Winbond Electronics Corp.

# 64K × 8 HIGH SPEED CMOS STATIC RAM

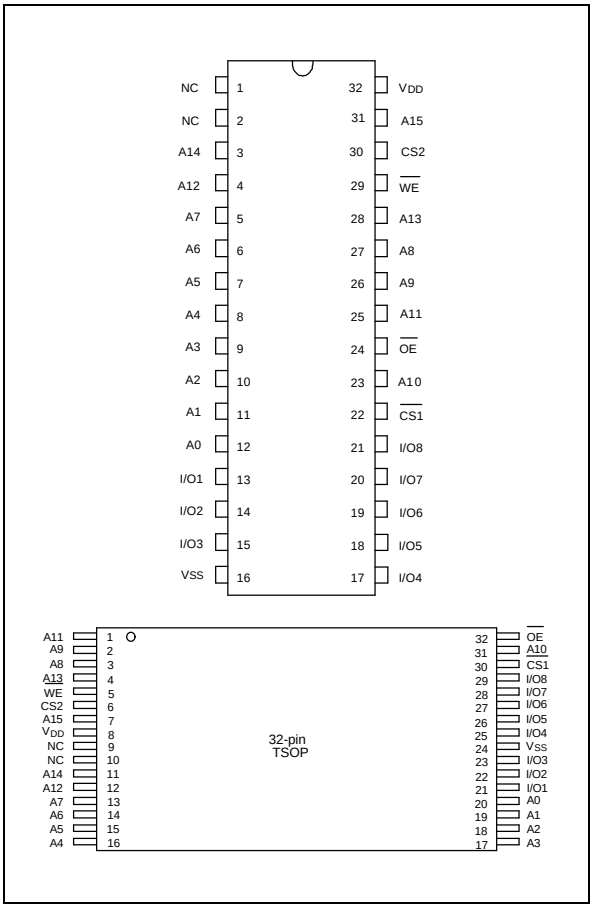
## GENERAL DESCRIPTION

The W24512A is a high speed, low power CMOS static RAM organized as 65536 × 8 bits that operates on a single 5-volt power supply. This device is manufactured using Winbond's high performance CMOS technology.

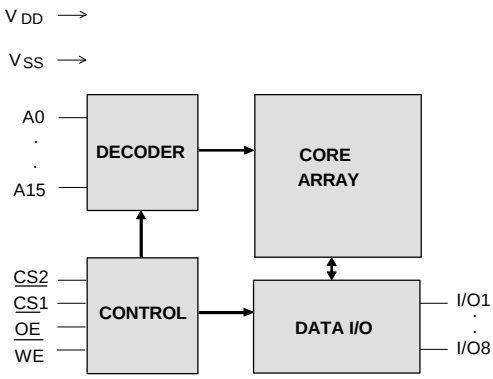
## FEATURES

- High speed access time: 15/20/25/35 nS (max.)
- Low power consumption:
  - Active: 500 mW (typ.)
- Single +5V power supply
- Fully static operation
- All inputs and outputs directly TTL compatible
- Three-state outputs
- Available packages: 32-pin 300 mil SOJ, skinny DIP, 450 mil SOP, and standard type one TSOP

## PIN CONFIGURATIONS




## BLOCK DIAGRAM




## PIN DESCRIPTION

| SYMBOL | DESCRIPTION |
|---|---|
| A0–A15 | Address Inputs |
| I/O1–I/O8 | Data Inputs/Outputs |
| $\overline{CS1}$, CS2 | Chip Select Inputs |
| $\overline{WE}$ | Write Enable Input |
| $\overline{OE}$ | Output Enable Input |
| VDD | Power Supply |
| VSS | Ground |
| NC | No Connection |

## TRUTH TABLE

| $\overline{CS1}$ | CS2 | $\overline{OE}$ | $\overline{WE}$ | MODE | I/O1- I/O8 | $V_{DD}$ CURRENT |
|---|---|---|---|---|---|---|
| H | X | X | X | Not Selected | High Z | $I_{SB}$, $I_{SB1}$ |
| X | L | X | X | Not Selected | High Z | $I_{SB}$, $I_{SB1}$ |
| L | H | H | H | Output Disable | High Z | $I_{DD}$ |
| L | H | L | H | Read | Data Out | $I_{DD}$ |
| L | H | X | L | Write | Data In | $I_{DD}$ |

## DC CHARACTERISTICS

### Absolute Maximum Ratings

| PARAMETER | RATING | UNIT |
|---|---|---|
| Supply Voltage to $V_{SS}$ Potential | -0.5 to +7.0 | V |
| Input/Output to $V_{SS}$ Potential | -0.5 to $V_{DD}$ +0.5 | V |
| Allowable Power Dissipation | 1.0 | W |
| Storage Temperature | -65 to +150 | °C |
| Operating Temperature | 0 to +70 | °C |

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

### Operating Characteristics

($V_{DD}$ = 5V ±10%, $V_{SS}$ = 0V, $T_A$ = 0 to 70° C)

| PARAMETER | SYM. | TEST CONDITIONS | | MIN. | TYP. | MAX. | UNIT |
|---|---|---|---|---|---|---|---|
| Input Low Voltage | $V_{IL}$ | - | | -0.5 | - | +0.8 | V |
| Input High Voltage | $V_{IH}$ | - | | +2.2 | - | $V_{DD}$ +0.5 | V |
| Input Leakage Current | $I_{LI}$ | $V_{IN}$ = $V_{SS}$ to $V_{DD}$ | | -10 | - | +10 | µA |
| Output Leakage Current | $I_{LO}$ | $V_{I/O}$ = $V_{SS}$ to $V_{DD}$<br>$\overline{CS1}$ = $V_{IH}$ or CS2 = $V_{IL}$ or<br>$\overline{OE}$ = $V_{IH}$ or $\overline{WE}$ = $V_{IL}$ | | -10 | - | +10 | µA |
| Output Low Voltage | $V_{OL}$ | $I_{OL}$ = +8.0 mA | | - | - | 0.4 | V |
| Output High Voltage | $V_{OH}$ | $I_{OH}$ = -4.0 mA | | 2.4 | - | - | V |
| Operating Power Supply Current | $I_{DD}$ | $\overline{CS1}$ = $V_{IL}$, CS2 = $V_{IH}$<br>I/O = 0 mA, Cycle = min.<br>Duty = 100% | 15 | - | - | 200 | mA |
| | | | 20 | | | 160 | |
| | | | 25 | | | 160 | |
| | | | 35 | - | - | 140 | |
| Standby Power Supply Current | $I_{SB}$ | $\overline{CS1}$ = $V_{IH}$ or CS2 = $V_{IL}$<br>Cycle = min., Duty = 100% | | - | - | 30 | mA |
| | $I_{SB1}$ | $\overline{CS1}$ ≥ $V_{DD}$ -0.2V or<br>CS2 ≤ 0.2V | | - | - | 10 | mA |

Note: Typical characteristics are at $V_{DD}$ = 5V, $T_A$ = 25° C.

## CAPACITANCE

($V_{DD}$ = 5V, $T_A$ = 25° C, f = 1 MHz)

| PARAMETER | SYM. | CONDITIONS | MAX. | UNIT |
|---|---|---|---|---|
| Input Capacitance | $C_{IN}$ | $V_{IN}$ = 0V | 8 | pF |
| Input/Output Capacitance | $C_{I/O}$ | $V_{OUT}$ = 0V | 10 | pF |

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

## THERMAL RESISTANCE

| PARAMETER | SYM. | CONDITIONS | MAX. | UNIT |
|---|---|---|---|---|
| Junction to Case Thermal Resistance | $\theta_{JC}$ | A. F. R. = 1m/sec, $T_A$ = 25° C | 20 | °C/W |
| Junction to Ambient Thermal Resistance | $\theta_{JA}$ | A. F. R. = 1m/sec, $T_A$ = 25° C | 60 | °C/W |

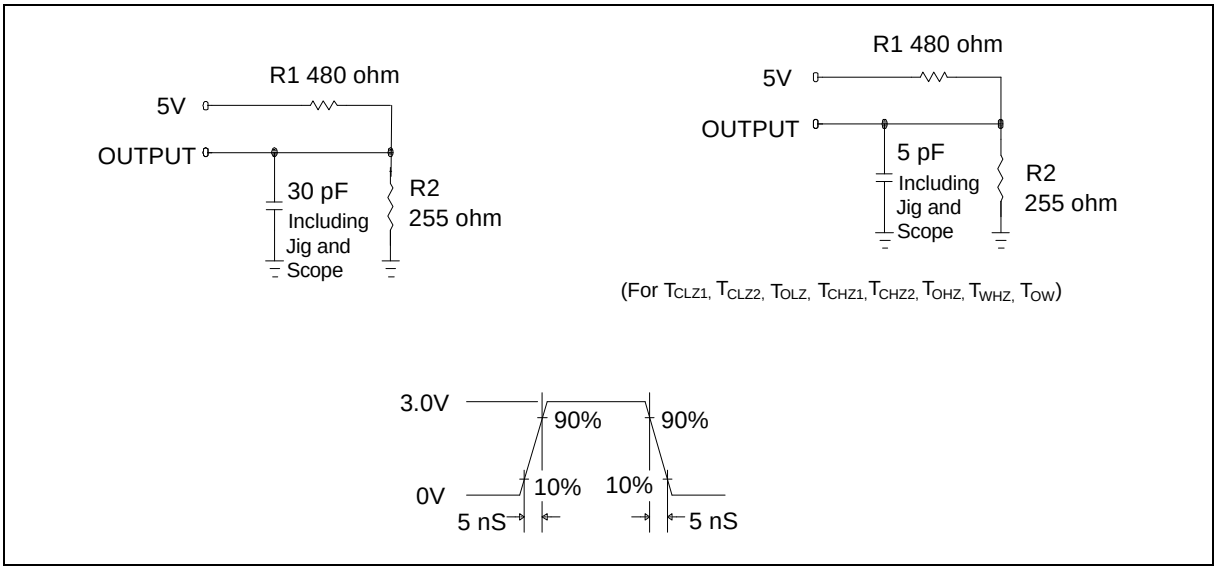
Note: These parameters are only applied to "TSOP" and "SOJ" package types.

## AC CHARACTERISTICS

### AC Test Conditions

| PARAMETER | CONDITIONS |
|---|---|
| Input Pulse Levels | 0V to 3V |
| Input Rise and Fall Times | 5 nS |
| Input and Output Timing Reference Level | 1.5V |
| Output Load | $C_L$ = 30 pF, $I_{OH}/I_{OL}$ = -4 mA/8 mA |

### AC Test Loads and Waveform



AC Characteristics, continued

($V_{DD}$ = 5V ±10%, $V_{SS}$ = 0V, $T_A$ = 0 to 70° C)

## Read Cycle

| PARAMETER | | SYM. | W24512A-15 | | W24512A-25 | | W24512A-25 | | W24512A-35 | | UNIT |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | MIN. | MAX. | MIN. | MAX. | MIN. | MAX. | MIN. | MAX. | |
| Read Cycle Time | | $T_{RC}$ | 15 | - | 20 | - | 25 | - | 35 | - | nS |
| Address Access Time | | $T_{AA}$ | - | 15 | - | 20 | - | 25 | - | 35 | nS |
| Chip Select Access Time | $\overline{CS1}$ | $T_{ACS1}$ | - | 15 | - | 20 | - | 25 | - | 35 | nS |
| | CS2 | $T_{ACS2}$ | - | 15 | - | 20 | - | 25 | - | 35 | nS |
| Output Enable to Output Valid | | $T_{AOE}$ | - | 7 | - | 10 | - | 12 | - | 17 | nS |
| Chip Selection to Output in Low Z | $\overline{CS1}$ | $T_{CLZ1}$* | 3 | - | 3 | - | 3 | - | 3 | - | nS |
| | CS2 | $T_{CLZ2}$* | 3 | - | 3 | - | 3 | - | 3 | - | nS |
| Output Enable to Output in Low Z | | $T_{OLZ}$* | 0 | - | 0 | - | 0 | - | 0 | - | nS |
| Chip Deselection to Output in High Z | $\overline{CS1}$ | $T_{CHZ1}$* | - | 7 | - | 10 | - | 12 | - | 17 | nS |
| | CS2 | $T_{CHZ2}$* | - | 7 | - | 10 | - | 12 | - | 17 | nS |
| Output Disable to Output in High Z | | $T_{OHZ}$* | - | 7 | - | 1 | - | 12 | - | 17 | nS |
| Output Hold from Address Change | | $T_{OH}$ | 3 | - | 3 | - | 3 | - | 3 | - | nS |

* These parameters are sampled but not 100% tested.

## Write Cycle

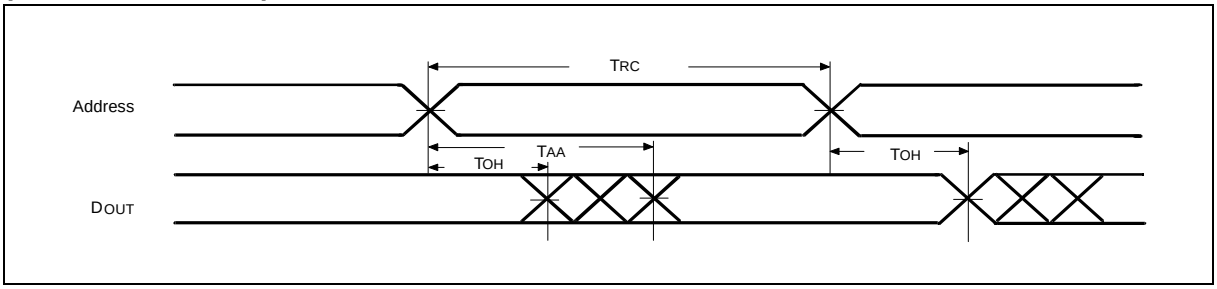
| PARAMETER | | SYM. | W24512A-15 | | W24512A-25 | | W24512A-25 | | W24512A-35 | | UNIT |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | MIN. | MAX. | MIN. | MAX. | MIN. | MAX. | MIN. | MAX. | |
| Write Cycle Time | | $T_{WC}$ | 15 | - | 20 | - | 25 | - | 35 | - | nS |
| Chip Selection to End of Write | $\overline{CS1}$ | $T_{CW1}$ | 13 | - | 17 | - | 18 | - | 20 | - | nS |
| | CS2 | $T_{CW2}$ | 13 | - | 17 | - | 18 | - | 20 | - | nS |
| Address Valid to End of Write | | $T_{AW}$ | 13 | - | 17 | - | 18 | - | 20 | - | nS |
| Address Setup Time | | $T_{AS}$ | 0 | - | 0 | - | 0 | - | 0 | - | nS |
| Write Pulse Width | | $T_{WP}$ | 10 | - | 12 | - | 15 | - | 18 | - | nS |
| Write Recovery Time | $\overline{CS1}$, $\overline{WE}$ | $T_{WR1}$ | 0 | - | 0 | - | 0 | - | 0 | - | nS |
| | CS2 | $T_{WR2}$ | 0 | - | 0 | - | 0 | - | 0 | - | nS |
| Data Valid to End of Write | | $T_{DW}$ | 9 | - | 10 | - | 12 | - | 15 | - | nS |
| Data Hold from End of Write | | $T_{DH}$ | 0 | - | 0 | - | 0 | - | 0 | - | nS |
| Write to Output in High Z | | $T_{WHZ}$* | - | 8 | - | 10 | - | 12 | - | 15 | nS |
| Output Disable to Output in High Z | | $T_{OHZ}$* | - | 8 | - | 10 | - | 12 | - | 15 | nS |
| Output Active from End of Write | | $T_{OW}$ | 0 | - | 0 | - | 0 | - | 0 | - | nS |

* These parameters are sampled but not 100% tested.

## TIMING WAVEFORMS

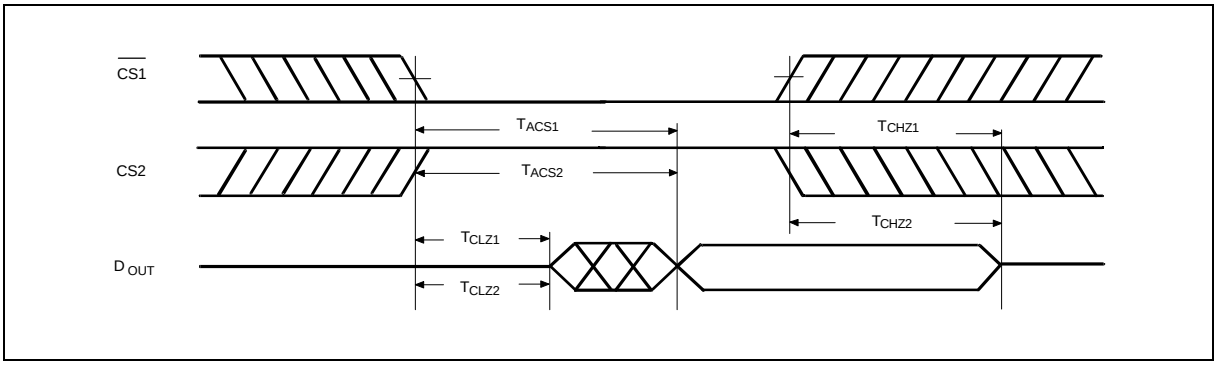
### Read Cycle 1

**(Address Controlled)**



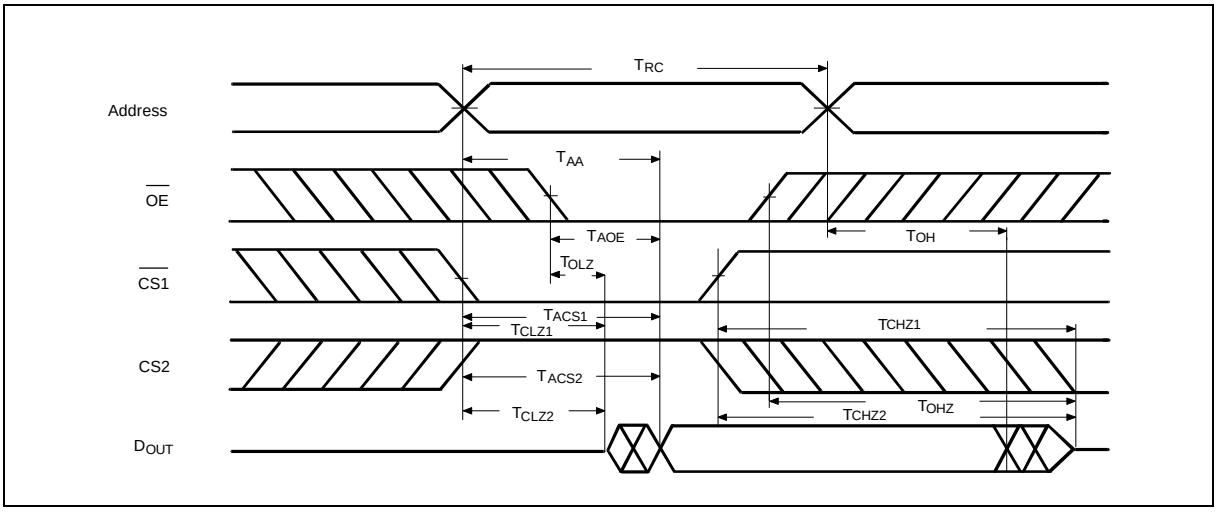

### Read Cycle 2

**(Chip Select Controlled)**




### Read Cycle 3

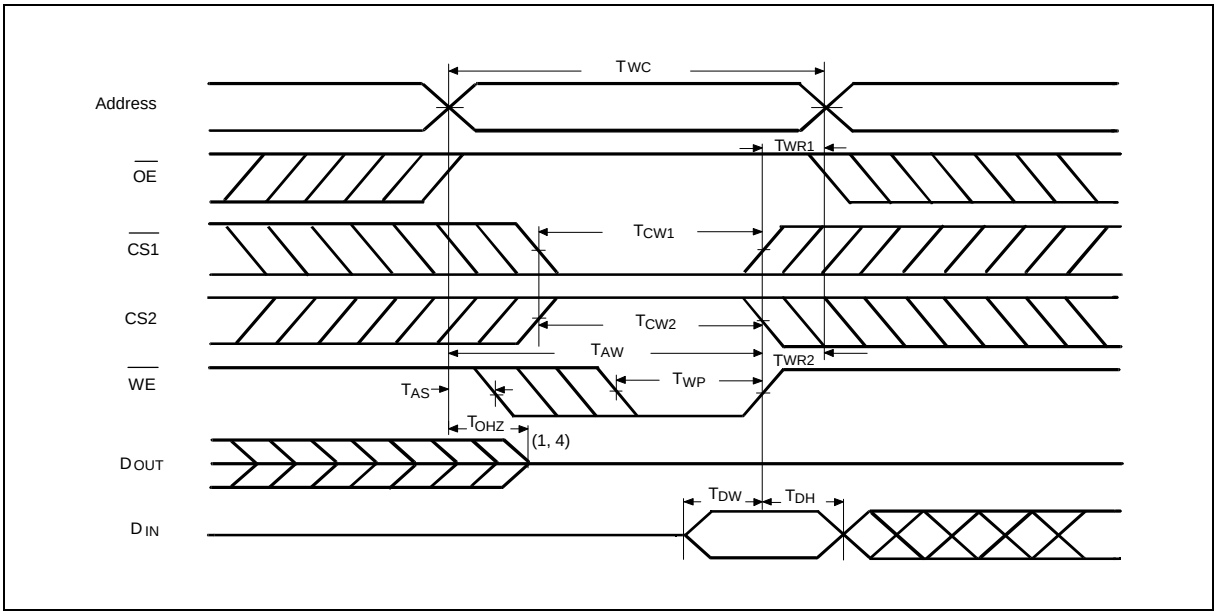
**(Output Enable Controlled)**



Timing Waveforms, continued

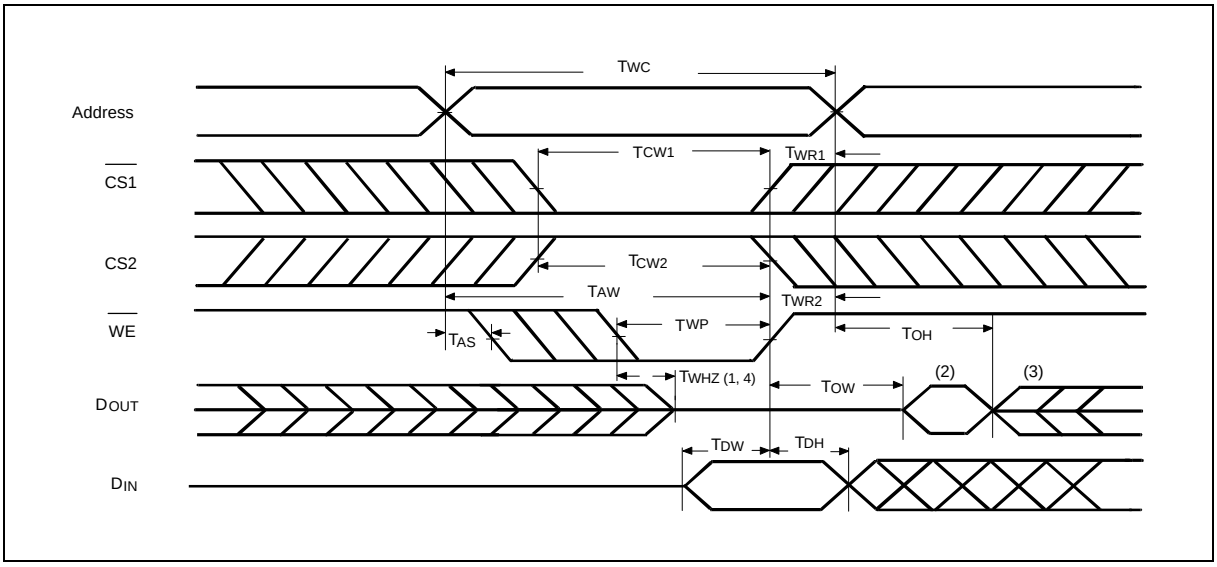
## Write Cycle 1

### ($\overline{OE}$ Clock)




## Write Cycle 2

### ($\overline{OE}$ = VIL 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 DOUT are the same as the data written to DIN during the write cycle.
3. DOUT provides the read data for the next address.
4. Transition is measured ±500 mV from steady state with CL = 5 pF. This parameter is guaranteed but not 100% tested.

## ORDERING INFORMATION

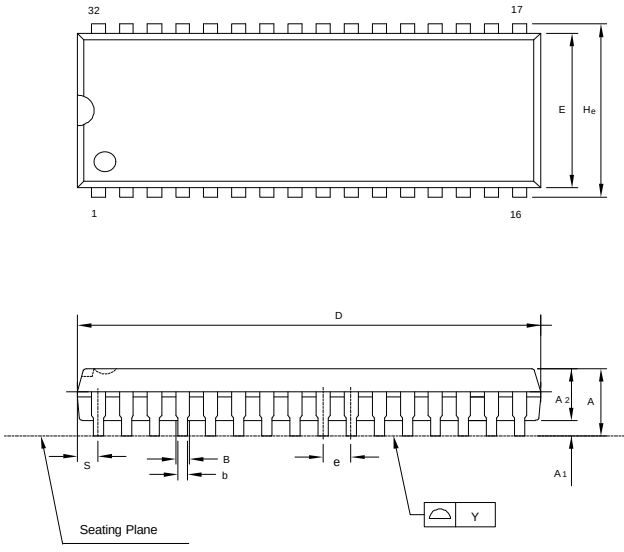
| PART NO. | ACCESS TIME (nS) | OPERATING CURRENT MAX. (mA) | STANDBY CURRENT MAX. (mA) | PACKAGE |
|---|---|---|---|---|
| W24512AK-15 | 15 | 200 | 10 | 300 mil skinny DIP |
| W24512AK-20 | 20 | 160 | 10 | 300 mil skinny DIP |
| W24512AK-25 | 25 | 160 | 10 | 300 mil skinny DIP |
| W24512AK-35 | 35 | 140 | 10 | 300 mil skinny DIP |
| W24512AJ-15 | 15 | 200 | 10 | 300 mil SOJ |
| W24512AJ-20 | 20 | 160 | 10 | 300 mil SOJ |
| W24512AJ-25 | 25 | 160 | 10 | 300 mil SOJ |
| W24512AJ-35 | 35 | 140 | 10 | 300 mil SOJ |
| W24512AS-15 | 15 | 200 | 10 | 450 mil SOP |
| W24512AS-20 | 20 | 160 | 10 | 450 mil SOP |
| W24512AS-25 | 25 | 160 | 10 | 450 mil SOP |
| W24512AS-35 | 35 | 140 | 10 | 450 mil SOP |
| W24512AT-15 | 15 | 200 | 10 | standard type one TSOP |
| W24512AT-20 | 20 | 160 | 10 | standard type one TSOP |
| W24512AT-25 | 25 | 160 | 10 | standard type one TSOP |
| W24512AT-35 | 35 | 140 | 10 | standard 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.

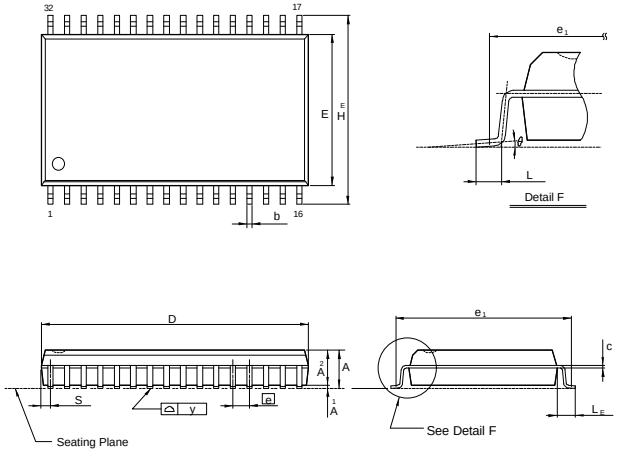
# PACKAGE DIMENSIONS

## 32-pin SOJ




| Symbol | Dimension in Inches | | | Dimension in mm | | |
|---|---|---|---|---|---|---|
| | Min. | Nom. | Max. | Min. | Nom. | Max. |
| A | — | — | 0.140 | — | — | 3.556 |
| $A_1$ | 0.020 | — | — | 0.508 | — | — |
| $A_2$ | 0.095 | 0.100 | 0.105 | 2.413 | 2.540 | 2.667 |
| B | 0.026 | 0.028 | 0.032 | 0.660 | 0.711 | 0.813 |
| b | 0.016 | 0.018 | 0.022 | 0.406 | 0.457 | 0.559 |
| c | 0.008 | 0.010 | 0.014 | 0.203 | 0.254 | 0.356 |
| D | 0.815 | 0.825 | 0.835 | 20.701 | 20.955 | 21.209 |
| E | 0.295 | 0.300 | 0.305 | 7.493 | 7.620 | 7.747 |
| e | 0.044 | 0.050 | 0.056 | 1.118 | 1.270 | 1.422 |
| $e_1$ | 0.247 | 0.267 | 0.287 | 6.274 | 6.782 | 7.290 |
| $H_e$ | 0.325 | 0.335 | 0.345 | 8.255 | 8.509 | 8.763 |
| L | 0.080 | — | — | 2.032 | | — |
| S | — | — | 0.045 | — | — | 1.143 |
| Y | — | | 0.004 | — | — | 0.102 |
| θ | 0 | | 10 | 0° | — | 10° |

## 32-pin SO Wide Body

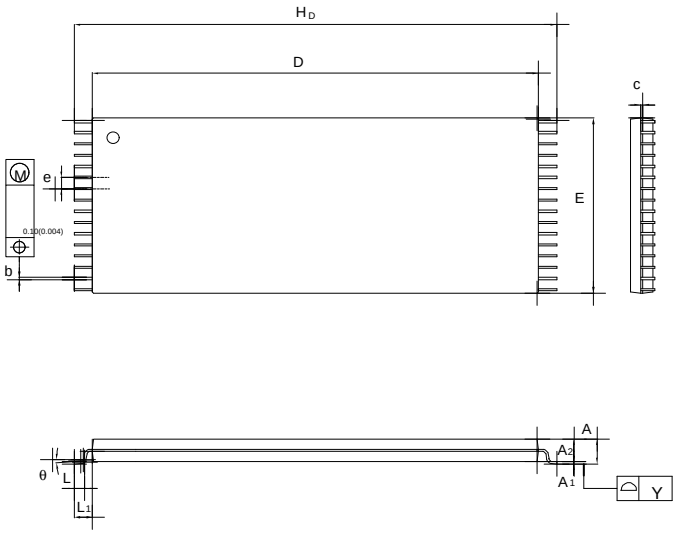



| Symbol | Dimension in Inches | | | Dimension in mm | | |
|---|---|---|---|---|---|---|
| | Min. | Nom. | Max. | Min. | Nom. | Max. |
| A | — | — | 0.118 | — | — | 3.00 |
| $A_1$ | 0.004 | — | — | 0.10 | — | — |
| $A_2$ | 0.101 | 0.106 | 0.111 | 2.57 | 2.69 | 2.82 |
| b | 0.014 | 0.016 | 0.020 | 0.36 | 0.41 | 0.51 |
| c | 0.006 | 0.008 | 0.012 | 0.15 | 0.20 | 0.31 |
| D | — | 0.805 | 0.817 | — | 20.45 | 20.75 |
| E | 0.440 | 0.445 | 0.450 | 11.18 | 11.30 | 11.43 |
| e | 0.044 | 0.050 | 0.056 | 1.12 | 1.27 | 1.42 |
| $H_E$ | 0.546 | 0.556 | 0.556 | 13.87 | 14.12 | 14.38 |
| L | 0.023 | 0.031 | 0.039 | 0.58 | 0.79 | 0.99 |
| $L_E$ | 0.047 | 0.055 | 0.063 | 1.19 | 1.40 | 1.60 |
| S | — | — | 0.036 | — | — | 0.91 |
| y | — | — | 0.004 | — | — | 0.10 |
| θ | 0° | — | 10° | 0° | — | 10° |

Notes:
1. Dimension D Max. & S include mold flash or tie bar burrs.
2. Dimension b does not include dambar protrusion/intrusion.
3. Dimension D & E include mold mismatch and are determined at the mold parting line.
4. Controlling dimension: Inches.
5. General appearance spec should be based on final visual inspection spec.

Package Dimensions, continued

## 32-pin TSOP

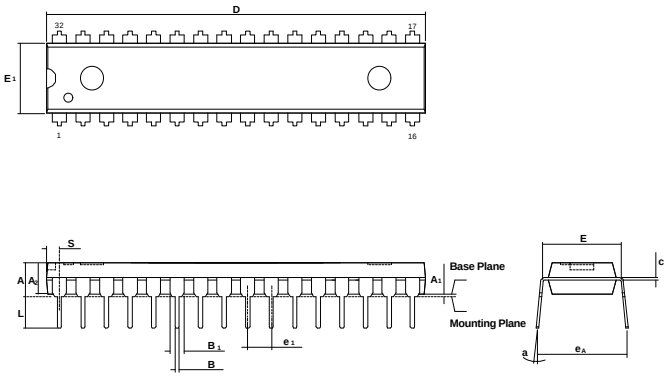



| Symbol | Dimension in Inches | | | Dimension in mm | | |
|---|---|---|---|---|---|---|
| | Min. | Nom. | Max. | Min. | Nom. | Max. |
| A | — | — | 0.047 | — | — | 1.20 |
| $A_1$ | 0.002 | — | 0.006 | 0.05 | — | 0.15 |
| $A_2$ | 0.037 | 0.039 | 0.041 | 0.95 | 1.00 | 1.05 |
| b | 0.007 | 0.008 | 0.009 | 0.17 | 0.20 | 0.23 |
| c | 0.005 | 0.006 | 0.007 | 0.12 | 0.15 | 0.17 |
| D | 0.720 | 0.724 | 0.728 | 18.30 | 18.40 | 18.50 |
| E | 0.311 | 0.315 | 0.319 | 7.90 | 8.00 | 8.10 |
| $H_D$ | 0.780 | 0.787 | 0.795 | 19.80 | 20.00 | 20.20 |
| e | — | 0.020 | — | — | 0.50 | — |
| L | 0.016 | 0.020 | 0.024 | 0.40 | 0.50 | 0.60 |
| $L_1$ | — | 0.031 | — | — | 0.80 | — |
| Y | 0.000 | — | 0.004 | 0.00 | — | 0.10 |
| θ | 1 | 3 | 5 | 1 | 3 | 5 |

Note:

Controlling dimension: Millimeter

## 32-pin P-DIP Skinny (300 mil)




| Symbol | Dimension in Inches | | | Dimension in mm | | |
|---|---|---|---|---|---|---|
| | Min. | Nom. | Max. | Min. | Nom. | Max. |
| A | — | — | 0.200 | — | — | 5.08 |
| $A_1$ | 0.015 | — | — | 0.38 | — | — |
| $A_2$ | 0.145 | 0.150 | 0.155 | 3.68 | 3.81 | 3.94 |
| B | 0.016 | 0.018 | 0.022 | 0.41 | 0.46 | 0.56 |
| $B_1$ | 0.058 | 0.060 | 0.064 | 1.47 | 1.52 | 1.63 |
| c | 0.008 | 0.010 | 0.014 | 0.20 | 0.25 | 0.36 |
| D | — | 1.60 | 1.62 | — | 40.64 | 41.15 |
| E | 0.295 | 0.315 | 0.335 | 7.49 | 8.00 | 8.50 |
| $E_1$ | 0.286 | 0.290 | 0.294 | 7.26 | 7.36 | 7.46 |
| $e_1$ | 0.090 | 0.100 | 0.110 | 2.29 | 2.54 | 2.79 |
| L | 0.120 | 0.130 | 0.140 | 3.05 | 3.30 | 3.56 |
| a | 0 | — | 15 | 0° | — | 15° |
| $e_A$ | 0.430 | 0.450 | 0.470 | 10.92 | 11.43 | 11.94 |
| S | — | — | 0.065 | — | — | 1.65 |

Notes:

1. Dimension D Max. & S include mold flash or tie bar burrs.
2. Dimension E1 does not include interlead flash.
3. Dimension D & E1 include mold mismatch and are determined at the mold parting line.
4. Dimension B1 does not include dambar protrusion/intrusion.
5. Controlling dimension: Inches.
6. General appearance spec. should be based or final visual inspection spec.

## VERSION HISTORY

| VERSION | DATE | PAGE | DESCRIPTION |
|---|---|---|---|
| A7 | Mar. 1999 | - | Arrange access time for 15/20/25/35 nS |

**Headquarters**
No. 4, Creation Rd. III,
Science-Based Industrial Park,
Hsinchu, Taiwan
TEL: 886-3-5770066
FAX: 886-3-5792647
http://www.winbond.com.tw/
Voice & Fax-on-demand: 886-2-7197006

**Taipei Office**
11F, No. 115, Sec. 3, Min-Sheng East Rd.,
Taipei, Taiwan
TEL: 886-2-7190505
FAX: 886-2-7197502

**Winbond Electronics (H.K.) Ltd.**
Rm. 803, World Trade Square, Tower II,
123 Hoi Bun Rd., Kwun Tong,
Kowloon, Hong Kong
TEL: 852-27513100
FAX: 852-27552064

**Winbond Electronics North America Corp.**
**Winbond Memory Lab.**
**Winbond Microelectronics Corp.**
**Winbond Systems Lab.**
2730 Orchard Parkway, San Jose,
CA 95134, U.S.A.
TEL: 1-408-9436666
FAX: 1-408-9436668