

TOSHIBA MOS DIGITAL INTEGRATED CIRCUIT SILICON GATE CMOS

131,072-WORD BY 8-BIT STATIC RAM

DESCRIPTION

The TC55V1001F/FT/TR/ST/SR 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 (typ) and a minimum cycle time of 85 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 ($CE2$) 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 TC55V1001F/FT/TR/ST/SR 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)
- Standby current of 3 μ A (maximum) at
 $T_a = 25^\circ\text{C}$
- 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

- Access Times (maximum):

	2.7 to 3.6 V	
	-85	-10
Access Time	85 ns	100 ns
$\overline{CE1}$ Access Time	85 ns	100 ns
$CE2$ Access Time	85 ns	100 ns
$\overline{OE}$ Access Time	45 ns	50 ns

- Packages:

SOP32-P-525-1.27 (F)	(Weight: 1.04 g typ)
TSOP I 32-P-0820-0.50 (FT)	(Weight: 0.34 g typ)
TSOP I 32-P-0820-0.50A (TR)	(Weight: 0.34 g typ)
TSOP I 32-P-0.50 (ST)	(Weight: 0.24 g typ)
TSOP I 32-P-0.50A (SR)	(Weight: 0.24 g typ)

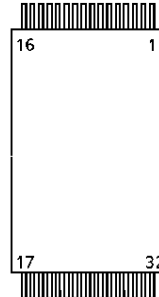
PIN ASSIGNMENT (TOP VIEW)

○ 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

○ 32 PIN TSOP

(Normal pinout)



(Reverse pinout)



PIN NAMES

A0 to A16	Address Inputs
R/W	Read/Write Control
$\overline{OE}$	Output Enable
$CE1$, $CE2$	Chip Enable
I/O1 to I/O8	Data Input/Output
V_{DD}	Power
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	A11	A9	A8	A13	R/W	$CE2$	A15	V_{DD}	NC	A16	A14	A12	A7	A6	A5	A4
Pin No.	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
Pin Name	A3	A2	A1	A0	I/O1	I/O2	I/O3	GND	I/O4	I/O5	I/O6	I/O7	I/O8	$\overline{CE1}$	A10	$\overline{OE}$

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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}

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

** 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	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 Input = V _{IH} /V _{IL}	V _{DD} = 3 V ± 10%	T _{cycle}	min	–	–	35	mA
					1 μs	–	–	10	
			V _{DD} = 3.3 V ± 0.3 V	T _{cycle}	min	–	–	40	
					1 μs	–	–	12	
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 V	V _{DD} = 3 V ± 10%	T _{cycle}	min	–	–	30	
					1 μs	–	–	5	
			V _{DD} = 3.3 V ± 0.3 V	T _{cycle}	min	–	–	35	
					1 μs	–	–	6	
I _{DDS1}	Standby Current	CE1 = V _{IH} or CE2 = V _{IL}				–	–	2	mA
I _{DDS2} (Note)		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		–	1	2	μA
				Ta = 0° to 70°C		–	–	20	
			V _{DD} = 3.3 V ± 0.3 V	Ta = 25°C		–	2	3	
				Ta = 0° to 70°C		–	–	25	
			V _{DD} = 3.0 V	Ta = 25°C		–	1	–	
				Ta = 0° to 40°C		–	–	3	
		Ta = 0° to 70°C		–	–	15			

Note: In standby mode with CE1 ≥ V_{DD} – 0.2 V, these limits are assured for the condition CE2 ≥ V_{DD} – 0.2 V or CE2 ≤ 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	TC55V1001F/FT/TR/ST/SR				UNIT
		-85		-10		
		MIN	MAX	MIN	MAX	
t _{RC}	Read Cycle Time	85	–	100	–	ns
t _{ACC}	Address Access Time	–	85	–	100	
t _{CO1}	Chip Enable ($\overline{CE1}$) Access Time	–	85	–	100	
t _{CO2}	Chip Enable (CE2) Access Time	–	85	–	100	
t _{OE}	Output Enable Access Time	–	45	–	50	
t _{COE}	Chip Enable Low to Output Active	10	–	10	–	
t _{OEE}	Output Enable Low to Output Active	5	–	5	–	
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	TC55V1001F/FT/TR/ST/SR				UNIT
		-85		-10		
		MIN	MAX	MIN	MAX	
t _{WC}	Write Cycle Time	85	–	100	–	ns
t _{WP}	Write Pulse Width	60	–	60	–	
t _{CW}	Chip Enable to End of Write	75	–	80	–	
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	5	–	5	–	
t _{DS}	Data Setup Time	35	–	40	–	
t _{DH}	Data Hold Time	0	–	0	–	

AC TEST CONDITIONS

Output load: 100 pF + one TTL gate

Input pulse level: 0.6 V, 2.2 V

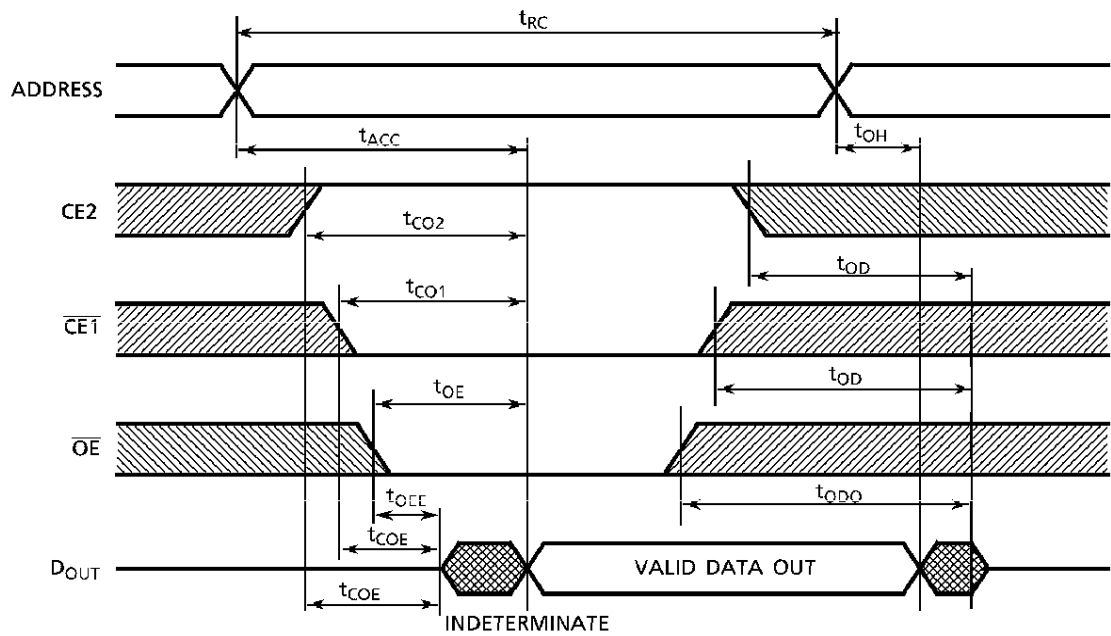
Timing measurements: 1.5 V

Reference level: 1.5 V

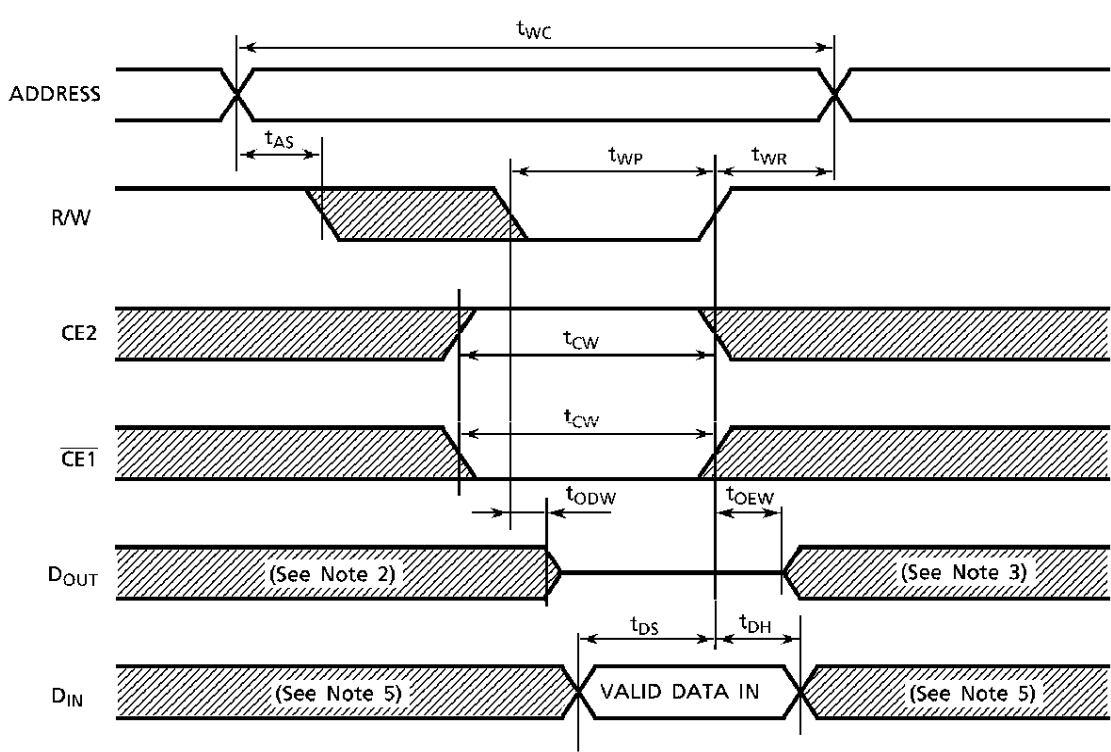
t_R , t_F : 5 ns

TIMING DIAGRAMS

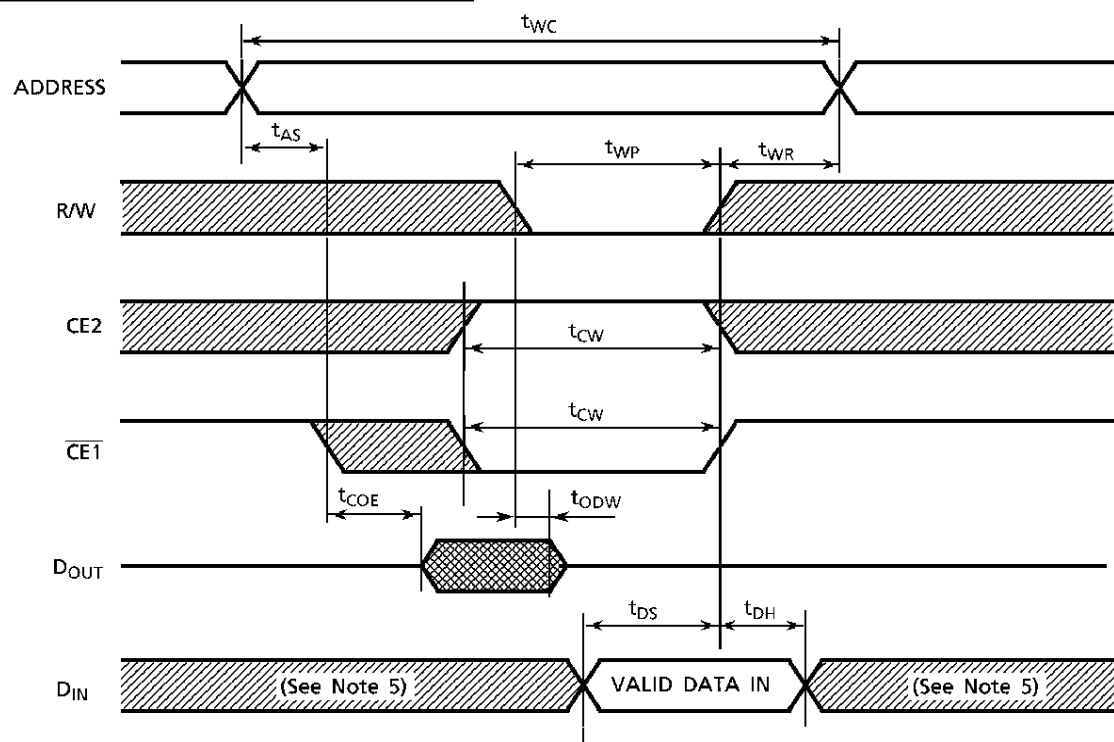
READ CYCLE (See Note 1)



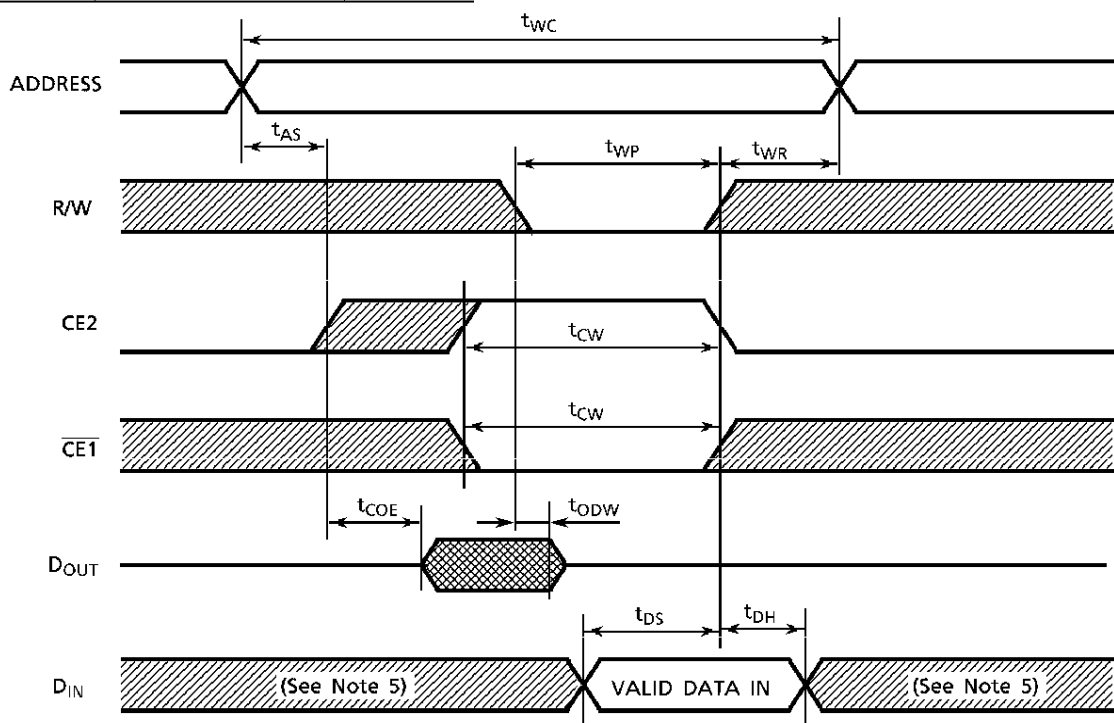
WRITE CYCLE 1 (R/W CONTROLLED) (See Note 4)



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



WRITE CYCLE 3 ($\overline{\text{CE2}}$ CONTROLLED) (See Note 4)



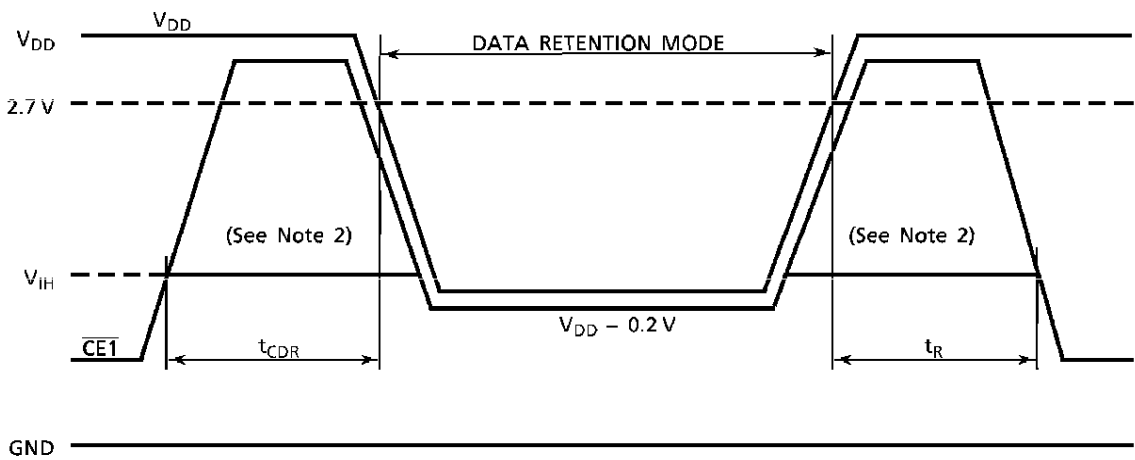
- Note: (1) R/W remains HIGH for the read cycle.
- (2) If $\overline{\text{CE1}}$ goes LOW (or CE2 goes HIGH) coincident with or after R/W goes LOW, the outputs will remain at high impedance.
- (3) If $\overline{\text{CE1}}$ goes HIGH (or CE2 goes LOW) coincident with or before R/W goes HIGH, the outputs 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.

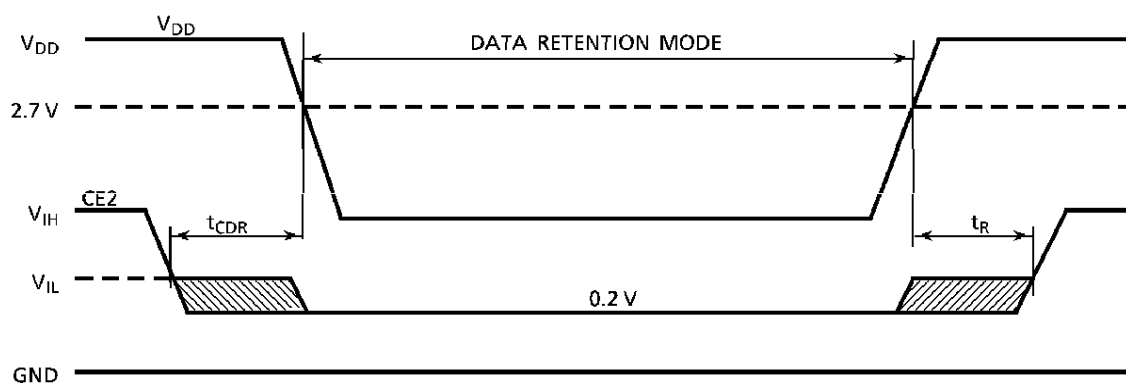
DATA RETENTION CHARACTERISTICS (Ta = 0° to 70°C)

SYMBOL	PARAMETER		MIN	TYP	MAX	UNIT
V _{DH}	Data Retention Supply Voltage		2.0	—	3.6	V
I _{DD\$2}	Standby Current	V _{DH} = 3.0 V	—	—	15*	μA
		V _{DH} = 3.6 V	—	—	25	
t _{CDR}	Chip Deselect to Data Retention Mode Time		0	—	—	nS
t _R	Recovery Time		5	—	—	mS

* 3 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 $\overline{CE1}$ controlled data retention mode, minimum standby current mode is entered when

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

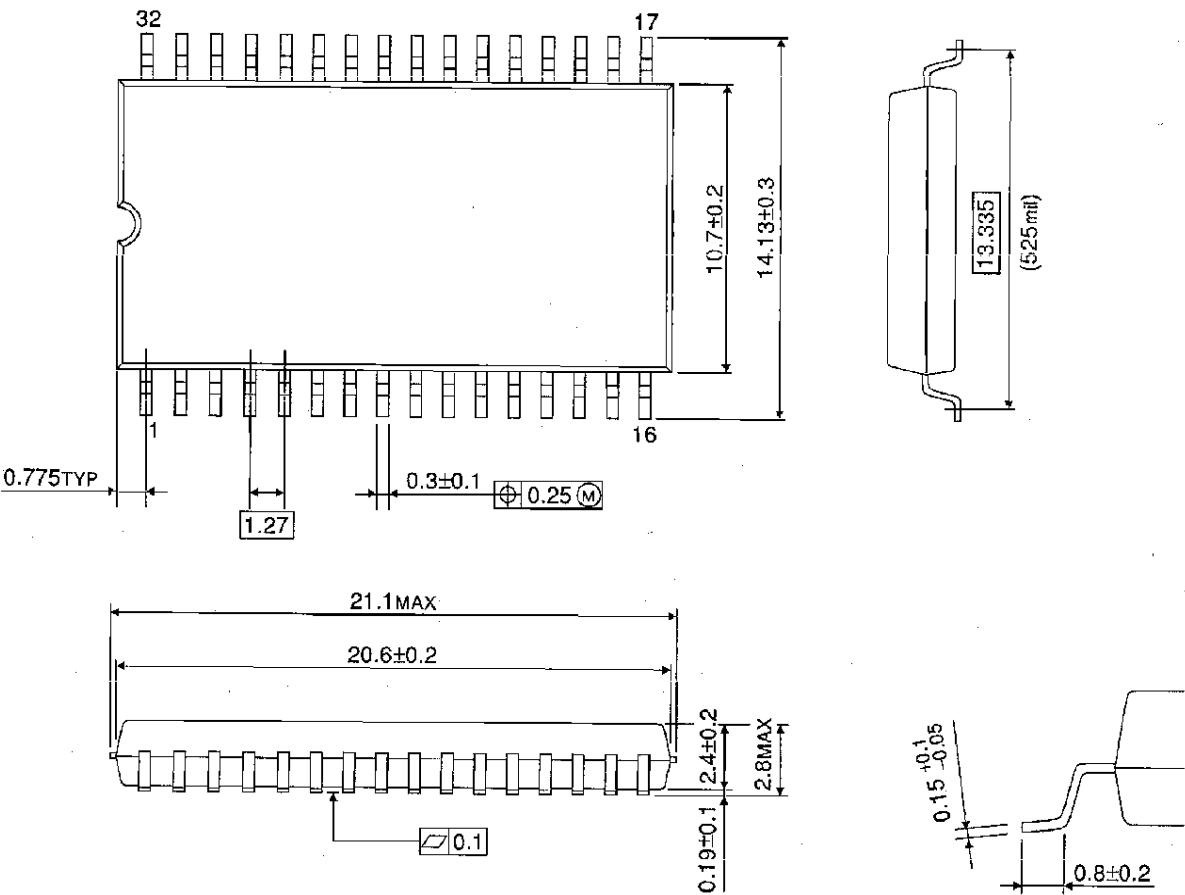
(2) When $\overline{CE1}$ is operating at the V_{IH} level (2 V), the operating current is given by I_{DDs1} during the transition of V_{DD} from 3.6 to 2.2 V.

(3) In CE2 controlled data retention mode, minimum standby current mode is entered when

$$\overline{CE2} \leq 0.2 \text{ V.}$$

PACKAGE DIMENSIONS (SOP32-P-525-1.27)

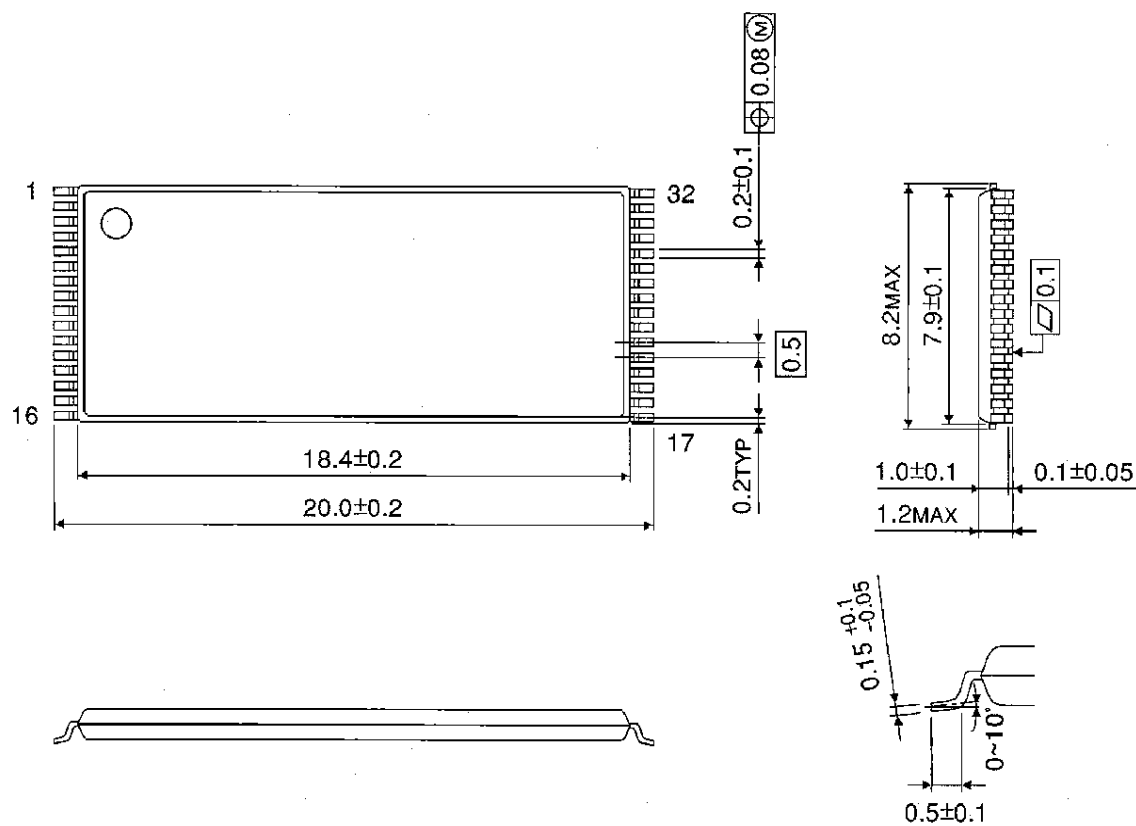
Units in mm



Weight: 1.04 g (typ)

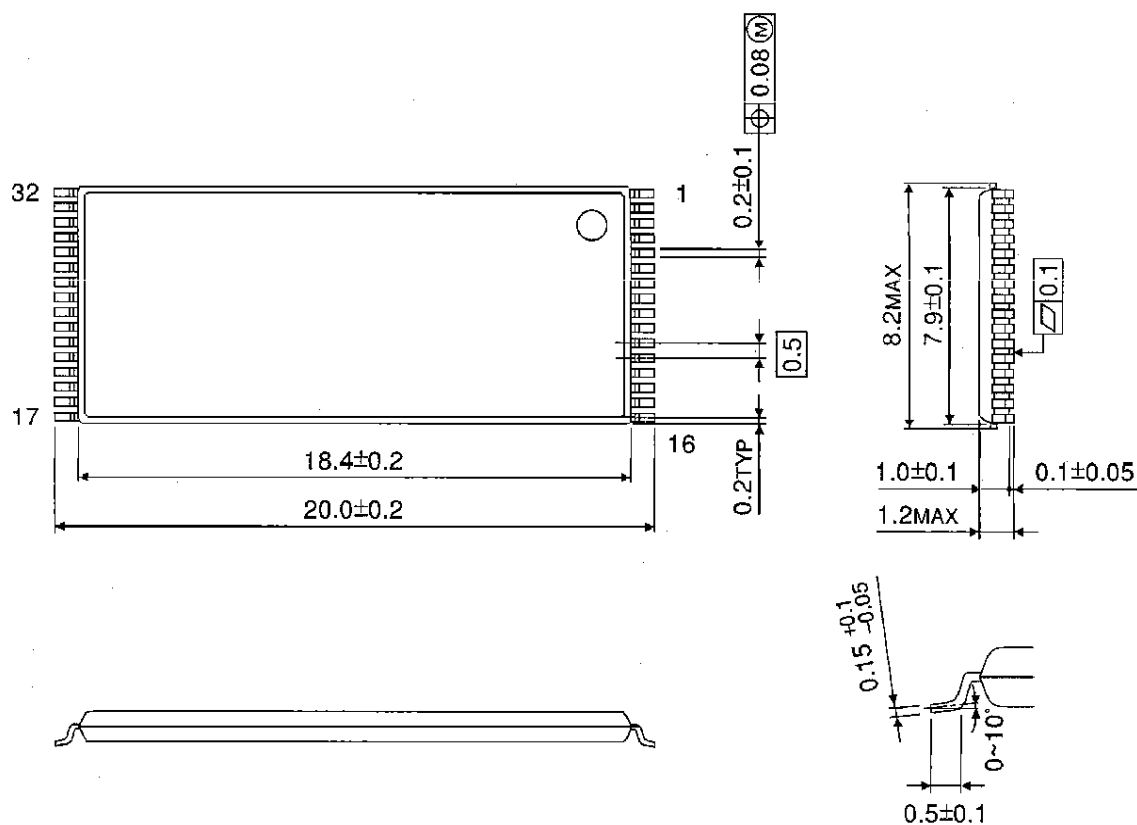
PACKAGE DIMENSIONS (TSOP I 32-P-0820-0.50)

Units in mm



Weight: 0.34 g (typ)

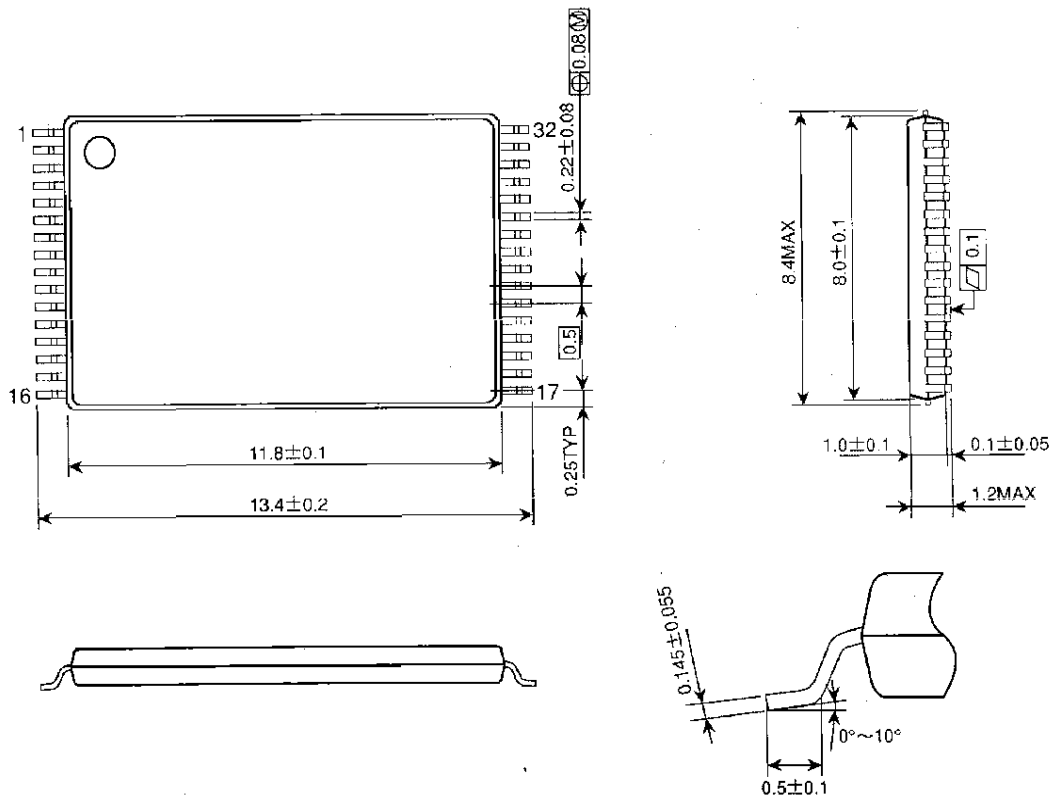
Units in mm



Weight: 0.34 g (typ)

PACKAGE DIMENSIONS (TSOP I 32-P-0.50)

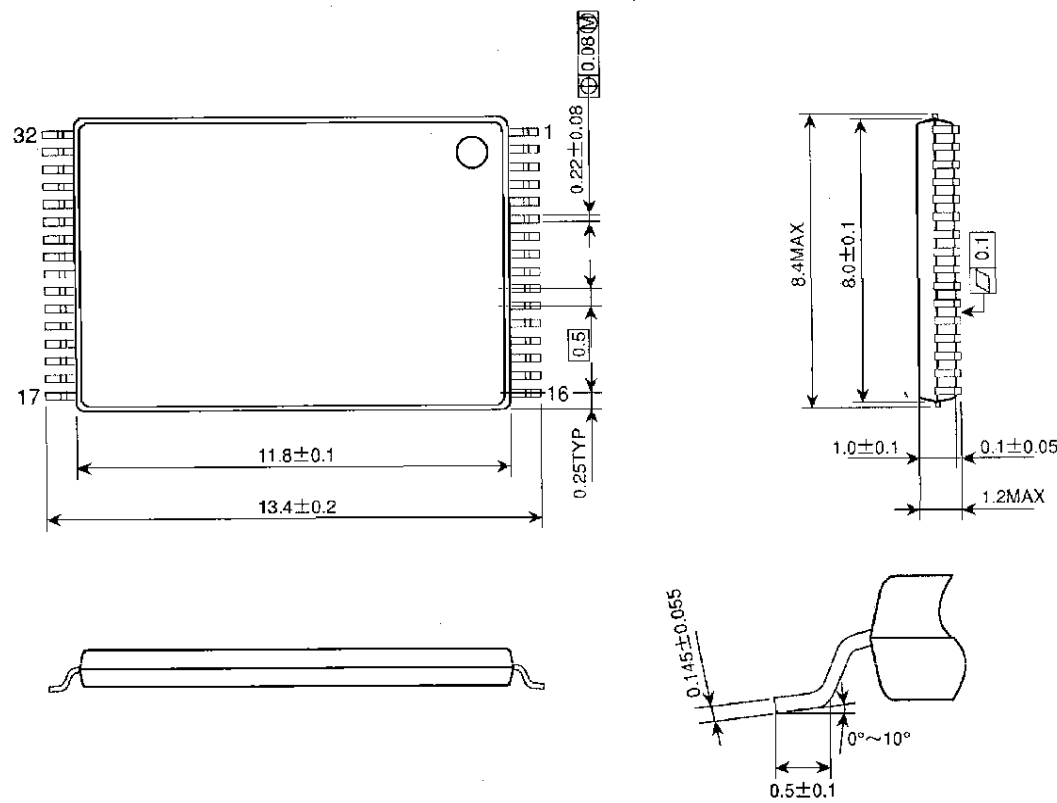
Units in mm



Weight: 0.24 g (typ)

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

Units in mm



Weight: 0.24 g (typ)