

MM2716E 16,384-Bit (2048 x 8) UV Erasable PROM Extended Temperature Range

General Description

The MM2716E is a high speed 16k UV erasable and electrically reprogrammable EPROM ideally suited for applications where fast turn-around and pattern experimentation are important requirements.

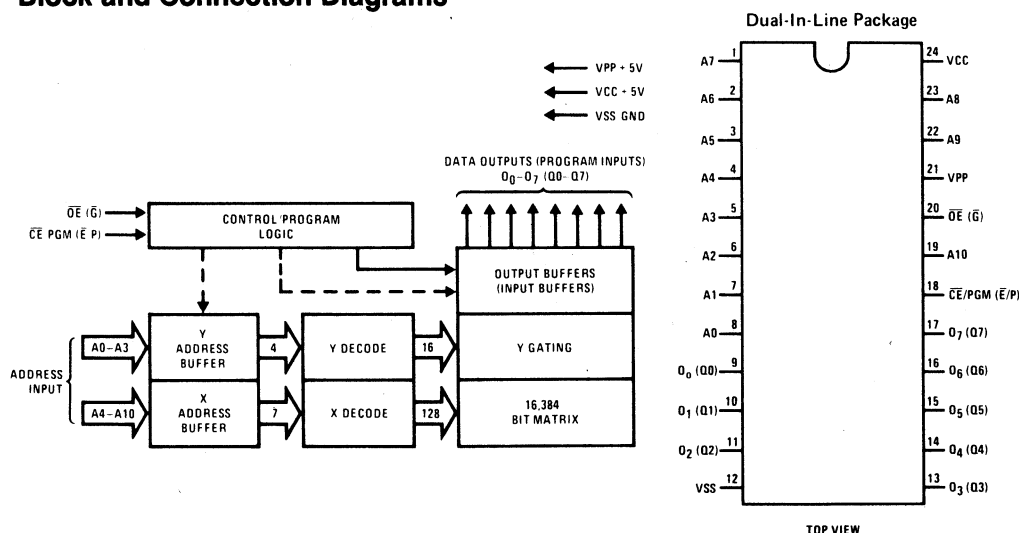
The MM2716E is packaged in a 24-pin dual-in-line package with transparent lid. The transparent lid allows the user to expose the chip to ultraviolet light to erase the bit pattern. A new pattern can then be written into the device by following the programming procedure.

This EPROM is fabricated with the reliable, high volume, time proven, N-channel silicon gate technology.

Features

- -40°C to $+85^{\circ}\text{C}$
- 2048 x 8 organization
- 550 mW max active power, 137.5 mW max standby power
- Low power during programming
- Access time — 450 ns
- Single 5V $\pm 10\%$ power supply
- Static—no clocks required
- Inputs and outputs TTL compatible during both read and program modes
- TRI-STATE[®] output

Block and Connection Diagrams*



Pin Connection During Read or Program

MODE	PIN NAME/NUMBER				
	CE/PGM (E/P) 18	OE (G) 20	VPP 21	VCC 24	OUTPUTS 9-11, 13-17
Read	VIL	VIL	5	5	DOUT
Program	Pulsed VIL to VIH	VIH	25	5	DIN

*Symbols in parentheses are proposed industry standard

Order Number MM2716QE
See NS Package J24CQ

Pin Names

A0-A10	Address Inputs
O0-O7 (Q0-Q7)	Data Outputs
CE/PGM (E/P)	Chip Enable/Program
OE (G)	Output Enable
VPP	Read 5V, Program 25V
VCC	Power (5V)
VSS	Ground

Absolu

Temperature
Storage Tem
VPP Supply
to VSS

READ

DC Op

$T_A = -40^{\circ}\text{C}$

SYMBOL

ILI
ILO
IPP1
ICC1
ICC2
VIL
VIH
VOH
VOL

AC Ch

$T_A = -40^{\circ}\text{C}$

SYM

ALTERNATI

t_{ACC}
t_{CE}
t_{OE}
t_{DF}
t_{OH}
t_{OD}

Capaci

$T_A = 25^{\circ}\text{C}$

SYMBOL

CI
CO

Note 1: "At
Temperature
provides con

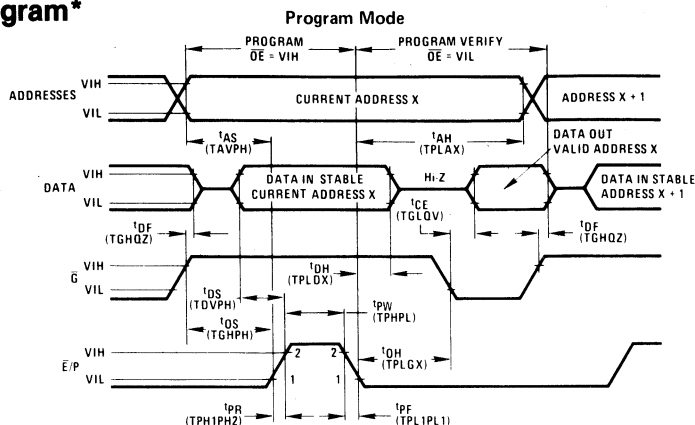
Note 2: Typ

Note 3: VPI
and the progr

Note 4: Outp

Note 5: Caps

Timing Diagram*



Note: VPP = 25V

Functional Description

DEVICE OPERATION

The MM2716E has 3 modes of operation in the normal system environment. These are shown in Table I.

Read Mode

The MM2716E read operation requires that $\overline{OE} = VIL$, $\overline{CE}/PGM = VIL$ and that addresses A0–A10 have been stabilized. Valid data will appear on the output pins after t_{ACC} , t_{OE} , t_{CE} times (see Switching Time Waveforms) depending on which is limiting.

Deselect Mode

The MM2716E is deselected by making $\overline{OE} = VIH$. This mode is independent of \overline{CE}/PGM and the condition of the addresses. The outputs are Hi-Z when $\overline{OE} = VIH$. This allows OR-tying 2 or more MM2716Es for memory expansion.

Standby Mode (Power Down)

The MM2716E may be powered down to the standby mode by making $\overline{CE}/PGM = VIH$. This is independent of \overline{OE} and automatically puts the outputs in their Hi-Z state. The power is reduced to 25% (150 mW max) of the normal operating power. VCC and VPP must be maintained at 5V. Access time at power up remains either t_{ACC} or t_{CE} (see Switching Time Waveforms).

PROGRAMMING

The MM2716E is shipped from National completely erased. All bits will be at a "1" level (output high) in this initial state and after any full erasure. Table II shows the 3 programming modes.

TABLE I. OPERATING MODES (VCC = VPP = 5V)

MODE	PIN NAME/NUMBER		
	\overline{CE}/PGM (\overline{E}/P) 18	\overline{OE} (\overline{G}) 20	OUTPUTS 9–11, 13–17
Read	VIL	VIL	DOUT
Deselect	Don't Care	VIH	Hi-Z
Standby	VIH	Don't Care	Hi-Z

TABLE II. PROGRAMMING MODES (VCC = 5V)

MODE	PIN NAME/NUMBER			
	\overline{CE}/PGM (\overline{E}/P) 18	\overline{OE} (\overline{G}) 20	VPP 21	OUTPUTS Q 9–11, 13–17
Program	Pulsed VIL to VIH	VIH	25	DIN
Program Verify	VIL	VIL	25(5)	DOUT
Program Inhibit	VIL	VIH	25	Hi-Z

*Symbols in parentheses are proposed industry standard

Functional Description (Continued)

Program Mode

The MM2716E is programmed by introducing "0"s into the desired locations. This is done 8 bits (a byte) at a time. Any individual address, a sequence of addresses, or addresses chosen at random may be programmed. Any or all of the 8 bits associated with an address location may be programmed with a single program pulse applied to the chip enable pin. All input voltage levels, including the program pulse on chip-enable are TTL compatible. The programming sequence is:

With $V_{PP} = 25V$, $V_{CC} = 5V$, $\overline{OE} = V_{IH}$ and $\overline{CE}/PGM = V_{IL}$, an address is selected and the desired data word is applied to the output pins. ($V_{IL} = "0"$ and $V_{IH} = "1"$ for both address and data.) After the address and data signals are stable the program pin is pulsed from V_{IL} to V_{IH} with a pulse width between 45 ms and 55 ms.

Multiple pulses are not needed but will not cause device damage. No pins should be left open. A high level (V_{IH} or higher) *must not* be maintained longer than $tpw(MAX)$ on the program pin during programming. MM2716Es may be programmed in parallel with the same data in this mode.

Program Verify Mode

The programming of the MM2716E may be verified either 1 word at a time during the programming (as shown in the timing diagram) or by reading all of the words out at the end of the programming sequence. This can be done with $V_{PP} = 25V$ (or 5V) in either case.

Program Inhibit Mode

The program inhibit mode allows programming several MM2716Es simultaneously with different data for each one by controlling which ones receive the program pulse. All similar inputs of the MM2716E may be paralleled. Pulsing the program pin (from V_{IL} to V_{IH}) will

program a unit while inhibiting the program pulse to a unit will keep it from being programmed and keeping $\overline{OE} = V_{IH}$ will put its outputs in the Hi-Z state.

ERASING

The MM2716E 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 MM2716E 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 (any intense light) can cause temporary functional failure due to generation of photo current. 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/cm² 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 MM2716E 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.

MM2716E

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