MOTOROLA

# MCM76161
# MCM76161A

TTL

## 16384-BIT PROGRAMMABLE READ ONLY MEMORIES

MCM76161,A — 2048 × 8 THREE-STATE

### 16384-BIT PROGRAMMABLE READ ONLY MEMORY

The MCM76161 and MC76161A, together with various other 76xx series TTL PROMS, comprise a complete and compatible family having common dc electrical characteristics and identical programming requirements. They are fully decoded, high-speed, field-programmable ROMs and are available in commonly used organizations, with three-state outputs. All bits are manufactured storing a logical "1" (outputs high), and can be selectively programmed for logical "0" (outputs low).

The field-programmable PROM can be custom-programmed to any pattern using a simple programming procedure. Schottky bipolar circuitry provides fast access time.

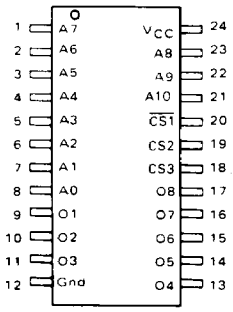
Pinouts are compatible to industry-standard PROMs and ROMs. The MCM76161 is a pin compatible replacement for the 1024 × 8 with Pin 21 connected as A10 on the 2048 × 8.

In addition to the conventional storage array, extra test rows and columns are included to assure high programmability, and guarantee parametric and ac performance. Fuses in these test rows and columns are blown prior to shipment.

- Common dc Electrical Characteristics and Programming Procedure
- Simple, High-Speed Programming Procedure (1.0 Second per 1024 Bits, Typical)
- Expandable — Three-State Outputs and Chip Enable Inputs
- Inputs and Outputs TTL-Compatible
  Low Input Current — 250 μA Logic "0", 40 μA Logic "1"
  Full Output Drive — 16 mA Sink, 2.0 mA Source
- Fast Access Time — Guaranteed for Worst-Case $N^2$ Sequencing, Over Commercial Temperature and Voltage Ranges
- Pin-Compatible with Industry-Standard PROMs and ROMs

PIN ASSIGNMENT

MCM76161DC/ADC
MCM76161PC/APC




**ABSOLUTE MAXIMUM RATINGS** (See Note)

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Operating Supply Voltage | $V_{CC}$ | +7.0 | Vdc |
| Input Voltage | $V_{in}$ | +5.5 | Vdc |
| Operating Output Voltage | $V_{OH}$ | +7.0 | Vdc |
| Supply Current | $I_{CC}$ | 650 | mAdc |
| Input Current | $I_{in}$ | -20 | mAdc |
| Output Sink Current | $I_o$ | 100 | mAdc |
| Operating Temperature Range MCM76161xxx | $T_A$ | 0 to +75 | °C |
| Storage Temperature Range | $T_{stg}$ | -55 to +150 | °C |
| Maximum Junction Temperature | $T_J$ | +175 | °C |

Note

Permanent device damage may occur if ABSOLUTE MAXIMUM RATINGS are exceeded. Functional operation should be restricted to RECOMMENDED OPERATING CONDITIONS. Exposure to higher than recommended voltages for extended periods of time could affect device reliability. (While programming, follow the programming specifications.)

**GUARANTEED OPERATING RANGE** ($T_A$ = 0°C to +75°C)

| Parameter | Symbol | Min | Nom | Max | Unit |
|---|---|---|---|---|---|
| Supply Voltage | $V_{CC}$ | 4.75 | 5.0 | 5.25 | Vdc |
| Input High Voltage | $V_{IH}$ | 2.0 | — | — | Vdc |
| Input Low Voltage | $V_{IL}$ | — | — | 0.8 | Vdc |

**DC OPERATING CONDITIONS AND CHARACTERISTICS**

| Symbol | Parameter | | Test Conditions | Three-State Output Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| $I_{IH}$<br>$I_{IL}$ | Address/Enable Input Current | "1"<br>"0" | $V_{IH} = V_{CC}$ Max<br>$V_{IL}$ = 0.45 V | —<br>— | —<br>-0.1 | 40<br>-0.25 | μAdc<br>mAdc |
| $V_{OH}$<br>$V_{OL}$ | Output Voltage | "1"<br>"0" | $I_{OH}$ = -2.0 mA, $V_{CC}$ Min<br>$I_{OL}$ = +16 mA, $V_{CC}$ Min | 2.4<br>— | 3.4<br>0.35 | —<br>0.45 | Vdc<br>Vdc |
| $I_{OHE}$<br>$I_{OLE}$ | Output Disabled Current | "1"<br>"0" | $V_{OH}$ = +5.25 V, $V_{CC}$ Max<br>$V_{OL}$ = +0.3 V, $V_{CC}$ Max | —<br>— | —<br>— | 40<br>-40 | μAdc<br>μAdc |
| $V_{IK}$ | Input Clamp Voltage | | $I_{in}$ = -18 mA | — | — | -1.2 | Vdc |
| $I_{OS}$ | Output Short Circuit Current | | $V_{CC}$ Max, $V_{out}$ = 0.0 V<br>One Output Only for 1.0 s Max | -15 | — | -70 | mAdc |
| $I_{CC}$ | Power Supply Current | | $V_{CC}$ Max<br>All Inputs Grounded | — | 130 | 180 | mAdc |

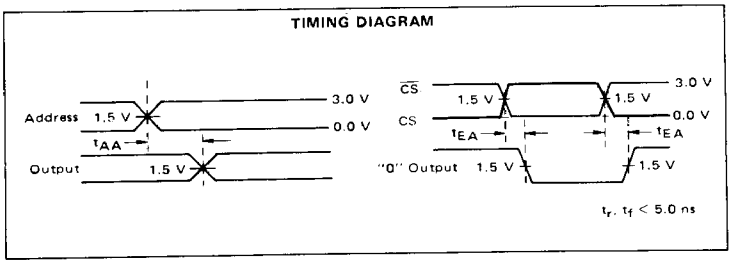
**CAPACITANCE** (f = 1.0 MHz, $T_A$ = 25°C, periodically sampled rather than 100% tested.)

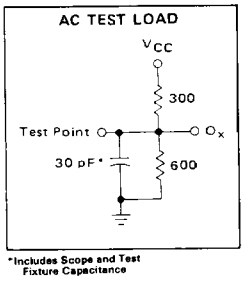
| Characteristic | Symbol | Typ | Unit |
|---|---|---|---|
| Input Capacitance | $C_{in}$ | 8.0 | pF |
| Output Capacitance | $C_{out}$ | 10 | pF |

**AC OPERATING CONDITIONS AND CHARACTERISTICS** (Full operating voltage and temperature)

| | | MCM76161 0 to +75°C | | MCM76161A 0 to +75°C | | |
|---|---|---|---|---|---|---|
| Characteristic | Symbol | Typ | Max | Typ | Max | Unit |
| Address to Output Access Time | $t_{AA}$ | 45 | 70 | 35 | 60 | ns |
| Chip Enable Access Time | $t_{EA}$ | 30 | 40 | 30 | 40 | ns |

**NOTE: AC limits guaranteed for worst case $N^2$ sequential with maximum test frequency of 5.0 MHz.**



## PROGRAMMING

The PROMs are manufactured with all bits/outputs Logical "1" (Output High). Any desired bit/output can be programmed to a Logical "0" (Output Low) by following the simple procedure shown below. One may build his own programmer to satisfy the specifications described in Table 1, or buy any of the commercially available programmers which meet these specifications. These PROMs can be programmed automatically or by the manual procedure shown below.

## PROGRAMMING PROCEDURE

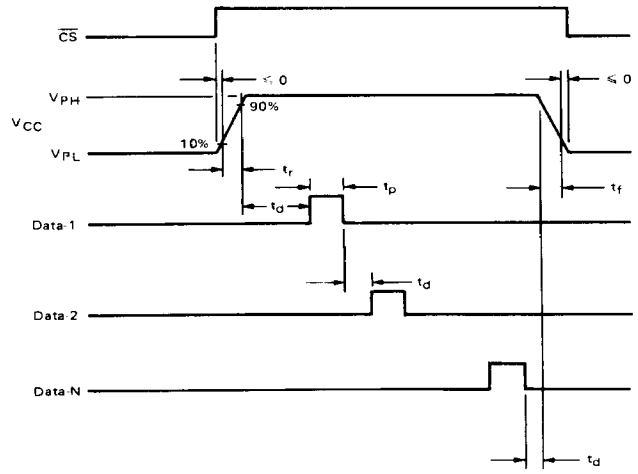
1. Address the PROM with the binary address of the selected word to be programmed. Address inputs are TTL-compatible. An open circuit should not be used to address the PROM.
2. Disable the chip by applying input high ($V_{IH}$) to the $\overline{CS}$ input. $\overline{CS}$ input must remain at $V_{IH}$ for programming. The chip select is TTL-compatible. An open circuit should not be used to disable the chip.
3. Disable the programming circuitry by applying an Output Voltage Disable of less than $V_{OPD}$ to the output of the PROM. The output may be left open to achieve the disable.
4. Raise $V_{CC}$ to $V_{PH}$ with rise time equal to $t_r$.
5. After a delay equal to or greater than $t_d$, apply a pulse with amplitude of $V_{OPE}$ and duration of $t_p$ to the output selected for programming. Note that the PROM is supplied with fuses intact generating an output high. Programming a fuse will cause the output to go low in the verify mode.
6. Other bits in the same word may be programmed while the $V_{CC}$ input is raised to $V_{PH}$ by applying output enable pulses to each output which is to be programmed. The output enable pulses must be separated by a minimum interval of $t_d$.
7. Lower $V_{CC}$ to 4.5 Volts following a delay of $t_d$ from the last programming enable pulse applied to an output.
8. Enable the PROM for verification by applying a logic "0" ($V_{IL}$) to the $\overline{CS}$ input.
9. If any bit does not verify as programmed, repeat Steps 2 through 8 until the bit has received a total of 1.0 ms of programming time. Bits which do not program within 1.0 ms may be considered programming rejects. Multiple pulse of durations shorter than 1.0 ms may be used to enhance programming speed.
10. Repeat Steps 1 through 9 for all other bits to be programmed in the PROM.
11. Programming rejects returned to the factory must be accompanied by data giving address with desired and actual output data of a location in which a programming failure has occured.

**TABLE 1 — PROGRAMMING SPECIFICATIONS**

| Symbol | Parameter | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| $V_{IH}$<br>$V_{IL}$ | Address Input<br>Voltage (1) | 2.4<br>0.0 | 5.0<br>0.4 | 5.0<br>0.8 | V<br>V |
| $V_{PH}$<br>$V_{PL}$ | Programming/Verify<br>Voltage to $V_{CC}$ | 11.75<br>4.5 | 12.0<br>4.5 | 12.25<br>5.5 | V<br>V |
| $I_{CCP}$ | Programming Voltage Current Limit with $V_{PH}$ Applied | 600 | 600 | 650 | mA |
| $t_r$<br>$t_f$ | Voltage Rise and<br>Fall Time | 1.0<br>1.0 | 1.0<br>1.0 | 10<br>10 | μs<br>μs |
| $t_d$ | Programming Delay | 10 | 10 | 100 | μs |
| $t_p$ | Programming Pulse Width | 100 | — | 1000 | μs |
| DC | Programming Duty Cycle | — | 50 | 90 | % |
| $V_{OPE}$<br>$V_{OPD}$ | Output Voltage<br>Enable<br>Disable (2) | 10.0<br>4.5 | 10.5<br>5.0 | 11.0<br>5.5 | V<br>V |
| $I_{OPE}$ | Output Voltage Enable Current | 2.0 | 4.0 | 10 | mA |
| $T_A$ | Ambient Temperature | — | 25 | 75 | °C |

(1) Address and chip select should not be left open for $V_{IH}$.
(2) Disable condition will be met with output open circuit.

**FIGURE 1 — TYPICAL PROGRAMMING WAVEFORMS**



MCM76161/161A BLOCK DIAGRAM