

## CMOS 4-Bit Microcontroller

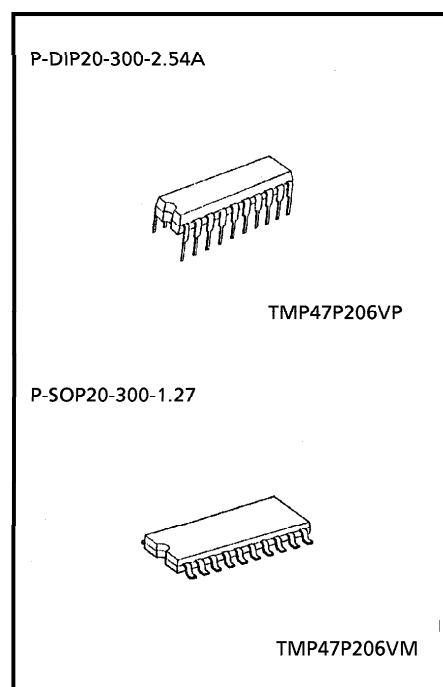
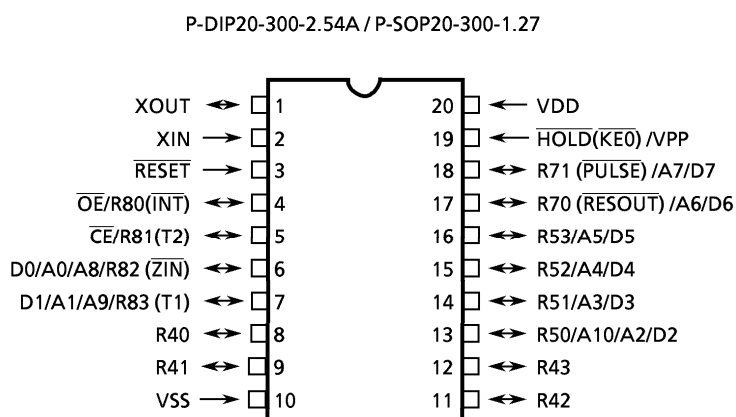
## TMP47P206VM/P

The TMP47P206V is the OTP microcontroller with 16 Kbit PROM. For program operation, the programming is achieved by using with EPROM programmer (TC57256AD type) and adapter socket.

The function of this device is exactly same as the TMP47C206.

Part No.	ROM	RAM	Package	OTP
TMP47P206VP	OTP	128 x 4-bit	P-DIP20-300-2.54A	BM11125
TMP47P206VM	2048 x 8-bit		P-SOP20-300-1.27	BM11126

## Pin Assignment (Top View)



000707EBA1

- For a discussion of how the reliability of microcontrollers can be predicted, please refer to Section 1.3 of the chapter entitled Quality and Reliability Assurance / Handling Precautions.
- TOSHIBA is continually working to improve the quality and reliability of its products. Nevertheless, semiconductor devices in general can malfunction or fail due to their inherent electrical sensitivity and vulnerability to physical stress. It is the responsibility of the buyer, when utilizing TOSHIBA products, to comply with the standards of safety in making a safe design for the entire system, and to avoid situations in which a malfunction or failure of such TOSHIBA products could cause loss of human life, bodily injury or damage to property. In developing your designs, please ensure that TOSHIBA products are used within specified operating ranges as set forth in the most recent TOSHIBA products specifications. Also, please keep in mind the precautions and conditions set forth in the "Handling Guide for Semiconductor Devices," or "TOSHIBA Semiconductor Reliability Handbook" etc..
- The TOSHIBA products listed in this document are intended for usage in general electronics applications (computer, personal equipment, office equipment, measuring equipment, industrial robotics, domestic appliances, etc.). These TOSHIBA products are neither intended nor warranted for usage in equipment that requires extraordinarily high quality and/or reliability or a malfunction or failure of which may cause loss of human life or bodily injury ("Unintended Usage"). Unintended Usage include atomic energy control instruments, airplane or spaceship instruments, transportation instruments, traffic signal instruments, combustion control instruments, medical instruments, all types of safety devices, etc.. Unintended Usage of TOSHIBA products listed in this document shall be made at the customer's own risk.
- The products described in this document are subject to the foreign exchange and foreign trade laws.
- The information contained herein is presented only as a guide for the applications of our products. No responsibility is assumed by TOSHIBA CORPORATION for any infringements of intellectual property or other rights of the third parties which may result from its use. No license is granted by implication or otherwise under any intellectual property or other rights of TOSHIBA CORPORATION or others.
- The information contained herein is subject to change without notice.

**Pin Function**

The TMP47P206V has MCU mode and PROM mode.

- (1) MCU mode  
The TMP47C206 and the TMP47P206V are pin compatible.
- (2) PROM mode

Pin Name	Input / Output	Functions	Pin Name (MCU mode)
D0 / A0 / A8	I/O	Data inputs / outputs or Address inputs	R82
D1 / A1 / A9			R83
D2 / A2 / A10			R50
D3 / A3			R51
D4 / A4			R52
D5 / A5			R53
D6 / A6			R70
D7 / A7			R71
$\overline{OE}$	Input	Output Enable input	R80
$\overline{CE}$		Chip Enable input	R81
VPP	Power supply	+ 12.5 V / 5 V (Program supply voltage)	$\overline{HOLD}$
VCC		+ 5 V	VDD
VSS		0 V	VSS
R43 to R40	I/O	Be fixed to low level.	
$\overline{RESET}$	Input	Be fixed to non connection.	
XIN	Input	Input the clock from the external oscillator.	
XOUT	Input	PROM control input	

## Operational Description

The following is an explanation of hardware configuration and operation in relation to the TMP47P206V. The TMP47P206V is the same as the TMP47C206 except that an OTP is used instead of a built-in mask ROM.

### 1. Operation mode

The TMP47P206V has a MCU mode and a PROM mode.

#### 1.1 MCU mode

The MCU mode is set by attaching a resonator between the XIN and XOUT pins. Operation in the MCU mode is the same as for the TMP47C206. In the TMP47P206V, RC oscillation is impossible.

##### 1.1.1 Program Memory

The program storage area is the same as for the TMP47C206.

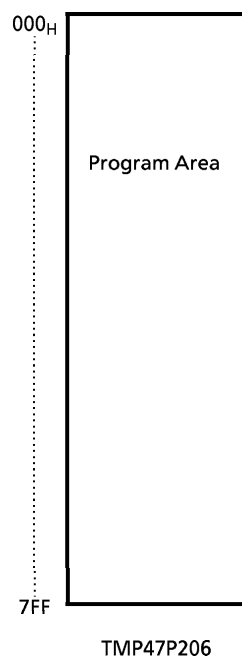


Figure 1-1. Program Area

##### 1.1.2 Data Memory

The TMP47P206V has 128 × 4-bit of data memory (RAM).

## Electrical Characteristics

Absolute Maximum Ratings (V<sub>SS</sub> = 0 V)

Parameter	Symbol	Pins	Ratings	Unit
Supply Voltage	V <sub>DD</sub>		- 0.3 to 6.5	V
Program Voltage	V <sub>PP</sub>	HOLD / V <sub>PP</sub>	- 0.3 to 13.0	V
Input Voltage	V <sub>IN</sub>		- 0.3 to V <sub>DD</sub> + 0.3	V
Output Voltage	V <sub>OUT</sub>		- 0.3 to V <sub>DD</sub> + 0.3	V
Output Current (Per 1 pin)	I <sub>OUT1</sub>	Port R4, R50	30	mA
	I <sub>OUT2</sub>	Port R51 to 53, R8, R70, R71	3.2	
Output Current (Total)	Σ I <sub>OUT1</sub>	Port R4, R50	100	mA
	Σ I <sub>OUT2</sub>	Port R51 to 53, R8, R70, R71	28.8	
Power Dissipation [T <sub>opr</sub> = 85°C]	PD	SOP	150	mW
		DIP	250	
Soldering Temperature (time)	T <sub>sld</sub>		260 (10 s)	°C
Storage Temperature	T <sub>stg</sub>		- 55 to 125	°C
Operating Temperature	T <sub>opr</sub>		- 40 to 85	°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<sub>SS</sub> = 0 V, T<sub>opr</sub> = - 40 to 85°C)

Parameter	Symbol	Pins	Conditions	Min	Max	Unit	
Supply Voltage	V <sub>DD</sub>	Normal mode	Crystar or ceramic	f <sub>c</sub> = 8 MHz	4.0 (2.7) *2	5.7	V
			RC	f <sub>c</sub> = 4.2 MHz	4.0 (2.2) *2		
				f <sub>c</sub> = 2.5 MHz	4.0 (2.2) *2		
		HOLD mode	-	-	4.0 (2.0) *2		
Input High Voltage	V <sub>IH1</sub>	Except Hysteresis Input	In the normal operating area	V <sub>DD</sub> × 0.7	V <sub>DD</sub>	V	
	V <sub>IH2</sub>	Hysteresis Input		V <sub>DD</sub> × 0.75			
	V <sub>IH3</sub>		In the HOLD mode	V <sub>DD</sub> × 0.9			
Input Low Voltage	V <sub>IL1</sub>	Except Hysteresis Input	In the normal operating area	0	V <sub>DD</sub> × 0.3	V	
	V <sub>IL2</sub>	Hysteresis Input			V <sub>DD</sub> × 0.25		
	V <sub>IL3</sub>		In the HOLD mode		V <sub>DD</sub> × 0.1		
Clock Frequency	f <sub>c</sub>	XIN, XOUT	V <sub>DD</sub> = 2.7 to 5.7 V	1	8	MHz	
			V <sub>DD</sub> = 2.2 to 5.7 V		4.2		

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: LVD is initially enable and initial Min. V<sub>DD</sub> is 4.0 V. After LVD is disabled above 4.0 V. Min. V<sub>DD</sub> will be 2.7 or 2.2 to 2.0 V.

## DC Characteristics

(V<sub>SS</sub> = 0 V, T<sub>opr</sub> = -40 to 85°C)

Parameter	Symbol	Pins	Conditions	Min	Typ.	Max	Unit
Hysteresis Voltage	V <sub>HS</sub>	Hysteresis Input		-	0.7	-	V
Input Current	I <sub>IN1</sub> (Note 1)	$\overline{\text{RESET}}$ , $\overline{\text{HOLD}}$	V <sub>DD</sub> = 5.7 V, V <sub>IN</sub> = 5.7 V / 0 V	-	-	± 2	μA
	I <sub>IN2</sub>	Open drain output ports					
Input Resistance	R <sub>IN</sub>	$\overline{\text{RESET}}$		100	220	450	kΩ
Pull down Resistance	R <sub>PD</sub>	R82		22	70	160	
Input Low Current	I <sub>IL</sub>	Push-pull output ports	V <sub>DD</sub> = 5.7 V, V <sub>IN</sub> = 0.4 V	-	-	-2	mA
Output Leakage Current	I <sub>LO</sub>	Open drain output ports	V <sub>DD</sub> = 5.7 V, V <sub>OUT</sub> = 5.7 V	-	-	2	μA
Output High Voltage	V <sub>OH</sub>	Push-pull output ports	V <sub>DD</sub> = 5 V, I <sub>OH</sub> = -100 μA	4.8	-	-	V
			V <sub>DD</sub> = 4.5 V, I <sub>OH</sub> = -200 μA	2.4	-	-	
			V <sub>DD</sub> = 2.2 V, I <sub>OH</sub> = -5 μA	2.0	-	-	
Output Low Voltage	V <sub>OL1</sub>	Port R8, R7, R51 to 53	V <sub>DD</sub> = 4.5 V, I <sub>OL</sub> = 3.3 mA	-	-	1.0	V
			V <sub>DD</sub> = 4.5 V, I <sub>OL</sub> = 1.6 mA	-	-	0.4	
			V <sub>DD</sub> = 2.2 V, I <sub>OL</sub> = 20 μA	-	-	0.1	
	V <sub>OL2</sub>	Port R4, R50	V <sub>DD</sub> = 4.5 V, I <sub>OL</sub> = 15 mA	-	-	1.0	
			V <sub>DD</sub> = 4.5 V, I <sub>OL</sub> = 7 mA	-	-	0.4	
			V <sub>DD</sub> = 2.2 V, I <sub>OL</sub> = 50 μA	-	-	0.1	
Output Low Current	I <sub>OL1</sub>	Port R8, R7, R51 to 53	V <sub>DD</sub> = 4.5 V, V <sub>OL</sub> = 0.4 V	1.6	-	-	mA
			V <sub>DD</sub> = 4.5 V, V <sub>OL</sub> = 1.0 V	15	-	-	
	I <sub>OL2</sub>	Port R4, R50	V <sub>DD</sub> = 4.5 V, V <sub>OL</sub> = 0.4 V	7	17	-	
Supply Current (in the Normal operating mode) (Note 2)	I <sub>DD</sub>		V <sub>DD</sub> = 5.7 V, f <sub>c</sub> = 8 MHz	-	3	6	mA
			V <sub>DD</sub> = 5.7 V, f <sub>c</sub> = 4 MHz	-	2	4	
			V <sub>DD</sub> = 3.0 V, f <sub>c</sub> = 4 MHz	-	1	2	
			V <sub>DD</sub> = 3.0 V, f <sub>c</sub> = 1 MHz	-	0.6	1.2	
Supply Current (in the HOLD operating mode) (Note 2)	I <sub>DDH</sub>	LVD always Enable	V <sub>DD</sub> = 5.7 V	-	50	200	μA
		LVD On and Off	V <sub>DD</sub> = 5.7 V	-	2.5	20	
Injection Current	I <sub>ZC</sub>	R82		-	-	1	mA

## &lt; General Conditions &gt;

Typ. values show those at T<sub>opr</sub> = 25°C, V<sub>DD</sub> = 5 V.Note 1: Input Current I<sub>IN1</sub>: The current through resistor is not included.Note 2: Supply Current: V<sub>IN</sub> = 5.5 V / 0.2 V (V<sub>DD</sub> = 5.7 V) or 2.8 V / 0.2 V (V<sub>DD</sub> = 3.0 V)

AC Characteristics

(V<sub>SS</sub> = 0 V, Topr = - 40 to 85°C)

Parameter	Symbol	Conditions	Min	Typ.	Max	Unit	
Instruction Cycle Time	t <sub>cy</sub>	V <sub>DD</sub> = 2.7 to 5.7 V	1.0	-	8	μs	
		V <sub>DD</sub> = 2.2 to 5.7 V	1.9				
High level Clock pulse Width	t <sub>WCH</sub>	For external clock operation	V <sub>DD</sub> ≥ 2.7 V	-	-	ns	
Low level Clock pulse Width	t <sub>WCL</sub>		V <sub>DD</sub> < 2.7 V				120
			V <sub>DD</sub> ≥ 2.7 V				60
			V <sub>DD</sub> < 2.7 V				120
Delay Reset Output Signal	t <sub>rd</sub>	f <sub>c</sub> = 1 MHz	-	-	16	μs	

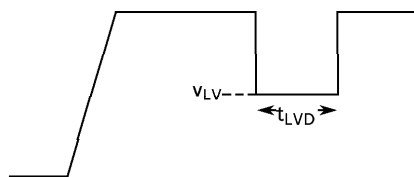
Low Voltage Detector Characteristics

(V<sub>SS</sub> = 0 V, Topr = - 40 to 85°C)

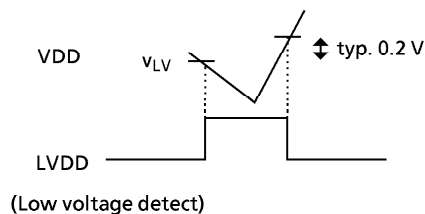
Parameter	Symbol	Conditions	Min	Typ.	Max	Unit
LVD interval time (Note 1)	t <sub>int</sub>		8.5	-	128	ms
LVD Enable time (Note 1)	t <sub>en</sub>		100	-	-	μs
LVD pulse width (Note 1, 2)	t <sub>LVD</sub>		50	-	-	μs
Detection Voltage (Note 3)	V <sub>LV</sub>	LVD <sub>DTY</sub> = 0 LVDD = 0	2.7	3.3	3.8	V
		LVD <sub>DTY</sub> = 1 LVDD = 0	2.2	2.7	3.3	
LVD Operating Voltage (Note 1)	V <sub>LV<sub>DD</sub></sub>		2.0	-	-	V

Note 1: These parameters are characterized but not tested.

Note 2: Less than Min. t<sub>LVD</sub>, CPU will not be reset.



Note 3: Detection voltage has typ. 0.2 V hysteresis.

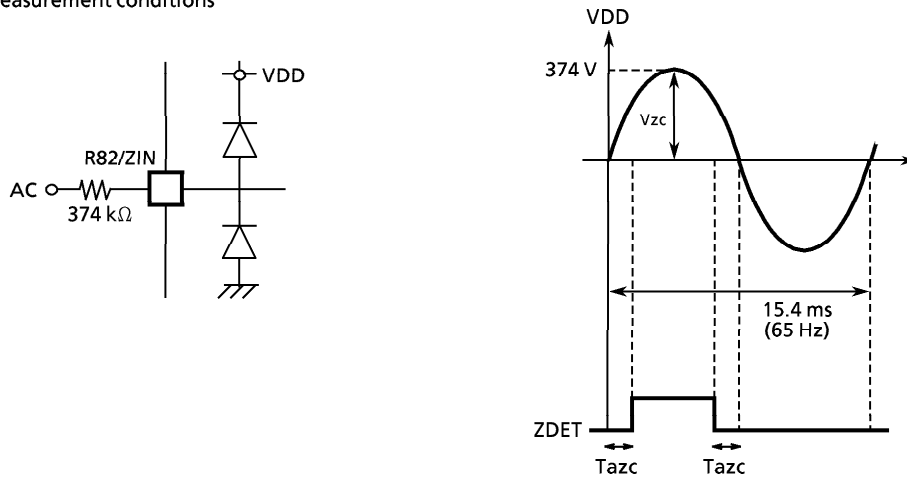


Zero-Cross Detection Characteristics

( $V_{SS} = 0\text{ V}$ ,  $T_{opr} = -40\text{ to }85^\circ\text{C}$ )

Parameter	Symbol	Conditions	Min	Typ.	Max	Unit
Zero-cross Accuracy	T <sub>ztc</sub>	f <sub>zc</sub> = 45 to 65 Hz (*)			90	μs
Injection Current	I <sub>zc</sub>				1	mA
Pull-down resistance	R <sub>PD</sub>		22	70	160	kΩ

(\*) Measurement conditions



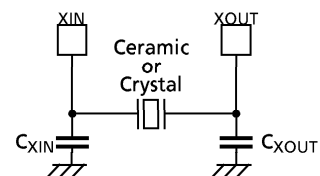
## Recommended Oscillating Conditions

 $(V_{SS} = 0\text{ V}, V_{DD} = 2.2\text{ to }5.7\text{ V}, T_{opr} = -40\text{ to }85^{\circ}\text{C})$ 

Recommended oscillating conditions of the TMP47P206V are equal to the TMP47C206's but RC oscillation is impossible.

## (1) 8 MHz

Ceramic Resonator

CSA8.00MGU (MURATA)  $C_{XIN} = C_{XOUT} = 30\text{pF}$ KBR-8.00MS (KYOCERA)  $C_{XIN} = C_{XOUT} = 30\text{pF}$ EFOEC8004A4 (NATIONAL)  $C_{XIN} = C_{XOUT} = 30\text{pF}$ 

## (2) 6 MHz

Ceramic Resonator

CSA6.00MGU (MURATA)  $C_{XIN} = C_{XOUT} = 30\text{pF}$ KBR-6.00MS (KYOCERA)  $C_{XIN} = C_{XOUT} = 30\text{pF}$ EFOEC6004A4 (NATIONAL)  $C_{XIN} = C_{XOUT} = 30\text{pF}$ 

## (3) 4 MHz

Ceramic Resonator

CSA4.00MGU (MURATA)  $C_{XIN} = C_{XOUT} = 30\text{pF}$ KBR-4.00MS (KYOCERA)  $C_{XIN} = C_{XOUT} = 30\text{pF}$ EFOEC4004A4 (NATIONAL)  $C_{XIN} = C_{XOUT} = 30\text{pF}$ 

Crystal Oscillator

204B-6F 4.0000 (TOYOCOM)  $C_{XIN} = C_{XOUT} = 20\text{pF}$ 

## (4) 1 MHz

Ceramic Resonator

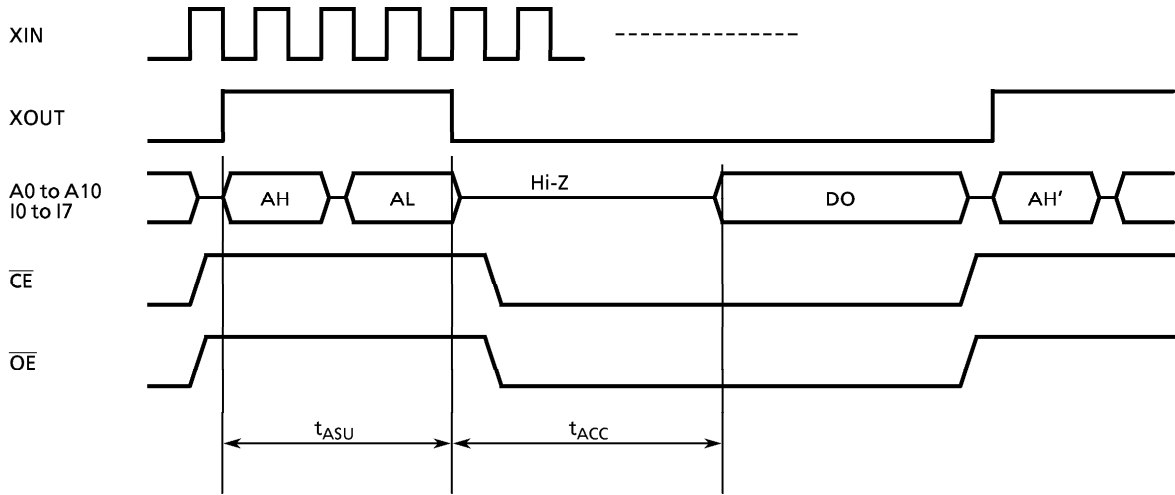
CSA1.00MGU (MURATA)  $C_{XIN} = C_{XOUT} = 30\text{pF}$ KBR-1.00MS (KYOCERA)  $C_{XIN} = C_{XOUT} = 30\text{pF}$ EFOEC1004A4 (NATIONAL)  $C_{XIN} = C_{XOUT} = 30\text{pF}$



DC/AC Characteristics (V<sub>SS</sub> = 0 V)

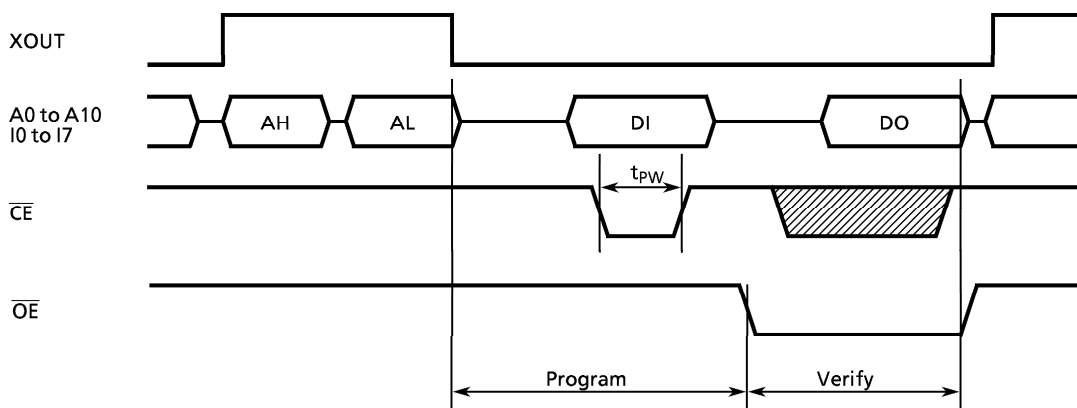
(1) Read Operation

Parameter	Symbol	Condition	Min	Typ.	Max	Unit
Output Level High Voltage	V <sub>IH4</sub>		V <sub>CC</sub> × 0.7	–	V <sub>CC</sub>	V
Output Level Low Voltage	V <sub>IL4</sub>		0	–	V <sub>CC</sub> × 0.3	V
Supply Voltage	V <sub>CC</sub>		4.75	–	6.0	V
Programming Voltage	V <sub>PP</sub>					
Address Set-up Time	t <sub>ASU</sub>		350	–	–	ns
Address Access Time	t <sub>ACC</sub>	V <sub>CC</sub> = 5.0 ± 0.25 V	–	–	300	ns



(2) High Speed Programming Operation

Parameter	Symbol	Condition	Min	Typ.	Max	Unit
Input High Voltage	$V_{IH4}$		$V_{CC} \times 0.7$	–	$V_{CC}$	V
Input Low Voltage	$V_{IL4}$		0	–	$V_{CC} \times 0.3$	V
Supply Voltage	$V_{CC}$		4.75	–	6.0	V
$V_{PP}$ Power Supply Voltage	$V_{PP}$		12.25	12.50	12.75	V
Programming Pulse Width	$t_{PW}$	$V_{CC} = 6.0 \pm 0.25 V$	0.095	0.1	0.105	ms



Note: DO; Data output (I0 to I7), AL; Address input (A0 to A7)  
 DI; Data input (I0 to I7), AH; Address input (A8 to A10)