



MOTOROLA

**MCM68732
MCM68L732**

4096 x 8-BIT UV ERASABLE PROM

The MCM68732/68L732 is a 32,768-bit Erasable and Electrically Reprogrammable PROM designed for system debug usage and similar applications requiring nonvolatile memory that could be reprogrammed periodically, or for replacing 32K ROMs for fast turnaround time. The transparent window on the package allows the memory content to be erased with ultraviolet light.

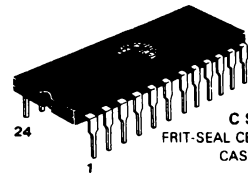
For ease of use, the device operates from a single power supply and has a static power-down mode. Pin-for-pin compatible mask programmable ROMs are available for large volume production runs of systems initially using the MCM68732/68L732.

- Single +5 V Power Supply
- Automatic Power-down Mode (Standby) with Chip Enable
- Organized as 4096 Bytes of 8 Bits
- Low Power Dissipation
- Fully TTL Compatible
- Maximum Access Time = 450 ns MCM68732
350 ns MCM68732-35
- Standard 24-Pin DIP for EPROM Upgradability
- Pin Compatible to MCM68A332 Mask Programmable ROM
- AR Selects the Operational 32K Portion of the Die
MCM68732-1 AR = 1 = HIGH
MCM68732-0 AR = 0 = LOW
- Pin Compatible With the MCM2532 32K EPROM in the Read Mode
- Low Power Version
MCM68L732 Active 60 mA Maximum
Standby 15 mA Maximum
MCM68L732-35 Active 100 mA Maximum
Standby 25 mA Maximum

MOS

(N-CHANNEL, SILICON-GATE)

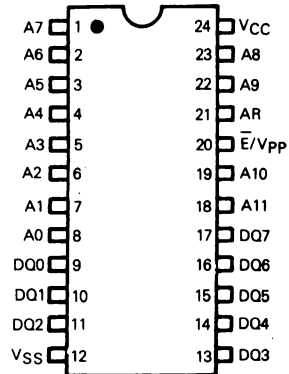
**4096 x 8-BIT
UV ERASABLE PROGRAMMABLE
READ ONLY MEMORY**



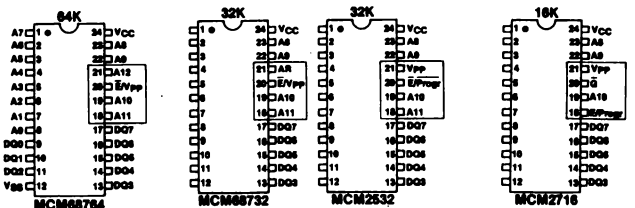
**C SUFFIX
FRIT-SEAL CERAMIC PACKAGE
CASE 623A-02**

**L SUFFIX SIDEBRAZE CERAMIC PACKAGE
ALSO AVAILABLE — CASE 718**

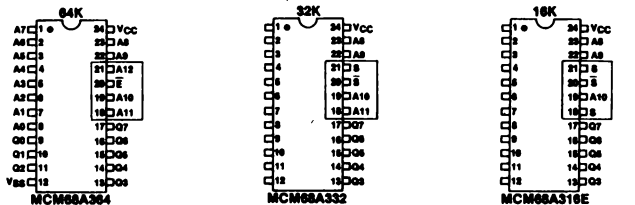
PIN ASSIGNMENT



MOTOROLA'S PIN-COMPATIBLE EPROM FAMILY



MOTOROLA'S PIN-COMPATIBLE ROM FAMILY



INDUSTRY STANDARD PINOUTS

***Pin Names**

- A Address
- AR Address Reference
- DQ Data Input/Output
- E/Vpp Chip Enable/Program

*New industry standard nomenclature

MCM68732•MCM68L732

ABSOLUTE MAXIMUM RATINGS (1)

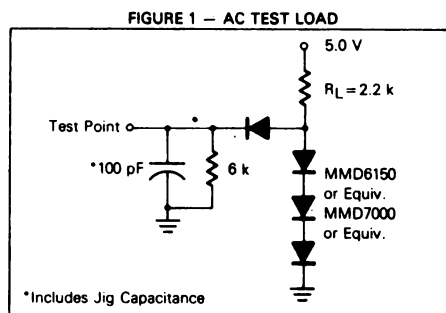
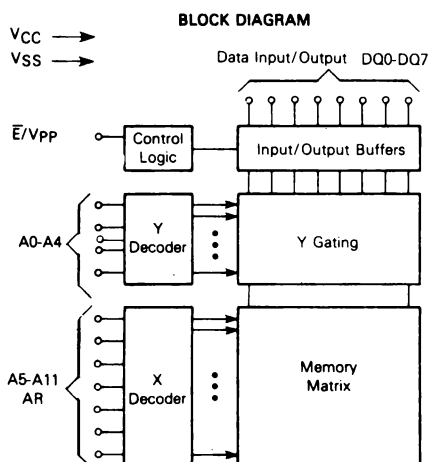
Rating	Value	Unit
Temperature Under Bias	- 10 to + 80	°C
Operating Temperature Range	0 to + 70	°C
Storage Temperature	- 65 to + 125	°C
All Input or Output Voltages with Respect to V _{SS}	+ 6 to - 0.3	Vdc
V _{PP} Supply Voltage with Respect to V _{SS}	+ 28 to - 0.3	Vdc

This device contains circuitry to protect the inputs against damage due to high static voltages or electric fields; however, it is advised that normal precautions be taken to avoid application of any voltage higher than maximum rated voltages to this high-impedance circuit.

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.

MODE SELECTION

Mode	Pin Number			
	9-11, 13-17, DQ	12 V _{SS}	20 \bar{E}/V_{PP}	24 V _{CC}
Read	Data out	V _{SS}	V _{IL}	V _{CC}
Output Disable	High Z	V _{SS}	V _{IH}	V _{CC}
Standby	High Z	V _{SS}	V _{IH}	V _{CC}
Program	Data in	V _{SS}	Pulsed V _{ILP} to V _{IHP}	V _{CC}



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

Characteristic	Symbol	Typ	Max	Unit
Input Capacitance (V _{in} = 0 V) Except \bar{E}/V_{PP}	C _{in}	4.0	6.0	pF
Input Capacitance \bar{E}/V_{PP}	C _{in}	60	100	pF
Output Capacitance (V _{out} = 0 V)	C _{out}	8.0	12	pF

Capacitance measured with a Boonton Meter or effective capacitance calculated from the equation: C = IΔt/ΔV.

MCM68732•MCM68L732

DC OPERATING CONDITIONS AND CHARACTERISTICS

(Full operating voltage and temperature range unless otherwise noted)

RECOMMENDED DC OPERATING CONDITIONS

Parameter	Symbol	Min	Nom	Max	Unit
Supply Voltage MCM68L732/MCM68732 MCM68L732-35/MCM68732-35	V_{CC}	4.75 4.5	5.0	5.25 5.5	V
Input High Voltage	V_{IH}	2.0	—	$V_{CC} + 1.0$	V
Input Low Voltage	V_{IL}	-0.1	—	0.8	V

RECOMMENDED DC OPERATING CHARACTERISTICS

Characteristic	Condition	Symbol	MCM68732			MCM68L732			Units
			Min	Typ	Max	Min	Typ	Max	
Address Input Sink Current	$V_{in} = 5.25$ V	I_{in}	—	—	10	—	—	10	μ A
Output Leakage Current	$V_{out} = 5.25$ V	I_{LO}	—	—	10	—	—	10	μ A
\bar{E}/V_{pp} Input Sink Current	$\bar{E}/V_{pp} = 0.4$	I_{EL}	—	—	100	—	—	100	μ A
	$\bar{E}/V_{pp} = 2.4$	$I_{EH} = I_{PL}$	—	—	400	—	—	400	μ A
V_{CC} Supply Current (Standby) MCM68732	$\bar{E}/V_{pp} = V_{IH}$	I_{CC1}	—	—	25	—	—	15	mA
V_{CC} Supply Current (Standby) MCM68732-35	$\bar{E}/V_{pp} = V_{IH}$	I_{CC1}	—	—	25	—	—	25	mA
V_{CC} Supply Current (Active) MCM68732 (Outputs Open)	$\bar{E}/V_{pp} = V_{IL}$	I_{CC2}	—	—	120	—	—	60	mA
V_{CC} Supply Current (Active) MCM68732-35 (Outputs Open)	$\bar{E}/V_{pp} = V_{IL}$	I_{CC2}	—	—	160	—	—	100	mA
Output Low Voltage	$I_{OL} = 2.1$ mA	V_{OL}	—	—	0.45	—	—	0.45	V
Output High Voltage	$I_{OH} = -400$ μ A	V_{OH}	2.4	—	—	2.4	—	—	V

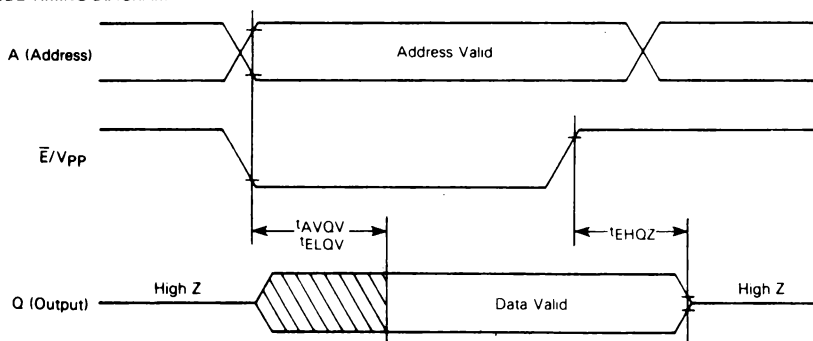
AC OPERATING CONDITIONS AND CHARACTERISTICS

(Full operating voltage and temperature range unless otherwise noted)

Input Pulse Levels 0.8 Volt and 2.2 Volts Output Timing Levels 0.8 Volt and 2 Volts
 Input Rise and Fall Times 20 ns Output Load See Figure 1
 Input Timing Levels 1.0 Volt and 2 Volts

Characteristic	Condition	Symbol	MCM68732-35		MCM68732		Units
			Min	Max	Min	Max	
Address Valid to Output Valid	$\bar{E} = V_{IL}$	t_{AVQV}	—	350	—	450	ns
\bar{E} to Output Valid	—	t_{ELOV}	—	350	—	450	ns
\bar{E} to Hi-Z Output	—	t_{EHQZ}	0	100	0	100	ns
Data Hold from Address	$\bar{E} = V_{IL}$	t_{AXDX}	0	—	0	—	ns

READ MODE TIMING DIAGRAM



DC PROGRAMMING CONDITIONS AND CHARACTERISTICS
($T_A = 25 \pm 5^\circ\text{C}$)

RECOMMENDED PROGRAMMING OPERATING CONDITIONS

Parameter	Symbol	Min	Nom	Max	Unit
Supply Voltage	V_{CC}	4.75	5.0	5.25	V
Input High Voltage for All Addresses and Data	V_{IH}	2.2	—	$V_{CC} + 1$	V
Input Low Voltage for All Addresses and Data	V_{IL}	-0.1	—	0.8	V
Program Pulse Input High Voltage	V_{IHP}	24	25	26	V
Program Pulse Input Low Voltage	V_{ILP}	2.0	V_{CC}	6.0	V

PROGRAMMING OPERATION DC CHARACTERISTICS

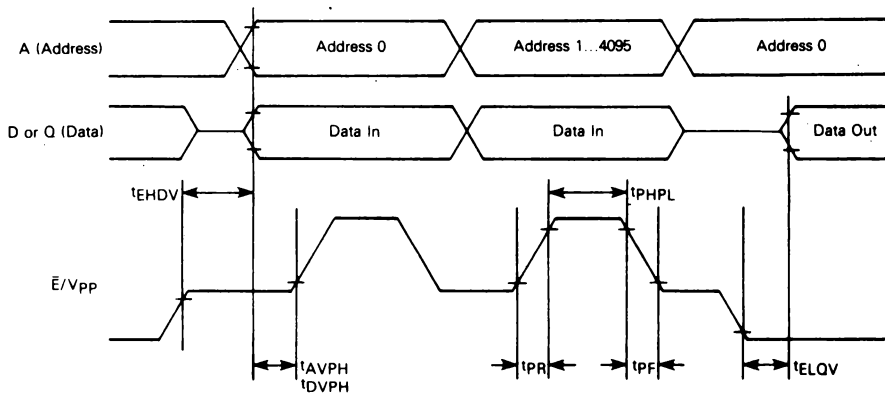
Characteristic	Condition	Symbol	Min	Typ	Max	Unit
Address Input Sink Current	$V_{in} = 5.25\text{ V}$	I_{LI}	—	—	10	μA
V_{pp} Program Pulse Supply Current ($V_{pp} = 25\text{ V} \pm 1\text{ V}$)	—	I_{PH}	—	—	30	mA
V_{pp} Supply Current ($V_{pp} = 2.4\text{ V}$)	—	$I_{PL} = I_{EH}$	—	—	400	μA
V_{CC} Supply Current ($V_{pp} = 5.0\text{ V}$)	—	I_{CC}	—	—	160	mA

AC PROGRAMMING OPERATING CONDITIONS AND CHARACTERISTICS

Characteristic	Symbol	Min	Max	Unit
Address Setup Time	t_{AVPH}	2.0	—	μs
Data Setup Time	t_{DVPH}	2.0	—	μs
Chip Enable to Valid Data	t_{ELQV}	450	—	ns
Chip Disable to Data In	t_{EHDV}	2.0	—	μs
Program Pulse Width	t_{PHPL}	1.9	2.1	ms
Program Pulse Rise Time	t_{PR}	0.5	2.0	μs
Program Pulse Fall Time	t_{PF}	0.5	2.0	μs
Cumulative Programming Time Per Word*	t_{CP}	12	50	ms

*Block mode programming must be used. Block mode programming is defined as one program pulse applied to each of the 4096 address locations in sequence. Multiple blocks are used to accumulate programming time (t_{CP}).

PROGRAMMING OPERATION TIMING DIAGRAM



PROGRAMMING INSTRUCTIONS

After the completion of an ERASE operation, every bit in the device is in the "1" state (represented by Output High). Data are entered by programming zeros (Output Low) into the required bits. The words are addressed the same way as in the READ operation. A programmed "0" can only be changed to a "1" by ultraviolet light erasure.

To set the memory up for Program Mode, the \bar{E}/V_{pp} input (Pin 20) should be between +2.0 and +6.0 V, which will three-state the outputs and allow data to be setup on the DQ terminals. The V_{CC} voltage is the same as for the Read operation. Only "0's" will be programmed when "0's" and "1's" are entered in the 8-bit data word.

After address and data setup, 25-volt programming pulse (V_{IH} to V_{IHP}) is applied to the E/V_{pp} input. A program pulse is applied to each address location to be programmed. The maximum program pulse width is 2 ms and the maximum program pulse amplitude is 26 V.

Multiple MCM68732s may be programmed in parallel by connecting like inputs and applying the program pulse to the \bar{E}/V_{pp} inputs. Different data may be programmed into multiple MCM68732s connected in parallel by selectively applying the programming pulse only to the MCM68732s to be programmed.

READ OPERATION

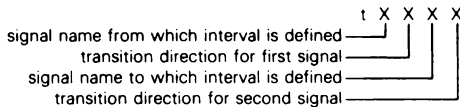
After access time, data is valid at the outputs in the Read mode. A single input (\bar{E}/V_{pp}) enables the outputs and puts the chip in active or standby mode. With $\bar{E}/V_{pp} = "0"$ the outputs are enabled and the chip is in active mode; with $\bar{E}/V_{pp} = "1"$ the outputs are three-stated and the chip is in standby mode. During standby mode, the power dissipation is reduced.

Multiple MCM68732s may share a common data bus with like outputs OR-tied together. In this configuration the E/V_{pp} input should be high on all unselected MCM68732s to prevent data contention.

ERASING INSTRUCTIONS

The MCM68732 can be erased by exposure to high intensity shortwave ultraviolet light, with a wavelength of 2537 angstroms. The recommended integrated dose (i.e., UV-intensity X exposure time) is 15 Ws/cm². As an example, using the "Model 30-000" UV-Eraser (Turner Designs, Mountain View, CA 94043) the ERASE-time is 36 minutes. The lamps should be used without shortwave filters and the MCM68732 should be positioned about one inch away from the UV-tubes.

TIMING PARAMETER ABBREVIATIONS



The transition definitions used in this data sheet are:

- H = transition to high
- L = transition to low
- V = transition to valid
- X = transition to invalid or don't care
- Z = transition to off (high impedance)

TIMING LIMITS

The table of timing values shows either a minimum or a maximum limit for each parameter. Input requirements are specified from the external system point of view. Thus, address setup time is shown as a minimum since the system must supply at least that much time (even though most devices do not require it). On the other hand, responses from the memory are specified from the device point of view. Thus, the access time is shown as a maximum since the device never provides data later than that time.

WAVEFORMS

Waveform Symbol	Input	Output
	Must Be Valid	Will Be Valid
	Change From H to L	Will Change From H to L
	Change From L to H	Will Change From L to H
	Don't Care: Any Change Permitted	Changing: State Unknown
		High Impedance