
HM9264B Series

8,192-word × 8-bit High Speed CMOS Static RAM

HITACHI

ADE-203-618A (Z)

Rev. 1.0

Jul. 23, 1996

Description

The Hitachi HM9264B is 64k-bit static RAM organized 8-kword × 8-bit. It realizes higher performance and low power consumption by 1.5 μm CMOS process technology. The device, packaged in 450 mil SOP (foot print pitch width), 600 mil plastic DIP, is available for high density mounting.

Features

- High speed
 - Fast access time: 85/100 ns (max)
- Low power
 - Standby: 10 μW (typ)
 - Operation: 15 mW (typ) (f = 1 MHz)
- Single 5 V supply
- Completely static memory
 - No clock or timing strobe required
- Equal access and cycle times
- Common data input and output
 - Three state output
- Directly TTL compatible
 - All inputs and outputs
- Battery backup operation capability

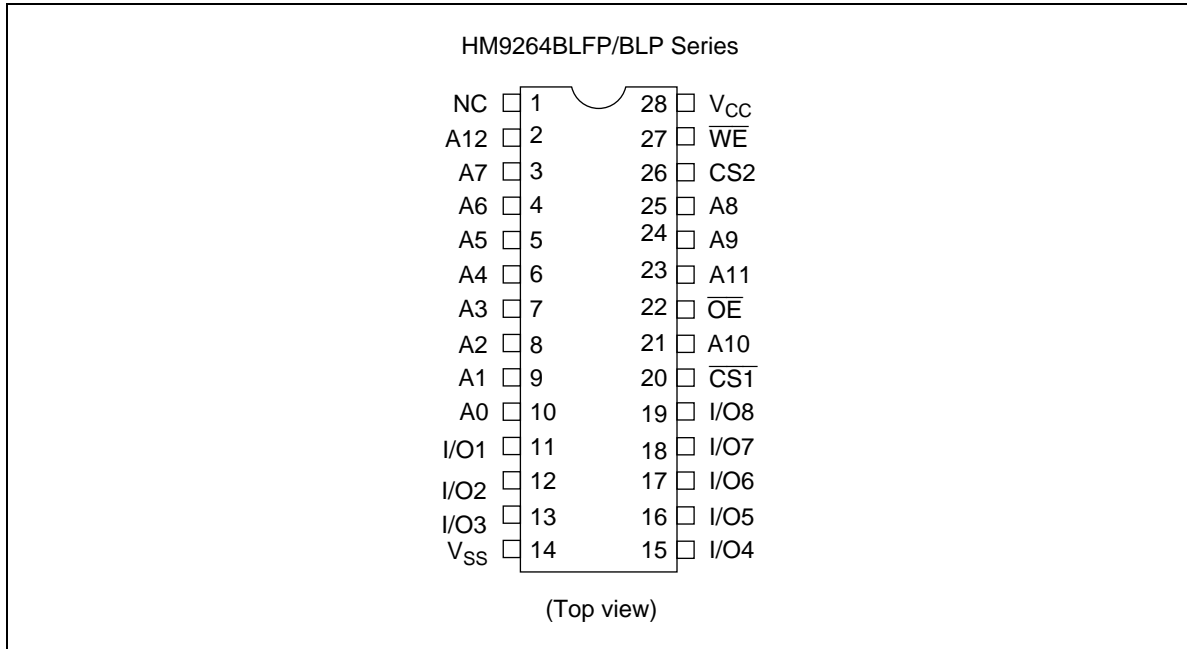
Ordering Information

Type No.	Access time	Package
HM9264BLFP-8L	85 ns	450-mil, 28-pin plastic SOP(FP-28DA)
HM9264BLFP-10L	100 ns	
HM9264BLP-8L	85 ns	600-mil, 28-pin plastic DIP (DP-28)
HM9264BLP-10L	100 ns	

Note: For Industrial machines (e.g. Communication Hubs, NC, and others), please use Hitachi HM6264B series. Then HM6264B series and HM9264B series can't be applied for Aerospace, Aircraft, Nucleus Plants, Main Flame Computers, Medical Life-support System, and Automobile Engine Controls.

HM9264B Series

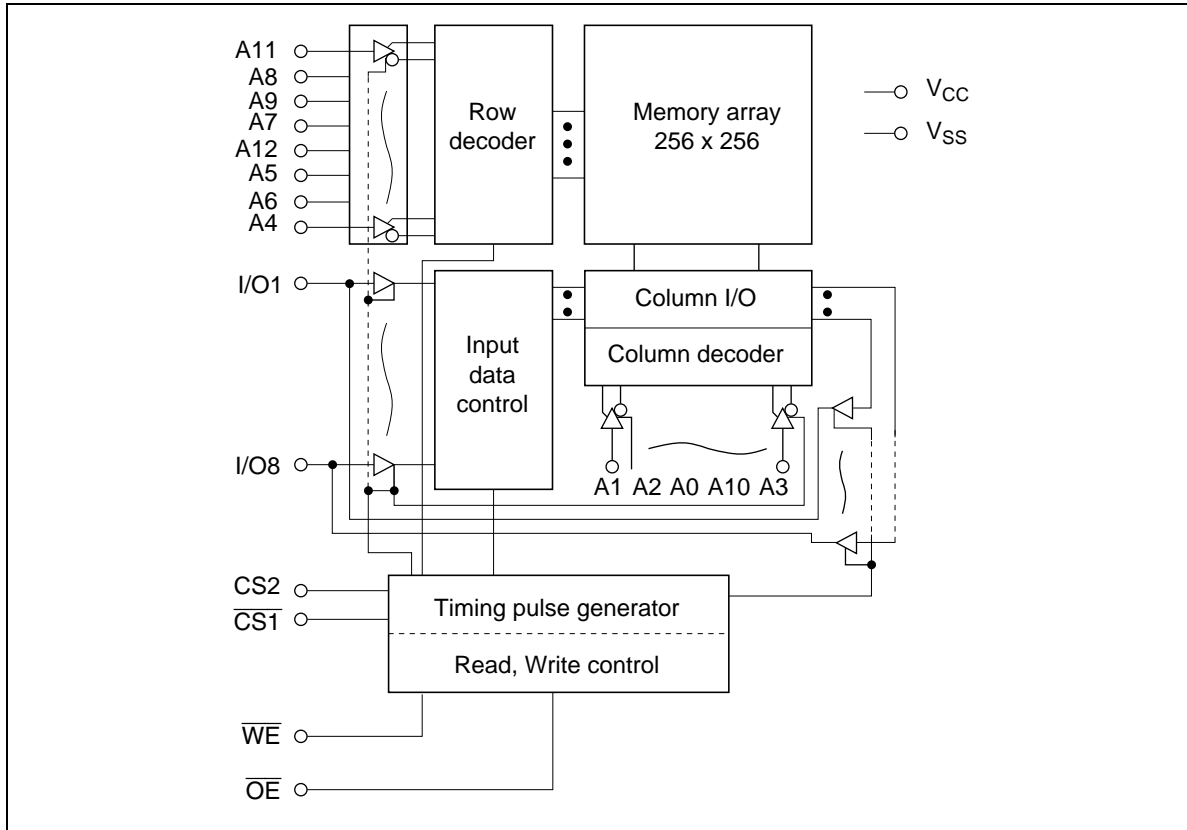
Pin Arrangement



Pin Description

Pin name	Function
A0 to A12	Address input
I/O1 to I/O8	Data input/output
$\overline{CS1}$	Chip select 1
CS2	Chip select 2
\overline{WE}	Write enable
\overline{OE}	Output enable
NC	No connection
V _{CC}	Power supply
V _{SS}	Ground

Block Diagram



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Function Table

\overline{WE}	$\overline{CS1}$	$CS2$	\overline{OE}	Mode	V_{CC} current	I/O pin	Ref. cycle
×	H	×	×	Not selected (power down)	I_{SB}, I_{SB1}	High-Z	—
×	×	L	×	Not selected (power down)	I_{SB}, I_{SB1}	High-Z	—
H	L	H	H	Output disable	I_{CC}	High-Z	—
H	L	H	L	Read	I_{CC}	Dout	Read cycle (1)–(3)
L	L	H	H	Write	I_{CC}	Din	Write cycle (1)
L	L	H	L	Write	I_{CC}	Din	Write cycle (2)

Note: ×: H or L

Absolute Maximum Ratings

Parameter	Symbol	Value	Unit
Power supply voltage ¹	V_{CC}	−0.5 to +7.0	V
Terminal voltage ¹	V_T	−0.5 ² to $V_{CC} + 0.3$ ³	V
Power dissipation	P_T	1.0	W
Operating temperature	T_{opr}	0 to +70	°C
Storage temperature	T_{stg}	−55 to +125	°C
Storage temperature under bias	T_{bias}	−10 to +85	°C

- Notes: 1. Relative to V_{SS}
 2. V_T min: −3.0 V for pulse half-width ≤ 50 ns
 3. Maximum voltage is 7.0 V

Recommended DC Operating Conditions ($T_a = 0$ to +70°C)

Parameter	Symbol	Min	Typ	Max	Unit
Supply voltage	V_{CC}	4.5	5.0	5.5	V
	V_{SS}	0	0	0	V
Input high voltage	V_{IH}	2.2	—	$V_{CC} + 0.3$	V
Input low voltage	V_{IL}	−0.3 ¹	—	0.8	V

Note: 1. V_{IL} min: −3.0 V for pulse half-width ≤ 50 ns

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

Parameter	Symbol	Min	Typ ¹	Max	Unit	Test conditions
Input leakage current	$ I_{LI} $	—	—	2	μA	$V_{in} = V_{SS}$ to V_{CC}
Output leakage current	$ I_{LO} $	—	—	2	μA	$\overline{CS1} = V_{IH}$ or $CS2 = V_{IL}$ or $\overline{OE} = V_{IH}$ or $\overline{WE} = V_{IL}$, $V_{IO} = V_{SS}$ to V_{CC}
Operating power supply current	I_{CCDC}	—	7	15	mA	$\overline{CS1} = V_{IL}$, $CS2 = V_{IH}$, $I_{IO} = 0\text{ mA}$ others = V_{IH}/V_{IL}
Average operating power supply current	I_{CC1}	—	30	45	mA	Min cycle, duty = 100%, $\overline{CS1} = V_{IL}$, $CS2 = V_{IH}$, $I_{IO} = 0\text{ mA}$ others = V_{IH}/V_{IL}
	I_{CC2}	—	3	5	mA	Cycle time = $1\ \mu\text{s}$, duty = 100%, $I_{IO} = 0\text{ mA}$ $\overline{CS1} \leq 0.2\text{ V}$, $CS2 \geq V_{CC} - 0.2\text{ V}$, $V_{IH} \geq V_{CC} - 0.2\text{ V}$, $V_{IL} \leq 0.2\text{ V}$
Standby power supply current	I_{SB}	—	1	3	mA	$\overline{CS1} = V_{IH}$, $CS2 = V_{IL}$
	I_{SB1}	—	2	50	μA	$\overline{CS1} \geq V_{CC} - 0.2\text{ V}$, $CS2 \geq V_{CC} - 0.2\text{ V}$ or $0\text{ V} \leq CS2 \leq 0.2\text{ V}$, $0\text{ V} \leq V_{in}$
Output low voltage	V_{OL}	—	—	0.4	V	$I_{OL} = 2.1\text{ mA}$
Output high voltage	V_{OH}	2.4	—	—	V	$I_{OH} = -1.0\text{ mA}$

Notes: 1. Typical values are at $V_{CC} = 5.0\text{ V}$, $T_a = +25^\circ\text{C}$ and not guaranteed.

Capacitance ($T_a = 25^\circ\text{C}$, $f = 1.0\text{ MHz}$)

Parameter	Symbol	Min	Typ	Max	Unit	Test conditions
Input capacitance ¹	C_{in}	—	—	5	pF	$V_{in} = 0\text{ V}$
Input/output capacitance ¹	C_{IO}	—	—	7	pF	$V_{IO} = 0\text{ V}$

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

HM9264B Series

AC Characteristics ($T_a = 0$ to $+70^\circ\text{C}$, $V_{CC} = 5\text{ V} \pm 10\%$, unless otherwise noted.)

Test Conditions

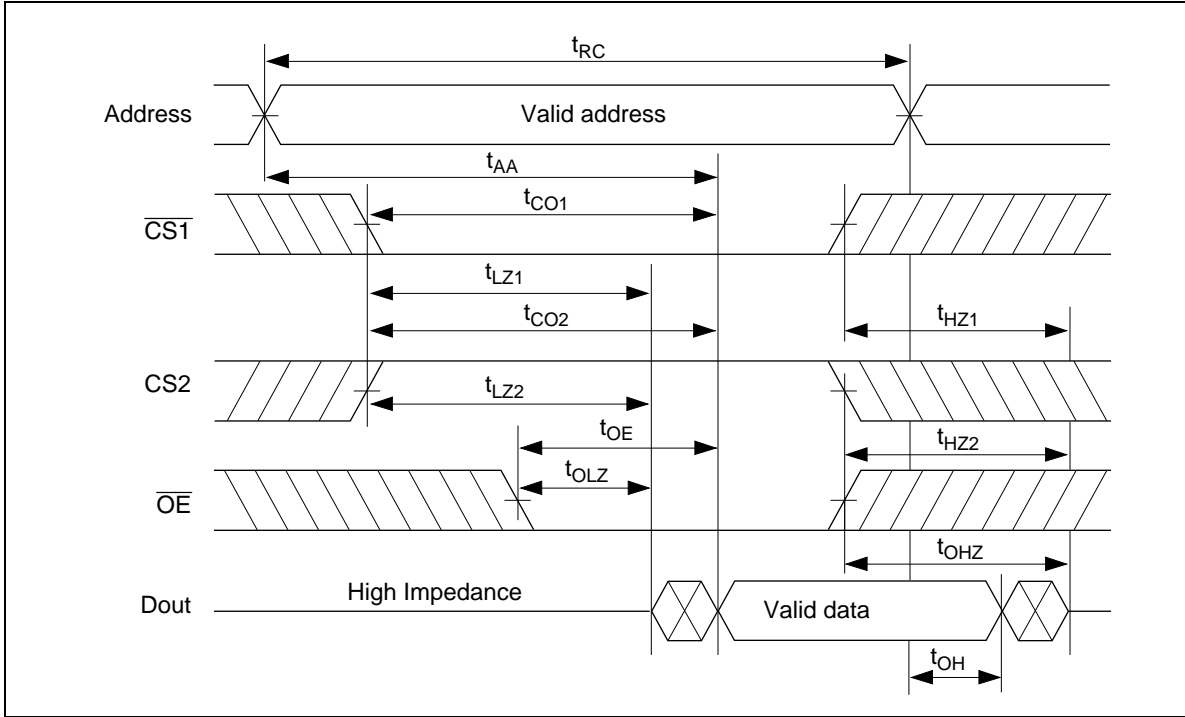
- Input pulse levels: 0.8 V to 2.4 V
- Input and output timing reference level: 1.5 V
- Input rise and fall time: 10 ns
- Output load: 1 TTL Gate + C_L (100 pF) (Including scope & jig)

Read Cycle

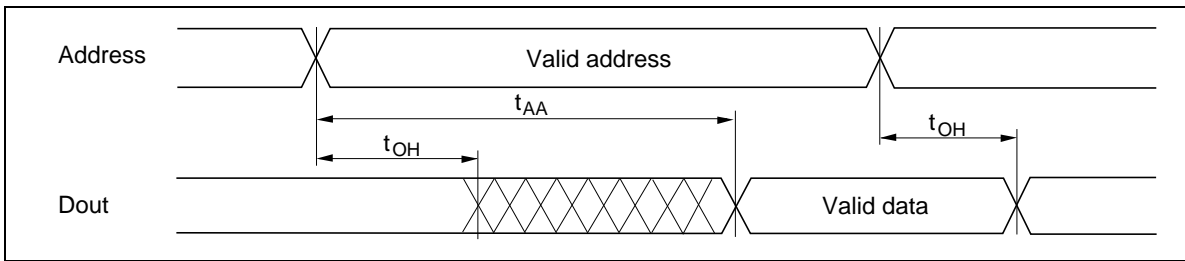
Parameter	Symbol	HM9264B-8L		HM9264B-10L		Unit	Notes
		Min	Max	Min	Max		
Read cycle time	t_{RC}	85	—	100	—	ns	
Address access time	t_{AA}	—	85	—	100	ns	
Chip select access time	$\overline{CS1}$ t_{CO1}	—	85	—	100	ns	
	CS2 t_{CO2}	—	85	—	100	ns	
Output enable to output valid	t_{OE}	—	45	—	50	ns	
Chip selection to output in low-Z	$\overline{CS1}$ t_{LZ1}	10	—	10	—	ns	2
	CS2 t_{LZ2}	10	—	10	—	ns	2
Output enable to output in low-Z	t_{OLZ}	5	—	5	—	ns	2
Chip deselection in to output in high-Z	$\overline{CS1}$ t_{HZ1}	0	30	0	35	ns	1, 2
	CS2 t_{HZ2}	0	30	0	35	ns	1, 2
Output disable to output in high-Z	t_{OHZ}	0	30	0	35	ns	1, 2
Output hold from address change	t_{OH}	10	—	10	—	ns	

- Notes: 1. t_{HZ} is defined as the time at which the outputs achieve the open circuit conditions and are not referred to output voltage levels.
2. At any given temperature and voltage condition, t_{HZ} maximum is less than t_{LZ} minimum both for a given device and from device to device.

Read Timing Waveform (1) ($\overline{WE} = V_{IH}$)

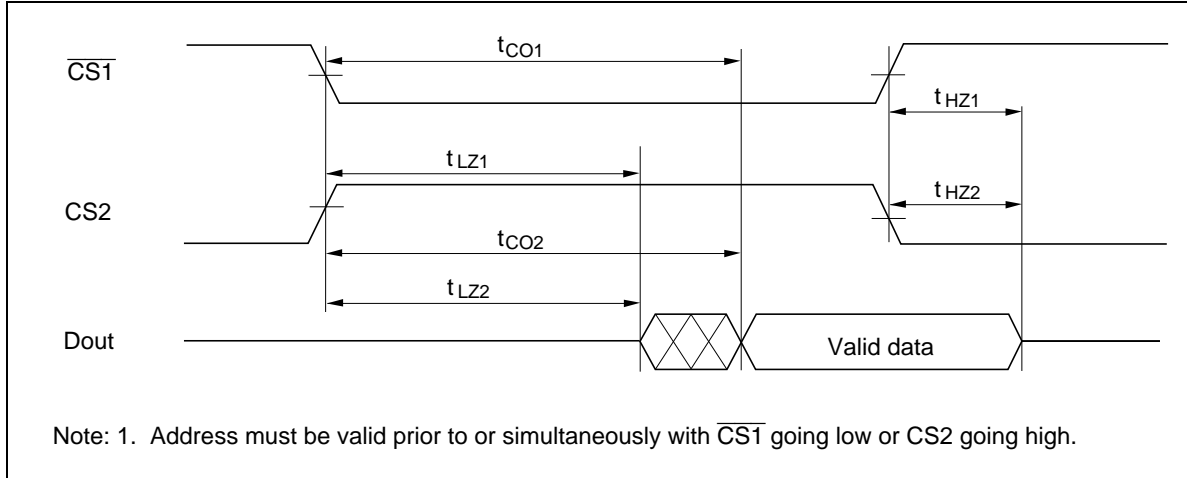


Timing Waveform (2) ($\overline{WE} = V_{IH}, \overline{OE} = V_{IL}$)



HM9264B Series

Read Timing Waveform (3) ($\overline{WE} = V_{IH}, \overline{OE} = V_{IL}$)^{*1}



Write Cycle

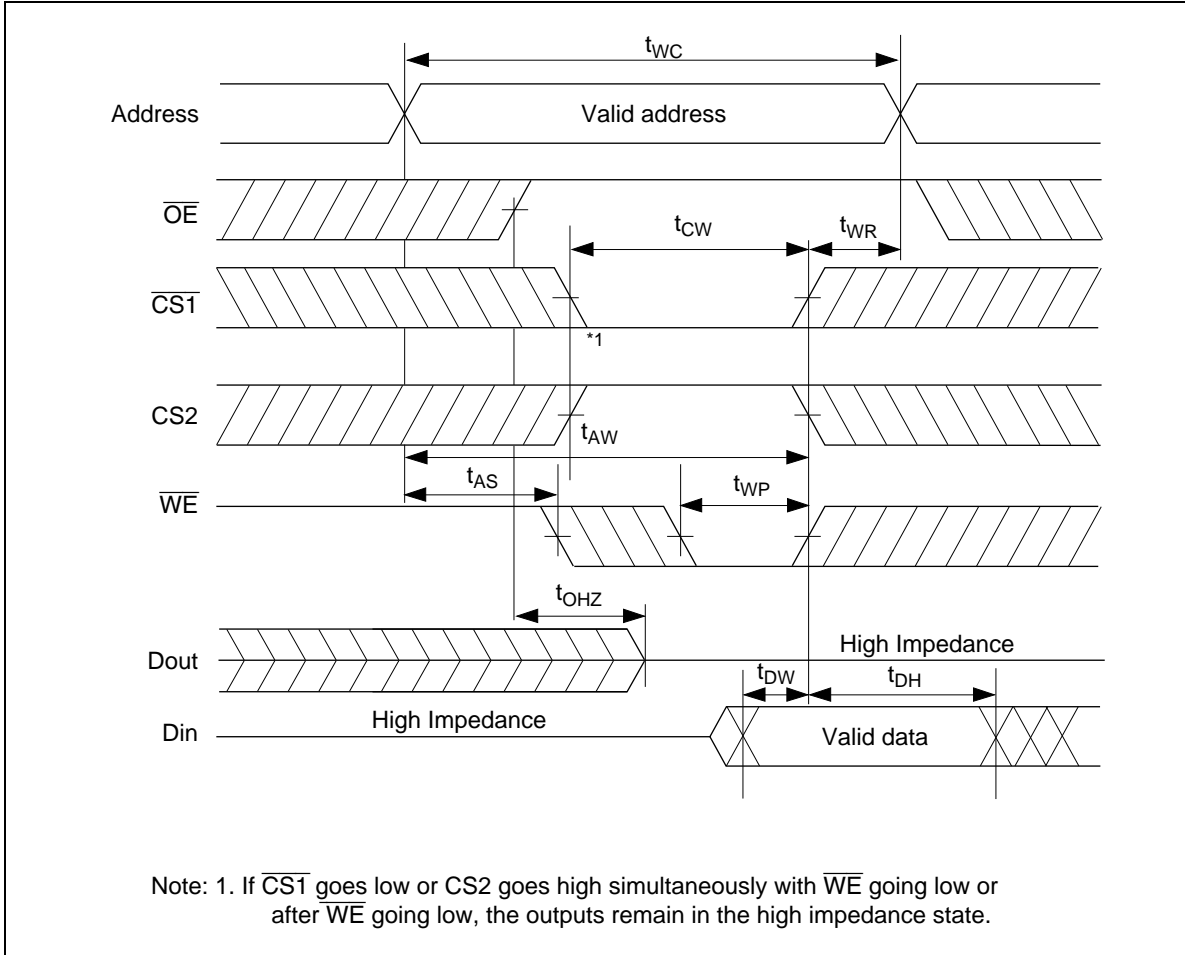
Parameter	Symbol	HM9264B-8L		HM9264B-10L		Unit	Notes
		Min	Max	Min	Max		
Write cycle time	t_{WC}	85	—	100	—	ns	
Chip selection to end of write	t_{CW}	75	—	80	—	ns	2
Address setup time	t_{AS}	0	—	0	—	ns	3
Address valid to end of write	t_{AW}	75	—	80	—	ns	
Write pulse width	t_{WP}	55	—	60	—	ns	1, 6
Write recovery time	t_{WR}	0	—	0	—	ns	4
\overline{WE} to output in high-Z	t_{WHZ}	0	30	0	35	ns	5
Data to write time overlap	t_{DW}	40	—	40	—	ns	
Data hold from write time	t_{DH}	0	—	0	—	ns	
Output active from end of write	t_{OW}	5	—	5	—	ns	
Output disable to output in high-Z	t_{OHZ}	0	30	0	35	ns	5

Notes: 1. A write occurs during the overlap of a low $\overline{CS1}$, and high CS2, and a high \overline{WE} . A write begins at the latest transition among $\overline{CS1}$ going low, CS2 going high and \overline{WE} going low. A write ends at the earliest transition among $\overline{CS1}$ going high, CS2 going low and \overline{WE} going high. Time t_{WP} is measured from the beginning of write to the end of write.

- t_{CW} is measured from the later of $\overline{CS1}$ going low or CS2 going high to the end of write.
- t_{AS} is measured from the address valid to the beginning of write.
- t_{WR} is measured from the earliest of $\overline{CS1}$ or \overline{WE} going high or CS2 going low to the end of write cycle.
- During this period, I/O pins are in the output state, therefore the input signals of the opposite phase to the outputs must not be applied.
- In the write cycle with \overline{OE} low fixed, t_{WP} must satisfy the following equation to avoid a problem of data bus contention

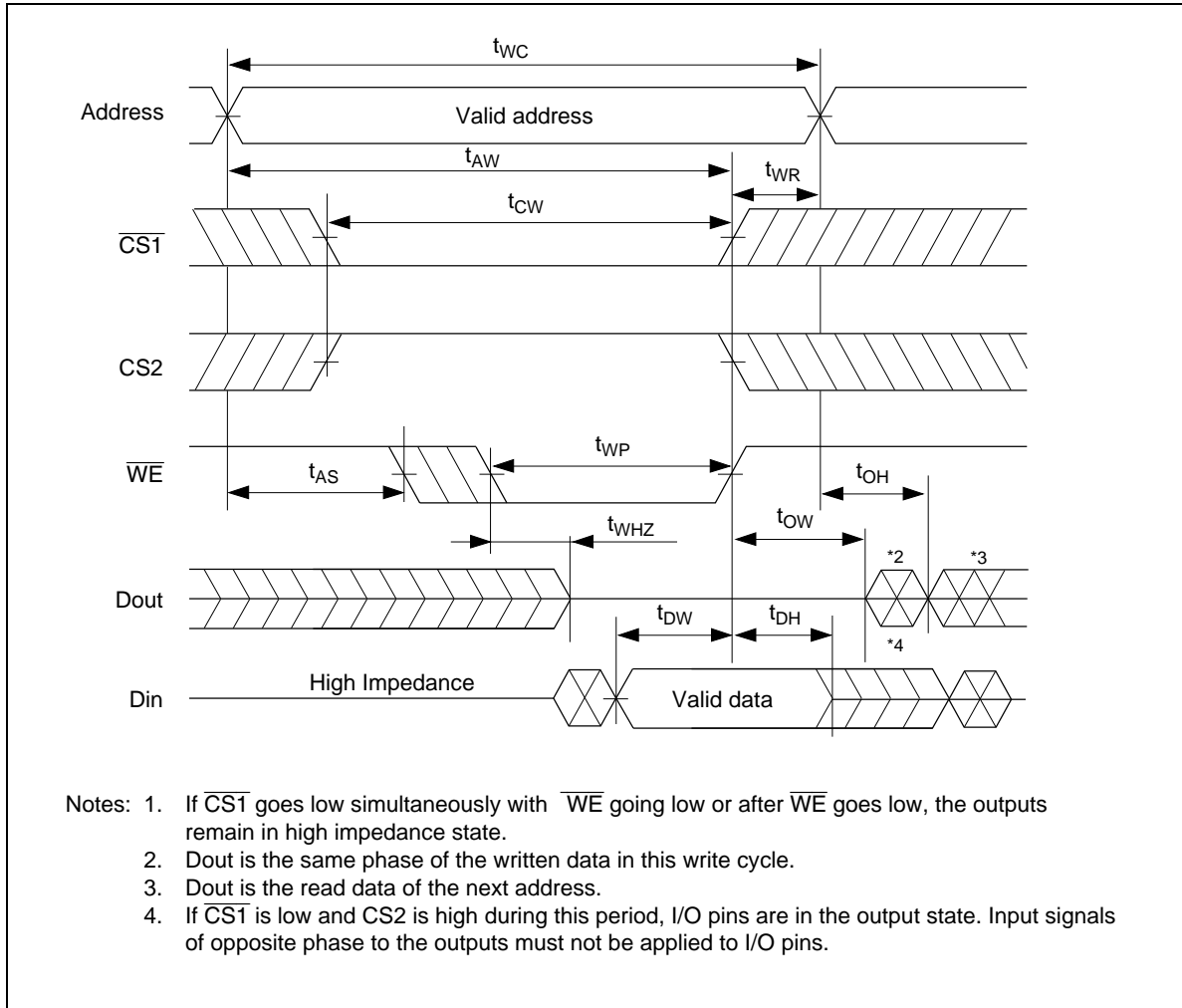
$$t_{WP} \geq t_{WHZ} \max + t_{DW} \min.$$

Write Timing Waveform (1) (\overline{OE} Clock)



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Write Timing Waveform (2) (\overline{OE} Low Fixed) ($\overline{OE} = V_{IL}$)

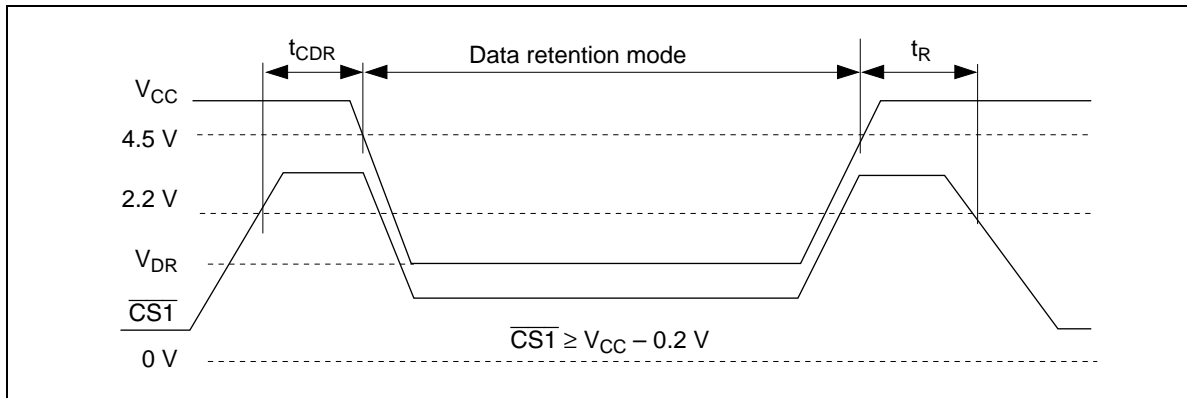


Low V_{CC} Data Retention Characteristics ($T_a = 0$ to $+70^\circ\text{C}$)

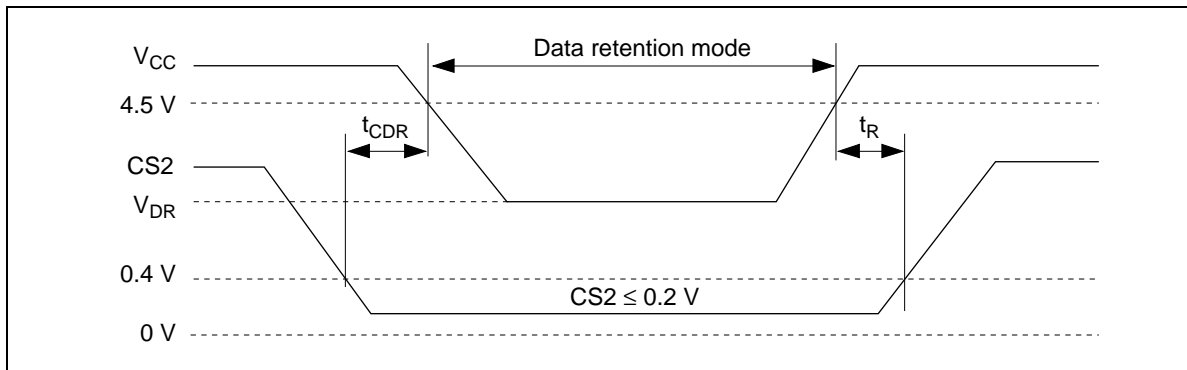
Parameter	Symbol	Min	Typ ¹	Max	Unit	Test conditions ⁴
V_{CC} for data retention	V_{DR}	2.0	—	—	V	$\overline{CS1} \geq V_{CC} - 0.2\text{ V}$, $CS2 \geq V_{CC} - 0.2\text{ V}$ or $CS2 \leq 0.2\text{ V}$
Data retention current	I_{CCDR}	—	1 ¹	25 ²	μA	$V_{CC} = 3.0\text{ V}$, $0\text{ V} \leq V_{in} \leq V_{CC}$ $\overline{CS1} \geq V_{CC} - 0.2\text{ V}$, $CS2 \geq V_{CC} - 0.2\text{ V}$ or $0\text{ V} \leq CS2 \leq 0.2\text{ V}$
Chip deselect to data retention time	t_{CDR}	0	—	—	ns	See retention waveform
Operation recovery time	t_R	t_{RC} ³	—	—	ns	

- Notes: 1. Reference data at $T_a = 25^\circ\text{C}$.
 2. 10 μA max at $T_a = 0$ to $+40^\circ\text{C}$.
 3. t_{RC} = read cycle time.
 4. CS2 controls address buffer, \overline{WE} buffer, $\overline{CS1}$ buffer, \overline{OE} buffer, and Din buffer. If CS2 controls data retention mode, V_{in} levels (address, \overline{WE} , \overline{OE} , $\overline{CS1}$, I/O) can be in the high impedance state. If $\overline{CS1}$ controls data retention mode, CS2 must be $CS2 \geq V_{CC} - 0.2\text{ V}$ or $0\text{ V} \leq CS2 \leq 0.2\text{ V}$. The other input levels (address, \overline{WE} , \overline{OE} , I/O) can be in the high impedance state.

Low V_{CC} Data Retention Timing Waveform (1) ($\overline{CS1}$ Controlled)



Low V_{CC} Data Retention Timing Waveform (2) (CS2 Controlled)

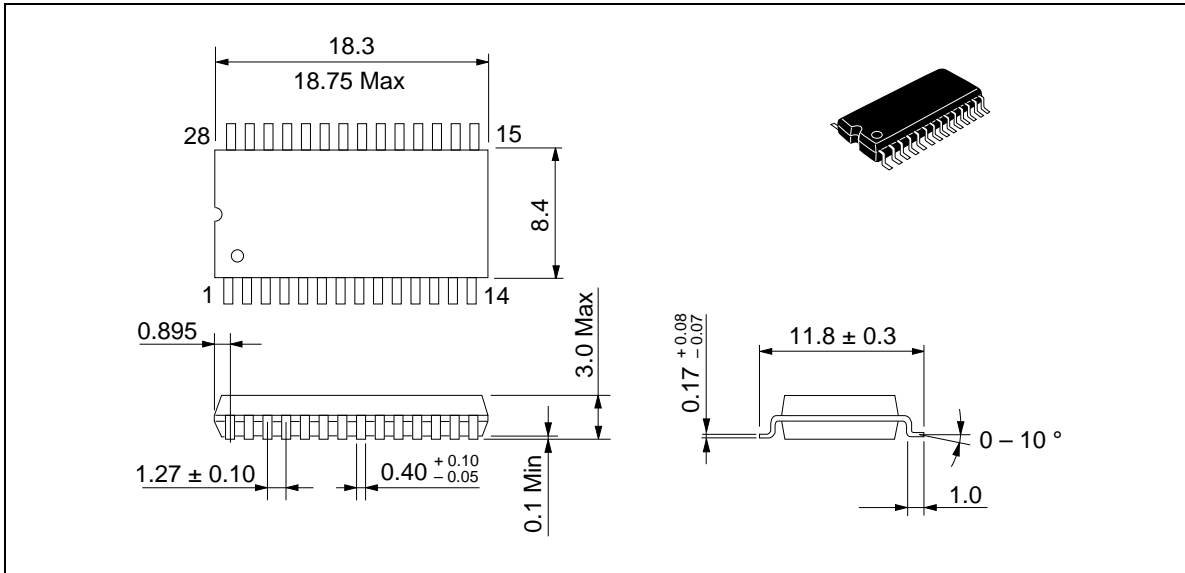


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Package Dimensions

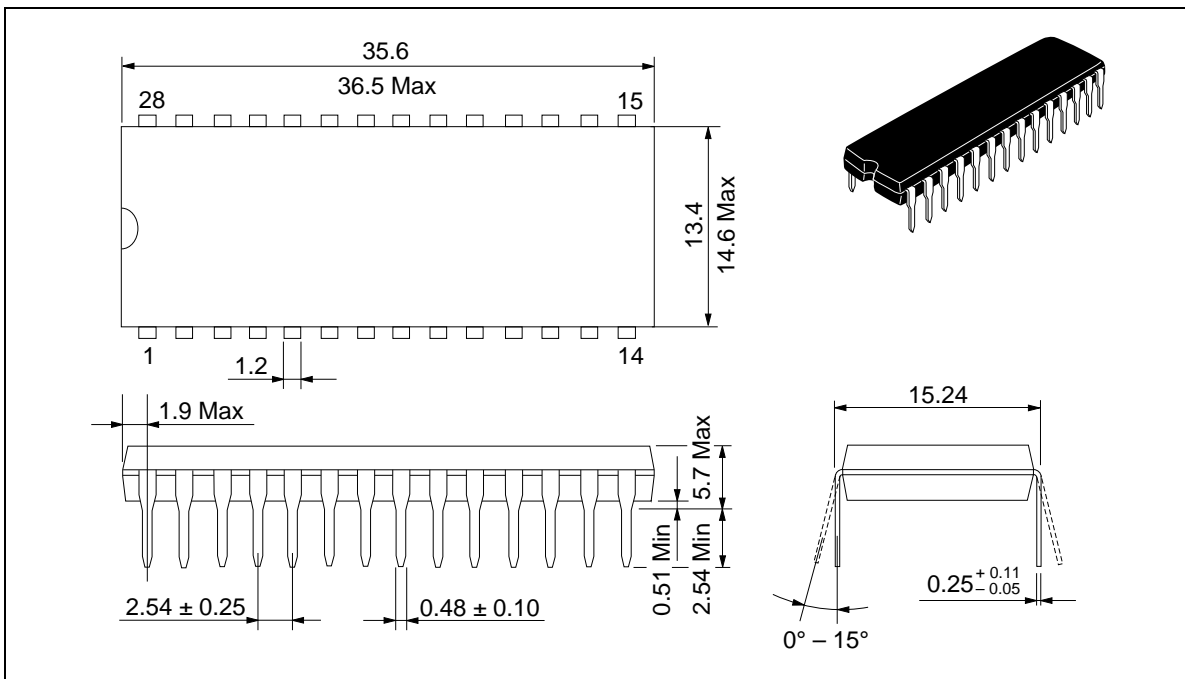
HM9264BLFP Series (FP-28DA)

Unit: mm



HM9264BLP Series (DP-28)

Unit: mm



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Revision Record

Rev.	Date	Contents of Modification	Drawn by	Approved by
1.0	Jul. 23, 1996	Initial issue		
