

AZ DISPLAYS, INC.

COMPLETE LCD SOLUTIONS

SPECIFICATIONS FOR LIQUID CRYSTAL DISPLAY

PART NUMBER:

AGM 1232E SERIES

DATE:

FEBRUARY 10, 2001

AGM1232E SERIES GRAPHIC MODULE

1.0 MECHANICAL SPECS

| 1. Item | Description |
|-------------------------------|--|
| 2. Overall Module Size | 66.1mm(W) x 27.3mm(H) x max 8.5mm(D) |
| 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 | EL |
| 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- Vee | 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) | V _{ih} | H level | 3.5 | - | V _{dd} | V |
| Input voltage (low) | V _{il} | L level | 0 | - | 1.5 | V |
| Recommended LC Driving Voltage (Standard Temp) | V _{dd} - V _{ee} | 0°C | - | 7.8 | 10.0 | V |
| | | 25°C | - | 6.5 | - | |
| | | 50°C | 4.3 | 5.5 | - | |
| Recommended LC Driving Voltage (Wide Temp) | V _{dd} -V _{ee} | -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 | I _{dd} | V _{dd} =5.0V | - | - | 13.0 | mA |
| LED Power Supply Voltage | V _{fled} | R=6.8Ω | - | 4.4 | 5.0 | V |
| LED Power Supply Current | I _{fled} | R=6.8Ω | - | 300 | 420 | mA |

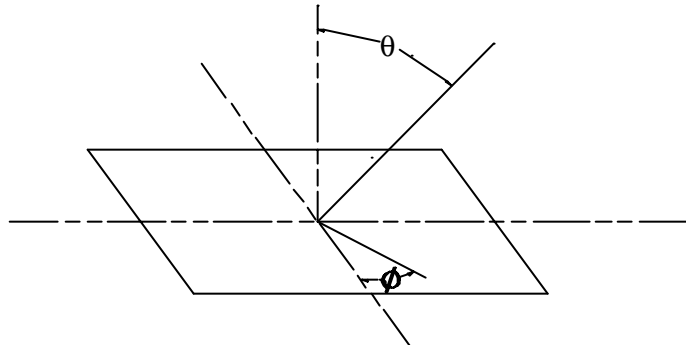
4.0 OPTICAL CHARACTERISTICS

| Item | | Cr (Contrast Ratio) | | θ (Viewing Angle) | | φ (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

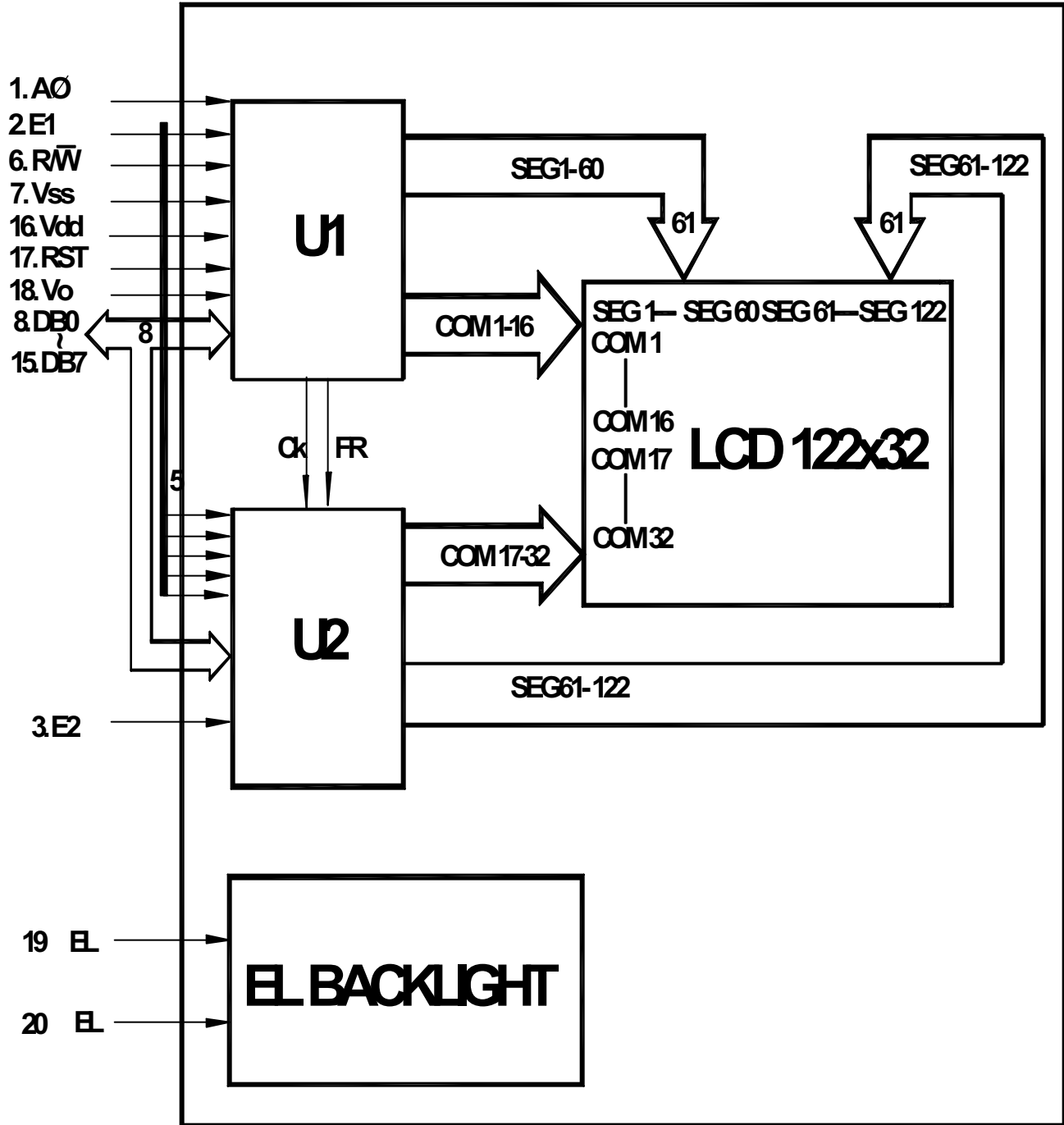
At: φ = 0°, θ = 0°



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

5.0 BLOCK DIAGRAM

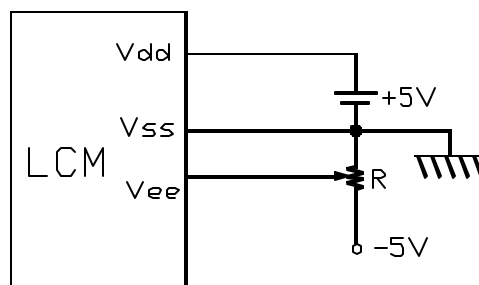


AGM1232E SERIES GRAPHIC MODULE

6.0 PIN ASSIGNMENT

| Pin No. | Symbol | Function | Level |
|---------|--------|--------------------------------|-------|
| 1 | AØ | Instruction/Data | H/L |
| 2 | E1 | Enable for IC1 | H/L |
| 3 | E2 | Enable for IC2 | H/L |
| 4 | NC | No Connect | |
| 5 | NC | No Connect | |
| 6 | R/W | H: Data read L: Data write | H/L |
| 7 | Vss | Ground | - |
| 8 | DB0 | Data bit 0 | H/L |
| 9 | DB1 | Data bit 1 | H/L |
| 10 | DB2 | Data bit 2 | H/L |
| 11 | DB3 | Data bit 3 | H/L |
| 12 | DB4 | Data bit 4 | H/L |
| 13 | DB5 | Data bit 5 | H/L |
| 14 | DB6 | Data bit 6 | H/L |
| 15 | DB7 | Data bit 7 | H/L |
| 16 | Vdd | Power Supply For Logic Circuit | |
| 17 | RST | Reset | |
| 18 | Vee | Power Supply For LCD Driving | |
| 19 | EL | Power Supply for EL | - |
| 20 | EL | Power Supply for EL | - |

7.0 POWER SUPPLY



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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 pulsewidth | Read | T_{EW} | 100 | | | ns |
| | Write | | 80 | | | ns |
| Rise and fall time | T_r, T_f | Fig. a, Fig. b | - | - | 15 | ns |

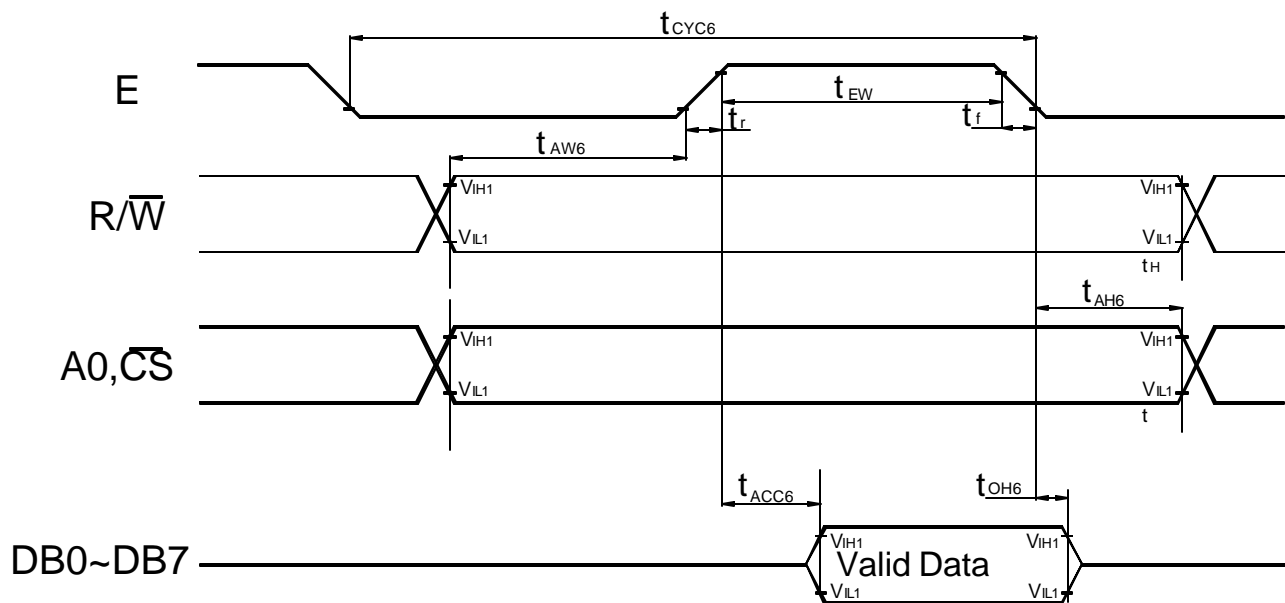


Fig. a Interface timing (data Read)

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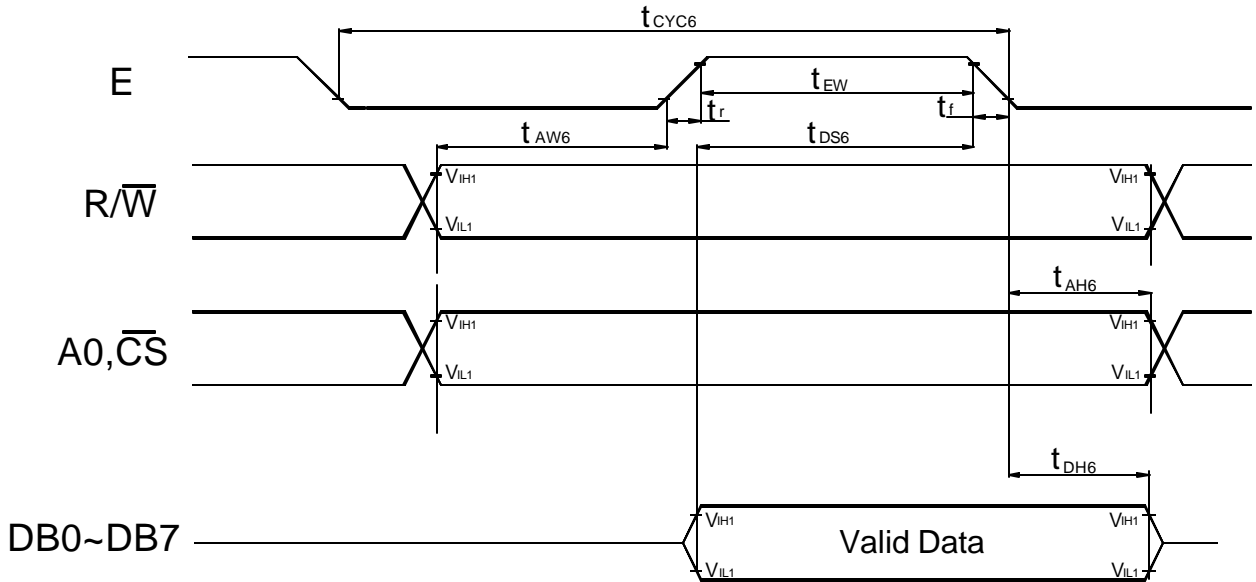


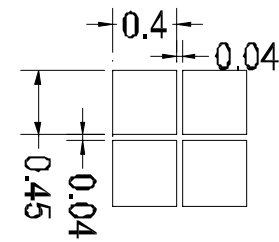
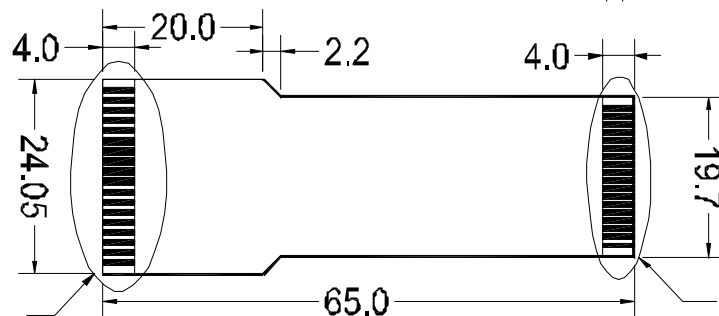
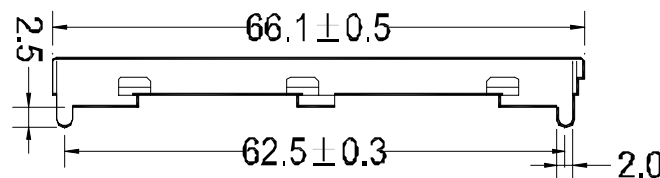
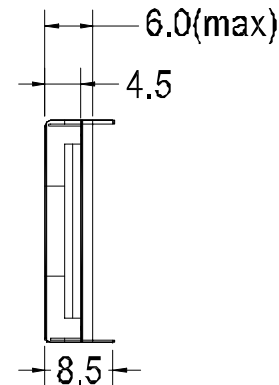
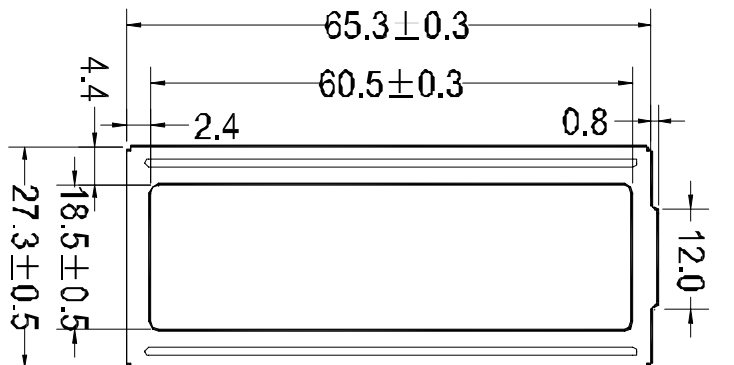
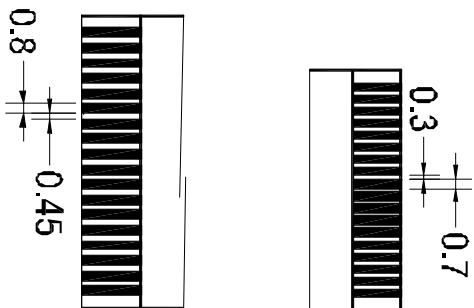
Fig. b Interface timing (data Write)

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 |

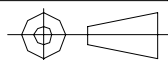
*Evaluations and assessment to be made two hours after returning to room temperature (25° C ± 5° C).

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



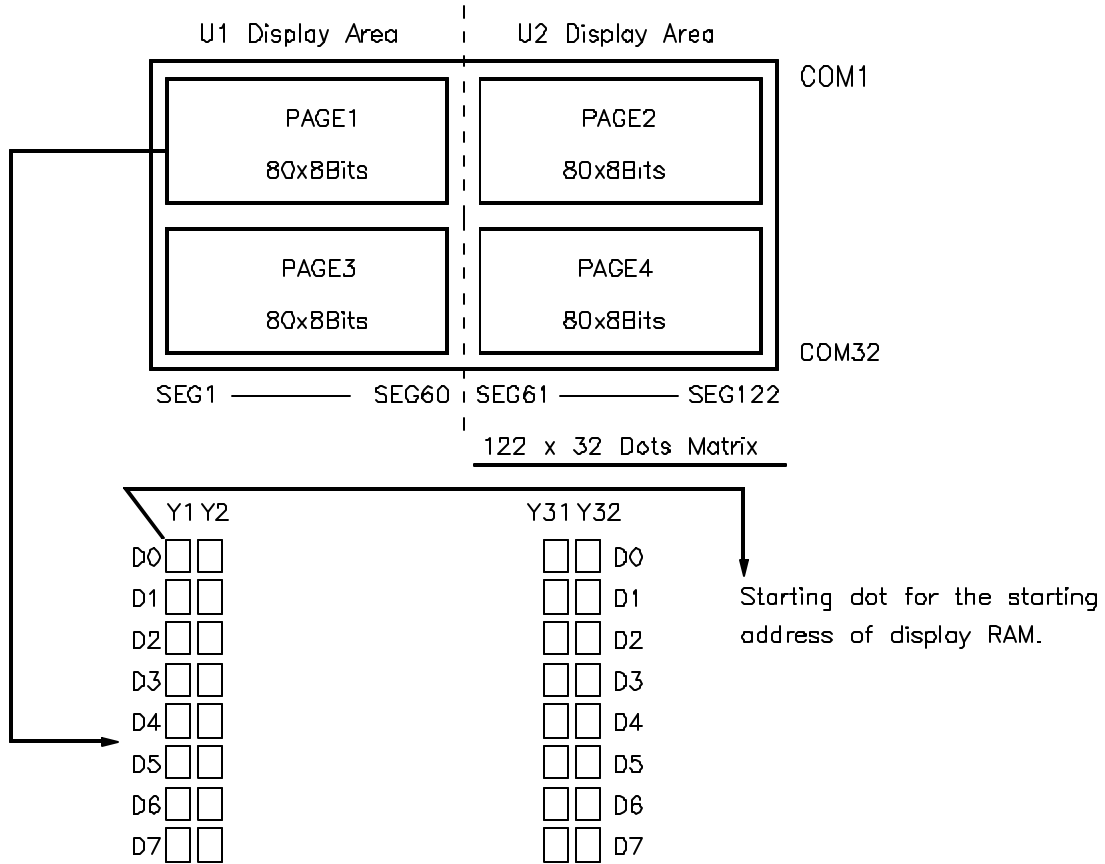
Display Pattern

| PIN | SYMBOL | FUNCTION |
|-----|--------|------------------------------|
| 1 | A0 | INSTRUCTION/DATA |
| 2 | E1 | ENAB_E FOR IC1 |
| 3 | E2 | ENAB_E FOR IC2 |
| 4 | NC | No Connect |
| 5 | NC | No Connect |
| 6 | R/W | READ/WRITE SINGAL |
| 7 | Vss | POWER SUPPLY (GND) |
| 8 | DB0 | DATA BUS LINE |
| 9 | DB1 | |
| 10 | DB2 | |
| 11 | DB3 | |
| 12 | DB4 | |
| 13 | DB5 | |
| 14 | DB6 | |
| 15 | DB7 | |
| 16 | Vdd | POWER SUPPLY (+5V) |
| 17 | RES | RESET |
| 18 | Vo | POWER SUPPLY FOR LCD DRIVING |
| 19 | EL | POWER SUPPLY EL |
| 20 | EL | POWER SUPPLY EL |

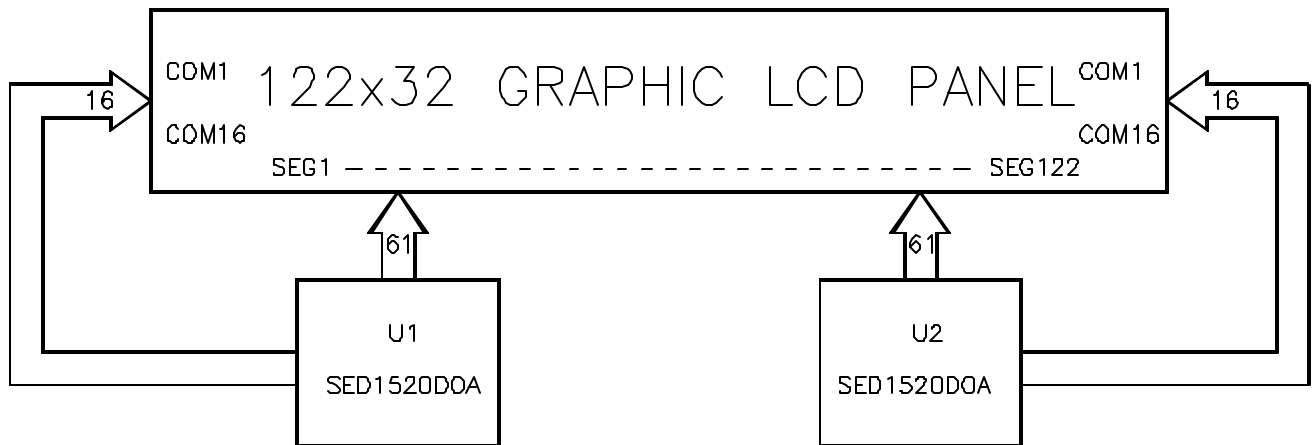
| | | | | | |
|---|--|--------------------------|------|---------------------------------|---|
| TITLE: AGM1232E SERIES LCD MODULE | | AZ DISPLAYS, INC. | | | |
| REVISION RECORD | | NAME | DATE | DRAWING NO. AGM1232E-1 CM-01 | DRAWN BY: |
| 1 | | | | | CHECKED BY: |
| 2 | | | | | APPROVED BY: |
| 3 | | | | REVISION: VER.1 | |
| 4 | | | | | |
| | | | | |  |
| | | | | | UNIT: MM SCALE: |

AGM1232E SERIES GRAPHIC MODULE

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