

**TOSHIBA**

TOSHIBA Original CMOS 4-Bit Microcontroller

**TLCS-47 Series**

TMP47P206VMG

TMP47P206VPG

**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
TMP47P206VP	P-DIP20-300-2.54A	TMP47P206VPG	DIP20-P-300-2.54A	—
TMP47P206VM	P-SOP20-300-1.27	TMP47P206VMG	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

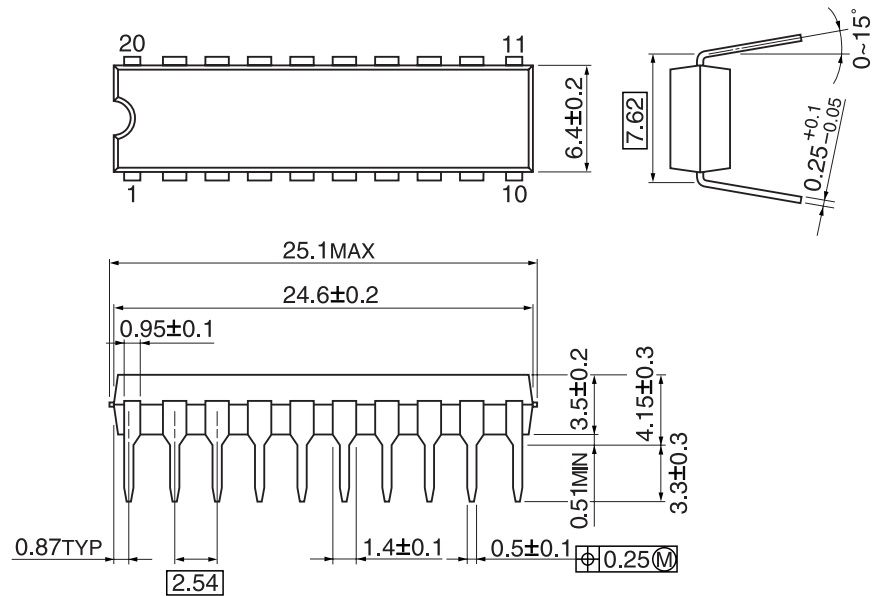
The publication date of this datasheet is printed at the lower right corner of this notification.

(Annex)

Package Dimensions

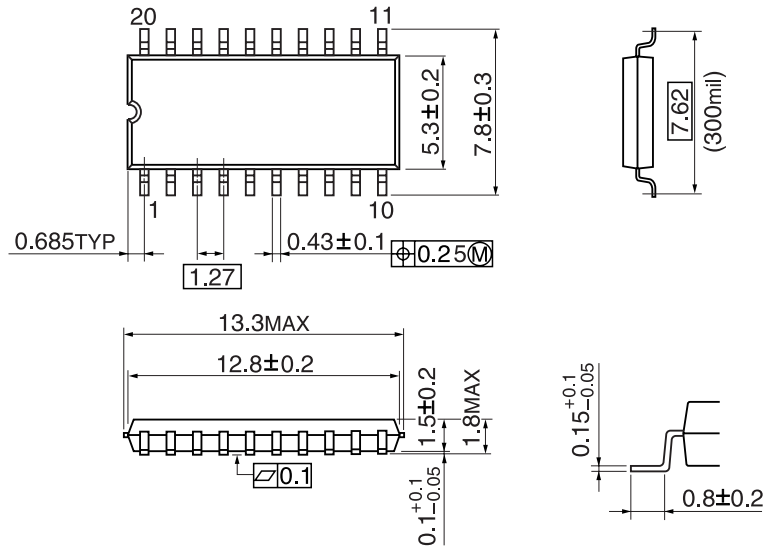
DIP20-P-300-2.54A

Unit: mm



SOP20-P-300-1.27

Unit: mm



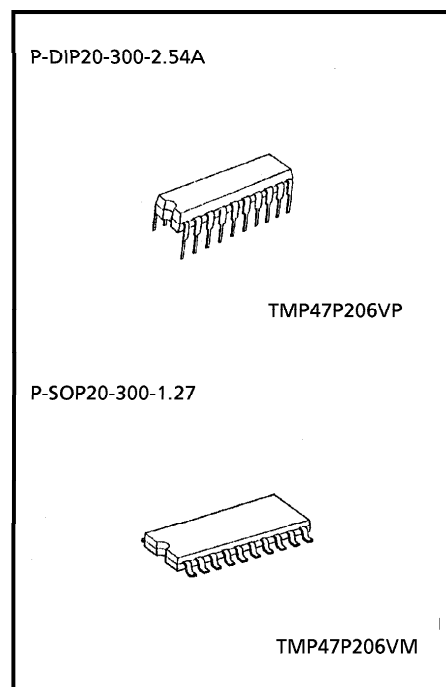
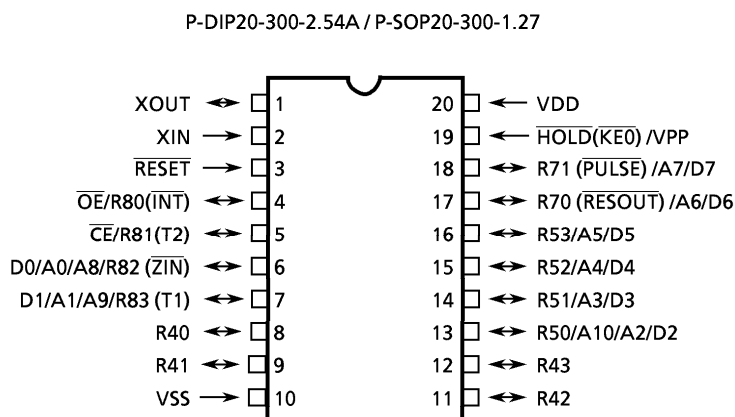
CMOS 4-Bit Microcontroller

TMP47P206VM/P

The TMP47P206V is the OTP microcontroller with 16 Kbit PROM. For program operation, the programming is achieved by using with EPROM programmer (TC57256AD type) and adapter socket. The function of this device is exactly same as the TMP47C206.

Part No.	ROM	RAM	Package	OTP
TMP47P206VP	OTP	128 x 4-bit	P-DIP20-300-2.54A	BM11125
TMP47P206VM	2048 x 8-bit		P-SOP20-300-1.27	BM11126

Pin Assignment (Top View)



000707EBA1

- 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.
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**Pin Function**

The TMP47P206V has MCU mode and PROM mode.

## (1) MCU mode

The TMP47C206 and the TMP47P206V 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)	$\overline{HOLD}$
VCC		+ 5 V	VDD
VSS		0 V	VSS
R43 to R40	I/O	Be fixed to low level.	
$\overline{RESET}$	Input	Be fixed to non connection.	
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 TMP47P206V. The TMP47P206V is the same as the TMP47C206 except that an OTP is used instead of a built-in mask ROM.

### 1. Operation mode

The TMP47P206V has a 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 TMP47C206. In the TMP47P206V, RC oscillation is impossible.

##### 1.1.1 Program Memory

The program storage area is the same as for the TMP47C206.

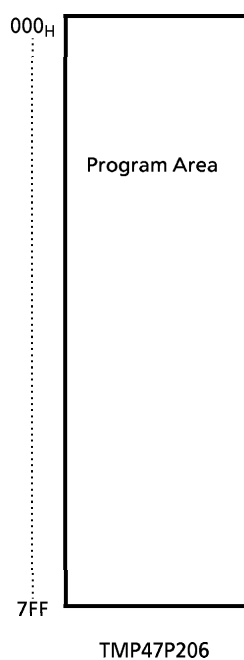


Figure 1-1. Program Area

##### 1.1.2 Data Memory

The TMP47P206V has 128 × 4-bit of data memory (RAM).



### 1.1.3 Input / Output Circuitry

- (1) Control pins  
This is the same as I/O code FB of the TMP47C206. In the TMP47P206V, RC oscillator is impossible. Connecting the resonator is required when using as evaluator of I/O code FE.
- (2) I/O Ports  
The input / output circuit of the TMP47P206V is the same as the TMP47C206.

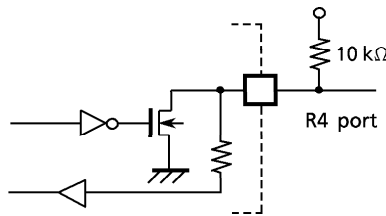


Figure 1-2. I/O code and external circuitry

### 1.2 PROM mode

The TMP47P206V 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 being attached. With the TMP47P206V, 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.

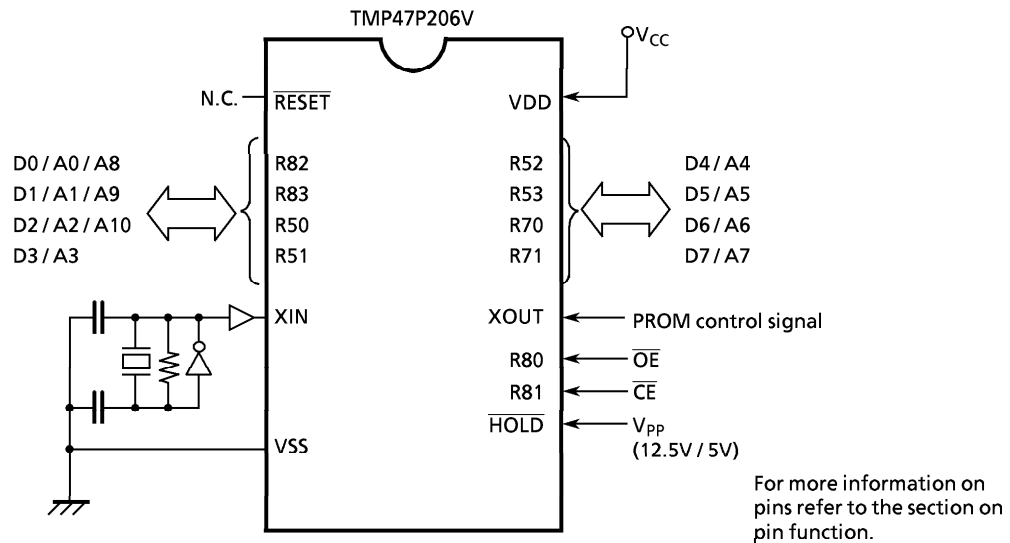


Figure 1-3. Setting for PROM mode

#### 1.2.1 Program Writing

When writing a program, set a ROM type to "TC57256AD" (programming voltage: 12.5 V). Since the TMP47P206V has a 2048 × 8-bit internal PROM (000 to 7FF<sub>H</sub>), set a stop address of a PROM writer to "7FF<sub>H</sub>". Please use a general-purpose PROM writer which does not have an electric signature mode or can release from it.

### 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  $V_{CC} = 6\text{ V}$  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  $V_{CC} = V_{PP} = 5\text{ V}$ .

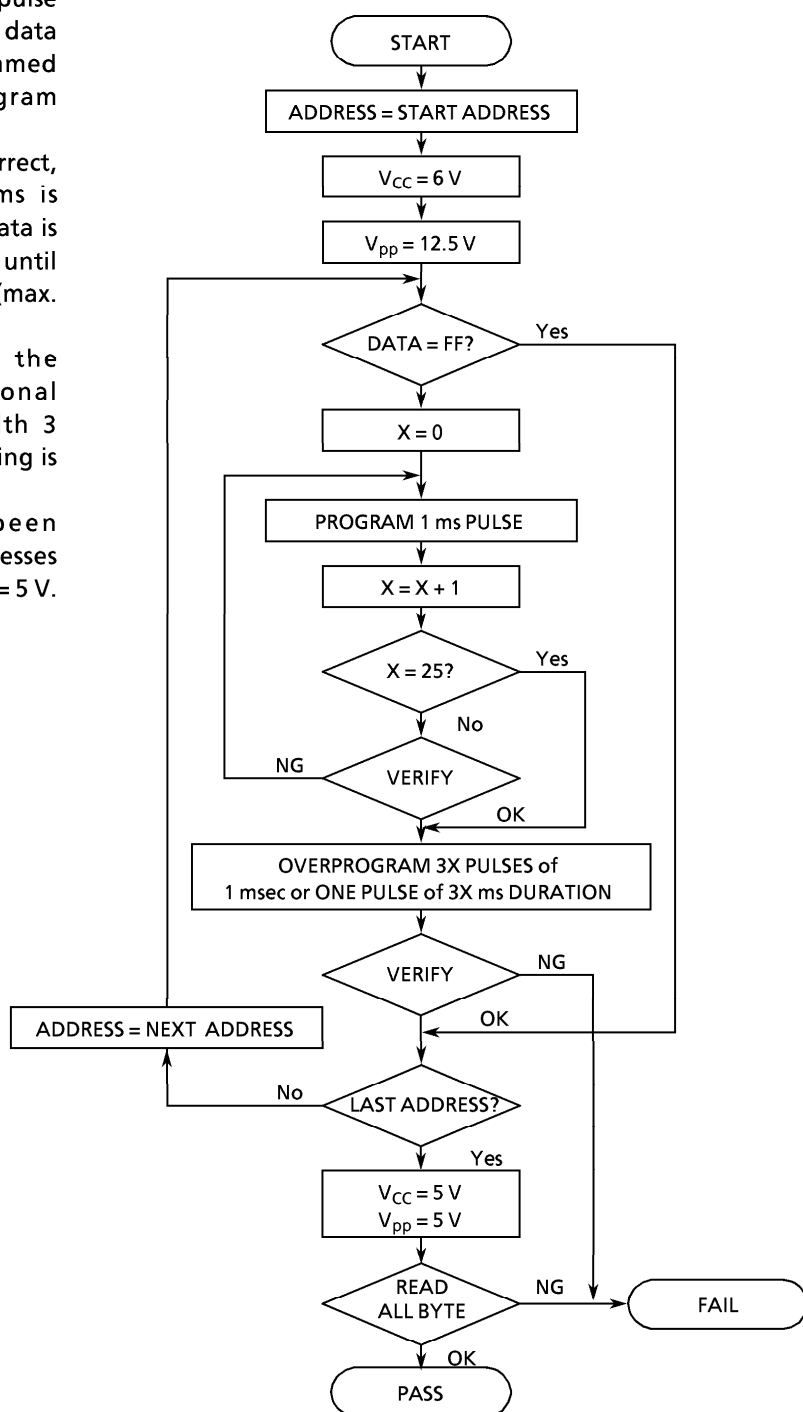


Figure 1-4. Flowchart

## 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 6.5	V
Program Voltage	V <sub>PP</sub>	HOLD / V <sub>PP</sub>	- 0.3 to 13.0	V
Input Voltage	V <sub>IN</sub>		- 0.3 to V <sub>DD</sub> + 0.3	V
Output Voltage	V <sub>OUT</sub>		- 0.3 to V <sub>DD</sub> + 0.3	V
Output Current (Per 1 pin)	I <sub>OUT1</sub>	Port R4, R50	30	mA
	I <sub>OUT2</sub>	Port R51 to 53, R8, R70, R71	3.2	
Output Current (Total)	∑ I <sub>OUT1</sub>	Port R4, R50	100	mA
	∑ I <sub>OUT2</sub>	Port R51 to 53, R8, R70, R71	28.8	
Power Dissipation [T <sub>opr</sub> = 85°C]	PD	SOP	150	mW
		DIP	250	
Soldering Temperature (time)	T <sub>sld</sub>		260 (10 s)	°C
Storage Temperature	T <sub>stg</sub>		- 55 to 125	°C
Operating Temperature	T <sub>opr</sub>		- 40 to 85	°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, T<sub>opr</sub> = - 40 to 85°C)

Parameter	Symbol	Pins	Conditions	Min	Max	Unit	
Supply Voltage	V <sub>DD</sub>	Normal mode	Crystar or ceramic	f <sub>c</sub> = 8 MHz	4.0 (2.7) *2	5.7	V
			RC	f <sub>c</sub> = 4.2 MHz	4.0 (2.2) *2		
				f <sub>c</sub> = 2.5 MHz	4.0 (2.2) *2		
		HOLD mode	-	-	4.0 (2.0) *2		
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	f <sub>c</sub>	XIN, XOUT	V <sub>DD</sub> = 2.7 to 5.7 V	1	8	MHz	
			V <sub>DD</sub> = 2.2 to 5.7 V		4.2		

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: LVD is initially enable and initial Min. V<sub>DD</sub> is 4.0 V. After LVD is disabled above 4.0 V. Min. V<sub>DD</sub> will be 2.7 or 2.2 to 2.0 V.

## DC Characteristics

(V<sub>SS</sub> = 0 V, T<sub>opr</sub> = -40 to 85°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> (Note 1)	$\overline{\text{RESET}}$ , $\overline{\text{HOLD}}$	V <sub>DD</sub> = 5.7 V, V <sub>IN</sub> = 5.7 V / 0 V	-	-	± 2	μA
	I <sub>IN2</sub>	Open drain output ports					
Input Resistance	R <sub>IN</sub>	$\overline{\text{RESET}}$		100	220	450	kΩ
Pull down Resistance	R <sub>PD</sub>	R82		22	70	160	
Input Low Current	I <sub>IL</sub>	Push-pull output ports	V <sub>DD</sub> = 5.7 V, V <sub>IN</sub> = 0.4 V	-	-	-2	mA
Output Leakage Current	I <sub>LO</sub>	Open drain output ports	V <sub>DD</sub> = 5.7 V, V <sub>OUT</sub> = 5.7 V	-	-	2	μA
Output High Voltage	V <sub>OH</sub>	Push-pull output ports	V <sub>DD</sub> = 5 V, I <sub>OH</sub> = -100 μA	4.8	-	-	V
			V <sub>DD</sub> = 4.5 V, I <sub>OH</sub> = -200 μA	2.4	-	-	
			V <sub>DD</sub> = 2.2 V, I <sub>OH</sub> = -5 μA	2.0	-	-	
Output Low Voltage	V <sub>OL1</sub>	Port R8, R7, R51 to 53	V <sub>DD</sub> = 4.5 V, I <sub>OL</sub> = 3.3 mA	-	-	1.0	V
			V <sub>DD</sub> = 4.5 V, I <sub>OL</sub> = 1.6 mA	-	-	0.4	
			V <sub>DD</sub> = 2.2 V, I <sub>OL</sub> = 20 μA	-	-	0.1	
	V <sub>OL2</sub>	Port R4, R50	V <sub>DD</sub> = 4.5 V, I <sub>OL</sub> = 15 mA	-	-	1.0	
			V <sub>DD</sub> = 4.5 V, I <sub>OL</sub> = 7 mA	-	-	0.4	
			V <sub>DD</sub> = 2.2 V, I <sub>OL</sub> = 50 μA	-	-	0.1	
Output Low Current	I <sub>OL1</sub>	Port R8, R7, R51 to 53	V <sub>DD</sub> = 4.5 V, V <sub>OL</sub> = 0.4 V	1.6	-	-	mA
			V <sub>DD</sub> = 4.5 V, V <sub>OL</sub> = 1.0 V	15	-	-	
	I <sub>OL2</sub>	Port R4, R50	V <sub>DD</sub> = 4.5 V, V <sub>OL</sub> = 0.4 V	7	17	-	
Supply Current (in the Normal operating mode) (Note 2)	I <sub>DD</sub>		V <sub>DD</sub> = 5.7 V, f <sub>c</sub> = 8 MHz	-	3	6	mA
			V <sub>DD</sub> = 5.7 V, f <sub>c</sub> = 4 MHz	-	2	4	
			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> = 1 MHz	-	0.6	1.2	
Supply Current (in the HOLD operating mode) (Note 2)	I <sub>DDH</sub>	LVD always Enable	V <sub>DD</sub> = 5.7 V	-	50	200	μA
		LVD On and Off	V <sub>DD</sub> = 5.7 V	-	2.5	20	
Injection Current	I <sub>ZC</sub>	R82		-	-	1	mA

## &lt; General Conditions &gt;

Typ. values show those at T<sub>opr</sub> = 25°C, V<sub>DD</sub> = 5 V.Note 1: Input Current I<sub>IN1</sub>: The current through resistor is not included.Note 2: Supply Current: V<sub>IN</sub> = 5.5 V / 0.2 V (V<sub>DD</sub> = 5.7 V) or 2.8 V / 0.2 V (V<sub>DD</sub> = 3.0 V)

AC Characteristics

(V<sub>SS</sub> = 0 V, Topr = -40 to 85°C)

Parameter	Symbol	Conditions	Min	Typ.	Max	Unit	
Instruction Cycle Time	t <sub>cy</sub>	V <sub>DD</sub> = 2.7 to 5.7 V	1.0	-	8	μs	
		V <sub>DD</sub> = 2.2 to 5.7 V	1.9				
High level Clock pulse Width	t <sub>WCH</sub>	For external clock operation	V <sub>DD</sub> ≥ 2.7 V	-	-	ns	
Low level Clock pulse Width	t <sub>WCL</sub>		V <sub>DD</sub> < 2.7 V				120
			V <sub>DD</sub> ≥ 2.7 V				60
			V <sub>DD</sub> < 2.7 V				120
Delay Reset Output Signal	t <sub>rd</sub>	f <sub>c</sub> = 1 MHz	-	-	16	μs	

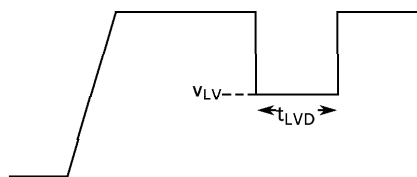
Low Voltage Detector Characteristics

(V<sub>SS</sub> = 0 V, Topr = -40 to 85°C)

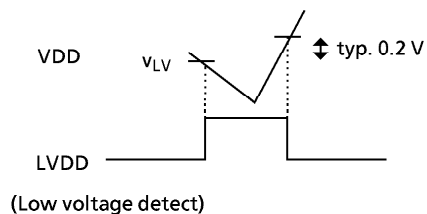
Parameter	Symbol	Conditions	Min	Typ.	Max	Unit
LVD interval time (Note 1)	t <sub>int</sub>		8.5	-	128	ms
LVD Enable time (Note 1)	t <sub>en</sub>		100	-	-	μs
LVD pulse width (Note 1, 2)	t <sub>LVD</sub>		50	-	-	μs
Detection Voltage (Note 3)	V <sub>LV</sub>	LVD <sub>DTY</sub> = 0 LVDD = 0	2.7	3.3	3.8	V
		LVD <sub>DTY</sub> = 1 LVDD = 0	2.2	2.7	3.3	
LVD Operating Voltage (Note 1)	V <sub>LVD</sub>		2.0	-	-	V

Note 1: These parameters are characterized but not tested.

Note 2: Less than Min. t<sub>LVD</sub>, CPU will not be reset.



Note 3: Detection voltage has typ. 0.2 V hysteresis.

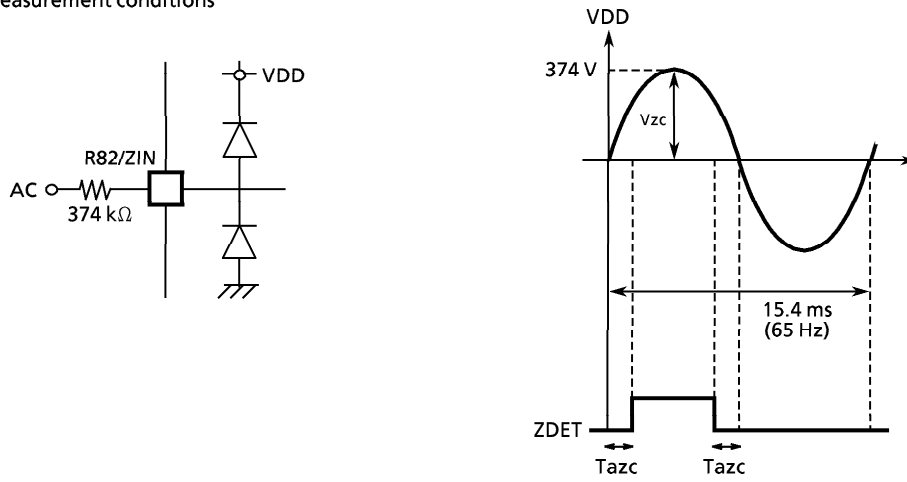


Zero-Cross Detection Characteristics

( $V_{SS} = 0\text{ V}$ ,  $T_{opr} = -40\text{ to }85^\circ\text{C}$ )

Parameter	Symbol	Conditions	Min	Typ.	Max	Unit
Zero-cross Accuracy	T <sub>ztc</sub>	f <sub>zc</sub> = 45 to 65 Hz (*)			90	μs
Injection Current	I <sub>zc</sub>				1	mA
Pull-down resistance	R <sub>PD</sub>		22	70	160	kΩ

(\*) Measurement conditions



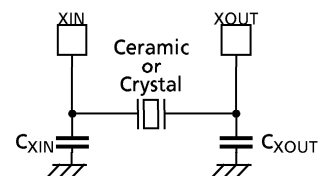
## Recommended Oscillating Conditions

(V<sub>SS</sub> = 0 V, V<sub>DD</sub> = 2.2 to 5.7 V, Topr = -40 to 85°C)

Recommended oscillating conditions of the TMP47P206V are equal to the TMP47C206's but RC oscillation is impossible.

## (1) 8 MHz

Ceramic Resonator

CSA8.00MGU (MURATA) C<sub>XIN</sub> = C<sub>XOUT</sub> = 30pFKBR-8.00MS (KYOCERA) C<sub>XIN</sub> = C<sub>XOUT</sub> = 30pFEFOEC8004A4 (NATIONAL) C<sub>XIN</sub> = C<sub>XOUT</sub> = 30pF

## (2) 6 MHz

Ceramic Resonator

CSA6.00MGU (MURATA) C<sub>XIN</sub> = C<sub>XOUT</sub> = 30pFKBR-6.00MS (KYOCERA) C<sub>XIN</sub> = C<sub>XOUT</sub> = 30pFEFOEC6004A4 (NATIONAL) C<sub>XIN</sub> = C<sub>XOUT</sub> = 30pF

## (3) 4 MHz

Ceramic Resonator

CSA4.00MGU (MURATA) C<sub>XIN</sub> = C<sub>XOUT</sub> = 30pFKBR-4.00MS (KYOCERA) C<sub>XIN</sub> = C<sub>XOUT</sub> = 30pFEFOEC4004A4 (NATIONAL) C<sub>XIN</sub> = C<sub>XOUT</sub> = 30pF

Crystal Oscillator

204B-6F 4.0000 (TOYOCOM) C<sub>XIN</sub> = C<sub>XOUT</sub> = 20pF

## (4) 1 MHz

Ceramic Resonator

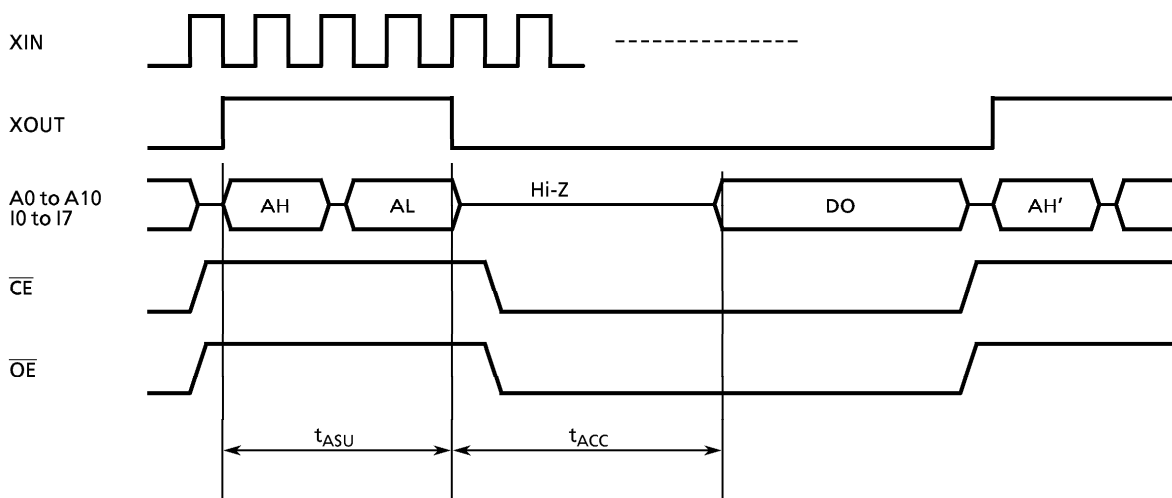
CSA1.00MGU (MURATA) C<sub>XIN</sub> = C<sub>XOUT</sub> = 30pFKBR-1.00MS (KYOCERA) C<sub>XIN</sub> = C<sub>XOUT</sub> = 30pFEFOEC1004A4 (NATIONAL) C<sub>XIN</sub> = C<sub>XOUT</sub> = 30pF

DC/AC Characteristics

(V<sub>SS</sub> = 0 V)

(1) Read Operation

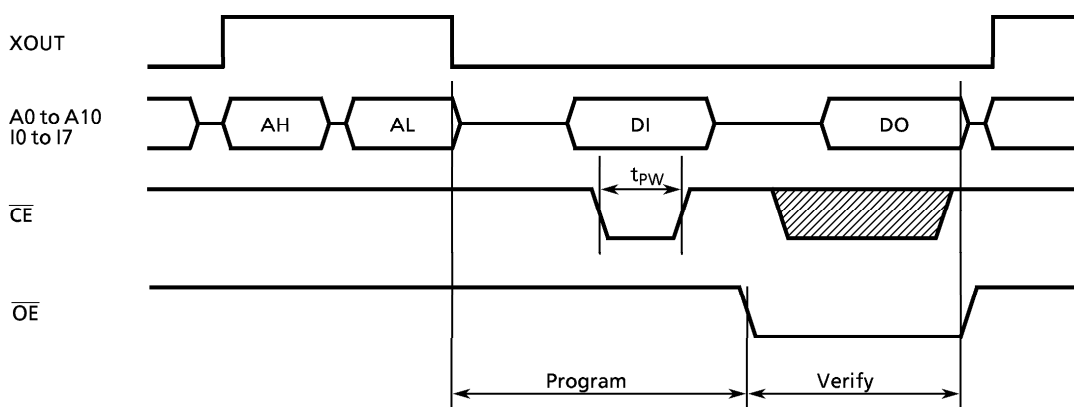
Parameter	Symbol	Condition	Min	Typ.	Max	Unit
Output Level High Voltage	V <sub>IH4</sub>		V <sub>CC</sub> × 0.7	–	V <sub>CC</sub>	V
Output Level Low Voltage	V <sub>IL4</sub>		0	–	V <sub>CC</sub> × 0.3	V
Supply Voltage	V <sub>CC</sub>		4.75	–	6.0	V
Programming Voltage	V <sub>PP</sub>					
Address Set-up Time	t <sub>ASU</sub>		350	–	–	ns
Address Access Time	t <sub>ACC</sub>	V <sub>CC</sub> = 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	$V_{PP}$		12.25	12.50	12.75	V
Programming Pulse Width	$t_{PW}$	$V_{CC} = 6.0 \pm 0.25$ V	0.095	0.1	0.105	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)