

CMOS 4-Bit Microcontroller

TMP47P860VN
TMP47P860VF

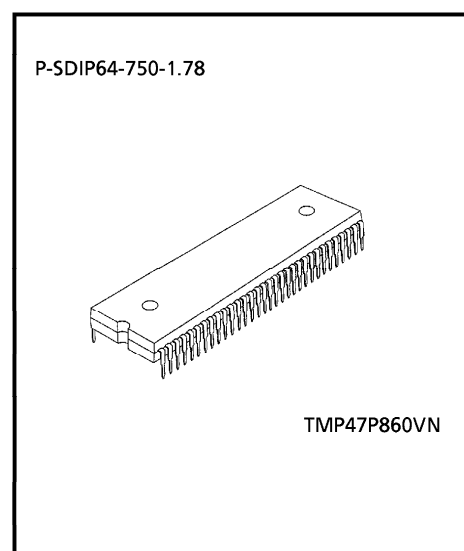
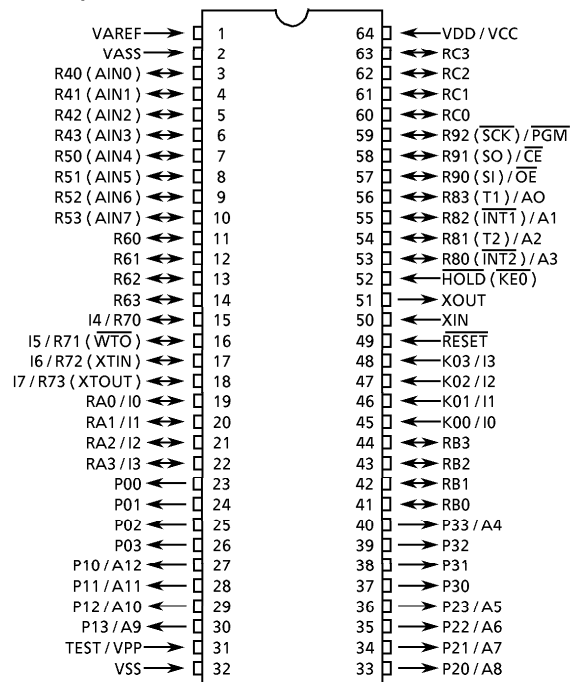
The TMP47P860V is the system evaluation LSI of TMP47C660A/860A with 64 Kbits one-time PROM. The TMP47P860V programs / verifies using an adapter socket to connect with PROM programmer, as it is in TMM2764AD.

In addition, the TMP47P860V and the TMP47C660A/860A are pin compatible. The TMP47P860V operates as the same as the TMP47C660A/860A by programming to the internal PROM.

Part No.	ROM	RAM	Package	Adapter Socket
TMP47P860VN	OTP	512 × 4-bit	P-SDIP64-750-1.78	BM1130
TMP47P860VF	8192 × 8-bit		P-QFP64-1420-1.00A	BM1132

Pin Assignment (Top View)

P-SDIP64-750-1.78

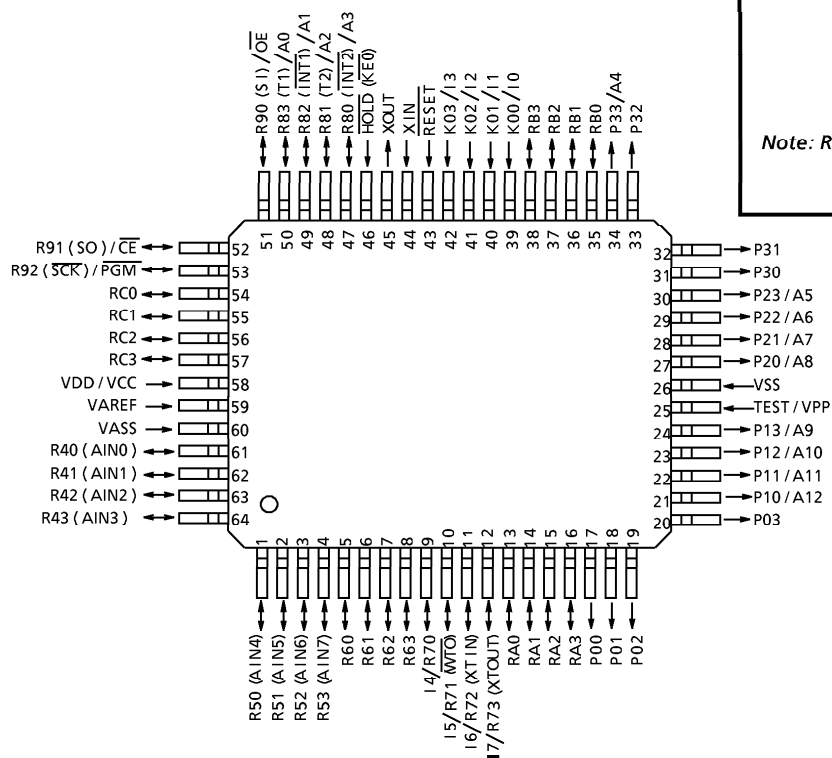


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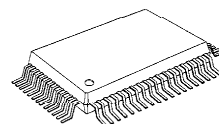
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Pin Assignment (Top View)

P-QFP64-1420-1.00A



P-QFP64-1420-1.00A



TMP47P860VF

Note: Refer to "10 package."

Pin Function

The TMP47P860V has MCU mode and PROM mode.

(1) MCU mode

The TMP47C660A/860A and the TMP47P860V 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 to A9	INPUT	Address inputs	P10 to P13
A8 to A5			P20 to P23
A4			P33
A3 to A0			R80 to R83
I7 to I4	I/O	Data outputs (Inputs)	R73 to R70
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	R90
VPP	Power supply	+ 21 V / 5 V (Program supply voltage)	TEST
VCC		+ 5 V	VDD
VSS		0 V	VSS
P03 to P00	output	Open	
P32 to P30			
RA3 to RA0	I/O	Be fixed to Low Level	
RB3 to RB0			
RC3 to RC0			
R43 to R40			
R53 to R50			
R63 to R60			
$\overline{\text{RESET}}$	Input	PROM mode setting pin. Be fixed to low level.	
$\overline{\text{HOLD}}$	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 TMP47P860V. The TMP47P860V is the same as the TMP47C660A/860A except that an OTP is used instead of a built-in mask ROM.

1. Operation mode

The TMP47P860V 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 TMP47C660A/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 TMP47C860A. Data conversion tables must be set in two locations when using the TMP47P860V to check TMP47C660A operation.

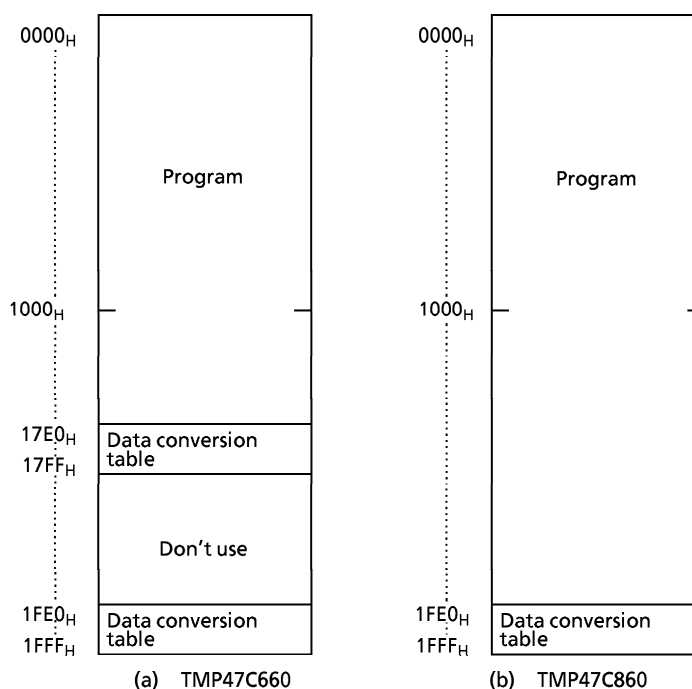


Figure 1-1. Program area

1.1.2 Data memory

The TMP47P860V has two built-in 256 × 4-bit data memory banks (Bank0, Bank1).

When using the TMP47P860V as a TMP47C660A evaluator, do not write data to address 80_H and following, even though the Bank1 addresses are 00, to FF_H. There is no necessity to take into consideration a special common function area because one is built in Bank0.

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 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 _{OUT3}	Ports P0, P3	15	
Output Current (Total)	Σ I _{OUT1}	Ports P0, P1	120	mA
	Σ I _{OUT2}	Ports P2, P3		
Power Dissipation [T _{opr} = 70°C]	PD		600	mW
Soldering Temperature (time)	T _{sld}		260 (10 s)	°C
Storage Temperature	T _{stg}		– 55 to 125	°C
Operating Temperature	T _{opr}		– 40 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, T_{opr} = – 40 to 70°C)

Parameter	Symbol	Pins	Conditions	Min	Max	Unit
Supply Voltage	V _{DD}		f _c = 6.0 MHz	4.5	5.5	V
			f _c = 4.2 MHz	2.7		
			In the SLOW mode			
			In the HOLD mode			
Input High Voltage	V _{IH1}	Except Hysteresis Input	V _{DD} ≥ 4.5 V	V _{DD} × 0.7	V _{DD}	V
	V _{IH2}	Hysteresis Input		V _{DD} × 0.75		
	V _{IH3}		V _{DD} < 4.5 V	V _{DD} × 0.9		
Input Low Voltage	V _{IL1}	Except Hysteresis Input	V _{DD} ≥ 4.5 V	0	V _{DD} × 0.3	V
	V _{IL2}	Hysteresis Input			V _{DD} × 0.25	
	V _{IL3}		V _{DD} < 4.5 V		V _{DD} × 0.1	
Clock Frequency	f _c		High-freq.clock	0.4	6.0	MHz
	f _s		Low-freq.clock	30	34	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: Input voltage V_{IH3}, V_{IL3}: In the SLOW or HOLD mode.

DC Characteristics

(V_{SS} = 0 V, Topr = – 40 to 70°C)

Parameter	Symbol	Pins	Conditions	Min	Typ.	Max	Unit
Hysteresis Voltage	V _{HS}	Hysteresis input		—	0.7	—	V
Input Current	I _{IN1}	Port K0, TEST, RESET, HOLD	V _{DD} = 5.5 V	—	—	± 2	μA
	I _{IN2}	Ports R (open-drain)	V _{IN} = 5.5 V / 0 V	—	—	—	
Input Resistance	R _{IN2}	RESET		100	220	450	kΩ
Low Level Input Current	I _{IL}	Ports R (push-pull)	V _{DD} = 5.5 V, V _{IN} = 0.4 V	—	—	– 2	mA
Output Leakage Current	I _{LO}	Ports R (open drain)	V _{DD} = 5.5 V, V _{OUT} = 5.5 V	—	—	2	μA
Output Level High Voltage	V _{OH}	Push-pull ports	V _{DD} = 4.5 V, I _{OH} = – 200 μA	2.4	—	—	V
Output Level Low Voltage	V _{OL}	Except XOUT, P ports	V _{DD} = 4.5 V, I _{OL} = 1.6 mA	—	—	0.4	
Low Level Output Current	I _{OL2}	Ports P1, P2	V _{DD} = 4.5 V, V _{OL} = 1.0 V	—	20	—	mA
	I _{OL3}	Ports P0, P3		—	7	—	
Supply Current (in the Nomal mode)	I _{DD}		V _{DD} = 5.5 V fc = 4 MHz	—	3	6	mA
Supply Current (in the SLOW mode)	I _{DDs}		V _{DD} = 5.0 V fs = 32.768 kHz	—	30	60	mA
Supply Current (in the HOLD mode)	I _{DDH}		V _{DD} = 5.5 V	—	0.5	10	μA

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

Note 2: Input Current I_{IN1}; The current through resistor is not included, when the input resistor (pull-up/pull-down) is contained.Note 3: I_{DD}, I_{DDH}; V_{IN} = 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_{DDs}; V_{IN} = 2.8 V / 0.2 V, low frequency clock is only oscillated (connecting XTIN, XTOU).

AD Conversion Characteristics

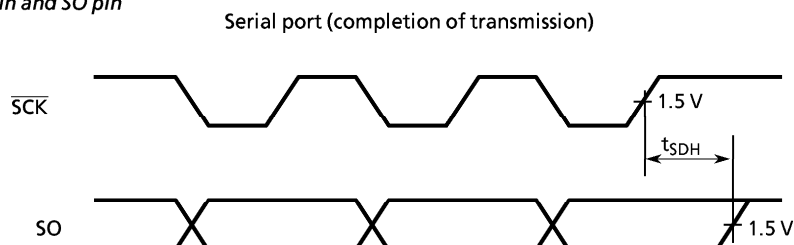
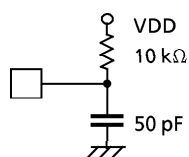
(Topr = – 40 to 70°C)

Parameter	Symbol	Conditions	Min	Typ.	Max	Unit
Analog Reference	V _{AREF}		V _{DD} – 1.5	—	V _{DD}	V
	V _{ASS}		V _{SS}	—	1.5	
Analog Reference Voltage Range	ΔV _{AREF}	V _{AREF} – V _{ASS}	2.5	—	—	V
Analog input Voltage	V _{AIN}		V _{ASS}	—	V _{AREF}	V
Analog Supply Current	I _{REF}		—	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 pornt Error			—	—	± 1	
Full scale Error			—	—	± 1	
Totar Error			—	—	± 2	

AC Characteristics

(V_{SS} = 0 V, V_{DD} = 4.5 to 6.0 V, T_{opr} = –40 to 70°C)

Parameter	Symbol	Condition	Min	Typ.	Max	Unit
Instruction Cycle Time	t _{cy}	in the Normal mode	1.3	–	20	μs
		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}					
AD Conversion Sampling Time	t _{AIN}	f _c = 4 MHz	–	2	–	μs
Shift Data Hold Time	t _{SDH}		0.5 t _{cy} – 0.3	–	–	μs

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

Recommended Oscillating Conditions

(V_{SS} = 0 V, V_{DD} = 4.5 to 5.5 V, T_{opr} = –40 to 70°C)

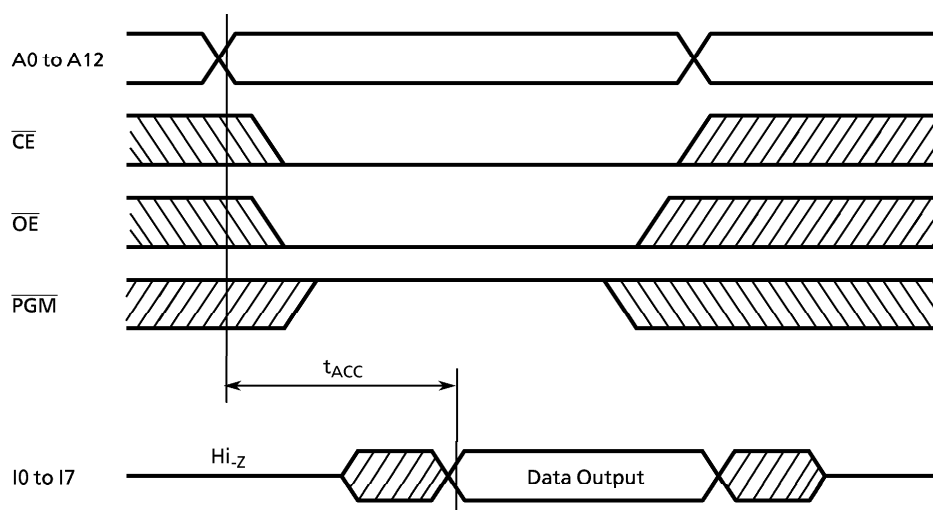
Recommended oscillating conditions of the TMP47P860V are equal to the TMP47C860A's.

DC/AC Characteristics

(V_{SS} = 0 V)

(1) Read operation

Parameter	Symbol	Condition	Min	Typ.	Max	Unit
Output Level High Voltage	V _{IH4}		V _{CC} × 0.7	–	V _{CC}	V
Output Level Low Voltage	V _{IL4}		0	–	V _{CC} × 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 ± 0.25 V	0	–	350	ns



(2) High speed programming operation

Parameter	Sybol	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

