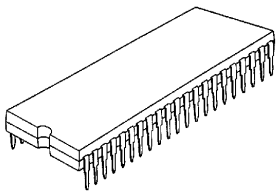
CMOS 8-Bit Microcontroller

TMP87PM34AN

The 87PM34A is a One-Time PROM microcontroller with low-power 287.5 Kbits (a 32 Kbytes program memory and a 256 characters OSD font memory) electrically programmable read only memory for the 87CH34B/K34B/M34B system evaluation. The 87PM34A is pin compatible with the 87CH34B/K34B/M34B. The operations possible with the 87CH34B/K34B/M34B can be performed by writing programs and OSD character data to PROM. The 87PM34A can write and verify in the same way as the TC57256AD using an adaptor socket BM1183A and an EPROM programmer.

Part No.	OTP	RAM	Package	Adaptor Socket
TMP87PM34AN	32 Kbytes + 8 × 9 × 256 bits	1 Kbytes	SDIP42	BM1183A

SDIP42-P-600-1.78



TMP87PM34AN

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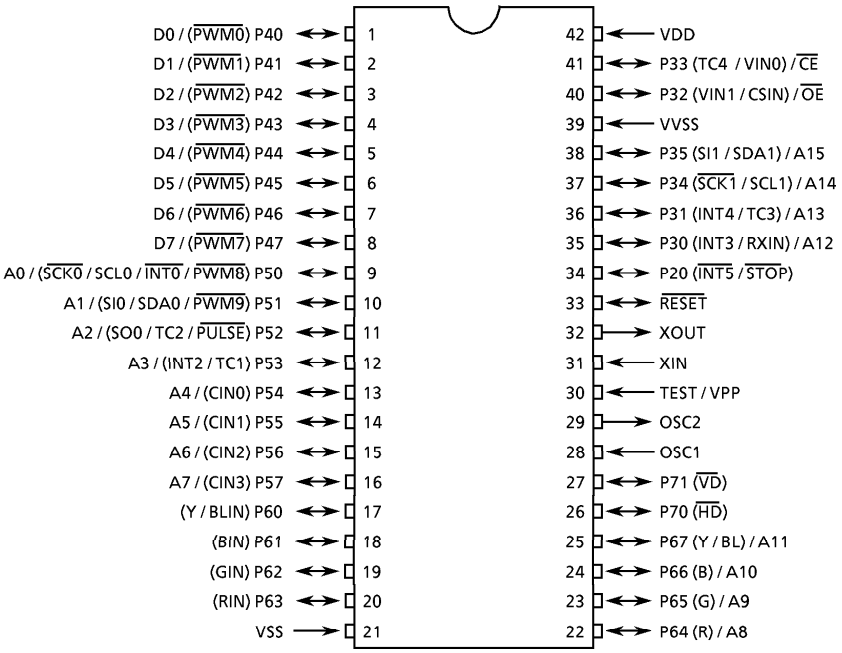
Pin Assignments (Top View)

SDIP42-P-600-1.78



Pin Function

The 87PM34A has two modes: MCU and PROM.

(1) MCU mode

In this mode, the 87PM34A is pin compatible with the 87CH34B/K34B/M34B (fix the TEST pin at low level).

(2) PROM mode

Pin Name (PROM mode)	Input/Output	Functions	Pin Name (MCU mode)
A13, A12	Input	PROM address inputs	P31, P30
A15, A14			P35, P34
A11 to A8			P67 to P64
A7 to A0			P57 to P50
D7 to D0	I/O	PROM data input/outputs	P47 to P40
$\overline{CE}$	Input	Chip enable signal input (active low)	P33
$\overline{OE}$		Output enable signal input (active low)	P32
VPP	Power supply	+ 12.5 V / 5 V (Program supply voltage)	TEST
VCC		+ 5 V	VDD
GND		0 V	VSS
GND		0 V	VVSS
P61	I/O	PROM mode setting pin. Be fixed at high level.	
P70			
P20		PROM mode setting pin. Be fixed at low level.	
P63, P62, P60			
P71			
$\overline{RESET}$			
XIN	Input	Connect an 8MHz oscillator to stabilize the internal state.	
XOUT	Output		
OSC1	Input	Non connection	
OSC2	Output		

Operational Description

The following explains the 87PM34A hardware configuration and operation. The configuration and functions of the 87PM34A are the same as those of the 87CH34B/K34B/M34B, except in that a one-time PROM is used instead of an on-chip mask ROM.

1. Operating Mode

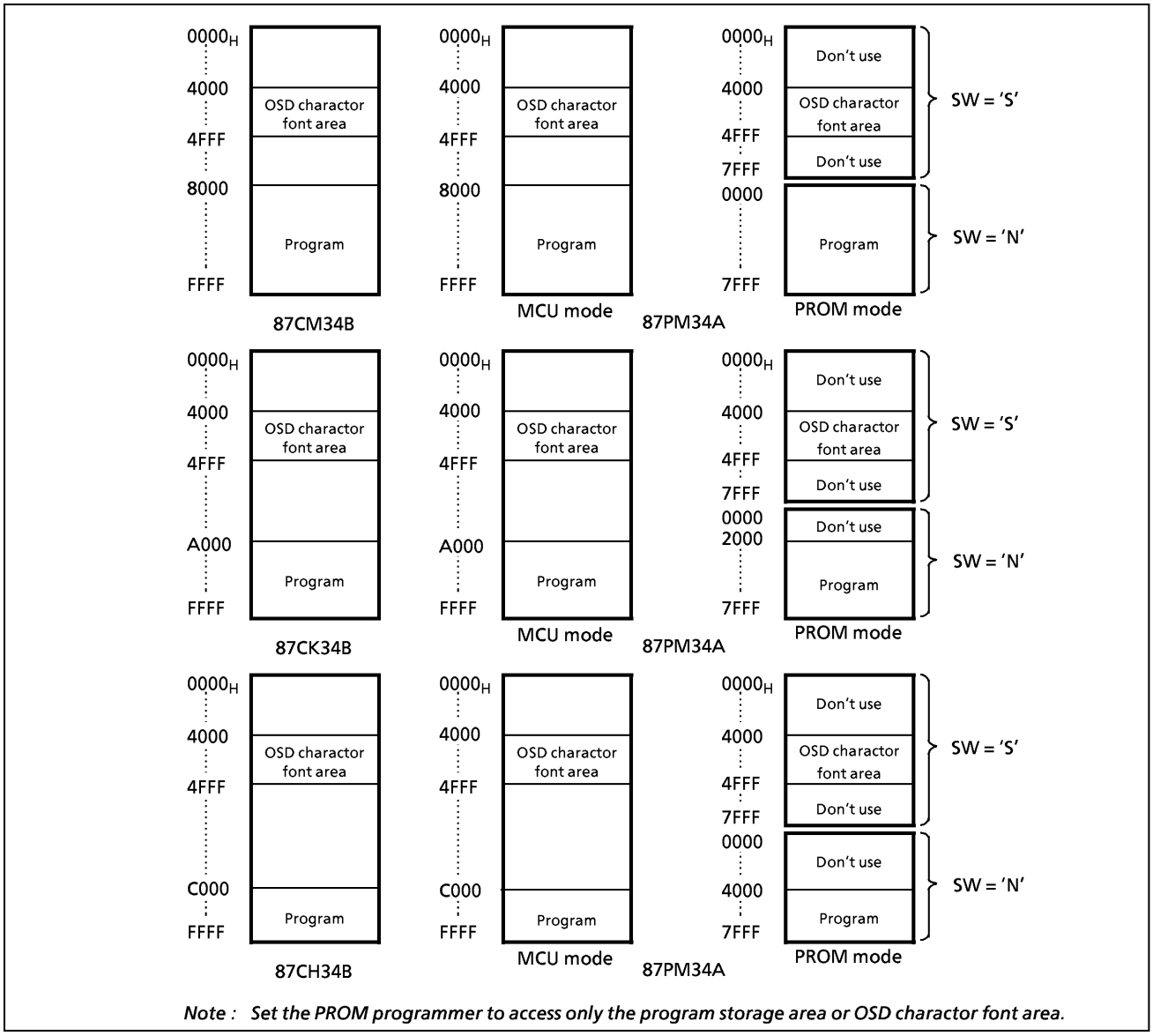
The 87PM34A has two modes: MCU and PROM.

1.1 MCU Mode

The MCU mode is activated by fixing the TEST / VPP pin at low level.
In the MCU mode, operation is the same as with the 87CH34B/K34B/M34B (the TEST / VPP pin cannot be used open because it has no built-in pull-down resistance).

1.1.1 Program memory and OSD character font memory

The 87PM34A has a 32 Kbytes of program memory and a 8 × 9 × 256 bits of OSD character font memory.



Note : Set the PROM programmer to access only the program storage area or OSD charactor font area.

Figure 1-1. Program Memory Area

Electrical Characteristics

Absolute Maximum Ratings (V_{SS} = 0 V)

Parameter	Symbol	Pins	Ratings	Unit
Supply Voltage	V_{DD}		– 0.3 to 6.5	V
Program Voltage	V_{PP}	TEST / VPP	– 0.3 to 13.0	V
Input Voltage	V_{IN}		– 0.3 to V_{DD} + 0.3	V
Output Voltage	V_{OUT1}		– 0.3 to V_{DD} + 0.3	V
Output Current (Per 1 pin)	I_{OUT1}	Ports P2, P3, P4, P5, P64 to P67, P7	3.2	mA
	I_{OUT2}	Ports P60 to P63	30	
Output Current (Total)	ΣI_{OUT1}	Ports P2, P3, P4, P5, P64 to P67, P7	120	mA
	ΣI_{OUT2}	Ports P60 to P63	120	
Power Dissipation	PD		600	mW
Soldering Temperature (time)	Tsld		260 (10 s)	°C
Storage Temperature	Tstg		– 55 to 125	°C
Operating Temperature	Topr		– 30 to 70	°C

Note: The absolute maximum ratings are rated values which must not be exceeded during operation, even for an instant. Any one of the ratings must not be exceeded. If any absolute maximum rating is exceeded, a device may break down or its performance may be degraded, causing it to catch fire or explode resulting in injury to the user. Thus, when designing products which include this device, ensure that no absolute maximum rating value will ever be exceeded.

Recommended Operating Conditions (V_{SS} = 0 V, Topr = – 30 to 70°C)

Parameter	Symbol	Pins	Conditions		Min	Max	Unit
Supply Voltage	V_{DD}		fc = 8 MHz	NORMAL mode	4.5	5.5	V
				IDLE mode			
				STOP mode	2.0		
Input High Voltage	V_{IH1}	Except hysteresis input	$V_{DD} \geqq 4.5$ V		$V_{DD} \times 0.70$	V_{DD}	V
	V_{IH2}	Hysteresis input			$V_{DD} \times 0.75$		
	V_{IH3}		$V_{DD} < 4.5$ V		$V_{DD} \times 0.90$		
Input Low Voltage	V_{IL1}	Except hysteresis input	$V_{DD} \geqq 4.5$ V		0	$V_{DD} \times 0.30$	V
	V_{IL2}	Hysteresis input				$V_{DD} \times 0.25$	
	V_{IL3}		$V_{DD} < 4.5$ V			$V_{DD} \times 0.10$	
Clock Frequency	fc	XIN, XOUT	V_{DD} = 4.5 to 5.5 V		4.0	8.0	MHz
	f_{OSC}	OSC1, OSC2	Double frequency mode (FORS = 1, VDD = 4.5 to 5.5 V)		2.0	$f_{OSC} \leqq fc \times 1.4 \leqq 6.0$	
			Normal frequency mode (FORS = 0, V_{DD} = 4.5 to 5.5 V)		4.0	$f_{OSC} \leqq fc \times 2.8 \leqq 12.0$	

Note1 : The recommended operating conditions for a device are operating conditions under which it can be guaranteed that the device will operate as specified. If the device is used under operating conditions other than the recommended operating conditions (supply voltage, operating temperature range, specified AC/DC values etc.), malfunction may occur. Thus, when designing products which include this device, ensure that the recommended operating conditions for the device are always adhered to.

Note2 : Clock Frequency fc ; The condition of supply voltage range is the value in NORMAL and IDLE mode.

Note3 : When using test video signal circuit and data slicer circuit, high frequency must be 8 MHz.

D.C. Characteristics

(V_{SS} = 0 V, T_{opr} = – 30 to 70°C)

Parameter	Symbol	Pins	Conditions	Min	Typ.	Max	Unit
Hysteresis Voltage	V_{HS}	Hysteresis inputs		–	0.9	–	V
Input Current	I_{IN1}	TEST	V_{DD} = 5.5 V, V_{IN} = 5.5 V / 0 V	–	–	± 2	μA
	I_{IN2}	Open drain ports	V_{DD} = 5.5 V, V_{IN} = 5.5 V	–	–	2	
	I_{IN3}	Tri-state ports	V_{DD} = 5.5 V, V_{IN} = 5.5 V / 0 V	–	–	± 2	
	I_{IN4}	$\overline{RESET}$, $\overline{STOP}$	V_{DD} = 5.5 V, V_{IN} = 5.5 V / 0 V	–	–	± 2	
Input Resistance	R_{IN2}	$\overline{RESET}$		100	220	450	kΩ
Output Leakage Current	I_{LO1}	Open drain ports	V_{DD} = 5.5 V, V_{OUT} = 5.5 V	–	–	2	μA
	I_{LO2}	Tri-state ports	V_{DD} = 5.5 V, V_{OUT} = 5.5 V / 0 V	–	–	± 2	
Output High Voltage	V_{OH2}	Tri- state ports	V_{DD} = 4.5 V, I_{OH} = – 0.7 mA	4.1	–	–	V
Output Low Voltage	V_{OL}	Except XOUT, OSC2 and ports P60 to P63	V_{DD} = 4.5 V, I_{OL} = 1.6 mA	–	–	0.4	V
Output Low Current	I_{OL3}	Ports P60 to P63	V_{DD} = 4.5 V, V_{OL} = 1.0 V	–	20	–	mA
Supply Current in NORMAL mode	I_{DD}		V_{DD} = 5.5 V fc = 8 MHz V_{IN} = 5.3 V / 0.2 V	–	15	25	mA
Supply Current in IDLE mode				–	10	18	mA
Supply Current in STOP mode			V_{DD} = 5.5 V V_{IN} = 5.3 V / 0.2 V	–	0.5	10	μA

Note 1 : Typical values show those at T_{opr} = 25°C , V_{DD} = 5 V.

Note 2 : Input Current I_{IN4} ; The current through pull-up resistor is not included.

Note 3 : Typical current consumption during A/D conversion is 1.2 mA.

A/D Conversion CHaracteristics

(V_{SS} = 0 V, V_{DD} = 4.5 to 5.5 V, Topr = – 30 to 70°C)

Parameter	Symbol	Pins	Conditions	Min	Typ.	Max	Unit
Analog Input Voltage Range	V_{AIN}	CIN3 to CIN0		V_{SS}	–	V_{DD}	V
Conversion Error			V_{DD} = 5.0 V	–	–	± 1.5	LSB

A.C. Characteristics

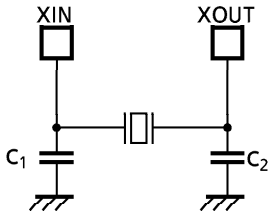
(V_{SS} = 0 V, V_{DD} = 4.5 to 5.5 V, Topr = – 30 to 70°C)

Parameter	Symbol	Conditions	Min	Typ.	Max	Unit
Machine Cycle Time	t_{cy}	In NORMAL mode	0.5	–	1.0	μs
		In IDLE mode				
High Level Clock Pulse Width	t_{WCH}	For external clock operation (XIN input), fc = 8 MHz	62.5	–	–	ns
Low Level Clock Pulse Width	t_{WCL}					

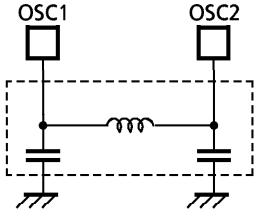
Recommended Oscillating Conditions

(V_{SS} = 0 V, V_{DD} = 4.5 to 5.5 V, Topr = – 30 to 70°C)

Parameter	Oscillator	Oscillation Frequency	Recommended Oscillator	Recommended Constant C_1	Recommended Constant C_2
High-frequency Oscillation	Ceramic Resonator	8 MHz	KYOCERA KBR8.0M	30 pF	30 pF
		4 MHz	KYOCERA KBR4.0MS		
			MURATA CSA4.00MG		
	Crystal Oscillator	8 MHz	TOYOCOM 210B 8.0000	20 pF	20 pF
		4 MHz	TOYOCOM 204B 4.0000		
OSD	LC Resonator	6 MHz	TOKO A285HCIS-13319 (5mm)	–	–
		12 MHz	TOKO TA285HCIS-13306 (5mm)		



(1) High-frequency Oscillation



(2) LC Resonator for OSD

Note : On our OSD circuit, the horizontal display start position is determined by counting the clock from LC oscillator. So, the unstable start of oscillation after the rising edge of Horizontal Sync. Signal will be cause the OSD distortion.
Generally, smaller C and larger L make clearer wave from at the beginning of oscillation. We recommend that the value of LC oscillator should be equal and digger than 33 μH.

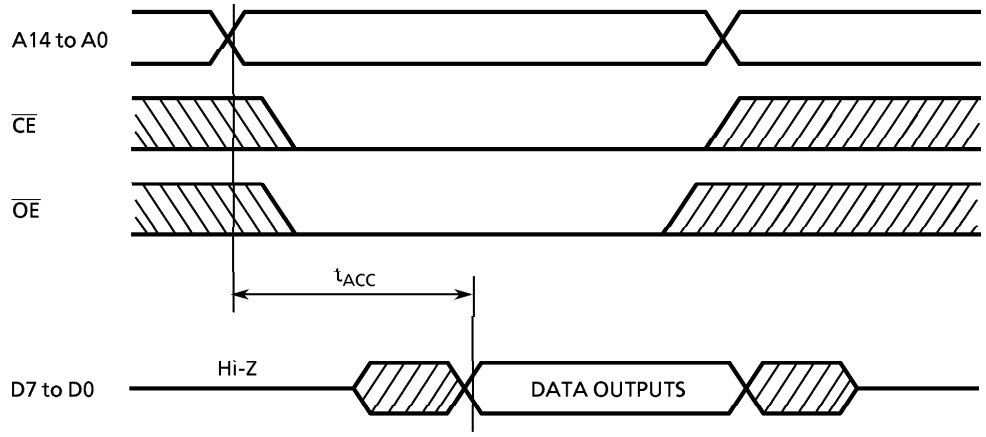
Note : To keep reliable operation, shield the device electrically with the metal plate on its package mold surface against the high electric field, for example, by CRT (Cathode Ray Tube).

D.C./A.C. Characteristics (PROM mode) (V_{SS} = 0 V)

(1) Read Operation (Ta = 25 ± 5°C)

Parameter	Symbol	Conditions	Min	Typ.	Max	Unit
Input High Voltage	V_{IH4}		$V_{CC} \times 0.7$	–	V_{CC}	V
Input Low Voltage	V_{IL4}		0	–	$V_{CC} \times 0.12$	V
Power Supply Voltage	V_{CC}		4.75	5.00	5.25	V
Program Power Supply Voltage	V_{PP}		V_{CC} – 0.6	V_{CC}	V_{CC} + 0.6	
Address Access Time	t_{ACC}	V_{CC} = 5.0 ± 0.25 V	–	1.5tcyc + 300	–	ns

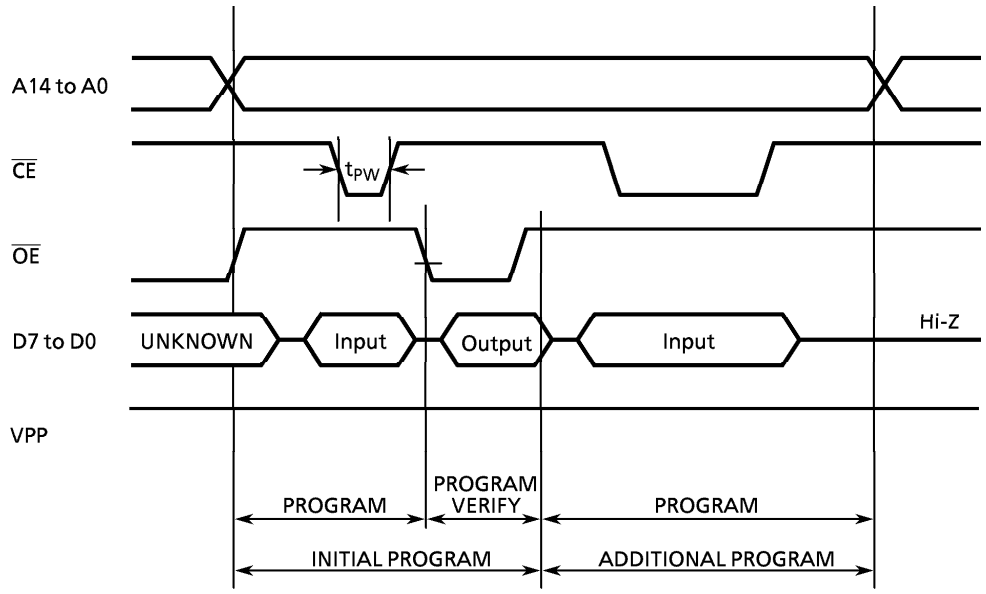
Note: tcyc = 500 ns at 8 MHz



Timing Waveforms of Read Operation

(2) High-Speed Programming Operation (High speed write mode Ⅰ) (Ta = 25 ± 5°C)

Parameter	Symbol	Conditions	Min	Typ.	Max	Unit
Input High Voltage	V_{IH4}		$V_{CC} \times 0.7$	–	V_{CC}	V
Input Low Voltage	V_{IL4}		0	–	$V_{CC} \times 0.12$	V
Power Supply Voltage	V_{CC}		5.75	6.0	6.25	V
Program Power Supply Voltage	V_{PP}		12.0	12.5	13.0	V
Initial Program Pulse Width	t_{PW}	V_{CC} = 6.0 ± 0.25 V, V_{PP} = 12.5 ± 0.25 V	0.95	1.0	1.05	ms

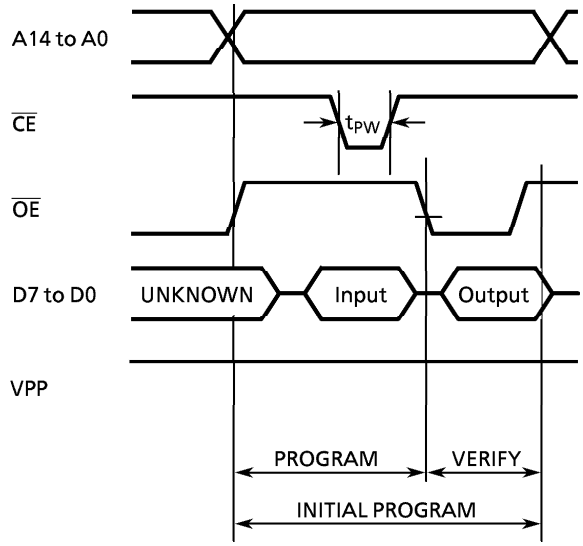


Timing Waveforms of Programming Operation

Note1:	*When V_{cc} power supply is turned on or after, V_{pp} (12.75 V) must be increased. When V_{cc} power supply is turned off or before, V_{pp} (12.75 V) must be decreased.*
Note2:	*The device must not be set to the EPROM programmer or picked up from it under applying the program voltage (12.75 V ± 0.25 V) to the V_{pp} pin as the device is damaged.*
Note3:	*Be sure to execute the recommended programing mode with the recommended programing adaptor. If a mode or an adaptor except the above, the misoperation sometimes occurs.*

(3) High-Speed Programming Operation (High speed write mode Ⅱ) (Topr = 25 ± 5°C)

Parameter	Symbol	Conditions	Min	Typ.	Max	Unit
Input High Voltage	V_{IH4}		$V_{CC} \times 0.7$	–	V_{CC}	V
Input Low Voltage	V_{IL4}		0	–	$V_{CC} \times 0.12$	V
Supply Voltage	V_{CC}		6.00	6.25	6.50	V
Program Supply Voltage	V_{PP}		12.50	12.75	13.0	V
Initial Program Pulse Width	t_{PW}	V_{CC} = 6.25 V ± 0.25 V, V_{PP} = 12.75 ± 0.25 V	0.095	0.1	0.105	ms



Note1: When V_{cc} power supply is turned on or after, V_{pp} (12.75 V) must be increased. When V_{cc} power supply is turned off or before, V_{pp} (12.75 V) must be decreased.

Note2: The device must not be set to the EPROM programmer or picked up from it under applying the program voltage (12.75 V ± 0.25 V) to the V_{pp} pin as the device is damaged.

Note3: Be sure to execute the recommended programing mode with the recommended programing adaptor. If a mode or an adaptor except the above, the misoperation sometimes occurs.