



1M x 4 Static RAM

Features

- High speed
 - $t_{AA} = 12 \text{ ns}$
- Low active power
 - 935 mW (max.)
- Low CMOS standby power (L version)
 - 2.75 mW (max.)
- 2.0V Data Retention (400 μW at 2.0V retention)
- Automatic power-down when deselected
- TTL-compatible inputs and outputs
- Easy memory expansion with $\overline{\text{CE}}$ and $\overline{\text{OE}}$ features

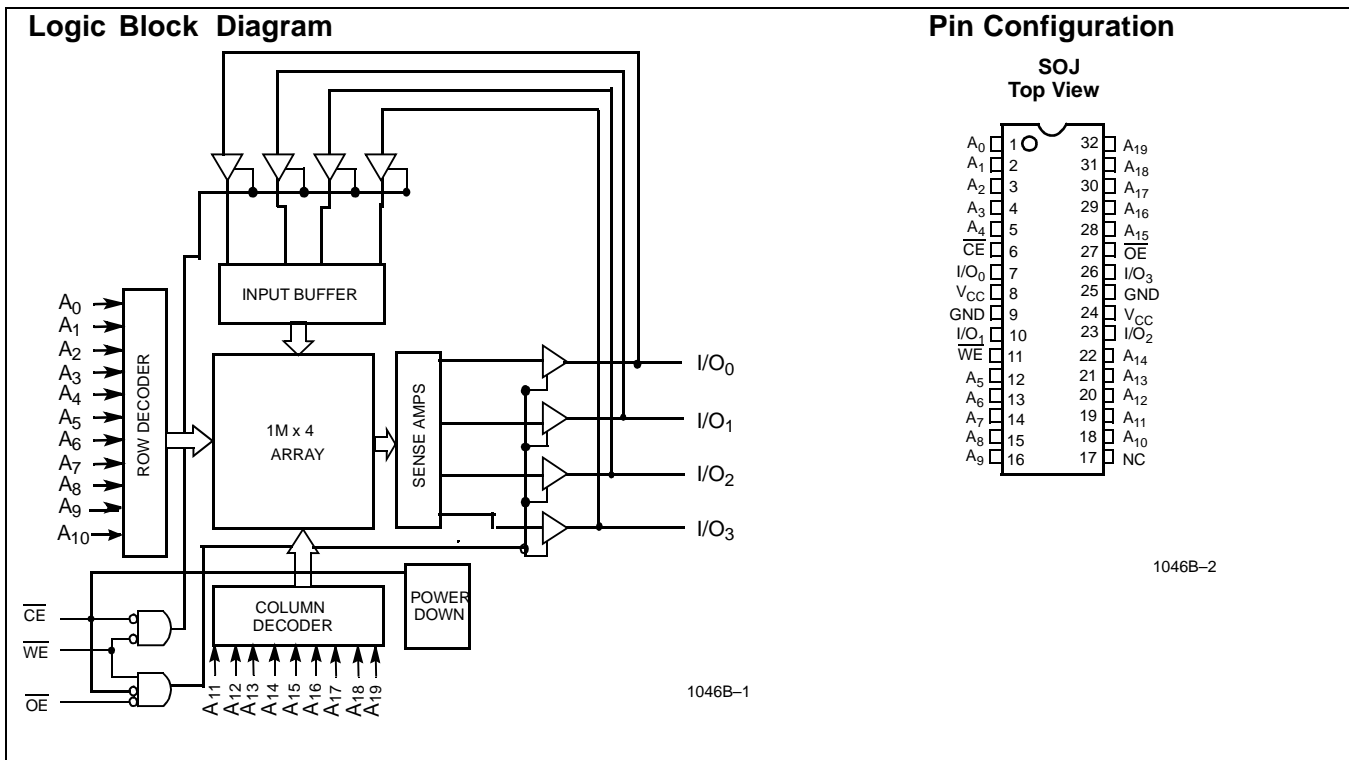
Functional Description

The CY7C1046B is a high-performance CMOS static RAM organized as 1,048,576 words by 4 bits. Easy memory expansion is provided by an active LOW Chip Enable ($\overline{\text{CE}}$), an active LOW Output Enable ($\overline{\text{OE}}$), and three-state drivers. Writing to the device is accomplished by taking Chip Enable ($\overline{\text{CE}}$) and Write Enable ($\overline{\text{WE}}$) inputs LOW. Data on the four I/O pins (I/O_0 through I/O_3) is then written into the location specified on the address pins (A_0 through A_{19}).

Reading from the device is accomplished by taking Chip Enable ($\overline{\text{CE}}$) and Output Enable ($\overline{\text{OE}}$) LOW while forcing Write Enable ($\overline{\text{WE}}$) HIGH. Under these conditions, the contents of the memory location specified by the address pins will appear on the I/O pins.

The four input/output pins (I/O_0 through I/O_3) are placed in a high-impedance state when the device is deselected ($\overline{\text{CE}}$ HIGH), the outputs are disabled ($\overline{\text{OE}}$ HIGH), or during a write operation ($\overline{\text{CE}}$ LOW, and $\overline{\text{WE}}$ LOW).

The CY7C1046B is available in a standard 400-mil-wide 32-pin SOJ package with center power and ground (revolutionary) pinout.



Selection Guide

	7C1046B-12	7C1046B-15	7C1046B-20
Maximum Access Time (ns)	12	15	20
Maximum Operating Current (mA)	170	150	130
Maximum CMOS Standby Current (mA)	Com'l	8	8
	L version	0.5	0.5

Shaded areas contain advance information.

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	4.5V–5.5V

Electrical Characteristics Over the Operating Range

Parameter	Description	Test Conditions	7C1046B-12		7C1046B-15		7C1046B-20		Unit
			Min.	Max.	Min.	Max.	Min.	Max.	
V_{OH}	Output HIGH Voltage	$V_{CC} = \text{Min.}, I_{OH} = -4.0 \text{ mA}$	2.4		2.4		2.4		V
V_{OL}	Output LOW Voltage	$V_{CC} = \text{Min.}, I_{OL} = 8.0 \text{ mA}$		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	$GND \leq V_I \leq V_{CC}$	-1	+1	-1	+1	-1	+1	μA
I_{OZ}	Output Leakage Current	$GND \leq V_{OUT} \leq V_{CC}$, Output Disabled	-1	+1	-1	+1	-1	+1	μA
I_{CC}	V_{CC} Operating Supply Current	$V_{CC} = \text{Max.}, f = f_{MAX} = 1/t_{RC}$		170		150		130	mA
I_{SB1}	Automatic CE Power-Down Current —TTL Inputs	Max. V_{CC} , $\overline{CE} \geq V_{IH}$ $V_{IN} \geq V_{IH}$ or $V_{IN} \leq V_{IL}, f = f_{MAX}$		20		20		20	mA
I_{SB2}	Automatic CE Power-Down Current —CMOS Inputs	Max. V_{CC} , $\overline{CE} \geq V_{CC} - 0.3V$, $V_{IN} \geq V_{CC} - 0.3V$, or $V_{IN} \leq 0.3V, f = 0$	Com'l	8		8		8	mA
			L version	0.5		0.5		0.5	

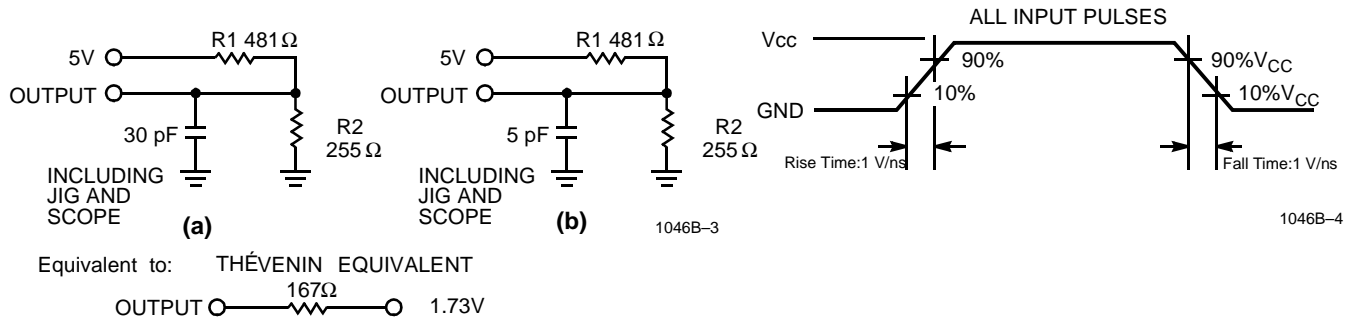
Shaded areas contain advance information.

Capacitance^[3]

Parameter	Description	Test Conditions	Max.	Unit
C_{IN}	Input Capacitance	$T_A = 25^\circ\text{C}, f = 1 \text{ MHz}, V_{CC} = 5.0V$	6	pF
C_{OUT}	I/O Capacitance		6	pF

Note:

- V_{IL} (min.) = -2.0V for pulse durations of less than 20 ns.
- T_A is the "Instant On" case temperature.
- Tested initially and after any design or process changes that may affect these parameters.

AC Test Loads and Waveforms

Switching Characteristics^[4] Over the Operating Range

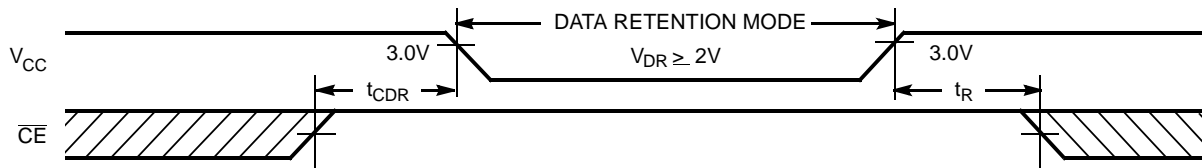
Parameter	Description	7C1046B-12		7C1046B-15		7C1046B-20		Unit
		Min.	Max.	Min.	Max.	Min.	Max.	
READ CYCLE								
t_{power}	V_{CC} (typical) to the first access ^[5]	1		1		1		μs
t_{RC}	Read Cycle Time	12		15		20		ns
t_{AA}	Address to Data Valid		12		15		20	ns
t_{OHA}	Data Hold from Address Change	3		3		3		ns
t_{ACE}	\overline{CE} LOW to Data Valid		12		15		20	ns
t_{DOE}	\overline{OE} LOW to Data Valid		6		7		8	ns
t_{LZOE}	\overline{OE} LOW to Low Z ^[7]	0		0		0		ns
t_{HZOE}	\overline{OE} HIGH to High Z ^[6, 7]		6		7		8	ns
t_{LZCE}	\overline{CE} LOW to Low Z ^[7]	3		3		3		ns
t_{HZCE}	\overline{CE} HIGH to High Z ^[6, 7]		6		7		8	ns
t_{PU}	\overline{CE} LOW to Power-Up	0		0		0		ns
t_{PD}	\overline{CE} HIGH to Power-Down		12		15		20	ns
WRITE CYCLE^[8, 9]								
t_{WC}	Write Cycle Time	12		15		20		ns
t_{SCE}	\overline{CE} LOW to Write End	8		10		15		ns
t_{AW}	Address Set-Up to Write End	8		10		15		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	8		10		12		ns
t_{SD}	Data Set-Up to Write End	6		8		10		ns
t_{HD}	Data Hold from Write End	0		0		0		ns
t_{LZWE}	\overline{WE} HIGH to Low Z ^[7]	3		3		3		ns
t_{HZWE}	\overline{WE} LOW to High Z ^[6, 7]		6		7		8	ns

Notes:

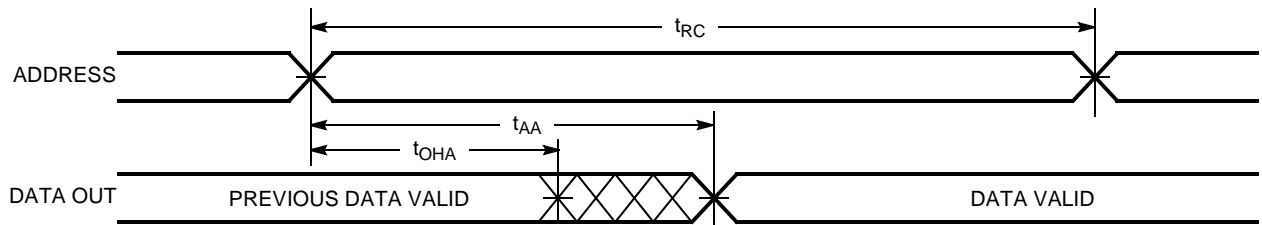
- Test conditions assume signal transition time of 3 ns or less, timing reference levels of 1.5V, input pulse levels of 0 to 3.0V, and output loading of the specified I_{OL}/I_{OH} and 30-pF load capacitance.
- This part has a voltage regulator which steps down the voltage from 5V to 3.3V internally. t_{power} time has to be provided initially before a read/write operation is started.
- 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.
- 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.
- The internal write time of the memory is defined by the overlap of \overline{CE} LOW, and \overline{WE} LOW. \overline{CE} and \overline{WE} must be LOW to initiate a write, and the transition of either 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.
- The minimum write cycle time for Write Cycle no. 3 (\overline{WE} controlled, \overline{OE} LOW) is the sum of t_{HZWE} and t_{SD} .

Data Retention Characteristics Over the Operating Range

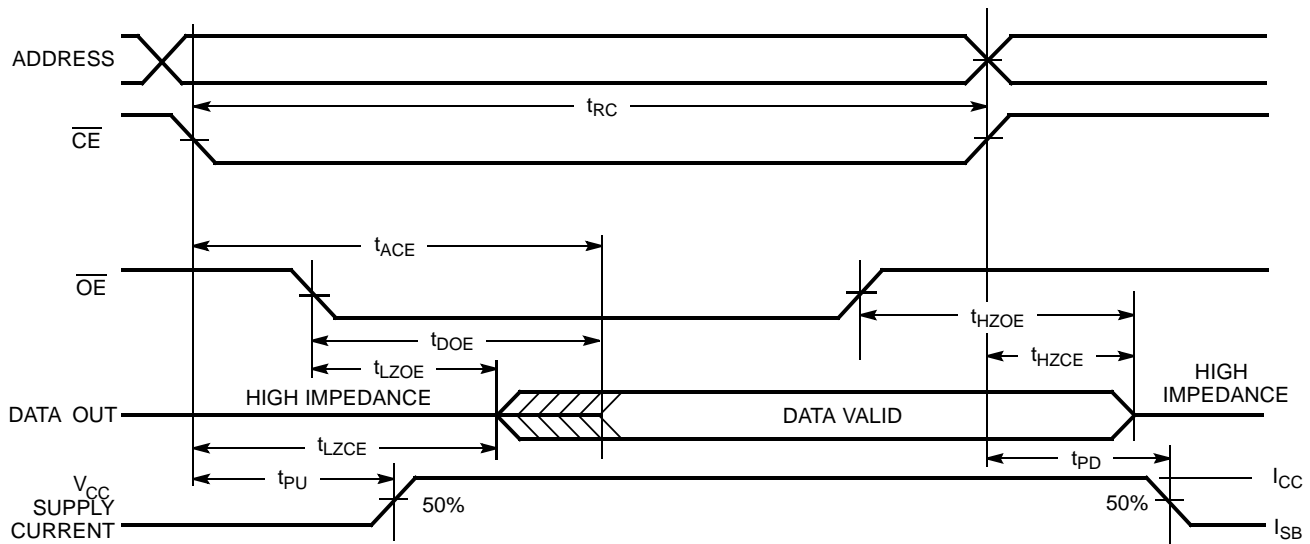
Parameter	Description	Conditions ^[10]	Min.	Max	Unit
V_{DR}	V_{CC} for Data Retention		2.0		V
I_{CCDR}	Data Retention Current	Com'l		200	μ A
$t_{CDR}^{[3]}$	Chip Deselect to Data Retention Time	$V_{CC} = V_{DR} = 2.0V,$ $CE \geq V_{CC} - 0.3V$ $V_{IN} \geq V_{CC} - 0.3V$ or $V_{IN} \leq 0.3V$	0		ns
t_R	Operation Recovery Time		200		μ s

Data Retention Waveform


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Switching Waveforms
Read Cycle No. 1^[11, 12]


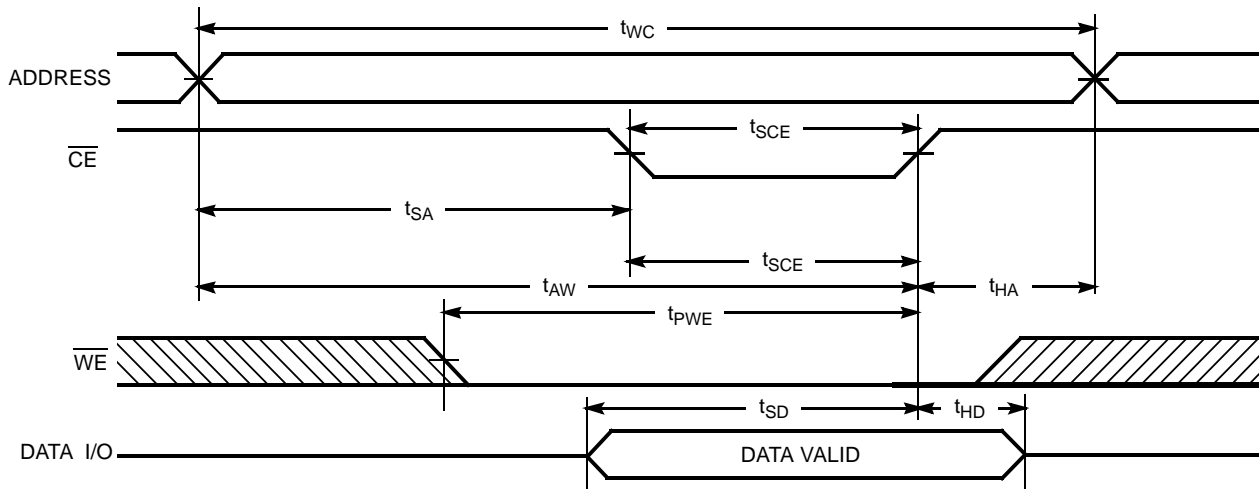
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Read Cycle No. 2 (OE Controlled)^[12, 13]


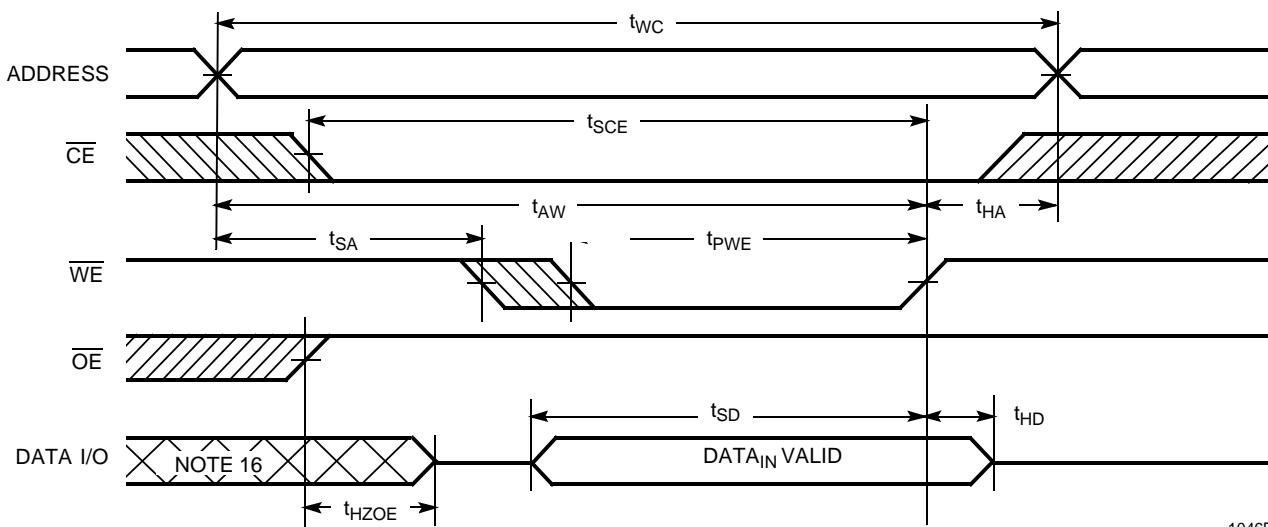
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Notes:

10. No input may exceed $V_{CC} + 0.5V$.
11. Device is continuously selected. $OE, CE = V_{IL}$.
12. \overline{WE} is HIGH for read cycle.
13. Address valid prior to or coincident with \overline{CE} transition LOW.

Switching Waveforms (continued)
Write Cycle No. 1 ($\overline{\text{CE}}$ Controlled)^[14, 15]


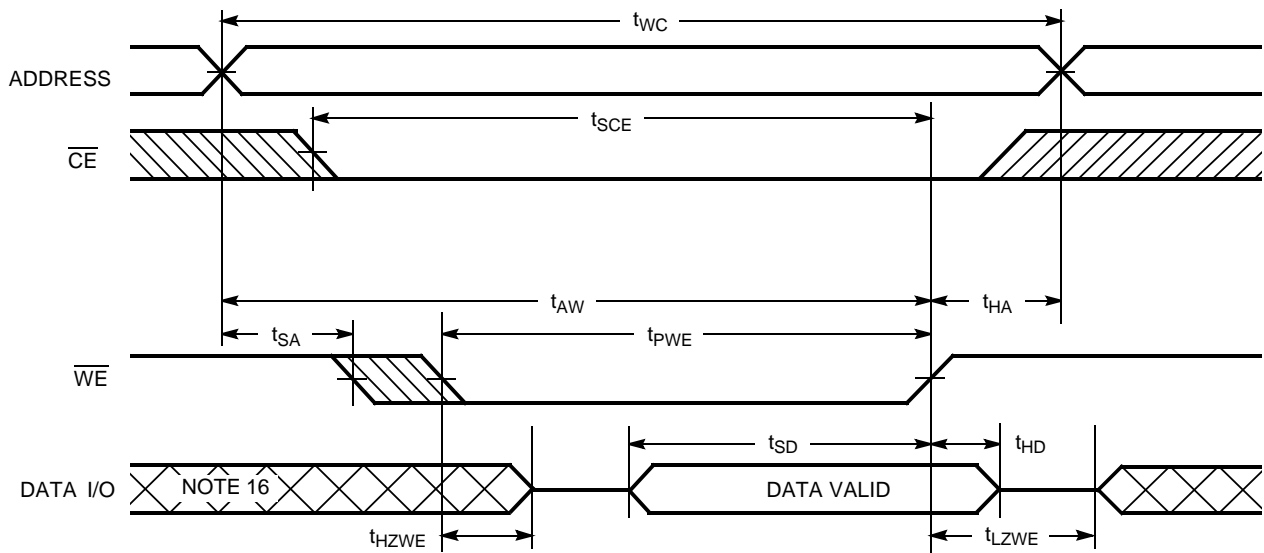
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Write Cycle No. 2 ($\overline{\text{WE}}$ Controlled, $\overline{\text{OE}}$ HIGH During Write)^[14, 15]


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Notes:

14. Data I/O is high impedance if $\overline{\text{OE}} = V_{\text{IH}}$.
15. If $\overline{\text{CE}}$ goes HIGH simultaneously with $\overline{\text{WE}}$ going HIGH, the output remains in a high-impedance state.
16. During this period the I/Os are in the output state and input signals should not be applied.

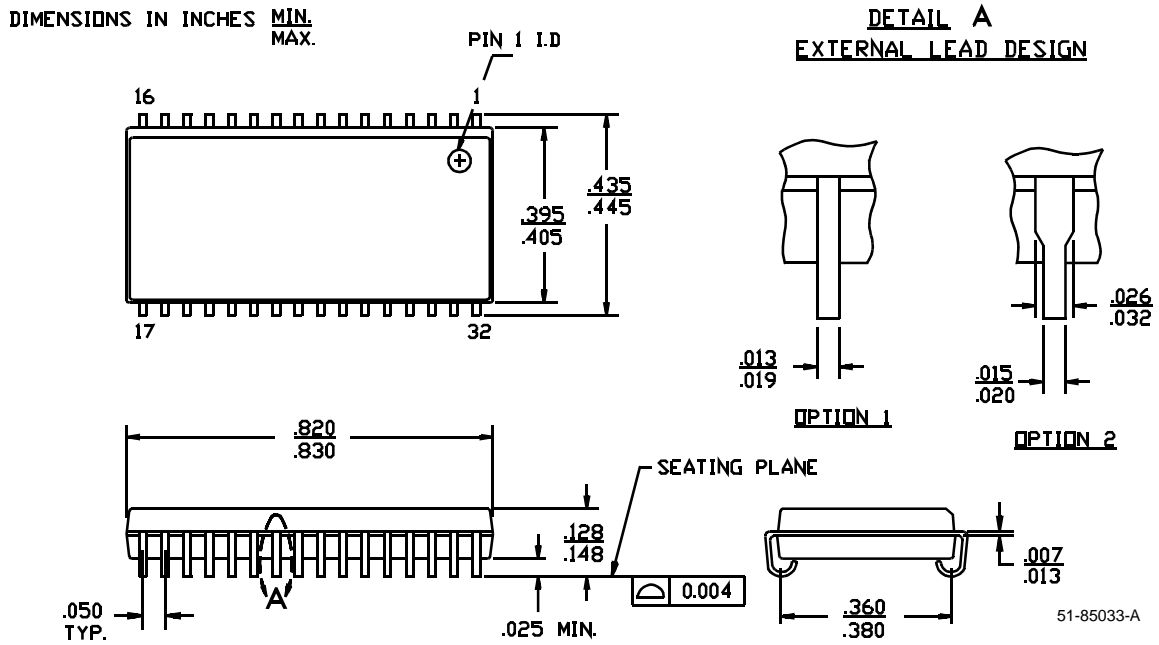
Switching Waveforms (continued)
Write Cycle No. 3 (\overline{WE} Controlled, \overline{OE} LOW)^[15]


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Ordering Information

Speed (ns)	Ordering Code	Package Name	Package Type	Operating Range
12	CY7C1046B-12VC	V33	32-Lead (400-Mil) Molded SOJ	Commercial
15	CY7C1046B-15VC	V33	32-Lead (400-Mil) Molded SOJ	
20	CY7C1046B-20VC	V33	32-Lead (400-Mil) Molded SOJ	
12	CY7C1046BL-12VC	V33	32-Lead (400-Mil) Molded SOJ	
15	CY7C1046BL-15VC	V33	32-Lead (400-Mil) Molded SOJ	
20	CY7C1046BL-20VC	V33	32-Lead (400-Mil) Molded SOJ	

Shaded areas contain advance information.

Package Diagram
32-Lead (400-Mil) Molded SOJ V33




Document Title: CY7C1046B 1M x 4 Static RAM Document Number: 38-05144				
REV.	ECN NO.	Issue Date	Orig. of Change	Description of Change
**	109888	09/22/01	SZV	Change from Spec number: 38-00948 to 38-05144