

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 0.5 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 0.9 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):

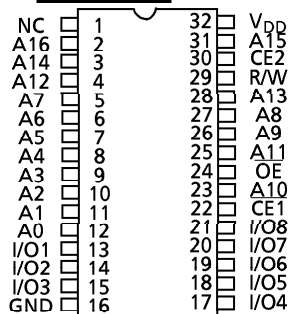
	2.7 to 3.6 V	
	-85L	-10L
Access Time	85 ns	100 ns
$\overline{CE1}$ Access Time	85 ns	100 ns
$CE2$ Access Time	85 ns	100 ns
\overline{OE} Access Time	45 ns	50 ns

• 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)

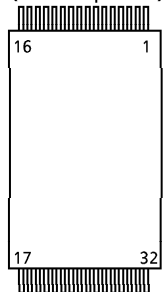
PIN ASSIGNMENT (TOP VIEW)

o 32 PIN SOP

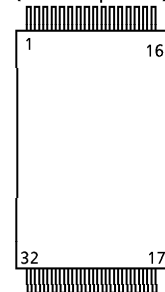


o 32 PIN TSOP

(Normal pinout)



(Reverse pinout)



PIN NAMES

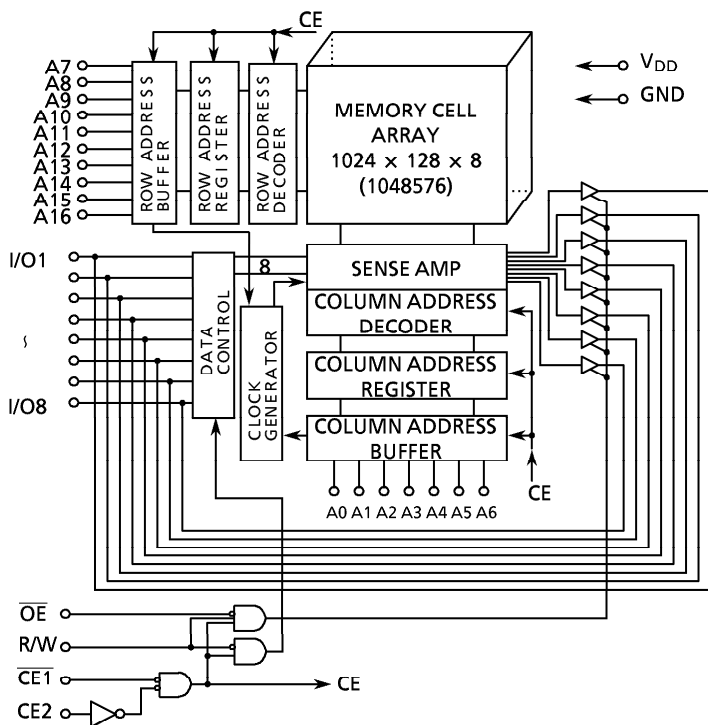
A0 to A16	Address Inputs
R/W	Read/Write Control
\overline{OE}	Output Enable
$CE1, CE2$	Chip Enable
I/O1 to I/O8	Data Input/Output
V_{DD}	Power
GND	Ground
NC	No Connection

Pin No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Pin Name	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
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	$\overline{CE1}$	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	
			V _{DD} = 3.3 V ± 0.3 V	Tcycle	min	-	-	40	
					1 μs	-	-	12	
I _{DDO2}		$\overline{CE1} = 0.2$ 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	
			V _{DD} = 3.3 V ± 0.3 V	Tcycle	min	-	-	35	
					1 μs	-	-	6	
I _{DDs1}	Standby Current	$\overline{CE1} = V_{IH}$ or CE2 = V _{IL}			-	-	2	mA	
I _{DDs2} (Note)			$\overline{CE1} = V_{DD} - 0.2$ V or CE2 = 0.2 V V _{DD} = 2.0 to 3.6 V	V _{DD} = 3 V ± 10%	Ta = 25°C	-	0.5	0.7	μA
					Ta = 0° to 70°C	-	-	15	
				V _{DD} = 3.3 V ± 0.3 V	Ta = 25°C	-	0.7	0.9	
					Ta = 0° to 70°C	-	-	20	
					Ta = 25°C	-	-	0.5	
	V _{DD} = 3.0 V	Ta = 0° to 40°C	-	-	2				
		Ta = 0° to 70°C	-	-	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 ≤ 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 (Ta = 0° to 70°C, V_{DD} = 2.7 to 3.6 V)

READ CYCLE

SYMBOL	PARAMETER	TC55V1001F/FT/TR/ST/SR				UNIT
		-85L		-10L		
		MIN	MAX	MIN	MAX	
t _{RC}	Read Cycle Time	85	–	100	–	ns
t _{ACC}	Address Access Time	–	85	–	100	
t _{CO1}	Chip Enable (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

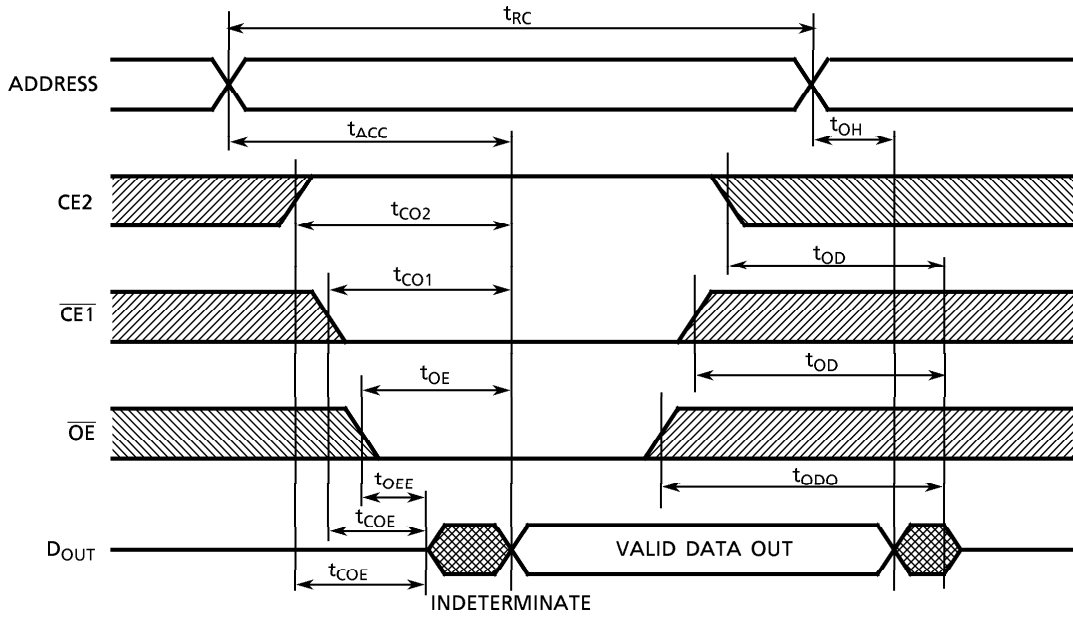
SYMBOL	PARAMETER	TC55V1001F/FT/TR/ST/SR				UNIT
		-85L		-10L		
		MIN	MAX	MIN	MAX	
t _{WC}	Write Cycle Time	85	–	100	–	ns
t _{WP}	Write Pulse Width	60	–	60	–	
t _{CW}	Chip Enable to End of Write	75	–	80	–	
t _{AS}	Address Setup Time	0	–	0	–	
t _{WR}	Write Recovery Time	0	–	0	–	
t _{ODW}	R/W Low to Output 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

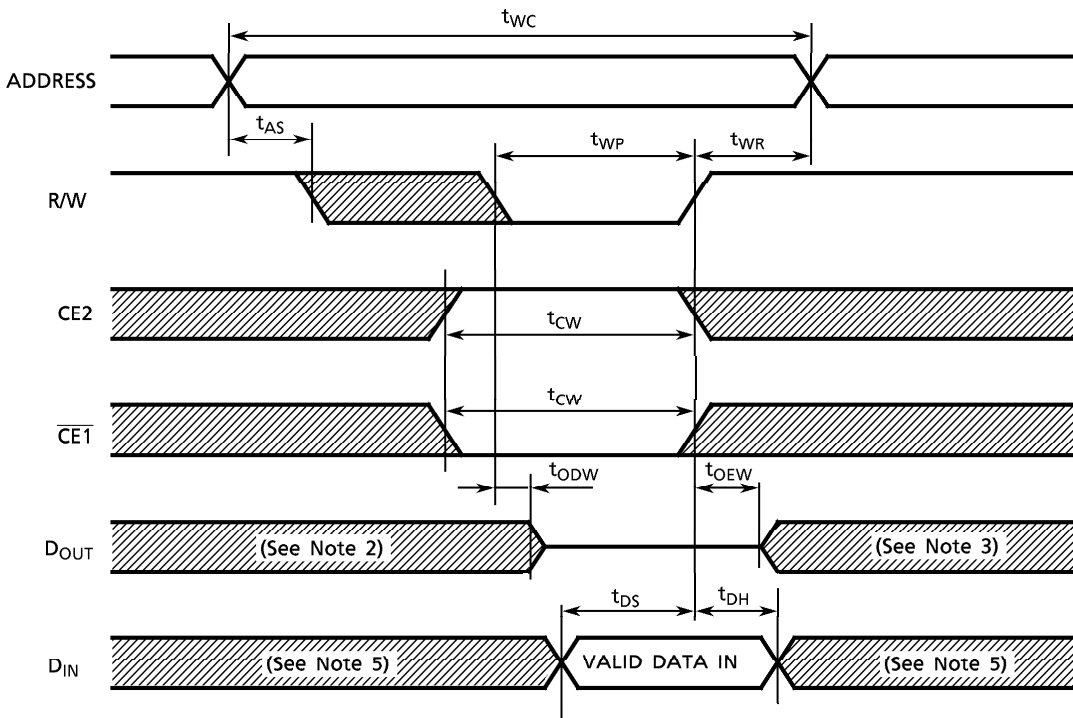
Output load: 100 pF + one TTL gate
 Input pulse level: 0.6 V, 2.2 V
 Timing measurements: 1.5 V
 Reference level: 1.5 V
 t_R, t_F: 5 ns

TIMING DIAGRAMS

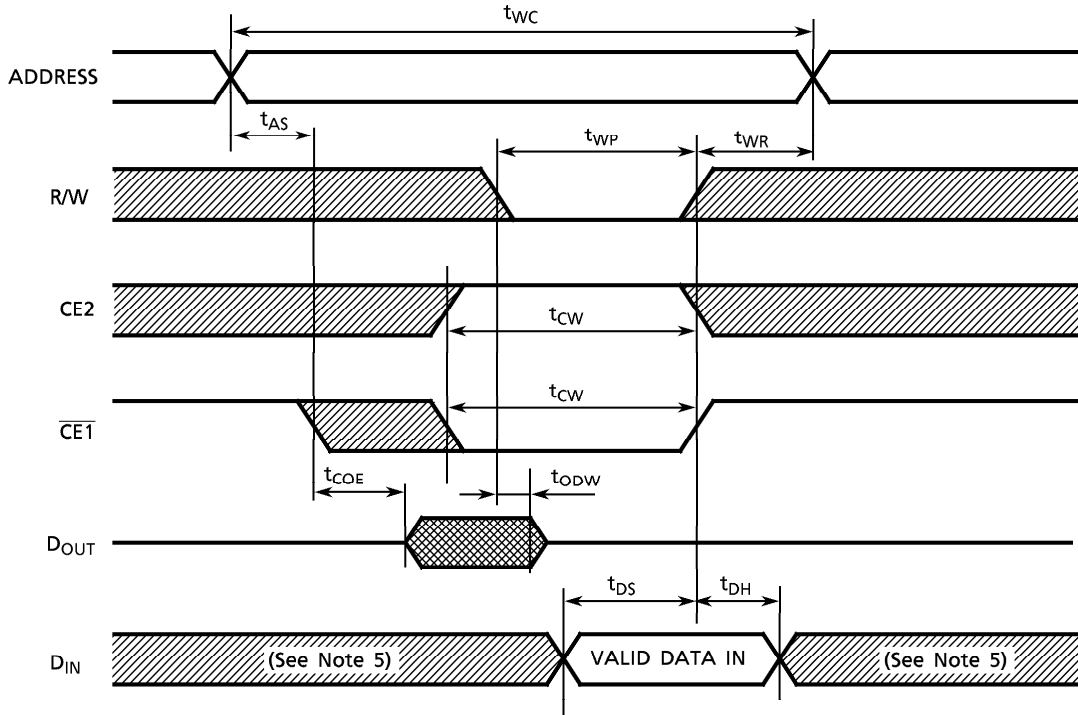
READ CYCLE (See Note 1)



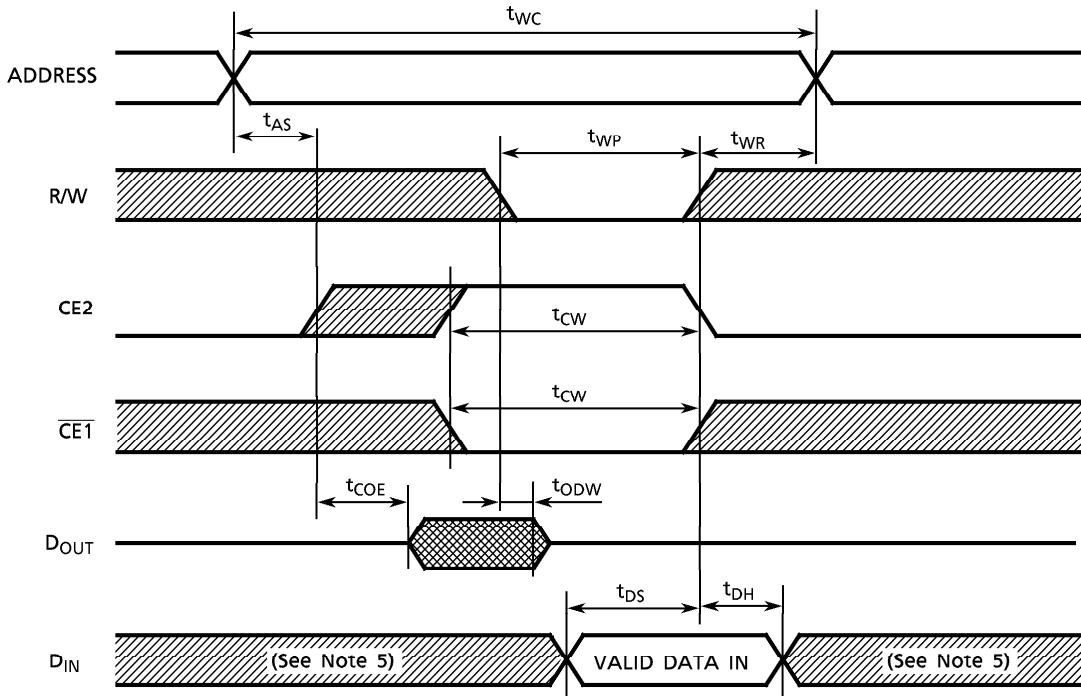
WRITE CYCLE 1 (R/W CONTROLLED) (See Note 4)



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



WRITE CYCLE 3 (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.

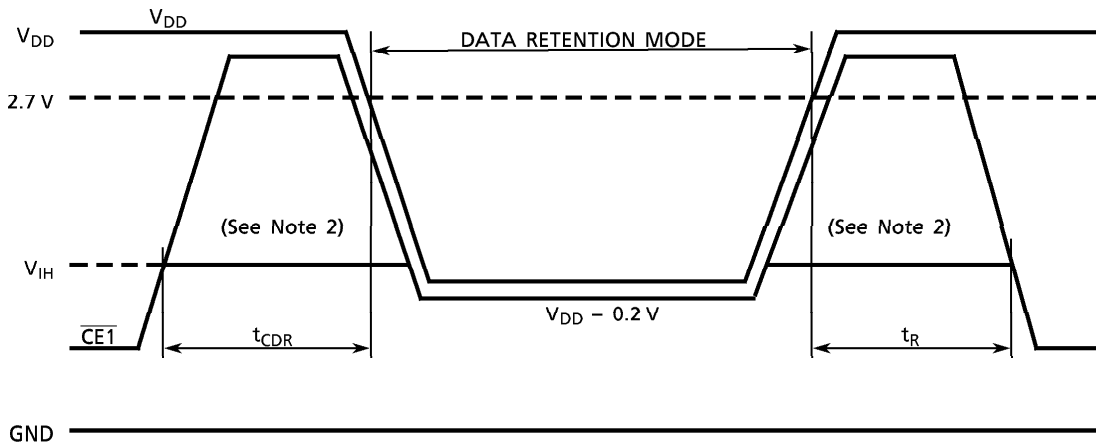
(5) Because I/O signals may be in the output state at this time, input signals of reverse polarity must not be applied.

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

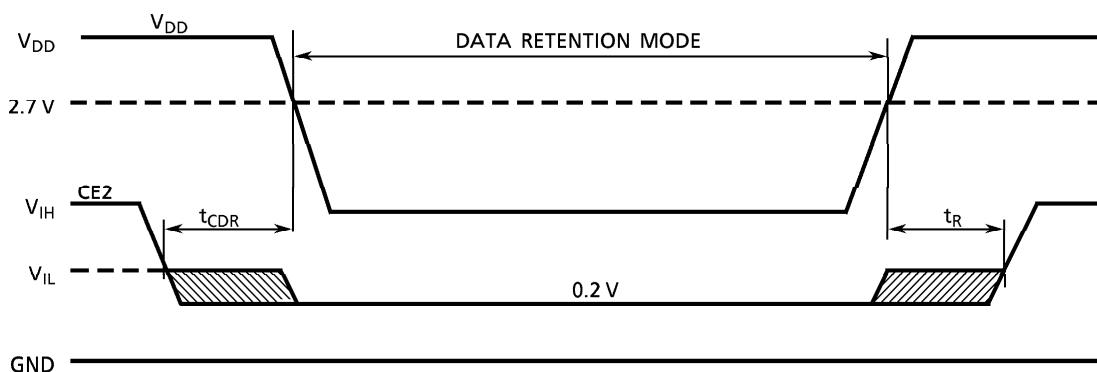
SYMBOL	PARAMETER	MIN	TYP	MAX	UNIT
V _{DH}	Data Retention Supply Voltage	2.0	–	3.6	V
I _{DDs2}	Standby Current	V _{DH} = 3.0 V	–	10*	μA
		V _{DH} = 3.6 V	–	20	
t _{CDR}	Chip Deselect to Data Retention Mode Time	0	–	–	nS
t _R	Recovery Time	5	–	–	mS

* 2 μA (max) at Ta = 0° to 40°C

CE1 CONTROLLED DATA RETENTION MODE (See Note 1)



CE2 CONTROLLED DATA RETENTION MODE (See Note 3)



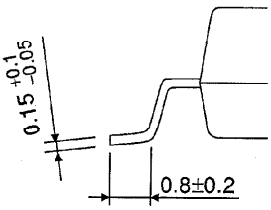
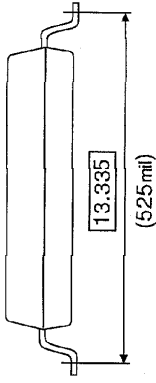
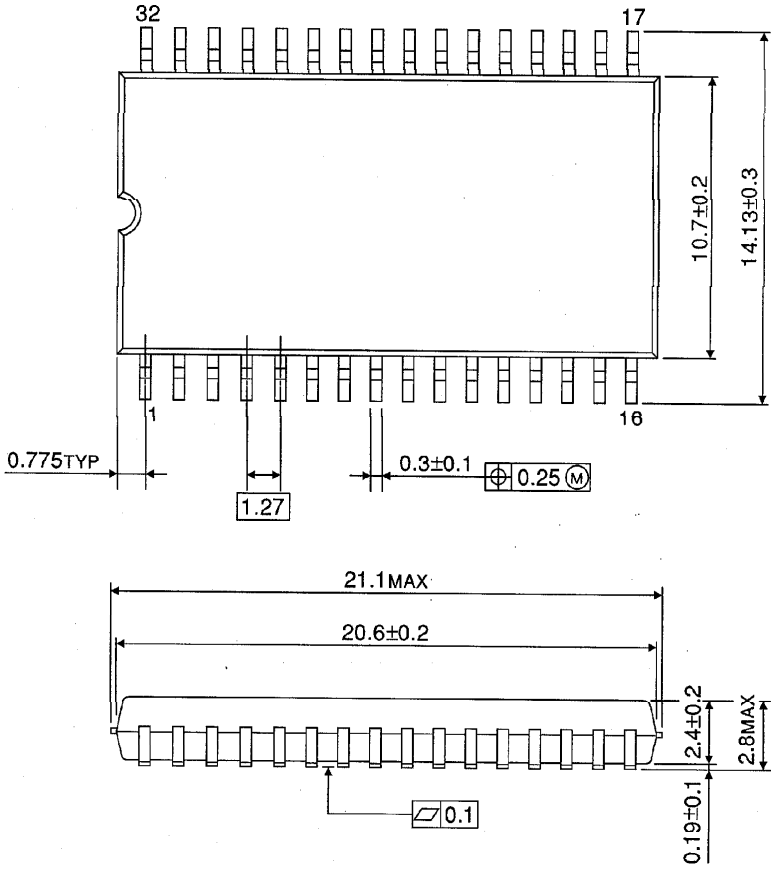
Note: (1) In $\overline{CE1}$ controlled data retention mode, minimum standby current mode is entered when $CE2 \leq 0.2 \text{ V}$ or $CE2 \geq V_{DD} - 0.2 \text{ V}$.

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

PACKAGE DIMENSIONS (SOP32-P-525-1.27)

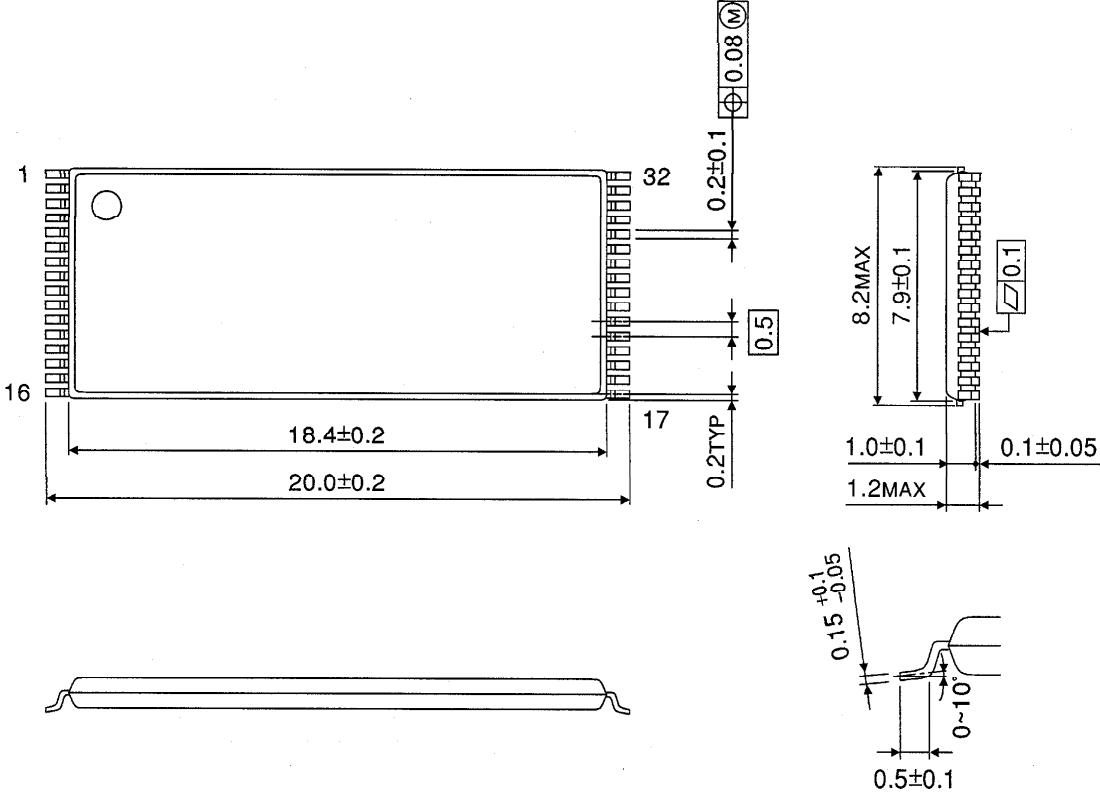
Units in mm



Weight: 1.04 g (typ)

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

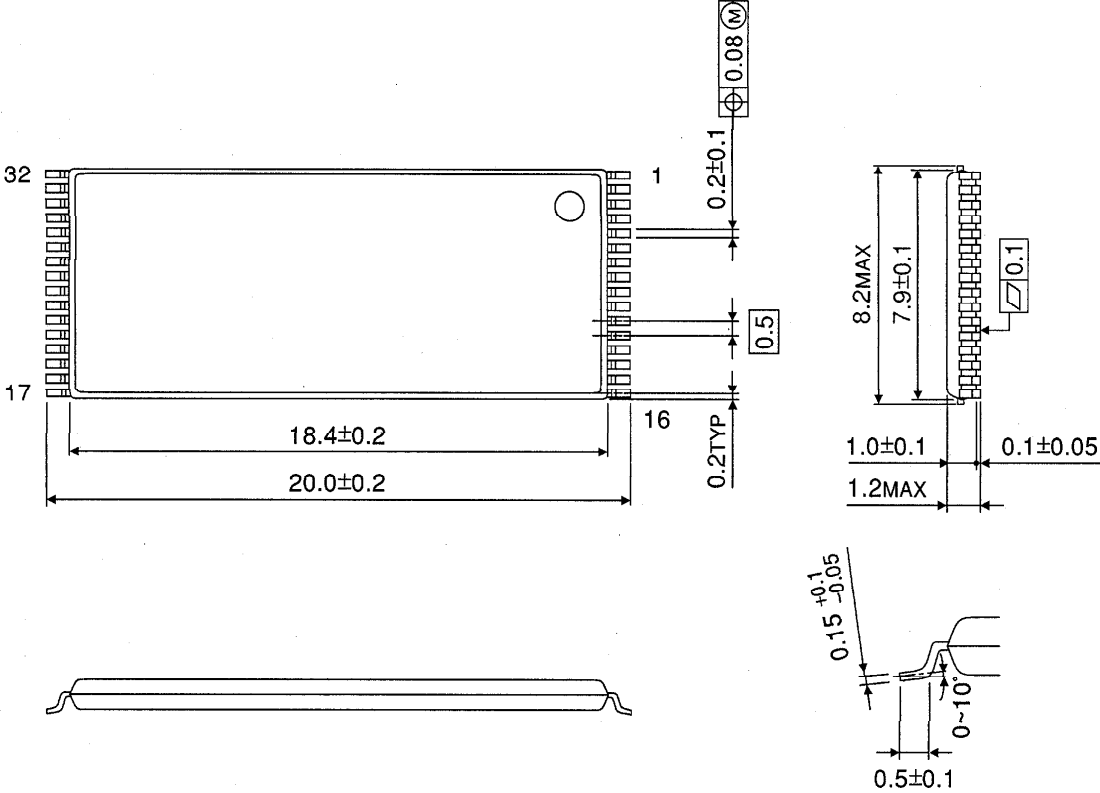
Units in mm



Weight: 0.34 g (typ)

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

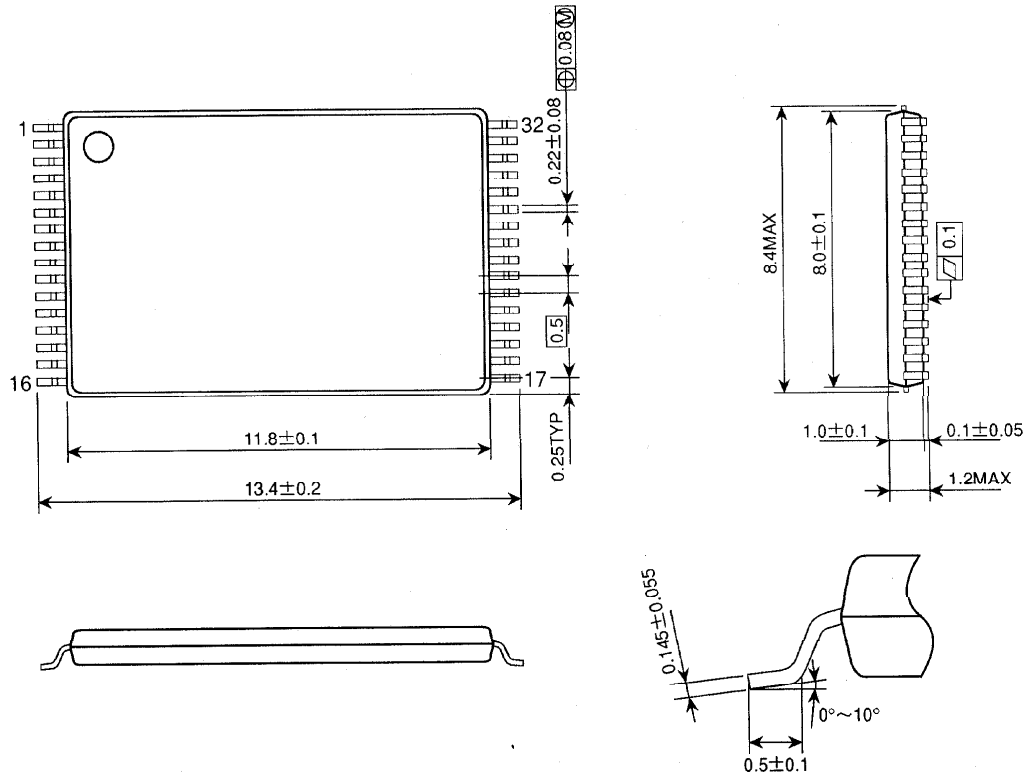
Units in mm



Weight: 0.34 g (typ)

PACKAGE DIMENSIONS (TSOP I 32-P-0.50)

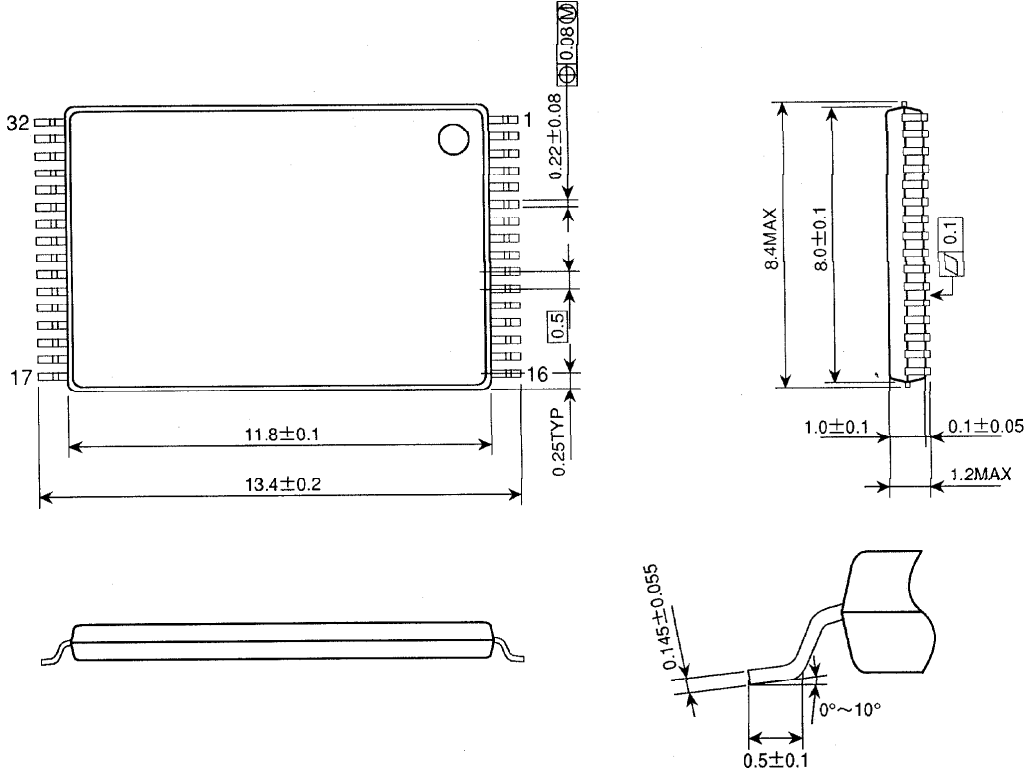
Units in mm



Weight: 0.24 g (typ)

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

Units in mm



Weight: 0.24 g (typ)