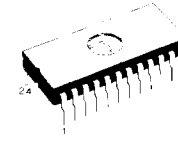
M2716

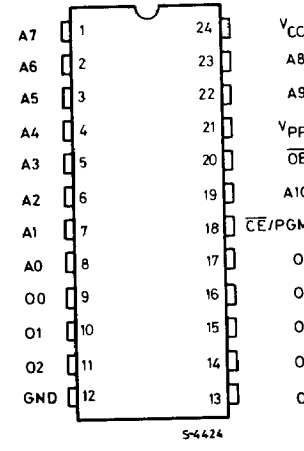
16K (2K x 8) UV ERASABLE PROM

- FAST ACCESS TIME:
  350ns MAX M2716-1
  450ns MAX M2716
- SINGLE +5V POWER SUPPLY
- LOW POWER DISSIPATION:
  525 mW MAX. ACTIVE POWER
  132 mW MAX. STANDBY POWER
- SIMPLE PROGRAMMING REQUIREMENTS
  — SINGLE LOCATION PROGRAMMING
  — PROGRAMS WITH ONE 50 ms PULSE
- INPUTS AND OUTPUTS TTL COMPATIBLE DURING READ PROGRAM
- COMPLETELY STATIC
- EXTENDED TEMPERATURE RANGE



F
Ceramic Package
ORDERING NUMBERS: M2716F1
M2716-1F1
M2716F6
M2716-1F6

PIN CONNECTIONS



PIN NAMES

A0-A10	ADDRESSES
$\overline{CE}$/PGM	CHIP ENABLE/PROGRAM
$\overline{OE}$	OUTPUT ENABLE
O0-O7	OUTPUTS

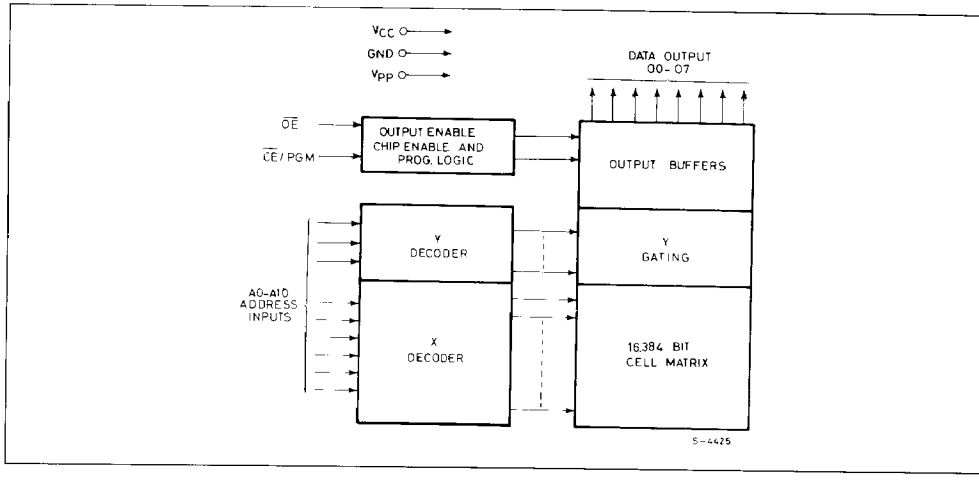
DESCRIPTION

The M2716 is a 16,384-bit ultraviolet erasable and electrically programmable read-only memory (EPROM). The M2716 operates from a single −5V power supply, has a static standby mode, and features fast single address location programming. It makes designing with EPROMs faster, easier and more economical. The M2716, with its single 5-volt supply and with an access time up to 350ns, is ideal for use with the newer high performance +5V microprocessor such as the Z8®, Z80® and Z8000™. The M2716P is also the first EPROM with a static standby mode which reduces the power dissipation without increasing access time. The maximum active power dissipation is 525 mW while the maximum standby power dissipation is only 132 mW, a 75% savings.

The M2716 has the simplest and fastest method yet devised for programming EPROMs — single pulse TTL level programming. No need for high voltage pulsing because all programming controls are handled by TTL signals. Program any location at any time-either individually, sequentially or at random, with the M2716's single address location programming. Total programming time for all 16,384 bits is only 100 seconds:

The M2716 is available in 24-lead dual in-line ceramic package glass lens (frit-seal)

BLOCK DIAGRAM



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V_I	All Input or Output voltages with respect to ground	+ 6 to − 0.3	V
V_{PP}	Supply voltage with respect to ground during program	+26.5 to − 0.3	V
T_{amb}	Ambient temperature under bias: standard extended	0 to + 70 −40 to + 85	°C
T_{stg}	Storage temperature range	−65 to +125	°C

Stresses above those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

OPERATING MODES

MODE \ PINS	$\overline{CE}$/PGM (18)	$\overline{OE}$ (20)	V_{PP} (21)	V_{CC} (24)	OUTPUTS (9-11, 13-17)
READ	V_{IL}	V_{IL}	+ 5	+5	D_{OUT}
STANDBY	V_{IH}	Don't Care	+ 5	+5	HIGH Z
PROGRAM	Pulse V_{IL} to V_{IH}	V_{IH}	+25	+5	D_{IN}
PROGRAM VERIFY	V_{IL}	V_{IL}	+25	+5	D_{OUT}
PROGRAM INHIBIT	V_{IL}	V_{IH}	+25	+5	HIGH Z

Note: The five modes of operation of the M2716P are listed in this table. It should be noted that all inputs for the five modes are at TTL levels. The power supplies required are a +5V V_{CC} and a V_{PP} power supply must be at 25V during the three programming modes, and must be at 5V in the other two modes.

READ OPERATION

DC AND AC OPERATING CONDITIONS

	M2716F1	M2716-1F1	M2716F6	M2716-1F6
Operating Temperature Range	0 to 70°C	0 to 70°C	−40 to 85°C	−40 to 85°C
V_{CC} Power Supply (1,2)	5V ±5%	5V ±10%	5V ±5%	5V ±10%
V_{PP} Power Supply (2)	V_{CC} ±0.6	V_{CC} ±0.6	V_{CC} ±0.6	V_{CC} ±0.6

DC AND OPERATING CHARACTERISTICS

Symbol	Parameter	Test Conditions	Values			Unit
			Min.	Typ. (3)	Max.	
I_{LI}	Input Load Current	$V_I = 5.25V$			10	μA
I_{LO}	Output Leakage Current	$V_O = 5.25V$			10	μA
I_{PP1}(2)	$V_{PP} = 5.25V$				5	mA
I_{CC1}(2)	V_{CC} Supply Current (Standby)	$\overline{CE} = V_{IH}$ $\overline{OE} = V_{IL}$		10	25	mA
I_{CC2}(2)	V_{CC} Supply Current (Active)	$\overline{OE} = \overline{CE} = V_{IL}$		57	100	mA
V_{IL}	Input Low Voltage		−0.1		0.8	V
V_{IH}	Input High Voltage		2.0		V_{CC} + 1	V
V_{OL}	Output Low Voltage	$I_{OL} = 2.1$ mA			0.45	V
V_{OH}	Output High Voltage	$I_{OH} = -400$ μA	2.4			V

AC CHARACTERISTICS

Symbol	Parameter	Test Conditions	M2716		M2716-1		Unit
			Min	Max	Min	Max	
t_{ACC}	Address to Output Delay	$\overline{CE} = \overline{OE} = V_{IL}$		450		350	ns
t_{CE}	$\overline{CE}$ to Output Delay	$\overline{OE} = V_{IL}$		450		350	ns
t_{OE}	$\overline{OE}$ to Output Delay	$\overline{CE} = V_{IL}$		120		120	ns
t_{DF}(4)	$\overline{OE}$ High to Output Float	$\overline{CE} = V_{IL}$	0	100	0	100	ns
t_{OH}	Output Hold from Address $\overline{CE}$ or $\overline{OE}$ Whichever Occurred First	$\overline{CE} = \overline{OE} = V_{IL}$	0		0		ns

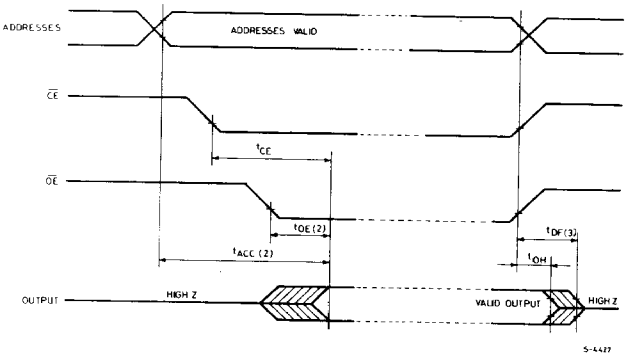
CAPACITANCE(4) (T_{amb} = 25°C, f = 1 MHz)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
C_{IN}	Input Capacitance	$V_I = 0V$		4	6	pF
C_{OUT}	Output Capacitance	$V_O = 0V$		8	12	pF

Notes:
1. V_{CC} must be applied simultaneously or before V_{PP} and removed simultaneously or after V_{PP}.
2. V_{PP} may be connected directly to V_{CC} except during programming. The supply current would then be the sum of I_{CC} and I_{PP1}.
3. Typical values are for T_{amb} = 25°C and nominal supply voltages.
4. This parameter is only sampled and not 100% tested.

AC TEST CONDITIONS
Output Load: 100pF + 1TTL Gate
Input Rise and Fall Times: ≤ = 20ns
Input Pulse Levels: 0.8 to 2.2V
Timing Measurement Reference Levels: Inputs 1 and 2V
Outputs 0.8 and 2V

AC WAVEFORMS



Notes:
1. V_{CC} must be applied simultaneously or before V_{PP} and removed simultaneously or after V_{PP}.
2. $\overline{OE}$ may be delayed up to $t_{ACC} - t_{OE}$ after the falling edge $\overline{CE}$ without impact on t_{ACC}.
3. t_{DF} is specified from $\overline{OE}$ or $\overline{CE}$ whichever occurs first.

READ MODE

The M2716 has two control functions, both of which must be logically satisfied in order to obtain data at the outputs. Chip Enable ($\overline{CE}$) is the power control and should be used for device selection. Output Enable ($\overline{OE}$) is the output control and should be used to gate data to the output pins, independent of device selection. Assuming that addresses are stable, address access time (t_{ACC}) is equal to the delay from $\overline{CE}$ to output (t_{CE}). Data is available at the outputs 120 ns (t_{OE}) after the falling edge of $\overline{OE}$, assuming that $\overline{CE}$ has been low and addresses have been stable for at least t_{ACC}-t_{OE}.

STANDBY MODE

The M2716 has a standby mode which reduces the active power dissipation by 75%, from 525mW to 132mW. The M2716 is placed in the standby mode by applying a TTL high signal to $\overline{CE}$ input. When in standby mode, the output are in a high impedance state, independent of the $\overline{OE}$ input.

OUTPUT OR-TIEING

Because M2716's are usually used in larger memory arrays, the product has 2 line control function that accommodates this use of multiple memory connection. The two line control function allows for:

a) the lowest possible memory power dissipation

b) complete assurance that output bus contention will not ouccur.

To most efficiently use these two control lines, it is recommended that $\overline{CE}$ be decoded and used as the primary device selecting function, while $\overline{OE}$ (pin 20) be made a common connection to all devices in the array and connected to the READ line from the system control bus. This assures that all deselected memory devices are in their low power standby mode and the output pins are only active when data is desired from a particular memory device.

PROGRAMMING OPERATION (1) (T_{amb} = 25°C ±5%, V_{CC}(2) = 5V ±5%, V_{PP}(2,3) = 25V ±1V)

DC AND OPERATING CHARACTERISTIC:

Symbol	Parameter	Test Conditions	Values			Unit
			Min.	Typ.	Max.	
I_{LI}	Input Current (for Any Input)	V_I = 5.25V/0.45			10	µA
V_{IL}	Input Low Level		−0.1		0.8	V
V_{IH}	Input High Level		2.0		V_{CC} + 1	V
I_{CC}	V_{CC} Supply Current				100	mA
I_{PP1}	V_{PP} Supply Current	$\overline{CE}$/PGM = V_{IL}			5	mA
I_{PP2}	V_{PP} Supply Current During Programming Pulse	$\overline{CE}$/PGM = V_{IH}			30	mA

AC CHARACTERISTICS

Symbol	Parameter	Test Conditions	Values			Unit
			Min.	Typ.	Max.	
t_{AS}	Address Setup Time		2			µs
t_{OES}	$\overline{OE}$ Setup Time		2			µs
t_{DS}	Data Setup Time		2			µs
t_{AH}	Address Hold Time		2			µs
t_{OEH}	$\overline{OE}$ Hold Time		2			µs
t_{DH}	Data Hold Time		2			µs
t_{DF}	Output Enable to Output Float Delay	$\overline{OE}$/PGM = V_{IL}	0		120	ns
t_{OE}	Output Enable to Output Delay	$\overline{CE}$/PGM = V_{IL}			120	ns
t_{PW}	Program Pulse Width		45	50	55	ms
t_{PRT}	Program Pulse Rise Time		5			ns
t_{PFT}	Program Pulse Fall Time		5			ns

CAUTION: The V_{CC} and V_{PP} supplied must be sequenced on and off such that V_{CC} is applied simultaneosly or before V_{PP} and removed simultaneosly or after V_{PP} to prevent damage to the M2716. The maximum allowable voltage during programming which may be applied to the V_{PP} with respect to ground is +26V. Care must be taken when switching the V_{PP} supply to prevent overshoot exceeding the 26-volt maximum specification. For convenience in programming, the M2716 may be verified with the V_{PP} supply at 25V ±1V. During normal read operation, however, V_{PP} must be at V_{CC}.

Notes:
1. SGS guarantees the product only if it is programmed to specifications described herein.
2. V_{CC} must be applied simultaneously or before V_{PP} and removed simultaneously or after V_{PP}. The M2716 must not be inserted into or removed from a board with V_{PP} at 25 ± 1V to prevent damage to the device.
3. The maximum allowable voltage which may be applied to the V_{PP} pin during programming is + 26V. Care must be taken when switching the V_{PP} supply to prevent overshoot exceeding this 26V maximum specification.

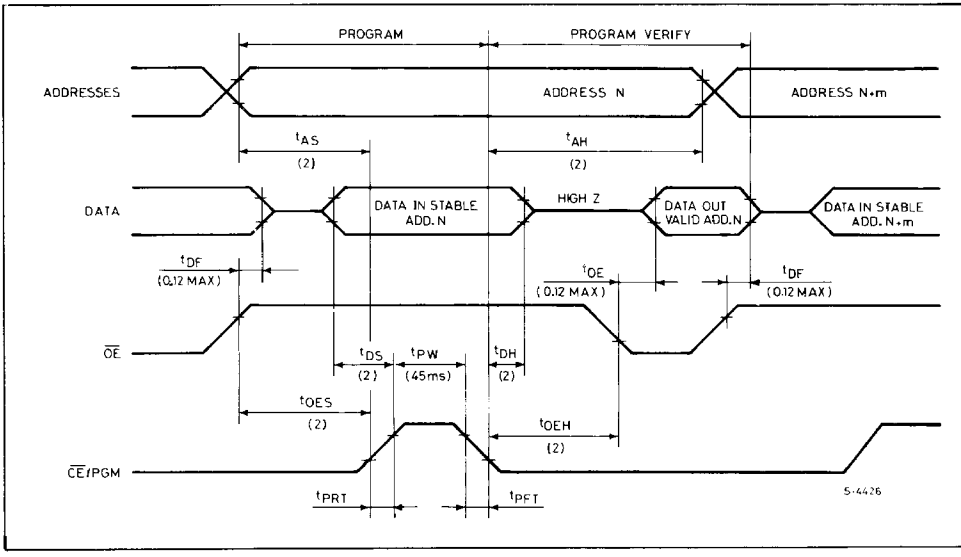
AC TEST CONDITIONS

$V_{CC} = 5V \pm 5\%$
$V_{PP} = 25V \pm 1V$
Input Rise and Fall Times (10% to 90%) = 20 ns

Input Pulse Levels = 0.8V to 2.2V
Input Timing Reference Level = 1V and 2V
Output Timing Reference Level = 0.8V and 2

PROGRAMMING WAVEFORMS

($V_{PP} = 25V \pm 1V$, $V_{CC} = 5V \pm 5\%$)



Note: All times shown in parentheses are minimum times and are μsec unless otherwise noted.

PROGRAMMING

Initially, and after each erasure, all bits of the M2716 are in the "1" state. Data is introduced by selectively programming "0's" into the desired bit locations. Although only "0's" will be programmed, both "1's" and "0's" can be presented in the data word. The only way to change a "0" to a "1" is by ultraviolet light erasure. The M2716 is in the programming mode when the V_{PP} power supply is at 25V and $\overline{OE}$ is at V_{IH}. The data to be programmed is applied 8 bits in parallel to the data output pins. The levels required for the address and data inputs are TTL. When the address and data are stable, a 50 msec, active high, TTL program pulse is applied to the $\overline{CE}$/PGM input. A program pulse must be applied at each address location to be programmed. You can program any location at any time — either individually, sequentially, or at random. The program pulse has a maximum width of 55 msec. The M2716 must not be programmed v a DC signal applied to the $\overline{CE}$/PGM input. Programming of multiple M2716s in parallel w the same data can be easily accomplished due the simplicity of the programming requiremer Like inputs of the paralleled M2716s may be c nected together when they are programmed w the same data. A high level TTL pulse applied the $\overline{CE}$/PGM input-programs the parallel M271

PROGRAM INHIBIT

Programming of multiple M2716s in parallel w different data is also easily accomplished. Exc for $\overline{CE}$/PGM, all like inputs (including $\overline{OE}$) of parallel M2716s may be common. A TTL level p gram pulse applied to a M2716's $\overline{CE}$/PGM in with V_{PP} at 25V will program that M2716. A level $\overline{CE}$/PGM input inhibits the other M2716 fr beign programmed.

PROGRAM VERIFY
A verify should be performed on the programmed bits to determine that they were correctly programmed. The verify may be performed with V_{PP} at 25V. Except during programming and program verify, V_{PP} must be at 5V.

ERASURE OPERATION

The erasure characteristics of the M2716 are such that erasure begins to occur when exposed to light with wavelengths shorter than approximately 4000 Angstroms (A). It should be noted that sunlight and certain types of fluorescent lamps have wavelengths in the 3000-4000 A range. Data show that constant exposure to room level fluorescent lighting could erase the typical M2716 in approximately 3 years, while it would take approximately 1 week to cause erasure when exposed to direct sunlight. If the M2716 is to be exposed to these types of lighting conditions for extended periods of time, it is suggested to put opaque labels over the M2716 window to prevent unintentional erasure.

The recommended erasure procedure for the M2716 is exposure to shortware ultraviolet light which has a wavelength of 2537 Angstroms (A). The integrated dose (i.e. UV intensity X exposure time) for erasure should be a minimum of 15 W-sec/cm^2. The erasure time with this dosage is approximately 15 to 20 minutes using an ultraviolet lamp with a 12000 μ W/cm^2 power rating. The M2716 should be placed within 2.5 cm of the lamp tubes during erasure. Some lamps have a filter on their tubes which should be removed before erasure.