CMOS 4-Bit Microcontroller

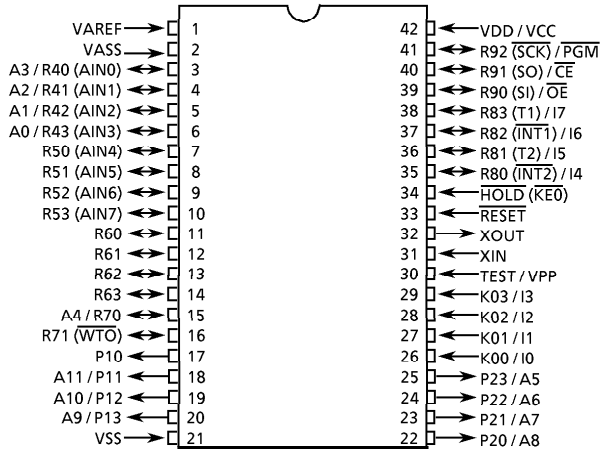
TMP47P440VN
TMP47P440VF

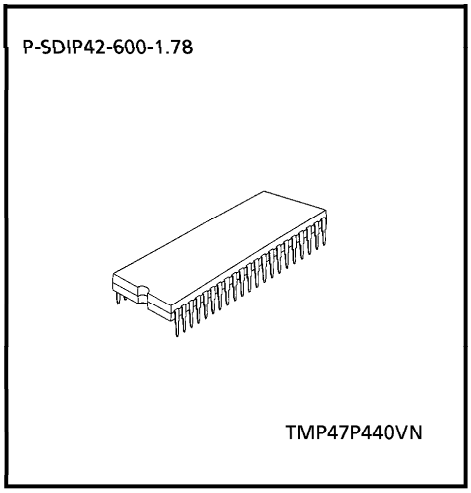
The TMP47P440V is the system evaluation LSI of TMP47C440B with 32K bits one-time PROM. The TMP47P440V programs / verifies using an adapter socket to connect with PROM programmer, as it is in TMM2764AD.
In addition, the TMP47P440V and the TMP47C440B are pin compatible. The TMP47P440V operates as the same as the TMP47C440B by programming to the internal PROM.

Part No.	ROM	RAM	Package	Adaptor Socket
TMP47P440VN	OTP 4096 × 8-bit	256 × 4-bit	P-SDIP42-600-1.78	BM1118
TMP47P440VF			P-QFP44-1414-0.80D	BM1125

Pin Assignment (Top View)

P-SDIP42-600-1.78





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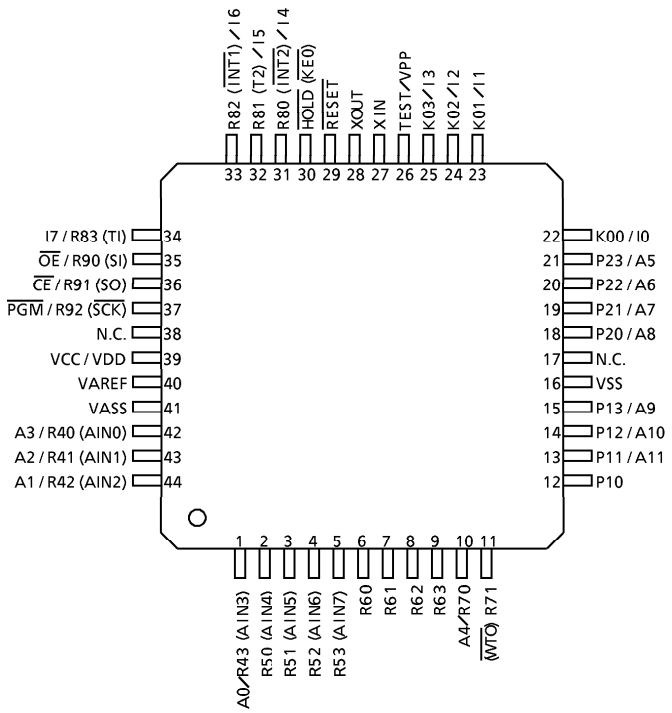
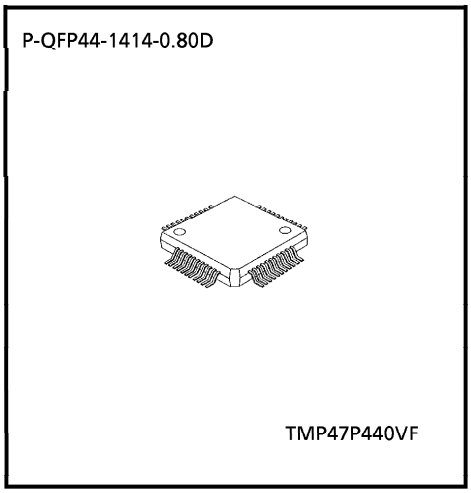
Pin Assignment (Top View)

P-QFP44-1414-0.80D





Pin Function

The TMP47P440V has MCU mode and PROM mode.

(1) MCU mode

The TMP47C440B and the TMP47P440V 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)
A11 to A9	INPUT	Address inputs	P11 to P13
A8 to A5			P20 to P23
A4			R70
A3 to A0			R40 to R43
I7 to I4	I/O	Data outputs (Inputs)	R83 to R80
I3 to I0			K03 to K00
$\overline{PGM}$	Input	Program control input	R92
$\overline{CE}$		Chip Enable input	R91
$\overline{OE}$		Output Enable input	R90
VPP	Power supply	+ 12.5 V / 5 V (Program supply voltage)	TEST
VCC		+ 5 V	VDD
VSS		0 V	VSS
P10	Output	Open	
R53 to R50	I/O	Be fixed to Low Level	
R63 to R60			
R71			
$\overline{RESET}$	Input	PROM mode setting pin. Be fixed to low level.	
$\overline{HOLD}$	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 TMP47P440V. The TMP47P440V is the same as the TMP47C440B except that an OTP is used instead of a built-in mask ROM.

1. Operation mode

The TMP47P440V 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 TMP47C440B, 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 TMP47C440B.

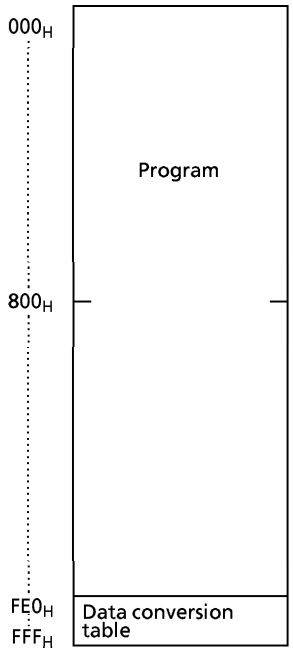


Figure 1-1. Program area

1.1.2 Data Memory

The TMP47P440V has 256 × 4-bit data memory (RAM).

Electrical Characteristics

Absolute Maximum Ratings (V_{SS} = 0 V)

Parameter	Symbol	Pins	Ratings	Unit
Supply Voltage	V_{DD}		– 0.3 to 6.5	V
Supply 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_{OUT}	Ports R	– 0.3 to V_{DD} + 0.3	V
Output Current (Per 1pin)	I_{OUT1}	Ports R	3.2	mA
	I_{OUT2}	Ports P1, P2	30	
Output Current (Total)	ΣI_{OUT}	Ports P1, P2	120	mA
Power Dissipation [Topr = 70°C]	PD		600	mW
Soldering Temperture (time)	Tsld		260 (10 s)	°C
Strorage Temperture	Tstg		– 55 to 125	°C
Operating Temperature	Topr		– 30 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 Opeating Conditions (V_{SS} = 0 V, Topr = – 30 to 70°C)

Parameter	Symbol	Pins	Conditions	Min	Max	Unit
Supply Voltage	V_{DD}		fc = 6.0 MHz	4.5	5.5	V
			fc = 4.2 MHz	2.7		
			In the HOLD mode	2.0		
Input High Voltage	V_{IH1}	Except Hysteresis Input	$V_{DD} \geqq 4.5$ V	$V_{DD} \times 0.7$	V_{DD}	V
	V_{IH2}	Hysteresis Input		$V_{DD} \times 0.75$		
	V_{IH3}		$V_{DD} < 4.5$ V	$V_{DD} \times 0.9$		
Input Low Voltage	V_{IL1}	Except Hysteresis Input	$V_{DD} \geqq 4.5$ V	0	$V_{DD} \times 0.3$	V
	V_{IL2}	Hysteresis Input			$V_{DD} \times 0.25$	
	V_{IL3}		$V_{DD} < 4.5$ V		$V_{DD} \times 0.1$	
Clock Frequency	fc		High-frequency	0.4	6.0	MHz

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, T_{opr} = – 30 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, $\overline{RESET}$, $\overline{HOLD}$	V_{DD} = 5.5 V, V_{IN} = 5.5 V / 0 V	—	—	± 2	μA
	I_{IN2}	Ports R (open drain)					
Low Input Current	I_{IL}	Ports R (push-pull)	V_{DD} = 5.5 V, V_{IN} = 0.4 V	—	—	– 2	mA
Input Resistance	R_{IN2}	$\overline{RESET}$		100	220	450	kΩ
Output Leakage Current	I_{LO}	Ports R (open drain)	V_{DD} = 5.5 V, V_{OUT} = 5.5 V	—	—	2	μA
Output Low Voltage	V_{OL2}	Except XOUT, ports P	V_{DD} = 4.5 V, I_{OL} = 1.6 mA	—	—	0.4	V
Low output Current	I_{OL1}	Ports P1, P2	V_{DD} = 4.5 V, V_{OL} = 1.0 V	—	20	—	mA
Supply Current (in the Normal mode)	I_{DD}		V_{DD} = 5.5 V, fc = 4 MHz	—	3	6	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, V_{DD} = 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: Supply Current I_{DD}, I_{DDH} ; V_{IN} = 5.3 V / 0.2 V
The voltage applied to the R port is within the valid range.

AD Conversion Characteristics

(Topr = – 30 to 70°C)

Parameter	Symbol	Conditions	Min	Typ.	Max	Unit
Analog Reference Voltage	V_{AREF}		V_{DD} – 1.5	—	V_{DD}	V
	V_{ASS}		V_{SS}	—	1.5	
Analog Reference Voltage Range	$\triangle V_{AREF}$	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 Point Error			—	—	± 1	
Full Scale Error			—	—	± 1	
Total Error			—	—	± 2	

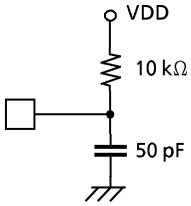
AC Characteristics

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

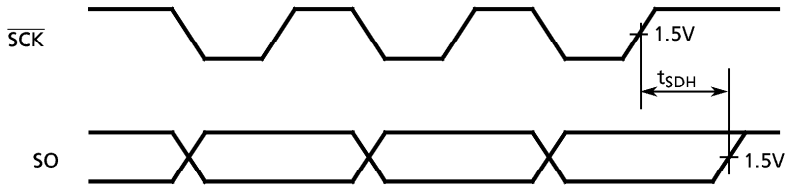
Parameter	Symbol	Conditions	Min	Typ.	Max	Unit
Instruction Cycle Time	t_{cy}		1.9	—	20	μs
High level Clock pulse Width	t_{WCH}	External clock mode	80	—	—	ns
Low level Clock pulse Width	t_{WCL}					
AD Sampling Time	t_{AIN}	fc = 4 MHz	—	4	—	μs
Shift Data Hold Time	t_{SDH}		0.5 tcy – 0.3	—	—	μs

Note: Shift Data Hold Time

External circuit for $\overline{SCK}$ pin and SO pin



Serial port (completion of transmission)



Recommended Oscillating Conditions

(V_{SS} = 0 V, V_{DD} = 4.5 to 5.5 V, T_{opr} = – 30 to 70°C)

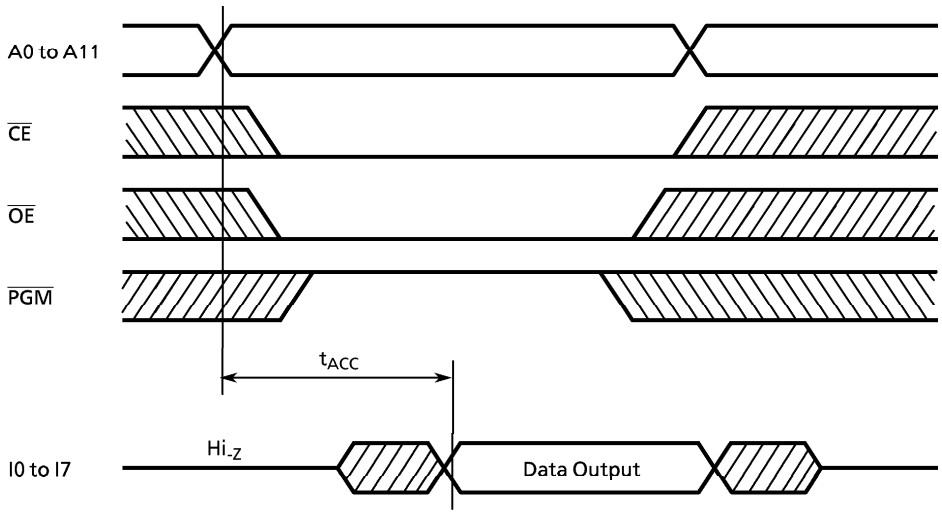
Recommended oscillating conditions of the TMP47P440V are equal to the TMP47C440B's.

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} × 0.8	–	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	–	–	350	ns



(2) High Speed Programming Operation

Parameter	Symbol	Condition	Min	Typ.	Max	Unit
Input High Voltage	V_{IH4}		$V_{CC} \times 0.8$	–	V_{CC}	V
Input Low Voltage	V_{IL4}		0	–	$V_{CC} \times 0.1$	V
Supply Voltage	V_{CC}		4.75	–	6.0	V
V_{PP} Power Supply Voltage	V_{PP}		12.0	12.5	13.0	V
Programming Pulse Width	t_{PW}	$V_{CC} = 6.0 \pm 0.25$ V	0.95	1.0	1.05	ms