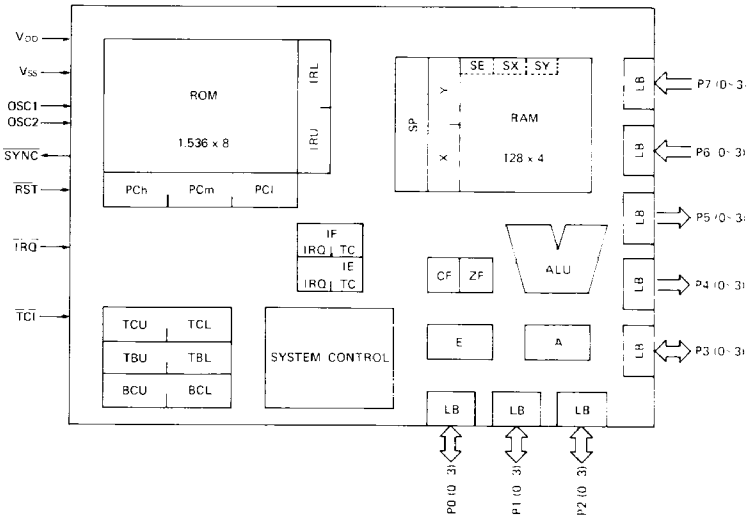
4-Bit One Chip Microcomputer MN1500 Series

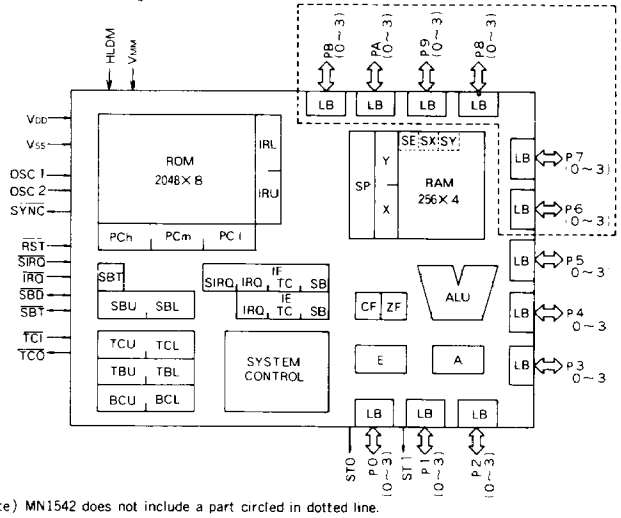
Type No.	Function	Maximum Ratings (Ta=25°C)	Item	Symbol	Condition	min.	typ.	max.	Unit
△MN1541	N-Channel LOCOS E/D MOS 4-Bit 1 chip Microcomputer	V_{DD}=−0.3~+8V V_I=−0.3~+8V V_O=−0.3~+8V $I_{OH(PK)}$=−2mA $I_{OL(PK)}$=8mA $I_{OH(av)}$=−1mA $I_{OL(av)}$=4mA P_D=1W Topr=−30~+70℃ Tstg=−55~+125℃	Supply Current	I_{DD}			60	120	mA
			Power Consumption	P_{tot}			0.3	0.6	W
			Input Terminals $\overline{TCI}$, $\overline{IRQ}$ (Schmitt Input) $\overline{RST}$						
			"H" Level Input Voltage	V_{IH1}		2.6		V_{DD}	V
			"L" Level Input Voltage	V_{IL1}		V_{SS}		0.8	V
			Input Current	I_{I1}	V_{IH}=0.8V	−100 − 15	−200 − 30	−400 − 60	μA
			Input Terminals P60~P73						
			"H" Level Input Voltage	V_{IH2}		1.4		V_{DD}	V
			"L" Level Input Voltage	V_{IL2}		V_{SS}		0.8	V
			Input Current	I_{I2}	V_{IH}=0.8V	−150	−300	−600	μA
			Input Output Terminals P00~P33						
			"H" Level Input Voltage	V_{IH3}		2.4		V_{DD}	V
			"L" Level Input Voltage	V_{IL3}		V_{SS}		0.8	V
		Operating Condition	Input Current	I_{I3}	V_I=0.8V Output "H"	−150	−300	−600	μA
			"H" Level Output Voltage	V_{OH3}	I_{OH}=−50μA	2.8			V
		V_{DD}=5V V_{SS}=0V Ta=25℃	"L" Level Output Voltage	V_{OL3}	I_{OL}=2mA			0.8	V
			Output Terminal P40—P53 $\overline{SYNC}$						
			"H" Level Output Current	V_{OH4}	I_{OH}=−300μA	2.8			V
			"L" Level Output Current	V_{OL4}	I_{OL}=2mA			0.5	V
			Terminal Capacitance						
			Input Capacitance	C_I	V_I=2V		5		pF
			Iutput Capacitance	C_O	V_I=2V(Include I/O)		10		pF
MN1542 MN1544 △MN1562 MN1564	N-Channel LOCOS E/D MOS 4-Bit 1Chip Microcomputers	V_{DD}=−0.3~+8V V_{MM}=−0.3~+8V V_I=−0.3~+8V V_O=−0.3~+8V $I_{OH(PK)}$=−2mA $I_{OL(PK)}$=8mA $I_{OH(av)}$=−1mA $I_{OL(av)}$=4mA P_D=1W Topr=−30~+70℃ Tstg=−55~+125℃	Supply Current	I_{DD}	Ta=25℃ Without load	MN1542 MN1544 MN1562 MN1564	80 85 90 95	155 165 175 185	mA mA mA mA
			Memory Supply Current	I_{MM}		MN1542, MN1562 MN1544, MN1564	1.2 2	3 5	mA mA
			Power Consumption	Ptot		MN1542 MN1544 MN1562 MN1564	0.4 0.45 0.45 0.5	0.8 0.85 0.9 0.95	W W W W
			Input Terminals $\overline{TCI}$, $\overline{IRQ}$, $\overline{SIRQ}$, $\overline{RST}$ (Schmitt Input)						
			"H" Level Input Voltage	V_{IH1}		2.6		V_{DD}	V
			"L" Level Input Voltage	V_{IL1}		V_{SS}		0.8	V
			Input Current	I_{I1}	V_I=0.8V $\overline{TCI}$, $\overline{IRQ}$, $\overline{SIRQ}$ $\overline{RST}$	−100 − 15	−200 − 30	−400 − 60	μA
			Input Terminal $\overline{HLDM}$						
			"H" Level Input Voltage	V_{IH2}		2.4		V_{DD}	V
			"L" Level Input Voltage	V_{IL2}		V_{SS}		0.8	V
			Input Current	I_{I2}	V_I=0.8V	−30	−60	−120	μA
			Input Output Terminals P00~P53, $\overline{SBD}$, SBT (Schmitt Input)						
			"H" Level Input Voltage	V_{IH3}		2.4		V_{DD}	V
			"L" Level Input Voltage	V_{IL3}		V_{SS}		0.8	V
		Operating Condition	Input Current	I_{I3}	V_I=0.8V, Output "H"	−150	−300	−600	μA
			"H" Level Output Voltage	V_{OH3}	I_{OH}=−50μA	2.8			V
		V_{DD}=5V V_{SS}=0V Ta=25℃	"L" Level Output Voltage	V_{OL3}	I_{OL}=2mA			0.5	V
			Output Terminals $\overline{TCO}$, ST0, ST1, $\overline{SYNC}$						
			"H" Level Output Voltage	V_{OH4}	I_{OH}=−300μA	2.8			V
			"L" Level Output Voltage	V_{OL4}	I_{OL}=2mA			0.5	V
			Terminal Capacitance						
			Input Capacitance	C_I	V_I=2V		5		pF
			Output Capacitance	C_O	V_O=2V, Include I/O		10		pF

Block Diagram

MN1541 (Package L—19,40—Lead Plastic DIL)

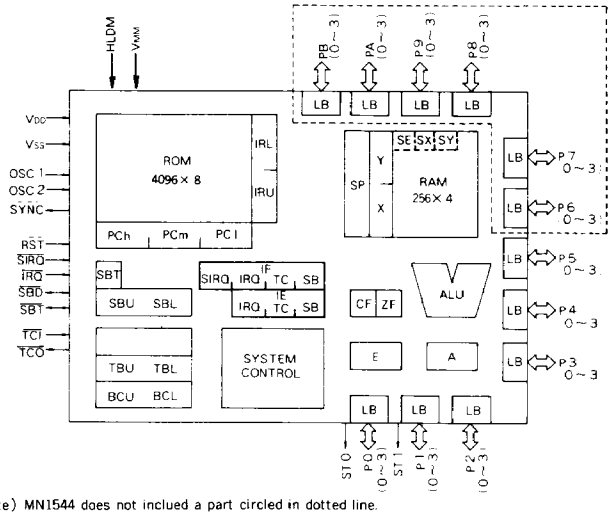


MN1542 (Package L—19,40—Lead Plastic DIL)
MN1562 (Package L—20,64—Lead Plastic QIL)



Note) MN1542 does not include a part circled in dotted line.

MN1544 (Package L—19,40—Lead Plastic DIL)
MN1564 (Package L—20,64—Lead Plastic QIL)



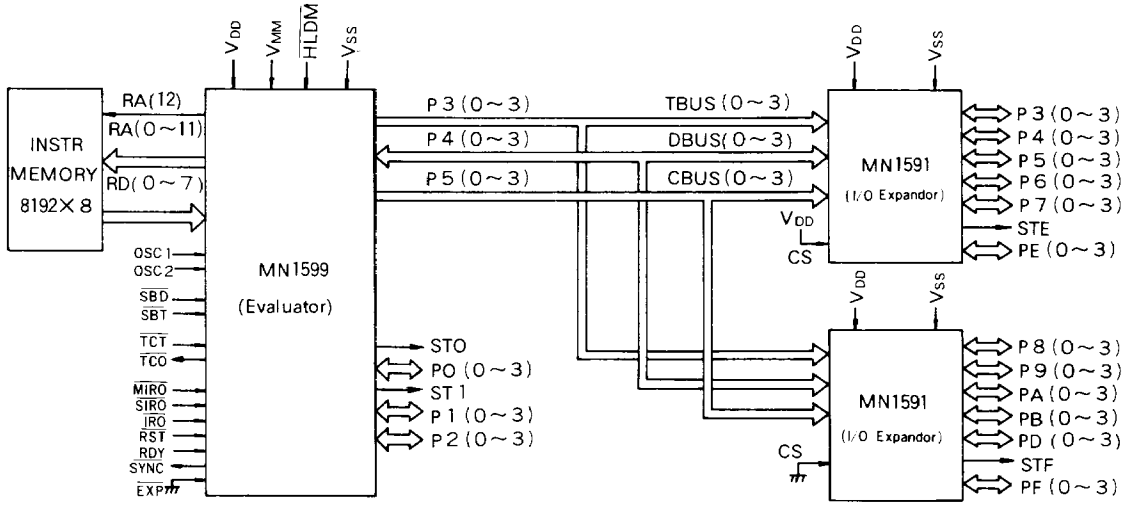
Note) MN1544 does not inclued a part circled in dotted line.

4-Bit One Chip Microcomputer MN1500 Series

Type No.	Function	Maximum Ratings (Ta=25°C)	Electrical Characteristics (Ta=25°C)						
			Item	Symbol	Condition	min.	typ.	max.	Unit
MN1591	N-Chonnel LOCOS E/D MOS I/O Expander	V_{DD}=−0.3~+8V V_I=−0.3~+8V V_O=−0.3~+8V $I_{OH(PK)}$=−2mA $I_{OL(PK)}$=8mA $I_{OH(av)}$=−1mA $I_{OL(av)}$=4mA P_D=1.2W Topr=−20~+70℃ Tstg=−55~+125℃	Supply Current	I_{DD}	Without loal. Ta=25℃		40	80	mA
			Power Consumption	Ptot			200	400	mW
			Input Terminal CBUS0~CBUS3, CS, TBUS0~TBUS3 (Exclude TBUSI)						
			"H" Level Input Voltage	V_{IH1}		2.4		V_{DD}	V
			"L" Level Input Voltage	V_{IL1}		V_{SS}		0.8	V
			Input Leak Current	I_{I1}	V_I=0~5V			±30	μA
			Input Terminal TBUS1						
			"H" Level Input Voltage	V_{IH2}		2.4		V_{DD}	V
			"L" Level Input Voltage	V_{IL2}		V_{SS}		0.8	V
			Input Current	I_{I2}	V_I=0.8V	−75	−150	−300	μA
			Input Output Terminal P30 (P80 ~ PE3 (PF3), DBUS0 ~ DBUS3						
			"H" Level Input Voltage	V_{IH3}		2.4		V_{DD}	V
			"L" Level Input Voltage	V_{IL3}		V_{SS}		0.8	V
		Operating Condition	Input Current	I_{I3}	V_I=0.8V, Output "H"	−50	−150	−300	μA
						−40	− 80	−160	μA
		V_{DD}=5V V_{SS}=0V Ta=25℃	"H" Level Output Voltage	V_{OH3}	I_{OH}=−20μA	2.8			V
			"L" Level Output Voltage	V_{OL3}	I_{OL}=2mA			0.5	V
			Output Terminal STE (STF)						
			"H" Level Output Voltage	V_{OH4}	I_{OH}=−300μA	2.8			V
			"L" Level Output Voltage	V_{OL4}	I_{OL}=2mA			0.5	V
			Terminal Capacitance						
			Input Capacitance	C_I	V_I=2V		5		pF
			Output Capacitance	C_O	V_O=2V (Include I/O Terminal)		10		pF
MN1599	N-Channel LOCOS E/D MOS Evaluator	V_{DD}=−0.3~+8V V_{MM}=−0.3~+8V V_I=−0.3~+8V V_O=−0.3~+8V $I_{OH(PK)}$=−2mA $I_{OL(PK)}$=8mA $I_{OH(av)}$=−1mA $I_{OL(av)}$=4mA P_D=1.2W Topr=−20~+70℃ Tstg=−55~+125℃	Supply Current	I_{DD}			100	190	mA
			Memory Supply Voltage	I_{MM}			2	10	mA
			Power Consumption	Ptot			0.5	1.0	W
			Input Terminals $\overline{TCI}$, $\overline{IRQ}$, $\overline{SIRQ}$, $\overline{MIRQ}$ (Schmitt Input)						
			"H" Level Input Voltage	V_{IH1}		2.6		V_{DD}	V
			"L" Level Input Voltage	V_{IL1}		V_{SS}		0.8	V
			Input Current	I_{I1}	V_I=0.8V	−100	−200	−400	μA
			Input Terminals $\overline{EXP}$, RDY, $\overline{HLDM}$, $\overline{RST}$, RD0~RD7						
			"H" Level Input Voltage	V_{IH2}		2.4		V_{DD}	V
			"L" Level Input Voltage	V_{IL2}		V_{SS}		0.8	V
			Input Current	I_{I2}	V_I=0.8V $\overline{EXP}$, RDY	−100	−200	−400	μA
					V_I=0.8V $\overline{HLDM}$	− 30	− 60	−120	μA
					V_I=0.8V $\overline{RST}$	− 15	− 30	− 60	μA
			Input/Output Terminals P00~P53, $\overline{SBD}$, $\overline{SBT}$ (Schmitt Input)						
			"H" Level Input Voltage	V_{IH3}		2.4		V_{DD}	V
		Operating Condition	"L" Level Input Voltage	V_{IL3}		V_{SS}		0.8	V
			Input Current	I_{I3}	V_I=0.8V, Output "H"	−150	−300	−600	μA
		V_{DD}=5V V_{SS}=0V Ta=25℃	"H" Level Output Voltage	V_{OH3}	I_{OH}=−50μA	2.8			V
			"L" Level Output Voltage	V_{OL3}	I_{OL}=2mA			0.5	V
			Output Terminal $\overline{TCO}$, STO, ST1, $\overline{SYNC}$, RA0~RA12						
			"H" Level Output Voltage	V_{OH4}	I_{OH}=−300μA	2.8			V
			"L" Level Output Voltage	V_{OL4}	I_{OL}=2mA			0.5	V
			Terminal Capacitance						
			Input Capacitance	C_I	V_I=2V		5		pF
			Output Capacitance	C_O	V_O=2V, Include I/O		10		pF

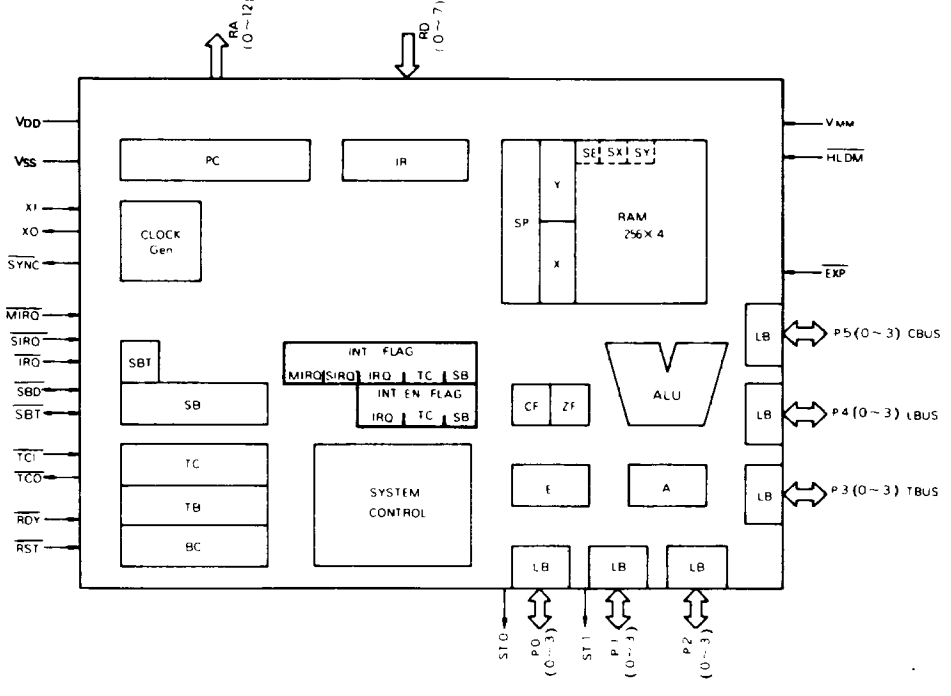
Block Diagram

MN1591 Evaluator Connection Diagram (Package L—19,40—Lead Plastic DIL)



Note) The MN1591 is not required for MN1544/1542 evaluation. ($\overline{EXP}$ High Level)

MN1599 (Package L—20,64—Lead Plastic QIL)



Support System

The system development steps for the MN1500 Series are as same as that of the MN1400 Series and described on page 282.

1. Cross-Assembling by General Purpose Computer (C Support 1500)

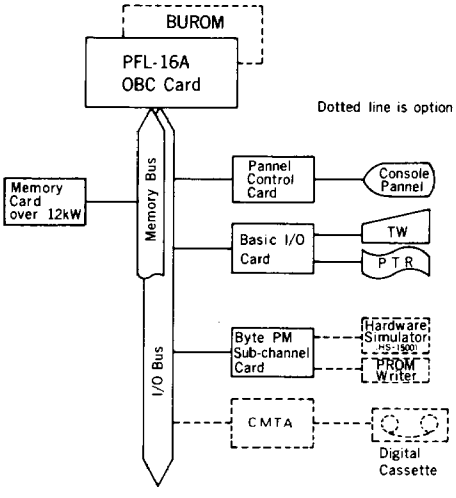
The C Support 1500 has the following functions;

- ○ Cross-assembling the source program by the MN1500 Series assembler.
- ○ Defining the macro-instruction.
- ○ Printing-out capability of listing.
- ○ Difining the format of the object output paper tape, and punching out paper tape.
- ○ Connecting the editing object which is re-allocated, making object program.

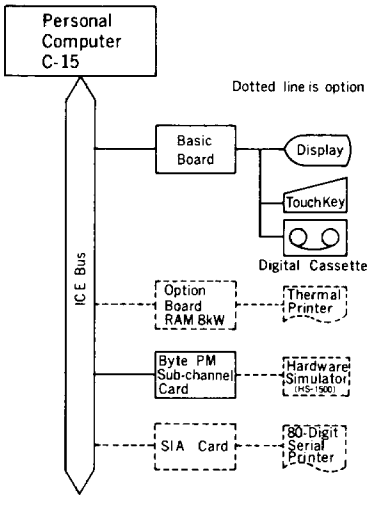
General purpose computers using the software written in Fortran IV is used as the host machine for the cross-assembling.
Card reader, magnetic tape unit and magnetic disk unit are used as the input units.
Printer or typewriter and paper tape puncher are used as the output units.

2. Cross-Assembling by Microcomputer (L Support 1500, P Support 1500)

The L Support 1500 and P Support 1500 have the following functions;



L Support 1500 Hardware System



P Support 1500 Hardware System

■ Functions

Editor

- ○ Cross-assembling the source programs.
- ○ Edition of the source programs. (Insertion, Elimination, Alteration, Shift)
- ○ Output listings (Assembly source listings, Name table, Instruction statistics listings).

Debugger

- ○ Transfer of the object program to the hardware simulator.
- ○ Output the internal status of the Hardware Simulator. (Internal register, flag, RAM, Stack, Timer, I/O port, etc.)
- ○ Emulation in various modes. (Straight mode by specifing the break condition, Real time mode by specifing the break address etc.)

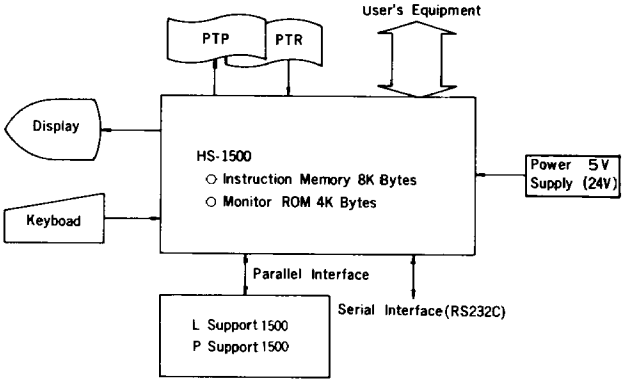
Utility

- ○ The object programs, name table and comment can be saved in the external media. (Paper tape, Cassette tape)
- ○ The object programs, name table and comment can be loaded to the external media.
- ○ PROM writing

3. Support Tool

3–1 Hardware Simulator (HS-1500)

The Hardware Simulator HS-1500 is designed for use in debugging the MN1500 Series microcomputer programs, and has the following functions;



System Block Diagram of Hardware Simulator (HS-1500)

■Functions

- ○Program loading from a paper tape reader, serial and parallel interface.
- ○Program output to a paper tape reader, serial and parallel interface.
- ○Read/Write the instruction memory.
- ○Read/Write the internal register, flag, RAM, stack, timer, I/O port, etc.
- ○Real time trace of the instruction memory execution. (255 instruction cycles)
- ○Break operation under various conditions. (Real time, Program time)
- ○Program execution and halt control. (Continuous operation, Single step operation)
- ○Remote control of the HS-1500 functions by serial and parallel interface.

3–2 Emulation Card (EC-1500)

The Emulation Card EC-1500 is used for simulating the MN1500 Series microcomputer by using the Evaluator MN1599 and PROM. The EC-1500 is useful in prototype production.
The EC-1500 can be equipped with the I/O Expander MN1591. The connector of the card is compatible with the HS-1500. When the programs have been debagged using the HS-1500 and written into the PROM, the HS-1500 is easily replaced with this card for facilitating the simulation.

3–3 I/O Card (I/O-1500)

The I/O-1500 card is designed for use with the HS-1500 and the EC-1500.
The I/O terminals of the I/O-1500 can be directly connected to the terminals of the HS-1500 and EC-1500. By connecting the card to the program loaded HS-1500 and the EC-1500, each output status of the output ports is displayed with the data input.

3–4 Evaluator (MN1599)

The Evaluator MN1599 is an external ROM type full-fledged microcomputer used for the evaluation of the MN1500 Series microcomputer.

3–5 I/O Expander (MN1591)

The MN1591 is used for expanding the input and output ports. The connection of the card to the MN1599 facilitates the simulation of the MN1562 and MN1564.