TOSHIBA

TOSHIBA Original CMOS 8-Bit Microcontroller

# TLCS-870 Series

## TMP87PM14NG
## TMP87PM14FG



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 |
|---|---|---|---|---|
| TMP87PM14N | SDIP64-P-750-1.78 | TMP87PM14NG | SDIP64-P-750-1.78 | — |
| TMP87PM14F | QFP64-P-1420-1.00A | TMP87PM14FG | QFP64-P-1420-1.00A | — |

*: 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)<br>·solder bath temperature = 230°C<br>·dipping time = 5 seconds<br>·the number of times = once<br>·use of R-type flux<br>(2) Use of Lead (Pb)-Free<br>·solder bath temperature = 245°C<br>·dipping time = 5 seconds<br>·the number of times = once<br>·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

- The information contained herein is subject to change without notice.
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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

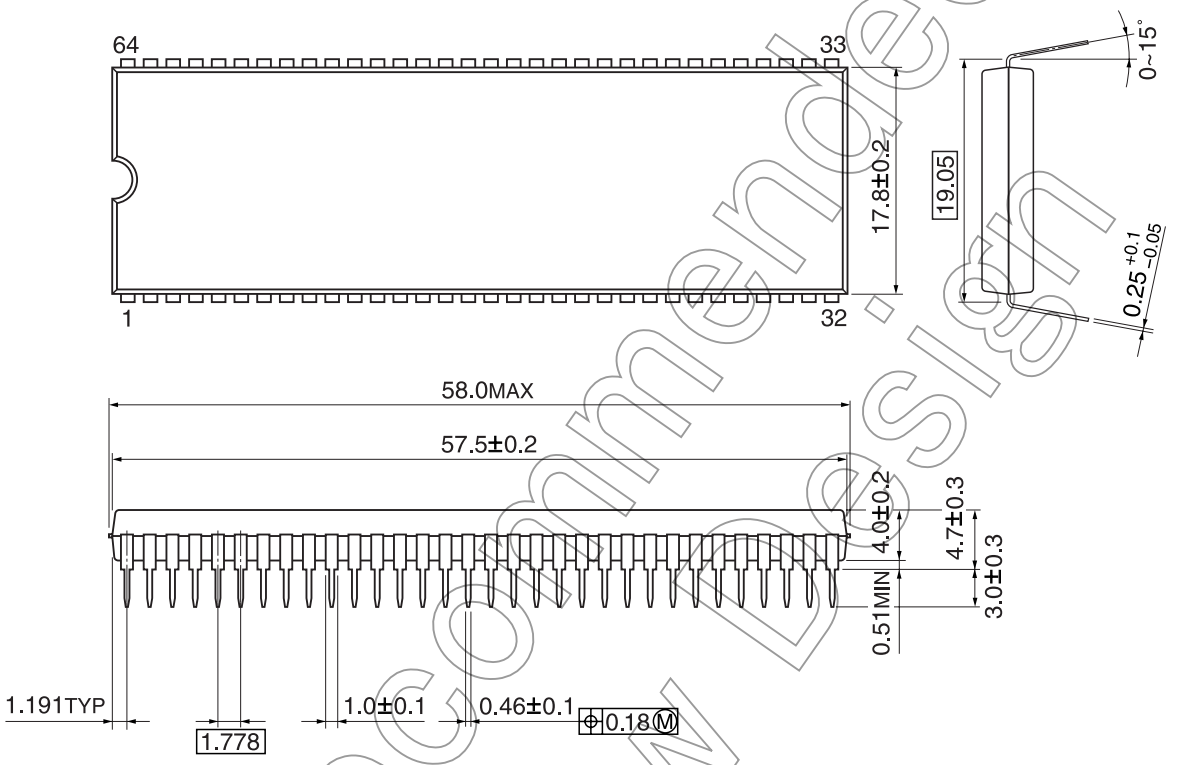
The publication date of this datasheet is printed at the lower right corner of this notification.

(Annex)

## Package Dimensions

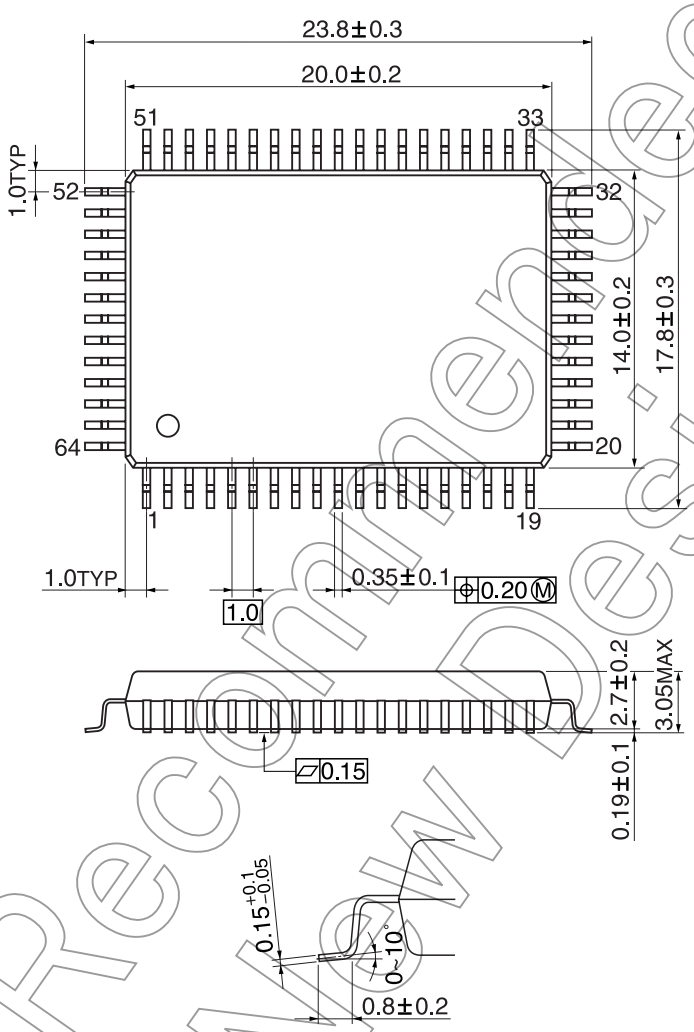
SDIP64-P-750-1.78

Unit: mm



QFP64-P-1420-1.00A

Unit: mm



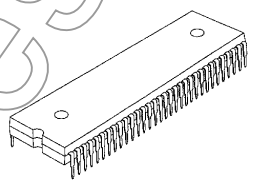
CMOS 8-Bit Microcontroller

# TMP87PM14N/F

The 87PM14 is a One-Time PROM microcontroller with low-power 256 K bits (32 Kbytes) electrically programmable read only memory for the 87C814/CH14/CK14/CM14 system evaluation. The 87PM14 is pin compatible with the 87C814/CH14/CK14/CM14. The operations possible with the 87C814/CH14/CK14/CM14 can be performed by writing programs to PROM. The 87PM14 can write and verify in the same way as the TC27256 using an adaptor socket BM1198/BM1199 and an EPROM programmer.

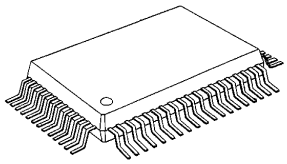
| Part No. | OTP | RAM | Package | Adaptor socket |
|---|---|---|---|---|
| TMP87PM14N | 32K × 8-bit | 1K × 8-bit | P-SDIP64-750-1.78 | BM1198 |
| TMP87PM14F | | | P-QFP64-1420-1.00A | BM1199 |

P-SDIP64-750-1.78



TMP87PM14N

P-QFP64-1420-1.00A

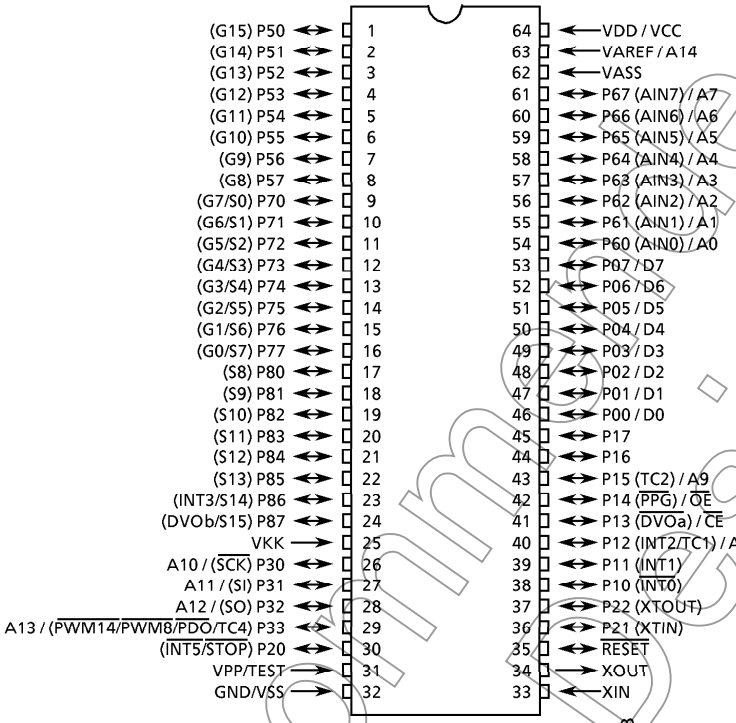


TMP87PM14F

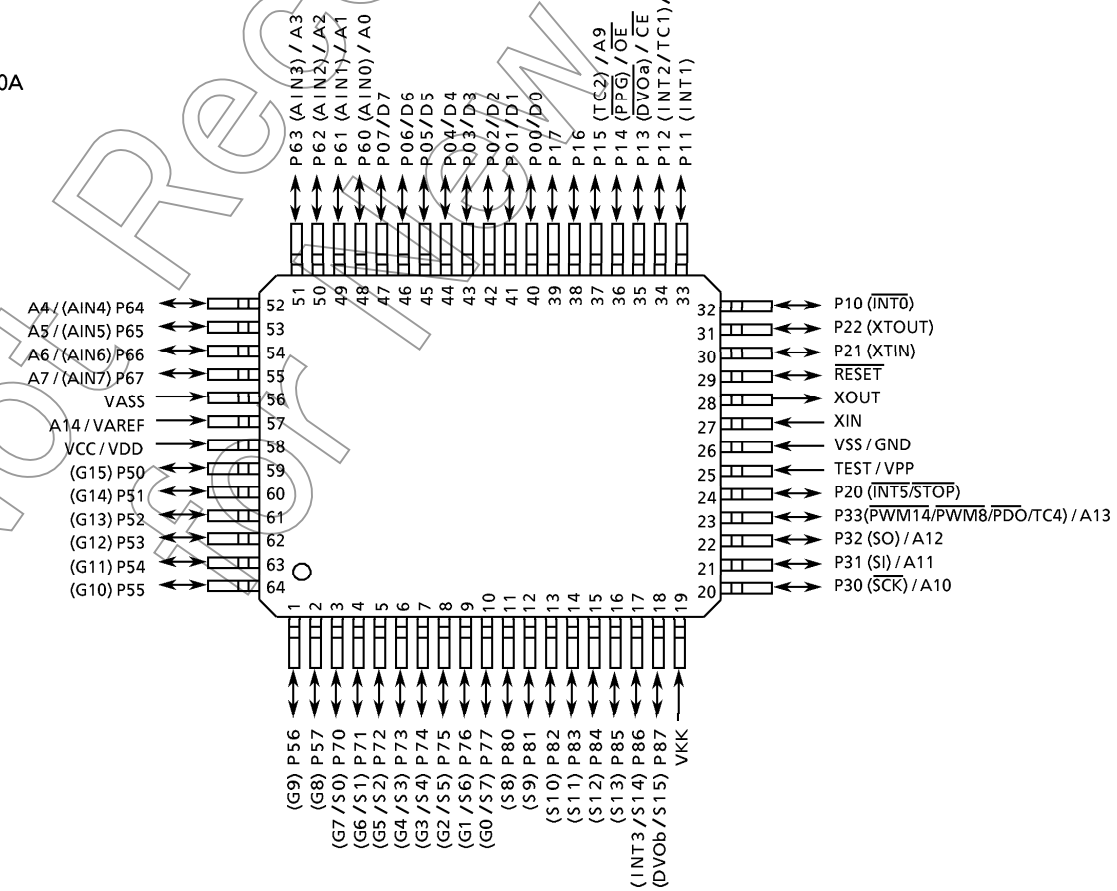
980910EBP1

## Pin Assignments (Top View)

P-SDIP64-750-1.78




P-QFP64-1420-1.00A



## Pin Function

The 87PM14 has two modes two modes: MCU and PROM.

(1) MCU mode

In this mode, the 87PM14 is pin compatible with the 87C814/CH14/CK14/CM14 (fix the TEST pin at low level).

(2) PROM mode

| Pin Name (PROM mode) | Input / Output | Functions | Pin Name (MCU mode) |
|---|---|---|---|
| A14 | Input | PROM address inputs | VAREF |
| A13 to A10 | | | P33 to P30 |
| A9 | | | P15 |
| A8 | | | P12 |
| A7 to A0 | | | P67 to P60 |
| D7 to D0 | I/O | PROM data input/outputs | P07 to P00 |
| $\overline{CE}$ | Input | Chip enable signal input (active low) | P13 |
| $\overline{OE}$ | | Output enable signal input (active low) | P14 |
| VPP | Power supply | + 12.5 V / 5 V (Program supply voltage) | TEST |
| VCC | | + 5 V | VDD |
| GND | | 0 V | VSS |
| P11 | I/O | PROM mode setting pin. Be fixed at high level. | |
| P21 | | | |
| P87 | | | |
| P10, P16, P17 | | PROM mode setting pin. Be fixed at low level. | |
| P22, P20 | | | |
| $\overline{RESET}$ | | | |
| XIN | Input | Connect an 8 MHz oscillator to stabilize the internal state. | |
| XOUT | output | | |
| P57 to P50 | I/O | Open | |
| P77 to P70 | | | |
| P86 to P80 | | | |
| VASS | Power supply | Open | |
| VKK | VFT Power supply | 0 V (GND) | |

## OPERATIONAL DESCRIPTION

The following explains the 87PM14 hardware configuration and operation. The configuration and functions of the 87PM14 are the same as those of the 87C814/CH14/CK14/CM14, except in that a one-time PROM is used instead of an on-chip mask ROM.

The 87PM14 is placed in the *single-clock* mode during reset. To use the dual-clock mode, the low-frequency oscillator should be turned on by executing [SET (SYSCR2). XTEN] instruction at the beginning of the program.

### 1. OPERATING MODE

The 87PM14 has two modes: MCU and PROM.

### 1.1 MCU Mode

The MCU mode is activated by fixing the TEST / VPP pin at low level.

In the MCU mode, operation is the same as with the 87C814/CH14/CK14/CM14 (the TEST / VPP pin cannot be used open because it has no built-in pull-down resistance).

### 1.1.1 Program Memory

The 87PM14 has a 32K × 8-bit (addresses $8000_H$-$FFFF_H$ in the MCU mode, addresses $0000_H$-$7FFF_H$ in the PROM mode) of program memory (OTP). To use the 87PM14 as the system evaluation for the 87C814/CH14/CK14/CM14 the program should be written to the program memory area as shown in Figure 1-1.

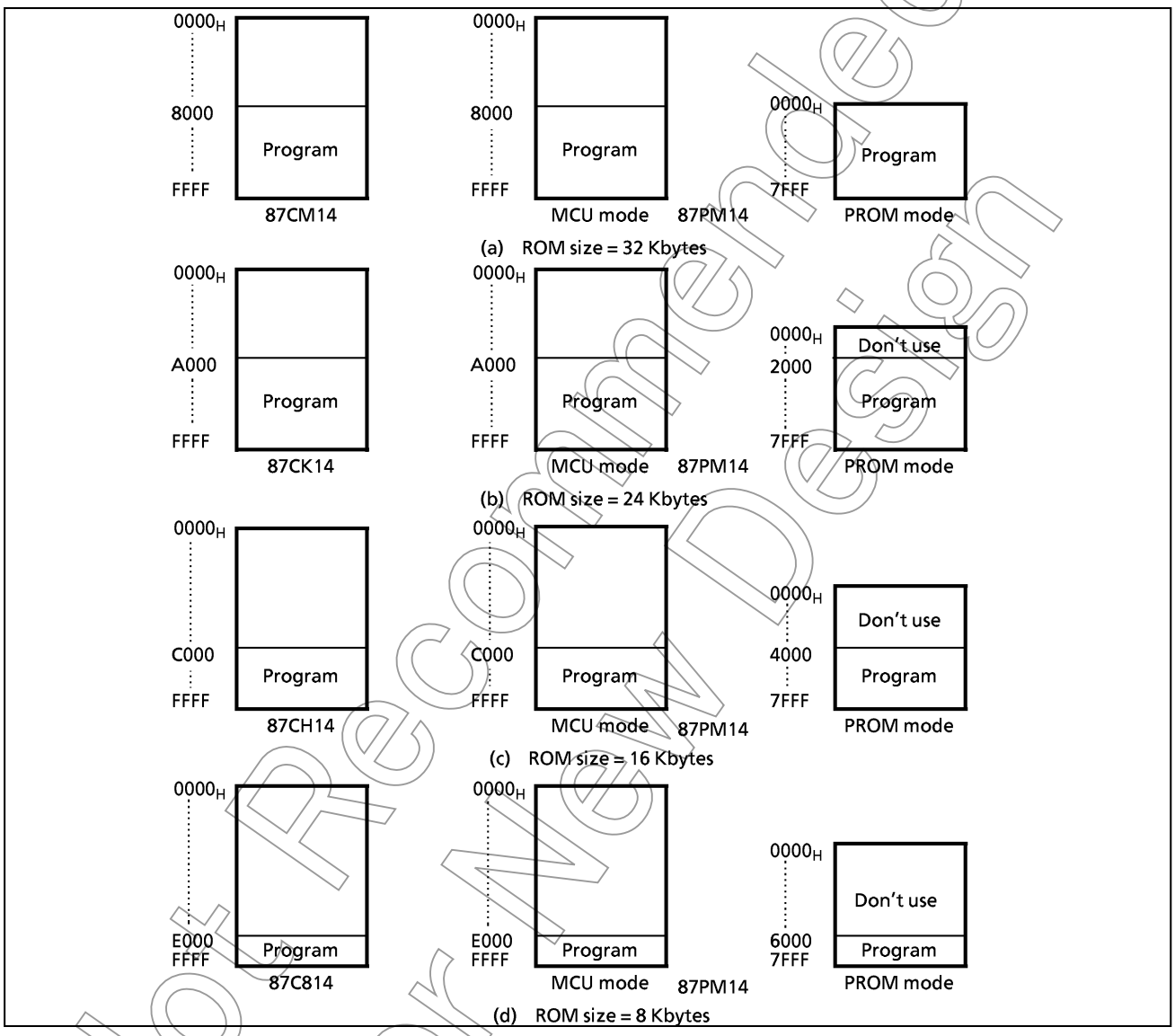



Figure 1-1. Program Memory Area

Either write the data $FF_H$ to the unused area or set the PROM programmer to access only the program storage area.

### 1.1.2 Data Memory

The 87PM14 has an on-chip 1k × 8-bit data memory (static RAM).

### 1.1.3 Input/Output Circuitry

(1) Control pins

The control pins of the 87PM14 are the same as those of the 87C814/CH14/CK14/CM14 except that the TEST pin has is no built-in pull-down resistance.

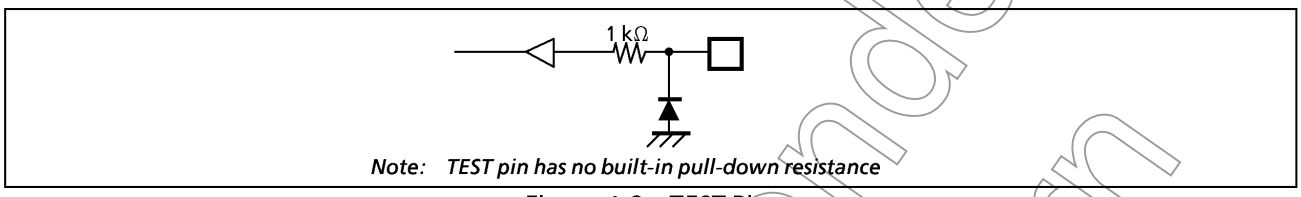



Figure 1-2. TEST Pin

(2) I/O ports

The I/O circuitries of 87PM14 I/O ports are the same as the code A type I/O circuitries of the 87C814/CH14/CK14/CM14.

## 1.2 PROM Mode

The PROM mode is activated by setting the pins TEST, $\overline{\text{RESET}}$ and the ports P17-P10, P22-P20 and P87 as shown in Figure 1-3. The PROM mode is used to write and verify programs with a general-purpose PROM programmer. The high-speed programming mode can be used for program operation.
The 87PM14 is not supported an electric signature mode, so the ROM type must be set to TC27256.
Set the adaptor socket switch to "N".

*Note: Please set the high-speed programming mode according to each manual of PROM program.*

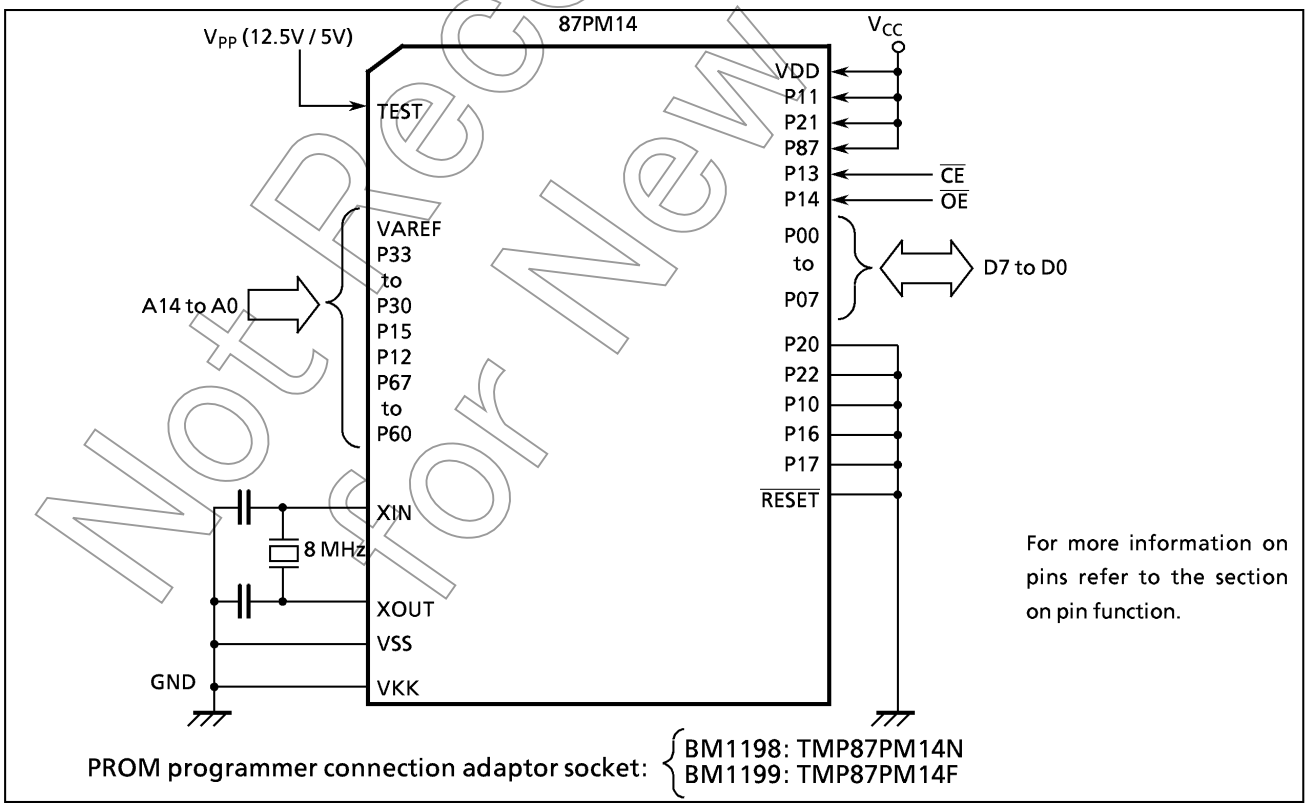



Figure 1-3. Setting for PROM Mode

### 1.2.1 Programming Flowchart (High-speed Programming Mode-I)

The high-speed programming mode is achieved by applying the program voltage ( + 12.5 V) to the Vpp pin when Vcc = 6 V. After the address and input data are stable, the data is programmed by applying a single 1ms program pulse to the $\overline{CE}$ input. The programmed data is verified. If incorrect, another 1ms program pulse is applied and then the programmed data is verified. This process should be repeated (up to 25 times) until the program operates correctly. Programming for one address is ended by applying additional program pulse with width 3 times that needed for initial programming (number of programmed times × 1 ms). After that, change the address and input data, and program as before. When programming has been completed, the data in all addresses should be verified with Vcc = Vpp = 5 V.

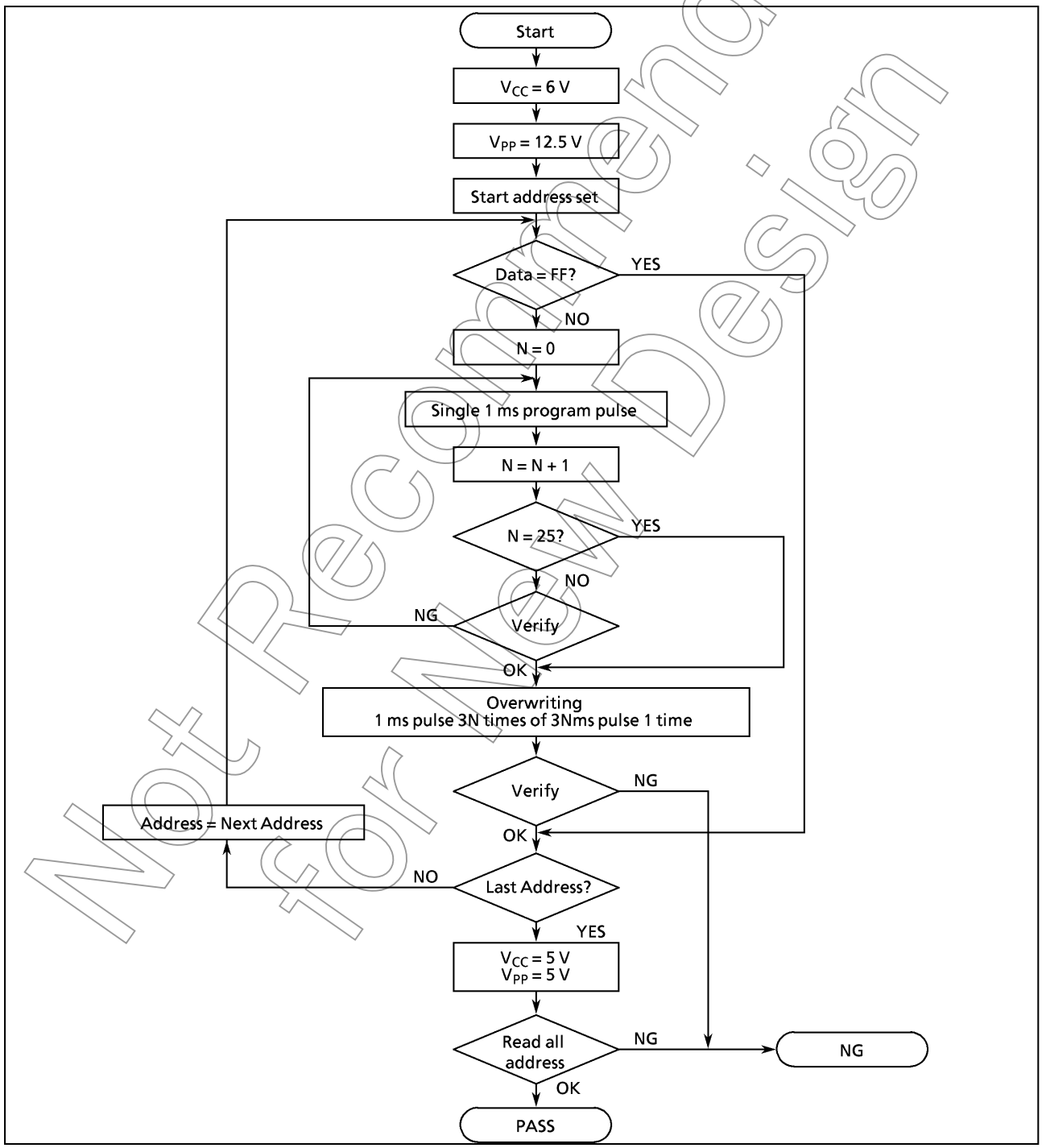



Figure 1-4. Flowchart of High-speed Programming Mode - I

### 1.2.2 Programming Flowchart (High-speed Programming Mode-II)

The high-speed programming mode is achieved by applying the program voltage ( + 12.75 V) to the Vpp pin when Vcc = 6.25 V. After the address and input data are stable, the data is programmed by applying a single 0.1ms program pulse to the $\overline{CE}$ input. The programmed data is verified. If incorrect, another 0.1ms program pulse is applied and then the programmed data is verified. This process should be repeated (up to 25 times) until the program operates correctly. After that, change the address and input data, and program as before. When programming has been completed, the data in all addresses should be verified with Vcc = Vpp = 5 V.

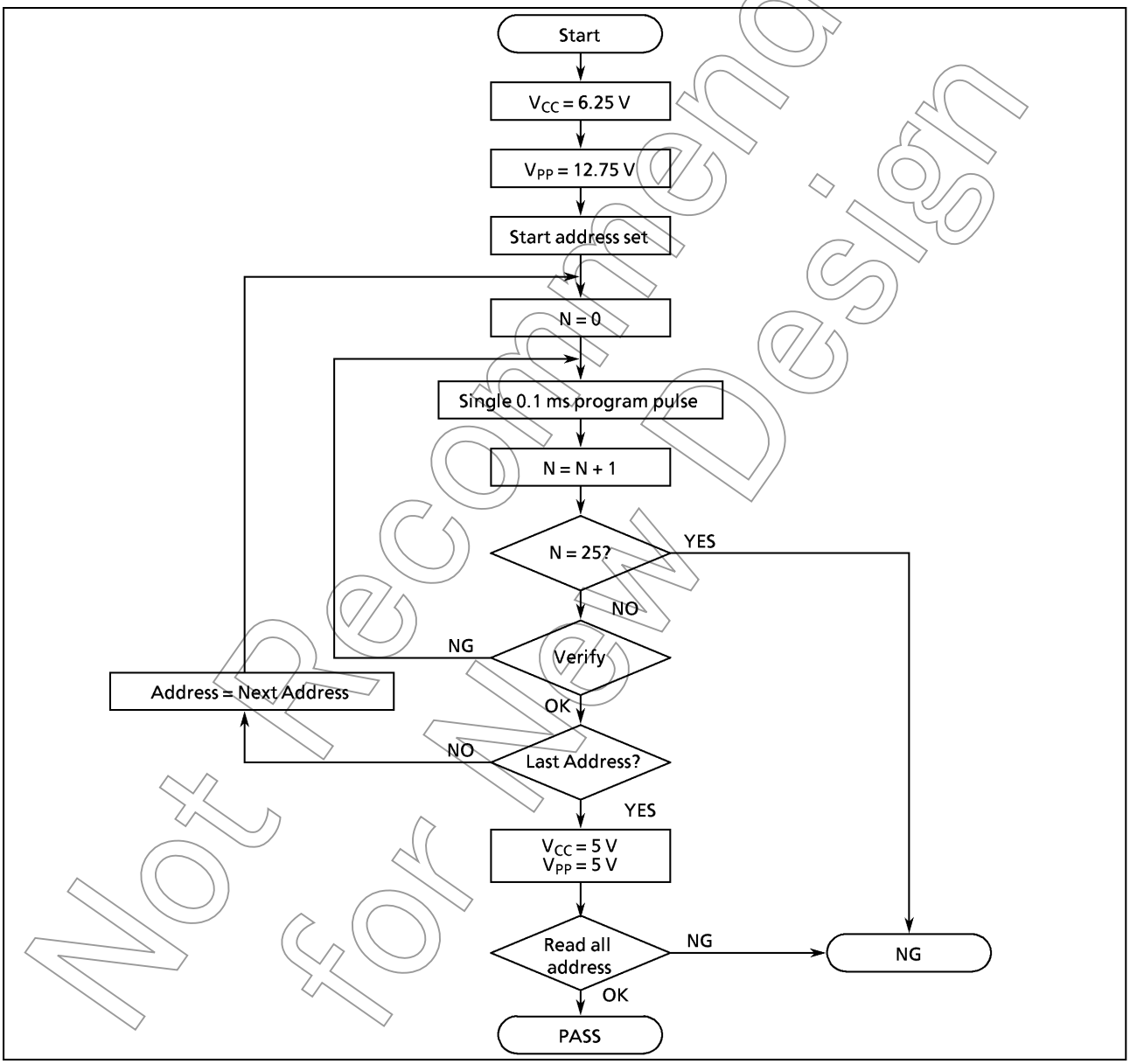



Figure 1-5. Flowchart of High-speed Programming Mode - II

### 1.2.3 Writing Method for General-purpose PROM Program

(1) Adapters
BM1198: TMP87PM14N
BM1199: TMP87PM14F

(2) Adapter setting
Switch (SW1) is set to side N.

(3) PROM programmer specifying
i) PROM type is specified to TC27256.
Writing voltage: 12.5 V (high-speed program I mode)
12.75 V (high-speed program II mode)

ii) Data transfer (copy) (note 1)
In TMP87PM14, EPROM is within the addresses 0000 to 7FFFH. Data is required to be transferred (copied) to the addresses where it is possible to write. The program area in MCU mode and PROM mode is referred to "Program memory area" in Figure 1-1.

Ex. In the block transfer (copy) mode, executed as below.
ROM capacity of 32KB: transferred addresses 8000 to FFFFH to addresses 0000 to 7FFFH

iii) Writing address is specified. (note 1)
Start address: 0000H
End address: 7FFFH

(4) Writing
Writing/Verifying is required to be executed in accordance with PROM programmer operating procedure.

*Note 1: The specifying method is referred to the PROM programmer description. The data in unused area must be specified to $FF_H$.*
*Note 2: When MCU is set to an adapter or the adapter is set to PROM programmer, a position of pin 1 must be adjusted. If the setting is reversed, MCU, the adapter and PROM program is damaged.*
*Note 3: TMP87PM14 does not support the electric signature mode (hereinafter referred to as "signature"). If the signature is used in PROM program, a device is damaged due to applying 12V ± 0.5V to the address pin 9 (A9). The signature must not be used.*

## 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 | $V_{PP}$ | TEST / VPP | – 0.3 to 13.0 | V |
| Input Voltage | $V_{IN}$ | | – 0.3 to $V_{DD}$ + 0.3 | V |
| Output Voltage | $V_{OUT1}$ | P0, P1, P2, P3, P6, XOUT, $\overline{RESET}$ | – 0.3 to $V_{DD}$ + 0.3 | V |
| | $V_{OUT2}$ | Source open drain ports | $V_{DD}$ – 40 to $V_{DD}$ + 0.3 | |
| Output Current (Per 1 pin) | $I_{OUT1}$ | P0, P1, P2, P3, P6 | 3.2 | mA |
| | $I_{OUT2}$ | P8 | – 12 | |
| | $I_{OUT3}$ | P5, P7 | – 25 | |
| Output Current (Total) | $\Sigma I_{OUT1}$ | P0, P1, P2, P3, P6 | 120 | mA |
| | $\Sigma I_{OUT2}$ | P5, P7, P8 | – 120 | |
| Power Dissipation [Topr = 25°C] | PD | | 600 | 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 = 8 MHz | NORMAL 1, 2 modes | 4.5 | 5.5 | V |
| | | | | IDLE1, 2 modes | | | |
| | | | fs = 32.768 kHz | SLOW mode | 2.7 | | |
| | | | | SLEEP mode | | | |
| | | | | STOP mode | 2.0 | | |
| Output Voltage | $V_{OUT2}$ | Source open drain ports | | | $V_{DD}$ – 38 | $V_{DD}$ | V |
| Input High Voltage | $V_{IH1}$ | Except hysteresis input | $V_{DD} \geqq 4.5$ V | | $V_{DD} \times 0.70$ | $V_{DD}$ | V |
| | $V_{IH2}$ | Hysteresis input | | | $V_{DD} \times 0.75$ | | |
| | $V_{IH3}$ | | $V_{DD} < 4.5$ V | | $V_{DD} \times 0.90$ | | |
| Input Low Voltage | $V_{IL1}$ | Except hysteresis input | $V_{DD} \geqq 4.5$ V | | 0 | $V_{DD} \times 0.30$ | V |
| | $V_{IL2}$ | Hysteresis input | | | | $V_{DD} \times 0.25$ | |
| | $V_{IL3}$ | | $V_{DD} < 4.5$ V | | | $V_{DD} \times 0.10$ | |
| Clock Frequency | fc | XIN, XOUT | $V_{DD}$ = 4.5 V to 5.5 V | | 0.4 | 8.0 | MHz |
| | fs | XTIN, XTOUT | | | 30.0 | 34.0 | kHz |

*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: Clock frequency fc: Supply voltage range is specified in NORMAL 1/2 mode and IDLE 1/2 mode.*

## D.C. Characteristics

($V_{SS}$ = 0 V, Topr = – 30 to 70°C)

| Parameter | Symbol | Pins | Conditions | Min | Typ. | Max | Unit |
|---|---|---|---|---|---|---|---|
| Hysteresis Voltage | $V_{HS}$ | Hysteresis input | | – | 0.9 | – | V |
| Input Current | $I_{IN1}$ | TEST | $V_{DD}$ = 5.5 V<br>$V_{IN}$ = 5.5 V/0 V | – | – | ± 2 | μA |
| | $I_{IN2}$ | Open drain ports, Tri-state ports | | | | | |
| | $I_{IN3}$ | $\overline{RESET}$, $\overline{STOP}$ | | | | | |
| Input Resistance | $R_{IN1}$ | $\overline{RESET}$ | | 100 | 220 | 450 | kΩ |
| Pull-down Resistance | $R_1$ | Source open drain ports | $V_{DD}$ = 5.5 V, $V_{OUT}$ = 5.5 V | – | 200 | – | |
| | $R_K$ | | $V_{DD}$ = 5.5 V, $V_{KK}$ = – 30 V | – | 80 | – | |
| Output Leakage Current | $I_{LO1}$ | Sink open drain ports | $V_{DD}$ = 5.5 V, $V_{OUT}$ = 5.5 V | – | – | 2 | μA |
| | $I_{LO2}$ | Source open drain ports | $V_{DD}$ = 5.5 V, $V_{OUT}$ = – 32 V | – | – | – 2 | |
| | $I_{LO3}$ | Tri-state ports | $V_{DD}$ = 5.5 V, $V_{OUT}$ = 5.5 V / 0 V | – | – | ± 2 | |
| Output High Voltage | $V_{OH1}$ | Tri-state ports | $V_{DD}$ = 4.5 V, $I_{OH}$ = – 0.7 mA | 4.1 | – | – | V |
| | $V_{OH2}$ | P8 | $V_{DD}$ = 4.5 V, $I_{OH}$ = – 8 mA | 2.4 | – | – | |
| Output Low Voltage | $V_{OL}$ | Except XOUT | $V_{DD}$ = 4.5 V, $I_{OL}$ = 1.6 mA | – | – | 0.4 | V |
| Output High current | $I_{OH}$ | P5, P7 | $V_{DD}$ = 4.5 V, $V_{OH}$ = 2.4 V | – | – 20 | – | mA |
| Supply Current in NORMAL 1, 2 modes | $I_{DD}$ | | $V_{DD}$ = 5.5 V<br>fc = 8 MHz | – | 12 | 18 | mA |
| Supply Current in IDLE 1, 2 modes | | | fs = 32.768 kHz<br>$V_{IN}$ = 5.3 V / 0.2 V | – | 4.5 | 6 | |
| Supply Current in SLOW mode | | | $V_{DD}$ = 3.0 V<br>fs = 32.768 kHz | – | 30 | 60 | μA |
| Supply Current in SLEEP mode | | | $V_{IN}$ = 2.8 V / 0.2 V | – | 15 | 30 | |
| Supply Current in STOP mode | | | $V_{DD}$ = 5.5 V<br>$V_{IN}$ = 5.3 V / 0.2 V | – | 0.5 | 10 | μA |

*Note 1: Typical values show those at Topr = 25°C , $V_{DD}$ = 5 V.*

*Note 2: Input Current $I_{IN1}$, $I_{IN3}$ ; The current through resistor is not included, when the input resistor (pull-up/pull-down) is contained.*

## A/D Conversion Characteristics

($V_{SS}$ = 0 V, $V_{DD}$ = 4.5 to 5.5 V, Topr = – 30 to 70°C)

| Parameter | Symbol | Conditions | Min | Typ. | Max | Unit |
|---|---|---|---|---|---|---|
| Analog Reference Voltage | $V_{AREF}$ | $V_{AREF} - V_{ASS} \geqq 2.5$ V | $V_{DD}$ – 1.5 | — | $V_{DD}$ | V |
| | $V_{ASS}$ | | $V_{SS}$ | — | 1.5 | |
| Analog Input Voltage | $V_{AIN}$ | | $V_{ASS}$ | — | $V_{AREF}$ | V |
| Analog Supply Current | $I_{REF}$ | $V_{AREF}$ = 5.5 V, $V_{ASS}$ = 0.0 V | — | 0.5 | 1.0 | mA |
| Nonlinearity Error | | $V_{DD}$ = 5.0 V, $V_{SS}$ = 0.0 V<br>$V_{AREF}$ = 5.000 V<br>$V_{ASS}$ = 0.000 V | — | — | ± 1 | LSB |
| Zero Point Error | | | — | — | ± 1 | |
| Full Scale Error | | | — | — | ± 1 | |
| Total Error | | | — | — | ± 2 | |

*Note: Quantizing error is not contained in those errors.*

## A.C. Characteristics

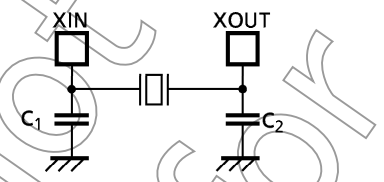
($V_{SS}$ = 0 V, $V_{DD}$ = 4.5 to 5.5 V, Topr = – 30 to 70°C)

| Parameter | Symbol | Conditions | Min | Typ. | Max | Unit |
|---|---|---|---|---|---|---|
| Machine Cycle Time | $t_{cy}$ | In NORMAL1, 2 modes | 0.5 | – | 10 | μs |
| | | In IDLE 1, 2 modes | | | | |
| | | In SLOW mode | 117.6 | – | 133.3 | |
| | | In SLEEP mode | | | | |
| High Level Clock Pulse Width | $t_{WCH}$ | For external clock operation (XIN input), fc = 8 MHz | 50 | – | – | ns |
| Low Level Clock Pulse Width | $t_{WCL}$ | | | | | |
| High Level Clock Pulse Width | $t_{WSH}$ | For external clock operation (XTIN input), fs = 32.768 kHz | 14.7 | – | – | μs |
| Low Level Clock Pulse Width | $t_{WSL}$ | | | | | |

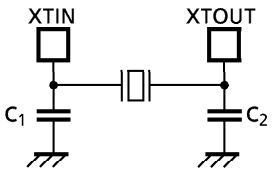
## Recommended Oscillating Conditions

($V_{SS}$ = 0 V, $V_{DD}$ = 4.5 to 5.5 V, Topr = – 30 to 70°C)

| Parameter | Oscillator | Oscillation Frequency | Recommended Oscillator | | Recommended Constant $C_1$ | Recommended Constant $C_2$ |
|---|---|---|---|---|---|---|
| High-frequency Oscillation | Ceramic Resonator | 8 MHz | KYOCERA | KBR8.0M | 30pF | 30pF |
| | | 4 MHz | KYOCERA | KBR4.0MS | | |
| | | | MURATA | CSA4.00MG | | |
| | Crystal Oscillator | 8 MHz | TOYOCOM | 210B 8.0000 | 20pF | 20pF |
| | | 4 MHz | TOYOCOM | 204B 4.0000 | | |
| Low-frequency Oscillation | Crystal Oscillator | 32.768 kHz | NDK | MX-38T | 15pF | 15pF |




(1) High-frequency Oscillation




(2) Low-frequency Oscillation

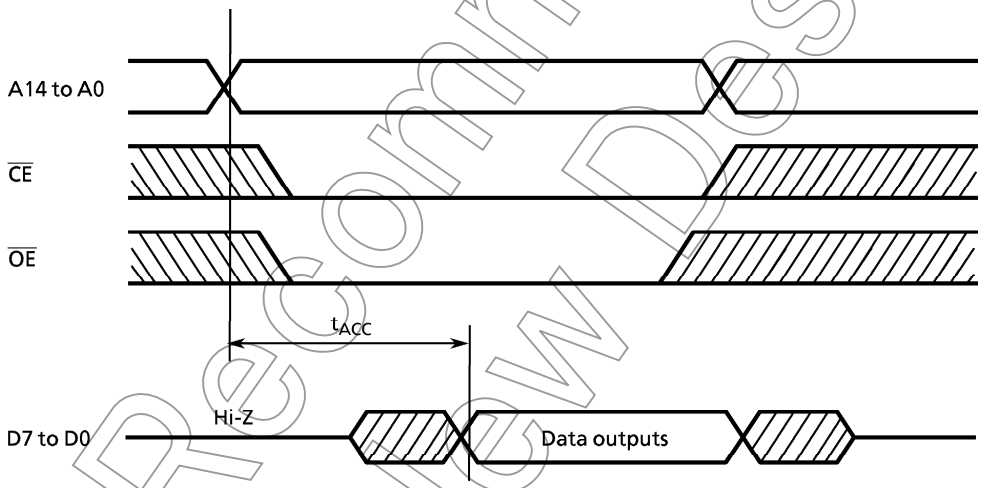
*Note: An electrical shield by metal shied plate on the IC package should be recommend able in order to prevent the device from the high electric fieldstress applied for continuous reliable operation.*

D.C./A.C. Characteristics (PROM mode) ($V_{SS}$ = 0 V)

(1) Read Operation

| Parameter | Symbol | Conditions | Min | Typ. | Max | Unit |
|---|---|---|---|---|---|---|
| Input High Voltage | $V_{IH4}$ | | $V_{CC} \times 0.7$ | – | $V_{CC}$ | V |
| Input Low Voltage | $V_{IL4}$ | | 0 | – | $V_{CC} \times 0.12$ | V |
| Power Supply Voltage | $V_{CC}$ | | 4.75 | 5.0 | 5.25 | V |
| Program Power Supply Voltage | $V_{PP}$ | | | | | |
| Address Access Time | $t_{ACC}$ | $V_{CC}$ = 5.0 ± 0.25 V | – | 1.5 tcyc + 300 | – | ns |

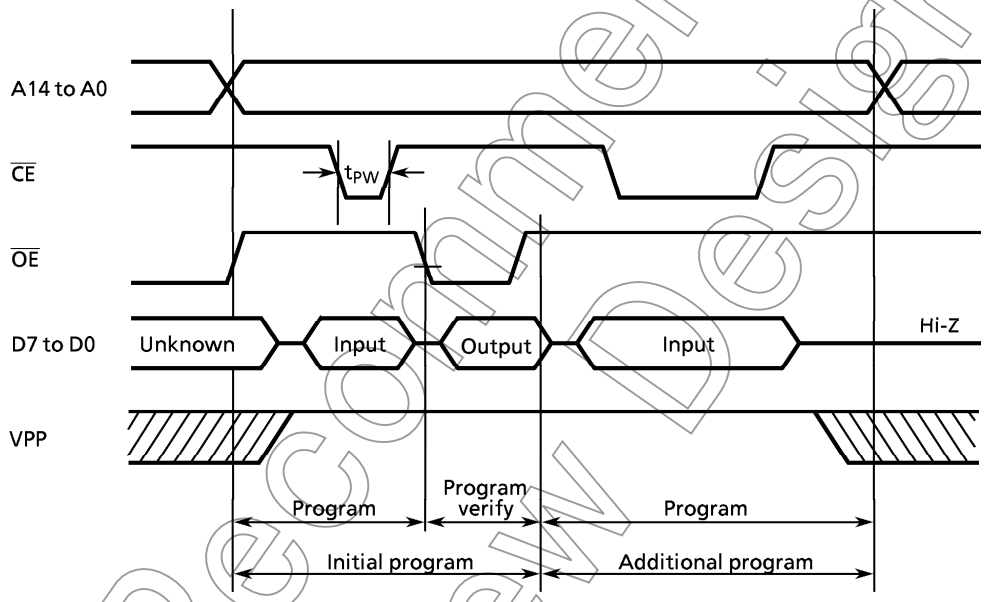
*Note: tcyc = 500 ns at 8 MHz*




Timing Waveforms of Read Operation

(2) Program Operation (High speed write mode-Ⅰ) (Topr = 25 ± 5°C)

| Parameter | Symbol | Conditions | Min | Typ. | Max | Unit |
|---|---|---|---|---|---|---|
| Input High Voltage | $V_{IH4}$ | | $V_{CC} \times 0.7$ | – | $V_{CC}$ | V |
| Input Low Voltage | $V_{IL4}$ | | 0 | – | $V_{CC} \times 0.12$ | V |
| Power Supply Voltage | $V_{CC}$ | | 5.75 | 6.0 | 6.25 | V |
| Program Power Supply Voltage | $V_{PP}$ | | 12.0 | 12.5 | 13.0 | V |
| Initial Program Pulse Width | $t_{PW}$ | $V_{CC}$ = 6.0 V | 0.95 | 1.0 | 1.05 | ms |



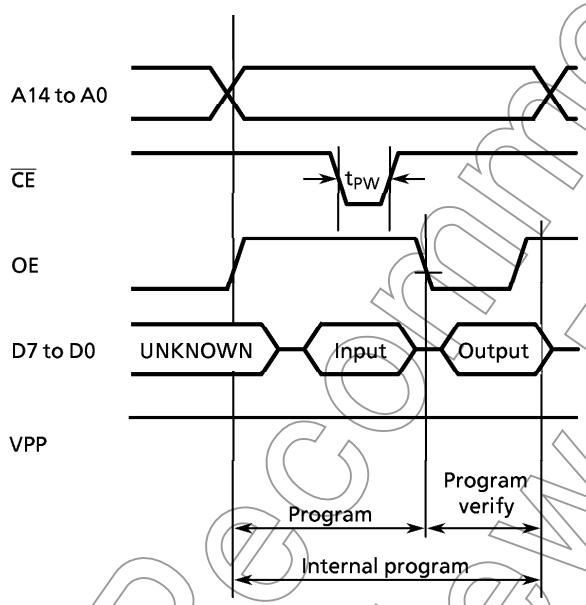

*Note 1: When $V_{cc}$ power supply is turned on or after, $V_{pp}$ must be increased.*
*When $V_{cc}$ power supply is turned off or before, $V_{pp}$ must be decreased.*

*Note 2: The device must not be set to the EPROM programmer or picked up from it under applying the program voltage (12.75 V ± 0.5 V) to the $V_{pp}$ pin as the device is damaged.*

Timing Waveforms of Programming Operation

(3) Program Operation (High speed write mode - II ) (Topr = 25 ± 5°C)

| Parameter | Symbol | Conditions | Min | Typ. | Max | Unit |
|---|---|---|---|---|---|---|
| Input High Voltage | $V_{IH4}$ | | $V_{CC} \times 0.7$ | – | $V_{CC}$ | V |
| Input Low Voltage | $V_{IL4}$ | | 0 | – | $V_{CC} \times 0.12$ | V |
| Supply Voltage | $V_{CC}$ | | 6.00 | 6.25 | 6.50 | V |
| Program Supply Voltage | $V_{PP}$ | | 12.50 | 12.75 | 13.0 | V |
| Initial Program Pulse Width | $t_{PW}$ | $V_{CC}$ = 6.25 V ± 0.25 V, $V_{PP}$ = 12.75 V ± 0.25 V | 0.095 | 0.1 | 0.105 | ms |




*Note 1: When $V_{cc}$ power supply is turned on or after, $V_{pp}$ must be increased.*
*When $V_{cc}$ power supply is turned off or before, $V_{pp}$ must be decreased.*

*Note 2: The device must not be set to the EPROM programmer or picked up from it under applying the program voltage (12.75 V ± 0.5 V) to the $V_{pp}$ pin as the device is damaged.*