

SPECIFICATION

For

EG7500B-LS

This specification consists of two documents as follows.

- 1. LCD Specification SC-010009000
- 2. LCD QA Standard M4-00100

| | |
|------------------------|--|
| Customer's Approval | |
| Date _____ By _____ | Date <u>Feb. 16 '93</u> Presented by <i>Y. Katayama</i> <i>Y. Takai</i> <i>M. Nakamura</i> Y. Katayama GM QA dep. |
| | SEIKO EPSON CORP. LCD DIV. Quality assurance Dep. |

Spec Code

S C - 010009000

S P E C I F I C A T I O N S

E G 7 5 0 0 B - L S

| Item No | Item | Sheet Code |
|---------|----------------------------|----------------------|
| 1 | Basic Specification | 1 1 - 010009000 |
| | | 1 2 - 32020000 |
| | Outline Dimensions | 1 3 - 14200000 |
| | | SD - 0 1 0 2 9 1 - B |
| 2 | Absolute Maximum Ratings | 2 1 - C0000018 |
| 3 | Electrical Characteristics | 3 1 - 010009000 |
| | | 3 2 - C0000002-A |
| | | 3 3 - C0000002-A |
| | | 3 4 - 32020000-A |
| | | 3 5 - 32020001 |
| 4 | Optical Characteristics | 4 1 - BE648L02 |
| | | 4 2 - EC000000 |
| | | 4 3 - N0000000 |
| | | 4 4 - N0000000 |
| 5 | Reliability | 5 1 - S0000003 |
| | | 5 2 - S0000000 |
| 6 | Package Specifications | 6 1 - 010009000 |
| | | 6 2 - 010009000 |
| 8 | Handling Precautions | B - TCMN0004(1~4) |
| 9 | Revision Record | 0 0 - 010009000 |

S E I K O E P S O N C O R P O R A T I O N
L C D D I V I S I O N

LD DESIGN Dep.

K. Uchiyoshi
Kense

H. Kobayashi
H. Kobayashi

M. Yoshida
M. Yoshida

I. Basic Specifications

1-1 Display Specifications

- (1) STN Mode Negative Display type ~~Transmissive Model~~
- (2) Display Color
 - Display Color : Display Data"1" : White
 - Background Color : Display Data"0" : Blue
- (3) Viewing Angle : 6 O'clock direction
- (4) Driving Duty : 1/200 Duty
- (5) Backlight : CCFT Backlight

*1) Color tone is slightly changed by temperature and driving voltage.

1-2 Mechanical Specifications

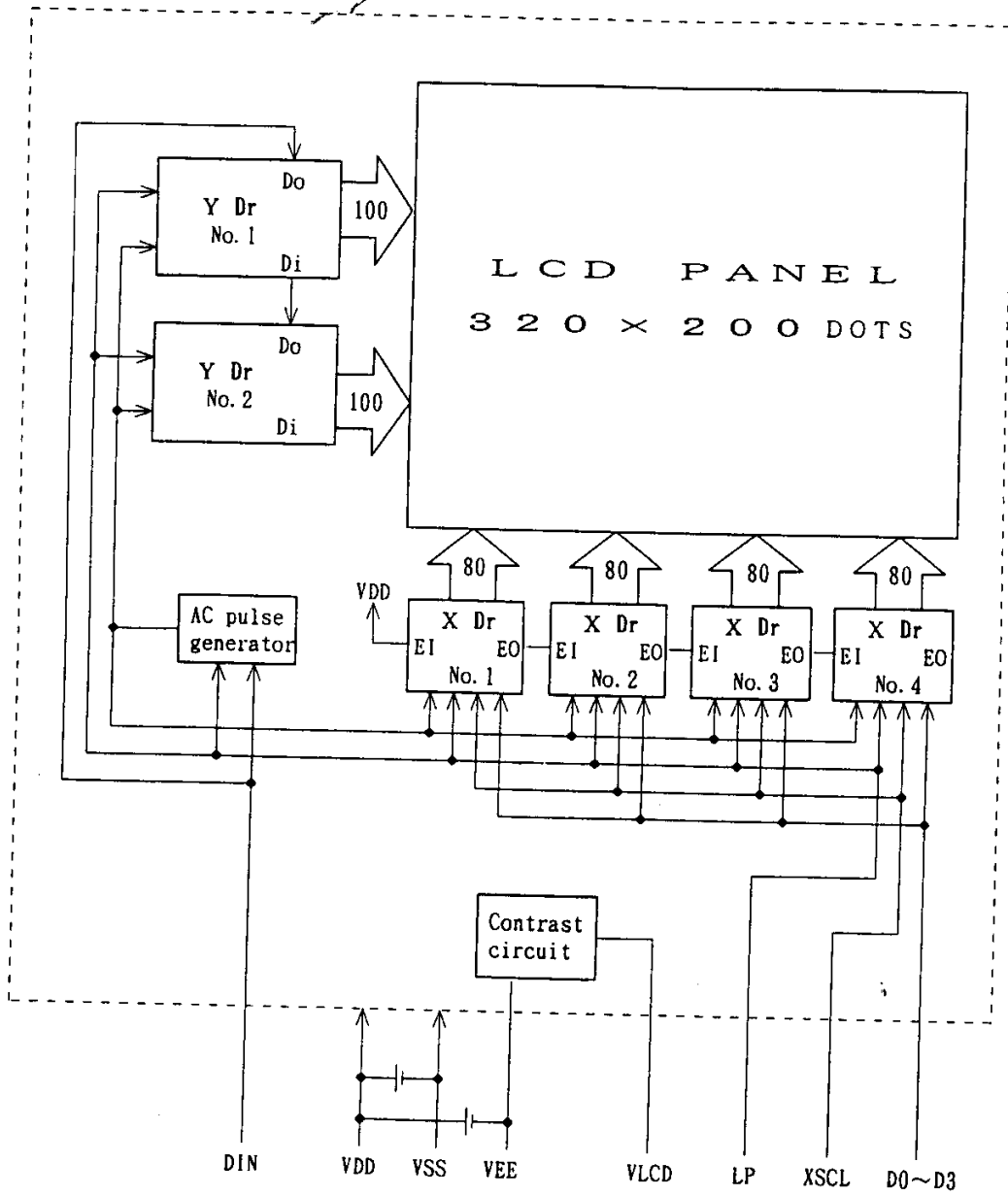
- (1) Outline Dimensions : Refer to attached Outline Dimensions figure SD-010291-B
- (2) Dot Matrix : 320 dots × 200 dots
- (3) Dot Size : 0.34 (W) × 0.48 (H) (mm)
- (4) Dot Pitch : 0.38 (W) × 0.52 (H) (mm)
- (5) Weight : 460 g (Approx.)

SEIKO EPSON CORPORATION

Sheet
Code

11-01009000

1-3 Block Diagram



SEIKO EPSON CORPORATION

Sheet
Code

12-32020000

1-4 Terminal Functions

(1) LCD

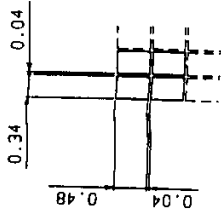
| Pin No. | Symbol | Function |
|---------|--------|--------------------------------|
| 1 | VDD | Power Supply for Logic |
| 2 | VSS | Ground |
| 3 | VEE | Power Supply for LCD |
| 4 | VLCD | Power Supply for LCD |
| 5 | NC | No Connection |
| 6 | LP | Latch Pulse Signal Input |
| 7 | NC | No Connection |
| 8 | NC | No Connection |
| 9 | DIN | Scan Start Pulse Input |
| 10 | XSC L | Display Data Shift Clock Input |
| 11 | D0 | Display Data Input |
| 12 | D1 | |
| 13 | D2 | |
| 14 | D3 | |

(2) INVERTER

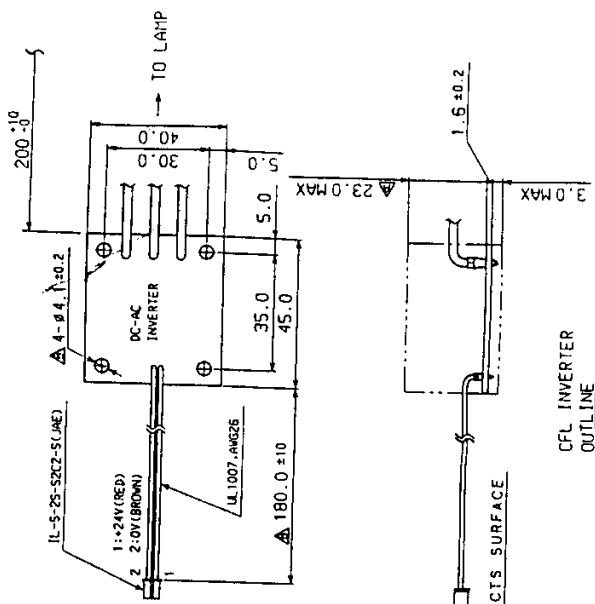
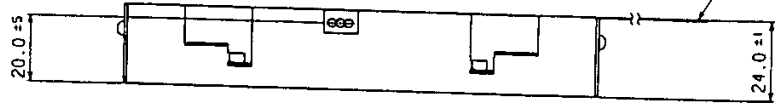
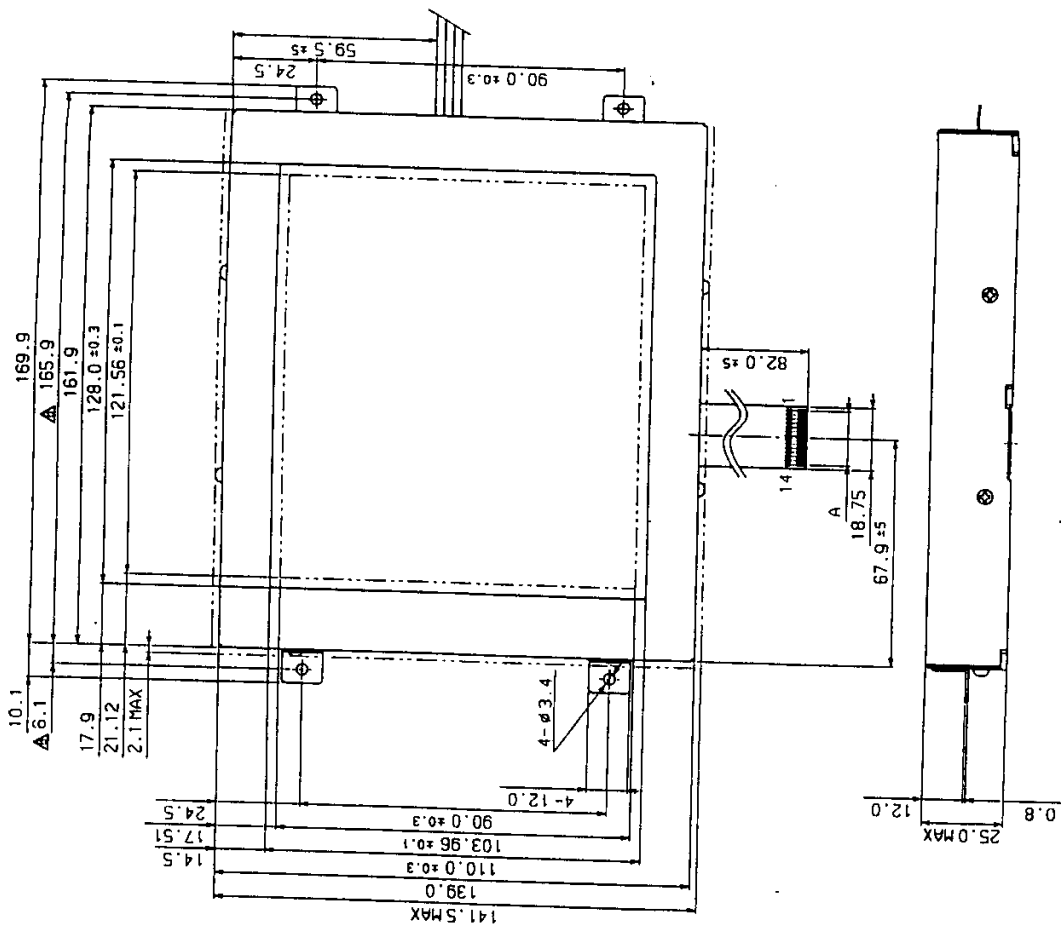
Model : IL-S-2S-S2C2-S (JAE)
 Applicable Connector : IL-S-2P-S2*2-EF (*=T or L) (JAE)

| Pin No. | Symbol | Function |
|---------|--------|---------------------------|
| 1 | VINV | Power Supply for INVERTER |
| 2 | GINV | Ground for INVERTER |

| PIN NO | SIGNAL |
|--------|--------|
| 1 | VDD |
| 2 | VSS |
| 3 | VFE |
| 4 | VLED |
| 5 | -- |
| 6 | LP |
| 7 | -- |
| 8 | -- |
| 9 | DTN |
| 10 | XSCI |
| 11 | DO |
| 12 | DI |
| 13 | D2 |
| 14 | D3 |



DOT DETAIL: 20/1



| REV | DATE | BY | CHK |
|-----|------|----|-----|
| 1 | | | |
| 2 | | | |
| 3 | | | |
| 4 | | | |
| 5 | | | |
| 6 | | | |
| 7 | | | |
| 8 | | | |
| 9 | | | |
| 10 | | | |
| 11 | | | |
| 12 | | | |
| 13 | | | |
| 14 | | | |

- NOTES
- DO NOT SCALE THIS DWG.
 - LCD: 320x200 DOTS.
 - A: PITCH 1.25 ± 0.1 x (14-1) = 16.25 ± 0.2.
 - CONNECTOR: SWCD-14X86-ESX 10-P1. 25-56 ± 2.5-N(SUMITOMO) or Equivalent

EG7500* - #5
 OUTWARD DWG.
 SD-010291-B
 1/21 mm ± 0.5 JUL 4 88

2. Absolute Maximum Ratings

| Item | Symbol | Standard Value | Unit | Condition |
|-----------------------------------|-----------------------------------|--|------|-----------------|
| Power Supply Voltage | V _{DD} - V _{SS} | 0 ~ +7.0 | V | |
| | V _{DD} - V _{EE} | 0 ~ +28.0 | | |
| LCD Driving Voltage | V _{LCD} | V _{EE} ≤ V _{LCD} ≤ V _{DD} | | |
| Input Voltage | V _{IN} | V _{SS} ≤ V _{IN} ≤ V _{DD} | | |
| Power Supply Voltage for INVERTER | V _{INV} | 0 ~ +30.0 | | |
| Operating Temperature Range | T _{OP} | 0 ~ +40 | °C | No Condensation |
| Storage Temperature Range | T _{ST} | -20 ~ +60 | | |

SEIKO EPSON CORPORATION

Sheet
Code

21-C000018

3. Electrical Characteristics

3-1 DC Characteristics

(1) Module DC Characteristics

Ta = 0 ~ 40°C, VDD = 5V ± 5%

| Item | Symbol | Standard Value | | | Unit | Applicable Terminal | Condition |
|----------------------|----------|--------------------------------------|-----|--------|------|----------------------------|-----------|
| | | MIN | TYP | MAX | | | |
| Power Supply Voltage | VDD | 4.75 | 5.0 | 5.25 | V | VDD | |
| | VDD-VLCD | Depending on Optical Characteristics | | | | VLCD | |
| "0" Input Voltage | VIL | 0 | - | 0.2VDD | V | LP DIN XSCL D0~D3 | |
| "1" Input Voltage | VIH | 0.8VDD | - | VDD | | | |
| I/O Leak Current | IL | - | - | 20 | | | |
| Power Supply Current | IDD | - | 5.3 | 13.5 | mA | VDD | |
| | IEE | - | 3.0 | 8.0 | | VEE | |

*1) VLCD=-17V, Frame Frequency=75Hz

(2) Backlight Electric Characteristics

Ta = 0 ~ 40°C

| Item | Symbol | Standard Value | | | Unit | Condition |
|----------------------------|--------|----------------|-----|------|------|-----------|
| | | MIN | TYP | MAX | | |
| Input Voltage for Inverter | VINV | 21.6 | 24 | 26.4 | V | |
| Input Current for Inverter | IINV | - | - | 0.22 | A | VINV=24V |
| Tube Current | IT | - | 4 | - | mA | |
| Tube Voltage | VT | - | 320 | - | Vrms | |

*1) The life of half brightness is 10,000 hours with continuous lighting of tube current 4.0mA.

SEIKO EPSON CORPORATION

Sheet
Code

31-010009000

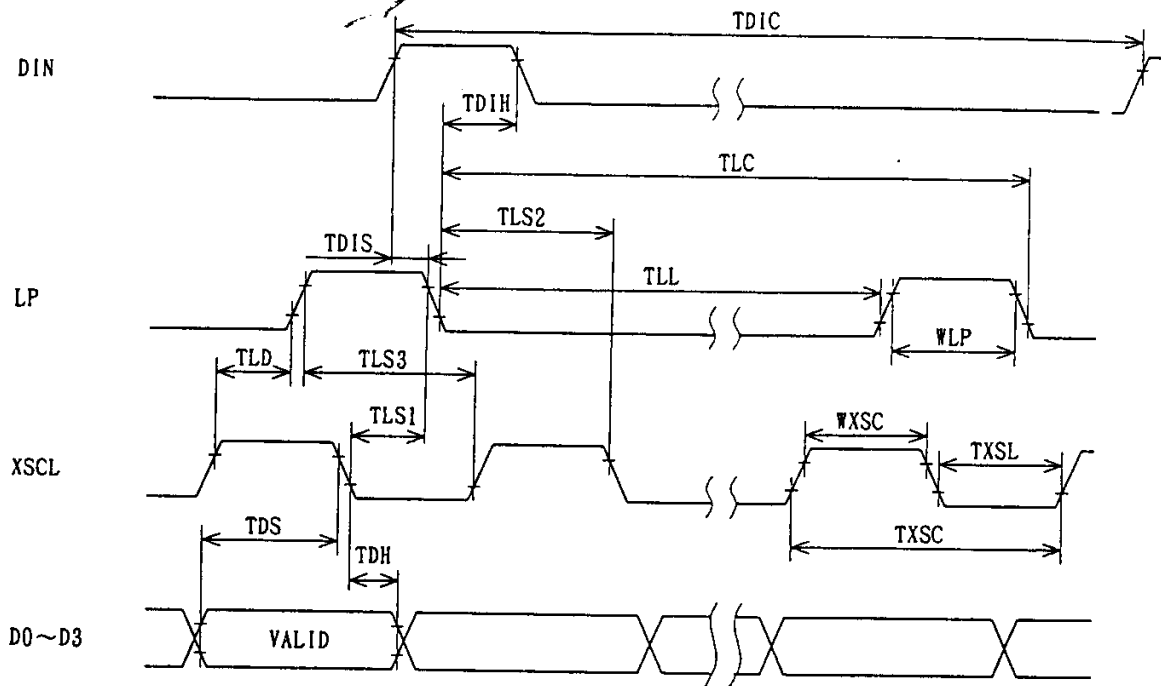
3-2 AC Characteristics

VDD = 5 V ± 5 %

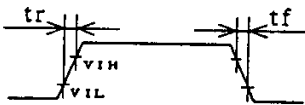
| Item | Symbol | Standard Value | | | Unit | Condition |
|---------------------------|--------|----------------|------|------|------|-----------|
| | | MIN | TYP | MAX | | |
| DIN Cycle | TDIC | 12 | 13.0 | 15.0 | nsec | |
| LP Cycle | TLC | 500 | | | nsec | |
| XSC L Cycle | TXSC | 166 | — | — | nsec | |
| LP "L" Time | TLL | 330 | — | — | nsec | |
| LP Pulse Width | WLP | 70 | — | — | nsec | |
| XSC L "L" Time | TXSL | 70 | — | — | nsec | |
| XSC L Pulse Width | WXSC | 70 | — | — | nsec | |
| Latch Timing | TLS1 | 70 | — | — | nsec | |
| | TLS2 | 70 | — | — | | |
| | TLS3 | 70 | — | — | | |
| | TLD | 0 | — | — | | |
| Data Setup Time | TDS | 60 | — | — | nsec | |
| Data Hold Time | TDH | 40 | — | — | nsec | |
| DIN Setup Time | TDIS | 100 | — | — | nsec | |
| DIN Hold Time | TDIH | 10 | — | — | nsec | |
| Input Wave Form Rise Time | tr | — | — | ※1 | nsec | |
| Input Wave Form Fall Time | tf | — | — | ※1 | nsec | |

*1) $\frac{TXSC - TXSL - WXSC}{2}$ with 50 nsec MAX

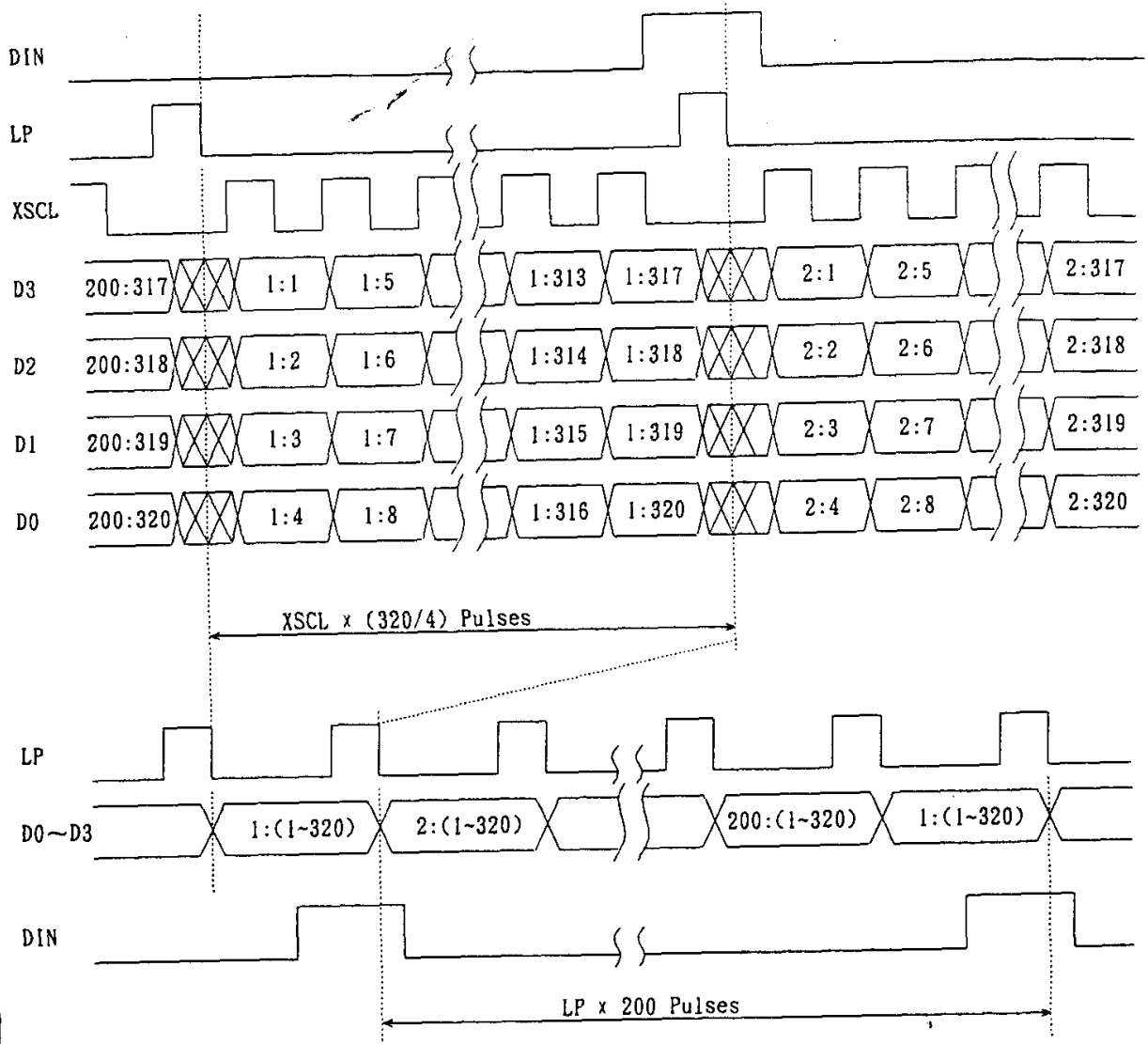
3-3 Timing Chart 1



Input Wave Form



3-4 Timing Chart 2



3-5 Relation between Data and Display

| | | | | | | | | |
|--------|--------|--------|--------|--|---------|---------|---------|---------|
| 1: 1 | 1: 2 | 1: 3 | 1: 4 | | 1:317 | 1:318 | 1:319 | 1:320 |
| 2: 1 | 2: 2 | 2: 3 | . | | . | 2:318 | 2:319 | 2:320 |
| 3: 1 | 3: 2 | . | . | | . | . | 3:319 | 3:320 |
| 4: 1 | . | . | . | | . | . | . | 4:320 |
| | | | | | | | | |
| 197: 1 | . | . | . | | . | . | . | 197:320 |
| 198: 1 | 198: 2 | . | . | | . | . | 198:319 | 198:320 |
| 199: 1 | 199: 2 | 199: 3 | . | | . | 199:318 | 199:319 | 199:320 |
| 200: 1 | 200: 2 | 200: 3 | 200: 4 | | 200:317 | 200:318 | 200:319 | 200:320 |

4. Optical Characteristics

4-1 Optical Characteristics

f FR = 7.5 Hz

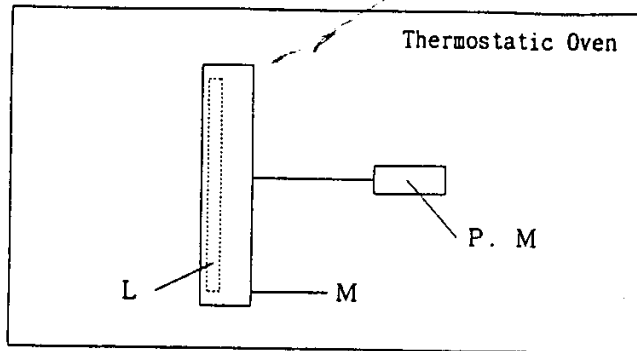
| Item | Symbol | Temp (°C) | Standard Value | | | Unit | Condition |
|--------------------------|-------------|-----------|----------------|------|------|-------------------|------------|
| | | | MIN | TYP | MAX | | |
| Driving Voltage | VOP *1 | 0 | - | 23.6 | 24.3 | V | |
| | | 25 | - | 21.8 | - | | |
| | | 40 | 19.3 | 19.9 | - | | |
| Response Time | Tr | 0 | - | 350 | 530 | ms | |
| | | 25 | - | 200 | 350 | | |
| | Tf | 0 | - | 950 | 1400 | | |
| | | 25 | - | 350 | 530 | | |
| Recommended Viewing Area | $\theta Y1$ | 25 | 20 | - | - | Deg | K \geq 2 |
| | $\theta Y2$ | | 20 | - | - | | |
| | $\theta X1$ | | 30 | - | - | | |
| | $\theta X2$ | | 30 | - | - | | |
| Contrast Ratio | K | 25 | - | 4 | - | | |
| Brightness *2 | B | 25 | 400 | 600 | - | cd/m ² | IT = 4.0mA |

*1) Vop=LCD Driving Voltage getting maximum contrast
=VDD-VLCD

*2) Initial values on the Center of the Backlight Diffuser

4-2 Definition of Optical Characteristics

(1) Optical Measuring Equipment



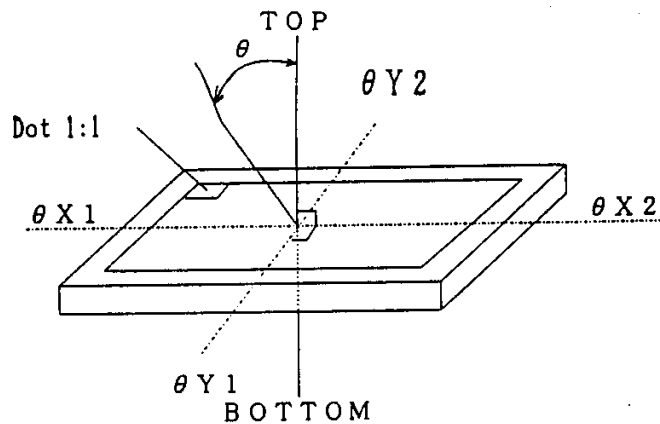
- L : Built-in Backlight
- P. M : Lighting Sensor
- M : Module

[Specification of Equipments and Measuring Condition]

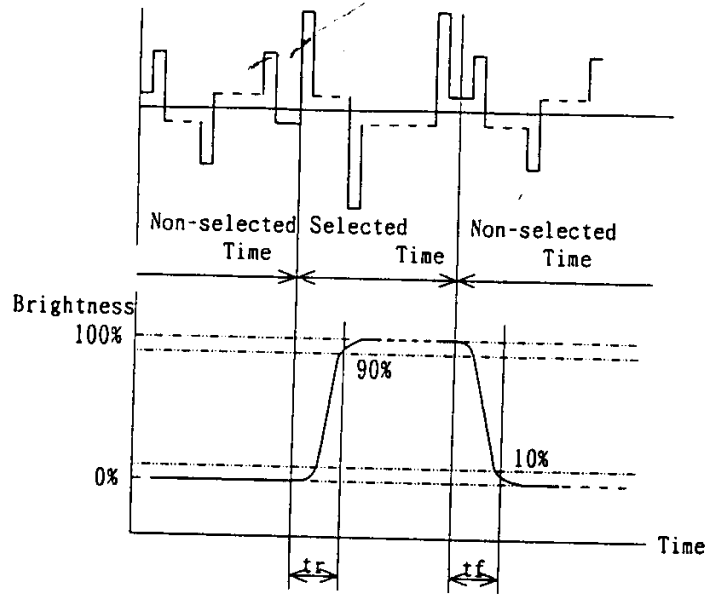
Luxmeter : Canon LC-3S
Brightness Measurement Spot Diameter $\phi 2\text{mm}$

Lighting Source : Built-in Backlight
Tube Current : The Typical Value specified
at "3-1 DC Characteristics".

(2) Definition of Viewing Angle



(3) Definition of Response Time

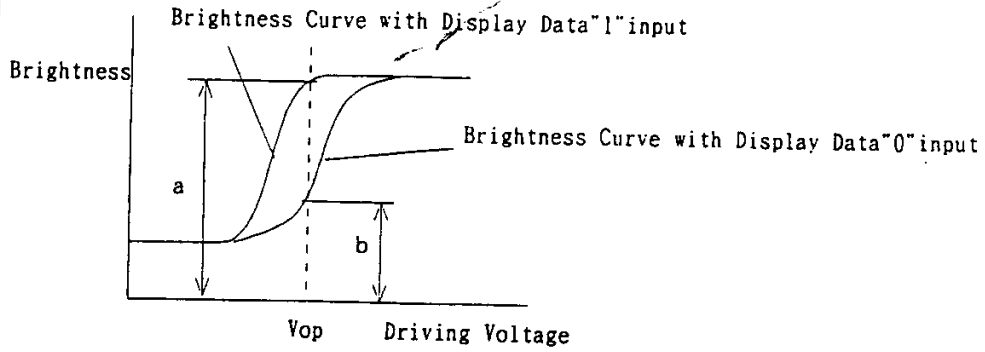


[Measuring Condition]

V_{op} = TYP. value at Operating Temperature

$\theta X = \theta Y = 0^\circ$

(4) Definition of Contrast Ratio



$$\text{Contrast Ratio} = \frac{\text{Brightness Curve with Display Data "1" input } a}{\text{Brightness Curve with Display Data "0" input } b}$$

[Measuring Condition]

V_{op} = TYP. value at Operating Temperature
 $\theta X = \theta Y = 0^\circ$

5. Reliability

5-1 Content of Reliability Test

| Environmental Test | | | | |
|--------------------|-------------------------------------|---|---|--|
| No | Test Item | Content of Test | Test Condition | Applicable standard |
| 1 | High temperature storage | Endurance test applying the high storage temperature for a long time. | 60 °C 200 H | — |
| 2 | Low temperature storage | Endurance test applying the low storage temperature for a long time. | -20 °C 200 H | — |
| 3 | High temperature Operation | Endurance test applying the electric stress (Voltage & Current) and the thermal stress to the element for a long time. | 40 °C 200 H | — |
| 4 | Low temperature operation | Endurance test applying the electric stress under low temperature for a long time. | 0 °C 200 H | — |
| 5 | High temperature/humidity storage | Endurance test applying the high temperature and high humidity storage for a long time. | 60 °C 90 %RH 96 H | MIL-202E-103B JIS-C5023 |
| 6 | High temperature/humidity operation | Endurance test applying the electric stress (Voltage & Current) and temperature/humidity stress to the element for a long time. | 40 °C 90 %RH 96 H | MIL-202E-103B JIS-C5023 |
| 7 | Temperature cycle | Endurance test applying the low and high temperature cycle. -20°C ↔ 25°C ↔ 60°C ↔ 25°C 30min. 5min. 30min. 5min. ← 1 cycle → | -20°C/60°C 10 cycle | — |
| Mechanical Test | | | | |
| 8 | Vibration test | Endurance test applying the vibration during transportation and using. | 10~22Hz → 1.5mm-p 22~500Hz → 1.5G Total 0.5H | MIL-202E-201A JIS-C5025 JIS-C7022-A-10 |
| 9 | Shock test | Constructional and mechanical endurance test applying the shock during transportation. | 50G Half sign wave 11msec 3 times of each direction | MIL-202E-213B |
| 10 | Atmospheric pressure test | Endurance test applying the atmospheric pressure during transportation by airl. | 115 mbar 40 H | MIL-202E-105C |
| Others | | | | |
| 11 | Static electricity test | Endurance test applying the electric stress to the terminal. | VS = 800 v RS = 1.5 kΩ CS = 100 PF 1 time | MIL-883B-3015.1 |

*1) Driving condition for operation test
 Power supply voltage for Logic system = 5V
 Power supply voltage for LCD system = Rating voltage at 25°C

SEIKO EPSON CORPORATION

Sheet Code 51-S0000003

5-2 Failure Judgement Criterion

| Criterriion Item | Test Item No. | | | | | | | | | | | Failure Judgment Criterion | |
|---------------------------|---------------|---|---|---|---|---|---|---|---|----|----|----------------------------|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | | |
| Basic Specification | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | Out of the Basic Specification |
| Electrical characteristic | ○ | | ○ | ○ | ○ | ○ | | | | | | ○ | Out of the DC and AC Characteristic |
| Mechanical characteristic | | | | | | ○ | ○ | ○ | ○ | | | | Out of the Mechanical Specification Color change : Out of Limit Apperance Specification |
| Optical characteristic | ○ | ○ | ○ | ○ | ○ | ○ | ○ | | | | ○ | ○ | Out of the Apperance Standard |

6. Package Specifications

6-1 Inner Carton Box

Each LCD module is wrapped with a antistatic pouch, and put into the inner carton box for containing 10 pcs of LCD module.

The following contents should be indicated on the carton box.

TYPE : EG7500B-LS
Q' TY : 10 pcs
Lot : Lot No.
EPSON : SEIKO EPSON CORP
DISPLAY DIVISION

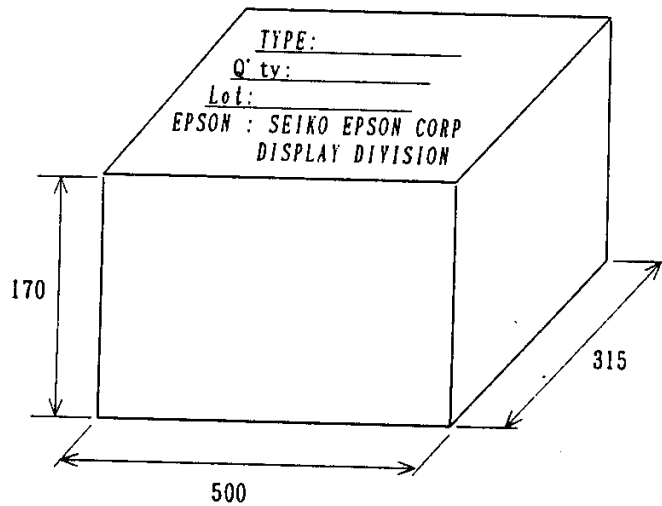


Fig.1 Outline Dimensions of Inner Carton BOX

SEIKO EPSON CORPORATION

Sheet
Code

61-010009000

6-2 Master Carton Box

The master carton box is for sending to each user.
 The master carton box contains 2 pcs of inner carton box.
 The indications are applied to four faces A, B, C and D of the master carton as shown Fig. 1 below.

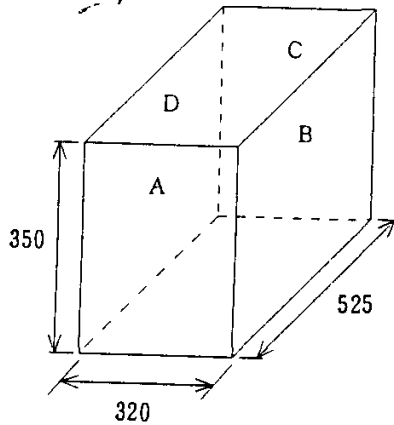


Fig. 1 Outline dimensions of Master Carton Box

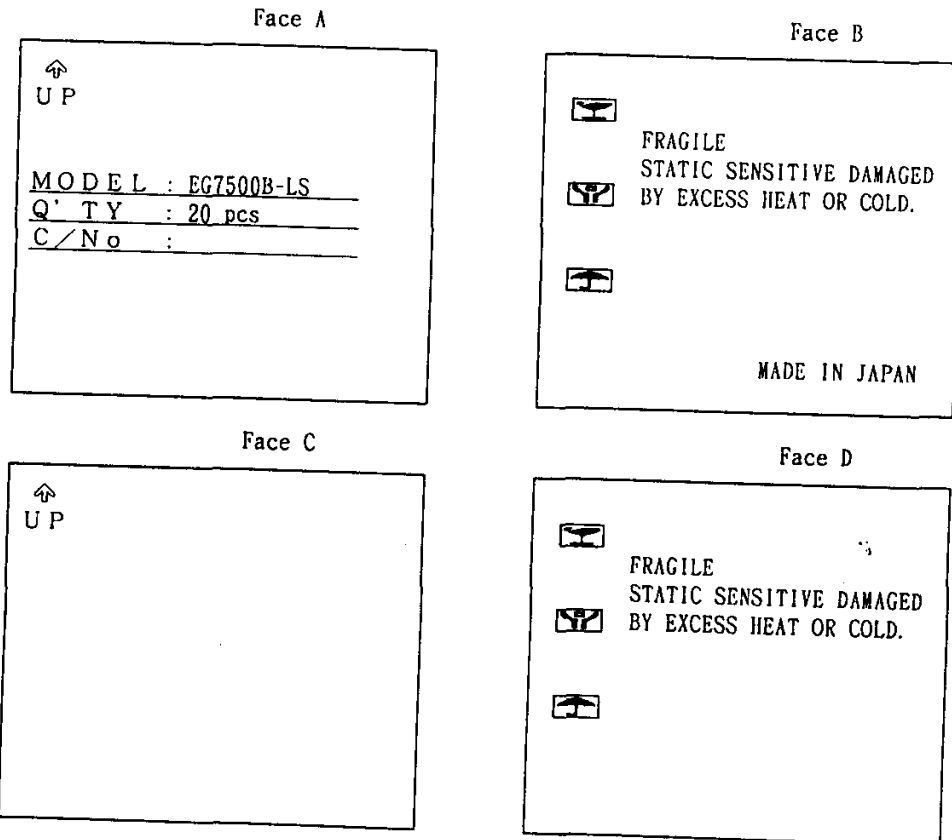


Fig. 2 Contents of Indication for Master Carton Box

SEIKO EPSON CORPORATION

Sheet Code 62-010009000

Precautions for use of LCD Modules

<Handling Precautions>

- The display panel is made of glass. Do not subject it to a mechanical shock by dropping it from a high place, etc.
- If the display panel is damaged and the liquid crystal substance inside it leaks out, be sure not to get any in your mouth. If the substance comes into contact with your skin or clothes, promptly wash it off using soap and water.
- Do not apply excessive force to the display surface or the adjoining areas since this may cause the color tone to vary.
- The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarizer carefully.
- If the display surface becomes contaminated, breathe on the surface and gently wipe it with a soft dry cloth. If it is heavily contaminated, moisten cloth with one of the following solvents.

- Isopropyl alcohol
- Ethyl alcohol

Solvents other than those mentioned above may damage the polarizer. Especially, do not use the following.

- Water
- Ketone
- Aromatic solvents

- Exercise care to minimize corrosion of the electrode. Corrosion of the electrodes is accelerated by water droplets, moisture condensation or a current flow in a high-humidity environment.
- Install the LCD Module by using the mounting holes. When mounting the LCD Module make sure that it is free of twisting, warping, and distortion. In particular, do not forcibly pull or bend the I/O cable or the backlight cable.
- Do not attempt to disassemble or process the LCD Module.
- NC terminal should be open. Do not connect anything.
- If the logic circuit power is off, do not apply the input signals.

SEIKO EPSON CORPORATION

Sheet
Code

B-TCMN0004(1)

- To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.
 - Be sure to ground the body when handling the LCD Modules.
 - Tools required for assembly, such as soldering irons, must be properly grounded.
 - To reduce the amount of static electricity generated, do not conduct assembly and other work under dry conditions.
 - The LCD Module is coated with a film to protect the display surface. Exercise care when peeling off this protective film since static electricity may be generated.
- Do not apply pressure to CCFT section at the rear of the module. Excessive pressure may damage CCFT.

<Storage Precautions>

- When storing the LCD Modules, avoid exposure to direct sunlight or to the light of fluorescent lamps. Keep the modules in bags designed to prevent static electricity charging under low temperature/normal humidity conditions (avoid high temperature/high humidity and low temperatures below 0 °C). Whenever possible, the LCD Modules should be stored in the same conditions in which they were shipped from our company.

<Design Precautions>

- The absolute maximum ratings represents the rated value beyond which LCD Modules cannot exceed. When the LCD Modules are used in excess of this rated value, their operating characteristics may be adversely affected.
- To prevent the occurrence of erroneous operation caused by noise, attention must be paid to satisfy VII, VIII, and the other specification values, including taking the precaution of using signal cables that are short.
- The liquid crystal display exhibits temperature dependency characteristics. Since recognition of the display becomes difficult when the LCD is used outside its designated operating temperature range, be sure to use the LCD within this range. Also, keep in mind that the voltage levels necessary for clear displays (VLCD or VDDII) will vary according to temperature.
- If DC is impressed on the liquid crystal display panel, display definition is rapidly deteriorated by the electrochemical reaction that occurs inside the liquid crystal panel. To eliminate the opportunity of DC impressing, be sure to maintain the AC characteristics of the input signals sent to the LCD Module (especially, LP, DIN, and FR).

SEIKO EPSON CORPORATION

Sheet
Code

B-TCMN0004(2)

- When turning the power supply ON/OFF, strictly follow the sequence shown in Fig.1 so that latch-up and DC driving of the LCD Module can be prevented.

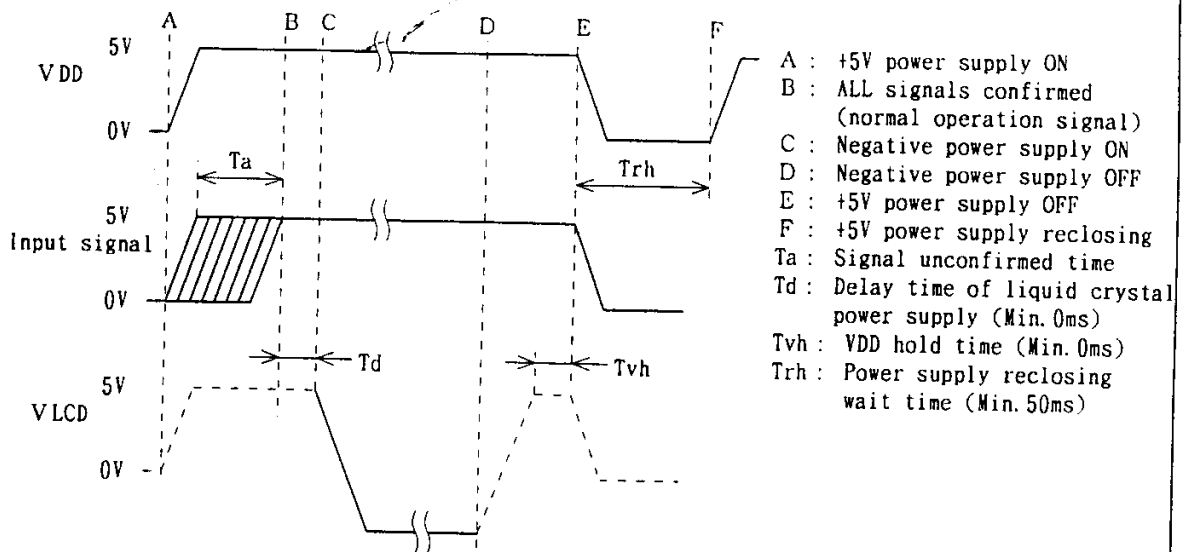


Fig.1 Power supply ON/OFF sequence

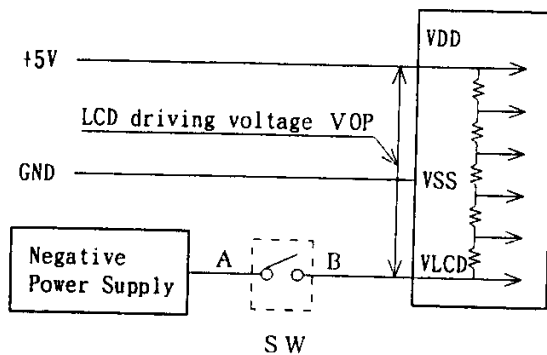


Fig.2 Example of power supply connection

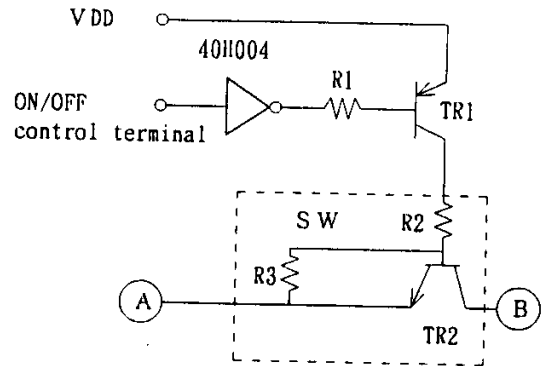


Fig.3 Example of SW section circuit

- Fig.1 shows the voltage levels at the module terminal section when the module is connected to a power supply and signal lines.
- Regarding VLCD in Fig.1, the dashed line shows the OFF status of SW in Fig.2, while the solid line indicates the ON status.
- Prepare the negative power supply shown in Fig.2 with a capacity that is at least sufficient to handle the current of the liquid crystal power supply in DC characteristics.
- Fig.3 provides an example of the circuit for SW section in Fig.2.

<Others>

- Liquid crystals solidify under low temperatures (below the storage temperature range) leading to defective orientation or the generation of air bubbles (black or white). Air bubbles may also be generated if the module is subjected to a strong shock at a low temperature.
- If the LCD Modules have been operating for a long time showing the same display patterns, the display patterns may remain on the screen as ghost images and a slight contrast irregularity may also appear. A normal operating status can be regained by suspending use for some time.
It should be noted that this phenomenon does not adversely affect performance reliability.
- Cold cathode fluorescent tube (CCFT) is used in this LCD Module. Since a small amount of mercury gas is contained by this CCFT, observe applicable regulations when disposing of the CCFT.
- Customers are requested to understand that our company will not be held responsible for any discrepancies that occur in connection with work performed by customers to replace CCFT.
If you intend to use the LCD Modules in a way requiring the replacement of the CCFT, please consult our company in advance.
- To minimize the performance degradation of the LCD Modules resulting from destruction caused by static electricity, etc., exercise care to avoid holding the following sections when handling the modules.
 - Terminal electrode sections

SEIKO EPSON CORPORATION

Sheet
Code

B-TCMN0004(4)

Revision Record

| REV. | Revision Items | Date |
|------|----------------|--------------|
| | New | 1993. 02. 02 |
| A | | |
| B | | |
| C | | |
| D | | |
| E | | |
| F | | |
| G | | |
| H | | |
| I | | |
| J | | |
| K | | |
| L | | |
| M | | |
| N | | |
| P | | |
| Q | | |
| R | | |
| S | | |
| T | | |
| U | | |
| V | | |
| W | | |
| X | | |

SEIKO EPSON CORPORATION

Sheet Code

00-010009000