TOSHIBA

TOSHIBA Original CMOS 4-Bit Microcontroller

TLCS-47 Series

TMP47P202VPG
TMP47P202VMG

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: TMPxxxxxxF → TMPxxxxxxFG

   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
TMP47P202VP	P-DIP20-300-2.54A	TMP47P202VPG	DIP20-P-300-2.54A	—
TMP47P202VM	P-SOP20-300-1.27	TMP47P202VMG	SOP20-P-300-1.27	—

*: 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

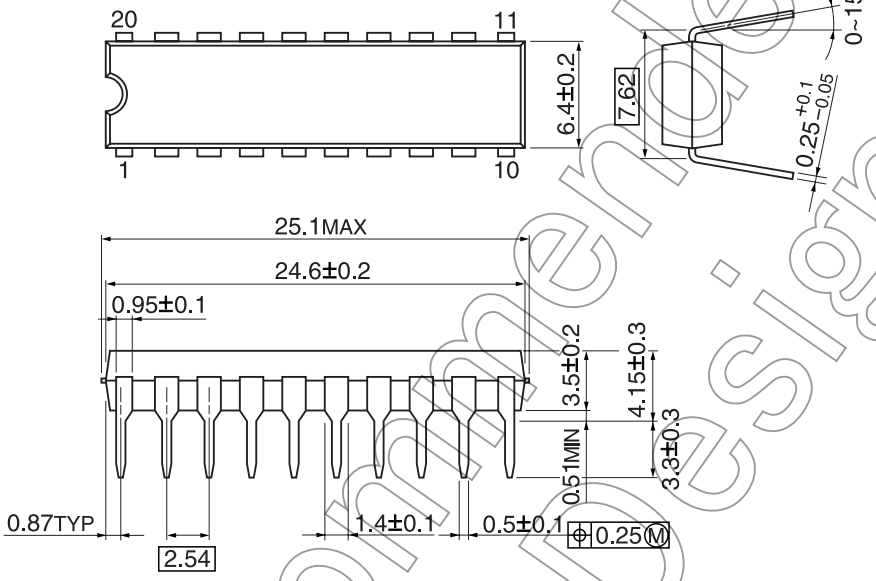
The publication date of this datasheet is printed at the lower right corner of this notification.

(Annex)

Package Dimensions

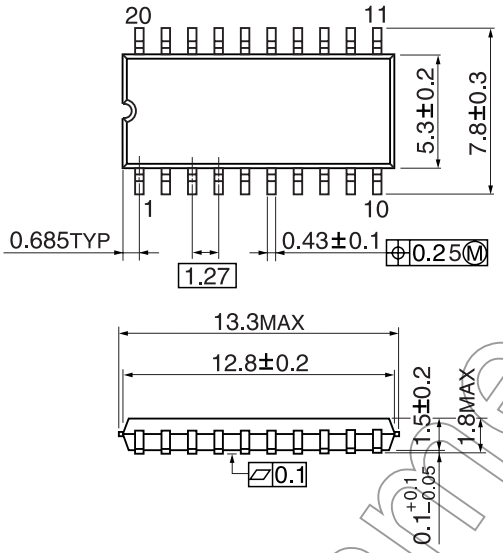
DIP20-P-300-2.54A

Unit: mm



SOP20-P-300-1.27

Unit: mm



CMOS 4-Bit Microcontroller

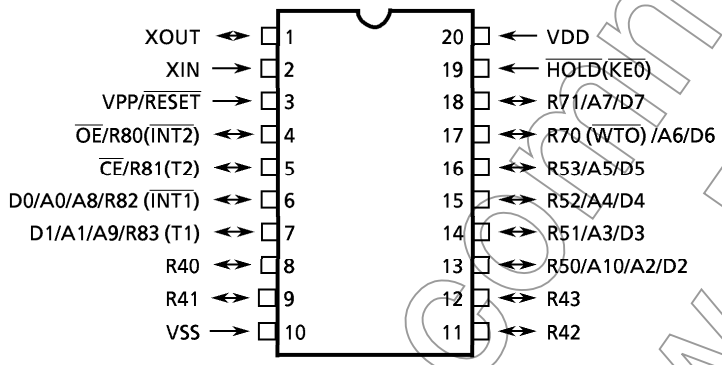
TMP47P202VP
TMP47P202VM

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.

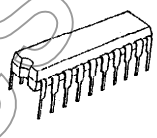
Part No.	ROM	RAM	Package	OTP
TMP47P202VP	OTP 2048 × 8-bit	128 × 4-bit	P-DIP20-300-2.54A	BM1187
TMP47P202VM			P-SOP20-300-1.27	BM11113

Pin Assignment (Top View)

P-DIP20-300-2.54A / P-SOP20-300-1.27

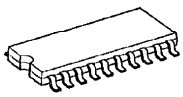


P-DIP20-300-2.54A



TMP47P202VP

P-SOP20-300-1.27



TMP47P202VM

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.

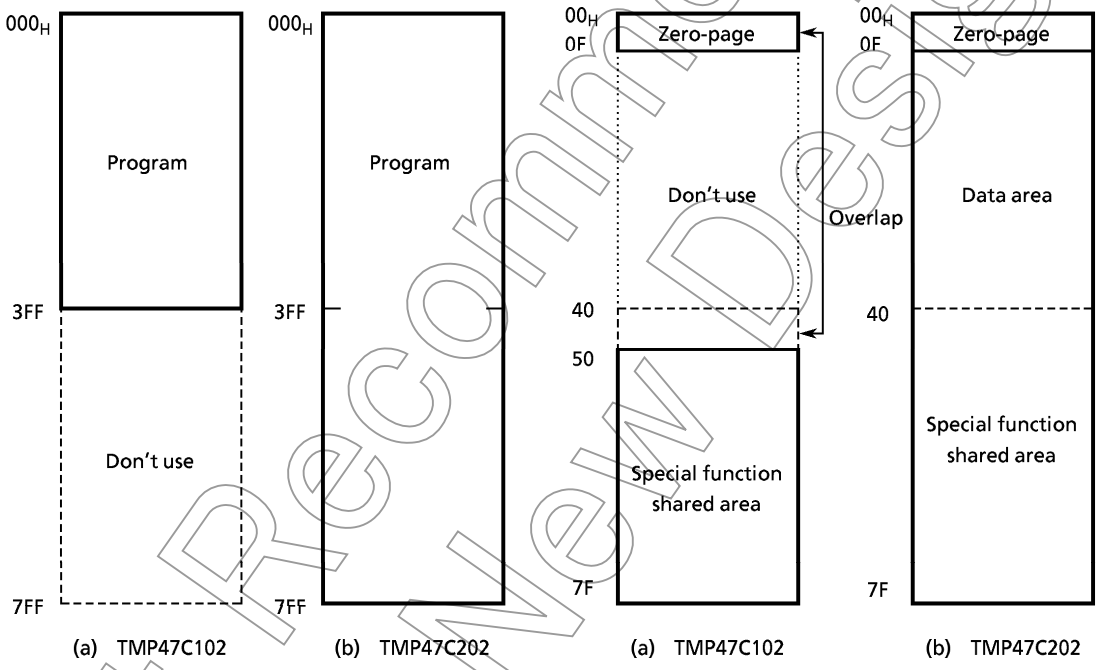


Figure 1-1. Program Area

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 extrernal clcok 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).

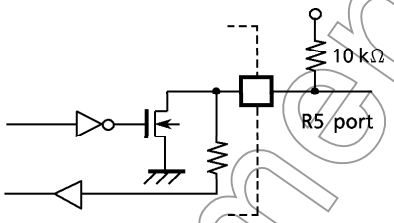


Figure 1-3. I/O code and external circuitry (Cordes FB, FE)

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.

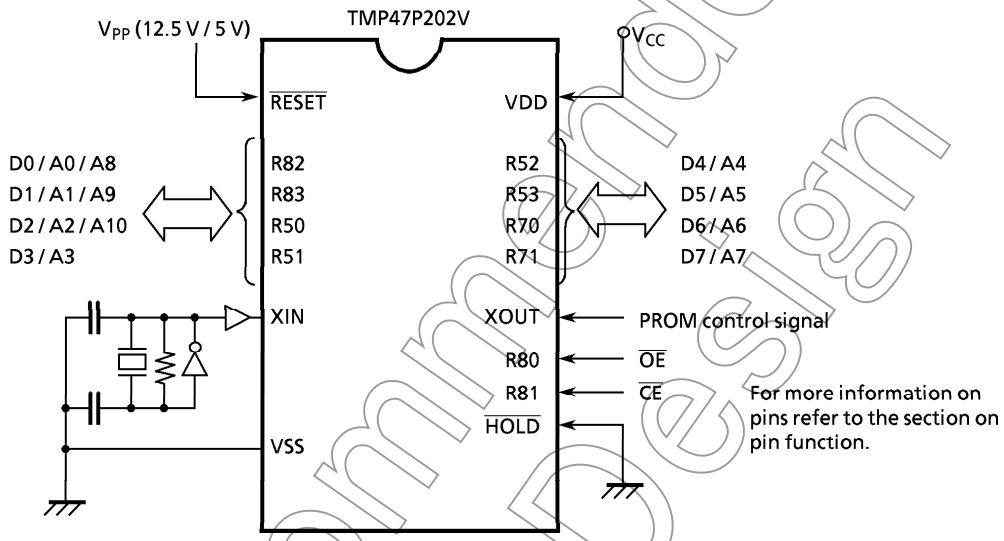


Figure 1-4. Setting for PROM mode

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.

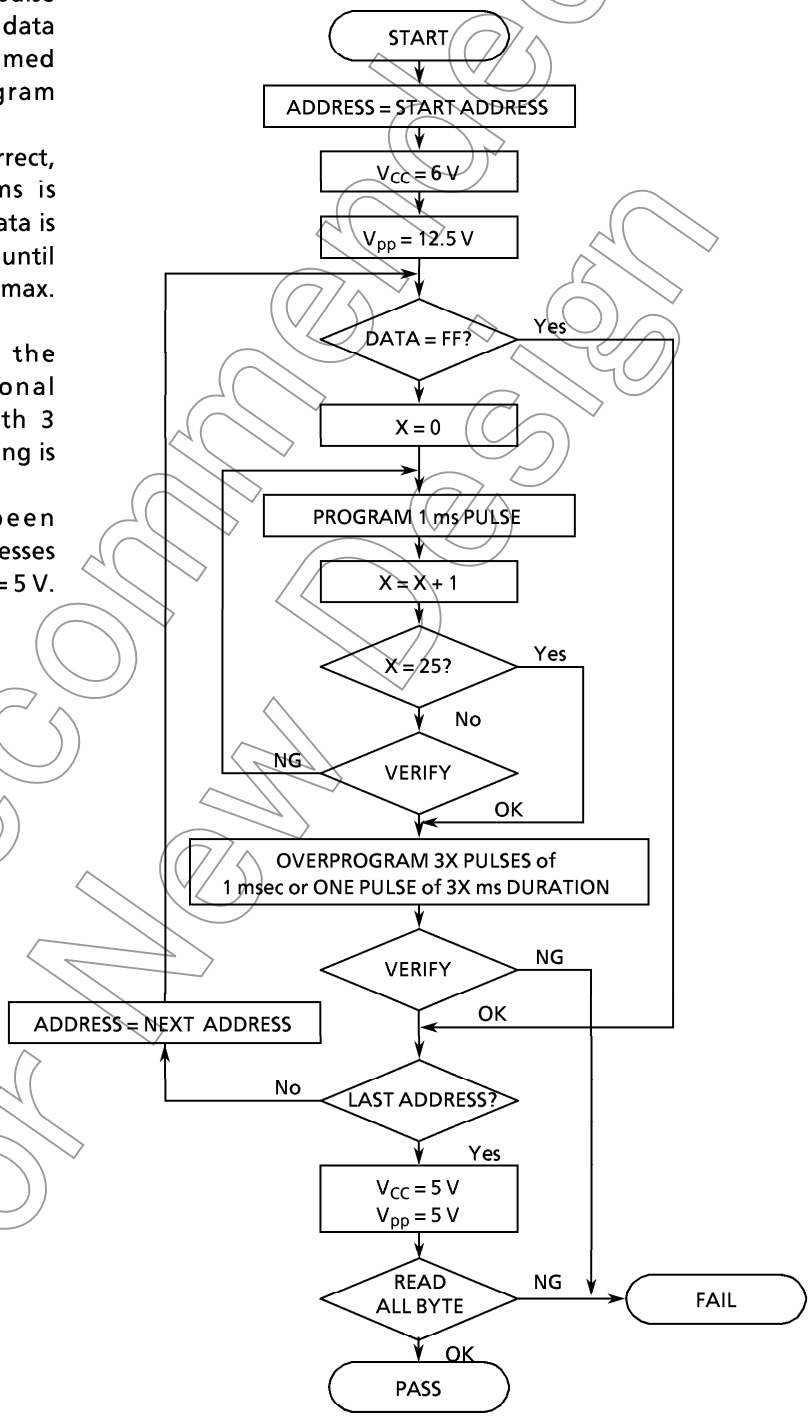


Figure 1-5. Flowchart

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}	$\overline{\text{RESET}}$ / 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)	ΣI_{OUT}	Port R4, R5	60	mA
Power Dissipation [Topr = 70°C]	PD		300	mW
Soldering Temperature (time)	Tsld		260 (10 s)	°C
Storage Temperature	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 Operating 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		
			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 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}	$\overline{RESET}$, $\overline{HOLD}$	V_{DD} = 5.5 V, V_{IN} = 5.5 V / 0 V	–	–	± 2	μA
	I_{IN2}	Open drain output ports					
Input Resistance	R_{IN}	$\overline{RESET}$		100	220	450	kΩ
Output Leakage Current	I_{LO}	Open drain output ports	V_{DD} = 5.5 V, V_{OUT} = 5.5 V	–	–	2	μA
Output Low Voltage	V_{OL}	Except XOUT and port R4	V_{DD} = 4.5 V, I_{OL} = 1.6 mA	–	–	0.4	V
Output Low Current	I_{OL1}	Port R4	V_{DD} = 4.5 V, V_{OL} = 1.0 V	–	20	–	mA
	I_{OL2}	Port R5		–	7	–	
Supply Current (in the Normal operating mode)	I_{DD}		V_{DD} = 5.5 V, fc = 4 MHz	–	2	4	mA
			V_{DD} = 3.0 V, fc = 4 MHz	–	1	2	
			V_{DD} = 3.0 V, fc = 400 kHz	–	0.5	1	
Supply Current (in the HOLD operating 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.

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

AC Characteristics

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

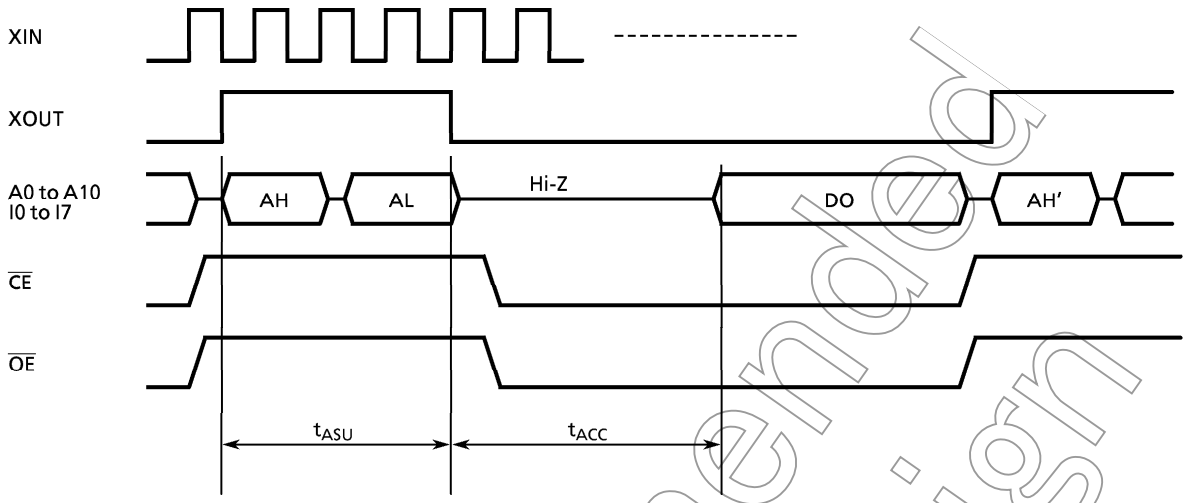
Recommended oscillating conditions of the TMP47P202V are equal to the TMP47C102/202's but RC oscillation is impossible.

DC/AC Characteristics

(V_{SS} = 0 V)

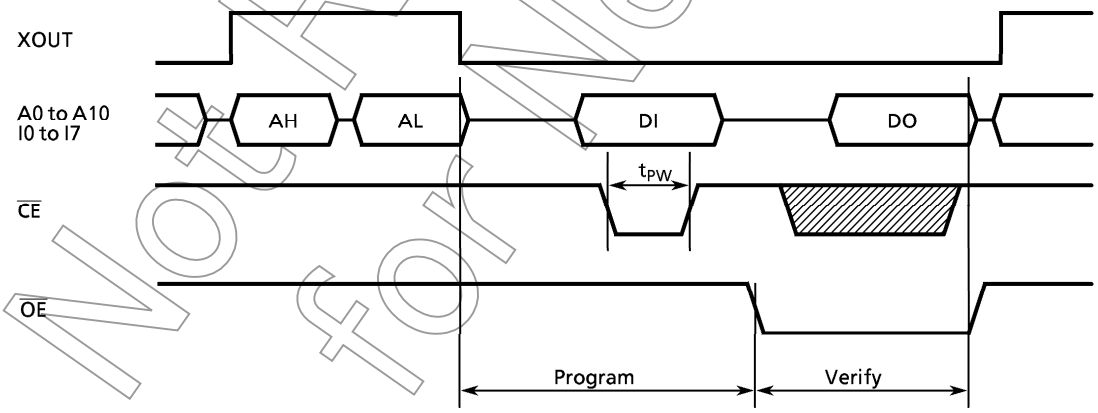
(1) Read Operation

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



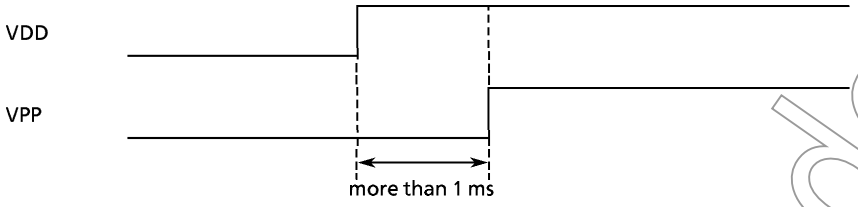
(2) High Speed Programming Operation

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 ± 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 PROMprogrammer 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)