

**TOSHIBA****TC55257DPL/DFL/DFTL/DTRL-55L,-70L,-85L**

TOSHIBA MOS DIGITAL INTEGRATED CIRCUIT SILICON GATE CMOS

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  $5\text{ V} \pm 10\%$  power supply. Advanced circuit technology provides both high speed and low power at an operating current of  $5\text{ mA/MHz}$  (typ) and a minimum cycle time of  $55\text{ ns}$ . It is automatically placed in low-power mode at  $0.3\text{ }\mu\text{A}$  standby current (typ) 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. 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:  $27.5\text{ mW/MHz}$  (typical)
- Standby current of  $2\text{ }\mu\text{A}$  (maximum) at  $T_a = 25^\circ\text{C}$
- Single power supply voltage of  $5\text{ V} \pm 10\%$
- Power down features using CE.
- Data retention supply voltage of 2 to  $5.5\text{ V}$
- Direct TTL compatibility for all inputs and outputs

## • Access Times (maximum):

|                | TC55257DPL/DFL/DFTL/DTRL |       |       |
|----------------|--------------------------|-------|-------|
|                | -55L                     | -70L  | -85L  |
| Access Time    | 55 ns                    | 70 ns | 85 ns |
| CE Access Time | 55 ns                    | 70 ns | 85 ns |
| OE Access Time | 30 ns                    | 35 ns | 45 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)**

## o 28 PIN DIP &amp; SOP

|     |    |    |                 |
|-----|----|----|-----------------|
| A14 | 1  | 28 | V <sub>DD</sub> |
| A12 | 2  | 27 | R/W             |
| A7  | 3  | 26 | A13             |
| A6  | 4  | 25 | A8              |
| A5  | 5  | 24 | A9              |
| A4  | 6  | 23 | A11             |
| A3  | 7  | 22 | OE              |
| A2  | 8  | 21 | A10             |
| A1  | 9  | 20 | CE              |
| A0  | 10 | 19 | VO8             |
| VO1 | 11 | 18 | VO7             |
| VO2 | 12 | 17 | VO6             |
| VO3 | 13 | 16 | VO5             |
| GND | 14 | 15 | VO4             |

## o 28 PIN TSOP

(Normal pinout)



(Reverse pinout)

**PIN NAMES**

|                 |                    |
|-----------------|--------------------|
| A0 to A14       | Address Inputs     |
| R/W             | Read/Write Control |
| OE              | Output Enable      |
| CE              | Chip Enable        |
| VO1 to VO8      | Data Input/Output  |
| V <sub>DD</sub> | Power (+ 5 V)      |
| GND             | Ground             |

| PIN NO.  | 1              | 2               | 3              | 4              | 5               | 6   | 7               | 8               | 9               | 10             | 11             | 12             | 13             | 14              |
|----------|----------------|-----------------|----------------|----------------|-----------------|-----|-----------------|-----------------|-----------------|----------------|----------------|----------------|----------------|-----------------|
| PIN NAME | OE             | A <sub>11</sub> | A <sub>9</sub> | A <sub>8</sub> | A <sub>13</sub> | R/W | V <sub>DD</sub> | A <sub>14</sub> | A <sub>12</sub> | A <sub>7</sub> | A <sub>5</sub> | A <sub>5</sub> | A <sub>4</sub> | A <sub>3</sub>  |
| PIN NO.  | 15             | 16              | 17             | 18             | 19              | 20  | 21              | 22              | 23              | 24             | 25             | 26             | 27             | 28              |
| PIN NAME | A <sub>2</sub> | A <sub>1</sub>  | A <sub>0</sub> | VO1            | VO2             | VO3 | GND             | VO4             | VO5             | VO6            | VO7            | VO8            | CE             | A <sub>10</sub> |

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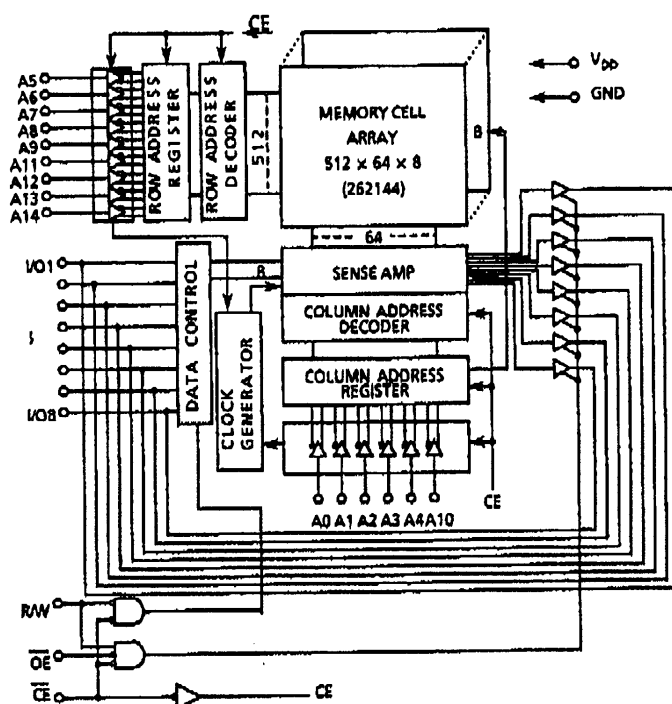
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**BLOCK DIAGRAM**

**OPERATION MODE**

| MODE             | $\overline{CE}$ | $\overline{OE}$ | R/W | I/O1 to I/O8     | POWER            |
|------------------|-----------------|-----------------|-----|------------------|------------------|
| Read             | L               | L               | H   | D <sub>OUT</sub> | I <sub>DDO</sub> |
| Write            | L               | x               | L   | D <sub>IN</sub>  | I <sub>DDO</sub> |
| Outputs Disabled | L               | H               | H   | High-Z           | I <sub>DDO</sub> |
| Standby          | H               | x               | x   | High-Z           | I <sub>DDO</sub> |

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

**ABSOLUTE MAXIMUM RATINGS**

| SYMBOL              | RATING                       | VALUE                           | UNIT |
|---------------------|------------------------------|---------------------------------|------|
| V <sub>DD</sub>     | Power Supply Voltage         | - 0.3 to 7.0                    | V    |
| V <sub>IN</sub>     | Input Voltage                | - 0.3* to 7.0                   | V    |
| V <sub>IO</sub>     | Input/Output Voltage         | - 0.5* to V <sub>DD</sub> + 0.5 | V    |
| P <sub>D</sub>      | Power Dissipation            | 1.0/0.6**                       | W    |
| T <sub>solder</sub> | Soldering Temperature (10 s) | 260                             | °C   |
| T <sub>strg</sub>   | Storage Temperature          | - 55 to 150                     | °C   |
| T <sub>opr</sub>    | Operating Temperature        | 0 to 70                         | °C   |

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

\*\* SOP

**DC RECOMMENDED OPERATING CONDITIONS** ( $T_a = 0^\circ \text{ to } 70^\circ \text{C}$ )

| 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    | -   | $V_{DD} + 0.3$ |      |
| $V_{IL}$ | Input Low Voltage             | - 0.3* | -   | 0.8            |      |
| $V_{DH}$ | Data Retention Supply Voltage | 2.0    | -   | 5.5            |      |

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

**DC CHARACTERISTICS** ( $T_a = 0^\circ \text{ to } 70^\circ \text{C}$ ,  $V_{DD} = 5 \text{ V} \pm 10\%$ )

| SYMBOL            | PARAMETER              | TEST CONDITION                                                                                                            |                           | MIN                         | TYP | MAX   | UNIT |    |
|-------------------|------------------------|---------------------------------------------------------------------------------------------------------------------------|---------------------------|-----------------------------|-----|-------|------|----|
| I <sub>IL</sub>   | Input Leakage Current  | V <sub>IN</sub> = 0 V to V <sub>DD</sub>                                                                                  |                           | -                           | -   | ± 1.0 | μA   |    |
| I <sub>OH</sub>   | Output High Current    | V <sub>OH</sub> = 2.4 V                                                                                                   |                           | - 1.0                       | -   | -     | mA   |    |
| I <sub>OL</sub>   | Output Low Current     | V <sub>OL</sub> = 0.4 V                                                                                                   |                           | 4.0                         | -   | -     | mA   |    |
| I <sub>LO</sub>   | Output Leakage Current | CE = V <sub>IH</sub> or RW = V <sub>IL</sub> or OE = V <sub>IH</sub><br>V <sub>OUT</sub> = 0 V to V <sub>DD</sub>         |                           | -                           | -   | ± 1.0 | μA   |    |
| I <sub>DDO1</sub> | Operating Current      | CE = V <sub>IL</sub><br>RW = V <sub>IH</sub> , I <sub>OUT</sub> = 0 mA<br>Other Inputs = V <sub>IH</sub> /V <sub>IL</sub> | t <sub>cycle</sub> = 1 μs | -                           | 10  | -     | mA   |    |
|                   |                        |                                                                                                                           | t <sub>cycle</sub> = min  | -                           | -   | 70    |      |    |
| I <sub>DDO2</sub> |                        | CE = 0.2 V<br>RW = V <sub>DD</sub> - 0.2 V, I <sub>OUT</sub> = 0 mA<br>Other Inputs = V <sub>DD</sub> - 0.2 V/0.2 V       | t <sub>cycle</sub> = 1 μs | -                           | 5   | -     | mA   |    |
|                   |                        |                                                                                                                           | t <sub>cycle</sub> = min  | -                           | -   | 60    |      |    |
| I <sub>DDs1</sub> | Standby Current        | CE = V <sub>IH</sub>                                                                                                      |                           | -                           | -   | 3     | mA   |    |
| I <sub>DDs2</sub> |                        | CE = V <sub>DD</sub> - 0.2 V<br>V <sub>DD</sub> = 2.0 to 5.5 V                                                            |                           | T <sub>a</sub> = 0° to 70°C | -   | -     | 20   | μA |
|                   |                        |                                                                                                                           |                           | T <sub>a</sub> = 25°C       | -   | 0.3   | 2    |    |

**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 ( $T_a = 0^\circ \text{ to } 70^\circ \text{C}$ ,  $V_{DD} = 5 \text{ V} \pm 10\%$ )READ CYCLE

| SYMBOL           | PARAMETER                           | TC55257DPL/DFL/DFTL/DTRL |     |      |     |      |     | UNIT |
|------------------|-------------------------------------|--------------------------|-----|------|-----|------|-----|------|
|                  |                                     | -55L                     |     | -70L |     | -85L |     |      |
|                  |                                     | MIN                      | MAX | MIN  | MAX | MIN  | MAX |      |
| t <sub>RC</sub>  | Read Cycle Time                     | 55                       | –   | 70   | –   | 85   | –   | ns   |
| t <sub>ACC</sub> | Address Access Time                 | –                        | 55  | –    | 70  | –    | 85  |      |
| t <sub>CO</sub>  | Chip Enable Access Time             | –                        | 55  | –    | 70  | –    | 85  |      |
| t <sub>OE</sub>  | Output Enable Access Time           | –                        | 30  | –    | 35  | –    | 45  |      |
| t <sub>COE</sub> | Chip Enable Low to Output Active    | 10                       | –   | 10   | –   | 10   | –   |      |
| t <sub>OEE</sub> | Output Enable Low to Output Active  | 5                        | –   | 5    | –   | 5    | –   |      |
| t <sub>OD</sub>  | Chip Enable High to Output High-Z   | –                        | 20  | –    | 25  | –    | 30  |      |
| t <sub>ODO</sub> | Output Enable High to Output High-Z | –                        | 20  | –    | 25  | –    | 30  |      |
| t <sub>OH</sub>  | Output Data Hold Time               | 10                       | –   | 10   | –   | 10   | –   |      |

WRITE CYCLE

| SYMBOL           | PARAMETER                   | TC55257DPL/DFL/DFTL/DTRL |     |      |     |      |     | UNIT |
|------------------|-----------------------------|--------------------------|-----|------|-----|------|-----|------|
|                  |                             | -55L                     |     | -70L |     | -85L |     |      |
|                  |                             | MIN                      | MAX | MIN  | MAX | MIN  | MAX |      |
| t <sub>WC</sub>  | Write Cycle Time            | 55                       | —   | 70   | —   | 85   | —   | ns   |
| t <sub>WP</sub>  | Write Pulse Width           | 45                       | —   | 50   | —   | 60   | —   |      |
| t <sub>CW</sub>  | Chip Enable to End of Write | 50                       | —   | 60   | —   | 65   | —   |      |
| t <sub>AS</sub>  | Address Setup Time          | 0                        | —   | 0    | —   | 0    | —   |      |
| t <sub>WR</sub>  | Write Recovery Time         | 0                        | —   | 0    | —   | 0    | —   |      |
| t <sub>ODW</sub> | R/W Low to Output High-Z    | —                        | 20  | —    | 25  | —    | 30  |      |
| t <sub>OEW</sub> | R/W High to Output Active   | 5                        | —   | 5    | —   | 5    | —   |      |
| t <sub>DS</sub>  | Data Setup Time             | 25                       | —   | 30   | —   | 40   | —   |      |
| t <sub>DH</sub>  | Data Hold Time              | 0                        | —   | 0    | —   | 0    | —   |      |

AC TEST CONDITIONS

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

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

Input pulse level: 0.6 V, 2.4 V

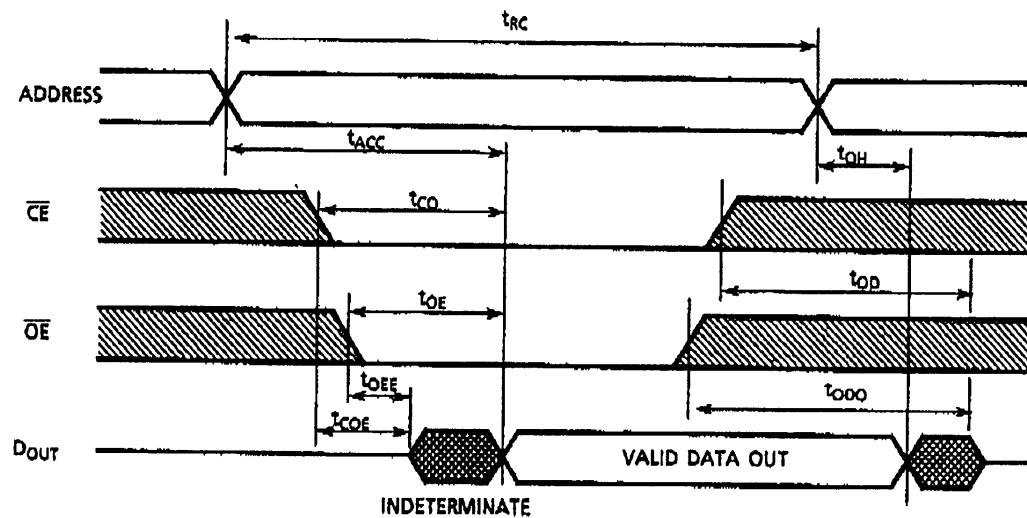
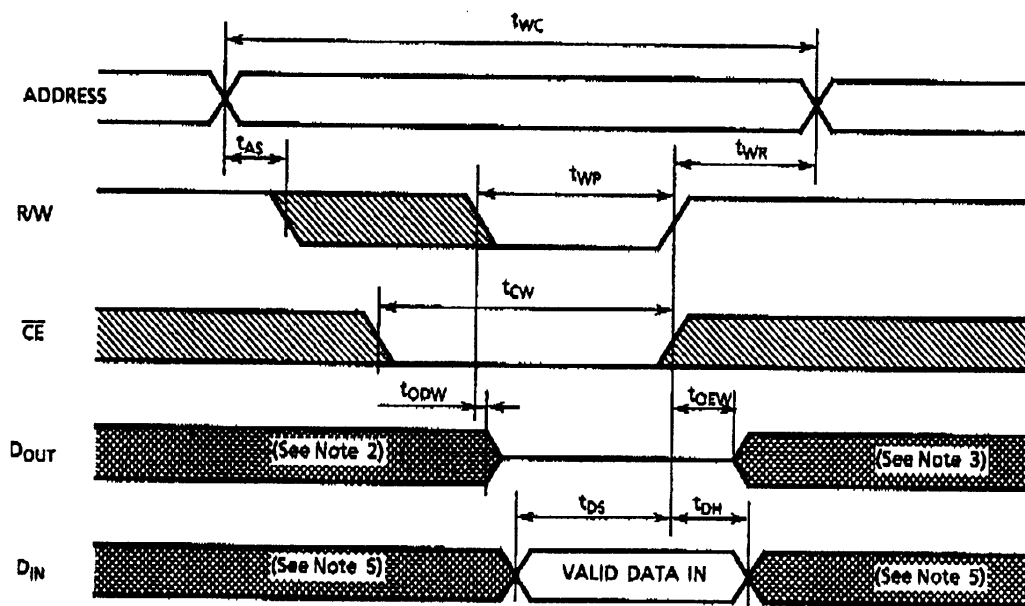
Timing measurements: 1.5 V

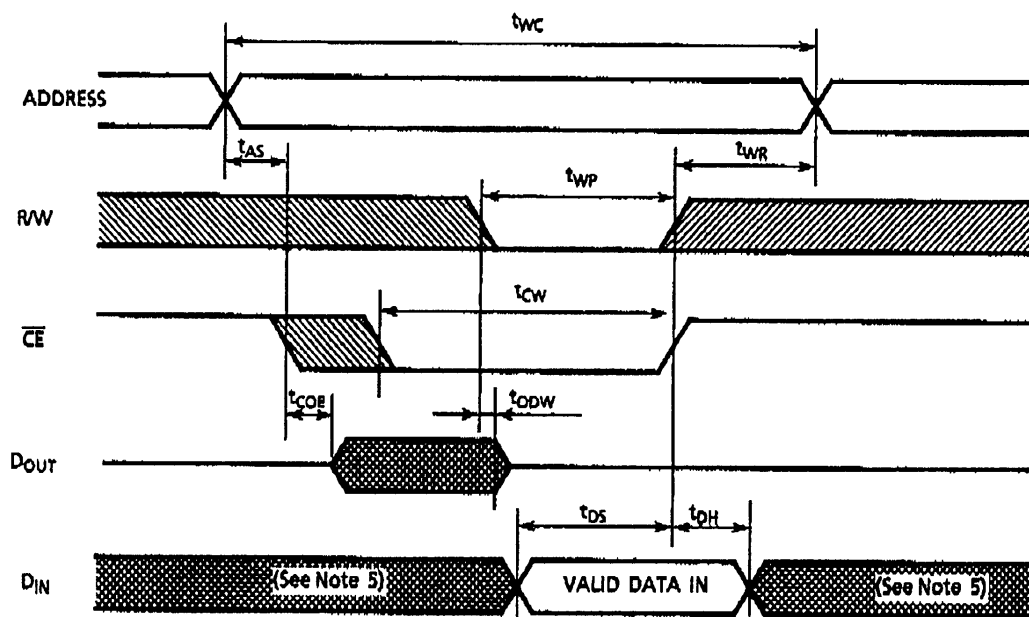
Reference level: 1.5 V

 $t_R, t_F$ : 5 ns

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## 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.

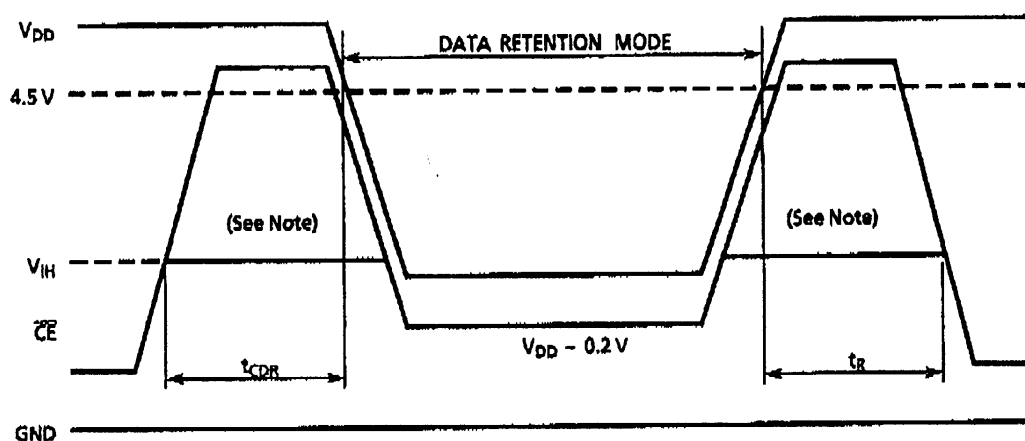
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DATA RETENTION CHARACTERISTICS ( $T_a = 0^\circ \text{ to } 70^\circ \text{C}$ )

| SYMBOL     | PARAMETER                                 | MIN                         | TYP | MAX | UNIT          |
|------------|-------------------------------------------|-----------------------------|-----|-----|---------------|
| $V_{DH}$   | Data Retention Supply Voltage             | 2.0                         | -   | 5.5 | V             |
| $I_{DDS2}$ | Standby Current                           | $V_{DH} = 3.0 \text{ V}$    | -   | 10* | $\mu\text{A}$ |
|            |                                           | $V_{DH} = 5.5 \text{ V}$    | -   | 20  |               |
| $t_{CDR}$  | Chip Deselect to Data Retention Mode Time | 0                           | -   | -   | ns            |
| $t_R$      | Recovery Time                             | $t_{RC} \text{ (See Note)}$ | -   | -   |               |

\*  $2 \mu\text{A}$  (max) at  $T_a = 0^\circ \text{ to } 40^\circ \text{C}$ 

Note: Read cycle time.

CE CONTROLLED DATA RETENTION MODE

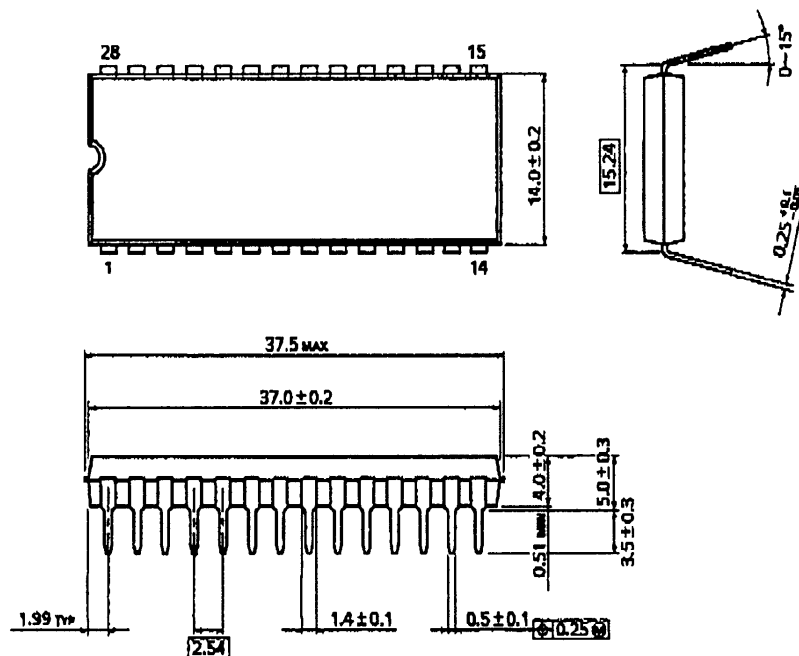
Note: When  $\overline{CE}$  is operating at the  $V_{IH}$  level (2.2 V), the standby current is given by  $I_{DDS1}$  during the transition of  $V_{DD}$  from 4.5 to 2.4 V.

**TOSHIBA**

**TC55257DPL/DFL/DFTL/DTRL-55L,-70L,-85L**

**PACKAGE DIMENSIONS (DIP28-P-600-2.54)**

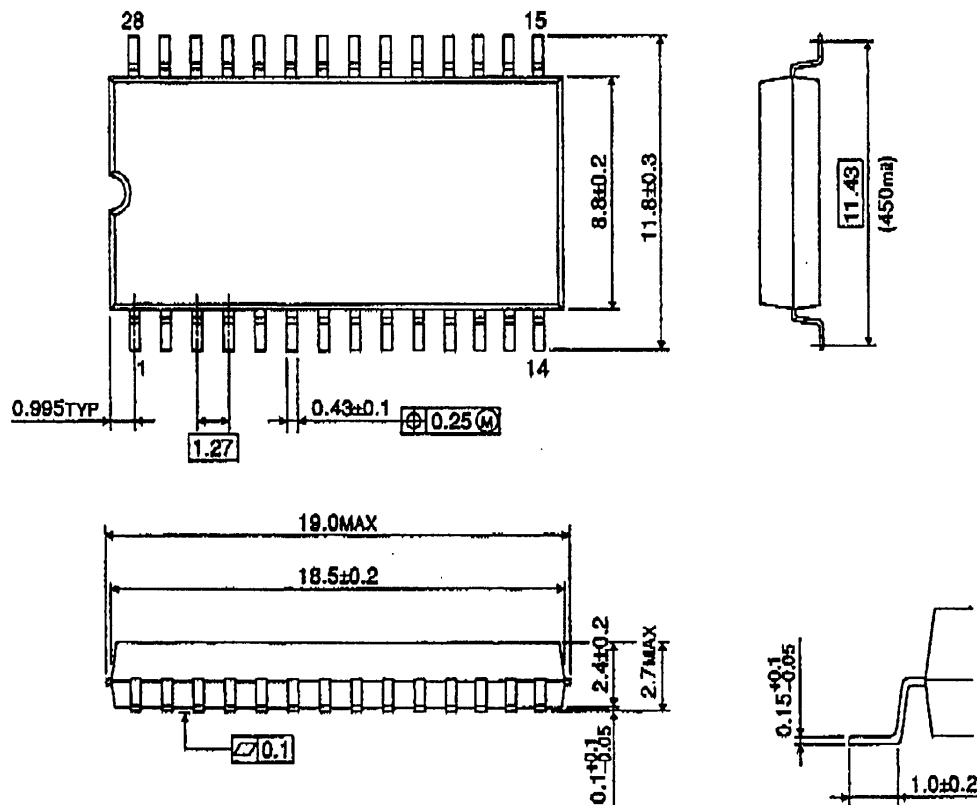
Units in mm



Weight: 4.42 g (typ)

**PACKAGE DIMENSIONS (SOP28-P-450-1.27)**

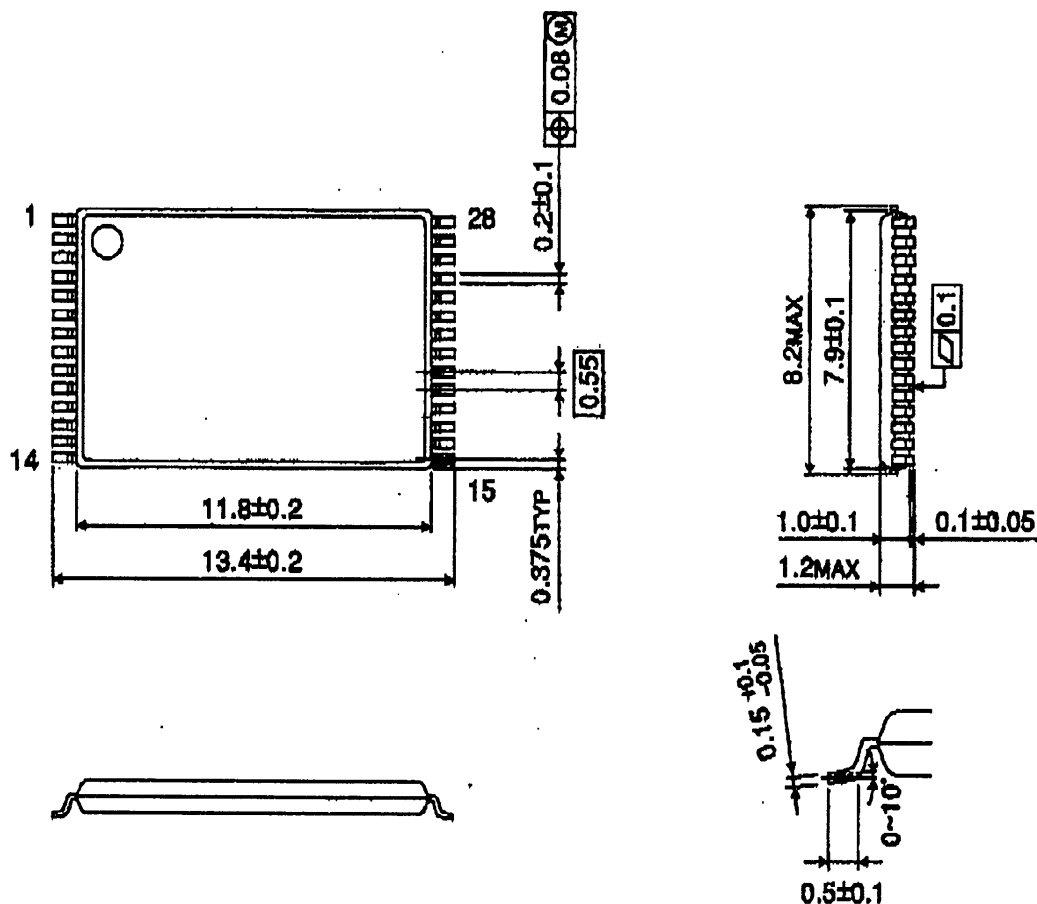
Units in mm



Weight: 0.79 g (typ)

PACKAGE DIMENSIONS (TSOP I 28-P-0.55)

Units in mm



Weight: 0.22 g (typ)

## Units in mm

