

# 32K x 8 Static RAM

## Features

- **High speed**  
— 10 ns
- **Fast  $t_{DOE}$**
- **CMOS for optimum speed/power**
- **Low active power**  
— 467 mW (max, 12 ns “L” version)
- **Low standby power**  
— 0.275 mW (max, “L” version)
- **2V 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**

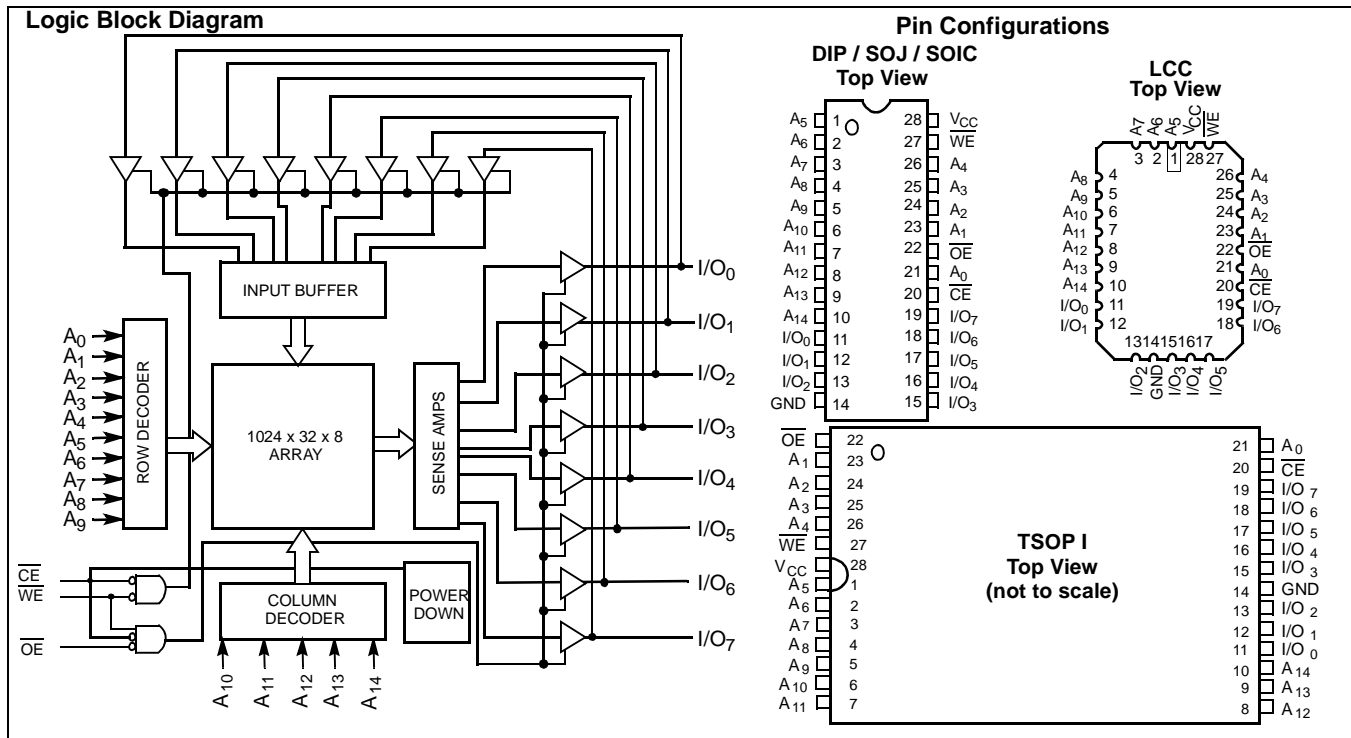
## Functional Description

The CY7C199 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 CY7C199 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.



## Selection Guide

|                              | 7C199 -8 | 7C199 -10 | 7C199 -12 | 7C199 -15 | 7C199 -20 | 7C199 -25 | 7C199 -35 | 7C199 -45 | Unit |
|------------------------------|----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|------|
| Maximum Access Time          | 8        | 10        | 12        | 15        | 20        | 25        | 35        | 45        | ns   |
| Maximum Operating Current    | 120      | 110       | 160       | 155       | 150       | 150       | 140       | 140       | mA   |
| L                            |          | 90        | 90        | 90        | 90        | 80        | 70        |           |      |
| Maximum CMOS Standby Current | 0.5      | 0.5       | 10        | 10        | 10        | 10        | 10        | 10        | mA   |
| L                            |          | 0.05      | 0.05      | 0.05      | 0.05      | 0.05      | 0.05      |           |      |

Shaded area contains advance information.

**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 28 to Pin 14) ..... -0.5V to +7.0V

 DC Voltage Applied to Outputs in High-Z State<sup>[1]</sup> ..... -0.5V to V<sub>CC</sub> + 0.5V

 DC Input Voltage<sup>[1]</sup> ..... -0.5V to V<sub>CC</sub> + 0.5V

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

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

Latch-up Current ..... &gt; 200 mA

**Operating Range**

| Range      | Ambient Temperature <sup>[2]</sup> | V <sub>CC</sub> |
|------------|------------------------------------|-----------------|
| Commercial | 0°C to +70°C                       | 5V ± 10%        |
| Industrial | -40°C to +85°C                     | 5V ± 10%        |
| Military   | -55°C to +125°C                    | 5V ± 10%        |

**Electrical Characteristics Over the Operating Range (-8, -10, -12, -15)<sup>[3]</sup>**

| Parameter        | Description                                 | Test Conditions   | 7C199-8 |                        | 7C199-10 |                        | 7C199-12 |                        | 7C199-15 |                        | Unit |    |
|------------------|---|---|---------|------------------------|----------|------------------------|----------|------------------------|----------|------------------------|------|----|
|                  |   |   | Min.    | Max.                   | 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      |                        | 2.4      |                        | V    |    |
| V <sub>OL</sub>  | Output LOW Voltage                          | V <sub>CC</sub> = Min., I <sub>OL</sub> = 8.0 mA  |         | 0.4                    |          | 0.4                    |          | 0.4                    |          | 0.4                    | V    |    |
| V <sub>IH</sub>  | Input HIGH Voltage                          |   | 2.2     | V <sub>CC</sub> + 0.3V | 2.2      | V <sub>CC</sub> + 0.3V | 2.2      | V <sub>CC</sub> + 0.3V | 2.2      | V <sub>CC</sub> + 0.3V | V    |    |
| V <sub>IL</sub>  | Input LOW Voltage                           |   | -0.5    | 0.8                    | -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>  | -5      | +5                     | -5       | +5                     | -5       | +5                     | -5       | +5                     | μA   |    |
| I <sub>OZ</sub>  | Output Leakage Current                      | GND ≤ V <sub>O</sub> ≤ V <sub>CC</sub> , Output Disabled  | -5      | +5                     | -5       | +5                     | -5       | +5                     | -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>   | Com'l   | 120                    |          | 110                    |          | 160                    |          | 155                    | mA   |    |
|                  |   |   | L       |                        |          | 85                     |          | 85                     |          | 100                    | mA   |    |
|                  |   |   | Mil     |                        |          |                        |          |                        |          | 180                    | 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> | Com'l   | 5                      |          | 5                      |          | 30                     |          | 30                     | mA   |    |
|                  |   |   | L       |                        |          | 5                      |          | 5                      |          | 5                      | mA   |    |
| I <sub>SB2</sub> | Automatic CE Power-down Current—CMOS Inputs | Max. V <sub>CC</sub> , CE ≥ V <sub>CC</sub> - 0.3V, V <sub>IN</sub> ≥ V <sub>CC</sub> - 0.3V or V <sub>IN</sub> ≤ 0.3V, f = 0               | Com'l   | 0.5                    |          | 0.5                    |          | 10                     |          | 10                     | mA   |    |
|                  |   |   | L       |                        | 0.05     |                        | 0.05     |                        | 0.05     |                        | 0.05 | mA |
|                  |   |   | Mil     |                        |          |                        |          |                        |          | 15                     | mA   |    |

**Electrical Characteristics Over the Operating Range (-20, -25, -35, -45)<sup>[3]</sup>**

| Parameter       | Description                              | Test Conditions   | 7C199-20 |                        | 7C199-25 |                        | 7C199-35 |                        | 7C199-45 |                        | Unit |
|-----------------|--|---|----------|------------------------|----------|------------------------|----------|------------------------|----------|------------------------|------|
|                 |  |   | Min.     | Max.                   | 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      |                        | 2.4      |                        | V    |
| V <sub>OL</sub> | Output LOW Voltage                       | V <sub>CC</sub> = Min., I <sub>OL</sub> = 8.0 mA  |          | 0.4                    |          | 0.4                    |          | 0.4                    |          | 0.4                    | V    |
| V <sub>IH</sub> | Input HIGH Voltage                       |   | 2.2      | V <sub>CC</sub> + 0.3V | 2.2      | V <sub>CC</sub> + 0.3V | 2.2      | V <sub>CC</sub> + 0.3V | 2.2      | V <sub>CC</sub> + 0.3V | V    |
| V <sub>IL</sub> | Input LOW Voltage                        |   | -0.5     | 0.8                    | -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>  | -5       | +5                     | -5       | +5                     | -5       | +5                     | -5       | +5                     | μA   |
| I <sub>OZ</sub> | Output Leakage Current                   | GND ≤ V <sub>I</sub> ≤ V <sub>CC</sub> , Output Disabled                                  | -5       | +5                     | -5       | +5                     | -5       | +5                     | -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> | Com'l    | 150                    |          | 150                    |          | 140                    |          | 140                    | mA   |
|                 |  |   | L        | 90                     |          | 80                     |          | 70                     |          | 70                     | mA   |
|                 |  |   | Mil      | 170                    |          | 150                    |          | 150                    |          | 150                    | mA   |

Shaded area contains advance information.

**Notes:**

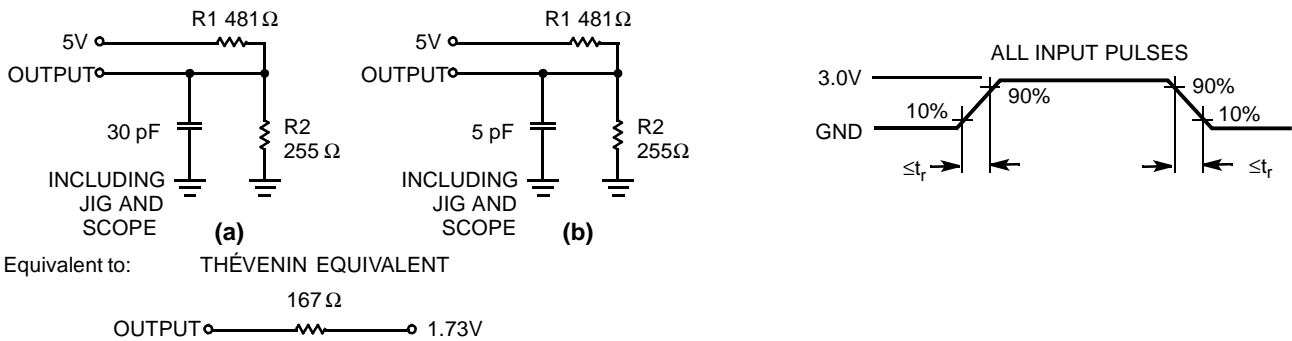
- V<sub>IL</sub> (min.) = -2.0V for pulse durations of less than 20 ns.
- T<sub>A</sub> is the "instant on" case temperature.
- See the last page of this specification for Group A subgroup testing information.

**Electrical Characteristics** Over the Operating Range (-20, -25, -35, -45) (continued)<sup>[3]</sup>

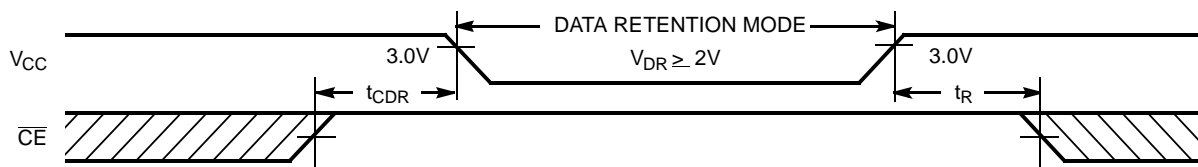
| Parameter | Description                                 | Test Conditions  | 7C199-20 |      | 7C199-25 |      | 7C199-35 |      | 7C199-45 |      | Unit |         |
|-----------|---|--|----------|------|----------|------|----------|------|----------|------|------|---------|
|           |   |  | Min.     | Max. | Min.     | Max. | Min.     | Max. | Min.     | Max. |      |         |
| $I_{SB1}$ | Automatic CE Power-down Current—TTL Inputs  | Max. $V_{CC}$ , $\overline{CE} \geq V_{IH}$ , $V_{IN} \geq V_{IH}$ or $V_{IN} \leq V_{IL}$ , $f = f_{MAX}$     | Com'l    |      | 30       |      | 30       |      | 25       |      | 25   | mA      |
|           |   |  | L        |      | 5        |      | 5        |      | 5        |      | 5    | 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 $V_{IN} \leq 0.3V$ , $f=0$ | Com'l    |      | 10       |      | 10       |      | 10       |      | 10   | mA      |
|           |   |  | L        |      | 0.05     |      | 0.05     |      | 0.05     |      | 0.05 | $\mu A$ |
|           |   |  | Mil      |      | 15       |      | 15       |      | 15       |      | 15   | mA      |

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

| Parameter | Description        | Test Conditions   | Max. | Unit |
|-----------|--------------------|---|------|------|
| $C_{IN}$  | Input Capacitance  | $T_A = 25^\circ C$ , $f = 1\text{ MHz}$ , $V_{CC} = 5.0V$ | 8    | pF   |
| $C_{OUT}$ | Output Capacitance |   | 8    | pF   |

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

**Data Retention Characteristics** Over the Operating Range (L-version only)

| Parameter                | Description                          | Conditions <sup>[6]</sup> | Min.  | Max. | Unit    |
|--------------------------|--------------------------------------|---------------------------|---|------|---------|
| $V_{DR}$                 | $V_{CC}$ for Data Retention          |                           | 2.0   |      | V       |
| $I_{CCDR}$               | Data Retention Current               | Com'l                     | $V_{CC} = V_{DR} = 2.0V$ , $\overline{CE} \geq V_{CC} - 0.3V$ , $V_{IN} \geq V_{CC} - 0.3V$ or $V_{IN} \leq 0.3V$ |      | $\mu A$ |
|                          |                                      | Com'l L                   |   | 10   | $\mu A$ |
| $t_{CDR}$ <sup>[4]</sup> | Chip Deselect to Data Retention Time |                           | 0   |      | ns      |
| $t_R$ <sup>[5]</sup>     | Operation Recovery Time              |                           | 200   |      | $\mu s$ |

**Data Retention Waveform**

**Note:**

4. Tested initially and after any design or process changes that may affect these parameters.
5.  $t_R \leq 3\text{ ns}$  for the -12 and the -15 speeds.  $t_R \leq 5\text{ ns}$  for the -20 and slower speeds
6. No input may exceed  $V_{CC} + 0.5V$ .

**Switching Characteristics** Over the Operating Range (-8, -10, -12, -15) [3, 7]

| Parameter                              | Description                         | 7C199-8 |      | 7C199-10 |      | 7C199-12 |      | 7C199-15 |      | Unit |
|--|-------------------------------------|---------|------|----------|------|----------|------|----------|------|------|
|  |                                     | Min.    | Max. | Min.     | Max. | Min.     | Max. | Min.     | Max. |      |
| <b>Read Cycle</b>                      |                                     |         |      |          |      |          |      |          |      |      |
| t <sub>RC</sub>                        | Read Cycle Time                     | 8       |      | 10       |      | 12       |      | 15       |      | ns   |
| t <sub>AA</sub>                        | Address to Data Valid               |         | 8    |          | 10   |          | 12   |          | 15   | ns   |
| t <sub>OHA</sub>                       | Data Hold from Address Change       | 3       |      | 3        |      | 3        |      | 3        |      | ns   |
| t <sub>ACE</sub>                       | CE LOW to Data Valid                |         | 8    |          | 10   |          | 12   |          | 15   | ns   |
| t <sub>DOE</sub>                       | OE LOW to Data Valid                |         | 4.5  |          | 5    |          | 5    |          | 7    | ns   |
| t <sub>LZOE</sub>                      | OE LOW to Low-Z <sup>[8]</sup>      | 0       |      | 0        |      | 0        |      | 0        |      | ns   |
| t <sub>HZOE</sub>                      | OE HIGH to High-Z <sup>[8, 9]</sup> |         | 5    |          | 5    |          | 5    |          | 7    | ns   |
| t <sub>LZCE</sub>                      | CE LOW to Low-Z <sup>[8]</sup>      | 3       |      | 3        |      | 3        |      | 3        |      | ns   |
| t <sub>HZCE</sub>                      | CE HIGH to High-Z <sup>[8,9]</sup>  |         | 4    |          | 5    |          | 5    |          | 7    | ns   |
| t <sub>PU</sub>                        | CE LOW to Power-up                  | 0       |      | 0        |      | 0        |      | 0        |      | ns   |
| t <sub>PD</sub>                        | CE HIGH to Power-down               |         | 8    |          | 10   |          | 12   |          | 15   | ns   |
| <b>Write Cycle</b> <sup>[10, 11]</sup> |                                     |         |      |          |      |          |      |          |      |      |
| t <sub>WC</sub>                        | Write Cycle Time                    | 8       |      | 10       |      | 12       |      | 15       |      | ns   |
| t <sub>SCE</sub>                       | CE LOW to Write End                 | 7       |      | 7        |      | 9        |      | 10       |      | ns   |
| t <sub>AW</sub>                        | Address Set-up to Write End         | 7       |      | 7        |      | 9        |      | 10       |      | ns   |
| t <sub>HA</sub>                        | Address Hold from Write End         | 0       |      | 0        |      | 0        |      | 0        |      | ns   |
| t <sub>SA</sub>                        | Address Set-up to Write Start       | 0       |      | 0        |      | 0        |      | 0        |      | ns   |
| t <sub>PWE</sub>                       | WE Pulse Width                      | 7       |      | 7        |      | 8        |      | 9        |      | ns   |
| t <sub>SD</sub>                        | Data Set-up to Write End            | 5       |      | 5        |      | 8        |      | 9        |      | ns   |
| t <sub>HD</sub>                        | Data Hold from Write End            | 0       |      | 0        |      | 0        |      | 0        |      | ns   |
| t <sub>HZWE</sub>                      | WE LOW to High-Z <sup>[9]</sup>     |         | 5    |          | 6    |          | 7    |          | 7    | ns   |
| t <sub>LZWE</sub>                      | WE HIGH to Low-Z <sup>[8]</sup>     | 3       |      | 3        |      | 3        |      | 3        |      | ns   |

**Switching Characteristics** Over the Operating Range (-20, -25, -35, -45)<sup>[3, 7]</sup>

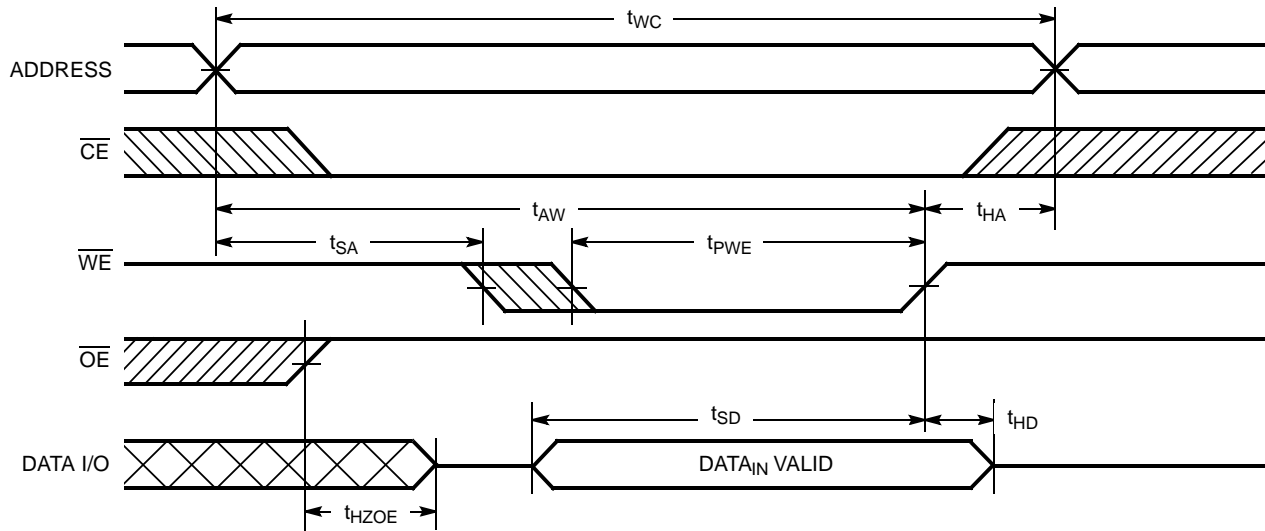
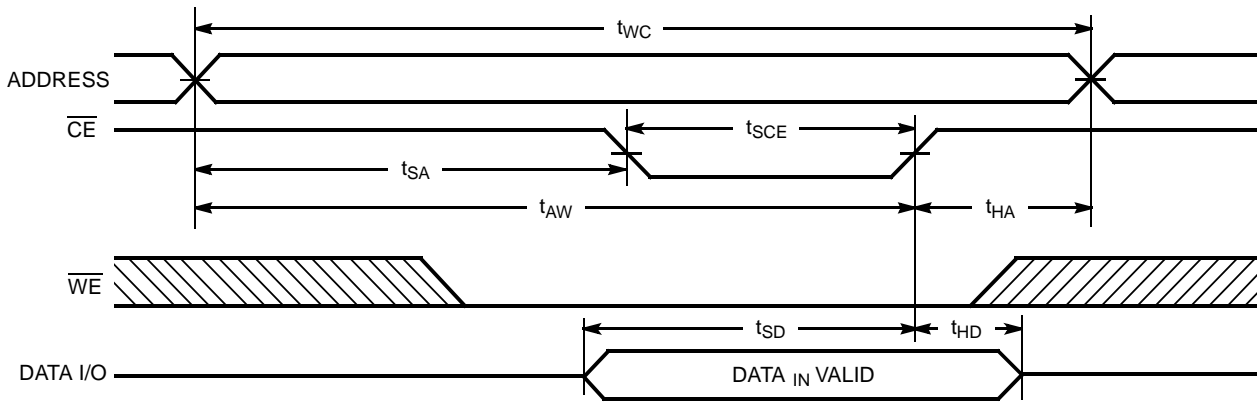
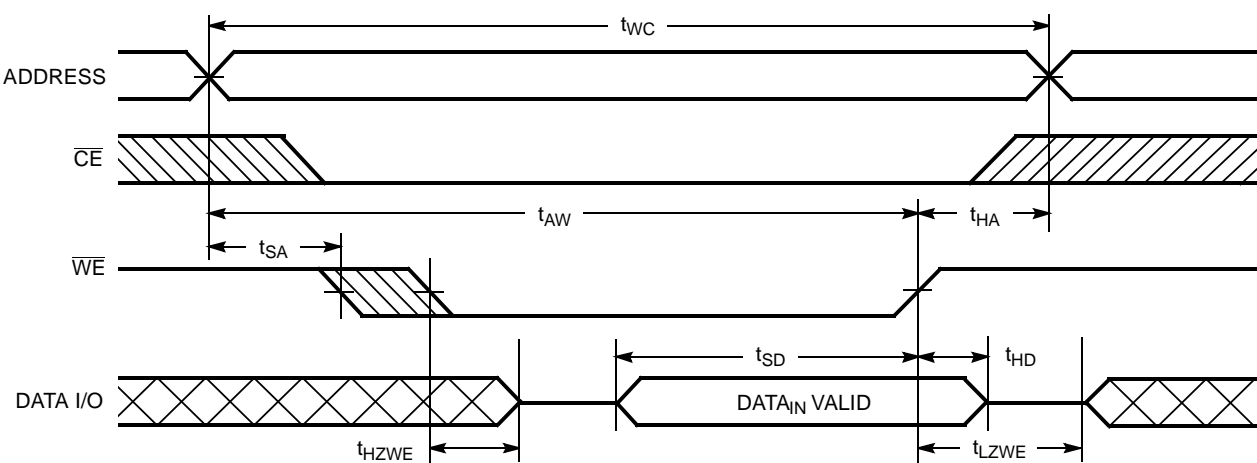
| Parameter         | Description                         | 7C199-20 |      | 7C199-25 |      | 7C199-35 |      | 7C199-45 |      | Unit |
|-------------------|-------------------------------------|----------|------|----------|------|----------|------|----------|------|------|
|                   |                                     | Min.     | Max. | Min.     | Max. | Min.     | Max. | Min.     | Max. |      |
| <b>Read Cycle</b> |                                     |          |      |          |      |          |      |          |      |      |
| t <sub>RC</sub>   | Read Cycle Time                     | 20       |      | 25       |      | 35       |      | 45       |      | ns   |
| t <sub>AA</sub>   | Address to Data Valid               |          | 20   |          | 25   |          | 35   |          | 45   | ns   |
| t <sub>OHA</sub>  | Data Hold from Address Change       | 3        |      | 3        |      | 3        |      | 3        |      | ns   |
| t <sub>ACE</sub>  | CE LOW to Data Valid                |          | 20   |          | 25   |          | 35   |          | 45   | ns   |
| t <sub>DOE</sub>  | OE LOW to Data Valid                |          | 9    |          | 10   |          | 16   |          | 16   | ns   |
| t <sub>LZOE</sub> | OE LOW to Low-Z <sup>[8]</sup>      | 0        |      | 0        |      | 0        |      | 0        |      | ns   |
| t <sub>HZOE</sub> | OE HIGH to High-Z <sup>[8, 9]</sup> |          | 9    |          | 11   |          | 15   |          | 15   | ns   |
| t <sub>LZCE</sub> | CE LOW to Low-Z <sup>[8]</sup>      | 3        |      | 3        |      | 3        |      | 3        |      | ns   |
| t <sub>HZCE</sub> | CE HIGH to High-Z <sup>[8, 9]</sup> |          | 9    |          | 11   |          | 15   |          | 15   | ns   |
| t <sub>PU</sub>   | CE LOW to Power-up                  | 0        |      | 0        |      | 0        |      | 0        |      | ns   |

Shaded area contains advance information.

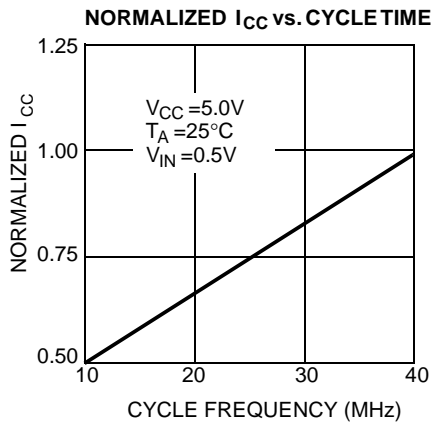
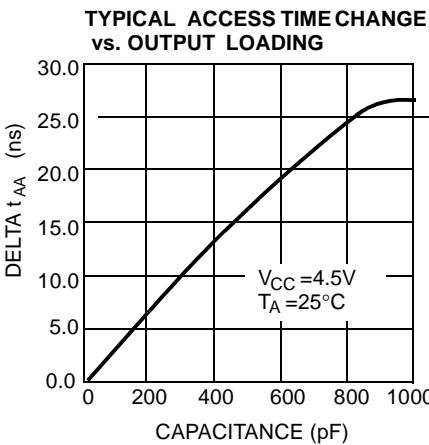
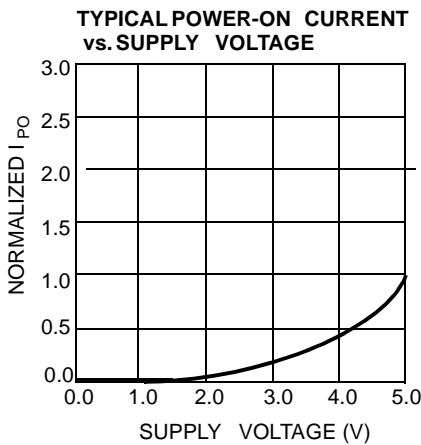
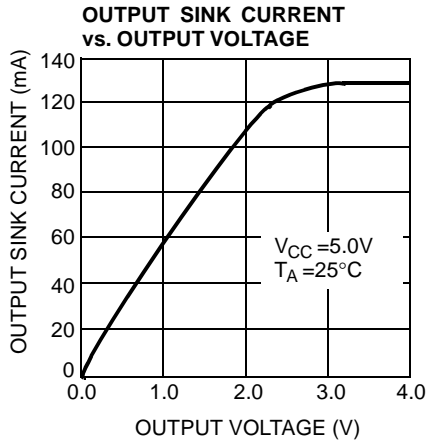
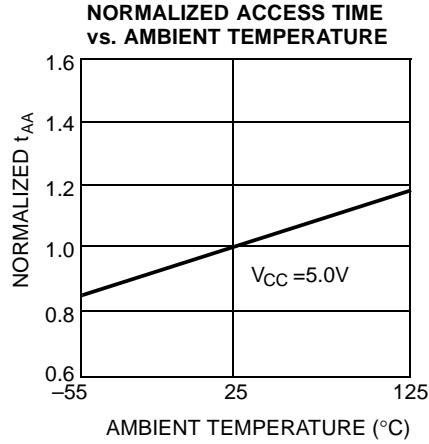
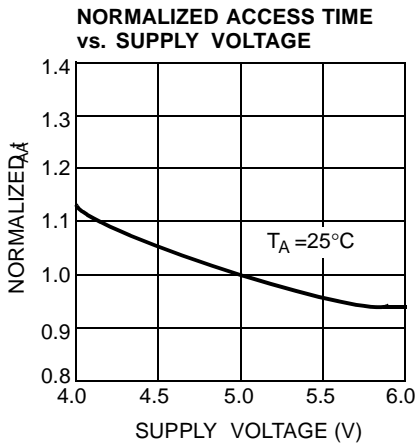
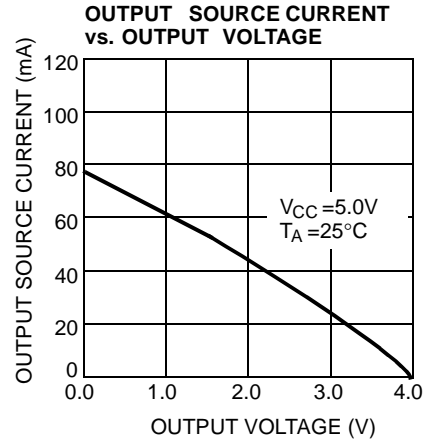
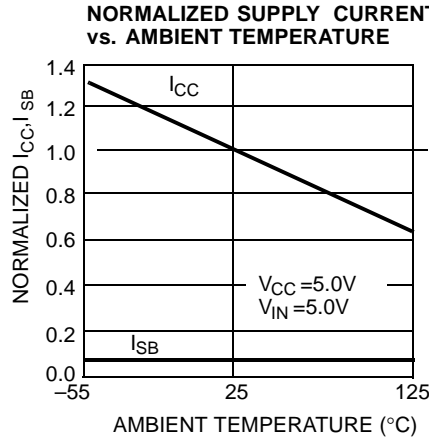
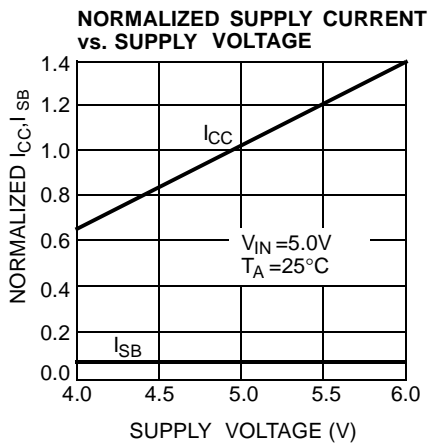
**Notes:**

- Test conditions assume signal transition time of 3 ns or less for -12 and -15 speeds and 5 ns or less for -20 and slower speeds, 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>HZCE</sub> is less than t<sub>OL</sub>/I<sub>OH</sub> and 30-pF load capacitance.
- t<sub>HZOE</sub>, t<sub>HZCE</sub>, and t<sub>HZWE</sub> are specified 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 CE LOW and 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 #3 (WE controlled, OE LOW) is the sum of t<sub>HZWE</sub> and t<sub>SD</sub>.



**Switching Waveforms (continued)**
**Write Cycle No. 1 (WE Controlled)**<sup>[10, 15, 16]</sup>

**Write Cycle No. 2 (CE Controlled)**<sup>[10, 15, 16]</sup>

**Write Cycle No. 3 (WE Controlled  $\overline{OE}$  LOW)**<sup>[11, 16]</sup>

**Notes:**

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.

**Typical DC and AC Characteristics**

**Truth Table**

| CE | WE | 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         | Deselect, Output disabled | Active ( $I_{CC}$ )  |

**Ordering Information**

| Speed (ns) | Ordering Code  | Package Name | Package Type                             | Operating Range |
|------------|----------------|--------------|--|-----------------|
| 8          | CY7C199-8VC    | V21          | 28-Lead Molded SOJ                       | Commercial      |
|            | CY7C199-8ZC    | Z28          | 28-Lead Thin Small Outline Package       |                 |
|            | CY7C199L-8VC   | V21          | 28-Lead Molded SOJ                       |                 |
|            | CY7C199L-8ZC   | Z28          | 28-Lead Thin Small Outline Package       |                 |
| 10         | CY7C199-10VC   | V21          | 28-Lead Molded SOJ                       | Commercial      |
|            | CY7C199-10ZC   | Z28          | 28-Lead Thin Small Outline Package       |                 |
|            | CY7C199L-10VC  | V21          | 28-Lead Molded SOJ                       |                 |
|            | CY7C199L-10ZC  | Z28          | 28-Lead Thin Small Outline Package       |                 |
|            | CY7C199-10VI   | V21          | 28-Lead Molded SOJ                       | Industrial      |
|            | CY7C199-10ZI   | Z28          | 28-Lead Thin Small Outline Package       |                 |
|            | CY7C199L-10VI  | V21          | 28-Lead Molded SOJ                       |                 |
|            | CY7C199L-10ZI  | Z28          | 28-Lead Thin Small Outline Package       |                 |
| 12         | CY7C199-12PC   | P21          | 28-Lead (300-Mil) Molded DIP             | Commercial      |
|            | CY7C199-12VC   | V21          | 28-Lead Molded SOJ                       |                 |
|            | CY7C199-12ZC   | Z28          | 28-Lead Thin Small Outline Package       |                 |
|            | CY7C199L-12PC  | P21          | 28-Lead (300-Mil) Molded DIP             |                 |
|            | CY7C199L-12VC  | V21          | 28-Lead Molded SOJ                       | Industrial      |
|            | CY7C199L-12ZC  | Z28          | 28-Lead Thin Small Outline Package       |                 |
|            | CY7C199-12VI   | V21          | 28-Lead Molded SOJ                       |                 |
|            | CY7C199-12ZI   | Z28          | 28-Lead Thin Small Outline Package       |                 |
|            | CY7C199L-12VI  | V21          | 28-Lead Molded SOJ                       |                 |
|            | CY7C199L-12ZI  | Z28          | 28-Lead Thin Small Outline Package       |                 |
| 15         | CY7C199-15PC   | P21          | 28-Lead (300-Mil) Molded DIP             | Commercial      |
|            | CY7C199-15VC   | V21          | 28-Lead Molded SOJ                       |                 |
|            | CY7C199-15ZC   | Z28          | 28-Lead Thin Small Outline Package       |                 |
|            | CY7C199L-15PC  | P21          | 28-Lead (300-Mil) Molded DIP             |                 |
|            | CY7C199L-15VC  | V21          | 28-Lead Molded SOJ                       | Industrial      |
|            | CY7C199L-15ZC  | Z28          | 28-Lead Thin Small Outline Package       |                 |
|            | CY7C199-15VI   | V21          | 28-Lead Molded SOJ                       |                 |
|            | CY7C199-15ZI   | Z28          | 28-Lead Thin Small Outline Package       |                 |
|            | CY7C199-15DMB  | D22          | 28-Lead (300-Mil) CerDIP                 | Military        |
|            | CY7C199-15LMB  | L54          | 28-Pin Rectangular Leadless Chip Carrier |                 |
|            | CY7C199L-15DMB | D22          | 28-Lead (300-Mil) CerDIP                 |                 |
|            | CY7C199L-15LMB | L54          | 28-Pin Rectangular Leadless Chip Carrier |                 |
| 20         | CY7C199-20PC   | P21          | 28-Lead (300-Mil) Molded DIP             | Commercial      |
|            | CY7C199-20VC   | V21          | 28-Lead Molded SOJ                       |                 |
|            | CY7C199-20ZC   | Z28          | 28-Lead Thin Small Outline Package       |                 |
|            | CY7C199L-20PC  | P21          | 28-Lead (300-Mil) Molded DIP             |                 |
|            | CY7C199L-20VC  | V21          | 28-Lead Molded SOJ                       | Industrial      |
|            | CY7C199L-20ZC  | Z28          | 28-Lead Thin Small Outline Package       |                 |
|            | CY7C199-20VI   | V21          | 28-Lead Molded SOJ                       |                 |
|            | CY7C199-20ZI   | Z28          | 28-Lead Thin Small Outline Package       |                 |
|            | CY7C199-20DMB  | D22          | 28-Lead (300-Mil) CerDIP                 | Military        |
|            | CY7C199-20LMB  | L54          | 28-Pin Rectangular Leadless Chip Carrier |                 |
|            | CY7C199L-20DMB | D22          | 28-Lead (300-Mil) CerDIP                 |                 |
|            | CY7C199L-20LMB | L54          | 28-Pin Rectangular Leadless Chip Carrier |                 |

Shaded area contains advance information. Contact your Cypress sales representative for availability



**Ordering Information** (continued)

| Speed (ns) | Ordering Code | Package Name | Package Type                             | Operating Range |
|------------|---------------|--------------|--|-----------------|
| 25         | CY7C199-25PC  | P21          | 28-Lead (300-Mil) Molded DIP             | Commercial      |
|            | CY7C199-25SC  | S21          | 28-Lead Molded SOIC                      |                 |
|            | CY7C199-25VC  | V21          | 28-Lead Molded SOJ                       |                 |
|            | CY7C199-25ZC  | Z28          | 28-Lead Thin Small Outline Package       | Industrial      |
|            | CY7C199-25SI  | S21          | 28-Lead Molded SOIC                      |                 |
|            | CY7C199-25VI  | V21          | 28-Lead Molded SOJ                       |                 |
|            | CY7C199-25ZI  | Z28          | 28-Lead Thin Small Outline Package       | Military        |
|            | CY7C199-25DMB | D22          | 28-Lead (300-Mil) CerDIP                 |                 |
|            | CY7C199-25LMB | L54          | 28-Pin Rectangular Leadless Chip Carrier |                 |
| 35         | CY7C199-35PC  | P21          | 28-Lead (300-Mil) Molded DIP             | Commercial      |
|            | CY7C199-35SC  | S21          | 28-Lead Molded SOIC                      |                 |
|            | CY7C199-35VC  | V21          | 28-Lead Molded SOJ                       |                 |
|            | CY7C199-35ZC  | Z28          | 28-Lead Thin Small Outline Package       | Industrial      |
|            | CY7C199-35SI  | S21          | 28-Lead Molded SOIC                      |                 |
|            | CY7C199-35VI  | V21          | 28-Lead Molded SOJ                       |                 |
|            | CY7C199-35ZI  | Z28          | 28-Lead Thin Small Outline Package       | Military        |
|            | CY7C199-35DMB | D22          | 28-Lead (300-Mil) CerDIP                 |                 |
|            | CY7C199-35LMB | L54          | 28-Pin Rectangular Leadless Chip Carrier |                 |
| 45         | CY7C199-45DMB | D22          | 28-Lead (300-Mil) CerDIP                 | Military        |
|            | CY7C199-45LMB | L54          | 28-Pin Rectangular Leadless Chip Carrier |                 |

Shaded area contains advance information. Contact your Cypress sales representative for availability

**MILITARY SPECIFICATIONS**
**Group A Subgroup Testing**
**DC Characteristics**

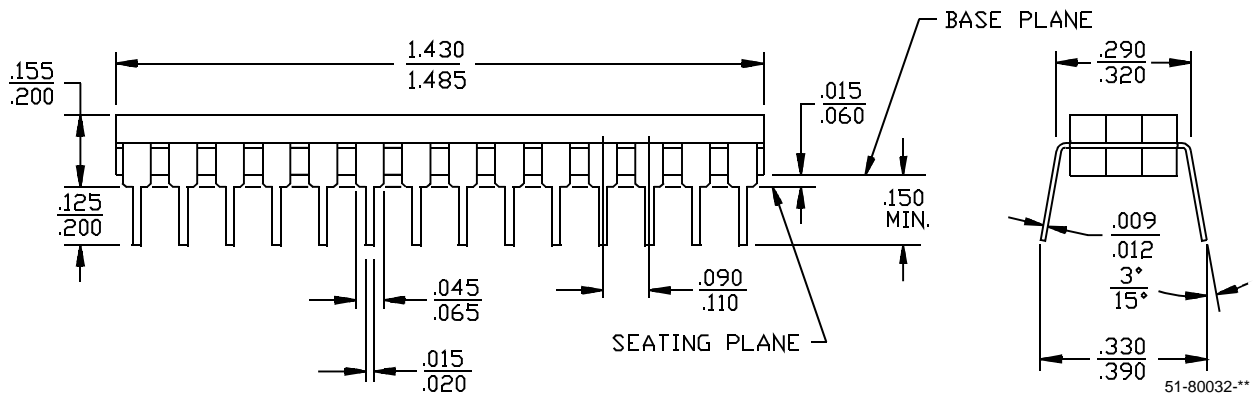
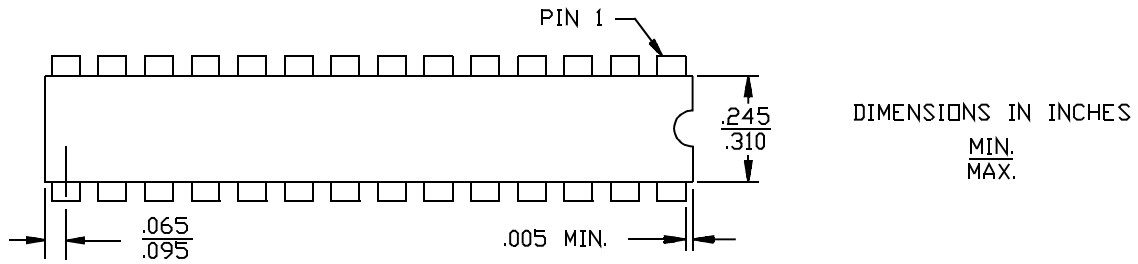
| Parameter     | Subgroups |
|---------------|-----------|
| $V_{OH}$      | 1, 2, 3   |
| $V_{OL}$      | 1, 2, 3   |
| $V_{IH}$      | 1, 2, 3   |
| $V_{IL}$ Max. | 1, 2, 3   |
| $I_{IX}$      | 1, 2, 3   |
| $I_{OZ}$      | 1, 2, 3   |
| $I_{CC}$      | 1, 2, 3   |
| $I_{SB1}$     | 1, 2, 3   |
| $I_{SB2}$     | 1, 2, 3   |

**Switching Characteristics**

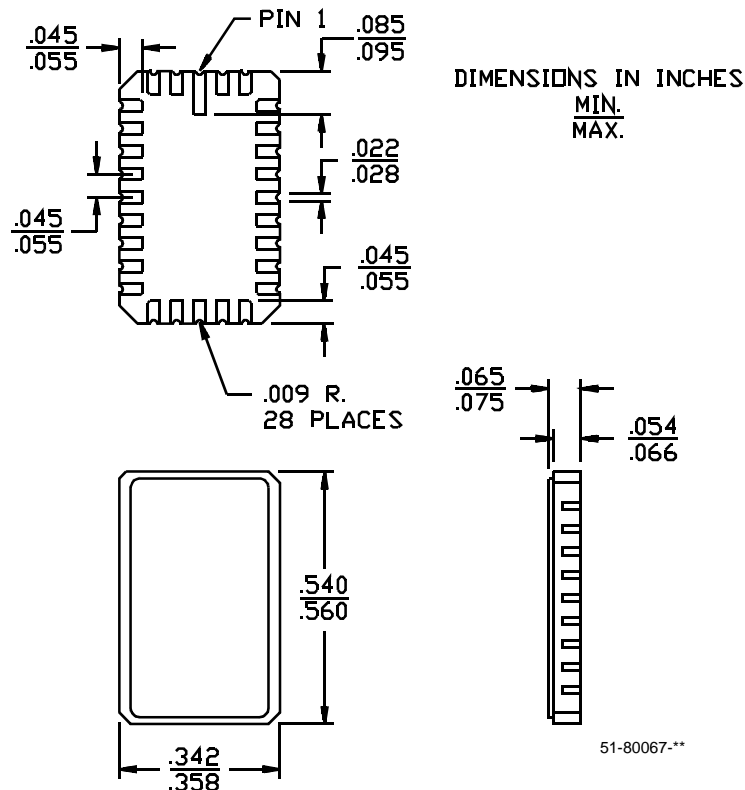
| Parameter          | Subgroups       |
|--------------------|-----------------|
| <b>Read Cycle</b>  |                 |
| $t_{RC}$           | 7, 8, 9, 10, 11 |
| $t_{AA}$           | 7, 8, 9, 10, 11 |
| $t_{OHA}$          | 7, 8, 9, 10, 11 |
| $t_{ACE}$          | 7, 8, 9, 10, 11 |
| $t_{DOE}$          | 7, 8, 9, 10, 11 |
| <b>Write Cycle</b> |                 |
| $t_{WC}$           | 7, 8, 9, 10, 11 |
| $t_{AA}$           | 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 |

Package Diagrams

**28-pin (300-Mil) CerDIP D22**  
MIL-STD-1835 D-15 Config. A

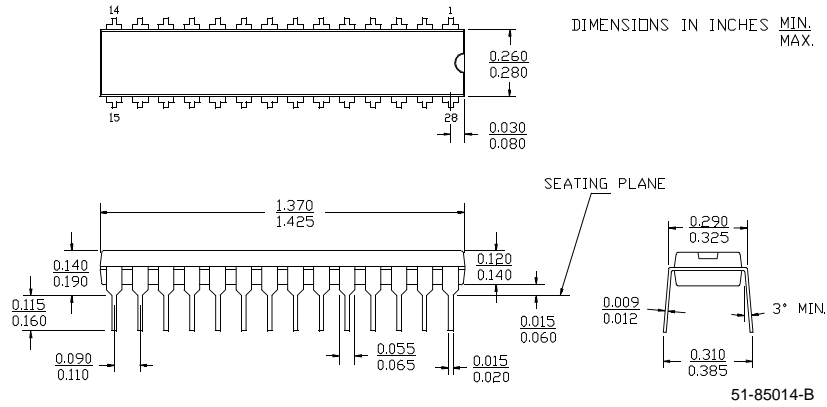


**28-pin Rectangular Leadless Chip Carrier L54**  
MIL-STD-1835C-11A

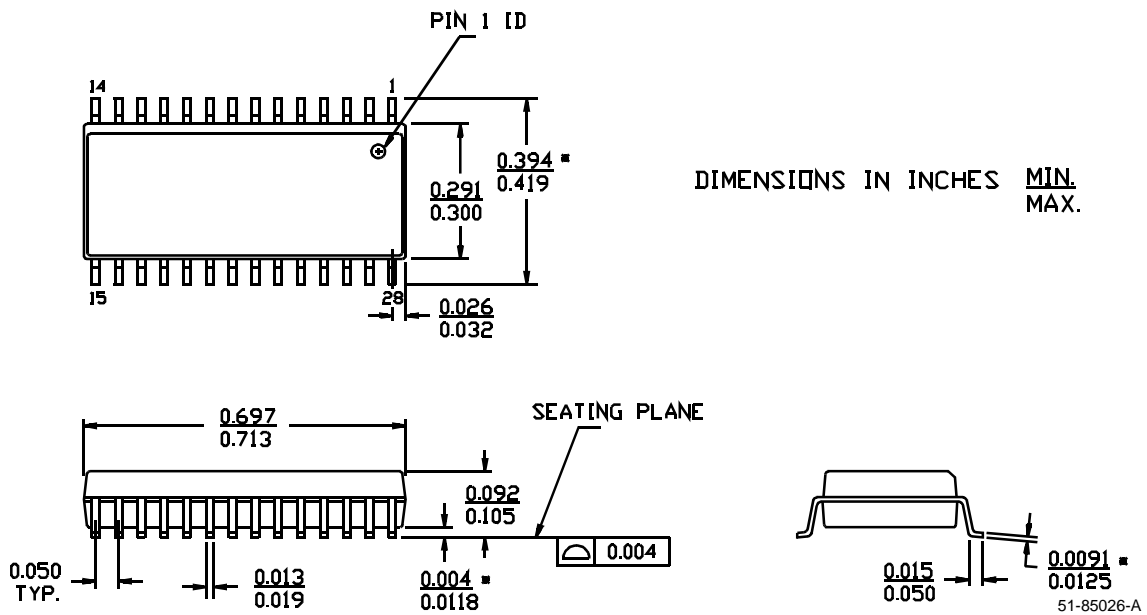


Package Diagrams (continued)

28-pin (300-Mil) Molded DIP P21

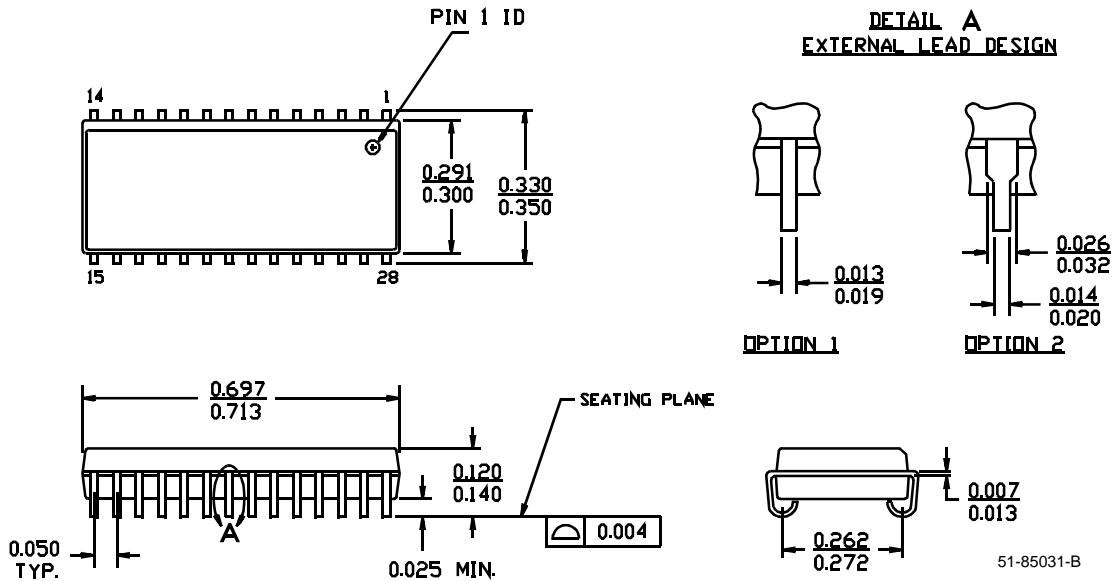


28-pin (300-Mil) Molded SOIC S21

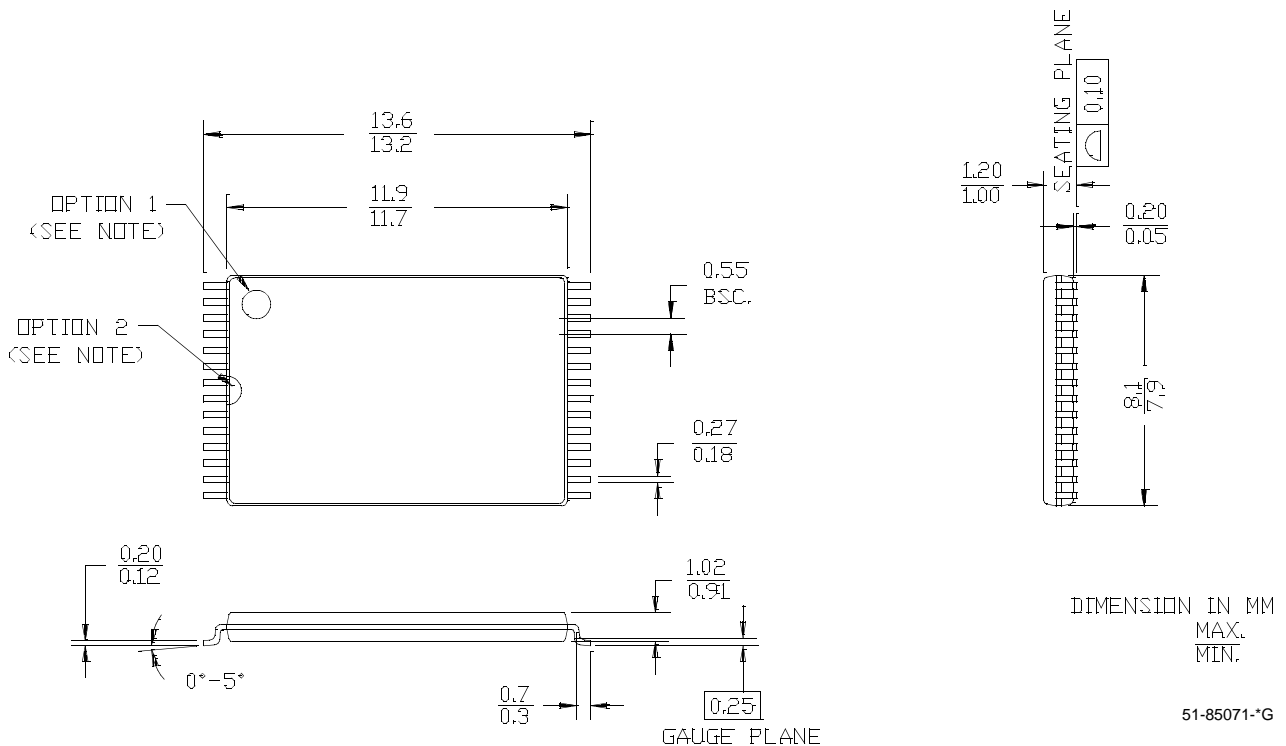


**Package Diagrams** (continued)

28-pin (300-Mil) Molded SOJ V21  
 DIMENSIONS IN INCHES    MIN.    MAX.


**28-Lead Thin Small Outline Package Type 1 (8x13.4 mm) Z28**

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



DIMENSION IN MM  
 MAX.  
 MIN.

51-85071-G

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**Document History Page**

| <b>Document Title: CY7C199 32K x 8 Static RAM</b><br><b>Document Number: 38-05160</b> |                |                   |                        |   |
|---|----------------|-------------------|------------------------|---|
| <b>REV.</b>   | <b>ECN NO.</b> | <b>Issue Date</b> | <b>Orig. of Change</b> | <b>Description of Change</b>                  |
| **  | 109971         | 10/28/01          | SZV                    | Change from Spec number: 38-00239 to 38-05160 |
| *A  | 121730         | 01/09/02          | DFP                    | Updated Product Offering table.               |