

TOSHIBA MOS DIGITAL INTEGRATED CIRCUIT SILICON GATE CMOS

4,194,304-WORD BY 4-BIT CMOS STATIC RAM

DESCRIPTION

The TC55V4400FT is a 16,777,216-bit high-speed static random access memory (SRAM) organized as 4,194,304 words by 4 bits. Fabricated using CMOS technology and advanced circuit techniques to provide high speed, it operates from a single 3.3 V power supply. Chip enable (\overline{CE}) can be used to place the device in a low-power mode, and output enable (\overline{OE}) provides fast memory access. This device is well suited to cache memory applications where high-speed access and high-speed storage are required. All inputs and outputs are directly LVTTL compatible. The TC55V4400FT is available in plastic 54-pin TSOP with 400mil width for high density surface assembly.

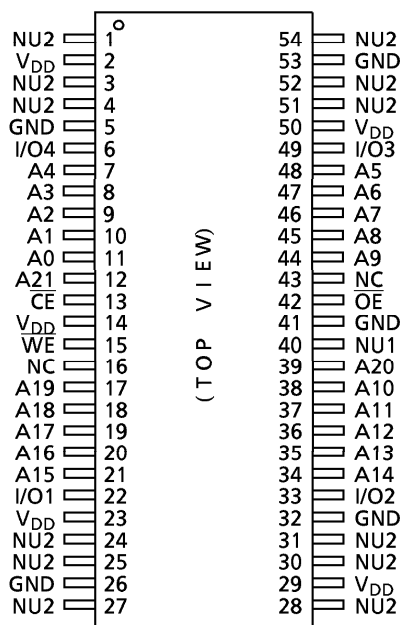
FEATURES

- Fast access time (the following are maximum values)
 - TC55V4400FT-10: 10 ns
 - TC55V4400FT-12: 12 ns
 - TC55V4400FT-15: 15 ns
- Low-power dissipation
- Single power supply : 3.3V \pm 5% (-10) : 3.3V \pm 0.3V (-12, -15)
- Fully static operation
- All inputs and outputs are LVTTL compatible
- Output buffer control using \overline{OE}
- Package: TSOP II 54-P-400-0.80B(FT) (Weight: 0.55g typ)

Cycle Time	10	12	15	ns
Operation (max)	410	380	360	mA

Standby: 4mA (max)

PIN ASSIGNMENT



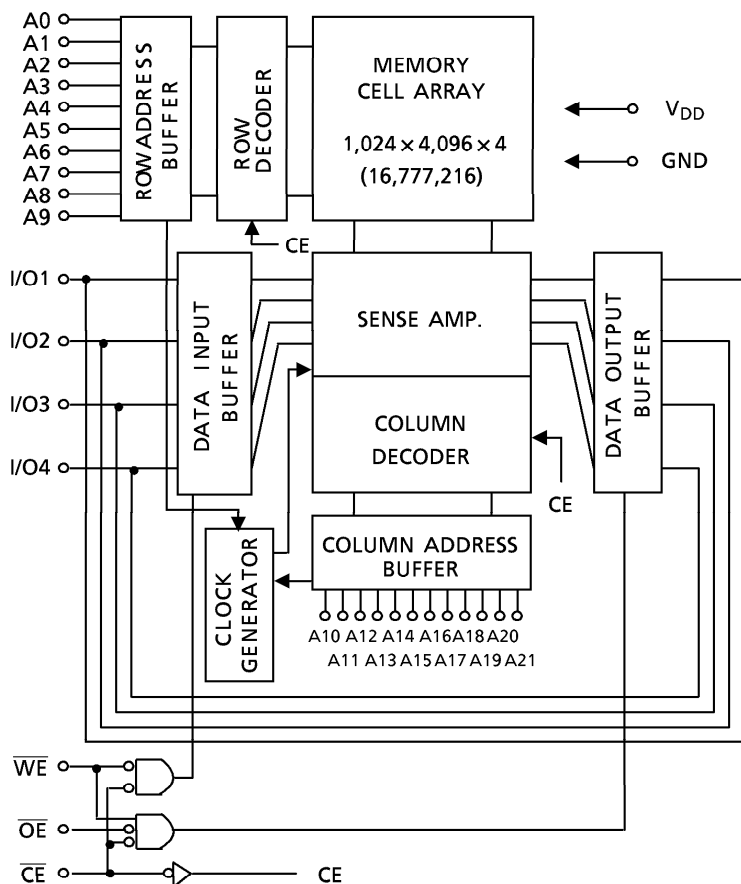
PIN NAMES

A0 to A21	Address Inputs
I/O1 to I/O4	Data Inputs / Outputs
\overline{CE}	Chip Enable Input
\overline{WE}	Write Enable Input
\overline{OE}	Output Enable Input
V_{DD}	Power (+ 3.3V)
GND	Ground
NC	No Connection
NU1, NU2	Not Usable

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BLOCK DIAGRAM



MAXIMUM RATINGS

SYMBOL	RATING	VALUE	UNIT
V _{DD}	Power Supply Voltage	- 0.5 to 4.6	V
V _{IN}	Input Terminal Voltage	- 0.5* to 4.6	V
V _{I/O}	Input/Output Terminal Voltage	- 0.5* to V _{DD} + 0.5**	V
P _D	Power Dissipation	1.8	W
T _{solder}	Soldering Temperature (10 s)	260	°C
T _{strg}	Storage Temperature	- 65 to 150	°C
T _{opr}	Operating Temperature	- 10 to 85	°C

* : -1.5V with a pulse width of 20% · t_{RC} min (4ns max)
 ** : V_{DD}+1.5V with a pulse width of 20% · t_{RC} min (4ns max)

DC RECOMMENDED OPERATING CONDITIONS (T_a = 0° to 70°C)

SYMBOL	PARAMETER	MIN	TYP	MAX	UNIT
V _{DD}	Power Supply Voltage	-10	3.135	3.3	V
		-12, -15	3.0	3.3	
V _{IH}	Input High Voltage	2.0	-	V _{DD} + 0.3**	V
V _{IL}	Input Low Voltage	- 0.3*	-	0.8	V

* : -1.0V with a pulse width of 20% · t_{RC} min (4ns max)
 ** : V_{DD}+1.0V with a pulse width of 20% · t_{RC} min (4ns max)

DC CHARACTERISTICS (Ta = 0° to 70°C, V_{DD} = 3.3V ± 5% : -10, V_{DD} = 3.3V ± 0.3V : -12,-15)

SYMBOL	PARAMETER	TEST CONDITION	MIN	TYP	MAX	UNIT
I _{IL}	Input Leakage Current (Except NU1 pin)	V _{IN} = 0 to V _{DD}	-1	-	1	μA
I _{LO}	Output Leakage Current	$\overline{CE} = V_{IH}$ or $\overline{WE} = V_{IL}$ or $\overline{OE} = V_{IH}$ V _{OUT} = 0 to V _{DD}	-1	-	1	μA
I _{I(NU1)}	Input Current (NU1 pin)	V _{IN} = 0 to 0.8V	-1	-	20	μA
		V _{IN} = 0 to 0.2V	-1	-	1	
V _{OH}	Output High Voltage	I _{OH} = -2mA	2.4	-	-	V
		I _{OH} = -100μA	V _{DD} - 0.2	-	-	
V _{OL}	Output Low Voltage	I _{OL} = 2mA	-	-	0.4	
		I _{OL} = 100μA	-	-	0.2	
I _{DDO}	Operating Current	$\overline{CE} = V_{IL}$, I _{out} = 0mA	tcycle = 10ns	-	-	410
		$\overline{OE} = V_{IH}$				380
		Other Inputs = V _{DD} - 0.2V or 0.2V				360
I _{DDS1}	Standby Current	$\overline{CE} = V_{IH}$, Other Inputs = V _{IH} or V _{IL}	-	-	105	mA
I _{DDS2}		$\overline{CE} = V_{DD} - 0.2V$ Other Inputs = V _{DD} - 0.2V or 0.2V	-	-	4	

CAPACITANCE (Ta = 25°C, f = 1.0 MHz)

SYMBOL	PARAMETER	TEST CONDITION	MAX	UNIT
C _{IN}	Input Capacitance	V _{IN} = GND	6	pF
C _{I/O}	Input/Output Capacitance	V _{I/O} = GND	8	pF

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

OPERATING MODE

MODE	\overline{CE}	\overline{OE}	\overline{WE}	I/O1 to I/O4	POWER
Read	L	L	H	Output	I _{DDO}
Write	L	X	L	Input	I _{DDO}
Outputs Disable	L	H	H	High Impedance	I _{DDO}
Standby	H	X	X	High Impedance	I _{DDS}

X : Don't care

Note: The NU1 and NU2 pins must be left unconnected or tied to GND or a voltage level of less than 0.8 V.

You must not apply a voltage of more than 0.8 V to the NU1 and NU2.

AC CHARACTERISTICS ($T_a = 0^\circ$ to 70°C ^(Note 1), $V_{DD} = 3.3\text{V} \pm 5\%$:-10, $V_{DD} = 3.3\text{V} \pm 0.3\text{V}$:-12,-15)
READ CYCLE

SYMBOL	PARAMETER	TC55V4400FT-10		TC55V4400FT-12		TC55V4400FT-15		UNIT
		MIN	MAX	MIN	MAX	MIN	MAX	
t_{RC}	Read Cycle Time	10	–	12	–	15	–	ns
t_{ACC}	Address Access Time	–	10	–	12	–	15	
t_{CO}	Chip Enable Access Time	–	10	–	12	–	15	
t_{OE}	Output Enable Access Time	–	5	–	6	–	8	
t_{OH}	Output Data Hold Time from Address Change	3	–	3	–	3	–	
t_{COE}	Output Enable Time from Chip Enable	3	–	3	–	3	–	
t_{OEE}	Output Enable Time from Output Enable	1	–	1	–	1	–	
t_{COD}	Output Disable Time from Chip Enable	–	6	–	7	–	8	
t_{ODO}	Output Disable Time from Output Enable	–	6	–	7	–	8	

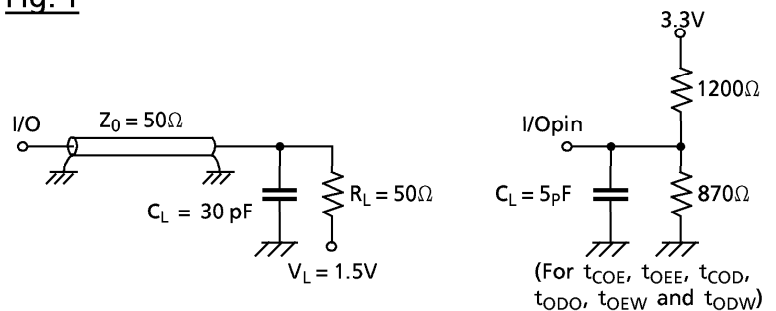
WRITE CYCLE

SYMBOL	PARAMETER	TC55V4400FT-10		TC55V4400FT-12		TC55V4400FT-15		UNIT
		MIN	MAX	MIN	MAX	MIN	MAX	
t_{WC}	Write Cycle Time	10	–	12	–	15	–	ns
t_{WP}	Write Pulse Width	7	–	8	–	10	–	
t_{CW}	Chip Enable to End of Write	8.5	–	9	–	11	–	
t_{AW}	Address Valid to End of Write	8.5	–	9	–	11	–	
t_{AS}	Address Setup Time	0	–	0	–	0	–	
t_{WR}	Write Recovery Time	0	–	0	–	0	–	
t_{DS}	Data Setup Time	6	–	7	–	8	–	
t_{DH}	Data Hold Time	0	–	0	–	0	–	
t_{OEW}	Output Enable Time from Write Enable	1	–	1	–	1	–	
t_{ODW}	Output Disable Time from Write Enable	–	6	–	7	–	8	

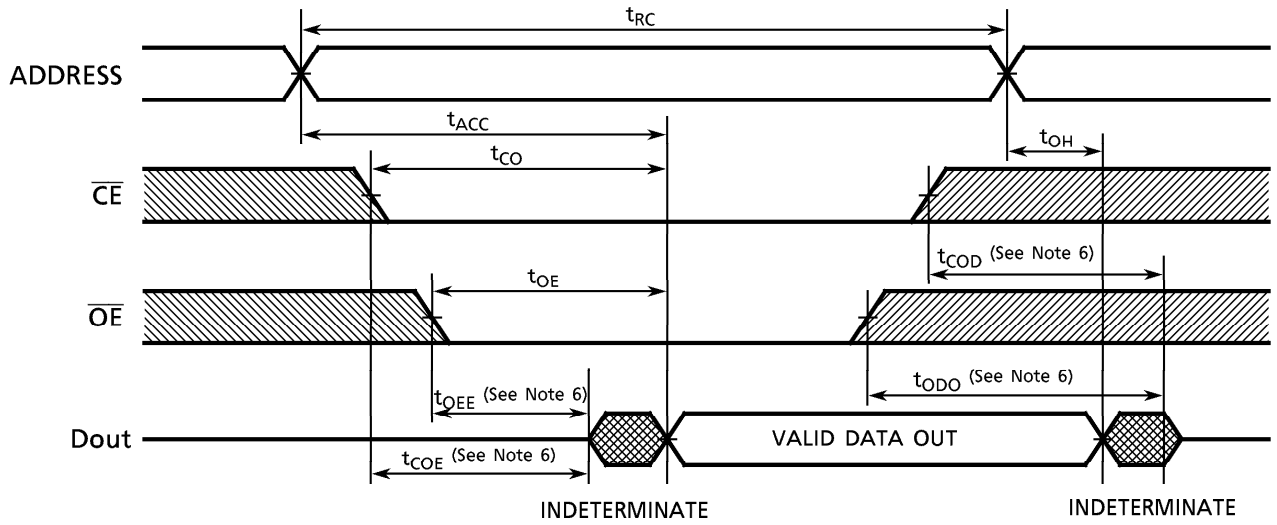
AC TEST CONDITIONS

Input Pulse Level	3.0V/0.0V
Input Pulse Rise and Fall Time	2ns
Input Timing Measurement Reference Level	1.5V
Output Timing Measurement Reference Level	1.5V
Output Load	Fig. 1

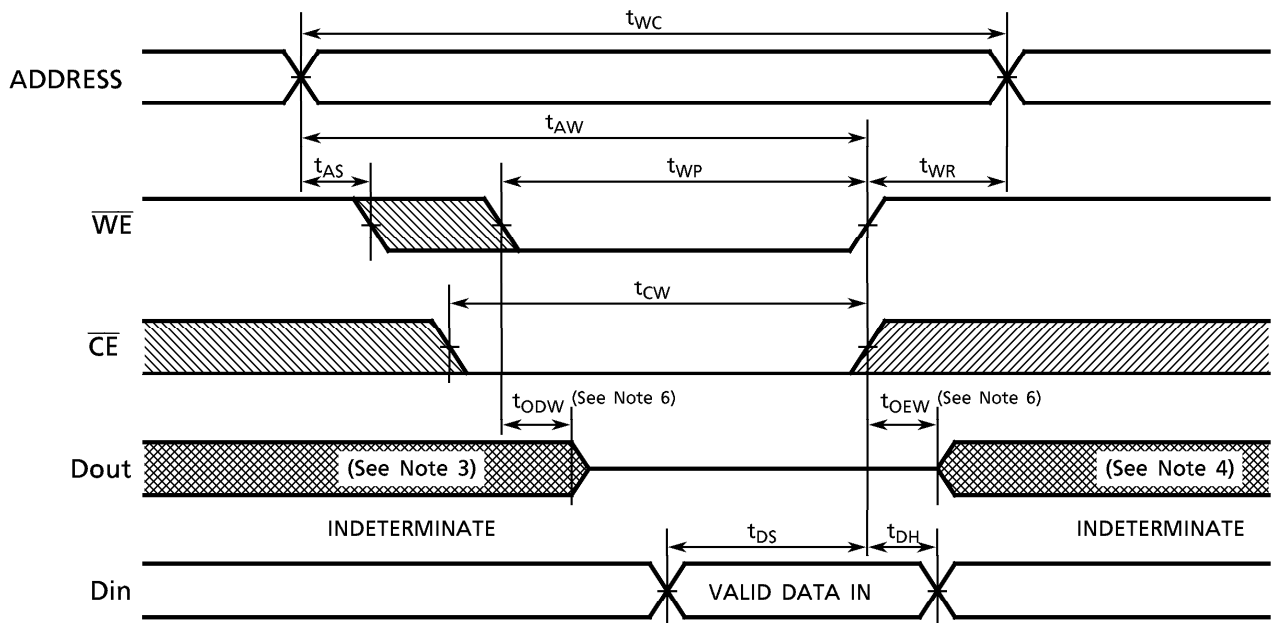
Fig. 1



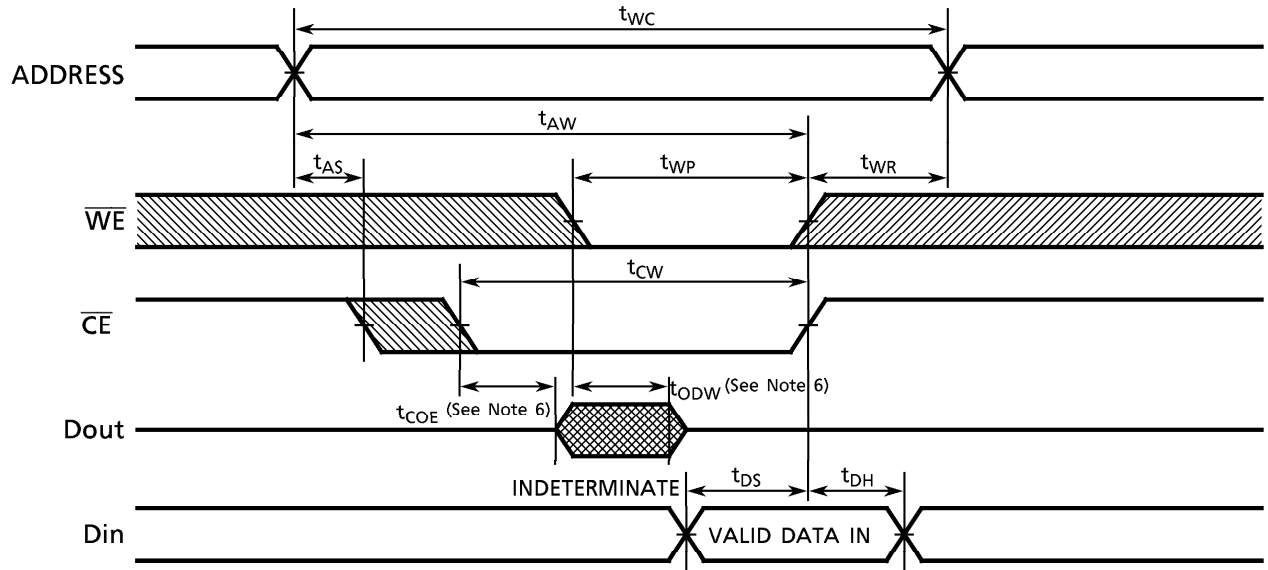
TIMING DIAGRAMS
READ CYCLE (See Note 2)



WRITE CYCLE 1 (\overline{WE} CONTROLLED) (See Note 5)



WRITE CYCLE 2 (\overline{CE} CONTROLLED) (See Note 5)



Note: (1) Operating temperature (Ta) is guaranteed for transverse air flow exceeding 400 linear feet per minute.

(2) \overline{WE} remains HIGH for the Read Cycle.

(3) If \overline{CE} goes LOW coincident with or after \overline{WE} goes LOW, the outputs will remain at high impedance.

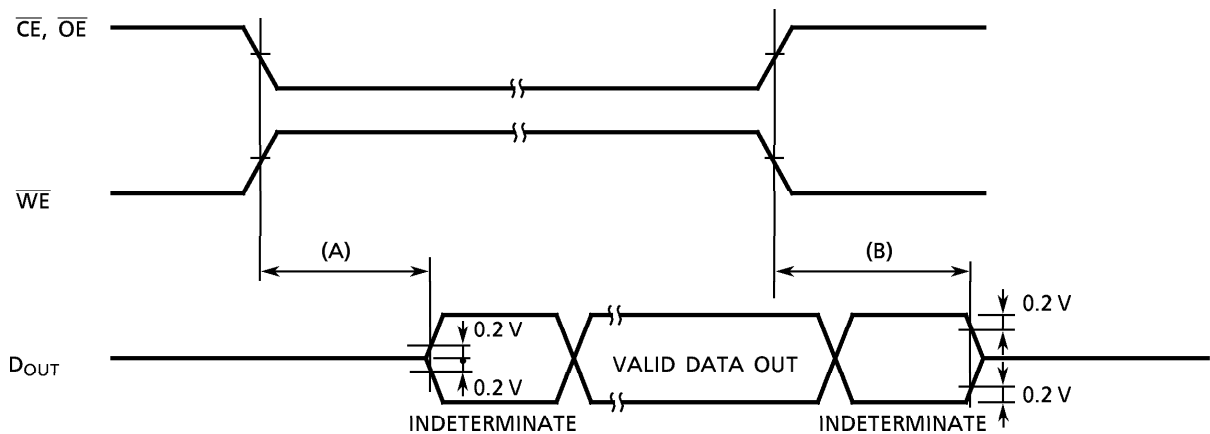
(4) If \overline{CE} goes HIGH coincident with or before \overline{WE} goes HIGH, the outputs will remain at high impedance.

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

(6) The parameters specified below are measured using the load shown in Fig. 1.

(A) $t_{COE}, t_{OEE}, t_{OEW}$ ····· Output Enable Time

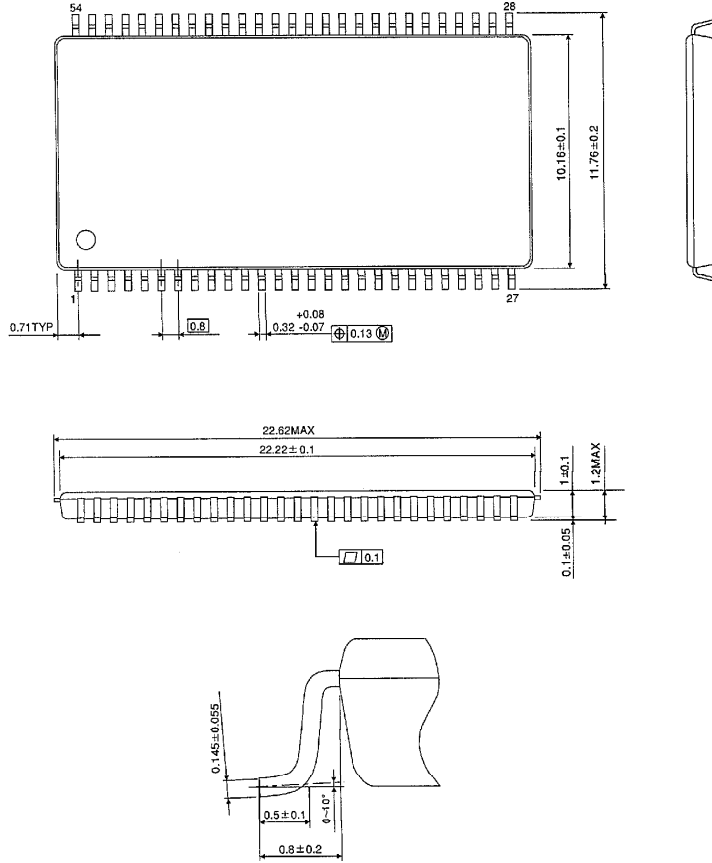
(B) $t_{COD}, t_{ODO}, t_{ODW}$ ····· Output Disable Time



PACKAGE DIMENSIONS

Plastic TSOP (TSOPII 54-P-400-0.80B)

Unit in mm



Weight : 0.55g (Typ)