

PRELIMINARY

SILICON GATE CMOS

131,072 WORD x 8 BIT STATIC RAM

Description

The TC551001BPL is a 1,048,576 bits static random access memory organized as 131,072 words by 8 bits using CMOS technology, and operated from a single 5V power supply. Advanced circuit techniques provide both high speed and low power features with an operating current of 5mA/MHz (typ.) and a minimum cycle time of 85ns. When $\overline{CE1}$ is a logical high, or CE2 is low, the device is placed in a low power standby mode in which the standby current is 2 μ A typically. The TC551001BPL has three control inputs. Chip Enable inputs (CE1, CE2) allow for device selection and data retention control, while an Output Enable input (\overline{OE}) provides fast memory access. The TC551001BPL is suitable for use in microprocessor application systems where high speed, low power, and battery backup are required. The TC551001BPI guarantees -40 ~ 85°C operating temperature so TC551001BPI is suitable for use in wide operating temperature system.

The TC551001BPL is offered in a standard dual-in-line 32-pin plastic package, a small outline plastic package, and a thin small outline plastic package (forward, reverse type).

Features

- Low power dissipation: 27.5mW/MHz (typ.)
- Standby current: 4 μ A (max.) at Ta = 25°C
- Single 2.7 ~ 5.5V power supply
- Access time (max.)

	5V±10%		2.7 ~ 5.5V
	-85V	-10V	-85V/-10V
Access Time	85ns	100ns	200ns
$\overline{CE1}$ Access Time	85ns	100ns	200ns
CE2 Access Time	85ns	100ns	200ns
\overline{OE} Access Time	45ns	50ns	100ns

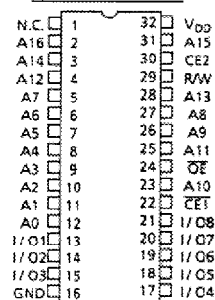
- Power down feature: $\overline{CE1}$, CE2
- Data retention supply voltage: 2.0 ~ 5.5V
- Inputs and outputs directly TTL compatible
- Wide operating temperature: -40 ~ 85°C
- Package TC551001BPI : DIP32-P-600
TC551001BFI : SOP32-P-525
TC551001BFTI : TSOP32-P-0820
TC551001BTRI : TSOP32-P-0820A

Pin Names

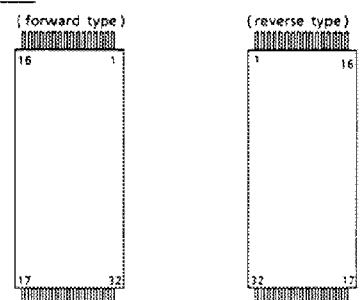
A0 ~ A16	Address Inputs
R/W	Read/Write Control Input
\overline{OE}	Output Enable Input
$\overline{CE1}$, CE2	Chip Enable Inputs
I/O1 ~ I/O8	Data Input/Output
V _{DD}	Power (+5V)
GND	Ground
N.C.	No Connection

Pin Connection (Top View)

32 PIN DIP & SOP



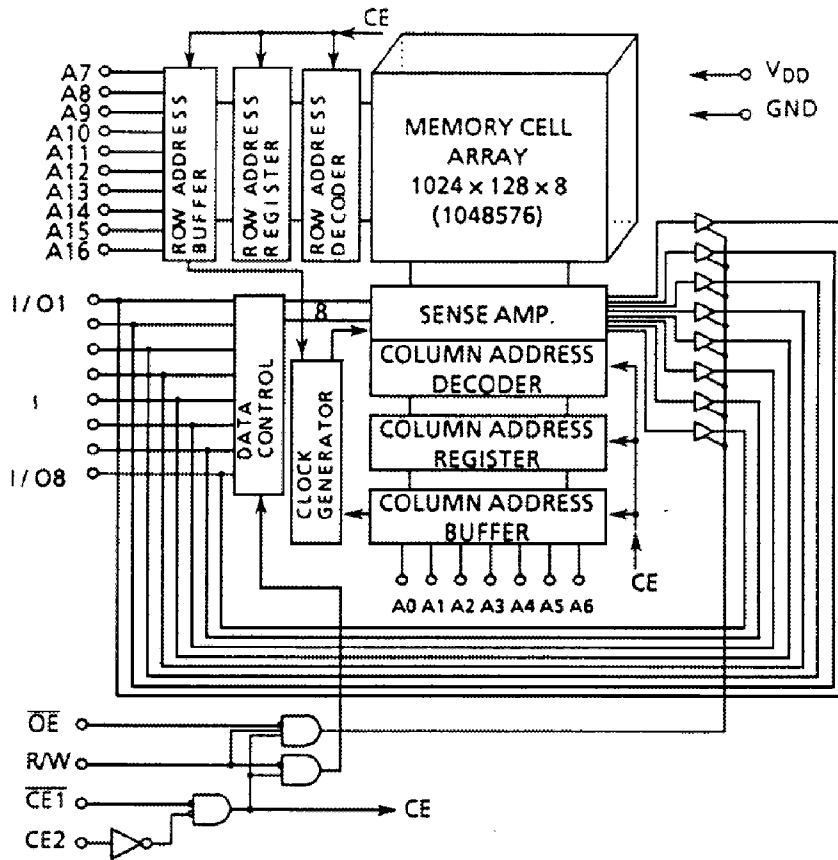
32 PIN TSOP



TSOP Pinout

PIN NO.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
PIN NAME	A ₁₁	A ₉	A ₈	A ₁₃	R/W	CE2	A ₁₅	V _{DD}	NC	A ₁₆	A ₁₄	A ₁₂	A ₇	A ₆	A ₅	A ₄
PIN NO.	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
PIN NAME	A ₃	A ₂	A ₁	A ₀	I/O1	I/O2	I/O3	GND	I/O4	I/O5	I/O6	I/O7	I/O8	$\overline{CE1}$	A ₁₀	\overline{OE}

Block Diagram



Operating Mode

OPERATING MODE	$\overline{CE1}$	CE2	\overline{OE}	R/W	I/O1 ~ I/O8	POWER
Read	L	H	L	H	D _{OUT}	I _{DDO}
Write	L	H	*	L	D _{IN}	I _{DDO}
Output Deselect	L	H	H	H	High-Z	I _{DDO}
Standby	H	*	*	*	High-Z	I _{DDS}
	*	L	*	*	High-Z	I _{DDS}

* H or L

Maximum Ratings

SYMBOL	ITEM	RATING	UNIT
V _{DD}	Power Supply Voltage	-0.3 ~ 7.0	V
V _{IN}	Input Voltage	-0.3* ~ 7.0	V
V _{I/O}	Input and Output Voltage	-0.5 ~ V _{DD} + 0.5	V
P _D	Power Dissipation	1.0/0.6**	W
T _{SOLDER}	Soldering Temperature (10s)	260	°C
T _{STRG}	Storage Temperature	-55 ~ 150	°C
T _{OPR}	Operating Temperature	0 ~ 70	°C

* -3.0V at pulse width 50ns Max.

** SOP

DC Recommended Operating Conditions (Ta = -40 ~ 85°C)

SYMBOL	PARAMETER	5V ± 10%			2.7 ~ 5.5V			UNIT
		MIN.	TYP.	MAX.	MIN.	MIN.	MAX.	
V _{DD}	Power Supply Voltage	4.5	5.0	5.5	2.7	–	5.5	V
V _{IH}	Input High Voltage	2.4	–	V _{DD} + 0.3	V _{DD} - 0.2	–	V _{DD} + 0.3	
V _{IL}	Input Low Voltage	-0.3*	–	0.6	-0.3*	–	0.2	
V _{DH}	Data Retention Supply Voltage	2.0	–	5.5	2.0	–	5.5	

* -3.0V with a pulse width of 50ns Max.

DC and Operating Characteristics (Ta = -40 ~ 85°C, V_{DD} = 5V±10%)

SYMBOL	PARAMETER	TEST CONDITION	MIN.	TYP.	MAX.	UNIT	
I _{LI}	Input Leakage Current	V _{IN} = 0 ~ V _{DD}	–	–	±1.0	μA	
I _{LO}	Output Leakage Current	$\overline{CE} = V_{IH}$ or R/W = V _{IL} or $\overline{OE} = V_{IH}$ V _{OUT} = 0 ~ V _{DD}	–	–	±1.0	μA	
I _{OH}	Output High Current	V _{OH} = 2.4V	-1.0	–	–	mA	
I _{OL}	Output Low Current	V _{OL} = 0.4V	4.0	–	–	mA	
I _{DDO1}	Operating Current	$\overline{CE} = V_{IL}$ R/W = V _{IH} Other Input = V _{IH} /V _{IL} I _{OUT} = 0mA	t _{cycle} = 1μs	–	–	70	mA
			t _{cycle} = Min. cycle	–	–	20	
I _{DDO2}	Operating Current	$\overline{CE} = 0.2V$ R/W = V _{DD} - 0.2V Other Input = V _{DD} - 0.2V/0.2V I _{OUT} = 0mA	t _{cycle} = 1μs	–	–	60	
			t _{cycle} = Min. cycle	–	–	10	
I _{DDS1}	Standby Current	$\overline{CE} = V_{IH}$	–	–	3	mA	
I _{DDS2}		$\overline{CE} = V_{DD} - 0.2V$ V _{DD} = 2.0V ~ 5.5V	Ta = -40 ~ 85°C	–	–	70	μA
			Ta = 25°C	–	2	4	

Note (1): In standby mode with $\overline{CE} \geq V_{DD} - 0.2V$, the specification limits are guaranteed under the condition of $CE2 \geq V_{DD} - 0.2V$ or $CE2 \leq 0.2V$.

DC and Operating Characteristics (Ta = -40 ~ 85°C, V_{DD} = 3V±10%)

SYMBOL	PARAMETER	TEST CONDITION	MIN.	TYP.	MAX.	UNIT		
I _{LI}	Input Leakage Current	V _{IN} = 0 ~ V _{DD}	–	–	±1.0	μA		
I _{LO}	Output Leakage Current	$\overline{CE} = V_{IH}$ or R/W = V _{IL} or $\overline{OE} = V_{IH}$, V _{OUT} = 0 ~ V _{DD}	–	–	±1.0	μA		
I _{OH}	Output High Current	V _{OH} = V _{DD} - 2.0V	-0.1	–	–	mA		
I _{OL}	Output Low Current	V _{OL} = 0.2V	0.1	–	–	mA		
I _{DDO2}	Operating Current	$\overline{CE} = 0.2V$ R/W = V _{DD} = 2.0V Other Input = V _{DD} - 0.2V/0.2V I _{OUT} = 0mA	t _{cycle}	Min.	–	–	20	mA
				1μs	–	–	5	
I _{DDS2}	Standby Current	$\overline{CE} = V_{DD} - 0.2V$	V _{DD} = 3V ± 10%	Ta = -40 ~ 85°C	–	–	40	μA
				Ta = 25°C	–	1	2	
			V _{DD} = 3.0V	Ta = -40 ~ 85°C	–	–	35	
				Ta = -40 ~ 40°C	–	–	3	
			Ta = 25°C	–	1	–		

TC551001BPI/BFI/BFTI/BTRI-85V/10V

Capacitance* (Ta = 25°C, f = 1MHz)

SYMBOL	PARAMETER	TEST CONDITION	MAX.	UNIT
C _{IN}	Input Capacitance	V _{IN} = GND	10	pF
C _{OUT}	Output Capacitance	V _{OUT} = GND	10	

Note: This parameter is periodically sampled and is not 100% tested.

AC Characteristics (Ta = -40 ~ 85°C, V_{DD} = 5V±10%)

Read Cycle

SYMBOL	PARAMETER	TC551001BPI/BFI/BFTI/BTRI				UNIT
		-85V		-10V		
		MIN.	MAX.	MIN.	MAX.	
t _{RC}	Read Cycle Time	85	–	100	–	ns
t _{ACC}	Address Access Time	–	85	–	100	
t _{CO}	\overline{CE} Access Time	–	85	–	100	
t _{OE}	Output Enable to Output in Valid	–	45	–	50	
t _{COE}	Chip Enable ($\overline{CE1}$, CE2) to Output in Low-Z	5	–	5	–	
t _{OOE}	Output Enable to Output in Low-Z	0	–	0	–	
t _{OD}	Chip Enable ($\overline{CE1}$, CE2) to Output in High-Z	–	35	–	40	
t _{ODO}	Output Enable to Output in High-Z	–	35	–	40	
t _{OH}	Output Data Hold Time	10	–	10	–	

Write Cycle

SYMBOL	PARAMETER	TC551001BPI/BFI/BFTI/BTRI				UNIT
		-85V		-10V		
		MIN.	MAX.	MIN.	MAX.	
t _{WC}	Write Cycle Time	85	–	100	–	ns
t _{WP}	Write Pulse Width	60	–	60	–	
t _{CW}	Chip Selection to End of Write	75	–	80	–	
t _{AS}	Address Setup Time	0	–	0	–	
t _{WR}	Write Recovery Time	0	–	0	–	
t _{ODW}	R/W to Output in High-Z	–	35	–	40	
t _{OEW}	R/W to Output in Low-Z	0	–	5	–	
t _{DS}	Data Setup Time	35	–	40	–	
t _{DH}	Data Hold Time	0	–	0	–	

AC Test Conditions

Input Pulse Levels	2.6V/0.4V
Input Pulse Rise and Fall Time	5ns
Input Timing Measurement Reference Levels	1.5V
Output Timing Measurement Reference Levels	1.5V
Output Load	1 TTL Gate and C _L = 100pF

AC Characteristics (Ta = -40 ~ 85°C, V_{DD} = 2.7 ~ 5.5V)**Read Cycle**

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
t _{RC}	Read Cycle Time	200	–	ns
t _{ACC}	Address Access Time	–	200	
t _{CO1}	$\overline{CE1}$ Access Time	–	200	
t _{CO2}	CE2 Access Time	–	200	
t _{OE}	Output Enable to Output in Valid	–	100	
t _{COE}	Chip Enable ($\overline{CE1}$, CE2) to Output in Low-Z	5	–	
t _{OEE}	Output Enable to Output in Low-Z	0	–	
t _{OD}	Chip Enable ($\overline{CE1}$, CE2) to Output in High-Z	–	60	
t _{ODO}	Output Enable to Output in High-Z	–	60	
t _{OH}	Output Data Hold Time	10	–	

Write Cycle

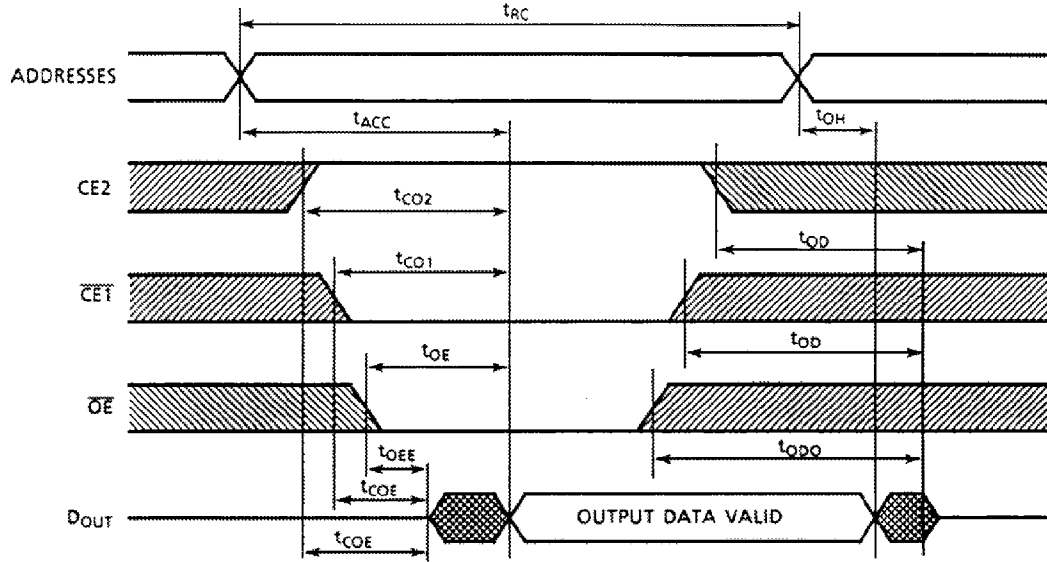
SYMBOL	PARAMETER	MIN.	MAX.	UNIT
t _{WC}	Write Cycle Time	200	–	ns
t _{WP}	Write Pulse Width	120	–	
t _{CW}	Chip Selection to End of Write	150	–	
t _{AS}	Address Setup Time	0	–	
t _{WR}	Write Recovery Time	0	–	
t _{ODW}	R/W to Output in High-Z	–	60	
t _{OEW}	R/W to Output in Low-Z	0	–	
t _{DS}	Data Setup Time	80	–	
t _{DH}	Data Hold Time	0	–	

AC Test Conditions

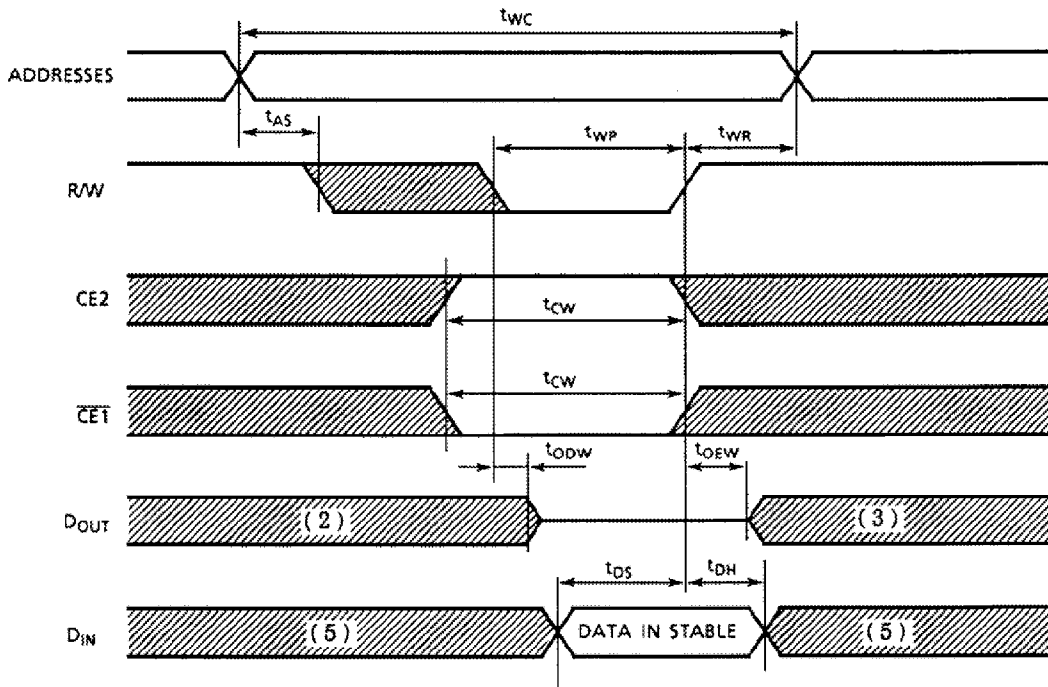
Input Pulse Levels	V _{DD} - 0.2V/0.2V
Input Pulse Rise and Fall Time	5ns
Input Timing Measurement Reference Level	1.5V
Output Timing Measurement Reference Level	1.5V
Output Load	C _L = 100pF (Include Jig)

Timing Waveforms

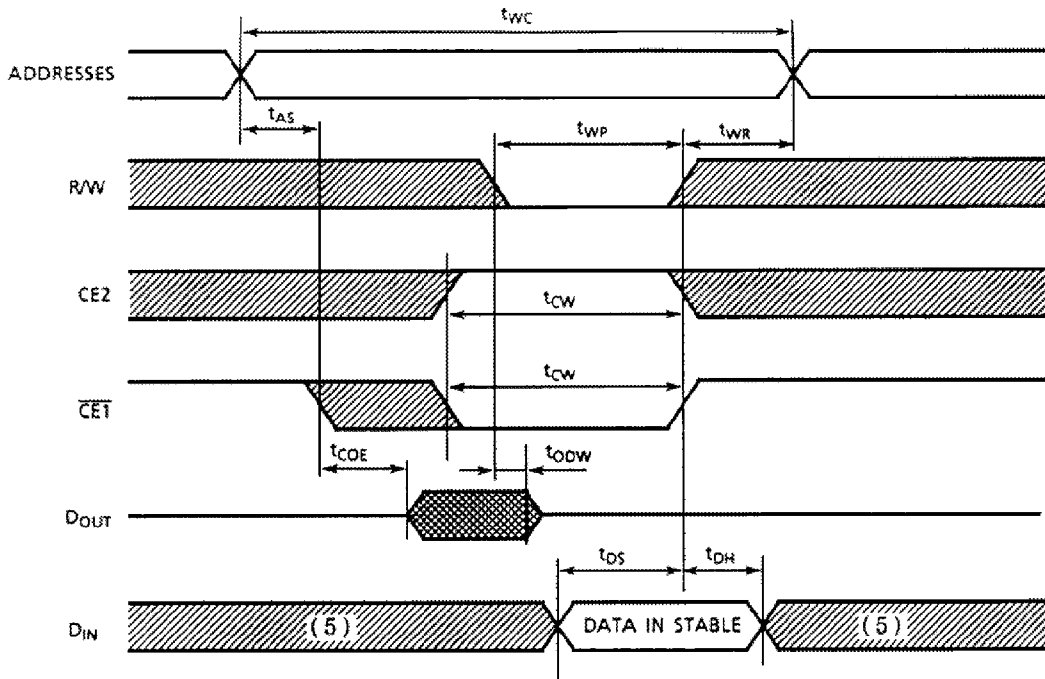
Read Cycle ⁽¹⁾



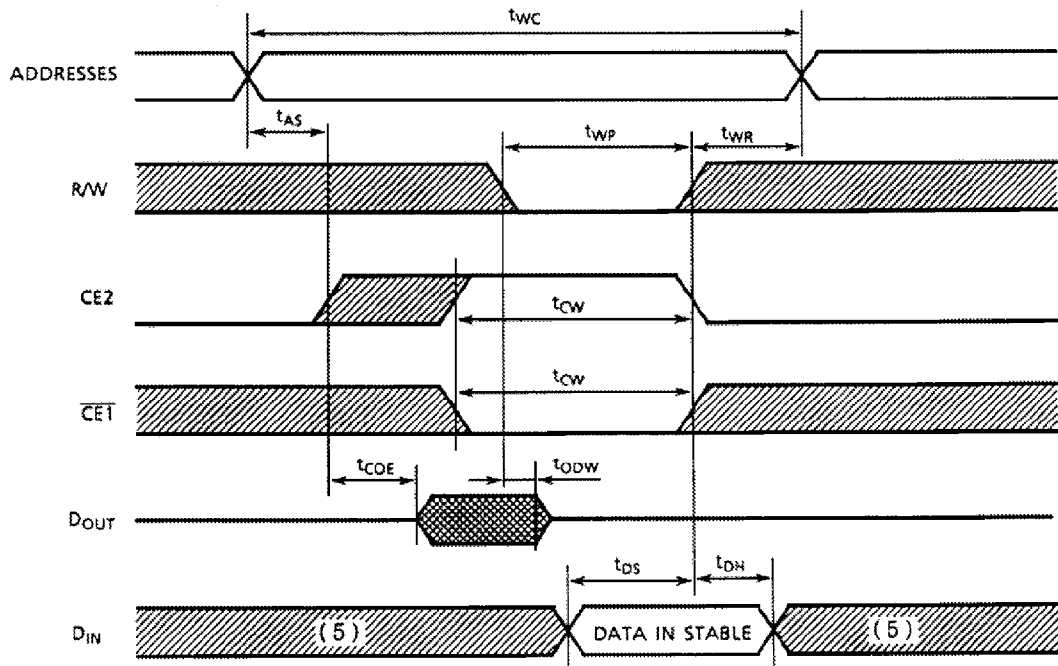
Write Cycle 1 ⁽⁴⁾ (R/W Controlled Write)



Write Cycle 2 ⁽⁴⁾ ($\overline{CE1}$ Controlled Write)



Write Cycle 3 ⁽⁴⁾ (CE2 Controlled Write)



Notes:

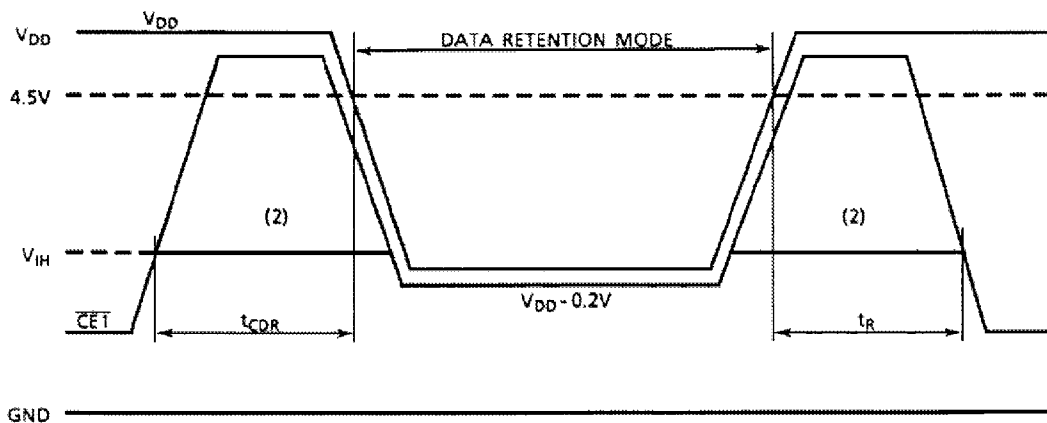
1. R/W is High for Read Cycle.
2. Assuming that $\overline{CE1}$ Low transition or CE2 High transition occurs coincident with or after the R/W Low transition, Outputs remain in a high impedance state.
3. Assuming that $\overline{CE1}$ High transition or CE2 Low transition occurs coincident with or prior to the R/W High transition, Outputs remain in a high impedance state.
4. Assuming that \overline{OE} is High for a Write Cycle, Outputs are in a high impedance state during this period.
5. The I/O may be in the output state during this time, input signals of opposite phase must not be applied.

Data Retention Characteristics (Ta = -40 ~ 85°C)

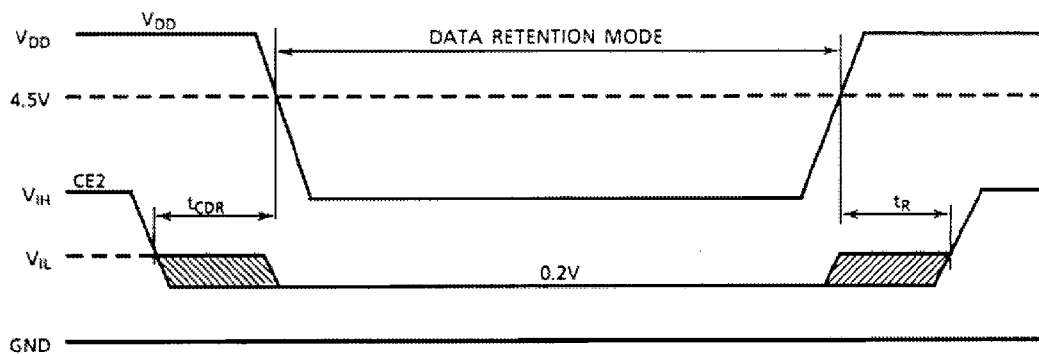
SYMBOL	PARAMETER	MIN.	TYP.	MAX.	UNIT
V_{DH}	Data Retention Supply Voltage	2.0	–	5.5	V
$I_{DD S2}$	Standby Current	$V_{DD} = 3.0V$	–	35*	μA
		$V_{DD} = 5.5V$	–	70	
t_{CDR}	Chip Deselect to Data Retention Mode	0	–	–	ns
t_R	Recovery Time	5	–	–	ms

*3 μA (max.) Ta = -40 ~ 40°C

$\overline{CE1}$ Controlled Data Retention Mode (1)



CE2 Controlled Data Retention Mode (3)



Notes:

1. In the $\overline{CE1}$ controlled data retention mode, minimum standby current is achieved under the condition of $CE2 \leq 0.2V$ or $CE2 \geq V_{DD} - 0.2V$.
2. If the V_{IH} of $\overline{CE1}$ is 2.4V in operation, during the period that the V_{DD} voltage is going down from 4.5V to 2.6V, $I_{DD S1}$ current flows.
3. In the CE2 controlled data retention mode, minimum standby current is achieved under the condition of $CE2 \leq 0.2V$.

3.3V Operation

DC Recommended Operating Conditions (Ta = -40 ~ 85°C)

SYMBOL	PARAMETER	MIN.	TYP.	MAX.	UNIT
V _{DD}	Power Supply Voltage	3.0	3.3	3.6	V
V _{IH}	Input High Voltage	V _{DD} - 0.2	–	V _{DD} + 0.3	
V _{IL}	Input Low Voltage	-0.3	–	0.2	

DC and Operating Characteristics (Ta = -40 ~ 85°C, V_{DD} = 3.3V±0.3V)

SYMBOL	PARAMETER	TEST CONDITION		MIN.	TYP.	MAX.	UNIT		
I _{LI}	Input Leakage Current	V _{IN} = 0 ~ V _{DD}		–	–	±1.0	μA		
I _{LO}	Output Leakage Current	$\overline{CE} = V_{IH}$ or R/W = V _{IL} or $\overline{OE} = V_{IH}$, V _{OUT} = 0 ~ V _{DD}		–	–	±1.0	μA		
I _{OH}	Output High Current	V _{OH} = V _{DD} - 2.0V		-0.1	–	–	mA		
I _{OL}	Output Low Current	V _{OL} = 0.2V		0.1	–	–	mA		
I _{DDO2}	Operating Current	$\overline{CE} = 0.2V$, R/W = V _{DD} = 2.0V Other Input = V _{DD} - 0.2V/0.2V I _{OUT} = 0mA		t _{cycle}	Min.	–	–	25	mA
					1μs	–	–	5	
I _{DDS2}	Standby Current	$\overline{CE} = V_{DD} - 0.2V$	V _{DD} = 3.3V ± 0.3V	Ta = -40 ~ 85°C	–	–	45	μA	
				Ta = 25°C	–	2	3		
			V _{DD} = 3.3V	Ta = -40 ~ 85°C	–	–	40		
				Ta = -40 ~ 40°C	–	–	5		
	Ta = 25°C	–	2	–					

Capacitance* (Ta = 25°C, f = 1MHz)

SYMBOL	PARAMETER	TEST CONDITION	MAX.	UNIT
C _{IN}	Input Capacitance	V _{IN} = GND	10	pF
C _{OUT}	Output Capacitance	V _{OUT} = GND	10	

Note: This parameter periodically sampled is not 100% tested.

3.3V Operation

AC Characteristics (Ta = -40 ~ 85°C, V_{DD} = 3.3V±0.3V)

Read Cycle

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
t _{RC}	Read Cycle Time	150	–	ns
t _{ACC}	Address Access Time	–	150	
t _{CO1}	CE1 Access Time	–	150	
t _{CO2}	CE2 Access Time	–	150	
t _{OE}	Output Enable to Output in Valid	–	75	
t _{COE}	Chip Enable CE to Output in Low-Z	5	–	
t _{OEE}	Output Enable to Output in Low-Z	0	–	
t _{OD}	Chip Enable CE to Output in High-Z	–	50	
t _{ODO}	Output Enable to Output in High-Z	–	50	
t _{OH}	Output Data Hold Time	10	–	

Write Cycle

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
t _{WC}	Write Cycle Time	150	–	ns
t _{WP}	Write Pulse Width	100	–	
t _{CW}	Chip Selection to End of Write	120	–	
t _{AS}	Address Setup Time	0	–	
t _{WR}	Write Recovery Time	0	–	
t _{ODW}	R/W to Output in High-Z	–	50	
t _{OEW}	R/W to Output in Low-Z	0	–	
t _{DS}	Data Setup Time	60	–	
t _{DH}	Data Hold Time	0	–	

AC Test Conditions

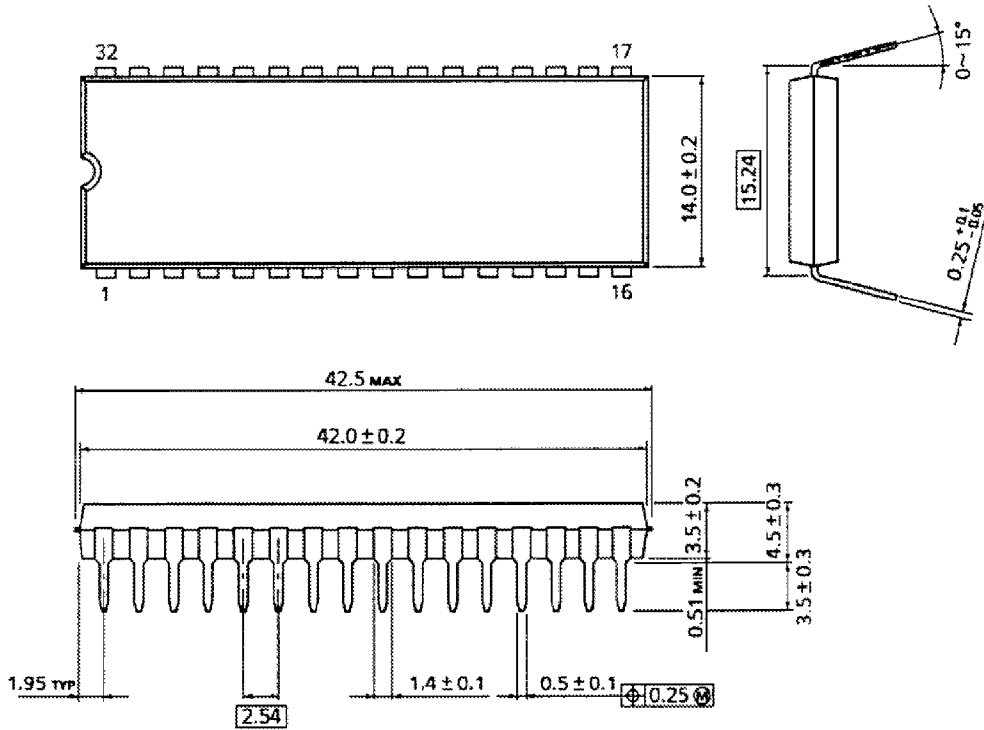
Input Pulse Levels	V _{DD} - 0.2V/0.2V
Input Pulse Rise and Fall Time	5ns
Input Timing Measurement Reference Level	1.5V
Output Timing Measurement Reference Level	1.5V
Output Load	C _L = 100pF (Include Jig)

TC551001BPI/BFI/BFTI/BTRI-85V/10V

Outline Drawing

DIP32-P-600

Unit in mm

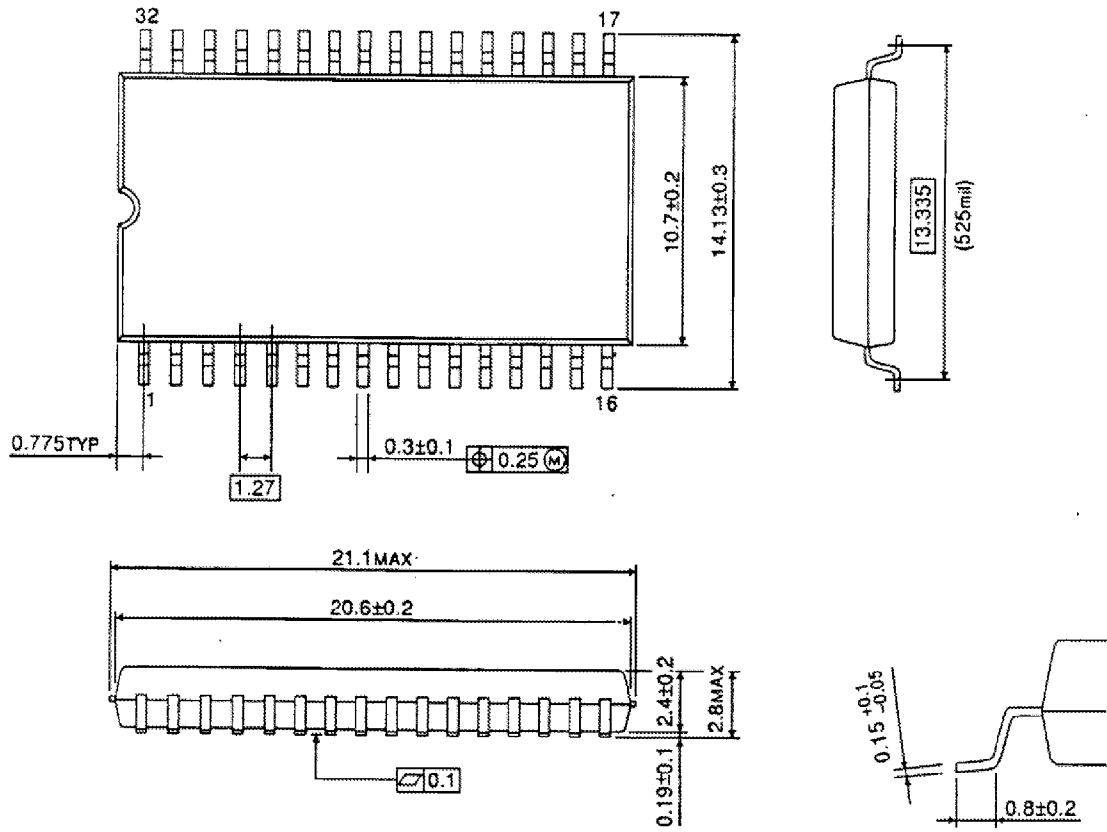


Weight : 4.45 g (Typ.)

Outline Drawing

SOP32-P-525

Unit in mm

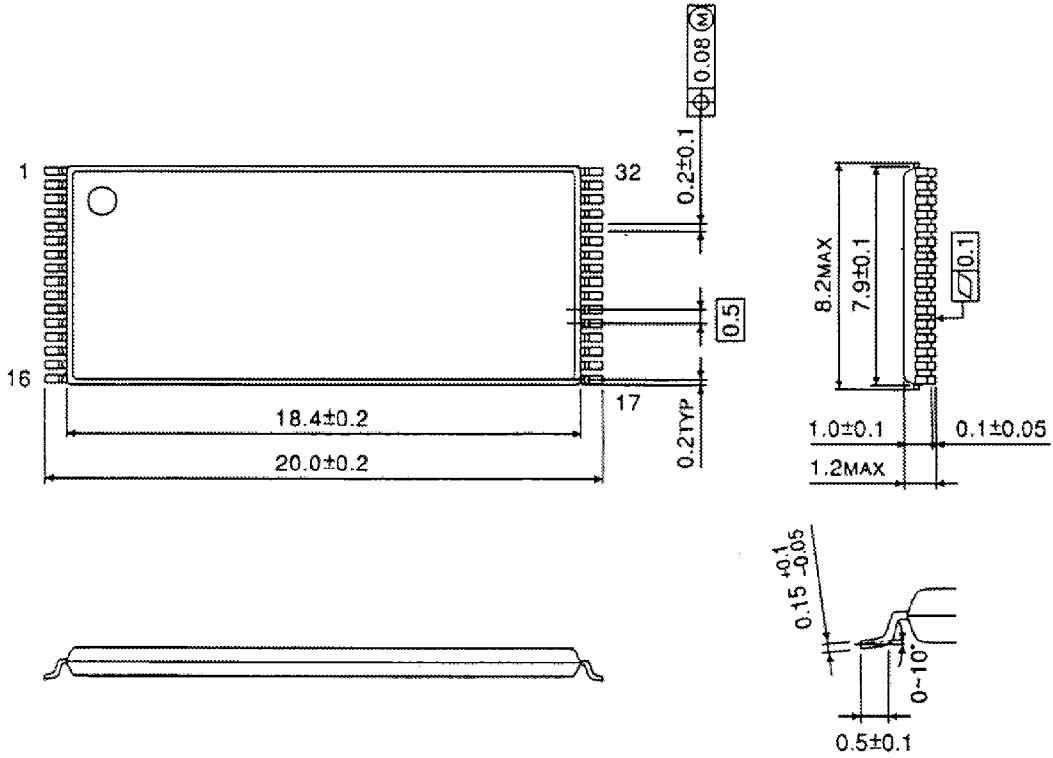


Weight : 1.04 g (Typ.)

Outline Drawing

TSOP32-P-0820

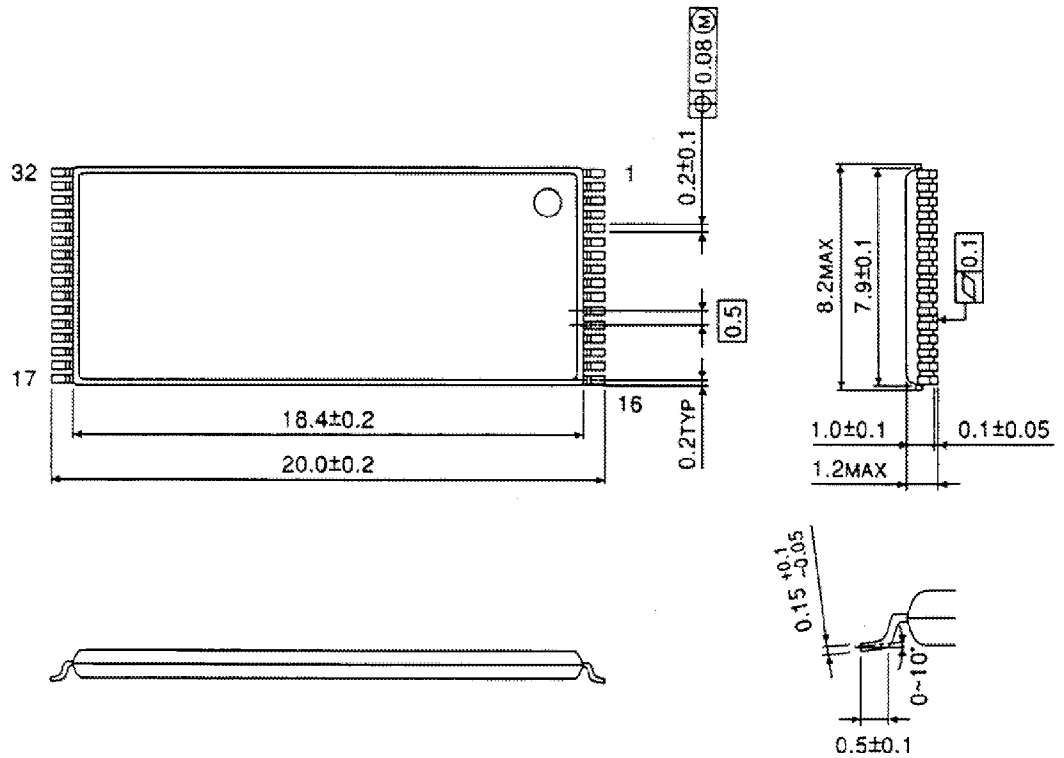
Unit in mm



Weight : 0.34 g (Typ.)

Outline Drawing
TSOP32-P-0820A

Unit in mm



Weight : 0.34 g (Typ.)

Notes

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