

TOSHIBA MOS DIGITAL INTEGRATED CIRCUIT SILICON GATE CMOS

262,144-WORD BY 8-BIT STATIC RAM

DESCRIPTION

The TC55V2001FI/FTI/TRI/STI/SRI is a 2,097,152-bit static random access memory (SRAM) organized as 262,144 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 85 ns. It is automatically placed in low-power mode at 1 μ A standby current (L-Version at $V_{DD}=3V$, $T_a=25^\circ C$) 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 TC55V2001FI/FTI/TRI/STI/SRI 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 $\overline{CE2}$.
- 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)

	TC55V2001FI/FTI/TRI/STI/SRI	
	-85, -10	-85L, -10L
3.6V	3 μ A	1.4 μ A
3.0V	2 μ A	1 μ A

- Access Times (maximum):

	TC55V2001FI/FTI/TRI/STI/SRI	
	-85, -85L	-10, -10L
Access Time	85ns	100ns
$\overline{CE1}$ Access Time	85ns	100ns
$\overline{CE2}$ Access Time	85ns	100ns
$\overline{OE}$ Access Time	45ns	50ns

- Packages:

SOP32-P-525-1.27 (FI)	(Weight: 1.06 g typ)
TSOP I 32-P-0820-0.50 (FTI)	(Weight: 0.34 g typ)
TSOP I 32-P-0820-0.50A (TRI)	(Weight: 0.34 g typ)
TSOP I 32-P-0.50 (STI)	(Weight: 0.24 g typ)
TSOP I 32-P-0.50A (SRI)	(Weight: 0.24 g typ)

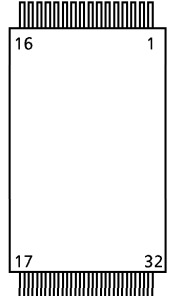
PIN ASSIGNMENT (TOP VIEW)

○ 32 PIN SOP

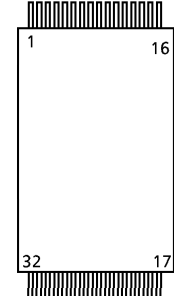
A17	1	32	V_{DD}
A16	2	31	A15
A14	3	30	$\overline{CE2}$
A12	4	29	R/W
A7	5	28	A13
A6	6	27	A8
A5	7	26	A9
A4	8	25	A11
A3	9	24	$\overline{OE}$
A2	10	23	A10
A1	11	22	$\overline{CE1}$
A0	12	21	I/O8
I/O1	13	20	I/O7
I/O2	14	19	I/O6
I/O3	15	18	I/O5
GND	16	17	I/O4

○ 32 PIN TSOP

(Normal pinout)



(Reverse pinout)



PIN NAMES

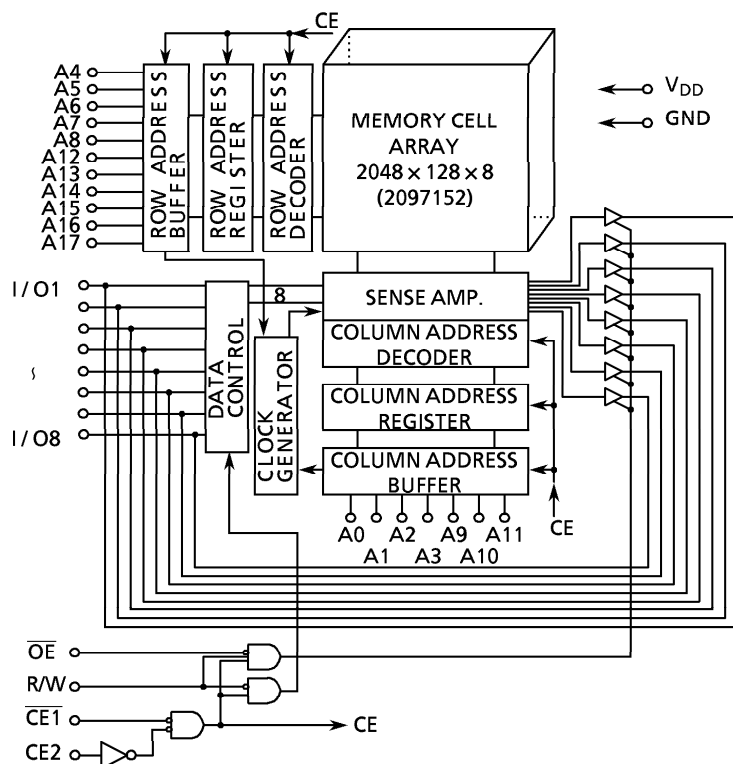
A0 to A17	Address Inputs
R/W	Read / Write Control Input
$\overline{OE}$	Output Enable Input
$\overline{CE1}, \overline{CE2}$	Chip Enable Input
I/O1 to I/O8	Data Input / Output
V_{DD}	Power
GND	Ground

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}	A ₁₇	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	- 40 to 85	°C

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

DC RECOMMENDED OPERATING CONDITIONS ($T_a = -40^\circ$ to 85°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	2.2	–	$V_{DD} + 0.3$	
V_{IL}	Input Low Voltage	– 0.3*	–	0.6	
V_{DH}	Data Retention Supply Voltage	2.0	–	3.6	

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

DC CHARACTERISTICS ($T_a = -40^\circ$ to 85°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%	Tcycle	min	–	–	35	mA
1 μs					–	–	10		
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} = 3.3 V ± 0.3 V	Tcycle	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%	Tcycle	min	–	–	30		
				1 μs	–	–	5		
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} = 3.3 V ± 0.3 V	Tcycle	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} = 3V ± 10%	Ta = 25°C	–85, –10	–	1	2.5	μA
					–85L, –10L	–	0.5	1.2	
				Ta = – 40° to 85°C	–85, –10	–	–	55	
					–85L, –10L	–	–	35	
			V _{DD} = 3.3V ± 0.3V	Ta = 25°C	–85, –10	–	1.5	3	
					–85L, –10L	–	0.7	1.4	
				Ta = – 40° to 85°C	–85, –10	–	–	60	
					–85L, –10L	–	–	40	
		V _{DD} = 3V	Ta = 25°C	–85, –10	–	1	2		
				–85L, –10L	–	0.5	1		
			Ta = – 40° to 40°C	–85, –10	–	–	5		
				–85L, –10L	–	–	3		
			Ta = – 40° to 85°C	–85, –10	–	–	50		
				–85L, –10L	–	–	30		

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 , $V_{DD} = 2.7$ to 3.6 V)

READ CYCLE

SYMBOL	PARAMETER	TC55V2001FI/FTI/TRI/STI/SRI				UNIT
		-85, -85L		-10, -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	5	–	5	–	
t _{OEE}	Output Enable Low to Output Active	0	–	0	–	
t _{OD}	Chip Enable High to Output High-Z	–	35	–	40	
t _{ODO}	Output Enable High to Output High-Z	–	35	–	40	
t _{OH}	Output Data Hold Time	10	–	10	–	

WRITE CYCLE

SYMBOL	PARAMETER	TC55V2001FI/FTI/TRI/STI/SRI				UNIT
		-85, -85L		-10, -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	–	35	–	40	
t _{OEW}	R/W High to Output Active	0	–	0	–	
t _{DS}	Data Setup Time	35	–	40	–	
t _{DH}	Data Hold Time	0	–	0	–	

AC TEST CONDITIONS

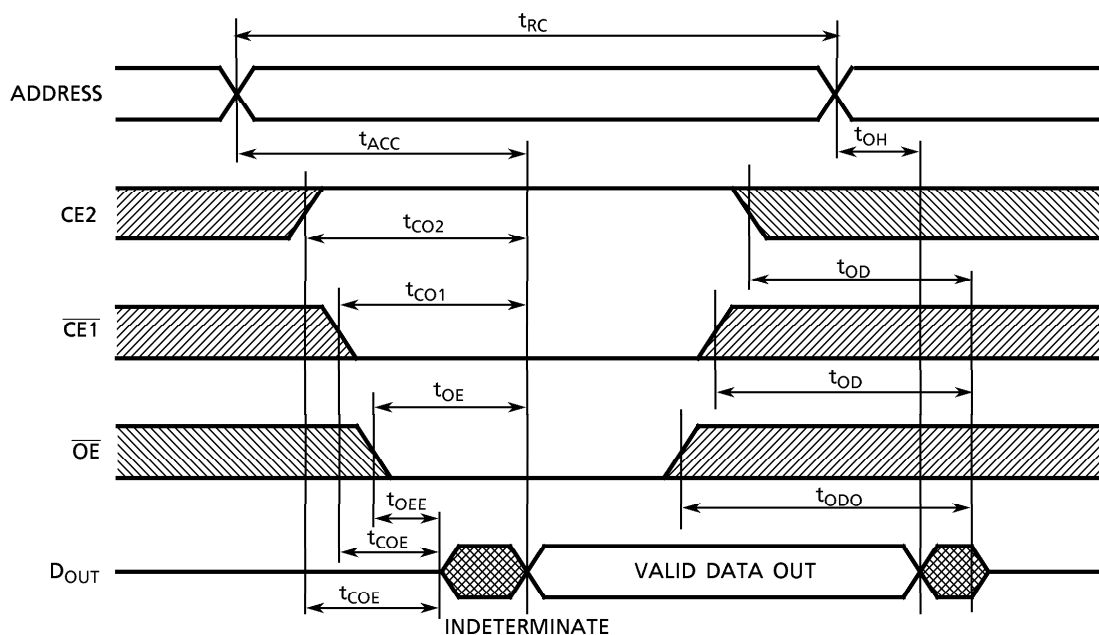
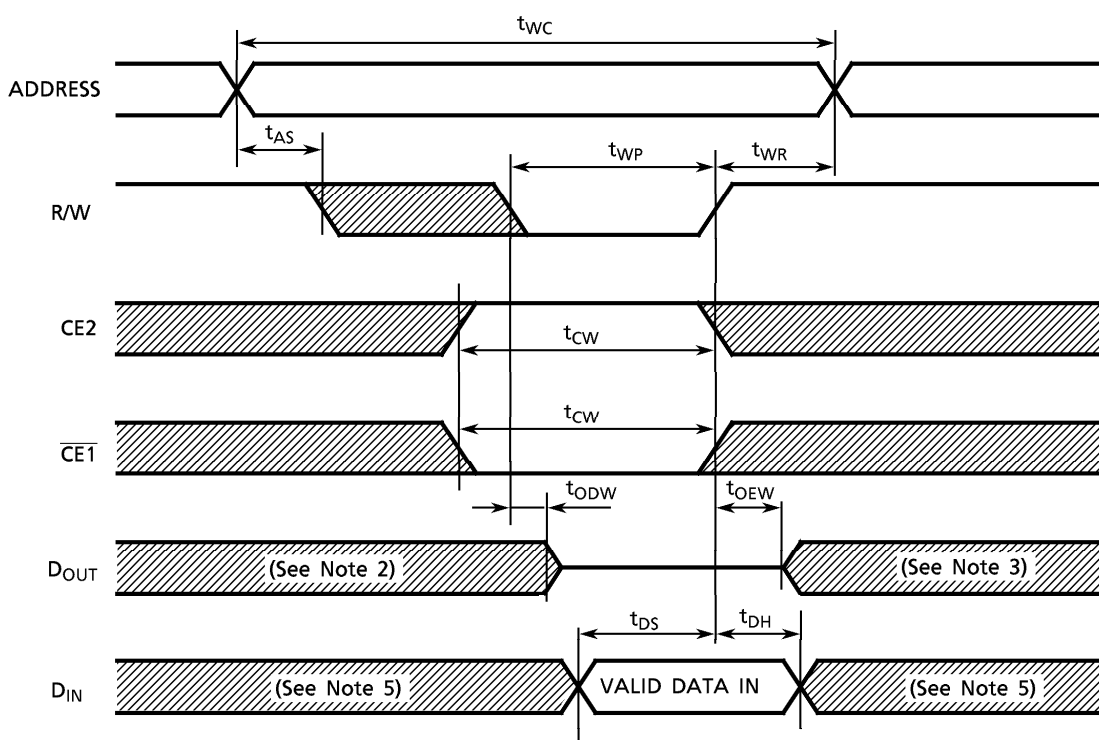
Output load: 100 pF + one TTL gate

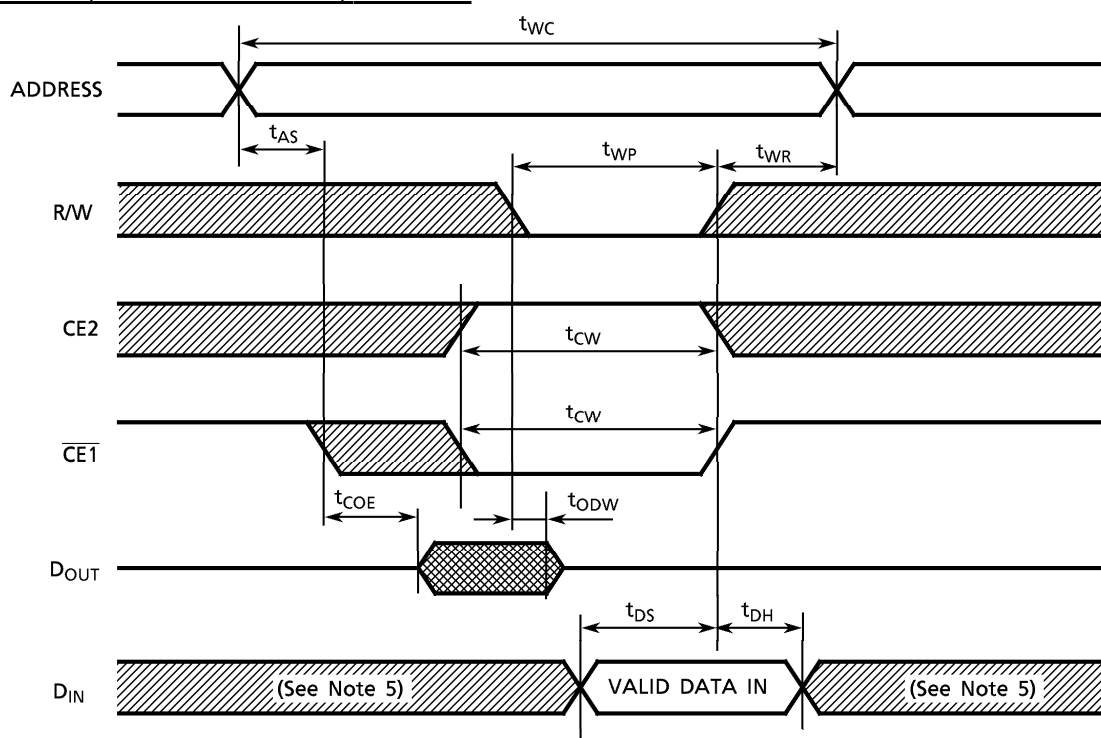
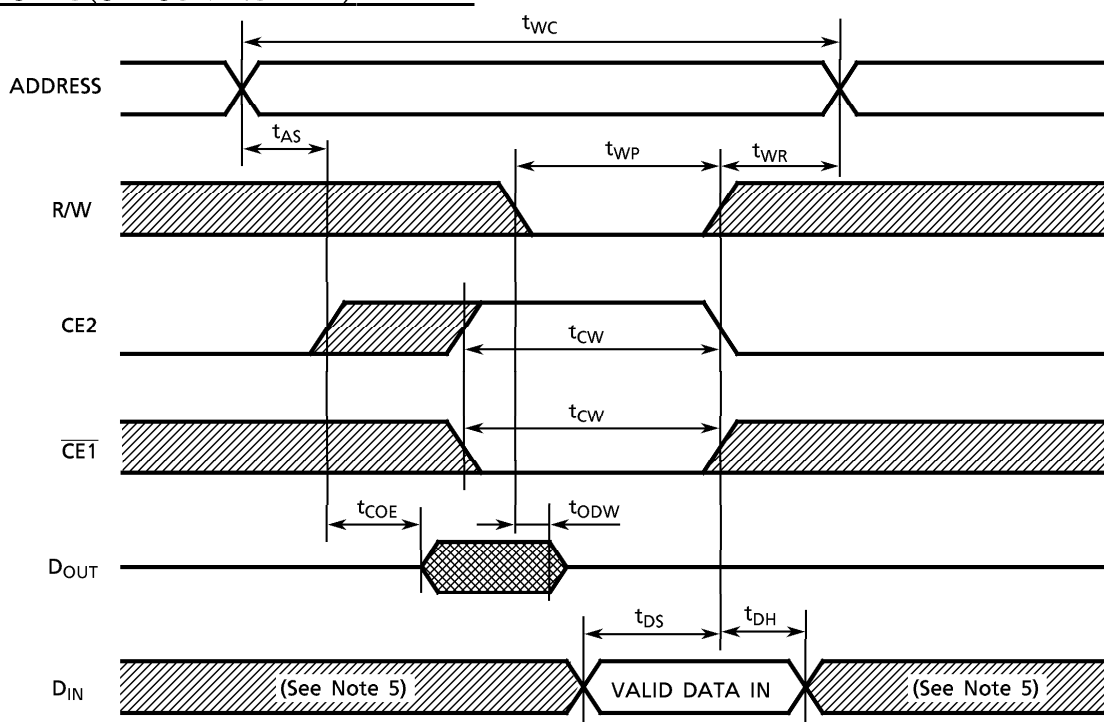
Input pulse level: 0.4 V, 2.4 V

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 $\overline{CE1}$ 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.

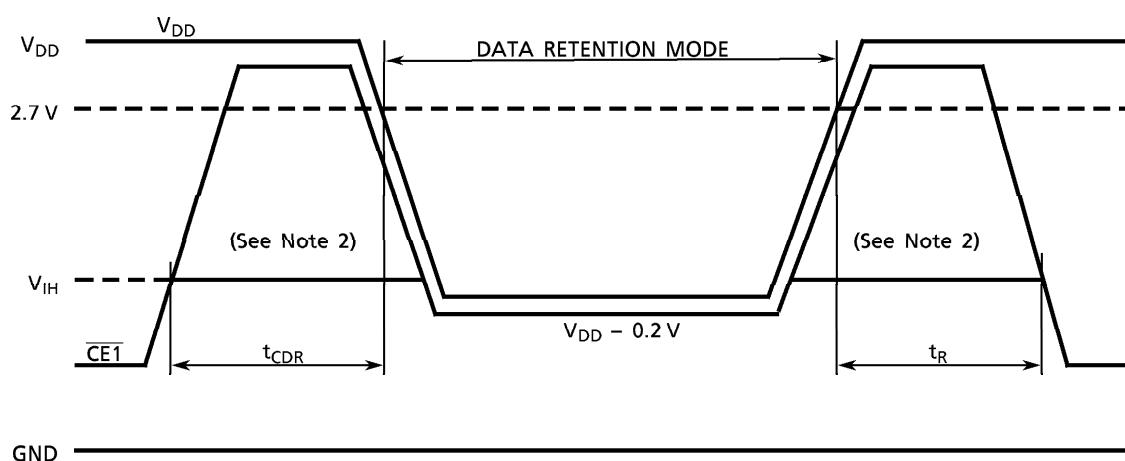
(4) If $\overline{OE}$ is HIGH during the write cycle, the outputs will remain at high impedance.

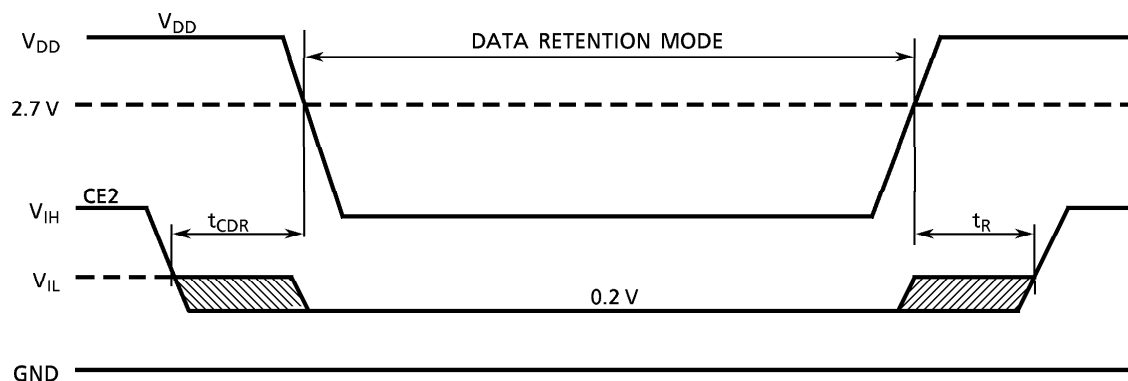
(5) Because I/O signals may be in the output state at this time, input signals of reverse polarity must not be applied.

DATA RETENTION CHARACTERISTICS ($T_a = -40^\circ$ to 85°C)

SYMBOL	PARAMETER				MIN	TYP	MAX	UNIT
V _{DH}	Data Retention Supply Voltage				2.0	–	3.6	V
I _{DD52}	Standby Current	V _{DH} = 3.0V	Ta = – 40° to 40°C	-85, -10	–	–	5	μA
				-85L, -10L	–	–	3	
		V _{DH} = 3.6V	Ta = – 40° to 85°C	-85, -10	–	–	50	
				-85L, -10L	–	–	30	
				-85, -10	–	–	60	
				-85L, -10L	–	–	40	
t _{CDR}	Chip Deselect to Data Retention Mode Time				0	–	–	nS
t _R	Recovery Time				5	–	–	mS

$\overline{CE1}$ 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

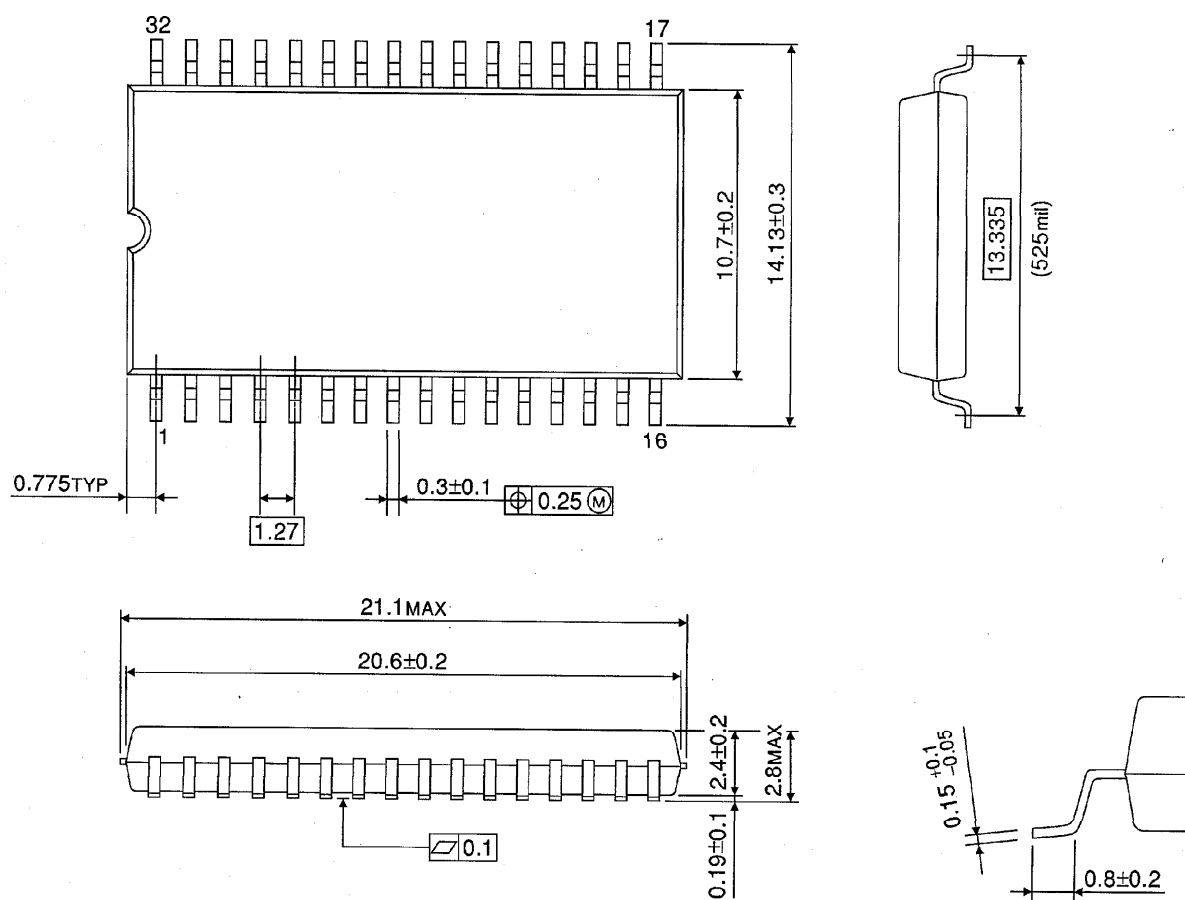
$$\overline{CE2} \leq 0.2 \text{ V or } \overline{CE2} \geq V_{DD} - 0.2 \text{ V.}$$

(2) When $\overline{CE1}$ is operating at the V_{IH} level (2.2 V), the operating current is given by I_{DDSI} during the transition of V_{DD} from 3.6 to 2.4 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)

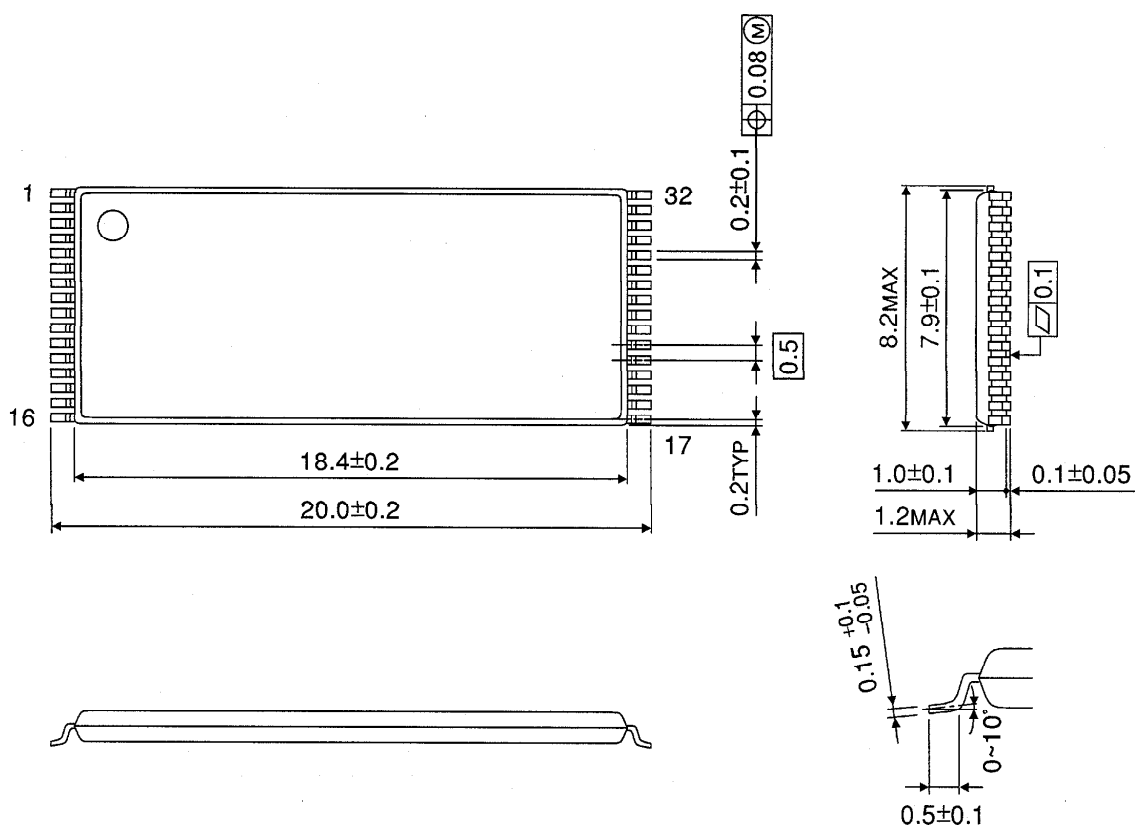
Units in mm



Weight: 1.06 g (typ)

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

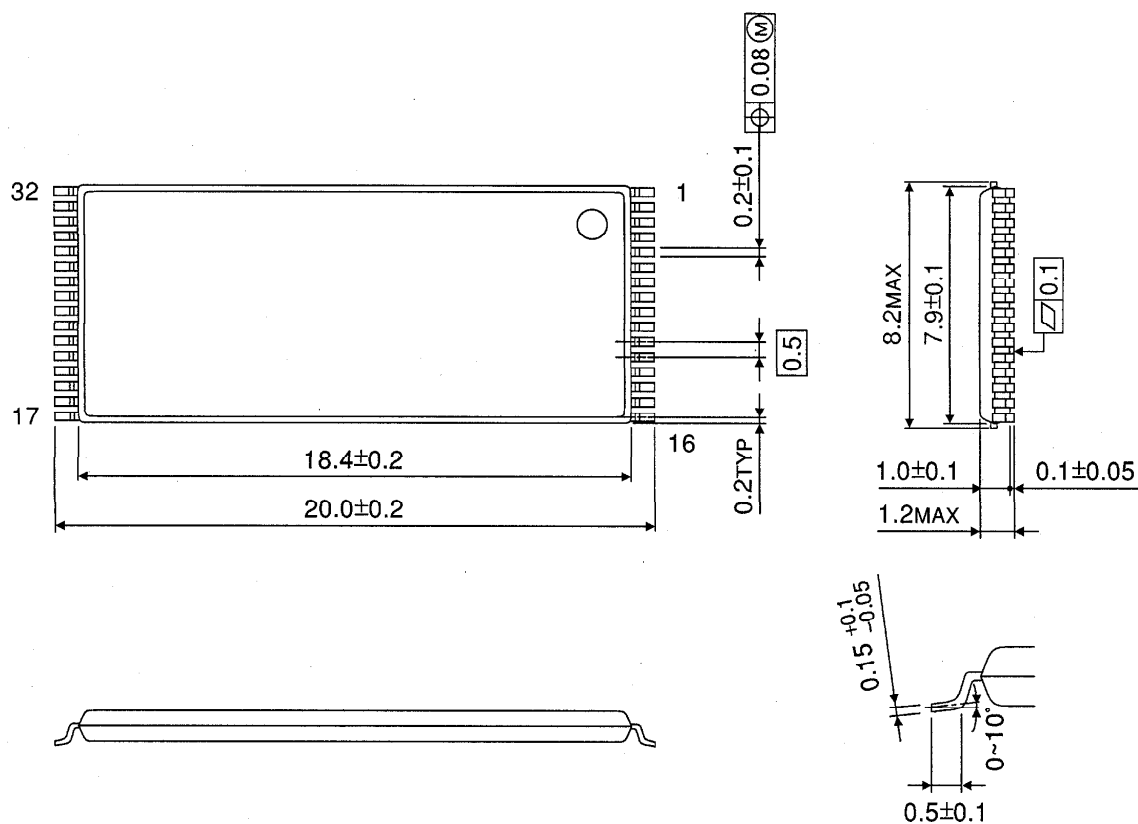
Units in mm



Weight: 0.34 g (typ)

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

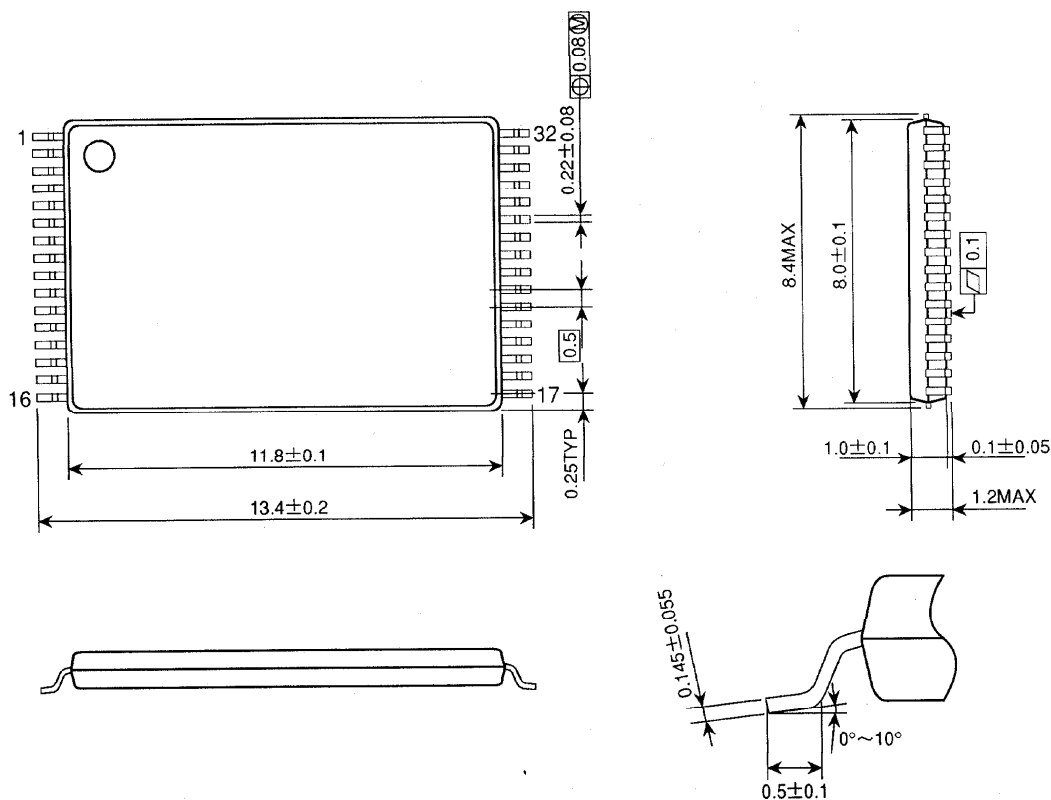
Units in mm



Weight: 0.34 g (typ)

PACKAGE DIMENSIONS (TSOP I 32-P-0.50)

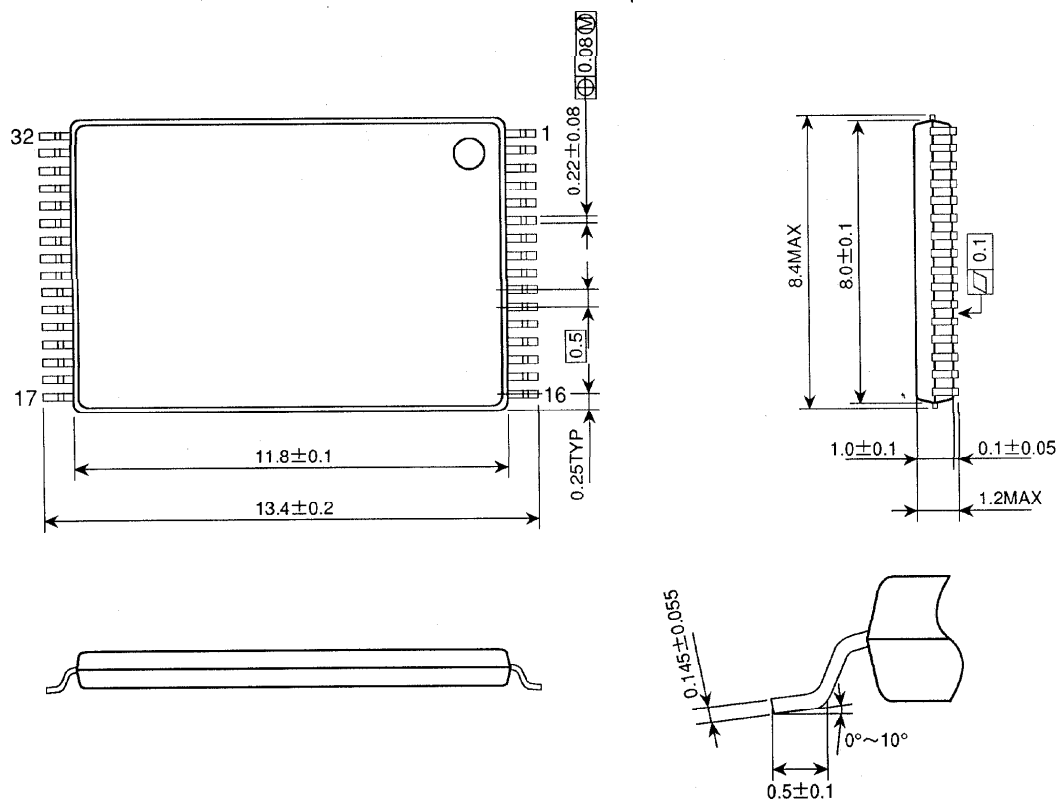
Units in mm



Weight: 0.24 g (typ)

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

Units in mm



Weight: 0.24 g (typ)