -         | 1.8  | 3.0      | ns    |      |
| tRIP1  | Input Data Position0 (T = 11.76ns) |                  | -0.4      | 0.0  | 0.4      | ns    |      |
| tRIP0  | Input Data Position1 (T = 11.76ns) |                  | T/7-0.4   | T/7  | T/7+0.4  | ns    |      |
| tRIP6  | Input Data Position2 (T = 11.76ns) |                  | 2T/7-0.4  | 2T/7 | 2T/7+0.4 | ns    |      |
| tRIP5  | Input Data Position3 (T = 11.76ns) |                  | 3T/7-0.4  | 3T/7 | 3T/7+0.4 | ns    |      |
| tRIP4  | Input Data Position4 (T = 11.76ns) |                  | 4T/7-0.4  | 4T/7 | 4T/7+0.4 | ns    |      |
| tRIP3  | Input Data Position5 (T = 11.76ns) |                  | 5T/7-0.4  | 5T/7 | 5T/7+0.4 | ns    |      |
| tRIP2  | Input Data Position6 (T = 11.76ns) |                  | 6T/7-0.4  | 6T/7 | 6T/7+0.4 | ns    |      |
| tRPLL  | Phase Lock Loop Set                |                  |           |      | 10.0     | ms    |      |



3.3.2 LVDS AC Timing



3.4 Back-Light Unit

The Back-light system is an edge-lighting type with 30 white LED (Light Emitting Diode)s. The characteristics of 30 white LEDs are shown in the following tables.

(Ta= Room Temp)

| Characteristics   | Symbol          | Min.    | Typ.  | Max.   | Unit | Note |
|-------------------|-----------------|---------|-------|--------|------|------|
| Forward Voltage   | VB              | (9.3)   | (9.9) | (10.5) | V    |      |
| Forward Current   | IB              | -       | 200   | -      | mA   | (1)  |
| Power Consumption | P <sub>BL</sub> | -       | 1980  | -      | mW   | (2)  |
| LED Life time     | -               | (40000) | -     | -      | hr   | (3)  |

Note (1) LEDs in 3 series x 10 parallel type.

(2) Where IB = 200mA, VB = 9.9, P<sub>BL</sub> = VB × IB

(3) The environmental conducted under ambient air flow ,at Ta=25±2°C, 60%RH±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.

Measuring equipment: BM-7A

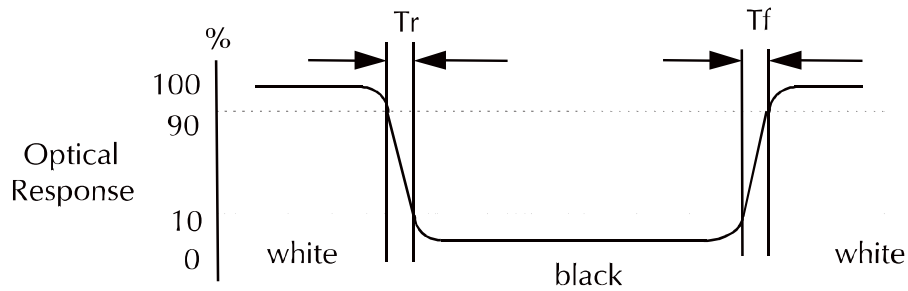
| Item                          | Symbol         | Condition                  | Min     | Type    | Max     | Unit              | Note  |
|-------------------------------|----------------|----------------------------|---------|---------|---------|-------------------|-------|
| Brightness                    | B              |                            | (450)   | (500)   | --      | cd/m <sup>2</sup> |       |
| Response time                 | T <sub>r</sub> | θ=0°                       | -       | 5       | 10      | ms                | .     |
|                               | T <sub>f</sub> |                            | --      | 15      | 20      | ms                |       |
| Contrast ratio                | CR             | At optimized viewing angle | (350)   | (400)   | --      | --                |       |
| Color Gamut                   | NTSC %         | --                         | --      | TBD     | --      | %                 |       |
| Luminance Uniformity          | ΔL             |                            | 70      | 75      |         | %                 |       |
| Color Chromaticity (CIE 1931) | White          | W <sub>x</sub>             | (0.270) | (0.320) | (0.370) | --                | BM-7A |
|                               |                | W <sub>y</sub>             | (0.300) | (0.350) | (0.400) |                   |       |
| Viewing Angle (6H)            | Hor.           | θ <sub>R</sub>             | 55      | 65      | --      | Degree            |       |
|                               |                | θ <sub>L</sub>             | 55      | 65      | --      |                   |       |
|                               | Ver.           | θ <sub>U</sub>             | 45      | 55      | --      |                   |       |
|                               |                | θ <sub>D</sub>             | 55      | 65      | --      |                   |       |

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".



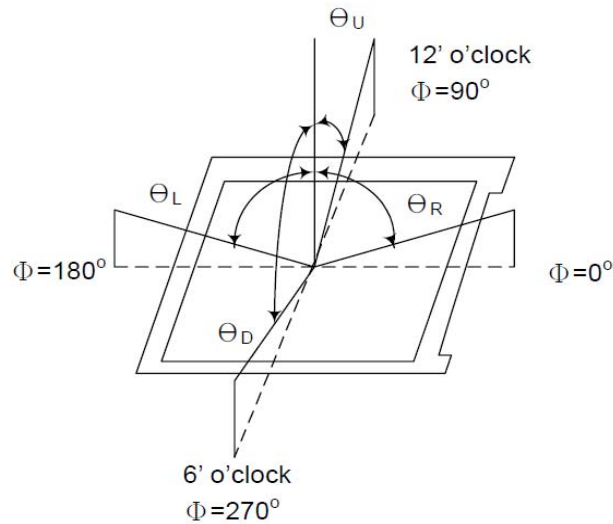
c. Definition of contrast ratio:

Brightness measured when LCD is at "white state"

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

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 |
|---------------------------------|----------|

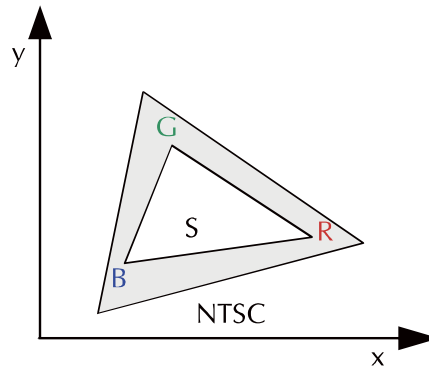
g. Definition of White Uniformity

$$\text{White Uniformity} = \frac{\text{Min. luminance of white among 9-points}}{\text{Max. luminance of white among 9-points}} \times 100\%$$

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

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

Color Gamut : NTSC(%) = ( RGB Triangle Area / NTSC Triangle Area ) x 100



**5. I/O Terminal**

**5.1 Pin Assignment (connector part No: MSB24013P20A or equivalent.)**

| Pin No. | Symbol | I/O | Function                               | Remark |
|---------|--------|-----|--|--------|
| 1       | VCC    | P   | Power Supply +3.3V                     |        |
| 2       | VCC    | P   | Power Supply +3.3V                     |        |
| 3       | VSS    | P   | Ground                                 |        |
| 4       | VSS    | P   | Ground                                 |        |
| 5       | RIN0-  | I   | Negative LVDS differential data input  |        |
| 6       | RIN0+  | I   | Positive LVDS differential data input  |        |
| 7       | VSS    | P   | Ground                                 |        |
| 8       | RIN1-  | I   | Negative LVDS differential data input  |        |
| 9       | RIN1+  | I   | Positive LVDS differential data input  |        |
| 10      | VSS    | P   | Ground                                 |        |
| 11      | RIN2-  | I   | Negative LVDS differential data input  |        |
| 12      | RIN2+  | I   | Positive LVDS differential data input  |        |
| 13      | VSS    | P   | Ground                                 |        |
| 14      | RCLK-  | I   | Negative LVDS differential clock input |        |
| 15      | RCLK+  | I   | Positive LVDS differential clock input |        |
| 16      | VSS    | P   | Ground                                 |        |
| 17      | NC     | -   | NO Connect                             |        |
| 18      | NC     | -   | NO Connect                             |        |
| 19      | VSS    | P   | Ground                                 |        |
| 20      | VSS    | P   | Ground                                 |        |

I: Input, P: Power

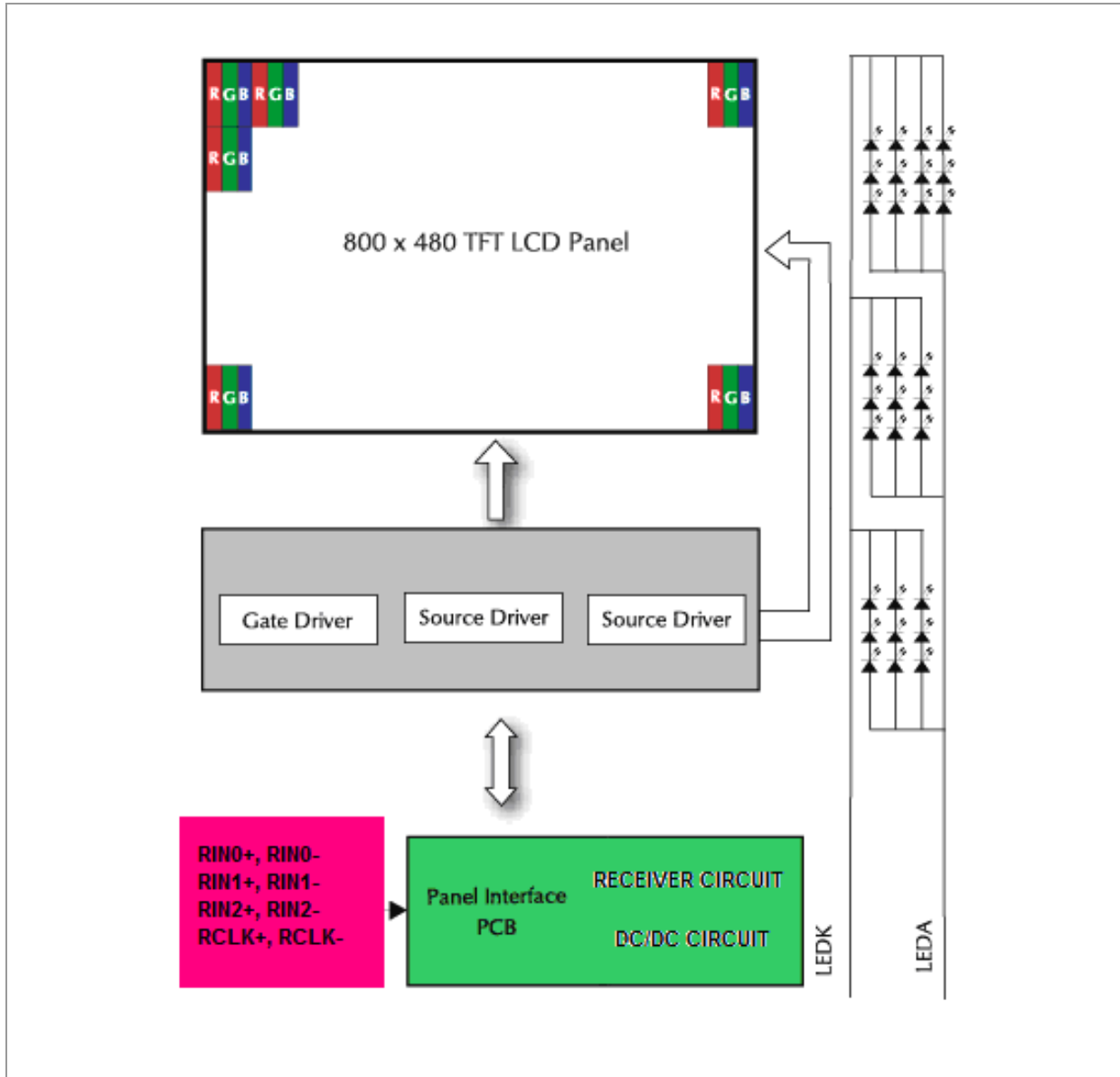
Notes:

- 1) NC Pin must be retained; this pin can't contact VSS or other signal.
- 2) VSS Pin must ground contact, can not be floating.

5.2 Back Light Unit (Connector Part No: JST:BHSR-02VS-01(N) or equivalent.)

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

5.3 Block Diagram



6. Displayed Color and Input Data

|             | Color & Gray Scale | Data Signal |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
|-------------|--------------------|-------------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
|             |                    | R5          | R4 | R3 | R2 | R1 | R0 | G5 | G4 | G3 | G2 | G1 | G0 | 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  |
|             | Red(0)             | 1           | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|             | Green(0)           | 0           | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  |
|             | Blue(0)            | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  |
|             | Cyan               | 0           | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  |
|             | Magenta            | 1           | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  |
|             | Yellow             | 1           | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 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  |
| Red         | Black              | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|             | Red(62)            | 0           | 0  | 0  | 0  | 0  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|             | Red(61)            | 0           | 0  | 0  | 0  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|             | :                  | :           | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  |
|             | Red(31)            | 0           | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|             | :                  | :           | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  |
|             | Red(1)             | 1           | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|             | Red(0)             | 1           | 1  | 1  | 1  | 1  | 1  | 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  |
|             | Green(62)          | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 0  | 0  | 0  | 0  | 0  | 0  |
|             | Green(61)          | 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  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|             | :                  | :           | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  |
|             | Green(1)           | 0           | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|             | Green(0)           | 0           | 0  | 0  | 0  | 0  | 0  | 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  |
|             | Blue(62)           | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  |
|             | Blue(61)           | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 0  |
|             | :                  | :           | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  |
|             | Blue(31)           | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  |
|             | :                  | :           | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  |
|             | Blue(1)            | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 0  |
|             | Blue(0)            | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  |

0 : Low level voltage, 1 :High level voltage

Each basic color can be displayed in 64 gray scales from 6 bit data signals. With the combination of total 18 bit data signals, the 262,144-color display can be achieved on the screen.

7. Reliability Condition

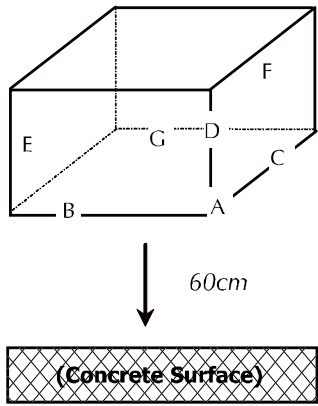
No change on display and in operation under the following test condition.

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).   | 1     |
| 3   | High Temperature Storage                          | 80°C±2°C, 240hrs.  | 2     |
| 4   | Low Temperature Storage                           | -30°C±2°C, 240hrs.   | 1,2   |
| 5   | High Temperature and High Humidity Operation Test | 60°C±2°C, 90%, 240hrs.   | 1,2   |
| 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.  | 3     |
| 7.  | Drop Test   | To be measured after dropping from 60cm high on the concrete surface in packing state.<br><br><i>Dropping method corner dropping:</i><br><i>A corner: Once edge dropping.</i><br><i>B, C, D edge: Once face dropping.</i><br><i>E, F, G face: Once.</i> |       |

- Notes:
1. No dew condensation to be observed.
  2. The function test shall be conducted after 4 hours storage at the normal temperature and humidity after removed from the test chamber.
  3. Vibration test will be conducted to the product itself without putting I in a container.

8. Dimensional Outlines

