

32,768-WORD BY 8-BIT STATIC RAM

DESCRIPTION

The TC55257DPL/DFL/DFTL/DTRL is a 262,144-bit static random access memory (SRAM) organized as 32,768 words by 8 bits. Fabricated using Toshiba's CMOS Silicon gate process technology, this device operates from a single 2.7 to 5.5 V power supply. Advanced circuit technology provides both high speed and low power at an operating current of 5 mA/MHz (typ) and a minimum cycle time of 55 ns. It is automatically placed in low-power mode at 0.3 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 TC55257DPL/DFL/DFTL/DTRL is available in a standard plastic 28-pin dual-in-line package (DIP), plastic 28-pin small-outline package (SOP) and normal and reverse pinout plastic 28-pin thin-small-outline package (TSOP).

FEATURES

- Low-power dissipation
Operating: 27.5 mW/MHz (typical)
- Standby current of 2 μ A (maximum) at $T_a = 25^\circ\text{C}$
- Single power supply voltage of 2.7 to 5.5 V
- Power down features using \overline{CE} .
- Data retention supply voltage of 2 to 5.5 V
- Direct TTL compatibility for all inputs and outputs

- Access Times (maximum):

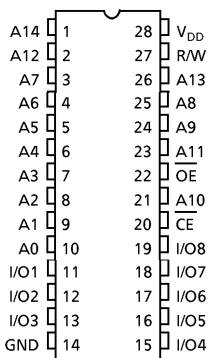
| | 5 V \pm 10% | | | 2.7 to 5.5 V | |
|-----------------------------|---------------|-------|-------|--------------|--------|
| | -55V | -70V | -85V | -55V/-70V | -85V |
| Access Time | 55 ns | 70 ns | 85 ns | 120 ns | 150 ns |
| \overline{CE} Access Time | 55 ns | 70 ns | 85 ns | 120 ns | 150 ns |
| \overline{OE} Access Time | 30 ns | 35 ns | 45 ns | 70 ns | 75 ns |

- Packages:

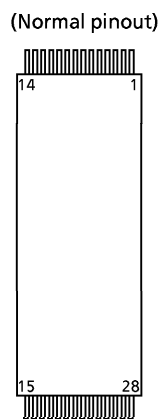
DIP28-P-600-2.54 (DPL) (Weight: 4.42 g typ)
 SOP28-P-450-1.27 (DFL) (Weight: 0.79 g typ)
 TSOP I 28-P-0.55 (DFTL) (Weight: 0.22 g typ)
 TSOP I 28-P-0.55A (DTRL) (Weight: 0.22 g typ)

PIN ASSIGNMENT (TOP VIEW)

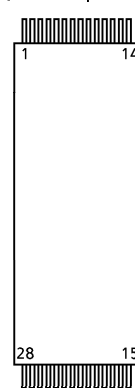
○ 28 PIN DIP & SOP



○ 28 PIN TSOP (Normal pinout)



(Reverse pinout)



PIN NAMES

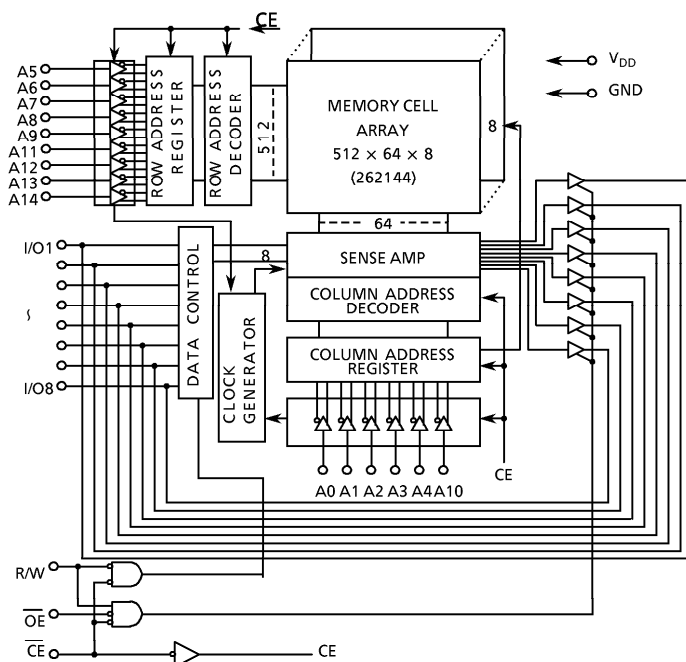
| | |
|-----------------|--------------------|
| A0 to A14 | Address Inputs |
| R/W | Read/Write Control |
| \overline{OE} | Output Enable |
| \overline{CE} | Chip Enable |
| I/O1 to I/O8 | Data Input/Output |
| V_{DD} | Power |
| GND | Ground |

| | | | | | | | | | | | | | | |
|----------|-----------------|-----------------|----------------|----------------|-----------------|------|----------|-----------------|-----------------|----------------|----------------|----------------|-----------------|-----------------|
| PIN NO. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 |
| PIN NAME | \overline{OE} | A ₁₁ | A ₉ | A ₈ | A ₁₃ | R/W | V_{DD} | A ₁₄ | A ₁₂ | A ₇ | A ₆ | A ₅ | A ₄ | A ₃ |
| PIN NO. | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 |
| PIN NAME | A ₂ | A ₁ | A ₀ | I/O1 | I/O2 | I/O3 | GND | I/O4 | I/O5 | I/O6 | I/O7 | I/O8 | \overline{CE} | A ₁₀ |

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BLOCK DIAGRAM



OPERATION MODE

| 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} |
| Outputs 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/Output Voltage | - 0.5* to V _{DD} + 0.5 | V |
| P _D | Power Dissipation | 1.0/0.6** | 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

** SOP

DC RECOMMENDED OPERATING CONDITIONS (Ta = 0° to 70°C)

| SYMBOL | PARAMETER | 5 V ± 10% | | | 2.7 to 5.5 V | | | UNIT |
|-----------------|-------------------------------|-----------|-----|-----------------------|-----------------------|-----|-----------------------|------|
| | | MIN | TYP | MAX | MIN | TYP | MAX | |
| V _{DD} | Power Supply Voltage | 4.5 | - | 5.5 | 2.7 | - | 5.5 | V |
| V _{IH} | Input High Voltage | 2.2 | - | V _{DD} + 0.3 | V _{DD} - 0.2 | - | V _{DD} + 0.3 | |
| V _{IL} | Input Low Voltage | - 0.3* | - | 0.8 | - 0.3* | - | 0.2 | |
| V _{DH} | Data Retention Supply Voltage | 2.0 | - | 5.5 | 2.0 | - | 5.5 | |

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

DC CHARACTERISTICS (Ta = 0° to 70°C, V_{DD} = 3 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 | 4.0 | - | - | 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 | $\overline{CE} = V_{IL}$ R/W = V _{IH} Other Inputs = V _{IH} /V _{IL} I _{OUT} = 0 mA | t _{cycle} = 1 μs | - | 10 | - | mA |
| | | | t _{cycle} = min | - | - | 70 | |
| I _{DDO2} | Operating Current | $\overline{CE} = 0.2 V$ R/W = V _{DD} - 0.2 V Other Inputs = V _{DD} - 0.2 V/0.2 V I _{OUT} = 0 mA | t _{cycle} = 1 μs | - | 5 | - | mA |
| | | | t _{cycle} = min | - | - | 60 | |
| I _{DDS1} | Standby Current | $\overline{CE} = V_{IH}$ | - | - | 3 | mA | |
| I _{DDS2} | Standby Current | $\overline{CE} = V_{DD} - 0.2 V$ | Ta = 0° to 70°C | - | - | 20 | μA |
| | | V _{DD} = 2.0 to 5.5 V | Ta = 25°C | - | 0.3 | 2 | μA |

DC CHARACTERISTICS (Ta = 0° to 70°C, VDD = 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} = V _{DD} - 0.2 V | | - 0.1 | - | - | mA | |
| I _{OL} | Output Low Current | V _{OL} = 0.2 V | | 0.1 | - | - | 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 _{DDO2} | Operating Current | $\overline{CE} = 0.2$ V R/W = V _{DD} - 0.2 V, I _{OUT} = 0 mA Other Inputs = V _{DD} - 0.2 V/0.2 V | T _{cycle} | min | - | - | 20 | mA |
| | | | | 1 μs | - | - | 5 | |
| I _{DSS2} | Standby Current | $\overline{CE} = V_{DD} - 0.2$ V | V _{DD} = 3 V ± 10% | Ta = 25°C | - | 1 | 1.5 | μA |
| | | | | Ta = 0° to 70°C | - | - | 15 | |
| | | | | Ta = 25°C | - | - | 1 | |
| | | | | Ta = 0° to 40°C | - | - | 2 | |
| | | | | Ta = 0° to 70°C | - | - | 10 | |

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 | |

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

AC CHARACTERISTICS AND OPERATING CONDITIONS (Ta = 0° to 70°C, V_{DD} = 5 V ± 10%)READ CYCLE

| SYMBOL | PARAMETER | TC55257DPL/DFL/DFTL/DTRL | | | | | | UNIT |
|------------------|-------------------------------------|--------------------------|-----|------|-----|------|-----|------|
| | | -55V | | -70V | | -85V | | |
| | | MIN | MAX | MIN | MAX | MIN | MAX | |
| t _{RC} | Read Cycle Time | 55 | – | 70 | – | 85 | – | ns |
| t _{ACC} | Address Access Time | – | 55 | – | 70 | – | 85 | |
| t _{CO} | Chip Enable Access Time | – | 55 | – | 70 | – | 85 | |
| t _{OE} | Output Enable Access Time | – | 30 | – | 35 | – | 45 | |
| 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 | – | 20 | – | 25 | – | 30 | |
| t _{ODO} | Output Enable High to Output High-Z | – | 20 | – | 25 | – | 30 | |
| t _{OH} | Output Data Hold Time | 10 | – | 10 | – | 10 | – | |

WRITE CYCLE

| SYMBOL | PARAMETER | TC55257DPL/DFL/DFTL/DTRL | | | | | | UNIT |
|------------------|-----------------------------|--------------------------|-----|------|-----|------|-----|------|
| | | -55V | | -70V | | -85V | | |
| | | MIN | MAX | MIN | MAX | MIN | MAX | |
| t _{WC} | Write Cycle Time | 55 | – | 70 | – | 85 | – | ns |
| t _{WP} | Write Pulse Width | 45 | – | 50 | – | 60 | – | |
| t _{CW} | Chip Enable to End of Write | 50 | – | 60 | – | 65 | – | |
| 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 | – | 20 | – | 25 | – | 30 | |
| t _{OEW} | R/W High to Output Active | 5 | – | 5 | – | 5 | – | |
| t _{DS} | Data Setup Time | 25 | – | 30 | – | 40 | – | |
| t _{DH} | Data Hold Time | 0 | – | 0 | – | 0 | – | |

AC TEST CONDITIONS

Output load: 30 pF + one TTL gate (-55V)

100 pF + one TTL gate (-70L, -85L)

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

AC CHARACTERISTICS AND OPERATING CONDITIONS ($T_a = 0^\circ$ to 70°C , $V_{DD} = 2.7$ to 5.5 V)READ CYCLE

| SYMBOL | PARAMETER | TC55257DPL/DFL/DFTL/DTRL | | | | UNIT |
|-----------|-------------------------------------|--------------------------|-----|------|-----|------|
| | | -55V/-70V | | -85V | | |
| | | MIN | MAX | MIN | MAX | |
| t_{RC} | Read Cycle Time | 120 | - | 150 | - | ns |
| t_{ACC} | Address Access Time | - | 120 | - | 150 | |
| t_{CO} | Chip Enable Access Time | - | 120 | - | 150 | |
| t_{OE} | Output Enable Access Time | - | 70 | - | 75 | |
| t_{COE} | Chip Enable Low to Output Active | 10 | - | 10 | - | |
| t_{OEE} | Output Enable Low to Output Active | 5 | - | 5 | - | |
| t_{OD} | Chip Enable High to Output High-Z | - | 50 | - | 50 | |
| t_{ODO} | Output Enable High to Output High-Z | - | 50 | - | 50 | |
| t_{OH} | Output Data Hold Time | 10 | - | 10 | - | |

WRITE CYCLE

| SYMBOL | PARAMETER | TC55257DPL/DFL/DFTL/DTRL | | | | UNIT |
|-----------|-----------------------------|--------------------------|-----|------|-----|------|
| | | -55V/-70V | | -85V | | |
| | | MIN | MAX | MIN | MAX | |
| t_{WC} | Write Cycle Time | 120 | - | 150 | - | ns |
| t_{WP} | Write Pulse Width | 80 | - | 100 | - | |
| t_{CW} | Chip Enable to End of Write | 100 | - | 120 | - | |
| t_{AS} | Address Setup Time | 0 | - | 0 | - | |
| t_{WR} | Write Recovery Time | 0 | - | 0 | - | |
| t_{ODW} | R/W Low to Output High-Z | - | 50 | - | 50 | |
| t_{OEW} | R/W High to Output Active | 5 | - | 5 | - | |
| t_{DS} | Data Setup Time | 50 | - | 60 | - | |
| t_{DH} | Data Hold Time | 0 | - | 0 | - | |

AC TEST CONDITIONS

Output load: 100 pF (including jig)

Input pulse level: 0.2 V, $V_{DD} - 0.2\text{ V}$

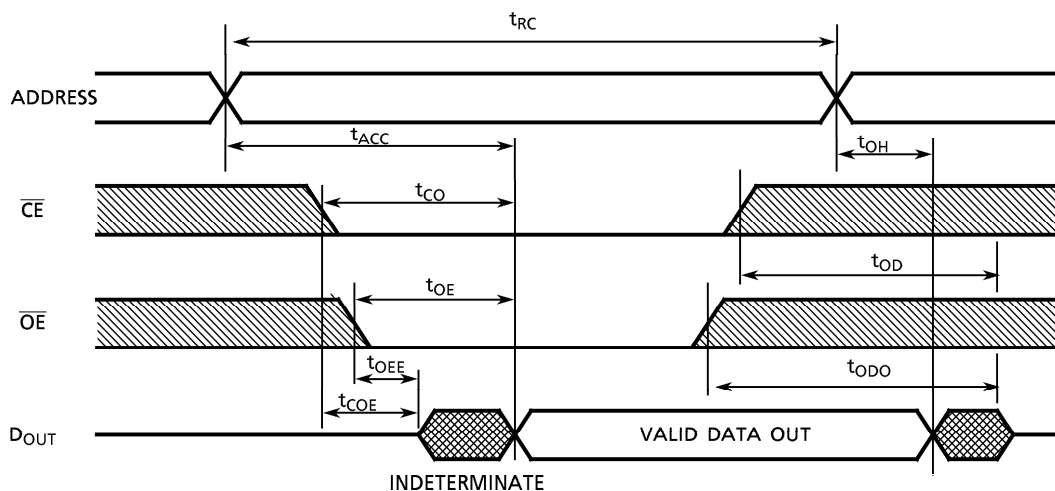
Timing measurements: 1.5 V

Reference level: 1.5 V

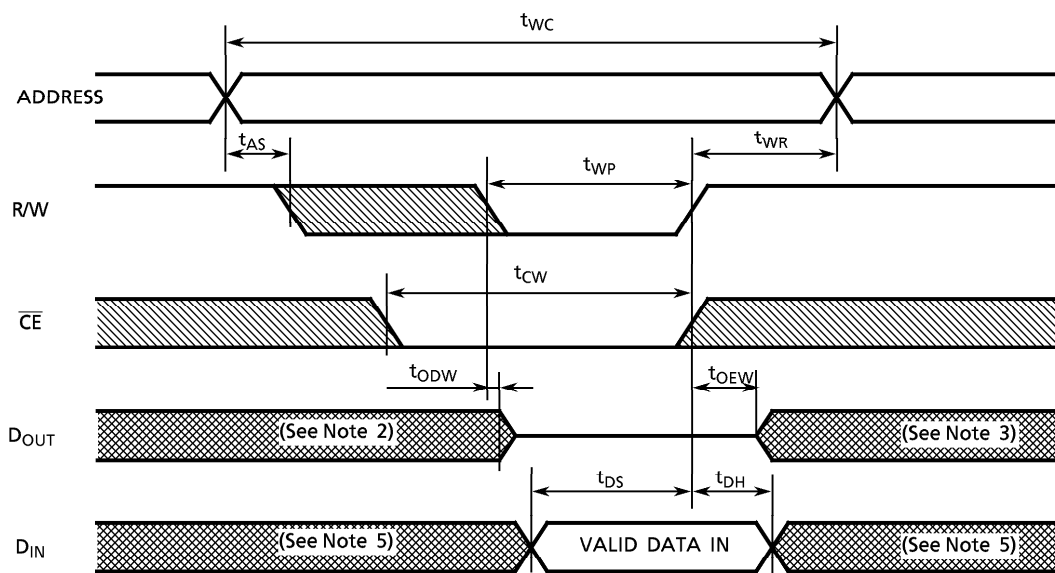
 t_R, t_F : 5 ns

TIMING DIAGRAMS

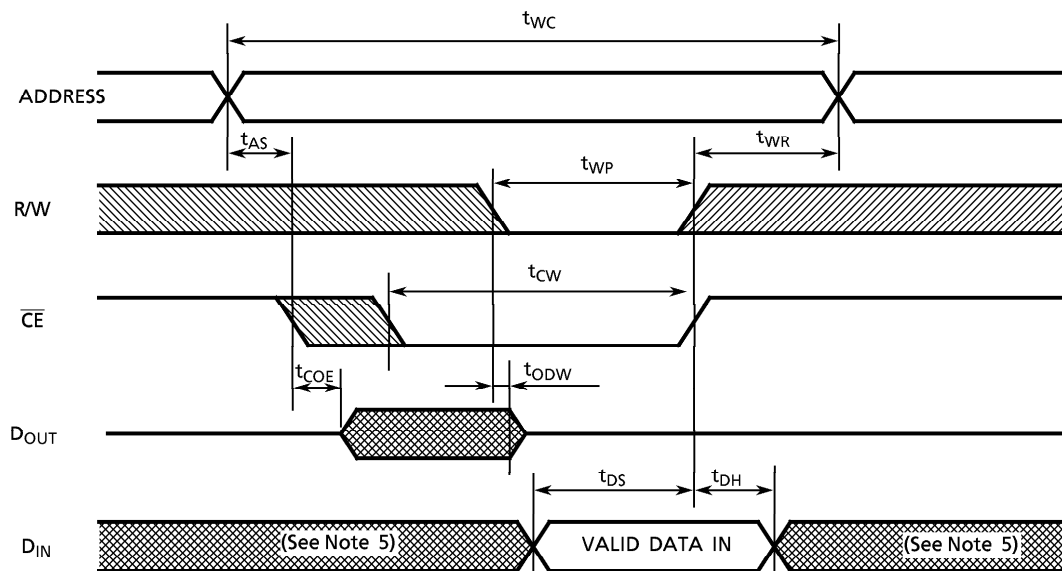
READ CYCLE (See Note 1)



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



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



Note: (1) R/W remains HIGH for the read cycle.

- (2) If \overline{CE} goes LOW coincident with or after R/W goes LOW, the outputs will remain at high impedance.
- (3) If \overline{CE} goes HIGH coincident with or before R/W goes HIGH, the outputs will remain at high impedance.
- (4) If \overline{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.

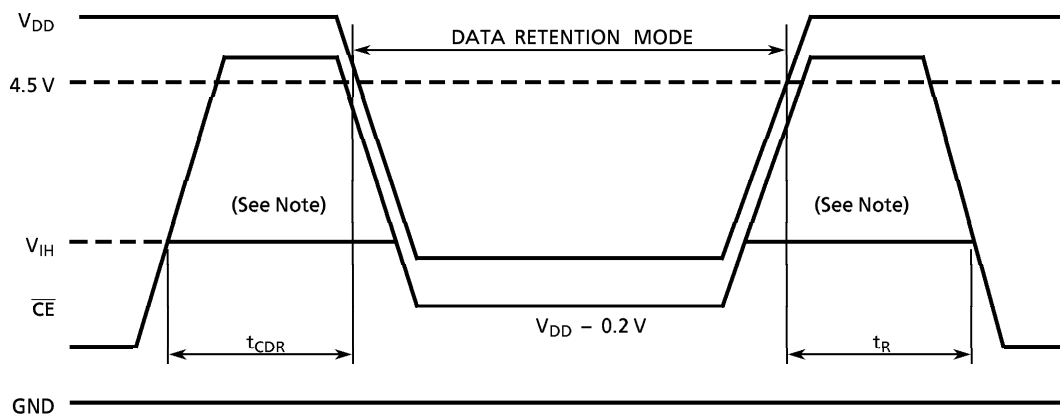
DATA RETENTION CHARACTERISTICS (Ta = 0° to 70°C)

| SYMBOL | PARAMETER | MIN | TYP | MAX | UNIT |
|-------------------|---|----------------------------|-----|-----|------|
| V _{DH} | Data Retention Supply Voltage | 2.0 | - | 5.5 | V |
| I _{DDs2} | Standby Current | V _{DH} = 3.0 V | - | 10* | μA |
| | | V _{DH} = 5.5 V | - | 20 | |
| t _{CDR} | Chip Deselect to Data Retention Mode Time | 0 | - | - | ns |
| t _R | Recovery Time | t _{RC} (See Note) | - | - | |

* 2 μA (max) at Ta = 0° to 40°C

Note: Read cycle time.

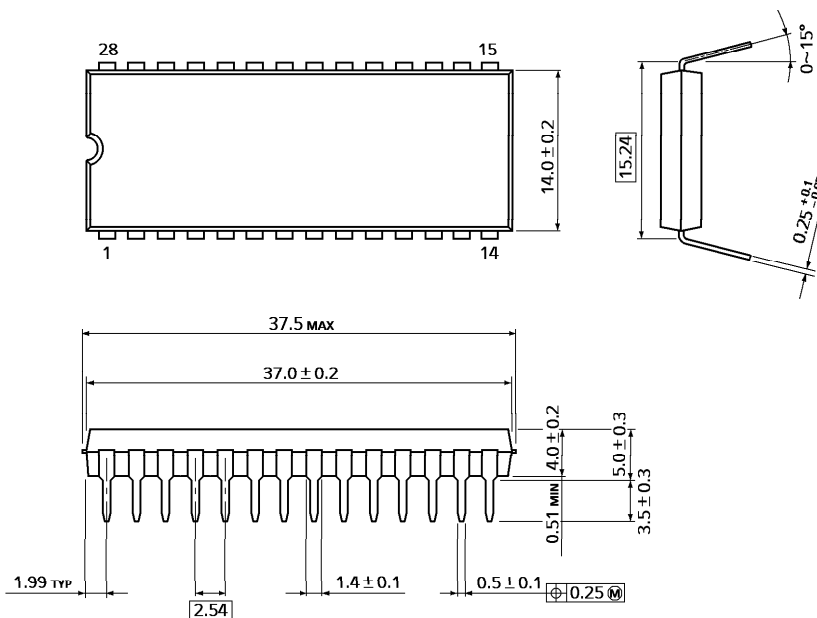
CE CONTROLLED DATA RETENTION MODE



Note: When \overline{CE} is operating at the V_{IH} level (2.2 V), the standby current is given by I_{DDs1} during the transition of V_{DD} from 4.5 to 2.4 V.

PACKAGE DIMENSIONS (DIP28-P-600-2.54)

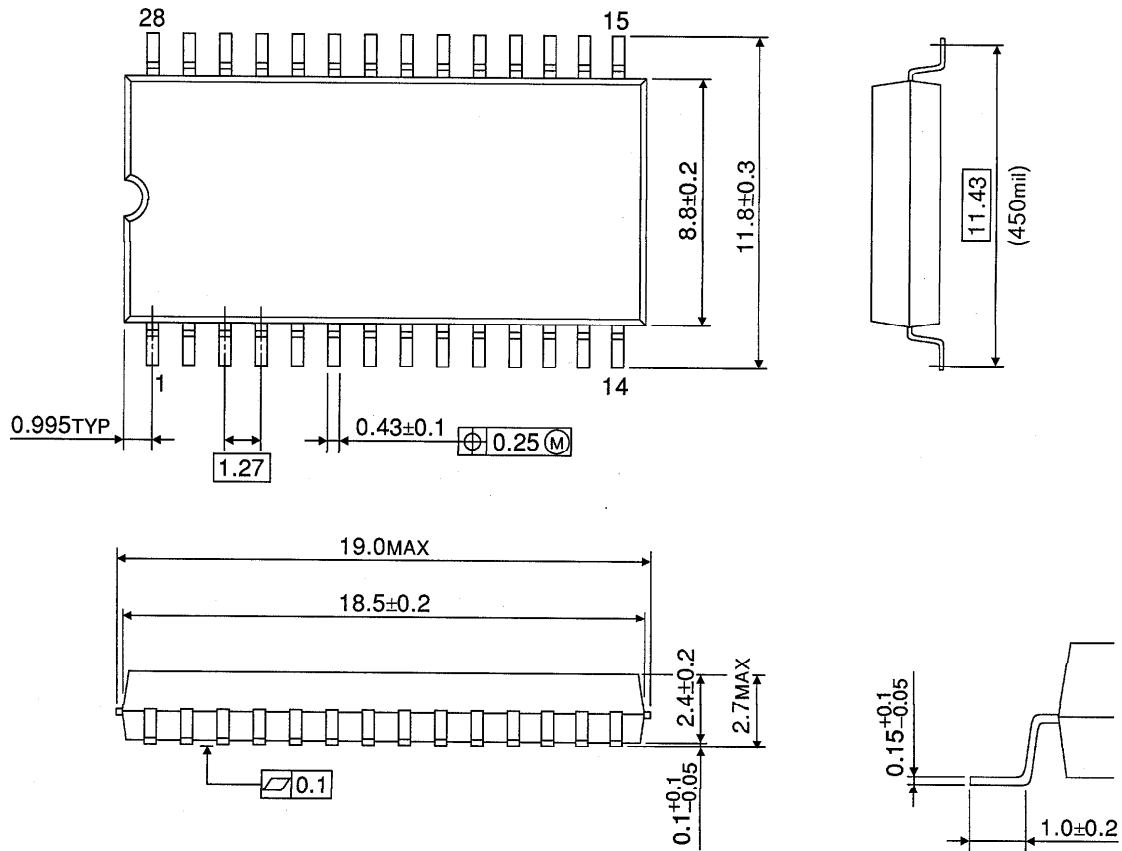
Units in mm



Weight: 4.42 g (typ)

PACKAGE DIMENSIONS (SOP28-P-450-1.27)

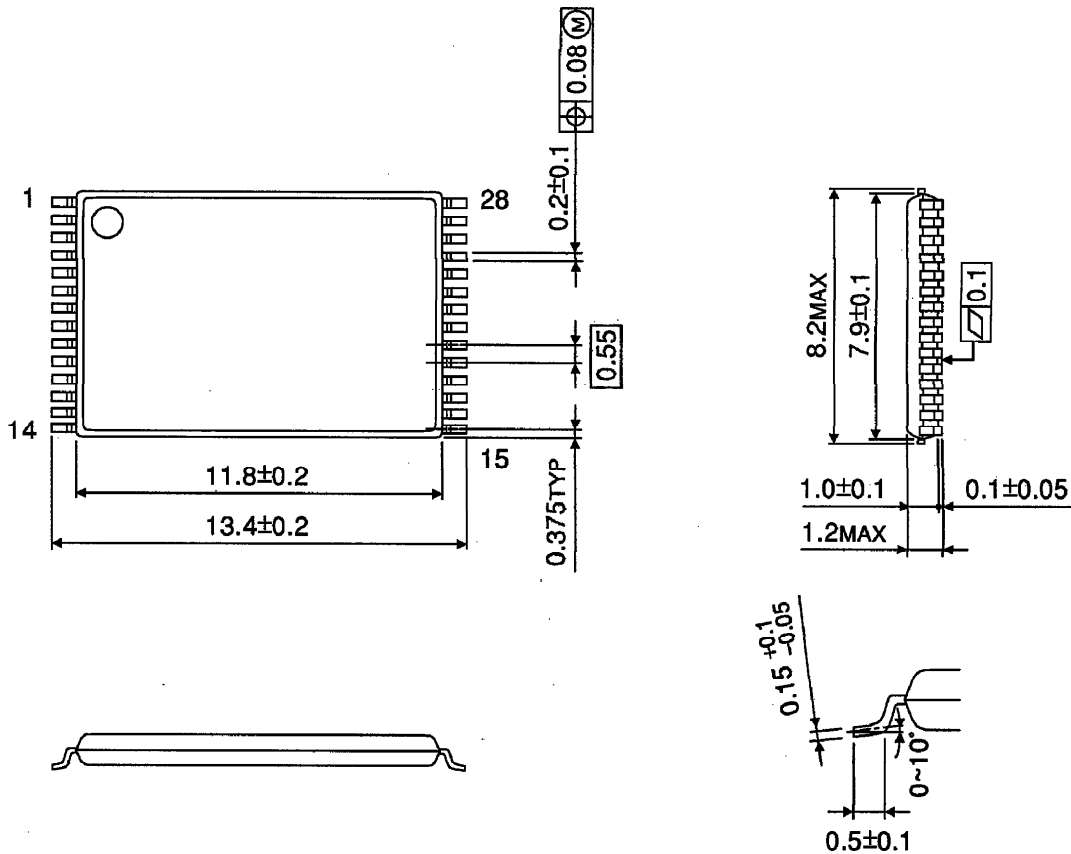
Units in mm



Weight: 0.79 g (typ)

PACKAGE DIMENSIONS (TSOP I 28-P-0.55)

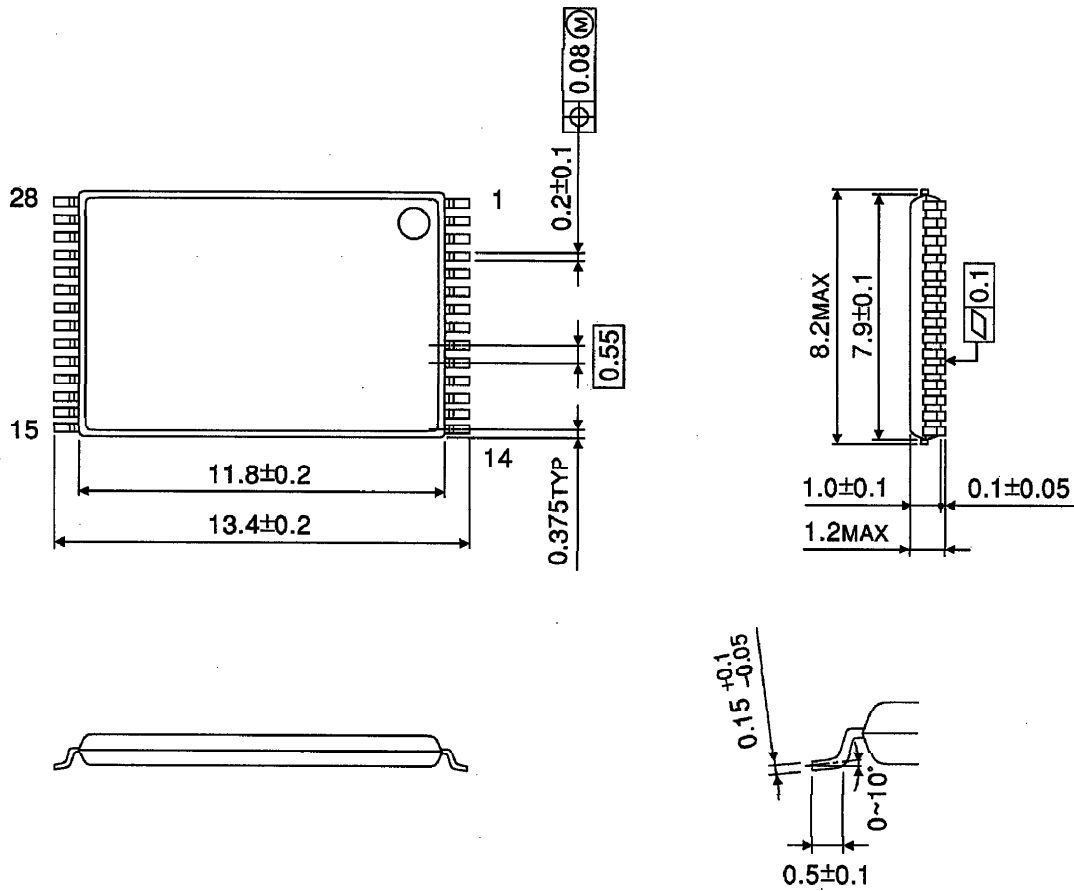
Units in mm



Weight: 0.22 g (typ)

PACKAGE DIMENSIONS (TSOP I 28-P-0.55A)

Units in mm



Weight: 0.22 g (typ)