

# 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 ( $\overline{CS}$ ) input is HIGH. The outputs are active only in the Read mode and the output data is the complement of the stored data.

### Features

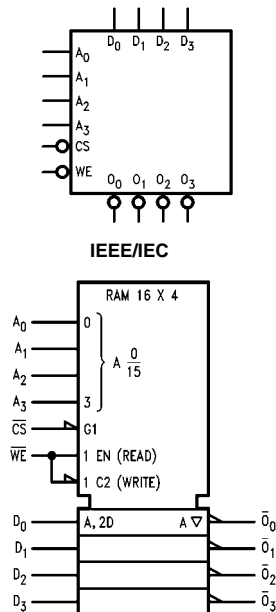
- 3-STATE outputs for data bus applications
- Buffered inputs minimize loading
- Address decoding on-chip
- Diode clamped inputs minimize ringing

### Ordering Code:

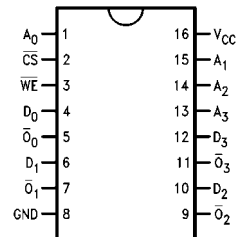
| Order Number | Package Number | Package Description  |
|--------------|----------------|--|
| 74F189SC     | M16B           | 16-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-013, 0.300" Wide |
| 74F189SJ     | M16D           | 16-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide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



### Connection Diagram



### Unit Loading/Fan Out

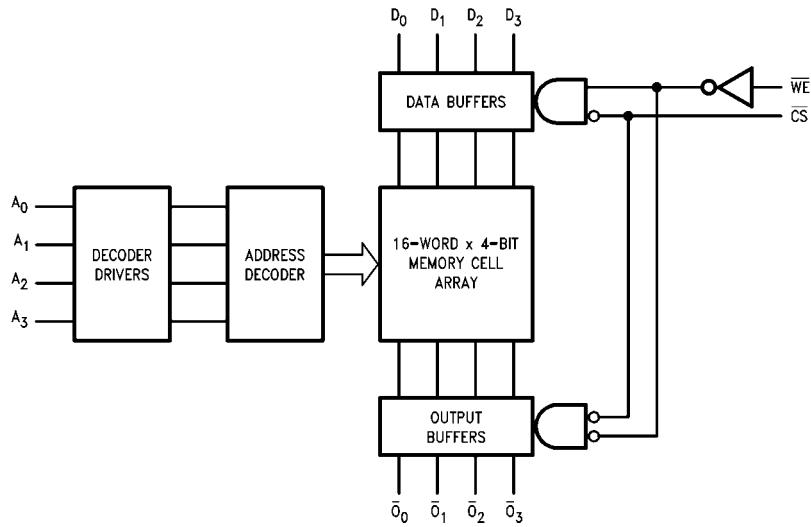
| Pin Names                       | Description                     | U.L.<br>HIGH/LOW | Input $I_H/I_{IL}$<br>Output $I_{OH}/I_{OL}$ |
|---------------------------------|---------------------------------|------------------|--|
| $A_0-A_3$                       | Address Inputs                  | 1.0/1.0          | 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.

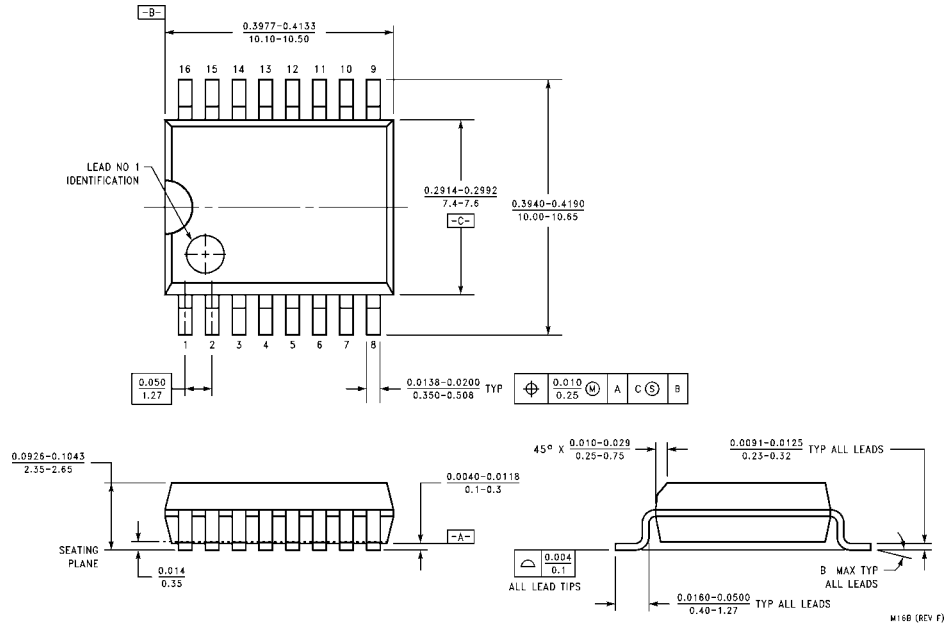
**Note 2:** Either voltage limit or current limit is sufficient to protect inputs.

**DC Electrical Characteristics**

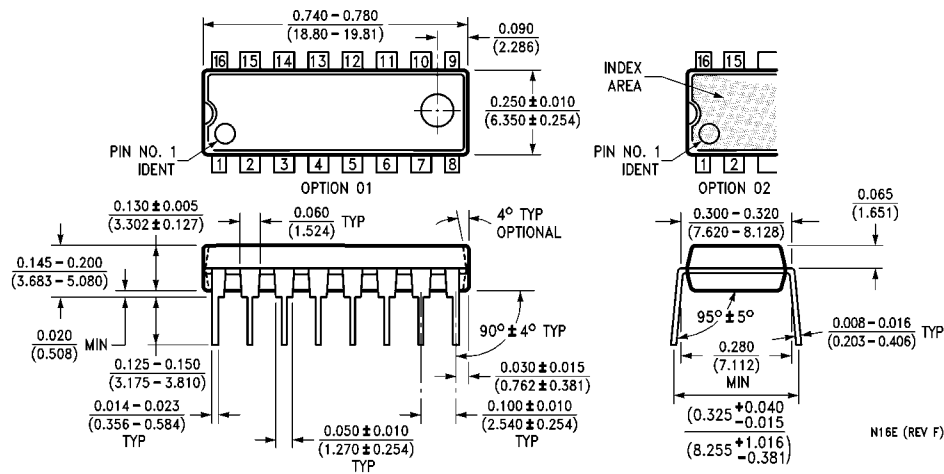
| Symbol           | Parameter                         | Min                 | Typ  | Max                     | Units | V <sub>CC</sub> | Conditions   |
|------------------|-----------------------------------|---------------------|------|-------------------------|-------|-----------------|--|
| V <sub>IH</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>CEx</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>IOD</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                                       | $T_A = +25^\circ\text{C}$<br>$V_{CC} = +5.0\text{V}$<br>$C_L = 50\text{ pF}$ |      |   | $T_A = -55^\circ\text{C to } +125^\circ\text{C}$<br>$V_{CC} = +5.0\text{V}$<br>$C_L = 50\text{ pF}$ |  | $T_A = 0^\circ\text{C to } +70^\circ\text{C}$<br>$V_{CC} = +5.0\text{V}$<br>$C_L = 50\text{ pF}$ |       | Units |
|                               |   | Min  | Typ  | Max   | Min   | Max  | Min  | Max   |       |
| $t_{PLH}$                     | Access Time, HIGH or LOW                        | 10.0   | 18.5 | 26.0  | 9.0   | 32.0   | 10.0   | 27.0  | ns    |
| $t_{PHL}$                     | $A_n$ to $\overline{O}_n$                       | 8.0  | 13.5 | 19.0  | 8.0   | 23.0   | 8.0  | 20.0  |       |
| $t_{PZH}$                     | Access Time, HIGH or LOW                        | 3.5  | 6.0  | 8.5   | 3.5   | 10.5   | 3.5  | 9.5   | ns    |
| $t_{PZL}$                     | $\overline{CS}$ to $\overline{O}_n$             | 5.0  | 9.0  | 13.0  | 5.0   | 15.0   | 5.0  | 14.0  |       |
| $t_{PHZ}$                     | Disable Time, HIGH or LOW                       | 2.0  | 4.0  | 6.0   | 2.0   | 8.0  | 2.0  | 7.0   | ns    |
| $t_{PLZ}$                     | $\overline{CS}$ to $\overline{O}_n$             | 3.0  | 5.5  | 8.0   | 2.5   | 10.0   | 3.0  | 9.0   |       |
| $t_{PZH}$                     | Write Recovery Time,                            | 6.5  | 15.0 | 28.0  | 6.5   | 37.5   | 6.5  | 29.0  | ns    |
| $t_{PZL}$                     | HIGH or LOW $\overline{WE}$ to $\overline{O}_n$ | 6.5  | 11.0 | 15.5  | 6.5   | 17.5   | 6.5  | 16.5  |       |
| $t_{PHZ}$                     | Disable Time, HIGH or LOW                       | 4.0  | 7.0  | 10.0  | 3.5   | 12.0   | 4.0  | 11.0  | ns    |
| $t_{PLZ}$                     | $\overline{WE}$ to $\overline{O}_n$             | 5.0  | 9.0  | 13.0  | 5.0   | 15.0   | 5.0  | 14.0  |       |
| AC Operating Requirements     |   |  |      |   |   |  |  |       |       |
| Symbol                        | Parameter                                       | $T_A = +25^\circ\text{C}$<br>$V_{CC} = +5.0\text{V}$                         |      | $T_A = -55^\circ\text{C to } +125^\circ\text{C}$<br>$V_{CC} = +5.0\text{V}$ |   | $T_A = 0^\circ\text{C to } +70^\circ\text{C}$<br>$V_{CC} = +5.0\text{V}$ |  | Units |       |
|                               |   | Min  | Max  | Min   | Max   | Min  | Max  |       |       |
| $t_S(H)$                      | Setup Time, HIGH or LOW                         | 0  |      | 0   |   | 0  |  | ns    |       |
| $t_S(L)$                      | $A_n$ to $\overline{WE}$                        | 0  |      | 0   |   | 0  |  |       |       |
| $t_H(H)$                      | Hold Time, HIGH or LOW                          | 2.0  |      | 2.0   |   | 2.0  |  | ns    |       |
| $t_H(L)$                      | $A_n$ to $\overline{WE}$                        | 2.0  |      | 2.0   |   | 2.0  |  |       |       |
| $t_S(H)$                      | Setup Time, HIGH or LOW                         | 10.0   |      | 11.0  |   | 10.0   |  | ns    |       |
| $t_S(L)$                      | $D_n$ to $\overline{WE}$                        | 10.0   |      | 11.0  |   | 10.0   |  |       |       |
| $t_H(H)$                      | Hold Time, HIGH or LOW                          | 0  |      | 2.0   |   | 0  |  | ns    |       |
| $t_H(L)$                      | $D_n$ to $\overline{WE}$                        | 0  |      | 2.0   |   | 0  |  |       |       |
| $t_S(L)$                      | Setup Time, LOW                                 | 0  |      | 0   |   | 0  |  | ns    |       |
|                               | $\overline{CS}$ to $\overline{WE}$              |  |      |   |   |  |  |       |       |
| $t_H(L)$                      | Hold Time, LOW                                  | 6.0  |      | 7.5   |   | 6.0  |  | ns    |       |
|                               | $\overline{CS}$ to $\overline{WE}$              |  |      |   |   |  |  |       |       |
| $t_W(L)$                      | $\overline{WE}$ Pulse Width, LOW                | 6.0  |      | 15.0  |   | 6.0  |  | ns    |       |

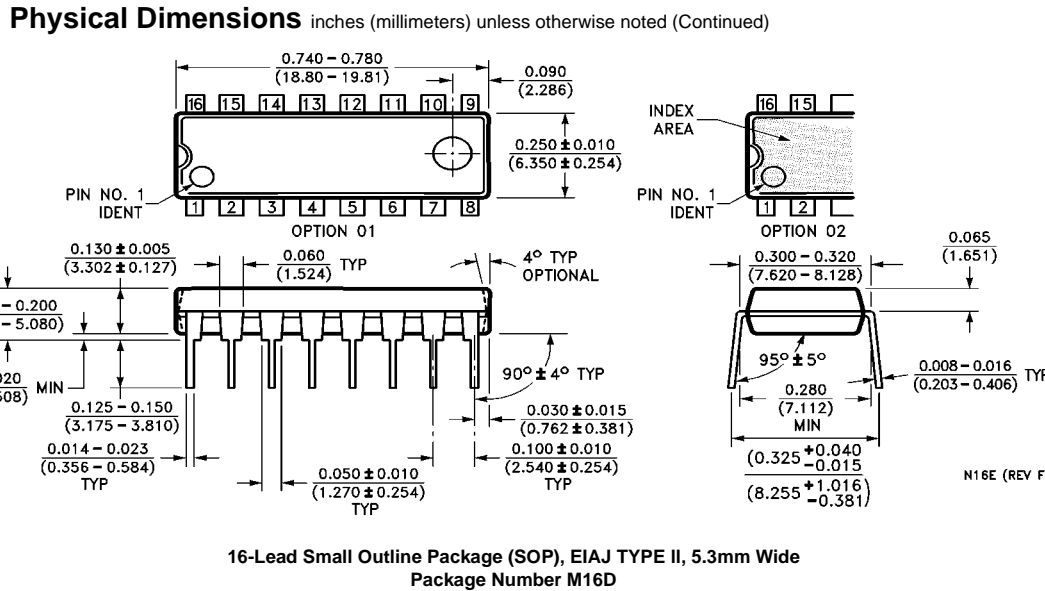
**Physical Dimensions** inches (millimeters) unless otherwise noted



**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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