# Revision History - AS7C164A

| Revision | Details | Date |
|---|---|---|
| Rev 1.0 | Preliminary datasheet | November 2009 |
| Rev 2.0 | Added 28pin Skinny PDIP(300mil) package option | May 2015 |
| Rev 3.0 | Added Industrial grade | Nov. 2016 |
| Rev 4.0 | Removed 12ns speed due to poor yields can only offer 15ns | May 2017 |

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**Alliance Memory Inc.** reserves the right to change products or specification without notice.

## FEATURES

- Fast access time : 15 ns
- Low power consumption:
  Operating current : 80mA (TYP.)
  Standby current : 1mA (TYP.)
- Single 5V power supply
- All inputs and outputs TTL compatible
- Fully static operation
- Tri-state output
- Data retention voltage : 2.0V (MIN.)
- **Green package available**
- Package : 28-pin 300 mil SOJ
  28-pin 300 mil Skinny P-DIP

## GENERAL DESCRIPTION

The AS7C164A is a 65,536-bit high speed CMOS static random access memory organized as 8,192 words by 8 bits. It is fabricated using very high performance, high reliability CMOS technology. Its standby current is stable within the range of operating temperature.

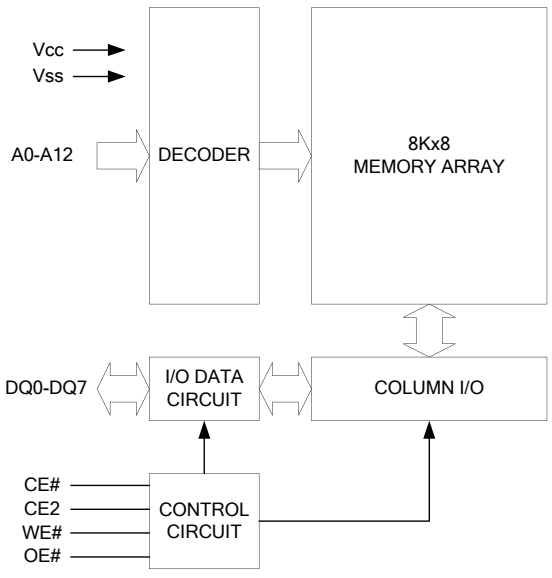
The AS7C164A is well designed for high speed system applications, and particularly well suited for battery back-up nonvolatile memory application.

The AS7C164A operates from a single power supply of 5V and all inputs and outputs are fully TTL compatible

## PRODUCT FAMILY

| Product Family | Operating Temperature | Vcc Range | Speed | Power Dissipation | |
|---|---|---|---|---|---|
| | | | | Standby($I_{SB1}$,TYP.) | Operating(Icc,TYP.) |
| AS7C164A | (C) 0 ~ 70°C<br>(I) -40 ~ 85°C | 4.5 ~ 5.5V | 15ns | 1mA | 90/80mA |

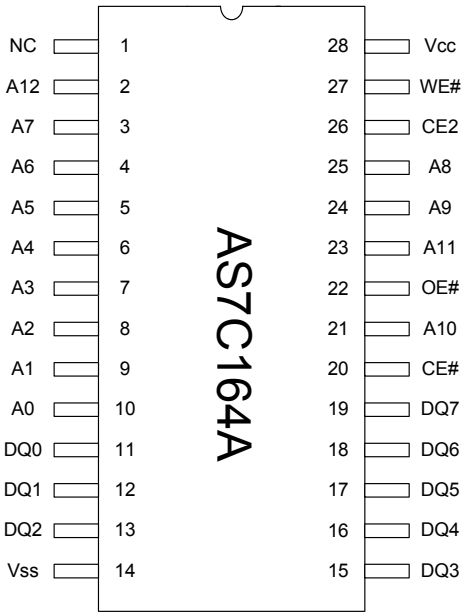
## FUNCTIONAL BLOCK DIAGRAM




## PIN DESCRIPTION

| SYMBOL | DESCRIPTION |
|---|---|
| A0 - A12 | Address Inputs |
| DQ0 – DQ7 | Data Inputs/Outputs |
| CE#, CE2 | Chip Enable Inputs |
| WE# | Write Enable Input |
| OE# | Output Enable Input |
| $V_{CC}$ | Power Supply |
| $V_{SS}$ | Ground |
| NC | No Connection |

## PIN CONFIGURATION




Skinny PDIP/SOJ

## ABSOLUTE MAXIMUM RATINGS*

| PARAMETER | SYMBOL | RATING | UNIT |
|---|---|---|---|
| Voltage on $V_{CC}$ relative to $V_{SS}$ | $V_{T1}$ | -0.5 to 6.5 | V |
| Voltage on any other pin relative to $V_{SS}$ | $V_{T2}$ | -0.5 to $V_{CC}$+0.5 | V |
| Operating Temperature | $T_A$ | 0 to 70(C grade)<br>-40 to 85(I grade) | ℃ |
| Storage Temperature | $T_{STG}$ | -65 to 150 | ℃ |
| Power Dissipation | $P_D$ | 1 | W |
| DC Output Current | $I_{OUT}$ | 50 | 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 or any other conditions above those indicated in the operational sections of this specification is not implied. Exposure to the absolute maximum rating conditions for extended period may affect device reliability.

## TRUTH TABLE

| MODE | CE# | CE2 | OE# | WE# | I/O OPERATION | SUPPLY CURRENT |
|---|---|---|---|---|---|---|
| Standby | H | X | X | X | High-Z | $I_{SB1}$ |
| | X | L | X | X | High-Z | $I_{SB1}$ |
| Output Disable | L | H | H | H | High-Z | $I_{CC}$ |
| Read | L | H | L | H | $D_{OUT}$ | $I_{CC}$ |
| Write | L | H | X | L | $D_{IN}$ | $I_{CC}$ |

Note: H = $V_{IH}$, L = $V_{IL}$, X = Don't care.

## DC ELECTRICAL CHARACTERISTICS

| PARAMETER | SYMBOL | TEST CONDITION | | MIN. | TYP. *4 | MAX. | UNIT |
|---|---|---|---|---|---|---|---|
| Supply Voltage | $V_{CC}$ | | | 4.5 | 5.0 | 5.5 | V |
| Input High Voltage | $V_{IH}$ *1 | | | 2.4 | - | $V_{CC}$+0.5 | V |
| Input Low Voltage | $V_{IL}$ *2 | | | - 0.5 | - | 0.8 | V |
| Input Leakage Current | $I_{LI}$ | $V_{CC} \geqq V_{IN} \geqq V_{SS}$ | | - 1 | - | 1 | µA |
| Output Leakage Current | $I_{LO}$ | $V_{CC} \geqq V_{OUT} \geqq V_{SS}$, Output Disabled | | - 1 | - | 1 | µA |
| Output High Voltage | $V_{OH}$ | $I_{OH}$ = -1mA | | 2.4 | - | - | V |
| Output Low Voltage | $V_{OL}$ | $I_{OL}$ = 2mA | | - | - | 0.4 | V |
| Average Operating Power supply Current | $I_{CC}$ | Cycle time = Min.<br>CE# = $V_{IL}$ and CE2 = $V_{IH}$,<br>$I_{I/O}$ = 0mA<br>Other pins at $V_{IH}$ or $V_{IL}$ | -15 | - | 80 | 140 | mA |
| Standby Power Supply Current | $I_{SB1}$ | CE# $\geqq V_{CC}$-0.2V or CE2 $\leqq$ 0.2V<br>Other pins at 0.2V or $V_{CC}$-0.2V | | - | 1 | 5 | mA |

Notes:
1. $V_{IH}$(max) = $V_{CC}$ + 3.0V for pulse width less than 10ns.
2. $V_{IL}$(min) = $V_{SS}$ - 3.0V for pulse width less than 10ns.
3. Over/Undershoot specifications are characterized, not 100% tested.
4. Typical values are included for reference only and are not guaranteed or tested.
   Typical valued are measured at $V_{CC}$ = $V_{CC}$(TYP.) and $T_A$ = 25℃

## CAPACITANCE ($T_A$ = 25℃, f = 1.0MHz)

| PARAMETER | SYMBOL | MIN. | MAX | UNIT |
|---|---|---|---|---|
| Input Capacitance | $C_{IN}$ | - | 6 | pF |
| Input/Output Capacitance | $C_{I/O}$ | - | 8 | pF |

Note : These parameters are guaranteed by device characterization, but not production tested.

## AC TEST CONDITIONS

| | |
|---|---|
| Input Pulse Levels | 0.2V to $V_{CC}$ - 0.2V |
| Input Rise and Fall Times | 3ns |
| Input and Output Timing Reference Levels | 1.5V |
| Output Load | $C_L$ = 30pF + 1TTL, $I_{OH}$/$I_{OL}$ = -4mA/8mA |

## AC ELECTRICAL CHARACTERISTICS

### (1) READ CYCLE

| PARAMETER | SYM. | AS7C164A-15 | | UNIT |
|---|---|---|---|---|
| | | MIN. | MAX. | |
| Read Cycle Time | $t_{RC}$ | 15 | - | ns |
| Address Access Time | $t_{AA}$ | - | 15 | ns |
| Chip Enable Access Time | $t_{ACE}$ | - | 15 | ns |
| Output Enable Access Time | $t_{OE}$ | - | 7 | ns |
| Chip Enable to Output in Low-Z | $t_{CLZ}$* | 4 | - | ns |
| Output Enable to Output in Low-Z | $t_{OLZ}$* | 0 | - | ns |
| Chip Disable to Output in High-Z | $t_{CHZ}$* | - | 7 | ns |
| Output Disable to Output in High-Z | $t_{OHZ}$* | - | 7 | ns |
| Output Hold from Address Change | $t_{OH}$ | 3 | - | ns |

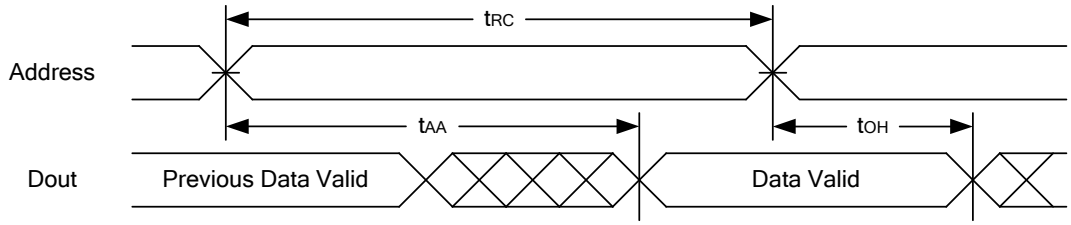
### (2) WRITE CYCLE

| PARAMETER | SYM. | AS7C164A-15 | | UNIT |
|---|---|---|---|---|
| | | MIN. | MAX. | |
| Write Cycle Time | $t_{WC}$ | 15 | - | ns |
| Address Valid to End of Write | $t_{AW}$ | 12 | - | ns |
| Chip Enable to End of Write | $t_{CW}$ | 12 | - | ns |
| Address Set-up Time | $t_{AS}$ | 0 | - | ns |
| Write Pulse Width | $t_{WP}$ | 10 | - | ns |
| Write Recovery Time | $t_{WR}$ | 0 | - | ns |
| Data to Write Time Overlap | $t_{DW}$ | 8 | - | ns |
| Data Hold from End of Write Time | $t_{DH}$ | 0 | - | ns |
| Output Active from End of Write | $t_{OW}$* | 4 | - | ns |
| Write to Output in High-Z | $t_{WHZ}$* | - | 8 | ns |

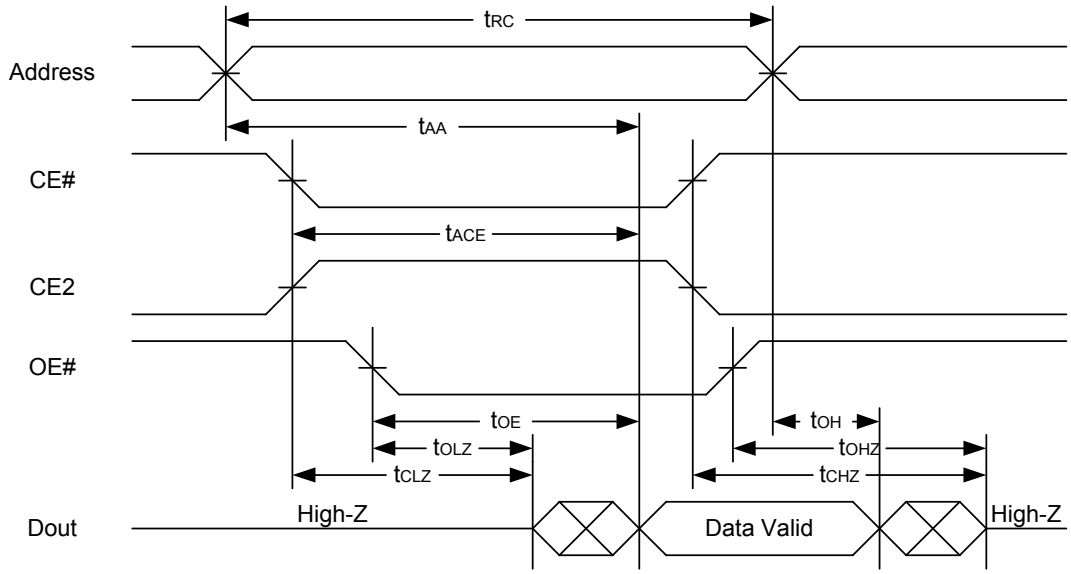
*These parameters are guaranteed by device characterization, but not production tested.

## TIMING WAVEFORMS

**READ CYCLE 1** (Address Controlled) (1,2)

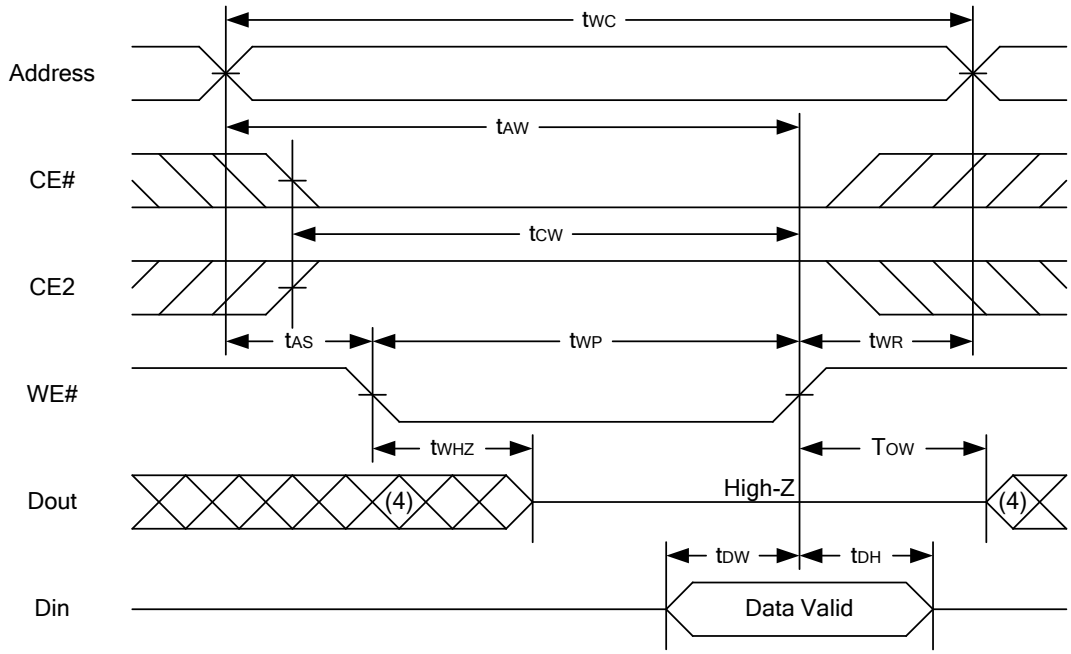



**READ CYCLE 2** (CE# and CE2 and OE# Controlled) (1,3,4,5)

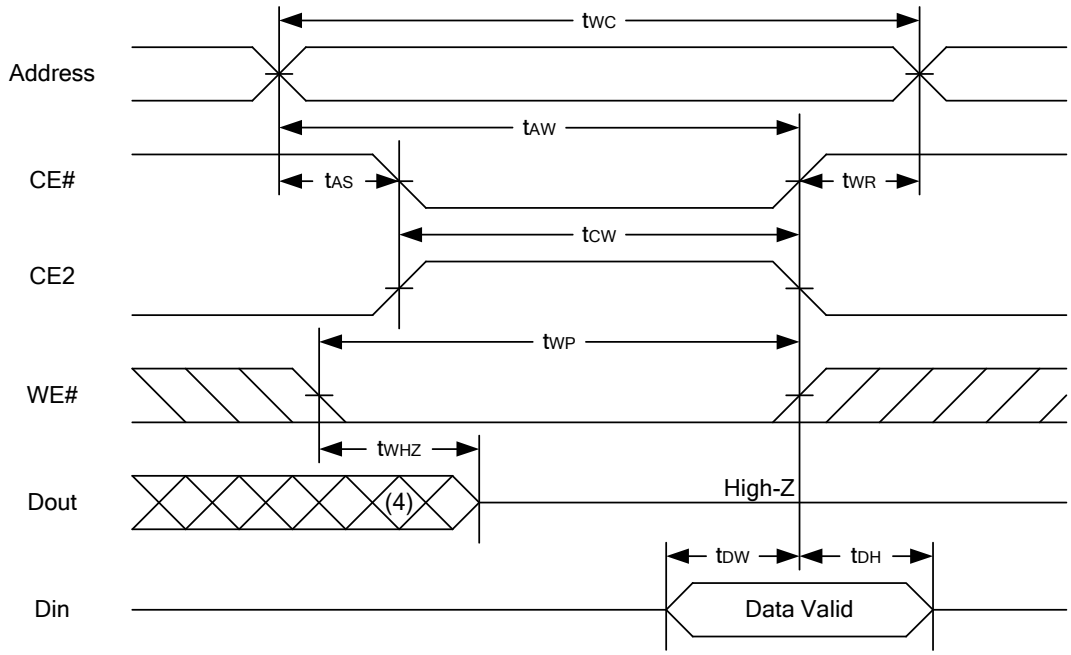



Notes :
1.WE# is high for read cycle.
2.Device is continuously selected OE# = low, CE# = low., CE2 = high.
3.Address must be valid prior to or coincident with CE# = low, CE2 = high; otherwise $t_{AA}$ is the limiting parameter.
4.$t_{CLZ}$, $t_{OLZ}$, $t_{CHZ}$ and $t_{OHZ}$ are specified with $C_L$ = 5pF. Transition is measured ±500mV from steady state.
5.At any given temperature and voltage condition, $t_{CHZ}$ is less than $t_{CLZ}$ , $t_{OHZ}$ is less than $t_{OLZ}$.

**WRITE CYCLE 1** (WE# Controlled) (1,2,3,5,6)




**WRITE CYCLE 2** (CE# and CE2 Controlled) (1,2,5,6)




Notes :
1.WE#, CE# must be high or CE2 must be low during all address transitions.
2.A write occurs during the overlap of a low CE#, high CE2, low WE#.
3.During a WE#controlled write cycle with OE# low, $t_{WP}$ must be greater than $t_{WHZ} + t_{DW}$ to allow the drivers to turn off and data to be placed on the bus.
4.During this period, I/O pins are in the output state, and input signals must not be applied.
5.If the CE#low transition and CE2 high transition occurs simultaneously with or after WE# low transition, the outputs remain in a high impedance state.
6.$t_{OW}$ and $t_{WHZ}$ are specified with $C_L$ = 5pF. Transition is measured ±500mV from steady state.

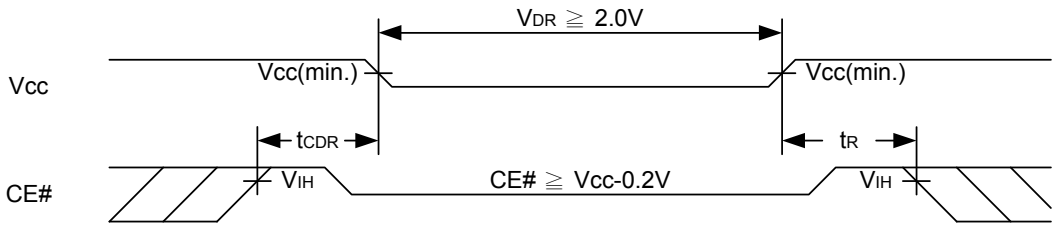
## DATA RETENTION CHARACTERISTICS

| PARAMETER | SYMBOL | TEST CONDITION | MIN. | TYP. | MAX. | UNIT |
|---|---|---|---|---|---|---|
| $V_{CC}$ for Data Retention | $V_{DR}$ | CE# ≧ $V_{CC}$ - 0.2V<br>or CE2 ≦ 0.2V | 2.0 | - | 5.5 | V |
| Data Retention Current | $I_{DR}$ | $V_{CC}$ = 2.0V<br>CE# ≧ $V_{CC}$ - 0.2V or CE2 ≦ 0.2V<br>Others at 0.2V or $V_{CC}$-0.2V | - | 0.6 | 3 | mA |
| Chip Disable to Data Retention Time | $t_{CDR}$ | See Data Retention Waveforms (below) | 0 | - | - | ns |
| Recovery Time | $t_R$ | | $t_{RC*}$ | - | - | ns |

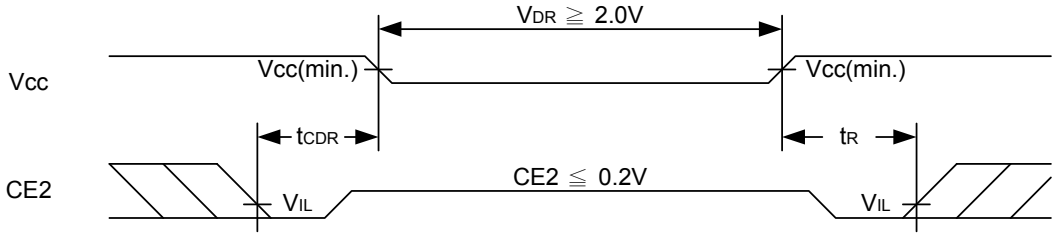
$t_{RC*}$ = Read Cycle Time

## DATA RETENTION WAVEFORM

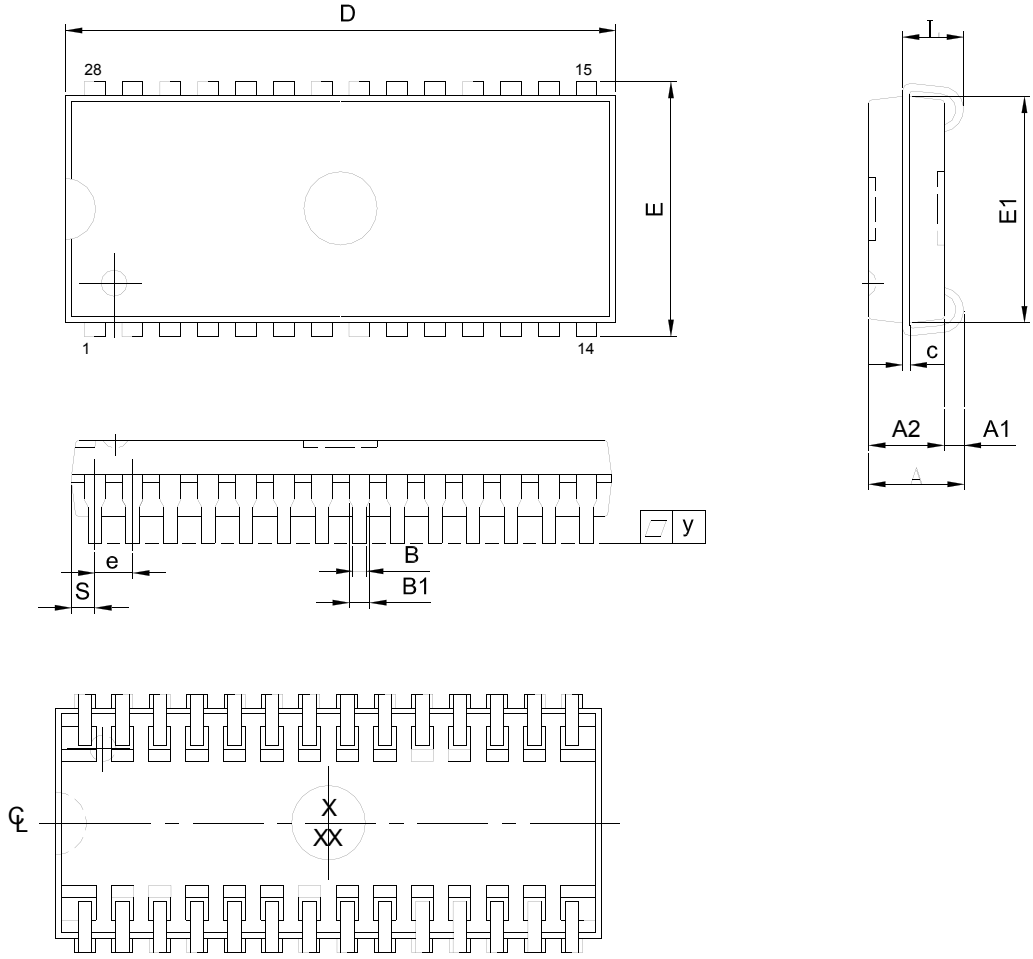
**Low Vcc Data Retention Waveform (1)** (CE# controlled)




**Low Vcc Data Retention Waveform (2)** (CE2 controlled)



**28-pin 300 mil SOJ Package Outline Dimension**

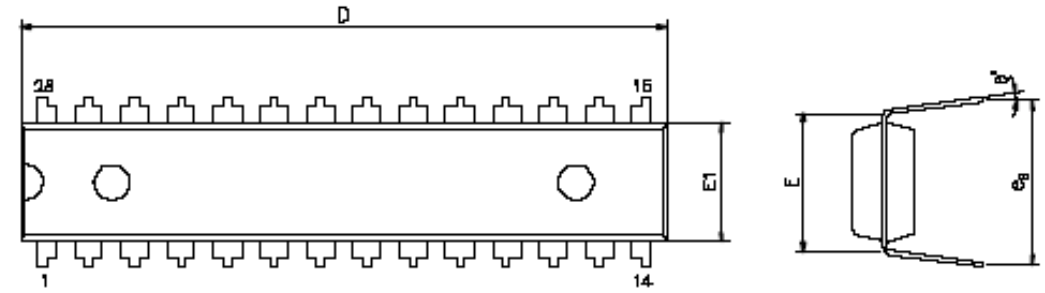


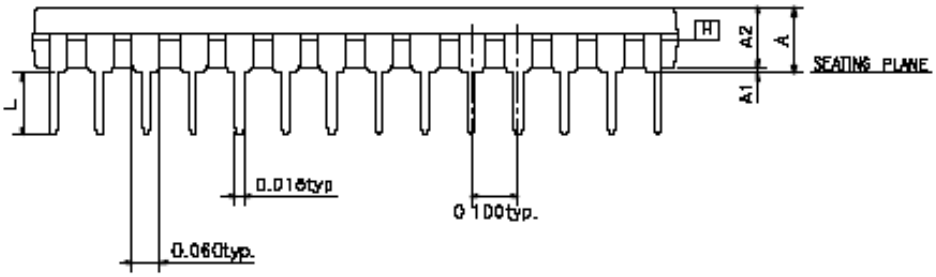

| SYM. \ UNIT | INCH(REF) | MM(BASE) |
|---|---|---|
| A | 0.140 (MAX) | 3.556 (MAX) |
| A1 | 0.026 (MIN) | 0.660 (MIN) |
| A2 | 0.100±0.005 | 2.540±0.127 |
| B | 0.018±0.003 | 0.457±0.076 |
| B1 | 0.028 ±0.003 | 0.711±0.076 |
| c | 0.010±0.003 | 0.254±0.076 |
| D | 0.710±0.010 | 18.03±0.254 |
| E | 0.337±0.010 | 8.560±0.254 |
| E1 | 0.300±0.005 | 7.620±0.127 |
| e | 0.050±0.003 | 1.270±0.076 |
| L | 0.087±0.010 | 2.210±0.254 |
| S | 0.030±0.004 | 0.762±0.102 |
| Y | 0.003 (MAX) | 0.076 (MAX) |

Note : 1.S/E/D dimension is not including mold flash.
2.The end flash in package lengthwise is not more than 10 mils each side.

## PACKAGE OUTLINE DIMENSION

**28 pin 300 mil PDIP Package Outline Dimension**




| SYMBOLS | MIN. | NOR. | MAX. |
|---|---|---|---|
| A | – | – | 0.210 |
| A1 | 0.015 | – | – |
| A2 | 0.125 | 0.130 | 0.135 |
| D | 1.385 | 1.390 | 1.400 |
| E | | 0.310 BSC | |
| E1 | 0.283 | 0.288 | 0.293 |
| L | 0.115 | 0.130 | 0.150 |
| $e_B$ | 0.330 | 0.350 | 0.370 |
| θ° | 0 | 7 | 15 |

UNIT : INCH

NOTE:
1.JEDEC OUTLINE : MS-015 AH

## ORDERING INFORMATION

| Package/Access Time | Temperature | 15 ns |
|---|---|---|
| 28-pin 300 mil SOJ | Commercial | AS7C164A-15JCN |
| 28-pin 300 mil Skinny P-DIP | Commercial | AS7C164A-15PCN |
| 28-pin 300 mil SOJ | Industrial | AS7C164A-15JIN |
| 28-pin 300 mil Skinny P-DIP | Industrial | AS7C164A-15PIN |

Suffix TR = tape and reel

## PART NUMBERING SYSTEM

| AS7C | | 164A | -15 | J/P | C/I | N |
|---|---|---|---|---|---|---|
| SRAM prefix | Voltage:<br>5V supply | Device Number | Access Time | J = SOJ, 300 mil<br>P= Skinny P-DIP, 300 mil | Temperature Range:<br>C = 0° ~ 70 °C<br>I = -40° ~ 85° C | N = Lead Free Part |

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