



SOLOMON

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FOR MESSRS : _____

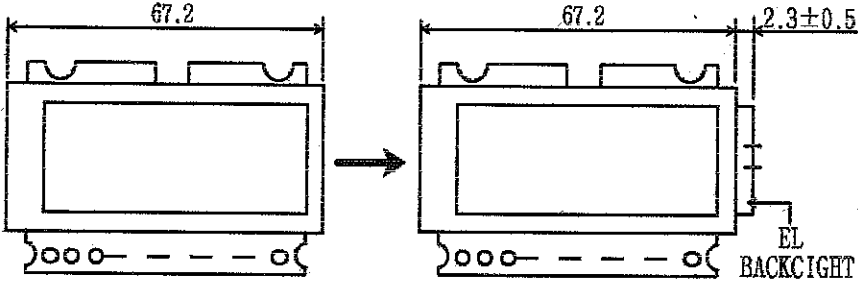
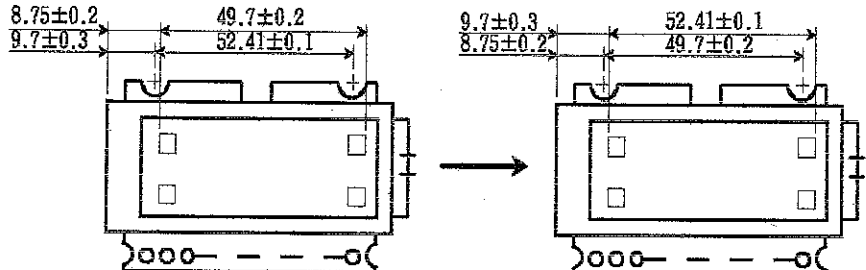
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Accepted by : _____

Proposed by : Bruce Liu.
Mar, 4, 95

RECORD OF REVISION

| DATA | PAGE | SUMMARY |
|----------|----------------|---|
| 84.03.13 | 3 | 3.3 MECHANICAL DATA (2) MODULE SIZE $67.2W * 31.75H * 8.0(MAX)mm$ → $69.5W * 31.75H * 8.0(MAX)mm$ |
| | 9 | 9.1 OUTLINE DIMENSION  |
| | 8 | Change Page 8 |
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| 84.04.20 | 9 | 9.1 OUTLINE DIMENSION  |

3. GENERAL SPECIFICATIONS AND MECHANICAL DATA

3.1 GENERAL SPECIFICATIONS

PLEASE REFER TO :

"CUSTOMER ACCEPTANCE STANDARD SPECIFICATIONS (SP-10-000)."

3.2 THIS INDIVIDUAL SPECIFICATIONS IS PRIOR TO GENERAL SPECIFICATIONS.

3.3 MECHANICAL DATA

- (1) NUMBER OF DOTS - - - - - 122 * 32 DOTS
- (2) MODULE SIZE - - - - - 69.5W * 31.75H * 8.0(MAX)mm
- (3) EFFECTIVE AREA - - - - - 57.2W * 17.2H mm
- (4) ACTIVE AREA - - - - - 52.41W * 14.19H
- (5) DOT SIZE - - - - - 0.38W * 0.38H mm
- (6) DOT PITCH - - - - - 0.43W * 0.43H mm
- (7) VIEWING DIRECTION - - - - - 6 O'CLOCK
- (8) LCD COLOR - - - - - STN-GRAY MONE, TRANSFLECTIVE
- (9) EL COLOR - - - - - WHITE

4. ABSOLUTE MAXIMUM RATINGS

4.1 ELECTRICAL ABSOLUTE MAXIMUM RATINGS

| ITEM | SYMBOL | MIN. | MAX. | UNIT | COMMENT |
|------------------------|---------|------|-------|------|--------------------------|
| POWER SUPPLY FOR LOGIC | VDD-VSS | 0 | 7.0 | V | |
| INPUT VOLTAGE | VI | VSS | VDD | V | |
| STATIC ELECTRICITY | — | — | 100 | V | NOTE (1) |
| POWER SUPPLY FOR EL | VEL | — | AC200 | Vrms | fEL=1.0KHZ 60 SEC.MAX |
| | fEL | — | 2.0 | KHZ | AC115 Vrms 60 SEC.MAX |

NOTE(1) : TEST METHOD AND CONDITIONS AFTER CHARGING UP 200 PF CAPACITOR BY STATED VOLTAGE, THE CAPACITOR IS CONNECTED WITH INTERFACE PINS OF THE MODULE.

4.2 ENVIRONMENTAL ABSOLUTE MAXIMUM RATINGS.

| ITEM | OPERATING | | STORAGE | | COMMENT |
|---------------------|----------------|--------------------------------|----------------|--------------------------------|--|
| | MIN. | MAX. | MIN. | MAX. | |
| AMBIENT TEMPERATURE | 0°C | 40°C | -20°C | 60°C | NOTE (2) |
| HUMIDITY | NOTE (3) | | NOTE (3) | | WITHOUT CONDENSATION |
| VIBRATION | — | 4.9 m/s ² (0.5G) | — | 19.6 m/s ² (2G) | 10~300HZ ZYZ DIRECTIONS 1 Hr EACH |
| SHOCK | — | 29.4 m/s ² (3G) | — | 490.0m/s ² (50G) | 10 mSEC XYZ DIRECTIONS 1 TIME EACH |
| CORROSIVE GAS | NOT ACCEPTABLE | | NOT ACCEPTABLE | | |

NOTE(2) : Ta AT -20°C : 48HR MAX.
60°C : 168HR MAX.

NOTE(3) : Ta ≤ 40°C : 85%RH MAX.

Ta > 40°C : ABSOLUTE HUMIDITY MUST BE LOWER THAN THE
HUMIDITY OF 85%RH AT 40°C. (50% RH AT 50°C)

5. ELECTRICAL CHARACTERISTICS.

| ITEM | SYMBOL | CONDITION | MIN. | TYP. | MAX. | UNIT |
|---|--------------------|---|-------|------|-------|------------------|
| POWER SUPPLY VOLTAGE FOR CIRCUIT | VDD-VSS | ————— | 4.75 | 5.0 | 5.25 | V |
| INPUT VOLTAGE | V _{IH} | H LEVEL | 2.0 | ——— | VDD | V |
| NOTE (2) | V _{IL} | L LEVEL | 0 | ——— | 0.8 | V |
| OUTPUT VOLTAGE | V _{OH} | I _{OH} =-3.0mA | 2.4 | ——— | ————— | V |
| NOTE (1) | V _{OL} | I _{OL} = 3.0mA | ————— | ——— | 0.4 | V |
| POWER SUPPLY CURRENT NOTE (3) | I _{DD} | VDD-VSS=5V | ————— | 1.2 | ————— | mA |
| LCD DISPLAY DUTY RATIO | DUTY | ————— | ————— | 1/32 | ————— | ——— |
| CLOCK OSCILLATION FREQUENCY | f _{OSC} | FOR LCD MODULE | 15 | 18 | 21 | KHZ |
| RECOMMENDED LCD DRIVING VOLTAGE NOTE (4) | VDD-V _O | T _a = 40 °C | ————— | ——— | ————— | V |
| | Φ=10° | T _a = 25 °C | ————— | 9.5 | ————— | V |
| | θ=0° | T _a = 0 °C | ————— | ——— | ————— | V |
| POWER SUPPLY FOR EL | V _{EL} | f _{EL} =400HZ | ————— | 11.5 | ————— | V _{rms} |
| | I _{EL} | V _{EL} =100V f _{EL} =400HZ | ————— | 1.5 | ————— | mA-rms |

NOTE (1) : APPLIED TO TERMINALS DB0 ~ DB7

NOTE (2) : APPLIED TO TERMINALS E , AO , DB0 ~ DB7

NOTE (3) : THE DISPLAY PATTERN IS ALL "ON" , OR ALL "OFF"

NOTE (4) : RECOMMENDED LCD DRIVING VOLTGE MAY FLUCTUATE ABOUT
± 0.5V BY EACH MODULE.

6. OPTICAL CHARACTERISTICS.

Ta=25°C

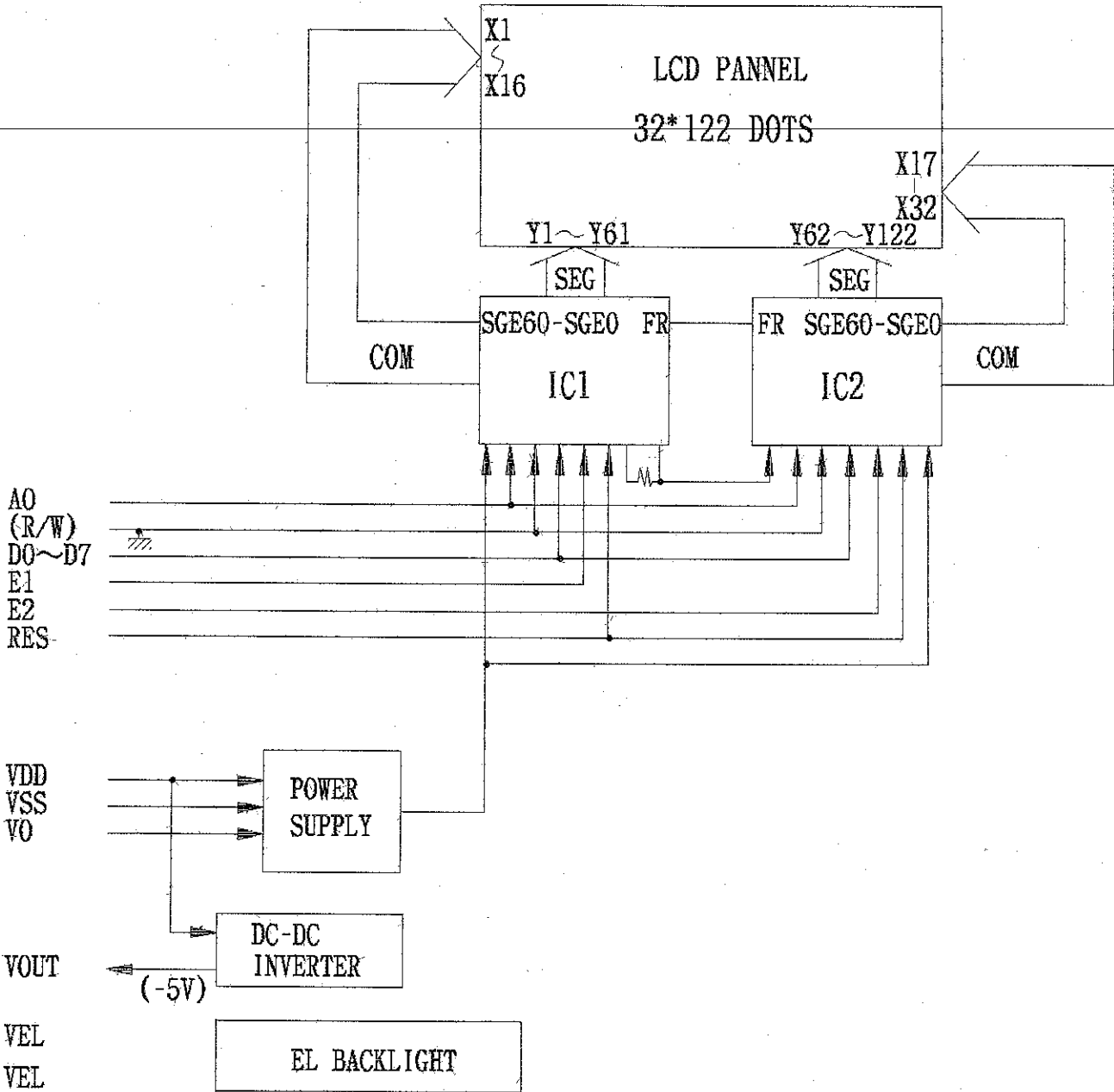
VDD = 5.0 V

| I T E M | SYMBOL | CONDITION | MIN. | TYP. | MAX. | UNIT | NOTE |
|---------------------------|-----------------|---|------|------|------|------|------|
| VIEWING AREA | $\Phi 2-\Phi 1$ | K = 1.4 | 20 | 30 | — | deg. | 1 |
| CONTRAST RATIO | K | $\Phi=10^\circ$ $\theta=0^\circ$ | 1.4 | 3 | — | — | 1 |
| RESPONSE TIME | tr (rise) | $\Phi=10^\circ$ $\theta=0^\circ$ | — | 250 | — | ms | 1 |
| | tf (fall) | $\Phi=10^\circ$ $\theta=0^\circ$ | — | 400 | — | ms | 1 |
| BRIGHTNESS WITH BACKLIGHT | B | (*) $\Phi=0^\circ$ $\theta=0^\circ$ | 4 | — | — | cd/m | 1 |

(* Under normal temperature and humidity in a dark room)

NOTE (1) : SEE CUSTOMER ACCEPTANCE STANDARD SPECIFICATION
FOR DEFINITION OF OPTICAL CHARACTERISTICS

7. BLOCK DIAGRAM

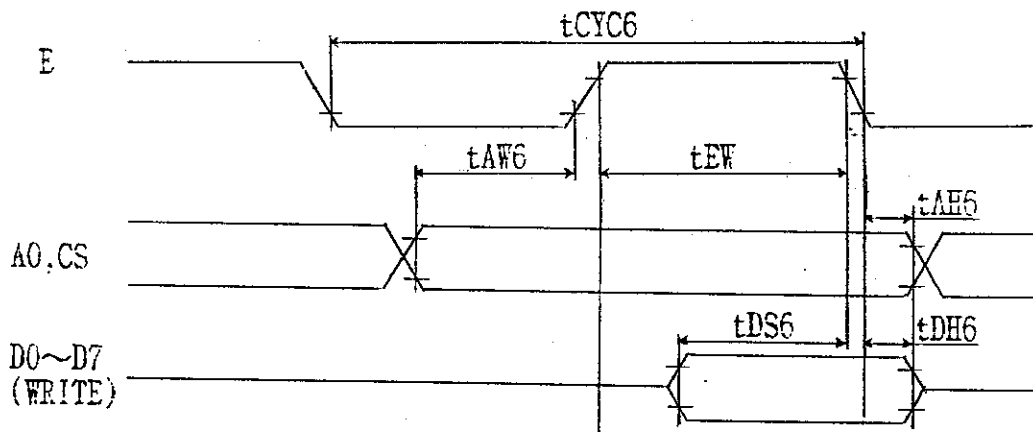


8. TIMING CHARACTERISTICS

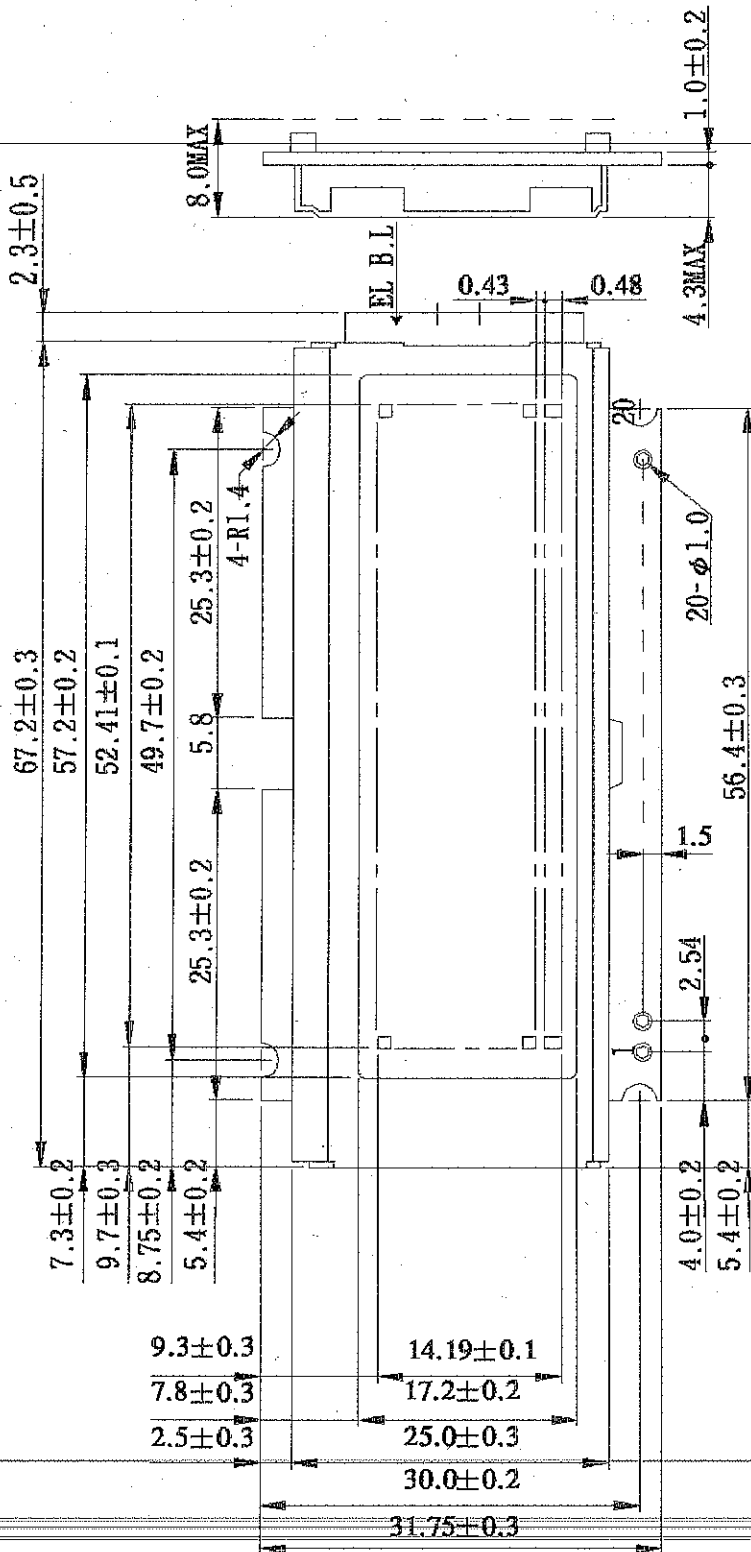
READ/WRITE TIMING FOR THE 68-PORT MPU

Ta=-20°C~75°C, VDD=5.0V±10%

| PARAMETER | | SIGNAL | SYMBOL | CONDITION | MIN. | TYP. | MAX. | UNIT |
|---------------------|-------|--------------|--------|------------|------|------|------|------|
| SYSTEM CYCLE TIME | | A0 | tCYC6 | | 1000 | — | — | ns |
| ADDRESS SET-UP TIME | | R/ \bar{W} | tAW6 | CL = 100pF | 20 | — | — | ns |
| ADDRESS HOLD TIME | | | tAH6 | | 10 | — | — | ns |
| DATA SET-UP TIME | | D0~D7 | tDS6 | | 80 | — | — | ns |
| DATA HOLD TIME | | | tDH6 | | 10 | — | — | ns |
| OUTPUT DISABLE TIME | | | tOH6 | 10 | — | 60 | ns | |
| ACCESS TIME | | | tACC6 | | — | 90 | ns | |
| ENABLE PULSE | READ | E | tEW | | 100 | — | — | ns |
| | WRITE | | | 80 | — | — | ns | |



9.1 OUTLINE DIMENSION



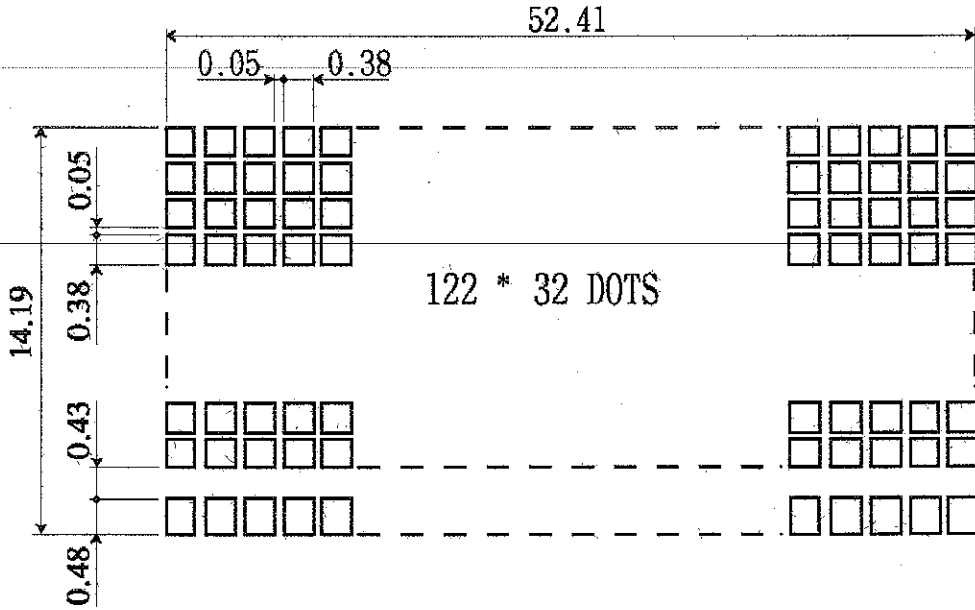
UNIT : mm
 SCALE : NTS
 NOTE : THE CONNECTOR IS SMTTYPE,
 AND SOLDER PATTERN IS LAYOURED
 ON BOTTOM SIDE

VIEWING DIRECTION (6 O'CLOCK)

INTERFACE PIN CONNECTION

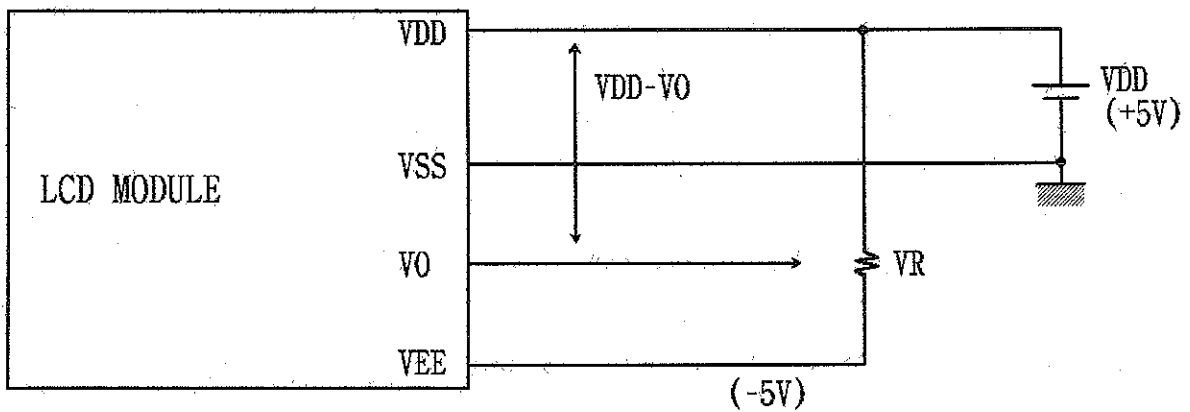
| | | | | | | | | | | | | | | | | | | | | |
|--------|-----|-----|----|-----|----|----|----|-----|-----|----|----|-----|-----|-----|-----|-----|-----|----|-----|-----|
| PIN NO | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| SYMBOL | YSS | VDD | V0 | VEE | A0 | E1 | E2 | DB0 | DB1 | NC | NC | DB2 | DB3 | DB4 | DB5 | DB6 | DB7 | NC | VEL | VEL |

9.2 DISPLAY PATTERN



UNIT : mm
SCALE : NTS

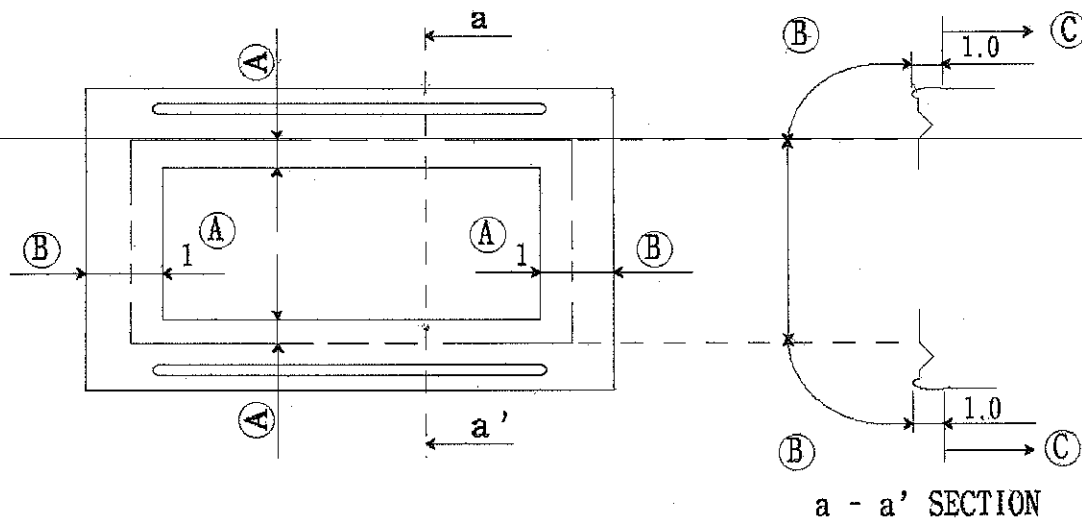
9.3 POWER SUPPLY FOR LCM



VDD-VO : LCD DRIVING VOLTAGE
VR : 10KΩ ~ 20KΩ

10. APPEARANCE STANDARD OF METAL FRAME

10.1 DIFINITION OF (A) (B) (C) ZONE



a - a' SECTION

10.2 APPEANCE STANDARD

UNIT : mm

| NO | ITEMS ZOOM | A | B | C | INSIDE | NOTE |
|----|------------------|---|--------|--------|--------|-------|
| 1 | SCRATCHEST | WIDTH:0.1 LENGTH:3.0 NUMBER : 2/SIDE | IGNORE | IGNORE | IGNORE | NOTE1 |
| 2 | CONVEX | DIA:<0.3(<0.1 IGNORE) NUMBER : 5 | IGNORE | IGNORE | IGNORE | |
| 3 | PEELING | NONE | IGNORE | IGNORE | IGNORE | |
| 4 | FOREIGN MATERIAL | NONE | IGNORE | IGNORE | IGNORE | |

NOTE 1 : We name it peeling when Zine plating was seen.

11. DISPLAY CONTROL INSTRUCTIONS

Table 1 lists the commands used with the SED1520. This LSI uses a combination of A0, R/W (\overline{RD} , \overline{WR}) to identify a data bus signal. Interpretation and execution of a command depends not on external clock but on internal timing alone. Therefore, a command can be executed so fast that no busy check is needed.

DETAILED DESCRIPTION OF COMMANDS

(1) DISPLAY ON/OFF

This command forces all display to turn on or off.

| | | | | | | | | | | |
|----|-----------------|-----------------|-----|----|---|---|---|---|---|----|
| A0 | \overline{RD} | \overline{WR} | R/W | D7 | | | | | | D0 |
| 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 1 | 1 | D |

D = 0 : Display OFF

D = 1 : Display ON

(2) DISPLAY START LINE

This command specifies a line address (shown in fig.3) thus marking the display line that corresponds to COM0. Display begins with the specified line address and covers as many lines as match the display duty in address ascending order. Dynamic line address change with the Display Start Line command enables column-wise scrolling or page change.

| | | | | | | | | | | |
|----|-----------------|-----|----|---|---|----|----|----|----|----|
| A0 | \overline{RD} | R/W | D7 | | | | | | D0 | |
| 0 | 1 | 0 | 1 | 1 | 0 | A4 | A3 | A2 | A1 | A0 |

High-order bits

| A4 | A3 | A2 | A1 | A0 | Line address |
|----|----|----|----|----|--------------|
| 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 1 | 1 |
| | | 5 | | | 5 |
| 1 | 1 | 1 | 1 | 1 | 31 |

(3) SET PAGE ADDRESS

This command is used to specify a page address equivalent to a row address for MPU access to the display data RAM. A required bit of the display data RAM can be accessed by specifying its page address and column address. Changing the page address causes no change in display.

| | | | | | | | | | | |
|----|-----------------|-------------------|----|---|---|---|---|---|----|----|
| A0 | \overline{RD} | R/ \overline{W} | D7 | | | | | | | D0 |
| 0 | 1 | 0 | 1 | 0 | 1 | 1 | 1 | 1 | A1 | A0 |

| A1 | A0 | PAGE |
|----|----|------|
| 0 | 0 | 0 |
| 0 | 1 | 1 |
| 1 | 0 | 2 |
| 1 | 1 | 3 |

(4) COLUMN ADDRESS

This command specifies a display data RAM column address. The column address is incremented by 1 each time the MPU accesses from the set address to the display data RAM. thus it is possible for the MPU to gain continuous access to only the data. This incrementing stops with address 80; the page address is not continuously changed.

| | | | | | | | | | | |
|----|-----------------|-------------------|----|----|----|----|----|----|----|----|
| A0 | \overline{RD} | R/ \overline{W} | D7 | | | | | | | D0 |
| 0 | 1 | 0 | 0 | A6 | A5 | A4 | A3 | A2 | A1 | A0 |

| A6 | A5 | A4 | A3 | A2 | A1 | A0 | COLUMN ADDRESS |
|----|----|----|----|----|----|----|----------------|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| 1 | 0 | 0 | 1 | 1 | 1 | 1 | 79 |

(5) WRITE DISPLAY DATA

THIS COMMAND ALLOWS THE MPU TO WRITE 8 BITS OF DATA INTO THE DISPLAY DATA RAM. ONCE THE DATA IS WRITETEN, THE COLUMN ADDRESS IS AUTOMATICALLY INCREMENTED BY 1; THIS ENABLES THE MPU TO WRITE MULTI-WORD DATA CONTINUOUSLY.



(6) SELECT ADC

This command inverts the relation of assignment between display data RAM column addresses and segment driver output. In other words. The select ACD command can software-invert the order of segment driver output pins, reducing the restrictions on the configuration of ICs at LCD module assembly. For details, see Fig.

Incrementing the column address by 1, which takes place after the MPU writing or reading display data, follows the sequence of column addresses specified in Fig.

| | | | | | | | | | | |
|----|-----------------|------------------|----|---|---|---|---|---|---|----|
| A0 | \overline{RD} | R/\overline{W} | D7 | | | | | | | D0 |
| 0 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | D |

D = 0 : Clockwise output (forward)

D = 1 : Counterclockwise output (reverse)

(7) STATIC DRIVE ON/OFF

This command forces all display to be on and, at the same time, all common output to be selected.

| | | | | | | | | | | |
|----|-----------------|------------------|----|---|---|---|---|---|---|----|
| A0 | \overline{RD} | R/\overline{W} | D7 | | | | | | | D0 |
| 0 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | D |

D = 0 : Static drive off

D = 1 : Static drive on

(8) Select Duty

This command is used to select the duty (degree of multiplexity) of LCD driving. It is valid for the SED1520F (actively operating LSI) only, not valid for the SED1521F (passively operating LSI). The SED1521F operates with any duty determined by the FR signal.

| | | | | | | | | | | |
|----|-----------------|------------------|----|---|---|---|---|---|---|----|
| A0 | \overline{RD} | R/\overline{W} | D7 | | | | | | | D0 |
| 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | D |

D = 0 : Duty 1/16

D = 1 : Duty 1/32

If the system contains both SED1520FOA (internal oscillation) and the SED1521FOA LSIs, they must have the same duty.

(9) Read Modify Write

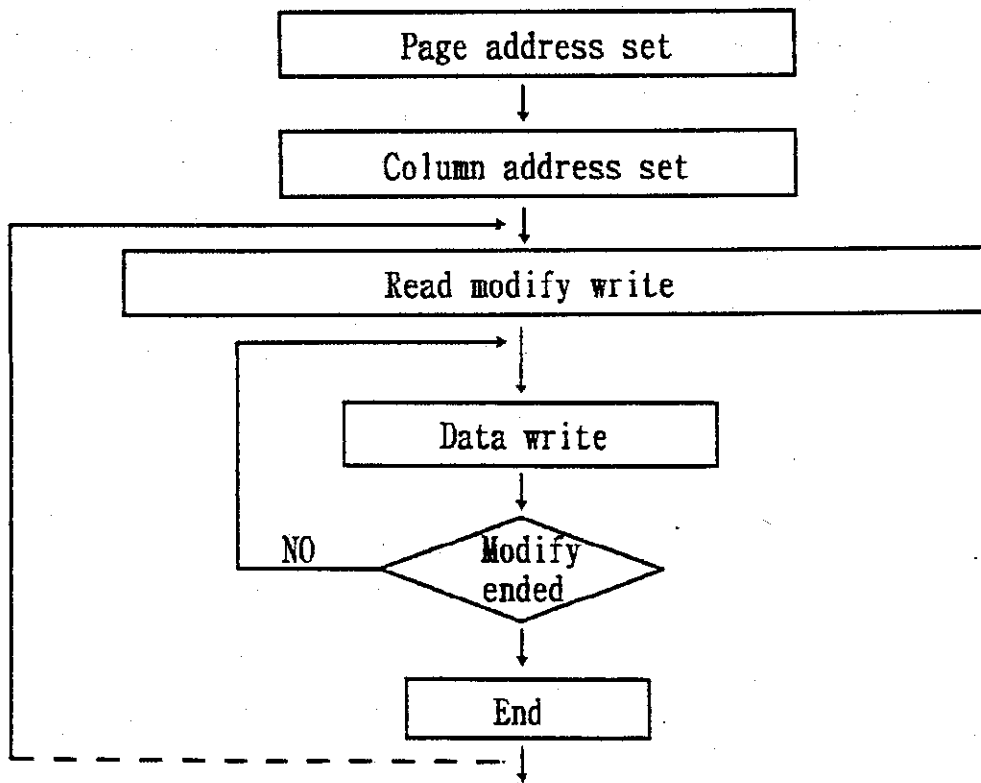
This command is used with the End command in a pair. Once it has been entered, the column address will be incremented not by the Read Display Data command but by the Write Display Data command only. This mode will stay until the End command is entered.

Entry of the End command causes the column address to return to the address which was valid when the Read Modify Write command was entered. This function lessens the load of the MPU when the data in a specific display area are repeatedly updated (as blinking cursor).

| | | | | | | | | | | |
|----|---|-----|----|---|---|---|---|---|---|----|
| A0 | E | R/W | D7 | | | | | | | D0 |
| 0 | ↓ | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |

*. Even in the Read Modify Write mode, any command other than Read/Write Data and Set Column Address may be used.

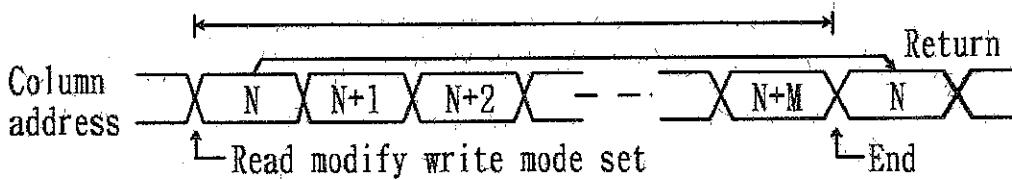
Cursor blinking sequence



(10) END

This command cancels the Read Modify Write command, returning the column address to the initial mode address

| AO | E | R/W | D7 | | | | | D0 | | |
|----|---|-----|----|---|---|---|---|----|---|---|
| 0 | ↓ | 0 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 0 |



(11) Reset

This command initializes the display start line register, column address counter, and page address counter without an effect on the display data RAM. For details, see 6-(12).

The reset operation follows entry to the Reset command.

| AO | E | R/W | D7 | | | | | D0 | | |
|----|---|-----|----|---|---|---|---|----|---|---|
| 0 | ↓ | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 0 |

Initialization at power-on is performed not by the Reset command but by a reset signal applied to the RES pin.

(12) USE COMMAND MUST BE:

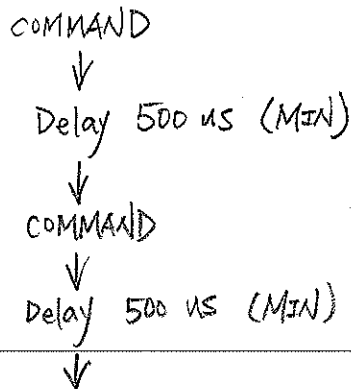


TABLE 1 COMMANDS

| COMMAND | CODE | | | | | | | | | | FUNCTION | | |
|---------|------|---|----|------------|-------------------------|----|------------------------------|----|----|------------|--|--|---|
| | A0 | E | RW | D7 | D6 | D5 | D4 | D3 | D2 | D1 | | D0 | |
| 1 | 0 | ↓ | 0 | 1 | 0 | 1 | 0 | 1 | 1 | 1 | 0/1 | <p>1 : ON</p> <p>0 : OFF (POWER-SAVING MODE WITH STATIC DRIVE ON)*</p> | |
| 2 | 0 | ↓ | 0 | 1 | 1 | 0 | DISPLAY START ADDRESS (0-31) | | | | <p>SPECIFIES RAM LINE CORRESPONDING TO UPPERMOST LINE (COMO) OF DISPLAY.</p> | | |
| 3 | 0 | ↓ | 0 | 1 | 0 | 1 | 1 | 1 | 0 | PAGE (0-3) | | <p>SETS DISPLAY RAM PAGE IN PAGE ADDRESS REGISTER.</p> | |
| 4 | 0 | ↓ | 0 | 0 | COLUMN ADDRESS (0 - 79) | | | | | | | <p>SETS DISPLAY RAM COLUMN ADDRESS IN COLUMN ADDRESS REGISTER.</p> | |
| 5 | 1 | ↓ | 0 | WRITE DATA | | | | | | | | | <p>WRITES DATA FROM DATA BUS WHOSE ADDRESS HAS BEEN PRESET IS ACCESSED. AFTER ACCESS, THE COLUMN ADDRESS IS INCREMENTED BY 1.</p> |
| 6 | 0 | ↓ | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0/1 | <p>USED TO INVERT RELATIONSHIP OF ASSIGNMENT BETWEEN DISPLAY RAM COLUMN ADDRESS AND SEGMENT DRIVER OUTPUTS.</p> <p>0 : CW OUTPUT (FORWARD)</p> <p>1 : CCW OUTPUT (REVERSE)</p> | |

| COMMAND | CODE | | | | | | | | | | FUNCTION | | |
|---------|------|---|----|----|----|----|----|----|----|----|----------|-----|---|
| | A0 | E | RW | D7 | D6 | D5 | D4 | D3 | D2 | D1 | | D0 | |
| 7 | 0 | ↓ | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0/1 | SELECTS NORMAL DISPLAY OR STATIC DRIVING OPERATION 1 : STATIC DRIVE (POWER-SAVING MODE) 0 : NORMAL DRIVING |
| 8 | 0 | ↓ | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0/1 | SELECTS LCD CELL DRIVING DUTY. 1 : 1/32 0 : 1/16 |
| 9 | 0 | ↓ | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | INCREMENT'S COLUMN ADDRESS COUNTER BY 1 WHEN DISPLAY DATA IS WRITTEN. (THIS IS NOT DONE WHEN DATA IS READ). |
| 10 | 0 | ↓ | 0 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 0 | CLEAR'S READ MODIFY WRITE MODE. |
| 11 | 0 | ↓ | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | SETS DISPLAY START LINE REGISTER ON THE FIRST LINE. ALSO SETS COLUMN ADDRESS COUNTER AND PAGE ADDRESS COUNTER TO 0. |

* WITH DISPLAY OFF (COMMAND (1)), STATIC DRIVE GOING ON (9) INVOLVES POWER-SAVING MODE.