

TOSHIBA

TOSHIBA Original CMOS 4-Bit Microcontroller

TLCS-47 Series

TMP47P201VPG

Not Recommended
for New Design

TOSHIBA CORPORATION

Semiconductor Company

Document Change Notification

The purpose of this notification is to inform customers about the launch of the Pb-free version of the device. The introduction of a Pb-free replacement affects the datasheet. Please understand that this notification is intended as a temporary substitute for a revision of the datasheet.

Changes to the datasheet may include the following, though not all of them may apply to this particular device.

1. Part number

Example: TMPxxxxxF TMPxxxxxFG

All references to the previous part number were left unchanged in body text. The new part number is indicated on the prelims pages (cover page and this notification).

2. Package code and package dimensions

Example: LQFP100-P-1414-0.50C LQFP100-P-1414-0.50F

All references to the previous package code and package dimensions were left unchanged in body text. The new ones are indicated on the prelims pages.

3. Addition of notes on lead solderability

Now that the device is Pb-free, notes on lead solderability have been added.

4. RESTRICTIONS ON PRODUCT USE

The previous (obsolete) provision might be left unchanged on page 1 of body text. A new replacement is included on the next page.

5. Publication date of the datasheet

The publication date at the lower right corner of the prelims pages applies to the new device.

1. Part number
2. Package code and dimensions

Previous Part Number (in Body Text)	Previous Package Code (in Body Text)	New Part Number	New Package Code	OTP
TMP47P201VP	P-DIP16-300-2.54A	TMP47P201VPG	DIP16-P-300-2.54A	—

*: For the dimensions of the new package, see the attached Package Dimensions diagram.

3. Addition of notes on lead solderability

The following solderability test is conducted on the new device.

Lead solderability of Pb-free devices (with the G suffix)

Test	Test Conditions	Remark
Solderability	(1) Use of Lead (Pb) ·solder bath temperature = 230°C ·dipping time = 5 seconds ·the number of times = once ·use of R-type flux (2) Use of Lead (Pb)-Free ·solder bath temperature = 245°C ·dipping time = 5 seconds ·the number of times = once ·use of R-type flux	Leads with over 95% solder coverage till lead forming are acceptable.

4. RESTRICTIONS ON PRODUCT USE

The following replaces the “RESTRICTIONS ON PRODUCT USE” on page 1 of body text.

RESTRICTIONS ON PRODUCT USE

20070701-EN

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- For a discussion of how the reliability of microcontrollers can be predicted, please refer to Section 1.3 of the chapter entitled Quality and Reliability Assurance/Handling Precautions.

5. Publication date of the datasheet

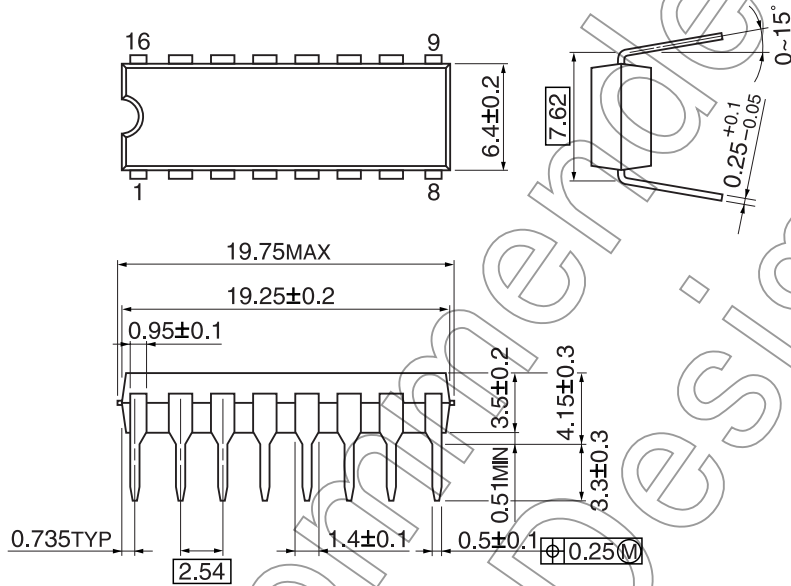
The publication date of this datasheet is printed at the lower right corner of this notification.

(Annex)

Package Dimensions

DIP16-P-300-2.54A

Unit: mm



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CMOS 4-Bit Microcontroller

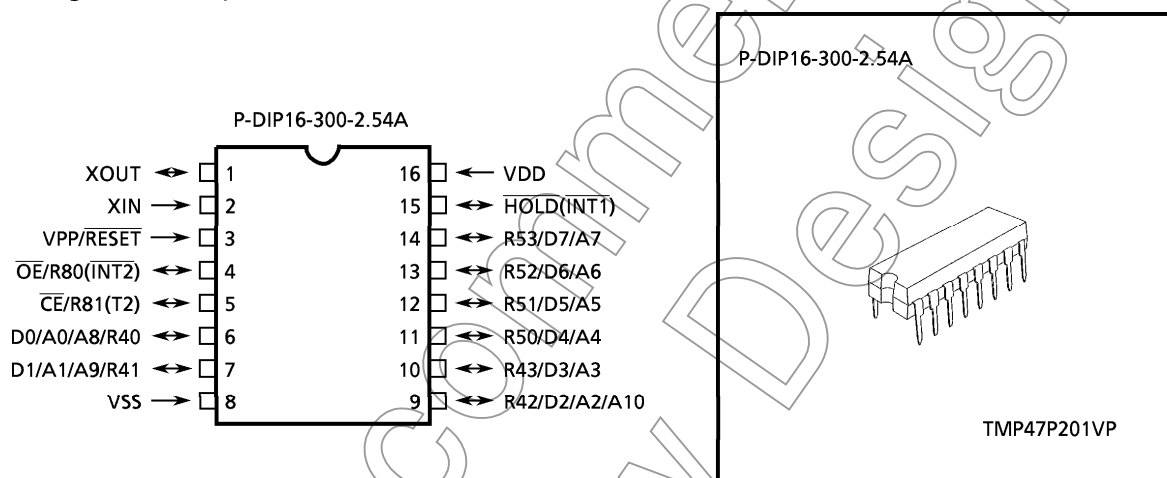
TMP47P201VP

The TMP47P201V is the system evaluation LSI of TMP47C101/201 with a 16 Kbit one-time PROM. The TMP47P201V programs / verifies using an adapter socket to connect with PROM programmer, as it is in TMM27256AD.

In addition, the TMP47P201V and the TMP47C101/201 are pin compatible. The TMP47P201V operates as the same as the TMP47C101/201 by programming to the internal PROM.

Part No.	ROM	RAM	Package	Adapter Socket
TMP47P201VP	OTP 2048 x 8-bit	128 x 4-bit	P-DIP16-300-2.54A	BM1187

Pin Assignment (Top View)



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Pin Function

The TMP47P201V has MCU mode and PROM mode.

(1) MCU mode

The TMP47C101/201 and the TMP47P201V 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	R40
D1 / A1 / A9			R41
D2 / A2 / A10			R42
D3 / A3			R43
D4 / A4			R50
D5 / A5			R51
D6 / A6			R52
D7 / A7			R53
\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
HOLD	Input	PROM mode setting pin. Be fixed to low level.	\overline{HOLD}
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 TMP47P201V. The TMP47P201V is the same as the TMP47C101/201 except that an OTP is used instead of a built-in mask ROM.

1. Operation mode

The TMP47P201V 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 TMP47C101/201. In the TMP47P201V, RC oscillation is impossible.

1.1.1 Program Memory

The program storage area is the same as for the TMP47C201. Don't use the addresses 400 to 7FF_H when using the TMP47P101V to check TMP47C101 operation.

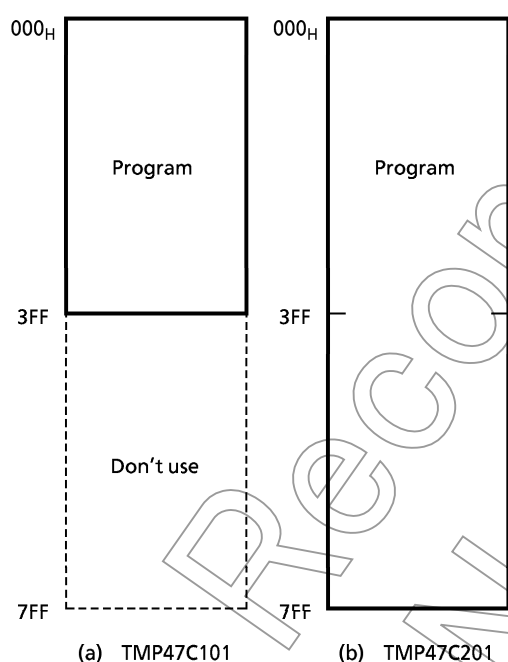


Figure 1-1. Program Area

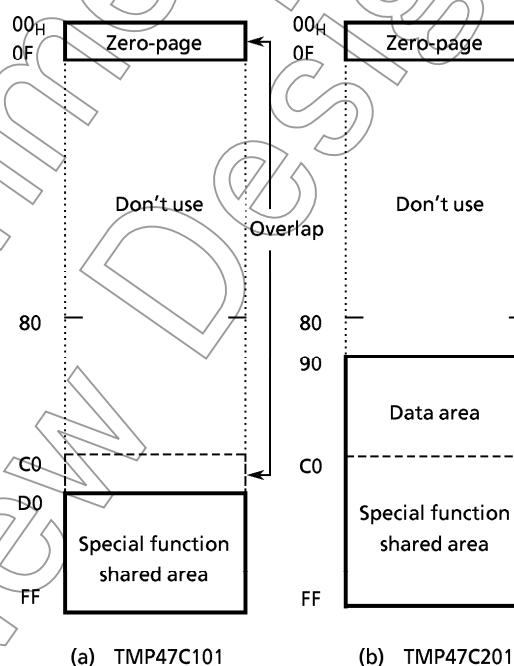


Figure 1-2. RAM Address Assignment

1.1.2 Data Memory

The TMP47P201V has 128×4-bit of data memory (RAM). When the TMP47P201V is used as the TMP47C101/201 evaluator, programming should be performed assuming that the RAM is assigned to address 00 to 0F_H and D0 to FF_H for TMP47C101, and 00 to 0F_H and 90 to FF_H for TMP47C201 as show in Figure 1-2. When the BM4721A (emulator) is used as the TMP47C101/201 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 TMP47C101.

1.1.3 Input/Output Circuitry

(1) Control pins

This is the same as I/O code FA of the TMP47C101/201. In the TMP47P201V, 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 TMP47P201V is the same as I/O code FA or FD of the TMP47C101/201.

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

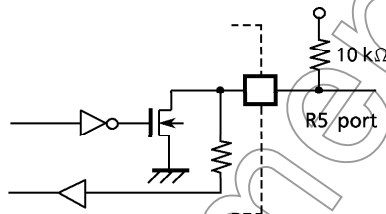


Figure 1-3. I/O code and external circuitry

1.2 PROM mode

The TMP47P201V 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 TMP47P201V, 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.

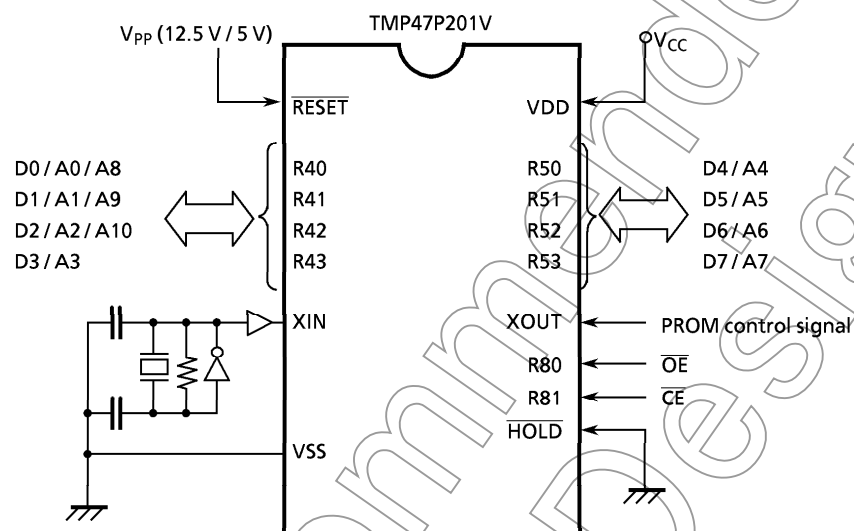


Figure 1-4. Setting for PROM mode

1.2.1 Program Writing

When writing a program, set a ROM type to "27256A" (programming voltage: 12.5 V) . Since the TMP47P201V 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 $V_{CC} = V_{PP} = 5 V$.

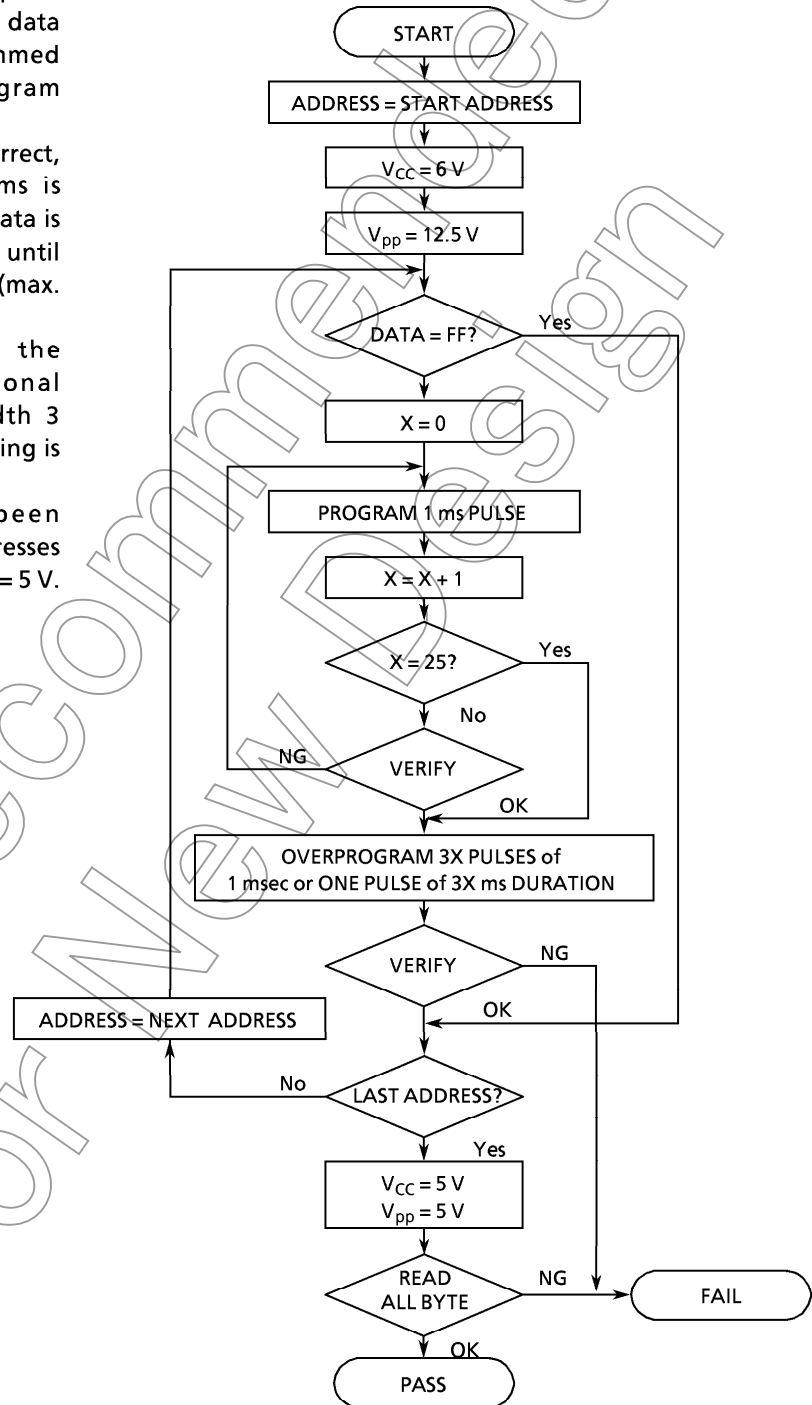


Figure 1-4. Flowchart

Electrical Characteristics

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

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}	Ports R5, R8, HOLD	3.2	
Output Current (Total)	ΣI_{OUT}	Port R4	60	mA
Power Dissipation [$T_{opr} = 70^\circ\text{C}$]	PD		300	mW
Soldering Temperature (time)	Tsld		260 (10s)	$^\circ\text{C}$
Storage Temperature	Tstg		-55 to 125	$^\circ\text{C}$
Operating Temperature	T_{opr}		-30 to 70	$^\circ\text{C}$

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

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		
			HOLD mode	2.0		
Input High Voltage	V_{IH1}	Except Hysteresis Input	In the normal operating area	$V_{DD} \times 0.7$	V_{DD}	V
	V_{IH2}	Hysteresis Input		$V_{DD} \times 0.75$		
	V_{IH3}			In the HOLD mode		
Input Low Voltage	V_{IL1}	Except Hysteresis Input	In the normal operating area	0	$V_{DD} \times 0.3$	V
	V_{IL2}	Hysteresis Input			$V_{DD} \times 0.25$	
	V_{IL3}				In the HOLD mode	
Clock Frequency	f_c	XIN, XOUT	$V_{DD} = 4.5\text{ to }5.5\text{ V}$	0.4	6.0	MHz
			$V_{DD} = 2.7\text{ to }5.5\text{ V}$		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
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 $2.8\text{ V}/0.2\text{ V}$ ($V_{DD} = 3.0\text{ V}$)

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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}	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

 $(V_{SS} = 0\text{ V}, V_{DD} = 2.7\text{ to }5.5\text{ V}, T_{opr} = -30\text{ to }70^{\circ}\text{C})$

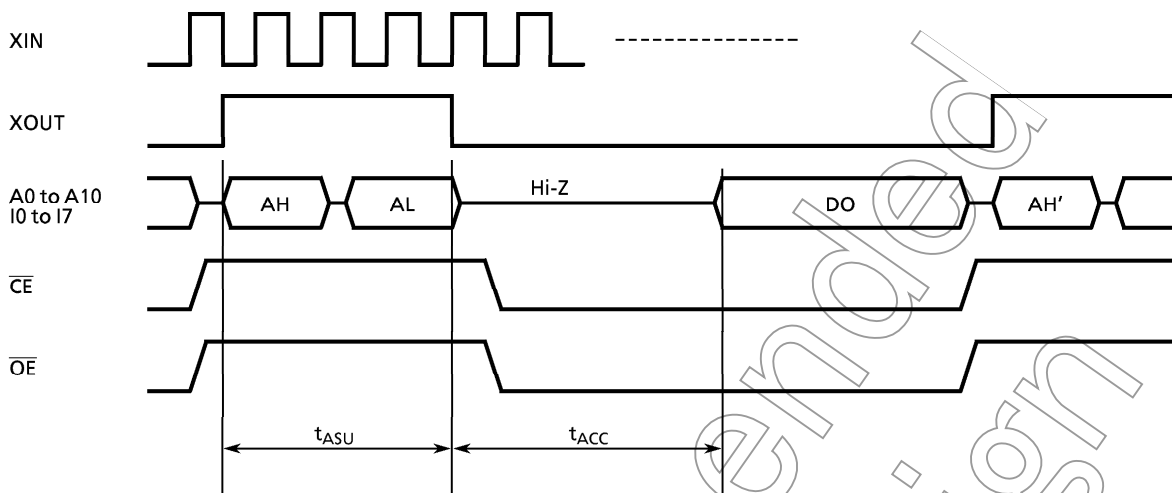
Recommended oscillating conditions of the TMP47P201V are equal to the TMP47C101/201's but RC oscillation is impossible.

DC/AC Characteristics

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

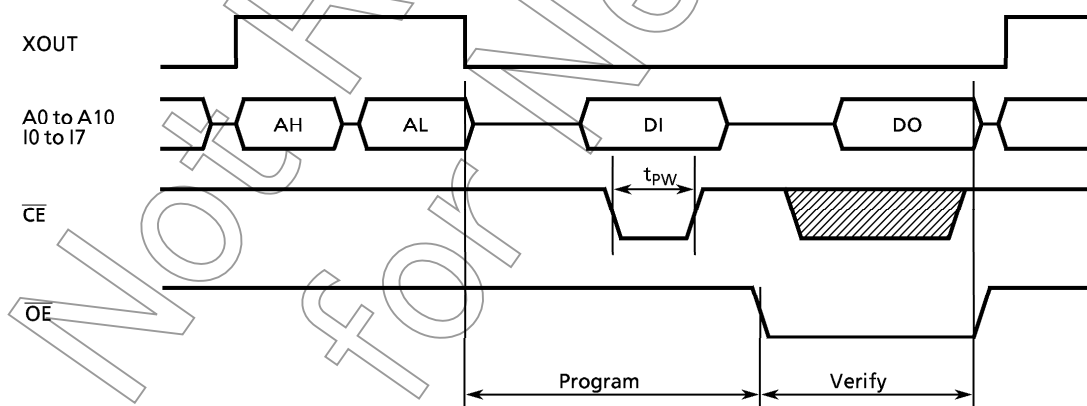
(1) Read Operation

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 Set-up Time	t_{ASU}		350	-	-	ns
Address Access Time	t_{ACC}	$V_{CC} = 5.0 \pm 0.25\text{ V}$	-	-	300	ns



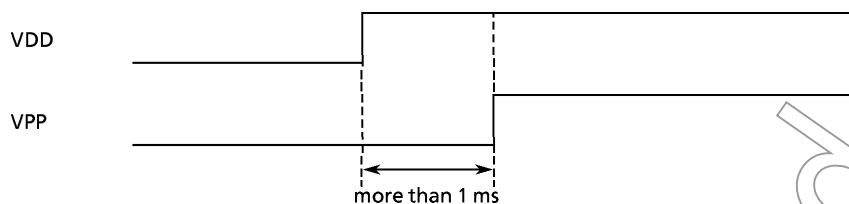
(2) High Speed Programming Operation

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}		12.00	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



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 TMP47P201V, 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.*



Recommend EPROM programmer

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

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