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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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.

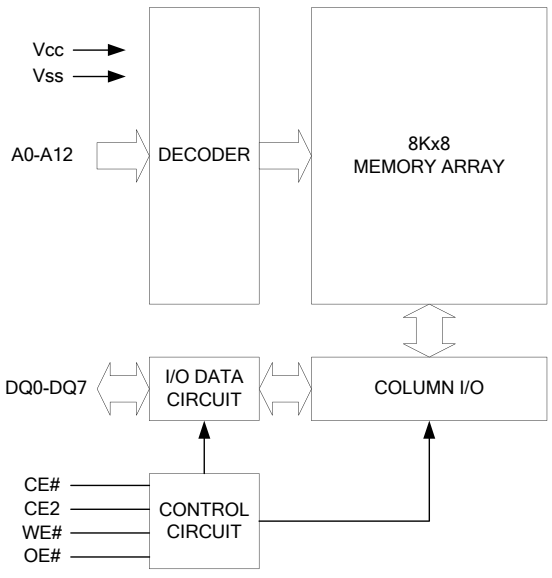
The AS7C164A is well designed for high speed system applications, and particularly well suited for battery back-up nonvolatile memory application.

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 (I) -40 ~ 85°C	4.5 ~ 5.5V	15ns	1mA	90/80mA

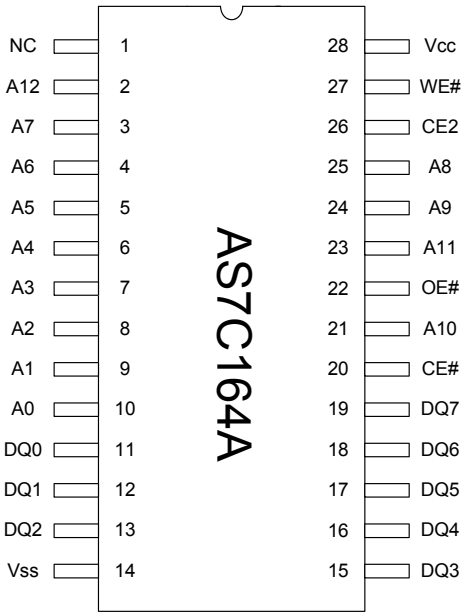
FUNCTIONAL BLOCK DIAGRAM



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) -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. CE# = V_{IL} and CE2 = V_{IH}, $I_{I/O}$ = 0mA 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 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

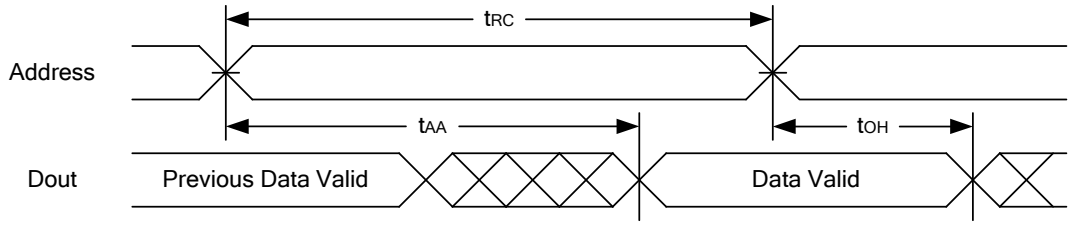
(2) WRITE CYCLE

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

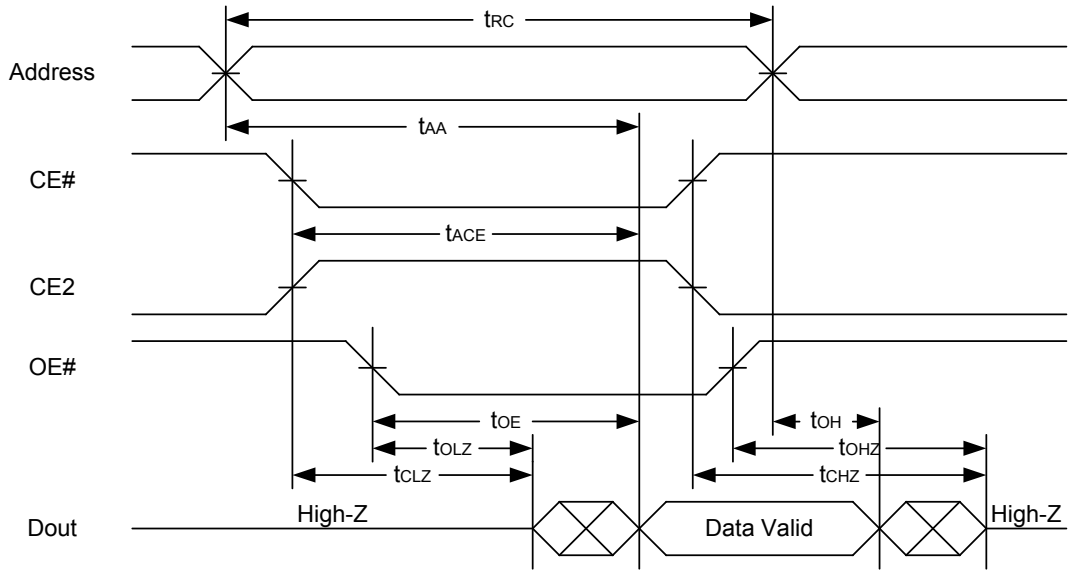
*These parameters are guaranteed by device characterization, but not production tested.

TIMING WAVEFORMS

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

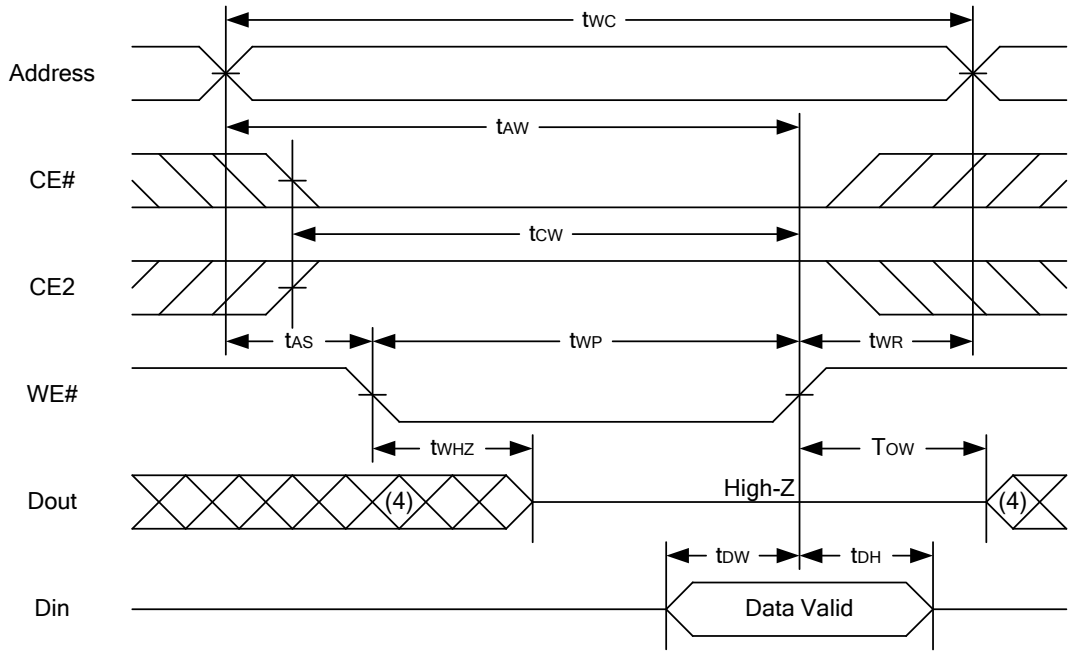


READ CYCLE 2 (CE# and CE2 and OE# Controlled) (1,3,4,5)

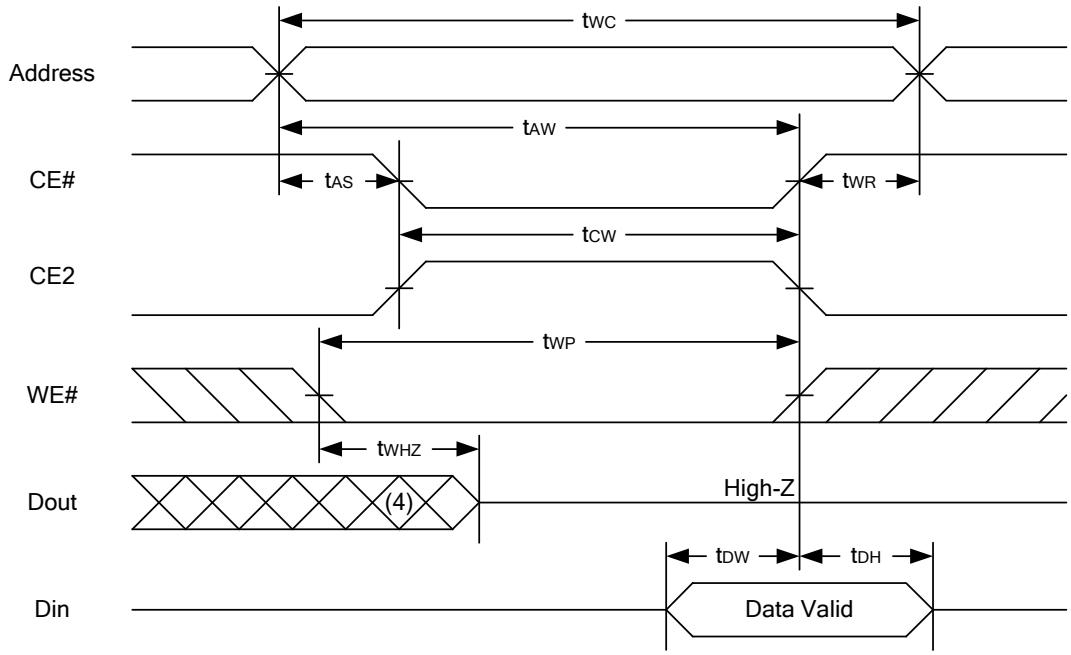


Notes :
1.WE# is high for read cycle.
2.Device is continuously selected OE# = low, CE# = low., CE2 = high.
3.Address must be valid prior to or coincident with CE# = low, CE2 = high; otherwise t_{AA} is the limiting parameter.
4.t_{CLZ}, t_{OLZ}, t_{CHZ} and t_{OHZ} are specified with C_L = 5pF. Transition 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.

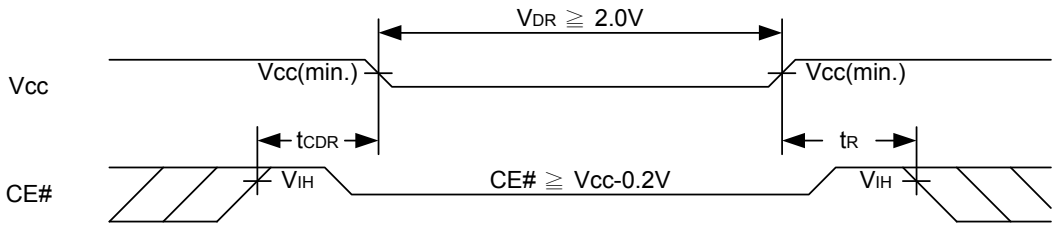
DATA RETENTION CHARACTERISTICS

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
V_{CC} for Data Retention	V_{DR}	CE# ≧ V_{CC} - 0.2V or CE2 ≦ 0.2V	2.0	-	5.5	V
Data Retention Current	I_{DR}	V_{CC} = 2.0V CE# ≧ V_{CC} - 0.2V or CE2 ≦ 0.2V 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

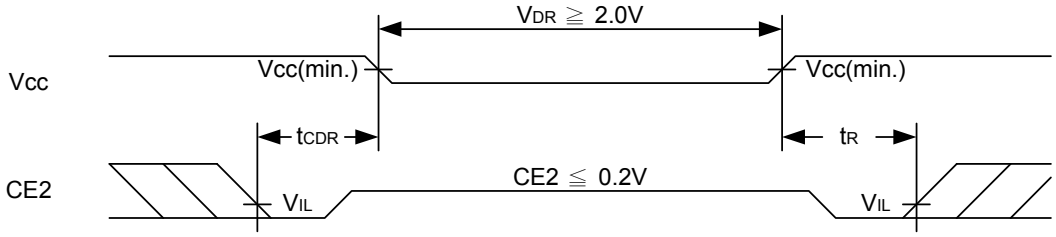
t_{RC*} = Read Cycle Time

DATA RETENTION WAVEFORM

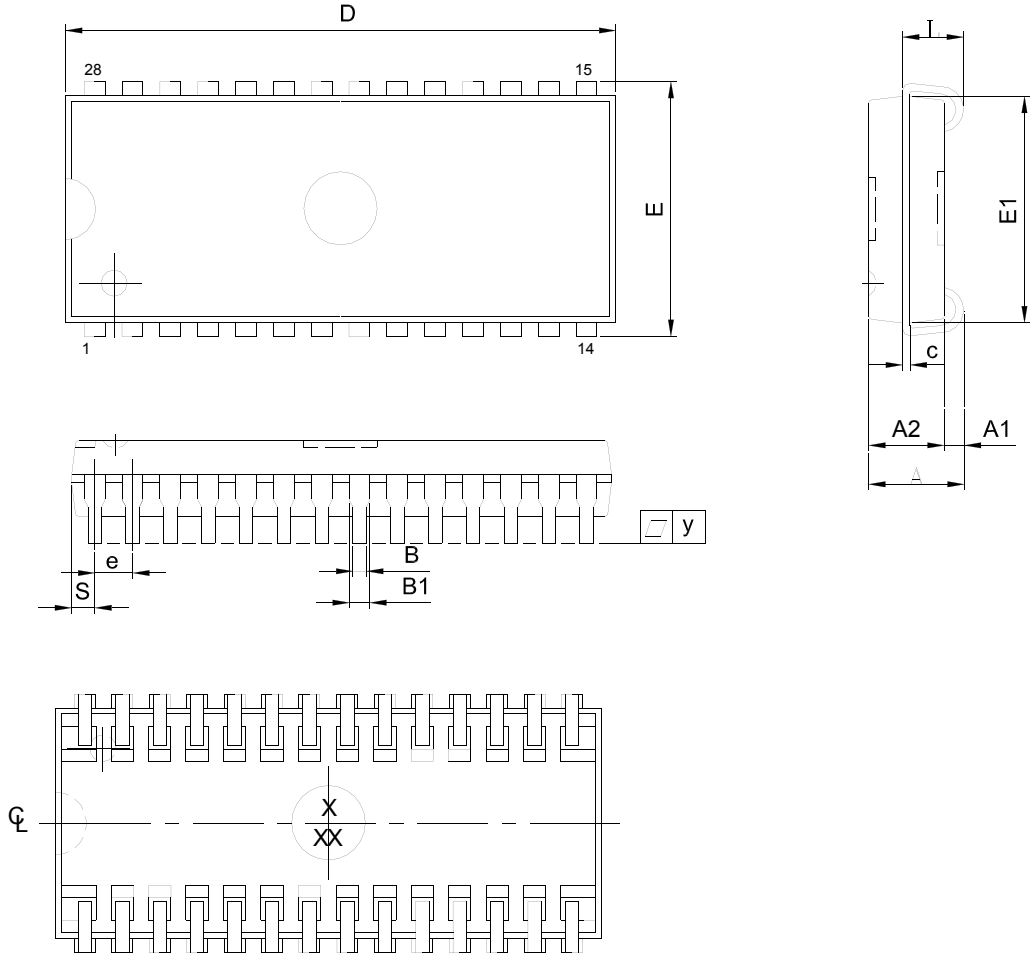
Low Vcc Data Retention Waveform (1) (CE# controlled)



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



28-pin 300 mil SOJ Package Outline Dimension

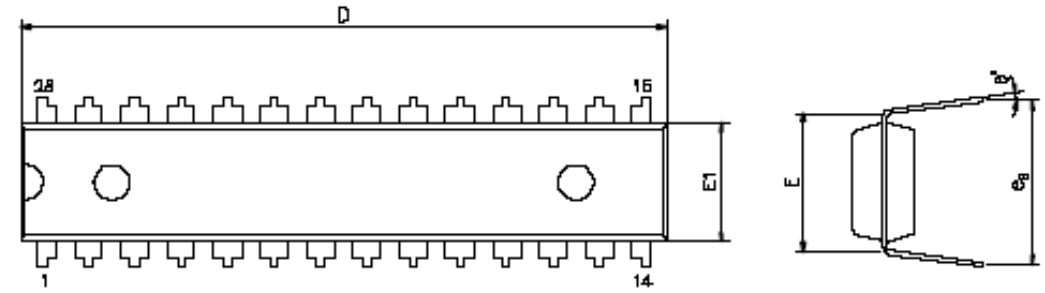


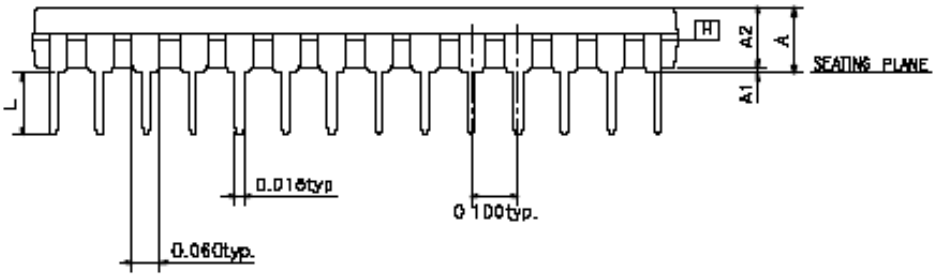
SYM. \ UNIT	INCH(REF)	MM(BASE)
A	0.140 (MAX)	3.556 (MAX)
A1	0.026 (MIN)	0.660 (MIN)
A2	0.100±0.005	2.540±0.127
B	0.018±0.003	0.457±0.076
B1	0.028 ±0.003	0.711±0.076
c	0.010±0.003	0.254±0.076
D	0.710±0.010	18.03±0.254
E	0.337±0.010	8.560±0.254
E1	0.300±0.005	7.620±0.127
e	0.050±0.003	1.270±0.076
L	0.087±0.010	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: 5V supply	Device Number	Access Time	J = SOJ, 300 mil P= Skinny P-DIP, 300 mil	Temperature Range: C = 0° ~ 70 °C I = -40° ~ 85° C	N = Lead Free Part

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