

## 74F189 64-Bit Random Access Memory with 3-STATE Outputs

### General Description

The F189 is a high-speed 64-bit RAM organized as a 16-word by 4-bit array. Address inputs are buffered to minimize loading and are fully decoded on-chip. The outputs are 3-STATE and are in the high impedance state whenever the Chip Select (CS) input is HIGH. The outputs are active only in the Read mode and the output data is the complement of the stored data.

### Features

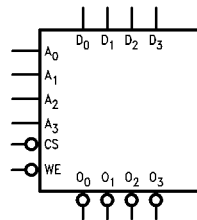
- 3-STATE outputs for data bus applications
- Buffered inputs minimize loading
- Address decoding on-chip
- Diode clamped inputs minimize ringing

### Ordering Code:

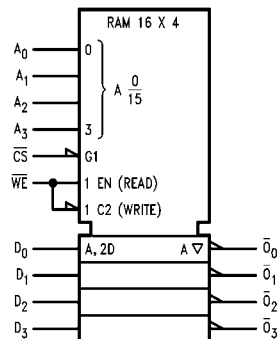
| Order Number | Package Number | Package Description  |
|--------------|----------------|--|
| 74F189SC     | M16B           | 16-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-013, 0.300" Wide |
| 74F189SJ     | M16D           | 16-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide              |
| 74F189PC     | N16E           | 16-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300" Wide     |

Devices also available in Tape and Reel. Specify by appending suffix "X" to the ordering code.

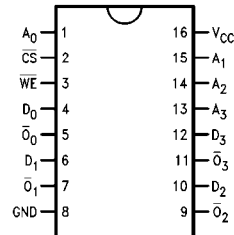
### Logic Symbols



IEEE/IEC



### Connection Diagram



### Unit Loading/Fan Out

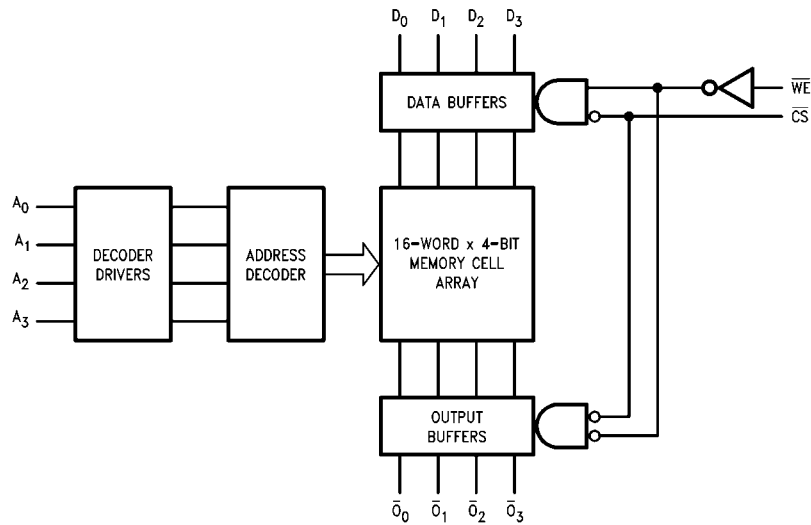
| Pin Names                           | Description                     | U.L.<br>HIGH/LOW | Input $I_{IH}/I_{IL}$<br>Output $I_{OH}/I_{OL}$ |
|-------------------------------------|---------------------------------|------------------|---|
| $A_0$ – $A_3$                       | Address Inputs                  | 1.0/1.0          | 20 $\mu$ A/–0.6 mA                              |
| $\overline{CS}$                     | Chip Select Input (Active LOW)  | 1.0/1.0          | 20 $\mu$ A/–1.2 mA                              |
| $\overline{WE}$                     | Write Enable Input (Active LOW) | 1.0/1.0          | 20 $\mu$ A/–0.6 mA                              |
| $D_0$ – $D_3$                       | Data Inputs                     | 1.0/1.0          | 20 $\mu$ A/–0.6 mA                              |
| $\overline{O}_0$ – $\overline{O}_3$ | Inverted Data Outputs           | 150/40 (33.3)    | –3.0 mA/24 mA (20 mA)                           |

### Function Table

| Inputs          |                 | Operation | Condition of Outputs      |
|-----------------|-----------------|-----------|---------------------------|
| $\overline{CS}$ | $\overline{WE}$ |           |                           |
| L               | L               | Write     | High Impedance            |
| L               | H               | Read      | Complement of Stored Data |
| H               | X               | Inhibit   | High Impedance            |

H = HIGH Voltage Level  
L = LOW Voltage Level  
X = Immaterial

### Block Diagram



**Absolute Maximum Ratings** (Note 1)

|   |                          |
|---|--------------------------|
| Storage Temperature   | -65°C to +150°C          |
| Ambient Temperature under Bias                                      | -55°C to +125°C          |
| Junction Temperature under Bias                                     | -55°C to +175°C          |
| V <sub>CC</sub> Pin Potential to Ground Pin                         | -0.5V to +7.0V           |
| Input Voltage (Note 2)  | -0.5V to +7.0V           |
| Input Current (Note 2)  | -30 mA to +5.0 mA        |
| Voltage Applied to Output in HIGH State (with V <sub>CC</sub> = 0V) |                          |
| Standard Output   | -0.5V to V <sub>CC</sub> |
| 3-STATE Output  | -0.5V to +5.5V           |
| Current Applied to Output in LOW State (Max)                        |                          |

**Recommended Operating Conditions**

|                              |                |
|------------------------------|----------------|
| Free Air Ambient Temperature | 0°C to +70°C   |
| Supply Voltage               | +4.5V to +5.5V |

**Note 1:** Absolute maximum ratings are values beyond which the device may be damaged or have its useful life impaired. Functional operation under these conditions is not implied.

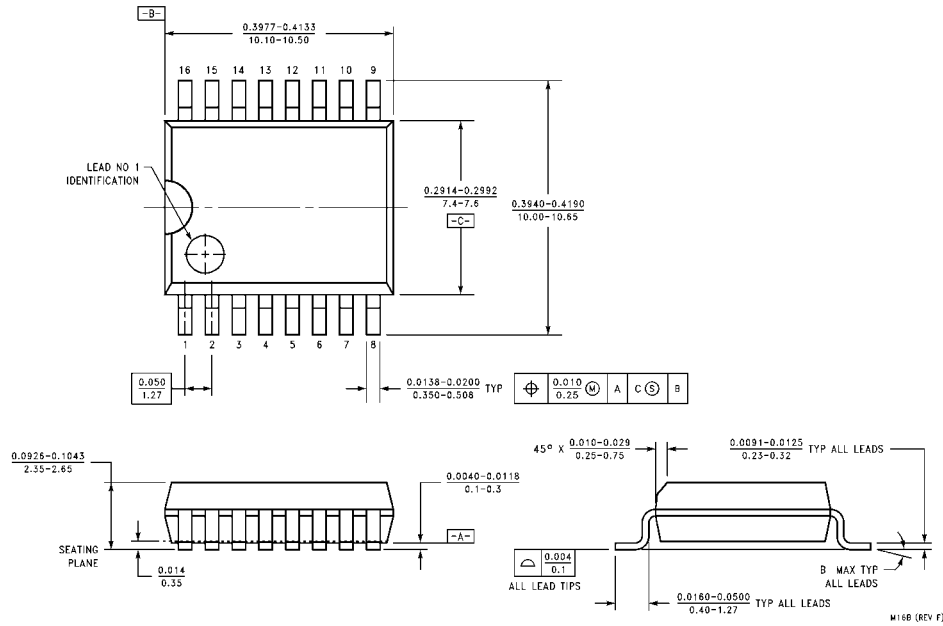
**Note 2:** Either voltage limit or current limit is sufficient to protect inputs.

**DC Electrical Characteristics**

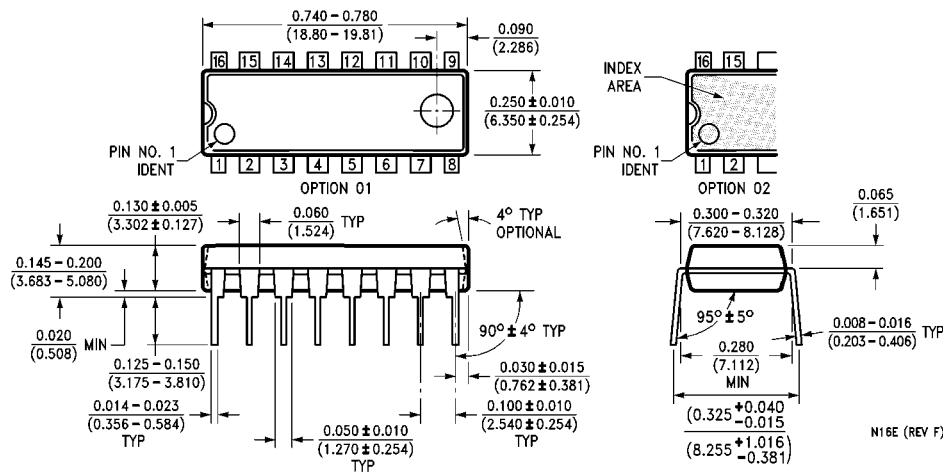
| Symbol            | Parameter                         | Min                 | Typ | Max          | Units | V <sub>CC</sub> | Conditions   |
|-------------------|-----------------------------------|---------------------|-----|--------------|-------|-----------------|--|
| V <sub>IH</sub>   | Input HIGH Voltage                | 2.0                 |     |              | V     |                 | Recognized as a HIGH Signal  |
| V <sub>IL</sub>   | Input LOW Voltage                 |                     |     | 0.8          | V     |                 | Recognized as a LOW Signal   |
| V <sub>CD</sub>   | Input Clamp Diode Voltage         |                     |     | -1.2         | V     | Min             | I <sub>IN</sub> = -18 mA   |
| V <sub>OH</sub>   | Output HIGH Voltage               | 10% V <sub>CC</sub> | 2.5 |              | V     | Min             | I <sub>OH</sub> = -1 mA  |
|                   |                                   | 10% V <sub>CC</sub> | 2.4 |              |       |                 | I <sub>OH</sub> = -3 mA  |
|                   |                                   | 5% V <sub>CC</sub>  | 2.7 |              |       |                 | I <sub>OH</sub> = -1 mA  |
|                   |                                   | 5% V <sub>CC</sub>  | 2.7 |              |       |                 | I <sub>OH</sub> = -3 mA  |
| V <sub>OL</sub>   | Output LOW Voltage                |                     |     | 0.5          | V     | Min             | I <sub>OL</sub> = 24 mA  |
| I <sub>IH</sub>   | Input HIGH Current                |                     |     | 5.0          | μA    | Max             | V <sub>IN</sub> = 2.7V   |
| I <sub>BVI</sub>  | Input HIGH Current Breakdown Test |                     |     | 7.0          | μA    | Max             | V <sub>IN</sub> = 7.0V   |
| I <sub>C EX</sub> | Output HIGH Leakage Current       |                     |     | 50           | μA    | Max             | V <sub>OUT</sub> = V <sub>CC</sub>   |
| V <sub>ID</sub>   | Input Leakage Test                | 4.75                |     |              | V     | 0.0             | I <sub>ID</sub> = 1.9 μA<br>All Other Pins Grounded  |
| I <sub>OD</sub>   | Output Leakage Circuit Current    |                     |     | 3.75         | μA    | 0.0             | V <sub>I OD</sub> = 150 mV<br>All Other Pins Grounded  |
| I <sub>IL</sub>   | Input LOW Current                 |                     |     | -0.6<br>-1.2 | mA    | Max             | V <sub>IN</sub> = 0.5V (except $\overline{CS}$ )<br>V <sub>IN</sub> = 0.5V ( $\overline{CS}$ ) |
| I <sub>OZH</sub>  | Output Leakage Current            |                     |     | 50           | μA    | Max             | V <sub>OUT</sub> = 2.7V  |
| I <sub>OZL</sub>  | Output Leakage Current            |                     |     | -50          | μA    | Max             | V <sub>OUT</sub> = 0.5V  |
| I <sub>OS</sub>   | Output Short-Circuit Current      | -60                 |     | -150         | mA    | Max             | V <sub>OUT</sub> = 0V  |
| I <sub>ZZ</sub>   | Bus Drainage Test                 |                     |     | 500          | μA    | 0.0V            | V <sub>OUT</sub> = 5.25V   |
| I <sub>CCZ</sub>  | Power Supply Current              |                     | 37  | 55           | mA    | Max             | V <sub>O</sub> = HIGH Z  |

| AC Electrical Characteristics |   |   |      |   |   |  |  |       |       |
|-------------------------------|---|---|------|---|---|--|--|-------|-------|
| Symbol                        | Parameter   | T <sub>A</sub> = +25°C<br>V <sub>CC</sub> = +5.0V<br>C <sub>L</sub> = 50 pF |      |   | T <sub>A</sub> = -55°C to +125°C<br>V <sub>CC</sub> = +5.0V<br>C <sub>L</sub> = 50 pF |  | T <sub>A</sub> = 0°C to +70°C<br>V <sub>CC</sub> = +5.0V<br>C <sub>L</sub> = 50 pF |       | Units |
|                               |   | Min   | Typ  | Max   | Min   | Max  | Min  | Max   |       |
| t <sub>PLH</sub>              | Access Time, HIGH or LOW  | 10.0  | 18.5 | 26.0  | 9.0   | 32.0   | 10.0   | 27.0  | ns    |
| t <sub>PHL</sub>              | A <sub>n</sub> to $\overline{O}_n$                                      | 8.0   | 13.5 | 19.0  | 8.0   | 23.0   | 8.0  | 20.0  |       |
| t <sub>PZH</sub>              | Access Time, HIGH or LOW  | 3.5   | 6.0  | 8.5   | 3.5   | 10.5   | 3.5  | 9.5   | ns    |
| t <sub>PZL</sub>              | $\overline{CS}$ to $\overline{O}_n$                                     | 5.0   | 9.0  | 13.0  | 5.0   | 15.0   | 5.0  | 14.0  |       |
| t <sub>PHZ</sub>              | Disable Time, HIGH or LOW   | 2.0   | 4.0  | 6.0   | 2.0   | 8.0  | 2.0  | 7.0   | ns    |
| t <sub>PLZ</sub>              | $\overline{CS}$ to $\overline{O}_n$                                     | 3.0   | 5.5  | 8.0   | 2.5   | 10.0   | 3.0  | 9.0   |       |
| t <sub>PZH</sub>              | Write Recovery Time,<br>HIGH or LOW $\overline{WE}$ to $\overline{O}_n$ | 6.5   | 15.0 | 28.0  | 6.5   | 37.5   | 6.5  | 29.0  | ns    |
| t <sub>PZL</sub>              | HIGH or LOW $\overline{WE}$ to $\overline{O}_n$                         | 6.5   | 11.0 | 15.5  | 6.5   | 17.5   | 6.5  | 16.5  |       |
| t <sub>PHZ</sub>              | Disable Time, HIGH or LOW   | 4.0   | 7.0  | 10.0  | 3.5   | 12.0   | 4.0  | 11.0  | ns    |
| t <sub>PLZ</sub>              | $\overline{WE}$ to $\overline{O}_n$                                     | 5.0   | 9.0  | 13.0  | 5.0   | 15.0   | 5.0  | 14.0  |       |
| AC Operating Requirements     |   |   |      |   |   |  |  |       |       |
| Symbol                        | Parameter   | T <sub>A</sub> = +25°C<br>V <sub>CC</sub> = +5.0V                           |      | T <sub>A</sub> = -55°C to +125°C<br>V <sub>CC</sub> = +5.0V |   | T <sub>A</sub> = 0°C to +70°C<br>V <sub>CC</sub> = +5.0V |  | Units |       |
|                               |   | Min   | Max  | Min   | Max   | Min  | Max  |       |       |
| t <sub>S(H)</sub>             | Setup Time, HIGH or LOW   | 0   |      | 0   |   | 0  |  | ns    |       |
| t <sub>S(L)</sub>             | A <sub>n</sub> to $\overline{WE}$                                       | 0   |      | 0   |   | 0  |  |       |       |
| t <sub>H(H)</sub>             | Hold Time, HIGH or LOW  | 2.0   |      | 2.0   |   | 2.0  |  | ns    |       |
| t <sub>H(L)</sub>             | A <sub>n</sub> to $\overline{WE}$                                       | 2.0   |      | 2.0   |   | 2.0  |  |       |       |
| t <sub>S(H)</sub>             | Setup Time, HIGH or LOW   | 10.0  |      | 11.0  |   | 10.0   |  | ns    |       |
| t <sub>S(L)</sub>             | D <sub>n</sub> to $\overline{WE}$                                       | 10.0  |      | 11.0  |   | 10.0   |  |       |       |
| t <sub>H(H)</sub>             | Hold Time, HIGH or LOW  | 0   |      | 2.0   |   | 0  |  | ns    |       |
| t <sub>H(L)</sub>             | D <sub>n</sub> to $\overline{WE}$                                       | 0   |      | 2.0   |   | 0  |  |       |       |
| t <sub>S(L)</sub>             | Setup Time, LOW<br>$\overline{CS}$ to $\overline{WE}$                   | 0   |      | 0   |   | 0  |  | ns    |       |
| t <sub>H(L)</sub>             | Hold Time, LOW<br>$\overline{CS}$ to $\overline{WE}$                    | 6.0   |      | 7.5   |   | 6.0  |  |       |       |
| t <sub>W(L)</sub>             | $\overline{WE}$ Pulse Width, LOW  | 6.0   |      | 15.0  |   | 6.0  |  | ns    |       |

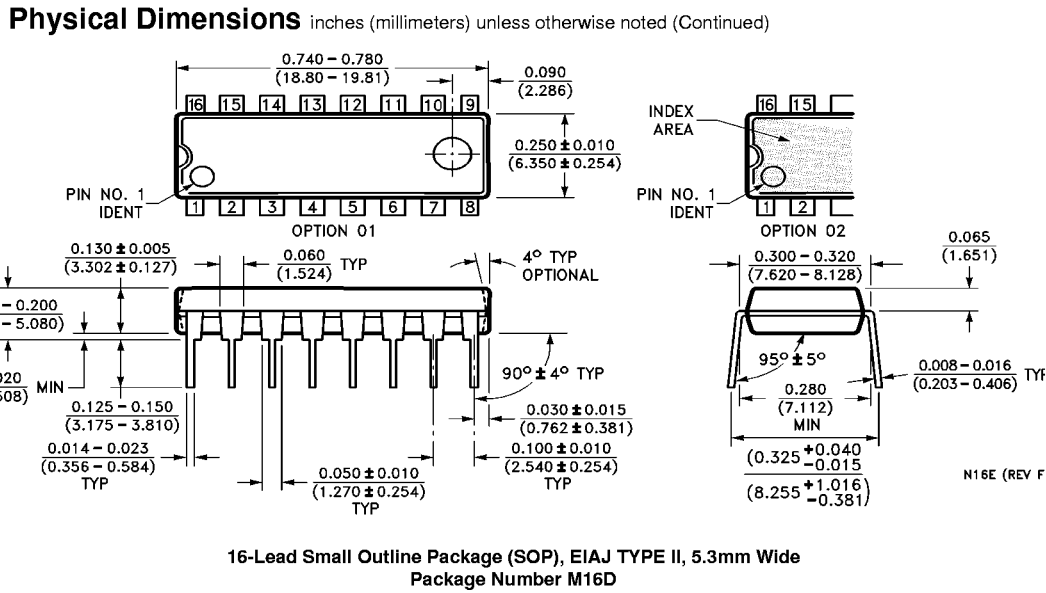
**Physical Dimensions** inches (millimeters) unless otherwise noted



**16-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS013, 0.300" Wide Body Package Number M16B**



**16-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300" Wide Package Number N16E**



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