HM628512AI Series

524288-word × 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 × 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

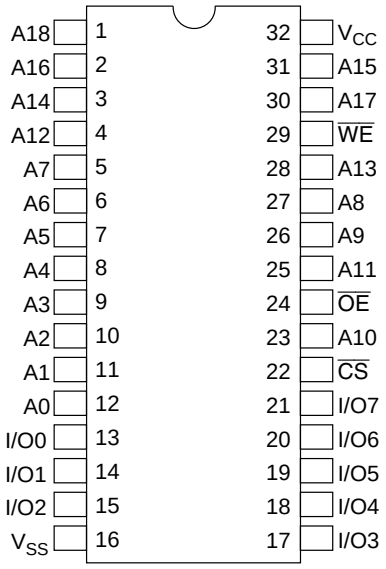
- Single 5 V supply: 5.0 V ± 10%
- Access time: 70/85 ns (max)
- Power dissipation
  - Active: 50 mW/MHz (typ)
  - Standby: 10 µW (typ)
- Completely static memory
  - No clock or timing strobe required
- Equal access and cycle times
- Common data input and output
  - Three state output
- Directly TTL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

Ordering Information

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

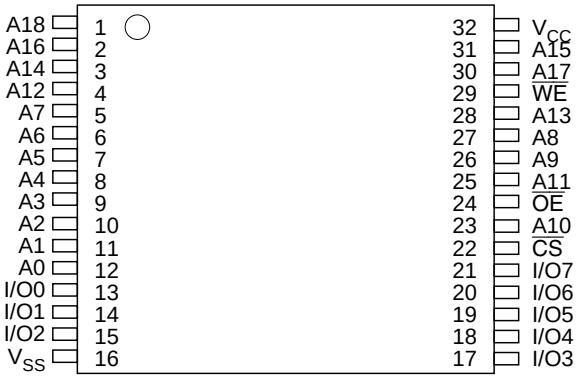
Pin Arrangement

HM628512ALPI Series
HM628512ALFPI Series



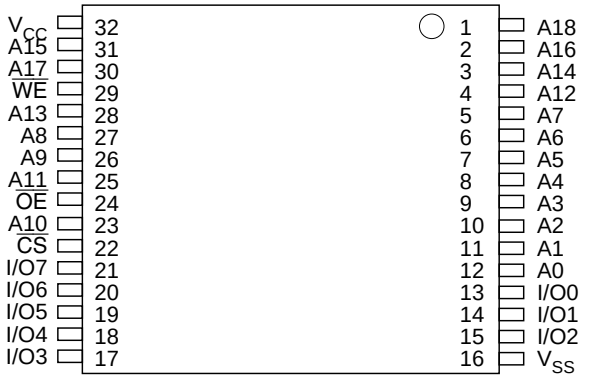
(Top view)

HM628512ALTTI Series



(Top view)

HM628512ALRRI Series

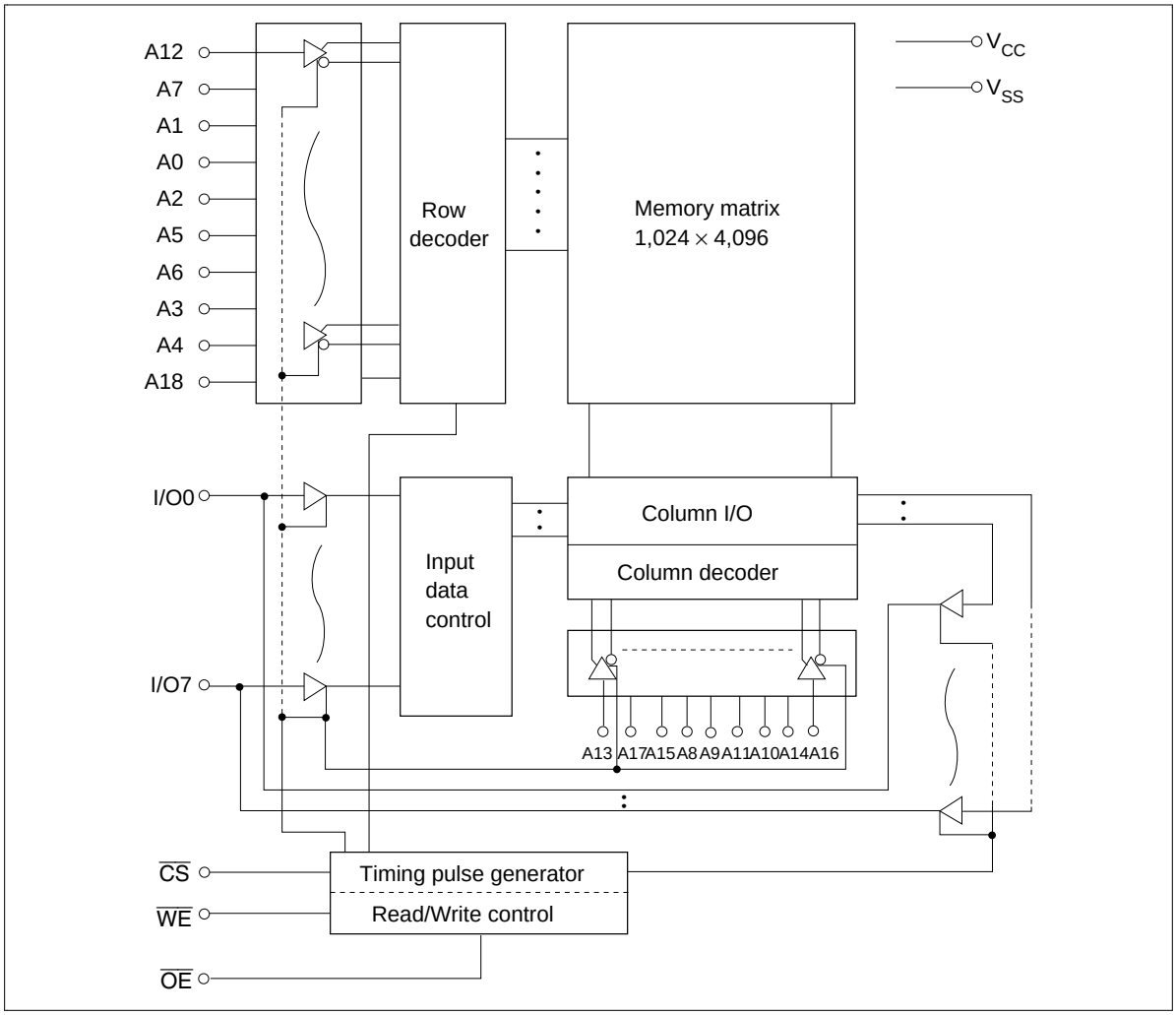


(Top view)

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
×	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	Topr	–40 to +85	°C
Storage temperature	Tstg	–55 to +125	°C
Storage temperature under bias	Tbias	–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 (Ta = –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	Vin = 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, $\overline{CS}$ ≤ 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	Vin ≥ 0 V, $\overline{CS}$ ≥ 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]	Cin	—	8	pF	Vin = 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)

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

		HM628512AI					
		-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 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	

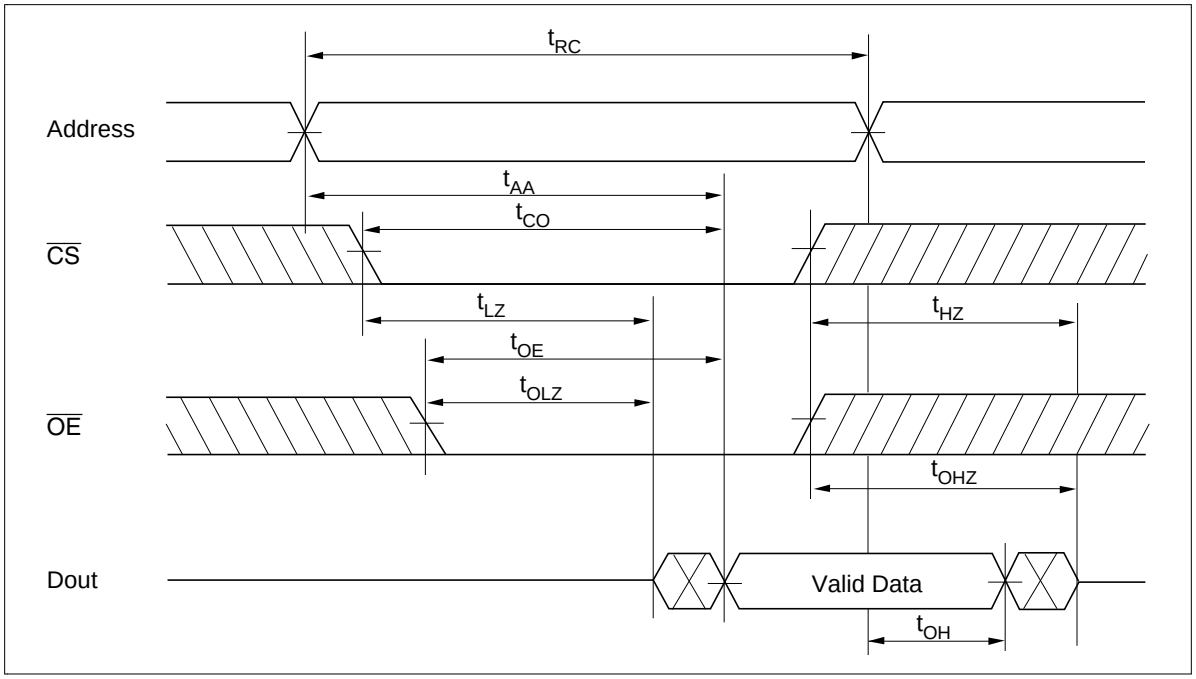
Write Cycle

		HM628512AI					
		-7		-8			
Parameter	**Symbol**	**Min**	**Max**	**Min**	**Max**	**Unit**	**Notes**
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

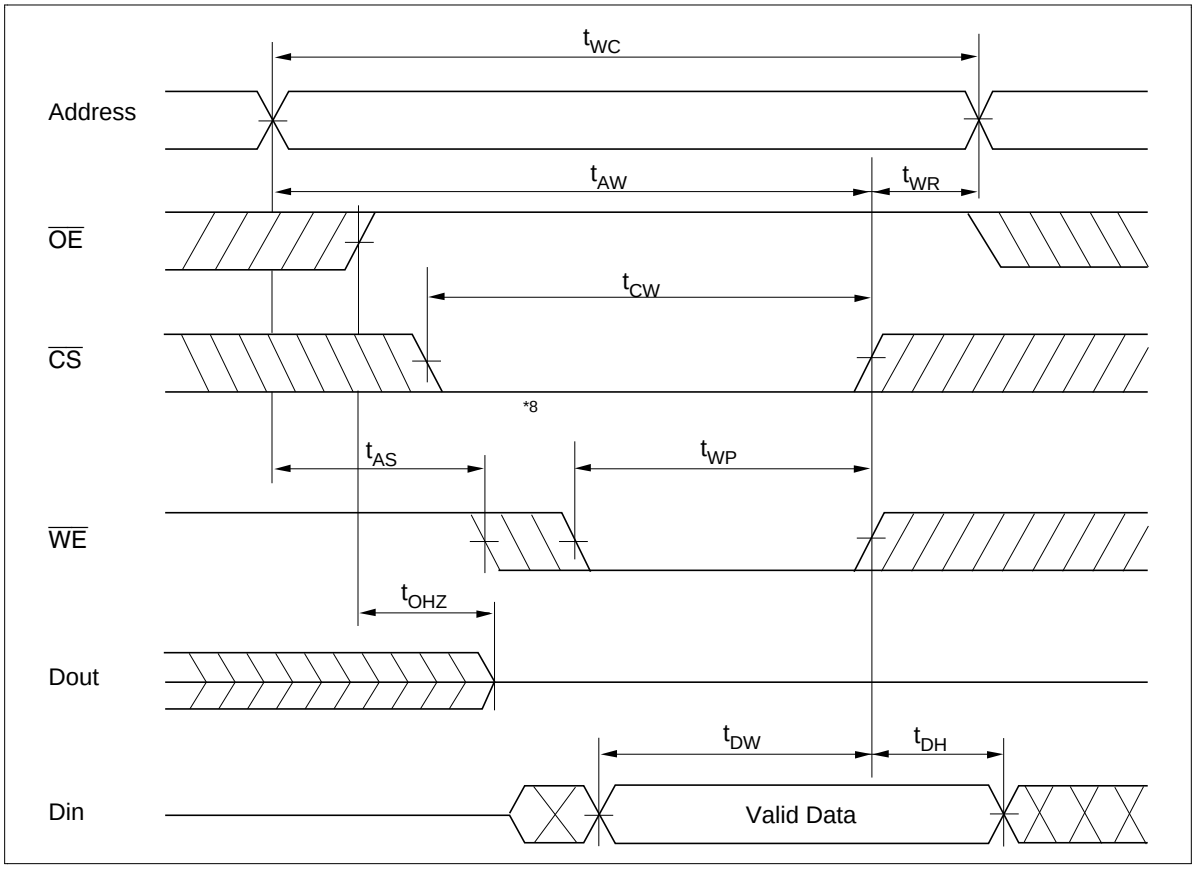
Notes:
1. t_{HZ}, t_{OHZ} and t_{WHZ} are defined as the time at which the outputs achieve the open circuit conditions and are not referred to output voltage levels.
2. This parameter is sampled and not 100% tested.
3. A write occurs during the overlap (t_{WP}) of a low $\overline{CS}$ and a low $\overline{WE}$.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

Timing Waveforms

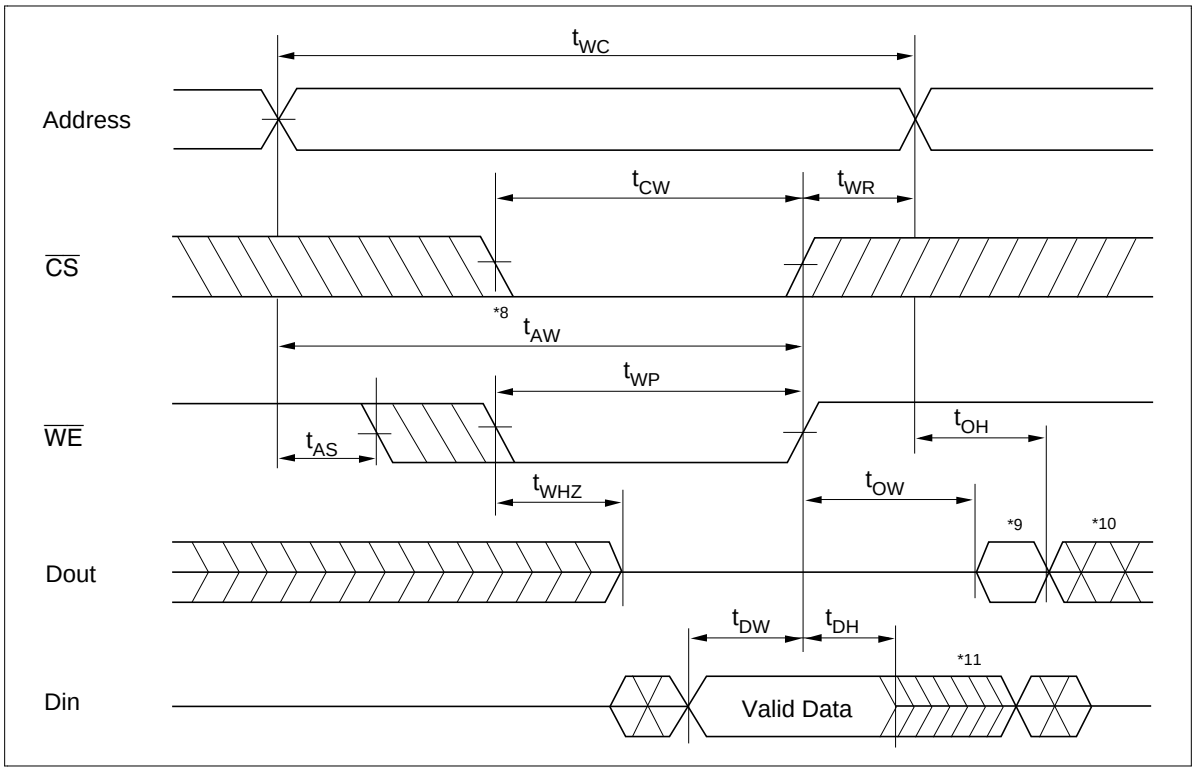
Read Timing Waveform ($\overline{WE}$ = V_{IH})



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



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

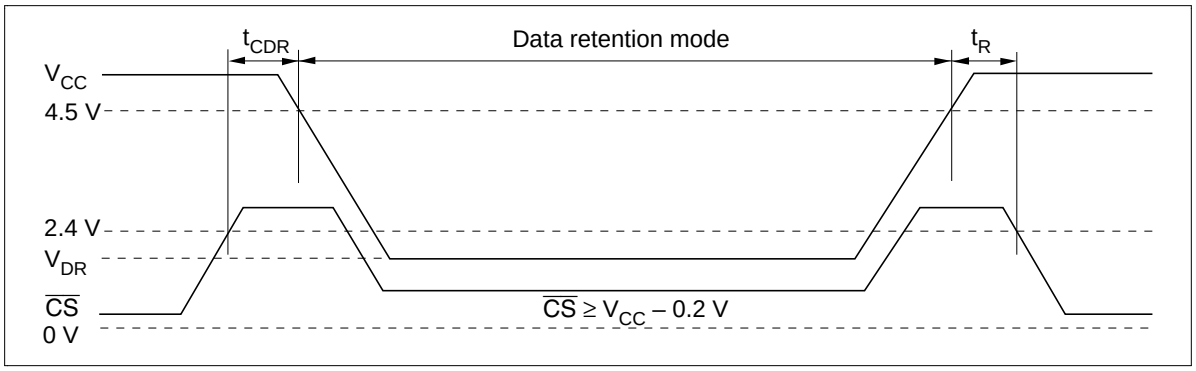


Low V_{CC} Data Retention Characteristics (Ta = –40 to +85°C)

Parameter	Symbol	Min	Typ	Max	Unit	Test conditions*[2]
V_{CC} for data retention	V_{DR}	2	—	—	V	$\overline{CS} \geq V_{CC} - 0.2$ V, Vin ≥ 0 V
Data retention current	I_{CCDR}	—	1*[3]	50*[1]	µA	V_{CC} = 3.0 V, Vin ≥ 0 V $\overline{CS} \geq V_{CC} - 0.2$ 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 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.

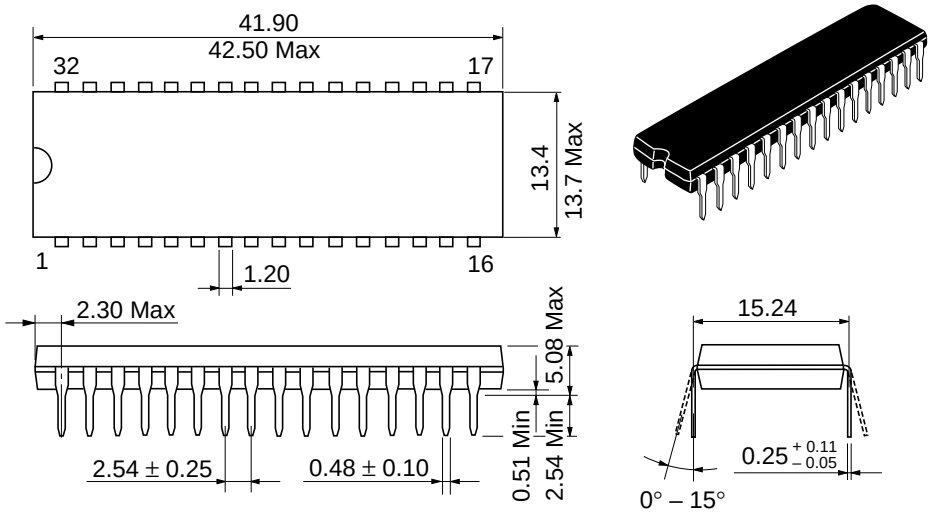
Low V_{CC} Data Retention Timing Waveform ($\overline{CS}$ Controlled)



Package Dimensions

HM628512ALPI Series (DP-32)

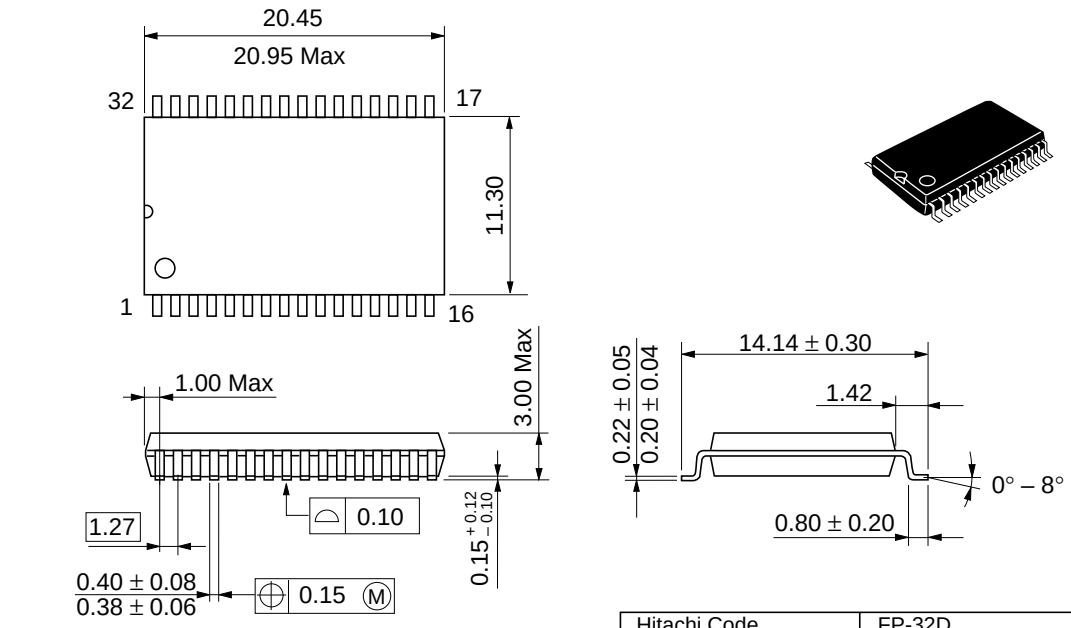
Unit: mm



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

HM628512ALFPI Series (FP-32D)

Unit: mm

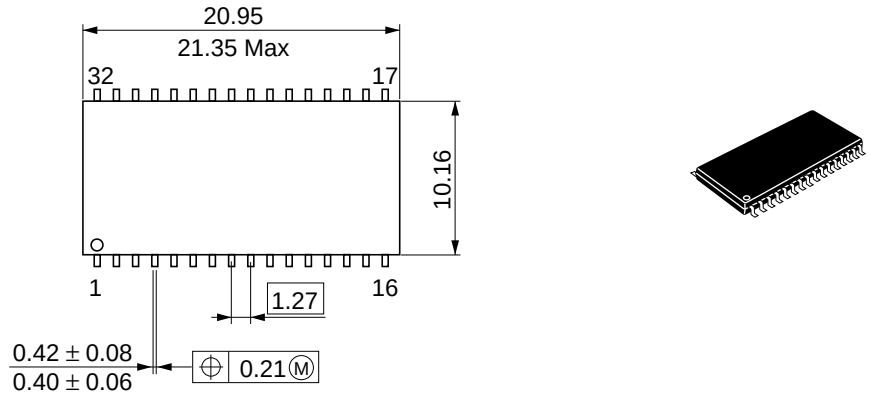


Dimension including the plating thickness
Base material dimension

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

HM628512ALTTI Series (TTP-32D)

Unit: mm

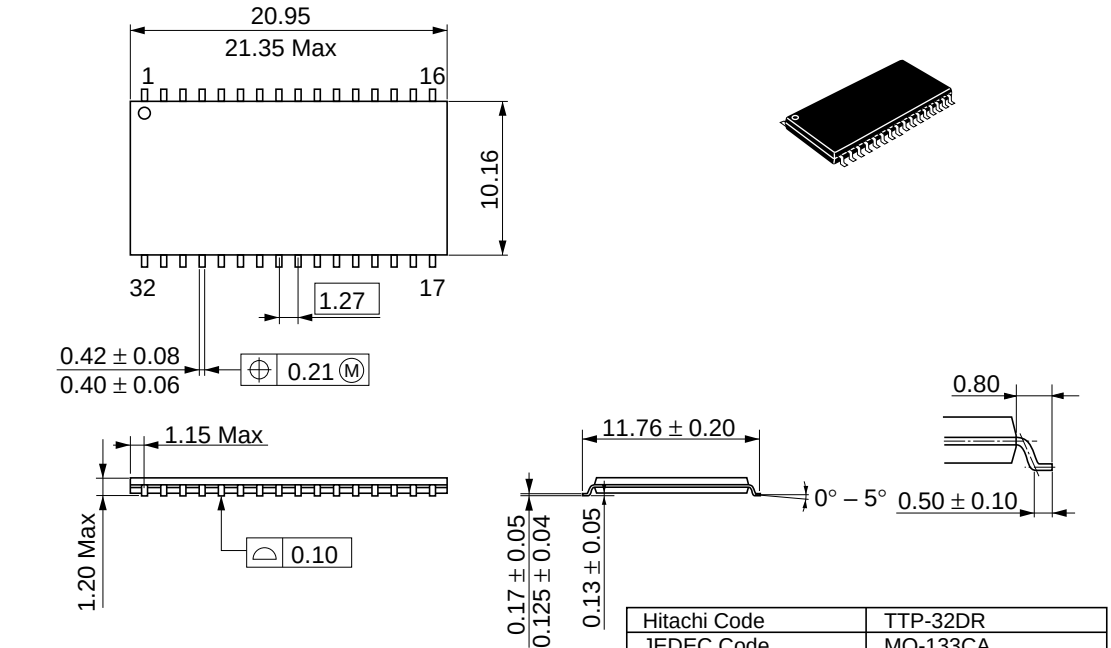


Dimension including the plating thickness
Base material dimension

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

HM628512ALRRI Series (TTP-32DR)

Unit: mm



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		