

CMOS 4-Bit Microcontroller

**TMP47P241VN**  
**TMP47P241VM**

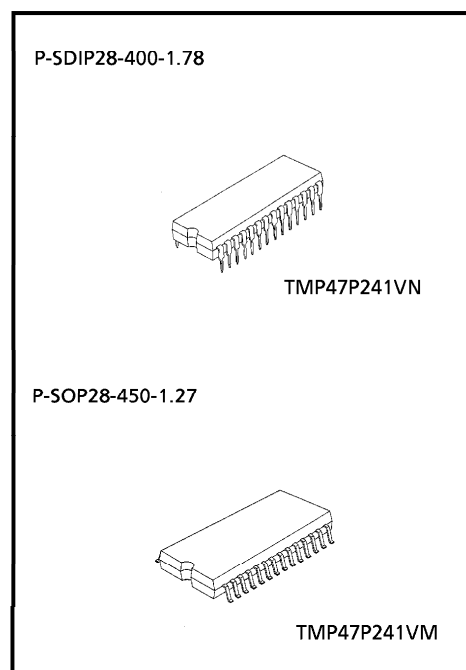
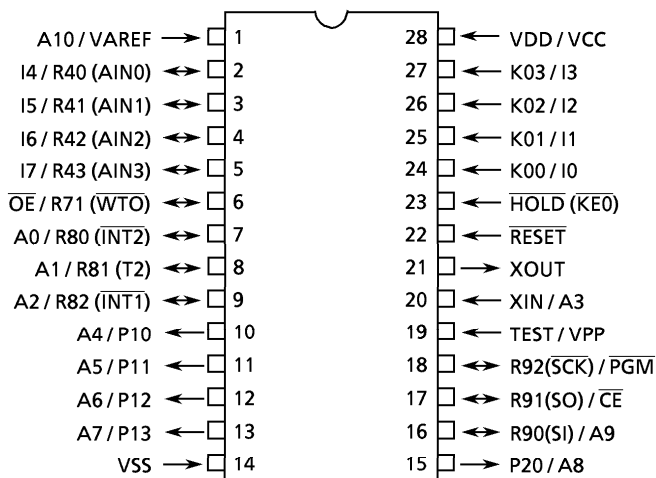
The TMP47P241V is the system evaluation LSI of TMP47C241 with a 16 Kbit one-time PROM. The TMP47P241V programs / verifies using an adaptor socket to connect with PROM programmer, as it is in TMM2764AD.

In addition, the TMP47P241V and the TMP47C241 are pin compatible. The TMP47P241V operates as the same as the TMP47C241 by programming to the internal PROM.

Part No.	ROM	RAM	Package	Adaptor Socket
TMP47P241VN	OTP	128 × 4-bit	P-SDIP28-400-1.78	BM1156
TMP47P241VM	2048 × 8-bit		P-SOP28-450-1.27	BM1157

**Pin Assignment (Top View)**

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



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**Pin Function**

The TMP47P241V has MCU mode and PROM mode.

## (1) MCU mode

The TMP47C241 and the TMP47P241V 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
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
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 TMP47P241V. The TMP47P241V is the same as the TMP47C241 except that an OTP is used instead of a built-in mask ROM.

### 1. Operation mode

The TMP47P241V 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 TMP47C241, except that the TEST/VPP pin does not have built in pull-down resistor and cannot be used open. In the TMP47P241V, RC oscillation is impossible.

##### 1.1.1 Program Memory

The program storage area is the same as for the TMP47C241.

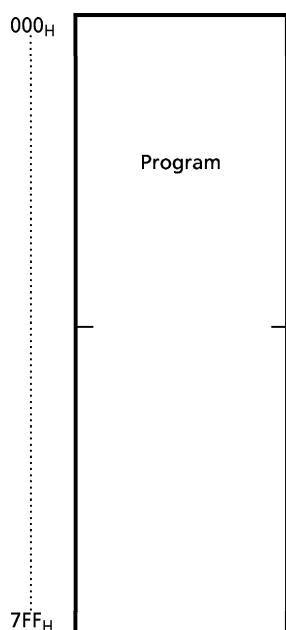


Figure 1-1. Program area (ROM)

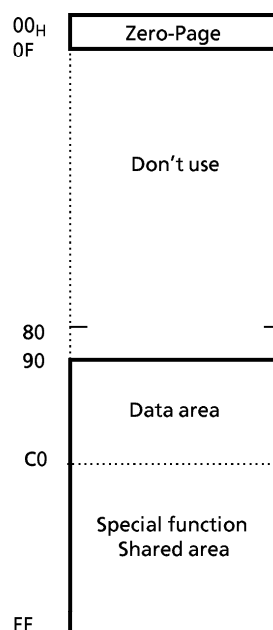


Figure 1-2. RAM addressing

##### 1.1.2 Data Memory

The TMP47P241V has 128 × 4-bit of data memory (RAM).

When the TMP47C940A is used as evaluator of the TMP47C241V, programming should be performed assuming that the RAM is assigned to addresses 00 to 7FH and 90 to FFH as show in Figure 1-2 by considering the application software evaluation. When the BM47214A (emulator) is used as the TMP47C241 evaluator, it is same.

##### 1.1.3 Input / Output Circuitry

###### (1) Control pins

This is the same as for the TMP47C241 except that there is no built-in pull-down resistance for the TEST pin. In the TMP47P241V, RC oscillation is impossible. Connecting the resonator is required when using as evaluator of I/O code SG.

## 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 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)	∑ I <sub>OUT1</sub>	Ports P1, P2, R9	120	mA
Power Dissipation [Topr = 70°C]	PD		300	mW
Soldering Temperature (time)	T <sub>sld</sub>		260 (10 s)	°C
Storage Temperature	T <sub>stg</sub>		- 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 Operating Conditions (V<sub>SS</sub> = 0 V, Topr = - 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	

*Note: 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.*

## DC 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, 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>IN1</sub>	Port K0 with pull-up/pull-down		30	70	150	kΩ
	R <sub>IN2</sub>	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.

## AD Conversion Characteristics

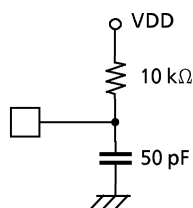
(T<sub>opr</sub> = -30 to 70°C)

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	

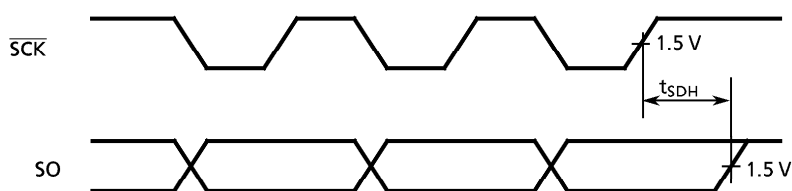
**AC Characteristics** ( $V_{SS} = 0\text{ V}$ ,  $T_{opr} = -30\text{ to }70^{\circ}\text{C}$ )

Parameter	Symbol	Conditions	Min	Typ.	Max	Unit
Instruction Cycle Time	$t_{cy}$	$V_{DD} = 4.5\text{ to }6.0\text{ V}$	1.3	—	20	$\mu\text{s}$
		$V_{DD} = 2.7\text{ to }6.0\text{ V}$	1.9			
High level Clock pulse Width	$t_{WCH}$	External clock mode	80	—	—	ns
Low level Clock pulse Width	$t_{WCL}$					
AD Sampling Time	$t_{AIN}$	$f_c = 4\text{ MHz}$	—	4	—	$\mu\text{s}$
Shift Data Hold Time	$t_{SDH}$		$0.5 t_{cy} - 0.3$	—	—	$\mu\text{s}$

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



Serial port (completion of transmission)



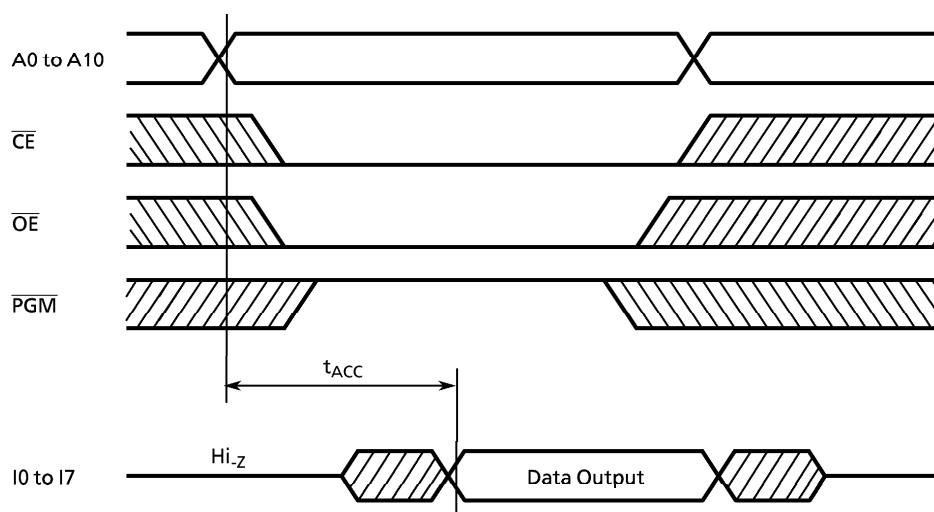
**Recommended Oscillating Conditions** ( $V_{SS} = 0\text{ V}$ ,  $V_{DD} = 4.5\text{ to }6.0\text{ V}$ ,  $T_{opr} = -40\text{ to }70^{\circ}\text{C}$ )

Recommended oscillating conditions of the TMP47P241V are equal to the TMP47C241's but RC oscillation is impossible.

**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	—	$V_{CC} \times 0.3$	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	-	$V_{CC} \times 0.3$	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

