

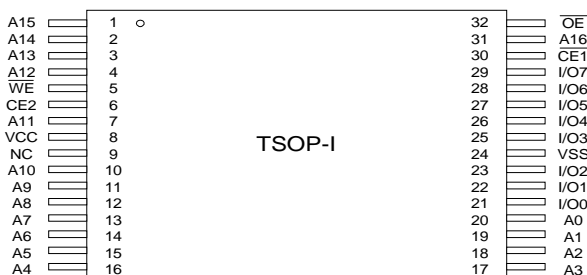
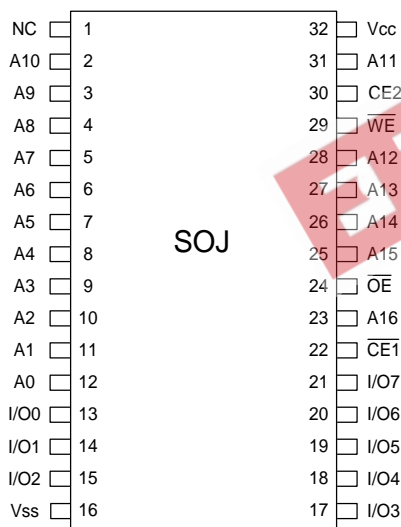
# SRAM

# 128K X 8 HIGH SPEED CMOS STATIC RAM

## FEATURES

- Fast Address Access Times : 10/12/15ns
- Single 5V +10% power supply
- Low Power Consumption : 110/105/100mA
- TTL I/O compatible
- 2.0V data retention mode
- Automatic power-down when deselected
- Available packages :  
32-pin 300 mil SOJ & 32-pin TSOP-I
- Industry Standard Pin Assignment

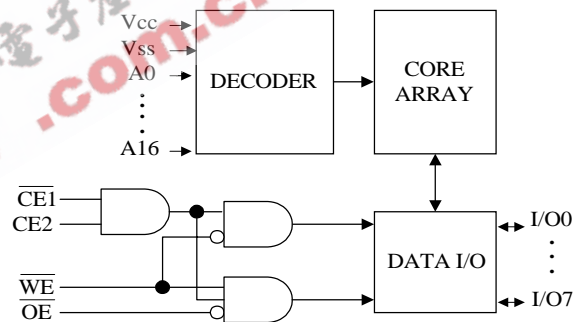
## PIN CONFIGURATION



## GENERAL DESCRIPTION

The T14M1024A is a one-megabit density, fast static random access memory organized as 131,072 words by 8 bits. It is designed for use in high performance memory applications such as main memory storage and high speed communication buffers. Fabricated using high performance CMOS technology, access times down to 10ns are achieved. Memory expansion by banking is easily accomplished using the chip enable pins  $\overline{CE1}$  and  $\overline{CE2}$ . This device is packaged in a standard 32-pin 300 mil SOJ and 32-pin TSOP-I.

## BLOCK DIAGRAM



## PIN DESCRIPTION

| SYMBOL                           | DESCRIPTION         |
|----------------------------------|---------------------|
| A0 - A16                         | Address Inputs      |
| I/O0 - I/O7                      | Data Inputs/Outputs |
| $\overline{CE1}, \overline{CE2}$ | Chip Select Inputs  |
| $\overline{WE}$                  | Write Enable        |
| $\overline{OE}$                  | Output Enable       |
| Vcc                              | Power Supply        |
| Vss                              | Ground              |

## PART NUMBER EXAMPLES

|               | PACKAGE         | SPEED |
|---------------|-----------------|-------|
| T14M1024A-10J | SOJ 300mil      | 10ns  |
| T14M1024A-10P | TSOP-I 8x13.4mm | 10ns  |
| T14M1024A-10H | TSOP-I 8x20mm   | 10ns  |

**DC CHARACTERISTICS ABSOLUTE MAXIMUM RATINGS**

| PARAMETER                    | SYM              | RATING                       | UNIT |
|------------------------------|------------------|------------------------------|------|
| Power Supply Voltage         | V <sub>CC</sub>  | -0.5 to 7.0                  | V    |
| Input Voltage                | V <sub>IN</sub>  | -0.5 to V <sub>CC</sub> +0.5 | V    |
| Output Voltage               | V <sub>OUT</sub> | -0.5 to V <sub>CC</sub> +0.5 | V    |
| Operating Temperature        | T <sub>OPR</sub> | 0 to +70                     | °C   |
| Storage Temperature          | T <sub>STG</sub> | -55 to +150                  | °C   |
| Power Dissipation            | P <sub>D</sub>   | 1.0                          | W    |
| Short Circuit Output Current | I <sub>OUT</sub> | 50                           | mA   |

**TRUTH TABLE**

| CE1 | CE2 | OE | WE | MODE           | I/O0- I/O7 | V <sub>CC</sub>                    |
|-----|-----|----|----|----------------|------------|------------------------------------|
| H   | X   | X  | X  | Not Selected   | High-Z     | I <sub>SB</sub> , I <sub>SB1</sub> |
| X   | L   | X  | X  | Not Selected   | High-Z     | I <sub>SB</sub> , I <sub>SB1</sub> |
| L   | H   | H  | H  | Output Disable | High-Z     | I <sub>CC</sub>                    |
| L   | H   | L  | H  | Read           | Data Out   | I <sub>CC</sub>                    |
| L   | H   | X  | L  | Write          | Data In    | I <sub>CC</sub>                    |

**OPERATING CHARACTERISTICS**

(V<sub>CC</sub> = 5V ± 10%, T<sub>a</sub> = 0 to 70°C)

| PARAMETER                      | SYM.             | TEST CONDITIONS   | MIN. | MAX.                 | UNIT |    |
|--------------------------------|------------------|---|------|----------------------|------|----|
| Power Supply Voltage           | V <sub>CC</sub>  |   | 4.5  | 5.5                  | V    |    |
| Input Low Voltage              | V <sub>IL</sub>  |   | -0.5 | 0.8                  | V    |    |
| Input High Voltage             | V <sub>IH</sub>  |   | 2.2  | V <sub>CC</sub> +0.5 | V    |    |
| Input Leakage Current          | I <sub>LI</sub>  | V <sub>IN</sub> = V <sub>SS</sub> to V <sub>CC</sub>  | -    | 5                    | uA   |    |
| Output Leakage Current         | I <sub>LO</sub>  | V <sub>IN</sub> = V <sub>SS</sub> to V <sub>CC</sub> , $\overline{CE1} = V_{IH}$ or CE2 = V <sub>IL</sub> or $\overline{OE} = V_{IH}$ or $\overline{WE} = V_{IL}$ | -    | 5                    | uA   |    |
| Output Low Voltage             | V <sub>OL</sub>  | I <sub>OL</sub> = 4.0 mA  | -    | 0.4                  | V    |    |
| Output High Voltage            | V <sub>OH</sub>  | I <sub>OH</sub> = -2.0 mA   | 2.4  | -                    | V    |    |
| Operating Power Supply Current | I <sub>CC</sub>  | CE1 = V <sub>IL</sub><br>CE2 = V <sub>IH</sub> ; f = max<br>IO = 0mA  | 10ns | -                    | 110  | mA |
|                                |                  |   | 12ns | -                    | 105  | mA |
|                                |                  |   | 15ns | -                    | 100  | mA |
| Standby Power Supply Current   | I <sub>SB</sub>  | $\overline{CE1} = V_{IH}$ , CE2 = V <sub>IL</sub> , IO = 0mA  | -    | 25                   | mA   |    |
|                                | I <sub>SB1</sub> | V <sub>CC</sub> = max; $\overline{CE1} \geq V_{CC}-0.2V$ or CE2 ≤ V <sub>SS</sub> +0.2V; f=0mhz; IO = 0mA   | -    | 5                    | mA   |    |

**Note:** Typical characteristics are at V<sub>CC</sub> = 5V, T<sub>a</sub> = 25°C

**RECOMMENDED OPERATING CONDITIONS**

| PARAMETER           | SYM             | MIN     | TYP | MAX                  | UNIT |
|---------------------|-----------------|---------|-----|----------------------|------|
| Supply Voltage      | V <sub>CC</sub> | Typ-10% | 5   | Typ+10%              | V    |
| Input Voltage, low  | V <sub>IL</sub> | -0.3    | -   | 0.8                  | V    |
| Input Voltage, high | V <sub>IH</sub> | 2.2     | -   | V <sub>CC</sub> +0.3 | V    |
| Ambient Temperature | T <sub>A</sub>  | 0       | -   | 70                   | °C   |

**CAPACITANCE**

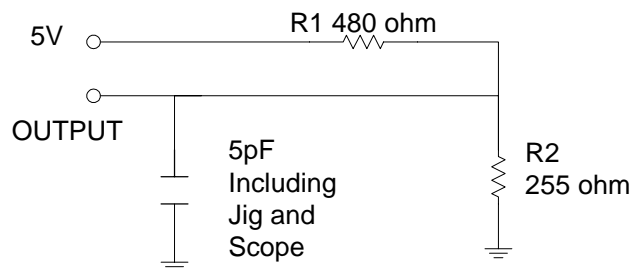
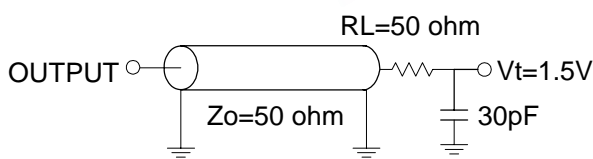
| PARAMETER                 | SYMBOL           | CONDITION             | MAX. | UNIT |
|---------------------------|------------------|-----------------------|------|------|
| Input Capacitance         | C <sub>IN</sub>  | V <sub>IN</sub> = 0V  | 6    | pF   |
| Input/ Output Capacitance | C <sub>I/O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

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

**AC TEST CONDITIONS**

| PARAMETER                               | CONDITIONS   |
|---|--|
| Input Pulse Levels                      | 0V to 3V   |
| Input Rise and Fall Times               | 3.0 ns   |
| Input and Output Timing Reference Level | 1.5V   |
| Output Load                             | C <sub>L</sub> = 30pF, I <sub>OH</sub> /I <sub>OL</sub> = -2mA/4mA |

**AC TEST LOADS AND WAVEFORM**



(For T<sub>CLZ</sub>, T<sub>OLZ</sub>, T<sub>CHZ</sub>, T<sub>OHZ</sub>, T<sub>WHZ</sub>, T<sub>OW</sub>)

**AC CHARACTERISTICS**

 ( $V_{CC}=5V \pm 10\%$ ,  $V_{SS} = 0V$ ,  $T_a = 0$  to  $70^\circ C$ )

**(1) READ CYCLE**

| PARAMETER                          | SYM.        | T14M1024A-10 |      | T14M1024A-12 |      | T14M1024A-15 |      | UNIT |
|------------------------------------|-------------|--------------|------|--------------|------|--------------|------|------|
|                                    |             | MIN.         | MAX. | MIN.         | MAX. | MIN.         | MAX. |      |
| Read Cycle Time                    | $t_{RC}$    | 10           | -    | 12           | -    | 15           | -    | ns   |
| Address Access Time                | $t_{AA}$    | -            | 10   | -            | 12   | -            | 15   | ns   |
| Chip Enable Access Time            | $t_{ACS}$   | -            | 10   | -            | 12   | -            | 15   | ns   |
| Output Enable to Output Valid      | $t_{AOE}$   | -            | 6    | -            | 7    | -            | 7    | ns   |
| Chip Enable to Output in Low Z     | $t_{CLZ}^*$ | 3            | -    | 3            | -    | 3            | -    | ns   |
| Output Enable to Output in Low Z   | $t_{OLZ}^*$ | 0            | -    | 0            | -    | 0            | -    | ns   |
| Chip Disable to Output in High Z   | $t_{CHZ}^*$ | -            | 5    | -            | 6    | -            | 7    | ns   |
| Output Disable to Output in High Z | $t_{OHZ}^*$ | -            | 5    | -            | 6    | -            | 7    | ns   |
| Output Hold from Address Change    | $t_{OH}$    | 3            | -    | 3            | -    | 3            | -    | ns   |

\* These parameters are sampled but not 100% tested.

**(2)WRITE CYCLE**

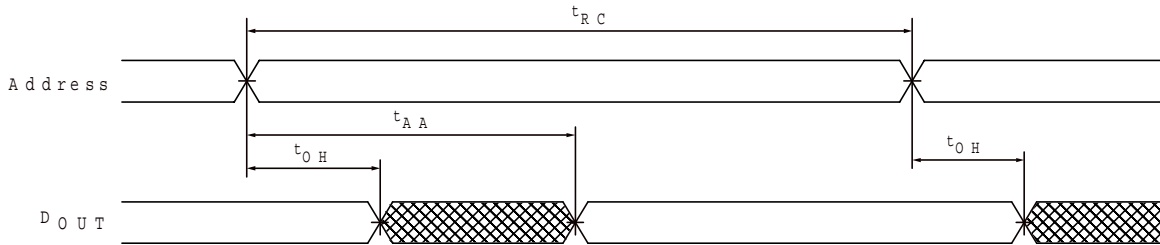
| PARAMETER                          | SYM.        | T14M1024A-10 |      | T14M1024A-12 |      | T14M1024A-15 |      | UNIT |
|------------------------------------|-------------|--------------|------|--------------|------|--------------|------|------|
|                                    |             | MIN.         | MAX. | MIN.         | MAX. | MIN.         | MAX. |      |
| Write Cycle Time                   | $t_{WC}$    | 10           | -    | 12           | -    | 15           | -    | ns   |
| Chip Enable to End of Write        | $t_{CW}$    | 8            | -    | 10           | -    | 11           | -    | ns   |
| Address Valid to End of Write      | $t_{AW}$    | 8            | -    | 10           | -    | 11           | -    | ns   |
| Address Setup Time                 | $t_{AS}$    | 0            | -    | 0            | -    | 0            | -    | ns   |
| Write Pulse Width                  | $t_{WP}$    | 8            | -    | 10           | -    | 11           | -    | ns   |
| Write Recovery Time                | $t_{WR}$    | 0            | -    | 0            | -    | 0            | -    | ns   |
| Data Valid to End of Write         | $t_{DW}$    | 6            | -    | 8            | -    | 8            | -    | ns   |
| Data Hold from End of Write        | $t_{DH}$    | 0            | -    | 0            | -    | 0            | -    | ns   |
| Write to Output in High Z          | $t_{WHZ}^*$ | -            | 5    | -            | 6    | -            | 6    | ns   |
| Output Disable to Output in High Z | $t_{OHZ}^*$ | -            | 5    | -            | 6    | -            | 7    | ns   |
| Output Active from End of Write    | $t_{OW}$    | 0            | -    | 0            | -    | 0            | -    | ns   |

\* These parameters are sampled but not 100% tested.

**TIMING WAVEFORMS**

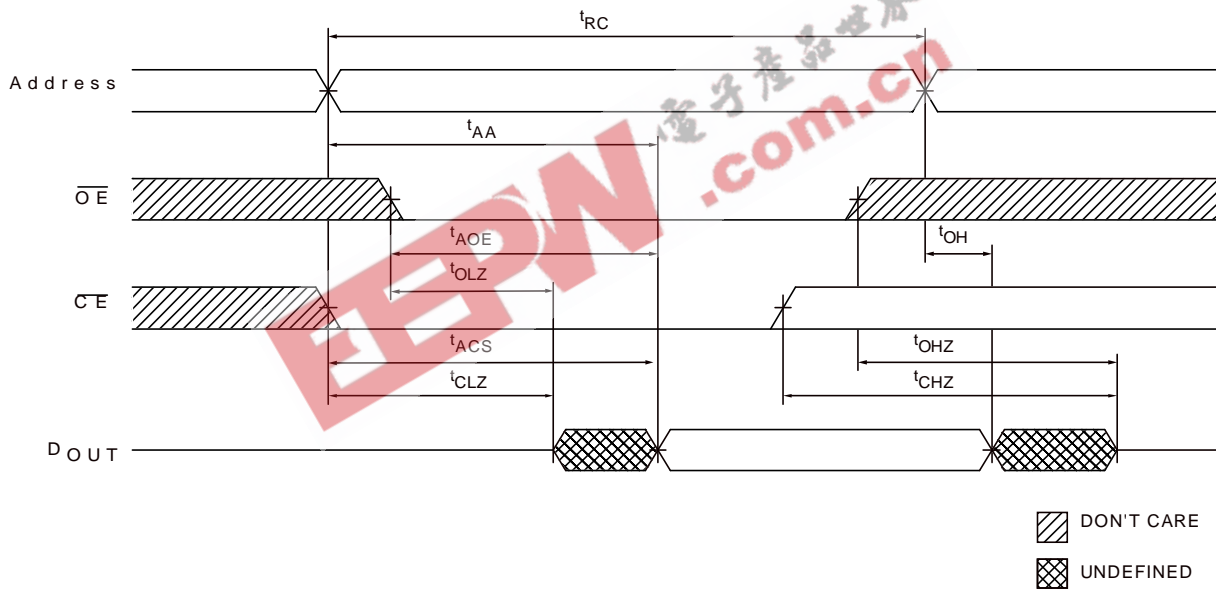
**READ CYCLE 1**

(Address Controlled)

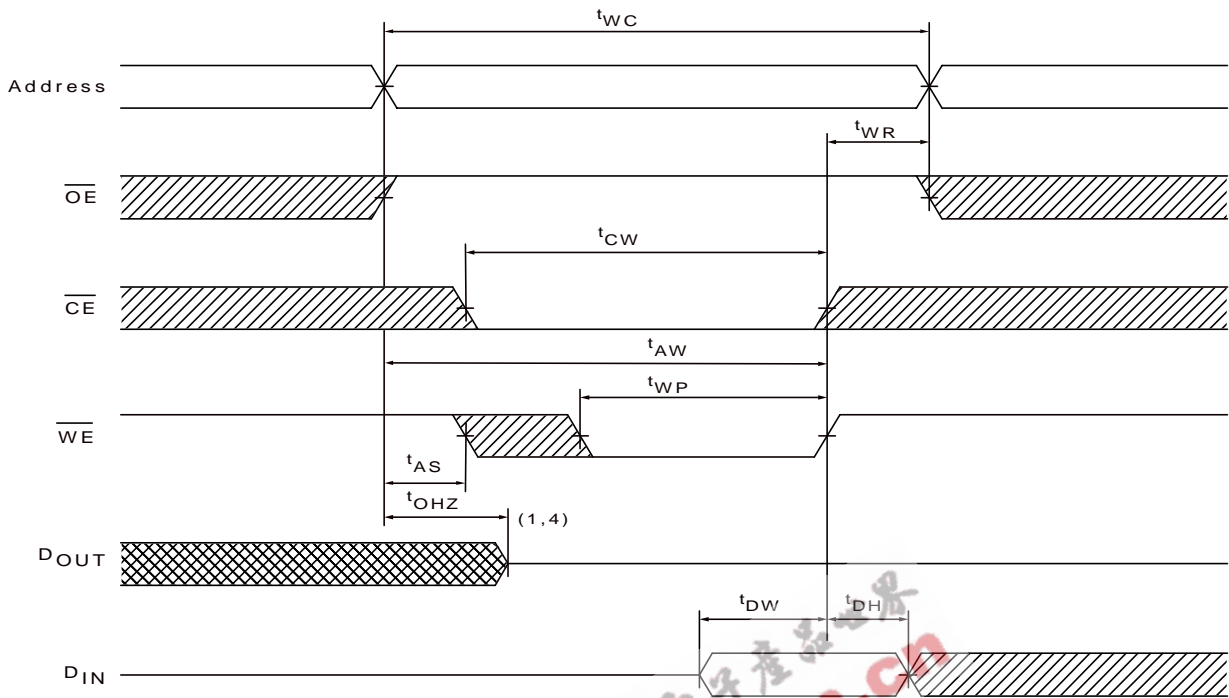


**READ CYCLE 2**

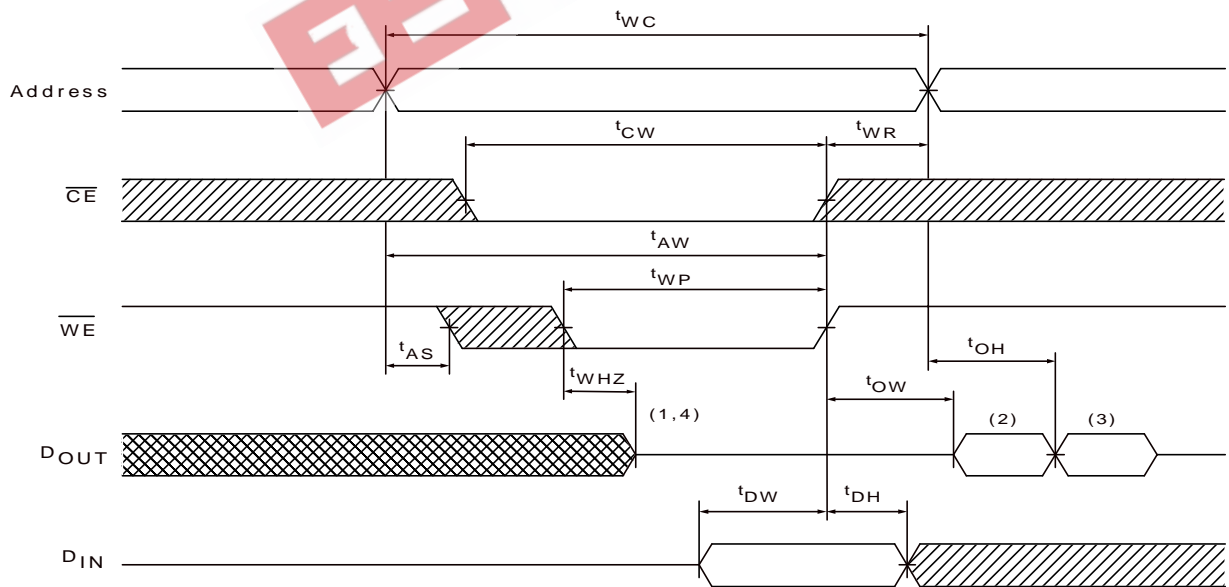
(Chip Enable Controlled)





WRITE CYCLE 1 ( $\overline{OE}$  CLOCK)



WRITE CYCLE 2 ( $\overline{OE} = V_{IL}$  Fixed)

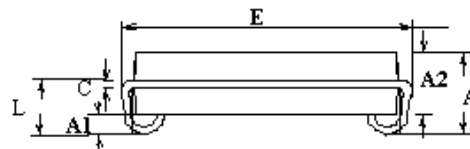
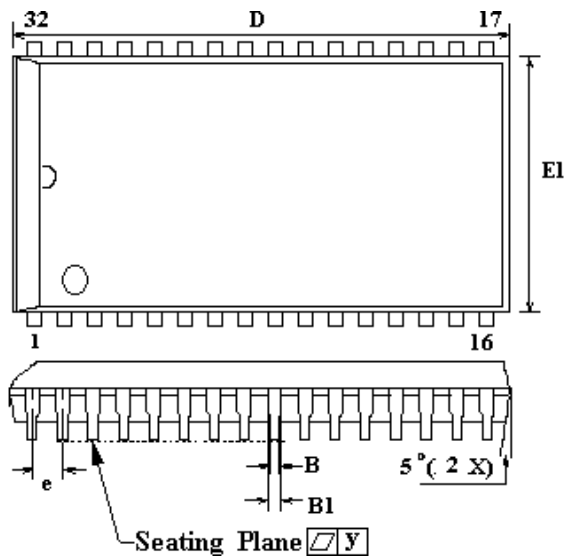


 DONT CARE  
 UNDEFINED

- 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.
  5. If  $\overline{OE}$  is low during a  $\overline{WE}$  controlled write cycle, the write pulse width must be the larger of  $t_{WP}$  or  $(t_{WHZ} + t_{DW})$  to allow the I/O drivers to turn off and data to be placed on the bus for the required  $t_{DW}$ . If  $\overline{OE}$  is high during a  $\overline{WE}$  controlled write cycle, this requirement does not apply and the write pulse can be as short as the specified  $t_{WP}$ .

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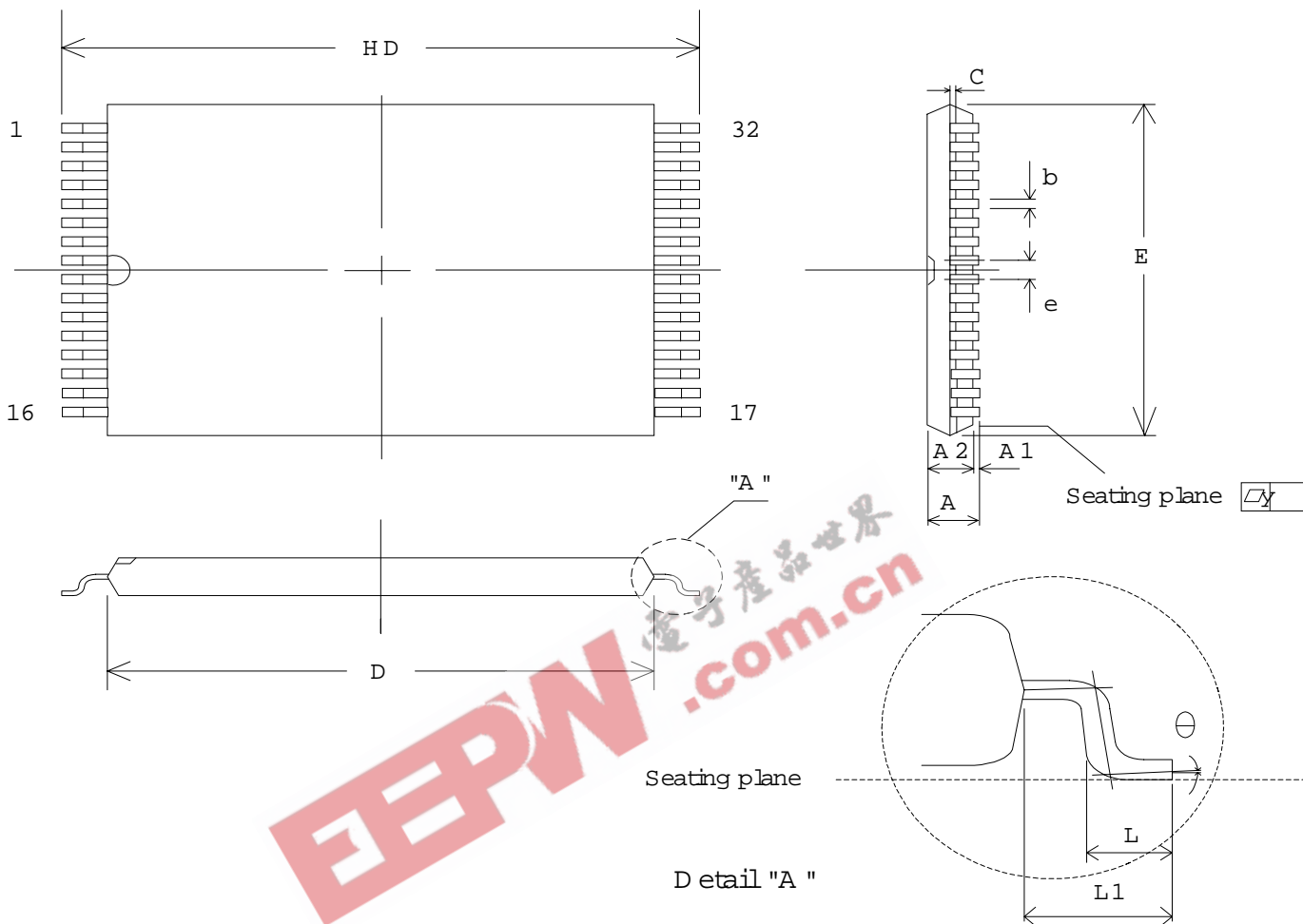
**PACKAGE DIMENSIONS**  
**32-LEAD SOJ SRAM (300 mil)**



| SYMBOL | DIMENSIONS IN INCHES | DIMENSIONS IN MM |
|--------|----------------------|------------------|
| A      | 0.140(MAX)           | 3.556(MAX)       |
| A1     | 0.026(MIN)           | 0.660(MIN)       |
| A2     | 0.100±0.005          | 2.540±0.127      |
| B      | 0.018(TYP)           | 0.457(TYP)       |
| B1     | 0.028(TYP)           | 0.711(TYP)       |
| C      | 0.008(TYP)           | 0.203(TYP)       |
| D      | 0.823±0.005          | 20.904±0.127     |
| E      | 0.335±0.010          | 8.509±0.254      |
| E1     | 0.300±0.005          | 7.620±0.127      |
| e      | 0.050(TYP)           | 1.270(TYP)       |
| L      | 0.086±0.010          | 2.184±0.254      |
| y      | 0.003(MAX)           | 0.076(MAX)       |



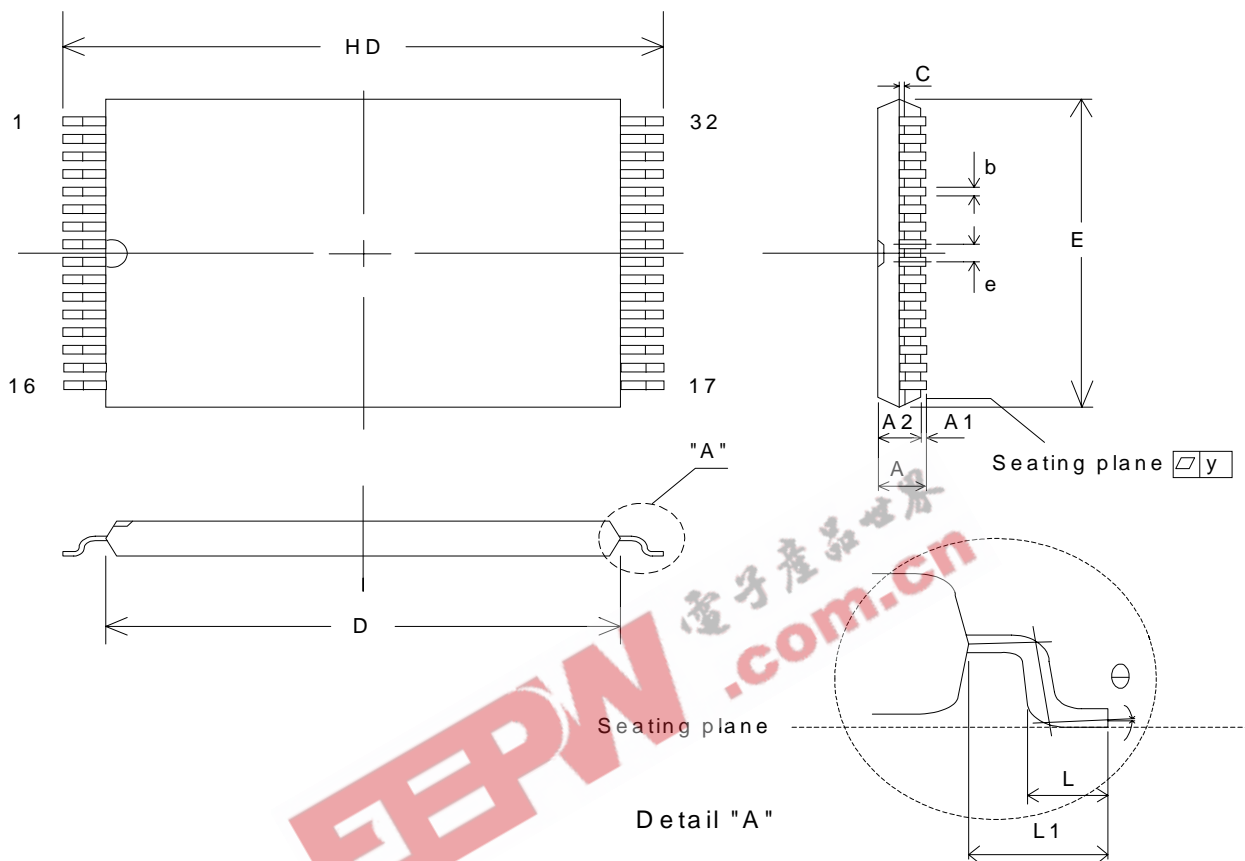
**PACKAGE DIMENSIONS**  
**32-LEAD TSOP-I (8x20mm)**



| SYMBOL | DIMENSIONS IN INCHES |       |       | DIMENSIONS IN MM |      |      |
|--------|----------------------|-------|-------|------------------|------|------|
|        | MIN                  | NOM   | MAX   | MIN              | NOM  | MAX  |
| A      | -                    | -     | 0.047 | -                | -    | 1.20 |
| A1     | 0.002                | -     | 0.006 | 0.05             | -    | 0.15 |
| A2     | 0.035                | 0.040 | 0.041 | 0.90             | 1.00 | 1.05 |
| b      | 0.007                | 0.008 | 0.011 | 0.17             | 0.20 | 0.27 |
| C      | 0.004                | 0.006 | 0.008 | 0.10             | 0.15 | 0.21 |
| HD     | 0.787 TYP            |       |       | 20.00 TYP        |      |      |
| D      | 0.724 TYP            |       |       | 18.40 TYP        |      |      |
| E      | 0.315 TYP            |       |       | 8.00 TYP         |      |      |
| e      | 0.020 TYP            |       |       | 0.50 TYP         |      |      |
| L      | 0.020                | 0.024 | 0.028 | 0.50             | 0.60 | 0.70 |
| L1     | 0.032 TYP            |       |       | 0.813 TYP        |      |      |
| θ      | 0°                   | 3°    | 5°    | 0°               | 3°   | 5°   |

**PACKAGE DIMENSIONS**

**32-LEAD TSOP-I (8x13.4mm)**



| SYMBOL | DIMENSIONS IN INCHES |       |       | DIMENSIONS IN MM |      |      |
|--------|----------------------|-------|-------|------------------|------|------|
|        | MIN                  | NOM   | MAX   | MIN              | NOM  | MAX  |
| A      | -                    | -     | 0.047 | -                | -    | 1.20 |
| A1     | 0.002                | -     | 0.006 | 0.05             | -    | 0.15 |
| A2     | 0.035                | 0.040 | 0.041 | 0.90             | 1.00 | 1.05 |
| b      | 0.007                | 0.008 | 0.011 | 0.17             | 0.20 | 0.27 |
| C      | 0.004                | 0.006 | 0.008 | 0.10             | 0.15 | 0.21 |
| HD     | 0.528 TYP            |       |       | 13.40 TYP        |      |      |
| D      | 0.465 TYP            |       |       | 11.80 TYP        |      |      |
| E      | 0.315 TYP            |       |       | 8.00 TYP         |      |      |
| e      | 0.020 TYP            |       |       | 0.50 TYP         |      |      |
| L      | 0.020                | 0.024 | 0.028 | 0.50             | 0.60 | 0.7  |
| L1     | 0.032 TYP            |       |       | 0.813 TYP        |      |      |
| θ      | 0°                   | 3°    | 5°    | 0°               | 3°   | 5°   |