M37120E6-XXXFP

PROM VERSION of M37120M6-XXXFP

DESCRIPTION

The M37120E6-XXXFP is a single-chip microcomputer designed with CMOS silicon gate technology. It is housed in a 80-pin plastic molded QFP. The features of this chip are similar to those of the M37120M6-XXXFP except that this chip has a 12288 bytes PROM built in. This single-chip microcomputer is useful for 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, this chip is suitable for small quantity production runs.

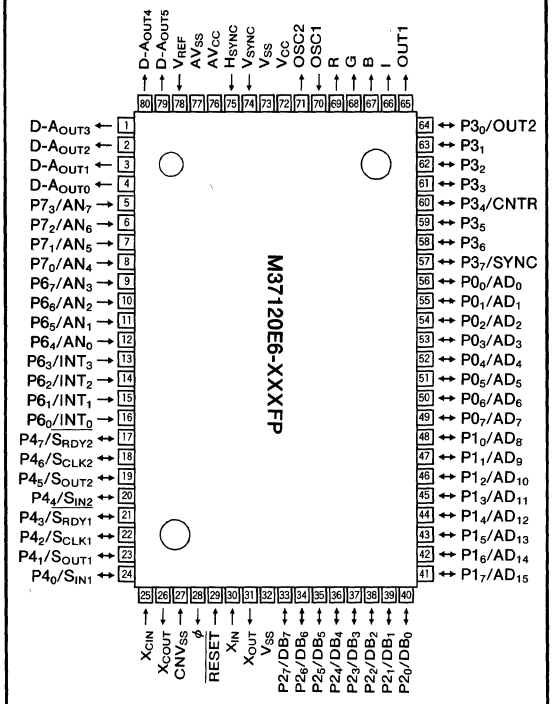
FEATURES

- Number of basic instructions 71
- Memory size PROM ..... 12288 bytes
  RAM ..... 256 bytes
- Instruction execution time
  ..... 1μs(minimum instructions at 4MHz frequency)
- Single power supply
  f(X_{IN})=4MHz ..... 5V±10%
- Power dissipation
  normal operation mode (at 4MHz frequency)
  ..... 75mW
- Subroutine nesting ..... 128 levels (Max.)
- Interrupt ..... 14 types, 14 vectors
- 8-bit timer 4
- Programmable I/O ports
  (Ports P0, P1, P2, P3, P4) 40
- Input ports (Ports P6, P7) 12
- Serial I/O (8-bit) 2
- A-D converter (8-bit resolution) ..... 8 channels
- D-A converter (8-bit resolution) ..... 6 channels
- Watchdog timer
- 72-character on screen display function
  Number of character ..... 24 characters ×3 lines
  Kinds of character 126
- Two clock generating circuits
  (One is for main clock, the other is for clock function)
- PROM (equivalent to the M5L27256)
  program voltage 12.5V

APPLICATION

TV, VCR

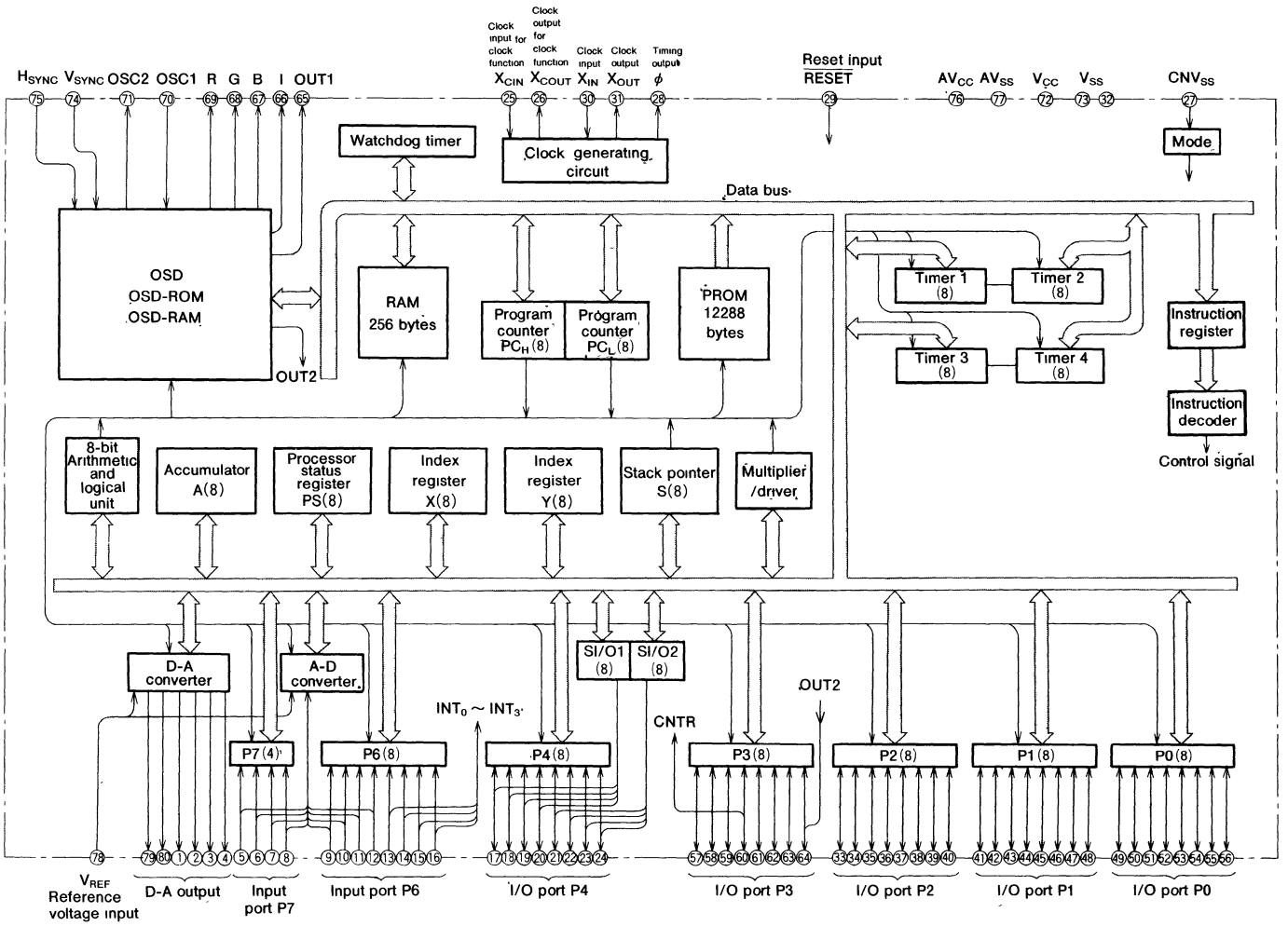
PIN CONFIGURATION (TOP VIEW)



Outline 80P6N

MITSUBISHI ELECTRIC

M37120E6-XXXFP BLOCK DIAGRAM



FUNCTIONS OF M37120E6-XXXFP

Parameters			Functions
Number of basic instructions			71
Instruction execution time			1μs (minimum instructions, at 4MHz of frequency)
Clock frequency			4MHz
Memory size	PROM		12288bytes
	RAM		256bytes
Input/Output port	P0, P1, P2, P3	I/O	8-bit×4
	P4	I/O	8-bit×1 (N-channel open drain output)
	P6	Input	8-bit×1
	P7	Input	4-bit×1
	I, B, G, R, OUT1	Output	1-bit×5(for CRT display function)
	V_{SYNC}, H_{SYNC}	Input	1-bit×2(for CRT display function)
	D-A_{OUT0}~D-A_{OUT5}	Output	1-bit×6
Serial I/O			8-bit×2
Timers			8-bit timer×4
Subrotine nesting			128(max)
Interrupt			Four external interrupts, nine internal interrupts, one software interrupt
Clock generating circuit			Two built-in circuits (ceramic or quartz crystal oscillator)
Supply voltage			5V±10%
Operating temperature range			−10~70℃
Device structure			CMOS silicon gate
Package			80-pin plastic molded QFP
CRT display function	Number of character		24 characters×3 lines
	Kinds of character		126(12×16 dots)

PIN DESCRIPTION

Pin	Mode	Name	Input/ Output	Functions
V_{CC}, V_{SS}	Single-chip /EPROM	Power supply		Supply 5V±10% to V_{CC} and 0V to V_{SS}
AV_{CC}, AV_{SS}	Single-chip	Analog power supply		Power supply input for A-D and D-A converters
	EPROM	Analog power supply		Connect to AV_{CC} to V_{CC} and AV_{SS} to V_{SS}
CNV_{SS}/ V_{PP}	Single-chip	CNV_{SS} input	Input	Connect 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 for A-D and D-A converters
	EPROM	Reference voltage input	Input	Connect to V_{SS}
$\overline{RESET}$	Single-chip	Reset input	Input	To reset, keep this input terminal low for more than 2μs (min) 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	Connect to 0V
X_{IN}	Single-chip	Clock input	Input	These are I/O pins of internal clock generating circuit for main clock 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	
X_{IN}	EPROM	Clock input	Input	Connect to V_{CC}
X_{OUT}		Clock output	Output	Open.
X_{CIN}	Single-chip	Clock input for clock function	Input	This is the I/O pins of the clock generating circuit for the clock function
X_{COUT}		Clock output for clock function	Output	
X_{CIN}	EPROM	Clock input for clock function	Input	Connect to V_{CC}.
X_{COUT}		Clock output for clock function	Output	Open.
ϕ	Single-chip	Timing output	Output	The function of this pin can be selected either timing output or resetout output
	EPROM	Timing output	Output	Open
$D\text{-}A_{OUT0}$ ⟆ $D\text{-}A_{OUT5}$	Single-chip	D-A output	Output	Analog signal from D-A converter is output
	EPROM	D-A output	Output	Open
$P0_0 \sim P0_7$	Single-chip	I/O port P0	I/O	Port P0 is an 8-bit I/O port with directional registers 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 $A_0 \sim A_7$	Input	P0 works as the lower 8 bit address input ($A_0 \sim A_7$)

PIN DESCRIPTION (Continued)

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
	EPROM	Address input A_8~A_{13}	Input	$P1_0$~$P1_6$ works as the higher 6 bit address inputs (A_8~A_{14}). Connect to $P1_7$ to V_{CC} when the microcomputer accesses to program ROM Connect to $P1_7$ to V_{SS} when the microcomputer accesses to OSD ROM
$P2_0$~$P2_7$	Single-chip	I/O port P2	I/O	Port P2 is an 8-bit I/O port and has basically the same function as port P0
	EPROM	Data input/ output D_0~D_7	I/O	Port P2 works as an 8 bit data bus (D_0~D_7)
$P3_0$~$P3_7$	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. Port $P3_0$ is in common with CRT input pin and $P3_4$ is in common with counter input pin
	EPROM	Select mode	Input	$P3_3$, $P3_4$ work as $\overline{CE}$ and $\overline{OE}$, respectively Connect to $P3_0$~$P3_2$ and $P3_5$~$P3_7$ to V_{CC}.
$P4_0$~$P4_7$	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, but the output structure is N-channel open drain
	EPROM	Input port P4	Input	Connect to V_{SS}
$P6_0$~$P6_7$	Single-chip	Input port P6	Input	Port P6 is an 8-bit input port $P6_0$~$P6_3$ are in common with interrupt input pins and $P6_4$~$P6_7$ are in common with analog input pins
	EPROM	Input port P6	Input	Connect to V_{SS}
$P7_0$~$P7_3$	Single-chip	Input port P7	Input	This port is an 4-bit input port and is in common with analog input pins
	EPROM	Input port P7	Input	Connect to V_{SS}
OSC1	Single-chip	Clock input for CRT display	Input	This is the input pin of the clock generating circuit for the CRT display function
	EPROM		Input	Connect to V_{CC}
OSC2	Single-chip	Clock output for CRT display	Output	This is the output pin of the clock generating circuit for the CRT display function
	EPROM		Output	Open
H_{SYNC}	Single-chip	H_{SYNC} input	Input	This is the horizontal synchronizing signal input for CRT display
	EPROM	H_{SYNC} input	Input	Connect to V_{SS}
V_{SYNC}	Single-chip	V_{SYNC} input	Input	This is the vertical synchronizing signal input for CRT display
	EPROM	V_{SYNC} input	Input	Connect to V_{SS}
R, G, B, I, OUT1	Single-chip	CRT output	Output	This is an 5-bit output pin for CRT display
	EPROM	CRT output	Output	Open

EPROM MODE

The M37120E6-XXXFP 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 connections in the EPROM mode. When in the EPROM mode, ports P0, P1, P2, $P3_3$, $P3_4$ and 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.

Table 1. Pin function in EPROM mode

	M37120E6-XXXFP	M5L27256
V_{CC}	V_{CC}	V_{CC}
V_{PP}	CNV_{SS}/V_{PP}	V_{PP}
V_{SS}	V_{SS}	V_{SS}
Address input	Ports P0, P1	$A_0 \sim A_{14}$
Data I/O	Port P2	$D_0 \sim D_7$
$\overline{CE}$	$P3_3/\overline{CE}$	$\overline{CE}$
$\overline{OE}$	$P3_4/\overline{OE}$	$\overline{OE}$

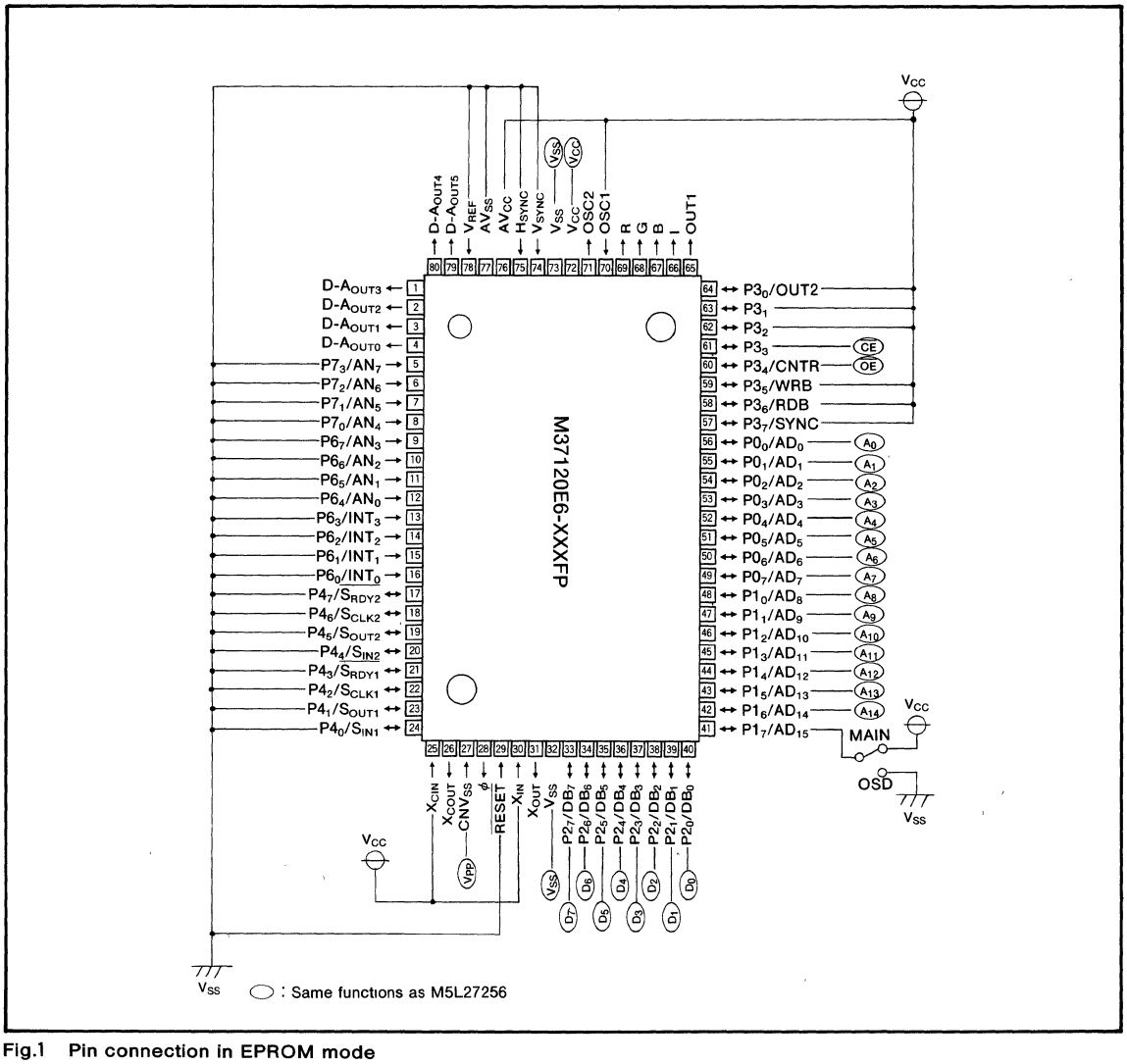


Fig.1 Pin connection in EPROM mode

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 ($A_0 \sim A_{14}$) to be read and the data will be output to the I/O pins $D_0 \sim D_7$. The data I/O pins will be floating when the $\overline{OE}$ pin is in the "H" state.

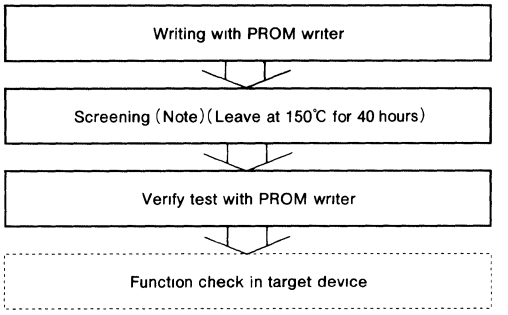
Writing

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 $A_0 \sim A_{14}$, and the data to be written is input to pins $D_0 \sim D_7$. Set the $\overline{CE}$ pin to a "L" level to begin writing.

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) For the programmable microcomputer (shipped in blank or OTP type), Mitsubishi does not perform PROM write test and screening in the assembly process and following processes. To improve reliability after write, performing write and test according to the flow below before use is recommended.



Note : Since the screening temperature is higher than storage temperature, never expose to 150°C exceeding 100 hours.

Table 2. I/O signal in each mode

Mode \ Pin	$\overline{CE}$(61)	$\overline{OE}$(60)	V_{PP}(27)	V_{CC}(72)	Data I/O (33~40, 42~56)
Read-out	V_{IL}	V_{IL}	5V	5V	Output
Output disable	V_{IL}	V_{IH}	5V	5V	Floating
	V_{IH}	X	5V	5V	Floating
Programming	V_{IL}	V_{IH}	12.5V	6V	Input
Programming verify	V_{IH}	V_{IL}	12.5V	6V	Output
Program disable	V_{IH}	V_{IH}	12.5V	6V	Floating

Note 1 : V_{IL} and V_{IH} indicate a "L" and "H" input voltage, respectively.
2 : An X indicates either V_{IL} or V_{IH}