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Renesas Technology Corp.
Customer Support Dept.
April 1, 2003

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HM628512CI Series

Wide Temperature Range Version
4 M SRAM (512-kword × 8-bit)



ADE-203-1211C (Z)
Rev. 3.0
Dec. 18, 2002

Description

The Hitachi HM628512CI is a 4-Mbit static RAM organized 512-kword × 8-bit. HM628512CI Series has realized higher density, higher performance and low power consumption by employing CMOS process technology (6-transistor memory cell). The HM628512CI Series offers low power standby power dissipation; therefore, it is suitable for battery backup systems. It has packaged in 32-pin SOP, 32-pin TSOP II and 32-pin DIP.

Features

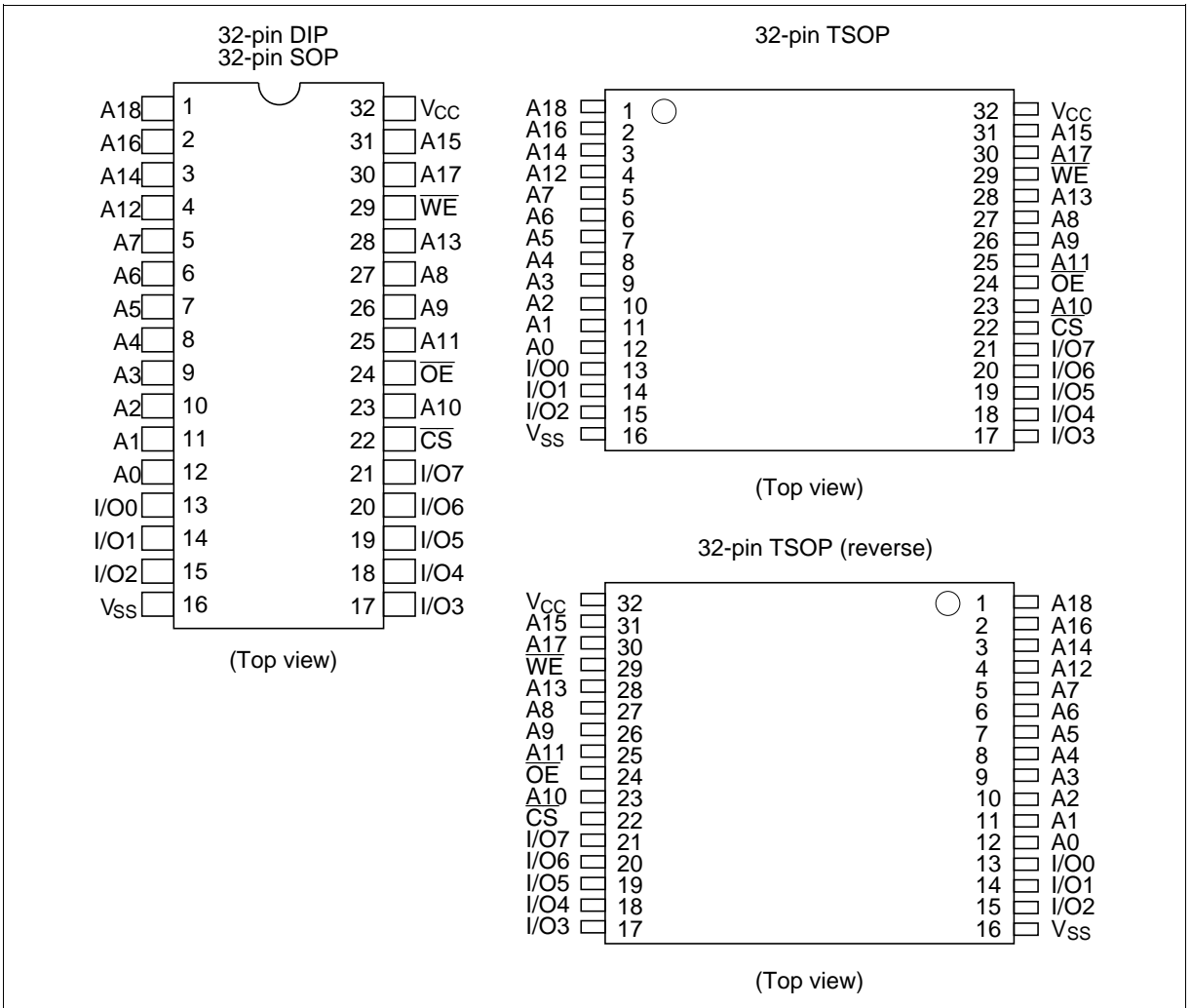
- Single 5 V supply
- Access time: 55/70 ns (max)
- Power dissipation
 - Active: 10 mW/MHz (typ)
 - Standby: 4 μW (typ)
- Completely static memory. No clock or timing strobe required
- Equal access and cycle times
- Common data input and output: Three state output
- Directly TTL compatible: All inputs and outputs
- Battery backup operation
- Operating temperature: -40 to +85°C

HM628512CI Series

Ordering Information

Type No.	Access time	Package
HM628512CLPI-7	70 ns	600-mil 32-pin plastic DIP (DP-32)
HM628512CLFPI-5	55 ns	525-mil 32-pin plastic SOP (FP-32D)
HM628512CLFPI-7	70 ns	
HM628512CLTTI-5	55 ns	400-mil 32-pin plastic TSOP II (TTP-32D)
HM628512CLTTI-7	70 ns	
HM628512CLRRI-7	70 ns	400-mil 32-pin plastic TSOP II reverse (TTP-32DR)

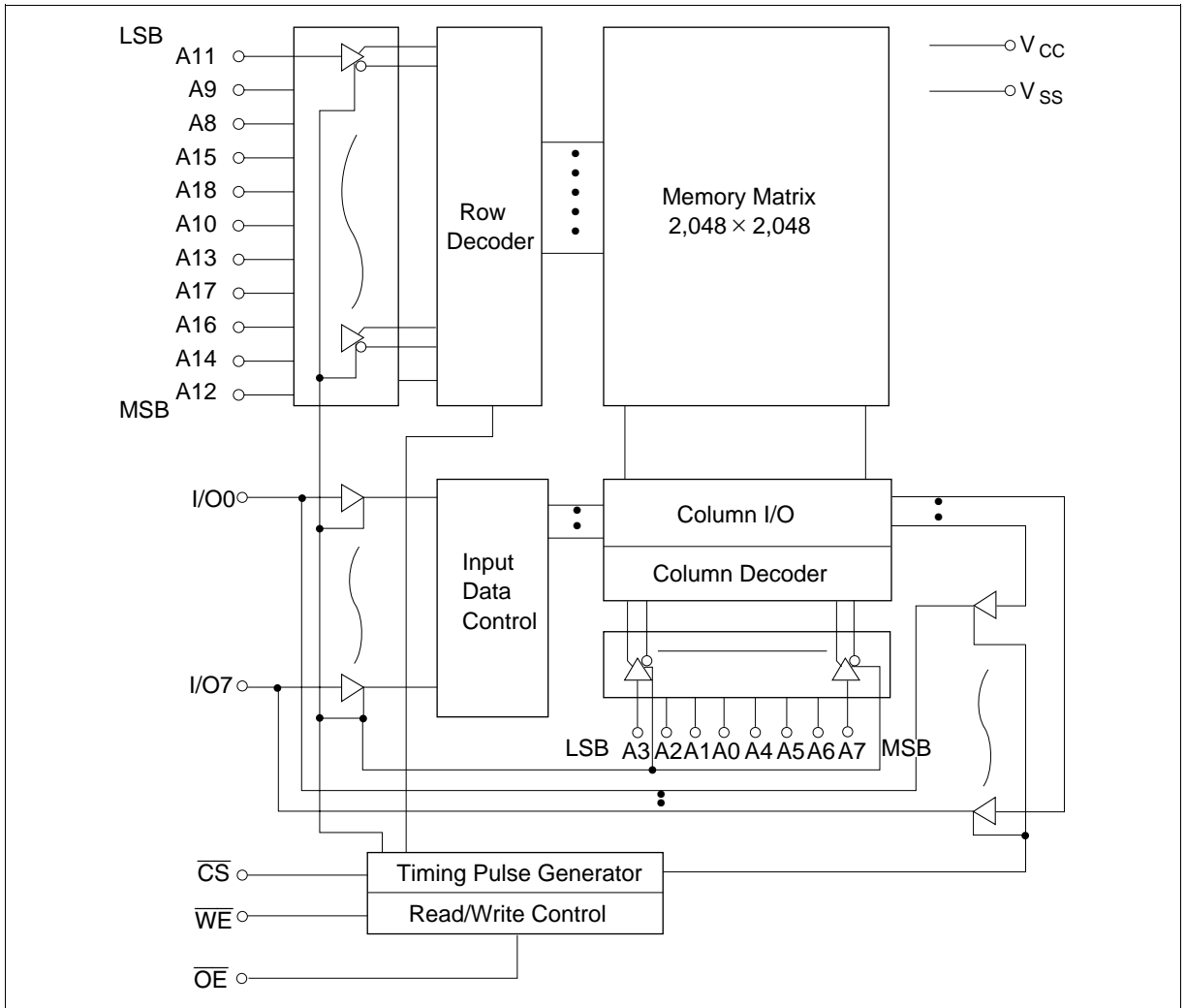
Pin Arrangement



Pin Description

Pin name	Function
A0 to A18	Address input
I/O0 to I/O7	Data input/output
CS	Chip select
OE	Output enable
WE	Write enable
V _{CC}	Power supply
V _{SS}	Ground

Block Diagram



Function Table

\overline{WE}	\overline{CS}	\overline{OE}	Mode	V_{CC} current	Dout pin	Ref. cycle
x	H	x	Not selected	I_{SB}, I_{SB1}	High-Z	—
H	L	H	Output disable	I_{CC}	High-Z	—
H	L	L	Read	I_{CC}	Dout	Read cycle
L	L	H	Write	I_{CC}	Din	Write cycle (1)
L	L	L	Write	I_{CC}	Din	Write cycle (2)

Note: x: H or L

Absolute Maximum Ratings

Parameter	Symbol	Value	Unit
Power supply voltage	V_{CC}	-0.5 to +7.0	V
Voltage on any pin relative to V_{SS}	V_T	-0.5* ¹ to $V_{CC} + 0.3$ * ²	V
Power dissipation	P_T	1.0	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: -3.0 V for pulse half-width \leq 30 ns.

2. Maximum voltage is 7.0 V.

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

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}	2.4	—	$V_{CC} + 0.3$	V
Input low voltage	V_{IL}	-0.3* ¹	—	0.6	V

Note: 1. V_{IL} min: -3.0 V for pulse half-width \leq 30 ns.

DC Characteristics

Parameter		Symbol	Min	Typ* ¹	Max	Unit	Test conditions
Input leakage current		$ I_{LI} $	—	—	1	μA	$V_{in} = V_{SS}$ to V_{CC}
Output leakage current		$ I_{LO} $	—	—	1	μA	$\overline{CS} = V_{IH}$ or $\overline{OE} = V_{IH}$ or $\overline{WE} = V_{IL}$, $V_{I/O} = V_{SS}$ to V_{CC}
Operating power supply current: DC		I_{CC}	—	1.5	3	mA	$\overline{CS} = V_{IL}$, others = V_{IH}/V_{IL} , $I_{I/O} = 0$ mA
Operating power supply current	HM628512CI-5	I_{CC1}	—	8	25	mA	Min cycle, duty = 100% $\overline{CS} = V_{IL}$, others = V_{IH}/V_{IL} $I_{I/O} = 0$ mA
	HM628512CI-7	I_{CC1}	—	7	25	mA	
Operating power supply current		I_{CC2}	—	2	5	mA	Cycle time = 1 μs , duty = 100% $I_{I/O} = 0$ mA, $\overline{CS} \leq 0.2$ V $V_{IH} \geq V_{CC} - 0.2$ V, $V_{IL} \leq 0.2$ V
Standby power supply current: DC		I_{SB}	—	0.1	0.5	mA	$\overline{CS} = V_{IH}$
Standby power supply current (1): DC		I_{SB1}	—	0.8* ²	20* ²	μA	$V_{in} \geq 0$ V, $\overline{CS} \geq V_{CC} - 0.2$ V
Output low voltage		V_{OL}	—	—	0.4	V	$I_{OL} = 2.1$ mA
Output high voltage		V_{OH}	2.4	—	—	V	$I_{OH} = -1.0$ mA

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

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

Parameter	Symbol	Typ	Max	Unit	Test conditions
Input capacitance* ¹	C_{in}	—	8	pF	$V_{in} = 0$ V
Input/output capacitance* ¹	$C_{I/O}$	—	10* ²	pF	$V_{I/O} = 0$ V

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

2. $C_{I/O}$ max = 12 pF only for HM628512CLPI Series.

AC Characteristics ($T_a = -40$ to $+85^\circ\text{C}$, $V_{CC} = 5\text{ V} \pm 10\%$, unless otherwise noted.)

Test Conditions

- Input pulse levels: 0.4 V to 2.4 V
- Input rise and fall time: 5 ns
- Input and output timing reference levels: 1.5 V
- Output load: 1 TTL Gate + C_L (50 pF) (HM628512CI-5)
 1 TTL Gate + C_L (100 pF) (HM628512CI-7)
 (Including scope and jig)

Read Cycle

Parameter	Symbol	HM628512CI				Unit	Notes
		-5		-7			
		Min	Max	Min	Max		
Read cycle time	t_{RC}	55	—	70	—	ns	
Address access time	t_{AA}	—	55	—	70	ns	
Chip select access time	t_{CO}	—	55	—	70	ns	
Output enable to output valid	t_{OE}	—	25	—	35	ns	
Chip selection to output in low-Z	t_{LZ}	10	—	10	—	ns	2
Output enable to output in low-Z	t_{OLZ}	5	—	5	—	ns	2
Chip deselection to output in high-Z	t_{HZ}	0	20	0	25	ns	1, 2
Output disable to output in high-Z	t_{OHZ}	0	20	0	25	ns	1, 2
Output hold from address change	t_{OH}	10	—	10	—	ns	

Write Cycle

Parameter	Symbol	HM628512CI				Unit	Notes
		-5		-7			
		Min	Max	Min	Max		
Write cycle time	t_{WC}	55	—	70	—	ns	
Chip selection to end of write	t_{CW}	50	—	60	—	ns	4
Address setup time	t_{AS}	0	—	0	—	ns	5
Address valid to end of write	t_{AW}	50	—	60	—	ns	
Write pulse width	t_{WP}	40	—	50	—	ns	3, 12
Write recovery time	t_{WR}	0	—	0	—	ns	6
\overline{WE} to output in high-Z	t_{WHZ}	0	20	0	25	ns	1, 2, 7
Data to write time overlap	t_{DW}	25	—	30	—	ns	
Data hold from write time	t_{DH}	0	—	0	—	ns	
Output active from output in high-Z	t_{OW}	5	—	5	—	ns	2
Output disable to output in high-Z	t_{OHZ}	0	20	0	25	ns	1, 2, 7

Notes: 1. t_{HZ} , t_{OHZ} and t_{WHZ} are defined as the time at which the outputs achieve the open circuit conditions and are not referred to output voltage levels.

2. This parameter is sampled and not 100% tested.

3. A write occurs during the overlap (t_{WP}) of a low \overline{CS} and a low \overline{WE} . A write begins at the later transition of \overline{CS} going low or \overline{WE} going low. A write ends at the earlier transition of \overline{CS} going high or \overline{WE} going high. t_{WP} is measured from the beginning of write to the end of write.

4. t_{CW} is measured from \overline{CS} going low to the end of write.

5. t_{AS} is measured from the address valid to the beginning of write.

6. t_{WR} is measured from the earlier of \overline{WE} or \overline{CS} going high to the end of write cycle.

7. During this period, I/O pins are in the output state so that the input signals of the opposite phase to the outputs must not be applied.

8. If the \overline{CS} low transition occurs simultaneously with the \overline{WE} low transition or after the \overline{WE} transition, the output remain in a high impedance state.

9. Dout is the same phase of the write data of this write cycle.

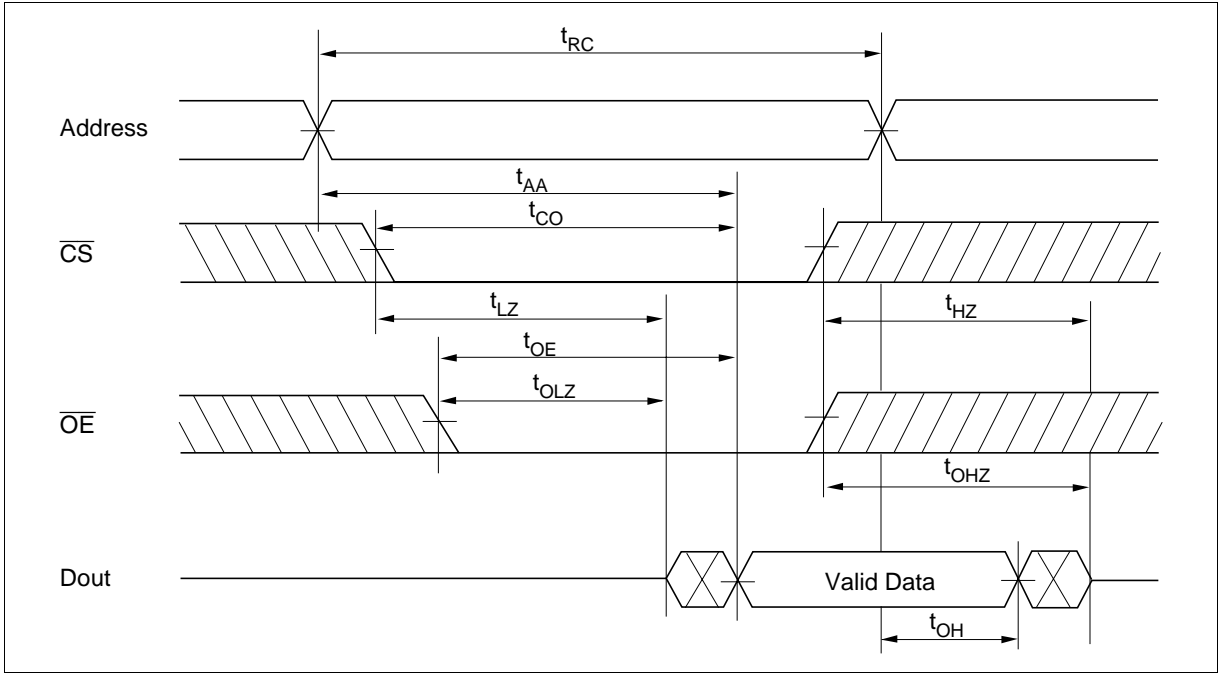
10. Dout is the read data of next address.

11. If \overline{CS} is low 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 to them.

12. In the write cycle with \overline{OE} low fixed, t_{WP} must satisfy the following equation to avoid a problem of data bus contention. $t_{WP} \geq t_{DW} \text{ min} + t_{WHZ} \text{ max}$

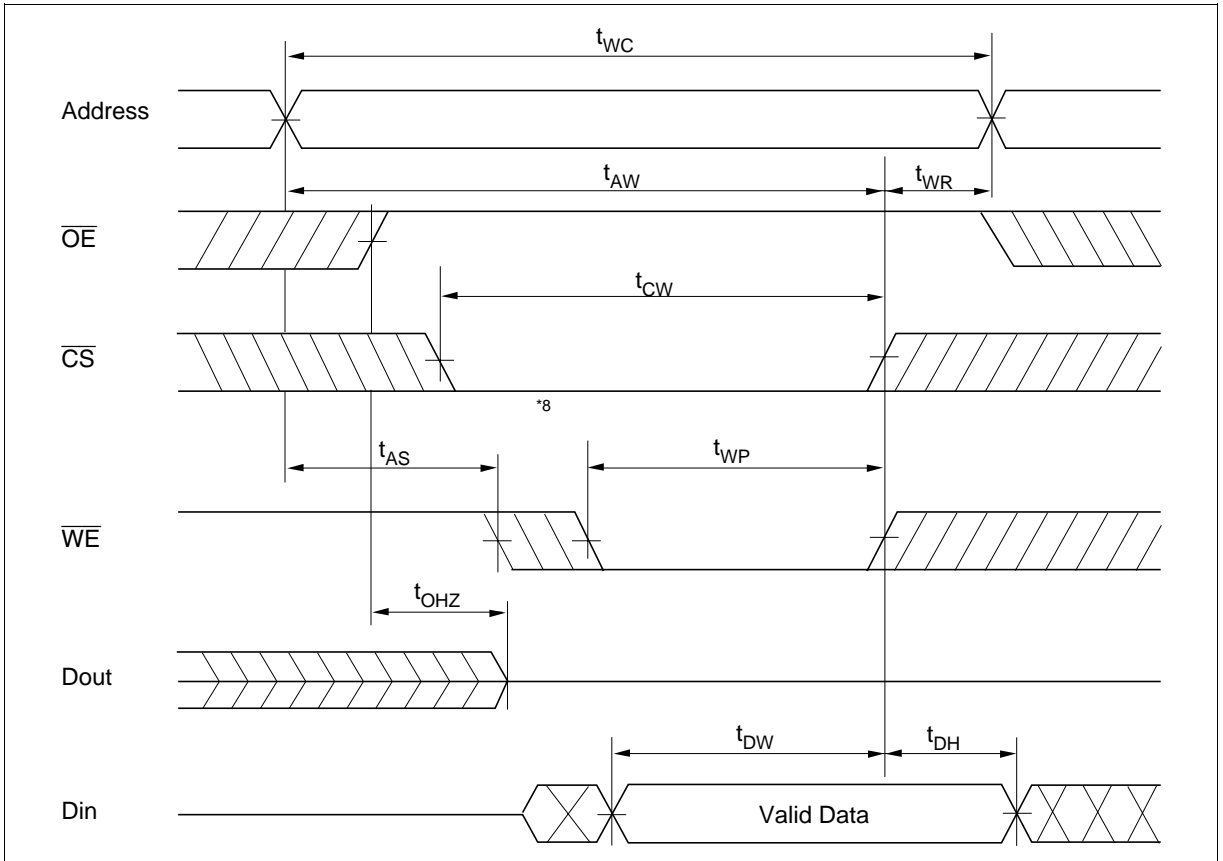
Timing Waveforms

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

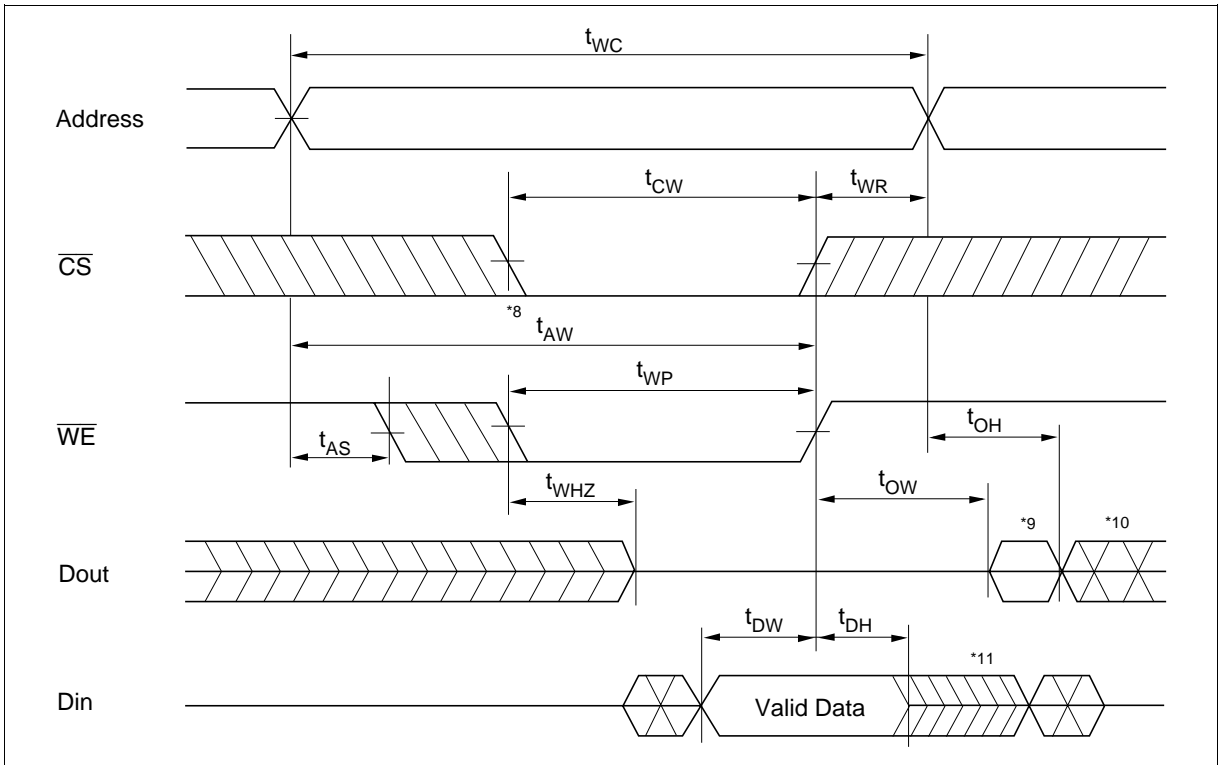


HM628512CI Series

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



Write Timing Waveform (2) (\overline{OE} Low Fixed)



Low V_{CC} Data Retention Characteristics ($T_a = -40$ to $+85^\circ\text{C}$)

Parameter	Symbol	Min	Typ	Max	Unit	Test conditions*2
V_{CC} for data retention	V_{DR}	2	—	—	V	$\overline{CS} \geq V_{CC} - 0.2 \text{ V}$, $V_{in} \geq 0 \text{ V}$
Data retention current	I_{CCDR}	—	0.8^{*3}	20^{*1}	μA	$V_{CC} = 3.0 \text{ V}$, $V_{in} \geq 0 \text{ V}$ $\overline{CS} \geq V_{CC} - 0.2 \text{ V}$
Chip deselect to data retention time	t_{CDR}	0	—	—	ns	See retention waveform
Operation recovery time	t_R	t_{RC}^{*4}	—	—	ns	

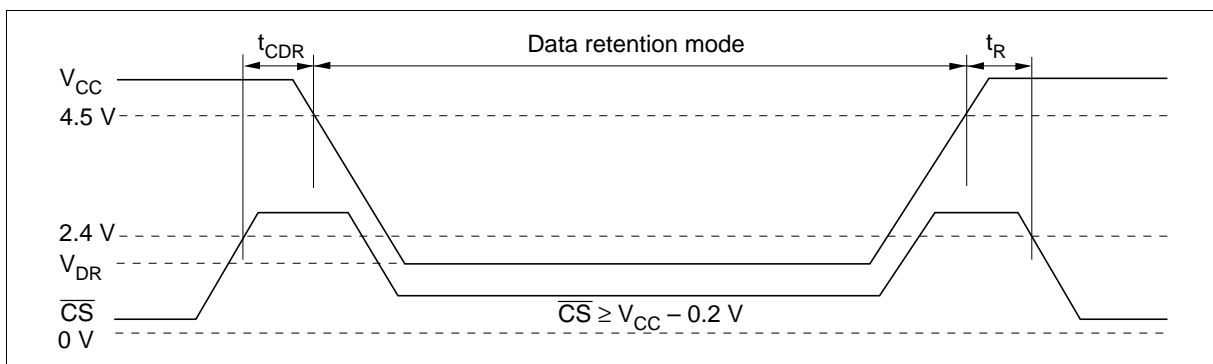
Notes: 1. $10 \mu\text{A}$ (max) at $T_a = -40$ to $+40^\circ\text{C}$.

2. \overline{CS} controls address buffer, \overline{WE} buffer, \overline{OE} buffer, and D_{in} buffer. In data retention mode, V_{in} levels (address, \overline{WE} , \overline{OE} , I/O) can be in the high impedance state.

3. Typical values are at $V_{CC} = 3.0 \text{ V}$, $T_a = +25^\circ\text{C}$ and specified loading, and not guaranteed.

4. t_{RC} = read cycle time.

Low V_{CC} Data Retention Timing Waveform (\overline{CS} Controlled)

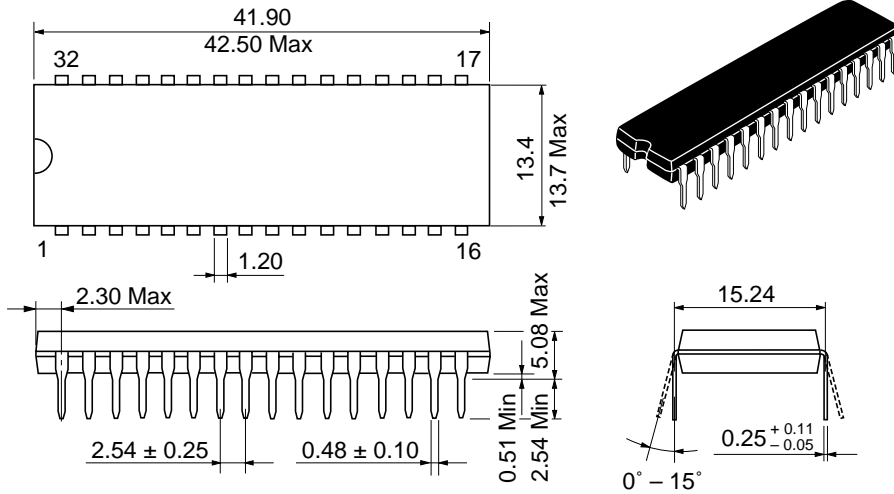


Package Dimensions

HM628512CLPI Series (DP-32)

As of July, 2002

Unit: mm



Hitachi Code	DP-32
JEDEC	—
JEITA	Conforms
Mass (reference value)	5.1 g

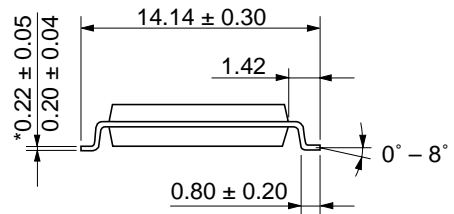
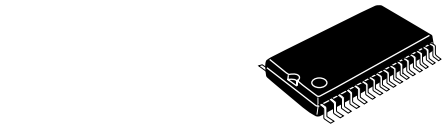
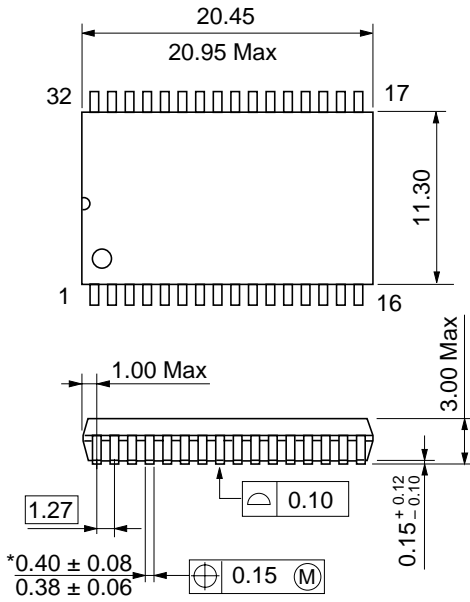
HM628512CI Series

Package Dimensions (cont.)

HM628512CLFPI Series (FP-32D)

As of July, 2002

Unit: mm



*Dimension including the plating thickness
Base material dimension

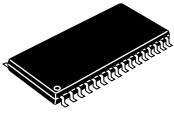
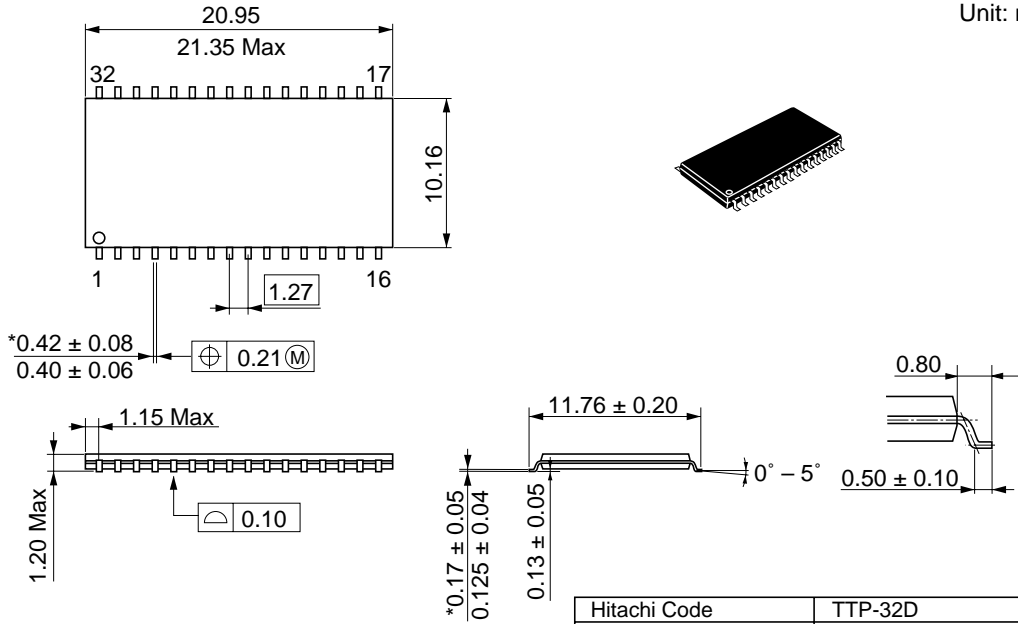
Hitachi Code	FP-32D
JEDEC	Conforms
JEITA	—
Mass (reference value)	1.3 g

Package Dimensions (cont.)

HM628512CLTTI Series (TTP-32D)

As of July, 2002

Unit: mm



*Dimension including the plating thickness
Base material dimension

Hitachi Code	TTP-32D
JEDEC	Conforms
JEITA	—
Mass (reference value)	0.51 g

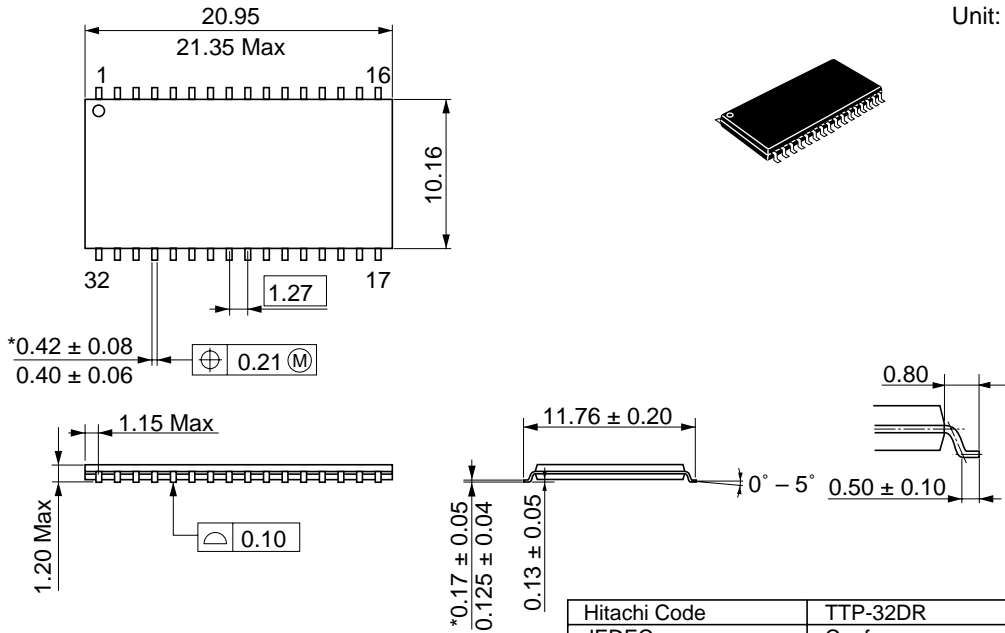
HM628512CI Series

Package Dimensions (cont.)

HM628512CLRR1 Series (TTP-32DR)

As of July, 2002

Unit: mm



Hitachi Code	TTP-32DR
JEDEC	Conforms
JEITA	—
Mass (reference value)	0.51 g

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