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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 $\times$ 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 $\times$ 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

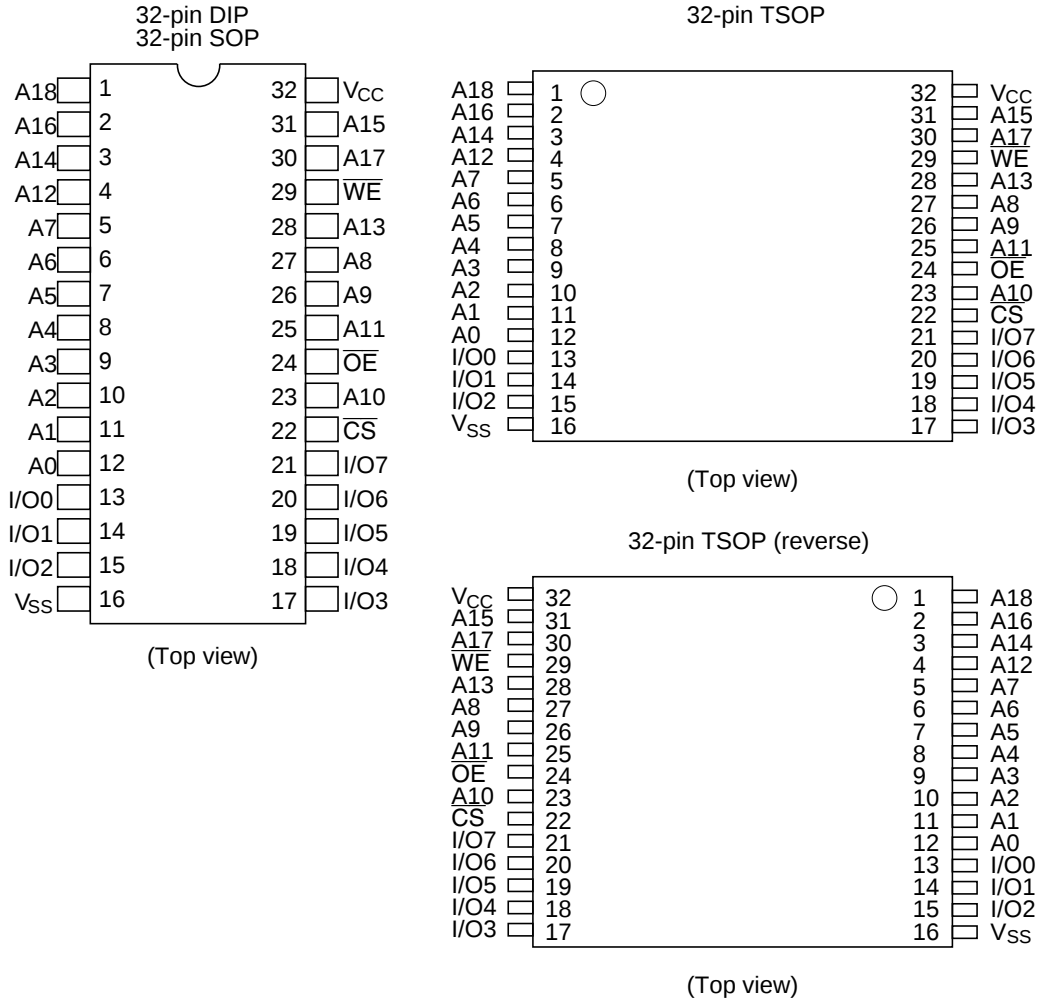
- Single 5 V supply
- Access time: 55/70 ns (max)
- Power dissipation
 - Active: 10 mW/MHz (typ)
 - Standby: 4 μ W (typ)
- Completely static memory. No clock or timing strobe required
- Equal access and cycle times
- Common data input and output: Three state output
- Directly TTL compatible: All inputs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

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)

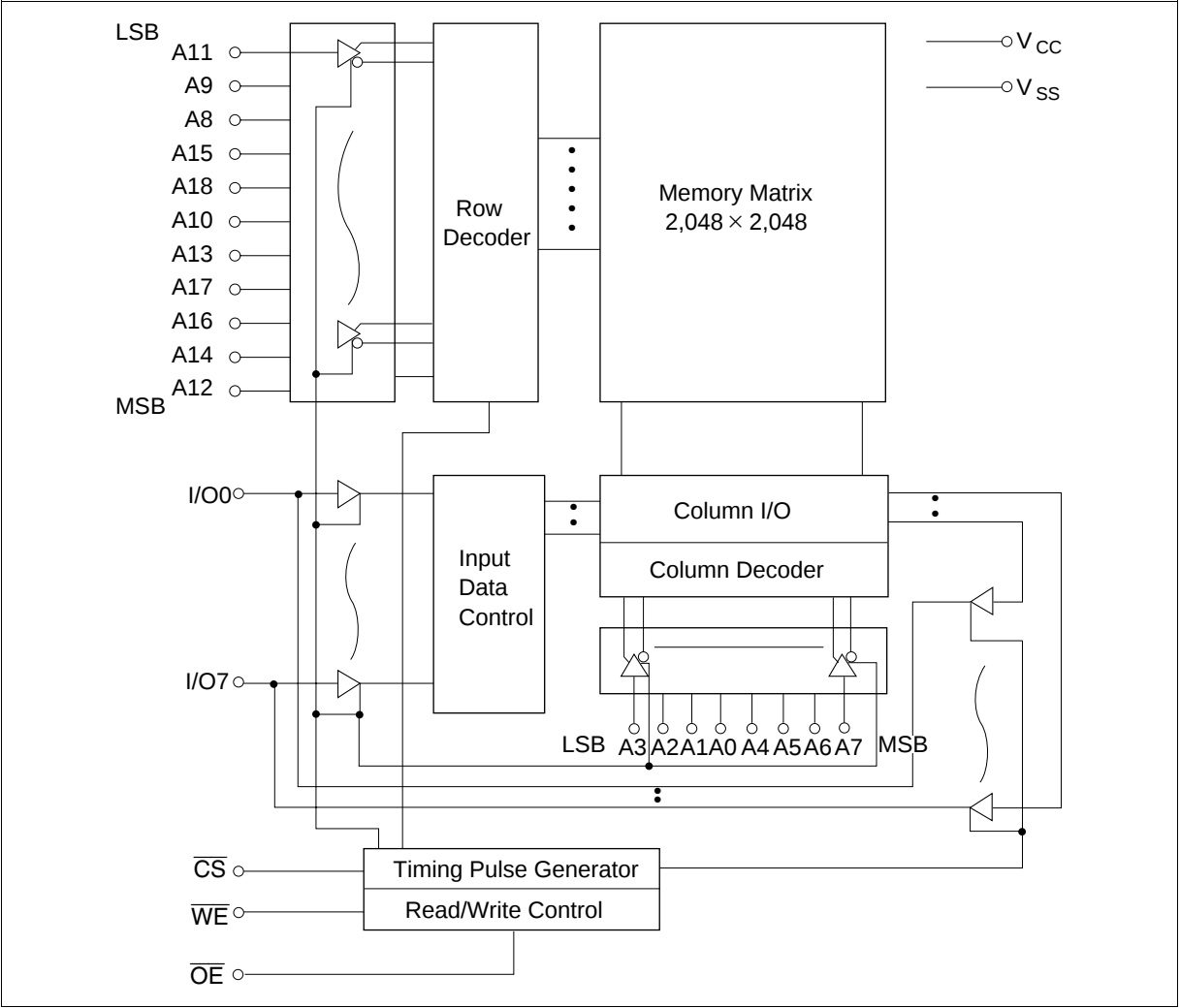
Pin Arrangement



Pin Description

Pin name	Function
A0 to A18	Address input
I/O0 to I/O7	Data input/output
$\overline{CS}$	Chip select
$\overline{OE}$	Output enable
$\overline{WE}$	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 ≤ 30 ns.

2. Maximum voltage is 7.0 V.

Recommended DC Operating Conditions ($T_a = -40$ to +85°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 ≤ 30 ns.

HM628512CI Series

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

		HM628512CI					
		-5		-7			
Parameter	Symbol	Min	Max	Min	Max	Unit	Notes
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

		HM628512CI					
		-5		-7			
Parameter	Symbol	Min	Max	Min	Max	Unit	Notes
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.

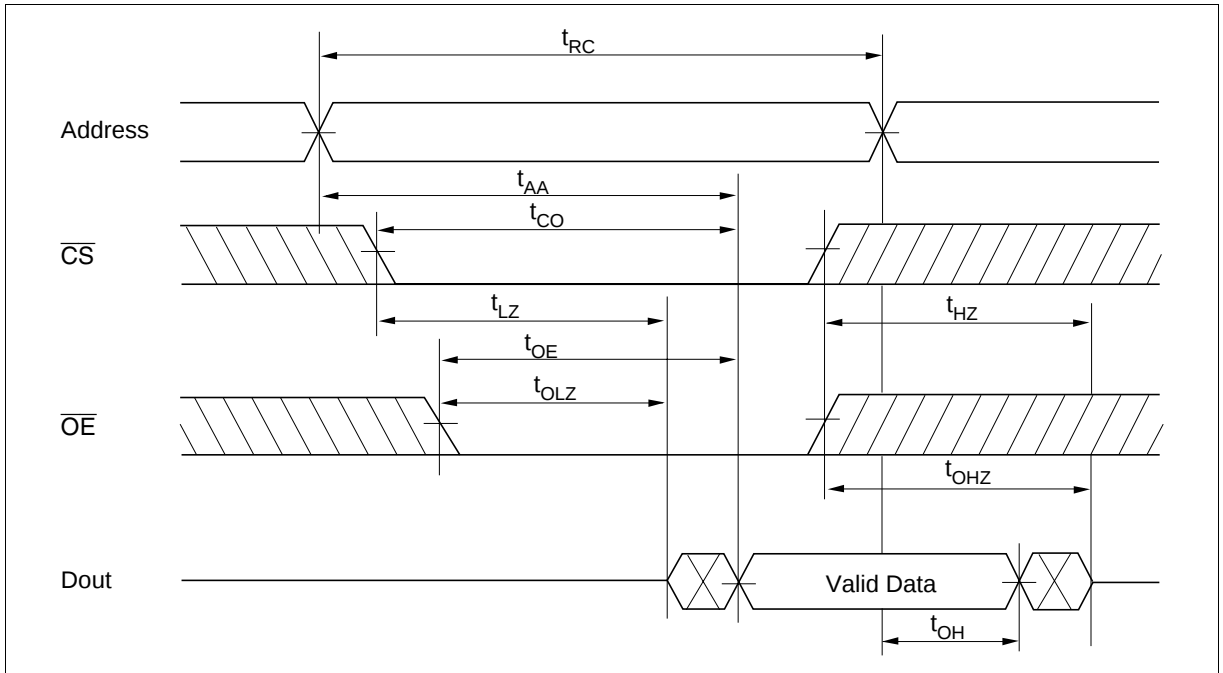
10. Dout is the read data of next address.

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.

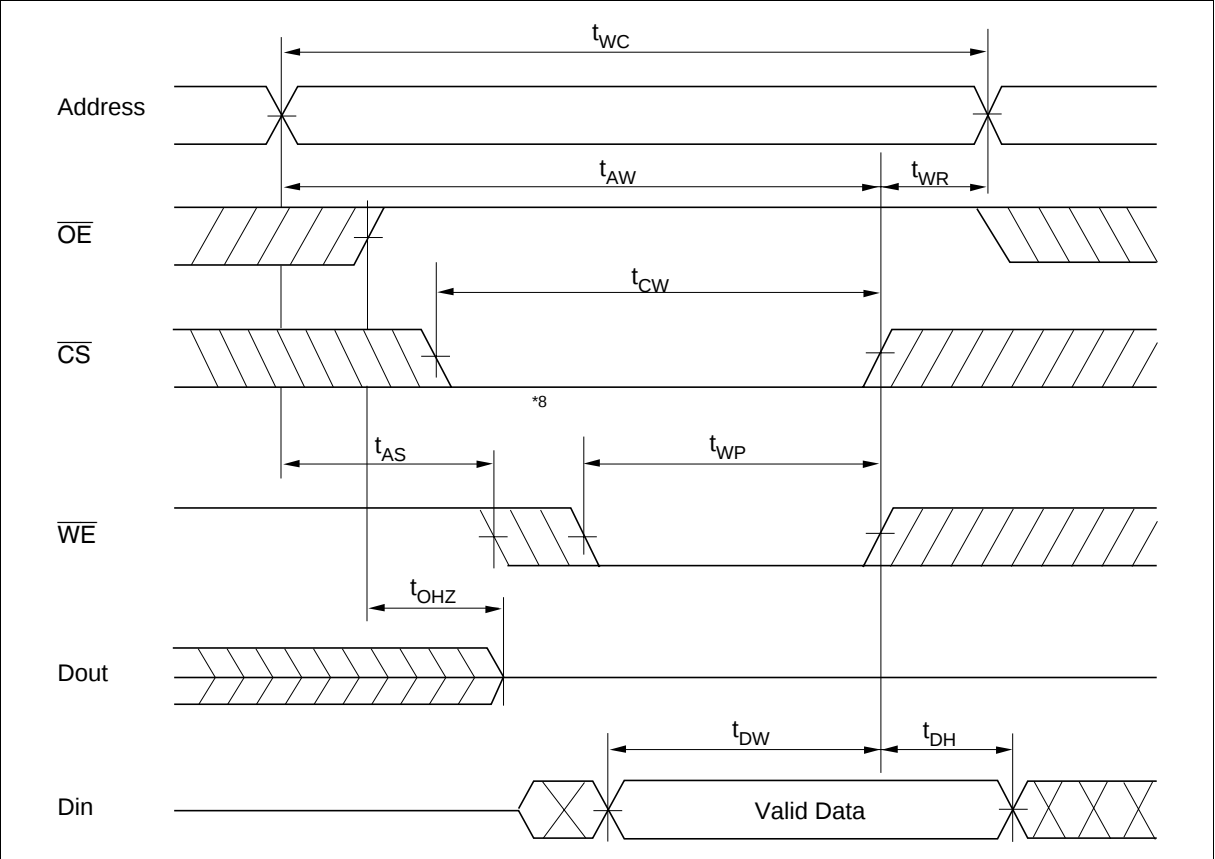
12. In the write cycle with $\overline{OE}$ low fixed, t_{WP} must satisfy the following equation to avoid a problem of data bus contention. $t_{WP} \geq t_{DW} \text{ min} + t_{WHZ} \text{ max}$

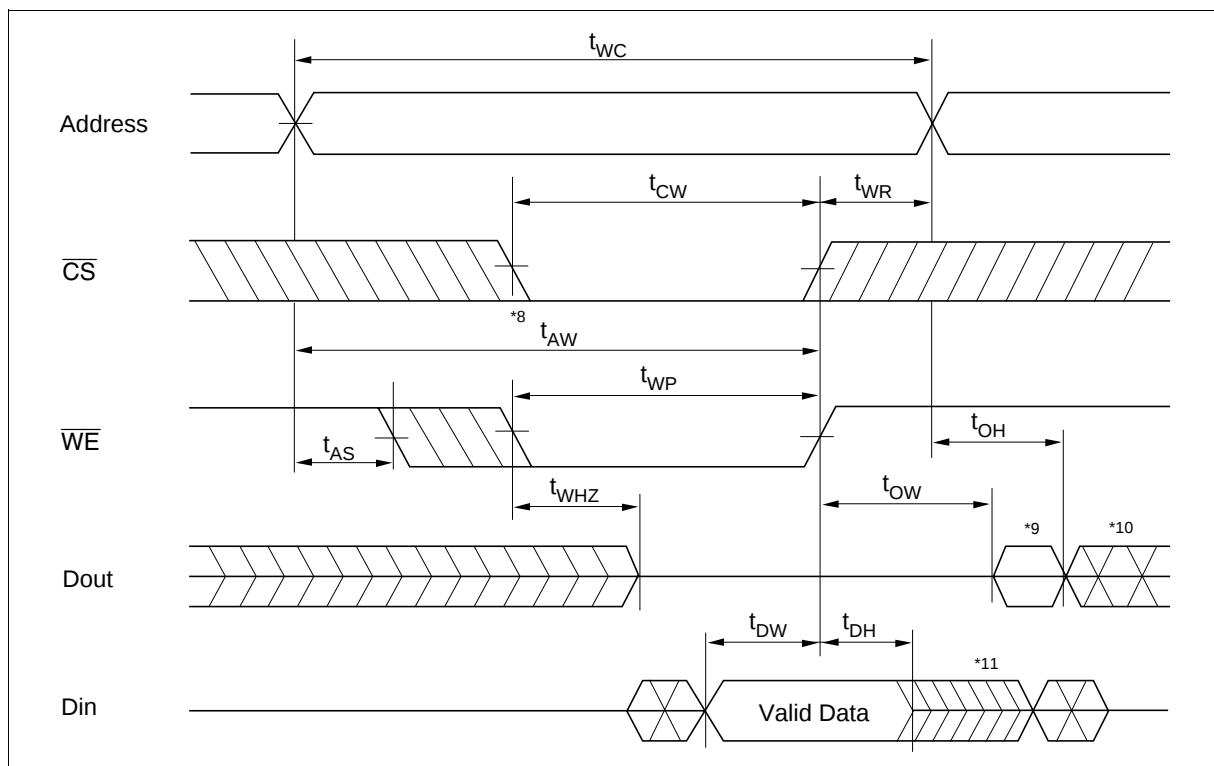
Timing Waveforms

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



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



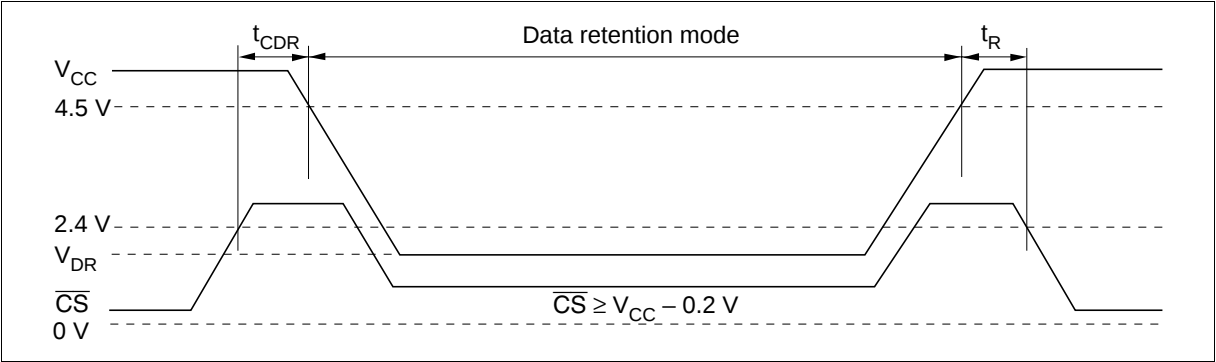
Write Timing Waveform (2) ($\overline{\text{OE}}$ Low Fixed)

Low V_{CC} Data Retention Characteristics (Ta = −40 to +85°C)

Parameter	Symbol	Min	Typ	Max	Unit	Test conditions*2
V _{CC} for data retention	V _{DR}	2	—	—	V	$\overline{CS} \geq V_{CC} - 0.2\text{ V}$, Vin ≥ 0 V
Data retention current	I _{CCDR}	—	0.8*3	20*1	μA	V _{CC} = 3.0 V, Vin ≥ 0 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 μA (max) at Ta = −40 to +40°C.
 - 2. $\overline{CS}$ controls address buffer, $\overline{WE}$ buffer, $\overline{OE}$ buffer, and Din buffer. In data retention mode, Vin levels (address, $\overline{WE}$, $\overline{OE}$, I/O) can be in the high impedance state.
 - 3. Typical values are at V_{CC} = 3.0 V, Ta = +25°C and specified loading, and not guaranteed.
 - 4. t_{RC} = read cycle time.

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

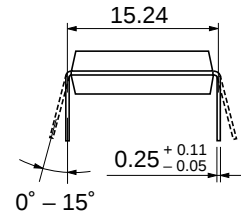
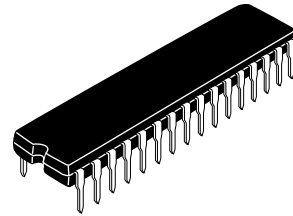
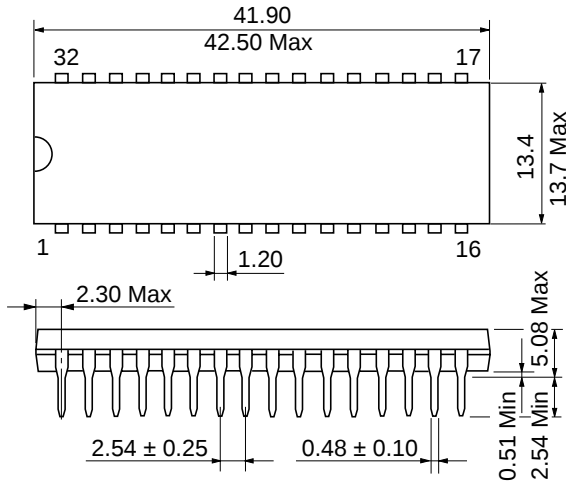


Package Dimensions

HM628512CLPI Series (DP-32)

As of July, 2002

Unit: mm



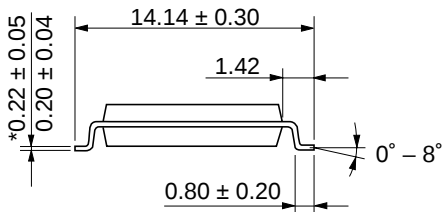
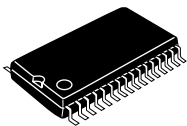
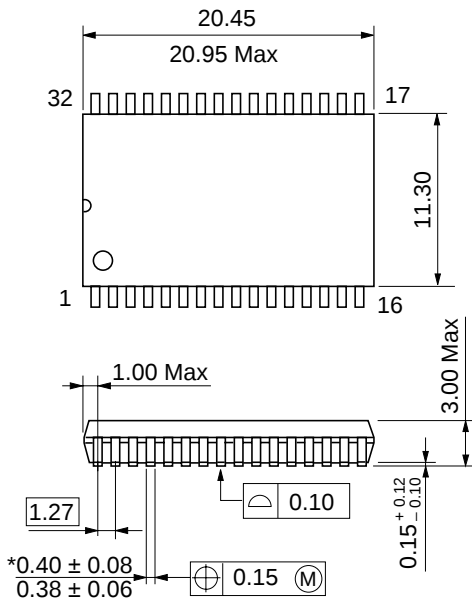
Hitachi Code	DP-32
JEDEC	—
JEITA	Conforms
Mass (reference value)	5.1 g

HM628512CI Series

Package Dimensions (cont.)

HM628512CLFPI Series (FP-32D)

As of July, 2002
Unit: mm



*Dimension including the plating thickness
Base material dimension

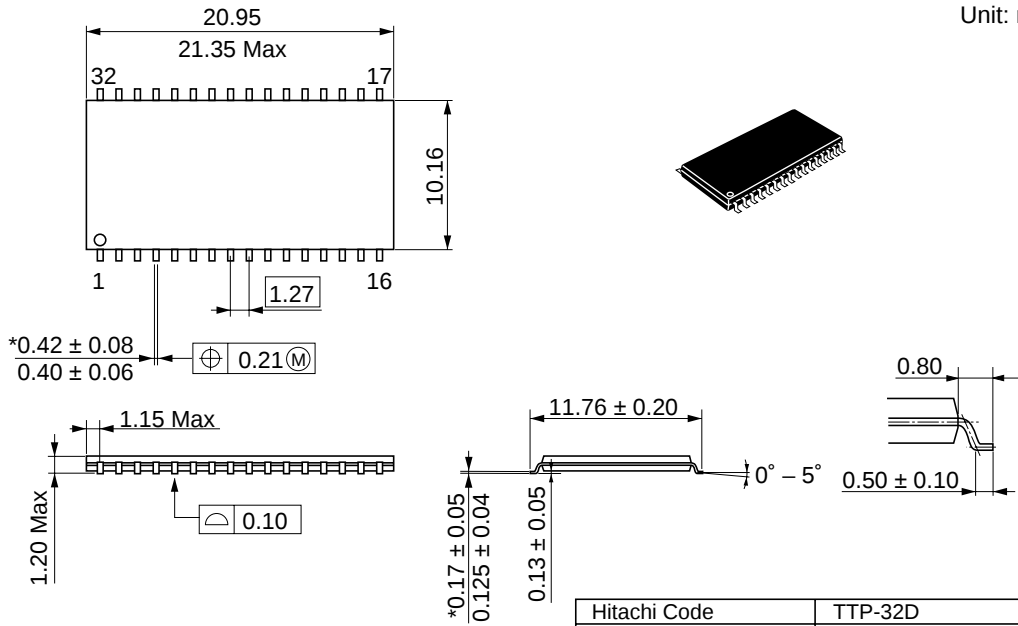
Hitachi Code	FP-32D
JEDEC	Conforms
JEITA	—
Mass (reference value)	1.3 g

Package Dimensions (cont.)

HM628512CLTTI Series (TTP-32D)

As of July, 2002

Unit: mm



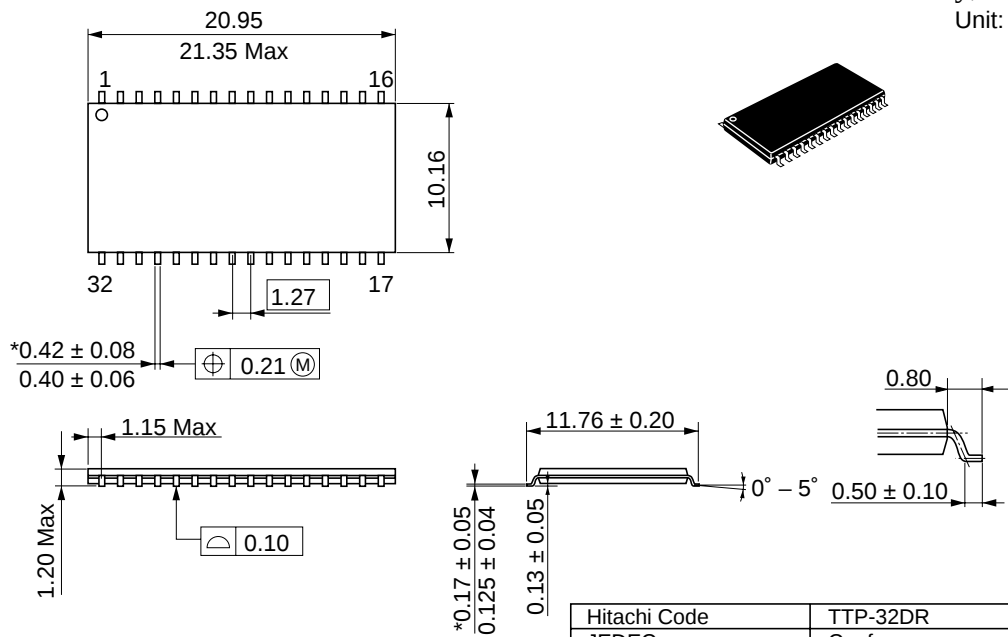
*Dimension including the plating thickness
Base material dimension

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

Package Dimensions (cont.)

HM628512CLRRI Series (TTP-32DR)

As of July, 2002
Unit: mm



*Dimension including the plating thickness
Base material dimension

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

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