

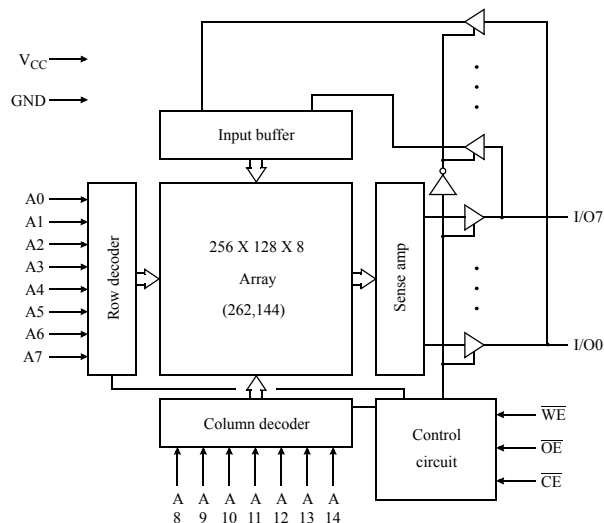


## 5V 32K X 8 CMOS SRAM (Common I/O)

### Features

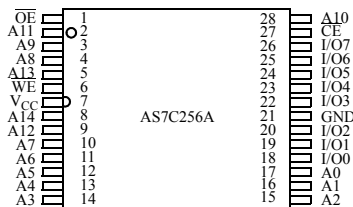
- Pin compatible with AS7C256
- Industrial and commercial temperature options
- Organization: 32,768 words × 8 bits
- High speed
  - 10/12/15/20 ns address access time
  - 5, 6, 7, 8 ns output enable access time
- Very low power consumption: ACTIVE
  - 412.5 mW max @ 10 ns
- Very low power consumption: STANDBY
  - 11 mW max CMOS I/O
- Easy memory expansion with  $\overline{CE}$  and  $\overline{OE}$  inputs
- TTL-compatible, three-state I/O
- 28-pin JEDEC standard packages
  - 300 mil SOJ
  - 8 × 13.4 mm TSOP 1
- ESD protection ≥ 2000 volts
- Latch-up current ≥ 200 mA
- 2.0V Data retention

### Logic block diagram

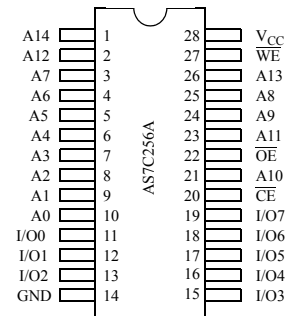


### Pin arrangement

28-pin TSOP 1 (8×13.4 mm)



28-pin SOJ (300 mil)



### Selection guide

|                                   | -10 | -12 | -15 | -20 | Unit |
|-----------------------------------|-----|-----|-----|-----|------|
| Maximum address access time       | 10  | 12  | 15  | 20  | ns   |
| Maximum output enable access time | 5   | 6   | 7   | 8   | ns   |
| Maximum operating current         | 75  | 70  | 65  | 60  | mA   |
| Maximum CMOS standby current      | 2   | 2   | 2   | 2   | mA   |



## Functional description

The AS7C256A is a 5.0V high-performance CMOS 262,144-bit Static Random-Access Memory (SRAM) device organized as 32,768 words  $\times$  8 bits. It is designed for memory applications requiring fast data access at low voltage, including Pentium™, PowerPC™, and portable computing. Alliance's advanced circuit design and process techniques permit 5.0V operation without sacrificing performance or operating margins.

The device enters *standby mode* when  $\overline{CE}$  is high. CMOS standby mode consumes  $\leq 11$  mW. Normal operation offers 75% power reduction after initial access, resulting in significant power savings during CPU idle, suspend, and stretch mode.

Equal address access and cycle times ( $t_{AA}$ ,  $t_{RC}$ ,  $t_{WC}$ ) of 10/12/15/20 ns with output enable access times ( $t_{OE}$ ) of 5, 6, 7, 8 ns are ideal for high-performance applications. The chip enable ( $\overline{CE}$ ) input permits easy memory expansion with multiple-bank memory organizations.

A write cycle is accomplished by asserting chip enable ( $\overline{CE}$ ) and write enable ( $\overline{WE}$ ) LOW. Data on the input pins I/O0-I/O7 is written on the rising edge of  $\overline{WE}$  (write cycle 1) or  $\overline{CE}$  (write cycle 2). To avoid bus contention, external devices should drive I/O pins only after outputs have been disabled with output enable ( $\overline{OE}$ ) or write enable ( $\overline{WE}$ ).

A read cycle is accomplished by asserting chip enable ( $\overline{CE}$ ) and output enable ( $\overline{OE}$ ) LOW, with write enable ( $\overline{WE}$ ) high. The chip drives I/O pins with the data word referenced by the input address. When chip enable or output enable is high, or write enable is low, output drivers stay in high-impedance mode.

All chip inputs and outputs are TTL-compatible. Operation is from a single 5.0  $\pm$  0.5V supply. The AS7C256A is packaged in high volume industry standard packages.

## Absolute maximum ratings

| Parameter                                 | Symbol     | Min  | Max            | Unit |
|-------------------------------------------|------------|------|----------------|------|
| Voltage on $V_{CC}$ relative to GND       | $V_{t1}$   | -0.5 | +7.0           | V    |
| Voltage on any pin relative to GND        | $V_{t2}$   | -0.5 | $V_{CC} + 0.5$ | V    |
| Power dissipation                         | $P_D$      | —    | 1.0            | W    |
| Storage temperature (plastic)             | $T_{stg}$  | -65  | +150           | °C   |
| Ambient temperature with $V_{CC}$ applied | $T_{bias}$ | -55  | +125           | °C   |
| DC current into outputs (low)             | $I_{OUT}$  | —    | 20             | mA   |

Stresses greater than those listed under *Absolute Maximum Ratings* may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions outside those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect reliability.

## Truth table

| $\overline{CE}$ | $\overline{WE}$ | $\overline{OE}$ | Data      | Mode                             |
|-----------------|-----------------|-----------------|-----------|----------------------------------|
| H               | X               | X               | High Z    | Standby ( $I_{SB}$ , $I_{SB1}$ ) |
| L               | H               | H               | High Z    | Output disable ( $I_{CC}$ )      |
| L               | H               | L               | $D_{OUT}$ | Read ( $I_{CC}$ )                |
| L               | L               | X               | $D_{IN}$  | Write ( $I_{CC}$ )               |

**Key:** X = Don't care, L = Low, H = High



### Recommended operating conditions

| Parameter                     |            | Symbol        | Min  | Typical | Max          | Unit |
|-------------------------------|------------|---------------|------|---------|--------------|------|
| Supply voltage                |            | $V_{CC}$      | 4.5  | 5.0     | 5.5          | V    |
| Input voltage                 |            | $V_{IH}^{**}$ | 2.2  | —       | $V_{CC}+0.5$ | V    |
|                               |            | $V_{IL}^*$    | -0.5 | —       | 0.8          | V    |
| Ambient operating temperature | commercial | $T_A$         | 0    | —       | 70           | °C   |
|                               | industrial | $T_A$         | -40  | —       | 85           | °C   |

\*  $V_{IL}$  min = -1.0V for pulse width less than 5ns.

\*\*  $V_{IH}$  max =  $V_{CC} + 2.0V$  for pulse width less than 5ns.

### DC operating characteristics (over the operating range)<sup>1</sup>

| Parameter                      | Sym        | Test conditions                                                                                                    | -10 |     | -12 |     | -15 |     | -20 |     | Unit | Notes |
|--------------------------------|------------|--------------------------------------------------------------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|------|-------|
|                                |            |                                                                                                                    | Min | Max | Min | Max | Min | Max | Min | Max |      |       |
| Input leakage current          | $ I_{LI} $ | $V_{CC} = \text{Max}, V_{in} = \text{GND to } V_{CC}$                                                              | —   | 1   | —   | 1   | —   | 1   | —   | 1   | μA   |       |
| Output leakage current         | $ I_{LO} $ | $V_{CC} = \text{Max}, V_{OUT} = \text{GND to } V_{CC}$                                                             | —   | 1   | —   | 1   | —   | 1   | —   | 1   | μA   |       |
| Operating power supply current | $I_{CC}$   | $V_{CC} = \text{Max}, \overline{CE} \leq V_{IL}$<br>$f = f_{\text{Max}}, I_{OUT} = 0\text{mA}$                     | —   | 75  | —   | 70  | —   | 65  | —   | 60  | mA   |       |
| Standby power supply current   | $I_{SB}$   | $V_{CC} = \text{Max}, \overline{CE} \geq V_{IH}$<br>$f = f_{\text{Max}}$                                           | —   | 45  | —   | 45  | —   | 40  | —   | 40  | mA   |       |
|                                | $I_{SB1}$  | $V_{CC} = \text{Max}, \overline{CE} \geq V_{CC}-0.2V$<br>$V_{IN} \leq 0.2V$ or<br>$V_{IN} \geq V_{CC}-0.2V, f = 0$ | —   | 2.0 | —   | 2.0 | —   | 2.0 | —   | 2.0 | mA   |       |
| Output voltage                 | $V_{OL}$   | $I_{OL} = 8 \text{ mA}, V_{CC} = \text{Min}$                                                                       | —   | 0.4 | —   | 0.4 | —   | 0.4 | —   | 0.4 | V    | 4     |
|                                | $V_{OH}$   | $I_{OH} = -4 \text{ mA}, V_{CC} = \text{Min}$                                                                      | 2.4 | —   | 2.4 | —   | 2.4 | —   | 2.4 | —   | V    | 4     |

### Capacitance ( $f = 1\text{MHz}$ , $T_A = \text{room temperature}$ , $V_{CC} = \text{NOMINAL}$ )<sup>4</sup>

| Parameter         | Symbol    | Signals                                                | Test conditions         | Max | Unit |
|-------------------|-----------|--------------------------------------------------------|-------------------------|-----|------|
| Input capacitance | $C_{IN}$  | A, $\overline{CE}$ , $\overline{WE}$ , $\overline{OE}$ | $V_{in} = 0V$           | 5   | pF   |
| I/O capacitance   | $C_{I/O}$ | I/O                                                    | $V_{in} = V_{out} = 0V$ | 7   | pF   |



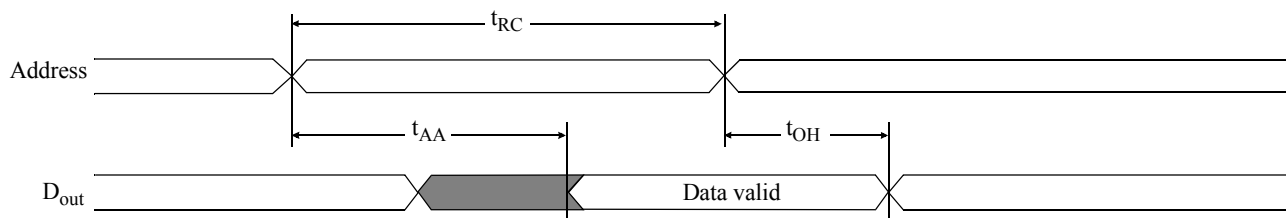
### Read cycle (over the operating range)<sup>2,8</sup>

| Parameter                                     | Symbol    | -10 |     | -12 |     | -15 |     | -20 |     | Unit | Notes |
|-----------------------------------------------|-----------|-----|-----|-----|-----|-----|-----|-----|-----|------|-------|
|                                               |           | Min | Max | Min | Max | Min | Max | Min | Max |      |       |
| Read cycle time                               | $t_{RC}$  | 10  | —   | 12  | —   | 15  | —   | 20  | —   | ns   |       |
| Address access time                           | $t_{AA}$  | —   | 10  | —   | 12  | —   | 15  | —   | 20  | ns   | 2     |
| Chip enable ( $\overline{CE}$ ) access time   | $t_{ACE}$ | —   | 10  | —   | 12  | —   | 15  | —   | 20  | ns   | 2     |
| Output enable ( $\overline{OE}$ ) access time | $t_{OE}$  | —   | 5   | —   | 6   | —   | 7   | —   | 8   | ns   |       |
| Output hold from address change               | $t_{OH}$  | 3   | —   | 3   | —   | 3   | —   | 3   | —   | ns   | 4     |
| $\overline{CE}$ LOW to output in low Z        | $t_{CLZ}$ | 3   | —   | 3   | —   | 3   | —   | 3   | —   | ns   | 3,4   |
| $\overline{CE}$ HIGH to output in high Z      | $t_{CHZ}$ | —   | 3   | —   | 3   | —   | 4   | —   | 5   | ns   | 3,4   |
| $\overline{OE}$ LOW to output in low Z        | $t_{OLZ}$ | 0   | —   | 0   | —   | 0   | —   | 0   | —   | ns   | 3,4   |
| $\overline{OE}$ HIGH to output in high Z      | $t_{OHZ}$ | —   | 3   | —   | 3   | —   | 4   | —   | 5   | ns   | 3,4   |
| Power up time                                 | $t_{PU}$  | 0   | —   | 0   | —   | 0   | —   | 0   | —   | ns   | 3,4   |
| Power down time                               | $t_{PD}$  | —   | 10  | —   | 12  | —   | 15  | —   | 20  | ns   | 3,4   |

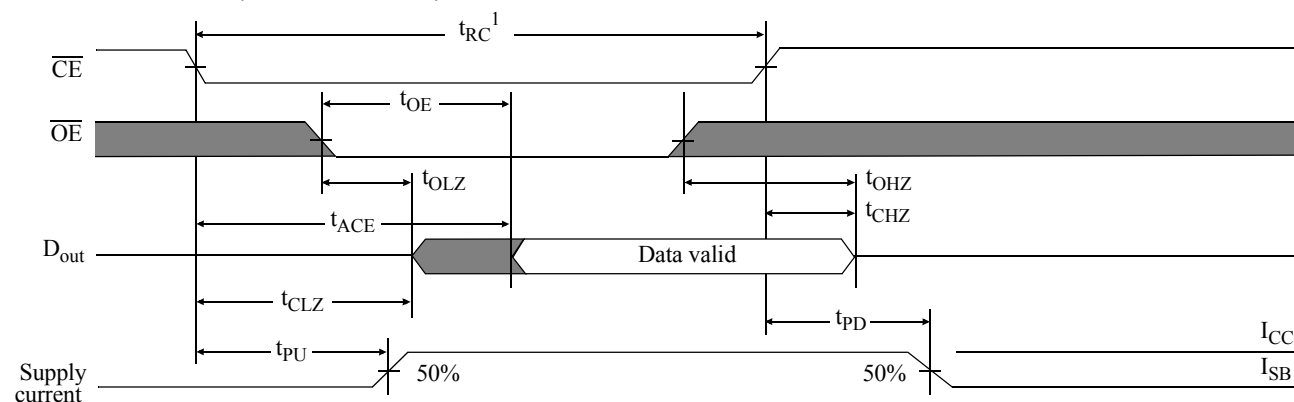
### Key to switching waveforms

Rising input    
 Falling input    
 Undefined output/don't care

### Read waveform 1 (address controlled)<sup>2,5,6,8</sup>



### Read waveform 2 ( $\overline{CE}$ controlled)<sup>2,5,7,8</sup>

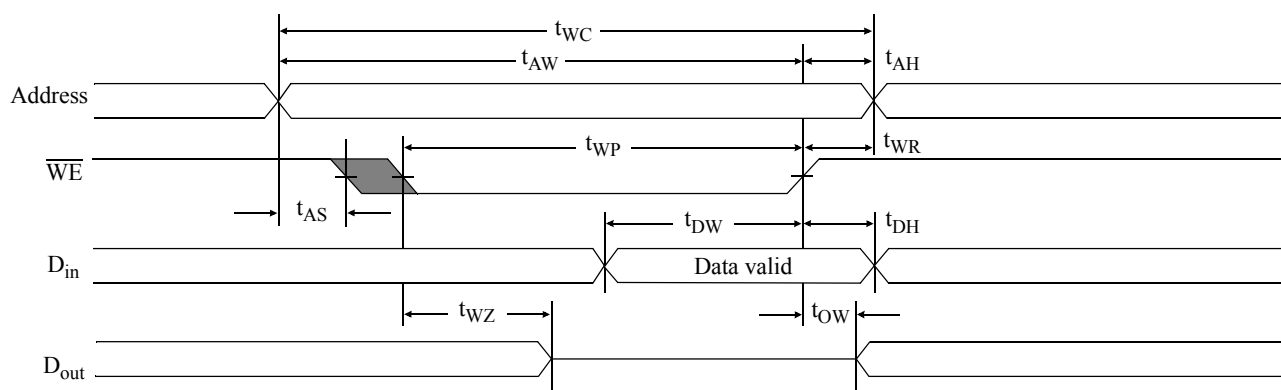




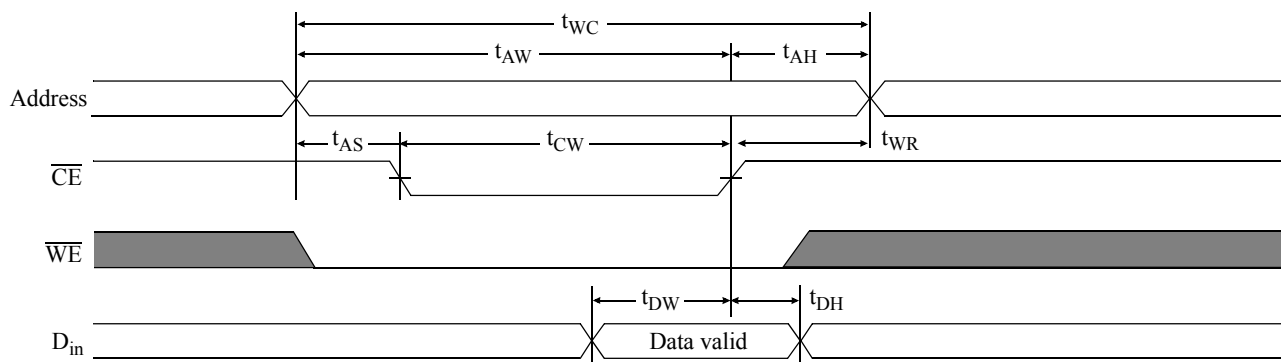
### Write cycle (over the operating range)<sup>9</sup>

| Parameter                        | Symbol   | -10 |     | -12 |     | -15 |     | -20 |     | Unit | Notes |
|----------------------------------|----------|-----|-----|-----|-----|-----|-----|-----|-----|------|-------|
|                                  |          | Min | Max | Min | Max | Min | Max | Min | Max |      |       |
| Write cycle time                 | $t_{WC}$ | 10  | –   | 12  | –   | 15  | –   | 20  | –   | ns   |       |
| Chip enable to write end         | $t_{CW}$ | 8   | –   | 8   | –   | 10  | –   | 12  | –   | ns   |       |
| Address setup to write end       | $t_{AW}$ | 8   | –   | 8   | –   | 10  | –   | 12  | –   | ns   |       |
| Address setup time               | $t_{AS}$ | 0   | –   | 0   | –   | 0   | –   | 0   | –   | ns   |       |
| Write pulse width                | $t_{WP}$ | 7   | –   | 8   | –   | 9   | –   | 12  | –   | ns   |       |
| Write recovery time              | $t_{WR}$ | 0   | –   | 0   | –   | 0   | –   | 0   | –   | ns   |       |
| Address hold from end of write   | $t_{AH}$ | 0   | –   | 0   | –   | 0   | –   | 0   | –   | ns   |       |
| Data valid to write end          | $t_{DW}$ | 5   | –   | 6   | –   | 8   | –   | 10  | –   | ns   |       |
| Data hold time                   | $t_{DH}$ | 0   | –   | 0   | –   | 0   | –   | 0   | –   | ns   | 3,4   |
| Write enable to output in high Z | $t_{WZ}$ | –   | 5   | –   | 6   | –   | 7   | –   | 8   | ns   | 3,4   |
| Output active from write end     | $t_{OW}$ | 3   | –   | 3   | –   | 3   | –   | 3   | –   | ns   | 3,4   |

### Write waveform 1 ( $\overline{WE}$ controlled)<sup>9</sup>



### Write waveform 2 ( $\overline{CE}$ controlled)<sup>9</sup>





## AC test conditions

- Output load: see Figure B
- Input pulse level: GND to  $V_{CC}$  See Figure A.
- Input rise and fall times: 2 ns. See Figure A.
- Input and output timing reference levels: 1.5V.

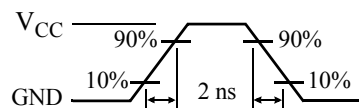


Figure A: Input pulse

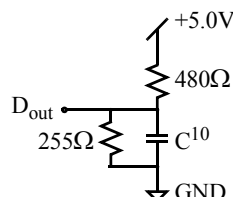
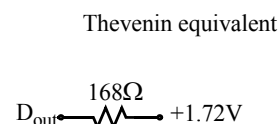


Figure B: Output load



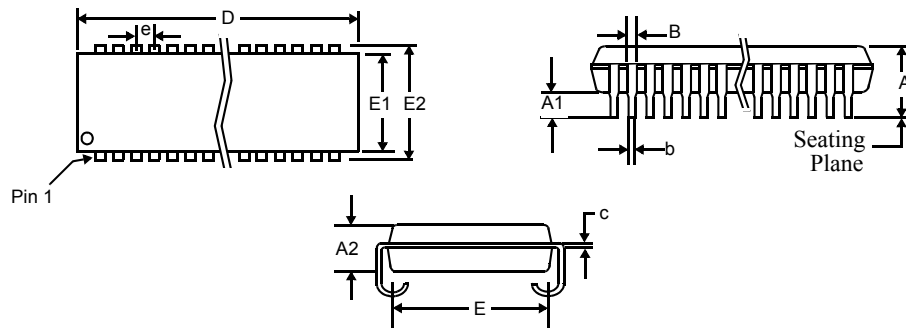
## Notes

- 1 During  $V_{CC}$  power-up, a pull-up resistor to  $V_{CC}$  on  $\overline{CE}$  is required to meet  $I_{SB}$  specification.
- 2 For test conditions, see *AC Test Conditions*, Figures A, B.
- 3 These parameters are specified with  $C_L = 5\text{pF}$ , as in Figures B. Transition is measured  $\pm 500\text{mV}$  from steady-state voltage.
- 4 This parameter is guaranteed, but not tested.
- 5  $\overline{WE}$  is High for read cycle.
- 6  $\overline{CE}$  and  $\overline{OE}$  are Low for read cycle.
- 7 Address valid prior to or coincident with  $\overline{CE}$  transition Low.
- 8 All read cycle timings are referenced from the last valid address to the first transitioning address.
- 9 All write cycle timings are referenced from the last valid address to the first transitioning address.
- 10  $C = 30\text{pF}$ , except on High Z and Low Z parameters, where  $C = 5\text{pF}$ .



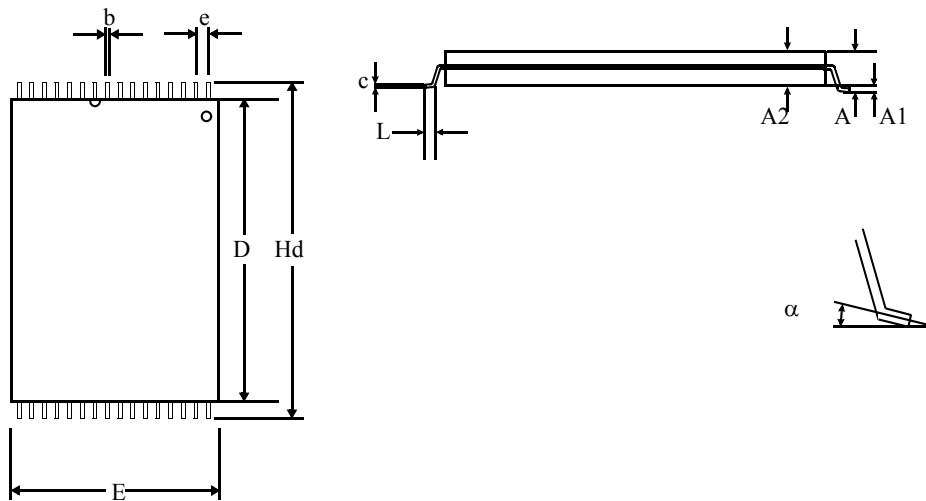
## Package diagrams

### 28-pin SOJ



| 28-pin SOJ |           |       |
|------------|-----------|-------|
|            | Min       | Max   |
| in inches  |           |       |
| <b>A</b>   | 0.128     | 0.148 |
| <b>A1</b>  | 0.026     | -     |
| <b>A2</b>  | 0.095     | 0.105 |
| <b>B</b>   | 0.026     | 0.032 |
| <b>b</b>   | 0.016     | 0.020 |
| <b>c</b>   | 0.007     | 0.010 |
| <b>D</b>   | 0.720     | 0.730 |
| <b>E</b>   | 0.255     | 0.275 |
| <b>E1</b>  | 0.295     | 0.305 |
| <b>E2</b>  | 0.330     | 0.340 |
| <b>e</b>   | 0.050 BSC |       |

### 28-pin TSOP1



| 28-pin TSOP1<br>8×13.4 mm  |              |       |
|----------------------------|--------------|-------|
|                            | Min          | Max   |
| <b>A</b>                   | 1.00         | 1.20  |
| <b>A1</b>                  | 0.05         | 0.15  |
| <b>A2</b>                  | 0.91         | 1.05  |
| <b>b</b>                   | 0.17         | 0.27  |
| <b>c</b>                   | 0.10         | 0.20  |
| <b>D</b>                   | 11.70        | 11.90 |
| <b>e</b>                   | 0.55 nominal |       |
| <b>E</b>                   | 7.90         | 8.10  |
| <b>Hd</b>                  | 13.20        | 13.60 |
| <b>L</b>                   | 0.50         | 0.70  |
| <b><math>\alpha</math></b> | 0°           | 5°    |



### Ordering information

| Package / Access time | Temperature | 10 ns         | 12 ns         | 15 ns         | 20 ns         |
|-----------------------|-------------|---------------|---------------|---------------|---------------|
| Plastic SOJ, 300 mil  | Commercial  | AS7C256A-10JC | AS7C256A-12JC | AS7C256A-15JC | AS7C256A-20JC |
|                       | Industrial  | AS7C256A-10JI | AS7C256A-12JI | AS7C256A-15JI | AS7C256A-20JI |
| TSOP 8x13.4mm         | Commercial  | AS7C256A-10TC | AS7C256A-12TC | AS7C256A-15TC | AS7C256A-20TC |
|                       | Industrial  | AS7C256A-10TI | AS7C256A-12TI | AS7C256A-15TI | AS7C256A-20TI |

**Note:** Add suffix 'N' to the above part number for lead free parts. (Ex. AS7C256A-10JIN)

### Part numbering system

| AS7C        | 256A          | -XX         | X                                                 | C or I                                                     | X                 |
|-------------|---------------|-------------|---------------------------------------------------|------------------------------------------------------------|-------------------|
| SRAM prefix | Device number | Access time | Packages:<br>J = SOJ 300 mil<br>T = TSOP 8x13.4mm | Temperature range:<br>C = 0 °C to 70 °C<br>I = -40C to 85C | N= Lead Free Part |



AS7C256A



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