

TENTATIVE

TOSHIBA MOS DIGITAL INTEGRATED CIRCUIT SILICON GATE CMOS

131,072-WORD BY 8-BIT STATIC RAM

DESCRIPTION

The TC551001CPI/CFI/CFTI/CTRI/CSTI/CSRI is a 1,048,576-bit static random access memory (SRAM) organized as 131,072 words by 8 bits. Fabricated using Toshiba's CMOS Silicon gate process technology, this device operates from a single $5\text{ V} \pm 10\%$ power supply. Advanced circuit technology provides both high speed and low power at an operating current of 5 mA/MHz (typ) and a minimum cycle time of 70 ns . It is automatically placed in low-power mode at $1\text{ }\mu\text{A}$ standby current (typ) when chip enable ($\overline{\text{CE1}}$) is asserted high or ($\overline{\text{CE2}}$) is asserted low. There are three control inputs. $\overline{\text{CE1}}$ and $\overline{\text{CE2}}$ are used to select the device and for data retention control, and output enable ($\overline{\text{OE}}$) provides fast memory access. This device is well suited to various microprocessor system applications where high speed, low power and battery backup are required. And, with a guaranteed operating range of -40° to 85°C , the TC551001CPI/CFI/CFTI/CTRI/CSTI/CSRI can be used in environments exhibiting extreme temperature conditions. The TC551001CPI/CFI/CFTI/CTRI/CSTI/CSRI is available in a standard plastic 32-pin dual-in-line package (DIP), plastic 32-pin small-outline package (SOP) and normal and reverse pinout plastic 32-pin thin-small-outline package (TSOP).

FEATURES

- Low-power dissipation
Operating: 27.5 mW/MHz (typical)
- Single power supply voltage of $5\text{ V} \pm 10\%$
- Power down features using $\overline{\text{CE1}}$ and $\overline{\text{CE2}}$.
- Data retention supply voltage of 2 to 5.5 V
- Direct TTL compatibility for all inputs and outputs
- Wide operating temperature range of -40° to 85°C

- Standby Current (maximum) :

	TC551001CPI/CFI/CFTI/CTRI/CSTI/CSRI	
	-70, -85	-70L, -85L
5.5V	$200\text{ }\mu\text{A}$	$40\text{ }\mu\text{A}$
3.0V	$100\text{ }\mu\text{A}$	$20\text{ }\mu\text{A}$

- Access Times (maximum):

	TC551001CPI/CFI/CFTI/CTRI/CSTI/CSRI	
	-70, -70L	-85, -85L
Access Time	70 ns	85 ns
$\overline{\text{CE1}}$ Access Time	70 ns	85 ns
$\overline{\text{CE2}}$ Access Time	70 ns	85 ns
$\overline{\text{OE}}$ Access Time	35 ns	45 ns

- Packages:

DIP32-P-600-2.54 (CPI)	(Weight: 4.45 g typ)
SOP32-P-525-1.27 (CFI)	(Weight: 1.04 g typ)
TSOP I 32-P-0820-0.50 (CFTI)	(Weight: 0.34 g typ)
TSOP I 32-P-0820-0.50A (CTRI)	(Weight: 0.34 g typ)
TSOP I 32-P-0.50 (CSTI)	(Weight: 0.24 g typ)
TSOP I 32-P-0.50A (CSRI)	(Weight: 0.24 g typ)

PIN ASSIGNMENT (TOP VIEW)

○ 32 PIN DIP & SOP

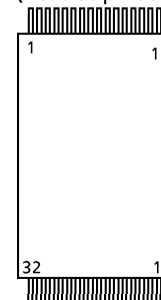
NC	1	32	V_{DD}
A16	2	31	A15
A14	3	30	$\overline{\text{CE2}}$
A12	4	29	R/W
A7	5	28	A13
A6	6	27	A8
A5	7	26	A9
A4	8	25	A11
A3	9	24	$\overline{\text{OE}}$
A2	10	23	A10
A1	11	22	$\overline{\text{CE1}}$
A0	12	21	I/O8
I/O1	13	20	I/O7
I/O2	14	19	I/O6
I/O3	15	18	I/O5
GND	16	17	I/O4

○ 32 PIN TSOP

(Normal pinout)



(Reverse pinout)



PIN NAMES

A0 to A16	Address Inputs
R/W	Read/Write Control
$\overline{\text{OE}}$	Output Enable
$\overline{\text{CE1}}$, $\overline{\text{CE2}}$	Chip Enable
I/O1 to I/O8	Data Input/Output
V_{DD}	Power (+ 5 V)
GND	Ground
NC	No Connection

Pin No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Pin Name	A ₁₁	A ₉	A ₈	A ₁₃	R/W	$\overline{\text{CE2}}$	A ₁₅	V_{DD}	NC	A ₁₆	A ₁₄	A ₁₂	A ₇	A ₆	A ₅	A ₄
Pin No.	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
Pin Name	A ₃	A ₂	A ₁	A ₀	I/O1	I/O2	I/O3	GND	I/O4	I/O5	I/O6	I/O7	I/O8	$\overline{\text{CE1}}$	A ₁₀	$\overline{\text{OE}}$

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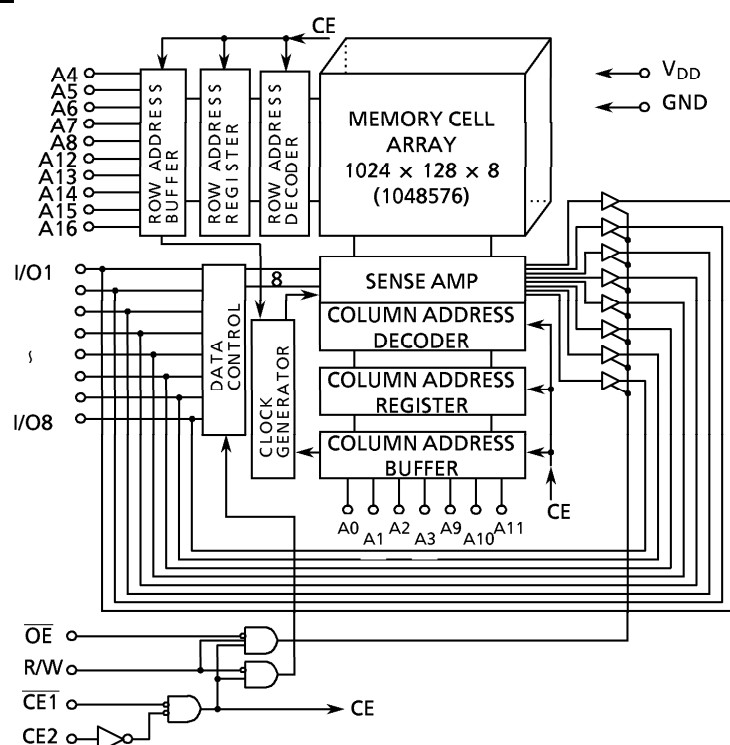
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BLOCK DIAGRAM



OPERATION MODE

MODE	CE1	CE2	OE	R/W	I/O1 to I/O8	POWER
Read	L	H	L	H	D _{OUT}	I _{DDO}
Write	L	H	x	L	D _{IN}	I _{DDO}
Outputs Disabled	L	H	H	H	High-Z	I _{DDO}
Standby	H	x	x	x	High-Z	I _{DDS}
	x	L	x	x	High-Z	I _{DDS}

Note: x = don't care. H = logic high. L = logic low.

ABSOLUTE MAXIMUM RATINGS

SYMBOL	RATING	VALUE	UNIT
V _{DD}	Power Supply Voltage	- 0.3 to 7.0	V
V _{IN}	Input Voltage	- 0.3* to 7.0	V
V _{IO}	Input and Output Voltage	- 0.5 to V _{DD} + 0.5	V
P _D	Power Dissipation	1.0/0.6**	W
T _{solder}	Soldering Temperature (10 s)	260	°C
T _{strg.}	Storage Temperature	- 55 to 150	°C
T _{opr.}	Operating Temperature	- 40 to 85	°C

* - 3.0 V when measured at a pulse width of 50 ns

** SOP

DC RECOMMENDED OPERATING CONDITIONS ($T_a = -40^\circ$ to 85°C)

SYMBOL	PARAMETER	MIN	TYP	MAX	UNIT
V_{DD}	Power Supply Voltage	4.5	5.0	5.5	V
V_{IH}	Input High Voltage	2.4	–	$V_{DD} + 0.3$	
V_{IL}	Input Low Voltage	-0.3^*	–	0.6	
V_{DH}	Data Retention Supply Voltage	2.0	–	5.5	

* -3.0 V when measured at a pulse width of 50 nsDC CHARACTERISTICS ($T_a = -40^\circ$ to 85°C , $V_{DD} = 5\text{ V} \pm 10\%$)

SYMBOL	PARAMETER	TEST CONDITION			MIN	TYP	MAX	UNIT	
I _{IL}	Input Leakage Current	V _{IN} = 0 V to V _{DD}			–	–	± 1.0	μA	
I _{OH}	Output High Current	V _{OH} = 2.4 V			– 1.0	–	–	mA	
I _{OL}	Output Low Current	V _{OL} = 0.4 V			4.0	–	–	mA	
I _{LO}	Output Leakage Current	$\overline{CE1} = V_{IH}$ or CE2 = V _{IL} or R/W = V _{IL} or $\overline{OE} = V_{IH}$, V _{OUT} = 0 V to V _{DD}			–	–	± 1.0	μA	
I _{DDO1}	Operating Current	$\overline{CE1} = V_{IL}$ and CE2 = V _{IH} and R/W = V _{IH} , I _{OUT} = 0 mA Other Inputs = V _{IH} /V _{IL}		Tcycle	min	–	–	70	mA
1 μs					–	–	20		
I _{DDO2}		$\overline{CE1} = 0.2\text{ V}$ and CE2 = V _{DD} – 0.2 V R/W = V _{DD} – 0.2 V, I _{OUT} = 0 mA Other Inputs = V _{DD} – 0.2 V/0.2 V		Tcycle	min	–	–	60	mA
1 μs					–	–	10		
I _{DDS1}	Standby Current	$\overline{CE1} = V_{IH}$ or CE2 = V _{IL}			–	–	3	mA	
I _{DDS2} (Note)		$\overline{CE1} = V_{DD} - 0.2\text{ V}$ or CE2 = 0.2 V V _{DD} = 2.0 to 5.5 V	-70, -85	Ta = 25°C		–	1	–	μA
				Ta = –40° to 85°C		–	–	200	
			-70L, -85L	Ta = 25°C		–	1	2	
				Ta = –40° to 85°C		–	–	40	

Note: In standby mode with $\overline{CE1} \geq V_{DD} - 0.2\text{ V}$, these limits are assured for the condition $CE2 \geq V_{DD} - 0.2\text{ V}$ or $CE2 \leq 0.2\text{ V}$.CAPACITANCE ($T_a = 25^\circ\text{C}$, $f = 1\text{ MHz}$)

SYMBOL	PARAMETER	TEST CONDITION	MAX	UNIT
C_{IN}	Input Capacitance	$V_{IN} = \text{GND}$	10	pF
C_{OUT}	Output Capacitance	$V_{OUT} = \text{GND}$	10	

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

AC CHARACTERISTICS AND OPERATING CONDITIONS ($T_a = -40^\circ$ to 85°C , $V_{DD} = 5\text{ V} \pm 10\%$)

READ CYCLE

SYMBOL	PARAMETER	TC551001CPI/CFI/CFTI/CTRI/CSTI/CSRI				UNIT
		-70, -70L		-85, -85L		
		MIN	MAX	MIN	MAX	
t _{RC}	Read Cycle Time	70	–	85	–	ns
t _{ACC}	Address Access Time	–	70	–	85	
t _{CO1}	Chip Enable (CE1) Access Time	–	70	–	85	
t _{CO2}	Chip Enable (CE2) Access Time	–	70	–	85	
t _{OE}	Output Enable Access Time	–	35	–	45	
t _{COE}	Chip Enable Low to Output Active	5	–	5	–	
t _{OEE}	Output Enable Low to Output Active	0	–	0	–	
t _{OD}	Chip Enable High to Output High-Z	–	30	–	35	
t _{ODO}	Output Enable High to Output High-Z	–	30	–	35	
t _{OH}	Output Data Hold Time	10	–	10	–	

WRITE CYCLE

SYMBOL	PARAMETER	TC551001CPI/CFI/CFTI/CTRI/CSTI/CSRI				UNIT
		-70, -70L		-85, -85L		
		MIN	MAX	MIN	MAX	
t _{WC}	Write Cycle Time	70	–	85	–	ns
t _{WP}	Write Pulse Width	50	–	60	–	
t _{CW}	Chip Enable to End of Write	60	–	75	–	
t _{AS}	Address Setup Time	0	–	0	–	
t _{WR}	Write Recovery Time	0	–	0	–	
t _{ODW}	R/W Low to Output High-Z	–	30	–	35	
t _{OEW}	R/W High to Output Active	0	–	0	–	
t _{DS}	Data Setup Time	30	–	35	–	
t _{DH}	Data Hold Time	0	–	0	–	

AC TEST CONDITIONS

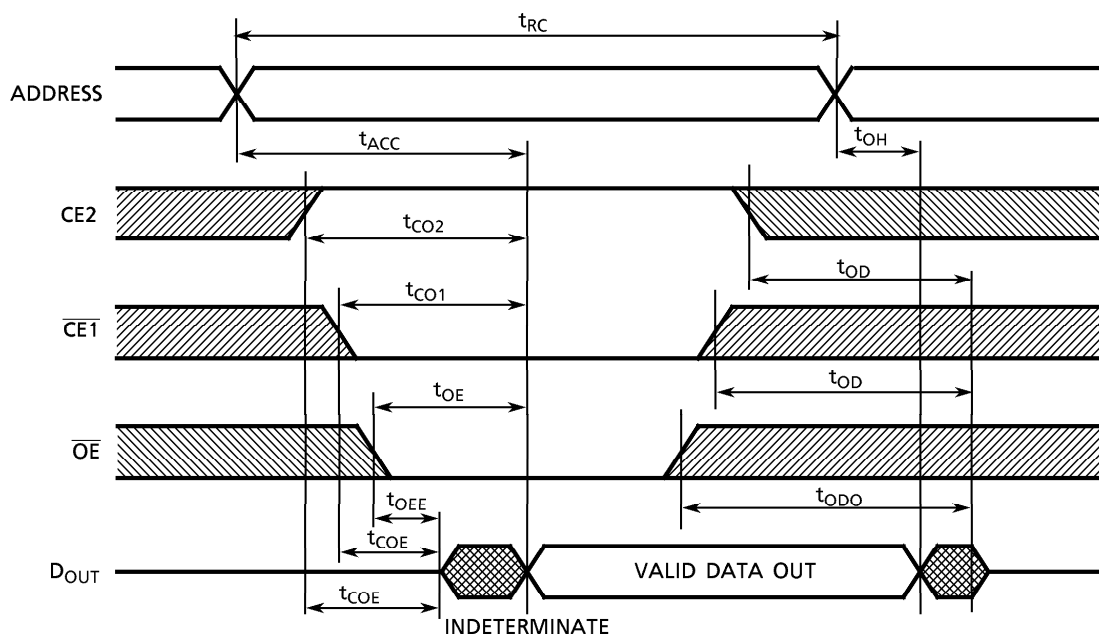
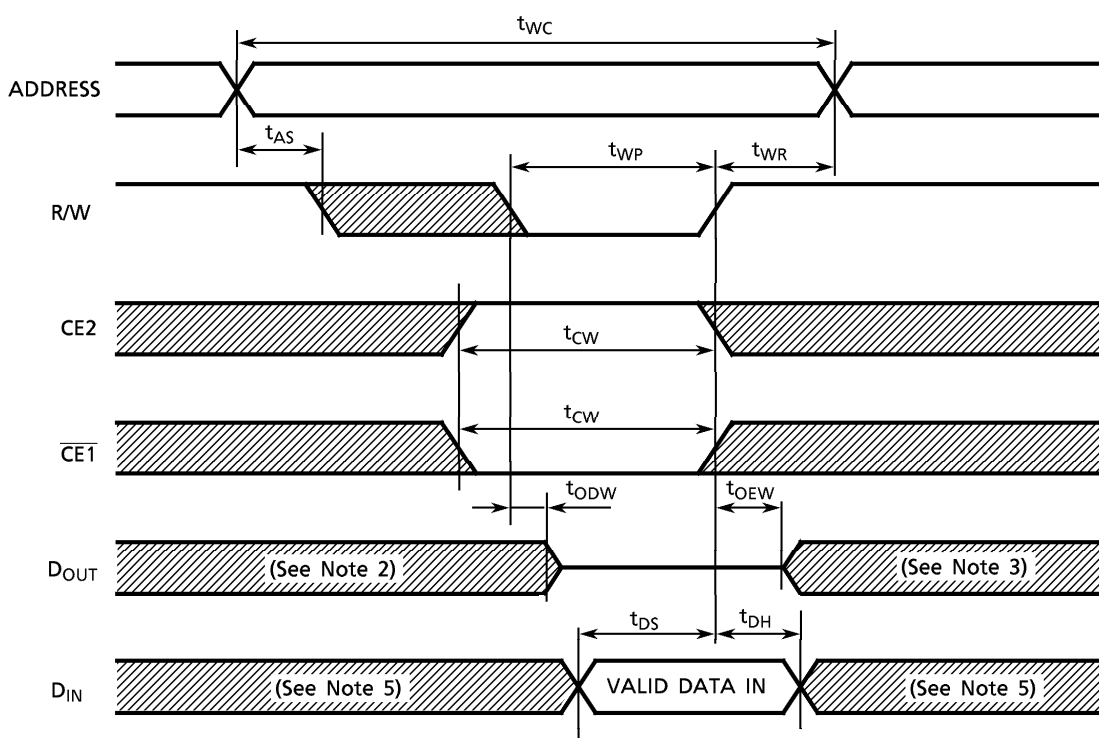
Output load: 100 pF + one TTL gate

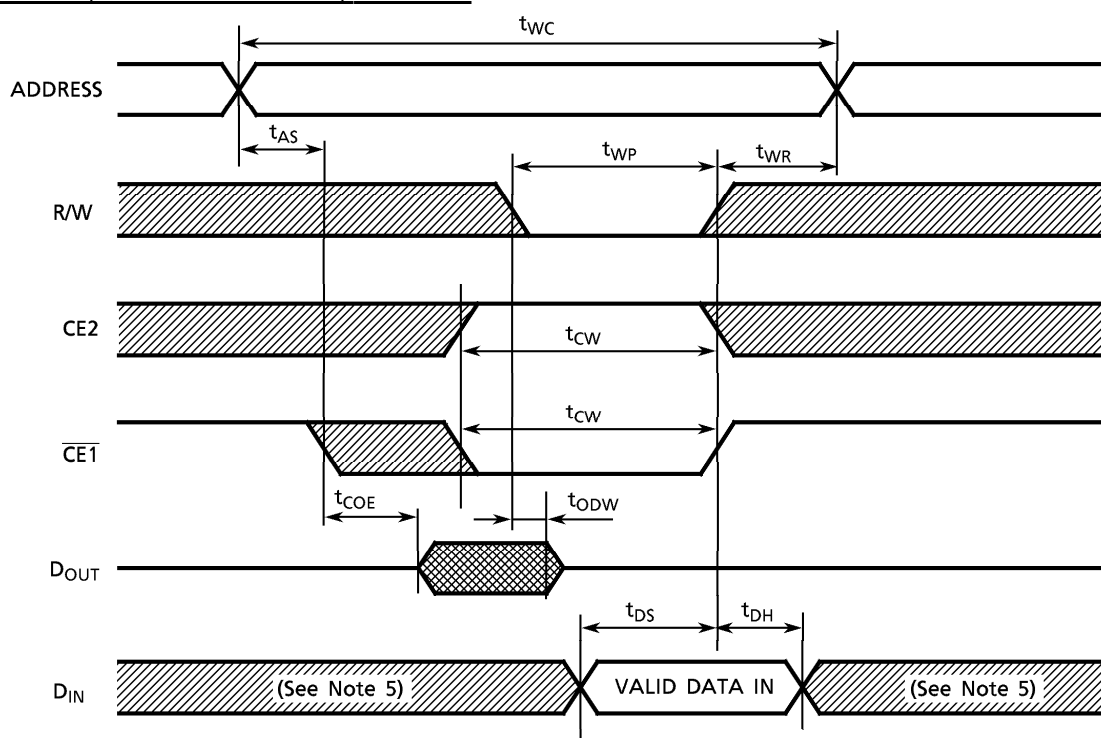
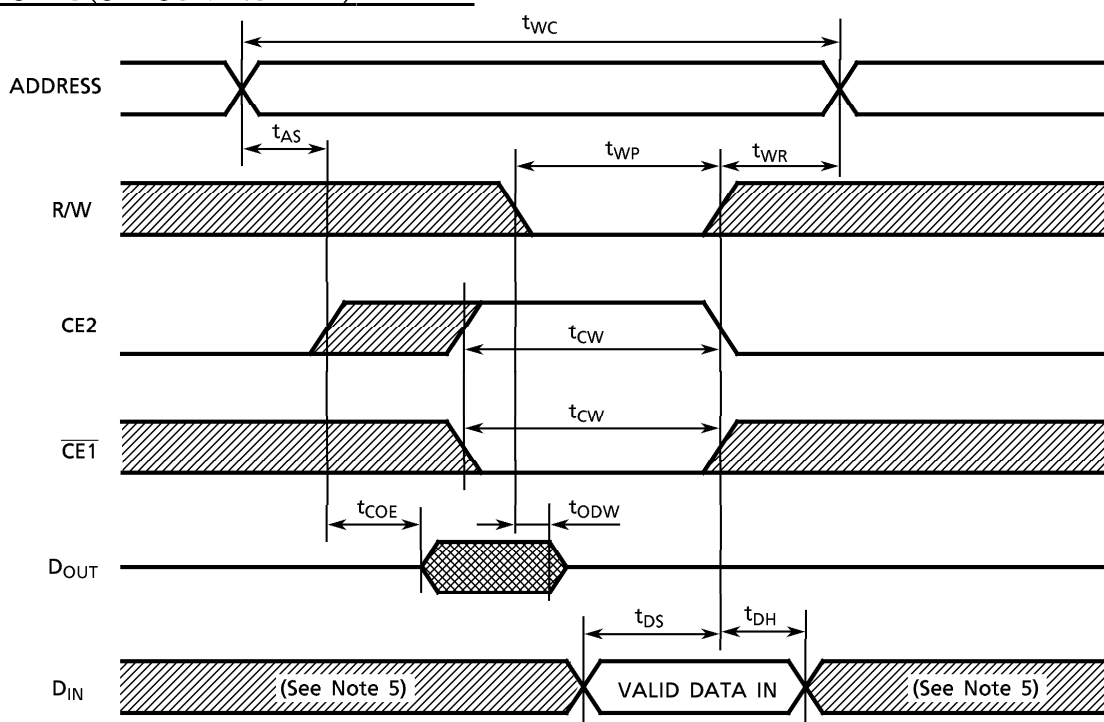
Input pulse level: 0.4 V, 2.6 V

Timing measurements: 1.5 V

Reference level: 1.5 V

t_R , t_F : 5 ns

TIMING DIAGRAMS
READ CYCLE (See Note 1)

WRITE CYCLE 1 (R/W CONTROLLED) (See Note 4)


WRITE CYCLE 2 ($\overline{\text{CE1}}$ CONTROLLED) (See Note 4)

WRITE CYCLE 3 (CE2 CONTROLLED) (See Note 4)


Note: (1) R/W remains HIGH for the read cycle.

(2) If $\overline{\text{CE1}}$ goes LOW (or CE2 goes HIGH) coincident with or after R/W goes LOW, the outputs will remain at high impedance.

(3) If $\overline{\text{CE1}}$ goes HIGH (or CE2 goes LOW) coincident with or before R/W goes HIGH, the outputs will remain at high impedance.

(4) If $\overline{\text{OE}}$ is HIGH during the write cycle, the outputs will remain at high impedance.

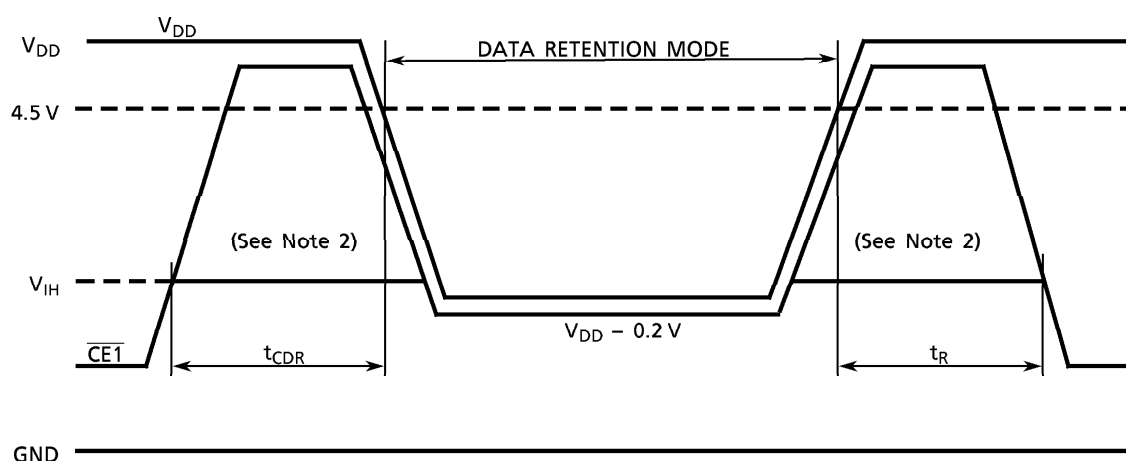
(5) Because I/O signals may be in the output state at this time, input signals of reverse polarity must not be applied.

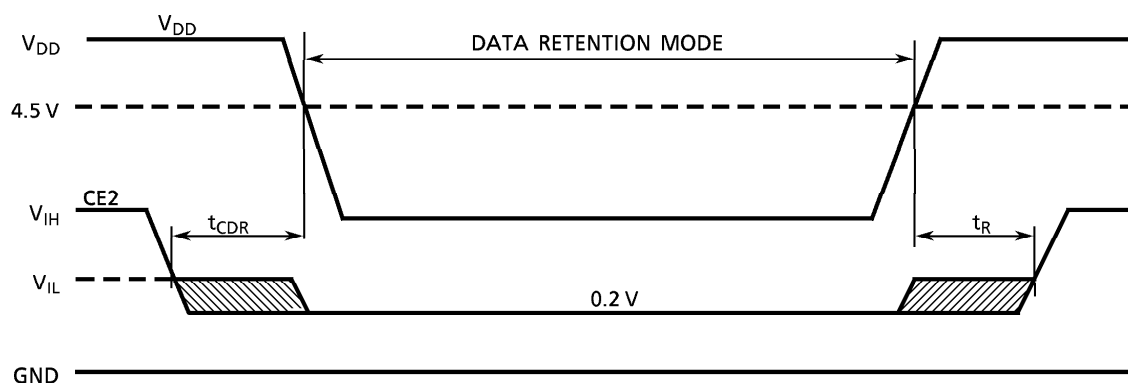
DATA RETENTION CHARACTERISTICS (Ta = - 40° to 85°C)

SYMBOL	PARAMETER			MIN	TYP	MAX	UNIT
V _{DH}	Data Retention Supply Voltage			2.0	–	5.5	V
I _{DD_{S2}}	Standby Current	-70, -85	V _{DH} = 3.0 V	–	–	100	μA
			V _{DH} = 5.5 V	–	–	200	
		-70L, -85L	V _{DH} = 3.0 V	–	–	20*	
			V _{DH} = 5.5 V	–	–	40	
t _{CDR}	Chip Deselect to Data Retention Mode Time			0	–	–	nS
t _R	Recovery Time			5	–	–	mS

* 2 μA (max) at Ta = - 40° to 40°C

$\overline{\text{CE1}}$ CONTROLLED DATA RETENTION MODE (See Note 1)



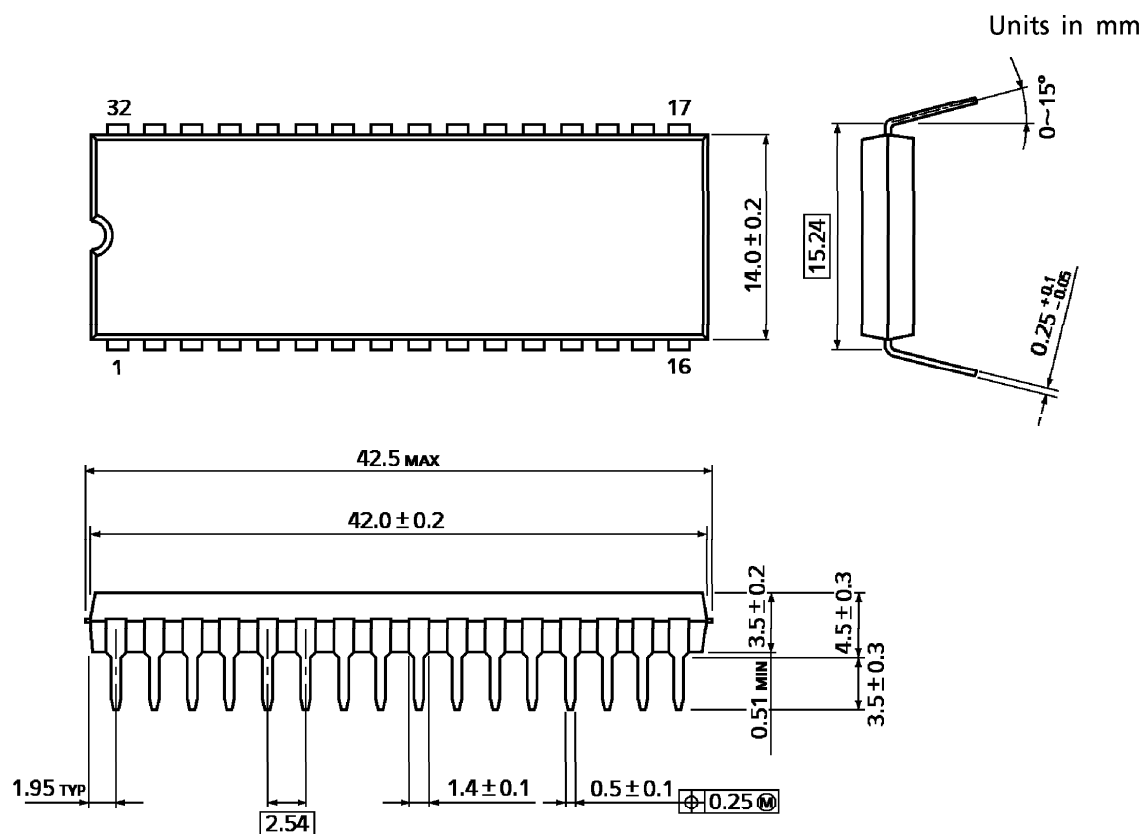
CE2 CONTROLLED DATA RETENTION MODE (See Note 3)


Note: (1) In $\overline{\text{CE1}}$ controlled data retention mode, minimum standby current mode is entered when

$$\text{CE2} \leq 0.2 \text{ V or } \text{CE2} \geq V_{\text{DD}} - 0.2 \text{ V.}$$

(2) When $\overline{\text{CE1}}$ is operating at the V_{IH} level (2.4 V), the operation current is given by I_{DDS1} during the transition of V_{DD} from 4.5 to 2.6 V.

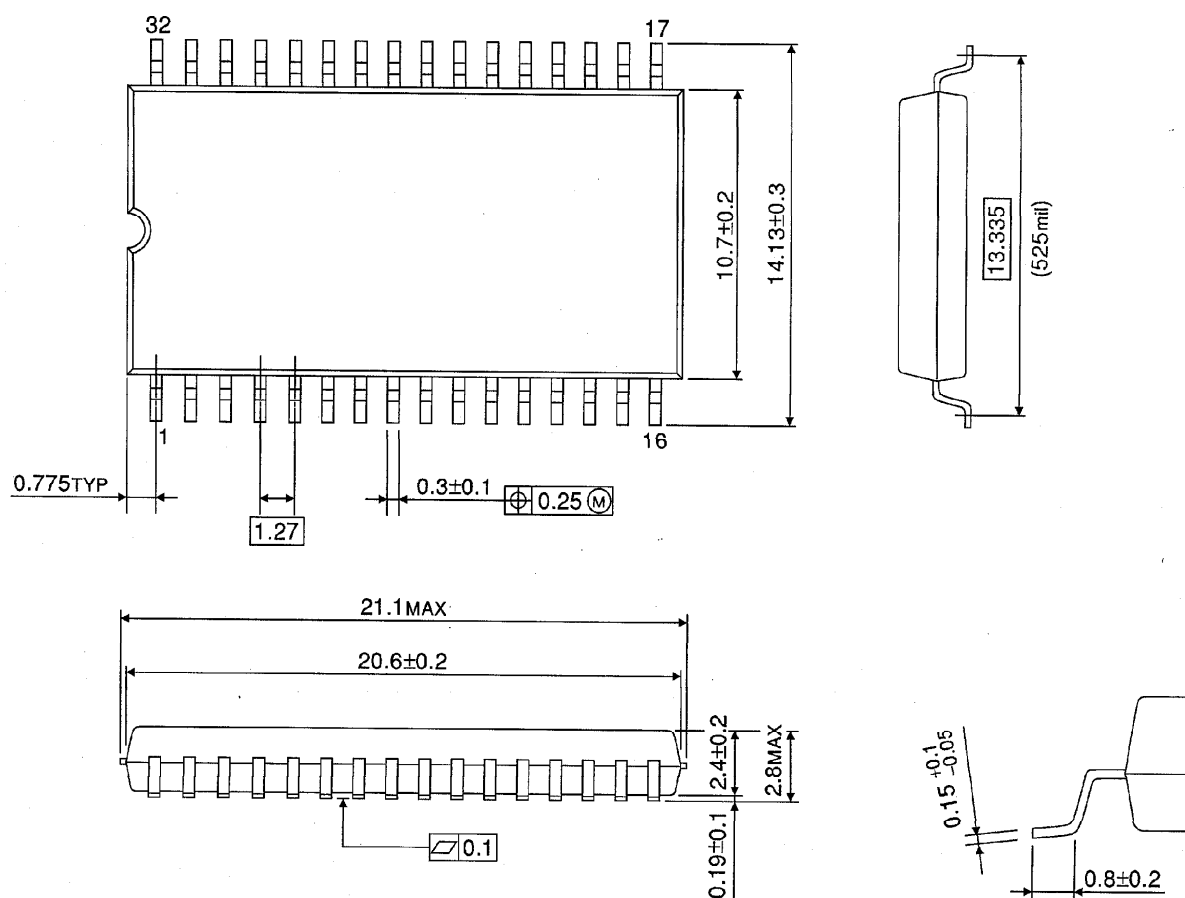
(3) In CE2 controlled data retention mode, minimum standby current mode is entered when $\text{CE2} \leq 0.2 \text{ V}$.

PACKAGE DIMENSIONS (DIP32-P-600-2.54)


Weight: 4.45 g (typ)

PACKAGE DIMENSIONS (SOP32-P-525-1.27)

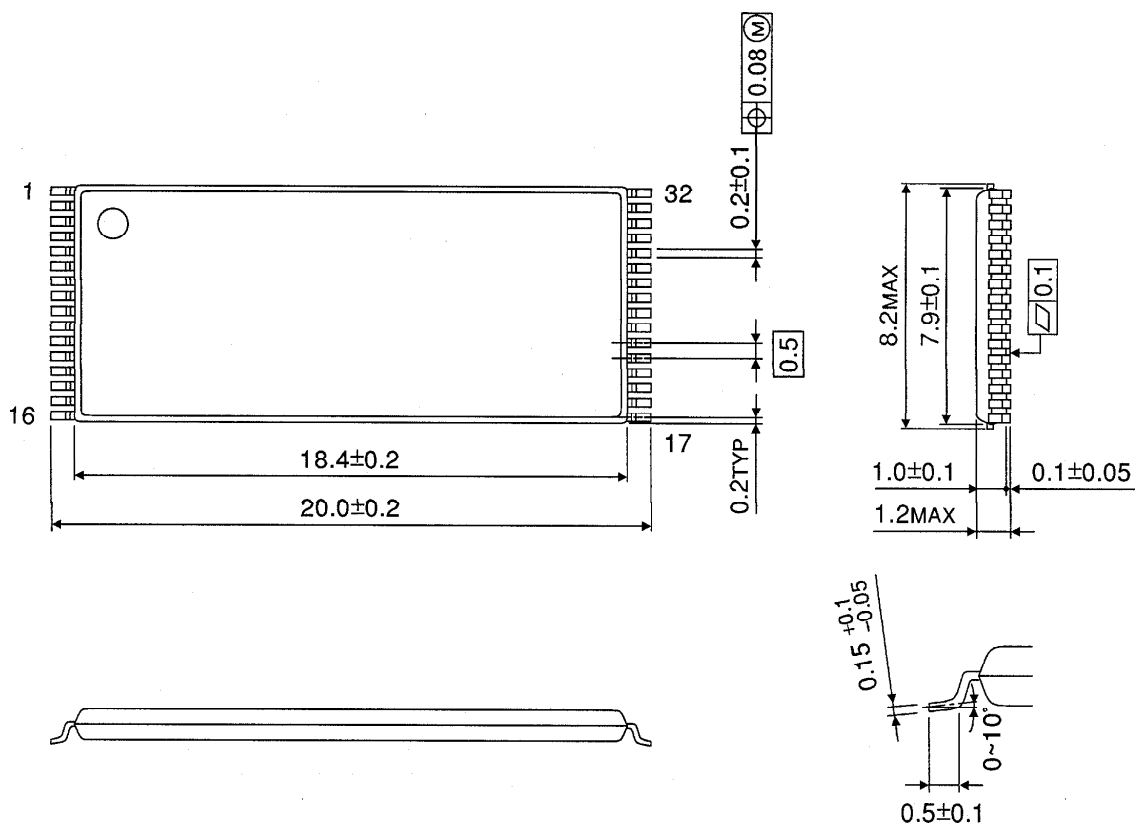
Units in mm



Weight: 1.04 g (typ)

PACKAGE DIMENSIONS (TSOP I 32-P-0820-0.50)

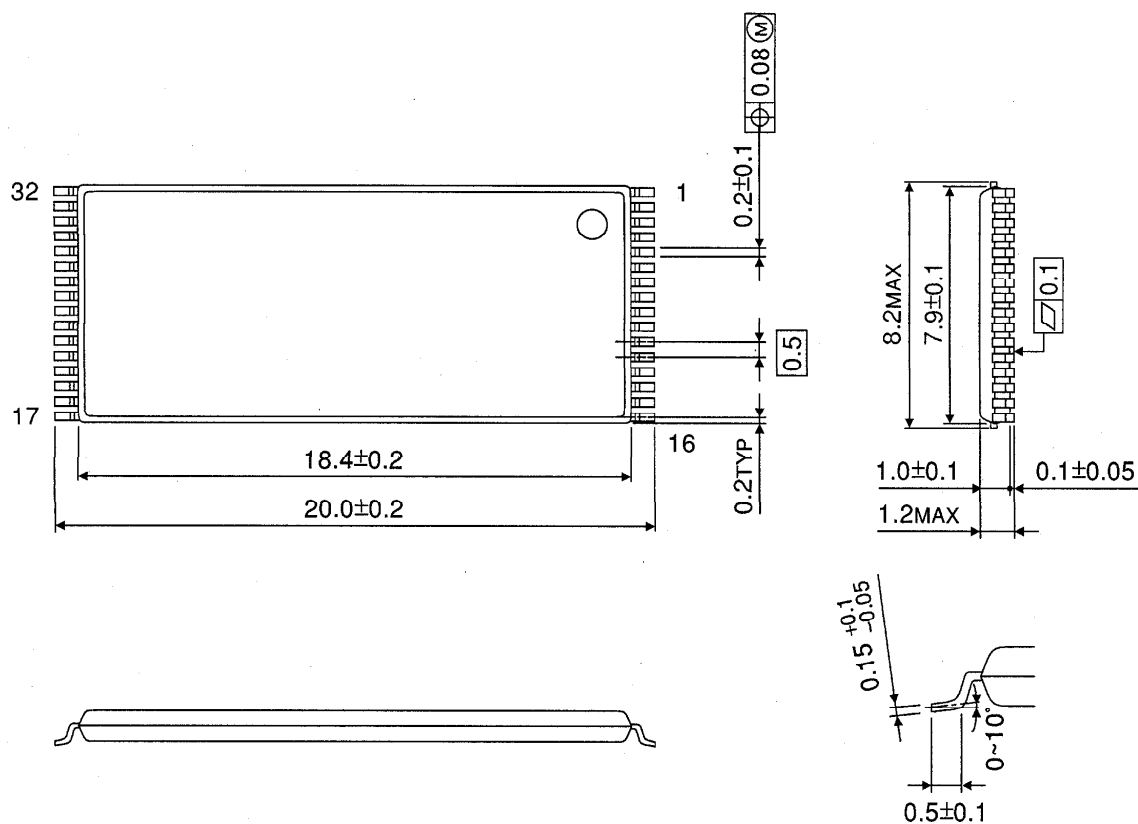
Units in mm



Weight: 0.34 g (typ)

PACKAGE DIMENSIONS (TSOP I 32-P-0820-0.50A)

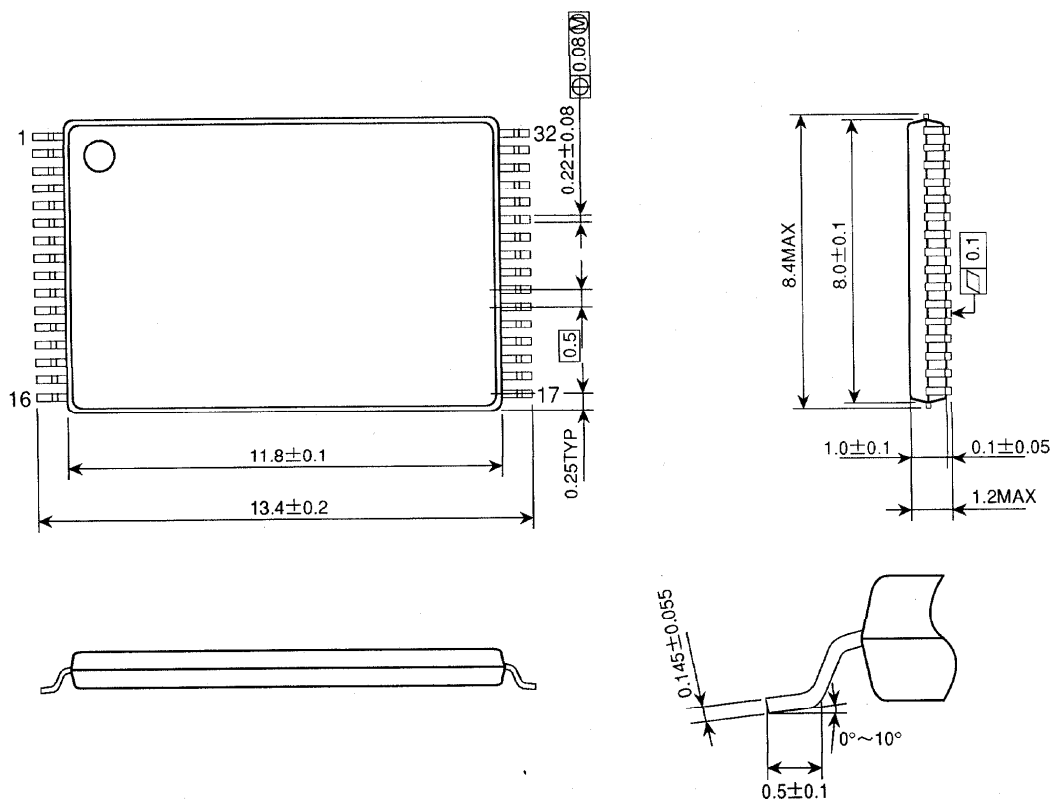
Units in mm



Weight: 0.34 g (typ)

PACKAGE DIMENSIONS (TSOP I 32-P-0.50)

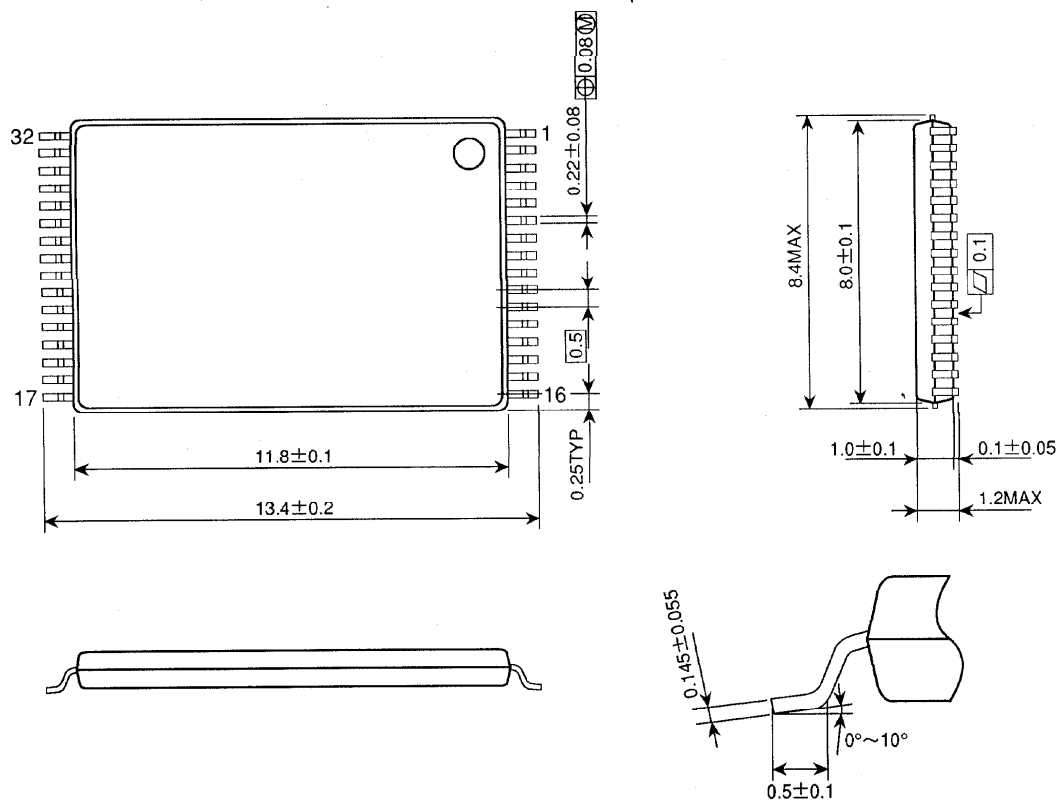
Units in mm



Weight: 0.24 g (typ)

PACKAGE DIMENSIONS (TSOP I 32-P-0.50A)

Units in mm



Weight: 0.24 g (typ)