

LM041L

- 16 character x 4 lines
- Controller LSI HD44780 is built-in (See page 115).
- +5V single power supply

MECHANICAL DATA (Nominal dimensions)

| | |
|-----------------------------|---------------------------|
| Module size | 87W x 60H x 12T (max.) mm |
| Effective display area | 61.8W x 25.2H mm |
| Character size (5 x 7 dots) | 2.95W x 4.15H mm |
| Character pitch | 3.55 mm |
| Dot size | 0.55W x 0.55H mm |
| Weight | about 60g |

ABSOLUTE MAXIMUM RATINGS

| | min. | max. |
|-----------------------------------------------|----------|------------|
| Power supply for logic ($V_{DD} - V_{SS}$) | 0 | 6.5 V |
| Power supply for LCD drive ($V_{DD} - V_O$) | 0 | 6.5 V |
| Input voltage (V_I) | V_{SS} | V_{DD} V |
| Operating temperature (T_a) | 0 | 50°C |
| Storage temperature (T_{stg}) | -20 | 70°C |

ELECTRICAL CHARACTERISTICS

$T_a=25^\circ\text{C}$, $V_{DD}=5.0\text{V}\pm 0.25\text{V}$

| | |
|---------------------------------------------------------------|----------------------------|
| Input "high" voltage (V_{IH}) | 2.2V min. |
| Input "low" voltage (V_{IL}) | 0.6V max. |
| Output "high" voltage (V_{OH}) ($-I_{OH}=0.2\text{mA}$) | 2.4V min. |
| Output "low" voltage (V_{OL}) ($I_{OL}=1.2\text{mA}$) | 0.4V max. |
| Power supply current (I_{DD}) ($V_{DD}=5.0\text{V}$) | 2.0 mA typ. 3.0 mA max. |
| Power supply for LCD drive (Recommended) ($V_{DD} - V_O$) | Duty = 1/16 1.5~5.25 V |
| Range of $V_{DD} - V_O$ | Duty = 1/16 1.5~5.25 V |
| $T_a=0^\circ\text{C}$ | 4.6 V typ. |
| $T_a=25^\circ\text{C}$ | 4.4 V typ. |
| $T_a=50^\circ\text{C}$ | 4.2 V typ. |

OPTICAL DATA See page 5.

INTERNAL PIN CONNECTION

| Pin No. | Symbol | Level | Function |
|---------|----------|----------|---------------------------------------------------------------------|
| 1 | V_{SS} | - | 0V |
| 2 | V_{DD} | - | +5V |
| 3 | V_O | - | - |
| 4 | RS | H/L | L: Instruction code input H: Data input |
| 5 | R/W | H/L | H: Data read (LCD module → MPU) L: Data write (LCD module ← MPU) |
| 6 | E | H, H → L | Enable signal |
| 7 | DB0 | H/L | Data bus line Note (1), (2) |
| 8 | DB1 | H/L | |
| 9 | DB2 | H/L | |
| 10 | DB3 | H/L | |
| 11 | DB4 | H/L | |
| 12 | DB5 | H/L | |
| 13 | DB6 | H/L | |
| 14 | DB7 | H/L | |

Notes:

In the HD44780, the data can be sent in either 4-bit 2-operation or 8-bit 1-operation so that it can interface to both 4 and 8 bit MPU's.

- (1) When interface data is 4 bits long, data is transferred using only 4 buses of $DB_4 \sim DB_7$, and $DB_0 \sim DB_3$ are not used. Data transfer between the HD44780 and the MPU completes when 4-bit data is transferred twice. Data of the higher order 4 bits (contents of $DB_4 \sim DB_7$, when interface data is 8 bits long) is transferred first and then lower order 4 bits (contents of $DB_0 \sim DB_3$, when interface data is 8 bits long).
- (2) When interface data is 8 bits long, data is transferred using 8 data buses of $DB_0 \sim DB_7$.

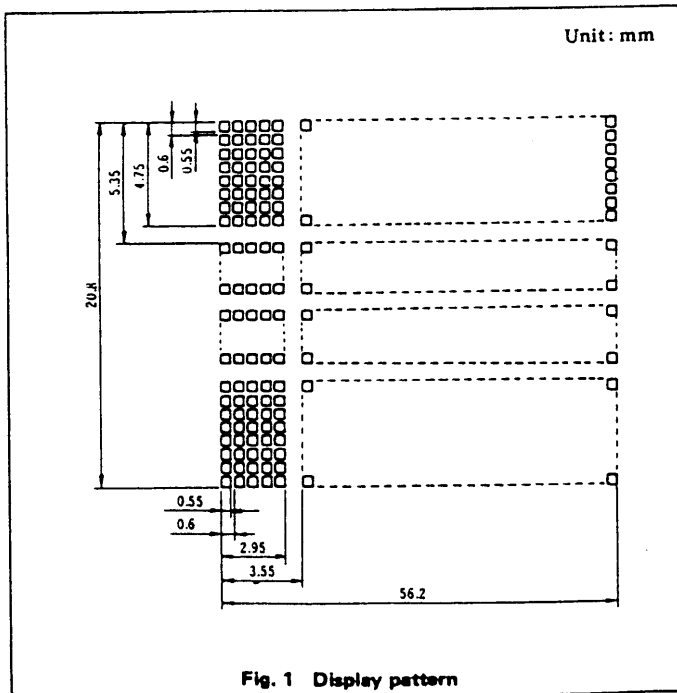


Fig. 1 Display pattern

DISPLAY POSITION AND DD RAM ADDRESS

| Character No. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
|---------------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| 1st line | 80 | 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 8A | 8B | 8C | 8D | 8E | 8F |
| 2nd line | C0 | C1 | C2 | C3 | C4 | C5 | C6 | C7 | C8 | C9 | CA | CB | CC | CD | CE | CF |
| 3rd line | 90 | 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 9A | 9B | 9C | 9D | 9E | 9F |
| 4th line | D0 | D1 | D2 | D3 | D4 | D5 | D6 | D7 | D8 | D9 | DA | DB | DC | DD | DE | DF |

Notes:

- (1) 80 ~ DF are described in hexadecimal for DD RAM address.
- (2) The set to HD44780 are "N" = "1", "F" = "0" (2 lines 5 x 7 + cursor)."
- (3) DD RAM address is no series in line. Address set is necessary to change the lines.
- (4) Circuit is equal to 32 characters by 2 lines type.
- (5) In case of executing shift, first line and third line are shifted continuously, also second line and fourth line. Therefore it happens that display of third line is transferred to first line.

Unit: mm

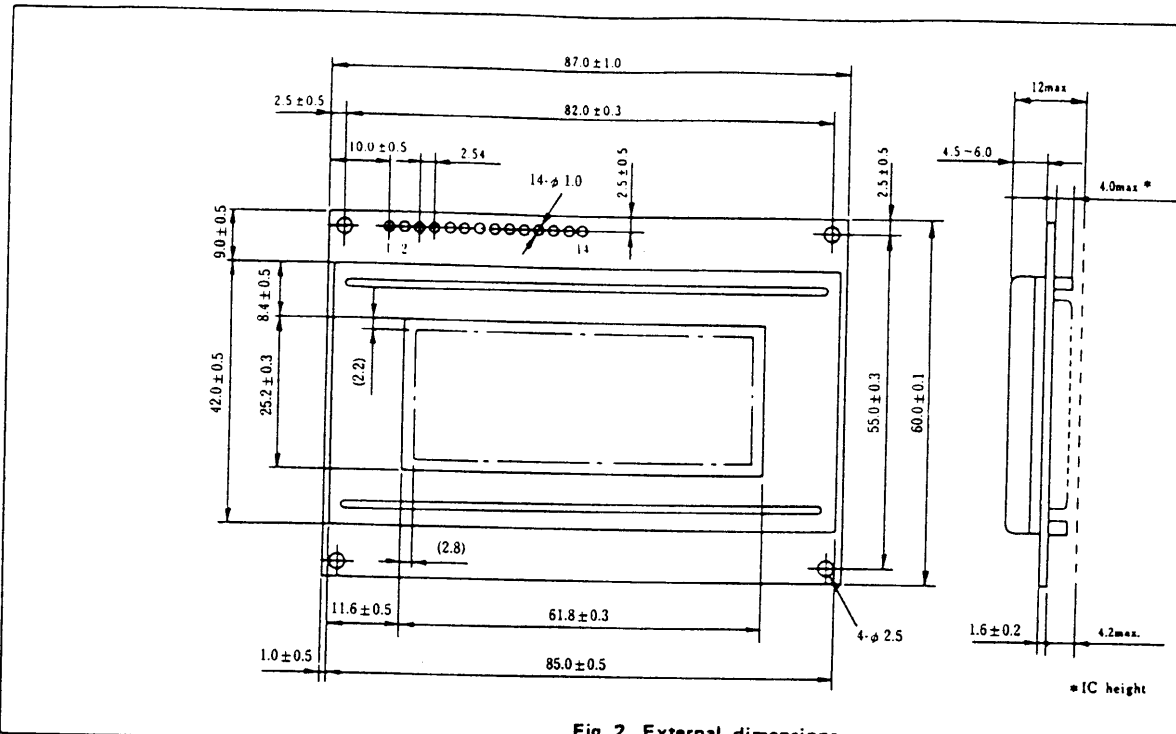


Fig. 2 External dimensions

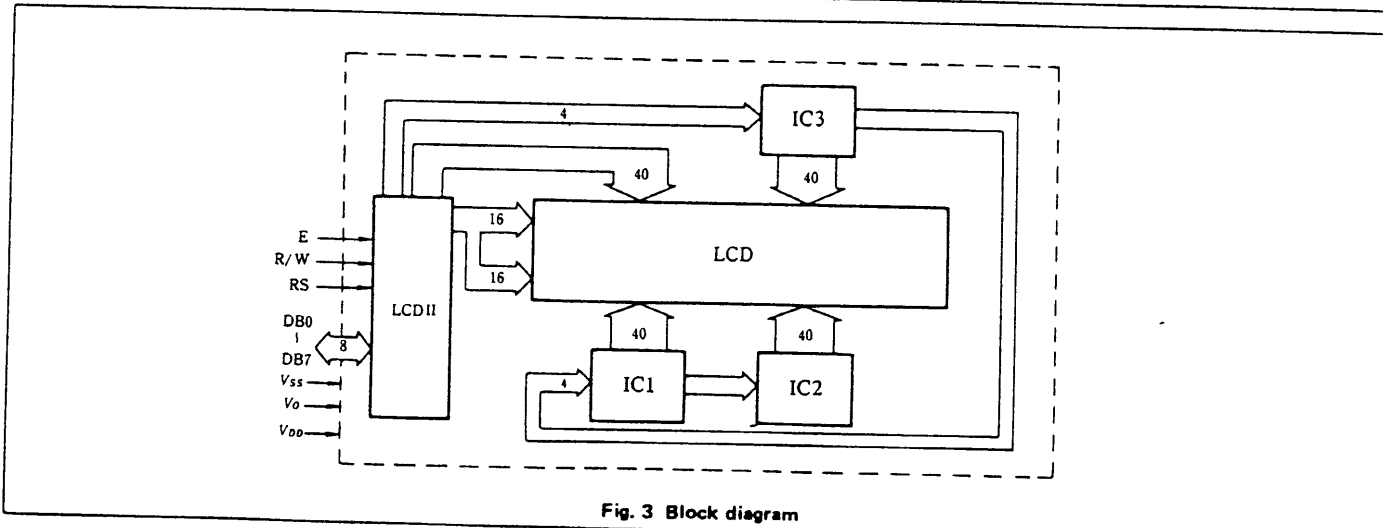


Fig. 3 Block diagram

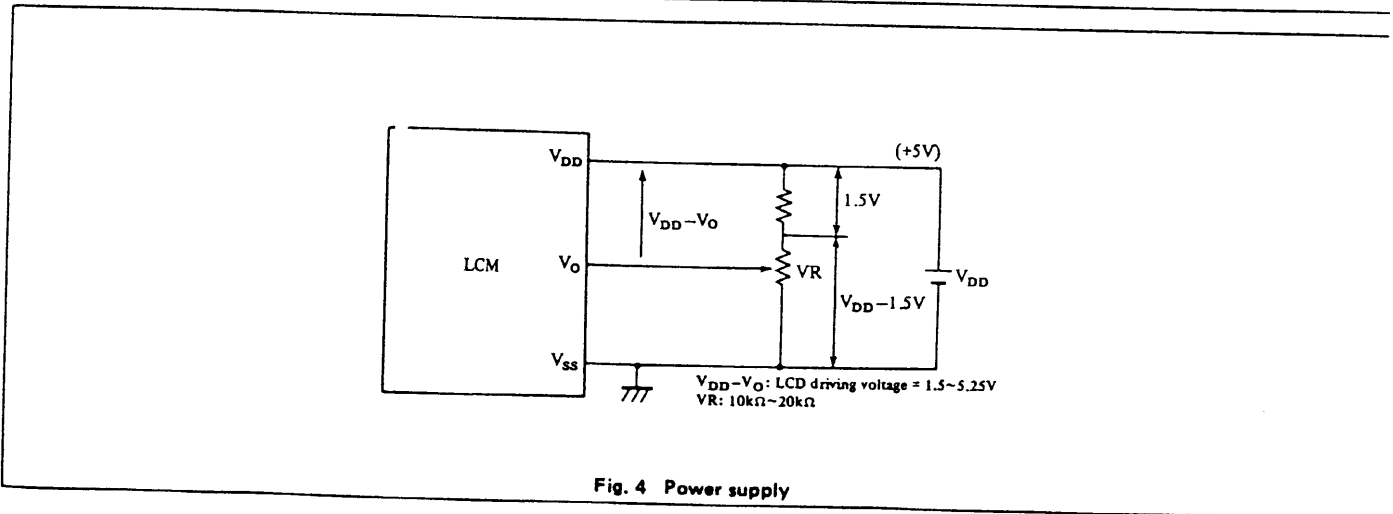


Fig. 4 Power supply

TIMING CHARACTERISTICS

| Item | Symbol | Test condition | Min. | Typ. | Max. | Unit |
|-----------------------|------------------|----------------|------|------|------|---------|
| Enable cycle time | t_{cyc} | Fig. 5, Fig. 6 | 1.0 | — | — | μs |
| Enable pulse width | PW_{EH} | Fig. 5, Fig. 6 | 450 | — | — | ns |
| Enable rise/fall time | t_{Er}, t_{Ef} | Fig. 5, Fig. 6 | — | — | 25 | ns |
| RS, R/W set up time | t_{AS} | Fig. 5, Fig. 6 | 140 | — | — | ns |
| Data delay time | t_{DDR} | Fig. 6 | — | — | 320 | ns |
| Data set up time | t_{DSW} | Fig. 5 | 195 | — | — | ns |
| Hold time | t_H | Fig. 5, Fig. 6 | 20 | — | — | ns |

