

DLC Display Co., Limited

德爾西顯示器有限公司



MODEL No: DLC0920AML

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Record of Revision

| Date | Revision No. | Summary |
|------------|--------------|--------------------|
| 2016-08-10 | 1.0 | Rev 1.0 was issued |
| | | |

1. Scope

This data sheet is to introduce the specification of DLC0920AML active matrix TFT module. It is composed of a color TFT-LCD panel, driver ICs, FPC and a backlight unit. The 9.2" display area contains 1920(RGB) x 480 pixels.

2. Application

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

3. General Information

| Item | Contents | Unit |
|-------------------------------|------------------------------|------|
| Size | 9.2 | inch |
| Resolution | 1920(RGB) x 480 | / |
| Interface | LVDS(24BIT)+SPI(3-wire) | / |
| Technology type | a-Si TFT | / |
| Pixel pitch | 0.1182 x 0.1182 | mm |
| Pixel Configuration | R.G.B. Vertical Stripe | |
| Outline Dimension (W x H x D) | 237.0 x 72.3 x 5.8 | mm |
| Active Area | 226.94 x 56.74 | mm |
| Display Mode | Transmissive, Normally White | / |
| Backlight Type | LED | / |
| Driver IC | HX8298-A-LT, HX8660-B | |

4. Outline Drawing

1920*RGB*480

Dimensions: 237.00, 228.94 BEZEL OPENING, 226.94 LCD A.A, (118.50), (33.77), 4.03, 5.03, 58.74 BEZEL OPENING, 56.74 LCD A.A, 72.30, 4.40, 5.40, 00.24, 60.00±5, CN2, RED +, BLACK +, 5.80±0.2, (8.70), (4.41), (46.41), (18.78), (13.68), (5.89), (35.93), 40, 1, CN1

| | | | | | |
|----|-------|----|-------|----|-------|
| 1 | GND | 16 | RX03+ | 31 | RXE3+ |
| 2 | GND | 17 | GND | 32 | GND |
| 3 | RX00- | 18 | RXE0- | 33 | GND |
| 4 | RX00+ | 19 | RXE0+ | 34 | CSB |
| 5 | GND | 20 | GND | 35 | SCL |
| 6 | RX01- | 21 | RXE1- | 36 | SDI |
| 7 | RX01+ | 22 | RXE1+ | 37 | NC |
| 8 | GND | 23 | GND | 38 | VCC |
| 9 | RX02- | 24 | RXE2- | 39 | VCC |
| 10 | RX02+ | 25 | RXE2+ | 40 | VCC |
| 11 | GND | 26 | GND | | |
| 12 | RX0C- | 27 | RXEC- | | |
| 13 | RX0C+ | 28 | RXEC+ | | |
| 14 | GND | 29 | GND | | |
| 15 | RX03- | 30 | RXE3- | | |

NOTES:

- 1.DISPLAY TYPE: a-si TFT
- 2.DISPLAY MODULE :Transmissive,Normally White
- 3.OPERATING TEMP: -30°C ~ 85°C
- 4.STORAGE TEMP: -40°C ~ 95°C
- 5.RoHS Complicant

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| | | | |
|---------------|-------------------|--------------|--------|
| DRAWN BY: | TITLE: DLC0920AML | | SCALE: |
| CHECKED BY: | DWG NO: | UNIT: mm | |
| APPROVED BY: | DWG NAME: | SHEET NO: 0F | |
| CONFIRMED BY: | | | |

5. Interface signals

5.1 CN1 pin assignment (LVDS interface)

FPC down Connector type: FH52E-40S-0.5SH

| Pin No. | Symbol | I/O | Description | Remarks |
|---------|--------|-----|--|---------|
| 1 | GND | P | Ground | |
| 2 | GND | P | Ground | |
| 3 | RX00- | I | Negative LVDS differential data input. Channel O0 (odd) | |
| 4 | RX00+ | I | Positive LVDS differential data input. Channel O0 (odd) | |
| 5 | GND | P | Ground | |
| 6 | RX01- | I | Negative LVDS differential data input. Channel O1 (odd) | |
| 7 | RX01+ | I | Positive LVDS differential data input. Channel O1 (odd) | |
| 8 | GND | P | Ground | |
| 9 | RX02- | I | Negative LVDS differential data input. Channel O2 (odd) | |
| 10 | RX02+ | I | Positive LVDS differential data input. Channel O2 (odd) | |
| 11 | GND | P | Ground | |
| 12 | RXOC- | I | Negative LVDS differential clock input. (odd) | |
| 13 | RXOC+ | I | Positive LVDS differential clock input. (odd) | |
| 14 | GND | P | Ground | |
| 15 | RX03- | I | Negative LVDS differential data input. Channel O3 (odd) | |
| 16 | RX03+ | I | Positive LVDS differential data input. Channel O3 (odd) | |
| 17 | GND | P | Ground | |
| 18 | RXE0- | I | Negative LVDS differential data input. Channel E0 (even) | |
| 19 | RXE0+ | I | Positive LVDS differential data input. Channel E0 (even) | |
| 20 | GND | P | Ground | |
| 21 | RXE1- | I | Negative LVDS differential data input. Channel E1 (even) | |
| 22 | RXE1+ | I | Positive LVDS differential data input. Channel E1 (even) | |
| 23 | GND | P | Ground | |
| 24 | RXE2- | I | Negative LVDS differential data input. Channel E2 (even) | |
| 25 | RXE2+ | I | Positive LVDS differential data input. Channel E2 (even) | |
| 26 | GND | P | Ground | |
| 27 | RXEC- | I | Negative LVDS differential clock input. (even) | |

| | | | | |
|----|-------|-----|--|--|
| 28 | RXEC+ | I | Positive LVDS differential clock input. (even) | |
| 29 | GND | P | Ground | |
| 30 | RXE3- | I | Negative LVDS differential data input. Channel E3 (even) | |
| 31 | RXE3+ | I | Positive LVDS differential data input. Channel E3 (even) | |
| 32 | GND | P | Ground | |
| 33 | GND | P | Ground | |
| 34 | CSB | I | Chip select, Serial interface chip enable signal. CSB=0:Selected. CSB=1: Not selected. | |
| 35 | SCL | I | SPI clock | |
| 36 | SDA | I/O | Serial interface address and data input/output. | |
| 37 | NC | - | No connection | |
| 38 | VCC | P | Power Input | |
| 39 | VCC | P | Power Input | |
| 40 | VCC | P | Power Input | |

I---Input, O---Output, P--- Power/Ground, "-"---No connection

5.2 CN2 Backlight interface

Connector type: BHSR-02VS-1
Mating Connector: SBHT-002T-P0.5 or equivalent

| Pin No. | Symbol | I/O | Description | Remarks |
|---------|---------------|-----|---------------------------------|---------|
| 1 | LED+(Anode) | P | LED power supply (high voltage) | |
| 2 | LED-(Cathode) | P | LED power supply (low voltage) | |

6. Absolute maximum Ratings

6.1. Electrical Absolute max. ratings

GND=0V, Ta = 25°C

| Item | Symbol | Min | Max | Unit | Remark |
|--------------------|-----------------|------|-----|------|--------|
| Power Voltage | VCC | -0.5 | 5.0 | V | |
| Data Input voltage | V _{IN} | -0.5 | 5.0 | V | Note |

Note: Signals include RXOn-/+ , RXEn-/+

6.2. Environment Conditions

| Item | Symbol | MIN | MAX | Unit | Remark |
|-----------------------|--------|-----|-----|------|--------|
| Operating Temperature | TOPR | -30 | 85 | °C | |
| Storage Temperature | TSTG | -40 | 95 | °C | |

6.3. LED Backlight Absolute max. ratings

| Item | Symbol | MIN | MAX | Unit | Remark |
|---------------------|------------------|-----|-----|------|--------------|
| LED Forward Current | I _{LED} | -- | 100 | mA | For each LED |

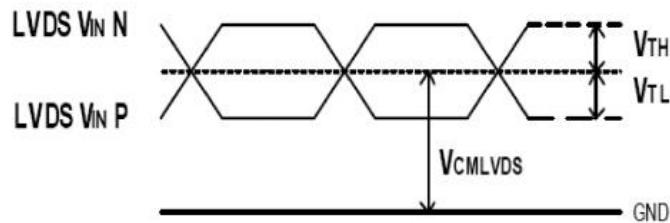
7. Electrical Specifications

7.1 Electrical characteristics

VCC=3.3V,GND=0V, Ta=25°C

| Item | Symbol | Min | Typ | Max | Unit | Remark |
|--|--------|-----|------|-----|------|-----------|
| Supply Voltage | VCC | 3.0 | 3.3 | 3.6 | V | |
| Power supply ripple | Vp-p | - | - | 200 | mV | |
| Power supply current | Icc | - | TBD | TBD | mA | Note |
| Differential input voltage | Vid | 250 | 350 | 450 | mV | |
| Differential Input threshold voltage for LVDS receiver | Low | Vtl | -100 | - | mV | Vcm=1.25V |
| | High | Vth | - | - | +100 | |
| Common Voltage | Vcm | 1.0 | 1.25 | 1.4 | V | |
| LVDS terminal Resistance | R | - | 100 | - | Ω | |

Note1: To test the current dissipation, use “all Black Pattern”.

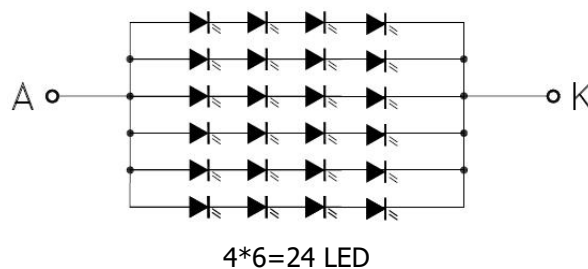


7.2 LED Backlight

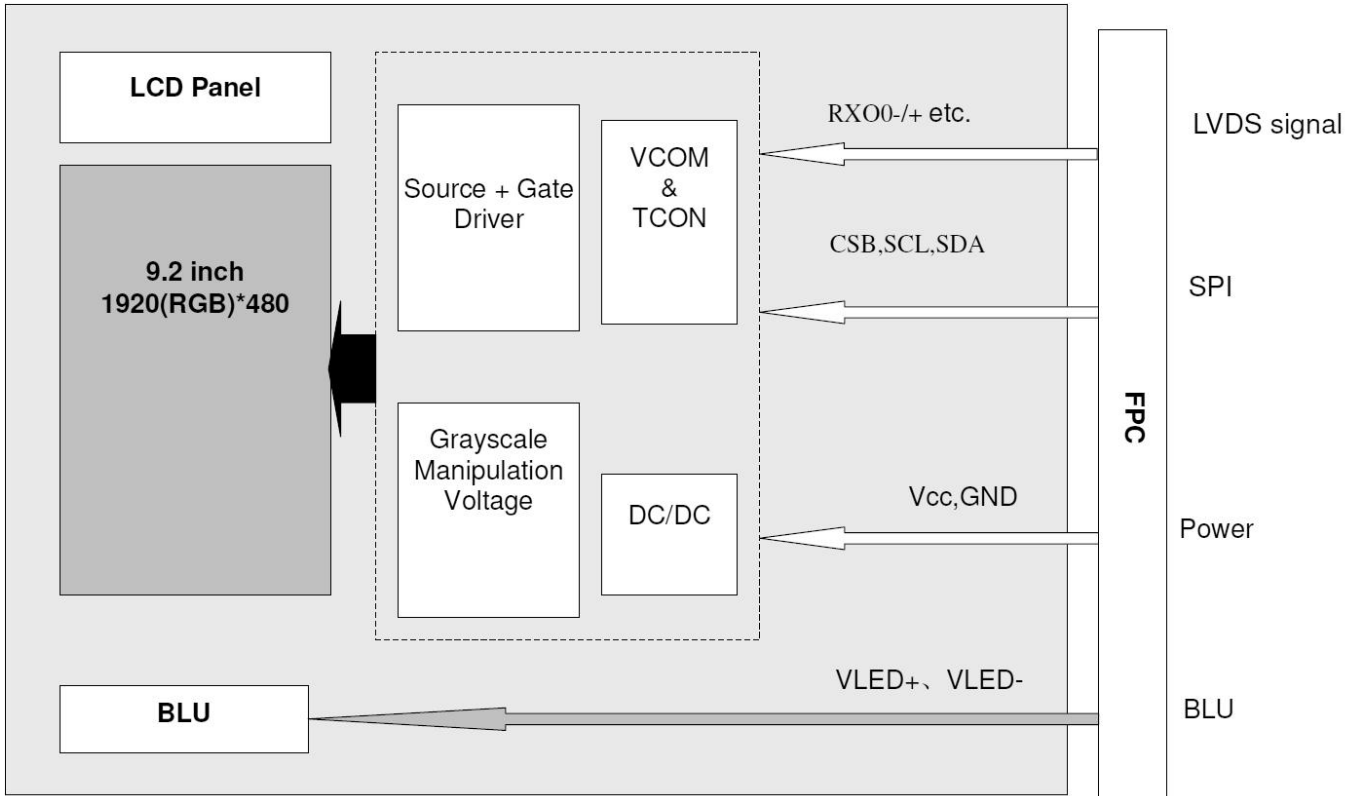
LED_GND=GND=0V Ta=25°C

| Item | Symbol | MIN | TYP | MAX | Unit | Remark |
|-----------------------------|--------|-----|--------|-----|------|--------|
| Channel1 | IF | - | 360 | - | mA | |
| Forward Voltage | VF | - | 12 | - | V | |
| Backlight Power Consumption | WBL | - | 4320 | - | mW | |
| Life Time | - | | 50,000 | | Hrs | Note |

Note : If LED is driven by high current, high ambient temperature & humidity condition. The life time of LED will be reduced. Operating life means brightness goes down to 50% initial brightness. Typical operating life time is an estimated data.



7.3 BLOCK DIAGRAM



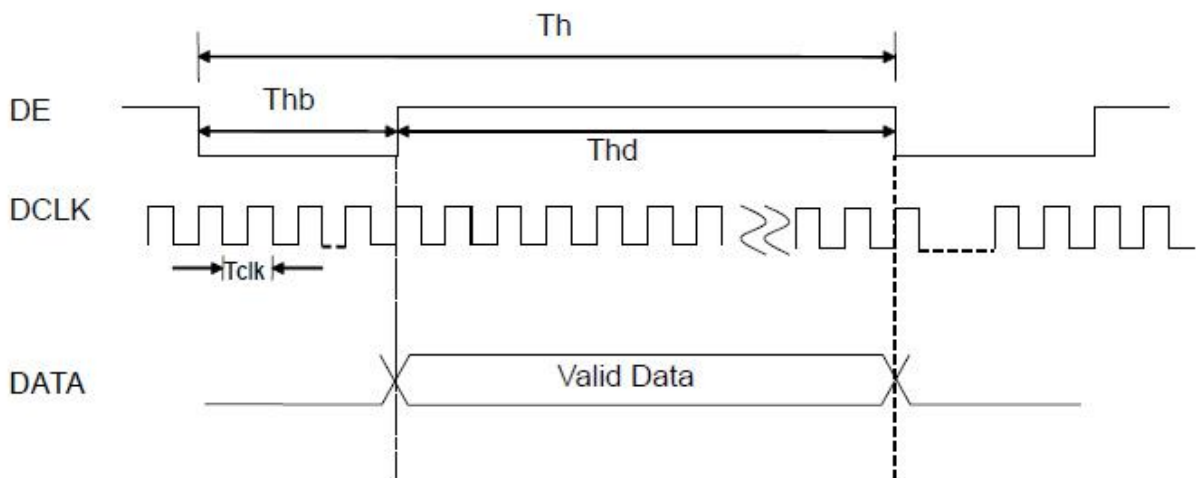
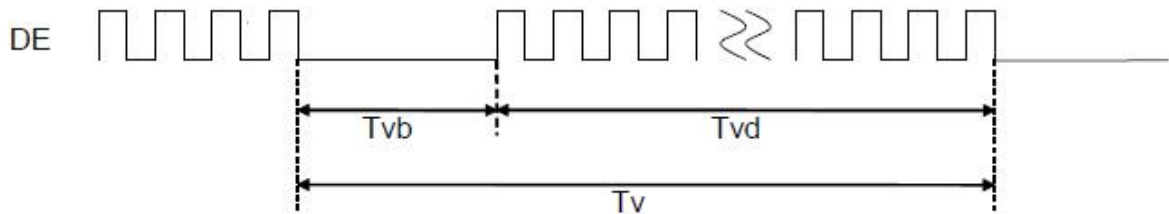
8. Command/AC Timing

8.1 Input Timing characteristics

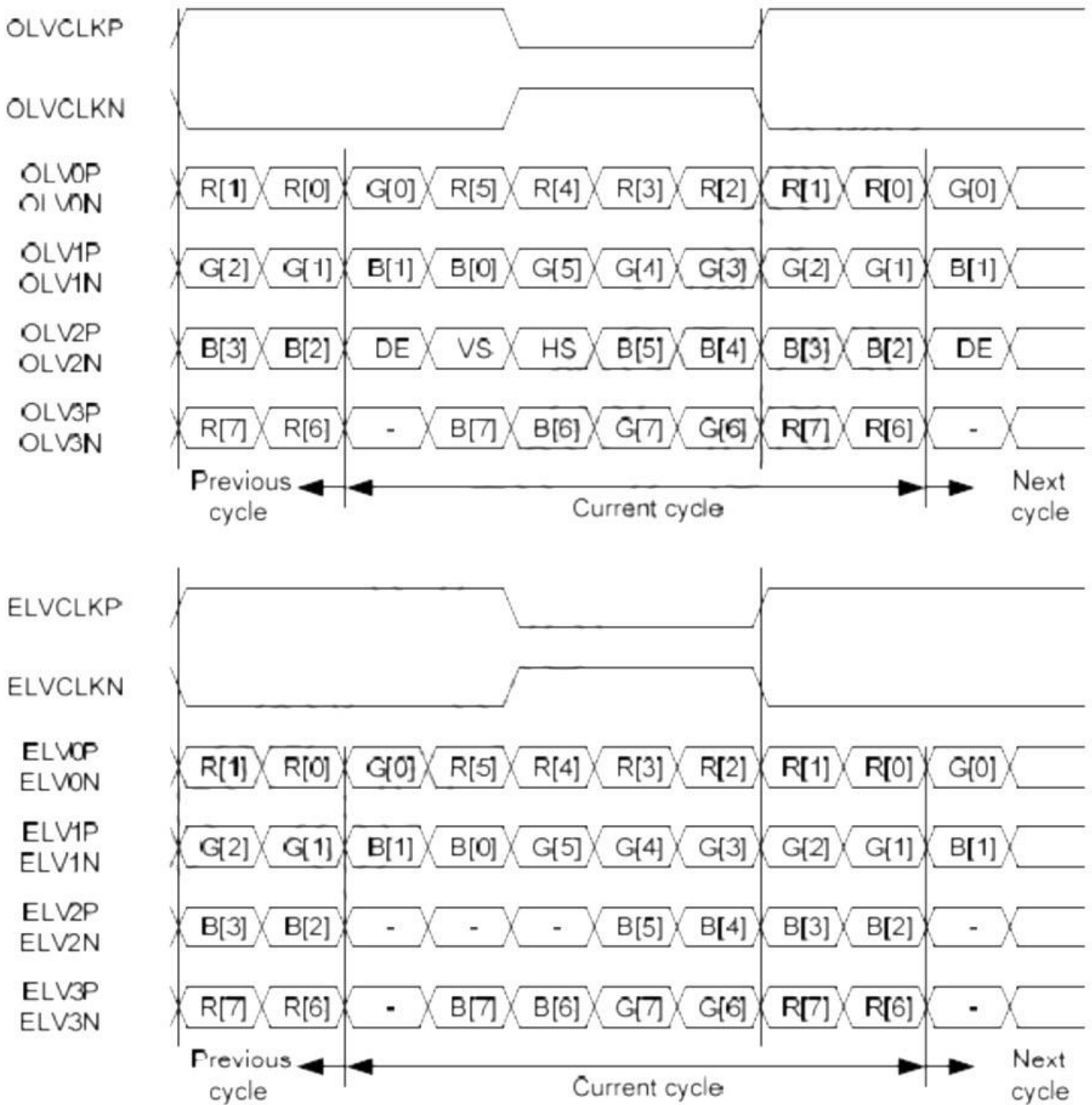
VCC=3.3V,GND=0V,Ta=25°C

| Parameter | | Symbol | Min | Typ | Max | Unit | Remark |
|-----------------------|---------------------|--------|-----|-------|-----|------|-------------|
| DCLK(Frame rate=60HZ) | | Fclk | | 35.11 | | MHz | Tclk=1/Fclk |
| | | Tclk | | 28.5 | | ns | |
| Horizontal section | Horizontal total | Th | - | 992 | - | Tclk | |
| | Valid Data Width | Thd | - | 960 | - | Tclk | |
| | Horizontal blanking | Thb | - | 32 | - | Tclk | |
| Vertical section | Vertical total | TV | - | 590 | - | TH | |
| | Valid Data Width | Tvd | - | 480 | - | TH | |
| | Vertical blanking | Tvb | - | 110 | - | TH | |

Input Clock and Data timing Diagram:

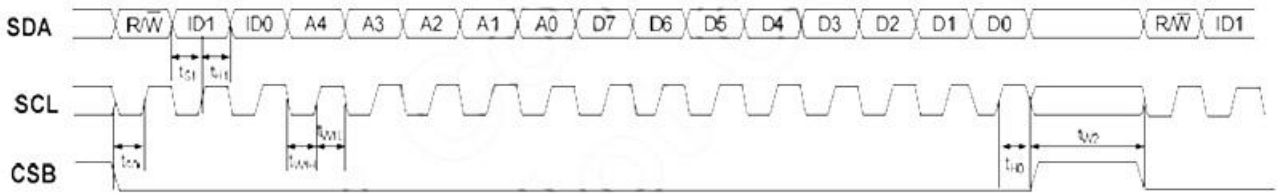


8.2 LVDS input data format



8.3 SPI interface characteristics(3-WIRE)

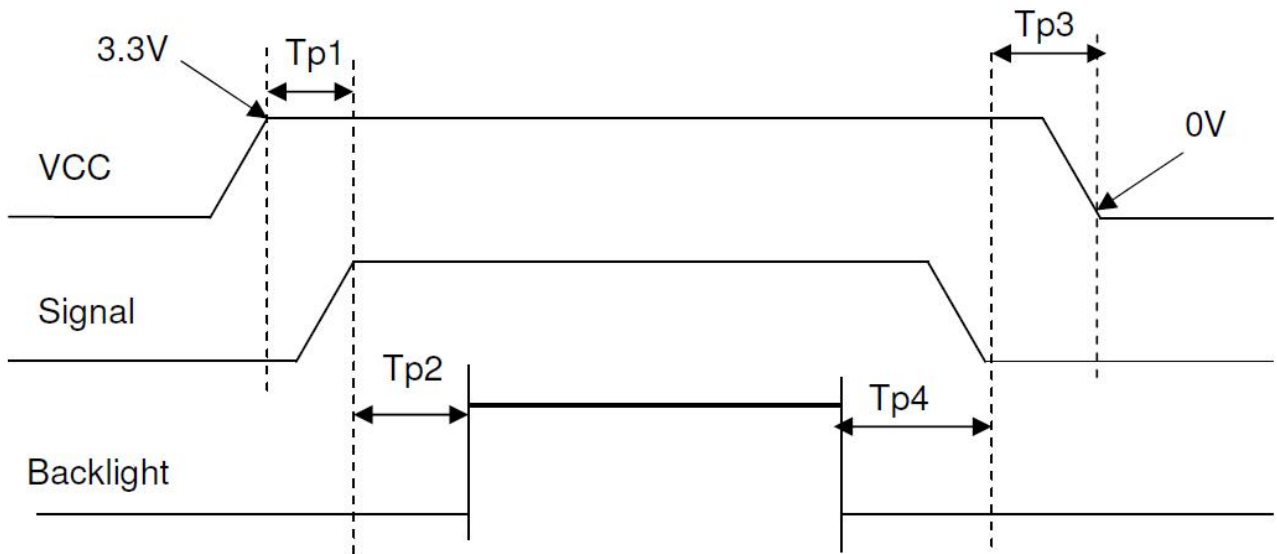
| Parameter | Symbol | Conditions | Min | Typ | Max | Unit |
|----------------|--------|-----------------|-----|-----|-----|------|
| SDA Setup Time | Ts0 | CSB to SCL | 60 | - | - | ns |
| | Ts1 | SDA to SCL | 60 | - | - | ns |
| SDA Hold Time | Th0 | CSB to SCL | 60 | - | - | ns |
| | Th1 | SDA to SCL | 60 | - | - | ns |
| Pulse Width | Tw1L | SCL pulse width | 75 | - | - | ns |
| | Tw1H | SCL pulse width | 75 | - | - | ns |
| | Tw2 | CSB pulse width | 1 | - | - | ns |
| Clock duty | - | - | 40 | 50 | 60 | % |



8.4 POWER ON/OFF SEQUENCE

| Item | Symbol | Min | Typ | Max | Unit | Remark |
|---------------------------------|--------|-----|-----|-----|------|--------|
| VCC 3.3V to signal starting | Tp1 | 5 | - | 50 | ms | |
| VCC rising time | Tr | 0.1 | - | 5 | ms | Note1 |
| Signal starting to backlight on | Tp2 | 150 | - | - | ms | |
| Signal off to VCC 0V | Tp3 | 5 | - | 50 | ms | |
| Backlight off to signal off | Tp4 | 150 | - | - | ms | |

Note1: Tr means the time of input voltage rise from 10% to 90%.



9. Optical Specification

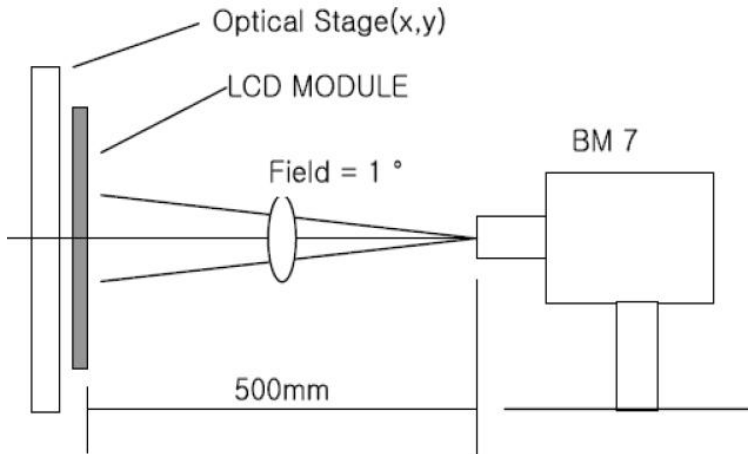
Ta=25°C

| Item | Symbol | Condition | Min | Typ. | Max. | Unit | Remark |
|----------------|------------------|------------------|---------------------|------|------|-------------------|-----------------|
| Contrast Ratio | CR | $\theta=0^\circ$ | 400 | 600 | - | | Note1 Note2 |
| Response Time | T _{ON} | 25°C | - | 20 | 30 | ms | Note1 Note3 |
| | T _{OFF} | | | | | | |
| View Angles | θ_T | CR \geq 10 | 60 | 70 | - | Degree | Note 4 |
| | θ_B | | 50 | 60 | - | | |
| | θ_L | | 70 | 80 | - | | |
| | θ_R | | 70 | 80 | - | | |
| Chromaticity | White | x | Brightness is on | TBD | TBD | TBD | Note5, Note1 |
| | | y | | TBD | TBD | TBD | |
| NTSC | S | | 60 | 75 | - | % | Note5 |
| Luminance | L | | 450 | 500 | - | cd/m ² | Note1 Note6 |
| Uniformity | U | | 75 | 80 | - | % | Note1 Note7 |

Note 1: Definition of optical measurement system.

Temperature = 25°C(±3°C)

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

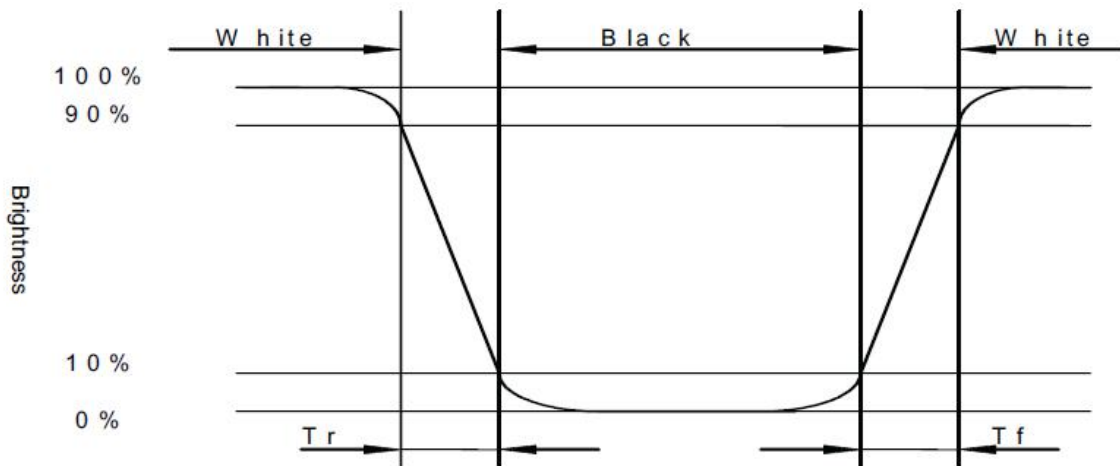


Note 2: Contrast ratio is defined as follow:

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

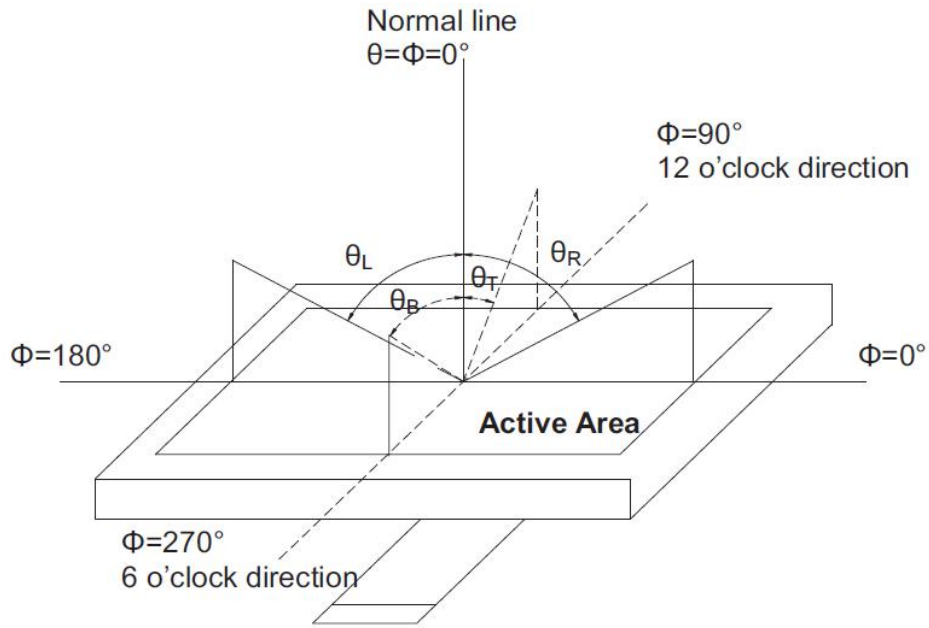
Note 3: Response time is defined as follow:

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



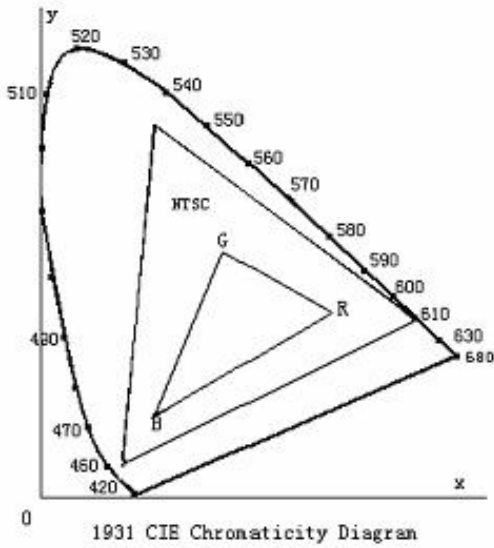
Note 4: Viewing angle range is defined as follow:

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



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

Color coordinates measured at center point of LCD.



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

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.

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

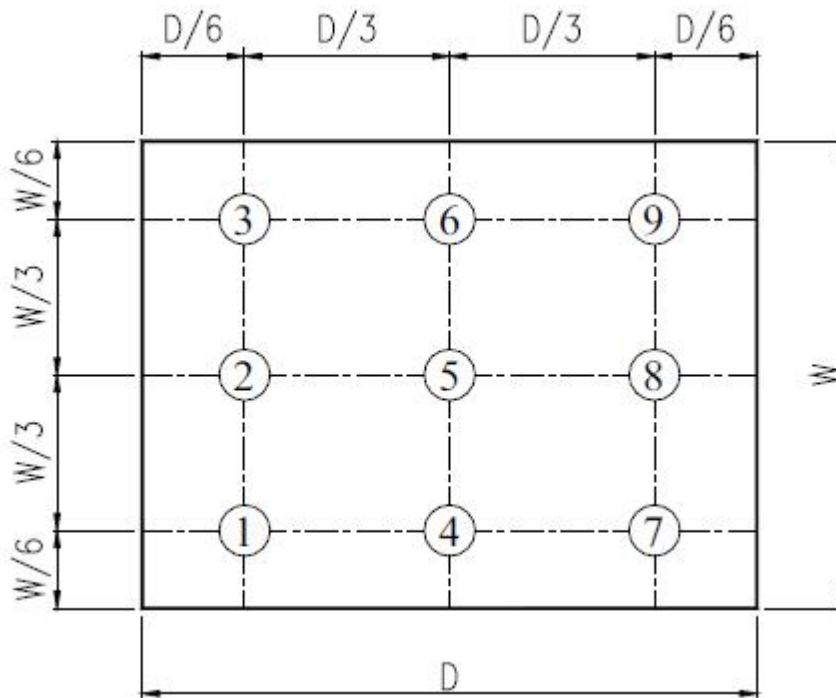


Fig. 2 Definition of uniformity

10. Environmental / Reliability Tests

| No | Test Item | Condition | Judgment criteria |
|----|-----------------------------------|--|---|
| 1 | High Temp Operation | Ts=+85°C, 120hrs | Per table in below |
| 2 | Low Temp Operation | Ta=-30°C, 120hrs | Per table in below |
| 3 | High Temp Storage | Ta=+95°C, 120hrs | Per table in below |
| 4 | Low Temp Storage | Ta=-40°C, 120hrs | Per table in below |
| 5 | High Temp & High Humidity Storage | Ta=+60°C, 90% RH 120 hours | Per table in below (polarizer discoloration is excluded) |
| 6 | Thermal Shock (Non-operation) | -30°C 30 min~+80°C 30 min, Change time:5min, 10 Cycles | Per table in below |
| 7 | ESD (Operation) | C=150pF, R=330Ω, 5points/panel Air:±8KV, 5times; Contact:±4KV, 5 times; | Per table in below |
| 8 | Vibration (Non-operation) | Frequency range:10~55Hz, Stroke:1.5mm Sweep:10Hz~55Hz~10Hz 2 hours for each direction of X.Y.Z. | Per table in below |
| 9 | Shock (Non-operation) | 60G 6ms, ±X,±Y,±Z 3times, for each direction | Per table in below |
| 10 | Package Drop Test | Height:80 cm, 1 corner, 3 edges, 6 surfaces | 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 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 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.

11.4 Storage

- A. Store the products in a dark place at $+25^{\circ}\text{C} \pm 10^{\circ}\text{C}$ with low humidity (40% RH to 60% RH). Don't expose to sunlight or fluorescent light.
- 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.

