

CMOS 4-BIT MICROCONTROLLER

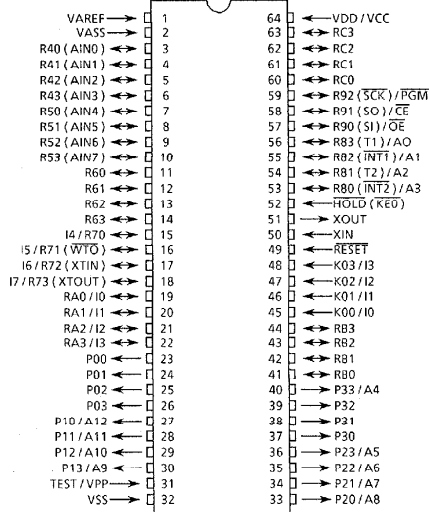
TMP47P860VN  
TMP47P860VF

The 47P860V is the system evaluation LSI of 47C660A/860A with 64K bits one-time PROM. The 47P860V programs/verifies using an adapter socket to connect with PROM programmer, as it is in TMM2764AD. In addition, the 47P860V and the 47C660A/860A are pin compatible. The 47P860V operates as the same as the 47C660A/860A by programming to the internal PROM.

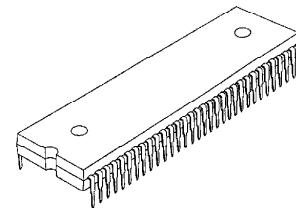
PART No.	ROM	RAM	PACKAGE	ADAPTER SOCKET
TMP47P860VN	OTP	512 x 4-bit	SDIP64-P-750-1.78	BM1130
TMP47P860VF	8192 x 8-bit		QFP64-P-1420-1.00A	BM1132

PIN ASSIGNMENT (TOP VIEW)

SDIP64-P-750-1.78

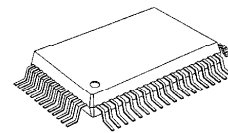


SDIP64-P-750-1.78



TMP47P860VN

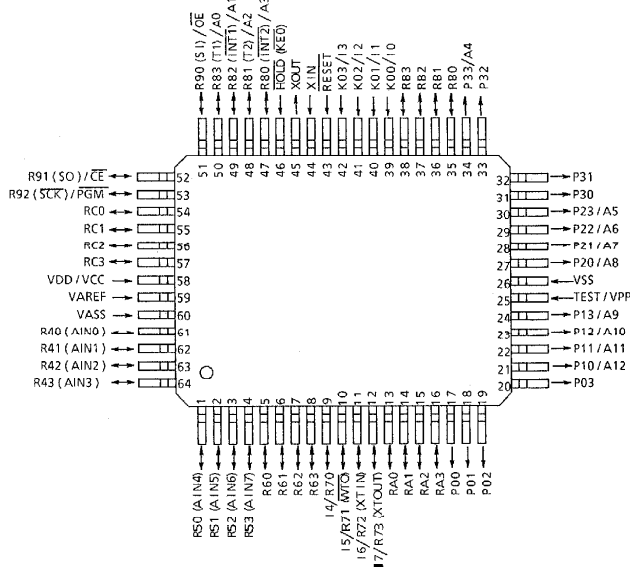
QFP64-P-1420-1.00A



TMP47P860VF

Note : Refer to "10 package."

QFP64-P-1420-1.00A



**PIN FUNCTION**

The 47P860V has MCU mode and PROM mode.

(1) MCU mode

The 47C660A/860A and the 47P860V 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)
A12 - A9	INPUT	Address inputs	P10 - P13
A8 - A5			P20 - P23
A4			P33
A3 - A0			R80 - R83
I7 - I4	I/O	Data outputs (Inputs)	R73 - R70
I3 - I0			K03 - K00
$\overline{\text{PGM}}$	Input	Program control input	R92
$\overline{\text{CE}}$		Chip Enable input	R91
$\overline{\text{OE}}$		Output Enable input	R90
VPP	Power supply	+ 21 V / 5 V (Program supply voltage)	TEST
VCC		+ 5 V	VDD
VSS		0V	VSS
P03 - P00	output	Open	
P32 - P30			
RA3 - RA0	I/O	Be fixed to Low Level	
RB3 - RB0			
RC3 - RC0			
R43 - R40			
R53 - R50			
R63 - R60			
$\overline{\text{RESET}}$			Input
$\overline{\text{HOLD}}$	Input		
XIN	Input	Resonator connecting pin	
XOUT	output		
VAREF	Power supply	Be fixed to low level	
VASS			

## OPERATIONAL DESCRIPTION

The following is an explanation of hardware configuration and operation in relation to the 47P860V. The 47P860V is the same as the 47C660A/860A except that an OTP is used instead of a built-in mask ROM.

### 1. OPERATION mode

The 47P860V 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 47C660A/860A, except that the TEST/VPP pin does not have built in pull-down resistor and cannot be used open.

##### 1.1.1 Program Memory

The program storage area is the same as for the 47C860A. Data conversion tables must be set in two locations when using the 47P860V to check 47C660A operation.

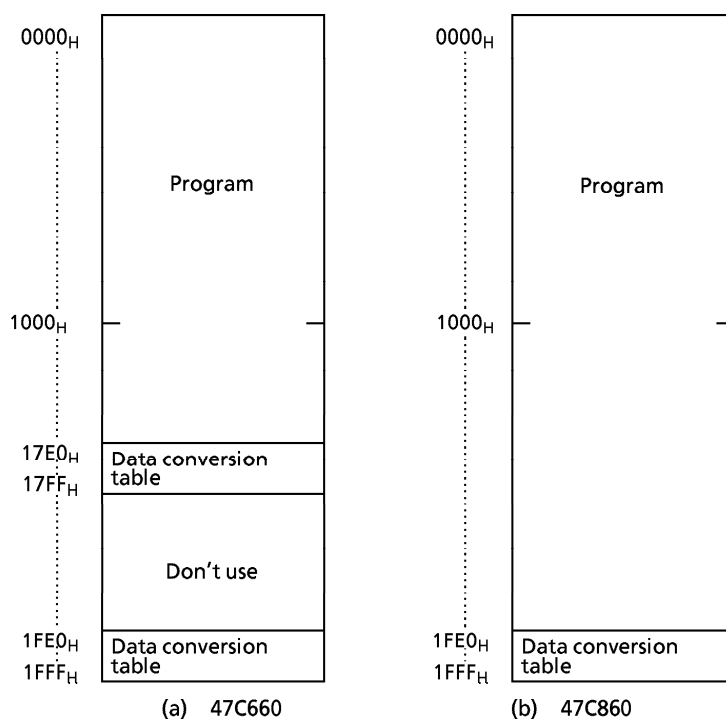


Figure 1-1. Program area

#### 1.1.2 Data Memory

The 47P860V has two built-in 256 × 4-bit data memory banks (Bank0, Bank1).

When using the 47P860V as a 47C660A evaluator, do not write data to address 80<sub>H</sub> and following, even though the Bank1 addresses are 00~FF<sub>H</sub>. There is no necessity to take into consideration a special common function area because one is built in Bank0.

### 1.1.3 Input/Output Circuitry

(1) Control pins

This is the same as for the 47C660A/860A except that there is no built-in pull-down resistance for the TEST pin.

(2) I/O Ports

The input/output circuit of the 47P860V is the same as I/O code IA of the 47C660A/860A. External resistance, for example, is required when using as evaluator of other I/O codes (IB, IC), (Refer to Figure 1.2)



Figure 1-2. I/O code and external circuitry

### 1.2 PROM mode

The PROM mode is set by setting the  $\overline{\text{RESET}}$ ,  $\overline{\text{HOLD}}$ , K00 and K01 pins to the "L" level. The PROM mode can be used as a general-purpose PROM writer for program writing and verification. (A high-speed program mode is used set the ROM type the same as for the TMM 2764AD.)

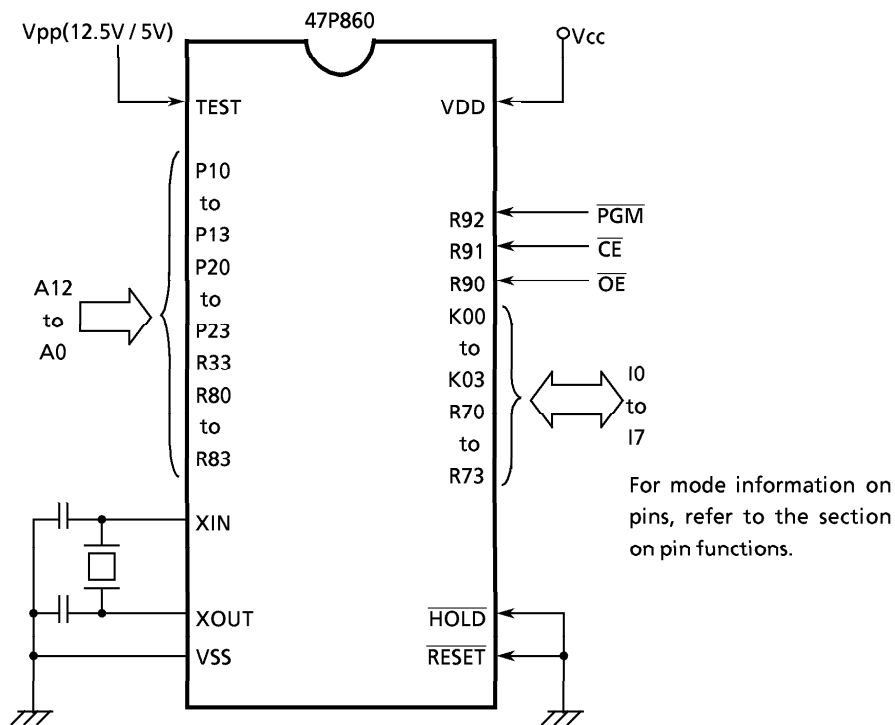


Figure 1-3. Setting for PROM mode

### 1.2.1 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 Vpp pin with Vcc = 6 V and  $\overline{\text{PGM}} = V_{IH4}$ . The programming is achieved by applying a single TTL low level 1 ms, pulse the  $\overline{\text{PGM}}$  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 1 ms 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 Vcc = Vpp = 5 V.

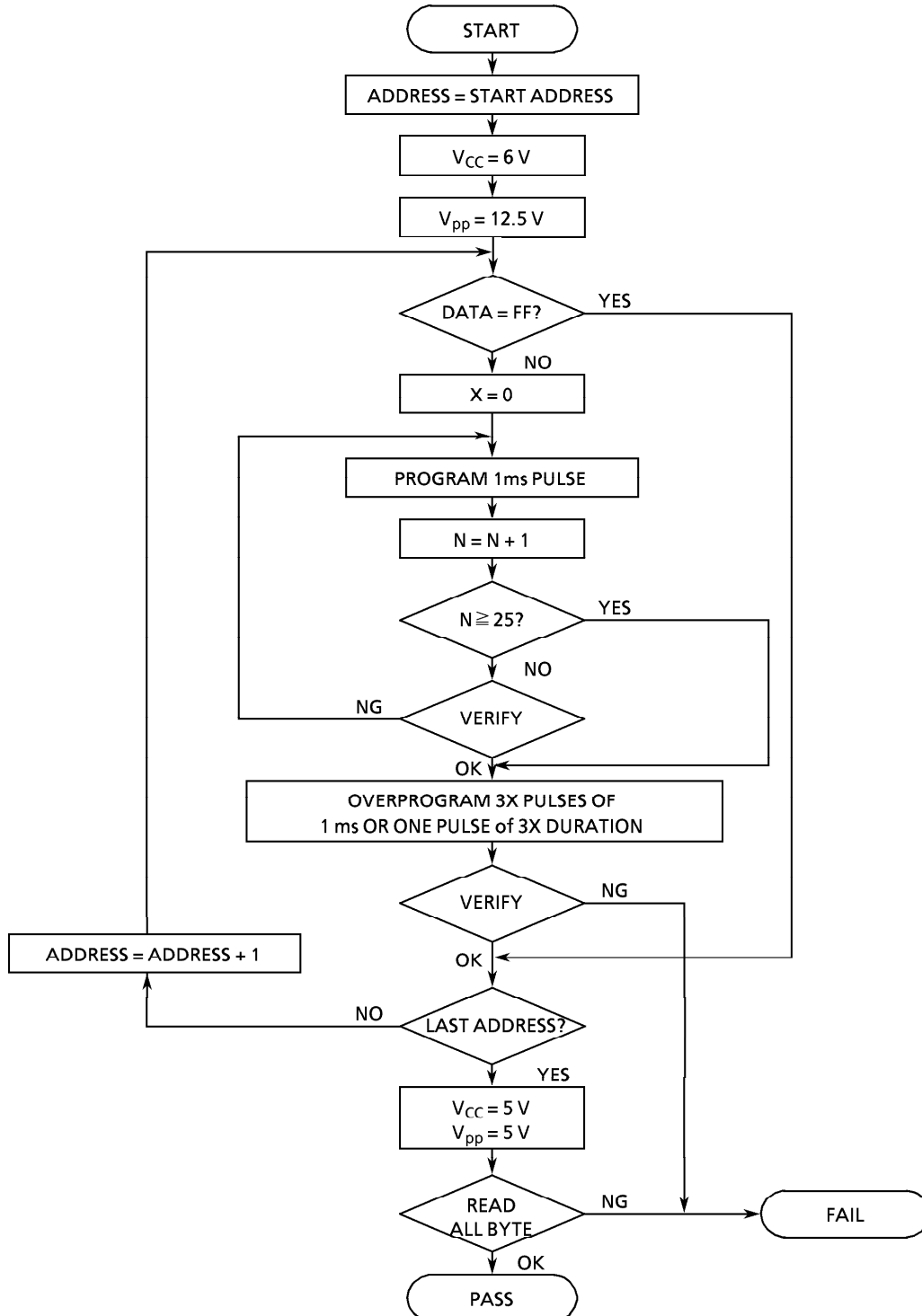


Figure1-4. Flow Chart

## ELECTRICAL CHARACTERISTICS

ABSOLUTE MAXIMUM RATINGS ( $V_{SS} = 0\text{ V}$ )

PARAMETER	SYMBOL	PINS	RATING	UNIT
Supply Voltage	$V_{DD}$		- 0.3 to 6.5	V
Program Voltage	$V_{PP}$	TEST / VPP pin	- 0.3 to 13.0	V
Input Voltage	$V_{IN}$		- 0.3 to $V_{DD} + 0.3$	V
Output Voltage	$V_{OUT1}$	Ports R4, R5, R7, push-pull	- 0.3 to $V_{DD} + 0.3$	V
	$V_{OUT2}$	Ports P1, P2, R6, R8, R9	- 0.3 to $V_{DD} + 0.3$	
Output (Per 1 pin)	$I_{OUT1}$	Port R	3.2	mA
	$I_{OUT2}$	Ports P1, P2	30	
	$I_{OUT2}$	Ports P0, P3	15	
Output Current (Total)	$\Sigma I_{OUT1}$	Ports P0, P1	120	mA
	$\Sigma I_{OUT2}$	Ports P2, P3	120	
Power Dissipation [ $T_{opr} = 70\text{ }^{\circ}\text{C}$ ]	PD		600	mW
Soldering Temperature (time)	$T_{slid}$		260 (10 s)	$^{\circ}\text{C}$
Storage Temperature	$T_{stg}$		- 55 to 125	$^{\circ}\text{C}$
Operating Temperature	$T_{opr}$		- 40 to 70	$^{\circ}\text{C}$

RECOMMENDED OPERATING CONDITIONS ( $V_{SS} = 0\text{ V}$ ,  $T_{opr} = -40\text{ to }70\text{ }^{\circ}\text{C}$ )

PARAMETER	SYMBOL	PINS	CONDITIONS	Min.	Max.	UNIT
Supply Voltage	$V_{DD}$		$f_c = 6.0\text{ MHz}$	4.5	5.5	V
			$f_c = 4.2\text{ MHz}$	2.7		
			in the SLOW mode	2.7		
			in the HOLD mode	2.0		
Input High Voltage	$V_{IH1}$	Except Hysteresis Input	$V_{DD} \geq 4.5\text{ V}$	$V_{DD} \times 0.7$	$V_{DD}$	V
	$V_{IH2}$	Hysteresis Input		$V_{DD} \times 0.75$		
	$V_{IH3}$		$V_{DD} < 4.5\text{ V}$	$V_{DD} \times 0.9$		
Input Low Voltage	$V_{IL1}$	Except Hysteresis Input	$V_{DD} \geq 4.5\text{ V}$	0	$V_{DD} \times 0.3$	V
	$V_{IL2}$	Hysteresis Input			$V_{DD} \times 0.25$	
	$V_{IL3}$		$V_{DD} < 4.5\text{ V}$		$V_{DD} \times 0.1$	
Clock Frequency	$f_c$		High-freq.clock	0.4	6.0	MHz
	$f_s$		Low-freq.clock	30	34	kHz

Note. Input Voltage  $V_{IH3}$ ,  $V_{IL3}$ : in the SLOW mode or HOLD mode

D.C. CHARACTERISTICS (V<sub>SS</sub> = 0 V, T<sub>opr</sub> = -40 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, RESET, 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 Resistance	R <sub>IN2</sub>	RESET		100	220	450	kΩ
Low Level Input Current	I <sub>IL</sub>	ports R (push-pull)	V <sub>DD</sub> = 5.5 V, V <sub>IN</sub> = 0.4 V	—	—	-2	mA
Output Leakage Current	I <sub>LO</sub>	ports R (open drain)	V <sub>DD</sub> = 5.5 V, V <sub>OUT</sub> = 5.5 V	—	—	2	μA
Output Level High Voltage	V <sub>OH</sub>	push-pull ports	V <sub>DD</sub> = 4.5 V, I <sub>OH</sub> = -200 μA	2.4	—	—	V
Output Level Low Voltage	V <sub>OL</sub>	Except XOUT, P ports	V <sub>DD</sub> = 4.5 V, I <sub>OL</sub> = 1.6 mA	—	—	0.4	
Low Level Output Current	I <sub>OL2</sub>	ports P1, P2	V <sub>DD</sub> = 4.5 V, V <sub>OL</sub> = 1.0 V	—	20	—	mA
	I <sub>OL3</sub>	ports P0, P3		—	7	—	
Supply Current (in the Nomal mode)	I <sub>DD</sub>		V <sub>DD</sub> = 5.5 V f <sub>c</sub> = 4 MHz	—	3	6	mA
Supply Current (in the SLOW mode)	I <sub>DDS</sub>		V <sub>DD</sub> = 5.0 V f <sub>s</sub> = 32.768 kHz	—	30	60	mA
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. I<sub>DD</sub>, I<sub>DDH</sub>; V<sub>IN</sub> = 5.3 V / 0.2 V

The K0 port is opened when the input resistor is contained.

The voltage applied to the R port is within the valid range.

I<sub>DDS</sub>; V<sub>IN</sub> = 2.8 V / 0.2 V, low frequency clock is only oscillated (connecting XTIN, XTOU).

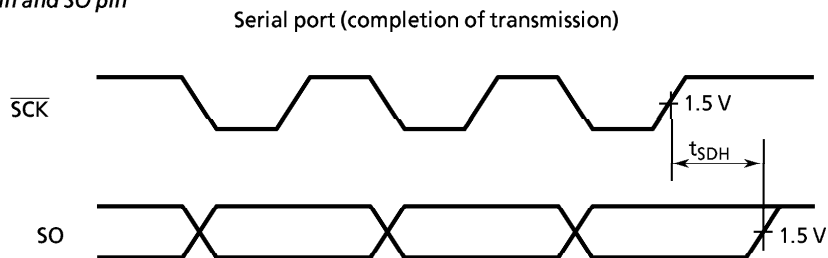
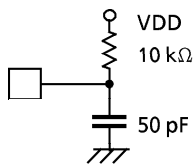
A / D CONVERSION CHARACTERISTICS (T<sub>opr</sub> = -40 to 70 °C)

PARAMETER	SYMBOL	CONDITIONS	Min.	Typ.	Max.	UNIT
Analog Reference	V <sub>AREF</sub>		V <sub>DD</sub> - 1.5	—	V <sub>DD</sub>	V
	V <sub>ASS</sub>		V <sub>SS</sub>	—	1.5	
Analog Reference Voltage Range	ΔV <sub>AREF</sub>	V <sub>AREF</sub> - V <sub>ASS</sub>	2.5	—	—	V
Analog input Voltage	V <sub>AIN</sub>		V <sub>ASS</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** ( $V_{SS} = 0\text{ V}$ ,  $V_{DD} = 4.5\text{ to }6.0\text{ V}$ ,  $T_{opr} = -40\text{ to }70\text{ }^\circ\text{C}$ )

PARAMETER	SYMBOL	CONDITION	Min.	Typ.	Max.	UNIT
Instruction Cycle Time	$t_{cy}$	in the Normal mode	1.3	–	20	$\mu\text{s}$
		in the SLOW mode	235	–	267	
High level Clock Pulse Width	$t_{WCH}$	For external clock operation	80	–	–	ns
Low level Clock Pulse Width	$t_{WCL}$					
A / D Conversion Sampling Time	$t_{AIN}$	$f_c = 4\text{ MHz}$	–	2	–	$\mu\text{s}$
Shift Data Hold Time	$t_{SDH}$		$0.5 t_{cy} - 300$	–	–	ns

Note. Shift data Hold Time:  
External circuit for  $\overline{\text{SCK}}$  pin and SO pin



**RECOMMENDED OSCILLATING CONDITIONS** ( $V_{SS} = 0\text{ V}$ ,  $V_{DD} = 4.5\text{ to }5.5\text{ V}$ ,  $T_{opr} = -40\text{ to }70\text{ }^\circ\text{C}$ )

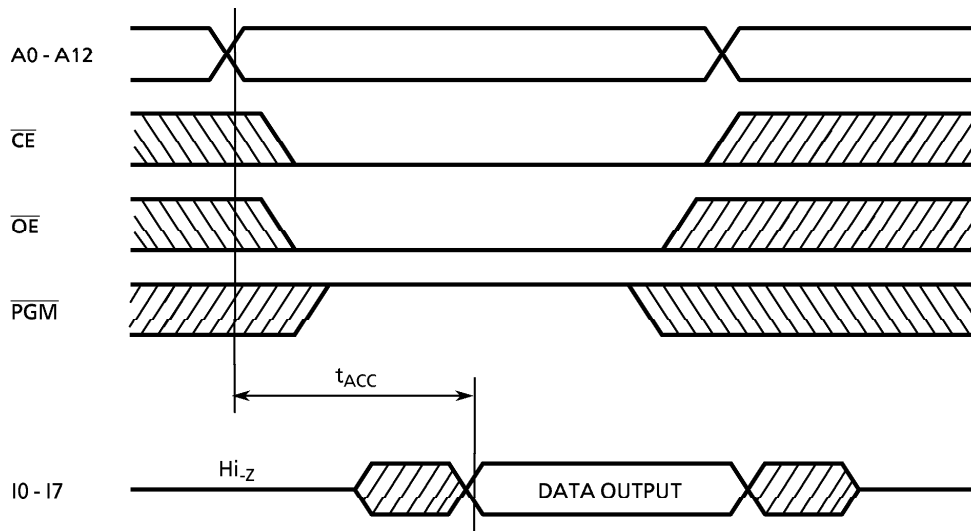
Recommended oscillating conditions of the 47P860V are equal to the 47C860A's.

**DC/AC CHARACTERISTICS** ( $V_{SS} = 0\text{ V}$ )

(1) Read Operation

PARAMETER	SYMBOL	CONDITION	Min.	Typ.	Max.	UNIT
Output Level High Voltage	$V_{IH4}$		$V_{CC} \times 0.7$	–	$V_{CC}$	V
Output Level Low Voltage	$V_{IL4}$		0	–	$V_{CC} \times 0.1$	V
Supply Voltage	$V_{CC}$		4.75	–	6.0	V
Programming Voltage	$V_{PP}$					
Address Access Time	$t_{ACC}$	$V_{CC} = 5.0 \pm 0.25\text{ V}$	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	-	$V_{CC} \times 0.12$	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	0.95	1.0	1.05	ms

