

# M5M27C512AK-10

**524288-BIT (65536-WORD BY 8-BIT)  
CMOS ERASABLE AND ELECTRICALLY REPROGRAMMABLE ROM**

## DESCRIPTION

The Mitsubishi M5M27C512AK-10 is a high-speed 524288-bit ultraviolet erasable and electrically reprogrammable read only memory. It is suitable for microprocessor programming applications where rapid turn-around is required. The M5M27C512AK-10 is fabricated by N-channel double polysilicon gate and CMOS technology for peripheral circuits, and is available in a 28-pin DIP with a transparent lid.

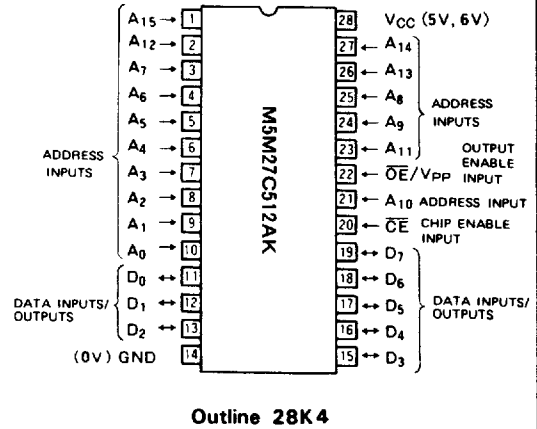
## FEATURES

- 65536 Word x 8 bit organization
- Access time M5M27C512AK-10.....100 ns (max)
- Programming voltage: 12.5V
- Two line control  $\overline{OE}$ ,  $\overline{CE}$
- Lower power current ( $I_{CC}$ ): Active . . . 50 mA (max)  
Stand-by . . . 1 mA (max)
- Single 5V power supply (read operation)
- 3-State output buffer
- Input and output TTL-compatible in read and program mode
- Standard 28-pin DIP
- Fast programming algorithm

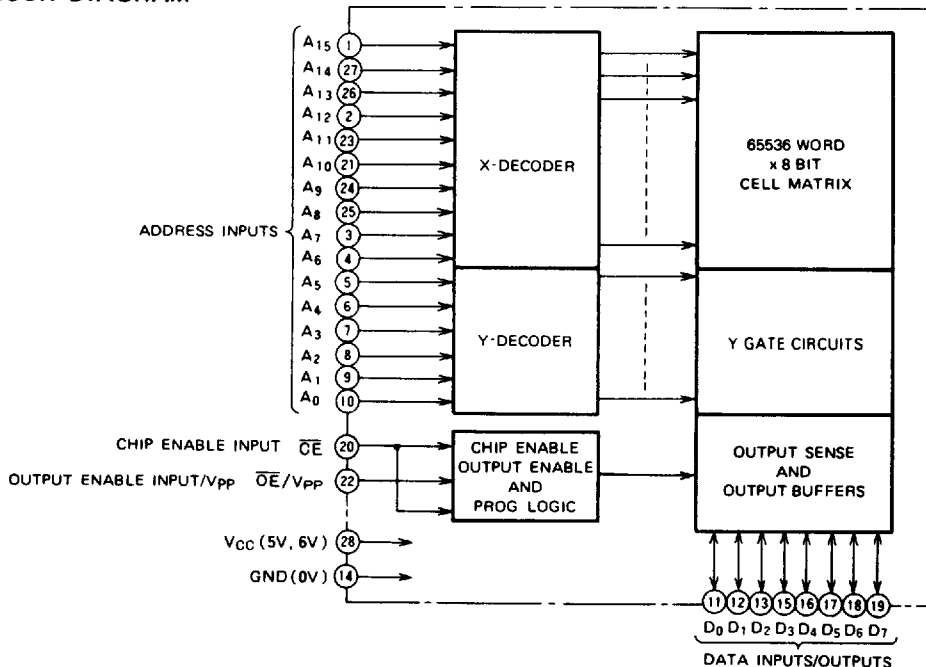
## APPLICATION

Microcomputer systems and peripheral equipment

## PIN CONFIGURATION (TOP VIEW)



## BLOCK DIAGRAM



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### FUNCTION

#### Read

Set the  $\overline{CE}$  and  $\overline{OE}/V_{PP}$  terminals to the read mode (low level). Low level input to  $\overline{CE}$  and  $\overline{OE}/V_{PP}$  and address signals to the address inputs ( $A_0 \sim A_{15}$ ) make the data contents of the designated address location available at the data input/output ( $D_0 \sim D_7$ ). When the  $\overline{CE}$  or  $\overline{OE}/V_{PP}$  signal is high, data input/output are in a floating state.

When the  $\overline{CE}$  signals is high, the device is in the standby mode or power-down mode.

#### Programming

##### (Fast programming algorithm)

First set  $V_{CC} = 6V$ ,  $\overline{OE}/V_{PP} = 12.5V$  and then set an address to first address to be programmed. After applying 1ms program pulse ( $\overline{CE}$ ) to the address, verify is performed. If the output data of that address is not verified correctly, apply one more 1ms program pulse. The programmer continues 1ms pulse-then-verify routines until the device verify correctly or twenty five of these pulse-then-verify routines have been completed. The programmer also maintains its total number of 1ms pulses applied to that address in register X. And then applied a program pulse 3 times of register X value long as an overprogram pulse. When the programming procedure above is finished, step to the next address and repeat this procedure till last address to be programmed.

#### Erase

Erase is effected by exposure to ultraviolet light with a wavelength of  $2537\text{\AA}$  at an intensity of approximately  $15\text{WS}/\text{cm}^2$ . Sunlight and fluorescent light may contain ultraviolet light sufficient to erase the programmed information. For any operation in the read mode, the transparent lid should be covered with opaque tape.

### MODE SELECTION

Mode	Pins	$\overline{CE}$ (20)	$\overline{OE}/V_{PP}$ (22)	$V_{CC}$ (28)	Outputs (11-13, 15-19)
Read		$V_{IL}$	$V_{IL}$	5 V	Data out
Output disable		$V_{IL}$	$V_{IH}$	5 V	Floating
Stand-by		$V_{IH}$	X*	5 V	Floating
Program		$V_{IL}$	12.5V	6 V	Data in
Program inhibit		$V_{IH}$	12.5V	6 V	Floating

\* X can be either  $V_{IL}$  or  $V_{IH}$

### ABSOLUTE MAXIMUM RATINGS (Note 1)

Symbol	Parameter	Rating	Unit
$T_{opr}$	Operating temperature	-10 ~ 80	°C
$T_{stg}$	Storage temperature	-65 ~ 125	°C
$V_{i1}$	All input or output voltage (Note 2)	-0.6 ~ 7.0	V
$V_{i2}$	$\overline{OE}/V_{pp}$ supply voltage (Note 2)	-0.6 ~ 14.0	V
$V_{i3}$	A9 input voltage (Note 2)	-0.6 ~ 13.5	V

Note 1 Stresses above those listed may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or at 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 affects device reliability.

2 With respect to Ground

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### READ OPERATION

#### DC ELECTRICAL CHARACTERISTICS (Ta=0~70°C, VCC=5V±10%, unless otherwise noted)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
I <sub>LI</sub>	Input leakage current	V <sub>IN</sub> = 0 ~ V <sub>CC</sub>			10	μA
I <sub>LO</sub>	Output leakage current	V <sub>OUT</sub> = 0 ~ V <sub>CC</sub>			10	μA
I <sub>SB1</sub>	V <sub>CC</sub> current stand-by	$\overline{CE} = V_{IH}$			1	mA
I <sub>SB2</sub>		$\overline{CE} = V_{CC}$		1	100	μA
I <sub>CC1</sub>	V <sub>CC</sub> current active	$\overline{CE} = \overline{OE}/V_{PP} = V_{IL}$ , DC, I <sub>OUT</sub> = 0mA			50	mA
I <sub>CC2</sub>		$\overline{CE} = V_{IL}$ , f = 10MHz, I <sub>OUT</sub> = 0mA			50	mA
V <sub>IL</sub>	Input low voltage		-0.1		0.8	V
V <sub>IH</sub>	Input high voltage		2.0		V <sub>CC</sub> + 1	V
V <sub>OL</sub>	Output low voltage	I <sub>OL</sub> = 2.1mA			0.45	V
V <sub>OH</sub>	Output high voltage	I <sub>OH</sub> = -400μA	2.4			V

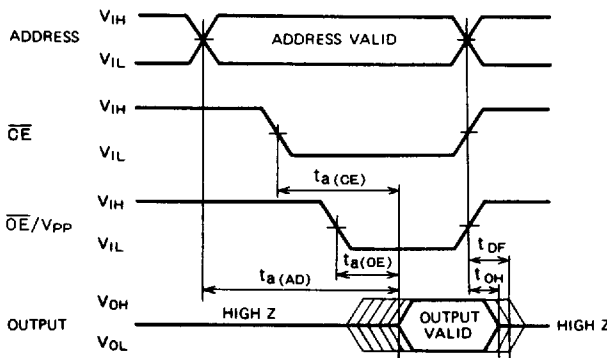
Note 3 Typical values are at Ta = 25°C and nominal supply voltages.

#### AC ELECTRICAL CHARACTERISTICS (Ta=0~70°C, VCC=5V±10%, unless otherwise noted)

Symbol	Parameter	Test conditions	Limits		Unit
			Min	Max	
t <sub>a</sub> (AD)	Address to output delay	$\overline{CE} = \overline{OE}/V_{PP} = V_{IL}$		100	ns
t <sub>a</sub> (CE)	$\overline{CE}$ to output delay	$\overline{OE}/V_{PP} = V_{IL}$		100	ns
t <sub>a</sub> (OE)	$\overline{OE}$ to output delay	$\overline{CE} = V_{IL}$		50	ns
t <sub>DF</sub>	$\overline{OE}$ high to output float	$\overline{CE} = V_{IL}$	0	45	ns
t <sub>OH</sub>	Output hold from $\overline{CE}$ , $\overline{OE}$ or address	$\overline{CE} = \overline{OE}/V_{PP} = V_{IL}$	0		ns

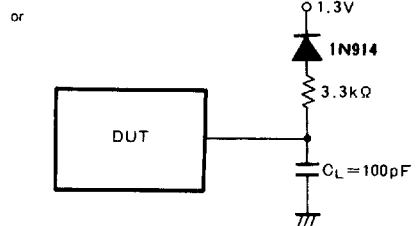
Note 4 V<sub>CC</sub> must be applied simultaneously or before  $\overline{OE}/V_{PP}$  and removed simultaneously or after  $\overline{OE}/V_{PP}$

### AC WAVEFORMS



Test conditions for A C characteristics  
 Input voltage V<sub>IL</sub> = 0.45V, V<sub>IH</sub> = 3.0V  
 Input rise and fall times ≤ 10ns  
 Reference voltage at timing measurement 1.5V

Output load 1TTL gate + C<sub>L</sub> (100pF)



### CAPACITANCE

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
C <sub>IN</sub>	Input capacitance	Ta = 25°C, f = 1MHz, V <sub>I</sub> = V <sub>O</sub> = 0V		4	6	pF
C <sub>OUT</sub>	Output capacitance			8	12	pF
C <sub>OE/VPP</sub>	$\overline{OE}/V_{PP}$ input capacitance			25	30	pF

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**PROGRAM OPERATION**

**FAST PROGRAMMING ALGORITHM**

**DC ELECTRICAL CHARACTERISTICS** ( $T_a = 25 \pm 5^\circ\text{C}$ ,  $V_{CC} = 6\text{V} \pm 0.25\text{V}$ ,  $V_{PP} = 12.5\text{V} \pm 0.3\text{V}$ , unless otherwise noted)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$I_{LI}$	Input leakage current	$V_{IN} = 0 - V_{CC}$			10	$\mu\text{A}$
$V_{OL}$	Output low voltage (verify)	$I_{OL} = 2.1\text{mA}$			0.45	V
$V_{OH}$	Output high voltage (verify)	$I_{OH} = -400\mu\text{A}$	2.4			V
$V_{IL}$	Input low voltage		-0.1		0.8	V
$V_{IH}$	Input high voltage		2.0		$V_{CC}$	V
$I_{CC2}$	$V_{CC}$ supply current				50	mA
$I_{PP2}$	$\overline{OE}/V_{pp}$ supply current	$\overline{CE} = V_{IL}$			50	mA

**AC ELECTRICAL CHARACTERISTICS** ( $T_a = 25 \pm 5^\circ\text{C}$ ,  $V_{CC} = 6\text{V} \pm 0.25\text{V}$ ,  $V_{PP} = 12.5\text{V} \pm 0.3\text{V}$ , unless otherwise noted)

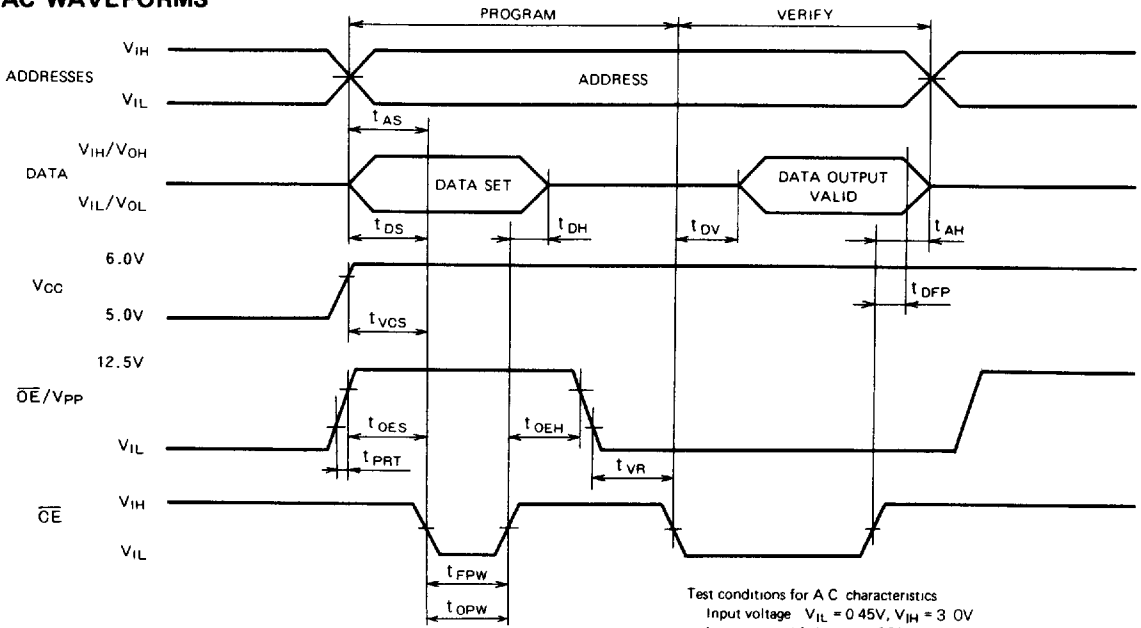
Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$t_{AS}$	Address setup time		2			$\mu\text{s}$
$t_{OES}$	$\overline{OE}/V_{pp}$ setup time		2			$\mu\text{s}$
$t_{OEH}$	$\overline{OE}/V_{pp}$ hold time		2			$\mu\text{s}$
$t_{DS}$	Data setup time		2			$\mu\text{s}$
$t_{AH}$	Address hold time		0			$\mu\text{s}$
$t_{DH}$	Data hold time		2			$\mu\text{s}$
$t_{DFP}$	$\overline{CE}$ to output float delay		0		130	ns
$t_{VCS}$	$V_{CC}$ setup time		2			$\mu\text{s}$
$t_{FPW}$	$\overline{CE}$ initial program pulse width		0.95	1.0	1.05	ms
$t_{OPW}$	$\overline{CE}$ over program pulse width		2.85		78.75	ms
$t_{DV}$	Data valid from $\overline{CE}$				1	$\mu\text{s}$
$t_{VR}$	$\overline{OE}/V_{pp}$ recovery time		2			$\mu\text{s}$
$t_{PRT}$	$\overline{OE}/V_{pp}$ pulse rise time during program		50			ns

Note 5  $V_{CC}$  must be applied simultaneously or before  $\overline{OE}/V_{pp}$  and removed simultaneously or after  $\overline{OE}/V_{pp}$

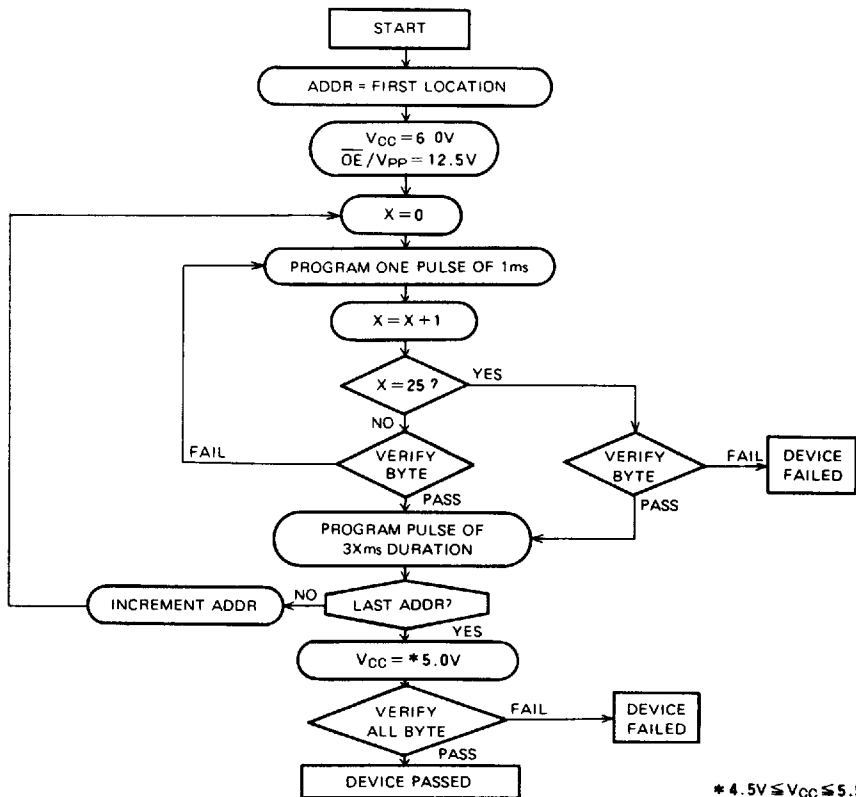
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### FAST PROGRAMMING AC WAVEFORMS



### FAST PROGRAMMING ALGORITHM FLOW CHART



# M5M27C512AK-10

## 524288-BIT(65536-WORD BY 8-BIT) CMOS ERASABLE AND ELECTRICALLY REPROGRAMMABLE ROM

### DEVICE IDENTIFIER MODE

The Device Identifier Mode allows the reading of a binary code from the EPROM that identifies the manufacturer and device type.

The EPROM Programmer reads the manufacturer code and the device code and automatically selects the corresponding programming algorithm.

### M5M27C512AK-10 DEVICE IDENTIFIER CODE

Code	Pin	A <sub>0</sub> (10)	D <sub>7</sub> (19)	D <sub>6</sub> (18)	D <sub>5</sub> (17)	D <sub>4</sub> (16)	D <sub>3</sub> (15)	D <sub>2</sub> (13)	D <sub>1</sub> (12)	D <sub>0</sub> (11)	Hex data
Manufacturer code	V <sub>IH</sub>	0	0	0	0	1	1	1	0	0	1C
Device code	V <sub>IL</sub>	0	0	0	0	0	0	1	1	1	07

Note 6 V<sub>CC</sub> = 5V ± 10%, A<sub>9</sub> = 12 0 ± 0.5V, A<sub>1</sub> ~ A<sub>8</sub>, A<sub>10</sub> ~ A<sub>15</sub>,  $\bar{C}E$ ,  $\bar{O}E$  / V<sub>PP</sub> = V<sub>IL</sub>