



# CYPRESS

## CY7C123

### 256 x 4 Static RAM

#### Features

- 256 x 4 static RAM for control store in high-speed computers
- CMOS for optimum speed/power
- High speed
  - 7 ns (commercial)
  - 10 ns (military)
- Low power
  - 660 mW (commercial)
  - 825 mW (military)
- Separate inputs and outputs
- 5-volt power supply  $\pm 10\%$  tolerance both commercial and military
- TTL-compatible inputs and outputs
- 24 pins
- 300-mil package

#### Functional Description

The CY7C123 is a high-performance CMOS static RAM organized as 256 words by 4 bits. Easy memory expansion is provided by an active LOW chip select one ( $\overline{CS}_1$ ) input, an active HIGH chip select two ( $CS_2$ ) input, and three-state outputs.

Writing to the device is accomplished when the chip select one ( $\overline{CS}_1$ ) and write enable ( $\overline{WE}$ ) inputs are both LOW and the chip select two input is HIGH. Data on the four data inputs ( $D_0$  through  $D_3$ ) is written into the memory location specified on the address pins ( $A_0$  through  $A_7$ ). The outputs are preconditioned so that the write data is present at the outputs when the write cycle is complete. This preconditioning

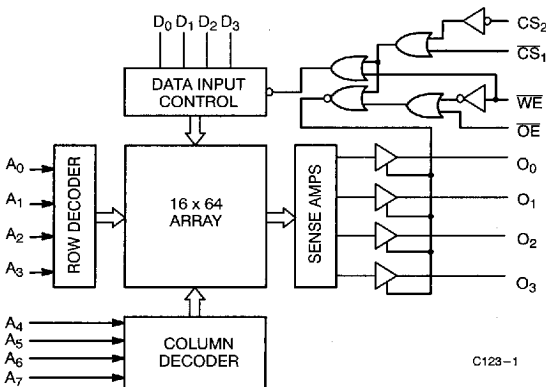
operation ensures minimum write recovery times by eliminating the "write recovery glitch."

Reading the device is accomplished by taking the chip select one ( $\overline{CS}_1$ ) and output enable ( $\overline{OE}$ ) inputs LOW, while the write enable ( $\overline{WE}$ ) and chip select two ( $CS_2$ ) inputs remain HIGH. Under these conditions, the contents of the memory location specified on the address pins will appear on the four output pins ( $O_0$  through  $O_3$ ).

The output pins remain in high-impedance state when chip select one ( $\overline{CS}_1$ ) or output enable ( $\overline{OE}$ ) is HIGH, or write enable ( $\overline{WE}$ ) or chip select two ( $CS_2$ ) is LOW.

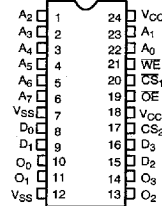
A die coat is used to insure alpha immunity.

#### Logic Block Diagram



#### Pin Configuration

##### DIP/SOJ Top View



C123-2

#### Selection Guide

|                                |            | 7C123-7 | 7C123-9 | 7C123-10 | 7C123-12 | 7C123-15 |
|--------------------------------|------------|---------|---------|----------|----------|----------|
| Maximum Access Time (ns)       | Commercial | 7       | 9       |          | 12       |          |
|                                | Military   |         |         | 10       | 12       | 15       |
| Maximum Operating Current (mA) | Commercial | 120     | 120     |          | 120      |          |
|                                | Military   |         |         | 150      | 150      | 150      |

**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 (Pins 24 and 18 to Pins 7 and 12) <sup>[1]</sup> ..... | -0.5V to +7.0V  |
| DC Voltage Applied to Outputs in High Z State <sup>[1]</sup> .....                        | -0.5V to +7.0V  |
| DC Input Voltage <sup>[1]</sup> .....                                                     | -0.5V to +7.0V  |

|                                         |         |
|-----------------------------------------|---------|
| Output Current into Outputs (LOW) ..... | 20 mA   |
| Latch-Up Current .....                  | >200 mA |

**Operating Range**

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

**Electrical Characteristics Over the Operating Range<sup>[3]</sup>**

| Parameter       | Description                      | Test Conditions                                                                                 | 7C123-7<br>7C123-9 |                 | 7C123-10<br>7C123-15 |                 | 7C123-12 |                 | Unit |
|-----------------|----------------------------------|-------------------------------------------------------------------------------------------------|--------------------|-----------------|----------------------|-----------------|----------|-----------------|------|
|                 |                                  |                                                                                                 | Min.               | Max.            | Min.                 | Max.            | Min.     | Max.            |      |
| V <sub>OH</sub> | Output HIGH Voltage              | V <sub>CC</sub> = Min., I <sub>OH</sub> = -5.2 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 <sup>[1]</sup> |                                                                                                 | -0.8               | +0.8            | -0.8                 | +0.8            | -0.8     | +0.8            | V    |
| I <sub>IX</sub> | Input Load Current               | V <sub>SS</sub> ≤ V <sub>I</sub> ≤ V <sub>CC</sub>                                              | -10                | +10             | -10                  | +10             | -10      | +10             | μA   |
| I <sub>OZ</sub> | Output Current (High Z)          | V <sub>SS</sub> ≤ V <sub>OUT</sub> ≤ V <sub>CC</sub> ,<br>Output Disabled                       | -10                | +10             | -10                  | +10             | -10      | +10             | μA   |
| I <sub>CC</sub> | Power Supply Current             | V <sub>CC</sub> = Max.,<br>I <sub>OUT</sub> = 0 mA,<br>f = f <sub>MAX</sub> = 1/t <sub>RC</sub> | Commercial         | 120             |                      |                 |          | 120             | mA   |
|                 |                                  | Military                                                                                        |                    |                 | 150                  |                 | 150      | 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 | 8    | pF   |
| C <sub>OUT</sub> | Output Capacitance |                                                             | 8    | pF   |

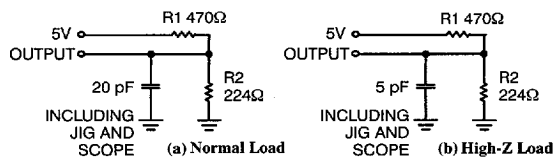
**Logic Table<sup>[5]</sup>**

| Input           |                   |                 |                 |                                 | Outputs                         | Mode             |
|-----------------|-------------------|-----------------|-----------------|---------------------------------|---------------------------------|------------------|
| $\overline{OE}$ | $\overline{CS}_1$ | CS <sub>2</sub> | $\overline{WE}$ | D <sub>0</sub> - D <sub>3</sub> |                                 |                  |
| X               | H                 | X               | X               | X                               | High Z                          | Not Selected     |
| X               | X                 | L               | X               | X                               | High Z                          | Not Selected     |
| L               | L                 | H               | H               | X                               | O <sub>0</sub> - O <sub>3</sub> | Read Stored Data |
| X               | L                 | H               | L               | L                               | High Z                          | Write "0"        |
| X               | L                 | H               | L               | H                               | High Z                          | Write "1"        |
| H               | L                 | H               | H               | X                               | High Z                          | Output Disabled  |

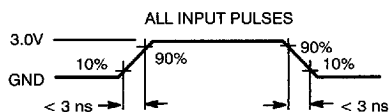
**Notes:**

- V<sub>IL</sub>(min.) = -3.0V 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.
- Tested initially and after any design or process changes that may affect these parameters.
- H = High Voltage, L = Low Voltage, X = Don't Care, and High Z = High Impedance.

## AC Test Loads and Waveforms

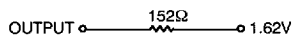


C123-3



C123-4

Equivalent to: THÉVENIN EQUIVALENT



## Switching Characteristics Over the Operating Range<sup>[3]</sup>

| Timing Characteristics for the Operating Range |                                         |         |      |         |      |          |      |          |      |          |      |      |
|------------------------------------------------|-----------------------------------------|---------|------|---------|------|----------|------|----------|------|----------|------|------|
| Parameter                                      | Description                             | 7C123-7 |      | 7C123-9 |      | 7C123-10 |      | 7C123-12 |      | 7C123-15 |      | Unit |
|                                                |                                         | Min.    | Max. | Min.    | Max. | Min.     | Max. | Min.     | Max. | Min.     | Max. |      |
| READ CYCLE                                     |                                         |         |      |         |      |          |      |          |      |          |      |      |
| t <sub>RC</sub>                                | Read Cycle Time                         | 7       |      | 9       |      | 10       |      | 12       |      | 15       |      | ns   |
| t <sub>AA</sub>                                | Address to Data Valid                   |         | 7    |         | 9    |          | 10   |          | 12   |          | 15   | ns   |
| t <sub>ACS</sub>                               | Chip Select to Data Valid               |         | 7    |         | 8    |          | 8    |          | 8    |          | 10   | ns   |
| t <sub>DOE</sub>                               | OE LOW to Data Valid                    |         | 7    |         | 8    |          | 8    |          | 8    |          | 10   | ns   |
| t <sub>HZCS</sub>                              | Chip Select to High Z <sup>[6, 7]</sup> |         | 5    |         | 6    |          | 6    |          | 6.5  |          | 8    | ns   |
| t <sub>HZOE</sub>                              | OE HIGH to High Z <sup>[6]</sup>        |         | 5    |         | 6    |          | 6    |          | 6.5  |          | 8    | ns   |
| t <sub>LZCS</sub>                              | Chip Select to Low Z <sup>[7]</sup>     | 2       |      | 2       |      | 2        |      | 2        |      | 2        |      | ns   |
| t <sub>LZOE</sub>                              | OE LOW to Low Z                         | 2       |      | 2       |      | 2        |      | 2        |      | 2        |      | ns   |
| WRITE CYCLE                                    |                                         |         |      |         |      |          |      |          |      |          |      |      |
| t <sub>WC</sub>                                | Write Cycle Time                        | 7       |      | 9       |      | 10       |      | 12       |      | 15       |      | ns   |
| t <sub>HZWE</sub>                              | WE LOW to High Z <sup>[6]</sup>         |         | 5.5  |         | 6    |          | 6    |          | 7    |          | 8    | ns   |
| t <sub>LZWE</sub>                              | WE HIGH to Low Z                        | 2       |      | 2       |      | 2        |      | 2        |      | 2        |      | ns   |
| t <sub>PWE</sub>                               | WE Pulse Width                          | 5       |      | 6.5     |      | 7        |      | 8        |      | 11       |      | ns   |
| t <sub>SD</sub>                                | Data Set-Up to Write End                | 5       |      | 6       |      | 7        |      | 8        |      | 11       |      | ns   |
| t <sub>HD</sub>                                | Data Hold from Write End                | 1       |      | 1       |      | 1        |      | 1        |      | 1        |      | ns   |
| t <sub>SA</sub>                                | Address Set-Up to Write Start           | 0.5     |      | 1       |      | 1        |      | 2        |      | 2        |      | ns   |
| t <sub>HA</sub>                                | Address Hold from Write End             | 1.5     |      | 1.5     |      | 2        |      | 2        |      | 2        |      | ns   |
| t <sub>SCS</sub>                               | CS LOW to Write End                     | 5       |      | 6.5     |      | 7        |      | 8        |      | 11       |      | ns   |
| t <sub>AW</sub>                                | Address Set-Up to Write End             | 5.5     |      | 7.5     |      | 8        |      | 10       |      | 13       |      | ns   |

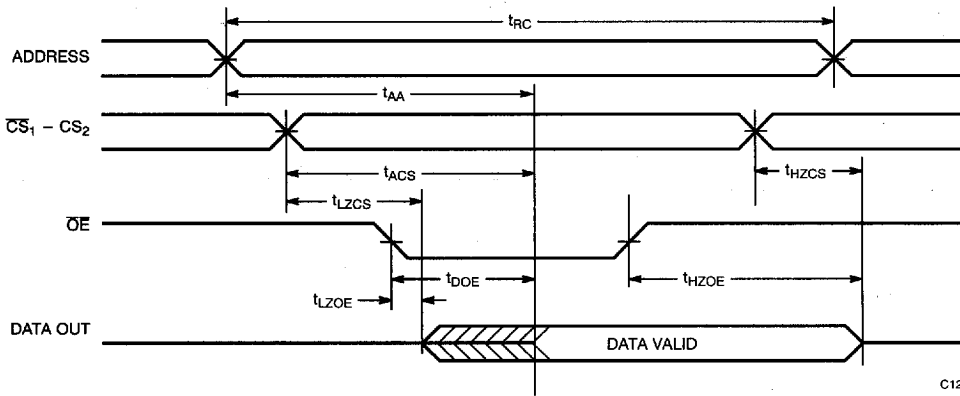
### Notes:

- Transition is measured at steady-state HIGH level – 500 mV or steady-state LOW level +500 mV on the output from 1.5V level on the input with load shown in part (b) of AC Test Loads.
- At any given temperature and voltage condition, t<sub>HZCS</sub> is less than t<sub>LZCS</sub> for any given device.

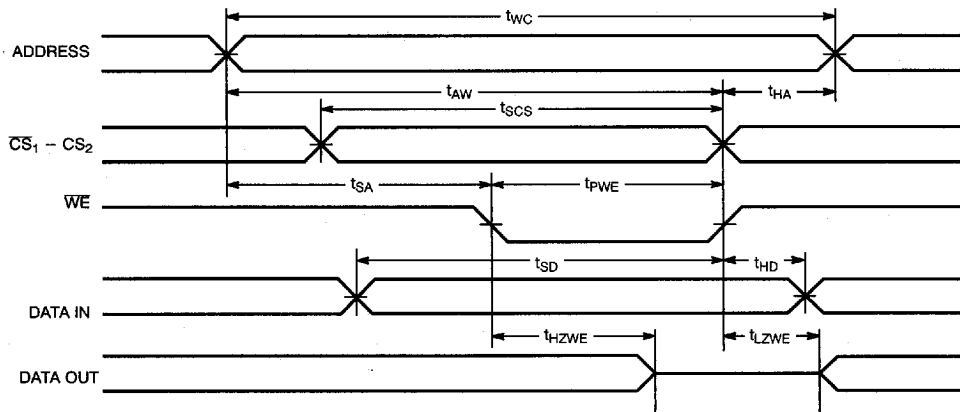


## Switching Waveforms

## Read Cycle [8, 9]



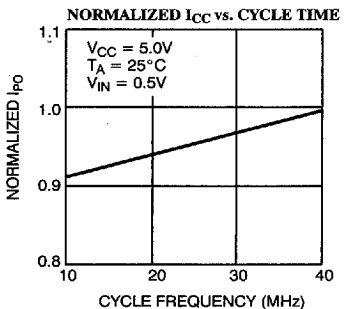
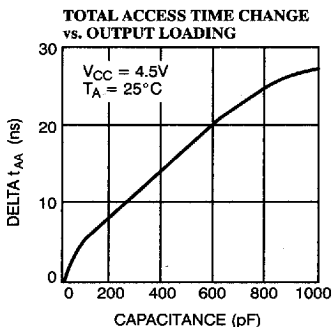
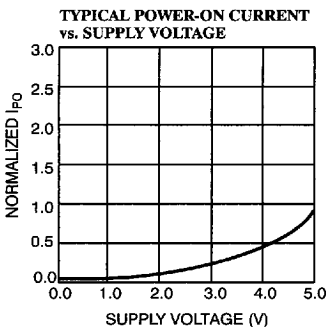
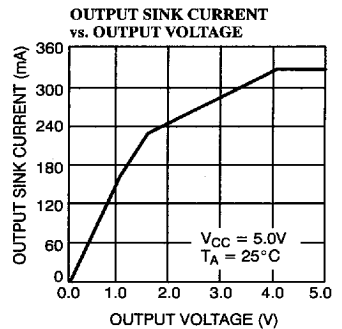
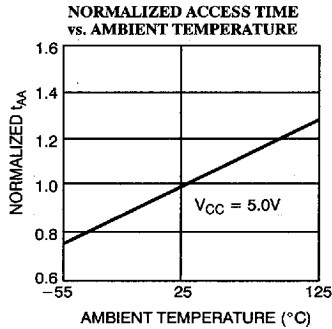
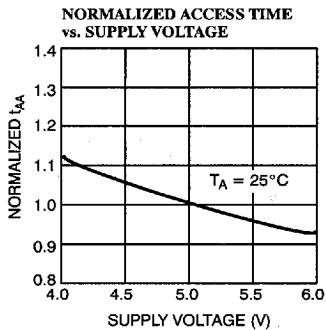
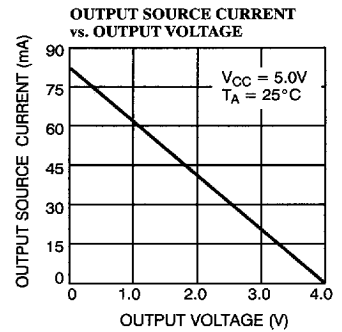
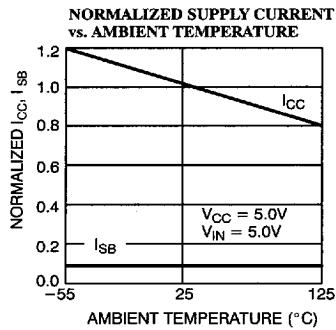
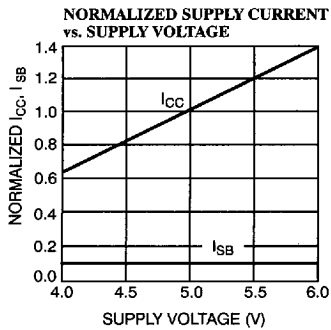
## Write Cycle [8, 9]



## Notes:

8. Measurements are referenced to 1.5V unless otherwise stated.

9. Timing diagram represents one solution that results in an optimum cycle time. Timing may be changed in various applications as long as the worst case limits are not violated.

**Typical DC and AC Characteristics**


**Ordering Information**

| Speed (ns) | Ordering Code | Package Name | Package Type                 | Operating Range |
|------------|---------------|--------------|------------------------------|-----------------|
| 7          | CY7C123-7PC   | P13A         | 24-Lead (300-Mil) Molded DIP | Commercial      |
|            | CY7C123-7VC   | V13          | 24-Lead Molded SOJ           |                 |
| 9          | CY7C123-9PC   | P13A         | 24-Lead (300-Mil) Molded DIP | Commercial      |
|            | CY7C123-9VC   | V13          | 24-Lead Molded SOJ           |                 |
| 10         | CY7C123-10DMB | D14          | 24-Lead (300-Mil) CerDIP     | Military        |
| 12         | CY7C123-12PC  | P13A         | 24-Lead (300-Mil) Molded DIP | Commercial      |
|            | CY7C123-12DMB | D14          | 24-Lead (300-Mil) CerDIP     | Military        |
| 15         | CY7C123-15DMB | 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>cc</sub>      | 1, 2, 3   |

**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>ACS</sub>   | 7, 8, 9, 10, 11 |
| t <sub>DOE</sub>   | 7, 8, 9, 10, 11 |
| <b>WRITE CYCLE</b> |                 |
| t <sub>WC</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>SA</sub>    | 7, 8, 9, 10, 11 |
| t <sub>HA</sub>    | 7, 8, 9, 10, 11 |
| t <sub>SCS</sub>   | 7, 8, 9, 10, 11 |
| t <sub>AW</sub>    | 7, 8, 9, 10, 11 |

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