National Semiconductor

MM2708, MM2708-1 8192-Bit (1024 x 8) UV Erasable PROMs

General Description

The MM2708, MM2708-1 are high speed 8192 UV erasable and electrically reprogrammable EPROMs ideally suited for applications where fast turn-around and pattern experimentation are important requirements.

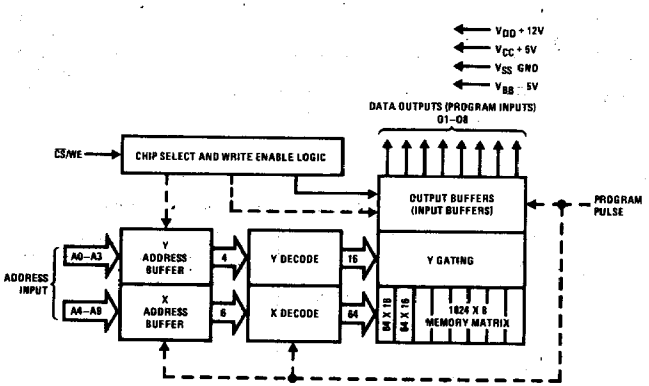
The MM2708, MM2708-1 are packaged in a 24-pin dual-in-line package with transparent lid. The transparent lid allows the user to expose the chip to ultraviolet light to erase the bit pattern. A new pattern can then be written into the devices by following the programming procedure.

These EPROMs are fabricated with the reliable, high volume, time proven, N-channel silicon gate technology.

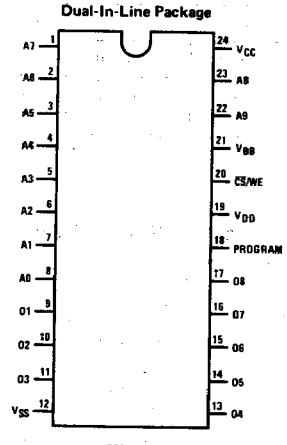
Features

- 1024 x 8 organization
- 800 mW max
- Low power during programming
- Access time – MM2708, 450 ns; MM2708-1, 350 ns
- Standard power supplies: 12V, 5V, −5V
- Static—no clocks required
- Inputs and outputs TTL compatible during both read and program modes
- TRI-STATE® output

Block and Connection Diagrams



Dual-In-Line Package



TOP VIEW

Order Number MM2708Q or MM2708Q-1
See NS Package J24CQ

Pin Connection During Read or Program

MODE	PIN NUMBER						
	9–11, 13–17	12	18	19	20	21	24
Read	D_{OUT}	V_{SS}	V_{SS}	V_{DD}	V_{IL}	V_{BB}	V_{CC}
Program	D_{IN}	V_{SS}	Pulsed V_{IHP}	V_{DD}	V_{IHW}	V_{BB}	V_{CC}

Pin Description

A0–A9	Address inputs
O1–O8	Data outputs
$\overline{CS}$/WE	Chip select/write enable input

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Absolute Maximum Ratings (Note 1)

Temperature Under Bias	−25°C to +85°C
Storage Temperature	−65°C to +125°C
V_{DD} with Respect to V_{BB}	20V to −0.3V
V_{CC} and V_{SS} with Respect to V_{BB}	15V to −0.3V
All Input or Output Voltages with Respect to V_{BB} During Read	15V to −0.3V
$\overline{CS}$/WE Input with Respect to V_{BB} During Programming	20V to −0.3V
Program Input with Respect to V_{BB}	35V to −0.3V
Power Dissipation	1.5 W
Lead Temperature (Soldering, 10 seconds)	300°C

Read Operation

DC Operating Characteristics

T_A = 0°C to +70°C, V_{CC} = 5V ±5%, V_{DD} = 12V ±5%, V_{BB} = −5V ±5%, V_{SS} = 0V, unless otherwise noted, (Note 3)

SYMBOL	PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
I_{LI}	Address and Chip Select Input Sink Current	V_{IN} = 5.25V or V_{IN} = V_{IL}		1	10	μA
I_{LO}	Output Leakage Current	V_{OUT} = 5.25V, $\overline{CS}$/WE = 5V		1	10	μA
I_{DD}	V_{DD} Supply Current	Worst-Case Supply Currents, All Inputs High, $\overline{CS}$/WE = 5V, T_A = 0°C		44	65	mA
I_{CC}	V_{CC} Supply Current	Worst-Case Supply Currents, All Inputs High, $\overline{CS}$/WE = 5V, T_A = 0°C		7	10	mA
I_{BB}	V_{BB} Supply Current	Worst-Case Supply Currents, All Inputs High, $\overline{CS}$/WE = 5V, T_A = 0°C		34	45	mA
V_{IL}	Input Low Voltage		V_{SS}		0.65	V
V_{IH}	Input High Voltage		3.0		V_{CC}+1	V
V_{OH1}	Output High Voltage	I_{OH} = −100 μA	3.7			V
V_{OH2}	Output High Voltage	I_{OH} = −1 mA	2.4			V
V_{OL}	Output Low Votlage	I_{OL} = 1.6 mA			0.45	V
P_D	Power Dissipation				800	mW

AC Electrical Characteristics

T_A = 0°C to +70°C, V_{CC} = 5V ±5%, V_{DD} = 12V ±5%, V_{BB} = −5V ±5%, V_{SS} = 0V, unless otherwise noted

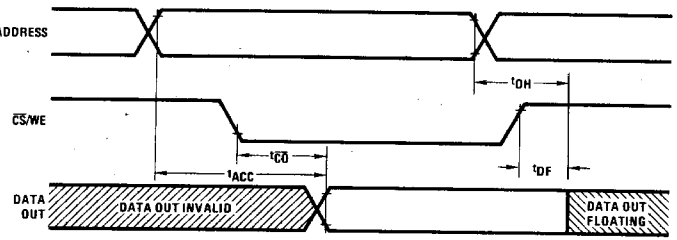
SYMBOL	PARAMETER	CONDITIONS	MM2708		MM2708-1		UNITS
			MIN	MAX	MIN	MAX	
t_{ACC}	Address to Output Delay	Output Load: 1 TTL Gate and C_L = 100 pF, Input Rise and Fall Times ≤ 20 ns: Timing Measurement Reference Levels: 0.8V and 2.8V for Inputs; 0.8V and 2.4V for Outputs, Input Pulse Levels: 0.65V to 3V		450		350	ns
t_{CO}	Chip Select to Output Delay			120		120	ns
t_{DF}	Chip Deselect to Output Delay		0	120		120	ns
t_{OH}	Address to Output Hold		0		0		ns
CAPACITANCE (Note 2)							
C_{IN}	Input Capacitance	V_{IN} = 0V, T_A = 25°C, f = 1 MHz		6		6	pF
C_{OUT}	Output Capacitance	V_{OUT} = 0V, T_A = 25°C, f = 1 MHz		12		12	pF

Note 1: "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. Except for "Operating Temperature 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. T_A = 25°C, f = 1 MHz

Note 3: Typical conditions are for operation at: T_A = 25°C, V_{CC} = 5V, V_{DD} = 12V, V_{BB} = −5V, and V_{SS} = 0V.

Switching Time Waveforms



Programming Instructions

Initially, and after each erasure, all bits of the MM2708, MM2708-1 are in the "1" state (output high). Information is introduced by selectively programming "0" into the desired bit locations. A programmed "0" can only be changed to a "1" by UV erasure.

The circuit is set up for programming operation by raising the $\overline{CE}$/WE input (pin 20) to +12V. The word address is selected in the same manner as in the read mode. Data to be programmed are presented, 8 bits in parallel, to the data output lines (O1–O8). Logic levels for address and data lines and the supply voltages are the same as for the read mode. After address and data set up, one program pulse per address is applied to the program input (pin 18). One pass through all addresses is defined as a program loop. The number of loops (N) required is a function of the program pulse width (t_{PW}) according to N x $t_{PW} \geq 100$ ms.

The width of the program pulse is from 0.1 to 1 ms. The number of loops (N) is from a minimum of 100 (t_{PW} = 1 ms) to greater than 1000 (t_{PW} = 0.1 ms). There must be N successive loops through all 1024 addresses. *It is not permitted to apply N program pulses to an address and then change to the next address to be programmed.* Caution should be observed regarding the end of a program sequence. The $\overline{CS}$/WE falling edge transition must occur before the first address transition when changing from a program to a read cycle. The program pin should also be pulled down to V_{ILP} with an active instead of a passive device. This pin will source a small amount of current (I_{IPL}) when $\overline{CS}$/WE is at V_{IHW} (12V) and the program pulse is at V_{ILP}.

Programming Characteristics

T_A = 25°C, V_{CC} = 5V ±5%, V_{DD} = 12V ±5%, V_{BB} = −5V ±5%, V_{SS} = 0V, unless otherwise noted

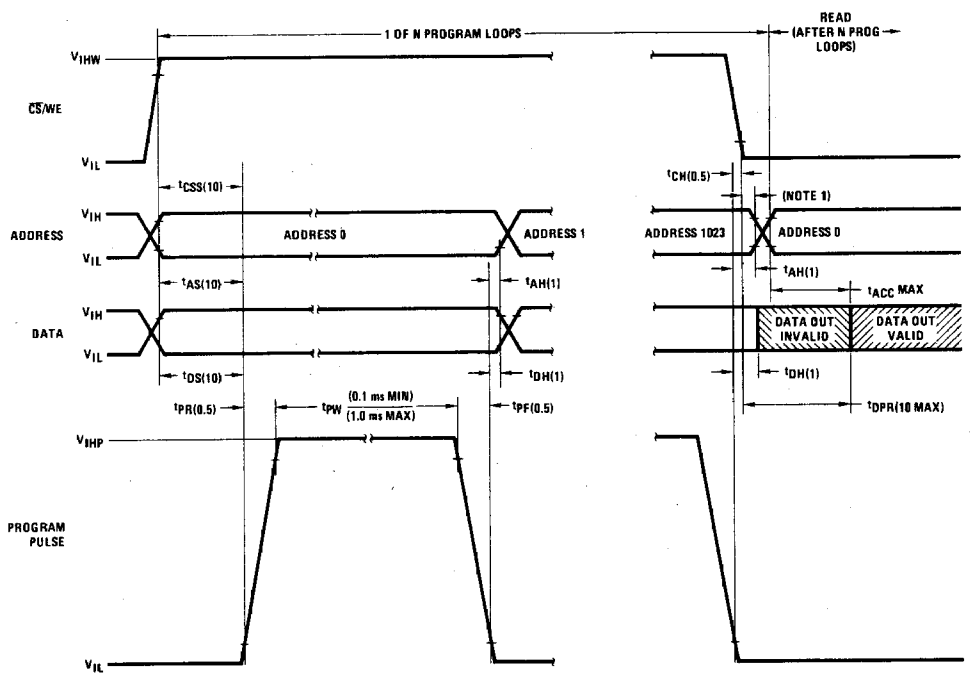
DC Programming Characteristics

SYMBOL	PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
I_{LI}	Address and $\overline{CS}$/WE Input Sink Current	V_{IN} = 5.25V			10	μA
I_{IPL}	Program Pulse Source Current				3	mA
I_{IPH}	Program Pulse Sink Current				20	mA
I_{DD}	V_{DD} Supply Current	Worst-Case Supply Currents, All Inputs High, $\overline{CS}$/WE = 5V, T_A = 0°C		44	65	mA
I_{CC}	V_{CC} Supply Current	Worst-Case Supply Currents, All Inputs High, $\overline{CS}$/WE = 5V, T_A = 0°C		7	10	mA
I_{BB}	V_{BB} Supply Current	Worst-Case Supply Currents, All Inputs High, $\overline{CS}$/WE = 5V, T_A = 0°C		34	45	mA
V_{IL}	Input Low Level (Except Program)		V_{SS}		0.65	V
V_{IH}	Input High Level, All Addresses and Data		3.0		V_{CC}+1	V
V_{IHW}	$\overline{CS}$/WE Input High Level	Referenced to V_{SS}	11.4		12.6	V
V_{IHP}	Program Pulse High Level	Referenced to V_{SS}	25		27	V
V_{ILP}	Program Pulse Low Level	$V_{IHP} - V_{ILP}$ = 25V Min	V_{SS}		1	V

AC Programming Characteristics

SYMBOL	PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
t_{AS}	Address Set-Up Time		10			μs
t_{CSS}	$\overline{CS}$/WE Set-Up Time		10			μs
t_{DS}	Data Set-Up Time		10			μs
t_{AH}	Address Hold Time		1			μs
t_{CH}	$\overline{CS}$/WE Hold Time		0.5			μs
t_{DH}	Data Hold Time		1			μs
t_{DF}	Chip Deselect to Output Float Delay		0		120	μs
t_{DPR}	Program to Read Delay				10	μs
t_{PW}	Program Pulse Width		0.1		1.0	ms
t_{PR}	Program Pulse Rise Time		0.5		2.0	μs
t_{PF}	Program Pulse Fall Time		0.5		2.0	μs

Programming Waveforms



Note 1: The $\overline{CS}$/WE transition must occur after the program pulse transition and before the address transition.
Note 2: Numbers in parentheses indicate minimum timing in microseconds unless otherwise specified.

Functional Description

ERASING

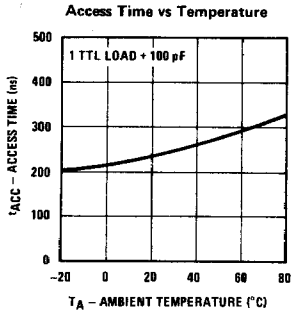
The MM2708 is erased by exposure to high intensity ultraviolet light through the transparent window. This exposure discharges the floating gate to its initial state through induced photo current. It is recommended that the MM2708 be kept out of direct sunlight. The UV content of sunlight may cause a partial erasure of some bits in a relatively short period of time. Direct sunlight can also cause temporary functional failure. Extended exposure to room level fluorescent lighting will also cause erasure. An opaque coating (paint, tape, label, etc.) should be placed over the package window if this product is to be operated under these lighting conditions.

An ultraviolet source of 2537 Å yielding a total integrated dosage of 15 watt-seconds/cm^2 is required. This will erase the part in approximately 15 to 20 minutes if a UV lamp with a 12,000 $\mu W/cm^2$ power rating is used. The MM2708 to be erased should be placed 1 inch away from the lamp and no filters should be used.

An erasure system should be calibrated periodically. The distance from lamp to unit should be maintained at 1 inch. The erasure time is increased by the square of the distance (if the distance is doubled the erasure time goes up by a factor of 4). Lamps lose intensity as they age. When a lamp is changed, the distance is changed, or the lamp is aged, the system should be checked to make certain full erasure is occurring. Incomplete erasure will cause symptoms that can be misleading. Programmers, components and system designs have been erroneously suspected when incomplete erasure was the basic problem.

Typical AC Performance Characteristics

Access Time vs Temperature



Access Time vs Load Capacitance