# CY7C194
# CY7C195
# CY7C196

## 64K x 4 Static RAM

### Features

- **High speed**
  - **—12 ns**
- **Output enable ($\overline{OE}$) feature (7C195 and 7C196)**
- **CMOS for optimum speed/power**
- **Low active power**
  - **—880 mW**
- **Low standby power**
  - **—220 mW**
- **TTL-compatible inputs and outputs**
- **Automatic power-down when deselected**

### Functional Description

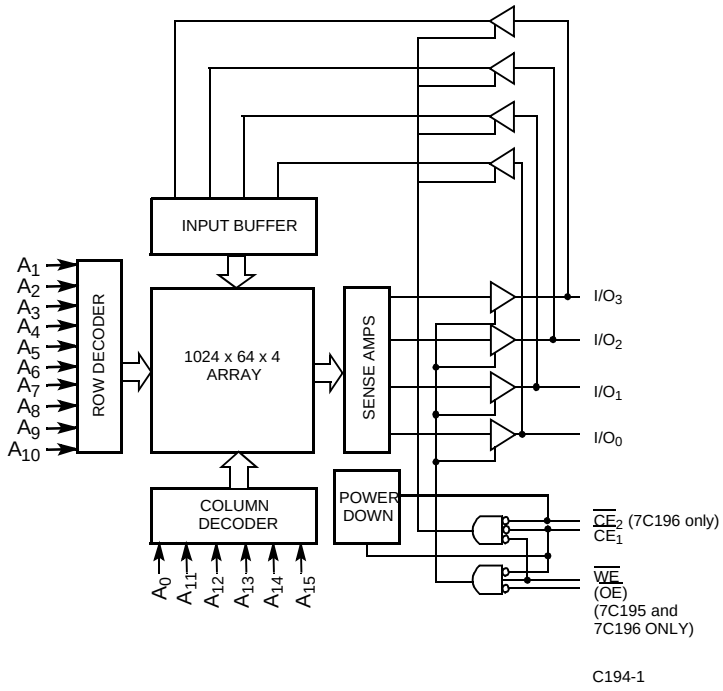
The CY7C194, CY7C195, and CY7C196 are high-performance CMOS static RAMs organized as 65,536 by 4 bits. Easy memory expansion is provided by active LOW Chip Enable(s) ($\overline{CE}$ on the CY7C194 and CY7C195, $\overline{CE}_1$, $\overline{CE}_2$ on the CY7C196) and three-state drivers. They have an automatic power-down feature, reducing the power consumption by 75% when deselected.

Writing to the device is accomplished when the Chip Enable(s) ($\overline{CE}$ on the CY7C194 and CY7C195, $\overline{CE}_1$, $\overline{CE}_2$ on the CY7C196) and Write Enable ($\overline{WE}$) inputs are both LOW. Data on the four input pins ($I/O_0$ through $I/O_3$) is written into the memory location, specified on the address pins ($A_0$ through $A_{15}$).

Reading the device is accomplished by taking the Chip Enable(s) ($\overline{CE}$ on the CY7C194 and CY7C195, $\overline{CE}_1$, $\overline{CE}_2$ on the CY7C196) 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 I/O pins.

A die coat is used to ensure alpha immunity.

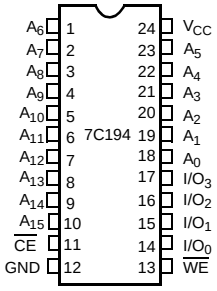
### Logic Block Diagram




C194-1

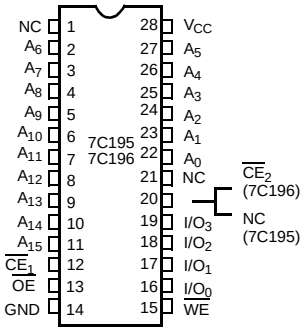
### Pin Configurations

**DIP/SOJ**
**Top View**




C194-2

**DIP/SOJ**
**Top View**




C194-3

### Selection Guide

| | 7C194-12<br>7C195-12<br>7C196-12 | 7C194-15<br>7C195-15<br>7C196-15 | 7C194-20<br>7C195-20<br>7C196-20 | 7C194-25<br>7C195-25<br>7C196-25 | 7C194-35<br>7C195-35<br>7C196-35 | 7C194-45<br>7C196-45 |
|---|---|---|---|---|---|---|
| Maximum Access Time (ns) | 12 | 15 | 20 | 25 | 35 | 45 |
| Maximum Operating Current (mA) | 155 | 145 | 135 | 115 | 115 | |
| Maximum Standby Current (mA) | 30 | 30 | 30 | 30 | 30 | 30 |

## 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[1]..... –0.5V to $V_{CC}$ + 0.5V

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

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[2] | $V_{CC}$ |
|---|---|---|
| Commercial | 0°C to +70°C | 5V ± 10% |

## Electrical Characteristics Over the Operating Range

| Parameter | Description | Test Conditions | 7C194-12 7C195-12 7C196-12 | | 7C194-15 7C195-15 7C196-15 | | Unit |
|---|---|---|---|---|---|---|---|
| | | | Min. | Max. | Min. | Max. | |
| $V_{OH}$ | Output HIGH Voltage | $V_{CC}$ = Min., $I_{OH}$ = –4.0 mA | 2.4 | | 2.4 | | V |
| $V_{OL}$ | Output LOW Voltage | $V_{CC}$ = Min., $I_{OL}$ = 8.0 mA | | 0.4 | | 0.4 | V |
| $V_{IH}$ | Input HIGH Voltage | | 2.2 | $V_{CC}$ + 0.3V | 2.2 | $V_{CC}$ + 0.3V | V |
| $V_{IL}$[1] | Input LOW Voltage | | –0.5 | 0.8 | –0.5 | 0.8 | V |
| $I_{IX}$ | Input Load Current | GND ≤ $V_I$ ≤ $V_{CC}$ | –5 | +5 | –5 | +5 | µA |
| $I_{OZ}$ | Output Leakage Current | GND ≤ $V_O$ ≤ $V_{CC}$, Output Disabled | –5 | +5 | –5 | +5 | µA |
| $I_{OS}$ | Output Short Circuit Current[3] | $V_{CC}$ = Max., $V_{OUT}$ = GND | | –300 | | –300 | mA |
| $I_{CC}$ | $V_{CC}$ Operating Supply Current | $V_{CC}$=Max., $I_{OUT}$=0 mA, f=$f_{MAX}$=1/$t_{RC}$ | | 155 | | 145 | mA |
| $I_{SB1}$ | Automatic $\overline{CE}$ Power-Down Current —TTL Inputs[4] | Max. $V_{CC}$, $\overline{CE}_{1,2}$ ≥ $V_{IH}$, $V_{IN}$ ≥ $V_{IH}$ or $V_{IN}$ ≤ $V_{IL}$, f = $f_{MAX}$ | | 30 | | 30 | mA |
| $I_{SB2}$ | Automatic $\overline{CE}$ Power-Down Current —CMOS Inputs[4] | Max. $V_{CC}$, $\overline{CE}_{1,2}$ ≥ $V_{CC}$ - 0.3V, $V_{IN}$ ≥ $V_{CC}$ - 0.3V or $V_{IN}$ ≤ 0.3V, f = 0 | | 10 | | 10 | mA |

**Notes:**
1. Minimum voltage is equal to –2.0V for pulse durations of less than 20 ns.
2. $T_A$ is the "Instant On" case temperature.
3. Not more than 1 output should be shorted at one time. Duration of the short circuit should not exceed 30 seconds.
4. A pull-up resistor to $V_{CC}$ on the $\overline{CE}$ input is required to keep the device deselected during $V_{CC}$ power-up, otherwise $I_{SB}$ will exceed values given.

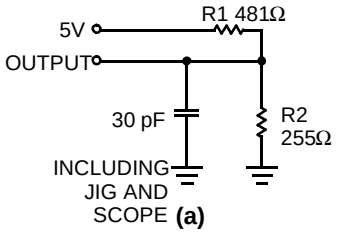
## Electrical Characteristics Over the Operating Range (continued)

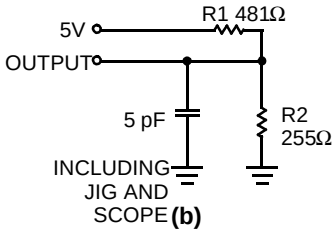
| Parameter | Description | Test Conditions | 7C194-20 7C195-20 7C196-20 | | 7C194-25, 35, 45 7C195-25, 35 7C196-25, 35, 45 | | Unit |
|---|---|---|---|---|---|---|---|
| | | | Min. | Max. | Min. | Max. | |
| $V_{OH}$ | Output HIGH Voltage | $V_{CC}$ = Min., $I_{OH}$ = –4.0 mA | 2.4 | | 2.4 | | V |
| $V_{OL}$ | Output LOW Voltage | $V_{CC}$ = Min., $I_{OL}$ = 8.0 mA | | 0.4 | | 0.4 | V |
| $V_{IH}$ | Input HIGH Voltage | | 2.2 | $V_{CC}$ + 0.3V | 2.2 | $V_{CC}$ +0.3V | V |
| $V_{IL}$ | Input LOW Voltage | | –0.5 | 0.8 | –0.5 | 0.8 | V |
| $I_{IX}$ | Input Load Current | GND ≤ $V_I$ ≤ $V_{CC}$ | –5 | +5 | –5 | +5 | µA |
| $I_{OZ}$ | Output Leakage Current | GND ≤ $V_O$ ≤ $V_{CC}$, Output Disabled | –5 | +5 | –5 | +5 | µA |
| $I_{OS}$ | Output Short Circuit Current[3] | $V_{CC}$ = Max., $V_{OUT}$ = GND | | –300 | | –300 | mA |
| $I_{CC}$ | $V_{CC}$ Operating Supply Current | $V_{CC}$=Max., $I_{OUT}$=0 mA, f=$f_{MAX}$=1/$t_{RC}$ | | 135 | | 115 | mA |
| $I_{SB1}$ | Automatic $\overline{CE}$ Power-Down Current —TTL Inputs[4] | Max. $V_{CC}$, $\overline{CE}_{1,2}$ ≥ $V_{IH}$, $V_{IN}$ ≥ $V_{IH}$ or $V_{IN}$ ≤ $V_{IL}$, f = $f_{MAX}$ | | 30 | | 30 | mA |
| $I_{SB2}$ | Automatic $\overline{CE}$ Power-Down Current —CMOS Inputs[4] | Max. $V_{CC}$, $\overline{CE}_{1,2}$ ≥ $V_{CC}$ – 0.3V, $V_{IN}$ ≥ $V_{CC}$ – 0.3V or $V_{IN}$ ≤ 0.3V, f = 0 | | 15 | | 15 | mA |

## Capacitance[5]

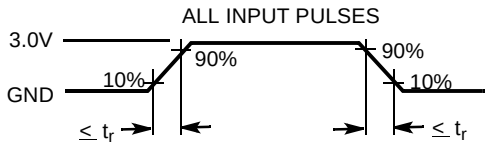
| Parameter | Description | Test Conditions | Max. | Unit |
|---|---|---|---|---|
| $C_{IN}$ | Input Capacitance | $T_A$ = 25°C, f = 1 MHz, $V_{CC}$ = 5.0V | 8 | pF |
| $C_{OUT}$ | Output Capacitance | | 10 | pF |

## AC Test Loads and Waveforms[6]

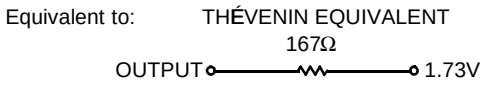



C194-4




C194-5




**Notes:**
5. Tested initially and after any design or process changes that may affect these parameters.
6. $t_r$ = ≤ 3 ns for the -12 and -15 speeds. T.$_r$ = ≤ 5 ns for the -20 and slower speeds.

## Switching Characteristics Over the Operating Range[7]

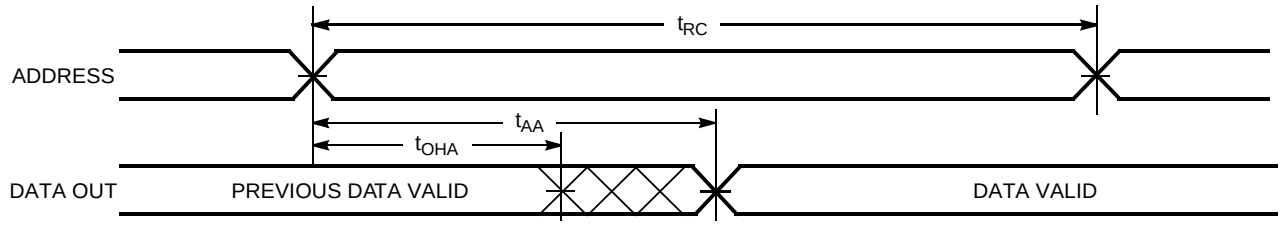
| Parameter | Description | | 7C194-12 7C195-12 7C196-12 | | 7C194-15 7C195-15 7C196-15 | | 7C194-20 7C195-20 7C196-20 | | 7C194-25 7C195-25 7C196-25 | | 7C194-35 7C195-35 7C196-35 | | 7C194-45 7C196-45 | | Unit |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Min. | Max. | Min. | Max. | Min. | Max. | Min. | Max. | Min. | Max. | Min. | Max. | |
| **READ CYCLE** | | | | | | | | | | | | | | | |
| $t_{RC}$ | Read Cycle Time | | 12 | | 15 | | 20 | | 25 | | 35 | | 45 | | ns |
| $t_{AA}$ | Address to Data Valid | | | 12 | | 15 | | 20 | | 25 | | 35 | | 45 | ns |
| $t_{OHA}$ | Output Hold from Address Change | | 3 | | 3 | | 3 | | 3 | | 3 | | 3 | | ns |
| $t_{ACE1}$, $t_{ACE2}$ | $\overline{CE}$ LOW to Data Valid | | | 12 | | 15 | | 20 | | 25 | | 35 | | 45 | ns |
| $t_{DOE}$ | $\overline{OE}$ LOW to Data Valid | 7C195, 7C196 | | 5 | | 7 | | 9 | | 10 | | 16 | | 16 | ns |
| $t_{LZOE}$ | $\overline{OE}$ LOW to Low Z | 7C195, 7C196 | 0 | | 0 | | 0 | | 3 | | 3 | | 3 | | ns |
| $t_{HZOE}$ | $\overline{OE}$ HIGH to High Z[8] | 7C195, 7C196 | | 5 | | 7 | | 9 | | 11 | | 15 | | 15 | ns |
| $t_{LZCE1}$, $t_{LZCE2}$ | $\overline{CE}$ LOW to Low Z[8] | | 3 | | 3 | | 3 | | 3 | | 3 | | 3 | | ns |
| $t_{HZCE1}$, $t_{HZCE2}$ | $\overline{CE}$ HIGH to High Z[8,8] | | | 5 | | 7 | | 9 | | 11 | | 15 | | 15 | ns |
| $t_{PU}$ | $\overline{CE}$ LOW to Power-Up | | 0 | | 0 | | 0 | | 0 | | 0 | | 0 | | ns |
| $t_{PD}$ | $\overline{CE}$ HIGH to Power-Down | | | 12 | | 15 | | 20 | | 25 | | 35 | | 45 | ns |
| **WRITE CYCLE**[10] | | | | | | | | | | | | | | | |
| $t_{WC}$ | Write Cycle Time | | 12 | | 15 | | 20 | | 25 | | 35 | | 45 | | ns |
| $t_{SCE}$ | $\overline{CE}$ LOW to Write End | | 9 | | 10 | | 15 | | 18 | | 22 | | 22 | | ns |
| $t_{AW}$ | Address Set-Up to Write End | | 9 | | 10 | | 15 | | 20 | | 25 | | 35 | | ns |
| $t_{HA}$ | Address Hold from Write End | | 0 | | 0 | | 0 | | 0 | | 0 | | 0 | | ns |
| $t_{SA}$ | Address Set-Up to Write Start | | 0 | | 0 | | 0 | | 0 | | 0 | | 0 | | ns |
| $t_{PWE}$ | $\overline{WE}$ Pulse Width | | 8 | | 9 | | 15 | | 18 | | 22 | | 22 | | ns |
| $t_{SD}$ | Data Set-Up to Write End | | 8 | | 9 | | 10 | | 10 | | 15 | | 15 | | ns |
| $t_{HD}$ | Data Hold from Write End | | 0 | | 0 | | 0 | | 0 | | 0 | | 0 | | ns |
| $t_{LZWE}$ | $\overline{WE}$ HIGH to Low Z[8] | | 3 | | 3 | | 3 | | 3 | | 3 | | 3 | | ns |
| $t_{HZWE}$ | $\overline{WE}$ LOW to High Z[8, 9] | | | 7 | | 7 | | 10 | 0 | 13 | 0 | 15 | 0 | 20 | ns |

**Notes:**

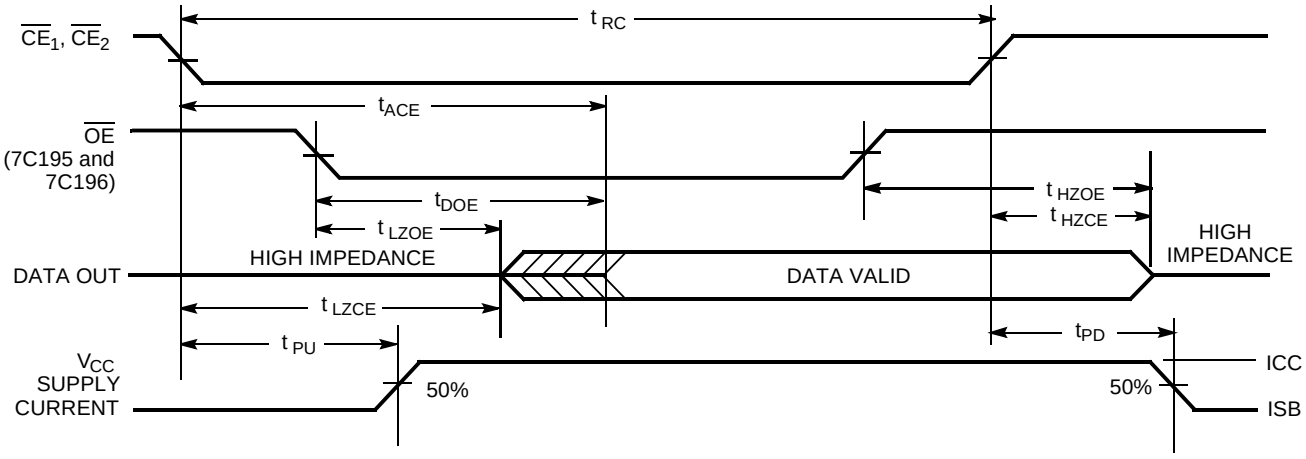
7. Test conditions assume signal transition time of 3 ns or less for -12 and -15 speeds and 5 ns or less for -20 and slower speeds, timing reference levels of 1.5V, input pulse levels of 0 to 3.0V, and output loading of the specified $I_{OL}/I_{OH}$ and 30-pF load capacitance.
8. $t_{HZOE}$, $t_{HZCE}$, and $t_{HZWE}$ are specified with $C_L$ = 5 pF as in part (b) of AC Test Loads. Transition is measured ±500 mV from steady-state voltage.
9. At any given temperature and voltage condition, $t_{HZCE}$ is less than $t_{LZCE}$ and $t_{HZWE}$ is less than $t_{LZWE}$ for any given device.
10. The internal write time of the memory is defined by the overlap of $\overline{CE}_1$ LOW, $CE_2$ LOW, and $\overline{WE}$ LOW. All signals must be LOW to initiate a write and any 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.

## Switching Waveforms

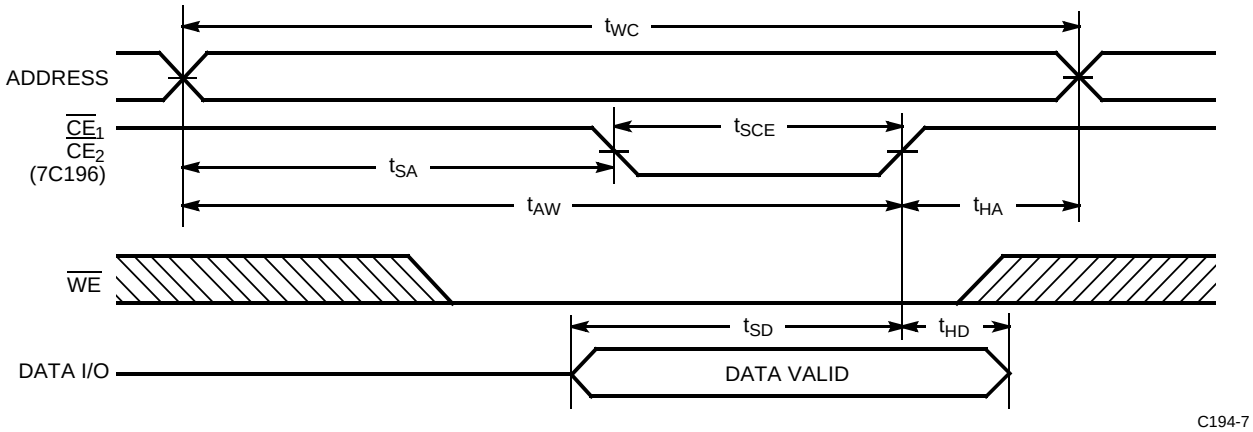
**Read Cycle No. 1** [11, 12]




**Read Cycle No. 2** [11, 13]



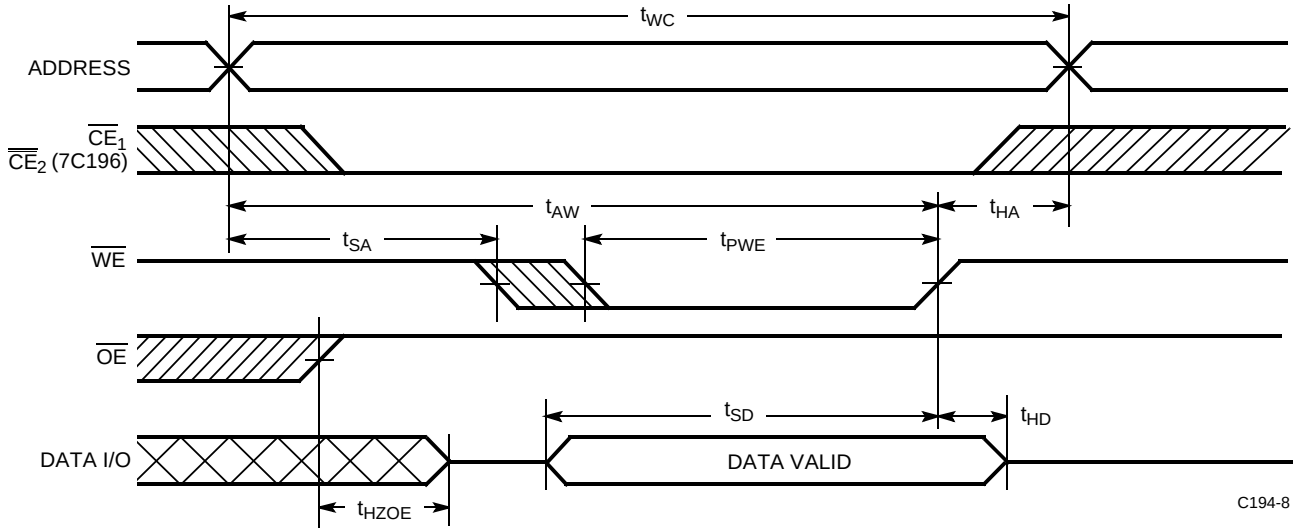

**Write Cycle No. 1 (CE Controlled)** [10, 14, 15]



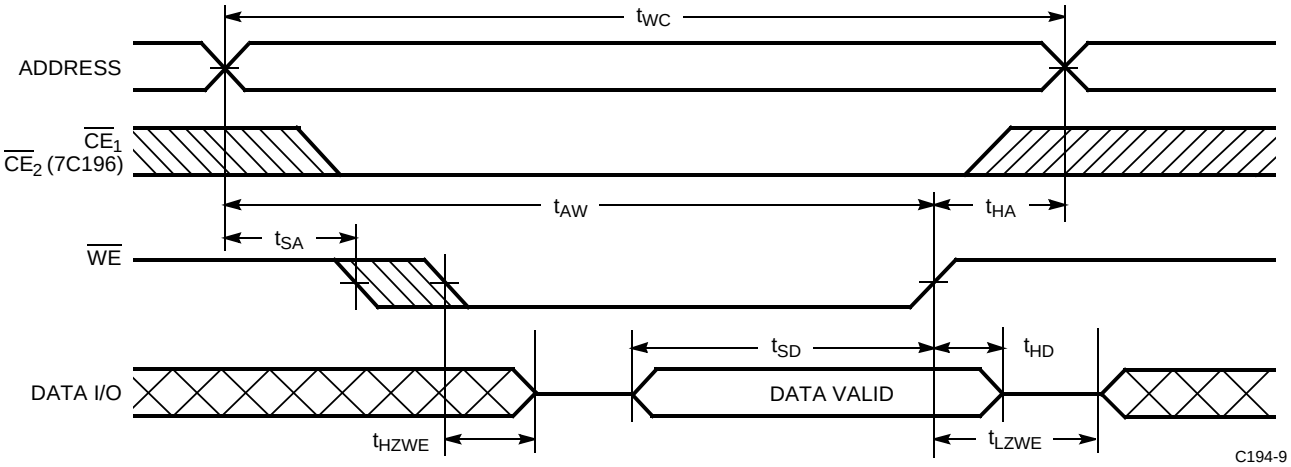

**Notes:**
11. $\overline{WE}$ is HIGH for read cycle.
12. Device is continuously selected: $\overline{CE_1} = V_{IL}$, $\overline{CE_2} = V_{IL}$ (7C196), and $\overline{OE} = V_{IL}$ (7C195 and 7C196).
13. Address valid prior to or coincident with $\overline{CE_1}$ and $\overline{CE_2}$ transition LOW.
14. Data I/O will be high impedance if $\overline{OE} = V_{IH}$ (7C195 and 7C196).
15. If any $\overline{CE}$ goes HIGH simultaneously with $\overline{WE}$ HIGH, the output remains in a high-impedance state.

## Switching Waveforms (continued)

**Write Cycle No. 2 ($\overline{WE}$ Controlled, $\overline{OE}$ HIGH During Write for 7C195 and 7C196 only)** [10, 14, 15]



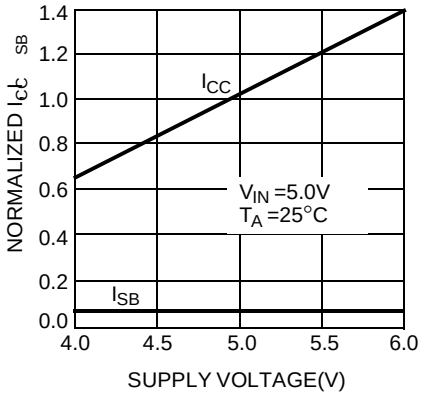

**Write Cycle No. 3 ($\overline{WE}$ Controlled, $\overline{OE}$ LOW)** [15, 16]



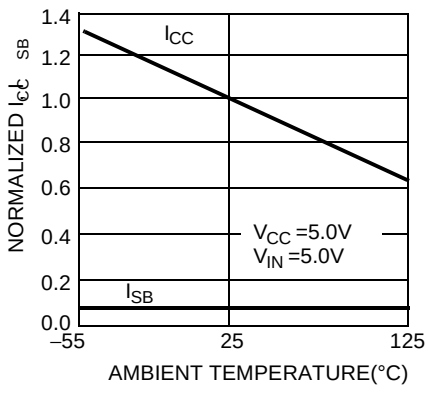

**Note:**
16. The minimum write cycle time for Write Cycle No. 3 ($\overline{WE}$ controlled, $\overline{OE}$ LOW) is the sum of $t_{HZWE}$ and $t_{SD}$.

## Typical DC and AC Characteristics

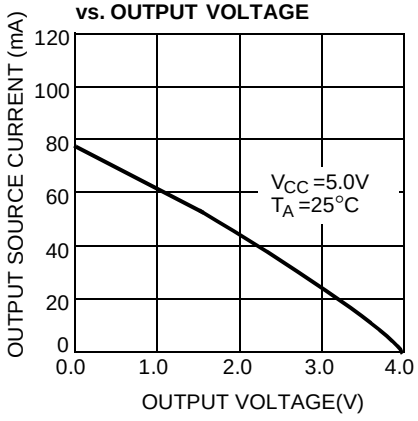
**NORMALIZED SUPPLY CURRENT vs. SUPPLY VOLTAGE**



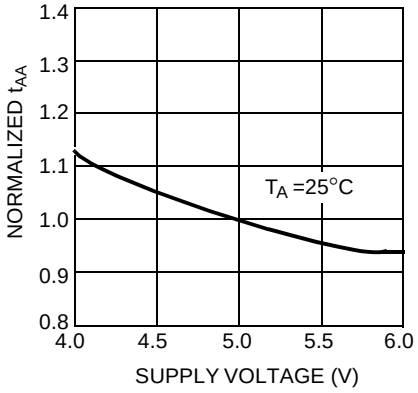

**NORMALIZED SUPPLY CURRENT vs. AMBIENT TEMPERATURE**



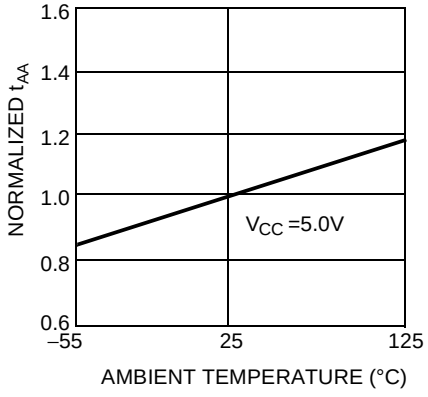

**OUTPUT SOURCE CURRENT vs. OUTPUT VOLTAGE**



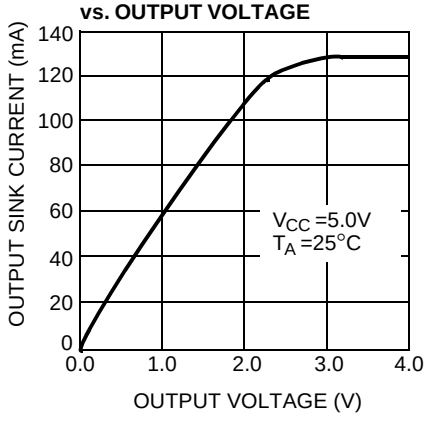

**NORMALIZED ACCESS TIME vs. SUPPLY VOLTAGE**



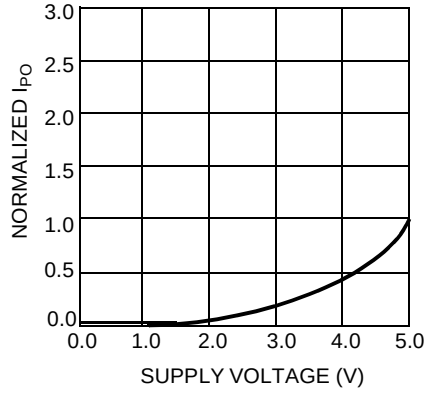

**NORMALIZED ACCESS TIME vs. AMBIENT TEMPERATURE**



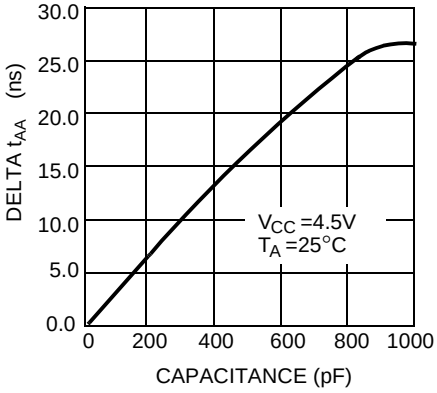

**OUTPUT SINK CURRENT vs. OUTPUT VOLTAGE**



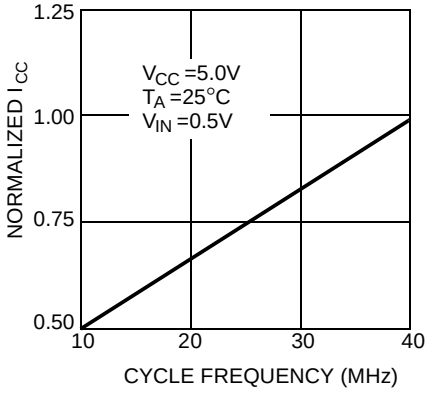

**TYPICAL POWER-ON CURRENT vs. SUPPLY VOLTAGE**




**TYPICAL ACCESS TIME CHANGE vs. OUTPUT LOADING**




**NORMALIZED $I_{CC}$ vs.CYCLE TIME**



### 7C194 Truth Table

| $\overline{CE}$ | $\overline{WE}$ | Data I/O | Mode | Power |
|---|---|---|---|---|
| H | X | High Z | Deselect/Power-Down | Standby ($I_{SB}$) |
| L | H | Data Out | Read | Active ($I_{CC}$) |
| L | L | Data In | Write | Active ($I_{CC}$) |

### 7C195 Truth Table

| $\overline{CE_1}$ | $\overline{WE}$ | $\overline{OE}$ | Data I/O | 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 | Active ($I_{CC}$) |

### 7C196 Truth Table

| $\overline{CE_1}$ | $\overline{CE_2}$ | $\overline{WE}$ | $\overline{OE}$ | Data I/O | Mode | Power |
|---|---|---|---|---|---|---|
| H | X | X | X | High Z | Deselect/Power-Down | Standby ($I_{SB}$) |
| X | H | X | X | | | |
| L | L | H | L | Data Out | Read | Active ($I_{CC}$) |
| L | L | L | X | Data In | Write | Active ($I_{CC}$) |
| L | L | H | H | High Z | Deselect | Active ($I_{CC}$) |

## Ordering Information

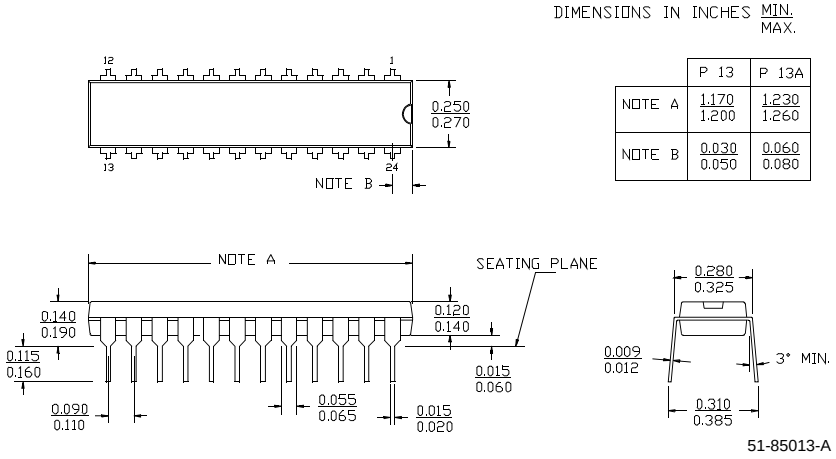
| Speed (ns) | Ordering Code | Package Name | Package Type | Operating Range |
|---|---|---|---|---|
| 12 | CY7C194-12PC | P13 | 24-Lead (300-Mil) Molded DIP | Commercial |
| | CY7C194-12VC | V13 | 24-Lead Molded SOJ | |
| 15 | CY7C194-15PC | P13 | 24-Lead (300-Mil) Molded DIP | Commercial |
| | CY7C194-15VC | V13 | 24-Lead Molded SOJ | |
| 20 | CY7C194-20PC | P13 | 24-Lead (300-Mil) Molded DIP | Commercial |
| | CY7C194-20VC | V13 | 24-Lead Molded SOJ | |
| 25 | CY7C194-25PC | P13 | 24-Lead (300-Mil) Molded DIP | Commercial |
| | CY7C194-25VC | V13 | 24-Lead Molded SOJ | |
| 35 | CY7C194-35PC | P13 | 24-Lead (300-Mil) Molded DIP | Commercial |
| | CY7C194-35VC | V13 | 24-Lead Molded SOJ | |
| 45 | CY7C194-45PC | P13 | 24-Lead (300-Mil) Molded DIP | Commercial |
| | CY7C194-45VC | V13 | 24-Lead Molded SOJ | |

| Speed (ns) | Ordering Code | Package Name | Package Type | Operating Range |
|---|---|---|---|---|
| 12 | CY7C195-12PC | P21 | 28-Lead (300-Mil) Molded DIP | Commercial |
| | CY7C195-12VC | V21 | 28-Lead Molded SOJ | |
| 15 | CY7C195-15PC | P21 | 28-Lead (300-Mil) Molded DIP | Commercial |
| | CY7C195-15VC | V21 | 28-Lead Molded SOJ | |
| 20 | CY7C195-20PC | P21 | 28-Lead (300-Mil) Molded DIP | Commercial |
| | CY7C195-20VC | V21 | 28-Lead Molded SOJ | |
| 25 | CY7C195-25PC | P21 | 28-Lead (300-Mil) Molded DIP | Commercial |
| | CY7C195-25VC | V21 | 28-Lead Molded SOJ | |
| 35 | CY7C195-35PC | P21 | 28-Lead (300-Mil) Molded DIP | Commercial |
| | CY7C195-35VC | V21 | 28-Lead Molded SOJ | |
| 45 | CY7C195-45PC | P21 | 28-Lead (300-Mil) Molded DIP | Commercial |
| | CY7C195-45VC | V21 | 28-Lead Molded SOJ | |

| Speed (ns) | Ordering Code | Package Name | Package Type | Operating Range |
|---|---|---|---|---|
| 12 | CY7C196-12PC | P21 | 28-Lead (300-Mil) Molded DIP | Commercial |
| | CY7C196-12VC | V21 | 28-Lead Molded SOJ | |
| 15 | CY7C196-15PC | P21 | 28-Lead (300-Mil) Molded DIP | Commercial |
| | CY7C196-15VC | V21 | 28-Lead Molded SOJ | |
| 20 | CY7C196-20PC | P21 | 28-Lead (300-Mil) Molded DIP | Commercial |
| | CY7C196-20VC | V21 | 28-Lead Molded SOJ | |
| 25 | CY7C196-25PC | P21 | 28-Lead (300-Mil) Molded DIP | Commercial |
| | CY7C196-25VC | V21 | 28-Lead Molded SOJ | |
| 35 | CY7C196-35PC | P21 | 28-Lead (300-Mil) Molded DIP | Commercial |
| | CY7C196-35VC | V21 | 28-Lead Molded SOJ | |

## Package Diagrams

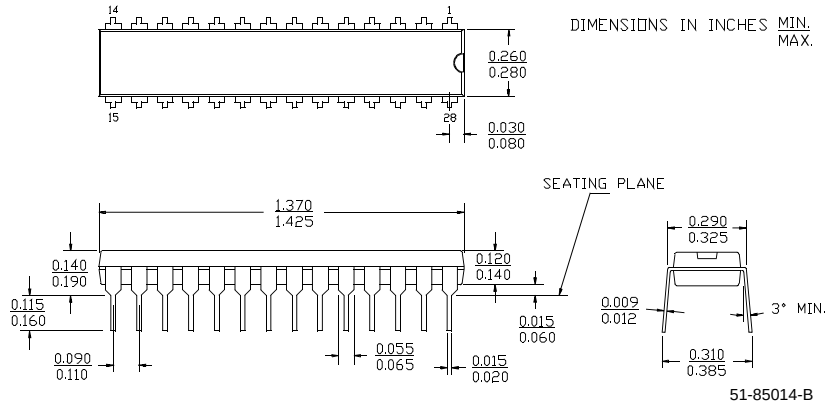
**24-Lead (300-Mil) Molded DIP P13/P13A**




| | 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 |

51-85013-A

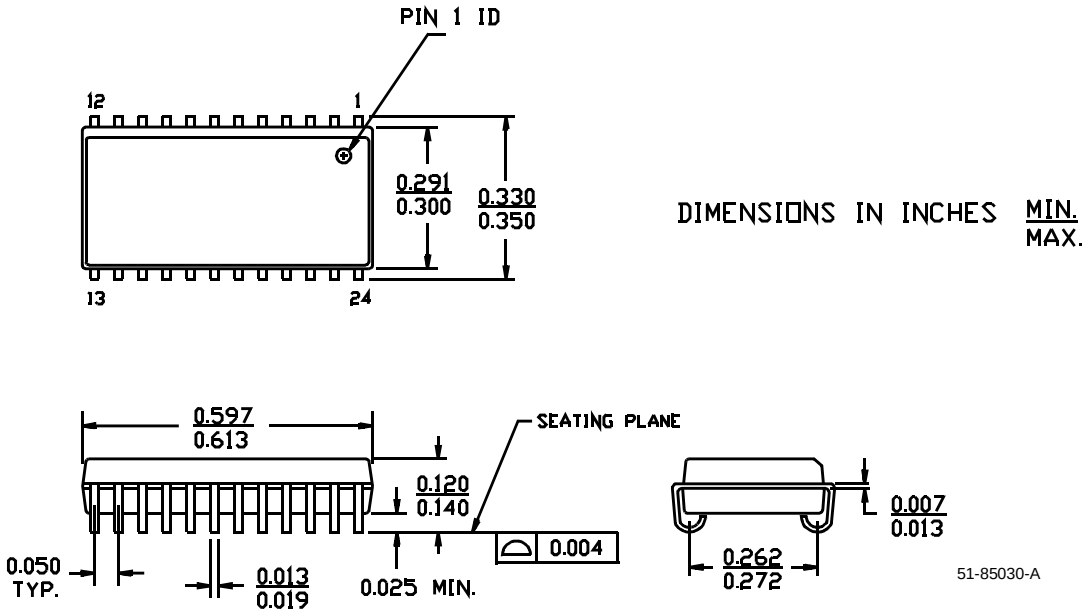
**28-Lead (300-Mil) Molded DIP P21**



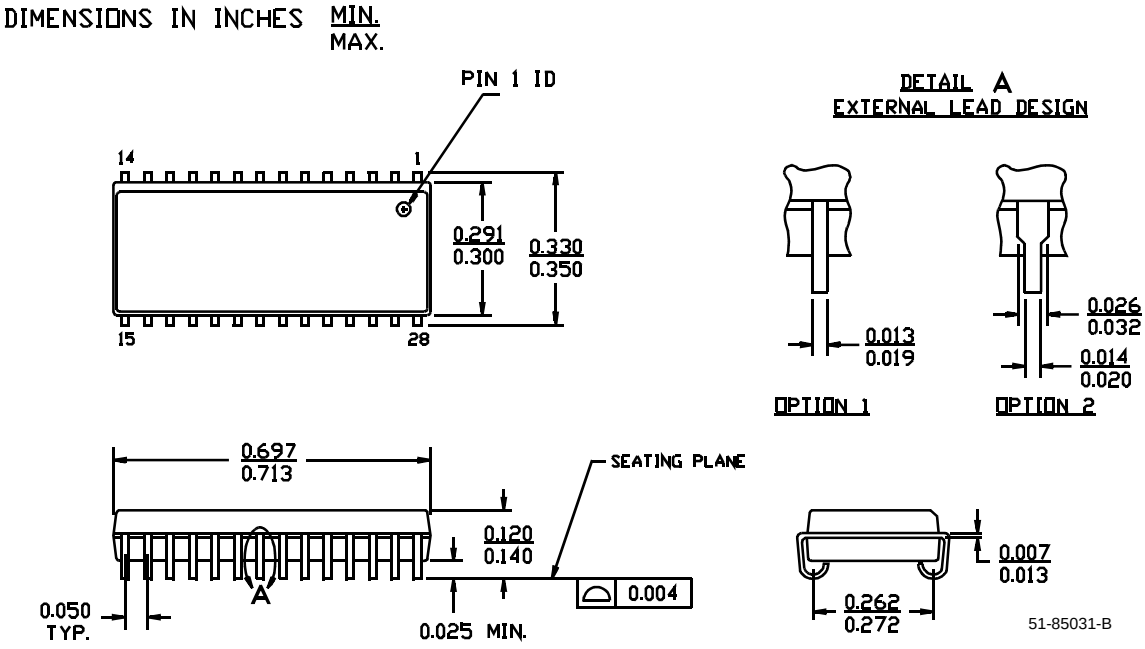

51-85014-B

**Package Diagrams** (continued)

**24-Lead (300-Mil) Molded SOJ V13**




**28-Lead (300-Mil) Molded SOJ V21**



| Document Title: CY7C194/CY7C195/CY7C196 64K x 4 Static RAM<br>Document Number: 38-05162 | | | | |
|---|---|---|---|---|
| **REV.** | **ECN NO.** | **Issue Date** | **Orig. of Change** | **Description of Change** |
| ** | 110172 | 09/29/01 | SZV | Change from Spec number: 38-00081 to 38-05162 |