

TOSHIBA MOS DIGITAL INTEGRATED CIRCUIT SILICON GATE CMOS

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

DESCRIPTION

The TC551664BJ/BFT 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, it operates from a single 5 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 ($\overline{LB}$, $\overline{UB}$) 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 TTL compatible. The TC551664BJ/BFT is available in a plastic 44-pin SOJ (400 mil width) and TSOP packages for high density surface assembly.

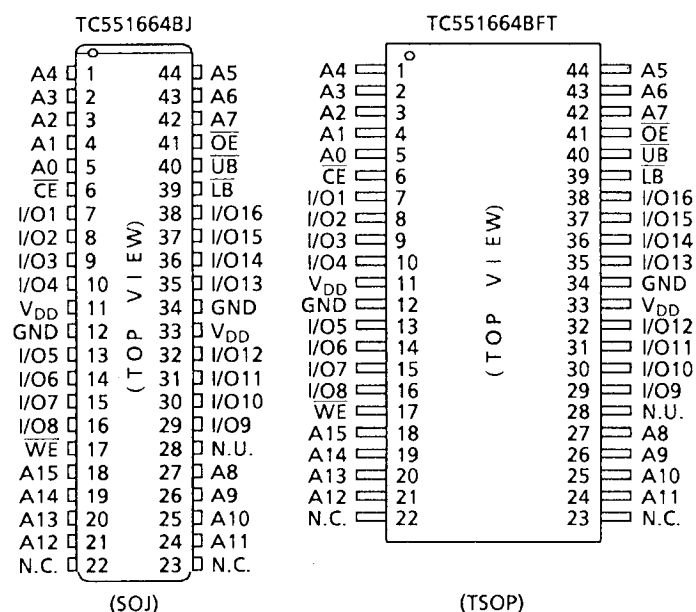
FEATURES

- Fast access time (the following are maximum values)
 - TC551664AJ-12: 12 ns
 - TC551664AJ-15: 15 ns
- Low-power dissipation (the following are maximum values)

Cycle Time	12	15	20	25	30	ns
Operation (max)	290	260	220	200	180	mA

Standby: 1 mA (both devices)
- Single power supply voltage of 5 V $\pm$ 10%.
- Fully static operation
- All inputs and outputs are TTL compatible
- Output buffer control using $\overline{OE}$
- Data byte control using $\overline{LB}$ (IO1 to IO8) and $\overline{UB}$ (IO9 to IO16)
- Package:
 - SOJ44-P-400-1.27 (BJ) (Weight: 1.64 g typ)
 - TSOP Π 44-P-400-0.80 (BFT) (Weight: 0.45 g typ)

PIN ASSIGNMENT



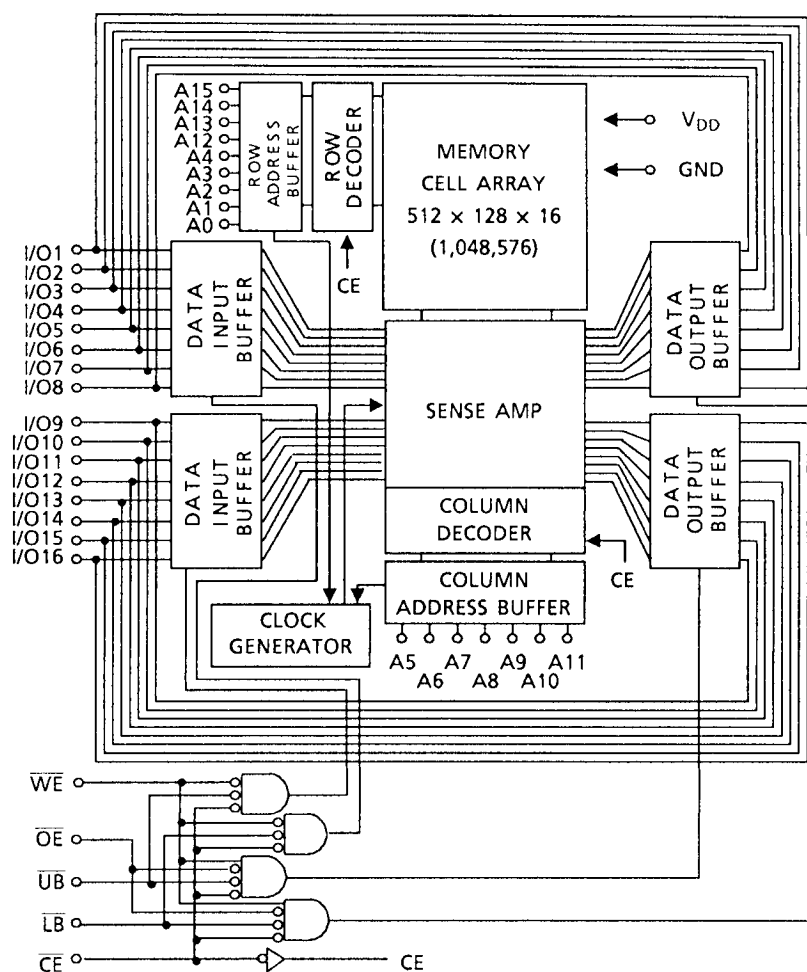
PIN NAMES

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 Input
V _{DD}	Power (+ 5 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 7.0	V
V_{IN}	Input Terminal Voltage	- 2.0 * to 7.0	V
V_{IO}	Input/Output Terminal Voltage	- 0.5 * to $V_{DD} + 0.5$	V
P_D	Power Dissipation	1.5	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

*: I/O pins : -2.0 V with a pulse width of 20% · Cycle Time min(4 ns max)
 Other pins : -2.5 V with a pulse width of 20% · Cycle Time min(4 ns max)

DC RECOMMENDED OPERATING CONDITIONS ($T_a = 0^\circ$ to 70°C)

SYMBOL	PARAMETER	MIN	TYP	MAX	UNIT
V_{DD}	Power Supply Voltage	4.5	5.0	5.5	V
V_{IH}	Input High Voltage	2.2	–	$V_{DD} + 0.5$	V
V_{IL}	Input Low Voltage	– 0.5 *	–	0.8	V

*: I/O pins : –1.5 V with a pulse width of 20% · Cycle Time min(4 ns max)

Other pins : –2.0 V with a pulse width of 20% · Cycle Time min(4 ns max)

DC CHARACTERISTICS ($T_a = 0^\circ$ to 70°C , $V_{DD} = 5\text{ V} \pm 10\%$)

SYMBOL	PARAMETER	TEST CONDITION		MIN	TYP	MAX	UNIT
I _{IL}	Input Leakage Current (Except NU Pin)	V _{IN} = 0 V to V _{DD}		–	–	± 10	μA
I _{LO}	Output Leakage Current	CE = V _{IH} or WE = V _{IL} or OE = V _{IH} V _{OUT} = 0 V to V _{DD}		–	–	± 10	μA
I _{I(NU)}	Input Current (NU Pin)	V _{IN} = 0 to 0.8 V		– 1	–	20	μA
I _{OH}	Output High Current	V _{OH} = 2.4 V		– 4	–	–	mA
I _{OL}	Output Low Current	V _{OL} = 0.4 V		8	–	–	mA
I _{DDO}	Operating Current	CE = V _{IL} , I _{out} = 0 mA Other Inputs = V _{IH} or V _{IL}	tcycle = 12 ns	–	–	290	mA
			tcycle = 15 ns	–	–	260	
			tcycle = 20 ns	–	–	220	
			tcycle = 25 ns	–	–	200	
			tcycle = 30 ns	–	–	180	
I _{DDS 1}	Standby Current	CE = V _{IH} , Other Inputs = V _{IH} or V _{IL}	–	–	30	mA	
I _{DDS 2}		CE = V _{DD} – 0.2 V Other Inputs = V _{DD} – 0.2 V or 0.2 V	–	–	1		

CAPACITANCE ($T_a = 25^\circ\text{C}$, $f = 1.0\text{ MHz}$)

SYMBOL	PARAMETER	TEST CONDITION	MAX	UNIT
C_{IN}	Input Capacitance	$V_{IN} = \text{GND}$	6	pF
$C_{I/O}$	Input/Output Capacitance	$V_{I/O} = \text{GND}$	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 ($T_a = 0^\circ \text{ to } 70^\circ \text{C}$ (Note 1), $V_{DD} = 5 \text{ V} \pm 10\%$)

READ CYCLE

SYMBOL	PARAMETER	TC551664BJ/BFT-12		TC551664BJ/BFT-15		UNIT
		MIN	MAX	MIN	MAX	
t_{RC}	Read Cycle Time	12	–	15	–	ns
t_{ACC}	Address Access Time	–	12	–	15	
t_{CO}	Chip Enable Access Time	–	12	–	15	
t_{OE}	Output Enable Access Time	–	6	–	8	
t_{BA}	Upper Byte, Lower Byte Access Time	–	6	–	8	
t_{OH}	Output Data Hold Time from Address Change	5	–	5	–	
t_{COE}	Output Enable Time from Chip Enable	5	–	5	–	
t_{OEE}	Output Enable Time from Output Enable	1	–	1	–	
t_{BE}	Output Enable Time from Upper Byte, Lower Byte	1	–	1	–	
t_{COD}	Output Disable Time from Chip Enable	–	8	–	8	
t_{ODO}	Output Disable Time from Output Enable	–	8	–	8	
t_{BD}	Output Disable Time from Upper Byte, Lower Byte	–	8	–	8	

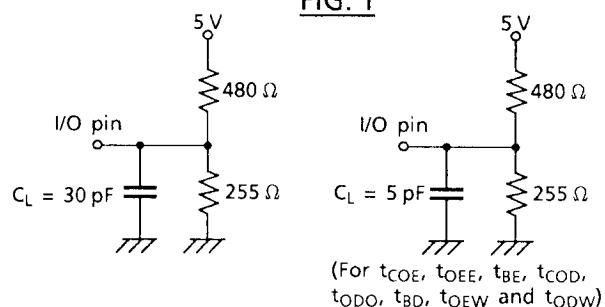
WRITE CYCLE

SYMBOL	PARAMETER	TC551664BJ/BFT-12		TC551664BJ/BFT-15		UNIT
		MIN	MAX	MIN	MAX	
t_{WC}	Write Cycle Time	12	–	15	–	ns
t_{WP}	Write Pulse Width	8	–	9	–	
t_{CW}	Chip Enable to End of Write	10	–	12	–	
t_{BW}	Upper Byte, Lower Byte Enable to End of Write	10	–	12	–	
t_{AW}	Address Valid to End of Write	10	–	12	–	
t_{AS}	Address Setup Time	0	–	0	–	
t_{WR}	Write Recovery Time	0	–	0	–	
t_{DS}	Data Setup Time	6	–	8	–	
t_{DH}	Data Hold Time	0	–	0	–	
t_{OEw}	Output Enable Time from Write Enable	1	–	1	–	
t_{ODw}	Output Disable Time from Write Enable	–	8	–	8	

AC TEST CONDITIONS

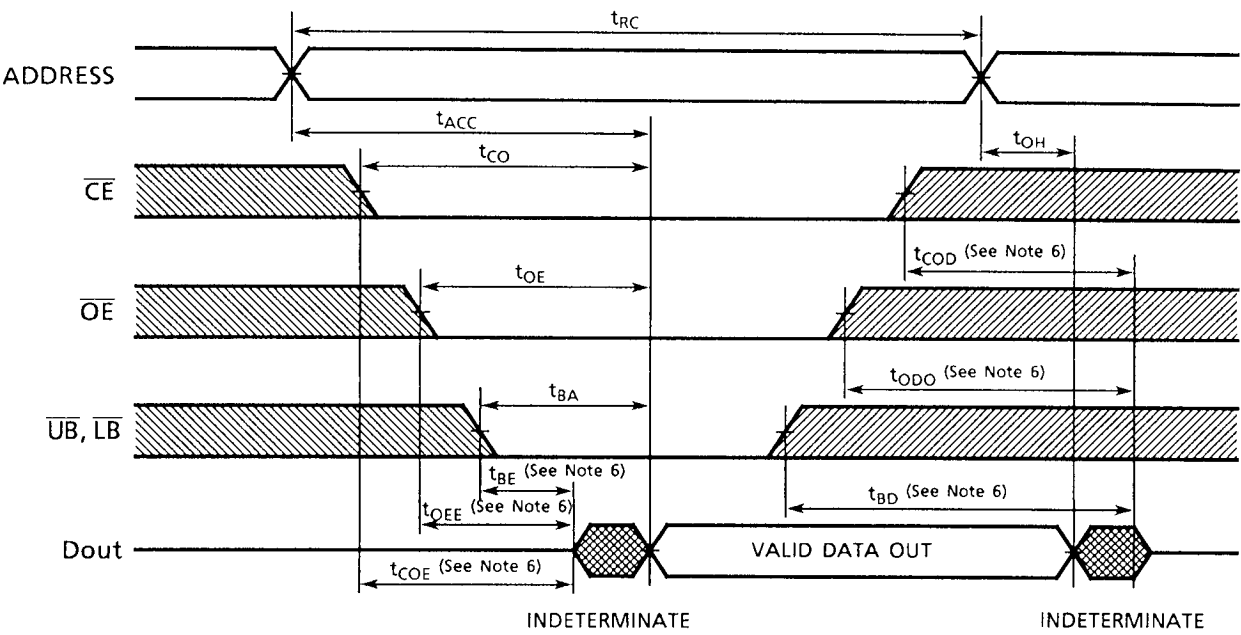
Input Pulse Level	3.0 V, 0.0 V
Input Pulse Rise and Fall Time	3 ns
Input Timing Measurement Reference Level	1.5 V
Output Timing Measurement Reference Level	1.5 V
Output Load	Fig. 1

FIG. 1

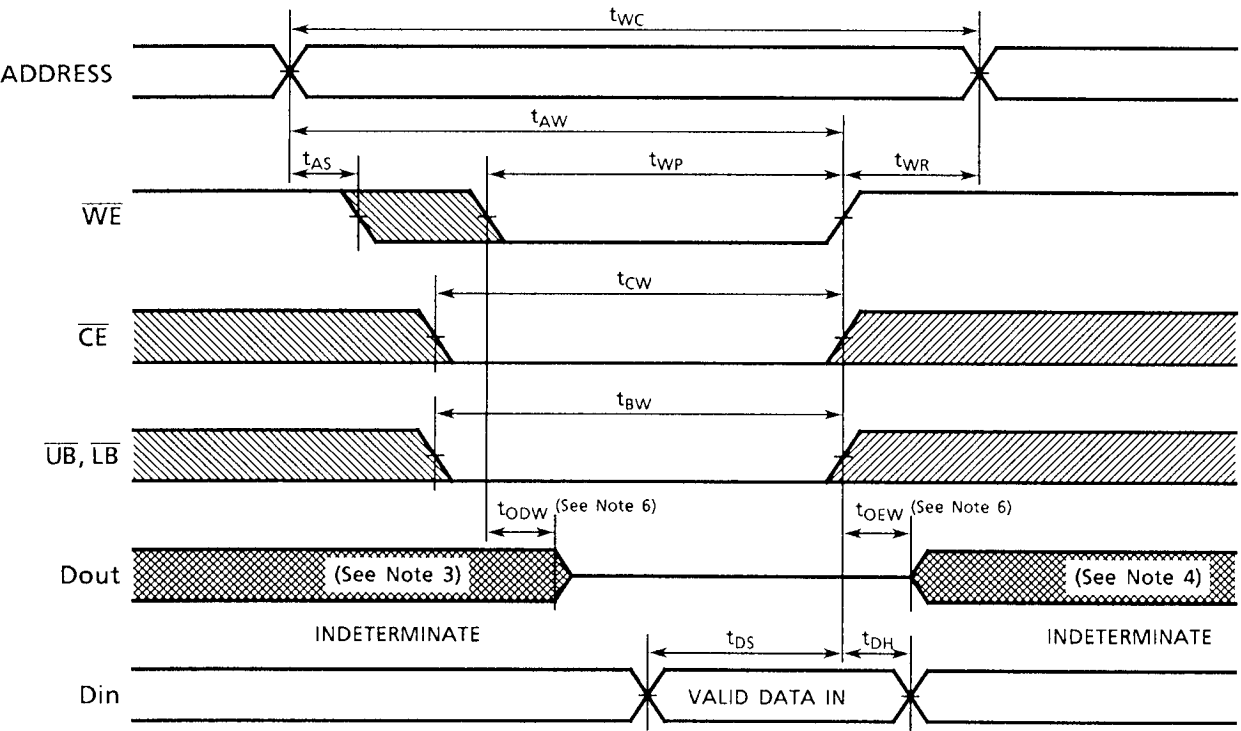


TIMING DIAGRAMS

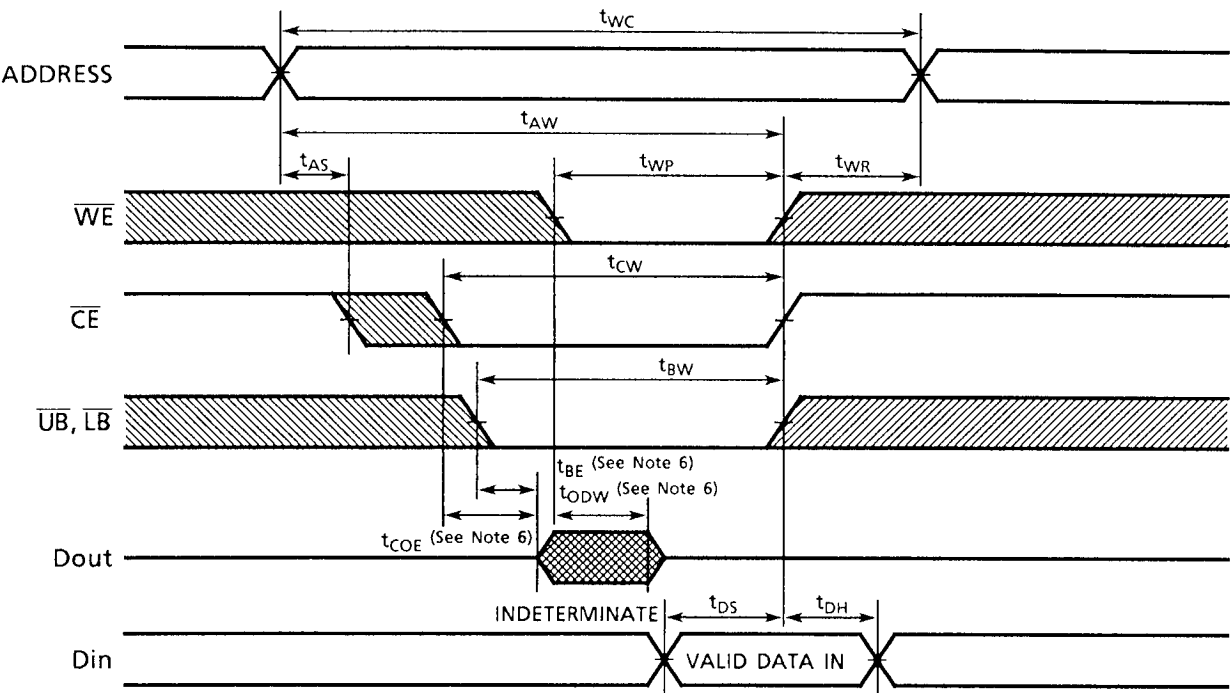
READ CYCLE (See Note 2)



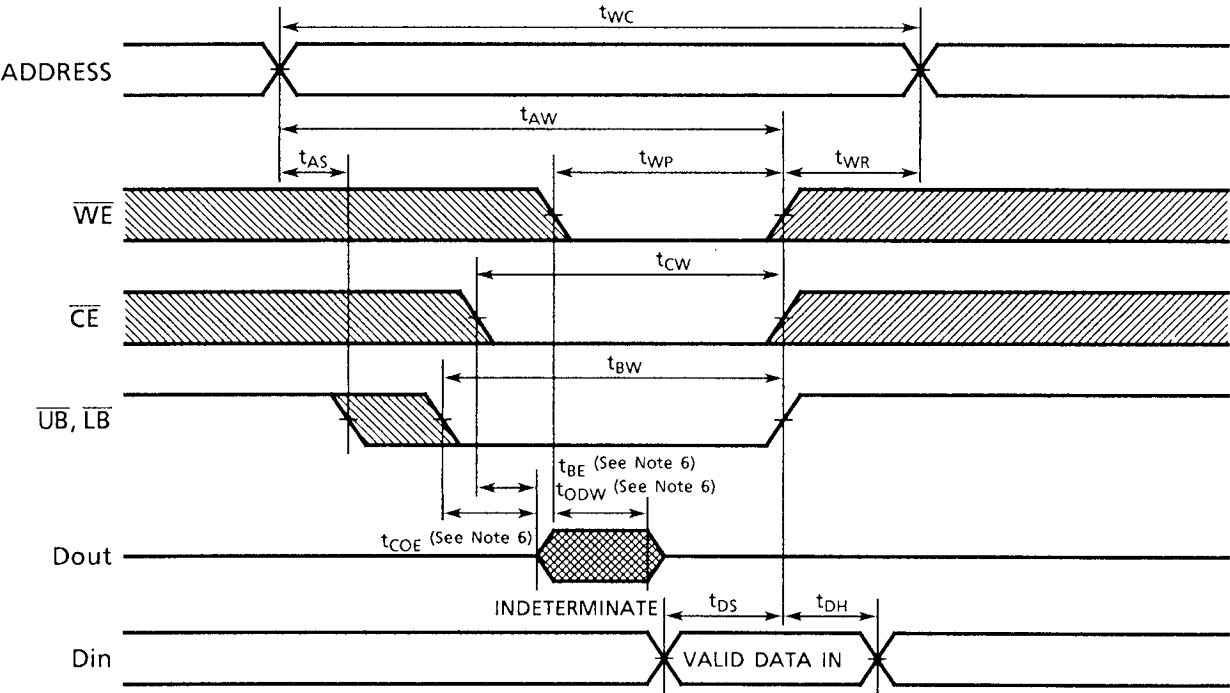
WRITE CYCLE 1 ($\overline{WE}$ CONTROLLED) (See Note 5)



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



WRITE CYCLE 3 ($\overline{UB}, \overline{LB}$ CONTROLLED) (See Note 5)



Note: (1) Operating temperature (T_a) 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.

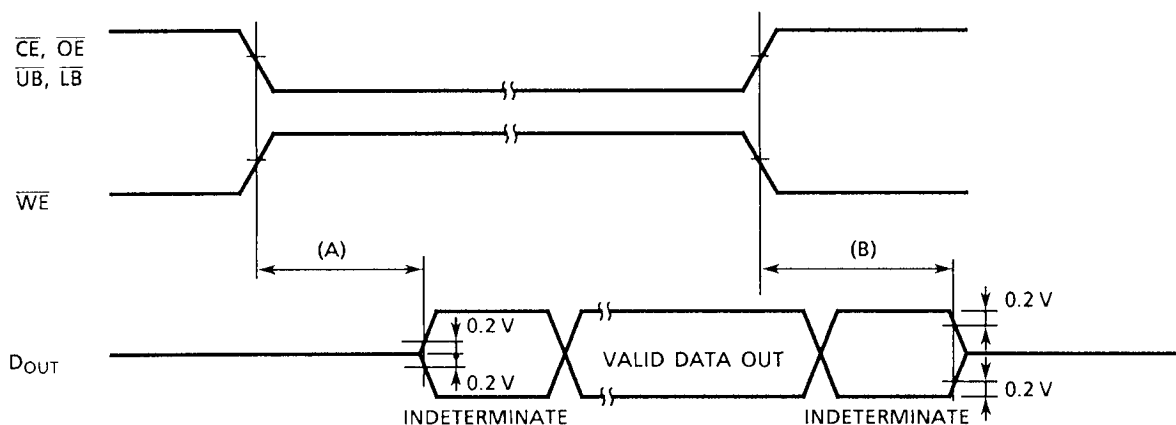
(4) If $\overline{CE}$ goes HIGH coincident with or before $\overline{WE}$ goes HIGH, the outputs will remain at high impedance.

(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} , $t_{OE\overline{W}}$ Output Enable Time

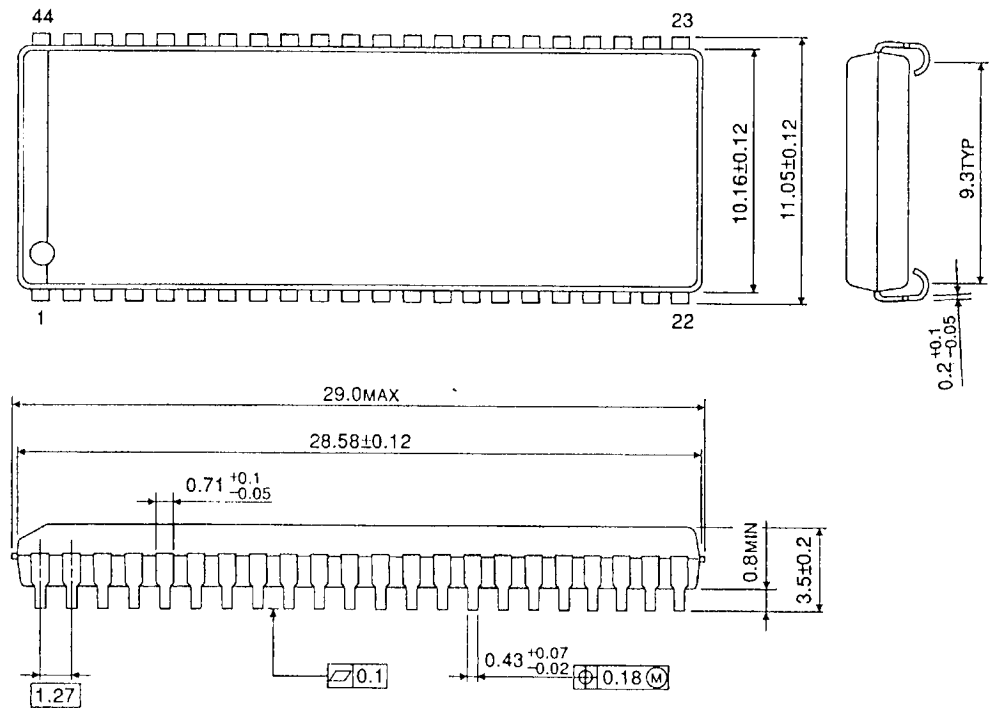
(B) t_{COD} , t_{ODO} , t_{BD} , $t_{OD\overline{W}}$ Output Disable Time



PACKAGE DIMENSIONS

Plastic SOJ (SOJ44-P-400-1.27)

Units in mm

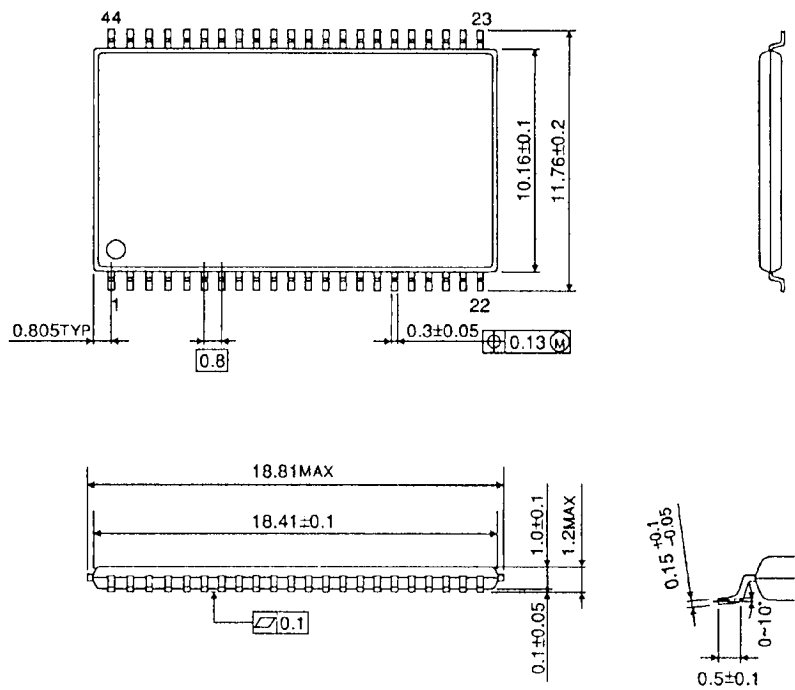


Weight: 1.64 g (typ)

PACKAGE DIMENSIONS

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

Units in mm



Weight: 0.45 g (typ)