

# AZ DISPLAYS, INC.

*Complete LCD Solutions*

## ACM2002P SERIES LCD MODULE

### 1.0 PHYSICAL DATA

| Item                            | Nominal Dimensions / Available Options   | Unit |
|---------------------------------|--|------|
| Number of Characters            | 20 characters x 2 lines  | -    |
| Character Format                | 5 x 7 dots with cursor   | -    |
| Overall Module Size (W x H x D) | 180.0 x 40.0 x max 14.5 for LED backlight version<br>180.0 x 40.0 x max 9.5 for reflective or EL backlight version | mm   |
| Dot Size (W x H)                | 1.12 x 1.12  | mm   |
| Dot Pitch (W x H)               | 1.22 x 1.22  | mm   |
| Duty                            | 1/16   | -    |
| Controller IC                   | KS0066   | -    |
| LC Fluid Options                | TN, STN  | -    |
| Polarizer Options               | Reflective, Transflective  | -    |
| Backlight Options               | EL, LED  | -    |
| Temperature Range Options       | Standard, Wide temp  | -    |

### 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 temp) | Top                              | -20             | -   | +70             | °C   |
| Storage temperature (Wide temp)   | Tst                              | -30             | -   | +80             | °C   |
| Input voltage                     | V <sub>I</sub>                   | V <sub>SS</sub> | -   | V <sub>DD</sub> | V    |
| Supply voltage for logic          | V <sub>DD</sub> -V <sub>SS</sub> | 0               | 5.0 | 6.5             | V    |
| Supply voltage for LCD drive      | V <sub>DD</sub> -V <sub>O</sub>  | 0               | -   | 6.5             | V    |

### 3.0 OPTICAL CHARACTERISTICS (T<sub>a</sub> = 25°C, V<sub>DD</sub> = 5.0V ± 0.25V, STN LC Fluid)

| Item                       | Symbol | Condition  | Min | Typ | Max | Unit |
|----------------------------|--------|------------|-----|-----|-----|------|
| Viewing angle (horizontal) | θ      | Cr ≥ 2.0   | ±30 | -   | ±45 | deg  |
| Viewing angle (vertical)   | φ      | Cr ≥ 2.0   | 60  | -   | 80  | deg  |
| Contrast Ratio             | Cr     | φ=0°, θ=0° | 4.5 | -   | 10  |      |
| Response time (rise)       | Tr     | φ=0°, θ=0° | -   | 120 | 240 | ms   |
| Response time (fall)       | Tf     | φ=0°, θ=0° | -   | 155 | 310 | ms   |

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## 4.0 ELECTRICAL CHARACTERISTICS (Ta = 25°C, VDD = 5.0V ± 0.25V)

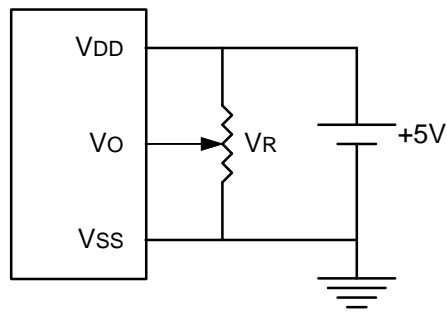
| Item                                     | Symbol | Condition         | Min  | Typ | Max  | Unit |
|--|--------|-------------------|------|-----|------|------|
| Supply voltage for LCD drive (Std temp)  | VDD-VO | Ta = 25°C, STN    |      | 4.5 |      | V    |
| Supply voltage for LCD drive (Wide temp) | VDD-VO | Ta = 25°C, STN    |      | 4.9 |      | V    |
| Supply voltage for LCD drive (Std temp)  | VDD-VO | Ta = 25°C, TN     |      | 4.5 |      | V    |
| Input voltage                            | VI     | -                 | 4.75 | 5.0 | 5.25 | V    |
| Input high voltage                       | VIH    | -                 | 2.2  | -   | VDD  | V    |
| Input low voltage                        | VIL    | -                 | 0    | -   | 0.6  | V    |
| Output high voltage                      | VOH    | IOH=0.2mA         | 2.4  | -   | -    | V    |
| Output low voltage                       | VOL    | IOL=1.2mA         | -    | -   | 0.4  | V    |
| Supply current                           | IDD    | VDD=5.0V          | -    |     | 3.0  | mA   |
| Input leakage current                    | ILKG   | -                 | -    | -   | 1.0  | uA   |
| LED power supply current                 | ILED   | VLED=5V, R=2.7Ω   | -    | 300 | -    | mA   |
| EL power supply current                  | IEL    | VEL=110VAC, 400HZ | -    | 8.0 | -    | mA   |

## 5.0 INTERFACE PIN CONNECTIONS

| Pin No. | Symbol | Level  | Pin Description           | Function                           |
|---------|--------|--------|---------------------------|------------------------------------|
| 1       | VSS    | -      | Ground                    | 0V                                 |
| 2       | VDD    | -      | Supply voltage for logic  | +5V                                |
| 3       | VO     | -      | LCD contrast adjust       | By user                            |
| 4       | RS     | H/L    | Register select           | H: Data; L: Instruction code       |
| 5       | R/W    | H/L    | Read / write              | H: Data read, L: Data write        |
| 6       | E      | H, H→L | Enable                    | Start signal for data read/write   |
| 7       | DB0    | H/L    | Data bit 0                | 8-bit interface                    |
| 8       | DB1    | H/L    | Data bit 1                | 8-bit interface                    |
| 9       | DB2    | H/L    | Data bit 2                | 8-bit interface                    |
| 10      | DB3    | H/L    | Data bit 3                | 8-bit interface                    |
| 11      | DB4    | H/L    | Data bit 4                | 4-bit or 8-bit interface           |
| 12      | DB5    | H/L    | Data bit 5                | 4-bit or 8-bit interface           |
| 13      | DB6    | H/L    | Data bit 6                | 4-bit or 8-bit interface           |
| 14      | DB7    | H/L    | Data bit 7                | 4-bit or 8-bit interface           |
| 15      | A      | -      | Anode for LED backlight   | Power supply for LED/EL backlights |
| 16      | K      | -      | Cathode for LED backlight | Power supply for LED/EL backlights |

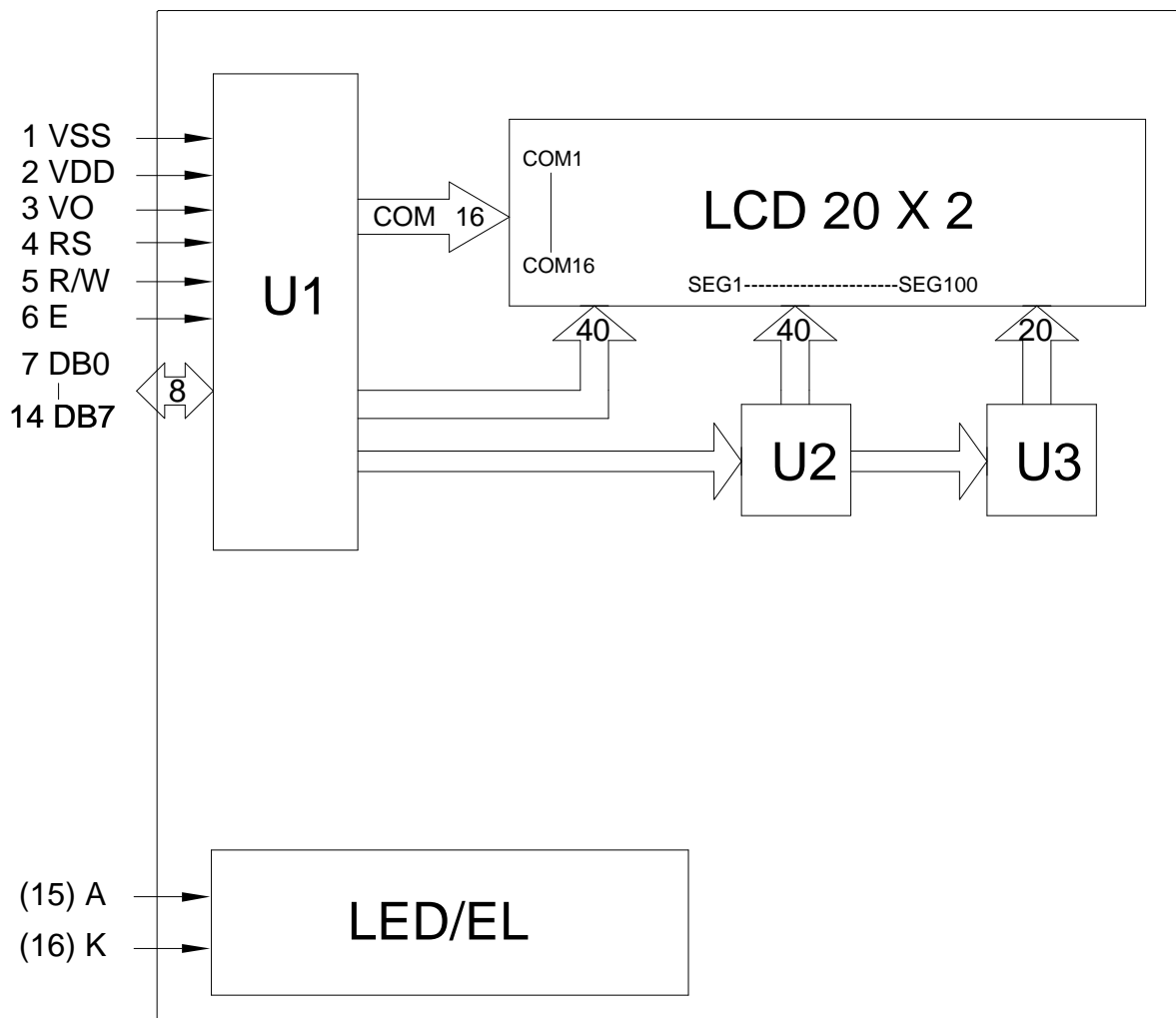
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## 6.0 POWER SUPPLY



$V_R = 10K\Omega \sim 20K\Omega$

## 7.0 BLOCK DIAGRAM



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## 8.0 TIMING CHARACTERISTICS (KS0066 Controller)

| Item                  | Symbol              | Test Condition | Min. | Typ. | Max. | Unit |
|-----------------------|---------------------|----------------|------|------|------|------|
| Enable cycle time     | $t_{CYC}$           | Fig. a, Fig. b | 500  | -    | -    | ns   |
| Enable pulse width    | $PW_{EH}$           | Fig. a, Fig. b | 220  | -    | -    | ns   |
| Enable rise/fall time | $t_{Er}$ , $t_{Ef}$ | Fig. a, Fig. b | -    | -    | 25   | ns   |
| RS, R/W set up time   | $t_{AS}$            | Fig. a, Fig. b | 40   | -    | -    | ns   |
| RS, R/W hold time     | $t_{H1}$            | Fig. a, Fig. b | 10   | -    | -    | ns   |
| Data set up time      | $t_{DSW}$           | Fig. a         | 60   | -    | -    | ns   |
| Data hold time        | $t_{H2}$            | Fig. a         | 10   | -    | -    | ns   |
| Data delay time       | $t_{DDR}$           | Fig. b         | -    | -    | 120  | ns   |
| Data hold time        | $t_{H2}$            | Fig. b         | 20   | -    | -    | ns   |

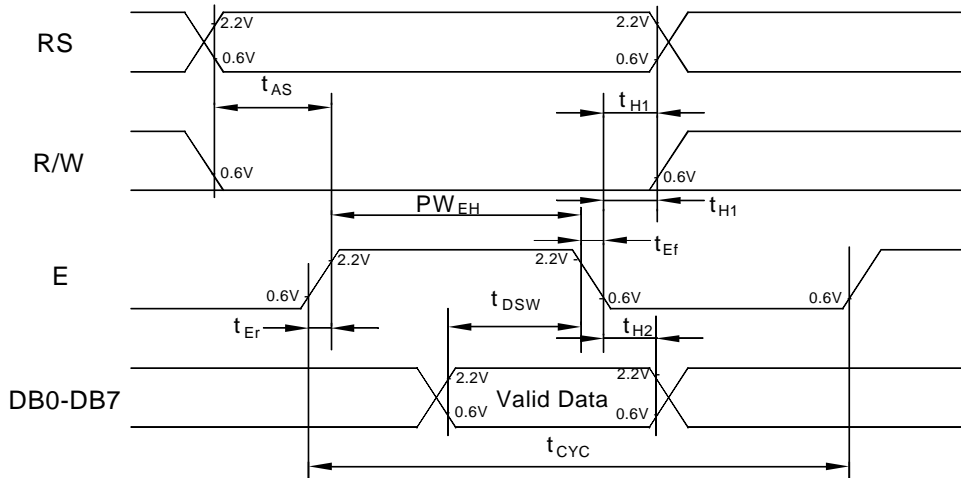


Fig. a Interface timing (data write)

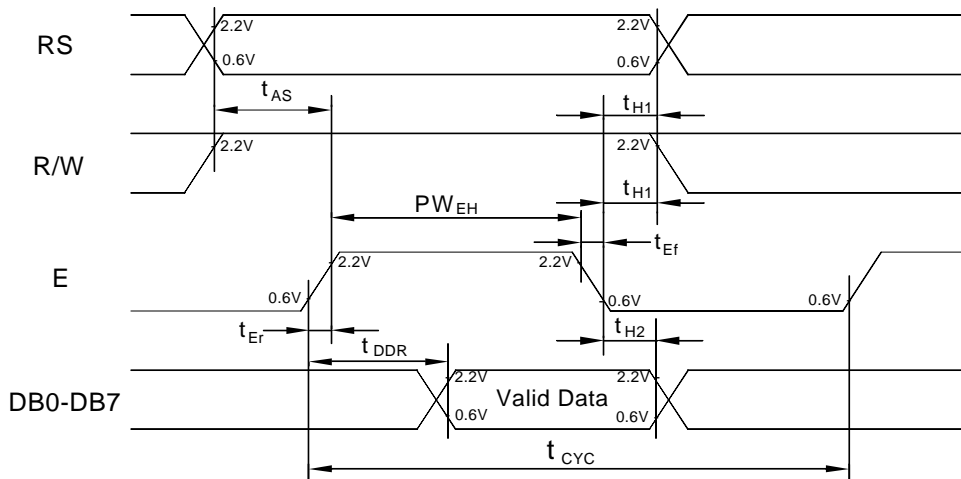
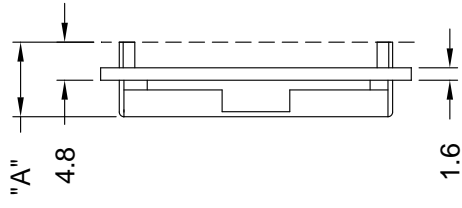
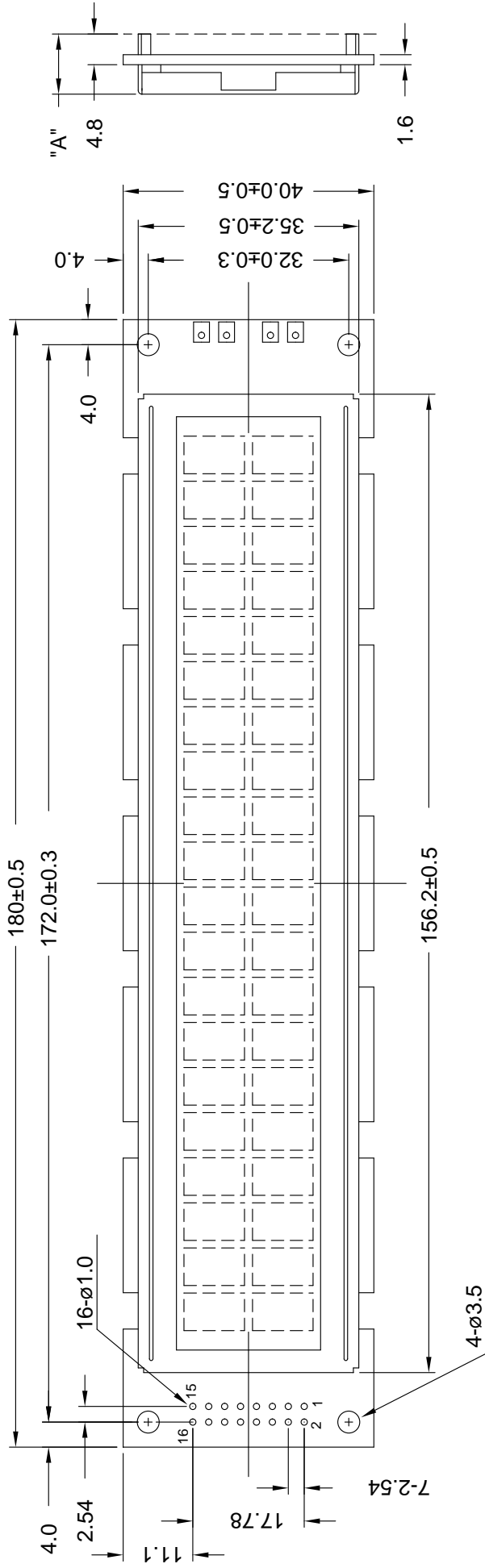
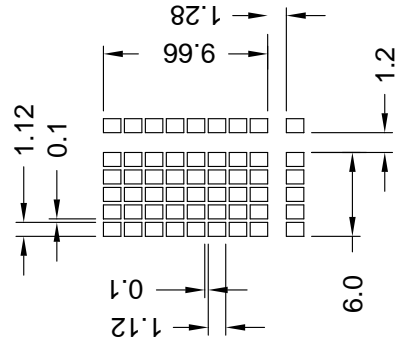


Fig. b Interface timing (data read)



DIM "A"  
 14.5(max)-LED B/L  
 9.5(max)-W/O LED B/L



|                   |      |        |                     |          |              |
|-------------------|------|--------|---------------------|----------|--------------|
| AZ DISPLAYS, INC. |      | TITLE  |                     | ACM2002P |              |
| NAME              | DATE | DWG-NO | UNIT : mm           |          | SCALE : NONE |
| APPROVE           |      |        | THIRD ANGLE PROJECT |          |              |
| CHECK             |      |        |                     |          |              |
| DESIGN            |      |        |                     |          |              |
| DRAW              |      |        |                     |          |              |