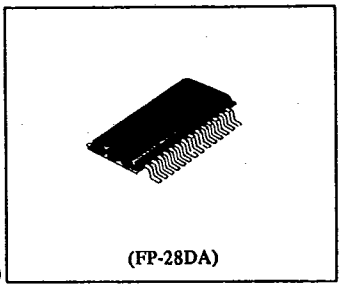
# HN27C256FP Series

T-46-13-25

## 32768-word x 8-bit CMOS One Time Electrically Programmable ROM

The HN27C256FP is a 32768-word by 8-bit one time electrically programmable ROM. Initially, all bits of the HN27C256FP are in the "1" State (Output High). Data is introduced by selectively programming "0" into the desired bit locations. This device is packaged in a 28 pin plastic flat package (SOP). Therefore, this device cannot be re-written.

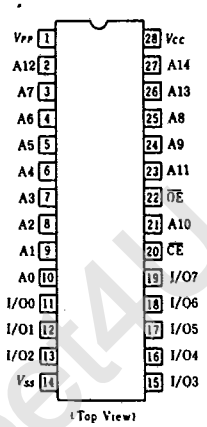


(FP-28DA)

### ■ FEATURES

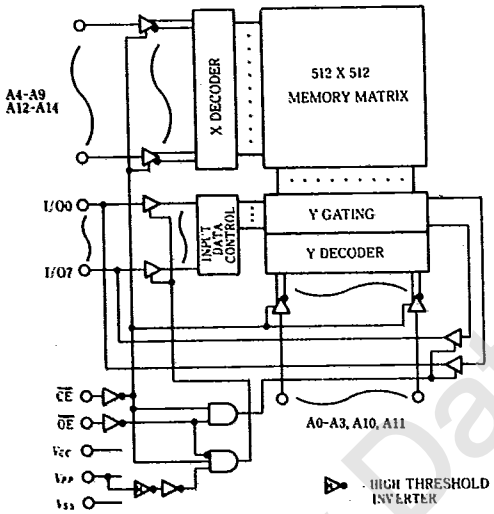
- Low Power Dissipation . . . . . 40mW/MHz max. (Active Mode)
  110μW max (Standby Mode)
- Access Time . . . . . 250ns max. (HN27C256FP-25T)
  300ns max. (HN27C256FP-30T)
- Single Power Supply . . . . . 5V ± 5%
- High Performance Programming . . Program Voltage: +12.5V DC
- Static . . . . . No Clocks 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

### ■ PIN ARRANGEMENT




(Top View)

### ■ BLOCK DIAGRAM



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## ■ MODE SELECTION

| Mode \ Pins | $\overline{CE}$ (20) | $\overline{OE}$ (22) | A9 (24) | $V_{PP}$ (1) | $V_{CC}$ (28) | I/O (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. $V_H$: 12.0 ± 0.5V.

## ■ ABSOLUTE MAXIMUM RATINGS

| Item | Symbol | Value | Unit |
|---|---|---|---|
| Operating Temperature Range | $T_{opr}$ | 0 to +70 | °C |
| Storage Temperature Range | $T_{stg}$ | −55 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 ≦ 50ns.

## ■ READ OPERATION

### • DC AND OPERATING CHARACTERISTICS ($T_a$ = 0 ~ +70°C, $V_{CC}$ = 5V ± 5%, $V_{PP}$ = $V_{CC}$)

| Parameter | Symbol | Test Condition | min | typ | max | Unit |
|---|---|---|---|---|---|---|
| Input Leakage Current | $I_{LI}$ | $V_{in}$ = 5.25V | – | – | 2 | μA |
| Output Leakage Current | $I_{LO}$ | $V_{out}$ = 5.25V/0.45V | – | – | 2 | μA |
| $V_{PP}$ Current | $I_{PP1}$ | $V_{PP}$ = 5.5V | – | 1 | 20 | μA |
| $V_{CC}$ Current (Standby) | $I_{SB1}$ | $\overline{CE}$ = $V_{IH}$ | – | – | 1 | mA |
| | $I_{SB2}$ | $\overline{CE}$ = $V_{CC}$ ± 0.3V | – | 1 | 20 | μA |
| $V_{CC}$ 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 μA | 2.4 | – | – | V |
| | $V_{OH2}$ | $I_{OH}$ = −100 μA | $V_{CC}$−0.7 | – | – | V |

Notes) *1. −1.0V for pulse width ≦ 50ns.
*2. $V_{CC}$ + 1.5V for pulse width ≦ 20ns. If $V_{IH}$ is over the specified maximum value, read operation cannot be guaranteed.

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## • AC CHARACTERISTICS ($T_a$ = 0 to +70°C, $V_{CC}$ = 5V ± 5%, $V_{PP}$ = $V_{CC}$)

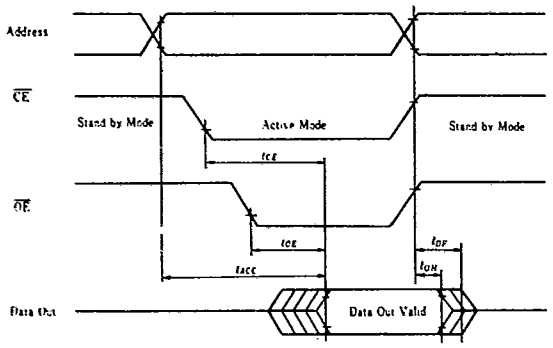
| Parameter | Symbol | Test Condition | HN27C256FP-25T | | HN27C256FP-30T | | Unit |
|---|---|---|---|---|---|---|---|
| | | | Min | Max | Min | Max | |
| Address to Output Delay | $t_{ACC}$ | $\overline{CE}$ = $\overline{OE}$ = $V_{IL}$ | – | 250 | – | 300 | ns |
| $\overline{CE}$ to Output Delay | $t_{CE}$ | $\overline{OE}$ = $V_{IL}$ | – | 250 | – | 300 | ns |
| $\overline{OE}$ to Output Delay | $t_{OE}$ | $\overline{CE}$ = $V_{IL}$ | 10 | 100 | 0 | 120 | ns |
| $\overline{OE}$ High to Output Float | $t_{DF}$ | $\overline{CE}$ = $V_{IL}$ | 0 | 60 | 0 | 105 | ns |
| Address to Output Hold | $t_{OH}$ | $\overline{CE}$ = $\overline{OE}$ = $V_{IL}$ | 0 | – | 0 | – | ns |

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

## • SWITCHING CHARACTERISTICS

### TEST CONDITION

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

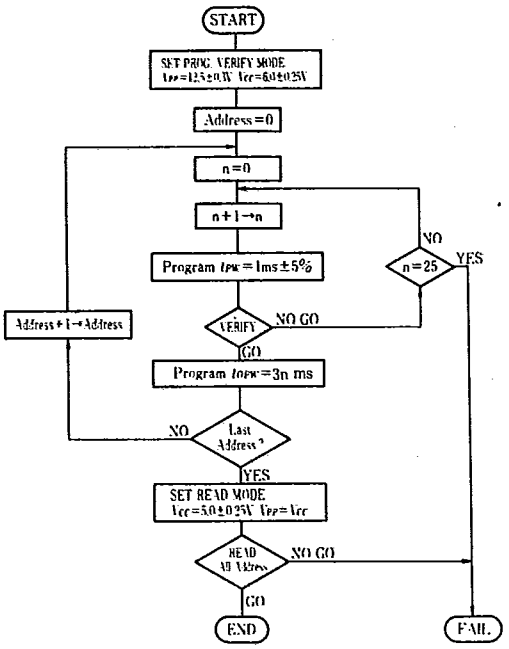



## • CAPACITANCE ($Ta$=25°C, $f$=1MHz)

| Parameter | Symbol | Test Condition | min. | typ. | max. | Unit. |
|---|---|---|---|---|---|---|
| Input Capacitance | $C_{in}$ | $V_{in}$ = 0 V | – | 4 | 6 | pF |
| Output Capacitance | $C_{out}$ | $V_{out}$ = 0 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

## ■ HIGH PERFORMANCE PROGRAMMING OPERATION

### • DC PROGRAMMING CHARACTERISTICS ($Ta$=25°C±5°C, $V_{CC}$=6V±0.25V, $V_{PP}$=12.5V±0.3V)

| Parameter | Symbol | Test Condition | min. | typ. | max. | Unit |
|---|---|---|---|---|---|---|
| Input Leakage Current | $I_{LI}$ | $V_{IN}$ = 6.25V/0.45V | – | – | 2 | μA |
| Output Low Voltage During Verify | $V_{OL}$ | $I_{OL}$ = 2.1 mA | – | – | 0.45 | V |
| Output High Voltage During Verify | $V_{OH}$ | $I_{OH}$ = −400 μA | 2.4 | – | – | V |
| $V_{CC}$ Current (Active) | $I_{CC2}$ | | – | – | 30 | mA |
| Input Low Level | $V_{IL}$ | | −0.1*5 | – | 0.8 | V |
| Input High Level | $V_{IH}$ | | 2.2 | – | $V_{CC}$+0.5*6 | V |
| $V_{PP}$ Supply Current | $I_{PP2}$ | $\overline{CE}$ = $V_{IL}$ | – | – | 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 $V_{PP}$ = 12.5V.
*4. Do not alter $V_{PP}$ either $V_{IL}$ to 12.5V or 12.5V to $V_{IL}$ when $\overline{CE}$ = Low.
*5. −0.6V for pulse width ≦ 20ns.
*6. If $V_{IH}$ is over the specified maximum value, programming operation cannot be guaranteed.

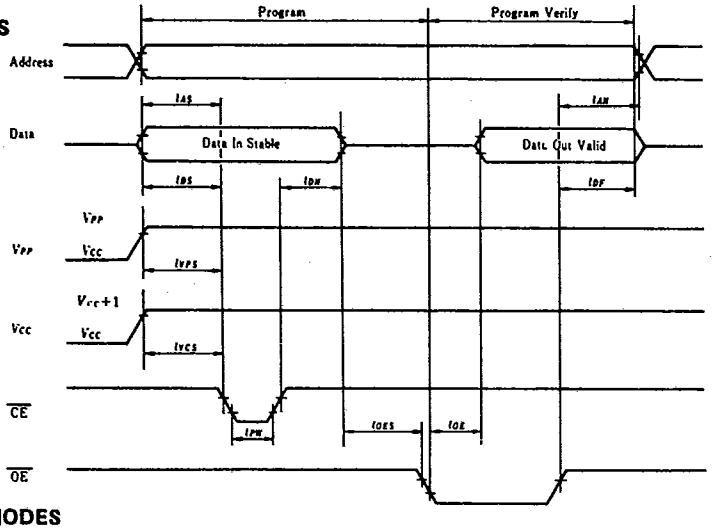
## • AC PROGRAMMING CHARACTERISTICS ($Ta$=25°C±5°C, $V_{CC}$=6V±0.25V, $V_{PP}$=12.5V±0.3V)

| Parameter | Symbol | Test Condition | min. | typ. | max. | Unit |
|---|---|---|---|---|---|---|
| Address Setup Time | $t_{AS}$ | | 2 | – | – | µs |
| $\overline{OE}$ Setup Time | $t_{OES}$ | | 2 | – | – | µs |
| Data Setup Time | $t_{DS}$ | | 2 | – | – | µs |
| Address Hold Time | $t_{AH}$ | | 0 | – | – | µs |
| Data Hold Time | $t_{DH}$ | | 2 | – | – | µs |
| $\overline{OE}$ to Output Float Delay | $t_{DF}$*1 | | 0 | – | 130 | ns |
| $V_{PP}$ Setup Time | $t_{VPS}$ | | 2 | – | – | µs |
| $V_{CC}$ Setup Time | $t_{VCS}$ | | 2 | – | – | µs |
| $\overline{CE}$ Pulse Width During Initial Programming | $t_{PW}$ | | 0.95 | 1.0 | 1.05 | ms |
| $\overline{CE}$ Pulse Width During Overprogramming | $t_{OPW}$*2 | | 2.85 | – | 78.75 | ms |
| Data Valid from $\overline{OE}$ | $t_{OE}$ | | 0 | – | 150 | ns |

Notes: *1. $t_{DF}$ is defined as the time at which the output achieves the open circuit condition and data is no longer driven.
*2. Refer to the programming flowchart for $t_{OPW}$.

## • SWITCHING CHARACTERISTICS TEST CONDITION

Input pulse level: 0.45V to 2.4V
Input rise and fall time: ≤20ns
Reference level for measuring timing: 0.8V and 2V



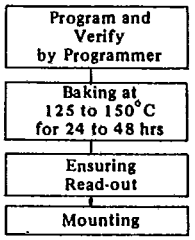

## • HN27C256FP IDENTIFIER MODES

| Identifier \ Pins | $A_0$ (10) | $I/O_7$ (19) | $I/O_6$ (18) | $I/O_5$ (17) | $I/O_4$ (16) | $I/O_3$ (15) | $I/O_2$ (13) | $I/O_1$ (12) | $I/O_0$ (11) | Hex Data |
|---|---|---|---|---|---|---|---|---|---|---|
| Manufacturer Code | $V_{IL}$ | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 07 |
| Device Code | $V_{IH}$ | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | B0 |

Notes: 1. $A_9$ = 12.0V ± 0.5V.
2. $A_1 - A_8$, $A_{10} - A_{14}$, $\overline{CE}$, $\overline{OE} = V_{IL}$.

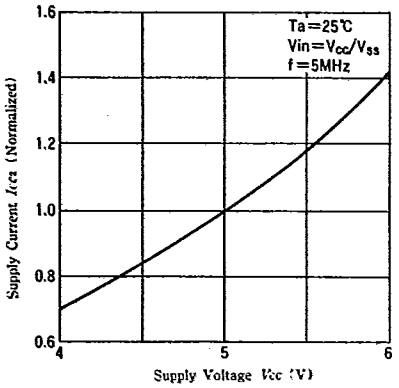
## ■ RECOMMENDED SCREENING CONDITIONS

Before mounting, please make the screening (baking without bias) shown in the right.

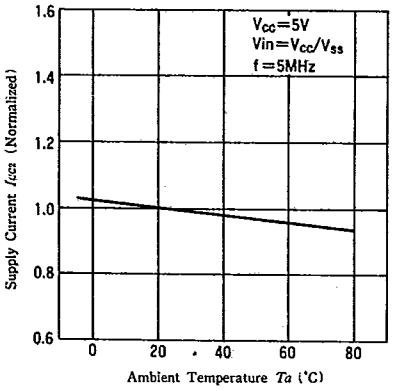



Recommended Screening conditions

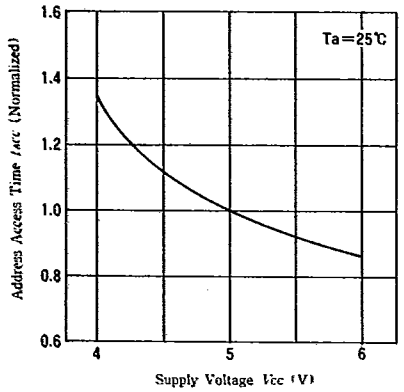
**SUPPLY CURRENT vs. SUPPLY VOLTAGE**



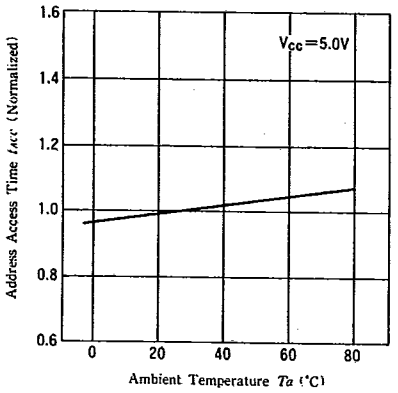

**SUPPLY CURRENT vs. AMBIENT TEMPERATURE**



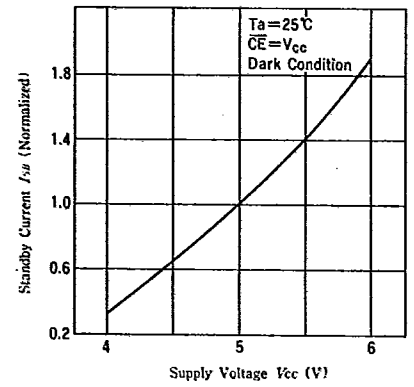

**ADDRESS ACCESS TIME vs. SUPPLY VOLTAGE**



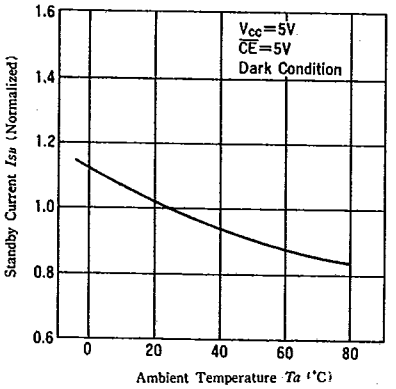

**ADDRESS ACCESS TIME vs. AMBIENT TEMPERATURE**




**STANDBY CURRENT vs. SUPPLY VOLTAGE**




**STANDBY CURRENT vs. AMBIENT TEMPERATURE**




* See Supply Voltage vs. Active Frequency, Access Time vs. Lord Capacitance, and Output Current vs. Output Voltage (1), (2) of HN27C256G.