



# CY7C171A CY7C172A

## 4K x 4 Static RAM with Separate I/O

### Features

- Automatic power-down when deselected
- CMOS for optimum speed/power
- High speed
  - $t_{AA} = 15 \text{ ns}$
- Transparent write (7C171A)
- Low active power
  - 375 mW
- Low standby power
  - 93 mW
- TTL-compatible inputs and outputs
- Capable of withstanding greater than 2001V electrostatic discharge

### Functional Description

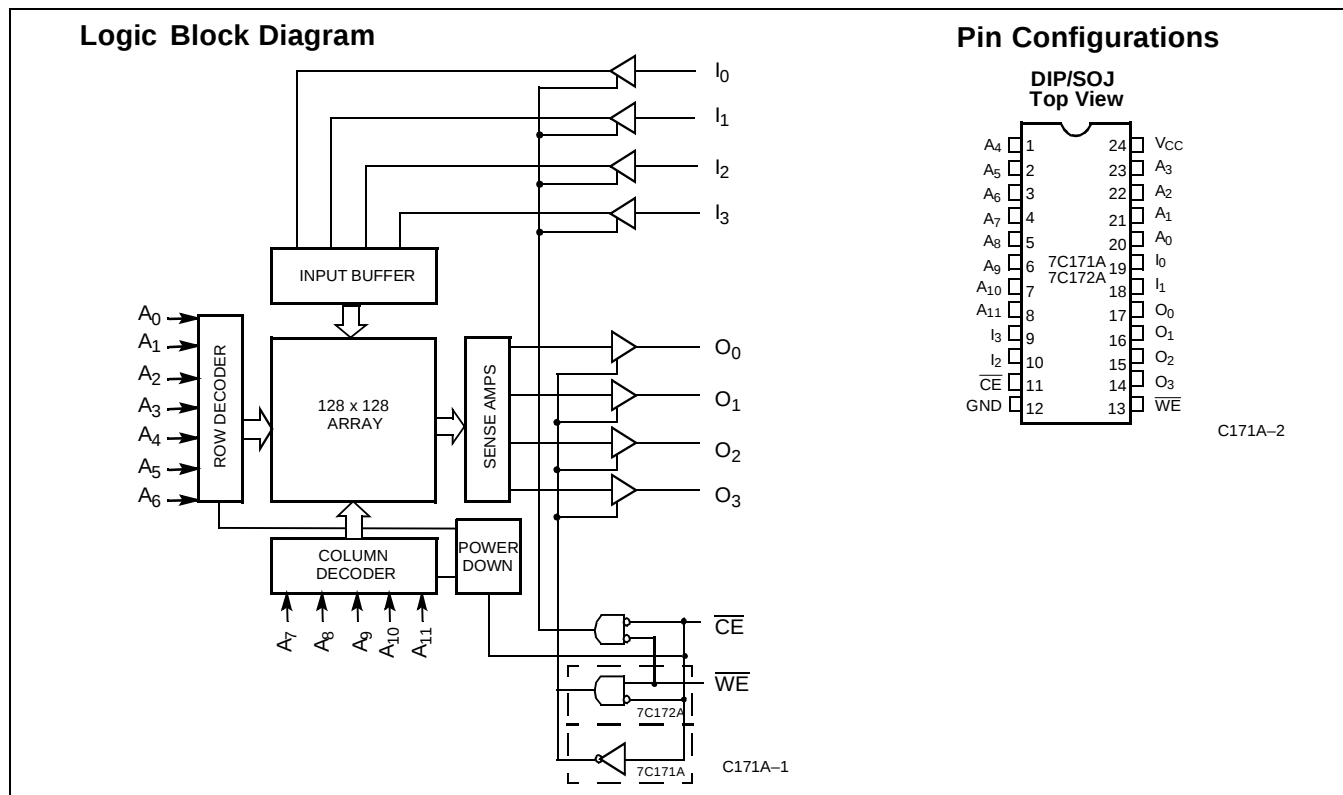
The CY7C171A and CY7C172A are high-performance CMOS static RAMs organized as 4096 by 4 bits with separate I/O. Easy memory expansion is provided by an active LOW chip enable ( $\overline{CE}$ ) and three-state drivers. They have an automatic power-down feature, reducing the power consumption by 77% when deselected.

Writing to the device is accomplished when the chip enable ( $\overline{CE}$ ) and write enable ( $\overline{WE}$ ) inputs are both LOW. Data on the four input/output pins ( $I_0$  through  $I_3$ ) is written into the memory location specified on the address pins ( $A_0$  through  $A_{11}$ ).

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

The output pins remain in a high-impedance state when write enable ( $\overline{WE}$ ) is LOW (7C172A only), or chip enable is HIGH.

A die coat is used to insure alpha immunity.



### Selection Guide

|                                |            | 7C171A-15<br>7C172A-15 | 7C171A-20<br>7C172A-20 | 7C171A-25<br>7C172A-25 | 7C171A-35<br>7C172A-35 | 7C171A-45<br>7C172A-45 |
|--------------------------------|------------|------------------------|------------------------|------------------------|------------------------|------------------------|
| Maximum Access Time (ns)       |            | 15                     | 20                     | 25                     | 35                     | 45                     |
| Maximum Operating Current (mA) | Commercial | 115                    | 80                     | 70                     | 70                     |                        |
|                                | Military   |                        | 90                     | 80                     | 70                     | 70                     |

## 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 ..... -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 <sub>CC</sub> |
|-------------------------|---------------------|-----------------|
| Commercial              | 0°C to +70°C        | 5V ± 10%        |
| Military <sup>[1]</sup> | -55°C to +125°C     | 5V ± 10%        |

Note:

1. T<sub>A</sub> is the "instant on" case temperature.

## Electrical Characteristics Over the Operating Range<sup>[2]</sup>

| Parameter        | Description                                  | Test Conditions                                                                                                                         | 7C171A-15<br>7C172A-15 |                 | 7C171A-20<br>7C172A-20 |                 | 7C171A-25<br>7C172A-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> = 8.0 mA                                                                                        |                        | 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                            |                                                                                                                                         | -3.0                   | 0.8             | -3.0                   | 0.8             | -3.0                   | 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> ,<br>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.,<br>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.<br>I <sub>OUT</sub> = 0 mA                                                                                       | Com'l                  | 115             |                        | 80              |                        | 70              | mA   |
|                  |                                              |                                                                                                                                         | Mil                    |                 |                        | 90              |                        | 80              |      |
| I <sub>SB1</sub> | Automatic $\overline{CE}$ Power-Down Current | Max. V <sub>CC</sub> , $\overline{CE} \geq V_{IH}$<br>Min. Duty Cycle = 100%                                                            | Com'l                  | 40              |                        | 40              |                        | 20              | mA   |
|                  |                                              |                                                                                                                                         | Mil                    |                 |                        | 40              |                        | 20              |      |
| I <sub>SB2</sub> | Automatic $\overline{CE}$ Power-Down Current | Max. V <sub>CC</sub> ,<br>$\overline{CE} \geq V_{IH} - 0.3V$ ,<br>V <sub>IN</sub> ≥ V <sub>CC</sub> - 0.3V or<br>V <sub>IN</sub> ≤ 0.3V | Com'l                  | 20              |                        | 20              |                        | 20              | mA   |
|                  |                                              |                                                                                                                                         | Mil                    |                 |                        | 20              |                        | 20              |      |



**Electrical Characteristics** Over the Operating Range<sup>[2]</sup> (continued)

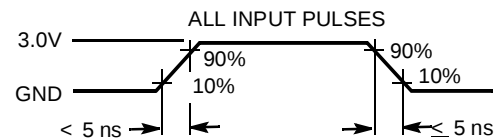
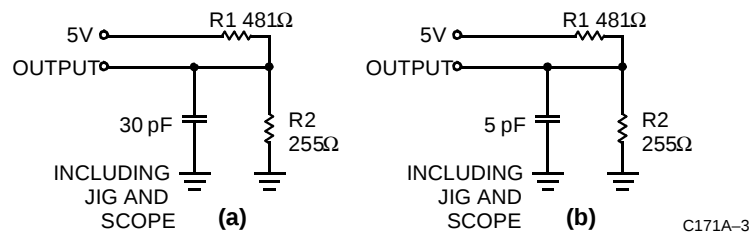
| Parameter        | Description                                         | Test Conditions                                                                                                                                       | 7C171A-35<br>7C172A-35 |                 | 7C171A-45<br>7C172A-45 |                 | 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> = 8.0 mA                                                                                                      |                        | 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                                   |                                                                                                                                                       | -3.0                   | 0.8             | -3.0                   | 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> ,<br>Output Disabled                                                                                           | -10                    | +10             | -10                    | +10             | μA   |
| I <sub>OS</sub>  | Output Short Circuit Current <sup>[3]</sup>         | V <sub>CC</sub> = Max.,<br>V <sub>OUT</sub> = GND                                                                                                     |                        | -350            |                        | -350            | mA   |
| I <sub>CC</sub>  | V <sub>CC</sub> Operating Supply Current            | V <sub>CC</sub> = Max.<br>I <sub>OUT</sub> = 0 mA                                                                                                     | Com'l                  |                 | 70                     |                 | mA   |
|                  |                                                     |                                                                                                                                                       | Mil                    |                 | 70                     | 70              | mA   |
| I <sub>SB1</sub> | Automatic $\overline{\text{CE}}$ Power-Down Current | Max. V <sub>CC</sub> , $\overline{\text{CE}} \geq V_{IH}$<br>Min. Duty Cycle = 100%                                                                   | Com'l                  |                 | 20                     |                 | mA   |
|                  |                                                     |                                                                                                                                                       | Mil                    |                 | 20                     | 20              | mA   |
| I <sub>SB2</sub> | Automatic $\overline{\text{CE}}$ Power-Down Current | Max. V <sub>CC</sub> ,<br>$\overline{\text{CE}} \geq V_{IH} - 0.3\text{V}$ ,<br>V <sub>IN</sub> ≥ V <sub>CC</sub> - 0.3V or<br>V <sub>IN</sub> ≤ 0.3V | Com'l                  |                 | 20                     |                 | mA   |
|                  |                                                     |                                                                                                                                                       | Mil                    |                 | 20                     | 20              | mA   |

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

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

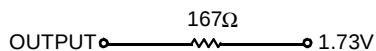
**Notes:**

- See the last page of this specification for Group A subgroup testing information.
- Not more than 1 output should be shorted at one time. Duration of the short circuit should not exceed 30 seconds.
- Tested initially and after any design or process changes that may affect these parameters

**AC Test Loads and Waveform**


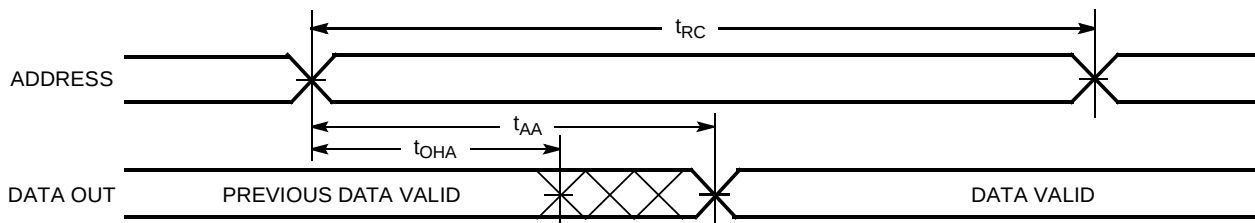
C171A-4

Equivalent to: THÉVENIN EQUIVALENT



**Switching Characteristics Over the Operating Range<sup>[2,5]</sup>**

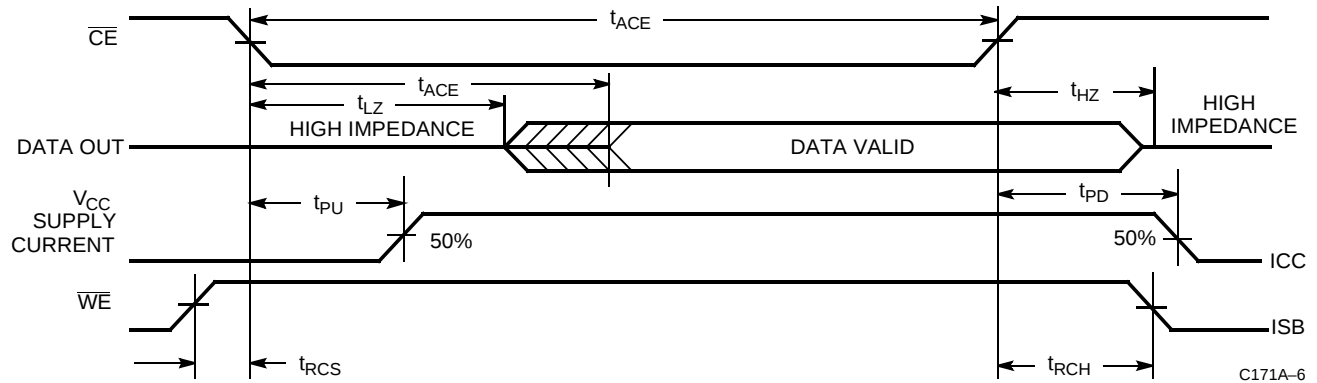
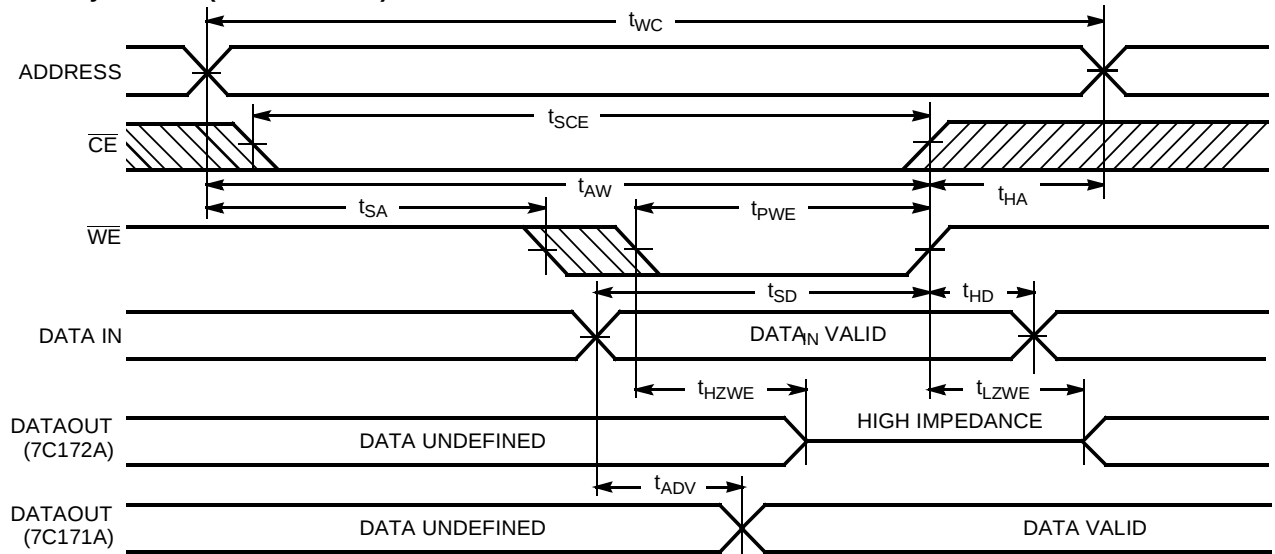
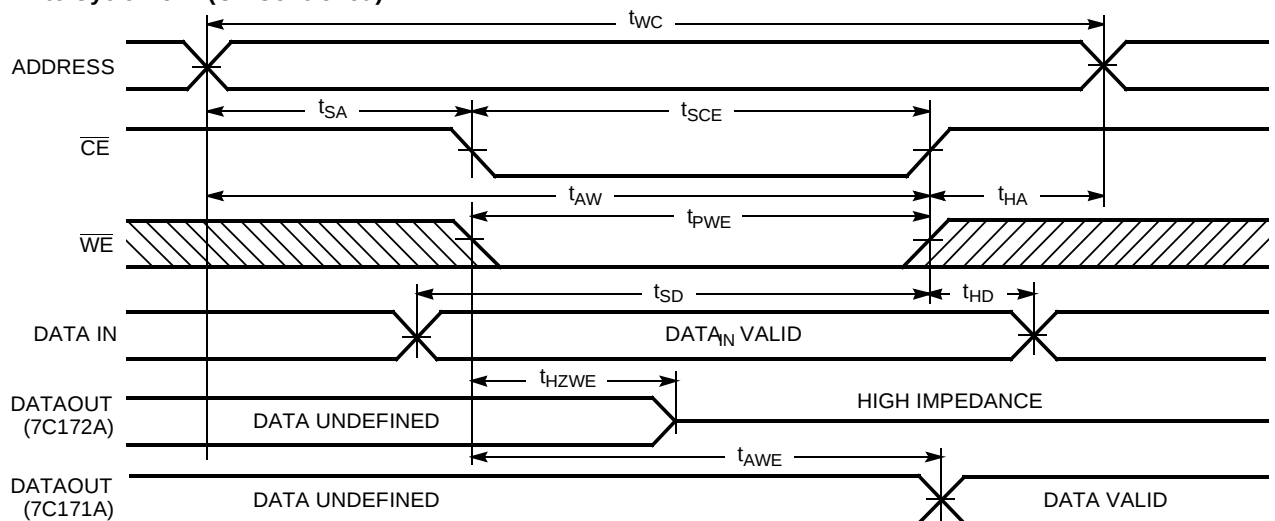
| Parameter                  | Description                                             | 7C171A-15<br>7C172A-15 |      | 7C171A-20<br>7C172A-20 |      | 7C171A-25<br>7C172A-25 |      | 7C171A-35<br>7C172A-35 |      | 7C171A-45<br>7C172A-45 |      | Unit |
|----------------------------|---------------------------------------------------------|------------------------|------|------------------------|------|------------------------|------|------------------------|------|------------------------|------|------|
|                            |                                                         | Min.                   | Max. | Min.                   | Max. | Min.                   | Max. | Min.                   | Max. | Min.                   | Max. |      |
| READ CYCLE                 |                                                         |                        |      |                        |      |                        |      |                        |      |                        |      |      |
| t <sub>RC</sub>            | Read Cycle Time                                         | 15                     |      | 20                     |      | 25                     |      | 35                     |      | 45                     |      | ns   |
| t <sub>AA</sub>            | Address to Data Valid                                   |                        | 15   |                        | 20   |                        | 25   |                        | 35   |                        | 45   | ns   |
| t <sub>OHA</sub>           | Output 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>[6]</sup>             | 5                      |      | 5                      |      | 5                      |      | 5                      |      | 5                      |      | ns   |
| t <sub>HZCE</sub>          | $\overline{CE}$ HIGH to HIGH Z <sup>[6, 7]</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   |
| t <sub>RCS</sub>           | Read Command Set-Up                                     | 0                      |      | 0                      |      | 0                      |      | 0                      |      | 0                      |      | ns   |
| t <sub>RCH</sub>           | Read Command Hold                                       | 0                      |      | 0                      |      | 0                      |      | 0                      |      | 0                      |      | ns   |
| WRITE CYCLE <sup>[8]</sup> |                                                         |                        |      |                        |      |                        |      |                        |      |                        |      |      |
| 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>LZWE</sub>          | $\overline{WE}$ HIGH to Low Z <sup>[6]</sup> (7C172A)   | 5                      |      | 5                      |      | 5                      |      | 5                      |      | 5                      |      | ns   |
| t <sub>HZWE</sub>          | $\overline{WE}$ LOW to High Z <sup>[6,7]</sup> (7C172A) |                        | 7    |                        | 7    |                        | 7    |                        | 10   |                        | 15   | ns   |
| t <sub>AWE</sub>           | $\overline{WE}$ LOW to Data Valid (7C171A)              |                        | 15   |                        | 20   |                        | 25   |                        | 30   |                        | 35   | ns   |
| t <sub>ADV</sub>           | Data Valid to Output Valid (7C171A)                     |                        | 15   |                        | 20   |                        | 25   |                        | 30   |                        | 35   | ns   |

**Switching Waveforms**
**Read Cycle No. 1<sup>[9,10]</sup>**


C171A-5

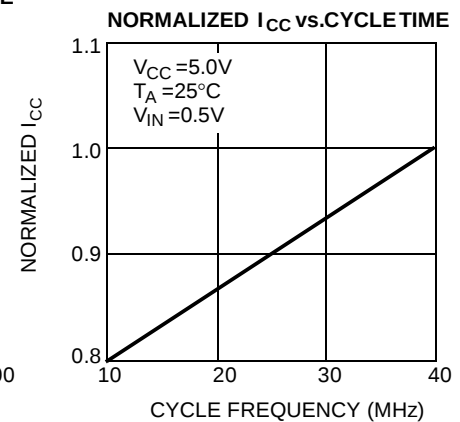
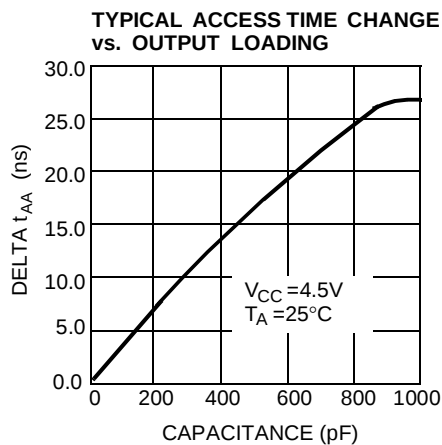
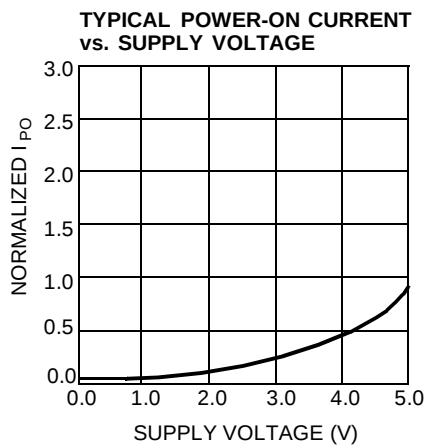
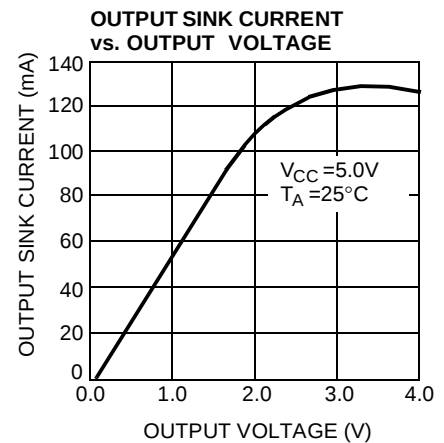
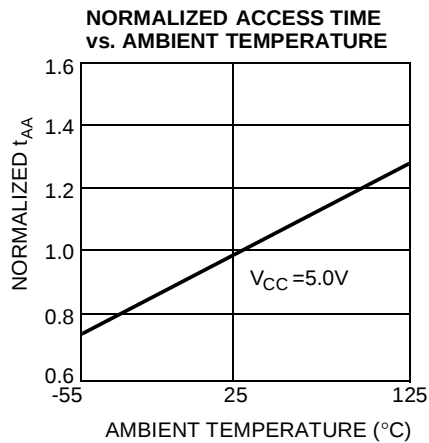
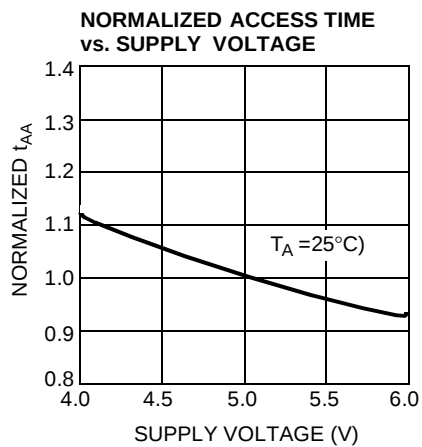
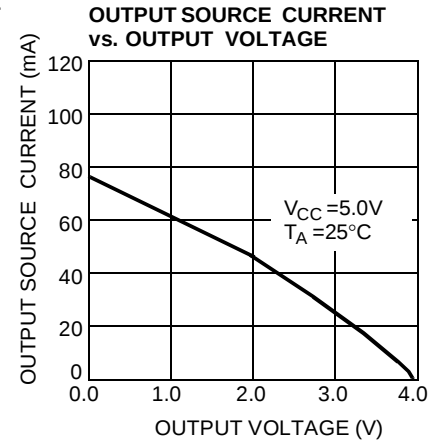
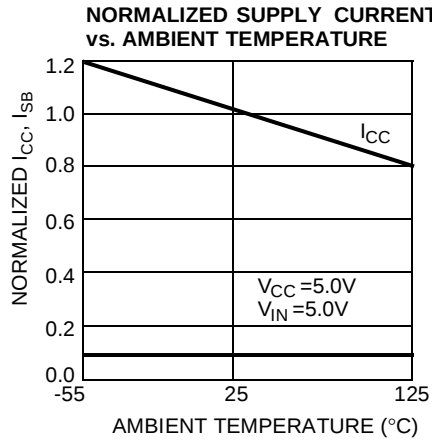
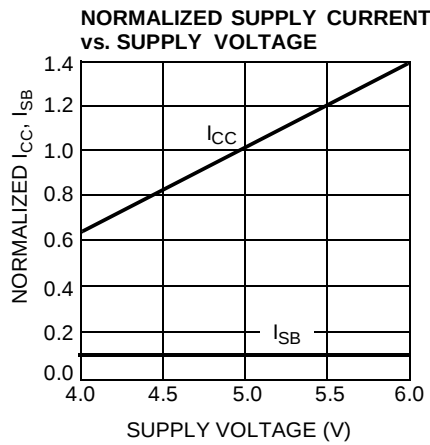
**Notes:**

- 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  $I_{OI}/I_{OH}$  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  $C_L = 5\text{pF}$  as in part (b) of AC Test Loads. Transition is measured  $\pm 500\text{ mV}$  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 setup and hold timing should be referenced to the rising edge of the signal that terminates the write.
- $\overline{WE}$  is HIGH for read cycle.
- Device is continuously selected,  $\overline{CE} = V_{IL}$ .

**Switching Waveforms (continued)**
**Read Cycle No. 2<sup>[9,11]</sup>**

**Write Cycle No. 1 (WE Controlled)<sup>[8]</sup>**

**Write Cycle No. 2 (CE Controlled)<sup>[8,12]</sup>**

**Notes:**

11. Address valid prior to or coincident with  $\overline{CE}$  transition LOW.
12. If  $\overline{CE}$  goes HIGH simultaneously with  $\overline{WE}$  HIGH, the output remains in a high-impedance state (7C172A).

## Typical DC and AC Characteristics





## Ordering Information

| Speed (ns) | Ordering Code | Package Name | Package Type                 | Operating Range |
|------------|---------------|--------------|------------------------------|-----------------|
| 15         | CY7C171A-15PC | P13          | 24-Lead (300-Mil) Molded DIP | Commercial      |
| 20         | CY7C171A-20PC | P13          | 24-Lead (300-Mil) Molded DIP | Commercial      |
| 25         | CY7C171A-25PC | P13          | 24-Lead (300-Mil) Molded DIP | Commercial      |
| 35         | CY7C171A-35PC | P13          | 24-Lead (300-Mil) Molded DIP | Commercial      |

| Speed (ns) | Ordering Code  | Package Name | Package Type                 | Operating Range |
|------------|----------------|--------------|------------------------------|-----------------|
| 15         | CY7C172A-15PC  | P13          | 24-Lead (300-Mil) Molded DIP | Commercial      |
|            | CY7C172A-15VC  | V13          | 24-Lead Molded SOJ           |                 |
| 20         | CY7C172A-20PC  | P13          | 24-Lead (300-Mil) Molded DIP | Commercial      |
|            | CY7C172A-20VC  | V13          | 24-Lead Molded SOJ           |                 |
|            | CY7C172A-20DMB | D14          | 24-Lead (300-Mil) CerDIP     | Military        |
| 25         | CY7C172A-25PC  | P13          | 24-Lead (300-Mil) Molded DIP | Commercial      |
|            | CY7C172A-25VC  | V13          | 24-Lead Molded SOJ           |                 |
|            | CY7C172A-25DMB | D14          | 24-Lead (300-Mil) CerDIP     | Military        |
| 35         | CY7C172A-35PC  | P13          | 24-Lead (300-Mil) Molded DIP | Commercial      |
|            | CY7C172A-35DMB | D14          | 24-Lead (300-Mil) CerDIP     | Military        |
| 45         | CY7C172A-45DMB | D14          | 24-Lead (300-Mil) CerDIP     | Military        |

## MILITARY SPECIFICATIONS

### Group A Subgroup Testing

#### DC Characteristics

| Parameter            | Subgroups |
|----------------------|-----------|
| V <sub>OH</sub>      | 1, 2, 3   |
| V <sub>OL</sub>      | 1, 2, 3   |
| V <sub>IH</sub>      | 1, 2, 3   |
| V <sub>IL</sub> Max. | 1, 2, 3   |
| I <sub>IX</sub>      | 1, 2, 3   |
| I <sub>OZ</sub>      | 1, 2, 3   |
| I <sub>OS</sub>      | 1, 2, 3   |
| I <sub>CC</sub>      | 1, 2, 3   |
| I <sub>SB1</sub>     | 1, 2, 3   |
| I <sub>SB1</sub>     | 1, 2, 3   |

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#### Switching Characteristics

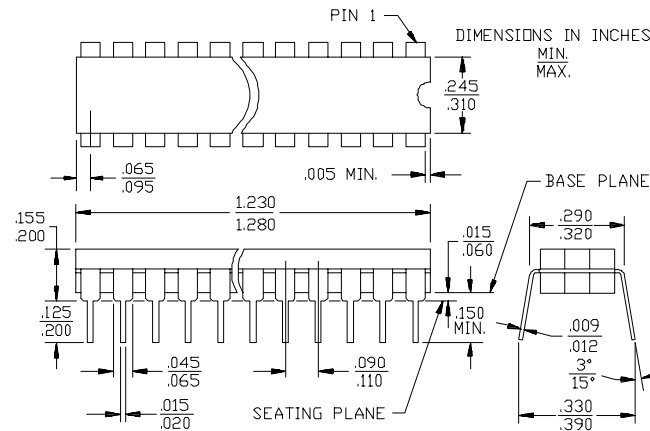
| Parameter                        | Subgroups       |
|----------------------------------|-----------------|
| <b>READ CYCLE</b>                |                 |
| t <sub>RC</sub>                  | 7, 8, 9, 10, 11 |
| t <sub>AA</sub>                  | 7, 8, 9, 10, 11 |
| t <sub>OHA</sub>                 | 7, 8, 9, 10, 11 |
| t <sub>ACE</sub>                 | 7, 8, 9, 10, 11 |
| t <sub>RCS</sub>                 | 7, 8, 9, 10, 11 |
| t <sub>RCH</sub>                 | 7, 8, 9, 10, 11 |
| <b>WRITE CYCLE</b>               |                 |
| t <sub>WC</sub>                  | 7, 8, 9, 10, 11 |
| t <sub>SCE</sub>                 | 7, 8, 9, 10, 11 |
| t <sub>AW</sub>                  | 7, 8, 9, 10, 11 |
| t <sub>HA</sub>                  | 7, 8, 9, 10, 11 |
| t <sub>SA</sub>                  | 7, 8, 9, 10, 11 |
| t <sub>PWE</sub>                 | 7, 8, 9, 10, 11 |
| t <sub>SD</sub>                  | 7, 8, 9, 10, 11 |
| t <sub>HD</sub>                  | 7, 8, 9, 10, 11 |
| t <sub>AWE</sub> <sup>[13]</sup> | 7, 8, 9, 10, 11 |
| t <sub>ADV</sub> <sup>[13]</sup> | 7, 8, 9, 10, 11 |

**Note:**

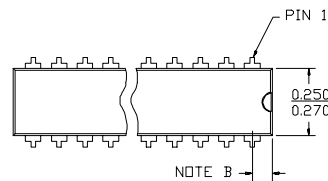
13. 7C171A only.

**Package Diagrams**
**24-Lead (300-Mil) CerDIP D14**

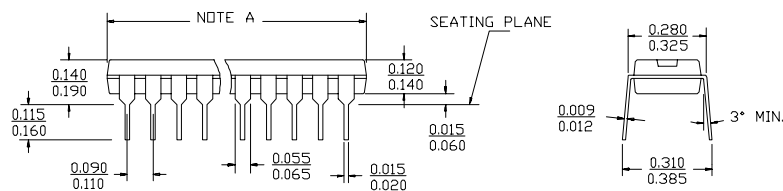
MIL-STD-1835 D-9 Config.A


**24-Lead (300-Mil) Molded DIP P13/P13A**

DIMENSIONS IN INCHES MIN. MAX.



|        | P 13           | P 13A          |
|--------|----------------|----------------|
| NOTE A | 1.170<br>1.200 | 1.230<br>1.260 |
| NOTE B | 0.030<br>0.050 | 0.060<br>0.080 |


**24-Lead Molded SOJ V13**

DIMENSIONS IN INCHES MIN. MAX.

