
HM628512AI Series

524288-word \times 8-bit High Speed CMOS Static RAM

HITACHI

ADE-203-791 (Z)

Preliminary

Rev. 0.0

Jun. 20, 1997

Description

The Hitachi HM628512AI is a 4-Mbit static RAM organized 512-kword \times 8-bit. It realizes higher density, higher performance and low power consumption by employing 0.5 μm Hi-CMOS process technology. The device, packaged in a 525-mil SOP (foot print pitch width) or 400-mil TSOP TYPE II or 600-mil plastic DIP, is available for high density mounting. L-version is suitable for battery backup system.

Features

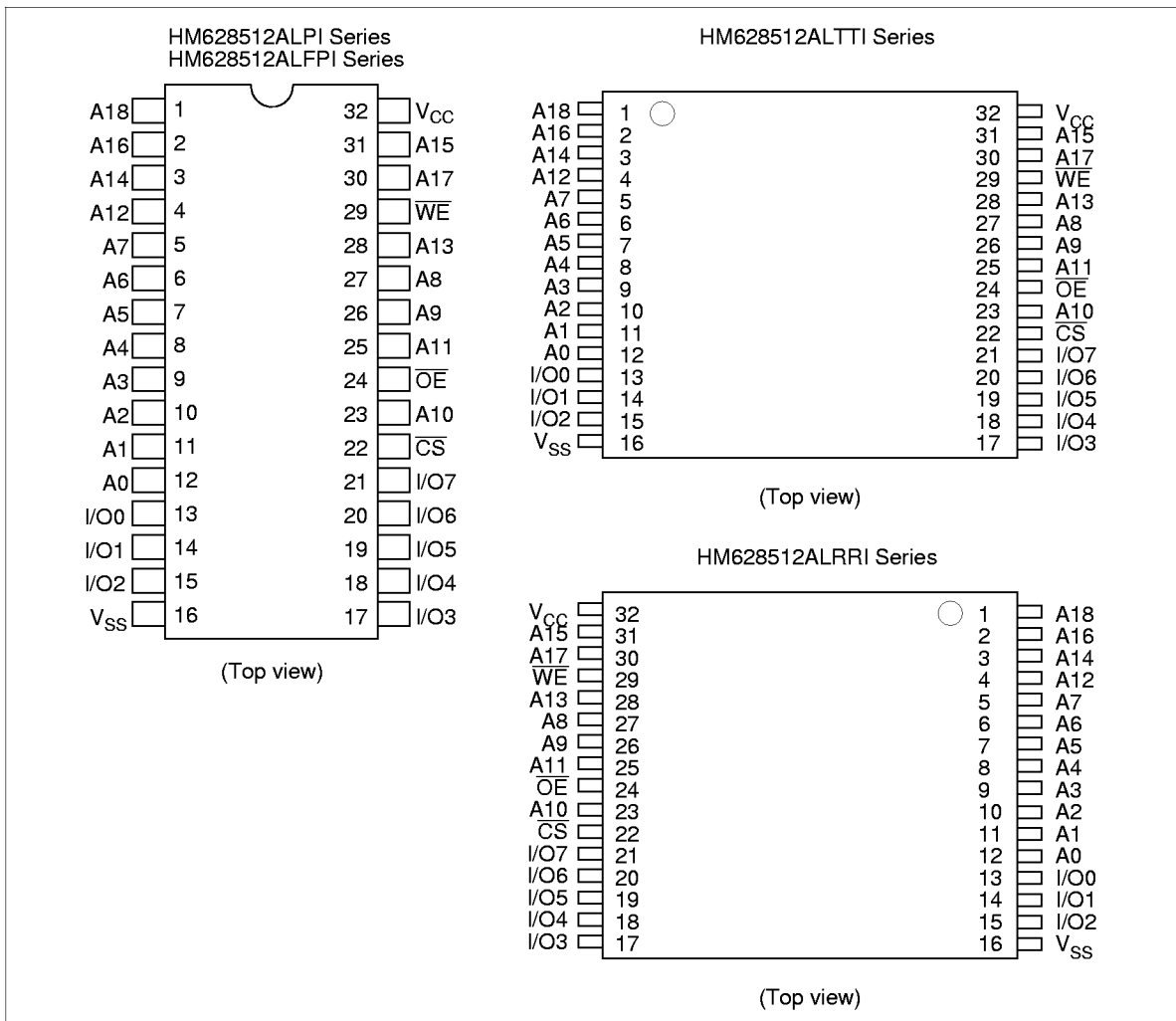
- Single 5 V supply: 5.0 V \pm 10%
- Access time: 70/85 ns (max)
- Power dissipation
 - Active: 50 mW/MHz (typ)
 - Standby: 10 μW (typ)
- Completely static memory
 - No clock or timing strobe required
- Equal access and cycle times
- Common data input and output
 - Three state output
- Directly TTL compatible
 - All inputs and outputs
- Battery backup operation
- Operating temperature: -40 to 85°C

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Ordering Information

Type No.	Access time	Package
HM628512ALPI-7	70 ns	600-mil 32-pin plastic DIP (DP-32)
HM628512ALPI-8	85 ns	
HM628512ALFPI-7	70 ns	525-mil 32-pin plastic SOP (FP-32D)
HM628512ALFPI-8	85 ns	
HM628512ALTTI-7	70 ns	400-mil 32-pin plastic TSOP II (TTP-32D)
HM628512ALTTI-8	85 ns	
HM628512ALRRI-7	70 ns	400-mil 32-pin plastic TSOP II reverse (TTP-32DR)
HM628512ALRRI-8	85 ns	

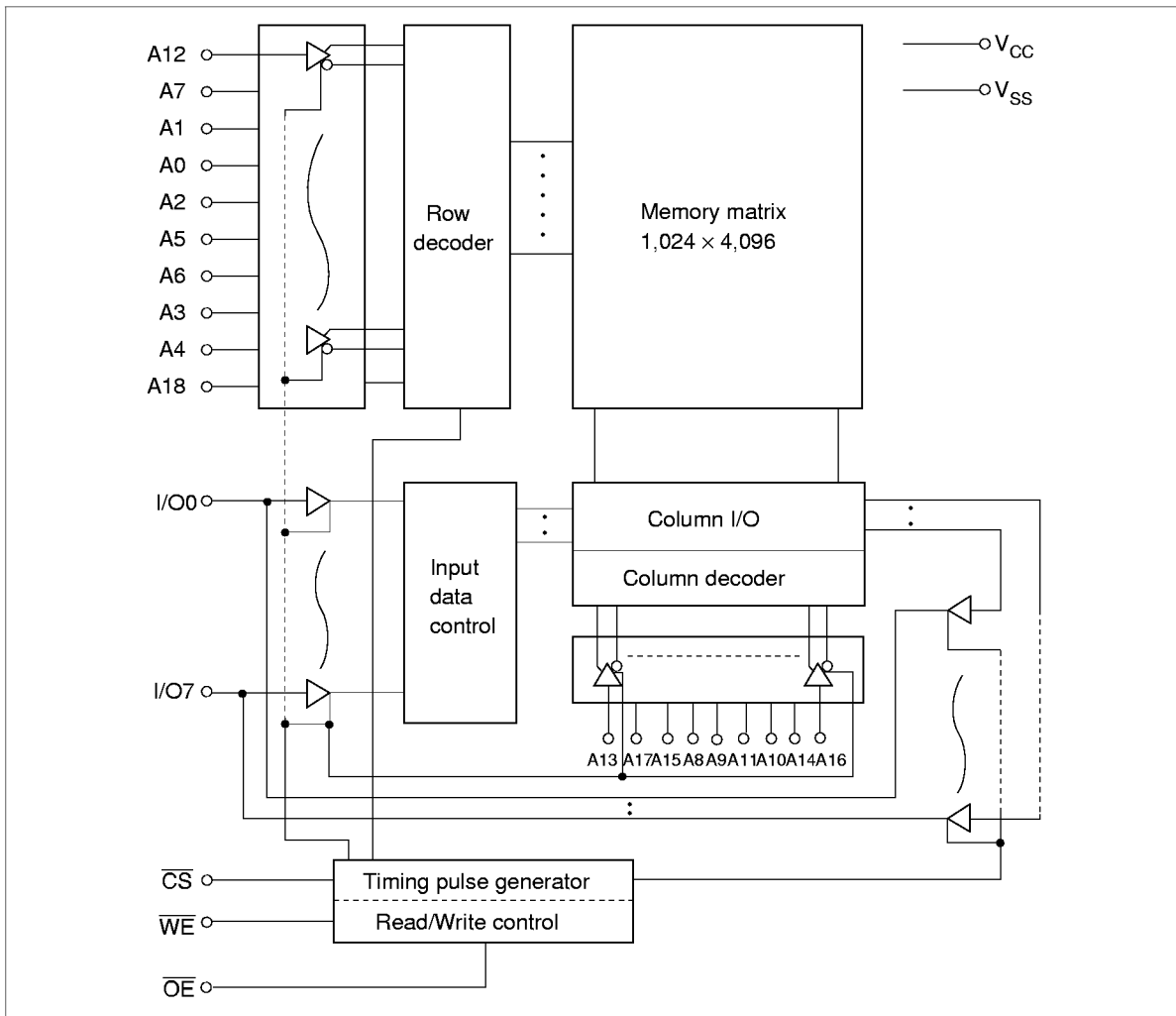
Pin Arrangement



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



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Function Table

\overline{WE}	\overline{CS}	\overline{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 relative to V_{SS}	V_{CC}	-0.5 to +7.0	V
Terminal 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

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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 current	I _{CC}	—	8	15	mA	$\overline{CS} = V_{IL}$, others = V _{IH} /V _{IL} , I _{I/O} = 0 mA
Average operating current	I _{CC1}	—	45	70	mA	Min cycle, duty = 100% $\overline{CS} = V_{IL}$, others = V _{IH} /V _{IL} I _{I/O} = 0 mA
	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 current	I _{SB}	—	1	3	mA	$\overline{CS} = V_{IH}$
	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

Notes: 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.

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

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 & jig)

Read Cycle

Parameter	Symbol	HM628512AI				Unit	Notes
		-7		-8			
		Min	Max	Min	Max		
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 select 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 deselect 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

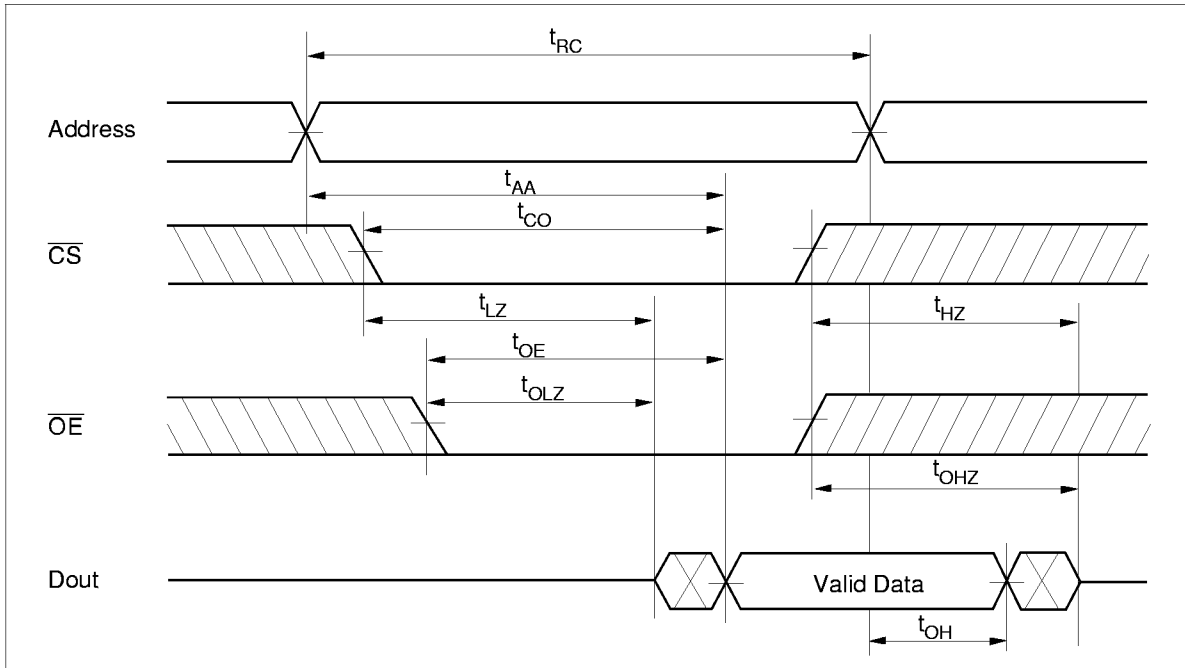
Parameter	Symbol	HM628512AI				Unit	Notes
		-7		-8			
		Min	Max	Min	Max		
Write cycle time	t_{WC}	70	—	85	—	ns	
Chip select to end of write	t_{CW}	60	—	75	—	ns	4
Address setup time	t_{AS}	0	—	0	—	ns	5
Address valid to end of write	t_{AW}	60	—	75	—	ns	
Write pulse width	t_{WP}	50	—	55	—	ns	3, 12
Write 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:
- 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.
 - This parameter is sampled and not 100% tested.
 - 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.
 - t_{CW} is measured from \overline{CS} going low to the end of write.
 - t_{AS} is measured from the address valid to the beginning of write.
 - t_{WR} is measured from the earlier of \overline{WE} or \overline{CS} going high to the end of write cycle.
 - 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.
 - 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.
 - Dout is the same phase of the write data of this write cycle.
 - Dout is the read data of next address.
 - 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.
 - In the write cycle with \overline{OE} low fixed, t_{WP} must satisfy the following equation to avoid a problem of data bus contention. $t_{WP} \geq t_{DW} \text{ min} + t_{WHZ} \text{ max}$

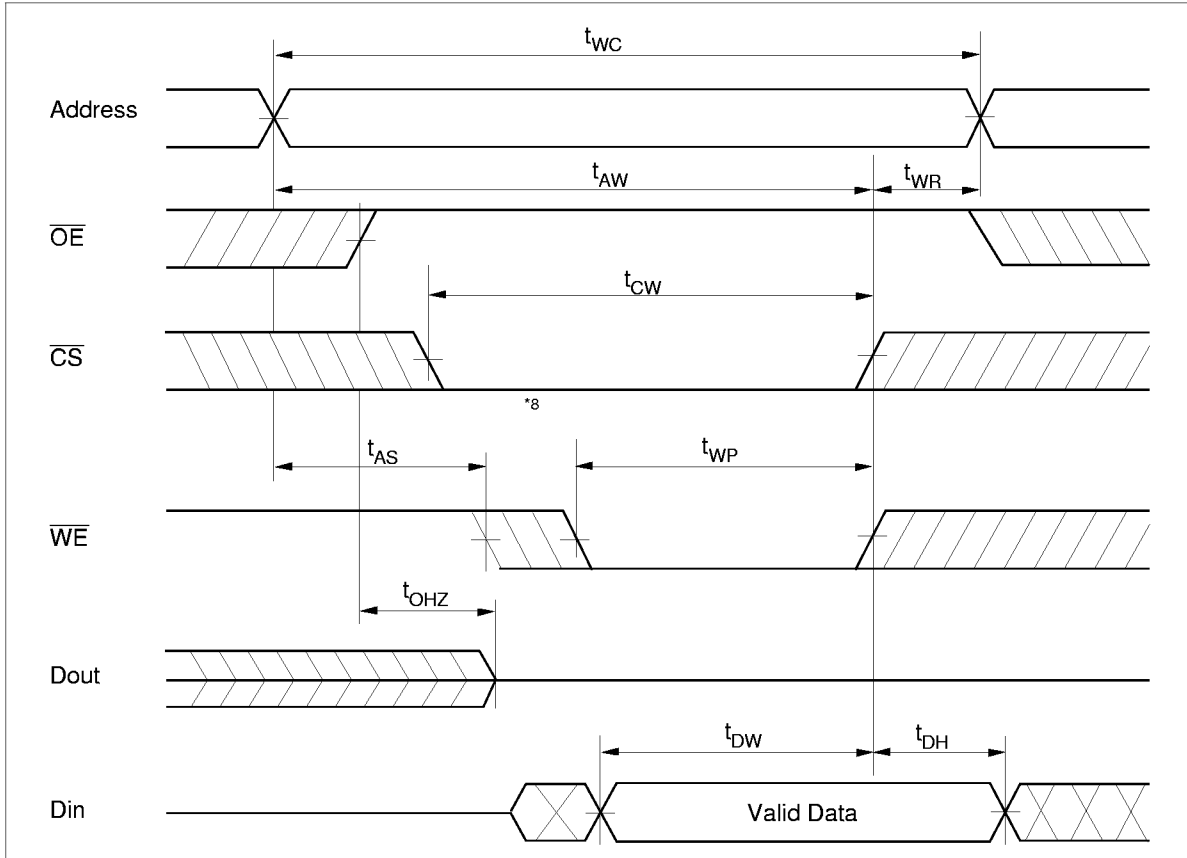
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Timing Waveforms

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

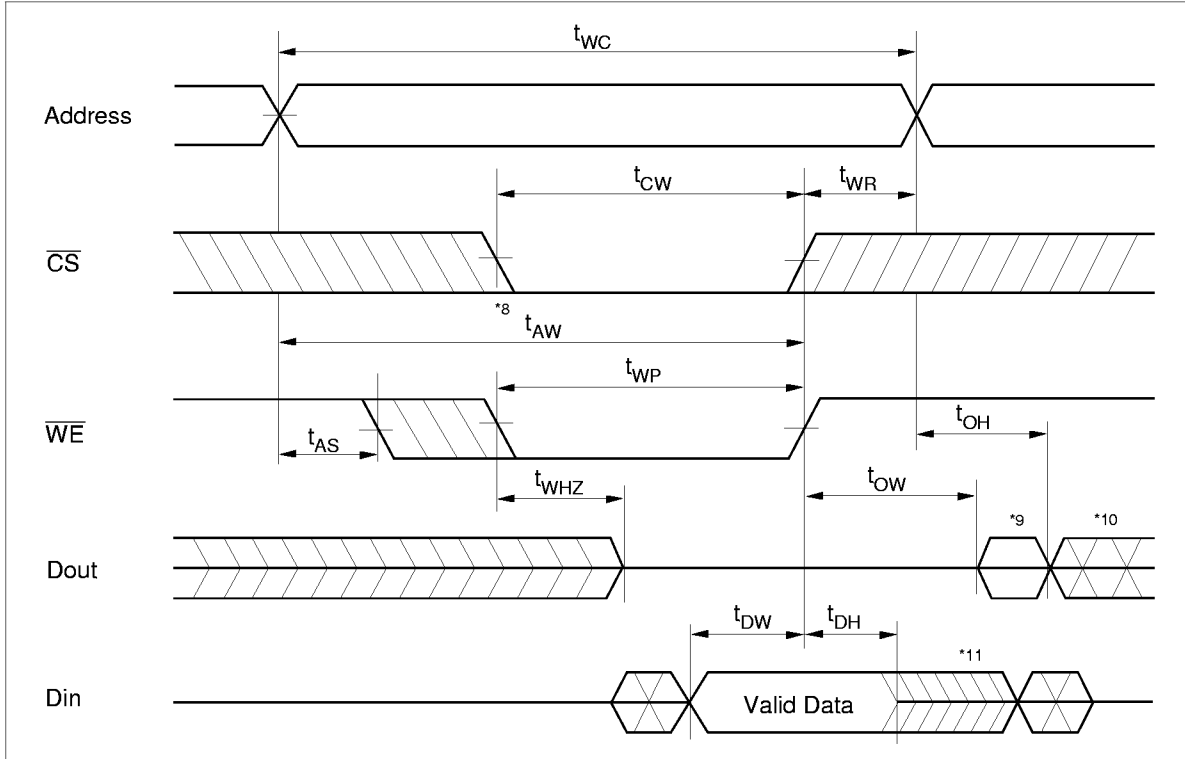


Write Timing Waveform (1) ($\overline{\text{OE}}$ Clock)



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

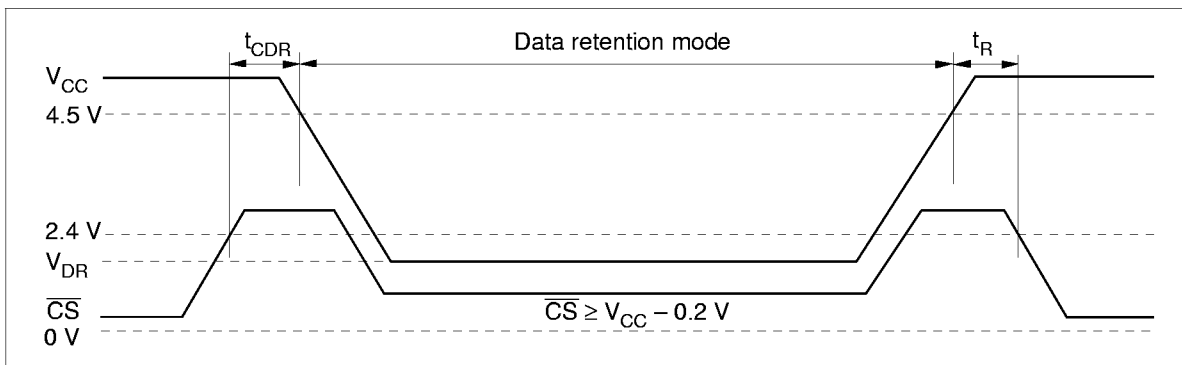


Low V_{CC} Data Retention Characteristics ($T_a = -40$ to $+85^\circ\text{C}$)

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}	—	1*3	50*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	5	—	—	ms	

- Notes: 1. 20 μA (max) at $T_a = -40$ to 40°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.

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

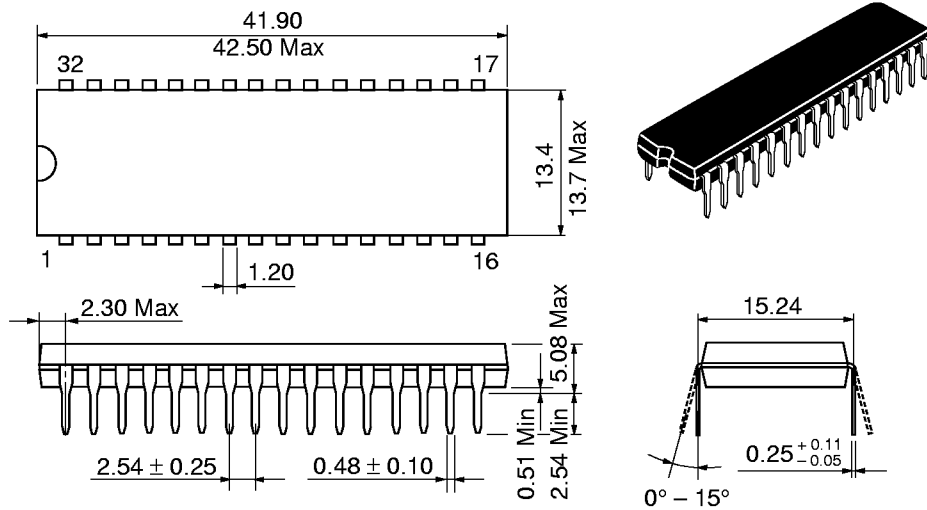


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Package Dimensions

HM628512ALPI Series (DP-32)

Unit: mm

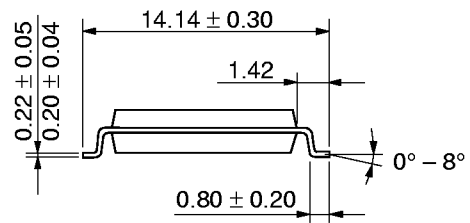
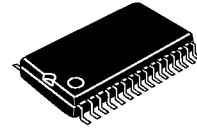
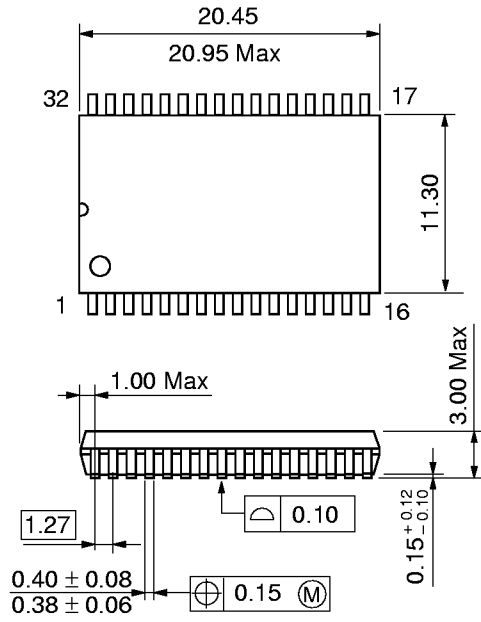


Hitachi Code	DP-32
JEDEC Code	—
EIAJ Code	SC-613
Weight (reference value)	5.1 g

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HM628512ALFPI Series (FP-32D)

Unit: mm



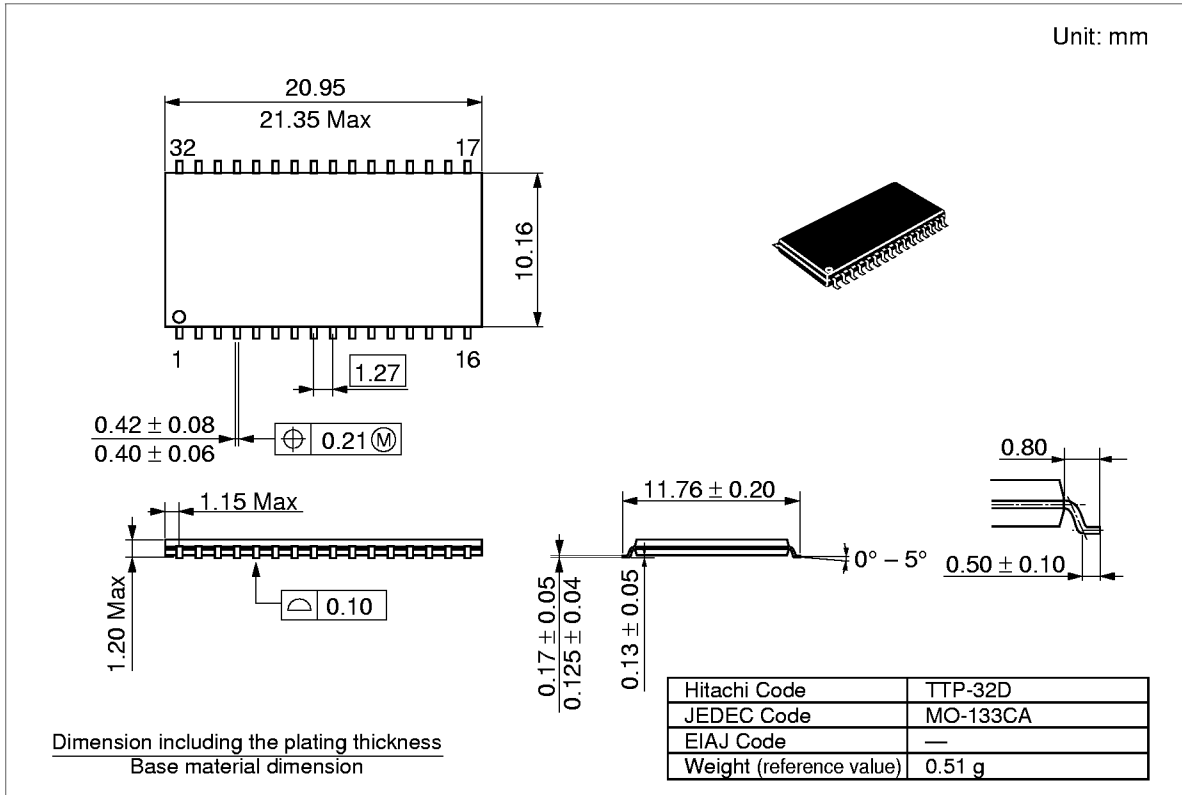
Dimension including the plating thickness
Base material dimension

Hitachi Code	FP-32D
JEDEC Code	MO-099AB
EIAJ Code	—
Weight (reference value)	1.3 g

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HM628512ALTTI Series (TTP-32D)

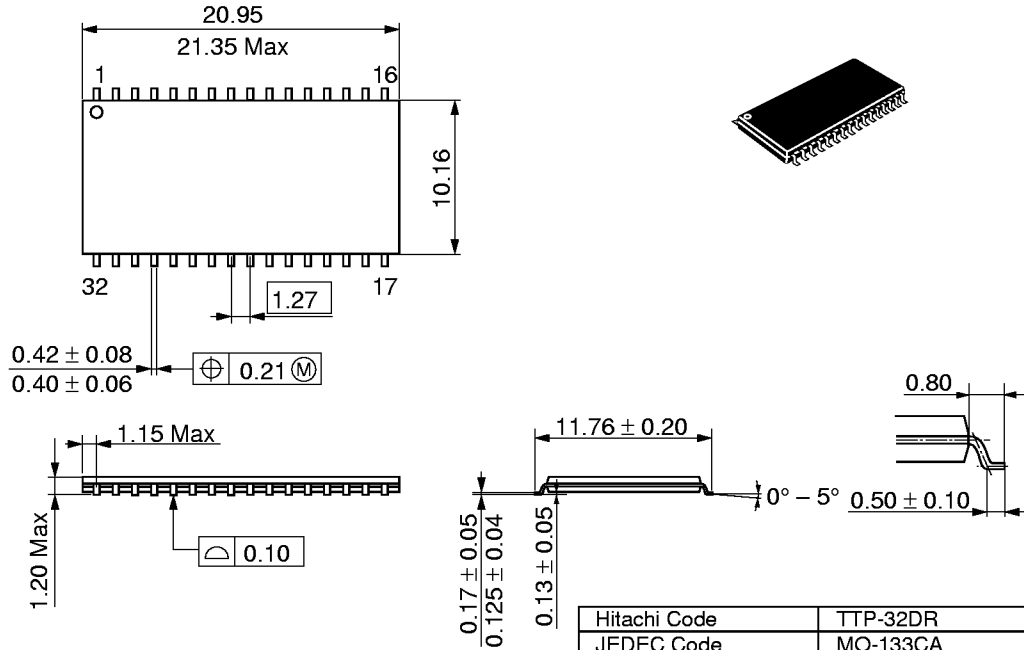
Unit: mm



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HM628512ALRRI Series (TTP-32DR)

Unit: mm



Dimension including the plating thickness
Base material dimension

Hitachi Code	TTP-32DR
JEDEC Code	MO-133CA
EIAJ Code	—
Weight (reference value)	0.51 g

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Revision Record

Rev.	Date	Contents of Modification	Drawn by	Approved by
0.0	Jun. 20, 1997	Initial issue		
