



CYPRESS SEMICONDUCTOR

T-46-23-05

CY7C167A

16,384 x 1 Static RAM

Features

- Automatic power-down when deselected
- CMOS for optimum speed/power
- High speed
— 15 ns
- Low active power
— 275 mW
- Low standby power
— 83 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.

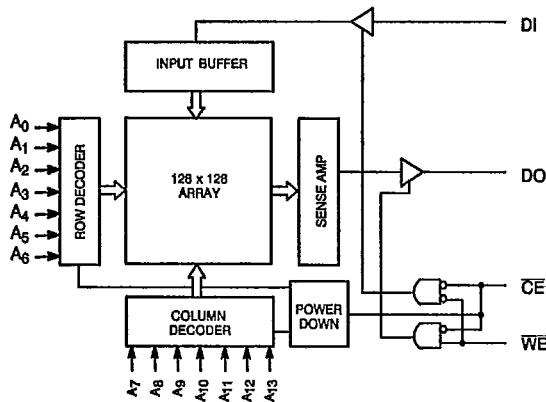
Writing to the device is accomplished when the chip select (\overline{CE}) and write enable (\overline{WE}) inputs are both LOW. Data on the input pin (DI) is written into the memory location specified on the address pins (A_0 through A_{13}).

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 locations 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.

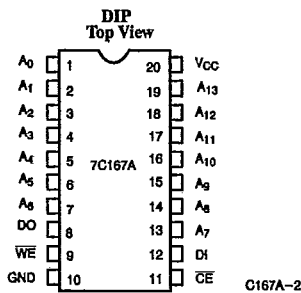
A die coat is used to insure alpha immunity.

Logic Block Diagram

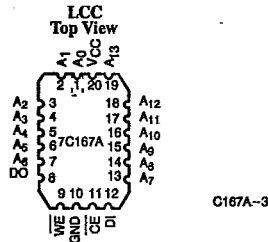


C167A-1

Pin Configurations



C167A-2



C167A-3

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)	Commercial	90	80	60	60	50
	Military		80	70	60	50



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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	V _{CC}
Commercial	0°C to +70°C	5V ± 10%
Military ^[1]	- 55°C to +125°C	5V ± 10%



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Electrical Characteristics Over the Operating Range^[2]

Parameters	Description	Test Conditions	7C167A-15		7C167A-20		7C167A-25		Units
			Min.	Max.	Min.	Max.	Min.	Max.	
V _{OH}	Output High Voltage	V _{CC} = Min., I _{OH} = -4.0 mA	2.4		2.4		2.4		V
V _{OL}	Output Low Voltage	V _{CC} = Min., I _{OL} = 12.0 mA, 8.0 mA Mil		0.4		0.4		0.4	V
V _{IH}	Input High Voltage		2.2	V _{CC}	2.2	V _{CC}	2.2	V _{CC}	V
V _{IL}	Input Low Voltage ^[3]		- 0.5	0.8	- 0.5	0.8	- 0.5	0.8	V
I _{IX}	Input Load Current	GND ≤ V _I ≤ V _{CC}	-10	+10	-10	+10	-10	+10	µA
I _{OZ}	Output Leakage Current	GND ≤ V _O ≤ V _{CC} Output Disabled	-10	+10	-10	+10	-10	+10	µA
I _{OS}	Output Short Circuit Current ^[4]	V _{CC} = Max., V _{OUT} = GND		-350		-350		-350	mA
I _{CC}	V _{CC} Operating Supply Current	V _{CC} = Max., I _{OUT} = 0 mA	Com'l	90		80		60	mA
			Mil			80		70	
I _{SB}	Automatic CE Power-Down Current ^[5]	Max. V _{CC} , CE ≥ V _{IH}	Com'l	40		40		20	mA
			Mil			40		20	

Parameters	Description	Test Conditions	7C167A-35		7C167A-45		Units
			Min.	Max.	Min.	Max.	
V _{OH}	Output High Voltage	V _{CC} = Min., I _{OH} = -4.0 mA	2.4		2.4		V
V _{OL}	Output Low Voltage	V _{CC} = Min., I _{OL} = 12.0 mA, 8.0 mA Mil		0.4		0.4	V
V _{IH}	Input High Voltage		2.2	V _{CC}	2.2	V _{CC}	V
V _{IL}	Input Low Voltage ^[3]		- 0.5	0.8	- 0.5	0.8	V
I _{IX}	Input Load Current	GND ≤ V _I ≤ V _{CC}	-10	+10	-10	+10	µA
I _{OZ}	Output Leakage Current	GND ≤ V _O ≤ V _{CC} Output Disabled	-10	+10	-10	+10	µA
I _{OS}	Output Short Circuit Current ^[4]	V _{CC} = Max., V _{OUT} = GND		-350		-350	mA
I _{CC}	V _{CC} Operating Supply Current	V _{CC} = Max., I _{OUT} = 0 mA	Com'l	60		50	mA
			Mil		60		
I _{SB}	Automatic CE Power-Down Current ^[5]	Max. V _{CC} , CE ≥ V _{IH}	Com'l	20		15	mA
			Mil		20		

- Notes:**
1. T_A is the "instant on" case temperature.
 2. See the last page of this specification for Group A subgroup testing information.
 3. V_{IL} min. = -3.0V for pulse durations less than 30 ns.
 4. Duration of the short circuit should not exceed 30 seconds.
 5. A pull-up resistor to V_{CC} on the CE input is required to keep the device deselected during V_{CC} power-up, otherwise I_{SB} will exceed values given.



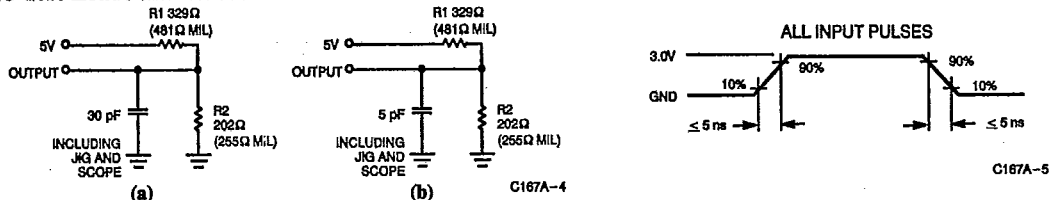
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Capacitance^[6]

Parameters	Description	Test Conditions	Max.	Units
C _{IN}	Input Capacitance	T _A = 25°C, f = 1 MHz, V _{CC} = 5.0V	10	pF
C _{OUT}	Output Capacitance		10	pF
C _{CE}	Chip Enable Capacitance		6	pF

AC Test Loads and Waveforms



Switching Characteristics Over the Operating Range^[2, 7]

Parameters	Description	7C167A-15		7C167A-20		7C167A-25		7C167A-35		7C167A-45		Units
		Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
READ CYCLE												
t _{RC}	Read Cycle Time	Com'l	15	20	25	30	40					ns
		Mil		20	25	35	40					ns
t _{AA}	Address to Data Valid	Com'l		15	20	25	30	40				ns
		Mil			20	25	35	40				ns
t _{OHA}	Data Hold from Address Change	5	5	5	5	5	5	5	5			ns
t _{ACE}	CE LOW to Data Valid		15	20	25	35	45					ns
t _{LZCE}	CE LOW to Low Z ^[8]	5	5	5	5	5	5	5	5			ns
t _{HZCE}	CE HIGH to High Z ^[8, 9]		8	8	10	15	15					ns
t _{PU}	CE LOW to Power-Up	0	0	0	0	0	0	0	0			ns
t _{PD}	CE HIGH to Power-Down		15	20	20	20	25					ns
WRITE CYCLE^[10]												
t _{WC}	Write Cycle Time	15	20	20	25	40						ns
t _{SCE}	CE LOW to Write End	12	15	20	25	30						ns
t _{AW}	Address Set-Up to Write End	12	15	20	25	30						ns
t _{HA}	Address Hold from Write End	0	0	0	0	0						ns
t _{SA}	Address Set-Up to Write Start	0	0	0	0	0						ns
t _{PWE}	WE Pulse Width	12	15	15	20	20						ns
t _{SD}	Data Set-Up to Write End	10	10	10	15	15						ns
t _{HD}	Data Hold from Write End	0	0	0	0	0						ns
t _{HZWE}	WE LOW to High Z ^[8, 9]		7	7	7	10	15					ns
t _{LZWE}	WE HIGH to Low Z ^[8]	5	5	5	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_{OL}/I_{OH} and 30-pF load capacitance.
- At any given temperature and voltage condition, t_{HZ} is less than t_{LZ} for any given device.
- t_{HZCE} and t_{HZWE} are tested with C_L = 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 CE LOW and 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 timings should be referenced to the rising edge of the signal that terminates the write.

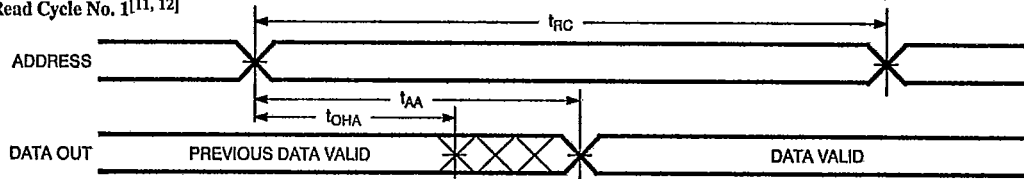


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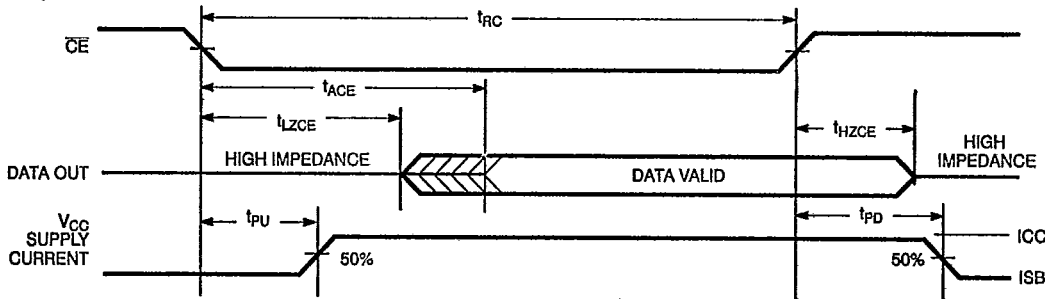
Switching Waveforms

Read Cycle No. 1^[11, 12]



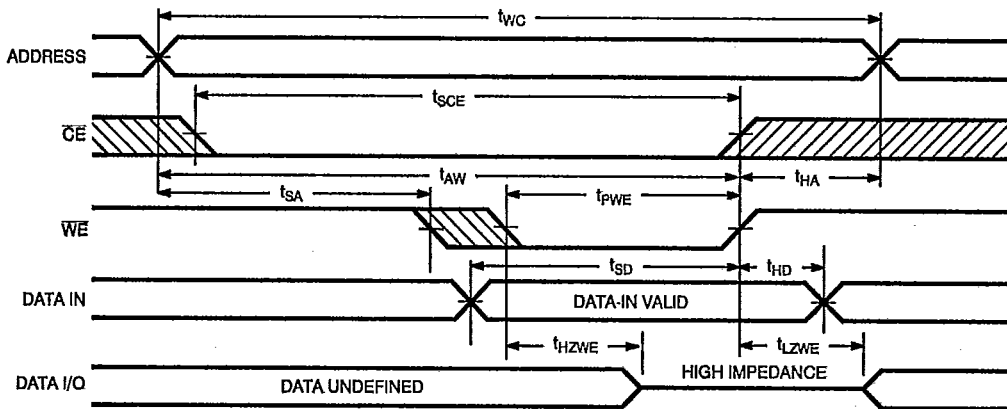
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Read Cycle No. 2^[11, 13]



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Write Cycle No. 1 (\overline{WE} Controlled)^[10]



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Notes:

- 11. \overline{WE} is high for read cycle.
- 12. Device is continuously selected, $\overline{CE} = V_{IL}$.
- 13. Address valid prior to or coincident with \overline{CE} transition LOW.
- 14. If \overline{CE} goes HIGH simultaneously with \overline{WE} HIGH, the output remains in a high-impedance state.

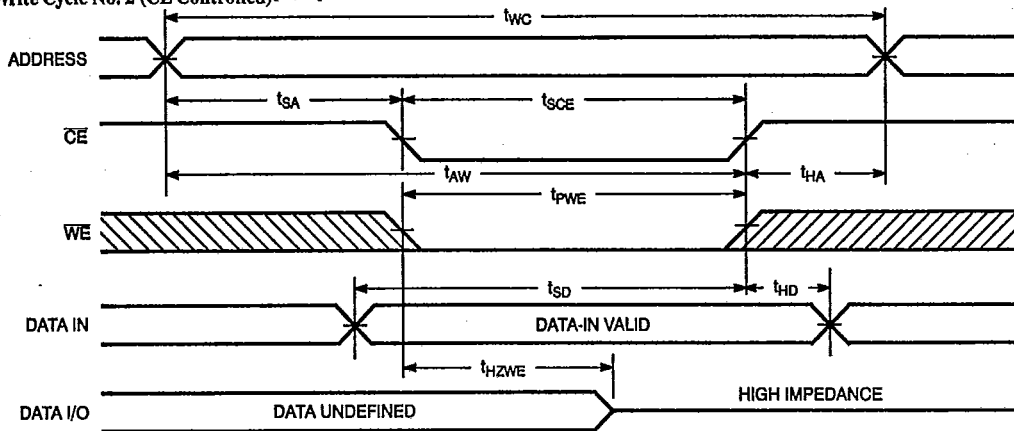




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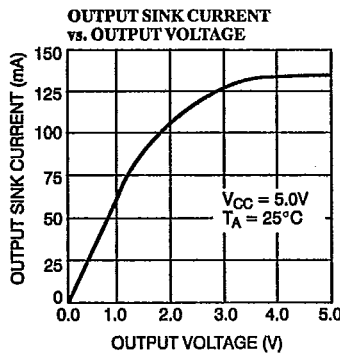
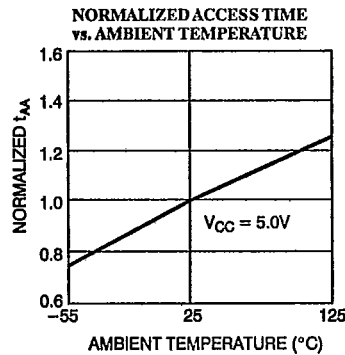
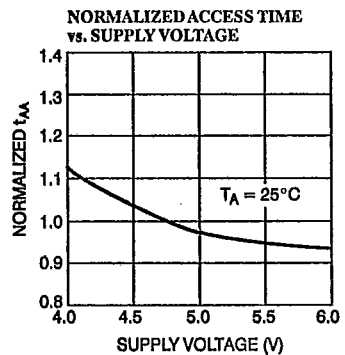
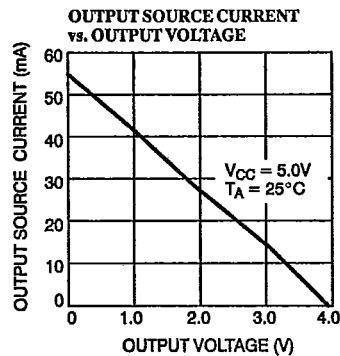
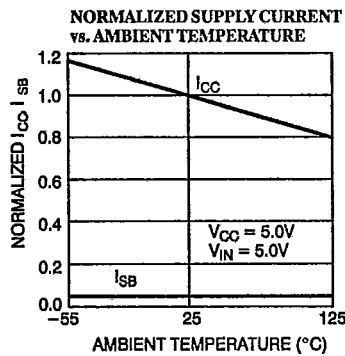
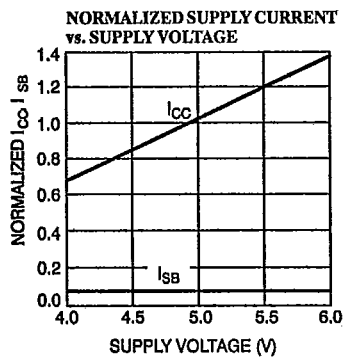
Switching Waveforms (continued)

Write Cycle No. 2 (CE Controlled) [10, 14]



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Typical DC and AC Characteristics

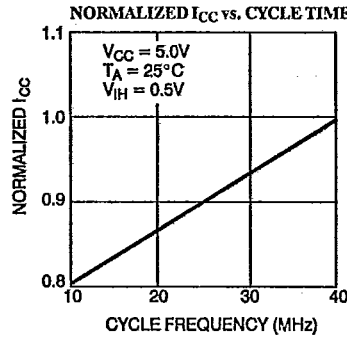
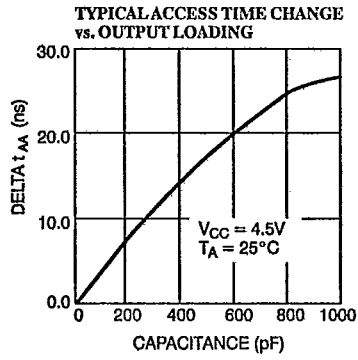
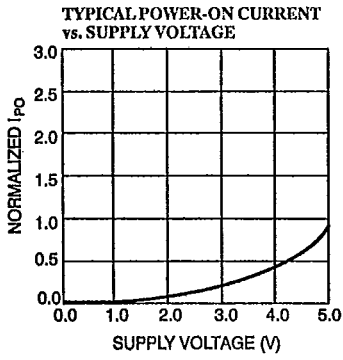




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Typical DC and AC Characteristics (continued)



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Ordering Information

Speed (ns)	ICC (mA)	Ordering Code	Package Type	Operating Range
15	80	CY7C167A-15PC	P5	Commercial
		CY7C167A-15DC	D6	
		CY7C167A-15VC	V5	
20	80	CY7C167A-20PC	P5	Commercial
		CY7C167A-20DC	D6	
		CY7C167A-20LC	L51	
		CY7C167A-20VC	V5	
		CY7C167A-20DMB	D6	Military
		CY7C167A-20LMB	L51	
		CY7C167A-20KMB	K71	
25	60	CY7C167A-25PC	P5	Commercial
		CY7C167A-25DC	D6	
		CY7C167A-25LC	L51	
		CY7C167A-25VC	V5	
		CY7C167A-25DMB	D6	Military
		CY7C167A-25LMB	L51	
		CY7C167A-25KMB	K71	

Speed (ns)	ICC (mA)	Ordering Code	Package Type	Operating Range
35	60	CY7C167A-35PC	P5	Commercial
		CY7C167A-35DC	D6	
		CY7C167A-35LC	L51	
		CY7C167A-35VC	V5	Military
		CY7C167A-35DMB	D6	
		CY7C167A-35LMB	L51	
45	50	CY7C167A-45PC	P5	Commercial
		CY7C167A-45DC	D6	
		CY7C167A-45LC	L51	
		CY7C167A-45VC	V5	Military
		CY7C167A-45DMB	D6	
		CY7C167A-45LMB	L51	
		CY7C167A-45KMB	K71	



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MILITARY SPECIFICATIONS
Group A Subgroup Testing
DC Characteristics

Parameters	Subgroups
V _{OH}	1,2,3
V _{OL}	1,2,3
V _{IH}	1,2,3
V _{IL Max.}	1,2,3
I _{IX}	1,2,3
I _{OZ}	1,2,3
I _{CC}	1,2,3
I _{SB}	1,2,3

Switching Characteristics

Parameters	Subgroups
READ CYCLE	
t _{RC}	7,8,9,10,11
t _{AA}	7,8,9,10,11
t _{OHA}	7,8,9,10,11
t _{ACE}	7,8,9,10,11
WRITE CYCLE	
t _{WC}	7,8,9,10,11
t _{SCE}	7,8,9,10,11
t _{AW}	7,8,9,10,11
t _{HA}	7,8,9,10,11
t _{SA}	7,8,9,10,11
t _{PWE}	7,8,9,10,11
t _{SD}	7,8,9,10,11
t _{HD}	7,8,9,10,11

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