

TOSHIBA MOS DIGITAL INTEGRATED CIRCUIT SILICON GATE CMOS

65,536-WORD BY 16-BIT CMOS STATIC RAM

DESCRIPTION

The TC55V1664FT is a 1,048,576-bit high-speed static random access memory (SRAM) organized as 65,536 words by 16 bits. Fabricated using CMOS technology and advanced circuit techniques to provide high speed and low-voltage operation, 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. Data byte control signals (LB, UB) provide lower and upper byte 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 LVTTTL compatible. The TC55V1664FT is available in plastic 44-pin TSOP packages (400 mil width) for high density surface assembly.

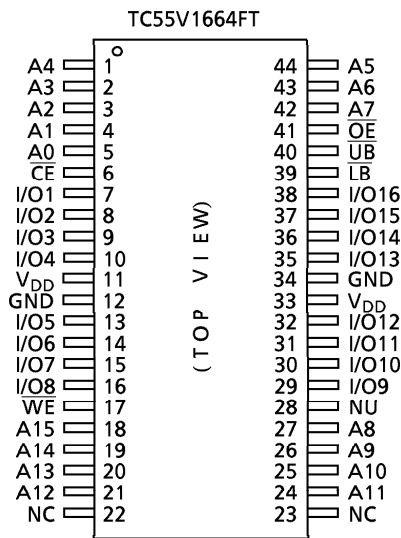
FEATURES

- Fast access time (the following are maximum values)
 - TC55V1664FT-12: 12 ns
 - TC55V1664FT-13: 13 ns
 - TC55V1664FT-15: 15 ns
- Low-power dissipation (the following are maximum values)
- Single power supply voltage of 3.3 ± 0.3 V.
 - TC55V1664FT-12, -13: $3.3 \text{ V} \pm 5\%$
 - TC55V1664FT-15: 3.3 ± 0.3 V
- Fully static operation
- All inputs and outputs are LVTTTL compatible
- Output buffer control using \overline{OE}
- Data byte control using \overline{LB} (IO1 to IO8) and \overline{UB} (IO9 to IO16)
- Packages:
 - TSOP II 44-P-400-0.80 (Weight: 0.45 g typ)

Cycle Time	12	13	15	20	30	ns
Operation (max)	190	180	170	150	130	mA

Standby: 2 mA (all devices)

PIN ASSIGNMENT



(TSOP)

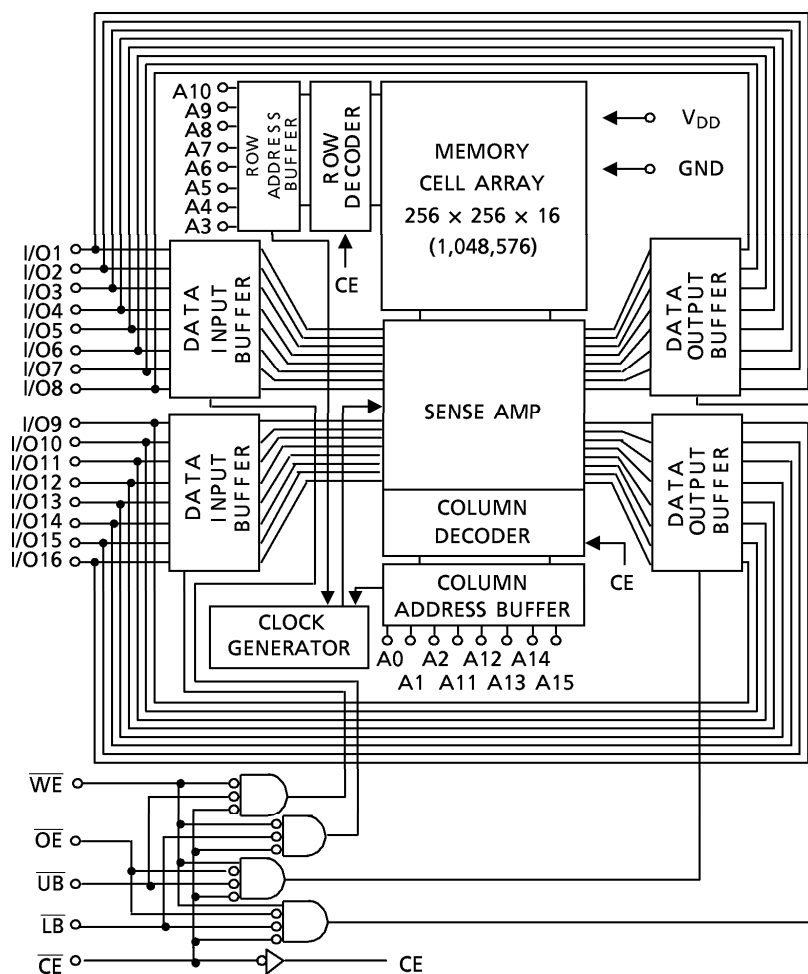
PIN NAMES

A0 to A15	Address Inputs
I/O1 to I/O16	Data Inputs/Outputs
\overline{CE}	Chip Enable
\overline{WE}	Write Enable Input
\overline{OE}	Output Enable
\overline{LB} , \overline{UB}	Data Byte Control Inputs
V_{DD}	Power (+ 3.3 V)
GND	Ground
NC	No Connection
NU	Not Used (Input)

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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	1.2	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

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

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

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

SYMBOL	PARAMETER		MIN	TYP	MAX	UNIT
V _{DD}	Power Supply Voltage	- 12, - 13	3.135	3.3	3.465	V
		- 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

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

DC CHARACTERISTICS (Ta = 0° to 70°C, -12, -13: V_{DD} = 3.3 V ± 5%, -15: V_{DD} = 3.3 ± 0.3 V)

SYMBOL	PARAMETER	TEST CONDITION	MIN	TYP	MAX	UNIT	
I _{IL}	Input Leakage Current (Except NU Pin)	V _{IN} = 0 V 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 V to V _{DD}	- 1	-	1	μA	
I _{I(NU)}	Input Current (NU Pin)	V _{IN} = 0 to 0.8 V	- 1	-	20	μA	
		V _{IN} = 0 to 0.2 V	- 1	-	1		
V _{OH}	Output High Voltage	I _{OH} = - 2 mA	2.4	-	-	V	
		I _{OH} = - 100 μA	V _{DD} - 0.2	-	-		
V _{OL}	Output Low Voltage	I _{OL} = 2 mA	-	-	0.4		
		I _{OL} = 100 μA	-	-	0.2		
I _{DDO}	Operating Current	$\overline{CE} = V_{IL}$, I _{out} = 0 mA Other Inputs = V _{IH} or V _{IL}	tcycle = 12 ns	-	-	190	mA
			tcycle = 13 ns	-	-	180	
			tcycle = 15 ns	-	-	170	
			tcycle = 20 ns	-	-	150	
			tcycle = 30 ns	-	-	130	
I _{DDS1}	Standby Current	$\overline{CE} = V_{IH}$, Other Inputs = V _{IH} /V _{IL}	-	-	20	mA	
I _{DDS2}		$\overline{CE} = V_{DD} - 0.2$ V Other Inputs = V _{DD} - 0.2 V/0.2 V	-	-	2		

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}	\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 Impedance	Output	I _{DDO}
				L	H	Output	High Impedance	I _{DDO}
Write	L	x	L	L	L	Input	Input	I _{DDO}
				H	L	High Impedance	Input	I _{DDO}
				L	H	Input	High Impedance	I _{DDO}
Outputs Disable	L	H	H	x	x	High Impedance	High Impedance	I _{DDO}
	L	x	x	H	H			
Standby	H	x	x	x	x	High Impedance	High Impedance	I _{DDS}

X: Don't care

Note: The NU pin 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 NU.

AC CHARACTERISTICS

($T_a = 0^\circ$ to 70°C (Note 1), -12,-13: $V_{DD} = 3.3\text{ V} \pm 5\%$, -15: $V_{DD} = 3.3 \pm 0.3\text{ V}$)

READ CYCLE

SYMBOL	PARAMETER	TC55V1664FT-12		TC55V1664FT-13		TC55V1664FT-15		UNIT
		MIN	MAX	MIN	MAX	MIN	MAX	
t_{RC}	Read Cycle Time	12	-	13	-	15	-	ns
t_{ACC}	Address Access Time	-	12	-	13	-	15	
t_{CO}	Chip Enable Access Time	-	12	-	13	-	15	
t_{OE}	Output Enable Access Time	-	6	-	6	-	8	
t_{BA}	Upper Byte, Lower Byte Access Time	-	6	-	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_{BE}	Output Enable Time from Upper Byte, Lower Byte	1	-	1	-	1	-	
t_{COD}	Output Disable Time from Chip Enable	-	7	-	7	-	8	
t_{ODO}	Output Disable Time from Output Enable	-	7	-	7	-	8	
t_{BD}	Output Disable Time from Upper Byte, Lower Byte	-	7	-	7	-	8	

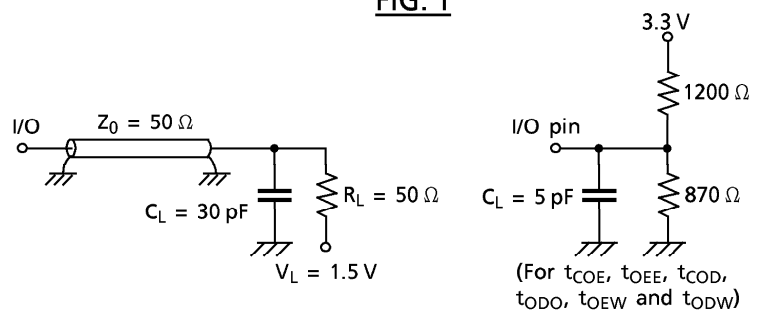
WRITE CYCLE

SYMBOL	PARAMETER	TC55V1664FT-12		TC55V1664FT-13		TC55V1664FT-15		UNIT
		MIN	MAX	MIN	MAX	MIN	MAX	
t_{WC}	Write Cycle Time	12	-	13	-	15	-	ns
t_{WP}	Write Pulse Width	8	-	8	-	9	-	
t_{CW}	Chip Enable to End of Write	10	-	10	-	12	-	
t_{BW}	Upper Byte, Lower Byte Enable to End of Write	10	-	10	-	11	-	
t_{AW}	Address Valid to End of Write	10	-	10	-	11	-	
t_{AS}	Address Setup Time	0	-	0	-	0	-	
t_{WR}	Write Recovery Time	0	-	0	-	0	-	
t_{DS}	Data Setup Time	7	-	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	-	7	-	7	-	8	

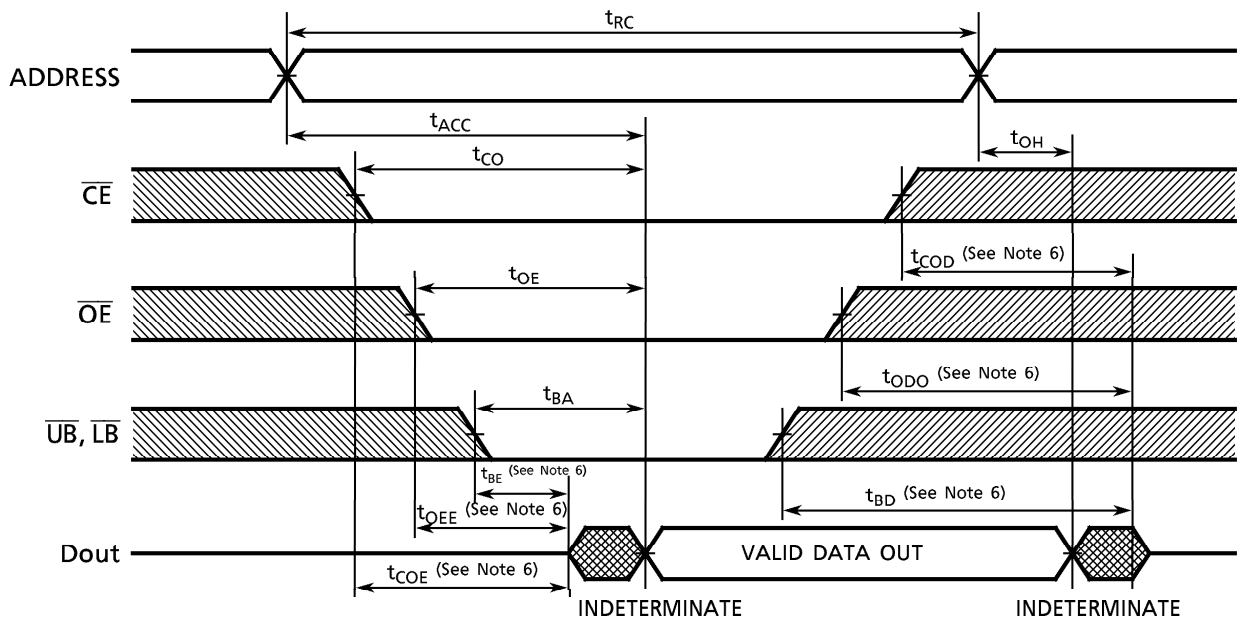
AC TEST CONDITIONS

Input Pulse Level	3.0 V, 0.0 V
Input Pulse Rise and Fall Time	3 ns
Input Timing Measurement Reference Level	1.5 V
Output Timing Measurement Reference Level	1.5 V
Output Load	Fig. 1

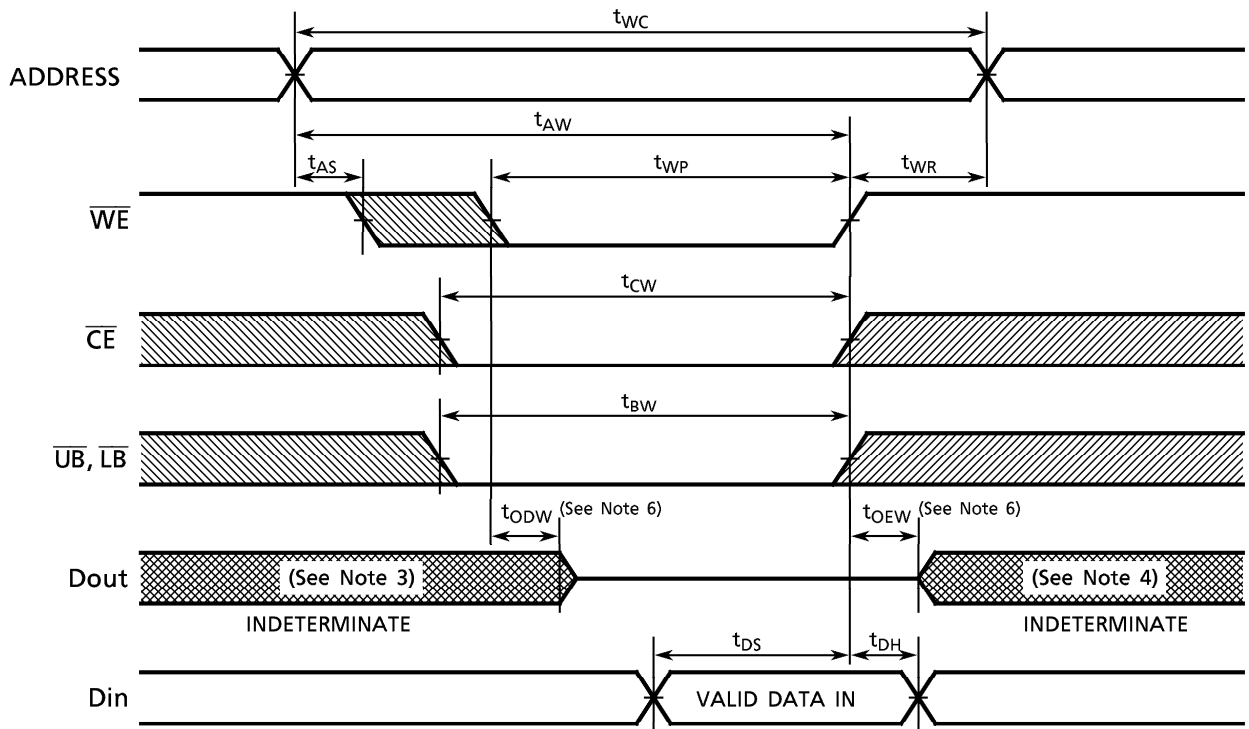
FIG. 1



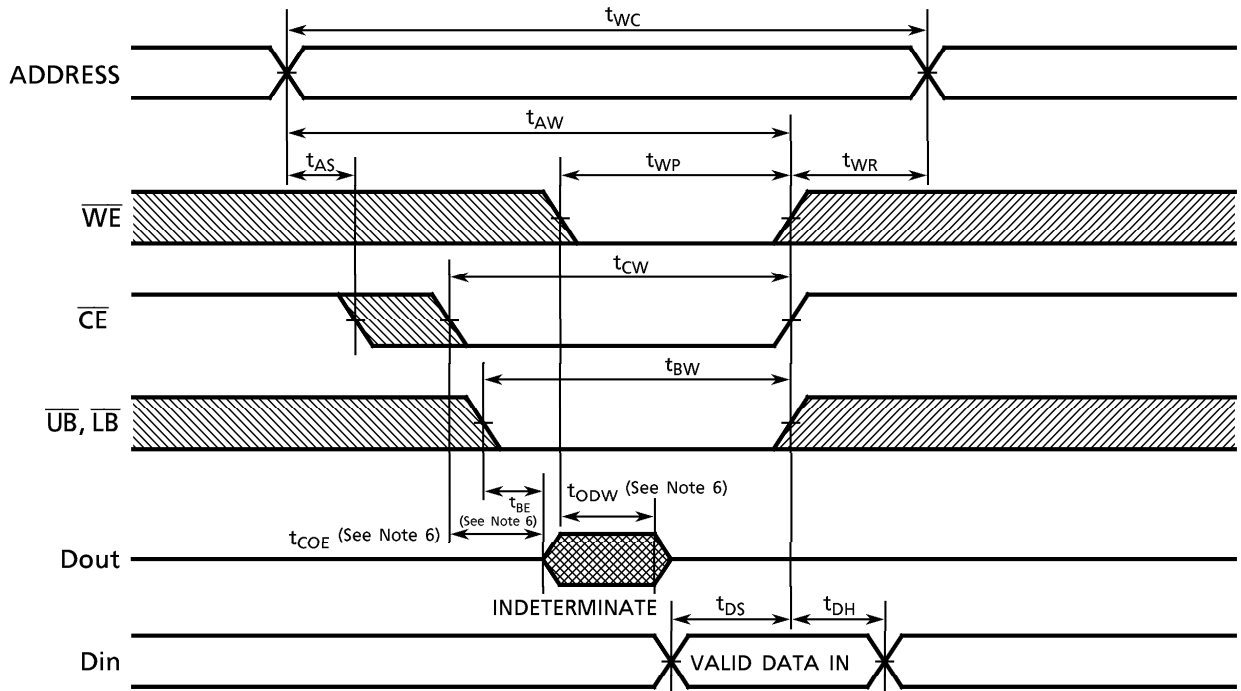
TIMING DIAGRAMS
READ CYCLE (See Note 2)



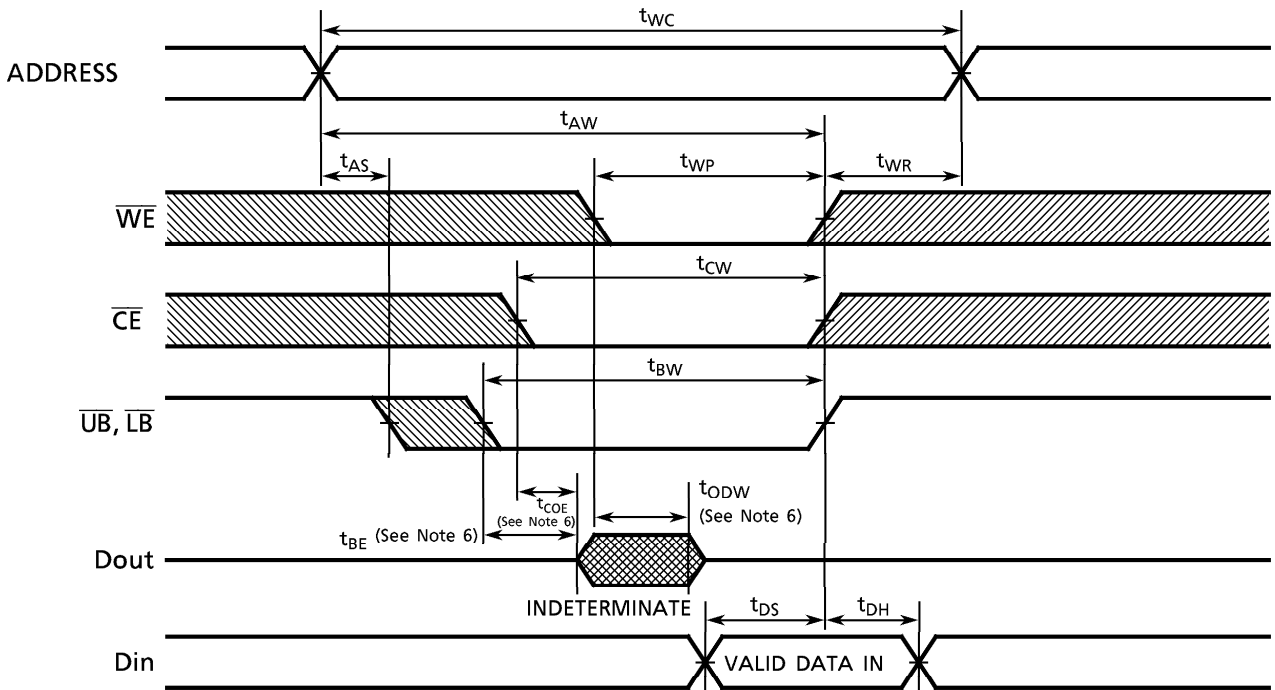
WRITE CYCLE 1 (\overline{WE} CONTROLLED) (Note 5)



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



WRITE CYCLE 3 ($\overline{UB}, \overline{LB}$ 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.

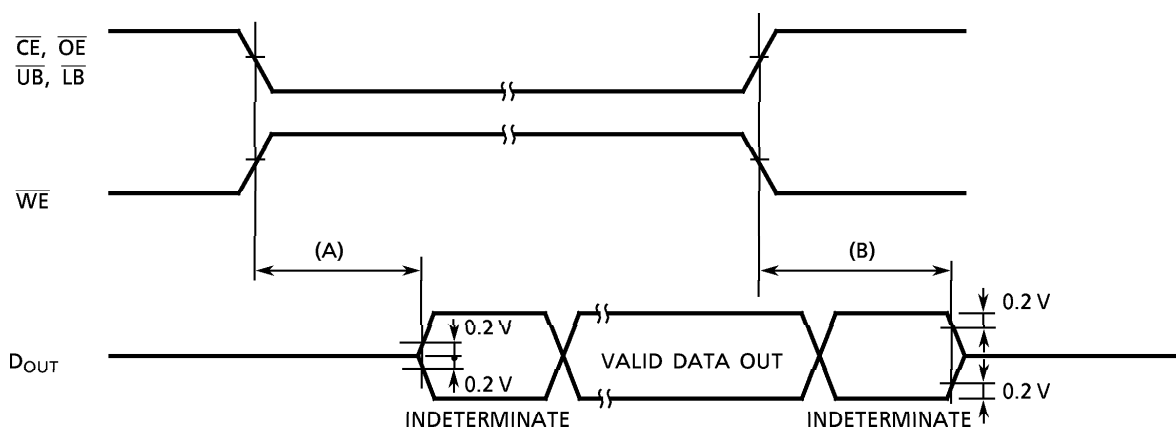
(4) If \overline{CE} goes HIGH coincident with or before \overline{WE} goes HIGH, the outputs will remain at high impedance.

(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) $t_{COE}, t_{OEE}, t_{BE}, t_{OEw}$ Output Enable Time

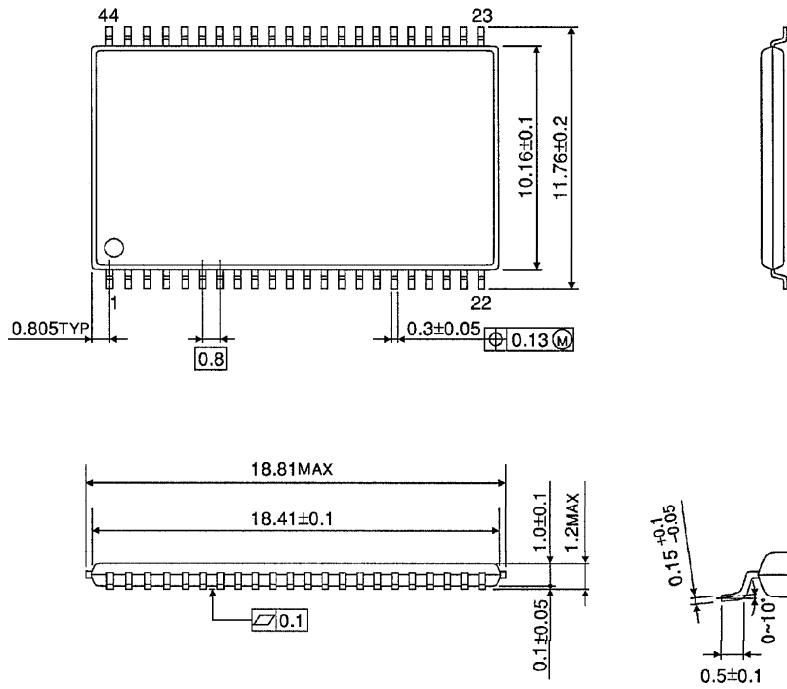
(B) $t_{COD}, t_{ODO}, t_{BD}, t_{ODw}$ Output Disable Time



PACKAGE DIMENSIONS

Plastic TSOP (TSOPII 44-P-400-0.80)

Units in mm



Weight: 0.45 g (typ)

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