MOTOROLA

MCM7643
MCM7643A

TTL

**4096-BIT PROGRAMMABLE
READ ONLY MEMORIES**

MCM7643,A — 1024 × 4 THREE-STATE

4096-BIT PROGRAMMABLE READ ONLY MEMORY

The MCM7643 and MCM7643A, 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.

All pinouts are compatible to industry-standard PROMs and ROMs.

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

MCM7643DC/ADC
MCM7643PC/APC

```
1 [  A6    VCC ] 18
2 [  A5    A7  ] 17
3 [  A4    A8  ] 16
4 [  A3    A9  ] 15
5 [  A0    O1  ] 14
6 [  A1    O2  ] 13
7 [  A2    O3  ] 12
8 [  CS1   O4  ] 11
9 [  Gnd   CS2 ] 10
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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 MCM7643xxx	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.)

TTL PROM

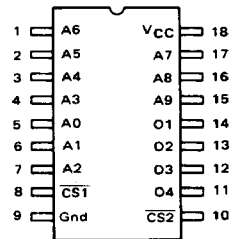## GUARANTEED OPERATING RANGE (T_A = 0°C to +75°C)

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			Unit
				Min	Typ	Max	
I_{IH}	Address/Enable	"1"	V_{IH} = V_{CC} Max	—	—	40	μAdc
I_{IL}	Input Current	"0"	V_{IL} = 0.45 V	—	-0.1	-0.25	mAdc
V_{OH}	Output Voltage	"1"	I_{OH} = -2.0 mA, V_{CC} Min	2.4	3.4	—	Vdc
V_{OL}		"0"	I_{OL} = +16 mA, V_{CC} Min	—	0.35	0.45	Vdc
I_{OHE}	Output Disabled	"1"	V_{OH} = +5.25 V, V_{CC} Max	—	—	40	μAdc
I_{OLE}	Current	"0"	V_{OL} = +0.3 V, V_{CC} Max	—	—	-40	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 One Output Only for 1.0 s Max	-15	—	-70	mAdc
I_{CC}	Power Supply Current		V_{CC} Max All Inputs Grounded	—	100	140	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)

Characteristic	Symbol	MCM7643 0 to +75°C		MCM7643A 0 to +75°C		Unit
		Typ	Max	Typ	Max	
Address to Output Access Time	t_{AA}	50	70	40	50	ns
Chip Enable Access Time	t_{EA}	25	30	25	30	ns

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

TIMING DIAGRAM

AC TEST LOAD
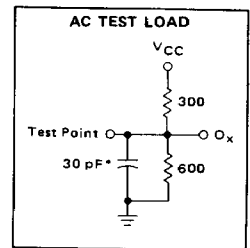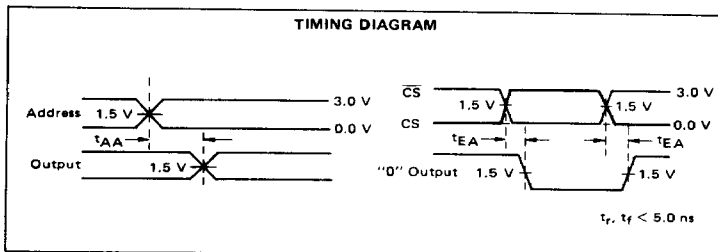
*Includes Scope and Test Fixture Capacitance

MCM7643/MCM7643A

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.
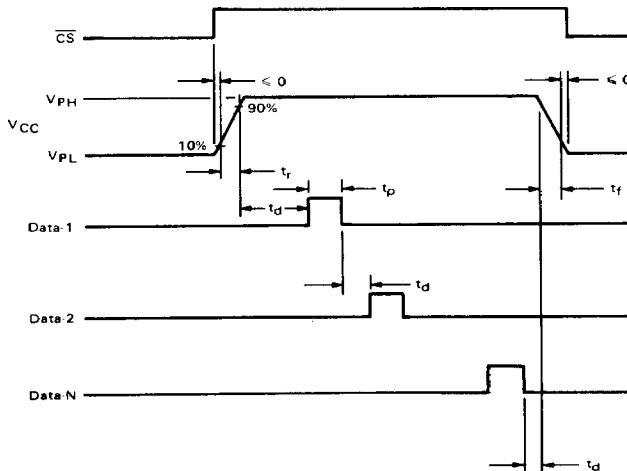6. Other bits in the same word may be programmed while the V_{CC} input is raised to V_{PH} by applying output enable pulses to each output which is to be programmed. The output enable pulses must be separated by a minimum interval of t_d.
7. Lower V_{CC} to 4.5 Volts following a delay of t_d from the 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}	Address Input	2.4	5.0	5.0	V
V_{IL}	Voltage (1)	0.0	0.4	0.8	V
V_{PH}	Programming/Verify	11.75	12.0	12.25	V
V_{PL}	Voltage to V_{CC}	4.5	4.5	5.5	V
I_{CCP}	Programming Voltage Current Limit with V_{PH} Applied	600	600	650	mA
t_r	Voltage Rise and	1.0	1.0	10	μs
t_f	Fall Time	1.0	1.0	10	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}	Output Voltage Enable	10.0	10.5	11.0	V
V_{OPD}	Disable (2)	4.5	5.0	5.5	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

TTL PROM

MCM7643/43A BLOCK DIAGRAM

(16) A8
(17) A7
(1) A6
(2) A5
(3) A4
(4) A3

6 Column Address Buffers

1 of 64 Column Decode

64

4096-Bit Memory Array (64 × 64)

64

64 Transmission Gates

16

(15) A9
(7) A2
(6) A1
(5) A0

4 Row Address Buffers

1 of 16 Row Decode

1 of 16 Decode | 1 of 16 Decode | 1 of 16 Decode | 1 of 16 Decode

(8) $\overline{CS1}$
(10) $\overline{CS2}$

Chip Select Buffer

V_{CC} = Pin 18
Gnd = Pin 9

Output Buffers

(14) O1
(13) O2
(12) O3
(11) O4