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# HM6216255H Series

4M high Speed SRAM (256-kword × 16-bit)

# HITACHI

ADE-203-763D (Z)  
Rev. 1.0  
Sep. 15, 1998

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## Description

The HM6216255H Series is a 4-Mbit high speed static RAM organized 256-k word × 16-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, high density memory and wide bit width configuration, such as cache and buffer memory in system. It is packaged in 400-mil 44-pin plastic SOJ and 400-mil 44-pin plastic TSOPII.

## Features

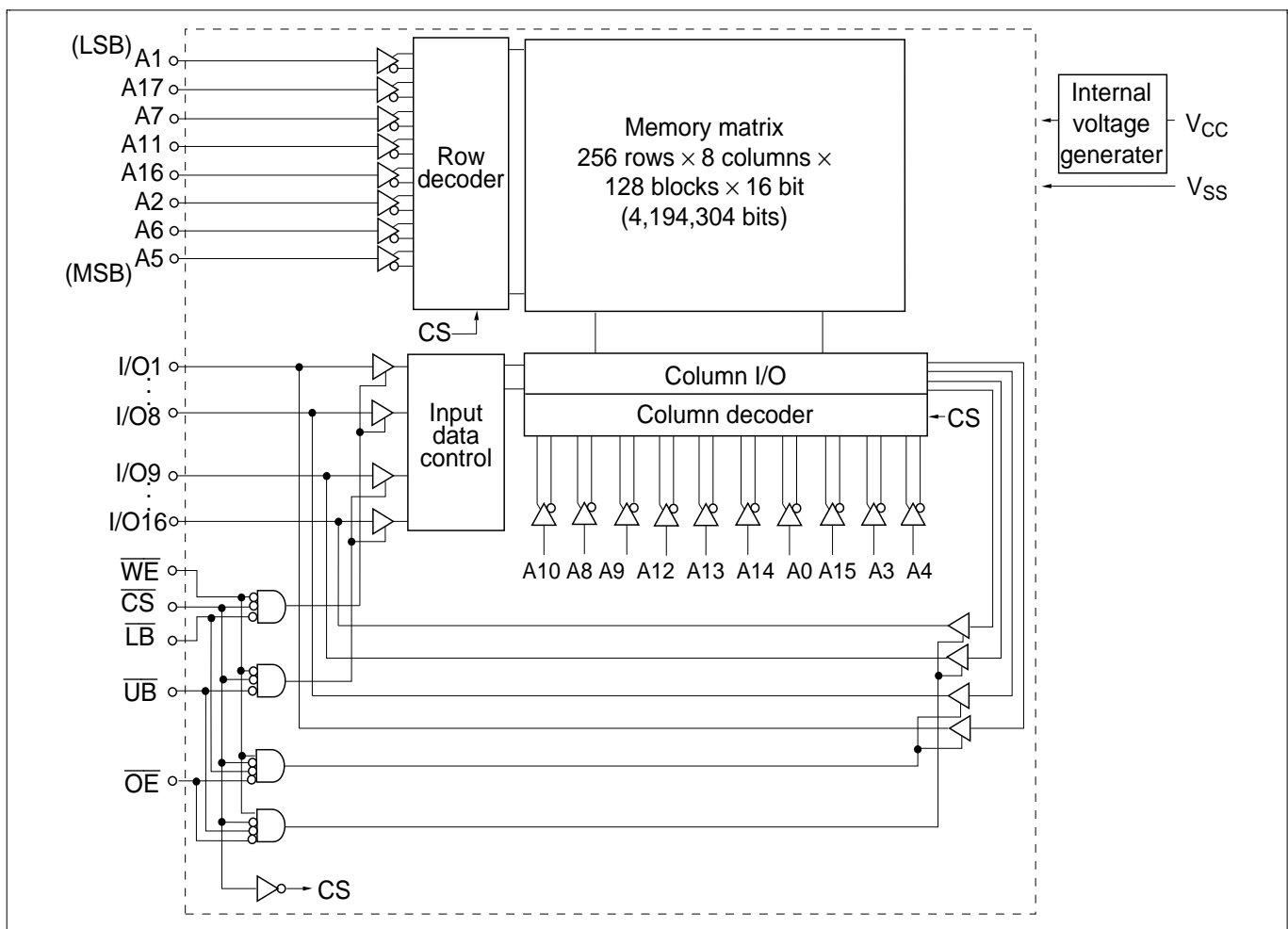
- Single 5.0 Vsupply : 5.0 V ± 10 %
- Access time: 10/12/15 ns (max)
- Completely static memory
  - No clock or timing strobe required
- Equal access and cycle times
- Directly TTL compatible
  - All inputs and outputs
- Operating current: 200/180/160 mA (max)
- TTL standby current: 70/60/50 mA (max)
- 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 V (min) (L-version)
- Center V<sub>CC</sub> and V<sub>SS</sub> type pinout



Pin Description

Pin name	Function	Pin name	Function
A0 to A17	Address input	$\overline{UB}$	Upper byte select
I/O1 to I/O16	Data input/output	$\overline{LB}$	Lower byte select
$\overline{CS}$	Chip select	$V_{CC}$	Power supply
$\overline{OE}$	Output enable	$V_{SS}$	Ground
$\overline{WE}$	Write enable	NC	No connection

Block Diagram



## Operation Table

$\overline{CS}$	$\overline{OE}$	$\overline{WE}$	$\overline{LB}$	$\overline{UB}$	Mode	$V_{CC}$ current	I/O1–I/O8	I/O9–I/O16	Ref. cycle
H	×	×	×	×	Standby	$I_{SB}, I_{SB1}$	High-Z	High-Z	—
L	H	H	×	×	Output disable	$I_{CC}$	High-Z	High-Z	—
L	L	H	L	L	Read	$I_{CC}$	Output	Output	Read cycle
L	L	H	L	H	Lower byte read	$I_{CC}$	Output	High-Z	Read cycle
L	L	H	H	L	Upper byte read	$I_{CC}$	High-Z	Output	Read cycle
L	L	H	H	H	—	$I_{CC}$	High-Z	High-Z	—
L	×	L	L	L	Write	$I_{CC}$	Input	Input	Write cycle
L	×	L	L	H	Lower byte write	$I_{CC}$	Input	High-Z	Write cycle
L	×	L	H	L	Upper byte write	$I_{CC}$	High-Z	Input	Write cycle
L	×	L	H	H	—	$I_{CC}$	High-Z	High-Z	—

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 <sup>*1</sup> to $V_{CC} + 0.5$ <sup>*2</sup>	V
Power dissipation	$P_T$	1.0 <sup>*3</sup> /1.3 <sup>*4</sup>	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.  $V_T$  (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  
 3. At still air condition  
 4. At air flow ≥ 1.0 m/s

**Recommended DC Operating Conditions** ( $T_a = 0$  to  $+70^\circ\text{C}$ )

Parameter	Symbol	Min	Typ	Max	Unit
Supply voltage	$V_{CC}^{*2}$	4.5	5.0	5.5	V
	$V_{SS}^{*3}$	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)  $\leq 8$  ns  
 2.  $V_{IH}$  (max) =  $V_{CC} + 2.0$  V for pulse width (over shoot)  $\leq 8$  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** ( $T_a = 0$  to  $+70^\circ\text{C}$ ,  $V_{CC} = 5.0$  V  $\pm 10\%$ ,  $V_{SS} = 0$  V)

Parameter	Symbol	Min	Typ <sup>*1</sup>	Max	Unit	Test conditions
Input leakage current	$ I_{LI} $	—	—	2	$\mu\text{A}$	$V_{in} = V_{SS}$ to $V_{CC}$
Output leakage current <sup>*1</sup>	$ I_{LO} $	—	—	2	$\mu\text{A}$	$V_{in} = V_{SS}$ to $V_{CC}$
Operating power supply current	10 ns cycle $I_{CC}$	—	—	200	mA	$\overline{CS} = V_{IL}$ , $I_{out} = 0$ 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	$\overline{CS} = V_{IH}$ , Other inputs = $V_{IH}/V_{IL}$
	12 ns cycle $I_{SB}$	—	—	60		
	15 ns cycle $I_{SB}$	—	—	50		
	$I_{SB1}$	—	0.1	5	mA	$V_{CC} \geq \overline{CS} \geq V_{CC} - 0.2$ V, (1) $0$ V $\leq V_{in} \leq 0.2$ V or (2) $V_{CC} \geq V_{in} \geq V_{CC} - 0.2$ V
		— <sup>*2</sup>	0.1 <sup>*2</sup>	1.2 <sup>*2</sup>		
Output voltage	$V_{OL}$	—	—	0.4	V	$I_{OL} = 8$ mA
	$V_{OH}$	2.4	—	—	V	$I_{OH} = -4$ mA

- Note: 1. Typical values are at  $V_{CC} = 5.0$  V,  $T_a = +25^\circ\text{C}$  and not guaranteed.  
 2. This characteristics is guaranteed only for L-version.

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## HM6216255H Series

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### Capacitance (Ta = +25°C, f = 1.0 MHz)

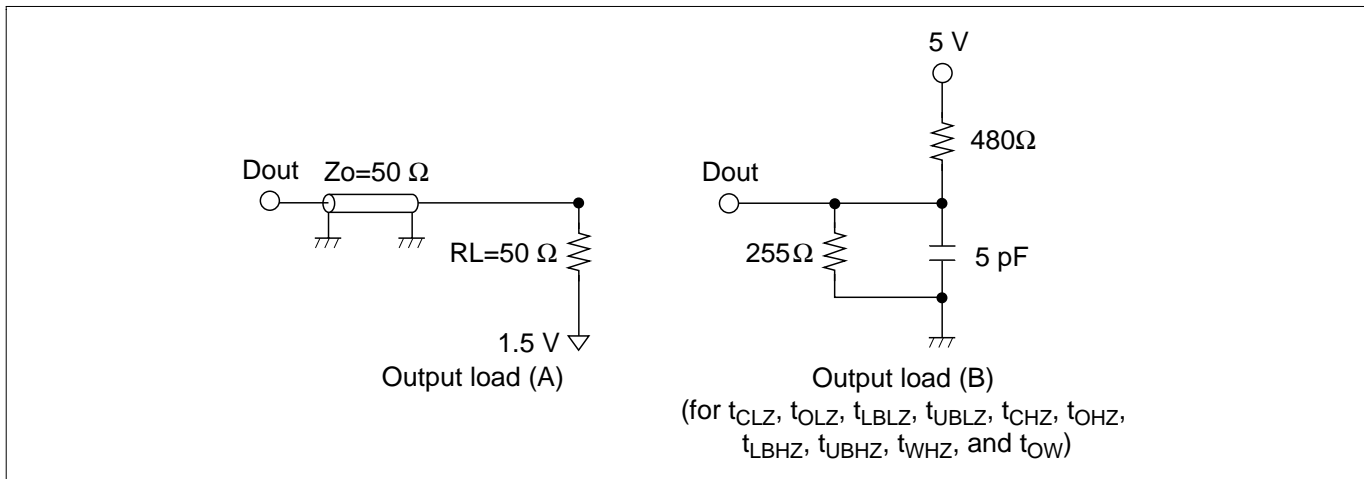
Parameter	Symbol	Min	Typ	Max	Unit	Test conditions
Input capacitance*1	C <sub>in</sub>	—	—	6	pF	V <sub>in</sub> = 0 V
Input/output capacitance*1	C <sub>io</sub>	—	—	8	pF	V <sub>io</sub> = 0 V

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

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

		HM6216255H							
		-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 output valid	$t_{OE}$	—	5	—	6	—	7	ns	
Byte select to output valid	$t_{LB}, t_{UB}$	—	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
Byte select to output in low-Z	$t_{LBLEZ}, t_{UBLZ}$	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
Byte deselect to output in high-Z	$t_{LBHZ}, t_{UBHZ}$	—	5	—	6	—	7	ns	1

## Write Cycle

Parameter	Symbol	HM6216255H						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	8
Write pulse width	$t_{WP}$	7	—	8	—	10	—	ns	7
Byte select to end of write	$t_{LBW}, t_{UBW}$	7	—	8	—	10	—	ns	9, 10
Address setup time	$t_{AS}$	0	—	0	—	0	—	ns	5
Write recovery time	$t_{WR}$	0	—	0	—	0	—	ns	6
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

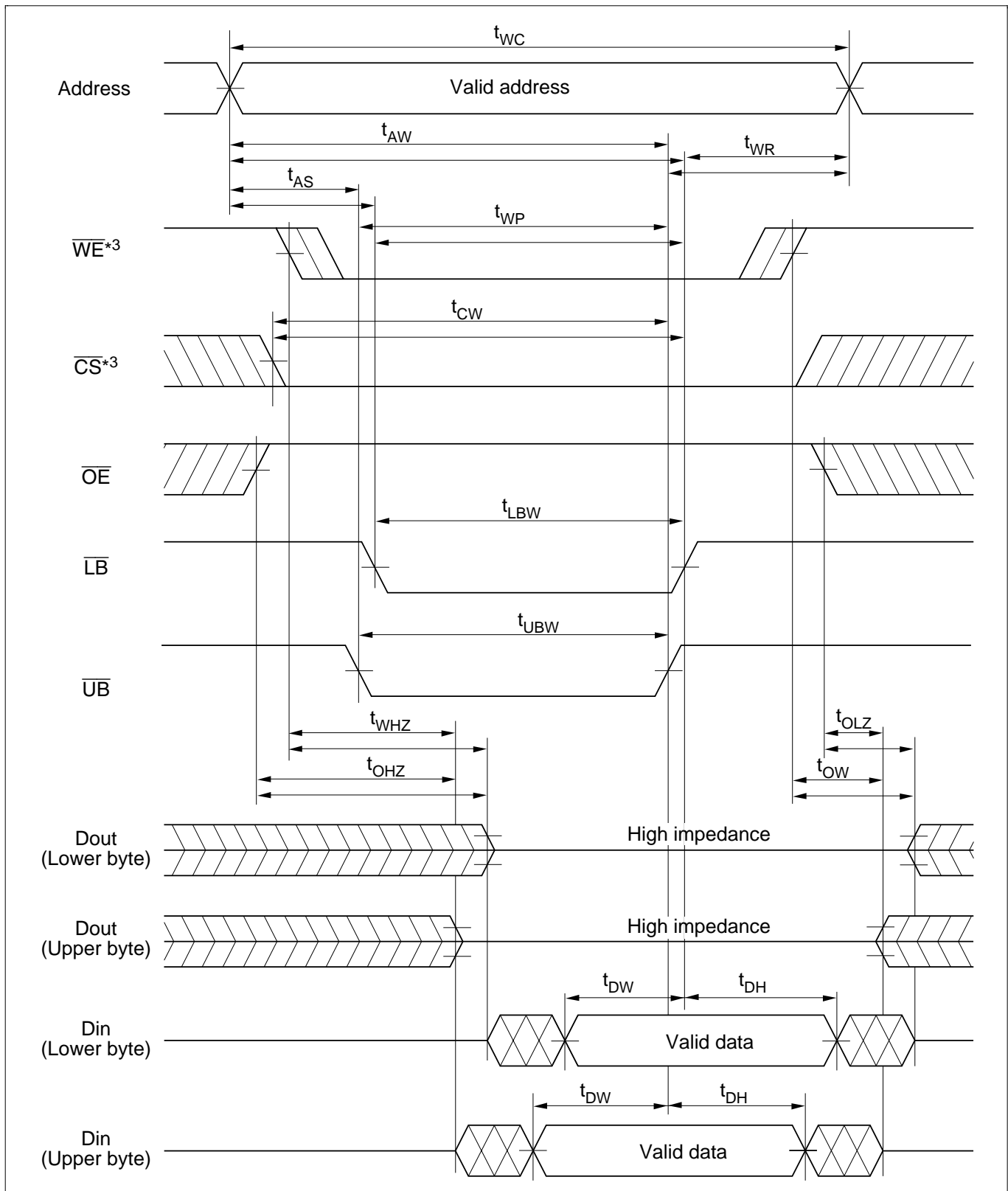
- Notes:
1. Transition is measured  $\pm 200$  mV from steady voltage with Load (B). This parameter is sampled and not 100% tested.
  2. If the  $\overline{CS}$  or  $\overline{LB}$  or  $\overline{UB}$  low transition occurs simultaneously with the  $\overline{WE}$  low transition or after the  $\overline{WE}$  transition, output remains a high impedance state.
  3.  $\overline{WE}$  and/or  $\overline{CS}$  must be high during address transition time.
  4. If  $\overline{CS}$ ,  $\overline{OE}$ ,  $\overline{LB}$  and  $\overline{UB}$  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.  $t_{AS}$  is measured from the latest address transition to the latest of  $\overline{CS}$ ,  $\overline{WE}$ ,  $\overline{LB}$  or  $\overline{UB}$  going low.
  6.  $t_{WR}$  is measured from the earliest of  $\overline{CS}$ ,  $\overline{WE}$ ,  $\overline{LB}$  or  $\overline{UB}$  going high to the first address transition.
  7. A write occurs during the overlap of low  $\overline{CS}$ , low  $\overline{WE}$  and low  $\overline{LB}$  or low  $\overline{UB}$ .
  8.  $t_{CW}$  is measured from the later of  $\overline{CS}$  going low to the end of write.
  9.  $t_{LBW}$  is measured from the later of  $\overline{LB}$  going low to the end of write.
  10.  $t_{UBW}$  is measured from the later of  $\overline{UB}$  going low to the end of write.



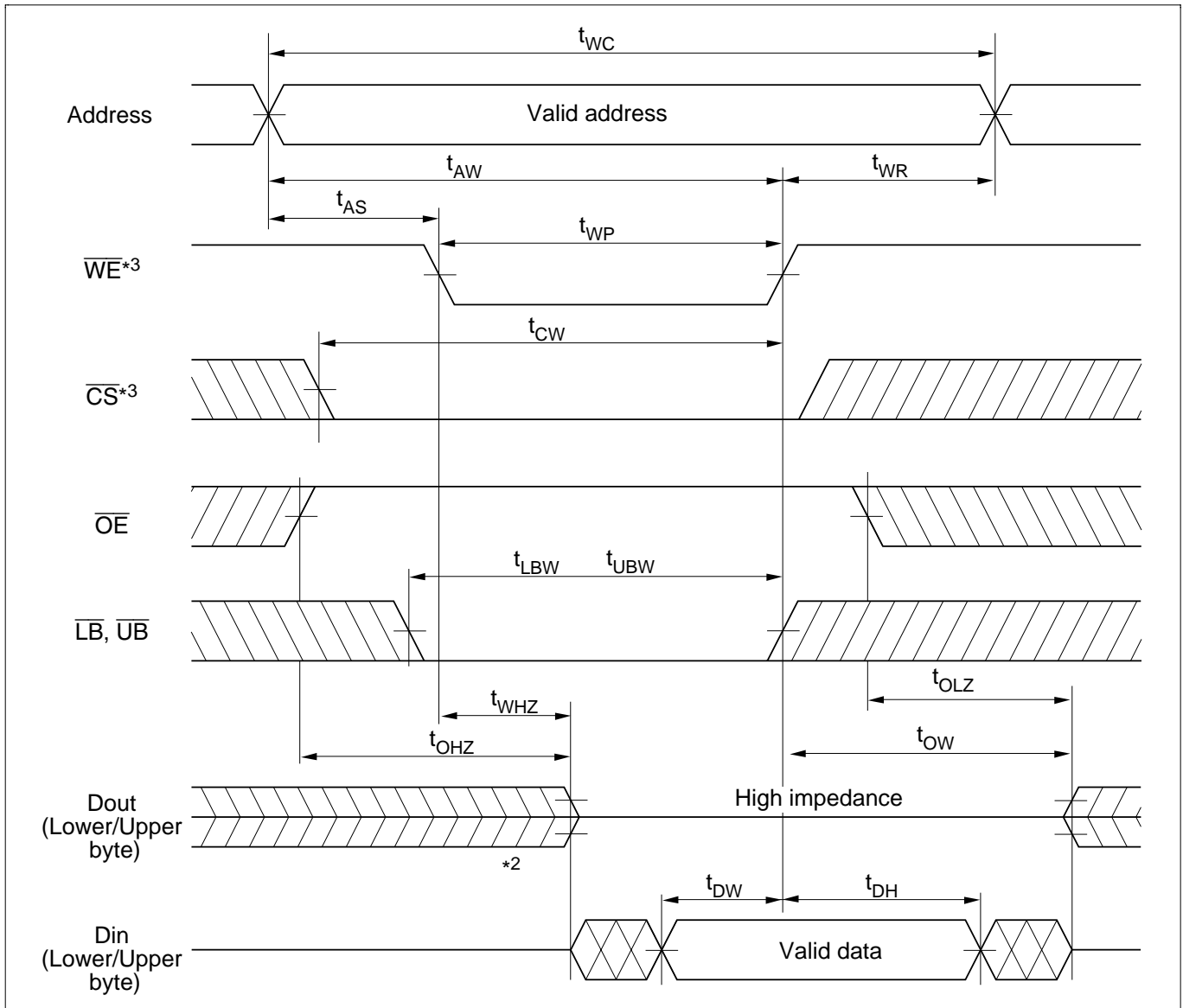




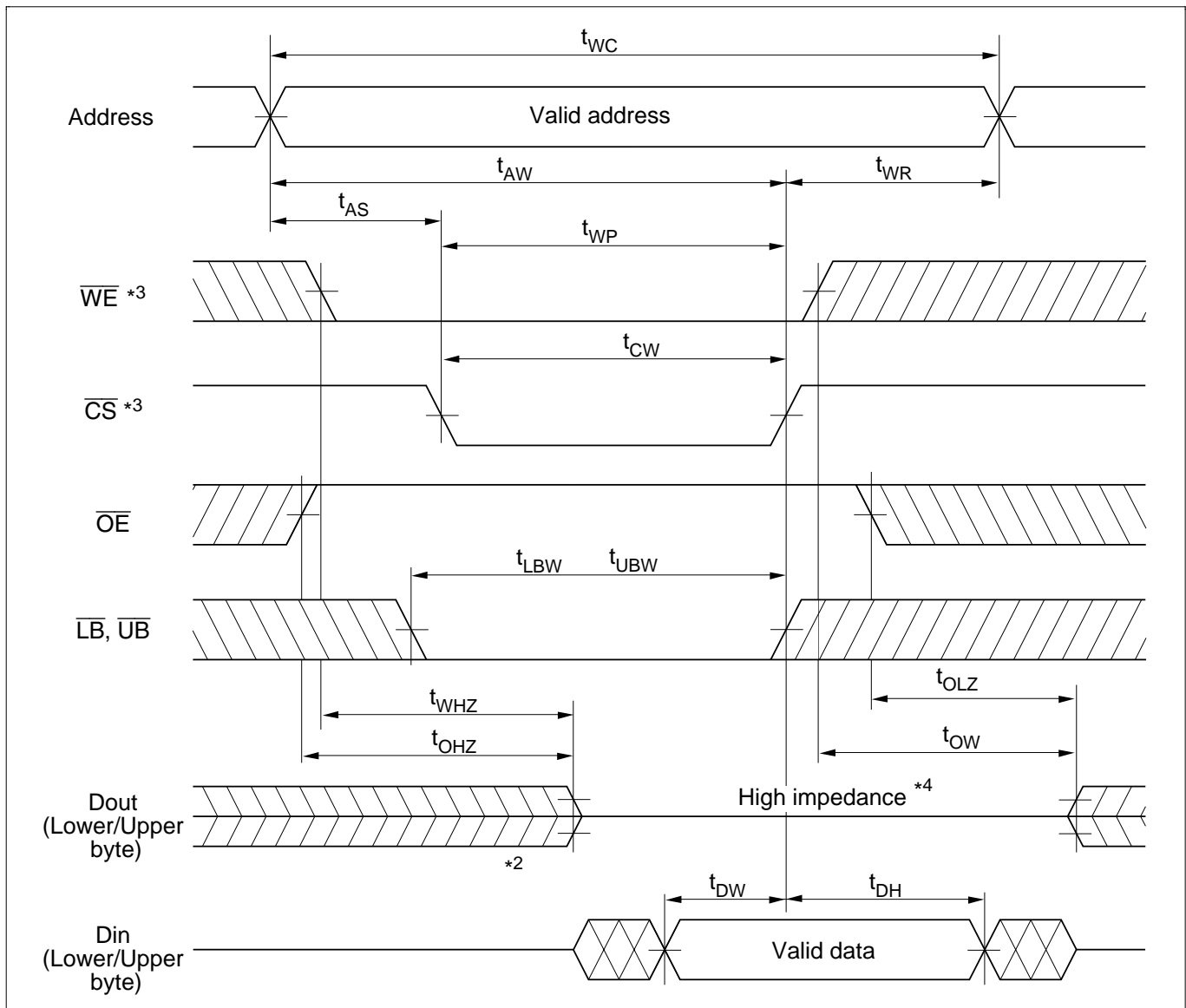
Write Timing Waveform (1) ( $\overline{\text{LB}}$ ,  $\overline{\text{UB}}$  Controlled)



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



Write Timing Waveform (3) ( $\overline{CS}$  Controlled)



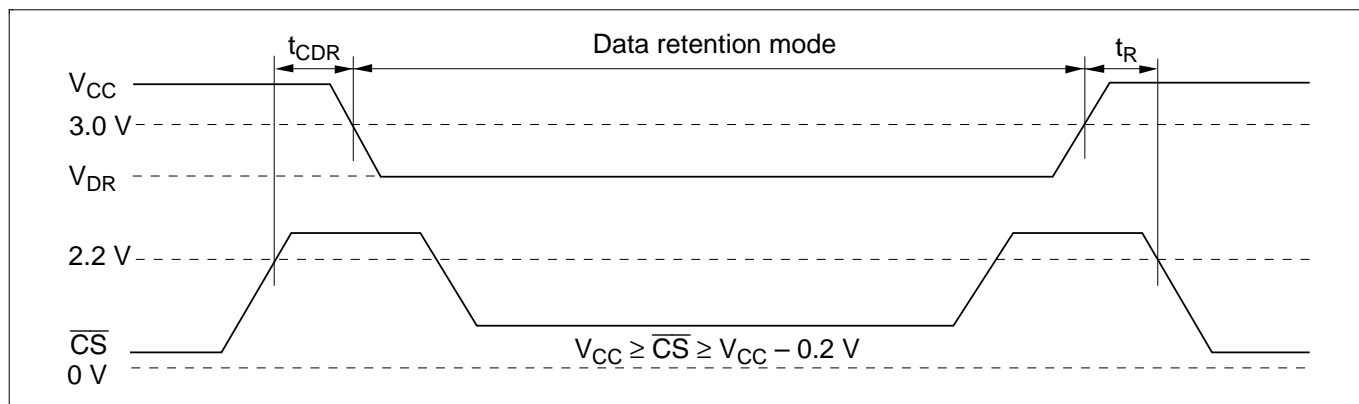
## Low $V_{CC}$ Data Retention Characteristics ( $T_a = 0$ to $+70^\circ\text{C}$ )

This characteristics is guaranteed only for L-version.

Parameter	Symbol	Min	Typ* <sup>1</sup>	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 $\leq$ $V_{in} \leq 0.2$ V or (2) $V_{CC} \geq V_{in} \geq V_{CC} - 0.2$ V
Data retention current	$I_{CCDR}$	—	50	800	$\mu\text{A}$	$V_{CC} = 3$ V $V_{CC} \geq \overline{CS} \geq V_{CC} - 0.2$ V, (1) $0$ V $\leq$ $V_{in} \leq 0.2$ V or (2) $V_{CC} \geq V_{in} \geq V_{CC} - 0.2$ 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,  $T_a = +25^\circ\text{C}$ , and not guaranteed.

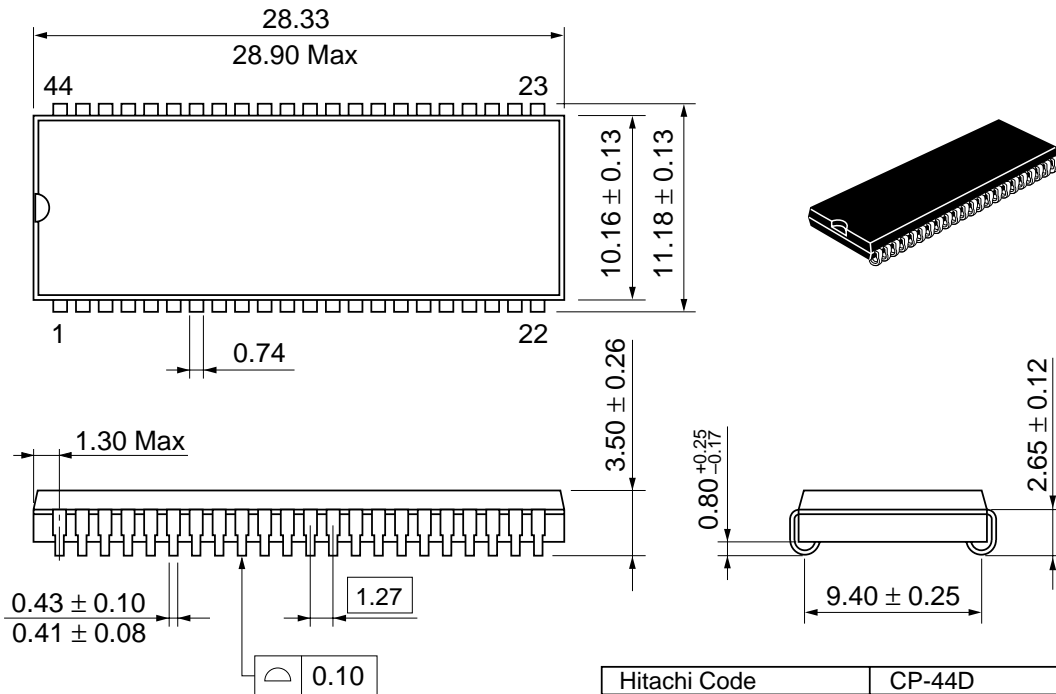
## Low $V_{CC}$ Data Retention Timing Waveform



## Package Dimensions

### HM6216255HJP/HLJP Series (CP-44D)

Unit: mm



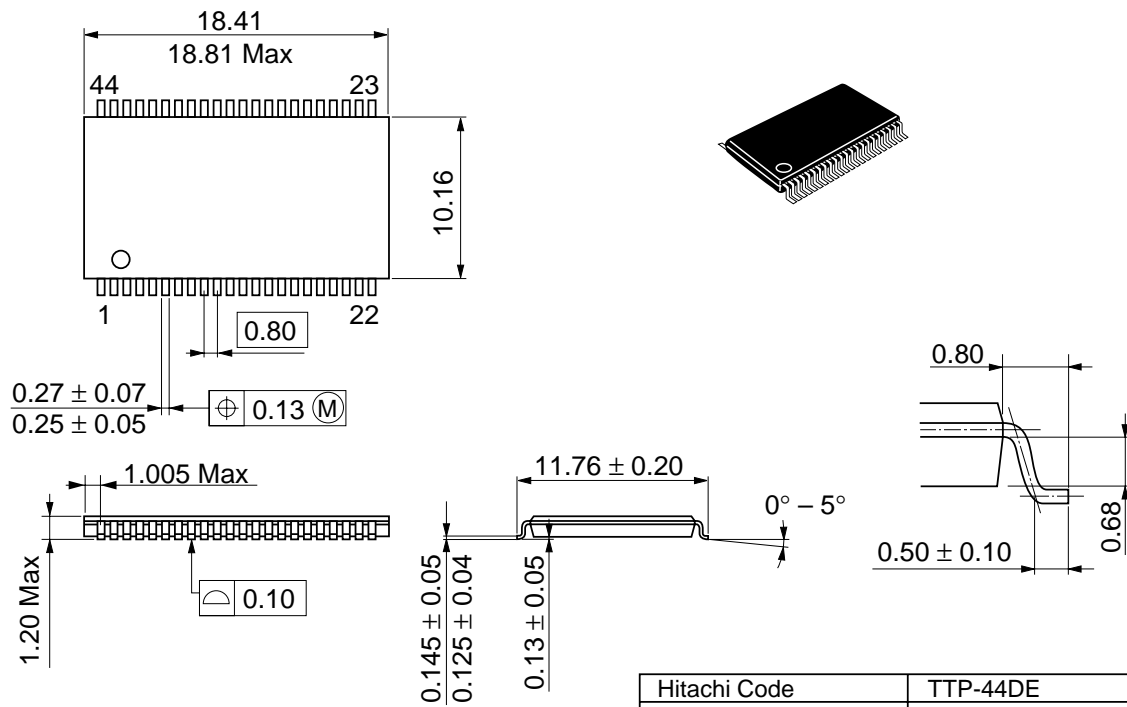
Dimension including the plating thickness  
Base material dimension

Hitachi Code	CP-44D
JEDEC	Conforms
EIAJ	—
Weight (reference value)	1.8 g

# HM6216255H Series

## HM6216255HTT/HLTT Series (TTP-44DE)

Unit: mm



Dimension including the plating thickness  
Base material dimension

Hitachi Code	TTP-44DE
JEDEC	—
EIAJ	—
Weight (reference value)	0.43 g



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