

# LM020L LM020LN (EL Backlit Version)

- 16 character x 1 line
- Controller LSI HD44780 is built-in (See page 115).
- +5V single power supply

### MECHANICAL DATA (Nominal dimensions)

Module size	80W x 36H x 12T (max.) mm
Effective display area	64.5W x 13.8H mm
Character size (5 x 7 dots)	3.07W x 5.73H mm
Character pitch	3.77 mm
Dot size	0.55W x 0.75H mm
Weight	about 25 g

### ABSOLUTE MAXIMUM RATINGS

	min.	max.
Power supply for logic ( $V_{DD}-V_{SS}$ )	0	7.0 V
Power supply for LCD drive ( $V_{DD}-V_O$ )	0	13.5 V
Input voltage (Vi)	$V_{SS}$	$V_{DD}$ V
Operating temperature (Ta)	0	50°C
Storage temperature (Tstg)	-20	70°C
EL Power Supply (when fitted)		
Voltage (VEL)		AC 150 Vms
Frequency (fEL) (at 100 Vms)		1kHz

### ELECTRICAL CHARACTERISTICS

Ta = 25°C,  $V_{DD} = 5.0 V \pm 0.25 V$

Input "high" voltage ( $V_{IH}$ )	2.2 V min.
Input "low" voltage ( $V_{IL}$ )	0.6 V max.
Output high voltage ( $V_{OH}$ ) ( $-I_{OH} = 0.2 mA$ )	2.4 V min.
Output low voltage ( $V_{OL}$ ) ( $I_{OL} = 1.2 mA$ )	0.4 V max.
Power supply current ( $I_{DD}$ ) ( $V_{DD} = 5.0 V$ )	1.0 mA typ. 2.0 mA max.
Power supply for LCD drive (Recommended) ( $V_{DD}-V_O$ )	
Duty = 1/16	
Range of $V_{DD}-V_O$	1.5~5.25 V
Ta = 0°C	4.6 V typ.
Ta = 25°C	4.4 V typ.
Ta = 50°C	4.2 V typ.
Power Supply for EL (when fitted)	
VEL (typ. at 400Mz)	100 Vms
fEL (max at VEL 100V, fEL 400Hz)	9.5mA

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	

Luminescent output of EL (where fitted) at  $\theta = 25^\circ C, \theta = 0^\circ C - 6cd / m^2$  typ.

### 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  $DB_0 \sim DB_7$ .

### DRIVING INFORMATION

To reduce component count, this module is configured as a 2 line of 8 character display but with these organised to visually appear as 1 line of 16 characters.

The consequences are :

- 1) on power up this must be configured as 2 line display
- 2) character address not continuous 0 - 7 address is 00HEX - 07HEX, 8 - 15 address is 40HEX - 47HEX

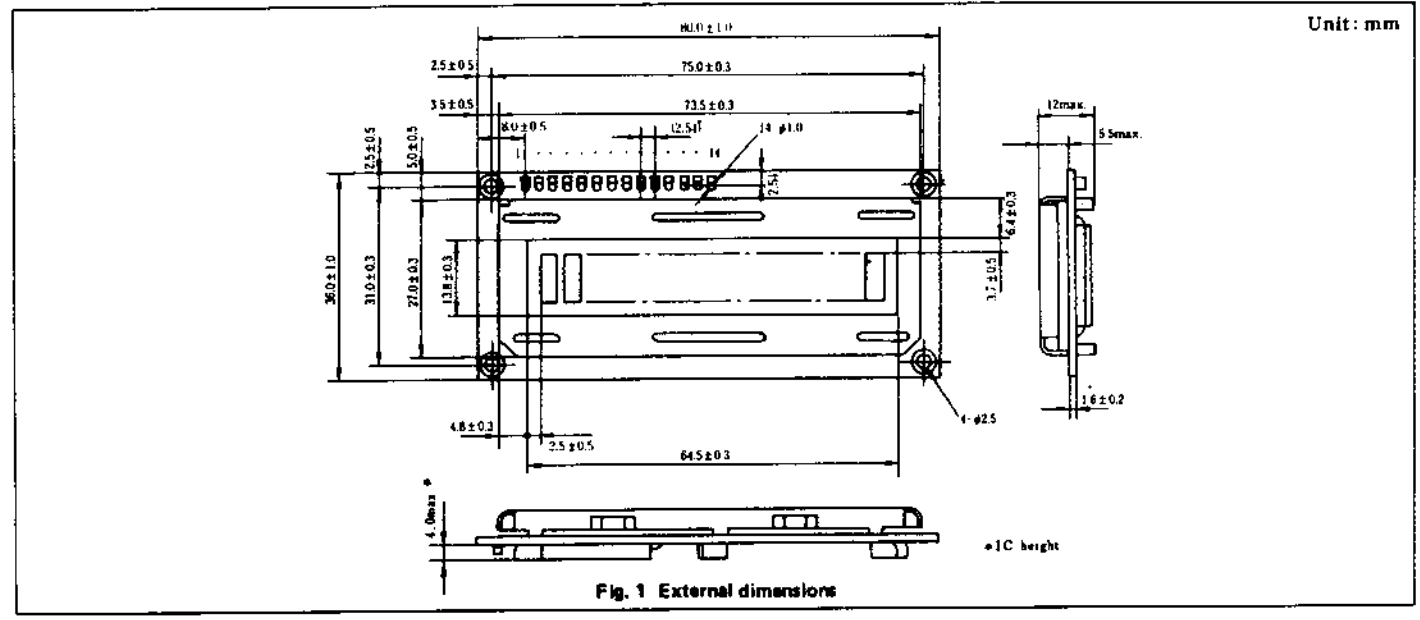


Fig. 1 External dimensions

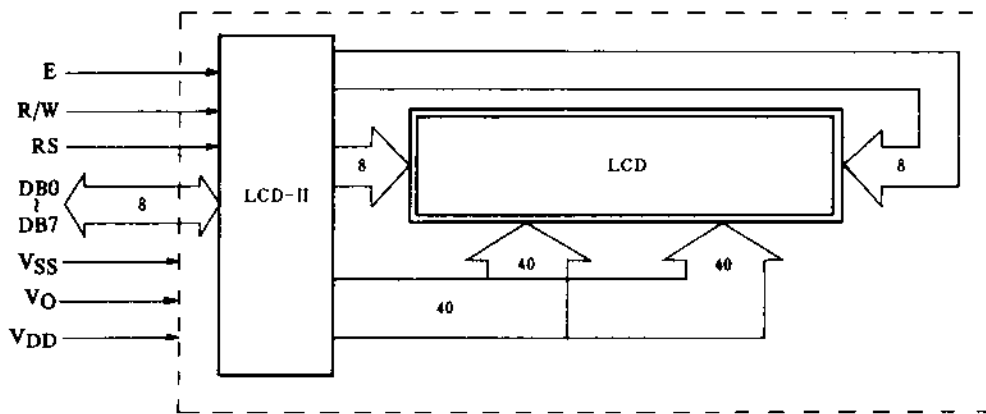
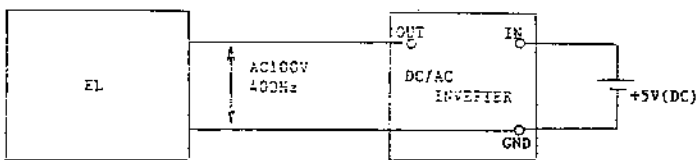
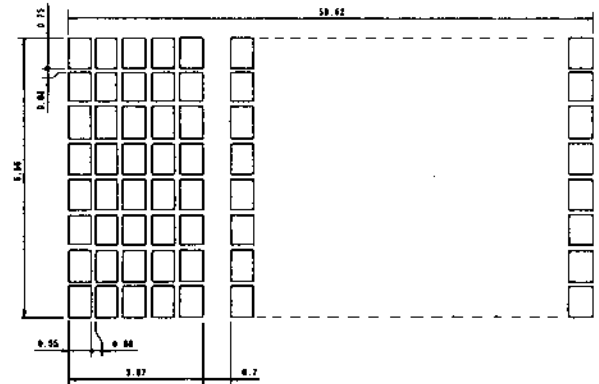
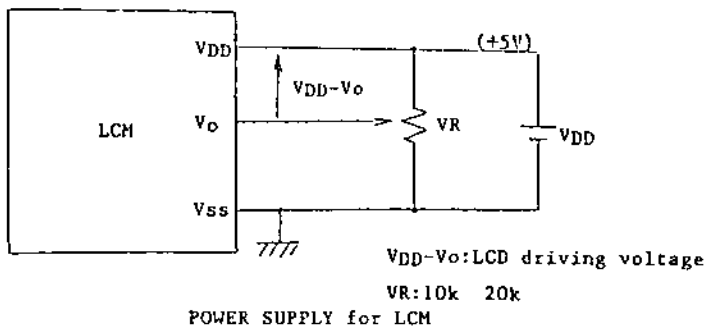
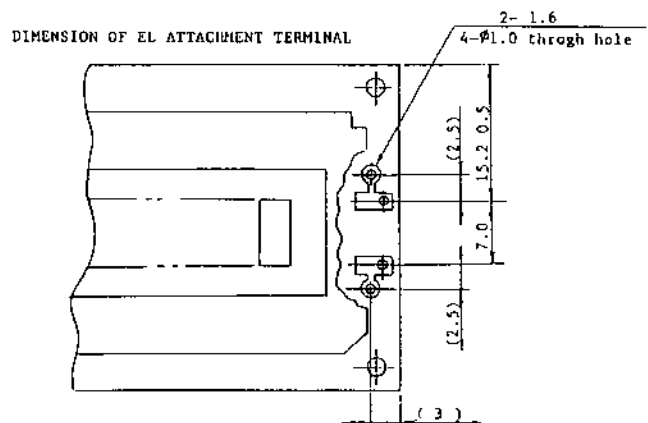


Fig. 2 Block diagram



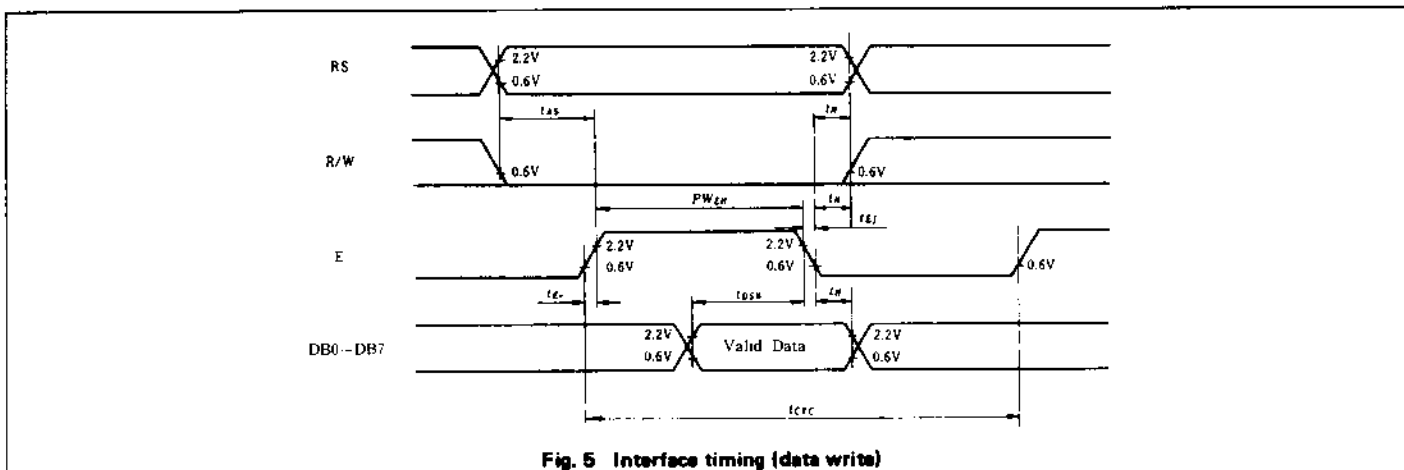
Recommended DC/AC INVERTER : NEL-D32-45  
(Made by NEC)

POWER SUPPLY for EL

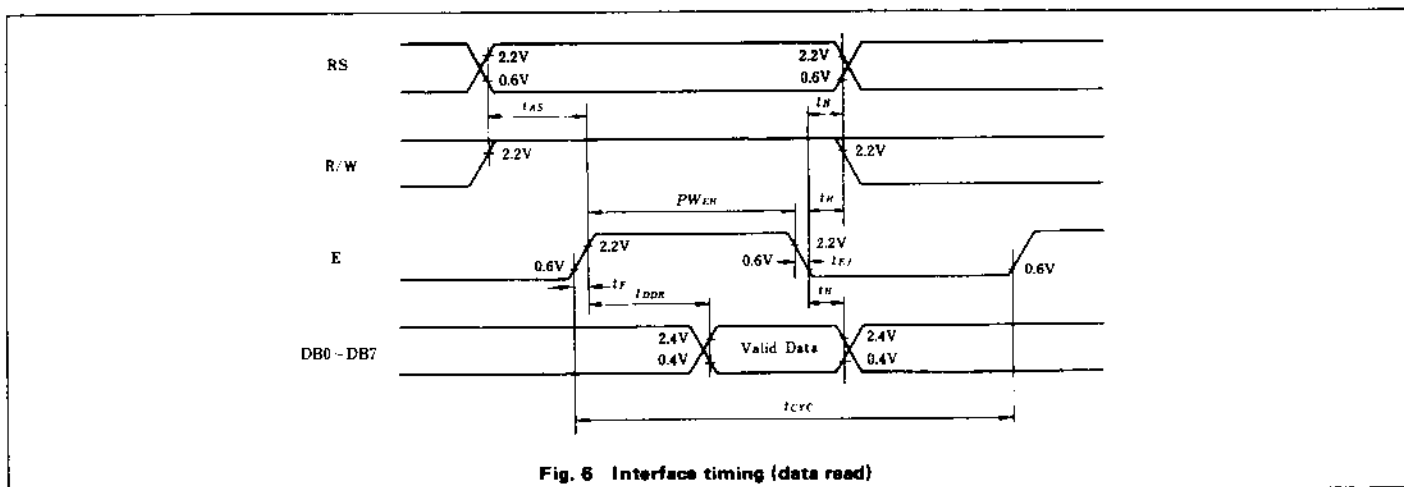


**TIMING CHARACTERISTICS**

Item	Symbol	Test condition	Min.	Typ.	Max.	Unit
Enable cycle time	$t_{cyc}$	Fig. 5, Fig. 6	1.0	—	—	$\mu s$
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



**Fig. 5 Interface timing (data write)**



**Fig. 6 Interface timing (data read)**