



HIGHNESSTM

HM070WV201I-RT

7" Color TFT-LCD

FUNCTIONAL DRAFT SPECIFICATION

(This document is meant for customers' approval)

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1. General Specifications

| No. | Item | Specification | Remark |
|-----|-----------------------------|------------------------------|--------|
| 1 | LCD size | 7.0 inch(Diagonal) | |
| 2 | Driver element | a-Si TFT active matrix | |
| 3 | Resolution | 800X3(RGB)X480 | |
| 4 | Display mode | Normally white, Transmissive | |
| 5 | Dot pitch | 0.0635(W)X0.1905(H) mm | |
| 6 | Active area | 152.4 (W)X91.44 (H) mm | |
| 7 | Module size | 165(W)X104(H)X5.7(D) mm | Note 1 |
| 8 | Surface treatment | Anti-Glare | |
| 9 | Color arrangement | RGB-stripe | |
| 10 | Interface | Digital (TTL) | |
| 11 | Backlight power consumption | 2.500W (Typ.) | Note 2 |
| 12 | Panel power consumption | 0.825W (Typ.) | Note 3 |
| 13 | Weight | 130g (Typ.) | |
| 14 | Touch Screen Type | Resistive Touch | - |
| 15 | Touch Screen Interface | USB | - |

Note 1: Refer to Mechanical Drawing.

Note 2: Including LED Driver power consumption.

Note 3: Including T-con Board power consumption.

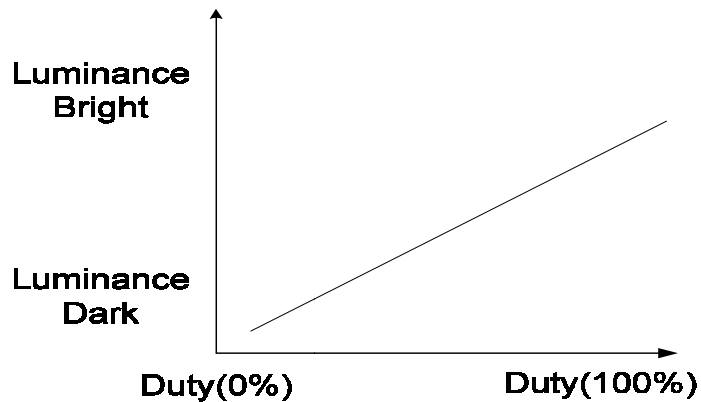
2. Pin Assignment

TTL Connector is used for the module electronic interface. The recommended model is “FH33-40S-0.5SH(10)”, manufactured by Hirose.

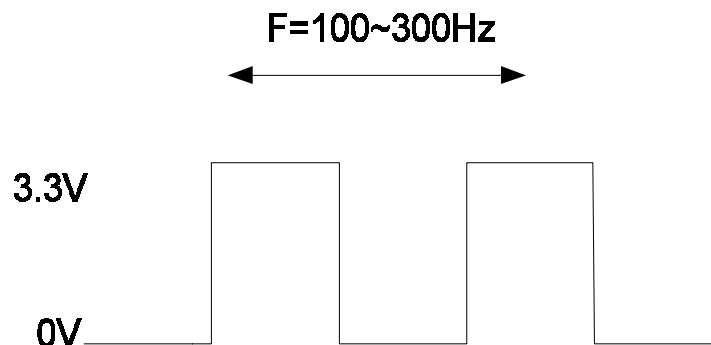
| Pin No. | Symbol | I/O | Function | Remark |
|---------|------------------|-----|--|----------|
| 1 | V _{LED} | P | Power supply for LED Driver | |
| 2 | V _{LED} | P | Power supply for LED Driver | |
| 3 | ADJ | I | Adjust the led brightness with PWM Pulse | Note 1,2 |
| 4 | G _{LED} | P | Ground for LED circuit | |
| 5 | G _{LED} | P | Ground for LED circuit | |
| 6 | V _{CC} | P | Power supply for digital circuit | |
| 7 | V _{CC} | P | Power supply for digital circuit | |
| 8 | MODE | I | DE or HV mode control | Note 3 |
| 9 | DE | I | Data enable | |
| 10 | VS | I | Vsync signal input | |
| 11 | HS | I | Hsync signal input | |
| 12 | GND | P | Power ground | |
| 13 | B5 | I | Blue data input (MSB) | |
| 14 | B4 | I | Blue data input | |
| 15 | B3 | I | Blue data input | |
| 16 | GND | P | Power ground | |
| 17 | B2 | I | Blue data input | |
| 18 | B1 | I | Blue data input | |
| 19 | B0 | I | Blue data input(LSB) | |
| 20 | GND | P | Power ground | |
| 21 | G5 | I | Green data input(MSB) | |
| 22 | G4 | I | Green data input | |
| 23 | G3 | I | Green data input | |
| 24 | GND | P | Power ground | |
| 25 | G2 | I | Green data input | |
| 26 | G1 | I | Green data input | |

| | | | | |
|----|------|---|---|----------|
| 27 | G0 | I | Green data input(LSB) | |
| 28 | GND | P | Power ground | |
| 29 | R5 | I | Red data input(MSB) | |
| 30 | R4 | I | Red data input | |
| 31 | R3 | I | Red data input | |
| 32 | GND | P | Power ground | |
| 33 | R2 | I | Red data input | |
| 34 | R1 | I | Red data input | |
| 35 | R0 | I | Red data input(LSB) | |
| 36 | GND | P | Power ground | |
| 37 | DCLK | I | Sample clock | |
| 38 | GND | P | Power ground | |
| 39 | L/R | I | Select left or right scanning direction | Note 4,5 |
| 40 | U/D | I | Select up or down scanning direction | Note 4,5 |

Note1: Pin3. is used to adjust brightness.



Note 2: ADJ signal=0 ~3.3V; Operating frequency:100~300Hz.

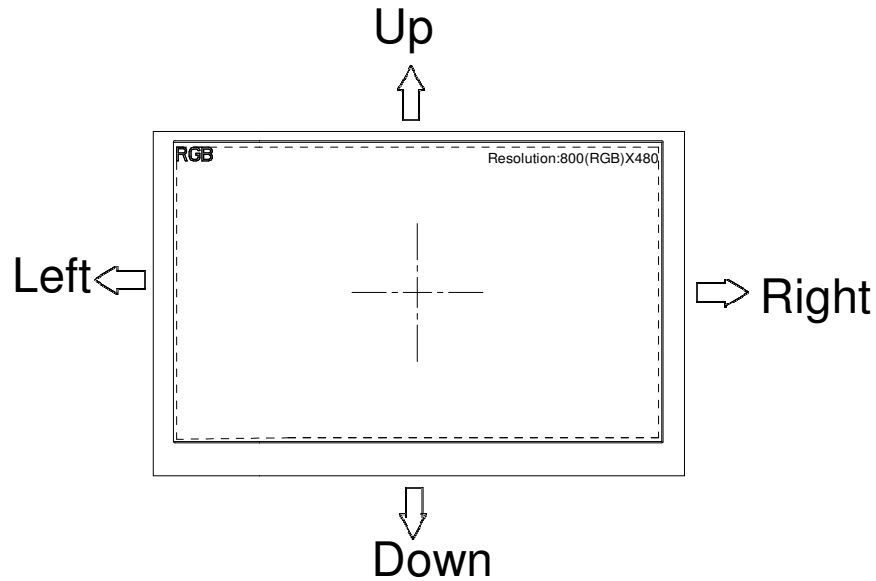


Note 3: DE Mode: Mode="H",HS floating and VS floating.
HV Mode: Mode="L" and DE floating.

Note 4: Selection of scanning mode

| Setting of scan control input | | Scanning direction |
|-------------------------------|-----------------|---------------------------|
| U/D | L/R | |
| GND | V _{CC} | Up to down, left to right |
| V _{CC} | GND | Down to up, right to left |
| GND | GND | Up to down, right to left |
| V _{CC} | V _{CC} | Down to up, left to right |

Note 5: Scanning direction refer to the figure below.



3. Operation Specifications

Absolute Maximum Ratings

| Item | Symbol | Values | | Unit | Remark |
|-----------------------|-----------|--------|------|------|--------|
| | | Min. | Max. | | |
| Power voltage | V_{CC} | -0.3 | 6.0 | V | |
| | V_{LED} | - | 5.5 | V | |
| Input signal voltage | V_I | -0.3 | 6.3 | V | |
| Operation Temperature | T_{OP} | -20 | 70 | °C | |
| Storage Temperature | T_{ST} | -30 | 80 | °C | |

Note: The absolute maximum rating values of this product are not allowed to be exceeded at any times. A module should be used with any of the absolute maximum ratings exceeded, the characteristics of the module may not be recovered, or in an extreme condition, the module may be permanently destroyed.

Typical Operation Conditions

| Item | Symbol | Values | | | Unit | Remark |
|--------------------------|-----------|-------------|------|-------------|------|--------|
| | | Min. | Typ. | Max. | | |
| Power voltage | V_{CC} | 3.1 | 3.3 | 3.5 | V | Note 1 |
| | V_{LED} | 4.8 | 5.0 | 5.2 | V | Note 2 |
| Current consumption | I_{CC} | - | 250 | 300 | mA | |
| | I_{LED} | - | 500 | 550 | mA | Note 3 |
| Input logic high voltage | V_{IH} | $0.7V_{CC}$ | - | V_{CC} | V | Note 4 |
| Input logic low voltage | V_{IL} | 0 | - | $0.3V_{CC}$ | V | |
| LED life time | - | 20,000 | - | - | Hr | Note 5 |

Note 1: V_{CC} setting should match the signals output voltage (refer to Note 4) of customer's system board.

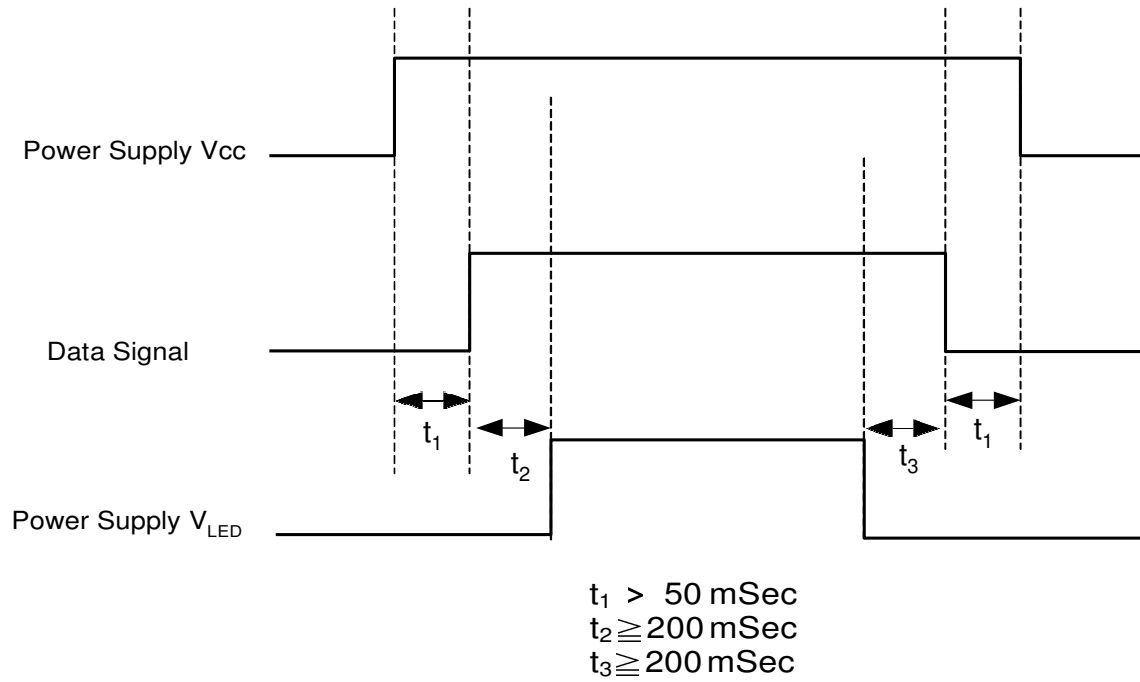
Note 2: LED driving voltage.

Note 3: LED driving current.

Note 4: DCLK, DE, HS, VS, R0~ R5, G0~ G5, B0~ B5.

Note 5: The "LED life time" is defined as the module brightness decrease to 50% original brightness at $T_a=25^{\circ}\text{C}$ and $V_{LED}=5.0\text{V}$. The LED lifetime could be decreased if operating V_{LED} is larger than 5.0V.

Power Sequence



Note: Data Signal includes DCLK, DE, HS, VS, R0~ R5, G0~ G5, B0~ B5.

Timing Characteristics

Timing Conditions

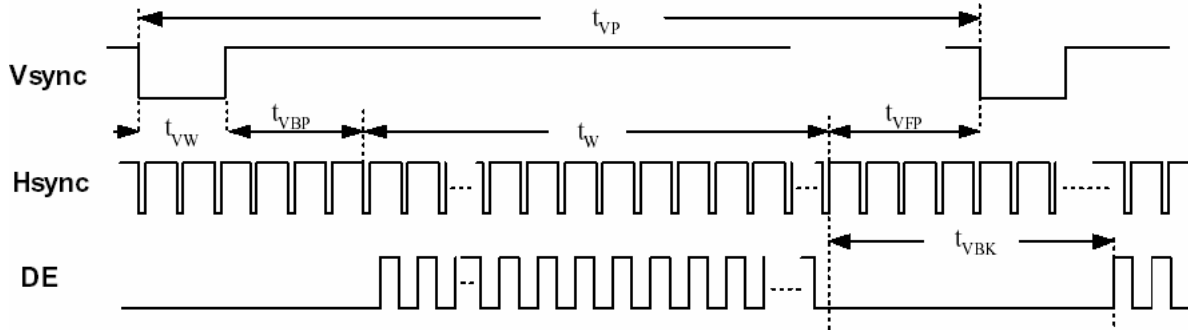
Input signal characteristics of SYNC mode.

| Item | Symbol | Values | | | Unit | Remark |
|-----------------------------|----------------------|--------------------------------------|------|------|-----------|--------|
| | | Min. | Typ. | Max. | | |
| Clock Period | t_{CLK} | 23.2 | 25.0 | 30.7 | ns | |
| Clock Frequency | f_{CLK} | 32.4 | 40.0 | 43.0 | MHz | |
| Clock Low Level Width | t_{WCL} | 8 | - | - | ns | |
| Clock High Level Width | t_{WCH} | 8 | - | - | | |
| Clock Rise/Fall Time | t_{CLKr}, t_{CLKf} | - | - | 3 | | |
| HSYNC Period | t_{HP} | 862 | 1056 | 1100 | t_{CLK} | |
| HSYNC Pulse Width | t_{HW} | - | 1 | - | t_{CLK} | |
| HSYNC Back Porch | t_{HBP} | - | 45 | - | t_{CLK} | |
| HSYNC Width + Back Porch | $t_{HW} + t_{HBP}$ | 46 | | | t_{CLK} | |
| Horizontal valid data width | t_{HV} | 800 | | | t_{CLK} | |
| HSYNC Front Porch | t_{HFP} | $t_{HP} - t_{HW} - t_{HBP} - t_{HV}$ | | | t_{CLK} | |
| Horizontal Blank | t_{HBK} | $t_{HP} - t_{HV}$ | | | t_{CLK} | |
| VSYNC Period | t_{VP} | 628 | 635 | 650 | t_{HP} | |
| VSYNC Pulse Width | t_{VW} | - | 1 | - | t_{HP} | |
| VSYNC Back Porch | t_{VBP} | 22 | | | t_{HP} | |
| Vertical valid data width | t_w | 480 | | | t_{HP} | |
| Vertical Front Porch | t_{VFP} | $t_{VP} - t_{VW} - t_{VBP} - t_w$ | | | t_{HP} | |
| Vertical Blank | t_{VBK} | $t_{VP} - t_w$ | | | t_{HP} | |
| Data Setup Time | t_{DS} | 5 | - | - | ns | |
| Data Hold Time | t_{DH} | 10 | - | - | ns | |

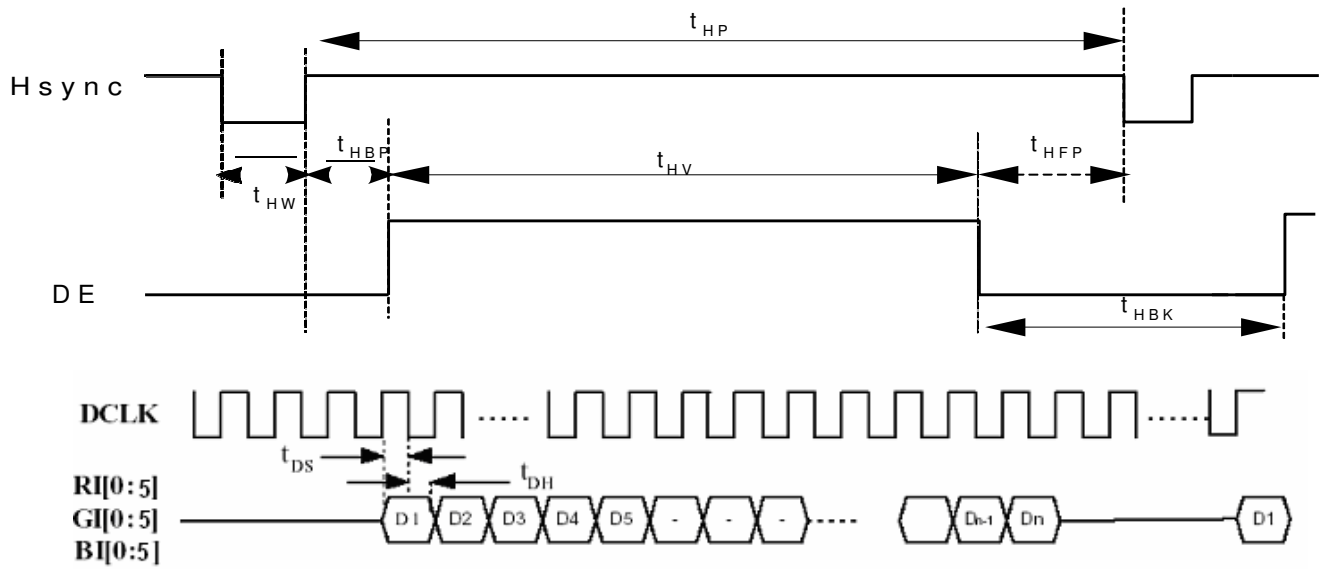
Input signal characteristics of DE mode.

| Item | | Symbol | Values | | | Unit | Remark |
|------|-------------------|----------------------|-------------------|------|------|-----------|----------------------|
| | | | Min. | Typ. | Max. | | |
| DCLK | Period | t_{CLK} | 23.2 | 25.0 | 30.7 | ns | |
| | Frequency | f_{CLK} | 32.4 | 40.0 | 43.0 | MHz | |
| | Low Level Width | t_{WCL} | 6 | - | - | ns | |
| | High Level Width | t_{WCH} | 6 | - | - | | |
| | Rise/Fall Time | t_{CLKr}, t_{CLKf} | - | - | 3 | | |
| | Duty | - | 0.45 | 0.50 | 0.55 | - | t_{CLKL} / t_{CLK} |
| DE | Setup Time | t_{DES} | 5 | - | - | ns | |
| | Hold Time | t_{DEH} | 10 | - | - | | |
| | Rise/Fall Time | t_{DEr}, t_{DEf} | - | - | 16 | | |
| | Horizontal Period | t_{HP} | 862 | 1056 | 1100 | t_{CLK} | |
| | Horizontal Valid | t_{HV} | 800 | | | | |
| | Horizontal Blank | t_{HBK} | $t_{HP} - t_{HV}$ | | | | |
| | Vertical Period | t_{VP} | 628 | 635 | 650 | t_{HP} | |
| | Vertical Valid | t_w | 480 | | | | |
| | Vertical Blank | t_{VBK} | $t_{VP} - t_w$ | | | | |
| DATA | Setup Time | t_{DS} | 5 | - | - | ns | |
| | Hold Time | t_{DH} | 10 | - | - | | |
| | Rise/Fall Time | t_{Dr}, t_{Df} | - | - | 3 | | |

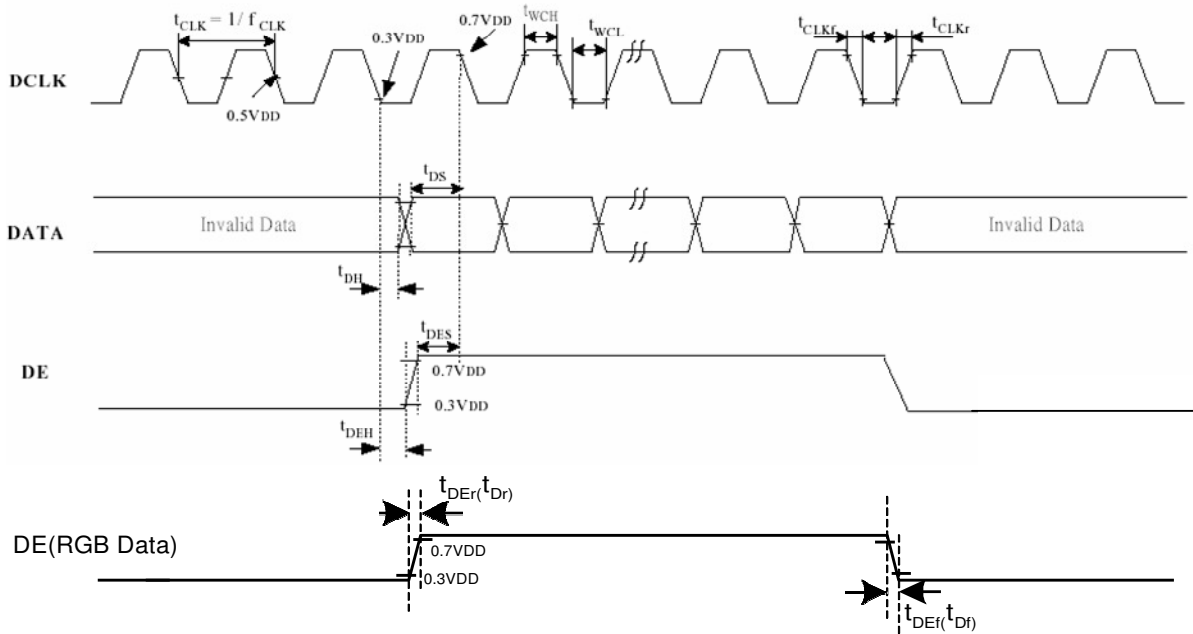
Timing Diagram



Input Vertical Timing



Input Horizontal Timing



DE and RGB Input Timing

4. Optical Specifications

| Item | Symbol | Condition | Values | | | Unit | Remark |
|---------------------------------|------------|---------------------------------|--------|------|------|-------------------|------------------|
| | | | Min. | Typ. | Max. | | |
| Viewing angle (CR \geq 10) | θ_L | $\Phi=180^\circ$ (9 o'clock) | 60 | 70 | - | degree | Note 1 |
| | θ_R | $\Phi=0^\circ$ (3 o'clock) | 60 | 70 | - | | |
| | θ_T | $\Phi=90^\circ$ (12 o'clock) | 40 | 50 | - | | |
| | θ_B | $\Phi=270^\circ$ (6 o'clock) | 60 | 70 | - | | |
| Response time | T_{ON} | Normal $\theta=\Phi=0^\circ$ | - | 10 | 20 | msec | Note 3 |
| | T_{OFF} | | - | 15 | 30 | msec | Note 3 |
| Contrast ratio | CR | | 400 | 500 | - | - | Note 4 |
| Color chromaticity | W_X | | 0.26 | 0.31 | 0.36 | - | Note 2 |
| | W_Y | | 0.28 | 0.33 | 0.38 | - | Note 5 Note 6 |
| Luminance | L | | 400 | 450 | - | cd/m ² | Note 6 |
| Luminance uniformity | Y_U | | 70 | 75 | - | % | Note 7 |

Test Conditions:

1. $V_{CC}=3.3V$, $V_{LED}=5.0V$.The ambient temperature is $25^\circ C$.
2. The test systems refer to Note 2.

Note 1: Definition of viewing angle range

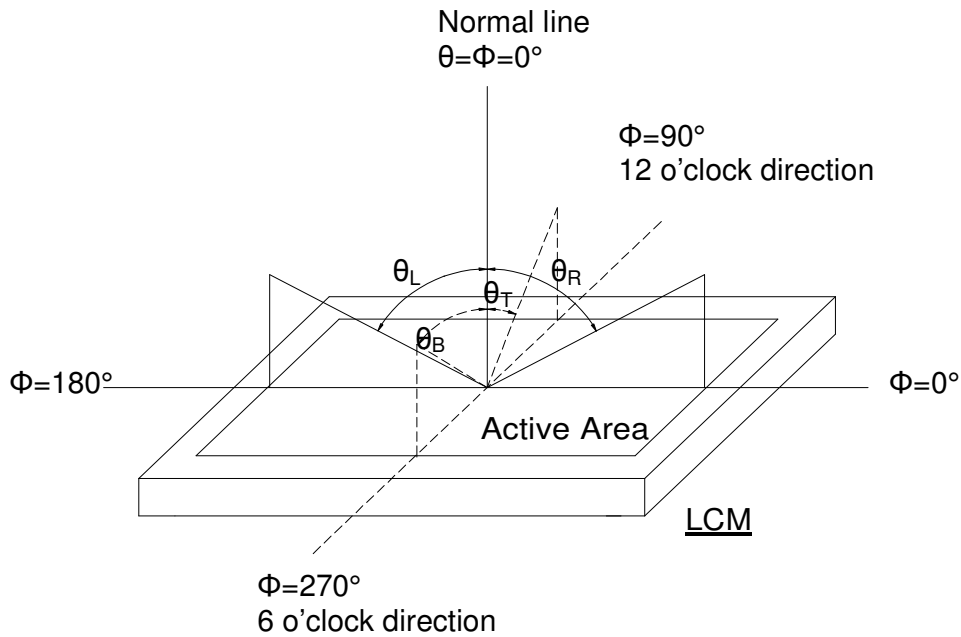


Fig. 4-1 Definition of viewing angle

Note 2: Definition of optical measurement system.

The optical characteristics should be measured in dark room. After 30 minutes operation, the optical properties are measured at the center point of the LCD screen. (Response time is measured by Photo detector TOPCON BM-7, other items are measured by BM-5A/Field of view: 1° /Height: 500mm.)

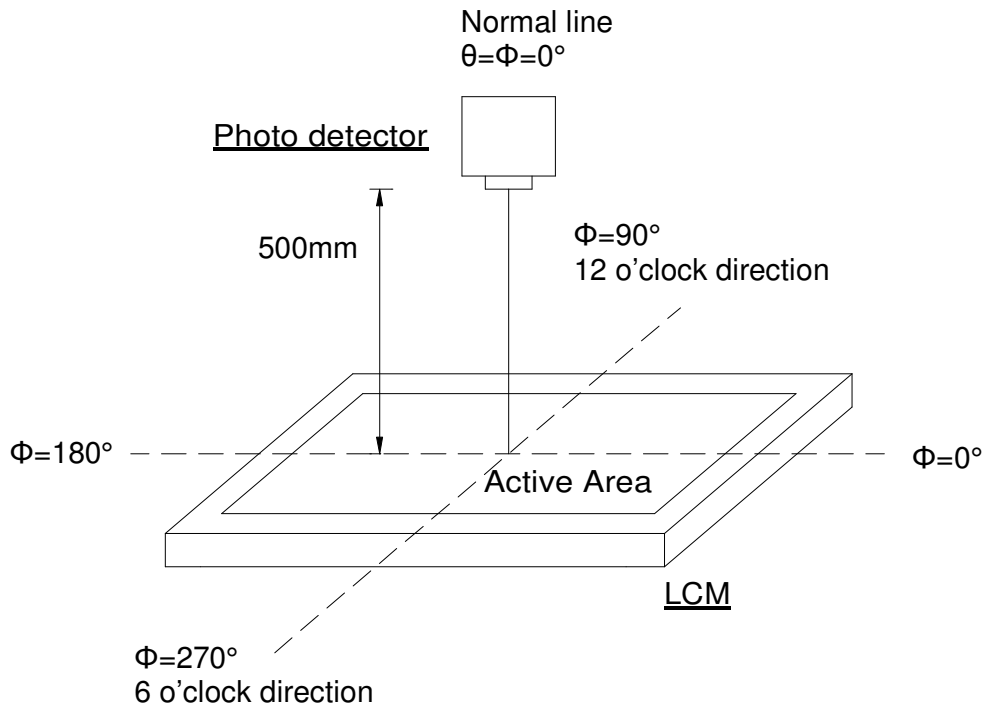


Fig. 4-2 Optical measurement system setup

Note 3: Definition of Response time

The response time is defined as the LCD optical switching time interval between "White" state and "Black" state. Rise time (T_{ON}) is the time between photo detector output intensity changed from 90% to 10%. And fall time (T_{OFF}) is the time between photo detector output intensity changed from 10% to 90%.

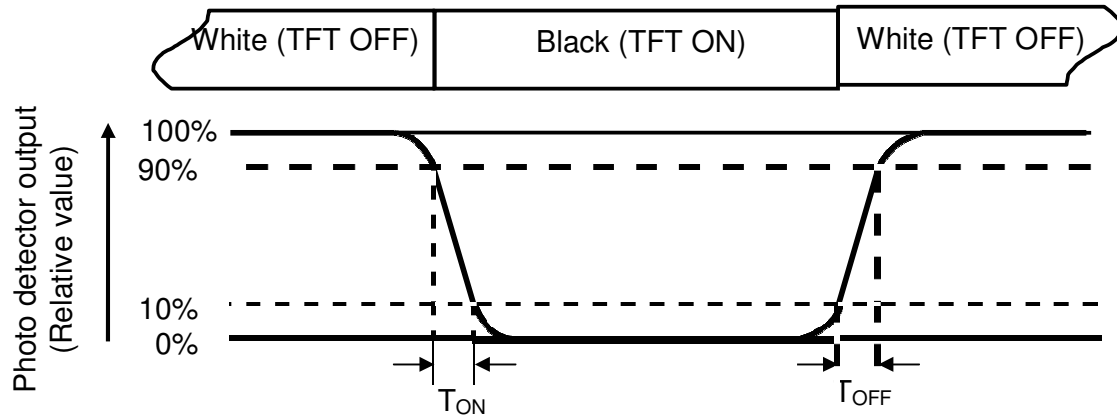


Fig. 4-3 Definition of response time

Note 4: Definition of contrast ratio

$$\text{Contrast ratio (CR)} = \frac{\text{Luminance measured when LCD on the "White" state}}{\text{Luminance measured when LCD on the "Black" state}}$$

Note 5: Definition of color chromaticity (CIE1931)

Color coordinates measured at center point of LCD.

Note 6: All input terminals LCD panel must be ground while measuring the center area of the panel. The LED driving condition is $V_{LED}=5.0V$.

Note 7: Definition of Luminance Uniformity

Active area is divided into 9 measuring areas (Refer to Fig. 4-4).Every measuring point is placed at the center of each measuring area.

$$\text{Luminance Uniformity } (Yu) = \frac{B_{min}}{B_{max}}$$

L-----Active area length W -----Active area width

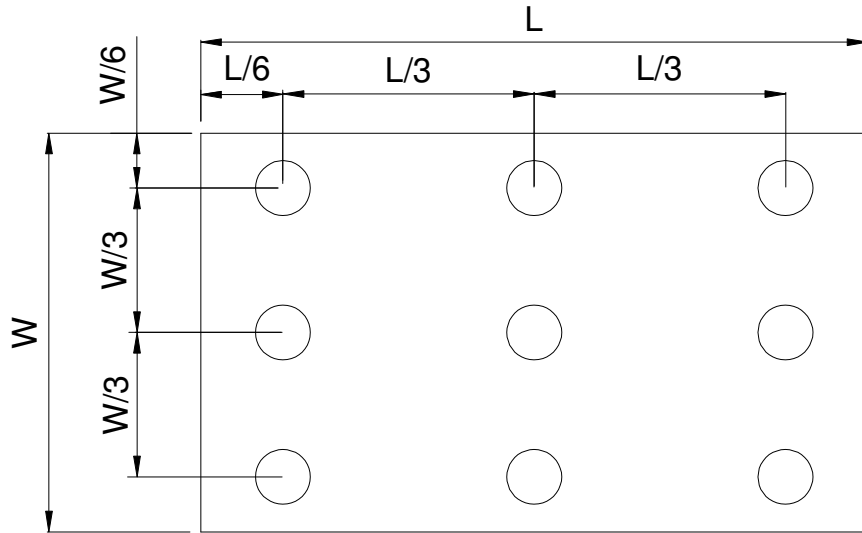


Fig. 4-4 Definition of measuring points

B_{max} : The measured maximum luminance of all measurement position.

B_{min} : The measured minimum luminance of all measurement position.

5. TOUCH SCREEN SPECIFICATION

| General Specifications | |
|-------------------------------------|-----------------------------------|
| Type | Analog Resistive type |
| Size | As per drawing |
| Input Method | Stylus or Finger |
| Glass Thickness | 1.1 mm |
| Environmental Specifications | |
| Operating Temperature | -30° to +70° C |
| Storage Temperature | -40° to +80° C |
| Operating Humidity | 20% to 85% RH (Non Condensing) |
| Storage Humidity | 10% to 90% RH (Non Condensing) |
| Optical Specifications | |
| Transparency | ≥ 85% (± 3%) |
| Haze | < 3% |
| Electrical Specifications | |
| Max. Voltage | 5V DC |
| Max. Current | 35mA |
| Loop Resistance | X: 20~500Ω, Y: 20~500Ω |
| Linearity | X ≤ 1.5%, Y ≤ 1.5% |
| Chattering | ≤ 15ms |
| Insulation | ≥ 20MΩ/25V (DC) |
| Mechanical Specifications | |
| Operating Force | 10-80 g |
| Durability | 3,000,000 touch at a single point |
| Hardness | > 3H |
| Capacitance | < 5 nF |

(2) Touch Screen Pin Assignment

| | |
|---|----|
| 1 | Y+ |
| 2 | X- |
| 3 | Y- |
| 4 | X+ |

6. Reliability Test Items

(Note3)

| Item | Test Conditions | Remark |
|--|---|----------------|
| High Temperature Storage | Ta = 80°C 240 hrs | Note 1, Note 4 |
| Low Temperature Storage | Ta = -30°C 240hrs | Note 1, Note 4 |
| High Temperature Operation | Ts = 70°C 240hrs | Note 2, Note 4 |
| Low Temperature Operation | Ta = -20°C 240hrs | Note 1, Note 4 |
| Operate at High Temperature and Humidity | +40°C, 90%RH max. 240 hrs | Note 4 |
| Thermal Shock | -30°C/30 min ~ +80°C/30 min for a total 100 cycles, Start with cold temperature and end with high temperature. | Note 4 |
| Vibration Test | Frequency range:10~55Hz Stroke:1.5mm Sweep:10Hz~55Hz~10Hz 2 hours for each direction of X. Y. Z. (6 hours for total) | |
| Mechanical Shock | 100G 6ms,±X, ±Y, ±Z 3 times for each direction | |
| Package Vibration Test | Random Vibration : 0.015G*G/Hz from 5-200HZ, -6dB/Octave from 200-500HZ 2 hours for each direction of X. Y. Z. (6 hours for total) | |
| Package Drop Test | Height:60 cm 1 corner, 3 edges, 6 surfaces | |
| Electro Static Discharge | ± 2KV, Human Body Mode, 100pF/1500Ω | |

Note 1: Ta is the ambient temperature of samples.

Note 2: Ts is the temperature of panel's surface.

Note 3: In the standard condition, there shall be no practical problem that may affect the display function. After the reliability test, the product only guarantees operation, but doesn't guarantee all the cosmetic specification.

Note 4: Before cosmetic and function test, the product must have enough recovery time, at least 2 hours at room temperature.

7. General Precautions

a. Safety

Liquid crystal is poisonous. Do not put it in your mouth. If liquid crystal touches your skin or clothes, wash it off immediately by using soap and water.

b. Handling

1. The LCD panel is plate glass. Do not subject the panel to mechanical shock or to excessive force on its surface.

2. The polarizer attached to the display is easily damaged. Please handle it carefully to avoid scratch or other damages.

3. To avoid contamination on the display surface, do not touch the module surface with bare hands.

4. Keep a space so that the LCD panels do not touch other components.

5. Put cover board such as acrylic board on the surface of LCD panel to protect panel from damages.

6. Transparent electrodes may be disconnected if you use the LCD panel under environmental conditions where the condensation of dew occurs.

7. Do not leave module in direct sunlight to avoid malfunction of the ICs.

c. Static Electricity

1. Be sure to ground module before turning on power or operating module.

2. Do not apply voltage which exceeds the absolute maximum rating value.

d. Storage

1. Store the module in a dark room where must keep at $25\pm 10^{\circ}\text{C}$ and 65%RH or less.

2. Do not store the module in surroundings containing organic solvent or corrosive gas.

3. Store the module in an anti-electrostatic container or bag.

e. Cleaning

1. Do not wipe the polarizer with dry cloth. It might cause scratch.

2. Only use a soft cloth with IPA to wipe the polarizer, other chemicals might permanent damage to the polarizer.

8. Mechanical Drawing

(To be advised)