

CMOS 4-BIT MICROCONTROLLER

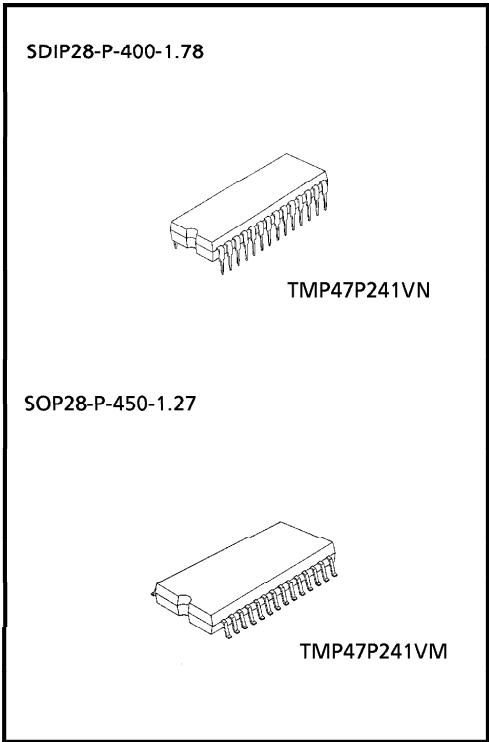
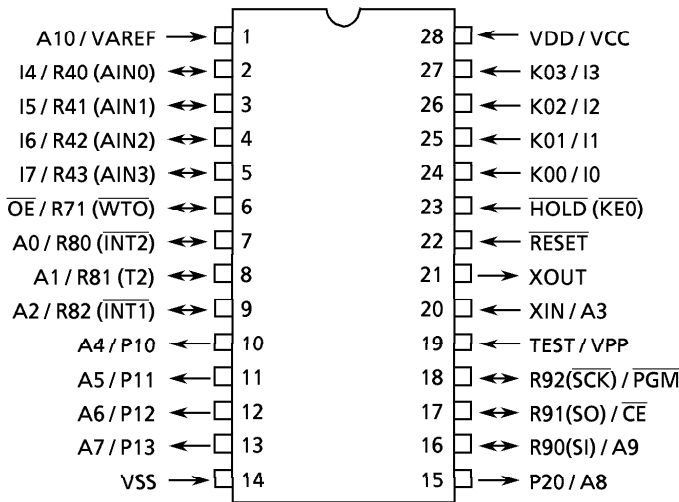
TMP47P241VN  
TMP47P241VM

The 47P241V is the system evaluation LSI of 47C241 with 16K bits one-time PROM. The 47P241V programs / verifies using an adaptor socket to connect with PROM programmer, as it is in TMM2764AD. In addition, the 47P241V and the 47C241 are pin compatible. The 47P241V operates as the same as the 47C241 by programming to the internal PROM.

PART No.	ROM	RAM	PACKAGE	ADAPTOR SOCKET
TMP47P241VN	OTP	128 × 4-bit	SDIP28-P-400-1.78	BM1156
TMP47P241VM	2048 × 8-bit		SOP28-P-450-1.27	BM1157

PIN ASSIGNMENT (TOP VIEW)

SDIP28-P-400-1.78 / SOP28-P-450-1.27



## PIN FUNCTION

The 47P241V has MCU mode and PROM mode.

## (1) MCU mode

The 47C241 and the 47P241V are pin compatible (TEST pin for out-going test. Be fixed to low level).

## (2) PROM mode

PIN NAME	INPUT / OUTPUT	FUNCTIONS	PIN NAME(MCU mode)
A10	INPUT	Address inputs	VAREF
A9			R90
A8			P20
A7 to A4			P13 to P10
A3			XIN
A2 to A0			R82 to R80
I7 to I4	I/O	Data outputs (Inputs)	R43 to R40
I3 to I0			K03 to K00
$\overline{\text{PGM}}$	Input	Program control input	R92
$\overline{\text{CE}}$		Chip Enable input	R91
$\overline{\text{OE}}$		Output Enable input	R71
VPP	Power supply	+ 12.5 V / 5 V (Program supply voltage)	TEST
VCC		+ 5 V	VDD
VSS		0 V	VSS
$\overline{\text{RESET}}$	Input	PROM mode setting pin. Be fixed to low level.	
HOLD	Input		
XOUT	Input	Input the clock from the external oscillator.	

## OPERATIONAL DESCRIPTION

The following is an explanation of hardware configuration and operation in relation to the 47P241V. The 47P241V is the same as the 47C241 except that an OTP is used instead of a built-in mask ROM.

### 1. OPERATION mode

The 47P241V has an MCU mode and a PROM mode.

#### 1.1 MCU mode

The MCU mode is set by fixing the TEST/VPP pin at the "L" level. Operation in the MCU mode is the same as for the 47C241, except that the TEST/VPP pin does not have built in pull-down resistor and cannot be used open. In the 47P241V, RC oscillation is impossible.

##### 1.1.1 Program Memory

The program storage area is the same as for the 47C241.

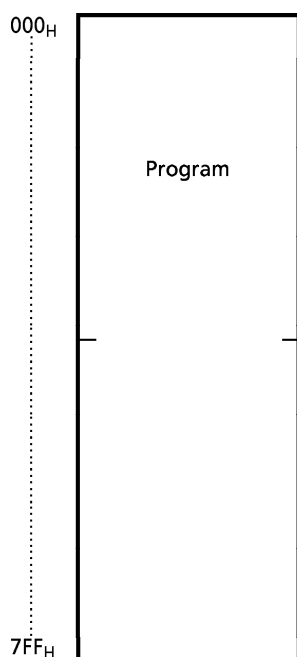


Figure 1-1. Program area (ROM)

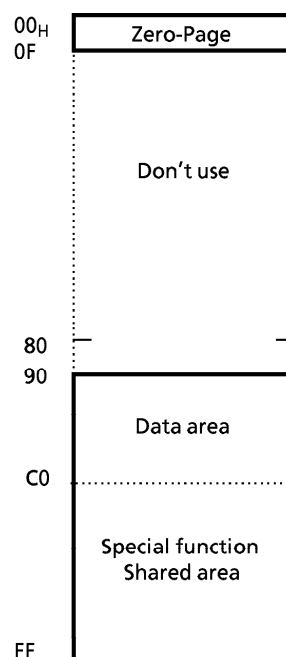


Figure 1-2. RAM addressing

#### 1.1.2 Data Memory

The 47P241V has 128 × 4-bit of data memory (RAM).

When the 47C940A is used as evaluator of the 47C241V, programming should be performed assuming that the RAM is assigned to addresses 00 to 7F<sub>H</sub> and 90 to FF<sub>H</sub> as show in Figure 1-2 by considering the application software evaluation. When the BM47214A (emulator) is used as the 47C241 evaluator, it is same.

#### 1.1.3 Input / Output Circuitry

##### (1) Control pins

This is the same as for the 47C241 except that there is no built-in pull-down resistance for the TEST pin. In the 47P241V, RC oscillation is impossible. Connecting the resonator is required when using as evaluator of I/O code SG.

## (2) I/O Ports

The input/output circuit of the 47P241V is the same as I/O code SA of the 47C241.

External resistance, for example, is required when using as evaluator of other I/O codes (SB, SC).



Figure 1-3. I/O code and external circuitry

## 1.2 PROM mode

The PROM mode is set by setting the  $\overline{\text{RESET}}$ ,  $\overline{\text{HOLD}}$  pins to the "L" level. In PROM mode, programs can be written or verified using a general-purpose PROM writer with an adapter socket being attached.

(A high-speed program mode is used to set the ROM type the same as for the TMM2764AD.)

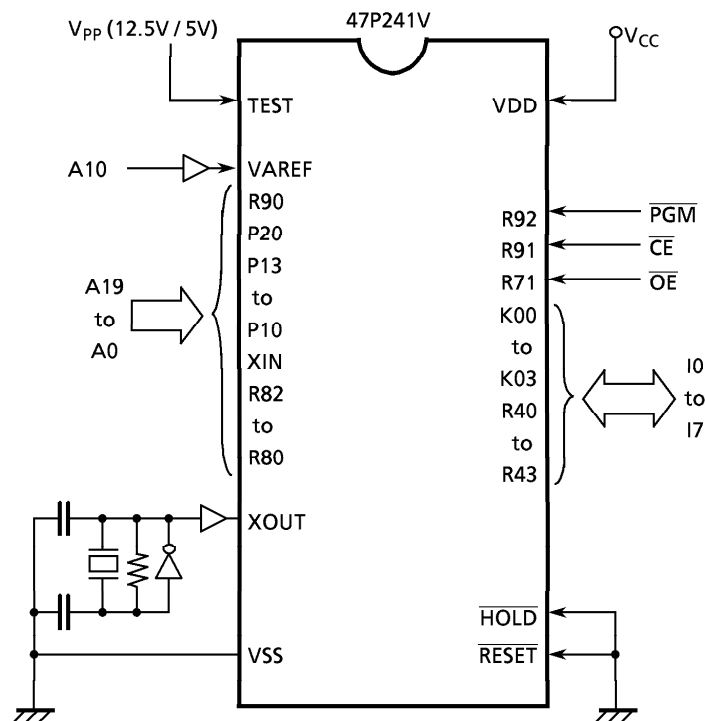


Figure 1-4. Setting for PROM mode

### 1.2.1 Program Writing

When writing a program, set a ROM type to "2764A" (programming voltage : 12.5V) . Since the 47P241V has a 2048 × 8-bit internal PROM (000 to 7FF<sub>H</sub>) , set a stop address of a PROM writer to "7FF<sub>H</sub>" . For a general-purpose PROM writer, use the writer which does not have or can release an electric signature mode.

### 1.2.2 High Speed Programming Mode

The program time can be greatly decreased by using this high speed programming mode. The device is set up in the high speed programming mode when the programming voltage (+ 12.5 V) is applied to the  $V_{PP}$  terminal with  $V_{CC} = 6\text{ V}$  and  $\overline{PGM} = V_{IH}$ .

The programming is achieved by applying a single low level 1ms pulse the  $\overline{PGM}$  input after addresses and data are stable. Then the programmed data is verified by using Program Verify Mode.

If the programmed data is not correct, another program pulse of 1ms is applied and then programmed data is verified. This should be repeated until the program operates correctly (max. 25 times).

After correctly programming the selected address, one additional program pulse with pulse width 3 times that needed for programming is applied.

When programming has been completed, the data in all addresses should be verified with  $V_{CC} = V_{PP} = 5\text{ V}$ .

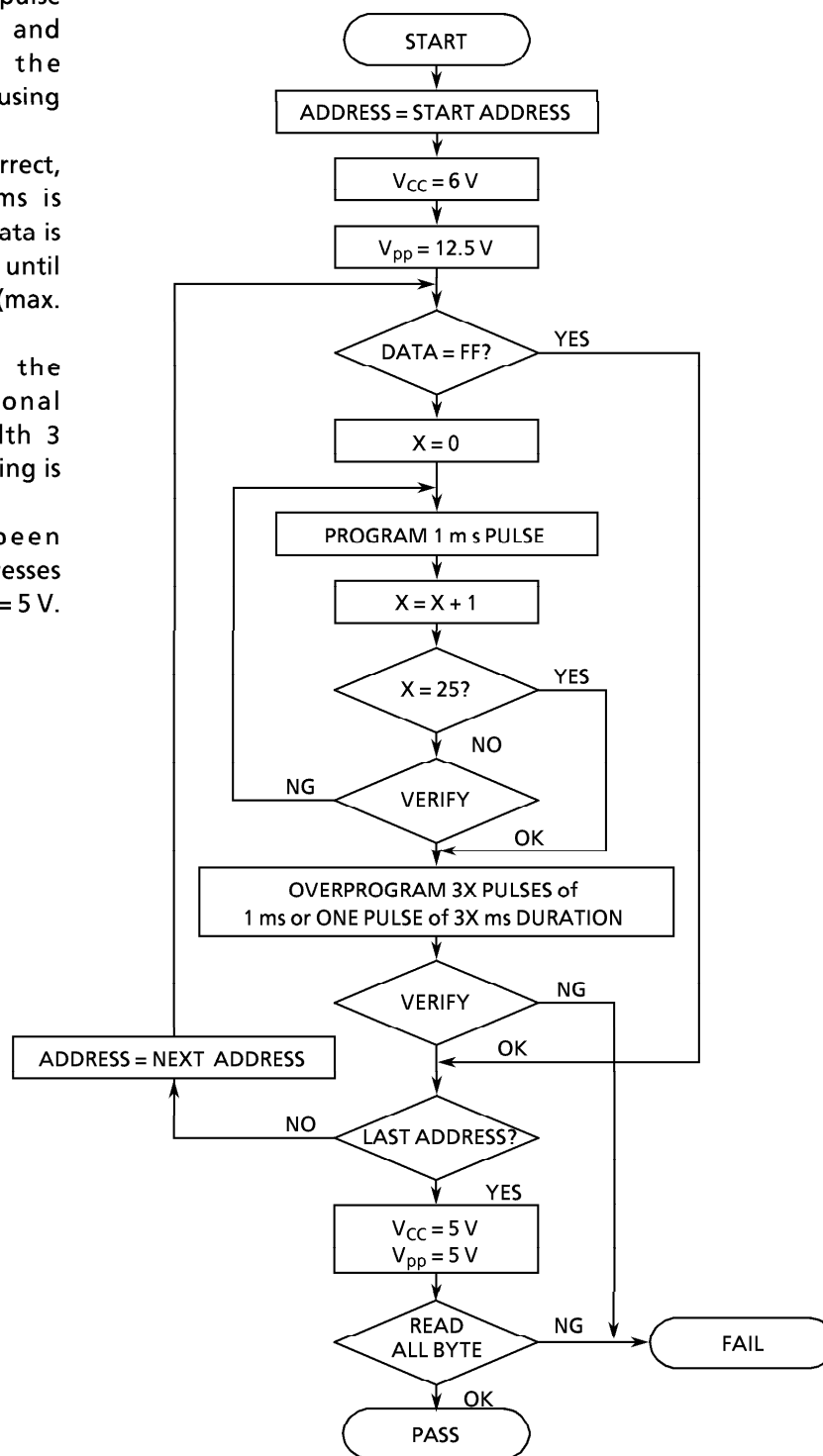


Figure 1-5. Flow Chart

## ELECTRICAL CHARACTERISTICS

## ABSOLUTE MAXIMUM RATINGS

(V<sub>SS</sub> = 0 V)

PARAMETER	SYMBOL	PINS	RATING	UNIT
Supply Voltage	V <sub>DD</sub>		– 0.3 to 7	V
Program Voltage	V <sub>PP</sub>	HOLD/VPP pin	– 0.3 to 14.0	V
Input Voltage	V <sub>IN</sub>		– 0.3 to V <sub>DD</sub> + 0.3	V
Output Voltage	V <sub>OUT1</sub>	Except sink open drain pin	– 0.3 to V <sub>DD</sub> + 0.3	V
	V <sub>OUT2</sub>	Ports P1, P2, R7 to R9	– 0.3 to 10	
	V <sub>OUT3</sub>	Port R4 (Analog inputs)	– 0.3 to V <sub>DD</sub> + 0.3	
Output Current (Per 1 pin)	I <sub>OUT1</sub>	Ports P1, P2	30	mA
	I <sub>OUT2</sub>	Port R9	15	
	I <sub>OUT3</sub>	Ports R4, R7, R8	3.2	
Output Current (Total)	ΣI <sub>OUT1</sub>	Ports P1, P2, R9	120	mA
Power Dissipation [T <sub>opr</sub> = 70 °C]	PD		600	mW
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>		– 30 to 70	°C

## RECOMMENDED OPERATING CONDITIONS

(V<sub>SS</sub> = 0 V, T<sub>opr</sub> = – 30 to 70 °C)

PARAMETER	SYMBOL	PINS	CONDITIONS	Min.	Max.	UNIT
Supply Voltage	V <sub>DD</sub>		fc = 6.0 MHz	4.5	6.0	V
			fc = 4.2 MHz	2.7		
			In the HOLD mode	2.0		
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	fc		V <sub>DD</sub> = 4.5 to 6.0 V	0.4	6.0	MHz
			V <sub>DD</sub> = 2.7 to 6.0 V		4.2	

## D.C. CHARACTERISTICS

(V<sub>SS</sub> = 0 V, T<sub>opr</sub> = -30 to 70 °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>	Port K0, TEST, $\overline{\text{RESET}}$ , $\overline{\text{HOLD}}$	V <sub>DD</sub> = 5.5 V,	—	—	± 2	μA
	I <sub>IN2</sub>	Ports R (open drain)	V <sub>IN</sub> = 5.5 V / 0 V				
Input Registance	R <sub>IN1</sub>	Port K0 with pull-up/pull-down		30	70	150	kΩ
	R <sub>IN2</sub>	$\overline{\text{RESET}}$		100	220	450	
Output Leakage Current	I <sub>LO</sub>	Ports R, P (open drain)	V <sub>DD</sub> = 5.5 V, V <sub>OUT</sub> = 5.5 V	—	—	2	μA
Output Low Voltage	V <sub>OL2</sub>	Except XOUT, ports P	V <sub>DD</sub> = 4.5 V, I <sub>OL</sub> = 1.6 mA	—	—	0.4	V
Low Output Current	I <sub>OL1</sub>	Ports P1, P2	V <sub>DD</sub> = 4.5 V, V <sub>OL</sub> = 1.0 V	—	20	—	mA
	I <sub>OL2</sub>	Port R9		—	7	—	
Supply Current (in the Normal mode)	I <sub>DD</sub>		V <sub>DD</sub> = 5.5 V, f <sub>c</sub> = 4 MHz	—	2	4	mA
			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> = 400 kHz	—	0.5	1	
Supply Current (in the HOLD mode)	I <sub>DDH</sub>		V <sub>DD</sub> = 5.5 V	—	0.5	10	μA

Note 1. Typ. values show those at T<sub>opr</sub> = 25 °C, V<sub>DD</sub> = 5 V.

Note 2. Input Current I<sub>IN1</sub> ; The current through resistor is not included, when the input resistor (pull-up / pull-down) is contained.

Note 3. Supply Current I<sub>DD</sub>, I<sub>DDH</sub> ; V<sub>IN</sub> = 5.3 V / 0.2 V  
The K0 port is open when the input resistor is contained. The voltage applied to the R port is within the valid range.

## A / D CONVERSION CHARACTERISTICS

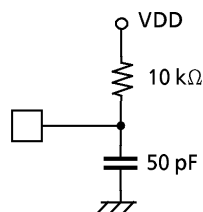
(T<sub>opr</sub> = -30 to 70 °C)

PARAMETER	SYMBOL	CONDITIONS	Min.	Typ.	Max.	UNIT
Analog Reference Voltage	V <sub>AREF</sub>		V <sub>DD</sub> - 1.5	—	V <sub>DD</sub>	V
Analog Reference Voltage Range	ΔV <sub>AREF</sub>	V <sub>AREF</sub> - V <sub>SS</sub>	2.7	—	—	V
Analog Input Voltage	V <sub>AIN</sub>		V <sub>SS</sub>	—	V <sub>AREF</sub>	V
Analog Supply current	I <sub>REF</sub>		—	0.5	1.0	mA
Nonlinearity Error		V <sub>DD</sub> = 5.0 V, V <sub>SS</sub> = 0.0 V V <sub>AREF</sub> = 5.000 V V <sub>ASS</sub> = 0.000 V	—	—	± 1	LSB
Zero Point Error			—	—	± 1	
Full Scale Error			—	—	± 1	
Total Error			—	—	± 2	

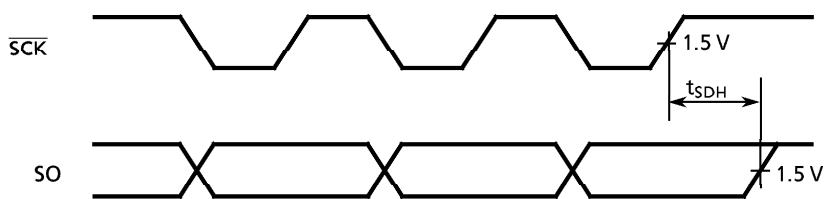
## A. C. CHARACTERISTICS

(V<sub>SS</sub> = 0 V, T<sub>opr</sub> = -30 to 70 °C)

PARAMETER	SYMBOL	CONDITIONS	Min.	Typ.	Max.	UNIT
Instruction Cycle Time	t <sub>cy</sub>	V <sub>DD</sub> = 4.5 to 6.0 V	1.3	—	20	μs
		V <sub>DD</sub> = 2.7 to 6.0 V	1.9			
High level Clock pulse Width	t <sub>WCH</sub>	External clock mode	80	—	—	ns
Low level Clock pulse Width	t <sub>WCL</sub>					
A/D Sampling Time	t <sub>AIN</sub>	f <sub>c</sub> = 4 MHz	—	4	—	μs
Shift Data Hold Time	t <sub>SDH</sub>		0.5 t <sub>cy</sub> - 300	—	—	ns

**Note.** Shift Data Hold TimeExternal circuit for  $\overline{\text{SCK}}$  pin and SO pin

Serial port (completion of transmission)



## RECOMMENDED OSCILLATING CONDITIONS

(V<sub>SS</sub> = 0 V, V<sub>DD</sub> = 4.5 to 6.0 V, T<sub>opr</sub> = -40 to 70 °C)

Recommended oscillating conditions of the 47P241V are equal to the 47C241's but RC oscillation is impossible.

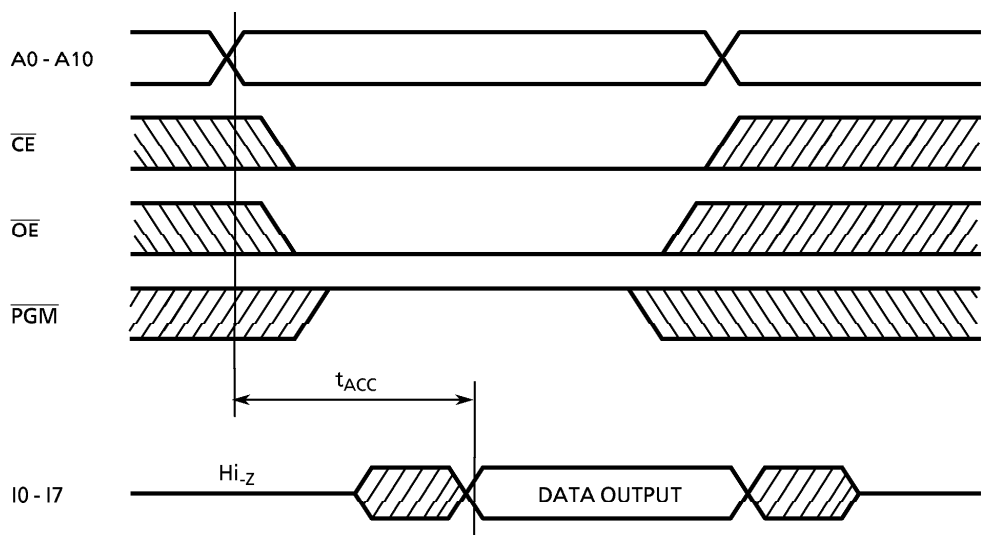
## DC/AC CHARACTERISTICS

(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 Access Time	t <sub>ACC</sub>	V <sub>CC</sub> = 5.0 ± 0.25 V	0	—	350	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	$V_{PP}$		12.00	12.50	13.00	V
Programming Pulse Width	$t_{PW}$	$V_{CC} = 6.0 \pm 0.25$ V	0.95	1.0	1.05	ms

