

# 16K x 1 Static RAM

## Features

- Automatic power-down when deselected
- CMOS for optimum speed/power
- High speed
  - 15 ns
- Low active power
  - 495 mW
- Low standby power
  - 220 mW
- TTL-compatible inputs and outputs
- Capable of withstanding greater than 2001V electrostatic discharge
- $V_{IH}$  of 2.2V

## Functional Description

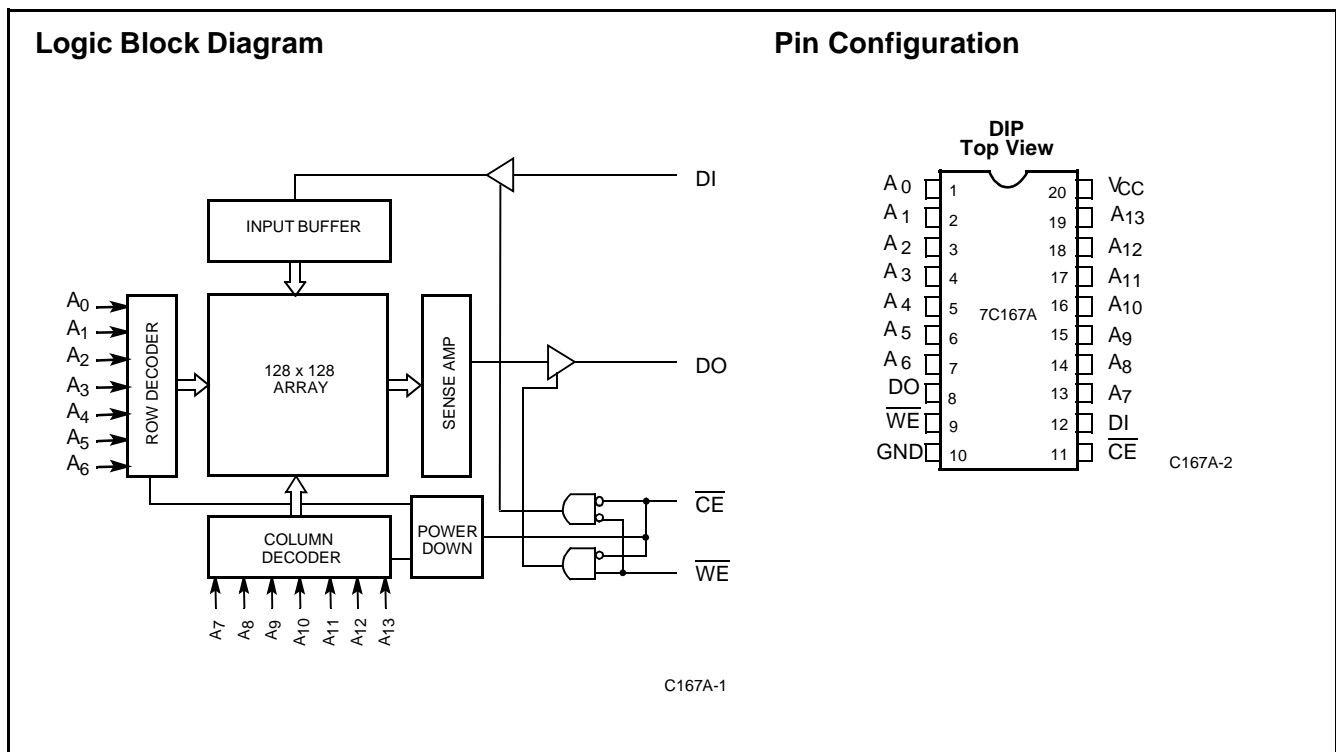
The CY7C167A is a high-performance CMOS static RAM organized as 16,384 words by 1 bit. Easy memory expansion is provided by an active LOW Chip Enable ( $\overline{CE}$ ) and three-state drivers. The CY7C167A has an automatic power-down feature, reducing the power consumption by 67% when deselected.

Writing to the device is accomplished when the Chip Select ( $\overline{CE}$ ) and Write Enable ( $\overline{WE}$ ) inputs are both LOW. Data on the input pin (DI) is written into the memory location specified on the address pins ( $A_0$  through  $A_{13}$ ).

Reading the device is accomplished by taking the Chip Enable ( $\overline{CE}$ ) LOW, while ( $\overline{WE}$ ) remains HIGH. Under these conditions, the contents of the location specified on the address pins will appear on the data output (DO) pin.

The output pin remains in a high-impedance state when Chip Enable is HIGH, or Write Enable ( $\overline{WE}$ ) is LOW.

A die coat is used to insure alpha immunity.



## Selection Guide

	7C167A-15	7C167A-20	7C167A-25	7C167A-35	7C167A-45
Maximum Access Time (ns)	15	20	25	35	45
Maximum Operating Current (mA)	90	90	90	90	90

**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 to Ground Potential (Pin 20 to Pin 10).....	-0.5V to +7.0V
DC Voltage Applied to Outputs in High Z State .....	-0.5V to +7.0V

DC Input Voltage .....	-3.0V to +7.0V
Output 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 <sup>[1]</sup>	V <sub>CC</sub>
Commercial	0°C to +70°C	5V ± 10%

**Electrical Characteristics** Over the Operating Range

Parameter	Description	Test Conditions	7C167A-15		7C167A-20		7C167A-25		Unit
			Min.	Max.	Min.	Max.	Min.	Max.	
V <sub>OH</sub>	Output High Voltage	V <sub>CC</sub> = Min., I <sub>OH</sub> = -4.0 mA	2.4		2.4		2.4		V
V <sub>OL</sub>	Output Low Voltage	V <sub>CC</sub> = Min., I <sub>OL</sub> = 12.0 mA, 8.0 mA Mil		0.4		0.4		0.4	V
V <sub>IH</sub>	Input High Voltage		2.2	V <sub>CC</sub>	2.2	V <sub>CC</sub>	2.2	V <sub>CC</sub>	V
V <sub>IL</sub>	Input Low Voltage <sup>[2]</sup>		-0.5	0.8	-0.5	0.8	-0.5	0.8	V
I <sub>IX</sub>	Input Load Current	GND ≤ V <sub>I</sub> ≤ V <sub>CC</sub>	-10	+10	-10	+10	-10	+10	μA
I <sub>OZ</sub>	Output Leakage Current	GND ≤ V <sub>O</sub> ≤ V <sub>CC</sub> Output Disabled	-10	+10	-10	+10	-10	+10	μA
I <sub>OS</sub>	Output Short Circuit Current <sup>[3]</sup>	V <sub>CC</sub> = Max., V <sub>OUT</sub> = GND		-350		-350		-350	mA
I <sub>CC</sub>	V <sub>CC</sub> Operating Supply Current	V <sub>CC</sub> = Max., I <sub>OUT</sub> = 0 mA		90		90		90	mA
I <sub>SB</sub>	Automatic CE Power-Down Current <sup>[4]</sup>	Max. V <sub>CC</sub> , CE ≥ V <sub>IH</sub>		40		40		20	mA

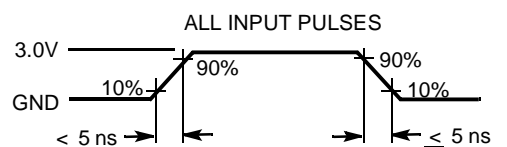
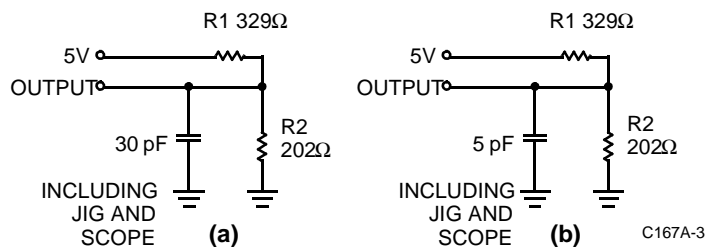
Parameter	Description	Test Conditions	7C167A-35		7C167A-45		Unit
			Min.	Max.	Min.	Max.	
V <sub>OH</sub>	Output High Voltage	V <sub>CC</sub> = Min., I <sub>OH</sub> = -4.0 mA	2.4		2.4		V
V <sub>OL</sub>	Output Low Voltage	V <sub>CC</sub> = Min., I <sub>OL</sub> = 12.0 mA, 8.0 mA Mil		0.4		0.4	V
V <sub>IH</sub>	Input High Voltage		2.2	V <sub>CC</sub>	2.2	V <sub>CC</sub>	V
V <sub>IL</sub>	Input Low Voltage <sup>[2]</sup>		-0.5	0.8	-0.5	0.8	V
I <sub>IX</sub>	Input Load Current	GND ≤ V <sub>I</sub> ≤ V <sub>CC</sub>	-10	+10	-10	+10	μA
I <sub>OZ</sub>	Output Leakage Current	GND ≤ V <sub>O</sub> ≤ V <sub>CC</sub> Output Disabled	-10	+10	-10	+10	μA
I <sub>OS</sub>	Output Short Circuit Current <sup>[3]</sup>	V <sub>CC</sub> = Max., V <sub>OUT</sub> = GND		-350		-350	mA
I <sub>CC</sub>	V <sub>CC</sub> Operating Supply Current	V <sub>CC</sub> = Max., I <sub>OUT</sub> = 0 mA		90		90	mA
I <sub>SB</sub>	Automatic CE Power-Down Current <sup>[4]</sup>	Max. V <sub>CC</sub> , CE ≥ V <sub>IH</sub>		20		20	mA

**Notes:**

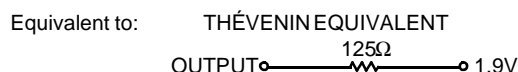
1. T<sub>A</sub> is the case temperature.
2. V<sub>IL</sub> min. = -3.0V for pulse durations less than 30 ns.
3. Duration of the short circuit should not exceed 30 seconds.
4. A pull-up resistor to V<sub>CC</sub> on the CE input is required to keep the device deselected during V<sub>CC</sub> power-up, otherwise I<sub>SB</sub> will exceed values given.

**Capacitance<sup>[5]</sup>**

Parameter	Description	Test Conditions	Max.	Unit
C <sub>IN</sub>	Input Capacitance	T <sub>A</sub> = 25°C, f = 1 MHz, V <sub>CC</sub> = 5.0V	10	pF
C <sub>OUT</sub>	Output Capacitance		10	pF
C <sub>CE</sub>	Chip Enable Capacitance		6	pF

**AC Test Loads and Waveforms**


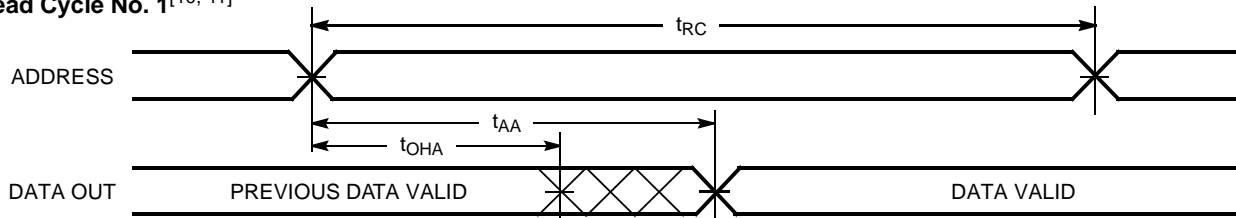
C167A-4


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

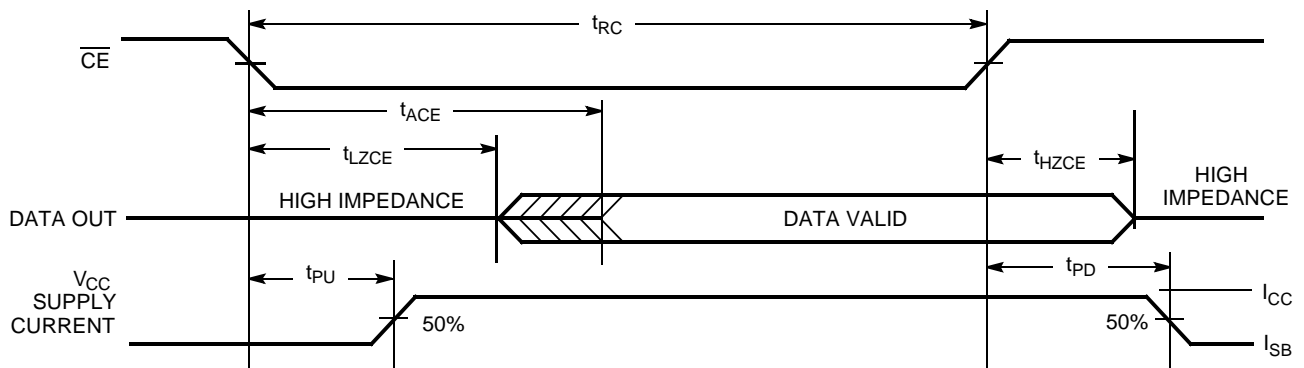
Parameter	Description	7C167A-15		7C167A-20		7C167A-25		7C167A-35		7C167A-45		Unit
		Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
<b>READ CYCLE</b>												
t <sub>RC</sub>	Read Cycle Time	15		20		25		30				ns
t <sub>AA</sub>	Address to Data Valid		15		20		25		30			ns
t <sub>OHA</sub>	Data Hold from Address Change	5		5		5		5		5		ns
t <sub>ACE</sub>	$\overline{CE}$ LOW to Data Valid		15		20		25		35		45	ns
t <sub>LZCE</sub>	$\overline{CE}$ LOW to Low Z <sup>[7]</sup>	5		5		5		5		5		ns
t <sub>HZCE</sub>	$\overline{CE}$ HIGH to High Z <sup>[7, 8]</sup>		8		8		10		15		15	ns
t <sub>PU</sub>	$\overline{CE}$ LOW to Power-Up	0		0		0		0		0		ns
t <sub>PD</sub>	$\overline{CE}$ HIGH to Power-Down		15		20		20		20		25	ns
<b>WRITE CYCLE<sup>[9]</sup></b>												
t <sub>WC</sub>	Write Cycle Time	15		20		20		25		40		ns
t <sub>SCE</sub>	$\overline{CE}$ LOW to Write End	12		15		20		25		30		ns
t <sub>AW</sub>	Address Set-Up to Write End	12		15		20		25		30		ns
t <sub>HA</sub>	Address Hold from Write End	0		0		0		0		0		ns
t <sub>SA</sub>	Address Set-Up to Write Start	0		0		0		0		0		ns
t <sub>PWE</sub>	$\overline{WE}$ Pulse Width	12		15		15		20		20		ns
t <sub>SD</sub>	Data Set-Up to Write End	10		10		10		15		15		ns
t <sub>HD</sub>	Data Hold from Write End	0		0		0		0		0		ns
t <sub>HZWE</sub>	$\overline{WE}$ LOW to High Z <sup>[7, 8]</sup>		7		7		7		10		15	ns
t <sub>LZWE</sub>	$\overline{WE}$ HIGH to Low Z <sup>[7]</sup>	5		5		5		5		5		ns

**Notes:**

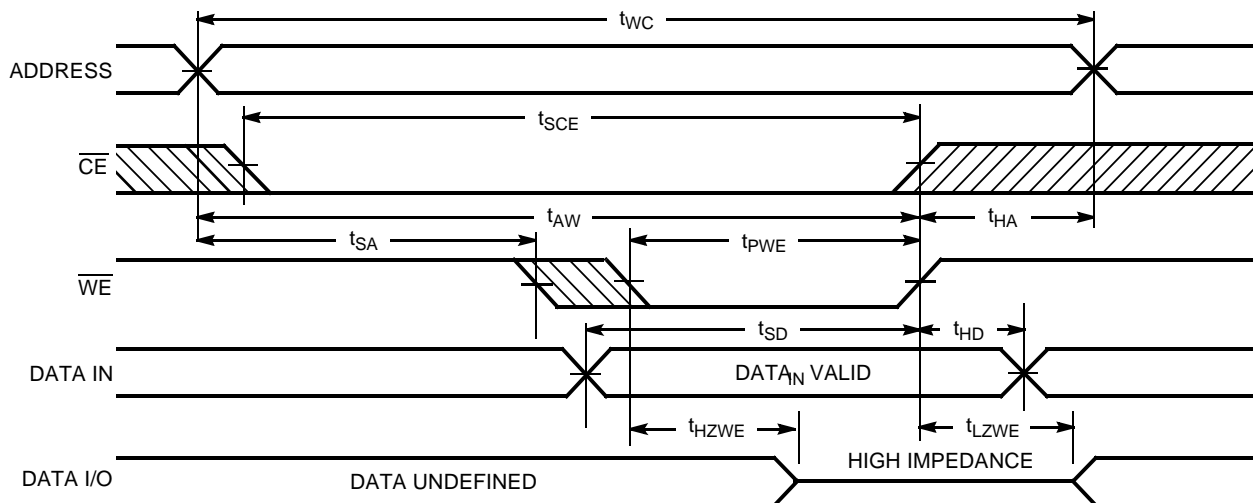
- Tested initially and after any design or process changes that may affect these parameters.
- Test conditions assume signal transition times of 5 ns or less, timing reference levels of 1.5V, input pulse levels of 0 to 3.0V, and output loading of the specified I<sub>OL</sub>/I<sub>OH</sub> and 30-pF load capacitance.
- At any given temperature and voltage condition, t<sub>HZ</sub> is less than t<sub>LZ</sub> for any given device.
- t<sub>HZCE</sub> and t<sub>HZWE</sub> are tested with C<sub>L</sub> = 5 pF as in part (b) of AC Test Loads. Transition is measured ±500 mV from steady state voltage.
- The internal write time of the memory is defined by the overlap of  $\overline{CE}$  LOW and  $\overline{WE}$  LOW. Both signal must be LOW to initiate a write and either signal can terminate a write by going HIGH. The data input set-up and hold timing should be referenced to the rising edge of the signal that terminates the write.

**Switching Waveforms**
**Read Cycle No. 1<sup>[10, 11]</sup>**


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**Read Cycle No. 2<sup>[10, 12]</sup>**


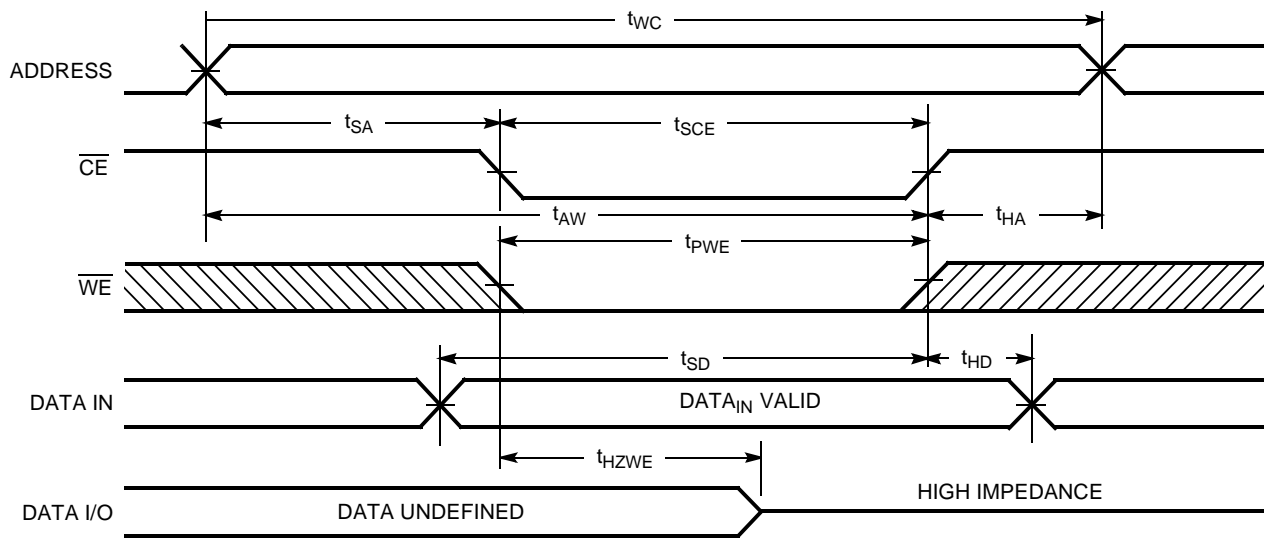
C167A-6

**Write Cycle No. 1 (WE Controlled)<sup>[9]</sup>**


C167A-7

**Notes:**

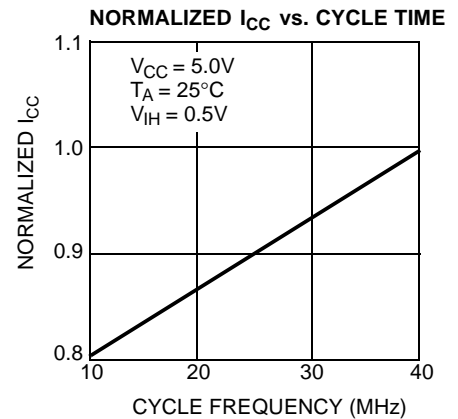
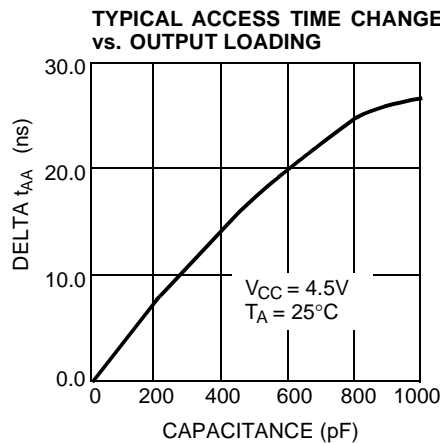
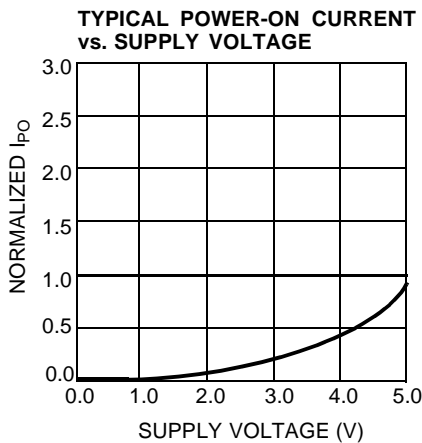
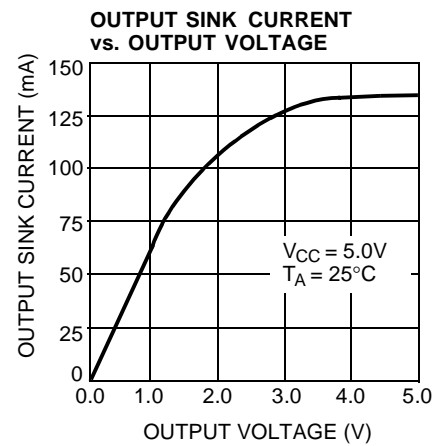
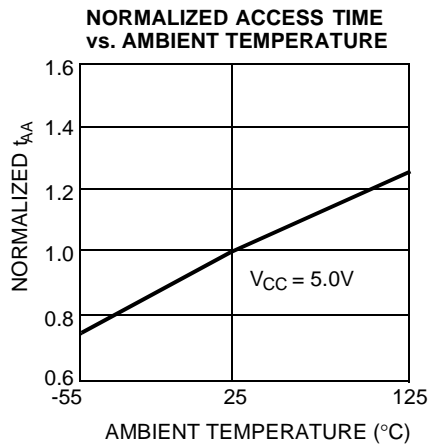
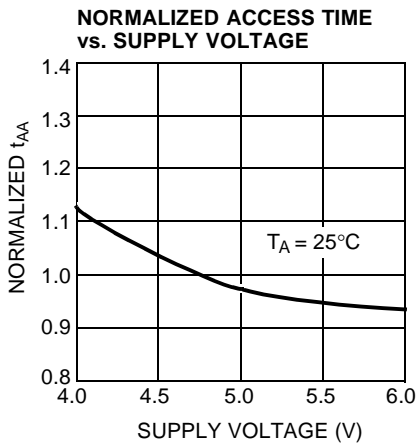
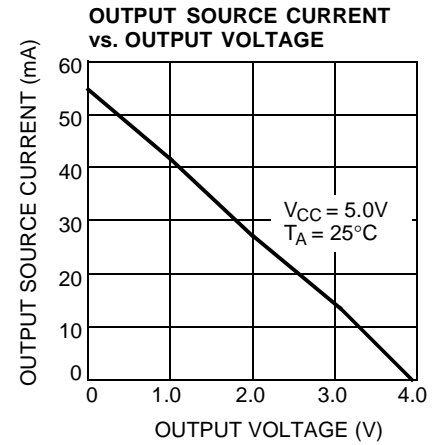
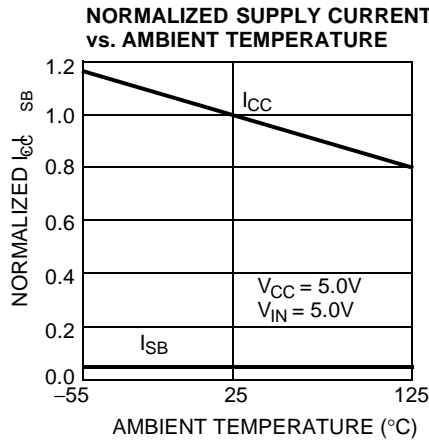
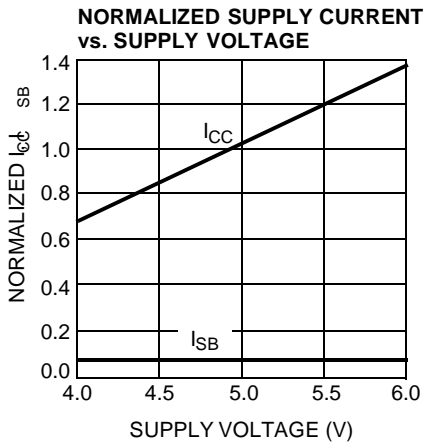
10. WE is high for read cycle.
11. Device is continuously selected,  $\overline{CE} = V_{IL}$ .
12. Address valid prior to or coincident with CE transition LOW.

**Switching Waveforms (continued)**
**Write Cycle No. 2 ( $\overline{CE}$  Controlled)<sup>[9, 13]</sup>**


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**Note:**

13. If  $\overline{CE}$  goes HIGH simultaneously with  $\overline{WE}$  HIGH, the output remains in a high-impedance state.

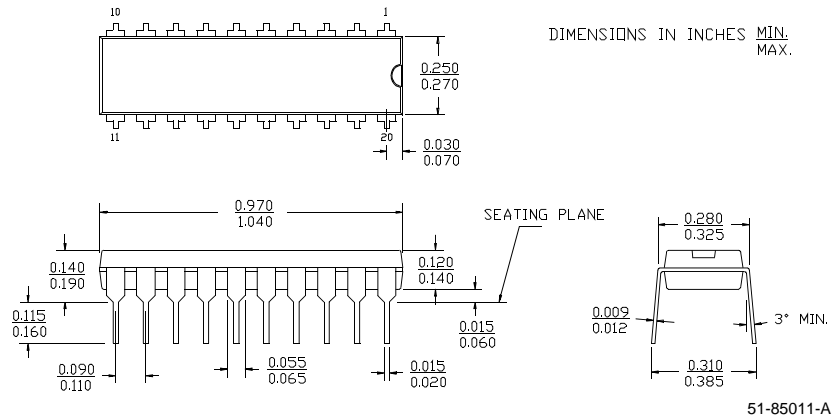
**Typical DC and AC Characteristics**


**Ordering Information**

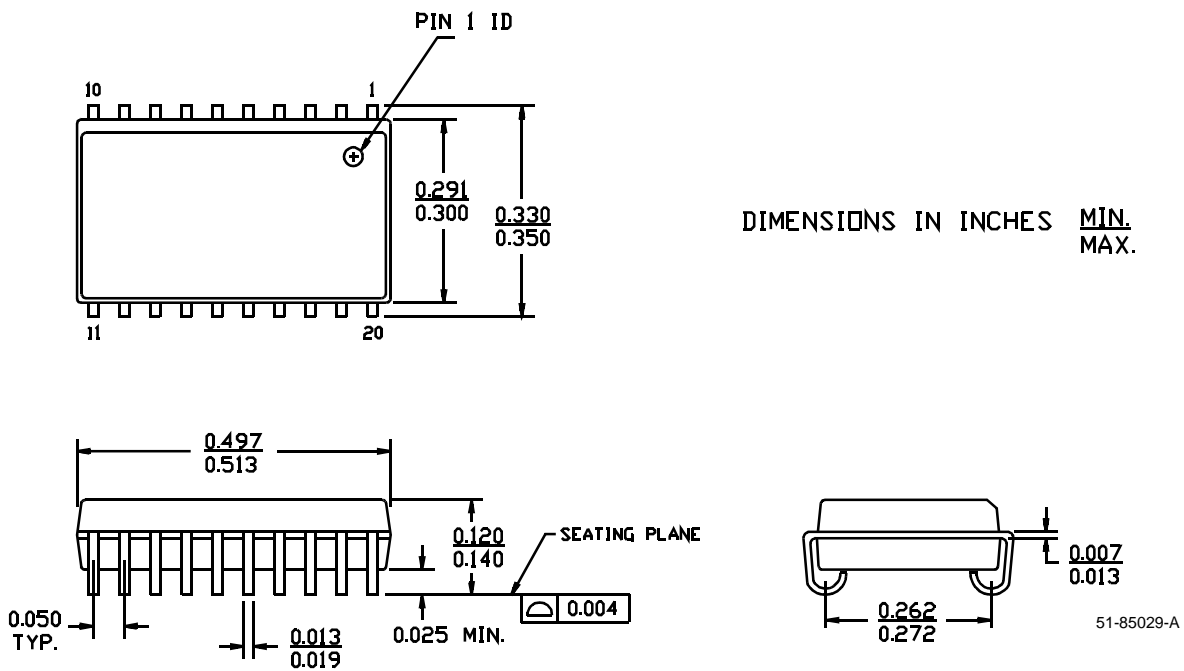
Speed (ns)	I <sub>CC</sub> (mA)	Ordering Code	Package Name	Package Type	Operating Range
15	80	CY7C167A-15PC	P5	20-Lead (300-Mil) Molded DIP	Commercial
		CY7C167A-15VC	V5	20-Lead Molded SOJ	
20	80	CY7C167A-20PC	P5	20-Lead (300-Mil) Molded DIP	Commercial
		CY7C167A-20VC	V5	20-Lead Molded SOJ	
25	60	CY7C167A-25PC	P5	20-Lead (300-Mil) Molded DIP	Commercial
		CY7C167A-25VC	V5	20-Lead Molded SOJ	
35	60	CY7C167A-35PC	P5	20-Lead (300-Mil) Molded DIP	Commercial
		CY7C167A-35VC	V5	20-Lead Molded SOJ	
45	50	CY7C167A-45PC	P5	20-Lead (300-Mil) Molded DIP	Commercial
		CY7C167A-45VC	V5	20-Lead Molded SOJ	

Package Diagrams

20-Lead (300-Mil) Molded DIP P5



20-Lead (300-Mil) Molded SOJ V5





<b>Document Title: CY7C167A 16K x 1 Static RAM</b> <b>Document Number: 38-05027</b>				
<b>REV.</b>	<b>ECN NO.</b>	<b>Issue Date</b>	<b>Orig. of Change</b>	<b>Description of Change</b>
**	106813	09/10/01	SZV	Change from Spec number: 38-00093 to 38-05027