# DMC-2079(40Characters×2lines) ●Display Fonts 5×8 Dots ●1/16 Duty Drive

## ■ABSOLUTE MAXIMUM RATINGS

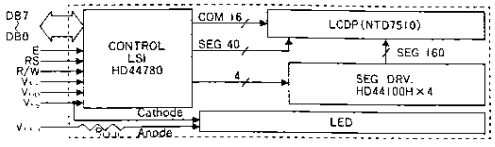
| Item | Symbol | Test Condition | Standard Value min. | Standard Value max. | Unit |
|---|---|---|---|---|---|
| Supply Voltage for Logic | $V_{CD}-V_{SS}$ | —— | −0.3 | 7 | V |
| Supply Voltage for LCD Drive | $V_{CD}-V_{EE}$ | —— | $V_{DD}-13.5$ | $V_{CC}+0.3$ | V |
| Input Voltage | $V_I$ | —— | −0.3 | $V_{CC}+0.3$ | V |
| Operating Temperature | Topr | —— | 0 | +50 | °C |
| Storage Temperature | Tstg | —— | −20 | +70 | °C |

## ■ELECTRICAL CHARACTERISTICS

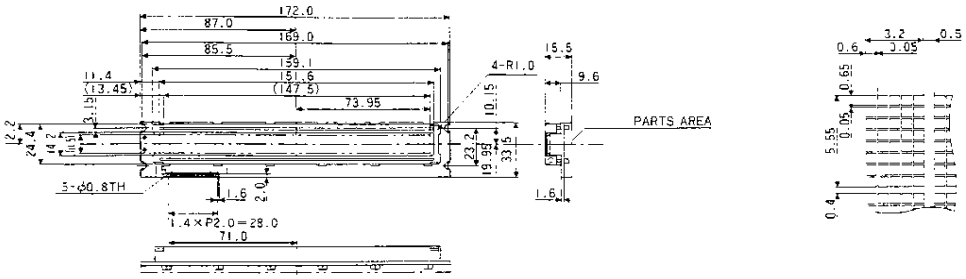
| Item | Symbol | Test Condition | Standard Value min. | Standard Value typ. | Standard Value max. | Unit |
|---|---|---|---|---|---|---|
| Logic Supply Voltage | $V_{CC}-V_{SS}$ | —— | 4.5 | —— | 5.5 | V |
| Input "High" Voltage | $V_{IH}$ | —— | 2.2 | —— | $V_{CC}$ | V |
| Input "Low" Voltage | $V_{IL}$ | —— | 0 | —— | 0.6 | V |
| Output "High" Voltage | $V_{OH}$ | $-I_{OH}$=0.205mA | 2.4 | —— | $V_{CC}$ | V |
| Output "Low" Voltage | $V_{OL}$ | $I_{OL}$=1.2mA | 0 | —— | 0.4 | V |
| Supply Current | $I_{CC}$ | $V_{CC}$=5.0V | —— | 2.8 | 5.8 | mA |

※$V_{CC}$=5.0V±5%, Ta=25°C

## ■BLOCK DIAGRAM




## ■DIMENSION




# DMC-40202(40Characters×2lines) ●Display Fonts 5×8 Dots ●1/16 Duty Drive

## ■ABSOLUTE MAXIMUM RATINGS

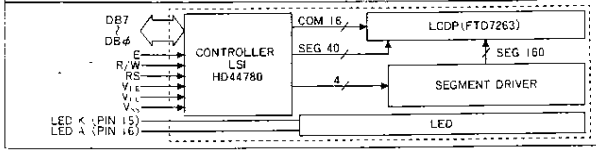
| Item | Symbol | Test Condition | Standard Value min. | Standard Value max. | Unit |
|---|---|---|---|---|---|
| Supply Voltage for Logic | $V_{CC}-V_{SS}$ | —— | −0.3 | 7 | V |
| Supply Voltage for LCD Drive | $V_{CC}-V_{EE}$ | —— | $V_{CC}-13.5$ | $V_{CC}+0.3$ | V |
| Input Voltage | $V_I$ | —— | −0.3 | $V_{CC}+0.3$ | V |
| LED Forward Current | $I_F$ | —— | —— | 500 | mA |
| LED Reverse Voltage | $V_R$ | —— | —— | 8 | V |
| LED Power Loss | $P_D$ | —— | —— | 2.1 | W |
| Operating Temperature | Topr | —— | 0 | +50 | °C |
| Storage Temperature | Tstg | —— | −20 | +70 | °C |

## ■ELECTRICAL CHARACTERISTICS

| Item | Symbol | Test Condition | Standard Value min. | Standard Value typ. | Standard Value max. | Unit |
|---|---|---|---|---|---|---|
| Input "High" Voltage | $V_{IH}$ | —— | 2.2 | —— | $V_{CC}$ | V |
| Input "Low" Voltage | $V_{IL}$ | —— | 0 | —— | 0.6 | V |
| Output "High" Voltage | $V_{OH}$ | $-I_{OH}$=0.205mA | 2.4 | —— | $V_{CC}$ | V |
| Output "Low" Voltage | $V_{OL}$ | $I_{OL}$=1.2mA | 0 | —— | 0.4 | V |
| LED Forward Voltage | $V_F$ | $I_F$=250mA | 3.8 | 4.0 | 4.2 | V |
| Brightness ※1 | L | $I_F$=250mA | 55 | 140 | —— | cd/m² |
| Supply Current | $I_{CC}$ | $V_{CC}$=5.0V | —— | 2.5 | 5.0 | mA |

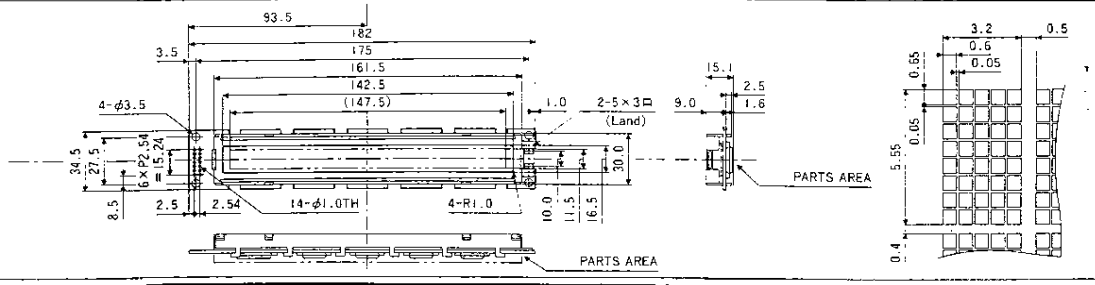
※$V_{CC}$=5.0V±5%, Ta=25°C ※NOTE 1) Measured at the bare LED backlight unit.

## ■BLOCK DIAGRAM





## ■DIMENSION



DMC Series

# DMC-50218 (20 Characters × 2 lines) ●Display Fonts 5 × 8 Dots ●1/16 Duty Drive

## ■ABSOLUTE MAXIMUM RATINGS

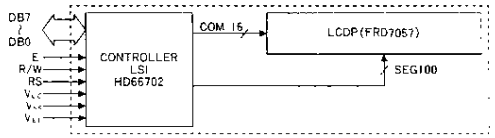
| Item | Symbol | Test Condition | Standard Value min. | Standard Value max. | Unit |
|---|---|---|---|---|---|
| Supply Voltage for Logic | $V_{CC}-V_{SS}$ | —— | −0.3 | 7 | V |
| Supply Voltage for LCD Drive | $V_{CC}-V_{EE}$ | —— | −0.3 | 7 | V |
| Input Voltage | $V_I$ | —— | −0.3 | $V_{CC}$+0.3 | V |
| Operating Temperature | Topr | —— | 0 | +50 | °C |
| Storage Temperature | Tstg | —— | −20 | +70 | °C |

## ■ELECTRICAL CHARACTERISTICS

| Item | Symbol | Test Condition | Standard Value min. | Standard Value typ. | Standard Value max. | Unit |
|---|---|---|---|---|---|---|
| Input "High" Voltage | $V_{IH}$ | —— | 2.2 | —— | $V_{CC}$ | V |
| Input "Low" Voltage | $V_{IL}$ | —— | 0 | —— | 0.6 | V |
| Output "High" Voltage | $V_{OH}$ | $-I_{OH}$=0.205mA | 2.4 | —— | $V_{CC}$ | V |
| Output "Low" Voltage | $V_{OL}$ | $I_{OL}$=1.6mA | 0 | —— | 0.4 | V |
| Supply Current | $I_{CC}$ | $V_{CC}$=5.0V | —— | 1.5 | 5.0 | mA |

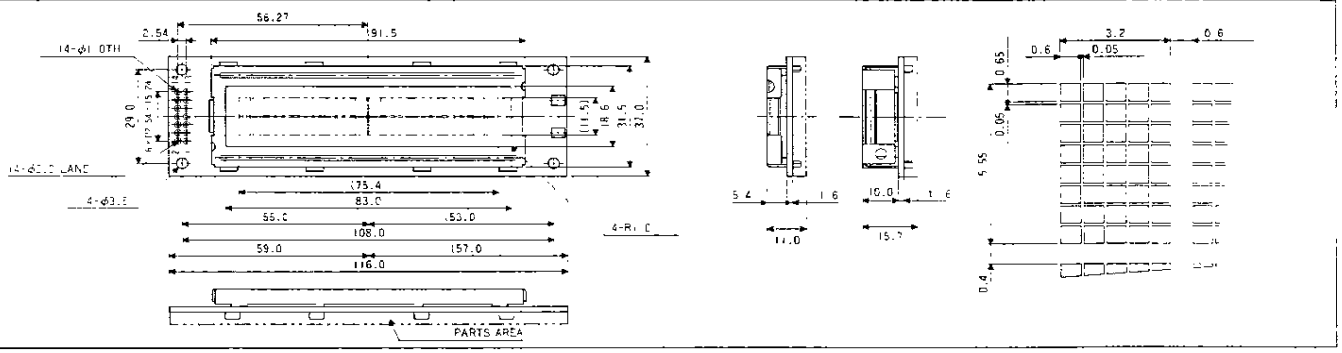
※$V_{CC}$=5.0V+5%, Ta=25°C

## ■BLOCK DIAGRAM





## ■DIMENSION




# DMC-20434 (20 Characters × 4 lines) ●Display Fonts 5 × 8 Dots ●1/16 Duty Drive

## ■ABSOLUTE MAXIMUM RATINGS

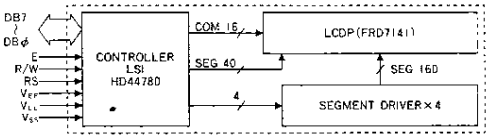
| Item | Symbol | Test Condition | Standard Value min. | Standard Value max. | Unit |
|---|---|---|---|---|---|
| Supply Voltage for Logic | $V_{CC}-V_{SS}$ | Ta=25°C | −0.3 | 6.5 | V |
| Supply Voltage for LCD Drive | $V_{CC}-V_{EE}$ | Ta=25°C | 0 | 6.5 | V |
| Input Voltage | $V_I$ | Ta=25°C | −0.3 | $V_{CC}$+0.3 | V |
| Operating Temperature | Topr | —— | 0 | +50 | °C |
| Storage Temperature | Tstg | —— | −20 | +70 | °C |

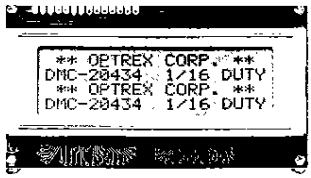
## ■ELECTRICAL CHARACTERISTICS

| Item | Symbol | Test Condition | Standard Value min. | Standard Value typ. | Standard Value max. | Unit |
|---|---|---|---|---|---|---|
| Input "High" Voltage | $V_{IH}$ | —— | 2.2 | —— | $V_{CC}$ | V |
| Input "Low" Voltage | $V_{IL}$ | —— | 0 | —— | 0.6 | V |
| Output "High" Voltage | $V_{OH}$ | $-I_{OH}$=0.205mA | 2.4 | —— | $V_{CC}$ | V |
| Output "Low" Voltage | $V_{OL}$ | $I_{OL}$=1.2mA | —— | —— | 0.4 | V |
| Supply Current | $I_{CC}$ | $V_{CC}$=5.0V | —— | 4.0 | 10.0 | mA |

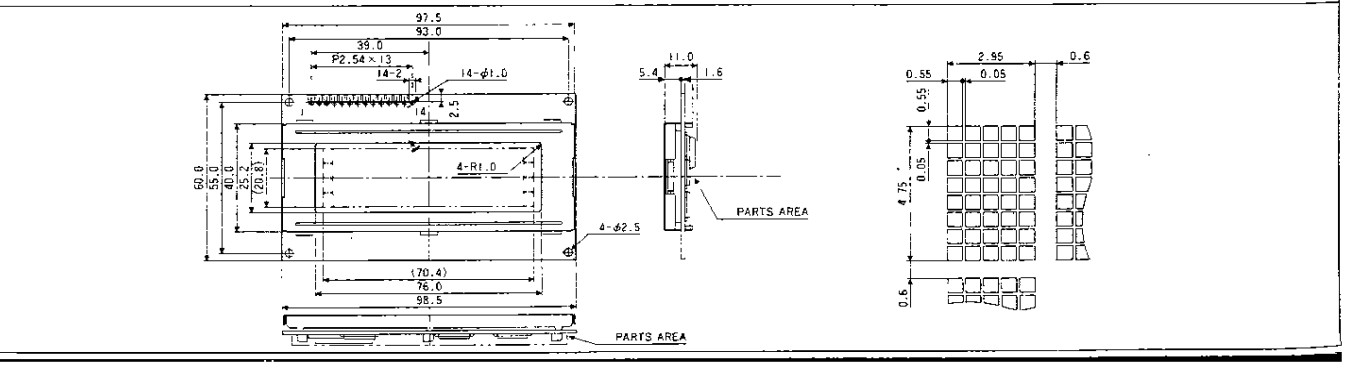
※$V_{CC}$=5.0V±5%, Ta=25°C

## ■BLOCK DIAGRAM




## ■DIMENSION

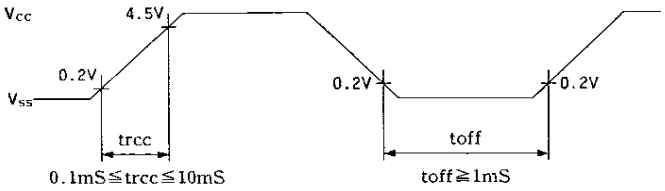


## POWER SUPPLY RESET (Except for DMC40401 series)

※In case control LSI is HD44780

The internal reset circuit will be operated properly when the following power suppiy conditions are satisfied.
If it is not operated properly, please perform initial setting along with the instruction.

| Item | Symbol | Measuring Condition | Standard Value | | | Unit |
|---|---|---|---|---|---|---|
| | | | min. | typ. | max. | |
| Power Supply Rise Time | trcc | —— | 0.1 | — | 10 | mS |
| Power Supply OFF Time | toff | —— | 1 | — | — | mS |




Note: toff defines period that power supply is off when power supply shuts down momentarily or repeats on /off state.

### RESET FUNCTION

● Initialization made by Internal Reset Circuit

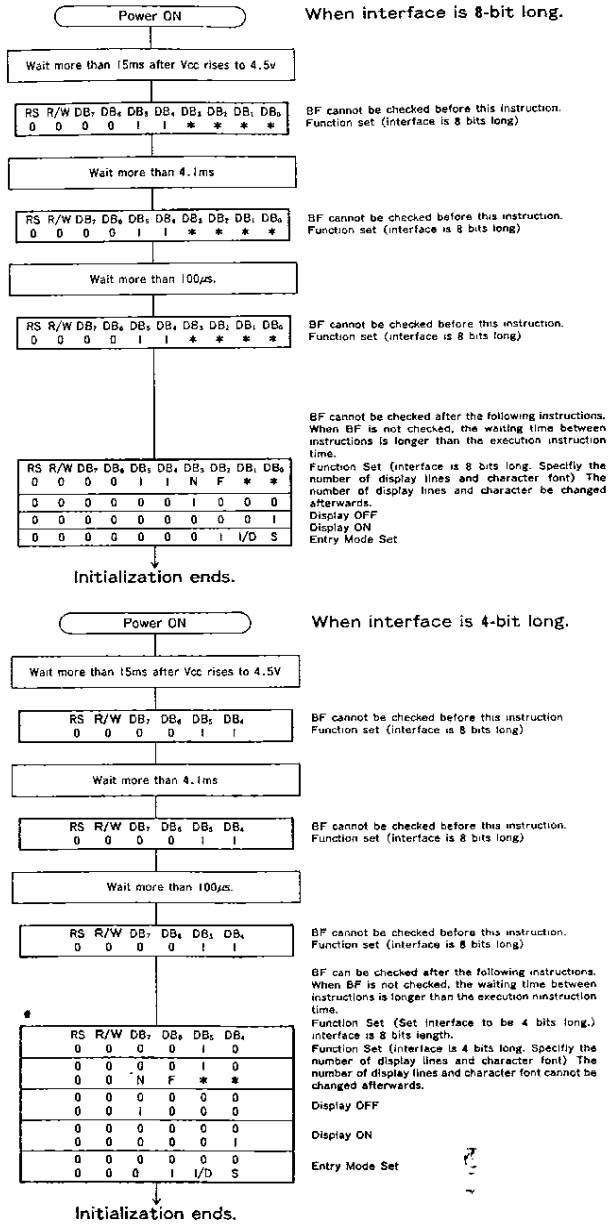
HD44780 automatically initializes (resets) when power is supplied (built-in internal reset circuit). The follwing instructions are executed in initialization. The busy flag (BF) is kept in busy state until initialization ends. (BF = 1) The busy state is 10ms after Vcc reach to 4.5V.

(1)Display clear
(2)Function set
  DL = 1: 8bit long interface data
  DL = 0: 4bit  F = 0: 5 × 7dot character font
  N = 1: 2lines
  N = 0: 1line
(3)Display ON/OFF control
  D = 0: Display OFF  C = 0: Cursor OFF  B = 0: Blink OFF
(4)Entry mode set
  I/D = 1: + (increment)  S = 0: No shift

Note: When conditions stated in "Power Supply Conditions Using Reset Circuit" are not satisfied, the internal reset circuit will not operate properly and initialization will not be performed. Please make initialization using MPU along with "Initialization along with Instruction"

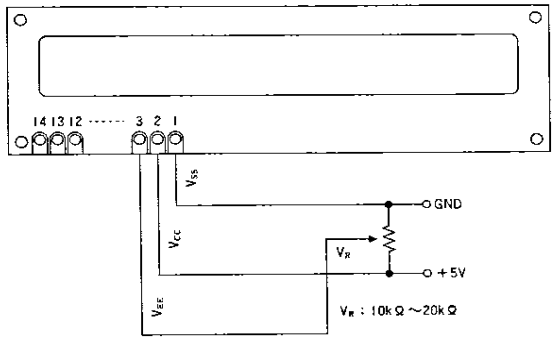
● Initialization along with Instruction

If power supply conditions are not satisfied, which for proper operation of internal reset circuit, it is required to make initialization along with instruction. Please make following procedures:

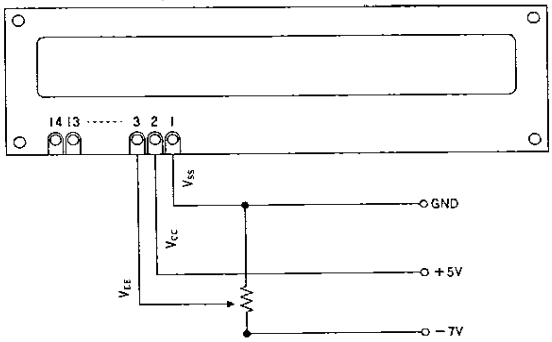


## EXAMPLE OF POWER SUPPLY (Except for DMC40401 series)

Normal Temperature Type



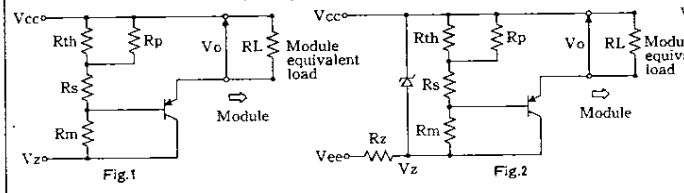

Extended Temperature Type



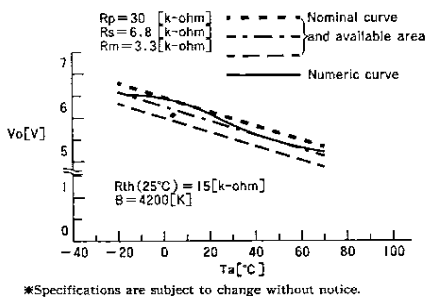

*NOTE: If $V_{EE}$ vary from recommended value, you cannot get proper contrast or viewing angle.

### ●Examples of Temperature Compensation Circuits for Extended Temp Tymp. (Only for reference)

(A) 1/8Duty—1/4Bias

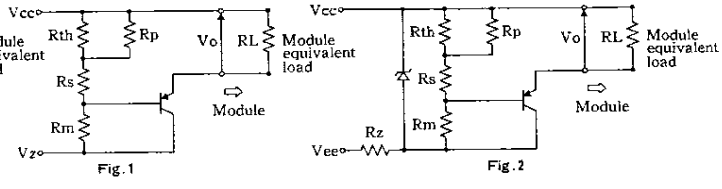



Thermistor: Rth(25℃)=15[k-ohm], B=4200[K]
Resistors: Rp=30[k-ohm], Rs=6.8[k-ohm], Rm=3.3[k-ohm]
Transistor: PNP Type
Vcc: +5V, Vss: 0V (Logic Supply)
Vz: −8[V] (−7.8 to −8.2[V])
Vee<Vz[V], Rz=(Vz−Vee)/5[k-ohm]

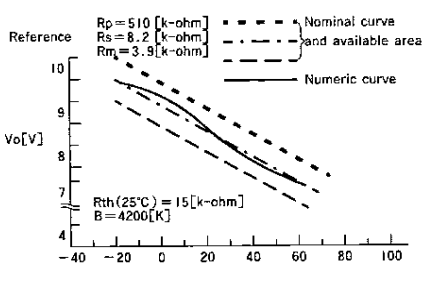



| Ta[℃] | Vo[V] |
|---|---|
| −20 | 6.56 |
| −10 | 6.50 |
| 0 | 6.40 |
| 10 | 6.26 |
| 20 | 6.09 |
| 30 | 5.88 |
| 40 | 5.67 |
| 50 | 5.47 |
| 60 | 5.29 |
| 70 | 5.15 |

(B) 1/16Duty—1/5Bias




Thermistor: Rth(25℃) =15[k-ohm], B=4200[K]
Resistors: Rp=510[k-ohm], Rs=8.2[k-ohm], Rm=3.9[k-ohm]
Transistor: PNP Type
Vcc: +5V, Vss: 0V (Logic Supply)
Vz: −11[V] (−10.725 to −11.275[V])
Vee<Vz[V], Rz=(Vz−Vee)/5[k-ohm]




| Ta[℃] | Vo[V] |
|---|---|
| −20 | 10.01 |
| −10 | 9.84 |
| 0 | 9.60 |
| 10 | 9.28 |
| 20 | 8.89 |
| 30 | 8.49 |
| 40 | 8.11 |
| 50 | 7.79 |
| 60 | 7.53 |
| 70 | 7.33 |

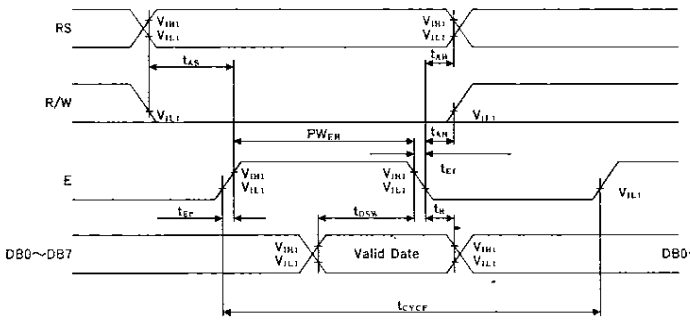
*Specifications are subject to change without notice.

## TIMING CHART (Except for DMC40401 series)

| Item | Symbol | Measuring Condition | Standard Value min. | typ. | max. | Unit |
|---|---|---|---|---|---|---|
| Enable Cycle Time | $T_{CYCE}$ | Figs.1, 2 | 1000 | —— | —— | ns |
| Enable Pulse Width, High Level | $PW_{EH}$ | Figs.1, 2 | 450 | —— | —— | ns |
| Enable Rise and Decay Time | $t_{Er}$, $t_{Ef}$ | Figs.1, 2 | —— | —— | 25 | ns |
| Address Setup Time, RS, R/W-E | $t_{AS}$ | Figs.1, 2 | 140 | —— | —— | ns |
| Data Delay Time | $t_{DDR}$ | Fig.2 | —— | —— | 320 | ns |
| Data Setup Time | $t_{DSW}$ | Fig.1 | 195 | —— | —— | ns |
| Data Hold Time (Write Operation) | $t_H$ | Fig.1 | 10 | —— | —— | ns |
| Data Hold Time (Read Operation) | $t_{DHR}$ | Fig.2 | 20 | —— | —— | ns |
| Address Hold Time | $t_{AH}$ | Figs.1, 2 | 10 | —— | —— | ns |

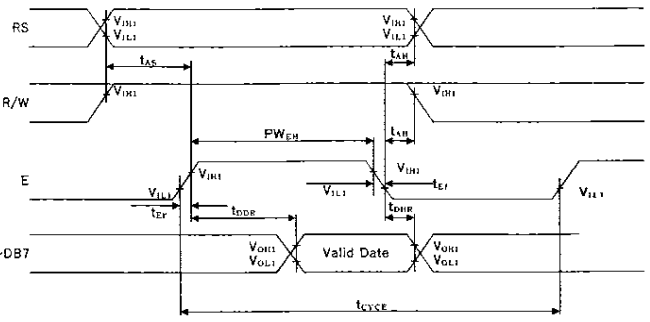
※$V_{CC}$=5.0V±10%, GND=0V, Ta=−20~+75°C (In case controller LSI is HD44780)

## FIG. 1 WRITE OPERATION




(Write Date from MPU to MODULE)

## FIG. 2 READ OPERATION




(Read Date from MODULE TO MPU)

## PIN ASSIGNMENT

| Pin No. | Symbol | Level | Function | |
|---|---|---|---|---|
| 1 | $V_{SS}$ | —— | Power Supply | 0V(GND) |
| 2 | $V_{CC}$ | —— | | +5V |
| 3 | $V_{EE}$ | —— | | for LCD Drive |
| 4 | RS | H/L | Register Select Signal<br>Register H: Data Input<br>Select L: Instruction Input | |
| 5 | R/W | H/L | H: Data Read (Module→MPU)<br>L: Data Write (Module→MPU) | |
| 6 | E | H,H→L | Enable Signal (No pull-up Resistor) | |
| 7 | DB0 | H/L | Data Bus Line | |
| 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 | | |

※Interface between Data Bus Line and 4-bit or 8-bit MPU is available. Data transfer are made in twice in case of 4-bit MPU, and once in case of 8-bit MPU.

**■IF INTERFACE DATA IS 4-BIT LONG**

Data transfer are made through 4 bus lines from DB4 to DB7, while the rest of 4 bus lines from DB0 to DB3 are not used. Data transfer with MPU are completed when 4-bit data are transfered in twice, first upper 4-bit data, then lower 4-bit data.

**■IF INTERFACE DATA IS 8-BIT LONG**

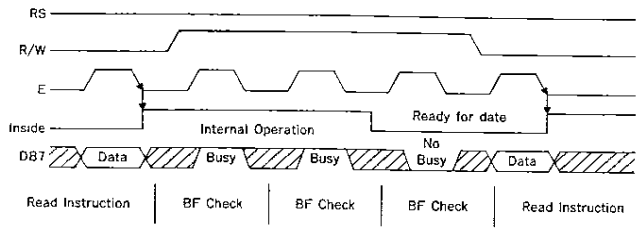
Data transfer are made through all of 8 bus lines from DB0 to DB7.

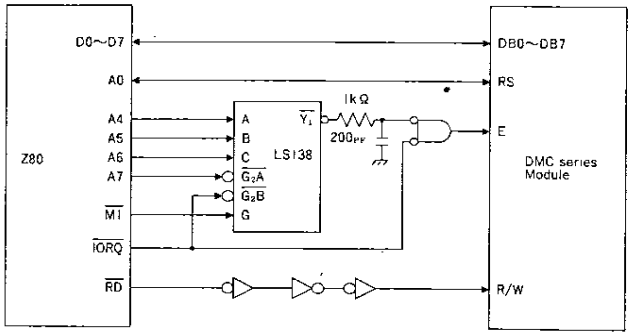
※Please refer to pp.80~81 for pin assignment of DMC 40457 series and DMC40401N series.

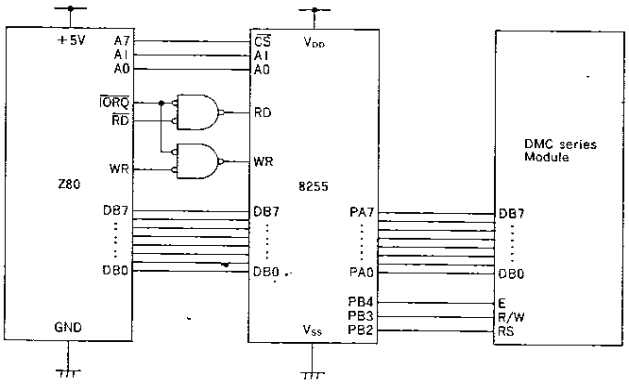
## INTERFACE WITH MPU

※In case Control LSI is HD44780

### Example of Interface with 8-bit MPU (Z80)

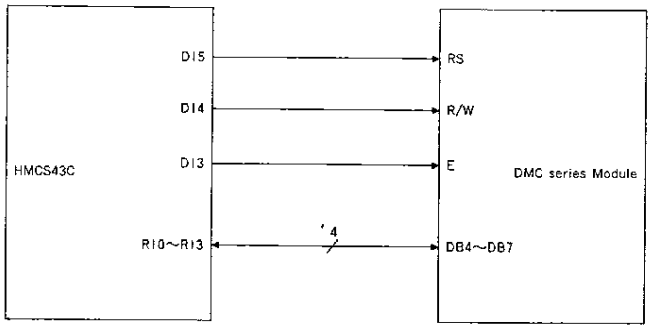


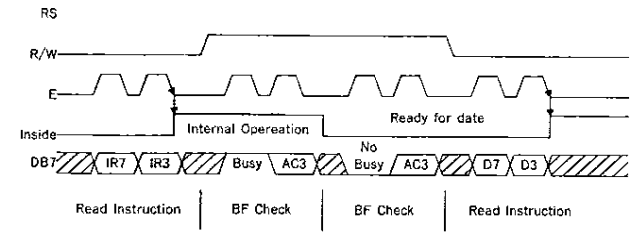




### Example of Interface with 4-bit MPU(HMCS43C)

Interface with 4-bit MPU can be made through I/O port of 4-bit MPU. If there are enough I/O ports, data can be transferred by 8-bit, however, if there isn't, data transfer can be done by 4-bit twice (select interface is 4-bit long), and timing sequence will be complicated in this case. Please take into account that 2 cycles of BF check is necessary, while 2 cycles of data transfer are also necessary.



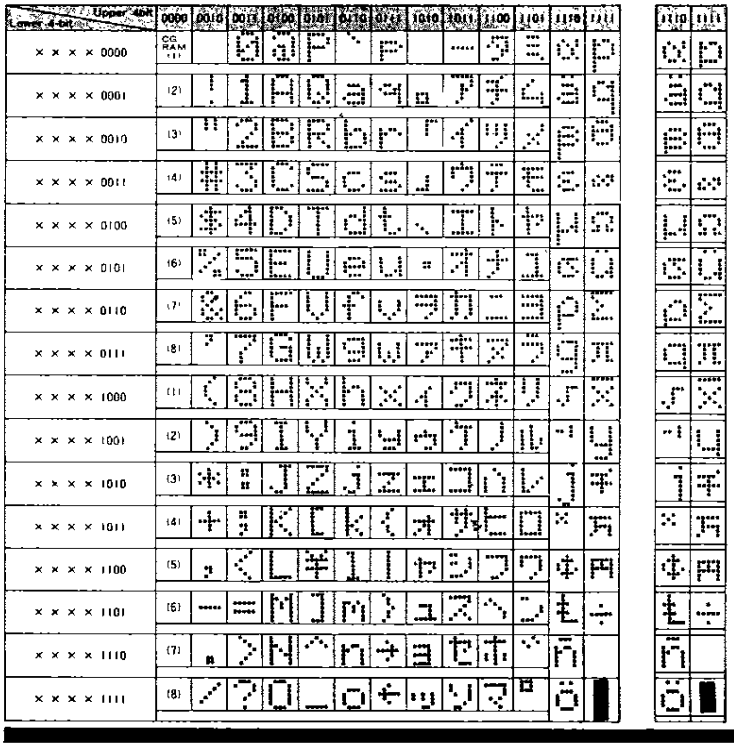

Note: IR7, IR3: 7th bit, 3rd bit of instuction
AC3 : 3th bit of Address Counter

## INSTRUCTIONS (Except for DMC40401 series)

| Instruction | Code RS | R/W | DB7 | DB6 | DB5 | DB4 | DB3 | DB2 | DB1 | DB0 | Description | Execution Time (fcp or fosc=270kHz) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Clear Display | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | Clears all display and returns the cursor to the home position (Address 0). | 1.64mS |
| Cursor At Home | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | * | Returns the cursor to the home position (Address 0). Also returns the display being shifted to the original position DDAM contents remain unchanged. | 1.64mS |
| Entry Mode Set | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | I/D | S | Sets the cursor move direction and specifies or not to shift the display. These operations are performed during data write and read. | 40μS |
| Display On/Off Control | 0 | 0 | 0 | 0 | 0 | 0 | 1 | D | C | B | Sets ON/OFF of all display (D) cursor ON/OFF (C), and blink of cursor position charact character(B). | 40μS |
| Cursor/Display Shift | 0 | 0 | 0 | 0 | 0 | 1 | S/C | R/L | * | * | Moves the cursor and shifts the display without changing DDRAM contents. | 40μS |
| Function Set | 0 | 0 | 0 | 0 | 1 | DL | N | F | * | * | Sets interface data length(DL), number of display lines(N) and character font(F). | 40μS |
| CGRAM Address Set | 0 | 0 | 0 | 1 | $A_{CG}$ | | | | | | Sets the CGRAM, data is sent and received after this setting. | 40μS |
| DDRAM Address Set | 0 | 0 | 1 | $A_{DD}$ | | | | | | | Sets the CGRAM, data is sent and received after this setting. | 40μS |
| Busy Flag/ Address Read | 0 | 1 | BF | AC | | | | | | | Reads Busy flag(FB) indicating internal operation is being performed and reads address counter contents. | 0μS |
| CGRAM/DDRAM Data Write | 1 | 0 | $W_{RITE}$ $D_{ATA}$ | | | | | | | | Writes data into DDRAM or CGRAM. | 40μS |
| CGRAM/DDRAM Data Read | 1 | 1 | $R_{EAD}$ $D_{ATA}$ | | | | | | | | Reads data into DDRAM or CGRAM. | 40μS |

| Code | Description | Executed Time (max.) |
|---|---|---|
| I/D=1: Increment<br>I/D=0: Decrement<br>S=1: With display shift<br>S/C=1: Display shift<br>S/C=0: Cursor movement<br>R/L=1: Shift to the right<br>R/L=0. Shift to the left<br>DL=1:8-bit<br>DL=0:4-bit<br>1/16Duty<br>1/8, 1/11Duty<br>F=1:5×10dots<br>F=0:5×7dots<br>BF=1:Internal operation is being performed<br>BF=0:Instruction acceptable | DDRAM: Display Data RAM<br>CGRAM: Character Generator RAM<br>ACG: CGRAM Address<br>ADD: DDRAM Address Corresponds to cursor address.<br>AC: Address Counter, used for both DDRAM and CGRAM<br>*: Invalid | fcp or fosc=250kHz<br>However, when frequency chanres, execution time also changes<br><br>Ex<br>If fcp or fosc is 270kHz,<br>$40\mu S \times \frac{250}{270} = 37\mu S$ |

## FONT TABLE (5×11Dots) (5×8Dots)



※CGRAM is Character Generator RAM which memorize characters that you can freely input by program.
※32 characters stated under upper 4-bit of 1110 and 1111 are 5×10 dots, and part of which is cut when you use in display which display fonts is 5×7 dots. Please note.

5×11 dots type product:
DMC16106A, DMC24138, DMC32132, DMC40131