

# 1-Mbit (128K x 8) Static RAM

## Features

- Pin- and function-compatible with CY7C1019CV33
- High speed
  - $t_{AA} = 10 \text{ ns}$
- Low Active Power
  - $I_{CC} = 60 \text{ mA @ } 10 \text{ ns}$
- Low CMOS Standby Power
  - $I_{SB2} = 3 \text{ mA}$
- 2.0V Data retention
- Automatic power-down when deselected
- CMOS for optimum speed/power
- Center power/ground pinout
- Easy memory expansion with  $\overline{CE}$  and  $\overline{OE}$  options
- Available in Pb-free 32-pin 400-Mil wide Molded SOJ, 32-pin TSOP II and 48-ball VFBGA packages

## Functional Description<sup>[1]</sup>

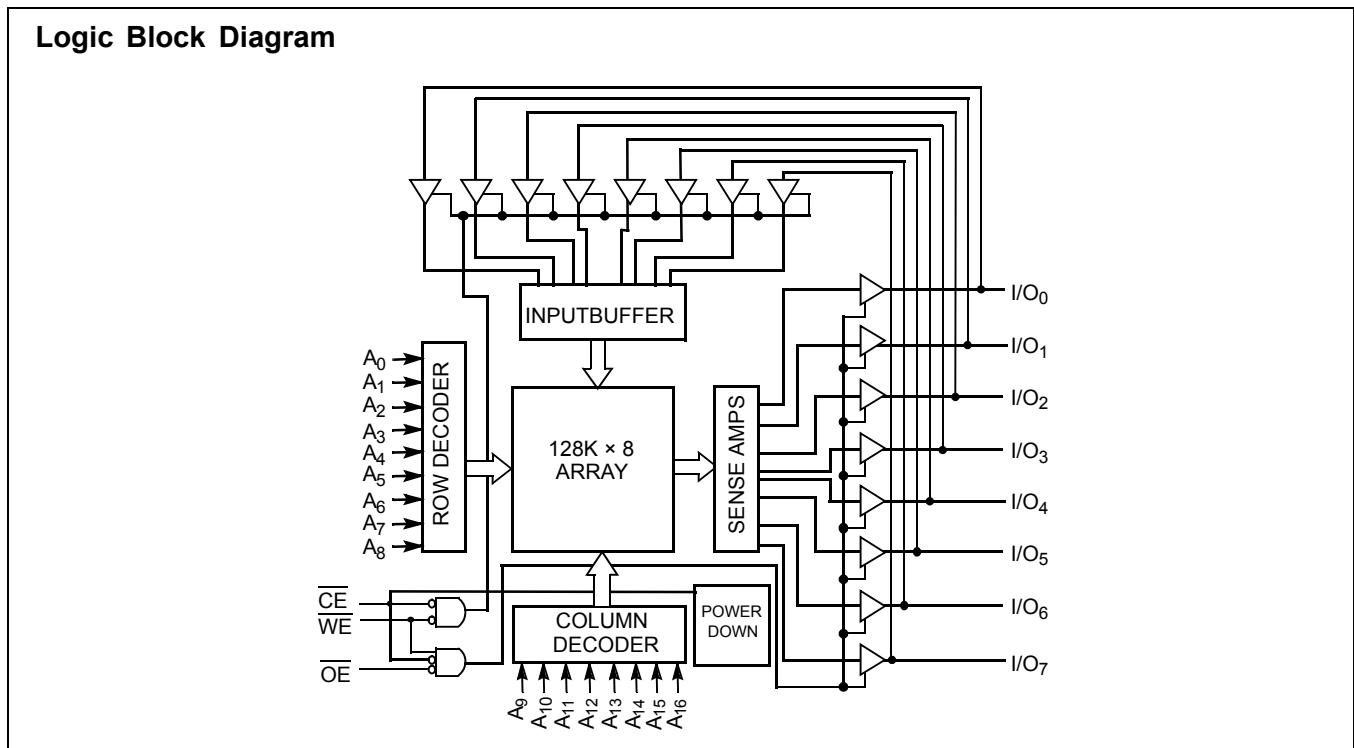
The CY7C1019DV33 is a high-performance CMOS static RAM organized as 131,072 words by 8 bits. Easy memory expansion is provided by an active LOW Chip Enable ( $\overline{CE}$ ), an active LOW Output Enable ( $\overline{OE}$ ), and three-state drivers. This device has an automatic power-down feature that significantly reduces power consumption when deselected.

Writing to the device is accomplished by taking Chip Enable ( $\overline{CE}$ ) and Write Enable ( $\overline{WE}$ ) inputs LOW. 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  $A_{16}$ ).

Reading from the device is accomplished by taking Chip Enable ( $\overline{CE}$ ) and Output Enable ( $\overline{OE}$ ) LOW while forcing Write Enable ( $\overline{WE}$ ) 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 ( $\overline{CE}$  HIGH), the outputs are disabled ( $\overline{OE}$  HIGH), or during a write operation ( $\overline{CE}$  LOW, and  $\overline{WE}$  LOW).

The CY7C1019DV33 is available in Pb-free 32-pin 400-Mil wide Molded SOJ, 32-pin TSOP II and 48-ball VFBGA packages.



### Note

1. For guidelines on SRAM system design, please refer to the 'System Design Guidelines' Cypress application note, available on the internet at [www.cypress.com](http://www.cypress.com)

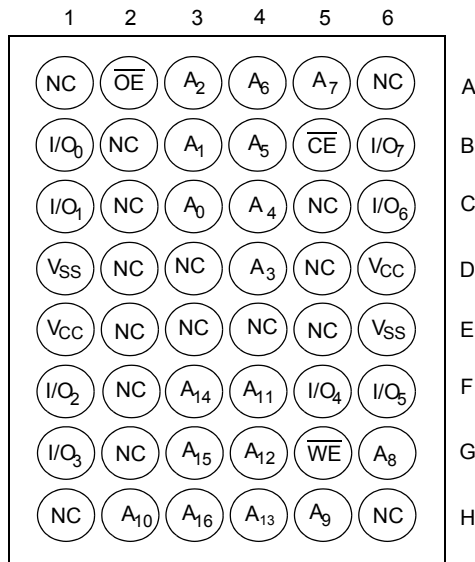
**Selection Guide**

	<b>-10 (Industrial)</b>	<b>Unit</b>
Maximum Access Time	10	ns
Maximum Operating Current	60	mA
Maximum Standby Current	3	mA

**Pin Configurations<sup>[2]</sup>**

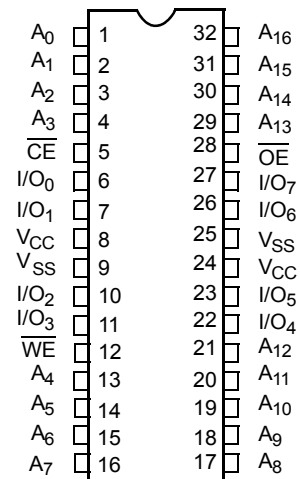
**48-ball VFBGA**

(Top View)



**SOJ/TSOPII**

Top View



**Note**

2. NC pins are not connected on the die.

**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>[3]</sup> ... -0.3V to + 4.6V  
 DC Voltage Applied to Outputs in High-Z State<sup>[3]</sup> ..... -0.3V to  $V_{CC} + 0.3V$

DC Input Voltage<sup>[3]</sup> ..... -0.3V to  $V_{CC} + 0.3V$   
 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	$V_{CC}$	Speed
Industrial	-40°C to +85°C	3.3V ± 0.3V	10 ns

**Electrical Characteristics** Over the Operating Range

Parameter	Description	Test Conditions	-10 (Industrial)		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		2.0	$V_{CC} + 0.3$	V
$V_{IL}$	Input LOW Voltage <sup>[3]</sup>		-0.3	0.8	V
$I_{IX}$	Input Leakage Current	$GND \leq V_I \leq V_{CC}$	-1	+1	µA
$I_{OZ}$	Output Leakage Current	$GND \leq V_I \leq V_{CC}$ , Output Disabled	-1	+1	µA
$I_{CC}$	$V_{CC}$ Operating Supply Current	$V_{CC} = \text{Max.}, I_{OUT} = 0 \text{ mA}, f = f_{MAX} = 1/t_{RC}$	100MHz	60	mA
			83MHz	55	mA
			66MHz	45	mA
			40MHz	30	mA
$I_{SB1}$	Automatic CE Power-down Current—TTL Inputs	Max. $V_{CC}, \overline{CE} \geq V_{IH}, V_{IN} \geq V_{IH}$ or $V_{IN} \leq V_{IL}, f = f_{MAX}$		10	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 $V_{IN} \leq 0.3V, f = 0$		3	mA

**Note**

3.  $V_{IL}(\text{min.}) = -2.0V$  and  $V_{IH}(\text{max.}) = V_{CC} + 1V$  for pulse durations of less than 5 ns.

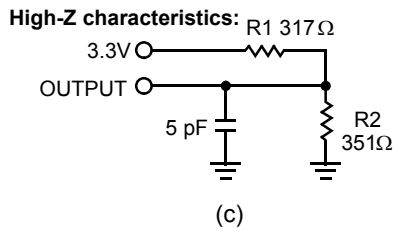
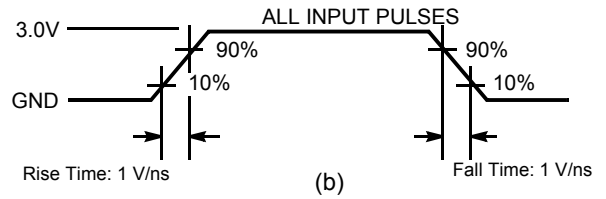
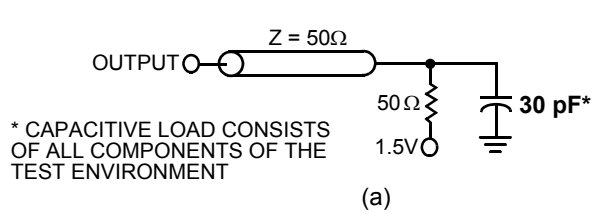
**Capacitance<sup>[4]</sup>**

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
$C_{OUT}$	Output Capacitance		8	pF

**Thermal Resistance<sup>[4]</sup>**

Parameter	Description	Test Conditions	SOJ	TSOP II	VFBGA	Unit
$\Theta_{JA}$	Thermal Resistance (Junction to Ambient)	Still Air, soldered on a 3 × 4.5 inch, four-layer printed circuit board	56.29	62.22	36	$^\circ\text{C/W}$
$\Theta_{JC}$	Thermal Resistance (Junction to Case)		38.14	21.43	9	$^\circ\text{C/W}$

**AC Test Loads and Waveforms<sup>[5]</sup>**



**Notes**

4. Tested initially and after any design or process changes that may affect these parameters.
5. AC characteristics (except High-Z) are tested using the load conditions shown in Figure (a). High-Z characteristics are tested for all speeds using the test load shown in Figure (c).

**Switching Characteristics** Over the Operating Range <sup>[6]</sup>

Parameter	Description	-10 (Industrial)		Unit
		Min.	Max.	
<b>Read Cycle</b>				
$t_{power}^{[7]}$	$V_{CC}$ (typical) to the first access	100		$\mu$ s
$t_{RC}$	Read Cycle Time	10		ns
$t_{AA}$	Address to Data Valid		10	ns
$t_{OHA}$	Data Hold from Address Change	3		ns
$t_{ACE}$	$\overline{CE}$ LOW to Data Valid		10	ns
$t_{DOE}$	$\overline{OE}$ LOW to Data Valid		5	ns
$t_{LZOE}$	$\overline{OE}$ LOW to Low Z	0		ns
$t_{HZOE}$	$\overline{OE}$ HIGH to High Z <sup>[8, 9]</sup>		5	ns
$t_{LZCE}$	$\overline{CE}$ LOW to Low Z <sup>[9]</sup>	3		ns
$t_{HZCE}$	$\overline{CE}$ HIGH to High Z <sup>[8, 9]</sup>		5	ns
$t_{PU}^{[10]}$	$\overline{CE}$ LOW to Power-Up	0		ns
$t_{PD}^{[10]}$	$\overline{CE}$ HIGH to Power-Down		10	ns
<b>Write Cycle<sup>[11, 12]</sup></b>				
$t_{WC}$	Write Cycle Time	10		ns
$t_{SCE}$	$\overline{CE}$ LOW to Write End	8		ns
$t_{AW}$	Address Set-Up to Write End	8		ns
$t_{HA}$	Address Hold from Write End	0		ns
$t_{SA}$	Address Set-Up to Write Start	0		ns
$t_{PWE}$	$\overline{WE}$ Pulse Width	7		ns
$t_{SD}$	Data Set-Up to Write End	5		ns
$t_{HD}$	Data Hold from Write End	0		ns
$t_{LZWE}$	$\overline{WE}$ HIGH to Low Z <sup>[9]</sup>	3		ns
$t_{HZWE}$	$\overline{WE}$ LOW to High Z <sup>[8, 9]</sup>		5	ns

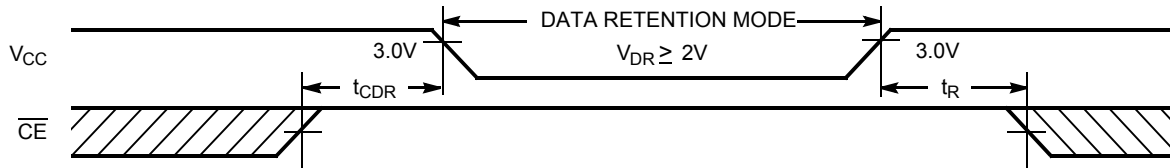
**Notes**

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.
7.  $t_{POWER}$  gives the minimum amount of time that the power supply should be at typical  $V_{CC}$  values until the first memory access can be performed
8.  $t_{HZOE}$ ,  $t_{HZCE}$ , and  $t_{HZWE}$  are specified with a load capacitance of 5 pF as in part (c) of AC Test Loads. Transition is measured when the outputs enter a high impedance state.
9. 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.
10. This parameter is guaranteed by design and is not tested.
11. 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 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.
12. 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)

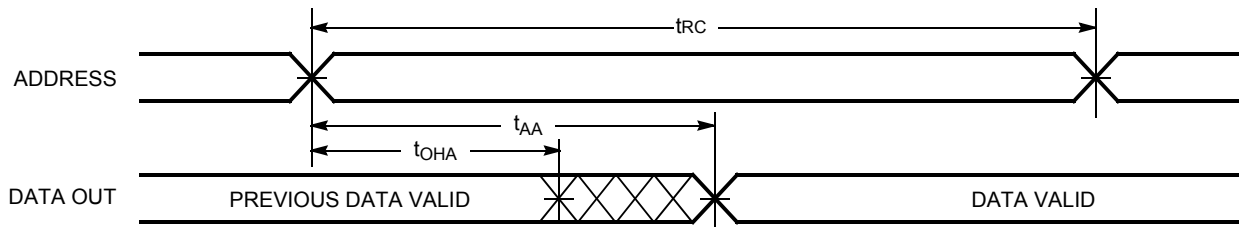
Parameter	Description	Conditions	Min.	Max.	Unit
$V_{DR}$	$V_{CC}$ for Data Retention		2.0		V
$I_{CCDR}$	Data Retention Current	$V_{CC} = V_{DR} = 2.0V, \overline{CE} \geq V_{CC} - 0.3V,$ $V_{IN} \geq V_{CC} - 0.3V$ or $V_{IN} \leq 0.3V$		3	mA
$t_{CDR}^{[4]}$	Chip Deselect to Data Retention Time		0		ns
$t_R^{[13]}$	Operation Recovery Time		$t_{RC}$		ns

**Data Retention Waveform**

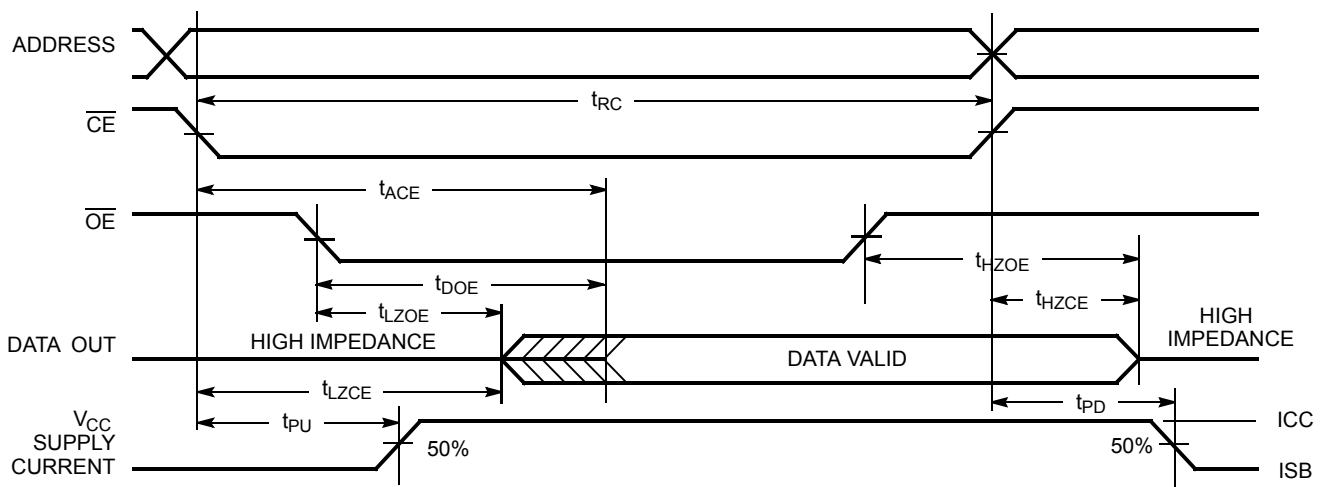


**Switching Waveforms**

**Read Cycle No. 1 (Address Transition Controlled)**<sup>[14, 15]</sup>



**Read Cycle No. 2 (OE Controlled)**<sup>[15, 16]</sup>

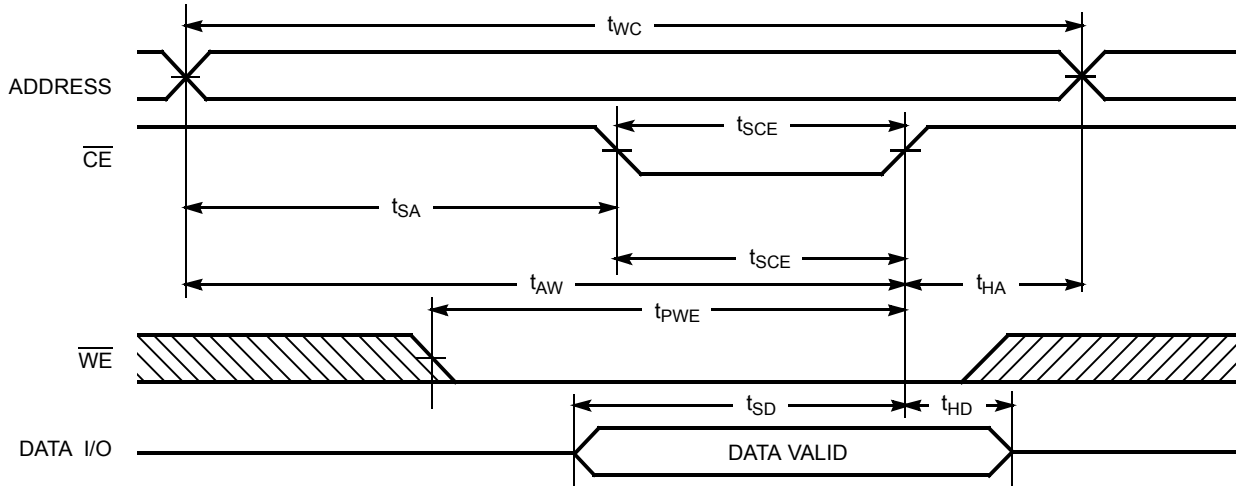


**Notes**

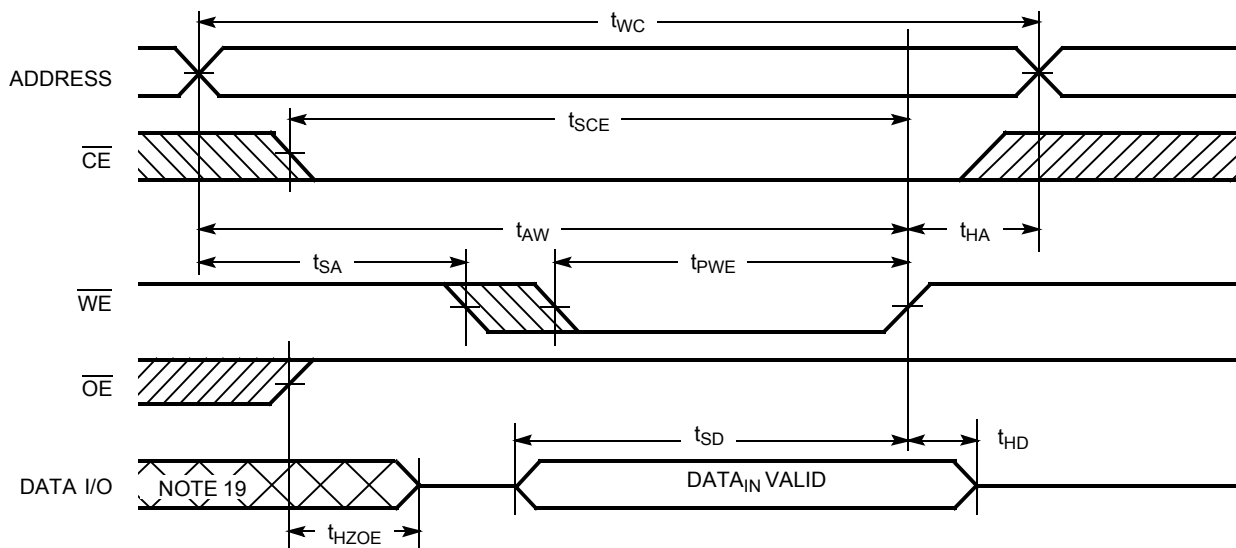
- 13. Full device operation requires linear  $V_{CC}$  ramp from  $V_{DR}$  to  $V_{CC(min.)} \geq 50 \mu s$  or stable at  $V_{CC(min.)} \geq 50 \mu s$ .
- 14. Device is continuously selected.  $OE, CE = V_{IL}$ .
- 15.  $WE$  is HIGH for Read cycle.
- 16. Address valid prior to or coincident with  $\overline{CE}$  transition LOW.

Switching Waveforms (continued)

Write Cycle No. 1 ( $\overline{CE}$  Controlled)<sup>[17, 18]</sup>



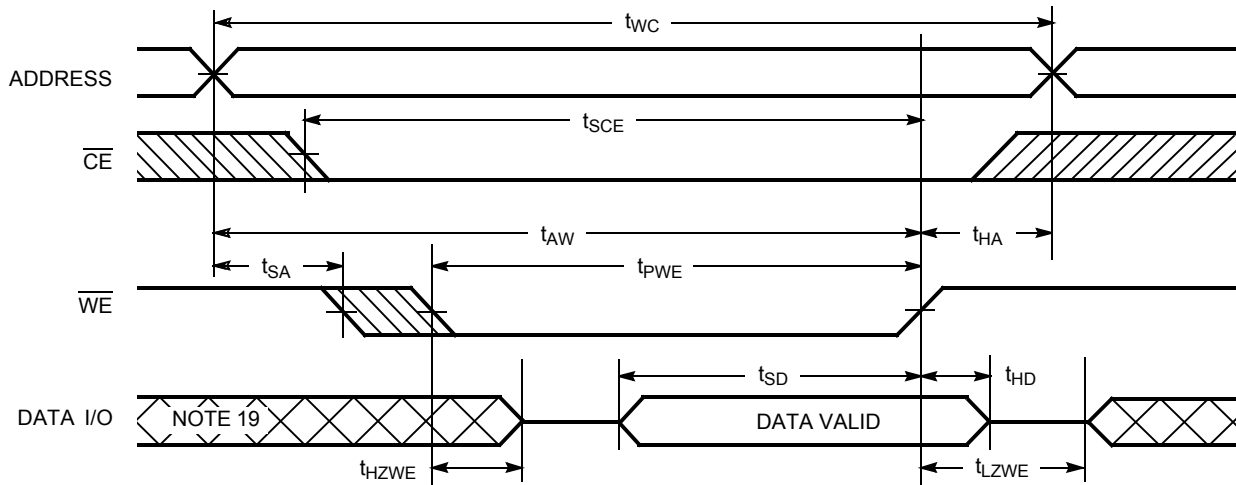
Write Cycle No. 2 ( $\overline{WE}$  Controlled,  $\overline{OE}$  HIGH During Write)<sup>[17, 18]</sup>



Notes

- 17. Data I/O is high impedance if  $\overline{OE} = V_{IH}$ .
- 18. If  $\overline{CE}$  goes HIGH simultaneously with  $\overline{WE}$  going HIGH, the output remains in a high-impedance state.
- 19. 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)**<sup>[12, 18]</sup>

**Truth Table**

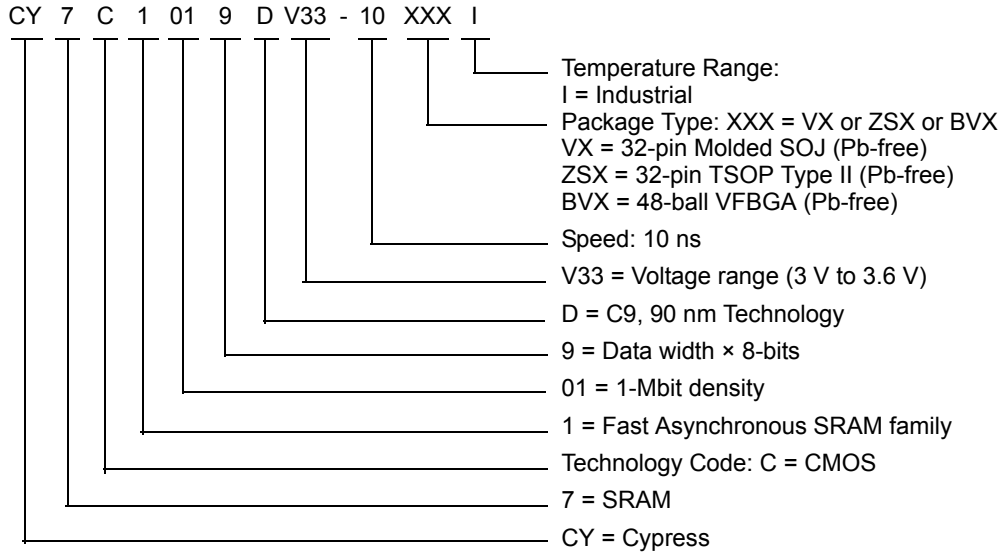
$\overline{CE}$	$\overline{OE}$	$\overline{WE}$	I/O <sub>0</sub> -I/O <sub>7</sub>	Mode	Power
H	X	X	High Z	Power-Down	Standby ( $I_{SB}$ )
L	L	H	Data Out	Read	Active ( $I_{CC}$ )
L	X	L	Data In	Write	Active ( $I_{CC}$ )
L	H	H	High Z	Selected, Outputs Disabled	Active ( $I_{CC}$ )



**Ordering Information**

Speed (ns)	Ordering Code	Package Diagram	Package Type	Operating Range
10	CY7C1019DV33-10VXI	51-85033	32-pin (400-Mil) Molded SOJ (Pb-free)	Industrial
	CY7C1019DV33-10ZSXI	51-85095	32-pin TSOP Type II (Pb-free)	
	CY7C1019DV33-10BVXI	51-85150	48-ball VFBGA (Pb-free)	

**Ordering Code Definitions**



Please contact your local Cypress sales representative for availability of these parts.

Package Diagrams

Figure 1. 32-pin (400-Mil) Molded SOJ (51-85033)

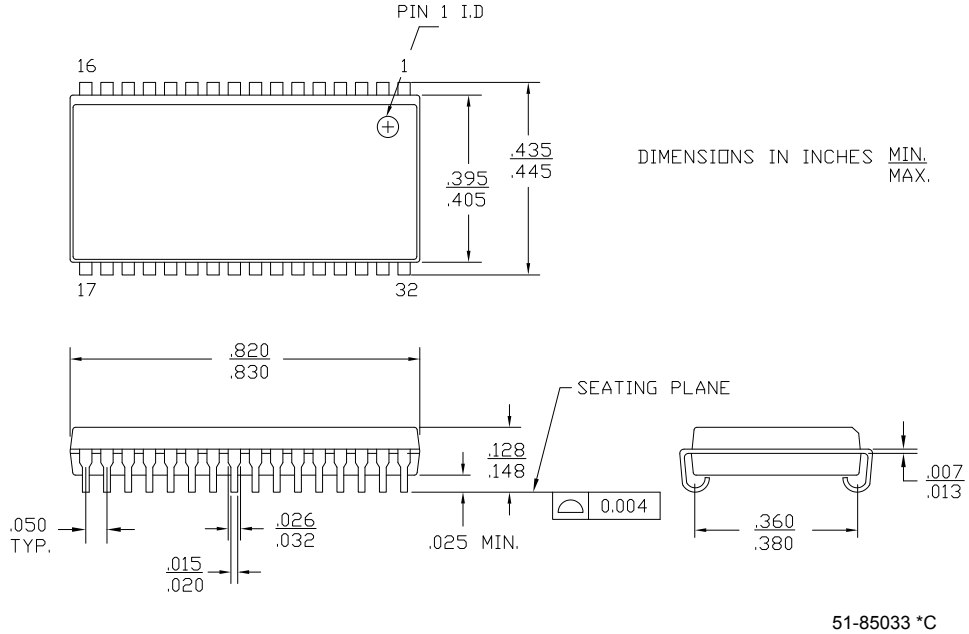
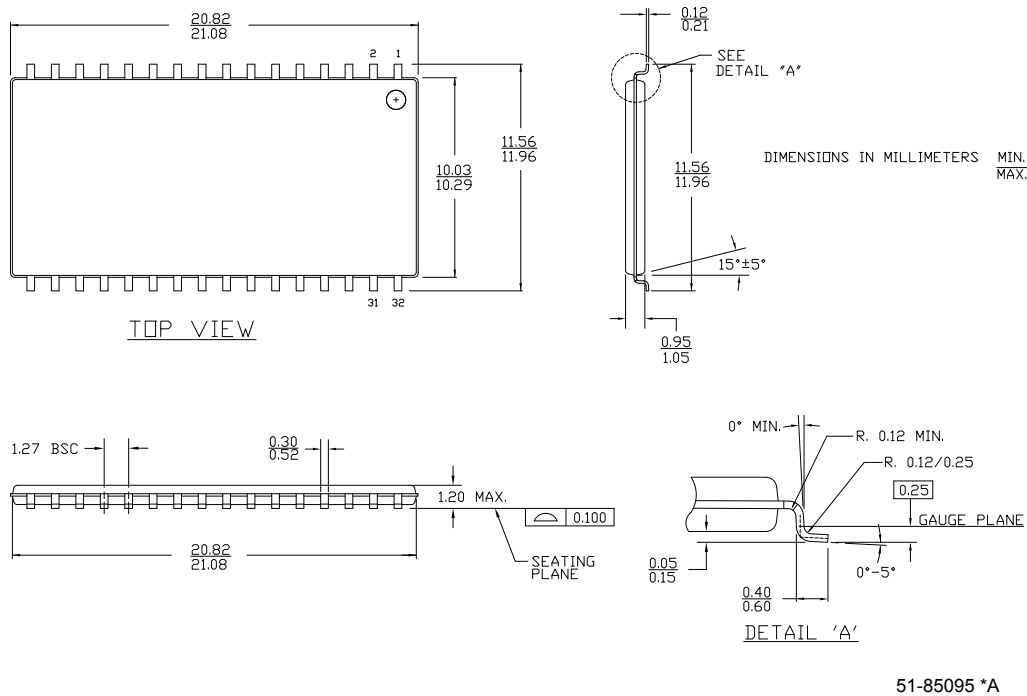
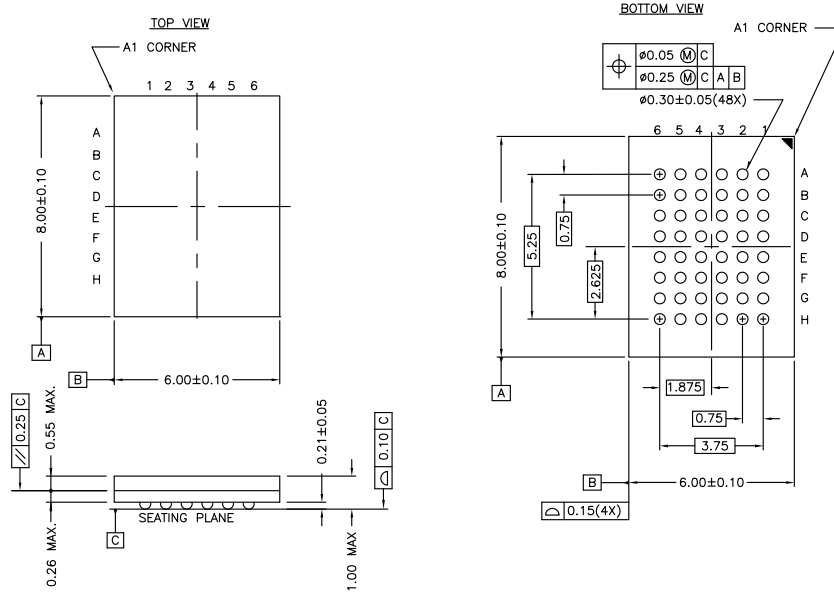


Figure 2. 32-pin Thin Small Outline Package Type II (51-85095)



Package Diagrams (continued)

Figure 3. 48-ball VFBGA (6 x 8 x 1 mm) (51-85150)



51-85150 \*F

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**Document History Page**

Document Title: CY7C1019DV33, 1-Mbit (128K x 8) Static RAM				
Document Number: 38-05481				
REV.	ECN NO.	Issue Date	Orig. of Change	Description of Change
**	201560	See ECN	SWI	Advance Information data sheet for C9 IPP
*A	233750	See ECN	RKF	DC parameters modified as per EROS (Spec # 01-02165 Rev *A) Pb-free Offering in Ordering Information
*B	262950	See ECN	RKF	Added Data Retention Characteristics table Added T <sub>power</sub> Spec in Switching Characteristics table Shaded Ordering Information
*C	307598	See ECN	RKF	Reduced Speed bins to -8 and -10 ns
*D	520652	See ECN	VKN	Converted from Preliminary to Final Removed Commercial Operating range Removed 8 ns speed bin Added I <sub>CC</sub> values for the frequencies 83MHz, 66MHz and 40MHz Added 48-ball VFBGA package Updated Thermal Resistance table Updated Ordering Information table Changed Overshoot spec from V <sub>CC</sub> +2V to V <sub>CC</sub> +1V in footnote #3
*E	3110052	12/14/2010	AJU	Added Ordering Code Definitions. Updated Package Diagrams.

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