

## 256K x 16 Static RAM

### Features

- **High speed**  
—  $t_{AA} = 15$  ns
- **Low active power**  
— 612 mW (max.)
- **Low CMOS standby power (Commercial L version)**  
— 1.8 mW (max.)
- **2.0V Data Retention (600  $\mu$ W at 2.0V retention)**
- **Automatic power-down when deselected**
- **TTL-compatible inputs and outputs**
- **Easy memory expansion with  $\overline{CE}$  and  $\overline{OE}$  features**

### Functional Description

The CY7C1041V33 is a high-performance CMOS Static RAM organized as 262,144 words by 16 bits.

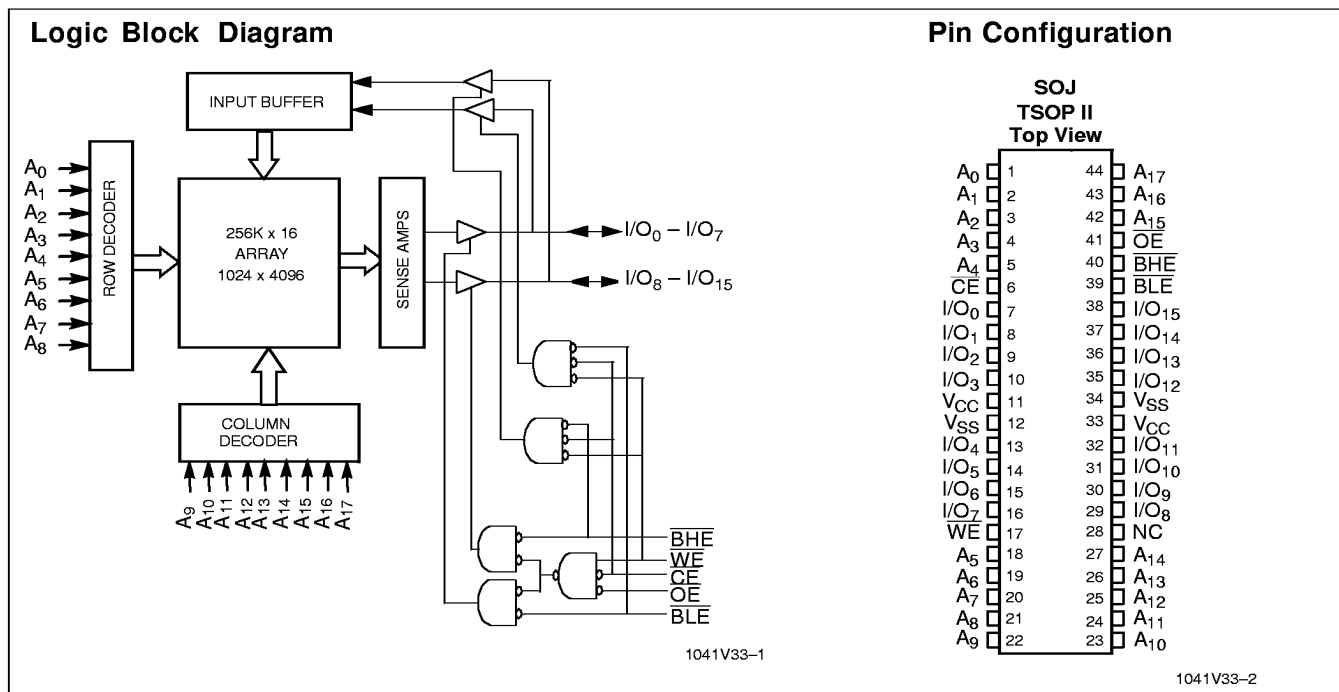
Writing to the device is accomplished by taking Chip Enable ( $\overline{CE}$ ) and Write Enable ( $\overline{WE}$ ) inputs LOW. If Byte Low Enable ( $\overline{BLE}$ ) is LOW, then data from I/O pins ( $I/O_0$  through  $I/O_7$ ), is

written into the location specified on the address pins ( $A_0$  through  $A_{17}$ ). If Byte High Enable ( $\overline{BHE}$ ) 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 ( $\overline{CE}$ ) and Output Enable ( $\overline{OE}$ ) LOW while forcing the Write Enable ( $\overline{WE}$ ) HIGH. If Byte Low Enable ( $\overline{BLE}$ ) 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 ( $\overline{BHE}$ ) 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 ( $\overline{CE}$  HIGH), the outputs are disabled ( $\overline{OE}$  HIGH), the  $\overline{BHE}$  and  $\overline{BLE}$  are disabled ( $\overline{BHE}$ ,  $\overline{BLE}$  HIGH), or during a write operation ( $\overline{CE}$  LOW, and  $\overline{WE}$  LOW).

The CY7C1041V33 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

		1041V33-12	1041V33-15	1041V33-17	1041V33-20	1041V33-25
Maximum Access Time (ns)		12	15	17	20	25
Maximum Operating Current (mA)		190	170	160	150	130
Maximum CMOS Standby Current (mA)	Com'l/Ind'l	8	8	8	8	8
	Com'l L	0.5	0.5	0.5	0.5	0.5

Shaded areas contain preliminary 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<sup>[1]</sup> .... -0.5V to +4.6V

DC Voltage Applied to Outputs

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

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

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

**Operating Range**

Range	Ambient Temperature <sup>[2]</sup>	$V_{CC}$
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	7C1041-12V33		7C1041V33-15		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 <sup>[1]</sup>		-0.5	0.8	-0.5	0.8	V	
$I_{IX}$	Input Load Current	$GND \leq V_I \leq V_{CC}$	-1	+1	-1	+1	μA	
$I_{OZ}$	Output Leakage Current	$GND \leq V_{OUT} \leq V_{CC}$ , Output Disabled	-1	+1	-1	+1	μA	
$I_{CC}$	$V_{CC}$ Operating Supply Current	$V_{CC} = \text{Max.}, f = f_{MAX} = 1/t_{RC}$		190		170	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		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 $V_{IN} \leq 0.3V$ , $f=0$	Com'l/Ind'l			8	8	mA
			Com'l	L		0.5	0.5	mA

Shaded areas contain preliminary information.

**Notes:**

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

**Electrical Characteristics** Over the Operating Range (continued)

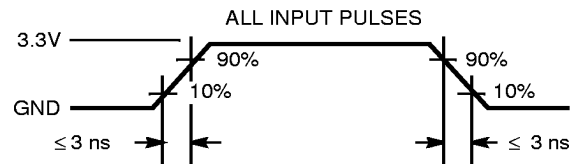
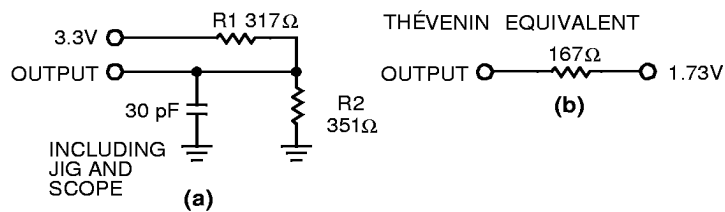
Parameter	Description	Test Conditions	1041V33-17		1041V33-20		1041V33-25		Unit
			Min.	Max.	Min.	Max.	Min.	Max.	
$V_{OH}$	Output HIGH Voltage	$V_{CC} = \text{Min.}, I_{OH} = -4.0 \text{ mA}$	2.4		2.4		2.4		V
$V_{OL}$	Output LOW Voltage	$V_{CC} = \text{Min.}, I_{OL} = 8.0 \text{ mA}$		0.4		0.4		0.4	V
$V_{IH}$	Input HIGH Voltage		2.2	$V_{CC} + 0.5$	2.2	$V_{CC} + 0.5$	2.2	$V_{CC} + 0.5$	V
$V_{IL}$	Input LOW Voltage <sup>[1]</sup>		-0.5	0.8	-0.5	0.8	-0.5	0.8	V
$I_{IX}$	Input Load Current	$GND \leq V_I \leq V_{CC}$	-1	+1	-1	+1	-1	+1	$\mu\text{A}$
$I_{OZ}$	Output Leakage Current	$GND \leq V_{OUT} \leq V_{CC}$ , Output Disabled	-1	+1	-1	+1	-1	+1	$\mu\text{A}$
$I_{CC}$	$V_{CC}$ Operating Supply Current	$V_{CC} = \text{Max.}$ , $f = f_{MAX} = 1/t_{RC}$		160		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 $V_{IN} \leq V_{IL}$ , $f = f_{MAX}$		40		40		40	mA
$I_{SB2}$	Automatic CE Power-Down Current —CMOS Inputs	Max. $V_{CC}$ , $\overline{CE} \geq V_{CC} - 0.3\text{V}$ , $V_{IN} \geq V_{CC} - 0.3\text{V}$ , or $V_{IN} \leq 0.3\text{V}$ , $f=0$	Com'I/Ind'I			8		8	mA
			Com'I	L		0.5		0.5	0.5

**Capacitance<sup>[3]</sup>**

Parameter	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

**Note:**

3. Tested initially and after any design or process changes that may affect these parameters.

**AC Test Loads and Waveforms**


1041V33-3

1041V33-4

**Switching Characteristics<sup>[4]</sup> Over the Operating Range**

Parameter	Description	1041V33-12		1041V33-15		1041V33-17		Unit
		Min.	Max.	Min.	Max.	Min.	Max.	
<b>READ CYCLE</b>								
$t_{RC}$	Read Cycle Time	12		15		17		ns
$t_{AA}$	Address to Data Valid		12		15		17	ns
$t_{OHA}$	Data Hold from Address Change	3		3		3		ns
$t_{ACE}$	$\overline{CE}$ LOW to Data Valid		12		15		17	ns
$t_{DOE}$	$\overline{OE}$ LOW to Data Valid		6		7		8	ns
$t_{LZOE}$	$\overline{OE}$ LOW to Low Z	0		0		0		ns
$t_{HZOE}$	$\overline{OE}$ HIGH to High Z <sup>[5, 6]</sup>		6		7		7	ns
$t_{LZCE}$	$\overline{CE}$ LOW to Low Z <sup>[6]</sup>	3		3		3		ns
$t_{HZCE}$	$\overline{CE}$ HIGH to High Z <sup>[5, 6]</sup>		6		7		7	ns
$t_{PU}$	$\overline{CE}$ LOW to Power-Up	0		0		0		ns
$t_{PD}$	$\overline{CE}$ HIGH to Power-Down		12		15		17	ns
$t_{DBE}$	Byte Enable to Data Valid		6		7		7	ns
$t_{LZBE}$	Byte Enable to Low Z	0		0		0		ns
$t_{HZBE}$	Byte Disable to High Z		6		7		8	ns
<b>WRITE CYCLE<sup>[7, 8]</sup></b>								
$t_{WC}$	Write Cycle Time	12		15		17		ns
$t_{SCE}$	$\overline{CE}$ LOW to Write End	10		12		12		ns
$t_{AW}$	Address Set-Up to Write End	10		12		12		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	10		12		12		ns
$t_{SD}$	Data Set-Up to Write End	7		8		9		ns
$t_{HD}$	Data Hold from Write End	0		0		0		ns
$t_{LZWE}$	$\overline{WE}$ HIGH to Low Z <sup>[6]</sup>	3		3		3		ns
$t_{HZWE}$	$\overline{WE}$ LOW to High Z <sup>[5, 6]</sup>		6		7		8	ns
$t_{BW}$	Byte Enable to End of Write	10		12		12		ns

Shaded areas contain preliminary information.

**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  $\pm 500$  mV from steady-state voltage.
- At any given temperature and voltage condition,  $t_{HZOE}$  is less than  $t_{LZOE}$ ,  $t_{HZCE}$  is less than  $t_{LZCE}$ , 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 Characteristics<sup>[4]</sup> Over the Operating Range (continued)**

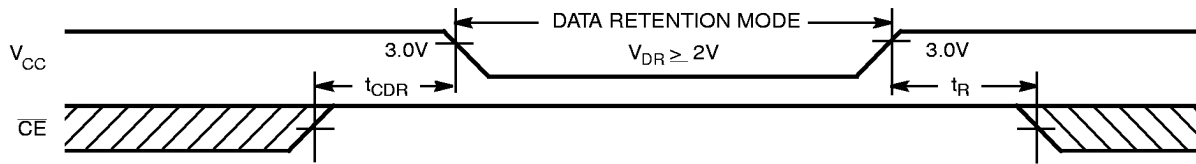
Parameter	Description	1041V33-20		1041V33-25		Unit
		Min.	Max.	Min.	Max.	
<b>READ CYCLE</b>						
$t_{RC}$	Read Cycle Time	20		25		ns
$t_{AA}$	Address to Data Valid		20		25	ns
$t_{OHA}$	Data Hold from Address Change	3		5		ns
$t_{ACE}$	$\overline{CE}$ LOW to Data Valid		20		25	ns
$t_{DOE}$	$\overline{OE}$ LOW to Data Valid		8		10	ns
$t_{LZOE}$	$\overline{OE}$ LOW to Low Z	0		0		ns
$t_{HZOE}$	$\overline{OE}$ HIGH to High Z <sup>[5, 6]</sup>		8		10	ns
$t_{LZCE}$	$\overline{CE}$ LOW to Low Z <sup>[6]</sup>	3		5		ns
$t_{HZCE}$	$\overline{CE}$ HIGH to High Z <sup>[5, 6]</sup>		8		10	ns
$t_{PU}$	$\overline{CE}$ LOW to Power-Up	0		0		ns
$t_{PD}$	$\overline{CE}$ HIGH to Power-Down		20		25	ns
$t_{DBE}$	Byte Enable to Data Valid		8		10	ns
$t_{LZBE}$	Byte Enable to Low Z	0		0		ns
$t_{HZBE}$	Byte Disable to High Z		8		10	ns
<b>WRITE CYCLE<sup>[7,8]</sup></b>						
$t_{WC}$	Write Cycle Time	20		25		ns
$t_{SCE}$	$\overline{CE}$ LOW to Write End	13		15		ns
$t_{AW}$	Address Set-Up to Write End	13		15		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	13		15		ns
$t_{SD}$	Data Set-Up to Write End	9		10		ns
$t_{HD}$	Data Hold from Write End	0		0		ns
$t_{LZWE}$	$\overline{WE}$ HIGH to Low Z <sup>[6]</sup>	3		5		ns
$t_{HZWE}$	$\overline{WE}$ LOW to High Z <sup>[5, 6]</sup>		8		10	ns
$t_{BW}$	Byte Enable to End of Write	13		15		ns

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

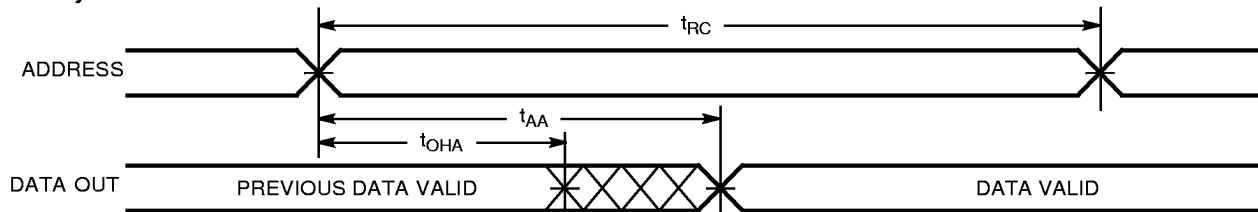
Parameter	Description	Conditions <sup>[10]</sup>	Min.	Max.	Unit
$V_{DR}$	$V_{CC}$ for Data Retention		2.0		V
$I_{CCDR}$	Data Retention Current	$V_{CC} = V_{DR} = 2.0V$ , $\overline{CE} \geq V_{CC} - 0.3V$ , $V_{IN} \geq V_{CC} - 0.3V$ or $V_{IN} \leq 0.3V$		330	$\mu A$
$t_{CDR}^{[3]}$	Chip Deselect to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

**Notes:**

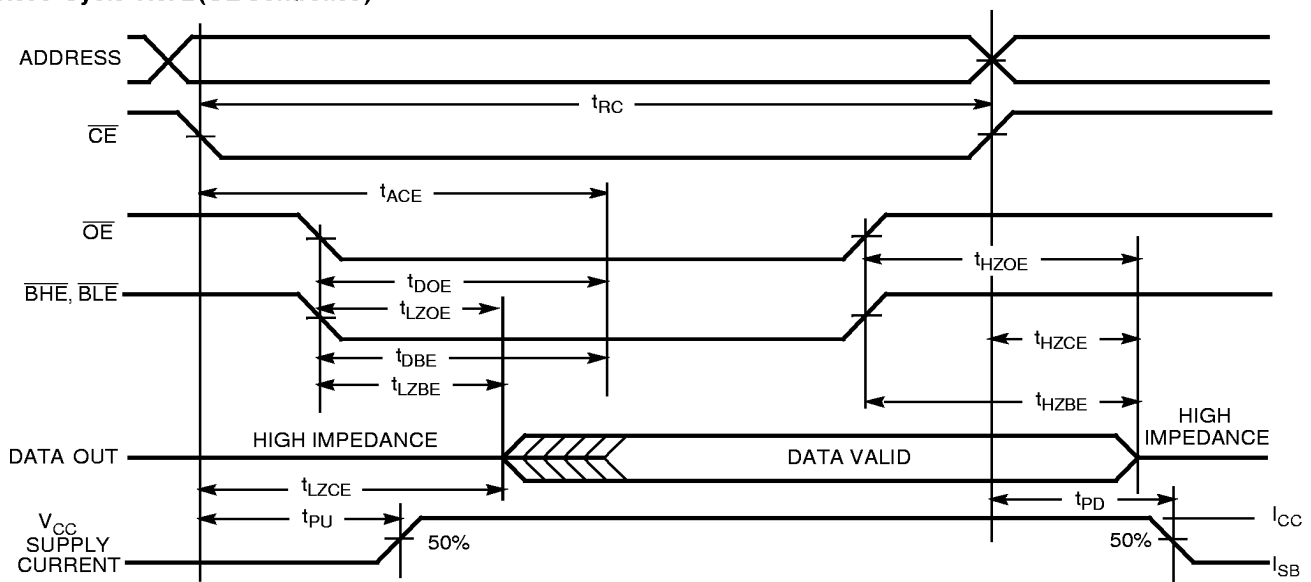
9.  $t_r \leq 3$  ns for the -12 and -15 speeds.  $t_r \leq 5$  ns for the -20 and slower speeds.  
 10. No input may exceed  $V_{CC} + 0.5V$ .

**Data Retention Waveform**


1041V33-5

**Switching Waveforms**
**Read Cycle No. 1** <sup>[11, 12]</sup>


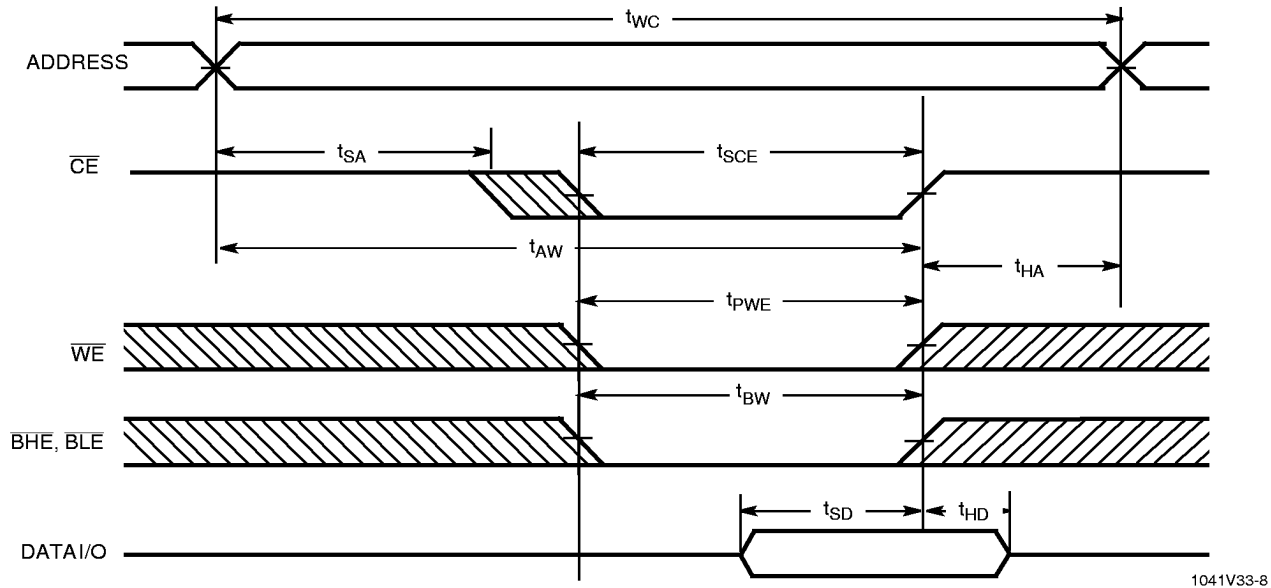
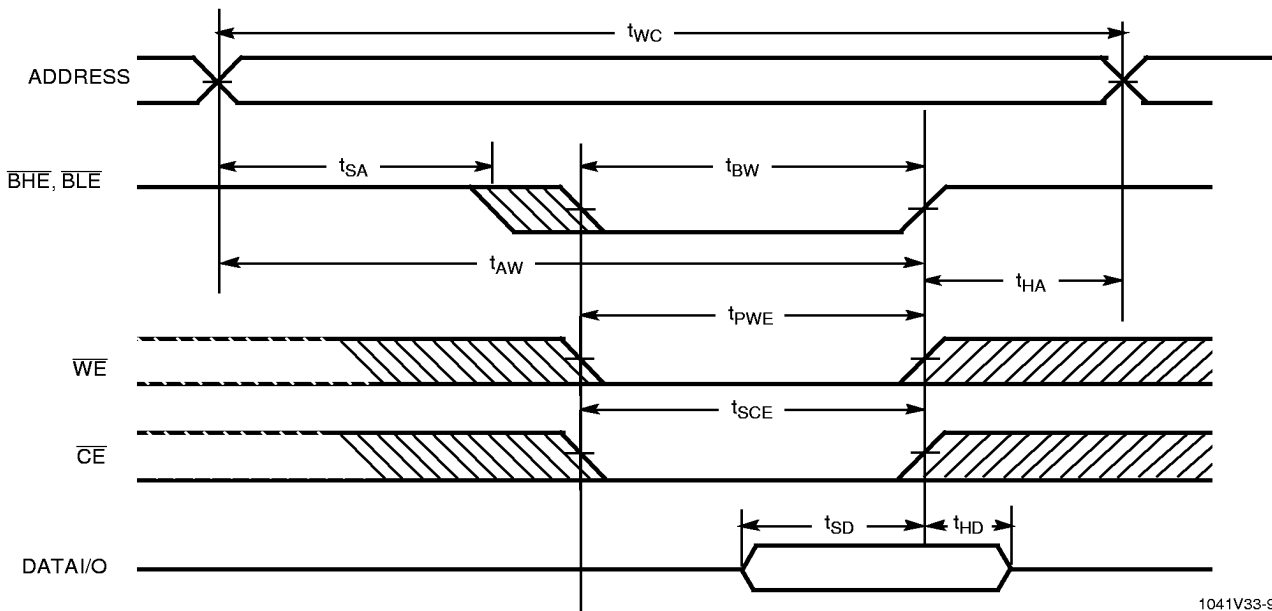
1041V33-6

**Read Cycle No. 2 ( $\overline{OE}$  Controlled)** <sup>[12, 13]</sup>


1041V33-7

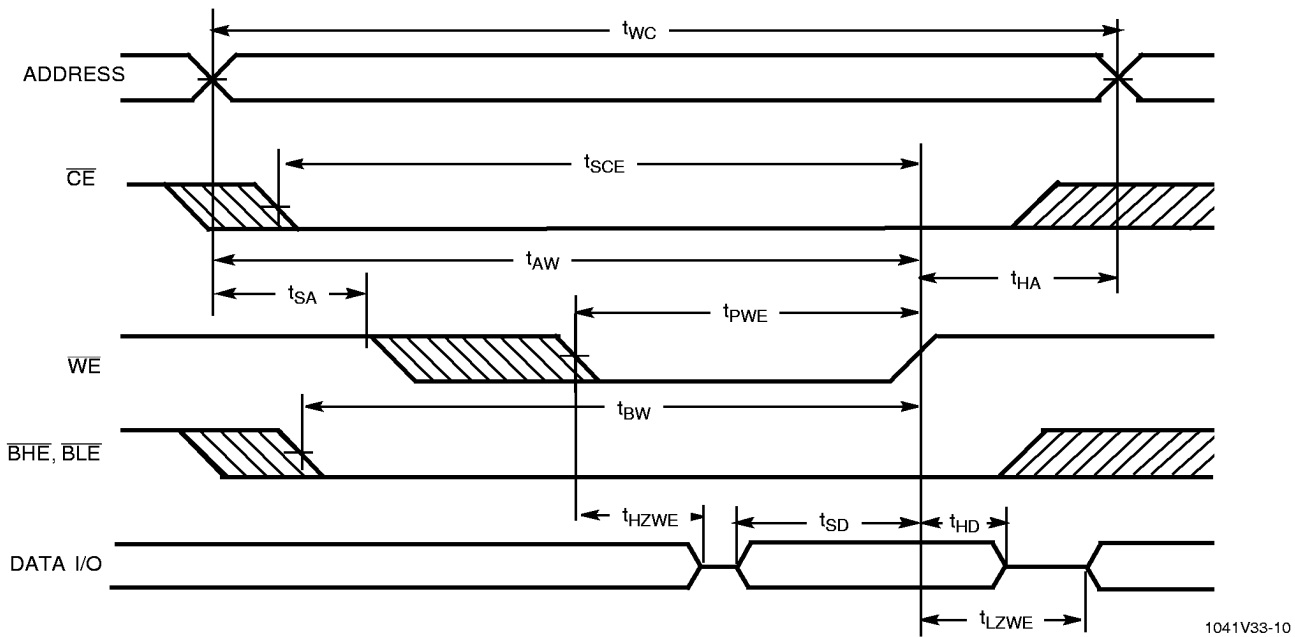
**Notes:**

11. Device is continuously selected.  $\overline{OE}$ ,  $\overline{CE}$ , BHE and/or BHE =  $V_{IL}$ .
12. 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)<sup>[14, 15]</sup>**

**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, LOW)**


1041V33-10

**Truth Table**

CE	OE	WE	BLE	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 ( $I_{SB}$ )
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 ( $I_{CC}$ )



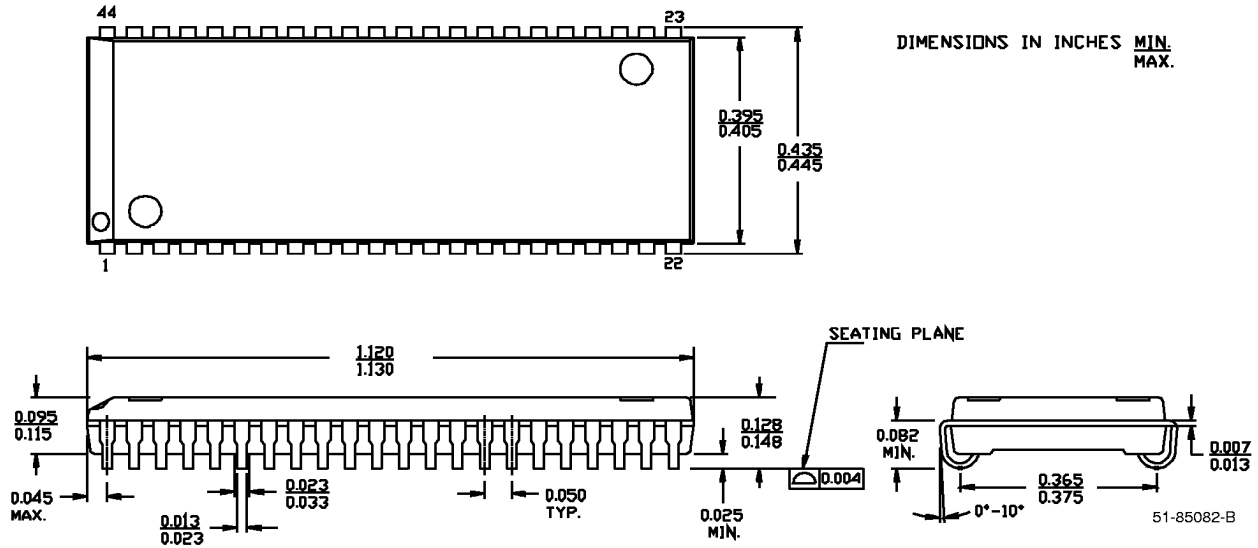
**Ordering Information**

Speed (ns)	Ordering Code	Package Name	Package Type	Operating Range
12	CY7C1041V33 -12VC	V34	44-Lead (400-Mil) Molded SOJ	Commercial
	CY7C1041V33L-12VC	V34	44-Lead (400-Mil) Molded SOJ	
	CY7C1041V33 - 12ZC	Z44	44-Pin TSOP II Z44	
	CY7C1041V33L-12ZC	Z44	44-Pin TSOP II Z44	
15	CY7C1041V33 -15VC	V34	44-Lead (400-Mil) Molded SOJ	
	CY7C1041V33L-15VC	V34	44-Lead (400-Mil) Molded SOJ	
	CY7C1041V33 - 15ZC	Z44	44-Pin TSOP II Z44	
	CY7C1041V33L-15ZC	Z44	44-Pin TSOP II Z44	
17	CY7C1041V33 - 17VC	V34	44-Lead (400-Mil) Molded SOJ	
	CY7C1041V33L-17VC	V34	44-Lead (400-Mil) Molded SOJ	
	CY7C1041V33 - 17ZC	Z44	44-Pin TSOP II Z44	
	CY7C1041V33L-17ZC	Z44	44-Pin TSOP II Z44	
20	CY7C1041V33 - 20VC	V34	44-Lead (400-Mil) Molded SOJ	
	CY7C1041V33L-20VC	V34	44-Lead (400-Mil) Molded SOJ	
	CY7C1041V33 - 20ZC	Z44	44-Pin TSOP II Z44	
	CY7C1041V33L-20ZC	Z44	44-Pin TSOP II Z44	
25	CY7C1041V33 - 25VC	V34	44-Lead (400-Mil) Molded SOJ	
	CY7C1041V33L-25VC	V34	44-Lead (400-Mil) Molded SOJ	
	CY7C1041V33 - 25ZC	Z44	44-Pin TSOP II Z44	
	CY7C1041V33L-25ZC	Z44	44-Pin TSOP II Z44	

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Package Diagrams

44-Lead (400-Mil) Molded SOJ V34



44-Pin TSOP II Z44

DIMENSION IN MM (INCH)  
MAX.  
MIN.

