

## TOSHIBA MOS DIGITAL INTEGRATED CIRCUIT SILICON GATE CMOS

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

#### DESCRIPTION

The TC551664AJ 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 TC551664AJ is available in a plastic 44-pin SOJ package (400 mil width) for high density surface assembly.

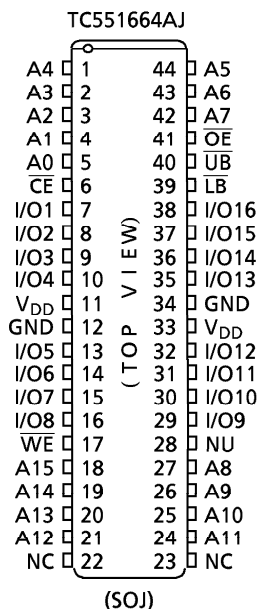
#### FEATURES

- Fast access time (the following are maximum values)
  - TC551664AJ-15: 15 ns
  - TC551664AJ-20: 20 ns
- Low-power dissipation (the following are maximum values)
- 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 (Weight: 1.64 g typ)

Cycle Time	15	20	25	30	50	ns
Operation (max)	260	220	200	180	150	mA

Standby: 1 mA (both devices)

#### PIN ASSIGNMENT



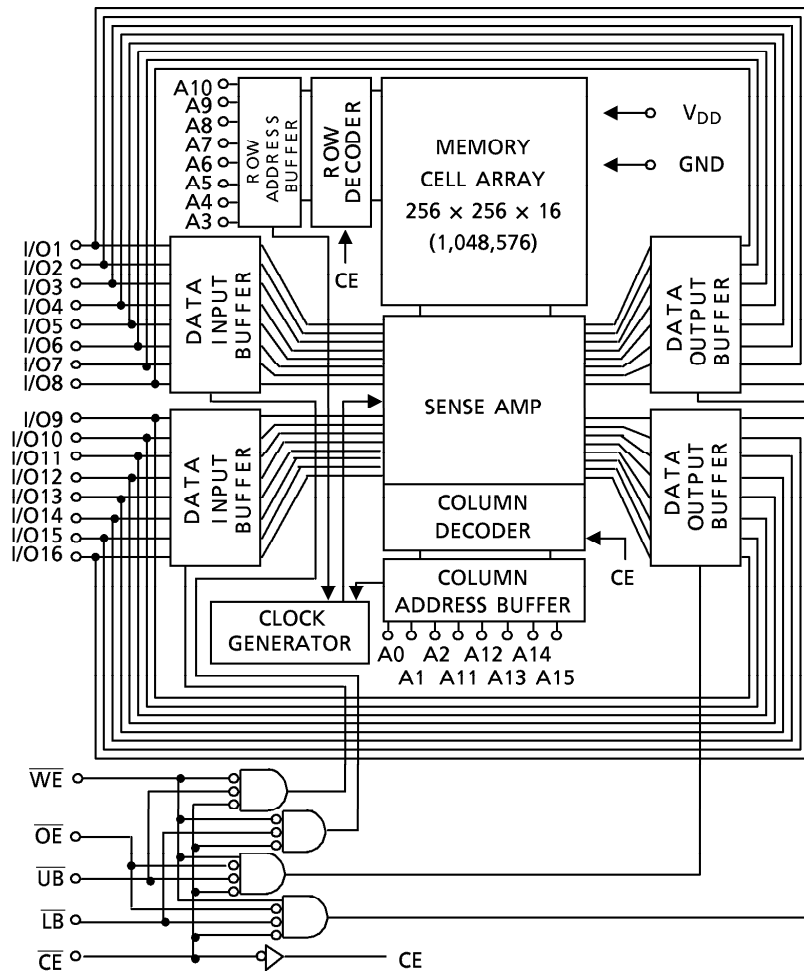
#### PIN NAMES

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
$V_{I/O}$	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

\*: - 3 V with a pulse width of 10 ns

**DC RECOMMENDED OPERATING CONDITIONS ( $T_a = 0^\circ$  to  $70^\circ\text{C}$ )**

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

\*: - 3 V with a pulse width of 10 ns

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

SYMBOL	PARAMETER	TEST CONDITION	MIN	TYP	MAX	UNIT	
$I_{IL}$	Input Leakage Current (Except NU Pin)	$V_{IN} = 0\text{ V to }V_{DD}$	-	-	$\pm 10$	$\mu\text{A}$	
$I_{LO}$	Output Leakage Current	$\overline{CE} = V_{IH}$ or $\overline{WE} = V_{IL}$ or $\overline{OE} = V_{IH}$ $V_{OUT} = 0\text{ V to }V_{DD}$	-	-	$\pm 10$	$\mu\text{A}$	
$I_{I(NU)}$	Input Current (NU Pin)	$V_{IN} = 0$ to $0.8\text{ V}$	- 1	-	20	$\mu\text{A}$	
$I_{OH}$	Output High Current	$V_{OH} = 2.4\text{ V}$	- 4	-	-	mA	
$I_{OL}$	Output Low Current	$V_{OL} = 0.4\text{ V}$	8	-	-	mA	
$I_{DDO}$	Operating Current	$\overline{CE} = V_{IL}$ , $I_{out} = 0\text{ mA}$ Other Inputs = $V_{IH}$ or $V_{IL}$	tcycle = 15 ns	-	-	260	mA
			tcycle = 20 ns	-	-	220	
			tcycle = 25 ns	-	-	200	
			tcycle = 30 ns	-	-	180	
			tcycle = 50 ns	-	-	150	
$I_{DDS1}$	Standby Current	$\overline{CE} = V_{IH}$ , Other Inputs = $V_{IH}$ or $V_{IL}$	-	-	30	mA	
$I_{DDS2}$		$\overline{CE} = V_{DD} - 0.2\text{ V}$ Other Inputs = $V_{DD} - 0.2\text{ V}$ or $0.2\text{ V}$	-	-	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	$I_{DDO}$
		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** (Ta = 0° to 70°C (Note 1), VDD = 5 V ± 10%)

**READ CYCLE**

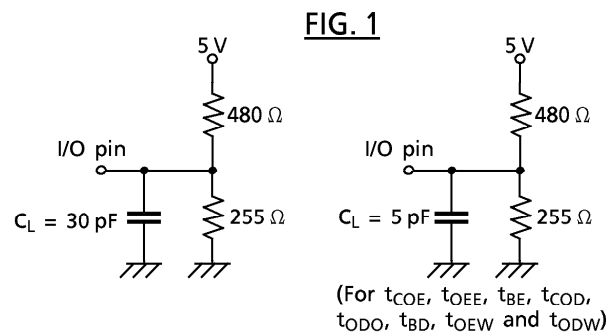
SYMBOL	PARAMETER	TC551664AJ-15		TC551664AJ-20		UNIT
		MIN	MAX	MIN	MAX	
t <sub>RC</sub>	Read Cycle Time	15	–	20	–	ns
t <sub>ACC</sub>	Address Access Time	–	15	–	20	
t <sub>CO</sub>	Chip Enable Access Time	–	15	–	20	
t <sub>OE</sub>	Output Enable Access Time	–	8	–	10	
t <sub>BA</sub>	Upper Byte, Lower Byte Access Time	–	8	–	10	
t <sub>OH</sub>	Output Data Hold Time from Address Change	5	–	5	–	
t <sub>COE</sub>	Output Enable Time from Chip Enable	5	–	5	–	
t <sub>OEE</sub>	Output Enable Time from Output Enable	1	–	1	–	
t <sub>BE</sub>	Output Enable Time from Upper Byte, Lower Byte	1	–	1	–	
t <sub>COD</sub>	Output Disable Time from Chip Enable	–	8	–	8	
t <sub>ODO</sub>	Output Disable Time from Output Enable	–	8	–	8	
t <sub>BD</sub>	Output Disable Time from Upper Byte, Lower Byte	–	8	–	8	

**WRITE CYCLE**

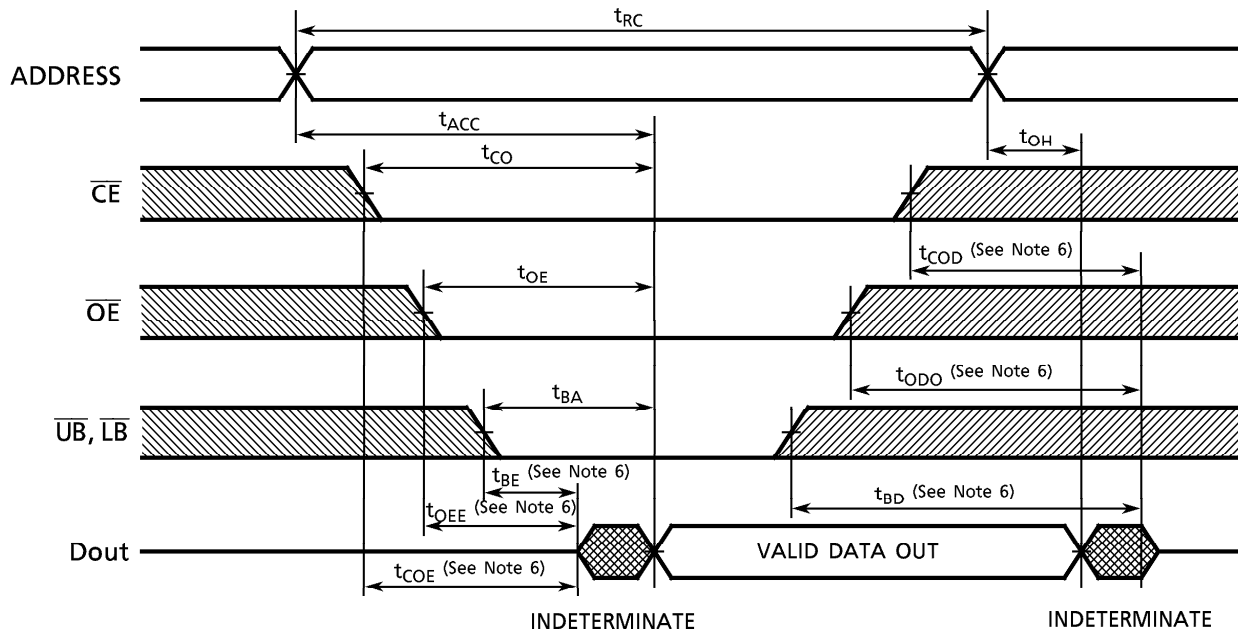
SYMBOL	PARAMETER	TC551664AJ-15		TC551664AJ-20		UNIT
		MIN	MAX	MIN	MAX	
t <sub>WC</sub>	Write Cycle Time	15	–	20	–	ns
t <sub>WP</sub>	Write Pulse Width	9	–	10	–	
t <sub>CW</sub>	Chip Enable to End of Write	12	–	13	–	
t <sub>BW</sub>	Upper Byte, Lower Byte Enable to End of Write	12	–	12	–	
t <sub>AW</sub>	Address Valid to End of Write	12	–	12	–	
t <sub>AS</sub>	Address Setup Time	0	–	0	–	
t <sub>WR</sub>	Write Recovery Time	0	–	0	–	
t <sub>DS</sub>	Data Setup Time	8	–	10	–	
t <sub>DH</sub>	Data Hold Time	0	–	0	–	
t <sub>OEW</sub>	Output Enable Time from Write Enable	1	–	1	–	
t <sub>ODW</sub>	Output Disable Time from Write Enable	–	8	–	8	

**AC TEST CONDITIONS**

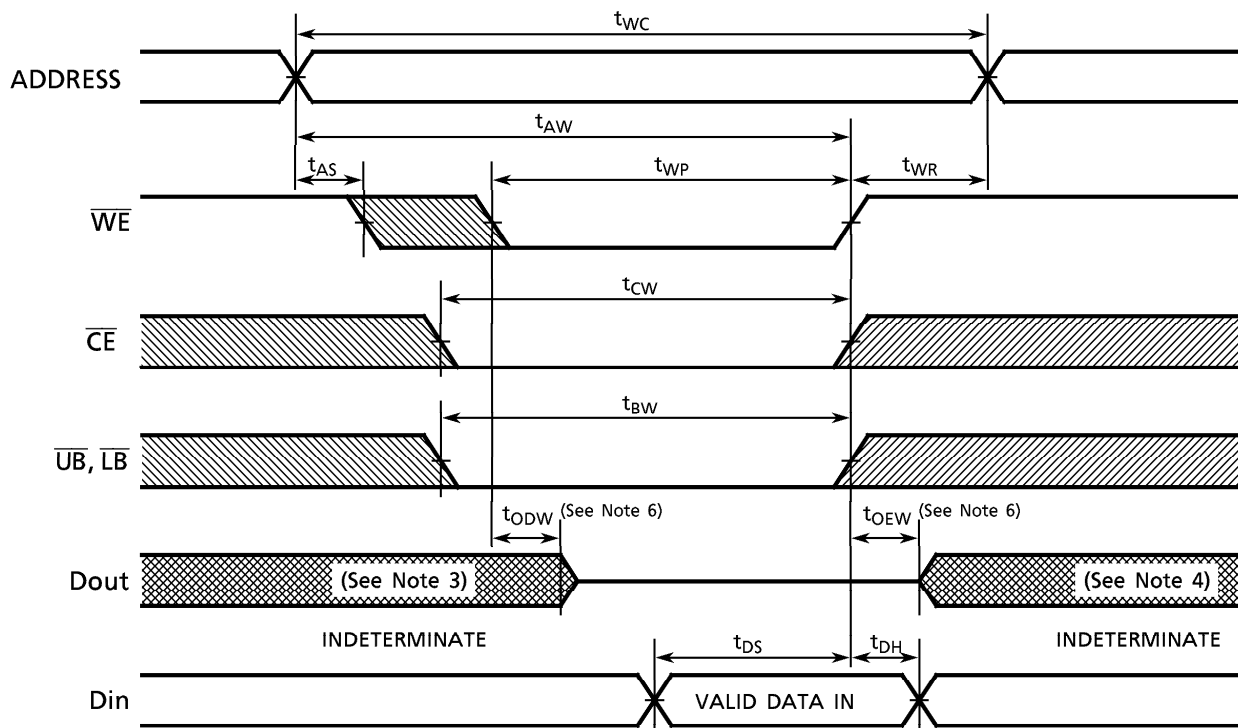
Input Pulse Level	3.0 V, 0.0 V
Input Pulse Rise and Fall Time	3 ns
Input Timing Measurement Reference Level	1.5 V
Output Timing Measurement Reference Level	1.5 V
Output Load	Fig. 1



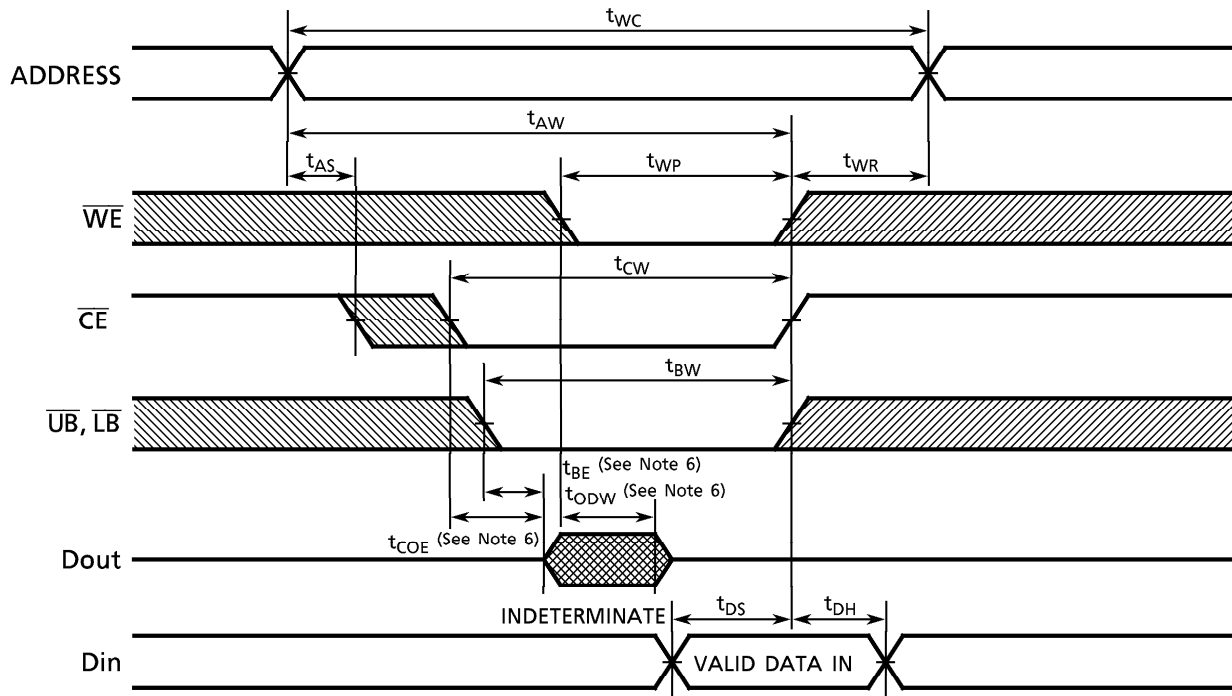
**TIMING DIAGRAMS**  
**READ CYCLE** (See Note 2)



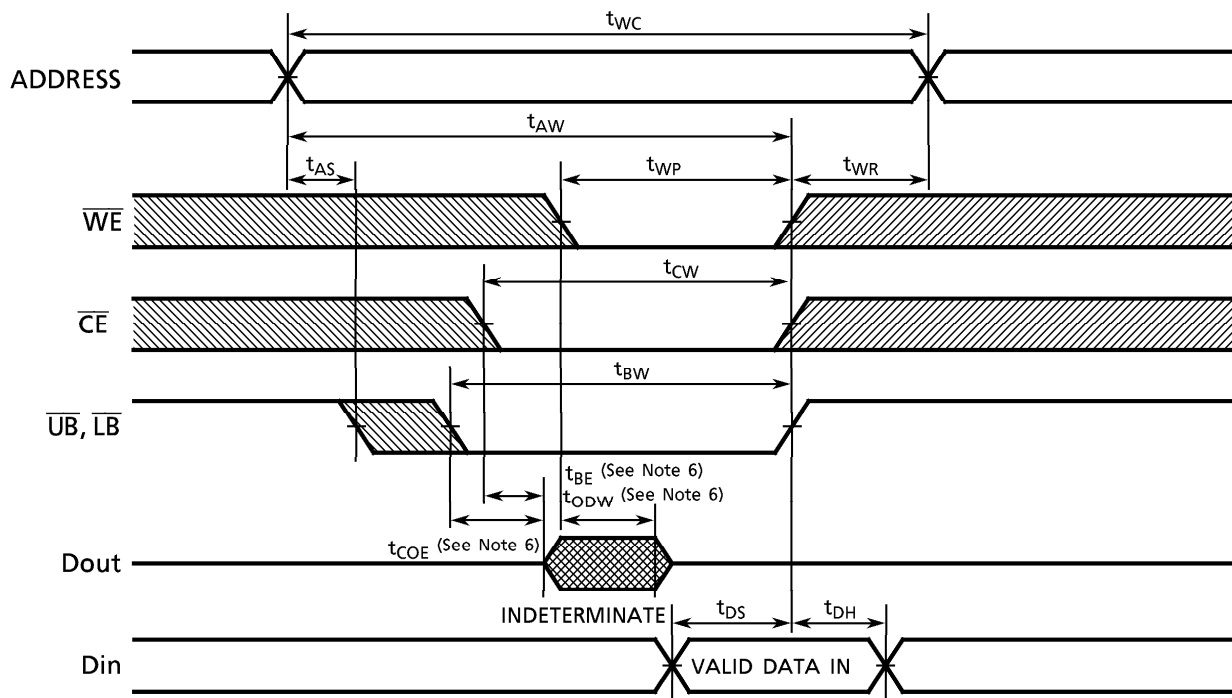
**WRITE CYCLE 1 ( $\overline{WE}$  CONTROLLED)** (See Note 5)



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



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

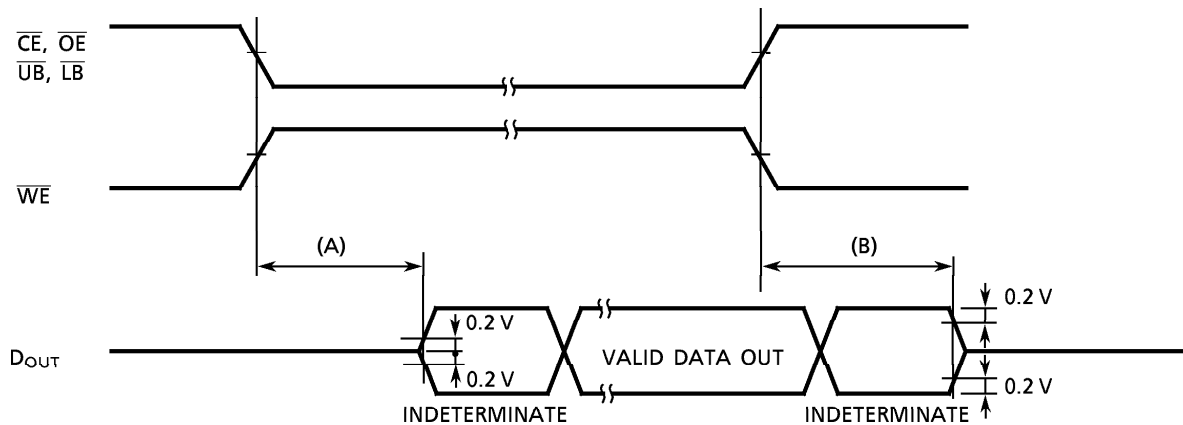


Note: (1) Operating temperature ( $T_a$ ) is guaranteed for transverse air flow exceeding 400 linear feet per minute.

- (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.

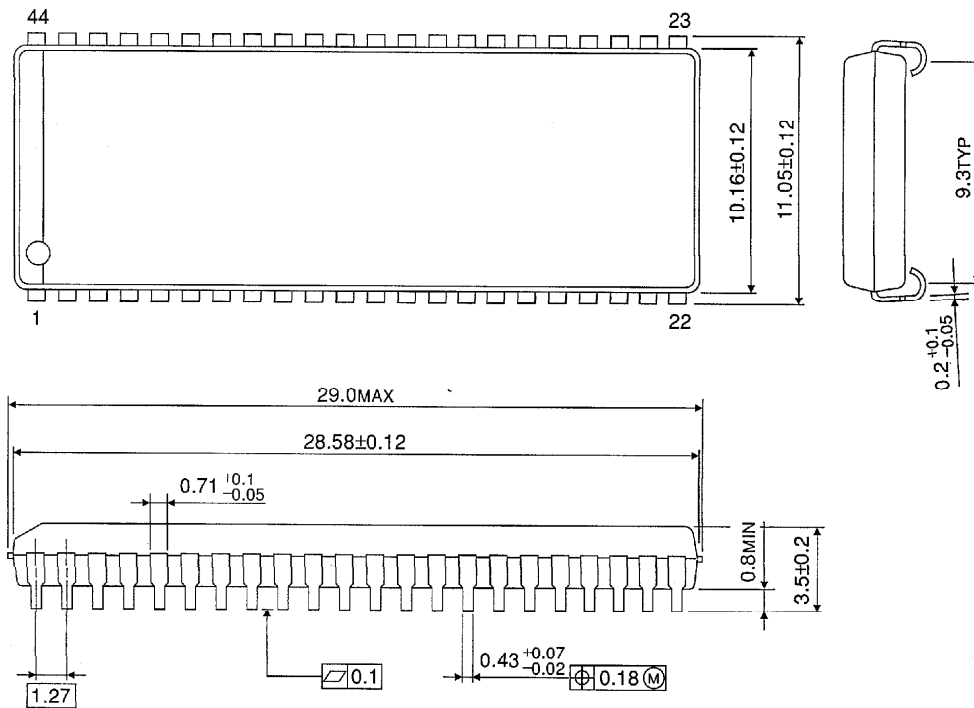
- (A)  $t_{COE}, t_{OEE}, t_{BE}, t_{OEw}$       ····· Output Enable Time
- (B)  $t_{COD}, t_{ODO}, t_{BD}, t_{ODW}$       ····· Output Disable Time



**PACKAGE DIMENSIONS**

Plastic SOJ (SOJ44-P-400-1.27)

Units in mm



Weight: 1.64 g (typ)