

TOSHIBA MOS DIGITAL INTEGRATED CIRCUIT SILICON GATE CMOS

524,288 WORDS × 8 BIT STATIC RAM

DESCRIPTION

The TC554001FL/FTL 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 10mA/MHz(typ) and minimum cycle time of 70 ns. It is automatically placed in low-power mode at 100 μ A standby current (max) 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 TC554001FL/FTL is available in a standard plastic 32-pin small-outline package(SOP) and 32-pin thin-small-outline package(TSOP).

FEATURES

- Low-power dissipation
Operating: 55 mW/MHz (typical)
- Standby current of 100 μ A (maximum)
- Single power supply voltage of $5V \pm 10\%$
- 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

- Access Time (maximum)

	TC554001FL/FTL		
	-70	-85	-10
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 (FL) (Weight: 1.14 g typ)
TSOP II 32-P-400-1.27 (FTL) (Weight: 0.51 g typ)

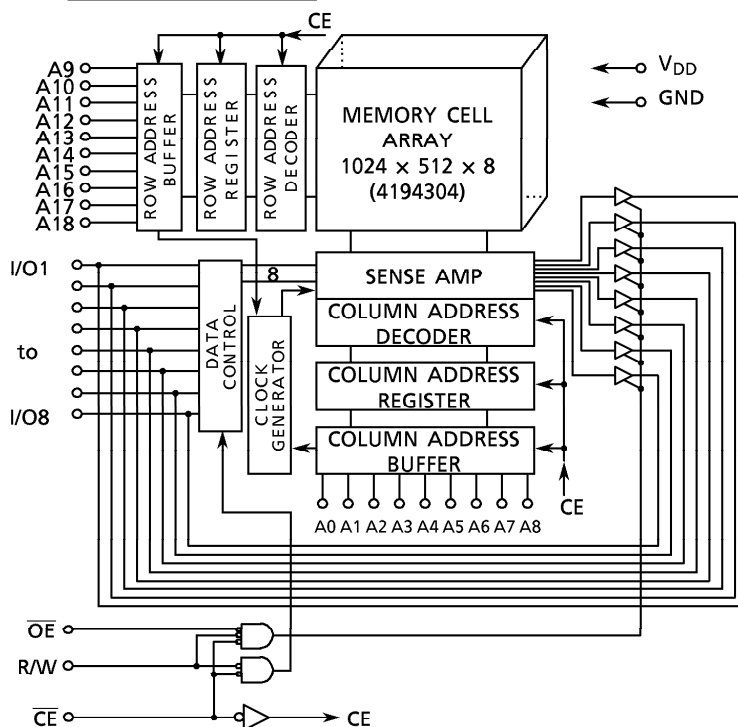
PIN ASSIGNMENT (TOP VIEW)

○ 32 PIN FL/FTL

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

PIN NAMES

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

BLOCK DIAGRAM

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OPERATION MODE

OPERATION MODE	$\overline{\text{CE}}$	$\overline{\text{OE}}$	R/W	I/O1 to I/O8	POWER
Read	L	L	H	D _{OUT}	I _{DDO}
Write	L	x	L	D _{IN}	I _{DDO}
Output Disabled	L	H	H	High-Z	I _{DDO}
Standby	H	x	x	High-Z	I _{DDS}

Note: x = don't care. H = logic high. L = logic low.

ABSOLUTE MAXIMUM RATINGS

SYMBOL	RATING	VALUE	UNIT
V _{DD}	Power Supply Voltage	- 0.3 to 7.0	V
V _{IN}	Input Voltage	- 0.3* to 7.0	V
V _{I/O}	Input and Output Voltage	- 0.5 to V _{DD} + 0.5	V
P _D	Power Dissipation	0.6	W
T _{solder}	Soldering Temperature (10 s)	260	°C
T _{strg.}	Storage Temperature	- 55 to 150	°C
T _{opr.}	Operating Temperature	0 to 70	°C

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

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	–	$V_{DD} + 0.3$	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 ($T_a = 0^\circ$ to 70°C , $V_{DD} = 5\text{ V} \pm 10\%$)

SYMBOL	PARAMETER	TEST CONDITION			MIN	TYP	MAX	UNIT
I _{IL}	Input Leakage Current	V _{IN} = 0 V to 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	CE = V _{IH} or R/W = V _{IL} or OE = V _{IH} V _{OUT} = 0 V to V _{DD}			–	–	± 1.0	μA
I _{DDO1}	Operating Current	CE = V _{IL} and R/W = V _{IH} I _{OUT} = 0 mA Other Inputs = V _{IH} /V _{IL}	Tcycle	min	–	–	80	mA
				1 μs	–	15	–	
I _{DDO2}		CE = 0.2 V and R/W = V _{DD} – 0.2 V I _{OUT} = 0 mA Other Inputs = V _{DD} – 0.2 V/0.2 V	Tcycle	min	–	–	70	mA
				1 μs	–	10	–	
I _{DDs1}	Standby Current	CE = V _{IH}			–	–	3	mA
I _{DDs2}		CE = V _{DD} – 0.2 V V _{DD} = 2.0 to 5.5 V, Ta = 0° to 70°C			–	–	100	μA

CAPACITANCE ($T_a = 25^\circ\text{C}$, $f = 1\text{ MHz}$)

SYMBOL	PARAMETER	TEST CONDITION	MAX	UNIT
C_{IN}	Input Capacitance	$V_{IN} = \text{GND}$	10	pF
C_{OUT}	Output Capacitance	$V_{OUT} = \text{GND}$	10	pF

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

AC CHARACTERISTICS AND OPERATING CONDITIONS ($T_a = 0^\circ$ to 70°C , $V_{DD} = 5\text{ V} \pm 10\%$)READ CYCLE

SYMBOL	PARAMETER	TC554001FL/FTL						UNIT
		-70		-85		-10		
		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 _{OEE}	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	TC554001FL/FTL						UNIT
		-70		-85		-10		
		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 Hige 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

Output Load: 30 pF + one TTL gate (-70)

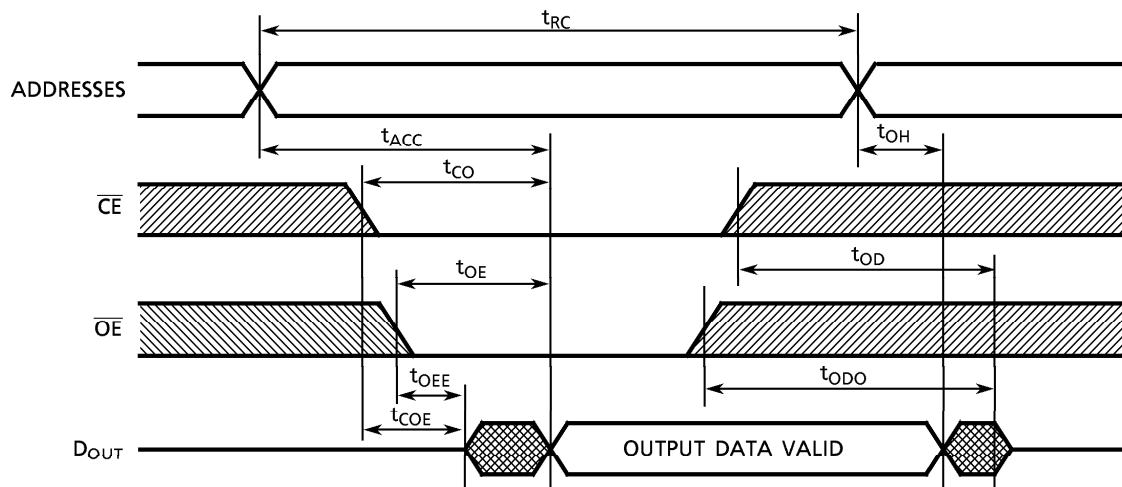
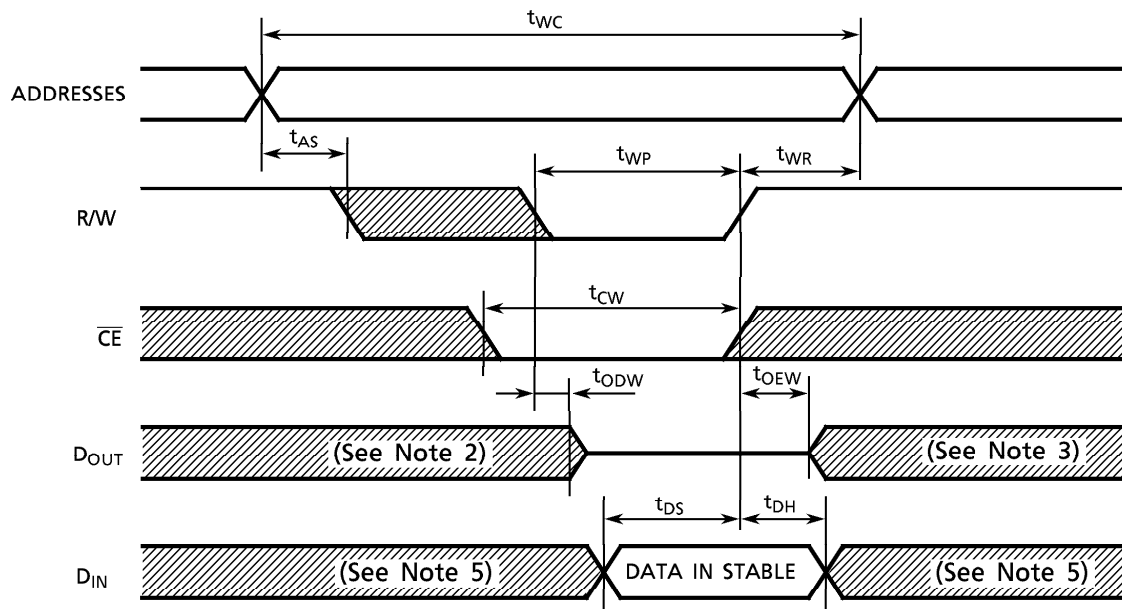
100 pF + one TTL gate (-85, -10)

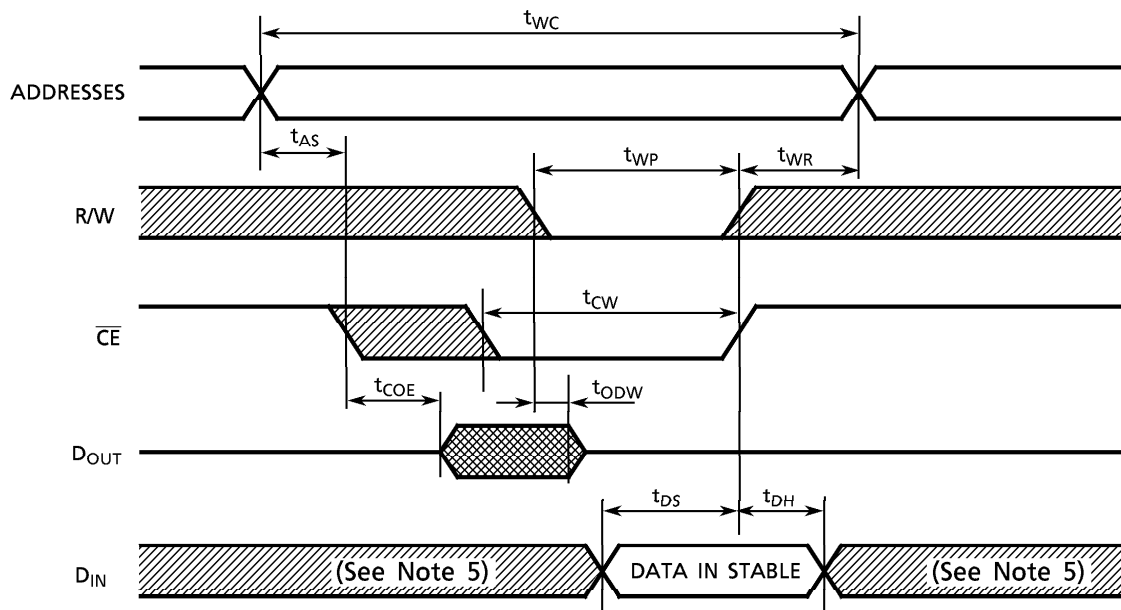
Input Pulse Level: 0.6 V, 2.4 V

Timing Measurements: 1.5 V

Reference Level: 1.5 V

 t_r, t_f : 5 ns

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

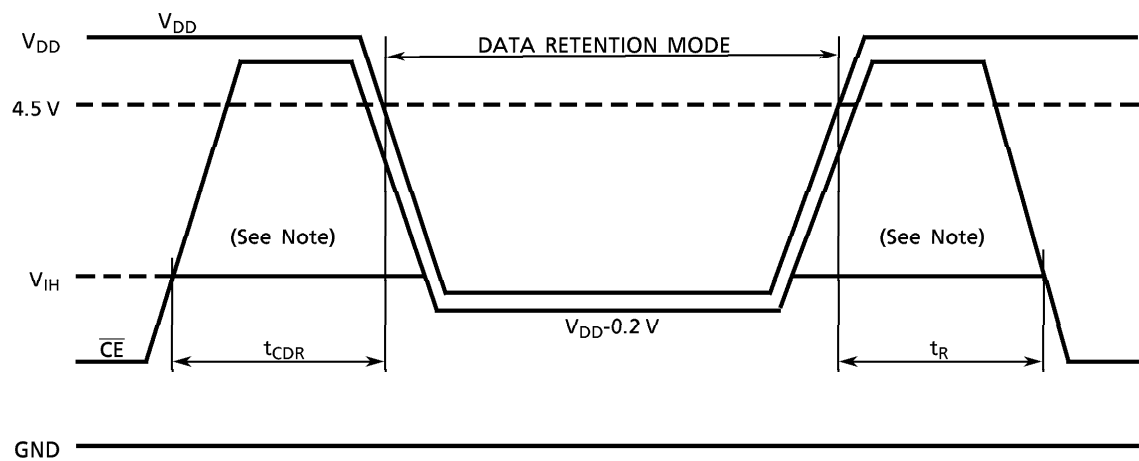
WRITE CYCLE 2 ($\overline{CE}$ CONTROLLED) (See Note 4)

- (1) R/W remains High for Read Cycle.
- (2) If $\overline{CE}$ goes coincident with or after R/W goes LOW, the output will remain at high impedance.
- (3) If $\overline{CE}$ goes HIGH coincident with or before R/W goes HIGH, the output will remain at high impedance.
- (4) IF $\overline{CE}$ 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	V _{DH} = 3.0 V	–	–	50	μA
		V _{DH} = 5.5 V	–	–	100	
t _{CDR}	Chip Deselect to Data Retention Mode Time		0	–	–	nS
t _R	Recovery Time		5	–	–	mS

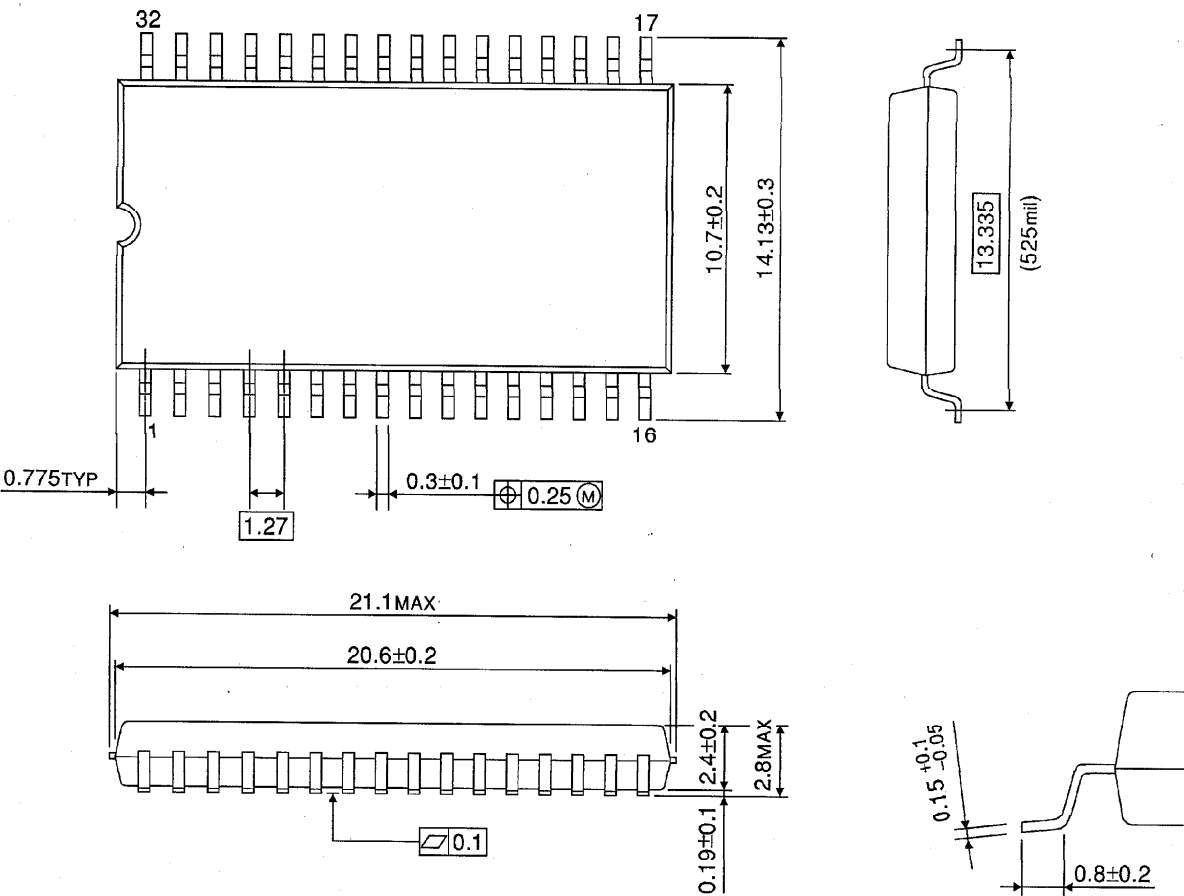
$\overline{CE}$ Controlled Data Retention Mode



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)

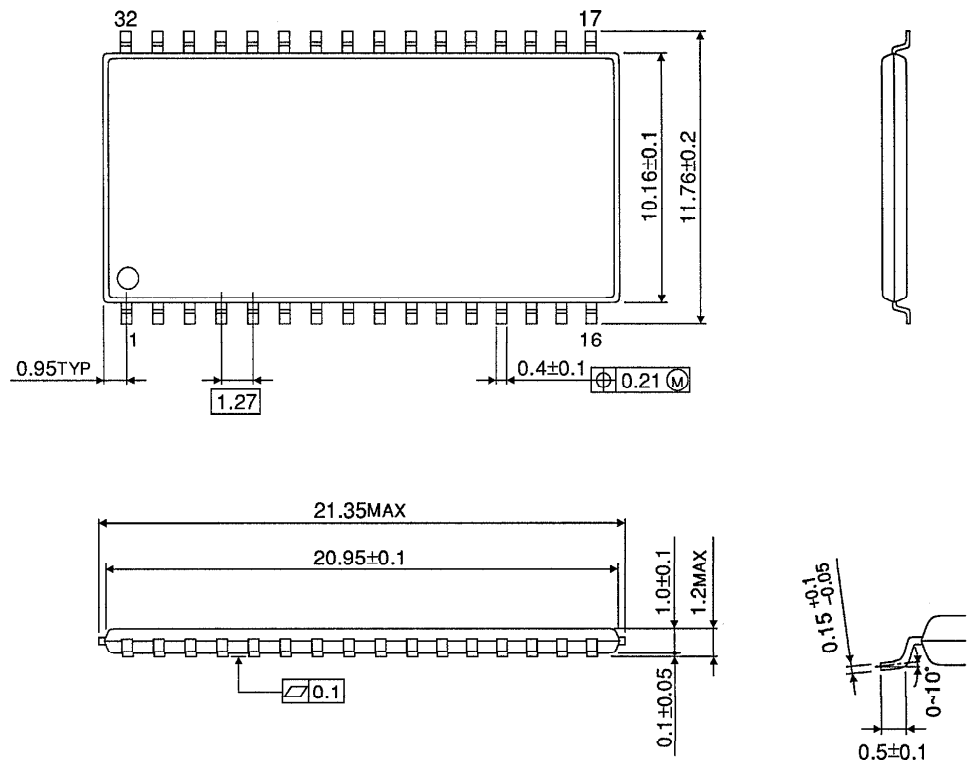
Unit in mm



Weight: 1.14 g (typ)

PACKAGE DIMENSIONS (TSOPII 32-P-400-1.27)

Unit in mm



Weight: 0.51 g (typ)