DMC20434 (20 characters ×4 lines) ● Display Fonts 5 × 8 Dots ● 1/16 Duty Drive

■ABSOLUTE MAXIMUM RATINGS

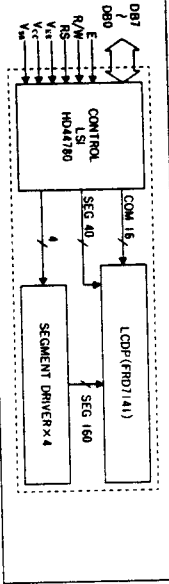| Item	Symbol	Test Condition	Standard Value min.	Standard Value max.	Unit
Supply Voltage for Logic	V_CC−V_SS	Ta=25°C	−0.3	7	V
Supply Voltage for LCD Drive	V_CC−V_EE	Ta=25°C	−0.3	13.5	V
Input Voltage	V_I	Ta=25°C	−0.3	V_CC+0.3	V
Operating Temperature	Topr	—	0	+50	°C
Storage Temperature	Tstg	—	−20	+70	°C

■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	—	—	—	0.6	V
Output "High" Voltage	V_OH	−I_OH=0.205mA	2.4	—	—	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_I=5.0V±5%, Ta=25°C

■BLOCK DIAGRAM

DB7 ~ DB0
E
R/W
RS
V_SS
V_CC
V_EE

CONTROL LSI HD44780

COM 16

SEG 40

SEGMENT DRIVER×4

LCDF(FRD7141)

SEG 160

■EXTERNAL DIMENSIONS

PARTS AREA

60.0
55.0
40.0
25.2
(20.8)
39.0
P2.54×13
14-?
14-φ1.0
4-R1.0
2.5
4-φ2.5
97
93.0
(70.4)
76.0
98.0

1.6
5.4
1.1Max
2.5
PARTS AREA

0.6
4.75
0.05
0.55
0.55
0.05
2.95
0.6

＊＊ OPTREX CORP. ＊＊
DMC-20434 1/16 DUTY
＊＊ OPTREX CORP. ＊＊
DMC-20434 1/16 DUTY
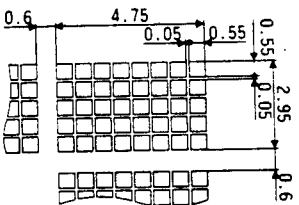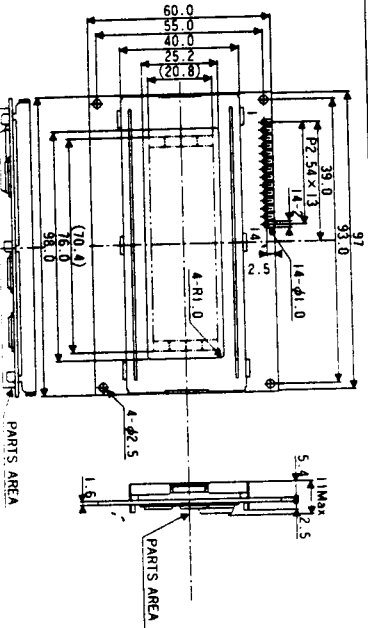
《Features》

(1)Interface with 8-bit or 4-bit MPU is available.

(2)192 kinds of alphabets, numerals, symbols and special characters
   can be displayed by built-in character generator(ROM)

(3)The preferred characters can be displayed by character generator(RAM)

(4)Various functions of instruction are available by programming:

● Clear display   ● Cursor at home   ● On/off cursor   ● Blink character

● Shift display   ● Shift cursor   ● Read/write display data, Etc.

(5)Compact and light weight design which can be easily assembled in devices.

(6)Single power supply +5V drive (except for extended temp. type)

(7)Low power consumption.

EXAMPLE OF POWER SUPPLY (Except for DMC40401 series)
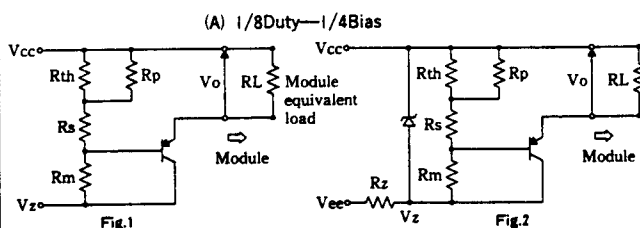
### Normal Temperature Type
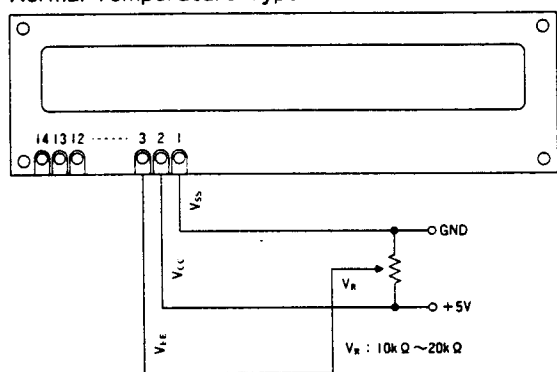
Extended Temperature Type
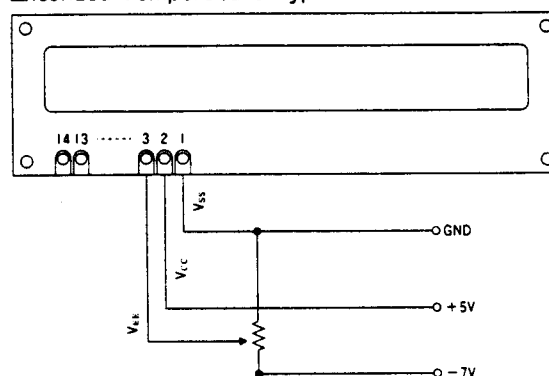
※NOTE: If V_{EE} vary from recommended value, you cannot get proper contrast or viewing angle.
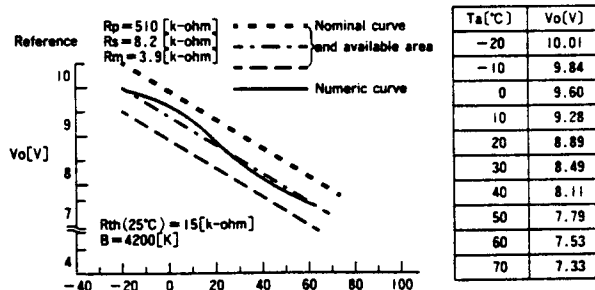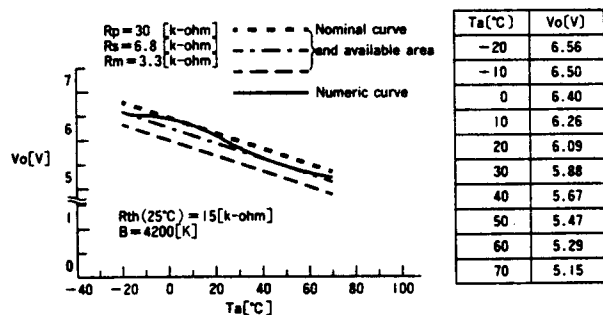
● Examples of Temperature Compensation Circuits for Extended Temp Type. (Only for reference)

(A) 1/8Duty—1/4Bias

(B) 1/16Duty—1/5Bias

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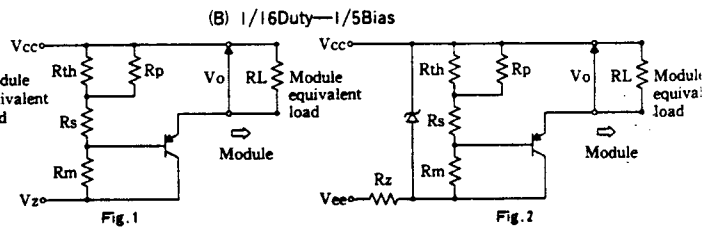
Thermistor: Rth(25℃)=15[k-ohm], B=4200[K]
Resistors: Rp=510[k-ohm], Rs=8.2[k-ohm], Rm=3.9[k-ohm]
Transistor: PNP Type
Vcc: +5V, Vss: 0V (Logic Supply)
Vz: −11[V](−10.725 to −11.275[V])
Vee<Vz[V], Rz=(Vz−Vee)/5[k-ohm]

Rp=30 [k-ohm]   - - - - Nominal curve
Rs=6.8[k-ohm]   -·-·-· and available area
Rm=3.3[k-ohm]   - - - -
                —— Numeric curve

Rth(25℃)=15[k-ohm]
B=4200[K]

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

Reference
Rp=510 [k-ohm]   - - - - Nominal curve
Rs=8.2 [k-ohm]   -·-·-· and available area
Rm=3.9[k-ohm]   - - - -
                —— Numeric curve

Rth(25℃)=15[k-ohm]
B=4200[K]

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.

The internal reset circuit will be operated properly when the following power supply conditions are satisfied.

If it is not operated properly, please perform initial setting along with the 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:

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

$0.1mS \leqq trcc \leqq 10mS$ $toff \geqq 1mS$
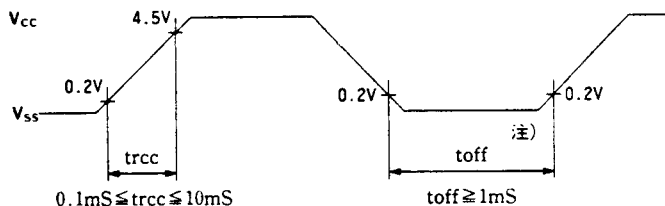
Note: toff defines period that power supply is off when power supply shut down momentarily or repeats on /off state.
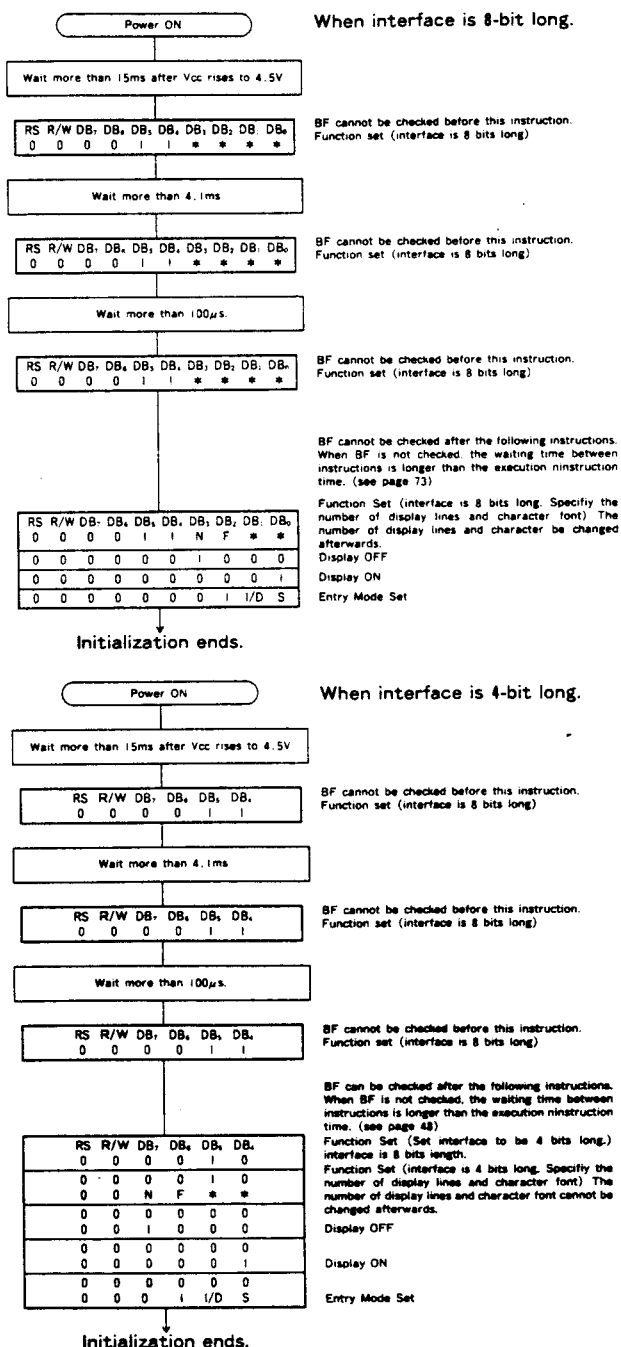
RESET FUNCTION

● **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"

When interface is 8-bit long.

Power ON

Wait more than 15ms after Vcc rises to 4.5V

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	0	0	1	1	*	*	*	*

BF cannot be checked before this instruction. Function set (interface is 8 bits long)

Wait more than 4.1ms

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	0	0	1	1	*	*	*	*

BF cannot be checked before this instruction. Function set (interface is 8 bits long)

Wait more than 100μs.

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	0	0	1	1	*	*	*	*

BF cannot be checked before this instruction. Function set (interface is 8 bits long)

BF cannot be checked after the following instructions. When BF is not checked, the waiting time between instructions is longer than the execution ninstruction time. (see page 73)

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	0	0	1	1	N	F	*	*
0	0	0	0	0	0	1	0	0	0
0	0	0	0	0	0	0	0	0	1
0	0	0	0	0	0	0	1	I/D	S

Function Set (interface is 8 bits long. Specifiy the number of display lines and character font) The number of display lines and character be changed afterwards.
Display OFF
Display ON
Entry Mode Set

Initialization ends.

When interface is 4-bit long.

Power ON

Wait more than 15ms after Vcc rises to 4.5V

RS	R/W	DB7	DB6	DB5	DB4
0	0	0	0	1	1

BF cannot be checked before this instruction. Function set (interface is 8 bits long)

Wait more than 4.1ms

RS	R/W	DB7	DB6	DB5	DB4
0	0	0	0	1	1

BF cannot be checked before this instruction. Function set (interface is 8 bits long)

Wait more than 100μs.

RS	R/W	DB7	DB6	DB5	DB4
0	0	0	0	1	1

BF cannot be checked before this instruction. Function set (interface is 8 bits long)

BF can be checked after the following instructions. When BF is not checked, the waiting time between instructions is longer than the execution ninstruction time. (see page 48)

RS	R/W	DB7	DB6	DB5	DB4
0	0	0	0	1	0
0	0	0	0	1	0
0	0	N	F	*	*
0	0	0	0	0	0
0	0	1	0	0	0
0	0	0	0	0	0
0	0	0	0	0	1
0	0	0	0	0	0
0	0	0	1	I/D	S

Function Set (Set interface to be 4 bits long.) interface is 8 bits length.
Function Set (interface is 4 bits long. Specifiy the number of display lines and character font) The number of display lines and character font cannot be changed afterwards.
Display OFF
Display ON
Entry Mode Set

Initialization ends.

TIMING CHART (Except for DMC40401 series)

Item	Symbol	Measuring Condition	Standard Value			Unit
			min.	typ.	max.	
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 control LSI is HD4478C

FIG. 1 WRITE OPERATION
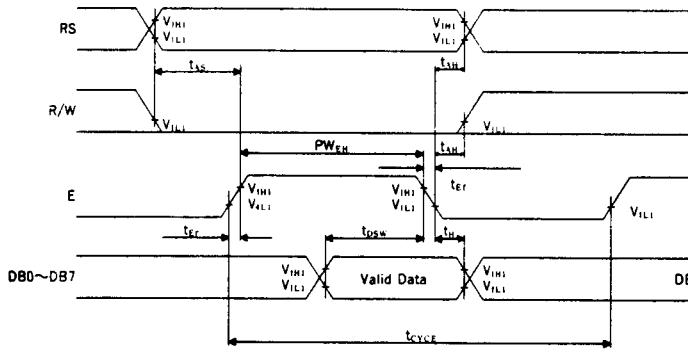
(Write Data from MPU to MODULE)

FIG. 2 READ OPERATION
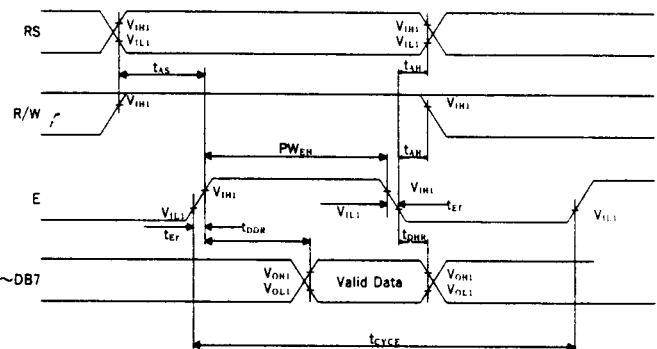
(Read Data from MODULE TO MPU)

PIN ASSIGNMENT

Pin No.	Symbol	Level	Function	
1	V_{SS}	——	Power Supply	0V(GND)
2	V_{CC}	——		+5V
3	V_{EE}	——		for LGD Drive
4	RS	H/L	Register Select Signal Register H: Data Input Select L: Instruction Input	
5	R/W	H/L	H: Data Read (Module→MPU) 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 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 but 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.
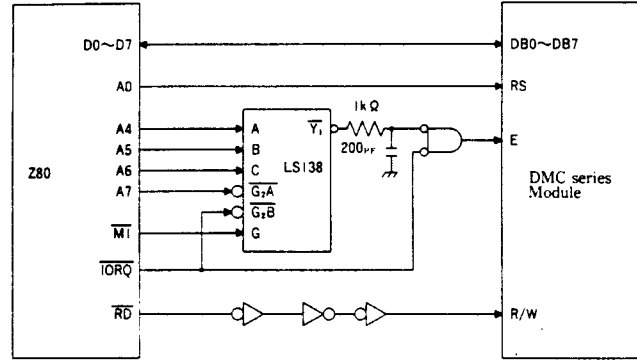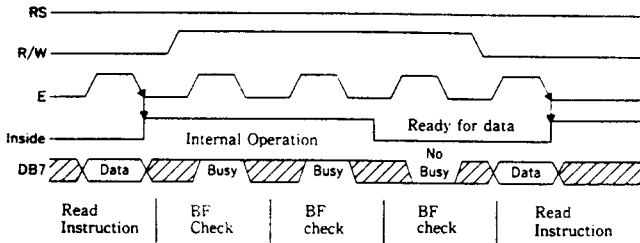
■IF INTERFACE DATA IS 8-BIT LONG

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

※Please refer to pp.94~95 for pin assignment of DMC 4045 series and DMC40401N series.

INTERFACE WITH MPU

※In case Control LSI is HD44780

Example of Interface with 8-bit MPU (Z80)

| Read Instruction | BF Check | BF check | BF check | Read Instruction |

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 in 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.
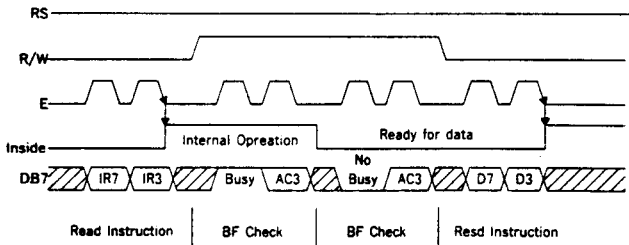
Note: IR7, IR3: 7th bit, 3rd bit of instuction
AC3: 3th bit of Address Counter
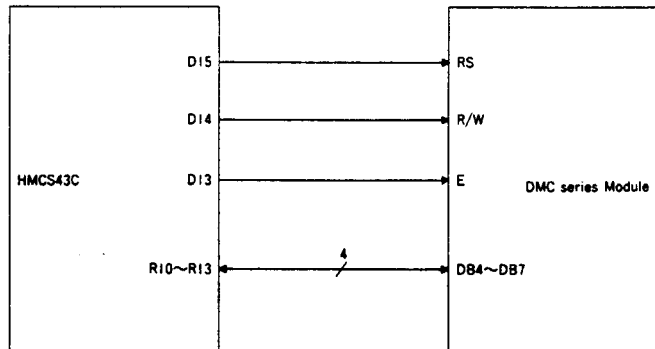
DMC Series

INSTRUCTIONS (Except for DMC40401 series)

Instruction	Code										Description	Executed Time (max.) fosc=250KHz
	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0		
Clear Display	0	0	0	0	0	0	0	0	0	I	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	I	*	Returns the cursor to the home position (Address 0). Also returns the display being shifted to the original position DDRAM contents remain unchanged.	1.64mS
Entry Mode Set	0	0	0	0	0	0	0	I	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	I	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	I	S/C	R/L	*	*	Moves the cursor and shifts the display without changing DDRAM contents.	40μS
Function Set	0	0	0	0	I	DL	N	F	*	*	Sets interface data lenght (DL) number of display lines (N) and character font (F).	40μS
CGRAM Address Set	0	0	0	I	A_{CG}						Sets the CGRAM address. CGRAM data is sent and received after this setting.	40μS
DDRAM Address Set	0	0	I	A_{DD}							Sets the DDRAM address. DDRAM data is sent and received after this setting.	40μS
Busy Flag/ Address Read	0	I	BF	AC							Reads Busy flag (FB) indicating internal operation is being performed and reads address counter contents.	0μS
CGRAM/DDRAM Data Write	I	0	W_{RITE} D_{ATA}								Writes data into DDRAM or CGRAM.	40μS
CGRAM/DDRAM Data Read	I	I	R_{EAD} D_{ATA}								Reads data from DDRAM or CGRAM.	40μS

Code		Description	Executed Time (max.)
I/D=I: Increment	DL=0:4-bit	DDRAM: Display Data RAM	fcp or fosc=250kHz
I/D=0: Decrement	N= I:2lines	CGRAM: Character Generator RAM	However, when frequency changes, execution time also changes
S=I: With display shift	N= 0:Ilines	ACG: CGRAM Address	
S/C=I: Display shift	F= I:5×I0dots	ADD: DDRAM Address Corresponds to cursor address.	Ex
S/C=0: Cursor movement	F= 0:5×7dots	AC: Address Counter, used for both DDRAM and CGRAM	If fcp or fosc is 270kHz.
R/L=I: Shift to the right	BF=I:Internal operation is being performed		$40\mu S \times \frac{250}{270} = 37\mu S$
R/L=0: Shift to the left	BF=0:Instruction acceptable	*: Invalid	
DL=I:8-bit			

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 applied product:
DMC16106A, DMC16101A, DMC24138, DMC32132, DMC40131