CY7C199N

32 K × 8 Static RAM

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

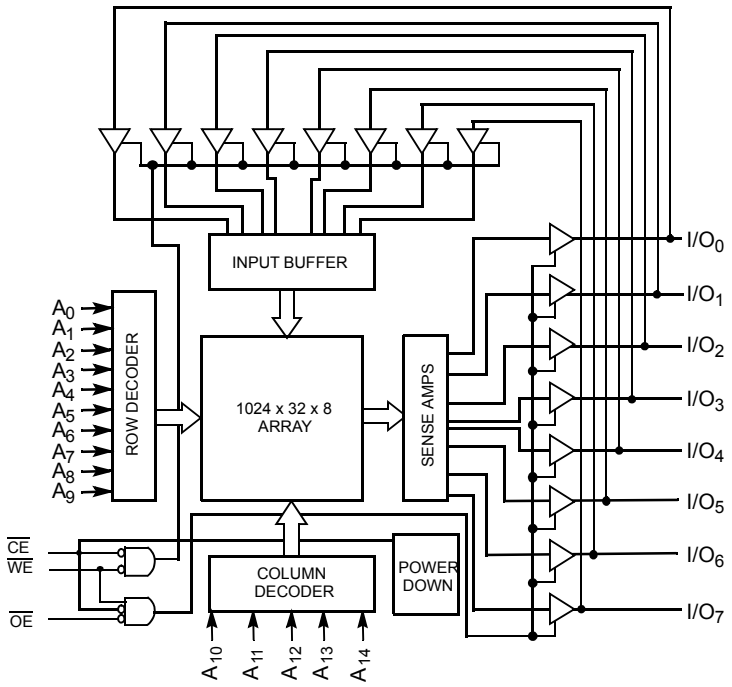
Functional Description

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 CY7C199NN is in the standard 300-mil-wide DIP, SOJ, and LCC packages.

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.

Logic Block Diagram



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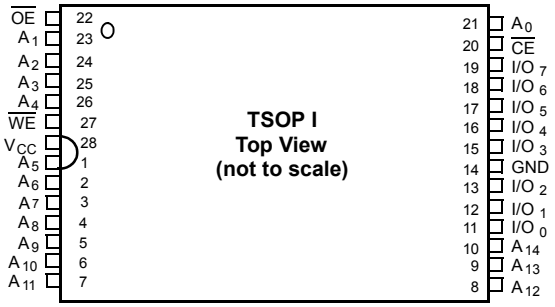
Pin Configuration



Selection Guide

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

[+] Feedback

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[1]..... –0.5 V to V_{CC} + 0.5 V

DC Input Voltage[1] ..... –0.5 V to V_{CC} + 0.5 V

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

Static Discharge Voltage..... > 2001 V (per MIL-STD-883, Method 3015)

Latch-up Current..... > 200 mA

Operating Range

Range	Ambient Temperature[2]	V_{CC}
Commercial	0 °C to +70 °C	5 V ± 10%

Electrical Characteristics

Over the Operating Range

Parameter	Description	Test Conditions		-15		Unit
				Min	Max	
V_{OH}	Output HIGH Voltage	V_{CC} = Min, I_{OH} = –4.0 mA		2.4	–	V
V_{OL}	Output LOW Voltage	V_{CC} = Min, I_{OL} = 8.0 mA		–	0.4	V
V_{IH}	Input HIGH Voltage			2.2	V_{CC} + 0.3 V	V
V_{IL}	Input LOW Voltage			–0.5	0.8	V
I_{IX}	Input Load Current	GND ≤ V_I ≤ V_{CC}		–5	+5	µA
I_{OZ}	Output Leakage Current	GND ≤ V_O ≤ V_{CC}, Output Disabled		–5	+5	µA
I_{CC}	V_{CC} Operating Supply Current	V_{CC} = Max, I_{OUT} = 0 mA, f = f_{MAX} = $1/t_{RC}$	L	–	100	mA
I_{SB1}	Automatic CE Power-down Current— TTL Inputs	Max V_{CC}, $\overline{CE}$ ≥ V_{IH}, V_{IN} ≥ V_{IH} or V_{IN} ≤ V_{IL}, f = f_{MAX}	L	–	5	mA
I_{SB2}	Automatic CE Power-down Current— CMOS Inputs	Max V_{CC}, $\overline{CE}$ ≥ V_{CC} – 0.3 V, V_{IN} ≥ V_{CC} – 0.3 V, or V_{IN} ≤ 0.3 V, f = 0	L	–	0.05	mA

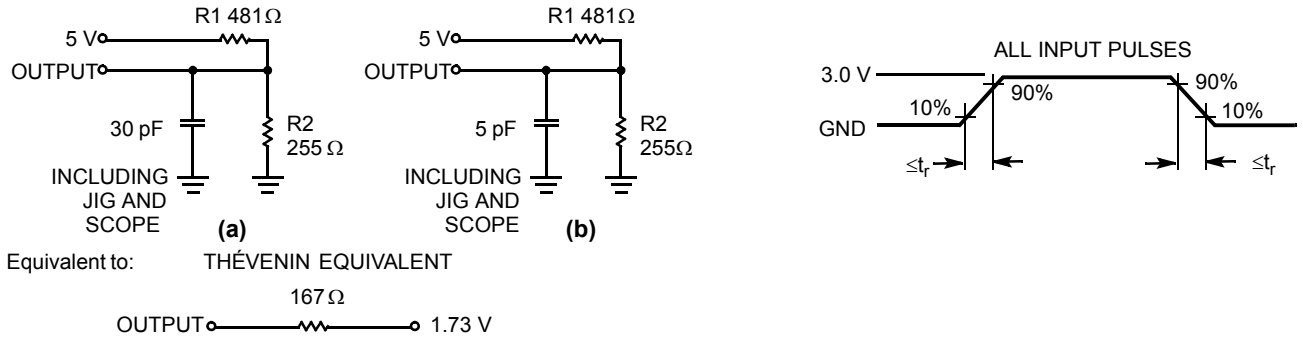
Notes
1. V_{IL} (min) = –2.0 V for pulse durations of less than 20 ns.
2. T_A is the "instant on" case temperature.

[+] Feedback

Capacitance[3]

Parameter	Description	Test Conditions	Max	Unit
C_{IN}	Input Capacitance	T_A = 25 °C, f = 1 MHz, V_{CC} = 5.0 V	8	pF
C_{OUT}	Output Capacitance		8	pF

AC Test Loads and Waveforms[4]

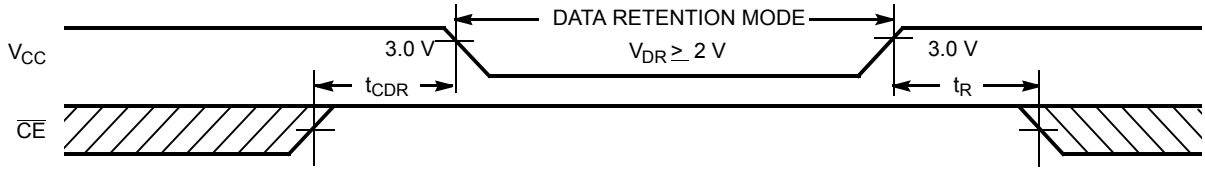


Data Retention Characteristics

Over the Operating Range (L-version only)

Parameter	Description		Conditions[5]	Min	Max	Unit
V_{DR}	V_{CC} for Data Retention		$\overline{CE} \geq V_{CC} - 0.3$ V, $V_{IN} \geq V_{CC} - 0.3$ V or $V_{IN} \leq 0.3$ V	2.0	–	V
I_{CCDR}	Data Retention Current	L		–	10	µA
t_{CDR}[3]	Chip Deselect to Data Retention Time			0	–	ns
t_R [4]	Operation Recovery Time			200	–	µs

Data Retention Waveform



Notes
3. Tested initially and after any design or process changes that may affect these parameters.
4. $t_R \leq 3$ ns for -15 speed.
5. No input may exceed V_{CC} + 0.5 V.

[+] Feedback

Switching Characteristics

Over the Operating Range[6]

Parameter	Description	7C199-15		Unit
		Min	Max	
Read Cycle				
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[7]	0	–	ns
t_{HZOE}	$\overline{OE}$ HIGH to High Z[7, 8]	–	7	ns
t_{LZCE}	$\overline{CE}$ LOW to Low Z[7]	3	–	ns
t_{HZCE}	$\overline{CE}$ HIGH to High Z[7, 8]	–	7	ns
t_{PU}	$\overline{CE}$ LOW to Power-up	0	–	ns
t_{PD}	$\overline{CE}$ HIGH to Power-down	–	15	ns
Write Cycle[9, 10]				
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[8]	–	7	ns
t_{LZWE}	$\overline{WE}$ HIGH to Low Z[7]	3	–	ns

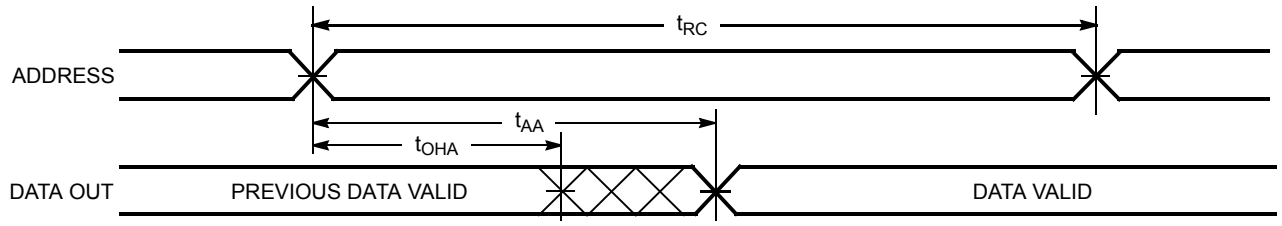
Notes

6. 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.
7. 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.
8. t_{HZOE}, t_{HZCE}, and t_{HZWE} are specified with C_L = 5 pF as in part (b) of AC Test Loads and Waveforms[4] on page 5. Transition is measured ±500 mV from steady-state voltage.
9. 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.
10. The minimum write cycle time for write cycle #3 ($\overline{WE}$ controlled, $\overline{OE}$ LOW) is the sum of t_{HZWE} and t_{SD}.

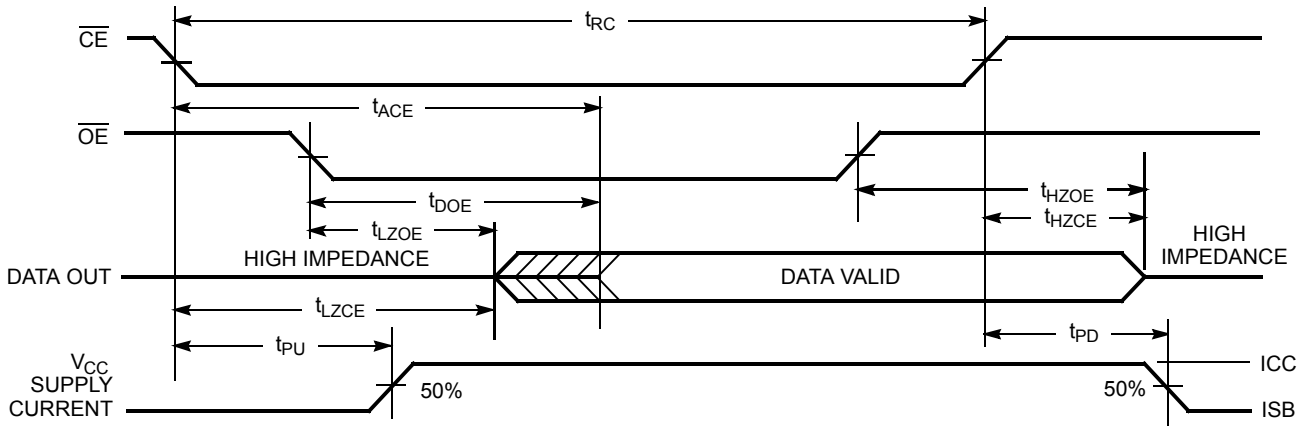
[+] Feedback

Switching Waveforms

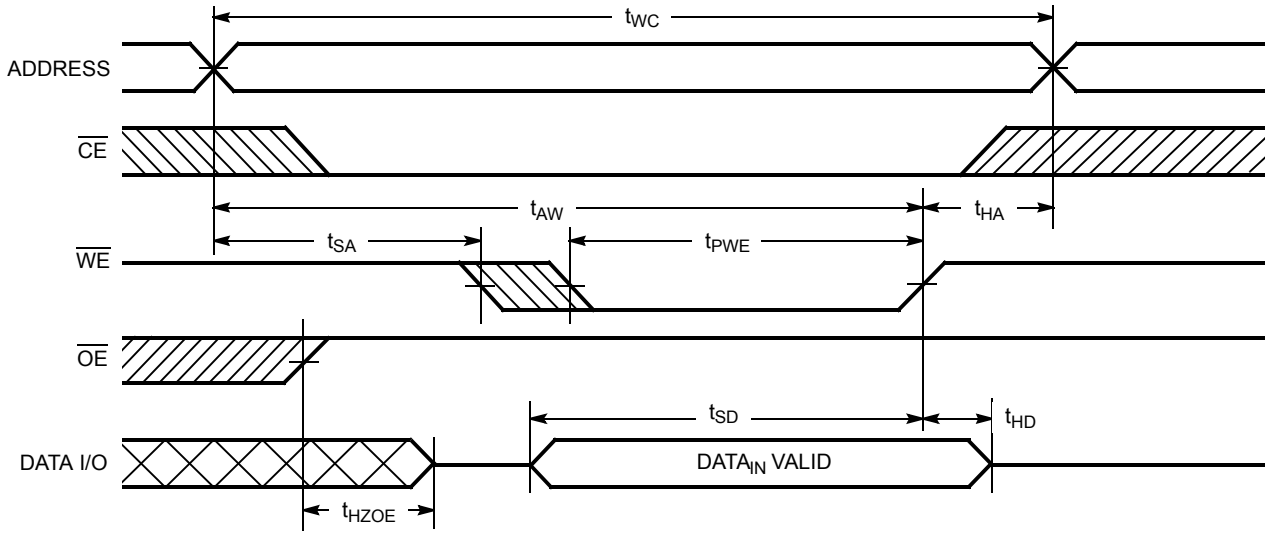
Read Cycle No. 1[11, 12]



Read Cycle No. 2 [12, 13]



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

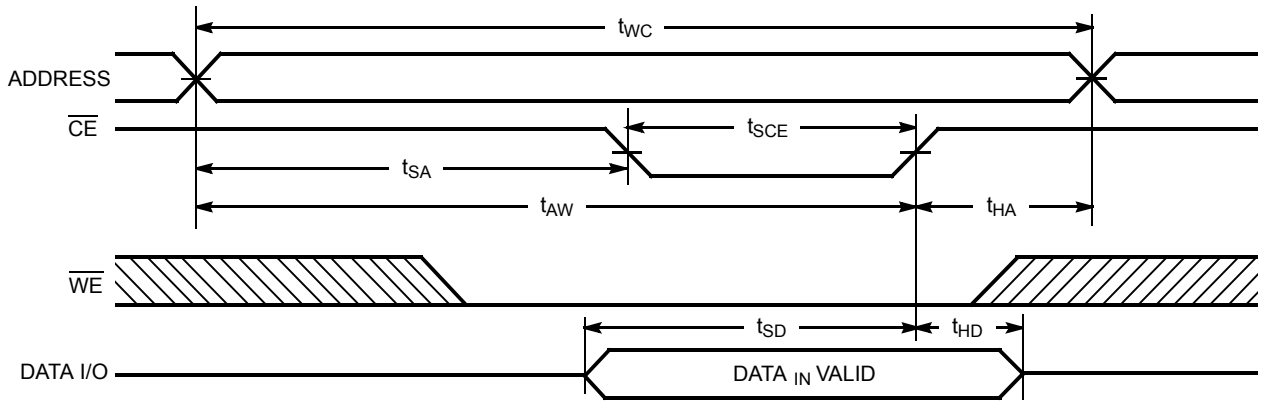


Notes
11. Device is continuously selected. $\overline{OE}$, $\overline{CE}$ = V_{IL}.
12. $\overline{WE}$ is HIGH for read cycle.
13. Address valid prior to or coincident with $\overline{CE}$ transition LOW.
14. The internal write time of the memory is defined by the overlap of $\overline{CE}$ LOW and $\overline{WE}$ 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.

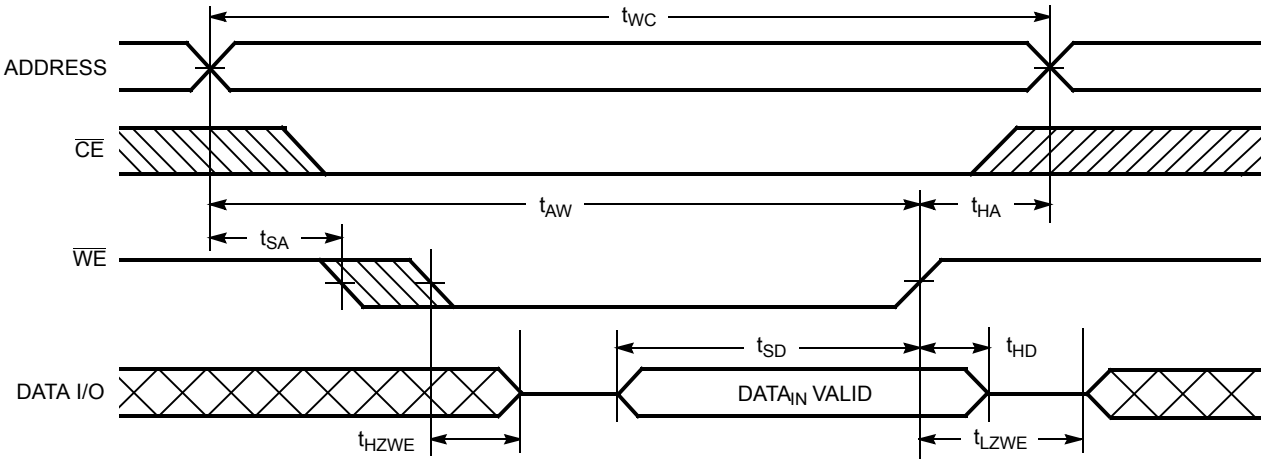
[+] Feedback

Switching Waveforms (continued)

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



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



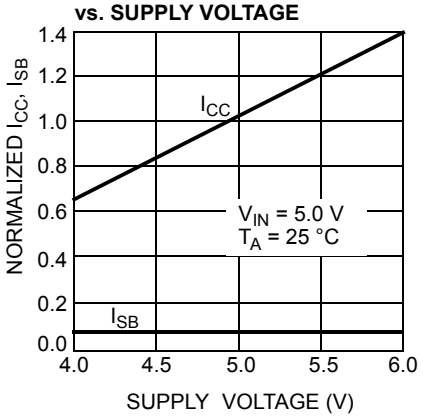
Notes

17. t_{HZOE}, t_{HZCE}, and t_{HZWE} are specified with C_L = 5 pF as in part (b) of AC Test Loads and Waveforms[4] on page 5. Transition is measured ±500 mV from steady-state voltage.
18. Data I/O is high impedance if $\overline{OE}$ = V_{IH}.
19. If $\overline{CE}$ goes HIGH simultaneously with $\overline{WE}$ HIGH, the output remains in a high-impedance state.
20. The minimum write cycle time for write cycle #3 ($\overline{WE}$ controlled, $\overline{OE}$ LOW) is the sum of t_{HZWE} and t_{SD}.

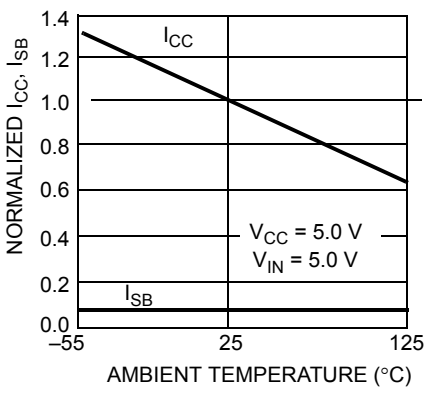
[+] Feedback

Typical DC and AC Characteristics

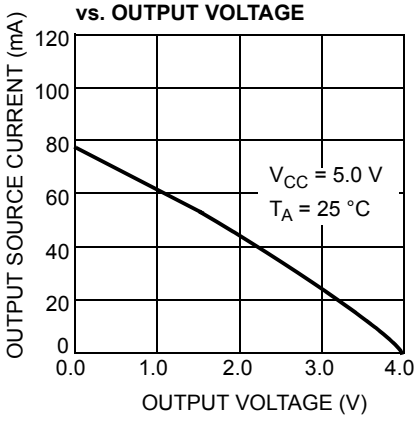
NORMALIZED SUPPLY CURRENT vs. SUPPLY VOLTAGE



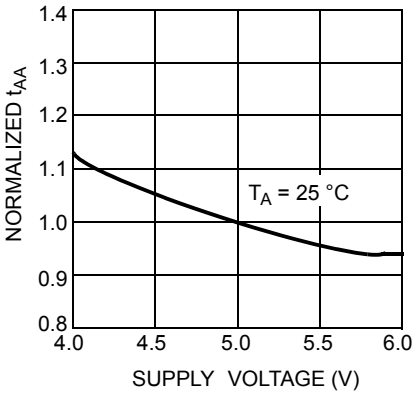
NORMALIZED SUPPLY CURRENT vs. AMBIENT TEMPERATURE



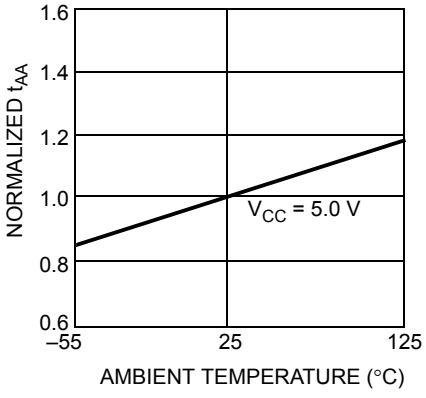
OUTPUT SOURCE CURRENT vs. OUTPUT VOLTAGE



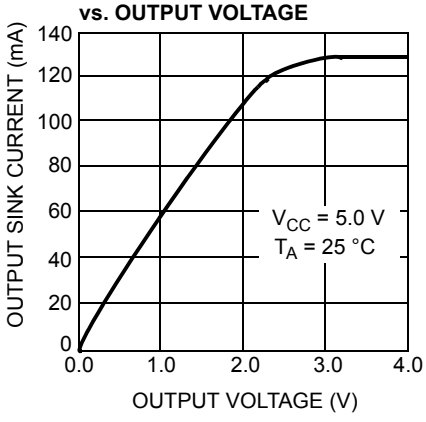
NORMALIZED ACCESS TIME vs. SUPPLY VOLTAGE



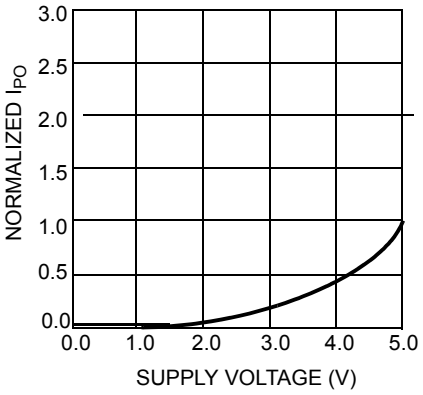
NORMALIZED ACCESS TIME vs. AMBIENT TEMPERATURE



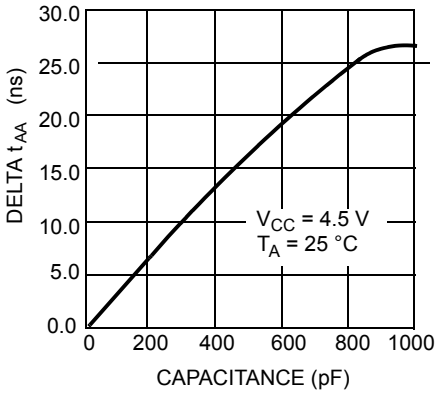
OUTPUT SINK CURRENT vs. OUTPUT VOLTAGE



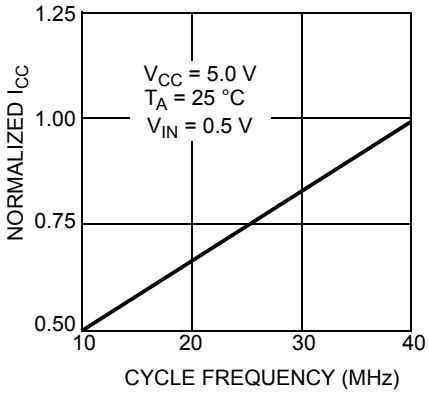
TYPICAL POWER-ON CURRENT vs. SUPPLY VOLTAGE



TYPICAL ACCESS TIME CHANGE vs. OUTPUT LOADING



NORMALIZED I_{CC} vs. CYCLE TIME



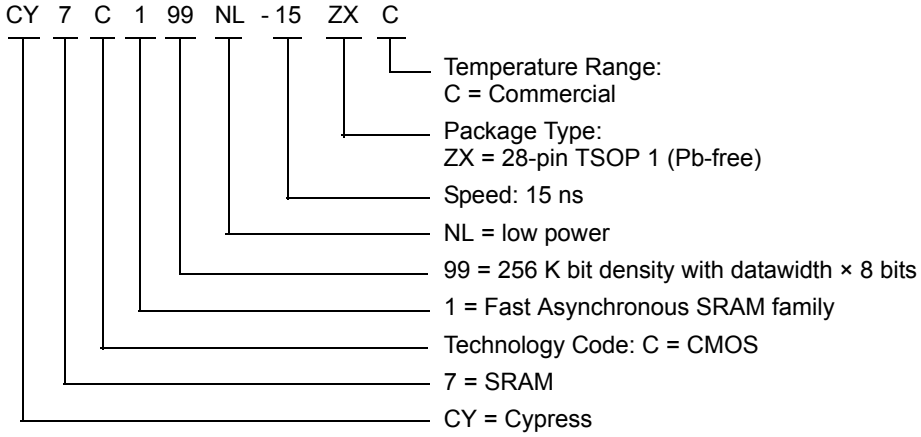
Truth Table

$\overline{CE}$	$\overline{WE}$	$\overline{OE}$	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 1 (Pb-free)	Commercial

Ordering Code Definitions



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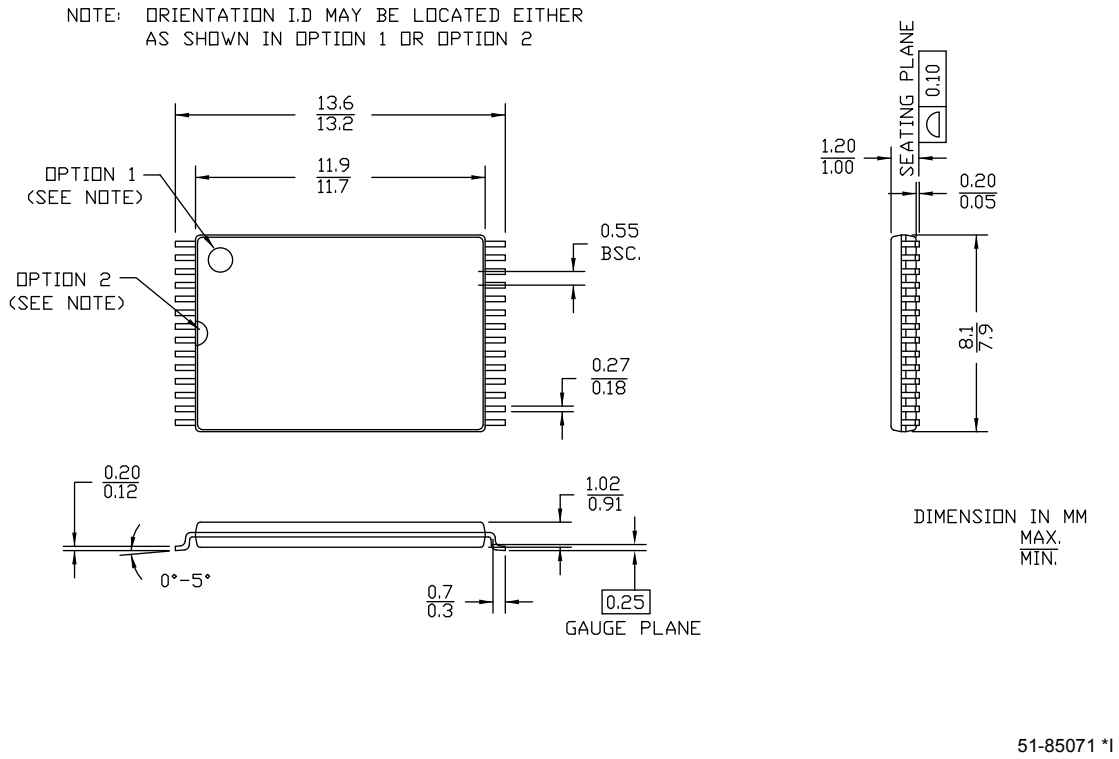
Package Diagrams

Figure 1. 28-pin TSOP 1 (8 × 13.4 × 1.2 mm), 51-85071



[+] Feedback

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
µA	micro Amperes
µs	micro seconds
MHz	Mega Hertz
mA	milli Amperes
ns	nano seconds
Ω	ohms
pF	pico Farad
V	Volts
mW	milli Watts
W	Watts
%	percent

Document History Page

Document Title: CY7C199N 32 K × 8 Static RAM Document Number: 001-06493				
REV.	**ECN NO.**	**Issue Date**	**Orig. of Change**	**Description of Change**
**	423877	See ECN	NXR	New Data Sheet
*A	2892510	03/18/2010	VKN	Removed speed bins from the data sheet: 12ns, 20ns, 25ns, 35ns, and 55ns. Removed Industrial and Military product information Removed 28-pin (300-Mil) PDIP package Updated Ordering Information table Updated Package Diagram
*B	3109199	12/13/2010	AJU	Added Ordering Code Definitions.
*C	3244591	04/29/2011	PRAS	Updated Package Diagrams. Added Acronyms and Units of Measure. Updated in new template.

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