PRELIMINARY

M37424E8-XXXSP
M37524E4-XXXSP

PROM VERSION of M37424M8-XXXSP,M37524M4-XXXSP

DESCRIPTION

The M37424E8-XXXSP, M37524E4-XXXSP are single-chip microcomputers designed with CMOS silicon gate technology. They are housed in a 64-pin shrink plastic molded DIP. The features of these chips are similar to those of the M37424M8-XXXSP, M37524M4-XXXSP except that these chips have a 16384 bytes PROM built in. These single-chip microcomputers are useful for home electrical appliances and consumer appliance controllers.

In addition to its simple instruction sets, the PROM, RAM, and I/O addresses are placed on the same memory map to enable easy programming. Since general purpose PROM writers can be used for the built-in PROM, these chips are suitable for small quantity production runs.

The differences between the M37424E8-XXXSP and the M37524E4-XXXSP are noted below. The following explanations apply to the M37424E8-XXXSP.

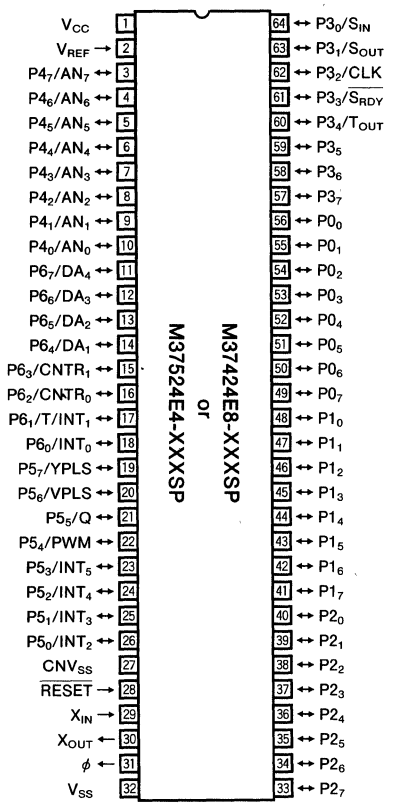
Specification variations for other chips are noted accordingly.

Type name	Port P1 output structure
M37424E8-XXXSP	CMOS
M37524E4-XXXSP	N-channel open drain

FEATURES

- Number of basic instructions 70
  68 MELPS 740 basic instructions + 2 multiply/divide instructions
- Memory size PROM ..... 16384 bytes
  RAM ..... 256 bytes
- Instruction execution time
  ..... 1 μs (minimum instructions, at 4MHz frequency)
- Single power supply ..... 5V $\pm$ 10%
- Power dissipation
  normal operation mode (at 4MHz frequency) 30mW
- Subroutine nesting ..... 96 levels (Max.)
- Interrupt ..... 16 types, 16 vectors
- 8-bit timer 4
- 16-bit timer 1
- Serial I/O (8-bit or 16-bit) 1
- PWM output (14-bit) 1
- A-D converter (8-bit resolution) 8-channel
- D-A converter (5-bit resolution) 2
- D-A converter (8-bit resolution) 2
- Watchdog timer
- External trigger output (1-bit) 1
- V pulse Y pulse generator
- Programmable I/O ports
  (Ports P0, P1, P2, P3, P4, P5, P6) 56
- PROM (equivalent to the M5L27256)
- Program voltage 12.5V

PIN CONFIGURATION (TOP VIEW)



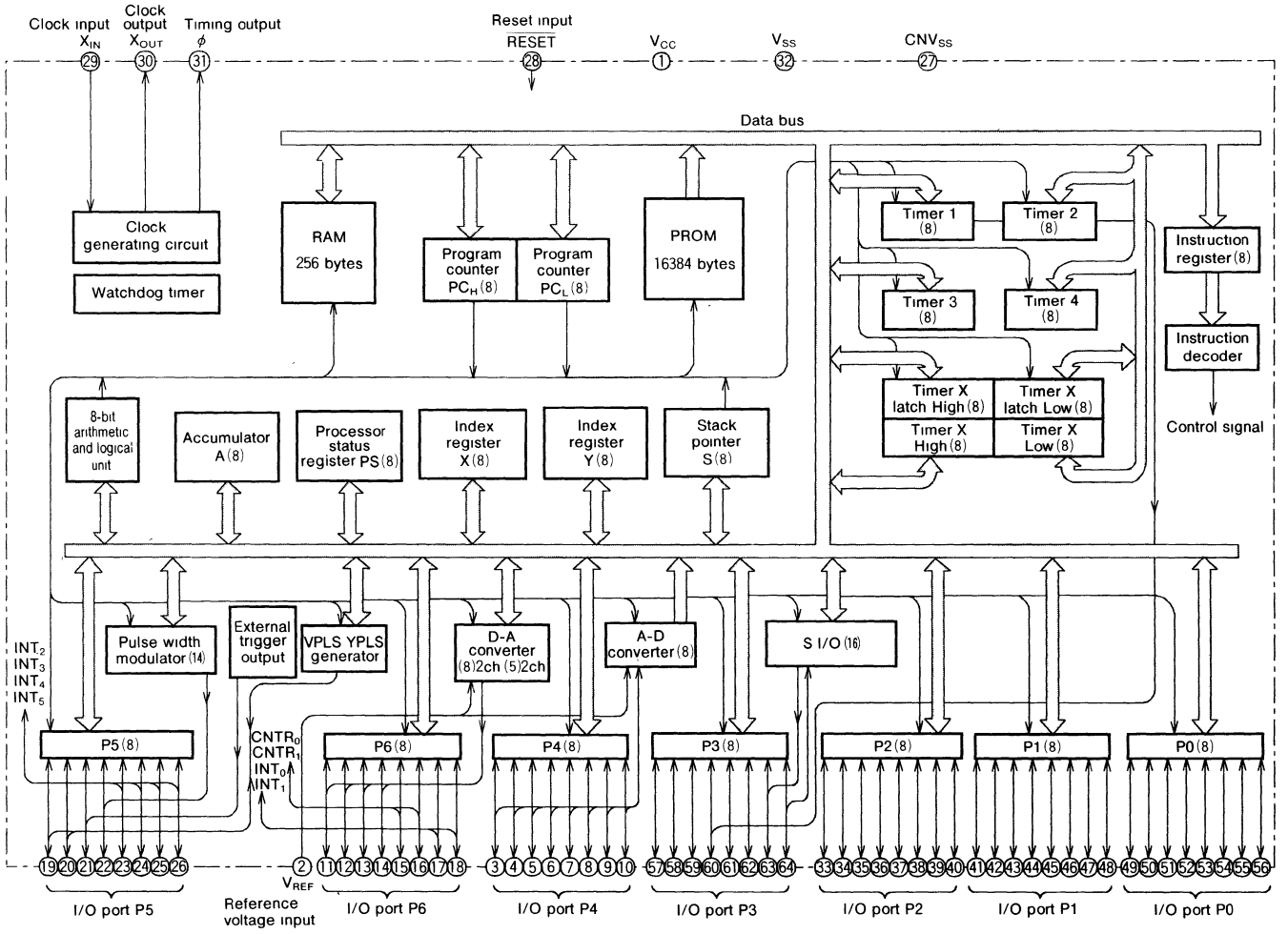
Outline 64P4B

APPLICATION

Office automation equipment
VCR equipment

MITSUBISHI ELECTRIC

M37424E8-XXXSP BLOCK DIAGRAM



FUNCTIONS OF M37424E8-XXXSP

Parameter			Functions
Number of basic instructions			70 (68 MELPS 740 basic instructions+2)
Instruction execution time			1μs (minimum instructions, at 4MHz frequency)
Clock frequency			4MHz
Memory size	PROM		16384 bytes
	RAM		256 bytes
Input/Output ports	P0, P1, P2, P3, P4, P5, P6	I/O	8-bit×7
Serial I/O			8-bit or 16-bit×1
Timers			8-bit×4, 16-bit×1
A-D conversion			8-bit×1 (8 channels)
D-A conversion			5-bit×2, 8-bit×2
Pulse width modulator			14-bit×1
Watchdog timer			15-bit×1
Subroutine nesting			96 levels (max.)
Interrupt			16 (external 8, internal 8)
Clock generating circuit			Built-in (ceramic or quartz crystal oscillator)
Supply voltage			5V±10%
Power dissipation			30mW (at 4MHz frequency)
Operating temperature range			−10 to 70℃
Device structure			CMOS silicon gate
Package			64-pin shrink plastic molded DIP

PIN DESCRIPTION

Pin	Mode	Name	Input/ Output	Functions
V_{CC}, V_{SS}	Single-chip /EPROM	supply voltage		Power supply inputs 5V±10% to V_{CC}, and 0V to V_{SS}
CNV_{SS}	Single-chip	CNV_{SS}		This is usually connected to V_{SS}
	EPROM	V_{PP} input	Input	Connect to V_{PP} when programming or verifing
V_{REF}	Single-chip	Reference voltage input	Input	Reference voltage input pin for A-D and D-A converter
	EPROM	Reference voltage input	Input	Connected to V_{SS}
$\overline{RESET}$	Single-chip	Reset input	Input	To enter the reset state, the reset input pin must be kept at a "L" for more than 4μs (under normal V_{CC} conditions) If more time is needed for the crystal oscillator to stabilize, this "L" condition should be maintained for the required time
	EPROM	Reset input	Input	Connected to V_{SS}.
X_{IN}	Single-chip /EPROM	Clock input	Input	This chip has an internal clock generating circuit To control generating frequency, an external ceramic or a quartz crystal oscillator is connected between the X_{IN} and X_{OUT} pins. If an external clock is used, the clock source should be connected the X_{IN} pin and the X_{OUT} pin should be left open
X_{OUT}		Clock output	Output	
ϕ	Single-chip /EPROM	Timing output	Output	This is the timing output pin
$P0_0$–$P0_7$	Single-chip	I/O port P0	I/O	Port P0 is an 8-bit I/O port with directional register allowing each I/O bit to be individually programmed as input or output At reset, this port is set to input mode The output structure is CMOS output
	EPROM	Address input A_0–A_7	Input	P0 works as the lower 8-bit address input

PIN DESCRIPTION (Continue)

Pin	Mode	Name	Input/ Output	Functions
$P1_0$-$P1_7$	Single-chip	I/O port P1	I/O	Port P1 is an 8-bit I/O port and has basically the same functions as port P0 The output structure of M37424M8-XXXSP is CMOS output and that of M37524M4-XXXSP is N-channel open drain output
	EPROM	Address input A_8-A_{14}	Input	$P1_0$ to $P1_6$ works as the higer 8-bit address input Connect V_{CC} to $P1_7$
$P2_0$-$P2_7$	Single-chip	I/O port P2	I/O	Port P2 is an 8-bit I/O port and has basically the same functions as port P0 The output structure is CMOS output
	EPROM	Data input/output D_0~D_7	I/O	P2 works as an 8-bit data bus
$P3_0$-$P3_7$	Single-chip	I/O port P3	I/O	Port P3 is an 8-bit I/O port and has basically the same functions as port P0 When serial I/O is used, $P3_3$, $P3_2$, $P3_1$, and $P3_0$ work as $\overline{S_{RDY}}$, CLK, S_{OUT}, and S_{IN} pins, respectively Also $P3_4$ works as T_{OUT} pin The output structure is N-channel open drain
	EPROM	Select mode	Input	$P3_3$ and $P3_4$ works as $\overline{CE}$ and $\overline{OE}$ inputs respectively Connect V_{CC} to $P3_0$-$P3_2$. Connect V_{SS} to $P3_5$-$P3_7$
$P4_0$-$P4_7$	Single-chip	I/O port P4	I/O	Port P4 is an 8-bit I/O port and has basically the same functions as port P0 $P4_0$ to $P4_7$ work as analog input port AN_0 to AN_7
	EPROM	Input port P4	Input	Connected to V_{SS}
$P5_0$-$P5_7$	Single-chip	I/O port P5	I/O	Port P5 is an 8-bit I/O port and has basically the same functions as port P0 $P5_7$, $P5_6$, $P5_5$, $P5_4$ and $P5_3$ to $P5_0$ are in common with the YPLS output, VPLS output, Q output, PWM output and interrupt input respectively
	EPROM	Input port P5	Input	Connected to V_{SS}
$P6_0$-$P6_7$	Single-chip	I/O port P6	I/O	Port P6 is an 8-bit I/O port and has basically the same functions as port P0 $P6_7$ to $P6_4$, $P6_3$, $P6_2$, and $P6_1$, $P6_0$ are in common with the D-A output, CNTR output and interrupt input respectively
	EPROM	Input port P6	Input	Connected to V_{SS}

EPROM MODE

The M37424E8-XXXSP features an EPROM mode in addition to its normal modes. When the $\overline{RESET}$ signal level is low ("L"), the chip automatically enters the EPROM mode. Table 1 list the correspondence between pins and Figure 1 gives the pin connection in the EPROM mode. When in the EPROM mode, ports P0 to P2, $P3_3$, $P3_4$, CNV_{SS} are used for the PROM (equivalent to the M5L27256). When in this mode, the built-in PROM can be written to or read from using these pins in the same way as with the M5L27256. The oscillator should be connected to the X_{IN} and X_{OUT} pins, or external clock should be connected to the X_{IN} pin.

Table 1. Pin function in EPROM mode

	M37424E8-XXXSP	M5L27256
V_{CC}	V_{CC}	V_{CC}
V_{PP}	CNV_{SS}	V_{PP}
V_{SS}	V_{SS}	V_{SS}
Address input	Ports P0, $P1_0$-$P1_6$	A_0-A_{14}
Data I/O	Port P2	D_0-D_7
$\overline{CE}$	$P3_3$	$\overline{CE}$
$\overline{OE}$	$P3_4$	$\overline{OE}$

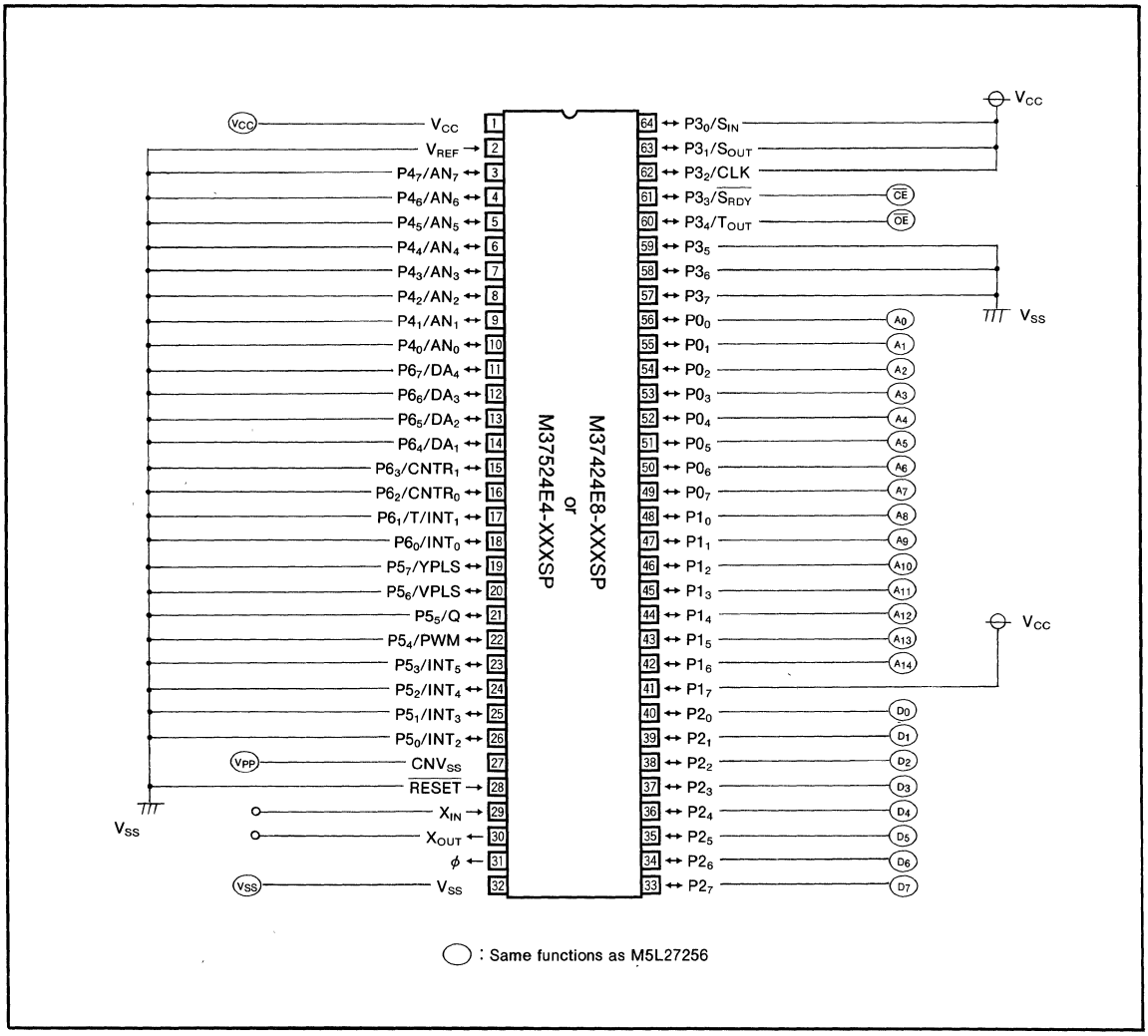


Fig.1 Pin connection in EPROM mode

MITSUBISHI ELECTRIC

PROM READING AND WRITING

Reading

To read the PROM, set the $\overline{CE}$ and $\overline{OE}$ pins to a "L" level. Input the address of the data (A_0-A_{14}) to be read and the data will be output to the I/O pins D_0-D_7. The data I/O pins will be floating when either the $\overline{CE}$ or $\overline{OE}$ pin is in the "H" state.

Writing

To write to the PROM, set the $\overline{OE}$ pin to a "H" level. The CPU will enter the program mode when V_{PP} is applied to the V_{PP} pin. The address to be written to is selected with pins A_0-A_{14}, and the data to be written is input to pins D_0-D_7. Set the $\overline{CE}$ pin to a "L" level to begin writing.

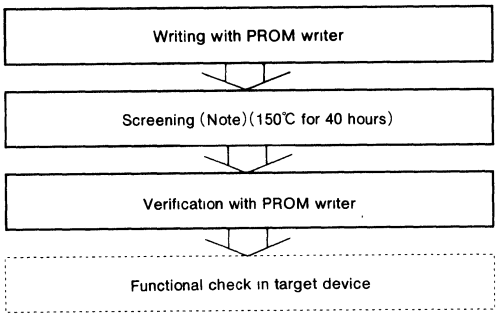
Notes on Writing

When using an PROM writer, the address range should be between 4000_{16} and $7FFF_{16}$. When data is written between addresses 0000_{16} and $7FFF_{16}$, fill addresses 0000_{16} to $3FFF_{16}$ with FF_{16}.

NOTES ON HANDLING

(1) Since a high voltage (12.5V) is used to write data, care should be taken when turning on the PROM writer's power.

(2) The PROM of the blank or the one-time programmable version is not tested and screened after assembly. To ensure proper operation after writing, we recommend that the procedure shown below is used to verify programming.



Note : The screening temperature is far higher than the storage temperature. Do not leave the microcomputer at 150℃ for longer than 100 hours.

Table 2. I/O signal in each mode

Mode \ Pin	$\overline{CE}$(61)	$\overline{OE}$(60)	V_{PP}(27)	V_{CC}(1)	Data I/O (33 to 40)
Read-out	V_{IL}	V_{IL}	V_{CC}	V_{CC}	Output
Output disable	V_{IL}	V_{IH}	V_{CC}	V_{CC}	Floating
Programming	V_{IL}	V_{IH}	V_{PP}	V_{CC}	Input
Programming verify	V_{IH}	V_{IL}	V_{PP}	V_{CC}	Output
Program disable	V_{IH}	V_{IH}	V_{PP}	V_{CC}	Floating

Note 1 : V_{IL} and V_{IH} indicate a "L" and "H" input voltage, respectively