

**TOSHIBA**

**TMP47P452V**

CMOS 4-BIT MICROCONTROLLER

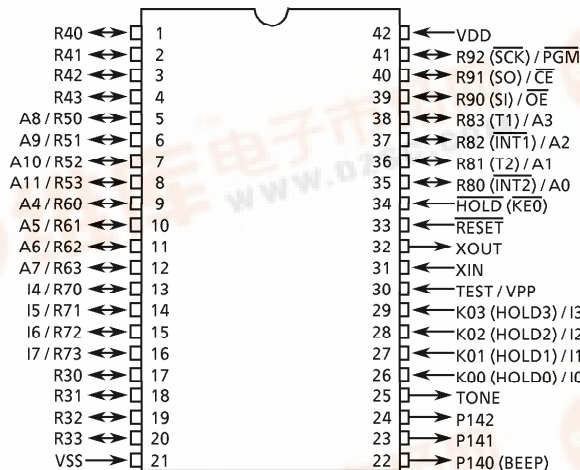
**TMP47P452VN**  
**TMP47P452VF**

The 47P452V is the OTP microcontroller with 32kbits PROM. For program operation, the programming is achieved by using with EPROM programmer (TMM2764AD type) and adapter socket (BM1120, BM1121). A.C./D.C characteristics are equivalent to Mask-programmed ROM device.

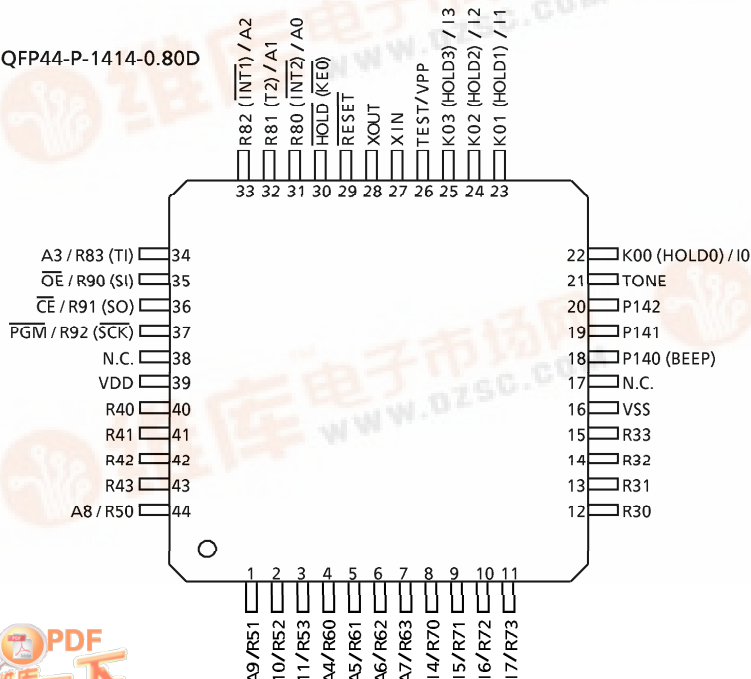
| PART No.    | ROM          | RAM         | PACKAGE            | ADAPTER SOCKET |
|-------------|--------------|-------------|--------------------|----------------|
| TMP47P452VN | OTP          | 768 × 4-bit | SDIP42-P-600-1.78  | BM1120         |
| TMP47P452VF | 4096 × 8-bit |             | QFP44-P-1414-0.80D | BM1121         |

# PIN ASSIGNMENT (TOP VIEW)

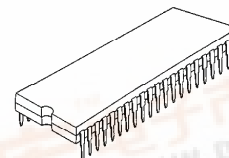
SDIP42-P-600-1.78



QFP44-P-1414-0.80D

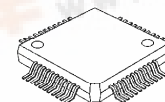


SDIP42-P-600-1.78



TMP47P452VN

QFP44-P-1414-0.80D



TMP47P452VF

## PIN FUNCTION

The 47P452V has MCU mode and PROM mode.

## (1) MCU mode

The 47C452A and the 47P452V 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) |
|---------------------------|--------------|----------------------------------------------------------|---------------------|
| A11 - A8                  | Input        | Address inputs                                           | R53 - R50           |
| A7 - A4                   |              |                                                          | R63 - R60           |
| A3 - A0                   |              |                                                          | R83 - R80           |
| I7 - I4                   | I/O          | Data inputs / outputs                                    | R73 - R70           |
| I3 - I0                   |              |                                                          | K03 - K00           |
| $\overline{\text{PGM}}$   | Input        | Program control input                                    | R92                 |
| $\overline{\text{CE}}$    |              | Chip Enable input                                        | R91                 |
| $\overline{\text{OE}}$    |              | Output Enable input                                      | R90                 |
| VPP                       | Power supply | + 12.5V / 5V (Program supply voltage)                    | TEST                |
| VCC                       |              | + 5V                                                     | VDD                 |
| VSS                       |              | 0V                                                       | VSS                 |
| TONE                      | Output       | Open                                                     |                     |
| R33 - R30                 | I/O          | Be fixed to low level                                    |                     |
| R43 - R40                 |              |                                                          |                     |
| P142 - P140               | Output       | Open                                                     |                     |
| $\overline{\text{RESET}}$ | Input        | PROM mode setting pins. Be fixed to low level.           |                     |
| $\overline{\text{HOLD}}$  | Input        |                                                          |                     |
| XIN                       | Input        | External clock input (to keep the internal state stable) |                     |
| XOUT                      | Output       | Open                                                     |                     |

## OPERATIONAL DESCRIPTION

The following is an explanation of hardware configuration and operation in relation to the 47P452V.

The 47P452V is the same as the 47C452A except that an OTP is used instead of a Mask ROM.

### 1. OPERATION MODE

The 47P452V 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 47C452A, except that the TEST / VPP pin does not have pull-down resistor and cannot be used open.

##### 1.1.1 Program Memory

The program storage area is the same as for the 47C452B.

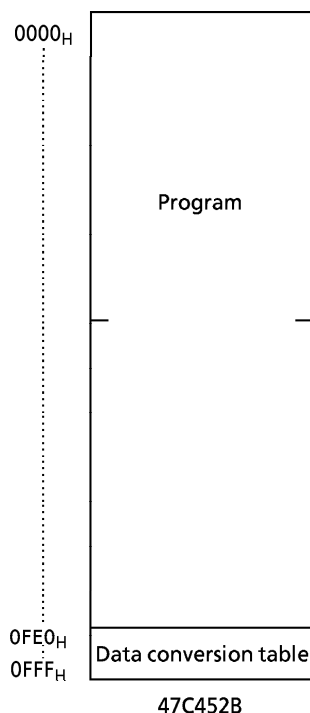


Figure 1-1. Program area

#### 1.1.2 Data Memory

The 47P452V has 768 × 4-bit data memory.

#### 1.1.3 Input/Output Circuitry

(1) Control pins

This is the same as for the 47C452B except that there is no built-in pull-down resistance for the TEST pin.

(2) I/O Ports

The input/output circuit of the 47P452V is the same as I/O code WB of the 47C452B.

External resistance, for example, is required when using as evaluator of other I/O codes (WE, WH) (Refer to Figure 1-2).

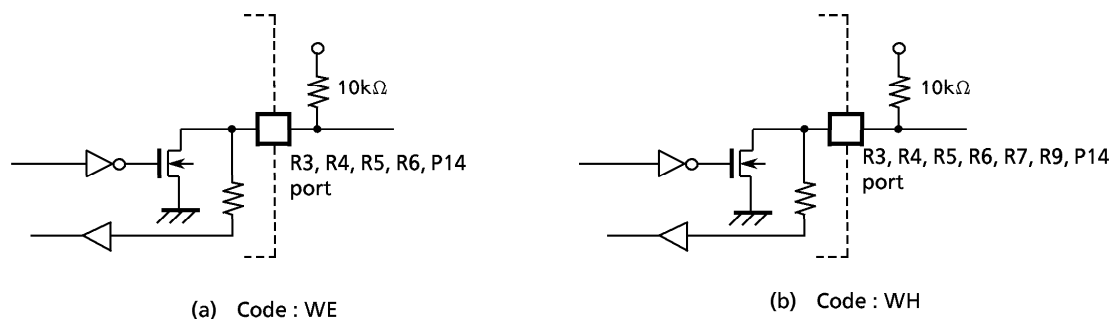


Figure 1-2. I/O code and external circuitry

## 1.2 PROM Mode

The PROM mode is set by setting the  $\overline{\text{RESET}}$ ,  $\overline{\text{HOLD}}$  pins to the "L" level. The PROM mode can be used as a general-purpose PROM writer for program writing and verification (A high-speed program mode is used set the ROM type the same as for the TMM2764AD).

An adapter socket (part No. BM1120 / BM1121) is available for connecting a PROM writer.

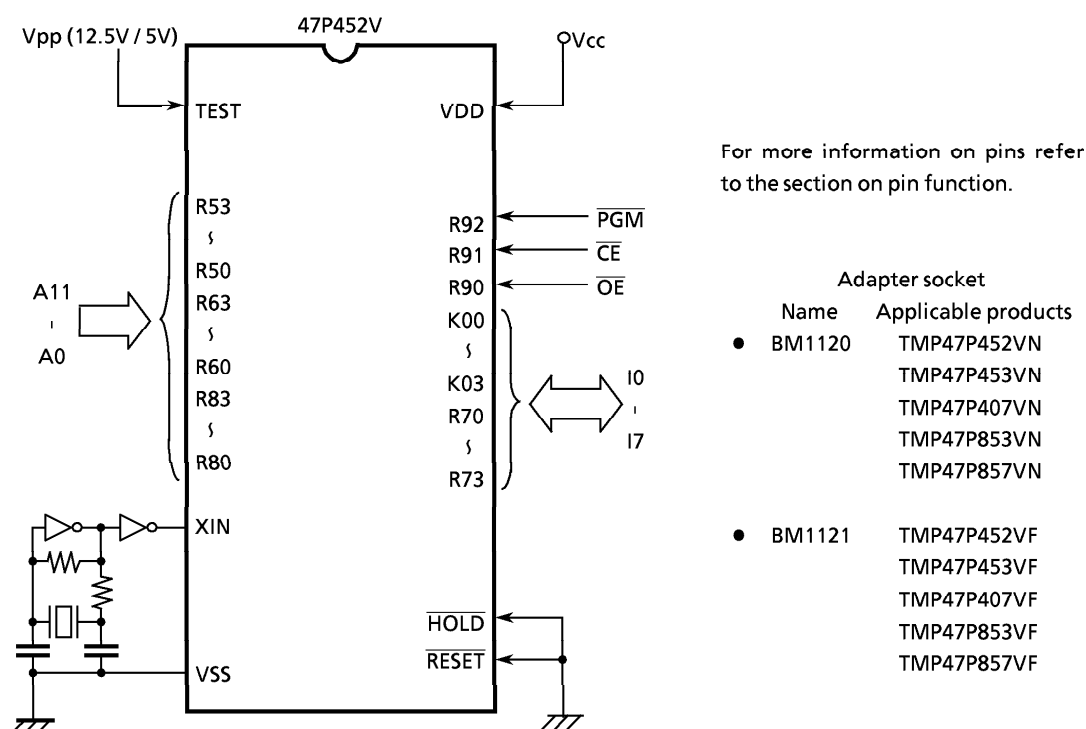


Figure 1-3. Setting for PROM mode

### 1.2.1 Writing

Set the PROM writer ROM to TMM2764AD (64k-bit), or equivalent. Before writing to a 47P452V (32k-bit), set the data area for writing to 32k-bits (start address: 0000<sub>H</sub>, ending address: 0FFF<sub>H</sub>), or else load the same data to the first 32k bits (0000<sub>H</sub>-0FFF<sub>H</sub>) and the second 32k bits (1000<sub>H</sub>-1FFF<sub>H</sub>).

### 1.2.2 High Speed Programming Mode

The device is set up in the high speed programming mode when the programming voltage (12.5V) is applied to the Vpp terminal with Vcc = 6V and  $\overline{\text{PGM}} = V_{\text{IH4}}$ . The programming is achieved by applying a Single TTL low level 1 ms, pulse the  $\overline{\text{PGM}}$  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 1 ms is applied and then programmed data is verified. This should be repeated until the program operates correctly (max. 15 times). After correctly programming the selected address, one additional program pulse with pulse width 4 times that needed for programming is applied. When programming has been completed, the data in all addresses should be verified with Vcc = Vpp = 5V.

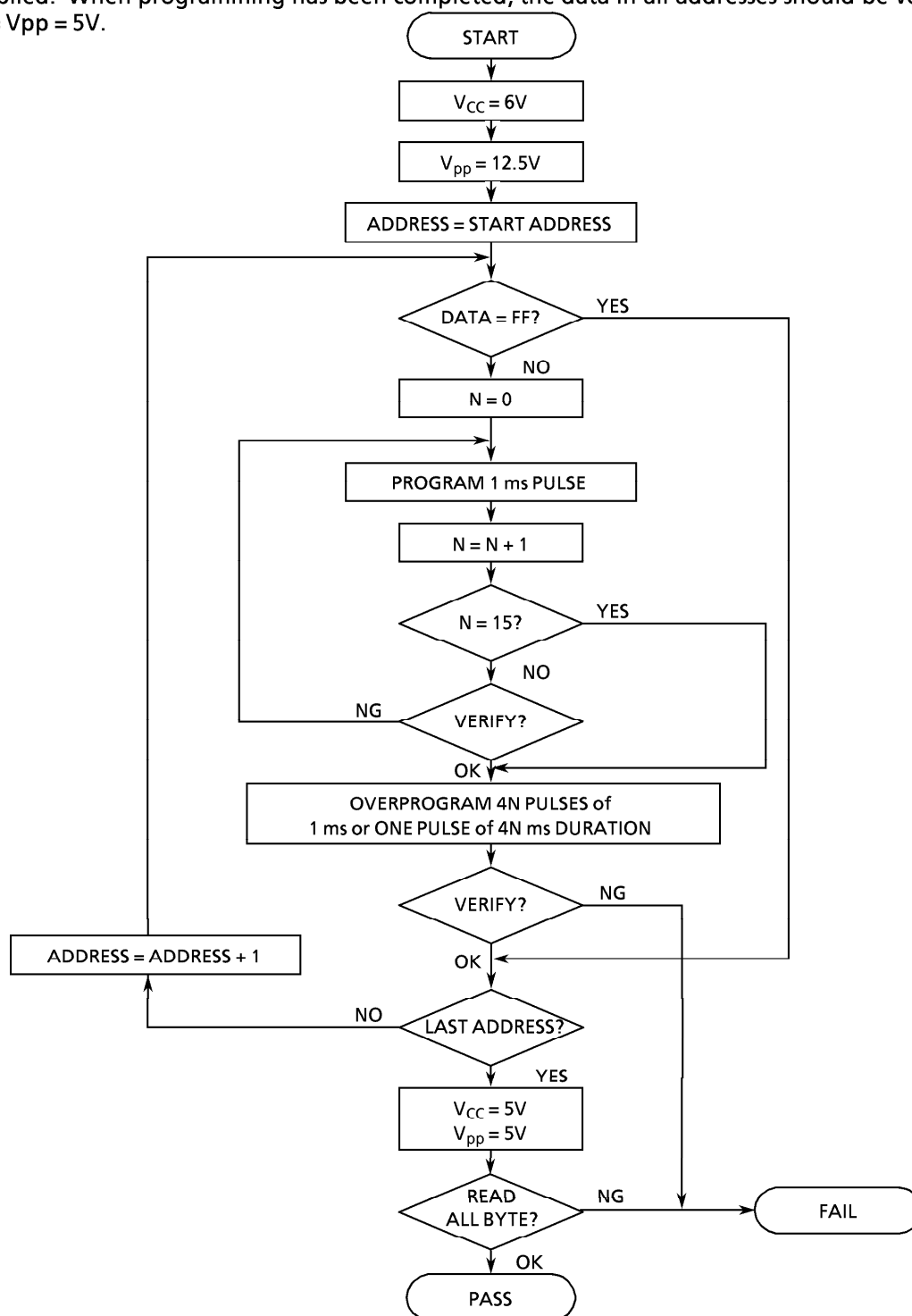


Figure1-4. FLOW CHART

## ELECTRICAL CHARACTERISTICS

## ABSOLUTE MAXIMUM RATINGS

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

| PARAMETER                                   | SYMBOL            | PINS                                       | RATINGS                        | UNIT |
|---------------------------------------------|-------------------|--------------------------------------------|--------------------------------|------|
| Supply Voltage                              | V <sub>DD</sub>   |                                            | – 0.3 to 7                     | V    |
| Program Voltage                             | V <sub>PP</sub>   | TEST/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, but include R7 | – 0.3 to V <sub>DD</sub> + 0.3 | V    |
|                                             | V <sub>OUT2</sub> | Sink open drain pin except R7              | – 0.3 to 10                    |      |
| Output Current (per 1 pin)                  | I <sub>OUT</sub>  |                                            | 3.2                            | mA   |
| Power Dissipation [T <sub>opr</sub> = 60°C] | PD                |                                            | 600                            | mW   |
| Soldering Temperature (time)                | T <sub>sld</sub>  |                                            | 260 (10s)                      | °C   |
| Storage Temperature                         | T <sub>stg</sub>  |                                            | – 55 to 125                    | °C   |
| Operating Temperature                       | T <sub>opr</sub>  |                                            | – 30 to 60                     | °C   |

Note. Characteristic of R7 is different from 47C452B

## RECOMMENDED OPERATING CONDITIONS

(V<sub>SS</sub> = 0V, T<sub>opr</sub> = – 30 to 60°C)

| PARAMETER          | SYMBOL           | PINS                    | CONDITIONS             | Min.                   | Max.                   | UNIT |
|--------------------|------------------|-------------------------|------------------------|------------------------|------------------------|------|
| Supply Voltage     | V <sub>DD</sub>  |                         | In the Normal mode     | 2.2                    | 6.0                    | V    |
|                    |                  |                         | In the HOLD mode       | 2.0                    |                        |      |
| Input High Voltage | V <sub>IH1</sub> | Except hysteresis input | V <sub>DD</sub> ≥ 4.5V | 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> |                         | V <sub>DD</sub> < 4.5V | V <sub>DD</sub> × 0.9  |                        |      |
| Input Low Voltage  | V <sub>IL1</sub> | Except hysteresis input | V <sub>DD</sub> ≥ 4.5V | 0                      | V <sub>DD</sub> × 0.3  | V    |
|                    | V <sub>IL2</sub> | Hysteresis input        |                        |                        | V <sub>DD</sub> × 0.25 |      |
|                    | V <sub>IL3</sub> |                         | V <sub>DD</sub> < 4.5V |                        | V <sub>DD</sub> × 0.1  |      |
| Clock Frequency    | f <sub>c</sub>   |                         |                        | 480                    |                        | kHz  |

## D.C. CHARACTERISTICS

(V<sub>SS</sub> = 0V, V<sub>DD</sub> = 2.2 to 6.0V, T<sub>opr</sub> = -30 to 60°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,<br>RESET, HOLD | V <sub>DD</sub> = 5.5V,<br>V <sub>IN</sub> = 5.5V / 0V                   | —    | —    | ± 2  | μA   |
|                                        | I <sub>IN2</sub> | Port R (open drain)           |                                                                          |      |      |      |      |
| Input Low Current                      | I <sub>IL</sub>  | Port R (push-pull)            | V <sub>DD</sub> = 5.5V, V <sub>IN</sub> = 0.4V                           | —    | —    | - 2  | mA   |
| Input Resistance                       | R <sub>IN1</sub> | Port K0                       |                                                                          | 30   | 70   | 150  | kΩ   |
|                                        | R <sub>IN2</sub> | RESET                         |                                                                          | 100  | 220  | 450  |      |
| Output Leakage Current                 | I <sub>LO</sub>  | Ports P, R (open drain)       | V <sub>DD</sub> = 5.5V, V <sub>OUT</sub> = 5.5V                          | —    | —    | 2    | μA   |
| Output High Voltage                    | V <sub>OH</sub>  | Port R (push-pull)            | V <sub>DD</sub> = 4.5V, I <sub>OH</sub> = - 200μA                        | 2.4  | —    | —    | V    |
| Output Low Voltage                     | V <sub>OL2</sub> | Except XOUT                   | V <sub>DD</sub> = 4.5V, I <sub>OL</sub> = 1.6mA                          | —    | —    | 0.4  | V    |
| Supply Current<br>(in the Normal mode) | I <sub>DD</sub>  |                               | Except TONE generating<br>V <sub>DD</sub> = 2.2V f <sub>c</sub> = 480kHz | —    | 0.2  | 0.4  | mA   |
|                                        | I <sub>DDT</sub> |                               | TONE generating<br>V <sub>DD</sub> = 2.2V f <sub>c</sub> = 480kHz        | —    | 0.5  | 1.0  |      |
| Supply Current<br>(in the HOLD mode)   | I <sub>DDH</sub> |                               | V <sub>DD</sub> = 5.5V                                                   | —    | 0.5  | 10   | μA   |
|                                        |                  |                               | V <sub>DD</sub> = 2.2V, T <sub>opr</sub> = 25°C                          | —    | —    | 0.5  |      |

Note 1. Typ.values show those at T<sub>opr</sub> = 25°C, V<sub>DD</sub> = 5V.

Note 2. Input Current I<sub>IN1</sub>: The current through resistor is not included, when the pull-up / pull-down resistor is contained.

Note 3. Supply Current: V<sub>IN</sub> = 2.0V / 0.2V

The K0 port is opened when the pull-up/pull-down resistor is contained.  
The Voltage applied to the R port is within the valid range V<sub>IL</sub> or V<sub>IH</sub>.

## TONE OUTPUT CHARACTERISTICS

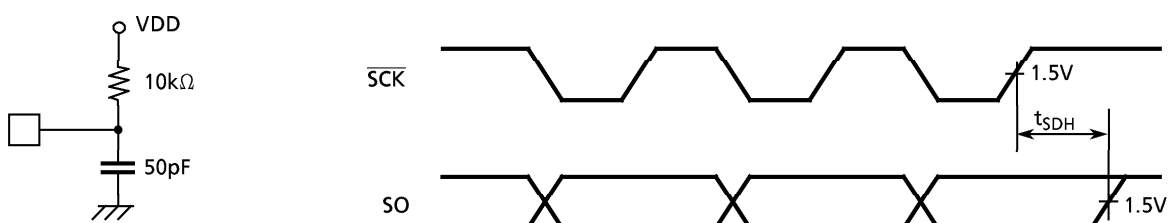
(V<sub>SS</sub> = 0V, V<sub>DD</sub> = 2.2 to 6.0V, T<sub>opr</sub> = -30 to 60°C)

| PARAMETER                          | SYMBOL            | CONDITIONS                        | Min. | Typ. | Max. | UNIT  |
|------------------------------------|-------------------|-----------------------------------|------|------|------|-------|
| Tone Output Voltage (ROW)          | V <sub>TONE</sub> | RL ≥ 10kΩ, V <sub>DD</sub> = 2.2V | 125  | 185  | 250  | mVrms |
| Pre-Emphasis High Band (COL / ROW) | PEHB              | PEHB = 20log (COL / ROW)          | 1    | 2    | 3    | dB    |
| Output Distortion                  | DIS               |                                   | —    | —    | 10   | %     |
| Frequency Stability                | Δf                | Except error of osc. frequency    | —    | —    | 0.7  | %     |

## A.C. CHARACTERISTICS

(V<sub>SS</sub> = 0V, V<sub>DD</sub> = 2.2 to 6.0V, T<sub>opr</sub> = -30 to 60°C)

| PARAMETER              | SYMBOL           | CONDITIONS | Min.                    | Typ. | Max. | UNIT |
|------------------------|------------------|------------|-------------------------|------|------|------|
| Instruction Cycle Time | t <sub>cy</sub>  |            | 16.7                    |      |      | μs   |
| Shift Data Hold Time   | t <sub>SDH</sub> |            | 0.5t <sub>cy</sub> -300 | —    | —    | ns   |

**Note.** Shift Data Hold Time :*External circuit for  $\overline{\text{SCK}}$  pin and SO pin      Serial port (completion of transmission)*

## RECOMMENDED OSCILLATING CONDITIONS

(V<sub>SS</sub> = 0V, V<sub>DD</sub> = 2.2 to 6.0V, T<sub>opr</sub> = -30 to 60°C)

Recommended oscillating conditions of the 47P452V are equal to the 47C452B's.

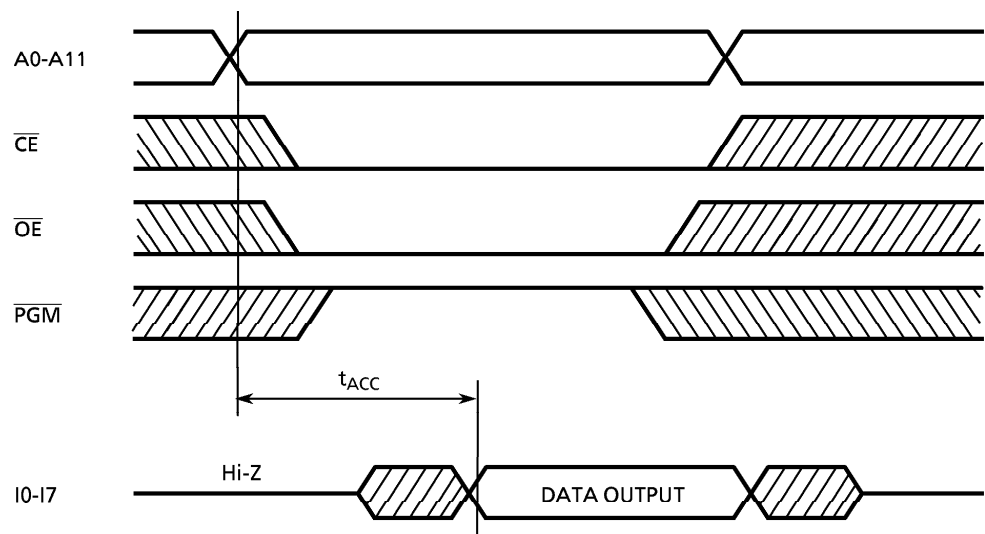
## D.C./A.C. CHARACTERISTICS

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

## (1) Read Operation

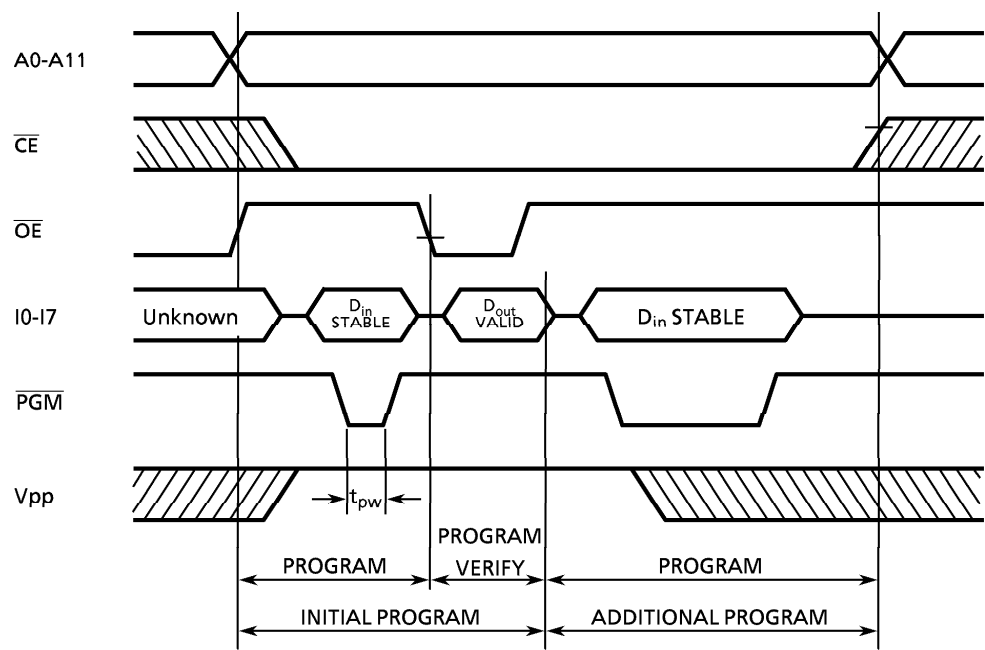
| PARAMETER                 | SYMBOL           | CONDITION                     | Min.                  | Typ. | Max.                  | UNIT |
|---------------------------|------------------|-------------------------------|-----------------------|------|-----------------------|------|
| Output Level 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 Access Time       | t <sub>ACC</sub> | V <sub>CC</sub> = 5.0 ± 0.25V | —                     | —    | 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 | $V_{PP}$  |                          | 12.0                | 12.5 | 13.0                | V    |
| Programming Pulse Width       | $t_{PW}$  | $V_{CC} = 6.0 \pm 0.25V$ | 0.95                | 1.0  | 1.05                | ms   |



## TYPICAL CHARACTERISTICS

