



## HIGH SPEED 2K x 8 CMOS PROM/RPROM

### KEY FEATURES

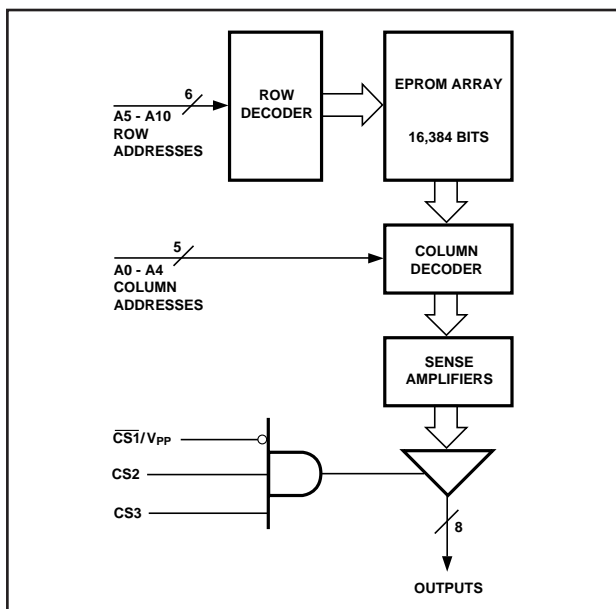
- **Ultra-Fast Access Time**
  - $t_{ACC} = 25 \text{ ns}$
  - $t_{CS} = 12 \text{ ns}$
- **Low Power Consumption**
- **Fast Programming**
- **Available in 300 Mil DIP and PLDCC**
- **Pin Compatible with Am27S191/291 and N82S191 Bipolar PROMs**
- **Immune to Latch-UP**
  - Up to 200 mA
- **ESD Protection Exceeds 2000V**

### GENERAL DESCRIPTION

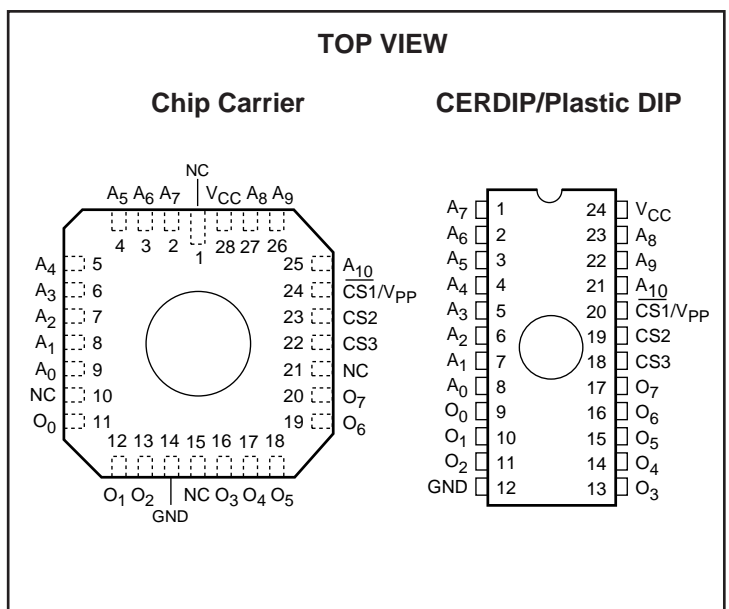
The WS57C191C/291C is an extremely High Performance 16K UV Erasable Electrically Re-Programmable Read Only Memory (RPROM). It is manufactured in an advanced CMOS technology which enables it to operate at Bipolar PROM speeds while consuming only 25% of the power required by its Bipolar counterparts. The WS57C191C/291C is also configured in the standard Bipolar PROM pinout which provides an easy upgrade path for systems which are currently using Bipolar PROMs.

The WS57C191C is packaged in a conventional 600 mil DIP package as well as a Plastic Leaded Chip Carrier (PLDCC) and a Ceramic Leadless Chip Carrier (CLLCC). The WS57C291C is packaged in a space saving 300 mil DIP package configuration. Both are available in commercial, industrial, and military operating temperature ranges.

### BLOCK DIAGRAM



### PIN CONFIGURATION



### PRODUCT SELECTION GUIDE

| PARAMETER                     | 191C/291C-25 | 191C/291C-35 | 191C/291C-45 | 191C/291C-55 |
|-------------------------------|--------------|--------------|--------------|--------------|
| Address Access Time (Max)     | 25 ns        | 35 ns        | 45 ns        | 55 ns        |
| CS to Output Valid Time (Max) | 12 ns        | 20 ns        | 20 ns        | 20 ns        |

**ABSOLUTE MAXIMUM RATINGS\***

Storage Temperature.....-65° to + 150°C  
 Voltage on any Pin with  
 Respect to Ground .....-0.6V to +7V  
 $V_{PP}$  with Respect to Ground.....-0.6V to + 14V  
 ESD Protection .....>2000V

**\*NOTICE:**

Stresses above those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods of time may affect device reliability.

**MODE SELECTION**

| <b>PINS<br/>MODE</b> | <b>CS1/<br/><math>V_{PP}</math></b> | <b>CS2</b> | <b>CS3</b> | <b><math>V_{CC}</math></b> | <b>OUTPUTS</b> |
|----------------------|-------------------------------------|------------|------------|----------------------------|----------------|
| Read                 | $V_{IL}$                            | $V_{IH}$   | $V_{IH}$   | $V_{CC}$                   | $D_{OUT}$      |
| Output Disable       | $V_{IH}$                            | X          | X          | $V_{CC}$                   | High Z         |
| Output Disable       | X                                   | $V_{IL}$   | X          | $V_{CC}$                   | High Z         |
| Program              | $V_{PP}$                            | X          | X          | $V_{CC}$                   | $D_{IN}$       |
| Program Verify       | $V_{IL}$                            | $V_{IH}$   | $V_{IH}$   | $V_{CC}$                   | $D_{OUT}$      |
| Output Disable       | X                                   | X          | $V_{IL}$   | $V_{CC}$                   | High Z         |

**OPERATING RANGE**

| <b>RANGE</b> | <b>TEMPERATURE</b> | <b><math>V_{CC}</math></b> |
|--------------|--------------------|----------------------------|
| Commercial   | 0°C to +70°C       | +5V ± 10%                  |
| Industrial   | -40°C to +85°C     | +5V ± 10%                  |
| Military     | -55°C to +125°C    | +5V ± 10%                  |

**DC READ CHARACTERISTICS** Over Operating Range. (See Above)

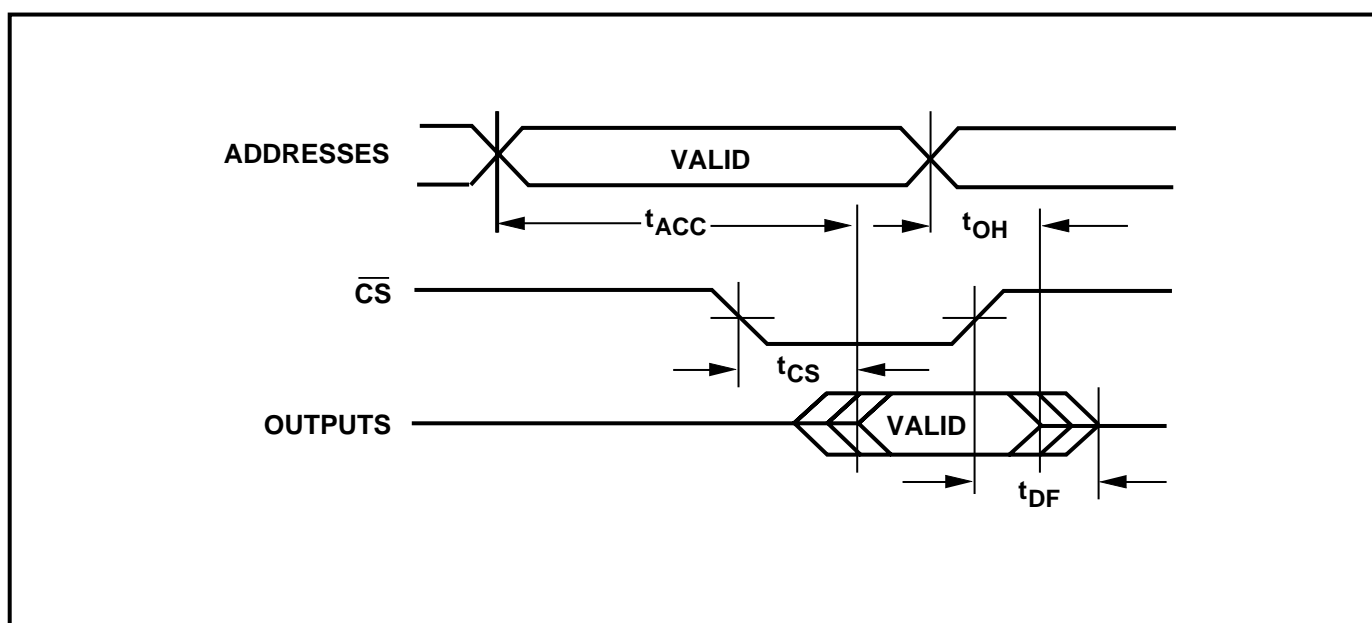
| <b>SYMBOL</b> | <b>PARAMETER</b>               | <b>TEST CONDITIONS</b>  | <b>MIN</b> | <b>MAX</b>     | <b>UNITS</b>  |
|---------------|--------------------------------|---|------------|----------------|---------------|
| $V_{IL}$      | Input Low Voltage              | (Note 3)  | -0.1       | 0.8            | V             |
| $V_{IH}$      | Input High Voltage             | (Note 3)  | 2.0        | $V_{CC} + 0.3$ | V             |
| $V_{OL}$      | Output Low Voltage             | $I_{OL} = 16 \text{ mA}$  |            | 0.4            | V             |
| $V_{OH}$      | Output High Voltage            | $I_{OH} = -4 \text{ mA}$  | 2.4        |                | V             |
| $I_{CC1}$     | $V_{CC}$ Active Current (CMOS) | $V_{CC} = 5.5\text{V}$ , $f = 0 \text{ MHz}$<br>(Note 1), Output Not Loaded<br>Add 2mA/MHz for AC Operation | Comm'l     | 30             | mA            |
|               |                                |   | Industrial | 35             | mA            |
|               |                                |   | Military   | 35             | mA            |
| $I_{CC2}$     | $V_{CC}$ Active Current (TTL)  | $V_{CC} = 5.5\text{V}$ , $f = 0 \text{ MHz}$<br>(Note 2), Output Not Loaded<br>Add 2mA/MHz for AC Operation | Comm'l     | 40             | mA            |
|               |                                |   | Industrial | 50             | mA            |
|               |                                |   | Military   | 50             | mA            |
| $I_{LI}$      | Input Leakage Current          | $V_{IN} = 5.5\text{V}$ or Gnd   | -10        | 10             | $\mu\text{A}$ |
| $I_{LO}$      | Output Leakage Current         | $V_{OUT} = 5.5 \text{ V}$ or Gnd  | -10        | 10             | $\mu\text{A}$ |

- NOTES:**
1. CMOS inputs:  $GND \pm 0.3\text{V}$  or  $V_{CC} \pm 0.3\text{V}$ .
  2. TTL inputs:  $V_{IL} \leq 0.8\text{V}$ ,  $V_{IH} \geq 2.0\text{V}$ .
  3. These are absolute voltages with respect to device ground pin and include all overshoots due to system and/or tester noise. Do not attempt to test these values without suitable equipment.

**AC READ CHARACTERISTICS** Over Operating Range. (See Above)

| PARAMETER                       | SYMBOL    | 191C/291C-25 |     | 191C/291C-35 |     | 191C/291C-45 |     | 191C/291C-55 |     | UNITS |
|---------------------------------|-----------|--------------|-----|--------------|-----|--------------|-----|--------------|-----|-------|
|                                 |           | MIN          | MAX | MIN          | MAX | MIN          | MAX | MIN          | MAX |       |
| Address to Output Delay         | $t_{ACC}$ |              | 25  |              | 35  |              | 45  |              | 55  | ns    |
| $\overline{CS}$ to Output Delay | $t_{CS}$  |              | 12  |              | 20  |              | 20  |              | 20  |       |
| Output Disable to Output Float* | $t_{DF}$  |              | 12  |              | 20  |              | 20  |              | 20  |       |
| Address to Output Hold          | $t_{OH}$  | 0            |     | 0            |     | 0            |     | 0            |     |       |

\* Sampled, Not 100% Tested

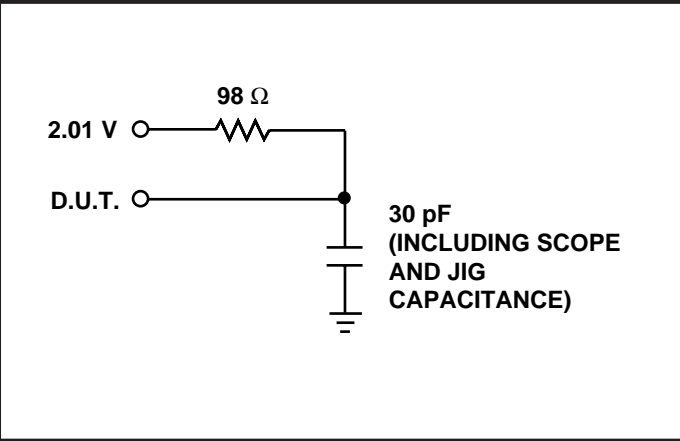
**AC READ TIMING DIAGRAM**

CAPACITANCE<sup>(4)</sup> T<sub>A</sub> = 25 °C, f = 1 MHz

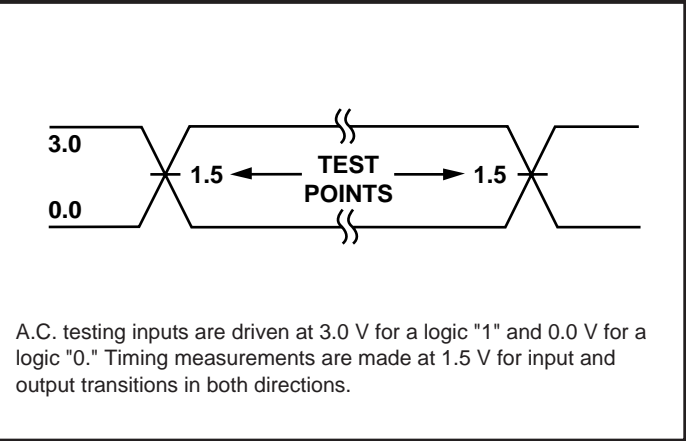
| SYMBOL           | PARAMETER                   | CONDITIONS            | TYP <sup>(5)</sup> | MAX | UNITS |
|------------------|-----------------------------|-----------------------|--------------------|-----|-------|
| C <sub>IN</sub>  | Input Capacitance           | V <sub>IN</sub> = 0V  | 4                  | 6   | pF    |
| C <sub>OUT</sub> | Output Capacitance          | V <sub>OUT</sub> = 0V | 8                  | 12  | pF    |
| C <sub>VPP</sub> | V <sub>PP</sub> Capacitance | V <sub>PP</sub> = 0 V | 18                 | 25  | pF    |

NOTES: 4. This parameter is only sampled and is not 100% tested.  
5. Typical values are for T<sub>A</sub> = 25 °C and nominal supply voltages.

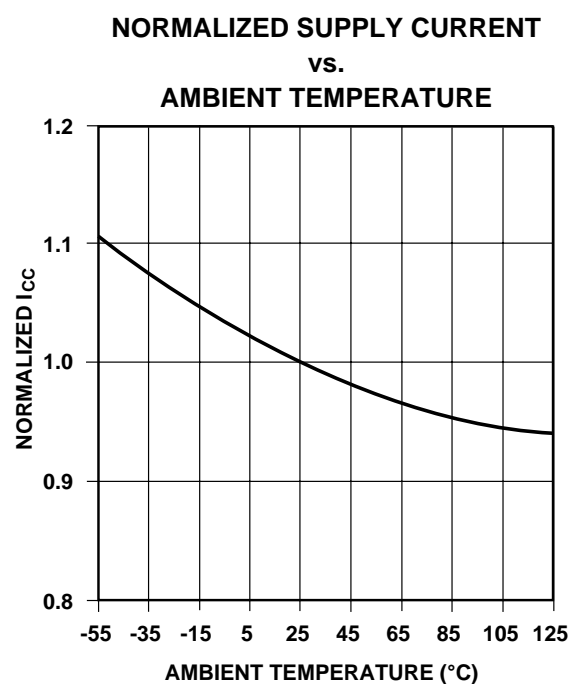
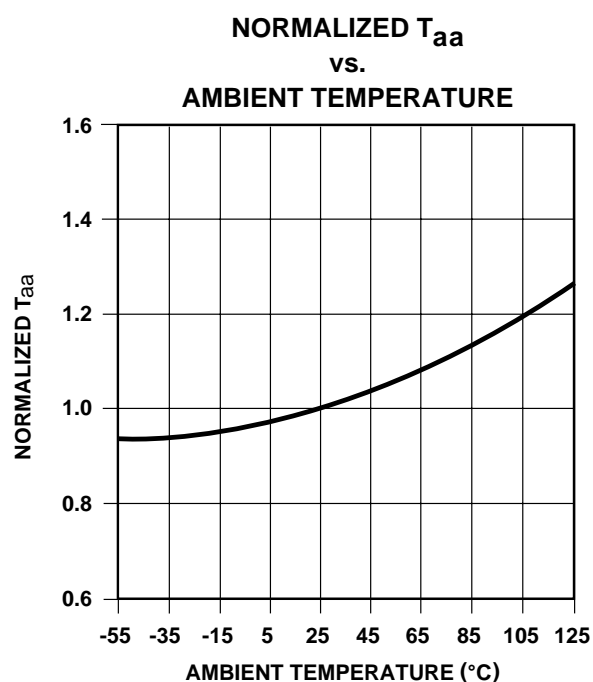
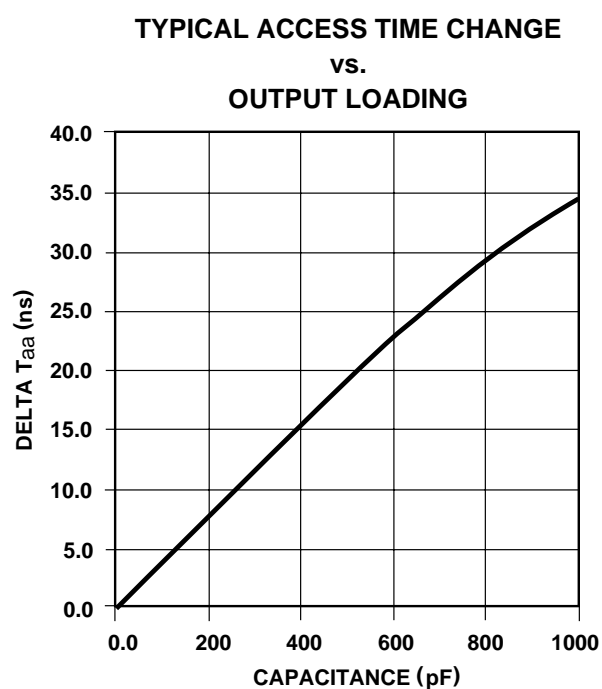
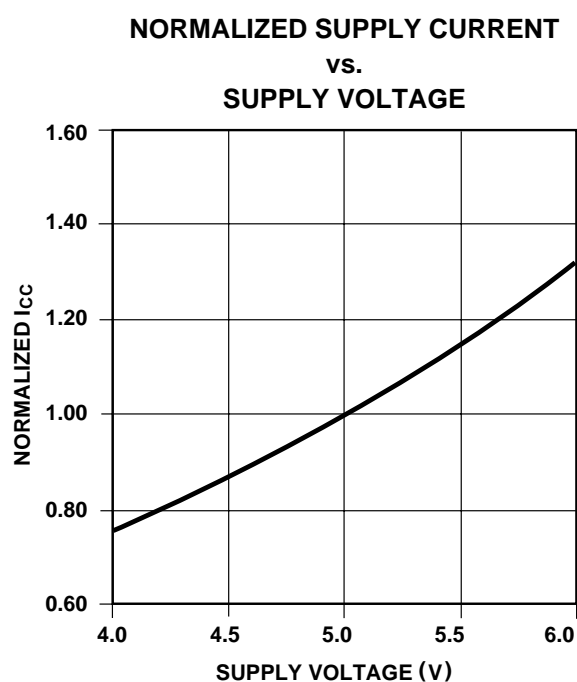
TEST LOAD (High Impedance Test Systems)



A.C. TESTING INPUT/OUTPUT WAVEFORM



NOTE: 6. Provide adequate decoupling capacitance as close as possible to this device to achieve the published A.C. and D.C. parameters. A 0.1 microfarad capacitor in parallel with a 0.01 microfarad capacitor connected between V<sub>CC</sub> and ground is recommended. Inadequate decoupling may result in access time degradation or other transient performance failures.



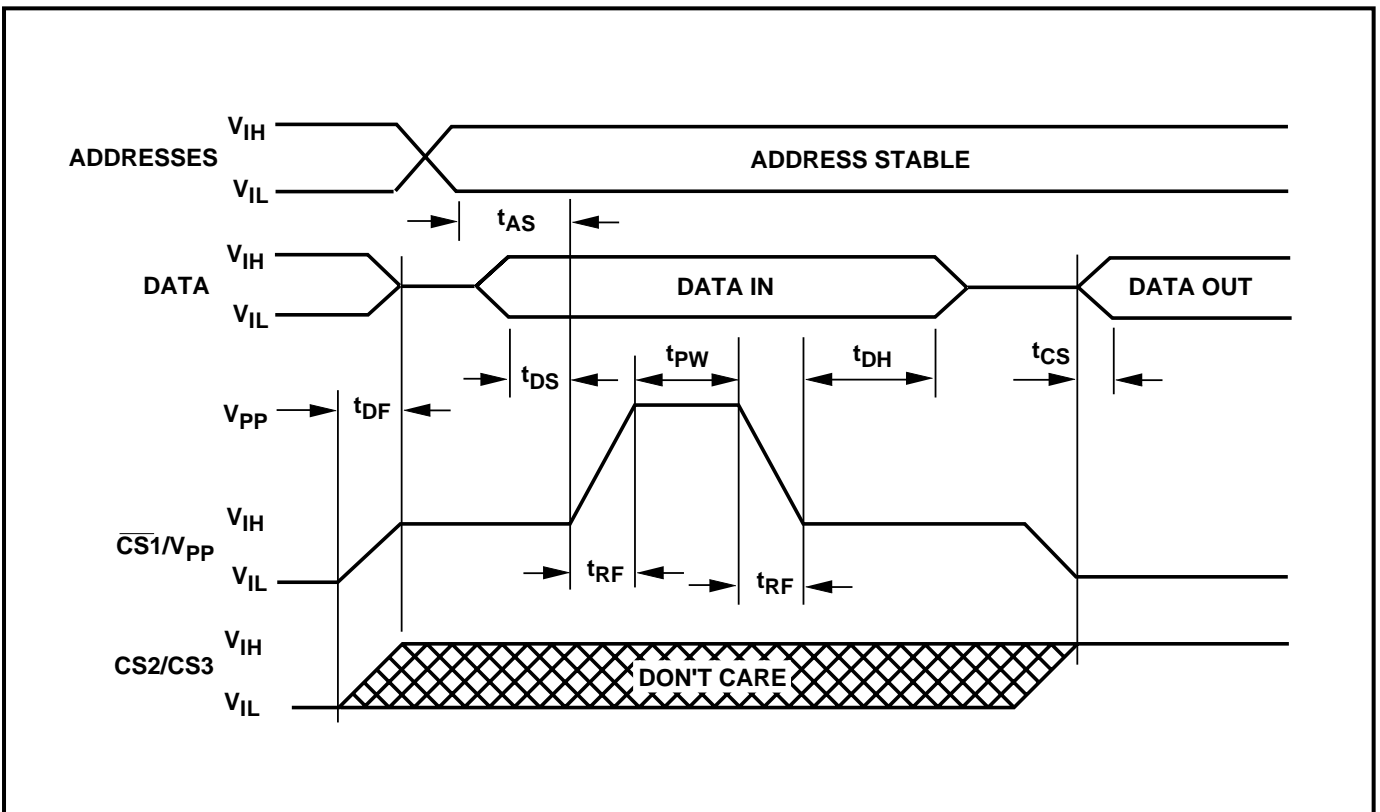
**PROGRAMMING INFORMATION****DC CHARACTERISTICS** ( $T_A = 25 \pm 5^\circ\text{C}$ ,  $V_{CC} = 6.25\text{ V} \pm 0.25\text{ V}$ ,  $V_{PP} = 12.75 \pm 0.25\text{ V}$ )

| SYMBOLS  | PARAMETER  | MIN | MAX  | UNITS         |
|----------|--|-----|------|---------------|
| $I_{LI}$ | Input Leakage Current<br>( $V_{IN} = V_{CC}$ or Gnd)             | -10 | 10   | $\mu\text{A}$ |
| $I_{PP}$ | $V_{PP}$ Supply Current During Programming Pulse                 |     | 60   | mA            |
| $I_{CC}$ | $V_{CC}$ Supply Current  |     | 25   | mA            |
| $V_{OL}$ | Output Low Voltage During Verify<br>( $I_{OL} = 16\text{ mA}$ )  |     | 0.45 | V             |
| $V_{OH}$ | Output High Voltage During Verify<br>( $I_{OH} = -4\text{ mA}$ ) | 2.4 |      | V             |

**NOTES:** 8.  $V_{PP}$  must not be greater than 13 volts including overshoot.

**AC CHARACTERISTICS** ( $T_A = 25 \pm 5^\circ\text{C}$ ,  $V_{CC} = 6.25\text{ V} \pm 0.25\text{ V}$ ,  $V_{PP} = 12.75 \pm 0.25\text{ V}$ )

| SYMBOLS  | PARAMETER                   | MIN | TYP | MAX | UNITS         |
|----------|-----------------------------|-----|-----|-----|---------------|
| $t_{AS}$ | Address Setup Time          | 2   |     |     | $\mu\text{s}$ |
| $t_{DF}$ | Chip Disable Setup Time     |     |     | 30  | ns            |
| $t_{DS}$ | Data Setup Time             | 2   |     |     | $\mu\text{s}$ |
| $t_{PW}$ | Program Pulse Width         | 100 |     | 200 | $\mu\text{s}$ |
| $t_{DH}$ | Data Hold Time              | 2   |     |     | $\mu\text{s}$ |
| $t_{CS}$ | Chip Select Delay           |     |     | 30  | ns            |
| $t_{RF}$ | $V_{PP}$ Rise and Fall Time | 1   |     |     | $\mu\text{s}$ |

**PROGRAMMING WAVEFORM**

**ORDERING INFORMATION**

| PART NUMBER      | SPEED (ns) | PACKAGE TYPE             | PACKAGE DRAWING | OPERATING TEMPERATURE RANGE | WSI MANUFACTURING PROCEDURE |
|------------------|------------|--------------------------|-----------------|-----------------------------|-----------------------------|
| <b>WS57C191C</b> |            |                          |                 |                             |                             |
| WS57C191C-25D    | 25         | 24 Pin CERDIP, 0.6"      | D1              | Comm'l                      | Standard                    |
| WS57C191C-25J    | 25         | 28 Pin PLDCC             | J3              | Comm'l                      | Standard                    |
| WS57C191C-25P    | 25         | 24 Pin Plastic DIP, 0.6" | P2              | Comm'l                      | Standard                    |
| WS57C191C-35D    | 35         | 24 Pin CERDIP, 0.6"      | D1              | Comm'l                      | Standard                    |
| WS57C191C-35J    | 35         | 28 Pin PLDCC             | J3              | Comm'l                      | Standard                    |
| WS57C191C-35P    | 35         | 24 Pin Plastic DIP, 0.6" | P2              | Comm'l                      | Standard                    |
| WS57C191C-45D    | 45         | 24 Pin CERDIP, 0.6"      | D1              | Comm'l                      | Standard                    |
| WS57C191C-45DI   | 45         | 24 Pin CERDIP, 0.6"      | D1              | Industrial                  | Standard                    |
| WS57C191C-45DMB* | 45         | 24 Pin CERDIP, 0.6"      | D1              | Military                    | MIL-STD-883C                |
| WS57C191C-45J    | 45         | 28 Pin PLDCC             | J3              | Comm'l                      | Standard                    |
| WS57C191C-45P    | 45         | 24 Pin Plastic DIP, 0.6" | P2              | Comm'l                      | Standard                    |
| WS57C191C-55D    | 55         | 24 Pin CERDIP, 0.6"      | D1              | Comm'l                      | Standard                    |
| WS57C191C-55DMB* | 55         | 24 Pin CERDIP, 0.6"      | D1              | Military                    | MIL-STD-883C                |
| <b>WS57C291C</b> |            |                          |                 |                             |                             |
| WS57C291C-25S    | 25         | 24 Pin Plastic DIP, 0.3" | S1              | Comm'l                      | Standard                    |
| WS57C291C-25T    | 25         | 24 Pin CERDIP, 0.3"      | T1              | Comm'l                      | Standard                    |
| WS57C291C-35S    | 35         | 24 Pin Plastic DIP, 0.3" | S1              | Comm'l                      | Standard                    |
| WS57C291C-35T    | 35         | 24 Pin CERDIP, 0.3"      | T1              | Comm'l                      | Standard                    |
| WS57C291C-35TMB* | 35         | 24 Pin CERDIP, 0.3"      | T1              | Military                    | MIL-STD-883C                |
| WS57C291C-45S    | 45         | 24 Pin Plastic DIP, 0.3" | S1              | Comm'l                      | Standard                    |
| WS57C291C-45T    | 45         | 24 Pin CERDIP, 0.3"      | T1              | Comm'l                      | Standard                    |
| WS57C291C-45TI   | 45         | 24 Pin CERDIP, 0.3"      | T1              | Industrial                  | Standard                    |
| WS57C291C-45TMB* | 45         | 24 Pin CERDIP, 0.3"      | T1              | Military                    | MIL-STD-883C                |
| WS57C291C-55T    | 55         | 24 Pin CERDIP, 0.3"      | T1              | Comm'l                      | Standard                    |
| WS57C291C-55TMB* | 55         | 24 Pin CERDIP, 0.3"      | T1              | Military                    | MIL-STD-883C                |

**NOTE:** 9. The actual part marking will not include the initials "WS."

\*SMD product. See section 4 for DESC SMD number.

**PROGRAMMING/ALGORITHMS/ERASURE/PROGRAMMERS**

**REFER TO  
PAGE 5-1**

The WS57C191C and WS57C291C are programmed using Algorithm D shown on page 5-9.