HN27C101AG Series
HN27C301AG Series

131072-word × 8-bit CMOS UV Erasable and Programmable ROM

HITACHI

ADE-203-
Rev. 0.0
Dec. 1, 1995

Description

The Hitachi HN27C101AG/HN27C301AG is a 1-Mbit ultraviolet erasable and electrically programmable ROM. This device is packaged in a 32-pin dual-in-line package with transparent lid. The transparent lid allows the memory content to be erased with ultraviolet light, whereby a new pattern can then be written into the device.

Features

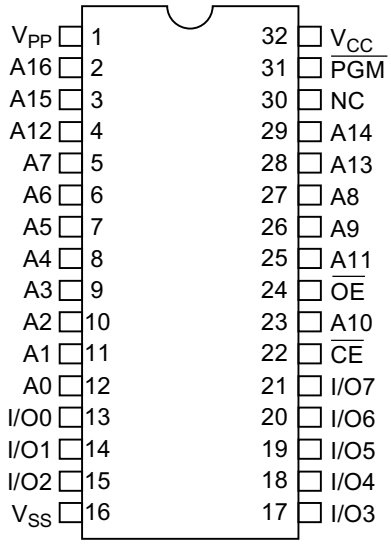
- Single power supply:
  +5 V ± 5% (HN27C101AG-10/HN27C301AG-10)
  +5 V ± 10% (HN27C101AG/HN27C301AG-12/15/17/20/ 25)
- Fast high-reliability programming mode and fast high-reliability page programming mode
  - Programming voltage: +12.5 V DC
  - Fast high-reliability page programming: 14 sec typ
- High speed inputs and outputs TTL compatible during both read and program modes
- Low power dissipation: 50 mW/MHz typ (active)
  5 µW typ (standby)
- Pin arrangement: 32-pin JEDEC standard (HN27C101AG)
  : replaceable 32 pin MASK ROM (HN27C301AG)
- Device identifier mode: manufacturer code and device code
- Fully compatible with HN27C101G/ HN27C301G series

Ordering Information

Type No.	Access Time	Package
HN27C101AG-10	100 ns	600-mil 32-pin cerdip (DG-32)
HN27C101AG-12	120 ns	
HN27C101AG-15	150 ns	
HN27C101AG-17	170 ns	
HN27C101AG-20	200 ns	
HN27C101AG-25	250 ns	
HN27C301AG-10	100 ns	
HN27C301AG-12	120 ns	
HN27C301AG-15	150 ns	
HN27C301AG-17	170 ns	
HN27C301AG-20	200 ns	
HN27C301AG-25	250 ns	

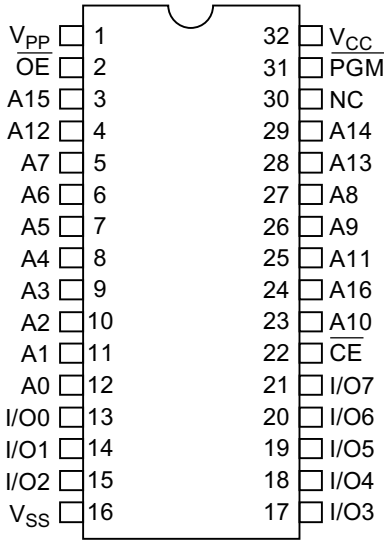
Pin Arrangement

HN27C101AG Series



(Top view)

HN27C301AG Series

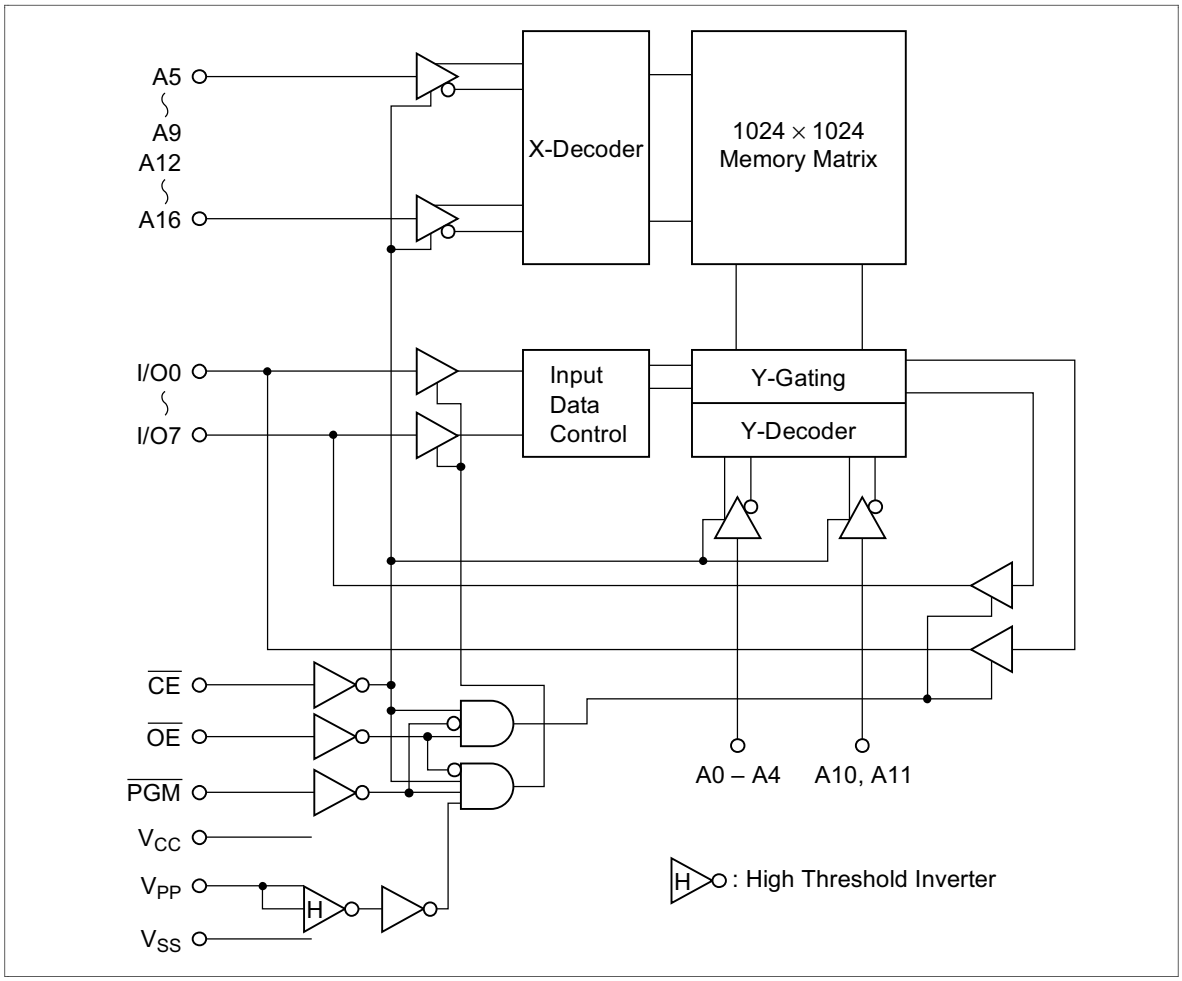


(Top view)

Pin Description

Pin Name	Function
A0 – A16	Address
I/O0 – I/O7	Input/output
$\overline{CE}$	Chip enable
$\overline{OE}$	Output enable
V_{CC}	Power supply
V_{PP}	Programming power supply
V_{SS}	Ground
$\overline{PGM}$	Programming enable
NC	No connection

Block Diagram



Mode Selection

Mode	$\overline{CE}$	$\overline{OE}$	$\overline{PGM}$	A9	V_{PP}	V_{CC}	I/O
HN27C101AG	**(22)**	**(24)**	**(31)**	**(26)**	**(1)**	**(32)**	**(13 – 15, 17 – 21)**
HN27C301AG	**(22)**	**(2)**	**(31)**	**(26)**	**(1)**	**(32)**	**(13 – 15, 17 – 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
Program inhibit	V_{IL}	V_{IL}	V_{IL}	X	V_{PP}	V_{CC}	High-Z
	V_{IL}	V_{IH}	V_{IH}				
	V_{IH}	V_{IL}	V_{IL}				
	V_{IH}	V_{IH}	V_{IH}				
Identifier	V_{IL}	V_{IL}	V_{IH}	V_H	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 +13.5	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	–65 to +125	°C
Storage temperature range under bias	Tbias	–10 to +80	°C

Notes: 1. Relative to V_{SS}
2. Vin, Vout and 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	—	—	10	pF	Vin = 0 V
Output capacitance	Cout	—	—	15	pF	Vout = 0 V

Read Operation

DC Characteristics (V_{CC} = 5 V ± 5%, V_{PP} = V_{CC}, Ta = 0 to +70°C) (HN27C101AG/HN27C301AG-10)
(V_{CC} = 5 V ± 10%, V_{PP} = V_{CC}, Ta = 0 to +70°C)
(HN27C101AG/HN27C301AG-12/15/17/20/25)

Parameter	Symbol	Min	Typ	Max	Unit	Test Conditions
Input leakage current	I_{LI}	—	—	2	µA	Vin = 0 V to V_{CC}
Output leakage current	I_{LO}	—	—	2	µA	Vout = 0 V to V_{CC}
V_{PP} current	I_{PP1}	—	1	20	µA	V_{PP} = 5.5 V
Standby V_{CC} current	I_{SB1}	—	—	1	mA	$\overline{CE}$ = V_{IH}
	I_{SB2}	—	1	20	µA	$\overline{CE}$ = V_{CC} ± 0.3 V
Operating V_{CC} current	I_{CC1}	—	—	30	mA	$\overline{CE}$ = V_{IL}, Iout = 0 mA
	I_{CC2}	—	—	30	mA	f = 5 MHz, Iout = 0 mA
		—	—	50	mA	f = 10 MHz, Iout = 0 mA
Input low voltage	V_{IL}	–0.3*[1]	—	0.8	V	
Input high voltage	V_{IH}	2.2	—	V_{CC} + 1.0*[2]	V	
Output low voltage	V_{OL}	—	—	0.45	V	I_{OL} = 2.1 mA
Output high voltage	V_{OH}	2.4	—	—	V	I_{OH} = –1 mA
		V_{CC} – 0.7	—	—	V	I_{OH} = –0.1 mA

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) (HN27C101AG/HN27C301AG-10)
(V_{CC} = 5 V ± 10%, V_{PP} = V_{CC}, Ta = 0 to +70°C)
(HN27C101AG/HN27C301AG-12/15/17/20/25)

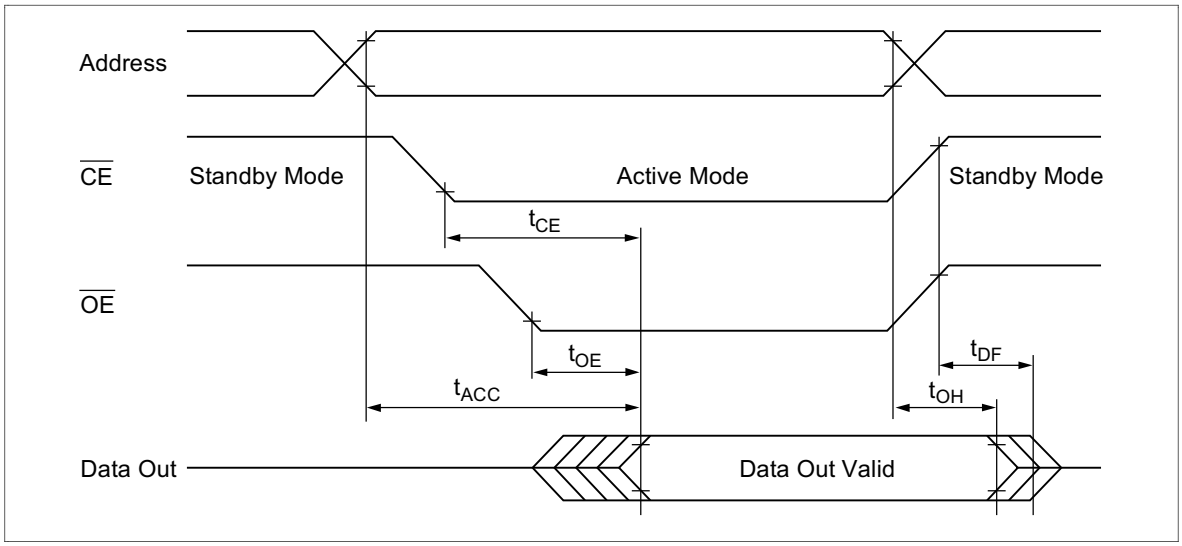
Test Conditions

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

		HN27C101AG/HN27C301AG													
		-10		-12		-15		-17		-20		-25			Test
Parameter	**Symbol**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Unit**	**Conditions**
Address to output delay	t_{ACC}	—	100	—	120	—	150	—	170	—	200	—	250	ns	$\overline{CE}$ = $\overline{OE}$ = V_{IL}
$\overline{CE}$ to output delay	t_{CE}	—	100	—	120	—	150	—	170	—	200	—	250	ns	$\overline{OE}$ = V_{IL}
$\overline{OE}$ to output delay	t_{OE}	—	60	—	60	—	70	—	70	—	70	—	100	ns	$\overline{CE}$ = V_{IL}
$\overline{OE}$ high to output float	t_{DF}	0	50	0	50	0	50	0	50	0	50	0	60	ns	$\overline{CE}$ = V_{IL}
Address to output hold	t_{OH}	0	—	0	—	0	—	0	—	0	—	0	—	ns	$\overline{CE}$ = $\overline{OE}$ = V_{IL}

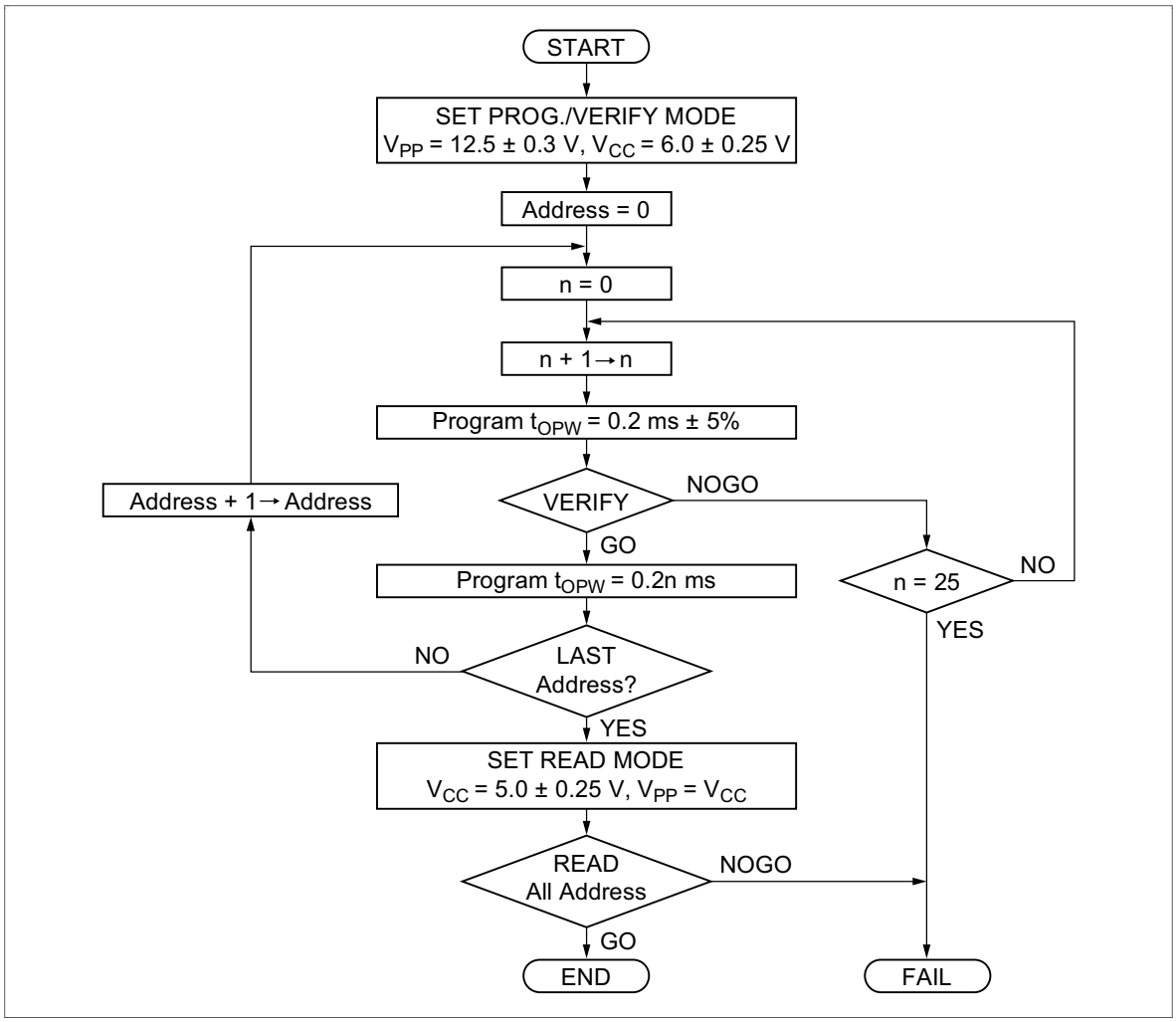
Note: t_{DF} is defined as the time at which the output achieves the open circuit condition and data is no longer driven.

Read Timing Waveform



Fast High-Reliability Programming

This device can be applied the 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.



Fast High-Reliability Programming Flowchart

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

Parameter	Symbol	Min	Typ	Max	Unit	Test Conditions
Input leakage current	I_{LI}	—	—	2	µA	Vin = 0 V to V_{CC}
V_{PP} supply current	I_{PP}	—	—	40	mA	$\overline{CE}$ = $\overline{PGM}$ = V_{IL}
Operating V_{CC} current	I_{CC}	—	—	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	
Output low voltage during verify	V_{OL}	—	—	0.45	V	I_{OL} = 2.1 mA
Output high voltage during verify	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 13.5 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 (Ta = 25°C ± 5°C, V_{CC} = 6 V ± 0.25 V, V_{PP} = 12.5 V ± 0.3 V)

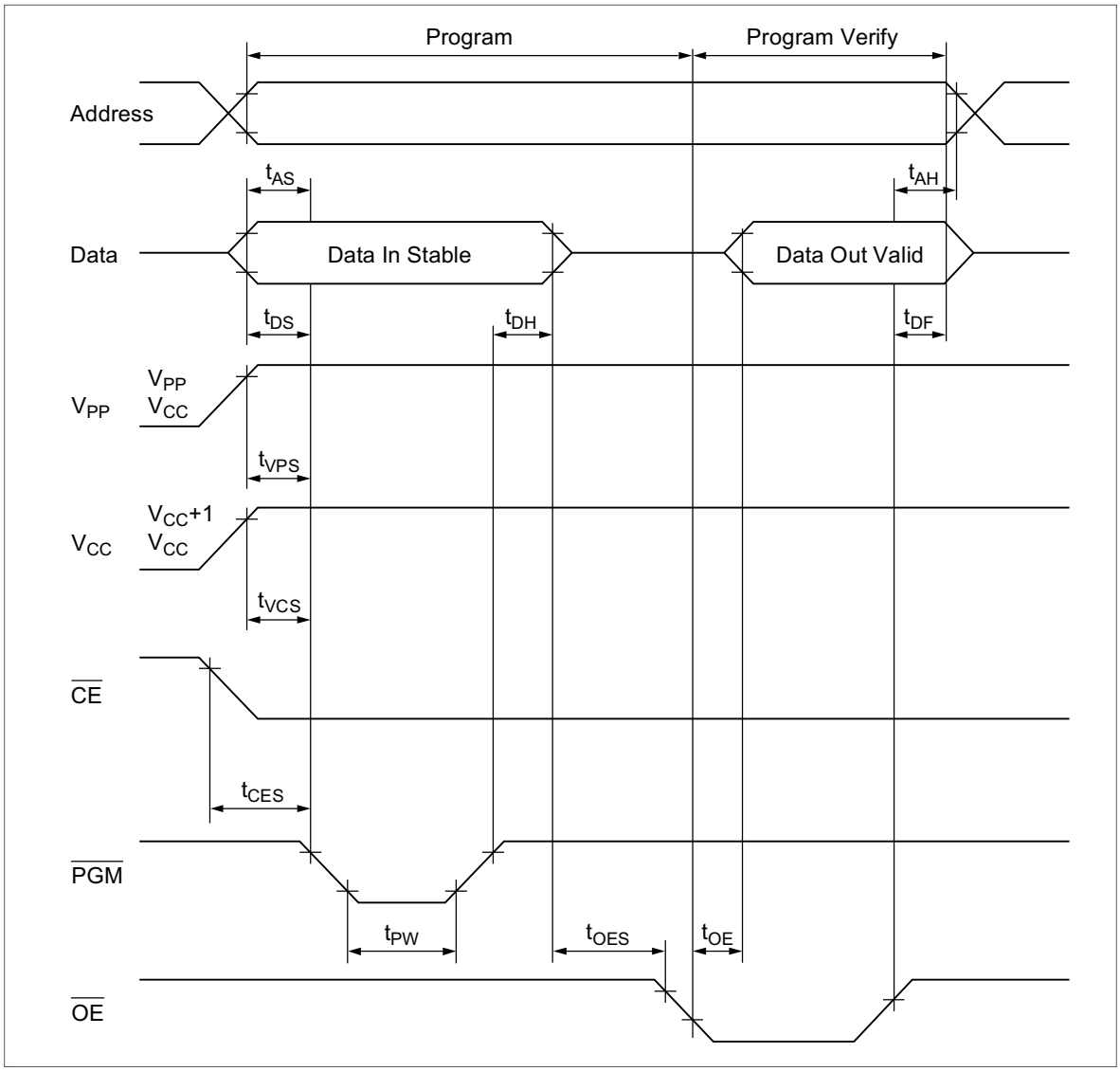
Test Conditions

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

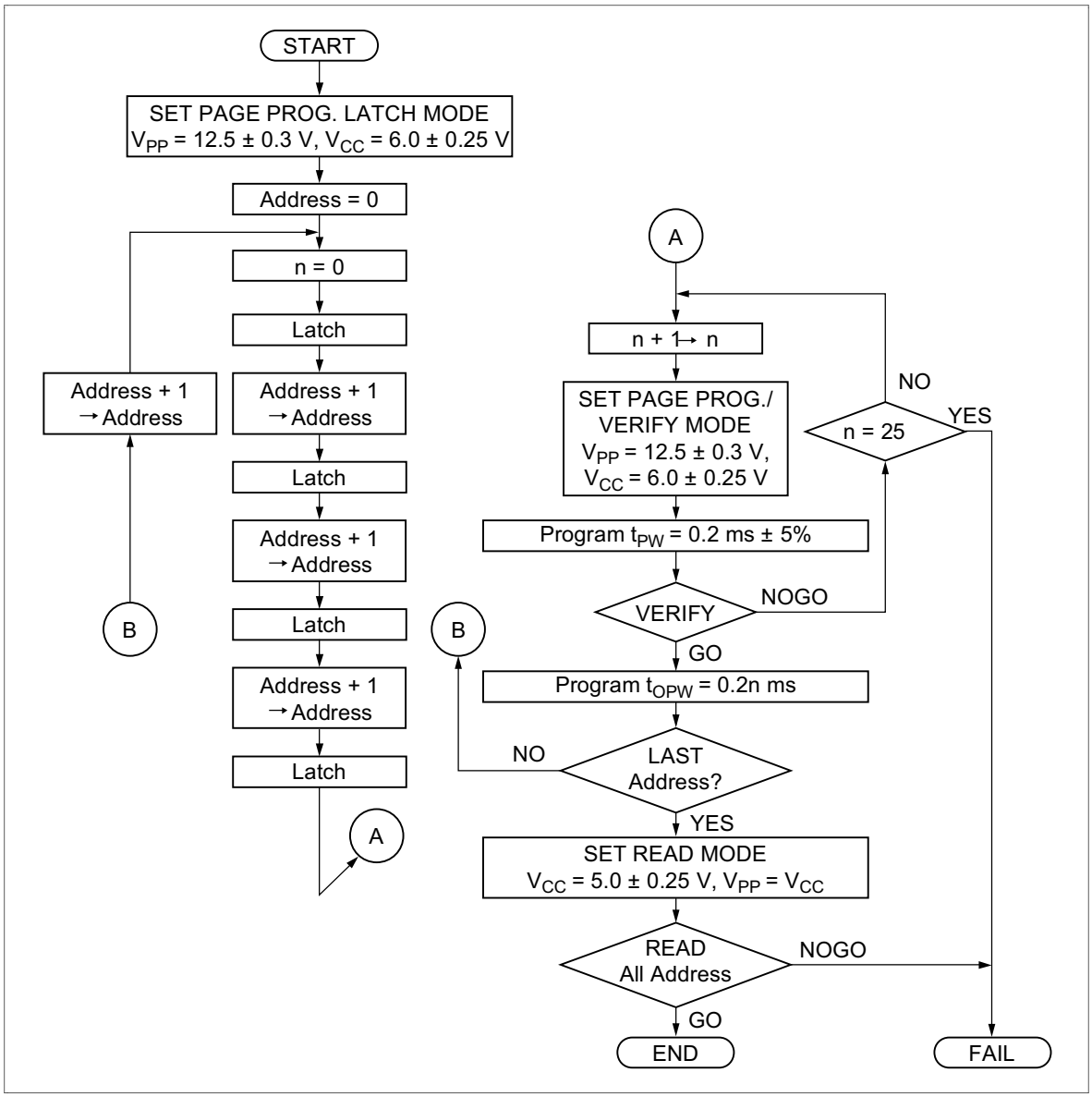
Notes: 1. t_{DF} is defined as the time at which the output achieves the open circuit condition and data is no longer driven.
2. Refer to the programming flowchart for t_{OPW}.

Fast High-Reliability Programming Timing Waveform



Fast High-Reliability Page Programming

This device can be applied the high performance page 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.



Fast High-Reliability Page Programming Flowchart

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

Parameter	Symbol	Min	Typ	Max	Unit	Test Conditions
Input leakage current	I_{LI}	—	—	2	µA	Vin = 0 V to V_{CC}
V_{PP} supply current	I_{PP}	—	—	50	mA	$\overline{CE}$ = $\overline{OE}$= V_{IH}, $\overline{PGM}$ = V_{IL}
Operating V_{CC} current	I_{CC}	—	—	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	
Output low voltage during verify	V_{OL}	—	—	0.45	V	I_{OL} = 2.1 mA
Output high voltage during verify	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 13.5 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 (Ta = 25°C ± 5°C, V_{CC} = 6 V ± 0.25 V, V_{PP} = 12.5 V ± 0.3 V)

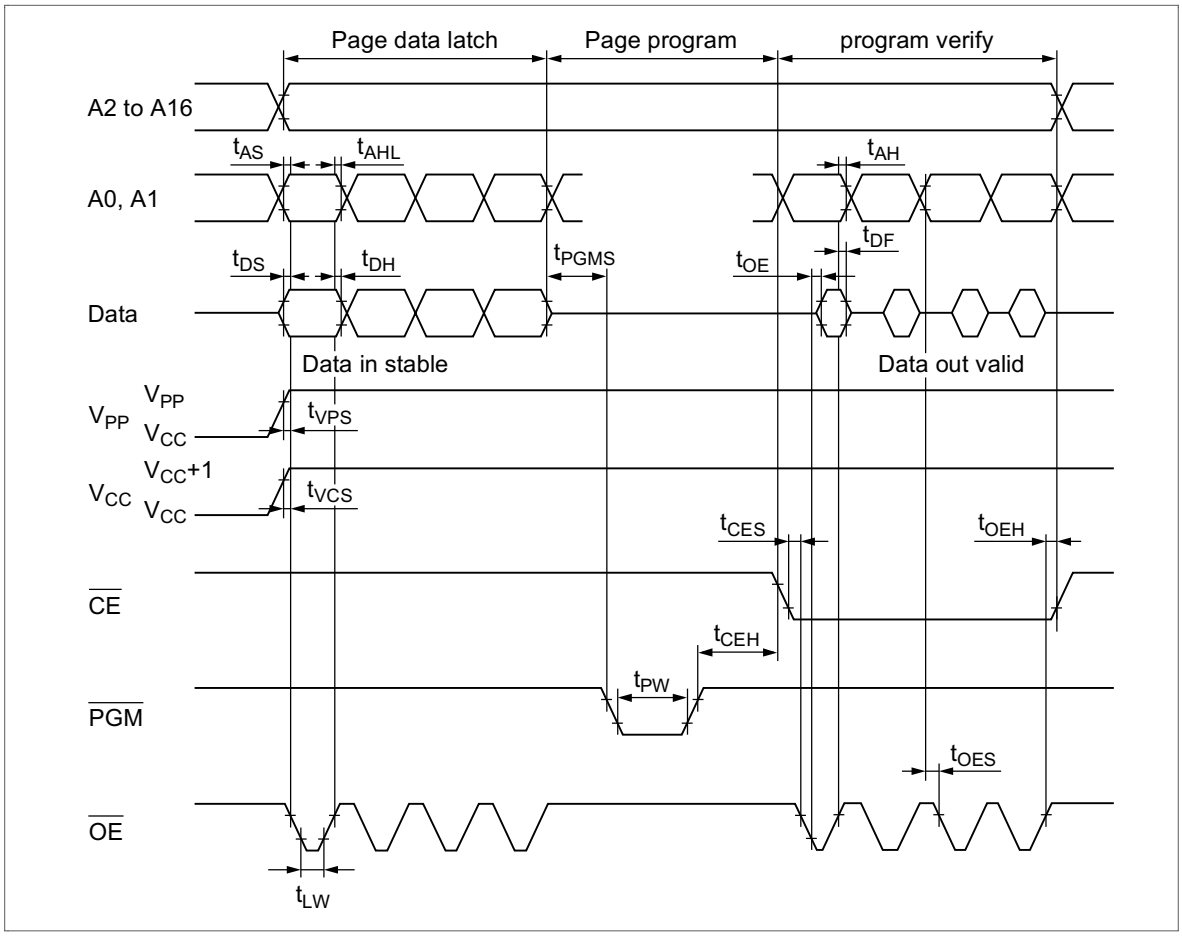
Test conditions

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

Parameter	Symbol	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
	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



Erase

Erasure of this device 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 × exposure time) for erasure is 15 W. sec/cm^2.

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 EPROM. By this mode, the device will be automatically matched its own corresponding programming algorithm, using programming equipment.

HN27C101AG Identifier Code

Identifier	A0 (12)	A9 (26)	I/O7 (21)	I/O6 (20)	I/O5 (19)	I/O4 (18)	I/O3 (17)	I/O2 (15)	I/O1 (14)	I/O0 (13)	Hex Data
Manufacturer code	V_{IL}	V_H	0	0	0	0	0	1	1	1	07
Device code	V_{IH}	V_H	0	0	1	1	1	0	0	0	38

HN27C301AG Identifier Code

Identifier	A0 (12)	A9 (26)	I/O7 (21)	I/O6 (20)	I/O5 (19)	I/O4 (18)	I/O3 (17)	I/O2 (15)	I/O1 (14)	I/O0 (13)	Hex Data
Manufacturer code	V_{IL}	V_H	0	0	0	0	0	1	1	1	07
Device code	V_{IH}	V_H	1	0	1	1	1	0	0	1	B9

Notes: 1. $V_H = 12.0\ V \pm 0.5\ V$
2. A1–A8, A10–A16, $\overline{CE}$, $\overline{OE} = V_{IL}$, $\overline{PGM} = V_{IH}$

Package Dimensions

HN27C101AG/HN27C301AG Series (DG-32) Unit: mm