

# 4496203 HITACHI/ LOGIC/ARRAYS/MEM

## HN27C256G Series

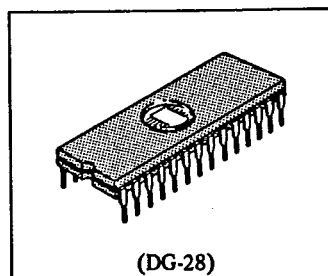
04E 13050 D

T-46-13-29

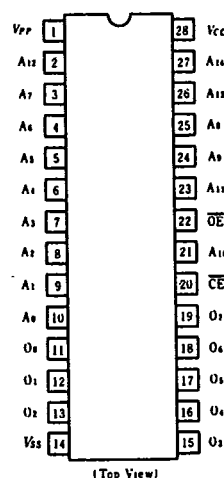
32768-word x 8-bit CMOS UV Erasable and Programmable ROM

### ■ FEATURES

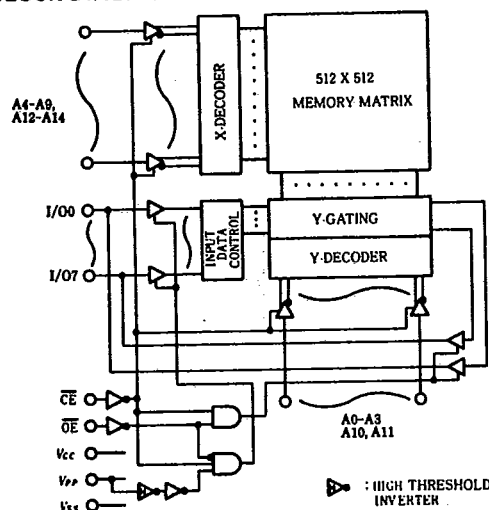
- Low Power Dissipation ..... 40mW/MHz max. (Active Mode)  
110μW max. (Stand-by Mode)
- Access Time ..... 170/200/250/300ns (max.)
- Single Power Supply ..... 5V ± 5%
- High Performance Programming ... Program Voltage: +12.5V DC
- Static ..... No Clocks Required
- Inputs and Outputs TTL Compatible During Both Read and Program Modes
- Absolute Max. Rating of  $V_{PP}$  pin. . . 14.0V
- Device Identifier Mode ..... Manufacturer Code and Device Code
- Compatible with INTEL 27256



### ■ PIN ARRANGEMENT



### ■ BLOCK DIAGRAM



### ■ MODE SELECTION

| Mode                     | Pins | $\overline{CE}$ (20) | $\overline{OE}$ (22) | A9 (24)    | $V_{PP}$ (1) | $V_{CC}$ (28) | Outputs (11 - 13, 15 - 19) |
|--------------------------|------|----------------------|----------------------|------------|--------------|---------------|----------------------------|
| Read                     |      | $V_{IL}$             | $V_{IL}$             | X          | $V_{CC}$     | $V_{CC}$      | Dout                       |
| Output Disable           |      | $V_{IL}$             | $V_{IH}$             | X          | $V_{CC}$     | $V_{CC}$      | High Z                     |
| Standby                  |      | $V_{IH}$             | X                    | X          | $V_{CC}$     | $V_{CC}$      | High Z                     |
| High Performance Program |      | $V_{IL}$             | $V_{IH}$             | X          | $V_{PP}$     | $V_{CC}$      | Din                        |
| Program Verify           |      | $V_{IH}$             | $V_{IL}$             | X          | $V_{PP}$     | $V_{CC}$      | Dout                       |
| Optional Verify          |      | $V_{IL}$             | $V_{IL}$             | X          | $V_{PP}$     | $V_{CC}$      | Dout                       |
| Program Inhibit          |      | $V_{IH}$             | $V_{IH}$             | X          | $V_{PP}$     | $V_{CC}$      | High Z                     |
| Identifier               |      | $V_{IL}$             | $V_{IL}$             | $V_H^{*2}$ | $V_{CC}$     | $V_{CC}$      | Code                       |

Notes) \*1. X: Don't care.

\*2.  $V_H$ : 12.0V ± 0.5V.

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## ■ ABSOLUTE MAXIMUM RATINGS

| Item                                 | Symbol            | Value           | Unit |
|--------------------------------------|-------------------|-----------------|------|
| Operating Temperature Range          | $T_{opr}$         | 0 to +70        | °C   |
| Storage Temperature Range            | $T_{stg}$         | -65 to +125     | °C   |
| Storage Temperature Range Under Bias | $T_{bias}$        | -10 to +80      | °C   |
| All Input and Output Voltage*1       | $V_{IN}, V_{OUT}$ | -0.6*2 to +7    | V    |
| Voltage on Pin 24 (A9)*1             | $V_{ID}$          | -0.6*2 to +13.5 | V    |
| $V_{PP}$ Voltage*1                   | $V_{PP}$          | -0.6 to +14     | V    |
| $V_{CC}$ Voltage*1                   | $V_{CC}$          | -0.6 to +7      | V    |

Notes: \*1. With respect to  $V_{SS}$ .\*2. -1.0V for pulse width  $\leq 50$ ns.

## ■ READ OPERATION

● DC AND OPERATING CHARACTERISTICS ( $T_a = 0$  to +70°C,  $V_{CC} = 5V \pm 5\%$ ,  $V_{PP} = V_{CC}$ )

| Parameter                  | Symbol    | Test Condition                           | min          | typ | max             | Unit    |
|----------------------------|-----------|------------------------------------------|--------------|-----|-----------------|---------|
| Input Leakage Current      | $I_{LI}$  | $V_{in} = 5.25V$                         | -            | -   | 2               | $\mu A$ |
| Output Leakage Current     | $I_{LO}$  | $V_{out} = 5.25V/0.45V$                  | -            | -   | 2               | $\mu A$ |
| $V_{PP}$ Current           | $I_{PP1}$ | $V_{PP} = 5.5V$                          | -            | 1   | 20              | $\mu A$ |
| $V_{CC}$ Current (Standby) | $I_{SB1}$ | $\overline{CE} = V_{IH}$                 | -            | -   | 1               | mA      |
|                            | $I_{SB2}$ | $\overline{CE} = V_{CC} \pm 0.3V$        | -            | 1   | 20              | $\mu A$ |
| $V_{CC}$ Current (Active)  | $I_{CC1}$ | $\overline{CE} = V_{IL}, I_{out} = 0$ mA | -            | -   | 30              | mA      |
|                            | $I_{CC2}$ | $f = 5$ MHz, $I_{out} = 0$ mA            | -            | -   | 30              | mA      |
|                            | $I_{CC3}$ | $f = 1$ MHz, $I_{out} = 0$ mA            | -            | -   | 8               | mA      |
| Input Voltage              | $V_{IL}$  |                                          | -0.3*1       | -   | 0.8             | V       |
|                            | $V_{IH}$  |                                          | 2.2          | -   | $V_{CC}+1.0$ *2 | V       |
| Output Voltage             | $V_{OL}$  | $I_{OL} = 2.1$ mA                        | -            | -   | 0.45            | V       |
|                            | $V_{OH1}$ | $I_{OH} = -400$ $\mu A$                  | 2.4          | -   | -               | V       |
|                            | $V_{OH2}$ | $I_{OH} = -100$ $\mu A$                  | $V_{CC}-0.7$ | -   | -               | V       |

Notes) \*1. -1.0V for pulse width  $\leq 50$ ns.\*2.  $V_{CC} + 1.5V$  for pulse width  $\leq 20$ ns. If  $V_{IH}$  is over the specified maximum value, read operation cannot be guaranteed.● AC CHARACTERISTICS ( $T_a = 0$  to +70°C,  $V_{CC} = 5V \pm 5\%$ ,  $V_{PP} = V_{CC}$ )

| Parameter                            | Symbol    | Test Condition                           | HN27C256G-17 |      | HN27C256G-20 |      | HN27C256G-25 |      | HN27C256G-30 |      | Unit |
|--------------------------------------|-----------|------------------------------------------|--------------|------|--------------|------|--------------|------|--------------|------|------|
|                                      |           |                                          | min.         | max. | min.         | max. | min.         | max. | min.         | max. |      |
| Address to Output Delay              | $t_{ACC}$ | $\overline{CE} = \overline{OE} = V_{IL}$ | -            | 170  | -            | 200  | -            | 250  | -            | 300  | ns   |
| $\overline{CE}$ to Output Delay      | $t_{CE}$  | $\overline{OE} = V_{IL}$                 | -            | 170  | -            | 200  | -            | 250  | -            | 300  | ns   |
| $\overline{OE}$ to Output Delay      | $t_{OE}$  | $\overline{CE} = V_{IL}$                 | 10           | 60   | 10           | 70   | 10           | 100  | 10           | 120  | ns   |
| $\overline{OE}$ High to Output Float | $t_{DF}$  | $\overline{CE} = V_{IL}$                 | 0            | 50   | 0            | 50   | 0            | 60   | 0            | 105  | ns   |
| Address to Output Hold               | $t_{OH}$  | $\overline{CE} = \overline{OE} = V_{IL}$ | 0            | -    | 0            | -    | 0            | -    | 0            | -    | ns   |

Note:  $t_{DF}$  defines the time at which the Output achieves the open circuit condition and Data is no longer driven.

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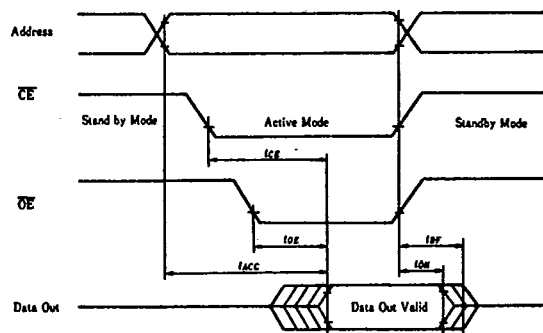
HN27C256G Series

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## ● SWITCHING CHARACTERISTICS

## TEST CONDITION

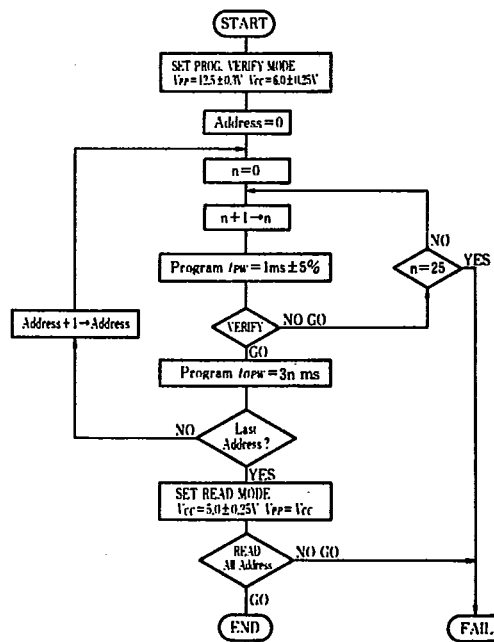
Input pulse levels: 0.45V to 2.4V  
 Input rise and fall time:  $\leq 20\text{ns}$   
 Output load: 1 TTL Gate +100pF  
 Reference level for measuring timing: 0.8V and 2.0V

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

| Parameter          | Symbol    | Test Condition         | Min. | Typ. | Max. | Unit. |
|--------------------|-----------|------------------------|------|------|------|-------|
| Input Capacitance  | $C_{in}$  | $V_{in} = 0\text{ V}$  | —    | 4    | 6    | pF    |
| Output Capacitance | $C_{out}$ | $V_{out} = 0\text{ V}$ | —    | 8    | 12   | pF    |

## ■ HIGH PERFORMANCE PROGRAMMING

This device can be applied the High Performance Programming algorithm shown in following flowchart. This algorithm allows to obtain faster programming time without any voltage stress to the device nor deterioration in reliability of programmed data.



High Performance Programming Flowchart



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## ■ HIGH PERFORMANCE PROGRAMMING OPERATION

● DC PROGRAMMING CHARACTERISTICS ( $T_a=25^\circ\text{C}\pm 5^\circ\text{C}$ ,  $V_{CC}=6\text{V}\pm 0.25\text{V}$ ,  $V_{PP}=12.5\text{V}\pm 0.3\text{V}$ )

| Parameter                         | Symbol    | Test Condition                       | min.               | typ. | max.                       | Unit          |
|-----------------------------------|-----------|--------------------------------------|--------------------|------|----------------------------|---------------|
| Input Leakage Current             | $I_{LI}$  | $V_{IN} = 6.25\text{V}/0.45\text{V}$ | —                  | —    | 2                          | $\mu\text{A}$ |
| Output Low Voltage During Verify  | $V_{OL}$  | $I_{OL} = 2.1\text{mA}$              | —                  | —    | 0.45                       | V             |
| Output High Voltage During Verify | $V_{OH}$  | $I_{OH} = -400\mu\text{A}$           | 2.4                | —    | —                          | V             |
| $V_{CC}$ Current (Active)         | $I_{CC2}$ |                                      | —                  | —    | 30                         | mA            |
| Input Low Level                   | $V_{IL}$  |                                      | -0.1 <sup>*5</sup> | —    | 0.8                        | V             |
| Input High Level                  | $V_{IH}$  |                                      | 2.2                | —    | $V_{CC}+0.5$ <sup>*6</sup> | V             |
| $V_{PP}$ Supply Current           | $I_{PP2}$ | $\overline{\text{CE}} = V_{IL}$      | —                  | —    | 40                         | mA            |

Notes)\*1.  $V_{CC}$  must be applied before  $V_{PP}$  and removed after  $V_{PP}$ .\*2.  $V_{PP}$  must not exceed 14V including overshoot.\*3. An influence may be had upon device reliability if the device is installed or removed while  $V_{PP} = 12.5\text{V}$ .\*4. Do not alter  $V_{PP}$  either  $V_{IL}$  to 12.5V or 12.5V to  $V_{IL}$  when  $\overline{\text{CE}} = \text{Low}$ .\*5. -0.6V for pulse width  $\leq 20\text{ns}$ .\*6. If  $V_{IH}$  is over the specified maximum value, programming operation cannot be guaranteed.● AC PROGRAMMING CHARACTERISTICS ( $T_a=25^\circ\text{C}\pm 5^\circ\text{C}$ ,  $V_{CC}=6\text{V}\pm 0.25\text{V}$ ,  $V_{PP}=12.5\text{V}\pm 0.3\text{V}$ )

| Parameter                                                     | Symbol    | Test Condition | min. | typ. | max.  | Unit          |
|---------------------------------------------------------------|-----------|----------------|------|------|-------|---------------|
| Address Setup Time                                            | $t_{AS}$  |                | 2    | —    | —     | $\mu\text{s}$ |
| $\overline{\text{OE}}$ Setup Time                             | $t_{OES}$ |                | 2    | —    | —     | $\mu\text{s}$ |
| Data Setup Time                                               | $t_{DS}$  |                | 2    | —    | —     | $\mu\text{s}$ |
| Address Hold Time                                             | $t_{AH}$  |                | 0    | —    | —     | $\mu\text{s}$ |
| Data Hold Time                                                | $t_{DH}$  |                | 2    | —    | —     | $\mu\text{s}$ |
| $\overline{\text{OE}}$ to Output Float Delay                  | $t_{DF}$  |                | 0    | —    | 130   | ns            |
| $V_{PP}$ Setup Time                                           | $t_{VPS}$ |                | 2    | —    | —     | $\mu\text{s}$ |
| $V_{CC}$ Setup Time                                           | $t_{VCS}$ |                | 2    | —    | —     | $\mu\text{s}$ |
| $\overline{\text{CE}}$ Pulse Width During Initial Programming | $t_{PW}$  |                | 0.95 | 1.0  | 1.05  | ms            |
| $\overline{\text{CE}}$ Pulse Width During Overprogramming     | $t_{OPW}$ |                | 2.85 | —    | 78.75 | ms            |
| Data Valid from $\overline{\text{OE}}$                        | $t_{OE}$  |                | 0    | —    | 150   | ns            |

Notes:  $t_{OPW}$  is defined as mentioned in flow chart. $t_{DF}$  defines the time at which the output achieves the open circuit condition and data is no longer driven.

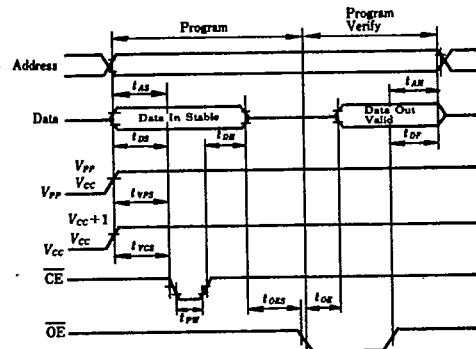
## ● SWITCHING CHARACTERISTICS

## Test Condition

Input pulse level: 0.45V to 2.4V

Input rise and fall time:  $\leq 20\text{ns}$ 

Reference level for measuring time: 0.8V and 2V



## ■ ERASE

Erasure of HN27C256G is performed by exposure to ultraviolet light of 2537 Å and all the output data are changed to "1" after this erasure procedure. The minimum integrated dose (i.e. UV intensity x exposure time) for erasure is 15W. sec/cm<sup>2</sup>



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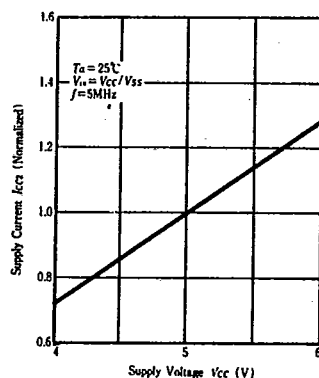
## • HN27C256G IDENTIFIER CODES

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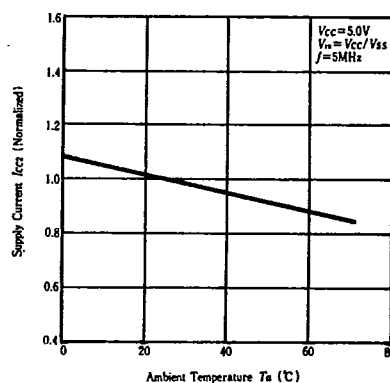
| Identifier        | Pins            | A <sub>0</sub><br>(10) | O <sub>1</sub><br>(19) | O <sub>2</sub><br>(18) | O <sub>3</sub><br>(17) | O <sub>4</sub><br>(16) | O <sub>5</sub><br>(15) | O <sub>6</sub><br>(13) | O <sub>7</sub><br>(12) | O <sub>8</sub><br>(11) | Hex<br>Data |
|-------------------|-----------------|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|-------------|
| Manufacturer Code | V <sub>IL</sub> | 0                      | 0                      | 0                      | 0                      | 0                      | 0                      | 1                      | 1                      | 1                      | 07          |
| Device Code       | V <sub>IH</sub> | 1                      | 0                      | 1                      | 1                      | 1                      | 0                      | 0                      | 0                      | 0                      | B0          |

Notes: 1. A<sub>9</sub> = 12.0V ± 0.5V.  
 2. A<sub>1</sub> - A<sub>8</sub>, A<sub>10</sub> - A<sub>14</sub>, CE, OE = V<sub>IL</sub>.

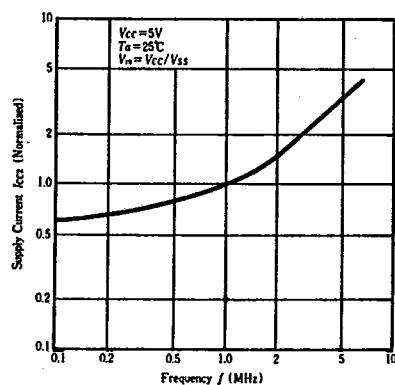
SUPPLY CURRENT VS. SUPPLY VOLTAGE



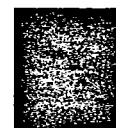
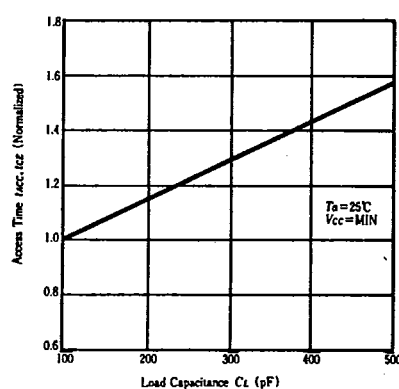
SUPPLY CURRENT VS. AMBIENT TEMPERATURE



SUPPLY CURRENT VS. FREQUENCY



ACCESS TIME VS. LOAD CAPACITANCE



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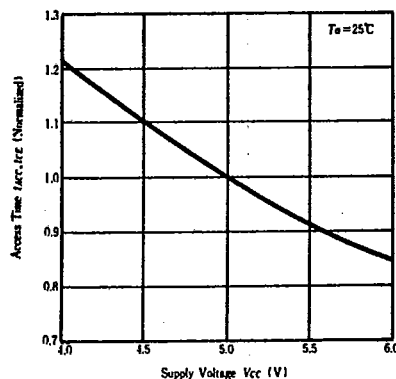
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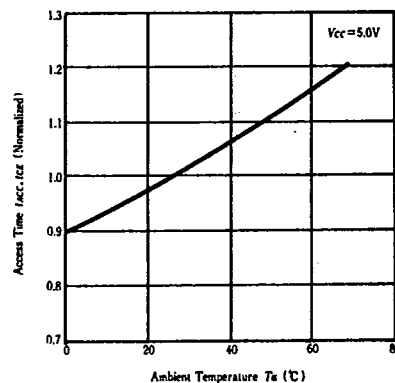
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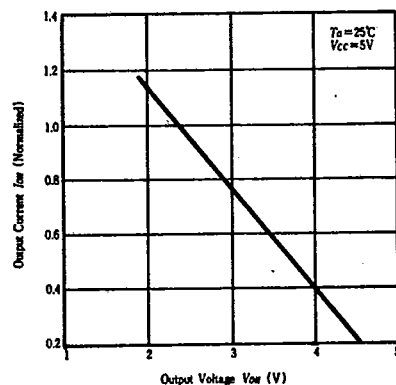
ACCESS TIME VS. SUPPLY VOLTAGE



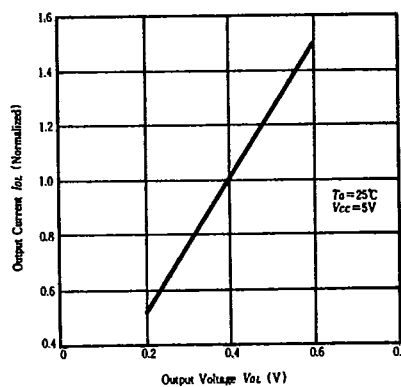
ACCESS TIME VS. AMBIENT TEMPERATURE



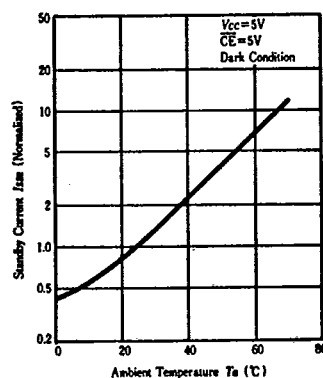
OUTPUT CURRENT VS. OUTPUT VOLTAGE



OUTPUT CURRENT VS. OUTPUT VOLTAGE



STANDBY CURRENT  
VS. AMBIENT TEMPERATURE



STANDBY CURRENT VS. SUPPLY VOLTAGE

