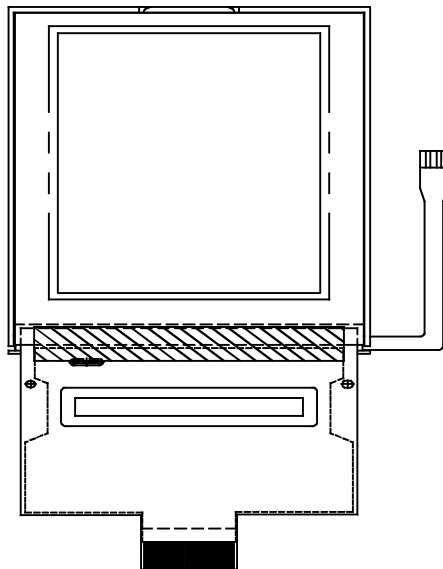


PRODUCT SPECIFICATION

HDM1216C-2

120x160 GRAPHICS
LCD DISPLAY MODULE



| | | | | |
|---|--------------------|---------------------|-------------------|-------------------------|
| HANTRONIX, INC. 10080 BUBB RD. CUPERTINO, CA 95014 | Q.A.: JK | REV.: 1.0 | HDM1216C-2 | SHEET 1 OF 17 |
| | | | | DATE: 3/03/03 |

1. MECHANICAL DATA

| | |
|-----------------------|--|
| (1) Product No. | HDM1216C-2 |
| (2) Module Size | 39.7 (W)mm X 83.05 (H)mm X 3.3 (D)mm |
| (3) Dot Size | 0.07 (W)mm X 0.23 (H)mm |
| (4) Dot Pitch | 0.08 (W)mm X 0.24 (H)mm |
| (5) Number of Dots | 120 (R.G.B.) (W) X 160 (H) Dots |
| (6) Duty | 1/160 |
| (7) LCD Display Mode | FSTN: Color STN module Rear Polarizer: Color Transflective type |
| (8) Viewing Direction | 6 O'clock |
| (9) Backlight | LED |
| (10) Controller | EPSON S4E15004002M000 (S1D15G00) |
| (11) Weight | 11.0g (Approx.) |

| | | | | |
|---|-------|-------|-------------------|------------------|
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2. ABSOLUTE MAXIMUM RATINGS

(1) ELECTRICAL ABSOLUTE RATINGS

V_{SS}=0V Standard

| ITEM | SYMBOL | MIN | MAX | UNIT | COMMENT |
|------------------------|--------|------|---------|------|---------|
| Power Supply for Logic | VDD | -0.3 | 3.6 | V | |
| Input Voltage | VI | -0.3 | VDD+0.5 | V | |
| Static Electricity | - | - | - | - | Note 1 |

Note 1 : LCM should be grounded during handling LCM.

(2) ENVIRONMENTAL ABSOLUTE MAXIMUM RATINGS

| ITEM | OPERATING | | STORAGE | |
|------------------------------------|-----------|------|----------|------|
| | MIN. | MAX. | MIN. | MAX. |
| Ambient Temperature | 0 | 50 | -20 | 70 |
| Humidity (Without Condensation) | Note 2,4 | | Note 3,4 | |

Note 2 : Ta ≤ 50°C : 85%RH max
 Ta > 50°C : Absolute humidity must be lower
 than the humidity of 85%RH at 50°C

Note 3 : Ta at -20°C will be < 48hrs, at 70°C will be < 120 hrs

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 OF LCM

(VDD = 3.0V±10%)

| ITEM | SYMBOL | CONDITION | | MIN. | TYP. | MAX. | UNIT | |
|--------------------------------|-------------------|--|---|--------|------|--------|------|-------------------|
| Input Voltage | VIH | H level | | 0.7VDD | - | VDD | V | |
| | VIO | L level | | 0 | - | 0.3VDD | V | |
| Recommended LC Driving Voltage | (Vop) (V3-MV1) | Duty= 1/160 Bias= 1/13 | 0°C | 11.5 | 11.8 | 12.1 | V | |
| | | | 25°C | 11.0 | 11.3 | 11.6 | | |
| | | | 50°C | 10.2 | 10.5 | 10.8 | | |
| Power Supply Current | IDD | VDD=3.0V | | - | 1.5 | 2.3 | mA | |
| Surface Luminance of LCM | - | ① Transmission Mode ② LED BACKLIGHT CONDITION : { Vf =5.0 V { If =45 mA | (Dots All On) PATTERN: ■ ■ ■ ■ ■ ■ ■ ■ | RED | - | 37.1 | - | cd/m ² |
| | | | | GREEN | - | 62.0 | - | |
| | | | | BLUE | - | 31.2 | - | |
| | | | | WHITE | - | 111.9 | - | |
| | | | | BLACK | - | 7.8 | - | |

3-2. ELECTRICAL CHARACTERISTICS OF BACKLIGHT

Used LED Rating

Temp. = 25°C

| ITEM | SYMBOL | MIN. | TYP. | MAX. | UNIT | REMARK |
|-------------------------|-----------------|------|-------|------|------|------------------------------------|
| Peak forward current | I _P | - | - | 60 | mA | - |
| Maximum reverse voltage | V _R | - | - | 5.0 | V | - |
| Applied forward current | I _{AK} | - | 45 | 60 | mA | at V _{AK} = 5.0 V |
| Applied forward voltage | V _{AK} | - | 5.0 | - | V | at I _{AK} = 45 mA |
| LED power consumption | P | - | 0.23 | - | W | - |
| LED life time | L _L | - | 40000 | - | hrs | at I _{AK} = 45 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

4-1. OPTICAL CHARACTERISTICS

AT Vop

| MODE | | ITEM | Cr(Contrast Ratio) | | | | | | θ (Viewing Angle) | | ϕ (Viewing Angle) | |
|------|---|--------------|--------------------|------|------|------|------|------|--------------------------|-------|------------------------|------|
| | | | 0°C | | 25°C | | 50°C | | 25° | | 25° | |
| | | | MIN. | TYP. | MIN. | TYP. | MIN. | TYP. | MIN. | TYP. | MIN. | TYP. |
| A | N | Reflective | - | 7.0 | - | 8.0 | - | 3.5 | - | 32-38 | - | ±18 |
| | | Transmission | - | 18.0 | - | 20.0 | - | 7.0 | - | 32-38 | - | ±18 |
| | | Note | NOTE 6 | | | | | | NOTE 5 | | | |

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

| ITEM | SYMBOL | CONDITION | MIN. | TYP. | MAX. | UNIT | NOTE |
|----------------------|--------|-----------|------|------|------|------|--------|
| Response Time (rise) | Tr | 0°C | - | 250 | 375 | ms | NOTE 2 |
| | | 25°C | - | 170 | 255 | | |
| | | 50°C | - | 50 | 75 | | |
| Response Time (fall) | Tf | 0°C | - | 300 | 450 | ms | NOTE 2 |
| | | 25°C | - | 80 | 120 | | |
| | | 50°C | - | 50 | 75 | | |

※《 The characteristics is tested by " LCD EVALUATION SYSTEM: LCD-7000 " (Exclude touch panel) 》

Note:

A: Transflective

N: Color STN module, 6 O'clock

| | | | | |
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4-2. Color of CIE Coordinate

$T_a = 25^\circ\text{C}$, Tolerance : ± 0.05

| ITEM | SYMBOL | CONDITION | VALUE | NOTE |
|-------------------------|--------|-----------|-------|-------|
| Color of CIE Coordinate | Red | X | 0.36 | Note* |
| | | y | 0.27 | |
| | Green | X | 0.30 | |
| | | y | 0.37 | |
| | Blue | X | 0.18 | |
| | | y | 0.20 | |
| | White | X | 0.29 | |
| | | y | 0.32 | |

Note* Measuring at position 3 on Fig.1 CIE chromaticity diagram

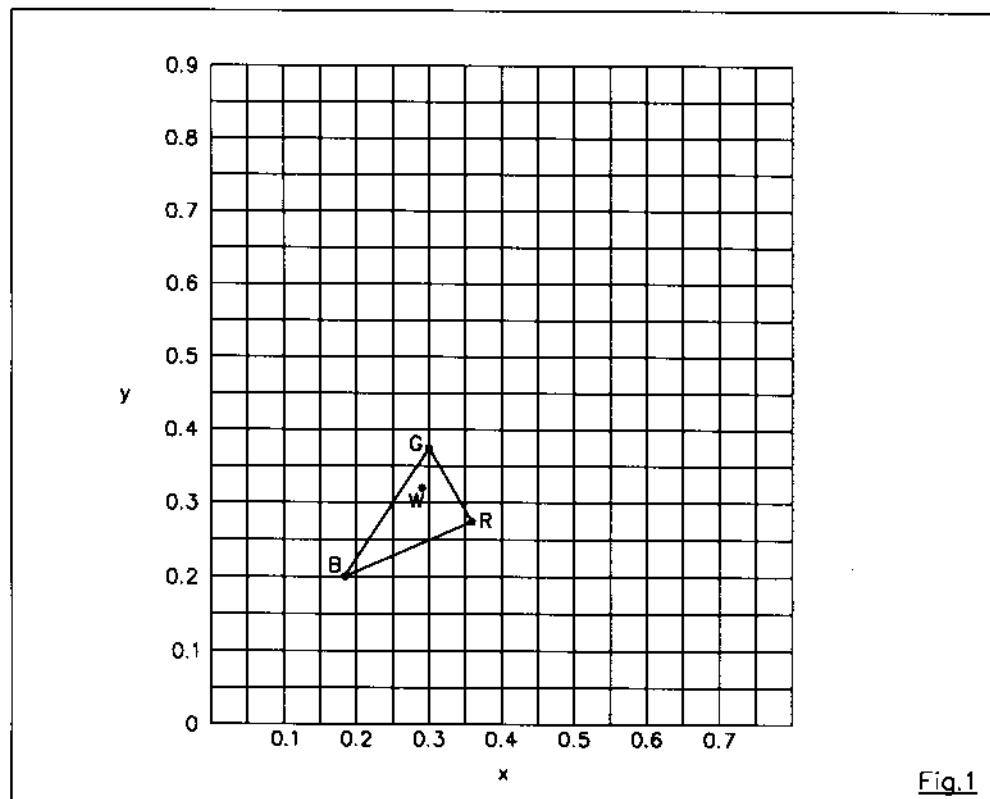


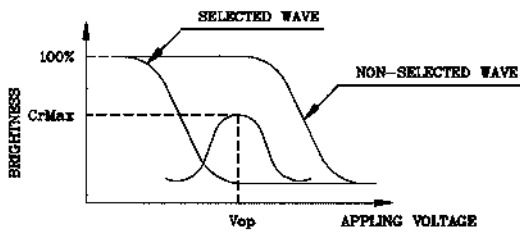
Fig.1

*« The characteristics is tested by " LUMINANCE COLORIMETER: BM-7 " LED BACKLIGHT CONDITION : $V_f = 5.0 \text{ V}$, $I_f = 60 \text{ mA}$ »

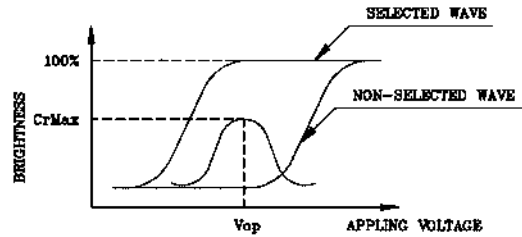
| | | | | |
|---|-------|-------|-------------------|---------------|
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(NOTE 1)

Definition of Operation Voltage(Vop)



(positive type)



(negative type)

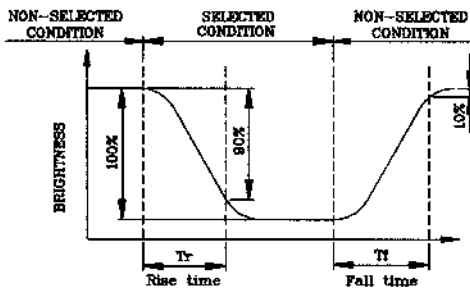
*Conditions

Viewing Angle : 0

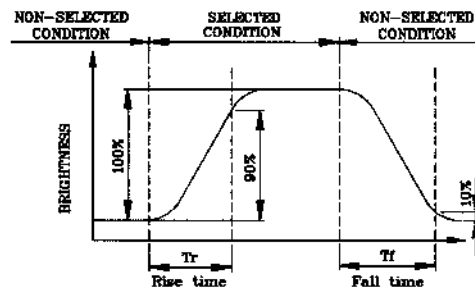
Applying Waveform : 1/N duty 1/a bias

(NOTE 2)

Definition of Response Time(Tr,Tf)



(positive type)



(negative type)

*Conditions

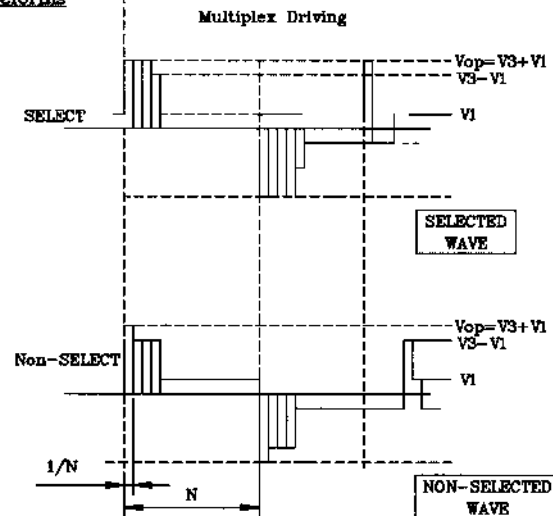
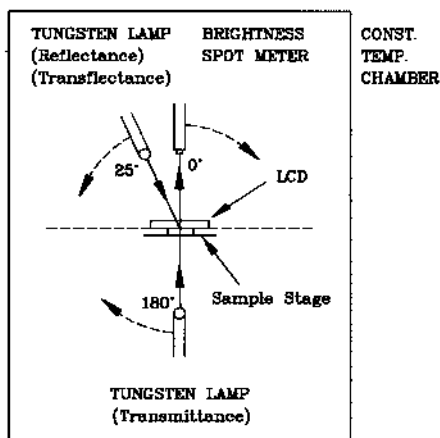
Operating Voltage : Vop

Viewing Angle (θ,φ) : (0,0)

Applying Waveform : 1/N duty 1/a bias

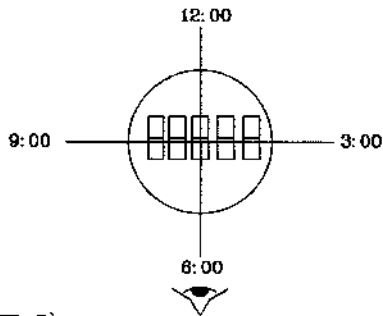
(NOTE 3)

Description of Measuring Equipment and Driving Waveforms



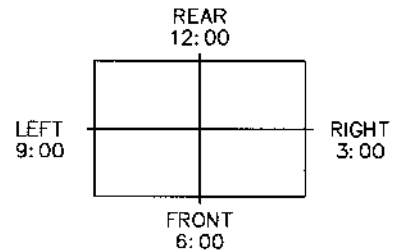
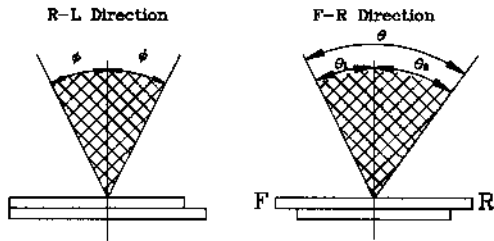
(NOTE 4)

Definition of Viewing Direction



(NOTE 5)

Definition of Viewing Angle



*For This Product
The Viewing Direction Is 6 O'clock
So $\theta_1 > \theta_2$

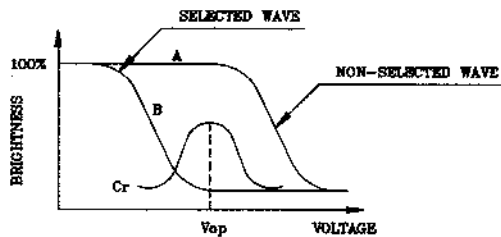
$$\theta = \theta_1 + \theta_2$$

*Conditions

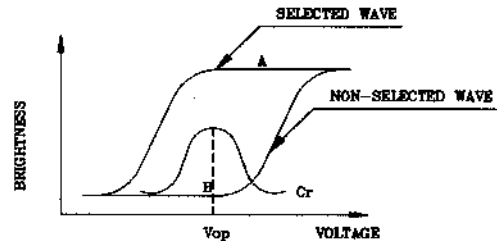
Operating Voltage : V_{op}
Applying Waveform : 1/N duty 1/a bias
Contrast Ratio : larger than 2

(NOTE 6)

Definition of Contrast Ratio (Cr)



(positive type)



(negative type)

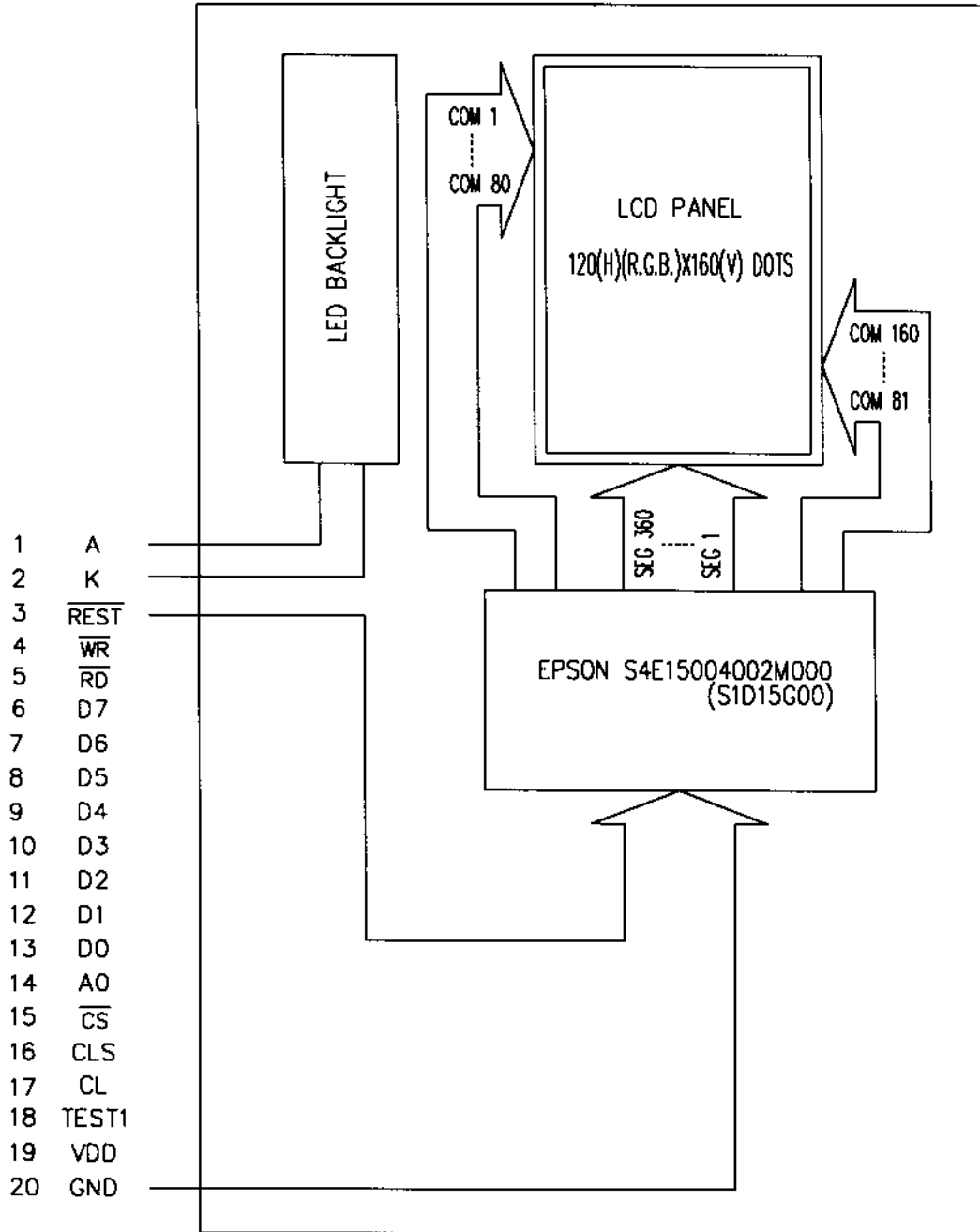
$$\text{Contrast Ratio : } Cr = A/B$$

*Conditions

Viewing Angle : 0
Applying Waveform : 1/N duty 1/a bias

| | | | | |
|---|-------|-------|-------------------|---------------|
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5. BLOCK DIAGRAM



| | | | | |
|---|-------|-------|-------------------|----------------|
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6. INTERFACE DEFINITION

CN1. LCD INTERFACE

| PIN NO | SYMBOL | FUNCTION |
|--------|-------------------------|--|
| 1 | GND | Ground |
| 2 | | |
| 3 | $\overline{\text{RES}}$ | Causing RES to LOW performs initialization. Reset operation is performed according the level of RES signal. It goes active LOW when connected to the 80 series MPU. |
| 4 | $\overline{\text{WR}}$ | This pin connects WR signal from the 80 series MPU. Signal on the data bus is latched at the positive going edge of WR signal. |
| 5 | $\overline{\text{RD}}$ | It goes active LOW when connected to the 80 series MPU. This pin is used to connect RD signal from the 80 series MPU. the data bus is maintained in the output status as long as this this signal is LOW. |
| 6 | D7 | Data bus. |
| 7 | D6 | |
| 8 | D5 | |
| 9 | D4 | |
| 10 | D3 | |
| 11 | D2 | |
| 12 | D1 | |
| 13 | D0 | |
| 14 | A0 | Normally, the least significant bit of the MPU's address bus is connected to identify a parameter or display data from a command. HIGH: Ideicates that data entered to D7 to D0 is a parameter or display data. LOW: Ideicates that data entered to D7 to D0 is a command. |
| 15 | $\overline{\text{CS}}$ | This pin is used to enter chip select signal. It is activated when $\overline{\text{CS}} = \text{LOW}$, enabling interface with MPU. |
| 16 | CLS | It is used to select the display clock. CLS = HIGH : Built-in CR oscillation is used. CLS = LOW : External clock is used. When the external clock is used (CLS=LOW), the signal is entered to CL pin. |
| 17 | CL | This pin inputs or outputs the display clock. It outputs the display clock only when M/S =HIGH and CLS =HIGH. Other than the above: External clock input. |
| 18 | TEST1 | It is the IC chip test pin. This pin must be fixed to LOW. |
| 19 | VDD | Power Supply for Logic |
| 20 | GND | Ground |

CN2. LED INTERFACE

| PIN NO | SYMBOL | FUNCTION |
|--------|--------|--------------------------------|
| 1 | A | Power Supply For LED Backlight |
| 2 | K | GND |

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Q.A.:
JK

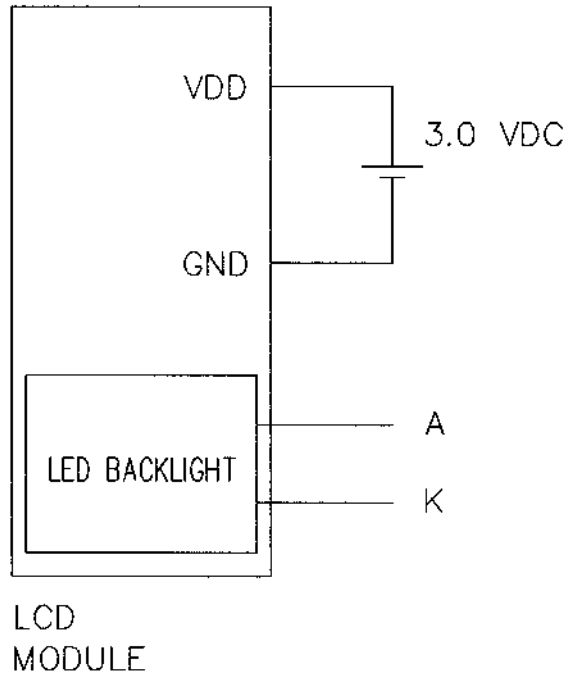
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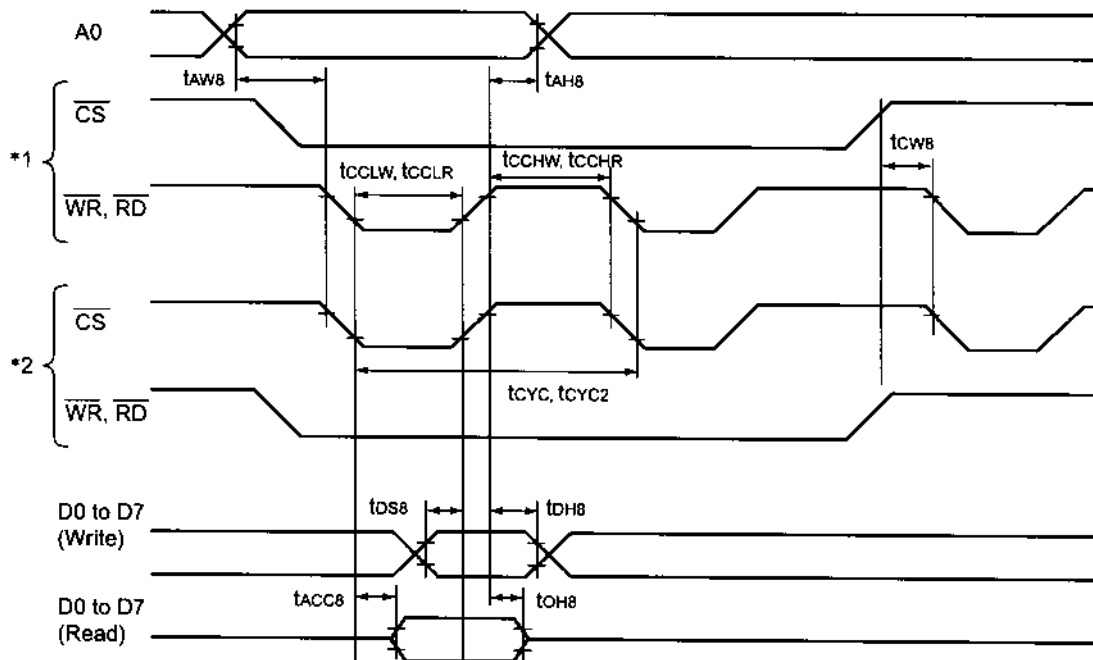
DATE:
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7. POWER SUPPLY



| | | | | |
|---|-------|-------|-------------------|------------------|
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8. TIMING CHARACTERISTICS



*1 is when access is made with \overline{WR} and \overline{RD} when \overline{CS} is LOW.
 *2 is when access is made with CS when \overline{WR} and \overline{RD} are LOW.

Ta= -40 to +85°C, VDD=2.6 to 3.6V, VDDI=2.6 to VDD

| Signal | Symbol | Parameter | Min. | Max. | Unit | Measuring conditions and others |
|---|--------|--|------|------|------|---------------------------------|
| A0 | tAH8 | Address hold time | 10 | - | ns | - |
| | tAW8 | Address setup time | 0 | - | ns | - |
| \overline{WR} , \overline{RD} , CS | tCYC | Write cycle | 130 | - | ns | - |
| | tCYC2 | Read cycle | 250 | - | ns | - |
| | tCCHW | Control pulse HIGH width (write) | 90 | - | ns | - |
| | tCCHR | Control pulse HIGH width (read) | 70 | - | ns | - |
| | tCCLW | Control pulse LOW width (write) | 30 | - | ns | - |
| | tCCLR | Control pulse LOW width (read) | 170 | - | ns | - |
| | tcw8 | \overline{CS} - \overline{WR} , \overline{RD} time | 30 | - | ns | - |
| D0 to D7 | tDS8 | Data setup time | 10 | - | ns | - |
| | tDH8 | Data hold time | 20 | - | ns | - |
| | tACC8 | Read access time | - | 170 | ns | CL=10 to 100pF |
| | tOH8 | Output disable time | 5 | 60 | ns | - |

* Rise and fall time of input signal (t_r , t_f) must be 15 ns maximum.
 * All timings must be specified using 30% and 70% of VDD-GND as the reference.
 * tCCLW and tCCLR are specified by the duration during which CS as well as \overline{WR} and \overline{RD} are LOW.
 * A0 timing is specified by the duration during which CS as well as \overline{WR} and \overline{RD} are LOW.

8-2. DISPLAY SEQUENCE

| | | | | | | |
|----|----|----|----|----|----|----|
| | Y1 | | | Y2 | | |
| X1 | R1 | G1 | B1 | R2 | G2 | B2 |
| X2 | R1 | G1 | B1 | R2 | G2 | B2 |

| | | | | | | |
|--|------|------|------|------|------|------|
| | Y119 | | | Y120 | | |
| | R119 | G119 | B119 | R120 | G120 | B120 |
| | R119 | G119 | B119 | R120 | G120 | B120 |

| | | | | | | |
|------|----|----|----|----|----|----|
| X159 | R1 | G1 | B1 | R2 | G2 | B2 |
| X160 | R1 | G1 | B1 | R2 | G2 | B2 |

| | | | | | |
|------|------|------|------|------|------|
| R119 | G119 | B119 | R120 | G120 | B120 |
| R119 | G119 | B119 | R120 | G120 | B120 |

9. RELIABILITY TEST

| NO | ITEM | CONDITION | | | STANDARD | NOTE |
|----|-------------------------------|---|-------|--|---------------------------|----------|
| 1 | High Temp. Storage | 70°C | 120HR | | Appearance without defect | |
| 2 | Low Temp. Storage | -25°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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NOTICE:

• 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 ketonics solvent & Aromatic solvent, use with a soft cloth soaked with a cleaning naphtha solvent.

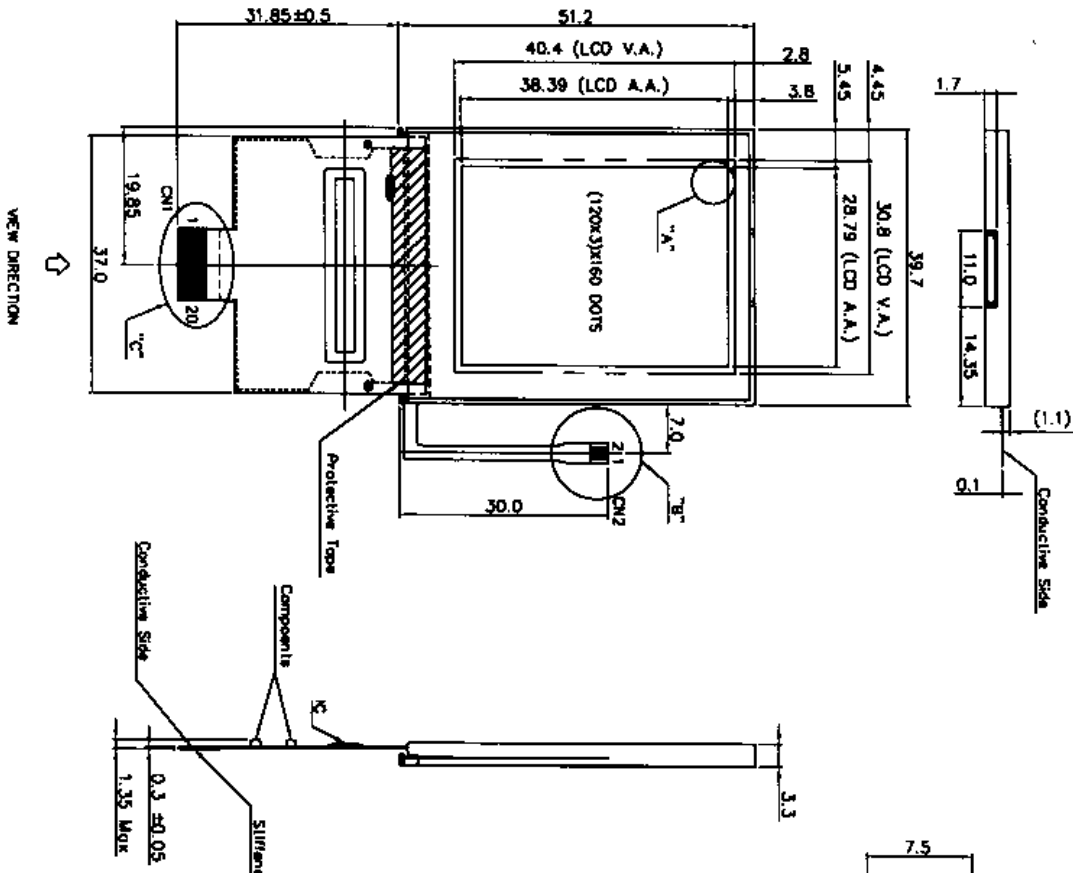
• STORAGE

- 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.

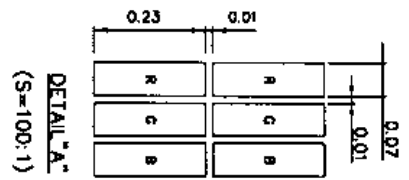
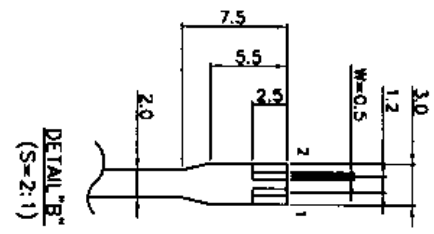
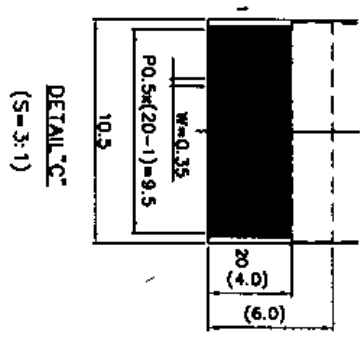
• TERMS OF WARRANT

- 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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- Notes :
1. Resolution : (120X3)X160 DOTS
 2. Controller IC: Epson S4E15004002 (S1D15G00)
 3. Backlight : LED (White)



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