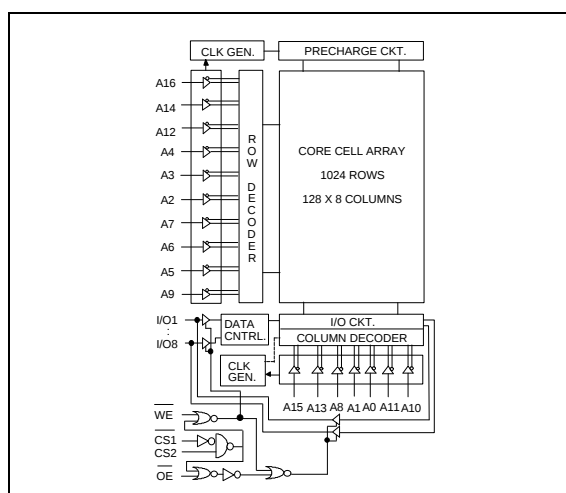
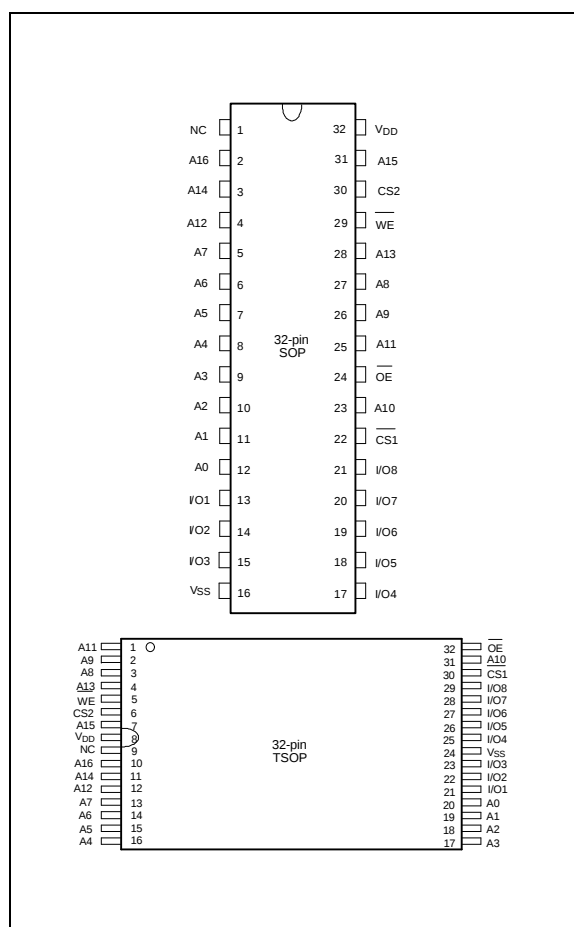


## GENERAL DESCRIPTION

## FEATURES

- Low power consumption:
  - Active: 144 mW (max.)
- Access time: 70 nS
- Single 3.3V power supply
- Fully static operation
- All inputs and outputs directly TTL compatible
- Three-state outputs
- Battery back-up operation capability
- Data retention voltage: 2V (min.)
- Packaged 450 mil SOP, standard type one, TSOP (8 mm × 20 mm), small type one and TSOP (8 mm × 13.4 mm)

### BLOCK DIAGRAM



## PIN DESCRIPTION

| SYMBOL                                | DESCRIPTION         |
|---------------------------------------|---------------------|
| A0–A16                                | Address Inputs      |
| I/O1–I/O8                             | Data Inputs/Outputs |
| $\overline{\text{CS}}_1, \text{CS}_2$ | Chip Select Input   |
| $\overline{\text{WE}}$                | Write Enable Input  |
| $\overline{\text{OE}}$                | Output Enable Input |
| VDD                                   | Power Supply        |
| VSS                                   | Ground              |
| NC                                    | No Connection       |

## TRUTH TABLE

| $\overline{\text{CS1}}$ | $\text{CS2}$ | $\overline{\text{OE}}$ | $\overline{\text{WE}}$ | MODE           | I/O1- I/O8 | V <sub>DD</sub> CURRENT |
|-------------------------|--------------|------------------------|------------------------|----------------|------------|-------------------------|
| H                       | X            | X                      | X                      | Not Selected   | High Z     | ISB, ISB1               |
| X                       | L            | X                      | X                      | Not Selected   | High Z     | ISB, ISB1               |
| L                       | H            | H                      | H                      | Output Disable | High Z     | I <sub>DD</sub>         |
| L                       | H            | L                      | H                      | Read           | Data Out   | I <sub>DD</sub>         |
| L                       | H            | X                      | L                      | Write          | Data In    | I <sub>DD</sub>         |

## DC CHARACTERISTICS

### Absolute Maximum Ratings

| PARAMETER                                   |      | RATING                       | UNIT |
|---------------------------------------------|------|------------------------------|------|
| Supply Voltage to V <sub>SS</sub> Potential |      | -0.5 to +4.6                 | V    |
| Input/Output to V <sub>SS</sub> Potential   |      | -0.5 to V <sub>DD</sub> +0.5 | V    |
| Allowable Power Dissipation                 |      | 1.0                          | W    |
| Storage Temperature                         |      | -65 to +150                  | °C   |
| Operating Temperature                       | L/LL | 0 to 70                      | °C   |
|                                             | LE   | -20 to 85                    |      |

Note: Exposure to conditions beyond those listed under Absolute Maximum Ratings may adversely affect the life and reliability of the device.

### Operating Characteristics

(V<sub>DD</sub> = 3.0V to 3.6V; V<sub>SS</sub> = 0V; T<sub>A</sub> (°C) = 0 to 70 for LL, -20 to 85 for LE)

| PARAMETER                      | SYM.            | TEST CONDITIONS                                                                                                                                                                                                                                                     | MIN. | MAX.                 | UNIT |
|--------------------------------|-----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|----------------------|------|
| Input Low Voltage              | V <sub>IL</sub> | -                                                                                                                                                                                                                                                                   | -0.5 | +0.6                 | V    |
| Input High Voltage             | V <sub>IH</sub> | -                                                                                                                                                                                                                                                                   | +2.0 | V <sub>DD</sub> +0.5 | V    |
| Input Leakage Current          | I <sub>LI</sub> | V <sub>IN</sub> = V <sub>SS</sub> to V <sub>DD</sub>                                                                                                                                                                                                                | -1   | +1                   | μA   |
| Output Leakage Current         | I <sub>LO</sub> | V <sub>I/O</sub> = V <sub>SS</sub> to V <sub>DD</sub> ,<br>$\overline{\text{CS1}}$ = V <sub>IH</sub> (min.) or<br>$\text{CS2}$ = V <sub>IL</sub> (max.) or<br>$\overline{\text{OE}}$ = V <sub>IH</sub> (min.) or<br>$\overline{\text{WE}}$ = V <sub>IL</sub> (max.) | -1   | +1                   | μA   |
| Output Low Voltage             | V <sub>OL</sub> | I <sub>OL</sub> = +2.1 mA                                                                                                                                                                                                                                           | -    | 0.4                  | V    |
| Output High Voltage            | V <sub>OH</sub> | I <sub>OH</sub> = -1.0 mA                                                                                                                                                                                                                                           | 2.2  | -                    | V    |
| Operating Power Supply Current | I <sub>DD</sub> | $\overline{\text{CS1}}$ = V <sub>IL</sub> (max.) and<br>$\text{CS2}$ = V <sub>IH</sub> (min.), I/O = 0 mA,<br>Cycle = min. Duty = 100%                                                                                                                              | -    | 40                   | mA   |



Operating Characteristics, continued

| PARAMETER                    | SYM. | TEST CONDITIONS                                                                                      | MIN.  | MAX. | UNIT    |
|------------------------------|------|------------------------------------------------------------------------------------------------------|-------|------|---------|
| Standby Power Supply Current | ISB  | $\overline{CS1} = V_{IH} \text{ (min.) or } CS2 = V_{IL} \text{ (max.)}$<br>Cycle = min. Duty = 100% | -     | 1    | mA      |
|                              | ISB1 | $\overline{CS1} \geq V_{DD} - 0.2V \text{ or } CS2 \leq 0.2V$                                        | LL/LE | 50   | $\mu A$ |
|                              |      |                                                                                                      | L     | 100  |         |

Note: Typical parameter is measured under ambient temperature  $T_A = 25^\circ C$  and  $V_{DD} = 3.3V$ 

## CAPACITANCE

(V<sub>DD</sub> = 3.3 V, T<sub>A</sub> = 25° C, f = 1 MHz)

| PARAMETER                | SYM.             | CONDITIONS            | MAX. | UNIT |
|--------------------------|------------------|-----------------------|------|------|
| Input Capacitance        | C <sub>IN</sub>  | V <sub>IN</sub> = 0V  | 6    | pF   |
| Input/Output Capacitance | C <sub>I/O</sub> | V <sub>OUT</sub> = 0V | 8    | pF   |

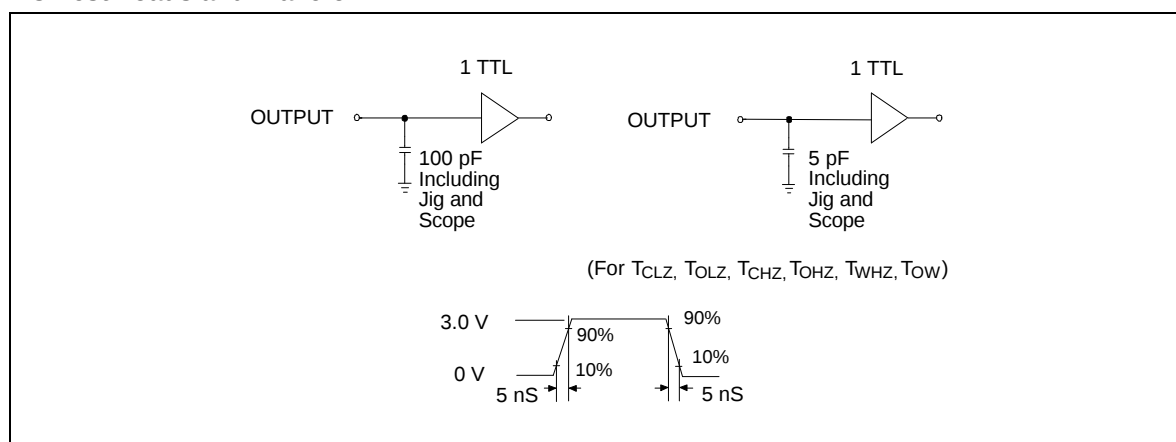
Note: These parameters are sampled but not 100% tested.

## AC Characteristics

### AC Test Conditions

| PARAMETER                               | CONDITIONS            |
|-----------------------------------------|-----------------------|
| Input Pulse Levels                      | 0V to 3.0V            |
| Input Rise and Fall Times               | 5 nS                  |
| Input and Output Timing Reference Level | 1.5V                  |
| Output Load                             | See the drawing below |

### AC Test Loads and Waveform





AC Characteristics, continued

(V<sub>DD</sub> = 3.0V to 3.6 V; V<sub>SS</sub> = 0V; T<sub>A</sub> (°C) = 0 to 70 for LL, -20 to 85 for LE)**Read Cycle**

| PARAMETER                            | SYMBOL | W24L11-70L/LL/LE |      | UNIT |
|--------------------------------------|--------|------------------|------|------|
|                                      |        | MIN.             | MAX. |      |
| Read Cycle Time                      | TRC    | 70               | -    | nS   |
| Address Access Time                  | TAA    | -                | 70   | nS   |
| Chip Select Access Time              | TACS   | -                | 70   | nS   |
| Output Enable to Output Valid        | TAOE   | -                | 35   | nS   |
| Chip Selection to Output in Low Z    | TCLZ*  | 10               | -    | nS   |
| Output Enable to Output in Low Z     | TOLZ*  | 5                | -    | nS   |
| Chip Deselection to Output in High Z | TCHZ*  | -                | 30   | nS   |
| Output Disable to Output in High Z   | TOHZ*  | -                | 30   | nS   |
| Output Hold from Address Change      | TOH    | 10               | -    | nS   |

\* These parameters are sampled but not 100% tested

**Write Cycle**

| PARAMETER                          |                                            | SYMBOL | W24L11-70L/LL/LE |      | UNIT |
|------------------------------------|--------------------------------------------|--------|------------------|------|------|
|                                    |                                            |        | MIN.             | MAX. |      |
| Write Cycle Time                   |                                            | TWC    | 70               | -    | nS   |
| Chip Selection to End of Write     |                                            | TCW    | 55               | -    | nS   |
| Address Valid to End of Write      |                                            | TAW    | 55               | -    | nS   |
| Address Setup Time                 |                                            | TAS    | 0                | -    | nS   |
| Write Pulse Width                  |                                            | TWP    | 50               | -    | nS   |
| Write Recovery Time                | $\overline{CS1}$ , $CS2$ , $\overline{WE}$ | TWR    | 0                | -    | nS   |
| Data Valid to End of Write         |                                            | TDW    | 45               | -    | nS   |
| Data Hold from End of Write        |                                            | TDH    | 0                | -    | nS   |
| Write to Output in High Z          |                                            | TWHZ*  | -                | 25   | nS   |
| Output Disable to Output in High Z |                                            | TOHZ*  | -                | 25   | nS   |
| Output Active from End of Write    |                                            | TOW    | 5                | -    | nS   |

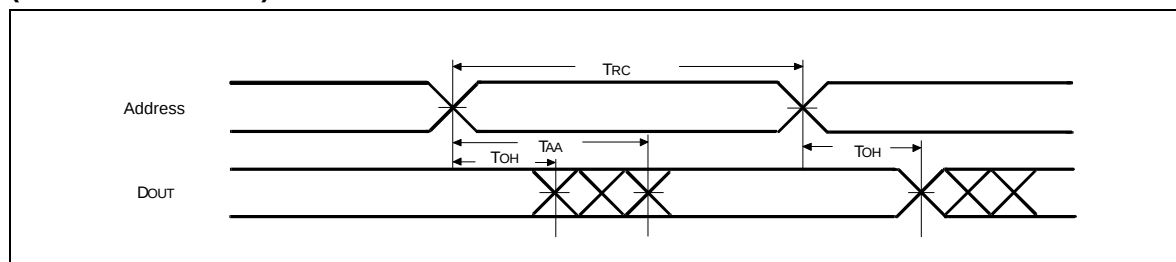
\* These parameters are sampled but not 100% tested



## TIMING WAVEFORMS

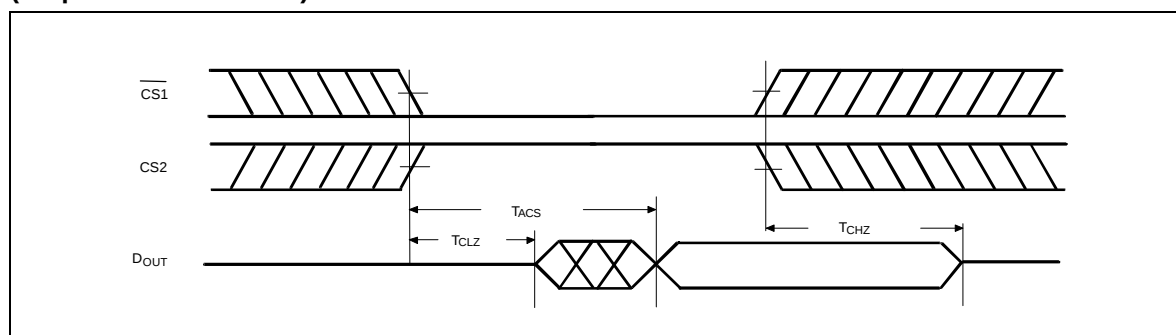
### Read Cycle 1

(Address Controlled)



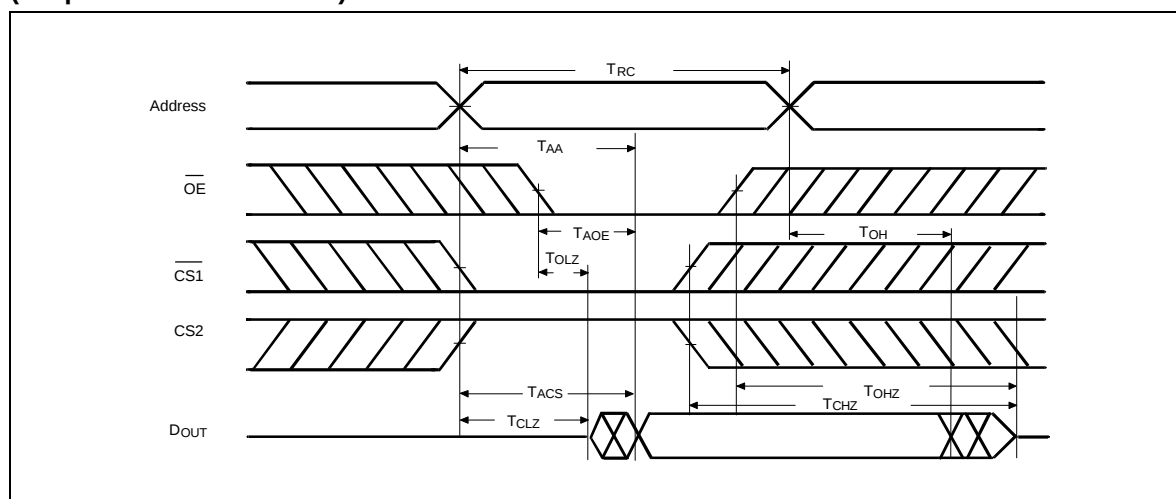
### Read Cycle 2

(Chip Select Controlled)



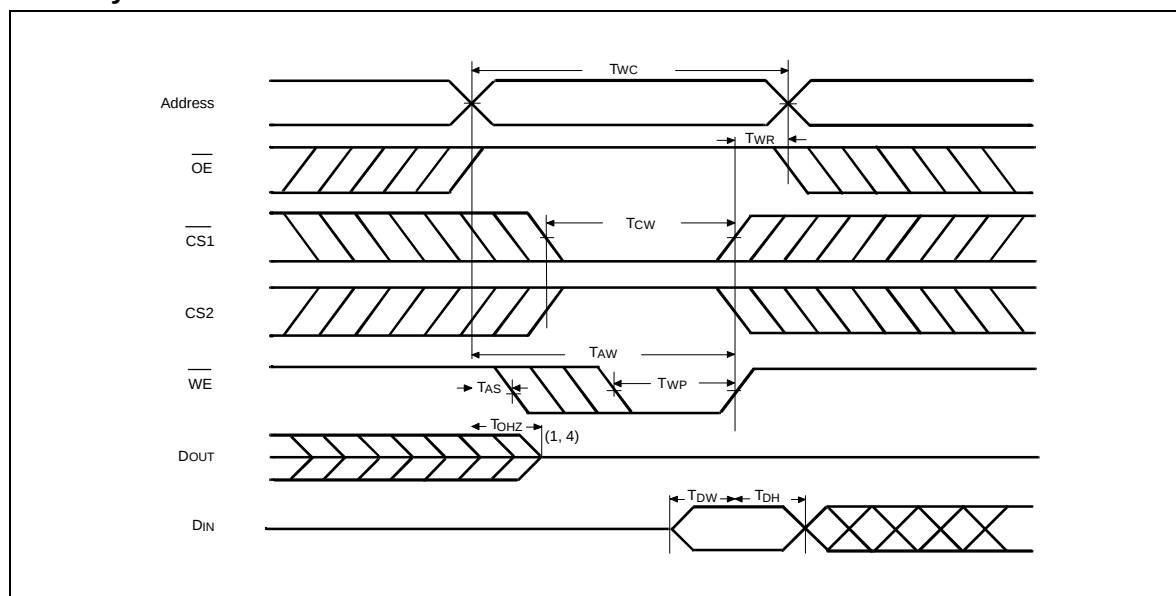
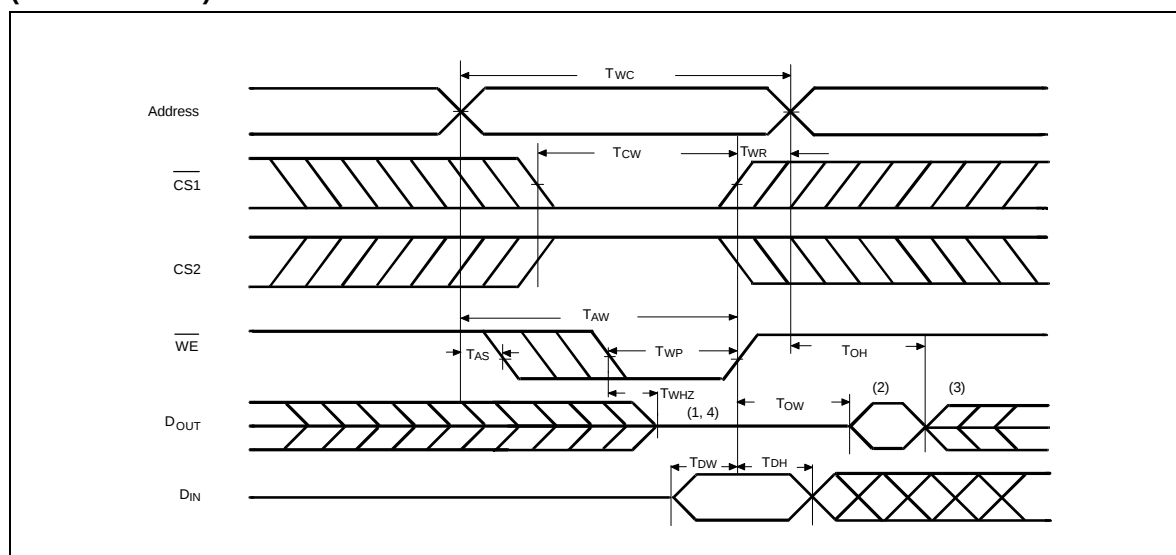
### Read Cycle 3

(Output Enable Controlled)





Timing Waveforms, continued

**Write Cycle 1****Write Cycle 2****(OE =  $V_{IL}$  Fixed)**

Notes:

1. During this period, I/O pins are in the output state, so input signals of opposite phase to the outputs should not be applied.
2. The data output from  $D_{OUT}$  are the same as the data written to  $D_{IN}$  during the write cycle.
3.  $D_{OUT}$  provides the read data for the next address.
4. Transition is measured  $\pm 500$  mV from steady state with  $C_L = 5$  pF. This parameter is guaranteed but not 100% tested.



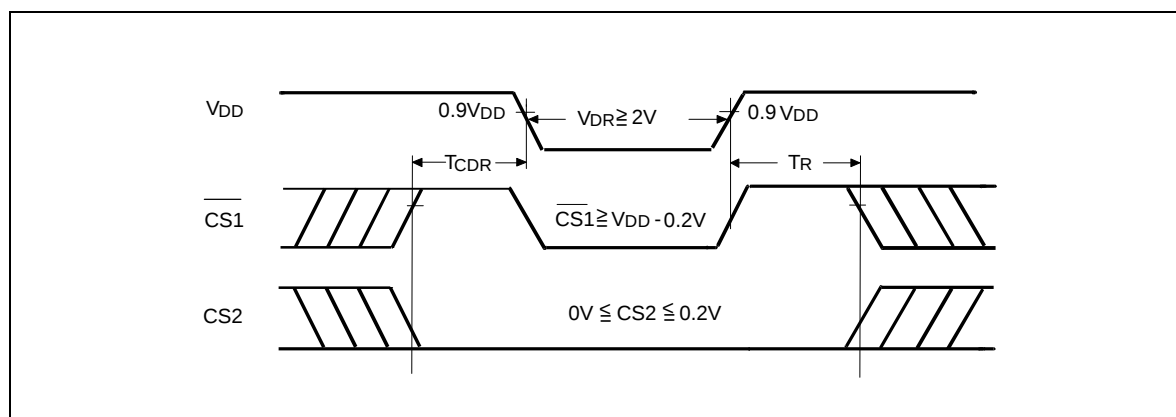
## DATA RETENTION CHARACTERISTICS

(T<sub>A</sub> (°C) = 0 to 70 for LL, -20 to 85 for LE)

| PARAMETER                            | SYM.              | TEST CONDITIONS                                                                  | MIN.              | TYP. | MAX. | UNIT |
|--------------------------------------|-------------------|----------------------------------------------------------------------------------|-------------------|------|------|------|
| V <sub>DD</sub> for Data Retention   | V <sub>DR</sub>   | $\overline{CS1} \geq V_{DD} - 0.2V$ or<br>$CS2 \leq 0.2V$                        | 2.0               | -    | -    | V    |
| Data Retention Current               | I <sub>DDDR</sub> | $\overline{CS1} \geq V_{DD} - 0.2V$ or<br>$CS2 \leq 0.2V$ , V <sub>DD</sub> = 3V | -                 | -    | 50   | μA   |
| Chip Deselect to Data Retention Time | T <sub>CDR</sub>  | See data retention waveform                                                      | 0                 | -    | -    | nS   |
| Operation Recovery Time              | T <sub>R</sub>    |                                                                                  | T <sub>RC</sub> * | -    | -    | nS   |

\* Read Cycle Time

## DATA RETENTION WAVEFORM



# W24L11



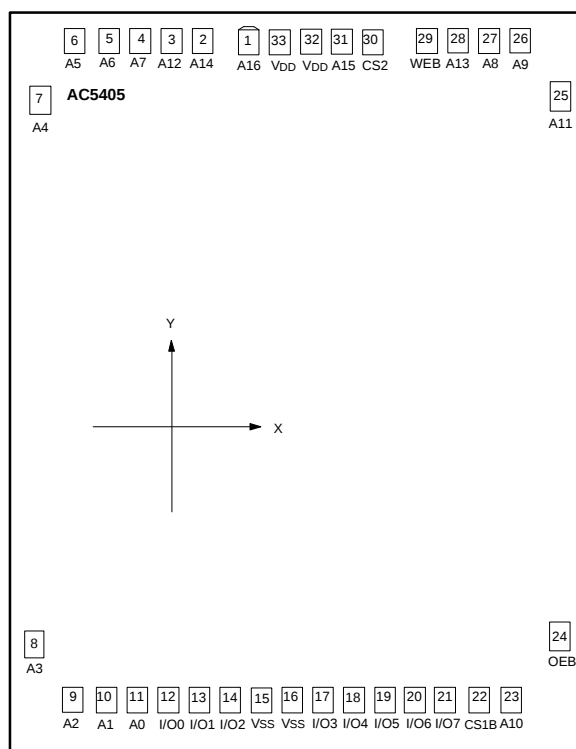
## ORDERING INFORMATION

| PART NO.     | ACCESS TIME (nS) | OPERATING VOLTAGE (V) | OPERATING TEMPERATURE (°C) | STANDBY CURRENT MAX. (mA) | PACKAGE                |
|--------------|------------------|-----------------------|----------------------------|---------------------------|------------------------|
| W24L11S-70LE | 70               | 3.0V to 3.6V          | -20 to 85                  | 50                        | 450 mil SOP            |
| W24L11T-70LE | 70               | 3.0V to 3.6V          | -20 to 85                  | 50                        | Standard type one TSOP |
| W24L11Q-70LE | 70               | 3.0V to 3.6V          | -20 to 85                  | 50                        | Small type one TSOP    |
| W24L11S-70LL | 70               | 3.0V to 3.6V          | 0 to 70                    | 50                        | 450 mil SOP            |
| W24L11T-70LL | 70               | 3.0V to 3.6V          | 0 to 70                    | 50                        | Standard type one TSOP |
| W24L11Q-70LL | 70               | 3.0V to 3.6V          | 0 to 70                    | 50                        | Small type one TSOP    |
| W24L11S-70L  | 70               | 3.0V to 3.6V          | 0 to 70                    | 100                       | 450 mil SOP            |
| W24L11T-70L  | 70               | 3.0V to 3.6V          | 0 to 70                    | 100                       | Standard type one TSOP |
| W24L11Q-70L  | 70               | 3.0V to 3.6V          | 0 to 70                    | 100                       | Small type one TSOP    |

Notes:

1. Winbond reserves the right to make changes to its products without prior notice.
2. Purchasers are responsible for performing appropriate quality assurance testing on products intended for use in applications where personal injury might occur as a consequence of product failure.

## BONDING PAD DIAGRAM

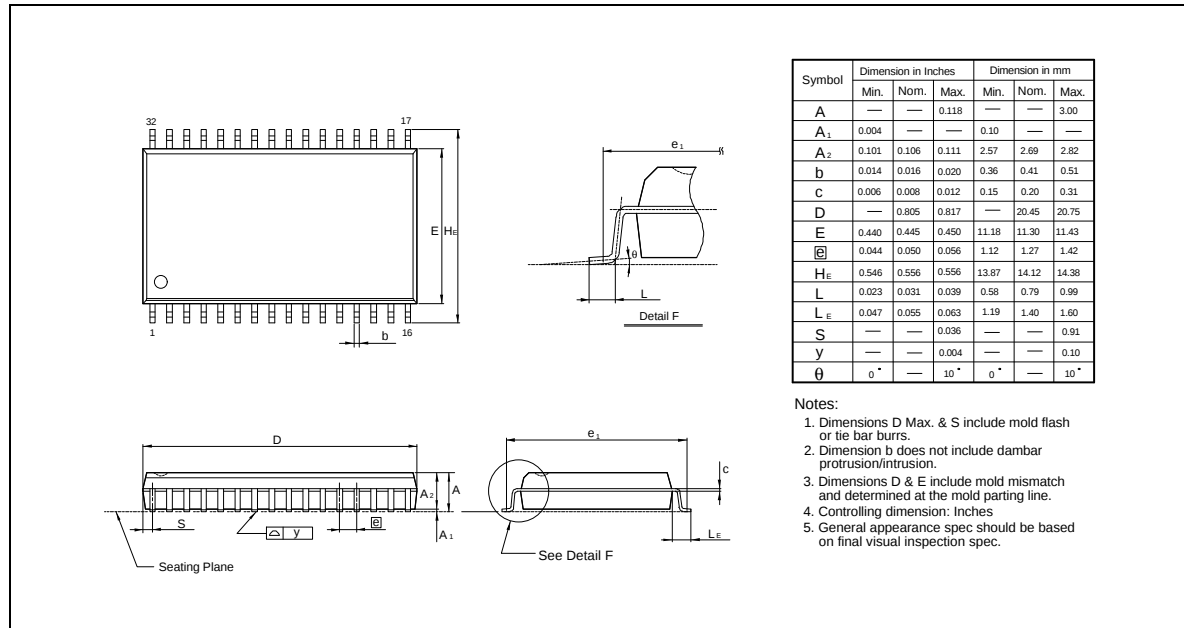


| PAD NO. | X        | Y        |
|---------|----------|----------|
| 1       | -485.31  | 2376.64  |
| 2       | -1200.87 | 2376.64  |
| 3       | -1341.05 | 2376.64  |
| 4       | -1480.80 | 2376.64  |
| 5       | -1622.21 | 2376.64  |
| 6       | -1767.47 | 2376.64  |
| 7       | -1993.03 | 2228.49  |
| 8       | -1990.55 | -2275.79 |
| 9       | -1789.57 | -2382.05 |
| 10      | -1556.20 | -2382.05 |
| 11      | -1405.83 | -2382.05 |
| 12      | -1169.73 | -2383.00 |
| 13      | -870.28  | -2383.00 |
| 14      | -567.65  | -2383.00 |
| 15      | -336.94  | -2385.00 |
| 16      | -112.55  | -2385.00 |
| 17      | 224.85   | -2383.00 |
| 18      | 497.55   | -2383.00 |
| 19      | 772.25   | -2383.00 |
| 20      | 1044.95  | -2383.00 |
| 21      | 1319.65  | -2383.00 |
| 22      | 1537.77  | -2382.05 |
| 23      | 1773.94  | -2382.05 |
| 24      | 1985.78  | -2297.62 |
| 25      | 1987.47  | 2221.27  |
| 26      | 1669.63  | 2376.64  |
| 27      | 1451.03  | 2376.64  |
| 28      | 1196.59  | 2376.64  |
| 29      | 956.65   | 2376.64  |
| 30      | 219.67   | 2376.64  |
| 31      | 79.47    | 2376.64  |
| 32      | -145.06  | 2343.58  |
| 33      | -353.56  | 2343.58  |

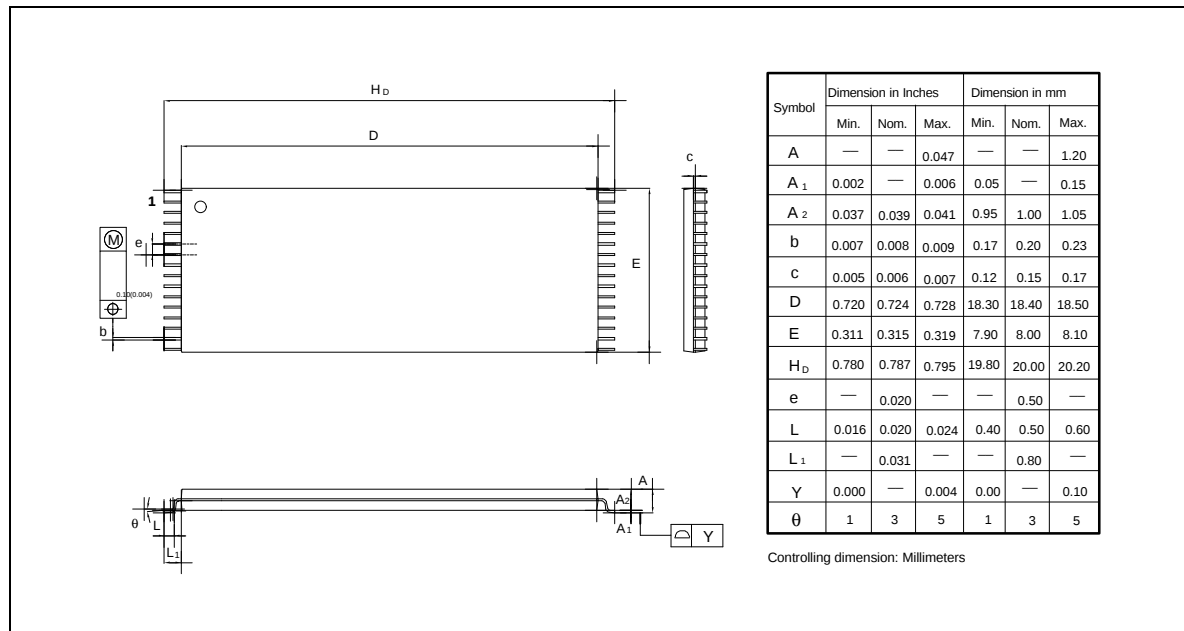
Note: For bare chip form (C.O.B.) applications, the substrate must be connected to VDD or left floating in the PCB layout.

## PACKAGE DIMENSIONS

### 32-pin SOP Wide Body

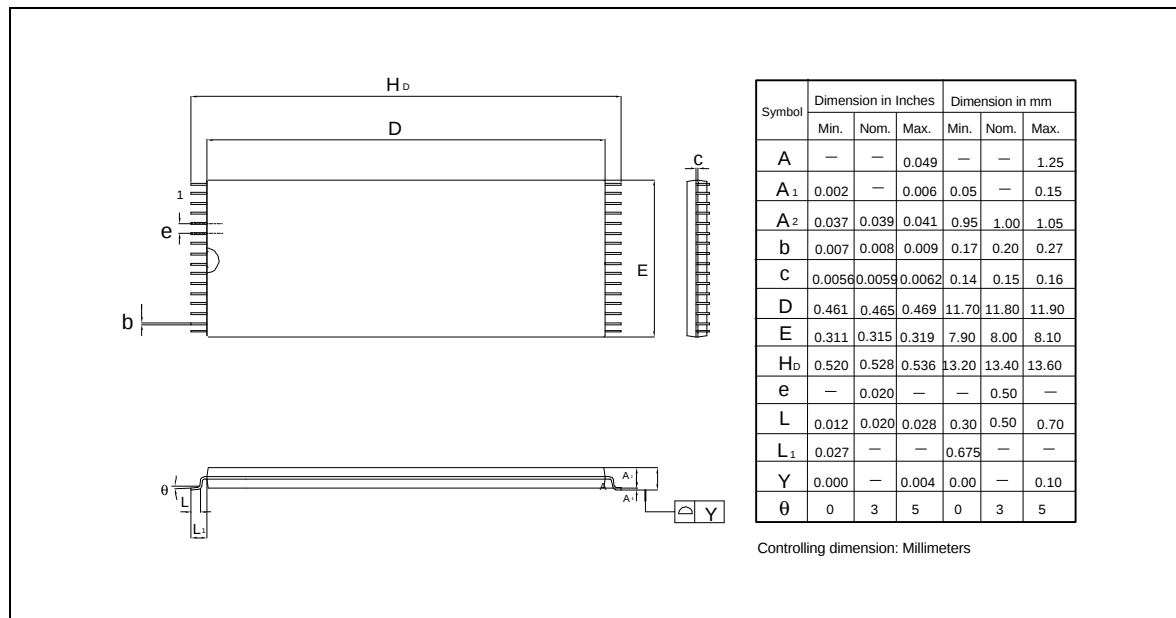


### 32-pin Standard Type One TSOP



Package Dimensions, continued

## 32-pin Small Type One TSOP





## VERSION HISTORY

| VERSION | DATE      | PAGE       | DESCRIPTION                                                                                                             |
|---------|-----------|------------|-------------------------------------------------------------------------------------------------------------------------|
| A1      | Oct. 1999 | -          | Initial Issued                                                                                                          |
| A2      | May 2000  | 1, 2, 8, 9 | Delete 32-pin P-DIP Package;<br>Add LE in Operating Characteristics, Data Retention<br>Characteristics & Ordering Info. |
|         |           | 9          | Add in Bonding Pad Diagram                                                                                              |



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Note: All data and specifications are subject to change without notice.