
HN27C101AG Series HN27C301AG Series

131072-word $\times$ 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 $\pm$ 5% (HN27C101AG-10/HN27C301AG-10)
 - +5 V $\pm$ 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 μ W 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

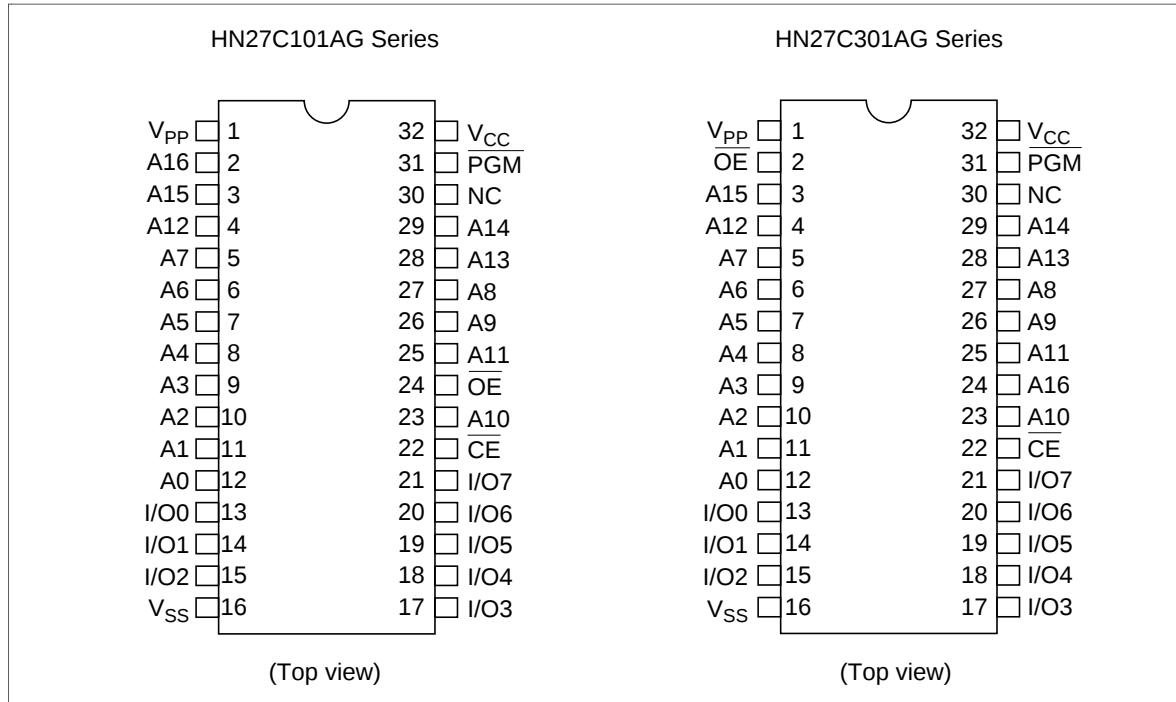
HN27C101AG/HN27C301AG Series

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	

HN27C101AG/HN27C301AG Series

Pin Arrangement

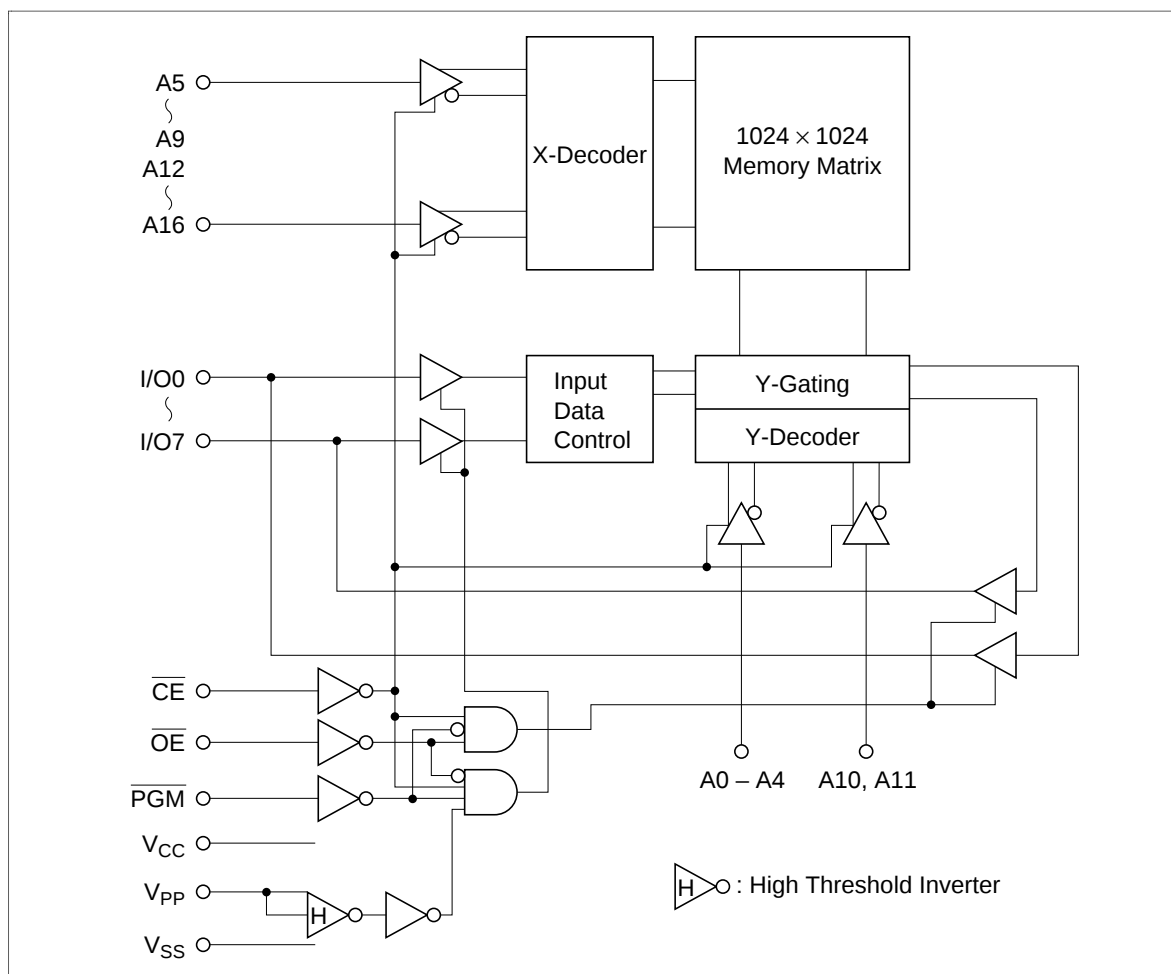


Pin Description

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
PGM	Programming enable
NC	No connection

HN27C101AG/HN27C301AG Series

Block Diagram



HN27C101AG/HN27C301AG Series

Mode Selection

Mode	$\overline{\text{CE}}$	$\overline{\text{OE}}$	$\overline{\text{PGM}}$	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	V _{in} , V _{out}	–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	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

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

Capacitance (T_a = 25°C, f = 1 MHz)

Parameter	Symbol	Min	Typ	Max	Unit	Test Conditions
Input capacitance	C _{in}	—	—	10	pF	V _{in} = 0 V
Output capacitance	C _{out}	—	—	15	pF	V _{out} = 0 V

HN27C101AG/HN27C301AG Series

Read Operation

DC Characteristics ($V_{CC} = 5\text{ V} \pm 5\%$, $V_{PP} = V_{CC}$, $T_a = 0\text{ to }+70^\circ\text{C}$) (HN27C101AG/HN27C301AG-10)

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

(HN27C101AG/HN27C301AG-12/15/17/20/25)

Parameter	Symbol	Min	Typ	Max	Unit	Test Conditions
Input leakage current	I_{LI}	—	—	2	μA	$V_{in} = 0\text{ V to }V_{CC}$
Output leakage current	I_{LO}	—	—	2	μA	$V_{out} = 0\text{ V to }V_{CC}$
V_{PP} current	I_{PP1}	—	1	20	μA	$V_{PP} = 5.5\text{ V}$
Standby V_{CC} current	I_{SB1}	—	—	1	mA	$\overline{CE} = V_{IH}$
	I_{SB2}	—	1	20	μA	$\overline{CE} = V_{CC} \pm 0.3\text{ V}$
Operating V_{CC} current	I_{CC1}	—	—	30	mA	$\overline{CE} = V_{IL}$, $I_{out} = 0\text{ mA}$
	I_{CC2}	—	—	30	mA	$f = 5\text{ MHz}$, $I_{out} = 0\text{ mA}$
		—	—	50	mA	$f = 10\text{ MHz}$, $I_{out} = 0\text{ mA}$
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	$I_{OL} = 2.1\text{ mA}$
Output high voltage	V_{OH}	2.4	—	—	V	$I_{OH} = -1\text{ mA}$
		$V_{CC} - 0.7$	—	—	V	$I_{OH} = -0.1\text{ mA}$

Notes: 1. V_{IL} min = -1.0 V for pulse width $\leq 50\text{ ns}$

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 cannot be guaranteed.

HN27C101AG/HN27C301AG Series

AC Characteristics ($V_{CC} = 5\text{ V} \pm 5\%$, $V_{pp} = V_{CC}$, $T_a = 0\text{ to }+70^\circ\text{C}$) (HN27C101AG/HN27C301AG-10)
 ($V_{CC} = 5\text{ V} \pm 10\%$, $V_{pp} = V_{CC}$, $T_a = 0\text{ to }+70^\circ\text{C}$)
 (HN27C101AG/HN27C301AG-12/15/17/20/25)

Test Conditions

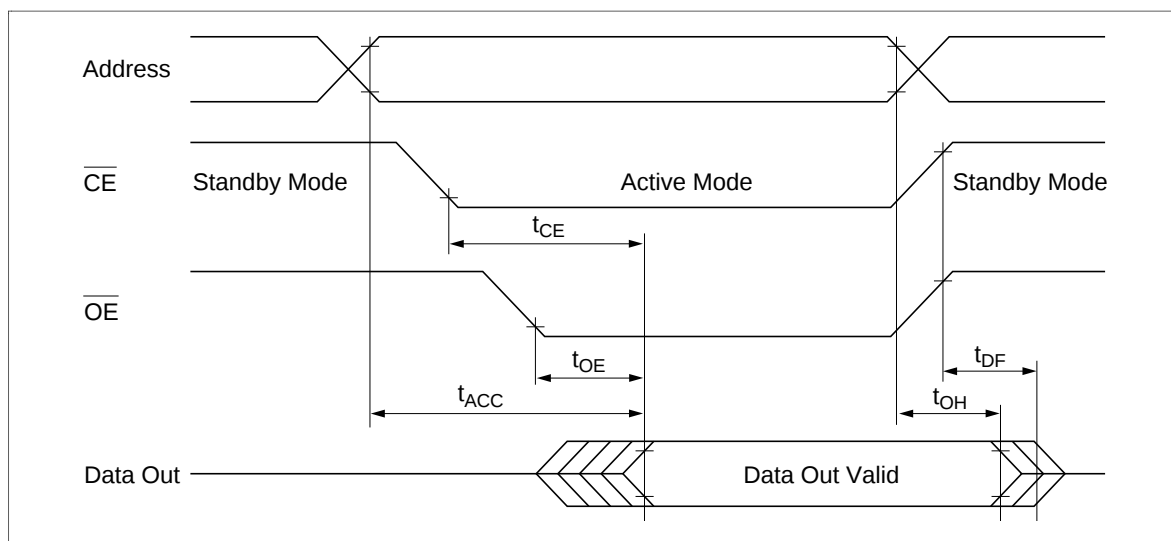
- Input pulse levels: 0.45 V to 2.4 V
- Input rise and fall time: $\leq 20\text{ ns}$
- Output load: 1 TTL gate +100 pF
- Reference levels for measuring timing: Inputs; 0.8 V and 2.0 V
 Outputs; 0.8 V and 2.0 V

		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.

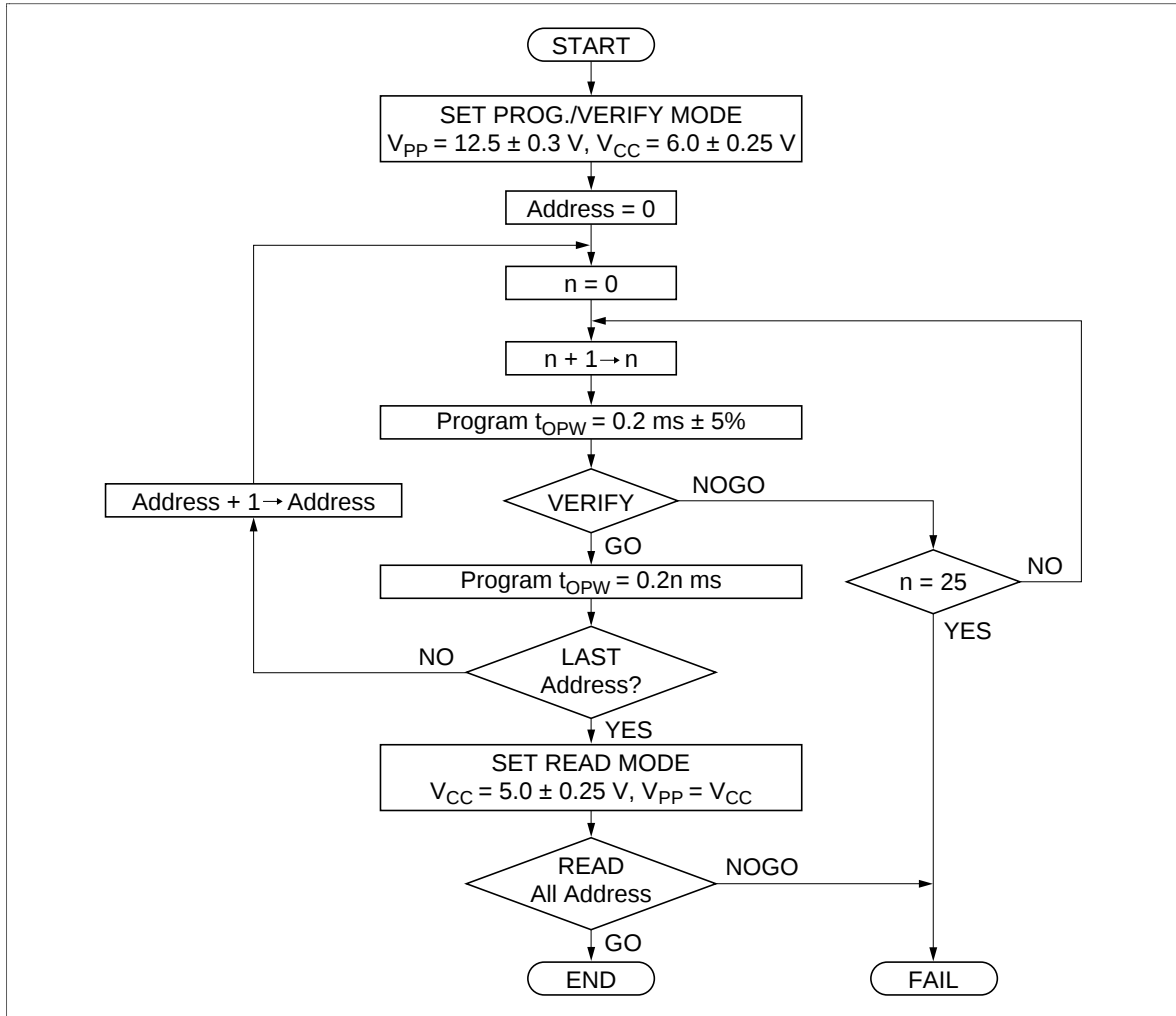
HN27C101AG/HN27C301AG Series

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

HN27C101AG/HN27C301AG Series

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

Parameter	Symbol	Min	Typ	Max	Unit	Test Conditions
Input leakage current	I_{LI}	—	—	2	μA	$V_{in} = 0\text{ V to } V_{CC}$
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	$I_{OL} = 2.1\text{ mA}$
Output high voltage during verify	V_{OH}	2.4	—	—	V	$I_{OH} = -400\text{ }\mu\text{A}$

- 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 $V_{PP} = 12.5\text{ V}$.
4. Do not alter V_{PP} either V_{IL} to 12.5 V or 12.5 V to V_{IL} when $\overline{CE} = \text{Low}$.
5. V_{IL} min = -0.6 V for pulse width $\leq 20\text{ ns}$
6. If V_{IH} is over the specified maximum value, programming operation cannot be guaranteed.

HN27C101AG/HN27C301AG Series

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

Test Conditions

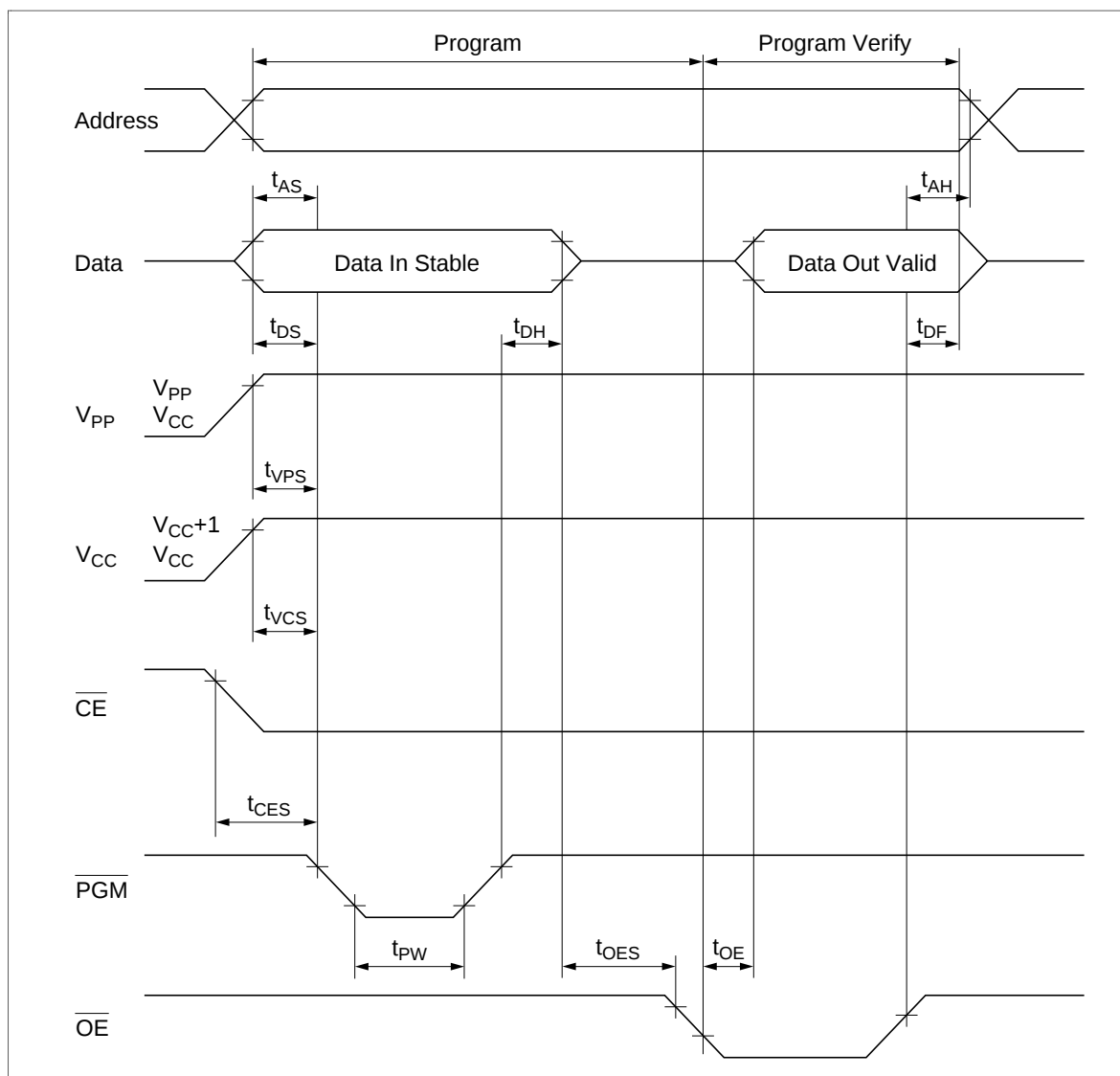
- Input pulse levels: 0.45 V to 2.4 V
- Input rise and fall time: $\leq 20\text{ ns}$
- Reference levels for measuring timing: Inputs; 0.8 V and 2.0 V
Outputs; 0.8 V and 2.0 V

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	
PGM initial programming pulse width	t_{PW}	0.19	0.2	0.21	ms	
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} .

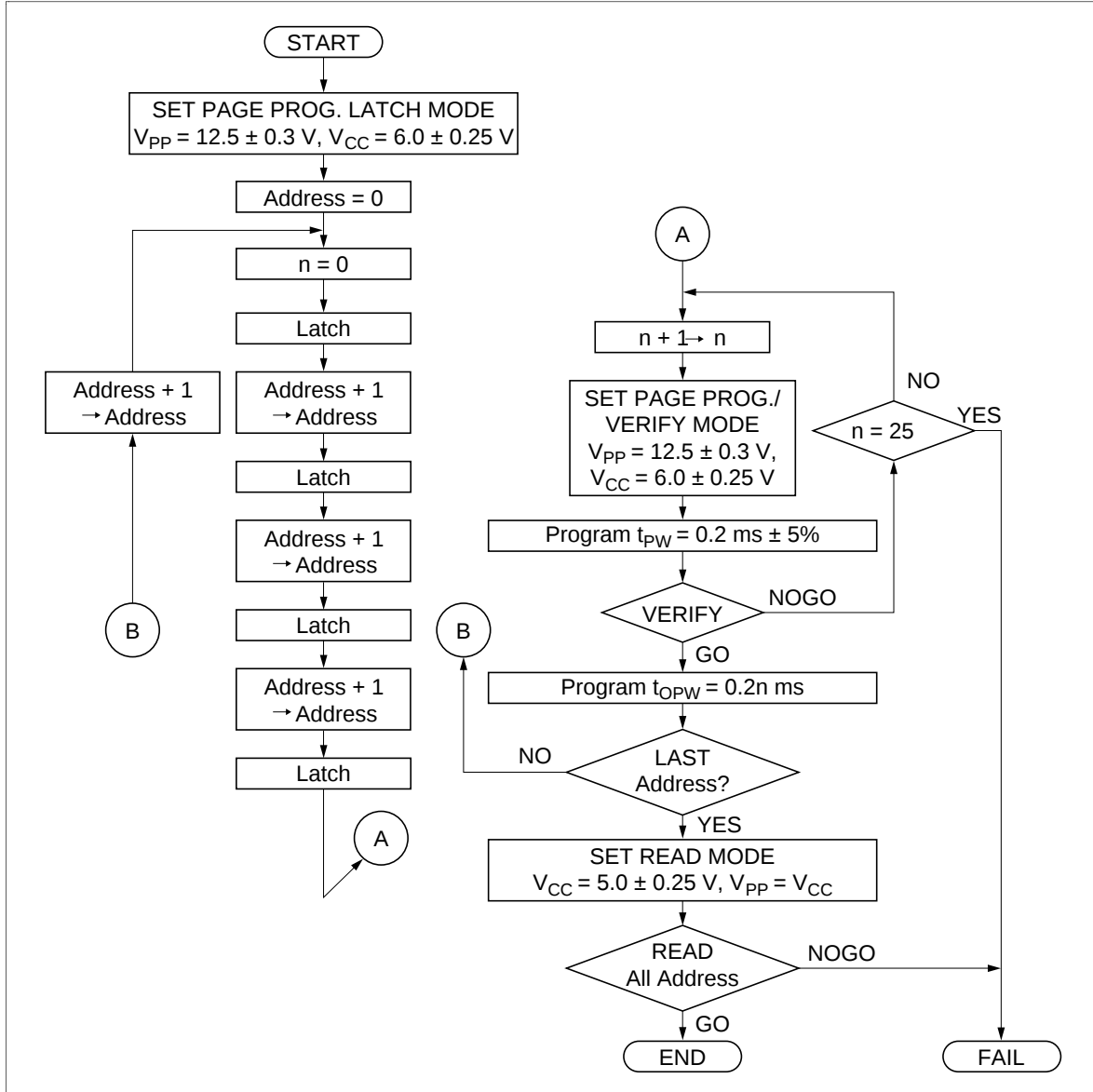
HN27C101AG/HN27C301AG Series

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

HN27C101AG/HN27C301AG Series

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

Parameter	Symbol	Min	Typ	Max	Unit	Test Conditions
Input leakage current	I_{LI}	—	—	2	μA	$V_{in} = 0\text{ V to } V_{CC}$
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	$I_{OL} = 2.1\text{ mA}$
Output high voltage during verify	V_{OH}	2.4	—	—	V	$I_{OH} = -400\text{ }\mu\text{A}$

- 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 $V_{PP} = 12.5\text{ V}$.
4. Do not alter V_{PP} either V_{IL} to 12.5 V or 12.5 V to V_{IL} when $\overline{CE} = \text{Low}$.
5. V_{IL} min = -0.6 V for pulse width $\leq 20\text{ ns}$
6. If V_{IH} is over the specified maximum value, programming operation cannot be guaranteed.

HN27C101AG/HN27C301AG Series

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

Test conditions

- Input pulse levels: 0.45 V to 2.4 V
- Input rise and fall time: $\leq 20\text{ ns}$
- Reference levels for measuring timing: Inputs; 0.8 V and 2.0 V
Outputs; 0.8 V and 2.0 V

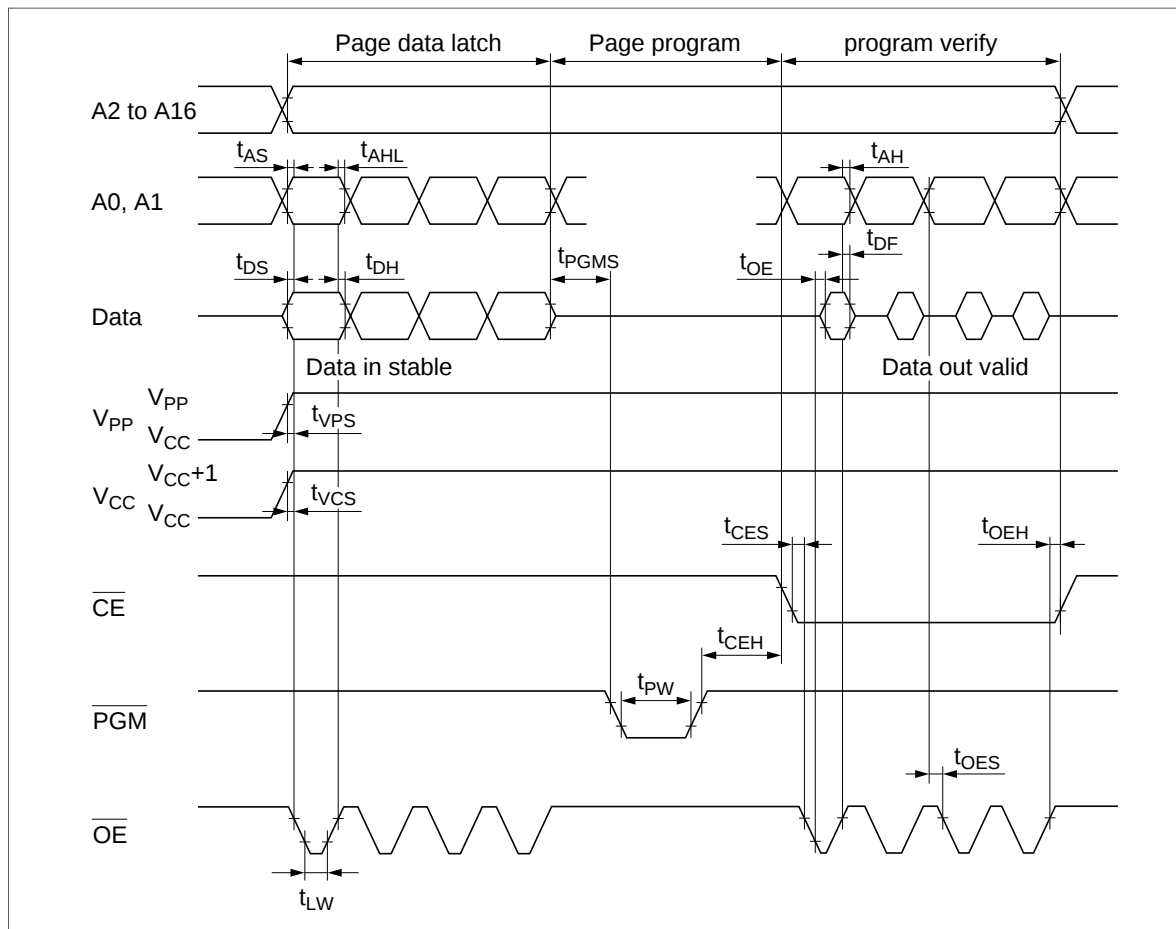
Parameter	Symbol	Min	Typ	Max	Unit
Address setup time	t_{AS}	2	—	—	μs
$\overline{OE}$ setup time	t_{OES}	2	—	—	μs
Data setup time	t_{DS}	2	—	—	μs
Address hold time	t_{AH}	0	—	—	μs
	t_{AHL}	2	—	—	μs
Data hold time	t_{DH}	2	—	—	μs
$\overline{OE}$ to output float delay	t_{DF}^{*1}	0	—	130	ns
V_{PP} setup 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} .

HN27C101AG/HN27C301AG Series

Fast High-Reliability Page Programming Timing Waveform



Erase

Erase 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/cm².

HN27C101AG/HN27C301AG Series

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 ± 0.5 V

2. A1–A8, A10–A16, $\overline{CE}$, $\overline{OE}$ = V_{IL}, PGM = V_{IH}

HN27C101AG/HN27C301AG Series

Package Dimensions

HN27C101AG/HN27C301AG Series (DG-32)

Unit: mm

