

SPECIFICATIONS

FOR

EA-X SERIES

EA-X16017AR (16 x 1)

EA-X16027AR (16 x 2)

EA-X20017AR (20 x 1)

EA-X20027AR (20 x 2)

EA-X24017AR (24 x 1)

EA-X40017AR (40 x 1)

EA-X40027AR (40 x 2)

JUNE 1 , 1986

SEIKO EPSON CORPORATION.

I N D E X

	PAGE
I. OUTLINE	1
A. DESCRIPTION	1
B. FEATURES	1
C. MODEL NUMBER TABLE & MECHANICAL SPECIFICATIONS	2
D. CONSTRUCTION	3
E. BLOCK DIAGRAM	4
II. SPECIFICATIONS	5
A. ABLOLUTE MAXIMUM RATINGS	5
B. ELECTRICAL CHARACTERISTICS	5
B-1) DC ELECTRICAL CHARACTERISTICS	5
B-2) AC ELECTRICAL CHARACTERISTICS	6
C. OPTICAL CHARACTERISTICS	9
III. INTERFACE	11
A. INPUT/OUTPUT TERMINAL CONFIGURATIONS	11
B. TERMINAL DESCRIPTIONS	12
C. LATCH-UP PREVENTION	13
IV. DISPLAY INSTRUCTIONS	14
A. INSTRUCTION COMMAND & CODE TABLE	14
B. OPERATION	15
C. INSTRUCTION DESCRIPTIONS	15
D. BUSY FLAG	19
E. CHARACTER ADDRESS CODE	20
F. CHARACTER CODE & CHARACTER FONT	21
V. HANDLING PRECAUTIONS	22
VI. DRAWINGS	

I OUTLINE

I-A Description

EPSON's Dot Matrix LCD Modules, EA-X series, consist of a newly developed TN Type Liquid Crystal Display with high-contrast and wide-viewing angle, C-MOS LCD driver and controller.

The combination of LCD and semiconductor technology features high reliability and low power consumption.

EA-X series realized more compact sizes and low cost modules by the development of low power driving Liquid Crystal Material which saves power supply circuits.

All modules of EA-X series have CHARACTER GENERATOR and DATA RAM on board which provide for easy interface with most CPUs, and all the display functions are controlled by the instructions from the controller.

A display character is composed of 5x7 dot matrix with cursor.

I-B Features

- Extremely compact construction (single PCB) / Light weight
- High contrast / Wide viewing angle
- Easy microprocessor interface
- Single "+5V" power supply
- Low power consumption
- Wide operating Temperature range
- C-MOS / TTL compatible signal level
- Easy installation
- 5x7 dot matrix format with cursor, alphanumeric and special symbols
- Built-in RAM for data storage / refresh
- 96 ASCII CHARACTER GENERATOR
- Multiple instruction set (based on 13 commands)

I-C . Model number & Mechanical Specifications

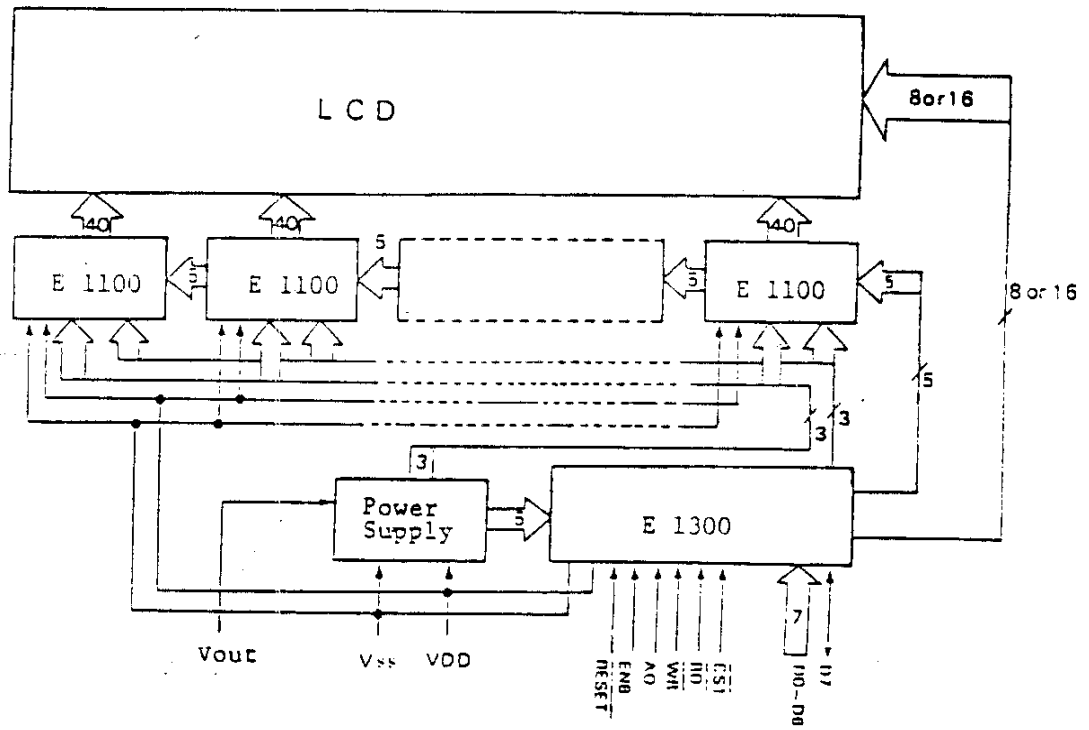
Part Number	Character Format Character x Line (s)	Character Size (with cursor)	Effective Viewing Area	Module Size (without connector) (W x H x D)	Duty Cycle	Weight (approx.)	Connector Type (No. of Contacts)
EA-X16017AR	16 x 1	2.9 x 4.8 (6.2) 0.114 x 0.189 (0.244)	61 x 16 2.402 x 0.630	80 x 36 x 11.1 3.150 x 1.417 x 0.437	1/8	35 1.2	Pin Hole (17)
EA-X16027AR	16 x 2	2.9 x 4.1 (5.3) 0.114 x 0.161 (0.209)	61 x 16 2.402 x 0.630	80 x 36 x 11.1 3.150 x 1.417 x 0.437	1/16	35 1.2	Pin Hole (17)
EA-X20017AR	20 x 1	3.4 x 5.15 (6.65) 0.134 x 0.203 (0.262)	88.2 x 20 3.472 x 0.787	120 x 36 x 11.1 4.724 x 1.417 x 0.437	1/8	50 1.8	Pin Hole (18)
EA-X20027AR	20 x 2	3.4 x 5.15 (6.65) 0.134 x 0.203 (0.262)	88.2 x 20 3.472 x 0.787	120 x 36 x 11.1 4.724 x 1.417 x 0.437	1/16	50 1.8	Pin Hole (18)
EA-X24017AR	24 x 1	2.9 x 4.45 (5.75) 0.114 x 0.175 (0.226)	93 x 20 3.661 x 0.787	120 x 36 x 11.1 4.724 x 1.417 x 0.437	1/8	50 1.8	Pin Hole (18)
EA-X40017AR	40 x 1	3.0 x 4.8 (6.2) 0.118 x 0.189 (0.244)	156 x 20 6.142 x 0.787	188 x 36 x 11.1 7.402 x 1.417 x 0.437	1/8	80 2.8	Pin Hole (18)
EA-X40027AR	40 x 2	3.0 x 4.8 (6.2) 0.118 x 0.189 (0.244)	156 x 20 6.142 x 0.787	188 x 36 x 11.1 7.402 x 1.417 x 0.437	1/16	80 2.8	Pin Hole (18)

I-D Construction

- 1) EA-X series LCD module is constructed from a LCD panel, a metal frame and a PCB which is assembled multiple segment driver / controller LSIs with common driver function and other circuit.
- 2) EA-X series LCD module is designed to function by single power supply (+5V).
- 3) The contrast of LCD panel depends on the temperature and the viewing angle.
You can adjust the contrast of EA-X series LCD module to be the best condition in any circumstances guaranteed in the Absolute Maximum Ratings by connecting recommended register to I/O connector between Vout and GND.
- 4) All display functions concerning display data, address data and cursor functions are controlled by the 13 basic instructions input through 8 bit data bus.
- 5) The controller, LSI includes DISPLAY DATA RAM and CHARACTER GENERATOR (based on ASCII Code). All that is required to display information is to write 8 bit data from the MPU into the DATA RAM.
- 6) Two kinds of address set methods are possible. One is direct address set method, another is automatic increment/decrement method.
- 7) The underline cursor or the all dot blinking (one character) cursor is selectable for the cursor format. The cursor has the functions of 'CURSOR RETURN' 'AT HOME' besides 1 Hz blinking of the underline cursor.
- 8) Moreover, the module has various functions like Reset whole system, Clear all data (Space code input), Display ON/OFF, Display suppress (this function is only for a single line display).

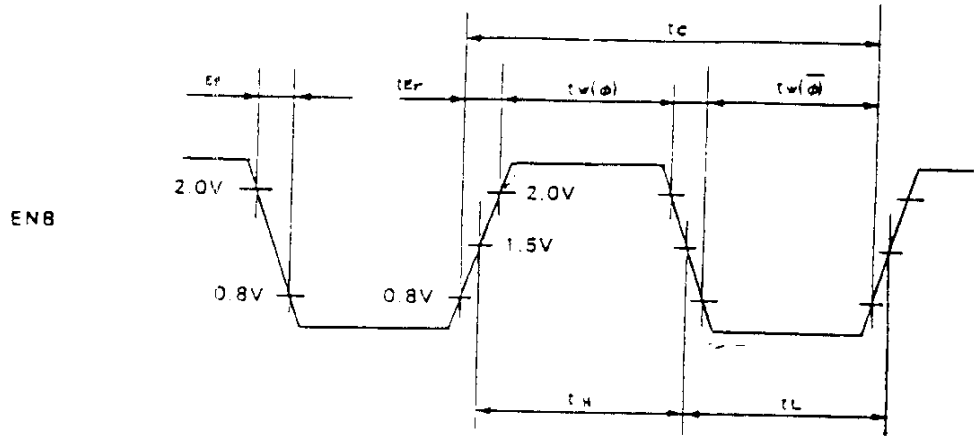
Note: Please refer to 'IV-C. Instruction Descriptions'.

I-E. Block Diagrams



B-2) AC Electrical Characteristics

(a) Clock Signal

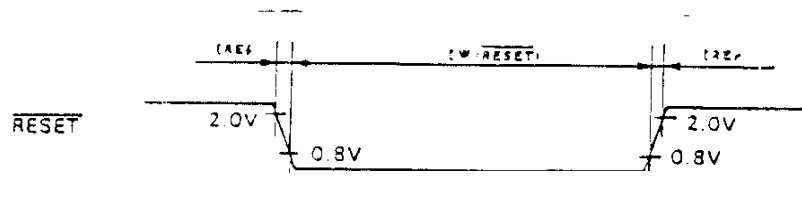


Item	Symbol	Value			Unit	Remark
		Min	Typ	Max		
Enable Clock Pulse Period	t_c	500	-	2000	nsec	
Enable Clock Pulse Width	$t_w(0)$, $t_w(1)$	220	-	1050	nsec	
Enable Clock Pulse Transition Time	t_{Er} , t_{Ef}	-	-	50	nsec	
Enable Clock Pulse Duty	Duty	45	50	55	%	Note

Top : 0 to +50 C, VDD : 5V +- 5%

$$\text{Note : Duty} = \frac{t_H}{t_H + t_L} \times 100 [\%]$$

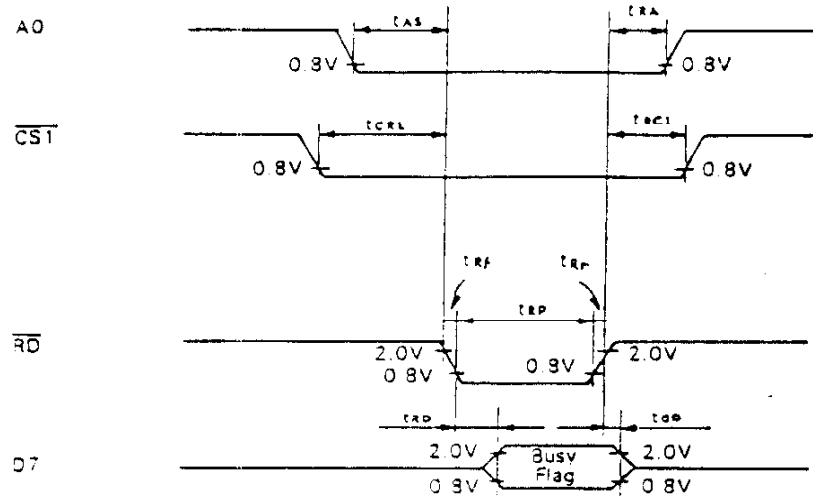
(b) Reset Signal



Item	Symbol	Value			Unit
		Min	Typ	Max	
Reset Pulse Width	$t_w(\text{RESET})$	5	-	-	msec
Reset Pulse Transition Time	t_{REr} , t_{REf}	-	-	500	usec

Top : 0 to 50 C, VDD : 5V +- 5%

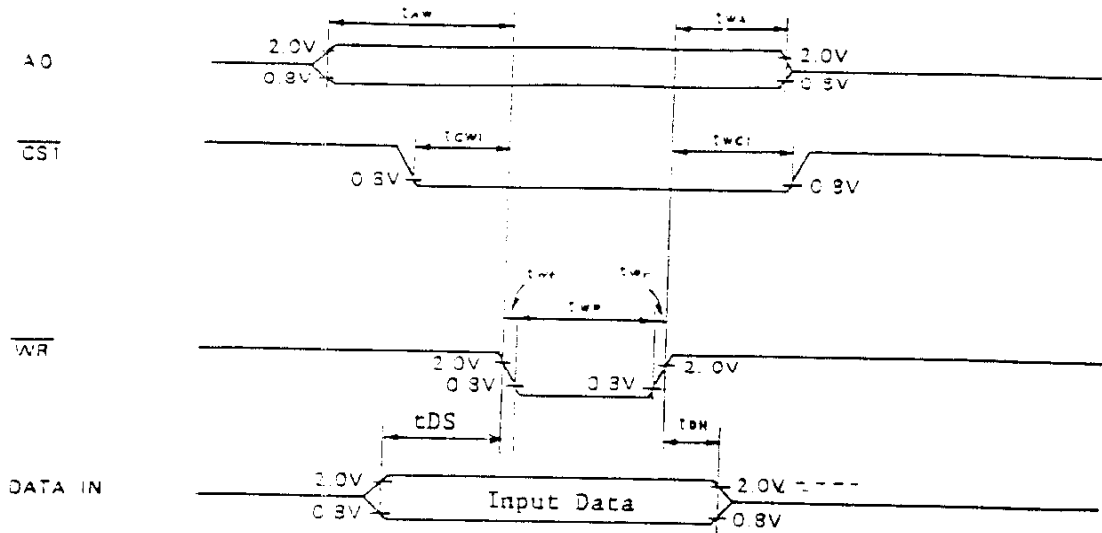
(c) Read Timing



Item	Symbol	Value			Unit
		Min	Typ	Max	
A0 → RD Set Time	t_{AS}	0	-	-	nsec
CS1 → RD Set Time	t_{CRL}	0	-	-	
Read Pulse Width	t_{RP}	350	-	t_{cX25}	
Read Pulse Transition Time	t_{Rr}	-	-	50	
RD → RDY Output Delay Time	t_{RD}	-	-	150	
A0 Hold Time	t_{RA}	30	-	-	
CS1 Hold Time	t_{RCL}	30	-	-	
Data Output Disable Time	t_{OD}	-	-	100	

Top : 0 to +50°C, VDD : 5V ± 5%

(d) Write Timing



Item	Symbol	Value			Unit	Remark
		Min	Typ	Max		
AO → WR Set Time	t_{AW}	0	-	-	nsec	
CS1 → WR Set Time	t_{WCl}	0	-	-		
Write Pulse Time	t_{WP}	350	-	t_{cX25}		
Write Pulse	t_{Wr}	-	-	50		
Write Pulse Transition Time	t_{Wf}	-	-	-		
Data Set Up Time	t_{DS}	0	-	-		
AO Hold Time	t_{WA}	30	-	-		
CS1 Hold Time	t_{WCl}	30	-	-		
Data Hold Time	t_{DH}	30	-	-		

Top : 0 to +50°C, VDD : 5V ± 5%

II SPECIFICATIONS

II-A Absolute Maximum Ratings

Item	Symbol	Value	Unit
Supply Voltage	VSS	0	V
	VDD	+ 6.5	
Input Voltage	VIN	$VSS \leq VIN \leq VDD$	V
Operating Temperature	Top	0 ~ 50	°C
Storage Temperature	Tstg	-20 ~ 60	°C

II-B Electrical Characteristics

B-1) DC Electrical Characteristics

Top=0 ~ 50°C, VDD=5V±5%

Item	Symbol	Condition	Value			Unit	Terminal
			Min.	Typ.	Max.		
Supply Voltage	VDD		4.75	5	5.25	V	
Supply Current	IDD	VDD=5V	(Note 2)			mA	
"0" Input Voltage	VIL		VSS		0.8	V	RESET, WR, RD, DO-D7, AO, ENB, CSI
"1" Input Voltage	VIH		2.0		VDD	V	RESET, WR, RD, DO-D7, AO, ENB, CSI
"0" Output Voltage	VOL	IOL=1.6mA			0.4	V	D7
"1" Output Voltage	VOH	IOH=-250mA	2.4			V	D7
"0" Input Leak Current	ILIL-1	VI=0V (Note 1)		-12		µA	RESET, WR, RD
"1" Input Leak Current	ILIH-1	VI=VDD			1.0	µA	RESET, WR, RD
"0" Input Leak Current	ILIL-2	VI=0V			-1.0	µA	DO-D7, AO, CSI
"1" Input Leak Current	ILIH-2	VQ=VDD				µA	ENB
"0" Output Leak Current	ILOL	VQ=0 ~ 0.4V			1.0	µA	DO-D7, AO, CSI
"1" Output Leak Current	ILOH	VQ=2.4V~VDD				µA	ENB

(Input/Output are TTL compatible and can be directly connected to LSTTL or C-MOS)

Note 1: Pull-up resistor is built-in.

Note 2: Supply Current (Power Consumption)

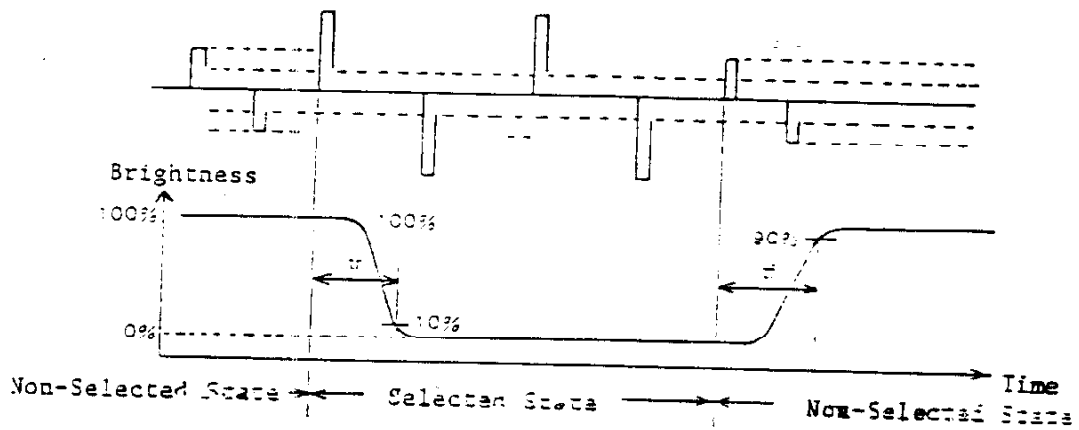
Model No.	TYP	MAX.	UNIT
EA-X16017AR	0.55	1.1	mA
EA-X16027AR	0.75	1.5	mA
EA-X20017AR	0.65	1.3	mA
EA-X20027AR	0.85	1.7	mA
EA-X24017AR	0.65	1.3	mA
EA-X40017AR	0.80	1.6	mA
EA-X40027AR	1.00	2.0	mA

II-C Optical Characteristics

Items	Sym-bols	Value			Unit	Note	
		Min.	Typ.	Max.			
Response	rise	tr	-	150	180	msec	1
	fall	tf	-	150	160		
Contrast	β		10				2
Viewing Angle	θ	10		40		Degree	3
	ϕ	-30		+30			
Expected Life	-	50,000	-	-		hour	4

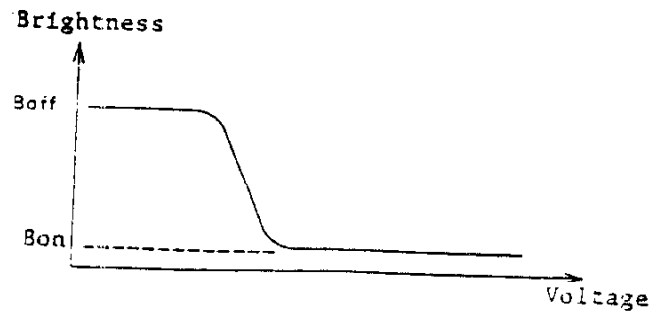
Top=25°C, VDD=5V ± 5%

Note 1) Definition of Response

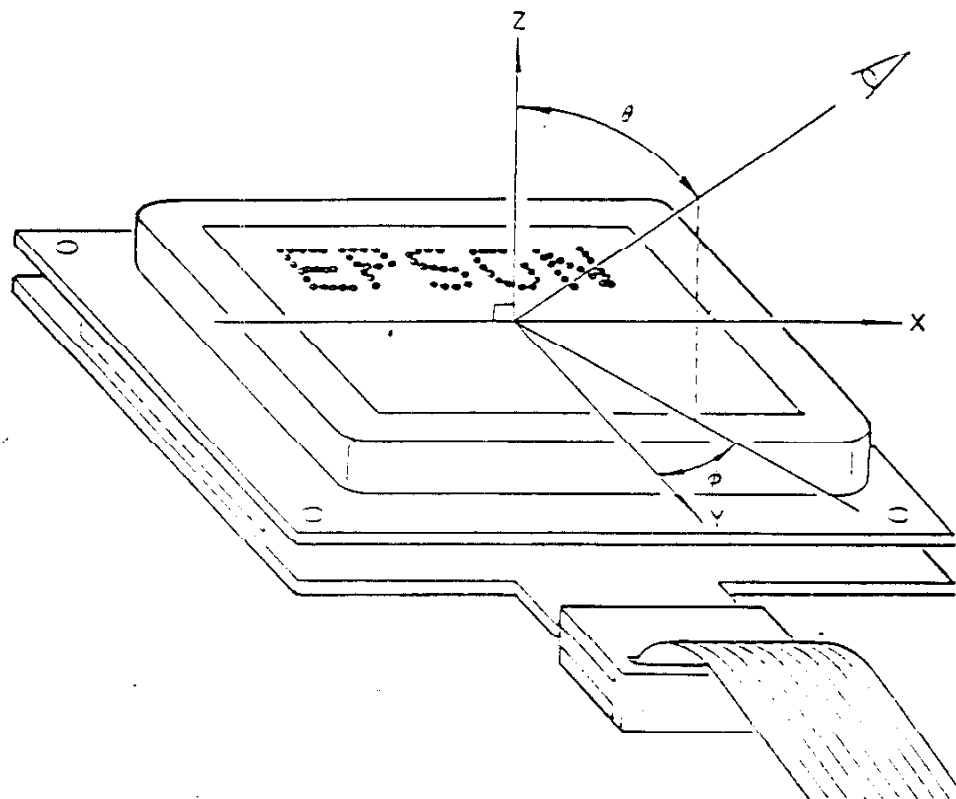


Note 2) Definition of Contrast

$$\text{Contrast} = \frac{\text{Brightness at Non-Selected State (Boff)}}{\text{Brightness at Selected State (Bon)}}$$



Note 3) Definition of Viewing Angle



Note 4) Definition of Expected Life

In normal use and storage conditions (Room temperature 25°C, without exposing to the sun light directly, and humidity 65% RH), no considerable degradation will be seen regarding the module functions, characteristics, appearances, etc.

III INTERFACE

III-A Input/Output Terminal Configurations

(1) EA-X16017AR, EA-X16027AR

No.	Signal	No.	Signal
1	VDD(+5V)	2	D0
3	D1	4	D2
5	D3	6	D4
7	D5	8	D6
9	D7	10	A0
11	WR	12	RD
13	ENB	14	CSI
15	RESET	16	Vout
17	Vss(GND)		

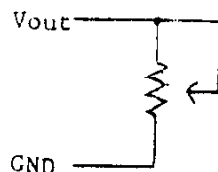
(2) EA-X20017AR, EA-X20027AR, EA-X24017AR, EA-X40017AR, EA-X40027AR.

No.	Signal	No.	Signal
1	VDD(+5V)	2	CSI
3	ENB	4	RD
5	WR	6	A0
7	D0	8	D1
9	D2	10	D3
11	D4	12	D5
13	D6	14	D7
15	NC	16	RESET
17	Vout	18	Vss(GND)

III- B Terminal Descriptions

Terminal	I/O	Function
VDD	I	Power Supply (+5 V +-5 %)
VSS	I	Power Supply (0 V)
RESET	I	RESET Signal Input Active-Low input for initialization (When RESET signal is supplied, the controller LSI is reset to the following status.) DISPLAY: off, CURSOR: off, CURSOR FONT: off, UNDERLINE CURSOR: blinking off, CURSOR DIRECTION: increment DISPLAY SUPPRESS : off For RESET signal in detail, refer to "Reset Signal (P. 15)". (Note) This terminal has a built-in pull-up resistor (= 500 kohm).
AO	I	Selection of Character Code Input/ Instruction Code Input AO = "1": Character Code Input AO = "0": Instruction Code Input
ENB	I	Clock Input Basical Clock to perform Instructions in Controller LSI. The Clock at the same timing as MPU are usually input
\overline{RD}	I	Busy Flag Read Signal Input RD = active "0" When RD is low, master processor can read status of Busy Flag register.
\overline{WR}	I	Data Write Signal Input WR = active "0" When WR is low, master processor can write Character Code or Instruction Code to the module.
DO - D7	I I/O (D7)	Data Input MSB = "D7" LSB = "D0" D7 is a I/O terminal, and outputs Busy signal when executing Busy Flag instruction. D7 = "1": Busy D7 = "0": Not Busy
$\overline{CS1}$	I	Chip Select Input CS1 = Active "0"
Vout	I	Contrast Adjusting Volume Terminal Please utilize following values of registers for adjusting the contrast ratio and viewing angle

* CONNECTION OF VR



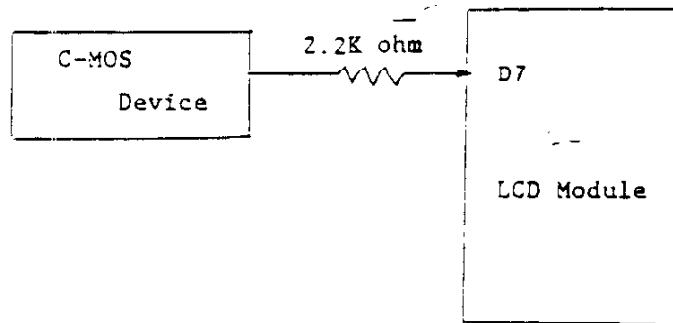
Model	Value of	VR
EA-X16017AR	20K	1/8W
EA-X16027AR	30K	1/8W
EA-X20017AR	20K	1/8W
EA-X20027AR	30K	1/8W
EA-X24017AR	20K	1/8W
EA-X40017AR	20K	1/8W
EA-X40027AR	30K	1/8W

III-C Latch-up Prevention

Since a Controller LSI (E 1300) which is used for EA Series is a C-MOS LSI, latch-up prevention is needed under the following condition.

Condition : EA Series are directly connected with C-MOS devices.

Prevention: Resistor (2.2K ohm) is to be set in series between a C-MOS device and D7.



IV DISPLAY INSTRUCTIONS

IV-A Instruction Command Code Table

No.	Command	CSI	WR	RD	A0	D7	D6	D5	D4	D3	D2	D1	D0	Description	Max. Execute Time (msec)	Remarks
1	System Reset	0	0	1	0	0	0	0	1	0	0	0	0	Resets the whole system DD RAM contents remain unchanged	tox26 (ALL) ↓	Note 1
2	Clear Display Dots	0	0	1	0	0	0	0	0	0	0	0	1	Clears the whole display and returns the cursor to the home position		
3	Cursor at Home	0	0	1	0	0	0	0	0	0	0	1	0	Returns the cursor to the home position. Display contents (DD RAM) contents remain unchanged		
4	Cursor Return	0	0	1	0	0	0	0	0	0	0	1	1	Returns the Cursor to the first address of the line. (line feed is done by the cursor address setting		
5	Set Cursor Direction	0	0	1	0	0	0	0	0	0	1	0	1/0	Set line cursor move direction, operations are performed during data write.		
6	Cursor Inc/Dec	0	0	1	0	0	0	0	0	0	1	1	1/0	Perform the cursor increment or decrement without changing DD RAM contents.		
7	Set Cursor Font	0	0	1	0	0	0	0	0	1	0	0	1/0	Select cursor font: 5x7 blinking or underline.		
8	Underline Cursor Blinking On/Off	0	0	1	0	0	0	0	0	1	0	1	1/0	Sets underline cursor continuously On/Off blinking		
9	Cursor On/Off	0	0	1	0	0	0	0	0	1	1	1	1/0	Sets cursor display On/Off		
10	Display On/Off	0	0	1	0	0	0	0	0	1	1	0	1/0	Sets the whole display On/Off		
11	Display Suppress On/Off	0	0	1	0	0	1/0	1	0	0	0	0	0	For one line displays only. Suppresses the display from the Cursor which is directed by "SET CURSOR DIRECTION"		
12	Set Cursor Address 1 line 2-8 lines	0	0	1	0	0	1	(N digits -1)U Note 4					Sets cursor address			
13	Set Character Data	0	0	1	1	(See character code map)							Writes character data into DD RAM			

Note 1

Model Name	tw(WT)
EA -X16017AR	5.0
EA -X16027AR	2.5
EA -X20017AR	5.0
EA -X20027AR	2.5
EA -X40017AR	5.0
EA -X40027AR	2.5
EA -X24017AR	5.0

Note 2) D0: Dec = "1", Inc = "0"

Note 3) On/Off: On="1", Off = "0"

Note 4) N digit -1)U making the value which is coded N digit) with binary code

Note 5) "to" in above max execute Time shows

IV-B Operation

The EA-X series contains a CHARACTER GENERATOR for 160 character patterns based on ASCII Code and a DISPLAY DATA RAM for the display refresh, which are operated by the Instructions.

The functions and the operations of each Instruction are explained below in detail.

The Instruction Codes and the Data are described with "Hexadecimal" of 8 bit ("__H").

Incorrect code input to the controller LSI could give some damages to the internal counters and/or the instruction flags, therefore, it is necessary to input the correct code according to the Instruction Codes and the Data codes.

IV-C Instruction Descriptions

C-1) SYSTEM RESET :

AO	WR	D7	D6	D5	D4	D3	D2	D1	D0	Hex
0	0	0	0	0	1	0	0	0	0	10

The following registers are set to the initial status by executing the "SYSTEM RESET" instruction. The Display Data RAM is not cleared and its contents remain unchanged.

Initial status

DISPLAY : off, CURSOR : off, UNDERLINE CURSOR : blinking off,
 CURSOR FONT : underline, DISPLAY SUPPRESS : off ,
 SET CURSOR DIRECTION : forward

C-2) CLEAR DISPLAY DATA

AO	WR	D7	D6	D5	D4	D3	D2	D1	D0	Hex
0	0	0	0	0	0	0	0	0	1	01

All locations in the Display Data RAM are set to the ASCII space code "20-Hex" by executing the "CLEAR DISPLAY DATA" instruction which clears the display. In addition, the cursor returns to the Home Position. For performance cycle, several msec are needed.

Note 1) The Home Position is the first address of the first line in the display area controlled by each controller and the address code is "80-Hex" (see "Address Code Map" P. 20)

Note 2) In this instruction, execute time depends upon each model (See "Write Timing" P. 8)

C-3) CURSOR AT HOME

AO	WR	D7	D6	D5	D4	D3	D2	D1	D0	Hex
0	0	0	0	0	0	0	0	1	0	02

The cursor returns to the Home Position of each LSI by executing the "CURSOR AT HOME" instruction.

Note) The Home Position in the first address of the first line in the display area controlled by each controller and the address code is "80-Hex" (See "Address Code Map" P. 20)

C-4) CURSOR RETURN

AO	WR	D7	D6	D5	D4	D3	D2	D1	D0	Hex
0	0	0	0	0	0	0	0	1	1	03

The cursor returns to the first address of the line (in the display area controlled by each controller) by executing "CURSOR RETURN" instruction.

Note 1) This "CURSOR RETURN" instructions is of no value if the cursor address in the Data RAM is out of the display area.

Note 2) Cursor Address should be preset to perform Line Feed.

C-5) SET CURSOR DIRECTION

AO	WR	D7	D6	D5	D4	D3	D2	D1	D0	Hex
0	0	0	0	0	0	0	1	0	0/1	04,05

The "SET CURSOR DIRECTION (FORWARD/REVERSE)" instruction selects the direction to move cursor either in the FORWARD or REVERSE direction according to the value of D0. Upon execution of this instruction, the cursor address automatically proceeds to the next address, only if the "SET CHARACTER DATA" instruction is implemented. This instruction also disables the other.

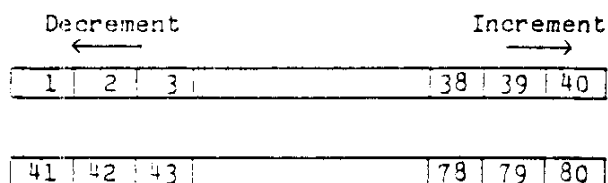
D0 = 0 Cursor Increment
D0 = 1 Cursor Decrement

The command of SET CURSOR DIRECTION is designed to have higher priority than that of CURSOR IN C/DEC.

When more than maximum digits data of 1 line are input, the cursor would disappear.

The design to dispose more than maximum digits should be fixed by Software in advance. Besides in the multiple lined display, the top address of the next line should be preset to return carriage.

And the directions of Increment/Decrement on display are as follows:



Display of EA-X40027AR (Top VIEW) Figures mean digits.

D0	DERECTION
0	FORWARD (INCREMENT)
1	REVERSE (DECREMENT)

Note) This instruction supersedes the "CURSOR INC/DEC" instruction.

C-6) CURSOR INC/DEC

AO	WR	D7	D6	D5	D4	D3	D2	D1	D0	Hex
0	0	0	0	0	0	0	1	1	0/1	06,07

The "CURSOR INC/DEC" instruction implements the cursor INCREMENT or DECREMENT according to the value of D0. Upon execution of this instruction, only the cursor will shift RIGHT or LEFT by one address.

D0	DERECTION
0	INCREMENT (RIGHT)
1	DECREMENT (LEFT)

C-7) SET CURSOR FONT

AO	WR	D7	D6	D5	D4	D3	D2	D1	D0	Hex
0	0	0	0	0	0	1	0	0	0/1	08,09

The "SET CURSOR FONT (UNDERLINE / 5x7 BLINKING)" instruction selects the cursor font style, UNDERLINE or 5x7 BLINKING, according to the value of D0. This instruction also disable the other.

D0	FONT STYLE
0	UNDERLINE
1	5x7 BLINKING

Note) In case of the 5x7 BLINKING CURSOR font style, blinking can not be stopped.

Underline Cursor (Refer to "UNDERLINE CURSOR BLINKING ON/OFF" and "CURSOR ON/OFF")

EP50

5x7 Blinking Cursor

EP50

C-8) UNDERLINE CURSOR BLINKING ON/OFF

AO	WR	D7	D6	D5	D4	D3	D2	D1	D0	Hex
0	0	0	0	0	0	1	0	1	0/1	0A,0B

The "UNDERLINE CURSOR BLINKING (ON/OFF)" instructs the blinking feature ON or OFF according to the value of D0, and also disables the other.

D0	BLINKING
0	OFF
1	ON

Note) For UNDERLINE CURSOR only. This instruction does not apply to the 5x7 blinking cursor.

C-9) CURSOR ON/OFF

AO	WR	D7	D6	D5	D4	D3	D2	D1	D0	Hex
0	0	0	0	0	0	1	1	1	0/1	0E,0F

The "CURSOR ON/OFF" instruction turns the display of the cursor ON or OFF according to the value of D0, and also disables the other.

D0	CURSOR DISPLAY
0	OFF (DISABLE)
1	ON (ENABLE)

Note) This instruction supersedes "SET CURSOR FONT" or "UNDERLINE CURSOR BLINKING"

C-10) DISPLAY ON/OFF

AO	WR	D7	D6	D5	D4	D3	D2	D1	D0	Hex
0	0	0	0	0	0	1	1	0	0/1	0C,0D

The "DISPLAY ON/OFF" instruction turn the entire display ON or OFF according to the value of D0, and also disables the other.

D0	DISPLAY
0	OFF (DISABLE)
1	ON (ENABLE)

Note) The Display Data RAM is not cleared and its contents remain unchanged.

C-11) DISPLAY SUPPRESS ON/OFF

The "DISPLAY SUPPRESS ON/OFF" instruction turns ON or OFF the character after the cursor which is directed by the "SET CURSOR DIRECTION", according to the value of D6, and also disables the other.

AO	WR	D7	D6	D5	D4	D3	D2	D1	D0	Hex
0	0	0	0/1	1	0	0	0	0	0	20,60

D6	DISPLAY SUPPRESS
0	OFF (Cancels Suppress Request)
1	ON (Suppress the display)

Note 1) The Display Data RAM is not cleared and its contents remain unchanged.

Note 2) In the 2 line display, when the cursor moves from 1st line to 2nd one in the performance of DISPLAY SUPPRESS, the previous data are likely to be displayed on the digits in the 1st line which is not suppressed on, therefore, this command should not be used for 2 line display.

C-12) SET CURSOR ADDRESS

AO	WR	D7	D6	D5	D4	D3	D2	D1	D0	Hex
0	0	1	Address		Data					80-E7

The "SET CURSOR ADDRESS" instruction designates a Data RAM location by an 8 bit address code and is used for presetting the cursor address. As for the correspondence between address code and the cursor address, refer to the Address Code Map P 20.

C-13) SET CHARACTER DATA

AO	WR	D7	D6	D5	D4	D3	D2	D1	D0	Hex
1	0	8 bit CHARACTER CODE								20-7F, A0-DF

The "SET CHARACTER DATA" instruction transfers 8 bits of immediate Character Code to the Display Data RAM location addressed by the address pointer.

IV-D Busy Flag

Reads the busy state, indicating internal operation is being performed at D7. (D7 output is TTL compatible)

ITEM	CS1	WR	RD	AO	D7	D6 to D0
BUSY	0	1	0	*	1	*
NOT BUSY	0	1	0	*	0	*

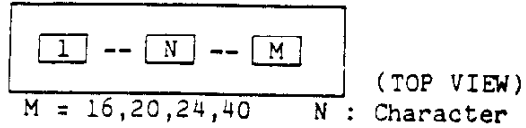
* Not applicable

IV-E Character Address Code

The correspondences of the character positions, Address Codes (Cursor Address) and Chip Select Terminals are shown below.

(1) EA-X16017AR, EA-X20017AR, EA-X24017AR, EA-X40017AR

- Character Map



- Address Code

L.	ch.	CSI	D7	D6	D5	D4	D3	D2	D1	D0
1	1 ~ M	0	1	(N-1)B						

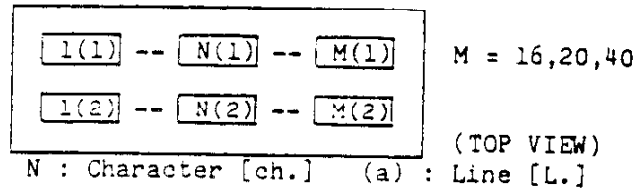
Example)

20 ch. x 1 line(M=20) 15th ch.(N=15)

ch.	CSI	D7	D6	D5	D4	D3	D2	D1	D0
15	0	1	0	0	0	1	1	1	0

(2) EA-X16027AR, EA-X20027AR, EA-X40027AR

- Character Map



- Address Code

L.	ch.	CSI	D7	D6	D5	D4	D3	D2	D1	D0
1	1 ~ M	0	1	0	[N(1)-1]B					
2	1 ~ M	0	1	1	[N(2)-1]B					

Example)

40 ch. x 2 line(M=40) 1st L., 20th ch.(N(1)=20)

L.	ch.	CSI	D7	D6	D5	D4	D3	D2	D1	D0
1	20	0	1	0	0	1	0	0	1	1

Example)

20 ch. x 2 line(M=20) 2nd L., 5th ch.(N(2)=5)

L.	ch.	CSI	D7	D6	D5	D4	D3	D2	D1	D0
2	5	0	1	1	0	0	0	1	0	0

IV-F.CHARACTER CODE & CHARACTER FONT

		Lower 4 bit (D0 to D3) of Character Code (Hexadecimal)															
		0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
Upper 4 bit (D4 to D7) of Character Code (Hexadecimal)	2	!	"	#	\$	%	&	'	()	*	+	,	-	.	/	
	3	0	1	2	3	4	5	6	7	8	9	:	;	<	=	>	?
	4	@	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
	5	P	Q	R	S	T	U	V	W	X	Y	Z	[\]	^	_
	6	`	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o
	7	p	q	r	s	t	u	v	w	x	y	z	{		}	~	■
	A	€	¢	£	¥	₹	₪	₧	₨	₪	₪	₪	₪	₪	₪	₪	₪
	B	№	№	№	№	№	№	№	№	№	№	№	№	№	№	№	№
	C	Ⓜ	Ⓜ	Ⓜ	Ⓜ	Ⓜ	Ⓜ	Ⓜ	Ⓜ	Ⓜ	Ⓜ	Ⓜ	Ⓜ	Ⓜ	Ⓜ	Ⓜ	Ⓜ
	D	†	‡	§	¶	⌘	⌘	⌘	⌘	⌘	⌘	⌘	⌘	⌘	⌘	⌘	⌘

* CHARACTER CODE MAP is subject to change without notice. Ask EPSON for the latest CHARACTER CODE MAP.

V HANDLING PRECAUTIONS

V-A EPSON LCD Modules employ C-MOS LSI drivers, so we recommend that you:

- Connect unused input terminals to VDD or VSS.
- Do not input any signals before power is turn on.
- Ground your body, work/assembly areas and assembly equipments to protect against STATIC ELECTRICITY.

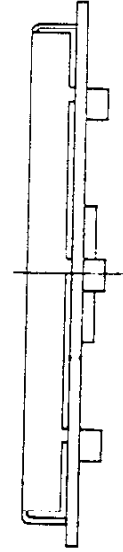
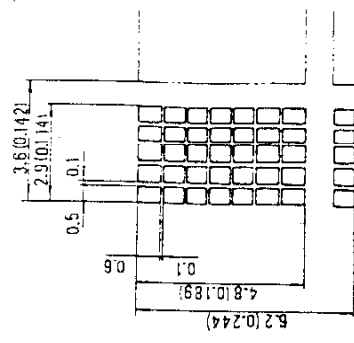
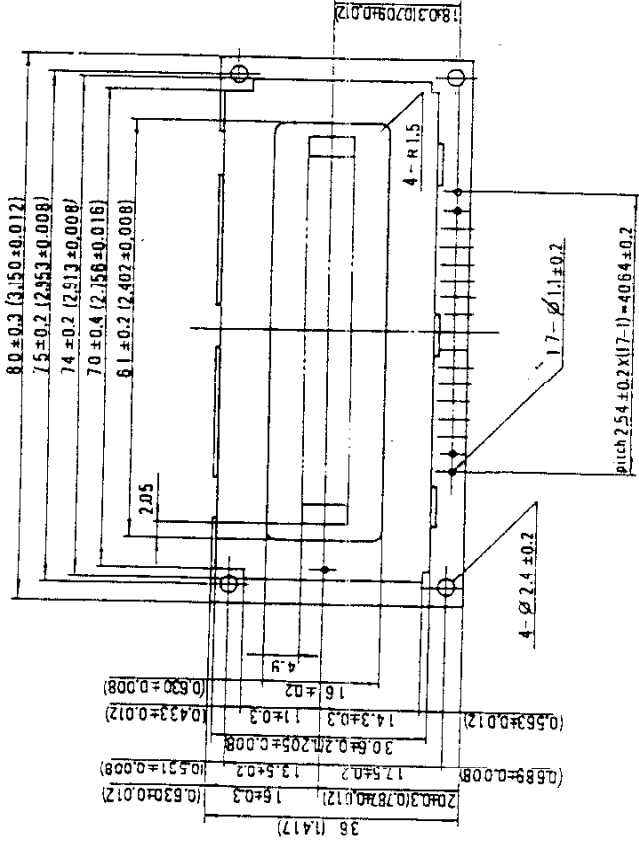
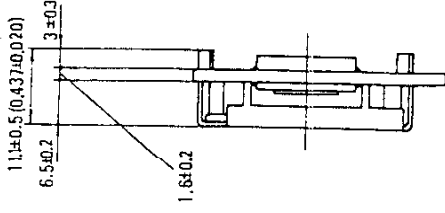
V-B The LCD panel consists of two thin plates of glass with polarizers (with UV cut filter) which easily get damage, so we recommend that you:

- Do not touch or press the display surface.
 - Do not wipe the display surface with dry or hard materials.
 - When cleaning the display surface, use soft cloths (ex. gauze) with the following solvents and wipe softly.
 - isopropyl alcohol
 - ethyl alcohol
 - trichlorotrifluoroethane
- Do not use the following solvents.
- water
 - ketone
 - aromatic

V-C Treat modules like glasses.
Avoid intense shocks and falls from heights.

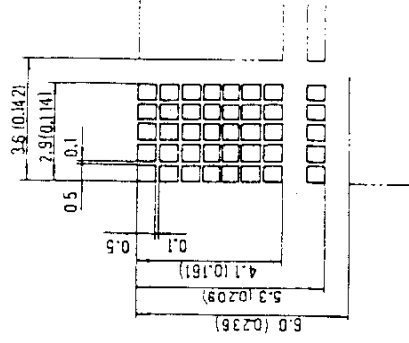
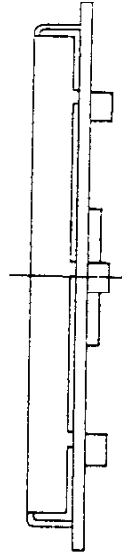
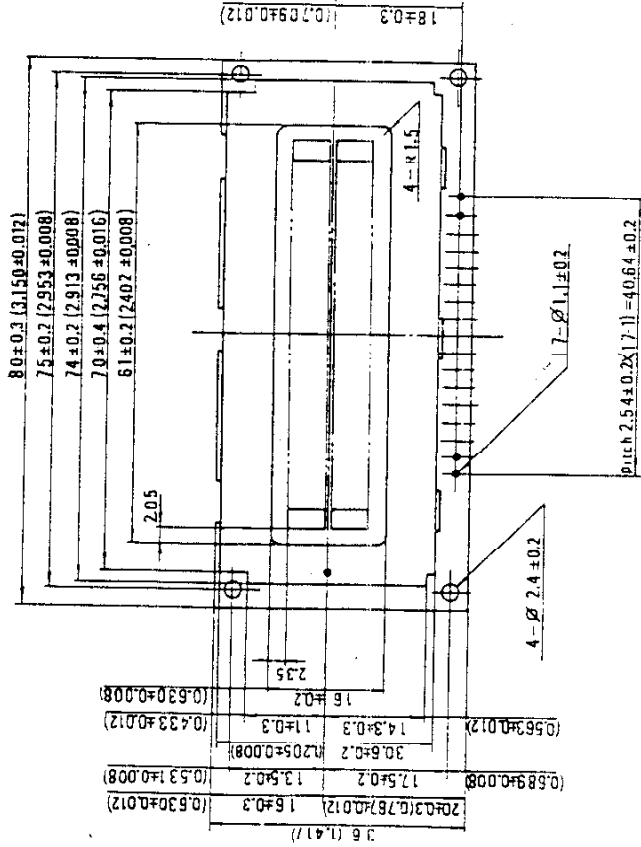
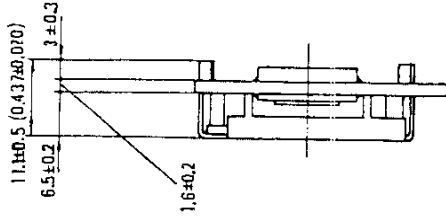
V-D To avoid degradation of the device, do not operate or store the module under the conditions of direct sunlights, high temperature or high humidity.

No.	Signal	No.	Signal
1	VDD	2	D0
3	D1	4	D2
5	D3	6	D4
7	D5	8	D6
9	D7	10	A0
11	WR	12	RD
13	ENB	14	CS1
15	RESET	16	YOUT
17	VSS		



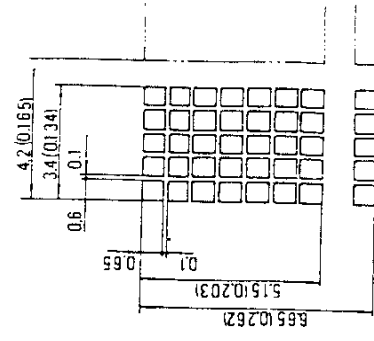
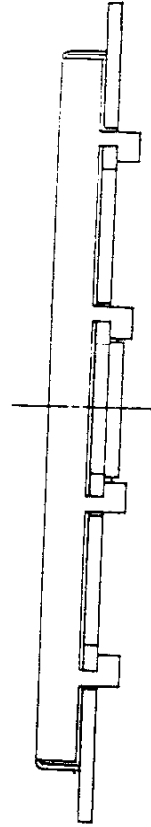
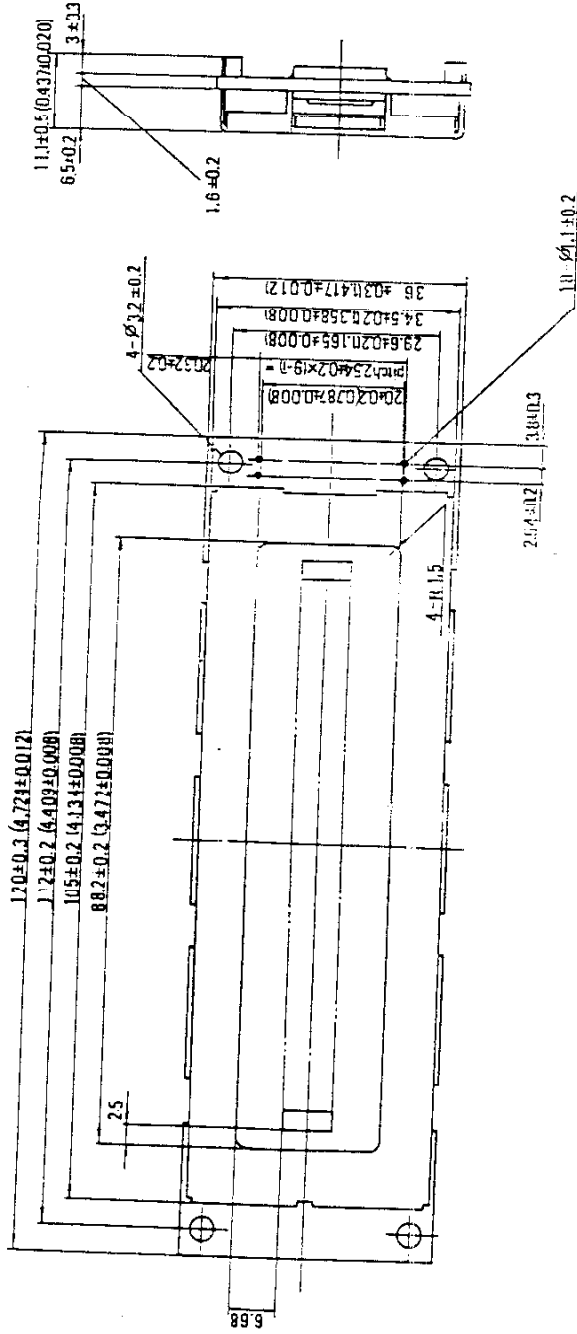
EA-X16017AR Size Unit: mm (inch)

NO.	Signal	NO.	Signal
1	VDD	2	D0
3	D1	4	D2
5	D3	6	D4
7	D5	8	D6
9	D7	10	A0
11	WR	12	RD
13	INB	14	CS1
15	RESET	16	VOUT
17	VSS		

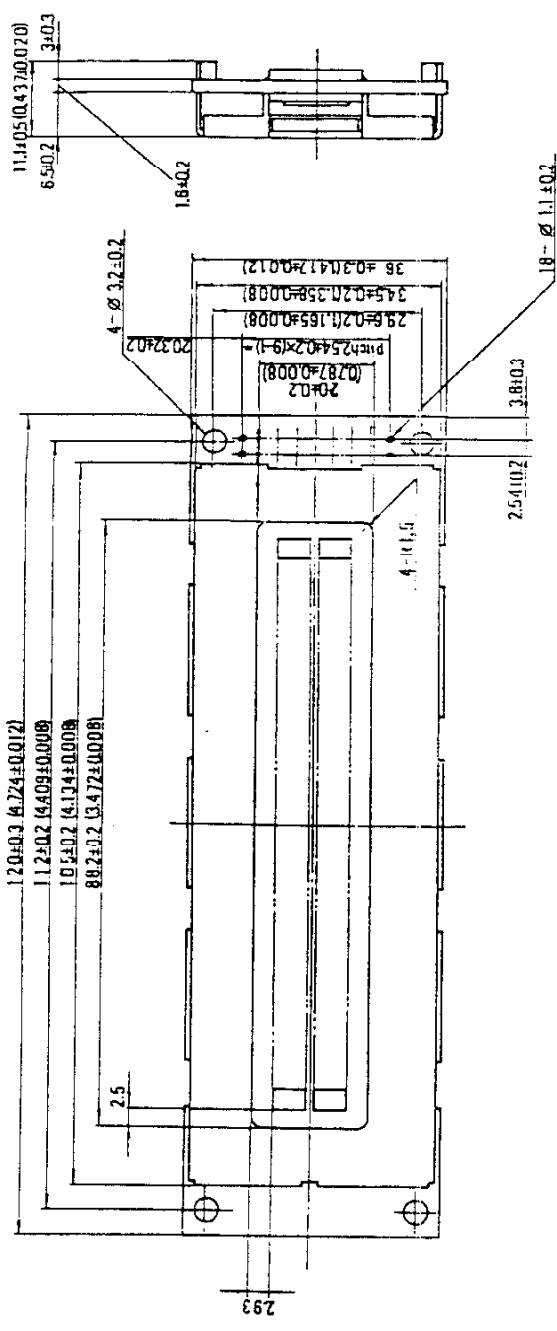


EA-X16027AR Size Unit: mm (inch)

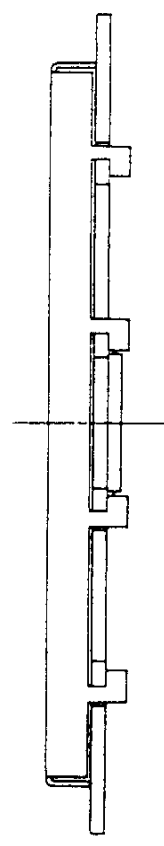
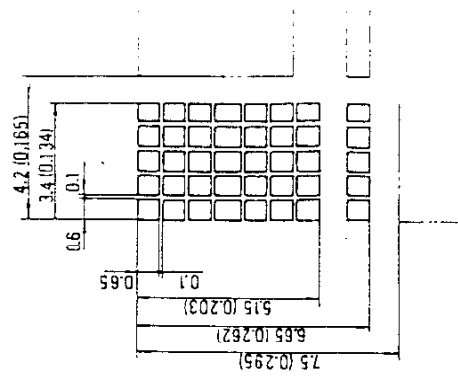
NO.	Signal	NO.	Signal
1	VDD	2	CS1
3	ENB	4	RD
5	WR	6	A0
7	D0	8	D1
9	D2	10	D3
11	D4	12	D5
13	D6	14	D7
15	NC	16	RESET
17	YOUT	18	VSS



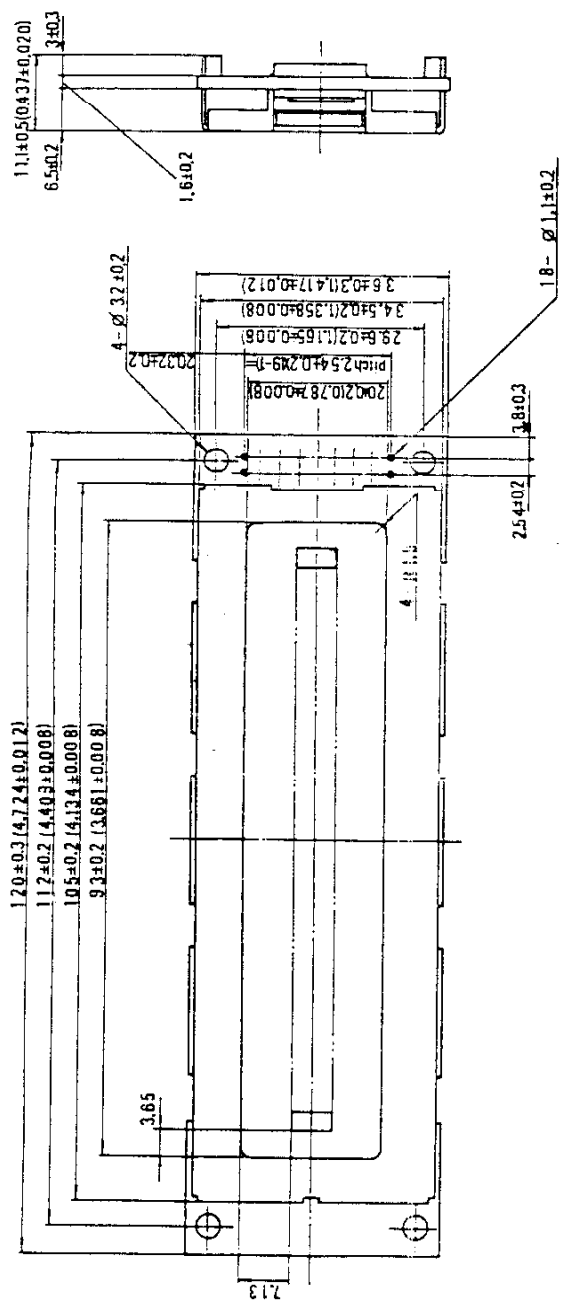
EA X20017AR Size Unit: mm (Inch)



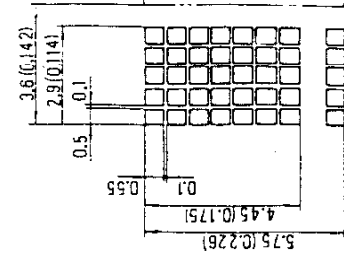
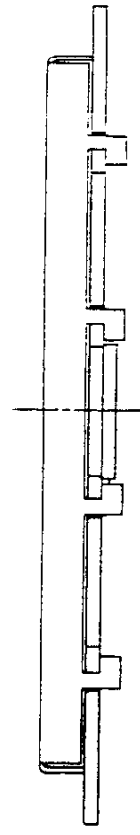
NO	Signal	NO	Signal
1	VDD	2	C51
3	ENB	4	R.D
5	WR	6	A.O
7	D0	8	D1
9	D2	10	D3
11	D4	12	D5
13	D6	14	D7
15	NC	16	RESET
17	VOUT	18	VSS



EA-X 20027AR Size Unit:mm (inch)

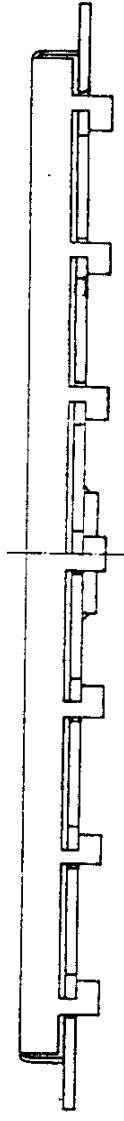
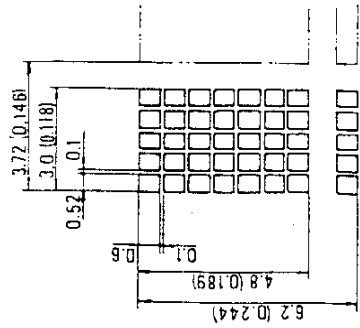
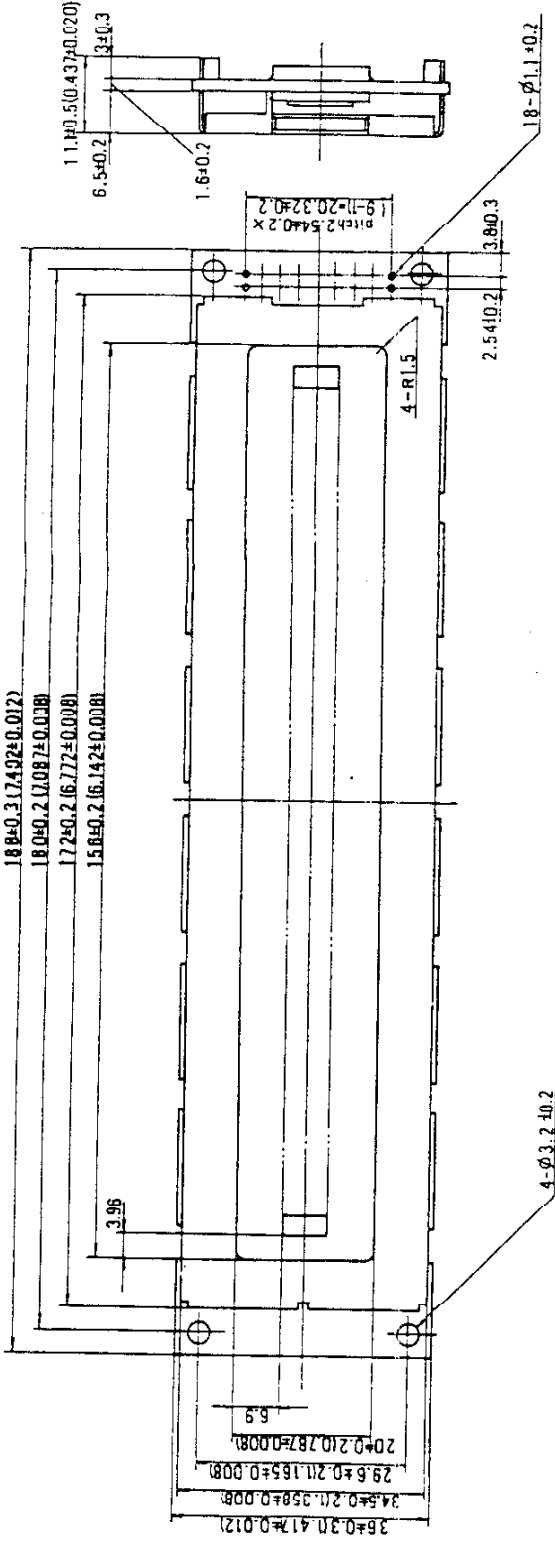


NO.	Signal	NO.	Signal
1	VDD	2	CS1
3	ENB	4	RD
5	WR	6	A0
7	D0	8	D1
9	D2	10	D3
11	D4	12	D5
13	D6	14	D7
15	NC	16	RESET
17	VOUT	18	VSS



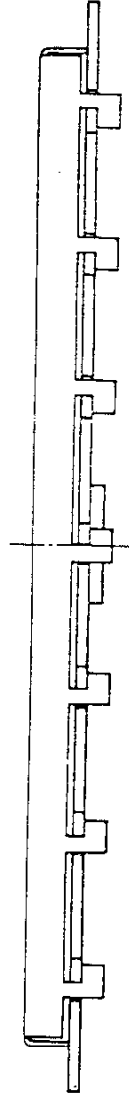
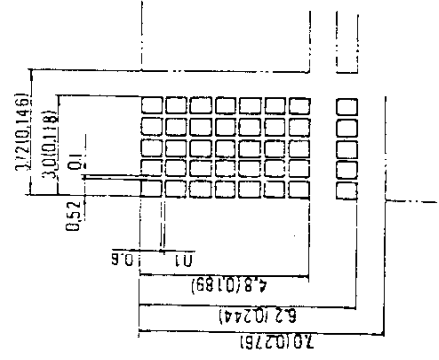
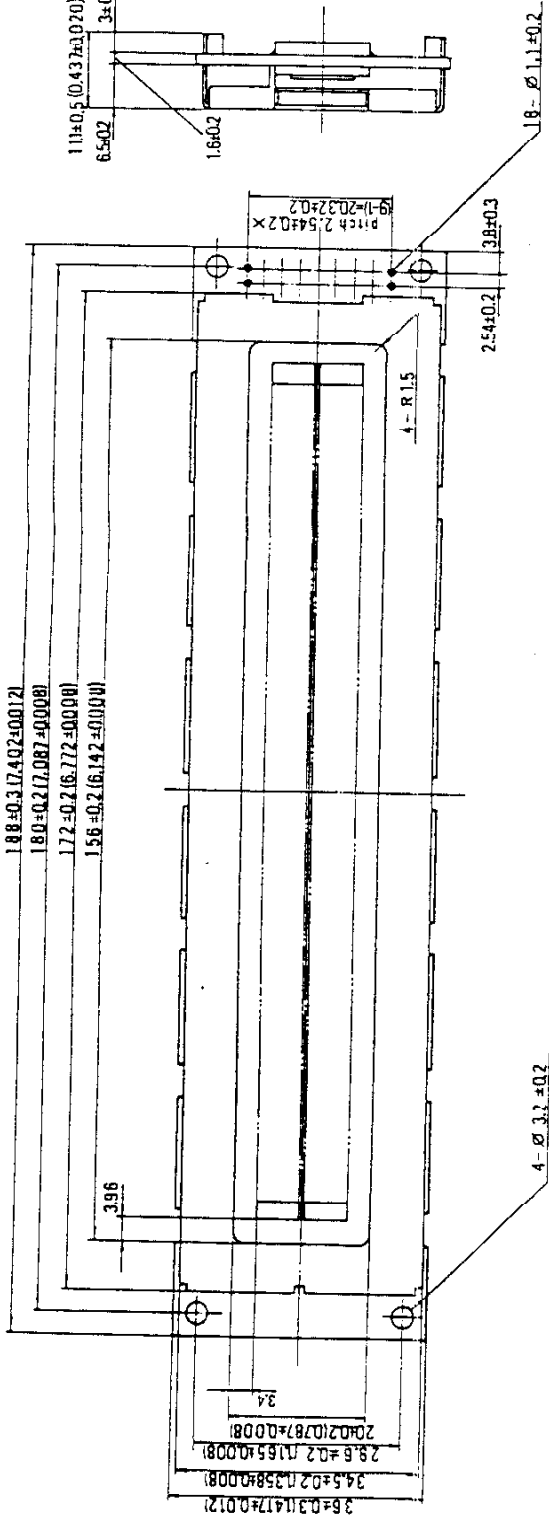
EA-X24017AR Size Unit:mm (inch)

No.	Signal	No.	Signal
1	VDD	2	CS
3	ENB	4	RD
5	WR	6	A0
7	D0	8	D1
9	D2	10	D3
11	D4	12	D5
13	D6	14	D7
15	RC	16	RESET
17	VOUT	18	VSS



EA-X40017AR Size Unit: mm (inch)

NO.	Signal	NO.	Signal
1	VDD	2	CS1
3	EMB	4	RD
5	WR	6	A0
7	D0	8	D1
9	D2	10	D3
11	D4	12	D5
13	D6	14	D7
15	NC	16	RESET
17	VOUT	18	VSS



EA-X40027AR Size Unit:mm (inch)