

131,072-WORD BY 8-BIT STATIC RAM

DESCRIPTION

The TC55V1001AF/AFT/ATR/AST/ASR 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 2.7 to 3.6 V power supply. Advanced circuit technology provides both high speed and low power at an operating current of 3 mA/MHz and a minimum cycle time of 70 ns. It is automatically placed in low-power mode at 0.5 μ A standby current (L-Version at $V_{DD}=3V$, $T_a=25^\circ C$) when chip enable ($\overline{CE1}$) is asserted high or ($CE2$) is asserted low. There are three control inputs. $\overline{CE1}$ and $CE2$ 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 TC55V1001AF/AFT/ATR/AST/ASR is available in a 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: 10.8 mW/MHz (typical)
- Single power supply voltage of 2.7 to 3.6 V
- Power down features using $\overline{CE1}$ and $CE2$.
- Data retention supply voltage of 2 to 3.6 V
- Direct TTL compatibility for all inputs and outputs
- Standby current ($T_a=25^\circ C$ maximum)

	TC55V1001AF/AFT/ATR/AST/ASR	
	-70	-70L
3.6V	3 μ A	0.9 μ A
3.0V	1 μ A	0.5 μ A

- Access Times (maximum):

Access Time	70ns
$\overline{CE1}$ Access Time	70ns
$CE2$ Access Time	70ns
\overline{OE} Access Time	35ns

- Packages:

SOP32-P-525-1.27 (AF) (Weight: 1.04 g typ)
 TSOP I 32-P-0820-0.50 (AFT) (Weight: 0.34 g typ)
 TSOP I 32-P-0820-0.50A (ATR) (Weight: 0.34 g typ)
 TSOP I 32-P-0.50 (AST) (Weight: 0.24 g typ)
 TSOP I 32-P-0.50A (ASR) (Weight: 0.24 g typ)

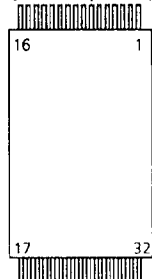
PIN ASSIGNMENT (TOP VIEW)

o 32 PIN SOP

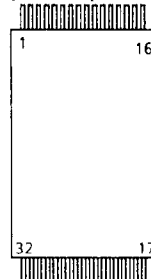
NC	1	32	V_{DD}
A16	2	31	A15
A14	3	30	$CE2$
A12	4	29	R/W
A7	5	28	A13
A6	6	27	A8
A5	7	26	A9
A4	8	25	A11
A3	9	24	\overline{OE}
A2	10	23	A10
A1	11	22	$\overline{CE1}$
A0	12	21	I/O8
I/O1	13	20	I/O7
I/O2	14	19	I/O6
I/O3	15	18	I/O5
GND	16	17	I/O4

o 32 PIN TSOP

(Normal pinout)



(Reverse pinout)



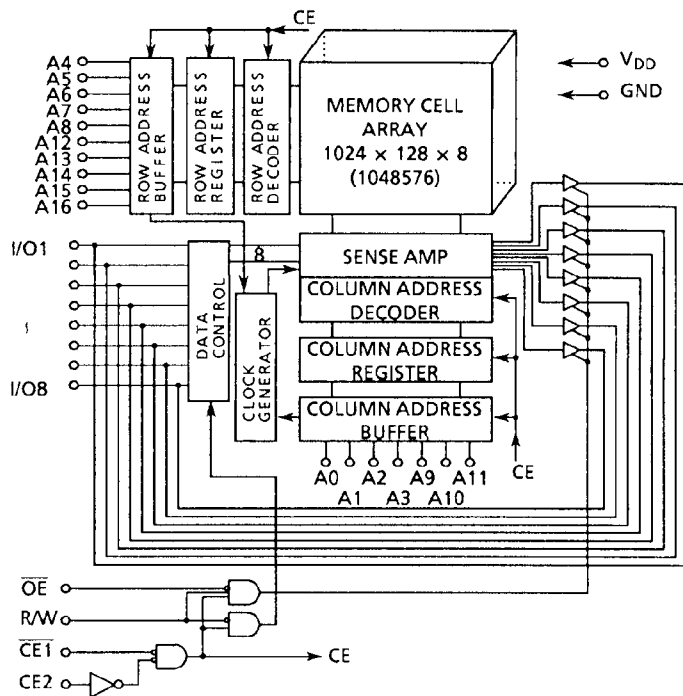
PIN NAMES

A0 to A16	Address Inputs	Pin No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
R/W	Read/Write Control	Pin Name	A ₁₁	A ₉	A ₈	A ₁₃	R/W	$CE2$	A ₁₅	V_{DD}	NC	A ₁₆	A ₁₄	A ₁₂	A ₇	A ₆	A ₅	A ₄
\overline{OE}	Output Enable	Pin No.	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
$\overline{CE1}$, $CE2$	Chip Enable	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}
I/O1 to I/O8	Data Input/Output																	
V_{DD}	Power																	
GND	Ground																	
NC	No Connection																	

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BLOCK DIAGRAM



OPERATION MODE

MODE	$\overline{CE1}$	CE2	\overline{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 4.6	V
V _{IN}	Input Voltage	- 0.3* to 4.6	V
V _{I/O}	Input/Output Voltage	- 0.5 to V _{DD} + 0.5	V
P _D	Power Dissipation	0.8	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 (Ta = 0° to 70°C)

SYMBOL	PARAMETER	2.7 to 3.6 V			UNIT
		MIN	TYP	MAX	
V _{DD}	Power Supply Voltage	2.7	-	3.6	V
V _{IH}	Input High Voltage	2.0	-	V _{DD} + 0.3	
V _{IL}	Input Low Voltage	- 0.3*	-	0.8	
V _{DH}	Data Retention Supply Voltage	2.0	-	3.6	

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

DC CHARACTERISTICS (Ta = 0° to 70°C, V_{DD} = 2.7 to 3.6 V)

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} = V _{DD} - 0.5 V	- 0.5	-	-	mA			
I _{OL}	Output Low Current	V _{OL} = 0.4 V	2.1	-	-	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 Input = V _{IH} /V _{IL}	V _{DD} = 3 V ± 10%	Tcycle	min	-	-	35	mA
					1 μs	-	-	10	
I _{DDO2}	Operating Current	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 V	V _{DD} = 3 V ± 10%	Tcycle	min	-	-	30	
					1 μs	-	-	5	
I _{DDO2}	Operating Current	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 V	V _{DD} = 3.3 V ± 0.3 V	Tcycle	min	-	-	12	
					1 μs	-	-	6	
I _{DDS1}	Standby Current	CE1 = V _{IH} or CE2 = V _{IL}	-	-	2	mA			
I _{DDS2} (Note)	Standby Current	$\overline{CE1} = V_{DD} - 0.2 V$ or CE2 = 0.2 V V _{DD} = 2.0 to 3.6 V	V _{DD} = 3 V ± 10%	Ta = 25°C	-70	-	1	2	
					-70L	-	0.5	0.7	
				Ta = 0° to 70°C	-70	-	-	20	
					-70L	-	-	15	
				V _{DD} = 3.3 V ± 0.3 V	Ta = 25°C	-70	-	2	3
						-70L	-	0.7	0.9
			Ta = 0° to 70°C		-70	-	-	25	
					-70L	-	-	20	
			V _{DD} = 3 V		Ta = 25°C	-70	-	-	1
						-70L	-	-	0.5
				Ta = 0° to 40°C	-70	-	-	3	
					-70L	-	-	2	
Ta = 0° to 70°C	-70	-	-	15					
	-70L	-	-	10					

Note: In standby mode with $\overline{CE1} \geq V_{DD} - 0.2 V$, these limits are assured for the condition CE2 $\geq V_{DD} - 0.2 V$ or CE2 $\leq 0.2 V$.

CAPACITANCE (Ta = 25°C, f = 1 MHz)

SYMBOL	PARAMETER	TEST CONDITION	MAX	UNIT
C _{IN}	Input Capacitance	V _{IN} = GND	10	pF
C _{OUT}	Output Capacitance	V _{OUT} = 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 , $V_{DD} = 2.7$ to 3.6 V)READ CYCLE

SYMBOL	PARAMETER	MIN	MAX	UNIT
t_{RC}	Read Cycle Time	70	–	ns
t_{ACC}	Address Access Time	–	70	
t_{CO1}	Chip Enable (CE1) Access Time	–	70	
t_{CO2}	Chip Enable (CE2) Access Time	–	70	
t_{OE}	Output Enable Access Time	–	35	
t_{COE}	Chip Enable Low to Output Active	10	–	
t_{OEE}	Output Enable Low to Output Active	5	–	
t_{OD}	Chip Enable High to Output High-Z	–	25	
t_{ODO}	Output Enable High to Output High-Z	–	25	
t_{OH}	Output Data Hold Time	10	–	

WRITE CYCLE

SYMBOL	PARAMETER	MIN	MAX	UNIT
t_{WC}	Write Cycle Time	70	–	ns
t_{WP}	Write Pulse Width	50	–	
t_{CW}	Chip Enable to End of Write	60	–	
t_{AS}	Address Setup Time	0	–	
t_{WR}	Write Recovery Time	0	–	
t_{ODW}	R/W Low to Output High-Z	–	25	
t_{OEW}	R/W High to Output Active	5	–	
t_{DS}	Data Setup Time	30	–	
t_{DH}	Data Hold Time	0	–	

AC TEST CONDITIONS

Output load: 100 pF + one TTL gate

Input pulse level: 0.6 V, 2.2 V

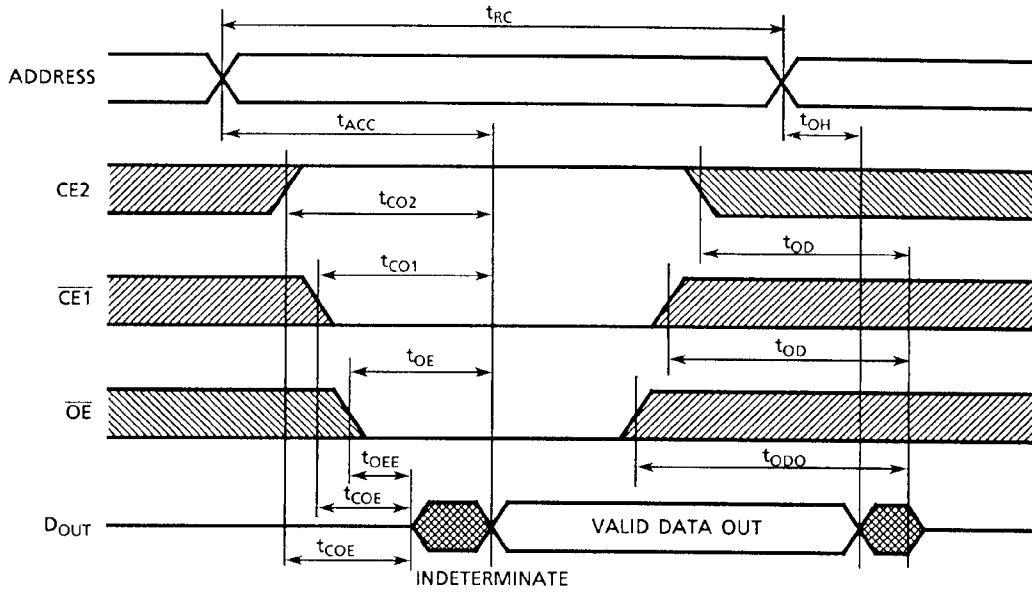
Timing measurements: 1.5 V

Reference level: 1.5 V

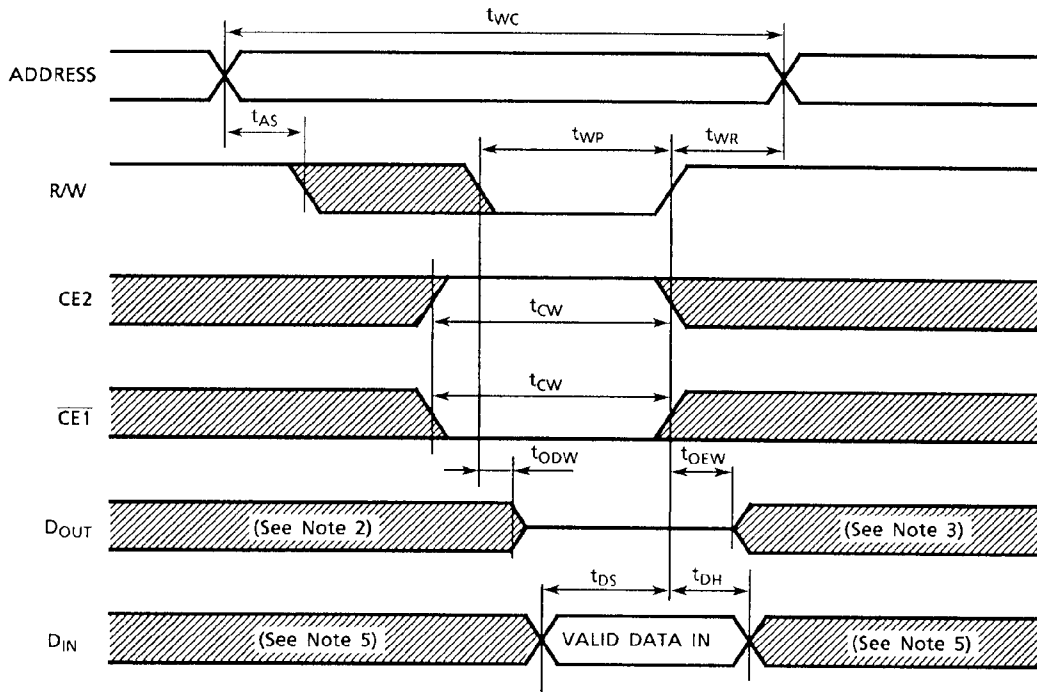
 $t_R, t_F: 5\text{ ns}$

TIMING DIAGRAMS

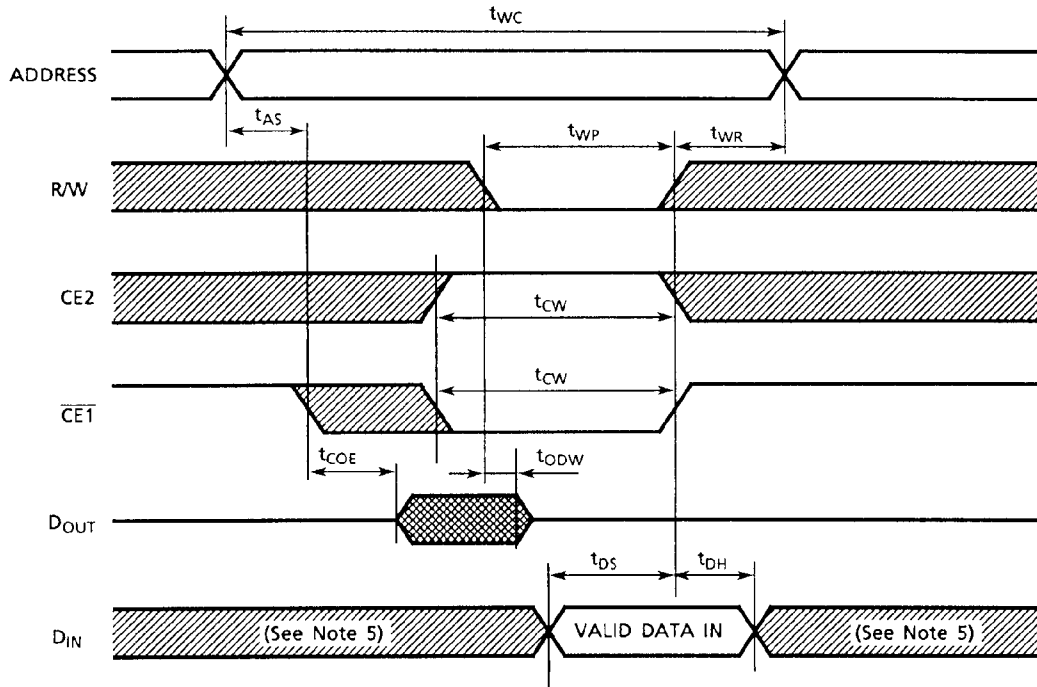
READ CYCLE (See Note 1)



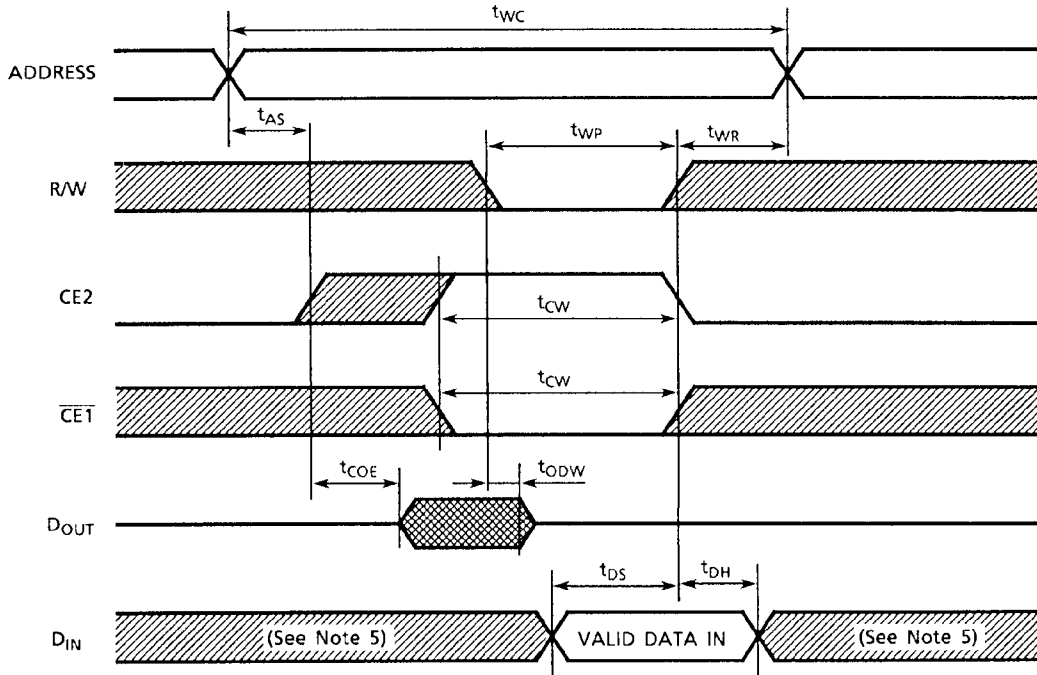
WRITE CYCLE 1 (R/W CONTROLLED) (See Note 4)



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



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



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

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

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

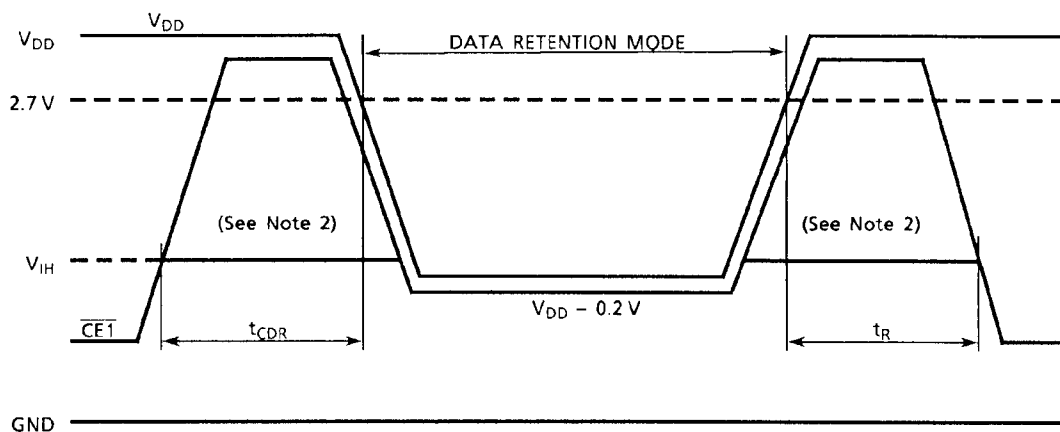
(4) If \overline{OE} is HIGH during the write cycle, the outputs will remain at high impedance.

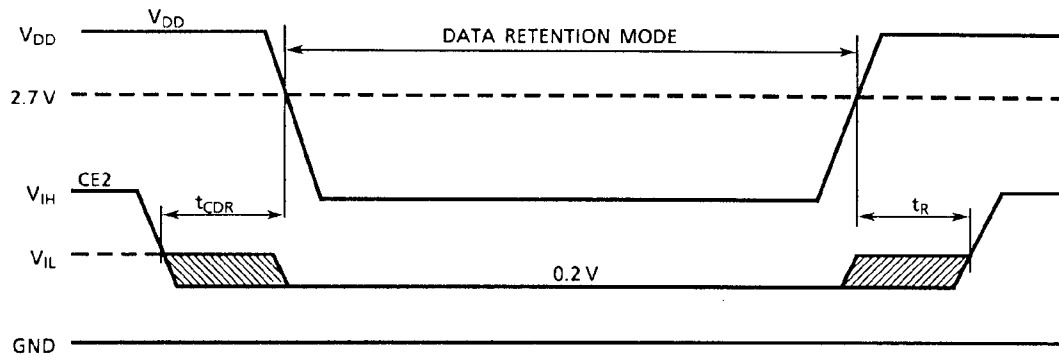
(5) Because I/O signals may be in the output state at this time, input signals of reverse polarity must not be applied.

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

SYMBOL	PARAMETER		MIN	TYP	MAX	UNIT	
V _{DH}	Data Retention Supply Voltage		2.0	-	3.6	V	
I _{DD2}	Standby Current	V _{DH} = 3.0V	Ta = 0° to 40°C	-70	-	3	μA
			-70L	-	-	2	
		V _{DH} = 3.6V	Ta = 0° to 70°C	-70	-	15	
			-70L	-	-	10	
		V _{DH} = 3.6V	Ta = 0° to 70°C	-70	-	25	
				-70L	-	20	
t _{CDR}	Chip Deselect to Data Retention Mode Time		0	-	-	nS	
t _R	Recovery Time		5	-	-	mS	

CE1 CONTROLLED DATA RETENTION MODE (See Note 1)

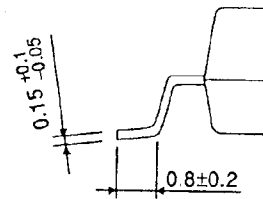
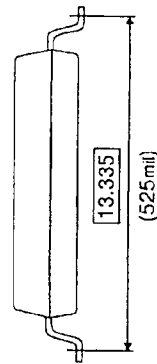
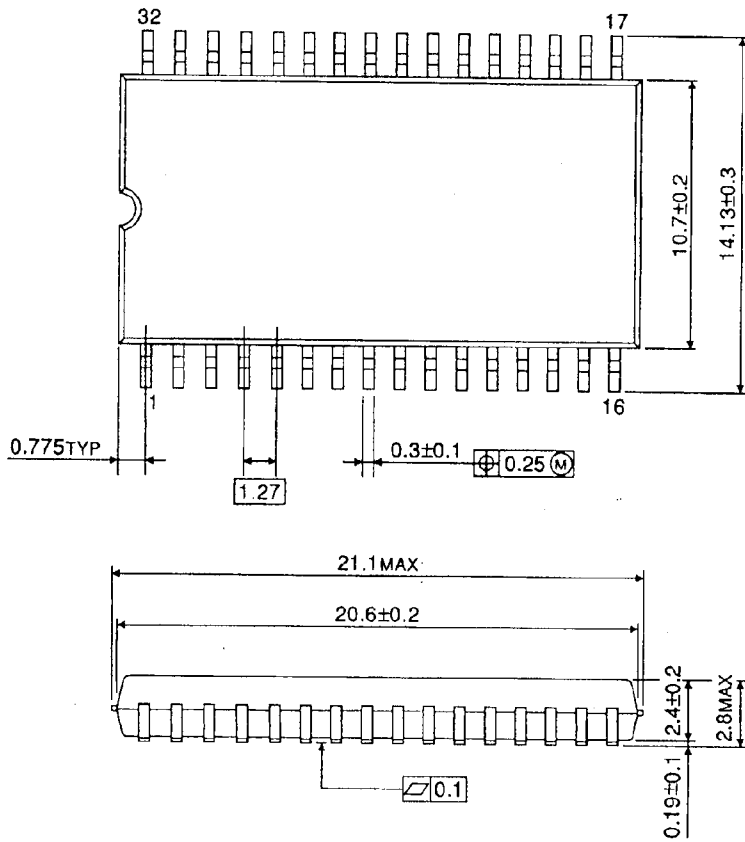


CE2 CONTROLLED DATA RETENTION MODE (See Note 3)

- 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 V), the operating current is given by I_{DDSI} during the transition of V_{DD} from 3.6 to 2.2 V.
- (3) In CE2 controlled data retention mode, minimum standby current mode is entered when $\text{CE2} \leq 0.2 \text{ V}$.

PACKAGE DIMENSIONS (SOP32-P-525-1.27)

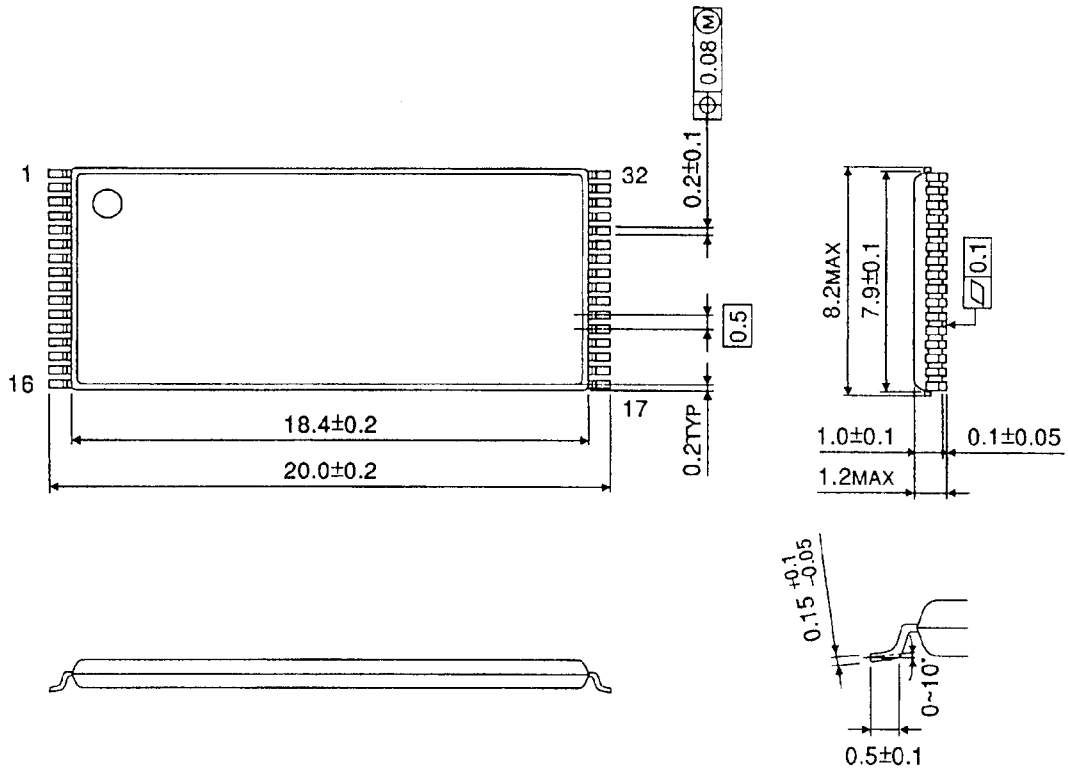
Units in mm



Weight: 1.04 g (typ)

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

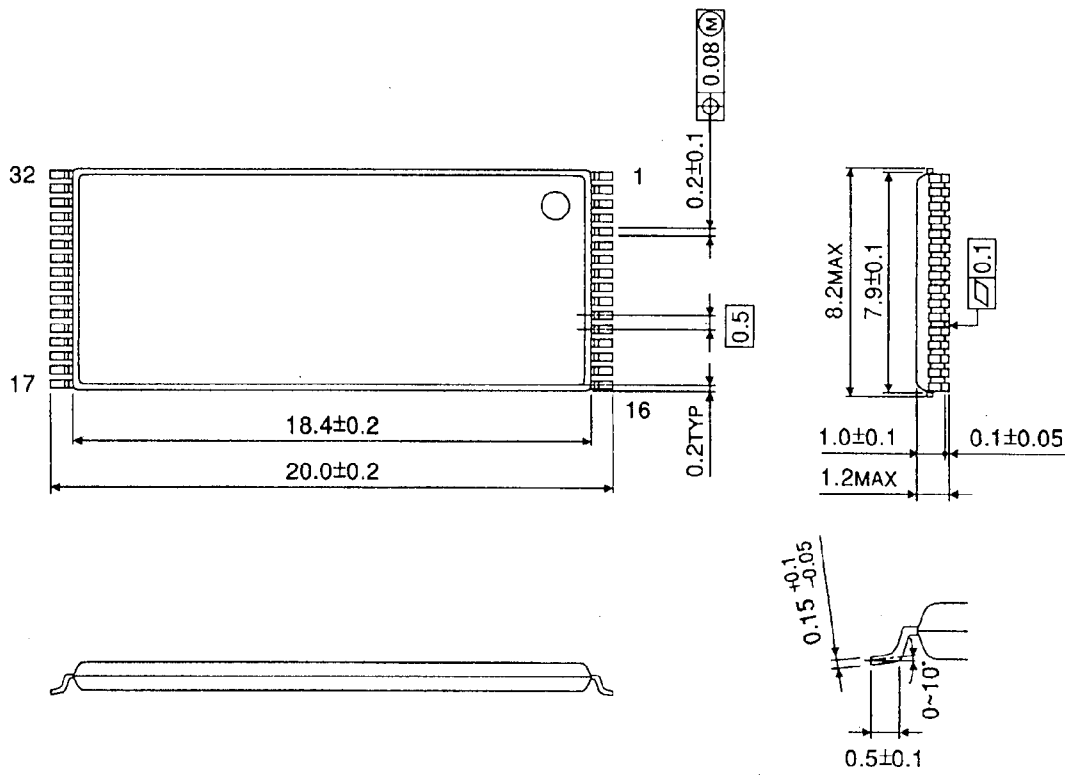
Units in mm



Weight: 0.34 g (typ)

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

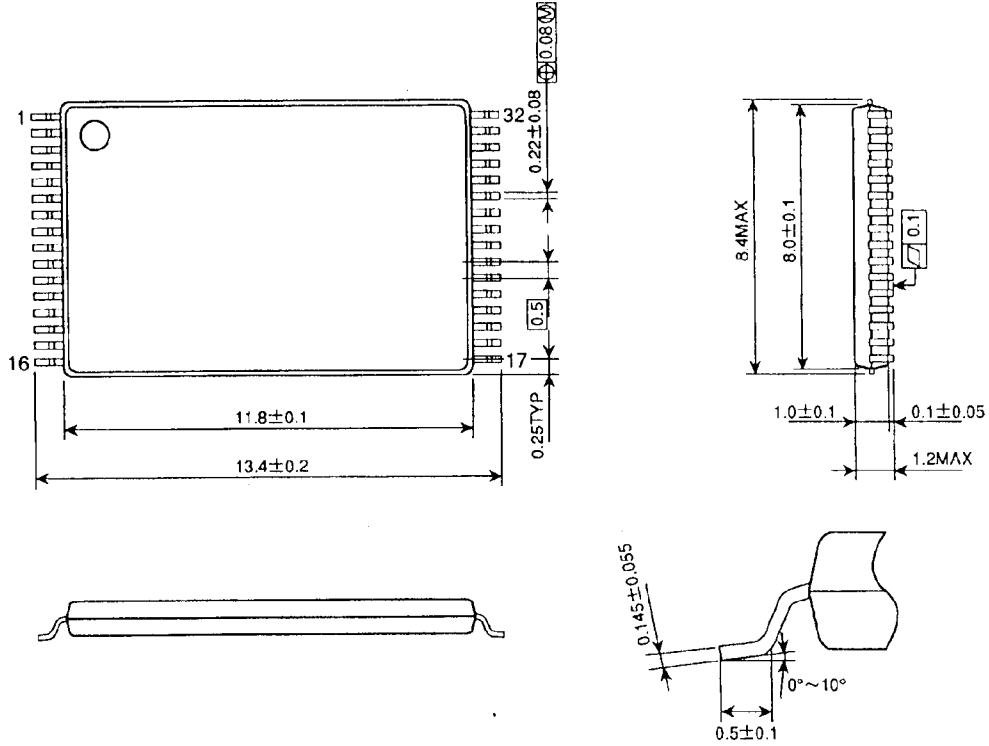
Units in mm



Weight: 0.34 g (typ)

PACKAGE DIMENSIONS (TSOP I 32-P-0.50)

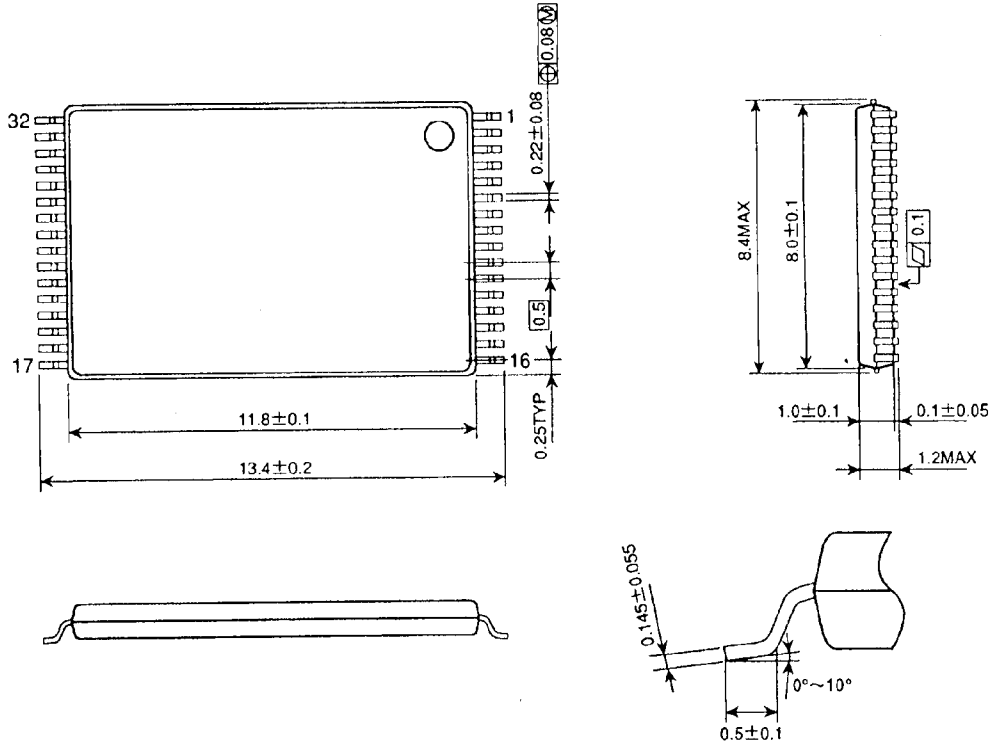
Units in mm



Weight: 0.24 g (typ)

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

Units in mm



Weight: 0.24 g (typ)