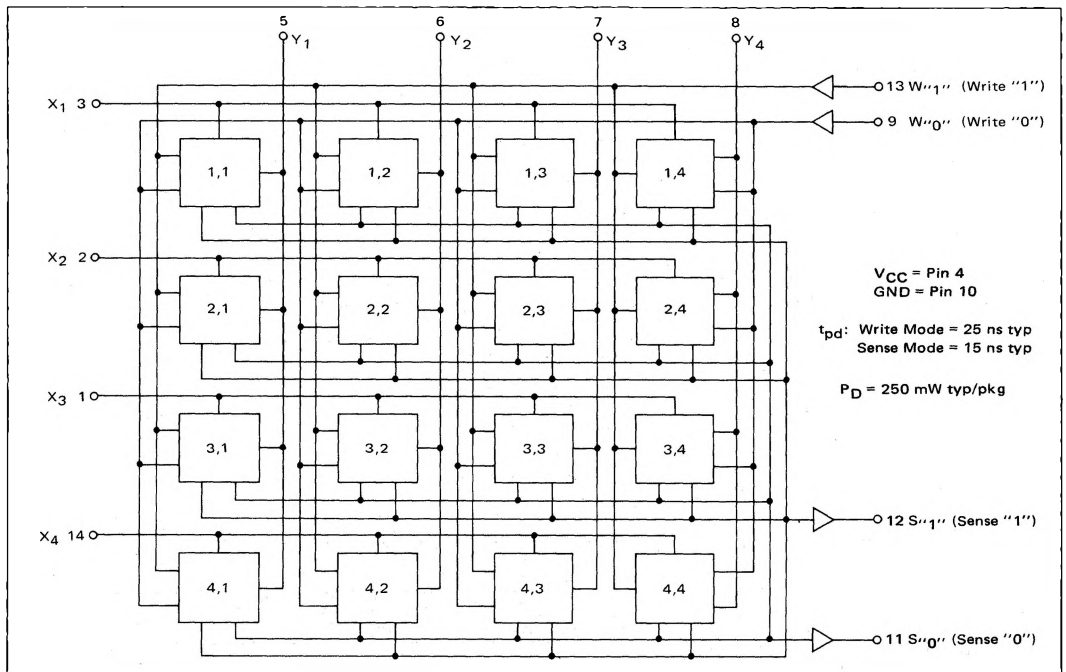


# MC4304F,L • MC4305F,L\* MC4004F,L,P • MC4005F,L,P\*

This 16-Bit memory cell serves as the basic building block for scratch pad memory systems having cycle times of less than 100 ns. The basic cell provides 16 words of one-bit memory operating in the non-destructive readout (NDRO) mode.

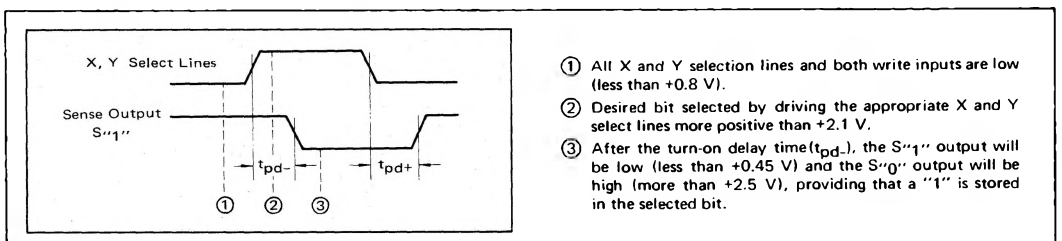
The memory contains 16 flip-flops arranged in a four-by-four matrix. A single bit of the matrix is selected by

driving one of four X select lines and one of four Y select lines above the select threshold. Two sense amplifiers are shared by all 16 bits and provide a double rail output from the selected bit. The sense output of many devices can be "wired ORed" together since the output stage does not have a pullup resistor or network. Two write amplifiers allow a "1" or a "0" to be written into a selected bit.



## — OPERATING SEQUENCE —

FIGURE 1 — READ MODE TIMING DIAGRAM

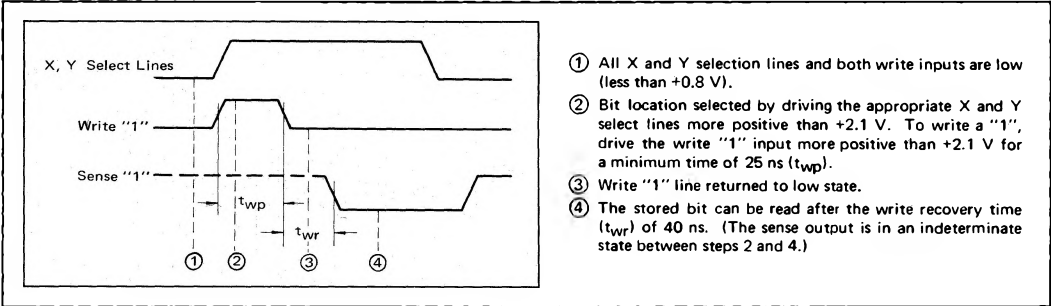


\*F suffix = TO-86 ceramic flat package (Case 607).

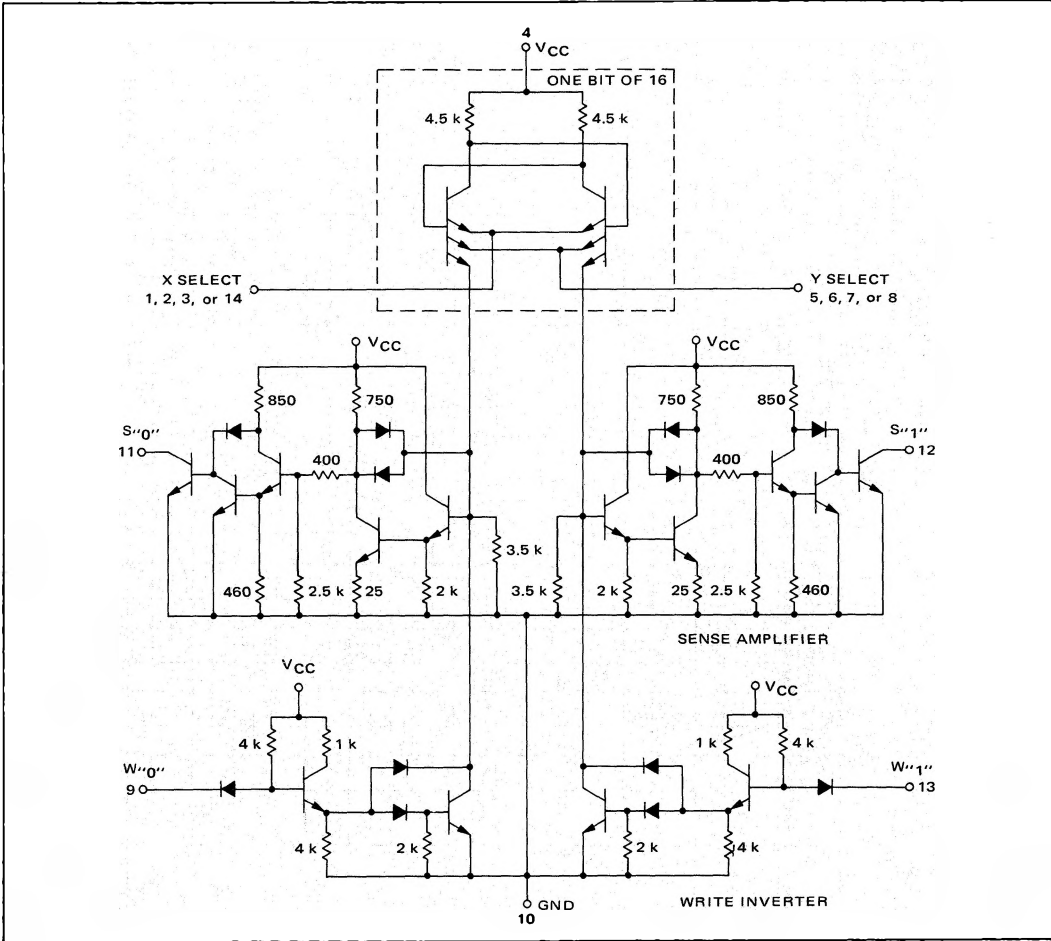
L suffix = TO-116 ceramic dual in-line package (Case 632).

P suffix = TO-116 plastic dual in-line package (Case 605).

FIGURE 2 – WRITE MODE TIMING DIAGRAM



CIRCUIT SCHEMATIC



## MC4304F,L, MC4305F,L, MC4004F,L,P, MC4005F,L,P (continued)

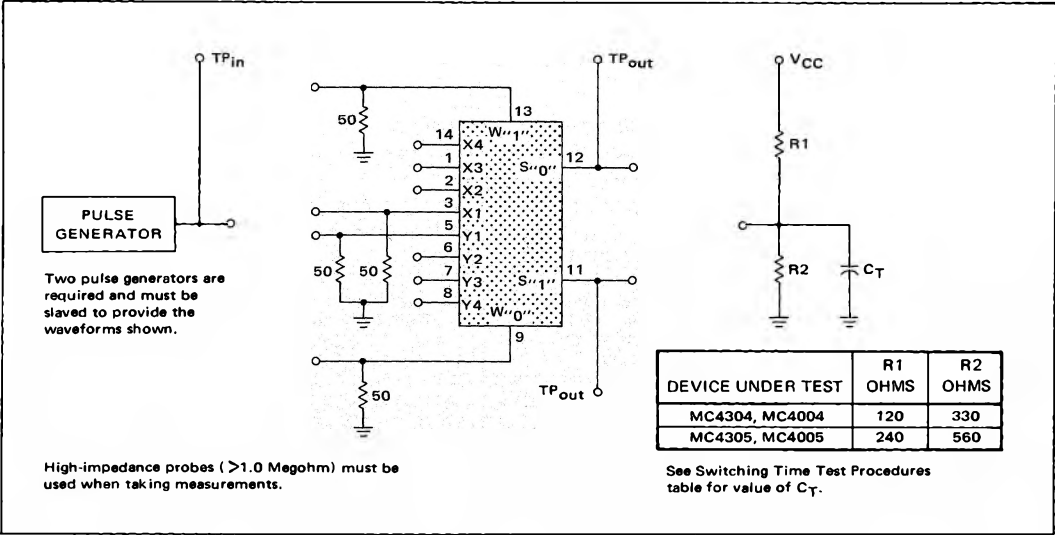
## ELECTRICAL CHARACTERISTICS

Test procedures are shown for only one bit. Other bits are tested in the same manner.

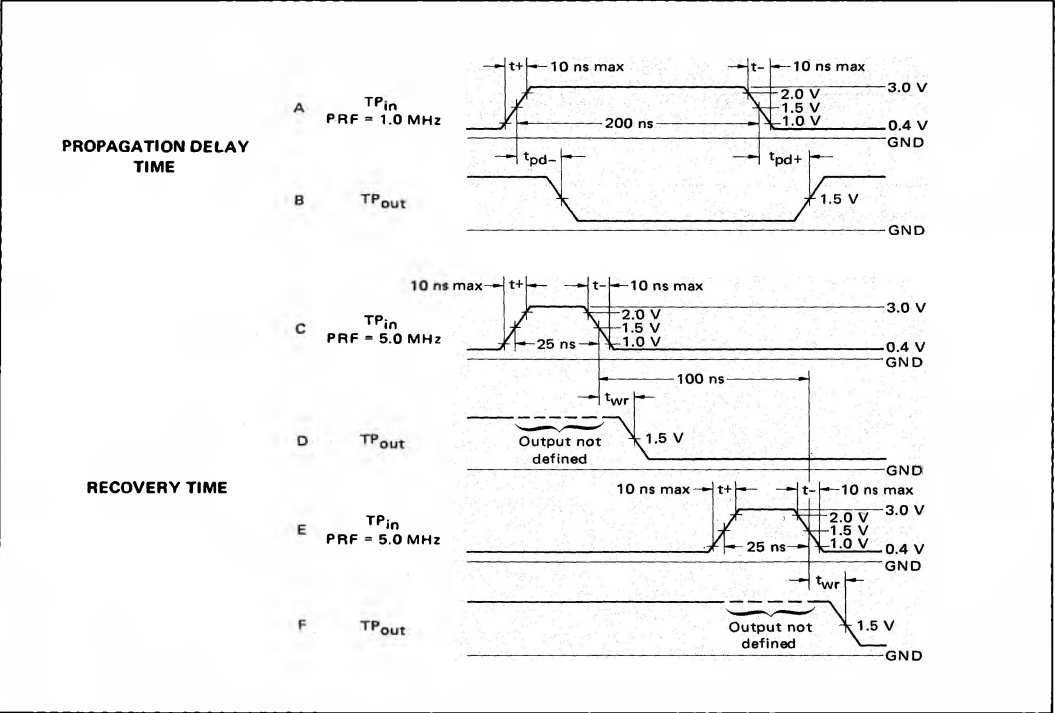
[illegible]

Note 1. Output logic "0" voltage and leakage current measurements are made as part of a functional test of a memory. Procedures identified by a double asterisk (\*\*) are preconditioning procedures for the subsequent test. All power supply and input voltages must be maintained between tests.

SWITCHING TIME TEST CIRCUIT



VOLTAGE WAVEFORMS AND DEFINITIONS



# MC4304F,L, MC4305F,L, MC4004F,L,P, MC4005F,L,P (continued)

## SWITCHING TIME TEST PROCEDURES (Letters shown in test columns refer to waveforms)

| Test                                                                | Symbol           | Pin Under Test | Input Pin                            |                     |                     |                      |                     |                     |                     |                     |                       |                        |                        | Output                 |                    | C <sub>T</sub> *<br>pF | Limits             |  |
|---------------------------------------------------------------------|------------------|----------------|--------------------------------------|---------------------|---------------------|----------------------|---------------------|---------------------|---------------------|---------------------|-----------------------|------------------------|------------------------|------------------------|--------------------|------------------------|--------------------|--|
|                                                                     |                  |                | 3<br>X <sub>1</sub>                  | 2<br>X <sub>2</sub> | 1<br>X <sub>3</sub> | 14<br>X <sub>4</sub> | 5<br>Y <sub>1</sub> | 6<br>Y <sub>2</sub> | 7<br>Y <sub>3</sub> | 8<br>Y <sub>4</sub> | 9<br>W <sub>0</sub> " | 13<br>W <sub>1</sub> " | 11<br>S <sub>0</sub> " | 12<br>S <sub>1</sub> " | MC4304-5<br>ns max |                        | MC4004-5<br>ns max |  |
| Turn-Off Delay Time<br>(Address Lines to Sense "0" Output)          | **               | —              | 3.0 V                                | 3.0 V               | 3.0 V               | 3.0 V                | 3.0 V               | 3.0 V               | 3.0 V               | 3.0 V               | Gnd                   | 3.0 V                  | —                      | —                      | —                  | —                      |                    |  |
|                                                                     | **               | —              | 3.0 V                                | Gnd                 | Gnd                 | Gnd                  | 3.0 V               | Gnd                 | Gnd                 | Gnd                 | 3.0 V                 | Gnd                    | —                      | —                      | —                  | —                      |                    |  |
|                                                                     | t <sub>pd+</sub> | 11             | A                                    | Gnd                 | Gnd                 | Gnd                  | A                   | Gnd                 | Gnd                 | Gnd                 | Gnd                   | Gnd                    | B                      | —                      | 30                 | 23                     |                    |  |
|                                                                     | t <sub>pd+</sub> | 11             | A                                    | Gnd                 | Gnd                 | Gnd                  | A                   | Gnd                 | Gnd                 | Gnd                 | Gnd                   | Gnd                    | B                      | —                      | 200                | 35                     |                    |  |
| Turn-Off Delay Time<br>(Address Lines to Sense "1" Output)          | **               | —              | 3.0 V                                | 3.0 V               | 3.0 V               | 3.0 V                | 3.0 V               | 3.0 V               | 3.0 V               | 3.0 V               | Gnd                   | 3.0 V                  | —                      | —                      | —                  | —                      |                    |  |
|                                                                     | **               | —              | 3.0 V                                | Gnd                 | Gnd                 | Gnd                  | 3.0 V               | Gnd                 | Gnd                 | Gnd                 | Gnd                   | 3.0 V                  | —                      | —                      | —                  | —                      |                    |  |
|                                                                     | t <sub>pd+</sub> | 12             | A                                    | Gnd                 | Gnd                 | Gnd                  | A                   | Gnd                 | Gnd                 | Gnd                 | Gnd                   | Gnd                    | —                      | B                      | 30                 | 23                     |                    |  |
|                                                                     | t <sub>pd+</sub> | 12             | A                                    | Gnd                 | Gnd                 | Gnd                  | A                   | Gnd                 | Gnd                 | Gnd                 | Gnd                   | Gnd                    | —                      | B                      | 200                | 35                     |                    |  |
| Turn-On Delay Time<br>(Address Lines to Sense "0" Output)           | **               | —              | 3.0 V                                | 3.0 V               | 3.0 V               | 3.0 V                | 3.0 V               | 3.0 V               | 3.0 V               | 3.0 V               | Gnd                   | 3.0 V                  | —                      | —                      | —                  | —                      |                    |  |
|                                                                     | **               | —              | 3.0 V                                | Gnd                 | Gnd                 | Gnd                  | 3.0 V               | Gnd                 | Gnd                 | Gnd                 | 3.0 V                 | Gnd                    | —                      | —                      | —                  | —                      |                    |  |
|                                                                     | t <sub>pd-</sub> | 11             | A                                    | Gnd                 | Gnd                 | Gnd                  | A                   | Gnd                 | Gnd                 | Gnd                 | Gnd                   | Gnd                    | B                      | —                      | 30                 | 23                     |                    |  |
|                                                                     | t <sub>pd-</sub> | 11             | A                                    | Gnd                 | Gnd                 | Gnd                  | A                   | Gnd                 | Gnd                 | Gnd                 | Gnd                   | Gnd                    | B                      | —                      | 200                | 35                     |                    |  |
| Turn-On Delay Time<br>(Address Lines to Sense "1" Output)           | **               | —              | 3.0 V                                | 3.0 V               | 3.0 V               | 3.0 V                | 3.0 V               | 3.0 V               | 3.0 V               | 3.0 V               | Gnd                   | 3.0 V                  | —                      | —                      | —                  | —                      |                    |  |
|                                                                     | **               | —              | 3.0 V                                | Gnd                 | Gnd                 | Gnd                  | 3.0 V               | Gnd                 | Gnd                 | Gnd                 | Gnd                   | 3.0 V                  | —                      | —                      | —                  | —                      |                    |  |
|                                                                     | t <sub>pd-</sub> | 12             | A                                    | Gnd                 | Gnd                 | Gnd                  | A                   | Gnd                 | Gnd                 | Gnd                 | Gnd                   | Gnd                    | —                      | B                      | 30                 | 23                     |                    |  |
|                                                                     | t <sub>pd-</sub> | 12             | A                                    | Gnd                 | Gnd                 | Gnd                  | A                   | Gnd                 | Gnd                 | Gnd                 | Gnd                   | Gnd                    | —                      | B                      | 200                | 35                     |                    |  |
| Turn-Off Delay Time<br>(4 Bits) (Address Lines to Sense "0" Output) | **               | —              | 3.0 V                                | 3.0 V               | 3.0 V               | 3.0 V                | 3.0 V               | 3.0 V               | 3.0 V               | 3.0 V               | Gnd                   | 3.0 V                  | —                      | —                      | —                  | —                      |                    |  |
|                                                                     | **               | —              | 3.0 V                                | Gnd                 | Gnd                 | Gnd                  | 3.0 V               | 3.0 V               | 3.0 V               | 3.0 V               | 3.0 V                 | Gnd                    | —                      | —                      | —                  | —                      |                    |  |
|                                                                     | t <sub>pd+</sub> | 11             | A                                    | Gnd                 | Gnd                 | Gnd                  | A                   | A                   | A                   | A                   | Gnd                   | Gnd                    | B                      | —                      | 30                 | 35                     |                    |  |
| Turn-Off Delay Time<br>(4 Bits) (Address Lines to Sense "1" Output) | **               | —              | 3.0 V                                | 3.0 V               | 3.0 V               | 3.0 V                | 3.0 V               | 3.0 V               | 3.0 V               | 3.0 V               | Gnd                   | 3.0 V                  | —                      | —                      | —                  | —                      |                    |  |
|                                                                     | **               | —              | 3.0 V                                | Gnd                 | Gnd                 | Gnd                  | 3.0 V               | 3.0 V               | 3.0 V               | 3.0 V               | Gnd                   | 3.0 V                  | —                      | —                      | —                  | —                      |                    |  |
|                                                                     | t <sub>pd+</sub> | 12             | A                                    | Gnd                 | Gnd                 | Gnd                  | A                   | A                   | A                   | A                   | Gnd                   | Gnd                    | —                      | B                      | 30                 | 35                     |                    |  |
| Write Recovery Time                                                 | t <sub>wr</sub>  | 12             | 3.0 V                                | Gnd                 | Gnd                 | Gnd                  | 3.0 V               | Gnd                 | Gnd                 | Gnd                 | E                     | C                      | —                      | D                      | 30                 | 40                     |                    |  |
|                                                                     |                  | 11             | 3.0 V                                | Gnd                 | Gnd                 | Gnd                  | 3.0 V               | Gnd                 | Gnd                 | Gnd                 | E                     | C                      | F                      | —                      | 30                 | 40                     |                    |  |
| Write Pulse Width                                                   | t <sub>wp</sub>  | —              | Tested during t <sub>wr</sub> tests. |                     |                     |                      |                     |                     |                     |                     |                       |                        |                        |                        |                    | ns min                 | ns min             |  |
|                                                                     |                  |                |                                      |                     |                     |                      |                     |                     |                     |                     |                       |                        |                        |                        |                    | 25                     | 25                 |  |

\*Capacitance value for load of the Switching Time Test Circuit

\*\*Preconditioning procedures for subsequent test.