

# AZ DISPLAYS, INC.

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*COMPLETE LCD SOLUTIONS*

## SPECIFICATIONS FOR LIQUID CRYSTAL DISPLAY

PART NUMBER:

AGM 1232G SERIES

DATE:

APRIL 26, 2001

# AGM1232G SERIES GRAPHIC MODULE

## 1.0 MECHANICAL SPECS

| 1. Item                       | Description  |
|-------------------------------|--|
| 2. Overall Module Size        | 84.0mm(W) x 44.0mm(H) x max 13.0mm(D) for LED backlight version<br>84.0mm(W) x 44.0mm(H) x max 9.0mm(D) for reflective version |
| 3. Dot Size                   | 0.40mm(W) x 0.45mm(H)  |
| 4. Dot Pitch                  | 0.44mm(W) x 0.49mm(H)  |
| 5. Duty                       | 1/32   |
| 6. Controller IC              | SED1520FOA/DOA   |
| 7. LC Fluid Options           | STN, FSTN  |
| 8. Polarizer Options          | Reflective, Transflective, Transmissive  |
| 9. Backlight Options          | LED  |
| 10. Temperature Range Options | Standard (0°C ~ 50°C), Wide (-20°C ~ 70°C)   |

## 2.0 ABSOLUTE MAXIMUM RATINGS

| Item                                     | Symbol   | Min  | Typ | Max | Unit |
|--|----------|------|-----|-----|------|
| Operating temperature (Standard)         | Top      | 0    | -   | 50  | °C   |
| Storage temperature (Standard)           | Tst      | -20  | -   | 70  | °C   |
| Operating temperature (Wide temperature) | Top      | -20  | -   | 70  | °C   |
| Storage temperature (Wide temperature)   | Tst      | -30  | -   | 80  | °C   |
| Input voltage                            | Vin      | Vss  |     | Vdd | V    |
| Supply voltage for logic                 | Vdd- Vss | -0.3 | -   | 7.0 | V    |
| Supply voltage for LCD drive             | Vdd- Vo  | 5.0  | 6.5 | 9.5 | V    |

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## 3.0 ELECTRICAL CHARACTERISTICS

| Item   | Symbol   | Condition | Min | Typ | Max  | Unit |
|--|----------|-----------|-----|-----|------|------|
| Input voltage (high)                           | Vih      | H level   | 3.5 | -   | Vdd  | V    |
| Input voltage (low)                            | Vil      | L level   | 0   | -   | 1.5  | V    |
| Recommended LC Driving Voltage (Standard Temp) | Vdd - Vo | 0°C       | -   | 7.8 | 10.0 | V    |
|  |          | 25°C      | -   | 6.5 | -    |      |
|  |          | 50°C      | 4.3 | 5.5 | -    |      |
| Recommended LC Driving Voltage (Wide Temp)     | Vdd -Vo  | -20°C     | -   | 8.5 | 10.8 | V    |
|  |          | 0°C       | -   | 7.8 | -    |      |
|  |          | 50°C      | 4.3 | 5.5 | -    |      |
|  |          | 70°C      | 3.5 | 4.8 | -    |      |
| Power Supply Current                           | Idd      | Vdd=5.0V  | -   | -   | 13.0 | mA   |
| LED Power Supply Voltage                       | Vfled    | R=6.8Ω    | -   | 4.4 | 5.0  | V    |
| LED Power Supply Current                       | Ifled    | R=6.8Ω    | -   | 300 | 420  | mA   |

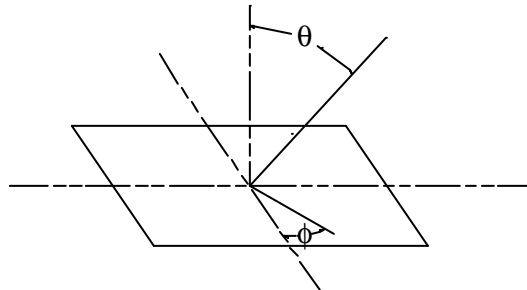
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## 4.0 OPTICAL CHARACTERISTICS

| Mode |   | Item |      | Cr (Contrast Ratio) |      | $\theta$ (Viewing Angle) |      | $\phi$ (Viewing Angle) |  |
|------|---|------|------|---------------------|------|--------------------------|------|------------------------|--|
|      |   |      |      | 25°C                |      | 25°C                     |      | 25°C                   |  |
|      |   | MIN. | TYP. | MIN                 | TYP. | MIN                      | TYP. |                        |  |
| R    | A | 2.8  | 3.05 | 80°                 | 85°  | -                        | 35°  |                        |  |
|      | B | 7.10 | 7.70 | 80°                 | 85°  | -                        | 35°  |                        |  |
|      | C | -    | -    | -                   | -    | -                        | -    |                        |  |
| S    | A | 2.49 | 2.99 | 80°                 | 85°  | -                        | 35°  |                        |  |
|      | B | 7.05 | 7.55 | 80°                 | 85°  | -                        | 35°  |                        |  |
|      | C | -    | -    | -                   | -    | -                        | -    |                        |  |

Note:

R: Reflective  
 S: Transflective  
 A: STN Gray  
 B: STN Yellow  
 C: FSTN

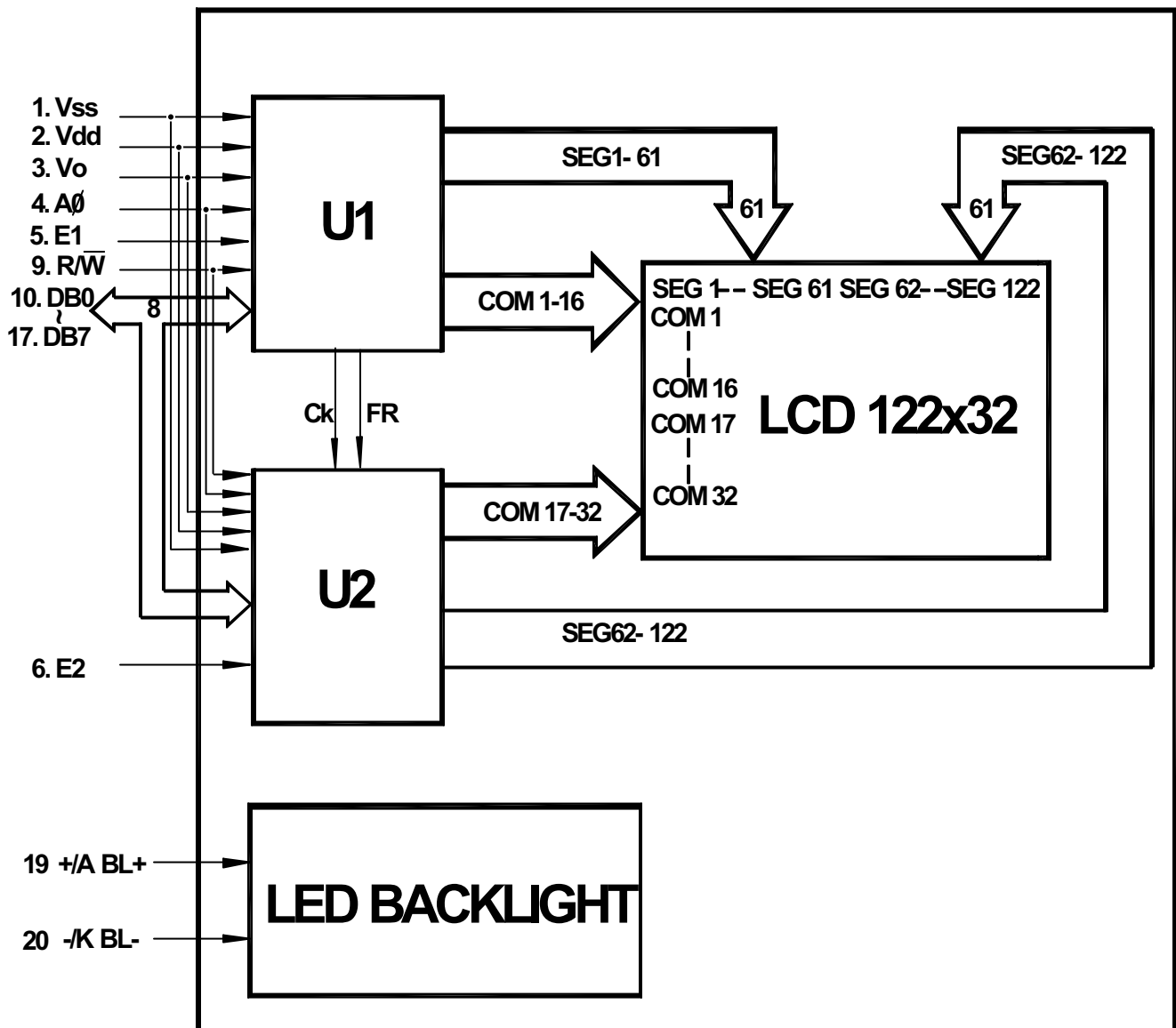


At:  $\phi = 0^\circ$ ,  $\theta = 0^\circ$

| Item                 | Symbol | Condition | Min | Typ | Max | Unit |
|----------------------|--------|-----------|-----|-----|-----|------|
| Response time (rise) | Tr     | 25°C      | -   | 80  | 160 | ms   |
| Response time (fall) | Tf     | 25°C      | -   | 50  | 100 | ms   |

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## 5.0 BLOCK DIAGRAM



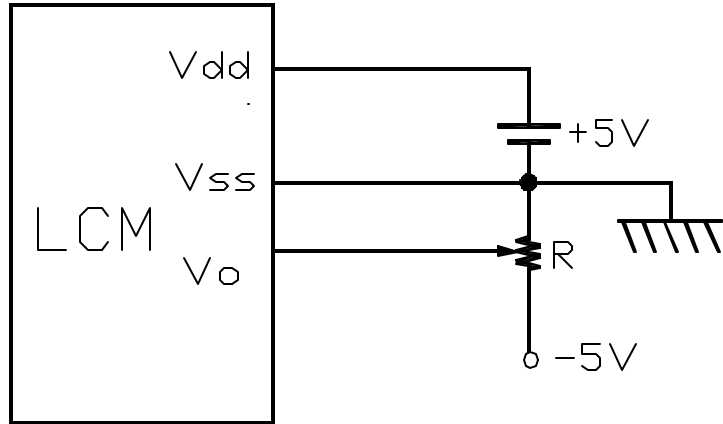
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## 6.0 PIN ASSIGNMENT

| Pin No. | Symbol            | Function                       | Level |
|---------|-------------------|--------------------------------|-------|
| 1       | Vss               | Ground                         | -     |
| 2       | Vdd               | Power Supply For Logic Circuit | -     |
| 3       | Vo                | Power Supply For LCD Driving   | -     |
| 4       | A $\emptyset$     | Instruction/Data               | H/L   |
| 5       | E1                | Enable for IC1                 | H/L   |
| 6       | E2                | Enable for IC2                 | H/L   |
| 7       | NC                |                                |       |
| 8       | NC                |                                |       |
| 9       | R/ $\overline{W}$ | H: Data read<br>L: Data write  | H/L   |
| 10      | DB0               | Data bit 0                     | H/L   |
| 11      | DB1               | Data bit 1                     | H/L   |
| 12      | DB2               | Data bit 2                     | H/L   |
| 13      | DB3               | Data bit 3                     | H/L   |
| 14      | DB4               | Data bit 4                     | H/L   |
| 15      | DB5               | Data bit 5                     | H/L   |
| 16      | DB6               | Data bit 6                     | H/L   |
| 17      | DB7               | Data bit 7                     | H/L   |
| 18      | $\overline{RES}$  | Display Reset on active "Low"  | H/L   |
| 19      | BL-               | Power Supply for BL+           | -     |
| 20      | BL+               | Power Supply for BL-           | -     |

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## 7.0 POWER SUPPLY



## 8.0 TIMING CHARACTERISTICS

| Item                | Symbol     | Test Condition | Min. | Typ. | Max. | Unit |
|---------------------|------------|----------------|------|------|------|------|
| System cycle time   | $t_{CYC6}$ | Fig. a, Fig. b | 1000 | -    | -    | ns   |
| Address setup time  | $t_{AW6}$  | Fig. a, Fig. b | 20   | -    | -    | ns   |
| Address hold time   | $t_{AH6}$  | Fig. a, Fig. b | 10   | -    | -    | ns   |
| Data hold time      | $t_{DH6}$  | Fig. a         | 10   | -    | -    | ns   |
| Data setup time     | $t_{DS6}$  | Fig. a         | 80   | -    | -    | ns   |
| Output disable time | $t_{OH6}$  | CL=100 pF      | 10   | -    | 60   | ns   |
| Access time         | $t_{ACC6}$ |                | -    | -    | 90   |      |
| Enable pulse width  | Read       | $T_{EW}$       | 100  |      |      |      |
|                     | Write      |                | 80   |      |      |      |
| Rise and fall time  | $T_r, T_f$ | Fig. a, Fig. b | -    | -    | 15   | ns   |

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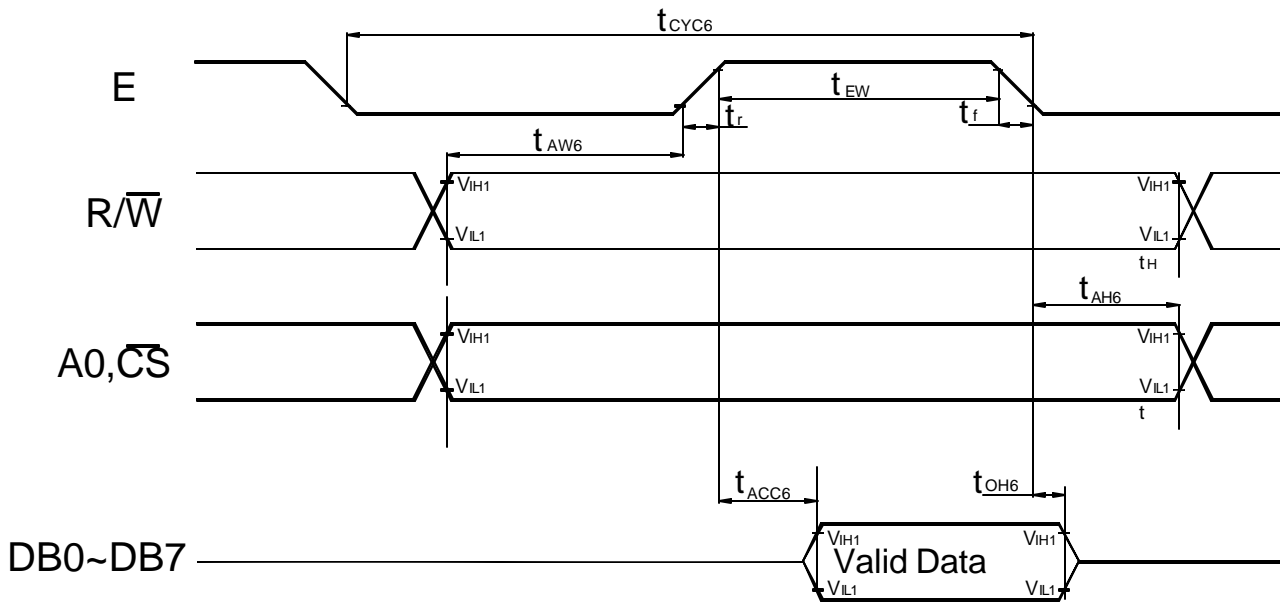


Fig. a Interface timing (data Read)

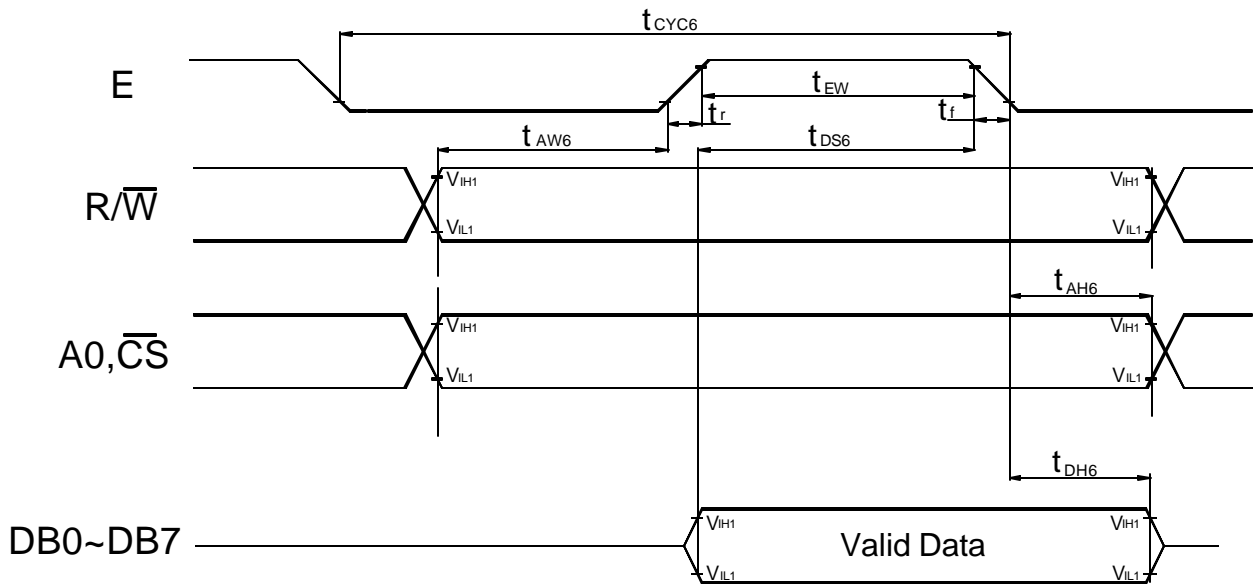


Fig. b Interface timing (data Write)



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## 9.0 RELIABILITY TEST

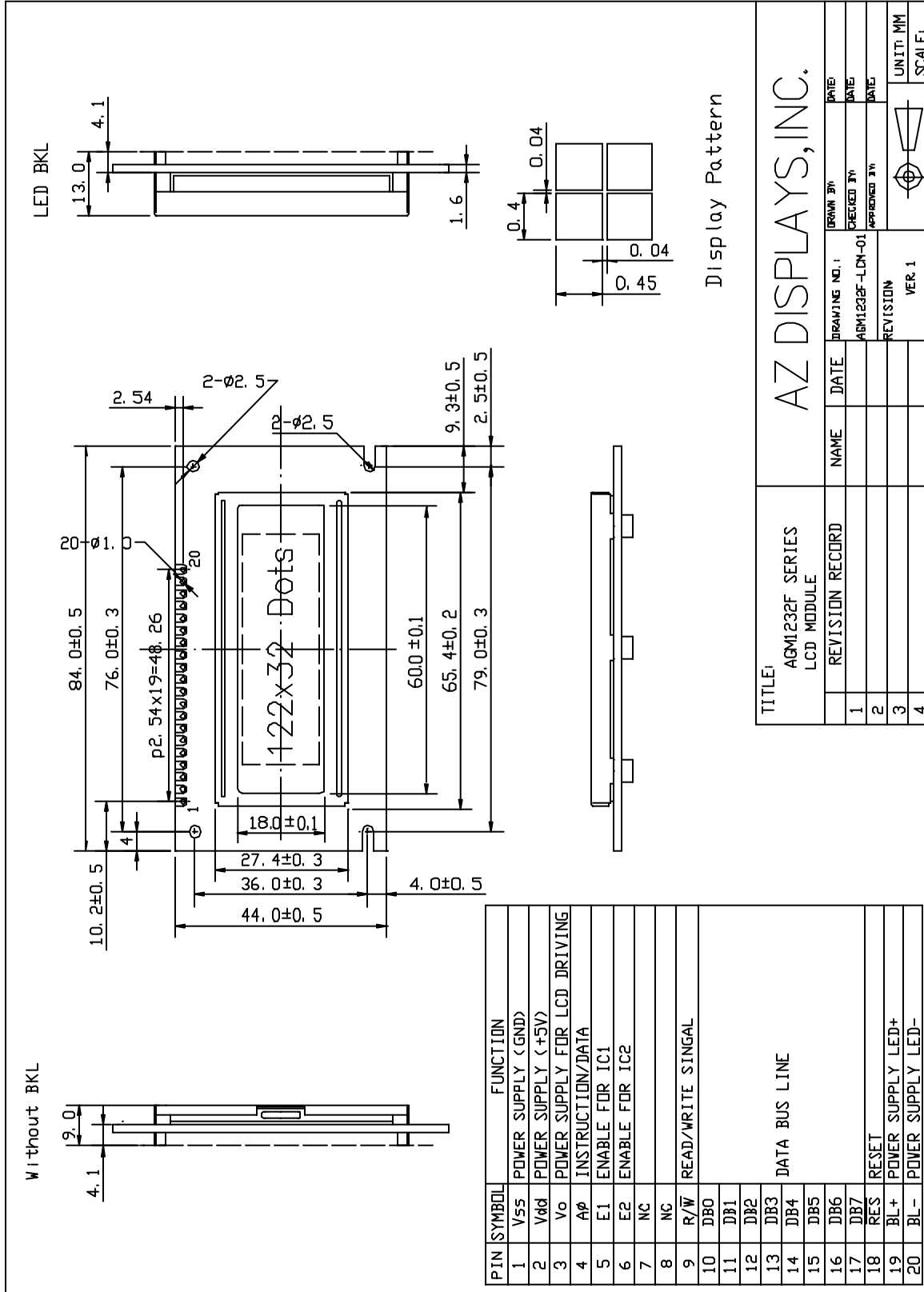
| Storage Condition                          | Content             | Evaluations and Assessment* |        |                                |                   |
|--|---------------------|-----------------------------|--------|--------------------------------|-------------------|
|  |                     | Current Consumption         | Oozing | Contrast                       | Other Appearances |
| Operation at high temperature and humidity | 40° C,90% RH,240hrs | Twice initial value or less | none   | More than 80% of initial value | No abnormality    |
| High temperature storage                   | 60° C, 240hrs       | Twice initial value or less | none   | More than 80% of initial value | No abnormality    |
| Low temperature storage                    | -20° C, 240hrs      | Twice initial value or less |        | More than 80% of initial value | No abnormality    |

\*Evaluations and assessment to be made two hours after returning to room temperature (25° C±5° C).

\*The LCDs subjected to the test must not have dew condensation.

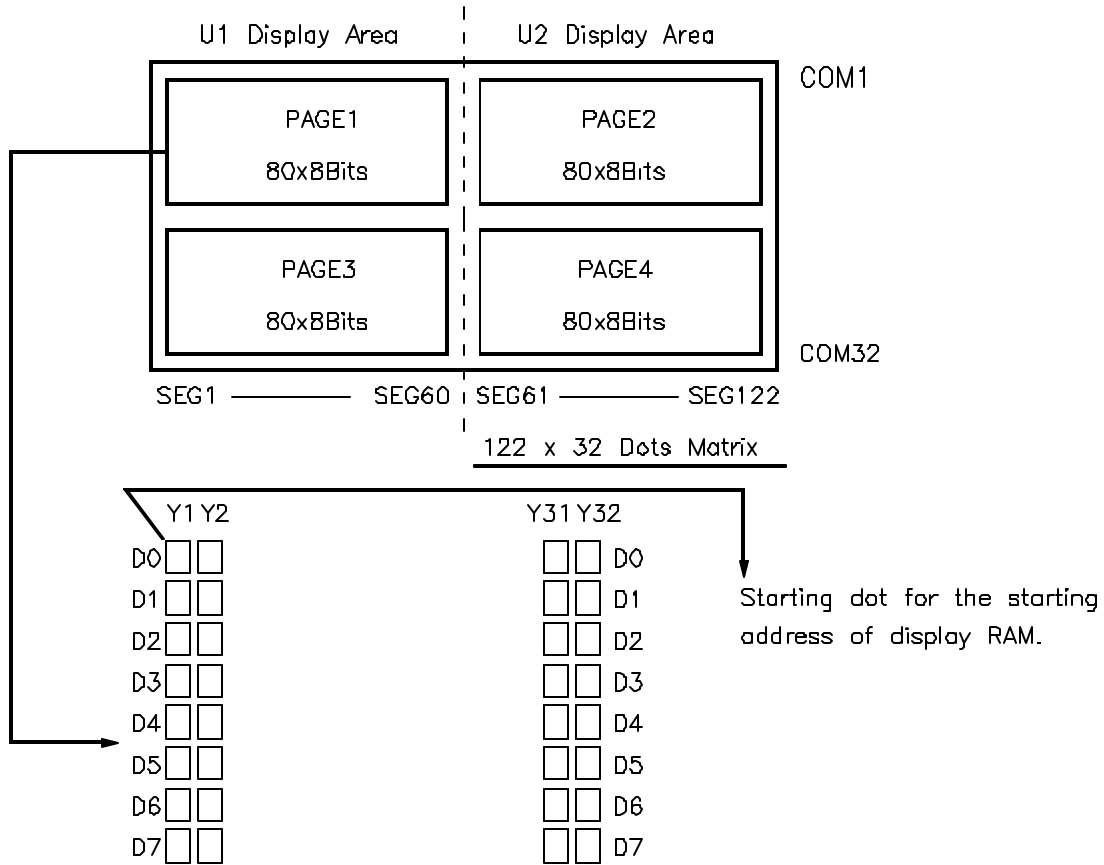
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## 10.0 MECHANICAL DIAGRAM

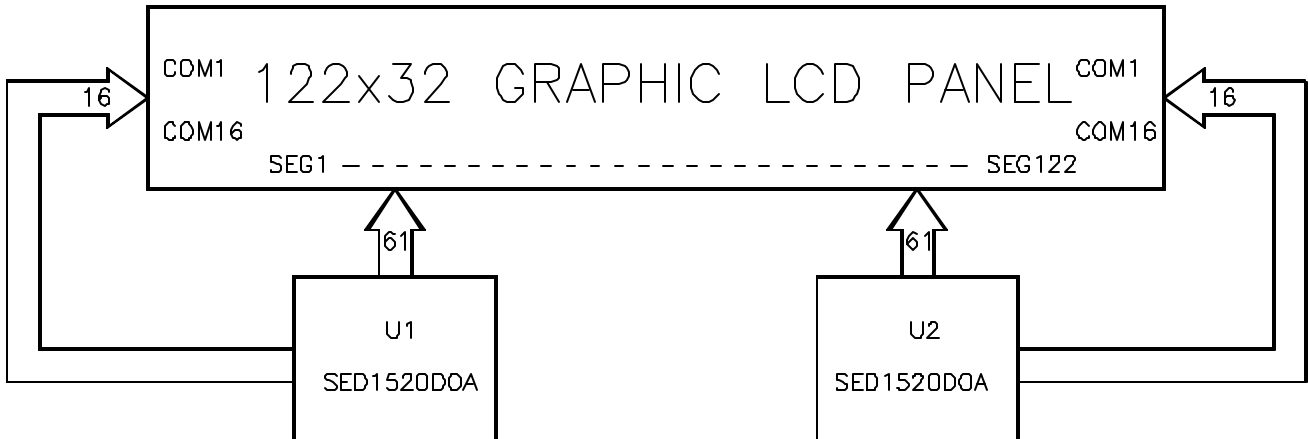


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## 11.0 RELATION BETWEEN DISPLAY PATTERN AND DRIVERS



Each segment driver has 4 pages RAM, and each page has 80x8 bits RAM. D0~D7 are 8 bits transmitted data, where D0 is LSB and D7 is MSB.



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## 12.0 DISPLAY CONTROL INSTRUCTION

The display control instructions control the internal state of the SED1520DOA/FOA. Instructions are received from MPU to SED1520DOA/FOA for the display control.

| INSTRUCTION                  | A0 | R/W | DB7        | DB6                   | DB5    | DB4                       | DB3 | DB2 | DB1        | DB0 | DESCRIPTION   |
|------------------------------|----|-----|------------|-----------------------|--------|---------------------------|-----|-----|------------|-----|---|
| Display ON/OFF               | 0  | 0   | 1          | 0                     | 1      | 0                         | 1   | 1   | 1          | 1/0 | Turns display on or off.<br>0: OFF. 1:ON  |
| Set Page Address             | 0  | 0   | 1          | 0                     | 1      | 1                         | 1   | 0   | Page (0~3) |     | Sets display RAM Page in Page address register  |
| Set Column (Segment address) | 0  | 0   | 0          | Column address (0~79) |        |                           |     |     |            |     | Sets display RAM column address in column address register  |
| Display Start Line           | 0  | 0   | 1          | 1                     | 0      | Display start line (0~31) |     |     |            |     | Indicates the display data RAM displayed at the top of the screen.  |
| Status Read                  | 0  | 1   | BUSY       | ADC                   | ON/OFF | RESET                     | 0   | 0   | 0          | 0   | Reads the following status:<br>BUSY 0: Ready<br>1: Busy<br>ADC 1: CW output<br>0: CCW output<br>ON/OFF 0: Display on<br>1: Display off<br>RESET 0: Normal<br>1: Being Reset |
| Write Display Data           | 1  | 0   | Write Data |                       |        |                           |     |     |            |     | Writes data DB0~DB7 from bus into display data RAM.   |
| Read Display Data            | 1  | 1   | Read Data  |                       |        |                           |     |     |            |     | Reads data DB0~DB7 from display data RAM onto the data bus.   |
| Select ADC                   | 0  | 0   | 1          | 0                     | 1      | 0                         | 0   | 0   | 0          | 0/1 | 0: CW output, 1: CCW output   |
| Static drive ON/OFF          | 0  | 0   | 1          | 0                     | 1      | 0                         | 0   | 1   | 0          | 0/1 | 1: Static drive,<br>0: Normal driving   |
| Select duty                  | 0  | 0   | 1          | 0                     | 1      | 0                         | 1   | 0   | 0          | 0/1 | Select LCD duty cycle<br>1:1/32, 0: 1/16  |
| Read-Modify-Write            | 0  | 0   | 1          | 1                     | 1      | 0                         | 0   | 0   | 0          | 0   | Read-Modify-write ON  |
| END                          | 0  | 0   | 1          | 1                     | 1      | 0                         | 1   | 1   | 1          | 0   | Read-Modify-write OFF   |
| Reset                        | 0  | 0   | 1          | 1                     | 1      | 0                         | 0   | 0   | 1          | 0   | Software reset  |