PRELIMINARY

CY7C1512

64K x 8 Static RAM

Features

- **High speed**
  - **—t_{AA} = 15 ns**
- **CMOS for optimum speed/power**
- **Low active power**
  - **—770 mW**
- **Low standby power**
  - **—28 mW**
- **Automatic power-down when deselected**
- **TTL-compatible inputs and outputs**
- **Easy memory expansion with $\overline{CE}_1$, CE_2, and $\overline{OE}$ options**

Functional Description

The CY7C1512 is a high-performance CMOS static RAM organized as 65,536 words by 8 bits. Easy memory expansion is provided by an active LOW chip enable ($\overline{CE}_1$), an active HIGH chip enable (CE_2), an active LOW output enable ($\overline{OE}$), and three-state drivers. This device has an automatic power-down feature that reduces power consumption by more than 75% when deselected.

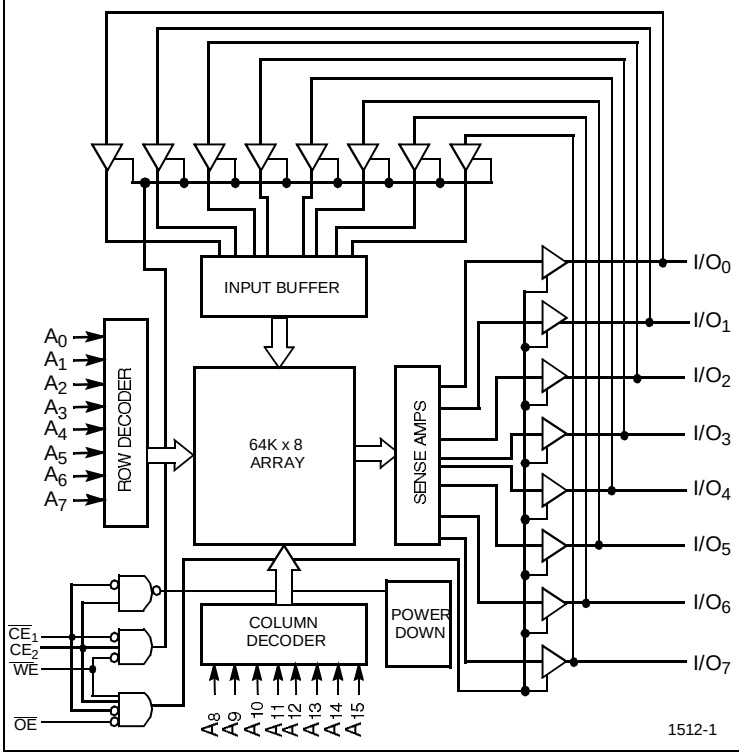
Writing to the device is accomplished by taking chip enable one ($\overline{CE}_1$) and write enable ($\overline{WE}$) inputs LOW and chip enable two (CE_2) input HIGH. Data on the eight I/O pins (I/O_0 through I/O_7) is then written into the location specified on the address pins (A_0 through A_{15}).

Reading from the device is accomplished by taking chip enable one ($\overline{CE}_1$) and output enable ($\overline{OE}$) LOW while forcing write enable ($\overline{WE}$) and chip enable two (CE_2) HIGH. Under these conditions, the contents of the memory location specified by the address pins will appear on the I/O pins.

The eight input/output pins (I/O_0 through I/O_7) are placed in a high-impedance state when the device is deselected ($\overline{CE}_1$ HIGH or CE_2 LOW), the outputs are disabled ($\overline{OE}$ HIGH), or during a write operation ($\overline{CE}_1$ LOW, CE_2 HIGH, and $\overline{WE}$ LOW).

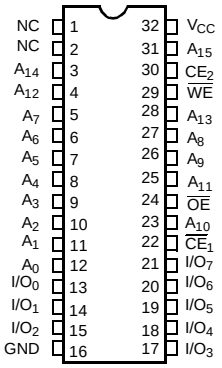
The CY7C1512 is available in standard TSOP type I and 450-mil-wide plastic SOIC packages.

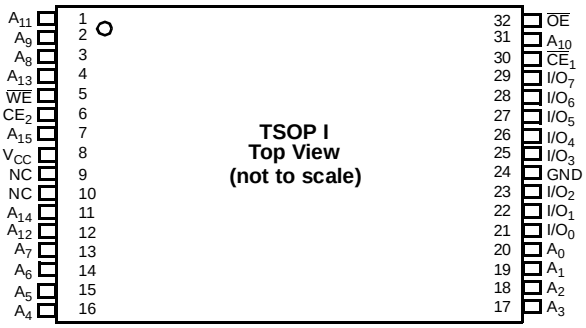
Logic Block Diagram



Pin Configurations

SOIC
Top View





TSOP I
Top View
(not to scale)

1512-2

Selection Guide

		7C1512-15	7C1512-20	7C1512-25	7C1512-35	7C1512-70
Maximum Access Time (ns)		15	20	25	35	70
Maximum Operating Current (mA)	Commercial	140	130	120	110	110
Maximum CMOS Standby Current (mA)	Commercial	5	5	5	5	5

Maximum Ratings

(Above which the useful life may be impaired. For user guidelines, not tested.)

Storage Temperature ..... –65°C to +150°C

Ambient Temperature with Power Applied..... –55°C to +125°C

Supply Voltage on V_{CC} to Relative GND[1] .... –0.5V to +7.0V

DC Voltage Applied to Outputs in High Z State[1].....–0.5V to V_{CC} +0.5V

DC Input Voltage[1].....–0.5V to V_{CC} +0.5V

Current into Outputs (LOW) ..... 20 mA

Static Discharge Voltage ..... >2001V (per MIL–STD–883, Method 3015)

Latch-Up Current..... >200 mA

Operating Range

Range	Ambient Temperature[2]	V_{CC}
Commercial	0°C to +70°C	5V ± 10%
Industrial	–40°C to +85°C	5V ± 10%

Electrical Characteristics Over the Operating Range[3]

Parameter	Description	Test Conditions	7C1512-15		7C1512-20		7C1512-25		Unit
			Min.	Max.	Min.	Max.	Min.	Max.	
V_{OH}	Output HIGH Voltage	V_{CC} = Min., I_{OH} = –4.0 mA	2.4		2.4		2.4		V
V_{OL}	Output LOW Voltage	V_{CC} = Min., I_{OL} = 8.0 mA		0.4		0.4		0.4	V
V_{IH}	Input HIGH Voltage		2.2	V_{CC}+ 0.3	2.2	V_{CC}+ 0.3	2.2	V_{CC}+ 0.3	V
V_{IL}	Input LOW Voltage[1]		–0.3	0.8	–0.3	0.8	–0.3	0.8	V
I_{IX}	Input Load Current	GND ≤ V_I ≤ V_{CC}	–1	+1	–1	+1	–1	+1	µA
I_{OZ}	Output Leakage Current	GND ≤ V_I ≤ V_{CC},Output Disabled	–5	+5	–5	+5	–5	+5	µA
I_{OS}	Output Short Circuit Current[4]	V_{CC} = Max., V_{OUT} = GND		–300		–300		–300	mA
I_{CC}	V_{CC} Operating Supply Current	V_{CC} = Max., I_{OUT} = 0 mA, f = f_{MAX} = $1/t_{RC}$		140		130		120	mA
I_{SB1}	Automatic CE Power–Down Current —TTL Inputs	Max. V_{CC}, $\overline{CE}_1$ ≥ V_{IH} or CE_2 ≤ V_{IL}, V_{IN} ≥ V_{IH} or V_{IN} ≤ V_{IL}, f = f_{MAX}		40		30		30	mA
I_{SB2}	Automatic CE Power–Down Current —CMOS Inputs	Max. V_{CC}, $\overline{CE}_1$ ≥ V_{CC} – 0.3V, or CE_2 ≤ 0.3V, V_{IN} ≥ V_{CC} – 0.3V, or V_{IN} ≤ 0.3V, f=0		5		5		5	mA

Parameter	Description	Test Conditions	7C1512-35		7C1512-70		Unit
			Min.	Max.	Min.	Max.	
V_{OH}	Output HIGH Voltage	V_{CC} = Min., I_{OH} = –4.0 mA	2.4		2.4		V
V_{OL}	Output LOW Voltage	V_{CC} = Min., I_{OL} = 8.0 mA		0.4		0.4	V
V_{IH}	Input HIGH Voltage		2.2	V_{CC}+ 0.3	2.2	V_{CC}+ 0.3	V
V_{IL}	Input LOW Voltage[1]		–0.3	0.8	–0.3	0.8	V
I_{IX}	Input Load Current	GND ≤ V_I ≤ V_{CC}	–1	+1	–1	+1	µA
I_{OZ}	Output Leakage Current	GND ≤ V_I ≤ V_{CC}, Output Disabled	–5	+5	–5	+5	µA
I_{OS}	Output Short Circuit Current[4]	V_{CC} = Max., V_{OUT} = GND		–300		–300	mA
I_{CC}	V_{CC} Operating Supply Current	V_{CC} = Max. I_{OUT} = 0 mA, f = f_{MAX} = $1/t_{RC}$		110		110	mA
I_{SB1}	Automatic CE Power-Down Current —TTL Inputs	Max. V_{CC}, $\overline{CE}_1$ ≥ V_{IH} or CE_2 ≤ V_{IL}, V_{IN} ≥ V_{IH} or V_{IN} ≤ V_{IL}, f = f_{MAX}		25		25	mA
I_{SB2}	Automatic CE Power-Down Current —CMOS Inputs	Max. V_{CC}, $\overline{CE}_1$ ≥ V_{CC} – 0.3V, or CE_2 ≤ 0.3V, V_{IN} ≥ V_{CC} – 0.3V, or V_{IN} ≤ 0.3V, f=0		5		5	mA

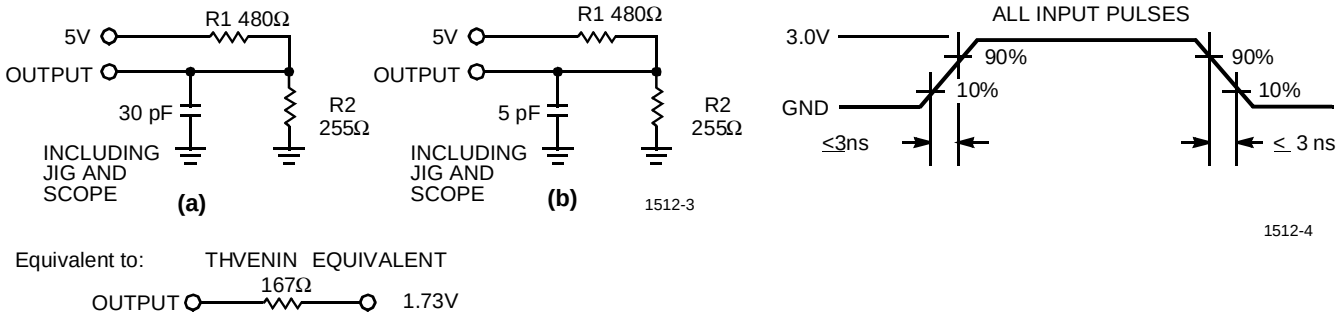
Notes:

1. V_{IL} (min.) = -2.0V for pulse durations of less than 20 ns.
2. T_A is the "instant on" case temperature.
3. See the last page of this specification for Group A subgroup testing information.
4. Not more than one output should be shorted at one time. Duration of the short circuit should not exceed 30 seconds.

Capacitance[5]

Parameter	Description	Test Conditions	Max.	Unit
C_{IN}	Input Capacitance	T_A = 25°C, f = 1 MHz, V_{CC} = 5.0V	9	pF
C_{OUT}	Output Capacitance		9	pF

AC Test Loads and Waveforms



Switching Characteristics [3, 6] Over the Operating Range

Parameter	Description	7C1512-15		7C1512-20		7C1512-25		Unit
		Min.	Max.	Min.	Max.	Min.	Max.	
READ CYCLE								
t_{RC}	Read Cycle Time	15		20		25		ns
t_{AA}	Address to Data Valid		15		20		25	ns
t_{OHA}	Data Hold from Address Change	3		3		5		ns
t_{ACE}	$\overline{CE}_1$ LOW to Data Valid, CE_2 HIGH to Data Valid		15		20		25	ns
t_{DOE}	$\overline{OE}$ LOW to Data Valid		7		8		10	ns
t_{LZOE}	$\overline{OE}$ LOW to Low Z	0		0		0		ns
t_{HZOE}	$\overline{OE}$ HIGH to High Z[7, 8]		7		8		10	ns
t_{LZCE}	$\overline{CE}_1$ LOW to Low Z, CE_2 HIGH to Low Z[8]	3		3		5		ns
t_{HZCE}	$\overline{CE}_1$ HIGH to High Z, CE_2 LOW to High Z[7, 8]		7		8		10	ns
t_{PU}	$\overline{CE}_1$ LOW to Power-Up, CE_2 HIGH to Power-Up	0		0		0		ns
t_{PD}	$\overline{CE}_1$ HIGH to Power-Down, CE_2 LOW to Power-Down		15		20		25	ns
WRITE CYCLE[9]								
t_{WC}	Write Cycle Time	15		20		25		ns
t_{SCE}	$\overline{CE}_1$ LOW to Write End, CE_2 HIGH to Write End	12		15		20		ns
t_{AW}	Address Set-Up to Write End	12		15		20		ns
t_{HA}	Address Hold from Write End	0		0		0		ns
t_{SA}	Address Set-Up to Write Start	0		0		0		ns
t_{PWE}	$\overline{WE}$ Pulse Width	12		15		20		ns
t_{SD}	Data Set-Up to Write End	8		10		15		ns
t_{HD}	Data Hold from Write End	0		0		0		ns
t_{LZWE}	$\overline{WE}$ HIGH to Low Z[8]	3		3		5		ns
t_{HZWE}	$\overline{WE}$ LOW to High Z[7, 8]		7		8		10	ns

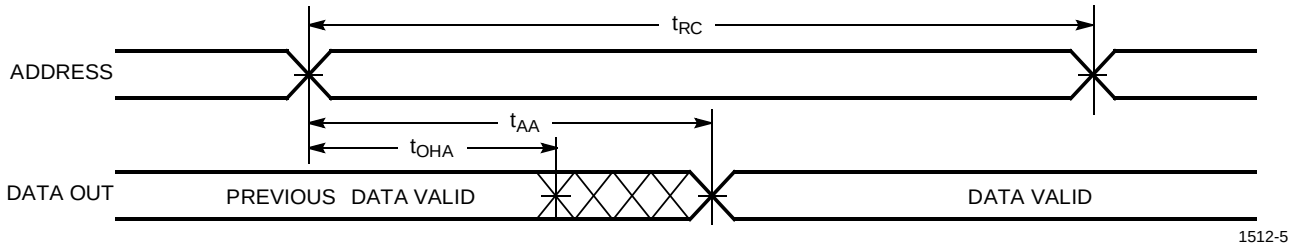
5. Tested initially and after any design or process changes that may affect these parameters.
6. Test conditions assume signal transition time of 3 ns or less, timing reference levels of 1.5V, input pulse levels of 0 to 3.0V, and output loading of the specified I_{OL}/I_{OH} and 30-pF load capacitance.
7. t_{HZOE}, t_{HZCE}, and t_{HZWE} are specified with a load capacitance of 5 pF as in part (b) of AC Test Loads. Transition is measured ±500 mV from steady-state voltage.
8. At any given temperature and voltage condition, t_{HZCE} is less than t_{LZCE}, t_{HZOE} is less than t_{LZOE}, and t_{HZWE} is less than t_{LZWE} for any given device.
9. The internal write time of the memory is defined by the overlap of $\overline{CE}_1$ LOW, CE_2 HIGH, and $\overline{WE}$ LOW. $\overline{CE}_1$ and $\overline{WE}$ must be LOW and CE_2 HIGH to initiate a write, and the transition of any of these signals can terminate the write. The input data set-up and hold timing should be referenced to the leading edge of the signal that terminates the write.

Switching Characteristics[3, 6] Over the Operating Range (continued)

Parameter	Description	7C1512-35		7C1512-70		Unit
		Min.	Min.	Min.	Min.	
READ CYCLE						
t_{RC}	Read Cycle Time	35		70		ns
t_{AA}	Address to Data Valid		35		70	ns
t_{OHA}	Data Hold from Address Change	5		5		ns
t_{ACE}	$\overline{CE}_1$ LOW to Data Valid, CE_2 HIGH to Data Valid		35		70	ns
t_{DOE}	$\overline{OE}$ LOW to Data Valid		15		15	ns
t_{LZOE}	$\overline{OE}$ LOW to Low Z	0		0		ns
t_{HZOE}	$\overline{OE}$ HIGH to High Z[7, 8]		15		15	ns
t_{LZCE}	$\overline{CE}_1$ LOW to Low Z, CE_2 HIGH to Low Z[8]	5		5		ns
t_{HZCE}	$\overline{CE}_1$ HIGH to High Z, CE_2 LOW to High Z[7, 8]		15		15	ns
t_{PU}	$\overline{CE}_1$ LOW to Power-Up, CE_2 HIGH to Power-Up	0		0		ns
t_{PD}	$\overline{CE}_1$ HIGH to Power-Down, CE_2 LOW to Power-Down		35		70	ns
WRITE CYCLE[9]						
t_{WC}	Write Cycle Time	35		70		ns
t_{SCE}	$\overline{CE}_1$ LOW to Write End, CE_2 HIGH to Write End	25		60		ns
t_{AW}	Address Set-Up to Write End	25		60		ns
t_{HA}	Address Hold from Write End	0		0		ns
t_{SA}	Address Set-Up to Write Start	0		0		ns
t_{PWE}	$\overline{WE}$ Pulse Width	25		60		ns
t_{SD}	Data Set-Up to Write End	20		55		ns
t_{HD}	Data Hold from Write End	0		0		ns
t_{LZWE}	$\overline{WE}$ HIGH to Low Z[8]	5		5		ns
t_{HZWE}	$\overline{WE}$ LOW to High Z[7, 8]		15		15	ns

Switching Waveforms

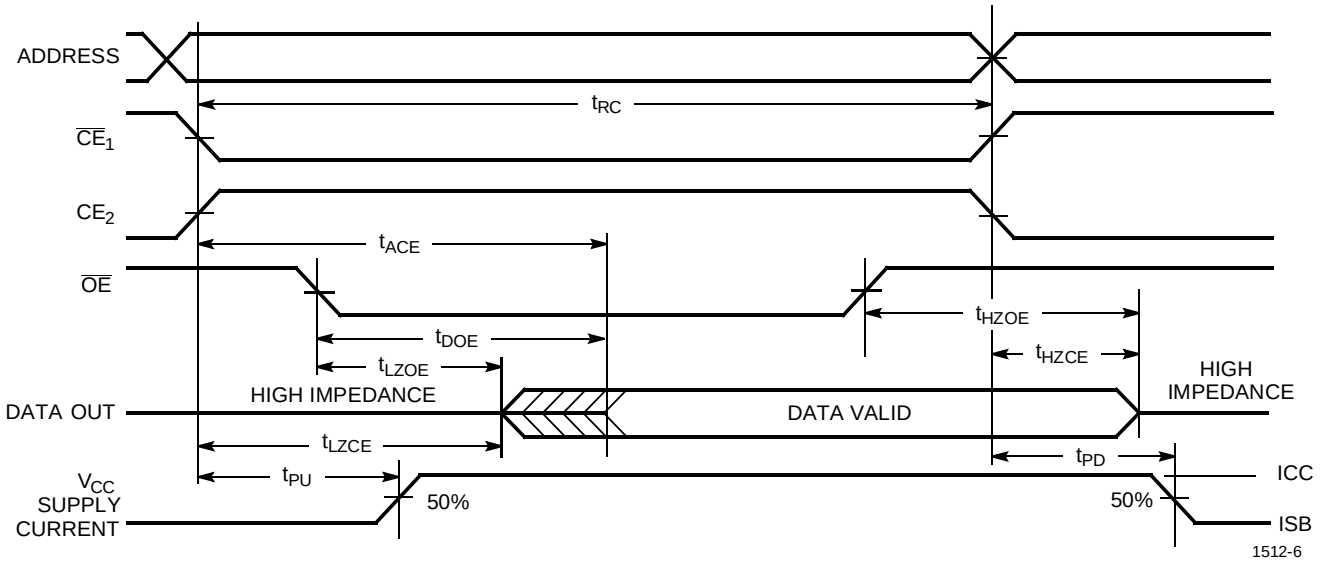
Read Cycle No. 1 [10, 11]



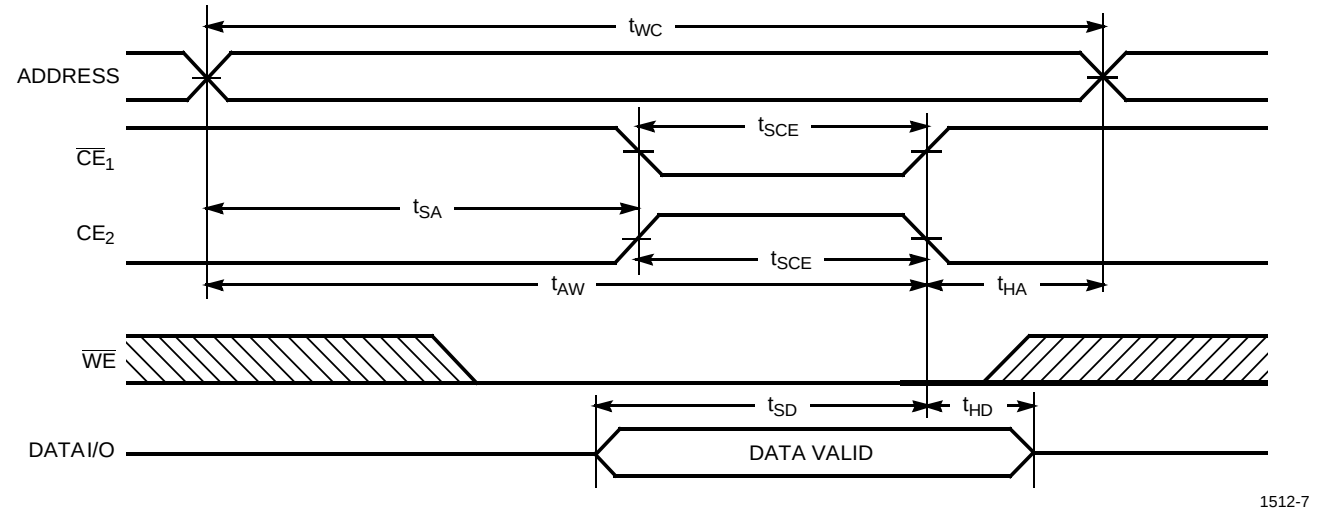
Notes:
10. Device is continuously selected. $\overline{OE}$, $\overline{CE}_1 = V_{IL}$, $CE_2 = V_{IH}$.
11. $\overline{WE}$ is HIGH for read cycle.

Switching Waveforms (continued)

Read Cycle No. 2 ($\overline{OE}$ Controlled) [11, 12]



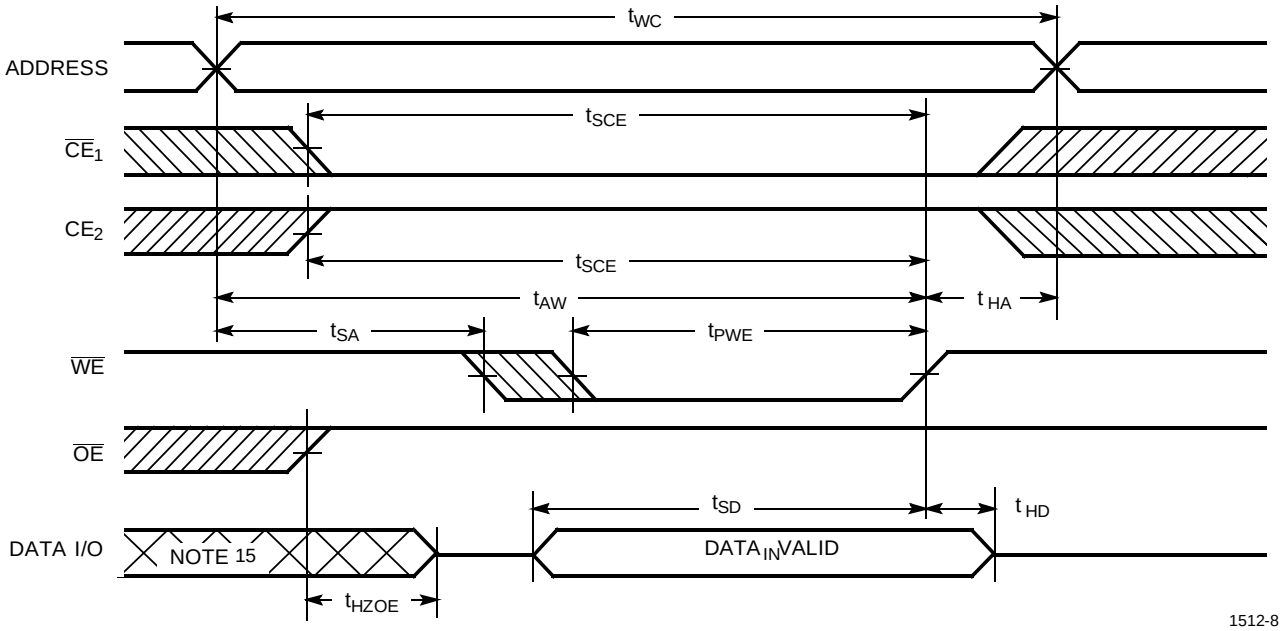
Write Cycle No. 1 ($\overline{CE_1}$ or CE_2 Controlled) [13, 14]



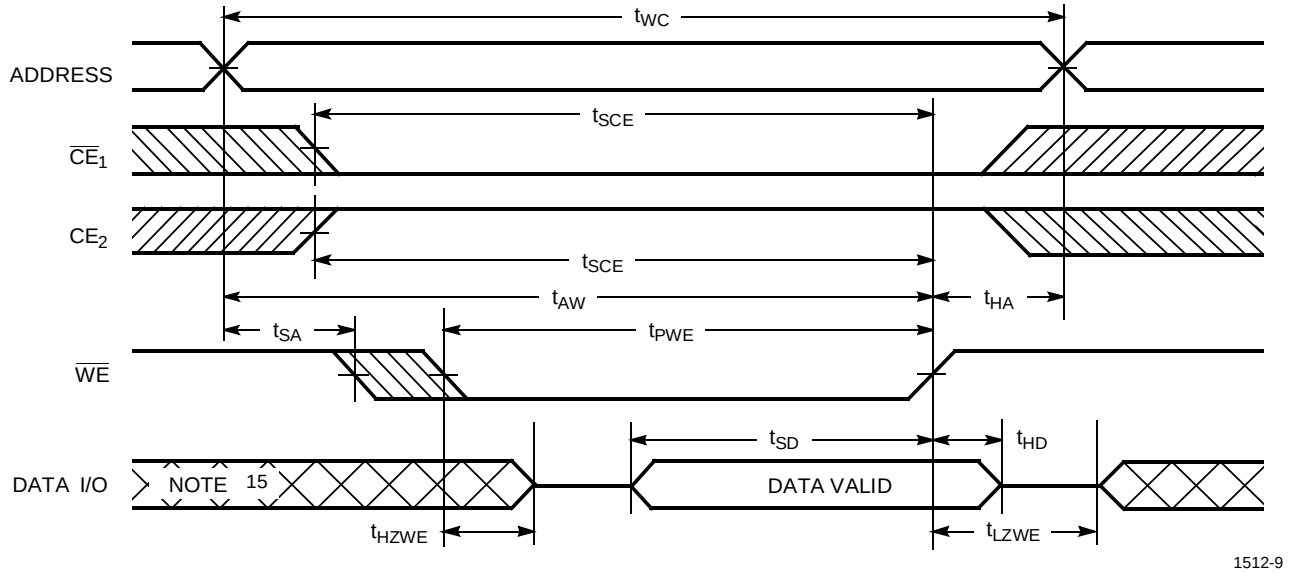
Notes:
12. Address valid prior to or coincident with $\overline{CE_1}$ transition LOW and CE_2 transition HIGH.
13. Data I/O is high impedance if $\overline{OE} = V_{IH}$.
14. If $\overline{CE_1}$ goes HIGH or CE_2 goes LOW simultaneously with $\overline{WE}$ going HIGH, the output remains in a high-impedance state.

Switching Waveforms (continued)

Read Cycle No. 2 ($\overline{WE}$ Controlled, $\overline{OE}$ HIGH During Write)[13, 14]



Write Cycle No. 3 ($\overline{WE}$ Controlled, $\overline{OE}$ LOW) [14]



Note:
15. During this period the I/Os are in the output state and input signals should not be applied.

Truth Table

$\overline{CE}_1$	CE_2	$\overline{OE}$	$\overline{WE}$	$I/O_0 - I/O_7$	Mode	Power
H	X	X	X	High Z	Power-Down	Standby (I_{SB})
X	L	X	X	High Z	Power-Down	Standby (I_{SB})
L	H	L	H	Data Out	Read	Active (I_{CC})
L	H	X	L	Data In	Write	Active (I_{CC})
L	H	H	H	High Z	Selected, Outputs Disabled	Active (I_{CC})

Ordering Information

Speed (ns)	Ordering Code	Package Name	Package Type	Operating Range
15	CY7C1512-15SC	S34	32-Lead (450-Mil) Molded SOIC	Commercial
	CY7C1512-15ZC	Z32	32-Lead TSOP Type I	
	CY7C1512-20ZI	Z32	32-Lead TSOP Type I	Industrial
20	CY7C1512-20SC	S34	32-Lead (450-Mil) Molded SOIC	Commercial
	CY7C1512-20ZC	Z32	32-Lead TSOP Type I	
	CY7C1512-20ZI	Z32	32-Lead TSOP Type I	Industrial
25	CY7C1512-25SC	S34	32-Lead (450-Mil) Molded SOIC	Commercial
	CY7C1512-25ZC	Z32	32-Lead TSOP Type I	
	CY7C1512-25ZI	Z32	32-Lead TSOP Type I	Industrial
35	CY7C1512-35SC	S34	32-Lead (450-Mil) Molded SOIC	Commercial
70	CY7C1512-70SC	S34	32-Lead (450-Mil) Molded SOIC	Commercial
	CY7C1512-70ZC	Z32	32-Lead TSOP Type I	
	CY7C1512-70ZI	Z32	32-Lead TSOP Type I	Industrial

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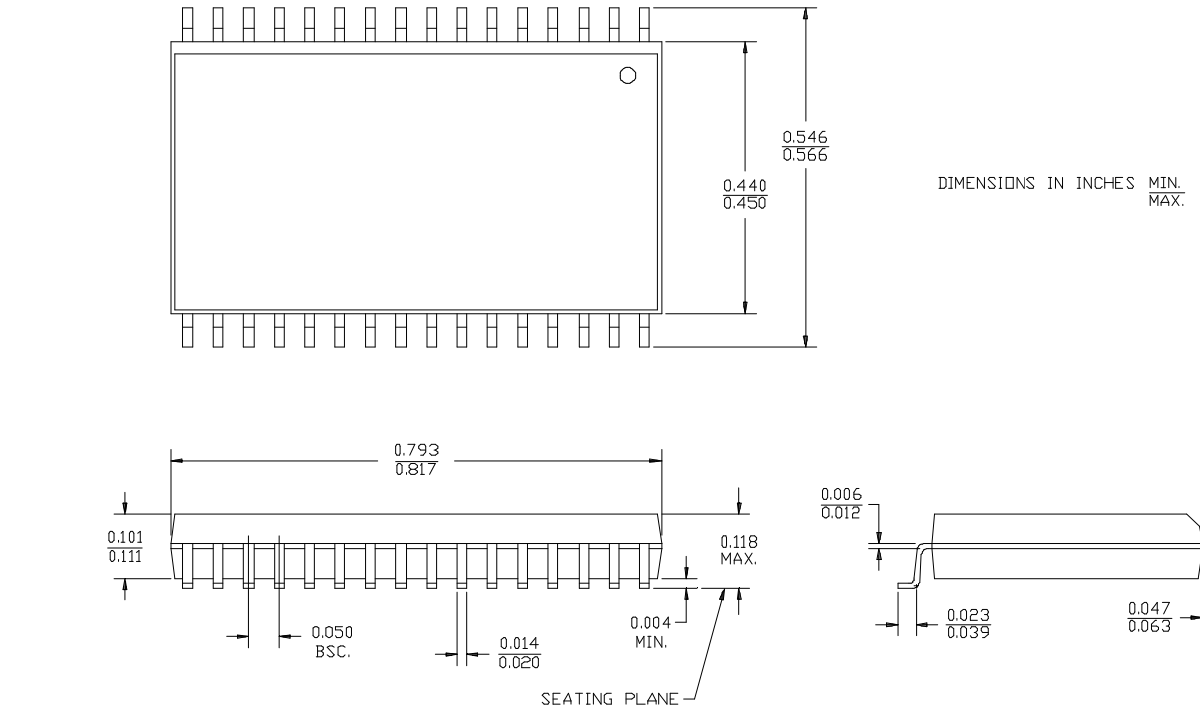
Package Diagrams

32-Lead (450 -Mil) Molded SOIC S34



32-Lead Thin Small Outline Package Z32