

HN27512 Series

Maintenance Only

512K (64K x 8-bit) UV and OTP EPROM

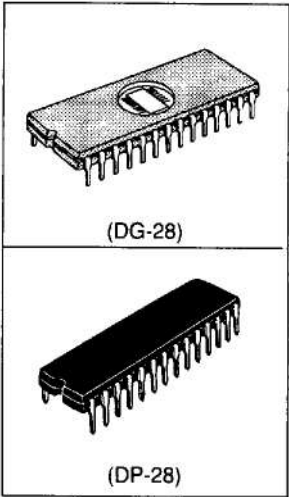
**DESCRIPTION**

The Hitachi HN27512 is a 512-Kilobit Ultraviolet Erasable and One-Time Programmable Electrically Programmable Read Only Memory organized as 65,536 x 8-bits.

The HN27512 features low power dissipation and high speed programming.

Hitachi's HN27512 is offered in JEDEC-Standard Byte-Wide EPROM pinouts in a 28-pin Ceramic and Plastic DIP packages.

- FEATURES**
- Fast Access Times:  
250 ns/300 ns (max)
  - Single Power Supply:  
 $V_{CC} = 5\text{ V} \pm 10\%$
  - Low Power Dissipation:  
Active Mode: 45 mA (typ)  
Standby Mode: 40 mA (max)
  - High Speed Programming
  - Programming Power Supply:  
 $V_{PP} = 12.5\text{ V} \pm 0.3\text{ V}$
  - Pin Arrangement:  
JEDEC Standard Byte-Wide EPROM
  - Package:  
28-pin Ceramic DIP  
28-pin Plastic DIP



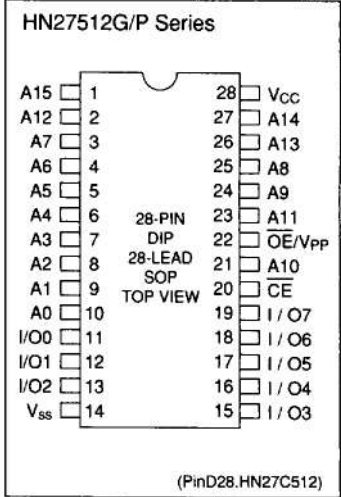
**ORDERING INFORMATION**

| Type No.    | Access Time | Package            |
|-------------|-------------|--------------------|
| HN27512G-25 | 250 ns      | 28-pin Ceramic DIP |
| HN27512G-30 | 300 ns      | (DG-28)            |
| HN27512P-25 | 250 ns      | 28-pin Plastic DIP |
| HN27512P-30 | 300 ns      | (DP-28)            |

**PIN DESCRIPTION**

| Pin Name        | Function           |
|-----------------|--------------------|
| $A_0 - A_{15}$  | Address            |
| $I/O_0 - I/O_7$ | Input/Output       |
| $\overline{CE}$ | Chip Enable        |
| $\overline{OE}$ | Output Enable      |
| $V_{CC}$        | Power Supply       |
| $V_{PP}$        | Programming Supply |
| $V_{SS}$        | Ground             |

**PIN ARRANGEMENT**



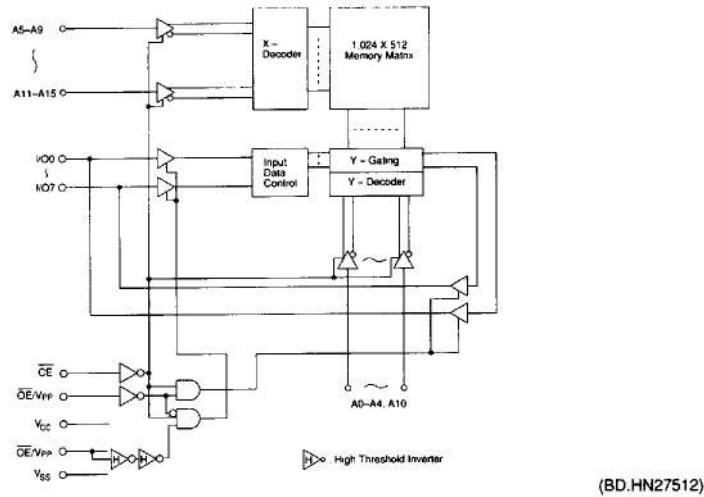
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BLOCK DIAGRAM



MODE SELECTION

| Mode            | V <sub>CC</sub> | CE              | OE/V <sub>PP</sub> | A <sub>9</sub>              | I/O              |
|-----------------|-----------------|-----------------|--------------------|-----------------------------|------------------|
| Read            | V <sub>CC</sub> | V <sub>IL</sub> | V <sub>IL</sub>    | X <sup>1</sup>              | D <sub>OUT</sub> |
| Output Disable  | V <sub>CC</sub> | V <sub>IL</sub> | V <sub>IH</sub>    | X                           | High-Z           |
| Standby         | V <sub>CC</sub> | V <sub>IH</sub> | X                  | X                           | High-Z           |
| Program         | V <sub>CC</sub> | V <sub>IL</sub> | V <sub>PP</sub>    | X                           | D <sub>IN</sub>  |
| Program Verify  | V <sub>CC</sub> | V <sub>IL</sub> | V <sub>IL</sub>    | X                           | D <sub>OUT</sub> |
| Program Inhibit | V <sub>CC</sub> | V <sub>IH</sub> | V <sub>PP</sub>    | X                           | High-Z           |
| Identifier      | V <sub>CC</sub> | V <sub>IL</sub> | V <sub>IL</sub>    | V <sub>H</sub> <sup>2</sup> | ID               |

Notes: 1. X = Don't Care.  
2. 11.5 V ≤ V<sub>H</sub> ≤ 12.5 V

ABSOLUTE MAXIMUM RATINGS

| Item                                      | Symbol                             | Value                                                | Unit |
|-------------------------------------------|------------------------------------|------------------------------------------------------|------|
| Supply Voltage <sup>1</sup>               | V <sub>CC</sub>                    | -0.6 to +7.0                                         | V    |
| Programming Voltage <sup>1</sup>          | V <sub>PP</sub>                    | -0.6 to +13.5                                        | V    |
| All Input and Output Voltage <sup>1</sup> | V <sub>IN</sub> , V <sub>OUT</sub> | -0.6 to +7.0                                         | V    |
| A <sub>9</sub> Input Voltage              | V <sub>ID</sub>                    | -0.6 to +13.5                                        | V    |
| Operating Temperature Range               | T <sub>OPR</sub>                   | 0 to +70                                             | °C   |
| Storage Temperature Range                 | T <sub>STG</sub>                   | -65 to +125 <sup>2</sup><br>-55 to +125 <sup>3</sup> | °C   |
| Storage Temperature Under Bias            | T <sub>BIAS</sub>                  | -10 to +80                                           | °C   |

Notes: 1. Relative to V<sub>SS</sub>.  
2. HN27512G.  
3. HN27512P.

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■ CAPACITANCE ( $T_a = 25^\circ\text{C}$ ,  $f = 1\text{MHz}$ )

| Item               | Symbol    | Typ. | Max. | Unit | Test Condition                                                |
|--------------------|-----------|------|------|------|---------------------------------------------------------------|
| Input Capacitance  | $C_{IN}$  | 4    | 6    | pF   | $V_{IN} = 0\text{V}$ , all pins except $\overline{OE}/V_{PP}$ |
| Output Capacitance | $C_{OUT}$ | 8    | 12   | pF   | $V_{OUT} = 0\text{V}$                                         |

## ■ DC ELECTRICAL CHARACTERISTICS FOR READ OPERATION

( $V_{CC} = 5\text{V} \pm 10\%$ ,  $T_a = 0$  to  $70^\circ\text{C}$ )

| Item                       | Symbol   | Min.              | Typ. | Max.           | Unit          | Test Condition                           |
|----------------------------|----------|-------------------|------|----------------|---------------|------------------------------------------|
| Input Leakage Current      | $I_{LI}$ | -                 | -    | 10             | $\mu\text{A}$ | $V_{IN} = 0\text{V}$ to $V_{CC}$         |
| Output Leakage Current     | $I_{LO}$ | -                 | -    | 10             | $\mu\text{A}$ | $V_{OUT} = 0\text{V}$ to $V_{CC}$        |
| Operating $V_{CC}$ Current | $I_{CC}$ | -                 | 45   | 100            | mA            | $\overline{CE} = \overline{OE} = V_{IL}$ |
| Standby $V_{CC}$ Current   | $I_{SB}$ | -                 | -    | 40             | mA            | $\overline{CE} = V_{IH}$                 |
| Input Voltage              | $V_{IH}$ | 2.2               | -    | $V_{CC} + 1^2$ | V             |                                          |
|                            | $V_{IL}$ | -0.1 <sup>1</sup> | -    | 0.8            | V             |                                          |
| Output Voltage             | $V_{OH}$ | 2.4               | -    | -              | V             | $I_{OH} = 1.0\text{mA}$                  |
|                            | $V_{OL}$ | -                 | -    | 0.45           | V             | $I_{OL} = 2.1\text{mA}$                  |

- Notes: 1.  $V_{IL}$  min = -0.6 V for pulse width  $\leq 20\text{ns}$ .  
 2.  $V_{IH}$  max =  $V_{CC} + 1.5\text{V}$  for pulse width  $\leq 20\text{ns}$ .  
 If  $V_{IH}$  is over the specified maximum value, Read operation can not be guaranteed.

## ■ AC ELECTRICAL CHARACTERISTICS FOR READ OPERATION

( $V_{CC} = 5\text{V} \pm 10\%$ ,  $T_a = 0$  to  $70^\circ\text{C}$ )

## Test Conditions

- Input pulse levels: 0.45 V / 2.4 V
- Input rise and fall times:  $\leq 20\text{ns}$
- Output load: 1 TTL Gate + 100 pF (Including scope and jig)
- Reference levels for measuring timing: 0.8 V / 2.0 V

| Item                                  | Symbol    | -25  |      | -30  |      | Unit | Test Condition                           |
|---------------------------------------|-----------|------|------|------|------|------|------------------------------------------|
|                                       |           | Min. | Max. | Min. | Max. |      |                                          |
| Address Access Time                   | $t_{ACC}$ | -    | 250  | -    | 300  | ns   | $\overline{CE} = \overline{OE} = V_{IL}$ |
| Chip Enable Access Time               | $t_{CE}$  | -    | 250  | -    | 300  | ns   | $\overline{OE} = V_{IL}$                 |
| Output Enable Access Time             | $t_{OE}$  | -    | 100  | -    | 120  | ns   | $\overline{CE} = V_{IL}$                 |
| Output Disable to High-Z <sup>1</sup> | $t_{DF}$  | 0    | 60   | 0    | 105  | ns   | $\overline{CE} = V_{IL}$                 |
| Output Hold to Address Change         | $t_{OH}$  | 0    | -    | 0    | -    | ns   | $\overline{CE} = \overline{OE} = V_{IL}$ |

- Note: 1.  $t_{DF}$  is defined as the time at which the output becomes an open circuit and data is no longer driven.

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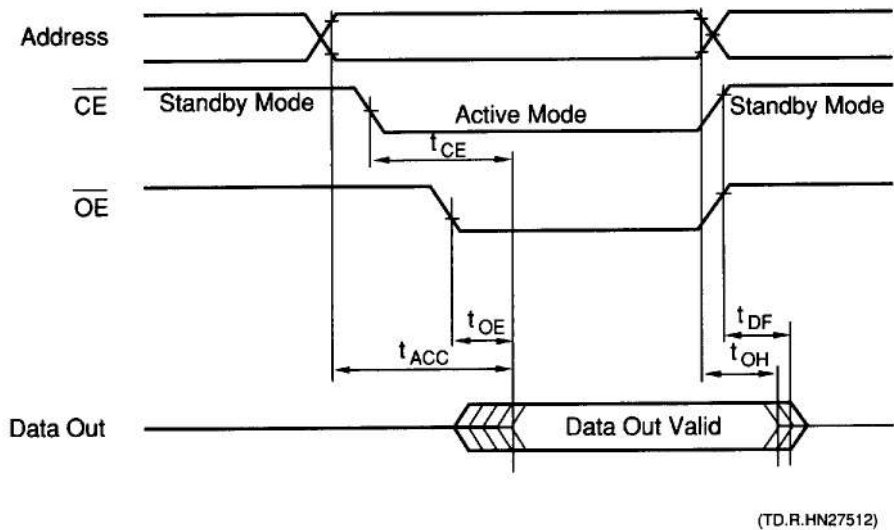
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HN27512 Series

■ READ TIMING WAVEFORM



■ DC ELECTRICAL CHARACTERISTICS FOR PROGRAMMING OPERATIONS

(V<sub>CC</sub> = 6.0 V ± 0.25 V, V<sub>PP</sub> = 12.5 V ± 0.3 V, T<sub>a</sub> = 25 °C ± 5 °C)

| Item                              | Symbol          | Min.               | Typ. | Max.                              | Unit | Test Condition            |
|-----------------------------------|-----------------|--------------------|------|-----------------------------------|------|---------------------------|
| Input Leakage Current             | I <sub>LI</sub> | -                  | -    | 10                                | μA   | V <sub>IN</sub> = 5.25 V  |
| Operating V <sub>CC</sub> Current | I <sub>CC</sub> | -                  | -    | 100                               | mA   |                           |
| Operating V <sub>PP</sub> Current | I <sub>PP</sub> | -                  | 35   | 50                                | mA   | $\overline{CE} = V_{IL}$  |
| Input Voltage <sup>1</sup>        | V <sub>IH</sub> | 2.0                | -    | V <sub>CC</sub> + .5 <sup>2</sup> | V    |                           |
|                                   | V <sub>IL</sub> | - 0.1 <sup>1</sup> | -    | 0.8                               | V    |                           |
| Output Voltage                    | V <sub>OH</sub> | 2.4                | -    | -                                 | V    | I <sub>OH</sub> = -400 μA |
|                                   | V <sub>OL</sub> | -                  | -    | 0.45                              | V    | I <sub>OH</sub> = 2.1 mA  |

- Notes: 1. V<sub>IL</sub> min = -0.6 V for pulse width ≤ 20 ns.  
2. If V<sub>IH</sub> is over the specified maximum value, programming operation can not be guaranteed.

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■ AC ELECTRICAL CHARACTERISTICS FOR PROGRAMMING OPERATIONS

( $V_{CC} = 6\text{ V} \pm 0.25\text{ V}$ ,  $V_{PP} = 12.5\text{ V} \pm 0.5\text{ V}$ ,  $T_a = 25^\circ\text{C} \pm 5^\circ\text{C}$ )

Test Conditions

- Input pulse levels: 0.45 V / 2.4 V
- Input rise and fall times:  $\leq 20\text{ ns}$
- Reference levels for measuring timing: 0.8 V / 2.0V

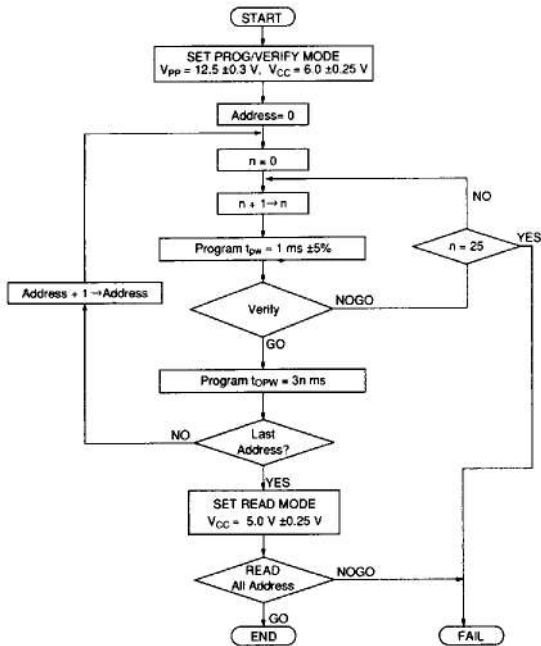
| Item                                            | Symbol    | Min. | Typ. | Max.  | Unit          | Test Condition |
|-------------------------------------------------|-----------|------|------|-------|---------------|----------------|
| Address Setup Time                              | $t_{AS}$  | 2    | -    | -     | $\mu\text{s}$ |                |
| Address Hold Time                               | $t_{AH}$  | 0    | -    | -     | $\mu\text{s}$ |                |
| Data Setup Time                                 | $t_{DS}$  | 2    | -    | -     | $\mu\text{s}$ |                |
| $V_{PP}$ Setup Time                             | $t_{VPS}$ | 2    | -    | -     | $\mu\text{s}$ |                |
| $V_{CC}$ Setup Time                             | $t_{VCS}$ | 2    | -    | -     | $\mu\text{s}$ |                |
| Output Enable Hold Time                         | $t_{OEh}$ | 2    | -    | -     | $\mu\text{s}$ |                |
| Output Disable Time                             | $t_{DF}$  | 0    | -    | 130   | ns            |                |
| $\overline{CE}$ Initial Programming Pulse Width | $t_{PW}$  | 0.95 | 1.0  | 1.05  | ms            |                |
| $\overline{CE}$ Overprogramming Pulse Width     | $t_{OPW}$ | 2.85 | -    | 78.75 | ms            |                |
| Data Hold Time                                  | $t_{DH}$  | 2    | -    | -     | $\mu\text{s}$ |                |
| $V_{PP}$ Recovery Time                          | $t_{VR}$  | 2    | -    | -     | $\mu\text{s}$ |                |
| Data Valid from Chip Enable                     | $t_{DV}$  | -    | -    | 1     | $\mu\text{s}$ |                |

Note: 1.  $t_{DF}$  is defined as the time at which the output becomes an open circuit and data is no longer driven.

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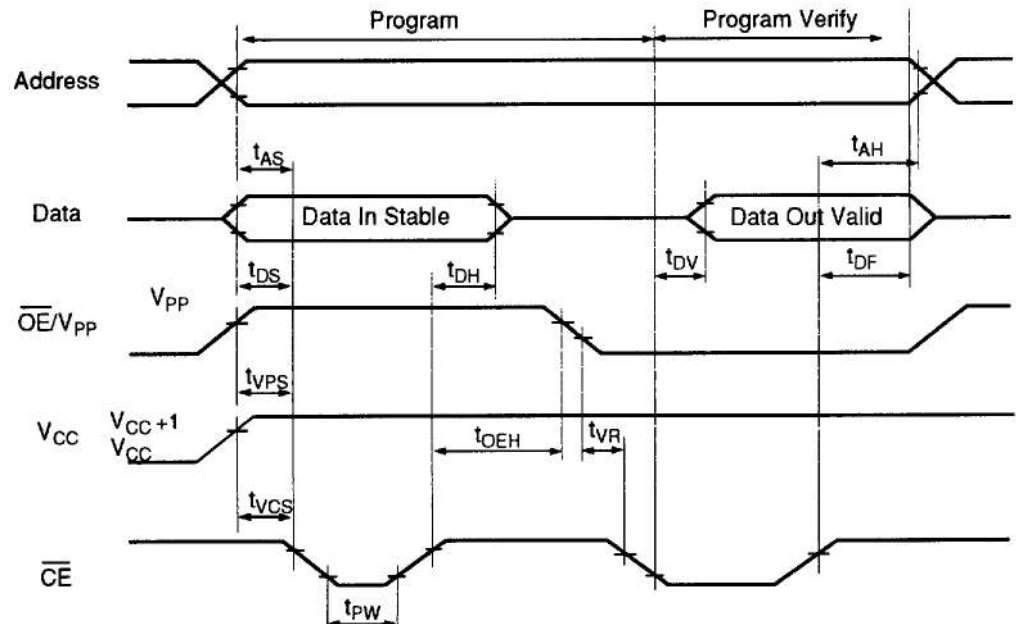
■ HIGH PERFORMANCE PROGRAMMING FLOWCHART

The Hitachi HN27512 can be programmed with the High Performance Programming algorithm shown in the following flowchart. This algorithm provides a fast programming time without voltage stress to the device or deterioration in reliability of programmed data.



(FC.P.HN27512)

■ HIGH PERFORMANCE PROGRAMMING TIMING WAVEFORM



(TD.PP.HN27512)

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HN27512 Series

■ ERASING THE HN27512

The Hitachi HN27512 Ceramic DIP package allows the device to be erased by exposure to ultraviolet light of 2537Å. All of the data is changed to "1" after this erasure procedure. The minimum integrated dose (UV intensity x exposure time) for erasure is 15 W-sec/cm².

■ DEVICE IDENTIFIER MODE DESCRIPTION

The Device Identifier Mode allows binary codes to be read from the outputs that identify the manufacturer and the type of device. Using this mode with programming equipment, the device will automatically match its own erase and programming algorithm.

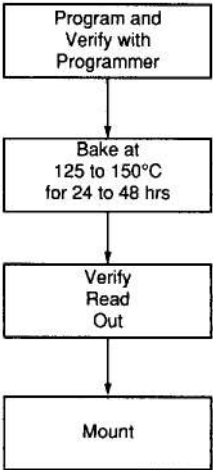
■ HN27512 SERIES IDENTIFIER CODE

| Identifier        | A <sub>0</sub>  | I/O <sub>7</sub> | I/O <sub>6</sub> | I/O <sub>5</sub> | I/O <sub>4</sub> | I/O <sub>3</sub> | I/O <sub>2</sub> | I/O <sub>1</sub> | I/O <sub>0</sub> | Hex Data |
|-------------------|-----------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|----------|
| Manufacturer Code | V <sub>IL</sub> | 0                | 0                | 0                | 0                | 0                | 1                | 1                | 1                | 07       |
| Device Code       | V <sub>IH</sub> | 1                | 0                | 0                | 1                | 0                | 1                | 0                | 0                | 94       |

- Notes: 1. A<sub>0</sub> = 12.0 V ± 0.5V  
3. A<sub>1</sub>-A<sub>8</sub>, A<sub>10</sub>-A<sub>15</sub>,  $\overline{CE}$ ,  $\overline{OE}$ /V<sub>PP</sub> = V<sub>IL</sub>

■ HN27512P RECOMMENDED SCREENING CONDITIONS

Before mounting the HN27512P package, please make the following screening (baking without bias) shown below:



(RSC.EPROM)

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