

AZ Displays, Inc.

1. MECHANICAL DATA

| | |
|-----------------------|--|
| (1) Product No. | AGM1212C |
| (2) Module Size | 72.4 (W)mm x 69.9 (H)mm x MAX13.5 (D)mm (LED B.L.) 72.4 (W)mm x 69.9 (H)mm x MAX9.5 (D)mm (W/O,EL B.L.) |
| (3) Dot Size | 0.32 (W)mm x 0.32 (H)mm |
| (4) Dot Pitch | 0.35 (W)mm x 0.35 (H)mm |
| (5) Number of Dots | 128 (W) x 128 (H)Dots |
| (6) Duty | 1/128 |
| (7) LCD Display Mode | STN: <input type="checkbox"/> Gray Mode <input type="checkbox"/> Yellow Mode <input type="checkbox"/> Blue Mode FSTN: <input type="checkbox"/> Black and White(Normal White/Positive Image) <input type="checkbox"/> Black and White(Normal Black/Negative Image) Rear Polarizer: <input type="checkbox"/> Reflective <input type="checkbox"/> Transflective <input type="checkbox"/> Transmissive <input type="checkbox"/> Transflective(High Transmissive) |
| (8) Viewing Direction | <input type="checkbox"/> 6 O'clock <input type="checkbox"/> 12 O'clock <input type="checkbox"/> ____O'clock |
| (9) Backlight | <input type="checkbox"/> W/O <input type="checkbox"/> EL <input type="checkbox"/> LED <input type="checkbox"/> CCFT |
| (10) LCD Controller | BUILT-IN LC7981 (SANYO) |
| (11) Weight | W/O B/L: about 53.9 g EL B/L: about 56.8 g LED B/L: about 68 g |

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2. ABSOLUTE MAXIMUM RATINGS

(1) ELECTRICAL ABSOLUTE RATINGS

V_{SS}=0V

| ITEM | SYMBOL | MIN | MAX | UNIT | COMMENT |
|---------------------------|----------------|------|------|------|---------|
| Power Supply for Logic | VDD-VSS | -0.3 | 7.0 | V | |
| Power Supply for LC Drive | VDD-VEE | 0 | 25.0 | V | |
| Input Voltage | V _I | -0.3 | 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 ≤ 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 ≤ 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

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3. ELECTRICAL CHARACTERISTICS

(VDD = 5V ± 10%)

| ITEM | SYMBOL | CONDITION | MIN. | TYP. | MAX. | UNIT |
|---|----------------------|--|--------|-------|--------|-------------------|
| Logic Circuit Power Supply | VDD-VSS | - | 4.75 | 5.0 | 5.25 | V |
| Input Voltage | VIH | H level | 0.8VDD | - | VDD | V |
| | VIL | L level | 0 | - | 0.2VDD | V |
| Recommended LC Driving Voltage (Normal Temp. LCM) | VDD-VEE 1/12 Bias | 0℃ | - | 19.0 | 20.0 | V |
| | | 25℃ | 16.8 | 17.6 | 18.2 | |
| | | 50℃ | 15.7 | 16.1 | - | |
| Recommended LC Driving Voltage (Wide Temp. LCM) | VDD-VEE 1/12 Bias | -20℃ | - | 16.9 | 17.4 | V |
| | | -10℃ | 15.2 | 16.1 | 16.7 | |
| | | 0℃ | 15.2 | 16.1 | 16.5 | |
| | | 25℃ | 15.2 | 16.1 | 16.4 | |
| | | 50℃ | 15.2 | 15.9 | 16.4 | |
| | | 70℃ | 14.3 | 14.9 | - | |
| Supply Current (LCD) (Normal Temp. LCM) | IDD | VDD = 5.0V | - | - | 9 | mA |
| | IEE | VEE = 12.6V | - | - | 4 | mA |
| LED Power Supply Current | I LED | V _{BL} = 5V _{dc} (R _{BL} = 3.3Ω) | - | 240 | 400 | mA |
| LED Average Brightness | B(LED) | | - | 32.1 | - | cd/m ² |
| EL Power Supply Current | I EL | V _{EL} = 110V _{Ac} 400Hz | - | - | 5 | mA |
| EL Average Brightness | B(EL) | | - | 20.18 | - | cd/m ² |

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4-1. OPTICAL CHARACTERISTICS

(For Normal Temperature Mode LCM)

AT Vop

| ITEM MODE | | Cr(Contrast Ratio) | | θ (Viewing Angle) | | ϕ (Viewing Angle) | |
|--------------|---|--------------------|------|--------------------------|------|------------------------|------|
| | | 25℃ | | 25℃ | | 25℃ | |
| | | MIN. | TYP. | MIN. | TYP. | MIN. | TYP. |
| R | A | 3 | 4 | 40 | 60 | 25 | 30 |
| | C | 4 | 6 | 40 | 60 | 25 | 35 |
| | J | 4 | 6 | 40 | 60 | 25 | 35 |
| S | A | 3 | 4 | 40 | 60 | 20 | 30 |
| | C | 4 | 6 | 40 | 60 | 25 | 35 |
| | J | 3.5 | 6 | 40 | 55 | 20 | 30 |
| T | E | 3 | 4 | 35 | 65 | 20 | 40 |
| | G | 6 | 15 | 45 | 90 | 30 | 50 |
| note | | NOTE6 | | NOTE5 | | | |

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

| ITEM | SYMBOL | CONDITION | MIN. | TYP. | MAX. | UNIT | NOTE |
|----------------------|--------|-----------|------|------|------|------|--------|
| Response Time (rise) | Tr | 0℃ | — | 450 | 900 | ms | NOTE 2 |
| | | 25℃ | — | 110 | 220 | | |
| | | 50℃ | — | 65 | 130 | | |
| Response Time (fall) | Tf | 0℃ | — | 650 | 1100 | ms | NOTE 2 |
| | | 25℃ | — | 135 | 250 | | |
| | | 50℃ | — | 80 | 150 | | |

note:

R: REFLECTIVE
 S: TRANSFLECTIVE
 T: TRANSMISSIVE
 A: GRAY
 C: YELLOW
 E: BLUE
 G: NORMALLY BLACK
 J: NORMALLY WHITE

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4-2.OPTICAL CHARACTERISTICS

(For Wide Temperature Mode LCM)

AT Vop

| ITEM MODE | | Cr(Contrast Ratio) | | θ (Viewing Angle) | | ϕ (Viewing Angle) | |
|--------------|---|--------------------|------|--------------------------|------|------------------------|------|
| | | 25℃ | | 25℃ | | 25℃ | |
| | | MIN. | TYP. | MIN. | TYP. | MIN. | TYP. |
| R | A | 3.0 | 4.0 | 40 | 60 | 28 | 35 |
| | C | — | — | — | — | — | — |
| | J | 4.0 | 6.5 | 35 | 52 | 25 | 33 |
| S | A | 3.0 | 3.8 | 35 | 50 | 20 | 25 |
| | C | — | — | — | — | — | — |
| | J | — | — | — | — | — | — |
| T | A | — | 2.5 | 20 | 40 | 15 | 20 |
| | G | 5 | 10 | 50 | 86 | 35 | 50 |
| note | | NOTE6 | | NOTE5 | | | |

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

| ITEM | SYMBOL | CONDITION | MIN. | TYP. | MAX. | UNIT | NOTE |
|----------------------|--------|-----------|------|------|------|------|--------|
| Response Time (rise) | Tr | -20℃ | — | 2200 | 4400 | ms | NOTE 2 |
| | | -10℃ | — | 940 | 1880 | | |
| | | 0℃ | — | 440 | 880 | | |
| | | 25℃ | — | 120 | 240 | | |
| | | 50℃ | — | 60 | 120 | | |
| | | 70℃ | — | 50 | 100 | | |
| Response Time (fall) | Tf | -20℃ | — | 3800 | 6000 | ms | NOTE 2 |
| | | -10℃ | — | 1260 | 2400 | | |
| | | 0℃ | — | 620 | 1200 | | |
| | | 25℃ | — | 180 | 350 | | |
| | | 50℃ | — | 80 | 150 | | |
| | | 70℃ | — | 70 | 130 | | |

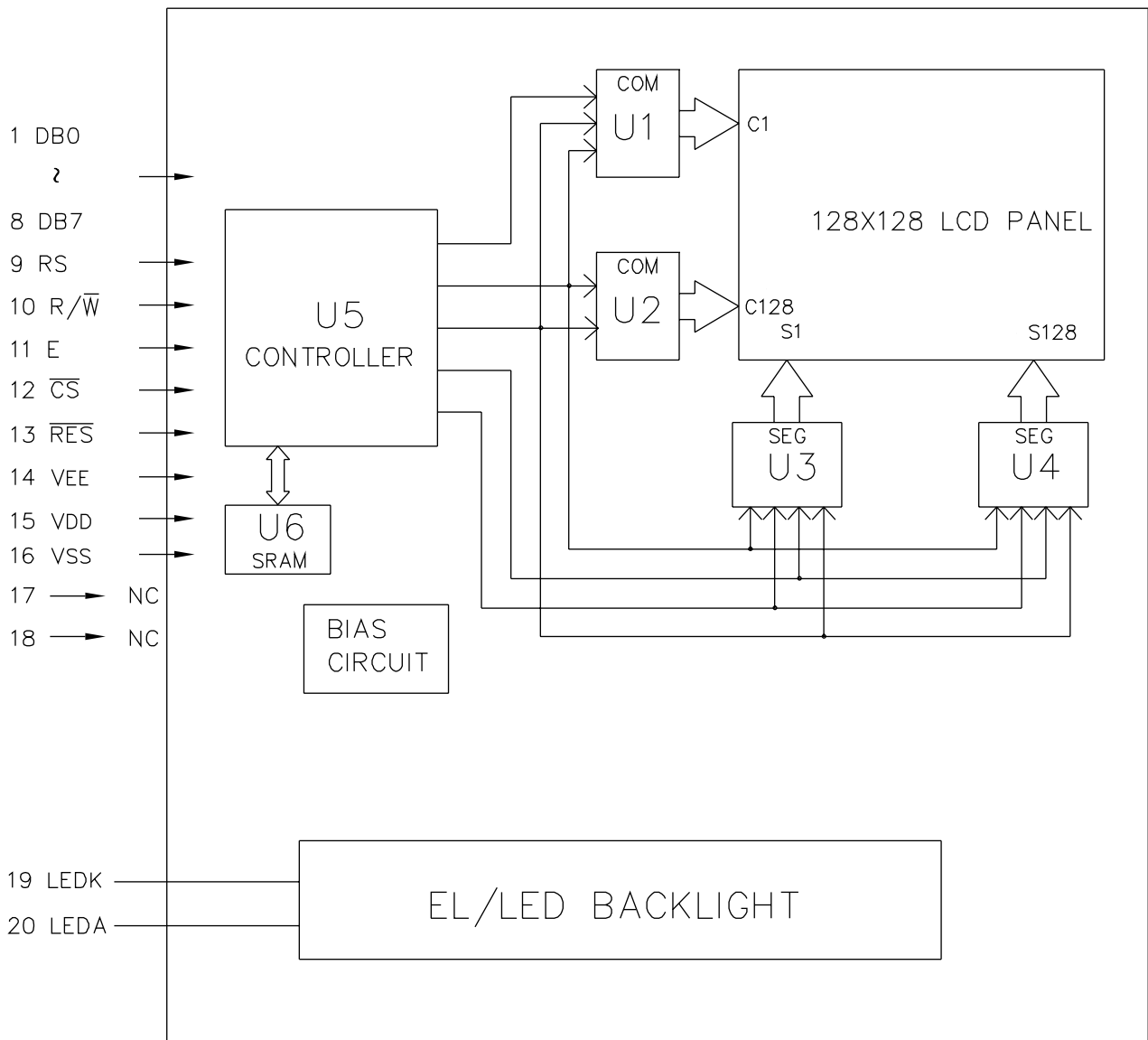
note:

R: REFLECTIVE
S: TRANSFLECTIVE
T: TRANSMISSIVE
A: GRAY

C: YELLOW
E: BLUE
G: NORMALLY BLACK
J: NORMALLY WHITE

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5. BLOCK DIAGRAM



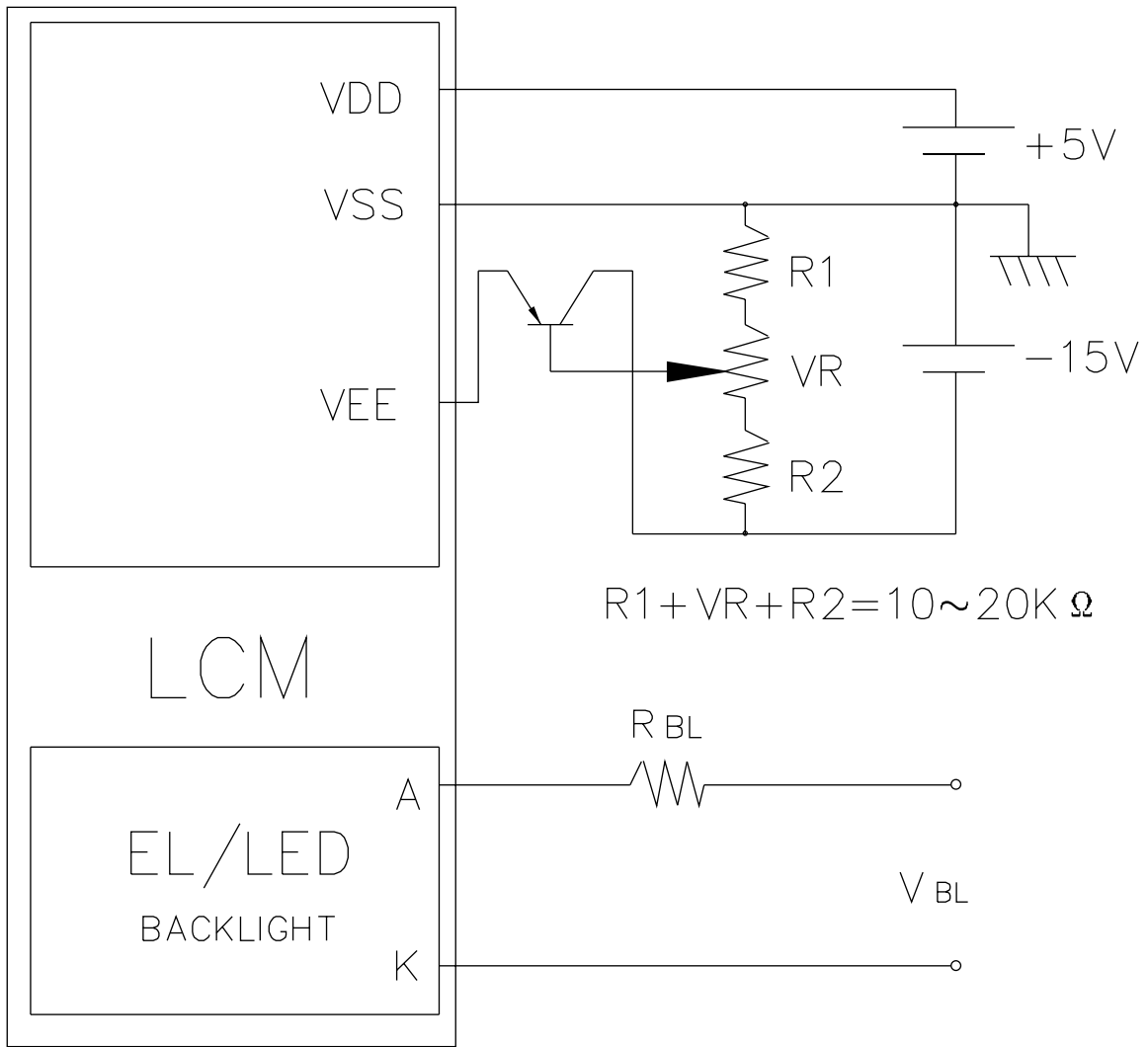
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6. INTERNAL PIN CONNECTION

| PinNo. | Symbol | Level | Function |
|--------|--------------|----------------------|---|
| 1 | DB0 | H/L | DATA BUS LINE |
| 2 | DB1 | H/L | |
| 3 | DB2 | H/L | |
| 4 | DB3 | H/L | |
| 5 | DB4 | H/L | |
| 6 | DB5 | H/L | |
| 7 | DB6 | H/L | |
| 8 | DB7 | H/L | |
| 9 | RS | H/L | H: INSTRUCTION CODE INPUT L: DATA INPUT |
| 10 | R/ \bar{W} | H/L | H: DATA READ (LCM TO MPU) L: DATA WRITE (MPU TO LCM) |
| 11 | E | H, H \rightarrow L | ENABLE SIGNAL |
| 12 | \bar{CS} | L | CHIP ENABLE ACTIVE "L" |
| 13 | \bar{RES} | L | RESET ACTIVE "L" |
| 14 | VEE | — | POWER SUPPLY FOR LCD CIRCUIT |
| 15 | VDD | — | POWER SUPPLY FOR LOGIC CIRCUIT |
| 16 | VSS | — | GROUND |
| 17 | N.C. | — | NO CONNECTION |
| 18 | N.C. | — | NO CONNECTION |
| 19 | LEDK | — | LED/EL BACKLIGHT |
| 20 | LEDA | — | LED/EL BACKLIGHT |

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7. POWER SUPPLY



Recommended Value for R_{BL} and V_{BL}

| ITEM Back Light Interface | R_{BL} | | V_{BL} | |
|---------------------------------|--------------|------------|------------------|------------------------------|
| | LED | EL | LED | EL |
| A,K PIN | 3.3 Ω | 0 Ω | 5V _{Dc} | 110 V _{Ac} 400Hz |

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8. TIMING CHARACTERISTICS

8-1 INTERFACE TIMING

| Item | Symbol | Test condition | Min. | Typ. | Max. | Unit |
|-----------------------|------------------|----------------|------|------|------|------|
| Enable cycle time | t_{cyc} | Fig a, Fig b | 1.0 | - | - | us |
| Enable pulse width | PW_{EH} | Fig a, Fig b | 450 | - | - | 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 | 140 | - | - | ns |
| Data delay time | t_{DDR} | Fig. b | - | - | 225 | ns |
| Data set up time | t_{DSW} | Fig a | 225 | - | - | ns |
| Hold time | t_H | Fig a, Fig b | 20 | - | - | ns |

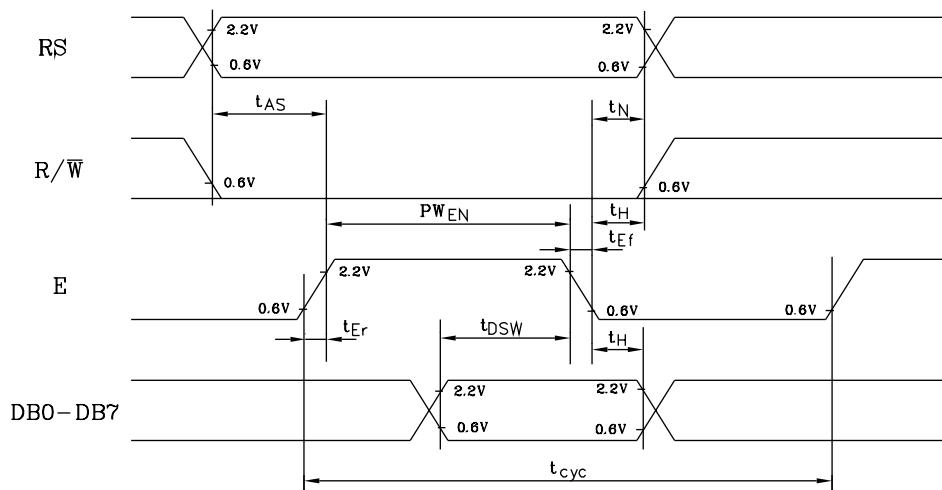


Fig. a Interface timing (data write)

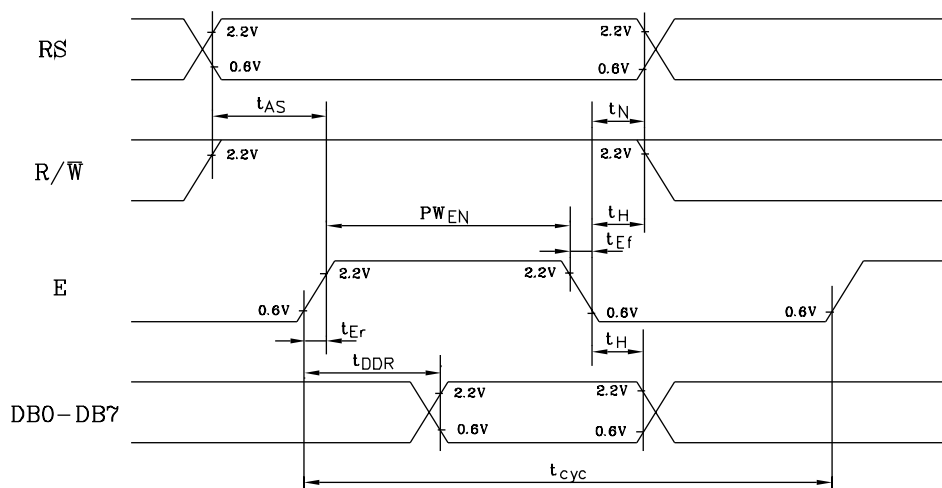
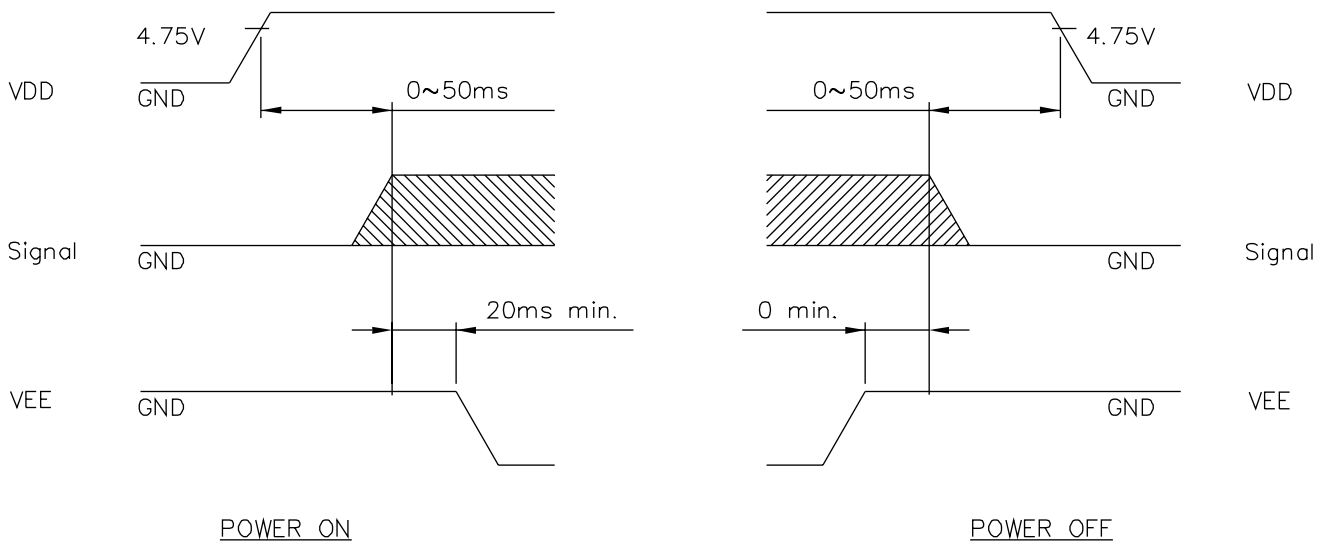


Fig. b Interface timing (data read)

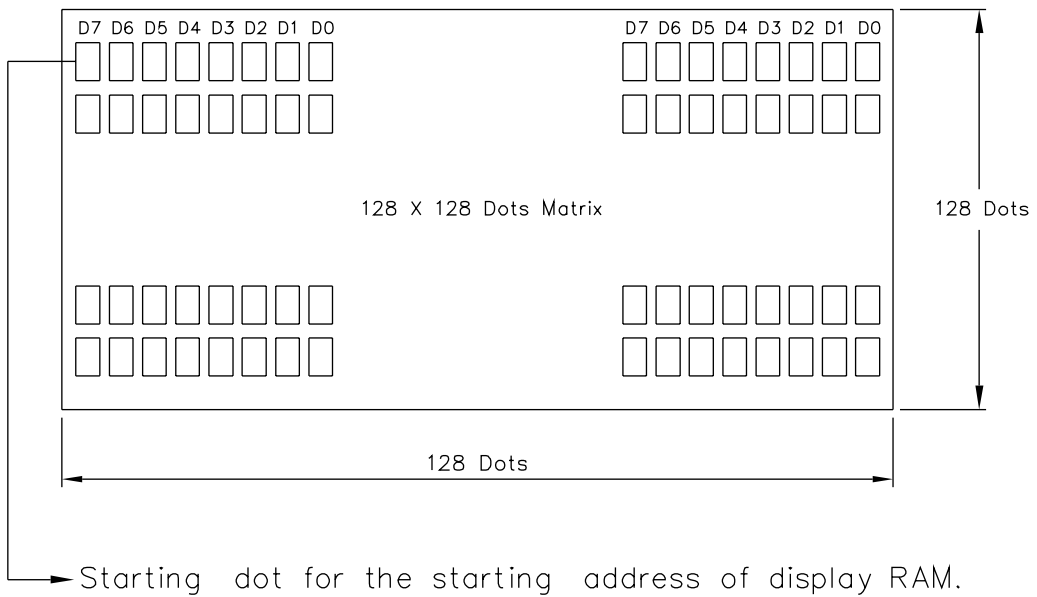
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8-2. POWER ON/OFF TIMING



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

9. DISPLAY PATTERN

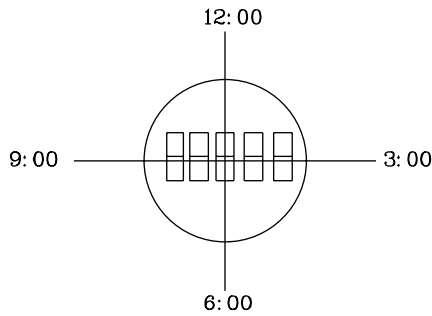


D0~D7 are 8 bits transmitted data ,where D0 is LSB and D7 is MSB.

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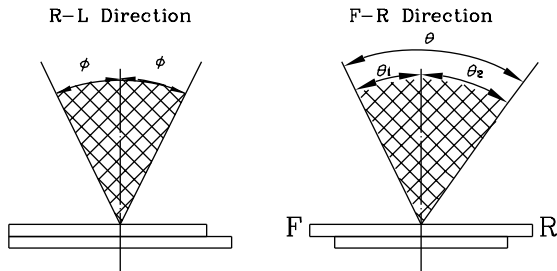
(NOTE 4)

Definition of Viewing Direction



(NOTE 5)

Definition of Viewing Angle



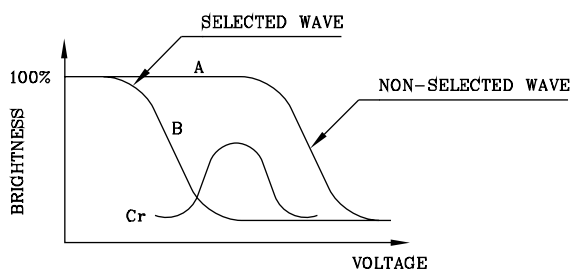
$$\theta = \theta_1 + \theta_2$$

*Conditions

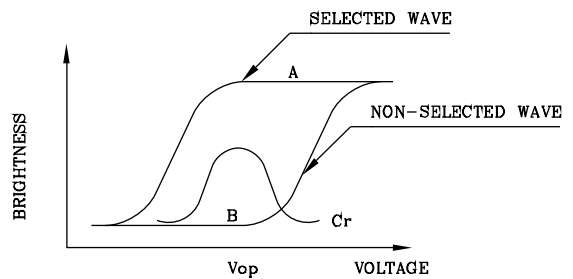
- Operating Voltage : Vop
- Frame Frequency : 70Hz
- Applying Waveform : 1/N duty 1/a bias
- Contrast Ratio : larger than 2

(NOTE 6)

Definition of Contrast Ratio (Cr)



(positive type)

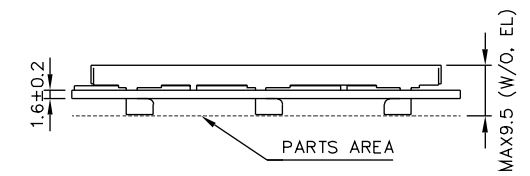
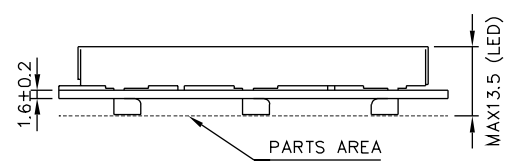
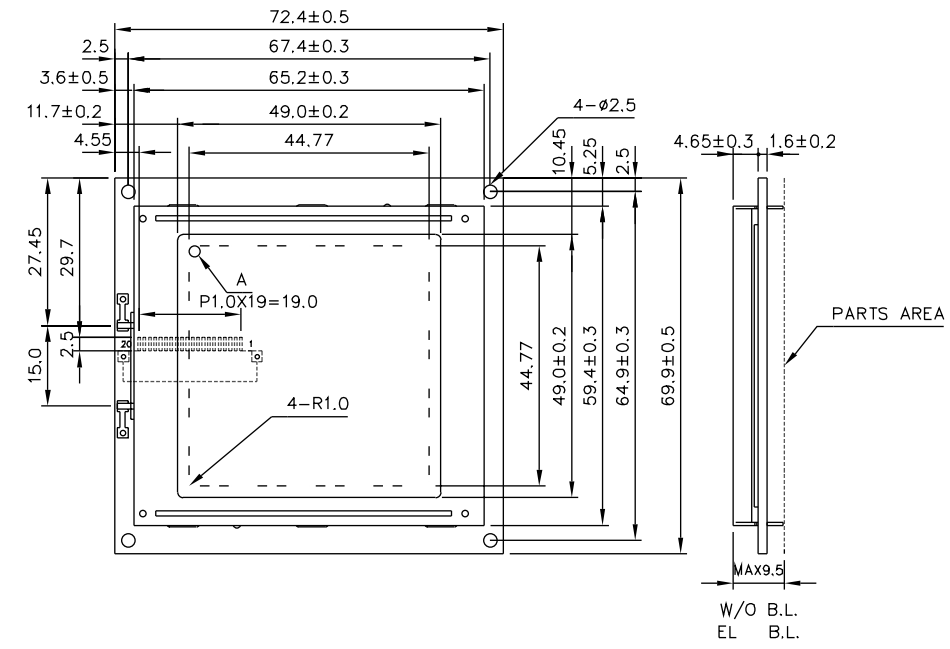
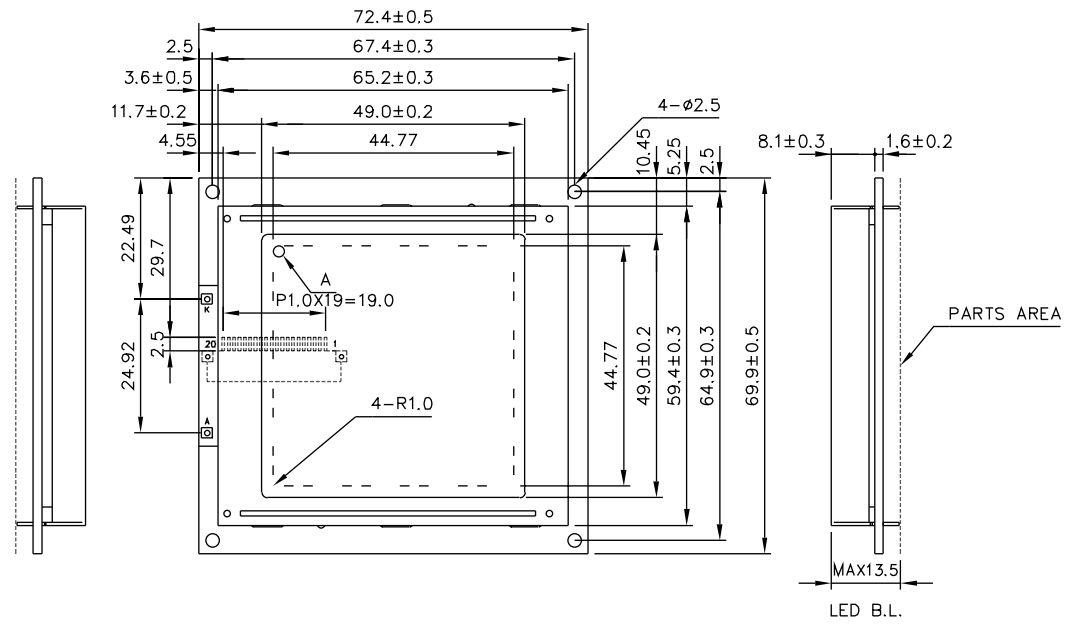


(negative type)

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

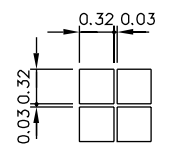
*Conditions

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



NOTES:

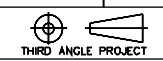
- 1.RESOLUTION: 128X128 DOTS
- 2.CONTROLLER: LC7981(SANYO)
- 3.DC/DC: WITHOUT
- 4.BACKLIGHT: LED(YELLOW GREEN)
EL(WHITE)
- 5.CONNECTOR: FPC2-T-020-20

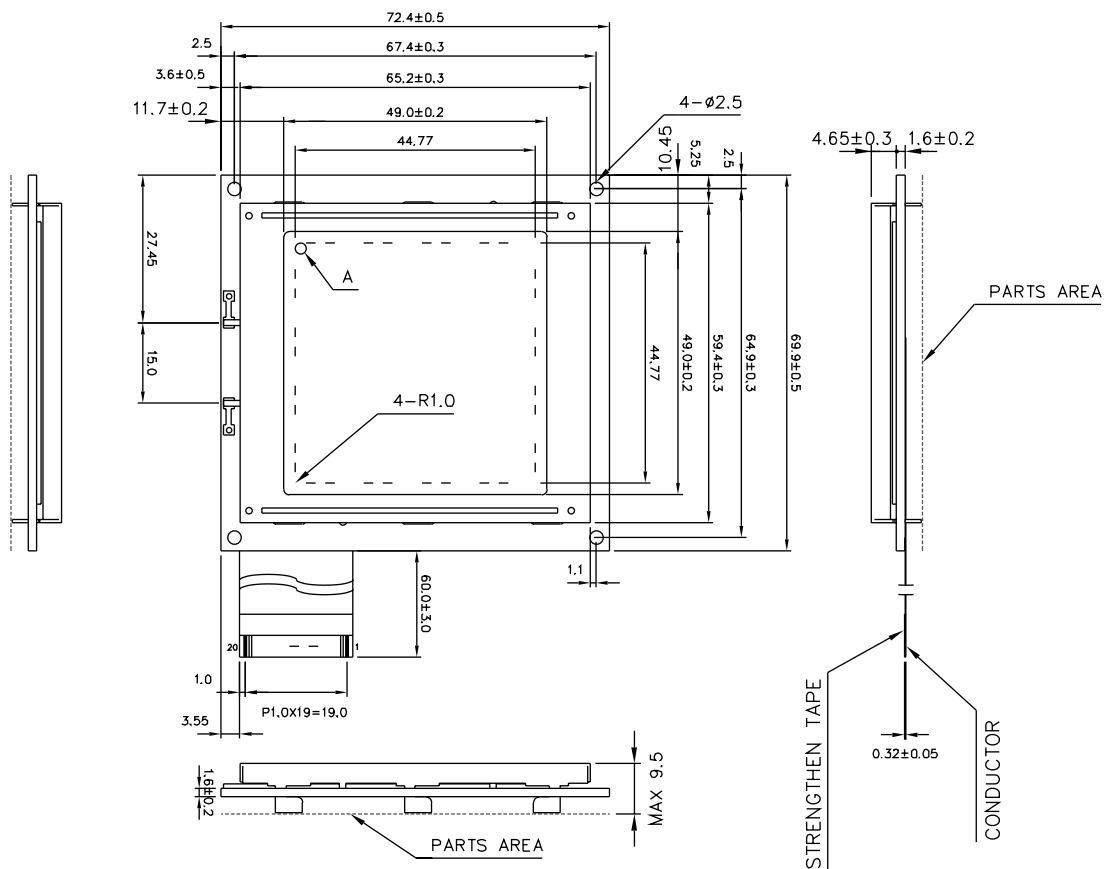


128X128
A DETAIL

| Pin No. | Symbol | Level | Function |
|---------|---------|-------|--------------------------------|
| 1-8 | DB0-DB7 | H/L | Data Bus Line |
| 9 | RS | H/L | H—Instruction L—Data |
| 10 | R/W | H/L | H:MPU—LC7981 L:MPU—LC7981 |
| 11 | E | H/L | Enable |
| 12 | CS | L | Chip Enable Active "L" |
| 13 | RES | L | Reset Active "L" |
| 14 | VEE | - | Power Supply for LCD Circuit |
| 15 | VDD | - | Power Supply for Logic Circuit |
| 16 | Vss | - | Ground |
| 17-18 | NC | | No Connection |
| 19 | LEDK | | LED or EL Backlight |
| 20 | LEDA | | LED or EL Backlight |

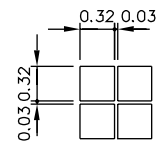
| AGM1212C | | AZ DISPLAYS, INC. | | |
|----------|----------|-------------------|--------|-------------------|
| APPROVE | NAME | DATE | TITLE | |
| CHECK | | | DWG-NO | MXAX026XXPX Rev.A |
| DESIGN | | | UNIT | : mm |
| DRAW | MAY PING | 85.05.07 | SCALE | : 2/3 |





NOTES :

- 1.RESOLUTION:128X128 DOTS
- 2.CONTROLLER:LC7981(SANYO)
- 3.DC/DC: WITHOUT
- 4.BACKLIGHT: EL(WHITE)



A DETAIL

| Pin No. | Symbol | Level | Function |
|---------|------------------|-------|--------------------------------|
| 1-8 | DB0-DB7 | H/L | Data Bus Line |
| 9 | RS | H/L | H—Instruction L—Data |
| 10 | R/W | H/L | H:MPU—LC7981 L:MPU—LC7981 |
| 11 | E | H/L | Enable |
| 12 | \overline{CS} | L | Chip Enable Active "L" |
| 13 | \overline{RES} | L | Reset Active "L" |
| 14 | VEE | - | Power Supply for LCD Circuit |
| 15 | VDD | - | Power Supply for Logic Circuit |
| 16 | VSS | - | Ground |
| 17-18 | NC | | No Connection |
| 19 | LEDK | | LED or EL Backlight |
| 20 | LEDA | | LED or EL Backlight |

| AGM1212C | | AZ DISPLAYS, INC. | | |
|----------|----------|-------------------|--------|------------------|
| APPROVE | NAME | DATE | TITLE | |
| CHECK | | | DWG-NO | MDAX026X5P Rev.A |
| DESIGN | | | UNIT | : mm |
| DRAW | MAY PING | 86.12.13 | SCALE | : 2/3 |

THIRD ANGLE PROJECT