

# AZ DISPLAYS, INC.

## 1. MECHANICAL DATA

|                       |   |
|-----------------------|---|
| (1) Product No.       | <b>AGM1232F</b>   |
| (2) Module Size       | 65.4 (W)mm x 29.0 (H)mm x MAX 5.7 (D)mm   |
| (3) Dot Size          | 0.36 (W)mm x 0.41 (H)mm   |
| (4) Dot Pitch         | 0.40 (W)mm x 0.45 (H)mm   |
| (5) Number of Dots    | 122 (W) x 32 (H)Dots  |
| (6) Duty              | 1/32  |
| (7) LCD Display Mode  | STN: <input type="checkbox"/> Gray Mode <input type="checkbox"/> Yellow Mode <input type="checkbox"/> Blue Mode<br>FSTN: <input type="checkbox"/> Black and White(Normally White/Positive Image)<br><input type="checkbox"/> Black and White(Normally Black/Negative Image) |
| (8) Viewing direction | Rear Polarizer: <input type="checkbox"/> Reflective <input type="checkbox"/> Transflective <input type="checkbox"/> Transmissive<br><input type="checkbox"/> 6 O'clock <input type="checkbox"/> 12 O'clock <input type="checkbox"/> ____O'clock                             |
| (9) Backlight         | LED   |
| (10) Weight           | 12.5g   |

Revised: November 20, 2001

## 2. ABSOLUTE MAXIMUM RATINGS

### (1) ELECTRICAL ABSOLUTE RATINGS

VSS=0V

| ITEM                   | SYMBOL  | MIN | MAX | UNIT | COMMENT |
|------------------------|---------|-----|-----|------|---------|
| Power Supply for Logic | VDD-VSS | 0   | 5.5 | V    |         |
| Input Voltage          | VI      | 0   | VDD | V    |         |
| Static Electricity     | -       | -   | -   | -    | NOTE 1  |

NOTE 1 LCM should be grounded during handling

### (2) ENVIRONMENTAL ABSOLUTE MAXIMUM RATINGS

| ITEM                            | NORMAL TEMP. |      |          |      | WIDE TEMP. |      |          |      |
|---------------------------------|--------------|------|----------|------|------------|------|----------|------|
|                                 | OPERATING    |      | STORAGE  |      | OPERATING  |      | STORAGE  |      |
|                                 | MIN.         | MAX. | MIN.     | MAX. | MIN.       | MAX. | MIN.     | MAX. |
| Ambient Temperature             | 0            | 50   | -20      | 70   | -20        | 70   | -30      | 80   |
| Humidity (Without Condensation) | Note 1,3     |      | Note 2,3 |      | Note 3,4   |      | Note 3,5 |      |

Note 1 Ta  $\leq$  50°C : 85%RH max  
 Ta > 50°C : Absolute humidity must be lower  
 than the humidity of 85%RH at 50°C

Note 2 Ta at -20°C will be < 48hrs, at 70°C will be < 120hrs

Note 3 Background color changes slightly depending on ambient temperature.  
 This phenomenon is reversible.

Note 4 Ta  $\leq$  70°C : 75%RH max  
 Ta > 70°C : Absolute humidity must be lower  
 than the humidity of 75%RH at 70°C

Note 5 Ta at -30°C will be < 48hrs, at 80°C will be < 120hrs

## 3. ELECTRICAL CHARACTERISTICS

| ITEM  | SYMBOL          | CONDITION                          | MIN.   | TYP. | MAX.   | UNIT |
|---|-----------------|------------------------------------|--------|------|--------|------|
| Supply Voltage for Logic                                | VDD             | 25°C                               | 2.7    | 3.0  | 4.5    | V    |
| Input Voltage   | V <sub>IH</sub> | H level                            | 0.8VDD | –    | VDD    | V    |
|   | V <sub>IO</sub> | L level                            | 0      | –    | 0.2VDD |      |
| Recommended<br>LC Driving Voltage<br>(Normal TEMP. LCM) | VDD–VLCD        | 0°C                                | 5.4    | 5.8  | 6.2    | V    |
|   |                 | 25°C                               | 5.2    | 5.6  | 6.0    |      |
|   |                 | 50°C                               | 4.8    | 5.2  | 5.6    |      |
| Recommended<br>LC Driving Voltage<br>(Wide TEMP. LCM)   | VDD–VLCD        | –20°C                              | 7.2    | 7.7  | 8.2    | V    |
|   |                 | 0°C                                | 7.1    | 7.6  | 8.1    |      |
|   |                 | 25°C                               | 7.0    | 7.5  | 8.0    |      |
|   |                 | 50°C                               | 6.6    | 7.1  | 7.6    |      |
|   |                 | 70°C                               | 6.3    | 6.7  | 7.1    |      |
| Power Supply Current                                    | I <sub>DD</sub> | VDD = 3.0V<br>VLCD = –2.7V<br>25°C | –      | –    | 0.6    | mA   |
| LED Forward Voltage                                     | V <sub>F</sub>  | I <sub>F</sub> = 100 mA            | 1.7    | 2.1  | 2.5    | V    |
| LED Forward Current                                     | I <sub>F</sub>  | V <sub>F</sub> = 2.1 V             | –      | 100  | 200    | mA   |

## 4. OPTICAL CHARACTERISTICS

### 4.1 Optical Char. of Normal Temp. Mode

At Vop

| ITEM<br>MODE |   | Cr (Contrast Ratio) |      | $\theta$ (Viewing Angle) |      | $\phi$ (Viewing Angle) |      |
|--------------|---|---------------------|------|--------------------------|------|------------------------|------|
|              |   | 25°C                |      | 25°C                     |      | 25°C                   |      |
|              |   | MIN.                | TYP. | MIN.                     | TYP. | MIN.                   | TYP. |
| R            | A | —                   | —    | —                        | —    | —                      | —    |
|              | C | —                   | —    | —                        | —    | —                      | —    |
|              | J | —                   | —    | —                        | —    | —                      | —    |
| S            | A | 2.5                 | 3.5  | 25                       | 35   | 15                     | 20   |
|              | C | 3.5                 | 6.0  | 20                       | 30   | 20                     | 30   |
|              | J | —                   | —    | —                        | —    | —                      | —    |
| NOTE         |   | NOTE 6              |      | NOTE 5                   |      |                        |      |

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

| ITEM                 | SYMBOL | CONDITION | MIN. | TYP. | MAX. | UNIT | NOTE   |
|----------------------|--------|-----------|------|------|------|------|--------|
| Response Time (rise) | Tr     | 0°C       | —    | 450  | 900  | ms   | NOTE 2 |
|                      |        | 25°C      | —    | 110  | 220  |      |        |
|                      |        | 50°C      | —    | 60   | 120  |      |        |
| Response Time (fall) | Tf     | 0°C       | —    | 550  | 1000 | ms   | NOTE 2 |
|                      |        | 25°C      | —    | 190  | 300  |      |        |
|                      |        | 50°C      | —    | 100  | 160  |      |        |

NOTE :

- R: REFLECTIVE
- S: TRANSFLECTIVE
- A: GRAY
- C: YELLOW
- J: NORMALLY WHITE

## 4.2 Optical Char. of Wide Temp. Mode

At Vop

| ITEM<br>MODE |   | Cr (Contrast Ratio) |      | $\theta$ (Viewing Angle) |      | $\phi$ (Viewing Angle) |      |
|--------------|---|---------------------|------|--------------------------|------|------------------------|------|
|              |   | 25°C                |      | 25°C                     |      | 25°C                   |      |
|              |   | MIN.                | TYP. | MIN.                     | TYP. | MIN.                   | TYP. |
| R            | A | –                   | –    | –                        | –    | –                      | –    |
|              | C | –                   | –    | –                        | –    | –                      | –    |
|              | J | –                   | –    | –                        | –    | –                      | –    |
| S            | A | 3.0                 | 4.0  | 25                       | 40   | 15                     | 25   |
|              | C | 4.0                 | 8.0  | 40                       | 70   | 25                     | 35   |
|              | J | –                   | –    | –                        | –    | –                      | –    |
| NOTE         |   | NOTE 6              |      | NOTE 5                   |      |                        |      |

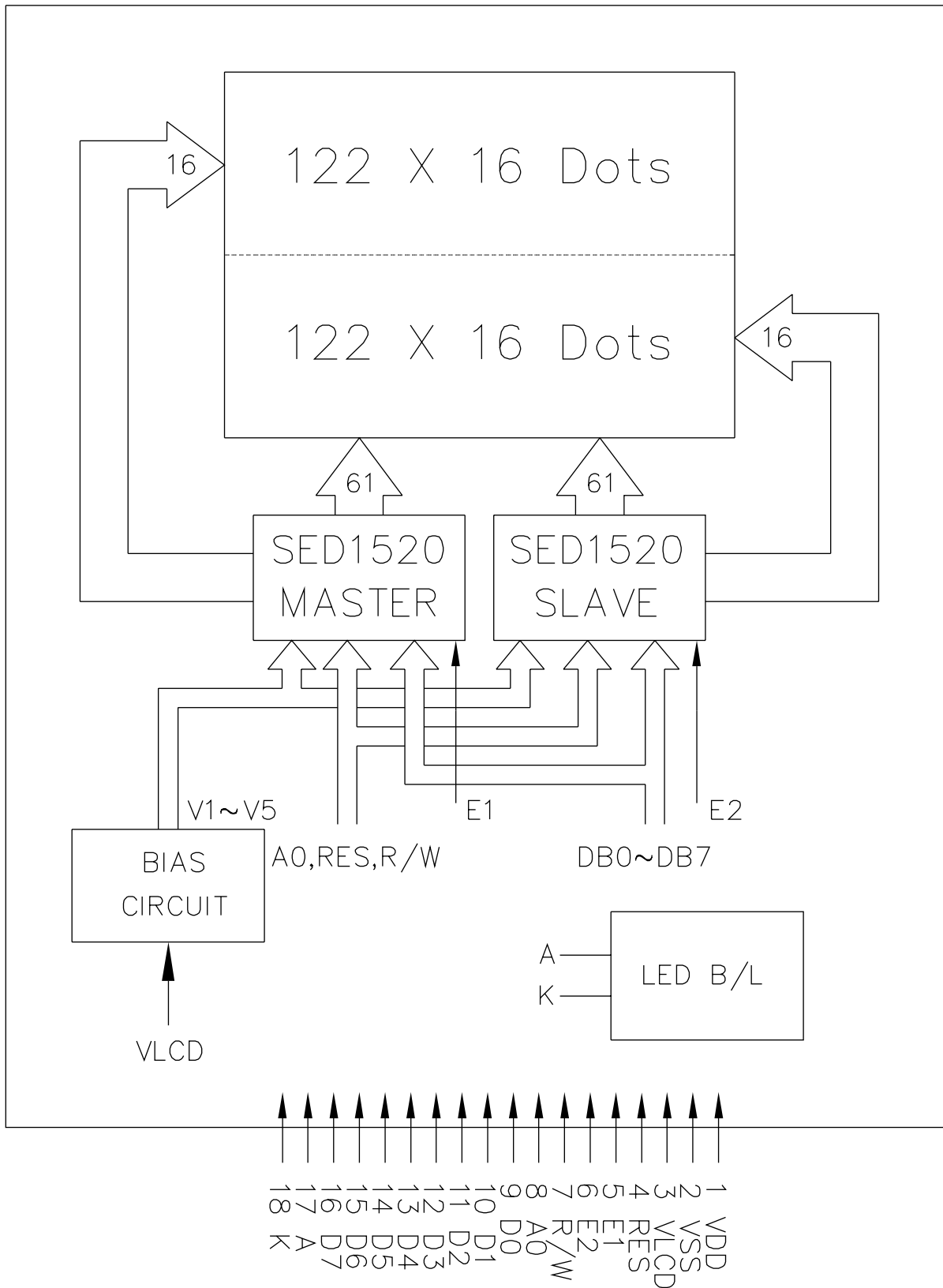
 At  $\phi=0^\circ$   $\theta=0^\circ$ 

| ITEM                 | SYMBOL | CONDITION | MIN. | TYP. | MAX. | UNIT | NOTE   |
|----------------------|--------|-----------|------|------|------|------|--------|
| Response Time (rise) | Tr     | 0°C       | –    | 1100 | 2200 | ms   | NOTE 2 |
|                      |        | 0°C       | –    | 450  | 900  |      |        |
|                      |        | 25°C      | –    | 150  | 300  |      |        |
|                      |        | 50°C      | –    | 90   | 180  |      |        |
|                      |        | 50°C      | –    | 60   | 120  |      |        |
| Response Time (fall) | Tf     | 0°C       | –    | 1800 | 2900 | ms   | NOTE 2 |
|                      |        | 0°C       | –    | 280  | 730  |      |        |
|                      |        | 25°C      | –    | 100  | 250  |      |        |
|                      |        | 50°C      | –    | 70   | 160  |      |        |
|                      |        | 50°C      | –    | 60   | 120  |      |        |

NOTE :

- R: REFLECTIVE
- S: TRANSFLECTIVE
- A: GRAY
- C: YELLOW
- J: NORMALLY WHITE

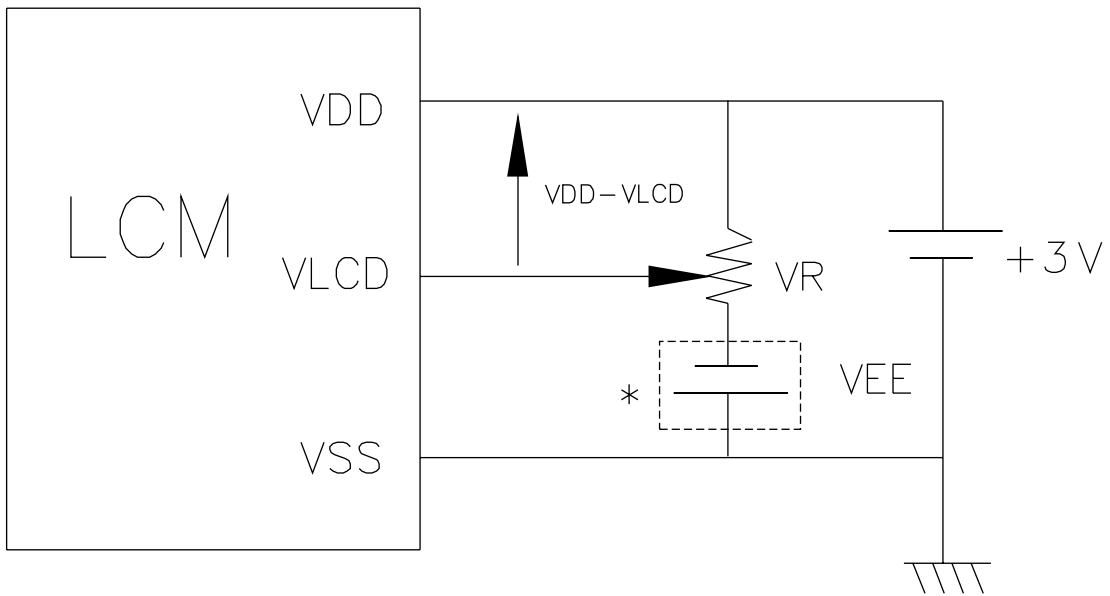
## 5. BLOCK DIAGRAM



## 6. INTERNAL PIN CONNECTION

| PinNo. | Symbol | Level | Function                   |
|--------|--------|-------|----------------------------|
| 1      | VDD    | –     | Power Supply (+3V)         |
| 2      | VSS    | –     | Power Supply (0V)          |
| 3      | VLCD   | –     | LCD Driving Voltage        |
| 4      | RES    | H/L   | Resets The System          |
| 5      | E1     | H/L   | Chip Enable for IC(Master) |
| 6      | E2     | H/L   | Chip Enable for IC(Slave)  |
| 7      | R/W    | H/L   | Read/Write Select Signal   |
| 8      | A0     | H/L   | Control/Data Selection     |
| 9      | D0     | H/L   | Data Bus                   |
| 10     | D1     | H/L   |                            |
| 11     | D2     | H/L   |                            |
| 12     | D3     | H/L   |                            |
| 13     | D4     | H/L   |                            |
| 14     | D5     | H/L   |                            |
| 15     | D6     | H/L   |                            |
| 16     | D7     | H/L   |                            |
| 17     | A      | –     | Anode of LED B/L           |
| 18     | K      | –     | Cathode of LED B/L         |

## 7. POWER SUPPLY



\* VEE = 6V



## 8. TIMING CHARACTERISTICS

### 8-1. INTERFACE TIMING

VDD=2.7~4.5V, T<sub>a</sub>=-20~70°C

| Item                       | Symbol                         | Test condition | Min. | Typ. | Max. | Unit |
|----------------------------|--------------------------------|----------------|------|------|------|------|
| System cycle time (Note 1) | t <sub>CYC</sub>               | Fig.a , Fig.b  | 2000 | -    | -    | ns   |
| Address setup time         | t <sub>AW</sub>                | Fig.a , Fig.b  | 40   | -    | -    | ns   |
| Address hold time          | t <sub>AH</sub>                | Fig.a , Fig.b  | 20   | -    | -    | ns   |
| Data setup time            | t <sub>DS</sub>                | Fig.b          | 160  | -    | -    | ns   |
| Data hold time             | t <sub>DH</sub>                | Fig.b          | 20   | -    | -    | ns   |
| Output disable time        | t <sub>OH</sub>                | Fig.a          | 20   | -    | 120  | ns   |
| Access time                | t <sub>ACC</sub>               | Fig.a          | -    | -    | 180  | ns   |
| Enable pulse width (Read)  | t <sub>EWR</sub>               | Fig.a          | 200  | -    | -    | ns   |
| Enable pulse width (Write) | t <sub>EWV</sub>               | Fig.b          | 160  | -    | -    | ns   |
| Rise and fall time         | t <sub>r</sub> ,t <sub>f</sub> | Fig.a , Fig.b  | -    | -    | 15   | ns   |

Note: 1.t<sub>CYC6</sub> is the cycle time of  $\overline{CS} \cdot E = H$ , not the cycle time of E.

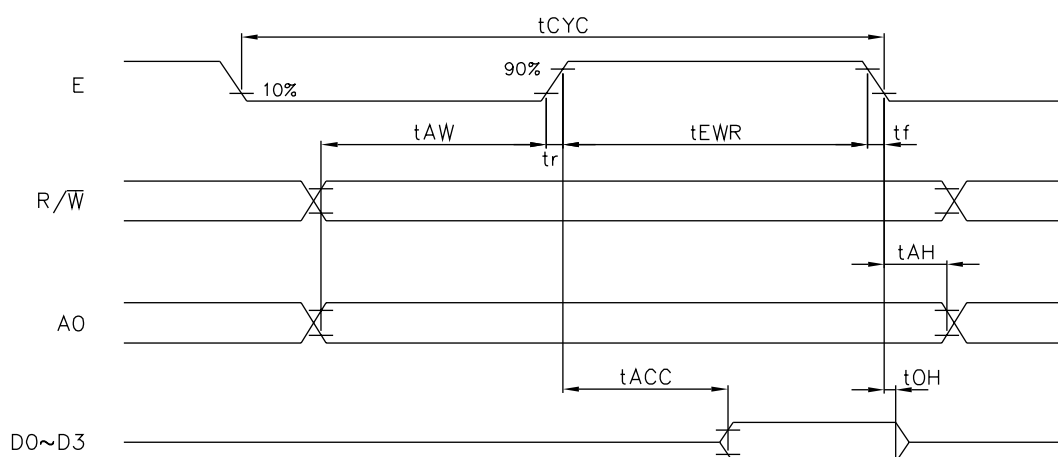


Fig . a Interface timing (Read)

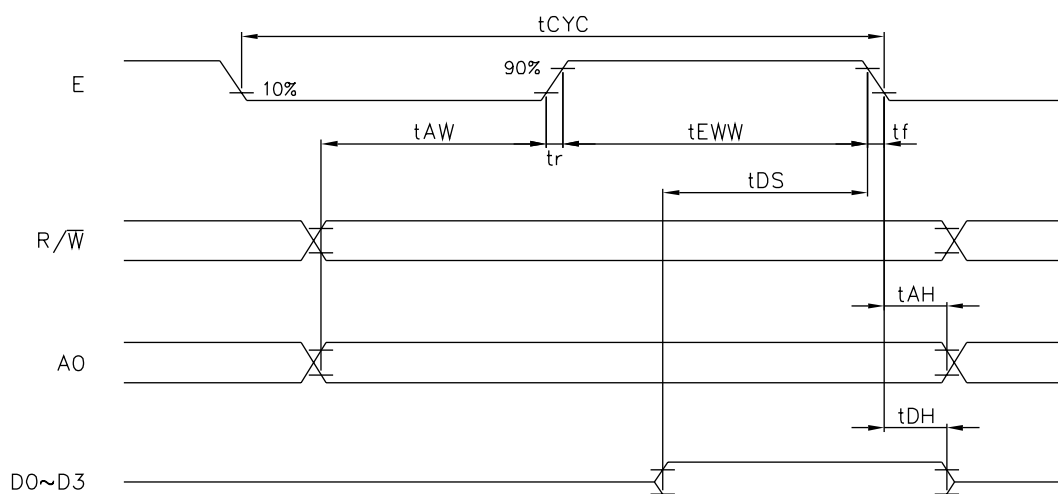
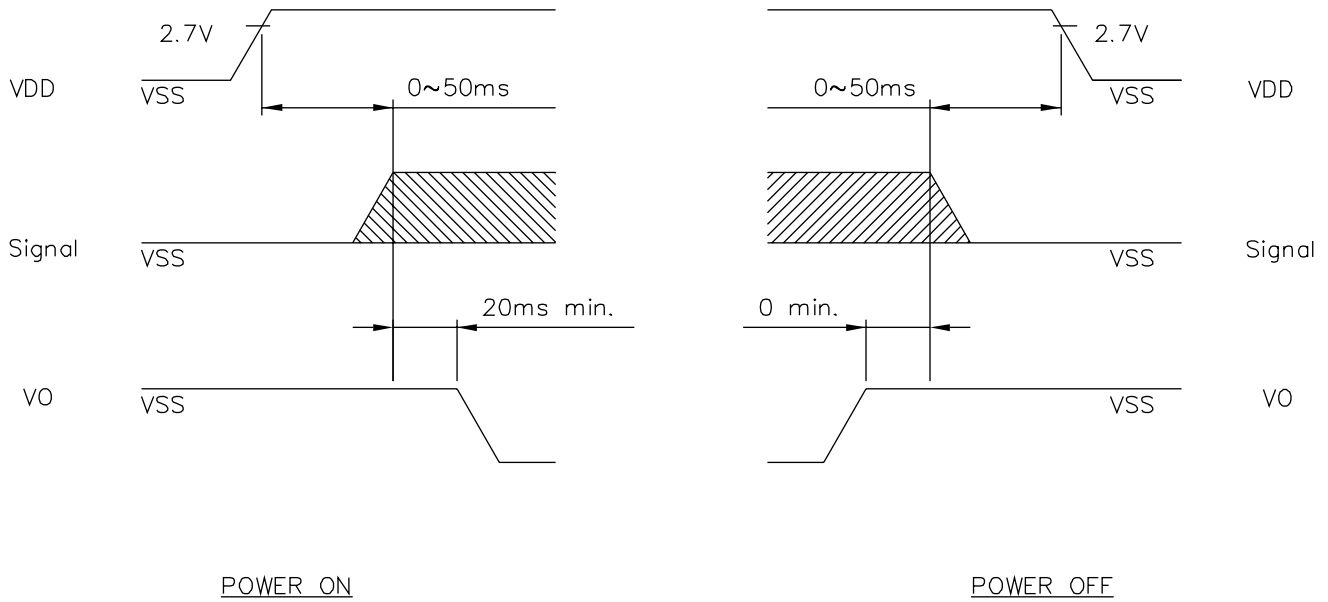


Fig . b Interface timing (Write)

## 8-2. POWER ON/OFF TIMING



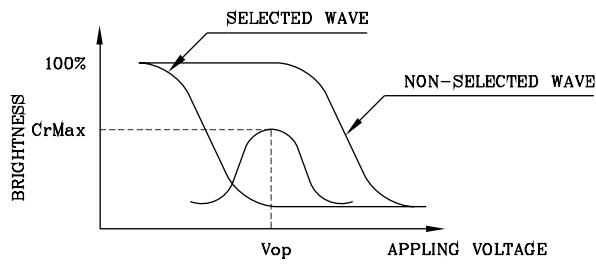
Missing pixels may occur when the LCM is driven beyond the above power interface timing sequence.

## 9. DISPLAY PATTERN

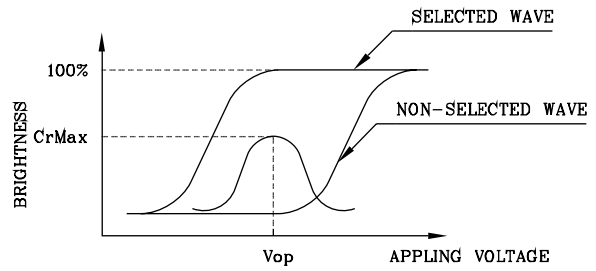
| Page            | DATA          |                 | Com NO.       | Driver |
|-----------------|---------------|-----------------|---------------|--------|
| 0               | D0<br>⋮<br>D7 | 122 x 16 Pixels | 1             | Master |
| 1               | D0<br>⋮<br>D7 |                 | ↓<br>16       |        |
| 2               | D0<br>⋮<br>D7 | 122 x 16 Pixels | 17            | Slave  |
| 3               | D0<br>⋮<br>D7 |                 | ↓<br>32       |        |
| Column<br>Addr. | ADC=0         | 00H —————> 3C   | 00H —————> 3C |        |
|                 | Seg NO.       | 1 —————> 61     | 62 —————> 122 |        |
|                 | Driver        | Master          | Slave         |        |

(NOTE 1)

Definition of Operation Voltage(Vop)



(positive type)



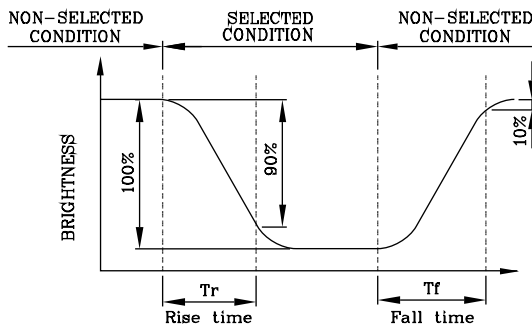
(negative type)

\*Conditions

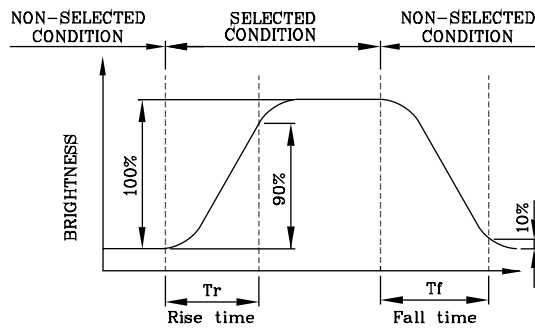
Viewing Angle : 0  
 Frame Frequency : 70Hz  
 Applying Waveform : I/N duty 1/a bias

(NOTE 2)

Definition of Response Time(Tr,Tf)



(positive type)



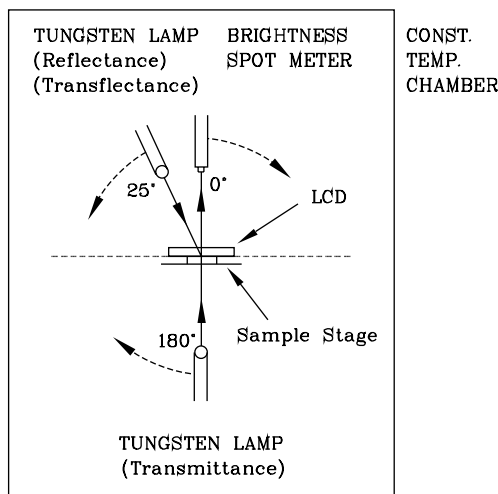
(negative type)

\*Conditions

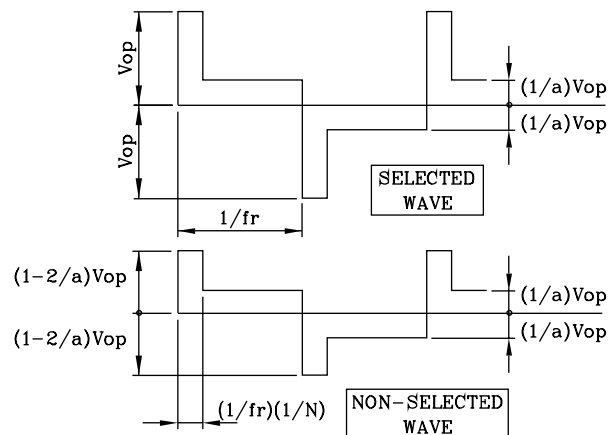
Operating Voltage : Vop  
 Viewing Angle (θ,φ) : (0,0)  
 Frame Frequency : 70Hz  
 Applying Waveform : I/N duty 1/a bias

(NOTE 3)

Description of Measuring Equipment and Driving Waveforms

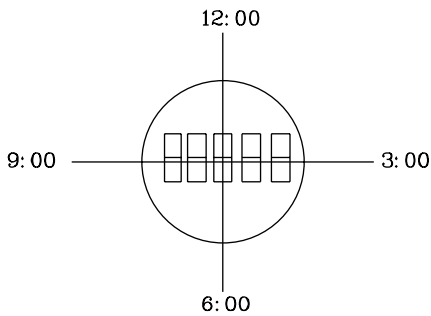


Multiplex Driving ( I/N duty 1/a bias )



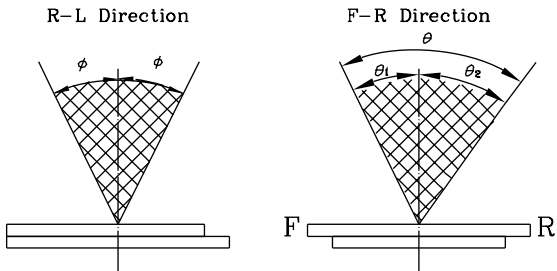
(NOTE 4)

Definition of Viewing Direction



(NOTE 5)

Definition of Viewing Angle



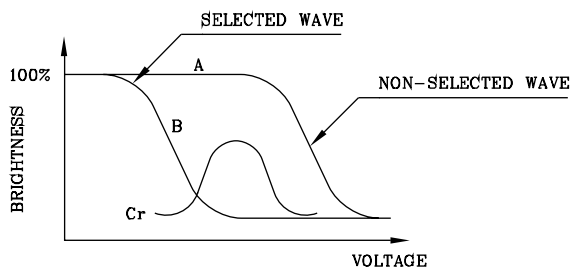
$$\theta = \theta_1 + \theta_2$$

\*Conditions

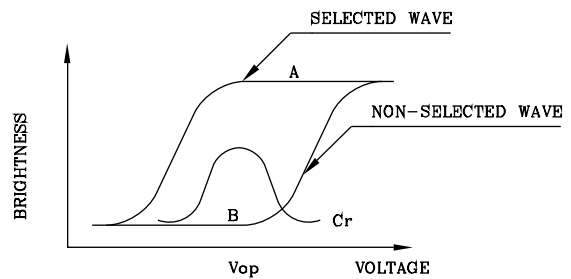
- Operating Voltage :  $V_{op}$
- Frame Frequency : 70Hz
- Applying Waveform : 1/N duty 1/a bias
- Contrast Ratio : larger than 2

(NOTE 6)

Definition of Contrast Ratio (Cr)



(positive type)

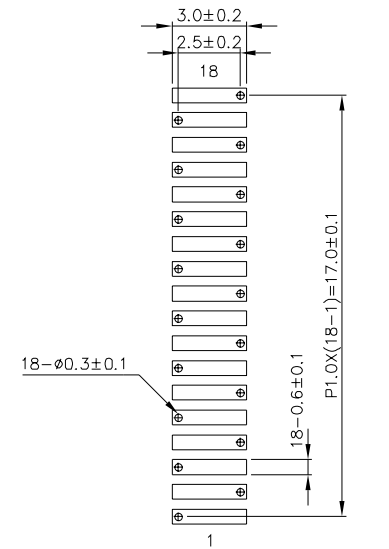
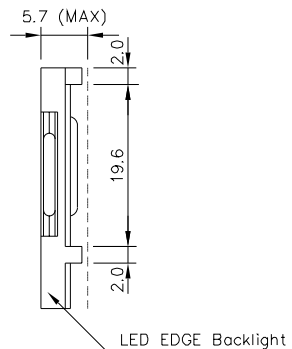
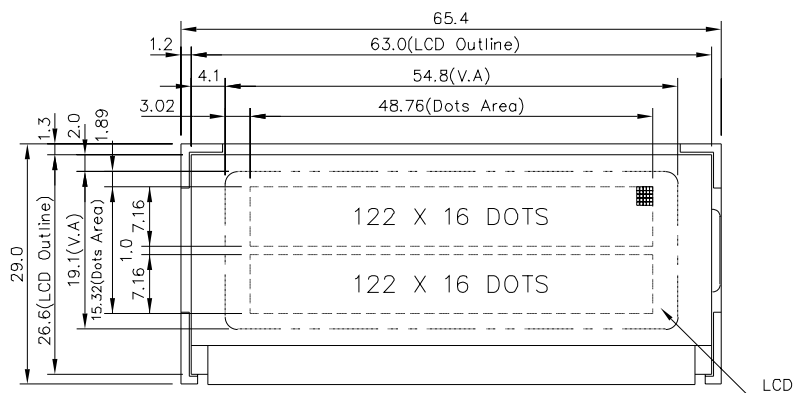


(negative type)

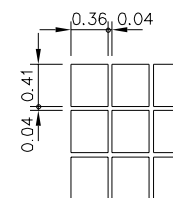
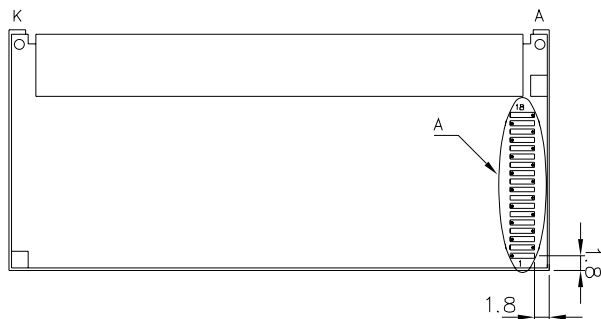
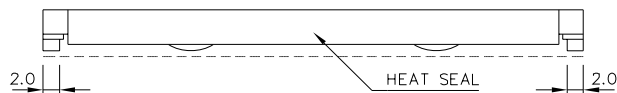
$$\text{Contrast Ratio : } Cr = A/B$$

\*Conditions

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



A (DETAIL of INTERFACE TERMINAL)



DOT DETAIL

NOTES :

1. RESOLUTION: 122 X 32
2. TOLERANCE NOT SPECIFIED: ±0.5mm

| NO. | SIGNAL |
|-----|--------|
| 1   | VDD    |
| 2   | VSS    |
| 3   | VLCD   |
| 4   | RES    |
| 5   | E1     |
| 6   | E2     |
| 7   | R/W    |
| 8   | A0     |
| 9   | D0     |
| 10  | D1     |
| 11  | D2     |
| 12  | D3     |
| 13  | D4     |
| 14  | D5     |
| 15  | D6     |
| 16  | D7     |
| 17  | A      |
| 18  | K      |

|         |          |             |      |                          |                      |
|---------|----------|-------------|------|--------------------------|----------------------|
|         |          | LMC62X095XM |      | <b>AZ DISPLAYS, INC.</b> |                      |
|         |          | NAME        | DATE |                          |                      |
| APPROVE |          |             |      | TITLE                    | <b>AGM1232F</b>      |
| CHECK   |          |             |      | DWG-NO                   | MCAx095xM Rev.A      |
| DESIGN  |          |             |      |                          |                      |
| DRAW    | MAY PING | 86.12.26    |      | THIRD ANGLE PROJECT      | UNIT : mm<br>SCALE : |