National Semiconductor Corporation

# DM77/87S190, DM77/87S191, DM77/87S290, DM77/87S291, DM77/87S191A, DM77/87S291A, DM77/87S191B, DM77/87S291B (2048 x 8) 16,384-Bit TTL PROMs

## General Description

These Schottky memories are organized in the popular 2048 words by 8 bits configuration. Memory enable inputs are provided to control the output states. When the device is enabled, the outputs represent the contents of the selected word. When disabled, the 8 outputs go to the "OFF" or high impedance state. The memories are available in both open-collector and TRI-STATE® versions.

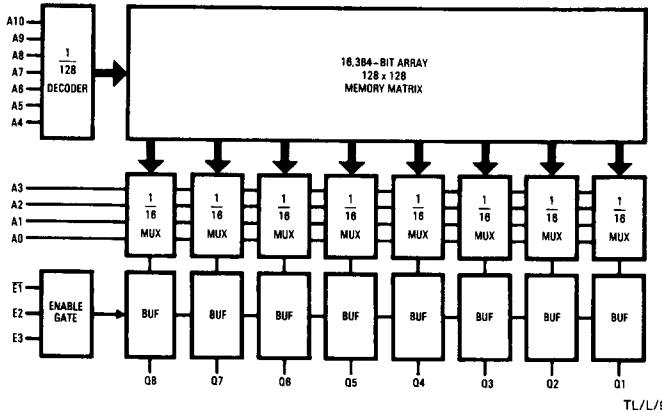
PROMs are shipped from the factory with lows in all locations. A high may be programmed into any selected location by following the programming instructions.

## Features

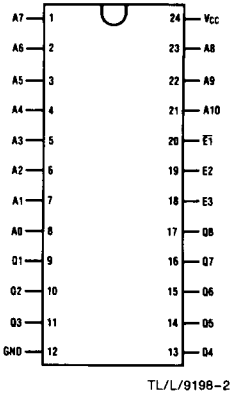
- Advanced tungsten (W) fuses
- Schottky-clamped for high speed
  - Address access—35 ns max (B Version)
  - Enable access—15 ns typ
  - Enable recovery—15 ns typ
- PNP inputs for reduced input loading
- All DC and AC parameters guaranteed over temperature
- Low voltage TRI-SAFE™ programming

| | Military | Commercial | Open-Collector | TRI-STATE | Package | 24-Pin Standard | 24-Pin Thin-Dip |
|---|---|---|---|---|---|---|---|
| DM87S190 | | X | X | | N, J, V | X | |
| DM87S191 | | X | | X | N, J, V | X | |
| DM77S190 | X | | X | | J | X | |
| DM77S191 | X | | | X | J | X | |
| DM87S290 | | X | X | | N, J, V | | X |
| DM87S291 | | X | | X | N, J, V | | X |
| DM77S290 | X | | X | | J | | X |
| DM77S291 | X | | | X | J | | X |

## Block and Connection Diagrams




TL/L/9198-1




TL/L/9198-2

**Top View**

**Order Number DM77/87S190J, 191J, 290J, 291J, 191A/BJ, 291A/BJ, DM87S190N, 191N, 290N, 291N, 191A/BN, 291A/BN, DM87S190V, 191V, 290V, 291V, 191A/BV or 291A/BV**
**See NS Package Number J24A, J24F, N24A, N24C or V28A**

## DC Electrical Characteristics (Note 1)

| Symbol | Parameter | Conditions | DM77S190/191 DM77S290/291 | | | DM87S190/191 DM87S290/291 | | | Units |
|---|---|---|---|---|---|---|---|---|---|
| | | | Min | Typ | Max | Min | Typ | Max | |
| $I_{IL}$ | Input Load Current | $V_{CC}$ = Max, $V_{IN}$ = 0.45V | | −80 | −250 | | −80 | −250 | μA |
| $I_{IH}$ | Input Leakage Current | $V_{CC}$ = Max, $V_{IN}$ = 2.7V | | | 25 | | | 25 | μA |
| | | $V_{CC}$ = Max, $V_{IN}$ = 5.5V | | | 1.0 | | | 1.0 | mA |
| $V_{OL}$ | Low Level Output Voltage | $V_{CC}$ = Min, $I_{OL}$ = 16 mA | | 0.35 | 0.50 | | 0.35 | 0.45 | V |
| $V_{IL}$ | Low Level Input Voltage | | | | 0.80 | | | 0.80 | V |
| $V_{IH}$ | High Level Input Voltage | | 2.0 | | | 2.0 | | | V |
| $I_{OZ}$ | Output Leakage Current (Open-Collector Only) | $V_{CC}$ = Max, $V_{CEX}$ = 2.4V | | | 50 | | | 50 | μA |
| | | $V_{CC}$ = Max, $V_{CEX}$ = 5.5V | | | 100 | | | 100 | μA |
| $V_C$ | Input Clamp Voltage | $V_{CC}$ = Min, $I_{IN}$ = −18 mA | | −0.8 | −1.2 | | −0.8 | −1.2 | V |
| $C_I$ | Input Capacitance | $V_{CC}$ = 5.0V, $V_{IN}$ = 2.0V $T_A$ = 25°C, 1 MHz | | 4.0 | | | 4.0 | | pF |
| $C_O$ | Output Capacitance | $V_{CC}$ = 5.0V, $V_O$ = 2.0V $T_A$ = 25°C, 1 MHz, Outputs Off | | 6.0 | | | 6.0 | | pF |
| $I_{CC}$ | Power Supply Current | $V_{CC}$ = Max, Input Grounded All Outputs Open | | 120 | 175 | | 120 | 175 | mA |
| **TRI-STATE Parameters** | | | | | | | | | |
| $I_{OS}$ | Short Circuit Output Current | $V_O$ = 0V, $V_{CC}$ = Max (Note 2) | −20 | | −70 | −20 | | −70 | mA |
| $I_{OZ}$ | Output Leakage (TRI-STATE) | $V_{CC}$ = Max, $V_O$ = 0.45V to 2.4V Chip Disabled | −50 | | 50 | −50 | | 50 | μA |
| $V_{OH}$ | Output Voltage High | $I_{OH}$ = −2.0 mA | 2.4 | 3.2 | | | | | V |
| | | $I_{OH}$ = − 6.5 mA | | | | 2.4 | 3.2 | | V |

**Note 1:** These limits apply over the entire operating range unless otherwise noted. All typical values are for $V_{CC}$ = 5.0V and $T_A$ = 25°C.

**Note 2:** During $I_{OS}$ measurement, only one output at a time should be grounded. Permanent damage may otherwise result.

## AC Electrical Characteristics With Standard Load and Operating Conditions

| Symbol | JEDEC Symbol | Parameter | DM77S190/191 DM77S290/291 | | | DM87S190/191 DM87S290/291 | | | Units |
|---|---|---|---|---|---|---|---|---|---|
| | | | Min | Typ | Max | Min | Typ | Max | |
| $t_{AA}$ | TAVQV | Address Access Time | | 35 | 80 | | 35 | 65 | ns |
| $t_{EA}$ | TEVQV | Enable Access Time | | 15 | 40 | | 15 | 30 | ns |
| $t_{ER}$ | TEXQX | Enable Recovery Time | | 15 | 40 | | 15 | 30 | ns |
| $t_{ZX}$ | TEVQX | Output Enable Time | | 15 | 40 | | 15 | 30 | ns |
| $t_{XZ}$ | TEXQZ | Output Disable Time | | 15 | 40 | | 15 | 30 | ns |

## AC Electrical Characteristics With Standard Load and Operating Conditions

| Symbol | JEDEC Symbol | | Parameters | DM77S191A/B DM77S291A/B | | | DM87S191A/B DM87S291A/B | | | Units |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Min | Typ | Max | Min | Typ | Max | |
| $t_{AA}$ | TAVQV | 191A/291A | Address Access Time | | 30 | 60 | | 30 | 45 | ns |
| | | 191B/291B | | | 30 | 50 | | 30 | 35 | ns |
| $t_{EA}$ | TEVQV | | Enable Access Time | | 15 | 30 | | 15 | 25 | ns |
| $t_{ER}$ | TEXQX | | Enable Recovery Time | | 15 | 30 | | 15 | 25 | ns |
| $t_{ZX}$ | TEVQX | | Output Enable Time | | 15 | 30 | | 15 | 25 | ns |
| $t_{XZ}$ | TEXQZ | | Output Disable Time | | 15 | 30 | | 15 | 25 | ns |