High Performance
32K×8
CMOS SRAM

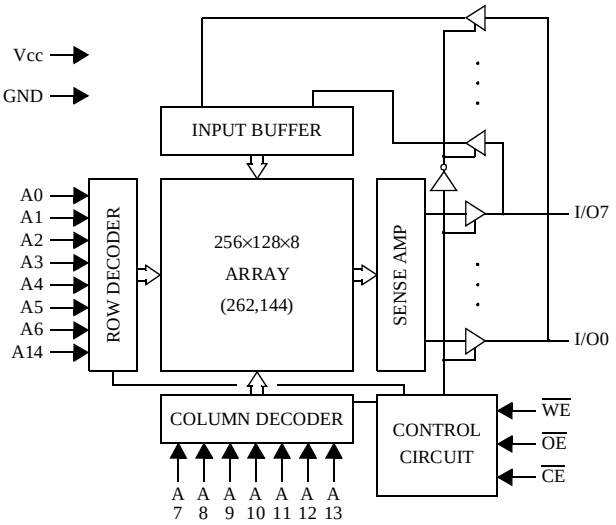
AS7C256
AS7C256L

32K×8 CMOS SRAM (Common I/O)

FEATURES

- Organization: 32,768 words × 8 bits
- High speed
  - 10/12/15/20/25/35 ns address access time
  - 3/3/4/5/6/8 ns output enable access time
- Low power consumption
  - Active: 660 mW max (10 ns cycle)
  - Standby: 11 mW max, CMOS I/O
    2.75 mW max, CMOS I/O, L version
  - Very low DC component in active power
- 2.0V data retention (L version)
- Equal access and cycle times
- Easy memory expansion with $\overline{CE}$ and $\overline{OE}$ inputs
- TTL-compatible, three-state I/O
- 28-pin JEDEC standard packages
  - 300 mil PDIP and SOJ
    Socket compatible with 7C512 and 7C1024
  - 330 mil SOIC
  - 8×13.4 TSOP
- ESD protection > 2000 volts
- Latch-up current > 200 mA

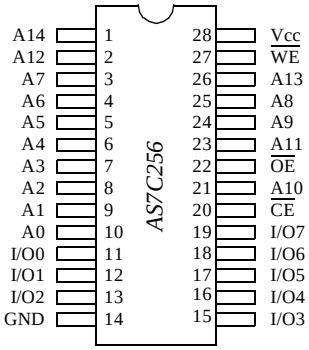
LOGIC BLOCK DIAGRAM



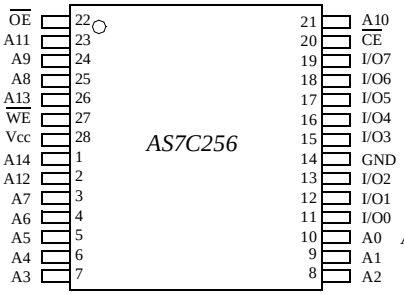
AS7C256-01

PIN ARRANGEMENT

DIP, SOJ, SOIC



TSOP 8×13.4



AS7C256-02

SELECTION GUIDE

		7C256-10	7C256-12	7C256-15	7C256-20	7C256-25	7C256-35	Unit
Maximum Address Access Time		10	12	15	20	25	35	ns
Maximum Output Enable Access Time		3	3	4	5	6	8	ns
Maximum Operating Current		120	115	110	100	90	80	mA
Maximum CMOS Standby Current		2.0	2.0	2.0	2.0	2.0	2.0	mA
	L	0.5	0.5	0.5	0.5	0.5	0.5	mA

FUNCTIONAL DESCRIPTION

The AS7C256 is a high performance CMOS 262,144-bit Static Random Access Memory (SRAM) organized as 32,768 words × 8 bits. It is designed for memory applications where fast data access, low power, and simple interfacing are desired.

Equal address access and cycle times (t_{AA}, t_{RC}, t_{WC}) of 10/12/15/20/25/35 ns with output enable access times (t_{OE}) of 3/3/4/5/6/8 ns are ideal for high performance applications. A chip enable ($\overline{CE}$) input permits easy memory expansion with multiple-bank memory organizations.

When $\overline{CE}$ is HIGH the device enters standby mode. The standard AS7C256 is guaranteed not to exceed 11 mW power consumption in standby mode; the L version is guaranteed not to exceed 2.75 mW, and typically requires only 500 µW. The L version also offers 2.0V data retention, with maximum power consumption in this mode of 300 µW.

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, and operation is from a single 5V supply. The AS7C256 is packaged in all high volume industry standard packages.

ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Min	Max	Unit
Voltage on Any Pin Relative to GND	V_t	–0.5	+7.0	V
Power Dissipation	P_D	–	1.0	W
Storage Temperature (Plastic)	T_{stg}	–55	+150	°C
Temperature Under Bias	T_{bias}	–10	+85	°C
DC Output Current	I_{out}	–	20	mA

NOTE: 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
L	H	L	D_{out}	Read
L	L	X	D_{in}	Write

Key: X = Don't Care, L = LOW, H = HIGH

RECOMMENDED OPERATING CONDITIONS

(T_a = 0°C to +70°C)

Parameter	Symbol	Min	Typ	Max	Unit
Supply Voltage	V_{CC}	4.5	5.0	5.5	V
	GND	0.0	0.0	0.0	V
Input Voltage	V_{IH}	2.2	–	V_{CC}+1	V
	V_{IL}	–0.5*	–	0.8	V

*V_{IL} min = –3.0V for pulse width less than $t_{RC}/2$.

DC OPERATING CHARACTERISTICS[1]

(V_{CC} = 5V±10%, GND = 0V, T_a = 0°C to +70°C)

				-10		-12		-15		-20		-25		-35		
Parameter	Symbol	Test Conditions		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Unit
Input Leakage Current	$\|I_{LI}\|$	V_{CC} = Max, V_{in} = GND to V_{CC}		–	1	–	1	–	1	–	1	–	1	–	1	µA
Output Leakage Current	$\|I_{LO}\|$	$\overline{CE}$ = V_{IH}, V_{CC} = Max, V_{out} = GND to V_{CC}		–	1	–	1	–	1	–	1	–	1	–	1	µA
Operating Power Supply Current	I_{CC}	$\overline{CE}$ = V_{IL}, f = f_{max}, I_{out} = 0 mA		–	120	–	115	–	110	–	100	–	90	–	80	mA
			L	–	115	–	110	–	105	–	95	–	85	–	75	mA
Standby Power Supply Current	I_{SB}	$\overline{CE}$ = V_{IH}, f = f_{max}		–	45	–	40	–	30	–	30	–	25	–	25	mA
			L	–	40	–	35	–	25	–	25	–	20	–	20	mA
	I_{SB1}	$\overline{CE}$ > V_{CC}–0.2V, f = 0, V_{in} ≤ 0.2V *or* V_{in} ≥ V_{CC}–0.2V		–	2.0	–	2.0	–	2.0	–	2.0	–	2.0	–	2.0	mA
			L	–	0.5	–	0.5	–	0.5	–	0.5	–	0.5	–	0.5	mA
Output Voltage	V_{OL}	I_{OL} = 8 mA, V_{CC} = Min		–	0.4	–	0.4	–	0.4	–	0.4	–	0.4	–	0.4	V
	V_{OH}	I_{OH} = –4 mA, V_{CC} = Min		2.4	–	2.4	–	2.4	–	2.4	–	2.4	–	2.4	–	V

CAPACITANCE[2]

(f = 1 MHz, T_a = Room Temperature, V_{CC} = 5V)

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

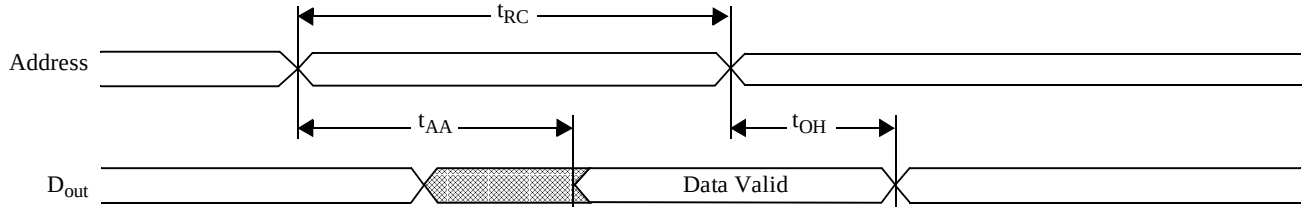
READ CYCLE [3, 9]

(V_{CC} = 5V±10%, GND = 0V, T_a = 0°C to +70°C)

		-10		-12		-15		-20		-25		-35			
Parameter	**Symbol**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Unit**	**Notes**
Read Cycle Time	t_{RC}	10	–	12	–	15	–	20	–	25	–	35	–	ns	
Address Access Time	t_{AA}	–	10	–	12	–	15	–	20	–	25	–	35	ns	3
Chip Enable ($\overline{CE}$) Access Time	t_{ACE}	–	10	–	12	–	15	–	20	–	25	–	35	ns	3
Output Enable ($\overline{OE}$) Access Time	t_{OE}	–	3	–	3	–	4	–	5	–	6	–	8	ns	
Output Hold from Address Change	t_{OH}	2	–	3	–	3	–	3	–	3	–	3	–	ns	5
$\overline{CE}$ LOW to Output in Low Z	t_{CLZ}	3	–	3	–	3	–	3	–	3	–	3	–	ns	4, 5
$\overline{CE}$ HIGH to Output in High Z	t_{CHZ}	–	3	–	3	–	4	–	5	–	6	–	8	ns	4, 5
$\overline{OE}$ LOW to Output in Low Z	t_{OLZ}	0	–	0	–	0	–	0	–	0	–	0	–	ns	4, 5
$\overline{OE}$ HIGH to Output in High Z	t_{OHZ}	–	3	–	3	–	4	–	5	–	6	–	8	ns	4, 5
Power Up Time	t_{PU}	0	–	0	–	0	–	0	–	0	–	0	–	ns	4, 5
Power Down Time	t_{PD}	–	10	–	12	–	15	–	20	–	25	–	35	ns	4, 5

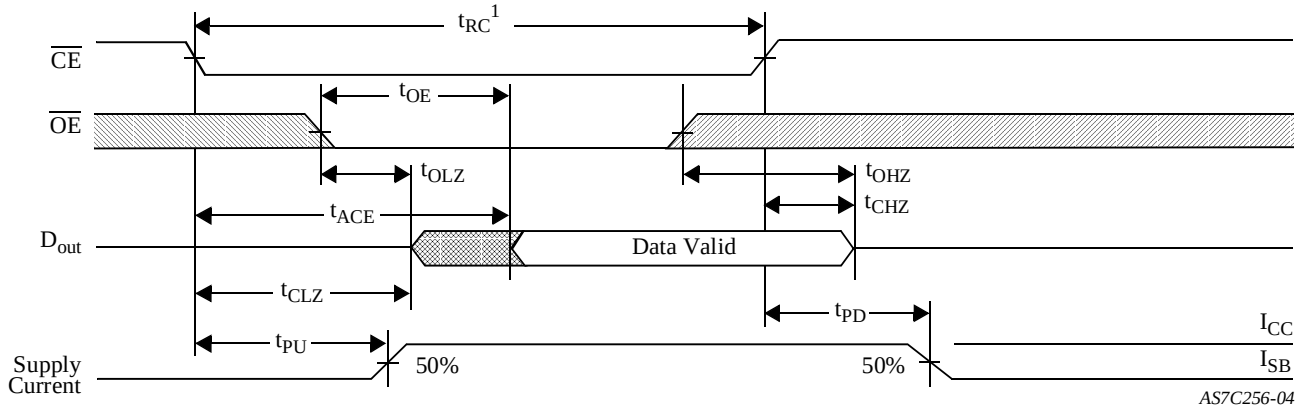
TIMING WAVEFORM OF READ CYCLE 1 [3, 6, 7, 9]

(Address Controlled)



TIMING WAVEFORM OF READ CYCLE 2 [3, 6, 8, 9]

($\overline{CE}$ Controlled)



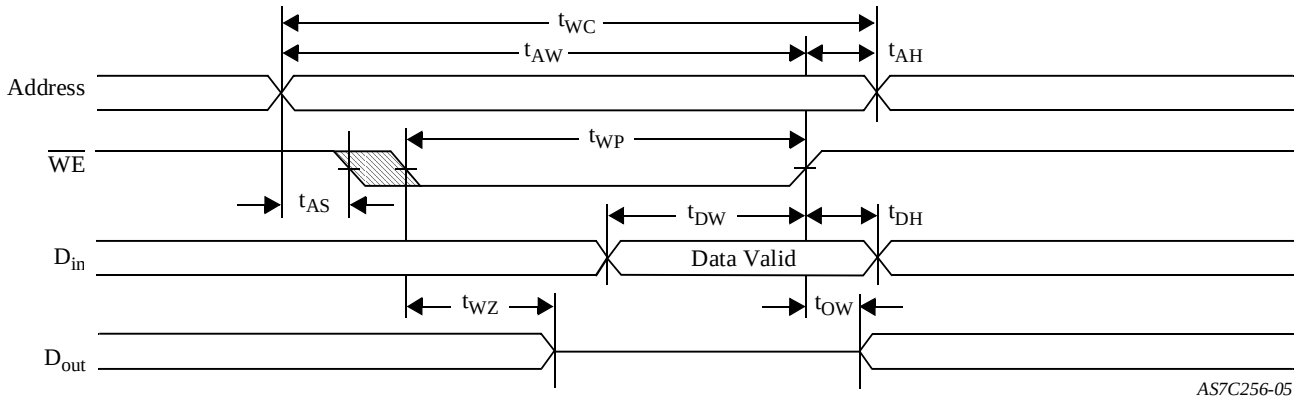
WRITE CYCLE [11]

(V_{CC} = 5V±10%, GND = 0V, T_a = 0°C to +70°C)

		-10		-12		-15		-20		-25		-35			
Parameter	**Symbol**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Unit**	**Notes**
Write Cycle Time	t_{WC}	10	–	12	–	15	–	20	–	20	–	30	–	ns	
Chip Enable to Write End	t_{CW}	9	–	10	–	12	–	12	–	15	–	20	–	ns	
Address Setup to Write End	t_{AW}	9	–	10	–	12	–	12	–	15	–	20	–	ns	
Address Setup Time	t_{AS}	0	–	0	–	0	–	0	–	0	–	0	–	ns	
Write Pulse Width	t_{WP}	7	–	8	–	9	–	12	–	15	–	17	–	ns	
Address Hold From End of Write	t_{AH}	0	–	0	–	0	–	0	–	0	–	0	–	ns	
Data Valid to Write End	t_{DW}	6	–	6	–	8	–	10	–	10	–	15	–	ns	
Data Hold Time	t_{DH}	0	–	0	–	0	–	0	–	0	–	0	–	ns	4, 5
Write Enable to Output in High Z	t_{WZ}	–	5	–	5	–	5	–	5	–	5	–	5	ns	4, 5
Output Active from Write End	t_{OW}	3	–	3	–	3	–	3	–	3	–	3	–	ns	4, 5

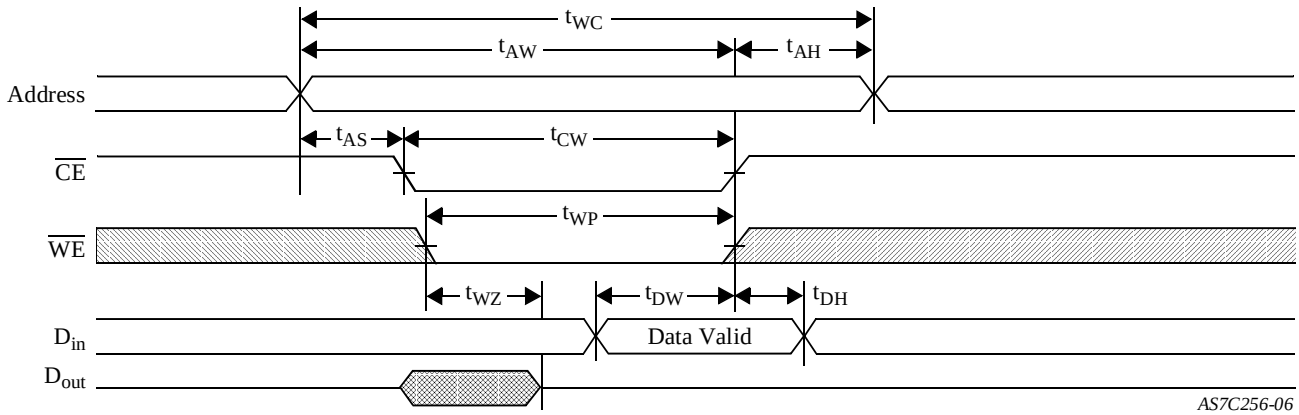
TIMING WAVEFORM OF WRITE CYCLE 1 [10, 11]

($\overline{WE}$ Controlled)



TIMING WAVEFORM OF WRITE CYCLE 2 [10, 11]

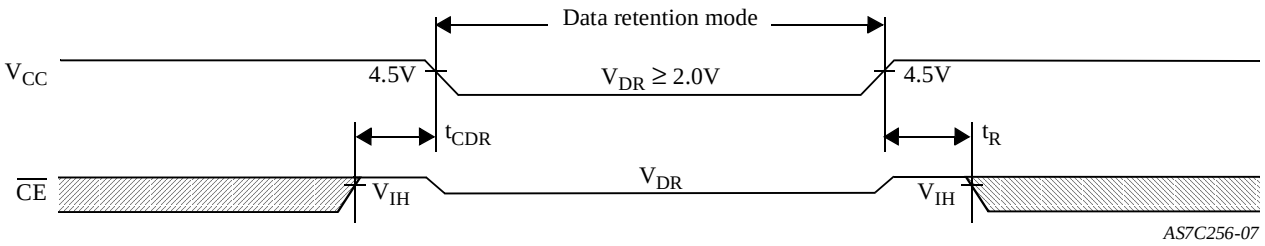
($\overline{CE}$ Controlled)



DATA RETENTION CHARACTERISTICS (L Version Only)

Parameter	Symbol	Test Conditions	Min	Max	Unit
V_{CC} for Data Retention	V_{DR}	V_{CC} = 2.0V $\overline{CE} \geq V_{CC}-0.2V$ $V_{in} \geq V_{CC}-0.2V$ *or* $V_{in} \leq 0.2V$	2.0	–	V
Data Retention Current	I_{CCDR}		–	150	µA
Chip Enable to Data Retention Time	t_{CDR}		0	–	ns
Operation Recovery Time	t_R		t_{RC}	–	ns
Input Leakage Current	$\lvert I_{LI} \rvert$		–	1	µA

DATA RETENTION WAVEFORM (L Version Only)



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AC TEST CONDITIONS

- Output load: see Figure B, except for t_{CLZ} and t_{CHZ} see Figure C.
- Input pulse level: GND to 3.0V. See Figure A.
- Input rise and fall times: 5 ns. See Figure A.
- Input and output timing reference levels: 1.5V.

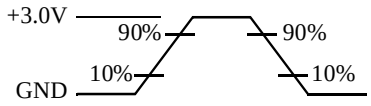


Figure A: Input Waveform

AS7C256-08

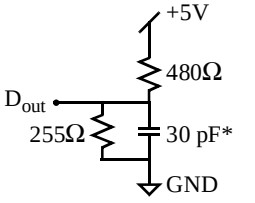
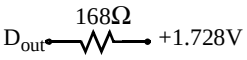


Figure B: Output Load

AS7C256-09

Thevenin Equivalent:



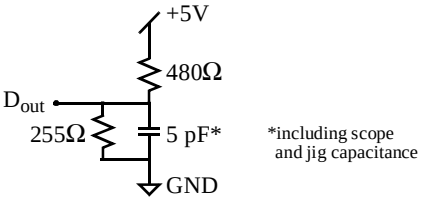


Figure C: Output Load for t_{CLZ}, t_{CHZ}

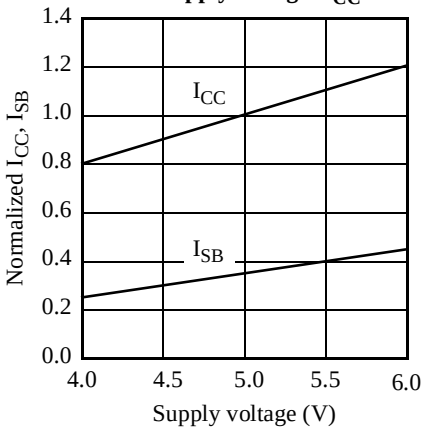
AS7C256-10

NOTES

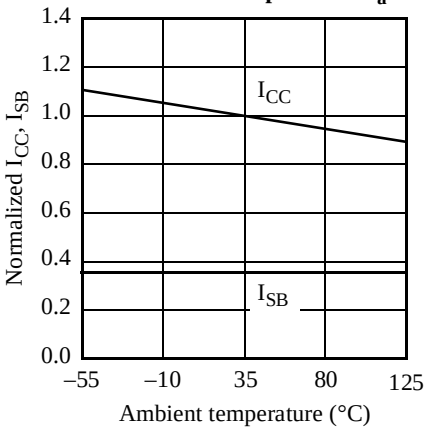
1. During V_{CC} power-up, a pull-up resistor to V_{CC} on $\overline{CE}$ is required to meet I_{SB} specification.
2. This parameter is sampled and not 100% tested.
3. For test conditions, see *AC Test Conditions*, Figures A, B, C.
4. t_{CLZ} and t_{CHZ} are specified with CL = 5pF as in Figure C. Transition is measured ±500mV from steady-state voltage.
5. This parameter is guaranteed but not tested.
6. $\overline{WE}$ is HIGH for read cycle.
7. $\overline{CE}$ and $\overline{OE}$ are LOW for read cycle.
8. Address valid prior to or coincident with $\overline{CE}$ transition LOW.
9. All read cycle timings are referenced from the last valid address to the first transitioning address.
10. $\overline{CE}$ or $\overline{WE}$ must be HIGH during address transitions.
11. All write cycle timings are referenced from the last valid address to the first transitioning address.

TYPICAL DC AND AC CHARACTERISTICS

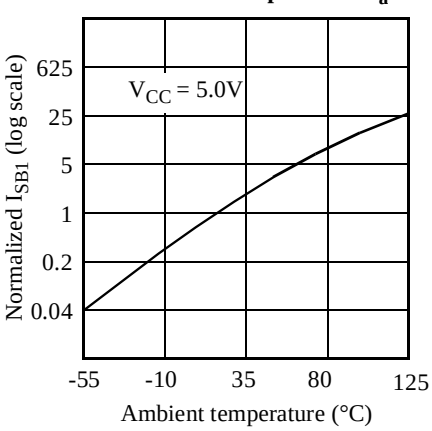
Normalized supply current I_{CC}, I_{SB} vs. supply voltage V_{CC}



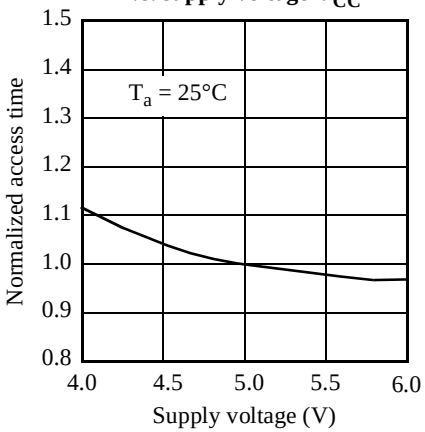
Normalized supply current I_{CC}, I_{SB} vs. ambient temperature T_a



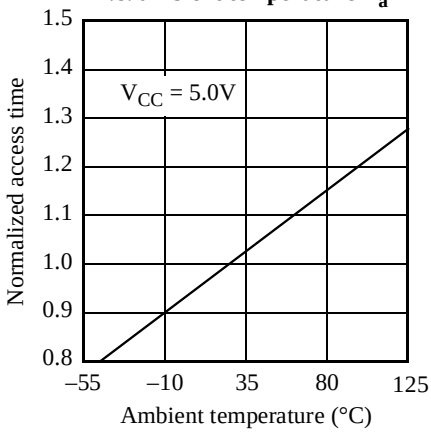
Normalized supply current I_{SB1} vs. ambient temperature T_a



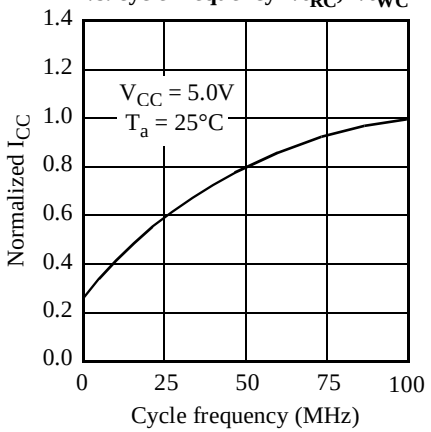
Normalized access time t_{AA} vs. supply voltage V_{CC}



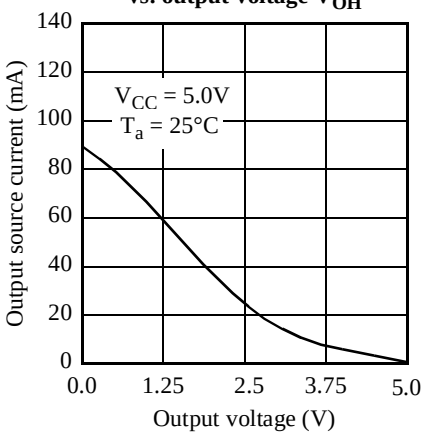
Normalized access time t_{AA} vs. ambient temperature T_a



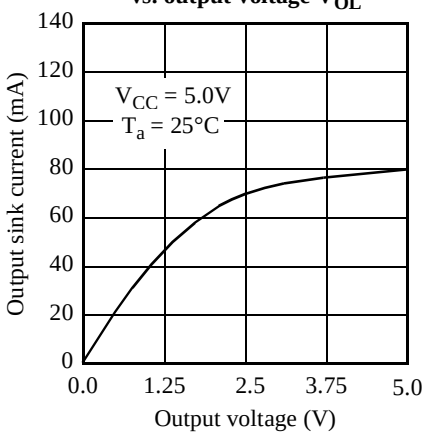
Normalized supply current I_{CC} vs. cycle frequency $1/t_{RC}$, $1/t_{WC}$



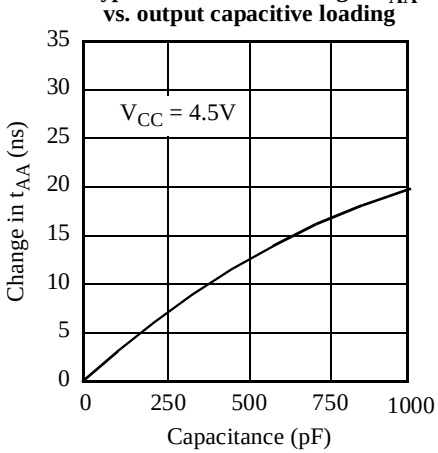
Output source current I_{OH} vs. output voltage V_{OH}



Output sink current I_{OL} vs. output voltage V_{OL}



Typical access time change Δt_{AA} vs. output capacitive loading



AS7C256-11

ORDERING CODES

Package / Access Time	10 ns	12 ns	15 ns	20 ns	25 ns	35 ns
Plastic DIP, 300 mil	AS7C256-10PC AS7C256L-10PC	AS7C256-12PC AS7C256L-12PC	AS7C256-15PC AS7C256L-15PC	AS7C256-20PC AS7C256L-20PC	AS7C256-25PC AS7C256L-25PC	AS7C256-35PC AS7C256L-35PC
Plastic SOJ, 300 mil	AS7C256-10JC AS7C256L-10JC	AS7C256-12JC AS7C256L-12JC	AS7C256-15JC AS7C256L-15JC	AS7C256-20JC AS7C256L-20JC	AS7C256-25JC AS7C256L-25JC	AS7C256-35JC AS7C256L-35JC
Plastic SOIC, 330 mil	AS7C256-10SC AS7C256L-10SC	AS7C256-12SC AS7C256L-12SC	AS7C256-15SC AS7C256L-15SC	AS7C256-20SC AS7C256L-20SC	AS7C256-25SC AS7C256L-25SC	AS7C256-35SC AS7C256L-35SC
TSOP 8×13.4	AS7C256-10TC AS7C256L-10TC	AS7C256-12TC AS7C256L-12TC	AS7C256-15TC AS7C256L-15TC	AS7C256-20TC AS7C256L-20TC	AS7C256-25TC AS7C256L-25TC	AS7C256-35TC AS7C256L-35TC

PART NUMBERING SYSTEM

AS7C	256	X		–XX	X		C
SRAM Prefix	Device Number	Blank L	= Standard Power = Low Power	Access Time	Package:	P = PDIP 300 mil J = SOJ 300 mil S = SOIC 330 mil T = TSOP 8×14	Commercial Temperature Range, 0°C to 70 °C

REPRESENTATIVES, DISTRIBUTORS, AND SALES OFFICES

DOMESTIC REPS

ALABAMA
Concord Component
(205) 772-8883

ARIZONA
Competitive Technology
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ARKANSAS
Southern States Marketing
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CALIFORNIA
North: Brooks Technical
(415) 960-3880
LA Area: Competitive Tech.
(714) 450-0170
San Diego: ATS
(619) 634-1488

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Technology Sales
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CONNECTICUT
Kitchen & Kutchin Inc.
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DELAWARE
Vantage Sales
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Tampa
(813) 393-5011

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Concord Component
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Brooks Technical
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(503) 684-8500

ILLINOIS
North: El-Mech
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South: CenTech
(314) 291-4230

INDIANA
CC Electro Sales
(317) 921-5000

KANSAS
CenTech
(816) 358-8100

KENTUCKY
CC Electro Sales
(317) 921-5000

LOUISIANA
Southern States Marketing
North: (214) 238-7500
South: (713) 868-5180

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Kitchen & Kutchin Inc.
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MARYLAND
Chesapeake Technology
(301) 236-0530

MASSACHUSETTS
Kitchen & Kutchin Inc.
(617) 229-2660

MICHIGAN
Enco Group
(810) 338-8600

MINNESOTA
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