

## Features

- High speed
  - $t_{AA} = 12 \text{ ns}$
- Low active power
  - 612 mW (max.)
- Low CMOS standby power
  - 1.8 mW (max.)
- 2.0 V Data Retention (660  $\mu\text{W}$  at 2.0 V 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 ( $\text{I/O}_0$  through  $\text{I/O}_7$ ), is written into the location specified on the address pins ( $\text{A}_0$  through  $\text{A}_{17}$ ). If Byte High Enable ( $\overline{\text{BHE}}$ ) is LOW, then data from I/O pins ( $\text{I/O}_8$  through  $\text{I/O}_{15}$ ) is written into the location specified on the address pins ( $\text{A}_0$  through  $\text{A}_{17}$ ).

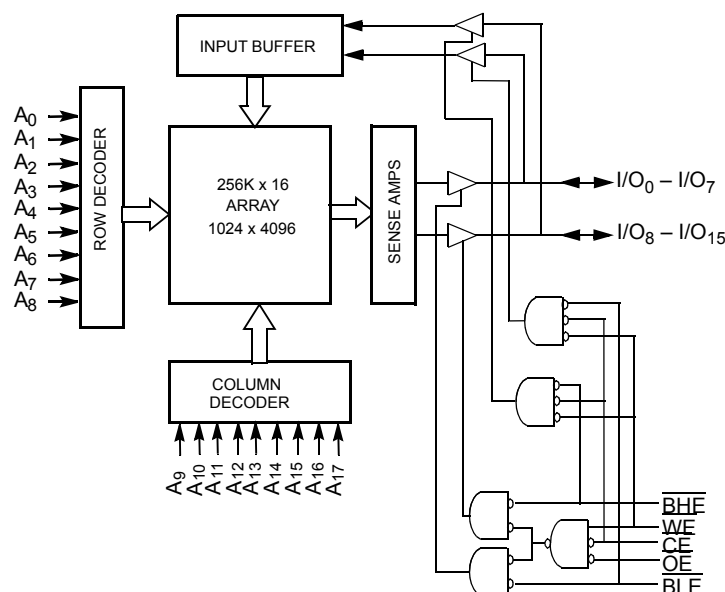
Reading from the device is accomplished by taking Chip Enable ( $\overline{\text{CE}}$ ) and Output Enable ( $\overline{\text{OE}}$ ) LOW while forcing the Write Enable ( $\overline{\text{WE}}$ ) HIGH. If Byte Low Enable ( $\overline{\text{BLE}}$ ) is LOW, then data from the memory location specified by the address pins will appear on  $\text{I/O}_0$  to  $\text{I/O}_7$ . If Byte High Enable ( $\overline{\text{BHE}}$ ) is LOW, then data from memory will appear on  $\text{I/O}_8$  to  $\text{I/O}_{15}$ . See the truth table at the back of this data sheet for a complete description of read and write modes.

The input/output pins ( $\text{I/O}_0$  through  $\text{I/O}_{15}$ ) 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.

For a complete list of related documentation, [click here](#).

## Logic Block Diagram

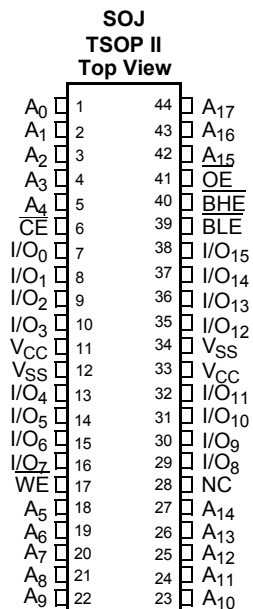


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## Pin Configuration

Figure 1. 44-pin SOJ / TSOP II pinout (Top View)



## Selection Guide

Description			-12
Maximum Access Time (ns)			12
Maximum Operating Current (mA)	Commercial		190
Maximum CMOS Standby Current (mA)	Commercial		0.5

## Maximum Ratings

Exceeding the maximum ratings may impair the useful life of the device. These user guidelines are 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 <sup>[1]</sup> ..... -0.5 V to +4.6 V

DC Voltage Applied to Outputs  
in High Z State <sup>[1]</sup> ..... -0.5 V to  $V_{CC} + 0.5$  V

DC Input Voltage <sup>[1]</sup> ..... -0.5 V to  $V_{CC} + 0.5$  V

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

Static discharge voltage  
(MIL-STD-883, method 3015) ..... > 2001 V

Latch up current ..... > 200 mA

## Operating Range

Range	Ambient Temperature <sup>[2]</sup>	$V_{CC}$
Commercial	0 °C to +70 °C	3.3 V ± 0.3 V

## Electrical Characteristics

Over the Operating Range

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

### Notes

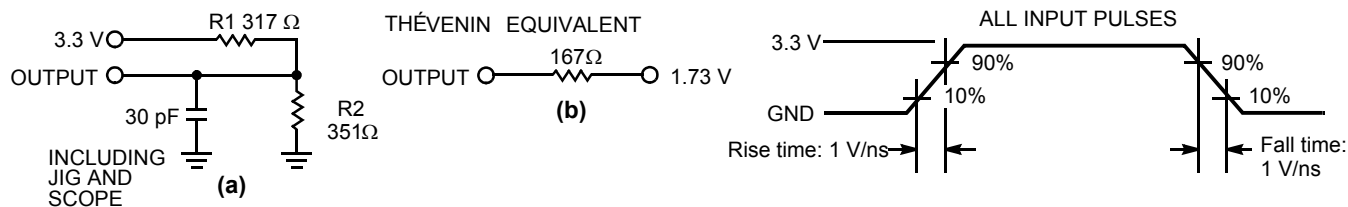
- $V_{IL}$  (min.) = -2.0 V for pulse durations of less than 20 ns.
- $T_A$  is the "Instant On" case temperature.

## Capacitance

Parameter <sup>[3]</sup>	Description	Test Conditions	Max	Unit
$C_{IN}$	Input capacitance	$T_A = 25^\circ\text{C}$ , $f = 1\text{ MHz}$ , $V_{CC} = 3.3\text{ V}$	8	pF
$C_{OUT}$	I/O capacitance		8	pF

## AC Test Loads and Waveforms

Figure 2. AC Test Loads and Waveforms



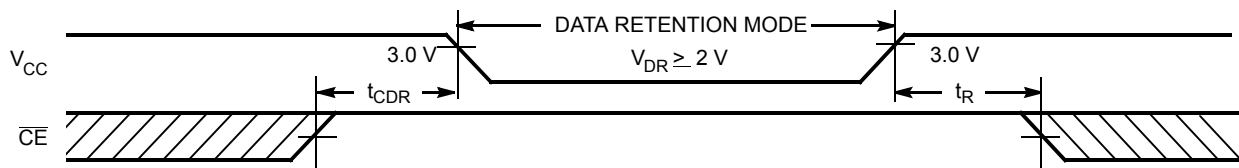
## Data Retention Characteristics

Over the Operating Range

Parameter	Description	Conditions <sup>[4]</sup>	Min	Max	Unit
$V_{DR}$	$V_{CC}$ for Data Retention		2.0	—	V
$I_{CCDR}$	Data Retention Current	$V_{CC} = V_{DR} = 2.0\text{ V}$ , $\overline{CE} \geq V_{CC} - 0.3\text{ V}$ , $V_{IN} \geq V_{CC} - 0.3\text{ V}$ or $V_{IN} \leq 0.3\text{ V}$	—	330	$\mu\text{A}$
$t_{CDR}^{[3]}$	Chip Deselect to Data Retention Time		0	—	ns
$t_R^{[5]}$	Operation Recovery Time		$t_{RC}$	—	ns

## Data Retention Waveform

Figure 3. Data Retention Waveform



### Notes

- Tested initially and after any design or process changes that may affect these parameters.
- No input may exceed  $V_{CC} + 0.5\text{ V}$ .
- $t_r \leq 3\text{ ns}$  for the -12 and -15 speeds.

## Switching Characteristics

Over the Operating Range

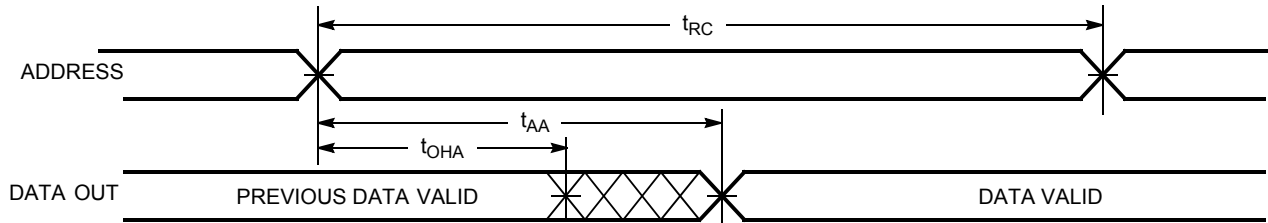
Parameter <sup>[6]</sup>	Description	-12		Unit
		Min	Max	
READ CYCLE				
t <sub>RC</sub>	Read Cycle Time	12	–	ns
t <sub>AA</sub>	Address to Data Valid	–	12	ns
t <sub>OHA</sub>	Data Hold from Address Change	3	–	ns
t <sub>ACE</sub>	$\overline{\text{CE}}$ LOW to Data Valid	–	12	ns
t <sub>DOE</sub>	$\overline{\text{OE}}$ LOW to Data Valid	–	6	ns
t <sub>LZOE</sub>	$\overline{\text{OE}}$ LOW to Low Z	0	–	ns
t <sub>HZOE</sub>	$\overline{\text{OE}}$ HIGH to High Z <sup>[7, 8]</sup>	–	6	ns
t <sub>LZCE</sub>	$\overline{\text{CE}}$ LOW to Low Z <sup>[8]</sup>	3	–	ns
t <sub>HZCE</sub>	$\overline{\text{CE}}$ HIGH to High Z <sup>[7, 8]</sup>	–	6	ns
t <sub>PU</sub>	$\overline{\text{CE}}$ LOW to Power-Up	0	–	ns
t <sub>PD</sub>	$\overline{\text{CE}}$ HIGH to Power-Down	–	12	ns
t <sub>DBE</sub>	Byte Enable to Data Valid	–	6	ns
t <sub>LZBE</sub>	Byte Enable to Low Z	0	–	ns
t <sub>HZBE</sub>	Byte Disable to High Z	–	6	ns
WRITE CYCLE <sup>[9, 10]</sup>				
t <sub>WC</sub>	Write Cycle Time	12	–	ns
t <sub>SCE</sub>	$\overline{\text{CE}}$ LOW to Write End	10	–	ns
t <sub>AW</sub>	Address Set-Up to Write End	10	–	ns
t <sub>HA</sub>	Address Hold from Write End	0	–	ns
t <sub>SA</sub>	Address Set-Up to Write Start	0	–	ns
t <sub>PWE</sub>	$\overline{\text{WE}}$ Pulse Width	10	–	ns
t <sub>SD</sub>	Data Set-Up to Write End	7	–	ns
t <sub>HD</sub>	Data Hold from Write End	0	–	ns
t <sub>LZWE</sub>	$\overline{\text{WE}}$ HIGH to Low Z <sup>[8]</sup>	3	–	ns
t <sub>HZWE</sub>	$\overline{\text{WE}}$ LOW to High Z <sup>[7, 8]</sup>	–	6	ns
t <sub>BW</sub>	Byte Enable to End of Write	10	–	ns

### Notes

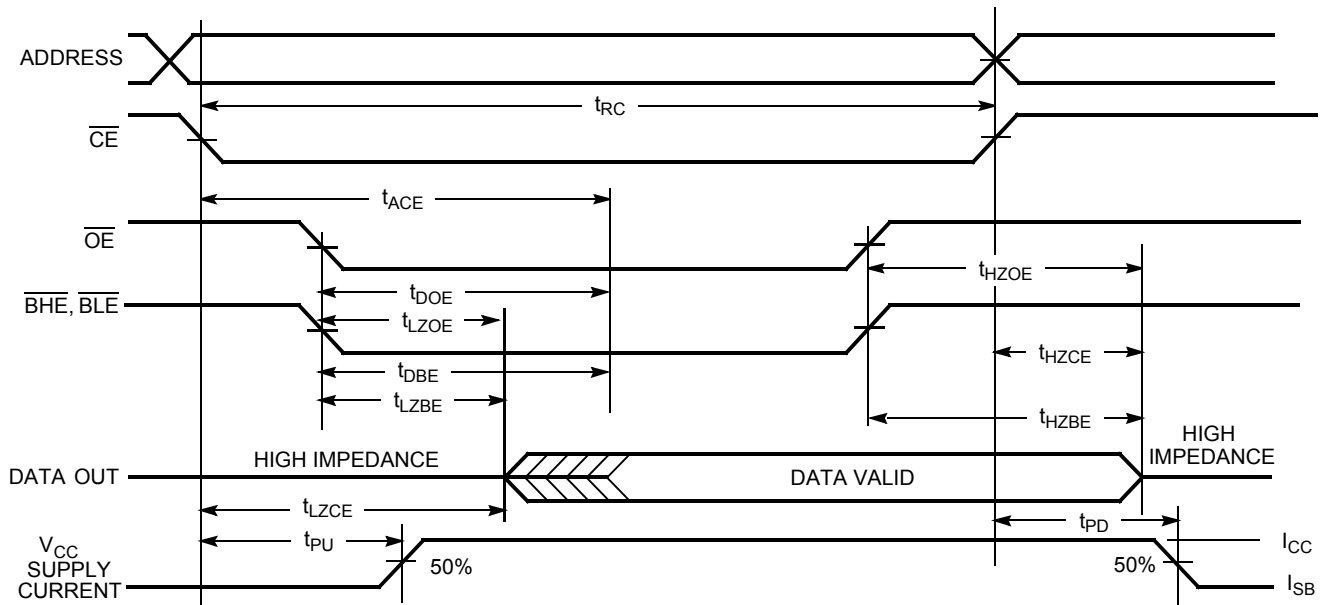
- Test conditions assume signal transition time of 3 ns or less, timing reference levels of 1.5 V, input pulse levels of 0 to 3.0 V, and output loading of the specified  $I_{OL}/I_{OH}$  and 30-pF load capacitance.
- $t_{HZOE}$ ,  $t_{HZCE}$ , and  $t_{HZWE}$  are specified with a load capacitance of 5 pF as in part (b) of Figure 2 on page 5. Transition is measured  $\pm 500$  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  $t_{SD}$ .

## Switching Waveforms

**Figure 4. Read Cycle No. 1** [11, 12]



**Figure 5. Read Cycle No. 2 ( $\overline{OE}$  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)

Figure 6. Write Cycle No. 1 ( $\overline{\text{CE}}$  Controlled) [14, 15]

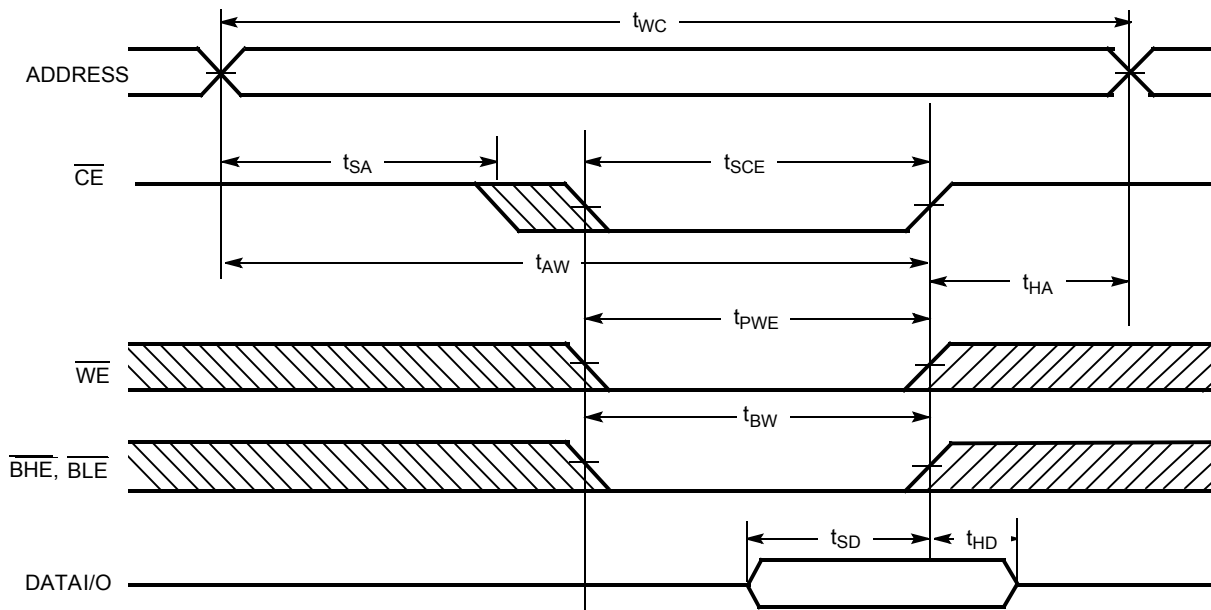
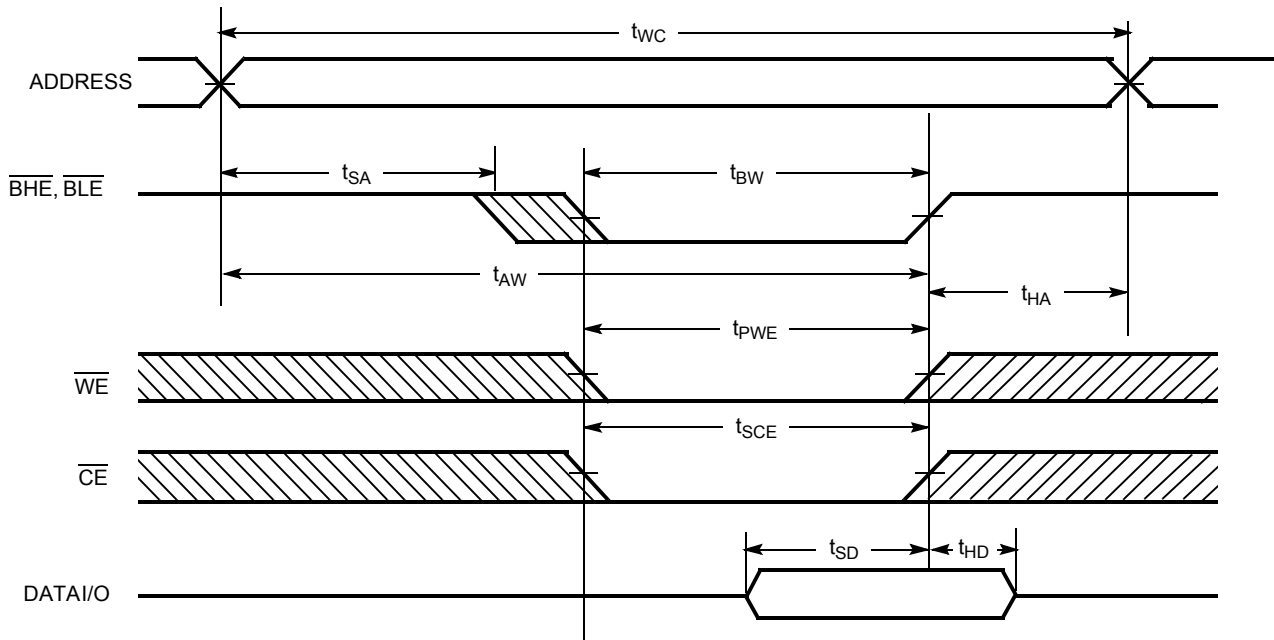


Figure 7. Write Cycle No. 2 ( $\overline{\text{BLE}}$  or  $\overline{\text{BHE}}$  Controlled)



### Notes

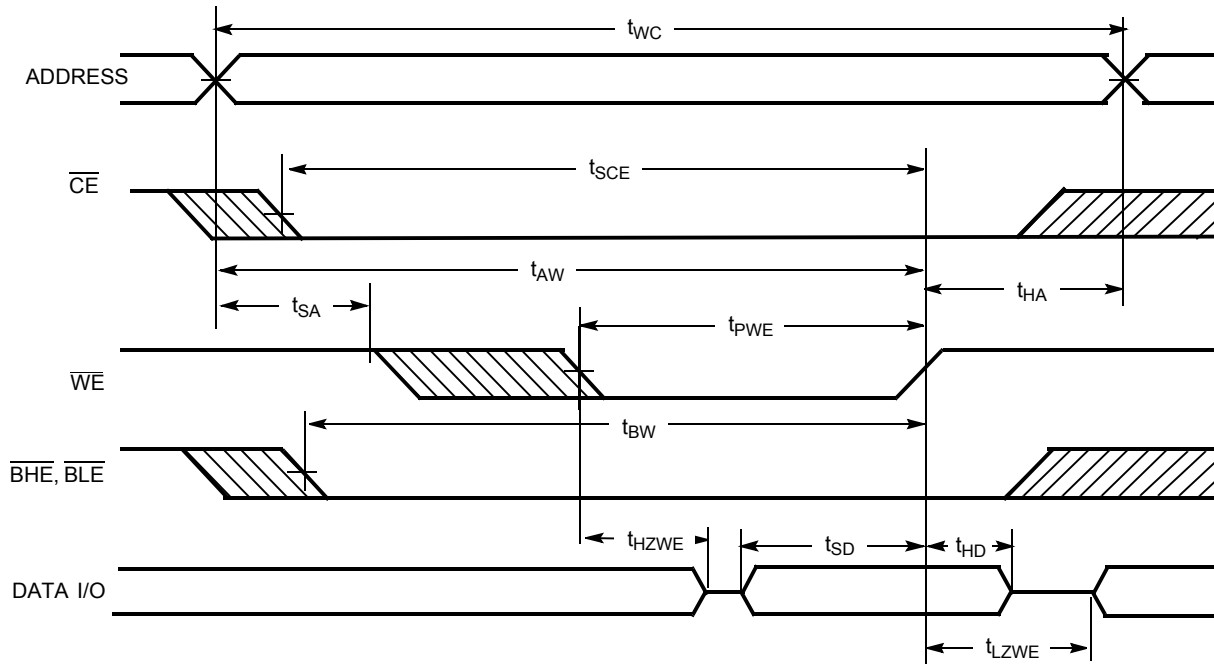
14. Data I/O is high-impedance if  $\overline{\text{OE}}$  or  $\overline{\text{BHE}}$  and/or  $\overline{\text{BLE}} = V_{IH}$ .

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)

Figure 8. Write Cycle No. 3 ( $\overline{\text{WE}}$  Controlled,  $\overline{\text{OE}}$  LOW)



## Truth Table

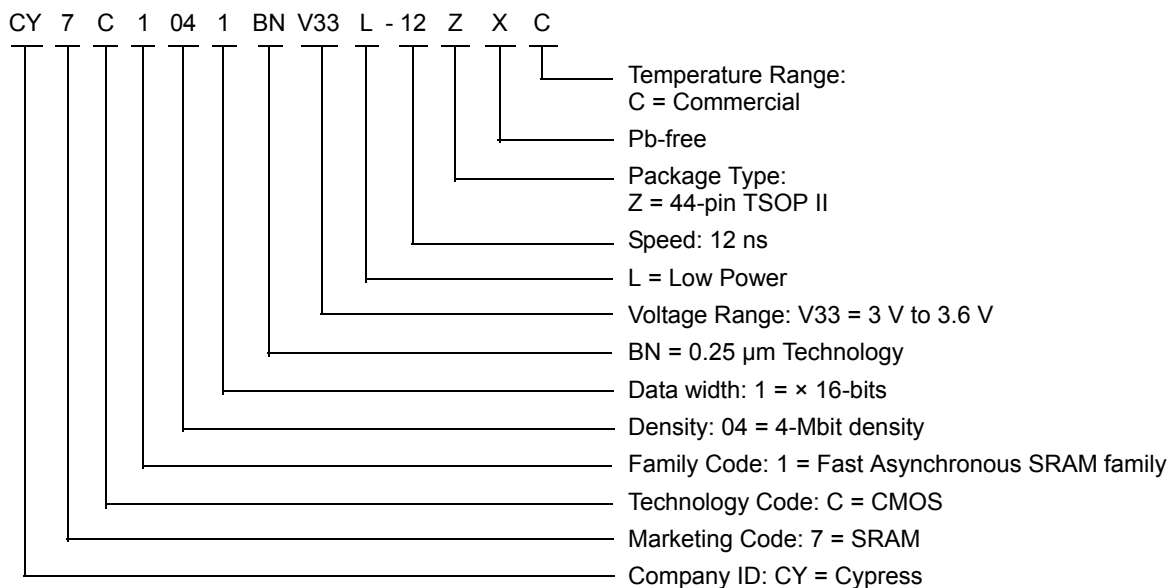
$\overline{CE}$	$\overline{OE}$	$\overline{WE}$	$\overline{BLE}$	$\overline{BHE}$	I/O <sub>0</sub> –I/O <sub>7</sub>	I/O <sub>8</sub> –I/O <sub>15</sub>	Mode	Power
H	X	X	X	X	High Z	High Z	Power Down	Standby (I <sub>SB</sub> )
L	L	H	L	L	Data Out	Data Out	Read All Bits	Active (I <sub>CC</sub> )
L	L	H	L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

## Ordering Information

Speed (ns)	Ordering Code	Package Diagram	Package Type	Operating Range
12	CY7C1041BNV33L-12ZXC	51-85087	44-pin TSOP II (Pb-free)	Commercial

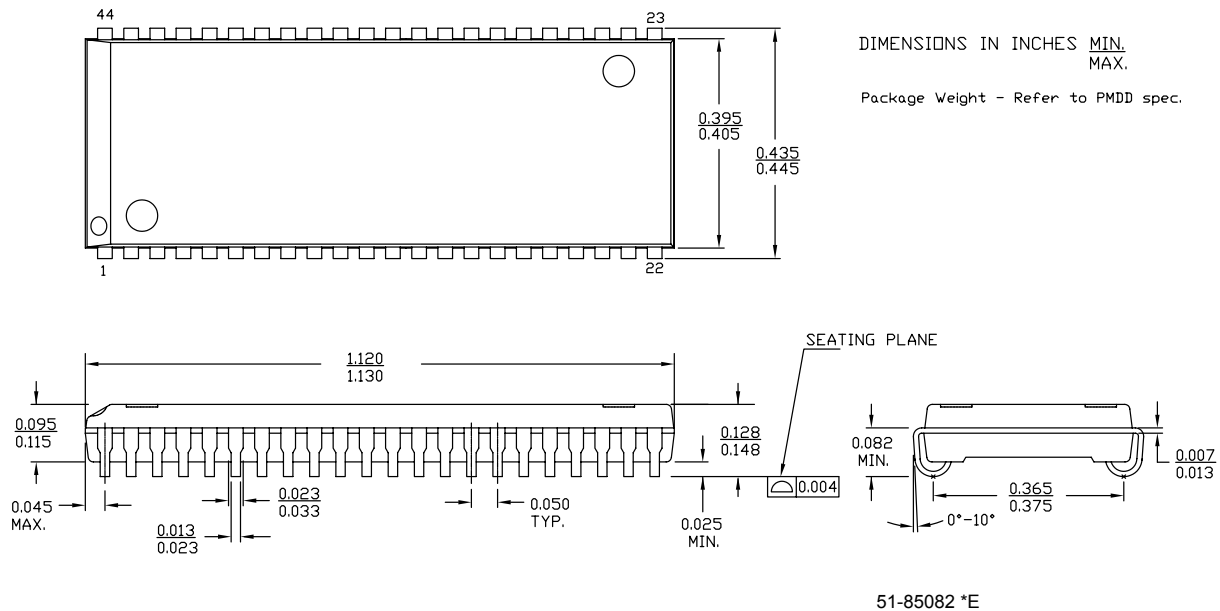
Please contact local sales representative regarding availability of these parts.

## Ordering Code Definitions

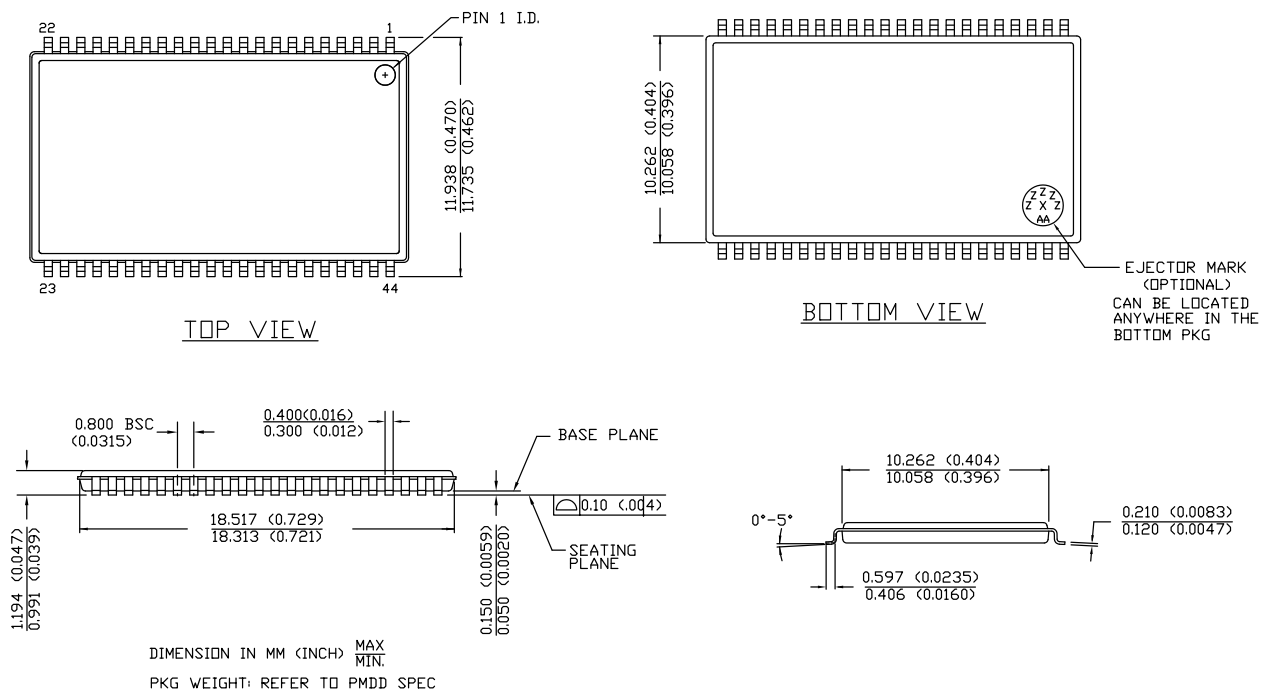


## Package Diagrams

**Figure 9. 44-pin SOJ (400 Mils) Package Outline, 51-85082**



**Figure 10. 44-pin TSOP II Package Outline, 51-85087**



## Acronyms

Acronym	Description
CMOS	Complementary Metal Oxide Semiconductor
$\overline{\text{CE}}$	Chip Enable
I/O	Input/Output
$\overline{\text{OE}}$	Output Enable
SRAM	Static Random Access Memory
SOJ	Small Outline J-lead
TTL	Transistor-Transistor Logic
TSOP	Thin Small-Outline Package
$\overline{\text{WE}}$	Write Enable

## Document Conventions

### Units of Measure

Symbol	Unit of Measure
°C	degree Celsius
MHz	megahertz
μA	microampere
μF	microfarad
μs	microsecond
μW	microwatt
mA	milliampere
ms	millisecond
mW	milliwatt
ns	nanosecond
Ω	ohm
%	percent
pF	picofarad
V	volt
W	watt

## Document History Page

Document Title: CY7C1041BNV33, 256 K × 16 Static RAM Document Number: 001-06434				
Revision	ECN	Orig. of Change	Submission Date	Description of Change
**	423877	NXR	See ECN	New data sheet.
*A	2899016	VKN	See ECN	Removed Industrial grade temperature related information. Removed 15 ns speed bin related information. Updated Ordering Information. Updated Package Diagrams.
*B	3109184	AJU	12/13/2010	Added <a href="#">Ordering Code Definitions</a> .
*C	3210222	PRAS	03/30/2011	Updated <a href="#">Selection Guide</a> . Added <a href="#">Acronyms</a> and <a href="#">Units of Measure</a> . Updated in new template.
*D	3232637	PRAS	05/04/2011	Fixed unit for Input Leakage current and Output Leakage current under Electrical Characteristics table from mA to $\mu$ A.
*E	3403051	AJU	10/12/2011	Updated <a href="#">Ordering Information</a> (Removed prune part number CY7C1041BNV33L-12VXC). Updated <a href="#">Package Diagrams</a> .
*F	4337921	VINI	04/09/2014	Updated <a href="#">Maximum Ratings</a> : Added "Static discharge voltage" and "Latch up current" details. Updated <a href="#">Package Diagrams</a> : spec 51-85082 – Changed revision from *D to *E. spec 51-85087 – Changed revision from *D to *E. Updated in new template. Completing Sunset Review.
*G	4578500	VINI	11/25/2014	Added related documentation hyperlink in page 1.

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