WAFERSCALE INTEGRATION, INC.

# HIGH SPEED 2K × 8 CMOS RPROM™

## KEY FEATURES

- **Ultra-Fast Access Time**
  — 45 ns
- **Low Power Consumption**
  — 225 mW Active Power
- **Fast Programming**
- **Pin Compatible With AM27S191/291 and N82S191 Bipolar PROMs**
- **Immune to Latch-Up**
  — Up to 200 mA
- **ESD Protection Exceeds 2000V**

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## GENERAL DESCRIPTION

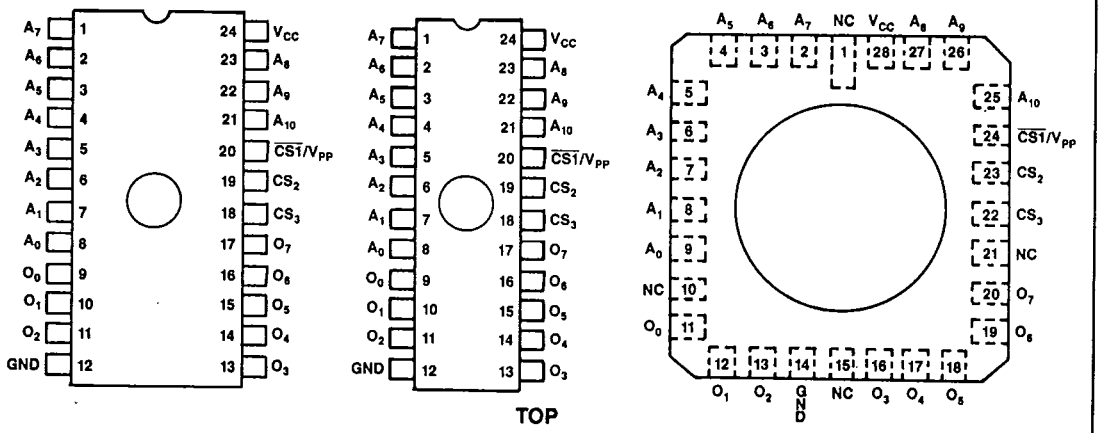
The WS57C191/291 is an extremely HIGH PERFORMANCE 16K UV Erasable Electrically Re-Programmable Read Only Memory. It is manufactured in an advanced CMOS technology which allows it to operate at Bipolar PROM speeds while consuming only 25% of the power of its Bipolar counterparts.

A further advantage of the WS57C191/291 over Bipolar PROM devices is the fact that it utilizes a proven EPROM technology. This allows the entire memory array to be tested for switching characteristics and functionality after assembly. Unlike devices which cannot be erased, every WS57C191/291 is 100% tested with worst case test patterns both before and after assembly.

Another feature of the WS57C191/291 is its uniquely designed output structure. When compared with other high speed devices, the output structure of the WS57C191/291 virtually eliminates the introduction of switch related noise into the system environment.

The WS57C191/291 is configured in the standard Bipolar PROM pinout. The WS57C191 is offered in a 600 mil wide Dip and the WS57C291 is offered in a 300 mil wide Dip. Both are offered in a Leadless Ceramic Chip Carrier.

## PIN CONFIGURATION




## PRODUCT SELECTION GUIDE

| PARAMETER | WS57C191/291-45 | WS57C191/291-55 |
|---|---|---|
| Address Access Time (Max) | 45 ns | 55 ns |
| Output Enable Time (Max) | 20 ns | 30 ns |

## ABSOLUTE MAXIMUM RATINGS*

Storage Temperature ..... -65° C to +150° C
Voltage on any pin with
respect to GND.....-0.6V to +7V
VPP with respect to GND .....-0.6V to +14.0V
ESD Protection .....>2000V

*Notice: Stresses above those listed here 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.

## OPERATING RANGE

| Range | Temperature | Vcc |
|---|---|---|
| Comm'l. | 0° to +70° C | +5V ± 5% |
| Military | -55° to +125° C | +5V ± 10% |

## DC READ CHARACTERISTICS Over Operating Range. (See above)

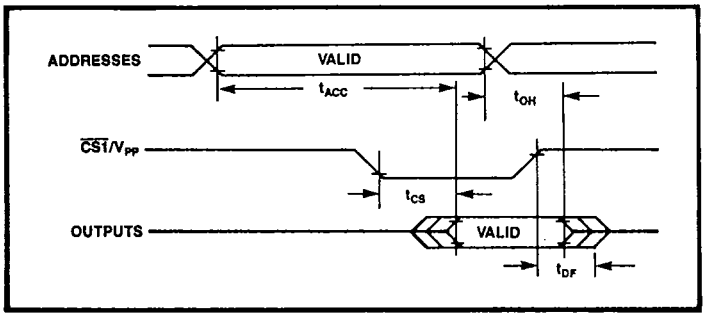
| SYMBOL | PARAMETER | TEST CONDITIONS | | MIN | MAX | UNITS |
|---|---|---|---|---|---|---|
| $V_{OL}$ | Output Low Voltage | $I_{OL}$= 16mA | | | 0.4 | V |
| $V_{OH}$ | Output High Voltage | $I_{OH}$= -4mA | | 2.4 | | |
| $I_{CC1}$ | Vcc Active Current (CMOS) | Notes 1 and 3 | Comm'l. | | 20 | mA |
| | | | Military | | 30 | |
| $I_{CC2}$ | Vcc Active Current (TTL) | Notes 2 and 3 | Comm'l. | | 25 | |
| | | | Military | | 35 | |
| $I_{LI}$ | Input Load Current | $V_{IN}$ = 5.5V or Gnd | | -10 | 10 | μA |
| $I_{LO}$ | Output Leakage Current | $V_{OUT}$ = 5.5V or Gnd | | -10 | 10 | |

NOTES: 1) CMOS inputs: GND ± 0.3V or $V_{CC}$ ± 0.3V.
2) TTL inputs: $V_{IL} \leq 0.8V$, $V_{IH} \geq 2.0V$.
3) A.C. Power component adds 3 mA/MHz.

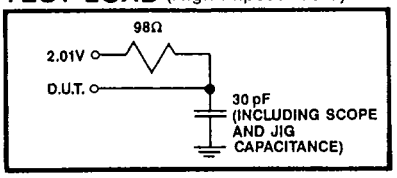
## AC READ CHARACTERISTICS Over Operating Range. (See Above)

| PARAMETER | SYMBOL | WS57C191/291-45 | | WS57C191/291-55 | | UNITS |
|---|---|---|---|---|---|---|
| | | MIN | MAX | MIN | MAX | |
| Address to Output Delay | $t_{ACC}$ | | 45 | | 55 | ns |
| CS to Output Delay | $t_{CS}$ | | 20 | | 30 | |
| Output Disable to Output Float | $t_{DF}$ | | 20 | | 30 | |
| Address to Output Hold | $t_{OH}$ | 0 | | 0 | | |

## AC READ TIMING DIAGRAM




## TEST LOAD (High Impedance Systems)




## TIMING LEVELS

Input Levels: 0 and 3V

Reference Levels: 1.5V

T-46-13-29

## PROGRAMMING INFORMATION

### DC CHARACTERISTICS ($T_A = 25 \pm 5°C$, $V_{CC} = 5.50V \pm 5\%$, $V_{PP} = 13.5 \pm 0.5V$)

| PARAMETER | SYMBOLS | MIN | MAX | UNIT |
|---|---|---|---|---|
| Input Leakage Current $V_{IN} = V_{CC}$ or Gnd | $I_{LI}$ | -10 | 10 | μA |
| $V_{PP}$ Supply Current During Programming Pulse | $I_{PP}$ | | 60 | mA |
| $V_{CC}$ Supply Current (Note 3) | $I_{CC}$ | | 25 | mA |
| Input Low Level | $V_{IL}$ | -0.1 | 0.8 | V |
| Input High Level | $V_{IH}$ | 2.0 | $V_{CC}$ + 0.3 | V |
| Output Low Voltage During Verify ($I_{OL}$ = 16mA) | $V_{OL}$ | | 0.45 | V |
| Output High Voltage During Verify ($I_{OH}$ = −4mA) | $V_{OH}$ | 2.4 | | V |

**NOTE:** 5) $V_{PP}$ must not be greater than 14 volts including overshoot.

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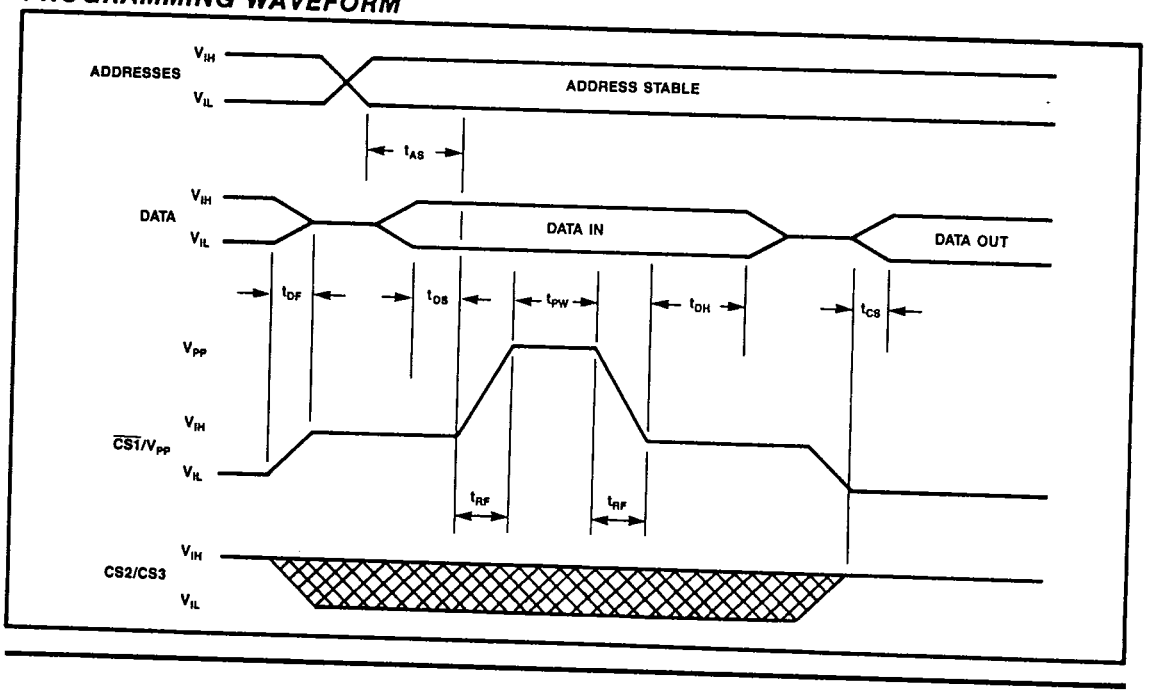
### AC CHARACTERISTICS ($T_A = 25 \pm 5°C$, $V_{CC} = 5.50V \pm 5\%$, $V_{PP} = 13.5 \pm 0.5V$)

| PARAMETER | SYMBOLS | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|
| Address Setup Time | $t_{AS}$ | 2 | | | μs |
| Chip Disable Setup Time | $t_{DF}$ | 2 | | 30 | ns |
| Data Set Up | $t_{DS}$ | | | | μs |
| Program Pulse Width (Note 6) | $t_{PW}$ | 1 | 3 | 10 | ms |
| Data Hold Time | $t_{DH}$ | 2 | | | μs |
| Chip Select Delay | $t_{CS}$ | | | 30 | ns |
| $V_{PP}$ Rise and Fall Time | $t_{RF}$ | 1 | | | μs |

**NOTE:** 6) For programmers utilizing a one shot programming pulse, a 10 ms pulse width should be used.

### PROGRAMMING WAVEFORM



## PROGRAMMING

Upon delivery from WaferScale Integration, Inc. or after each erasure (see Erasure section), the WS57C191/291 has all 2048 x 8 Bits in the "1," or high state. "0's" are loaded into the WS57C191/291 through the procedure of programming.

Programming is performed by raising $V_{CC}$ to 5.75V, disabling the outputs, addressing the byte to be programmed, presenting the data to be programmed onto the data pins, and applying a 13.5V pulse to the $\overline{CS1}/V_{PP}$ pin for 5 ms. The byte is then verified by removing the input data and reading the programmed byte as in the read operation. A 0.1 µF capacitor between $V_{PP}$ and GND is needed to prevent excessive voltage transients which could damage the device.

## PROGRAMMERS

Data I/O Unipak 2 or 2B, family/pinout code 7B/21; WSI's MagicPro™ IBM PC Compatible Engineering Program.

## ERASURE

In order to clear all locations of their programmed contents, it is necessary to expose the WS57C191/291 to an ultra-violet light source. A dosage of 15W-second/cm$^2$ is required to completely erase a WS57C191/291.

This dosage can be obtained by exposure to an ultra-violet lamp (wavelength of 2537 Angstroms (Å) ) with intensity of 12000µ W/cm$^2$ for 15 to 20 minutes. The WS57C191/291 should be about one inch from the source and all filters should be removed from the UV light source prior to erasure.

It is important to note that the WS57C191/291 and similar devices will erase with light sources having wavelengths shorter than 4000Å. Although erasure times will be much longer than with UV sources at 2537Å, the exposure to fluorescent light and sunlight will eventually erase the WS57C191/291 and exposure to them should be prevented to realize maximum system reliability. If used in such an environment, the package windows should be covered by an opaque label or substance.

## ORDERING INFORMATION

| PART NUMBER | SPEED (ns) | PACKAGE TYPE | PACKAGE DRAWING | OPERATING TEMPERATURE RANGE | WSI MANUFACTURING PROCEDURE |
|---|---|---|---|---|---|
| WS57C191-45D | 45 | 24 Pin CERDIP, 0.6" | D1 | Comm'l | Standard |
| WS57C291-45T | 45 | 24 Pin CERDIP, 0.3" | T1 | Comm'l | Standard |
| WS57C191-55D | 55 | 24 Pin CERDIP, 0.6" | D1 | Comm'l | Standard |
| WS57C291-55T | 55 | 24 Pin CERDIP, 0.3" | T1 | Comm'l | Standard |
| WS57C191-55CMB | 55 | 28 Pad CLLCC | C1 | Military | MIL-STD-883C |
| WS57C191-55DMB | 55 | 24 Pin CERDIP, 0.6" | D1 | Military | MIL-STD-883C |
| WS57C291-55TMB | 55 | 24 Pin CERDIP, 0.3" | T1 | Military | MIL-STD-883C |