

ALL ELECTRONICS CORP.

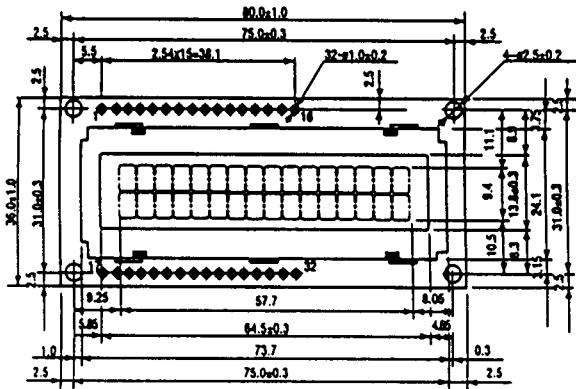
LCD-52

GENERIC SPEC AND HOOK-UP SHEET FOR 16 X 2 LCDS

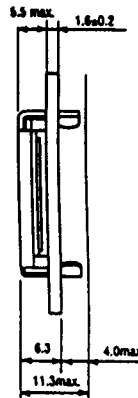
LCD-53

Since we do not have the "official" literature for this LCD, and since most LCDs are similar in structure and connectivity, we have put together this spec/hook-up sheet from the literature of three different manufacturers. We hope it contains the necessary information.

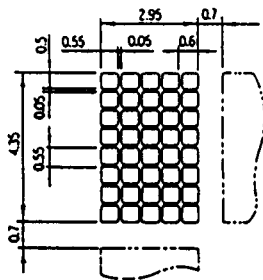
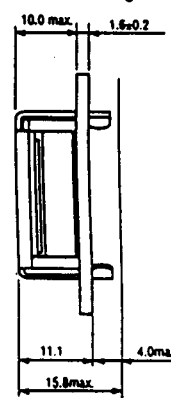
Most 16 character x 2 line LCDs have 14 connections for the display either on the top or bottom of the display. For orientation, look for a numeral 1 next to connection 1. If the LCD has a backlight, it will be powered by pins 15 and 16 or by two connections to the side of the display.



Reflective/EL Backlight



LED Backlight

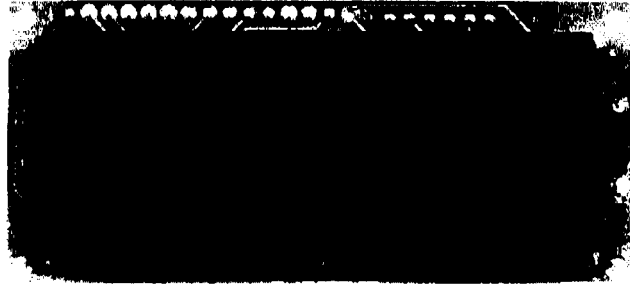


*LED Powered
through pins 15 & 16
or 31 & 32

PIN FUNCTIONS

No.	No.	Name	Function
1	17	V _{cc}	GND
2	18	V _{cc}	Power supply voltage + 5 V
3	19	V _{cc}	Liquid crystal driving voltage
4	20	RS	L: Instruction code input. H: Data input
5	21	R/W	L: Data write from MPU to LCM. H: Data read from LCM to
6	22	E	Enable
7	23	DB0	Data bus line
8	24	DB1	Data bus line
9	25	DB2	Data bus line
10	26	DB3	Data bus line
11	27	DB4	Data bus line
12	28	DB5	Data bus line
13	29	DB6	Data bus line
14	30	DB7	Data bus line
15	31	V _e '	Anode
16	32	V _e "	Cathode

HDM-16216L-5



FEATURE

Display format	16 Characters x 2 lines
Display type	TN
Display mode	Positive
Viewing direction	6 O'clock
Driving method	1/16 Duty

PHYSICAL DATA

Module size	80.0W x 36.0H x 13.0T mm
Min. view area	65.6W x 13.8H mm
Character construction	5 x 7 dots
Character size	2.95W x 3.8H mm
Character pitch	3.65 mm
Dot size	0.55W x 0.5H mm
Weight	about 30 g

ABSOLUTE MAXIMUM RATINGS

Item	Symbol	Test Condition	Standard Value		Unit
			min.	max.	
Power supply for logic	V _{DD} -V _{SS}	T _a = 25°C	0	7.0	V
Power supply for LCD	V _{DD} -V _L	T _a = 25°C	0	13.5	V
Input voltage	V _{IN}	T _a = 25°C	V _{SS}	V _{DD}	V
LED forward current	I _F	-	-	120	mA
LED reverse voltage	V _R	-	-	8	V
LED power consumption	P _D	-	-	0.54	W
Operation temperature	T _{OP}	-	0	50	°C
Storage temperature	T _{STG}	-	-20	60	°C

ELECTRICAL CHARACTERISTICS

Item	Symbol	Test Condition	Standard Value			Unit
			min.	typ.	max.	
Input high voltage	V _{IH}	-	2.2	-	-	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
Power supply current	I _{DD}	V _{DD} = 5.0V T _a = 0°C	-	0.8	1.8	mA
Power supply for LCD (note-1)	V _{DD} -V _L	T _a = 25°C	-	4.4	-	V
		T _a = 50°C	-	3.6	-	V
		T _a = 0°C	-	3.9	4.1	4.5
Brightness (note-2)	L	I _F = 75 mA	30	50	-	NIT

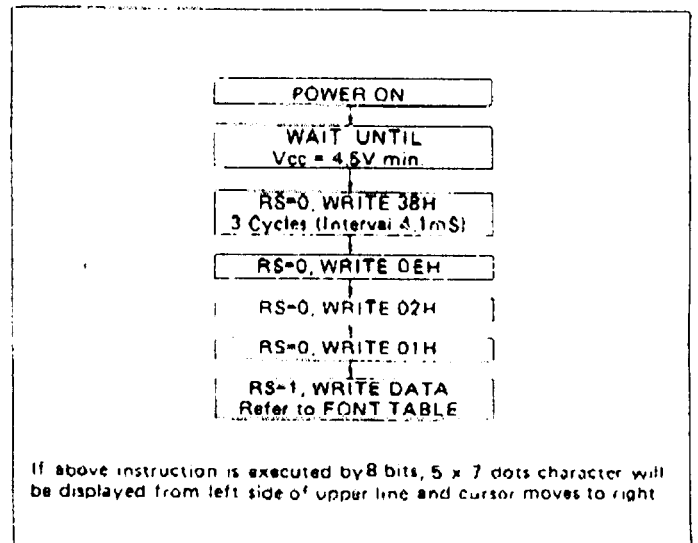
NOTE 1. Power supply for LCD is variable with RL in accordance with contrast.
2. Measured on the bare LED backlight unit

PIN CONNECTIONS

Pin No.	Symbol	Level	Function
1	V _{SS}	-	Power supply
2	V _{DD}	-	
3	V _L	-	
4	RS	H/L	H: Data input L: Instruction data input
5	R/W	H/L	H: Data read L: Data write
6	E	H,H*L	Enable signal
7	D0	H/L	Data bus line*
8	D1	H/L	
9	D2	H/L	
10	D3	H/L	
11	D4	H/L	
12	D5	H/L	
13	D6	H/L	
14	D7	H/L	
15	A	-	ANODE for LED backlighting

* In case of 4 bits instruction, data is transferred by twice using only 4 buses of D4-D7, and D0-D3 are not used; first operation is higher order 4 bits and second is lower 4 bits of 8 bits, but in case of 8 bits instruction, data is transferred by data bus of D0-D7.

TEST PROCEDURE

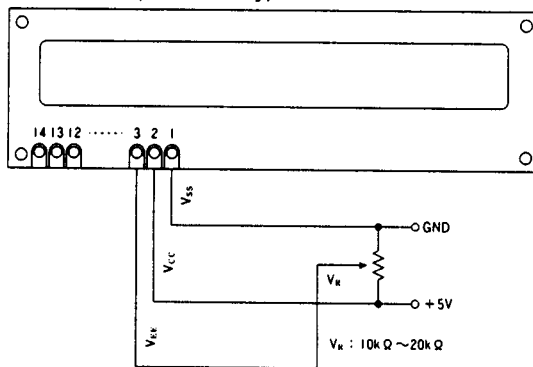


«Features»

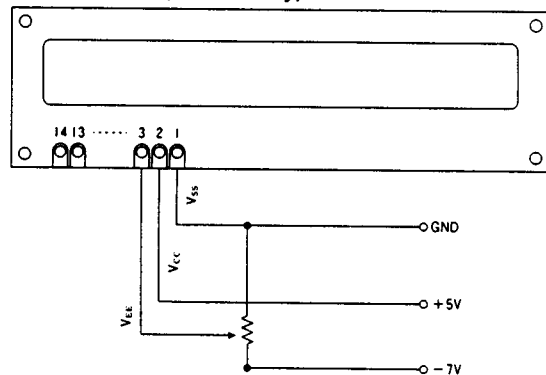
- (1) Interface with 8-bit or 4-bit MPU is available.
- (2) 192 kind of alphabets, numerals, symbols and special characters can be displayed by built-in character generator (ROM)
- (3) Other preferred characters can be displayed by character generator (RAM)
- (4) Various functions of instruction are available by programming:
 - Clear display ● Cursor at home ● On/off cursor ● Blink character
 - Shift display ● Shift cursor ● Resd/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

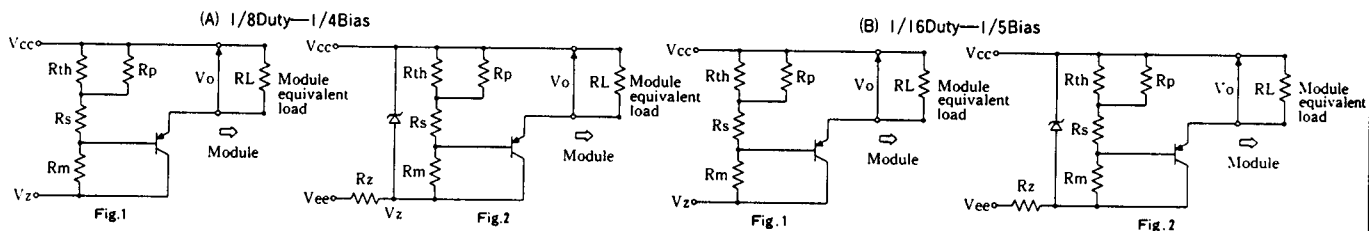


Extended Temperature Type



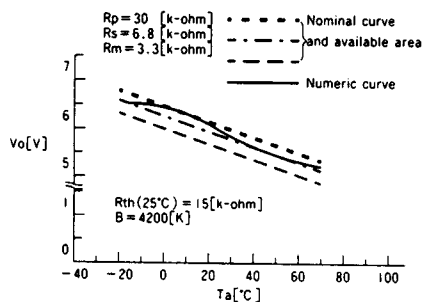
*NOTE: If V_{EE} vary from recommended value, you cannot get proper contrast or viewing angle.

Examples of Temperature Compensation Circuits for Extended Temp Typ. (Only for reference)

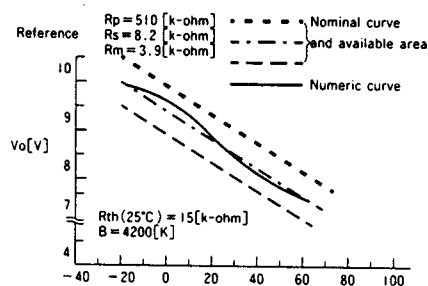


Thermistor: $R_{th}(25^{\circ}\text{C}) = 15[\text{k}\text{-ohm}]$, $B = 4200[\text{K}]$
 Resistors: $R_p = 30[\text{k}\text{-ohm}]$, $R_s = 6.8[\text{k}\text{-ohm}]$, $R_m = 3.3[\text{k}\text{-ohm}]$
 Transistor: PNP Type
 $V_{cc} = +5\text{V}$, $V_{ss} = 0\text{V}$ (Logic Supply)
 $V_z = -8[\text{V}]$ (-7.8 to -8.2[V])
 $V_{ee} < V_z[\text{V}]$, $R_z = (V_z - V_{ee})/5[\text{k}\text{-ohm}]$

Thermistor: $R_{th}(25^{\circ}\text{C}) = 15[\text{k}\text{-ohm}]$, $B = 4200[\text{K}]$
 Resistors: $R_p = 510[\text{k}\text{-ohm}]$, $R_s = 8.2[\text{k}\text{-ohm}]$, $R_m = 3.9[\text{k}\text{-ohm}]$
 Transistor: PNP Type
 $V_{cc} = +5\text{V}$, $V_{ss} = 0\text{V}$ (Logic Supply)
 $V_z = -11[\text{V}]$ (-10.725 to -11.275[V])
 $V_{ee} < V_z[\text{V}]$, $R_z = (V_z - V_{ee})/5[\text{k}\text{-ohm}]$



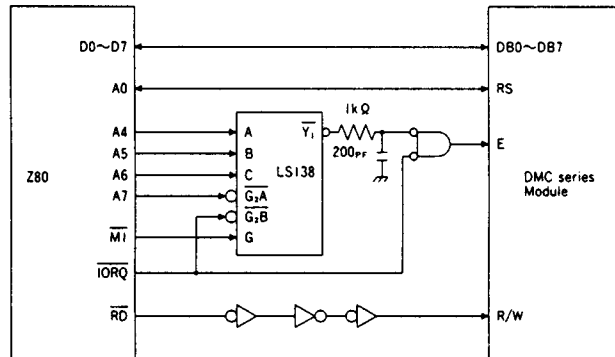
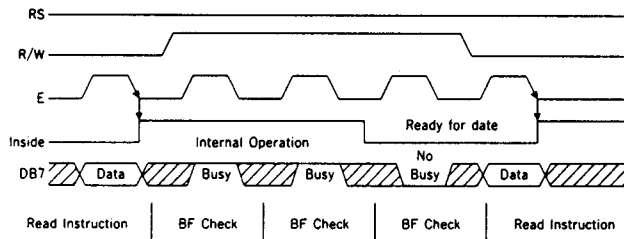
Ta [°C]	Vo [V]
-20	6.56
-10	6.50
0	6.40
10	6.26
20	6.09
30	5.88
40	5.67
50	5.47
60	5.29
70	5.15



Ta [°C]	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

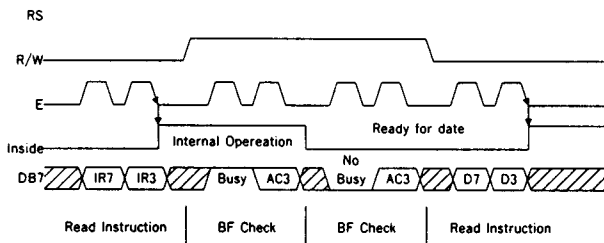
*Specifications are subject to change without notice.

Example of Interface with 8-bit MPU (Z80)

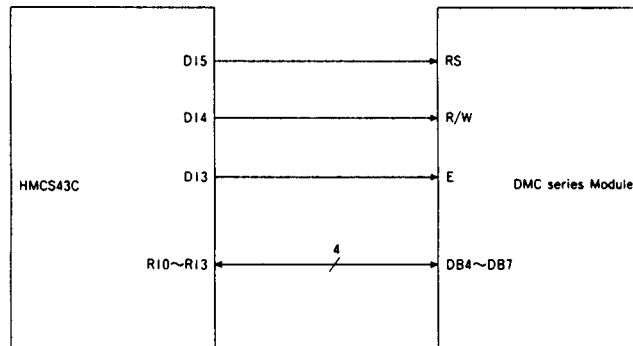


Example of Interface with 4-bit MPU(HMCS43C)

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 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 instruction
AC3: 3th bit of Address Counter



INSTRUCTIONS (Except for DMC40401 series)

Instruction	Code										Executed Time (max.) fosc=250kHz	
	RS	R/W/DF	DR	DS	DF	DR	DS	DF	DR	DS		
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	0	*	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 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 (BF) indicating internal operation is being performed and reads address counter contents.	0μS		
CGRAM/DDRAM Data Write	1	0	W _{RITE DATA}					Writes data into DDRAM or CGRAM.	40μS			
CGRAM/DDRAM Data Read	1	1	R _{EAD DATA}					Reads data into DDRAM or CGRAM.	40μS			

Code	Description	Executed Time (max.)
I/D=1: Increment I/D=0: Decrement S=1: With display shift S/C=1: Display shift S/C=0: Cursor movement R/L=1: Shift to the right R/L=0: Shift to the left DL=1: 8-bit DL=0: 4-bit N=1: 2lines N=0: 1lines F=1: 5×10dots F=0: 5×7dots BF=1: Internal operation is being performed BF=0: Instruction acceptable	DDRAM: Display Data RAM CGRAM: Character Generator RAM ACG: CGRAM Address ADD: DDRAM Address Corresponds to cursor address. AC: Address Counter, used for both DDRAM and CGRAM *: Invalid	fcp or fosc=250kHz However, when frequency changes, execution time also changes Ex if fcp or fosc is 270kHz, $40\mu S \times \frac{250}{270} = 37\mu S$

FONT TABLE (5×11Dots)

Lower 4-bit	Upper 4-bit	0000	0010	0011	0100	0101	0110	0111	1000	1001	1010	1011	1100	1101	1110	1111
xxxx0000	CG RAM (1)	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4
xxxx0001	(2)	!	1	!@	!@	!@	!@	!@	!@	!@	!@	!@	!@	!@	!@	!@
xxxx0010	(3)	"	2	"	"	"	"	"	"	"	"	"	"	"	"	"
xxxx0011	(4)	#	3	#	#	#	#	#	#	#	#	#	#	#	#	#
xxxx0100	(5)	\$	4	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$
xxxx0101	(6)	%	5	%	%	%	%	%	%	%	%	%	%	%	%	%
xxxx0110	(7)	&	6	&	&	&	&	&	&	&	&	&	&	&	&	&
xxxx0111	(8)	'	7	'	'	'	'	'	'	'	'	'	'	'	'	'
xxxx1000	(1)	(8	(((((((((((((
xxxx1001	(2))	9)))))))))))))
xxxx1010	(3)	*	:	*	:	*	:	*	:	*	:	*	:	*	:	*
xxxx1011	(4)	+	:	+	:	+	:	+	:	+	:	+	:	+	:	+
xxxx1100	(5)	,	<	,	<	,	<	,	<	,	<	,	<	,	<	,
xxxx1101	(6)	-	=	-	=	-	=	-	=	-	=	-	=	-	=	-
xxxx1110	(7)	.	>	.	>	.	>	.	>	.	>	.	>	.	>	.
xxxx1111	(7)	.	>	.	>	.	>	.	>	.	>	.	>	.	>	.

(5×8Dots)

110	111
00	00
01	01
02	02
03	03
04	04
05	05
06	06
07	07
08	08
09	09
10	10
11	11
12	12
13	13
14	14
15	15
16	16
17	17
18	18
19	19
20	20
21	21
22	22
23	23
24	24
25	25
26	26
27	27
28	28
29	29
30	30
31	31
32	32
33	33
34	34
35	35
36	36
37	37
38	38
39	39
40	40
41	41
42	42
43	43
44	44
45	45
46	46
47	47
48	48
49	49
50	50
51	51
52	52
53	53
54	54
55	55
56	56
57	57
58	58
59	59
60	60
61	61
62	62
63	63
64	64
65	65
66	66
67	67
68	68
69	69
70	70
71	71
72	72
73	73
74	74
75	75
76	76
77	77
78	78
79	79
80	80
81	81
82	82
83	83
84	84
85	85
86	86
87	87
88	88
89	89
90	90
91	91
92	92
93	93
94	94
95	95
96	96
97	97
98	98
99	99
100	100
101	101
102	102
103	103
104	104
105	105
106	106
107	107
108	108
109	109
110	110
111	111
112	112
113	113
114	114
115	115
116	116
117	117
118	118
119	119
120	120
121	121
122	122
123	123
124	124
125	125
126	126
127	127
128	128
129	129
130	130
131	131
132	132
133	133
134	134
135	135
136	136
137	137
138	138
139	139
140	140
141	141
142	142
143	143
144	144
145	145
146	146
147	147
148	148
149	149
150	150
151	151
152	152
153	153
154	154
155	155
156	156
157	157
158	158
159	159
160	160
161	161
162	162
163	163
164	164
165	165
166	166
167	167
168	168
169	169
170	170
171	171
172	172
173	173
174	174
175	175
176	176
177	177
178	178
179	179
180	180
181	181
182	182
183	183
184	184
185	185
186	186
187	187
188	188
189	189
190	190
191	191
192	192
193	193
194	194
195	195
196	196
197	197
198	198
199	199
200	200
201	201
202	202
203	203
204	204
205	205
206	206
207	207
208	208
209	209
210	210
211	211
212	212
213	213
214	214
215	215
216	216
217	217
218	218
219	219
220	220
221	221
222	222
223	223
224	224
225	225
226	226
227	227
228	228
229	229
230	230
231	231
232	232
233	233
234	234
235	235
236	236
237	237
238	238
239	239
240	240
241	241
242	242
243	243
244	244
245	245
246	246
247	247
248	248
249	249
250	250

*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, DMC16101A, DMC24138, DMC32132, DMC40131

