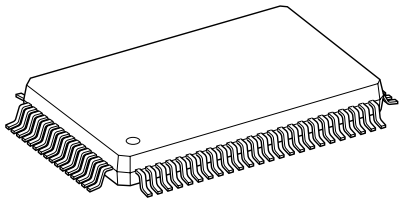
CMOS 8-Bit Microcontroller
TMP88PU74F

The TMP88PU74 are the high-speed and high performance 8-bit single chip microcomputers which built in a program storage area (96 Kbytes) and the One-Time PROM of bector table storage area (256 bytes). The TMP88PU74 is pin compatible with the TMP88CU74. The operations possible with the TMP88PU74 can be performed by writing programs to PROM. The TMP88PU74 can write and verify in the same way as the TC571000 an EPROM programmer.

Product No.	OTP	RAM	Package	Adaptor Socket
TMP88PU74F	96 Kbytes + 256 bytes	2 Kbytes	P-QFP80-1420-0.80B	BM11131

P-QFP80-1420-0.80B



TMP88PU74F

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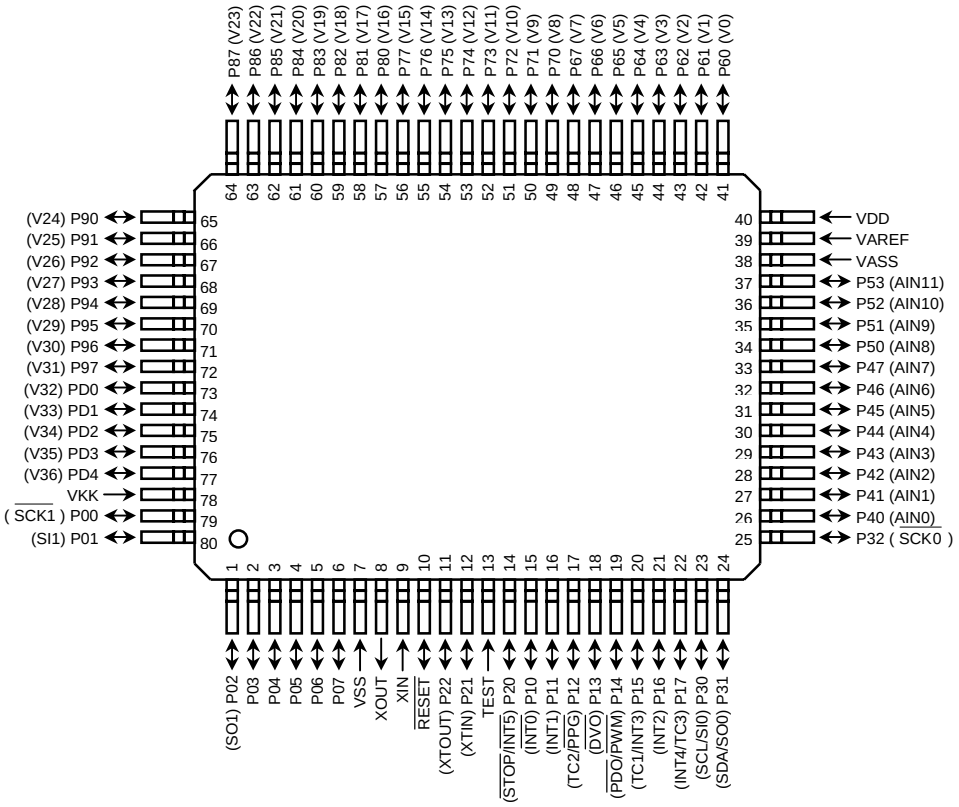
Pin Assignments (Top View)

P-QFP80-1420-0.80B



Pin Function

The TMP88PU74 has two modes: MCU and PROM.

(1) MCU mode

In this mode, the TMP88PU74 is pin compatible with the TMP88CU74 (fix the TEST pin at low level).

(2) PROM mode

Pin Name (PROM mode)	Input/ Output	Functions	Pin Name (MCU mode)
A16	Input	PROM address inputs	P60
A15 to A8			P05, P32 to 30, P53 to 50
A7 to A0			P47 to P40
D7 to D0	I/O	PROM data input/outputs	P17 to P10
$\overline{CE}$	Input	Chip enable signal input (active low)	P03
$\overline{OE}$		Output enable signal input (active low)	P04
$\overline{PGM}$		Program mode single input	P02
VPP	Power supply	+12.75 V/5 V (Program supply voltage)	TEST
VCC		+ 6.25 V/5 V	VDD
GND		0 V	VSS
P37 to P30	Input	Pull-up with resistance for input processing	
P47 to P41			
P54 to P50			
P01		PROM mode setting pin. Be fixed at high level.	
P21			
P07, P06, P00		PROM mode setting pin. Be fixed at low level.	
P22, P20			
$\overline{RESET}$			
P67 to P61	Output	Open	
P77 to P70			
P87 to P80			
P97 to P90			
PD4 to PD0			
XIN	Input	Connect an 10 MHz oscillator to stabilize the internal state.	
XOUT	Output		
VAREF	Power supply	0 V (GND)	
VASS			
VKK		Open	

Operational Description

The configuration and functions of the TMP88PU74 are the same as those of the TMP88CU74, except in that a one-time PROM is used instead of an on-chip mask ROM.

1. Operating Mode

The TMP88PU74 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 TMP88CU74 (the TEST/VPP pin cannot be used open because it has no built-in pull-down resistance).

1.1.1 Program Memory

The TMP88PU74 has a 96 Kbytes (addresses 04000H to 1BFFFH in the MCU mode, addresses 00000H to 17FFFH in the PROM mode) of program storage area and 256 byte (addresses FFF00 to FFFFFH in the MCU mode, addresses 1FF00 to 1FFFFH in the PROM mode) one-time PROM of vector table storage area.

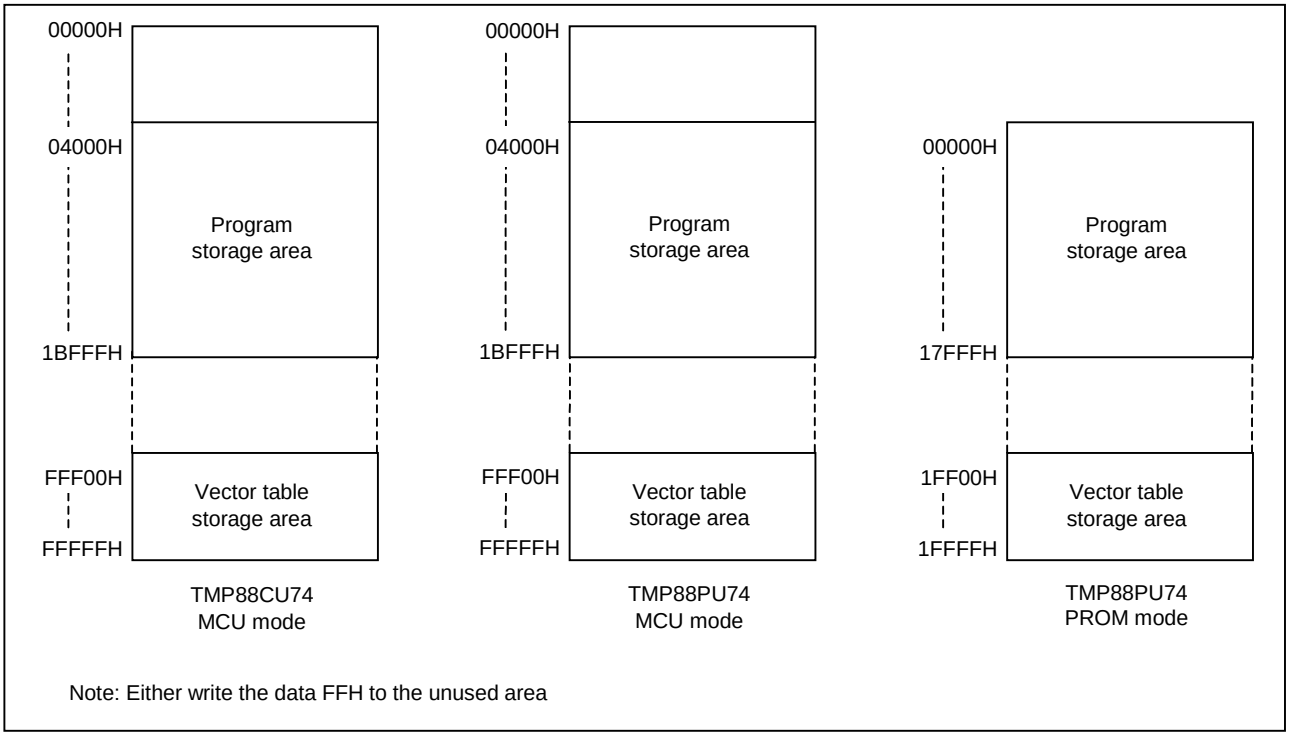


Figure 1.1.1 Program Storage Area

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	
Input Voltage	V_{IN}		−0.3 to V_{DD} + 0.3	
Output Voltage	V_{OUT1}	P2, P3 (at open drain)	−0.3 to V_{DD} + 0.3	
	V_{OUT2}	P6, P7, P8, P9, PD	V_{DD} − 40 to V_{DD} + 0.3	
Output Current (Per 1 pin)	I_{OUT1}	P0, P1, P2, P4, P5	3.2	mA
	I_{OUT2}	P6, P7, P8, P9, PD	−25	
Output Current (Total)	ΣI_{OUT1}	P0, P1, P3, P4, P5	−40	
	ΣI_{OUT2}	P0, P1, P2, P3, P4, P5	120	
	ΣI_{OUT3}	P6, P7, P8, P9, PD	−160	
Power Dissipation [Topr =25℃]	PD (Note 2)		1200	mW
Soldering Temperature (time)	Tsld		260 (10 s)	°C
Storage Temperature	Tstg		−55 to + 125	
Operating Temperature	Topr		−30 to 70	

Note 1: 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.

Note 2: Power Dissipation (PD); For PD, it is necessary to decrease 14.3 mW/°C.
(Refernce to TMP88CU74)

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

Parameter	Symbol	Pins	Conditions		Min	Max	Unit
Supply Voltage	V_{DD}		fc = 12.5 MHz	NORMAL1, 2 modes	4.5	5.5	V
				IDLE1, 2 modes			
			fs = 32.768 KHz	SLOW modes	2.7		
				SLEEP modes			
				STOP modes	2.0		
Input High Voltage	V_{IH1}	Except hysteresis input	$V_{DD} \geq 4.5$ V		$V_{DD} \times 0.70$	V_{DD}	
	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	$V_{DD} \geq 4.5$ V		0	$V_{DD} \times 0.30$	
	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 (Note 2)		8	12.5	MHz
		XTIN, XTOUT	V_{DD} = 2.7 to 5.5 V		30.0	34.0	kHz

Note 1: 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.

Note 2: Clock frequency fc: Supply voltage range is specified in NORMAL 1/2 mode and IDLE 1/2 mode.

DC Characteristics (V_{SS} = 0 V, Topr = –30 to 70°C)

Parameter	Symbol	Pins	Conditions	Min	Typ.	Max	Unit
Hysteresis Voltage	V_{HS}	Hysteresis input		—	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, Tri-state ports					
	I_{IN3}	$\overline{RESET}$, $\overline{STOP}$					
Input Resistance	R_{IN3}	$\overline{RESET}$		100	220	450	kΩ
Pull-down Resistance	R_K	Source open drain ports	V_{DD} = 5.5 V, V_{KK} = –30 V	50	80	110	
Output Leakage Current	I_{LO1}	Sink open drain ports	V_{DD} = 5.5 V, V_{OUT} = 5.5 V	—	—	2	μA
	I_{LO2}	Source open drain ports	V_{DD} = 5.5 V, V_{OUT} = –32 V	—	—	–2	
	I_{LO3}	Tri-state ports	V_{DD} = 5.5 V, V_{OUT} = 5.5 V/ 0V	—	—	2	
Output High Voltage	V_{OH}	Tri-state ports	V_{DD} = 4.5 V, I_{OH} = –0.7 mA	4.1	—	—	V
Output Low Voltage	V_{OL}	Except XOUT	V_{DD} = 4.5 V, I_{OL} = 1.6 mA	—	—	0.4	
Output High current	I_{OH}	P6, P7, P8, P9, PD port	V_{DD} = 4.5 V, V_{OH} = 2.4 V	—	–20	—	mA
Supply Current in NORMAL 1, 2 modes	I_{DD}		V_{DD} = 5.5 V V_{IN} = 5.3 V/0.2 V fc = 12.5 MHz fs = 32.768 kHz	—	13.5	20	
Supply Current in IDLE 1, 2 modes				—	5.5	8.5	
Supply Current in SLOW mode			V_{DD} = 3.0 V V_{IN} = 2.8 V/0.2 V fs = 32.768 kHz	—	30	60	μA
Supply Current in SLEEP mode				—	15	30	
Supply Current in STOP mode			V_{DD} = 5.5 V V_{IN} = 5.3 V/0.2 V	—	0.5	10	

Note 1: Typical values show those at Topr = 25°C, VDD = 5 V.

Note 2: Input Current IIN3; The current through resistor is not included, when the input resistor (pull-up/pull-down) is contained.

AD Conversion 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
Analog Reference Voltage	V_{AREF}		4.5	—	V_{DD}	V
	V_{ASS}		V_{SS}			
Analog Reference Voltage Range	V_{AIN}		V_{ASS}	—	V_{AREF}	
Analog Input Voltage	I_{REF}	V_{AREF} = 5.5 V, V_{ASS} = 0.0 V	—	0.5	1.0	mA
Nonlinearity Error		V_{DD} = 5.0 V, V_{SS} = 0.0 V V_{AREF} = 5.000 V V_{ASS} = 0.000 V	—	—	±1	LSB
Zero Point Error			—	—	±1	
Full Scale Error			—	—	±1	
Total Error			—	—	±2	

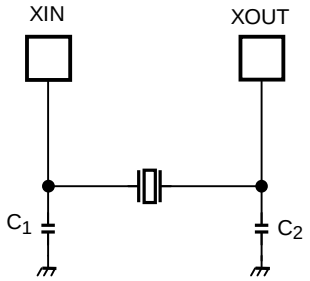
Note: Quantizing error is not contained in those errors.

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

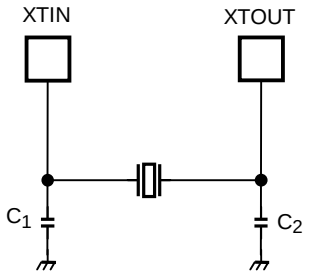
Parameter	Symbol	Conditions	Min	Typ.	Max	Unit
Machine Cycle Time	tcy	In NORMAL1, 2 modes	0.32	—	0.5	μs
		In IDLE1, 2 modes				
		In SLOW mode	117.6	—	133.3	
		In SLEEP mode				
High Level Clock Pulse Width	t_{WCH}	For external clock operation (XIN input), fc = 12.5 MHz	33.75	—	—	ns
Low Level Clock Pulse Width	t_{WCL}					
High Level Clock Pulse Width	t_{WSH}	For external clock operation (XTIN input), fs = 32.768 kHz	14.7	—	—	μs
Low Level Clock Pulse Width	t_{WSL}					

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	C_2
High-frequency Oscillation	Ceramic Resonator	12.5 MHz	Murata CSA12.5MTZ	30 pF	30 pF
		8 MHz	Murata CSA8.00MTZ	30 pF	30 pF
	Crystal Oscillator	12.5 MHz	NDK AT-51	10 pF	10 pF
Low-frequency Oscillation	Crystal Oscillator	32.768 KHz	NDK MX-38T	15 pF	15 pF



(1) High-frequency Oscillation



(2) Low-frequency Oscillation

Note 1: An electrical shield by metal shied plate on the IC package should be recommend able in order to prevent the device from the high electric fieldstress applied for continuous reliable operation.

Note 2: The product numbers and specifications of the resonators by Murata Manufacturing Co., Ltd. are subject to change. For up-to-date information, please refer to the following URL;

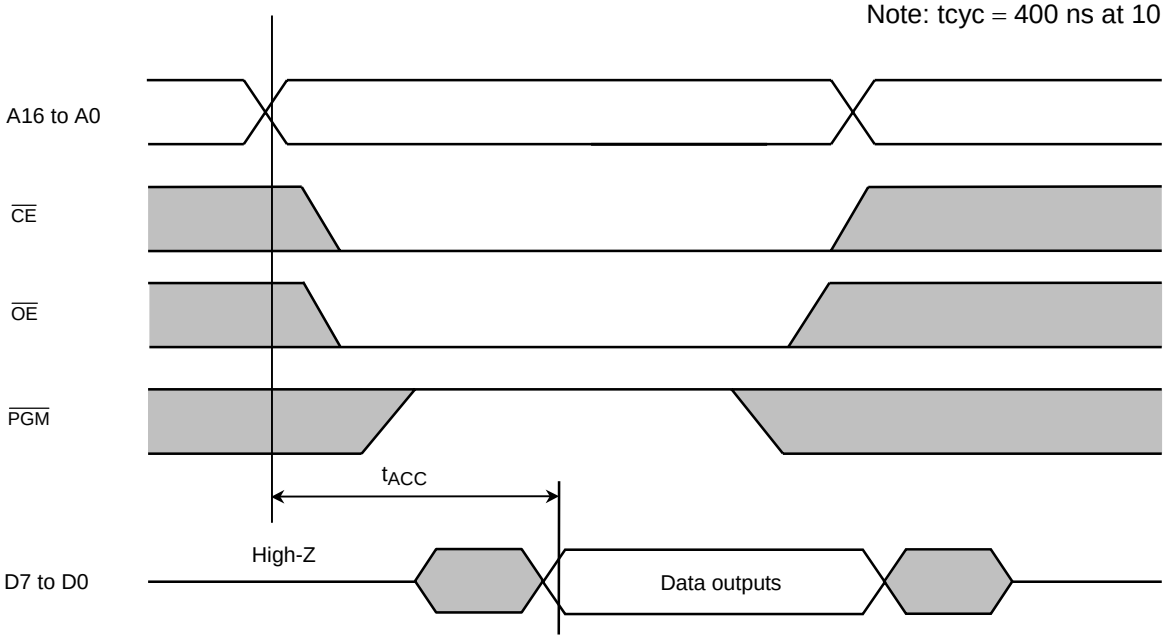
http://www.murata.co.jp/search/index.html

DC/AC Characteristics (PROM mode) (V_{SS} = 0 V)

(1) Read operation (VDD = 5.0 ± 0.25 V, Topr = 25 ± 5°C)

Parameter	Symbol	Conditions	Min	Typ.	Max	Unit
Input High Voltage (A0 to A16, $\overline{CE}$, $\overline{OE}$, $\overline{PGM}$)	V_{IH4}		$V_{DD} \times 0.7$	–	V_{DD}	V
Input Low Voltage (A0 to A16, $\overline{CE}$, $\overline{OE}$, $\overline{PGM}$)	V_{IL4}		0	–	0.8	
Program Power Supply Voltage	V_{PP}		4.75	5.0	5.25	
Address Access Time	t_{ACC}		–	1.5tcyc + 300	–	ns

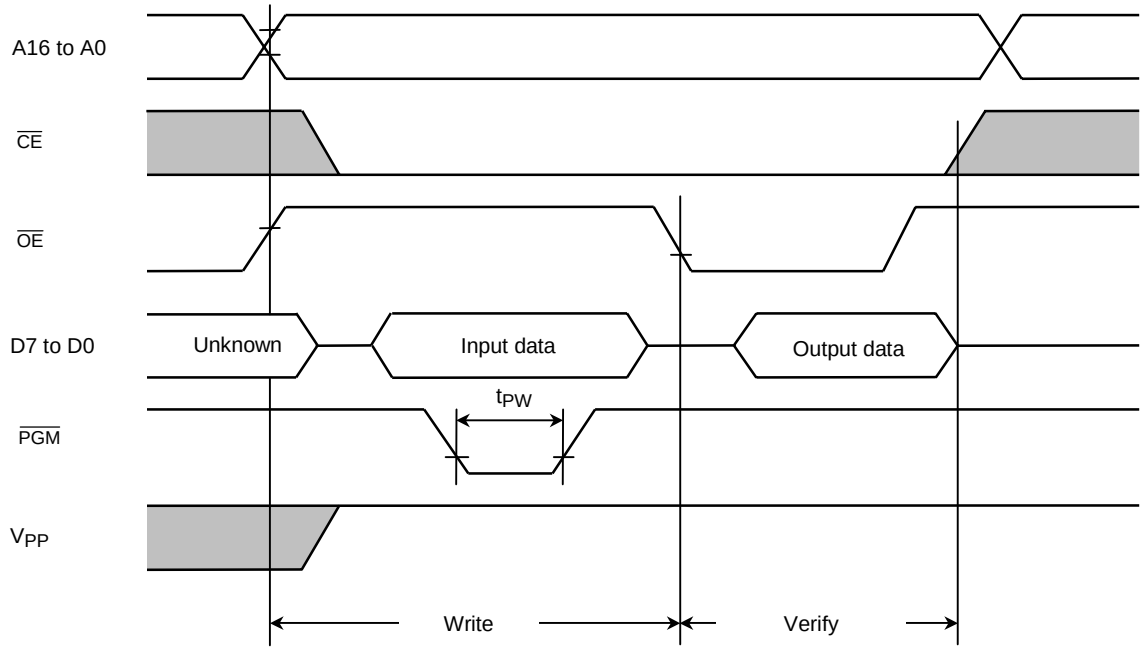
Note: tcyc = 400 ns at 10 MHz



(2) High-speed programming operation (Topr = 25 ± 5°C, VDD = 6.25 ± 0.25 V)

Parameter	Symbol	Conditions	Min	Typ.	Max	Unit
Input High Voltage (D0 to D7, A0 to A16 $\overline{CE}$, $\overline{OE}$, $\overline{PGM}$)	V_{IH4}		$V_{DD} \times 0.7$	–	V_{DD}	V
Input Low Voltage (D0 to D7, A0 to A16, $\overline{CE}$, $\overline{OE}$, $\overline{PGM}$)	V_{IL4}		0	–	0.8	
Program Power Supply Voltage	V_{PP}		12.5	12.75	13.0	
Initial Program Pulse Width	t_{PW}	V_{DD} = 6.0 V	0.095	0.1	0.105	ms

High-program



Note 1: When V_{CC} power supply is turned on or after, V_{PP} must be increased.
When V_{CC} power supply is turned off or before, V_{PP} must be decreased.

Note 2: The device must not be set to the EPROM programmer or picked up from it under applying the program voltage (12.75 V ± 0.5 V) to the V_{PP} pin as the device is damaged.

Note 3: 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.