HM624100H Series

4M High Speed SRAM (1-Mword × 4-bit)

HITACHI

ADE-203-789D (Z)
Rev. 1.0
Sept. 15, 1998

Description

The HM624100H is a 4-Mbit high speed static RAM organized 1-Mword × 4-bit. It has realized high speed access time by employing CMOS process (4-transistor + 2-poly resistor memory cell) and high speed circuit designing technology. It is most appropriate for the application which requires high speed and high density memory, such as cache and buffer memory in system. The HM624100H is packaged in 400-mil 32-pin SOJ for high density surface mounting.

Features

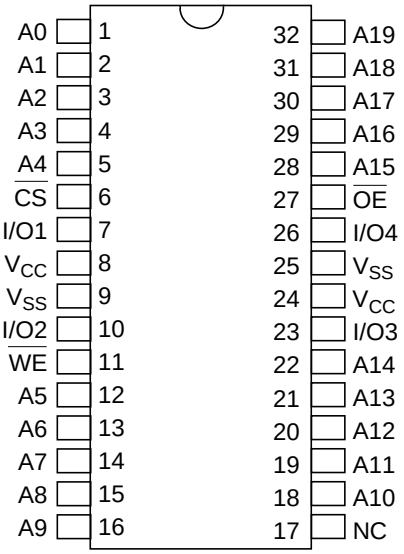
- Single 5.0 V supply : 5.0 V ± 10 %
- Access time 10/12/15 ns (max)
- Completely static memory
  - No clock or timing strobe required
- Equal access and cycle times
- Directly TTL compatible
  - All inputs and outputs
- Operating current : 200/180/160 mA (max)
- TTL standby current : 70/60/50 mA (max)
- CMOS standby current : 5 mA (max)
  : 1.2 mA (max) (L-version)
- Data retention current : 0.8 mA (max) (L-version)
- Data retention voltage : 2.0 V (min) (L-version)
- Center V_{CC} and V_{SS} type pinout

Ordering Information

Type No.	Access time	Package
HM624100HJP-10	10 ns	400-mil 32-pin plastic SOJ (CP-32DB)
HM624100HJP-12	12 ns	
HM624100HJP-15	15 ns	
HM624100HLJP-10	10 ns	
HM624100HLJP-12	12 ns	
HM624100HLJP-15	15 ns	

Pin Arrangement

HM624100HJP/HLJP Series

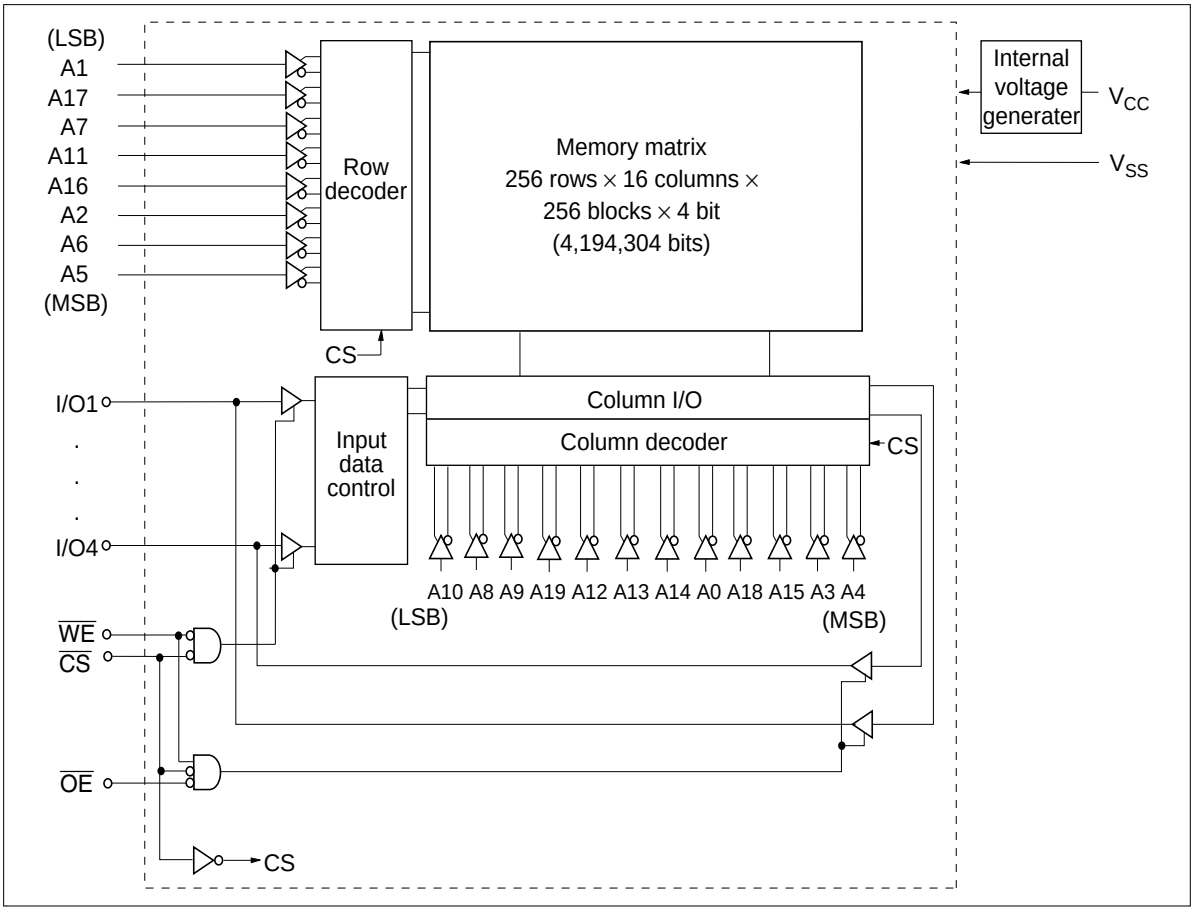


(Top view)

Pin Description

Pin name	Function
A0 to A19	Address input
I/O1 to I/O4	Data input/output
$\overline{CS}$	Chip select
$\overline{OE}$	Output enable
$\overline{WE}$	Write enable
V_{CC}	Power supply
V_{SS}	Ground
NC	No connection

Block Diagram



Operation Table

$\overline{CS}$	$\overline{OE}$	$\overline{WE}$	Mode	V_{CC} current	I/O	Ref. cycle
H	×	×	Standby	I_{SB}, I_{SB1}	High-Z	—
L	H	H	Output disable	I_{CC}	High-Z	—
L	L	H	Read	I_{CC}	Dout	Read cycle (1) to (3)
L	H	L	Write	I_{CC}	Din	Write cycle (1)
L	L	L	Write	I_{CC}	Din	Write cycle (2)

Note: ×: H or L

Absolute Maximum Ratings

Parameter	Symbol	Value	Unit
Supply voltage relative to V_{SS}	V_{CC}	–0.5 to +7.0	V
Voltage on any pin relative to V_{SS}	V_T	–0.5*[1] to V_{CC}+0.5*[2]	V
Power dissipation	P_T	1.0	W
Operating temperature	Topr	0 to +70	°C
Storage temperature	Tstg	–55 to +125	°C
Storage temperature under bias	Tbias	–10 to +85	°C

Notes: 1. V_T (min) = –2.0 V for pulse width (under shoot) ≤ 8 ns
2. V_T (max) = V_{CC} + 2.0 V for pulse width (over shoot) ≤ 8 ns

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

Parameter	Symbol	Min	Typ	Max	Unit
Supply voltage	V_{CC}*[3]	4.5	5.0	5.5	V
	V_{SS}*[4]	0	0	0	V
Input voltage	V_{IH}	2.2	—	V_{CC} + 0.5*[2]	V
	V_{IL}	–0.5*[1]	—	0.8	V

Notes: 1. V_{IL} (min) = –2.0 V for pulse width (under shoot) ≤ 8 ns
2. V_{IH} (max) = V_{CC} + 2.0 V for pulse width (over shoot) ≤ 8 ns
3. The supply voltage with all V_{CC} pins must be on the same level.
4. The supply voltage with all V_{SS} pins must be on the same level.

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

Parameter		Symbol	Min	Typ*[1]	Max	Unit	Test conditions
Input leakage current		$\|I_{LI}\|$	—	—	2	µA	Vin = V_{SS} to V_{CC}
Output leakage current		$\|I_{LO}\|$	—	—	2	µA	Vin = V_{SS} to V_{CC}
Operation power supply current	10 ns cycle	I_{CC}	—	—	200	mA	Min cycle $\overline{CS}$ = V_{IL}, Iout = 0 mA Other inputs = V_{IH}/V_{IL}
	12 ns cycle	I_{CC}	—	—	180		
	15 ns cycle	I_{CC}	—	—	160		
Standby power supply current	10 ns cycle	I_{SB}	—	—	70	mA	Min cycle, $\overline{CS}$ = V_{IH}, Other inputs = V_{IH}/V_{IL}
	12 ns cycle	I_{SB}	—	—	60		
	15 ns cycle	I_{SB}	—	—	50		
		I_{SB1}	—	0.1	5	mA	f = 0 MHz V_{CC} ≥ $\overline{CS}$ ≥ V_{CC} - 0.2 V, (1) 0 V ≤ Vin ≤ 0.2 V or (2) V_{CC} ≥ Vin ≥ V_{CC} - 0.2 V
			—*[2]	0.1*[2]	1.2*[2]		
Output voltage		V_{OL}	—	—	0.4	V	I_{OL} = 8 mA
		V_{OH}	2.4	—	—	V	I_{OH} = –4 mA

Notes: 1. Typical values are at V_{CC} = 5.0 V, Ta = +25°C and not guaranteed.
2. This characteristics is guaranteed only for L-version.

Capacitance (Ta = +25°C, f = 1.0 MHz)

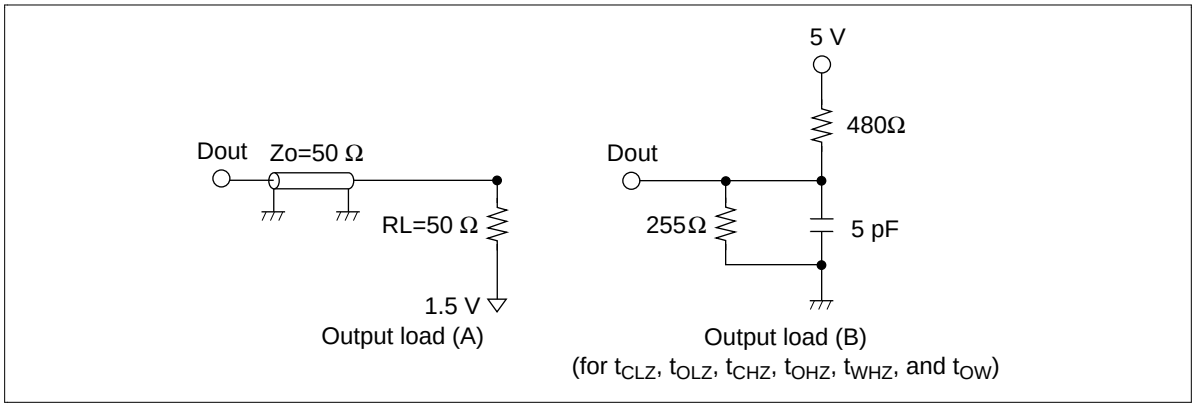
Parameter	Symbol	Min	Typ	Max	Unit	Test conditions
Input capacitance*[1]	Cin	—	—	6	pF	Vin = 0 V
Input/output capacitance*[1]	$C_{I/O}$	—	—	8	pF	$V_{I/O}$ = 0 V

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

AC Characteristics (Ta = 0 to +70°C, V_{CC} = 5.0 V ± 10 %, unless otherwise noted.)

Test Conditions

- Input pulse levels: 3.0 V/0.0 V
- Input rise and fall time: 3 ns
- Input and output timing reference levels: 1.5 V
- Output load: See figures (Including scope and jig)



Read Cycle

		HM624100H							
		-10		-12		-15			
Parameter	**Symbol**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Unit**	**Notes**
Read cycle time	t_{RC}	10	—	12	—	15	—	ns	
Address access time	t_{AA}	—	10	—	12	—	15	ns	
Chip select access time	t_{ACS}	—	10	—	12	—	15	ns	
Output enable to outpput valid	t_{OE}	—	5	—	6	—	7	ns	
Output hold from address change	t_{OH}	3	—	3	—	3	—	ns	
Chip select to output in low-Z	t_{CLZ}	3	—	3	—	3	—	ns	1
Output enable to output in low-Z	t_{OLZ}	0	—	0	—	0	—	ns	1
Chip deselect to output in high-Z	t_{CHZ}	—	5	—	6	—	7	ns	1
Output disable to output in high-Z	t_{OHZ}	—	5	—	6	—	7	ns	1

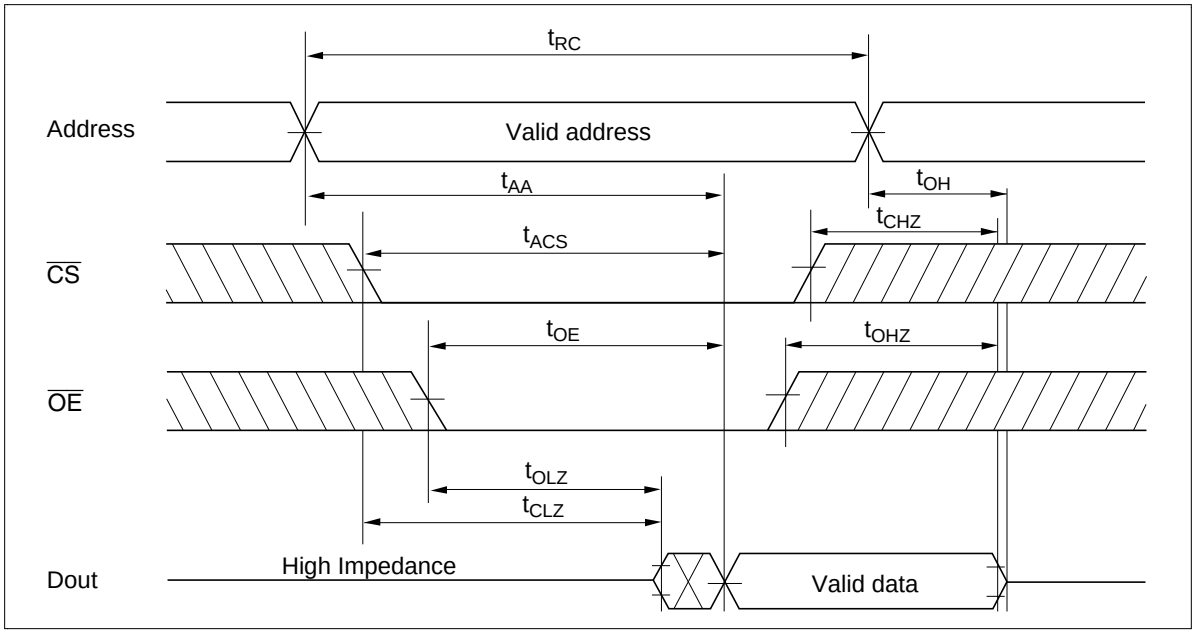
Write Cycle

Parameter	Symbol	HM624100H						Unit	Notes
		-10		-12		-15			
		Min	Max	Min	Max	Min	Max		
Write cycle time	t_{WC}	10	—	12	—	15	—	ns	
Address valid to end of write	t_{AW}	7	—	8	—	10	—	ns	
Chip select to end of write	t_{CW}	7	—	8	—	10	—	ns	9
Write pulse width	t_{WP}	7	—	8	—	10	—	ns	8
Address setup time	t_{AS}	0	—	0	—	0	—	ns	6
Write recovery time	t_{WR}	0	—	0	—	0	—	ns	7
Data to write time overlap	t_{DW}	5	—	6	—	7	—	ns	
Data hold from write time	t_{DH}	0	—	0	—	0	—	ns	
Write disable to output in low-Z	t_{OW}	3	—	3	—	3	—	ns	1
Output disable to output in high-Z	t_{OHZ}	—	5	—	6	—	7	ns	1
Write enable to output in high-Z	t_{WHZ}	—	5	—	6	—	7	ns	1

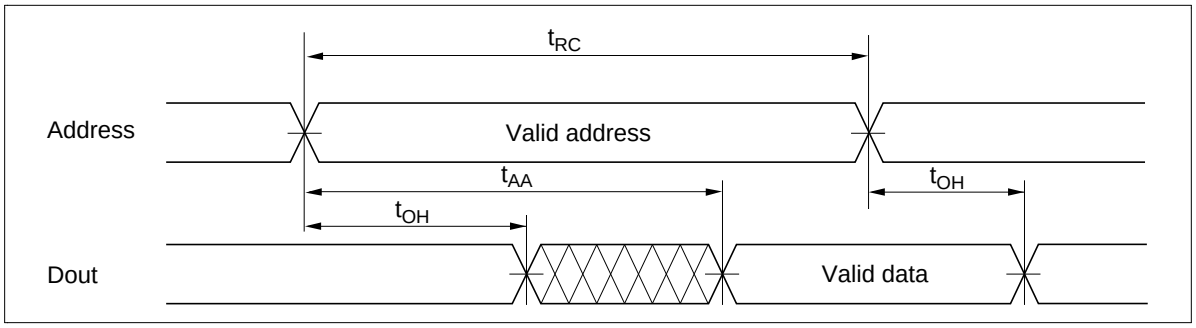
Note:
1. Transition is measured ±200 mV from steady voltage with Load (B). This parameter is sampled and not 100% tested.
2. Address should be valid prior to or coincident with $\overline{CS}$ transition low.
3. $\overline{WE}$ and/or $\overline{CS}$ must be high during address transition time.
4. if $\overline{CS}$ and $\overline{OE}$ are low during this period, I/O pins are in the output state. Then, the data input signals of opposite phase to the outputs must not be applied to them.
5. If the $\overline{CS}$ low transition occurs simultaneously with the $\overline{WE}$ low transition or after the $\overline{WE}$ transition, output remains a high impedance state.
6. t_{AS} is measured from the latest address transition to the later of $\overline{CS}$ or $\overline{WE}$ going low.
7. t_{WR} is measured from the earlier of $\overline{CS}$ or $\overline{WE}$ going high to the first address transition.
8. A write occurs during the overlap of a low $\overline{CS}$ and a low $\overline{WE}$. A write begins at the latest transition among $\overline{CS}$ going low and $\overline{WE}$ going low. A write ends at the earliest transition among $\overline{CS}$ going high and $\overline{WE}$ going high. t_{WP} is measured from the beginning of write to the end of write.
9. t_{CW} is measured from the later of $\overline{CS}$ going low to the end of write.

Timing Waveforms

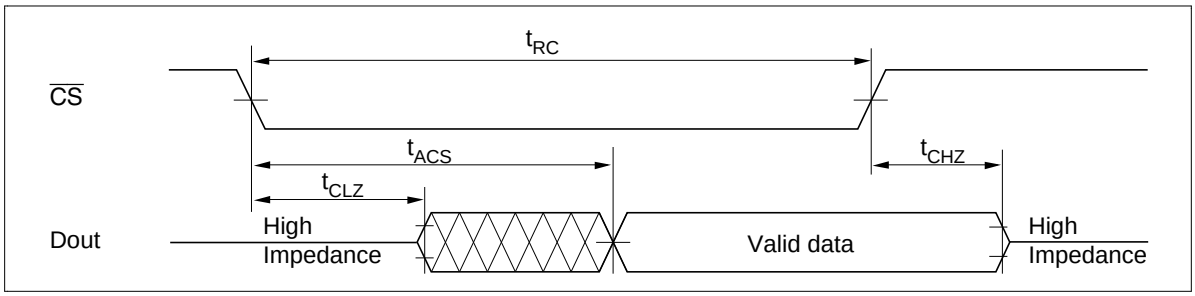
Read Timing Waveform (1) ($\overline{WE}$ = V_{IH})



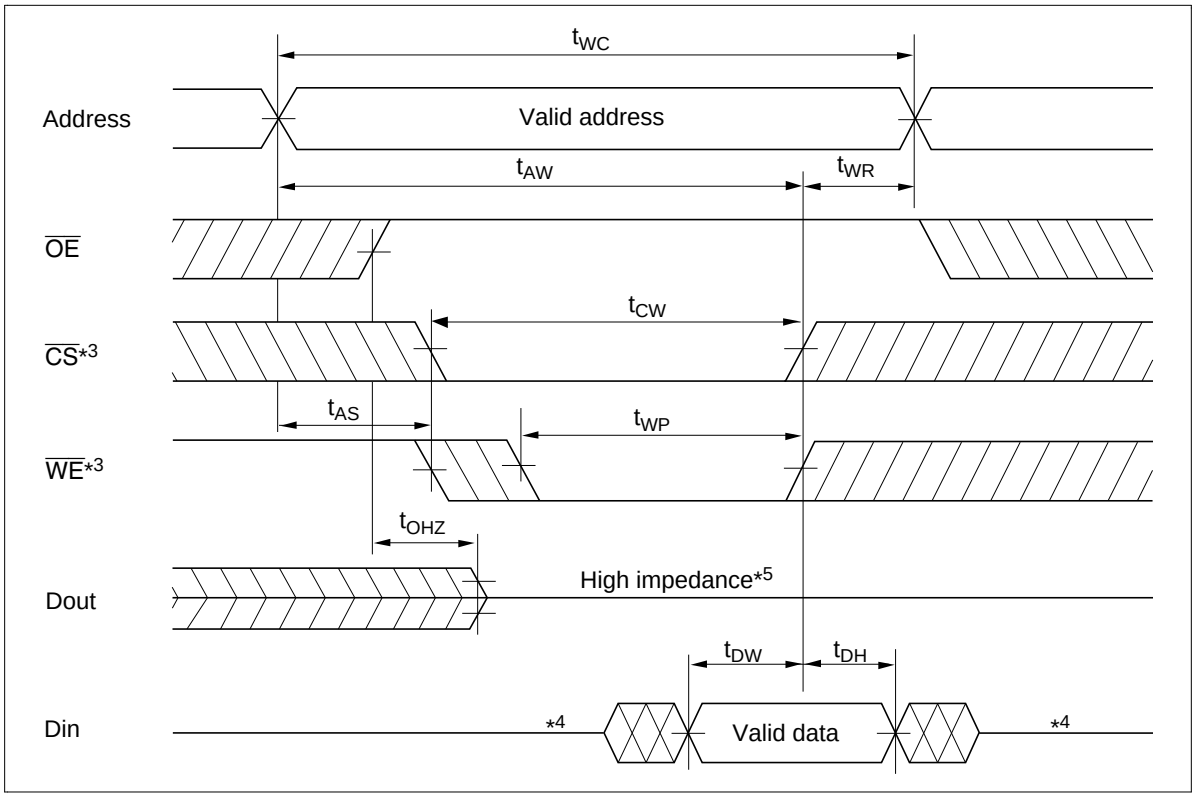
Read Timing Waveform (2) ($\overline{WE}$ = V_{IH}, $\overline{CS}$ = V_{IL}, $\overline{OE}$ = V_{IL})



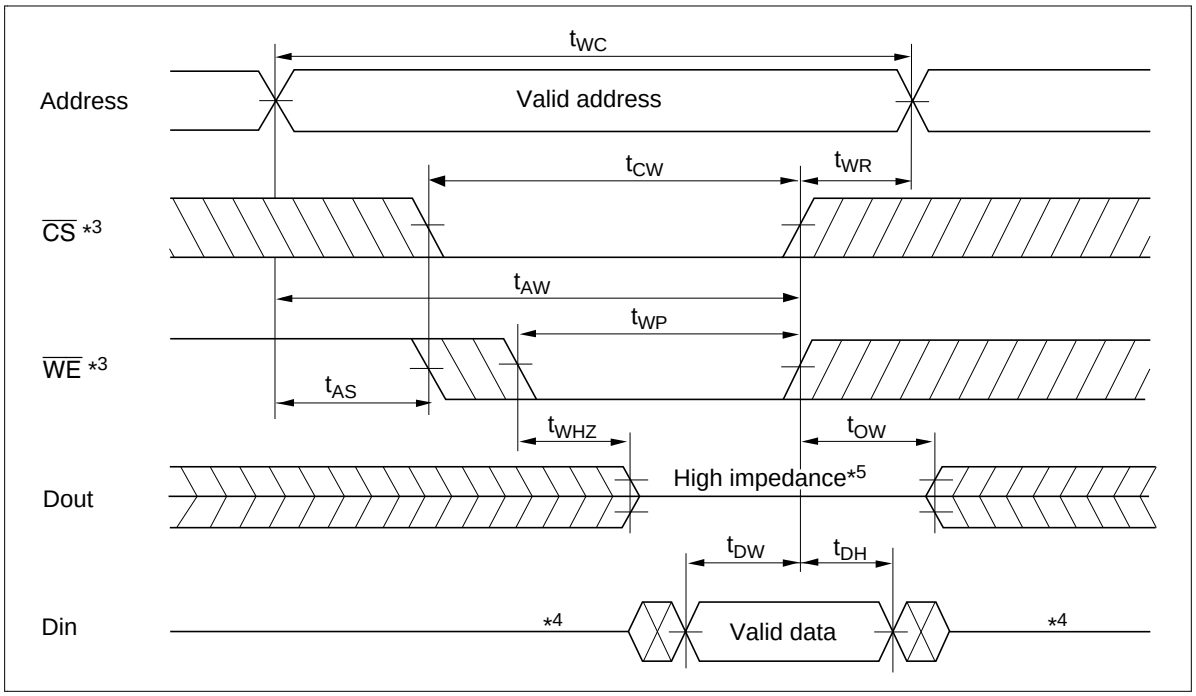
Read Timing Waveform (3) ($\overline{WE}$ = V_{IH}, $\overline{CS}$ = V_{IL}, $\overline{OE}$ = V_{IL})*2



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



Write Timing Waveform (2) ($\overline{CS}$ Controlled)



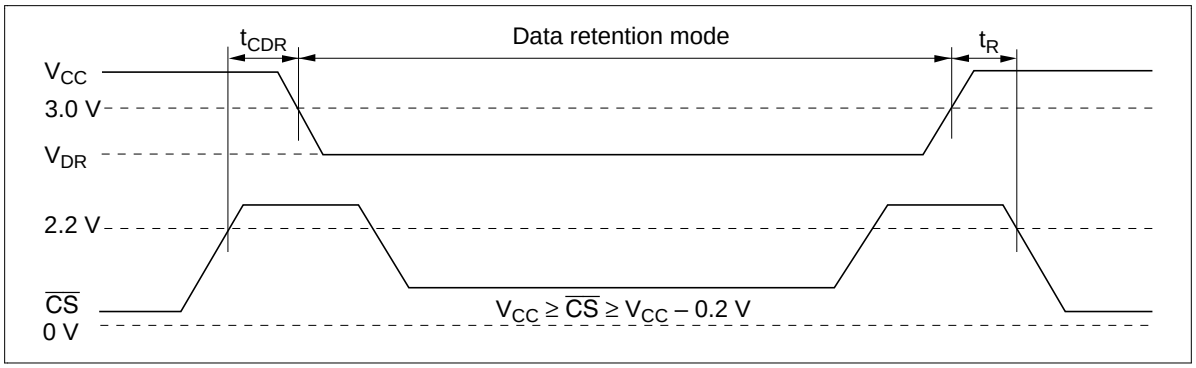
Low V_{CC} Data Retention Characteristics (Ta = 0 to +70°C)

This characteristics is guaranteed only for L-version.

Parameter	Symbol	Min	Typ*[1]	Max	Unit	Test conditions
V_{CC} for data retention	V_{DR}	2.0	—	—	V	$V_{CC} \geq \overline{CS} \geq V_{CC} - 0.2$ V (1) 0 V ≤ Vin ≤ 0.2 V or (2) $V_{CC} \geq$ Vin $\geq V_{CC} - 0.2$ V
Data retention current	I_{CCDR}	—	50	800	µA	V_{CC} = 3 V, $V_{CC} \geq \overline{CS} \geq V_{CC} - 0.2$ V (1) 0 V ≤ Vin ≤ 0.2 V or (2) $V_{CC} \geq$ Vin $\geq V_{CC} - 0.2$ V
Chip deselect to data retention time	t_{CDR}	0	—	—	ns	See retention waveform
Operation recovery time	t_R	5	—	—	ms	

Note: 1. Typical values are at V_{CC} = 3.0 V, Ta = +25°C, and not guaranteed.

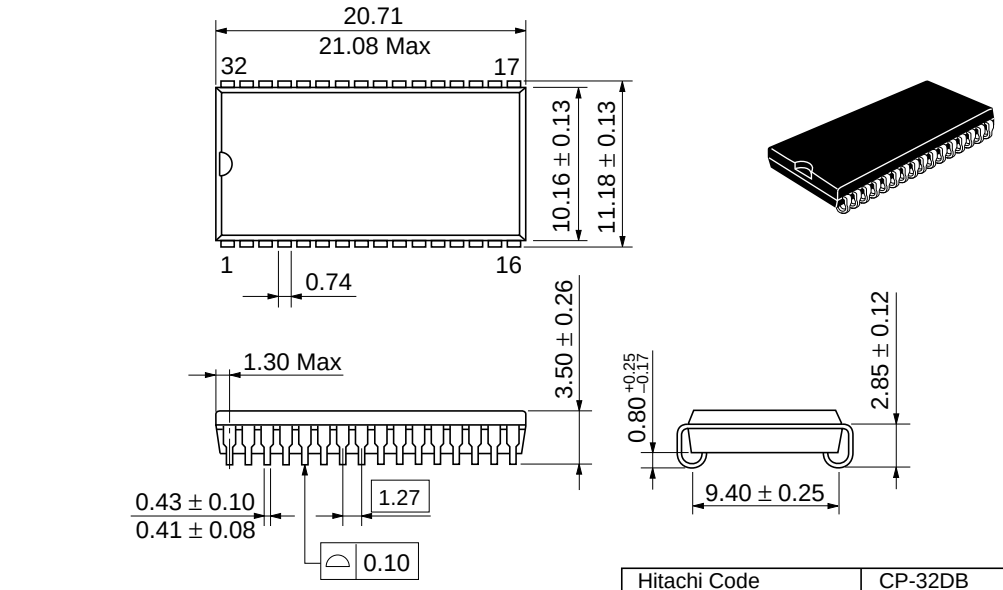
Low V_{CC} Data Retention Timing Waveform



Package Dimensions

HM624100HJP/HLJP Series (CP-32DB)

Unit: mm



Hitachi Code	CP-32DB
JEDEC	Conforms
EIAJ	Conforms
Weight (reference value)	1.2 g

Dimension including the plating thickness
Base material dimension

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Revision Record

Rev.	Date	Contents of Modification	Drawn by	Approved by
0.0	Jun. 4, 1997	Initial issue	Y. Saitoh	A. Ide
0.1	Nov. 20, 1997	Change of subtitle	K. Makuta	K. Makuta
0.2	Dec. 5, 1997	Features Addition of Operating current Addition of TTL standby current Addition of CMOS standby current Addition of Data retention current Addition of Data retention voltage Change of Block Diagram Absolute Maximum Ratings P_T: 1.0/1.5 W to 1.0 W Change of notes Recommended DC Operating Conditions Change of notes DC Characteristics I_{CC} (max): 240/200/190 mA to 170/150/130 mA I_{SB} (max): 100/100/100 mA to 70/60/50 mA I_{SB1} (max): 10/1 mA to 5/1 mA Test conditions I_{CC} and I_{SB}: Addition of Min cycle Test conditions I_{SB1}: Addition of f = 0 MHz AC Characteristics Change of Output load (A) t_{OE}, t_{CHZ} and t_{OHZ} (max): 5/6/8 ns to 5/6/7 ns t_{AW}, t_{CW} and t_{WP} (min): 6/8/10 ns to 7/8/10 ns t_{DW} (min): 5/6/8 ns to 5/6/7 ns t_{OHZ} and t_{WHZ} (max): 5/6/8 ns to 5/6/7 ns Low V_{CC} Data Retention Characteristics I_{CCDR}: —/2/300 µA to —/—/300 µA	T. Fukazawa	K. Makuta
0.3	May. 15, 1998	Features Change of Operating current Change of Block Diagram DC Characteristics I_{CC} (max): 170/150/130 mA to 200/180/160 mA	T. Fukazawa	K. Makuta
1.0	Sep. 15, 1998	Features Change of CMOS standby current (L-version) Change of Data retention current DC Characteristics I_{SB1} (max): 5/1 mA to 5/1.2 mA I_{SB1} (typ): —/— mA to 0.1/0.1 mA Low V_{CC} Data Retention Characteristics I_{CCDR}: —/—/300 µA to —/50/800 µA		