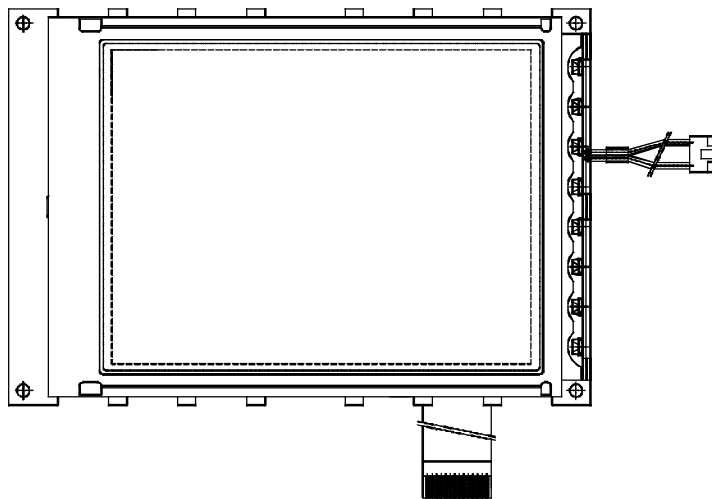




PRODUCT SPECIFICATION

HDM3224L-1

320X240 (1/4 VGA) GRAPHICS
LCD DISPLAY MODULE



| | | | | |
|---|-------|-------|-------------------|-----------------|
| HANTRONIX, INC. 10080 BUBB RD. CUPERTINO, CA 95014 | Q.A.: | REV.: | HDM3224L-1 | SHEET 1 OF 18 |
| | JK | 1.0 | | DATE: 5/1/03 |

1. MECHANICAL DATA

| | |
|-----------------------|--|
| (1) Product No. | HDM3224L-1 |
| (2) Module Size | 160.0 (W)mm x 109.0 (H)mm x MAX.11.0 (D)mm |
| (3) Dot Size | 0.33 (W)mm x 0.33 (H)mm |
| (4) Dot Pitch | 0.36 (W)mm x 0.36 (H)mm |
| (5) Number of Dots | 320 (W) x 240 (H)Dots |
| (6) Duty | 1/240 |
| (7) LCD Display Mode | STN: Blue Mode Rear Polarizer: Transmission(Smoke Gray) |
| (8) Viewing Direction | 6 O'clock |
| (9) Backlight | LED B/L(White) |
| (10) Weight | 199 g(Approx.) |

| | | | | |
|---|-------|-------|-------------------|-----------------|
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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 | OPERATION | | STORAGE | |
|--------------------------------|-----------|------|----------|------|
| | MIN. | MAX. | MIN. | MAX. |
| Ambient Temperature | -20 | 70 | -30 | 80 |
| Humidity(Without Condensation) | Note 2,4 | | Note 3,4 | |

Note 2 Ta \leq 70°C : 75%RH max
 Ta > 70°C : Absolute humidity must be lower
 than the humidity of 75%RH at 70°C

Note 3 Ta at -30°C will be < 48hrs, at 80°C will be < 120hrs

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

| | | | | |
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3. ELECTRICAL CHARACTERISTICS

3-1. ELECTRICAL CHARACTERISTICS

(VDD = 5.0V±5%)

| 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-VO | Duty=1/240 | -20°C | 25.2 | 25.5 | 25.8 | V |
| | | | 0°C | 23.6 | 23.9 | 24.2 | |
| | | | 25°C | 22.8 | 23.1 | 23.4 | |
| | | | 50°C | 21.3 | 21.6 | 21.9 | |
| | | | 70°C | 20.3 | 20.6 | 21.9 | |
| Power Supply Current | IDD | FLM = 70 Hz VDD = 5.0 V VEE = -24.0 V VDD-VO = 23.1 V | - | 4.51 | 6.77 | mA | |
| | IEE | PATTERN : □ ■ □ ■ □ ■ ■ □ ■ □ ■ □ | - | 3.85 | 5.78 | mA | |
| Surface Luminance | L | (Dots All On) | - | 133 | - | cd/m ² | |
| | | (Dots All Off) | - | 23.1 | - | | |

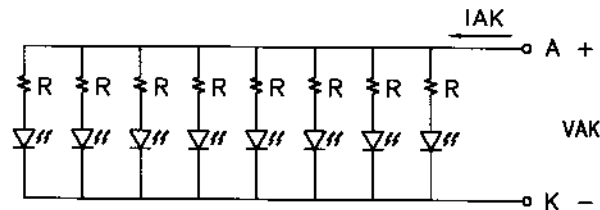
3-2.ELECTRICAL CHARACTERISTICS OF BACKLIGHT

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 | LL | - | 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 .



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4.OPTICAL CHARACTERISTICS

AT Vop

| ITEM MODE | | Cr(Contrast Ratio) | | | | | | | | | | θ (Viewing Angle) | | θ (Viewing Angle) | |
|--------------|---|--------------------|------|------|------|------|------|------|------|------|------|--------------------------|------|--------------------------|------|
| | | -20℃ | | 0℃ | | 25℃ | | 50℃ | | 70℃ | | 25℃ | | 25℃ | |
| | | MIN. | TYP. | MIN. | TYP. | MIN. | TYP. | MIN. | TYP. | MIN. | TYP. | MIN. | TYP. | MIN. | TYP. |
| N | S | 2.5 | 4.0 | 3.5 | 5.0 | 4.0 | 5.5 | 3.0 | 4.5 | 2.0 | 3.0 | - | 67 | - | ±32 |
| NOTE | | NOTE 6 | | | | | | | | | | NOTE 5 | | | |

NOTE :

N : TRANSMISSION
S : BLUE

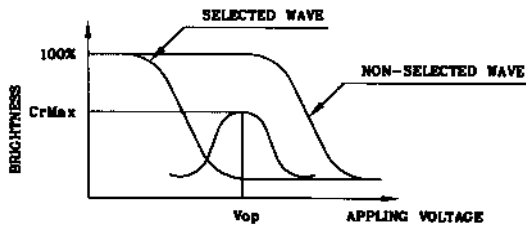
AT $\theta=0^\circ$ $\theta=0^\circ$

| ITEM | SYMBOL | CONDITION | MIN. | TYP. | MAX. | UNIT | NOTE |
|----------------------|--------|-----------|------|------|------|------|--------|
| Response Time (rise) | Tr | -20℃ | 3200 | 4000 | 6000 | ms | NOTE 2 |
| | | 0℃ | 240 | 300 | 450 | | |
| | | 25℃ | 100 | 120 | 180 | | |
| | | 50℃ | 65 | 80 | 120 | | |
| | | 70℃ | 45 | 60 | 90 | | |
| Response Time (fall) | Tf | -20℃ | 1600 | 2000 | 3000 | ms | NOTE 2 |
| | | 0℃ | 350 | 450 | 670 | | |
| | | 25℃ | 110 | 140 | 210 | | |
| | | 50℃ | 45 | 60 | 90 | | |
| | | 70℃ | 40 | 50 | 75 | | |

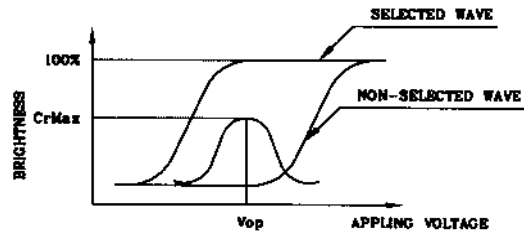
| | | | | |
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(FIG 1)

Definition of Operation Voltage(Vop)



(positive type)



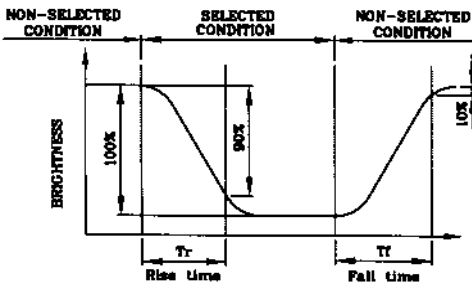
(negative type)

*Conditions

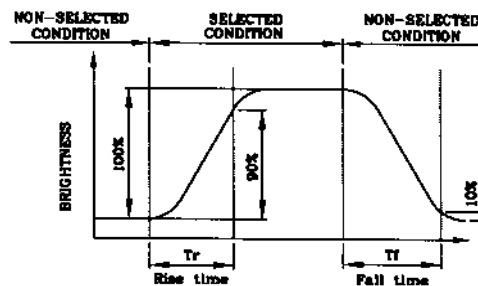
Viewing Angle : 0
 Frame Frequency : 70Hz
 Applying Waveform : 1/N duty 1/a bias

(FIG 2)

Definition of Response Time(Tr,Tf)



(positive type)



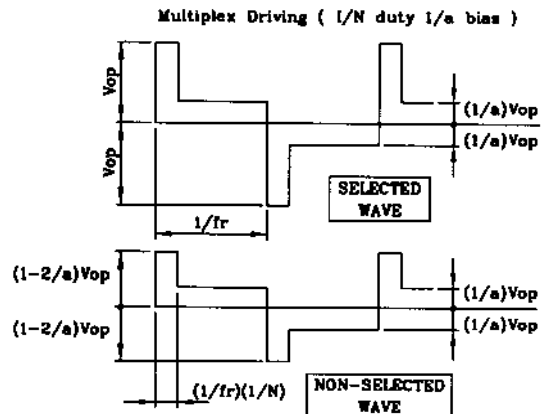
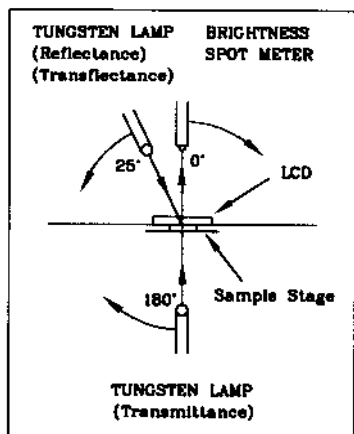
(negative type)

*Conditions

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

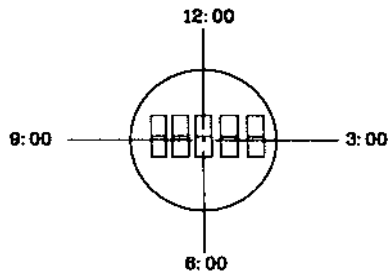
(FIG 3)

Description of Measuring Equipment and Driving Waveforms



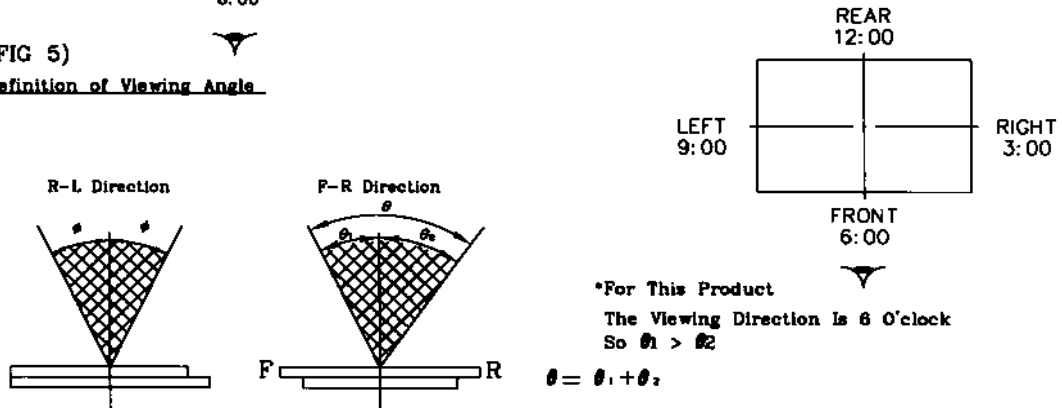
(FIG 4)

Definition of Viewing Direction



(FIG 5)

Definition of Viewing Angle

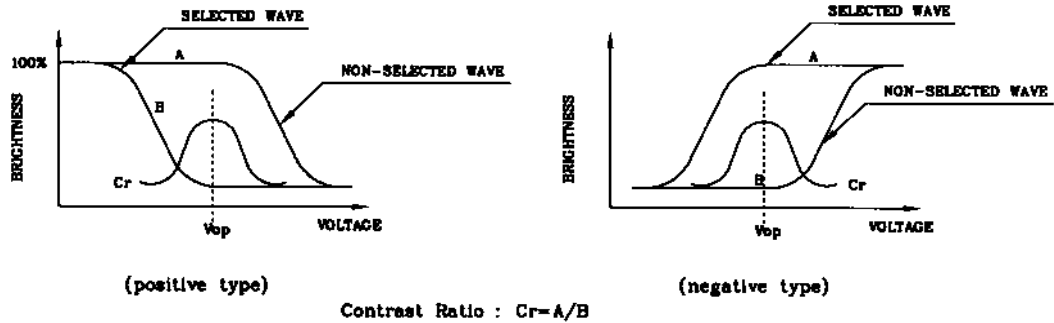


*Conditions

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

(FIG 6)

Definition of Contrast Ratio (Cr)

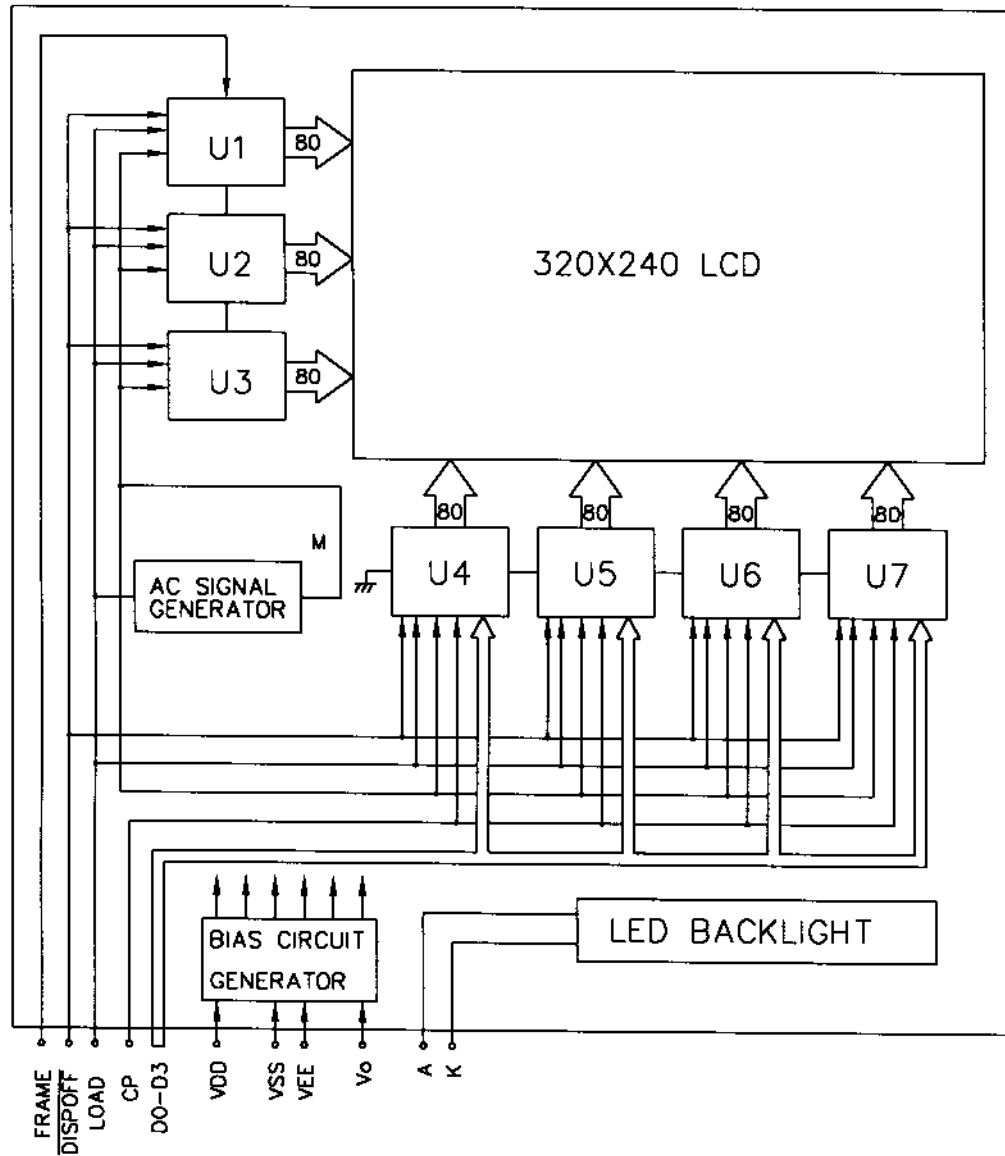


*Conditions

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

| | | | | |
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5. BLOCK DIAGRAM



* AC SIGNAL SETTING

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

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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 | 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(OV) |
| 12 | VEE | - | POWER SUPPLY FOR LCD |
| 13 | VO | - | LCD CONTRAST ADJUST VOLTAGE |
| 14 | FGND | - | FRONT PANNEL 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 |

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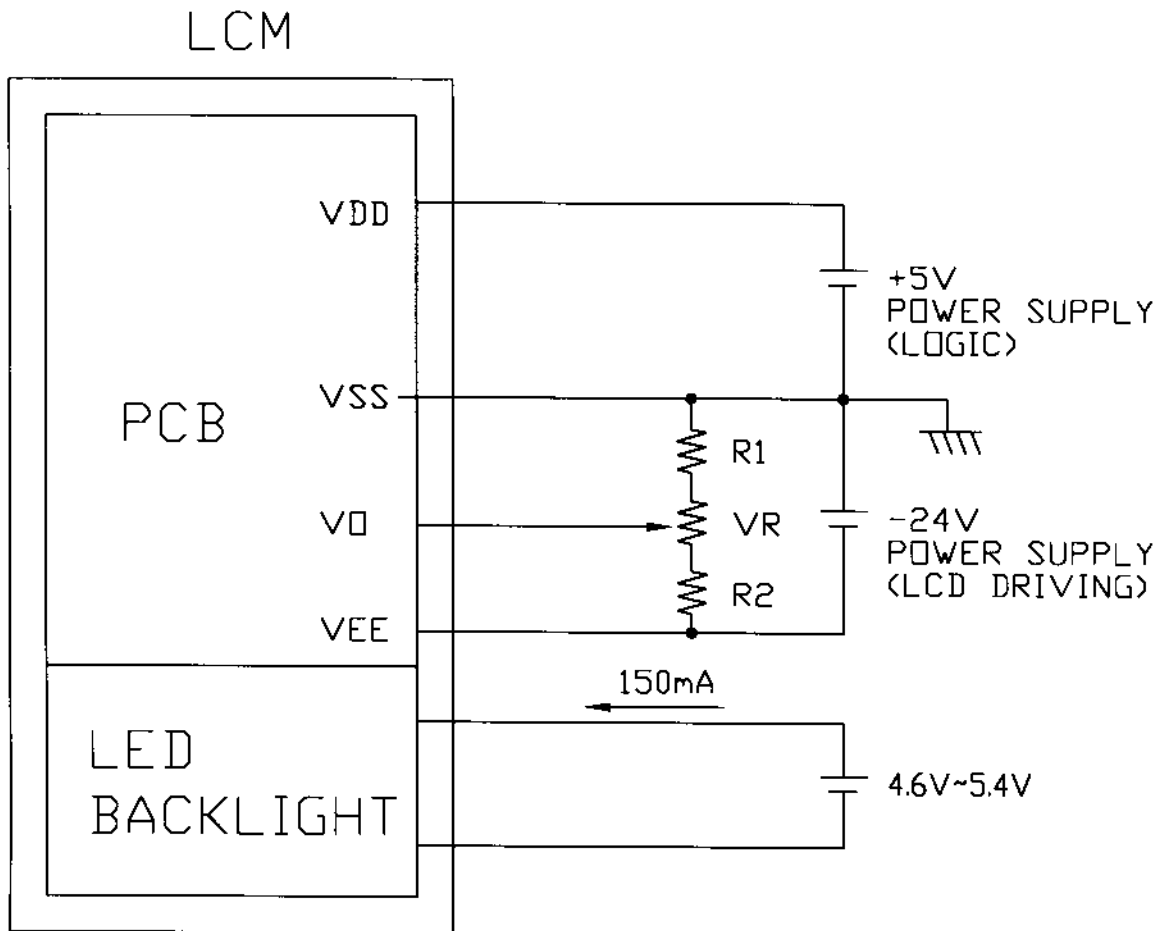
REV.:
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7. POWER SUPPLY



$$1. R1 + VR + R2 = 10K \sim 20K \Omega$$

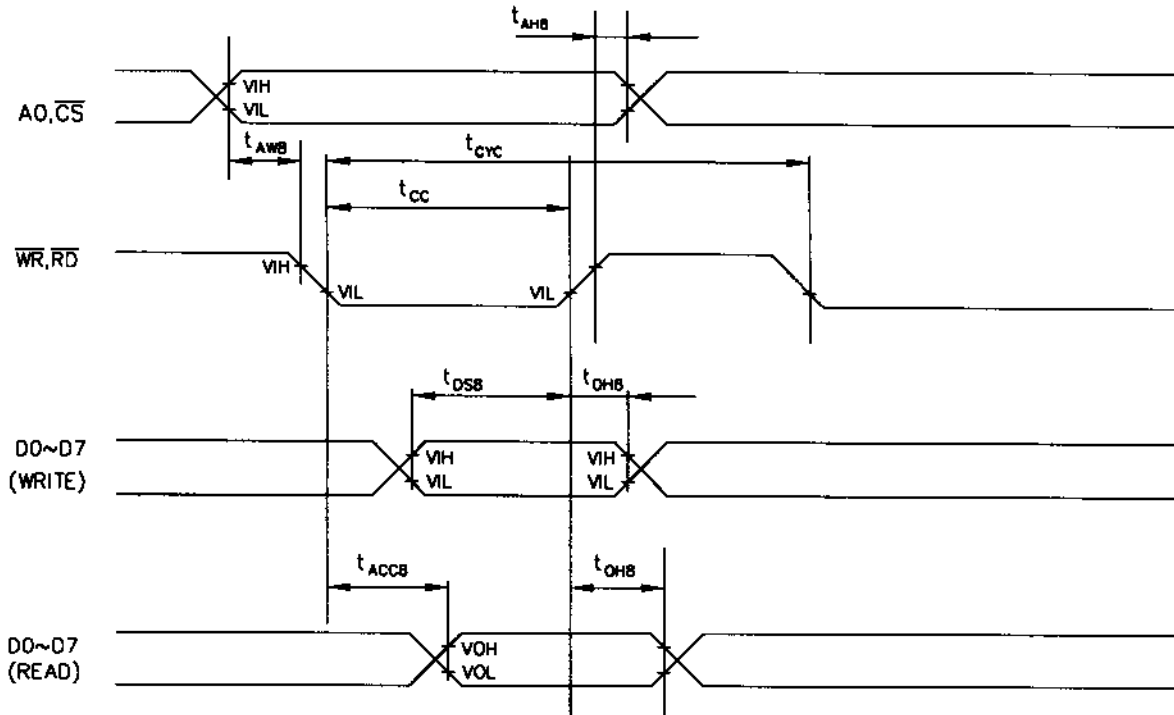
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8. TIMING CHARACTERISTICS

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

VDD=5.0V±5%

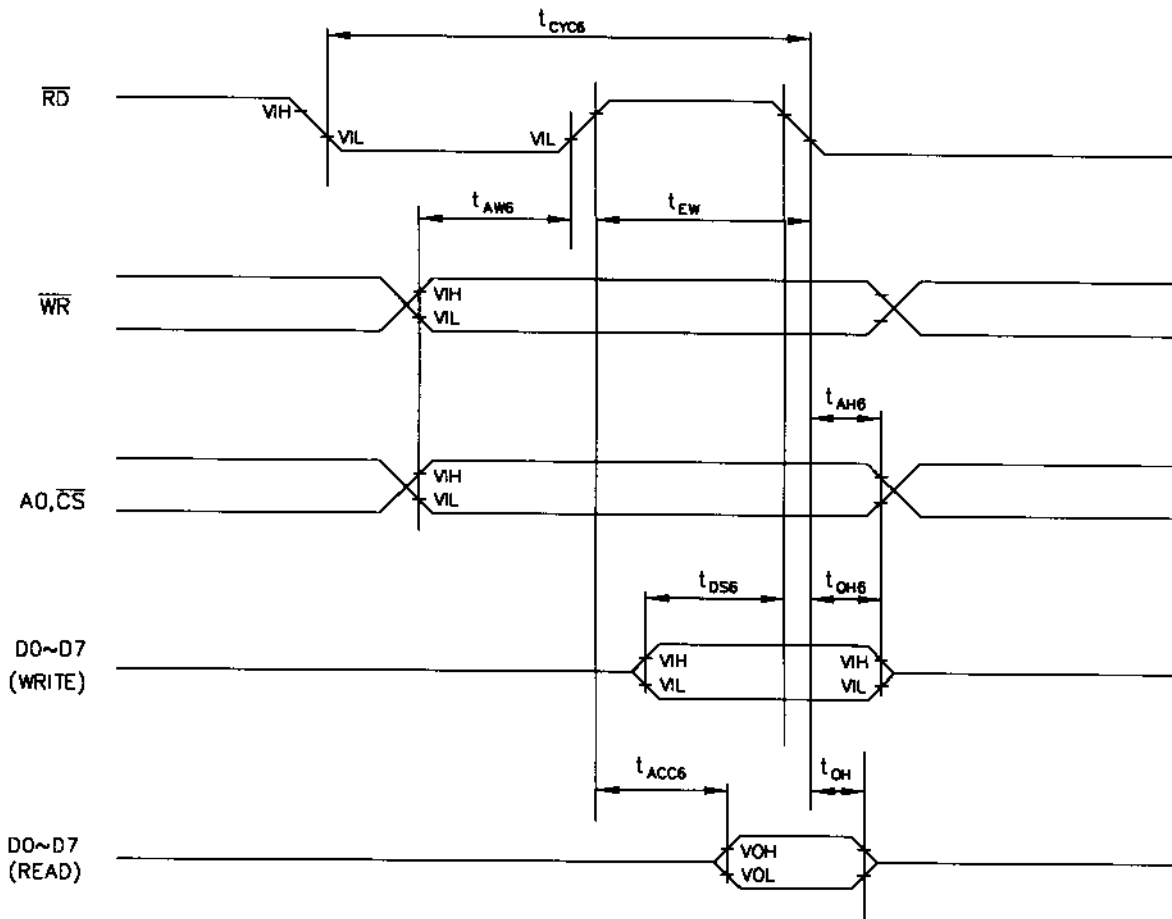
| ITEM | ITEM | SYMBOL | MIN. | TYP. | MAX. | UNIT |
|--------------------------------|---------------------|------------|------|------|------|------|
| A0, \overline{CS} | ADDRESS HOLD TIME | t_{AHB} | 10 | - | - | ns |
| | ADDRESS SETUP TIME | t_{AWB} | 0 | - | - | ns |
| $\overline{WR}, \overline{RD}$ | SYSTEM CYCLE TIME | t_{CYC} | 1 | - | - | ns |
| | STROBE PULSE WIDTH | t_{CC} | 120 | - | - | ns |
| D0 to D7 | DATA HOLD TIME | t_{DHB} | 5 | - | - | ns |
| | DATA SETUP TIME | t_{DSB} | 120 | - | - | ns |
| | RD ACCESS TIME | t_{ACCB} | - | - | 50 | ns |
| | OUTPUT DISABLE TIME | t_{OHB} | 10 | - | 50 | ns |



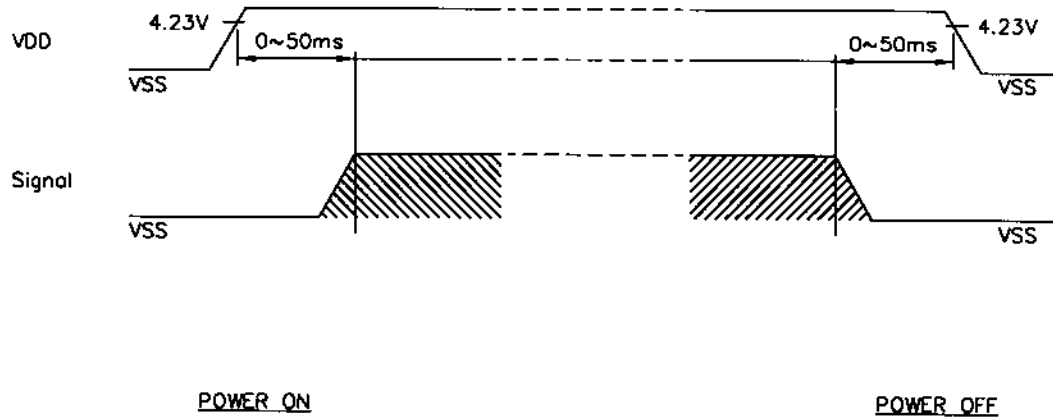
8-2.READ/WRITE CHARACTERISTICS(6800 FAMILY MPU)

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_{AS6} | 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 |



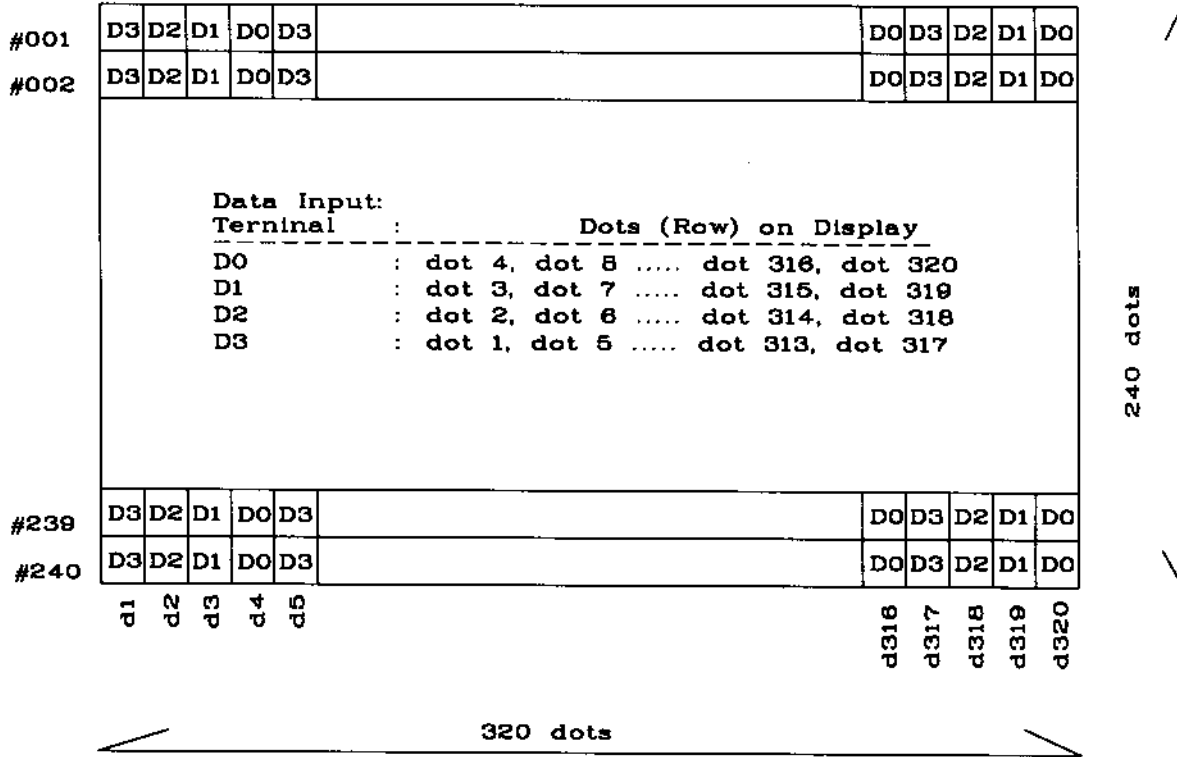
8-3. POWER ON/OFF TIMING



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

| | | | | |
|---|-------|-------|-------------------|----------------|
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8-4.DISPLAY PATTERN



9. RELIABILITY TEST

| NO | ITEM | CONDITION | | | STANDARD | NOTE |
|----|---------------------------------|---|-------|--|---------------------------|----------|
| | | | | | | |
| 1 | High Temp. Storage | 70°C | 120HR | | Appearance without defect | |
| 2 | Low Temp. Storage | -20°C | 120HR | | Appearance without defect | |
| 3 | High Temp. & High Humi. Storage | 40°C 90%RH | 120HR | | Appearance without defect | |
| 4 | Thermal Shock | -20°C, 30min → 25°C, 5min → 70°C, 30min → 25°C, 5min (1cycle) | | | Appearance without defect | 5 cycles |

| | | | | |
|---|-------|-------|-------------------|----------------|
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NOTE:

• SAFETY

- 1.If the LCD panel breaks, be careful not to get the liquid crystal to touch your skin.
- 2.If the liquid crystal touches your skin or clothes, please wash it off immediately by using soap and water.

• HANDLING

- 1.Avoid static electricity which can damage the CMOS LSI.
- 2.Do not remove the panel or frame from the module.
- 3.The polarizing plate of the display is very fragile. So, please handle it very carefully.
- 4.Do not wipe the polarizing plate with a dry cloth, as it may easily scratch the surface of plate.
- 5.Do not use ketanics solvent & Aromatic solvent, use with a soft cloth soaked with a cleaning naphtha solvent.

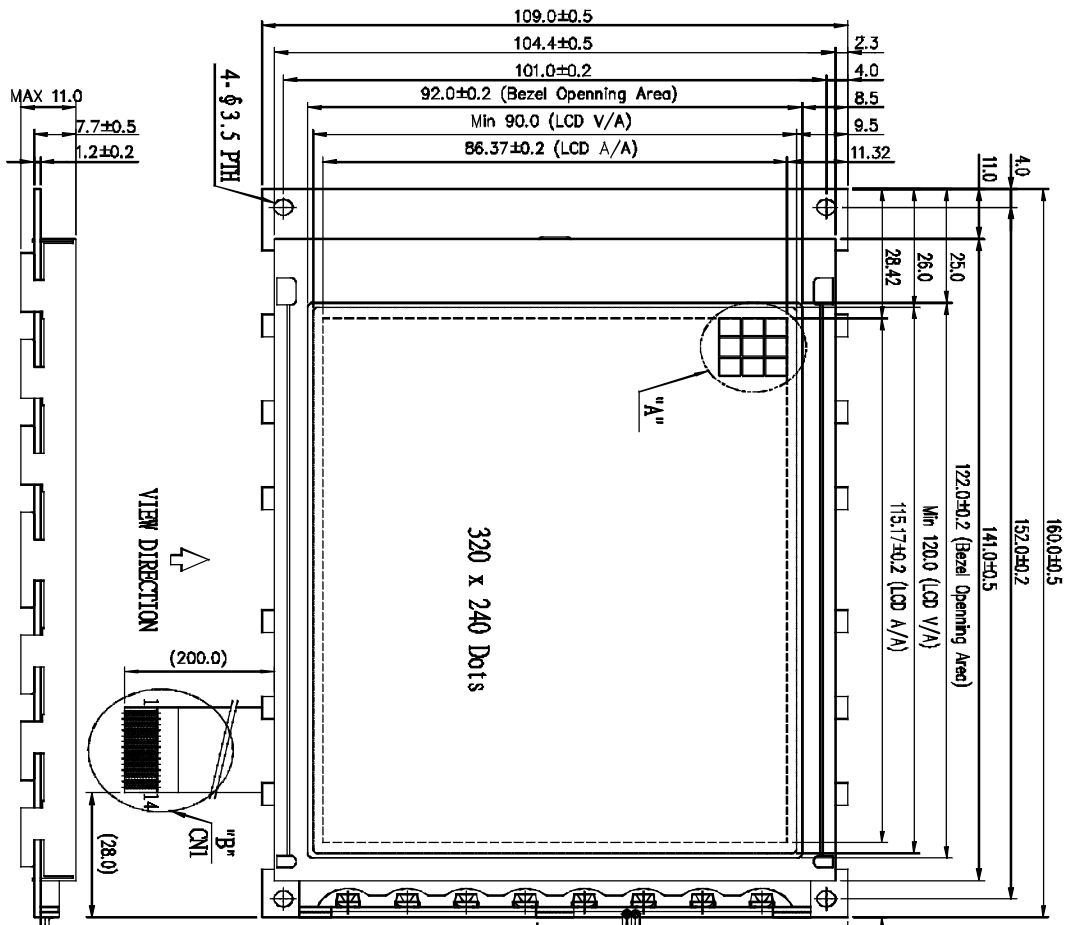
• STORAGE

- 1.Store the panel or module in a dark place where the temperature is $25^{\circ}\text{C}\pm 5^{\circ}\text{C}$ and the humidity is below 65% RH.
- 2.Do not place the module near organics solvents or corrosive gases.
- 3.Do not crush, shake, or jolt the module.

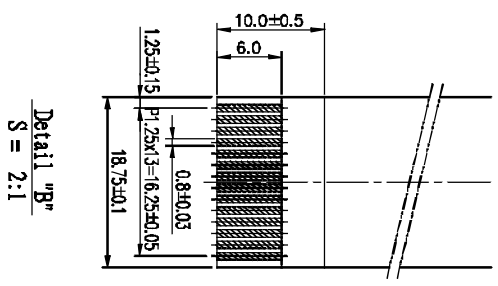
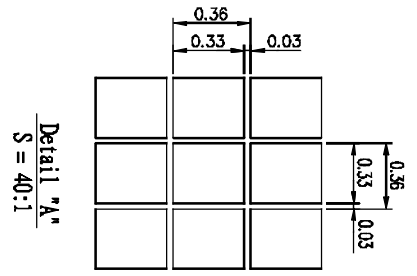
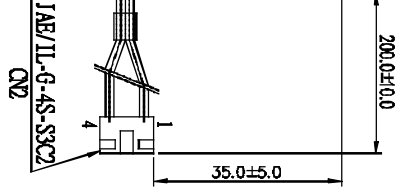
• TERMS OF WARRANT

- 1.Acceptance inspection period
The period is within one month after the arrival of contracted commodity at the buyer's factory site.
- 2.Applicable warrant period
The period is within twelve months since the date of shipping out under normal using and storage conditions.

| | | | | |
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ON: PITCH 1.25mm WIDTH 18.75mm
 CN2: I.A.E./TL-G-4S-SSC2



- NOTES :
1. RESOLUTION : 320 x 240 DOTS
 2. DRIVER IC: "SAMSUNG" KS90986
 3. BACKLIGHT: LED
 4. FRAME: SSCC (0.5t)

| | | | | |
|---|-------|-------|-------------------|-----------------|
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[PW](#) [DEM 320240C SBH-PW-N](#)