

## TOSHIBA MOS DIGITAL INTEGRATED CIRCUIT SILICON GATE CMOS

### 262,144-WORD BY 16-BIT CMOS STATIC RAM

#### DESCRIPTION

The TC55V16256JI/FTI is a 4,194,304-bit high-speed static random access memory (SRAM) organized as 262,144 words by 16 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. 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 LVTTL compatible. The TC55V16256JI/FTI is available in plastic 44-pin SOJ and 44-pin TSOP with 400mil width for high density surface assembly. The TC55V16256JI/FTI guarantees  $-40^{\circ}$  to  $85^{\circ}\text{C}$  operating temperature so it is suitable for use in wide operating temperature system.

#### FEATURES

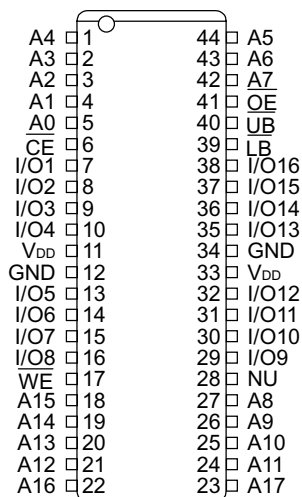
- Fast access time (the following are maximum values)
  - TC55V16256JI/FTI-12:12 ns
  - TC55V16256JI/FTI-15:15 ns
- Low-power dissipation (the following are maximum values)
 

Cycle Time	12	15	20	25	ns
Operation (max)	230	200	170	150	mA

Standby:10 mA (both devices)
- Single power supply voltage of  $3.3\text{ V} \pm 0.3\text{ V}$
- Fully static operation
- All inputs and outputs are LVTTL compatible
- Output buffer control using  $\overline{OE}$
- Data byte control using  $\overline{LB}$  (I/O1 to I/O8) and  $\overline{UB}$  (I/O9 to I/O16)
- Package:
  - SOJ44-P-400-1.27 (JI) (Weight: 1.64 g typ)
  - TSOP II44-P-400-0.80 (FTI) (Weight: 0.45 g typ)

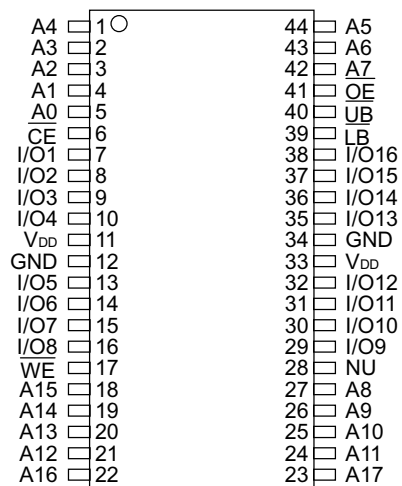
#### PIN ASSIGNMENT (TOP VIEW)

##### 44 PIN SOJ



(TC55V16256JI)

##### 44 PIN TSOP

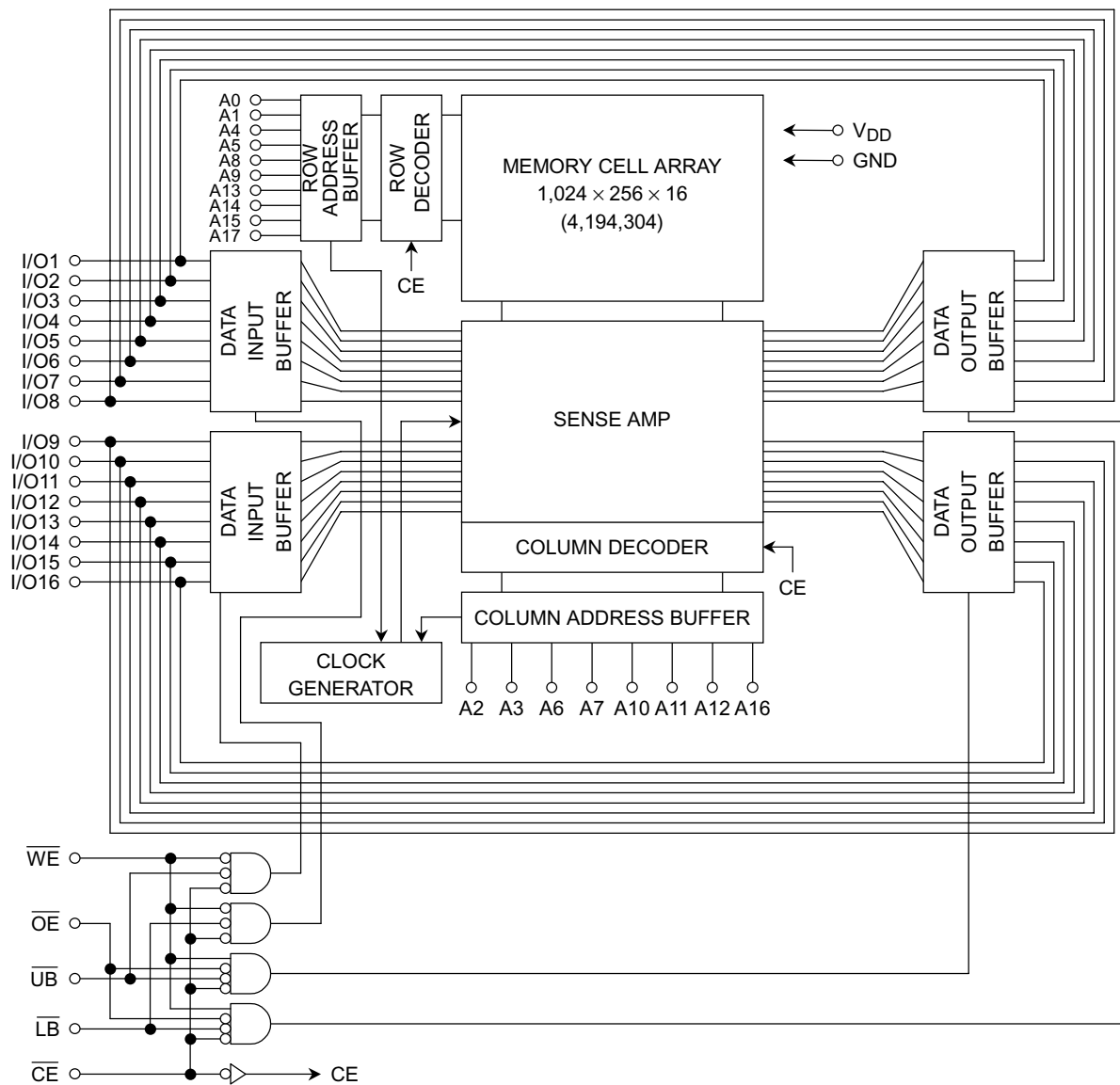


(TC55V16256FTI)

#### PIN NAMES

A0 to A17	Address Inputs
I/O1 to I/O16	Data Inputs/Outputs
$\overline{CE}$	Chip Enable Input
$\overline{WE}$	Write Enable Input
$\overline{OE}$	Output Enable Input
$\overline{LB}$ , $\overline{UB}$	Data Byte Control Inputs
V <sub>DD</sub>	Power (+3.3 V)
GND	Ground
NU	Not Usable (Input)

## BLOCK DIAGRAM



## MAXIMUM RATINGS

SYMBOL	RATING	VALUE	UNIT
V <sub>DD</sub>	Power Supply Voltage	-0.5 to 4.6	V
V <sub>IN</sub>	Input Terminal Voltage	-0.5* to 4.6	V
V <sub>I/O</sub>	Input/Output Terminal Voltage	-0.5* to V <sub>DD</sub> + 0.5**	V
P <sub>D</sub>	Power Dissipation	1.4	W
T <sub>solder</sub>	Soldering Temperature (10s)	260	°C
T <sub>stg</sub>	Storage Temperature	-65 to 150	°C
T <sub>opr</sub>	Operating Temperature	-40 to 100	°C

\*: -1.5 V with a pulse width of 20% · t<sub>RC</sub> min (4 ns max)

\*\* : V<sub>DD</sub> + 1.5 V with a pulse width of 20% · t<sub>RC</sub> min (4 ns max)

## DC RECOMMENDED OPERATING CONDITIONS (Ta = -40° to 85°C)

SYMBOL	PARAMETER	MIN	TYP	MAX	UNIT
V <sub>DD</sub>	Power Supply Voltage	3.0	3.3	3.6	V
V <sub>IH</sub>	Input High Voltage	2.0	—	V <sub>DD</sub> + 0.3**	V
V <sub>IL</sub>	Input Low Voltage	-0.3*	—	0.8	V

\*: -1.0 V with a pulse width of 20%·t<sub>RC</sub> min (4 ns max)

\*\* : V<sub>DD</sub> + 1.0 V with a pulse width of 20%·t<sub>RC</sub> min (4 ns max)

## DC CHARACTERISTICS (Ta = -40° to 85°C, V<sub>DD</sub> = 3.3 V ± 0.3 V)

SYMBOL	PARAMETER	TEST CONDITION	MIN	TYP	MAX	UNIT	
I <sub>IL</sub>	Input Leakage Current (Except NU pin)	V <sub>IN</sub> = 0 to V <sub>DD</sub>	-1	—	1	μA	
I <sub>LO</sub>	Output Leakage Current	$\overline{CE} = V_{IH}$ or $\overline{WE} = V_{IL}$ or $\overline{OE} = V_{IH}$ , V <sub>OUT</sub> = 0 to V <sub>DD</sub>	-1	—	1	μA	
I <sub>I</sub> (NU)	Input Current (NU pin)	V <sub>IN</sub> = 0 to 0.8 V	-1	—	20	μA	
		V <sub>IN</sub> = 0 to 0.2 V	-1	—	1		
V <sub>OH</sub>	Output High Voltage	I <sub>OH</sub> = -2 mA	2.4	—	—	V	
		I <sub>OH</sub> = -100 μA	V <sub>DD</sub> - 0.2	—	—		
V <sub>OL</sub>	Output Low Voltage	I <sub>OL</sub> = 2 mA	—	—	0.4		
		I <sub>OL</sub> = 100 μA	—	—	0.2		
I <sub>DDO</sub>	Operating Current	$\overline{CE} = V_{IL}$ , I <sub>OUT</sub> = 0 mA, $\overline{OE} = V_{IH}$ , Other Input = V <sub>IH</sub> /V <sub>IL</sub>	t <sub>cycle</sub> = 12 ns	—	—	230	mA
			t <sub>cycle</sub> = 15 ns	—	—	200	
			t <sub>cycle</sub> = 20 ns	—	—	170	
			t <sub>cycle</sub> = 25 ns	—	—	150	
I <sub>DDS1</sub>	Standby Current	$\overline{CE} = V_{IH}$ , Other Input = V <sub>IH</sub> or V <sub>IL</sub>	—	—	55	mA	
I <sub>DDS2</sub>		$\overline{CE} = V_{DD} - 0.2$ V, Other Input = V <sub>DD</sub> - 0.2 V or 0.2 V	—	—	10		

## CAPACITANCE (Ta = 25°C, f = 1.0 MHz)

SYMBOL	PARAMETER	TEST CONDITION	MAX	UNIT
C <sub>IN</sub>	Input Capacitance	V <sub>IN</sub> = GND	6	pF
C <sub>I/O</sub>	Input/Output Capacitance	V <sub>I/O</sub> = 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	*	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	*	*	High Impedance	High Impedance	$I_{DDO}$
	L	*	*	H	H			
Standby	H	*	*	*	*	High Impedance	High Impedance	$I_{DDS}$

\* : 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 = -40° to 85°C (See Note 1), VDD = 3.3 V ± 0.3 V)

### READ CYCLE

SYMBOL	PARAMETER	TC55V16256JI/FTI				UNIT
		-12		-15		
		MIN	MAX	MIN	MAX	
t <sub>RC</sub>	Read Cycle Time	12	—	15	—	ns
t <sub>ACC</sub>	Address Access Time	—	12	—	15	
t <sub>CO</sub>	Chip Enable Access Time	—	12	—	15	
t <sub>OE</sub>	Output Enable Access Time	—	6	—	8	
t <sub>BA</sub>	Upper Byte, Lower Byte Access Time	—	6	—	8	
t <sub>OH</sub>	Output Data Hold Time from Address Change	3	—	4	—	
t <sub>COE</sub>	Output Enable Time from Chip Enable	3	—	4	—	
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	—	7	—	8	
t <sub>ODO</sub>	Output Disable Time from Output Enable	—	7	—	8	
t <sub>BD</sub>	Output Disable Time from Upper Byte, Lower Byte	—	7	—	8	

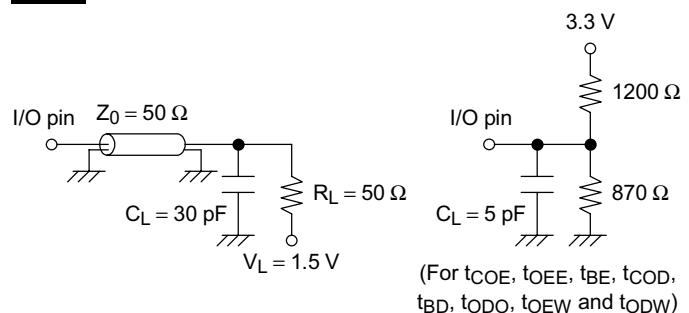
### WRITE CYCLE

SYMBOL	PARAMETER	TC55V16256JI/FTI				UNIT
		-12		-15		
		MIN	MAX	MIN	MAX	
t <sub>WC</sub>	Write Cycle Time	12	—	15	—	ns
t <sub>WP</sub>	Write Pulse Width	8	—	9	—	
t <sub>CW</sub>	Chip Enable to End of Write	10	—	12	—	
t <sub>BW</sub>	Upper Byte, Lower Byte Enable to End of Write	10	—	12	—	
t <sub>AW</sub>	Address Valid to End of Write	10	—	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	7	—	8	—	
t <sub>DH</sub>	Data Hold Time	0	—	0	—	
t <sub>OE<sub>W</sub></sub>	Output Enable Time from Write Enable	1	—	1	—	
t <sub>OD<sub>W</sub></sub>	Output Disable Time from Write Enable	—	7	—	8	

### AC TEST CONDITIONS

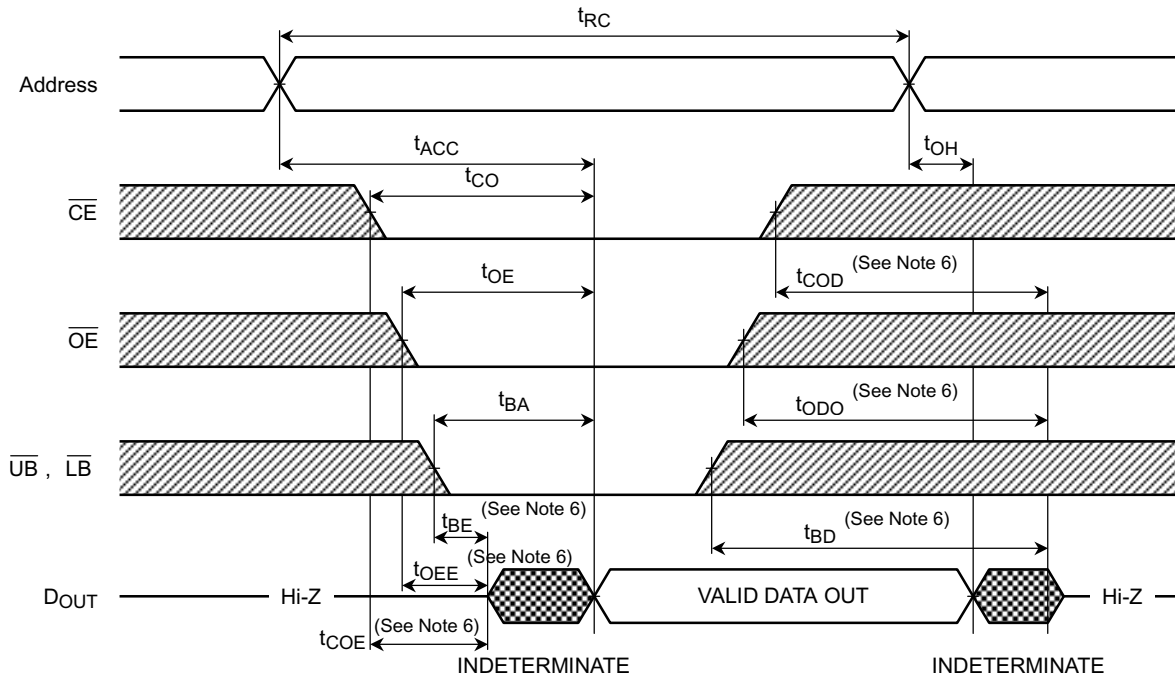
PARAMETER	TEST CONDITION
Input Pulse Level	3.0 V/ 0.0 V
Input Pulse Rise and Fall Time	2 ns
Input Timing Measurement Reference Level	1.5 V
Output Timing Measurement Reference Level	1.5 V
Output Load	Fig.1

Fig.1

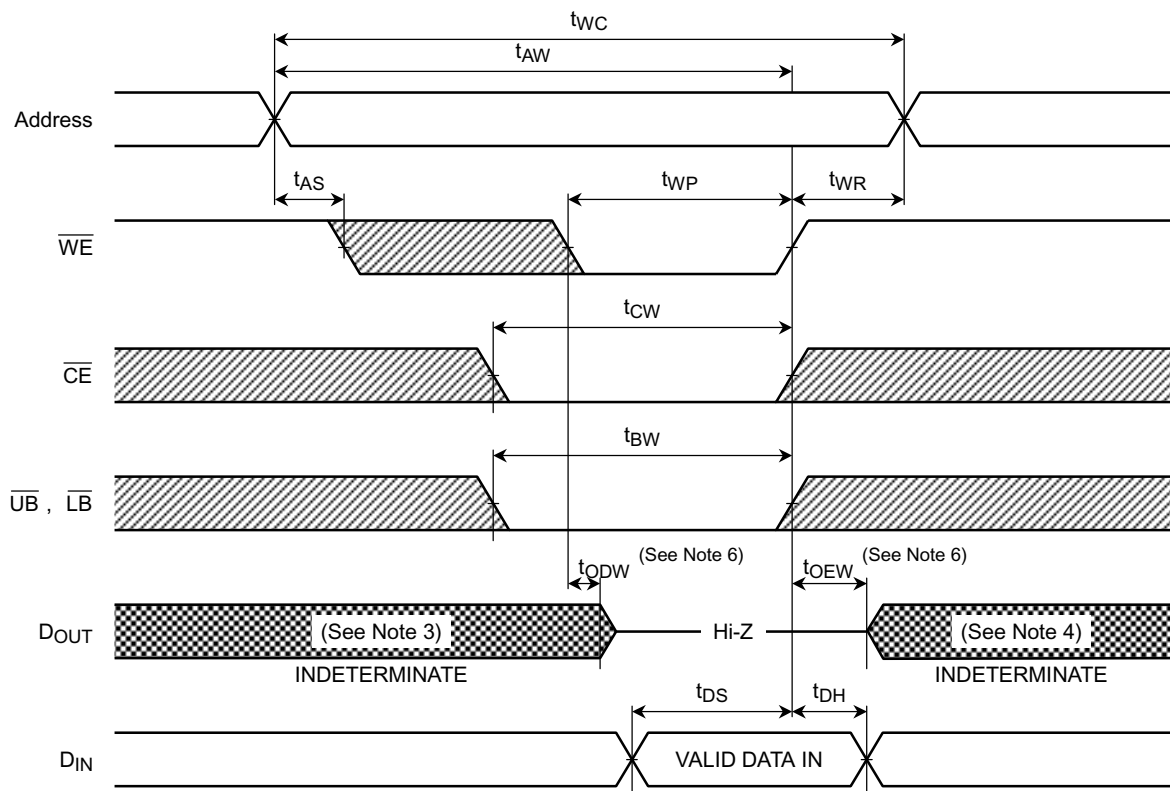


## TIMING DIAGRAMS

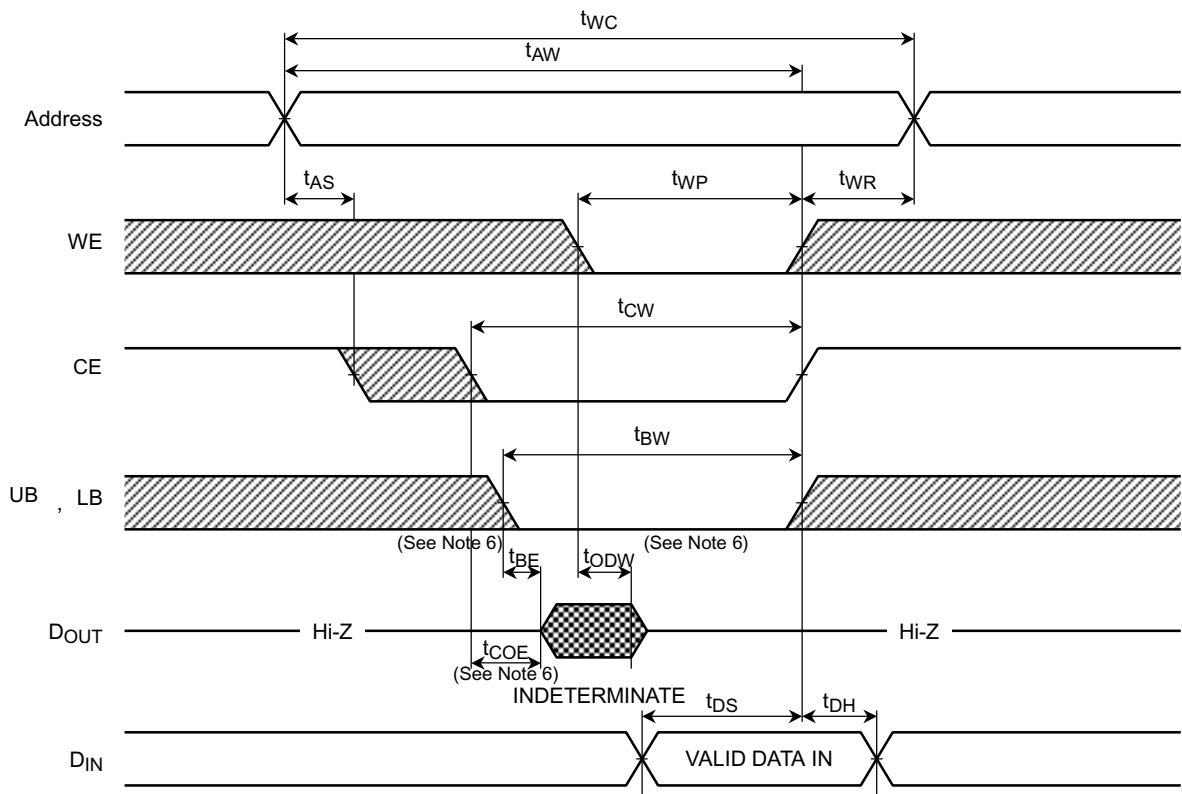
### READ CYCLE (See Note 2)



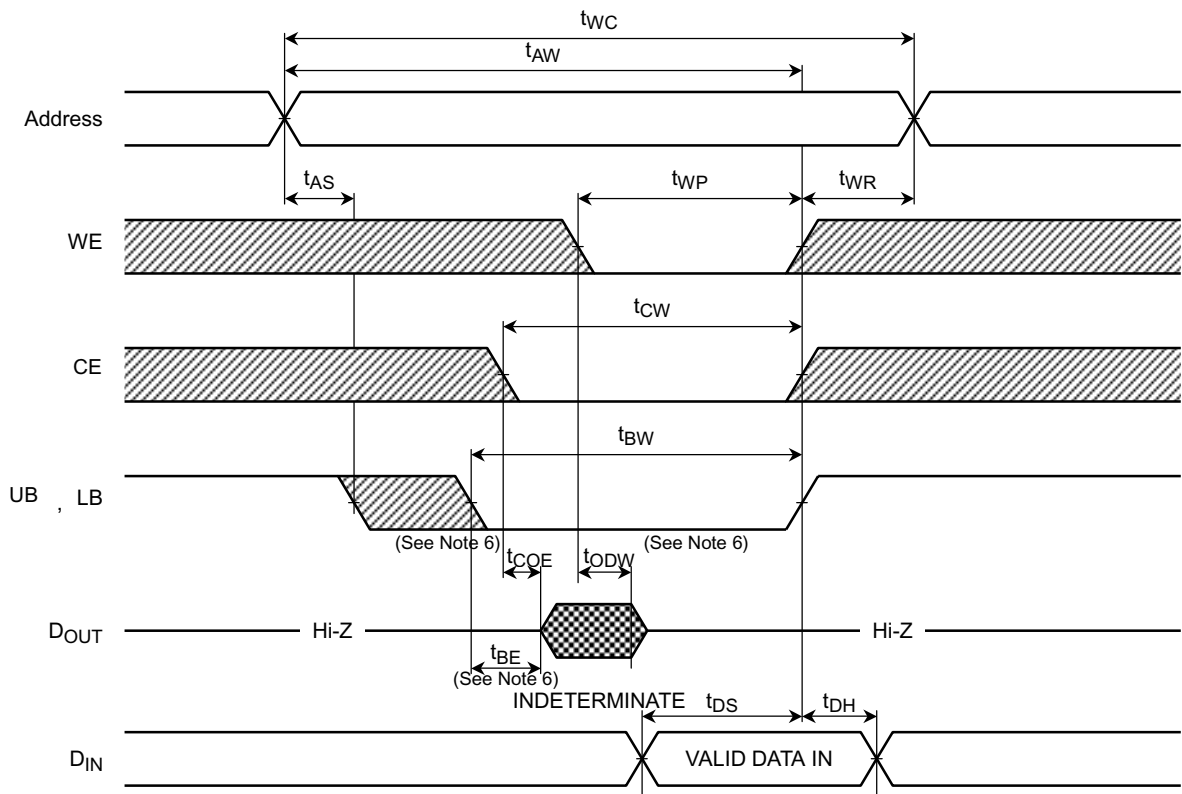
### WRITE CYCLE 1 ( $\overline{WE}$ CONTROLLED) (See Note 5)



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



WRITE CYCLE 2 ( $\overline{UB}$ ,  $\overline{LB}$  CONTROLLED) (See Note 5)

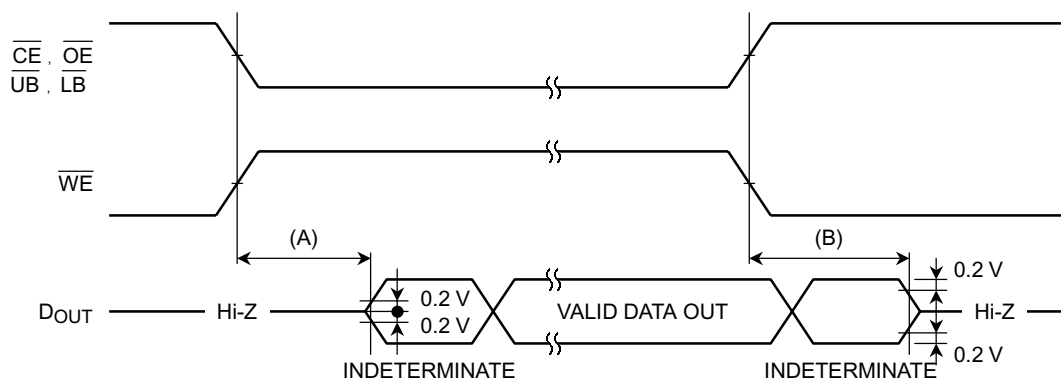


Note:

- (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) tCOE, tOEE, tBE, tOEW ..... Output Enable Time

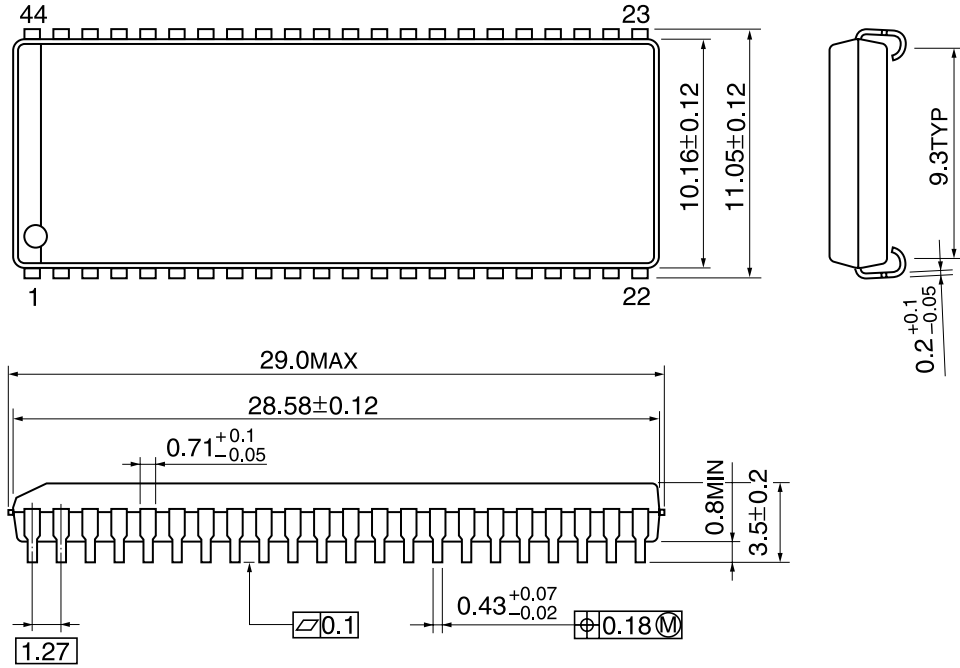
(B) tCOD, tODO, tBD, tODW ..... Output Disable Time





## PACKAGE DIMENSIONS

SOJ44-P-400-1.27

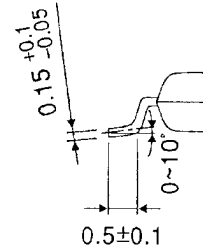
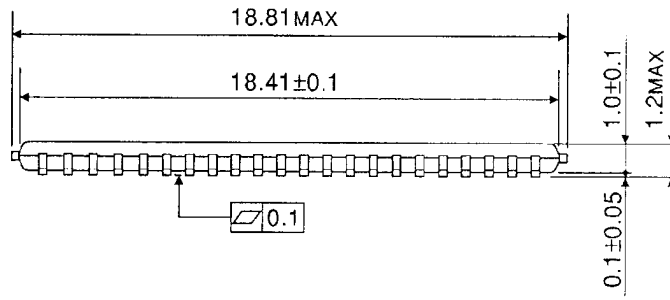
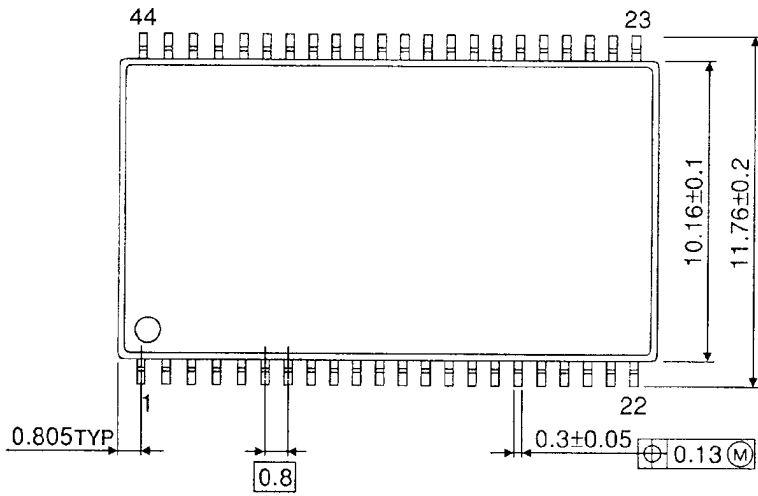


Weight: 1.64 g (typ)

## PACKAGE DIMENSIONS

TSOPII 44-P-400-0.80

Unit : mm



Weight: 0.45 g (typ)

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