

**54189/74189 64-Bit Random-Access Memory with 3-State Output (64-Bit RAM)**

|           | Schottky TTL |         |   |   |     | High-Speed TTL |         |   |   |    | Low-Power Schottky TTL |         |   |         |    | Standard TTL |         |   |   |    | Low-Power TTL |         |   |   |    |
|-----------|--------------|---------|---|---|-----|----------------|---------|---|---|----|------------------------|---------|---|---------|----|--------------|---------|---|---|----|---------------|---------|---|---|----|
|           | Device Type  | Package |   |   |     | Device Type    | Package |   |   |    | Devie Type             | Package |   |         |    | Device Type  | Package |   |   |    | Device Type   | Package |   |   |    |
|           |              | C       | P | M | CF  |                | C       | P | M | CF |                        | C       | P | M       | CF |              | C       | P | M | CF |               | C       | P | M | CF |
| T. I.     | SN54S189     | J ①     |   |   | W ① |                |         |   |   |    |                        |         |   |         |    |              |         |   |   |    |               |         |   |   |    |
|           | SN74S189     | J ① N ① |   |   |     |                |         |   |   |    |                        |         |   |         |    |              |         |   |   |    |               |         |   |   |    |
| FAIRCHILD |              |         |   |   |     |                |         |   |   |    |                        |         |   |         |    |              |         |   |   |    |               |         |   |   |    |
| MOTOROLA  |              |         |   |   |     |                |         |   |   |    |                        |         |   |         |    |              |         |   |   |    |               |         |   |   |    |
| N. S. C.  | DM54S189     | ①       |   |   |     |                |         |   |   |    |                        |         |   | DM54189 | ①  |              |         |   |   |    |               |         |   |   |    |
|           | DM74S189     | ①       |   |   |     |                |         |   |   |    |                        |         |   | DM74189 | ①  |              |         |   |   |    |               |         |   |   |    |
| PHILIPS   |              |         |   |   |     |                |         |   |   |    |                        |         |   |         |    |              |         |   |   |    |               |         |   |   |    |
| SIGNETICS |              |         |   |   |     |                |         |   |   |    |                        |         |   |         |    |              |         |   |   |    |               |         |   |   |    |
| SIEMENS   |              |         |   |   |     |                |         |   |   |    |                        |         |   |         |    |              |         |   |   |    |               |         |   |   |    |
| FUJITSU   |              |         |   |   |     |                |         |   |   |    |                        |         |   |         |    |              |         |   |   |    |               |         |   |   |    |
| HITACHI   |              |         |   |   |     |                |         |   |   |    |                        |         |   |         |    |              |         |   |   |    |               |         |   |   |    |
| MTSUBISHI |              |         |   |   |     |                |         |   |   |    |                        |         |   |         |    |              |         |   |   |    |               |         |   |   |    |
| NEC       |              |         |   |   |     |                |         |   |   |    |                        |         |   |         |    |              |         |   |   |    |               |         |   |   |    |
| TOSHIBA   |              |         |   |   |     |                |         |   |   |    |                        |         |   |         |    |              |         |   |   |    |               |         |   |   |    |

**Electrical Characteristics SN54S189/SN74S189**

| absolute maximum ratings over operating free-air temperature range |      |                                      |                                           |
|--------------------------------------------------------------------|------|--------------------------------------|-------------------------------------------|
| Supply voltage, $V_{CC}$                                           | 7V   | Operating free-air temperature range | SN54S -55°C to 125°C<br>SN74S 0°C to 70°C |
| Input voltage                                                      | 5.5V | Storage temperature range            | -65°C to 150°C                            |
| Off-state output voltage                                           | 5.5V |                                      |                                           |

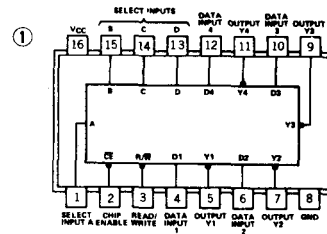
**recommended operating conditions**

|                                                       | SN54S189                    |      |      | SN74S189 |     |      | UNIT |
|-------------------------------------------------------|-----------------------------|------|------|----------|-----|------|------|
|                                                       | MIN                         | NOM  | MAX  | MIN      | NOM | MAX  |      |
| Supply voltage, $V_{CC}$                              | 4.5                         | 5    | 5.5  | 4.75     | 5   | 5.25 | V    |
| High-level output voltage, $V_{OH}$                   |                             |      | -2   |          |     | -6.5 | V    |
| Low-level output current, $I_{OL}$                    |                             |      | 16   |          |     | 16   | mA   |
| Width of write-enable pulse (read/write low), $t_{w}$ | 25                          |      | 25   |          |     |      | ns   |
| Setup time, $t_{setup}$                               | Address to read/write       | 0 ↓  | 0 ↓  |          |     |      | ns   |
|                                                       | Data to read/write          | 25 ↑ | 25 ↑ |          |     |      |      |
|                                                       | Chip enable to read/write   | 0 ↓  | 0 ↓  |          |     |      |      |
| Hold time, $t_{hold}$                                 | Address from read/write     | 0 ↑  | 0 ↑  |          |     |      | ns   |
|                                                       | Data from read/write        | 0 ↑  | 0 ↑  |          |     |      |      |
|                                                       | Chip enable from read/write | 0 ↑  | 0 ↑  |          |     |      |      |
| Operating free-air temperature, $T_A$                 | -55                         |      | 125  | 0        |     | 70   | °C   |

**electrical characteristics over recommended operating free-air temperature range**

| PARAMETER                                                     | TEST CONDITIONS†                                                                                               | MIN | TYP‡ | MAX  | UNIT |
|---------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------|-----|------|------|------|
| $V_{IH}$ High-level input voltage                             |                                                                                                                |     | 2    |      | V    |
| $V_{IL}$ Low-level input voltage                              |                                                                                                                |     |      | 0.8  | V    |
| $V_i$ Input clamp voltage                                     | $V_{CC} = \text{MIN.}$ , $I_i = -18 \text{ mA}$                                                                |     |      | -1.2 | V    |
| $V_{OH}$ High-level output voltage                            | SN54S: $V_{CC} = \text{MIN.}$ , $V_{IH} = 2 \text{ V.}$ , $V_{IL} = 0.8 \text{ V.}$ , $I_{OH} = \text{MAX.}$   | 2.4 | 3.4  |      | V    |
|                                                               | SN74S: $V_{CC} = \text{MAX.}$ , $V_{IH} = 2 \text{ V.}$ , $V_{IL} = 0.8 \text{ V.}$ , $I_{OL} = 16 \text{ mA}$ |     |      | 0.5  | V    |
| $V_{OL}$ Low-level output voltage                             | SN54S: $V_{CC} = \text{MIN.}$ , $V_{IH} = 2 \text{ V.}$ , $V_{IL} = 0.8 \text{ V.}$ , $I_{OL} = 16 \text{ mA}$ |     |      | 0.45 | V    |
| $I_{OZH}$ Off-state output current high-level voltage applied | $V_{CC} = \text{MAX.}$ , $V_{IH} = 2 \text{ V.}$ , $V_{IL} = 0.8 \text{ V.}$ , $V_O = 2.4 \text{ V.}$          |     |      | 50   | μA   |
| $I_{OZL}$ Off-state output current low-level voltage applied  | $V_{CC} = \text{MAX.}$ , $V_{IH} = 2 \text{ V.}$ , $V_{IL} = 0.8 \text{ V.}$ , $V_O = 0.5 \text{ V.}$          |     |      | -50  | μA   |
| $I_i$ Input current at maximum input voltage                  | $V_{CC} = \text{MAX.}$ , $V_i = 5.5 \text{ V.}$                                                                |     |      | 1    | mA   |
| $I_{IH}$ High-level input current                             | $V_{CC} = \text{MAX.}$ , $V_i = 2.7 \text{ V.}$                                                                |     |      | 25   | μA   |
| $I_{IL}$ Low-level input current                              | $V_{CC} = \text{MAX.}$ , $V_i = 0.5 \text{ V.}$                                                                |     |      | -250 | μA   |
| $I_{OS}$ Short-circuit output current, ◆                      | $V_{CC} = \text{MAX.}$                                                                                         | -30 |      | -100 | mA   |
| $I_{CC}$ Supply current                                       | $V_{CC} = \text{MAX.}$ , See Note                                                                              |     | 75   | 110  | mA   |
| $t_{PLH}$ Access times                                        | SN54S: $V_{CC} = 5 \text{ V.}$ , $T_A = 25^\circ \text{C.}$ , $C_L = 30 \text{ pF.}$ , $R_L = 280 \Omega.$     |     | 25   | 50   | ns   |
|                                                               | SN74S: $V_{CC} = 5 \text{ V.}$ , $T_A = 25^\circ \text{C.}$ , $C_L = 30 \text{ pF.}$ , $R_L = 280 \Omega.$     |     | 25   | 35   | ns   |
| $t_{PLH}$ from address                                        | SN54S: $V_{CC} = 5 \text{ V.}$ , $T_A = 25^\circ \text{C.}$ , $C_L = 30 \text{ pF.}$ , $R_L = 280 \Omega.$     |     | 25   | 50   | ns   |
|                                                               | SN74S: $V_{CC} = 5 \text{ V.}$ , $T_A = 25^\circ \text{C.}$ , $C_L = 30 \text{ pF.}$ , $R_L = 280 \Omega.$     |     | 25   | 35   | ns   |
| $t_{ZH}$ Access times from                                    | SN54S: $V_{CC} = 5 \text{ V.}$ , $T_A = 25^\circ \text{C.}$ , $C_L = 30 \text{ pF.}$ , $R_L = 280 \Omega.$     |     | 12   | 25   | ns   |
|                                                               | SN74S: $V_{CC} = 5 \text{ V.}$ , $T_A = 25^\circ \text{C.}$ , $C_L = 30 \text{ pF.}$ , $R_L = 280 \Omega.$     |     | 12   | 17   | ns   |
| $t_{ZL}$ chip enable                                          | SN54S: $V_{CC} = 5 \text{ V.}$ , $T_A = 25^\circ \text{C.}$ , $C_L = 30 \text{ pF.}$ , $R_L = 280 \Omega.$     |     | 12   | 25   | ns   |
|                                                               | SN74S: $V_{CC} = 5 \text{ V.}$ , $T_A = 25^\circ \text{C.}$ , $C_L = 30 \text{ pF.}$ , $R_L = 280 \Omega.$     |     | 12   | 17   | ns   |

|                                        |                                                                                                     |           |    |    |
|----------------------------------------|-----------------------------------------------------------------------------------------------------|-----------|----|----|
| $t_{ZH}$ Sense recovery times          | $V_{CC} = 5 \text{ V.}$ , $T_A = 25^\circ \text{C.}$ , $C_L = 30 \text{ pF.}$ , $R_L = 280 \Omega.$ | SN54S: 22 | 40 | ns |
| $t_{ZL}$ from read/write               |                                                                                                     | SN74S: 22 | 35 |    |
| $t_{HZ}$ Disable times from            | $V_{CC} = 5 \text{ V.}$ , $T_A = 25^\circ \text{C.}$ , $C_L = 5 \text{ pF.}$ , $R_L = 280 \Omega.$  | SN54S: 12 | 25 |    |
| $t_{LZ}$ chip enable                   |                                                                                                     | SN74S: 12 | 17 |    |
| $t_{HZ}$ Disable times from read/write |                                                                                                     | SN54S: 12 | 25 | ns |
| $t_{LZ}$ from read/write               |                                                                                                     | SN74S: 12 | 17 |    |

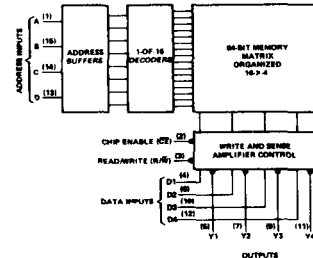
**Pin Assignment (Top View)**


positive logic:

**Function Table**

| FUNCTION                         | INPUTS      |             | OUTPUT         |
|----------------------------------|-------------|-------------|----------------|
|                                  | CHIP ENABLE | READ/ WRITE |                |
| Write (Store Complement of Data) | L           | L           | High Impedance |
| Read                             | L           | H           | Stored Data    |
| Inhibit                          | H           | X           | High Impedance |

H = high level, L = low level, X = irrelevant

**Functional Block Diagram**


$t_{CC}$  is measured with the read/write and chip-enable inputs grounded, all other inputs at 4.5V, and the outputs open.

† The arrow indicates the transition of the read/write input used for reference: † for the low-to-high transition, ‡ for the high-to-low transition.

◆  $t_{PLH}$  = Propagation delay time, low-to-high-level output  $t_{ZH}$  = Output enable time to high level  $t_{HZ}$  = Output disable time from high level  $t_{PLH}$  = Propagation delay time, high-to-low-level output  $t_{ZL}$  = Output enable time to low level  $t_{LZ}$  = Output disable time from low level

† For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.

‡ All typical values are at  $V_{CC} = 5 \text{ V.}$ ,  $T_A = 25^\circ \text{C.}$

◆ Duration of the short-circuit should not exceed one second.