

524,288 WORDS × 8 BIT STATIC RAM

DESCRIPTION

The TC554001FI/FTI 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 ± 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 85 ns. It is automatically placed in low-power mode at 200 μA standby current (max) when chip enable (CE) is asserted high. There are two control inputs. CE is used to select the device and for data retention control, and output enable (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. And, with a guaranteed operating range of -40 to 85°C, the TC554001FI/FTI can be used in environments exhibiting extreme temperature conditions. The TC554001FI/FTI is available in a standard plastic 32-pin small-outline package(SOP) and 32-pin thin-small-outline package(TSOP).

FEATURES

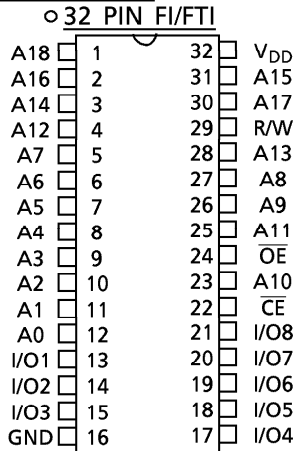
- Low-power dissipation
Operating: 55 mW/MHz (typical)
- Standby current of 200 μA (maximum)
- Single power supply voltage of 5 V ± 10 %
- Power down features using \overline{CE}
- Data retention supply voltage of 2.0 to 5.5 V
- Direct TTL compatibility for all inputs and outputs
- Wide operating temperature range of - 40° to 80°C

- Access Time (maximum)

| | TC551001FI/FTI | |
|----------------|----------------|--------|
| | -85 | -10 |
| Access Time | 85 ns | 100 ns |
| CE Access Time | 85 ns | 100 ns |
| OE Access Time | 45 ns | 50 ns |

- Package:
SOP32-P-525-1.27 (FI) (Weight: 1.14 g typ)
TSOP II 32-P-400-1.27 (FTI) (Weight: 0.51 g typ)

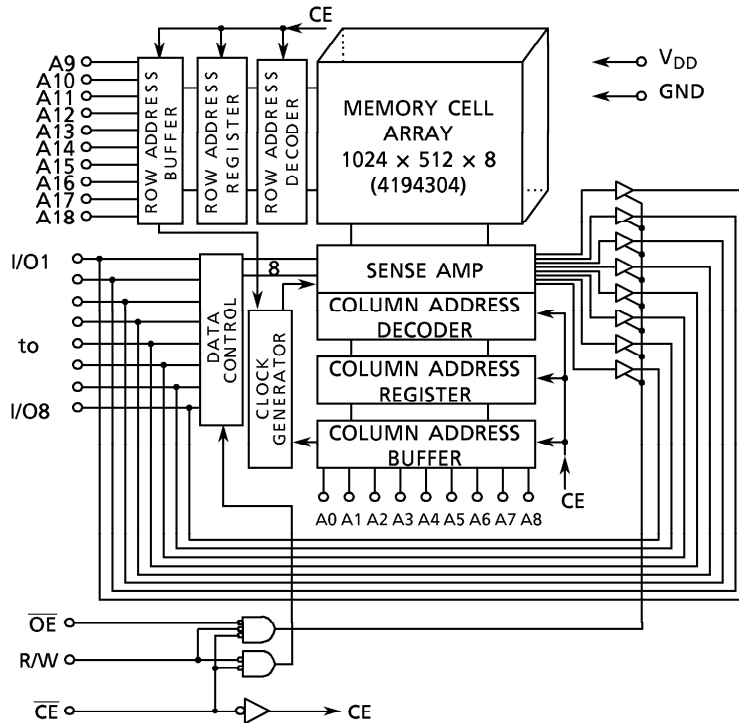
PIN ASSIGNMENT (TOP VIEW)



PIN NAMES

| | |
|-----------------|--------------------|
| A0 to A18 | Address Inputs |
| R/W | Read/Write Control |
| OE | Output Enable |
| 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{CE} | \overline{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 | - 40 to 85 | °C |

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

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

| SYMBOL | PARAMETER | MIN | TYP | MAX | UNIT |
|-----------------|-------------------------------|--------|-----|-----------------------|------|
| V _{DD} | Power Supply Voltage | 4.5 | 5.0 | 5.5 | V |
| V _{IH} | Input High Voltage | 2.4 | - | V _{DD} + 0.3 | V |
| V _{IL} | Input Low Voltage | - 0.3* | - | 0.6 | 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 = - 40° to 85 °C, V_{DD} = 5 V ± 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 | $\overline{CE} = V_{IH}$ or R/W = V _{IL} or $\overline{OE} = V_{IH}$ V _{OUT} = 0 V to V _{DD} | - | - | ± 1.0 | μA | | |
| I _{DDO1} | Operating Current | $\overline{CE} = V_{IL}$ and R/W = V _{IH} I _{OUT} = 0 mA Other Inputs = V _{IH} /V _{IL} | Tcycle | min | - | - | 80 | mA |
| | | | | 1 μs | - | 15 | - | |
| I _{DDO2} | Operating Current | $\overline{CE} = 0.2$ 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 | $\overline{CE} = V_{IH}$ | - | - | 3 | mA | | |
| I _{DDS2} | | $\overline{CE} = V_{DD} - 0.2$ V V _{DD} = 2.0 to 5.5 V, Ta = - 40° to 85°C | - | - | 200 | μA | | |

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 = - 40° to 85°C, VDD = 5 V ± 10%)

READ CYCLE

| SYMBOL | PARAMETER | TC554001FI/FTI | | | | UNIT |
|------------------|-------------------------------------|----------------|-----|-----|-----|------|
| | | -85 | | -10 | | |
| | | MIN | MAX | MIN | MAX | |
| t _{RC} | Read Cycle Time | 85 | – | 100 | – | ns |
| t _{ACC} | Address Access Time | – | 85 | – | 100 | |
| t _{CO} | Chip Enable Access Time | – | 85 | – | 100 | |
| t _{OE} | Output Enable Access Time | – | 45 | – | 50 | |
| t _{COE} | Chip Enable Low to Output Active | 5 | – | 5 | – | |
| t _{OOE} | Output Enable Low to Output Active | 0 | – | 0 | – | |
| t _{OD} | Chip Enable Hige to Output High-Z | – | 35 | – | 40 | |
| t _{ODO} | Output Enable Hige to Output High-Z | – | 35 | – | 40 | |
| t _{OH} | Output Data Hold Time | 10 | – | 10 | – | |

WRITE CYCLE

| SYMBOL | PARAMETER | TC554001FI/FTI | | | | UNIT |
|------------------|-----------------------------|----------------|-----|-----|-----|------|
| | | -85 | | -10 | | |
| | | MIN | MAX | MIN | MAX | |
| t _{WC} | Write Cycle Time | 85 | – | 100 | – | ns |
| t _{WP} | Write Pulse Width | 55 | – | 60 | – | |
| t _{CW} | Chip Enable to End of Write | 70 | – | 80 | – | |
| t _{AS} | Address Setup Time | 0 | – | 0 | – | |
| t _{WR} | Write Recovery Time | 0 | – | 0 | – | |
| t _{ODW} | R/W Low to Output High-Z | – | 35 | – | 40 | |
| t _{OEW} | R/W High to Output Active | 0 | – | 0 | – | |
| t _{DS} | Data Setup Time | 35 | – | 40 | – | |
| t _{DH} | Data Hold Time | 0 | – | 0 | – | |

AC TEST CONDITIONS

Output Load: 100 pF + one TTL gate

Input Pulse Level: 0.4 V, 2.6 V

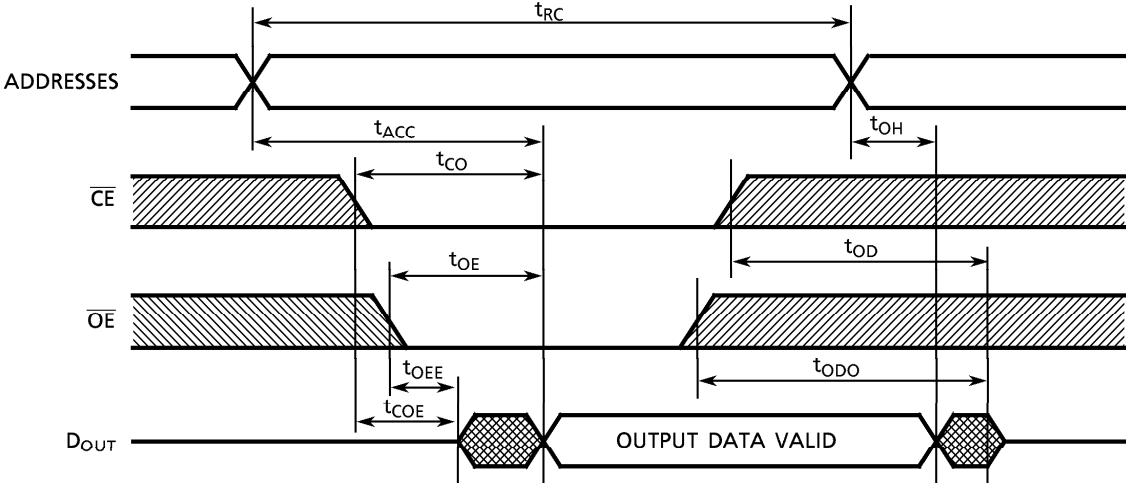
Timing Measurements: 1.5 V

Reference Level: 1.5 V

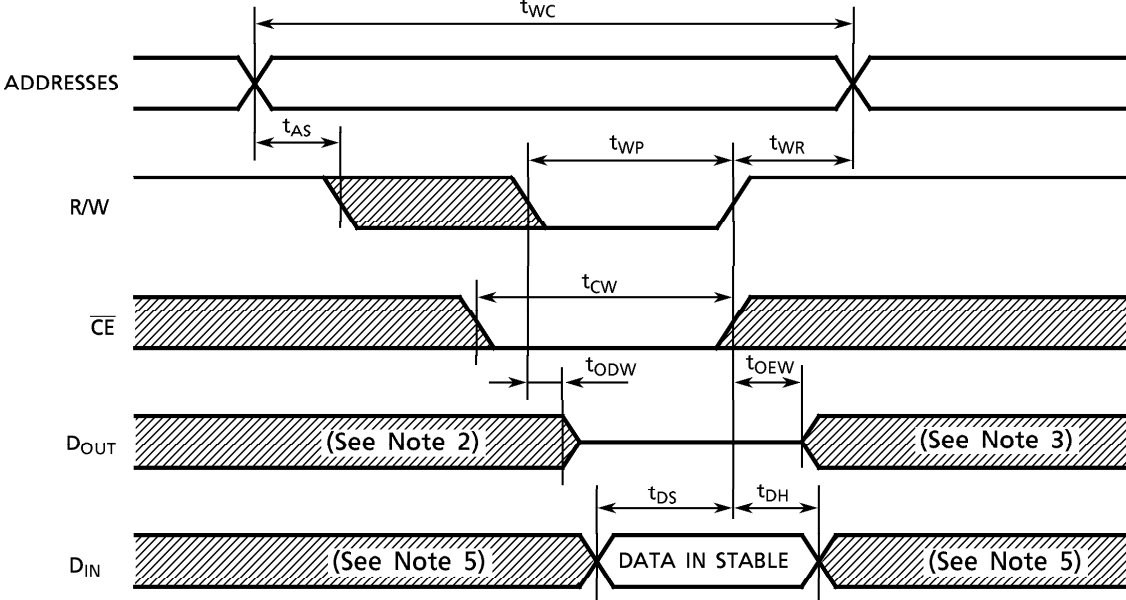
t_r, t_f: 5 ns

TIMING WAVEFORMS

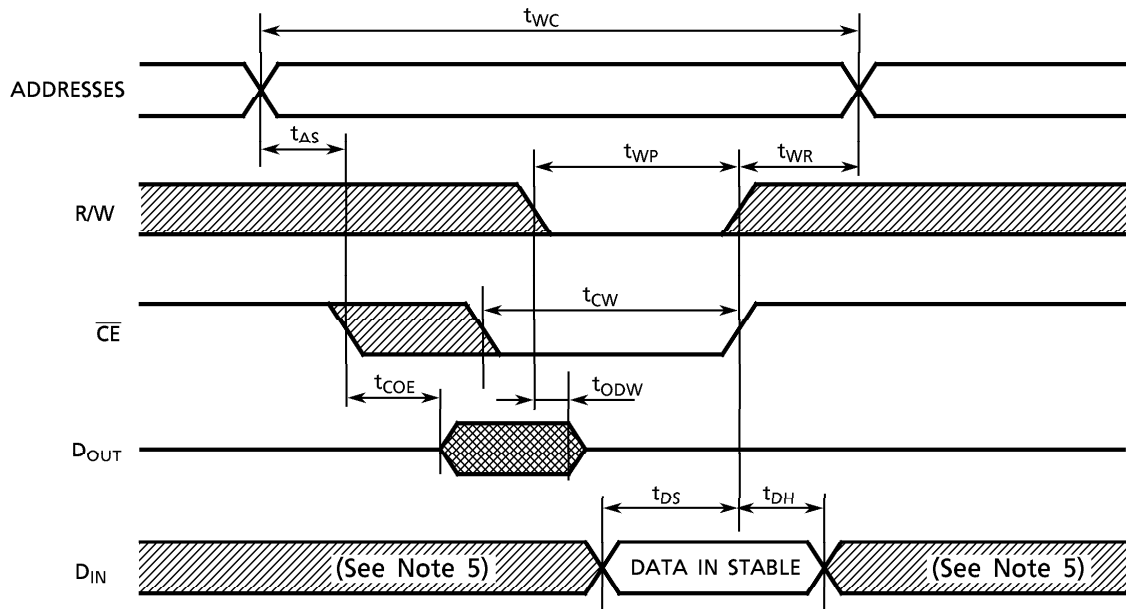
READ CYCLE (See Note 1)



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



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

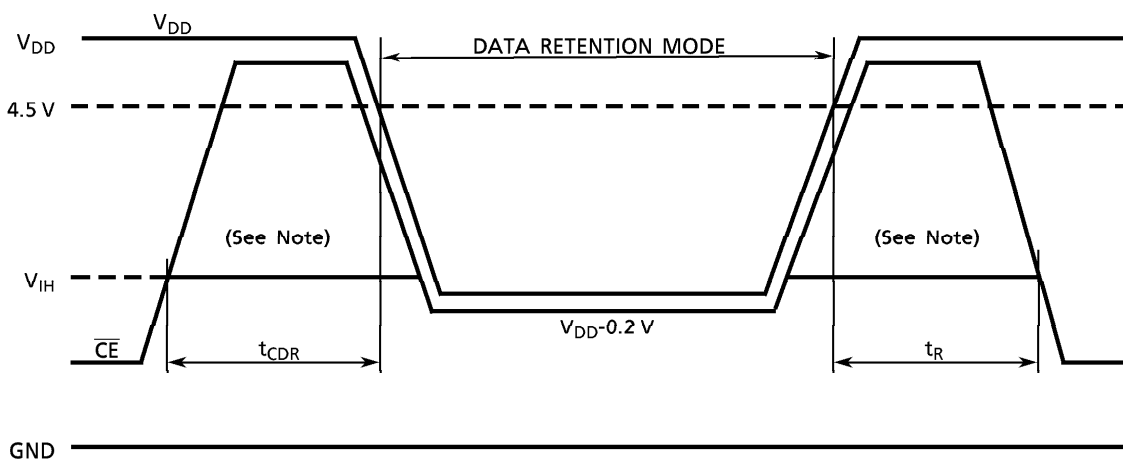


- (1) R/W remains High for Read Cycle.
- (2) If \overline{CE} goes coincident with or after R/W goes LOW, the output will remain at high impedance.
- (3) If \overline{CE} goes HIGH coincident with or before R/W goes HIGH, the output will remain at high impedance.
- (4) IF \overline{CE} is HIGH during 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 = - 40° to 85°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 | - | 100 | μA |
| | | V _{DH} = 5.5 V | - | 200 | |
| t _{CDR} | Chip Deselect to Data Retention Mode Time | 0 | - | - | nS |
| t _R | Recovery Time | 5 | - | - | mS |

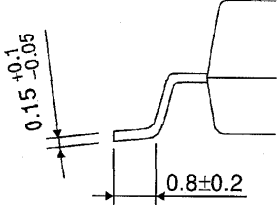
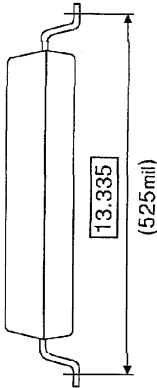
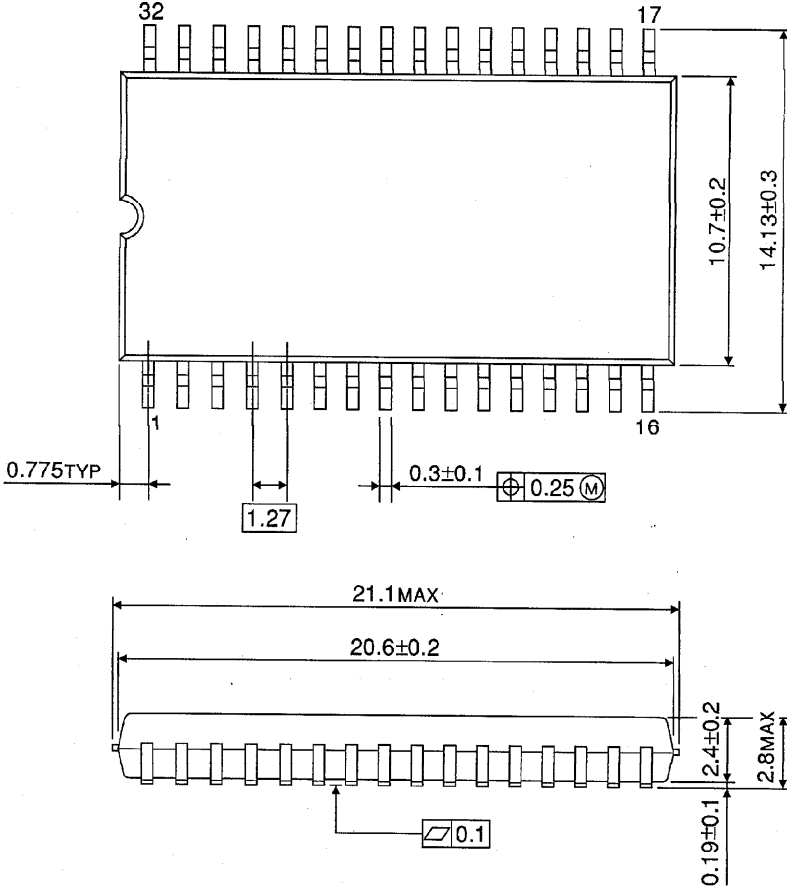
CE Controlled Data Retention Mode



Note: When \overline{CE} is operating at the V_{IH} level (2.4V), the standby current is given by I_{DDS1} during the transition of V_{DD} from 4.5 to 2.6V.

PACKAGE DIMENSIONS (SOP32-P-525-1.27)

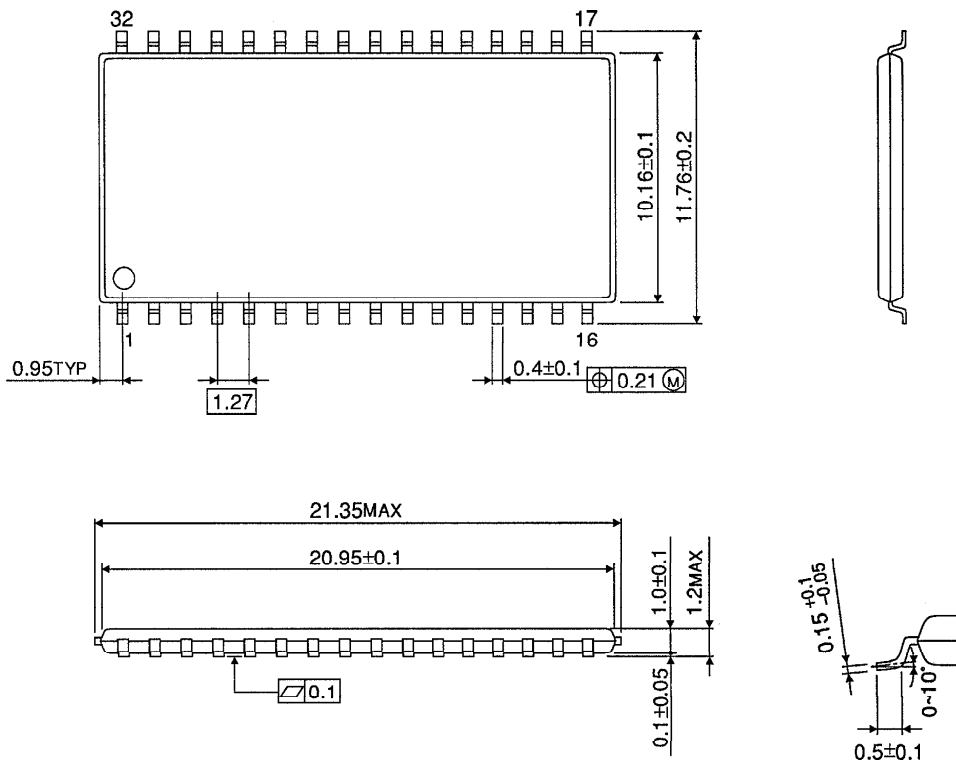
Unit in mm



Weight: 1.14 g (typ)

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

Unit in mm



Weight: 0.51g (typ)