

TENTATIVE

TOSHIBA MOS DIGITAL INTEGRATED CIRCUIT SILICON GATE CMOS

131,072-WORD BY 8-BIT STATIC RAM

DESCRIPTION

The TC551001CP/CF/CFT/CTR/CST/CSR 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 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 55 ns. It is automatically placed in low-power mode at 1 μ A standby current (typ) when chip enable ($\overline{CE1}$) is asserted high or ($\overline{CE2}$) is asserted low. There are three control inputs. $\overline{CE1}$ and $\overline{CE2}$ are used to select the device and for data retention control, and output enable (\overline{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. The TC551001CP/CF/CFT/CTR/CST/CSR 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 V \pm 10%
- Power down features using $\overline{CE1}$ and $\overline{CE2}$.
- Data retention supply voltage of 2 to 5.5 V
- Direct TTL compatibility for all inputs and outputs
- Standby Current (maximum) :

	TC551001CP/CF/CFT/CTR/CST/CSR	
	-55, -70, -85	-55L, -70L, -85L
5.5V	100 μ A	20 μ A
3.0V	50 μ A	10 μ A

- Access Times (maximum):

	TC551001CP/CF/CFT/CTR/CST/CSR		
	-55, -55L	-70, -70L	-85, -85L
Access Time	55 ns	70 ns	85 ns
$\overline{CE1}$ Access Time	55 ns	70 ns	85 ns
$\overline{CE2}$ Access Time	55 ns	70 ns	85 ns
\overline{OE} Access Time	30 ns	35 ns	45 ns

- Packages:

DIP32-P-600-2.54 (CP)	(Weight: 4.45 g typ)
SOP32-P-525-1.27 (CF)	(Weight: 1.04 g typ)
TSOP I 32-P-0820-0.50 (CFT)	(Weight: 0.34 g typ)
TSOP I 32-P-0820-0.50A (CTR)	(Weight: 0.34 g typ)
TSOP I 32-P-0.50 (CST)	(Weight: 0.24 g typ)
TSOP I 32-P-0.50A (CSR)	(Weight: 0.24 g typ)

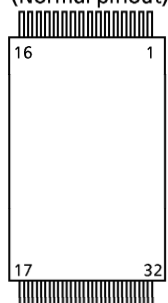
PIN ASSIGNMENT (TOP VIEW)

○ 32 PIN DIP & SOP

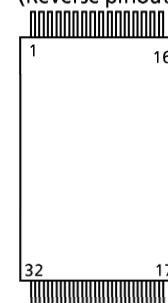
NC	1	32	V _{DD}
A16	2	31	A15
A14	3	30	$\overline{CE2}$
A12	4	29	R/W
A7	5	28	A13
A6	6	27	A8
A5	7	26	A9
A4	8	25	A11
A3	9	24	\overline{OE}
A2	10	23	A10
A1	11	22	$\overline{CE1}$
A0	12	21	I/O8
I/O1	13	20	I/O7
I/O2	14	19	I/O6
I/O3	15	18	I/O5
GND	16	17	I/O4

○ 32 PIN TSOP

(Normal pinout)



(Reverse pinout)



PIN NAMES

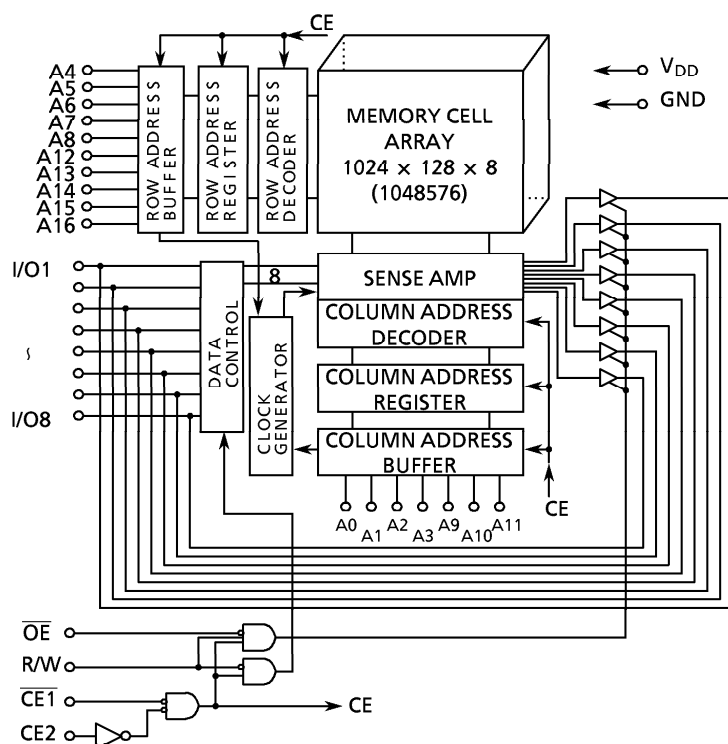
A0 to A16	Address Inputs
R/W	Read/Write Control
\overline{OE}	Output Enable
$\overline{CE1}$, $\overline{CE2}$	Chip Enable
I/O1 to I/O8	Data Input/Output
V _{DD}	Power (+ 5 V)
GND	Ground
NC	No Connection

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	$\overline{CE2}$	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	$\overline{CE1}$	A ₁₀	\overline{OE}

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BLOCK DIAGRAM



OPERATION MODE

MODE	$\overline{\text{CE1}}$	CE2	$\overline{\text{OE}}$	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 _{I/O}	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	0 to 70	°C

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

**** SOP**

DC RECOMMENDED OPERATING CONDITIONS ($T_a = 0^\circ$ to 70°C)

SYMBOL	PARAMETER	MIN	TYP	MAX	UNIT
V_{DD}	Power Supply Voltage	4.5	5.0	5.5	V
V_{IH}	Input High Voltage	2.2	–	$V_{DD} + 0.3$	
V_{IL}	Input Low Voltage	– 0.3*	–	0.8	
V_{DH}	Data Retention Supply Voltage	2.0	–	5.5	

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

DC CHARACTERISTICS ($T_a = 0^\circ$ to 70°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	CE1 = V _{IH} or CE2 = V _{IL} or R/W = V _{IL} or OE = V _{IH} , V _{OUT} = 0 V to V _{DD}			–	–	± 1.0	μA	
I _{DDO1}	Operating Current	CE1 = V _{IL} and CE2 = V _{IH} and R/W = V _{IH} , I _{OUT} = 0 mA Other Inputs = V _{IH} /V _{IL}	Tcycle = min	-55, -55L	–	–	80	mA	
				-70, -70L, -85, -85L	–	–	70		
			Tcycle = 1 μs			–	–	20	
I _{DDO2}			CE1 = 0.2 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	Tcycle = min	-55, -55L	–	–	70	mA
	-70, -70L, -85, -85L	–			–	60			
	Tcycle = 1 μs				–	–	10		
I _{DD1}	Standby Current	CE1 = V _{IH} or CE2 = V _{IL}			–	–	3	mA	
I _{DD2} (Note)		CE1 = V _{DD} – 0.2 V or CE2 = 0.2 V V _{DD} = 2.0 to 5.5 V	-55, -70, -85	Ta = 25°C	–	1	–	μA	
				Ta = 0° to 70°C	–	–	100		
			-55L, -70L, -85L	Ta = 25°C	–	1	2		
				Ta = 0° to 70°C	–	–	20		

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 ($T_a = 0^\circ$ to 70°C , $V_{DD} = 5\text{ V} \pm 10\%$)

READ CYCLE

SYMBOL	PARAMETER	TC551001CP/CF/CFT/CTR/CST/CSR						UNIT
		-55, -55L		-70, -70L		-85, -85L		
		MIN	MAX	MIN	MAX	MIN	MAX	
t _{RC}	Read Cycle Time	55	–	70	–	85	–	ns
t _{ACC}	Address Access Time	–	55	–	70	–	85	
t _{CO1}	Chip Enable (CE1) Access Time	–	55	–	70	–	85	
t _{CO2}	Chip Enable (CE2) Access Time	–	55	–	70	–	85	
t _{OE}	Output Enable Access Time	–	30	–	35	–	45	
t _{COE}	Chip Enable Low to Output Active	10	–	10	–	10	–	
t _{OEE}	Output Enable Low to Output Active	5	–	5	–	5	–	
t _{OD}	Chip Enable High to Output High-Z	–	20	–	25	–	30	
t _{ODO}	Output Enable High to Output High-Z	–	20	–	25	–	30	
t _{OH}	Output Data Hold Time	10	–	10	–	10	–	

WRITE CYCLE

SYMBOL	PARAMETER	TC551001CP/CF/CFT/CTR/CST/CSR						UNIT
		-55, -55L		-70, -70L		-85, -85L		
		MIN	MAX	MIN	MAX	MIN	MAX	
t _{WC}	Write Cycle Time	55	–	70	–	85	–	ns
t _{WP}	Write Pulse Width	45	–	50	–	60	–	
t _{CW}	Chip Enable to End of Write	5	–	60	–	75	–	
t _{AS}	Address Setup Time	0	–	0	–	0	–	
t _{WR}	Write Recovery Time	0	–	0	–	0	–	
t _{ODW}	R/W Low to Output High-Z	–	20	–	25	–	30	
t _{OEW}	R/W High to Output Active	5	–	5	–	5	–	
t _{DS}	Data Setup Time	25	–	30	–	35	–	
t _{DH}	Data Hold Time	0	–	0	–	0	–	

AC TEST CONDITIONS

Output load: 30 pF + one TTL gate (-55, -55L)

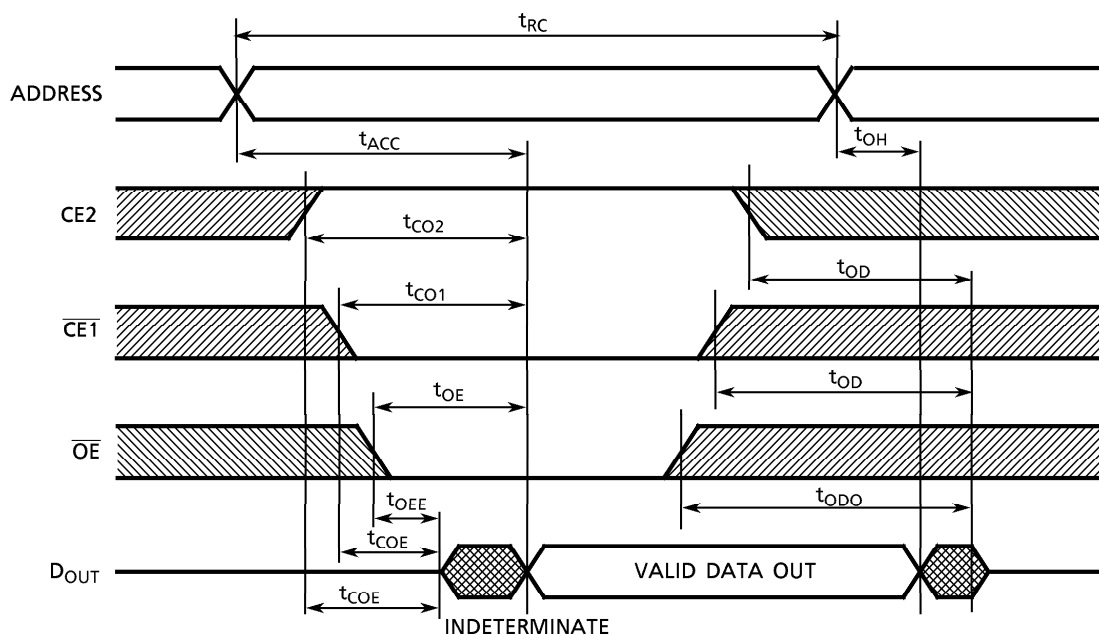
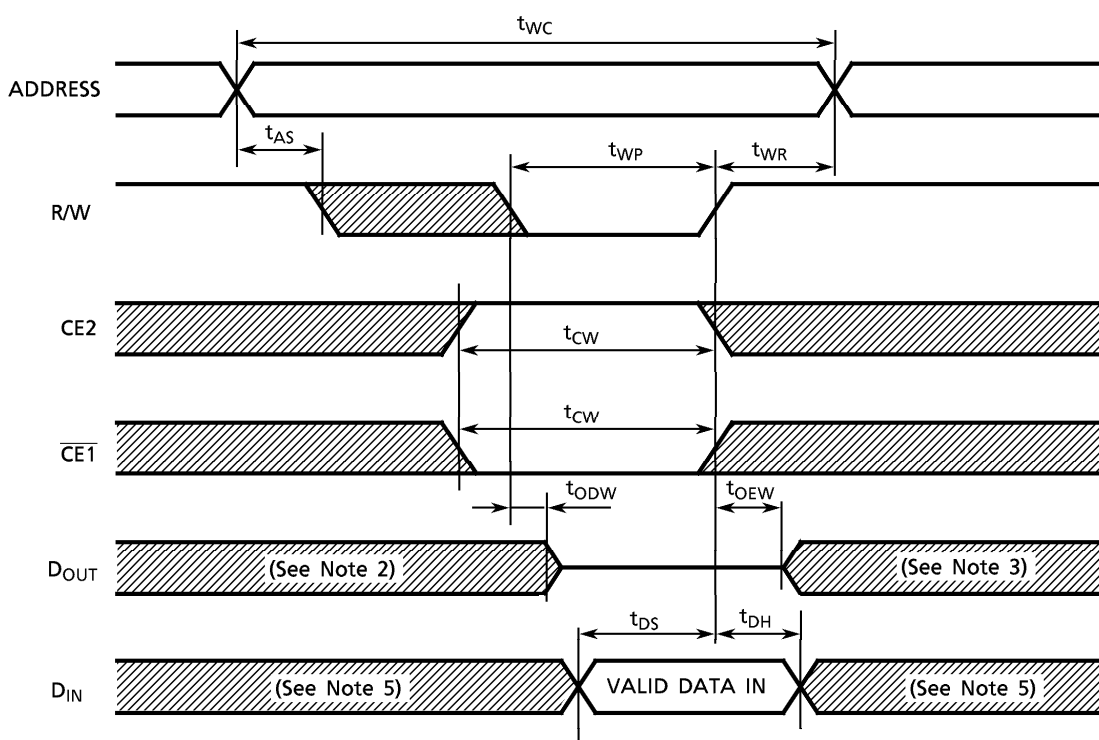
: 100 pF + one TTL gate (-70, -70L, -85, -85L)

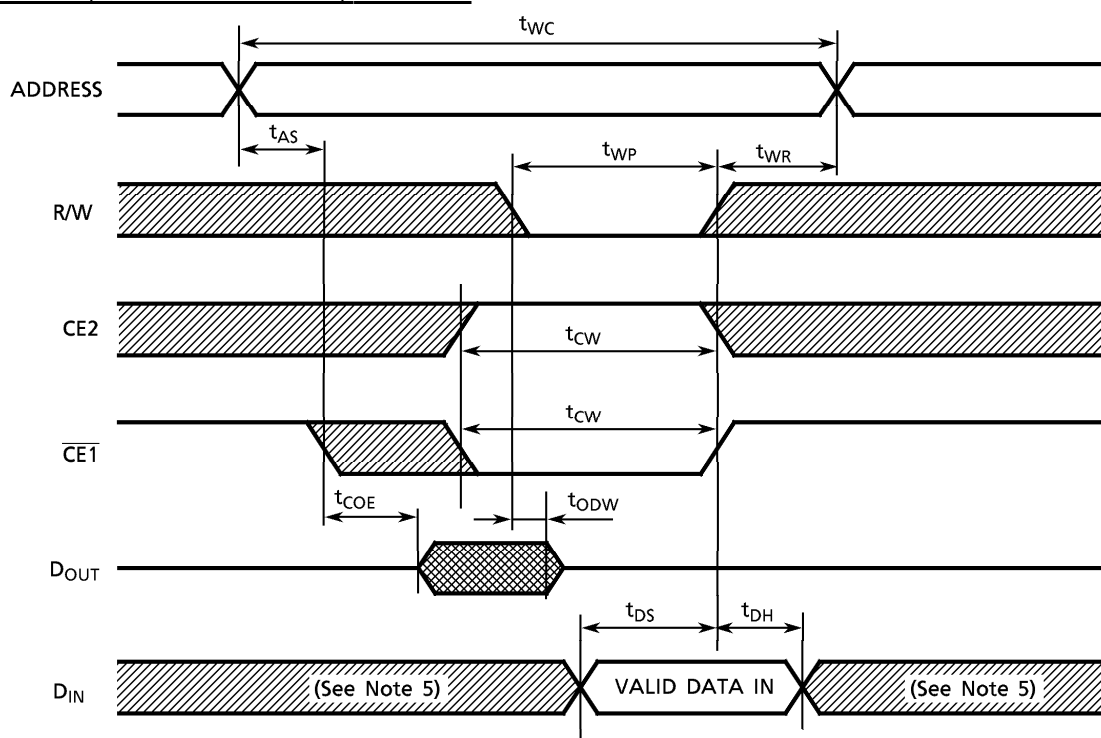
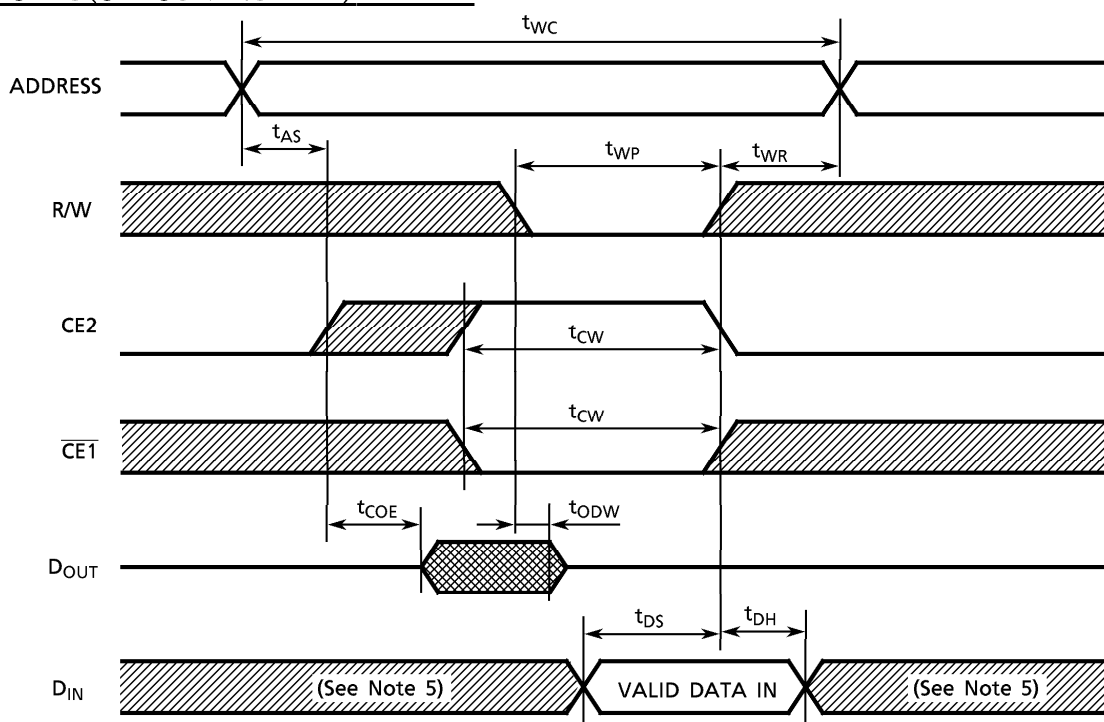
Input pulse level: 0.6 V, 2.4 V

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.

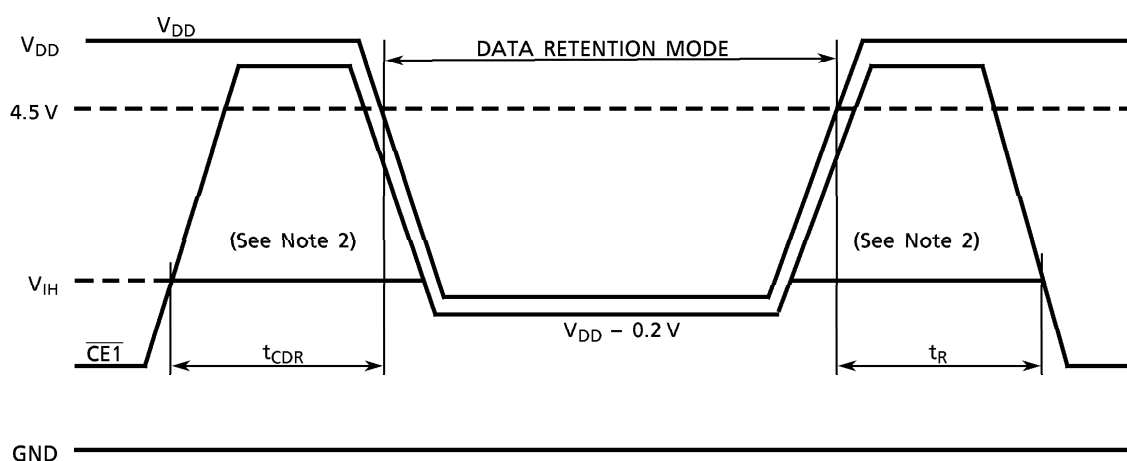
(5) Because I/O signals may be in the output state at this time, input signals of reverse polarity must not be applied.

DATA RETENTION CHARACTERISTICS (Ta = 0° to 70°C)

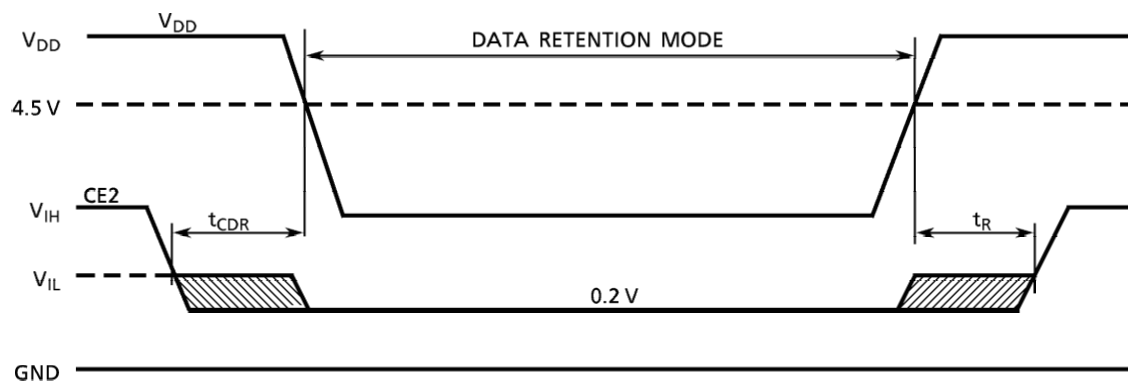
SYMBOL	PARAMETER			MIN	TYP	MAX	UNIT
V _{DH}	Data Retention Supply Voltage			2.0	–	5.5	V
I _{DD52}	Standby Current	-55, -70, -85	V _{DH} = 3.0 V	–	–	50	μA
			V _{DH} = 5.5 V	–	–	100	
		-55L, -70L, -85L	V _{DH} = 3.0 V	–	–	10*	
			V _{DH} = 5.5 V	–	–	20	
t _{CDR}	Chip Deselect to Data Retention Mode Time			0	–	–	nS
t _R	Recovery Time			5	–	–	mS

* 2 μA (max) at Ta = 0° to 40°C

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

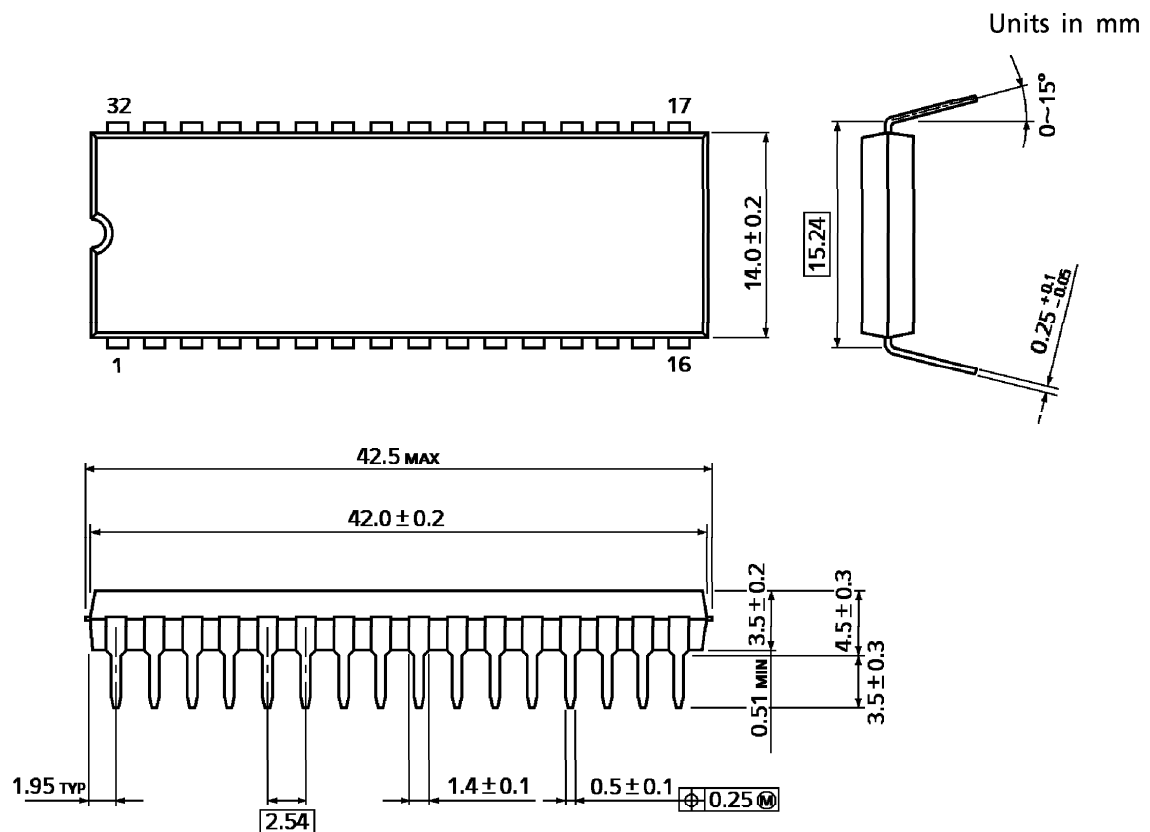


CE2 CONTROLLED DATA RETENTION MODE (See Note 3)



- 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 (2.2 V), the operation current is given by I_{DDSI} during the transition of V_{DD} from 4.5 to 2.4 V.
- (3) In CE2 controlled data retention mode, minimum standby current mode is entered when $\text{CE2} \leq 0.2 \text{ V}$.

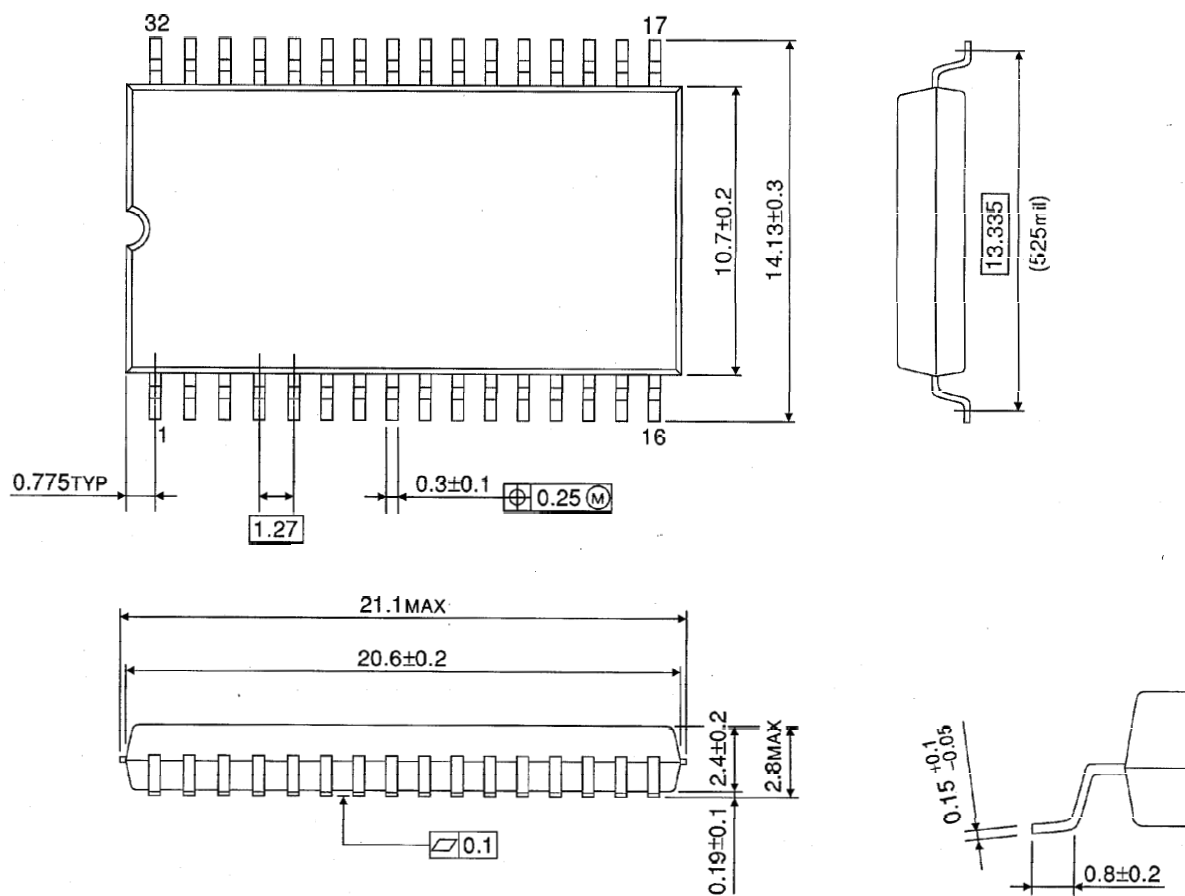
PACKAGE DIMENSIONS (DIP32-P-600-2.54)



Weight: 4.45 g (typ)

PACKAGE DIMENSIONS (SOP32-P-525-1.27)

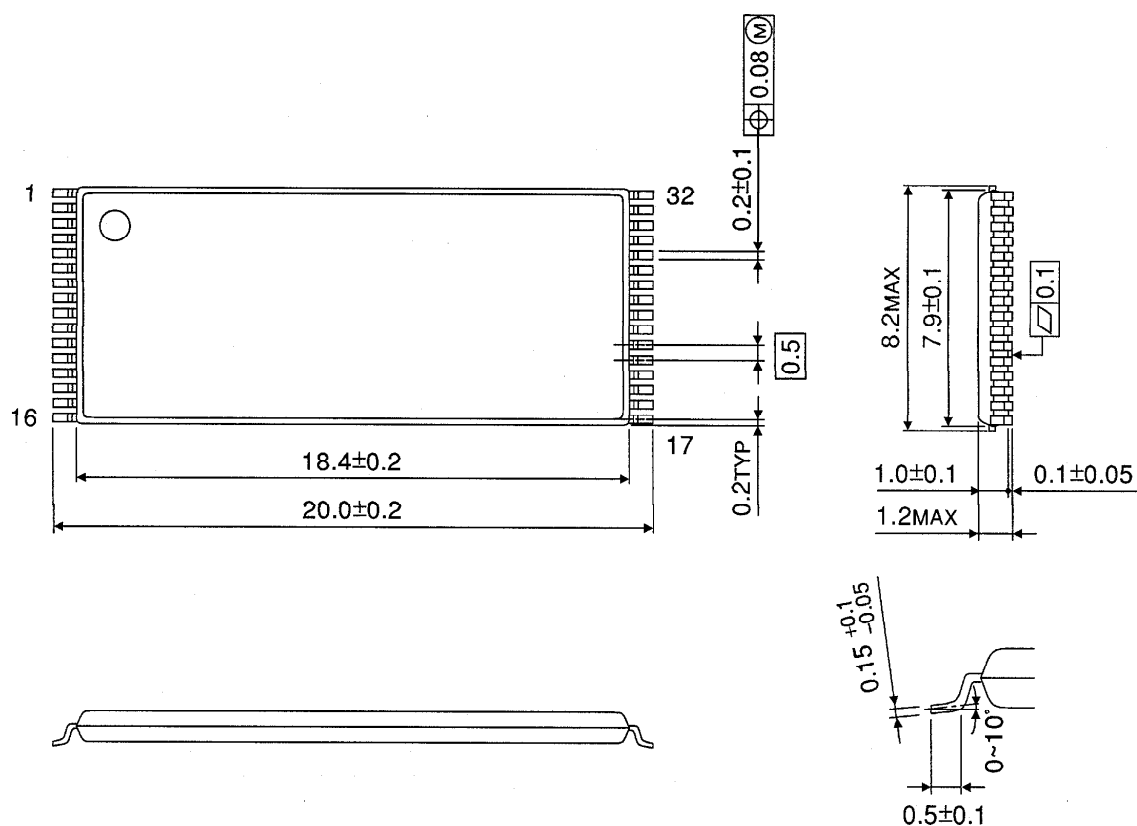
Units in mm



Weight: 1.04 g (typ)

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

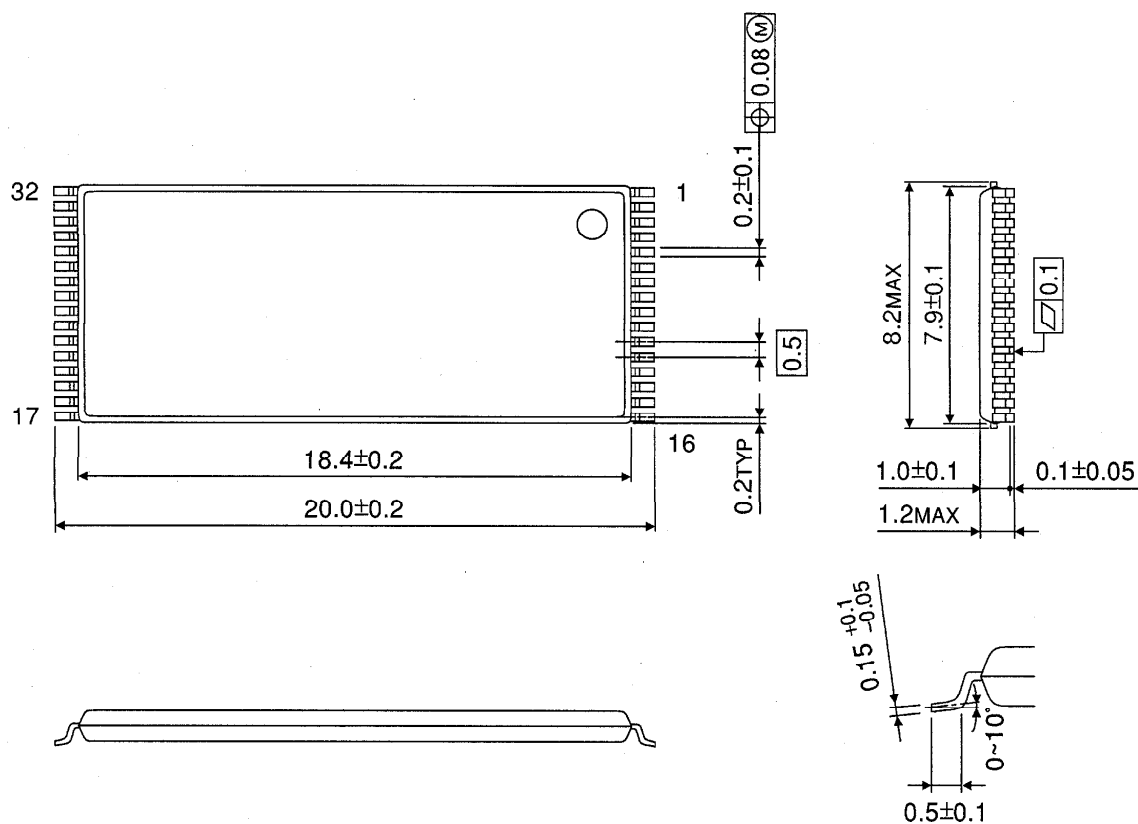
Units in mm



Weight: 0.34 g (typ)

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

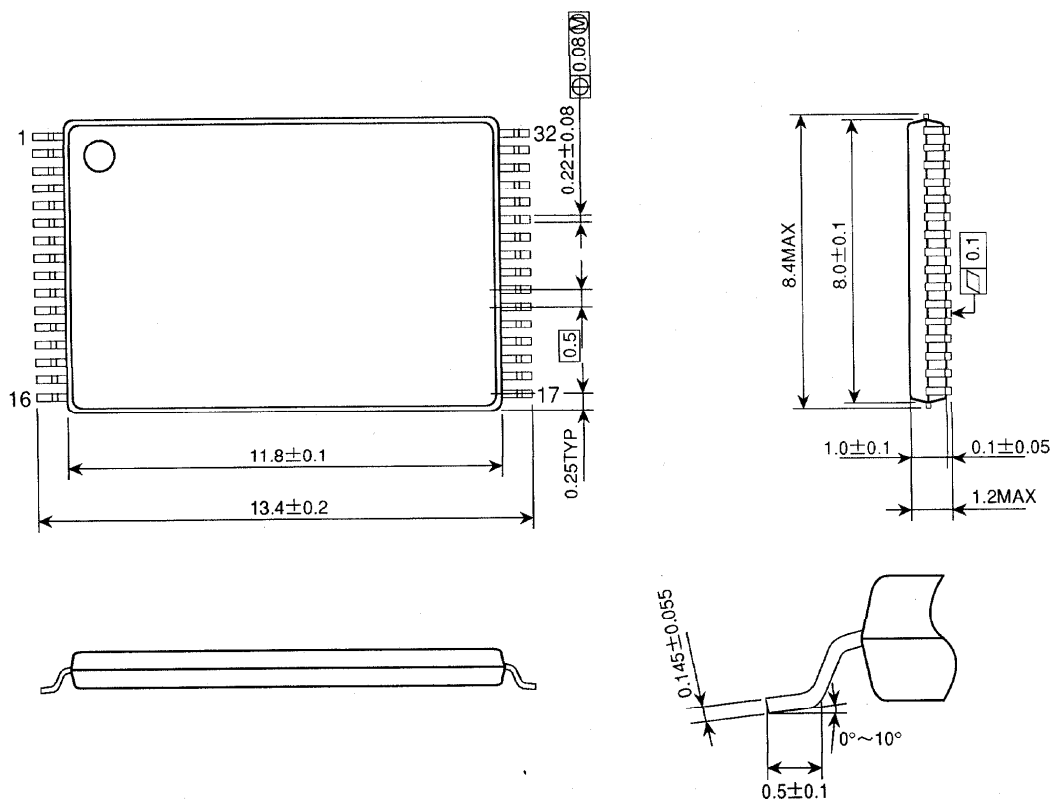
Units in mm



Weight: 0.34 g (typ)

PACKAGE DIMENSIONS (TSOP I 32-P-0.50)

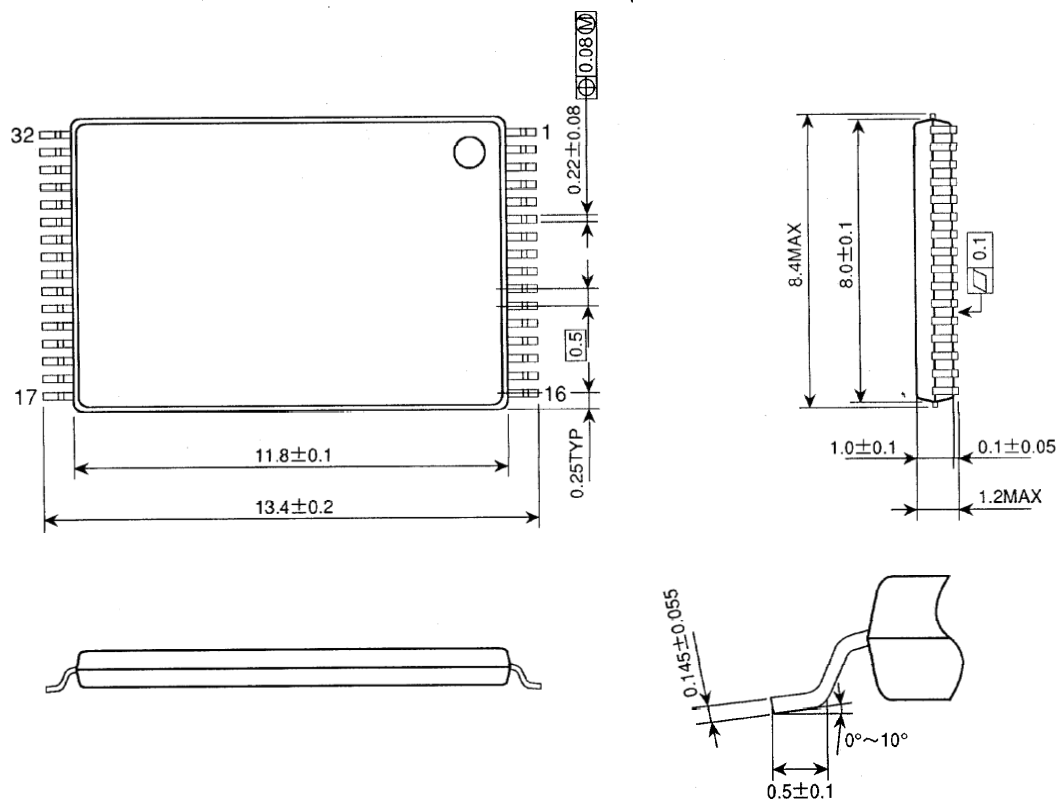
Units in mm



Weight: 0.24 g (typ)

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

Units in mm



Weight: 0.24 g (typ)