SANYO

No. 1778B

DM1620

LIQUID CRYSTAL
DOT MATRIX DISPLAY MODULE
16 characters x 2 lines

General Description

The DM1620 is a liquid crystal dot matrix display module that consists of LCD panel LCD-5021, LCD control driver HD44780, driver LC7930 and is capable of providing (16 characters x 2 lines) display. It contains a controller, a data RAM, and a character generator ROM required for providing display. Data interfacing is in 8-bit parallel or 4-bit parallel and data can be written in or read from a microprocessor.

General Specifications

1. Display stem   1/5bias 1/16duty
2. Display content   16 character x 2 lines
3. Dots organizing 1 character   5 x 7 dots/character + cursor
4. Display data RAM   80 x 8 bits
5. Character generator ROM   160-character JIS font set + 32-character special font set
   Refer to Table 1.
6. Character generator RAM   64 x 8 bits   5 x 7 dots   8 characters
7. Instruction function   Refer to Table 2.
8. Circuit diagram   Refer to Fig. 3

Outline

1. Module outline   32.6(W) x 85.0(L) x 10(T) (mm)
2. View area   60.5 x 14.4 (mm)
3. Dot size   0.55 x 0.65 (mm)
4. Dot pitch   0.60 x 0.70 (mm)
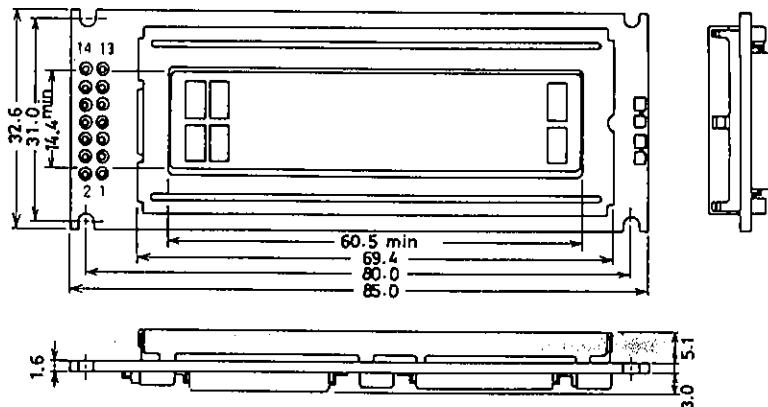5. Character size (5 x 8 dots)   2.95 x 5.55 (mm)

Absolute Maximum Ratings/Ta=25 °C

			unit
Supply Voltage	$V_{DD}-V_{SS}$	-0.3 to +7	V
Input Voltage	V_I	-0.3 to $V_{DD}+0.3$	V
Drive Voltage	$V_{DD}-V_O$	-0.3 to +9	V
Operating Temperature	Topr	0 to +50	°C
Storage Temperature	Tstg	-20 to +70	°C

Module Dimensions   5000A
(unit: mm)
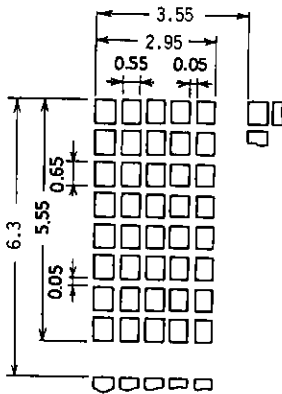
Display Pattern

Electrooptical Characteristics/V_{DD}-V_{SS}=5.0V, Ta=25°C unless otherwise specified

			min	typ	max	unit
Input "High" Voltage	V_{IH}		2.2		5.0	V
Input "LOW" Voltage	V_{IL}		0		0.5	V
Output "High" Voltage	V_{OH}	DB0 to DB7, -I_{OH}=0.2mA	2.4			V
Output "Low" Voltage	V_{OL}	DB0 to DB7, -I_{OL}=1.2mA			0.4	V
Input Current	I_P	Pull-up MOS V_{DD}=5V	50	125	250	μA
Current Dissipation	I_{DD}	No input/output current included		(1.2)	2.5	mA
Oscillation Frequency	F_{OSC}		190	270	350	kHz
Viewing Angle	$\phi2 - \phi1$	K=1.4 θ=0°	20			degree
Contrast Ratio	K	ϕ=20° θ=0°	3.0			
Rise Time	t_r	ϕ=20° θ=0°		150	250	ms
Fall Time	t_f	ϕ=20° θ=0°		150	250	ms
LCD Drive Voltage	V_{DD}-V_O	Ta=0°C ϕ=20°, θ=0°, K≧3	4.4	4.5	4.6	V
(Recommend Value)	V_{DD}-V_O	Ta=25°C " " "	4.0	4.1	4.2	V
1/16 duty	V_{DD}-V_O	Ta=50°C " " "	3.4	3.5	3.6	V

(1) Test Condition for Response Time (t_r,t_f)
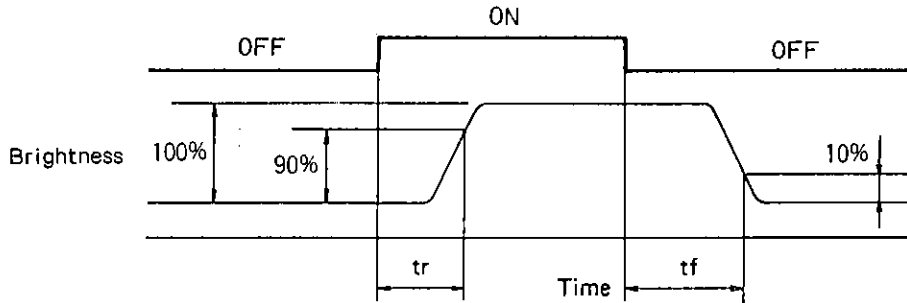
(2) Definition of Contrast (K)

$$K = B2/B1$$
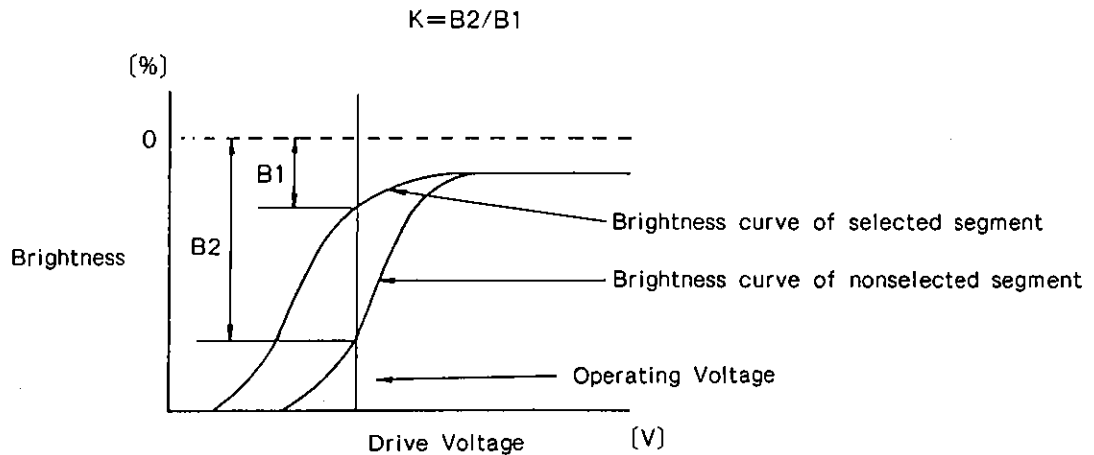
(3) Contrast Ratio Measuring Method

$Z(\theta = 0)$
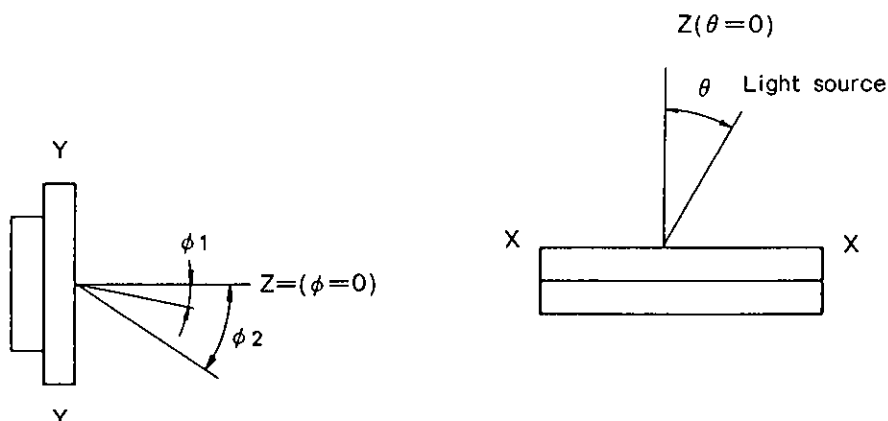
θ Light source

Angles ϕ and θ are defined shown above.
The light source is placed in the θ direction at an angle of 30° and the sensor is placed in the ϕ direction to measure the contrast.

Pin Description

No.	Pin Name	Function
1	V_{SS}	(−) power supply pin 0V
2	V_{DD}	(+) power supply pin +5V
3	V_O	Pin for applying LCD drive voltage
4	RS	Input pin HI=Data LOW=Instruction
5	R/W	Input pin HI=Read LOW=Write
6	E	Input pin Enable signal
7	DB0	
8	DB1	
9	DB2	
10	DB3	Data bus line
11	DB4	
12	DB5	
13	DB6	
14	DB7	

Note 1. The LCD drive voltage can be varied from 3V to 5V by a variable resistor of 5kohm connected across V_{SS} and V_O.

Timing Characteristics

				min	typ	max	unit
Enable Cycle Time		tcycE		1000			ns
Enable Pulse Width	High level	PWEH		450			ns
Enable Rise/Fall time		tEr,tEf	Figs. 1,2			25	ns
Set Up Time	RS/RW-E	tAs		140			ns
Address Hold Time		tAH		10			ns
Data Delay time		tDDR				320	ns
Data Set Up Time		tDSW		195			ns
Data Hold Time		tH(tDHR)		10 (20)			ns

Write Operation

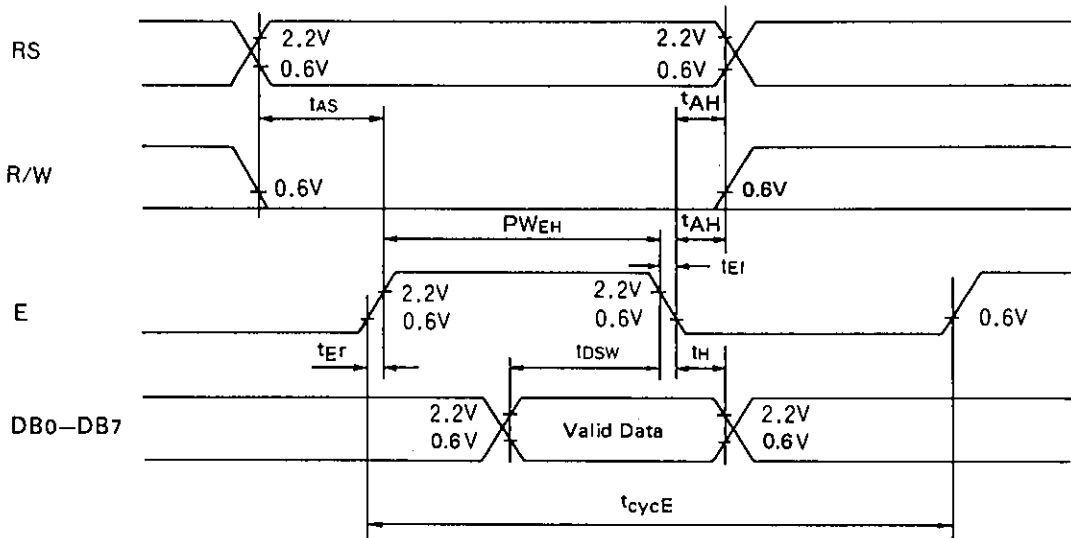Fig. 1 Interface Timing (Data Write)

Read Operation
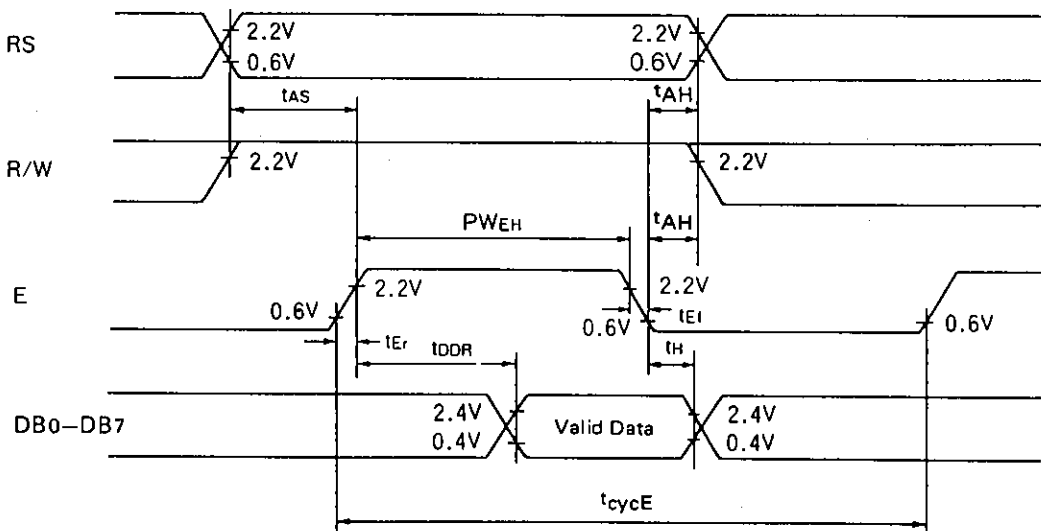
Fig. 2 Interface Timing (Data Read)

Table 1   Character code

Low-order 4-bit \ Hi-order 4-bit	0000	0010	0011	0100	0101	0110	0111	1010	1011	1100	1101	1110	1111
××××0000	CG RAM (1)		0	@	P	`	p		―	タ	ミ	α	p
××××0001	(2)	!	1	A	Q	a	q	。	ア	チ	ム	ä	q
××××0010	(3)	"	2	B	R	b	r	「	イ	ツ	メ	β	θ
××××0011	(4)	#	3	C	S	c	s	」	ウ	テ	モ	ε	∞
××××0100	(5)	$	4	D	T	d	t	、	エ	ト	ヤ	μ	Ω
××××0101	(6)	%	5	E	U	e	u	・	オ	ナ	ユ	σ	ü
××××0110	(7)	&	6	F	V	f	v	ヲ	カ	ニ	ヨ	ρ	Σ
××××0111	(8)	'	7	G	W	g	w	ア	キ	ヌ	ラ	g	π
××××1000	(1)	(	8	H	X	h	x	イ	ク	ネ	リ	√	x
××××1001	(2)	)	9	I	Y	i	y	ウ	ケ	ノ	ル	⁻¹	y
××××1010	(3)	*	:	J	Z	j	z	エ	コ	ハ	レ	j	千
××××1011	(4)	+	;	K	[	k	{	オ	サ	ヒ	ロ	×	万
××××1100	(5)	,	<	L	¥	l	|	ャ	シ	フ	ワ	¢	円
××××1101	(6)	-	=	M	]	m	}	ュ	ス	ヘ	ン	£	÷
××××1110	(7)	.	>	N	^	n	→	ョ	セ	ホ	゙	ñ	
××××1111	(8)	/	?	O	_	o	←	ッ	ソ	マ	゚	ö	█

(Note) The CG RAM is a character generator RAM used to store the character patterns that can be program-rewritten, as desired, by the user.

Table 2 Instruction function

Instruction	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	Contents	Execution Time (f$_{OSC}$=250kHz)
Display clear	0	0	0	0	0	0	0	0	0	1	Clears all display and returns the cursor to the home position (address 0).	82μs to 1.64ms
Cursor 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. The DD RAM contents remain unaffected.	40 μs to 1.6ms
Entry mode set	0	0	0	0	0	0	0	1	I/D	S	Sets the cursor move direction and specified whether to 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 all display ON/OFF(D), cursor ON/OFF(C), cursor position character blink(B).	40μs
Cursor/ display shift	0	0	0	0	0	1	S/C	R/L	*	*	Moves the cursor and shifts the display without affecting the DD RAM contents.	40μs
Function set	0	0	0	0	1	DL	N	F	*	*	Sets the interface data length (DL), number of display lines (L), and character font (F).	40μs
CG RAM address set	0	0	0	1	ACG						Sets the CG RAM address. RAM data is sent/received after this setting.	40μs
DD RAM address set	0	0	1	ADD							Sets the DD RAM address. DD RAM data is sent/received after this setting.	40μs
Busy flag/ address read	0	1	BF	AC							Reads the contents of busy flag (BF) indicating internal operation is in progress and reads the contents of address counter.	1μs
CG RAM DD RAM data write	1	0	Write Data								Writes data into the DD RAM or CG RAM.	40μs
CG RAM/ DD RAM data read	1	1	Read Data								Reads data from the DD RAM or CG RAM.	40μs

I/D = 1: Increment (+1)
I/D = 0: Decrement (-)
S = 1: Accompanied by display shift
S/C = 1: Display shift
S/C = 0: Cursor move
R/L = 1: Right-shift
R/L = 0: Left-shift
DL = 1: 8 bits   DL = 0: 4 bits
N = 1: 2 lines   N = 0: 1 line
F = 1: 5 x 10 dots   F = 0: 5 x 7 dots
BF = 1: Internally operating
BF = 0: Possible to accept Instruction

DD RAM: Display data RAM
CG RAM: Character generator RAM
ACG: CG RAM address
ADD: DD RAM address
        Corresponds to cursor address.
AC: Address counter used for both DD RAM and CG RAM.

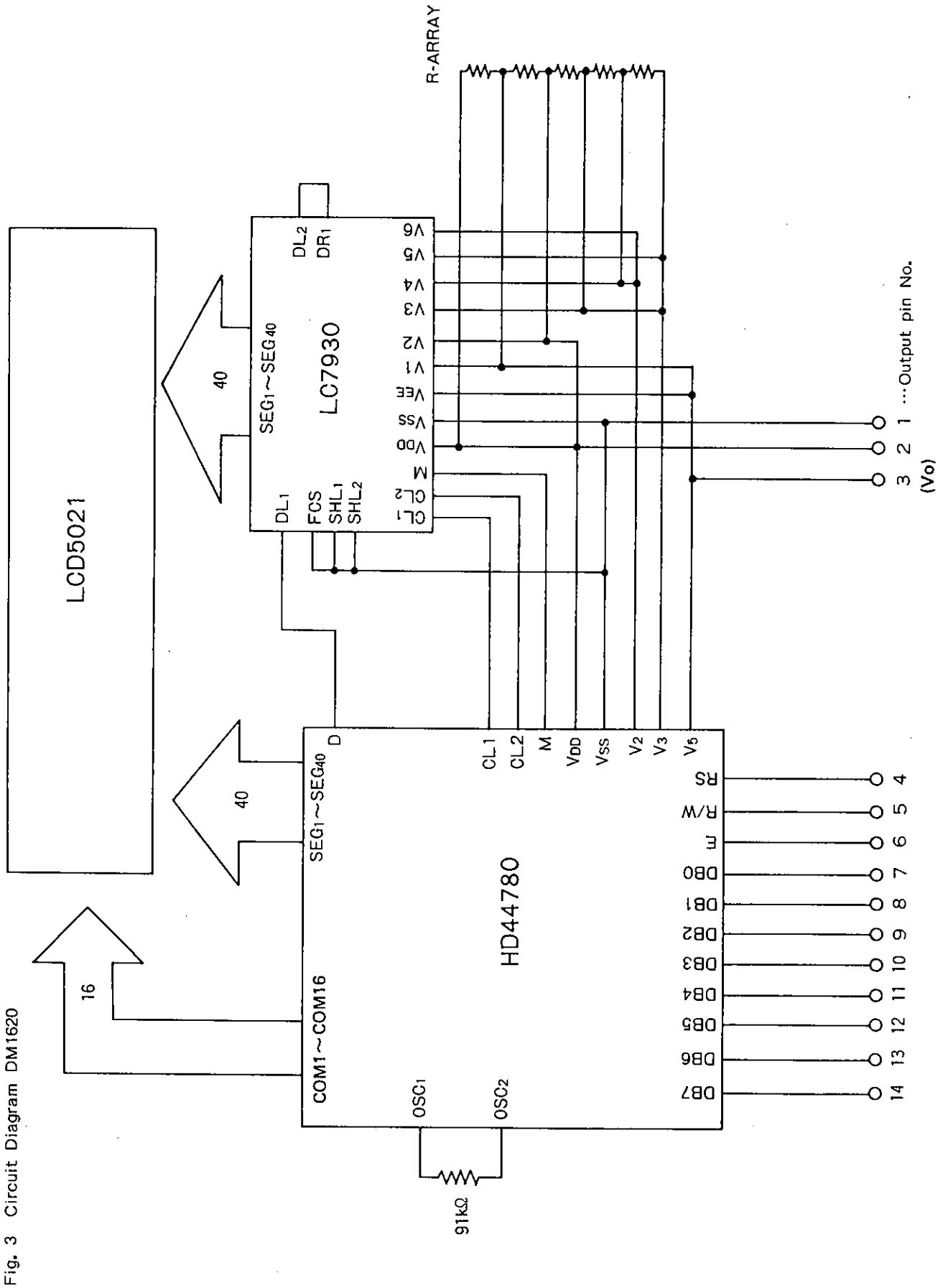The change in the frequency (f$_{OSC}$) also causes the execution time to be changed. (Example) When f$_{OSC}$=270kHz, 40μs x 250/270 =37μs.

Fig. 3 Circuit Diagram DM1620