

TOSHIBA MOS DIGITAL INTEGRATED CIRCUIT SILICON GATE CMOS

262,144-WORD BY 16-BIT STATIC RAM

DESCRIPTION

The TC554161FTI is a 4,194,304-bit static random access memory (SRAM) organized as 262,144 words by 16 bits. Fabricated using Toshiba's CMOS Silicon gate process technology, this device operates from a single 5 V $\pm$ 10% power supply. Advanced circuit technology provides both high speed and low power at an operating current of 10 mA/MHz (typ) and a minimum cycle time of 85 ns. It is automatically placed in low-power mode at 200 μ A standby current (max) when chip enable ($\overline{CE}$) is asserted high. There are two control inputs. $\overline{CE}$ is used to select the device and for data retention control, and output enable ($\overline{OE}$) provides fast memory access. Data byte control pin ($\overline{LB}$, $\overline{UB}$) provides lower and upper byte access. This device is well suited to various microprocessor system applications where high speed, low power and battery backup are required. And, with a guaranteed operating range of -40° to 85°C , the TC554161FTI can be used in environments exhibiting extreme temperature conditions. The TC554161FTI is available in a plastic 54-pin thin-small-outline package (TSOP).

FEATURES

- Low-power dissipation
Operating: 55 mW/MHz (typical)
- Standby current of 8 μ A (maximum) at
 $T_a = 25^{\circ}\text{C}$
- Single power supply voltage of 5 V $\pm$ 10%
- Power down features using $\overline{CE}$.
- Data retention supply voltage of 2 to 5.5 V
- Direct TTL compatibility for all inputs and outputs
- Wide operating temperature range of -40° to 85°C

- Access Times (maximum):

	TC554161FTI	
	-85L	-10L
Access Time	85 ns	100 ns
$\overline{CE}$ Access Time	85 ns	100 ns
$\overline{OE}$ Access Time	45 ns	50 ns

- Package:

TSOP II 54-P-400-0.80 (FTI) (Weight: 0.55 g typ)

PIN ASSIGNMENT (TOP VIEW)

NC	1	54	A4
A3	2	53	A5
A2	3	52	A6
A1	4	51	A7
A0	5	50	NC
I/O16	6	49	I/O1
I/O15	7	48	I/O2
V _{DD}	8	47	V _{DD}
GND	9	46	GND
I/O14	10	45	I/O3
I/O13	11	44	I/O4
$\overline{UB}$	12	43	$\overline{LB}$
$\overline{CE}$	13	42	$\overline{OE}$
OP	14	41	OP
R/W	15	40	NC
I/O12	16	39	I/O5
I/O11	17	38	I/O6
GND	18	37	GND
V _{DD}	19	36	V _{DD}
I/O10	20	35	I/O7
I/O9	21	34	I/O8
NC	22	33	A8
A17	23	32	A9
A16	24	31	A10
A15	25	30	A11
A14	26	29	A12
A13	27	28	NC

(Normal pinout)

PIN NAMES

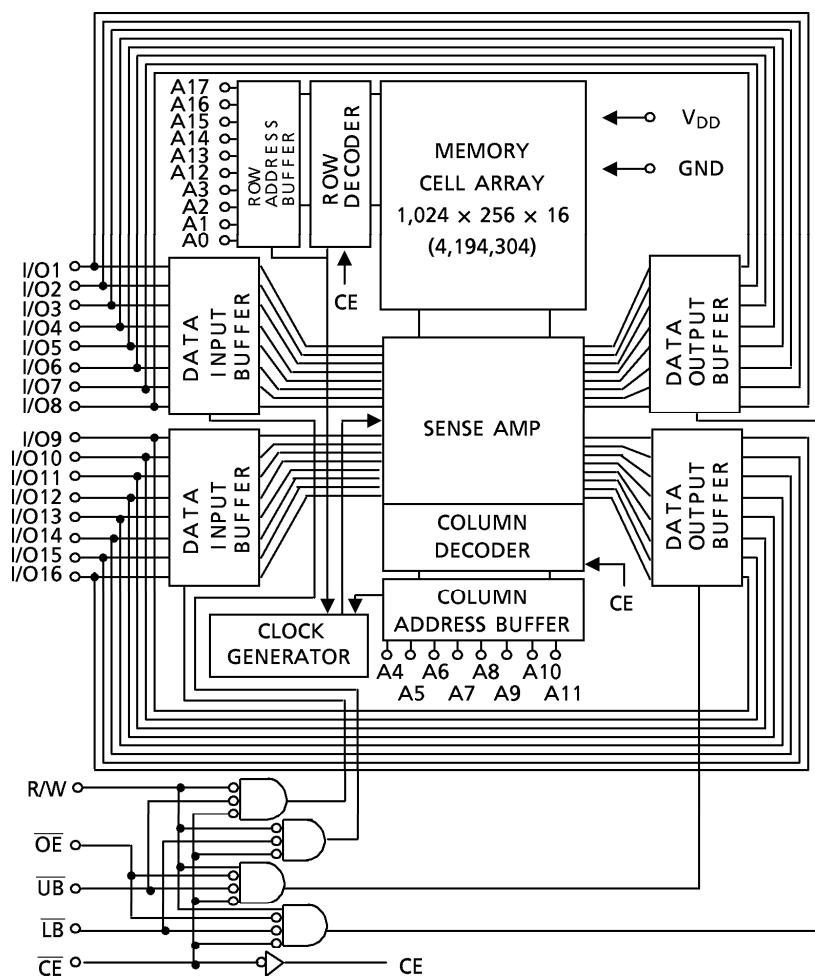
A0 to A17	Address Inputs
I/O1 to I/O16	Data Inputs/Outputs
$\overline{CE}$	Chip Enable
R/W	Read/Write Control
$\overline{OE}$	Output Enable
$\overline{LB}$, $\overline{UB}$	Data Byte Control Input
V _{DD}	Power (+ 5 V)
GND	Ground
NC	No Connection
OP*	Option

*: OP pin must be open or connected to GND.

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BLOCK DIAGRAM



MAXIMUM RATINGS

SYMBOL	RATING	VALUE	UNIT
V_{DD}	Power Supply Voltage	- 0.3 to 7.0	V
V_{IN}	Input Voltage	- 0.3 * to 7.0	V
$V_{I/O}$	Input/Output Voltage	- 0.5 * to $V_{DD} + 0.5$	V
P_D	Power Dissipation	0.6	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 30 ns

DC RECOMMENDED OPERATING CONDITIONS ($T_a = -40^{\circ}$ to 85°C)

SYMBOL	PARAMETER	MIN	TYP	MAX	UNIT
V_{DD}	Power Supply Voltage	4.5	5.0	5.5	V
V_{IH}	Input High Voltage	2.4	-	$V_{DD} + 0.3$	V
V_{IL}	Input Low Voltage	- 0.3 *	-	0.6	V
V_{DH}	Data Retention Supply Voltage	2.0	-	5.5	V

* - 3.0 V when measured at a pulse width of 30 ns

DC CHARACTERISTICS ($T_a = -40^\circ\text{ to }85^\circ\text{C}$, $V_{DD} = 5\text{ V} \pm 10\%$)

SYMBOL	PARAMETER	TEST CONDITION			MIN	TYP	MAX	UNIT
I _{IL}	Input Leakage Current	V _{IN} = 0 V to V _{DD}			–	–	± 1.0	μA
I _{LO}	Output Leakage Current	CE = V _{IH} or R/W = V _{IL} or OE = V _{IH} V _{OUT} = 0 V to V _{DD}			–	–	± 1.0	μA
I _{OH}	Output High Current	V _{OH} = 2.4 V			– 1.0	–	–	mA
I _{OL}	Output Low Current	V _{OL} = 0.4 V			2.1	–	–	mA
I _{DDO 1}	Operating Current	CE = V _{IL} R/W = V _{IH} , I _{OUT} = 0 mA Other Inputs = V _{IH} /V _{IL}	Tcycle	min	–	–	100	mA
				1 μs	–	15	–	
I _{DDO 2}		CE = 0.2 V R/W = V _{DD} – 0.2 V, I _{OUT} = 0 mA Other Inputs = V _{DD} – 0.2 V/0.2 V	Tcycle	min	–	–	90	mA
				1 μs	–	10	–	
I _{DDS 1}	Standby Current	CE = V _{IH}			–	–	3	mA
I _{DDS 2}		CE = V _{DD} – 0.2 V V _{DD} = 2.0 to 5.5 V	Ta = 25°C		–	4	8	μA
			Ta = – 40° to 85°C		–	–	140	

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	pF

Note: This parameter is periodically sampled and is not 100% tested.

OPERATING MODE

MODE	$\overline{CE}$	$\overline{OE}$	R/W	$\overline{LB}$	$\overline{UB}$	I/O1 to I/O8	I/O9 to I/O16	POWER
Read	L	L	H	L	L	Output	Output	I_{DDO}
				H	L	High-Z	Output	I_{DDO}
				L	H	Output	High-Z	I_{DDO}
Write	L	x	L	L	L	Input	Input	I_{DDO}
				H	L	High-Z	Input	I_{DDO}
				L	H	Input	High-Z	I_{DDO}
Outputs Disable	L	H	H	x	x	High-Z	High-Z	I_{DDO}
	L	x	x	H	H			
Standby	H	x	x	x	x	High-Z	High-Z	I_{DDS}

x = don't care
H = logic high
L = logic low

AC CHARACTERISTICS AND OPERATING CONDITIONS ($T_a = -40^\circ$ to 85°C , $V_{DD} = 5\text{ V} \pm 10\%$)READ CYCLE

SYMBOL	PARAMETER	TC554161FTI				UNIT
		-85L		-10L		
		MIN	MAX	MIN	MAX	
t _{RC}	Read Cycle Time	85	–	100	–	ns
t _{ACC}	Address Access Time	–	85	–	100	
t _{CO}	Chip Enable Access Time	–	85	–	100	
t _{OE}	Output Enable Access Time	–	45	–	50	
t _{BA}	Data Byte Control Access Time	–	45	–	50	
t _{OH}	Output Data Hold Time	10	–	10	–	
t _{COE}	Chip Enable Low to Output Active	5	–	5	–	
t _{OEE}	Output Enable Low to Output Active	0	–	0	–	
t _{BE}	Data Byte Control 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 _{BD}	Data Byte Control High to Output High-Z	–	35	–	40	

WRITE CYCLE

SYMBOL	PARAMETER	TC554161FTI				UNIT
		-85L		-10L		
		MIN	MAX	MIN	MAX	
t _{WC}	Write Cycle Time	85	–	100	–	ns
t _{WP}	Write Pulse Width	55	–	60	–	
t _{CW}	Chip Enable to End of Write	70	–	80	–	
t _{BW}	Data Byte Control to End of Write	55	–	60	–	
t _{AS}	Address Setup Time	0	–	0	–	
t _{WR}	Write Recovery Time	0	–	0	–	
t _{DS}	Data Setup Time	35	–	40	–	
t _{DH}	Data Hold Time	0	–	0	–	
t _{OE_W}	R/W High to Output Active	0	–	0	–	
t _{OD_W}	R/W Low to Output High-Z	–	35	–	40	

AC TEST CONDITIONS

Output load: 100 pF + one TTL gate

Input pulse level: 0.4 V, 2.6 V

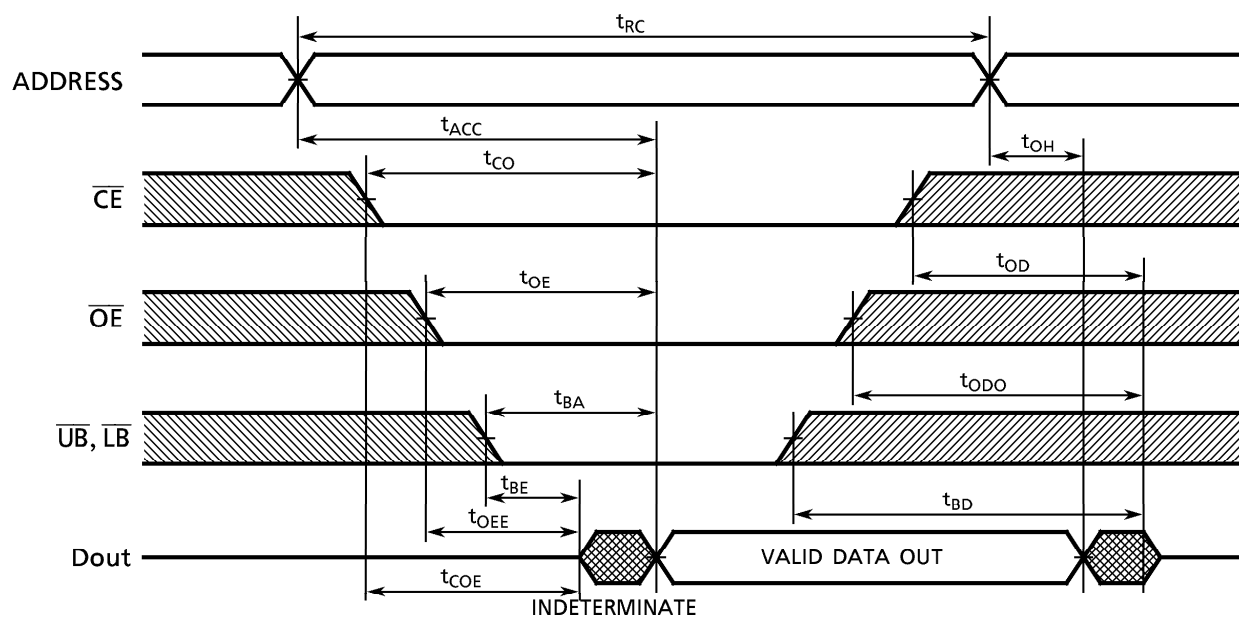
Timing measurements: 1.5 V

Reference level: 1.5 V

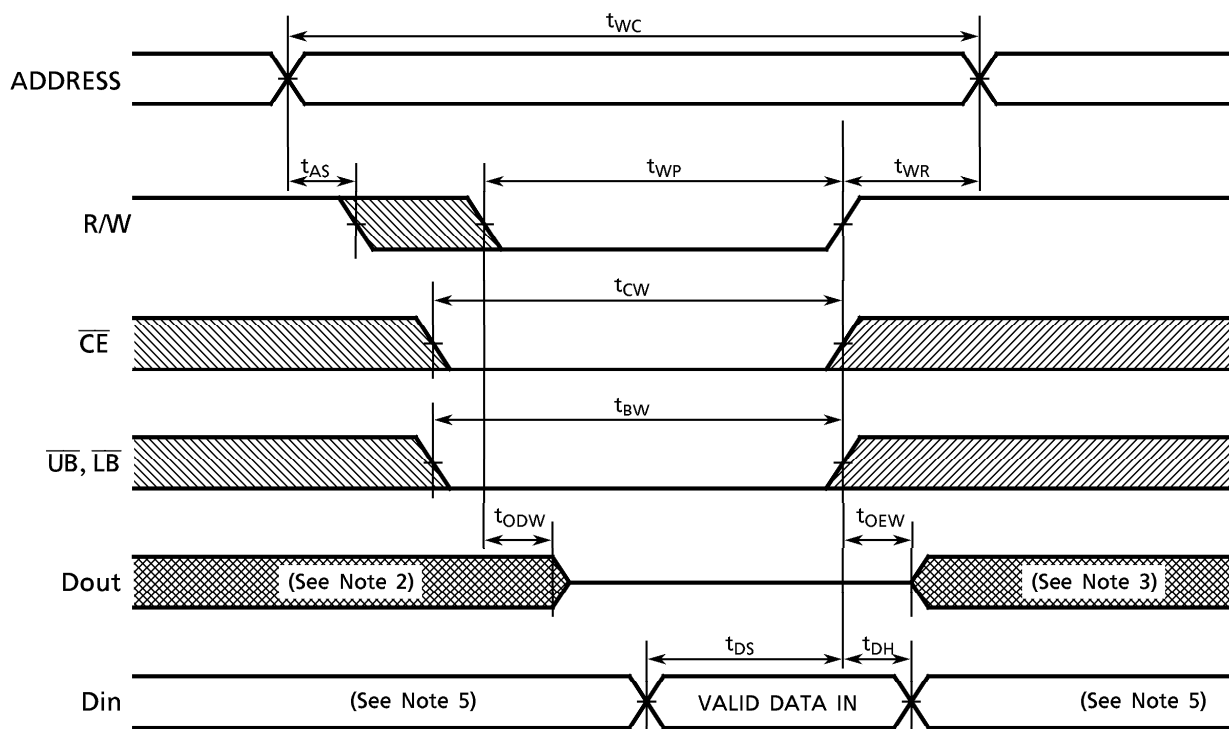
 t_R, t_F : 5 ns

TIMING DIAGRAMS

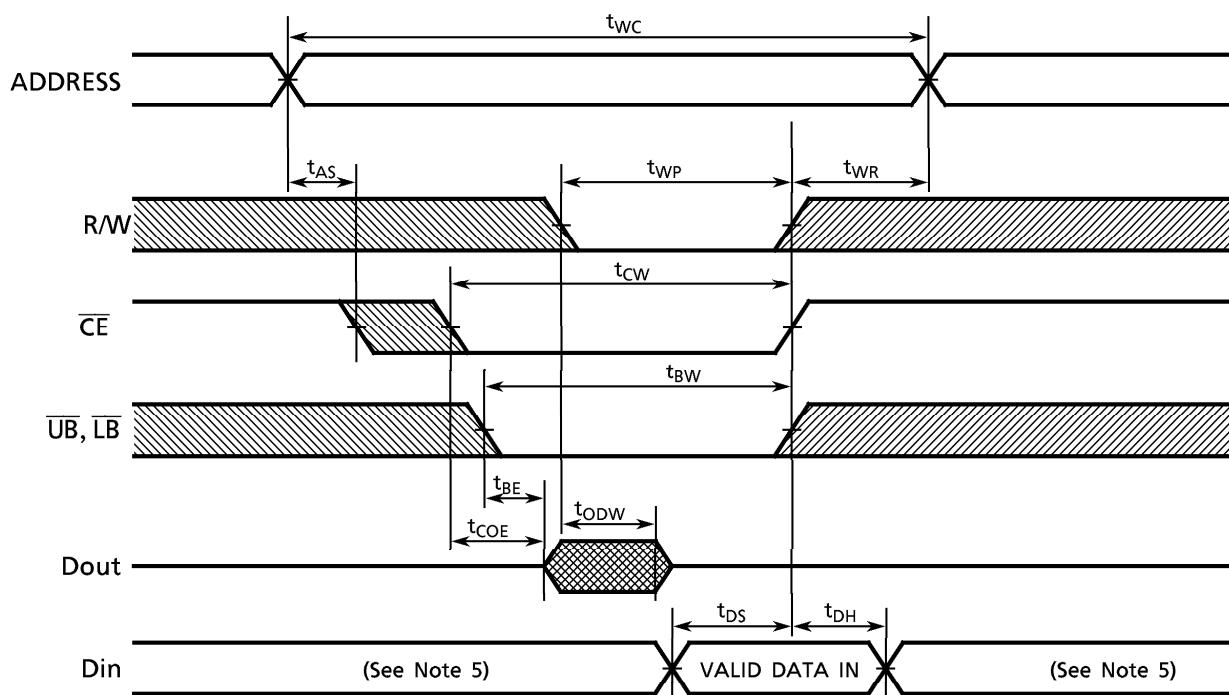
READ CYCLE (See Note 1)



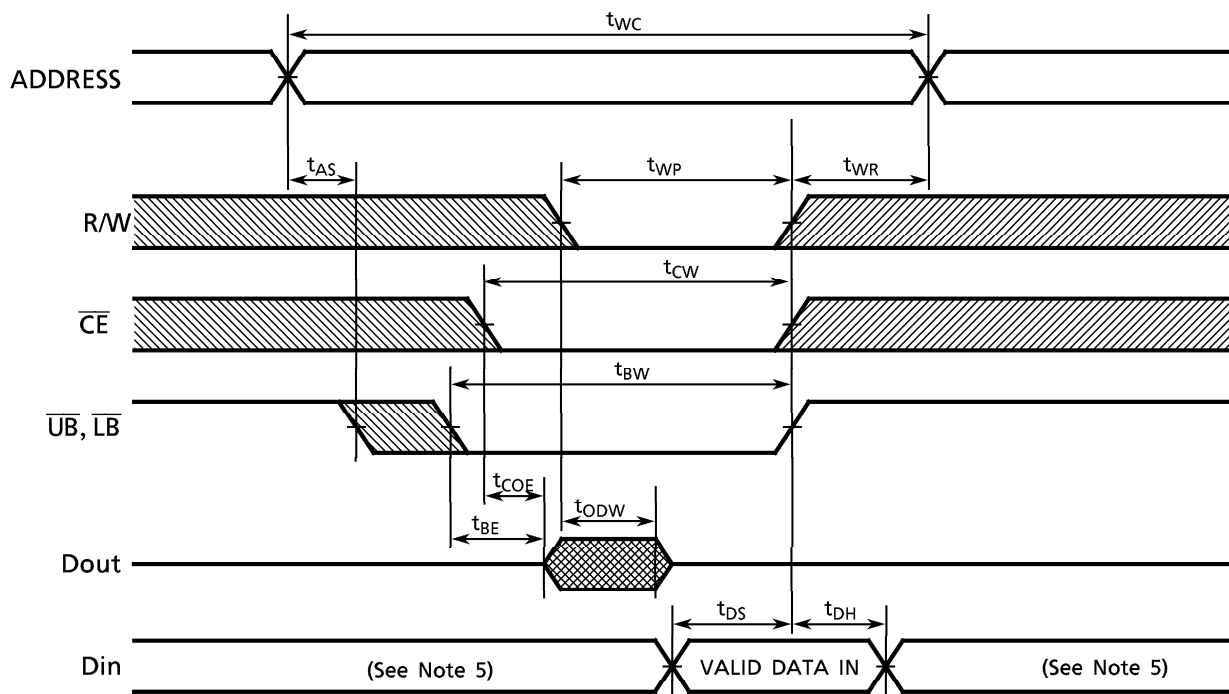
WRITE CYCLE 1 (R/W CONTROLLED) (See Note 4)



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



WRITE CYCLE 3 ($\overline{\text{UB}}, \overline{\text{LB}}$ CONTROLLED) (See Note 4)



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

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

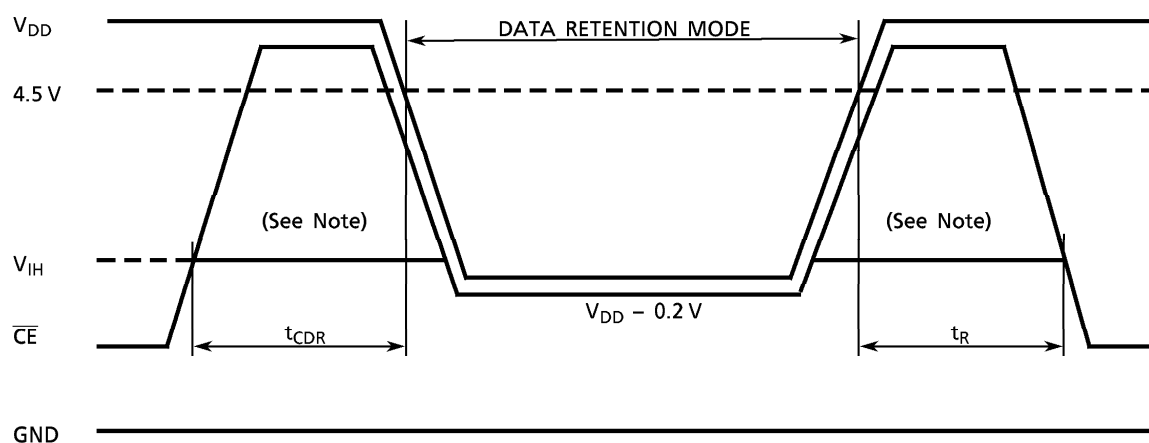
(3) If $\overline{CE}$ goes HIGH coincident with or before R/W goes HIGH, the outputs will remain at high impedance.

(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)

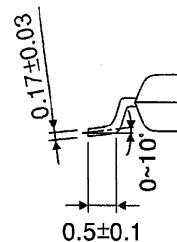
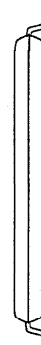
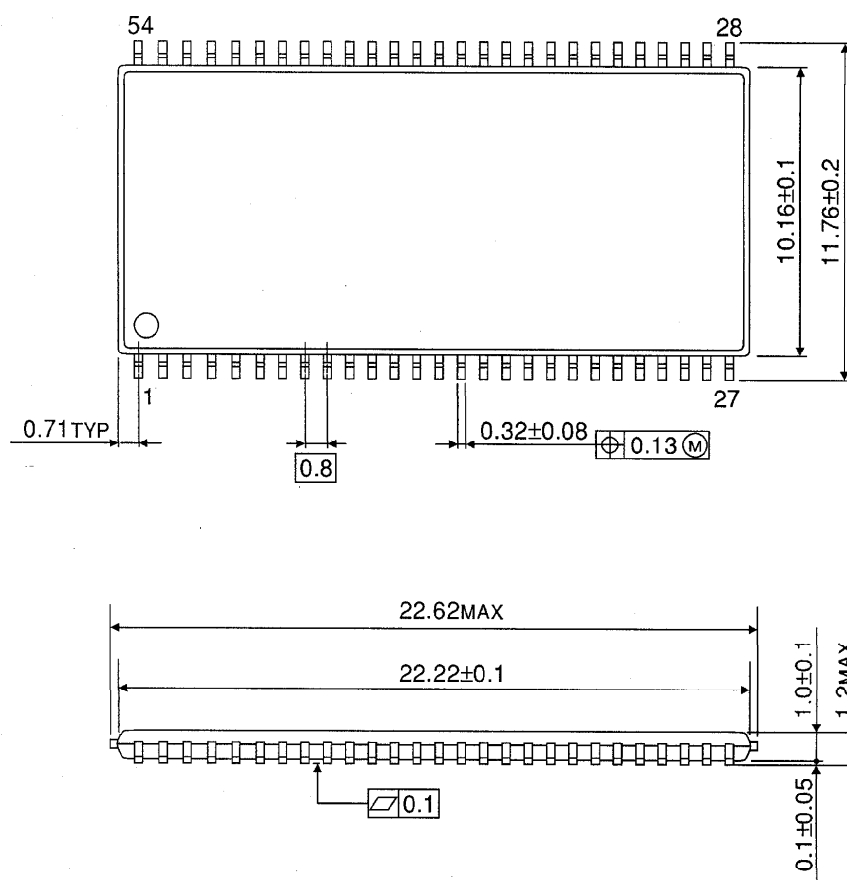
SYMBOL	PARAMETER	MIN	TYP	MAX	UNIT
V_{DH}	Data Retention Supply Voltage	2.0	–	5.5	V
I_{DDS2}	Standby Current	$V_{DH} = 3.0\text{ V}$	–	70*	μA
		$V_{DH} = 5.5\text{ V}$	–	140	
t_{CDR}	Chip Deselect to Data Retention Mode Time	0	–	–	nS
t_R	Recovery Time	5	–	–	mS

* $6\text{ }\mu\text{A}$ (max) at $T_a = -40^\circ$ to 40°C $\overline{\text{CE}}$ CONTROLLED DATA RETENTION MODE

Note: When $\overline{\text{CE}}$ is operating at the V_{IH} level (2.4 V), the operating current is given by I_{DDS1} during the transition of V_{DD} from 4.5 V to 2.6 V.

PACKAGE DIMENSIONS (TSOPII 54-P-400-0.80)

Units in mm



Weight: 0.55 g (typ)