

TOSHIBA MOS DIGITAL INTEGRATED CIRCUIT SILICON GATE CMOS

32,768-WORD BY 8-BIT STATIC RAM

**DESCRIPTION**

The TC55257DPI/DFI/DFTI/DTRI 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 V ± 10% 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 70 ns. It is automatically placed in low-power mode at 0.3 μA 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. And, with a guaranteed operating range of - 40° to 85°C, the TC55257DPI/DFI/DFTI/DTRI can be used in environments exhibiting extreme temperature conditions. The TC55257DPI/DFI/DFTI/DTRI is available in a 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 μA (maximum) at Ta = 25°C
- Single power supply voltage of 5 V ± 10%
- Power down features using CE.
- Data retention supply voltage of 2 to 5.5 V
- Direct TTL compatibility for all inputs and outputs
- Wide operating temperature range of - 40° to 85°C

● Access Times (maximum):

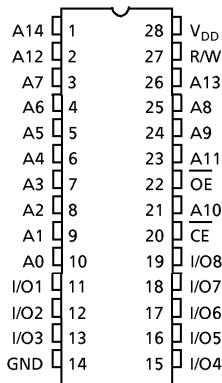
	TC55257DPI/DFI/DFTI/DTRI	
	-70L	-85L
Access Time	70 ns	85 ns
CE Access Time	70 ns	85 ns
OE Access Time	35 ns	45 ns

● Packages:

- DIP28-P-600-2.54 (DPI) (Weight: 4.42 g typ)
- SOP28-P-450-1.27 (DFI) (Weight: 0.79 g typ)
- TSOP I 28-P-0.55 (DFTI) (Weight: 0.22 g typ)
- TSOP I 28-P-0.55A (DTRI) (Weight: 0.22 g typ)

**PIN ASSIGNMENT (TOP VIEW)**

○ 28 PIN DIP & SOP

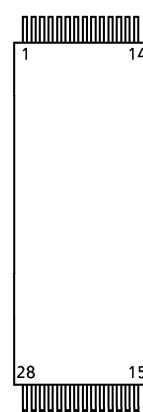


○ 28 PIN TSOP

(Normal pinout)



(Reverse pinout)



**PIN NAMES**

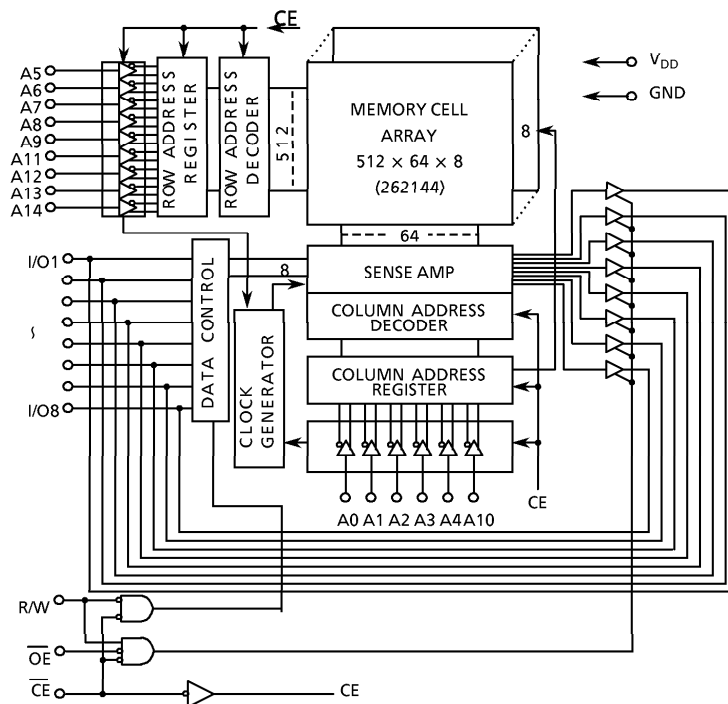
A0 to A14	Address Input
R/W	Read/Write Control
OE	Output Enable
CE	Chip Enable
I/O1 to I/O8	Data Input/Output
V <sub>DD</sub>	Power (+ 5 V)
GND	Ground

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>6</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>	I/O1	I/O2	I/O3	GND	I/O4	I/O5	I/O6	I/O7	I/O8	CE	A <sub>10</sub>

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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>DDS</sub>

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

**ABSOLUTE MAXIMUM VALUES**

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>I/O</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	- 40 to 85	°C

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

\*\* SOP

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

SYMBOL	PARAMETER	MIN	TYP	MAX	UNIT
V <sub>DD</sub>	Power Supply Voltage	4.5	5.0	5.5	V
V <sub>IH</sub>	Input High Voltage	2.4	-	V <sub>DD</sub> + 0.3	
V <sub>IL</sub>	Input Low Voltage	- 0.3*	-	0.6	
V <sub>DH</sub>	Data Retention Supply Voltage	2.0	-	5.5	

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

**DC CHARACTERISTICS (Ta = - 40° to 85°C, V<sub>DD</sub> = 5 V ± 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	$\overline{CE} = V_{IH}$ or R/W = V <sub>IL</sub> or $\overline{OE} = V_{IH}$ V <sub>OUT</sub> = 0 V to V <sub>DD</sub>	-	-	± 1.0	μA	
I <sub>DDO1</sub>	Operating Current	$\overline{CE} = V_{IL}$ R/W = V <sub>IH</sub> , I <sub>OUT</sub> = 0 mA 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>	Operating Current	$\overline{CE} = 0.2$ V R/W = V <sub>DD</sub> - 0.2 V, I <sub>OUT</sub> = 0 mA 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	$\overline{CE} = V_{IH}$		-	-	3	mA
I <sub>DDS2</sub>		$\overline{CE} = V_{DD} - 0.2$ V V <sub>DD</sub> = 2.0 to 5.5 V	Ta = - 40° to 85°C	-	-	30	μA
		Ta = 25°C	-	0.3	2		

**CAPACITANCE (Ta = 25°C, f = 1 MHz)**

SYMBOL	PARAMETER	TEST CONDITION	MAX	UNIT
C <sub>IN</sub>	Input Capacitance	V <sub>IN</sub> = GND	10	pF
C <sub>OUT</sub>	Output Capacitance	V <sub>OUT</sub> = GND	10	pF

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

AC CHARACTERISTICS AND OPERATING CONDITIONS (Ta = - 40° to 85°C, V<sub>DD</sub> = 5 V ± 10%)

READ CYCLE

SYMBOL	PARAMETER	TC55257DPI/DFI/DFTI/DTRI				UNIT
		-70L		-85L		
		MIN	MAX	MIN	MAX	
t <sub>RC</sub>	Read Cycle Time	70	-	85	-	ns
t <sub>ACC</sub>	Address Access Time	-	70	-	85	
t <sub>CO</sub>	Chip Enable Access Time	-	70	-	85	
t <sub>OE</sub>	Output Enable Access Time	-	35	-	45	
t <sub>COE</sub>	Chip Enable Low to Output Active	5	-	5	-	
t <sub>OEE</sub>	Output Enable Low to Output Active	0	-	0	-	
t <sub>OD</sub>	Chip Enable High to Output High-Z	-	25	-	30	
t <sub>ODO</sub>	Output Enable High to Output High-Z	-	25	-	30	
t <sub>OH</sub>	Output Data Hold Time	10	-	10	-	

WRITE CYCLE

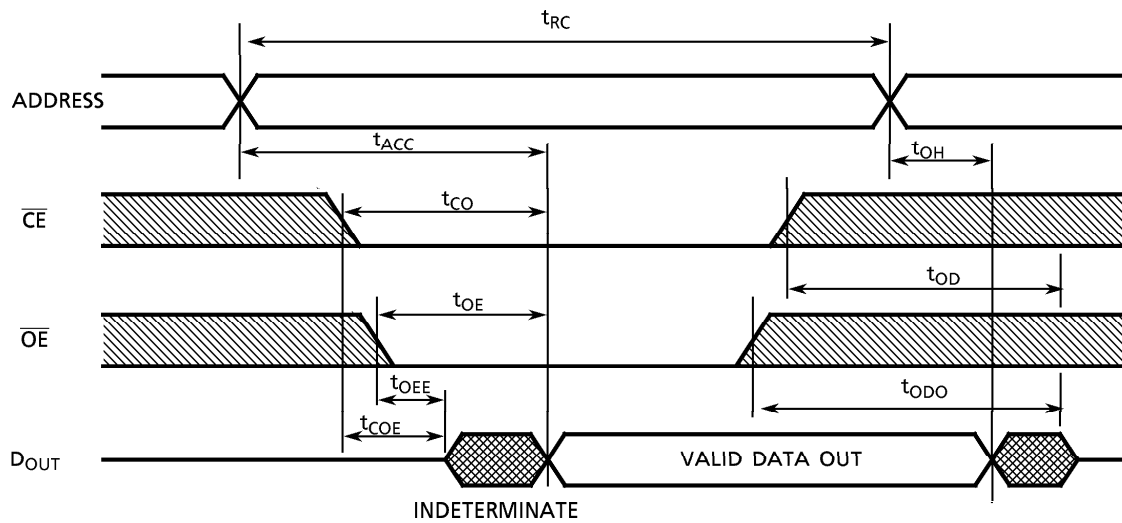
SYMBOL	PARAMETER	TC55257DPL/DFL/DFTL/DTRL				UNIT
		-70L		-85L		
		MIN	MAX	MIN	MAX	
t <sub>WC</sub>	Write Cycle Time	70	-	85	-	ns
t <sub>WP</sub>	Write Pulse Width	50	-	60	-	
t <sub>CW</sub>	Chip Enable to End of Write	60	-	65	-	
t <sub>AS</sub>	Address Setup Time	0	-	0	-	
t <sub>WR</sub>	Write Recovery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

AC TEST CONDITIONS

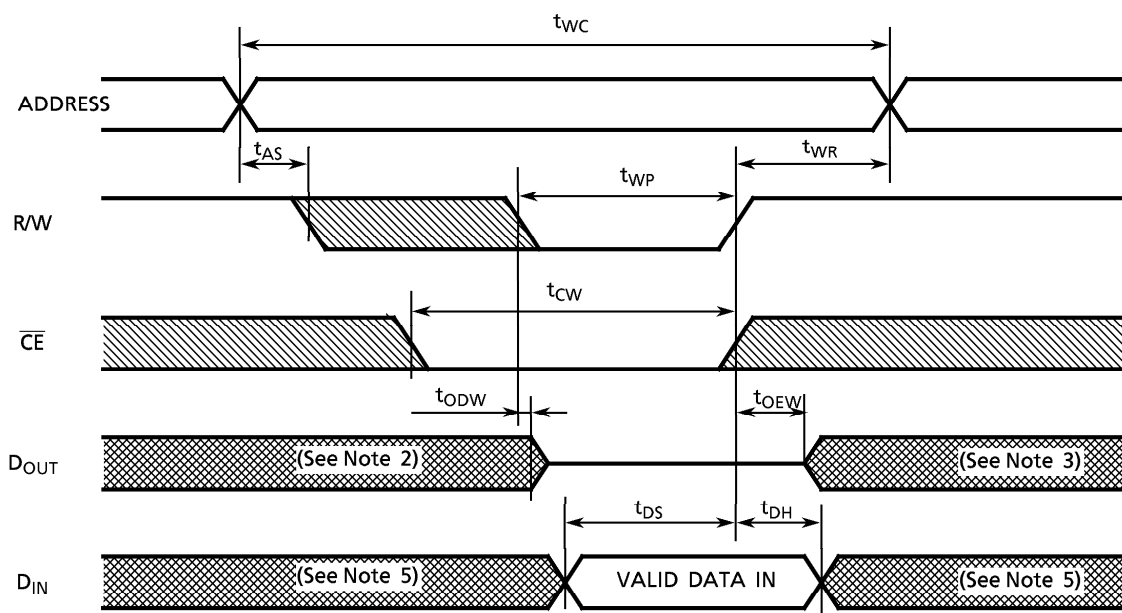
Output load: 100 pF + one TTL gate  
 Input pulse level: 0.4 V, 2.6 V  
 Timing measurements: 1.5 V  
 ReferenChip Enable level: 1.5 V  
 t<sub>R</sub>, t<sub>F</sub>: 5 ns

**TIMING DIAGRAMS**

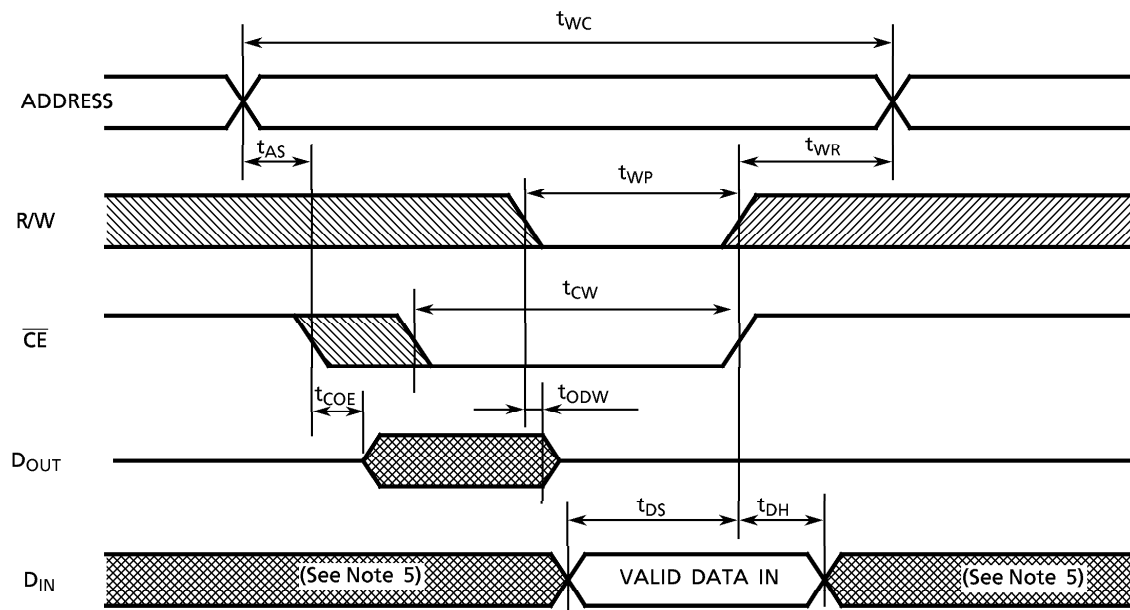
**READ CYCLE (See Note 1)**



**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.

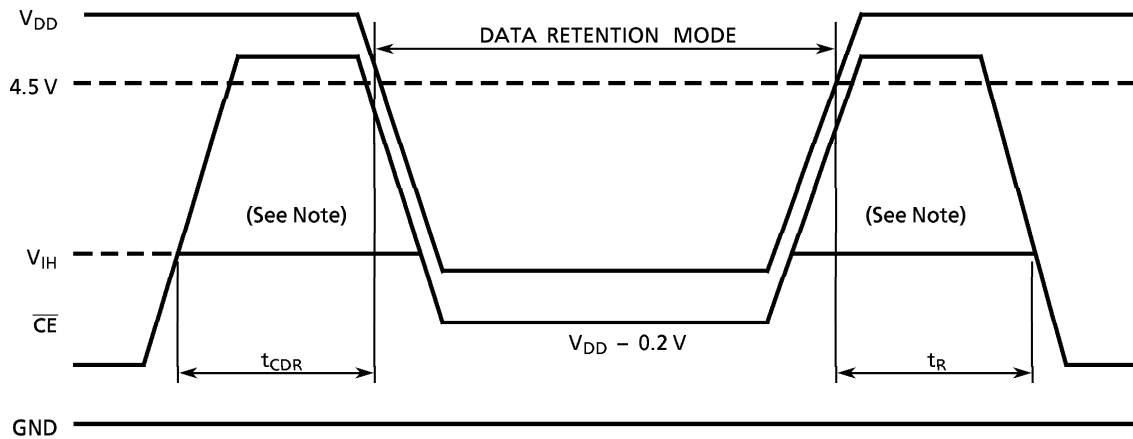
**DATA RETENTION CHARACTERISTICS (Ta = - 40° to 85°C)**

SYMBOL	PARAMETER	MIN	TYP	MAX	UNIT
V <sub>DH</sub>	Data Retention Supply Voltage	2.0	-	5.5	V
I <sub>DD2</sub>	Standby Current	V <sub>DH</sub> = 3.0 V	-	15*	μA
		V <sub>DH</sub> = 5.5 V	-	30	μA
t <sub>CDR</sub>	Chip Deselect to Data Retention Mode Time	0	-	-	
t <sub>R</sub>	Recovery Time	t <sub>RC</sub> (See Note)	-	-	ns

\* 2 μA (max) at Ta = - 40° to 40°C

Note: Read cycle time.

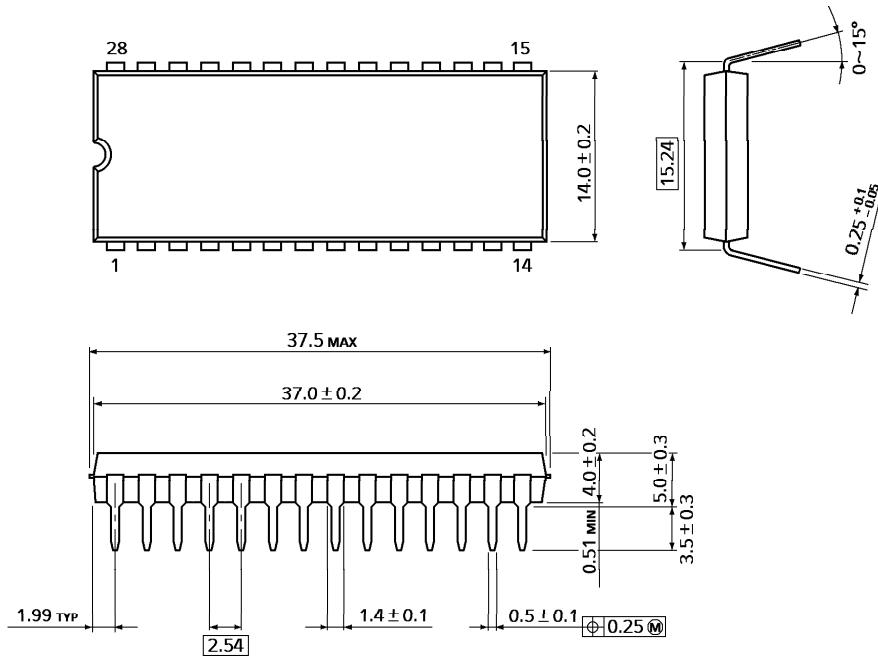
**CE CONTROLLED DATA RETENTION MODE**



Note: When  $\overline{CE}$  is operating at the V<sub>IH</sub> level (2.4 V), the standby current is given by I<sub>DD1</sub> during the transition of V<sub>DD</sub> from 4.5 to 2.6 V.

PACKAGE DIMENSIONS (DIP28-P-600-2.54)

Units in mm

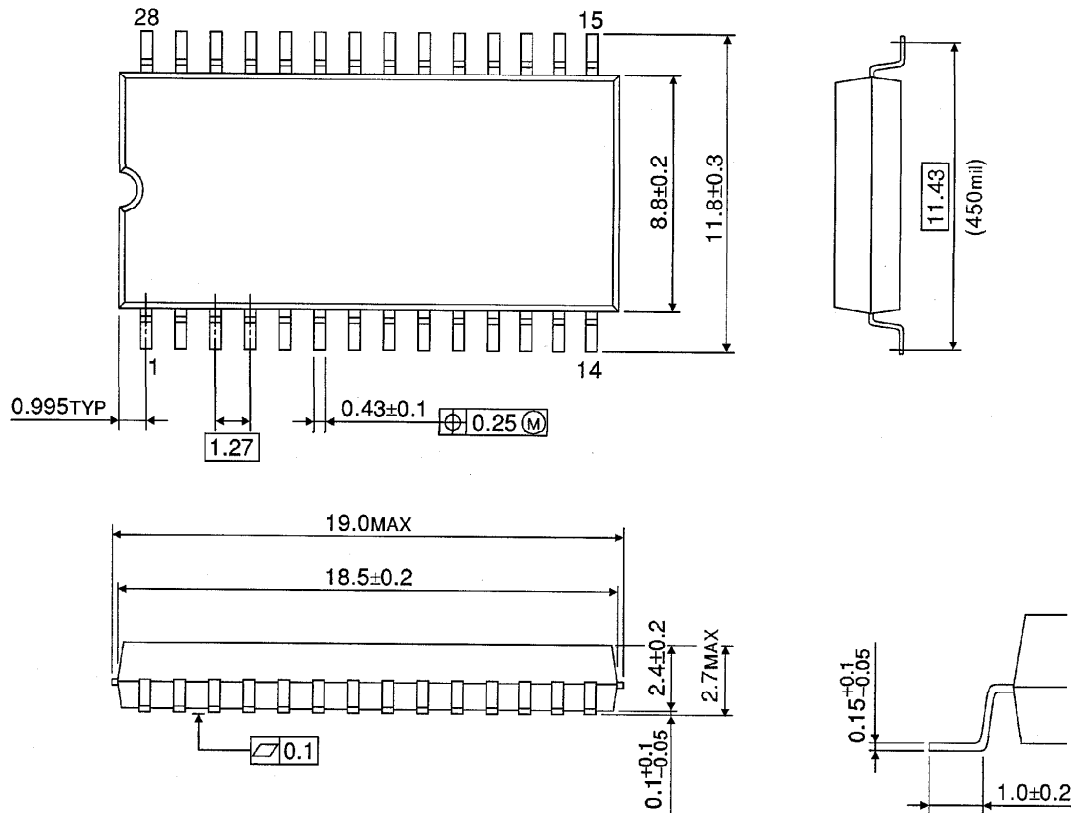


Weight: 4.42 g (typ)



PACKAGE DIMENSIONS (SOP28-P-450-1.27)

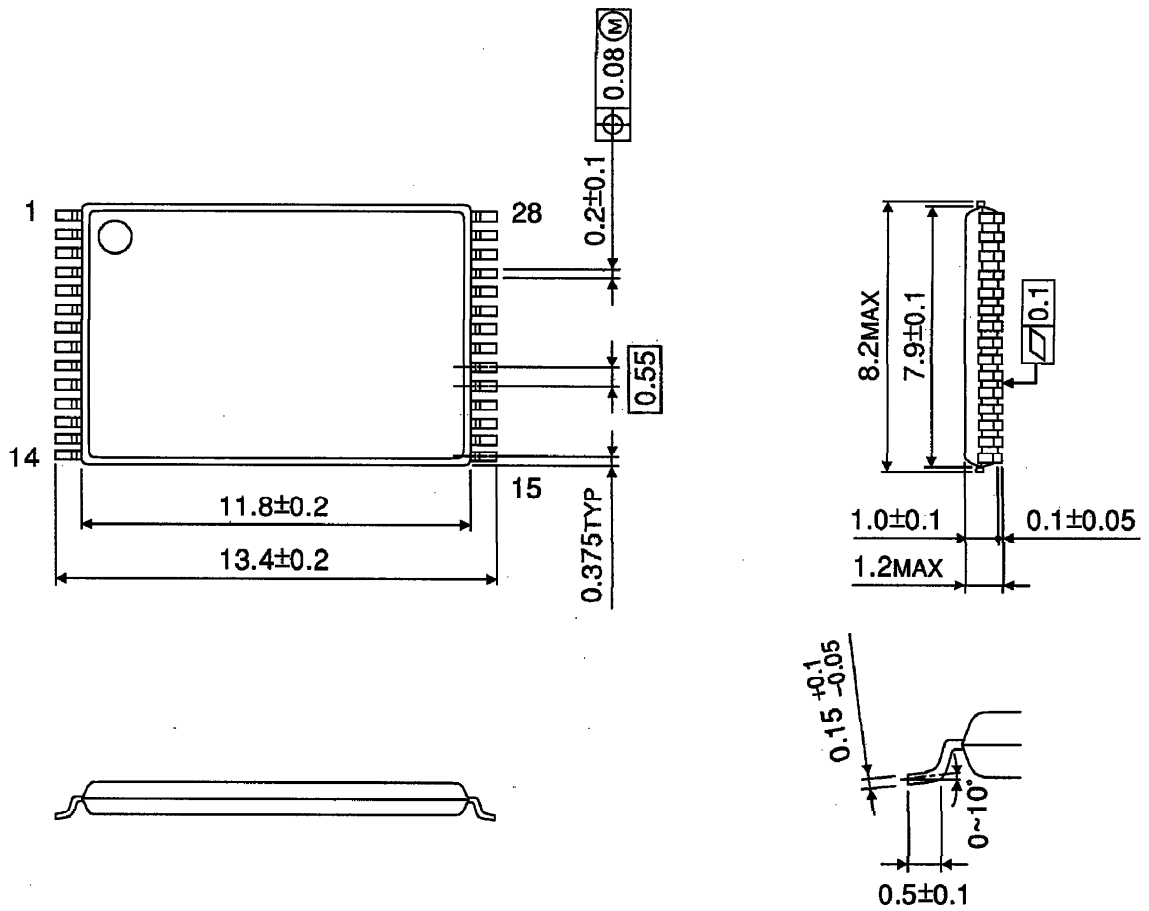
Units in mm



Weight: 0.79 g (typ)

PACKAGE DIMENSIONS (TSOP I 28-P-0.55)

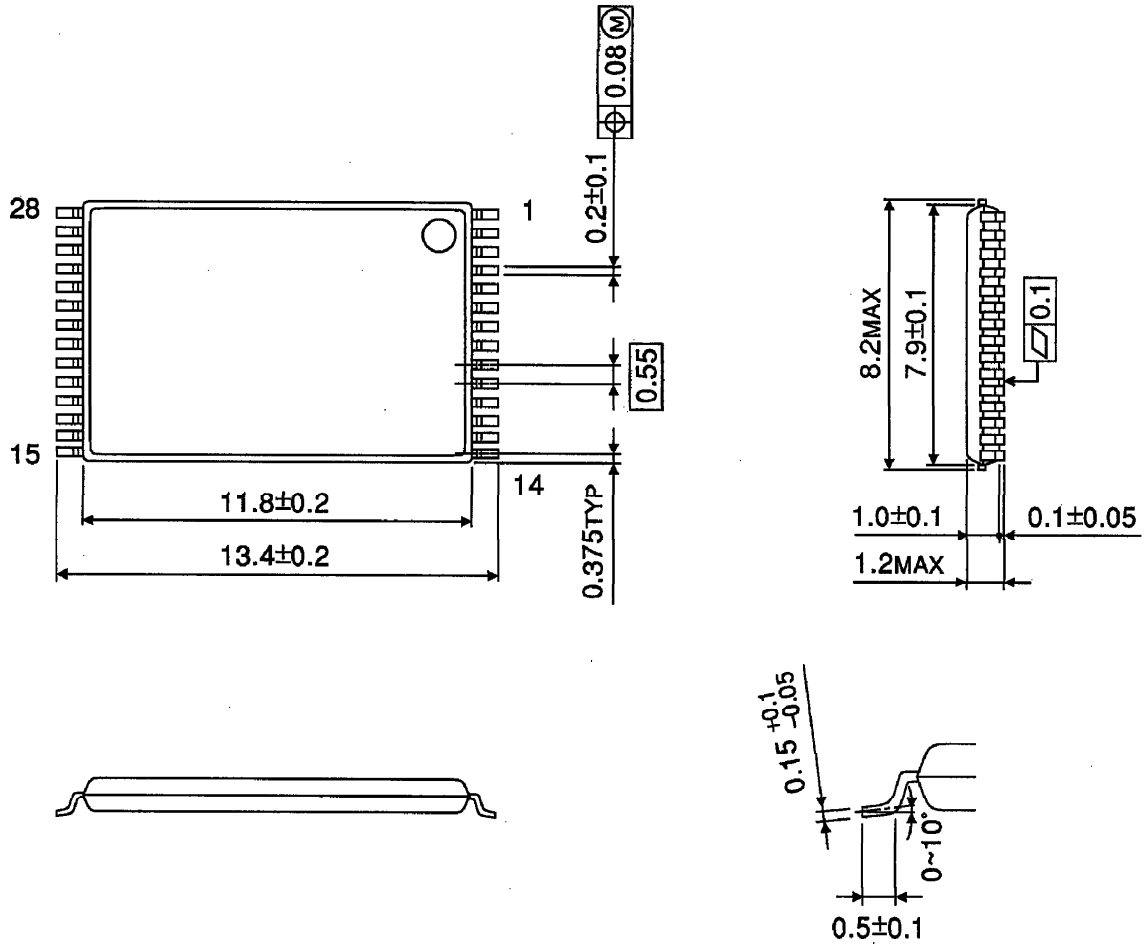
Units in mm



Weight: 0.22 g (typ)

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

Units in mm



Weight: 0.22 g (typ)