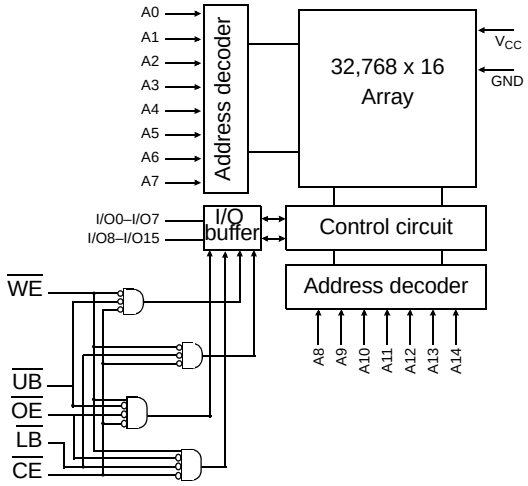
5 V 32K X 16 CMOS SRAM

Features

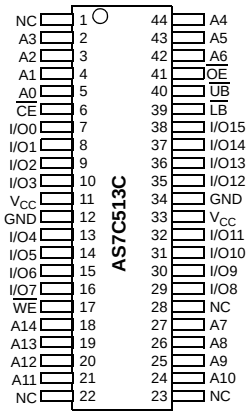
- Industrial (-40^{o} to 85^{o}C) temperature
- Organization: 32,768 words × 16 bits
- Center power and ground pins for low noise
- High speed
  - 12 ns address access time
  - 6 ns output enable access time
- Low power consumption via chip deselect
- Easy memory expansion with $\overline{CE}$, $\overline{OE}$ inputs
- TTL-compatible, three-state I/O
- Upper and Lower byte pin
- JEDEC standard packaging
  - 44-pin 400 mil SOJ
  - 44-pin TSOP 2
- ESD protection ≥ 2000 volts

Logic block diagram



Pin arrangement

44-Pin SOJ (400 mil), TSOP 2



Functional description

The AS7C513C is a 5V high-performance CMOS 524,288-bit Static Random Access Memory (SRAM) device organized as 32,768 words × 16 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 12 ns with output enable access times (t_{OE}) of 6 ns are ideal for high-performance applications.

When $\overline{CE}$ is high, the device enters standby mode. If inputs are still toggling, the device will consume I_{SB} power. If the bus is static, then full standby power is reached (I_{SB1}).

A write cycle is accomplished by asserting write enable ($\overline{WE}$) and chip enable ($\overline{CE}$). Data on the input pins I/O0 through I/O15 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 output enable ($\overline{OE}$) and chip enable ($\overline{CE}$) with write enable ($\overline{WE}$) high. The chip drives I/O pins with the data word referenced by the input address. When either chip enable or output enable is inactive or write enable is active, output drivers stay in high-impedance mode.

The device provides multiple center power and ground pins, and separate byte enable controls, allowing individual bytes to be written and read. $\overline{LB}$ controls the lower bits, I/O0 through I/O7, and $\overline{UB}$ controls the higher bits, I/O8 through I/O15.

All chip inputs and outputs are TTL-compatible, and operation is from a single 5 V supply. The AS7C513C is packaged in common industry standard packages.

Absolute maximum ratings

Parameter	Symbol	Min	Max	Unit
Voltage on V_{CC} relative to GND	V_{t1}	–0.50	+7.0	V
Voltage on any pin relative to GND	V_{t2}	–0.50	V_{CC} +0.50	V
Power dissipation	P_D	–	1.25	W
Storage temperature (plastic)	T_{stg}	–55	+125	°C
Ambient temperature with VCC applied	T_{bias}	–55	+125	°C
DC current into outputs (low)	I_{OUT}	–	50	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

$\overline{CE}$	$\overline{WE}$	$\overline{OE}$	$\overline{LB}$	$\overline{UB}$	I/O0–I/O7	I/O8–I/O15	Mode
H	X	X	X	X	High Z	High Z	Standby (I_{SB}), I_{SBI})
L	H	L	L	H	D_{OUT}	High Z	Read I/O0–I/O7 (I_{CC})
L	H	L	H	L	High Z	D_{OUT}	Read I/O8–I/O15 (I_{CC})
L	H	L	L	L	D_{OUT}	D_{OUT}	Read I/O0–I/O15 (I_{CC})
L	L	X	L	L	D_{IN}	D_{IN}	Write I/O0–I/O15 (I_{CC})
L	L	X	L	H	D_{IN}	High Z	Write I/O0–I/O7 (I_{CC})
L	L	X	H	L	High Z	D_{IN}	Write I/O8–I/O15 (I_{CC})
L L	H X	H X	X H	X H	High Z	High Z	Output disable (I_{CC})

Key: H = high, L = low, X = don't care.

Recommended operating conditions

Parameter	Symbol	Min	Nominal	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 (Industrial)	T_A	–40	–	85	^{o} C

Notes:

V_{IL} min = -1.5V for pulse width less than 5ns, once per cycle.

V_{IH} max = V_{CC}+2.0V for pulse width less than 5ns, once per cycle.

DC operating characteristics (over the operating range)[1]

Parameter	Sym	Test conditions	AS7C513C-12		Unit
			Min	Max	
Input leakage current	$\lvert I_{LI} \rvert$	V_{CC} = Max, V_{IN} = GND to V_{CC}	–	5	µA
Output leakage current	$\lvert I_{LO} \rvert$	V_{CC} = Max, $\overline{CE}$ = V_{IH}, V_{OUT} = GND to V_{CC}	–	5	µA
Operating power supply current	I_{CC}	V_{CC} = Max, $\overline{CE} \le V_{IL}$, I_{OUT} = 0mA, f = f_{Max}	–	210	mA
Standby power supply current	I_{SB}	V_{CC} = Max, $\overline{CE} \ge V_{IH}$, f = f_{Max}	–	60	mA
	I_{SB1}	V_{CC} = Max, $\overline{CE} \ge V_{CC}$–0.2 V, $V_{IN} \le 0.2$ V or $V_{IN} \ge V_{CC}$–0.2 V, f = 0	–	10	mA
Output voltage	V_{OL}	I_{OL} = 8 mA, V_{CC} = Min	–	0.4	V
	V_{OH}	I_{OH} = –4 mA, V_{CC} = Min	2.4	–	V

Capacitance (f = 1MHz, T_a = 25 °C, V_{CC} = NOMINAL)[2]

Parameter	Symbol	Signals	Test conditions	Max	Unit
Input capacitance	C_{IN}	A, $\overline{CE}$, $\overline{WE}$, $\overline{OE}$, $\overline{LB}$, $\overline{UB}$	V_{IN} = 3dV	6	pF
I/O capacitance	$C_{I/O}$	I/O	V_{OUT} = 3dV	7	pF

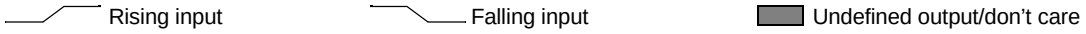
Note:

This parameter is guaranteed by device characterization, but is not production tested.

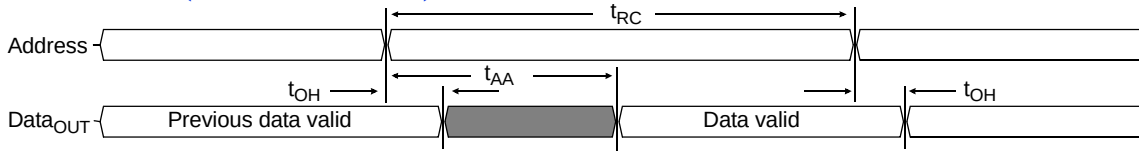
Read cycle (over the operating range)[3,9]

Parameter	Symbol	AS7C513C-12		Unit	Notes
		Min	Max		
Read cycle time	t_{RC}	12	–	ns	
Address access time	t_{AA}	–	12	ns	3
Chip enable ($\overline{CE}$) access time	t_{ACE}	–	12	ns	3
Output enable ($\overline{OE}$) access time	t_{OE}	–	7	ns	
Output hold from address change	t_{OH}	4	–	ns	5
$\overline{CE}$ low to output in low Z	t_{CLZ}	4	–	ns	4, 5
$\overline{CE}$ high to output in high Z	t_{CHZ}	–	6	ns	4, 5
$\overline{OE}$ low to output in low Z	t_{OLZ}	0	–	ns	4, 5
Byte select access time	t_{BA}	–	7	ns	
Byte select Low to low Z	t_{BLZ}	0	–	ns	4, 5
Byte select High to high Z	t_{BHZ}	–	6	ns	4, 5
$\overline{OE}$ high to output in high Z	t_{OHZ}	–	6	ns	4, 5
Power up time	t_{PU}	0	–	ns	4, 5
Power down time	t_{PD}	–	12	ns	4, 5

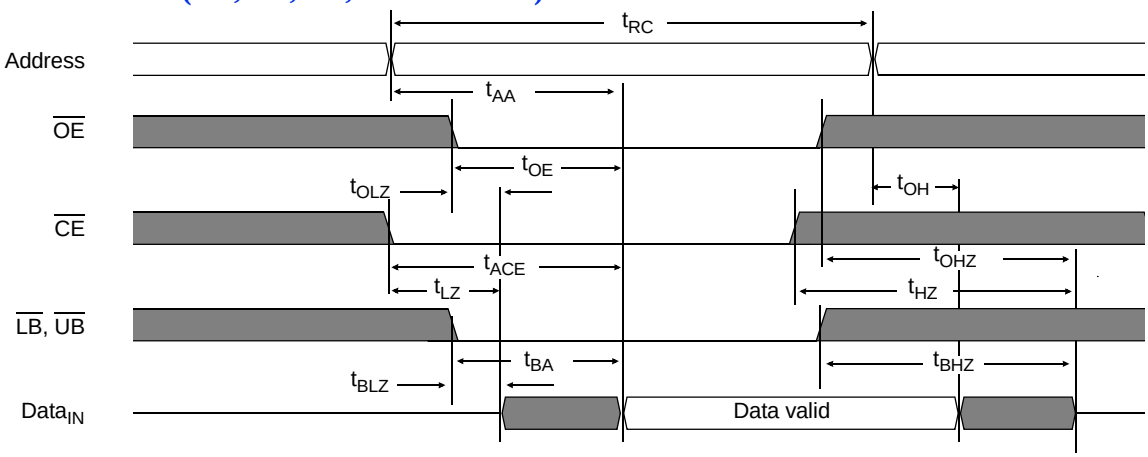
Key to switching waveforms



Read waveform 1 (address controlled)[3,6,7,9]



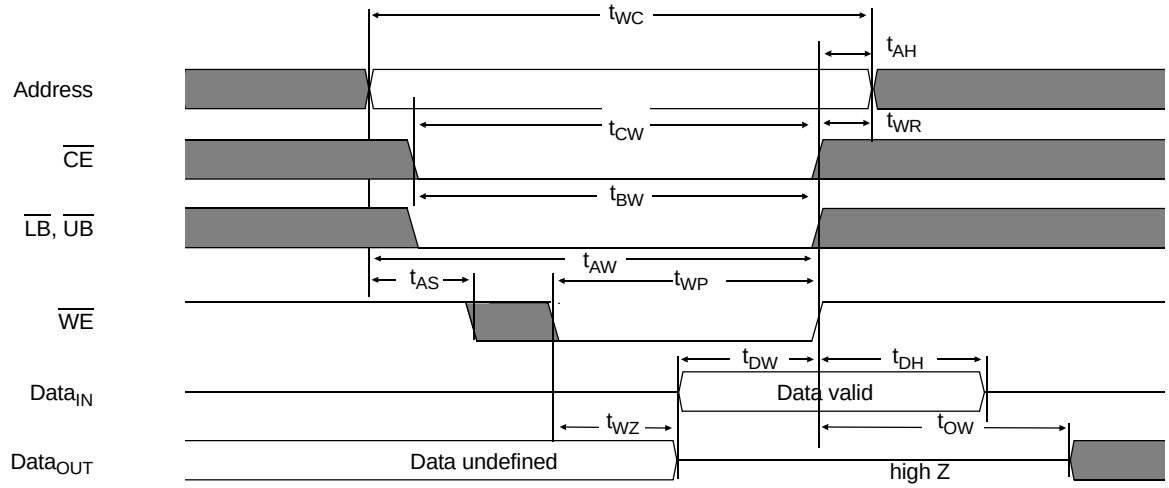
Read waveform 2 ($\overline{OE}$, $\overline{CE}$, $\overline{UB}$, $\overline{LB}$ controlled)[3,6,8,9]



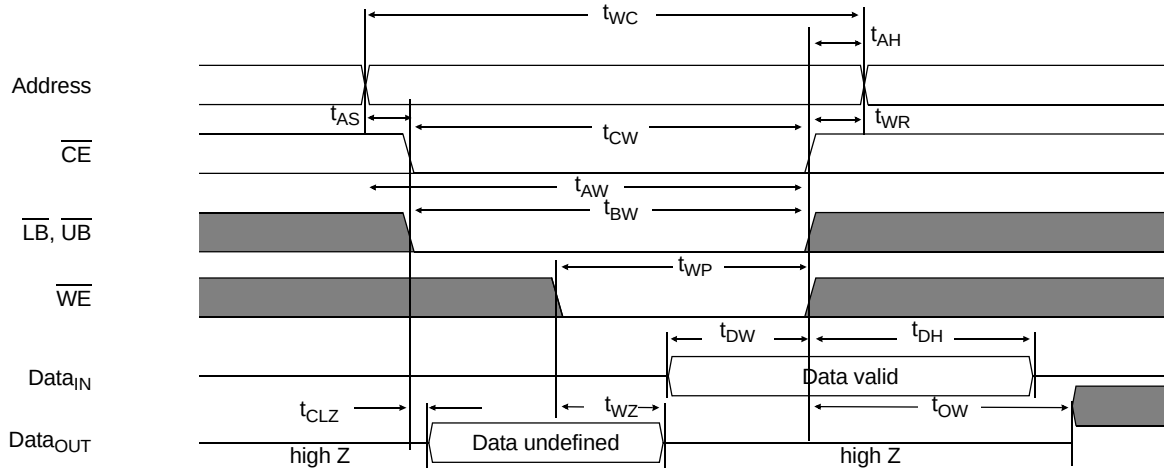
Write cycle (over the operating range) [11]

Parameter	Symbol	AS7C513C-12		Unit	Notes
		Min	Max		
Write cycle time	t_{WC}	12	–	ns	
Chip enable ($\overline{CE}$) to write end	t_{CW}	9	–	ns	
Address setup to write end	t_{AW}	9	–	ns	
Address setup time	t_{AS}	0	–	ns	
Write pulse width	t_{WP}	9	–	ns	
Write recovery time	t_{WR}	0	–	ns	
Address hold from end of write	t_{AH}	0	–	ns	
Data valid to write end	t_{DW}	7	–	ns	
Data hold time	t_{DH}	0	–	ns	5
Write enable to output in high Z	t_{WZ}	–	6	ns	4, 5
Output active from write end	t_{OW}	1	–	ns	4, 5
Byte select low to end of write	t_{BW}	9	–	ns	

Write waveform 1 ($\overline{WE}$ controlled)[11]



Write waveform 2 ($\overline{CE}$ controlled)[11]



AC test conditions

- Output load: see Figure B.
- Input pulse level: GND to 3.0 V. See Figure A.
- Input rise and fall times: 3 ns. See Figure A.
- Input and output timing reference levels: 1.5

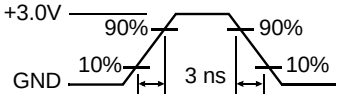


Figure A: Input pulse

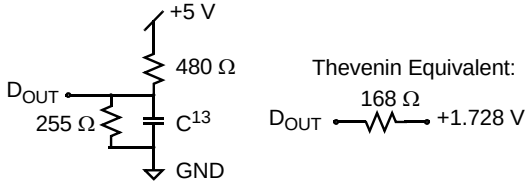
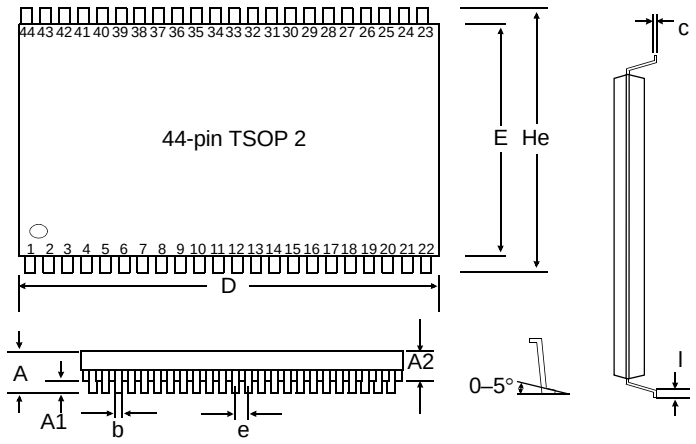


Figure B: 5 V Output load

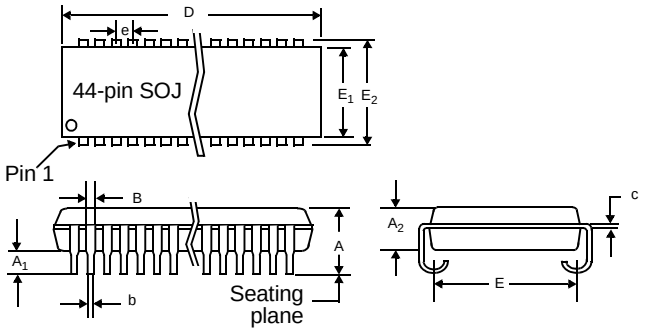
Notes:

1 During V_{CC} power-up, a pull-up resistor to V_{CC} on $\overline{CE}$ is required to meet I_{SB} specification.
2 This parameter is sampled, but not 100% tested.
3 For test conditions, see *AC Test Conditions*, Figures A and B.
4 These parameters are specified with C_L = 5 pF, as in Figures B. Transition is measured ± 200 mV 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 is 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 N/A.
11 All write cycle timings are referenced from the last valid address to the first transitioning address.
12 Not applicable.
13 C = 30 pF, except all high Z and low Z parameters where C = 5 pF.

Package dimensions



	44-pin TSOP 2	
	Min (mm)	Max (mm)
A		1.2
A1	0.05	0.15
A2	0.95	1.05
b	0.30	0.45
c	0.120	0.21
D	18.31	18.52
E	10.06	10.26
He	11.68	11.94
e	0.80 (typical)	
l	0.40	0.60



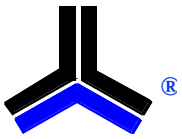
	44-pin SOJ 400 mil	
	Min (in)	Max (in)
A	0.128	0.148
A_1	0.025	–
A_2	0.105	0.115
B	0.026	0.032
b	0.015	0.020
c	0.007	0.013
D	1.120	1.130
E	0.370 NOM	
E_1	0.395	0.405
E_2	0.435	0.445
e	0.050 NOM	

Ordering codes

Package	Volt/Temp	12 ns
Plastic SOJ, 400 mil	5V Industrial	AS7C513C-12JIN
TSOP 2, 10.2 x 18.4 mm	5V Industrial	AS7C513C-12TIN

Part numbering system

AS7C	513C	–XX	X	X	X
SRAM prefix	Device number	Access time	Package: J = SOJ 400 mil T = TSOP 2, 10.2 x 18.4 mm	Temperature range: I = industrial: -40° C to 85° C	N = LEAD FREE PART



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