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.

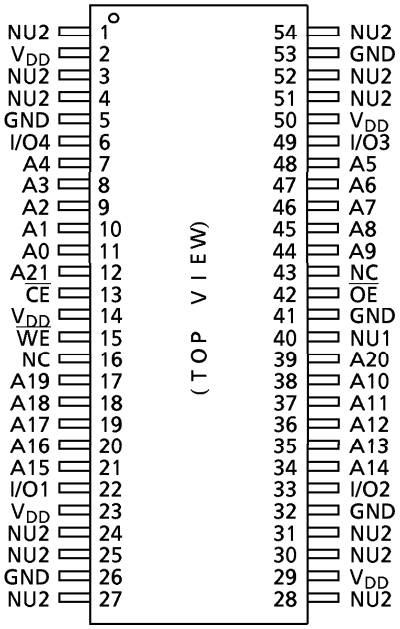
FEATURES

- Fast access time (the following are maximum values)
  TC55V4400FT-10: 10 ns
  TC55V4400FT-12: 12 ns
  TC55V4400FT-15: 15 ns
- Low-power dissipation

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

  Standby: 4mA (max)
- Single power supply : 3.3V±5% (-10)
  : 3.3V±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)

PIN ASSIGNMENT



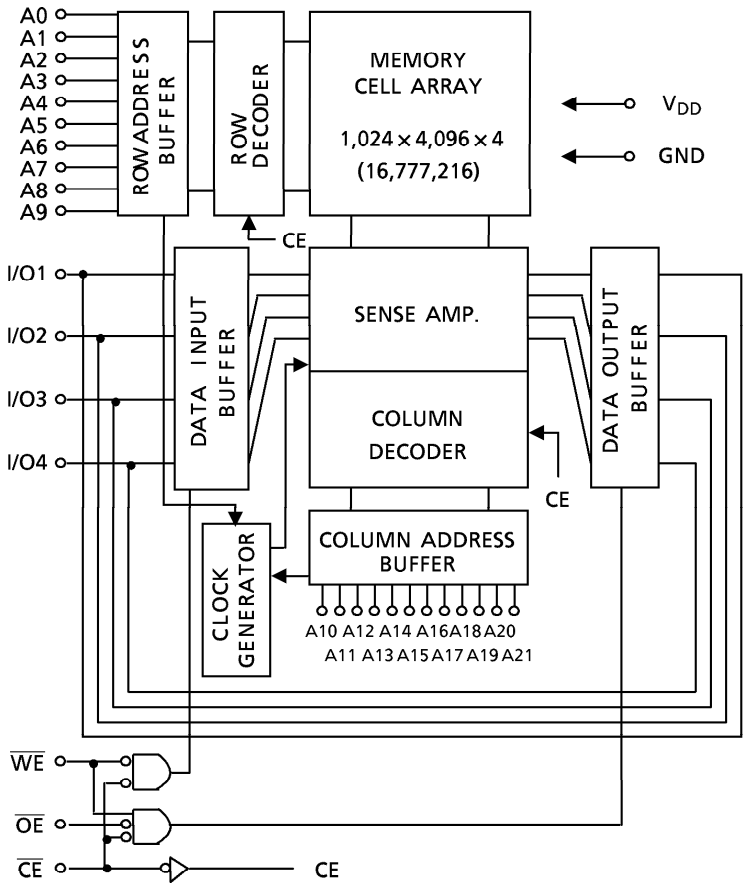
PIN NAMES

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 (Ta = 0° to 70°C)

SYMBOL	PARAMETER		MIN	TYP	MAX	UNIT
V_{DD}	Power Supply Voltage	-10	3.135	3.3	3.465	V
		-12, -15	3.0	3.3	3.6	
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}, Iout = 0mA $\overline{OE}$ = V_{IH} Other Inputs = V_{DD} – 0.2V or 0.2V	tcycle = 10ns	–	–	410	mA
			tcycle = 12ns	–	–	380	
			tcycle = 15ns	–	–	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 (Ta = 0° to 70°C(Note 1), V_{DD} = 3.3V ± 5%:-10, V_{DD} = 3.3V ± 0.3V:-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	

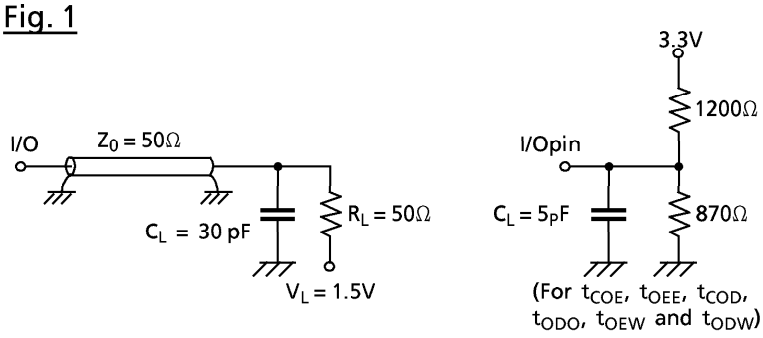
WRITE CYCLE

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

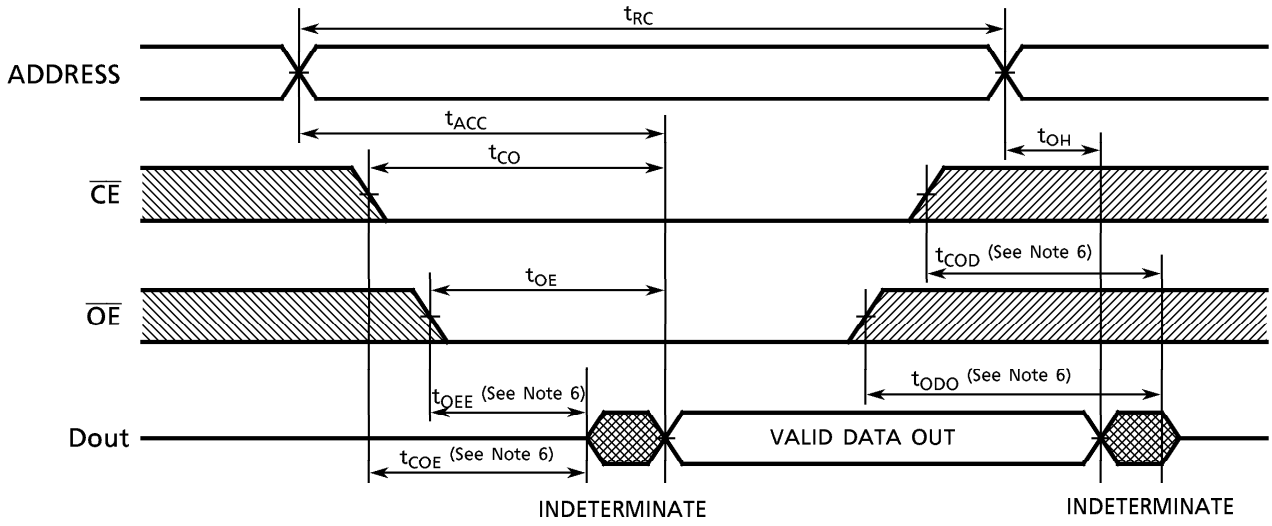
Input Pulse Level	3.0V/0.0V
Input Pulse Rise and Fall Time	2ns
Input Timing Measurement Reference Level	1.5V
Output Timing Measurement Reference Level	1.5V
Output Load	Fig. 1

Fig. 1

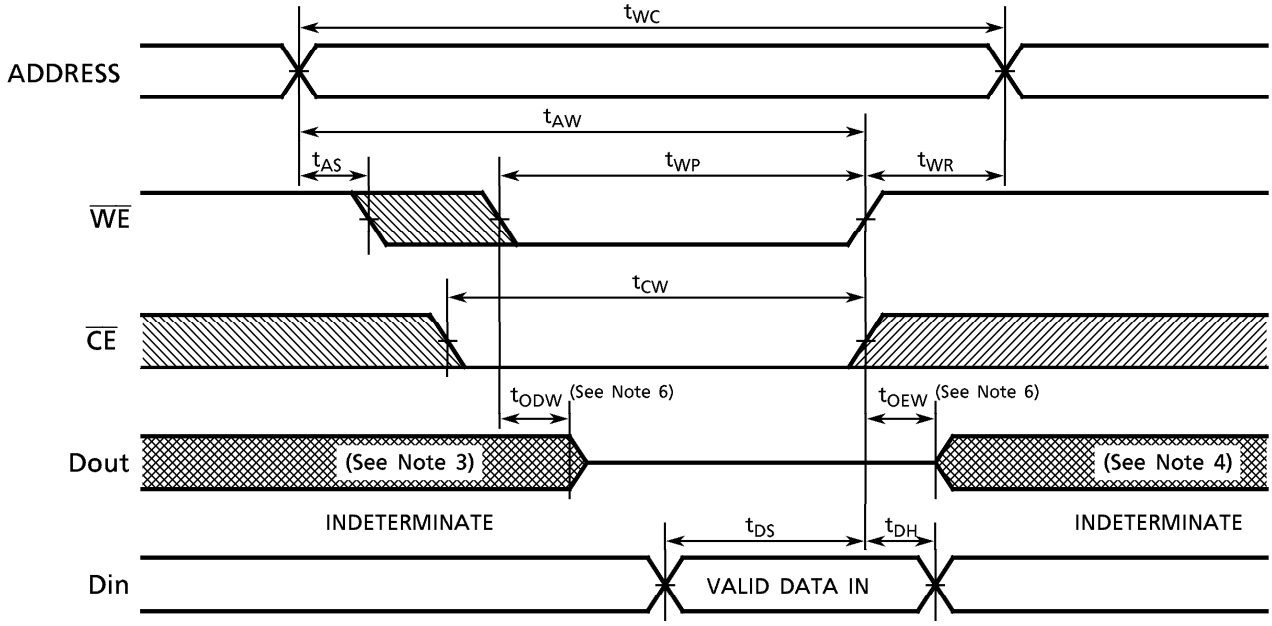


TIMING DIAGRAMS

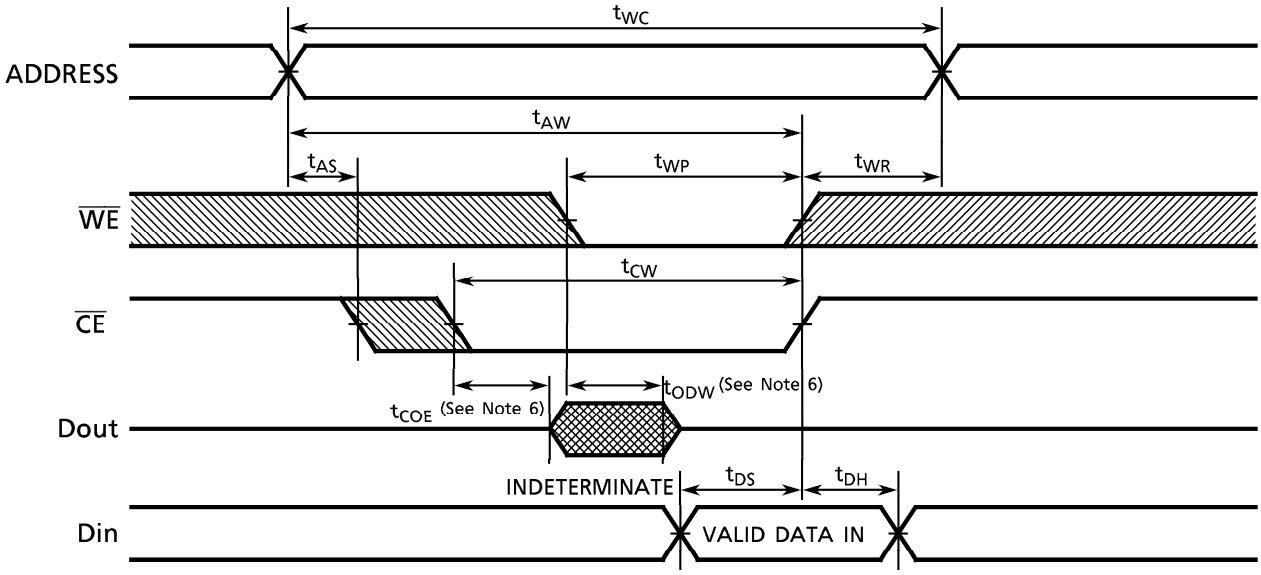
READ CYCLE (See Note 2)



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.

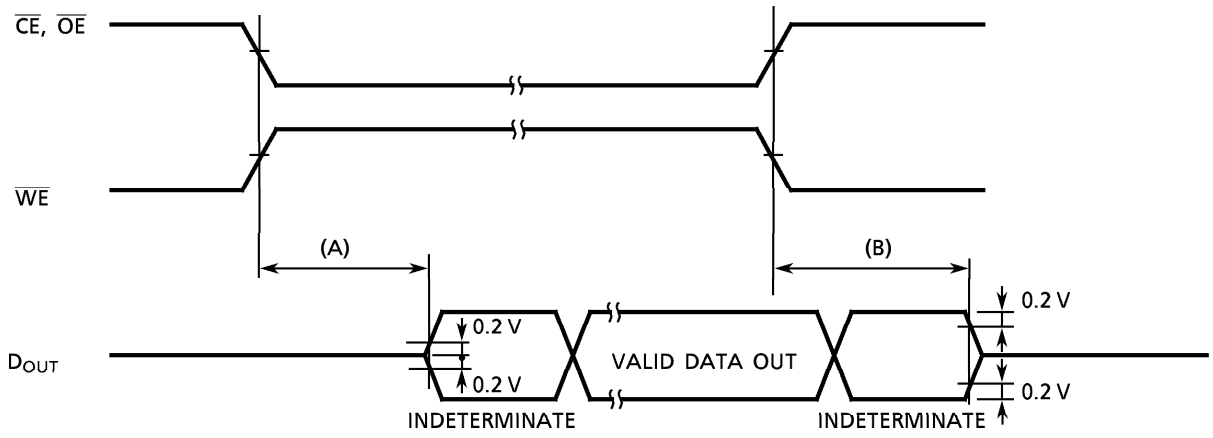
(4) If $\overline{CE}$ goes HIGH coincident with or before $\overline{WE}$ goes HIGH, the outputs will remain at high impedance.

(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

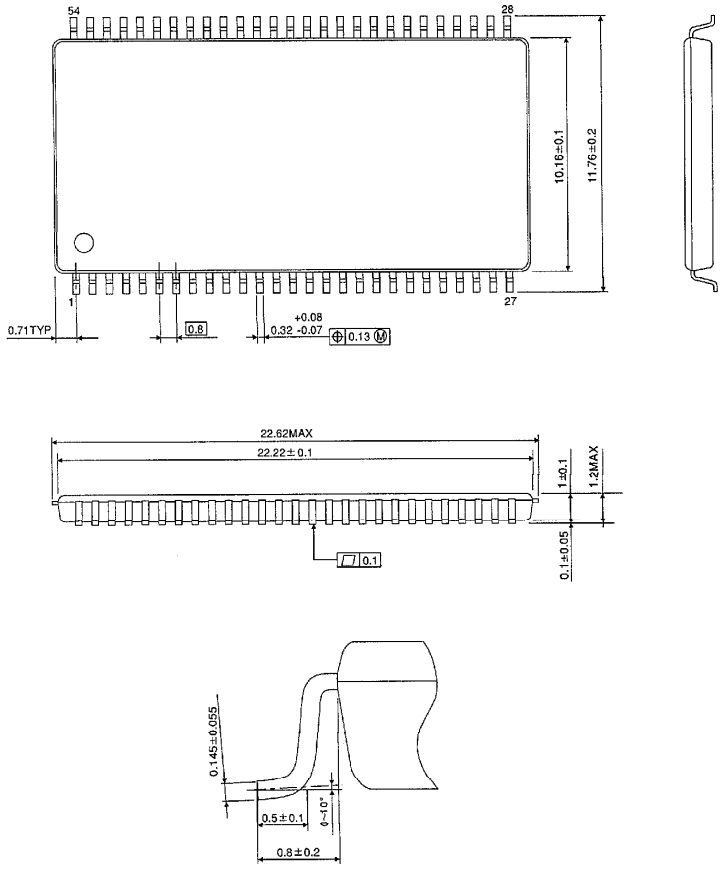
(B) t_{COD}, t_{ODO}, t_{ODW} ····· Output Disable Time



PACKAGE DIMENSIONS

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

Unit in mm



Weight : 0.55g (Typ)