# DLC Display Co., Limited

# 德爾西顯示器有限公司

MODEL No: DLC1040AIG

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# Record of Revision

| Date | Revision No. | Summary |
|---|---|---|
| 2014-03-26 | 1.0 | Rev 1.0 was issued |
| | | |

## 1. Scope

This data sheet is to introduce the specification of DLC1040AIG active matrix TFT module. It is composed of a color TFT-LCD panel, driver ICs, FPC and a backlight unit. The 10.4'' display area contains 800(RGB) x 600 pixels.

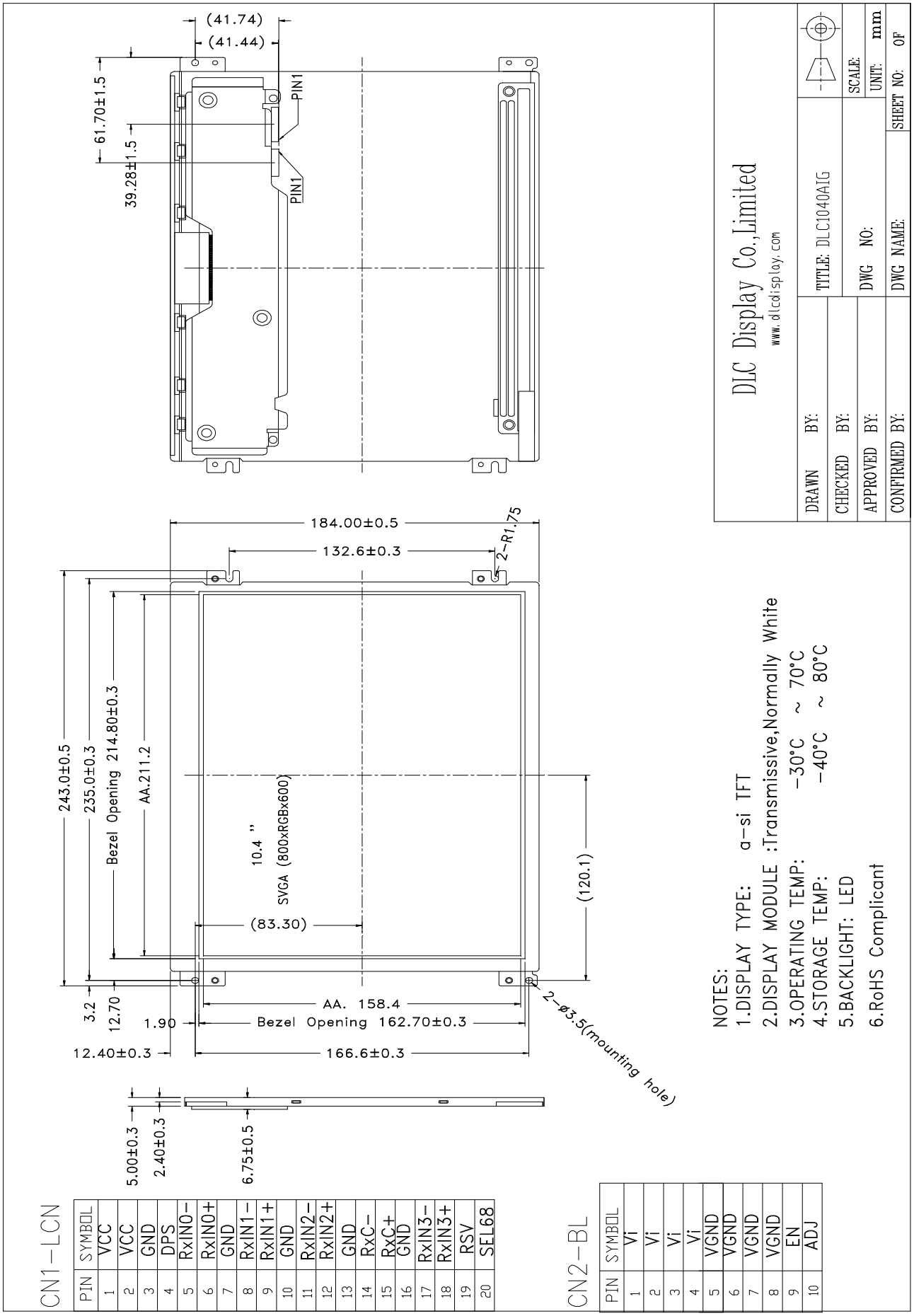
## 2. Application

Digital equipments which need color display, navigator/video systems, industrial PC.

## 3. General Information

| Item | Contents | Unit |
|---|---|---|
| Size | 10.4 | inch |
| Resolution | 800(RGB) x 600 | / |
| Interface | LVDS | / |
| Technology type | a-Si TFT | / |
| Pixel pitch | 0.264x0.264 | mm |
| Pixel Configuration | R.G.B. Vertical Stripe | |
| Outline Dimension (W x H x D) | 243.0x184.0x5.0 (max.) | mm |
| Active Area | 211.20 x 158.40 | mm |
| Display Mode | Transmissive<br>Normally White | / |
| Backlight Type | LED | / |

## 4. Outline Drawing




CN1-LCN

| PIN | SYMBOL |
|---|---|
| 1 | VCC |
| 2 | VCC |
| 3 | GND |
| 4 | DPS |
| 5 | RxIN0- |
| 6 | RxIN0+ |
| 7 | GND |
| 8 | RxIN1- |
| 9 | RxIN1+ |
| 10 | GND |
| 11 | RxIN2- |
| 12 | RxIN2+ |
| 13 | GND |
| 14 | RxC- |
| 15 | RxC+ |
| 16 | GND |
| 17 | RxIN3- |
| 18 | RxIN3+ |
| 19 | RSV |
| 20 | SEL68 |

CN2-BL

| PIN | SYMBOL |
|---|---|
| 1 | Vi |
| 2 | Vi |
| 3 | Vi |
| 4 | Vi |
| 5 | VGND |
| 6 | VGND |
| 7 | VGND |
| 8 | VGND |
| 9 | EN |
| 10 | ADJ |

# 5. Interface signals

## 5.1 TFT LCD Panel

| No | Symbol | I/O | Description | Comment |
|---|---|---|---|---|
| 1 | VCC | P | Power Supply | |
| 2 | VCC | P | Power Supply | |
| 3 | GND | P | Ground | |
| 4 | DPS | I | Reverse Scan Function [H: Enable; L/NC: Disable] | |
| 5 | RxIN0- | I | LVDS receiver signal channel 0(Negative ) | |
| 6 | RxIN0+ | I | LVDS receiver signal channel 0( Positive ) | |
| 7 | GND | P | Ground | |
| 8 | RxIN1- | I | LVDS receiver signal channel 1(Negative ) | |
| 9 | RxIN1+ | I | LVDS receiver signal channel 1( Positive ) | |
| 10 | GND | P | Ground | |
| 11 | RxIN2- | I | LVDS receiver signal channel 2(Negative ) | |
| 12 | RxIN2+ | I | LVDS receiver signal channel 2( Positive ) | |
| 13 | GND | P | Ground | |
| 14 | RxC- | I | Differential Clock Input(Negative ) | |
| 15 | RxC+ | I | Differential Clock Input( Positive ) | |
| 16 | GND | P | Ground | |
| 17 | RxIN3- | I | LVDS receiver signal channel 0(Negative ) | |
| 18 | RxIN3+ | I | LVDS receiver signal channel 0( Positive ) | |
| 19 | RSV | I | Reserved | |
| 20 | SEL68 | P | 6-bit/8-bit LVDS data input selection [H: 8-bit L/NC: 6-bit] | |

Note1: Connector Part No.: STARCONN 107A20-0001RA-G3-R or equivalent

Note 2: User's connector Part No.: STARCONN 093A20-010010-T4 or equivalent.

Note 3: "Low" stands for 0V. "High" stands for 3.3V. "NC" stands for "No Connected".

5.2 CN2 (Backlight Connector)

Connector type: 3808K-F05N-03R (ENTERY)

| No | Symbol | Description | Remark |
|---|---|---|---|
| 1 | Vi | Converter input voltage | 12V |
| 2 | Vi | Converter input voltage | 12V |
| 3 | Vi | Converter input voltage | 12V |
| 4 | Vi | Converter input voltage | 12V |
| 5 | VGND | Converter ground | Ground |
| 6 | VGND | Converter ground | Ground |
| 7 | VGND | Converter ground | Ground |
| 8 | VGND | Converter ground | Ground |
| 9 | EN | Enable pin | 3.3V |
| 10 | ADJ | Backlight Adjust | PWM Dimming (190-210Hz, Hi: 3.3$V_{DC}$, Lo: 0$V_{DC}$) |

Note1: Connector Part No.: 91208-01001-H01 (ACES) or equivalent

Note2: User's connector Part No.: 91209-01011 (ACES) or equivalent

# 6. Absolute maximum Ratings

## 6.1. Electrical Absolute max. ratings

| Parameter | Symbol | MIN | MAX | Unit | Remark |
|---|---|---|---|---|---|
| Power Voltage | VCC | -0.3 | 7.0 | V | |
| Converter Voltage for LED | Vi | -0.3 | 18 | V | |
| Enable Voltage for backlight | EN | -- | 5.5 | V | Note1 |
| Backlight Adjust | ADJ | -- | 5.5 | V | Note2 |

Note1: Permanent damage to the device may occur if maximum values are exceeded. Function operation should be restricted to the conditions described under Normal Operating Conditions.

## 6.2. Environment Conditions

| Item | Symbol | MIN | MAX | Unit | Remark |
|---|---|---|---|---|---|
| Operating Temperature | TOPR | -30 | 70 | ℃ | |
| Storage Temperature | TSTG | -40 | 80 | ℃ | |

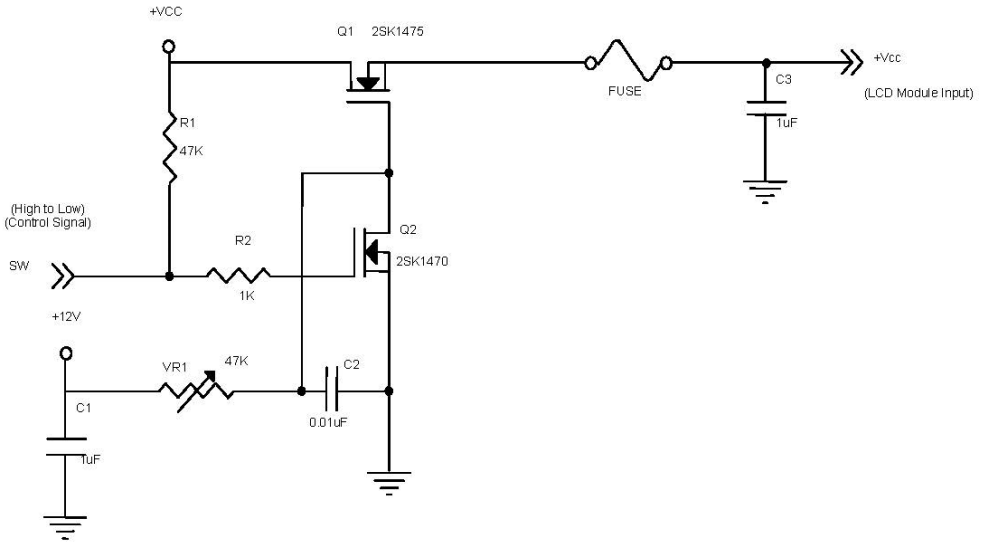
# 7. Electrical Specifications

## 7.1 Electrical characteristics

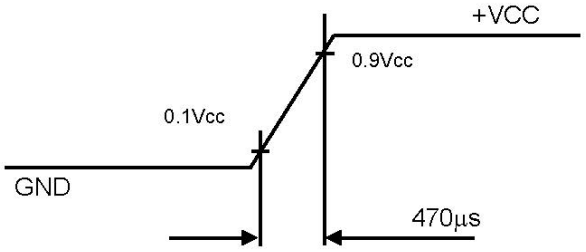
GND=0V, Ta=25℃

| Item | | Symbol | MIN | TYP | MAX | Unit | Remark |
|---|---|---|---|---|---|---|---|
| Supply Voltage | | VCC | 3.0 | 3.3 | 3.6 | V | |
| Rush Current | | $I_{RUSH}$ | -- | -- | 4 | A | |
| Power Supply Current | White | -- | -- | 410 | 1490 | mA | |
| | Black | -- | -- | 540 | 650 | mA | |
| Power Consumption | | PL | -- | 2.0 | -- | V | |
| LVDS differential input voltage | | \|VID\| | 100 | -- | 600 | V | |
| LVDS common input voltage | | VICM | 0.7- | -- | 1.6 | V | |

Note 1 : The assembly should be always operated within above ranges.
Note 2 : Measurement Conditions:

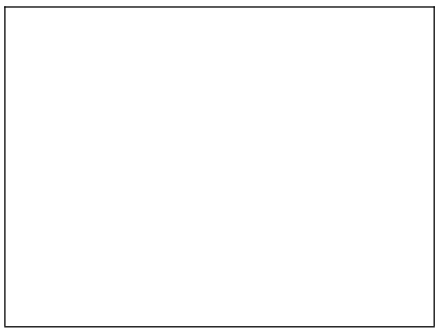



**Vcc rising time is 470μs**



Note 3: The specified power supply current is under the conditions at Vcc = 3.3V, Ta = 25 ± 2 ºC, $f_v$ = 60Hz, whereas a power dissipation check pattern below is displayed.

a. White Pattern



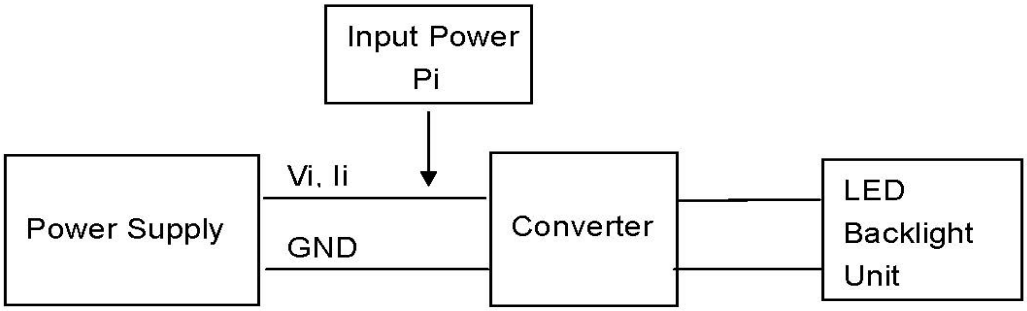
b. Black Pattern

7.2 LED Backlight

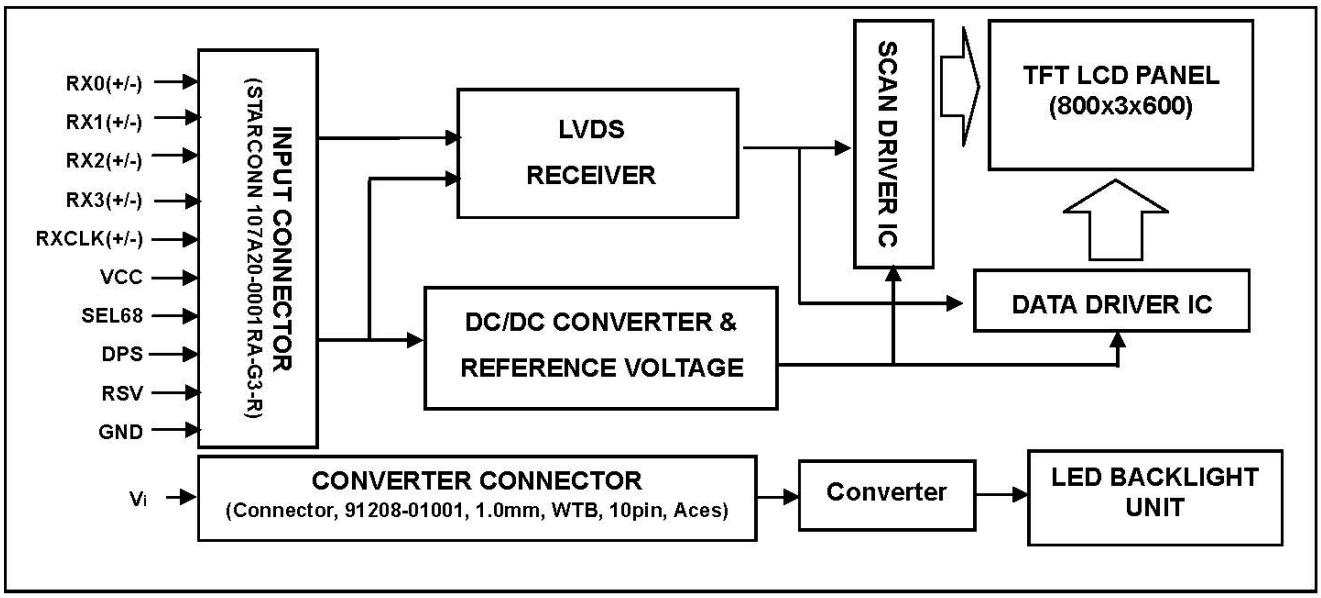
Ta=25℃

| Item | | Symbol | Min | Typ | Max | Unit | Remark |
|---|---|---|---|---|---|---|---|
| Converter Power Supply Voltage | | VCC | 7 | 12 | 17 | V | |
| Converter Power Supply Current | | $I_i$ | -- | 0.25 | 0.3 | A | Vi = 12V (Duty 100%) |
| LED Power Consumption | | $P_{LED}$ | -- | 3.0 | 3.6 | W | Vi = 12V (Duty 100%) |
| EN Control Level | Backlight on | -- | 2.0 | 3.3 | 5.0 | V | |
| | Backlight off | -- | 0 | -- | 0.8 | V | |
| PWM Control Level | PWM High Level | -- | 2.0 | 3.3 | 5.0 | V | |
| | PWM Low Level | -- | 0 | -- | 0.15 | V | |
| PWM Control Duty Ratio | | -- | 10 | -- | 100 | % | |
| PWM Control Frequency | | $f_{PWM}$ | 190 | 200 | 210 | Hz | |
| LED Life Time | | -- | 30,000 | -- | -- | Hours | |

Note 1: LED current is measured by utilizing a high frequency current meter as shown below:
Note 2: The lifetime of LED is defined as the time when it continues to operate under the conditions at Ta = 25 ±2 ℃ and Duty 100% until the brightness becomes ≦ 50% of its original value.



## 7.3 Block Diagram



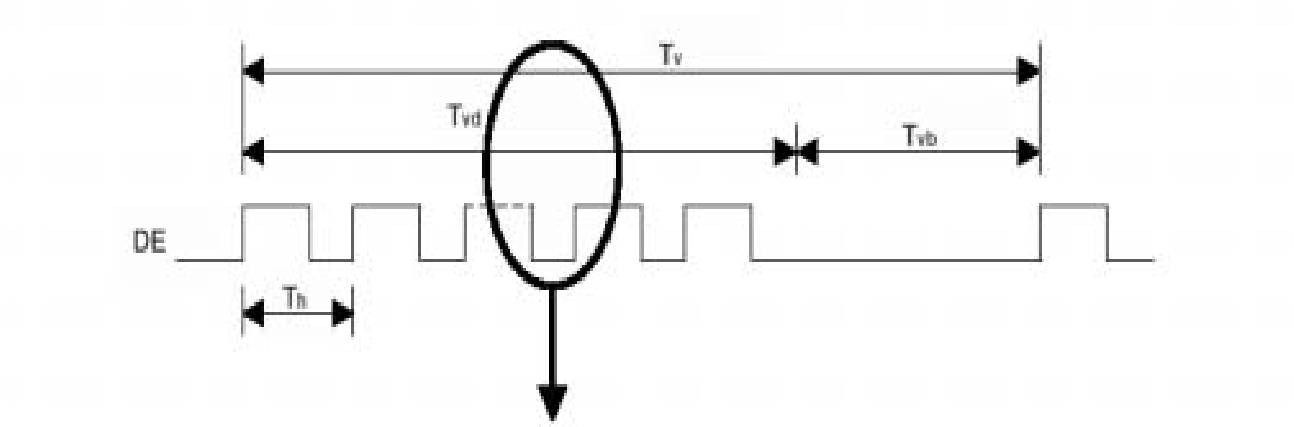
# 8. Command/AC Timing

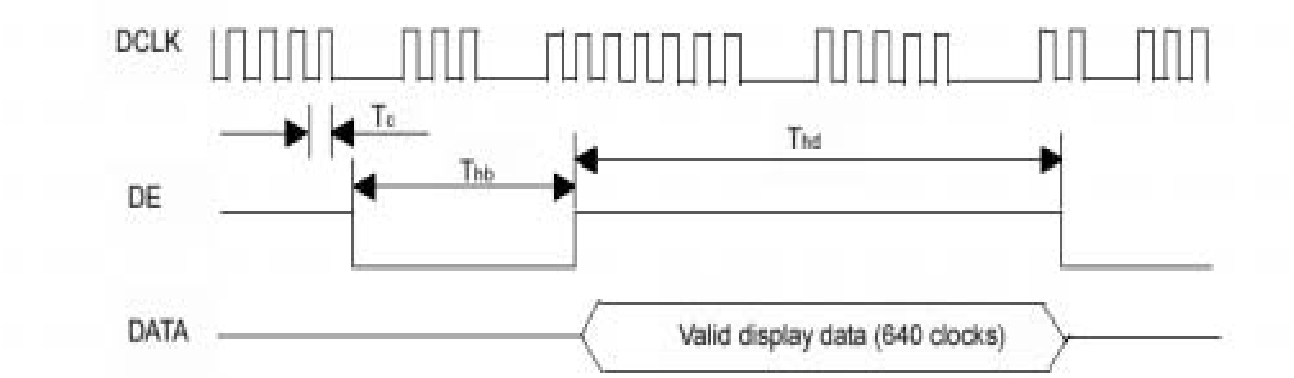
## 8.1 INPUT SIGNAL TIMING SPECIFICATIONS

| Signal | Item | Symbol | Min | Typ | Max | Unit | Condition |
|---|---|---|---|---|---|---|---|
| DCLK | Frequency | Fc | -- | 40 | -- | MHZ | |
| Vertical Active Display Term | Total | Tv | -- | 628 | -- | Th | Tv=Tvd+Tvb |
| | Display | Tvd | -- | 600 | -- | Th | |
| | Blank | Tvb | -- | 28 | -- | Th | |
| Horizontal Active Display Term | Total | Th | -- | 1056 | -- | Tc | Th=Thd+Thb |
| | Display | Thd | -- | 800 | -- | Tc | |
| | Blank | Thb | -- | 256 | -- | Tc | |

Note 1: Since this assembly is operated in DE only mode, Hsync and Vsync input signals should be set to low logic level. Otherwise, this assembly would operate abnormally.

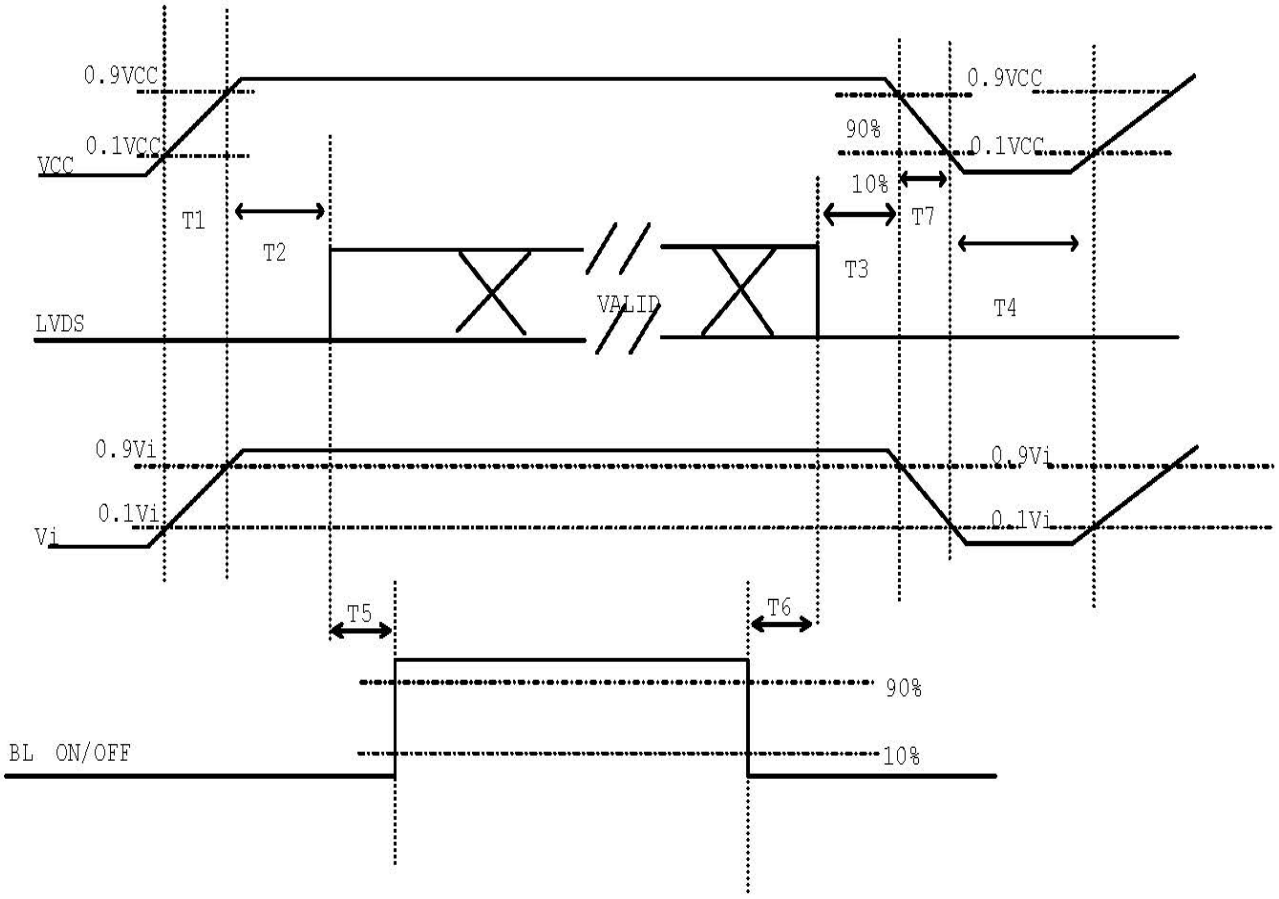
Note 2:Frame rate is 60Hz



## 8.2 SPI Interface TimingPower On/Off Sequence

To prevent a latch-up or DC operation of LCD assembly, the power on/off sequence should be as the diagram below




Note 1: Please avoid floating state of interface signal at invalid period.

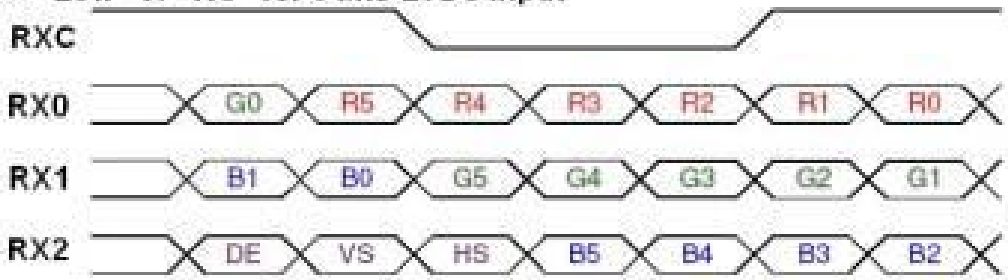
Note 2: When the interface signal is invalid, be sure to pull down the power supply of LCD VCC to 0 V.

Note 3 : The Backlight converter power must be turned on after the power supply for the logic and the interface signal is valid. The Backlight converter power must be turned off before the power supply for the logic and the interface signal is invalid.

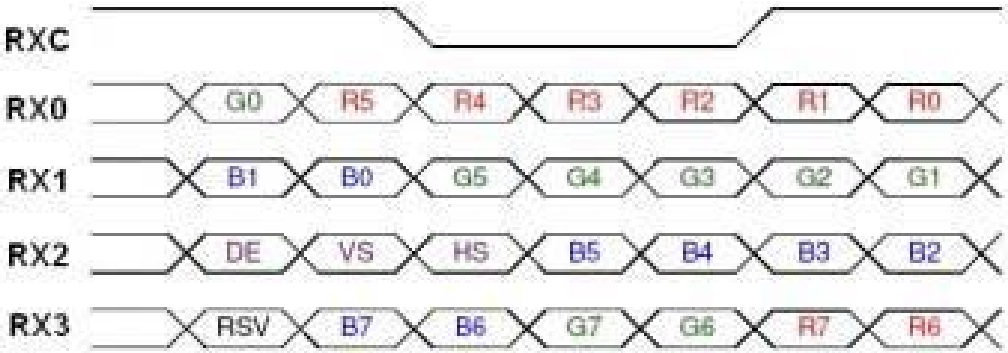
| Parameter | Value | | | Unit |
|---|---|---|---|---|
| | Min | Typ | Max | |
| T1 | 0.5 | -- | 10 | ms |
| T2 | 0 | -- | 50 | ms |
| T3 | 0 | -- | 50 | ms |
| T4 | 500 | -- | -- | ms |
| T5 | 200 | -- | -- | ms |
| T6 | 200 | -- | -- | ms |
| T7 | 5 | -- | 300 | ms |

## 8.3 The Input Data Format

SEL68 = "Low" or "NC" for 6 bits LVDS Input




SEL68 = "High" for 8 bits LVDS Input




Note 1: R/G/B data 7: MSB, R/G/B data 0: LSB

Note 2: Please follow PSWG

| Signal Name | Description | Remark |
|---|---|---|
| R7 | Red Data 7 (MSB) | Red-pixel Data |
| R6 | Red Data 6 | Each red pixel's brightness data consists of these |
| R5 | Red Data 5 | 8 bits pixel data. |
| R4 | Red Data 4 | |
| R3 | Red Data 3 | |
| R2 | Red Data 2 | |
| R1 | Red Data 1 | |
| R0 | Red Data 0 (LSB) | |
| G7 | Green Data 7 (MSB) | Green-pixel Data |
| G6 | GreenData 6 | Each green pixel's brightness data consists of these |
| G5 | GreenData 5 | 8 bits pixel data. |
| G4 | GreenData 4 | |
| G3 | GreenData 3 | |
| G2 | GreenData 2 | |
| G1 | GreenData 1 | |
| G0 | GreenData 0 (LSB) | |
| B7 | Blue Data 7 (MSB) | Blue-pixel Data |
| B6 | Blue Data 6 | Each blue pixel's brightness data consists of these |
| B5 | Blue Data 5 | 8 bits pixel data. |
| B4 | Blue Data 4 | |
| B3 | Blue Data 3 | |
| B2 | Blue Data 2 | |
| B1 | Blue Data 1 | |
| B0 | Blue Data 0 (LSB) | |
| RXCLKIN+<br>RXCLKIN- | LVDS Clock Input | |
| DE | Display Enable | |
| VS | Vertical Sync | |
| HS | Horizontal Sync | |

Note 3 : Output signals from any system shall be low or Hi-Z state when VCC is off.

## 8.4 Scanning Direction

The following figures show the image see from the front view. The arrow indicates the direction of scan.

**Fig.1 Normal Scan** **Fig.2 Reverse Scan**

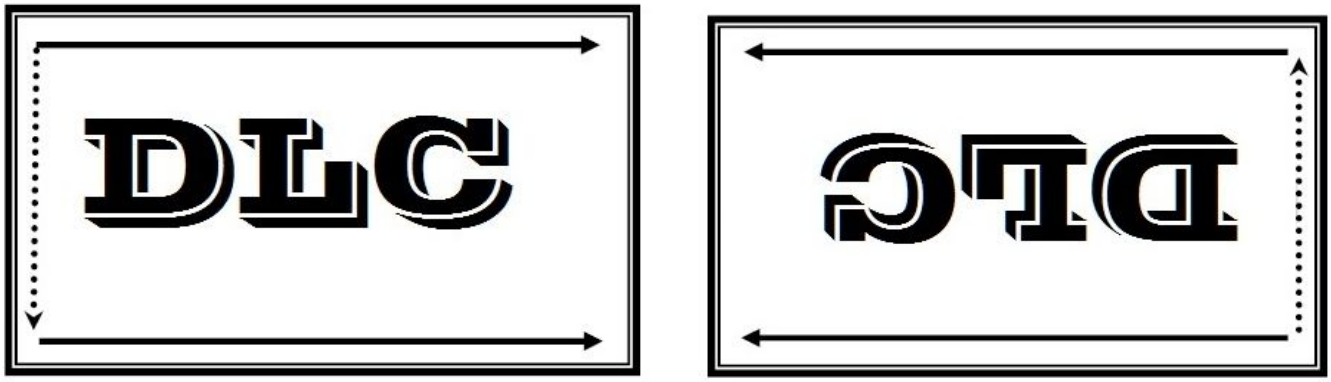



Fig. 1 Normal scan ( pin 4, DPS = Low or NC)

Fig. 2 Reverse scan ( pin 4, DPS = High )

## 8.5 COLOR DATA INPUT ASSIGNMENT

The brightness of each primary color (red, green and blue) is based on the 6-bit gray scale data input for the color. The higher the binary input, the brighter the color. The table below provides the assignment of color versus data input.

| Color | | Data Signal | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Red | | | | | | Green | | | | | | Blue | | | | | |
| | | R5 | R4 | R3 | R2 | R1 | R0 | G5 | G4 | G3 | G2 | G1 | G0 | B5 | B4 | B3 | B2 | B1 | B0 |
| | Black | 0 | 0 | 0 | 0 | 0 | 0 | 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 |
| | Green | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Basic | Blue | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 |
| Colors | 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(0)/Dark | 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 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Gray | Red(2) | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Scale | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| Of | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| Red | Red(61) | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Red(62) | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Red(63) | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Green(0)/Dark | 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 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Gray | Green(2) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Scale | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| Of | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| Green | Green(61) | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Green(62) | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Green(63) | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Blue(0)/Dark | 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 | 1 |
| Gray | Blue(2) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| Scale | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| Of | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| Blue | Blue(61) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 1 |
| | Blue(62) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 0 |
| | Blue(63) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 |

Note (1) 0: Low Level Voltage, 1: High Level Voltage

The brightness of each primary color (red, green and blue) is based on the 8-bit gray scale data input for the color. The higher the binary input, the brighter the color. The table below provides the assignment of color versus data input.

| Color | | Data Signal | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Red | | | | | | | | Green | | | | | | | | Blue | | | | | | | |
| | | 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 Colors | Black | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Red | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Green | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Blue | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 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 | 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 | 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 | 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 | 1 |
| Gray Scale Of Red | Red(0) / Dark | 0 | 0 | 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 | 0 | 0 |
| | Red(2) | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| | Red(253) | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Red(254) | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Red(255) | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Gray Scale Of Green | Green(0)/ Dark | 0 | 0 | 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 | 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 | 0 | 0 |
| | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| | Green(253) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Green(254) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Green(255) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Gray Scale Of Blue | Blue(0) / Dark | 0 | 0 | 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 | 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 | 0 | 1 | 0 |
| | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| | Blue(253) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 |
| | Blue(254) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 |
| | Blue(255) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

Note (1) 0: Low Level Voltage, 1: High Level Voltage

## 9. Optical Specification

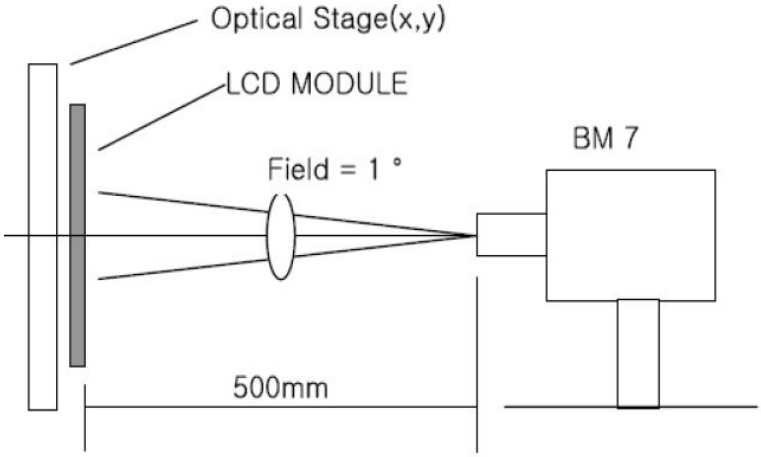
Ta=25℃

| Item | | Symbol | Condition | Min | Typ. | Max. | Unit | Remark |
|---|---|---|---|---|---|---|---|---|
| Contrast Ratio | | CR | θ=0° | 500 | 700 | - | | Note1<br>Note2 |
| Response Time | | Ton | 25℃ | - | 5 | 10 | ms | Note1<br>Note3 |
| | | Toff | | - | 11 | 16 | | |
| View Angles | | ΘT | CR≧10 | 60 | 70 | - | Degree | Note 4 |
| | | ΘB | | 60 | 70 | - | | |
| | | ΘL | | 70 | 80 | - | | |
| | | θR | | 70 | 80 | - | | |
| Chromaticity | White | x | Brightness is on | Typ-0.05 | 0.313 | Typ+0.05 | | Note5, Note1 |
| | | y | | | 0.329 | | | |
| | Red | x | | | 0.573 | | | |
| | | y | | | 0.350 | | | |
| | Green | x | | | 0.336 | | | |
| | | y | | | 0.597 | | | |
| | Blue | x | | | 0.152 | | | |
| | | y | | | 0.112 | | | |
| Luminance | | L | - | 250 | 350 | - | cd/m$^2$ | Note1<br>Note6 |
| Uniformity | | U | | 70 | 80 | - | % | Note1<br>Note7 |

Note 1: Definition of optical measurement system.

Temperature = 25℃(±3℃)

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

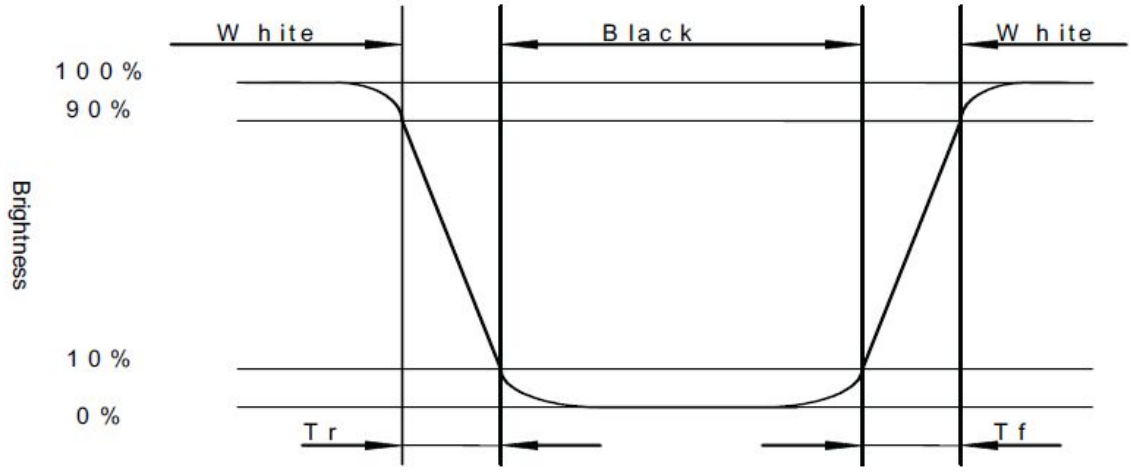


Note 2: Contrast ratio is defined as follow:

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

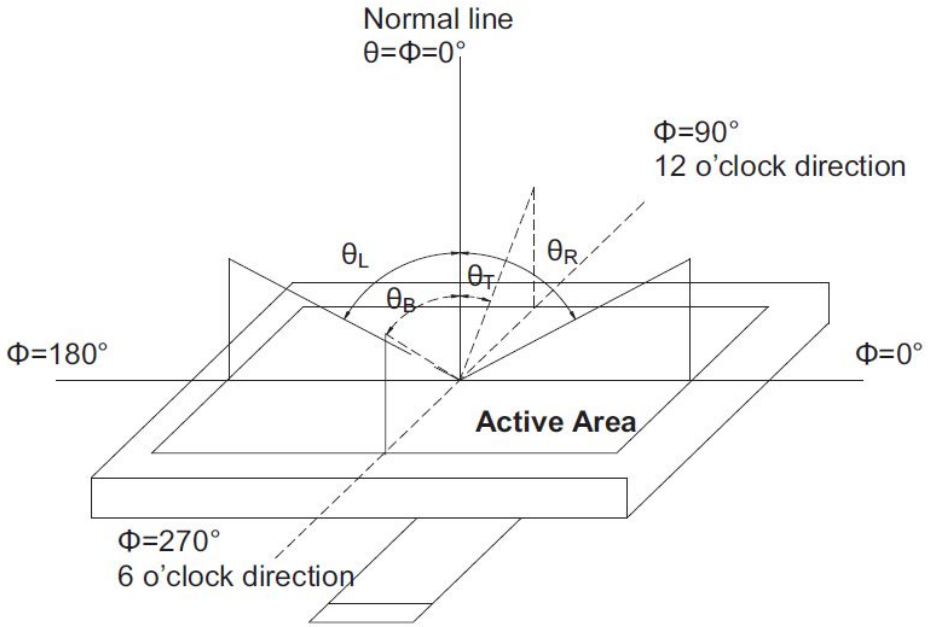
Note 3: Response time is defined as follow:

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).



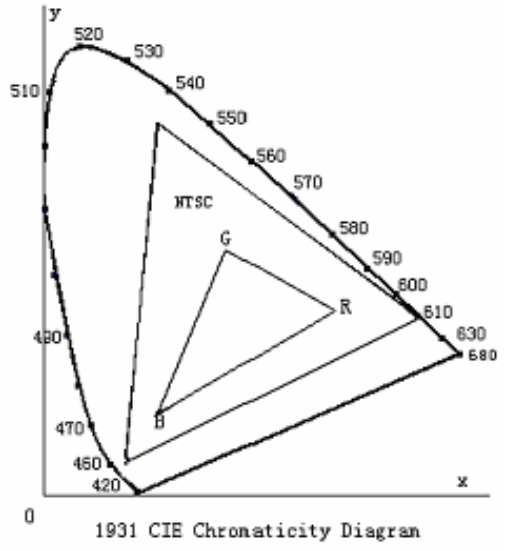

Note 4: Viewing angle range is defined as follow:

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.




$$S = \frac{\text{area of RGB triangle}}{\text{area of NTSC triangle}} \times 100\%$$

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.

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

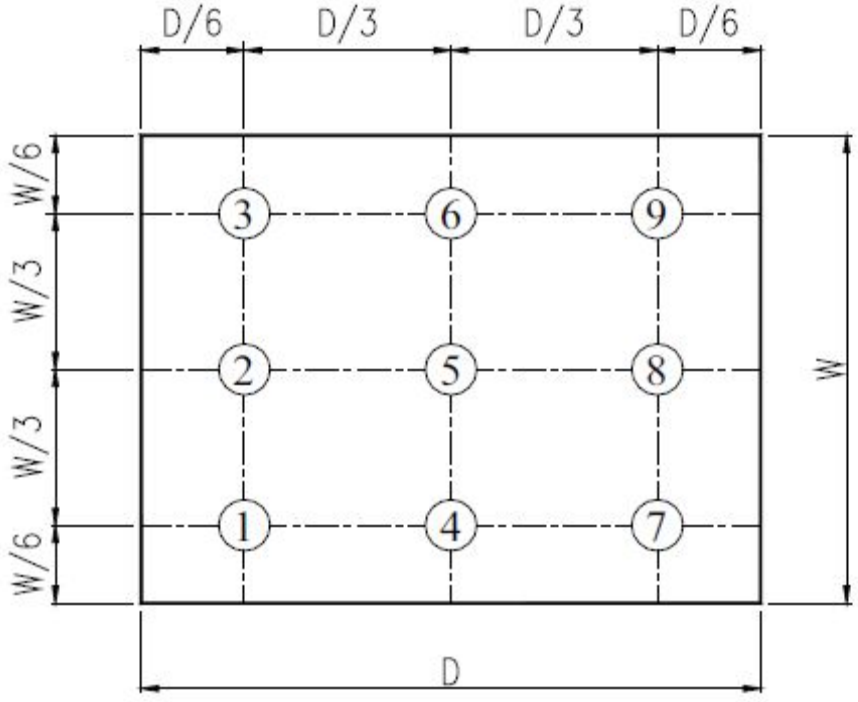



Fig. 2 Definition of uniformity

## 10. Environmental / Reliability Tests

| No | Test Item | Condition | Judgment criteria |
|---|---|---|---|
| 1 | High Temp Operation | Ts=+70℃, 240hrs | Per table in below |
| 2 | Low Temp Operation | Ta=-30℃, 240hrs | Per table in below |
| 3 | High Temp Storage | Ta=+80℃, 240hrs | Per table in below |
| 4 | Low Temp Storage | Ta=-40℃, 240hrs | Per table in below |
| 5 | High Temp & High Humidity Storage | Ta=+60℃, 90% RH<br>240 hours | Per table in below<br>(polarizer discoloration is excluded) |
| 6 | Thermal Shock (Non-operation) | -30℃ 30 min~+70℃ 30 min,<br>Change time:5min, 100 Cycles | Per table in below |
| 7 | Vibration (Non-operation) | 1.5G, 10 ~ 300 Hz, 10min/cycle, 3 cycles each X, Y, Z | Per table in below |
| 8 | Shock (Non-operation) | 200G, 2ms, half sine wave, 1 time for ± X, ± Y, ± Z. | Per table in below |
| 9 | Package Drop Test | 1 Angle, 3 Edge, 6 Face, 61 cm | Per table in below |
| 10 | Package Vibration Test | ISTA STANDARD<br>Random, Frequency Range: 2 – 200 Hz<br>Top & Bottom: 30 minutes (+Z), 10 min (-Z),<br>Right & Left: 10 minutes (X)<br>Back & Forth 10 minutes (Y) | Per table in 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

A. 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.
B. Do not handle the product by holding the flexible pattern portion in order to assure the reliability
C. 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.
D. Provide a space so that the panel does not come into contact with other components.
E. To protect the product from external force, put a covering lens (acrylic board or similar board) and keep an appropriate gap between them.
F. Transparent electrodes may be disconnected if the panel is used under environmental conditions where dew condensation occurs.
G. Property of semiconductor devices may be affected when they are exposed to light, possibly resulting in IC malfunctions.
H. 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

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

## 11.4Storage

A. Store the products in a dark place at +25℃±10℃ with low humidity (40% RH to 60% RH). Don't expose to sunlight or fluorescent light.
B. Storage in a clean environment, free from dust, active gas, and solvent.

## 11.5 Cleaning

A. Do not wipe the touch panel with dry cloth, as it may cause scratch.
B. 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.