

256K x 16 Static RAM

Features

- **High speed**
— $t_{AA} = 12 \text{ ns}$
- **Low active power**
— 612 mW (max.)
- **Low CMOS standby power (Commercial L version)**
— 1.8 mW (max.)
- **2.0V Data Retention (660 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

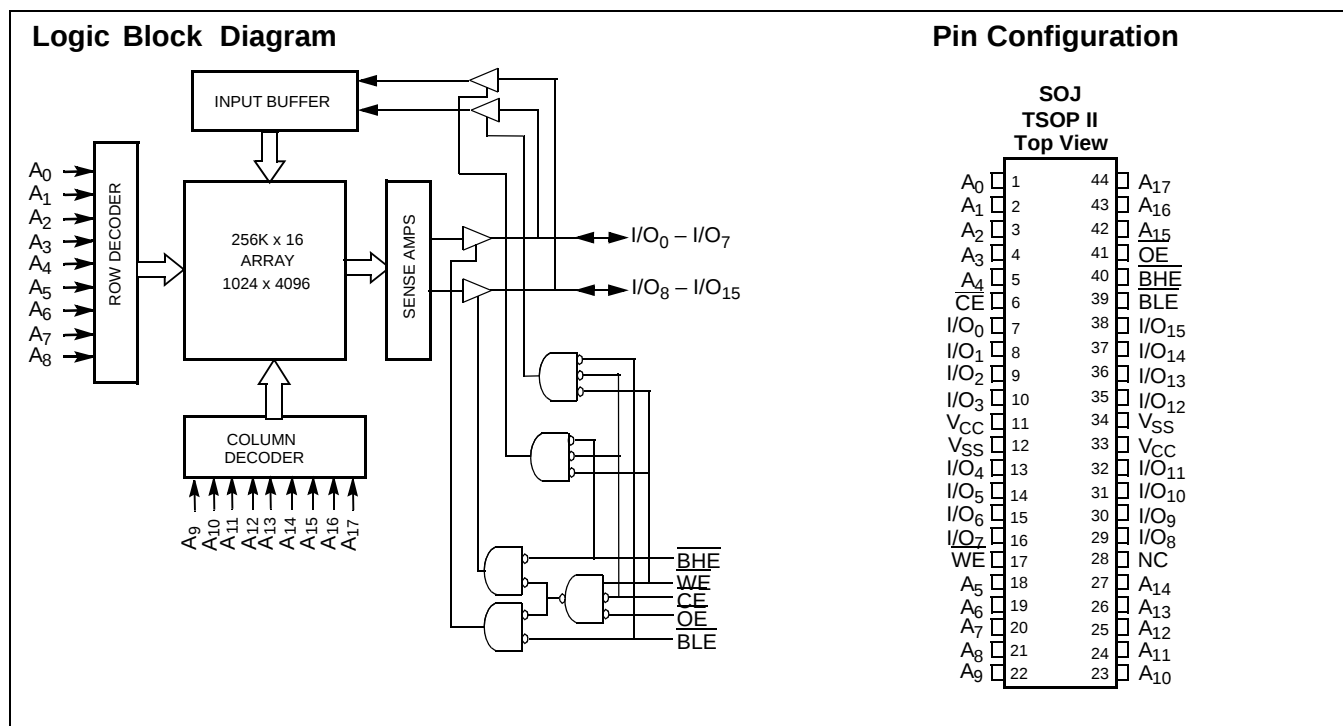
The CY7C1041BNV33 is a high-performance CMOS Static RAM organized as 262,144 words by 16 bits.

Writing to the device is accomplished by taking Chip Enable ($\overline{\text{CE}}$) and Write Enable ($\overline{\text{WE}}$) inputs LOW. If Byte Low Enable ($\overline{\text{BLE}}$) is LOW, then data from I/O pins (I/O_0 through I/O_7), is written into the location specified on the address pins (A_0 through A_{17}). If Byte High Enable ($\overline{\text{BHE}}$) is LOW, then data from I/O pins (I/O_8 through I/O_{15}) is written into the location specified on the address pins (A_0 through A_{17}).

Reading from the device is accomplished by taking Chip Enable ($\overline{\text{CE}}$) and Output Enable ($\overline{\text{OE}}$) LOW while forcing the Write Enable ($\overline{\text{WE}}$) HIGH. If Byte Low Enable ($\overline{\text{BLE}}$) is LOW, then data from the memory location specified by the address pins will appear on I/O_0 to I/O_7 . If Byte High Enable ($\overline{\text{BHE}}$) is LOW, then data from memory will appear on I/O_8 to I/O_{15} . See the truth table at the back of this data sheet for a complete description of read and write modes.

The input/output pins (I/O_0 through I/O_{15}) are placed in a high-impedance state when the device is deselected ($\overline{\text{CE}}$ HIGH), the outputs are disabled ($\overline{\text{OE}}$ HIGH), the $\overline{\text{BHE}}$ and $\overline{\text{BLE}}$ are disabled ($\overline{\text{BHE}}$, $\overline{\text{BLE}}$ HIGH), or during a write operation ($\overline{\text{CE}}$ LOW, and $\overline{\text{WE}}$ LOW).

The CY7C1041BNV33 is available in a standard 44-pin 400-mil-wide body width SOJ and 44-pin TSOP II package with center power and ground (revolutionary) pinout.



Selection Guide

			-12	-15
Maximum Access Time (ns)			12	15
Maximum Operating Current (mA)	Comm'l		190	170
	Ind'l		-	190
Maximum CMOS Standby Current (mA)	Com'l/Ind'l		8	8
	Com'l	L	0.5	0.5

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 +4.6V

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

Operating Range

Range	Ambient Temperature ^[2]	V_{CC}
Commercial	0°C to +70°C	3.3V ± 0.3V
Industrial	-40°C to +85°C	

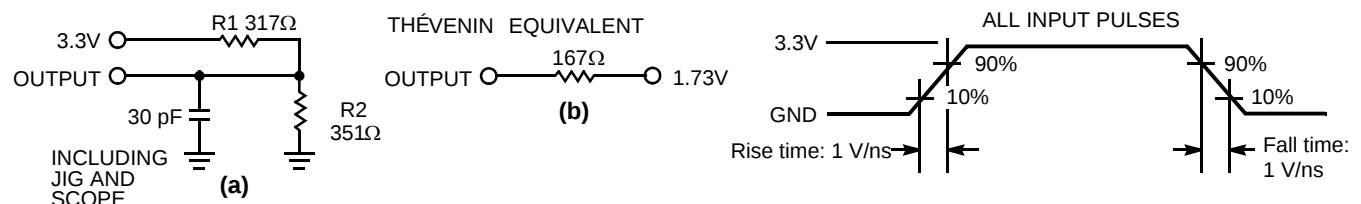
Electrical Characteristics Over the Operating Range

Parameter	Description	Test Conditions	-12		-15		Unit
			Min.	Max.	Min.	Max.	
V_{OH}	Output HIGH Voltage	$V_{CC} = \text{Min.}, I_{OH} = -4.0 \text{ mA}$	2.4		2.4		V
V_{OL}	Output LOW Voltage	$V_{CC} = \text{Min.}, I_{OL} = 8.0 \text{ mA}$		0.4		0.4	V
V_{IH}	Input HIGH Voltage		2.2	$V_{CC}+0.5$	2.2	$V_{CC}+0.5$	V
V_{IL}	Input LOW Voltage ^[1]		-0.5	0.8	-0.5	0.8	V
I_{IX}	Input Leakage Current	$GND \leq V_I \leq V_{CC}$	-1	+1	-1	+1	mA
I_{OZ}	Output Leakage Current	$GND \leq V_{OUT} \leq V_{CC}$, Output Disabled	-1	+1	-1	+1	mA
I_{CC}	V_{CC} Operating Supply Current	$V_{CC} = \text{Max.}, f = f_{MAX} = 1/t_{RC}$		190		170	mA
		Comm'l					
I_{SB1}	Automatic CE Power-Down Current — TTL Inputs	Max. V_{CC} , $\overline{CE} \geq V_{IH}$, $V_{IN} \geq V_{IH}$ or $V_{IN} \leq V_{IL}$, $f = f_{MAX}$		40		40	mA
		Ind'l		-		190	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 $V_{IN} \leq 0.3V$, $f = 0$		8		8	mA
		Com'l/Ind'l					
		Com'l L		0.5		0.5	mA

Capacitance^[3]

Parameter	Description	Test Conditions	Max.	Unit
C_{IN}	Input Capacitance	$T_A = 25^\circ\text{C}, f = 1 \text{ MHz}, V_{CC} = 3.3V$	8	pF
C_{OUT}	I/O Capacitance		8	pF

AC Test Loads and Waveforms



Notes:

- $V_{IL}(\text{min.}) = -2.0V$ 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.

Switching Characteristics^[4] Over the Operating Range

Parameter	Description	-12		-15		Unit
		Min.	Max.	Min.	Max.	
READ CYCLE						
t _{RC}	Read Cycle Time	12		15		ns
t _{AA}	Address to Data Valid		12		15	ns
t _{OHA}	Data Hold from Address Change	3		3		ns
t _{ACE}	$\overline{CE}$ LOW to Data Valid		12		15	ns
t _{DOE}	$\overline{OE}$ LOW to Data Valid		6		7	ns
t _{LZOE}	$\overline{OE}$ LOW to Low Z	0		0		ns
t _{HZOE}	$\overline{OE}$ HIGH to High Z ^[5, 6]		6		7	ns
t _{LZCE}	$\overline{CE}$ LOW to Low Z ^[6]	3		3		ns
t _{HZCE}	$\overline{CE}$ HIGH to High Z ^[5, 6]		6		7	ns
t _{PU}	$\overline{CE}$ LOW to Power-Up	0		0		ns
t _{PD}	$\overline{CE}$ HIGH to Power-Down		12		15	ns
t _{DBE}	Byte Enable to Data Valid		6		7	ns
t _{LZBE}	Byte Enable to Low Z	0		0		ns
t _{HZBE}	Byte Disable to High Z		6		7	ns
WRITE CYCLE ^[7, 8]						
t _{WC}	Write Cycle Time	12		15		ns
t _{SCE}	$\overline{CE}$ LOW to Write End	10		12		ns
t _{AW}	Address Set-Up to Write End	10		12		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	10		12		ns
t _{SD}	Data Set-Up to Write End	7		8		ns
t _{HD}	Data Hold from Write End	0		0		ns
t _{LZWE}	$\overline{WE}$ HIGH to Low Z ^[6]	3		3		ns
t _{HZWE}	$\overline{WE}$ LOW to High Z ^[5, 6]		6		7	ns
t _{BW}	Byte Enable to End of Write	10		12		ns

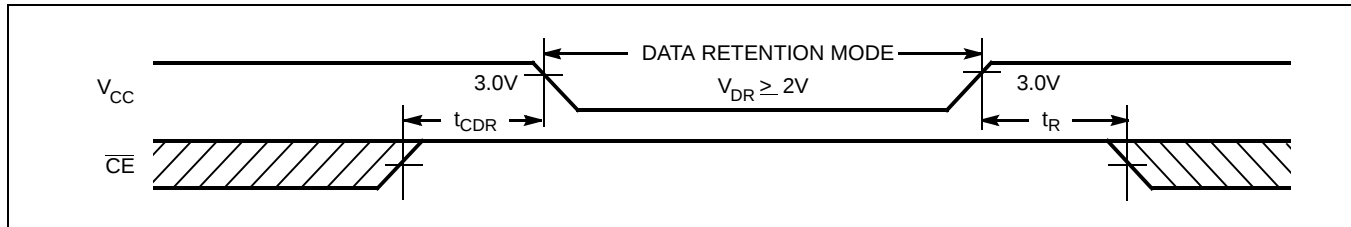
Data Retention Characteristics Over the Operating Range (For L version only)

Parameter	Description	Conditions ^[10]	Min.	Max.	Unit
V_{DR}	V_{CC} for Data Retention		2.0		V
I_{CCDR}	Data Retention Current	$V_{CC} = V_{DR} = 2.0V$, $CE \geq V_{CC} - 0.3V$, $V_{IN} \geq V_{CC} - 0.3V$ or $V_{IN} \leq 0.3V$		330	μA
$t_{CDR}^{[3]}$	Chip Deselect to Data Retention Time		0		ns
$t_R^{[9]}$	Operation Recovery Time		t_{RC}		ns

Notes:

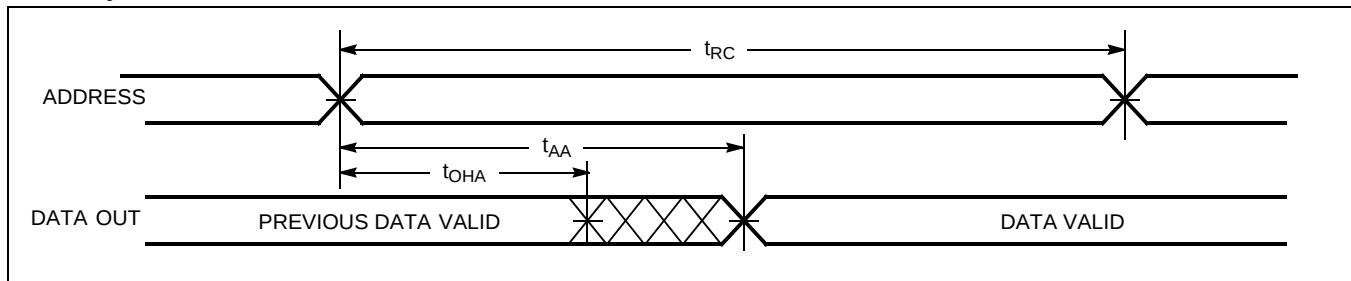
- Test conditions assume signal transition time of 3 ns or less, timing reference levels of 1.5V, input pulse levels of 0 to 3.0V, and output loading of the specified I_{OL}/I_{OH} and 30-pF load capacitance.
- t_{HZOE} , t_{HZCE} , and t_{HZWE} are specified with a load capacitance of 5 pF as in part (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} .
- $t_r \leq 3$ ns for the -12 and -15 speeds.
- No input may exceed $V_{CC} + 0.5V$.

Data Retention Waveform

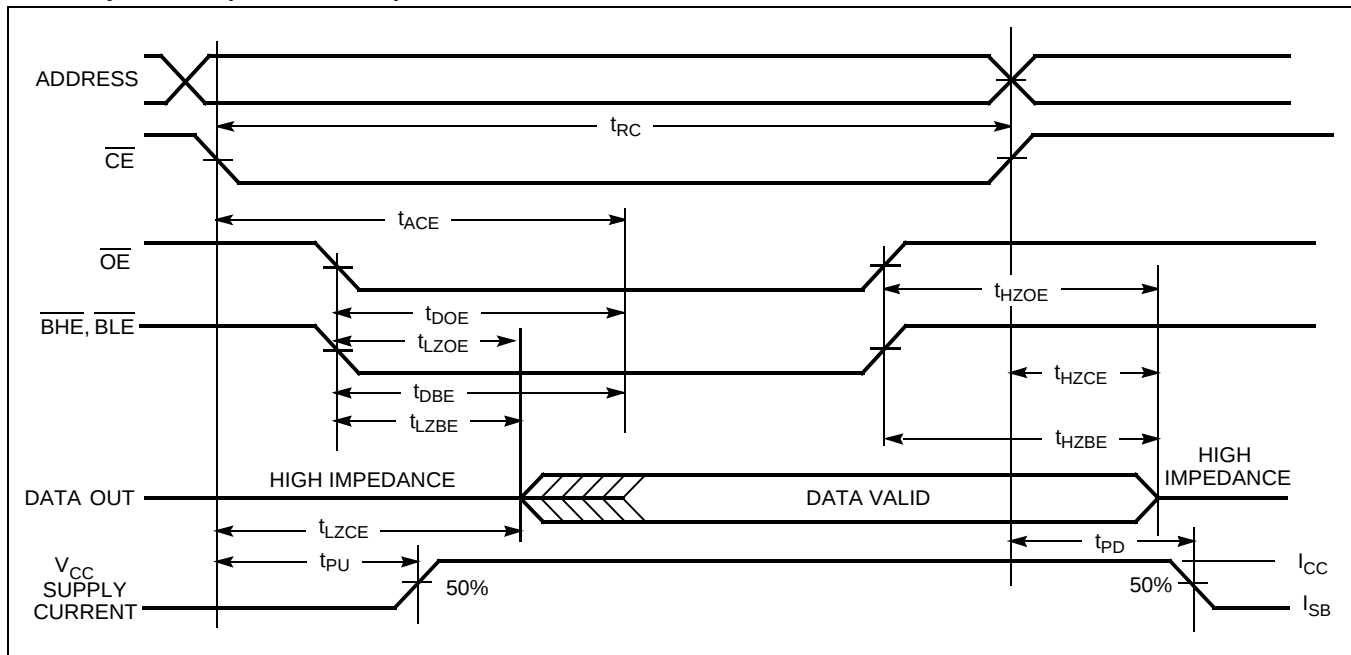


Switching Waveforms

Read Cycle No. 1^[11, 12]

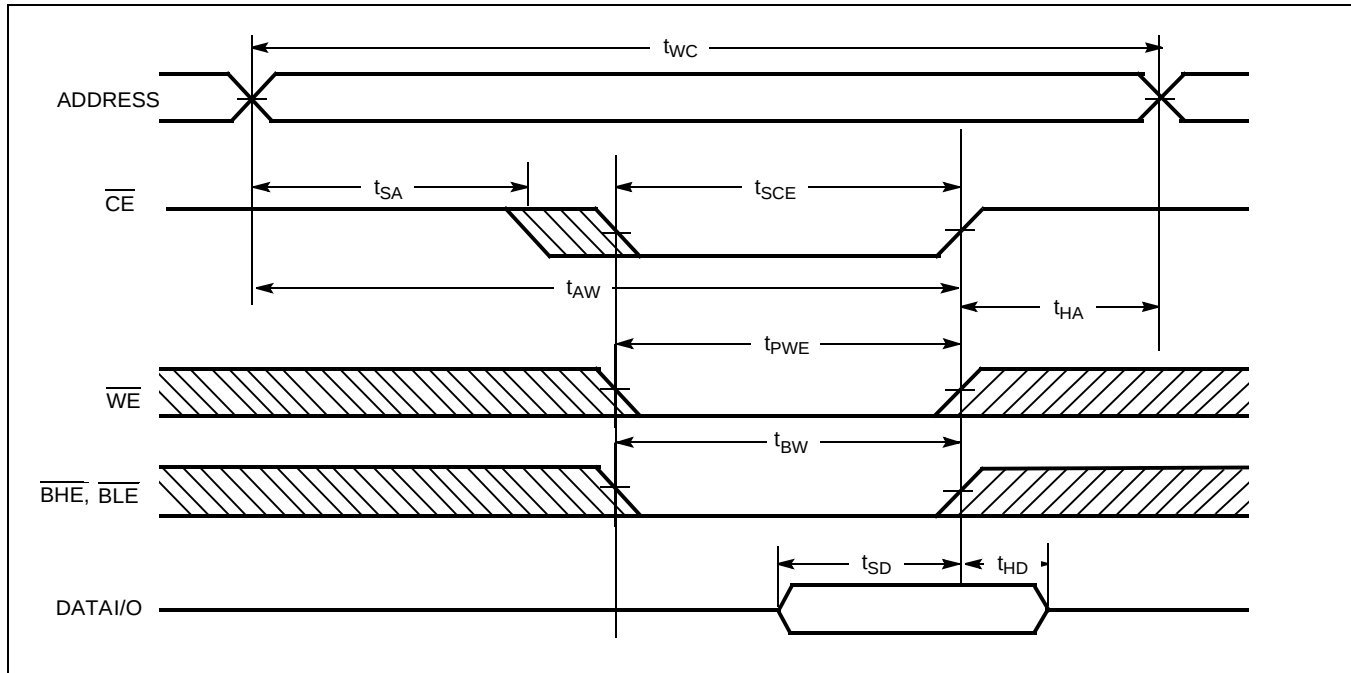
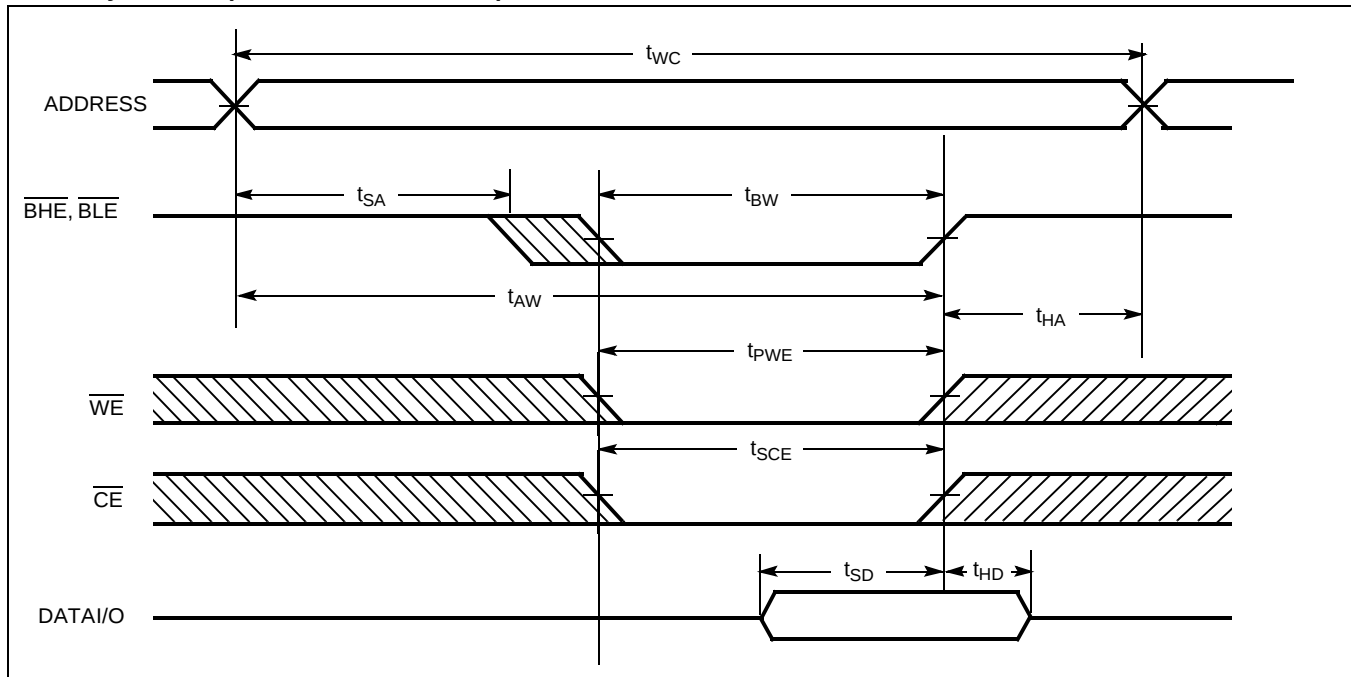


Read Cycle No. 2 (OE Controlled)^[12, 13]



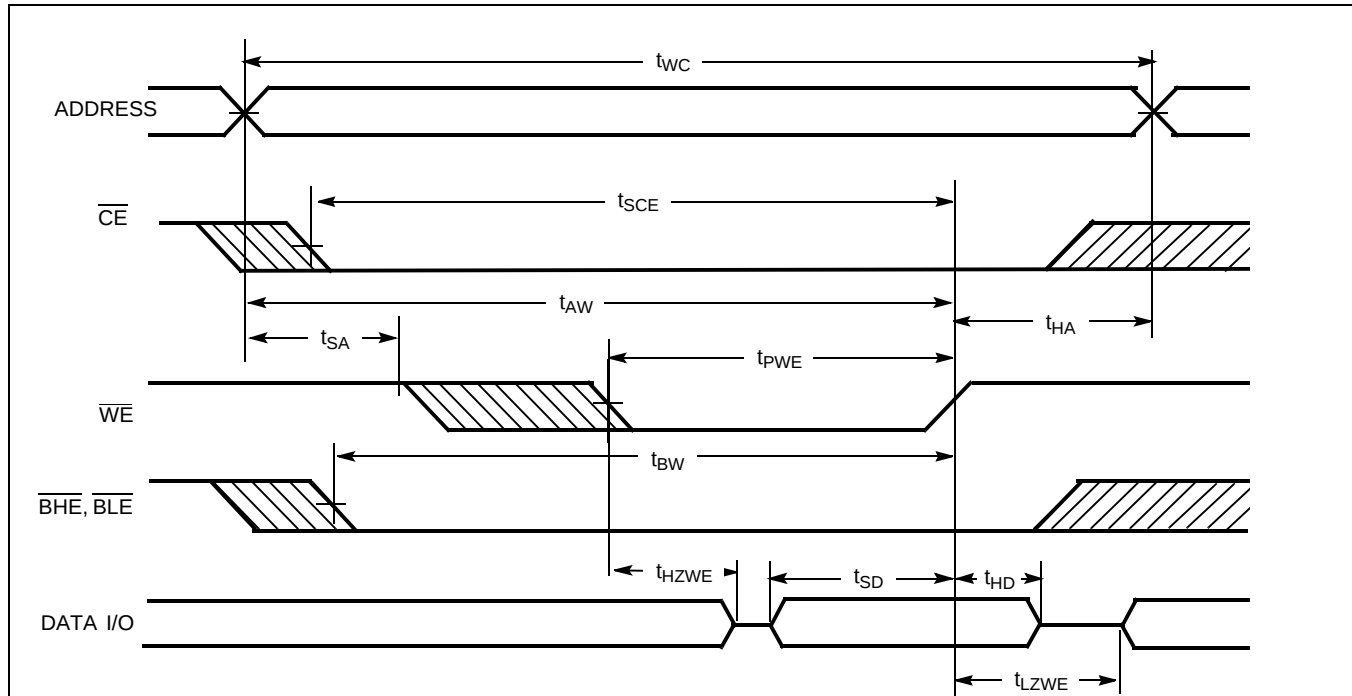
Notes:

11. Device is continuously selected. $\overline{OE}$, $\overline{CE}$, $\overline{BHE}$ and/or $\overline{BLE}$ = 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]

Write Cycle No. 2 ($\overline{\text{BLE}}$ or $\overline{\text{BHE}}$ Controlled)

Notes:

14. Data I/O is high-impedance if $\overline{\text{OE}}$ or $\overline{\text{BHE}}$ and/or $\overline{\text{BLE}} = V_{IH}$.
 15. If $\overline{\text{CE}}$ goes HIGH simultaneously with $\overline{\text{WE}}$ going HIGH, the output remains in a high-impedance state.

Switching Waveforms (continued)

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

Truth Table

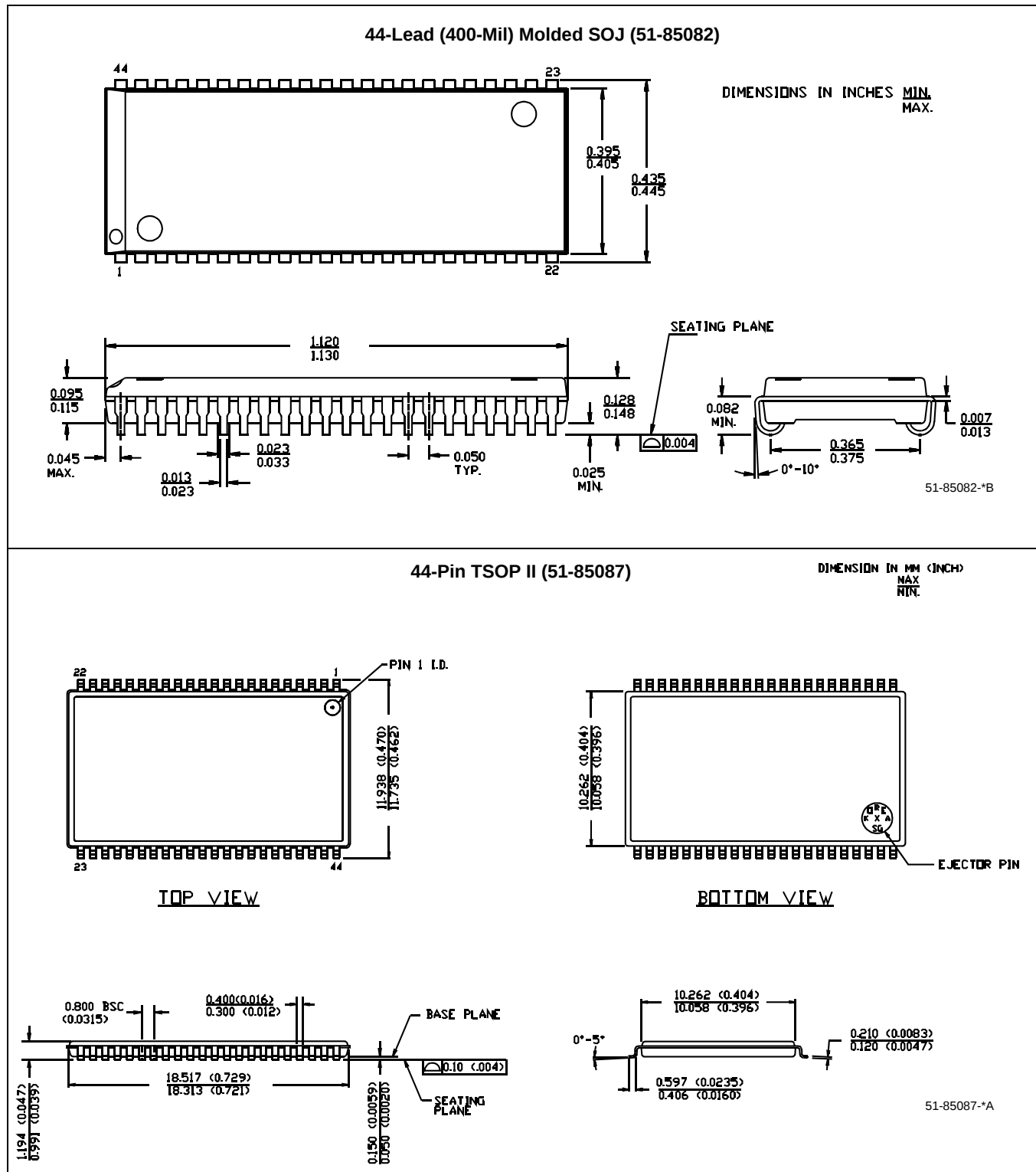
$\overline{CE}$	$\overline{OE}$	$\overline{WE}$	$\overline{BLE}$	$\overline{BHE}$	I/O ₀ -I/O ₇	I/O ₈ -I/O ₁₅	Mode	Power
H	X	X	X	X	High Z	High Z	Power Down	Standby (I_{SB})
L	L	H	L	L	Data Out	Data Out	Read All Bits	Active (I_{CC})
L	L	H	L	H	Data Out	High Z	Read Lower Bits Only	Active (I_{CC})
L	L	H	H	L	High Z	Data Out	Read Upper Bits Only	Active (I_{CC})
L	X	L	L	L	Data In	Data In	Write All Bits	Active (I_{CC})
L	X	L	L	H	Data In	High Z	Write Lower Bits Only	Active (I_{CC})
L	X	L	H	L	High Z	Data In	Write Upper Bits Only	Active (I_{CC})
L	H	H	X	X	High Z	High Z	Selected, Outputs Disabled	Active (I_{CC})

Ordering Information

Speed (ns)	Ordering Code	Package Diagram	Package Type	Operating Range
12	CY7C1041BNV33-12VXC	51-85082	44-Lead (400-Mil) Molded SOJ (Pb-free)	Commercial
	CY7C1041BNV33L-12VXC	51-85082	44-Lead (400-Mil) Molded SOJ (Pb-free)	
	CY7C1041BNV33L-12VC	51-85082	44-Lead (400-Mil) Molded SOJ	
	CY7C1041BNV33L-12ZC	51-85087	44-Pin TSOP II Z44	
	CY7C1041BNV33L-12ZXC	51-85087	44-Pin TSOP II Z44 (Pb-free)	
15	CY7C1041BNV33-15VXC	51-85082	44-Lead (400-Mil) Molded SOJ (Pb-free)	Commercial
	CY7C1041BNV33L-15VXC	51-85082	44-Lead (400-Mil) Molded SOJ (Pb-free)	
	CY7C1041BNV33L-15ZXC	51-85087	44-Pin TSOP II Z44 (Pb-free)	
	CY7C1041BNV33-15VXI	51-85082	44-Lead (400-Mil) Molded SOJ (Pb-free)	Industrial

Please contact local sales representative regarding availability of these parts.

Package Diagrams



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Document History Page

Document Title: CY7C1041BNV33 256K x 16 Static RAM Document Number: 001-06434				
REV.	ECN NO.	Issue Date	Orig. of Change	Description of Change
**	423877	See ECN	NXR	New Data Sheet