■ Features

Model name	LCD Mode	B/L
EA-D16025AR	TN Reflective	–
EA-D16025AR-S	STN Reflective	–
EA-D16025ER	TN Transflective	EL
EA-D16025ER-S	STN Transflective	EL
EA-D16025PR-S	STN Transmissive	LED

- Number of Character : 16 x 2
- Character Font : 5 x 8 Dots
- Duty : 1/16
- Type : Positive Type

■ Mechanical Specifications

Parameter	Dimensions (mm)
Overall Size	84.0 x 44.0 x 10.3
Viewing Area	61.0 x 15.8
Character Size	2.96 x 5.56
Character Pitch	3.55 x 5.94
Dot Size	0.56 x 0.66
Weight	40 (g)

■ Outline Dimensions
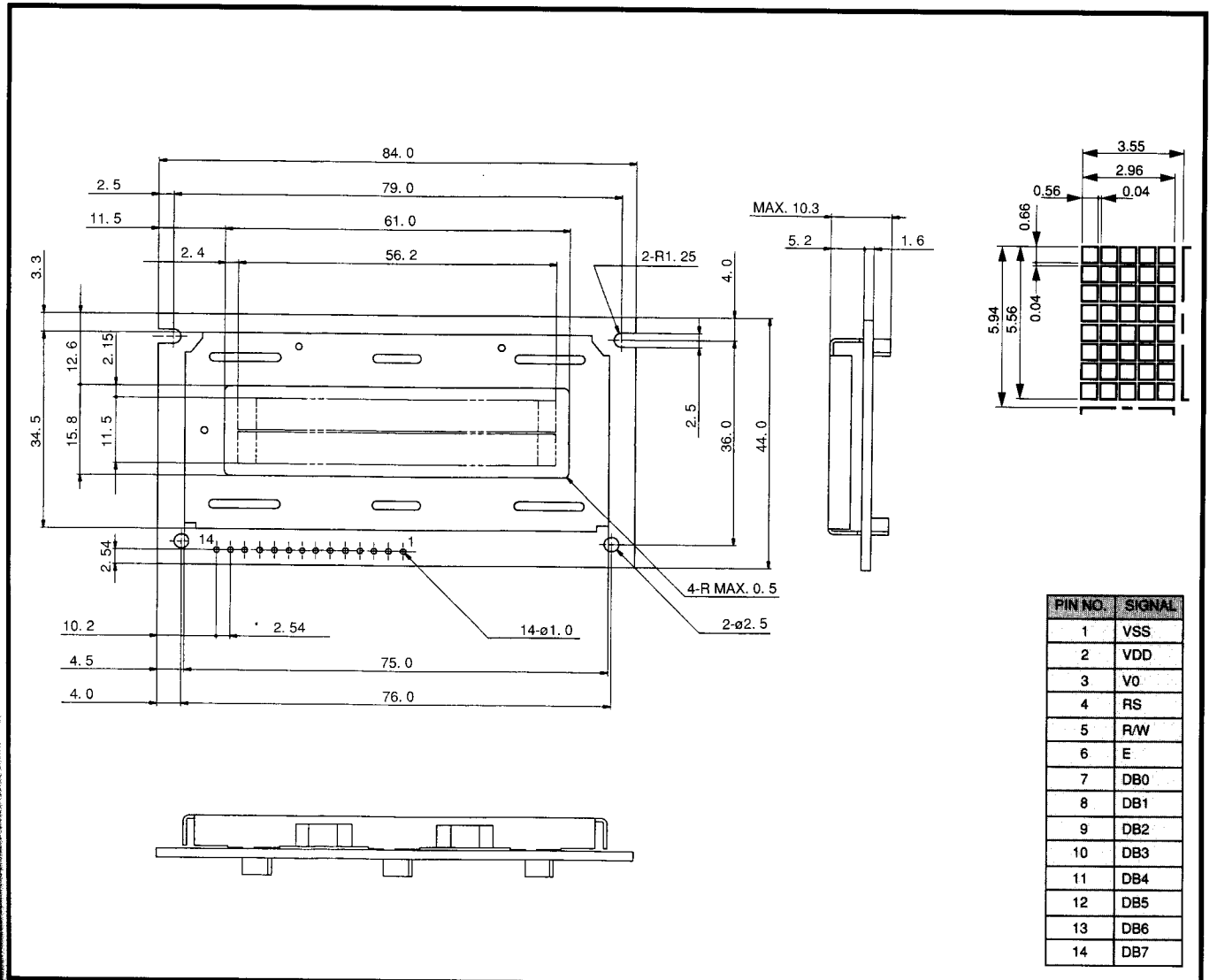
PIN NO.	SIGNAL
1	VSS
2	VDD
3	V0
4	RS
5	R/W
6	E
7	DB0
8	DB1
9	DB2
10	DB3
11	DB4
12	DB5
13	DB6
14	DB7

■ Characteristics

EA-D Series
- Incorporates an LSI exclusive for character display, equivalent to HD44780 or HD66780.
- Interface for Types 68/80.
- Built-in character generator ROM, 160 characters (JIS) and 32 characters (special characters).
- Built-in character generator RAM, 8 characters.
- 5V single power supply

■ Absolute Maximum Rating

Item	Symbol	Min	Max	Unit
Power voltage	VDD-VSS	0	+7	V
Input voltage	VIN	VSS	VDD	V
Operating temperature range	TOP	0	+50	°C
Storage temperature range	TST	−20	+60	°C

■ Optical Characteristics

Item	Symbol	TN			STN			Unit
		MIN	TYP	MAX	MIN	TYP	MAX	
Response Time	tr		100	150		200	300	msec
	tf		100	150		200	300	msec
Viewing Cone	θ	10		30	10		40	degree
	ø	−30		30	−30		30	degree
Contrast	Cr		3			5		

■ Description of Terminals

Signal Name	Input/ Output	External Connection	Function
RS	Input	MPU	Register select signal "0" : Instruction register (when writing) Busy flag and address counter (when reading) "1" : Data register (when writing and reading)
R/W	Input	MPU	Read/write select signal "0" : Writing "1" : Reading
E	Input	MPU	Operation (data read/write) enable signal
DB4-DB7	Input/ Output	MPU	High-order lines of data bus with three-state, bidirectional function for use in data trasactions with the MPU. DB7 may also be used to check the busy flag.
DB0-DB3	Input/ Output	MPU	Low-order lines of data bus with three-state, bidirectional function for use in data transactions with the MPU. These lines are not used when interfacing with a 4-bit microprocessor.
VDD, VSS		Power Supply	VDD: +5V, VSS: GND
V0		Power Supply	Contrast adjustment voltage

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■ DC Characteristics

$V_{DD} = 5V \pm 5\%$
$V_{SS} = 0V$, Top = 0~50°C

Item	Symbol	Condition	Standard value			Unit	Applicable terminal
			MIN	TYP	MAX		
Power voltage	VDD		4.75	5.00	5.25	V	VDD
Input H-level voltage	VIH		2.2		VDD	V	RS, R/W, E, DB0~DB7
Input L-level voltage	VIL		VSS		0.6	V	
Output H-level voltage	VOH	−IOH=0.205mA	2.4			V	DB0~DB7
Output L-level voltage	VOL	IOL=1.2mA			0.4	V	
I/O leak current	ILI	VIN=0 ~ VDD			1.0	μA	RS, R/W,E, DB0~DB7
Power current	IDD	VDD=5V		1.0	3.0	mA	VDD
LC operating voltage	VLCD	VDD−V0	3.46		4.86	V	V0

■ AC Characteristics

$V_{DD} = 5V \pm 5\%$
$V_{DD} = 0V$, Top = 0~50°C

Item		Symbol	MIN	MAX	Unit
Enable cycle time		tCYCE	500	–	ns
Enable pulse width	"High" level	PWEH	220	–	ns
Enable rise/fall time		tEr, tEf	–	25	ns
Set-up time	RS, R/W-E	tAS	60	–	ns
Address hold time		tAH	10	–	ns
Data set-up time		tDSW	100	–	ns
Data delay time		tDDR	–	170	ns
Data hold time (writing)		tH	10	–	ns
Data hold time (reading)		tDHR	20	–	ns
Clock oscillating frequency		fOSC	270 (TYP.)		KHz

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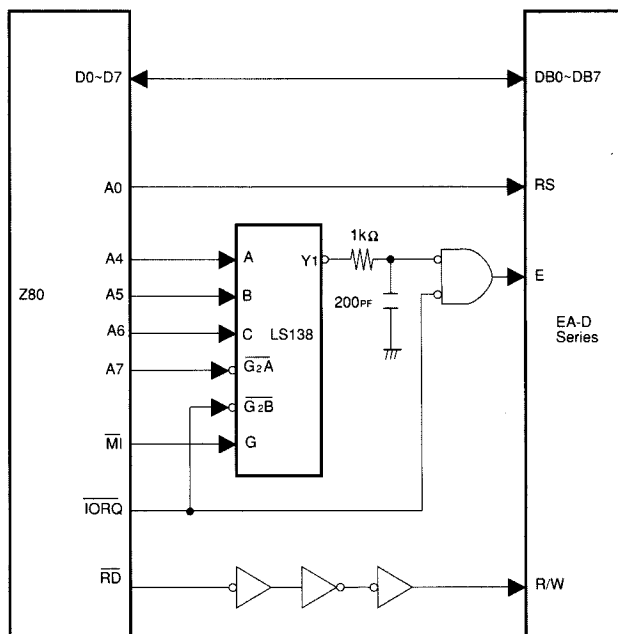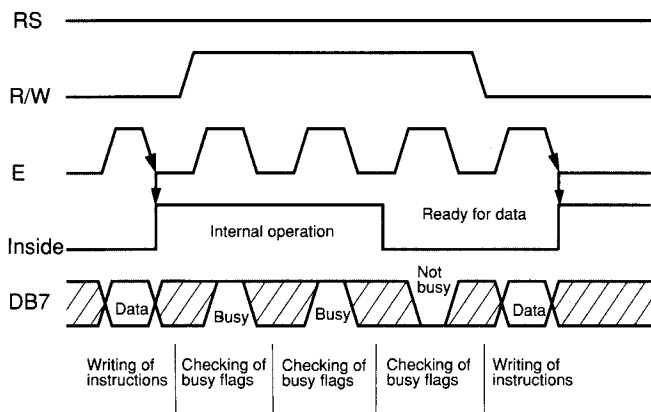## ■ Timing Characteristics

Writing Timing
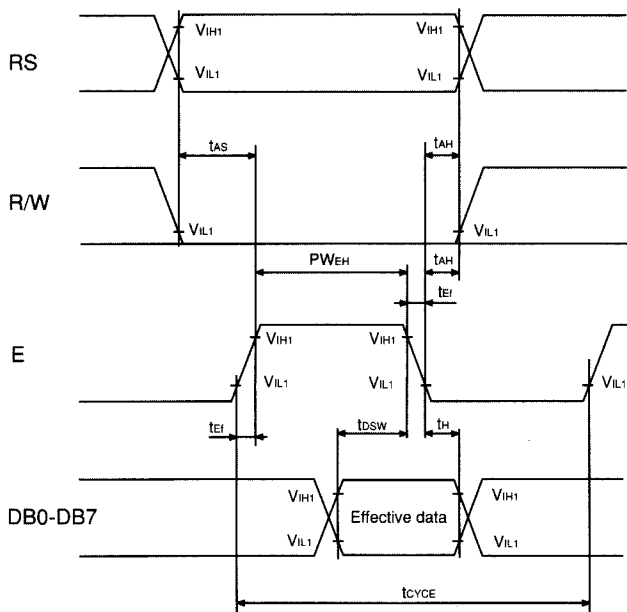
Reading Timing
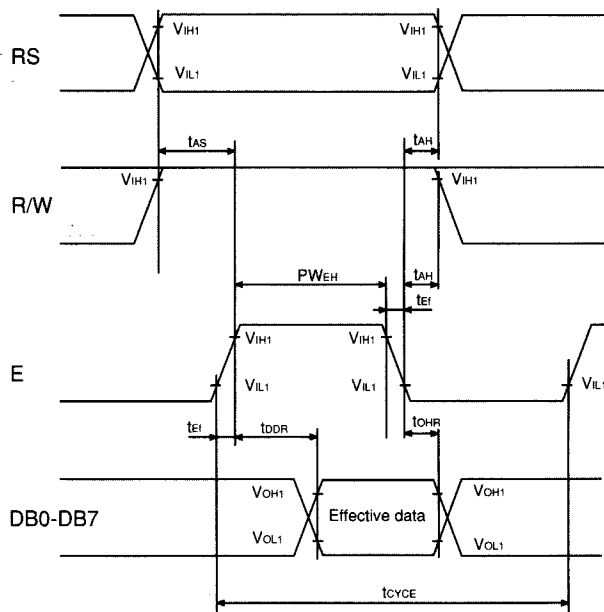
■ Connecting Block Diagram

- **Example of interface with 8-bit MPU (Z80)**

■ Display Commands

No.	Instruction	Code										Description
		RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	
1	Clear Display	0	0	0	0	0	0	0	0	0	1	Clears all display and returns the cursor to the home position (Address 00H).
2	Return Home	0	0	0	0	0	0	0	0	1	*	Returns the cursor to the home position (Address 00H). Also returns the display being shifted to the original position. DD RAM contents remain unchanged.
3	Entry Mode Set	0	0	0	0	0	0	0	1	I/D	S	Sets the cursor move direction and specifies to shift the display or not. These operations are performed during data write and read.
4	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).
5	Cursor or Display Shift	0	0	0	0	0	1	S/C	R/L	*	*	Moves the cursor and shifts the display without changing DD RAM contents.
6	System Set	0	0	0	0	1	IF	N	F	*	*	Sets inteface data length (IF), number of display Lines (L), and character front (F).
7	Set CG RAM Address	0	0	0	1	ACG						Sets the CG RAM address. CG RAM data is sent and received after this setting.
8	Set DD RAM Address	0	0	1	ADD							Sets the DD RAM address. DD RAM data is sent and received after this setting.
9	Read Busy Flag & Address	0	1	BF	AC							Reads Busy flag (BF), and address counter contents.
10	Write data to CG or DD RAM	1	0	Write Data								Writes data into DD RAM or CG RAM.
11	Read Data from CG or DD RAM	1	1	Read Data								Reads data from DD RAM or CG RAM.

* : No effect

[Note 1]
I/D=1	:	Increment
I/D=0	:	Decrement
S=1	:	Accompanies display shift
S/C=1	:	Display shift
S/C=0	:	Cursor move
R/L=1	:	Shift to the right
R/L=0	:	Shift to the left
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	:	Busy
BF=0	:	Not Busy

[Note 2]
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 of DD and CG RAM address

■ Character Code Map

Lower 4 bit (D0~D3)	Upper 4 bit (D4 ~ D7) of Character Code (Hexadecimal)													
	0	2	3	4	5	6	7	A	B	C	D	E	F
0	CG RAM (1)		0	@	P	`	p		—	タ	ミ	α	p
1	(2)	!	1	A	Q	a	q	。	ア	チ	ム	ä	q
2	(3)	"	2	B	R	b	r	「	イ	ツ	メ	β	θ
3	(4)	#	3	C	S	c	s	」	ウ	テ	モ	ε	∞
4	(5)	$	4	D	T	d	t	、	エ	ト	ヤ	μ	Ω
5	(6)	%	5	E	U	e	u	・	オ	ナ	ユ	σ	ü
6	(7)	&	6	F	V	f	v	ヲ	カ	ニ	ヨ	ρ	Σ
7	(8)	'	7	G	W	g	w	ア	キ	ヌ	ラ	g	π
8	(1)	(	8	H	X	h	x	イ	ク	ネ	リ	√	x̄
9	(2)	)	9	I	Y	i	y	ゥ	ケ	ノ	ル	⁻¹	y
A	(3)	*	:	J	Z	j	z	エ	コ	ハ	レ	j	千
B	(4)	+	;	K	[	k	{	オ	サ	ヒ	ロ	×	万
C	(5)	,	<	L	¥	l			ャ	シ	フ	ワ	¢	円
D	(6)	-	=	M	]	m	}	ュ	ス	ヘ	ン	£	÷
E	(7)	.	>	N	^	n	→	ョ	セ	ホ	゛	ñ	
F	(8)	/	?	O	_	o	←	ッ	ソ	マ	゜	ö	■

Note 1) CG RAM is a character generator RAM which can store the character pattern rewriting with a program freely by a user.

2) 32 characters of upper bit "1110" and "1111" are character pattern. And some kinds of font will be jutted out at some portion in the LCD unit of 5 x 7 dot font. So don't use them.