
HM628512BI Series

4 M SRAM (512-kword $\times$ 8-bit)

HITACHI

ADE-203-935C (Z)

Rev. 2.0

Aug. 24, 1999

Description

The Hitachi HM628512BI is a 4-Mbit static RAM organized 512-kword $\times$ 8-bit. HM628512BI Series has realized higher density, higher performance and low power consumption by employing Hi-CMOS process technology. The HM628512BI 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

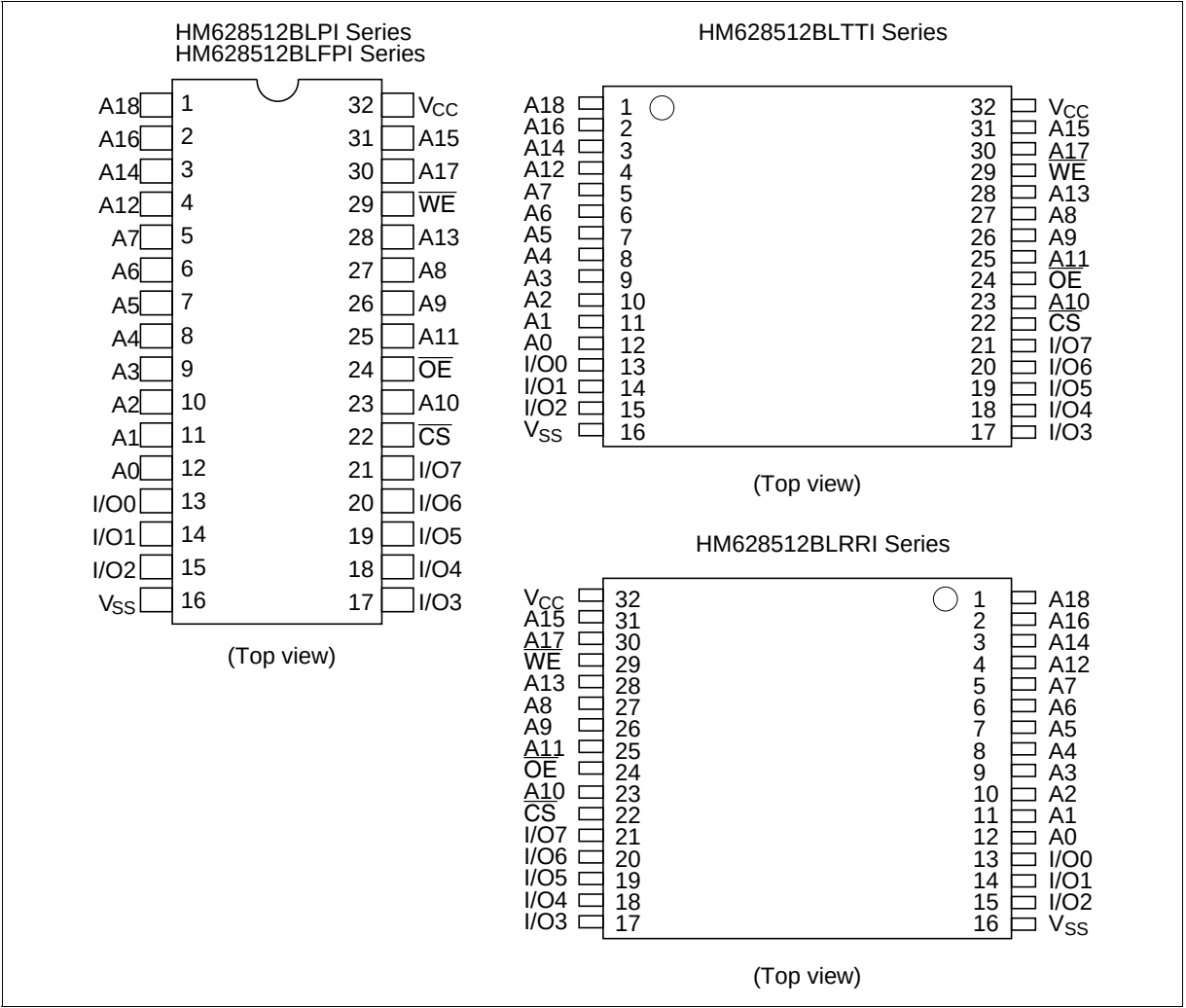
- Single 5 V supply
- Access time: 70/85 ns (max)
- Power dissipation
 - Active: 50 mW/MHz (typ)
 - Standby: 10 μ W (typ)
- Completely static memory. No clock or timing strobe required
- Equal access and cycle times
- Common data input and output: Three state output
- Directly TTL compatible: All inputs and outputs
- Battery backup operation
- Operating temperature: -40 to $+85^{\circ}\text{C}$

HM628512BI Series

Ordering Information

Type No.	Access time	Package
HM628512BLPI-7	70 ns	600-mil 32-pin plastic DIP (DP-32)
HM628512BLPI-8	85 ns	
HM628512BLFPI-7	70 ns	525-mil 32-pin plastic SOP (FP-32D)
HM628512BLFPI-8	85 ns	
HM628512BLTTI-7	70 ns	400-mil 32-pin plastic TSOP II (TTP-32D)
HM628512BLTTI-8	85 ns	
HM628512BLRRI-7	70 ns	400-mil 32-pin plastic TSOP II reverse (TTP-32DR)
HM628512BLRRI-8	85 ns	

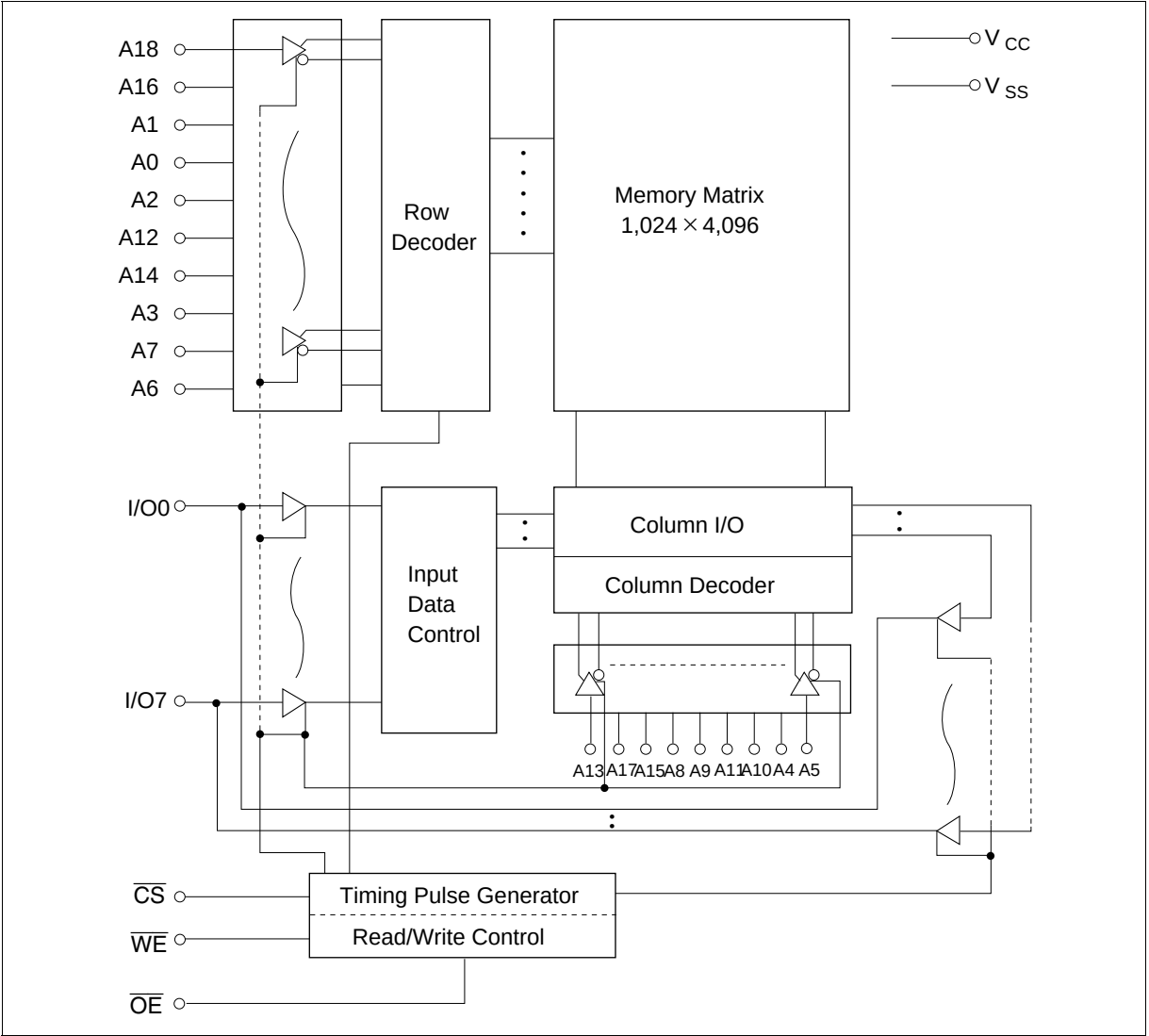
Pin Arrangement



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

WE	CS	OE	Mode	V _{CC} current	Dout pin	Ref. cycle
×	H	×	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: ×: 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. −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. −3.0 V for pulse half-width ≤ 30 ns

DC Characteristics (Ta = -40 to +85°C, V_{CC} = 5 V ±10% , V_{SS} = 0 V)

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}	—	8	15	mA	$\overline{CS} = V_{IL}$, others = V _{IH} /V _{IL} , I _{I/O} = 0 mA
Operating power supply current	I _{CC1}	—	45	70	mA	Min cycle, duty = 100% $\overline{CS} = V_{IL}$, others = V _{IH} /V _{IL} I _{I/O} = 0 mA
Operating power supply current	I _{CC2}	—	10	20	mA	Cycle time = 1 μs, duty = 100% I _{I/O} = 0 mA, $\overline{CS} \leq 0.2$ V V _{IH} ≥ V _{CC} - 0.2 V, V _{IL} ≤ 0.2 V
Standby power supply current: DC	I _{SB}	—	1	3	mA	$\overline{CS} = V_{IH}$
Standby power supply current (1): DC	I _{SB1}	—	2	100	μA	V _{in} ≥ 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

Note: 1. Typical values are at V_{CC} = 5.0 V, Ta = +25°C and specified loading, and not guaranteed.

Capacitance (Ta = +25°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	pF	V _{I/O} = 0 V

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

AC Characteristics (Ta = -40 to +85°C, V_{CC} = 5 V ± 10%, unless otherwise noted.)

Test Conditions

- Input pulse levels: 0.5 V to 2.5 V
- Input rise and fall time: 5 ns
- Input and output timing reference levels: 1.5 V
- Output load: 1 TTL Gate + C_L (100 pF) (Including scope and jig)

Read Cycle

		HM628512BI					
		-7		-8			
Parameter	Symbol	Min	Max	Min	Max	Unit	Notes
Read cycle time	t _{RC}	70	—	85	—	ns	
Address access time	t _{AA}	—	70	—	85	ns	
Chip select access time	t _{CO}	—	70	—	85	ns	
Output enable to output valid	t _{OE}	—	35	—	45	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	25	0	30	ns	1, 2
Output disable to output in high-Z	t _{OHZ}	0	25	0	30	ns	1, 2
Output hold from address change	t _{OH}	10	—	10	—	ns	

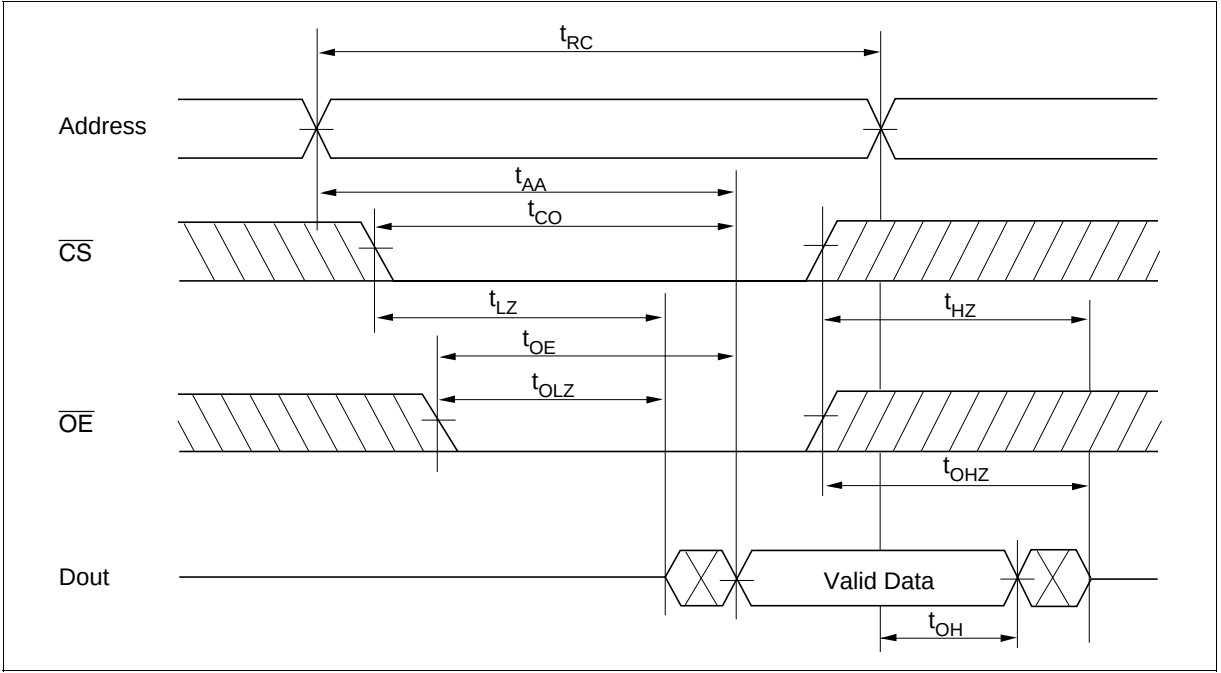
Write Cycle

		HM628512BI					
		-7		-8			
Parameter	Symbol	Min	Max	Min	Max	Unit	Notes
Write cycle time	t _{WC}	70	—	85	—	ns	
Chip selection to end of write	t _{CW}	60	—	75	—	ns	4
Address setup time	t _{AS}	0	—	0	—	ns	5
Address valid to end of write	t _{AW}	60	—	75	—	ns	
Write pulse width	t _{WP}	50	—	55	—	ns	3, 12
Write recovery time	t _{WR}	0	—	0	—	ns	6
$\overline{WE}$ to output in high-Z	t _{WHZ}	0	25	0	30	ns	1, 2, 7
Data to write time overlap	t _{DW}	30	—	35	—	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	25	0	30	ns	1, 2, 7

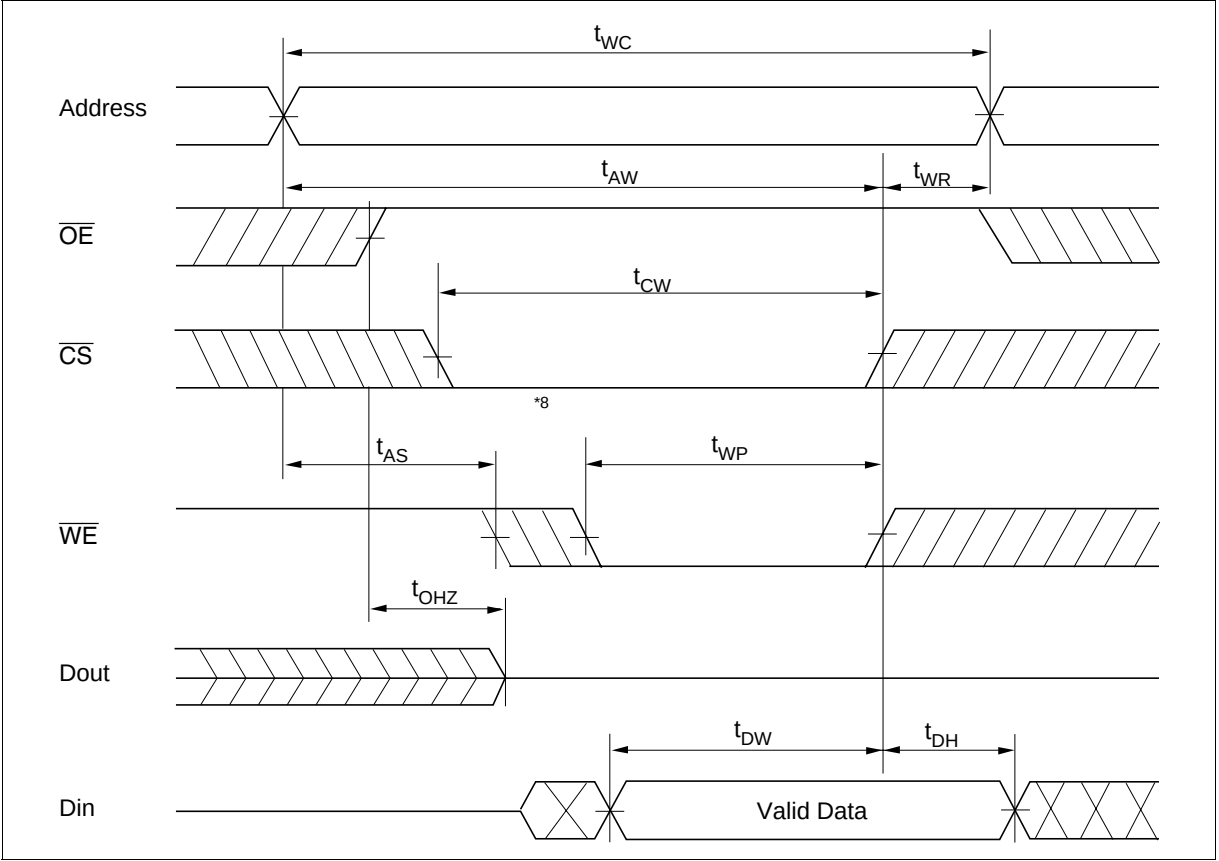
- Notes:
1. t_{HZ} , t_{OHZ} and t_{WHZ} are defined as the time at which the outputs achieve the open circuit conditions and are not referred to output voltage levels.
 2. This parameter is sampled and not 100% tested.
 3. A write occurs during the overlap (t_{WP}) of a low $\overline{CS}$ and a low $\overline{WE}$. 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

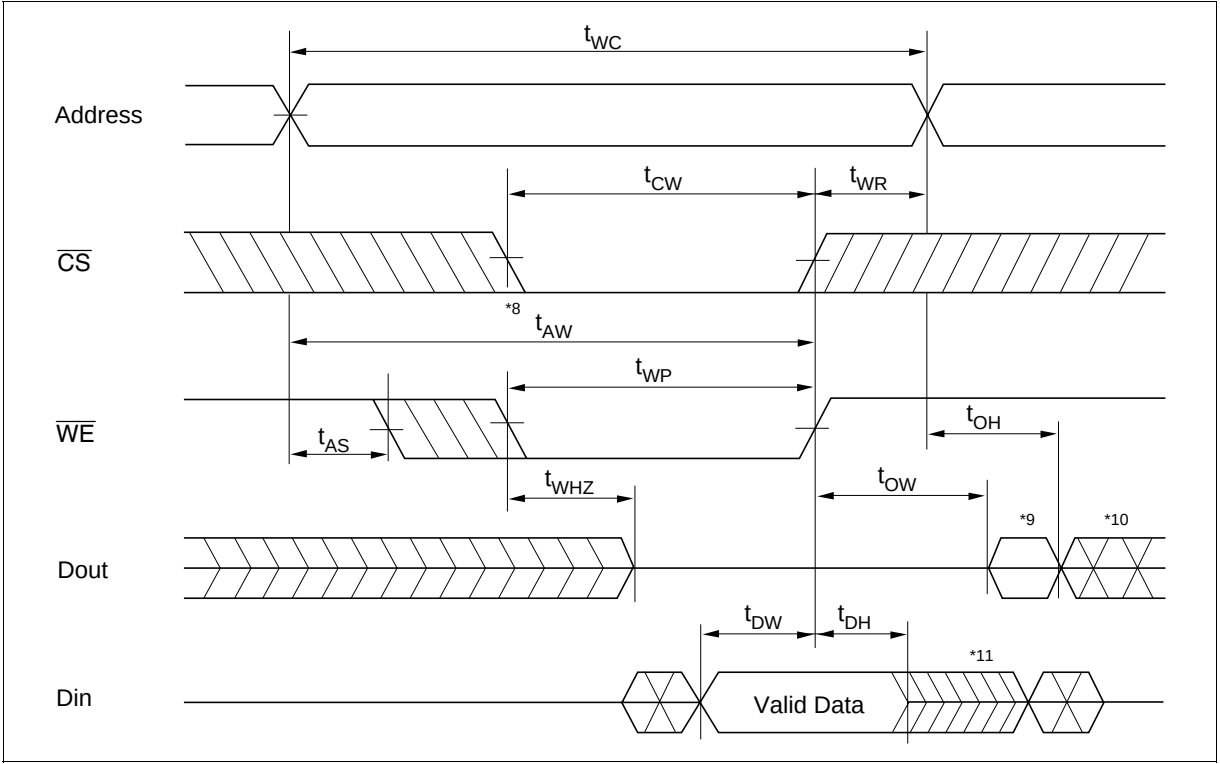
Read Timing Waveform ($\overline{WE} = V_{IH}$)



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



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

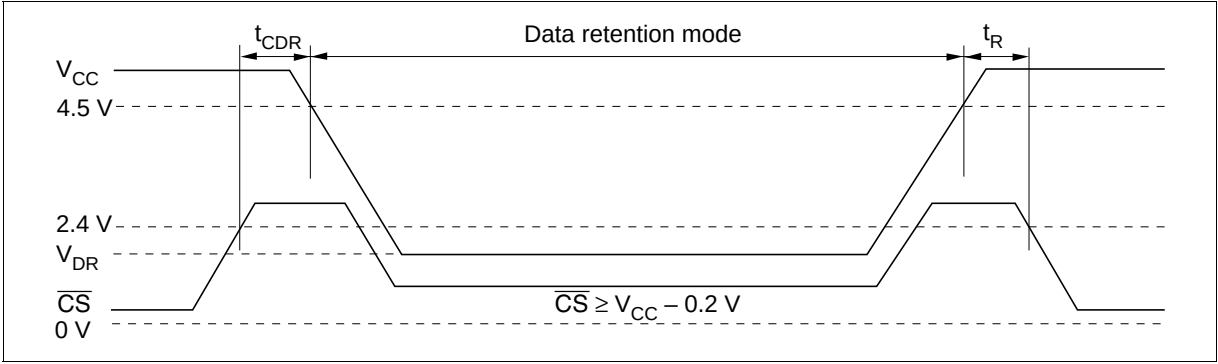


Low V_{CC} Data Retention Characteristics (Ta = -40 to +85°C)

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}	—	1* ³	50* 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. For L-version and 20 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.

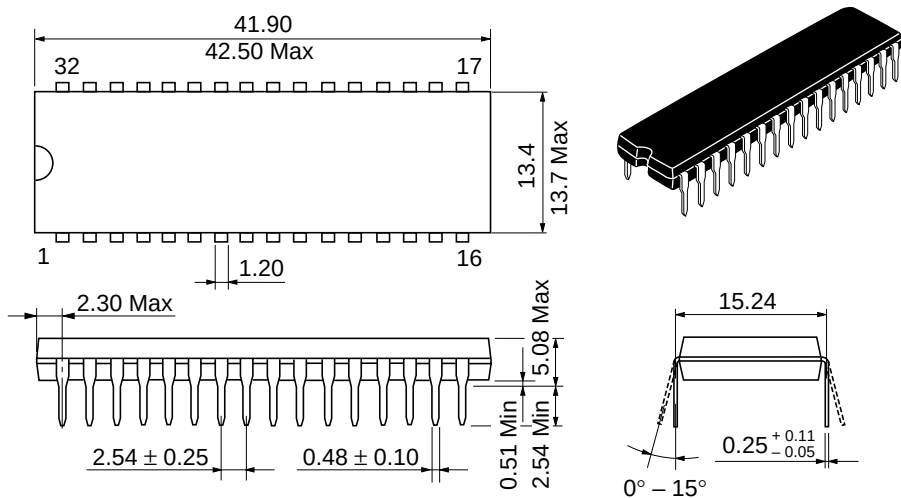
Low V_{CC} Data Retention Timing Waveform ($\overline{CS}$ Controlled)



Package Dimensions

HM628512BLPI Series (DP-32)

Unit: mm

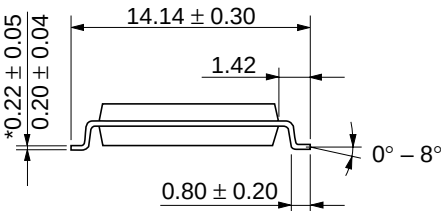
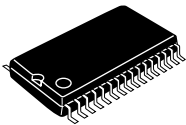
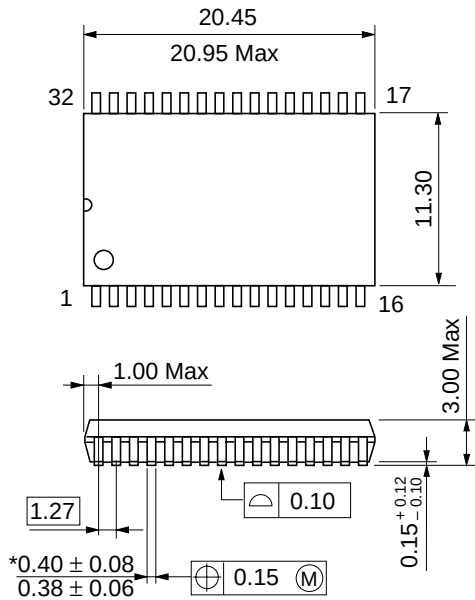


Hitachi Code	DP-32
JEDEC	—
EIAJ	Conforms
Weight (reference value)	5.1 g

Package Dimensions (cont.)

HM628512BLFPI Series (FP-32D)

Unit: mm



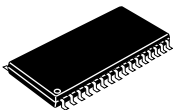
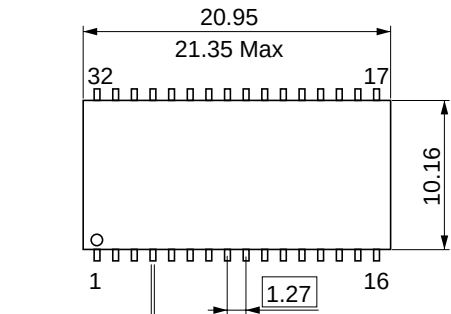
*Dimension including the plating thickness
Base material dimension

Hitachi Code	FP-32D
JEDEC	Conforms
EIAJ	—
Weight (reference value)	1.3 g

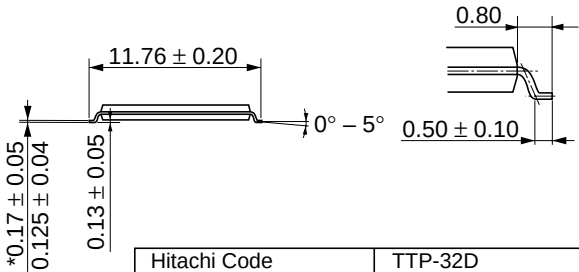
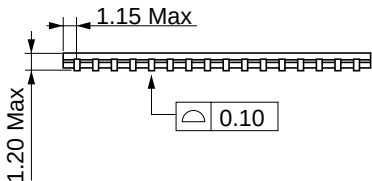
Package Dimensions (cont.)

HM628512BLTTI Series (TTP-32D)

Unit: mm



* 0.42 ± 0.08
 0.40 ± 0.06



*Dimension including the plating thickness
Base material dimension

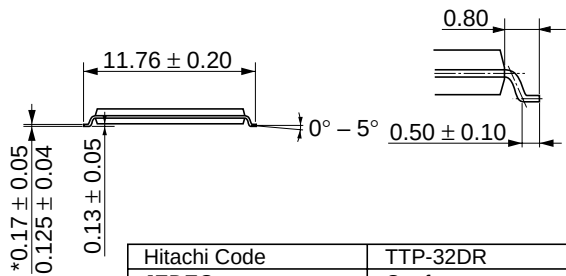
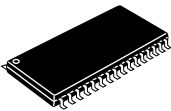
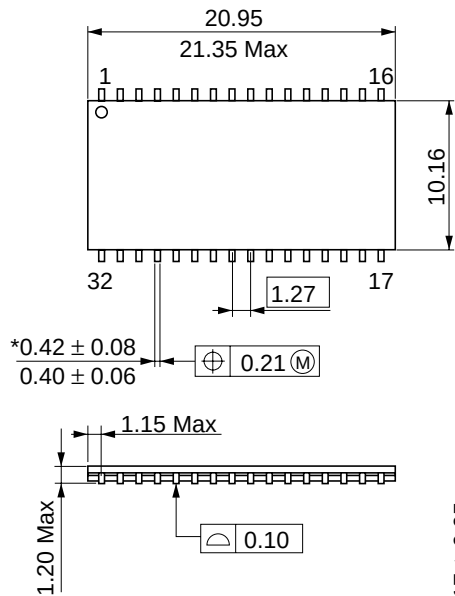
Hitachi Code	TTP-32D
JEDEC	Conforms
EIAJ	—
Weight (reference value)	0.51 g

HM628512BI Series

Package Dimensions (cont.)

HM628512BLRRI Series (TTP-32DR)

Unit: mm



*Dimension including the plating thickness
Base material dimension

Hitachi Code	TTP-32DR
JEDEC	Conforms
EIAJ	—
Weight (reference value)	0.51 g

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Revision Record

Rev.	Date	Contents of Modification	Drawn by	Approved by
0.0	Nov. 2, 1998	Initial issue	K. Imato	K. Imato
0.1	Dec. 14, 1998	DC Characteristics I _{CC1} : —/40/60 mA to —/45/70 mA I _{SBI} max: 40 μA to 100 μA Low V _{CC} Data Retention Characteristics I _{CCDR} max: 20 μA to 50 μA t _R min: 5 ms to t _{RC} ms Change of note1 Addition of note4	S. Kunito	K. Imato
1.0	Jul. 2, 1999	Deletion of Preliminary	S. Kunito	K. Imato
2.0	Aug. 24, 1999	Low V _{CC} Data Retention Characteristics Correct error: t _R unit ms to ns		