# AZ DISPLAYS, INC.

## SPECIFICATIONS FOR

## LIQUID CRYSTAL DISPLAY

| | |
|---|---|
| PART NUMBER: | AGM3224D |
| DATE: | May 20, 2005 |

# 1. MECHANICAL DATA

| NO | ITEM | CONTENTS | UNIT |
|---|---|---|---|
| 1 | Product No. | AGM3224D-FLW-FBW | – |
| 2 | Module Size | 160.0 (W) x 109.0 (H) x MAX.11.0 (D) | mm |
| 3 | Dot Size | 0.33 (W) x 0.33 (H) | mm |
| 4 | Dot Pitch | 0.36 (W) x 0.36 (H) | mm |
| 5 | Number of Dots | 320 (W) x 240 (H) | Dot |
| 6 | Duty | 1/240 | – |
| 7 | LCD Display Mode | Black and White(Normally White/Positive Image) | – |
| 8 | Rear Polarizer | Transflective(Normal) | – |
| 9 | Viewing Direction | 6 | O'clock |
| 10 | Backlight | LED B/L(White) | – |
| 11 | Controller | Excluded | – |
| 12 | DC/DC Converter | Excluded | – |
| 13 | Touch Panel | Excluded | – |
| 14 | Weight | 200 (Approx.) | g |

# 2. ABSOLUTE MAXIMUM RATINGS

(1) ELECTRICAL ABSOLUTE RATINGS

VSS=0V

| ITEM | SYMBOL | MIN | MAX | UNIT | COMMENT |
|---|---|---|---|---|---|
| Power Supply for Logic | VDD−VSS | −0.3 | 7.0 | V | |
| Input Voltage | VI | −0.3 | VDD+0.3 | V | |
| Static Electricity | − | − | − | − | Note 1 |

Note 1 LCM should be grounded during handling LCM.

(2) ENVIRONMENTAL ABSOLUTE MAXIMUM RATINGS

| ITEM | WIDE TEMP. | | | |
|---|---|---|---|---|
| | OPERATING | | STORAGE | |
| | MIN. | MAX. | MIN. | MAX. |
| Ambient Temperature | −20 | 70 | −40 | 80 |
| Humidity (Without Condensation) | Note 2,4 | | Note 3,4 | |

Note 2 Ta ≦ 70℃ : 75%RH max

Note 3 Please refer to item of reliability test

Note 4 Background color will change slightly depending on ambient temperature. That phenomenon is reversible.

# 3. ELECTRICAL CHARACTERISTICS

## 3-1. ELECTRICAL CHARACTERISTICS

| ITEM | SYMBOL | CONDITION | | MIN. | TYP. | MAX. | UNIT |
|---|---|---|---|---|---|---|---|
| Power Supply for Logic | VDD-GND | - | | 4.75 | 5.0 | 5.25 | V |
| Input Voltage | VIH | H level | | 0.7VDD | - | VDD | V |
| | VIL | L level | | 0 | - | 0.3VDD | V |
| Recommended LC Driving Voltage | VDD-V0 | Duty=1/240 | -20°C | 25.4 | 25.7 | 26.0 | V |
| | | | 0°C | 23.8 | 24.1 | 24.4 | |
| | | | 25°C | 22.9 | 23.2 | 23.5 | |
| | | | 50°C | 21.5 | 21.8 | 22.1 | |
| | | | 70°C | 20.5 | 20.8 | 21.1 | |
| Power Supply Current | IDD | FLM = 70 Hz<br>VDD = 5.0 V<br>VEE = -24.0 V<br>VDD-V0 = 23.2 V<br>PATTERN : | | - | 4.5 | 7 | mA |
| | IEE | | | - | 4 | 6 | mA |
| Surface Luminance of LCM | L | PATTERN:<br>(Dots All ON) | | - | 6 | 10 | cd/m² |
| | | PATTERN:<br>(Dots All Off) | | 15 | 25 | - | |

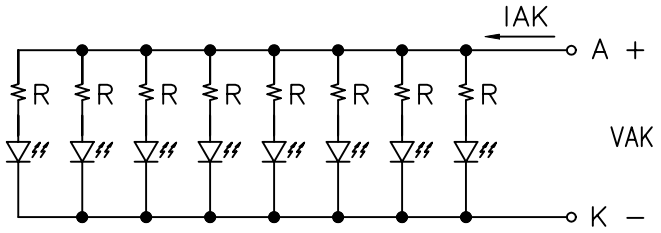
## 3-2.ELECTRICAL CHARACTERISTICS OF BACKLIGHT

Used LED Rating

Temp.=25°C

| ITEM | SYMBOL | MIN. | TYP. | MAX. | UNIT | REMARK |
|---|---|---|---|---|---|---|
| Peak forward current | $I_P$ | – | – | 240 | mA | – |
| Maximum reverse voltage | $V_R$ | – | – | 5 | V | – |
| Applied forward current | $I_{AK}$ | – | 150 | 160 | mA | at $V_{AK}$ = 5.0 V |
| Applied forward voltage | $V_{AK}$ | – | 5.0 | – | V | at $I_{AK}$ = 150 mA |
| LED power consumption | $P_F$ | – | 0.75 | – | W | – |
| LED life time | $L_L$ | – | 10000 | – | hrs | at $V_{AK}$ = 150 mA (*1) |

(*1) LED life time is defined as follows : The final brightness is at 50% of original brightness .



# 4. OPTICAL CHARACTERISTICS

AT $V_{OP}$

| ITEM / MODE | | Cr(Contrast Ratio) | | | | | | | | | | θ(Viewing Angle) | | ø(Viewing Angle) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | −20℃ | | 0℃ | | 25℃ | | 50℃ | | 70℃ | | 25℃ | | 25℃ | |
| | | MIN. | TYP. | MIN. | TYP. | MIN. | TYP. | MIN. | TYP. | MIN. | TYP. | MIN. | TYP. | MIN. | TYP. |
| S | J | 4.5 | 5.5 | 5.5 | 6.5 | 5.5 | 6.5 | 4.5 | 5.5 | 3.0 | 4.0 | – | 66 | – | ±34 |
| NOTE | | NOTE 6 | | | | | | | | | | NOTE 5 | | | |

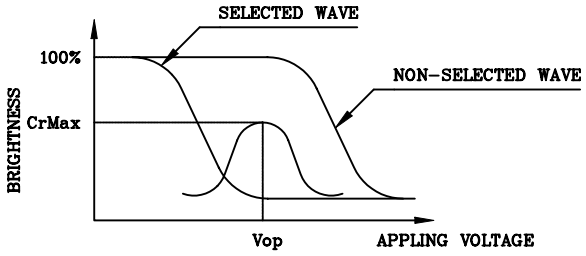
NOTE : S: Transflective(Normal)
J: Normally White , 6 O'clock

AT ø=0° θ=0°

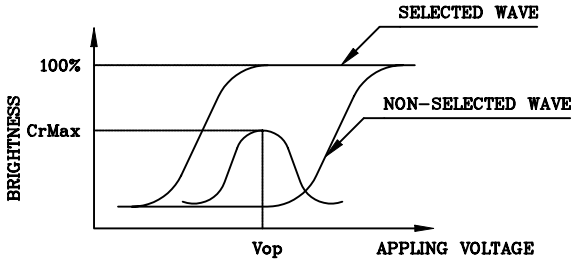
| ITEM | SYMBOL | CONDITION | MIN. | TYP. | MAX. | UNIT | NOTE |
|---|---|---|---|---|---|---|---|
| Response Time (rise) | Tr | −20℃ | 2000 | 4000 | 6000 | ms | NOTE 2 |
| | | 0℃ | 400 | 750 | 1100 | | |
| | | 25℃ | 125 | 250 | 375 | | |
| | | 50℃ | 60 | 120 | 180 | | |
| | | 70℃ | 35 | 70 | 105 | | |
| Response Time (fall) | Tf | −20℃ | 1000 | 2000 | 3000 | ms | NOTE 2 |
| | | 0℃ | 210 | 420 | 630 | | |
| | | 25℃ | 60 | 120 | 180 | | |
| | | 50℃ | 30 | 60 | 90 | | |
| | | 70℃ | 20 | 40 | 60 | | |

(NOTE 1)

Definition of Operation Voltage(Vop)




(positive type)



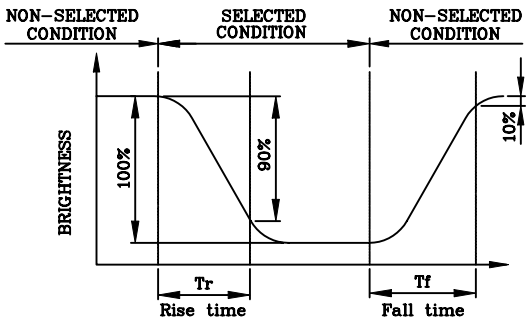

(negative type)

*Conditions

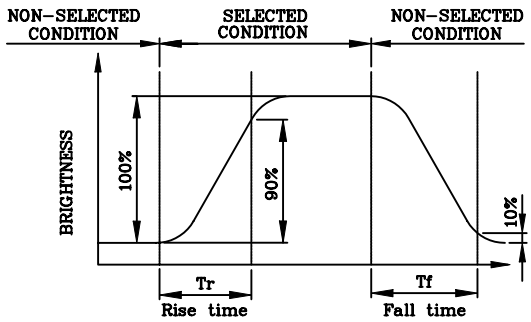
Viewing Angle : 0
Frame Frequency : 70Hz
Applying Waveform : 1/N duty 1/a bias

(NOTE 2)

Definition of Response Time(Tr.Tf)




(positive type)



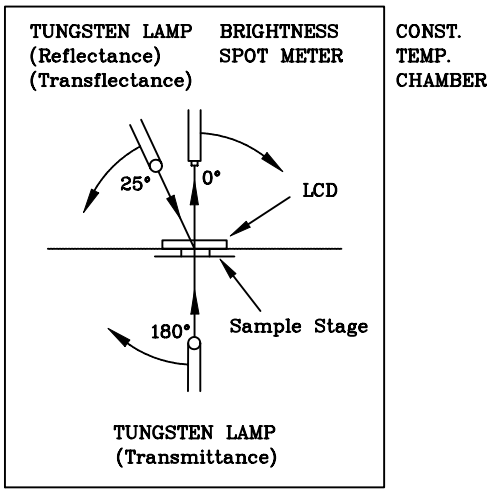

(negative type)

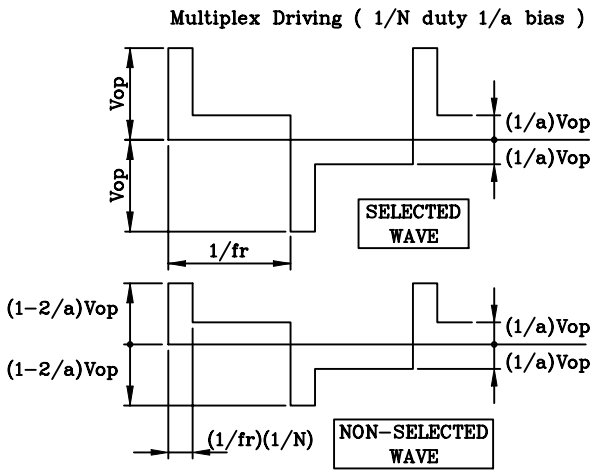
*Conditions

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

(NOTE 3)

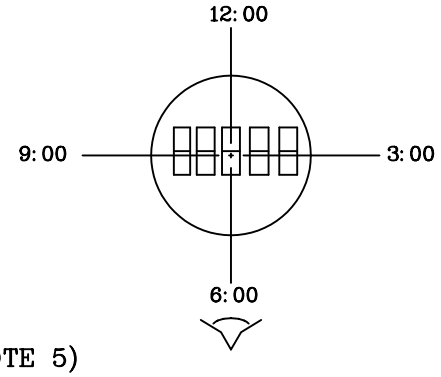
Description of Measuring Equipment and Driving Waveforms



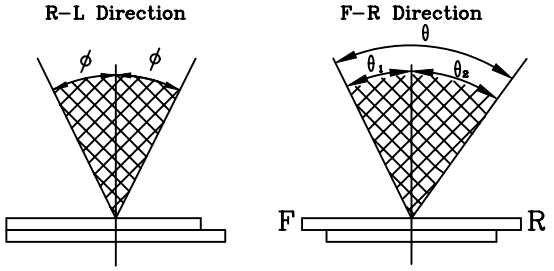
(NOTE 4)

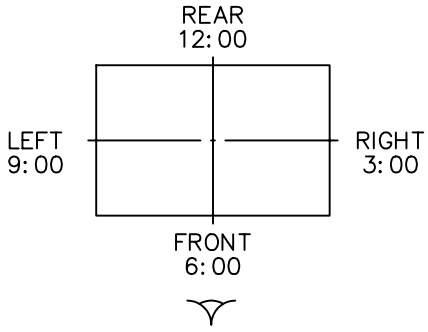
Definition of Viewing Direction




(NOTE 5)

Definition of Viewing Angle



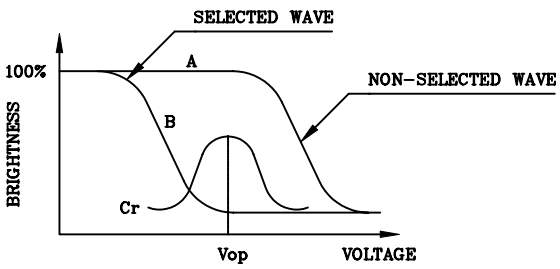

$\theta = \theta_1 + \theta_2$

*Conditions

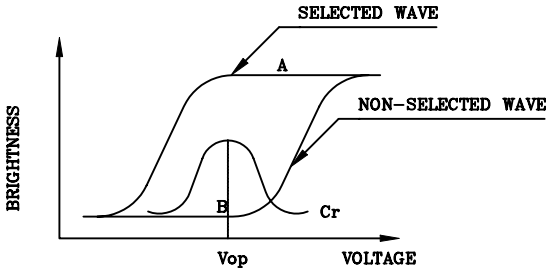
Operating Voltage : Vop
Frame Frequency : 70Hz
Applying Waveform : 1/N duty 1/a bias
Contrast Ratio : larger than 2

(NOTE 6)

Definition of Contrast Ratio (Cr)




(positive type)



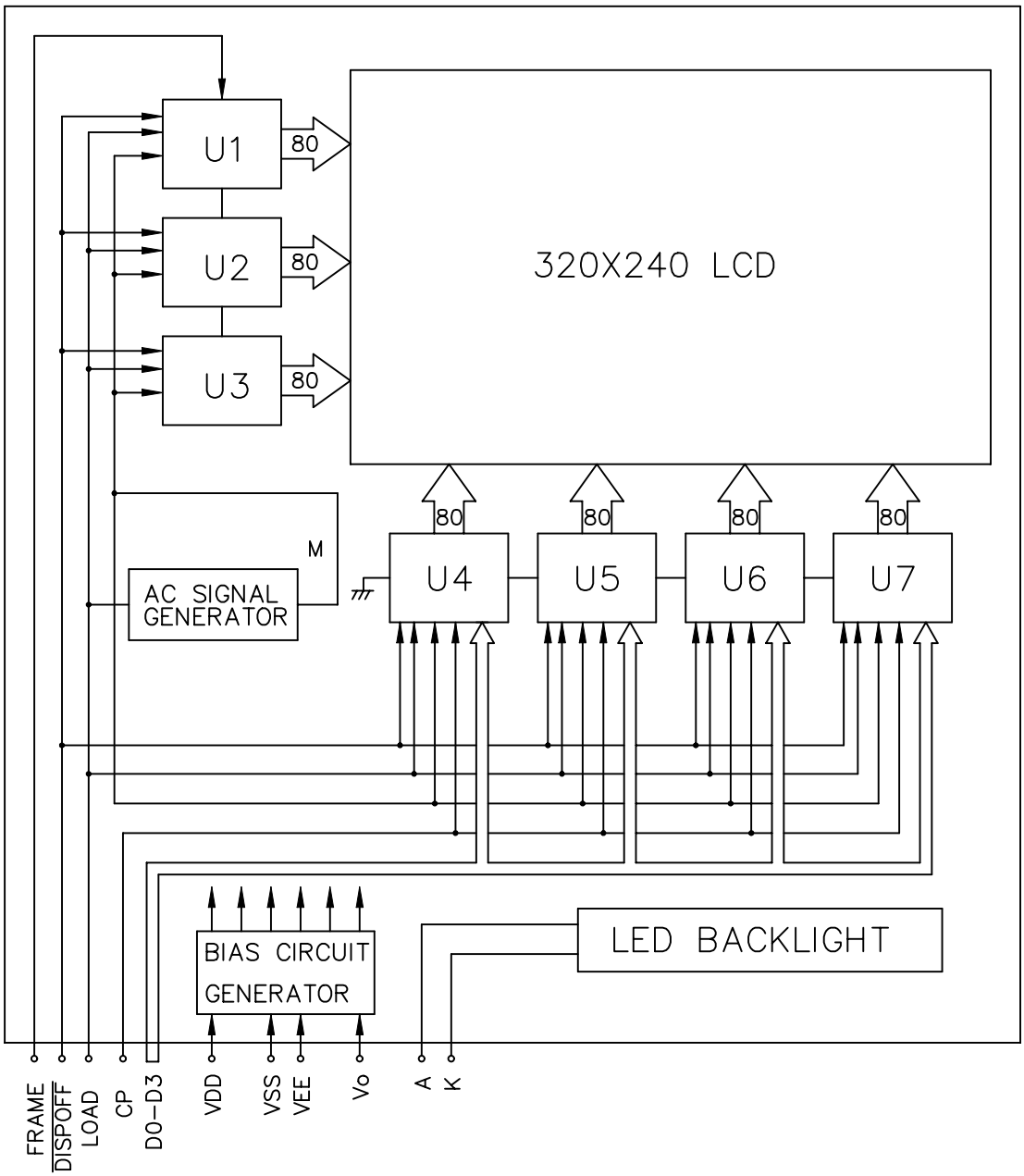

(negative type)

Contrast Ratio : Cr=A/B

*Conditions

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

# 5. BLOCK DIAGRAM




* AC SIGNAL SETTING

| J1 | J2 | J3 | J4 | J5 | J6 | J7 | J8 |
|---|---|---|---|---|---|---|---|
| L | H | H | L | L | L | L | L |

# 6.INTERNAL PIN CONNECTION

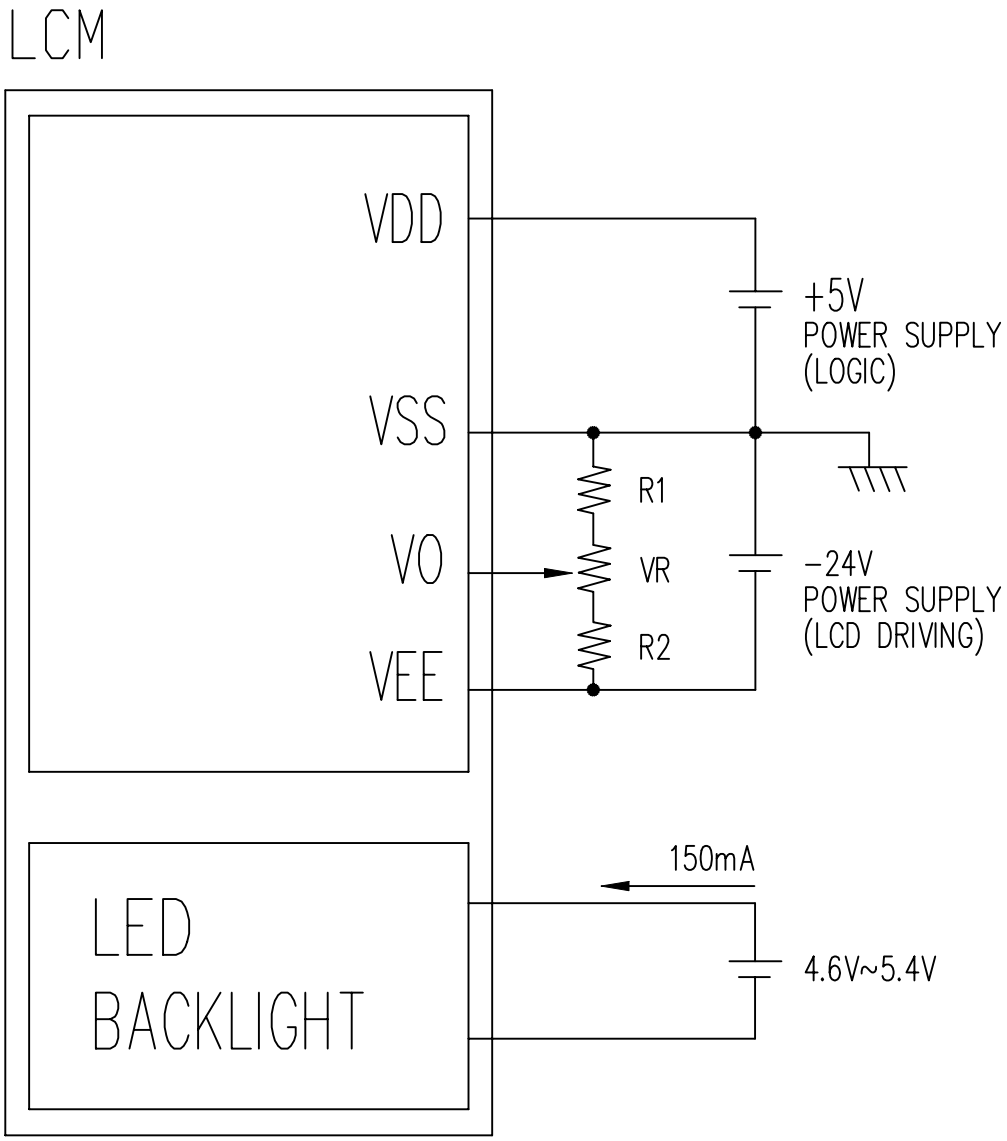
CN1:PITCH 1.25mm WIDTH 18.75mm

| PIN NO. | SYMBOL | LEVEL | FUNCTION |
|---|---|---|---|
| 1 | D0 | H/L | DISPLAY DATA SIGNAL |
| 2 | D1 | | |
| 3 | D2 | | |
| 4 | D3 | | |
| 5 | $\overline{\text{DISPOFF}}$ | H/L | H:ON/L:OFF |
| 6 | FRAME | H | SCAN START-UP SIGNAL |
| 7 | NC | – | NO CONNECTION |
| 8 | LOAD | H-L | INPUT DATA LATCH SIGNAL |
| 9 | CP | H-L | DATA INPUT CLOCK SIGNAL |
| 10 | VDD | – | POWER SUPPLY FOR LOGIC(+5V) |
| 11 | VSS | – | SIGNAL GROUND(0V) |
| 12 | VEE | – | POWER SUPPLY FOR LCD |
| 13 | VO | – | LCD CONTRAST ADJUST VOLTAGE |
| 14 | FGND | – | FRAME GROUND |

CN2:J.A.E./IL-G-4S-S3C2

| PIN NO. | SYMBOL | LEVEL | FUNCTION |
|---|---|---|---|
| 1 | A | – | POWER SUPPLY VOLTAGE FOR LED |
| 2 | NC | – | – |
| 3 | NC | – | – |
| 4 | K | – | GROUND |

# 7. POWER SUPPLY




(Note)

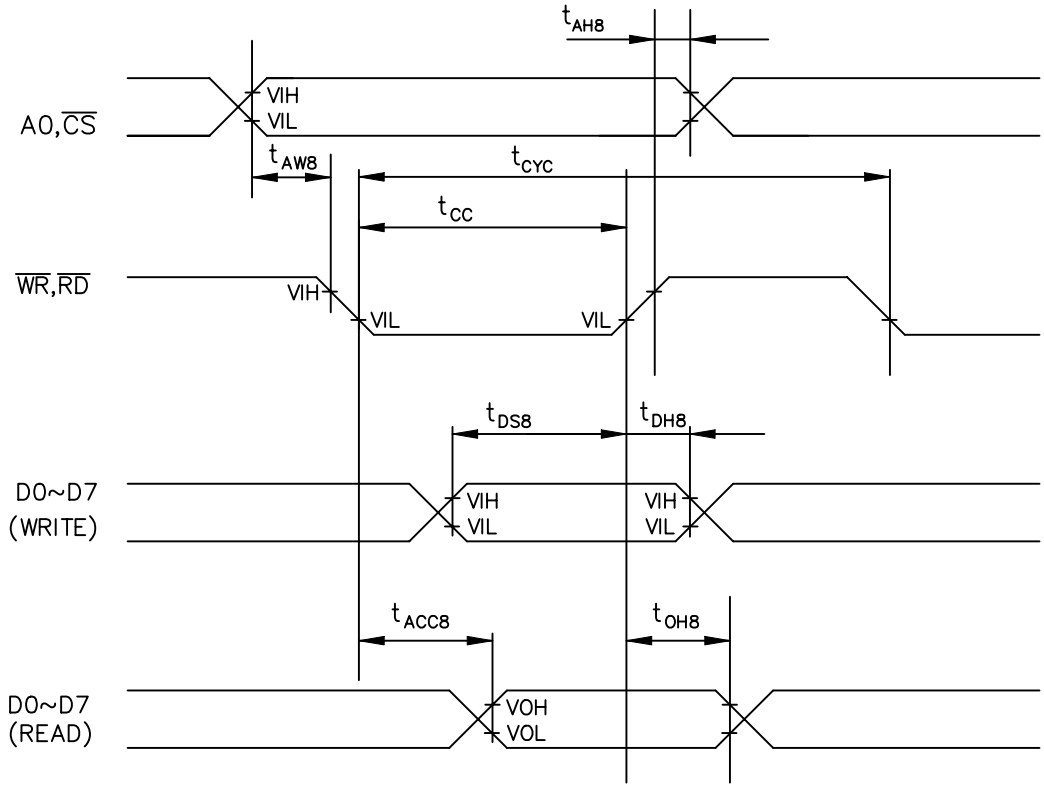
1.R1+VR+R2=10K~20KΩ

# 8. TIMING CHARACTERISTICS

## 8-1. READ/WRITE CHARACTERISTICS(8080 FAMILY MPU)

VDD=5.0V±5%

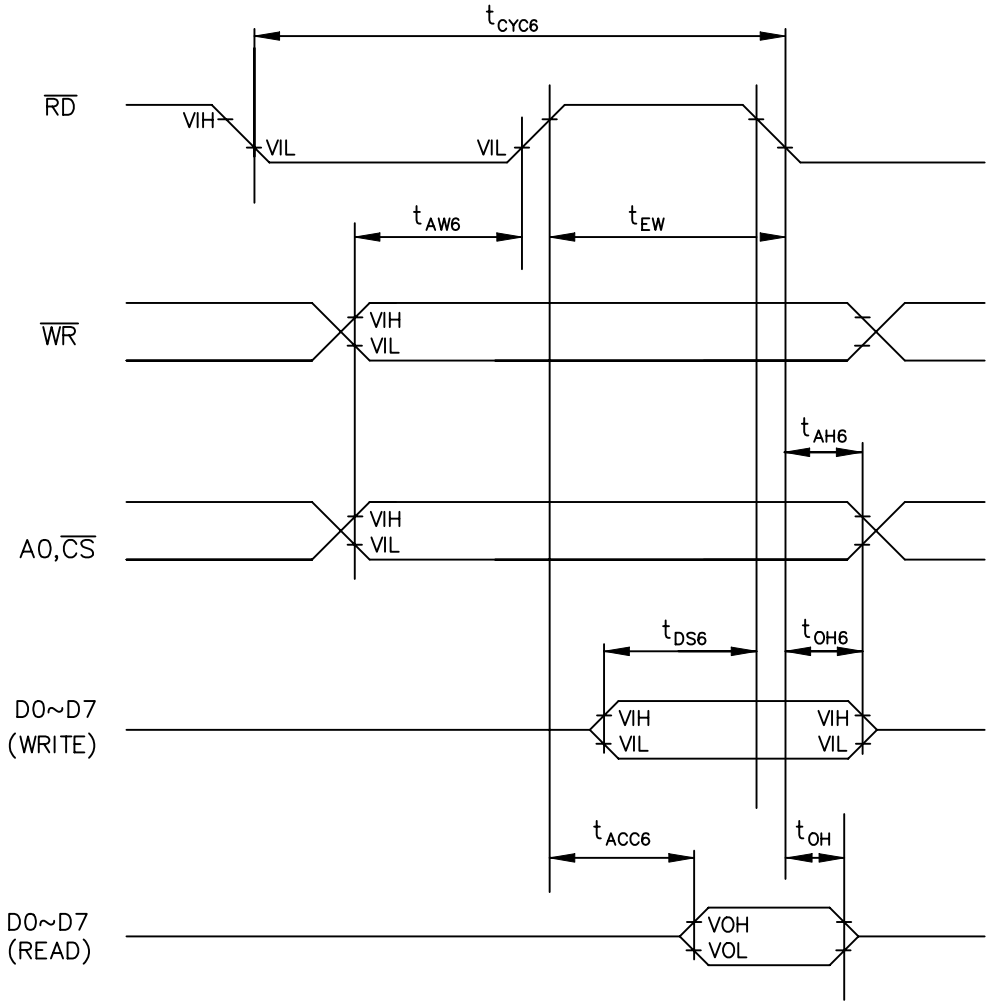
| ITEM | ITEM | SYMBOL | MIN. | TYP. | MAX. | UNIT |
|---|---|---|---|---|---|---|
| A0,$\overline{CS}$ | ADDRESS HOLD TIME | $t_{AH8}$ | 10 | – | – | ns |
| | ADDRESS SETUP TIME | $t_{AW8}$ | 0 | – | – | ns |
| $\overline{WR}$,$\overline{RD}$ | SYSTEM CYCLE TIME | $t_{CYC8}$ | 1 | – | – | ns |
| | STROBE PULSE WIDTH | $t_{CC}$ | 120 | – | – | ns |
| D0 to D7 | DATA HOLD TIME | $t_{DH8}$ | 5 | – | – | ns |
| | DATA SETUP TIME | $t_{DS8}$ | 120 | – | – | ns |
| | $\overline{RD}$ ACCESS TIME | $t_{ACC8}$ | – | – | 50 | ns |
| | OUTPUT DISABLE TIME | $t_{OH8}$ | 10 | – | 50 | ns |



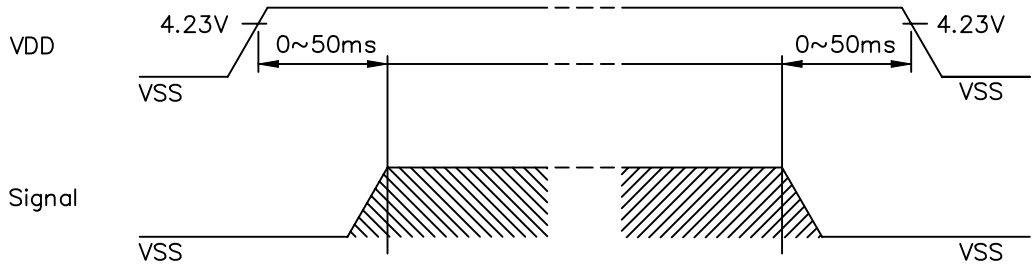
## 8-2.READ/WRITE CHARACTERISTICS(6800 FAMILY MPU)

VDD=5.0V±5%

| ITEM | ITEM | SYMBOL | MIN. | TYP. | MAX. | UNIT |
|---|---|---|---|---|---|---|
| A0,$\overline{CS}$,$\overline{WR}$ | ADDRESS HOLD TIME | $t_{AH6}$ | 0 | – | – | ns |
| | ADDRESS SETUP TIME | $t_{AW6}$ | 0 | – | – | ns |
| | SYSTEM CYCLE TIME | $t_{CYC6}$ | 1 | – | – | ns |
| D0 to D7 | DATA HOLD TIME | $t_{DH6}$ | 0 | – | – | ns |
| | DATA SETUP TIME | $t_{DS6}$ | 100 | – | – | ns |
| | ACCESS TIME | $t_{ACC6}$ | – | – | 85 | ns |
| | OUTPUT DISABLE TIME | $t_{OH6}$ | 10 | – | 50 | ns |
| $\overline{RD}$ | ENABLE PULSE WIDTH | $t_{RDW}$ | 120 | – | 50 | ns |



## 8-3.POWER ON/OFF TIMING

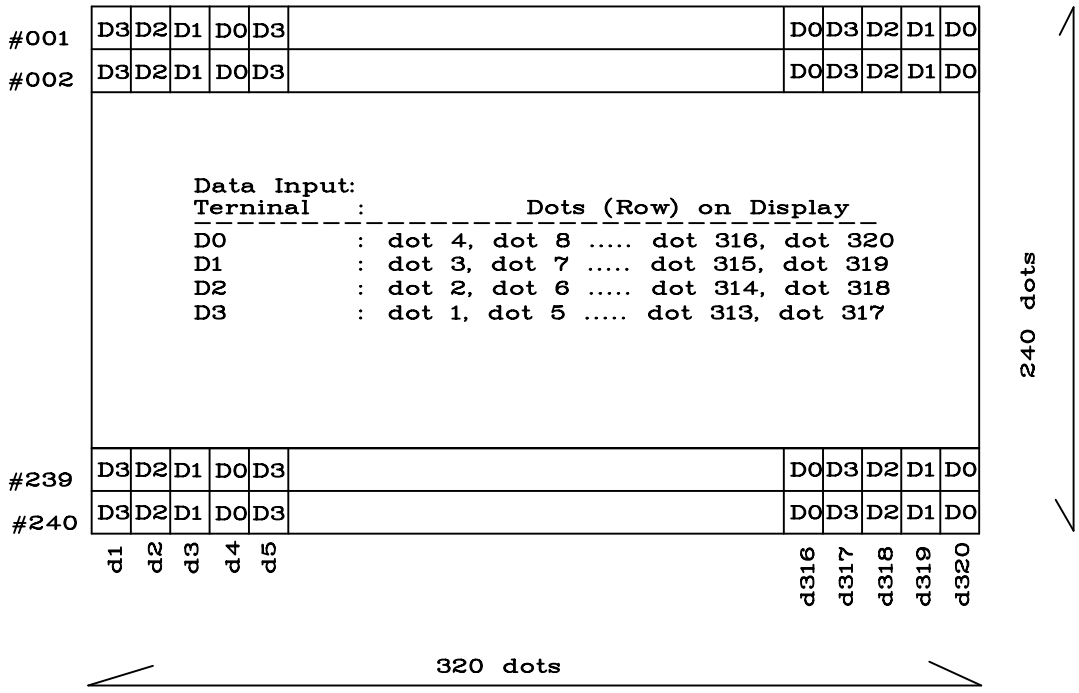



POWER ON POWER OFF

(Note)

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

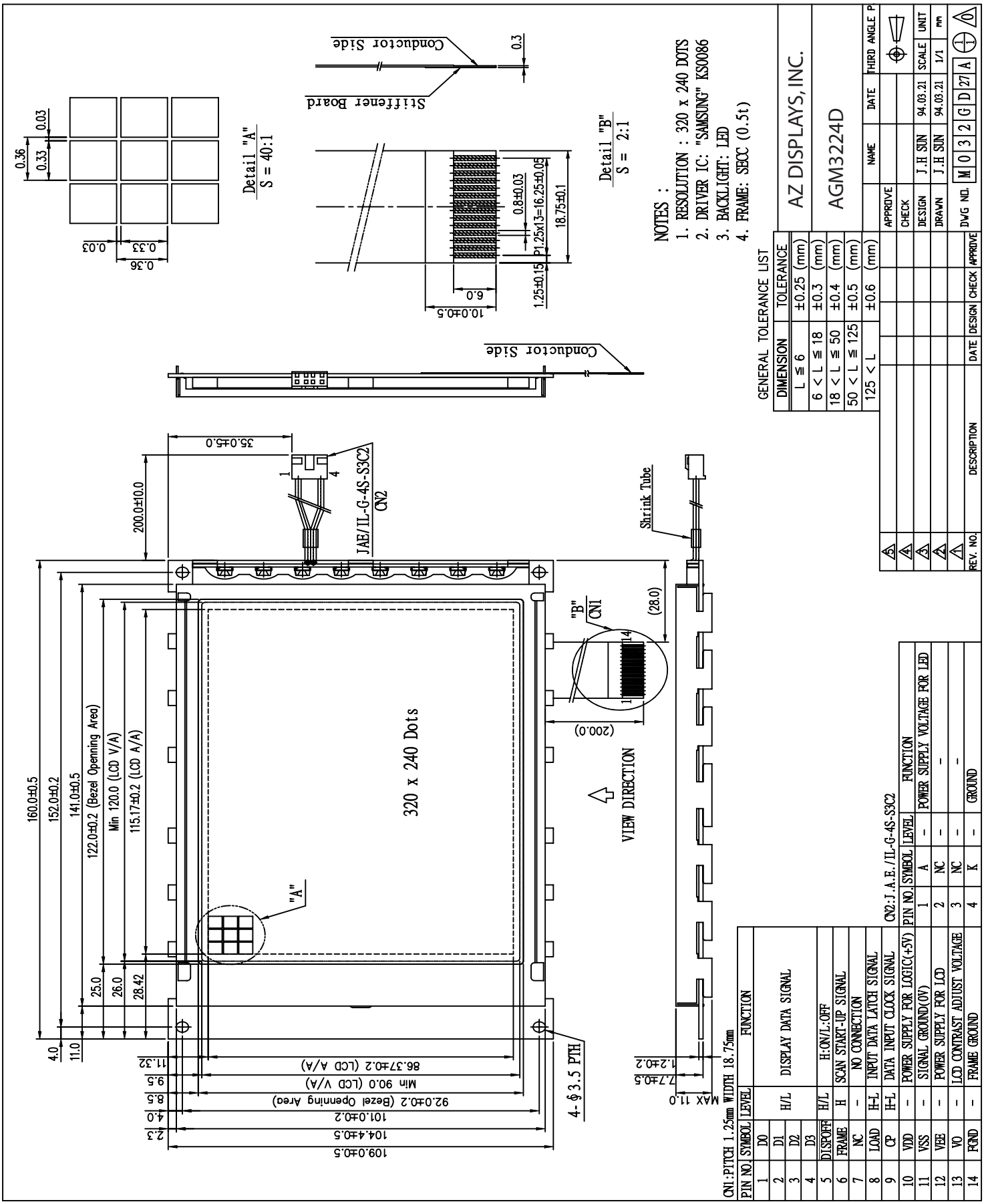
## 8-4.DISPLAY PATTERN



# 9. RELIABILITY TEST

WIDE TEMPERATURE RELIABILITY TEST

| NO | ITEM | CONDITION | | | STANDARD | NOTE |
|---|---|---|---|---|---|---|
| 1 | High Temp. Storage | 70°C | 120Hrs | | Appearance without defect | |
| 2 | Low Temp. Storage | −40°C | 120Hrs | | Appearance without defect | |
| 3 | High Temp. & High Humi. Storage | 60°C 90%RH | 120Hrs | | Appearance without defect | |
| 4 | High Temp. Operating Display | 60°C | 120Hrs | | Appearance without defect | |
| 5 | Low Temp. Operating Display | −20°C | 120Hrs | | Appearance without defect | |
| 6 | Thermal Shock | −20°C,30min → 70°C,30min ↑ (1cycle) | | | Appearance without defect | 10 cycles |


NOTES :
1. RESOLUTION : 320 x 240 DOTS
2. DRIVER IC: "SAMSUNG" KS0086
3. BACKLIGHT: LED
4. FRAME: SEGC (0.5t)
GENERAL TOLERANCE LIST
DIMENSION | TOLERANCE
L ≦ 6 | ±0.25 (mm)
6 < L ≦ 18 | ±0.3 (mm)
18 < L ≦ 50 | ±0.4 (mm)
50 < L ≦ 125 | ±0.5 (mm)
125 < L | ±0.6 (mm)
AZ DISPLAYS, INC.
AGM3224D
DESIGN J.H SUN 94.03.21
DRAWN J.H SUN 94.03.21
APPROVE
CHECK
SCALE 1/1
UNIT mm
THIRD ANGLE P
DWG NO. M0324GD27A
REV. NO. DESCRIPTION DATE DESIGN CHECK APPROVE
Detail "A" S = 40:1
Detail "B" S = 2:1
Conductor Side
Stiffener Board
0.3
0.36
0.33
0.03
0.8±0.03
18.75±0.1
P1.25x13=16.25±0.05
1.25±0.15
10.0±0.5
6.0
320 x 240 Dots
VIEW DIRECTION
"A"
"B"
CN1
CN2
JAE/IL-G-4S-S3C2
Shrink Tube
35.0±5.0
200.0±10.0
(28.0)
(200.0)
160.0±0.5
152.0±0.2
141.0±0.5
122.0±0.2 (Bezel Openning Area)
Min 120.0 (LCD V/A)
115.17±0.2 (LCD A/A)
25.0
26.0
28.42
4.0
11.0
11.32
9.5
8.5
4.0
2.3
86.37±0.2 (LCD A/A)
Min 90.0 (LCD V/A)
92.0±0.2 (Bezel Opening Area)
101.0±0.2
104.4±0.5
109.0±0.5
4-φ3.5 PTH
MAX 11.0
7.7±0.5
1.2±0.2
CN1:PITCH 1.25mm WIDTH 18.75mm
PIN NO. | SYMBOL | LEVEL | FUNCTION
1 | D0 | H/L | DISPLAY DATA SIGNAL
2 | D1
3 | D2
4 | D3
5 | DISPOFF | H/L | H:ON/L:OFF
6 | FRAME | H | SCAN START-UP SIGNAL
7 | NC | - | NO CONNECTION
8 | LOAD | H-L | INPUT DATA LATCH SIGNAL
9 | CP | H-L | DATA INPUT CLOCK SIGNAL
10 | VDD | - | POWER SUPPLY FOR LOGIC(+5V)
11 | VSS | - | SIGNAL GROUND(0V)
12 | VEE | - | POWER SUPPLY FOR LCD
13 | VO | - | LCD CONTRAST ADJUST VOLTAGE
14 | FGND | - | FRAME GROUND
CN2:J.A.E./IL-G-4S-S3C2
PIN NO. | SYMBOL | LEVEL | FUNCTION
1 | A | - | POWER SUPPLY VOLTAGE FOR LED
2 | NC | - | -
3 | NC | - | -
4 | K | - | GROUND