

## CMOS 4-Bit Microcontroller

**TMP47P400VN**  
**TMP47P400VF**

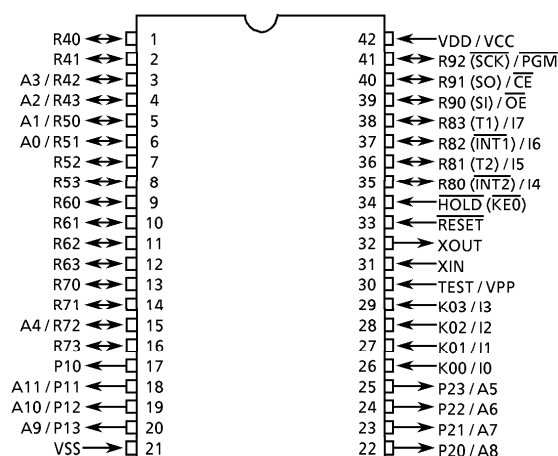
The TMP47P400V is the system evaluation LSI of TMP47C200B/400B with 32K bits one-time PROM. The TMP47P400V programs / verifies using an adapter socket to connect with PROM programmer, as it is in TMM2764AD.

In addition, the TMP47P400V and the TMP47C200B/400B are pin compatible. The TMP47P400V operates as the same as the TMP47C200B/400B by programming to the internal PROM.

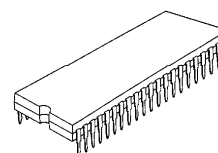
| Part No.    | ROM          | RAM         | Package            | Adapter Socket |
|-------------|--------------|-------------|--------------------|----------------|
| TMP47P400VN | OTP          | 256 × 4-bit | P-SDIP42-600-1.78  | BM1118         |
| TMP47P400VF | 4096 × 8-bit |             | P-QFP44-1414-0.80D | BM1125         |

## Pin Assignment (Top View)

P-SDIP42-600-1.78



P-SDIP42-600-1.78



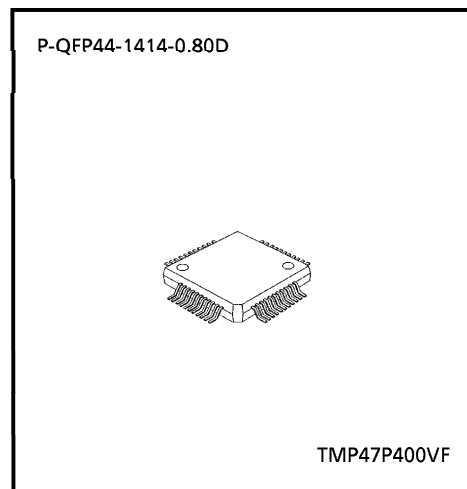
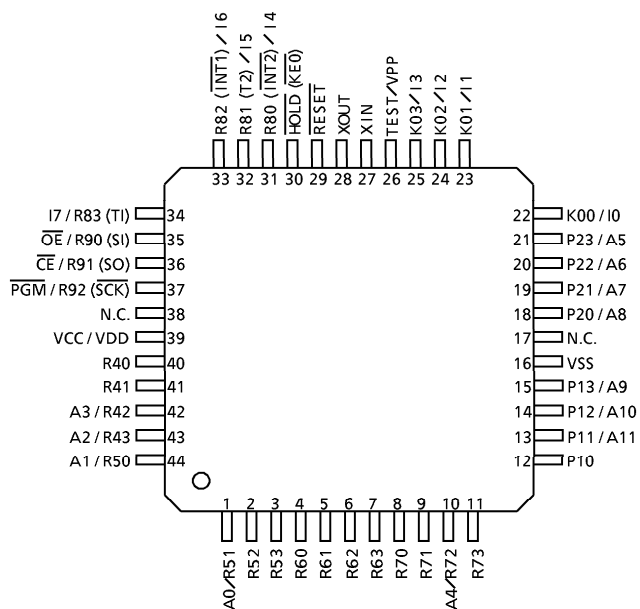
TMP47P400VN

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**Pin Assignment (Top View)**

P-QFP44-1414-0.80D



## Pin Function

The TMP47P400V has MCU mode and PROM mode.

### (1) MCU mode

The TMP47C200B/400B and the TMP47P400V 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 to A9                 | Input          | Address inputs                                 | P11 to P13          |
| A8 to A5                  |                |                                                | P20 to P23          |
| A4                        |                |                                                | R72                 |
| A3 , A2                   |                |                                                | R42 , R43           |
| A1 , A0                   |                |                                                | R50 , R51           |
| I7 to I4                  | I/O            | Data inputs / outputs                          | R83 to R80          |
| I3 to I0                  |                |                                                | K03 to 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   | + 12.5 V / 5 V (Program supply voltage)        | TEST                |
| VCC                       |                | + 5 V                                          | VDD                 |
| VSS                       |                | 0 V                                            | VSS                 |
| P10                       | Output         | Open or Be fixed to low level.                 |                     |
| R41 , R40                 | I/O            | Be fixed to low level                          |                     |
| R53 , R52                 |                |                                                |                     |
| R63 to R60                |                |                                                |                     |
| R70, R71, R73             |                |                                                |                     |
| $\overline{\text{RESET}}$ | Input          | PROM mode setting pins. Be fixed to low level. |                     |
| $\overline{\text{HOLD}}$  | Input          |                                                |                     |
| XIN                       | Input          | Resonator connecting pins.                     |                     |
| XOUT                      | Output         |                                                |                     |

## Operational Description

The following is an explanation of hardware configuration and operation in relation to the TMP47P400V. The TMP47P400V is the same as the TMP47C200B/400B except that an OTP is used instead of a Mask ROM.

## 1. Operation Mode

The TMP47P400V 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 TMP47C200B/400B, 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 TMP47C200B/400B. Data conversion tables must be set in two locations when using the TMP47P400V to check TMP47C200B operation.

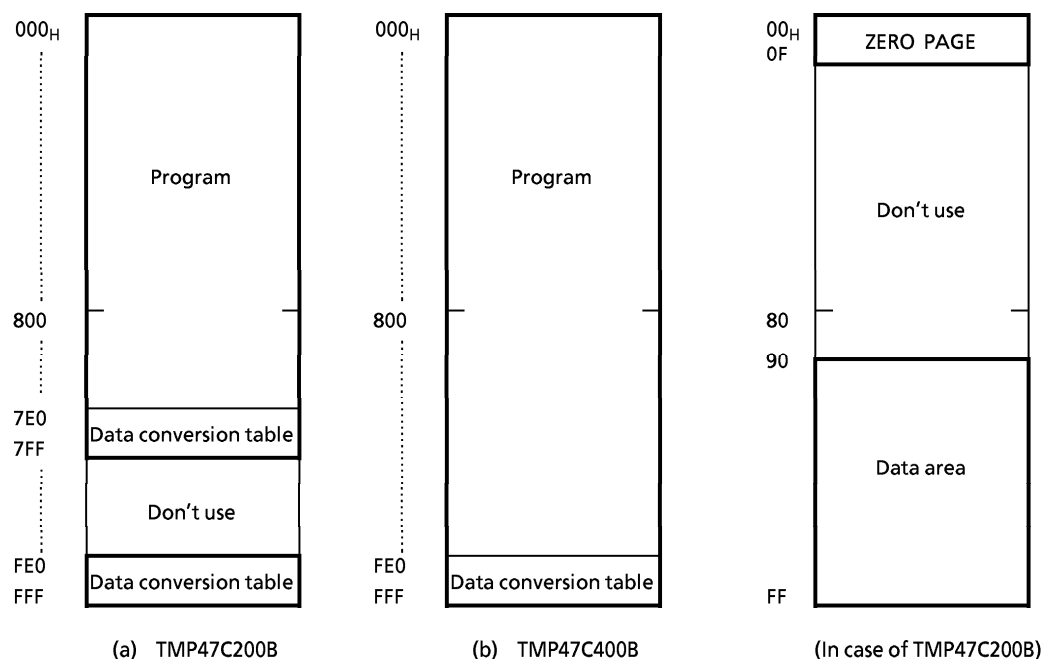


Figure 1-1. Program area (RAM)

Figure 1-2. Shared RAM address (RAM)

#### 1.1.2 Data Memory

The TMP47P400V has 256 × 4-bit data memory. When using the TMP47P400V as a TMP47C200B evaluator, programing should be performed assuming that the RAM is assigned to addresses 00 to 0FH and 90 to FFH as show in Figure 1-2 by considering the application software evaluation.

## 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 7                     | V    |
| Program Voltage                             | V <sub>PP</sub>     | TEST / VPP pin                             | – 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>OUT1</sub>   | Except sink open drain pin, but include R8 | – 0.3 to V <sub>DD</sub> + 0.3 | V    |
|                                             | V <sub>OUT2</sub>   | Sink open drain pin except R8              | – 0.3 to 10                    |      |
| Output Current (per 1 pin)                  | I <sub>OUT1</sub>   | P1, P2                                     | 30                             | mA   |
|                                             | I <sub>OUT2</sub>   | R4 to R9                                   | 3.2                            |      |
| Output Current (total all pin)              | Σ I <sub>OUT1</sub> | P1, P2                                     | 120                            | mA   |
| Power Dissipation [T <sub>opr</sub> = 70°C] | PD                  |                                            | 600                            | mW   |
| 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>    |                                            | – 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<sub>SS</sub> = 0 V, T<sub>opr</sub> = – 30 to 70°C)

| Parameter          | Symbol           | Pins                    | Conditions                     | Min                    | Max                    | Unit |
|--------------------|------------------|-------------------------|--------------------------------|------------------------|------------------------|------|
| Supply Voltage     | V <sub>DD</sub>  |                         | In the Normal mode             | 2.7                    | 6.0                    | V    |
|                    |                  |                         | In the HOLD mode               | 2.0                    |                        |      |
| Input High Voltage | V <sub>IH1</sub> | Except hysteresis input | V <sub>DD</sub> ≥ 4.5 V        | 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> < 4.5 V        | V <sub>DD</sub> × 0.9  |                        |      |
| Input Low Voltage  | V <sub>IL1</sub> | Except hysteresis input | V <sub>DD</sub> ≥ 4.5 V        | 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> < 4.5 V        |                        | V <sub>DD</sub> × 0.1  |      |
| Clock Frequency    | f <sub>c</sub>   |                         | V <sub>DD</sub> = 2.7 to 6.0 V | 0.4                    | 4.2                    | MHz  |

**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<sub>SS</sub> = 0 V, T<sub>opr</sub> = – 30 to 70°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> = 5.5 V,<br>V <sub>IN</sub> = 5.5 V / 0 V | —   | —    | ± 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> = 5.5 V, V <sub>IN</sub> = 0.4 V          | —   | —    | – 2 | mA   |
| Input Resistance                       | R <sub>IN2</sub> | RESET                         |                                                           | 100 | 220  | 450 | kΩ   |
| Output Leakage Current                 | I <sub>LO</sub>  | Ports P, R (open drain)       | V <sub>DD</sub> = 5.5 V, V <sub>OUT</sub> = 5.5 V         | —   | —    | 2   | μA   |
| Output High Voltage                    | V <sub>OH</sub>  | Port R (push-pull)            | V <sub>DD</sub> = 4.5 V, I <sub>OH</sub> = – 200 μA       | 2.4 | —    | —   | V    |
| Output Low Voltage                     | V <sub>OL2</sub> | Except XOUT, Port P           | V <sub>DD</sub> = 4.5 V, I <sub>OL</sub> = 1.6 mA         | —   | —    | 0.4 | V    |
| Output Low Current                     | I <sub>OL1</sub> | Port P                        | V <sub>DD</sub> = 4.5 V, V <sub>OL</sub> = 1.0 V          | —   | 30   | —   | mA   |
| Supply Current<br>(in the Normal mode) | I <sub>DD</sub>  |                               | V <sub>DD</sub> = 5.5 V f <sub>c</sub> = 4 MHz            | —   | 2    | 4   | mA   |
|                                        |                  |                               | V <sub>DD</sub> = 3.0 V f <sub>c</sub> = 4 MHz            | —   | 1    | 2   | mA   |
| Supply Current<br>(in the HOLD mode)   | I <sub>DDH</sub> |                               | V <sub>DD</sub> = 5.5 V                                   | —   | 0.5  | 10  | μA   |

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

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

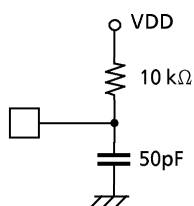
Note 3: Supply Current: V<sub>IN</sub> = 5.3 V / 0.2 V (V<sub>DD</sub> = 5.5 V), 2.8 / 0.2 V (V<sub>DD</sub> = 3.0 V)

## AC Characteristics

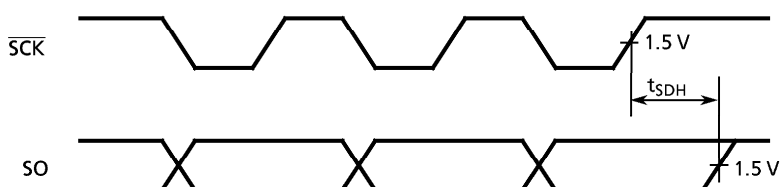
(V<sub>SS</sub> = 0 V, V<sub>DD</sub> = 2.7 to 6.0 V, T<sub>opr</sub> = – 30 to 70°C)

| Parameter                    | Symbol           | Conditions          | Min                       | Typ. | Max | Unit |
|------------------------------|------------------|---------------------|---------------------------|------|-----|------|
| Instruction Cycle Time       | t <sub>cy</sub>  |                     | 1.9                       | –    | 20  | μs   |
| High Level Clock Pulse Width | t <sub>WCH</sub> | External clock mode | 80                        | –    | –   | ns   |
| Low Level Clock Pulse Width  | t <sub>WCL</sub> |                     |                           |      |     |      |
| Shift Data Hold Time         | t <sub>SDH</sub> |                     | 0.5 t <sub>cy</sub> – 0.3 | –    | –   | μs   |

Note: Shift Data Hold Time:

External circuit for  $\overline{SCK}$  pin and SO pin

Serial port (completion of transmission)



## Recommended Oscillating Conditions

(V<sub>SS</sub> = 0 V, V<sub>DD</sub> = 2.7 to 6.0 V, T<sub>opr</sub> = – 30 to 70°C)

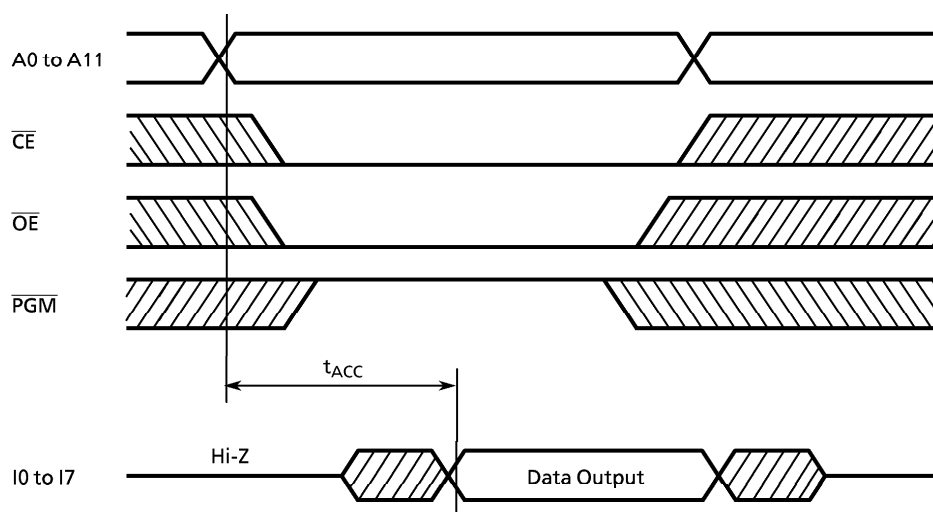
Recommended oscillating conditions of the TMP47P400V are equal to the TMP47C200B/400B's.

## DC/AC Characteristics (PROM mode)

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

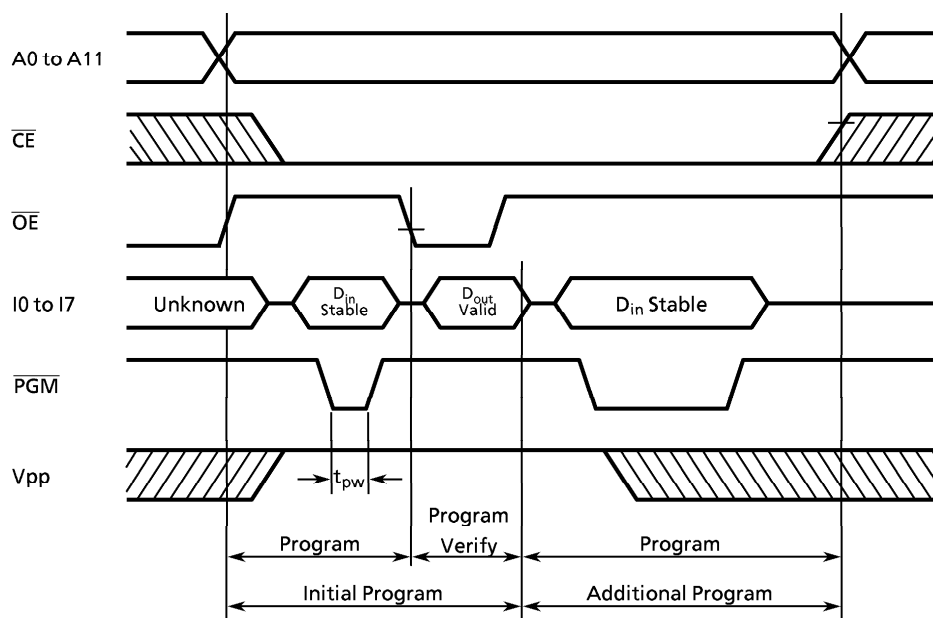
## (1) Read Operation

| 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 Access Time       | t <sub>ACC</sub> | V <sub>CC</sub> = 5.0 ± 0.25 V | –                     | –    | 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       | $t_{PW}$  | $V_{CC} = 6.0 \pm 0.25$ V | 0.95                | 1.0  | 1.05                | ms   |



## Typical Characteristics

