

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)

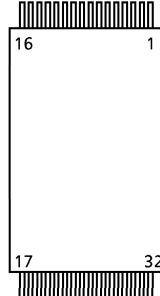
PIN ASSIGNMENT (TOP VIEW)

○ 32 PIN SOP

A17	1	32	V_{DD}
A16	2	31	A15
A14	3	30	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	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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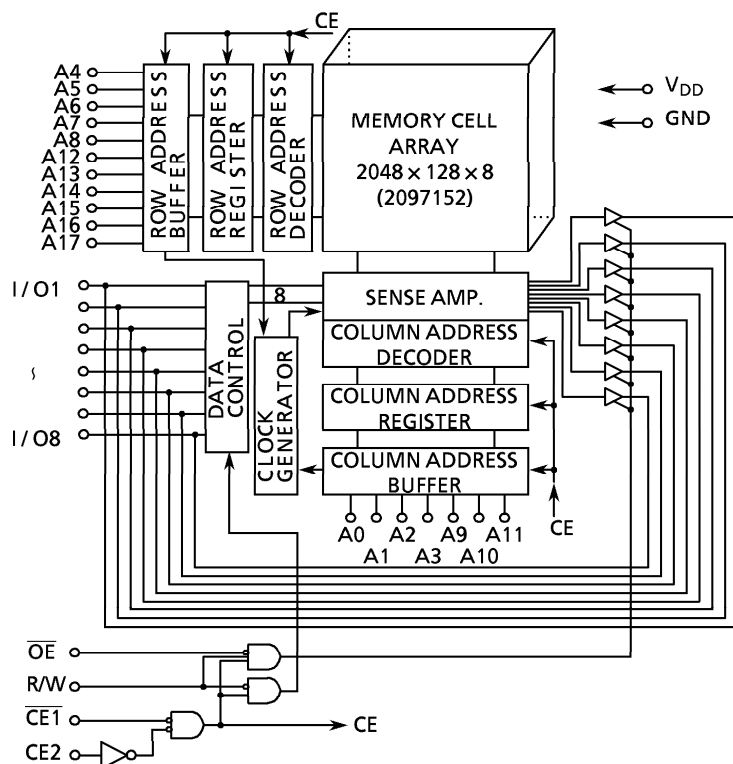
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BLOCK DIAGRAM



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 (Ta = -40° 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 (Ta = -40° 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	$\overline{CE1} = V_{IH}$ 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	$\overline{CE1} = V_{IL}$ 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	$\overline{CE1} = 0.2$ 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} = 3.3 V ± 0.3 V	Tcycle	min	-	-	40		
					1 μs	-	-	12		
I _{DDO2}	Operating Current	$\overline{CE1} = 0.2$ 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		
I _{DDO2}	Operating Current	$\overline{CE1} = 0.2$ 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} = 3.3 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)		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	-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} = 3.3 V ± 0.3 V				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} = 3 V			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 $\overline{CE1} \geq V_{DD} - 0.2$ 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 ($T_a = -40^\circ$ 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

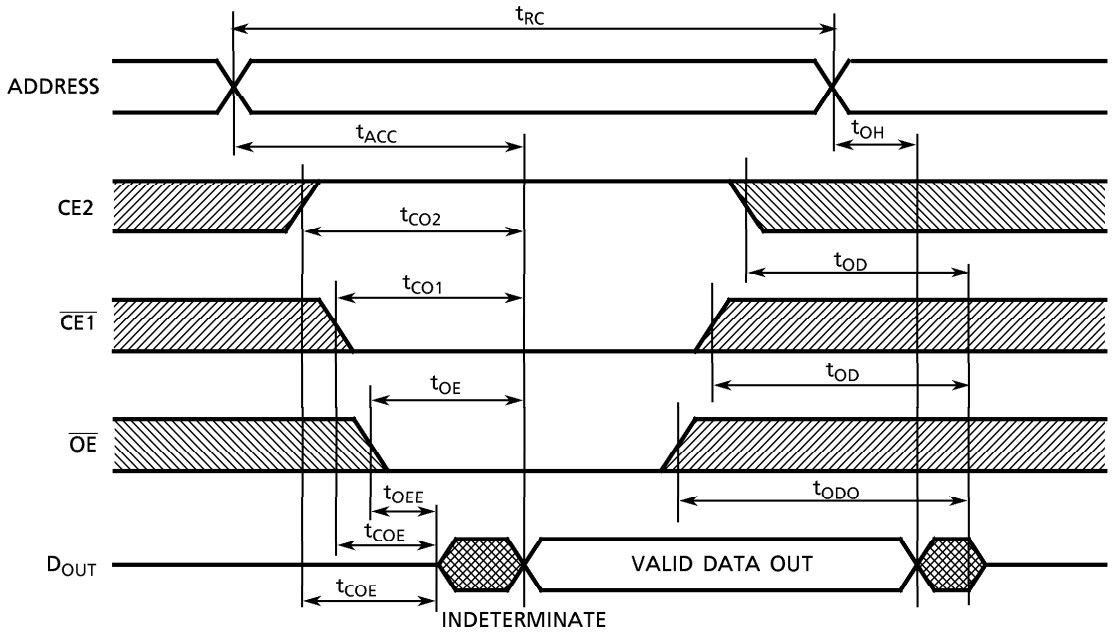
SYMBOL	PARAMETER	TC55V2001FI/FTI/TRI/STI/SRI				UNIT
		-85, -85L		-10, -10L		
		MIN	MAX	MIN	MAX	
t_{WC}	Write Cycle Time	85	–	100	–	ns
t_{WP}	Write Pulse Width	60	–	60	–	
t_{CW}	Chip Enable to End of Write	75	–	80	–	
t_{AS}	Address Setup Time	0	–	0	–	
t_{WR}	Write Recovery Time	0	–	0	–	
t_{ODW}	R/W Low 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

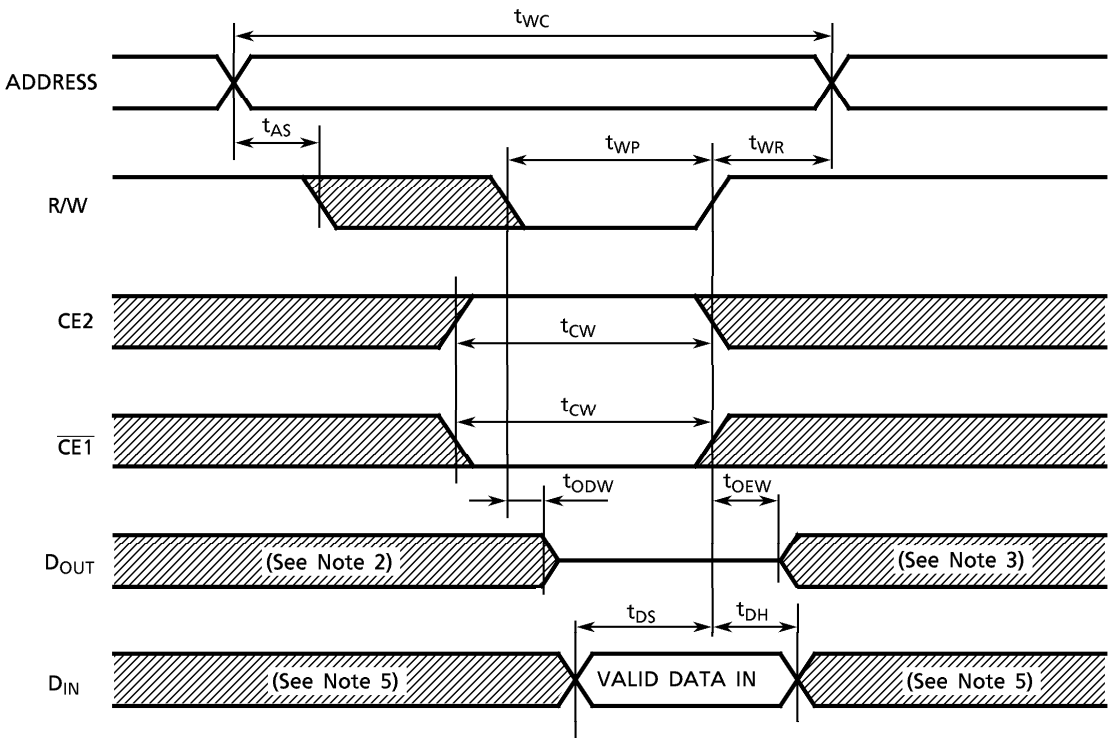
Output load: 100 pF + one TTL gate
 Input pulse level: 0.4 V, 2.4 V
 Timing measurements: 1.5 V
 Reference level: 1.5 V
 t_R, t_F : 5 ns

TIMING DIAGRAMS

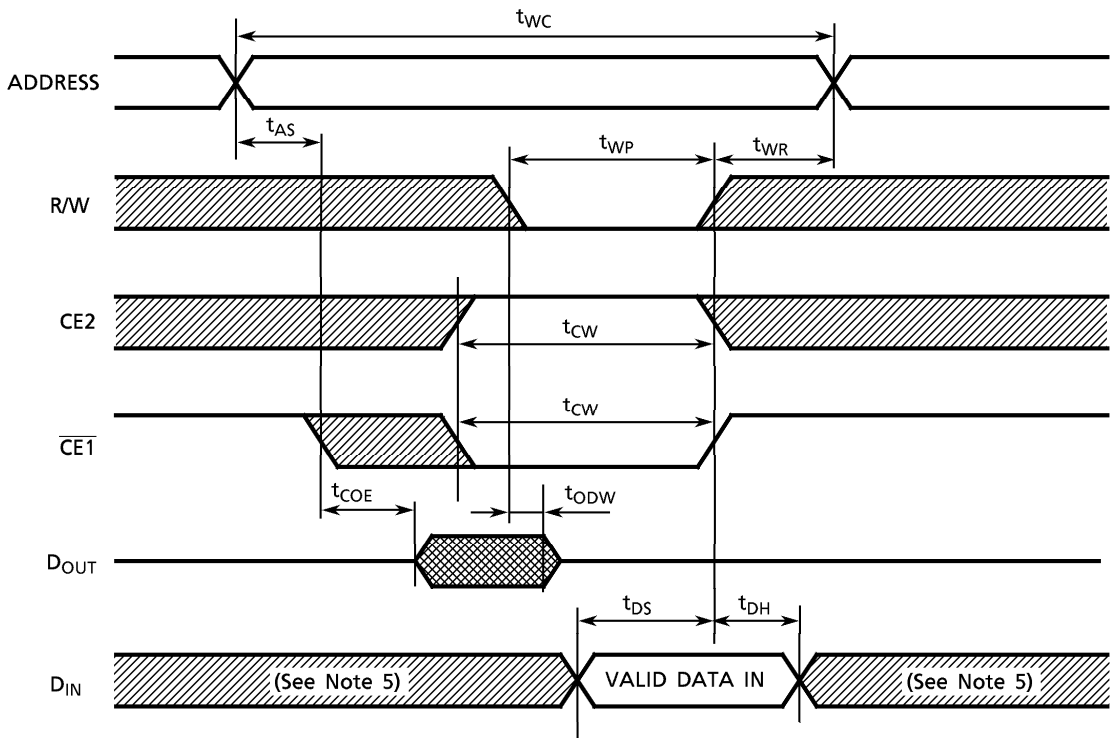
READ CYCLE (See Note 1)



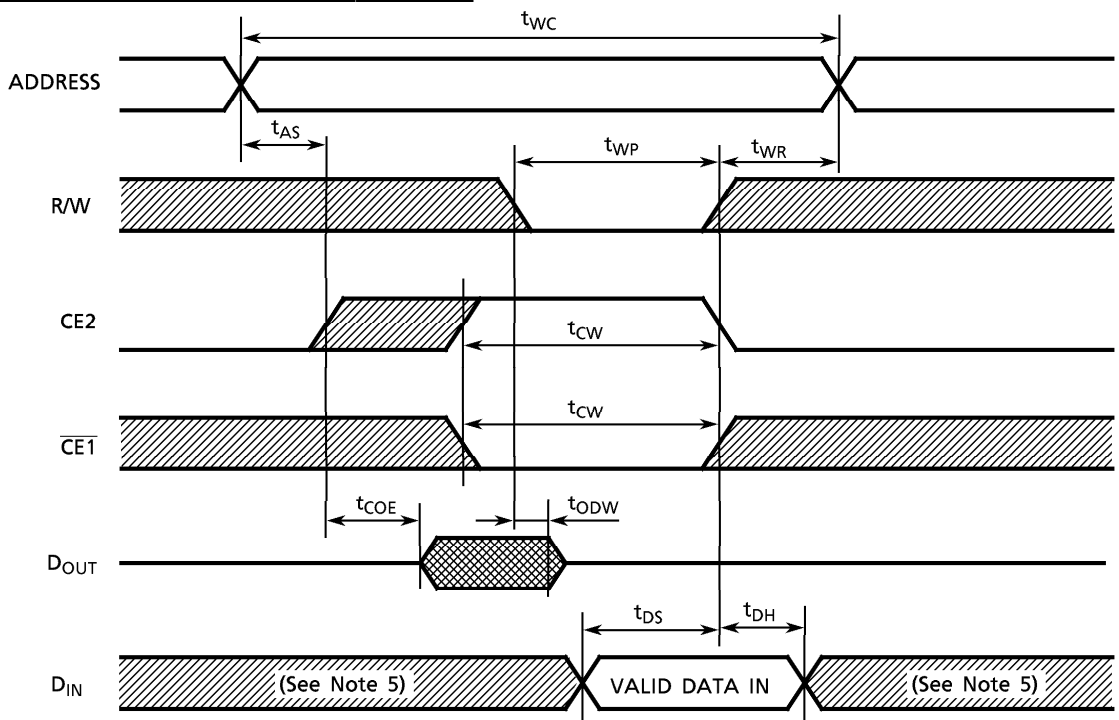
WRITE CYCLE 1 (R/W CONTROLLED) (See Note 4)



WRITE CYCLE 2 ($\overline{CE1}$ 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.

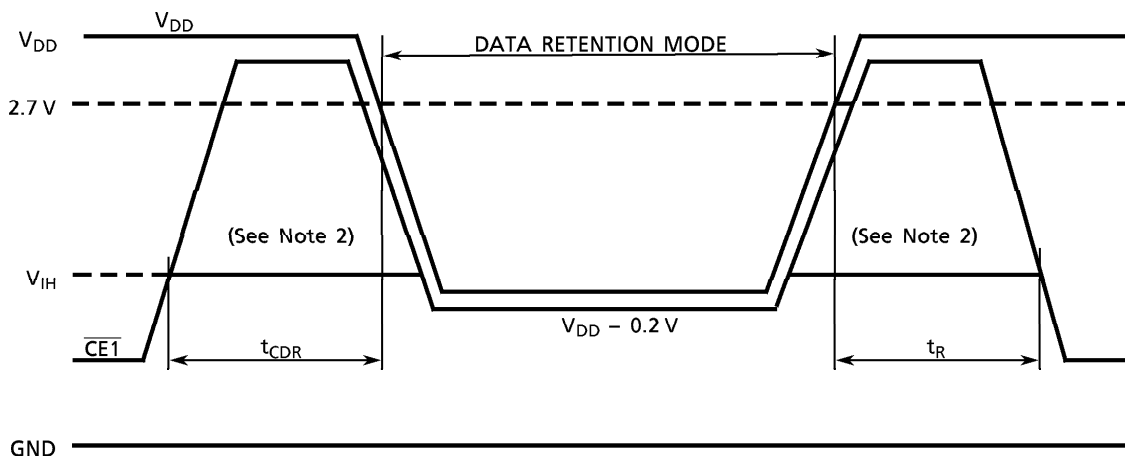
(4) If \overline{OE} is HIGH during the write cycle, the outputs will remain at high impedance.

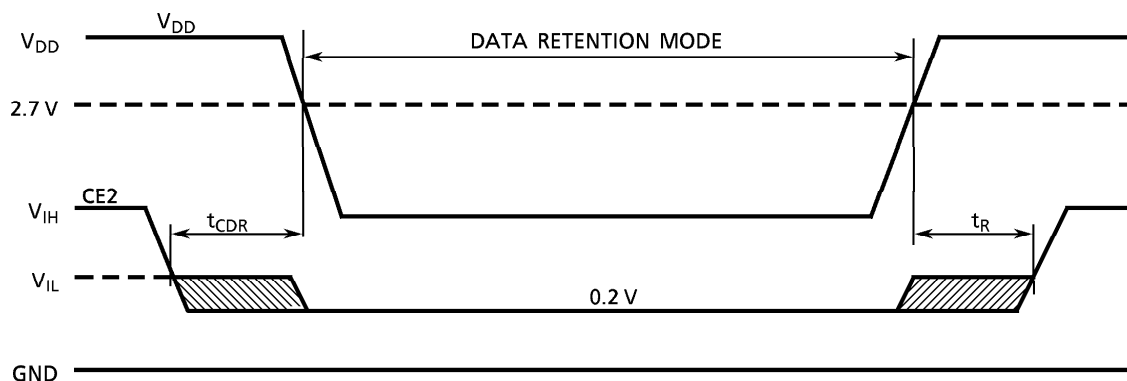
(5) Because I/O signals may be in the output state at this time, input signals of reverse polarity must not be applied.

DATA RETENTION CHARACTERISTICS (Ta = -40° to 85°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 = -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	
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)

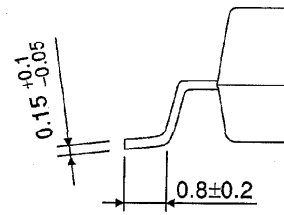
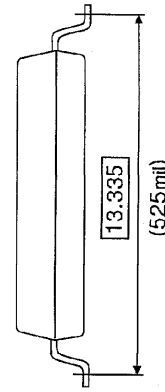
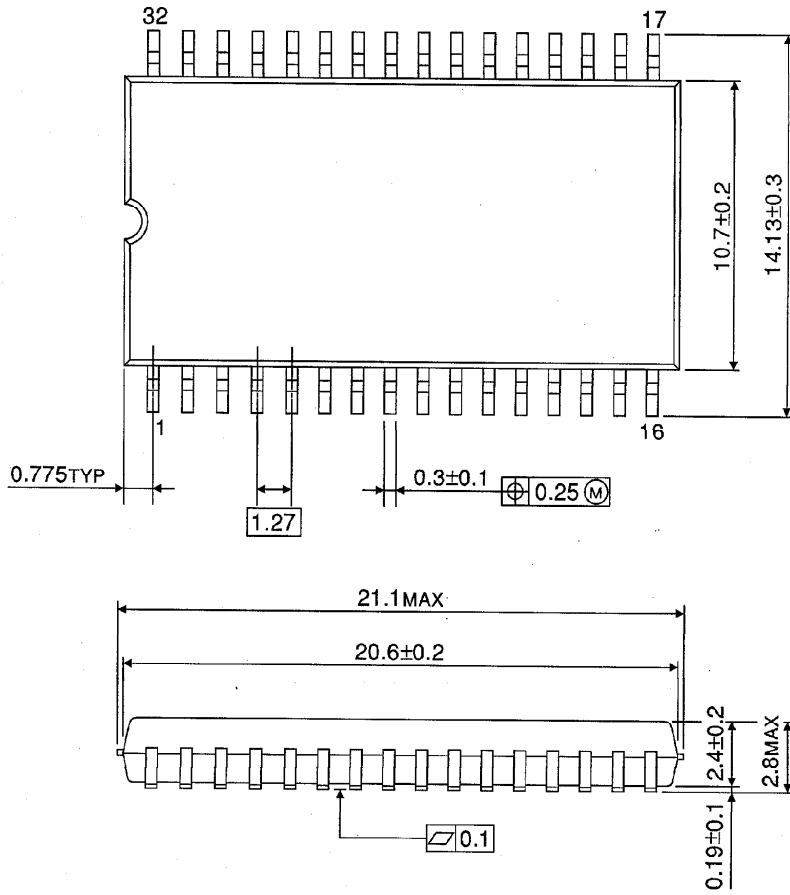


CE2 CONTROLLED DATA RETENTION MODE (See Note 3)

- 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 (2.2 V), the operating current is given by I_{DDS1} 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 $\text{CE2} \leq 0.2 \text{ V}$.

PACKAGE DIMENSIONS (SOP32-P-525-1.27)

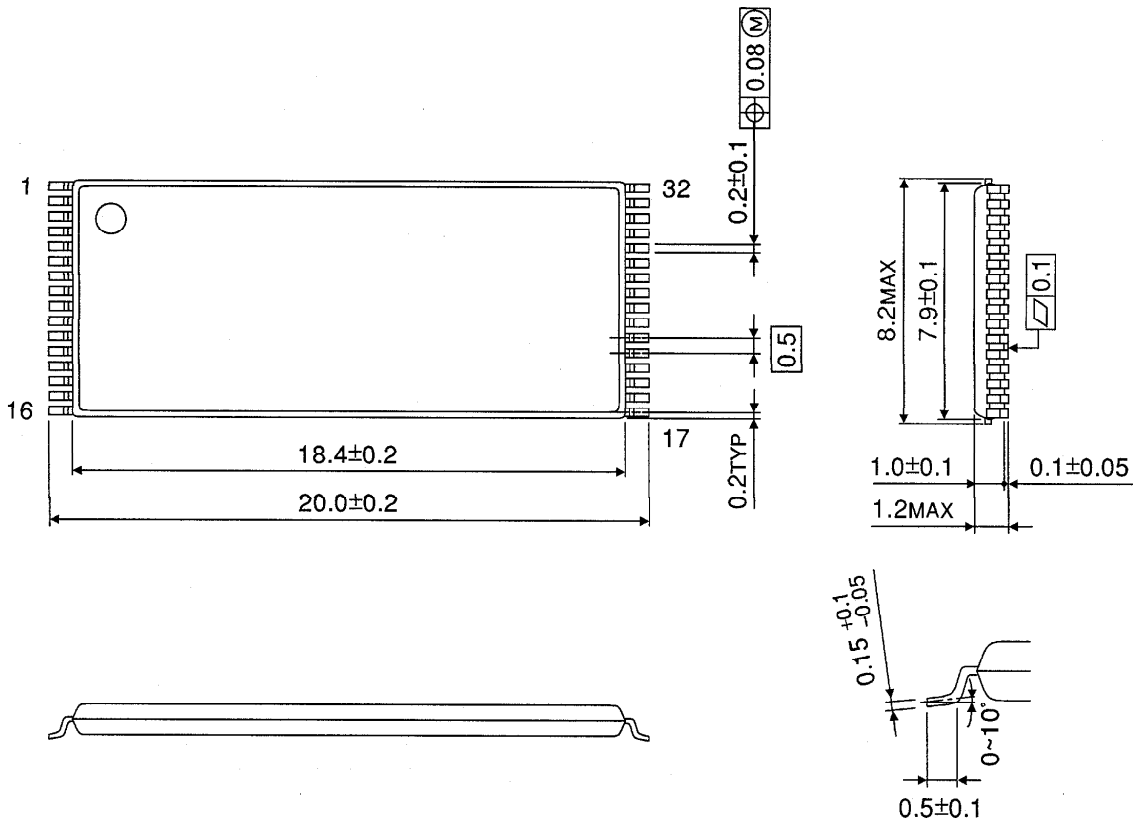
Units in mm



Weight: 1.06 g (typ)

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

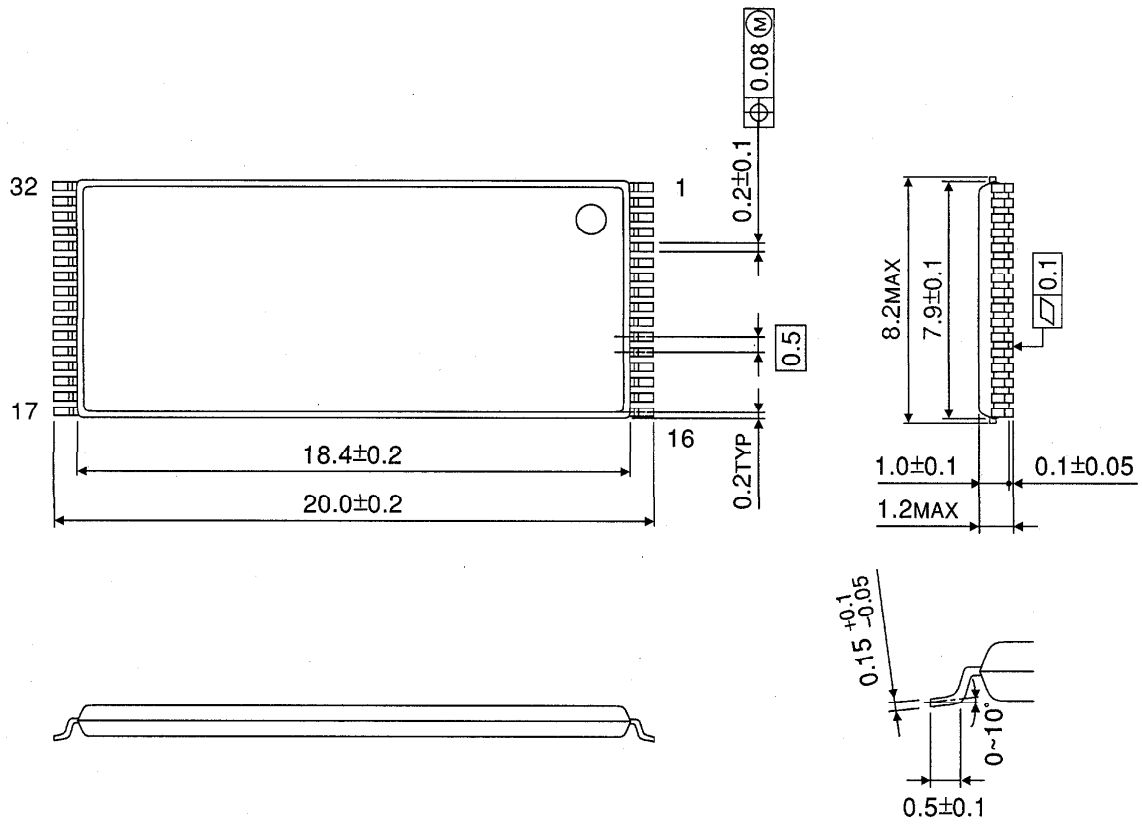
Units in mm



Weight: 0.34 g (typ)

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

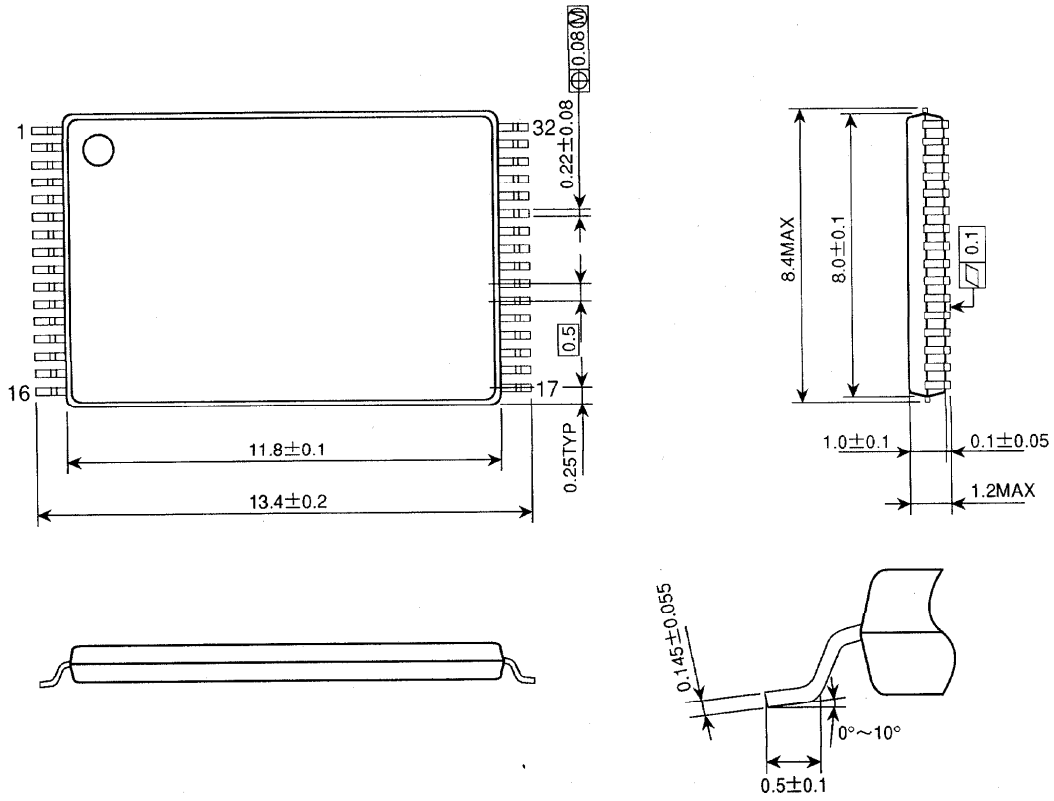
Units in mm



Weight: 0.34 g (typ)

PACKAGE DIMENSIONS (TSOP I 32-P-0.50)

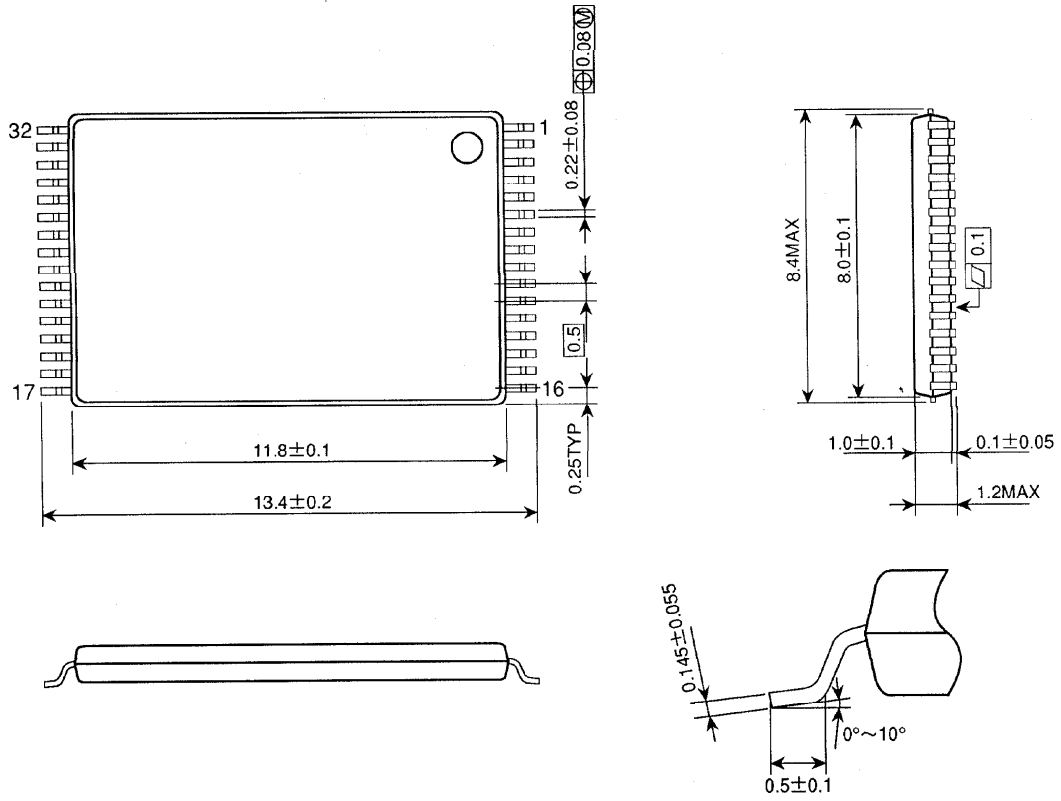
Units in mm



Weight: 0.24 g (typ)

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

Units in mm



Weight: 0.24 g (typ)