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# HM6216255HI Series

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

## HITACHI

ADE-203-1037A (Z)

Rev. 1.0

Apr. 15, 1999

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### Description

The HM6216255HI 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: 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 mA (max)
- TTL standby current: 60/50 mA (max)
- CMOS standby current: 5 mA (max)
- Center V<sub>CC</sub> and V<sub>SS</sub> type pinout
- Temperature range: -40 to 85°C

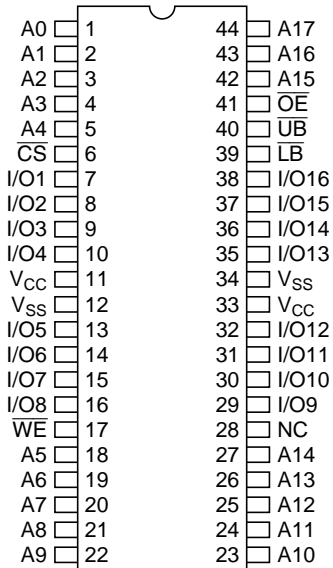
# HM6216255HI Series

## Ordering Information

Type No.	Access time	Package
HM6216255HJPI-12	12 ns	400-mil 44-pin plastic SOJ (CP-44D)
HM6216255HJPI-15	15 ns	
HM6216255HTTI-12	12 ns	400-mil 44-pin plastic TSOPII (TTP-44DE)
HM6216255HTTI-15	15 ns	

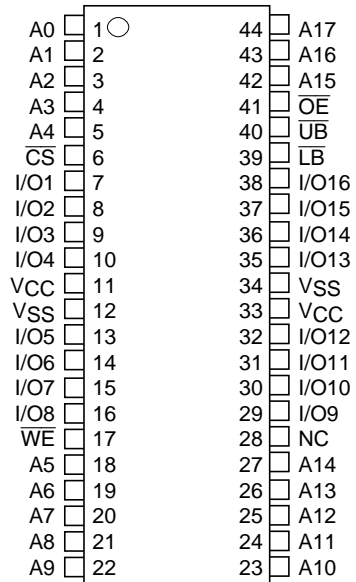
## Pin Arrangement

HM6216255HJPI Series



(Top View)

HM6216255HTTI Series

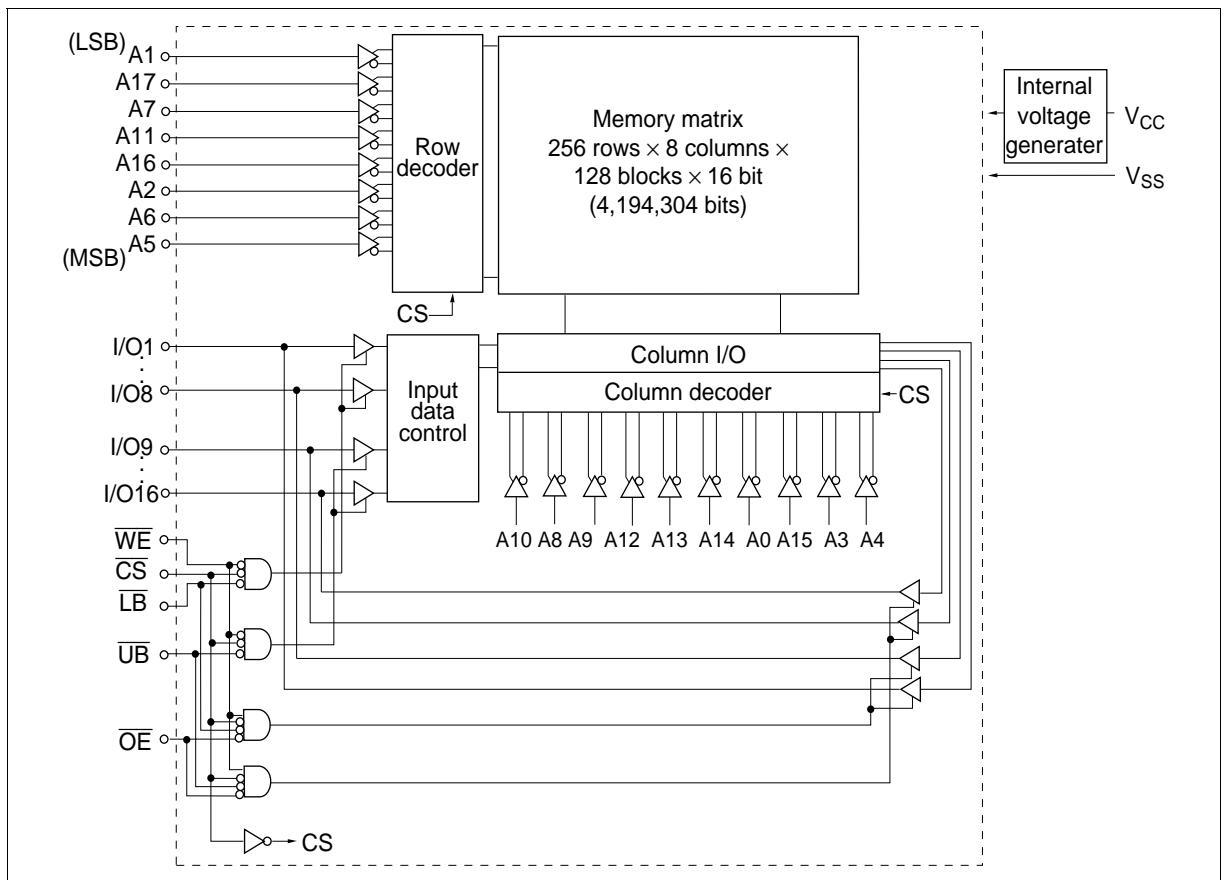


(Top View)

## 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	x	x	x	x	Standby	$I_{SB}, I_{SB1}$	High-Z	High-Z	—
L	H	H	x	x	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	x	L	L	L	Write	$I_{CC}$	Input	Input	Write cycle
L	x	L	L	H	Lower byte write	$I_{CC}$	Input	High-Z	Write cycle
L	x	L	H	L	Upper byte write	$I_{CC}$	High-Z	Input	Write cycle
L	x	L	H	H	—	$I_{CC}$	High-Z	High-Z	—

Note: x: 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	$T_{opr}$	–40 to +85	°C
Storage temperature	$T_{stg}$	–55 to +125	°C
Storage temperature under bias	$T_{bias}$	–40 to +85	°C

- Notes: 1.  $V_T$  (min) = –2.0 V for pulse width (under shoot)  $\leq 8$  ns  
 2.  $V_T$  (max) =  $V_{CC} + 2.0$  V for pulse width (over shoot)  $\leq 8$  ns  
 3. At still air condition  
 4. At air flow  $\geq 1.0$  m/s

**Recommended DC Operating Conditions** ( $T_a = -40$  to  $+85^\circ\text{C}$ )

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** ( $T_a = -40$  to  $+85^\circ\text{C}$ ,  $V_{CC} = 5.0$  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	12 ns cycle $I_{CC}$	—	—	200	mA	Min cycle $\overline{CS} = V_{IL}$ , $I_{out} = 0$ mA Other inputs = $V_{IH}/V_{IL}$
	15 ns cycle $I_{CC}$	—	—	180		
Standby power supply current	12 ns cycle $I_{SB}$	—	—	60	mA	Min cycle, $\overline{CS} = V_{IH}$ , Other inputs = $V_{IH}/V_{IL}$
	15 ns cycle $I_{SB}$	—	—	50		
	$I_{SB1}$	—	0.1	5	mA	$f = 0$ MHz $V_{CC} \geq \overline{CS} \geq V_{CC} - 0.2$ V, (1) $0$ V $\leq V_{in} \leq 0.2$ V or (2) $V_{CC} \geq V_{in} \geq V_{CC} - 0.2$ V
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.

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

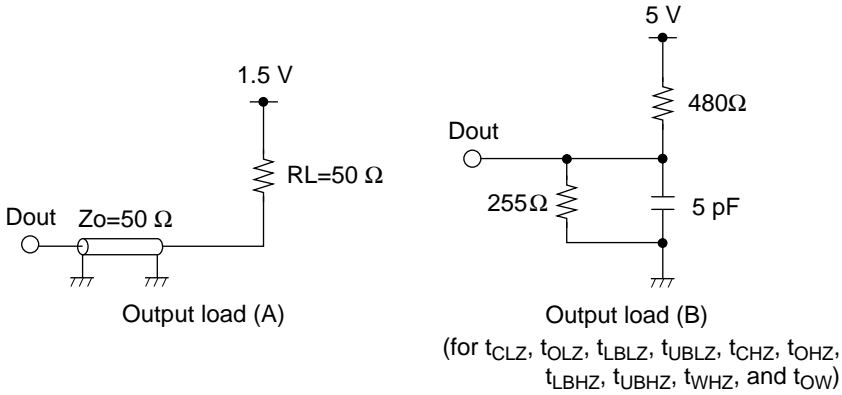
Parameter	Symbol	Min	Typ	Max	Unit	Test conditions
Input capacitance <sup>*1</sup>	$C_{in}$	—	—	6	pF	$V_{in} = 0$ V
Input/output capacitance <sup>*1</sup>	$C_{I/O}$	—	—	8	pF	$V_{I/O} = 0$ V

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

**AC Characteristics** ( $T_a = -40$  to  $+85^\circ\text{C}$ ,  $V_{CC} = 5.0\text{ V} \pm 10\%$ , 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

Parameter	Symbol	HM6216255HI				Unit	Notes
		-12		-15			
		Min	Max	Min	Max		
Read cycle time	$t_{RC}$	12	—	15	—	ns	
Address access time	$t_{AA}$	—	12	—	15	ns	
Chip select access time	$t_{ACS}$	—	12	—	15	ns	
Output enable to output valid	$t_{OE}$	—	6	—	7	ns	
Byte select to output valid	$t_{LB}$ , $t_{UB}$	—	6	—	7	ns	
Output hold from address change	$t_{OH}$	3	—	3	—	ns	
Chip select to output in low-Z	$t_{CLZ}$	3	—	3	—	ns	1
Output enable to output in low-Z	$t_{OLZ}$	0	—	0	—	ns	1
Byte select to output in low-Z	$t_{LBLZ}$ , $t_{UBLZ}$	0	—	0	—	ns	1
Chip deselect to output in high-Z	$t_{CHZ}$	—	6	—	7	ns	1
Output disable to output in high-Z	$t_{OHZ}$	—	6	—	7	ns	1
Byte deselect to output in high-Z	$t_{LBHZ}$ , $t_{UBHZ}$	—	6	—	7	ns	1

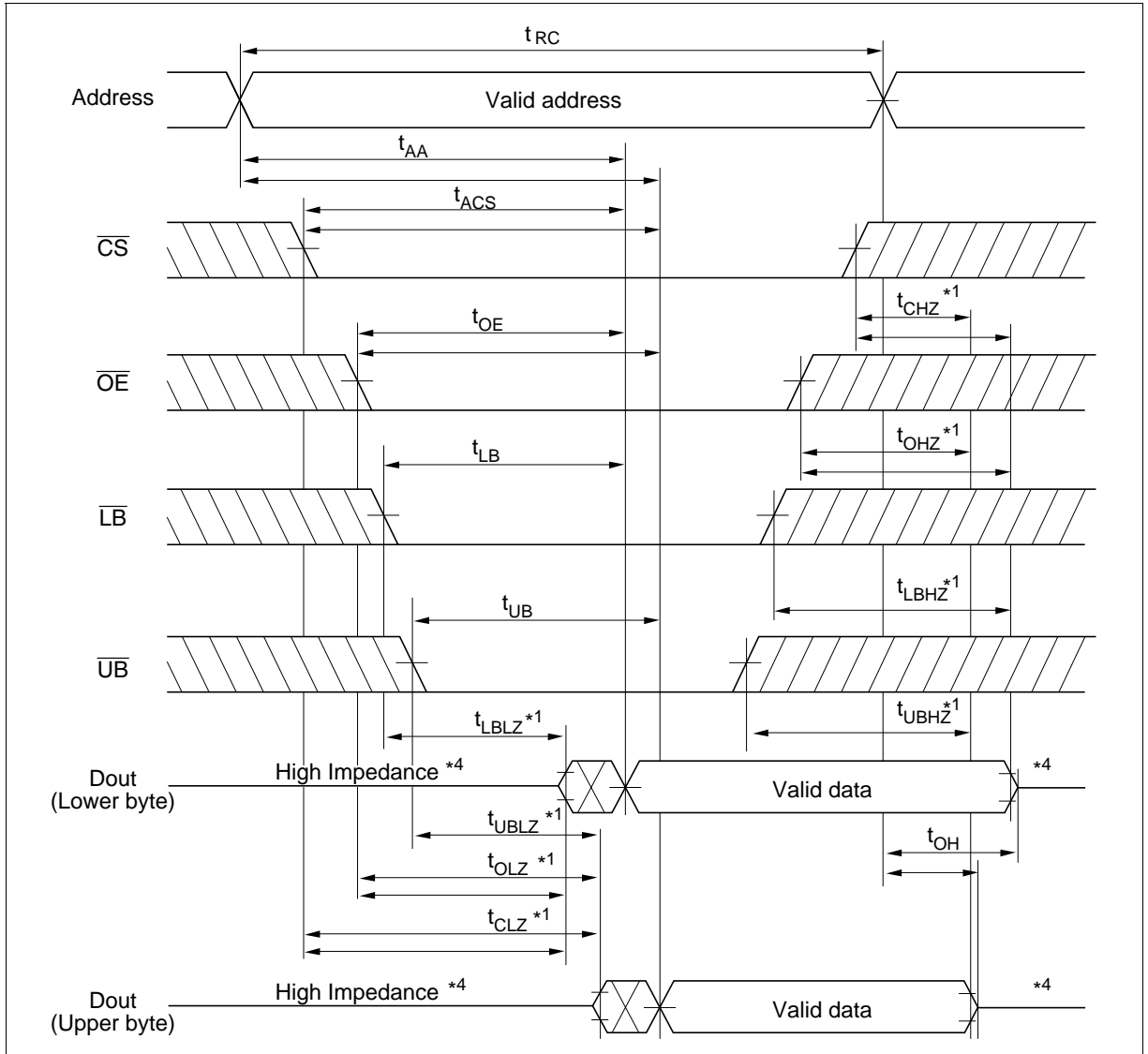
Write Cycle

Parameter	Symbol	HM6216255HI				Unit	Notes
		-12		-15			
		Min	Max	Min	Max		
Write cycle time	$t_{WC}$	12	—	15	—	ns	
Address valid to end of write	$t_{AW}$	8	—	10	—	ns	
Chip select to end of write	$t_{CW}$	8	—	10	—	ns	8
Write pulse width	$t_{WP}$	8	—	10	—	ns	7
Byte select to end of write	$t_{LBW}, t_{UBW}$	8	—	10	—	ns	9, 10
Address setup time	$t_{AS}$	0	—	0	—	ns	5
Write recovery time	$t_{WR}$	0	—	0	—	ns	6
Data to write time overlap	$t_{DW}$	6	—	7	—	ns	
Data hold from write time	$t_{DH}$	0	—	0	—	ns	
Write disable to output in low-Z	$t_{OW}$	3	—	3	—	ns	1
Output disable to output in high-Z	$t_{OHZ}$	—	6	—	7	ns	1
Write enable to output in high-Z	$t_{WHZ}$	—	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.

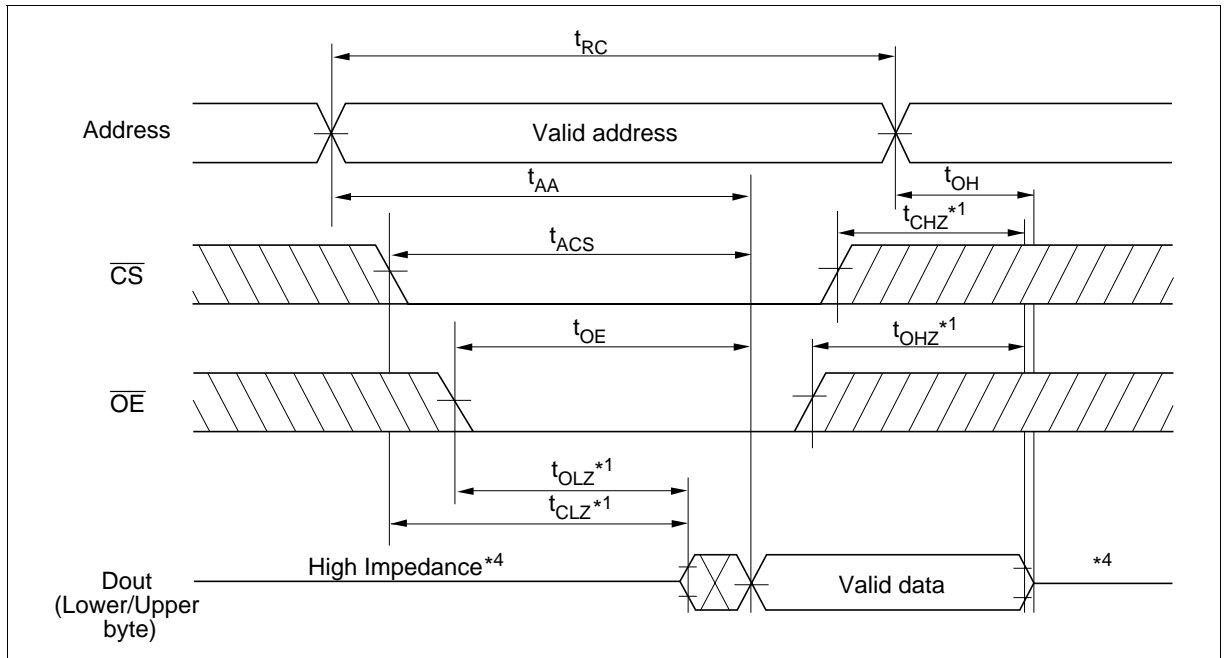
## Timing Waveforms

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

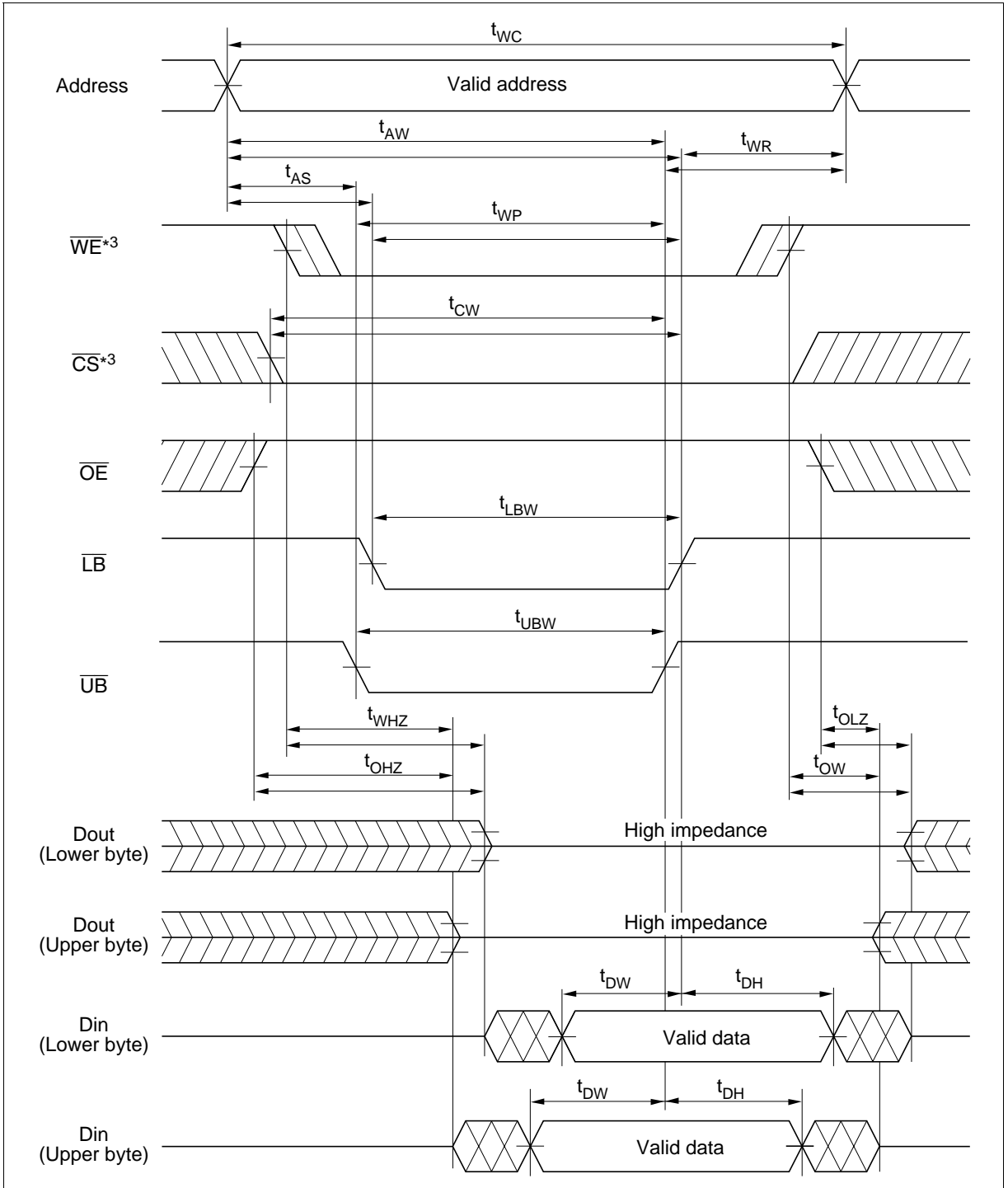




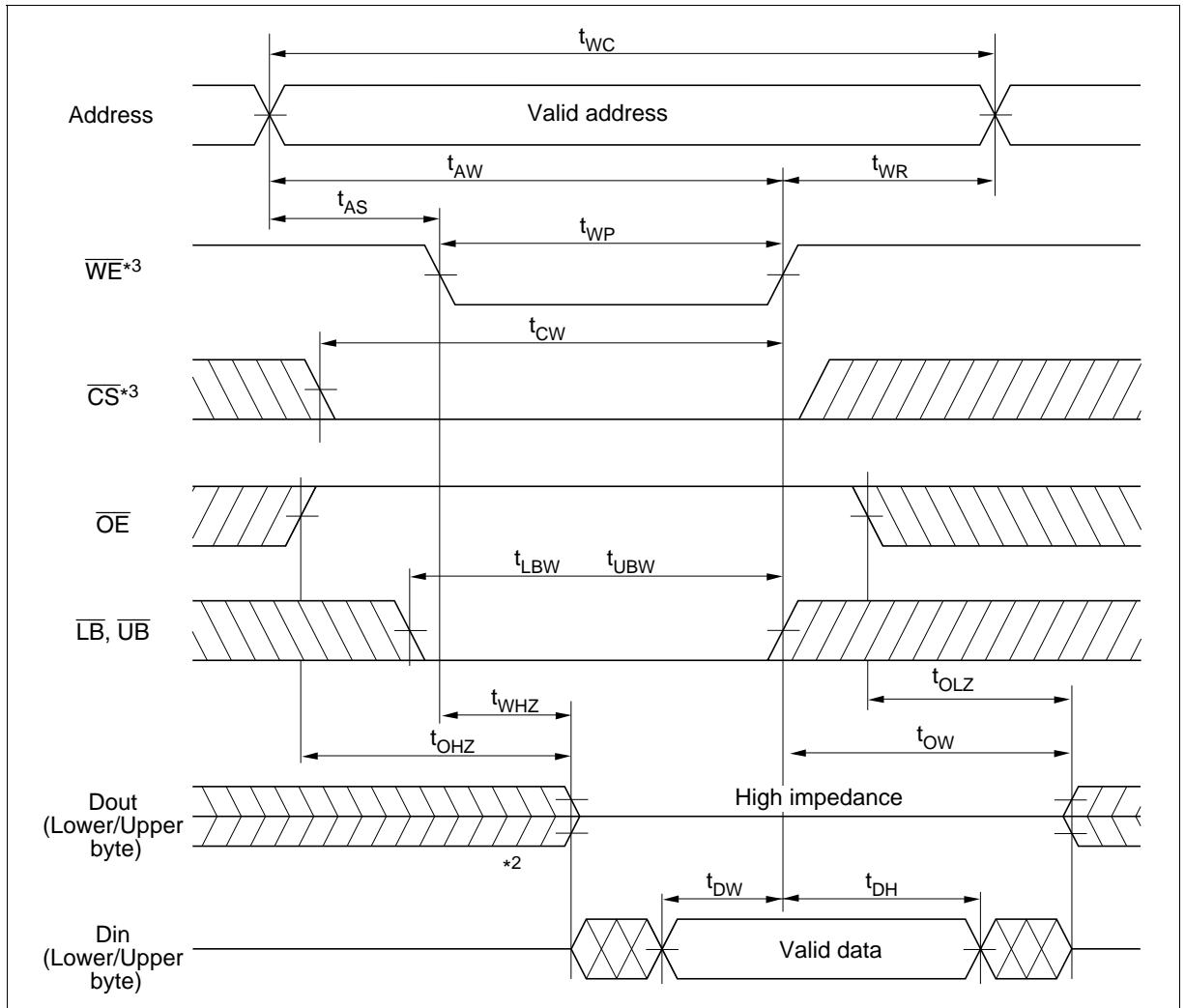
Read Timing Waveform (2) ( $\overline{WE} = V_{IH}, \overline{LB} = V_{IL}, \overline{UB}, = V_{IL}$ )



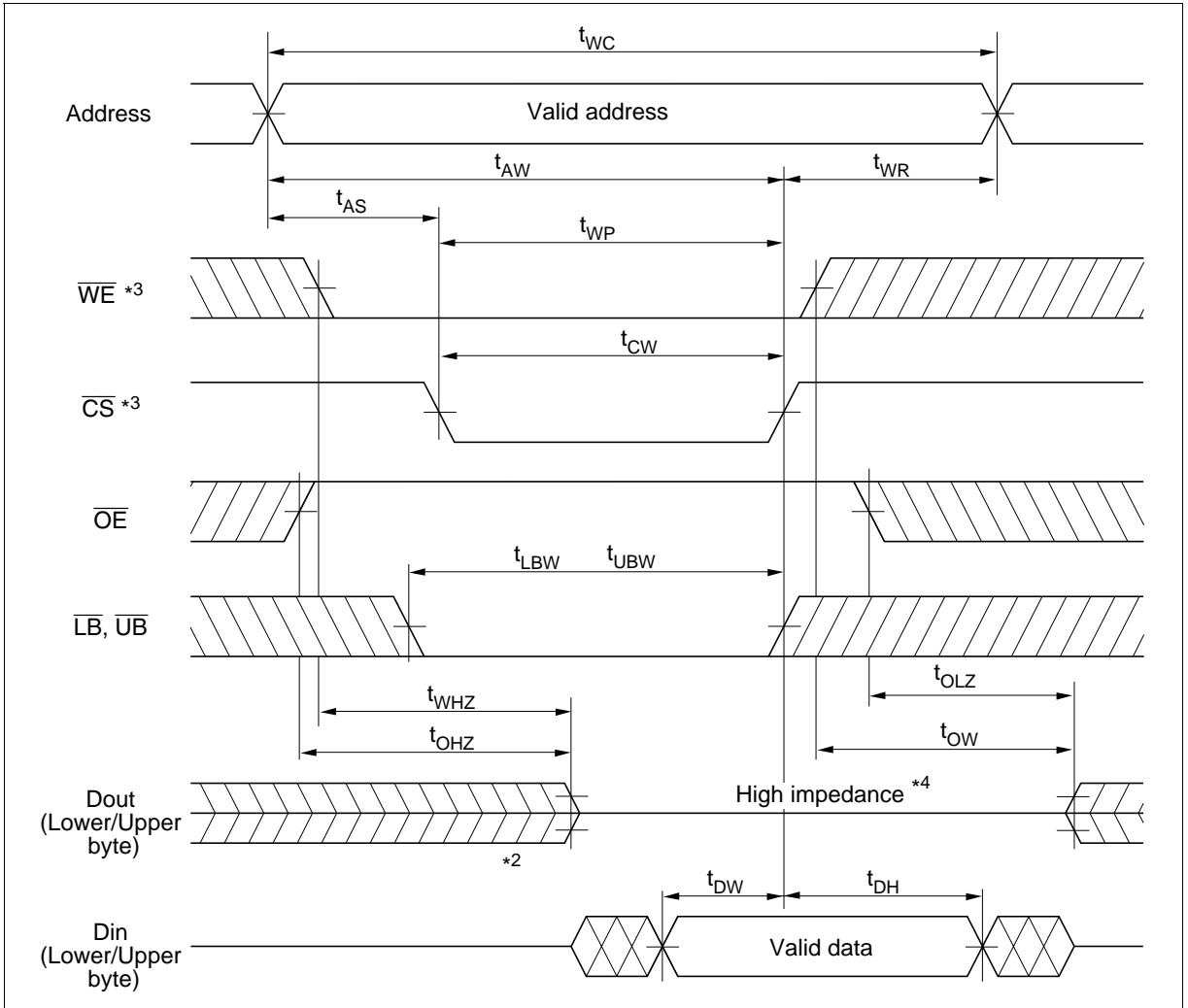
## Write Timing Waveform (1) ( $\overline{LB}$ , $\overline{UB}$ Controlled)



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



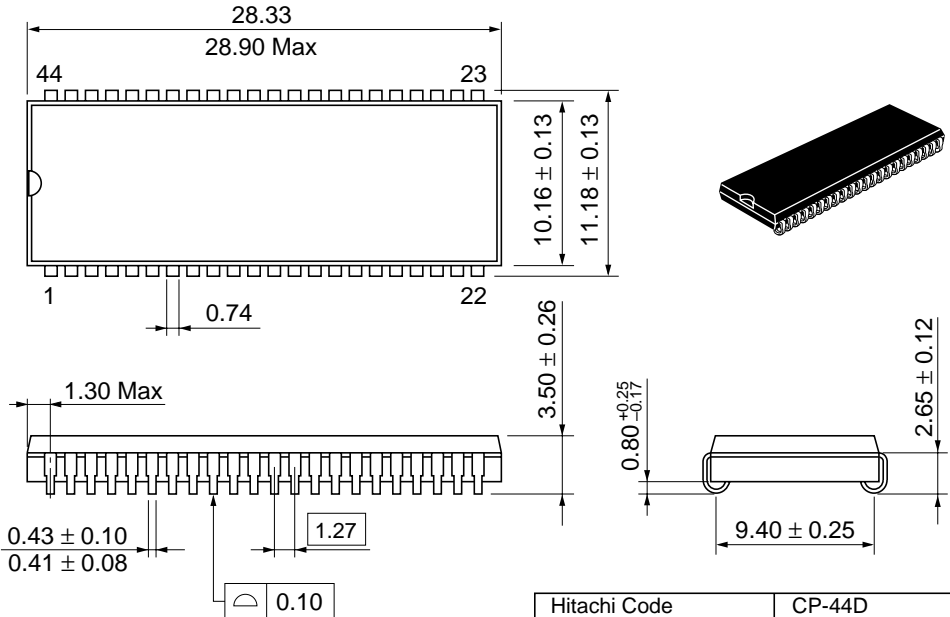
## Write Timing Waveform (3) ( $\overline{CS}$ Controlled)



## Package Dimensions

### HM6216255HJPI Series (CP-44D)

Unit: mm



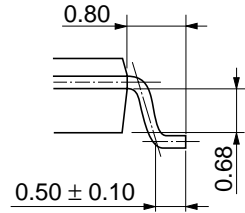
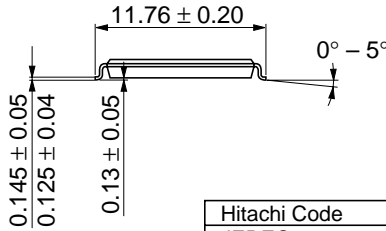
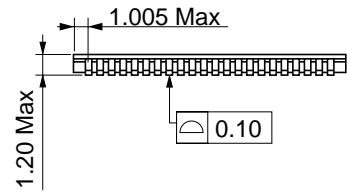
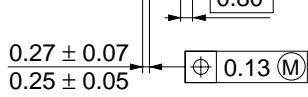
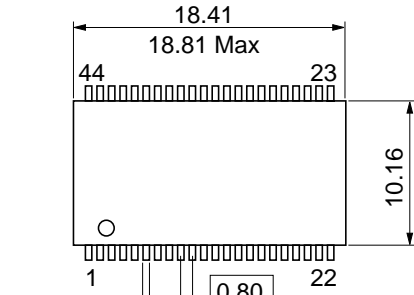
Dimension including the plating thickness  
Base material dimension

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

# HM6216255HI Series

## HM6216255HTTI 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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**Hitachi, Ltd.**

Semiconductor & Integrated Circuits.  
 Nippon Bldg., 2-6-2, Ohte-machi, Chiyoda-ku, Tokyo 100-0004, Japan  
 Tel: Tokyo (03) 3270-2111 Fax: (03) 3270-5109

URL      NorthAmerica      : <http://semiconductor.hitachi.com/>  
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**For further information write to:**

Hitachi Semiconductor  
 (America) Inc.  
 179 East Tasman Drive,  
 San Jose, CA 95134  
 Tel: <1> (408) 433-1990  
 Fax: <1> (408) 433-0223

Hitachi Europe GmbH  
 Electronic components Group  
 Dornacher Straße 3  
 D-85622 Feldkirchen, Munich  
 Germany  
 Tel: <49> (89) 9 9180-0  
 Fax: <49> (89) 9 29 30 00

Hitachi Europe Ltd.  
 Electronic Components Group.  
 Whitebrook Park  
 Lower Cookham Road  
 Maidenhead  
 Berkshire SL6 8YA, United Kingdom  
 Tel: <44> (1628) 585000  
 Fax: <44> (1628) 778322

Hitachi Asia Pte. Ltd.  
 16 Collyer Quay #20-00  
 Hitachi Tower  
 Singapore 049318  
 Tel: 535-2100  
 Fax: 535-1533

Hitachi Asia Ltd.  
 Taipei Branch Office  
 3F, Hung Kuo Building, No.167,  
 Tun-Hwa North Road, Taipei (105)  
 Tel: <886> (2) 2718-3666  
 Fax: <886> (2) 2718-8180

Hitachi Asia (Hong Kong) Ltd.  
 Group III (Electronic Components)  
 7/F., North Tower, World Finance Centre,  
 Harbour City, Canton Road, Tsim Sha Tsui,  
 Kowloon, Hong Kong  
 Tel: <852> (2) 735 9218  
 Fax: <852> (2) 730 0281  
 Telex: 40815 HITEC HX

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## Revision Record

Rev.	Date	Contents of Modification	Drawn by	Approved by
1.0	Apr. 15, 1999	Initial issue		

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