

TOSHIBA MOS DIGITAL INTEGRATED CIRCUIT SILICON GATE CMOS

524,288-WORD BY 8-BIT STATIC RAM

DESCRIPTION

The TC554001AF/AFT/ATR is a 4,194,304-bit static random access memory (SRAM) organized as 524,288 words by 8 bits. Fabricated using Toshiba's CMOS Silicon gate process technology, this device operates from a single 5V $\pm$ 10% power supply. Advanced circuit technology provides both high speed and low power at an operating current of 10 mA/MHz (typ) and a minimum cycle time of 70 ns. It is automatically placed in low-power mode at 2 μ A standby current (typ) when chip enable ($\overline{CE}$) is asserted high. There are two control inputs. $\overline{CE}$ is used to select the device and for data retention control, and output enable ($\overline{OE}$) provides fast memory access. This device is well suited to various microprocessor system applications where high speed, low power and battery backup are required. The TC554001AF/AFT/ATR is available in a standard plastic 32-pin small-outline package (SOP) and normal and reverse pinout plastic 32-pin thin-small-outline package (TSOP).

FEATURES

- Low-power dissipation
Operating: 55 mW/MHz (typical)
- Single power supply voltage of 5 V $\pm$ 10%
- Power down features using $\overline{CE}$.
- Data retention supply voltage of 2.0 to 5.5 V
- Direct TTL compatibility for all inputs and outputs
- Standby Current (maximum):

	TC554001AF/AFT/ATR	
	-70,-85,-10	-70L,-85L,-10L
5.5 V	100 μ A	50 μ A
3.0 V	50 μ A	25 μ A

- Access Times (maximum):

	TC554001AF/AFT/ATR		
	-70,-70L	-85,-85L	-10,-10L
Access Time	70 ns	85 ns	100 ns
$\overline{CE}$ Access Time	70 ns	85 ns	100 ns
$\overline{OE}$ Access Time	35 ns	45 ns	50 ns

- Package:
SOP32-P-525-1.27 (AF) (Weight: 1.14 g typ)
TSOP II32-P-400-1.27 (AFT) (Weight: 0.53 g typ)
TSOP II32-P-400-1.27A (ATR) (Weight: 0.53 g typ)

PIN ASSIGNMENT (TOP VIEW)

32 PIN SOP & TSOP

A18 □ 1	32 □ V _{DD}	V _{DD} □ 1	32 □ A18
A16 □ 2	31 □ A15	A15 □ 2	31 □ A16
A14 □ 3	30 □ A17	A17 □ 3	30 □ A14
A12 □ 4	29 □ R/W	R/W □ 4	29 □ A12
A7 □ 5	28 □ A13	A13 □ 5	28 □ A7
A6 □ 6	27 □ A8	A8 □ 6	27 □ A6
A5 □ 7	26 □ A9	A9 □ 7	26 □ A5
A4 □ 8	25 □ A11	A11 □ 8	25 □ A4
A3 □ 9	24 □ $\overline{OE}$	$\overline{OE}$ □ 9	24 □ A3
A2 □ 10	23 □ A10	A10 □ 10	23 □ A2
A1 □ 11	22 □ $\overline{CE}$	$\overline{CE}$ □ 11	22 □ A1
A0 □ 12	21 □ I/O8	I/O8 □ 12	21 □ A0
I/O1 □ 13	20 □ I/O7	I/O7 □ 13	20 □ I/O1
I/O2 □ 14	19 □ I/O6	I/O6 □ 14	19 □ I/O2
I/O3 □ 15	18 □ I/O5	I/O5 □ 15	18 □ I/O3
GND □ 16	17 □ I/O4	I/O4 □ 16	GND □ 17

(AF/AFT)

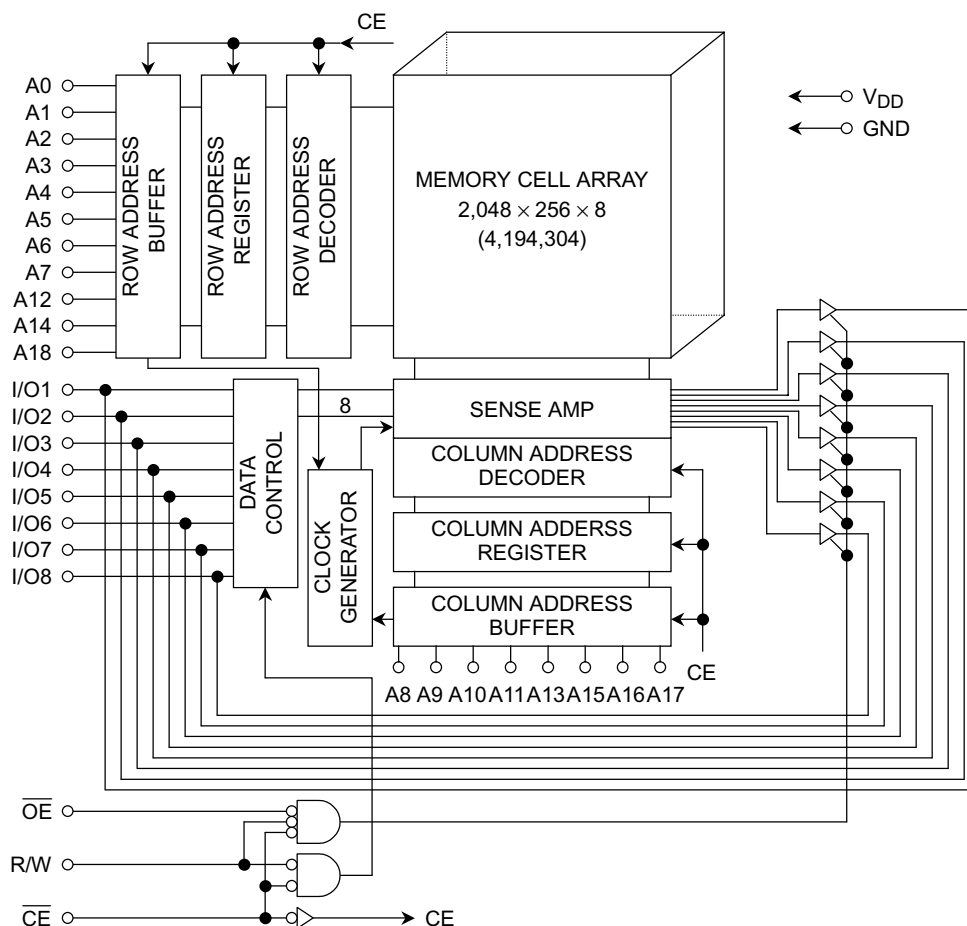
32 PIN TSOP

V _{DD} □ 1	32 □ A18
A15 □ 2	31 □ A16
A17 □ 3	30 □ A14
R/W □ 4	29 □ A12
A13 □ 5	28 □ A7
A8 □ 6	27 □ A6
A9 □ 7	26 □ A5
A11 □ 8	25 □ A4
$\overline{OE}$ □ 9	24 □ A3
A10 □ 10	23 □ A2
$\overline{CE}$ □ 11	22 □ A1
I/O8 □ 12	21 □ A0
I/O7 □ 13	20 □ I/O1
I/O6 □ 14	19 □ I/O2
I/O5 □ 15	18 □ I/O3
I/O4 □ 16	17 □ GND

(ATR)

PIN NAMES

A0~A18	Address Inputs
R/W	Read/Write Control
$\overline{OE}$	Output Enable
$\overline{CE}$	Chip Enable
I/O1~I/O8	Data Inputs/Outputs
V _{DD}	Power (+5 V)
GND	Ground

BLOCK DIAGRAM

OPERATING MODE

MODE	$\overline{CE}$	$\overline{OE}$	R/W	I/O1~I/O8	POWER
Read	L	L	H	Output	I_{DDO}
Write	L	*	L	Input	I_{DDO}
Output Deselect	L	H	H	High-Z	I_{DDO}
Standby	H	*	*	High-Z	I_{DSD}

* = don't care
 H = logic high
 L = logic low

MAXIMUM RATINGS

SYMBOL	RATING	VALUE	UNIT
V_{DD}	Power Supply Voltage	-0.3~7.0	V
V_{IN}	Input Voltage	-0.3*~7.0	V
$V_{I/O}$	Input/Output Voltage	-0.5~ $V_{DD} + 0.5$	V
P_D	Power Dissipation	0.6	W
T_{solder}	Soldering Temperature (10s)	260	°C
T_{stg}	Storage Temperature	-55~150	°C
T_{opr}	Operating Temperature	0~70	°C

*: -3.0 V when measured at a pulse width of 50ns

DC RECOMMENDED OPERATING CONDITIONS (Ta = 0° 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} + 0.3	V
V _{IL}	Input Low Voltage	-0.3*	—	0.8	V
V _{DH}	Data Retention Supply Voltage	2.0	—	5.5	V

*: -3.0 V when measured at a pulse width of 50 ns

DC CHARACTERISTICS (Ta = 0° to 70°C, V_{DD} = 5 V ± 10%)

SYMBOL	PARAMETER	TEST CONDITION			MIN	TYP	MAX	UNIT
I _{IL}	Input Leakage Current	V _{IN} = 0 V~V _{DD}			—	—	±1.0	μA
I _{OH}	Output High Current	V _{OH} = 2.4 V			−1.0	—	—	mA
I _{OL}	Output Low Current	V _{OL} = 0.4 V			2.1	—	—	mA
I _{LO}	Output Leakage Current	$\overline{CE}$ = V _{IH} or R/W = V _{IL} or $\overline{OE}$ = V _{IH} , V _{OUT} = 0 V~V _{DD}			—	—	±1.0	μA
I _{DDO1}	Operating Current	$\overline{CE}$ = V _{IL} and R/W = V _{IH} , I _{OUT} = 0 mA, Other Input = V _{IH} /V _{IL}		t _{cycle} = MIN	—	—	70	mA
				t _{cycle} = 1 μs	—	15	—	
I _{DDO2}		$\overline{CE}$ = 0.2 V and R/W = V _{DD} − 0.2 V, I _{OUT} = 0 mA, Other Input = V _{DD} − 0.2 V/0.2 V		t _{cycle} = MIN	—	—	60	mA
				t _{cycle} = 1 μs	—	10	—	
I _{DDS1}	Standby Current	$\overline{CE}$ = V _{IH}			—	—	3	mA
I _{DDS2}		$\overline{CE}$ = V _{DD} − 0.2 V, V _{DD} = 2.0 V~5.5 V	-70,-85,-10	Ta = 25°C	—	2	—	μA
				Ta = 0~70°C	—	—	100	
			-70L,-85L,-10L	Ta = 25°C	—	2	5	
				Ta = 0~70°C	—	—	50	

CAPACITANCE (Ta = 25°C, f = 1 MHz)

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

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

AC CHARACTERISTICS AND OPERATING CONDITIONS (Ta = 0° to 70°C, VDD = 5 V ± 10%)

READ CYCLE

SYMBOL	PARAMETER	TC554001AF/AFT/ATR						UNIT
		-70,-70L		-85,-85L		-10,-10L		
		MIN	MAX	MIN	MAX	MIN	MAX	
t _{RC}	Read Cycle Time	70	—	85	—	100	—	ns
t _{ACC}	Address Access Time	—	70	—	85	—	100	
t _{CO}	Chip Enable Access Time	—	70	—	85	—	100	
t _{OE}	Output Enable Access Time	—	35	—	45	—	50	
t _{COE}	Chip Enable Low to Output Active	10	—	10	—	10	—	
t _{OOE}	Output Enable Low to Output Active	5	—	5	—	5	—	
t _{OD}	Chip Enable High to Output High-Z	—	25	—	30	—	35	
t _{ODO}	Output Enable High to Output High-Z	—	25	—	30	—	35	
t _{OH}	Output Data Hold Time	10	—	10	—	10	—	

WRITE CYCLE

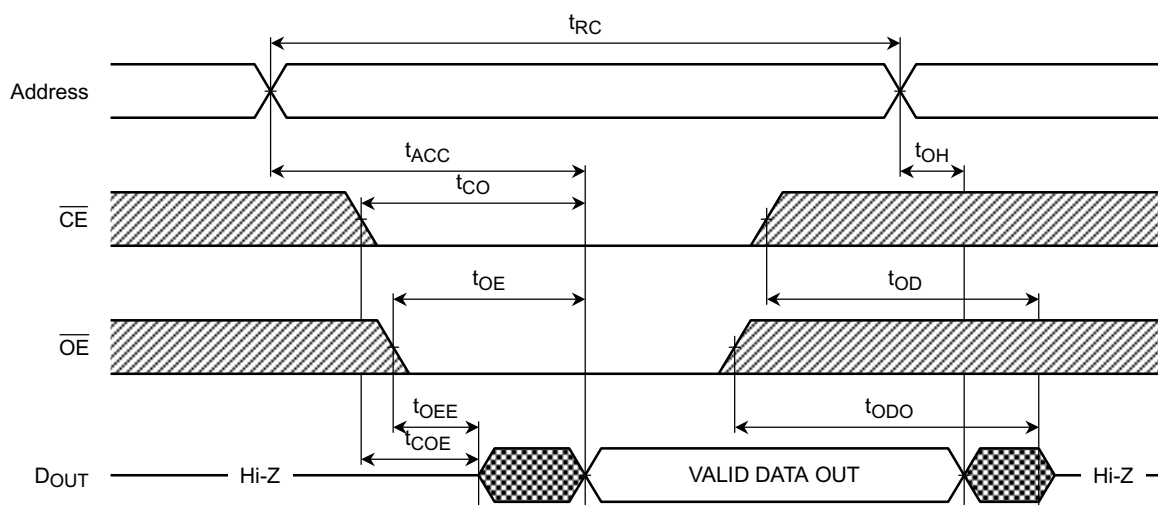
SYMBOL	PARAMETER	TC554001AF/AFT/ATR						UNIT
		-70,-70L		-85,-85L		-10,-10L		
		MIN	MAX	MIN	MAX	MIN	MAX	
t _{WC}	Write Cycle Time	70	—	85	—	100	—	ns
t _{WP}	Write Pulse Width	50	—	55	—	60	—	
t _{CW}	Chip Enable to End of Write	60	—	70	—	80	—	
t _{AS}	Address Setup Time	0	—	0	—	0	—	
t _{WR}	Write Recovery Time	0	—	0	—	0	—	
t _{ODW}	R/W Low to Output High-Z	—	25	—	30	—	35	
t _{OEW}	R/W High to Output Active	5	—	5	—	5	—	
t _{DS}	Data Setup Time	30	—	35	—	40	—	
t _{DH}	Data Hold Time	0	—	0	—	0	—	

AC TEST CONDITIONS

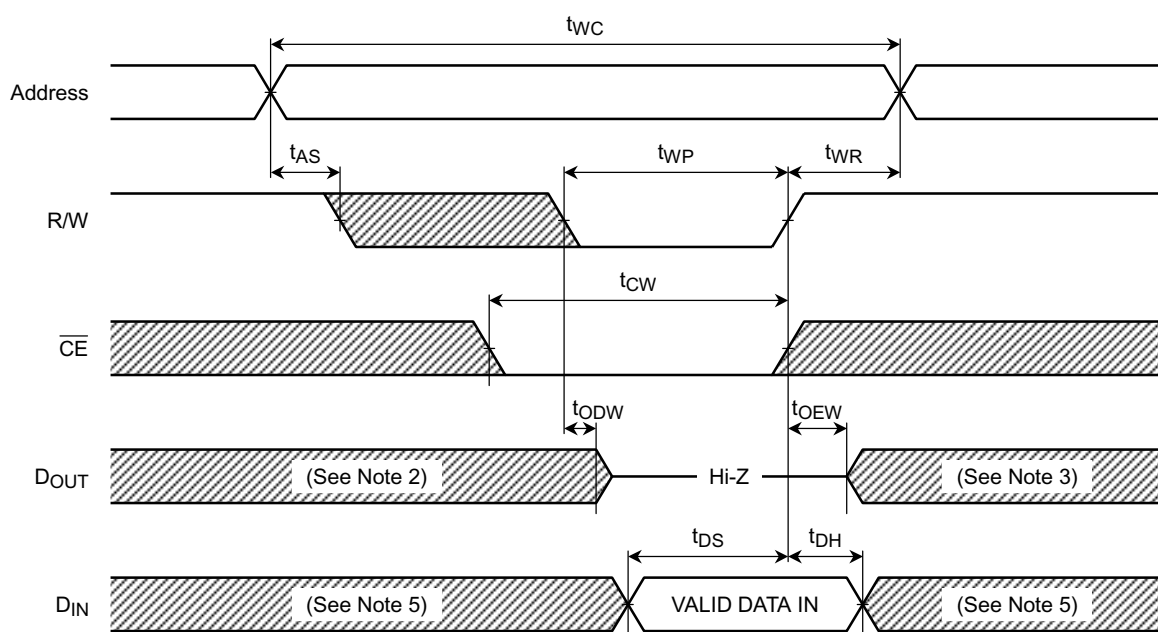
PARAMETER	TEST CONDITION
Output load	100 pF + 1 TTL Gate
Input pulse level	0.6 V, 2.4 V
Timing measurements	1.5 V
Reference level	1.5 V
t _R , t _F	5 ns

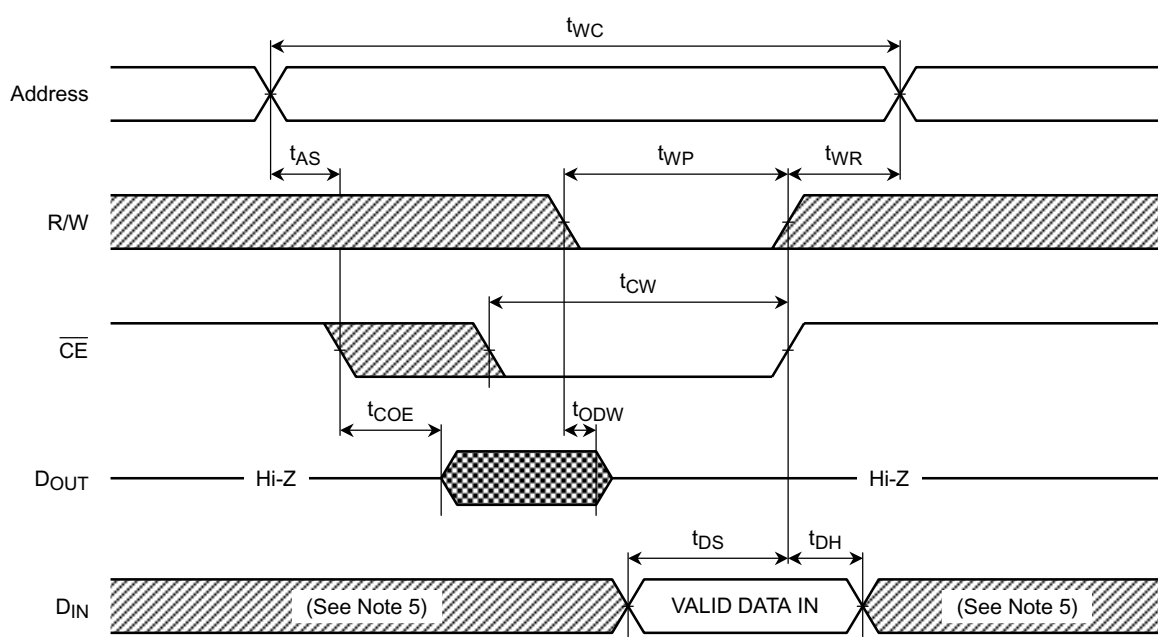
TIMING DIAGRAMS

READ CYCLE (See Note 1)



WRITE CYCLE 1 (R/W CONTROLLED) (See Note 4)



WRITE CYCLE 2 ($\overline{\text{CE}}$ CONTROLLED) (See Note 4)


Note:

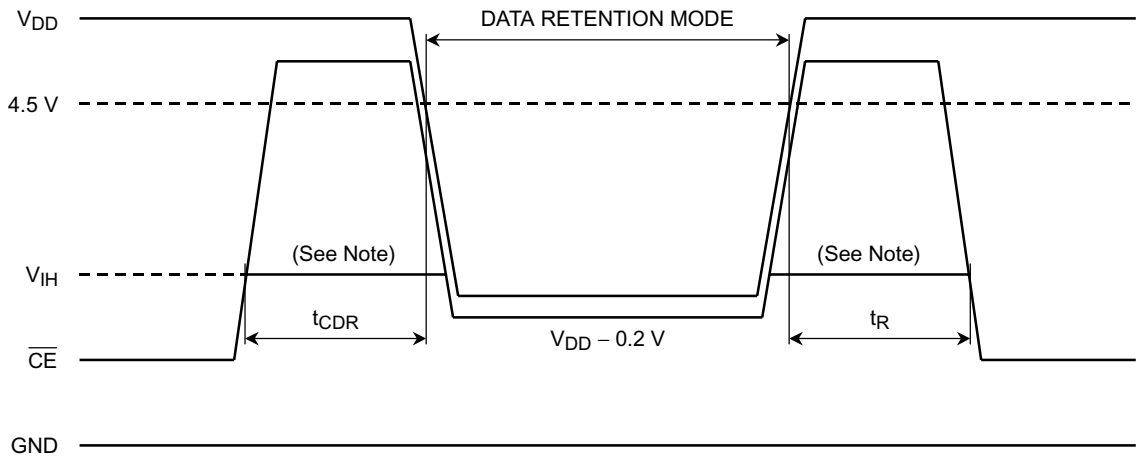
- (1) R/W remains HIGH for the read cycle.
- (2) If $\overline{\text{CE}}$ goes LOW coincident with or after R/W goes LOW, the outputs will remain at high impedance.
- (3) If $\overline{\text{CE}}$ goes HIGH coincident with or before R/W goes HIGH, the outputs will remain at high impedance.
- (4) If $\overline{\text{OE}}$ is HIGH during the write cycle, the outputs will remain at high impedance.
- (5) Because I/O signals may be in the output state at this time, input signals of reverse polarity must not be applied.

DATA RETENTION CHARACTERISTICS (Ta = 0° to 70°C)

SYMBOL	PARAMETER			MIN	TYP	MAX	UNIT
V _{DH}	Data Retention Supply Voltage			2.0	—	5.5	V
I _{DDS2}	Standby Current	-70,-85,-10	V _{DH} = 3.0 V	—	—	50	μA
			V _{DH} = 5.5 V	—	—	100	
		-70L,-85L,-10L	V _{DH} = 3.0 V	—	—	25*	
			V _{DH} = 5.5 V	—	—	50	
t _{CDR}	Chip Deselect to Data Retention Mode Time			0	—	—	ns
t _R	Recovery Time			5	—	—	ms

*: 5 μA (max) at Ta = 0° to 40°C

CE CONTROLLED DATA RETENTION MODE

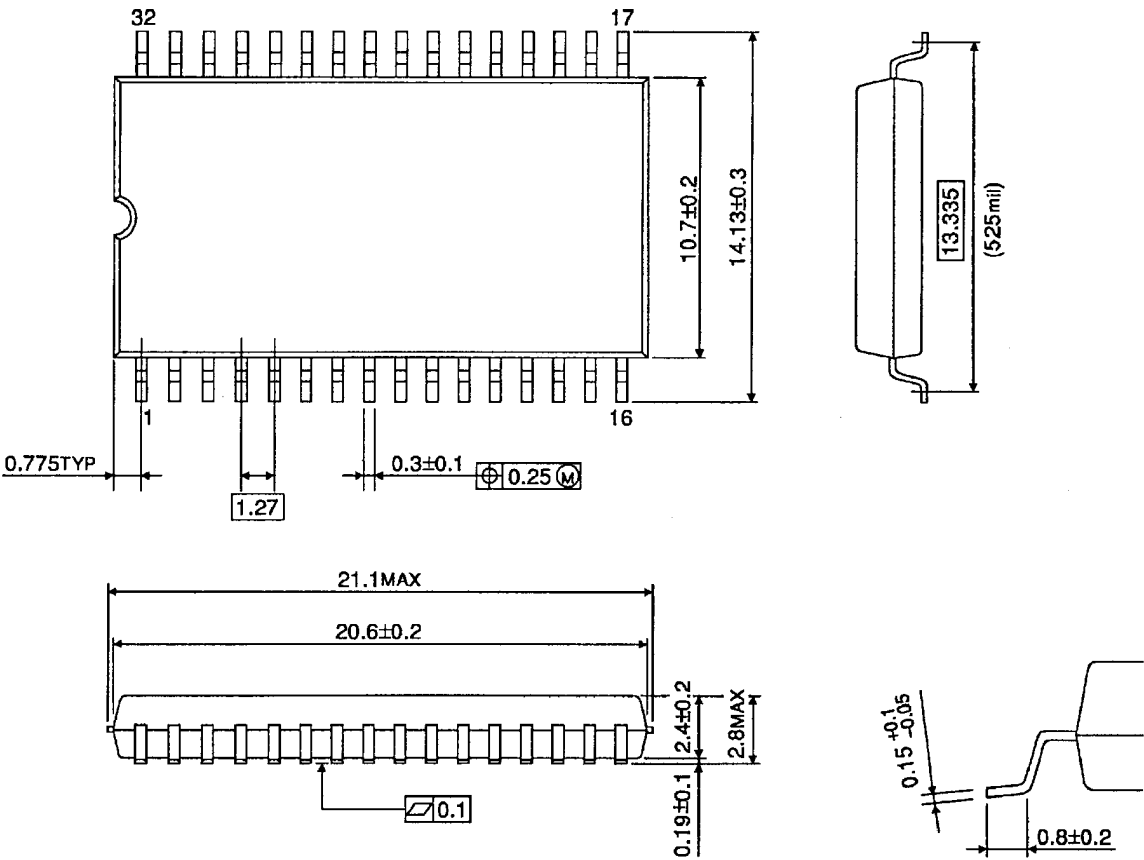


Note: When $\overline{CE}$ is operating at the V_{IH} level (2.2V), the standby current is given by I_{DDS1} during the transition of V_{DD} from 4.5 to 2.4V.

PACKAGE DIMENSIONS

SOP32-P-525-1.27

Unit : mm

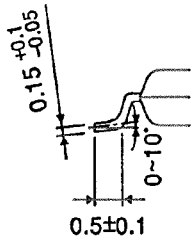
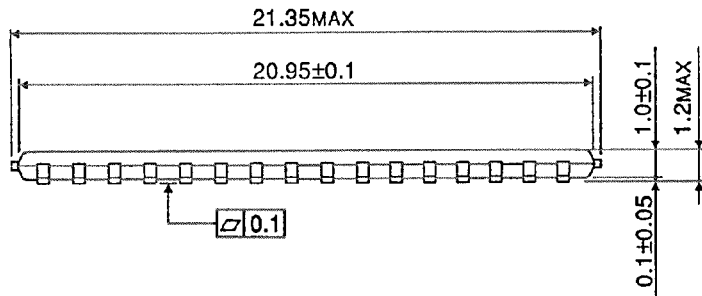
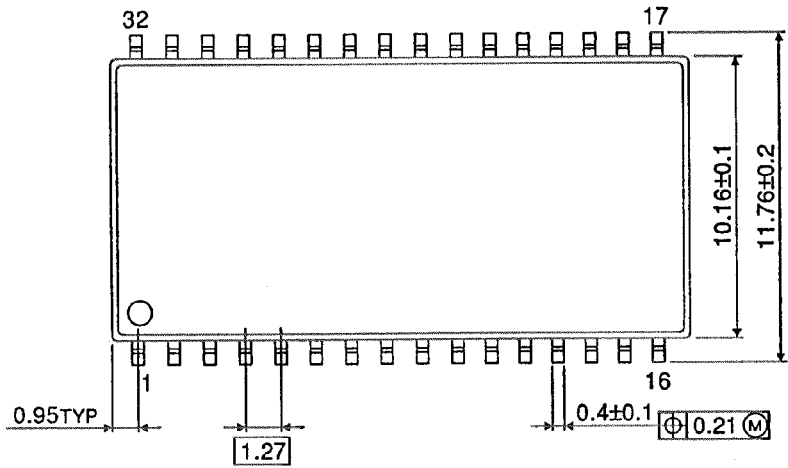


Weight: 1.14 g (typ)

PACKAGE DIMENSIONS

TSOPII32-P-400-1.27

Unit: mm

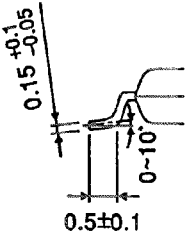
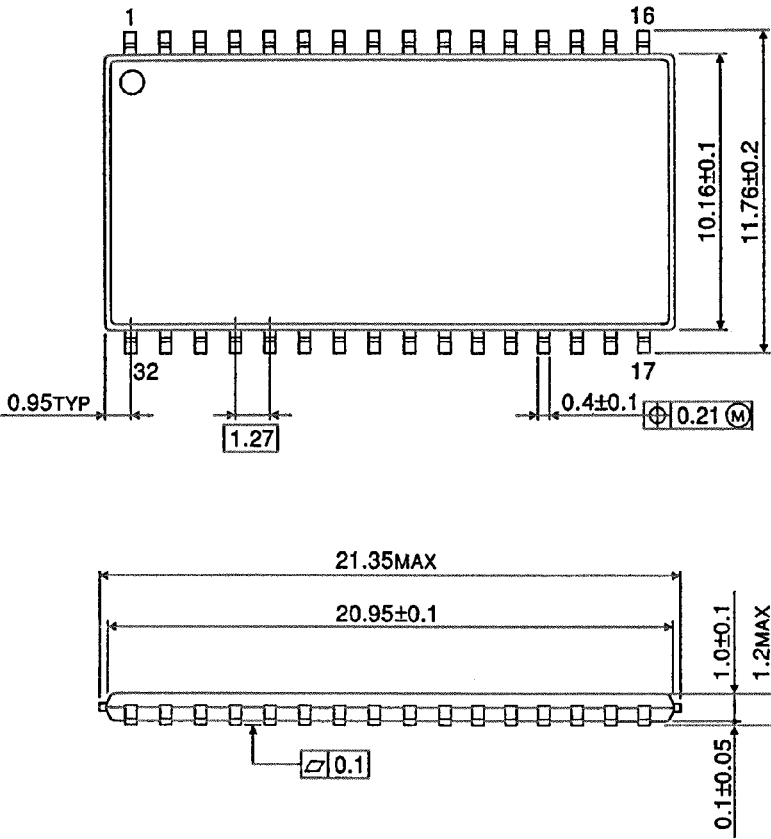


Weight: 0.53 g (typ)

PACKAGE DIMENSIONS

TSOPII32-P-400-1.27A

Unit: mm



Weight: 0.53 g (typ)

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