

CMOS 4-Bit Microcontroller

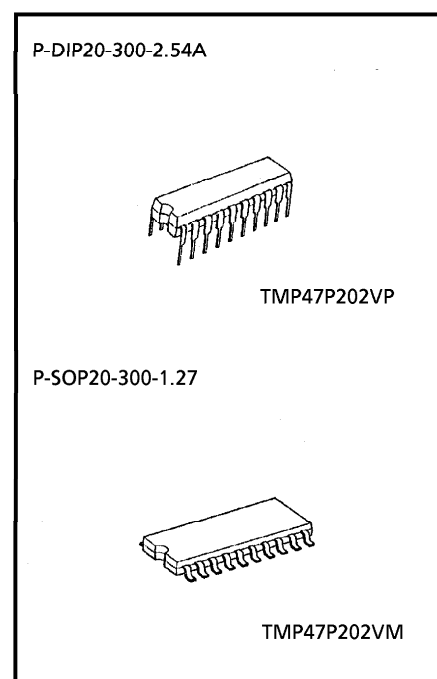
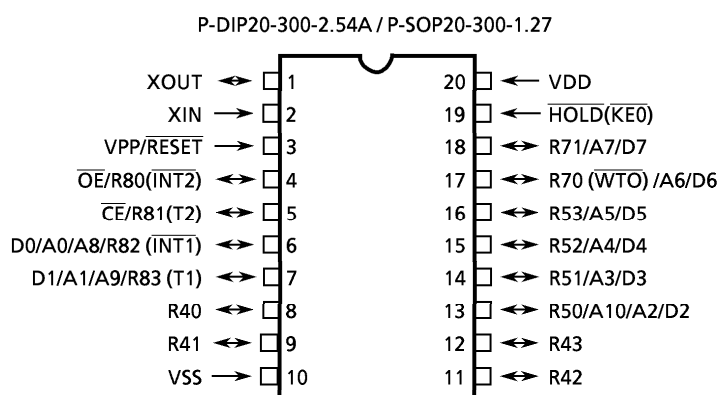
TMP47P202VP
TMP47P202VM

The TMP47P202V is the system evaluation LSI of TMP47C102/202 with a 16 Kbit one-time PROM. The TMP47P202V programs / verifies using an adapter socket to connect with PROM programmer, as it is in TMM27256AD.

In addition, the TMP47P202V and the TMP47C102/202 are pin compatible. The TMP47P202V operates as the same as the TMP47C102/202 by programming to the internal PROM.

Part No.	ROM	RAM	Package	OTP
TMP47P202VP	OTP		P-DIP20-300-2.54A	BM1187
TMP47P202VM	2048 x 8-bit	128 x 4-bit	P-SOP20-300-1.27	BM11113

Pin Assignment (Top View)



000707EBA1

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Pin Function

The TMP47P202V has MCU mode and PROM mode.

(1) MCU mode

The TMP47C102/202 and the TMP47P202V are pin compatible.

(2) PROM mode

Pin Name	Input / Output	Functions	Pin Name (MCU mode)
D0 / A0 / A8	I/O	Data inputs / outputs or Address inputs	R82
D1 / A1 / A9			R83
D2 / A2 / A10			R50
D3 / A3			R51
D4 / A4			R52
D5 / A5			R53
D6 / A6			R70
D7 / A7			R71
\overline{OE}	Input	Output Enable input	R80
\overline{CE}		Chip Enable input	R81
VPP	Power supply	+ 12.5 V / 5 V (Program supply voltage)	\overline{RESET}
VCC		+ 5 V	VDD
VSS		0 V	VSS
R43 to R40	I/O	Be fixed to low level.	
\overline{HOLD}	Input	PROM mode setting pin. Be fixed to low level.	
XIN	Input	Input the clock from the external oscillator.	
XOUT	Input	PROM control input	

Operational Description

The following is an explanation of hardware configuration and operation in relation to the TMP47P202V. The TMP47P202V is the same as the TMP47C102/202 except that an OTP is used instead of a built-in mask ROM.

1. Operation mode

The TMP47P202V has an MCU mode and a PROM mode.

1.1 MCU mode

The MCU mode is set by attaching a resonator between the XIN and XOUT pins. Operation in the MCU mode is the same as for the TMP47C102/202. In the TMP47P202V, RC oscillation is impossible.

1.1.1 Program Memory

The program storage area is the same as for the TMP47C202. Don't use the addresses 400 to 7FF_H when using the TMP47P102V to check TMP47C102 operation.

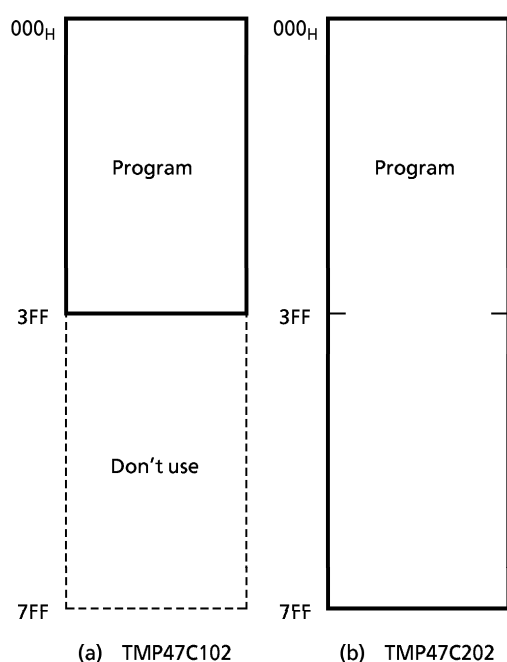


Figure 1-1. Program Area

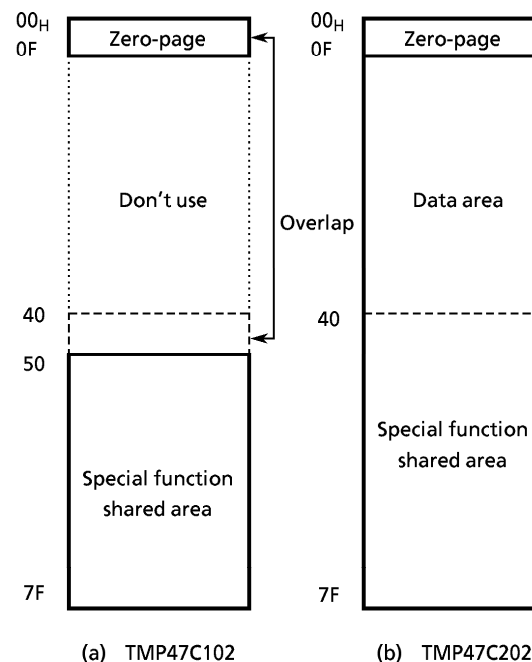


Figure 1-2. RAM Address Assignment

1.1.2 Data Memory

The TMP47P202V has 128 × 4-bit of data memory (RAM). When the TMP47P202V is used as the TMP47C102 evaluator, programming should be performed assuming that the RAM is assigned to address 00 to 0F_H and 50 to 7F_H as show in Figure 1-2. When the BM47C203 (emulator) is used as the TMP47C102 evaluator, it is same.

Further, zero-page (addresses 00 to 0F_H) and special function shared area (stack location 0 to 3) are overlapped on the TMP47C102.

1.1.3 Input / Output Circuitry

(1) Control pins

This is the same as I/O code FA of the TMP47C102/202. In the TMP47P202V, RC oscillator is impossible. Connecting the resonator or inputting the external clock to XIN pin are required when using as evaluator of I/O code FD, FE.

(2) I/O Ports

The input / output circuit of the TMP47P202V is the same as I/O code FA or FD of the TMP47C102/202.

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

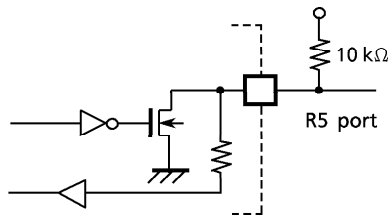


Figure 1-3. I/O code and external circuitry (Codes FB, FE)

1.2 PROM mode

The TMP47P202V enters PROM mode by sending external clock signal from XIN pin when XOUT pin is at low level. In PROM mode, programs can be written or verified using a general-purpose PROM writer with an adapter socket (BM1187) being attached.

With the TMP47P202V, the PROM address input and data input/output use the same port. PROM mode control signal (XOUT) is used for switching between two functions. XOUT pin becomes control signal input after PROM mode is completed.

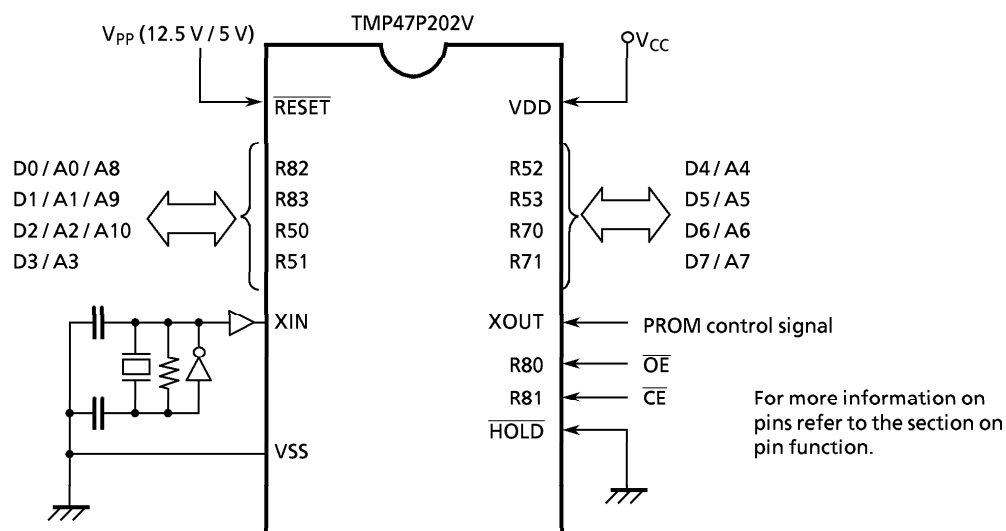


Figure 1-4. Setting for PROM mode

1.2.1 Program Writing

When writing a program, set a ROM type to "27256A" (programming voltage: 12.5 V) . Since the TMP47P202V has a 2048×8-bit internal PROM (000 to 7FF_H) , set a stop address of a PROM writer to "7FF_H" . For a general-purpose PROM writer, use the writer which does not have or can release an electric signature mode.

Note: When the data written to OTP is same as the data of PROM programmer, there is the possibility that the security writing can not be executed, which is depended on the types of PROM programmers.

In this case, set the data of PROM programmer to "00" and execute the security writing after writing the data to OTP.

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 $V_{CC} = 6 V$ and $\overline{CE} = V_{IH}$.

The programming is achieved by applying a single low level 1ms pulse the \overline{CE} 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 $V_{CC} = V_{PP} = 5 V$.

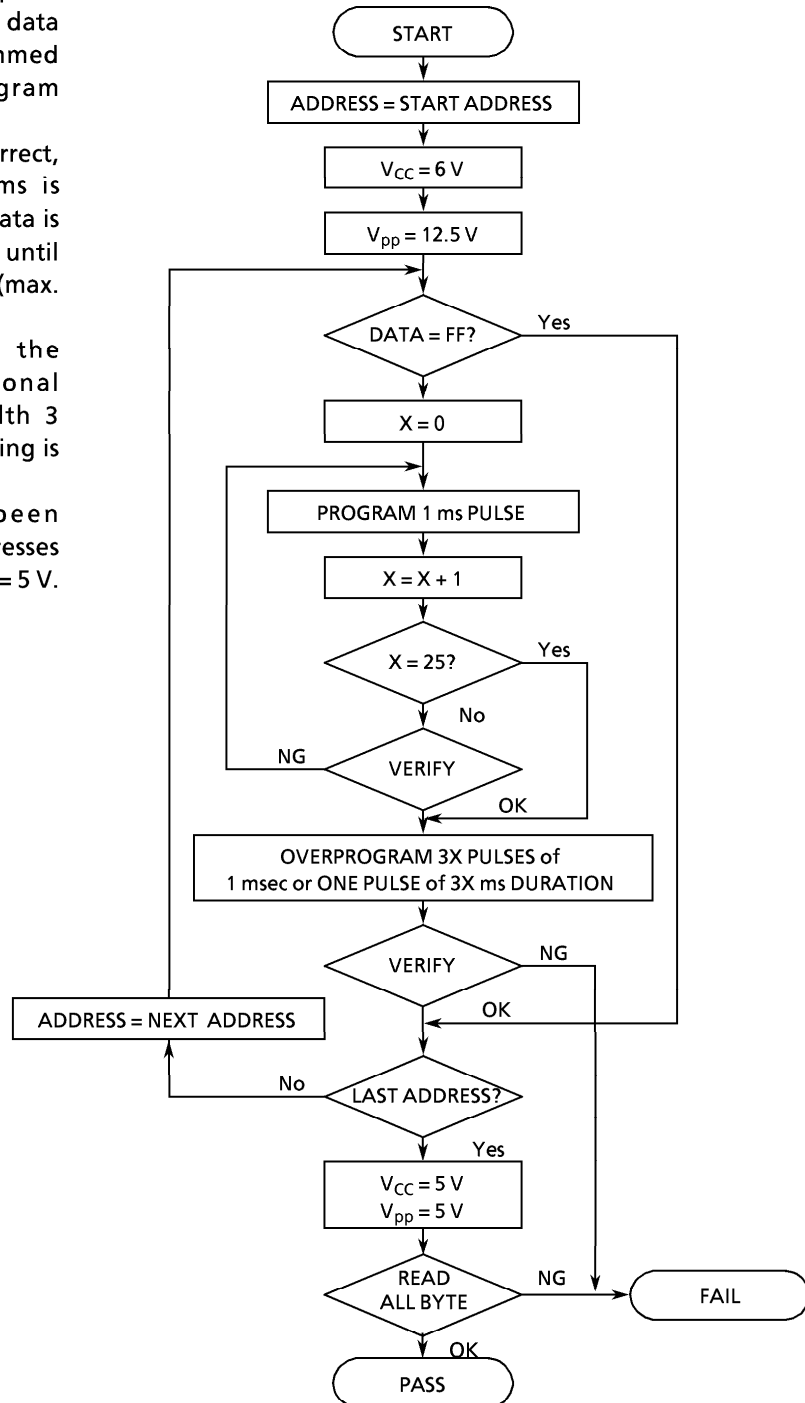


Figure 1-5. Flowchart

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}	RESET / VPP	- 0.3 to 13.0	V
Input Voltage	V _{IN}		- 0.3 to V _{DD} + 0.3	V
Output Voltage	V _{OUT}		- 0.3 to V _{DD} + 0.3	V
Output Current (Per 1 pin)	I _{OUT1}	Port R4	30	mA
	I _{OUT2}	Port R5	15	
	I _{OUT3}	Port R7, R8	3.2	
Output Current (Total)	Σ I _{OUT}	Port R4, R5	60	mA
Power Dissipation [T _{opr} = 70°C]	PD		300	mW
Soldering Temperature (time)	T _{sld}		260 (10 s)	°C
Storage Temperature	T _{stg}		- 55 to 125	°C
Operating Temperature	T _{opr}		- 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_{SS} = 0 V, T_{opr} = - 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		
			HOLD mode	2.0		
Input High Voltage	V _{IH1}	Except Hysteresis Input	In the normal operating area	V _{DD} × 0.7	V _{DD}	V
	V _{IH2}	Hysteresis Input		V _{DD} × 0.75		
	V _{IH3}		In the HOLD mode	V _{DD} × 0.9		
Input Low Voltage	V _{IL1}	Except Hysteresis Input	In the normal operating area	0	V _{DD} × 0.3	V
	V _{IL2}	Hysteresis Input			V _{DD} × 0.25	
	V _{IL3}		In the HOLD mode		V _{DD} × 0.1	
Clock Frequency	fc	XIN, XOUT	V _{DD} = 4.5 to 5.5 V	0.4	6.0	MHz
			V _{DD} = 2.7 to 5.5 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

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

Parameter	Symbol	Pins	Conditions	Min	Typ.	Max	Unit
Hysteresis Voltage	V_{HS}	Hysteresis Input		–	0.7	–	V
Input Current	I_{IN1}	RESET, HOLD	$V_{DD} = 5.5\text{ V}, V_{IN} = 5.5\text{ V} / 0\text{ V}$	–	–	± 2	μA
	I_{IN2}	Open drain output ports					
Input Resistance	R_{IN}	RESET		100	220	450	$\text{k}\Omega$
Output Leakage Current	I_{LO}	Open drain output ports	$V_{DD} = 5.5\text{ V}, V_{OUT} = 5.5\text{ V}$	–	–	2	μA
Output Low Voltage	V_{OL}	Except XOUT and port R4	$V_{DD} = 4.5\text{ V}, I_{OL} = 1.6\text{ mA}$	–	–	0.4	V
Output Low Current	I_{OL1}	Port R4	$V_{DD} = 4.5\text{ V}, V_{OL} = 1.0\text{ V}$	–	20	–	mA
	I_{OL2}	Port R5		–	7	–	
Supply Current (in the Normal operating mode)	I_{DD}		$V_{DD} = 5.5\text{ V}, f_c = 4\text{ MHz}$	–	2	4	mA
			$V_{DD} = 3.0\text{ V}, f_c = 4\text{ MHz}$	–	1	2	
			$V_{DD} = 3.0\text{ V}, f_c = 400\text{ kHz}$	–	0.5	1	
Supply Current (in the HOLD operating mode)	I_{DDH}		$V_{DD} = 5.5\text{ V}$	–	0.5	10	μA

Note 1: Typ. values show those at $T_{opr} = 25^{\circ}\text{C}$, $V_{DD} = 5\text{ V}$.

Note 2: Input Current I_{IN1} : The current through resistor is not included.

Note 3: Supply Current: $V_{IN} = 5.3\text{ V} / 0.2\text{ V}$ ($V_{DD} = 5.5\text{ V}$) or $2.8\text{ V} / 0.2\text{ V}$ ($V_{DD} = 3.0\text{ V}$)

AC Characteristics

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

Parameter	Symbol	Conditions	Min	Typ.	Max	Unit
Instruction Cycle Time	t _{cy}	VDD = 4.5 to 5.5 V	1.3	–	20	μs
		VDD = 2.7 to 5.5 V	1.9			
High level Clock pulse Width	t _{WCH}	For external clock operation	80	–	–	ns
Low level Clock pulse Width	t _{WCL}					

Recommended Oscillating Conditions

(V_{SS} = 0 V, V_{DD} = 2.7 to 5.5 V, T_{opr} = – 30 to 70°C)

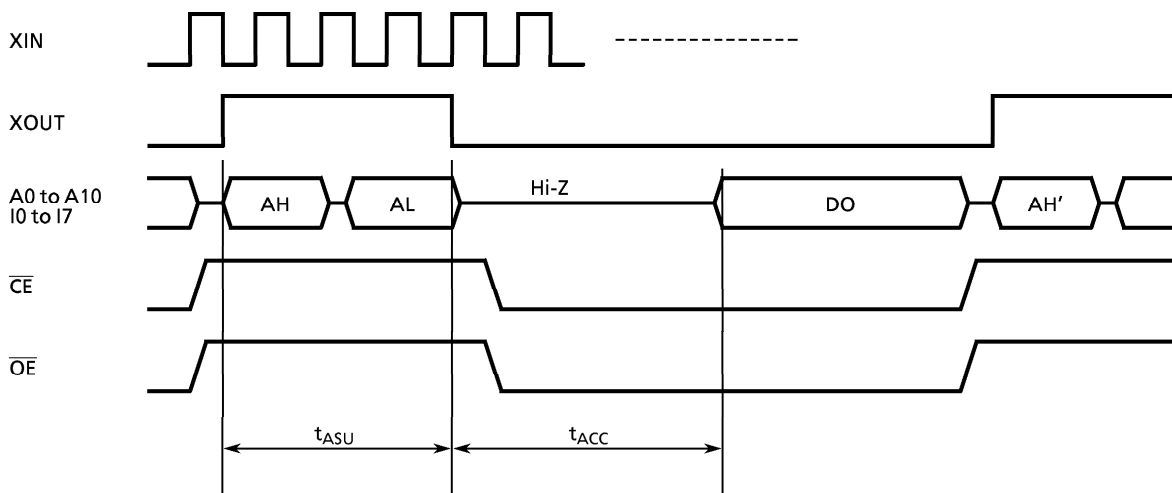
Recommended oscillating conditions of the TMP47P202V are equal to the TMP47C102/202's but RC oscillation is impossible.

DC/AC Characteristics

(V_{SS} = 0 V)

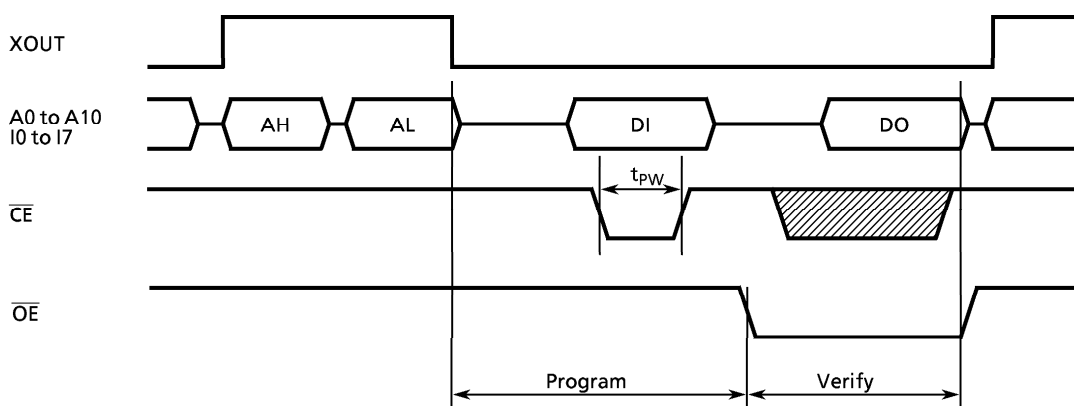
(1) Read Operation

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} × 0.3	V
Supply Voltage	V _{CC}		4.75	–	6.0	V
Programming Voltage	V _{PP}					
Address Set-up Time	t _{ASU}		350	–	–	ns
Address Access Time	t _{ACC}	V _{CC} = 5.0 ± 0.25 V	–	–	300	ns



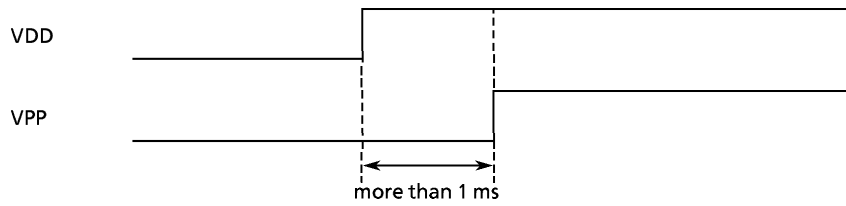
(2) High Speed Programming Operation

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}		12.0	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



Note: DO ; Data output (I0 to I7), AL ; Address input (A0 to A7)
 DI ; Data input (I0 to I7), AH ; Address input (A8 to A10)

*Note: There are some PROM programmer types which cannot program OTP.
In TMP47P202V, VPP pin is also used as RESET pin. To set a mode, REST/VPP pin must be set to "low" during 1 ms and more after the rising of power-on and the rising of VDD electrical power.*



Recommende EPROM programmer

TYPE
R4945 (ADVANTEST)
UNISITE (DATA I/O)
AF - 9706 (ANDO)
PECKER - 11 (AVAL DATA)