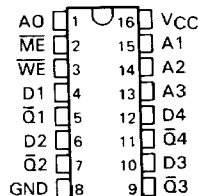


# SN7489 64-BIT RANDOM-ACCESS READ/WRITE MEMORY

D1416, DECEMBER 1972—REVISED FEBRUARY 1984

- For Application as a "Scratch Pad" Memory with Nondestructive Read-Out
- Fully Decoded Memory Organized as 16 Words of Four Bits Each
- Fast Access Time . . . 33 ns Typical
- Diode-Clamped, Buffered Inputs
- Open-Collector Outputs Provide Wire-AND Capability
- Typical Power Dissipation . . . 375 mW
- Compatible with Most TTL Circuits

SN7489 . . . J OR N PACKAGE  
(TOP VIEW)

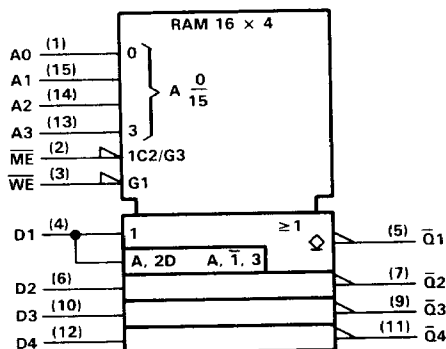


## description

This 64-bit active-element memory is a monolithic, high-speed, transistor-transistor logic (TTL) array of 64 flip-flop memory cells organized in a matrix to provide 16 words of four bits each. Each of the 16 words is addressed in straight binary with full on-chip decoding.

The buffered memory inputs consist of four address lines, four data inputs, a write enable, and a memory enable for controlling the entry and access of data. The memory has open-collector outputs which may be wired-AND connected to permit expansion up to 4704 words of N-bit length without additional output buffering. Access time is typically 33 nanoseconds; power dissipation is typically 375 milliwatts.

## logic symbol



FUNCTION TABLE

| ME | WE | OPERATION       | CONDITION OF OUTPUTS        |
|----|----|-----------------|-----------------------------|
| L  | L  | Write           | Complement of Data Inputs   |
| L  | H  | Read            | Complement of Selected Word |
| H  | L  | Inhibit Storage | Complement of Data Inputs   |
| H  | H  | Do Nothing      | High                        |

## write operation

Information present at the data inputs is written into the memory by addressing the desired word and holding both the memory enable and write enable low. Since the internal output of the data input gate is common to the input of the sense amplifier, the sense output will assume the opposite state of the information at the data inputs when the write enable is low.

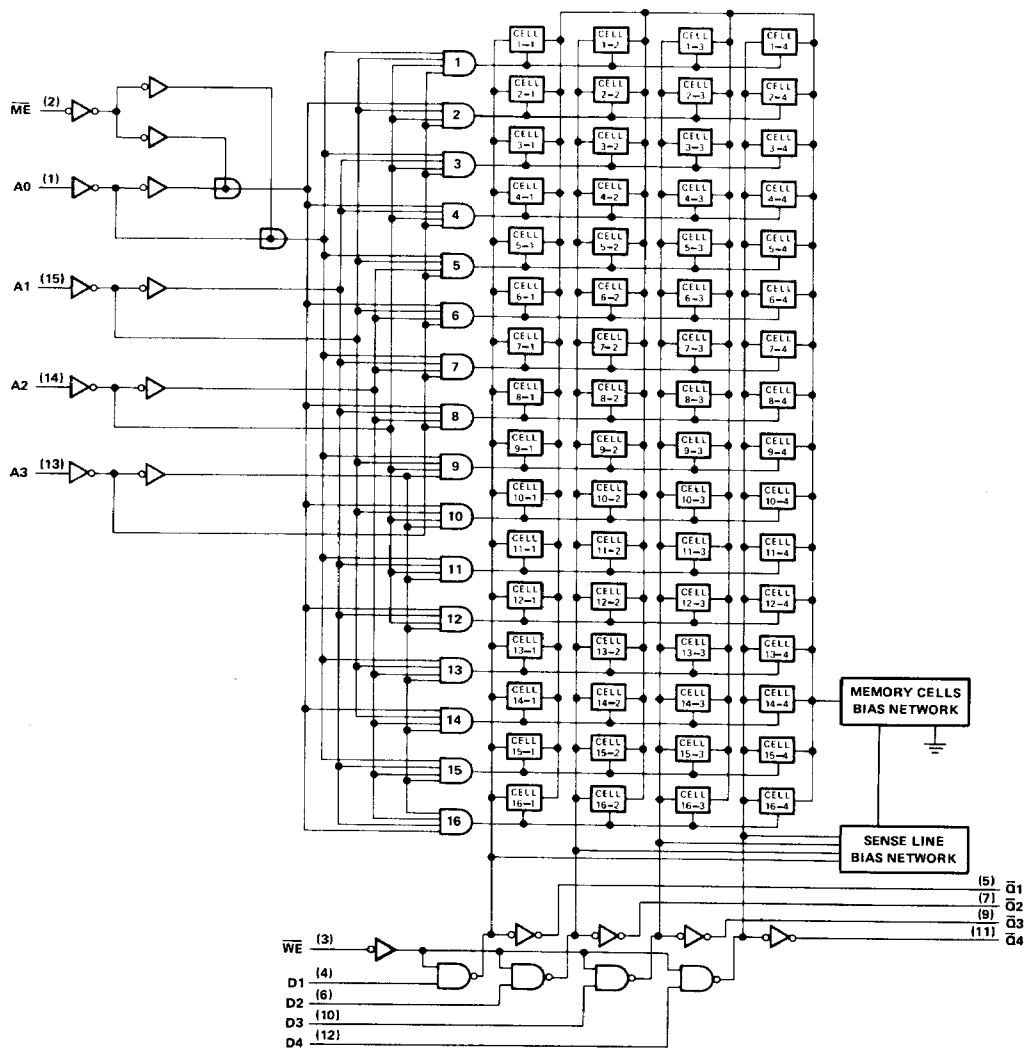
## read operation

The complement of the information which has been written into the memory is nondestructively read out at the four sense outputs. This is accomplished by holding the memory enable low, the write enable high, and selecting the desired address.

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# **SN7489** **64-BIT RANDOM-ACCESS READ/WRITE MEMORY**

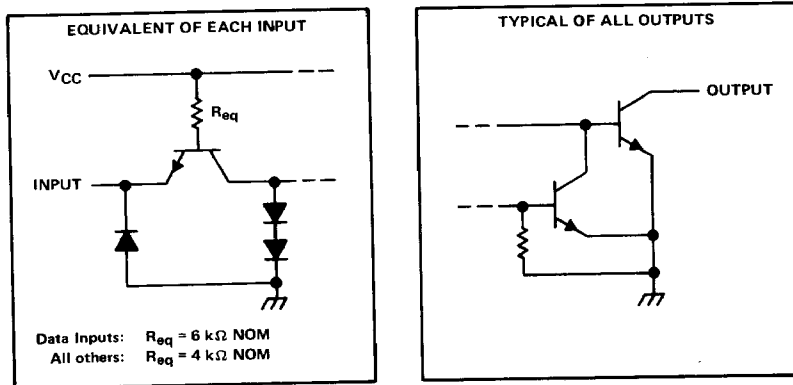
logic diagram



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# SN7489 64-BIT RANDOM-ACCESS READ/WRITE MEMORY

## schematics of inputs and outputs



## absolute maximum ratings over operating free-air temperature range (unless otherwise noted)

|                                                         |                |
|---------------------------------------------------------|----------------|
| Supply voltage, $V_{CC}$ (see Note 1)                   | 7 V            |
| Input voltage (see Note 1)                              | 5.5 V          |
| High-level output voltage, $V_{OH}$ (see Notes 1 and 2) | 5.5 V          |
| Operating free-air temperature range                    | 0°C to 70°C    |
| Storage temperature range                               | -65°C to 150°C |

NOTES: 1. Voltage values are with respect to network ground terminal.  
2. This is the maximum voltage that should be applied to any output when it is in the off state.

## recommended operating conditions

|                                                                              | MIN  | NOM | MAX  | UNIT |
|------------------------------------------------------------------------------|------|-----|------|------|
| Supply voltage, $V_{CC}$                                                     | 4.75 | 5   | 5.25 | V    |
| Width of write-enable pulse, $t_w$                                           | 40   |     |      | ns   |
| Setup time, data input with respect to write enable, $t_{su}$ (see Figure 1) | 40   |     |      | ns   |
| Hold time, data input with respect to write enable, $t_h$ (see Figure 1)     | 5    |     |      | ns   |
| Select input setup time with respect to write enable, $t_{su}$               | 0    |     |      | ns   |
| Select input hold time after writing, $t_h$ (see Figure 1)                   | 5    |     |      | ns   |
| Operating free-air temperature, $T_A$                                        | 0    |     | 70   | °C   |

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electrical characteristics over recommended operating free-air temperature range  
(unless otherwise noted)

| PARAMETER                                             | TEST CONDITIONS†                                                                                     | MIN | TYP‡ | MAX  | UNIT |
|-------------------------------------------------------|------------------------------------------------------------------------------------------------------|-----|------|------|------|
| V <sub>IH</sub> High-level input voltage              |                                                                                                      | 2   |      |      | V    |
| V <sub>IL</sub> Low-level input voltage               |                                                                                                      |     |      | 0.8  | V    |
| V <sub>IK</sub> Input clamp voltage                   | V <sub>CC</sub> = MIN,<br>I <sub>I</sub> = -12 mA                                                    |     |      | -1.5 | V    |
| I <sub>OH</sub> High-level output current             | V <sub>CC</sub> = MIN,<br>V <sub>IL</sub> = 0.8 V, V <sub>IH</sub> = 2 V,<br>V <sub>OH</sub> = 5.5 V |     |      | 20   | μA   |
| V <sub>OL</sub> Low-level output voltage              | V <sub>CC</sub> = MIN, V <sub>IH</sub> = 2 V,<br>I <sub>OL</sub> = 12 mA                             |     |      | 0.4  | V    |
|                                                       | V <sub>IL</sub> = 0.8 V, I <sub>OL</sub> = 16 mA                                                     |     |      | 0.45 | V    |
| I <sub>I</sub> Input current at maximum input voltage | V <sub>CC</sub> = MAX, V <sub>I</sub> = 5.5 V                                                        |     |      | 1    | mA   |
| I <sub>IH</sub> High-level input current              | V <sub>CC</sub> = MAX, V <sub>I</sub> = 2.4 V                                                        |     |      | 40   | μA   |
| I <sub>IL</sub> Low-level input current               | V <sub>CC</sub> = MAX, V <sub>I</sub> = 0.4 V                                                        |     |      | -1.6 | mA   |
| I <sub>CC</sub> Supply current                        | V <sub>CC</sub> = MAX, See Note 3                                                                    |     | 75   | 105  | mA   |
| C <sub>O</sub> Off-state output capacitance           | V <sub>CC</sub> = 5 V, V <sub>O</sub> = 2.4 V,<br>f = 1 MHz                                          |     | 6.5  |      | pF   |

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

‡All typical values are at V<sub>CC</sub> = 5 V, T<sub>A</sub> = 25°C.

NOTE 3: I<sub>CC</sub> is measured with the memory enable grounded, all other inputs at 4.5 V, and all outputs open.

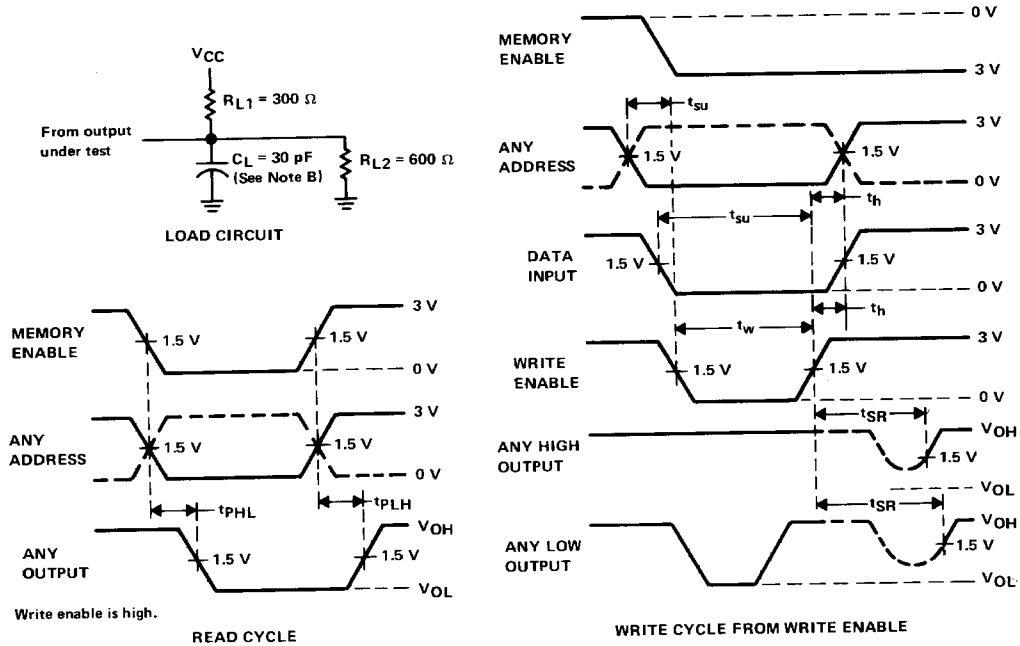
switching characteristics, V<sub>CC</sub> = 5 V, T<sub>A</sub> = 25°C

| PARAMETER        |                                                                         |                       | TEST CONDITIONS                                                                                 | MIN | TYP | MAX | UNIT |
|------------------|-------------------------------------------------------------------------|-----------------------|-------------------------------------------------------------------------------------------------|-----|-----|-----|------|
| t <sub>PLH</sub> | Propagation delay time, low-to-high-level output from memory enable     |                       | C <sub>L</sub> = 30 pF,<br>R <sub>L1</sub> = 300 Ω,<br>R <sub>L2</sub> = 600 Ω,<br>See Figure 1 |     | 26  | 50  | ns   |
| t <sub>PHL</sub> | Propagation delay time, high-to-low-level output from memory enable     |                       |                                                                                                 |     | 33  | 50  |      |
| t <sub>PLH</sub> | Propagation delay time, low-to-high-level output from any address input |                       |                                                                                                 |     | 30  | 60  | ns   |
| t <sub>PHL</sub> | Propagation delay time, high-to-low-level output from any address input |                       |                                                                                                 |     | 35  | 60  |      |
| t <sub>SR</sub>  | Sense recovery time after writing                                       | Output initially high |                                                                                                 |     | 39  | 70  | ns   |
|                  |                                                                         | Output initially low  |                                                                                                 |     | 48  | 70  |      |

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**PARAMETER MEASUREMENT INFORMATION**



NOTES: A. The input pulse generators have the following characteristics:  $t_r \leq 10 \text{ ns}$ ,  $t_f \leq 10 \text{ ns}$ ,  $\text{PRR} = 1 \text{ MHz}$ ,  $Z_{out} \approx 50 \Omega$ .  
B.  $C_L$  includes probe and jig capacitance.

FIGURE 1—SWITCHING CHARACTERISTICS

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**TYPICAL CHARACTERISTICS**

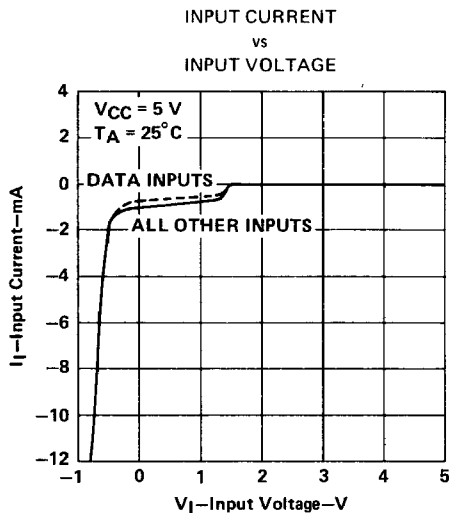


FIGURE 2

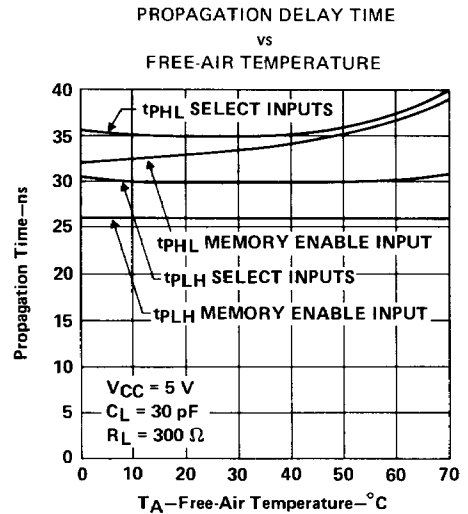


FIGURE 3

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