

# AZ DISPLAYS, INC.

---

## SPECIFICATIONS FOR LIQUID CRYSTAL DISPLAY

PART NUMBER:

AGM3224C

DATE:

October 19, 2005

## 1. MECHANICAL DATA

| NO | ITEM              | CONTENTS                         | UNIT    |
|----|-------------------|----------------------------------|---------|
| 1  | Product No.       | AGM3224C                         | —       |
| 2  | Module Size       | 154.6 (W) x 114.8 (H) x 10.5 (D) | mm      |
| 3  | Dot Size          | 0.345 (W) x 0.345 (H)            | mm      |
| 4  | Dot Pitch         | 0.36 (W) x 0.36 (H)              | mm      |
| 5  | Number of Dots    | 320 (W) x 240 (H)                | Dot     |
| 6  | Duty              | 1/240                            | —       |
| 7  | LCD Display Mode  | FSTN, Normally Black             | —       |
| 8  | Rear Polarizer    | Transmissive Type                | —       |
| 9  | Viewing Direction | 12                               | O'clock |
| 10 | Backlight         | CCFL                             | —       |
| 11 | Controller        | Excluded                         | —       |
| 12 | DC/DC Converter   | Excluded                         | —       |
| 13 | Touch Panel       | Included                         | —       |
| 14 | Weight            | 225 (Approx.)                    | g       |

## 2. ABSOLUTE MAXIMUM RATINGS

### (1) ELECTRICAL ABSOLUTE RATINGS

VSS=0V

|                            | SYMBOL  | MIN. | MAX. | UNIT | COMMENT |
|----------------------------|---------|------|------|------|---------|
| Power Supply for Logic     | VDD-VSS | -0.3 | 7.0  | V    |         |
| Power Supply for LCD Drive | VEE-VSS | 0    | 30.0 | V    |         |
| Input Voltage              | VI      | -0.3 | VDD  | V    |         |
| Static Electricity         | -       | -    | -    | -    | Note 1  |

Note 1 LCM should be grounded during handling LCM.

### (2) ENVIRONMENTAL ABSOLUTE MAXIMUM RATINGS

| ITEM                            | WIDE TEMP. |      |          |      |
|---------------------------------|------------|------|----------|------|
|                                 | OPERATING  |      | STORAGE  |      |
|                                 | MIN.       | MAX. | MIN.     | MAX. |
| Ambient Temperature             | -20        | 70   | -40      | 80   |
| Humidity (Without Condensation) | Note 2,4   |      | Note 3,4 |      |

Note 2  $T_a \leq 70^{\circ}\text{C}$  : 75%RH max

Note 3 Please refer to item of reliability test

Note 4 Background color will change slightly depending on ambient temperature.

That phenomenon is reversible.

Note 5 Operation temp not include CCFL Lamp

## 3. ELECTRICAL CHARACTERISTICS

### 3-1. ELECTRICAL CHARACTERISTICS OF LCM

| ITEM  |                   |      | SYMBOL    | CONDITION  | MIN.                       | TYP. | MAX.   | UNIT |                   |
|---|-------------------|------|-----------|--|----------------------------|------|--------|------|-------------------|
| Power Supply for Logic                          |                   |      | VDD-VSS   | -  | 3.0                        | 3.3  | 3.6    | V    |                   |
|   |                   |      |           |  | 4.5                        | 5.0  | 5.5    |      |                   |
| Recommended LC Driving Voltage (Wide Temp. LCM) |                   |      | VEE-VSS   | Duty=1/240   | -20°C                      | 25.3 | 25.7   | 26.1 | V                 |
|   |                   |      |           |  | 0°C                        | 23.6 | 24.0   | 24.4 |                   |
|   |                   |      |           |  | 25°C                       | 22.3 | 22.7   | 23.1 |                   |
|   |                   |      |           |  | 50°C                       | 20.9 | 21.3   | 21.7 |                   |
|   |                   |      |           |  | 70°C                       | 19.9 | 20.3   | 20.7 |                   |
| Input Voltage                                   |                   |      | VIH       | H level  | 0.8VDD                     | -    | VDD    | V    |                   |
|   |                   |      | VIL       | L level  | 0                          | -    | 0.2VDD |      |                   |
| Power Supply Current                            |                   |      | IDD       | FLM = 70 Hz<br>VSS = 0 V<br>VDD = 5 V<br>VEE-VSS= 22.7 V | -                          | 0.5  | 1.0    | mA   |                   |
|   |                   |      | IEE       | PATTERN :<br>□ ■ □ ■ □ ■<br>■ □ ■ □ ■ □                  | -                          | 8    | 12     |      |                   |
| LCM   | Surface Luminance | CCFL | T696H26CK | VSS=0V<br>VEE-VSS=22.7V                                  | PATTERN:<br>(Dots All ON)  | 100  | 120    | -    | cd/m <sup>2</sup> |
|   |                   |      |           |  | PATTERN:<br>(Dots All OFF) | -    | 12     | 25   |                   |

## 3-2. ELECTRICAL CHARACTERISTICS OF BACKLIGHT

Used CCFL Rating

Temp.=25°C

| ITEM                   | SYMBOL         | MIN. | TYP.  | MAX. | UNIT              | REMARK                                    |
|------------------------|----------------|------|-------|------|-------------------|---|
| Lamp voltage           | V <sub>L</sub> | —    | 470   | —    | V <sub>rms</sub>  | —   |
| Lamp current           | I <sub>L</sub> | 4    | 5     | 6    | mA <sub>rms</sub> | —   |
| Lamp power consumption | P <sub>L</sub> | —    | 2.35  | —    | W                 | (*1)                                      |
| Lamp frequency         | F <sub>L</sub> | 20   | 35    | 50   | KHz               | —   |
| Lamp life time         | L <sub>L</sub> | —    | 20000 | —    | hrs               | I <sub>L</sub> = 5 mA <sub>rms</sub> (*2) |

(\*1) Power consumption excluded inverter loss .

(\*2) Lamp life time is defined as follows : The final brightness is at 50% of original brightness .

## 4. OPTICAL CHARACTERISTICS

WIDE TEMPERATURE MODE

AT V<sub>OP</sub>

| ITEM<br>MODE |   | Cr(Contrast Ratio) |      |      |      |      |      |      |      |      |      | $\theta$ (Viewing Angle) |                 | $\theta$ (Viewing Angle) |                 |
|--------------|---|--------------------|------|------|------|------|------|------|------|------|------|--------------------------|-----------------|--------------------------|-----------------|
|              |   | -20°C              |      | 0°C  |      | 25°C |      | 50°C |      | 70°C |      | 25°C                     |                 | 25°C                     |                 |
|              |   | MIN.               | TYP. | MIN. | TYP. | MIN. | TYP. | MIN. | TYP. | MIN. | TYP. | MIN.                     | TYP.            | MIN.                     | TYP.            |
| T            | H | 10                 | 15   | 12   | 18   | 14   | 20   | 5    | 7    | 2    | 3    | —                        | *F: 25<br>R: 45 | —                        | *L: 30<br>R: 30 |
| NOTE         |   | NOTE 6             |      |      |      |      |      |      |      |      |      | NOTE 5                   |                 |                          |                 |

NOTE :

\* : under Cr>5 Condition

T : Transmissive

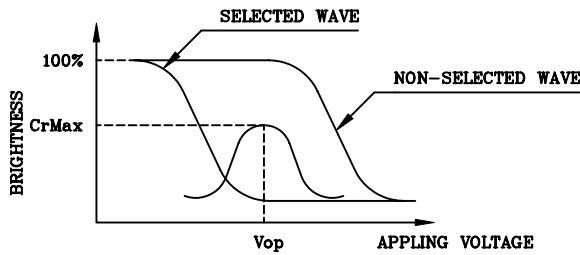
H : Normally Black, 12 O'clock

AT  $\phi=0^\circ$   $\theta=0^\circ$

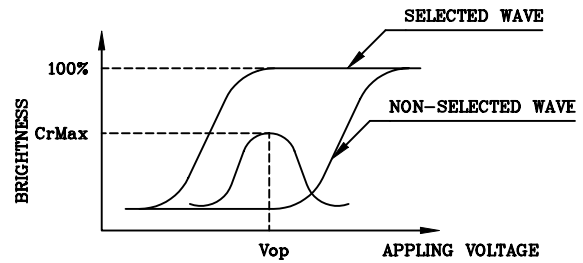
| ITEM                 | SYMBOL | CONDITION | MIN. | TYP. | MAX. | UNIT | NOTE   |
|----------------------|--------|-----------|------|------|------|------|--------|
| Response Time (rise) | Tr     | -20℃      | 3200 | 4000 | 6000 | ms   | NOTE 2 |
|                      |        | 0℃        | 880  | 1100 | 1600 |      |        |
|                      |        | 25℃       | 240  | 300  | 450  |      |        |
|                      |        | 50℃       | 95   | 120  | 180  |      |        |
|                      |        | 70℃       | 48   | 60   | 90   |      |        |
| Response Time (fall) | Tf     | -20℃      | 2000 | 2500 | 3700 | ms   | NOTE 2 |
|                      |        | 0℃        | 360  | 450  | 670  |      |        |
|                      |        | 25℃       | 95   | 120  | 180  |      |        |
|                      |        | 50℃       | 55   | 70   | 110  |      |        |
|                      |        | 70℃       | 32   | 40   | 60   |      |        |

(NOTE 1)

Definition of Operation Voltage(Vop)



(positive type)



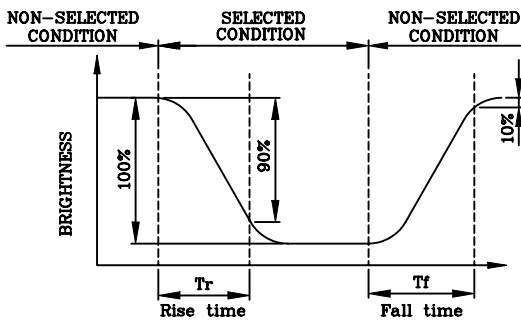
(negative type)

\*Conditions

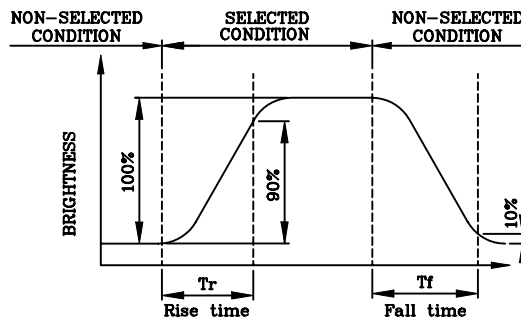
- Viewing Angle : 0
- Frame Frequency : 70Hz
- Applying Waveform : 1/N duty 1/a bias

(NOTE 2)

Definition of Response Time(Tr,Tf)



(positive type)



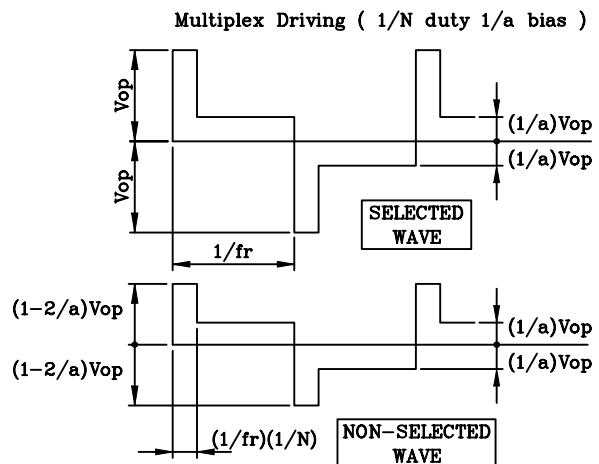
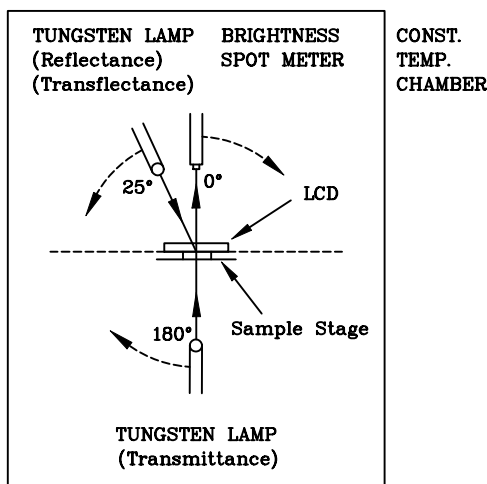
(negative type)

\*Conditions

- Operating Voltage : Vop
- Viewing Angle ( $\theta, \phi$ ) : (0,0)
- Frame Frequency : 70Hz
- Applying Waveform : 1/N duty 1/a bias

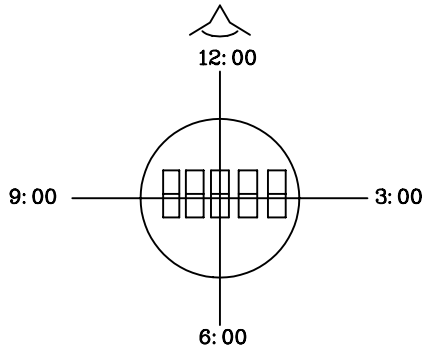
(NOTE 3)

Description of Measuring Equipment and Driving Waveforms



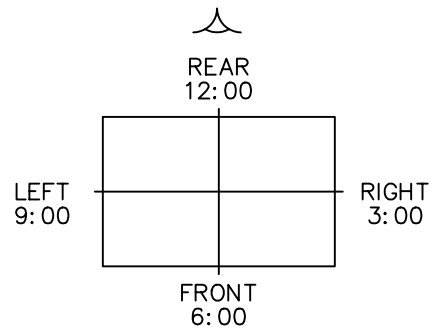
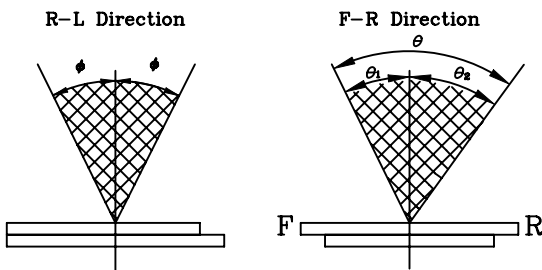
(NOTE 4)

Definition of Viewing Direction



(NOTE 5)

Definition of Viewing Angle



**\*For This Product**  
 The Viewing Direction Is 12 O'clock  
 So  $\theta_1 < \theta_2$

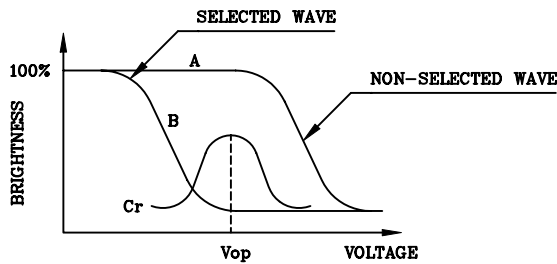
$$\theta = \theta_1 + \theta_2$$

**\*Conditions**

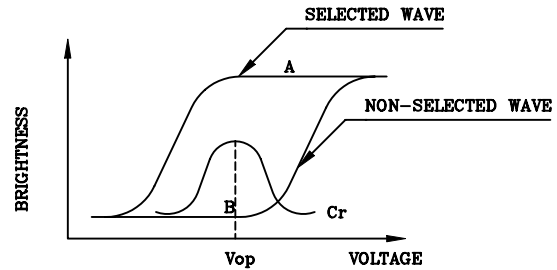
- Operating Voltage :  $V_{op}$
- Frame Frequency : 70Hz
- Applying Waveform : 1/N duty 1/a bias
- Contrast Ratio : larger than 2

(NOTE 6)

Definition of Contrast Ratio (Cr)



(positive type)



(negative type)

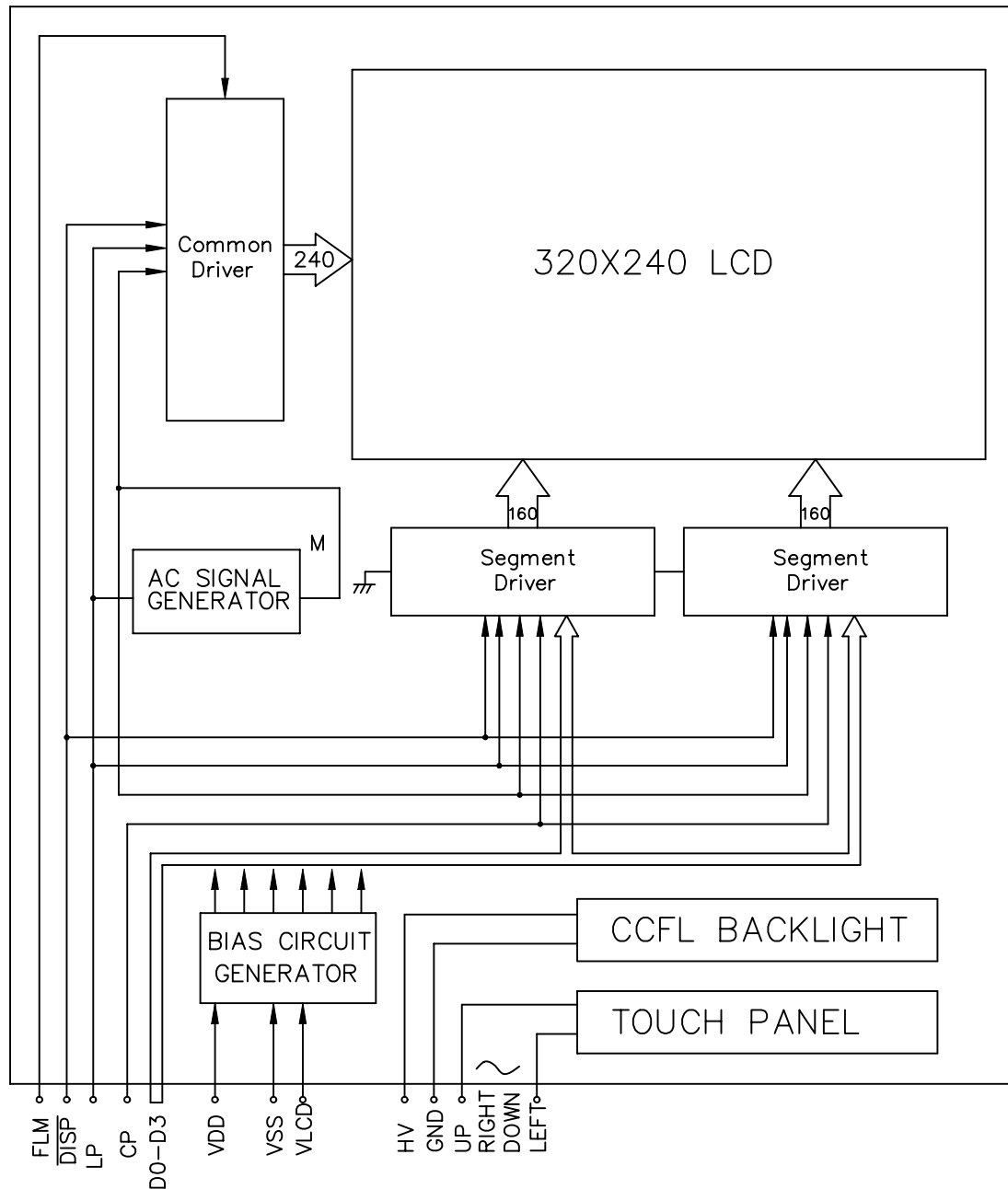
$$\text{Contrast Ratio : } Cr = A/B$$

**\*Conditions**

- Viewing Angle : 0
- Frame Frequency : 70Hz
- Applying Waveform : 1/N duty 1/a bias



## 5. BLOCK DIAGRAM



## 6. INTERNAL PIN CONNECTION

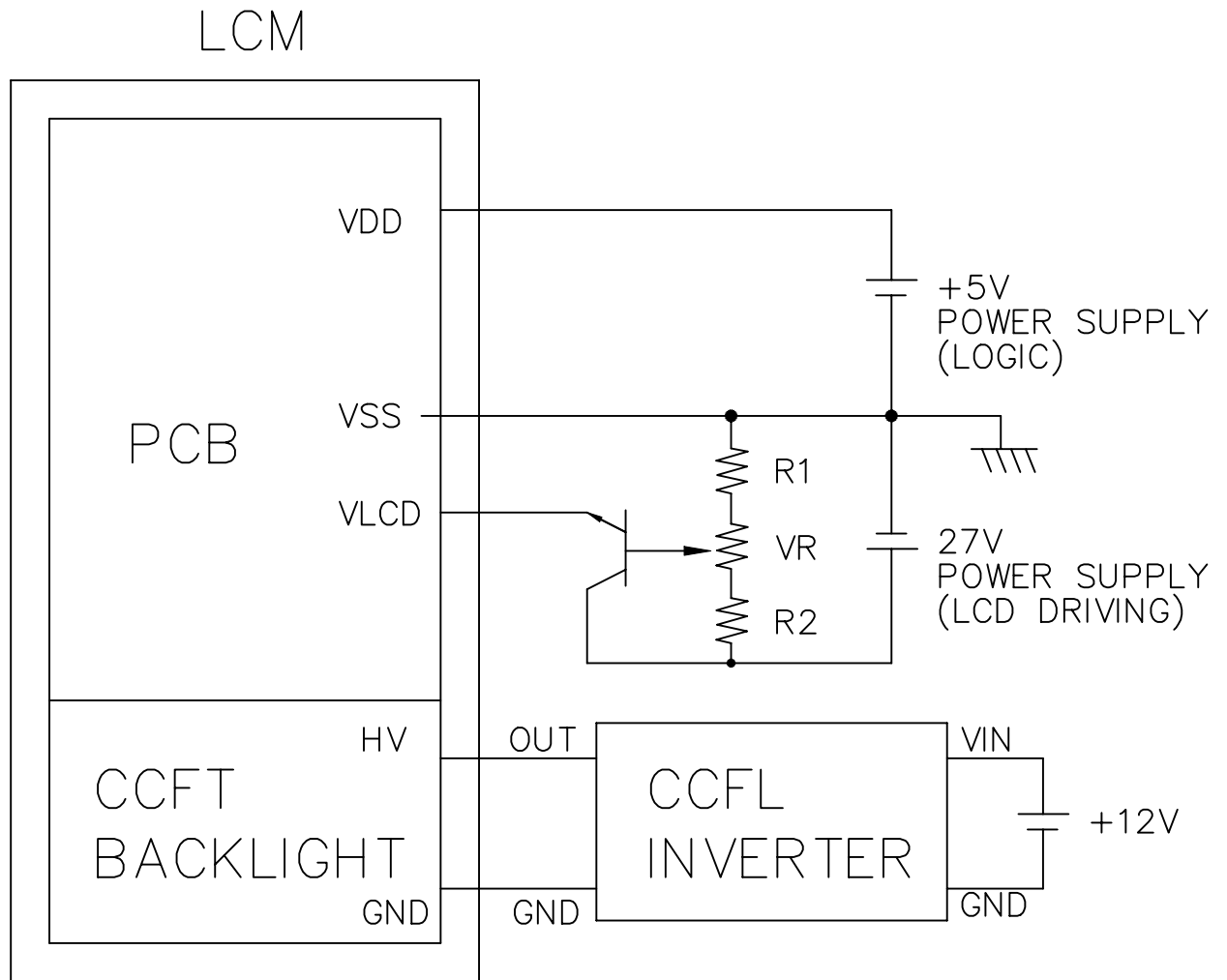
\*CN1 : LCD Connector (Molex 53398-1290)

| Pin No. | SYMBOL                      | LEVEL | FUNCTION                        |
|---------|-----------------------------|-------|---------------------------------|
| 1       | FLM                         | H/L   | FIRST LINE MARKER               |
| 2       | LP                          | H→L   | DATA LATCH SIGNAL               |
| 3       | CP                          | H→L   | DATA SHIFT CLOCK SIGNAL         |
| 4       | $\overline{\text{DISPOFF}}$ | H/L   | H: ON/L: OFF                    |
| 5       | VDD                         | —     | POWER SUPPLY FOR LOGIC          |
| 6       | VSS                         | —     | GND                             |
| 7       | VLCD                        | —     | POWER SUPPLY FOR LCD DRIVER (+) |
| 8       | D0                          | H/L   | DISPLAY DATA                    |
| 9       | D1                          | H/L   | DISPLAY DATA                    |
| 10      | D2                          | H/L   | DISPLAY DATA                    |
| 11      | D3                          | H/L   | DISPLAY DATA                    |
| 12      | VSS                         | —     | GND                             |

\*CN2 : CCFL Connector (JST BHR-03VS-1)

| Pin No. | SYMBOL | LEVEL | FUNCTION                    |
|---------|--------|-------|-----------------------------|
| 1       | GND    | —     | GROUND LINE (FROM INVERTER) |
| 2       | NC     | —     | NO CONNECTION               |
| 3       | HV     | AC    | POWER SUPPLY FOR CCFL       |

## 7. POWER SUPPLY

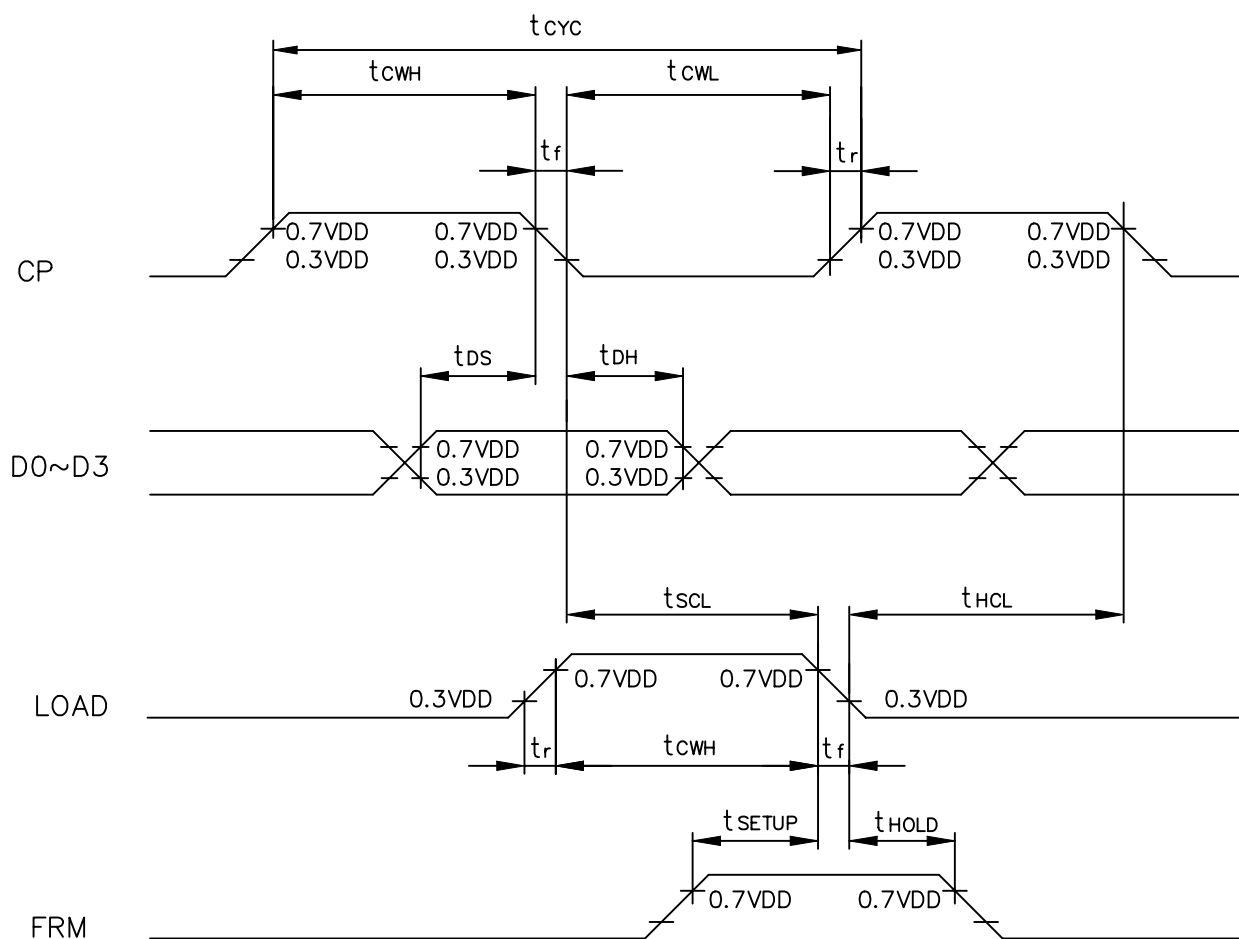


$$R1 + VR + R2 = 10K \sim 20K \Omega$$

## 8. TIMING CHARACTERISTICS

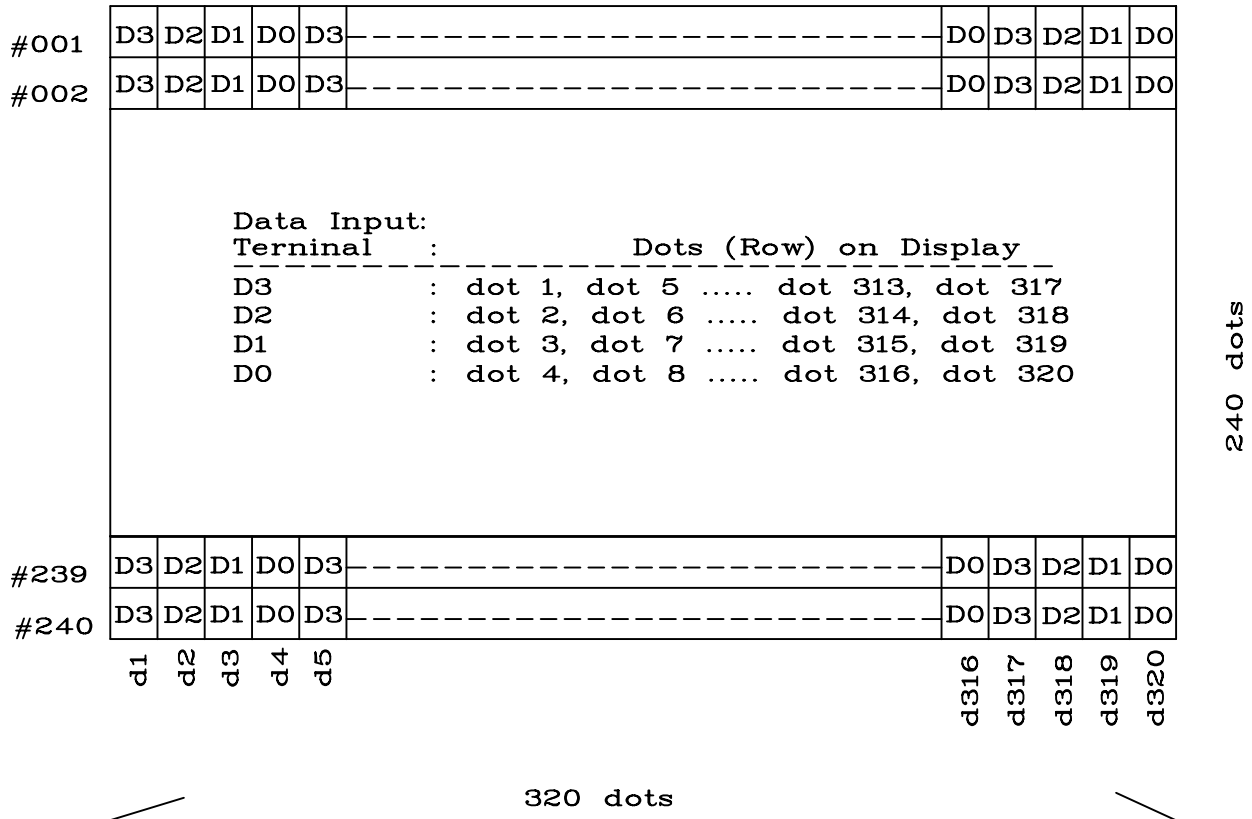
### 8-1. INTERFACE TIMING

| ITEM                   | SYMBOL      | MIN. | TYP. | MAX. | UNIT |
|------------------------|-------------|------|------|------|------|
| CLOCK CYCLE TIME       | $t_{cyc}$   | 125  | —    | —    | ns   |
| CLOCK HIGH LEVEL WIDTH | $t_{cwh}$   | 51   | —    | —    | ns   |
| CLOCK LOW LEVEL WIDTH  | $t_{cwl}$   | 51   | —    | —    | ns   |
| CLOCK RISE TIME        | $t_r$       | —    | —    | 50   | ns   |
| CLOCK FALL TIME        | $t_f$       | —    | —    | 50   | ns   |
| DATA SETUP TIME        | $t_{ds}$    | 30   | —    | —    | ns   |
| DATA HOLD TIME         | $t_{dh}$    | 40   | —    | —    | ns   |
| CLOCK SETUP TIME       | $t_{scl}$   | 51   | —    | —    | ns   |
| CLOCK HOLD TIME        | $t_{hcl}$   | 51   | —    | —    | ns   |
| FRAME SETUP TIME       | $t_{setup}$ | 100  | —    | —    | ns   |
| FRAME HOLD TIME        | $t_{hold}$  | 100  | —    | —    | ns   |

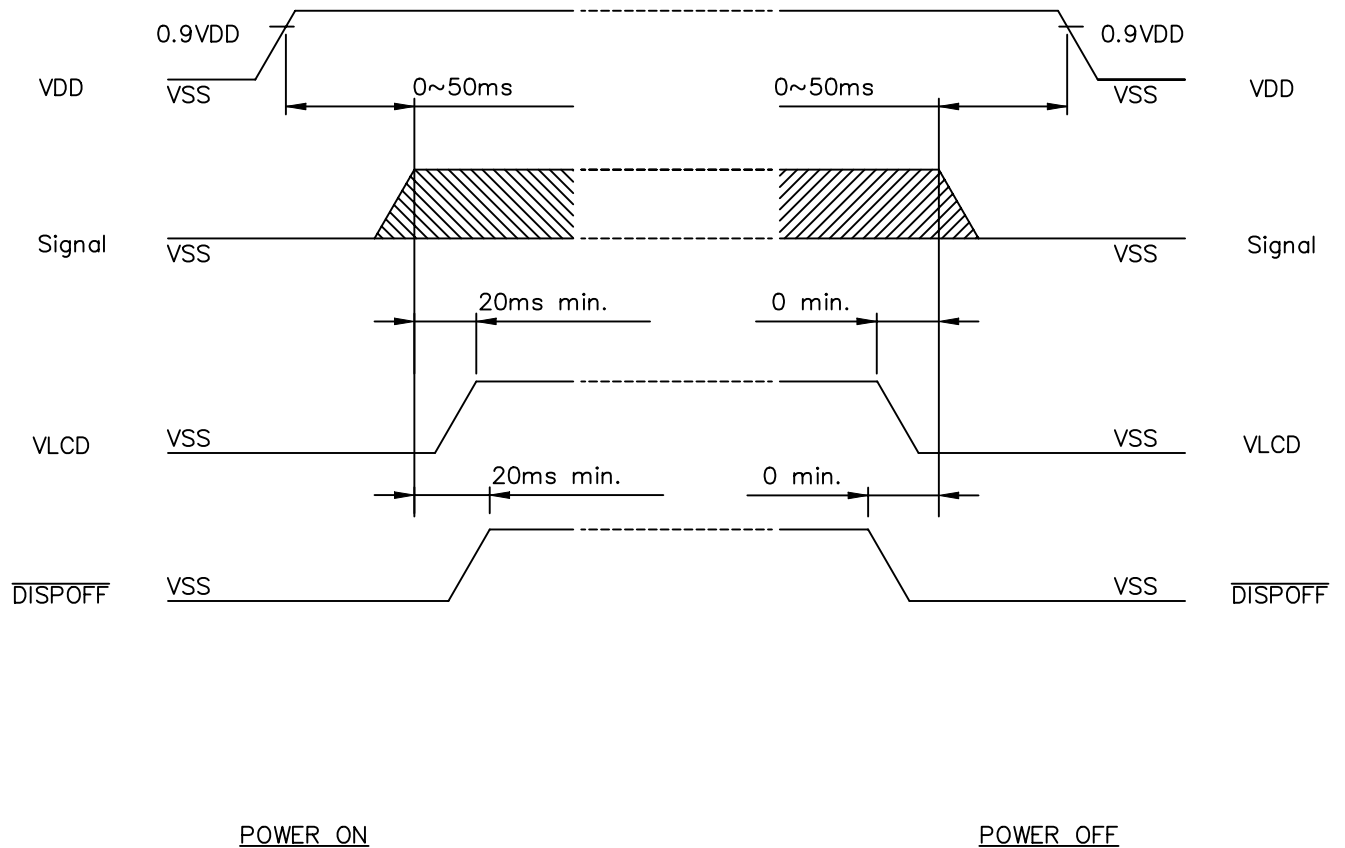




## 8-3.DISPLAY PATTERN



## 8-4. POWER ON/OFF TIMING



The missing pixels may occur when the LCM is driven beyond above power interface timing sequence.

