



深圳市拓普微科技开发有限公司

SHENZHEN TOPWAY TECHNOLOGY CO., LTD.

LMT070DICFWD-6

LCD Module User Manual

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

| Rev. | Descriptions | Release Date |
|------|---------------------|--------------|
| 0.1 | Preliminary release | 2017-05-17 |
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1. Applications

This Module is designed for portable DVD, GPS car TV & PMP(portable multimedia player) application which require high quality flat panel displays. It is also a good substitute for many outmoded CSTN module in the industrial application.

This product is composed of a TFT-LCD panel, driver ICs, FPC ,LED backlight unit .

2. General Specification

| | |
|-------------------------|--|
| Signal Interface : | Digital 24-bits RGB |
| Display Technology : | a-Si TFT active matrix |
| Display Mode : | TN Type Full Color / Transmissive / Normal White |
| Screen Size(Diagonal) : | 7.0" |
| Outline Dimension : | 164.9 x 100.0 x 5.7 (mm) (see attached drawing for details) |
| Active Area : | 154.08 x 85.92 (mm) |
| Number of dots : | 800 x 3 (RGB) x 480 |
| Pixel Pitch : | 0.1926 x 0.179 (mm) |
| Pixel Configuration : | RGB Stripe |
| Backlight : | LED |
| Viewing Direction : | 6 o'clock(Gray scale Inversion) (*1) 12 o'clock (*2) |
| Operating Temperature : | -20 ~ +70°C |
| Storage Temperature : | -30 ~ +80°C |
| Surface Treatment : | Anti-Glare Treatment |

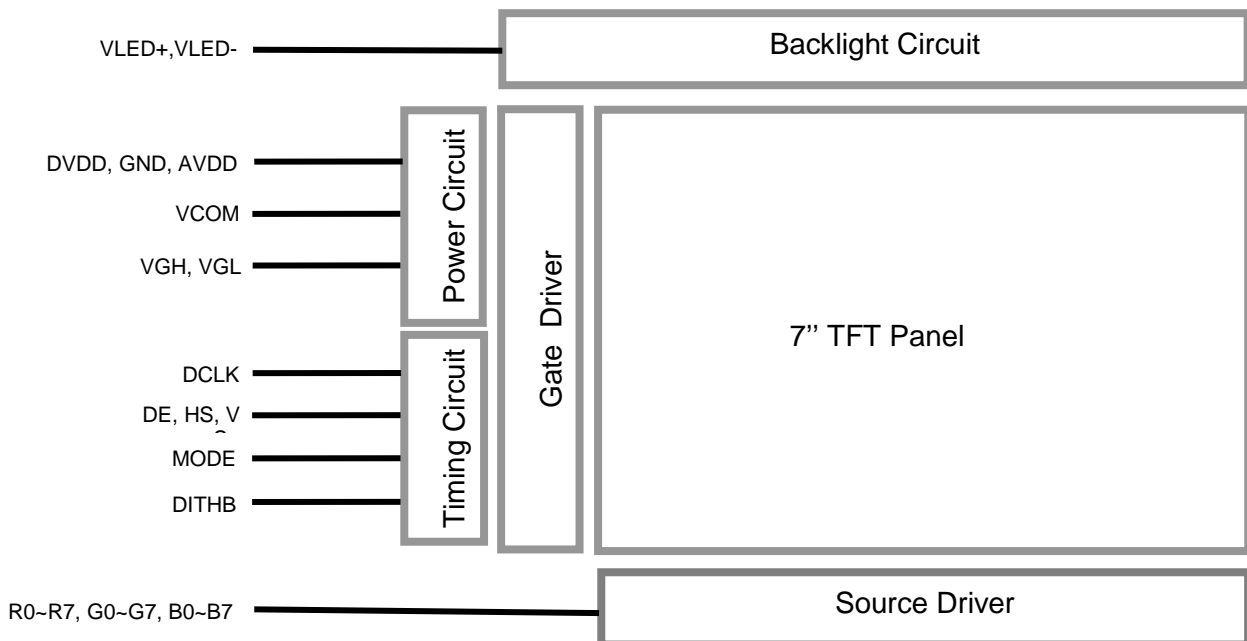
Note:

*1. For saturated color display content (eg. pure-red, pure-green, pure-blue or pure-colors-combinations).

*2. For "color scales" display content.

*3. Color tone may slightly change by temperature and driving condition.

3. Block Diagram



4. Terminal Function

4.1 K1 TFT Input Terminal

| Pin No. | Pin Name | I/O | Descriptions |
|---------|-------------------|-------|---------------------------------|
| 1 | V _{LED+} | Power | Positive Backlight Power Supply |
| 2 | V _{LED+} | | |
| 3 | V _{LED-} | Power | Negative Backlight Power Supply |
| 4 | V _{LED-} | | |
| 5 | GND | Power | Power GND (0V) |
| 6 | V _{COM} | Input | Common voltage |
| 7 | DV _{DD} | Power | Power for Digital Circuit |
| 8 | MODE | Input | DE/SYNC mode select (*1) |
| 9 | DE | Input | Data input enable |
| 10 | VS | Input | Vertical Sync Input |
| 11 | HS | Input | Horizontal Sync Input |
| 12 | B7 | Input | 8bit Data for Blue |
| : | : | | |
| 19 | B0 | | |
| 20 | G7 | Input | 8bit Data for Green |
| : | : | | |
| 27 | G0 | | |
| 28 | R7 | Input | 8bit Data for Red |
| : | : | | |
| 35 | R0 | | |
| 36 | GND | Power | Power GND (0V) |
| 37 | DCLK | Input | Sample clock(*2) |
| 38 | GND | Power | Power GND (0V) |
| 39 | L/R | Input | Left / right selection (*3) |
| 40 | U/D | Input | Up/down selection (*3) |
| 41 | V _{GH} | Power | Gate ON Voltage |
| 42 | V _{GL} | Power | Gate OFF Voltage |
| 43 | AV _{DD} | Power | Power for Analog Circuit |
| 44 | RESET | Input | Global reset pin (*4) |
| 45 | NC | - | No connection |
| 46 | V _{COM} | Input | Common Voltage |
| 47 | DITHB | Input | Dithering function (*5) |
| 48 | GND | Power | Power GND (0V) |
| 49 | NC | - | No connection |
| 50 | NC | | |

Note:

- * 1: DE/SYNC mode select. Normally pull high.
When select DE mode, MODE="1", VS and HS must pull high.
When select SYNC mode, MODE="0", DE must be grounded.
- * 2: Data shall be latched at the falling edge of DCLK.
- * 3: Selection of scanning mode

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

- *4: Global reset pin. Active low to enter reset state. Suggest to connect with an RC reset circuit for stability. Normally pull high.
- *5: Dithering function enable control, normally pull high.
When DITHB="1", Disable internal dithering function.
When DITHB="0", Enable internal dithering function.

5. Absolute Maximum Ratings

| Items | Symbol | Min. | Max. | Unit | Condition |
|-----------------------|----------------------------------|-------|------|------|-----------------|
| Power voltage | DV _{DD} | -0.3 | 5.0 | V | |
| | AV _{DD} | 6.5 | 13.5 | V | |
| | V _{GH} | -0.3 | 40.0 | V | |
| | V _{GL} | -20.0 | 0.3 | V | |
| | V _{GH} -V _{GL} | - | 40.0 | V | |
| Operating Temperature | T _{OP} | -20 | 70 | °C | No Condensation |
| Storage Temperature | T _{ST} | -30 | 80 | °C | No Condensation |

Note:

- *1. This rating applies to all parts of the module. And should not be exceeded.
- *2. The operating temperature only guarantees operation of the circuit. The contrast, response speed, and the other specification related to electro-optical display quality is determined at the room temperature, T_{OP}=25.
- *3. Ambient temperature when the backlight is lit (reference value)
- *4. Any Stresses exceeding the Absolute Maximum Ratings may cause substantial damage to the device. Functional operation of this device at other conditions beyond those listed in the specification is not implied and prolonged exposure to extreme conditions may affect device reliability.

6. Electrical Characteristics

6.1 DC Characteristics

| Items | Symbol | Min. | Typ. | Max. | Unit | Remark |
|--------------------------|------------------|--------------------|------|---------------------|------|--------|
| Power voltage | DV _{DD} | 3.0 | 3.3 | 3.6 | V | *2 |
| | AV _{DD} | 10.2 | 10.4 | 10.6 | V | |
| | V _{GH} | 15.3 | 16.0 | 16.7 | V | |
| | V _{GL} | -7.7 | -7.0 | -6.3 | V | |
| Input signal voltage | V _{COM} | 3.6 | 3.8 | 4.0 | V | |
| Input logic high voltage | V _{IH} | 0.7V _{DD} | - | DV _{DD} | V | *3 |
| Input logic low voltage | V _{IL} | 0 | - | 0.3DV _{DD} | V | |

Note:

- *1. Be sure to apply DV_{DD} and V_{GL} to the LCD first, and then apply V_{GH}.
- *2: DV_{DD} setting should match the signals output voltage (refer to Note 3) of customer's system board.
- *3: DCLK, HS, VS, RESET, U/D, L/R, DE, R0~R7, G0~G7, B0~B7, MODE, DITHB.

6.2 Current Consumption

| Items | Symbol | Min. | Typ. | Max. | Unit | Remark |
|--------------------|-------------------------------|------|------|------|------|-------------------------|
| Current for Driver | I _{GH} | - | 0.2 | 1.0 | mA | V _{GH} = 16.0V |
| | I _{GL} | - | 0.2 | 1.0 | mA | V _{GL} = -7.0V |
| | IDV _{DD} | - | 4.0 | 10 | mA | DV _{DD} =3.3V |
| | I _{AV} _{DD} | - | 20 | 50 | mA | AV _{DD} =10.4V |

6.3 LED Backlight Circuit Characteristics

Top=25°C

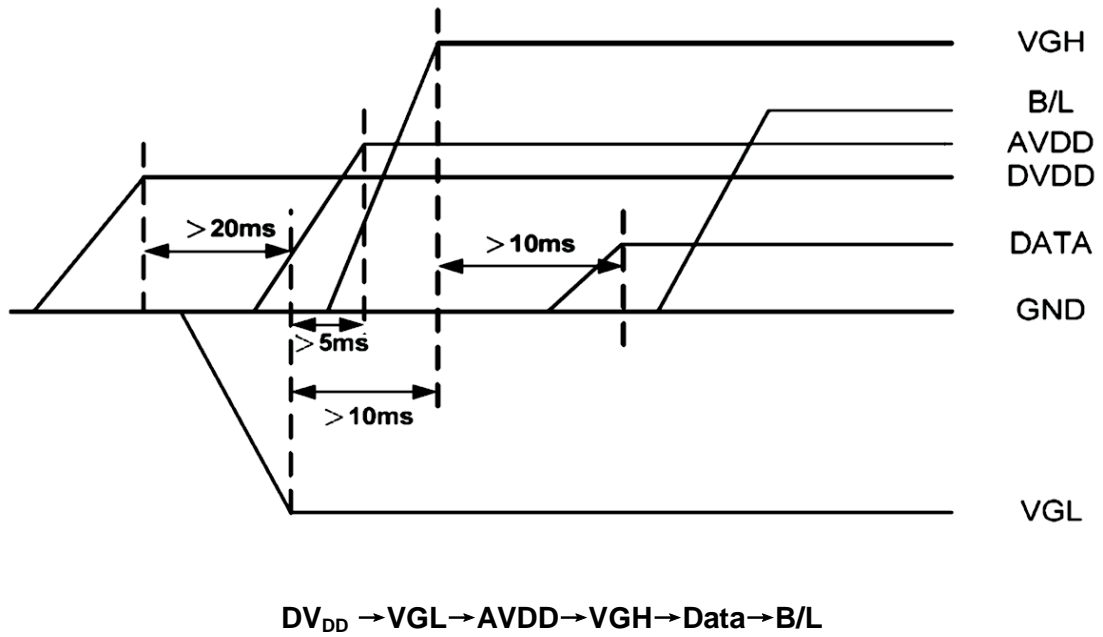
| Items | Symbol | MIN. | TYP. | MAX. | Unit | Note |
|-----------------|----------------|------|------|------|------|------|
| Forward Voltage | V _f | 8.8 | | 10.5 | V | |
| Forward Current | I _f | - | 200 | 230 | mA | |

Cautions:

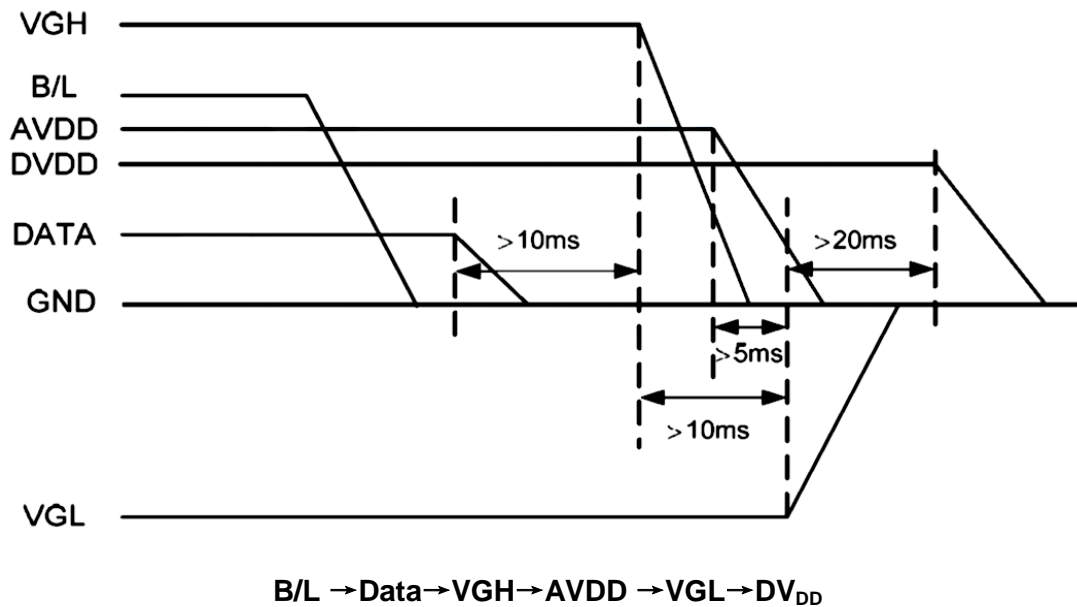
Exceeding the recommended driving current could cause substantial damage to the backlight and shorten its lifetime.

6.4 Power Sequence

6.4.1 Power on:



6.4.2 Power off:



Note :Data include R0~R7,B0~B7,G0~G7,U/D,L/R,DCLK,HS,VS,DE.

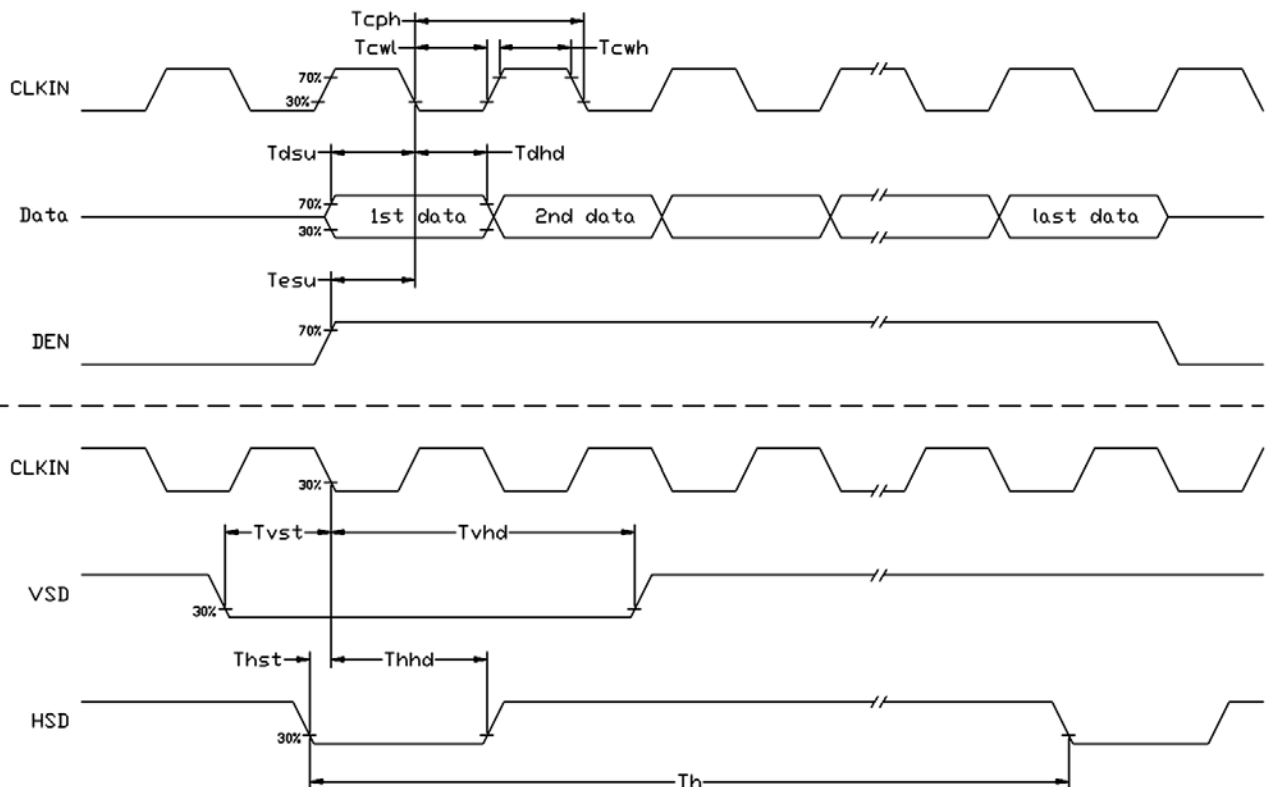
7. AC Characteristics

7.1 Timing Characteristics

| Item | Symbol | MIN. | TYP. | MAX. | Unit | Remark |
|-------------------------------------|--------|------|------|------|------|--------------------------------|
| HS setup time | Thst | 8 | - | - | ns | |
| HS hold time | Thhd | 8 | - | - | ns | |
| VS setup time | Tvst | 8 | - | - | ns | |
| VS hold time | Tvhd | 8 | - | - | ns | |
| Data setup time | Tdsu | 8 | - | - | ns | |
| Data hole time | Tdhd | 8 | - | - | ns | |
| DE setup time | Tesu | 8 | - | - | ns | |
| DV _{DD} Power On Slew rate | TPOR | - | - | 20 | ms | From 0 to 90% DV _{DD} |
| DCLK cycle time | Tcph | 20 | - | - | ns | |
| DCLK pulse duty | Tcwh | 40 | 50 | 60 | % | |

Note: For the details of the timing, please see the Driver IC data sheet.

7.2 Input Clock and Data Timing Diagram



7.3 Timing

| Item | Symbol | MIN. | TYP. | MAX. | Unit | Remark |
|-------------------------|--------|------|------|------|------|--------|
| Horizontal Display Area | thd | - | 800 | - | DCLK | |
| DCLK Frequency | fclk | 26.4 | 33.3 | 46.8 | MHz | |
| One Horizontal Line | th | 862 | 1056 | 1200 | DCLK | |
| HS pulse width | thpw | 1 | - | 40 | DCLK | |
| HS Blanking | thb | 46 | 46 | 46 | DCLK | |
| HS Front Porch | thfp | 16 | 210 | 354 | DCLK | |
| Vertical Display Area | tvd | - | 480 | - | TH | |
| VS period time | tv | 510 | 525 | 650 | TH | |
| VS pulse width | tvpw | 1 | - | 20 | TH | |
| VS Blanking | tvb | 23 | 23 | 23 | TH | |
| VS Front Porch | tvfp | 7 | 22 | 147 | TH | |

7.4 Data Input Format

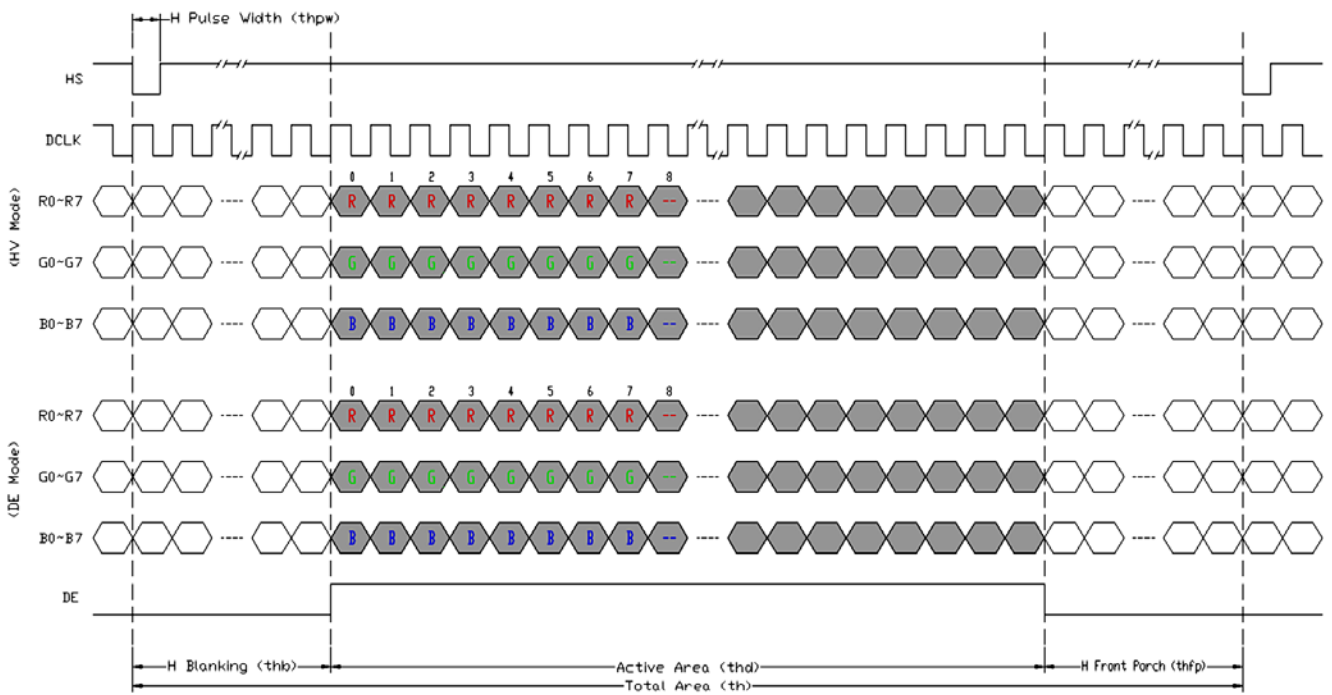


Figure 6-4-1 Horizontal input timing diagram.

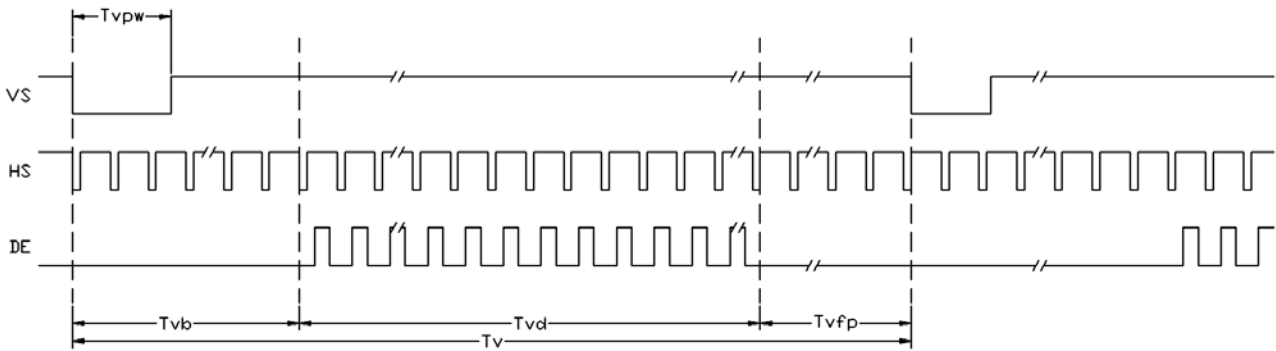


Figure 6-4-2 Vertical input timing diagram.

7.5 Optical Characteristics

| Item | Symbol | Condition | MIN. | TYP. | MAX. | UNIT | Note. |
|----------------------------|------------|----------------------------|------|------|------|-------------------|-------|
| Viewing angle (CR ≥ 10) | θ_L | 9 o'clock | 60 | 70 | - | degree | *2 |
| | θ_R | 3 o'clock | 60 | 70 | - | | |
| | θ_T | 12 o'clock | 40 | 50 | - | | |
| | θ_B | 6 o'clock | 60 | 70 | - | | |
| Response Time | T_f | Normal $\theta=0^\circ$ | - | 10 | 20 | msec | *3 |
| | T_r | | - | 15 | 30 | msec | |
| Contrast ratio | CR | | 400 | 500 | - | - | *1 |
| Color chromaticlty | W_X | | 0.26 | 0.31 | 0.26 | - | |
| | W_Y | | 0.28 | 0.33 | 0.38 | - | |
| Luminance | L | | - | 700 | - | cd/m ² | *4 |
| Luminance uniformity | Y_U | | 70 | 75 | - | % | *4 |

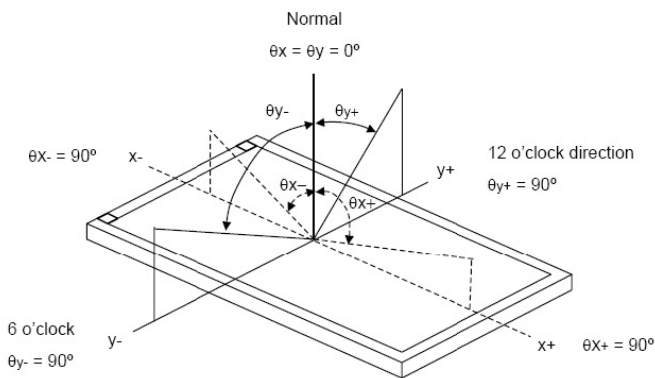
Note:

*1. Definition of Contrast Ratio

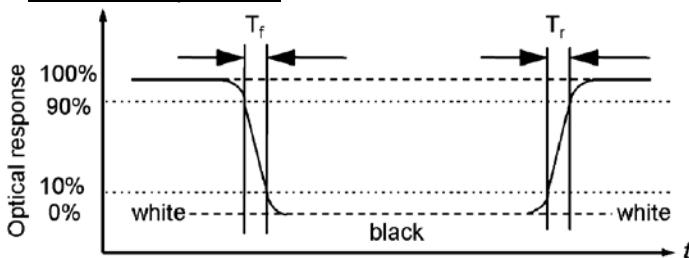
The contrast ratio could be calculate by the following expression:

Contrast Ratio (CR) = Luminanc with all pixels white / Luminance with all pixels black

*2 Definition of Viewing Angle



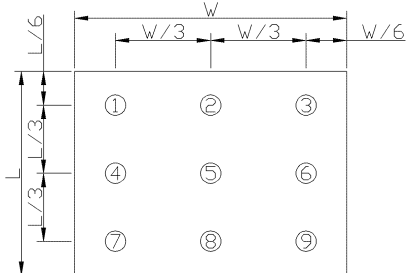
*3 Definition of response time



*4 Definition of Luminance Uniformity

Luminance uniformity (Lu)=

Min. Luminance form pt1~pt9 / Max Luminance form Pt1~pt9



8. Precautions of using LCD Modules

Mounting

- Mounting must use holes arranged in four corners or four sides.
- The mounting structure so provide even force on to LCD module. Uneven force (ex. Twisted stress) should not applied to the module. And the case on which a module is mounted should have sufficient strength so that external force is not transmitted directly to the module.
- It is suggested to attach a transparent protective plate to the surface in order to protect the polarizer. It should have sufficient strength in order to the resist external force.
- The housing should adopt radiation structure to satisfy the temperature specification.
- Acetic acid type and chlorine type materials for the cover case are not desirable because the former generates corrosive gas of attacking the polarizer at high temperature and the latter causes circuit break by electro-chemical reaction.
- Do not touch, push or rub the exposed polarizers with glass, tweezers or anything harder than HB pencil lead. Never rub with dust clothes with chemical treatment. Do not touch the surface of polarizer for bare hand or greasy cloth.(Some cosmetics deteriorate the polarizer.)
- When the surface becomes dusty, please wipe gently with absorbent cotton or other soft materials like chamois soaks with petroleum benzine. Normal-hexane is recommended for cleaning the adhesives used to attach front / rear polarizers. Do not use acetone, toluene and alcohol because they cause chemical damage to the polarizer.
- Wipe off saliva or water drops as soon as possible. Their long time contact with polarizer

Operating

- The spike noise causes the mis-operation of circuits. It should be within the $\pm 200\text{mV}$ level (Over and under shoot voltage)
- Response time depends on the temperature.(In lower temperature, it becomes longer.)
- Brightness depends on the temperature. (In lower temperature, it becomes lower.) And in lower temperature, response time(required time that brightness is stable after turned on) becomes longer.
- Be careful for condensation at sudden temperature change. Condensation makes damage to polarizer or electrical contacted parts. And after fading condensation, smear or spot will occur.
- When fixed patterns are displayed for a long time, remnant image is likely to occur.
- Module has high frequency circuits. Sufficient suppression to the electromagnetic interference shall be done by system manufacturers. Grounding and shielding methods may be important to minimized the interference

Electrostatic Discharge Control

Since a module is composed of electronic circuits, it is not strong to electrostatic discharge. Make certain that treatment persons are connected to ground through wrist band etc. And don't touch interface pin directly.

Strong Light Exposure

Strong light exposure causes degradation of polarizer and color filter.

Storage

When storing modules as spares for a long time, the following precautions are necessary.

- Store them in a dark place. Do not expose the module to sunlight or fluorescent light. Keep the temperature between 5°C and 35°C at normal humidity.
- The polarizer surface should not come in contact with any other object. It is recommended that they be stored in the container in which they were shipped.

Protection Film

- When the protection film is peeled off, static electricity is generated between the film and polarizer. This should be peeled off slowly and carefully by people who are electrically grounded and with well ion-blown equipment or in such a condition, etc.
- The protection film is attached to the polarizer with a small amount of glue. If some stress is applied to rub the protection film against the polarizer during the time you peel off the film, the glue is apt to be main on the polarizer. Please carefully peel off the protection film without rubbing it against the polarizer.
- When the module with protection film attached is stored for a long time, sometimes there remains a very small amount of glue still on the polarizer after the protection film is peeled off.
- You can remove the glue easily. When the glue remains on the polarizer surface or its vestige is recognized, please wipe them off with absorbent cotton waste or other soft material like chamois soaked with normal-hexane.

Transportation

The LCD modules should be no falling and violent shocking during transportation, and also should avoid excessive press, water, damp and sunshine.