HN27C1024HCP Series

65536-word × 16-bit CMOS One Time Electrically Programmable ROM

HITACHI

Description

The Hitachi HN27C1024HCP is 65536-word × 16-bit one time electrically programmable ROM. Initially, all bits of the HN27C1024HCP are in the "1" state (output high). Data is introduced by selectively programming "0" into the desired bit location. This device is packaged in plastic package, therefore, it cannot be rewritten and erased.

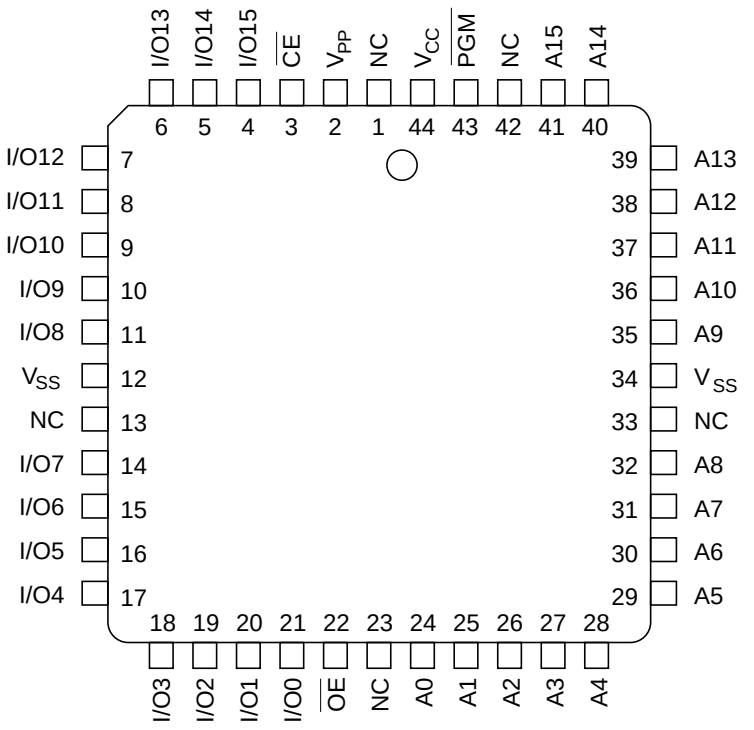
Features

- Small outline package for high density mounting
- Fast high-reliability page programming and fast high-reliability programming:
  Program voltage; +12.5 V DC
  Program time; 14 sec (typ) (Theoretical in page programming)
- High speed:
  Access time 100 ns/120 ns/150 ns (max)
- Low power dissipation:
  Active mode; 60 mW/MHz (typ)
- Inputs and outputs TTL compatible during both read and program modes
- Device identifier mode: Manufacturer code and device code

Ordering Information

Type No.	Access Time	Package
HN27C1024HCP-10	100 ns	44-pin PLCC (CP-44)
HN27C1024HCP-12	120 ns	
HN27C1024HCP-15	150 ns	

Pin Arangement

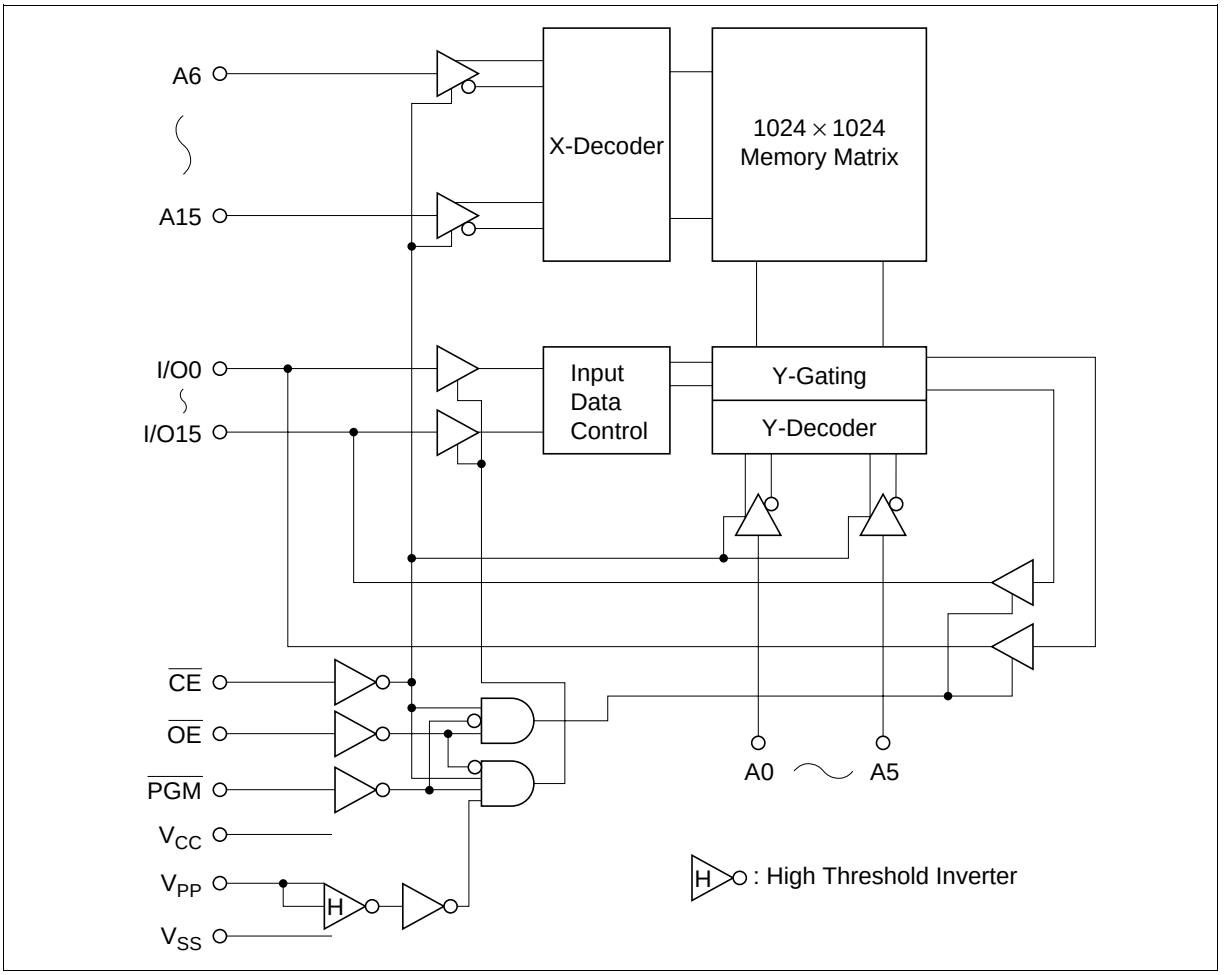


(Top View)

Pin Description

Pin Name	Function
A0 – A15	Address
I/O0 – I/O15	Input/output
$\overline{CE}$	Chip enable
$\overline{OE}$	Output enable
$\overline{PGM}$	Programming enable
V_{CC}	Power supply
V_{PP}	Programming power supply
V_{SS}	Ground
NC	No connection

Block Diagram



Mode Selection

Mode	$\overline{CE}$ (3)	$\overline{OE}$ (22)	$\overline{PGM}$ (43)	A9 (35)	V_{PP} (2)	V_{CC} (44)	I/O (4 – 11, 14 – 21)
Read	V_{IL}	V_{IL}	V_{IH}	X	V_{CC}	V_{CC}	Dout
Output disable	V_{IL}	V_{IH}	V_{IH}	X	V_{CC}	V_{CC}	High-Z
Standby	V_{IH}	X	X	X	V_{CC}	V_{CC}	High-Z
Program	V_{IL}	V_{IH}	V_{IL}	X	V_{PP}	V_{CC}	Din
Program verify	V_{IL}	V_{IL}	V_{IH}	X	V_{PP}	V_{CC}	Dout
Page data latch	V_{IH}	V_{IL}	V_{IH}	X	V_{PP}	V_{CC}	Din
Page program	V_{IH}	V_{IH}	V_{IL}	X	V_{PP}	V_{CC}	High-Z
	V_{IL}	V_{IL}	V_{IL}	X	V_{PP}	V_{CC}	High-Z
Program inhibit	V_{IL}	V_{IH}	V_{IH}	X	V_{PP}	V_{CC}	High-Z
	V_{IH}	V_{IL}	V_{IL}	X	V_{PP}	V_{CC}	High-Z
	V_{IH}	V_{IH}	V_{IH}	X	V_{PP}	V_{CC}	High-Z
Identifier	V_{IL}	V_{IL}	V_{IH}	V_H*2	V_{CC}	V_{CC}	Code

Notes: 1. X: Don't care.
2. V_H: 12.0 V ± 0.5 V

Absolute Maximum Ratings

Parameter	Symbol	Value	Unit
All input and output voltages*1	Vin, Vout	–0.6*2 to +7.0	V
A9 input voltage*1	V_{ID}	–0.6*2 to +13.5	V
V_{PP} voltage*1	V_{PP}	–0.6 to +13.0	V
V_{CC} voltage*1	V_{CC}	–0.6 to +7.0	V
Operating temperature range	Topr	0 to +70	°C
Storage temperature range	Tstg	–55 to +125	°C
Storage temperature under bias	Tbias	–10 to +80	°C

Notes: 1. Relative to V_{SS}.
2. Vin, Vout, V_{ID} min = –1.0 V for pulse width ≤ 50 ns

Capacitance (Ta = 25°C, f = 1 MHz)

Parameter	Symbol	Min	Typ	Max	Unit	Test Conditions
Input capacitance	Cin	—	—	6	pF	Vin = 0 V
Output capacitance	Cout	—	—	12	pF	Vout = 0 V

Read Operation

DC Characteristics (V_{CC} = 5 V ± 5%, V_{PP} = V_{CC}, Ta = 0 to +70°C)

Parameter	Symbol	Min	Typ	Max	Unit	Test Conditions
Input leakage current	I_{LI}	—	—	2	µA	Vin = 5.25 V
Output leakage current	I_{LO}	—	—	2	µA	Vout = 5.25 V/0.45 V
V_{PP} current	I_{PP1}	—	1	20	µA	V_{PP} = 5.5 V
Standby V_{CC} current	I_{SB}	—	—	25	mA	$\overline{CE}$ = V_{IH}
Operating V_{CC} current	I_{CC1}	—	—	50	mA	Iout = 0 mA, $\overline{CE}$ = V_{IL}
	I_{CC2}	—	—	100	mA	Iout = 0 mA, f = 10 MHz
	I_{CC3}	—	—	25	mA	Iout = 0 mA, f = 1 MHz
Input voltage	V_{IL}	–0.3*[1]	—	0.8	V	
	V_{IH}	2.2	—	V_{CC} + 1*[2]	V	
Output voltage	V_{OL}	—	—	0.45	V	I_{OL} = 2.1 mA
	V_{OH}	2.4	—	—	V	I_{OH} = –400 µA

Notes: 1. V_{IL} min = –1.0 V for pulse width ≤ 50 ns
2. V_{IH} max = V_{CC} +1.5 V for pulse width ≤ 20 ns
If V_{IH} is over the specified maximum value, read operation cannot be guaranteed.

AC Characteristics (V_{CC} = 5 V ± 5%, V_{PP} = V_{CC}, Ta = 0 to +70°C)

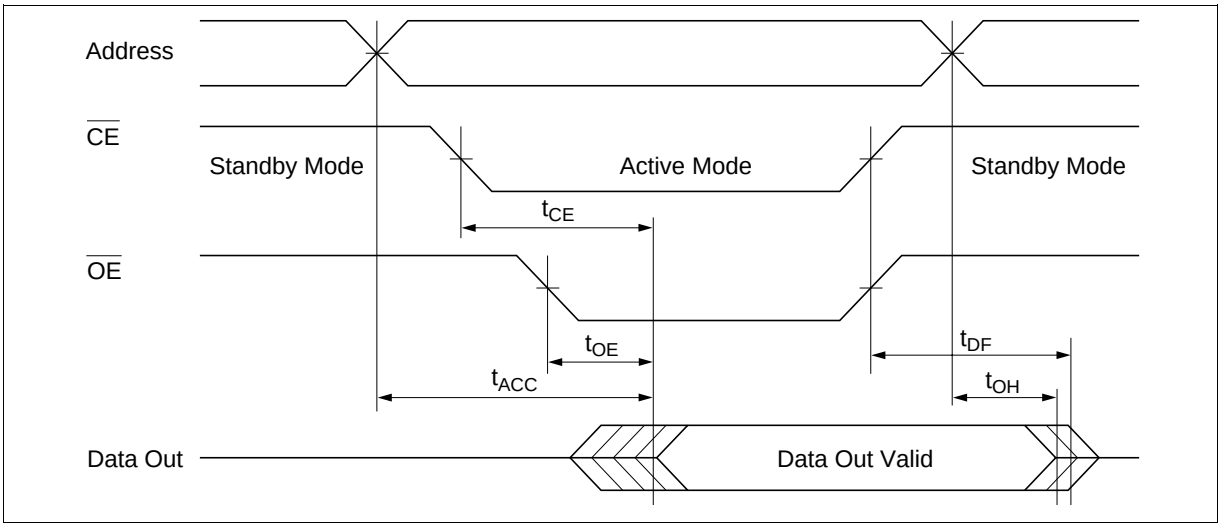
Test Conditions

- Input pulse levels: 0.45 to 2.4 V
- Input rise and fall time: ≤ 10 ns
- Output load: 1 TTL gate +100 pF
- Reference levels for measuring timing: 1.5 V

		HN27C1024HCP							
		-10		-12		-15			
Parameter	Symbol	Min	Max	Min	Max	Min	Max	Unit	Test Conditions
Address to output delay	t_{ACC}	—	100	—	120	—	150	ns	$\overline{CE}$ = $\overline{OE}$ = V_{IL}
$\overline{CE}$ to output delay	t_{CE}	—	100	—	120	—	150	ns	$\overline{OE}$ = V_{IL}
$\overline{OE}$ to output delay	t_{OE}	—	50	—	50	—	50	ns	$\overline{CE}$ = V_{IL}
$\overline{OE}$ high to output float*[1]	t_{DF}	0	50	0	50	0	50	ns	$\overline{CE}$ = V_{IL}
Address to output hold	t_{OH}	0	—	0	—	0	—	ns	$\overline{CE}$ = $\overline{OE}$ = V_{IL}

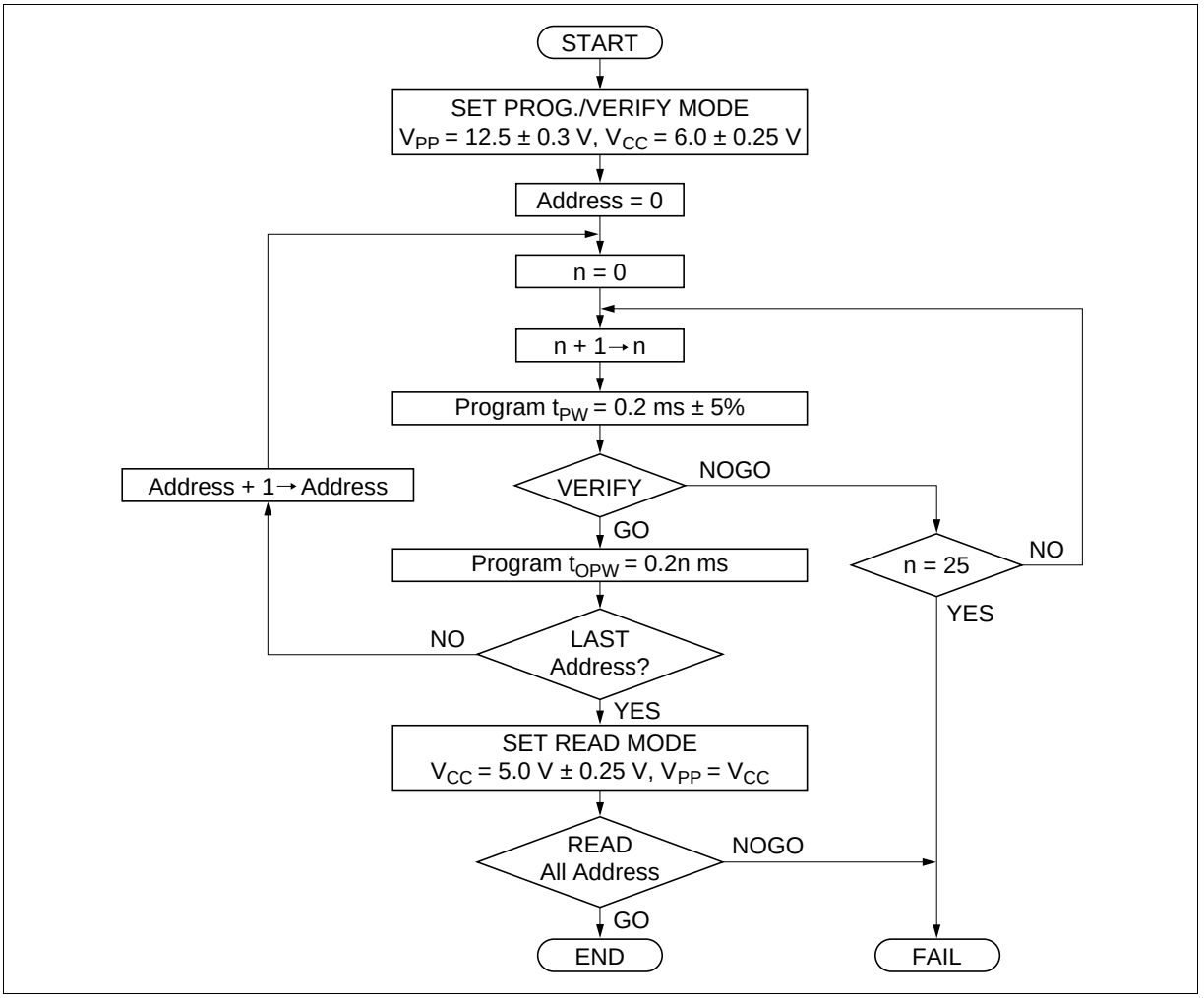
Note: 1. t_{DF} is defined as the time at which the output achieves the open circuit condition and data is no longer driven.

Read Timing Waveform



Fast High-Reliability Programming

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



Fast High-Reliability Programming Flowchart

DC Characteristics (V_{CC} = 6 V ± 0.25 V, V_{PP} = 12.5 V ± 0.3 V, Ta = 25°C ± 5°C)

Parameter	Symbol	Min	Typ	Max	Unit	Test Conditions
Input leakage current	I_{LI}	—	—	2	µA	Vin = 6.25 V/0.45 V
V_{PP} supply current	I_{PP}	—	—	40	mA	$\overline{CE}$ = $\overline{PGM}$ = V_{IL}
Operating V_{CC} current	I_{CC}	—	—	50	mA	
Input voltage	V_{IL}	–0.1*[5]	—	0.8	V	
	V_{IH}	2.2	—	V_{CC} + 0.5*[6]	V	
Output voltage	V_{OL}	—	—	0.45	V	I_{OL} = 2.1 mA
	V_{OH}	2.4	—	—	V	I_{OH} = –400 µA

Notes:
1. V_{CC} must be applied simultaneously or before V_{PP} and removed simultaneously or after V_{PP}.
2. V_{PP} must not exceed 13 V including overshoot.
3. An influence may be had upon device reliability if the device is installed or removed while V_{PP} = 12.5 V.
4. Do not alter V_{PP} either V_{IL} to 12.5 V or 12.5 V to V_{IL} when $\overline{CE}$ = low.
5. V_{IL} min = –0.6 V for pulse width ≤ 20 ns.
6. If V_{IH} is over the specified maximum value, programming operation cannot be guaranteed.

AC Characteristics (V_{CC} = 6 V ± 0.25 V, V_{PP} = 12.5 V ± 0.3 V, Ta = 25°C ± 5°C)

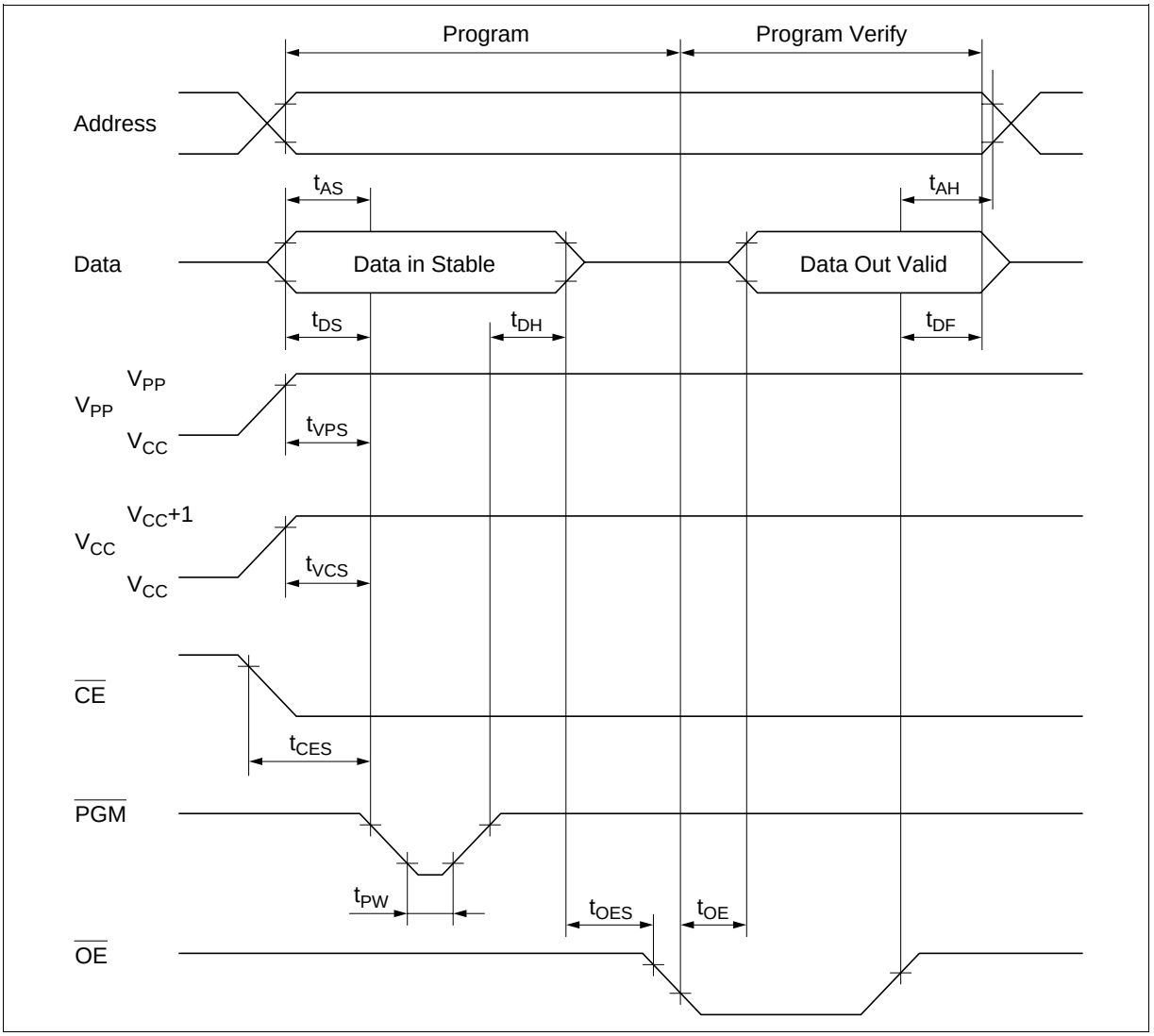
Test Conditions

- Input pulse levels: 0.45 to 2.4 V
- Input rise and fall time: ≤ 20 ns
- Reference levels for measuring timing:
  Inputs; 0.8 V, 2.0 V,
  Outputs; 0.8 V, 2.0 V

Parameter	Symbol	Min	Typ	Max	Unit	Test Conditions
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	
$\overline{PGM}$ initial programming pulse width	t_{PW}	0.19	0.2	0.21	ms	
$\overline{PGM}$ overprogramming pulse width	t_{OPW}*2	0.19	—	5.25	ms	
$\overline{CE}$ setup time	t_{CES}	2	—	—	µs	
Data valid from $\overline{OE}$	t_{OE}	0	—	150	ns	

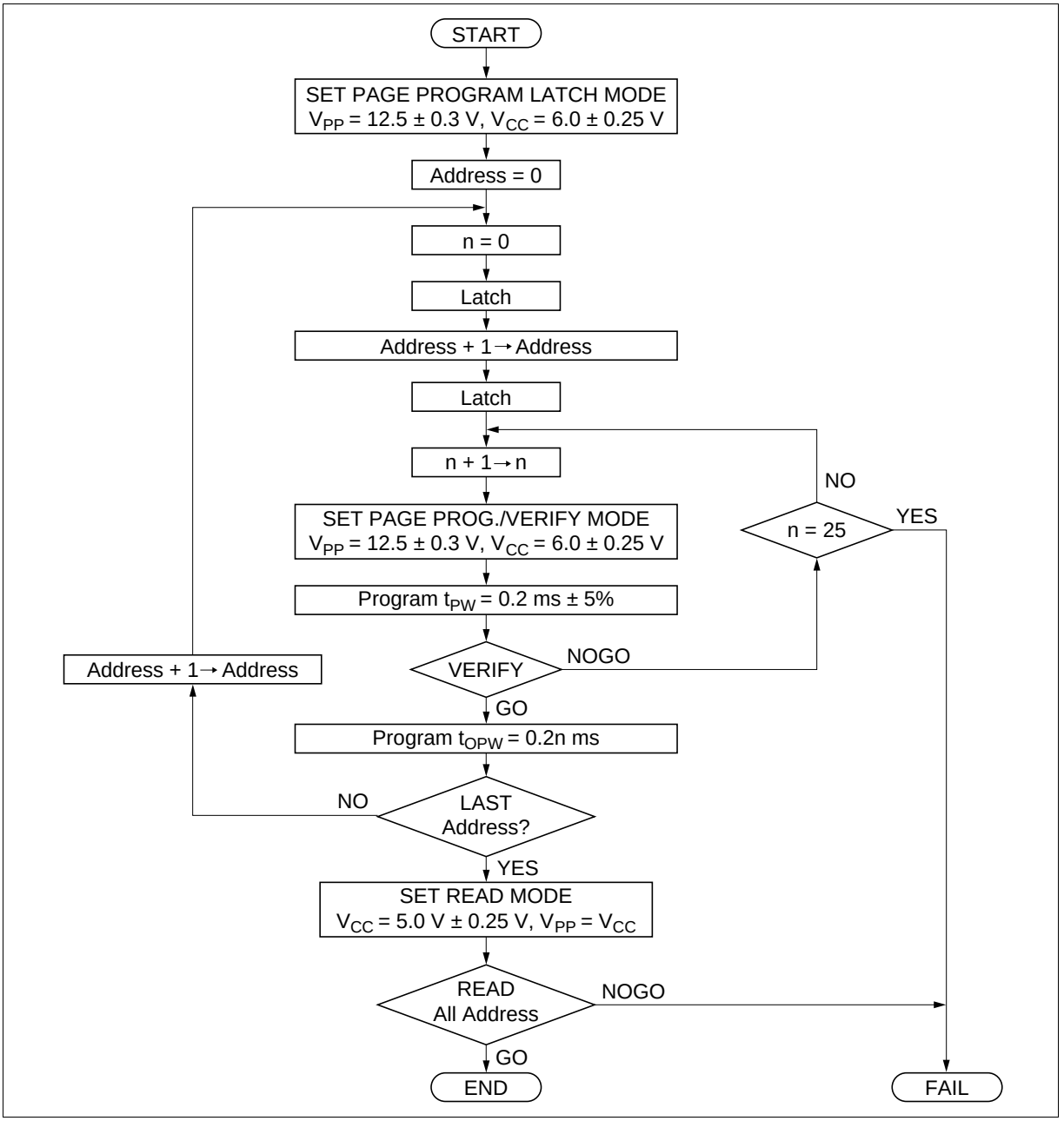
Notes: 1. t_{DF} is defined as the time at which the output achieves the open circuit condition and data is no longer driven.
2. Refer to the programming flowchart for $t_{OPW.}$

Fast High-Reliability Programming Timing Waveform



Fast High-Reliability Page Programming

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



Fast High-Reliability Page Programming Flowchart

DC Characteristics (V_{CC} = 6 V ± 0.25 V, V_{PP} =12.5 V ± 0.3 V, Ta = 25°C ± 5°C)

Parameter	Symbol	Min	Typ	Max	Unit	Test Conditions
Input leakage current	I_{LI}	—	—	2	µA	Vin = 6.25 V/0.45 V
Output voltage during verify	V_{OL}	—	—	0.45	V	I_{OL} = 2.1 mA
	V_{OH}	2.4	—	—	V	I_{OH} = –400 µA
Operating V_{CC} current	I_{CC}	—	—	50	mA	
Input voltage*[3]	V_{IL}	–0.1*[5]	—	0.8	V	
	V_{IH}	2.2	—	V_{CC} + 0.5*[6]	V	
V_{PP} supply current	I_{PP}	—	—	50	mA	$\overline{PGM}$ = V_{IL}

Notes:
1. V_{CC} must be applied simultaneously or before V_{PP} and removed simultaneously or after V_{PP}.
2. V_{PP} must not exceed 13 V including overshoot.
3. An influence may be had upon device reliability if the device is installed or removed while V_{PP} = 12.5 V.
4. Do not alter V_{PP} either V_{IL} to 12.5 V or 12.5 V to V_{IL} when $\overline{CE}$ = low.
5. V_{IL} min = –0.6 V for pulse width ≤ 20 ns.
6. If V_{IH} is over the specified maximum value, programming operation cannot be guaranteed.

AC Characteristics (V_{CC} = 6 V ± 0.25 V, V_{PP} = 12.5 V ± 0.3 V, Ta = 25°C ± 5°C)

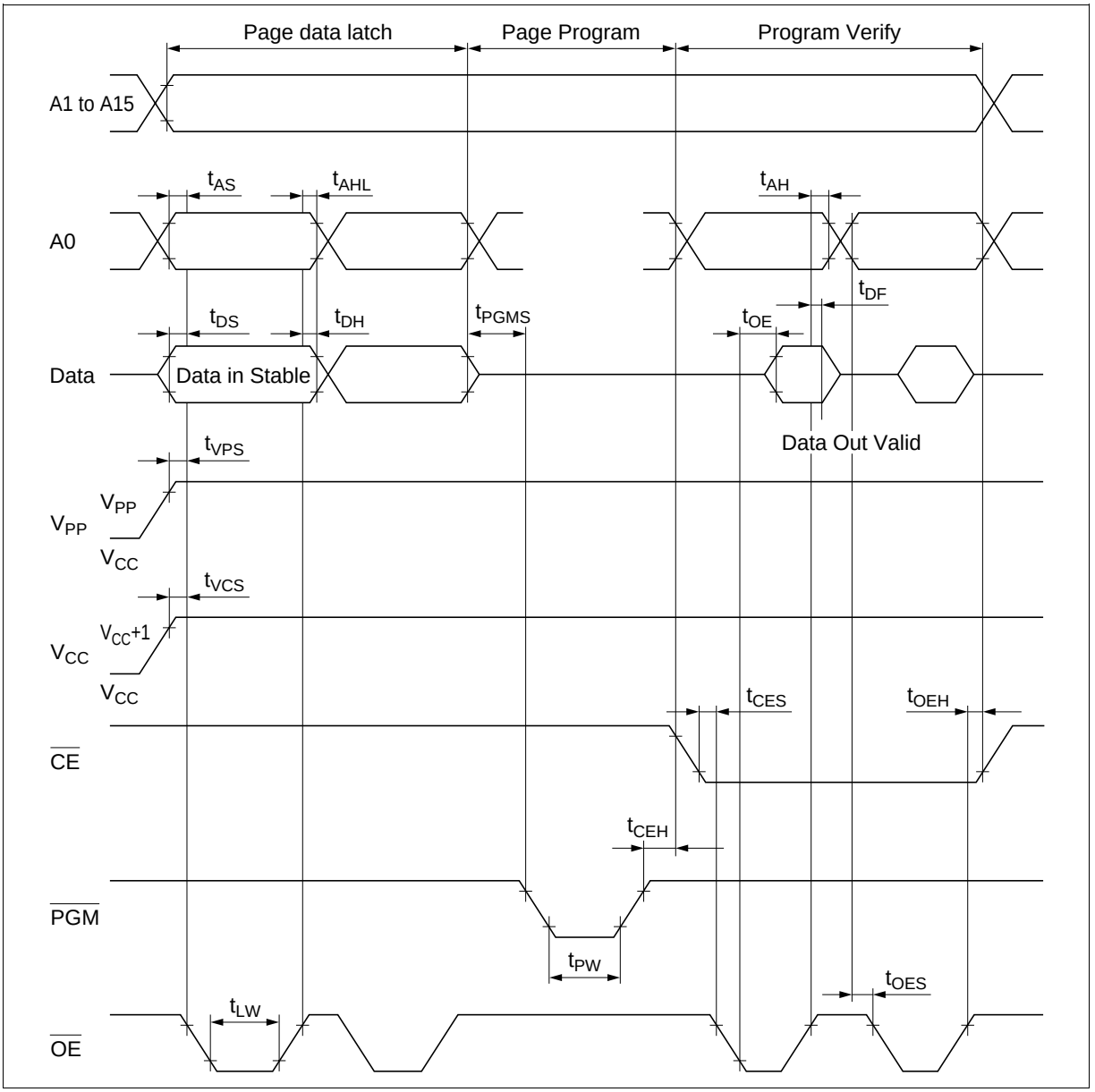
Test Conditions

- Input pulse levels: 0.45 to 2.4 V
- Input rise and fall time: ≤ 20 ns
- Reference levels for measuring timings: 0.8 V, 2.0 V

Parameter	Symbol	Min	Typ	Max	Unit	Test Conditions
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	
	t_{AHL}	2	—	—	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	
$\overline{PGM}$ initial programming pulse width	t_{PW}	0.19	0.2	0.21	ms	
$\overline{PGM}$ overprogramming pulse width	t_{OPW}*[2]	0.19	—	5.25	ms	
$\overline{CE}$ setup time	t_{CES}	2	—	—	µs	
Data valid from $\overline{OE}$	t_{OE}	0	—	150	ns	
$\overline{OE}$ pulse width during data latch	t_{LW}	1	—	—	µs	
$\overline{PGM}$ setup time	t_{PGMS}	2	—	—	µs	
$\overline{CE}$ hold time	t_{CEH}	2	—	—	µs	
$\overline{OE}$ hold time	t_{OEH}	2	—	—	µs	

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}.

Fast High-Reliability Page Programming Timing Waveform



Mode Description

Device Identifier Mode

The device identifier mode allows the reading out of binary codes that identify manufacturer and type of device, from outputs of OTPROM. By this mode, the device will be automatically matched its own corresponding programming algorithm, using programming equipment

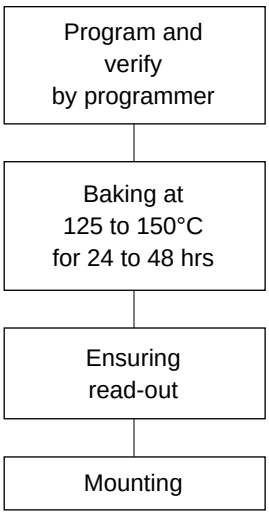
HN27C1024HCP Identifier Code

Identifier	A0 (24)	I/O8–I/O15 (11)–(4)	I/O7 (14)	I/O6 (15)	I/O5 (16)	I/O4 (17)	I/O3 (18)	I/O2 (19)	I/O1 (20)	I/O0 (21)	Hex Data
Manufacturer code	V_{IL}	x	0	0	0	0	0	1	1	1	07
Device code	V_{IH}	x	1	0	1	1	1	0	1	0	BA

Notes: 1. A9 = 12.0 V ± 0.5 V
2. A1 –A8, A10–A15, $\overline{CE}$, $\overline{OE}$ = V_{IL}, $\overline{PGM}$ = V_{IH}
3. X; Don't care.

Recommended Screening Conditions

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



Recommended Screening Conditions

Package Dimensions

HN27C1024HCP Series (CP-44) Unit: mm