

HN58C257 Series

32768-word \times 8-bit Electrically Erasable and Programmable CMOS ROM

HITACHI

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The Hitachi HN58C257 is a electrically erasable and programmable ROM organized as 32768-word \times 8-bit. It realizes high speed, low power consumption, and a high level of reliability, employing advanced MNOS memory technology and CMOS process and circuitry technology. It also has a 64-byte page programming function to make its erase and write operations faster.

Ordering Information

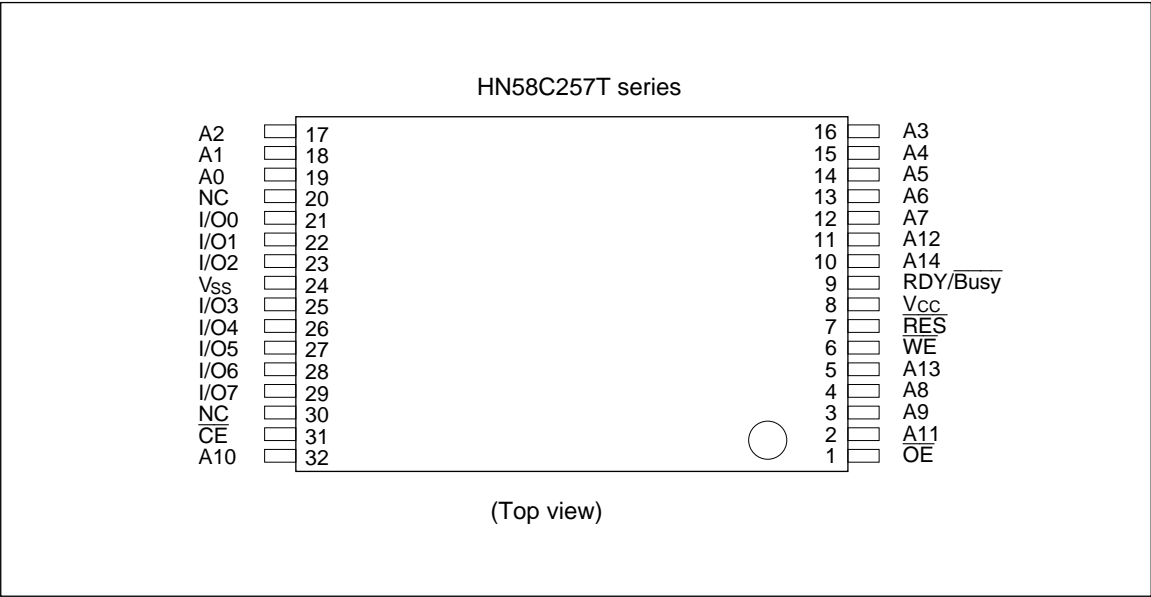
Type no.	Access time	Package
HN58C257T-20	200 ns	32-pin plastic TSOP (TFP-32DA)

Features

- Single 5 V supply
- On-chip latches: address, data, $\overline{\text{CE}}$, $\overline{\text{OE}}$, $\overline{\text{WE}}$
- Automatic byte write: 10 ms max
- Automatic page write (64 bytes): 10 ms max
- Fast access time: 200 ns max
- Low power dissipation:
 - 20 mW/MHz typ (active)
 - 1.1 mW max (standby)
- Data polling
- Data protection circuit on power on/off
- Conforms to JEDEC byte-wide standard
- Reliable CMOS with MNOS cell technology
- 10^5 erase/write cycles (in page mode)
- 10 years data retention
- Write protection by $\overline{\text{RES}}$ pin

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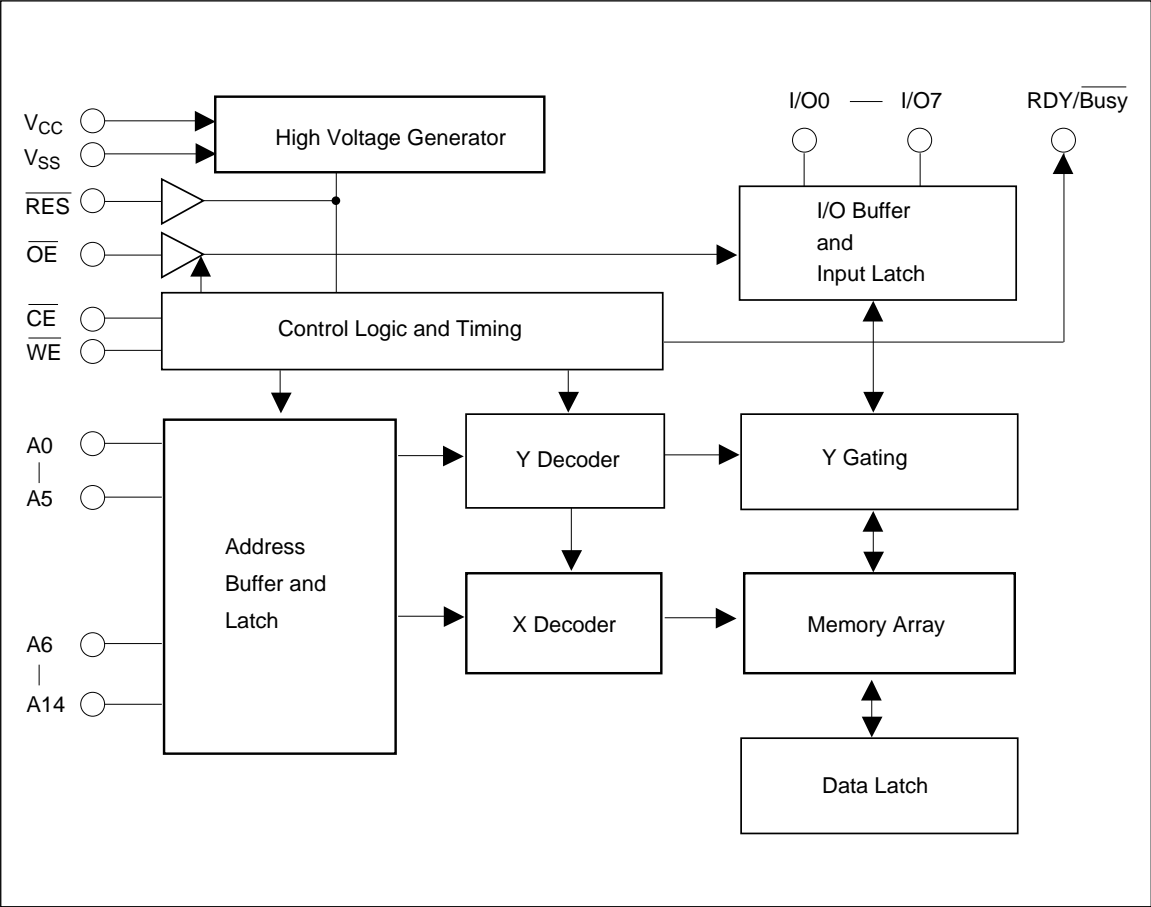
Pin Arrangement



Pin Description

Pin name	Function
A0–A14	Address inputs
I/O0–I/O7	Data input/output
OE	Output enable
CE	Chip enable
WE	Write enable
Vcc	Power (+5 V)
Vss	Ground
RES	Reset
RDY/Busy	Ready /Busy

Block Diagram



Mode Selection

Pin Mode	\overline{CE} (31)	\overline{OE} (1)	\overline{WE} (6)	RDY/Busy (9)	\overline{RES} (7)	I/O (21-23, 25-29)
Read	V_{IL}	V_{IL}	V_{IH}	High-Z	V_H^{*1}	Dout
Standby	V_{IH}	\times^{*2}	\times	High-Z	\times	High-Z
Write	V_{IL}	V_{IH}	V_{IL}	High-Z to V_{OL}	V_H	Din
Deselect	V_{IL}	V_{IH}	V_{IH}	High-Z	V_H	High-Z
Write inhibit	\times	\times	V_{IH}	High-Z	\times	—
	\times	V_{IL}	\times			
Data polling	V_{IL}	V_{IL}	V_{IH}	V_{OL}	V_H	Data out (I/O7)
Program reset	\times	\times	\times	High-Z	V_{IL}	High-Z

Note: 1. Refer to the recommended DC operating condition.
2. \times = Don't care

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Absolute Maximum Ratings

Parameter	Symbol	Value	Unit
Supply voltage *1	V _{CC}	−0.6 to +7.0	V
Input voltage *1	V _{in}	−0.5*2 to +7.0	V
Operating temperature range *3	T _{opr}	0 to +70	°C
Storage temperature range	T _{stg}	−55 to +125	°C

- Notes: 1. With respect to V_{SS}
2. V_{in} min = −3.0 V for pulse width ≤ 50 ns
3. Including electrical characteristics and data retention

Recommended DC Operating Conditions

Parameter	Symbol	Min	Typ	Max	Unit
Supply voltage	V _{CC}	4.5	5.0	5.5	V
Input voltage	V _{IL}	−0.3	—	0.8	V
	V _{IH}	2.2	—	V _{CC} + 1.0	V
	V _H	V _{CC} − 0.5	—	V _{CC} + 1.0	V
Operating temperature	T _{opr}	0	—	70	°C

DC Characteristics (Ta=0 to +70°C, V_{CC} = 5.0 V ± 10 %)

Parameter	Symbol	Min	Typ	Max	Unit	Test conditions
leakage current	I _{LI}	—	—	2*1	μA	V _{CC} = 5.5 V, V _{in} = 5.5 V
Output leakage current	I _{LO}	—	—	2	μA	V _{CC} = 5.5 V, V _{out} = 5.5/0.4 V
V _{CC} current (standby)	I _{CC1}	—	—	200	μA	$\overline{CE} = V_{CC}$
	I _{CC2}	—	—	1	mA	$\overline{CE} = V_{IH}$
V _{CC} current (active)	I _{CC3}	—	—	12	mA	I _{out} = 0 mA, Duty = 100%, Cycle = 1 μs at V _{CC} = 5.5 V
	—	—	—	30	mA	I _{out} = 0 mA, Duty = 100%, Cycle = 200 ns at V _{CC} = 5.5 V
Input low voltage	V _{IL}	−0.3*2	—	0.8	V	
Input high voltage	V _{IH}	2.2	—	V _{CC} + 1.0	V	
	V _H	V _{CC} − 0.5	—	V _{CC} + 1.0	V	
Output low voltage	V _{OL}	—	—	0.4	V	I _{OL} = 2.1 mA
Output high voltage	V _{OH}	2.4	—	—	V	I _{OH} = −400 μA

- Note: 1. I_{LI} on \overline{RES} = 100 μA max
2. V_{IL} min = −1.0 V for pulse width ≤ 50 ns

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

Parameter	Symbol	Min	Typ	Max	Unit	Test condition
Input capacitance*1	Cin	—	—	6	pF	Vin = 0 V
Output capacitance*1	Cout	—	—	12	pF	Vout = 0 V

Note: 1. This parameter is periodically sampled and not 100% tested.

AC Characteristics ($T_a = 0\text{ to }+70^\circ\text{C}$, $V_{CC} = 5.0\text{ V} \pm 10\%$)

Test Conditions

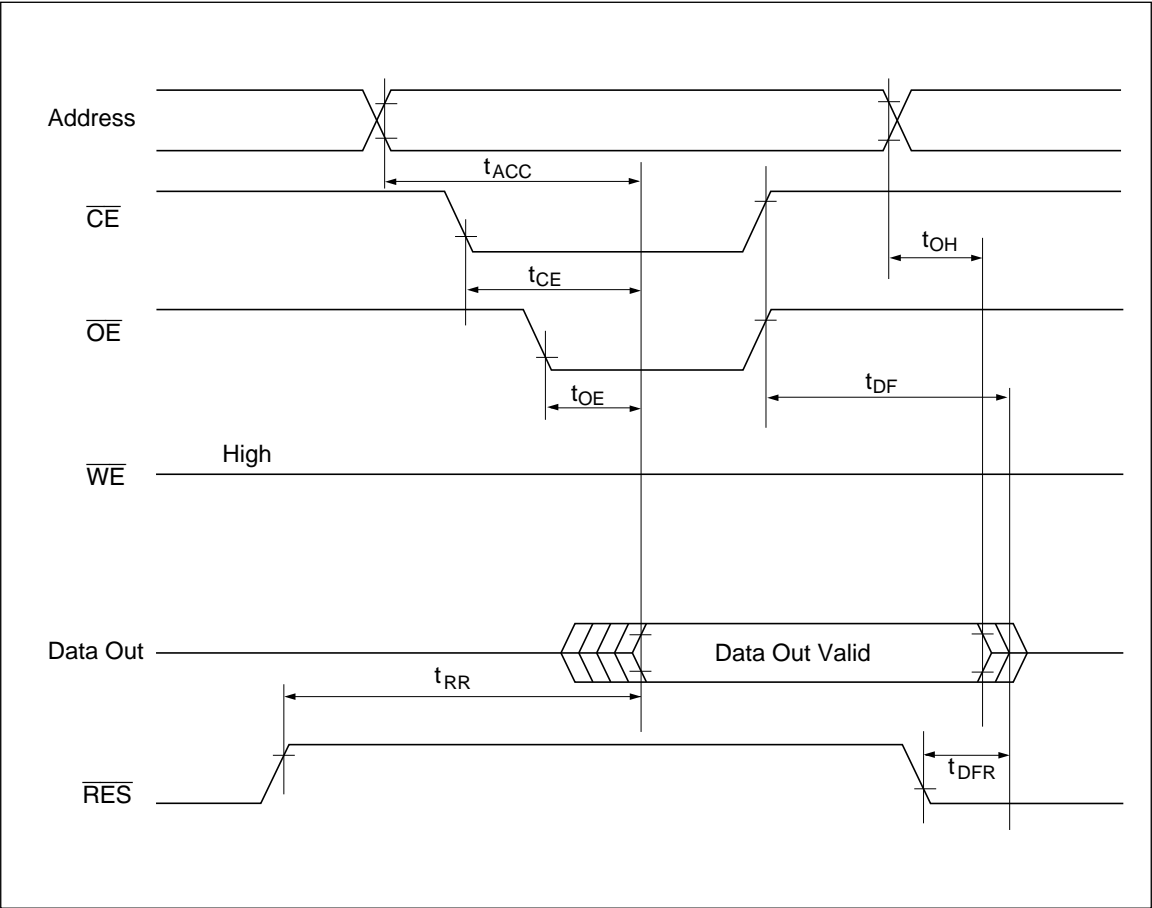
- Input pulse levels : 0.4 V to 2.4 V
0V to V_{CC} ($\overline{\text{RES}}$ pin)
- Input rise and fall time : $\leq 20\text{ ns}$
- Output load : 1TTL Gate +100 pF
- Reference levels for measuring timing : 0.8 V, 2.0 V

Read Cycle

Parameter	Symbol	Min	Max	Unit	Test conditions
Address to output delay	t_{ACC}	—	200	ns	$\overline{\text{CE}} = \overline{\text{OE}} = V_{\text{IL}}$, $\overline{\text{WE}} = V_{\text{IH}}$
$\overline{\text{CE}}$ to output delay	t_{CE}	—	200	ns	$\overline{\text{OE}} = V_{\text{IL}}$, $\overline{\text{WE}} = V_{\text{IH}}$
$\overline{\text{OE}}$ to output delay	t_{OE}	10	90	ns	$\overline{\text{CE}} = V_{\text{IL}}$, $\overline{\text{WE}} = V_{\text{IH}}$
$\overline{\text{OE}}$ ($\overline{\text{CE}}$) high to output float*1	t_{DF}	0	70	ns	$\overline{\text{CE}} = V_{\text{IL}}$, $\overline{\text{WE}} = V_{\text{IH}}$
$\overline{\text{RES}}$ low to output float*1	t_{DFR}	0	350	ns	$\overline{\text{CE}} = \overline{\text{OE}} = V_{\text{IL}}$, $\overline{\text{WE}} = V_{\text{IH}}$
Data output hold	t_{OH}	0	—	ns	$\overline{\text{CE}} = \overline{\text{OE}} = V_{\text{IL}}$, $\overline{\text{WE}} = V_{\text{IH}}$
$\overline{\text{RES}}$ to output delay	t_{RR}	0	450	ns	$\overline{\text{CE}} = \overline{\text{OE}} = V_{\text{IL}}$, $\overline{\text{WE}} = V_{\text{IH}}$

Note: 1. t_{DF} , t_{DFR} are defined at which the outputs achieve the open circuit conditions and are no longer driven.

Read Timing Waveform



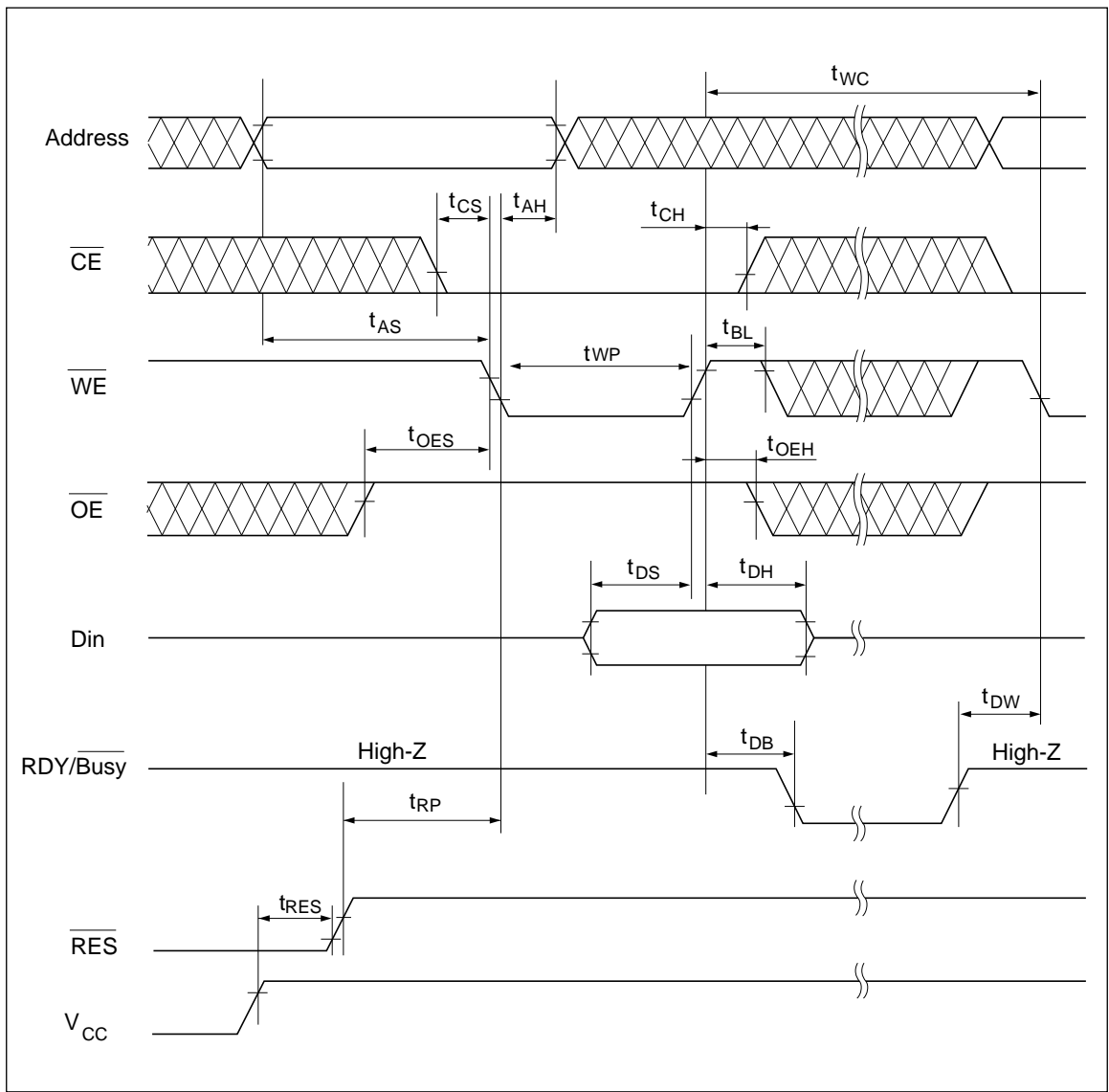
Write Cycle

Parameter	Symbol	Min ^{*1}	Typ	Max	Unit	Test conditions
Address setup time	t _{AS}	0	—	—	ns	
Address hold time	t _{AH}	150	—	—	ns	
$\overline{\text{CE}}$ to write setup time ($\overline{\text{WE}}$ controlled)	t _{CS}	0	—	—	ns	
$\overline{\text{CE}}$ hold time ($\overline{\text{WE}}$ controlled)	t _{CH}	0	—	—	ns	
$\overline{\text{WE}}$ to write setup time ($\overline{\text{CE}}$ controlled)	t _{WS}	0	—	—	ns	
$\overline{\text{WE}}$ hold time ($\overline{\text{CE}}$ controlled)	t _{WH}	0	—	—	ns	
$\overline{\text{OE}}$ to write setup time	t _{OES}	0	—	—	ns	
$\overline{\text{OE}}$ hold time	t _{OEH}	0	—	—	ns	
Data setup time	t _{DS}	100	—	—	ns	
Data hold time	t _{DH}	0	—	—	ns	
$\overline{\text{WE}}$ pulse width ($\overline{\text{WE}}$ controlled)	t _{WP}	150	—	—	ns	
$\overline{\text{CE}}$ pulse width ($\overline{\text{CE}}$ controlled)	t _{CW}	150	—	—	ns	
Data latch time	t _{DL}	200	—	—	ns	
Byte load cycle	t _{BLC}	0.35	—	30	μs	
Byte load window	t _{BL}	100	—	—	μs	
Write cycle time	t _{WC}	—	—	10 ^{*2}	ms	
Time to device busy	t _{DB}	120	—	—	ns	
Write start time	t _{DW}	150 ^{*3}	—	—	ns	
Reset protect time	t _{RP}	100	—	—	μs	
Reset low time	t _{RES}	1	—	—	μs	

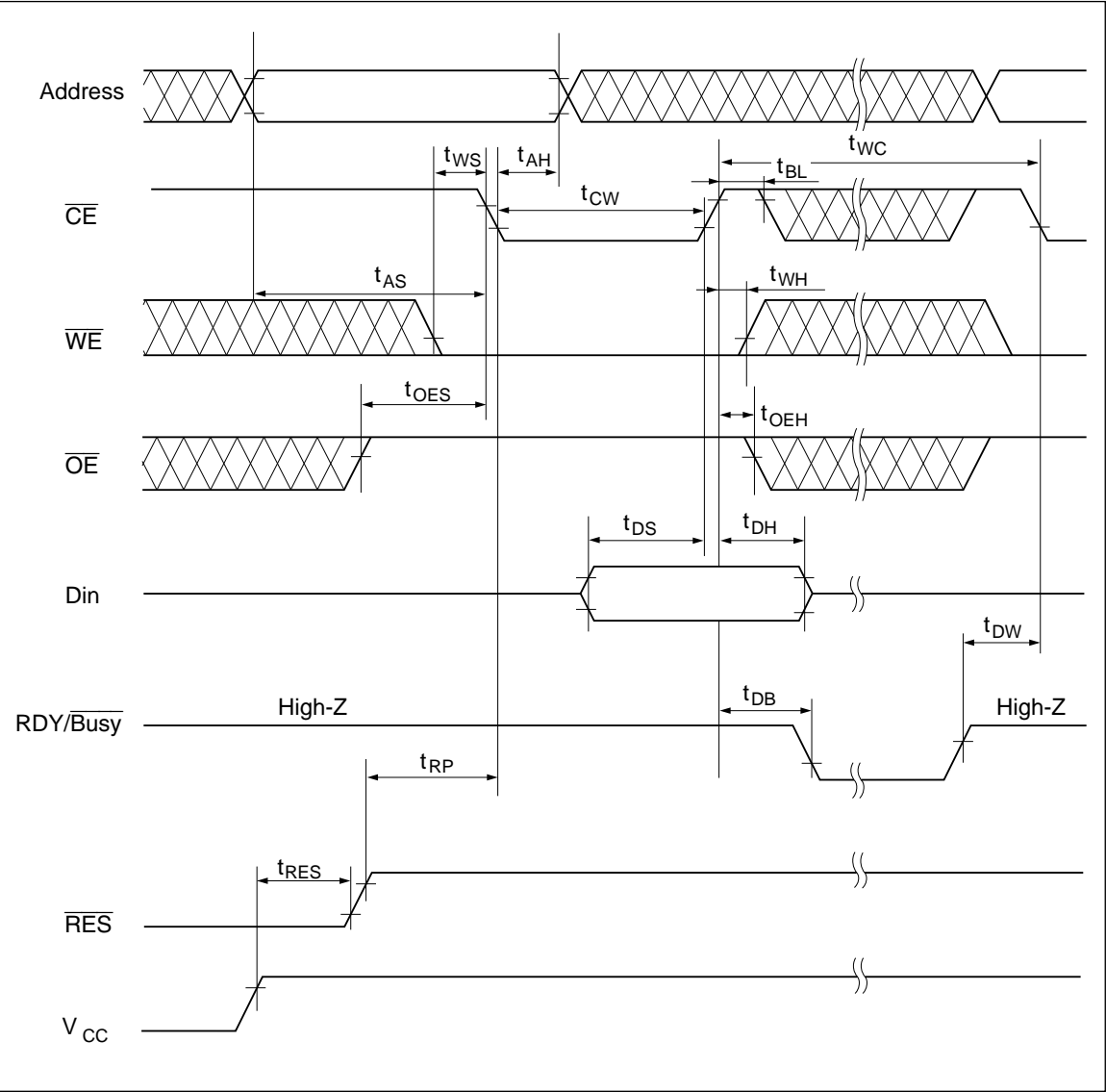
- Note:
1. Use this device in longer cycle than this value.
 2. t_{WC} must be longer than this value unless polling technique or RDY/ $\overline{\text{Busy}}$ are used. This device automatically completes the internal write operation within this value.
 3. Next read or write operation can be initiated after t_{DW} if polling technique or RDY/ $\overline{\text{Busy}}$ are used.

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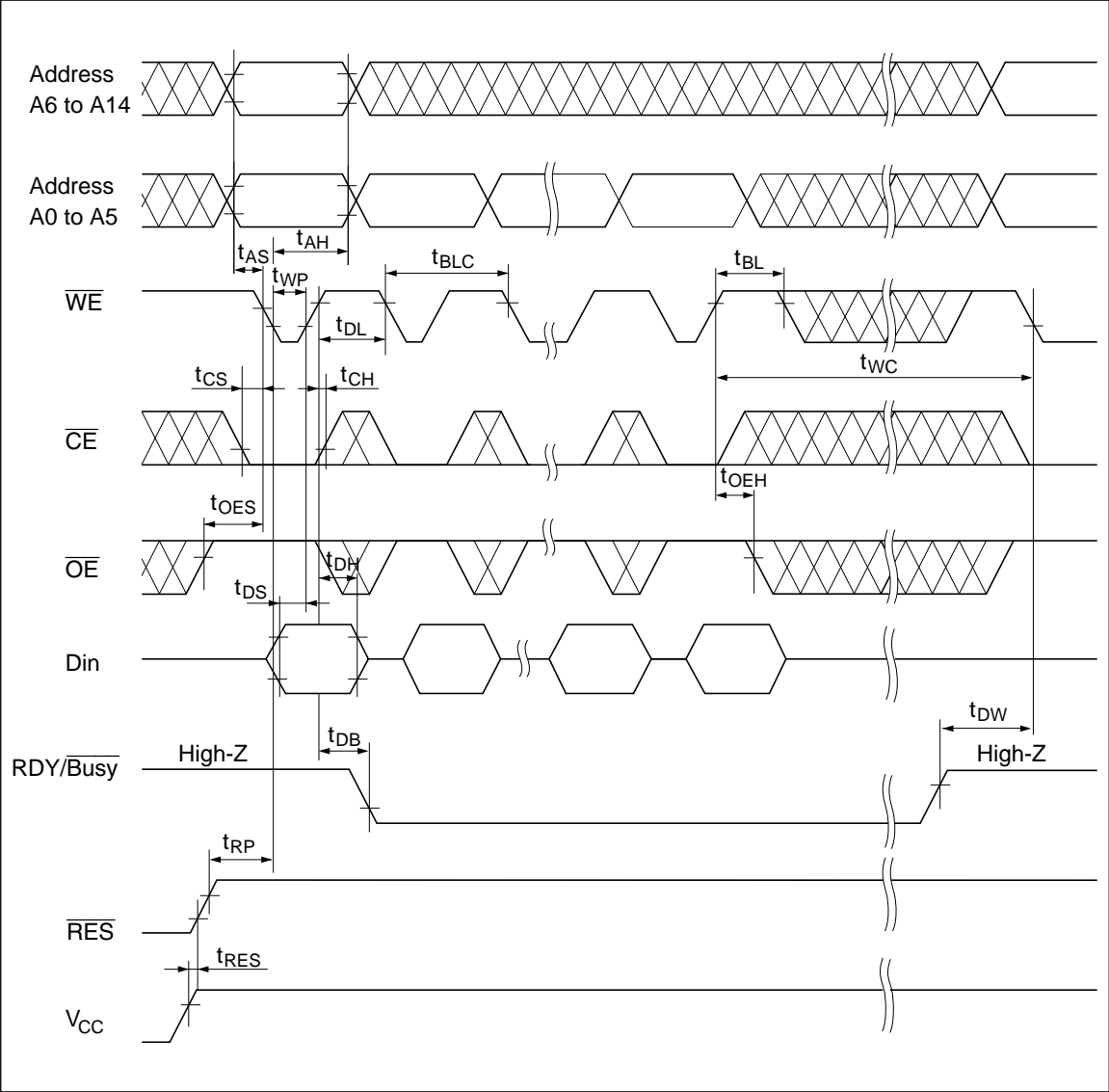
Byte Write Timing Waveform(1) ($\overline{\text{WE}}$ Controlled)



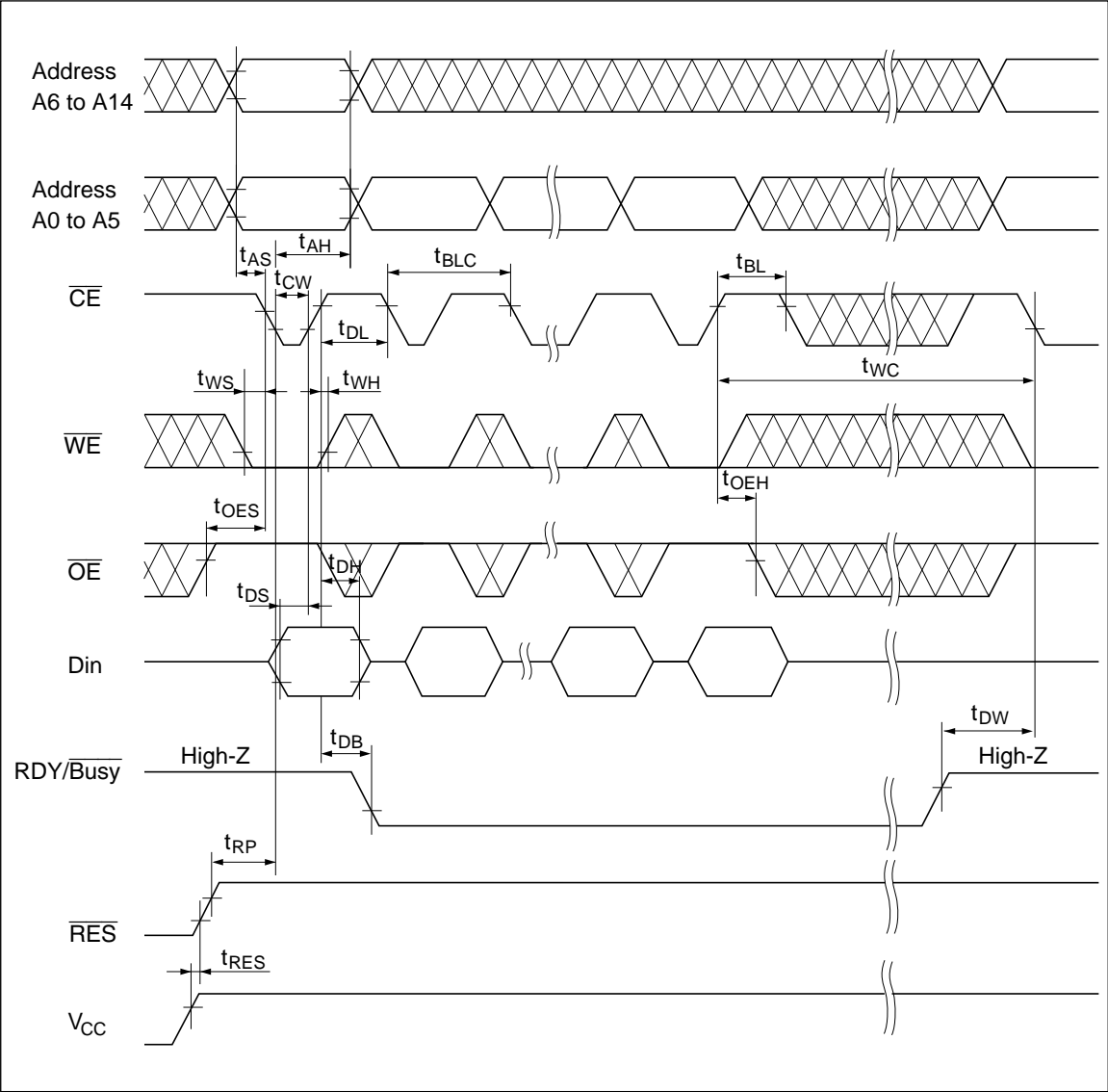
Byte Write Timing Waveform(2) ($\overline{\text{CE}}$ Controlled)



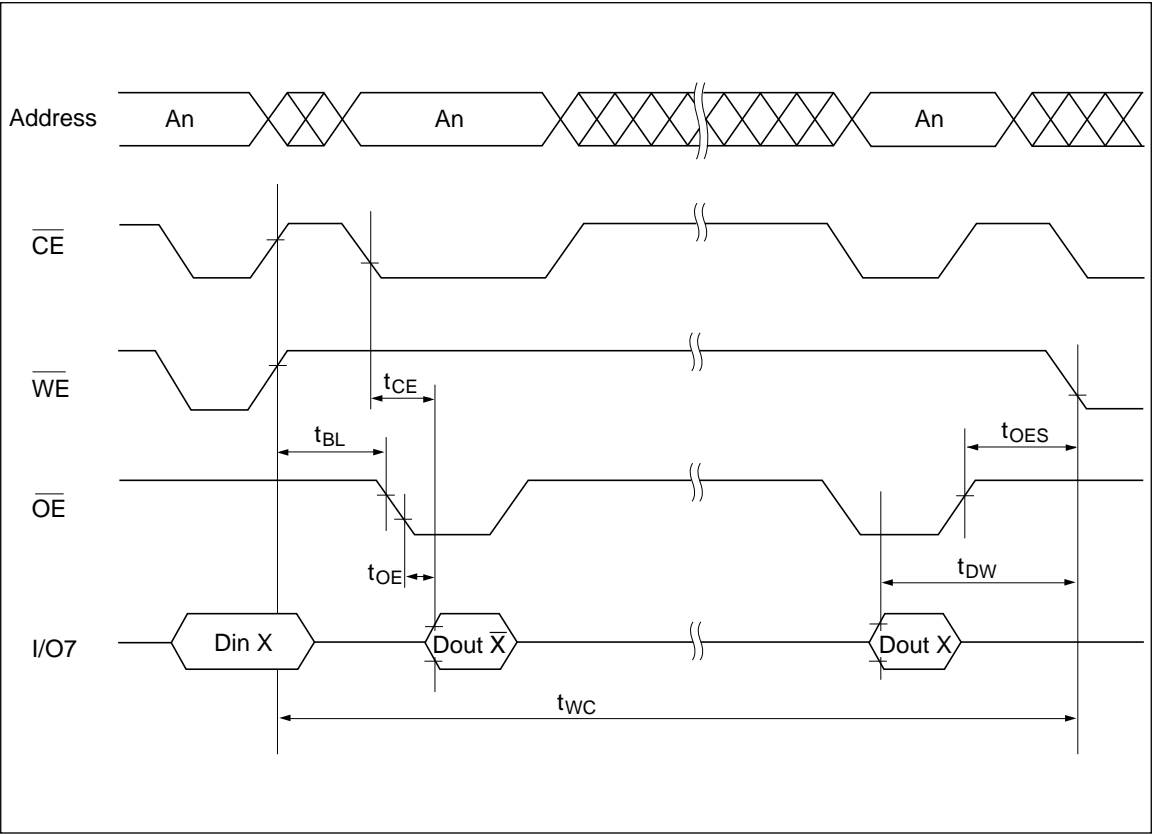
Page Write Timing Waveform (1)($\overline{\text{WE}}$ Controlled)



Page Write Timing Waveform (2)($\overline{\text{CE}}$ Controlled)



Data Polling Timing Waveform



Functional Description

Automatic Page Write

Page-mode write feature allows 1 to 64 bytes of data to be written into the EEPROM in a single write cycle. Following the initial byte cycle, an additional 1 to 63 bytes can be written in the same manner. Each additional byte load cycle must be started within 30 μ s from the preceding falling edge of $\overline{\text{WE}}$ or $\overline{\text{CE}}$. When $\overline{\text{CE}}$ or $\overline{\text{WE}}$ is high for 100 μ s after data input, the EEPROM enters write mode automatically and the input data are written into the EEPROM.

Data Polling

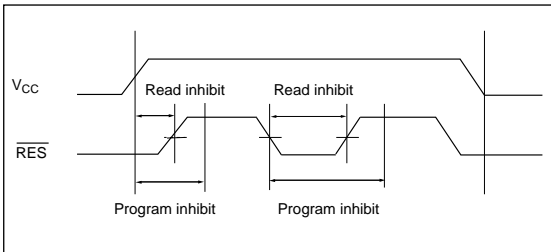
Data polling allows the status of the EEPROM to be determined. If EEPROM is set to read mode during a write cycle, an inversion of the last byte of data to be loaded outputs from I/O7 to indicate that the EEPROM is performing a write operation.

RDY/ $\overline{\text{Busy}}$ Signal

RDY/ $\overline{\text{Busy}}$ signal also allows the status of the EEPROM to be determined. The RDY/ $\overline{\text{Busy}}$ signal has high impedance except in write cycle and is lowered to V_{OL} after the first write signal. At the end of a write cycle, the RDY/ $\overline{\text{Busy}}$ signal changes state to high impedance.

$\overline{\text{RES}}$ Signal

When RES is low, the EEPROM cannot be read or programmed. Therefore, data can be protected by keeping RES low when VCC is switched. RES should be high during read and programming because it doesn't provide a latch function.



$\overline{\text{WE}}$, $\overline{\text{CE}}$ Pin Operation

During a write cycle, addresses are latched by the falling edge of $\overline{\text{WE}}$ or $\overline{\text{CE}}$, and data is latched by the rising edge of $\overline{\text{WE}}$ or $\overline{\text{CE}}$.

Write/Erase Endurance and Data Retention Time

The endurance is 10^5 cycles in case of the page programming and 10^4 cycles in case of byte programming (1% cumulative failure rate). The data retention time is more than 10 years when a device is page-programmed less than 10^4 cycles.

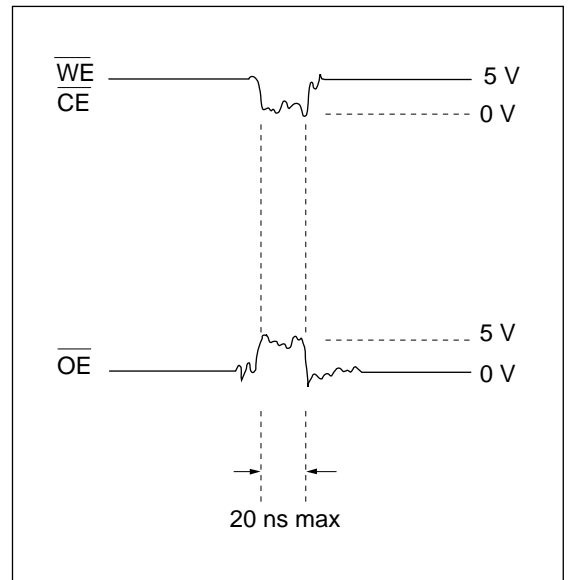
Data Protection

1. Data Protection against Noise on Control Pins (CE, OE, WE) during Operation

During readout or standby, noise on the control pins may act as a trigger and turn the EEPROM to programming mode by mistake.

To prevent this phenomenon, this device has a noise cancelation function that cuts noise if its width is 20 ns or less in program mode.

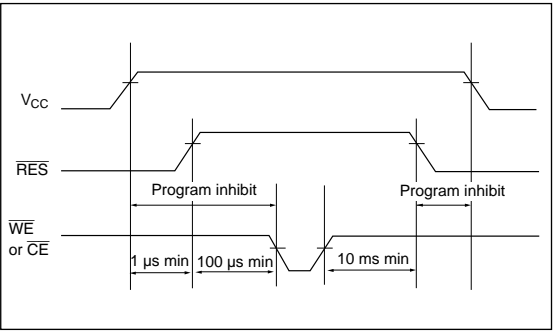
Be careful not to allow noise of a width of more than 20 ns on the control pins.



2. Data Protection at V_{CC} On/Off

When V_{CC} is turned on or off, noise on the control pins generated by external circuits (CPU, etc) may turn the EEPROM to programming mode by mistake. To prevent this unintentional programming, the EEPROM must be kept in unprogrammable state by using a CPU reset signal to RES pin. RES pin should be kept at V_{SS} level when V_{CC} is turned on or off.

The EEPROM breaks off programming operation when $\overline{\text{RES}}$ becomes low, programming operation doesn't finish correctly in case that RES falls low during programming operation. RES should be kept high for 10 ms after the last data input.



Package Dimensions

HN58C257T Series (TFP-32DA)

Unit : mm

