

## Features

- High speed
  - 15 ns
- Fast  $t_{DOE}$
- CMOS for optimum speed/power
- Low active power
  - 550 mW (max, 15 ns “L” version)
- Low standby power
  - 0.275 mW (max, “L” version)
- 2 V data retention (“L” version only)
- Easy memory expansion with  $\overline{CE}$  and  $\overline{OE}$  features
- TTL-compatible inputs and outputs
- Automatic power-down when deselected

## Functional Description

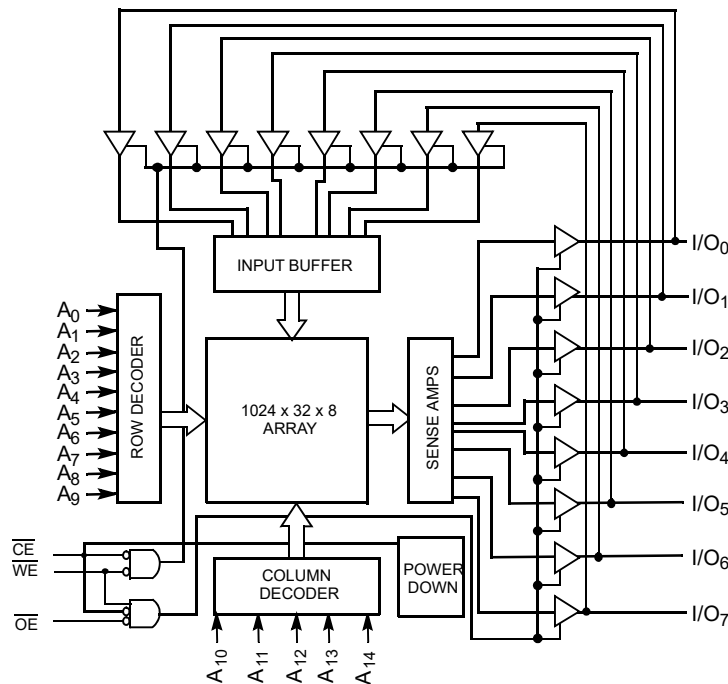
The CY7C199N is a high-performance CMOS static RAM organized as 32,768 words by 8 bits. Easy memory expansion is provided by an active LOW Chip Enable ( $\overline{CE}$ ) and active LOW Output Enable ( $\overline{OE}$ ) and three-state drivers. This device has an automatic power-down feature, reducing the power consumption by 81% when deselected. The CY7C199N is available in 28-pin TSOP I package.

An active LOW Write Enable signal ( $\overline{WE}$ ) controls the writing/reading operation of the memory. When  $\overline{CE}$  and  $\overline{WE}$  inputs are both LOW, data on the eight data input/output pins ( $I/O_0$  through  $I/O_7$ ) is written into the memory location addressed by the address present on the address pins ( $A_0$  through  $A_{14}$ ). Reading the device is accomplished by selecting the device and enabling the outputs,  $\overline{CE}$  and  $\overline{OE}$  active LOW, while  $\overline{WE}$  remains inactive or HIGH. Under these conditions, the contents of the location addressed by the information on address pins are present on the eight data input/output pins.

The input/output pins remain in a high-impedance state unless the chip is selected, outputs are enabled, and Write Enable ( $\overline{WE}$ ) is HIGH. A die coat is used to improve alpha immunity.

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

## Logic Block Diagram

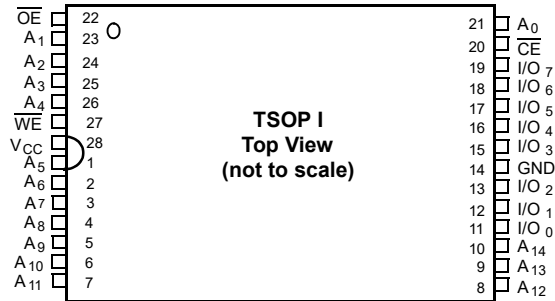


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## Pin Configuration

Figure 1. 28-pin TSOP 1 pinout



## Selection Guide

Description		-15	Unit
Maximum Access Time		15	ns
Maximum Operating Current	L	100	mA
Maximum CMOS Standby Current	L	0.05	mA

### 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 to Ground Potential (Pin 28 to Pin 14) ..... -0.5 V to +7.0 V
- DC Voltage Applied to Outputs in High Z State <sup>[1]</sup> ..... -0.5 V to V<sub>CC</sub> + 0.5 V

- DC Input Voltage <sup>[1]</sup> ..... -0.5 V to V<sub>CC</sub> + 0.5 V
- Output Current into Outputs (LOW) ..... 20 mA
- Static Discharge Voltage (per MIL-STD-883, Method 3015) ..... > 2001 V
- Latch-up Current ..... > 200 mA

### Operating Range

Range	Ambient Temperature <sup>[2]</sup>	V <sub>CC</sub>
Commercial	0 °C to +70 °C	5 V ± 10%

### Electrical Characteristics

Over the Operating Range

Parameter	Description	Test Conditions	-15		Unit
			Min	Max	
V <sub>OH</sub>	Output HIGH Voltage	V <sub>CC</sub> = Min, I <sub>OH</sub> = -4.0 mA	2.4	-	V
V <sub>OL</sub>	Output LOW Voltage	V <sub>CC</sub> = Min, I <sub>OL</sub> = 8.0 mA	-	0.4	V
V <sub>IH</sub>	Input HIGH Voltage		2.2	V <sub>CC</sub> + 0.3	V
V <sub>IL</sub>	Input LOW Voltage		-0.5	0.8	V
I <sub>IX</sub>	Input Load Current	GND ≤ V <sub>I</sub> ≤ V <sub>CC</sub>	-5	+5	μA
I <sub>OZ</sub>	Output Leakage Current	GND ≤ V <sub>O</sub> ≤ V <sub>CC</sub> , Output Disabled	-5	+5	μA
I <sub>CC</sub>	V <sub>CC</sub> Operating Supply Current	V <sub>CC</sub> = Max, I <sub>OUT</sub> = 0 mA, f = f <sub>MAX</sub> = 1/t <sub>RC</sub>	L	-	100 mA
I <sub>SB1</sub>	Automatic CE Power-down Current – TTL Inputs	Max V <sub>CC</sub> , CE ≥ V <sub>IH</sub> , V <sub>IN</sub> ≥ V <sub>IH</sub> or V <sub>IN</sub> ≤ V <sub>IL</sub> , f = f <sub>MAX</sub>	L	-	5 mA
I <sub>SB2</sub>	Automatic CE Power-down Current – CMOS Inputs	Max V <sub>CC</sub> , CE ≥ V <sub>CC</sub> - 0.3 V, V <sub>IN</sub> ≥ V <sub>CC</sub> - 0.3 V, or V <sub>IN</sub> ≤ 0.3 V, f = 0	L	-	0.05 mA

**Notes**

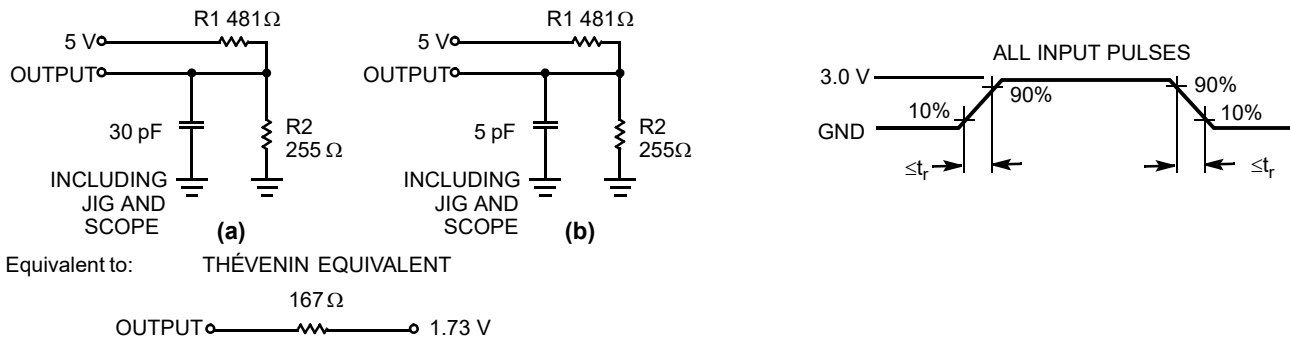
1. V<sub>IL</sub> (min) = -2.0 V for pulse durations of less than 20 ns.
2. T<sub>A</sub> is the "instant on" case temperature.

### Capacitance

Parameter <sup>[3]</sup>	Description	Test Conditions	Max	Unit
C <sub>IN</sub>	Input capacitance	T <sub>A</sub> = 25 °C, f = 1 MHz, V <sub>CC</sub> = 5.0 V	8	pF
C <sub>OUT</sub>	Output capacitance		8	pF

### AC Test Loads and Waveforms

Figure 2. AC Test Loads and Waveforms <sup>[4]</sup>



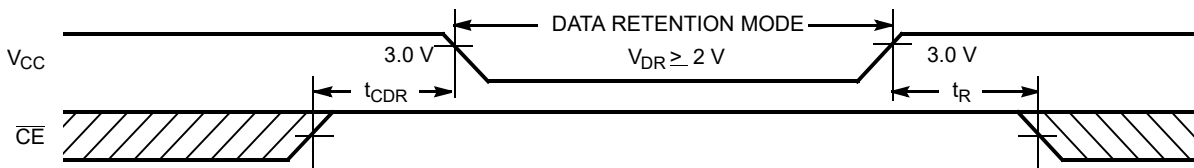
### Data Retention Characteristics

Over the Operating Range (L-version only)

Parameter	Description	Conditions <sup>[5]</sup>	Min	Max	Unit	
V <sub>DR</sub>	V <sub>CC</sub> for Data Retention	V <sub>CC</sub> = V <sub>DR</sub> = 2.0 V, CE ≥ V <sub>CC</sub> - 0.3 V, V <sub>IN</sub> ≥ V <sub>CC</sub> - 0.3 V or V <sub>IN</sub> ≤ 0.3 V	2.0	–	V	
I <sub>CCDR</sub>	Data Retention Current		L	–	10	μA
t <sub>CDR</sub> <sup>[3]</sup>	Chip Deselect to Data Retention Time		0	–	ns	
t <sub>R</sub> <sup>[4]</sup>	Operation Recovery Time		200	–	μs	

### Data Retention Waveform

Figure 3. Data Retention Waveform



**Notes**

- 3. Tested initially and after any design or process changes that may affect these parameters.
- 4. t<sub>R</sub> ≤ 3 ns for -15 speed.
- 5. No input may exceed V<sub>CC</sub> + 0.5 V.

## Switching Characteristics

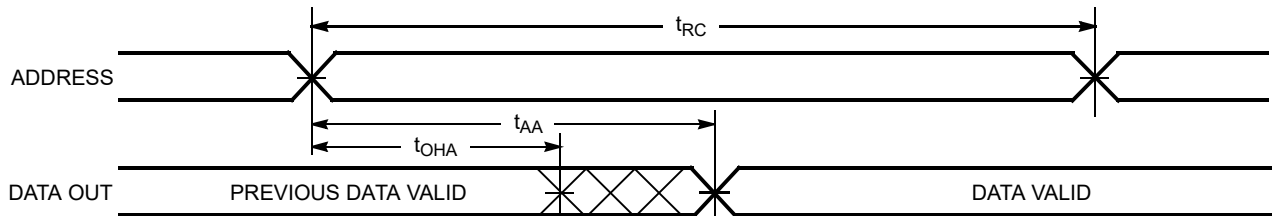
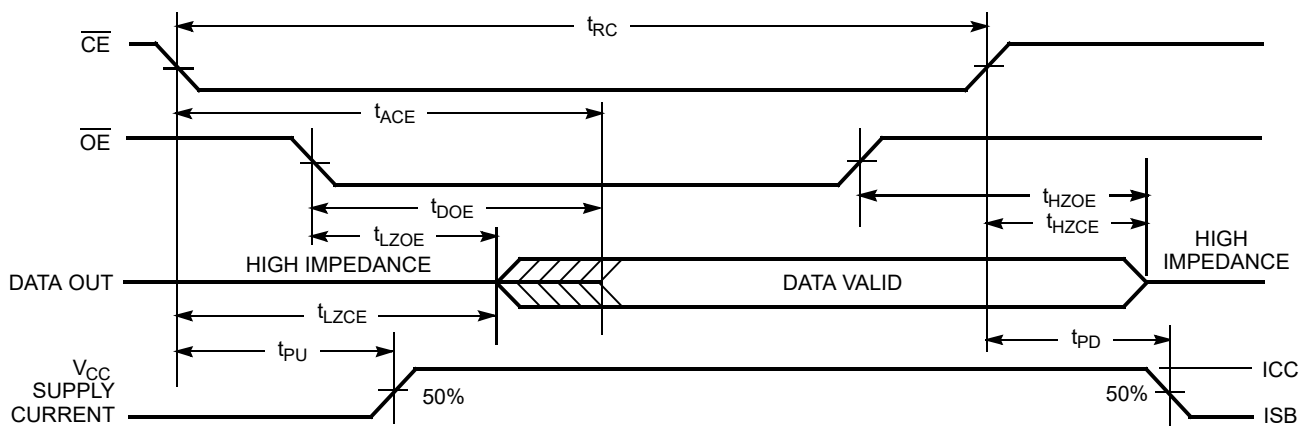
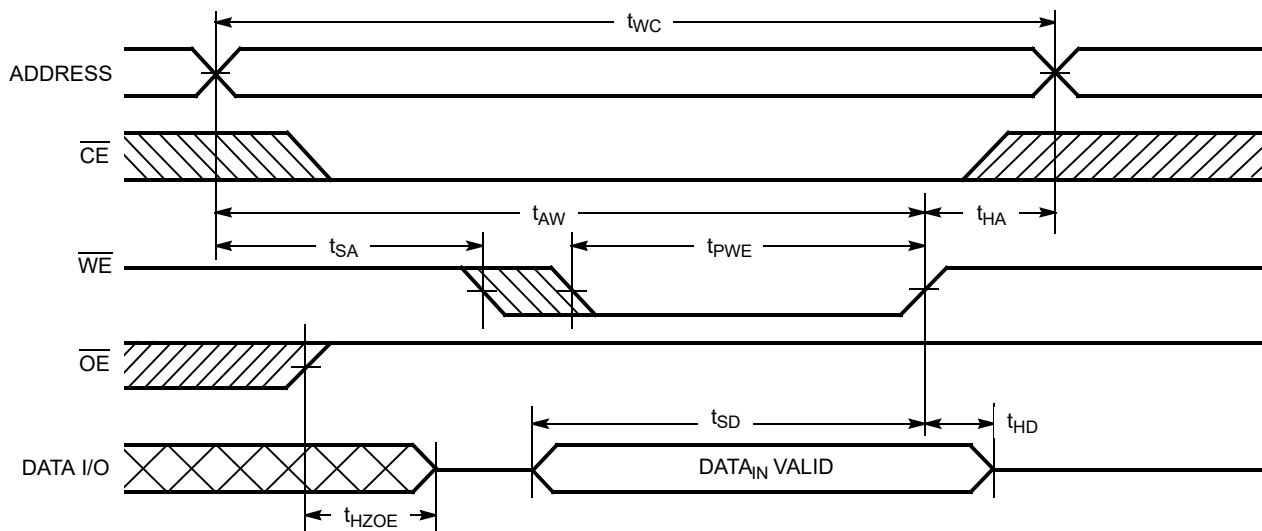
Over the Operating Range

Parameter <sup>[6]</sup>	Description	7C199-15		Unit
		Min	Max	
<b>Read Cycle</b>				
$t_{RC}$	Read Cycle Time	15	–	ns
$t_{AA}$	Address to Data Valid	–	15	ns
$t_{OHA}$	Data Hold from Address Change	3	–	ns
$t_{ACE}$	$\overline{CE}$ LOW to Data Valid	–	15	ns
$t_{DOE}$	$\overline{OE}$ LOW to Data Valid	–	7	ns
$t_{LZOE}$	$\overline{OE}$ LOW to Low Z <sup>[7]</sup>	0	–	ns
$t_{HZOE}$	$\overline{OE}$ HIGH to High Z <sup>[7, 8]</sup>	–	7	ns
$t_{LZCE}$	$\overline{CE}$ LOW to Low Z <sup>[7]</sup>	3	–	ns
$t_{HZCE}$	$\overline{CE}$ HIGH to High Z <sup>[7, 8]</sup>	–	7	ns
$t_{PU}$	$\overline{CE}$ LOW to Power-up	0	–	ns
$t_{PD}$	$\overline{CE}$ HIGH to Power-down	–	15	ns
<b>Write Cycle <sup>[9, 10]</sup></b>				
$t_{WC}$	Write Cycle Time	15	–	ns
$t_{SCE}$	$\overline{CE}$ LOW to Write End	10	–	ns
$t_{AW}$	Address Set-up to Write End	10	–	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	9	–	ns
$t_{SD}$	Data Set-up to Write End	9	–	ns
$t_{HD}$	Data Hold from Write End	0	–	ns
$t_{HZWE}$	$\overline{WE}$ LOW to High Z <sup>[7, 8]</sup>	–	7	ns
$t_{LZWE}$	$\overline{WE}$ HIGH to Low Z <sup>[7]</sup>	3	–	ns

### Notes

- Test conditions assume signal transition time of 3 ns or less for -15 speed, 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.
- 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.
- $t_{HZOE}$ ,  $t_{HZCE}$ , and  $t_{HZWE}$  are specified with  $C_L = 5$  pF as in part (b) of [Figure 2 on page 5](#). Transition is measured  $\pm 500$  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 signals 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.
- 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** [12, 13]

**Figure 6. Write Cycle No. 1 ( $\overline{WE}$  Controlled)** [14, 15, 16]

**Notes**

11. Device is continuously selected.  $\overline{OE}$ ,  $\overline{CE} = V_{IL}$ .
12.  $\overline{WE}$  is HIGH for read cycle.
13. Address valid prior to or coincident with  $\overline{CE}$  transition LOW.
14. The internal write time of the memory is defined by the overlap of  $\overline{CE}$  LOW and  $\overline{WE}$  LOW. Both signals 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.
15. Data I/O is high impedance if  $\overline{OE} = V_{IH}$ .
16. If  $\overline{CE}$  goes HIGH simultaneously with  $\overline{WE}$  HIGH, the output remains in a high-impedance state.

Switching Waveforms (continued)

Figure 7. Write Cycle No. 2 ( $\overline{\text{CE}}$  Controlled) [17, 18, 19]

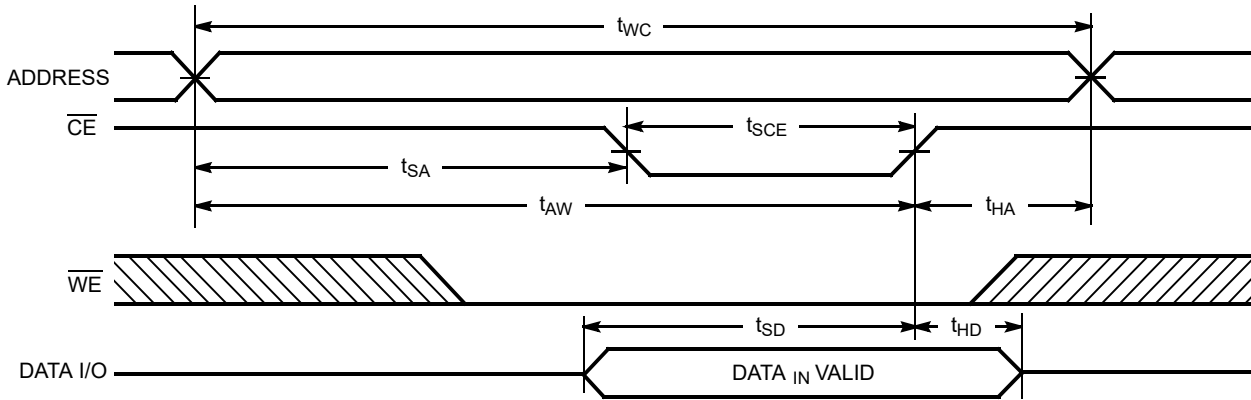
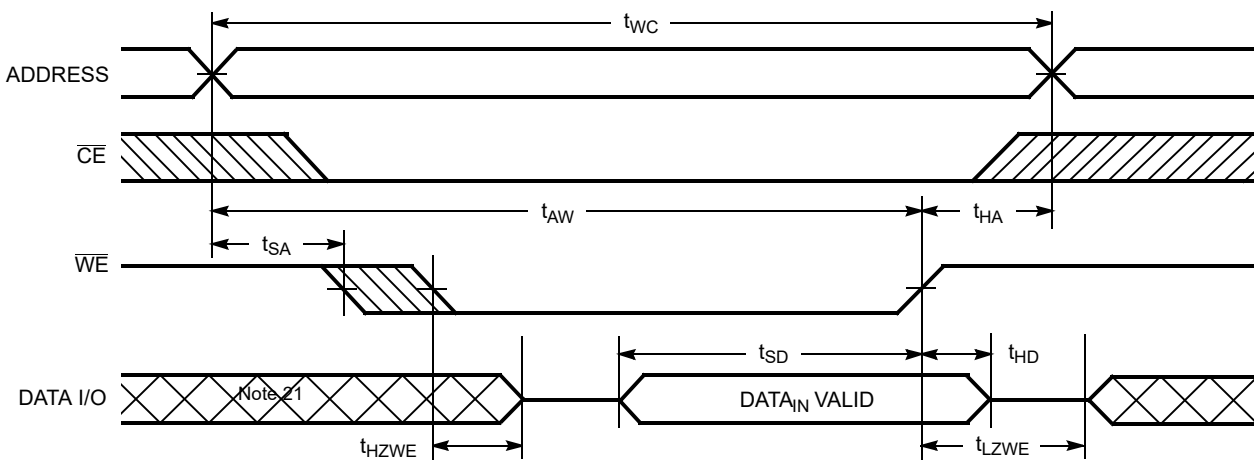


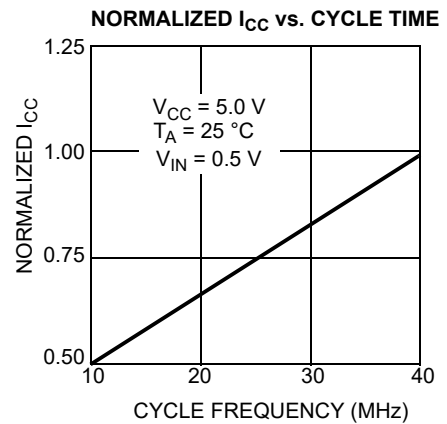
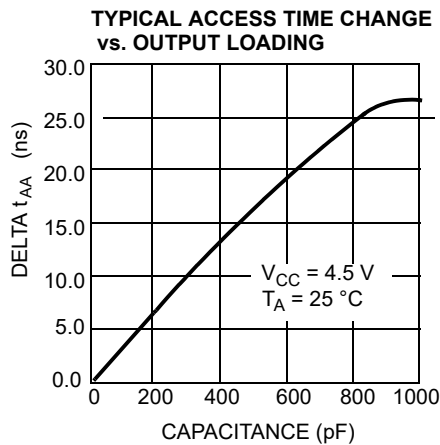
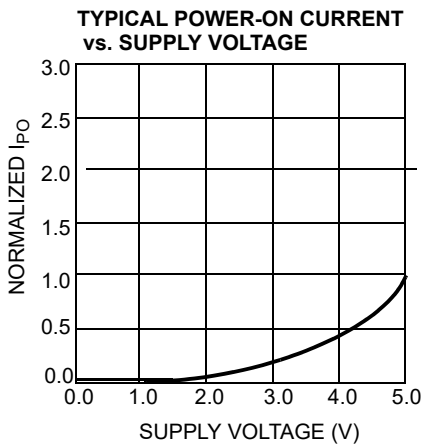
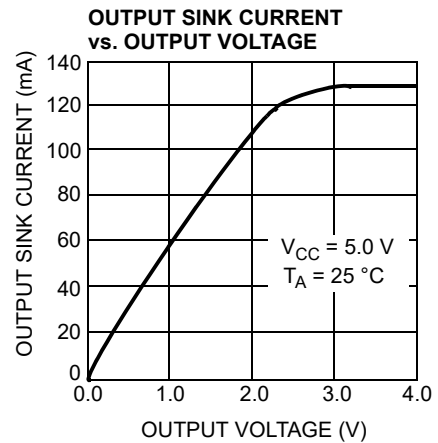
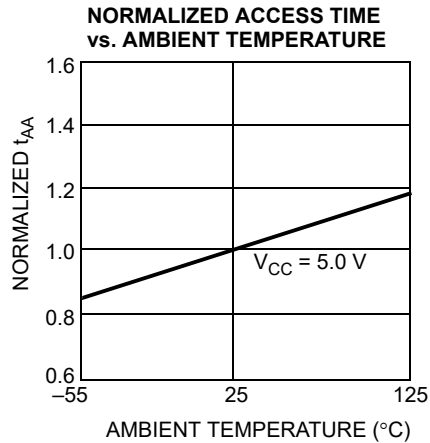
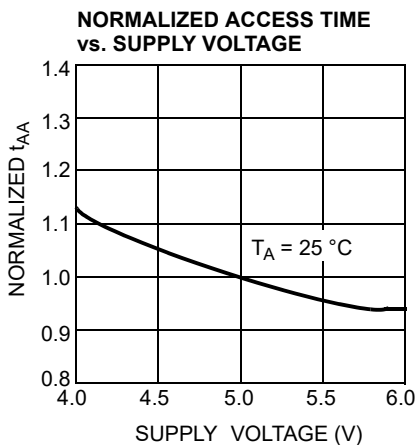
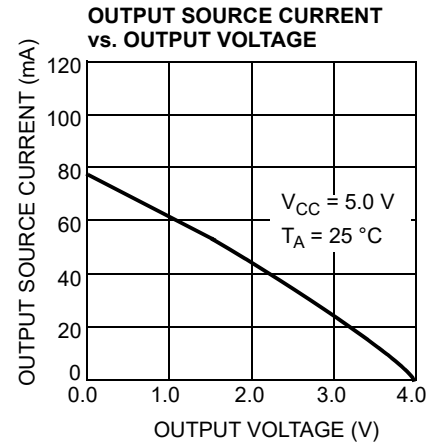
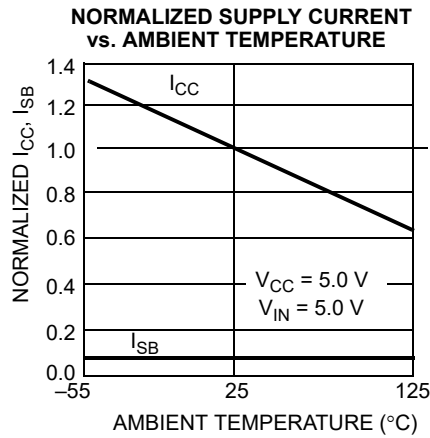
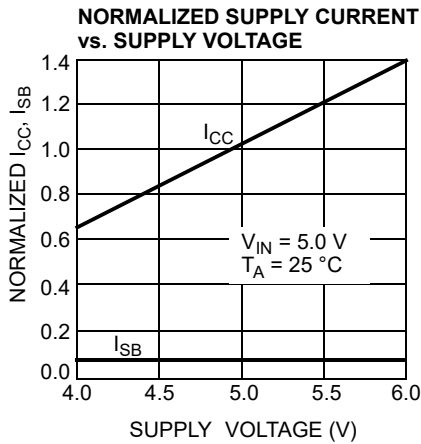
Figure 8. Write Cycle No. 3 ( $\overline{\text{WE}}$  Controlled,  $\overline{\text{OE}}$  LOW) [19, 20]



Notes

- 17.  $t_{HZOE}$ ,  $t_{HZCE}$ , and  $t_{HZWE}$  are specified with  $C_L = 5$  pF as in part (b) of Figure 2 on page 5. Transition is measured  $\pm 500$  mV from steady-state voltage.
- 18. Data I/O is high impedance if  $\overline{\text{OE}} = V_{IH}$ .
- 19. If  $\overline{\text{CE}}$  goes HIGH simultaneously with  $\overline{\text{WE}}$  HIGH, the output remains in a high-impedance state.
- 20. The minimum write cycle time for Write Cycle No. 3 ( $\overline{\text{WE}}$  Controlled,  $\overline{\text{OE}}$  LOW) is the sum of  $t_{HZWE}$  and  $t_{SD}$ .
- 21. During this period, the I/Os are in the output state. Do not apply input signals.



**Typical DC and AC Characteristics**


### Truth Table

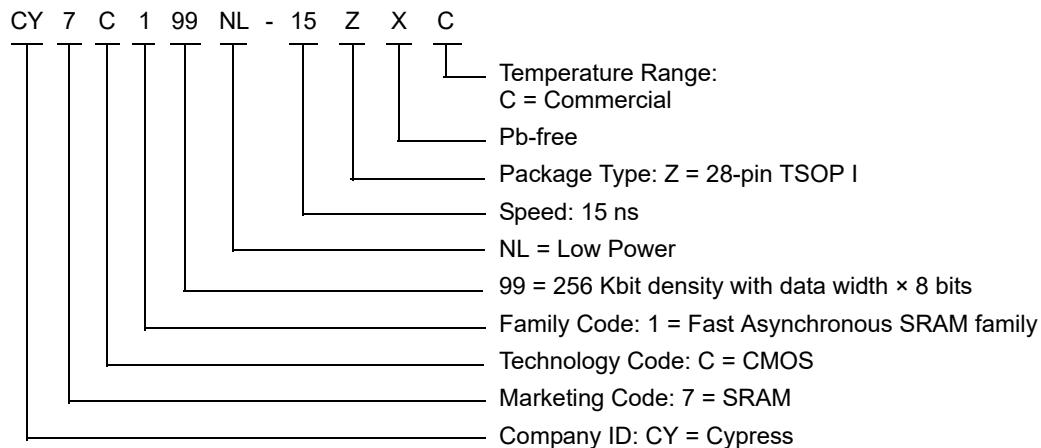
$\overline{CE}$	$\overline{WE}$	$\overline{OE}$	Inputs/Outputs	Mode	Power
H	X	X	High Z	Deselect/Power-down	Standby ( $I_{SB}$ )
L	H	L	Data Out	Read	Active ( $I_{CC}$ )
L	L	X	Data In	Write	Active ( $I_{CC}$ )
L	H	H	High Z	Selected, Output disabled	Active ( $I_{CC}$ )

### Ordering Information

Speed (ns)	Ordering Code	Package Diagram	Package Type	Operating Range
15	CY7C199NL-15ZXC	51-85071	28-pin TSOP I (Pb-free)	Commercial

Contact your Local Cypress sales representative for availability of these parts

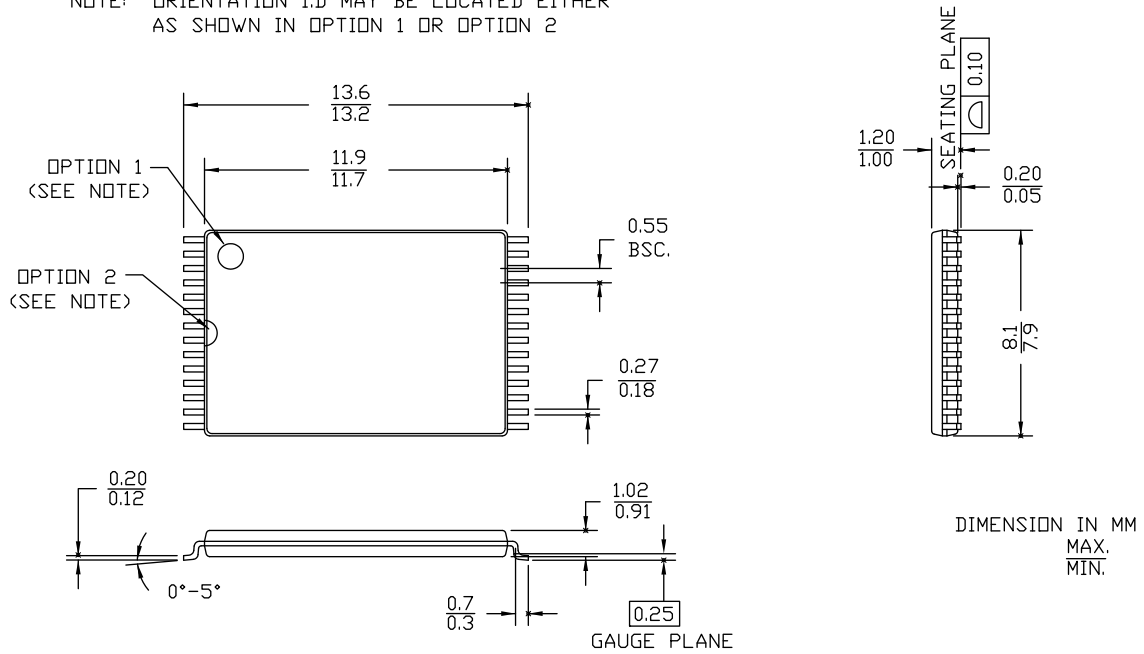
### Ordering Code Definitions



Package Diagrams

Figure 9. 28-pin TSOP I (8 × 13.4 × 1.2 mm) Package Outline, 51-85071

NOTE: ORIENTATION I.D. MAY BE LOCATED EITHER AS SHOWN IN OPTION 1 OR OPTION 2



51-85071 \*J

### Acronyms

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

### Document Conventions

#### Units of Measure

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

**Document History Page**

Document Title: CY7C199N, 32K × 8 Static RAM				
Document Number: 001-06493				
Rev.	ECN No.	Orig. of Change	Submission Date	Description of Change
**	423877	NXR	02/02/2006	New data sheet.
*A	2892510	VKN	03/18/2010	Removed 12 ns, 20 ns, 25 ns, 35 ns, and 55 ns speed bins related information in all instances across the document. Removed Industrial and Military Temperature Range related information in all instances across the document. Removed 28-pin PDIP (300 Mils) package related information in all instances across the document. Updated <a href="#">Ordering Information</a> : Updated part numbers. Updated <a href="#">Package Diagrams</a> : spec 51-85071 – Changed revision from *G to *H. Removed spec 51-85014 *D. Updated to new template.
*B	3109199	AJU	12/13/2010	Updated <a href="#">Ordering Information</a> : No change in part numbers. Added <a href="#">Ordering Code Definitions</a> .
*C	3244591	PRAS	04/29/2011	Updated <a href="#">Package Diagrams</a> : spec 51-85071 – Changed revision from *H to *I. Added <a href="#">Acronyms</a> and <a href="#">Units of Measure</a> . Updated to new template. Completing Sunset Review.
*D	4379476	VINI	05/14/2014	Updated <a href="#">Switching Waveforms</a> : Added Note 21 and referred the same note in DATA I/O in <a href="#">Figure 8</a> . Updated <a href="#">Package Diagrams</a> : spec 51-85071 – Changed revision from *I to *J. Updated to new template. Completing Sunset Review.
*E	4573121	VINI	11/18/2014	Updated <a href="#">Functional Description</a> : Added "For a complete list of related documentation, <a href="#">click here</a> ." at the end.
*F	4776874	VINI	05/26/2015	Updated <a href="#">Functional Description</a> : Updated description. Updated to new template. Completing Sunset Review.
*G	5984694	AESATMP8	12/05/2017	Updated logo and Copyright.
*H	6102775	VINI	03/19/2018	Updated to new template. Completing Sunset Review.

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