



MM54C89/MM74C89 64-Bit TRI-STATE® Random Access Read/Write Memory

General Description

The MM54C89/MM74C89 is a 16-word by 4-bit random access read/write memory. Inputs to the memory consist of four address lines, four data input lines, a write enable line and a memory enable line. The four binary address inputs are decoded internally to select each of the 16 possible word locations. An internal address register, latches the address information on the positive to negative transition of the memory enable input. The four TRI-STATE® data output lines working in conjunction with the memory enable input provides for easy memory expansion.

Address Operation: Address inputs must be stable t_{SA} prior to the positive to negative transition of memory enable. It is thus not necessary to hold address information stable for more than t_{HA} after the memory is enabled (positive to negative transition of memory enable).

Note: The timing is different that the DM7489 in that a positive to negative transition of the memory enable must occur for the memory to be selected.

Write Operation: Information present at the data inputs is written into the memory at the selected address by bringing write enable and memory enable low.

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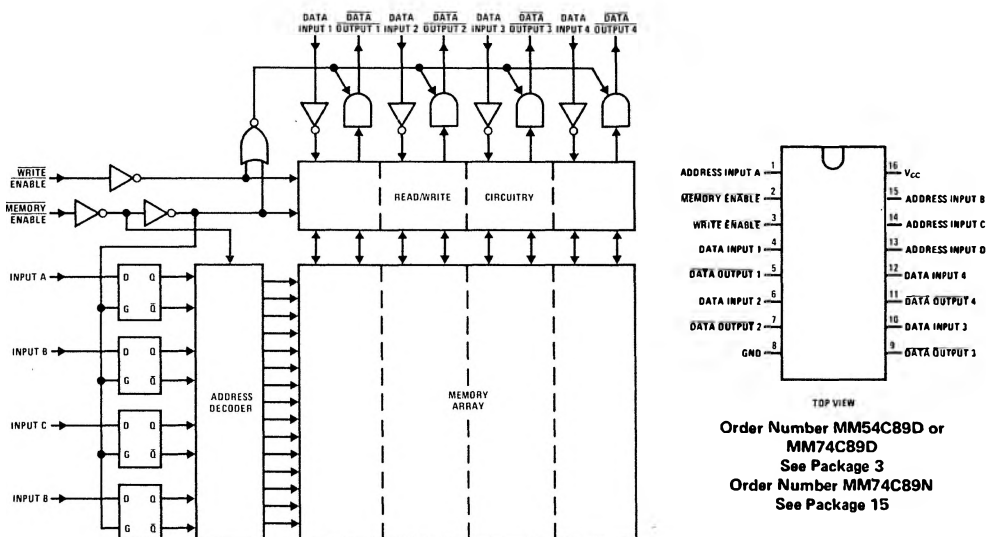
Read Operation: The complement of the information which was written into the memory is non-destructively read out at the four outputs. This is accomplished by selecting the desired address and bringing memory enable low and write enable high.

When the device is writing or disabled the output assumes a TRI-STATE (Hi-Z) condition.

Features

- Wide supply voltage range 3.0V to 15V
- Guaranteed noise margin 1.0V
- High noise immunity 0.45 V_{CC} (typ.)
- Low power fan out of 2 driving 74L
- Low power consumption 100nW/package (typ.)
- Fast access time 130ns (typ.) at $V_{CC} = 10V$
- TRI-STATE output

Logic and Connection Diagrams



Absolute Maximum Ratings (Note 1)

Voltage at Any Pin	- 0.3V to $V_{CC} + 0.3V$	Package Dissipation	500 mW
Operating Temperature Range		Operating V_{CC} Range	3.0V to 15V
MM54C89	-55°C to +125°C	Absolute Maximum V_{CC}	18V
MM74C89	-40°C to +85°C	Lead Temperature (Soldering, 10 seconds)	300°C
Storage Temperature Range	-65°C to +150°C		

DC Electrical Characteristics Min/max limits apply across temperature range, unless otherwise noted.

Parameter		Conditions	Min.	Typ.	Max.	Units
CMOS to CMOS						
$V_{IN(1)}$	Logical "1" Input Voltage	$V_{CC} = 5.0V$ $V_{CC} = 10V$	3.5 8.0			V
$V_{IN(0)}$	Logical "0" Input Voltage	$V_{CC} = 5.0V$ $V_{CC} = 10V$			1.5 2.0	V
$V_{OUT(1)}$	Logical "1" Output Voltage	$V_{CC} = 5.0V, I_O = -10\mu A$ $V_{CC} = 10V, I_O = -10\mu A$	4.5 9.0			V
$V_{OUT(0)}$	Logical "0" Output Voltage	$V_{CC} = 5.0V, I_O = +10\mu A$ $V_{CC} = 10V, I_O = +10\mu A$			0.5 1.0	V
$I_{IN(1)}$	Logical "1" Input Current	$V_{CC} = 15V, V_{IN} = 15V$		-0.005	1.0	μA
$I_{IN(0)}$	Logical "0" Input Current	$V_{CC} = 15V, V_{IN} = 0V$	-1.0	-0.005		μA
	Output Current in High Impedance State	$V_{CC} = 15V, V = 15V$ $V_{CC} = 15V, V_O = 0V$		0.005 -0.005	1.0	μA
I_{CC}	Supply Current	$V_{CC} = 15V$	-1.0		300	μA
CMOS/LPTTL Interface						
$V_{IN(1)}$	Logical "1" Input Voltage	54C, $V_{CC} = 4.5V$ 74C, $V_{CC} = 4.75V$	$V_{CC} - 1.5$ $V_{CC} - 1.5$			V
$V_{IN(0)}$	Logical "0" Input Voltage	54C, $V_{CC} = 4.5V$ 74C, $V_{CC} = 4.75V$			0.8 0.8	V
$V_{OUT(1)}$	Logical "1" Output Voltage	54C, $V_{CC} = 4.5V, I_O = -360\mu A$ 74C, $V_{CC} = 4.75V, I_O = -360\mu A$	2.4 2.4			V
$V_{OUT(0)}$	Logical "0" Output Voltage	54C, $V_{CC} = 4.5V, I_O = +360\mu A$ 74C, $V_{CC} = 4.75V, I_O = +360\mu A$			0.4 0.4	V
Output Drive (See 54C/74C Family Characteristics Data Sheet) (short circuit current)						
I_{SOURCE}	Output Source Current (P-Channel)	$V_{CC} = 5.0V, V_{OUT} = 0V$ $T_A = 25^\circ C$	-1.75	-3.3		mA
I_{SOURCE}	Output Source Current (P-Channel)	$V_{CC} = 10V, V_{OUT} = 0V$ $T_A = 25^\circ C$	-8.0	-15		mA
I_{SINK}	Output Sink Current (N-Channel)	$V_{CC} = 5.0V, V_{OUT} = V_{CC}$ $T_A = 25^\circ C$	1.75	3.6		mA
I_{SINK}	Output Sink Current (N-Channel)	$V_{CC} = 10V, V_{OUT} = V_{CC}$ $T_A = 25^\circ C$	8.0	16		mA

AC Electrical Characteristics $T_A = 25^\circ C$, $C_L = 50pF$, unless otherwise noted.

Parameter		Conditions	Min.	Typ.	Max.	Units
t_{pd}	Propagation Delay from Memory Enable	$V_{CC} = 5.0V$ $V_{CC} = 10V$		270 100	500 220	ns
t_{ACC}	Access Time from Address Input	$V_{CC} = 5.0V$ $V_{CC} = 10V$		350 130	650 280	ns
t_{SA}	Address Setup Time	$V_{CC} = 5.0V$ $V_{CC} = 10V$	150 60			ns
t_{HA}	Address Hold Time	$V_{CC} = 5.0V$ $V_{CC} = 10V$	60 40			ns
t_{ME}	Memory Enable Pulse Width	$V_{CC} = 5.0V$ $V_{CC} = 10V$	400 150	250 90		ns
t_{ME}	Memory Enable Pulse Width	$V_{CC} = 5.0V$ $V_{CC} = 10V$	400 150	200 70		ns

AC Electrical Characteristics (Cont'd.)

Parameter		Conditions	Min.	Typ.	Max.	Units
t _{SR}	Write Enable Setup Time for a Read	V _{CC} = 5.0V	0			ns
		V _{CC} = 10V	0			ns
t _{WS}	Write Enable Setup Time for a Write	V _{CC} = 5.0V			t _{ME}	ns
		V _{CC} = 10V			t _{ME}	ns
t _{WE}	Write Enable Pulse Width	V _{CC} = 5.0V, t _{WS} = 0	300	160		ns
		V _{CC} = 10V, t _{WS} = 0	100	60		ns
t _{HD}	Data Input Hold Time	V _{CC} = 5.0V	50			ns
		V _{CC} = 10V	25			ns
t _{SD}	Data Input Setup	V _{CC} = 5.0V	50			ns
		V _{CC} = 10V	25			ns
t _{IH} , t _{OH}	Propagation Delay from a Logical "1" or Logical "0" to the High Impedance State from Memory Enable	V _{CC} = 5.0V, C _L = 5.0 pF, R _L = 10 k		180	300	ns
		V _{CC} = 10V, C _L = 5.0 pF, R _L = 10 k		-85	120	ns
t _{IH} , t _{OH}	Propagation Delay from a Logical "1" or Logical "0" to the High Impedance State from Write Enable	V _{CC} = 5.0V, C _L = 5.0 pF, R _L = 10 k		180	300	ns
		V _{CC} = 10V, C _L = 5.0 pF, R _L = 10 k		85	120	ns
C _{IN}	Input Capacity	Any Input (Note 2)		5.0		pF
C _{OUT}	Output Capacity	Any Output (Note 2)		6.5		pF
C _{PD}	Power Dissipation Capacity	(Note 3)		230		pF

Note 1: "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. Except for "Operating Range" they are not meant to imply that the devices should be operated at these limits. The table of "Electrical Characteristics" provides conditions for actual device operation.

Note 2: Capacitance is guaranteed by periodic testing.

Note 3: C_{PD} determines the no load AC power consumption of any CMOS device. For complete explanation see 54C/74C Family Characteristics application note, AN-90.

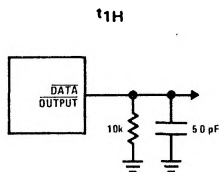
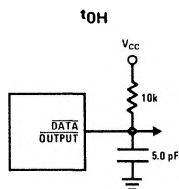
AC Electrical Characteristics (Guaranteed across the specified temperature range, C_L = 50 pF) (cont'd)

Parameter	Conditions	MM54C89 T _A = 55°C to +125°C		MM74C89 T _A = -45°C to +85°C		Units
		Min.	Max.	Min.	Max.	
t _{PD}	V _{CC} = 5.0V		700		600	ns
	V _{CC} = 10V		310		265	ns
	V _{CC} = 15V		250		210	ns
t _{ACC}	V _{CC} = 5.0V		910		780	ns
	V _{CC} = 10V		400		345	ns
	V _{CC} = 15V		320		270	ns
t _{SA}	V _{CC} = 5.0V	210		180		ns
	V _{CC} = 10V	90		80		ns
	V _{CC} = 15V	70		60		ns
t _{HA}	V _{CC} = 5.0V	80		70		ns
	V _{CC} = 10V	55		50		ns
	V _{CC} = 15V	45		40		ns
t _{ME}	V _{CC} = 5.0V	560		480		ns
	V _{CC} = 10V	210		180		ns
	V _{CC} = 15V	170		150		ns
t _{ME}	V _{CC} = 5.0V	560		480		ns
	V _{CC} = 10V	210		180		ns
	V _{CC} = 15V	170		150		ns
t _{WE}	V _{CC} = 5.0V	420		360		ns
	V _{CC} = 10V	140		120		ns
	V _{CC} = 15V	110		100		ns
t _{HD}	V _{CC} = 5.0V	70		60		ns
	V _{CC} = 10V	35		30		ns
	V _{CC} = 15V	30		25		ns
t _{SA}	V _{CC} = 5.0V	70		60		ns
	V _{CC} = 10V	35		30		ns
	V _{CC} = 15V	30		25		ns
t _{IH} , t _{OH}	V _{CC} = 5.0V		420		360	ns
	V _{CC} = 10V, C _L = 5.0 pF		170		145	ns
	V _{CC} = 15V, R _L = 10 kΩ		135		115	ns

Truth Table

ME	WE	OPERATION	CONDITION OF OUTPUTS
L	L	Write	TRI-STATE®
L	H	Read	Complement of Selected Word
H	L	Inhibit, Storage	TRI-STATE®
H	H	Inhibit, Storage	TRI-STATE®

AC Test Circuit



Switching Time Waveforms

