

# M5M27C202P,FP,J,VP,RV-12,-15

2097152-BIT(131072-WORD BY 16-BIT)  
CMOS ONE TIME PROGRAMMABLE ROM

## DESCRIPTION

The Mitsubishi M5M27C202P,FP,J,VP,RV are high-speed 2097152-bit one time programmable read only memories. They are suitable for microprocessor programming applications where rapid turn-around is required. The M5M27C202P, FP, J, VP, RV are fabricated by N-channel double polysilicon gate for Memory and CMOS technology for peripheral circuits, and are available in 40 pin (DIP, SOP, TSOP) or 44 pin (PLCC) plastic packages.

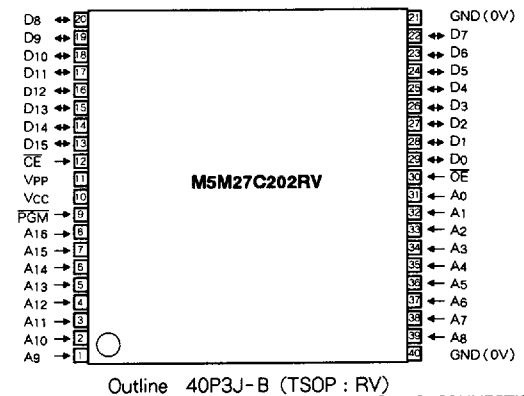
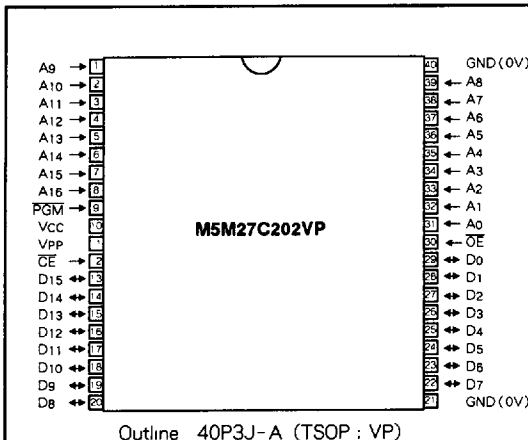
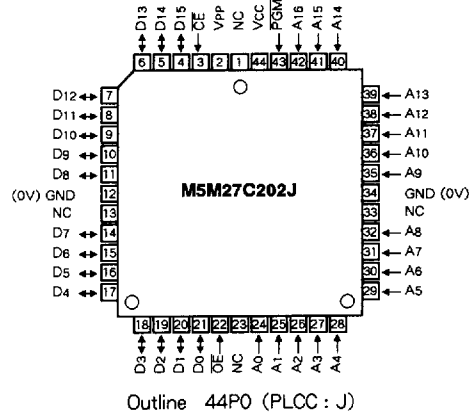
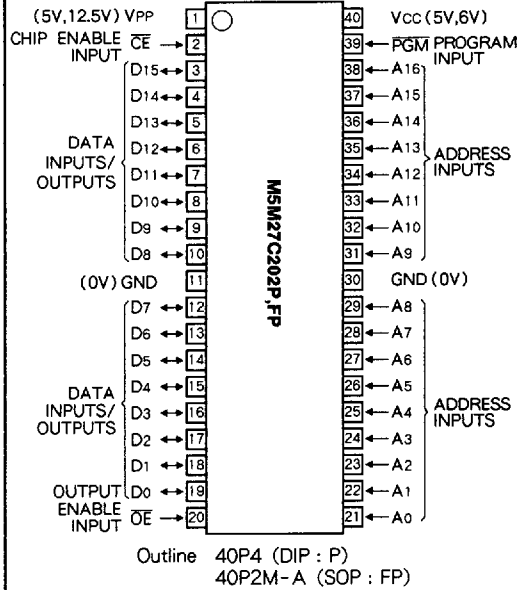
## FEATURES

- 131072 word × 16 bit organization
- Package DIP ..... M5M27C202P  
SOP (525mil) ..... M5M27C202FP  
PLCC ..... M5M27C202J  
TSOP ..... M5M27C202VP  
TSOP (Reverse) ..... M5M27C202RV
- Access time M5M27C202P-12 ..... 120ns (max.)  
M5M27C202P-15 ..... 150ns (max.)
- Programming voltage : 12.5V
- Two line control  $\overline{OE}$ ,  $\overline{CE}$
- Low power current ( $I_{cc}$ ) : Active ..... 30mA (max.)  
( $I_{sby}$ ) : Stand-by ..... 0.1mA (max.)
- Single 5V power supply (read operation)
- 3 State output buffer
- Input and output TTL-compatible in read and program mode
- Word programming algorithm
- Page programming algorithm
- Standard 40 pin DIP, 44 pin PLCC and pin-compatible with 2M EPROM

## APPLICATION

Microcomputer systems and peripheral equipment

## PIN CONFIGURATION (TOP VIEW)

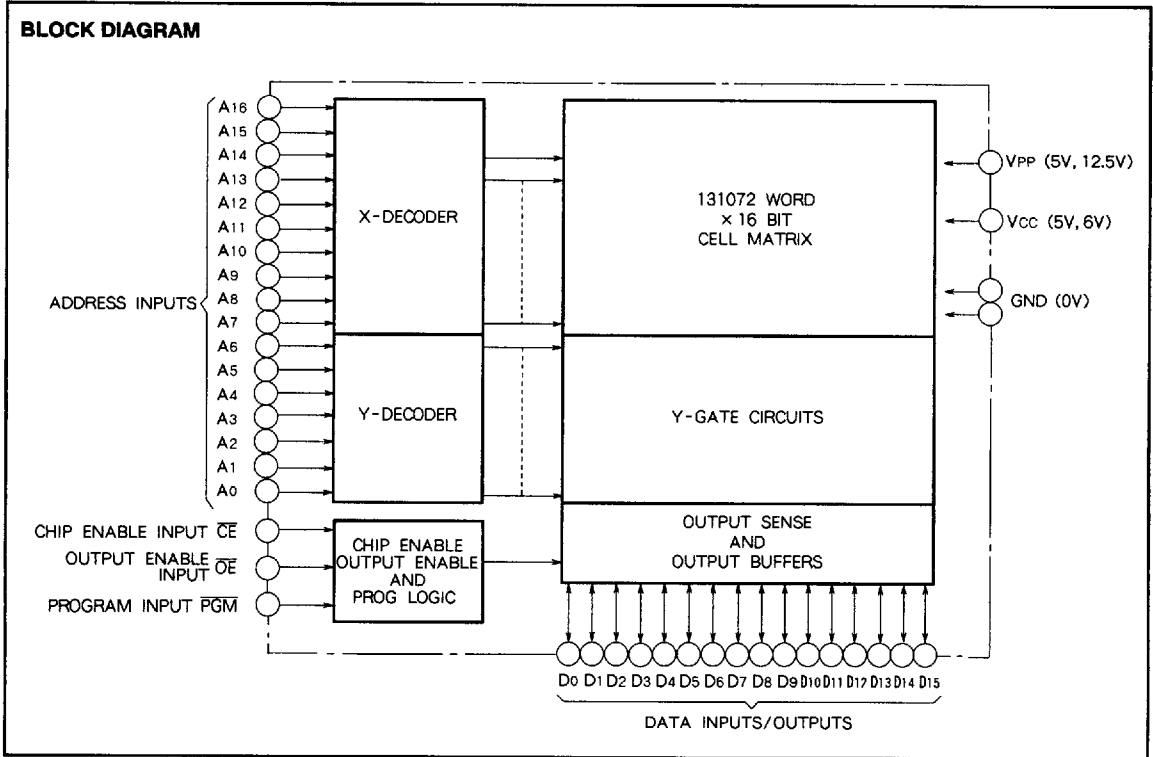


NC : NO CONNECTION

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## BLOCK DIAGRAM



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## FUNCTION

### Read

Set the  $\overline{CE}$  and  $\overline{OE}$  terminals to the read mode (low level). Low level input to  $\overline{CE}$  and  $\overline{OE}$  and address signals to the address inputs ( $A_0 \sim A_{16}$ ) make the data contents of the designated address location available at the data input/output ( $D_0 \sim D_{15}$ ). When the  $\overline{CE}$  or  $\overline{OE}$  signal is high, data input/output are in a floating state.

When the  $\overline{CE}$  signal is high, the device is in the stand by mode or power-down mode.

### Programming

#### (Word programming algorithm)

The M5M27C202P, FP, J, VP, RV enter the word programming mode when 12.5V is supplied to the  $V_{PP}$  power supply input,  $\overline{CE}$  is at low level and  $\overline{OE}$  is at high level. A location is designated by address signals ( $A_0 \sim A_{16}$ ), and the data to be programmed must be applied at 16-bits in parallel to the data inputs ( $D_0 \sim D_{15}$ ). In this state, word programming is completed when  $\overline{PGM}$  is at low level.

#### (Page programming algorithm)

Page programming feature of the M5M27C202P, FP, J, VP, RV allows 2 words of data to be simultaneously programmed. The destination addresses for a page programming operation must reside on the same page; that is,  $A_1$  through  $A_{16}$  must not change. At first, the M5M27C202P, FP, J, VP, RV enter the page data latch mode when  $V_{PP} = 12.5V$ ,  $\overline{CE} = "H"$ ,  $\overline{OE} = "L"$  and  $\overline{PGM} = "H"$ . A first and second locations in same page are designated by address signals ( $A_0 \sim A_{16}$ ), and the data to be programmed must be applied to each location at 16-bits in parallel to the data inputs ( $D_0 \sim D_{15}$ ). In this state, the data (2 words) latch is completed. Then the M5M27C202P, FP, J, VP, RV enter the page programming mode when  $\overline{OE} = "H"$ . In this state, page (2 words) programming is completed when  $\overline{PGM} = "L"$ .

### Erase

The M5M27C202P, FP, J, VP, RV cannot be erased, because they are packaged in plastic without transparent lid.

## MODE SELECTION

Mode	Pins	$\overline{CE}$	$\overline{OE}$	$\overline{PGM}$	$V_{PP}$	$V_{CC}$	Data I/O
Read		$V_{IL}$	$V_{IL}$	X*	5V	5V	Data out
Output disable		$V_{IL}$	$V_{IH}$	X*	5V	5V	Floating
Stand-by (Power down)		$V_{IH}$	X*	X*	5V	5V	Floating
Word program		$V_{IL}$	$V_{IH}$	$V_{IL}$	12.5V	6V	Data in
Program verify		$V_{IL}$	$V_{IL}$	$V_{IH}$	12.5V	6V	Data out
Page data latch		$V_{IH}$	$V_{IL}$	$V_{IH}$	12.5V	6V	Data in
Page program		$V_{IH}$	$V_{IH}$	$V_{IL}$	12.5V	6V	Floating
Program inhibit		$V_{IL}$	$V_{IL}$	$V_{IL}$	12.5V	6V	Floating
		$V_{IL}$	$V_{IH}$	$V_{IH}$	12.5V	6V	
		$V_{IH}$	$V_{IL}$	$V_{IL}$	12.5V	6V	
		$V_{IH}$	$V_{IH}$	$V_{IH}$	12.5V	6V	

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

## ABSOLUTE MAXIMUM RATINGS (Note 1)

Symbol	Parameter	Conditions	Ratings	Unit
$V_{I1}$	All input or output voltage except $V_{PP} \cdot A_9$	With respect to Ground	- 0.6~7	V
$V_{I2}$	$V_{PP}$ supply voltage		- 0.6~14.0	V
$V_{I3}$	$A_9$ supply voltage		- 0.6~13.5	V
$T_{opr}$	Operating temperature		- 10~80	°C
$T_{stg}$	Storage temperature		- 65~150	°C

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 those 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.

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## READ OPERATION

**DC ELECTRICAL CHARACTERISTICS** ( $T_a = 0 \sim 70^\circ\text{C}$ ,  $V_{CC} = 5V \pm 10\%$ ,  $V_{PP} = V_{CC}$ , unless otherwise noted)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
I <sub>LI</sub>	Input leakage current	$V_{IN} = 0 \sim V_{CC}$			10	$\mu\text{A}$
I <sub>LO</sub>	Output leakage current	$V_{OUT} = 0 \sim V_{CC}$			10	$\mu\text{A}$
I <sub>PP1</sub>	$V_{PP}$ current read/stand-by	$V_{PP} = V_{CC} = 5.5V$		1	100	$\mu\text{A}$
I <sub>SB1</sub>	$V_{CC}$ current stand-by	$\overline{CE} = V_{IH}$			1	$\text{mA}$
I <sub>SB2</sub>		$\overline{CE} = V_{CC}$		1	100	$\mu\text{A}$
I <sub>CC1</sub>	$V_{CC}$ current active	$\overline{CE} = \overline{OE} = V_{IL}$ , DC, $I_{OUT} = 0\text{mA}$			30	$\text{mA}$
I <sub>CC2</sub>		$\overline{CE} = V_{IL}$ , $f = 8.3\text{MHz}$ , $I_{OUT} = 0\text{mA}$			30	$\text{mA}$
V <sub>IL</sub>	Input low voltage		-0.1		0.8	V
V <sub>IH</sub>	Input high voltage		2.2		$V_{CC} + 1$	V
V <sub>OL</sub>	Output low voltage	$I_{OL} = 2.1\text{mA}$			0.45	V
V <sub>OH</sub>	Output high voltage	$I_{OH} = -400\mu\text{A}$	2.4			V

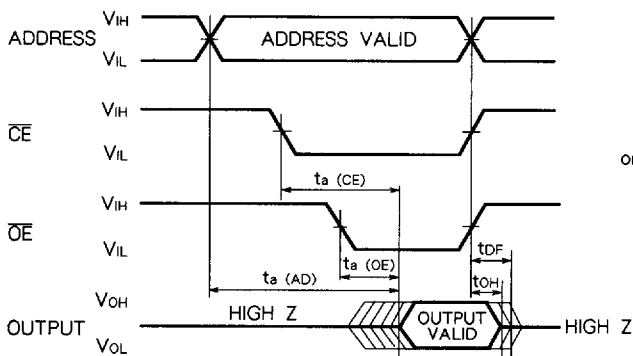
Note 2: Typical values are at  $T_a = 25^\circ\text{C}$  and normal supply voltages

**AC ELECTRICAL CHARACTERISTICS** ( $T_a = 0 \sim 70^\circ\text{C}$ ,  $V_{CC} = 5V \pm 10\%$ ,  $V_{PP} = V_{CC}$ , unless otherwise noted)

Symbol	Parameter	Test conditions	Limits				Units
			M5M27C202P-12		M5M27C202P-15		
			Min	Max	Min	Max	
$t_a$ (AD)	Address to output delay	$\overline{CE} = \overline{OE} = V_{IL}$		120		150	ns
$t_a$ (CE)	$\overline{CE}$ to output delay	$\overline{OE} = V_{IL}$		120		150	ns
$t_a$ (OE)	Output enable to output delay	$\overline{CE} = V_{IL}$		60		60	ns
t <sub>DF</sub>	Output enable high to output float	$\overline{CE} = V_{IL}$	0	50	0	50	ns
t <sub>OH</sub>	Output hold from $\overline{CE}$ , $\overline{OE}$ or address		0		0		ns

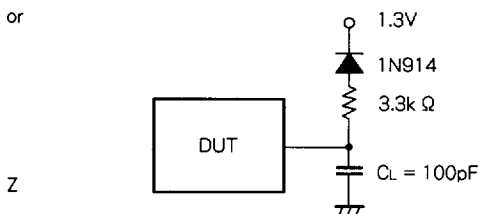
Note 3:  $V_{CC}$  must be applied simultaneously  $V_{PP}$  and removed simultaneously  $V_{PP}$ .

## AC WAVEFORMS



Test conditions for A.C. characteristics  
 Input voltage:  $V_{IL} = 0.45V$ ,  $V_{IH} = 2.4V$   
 Input rise and fall times:  $\leq 10\text{ns}$   
 Reference voltage at timing measurement:  $1.5V$

Output load: 1TTL gate +  $C_L (= 100\text{pF})$



## CAPACITANCE

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
C <sub>IN</sub>	Input capacitance (Address, $\overline{CE}$ , $\overline{OE}$ )	$T_a = 25^\circ\text{C}$ , $f = 1\text{MHz}$ , $V_i = V_o = 0V$			15	$\text{pF}$
C <sub>OUT</sub>	Output capacitance				15	$\text{pF}$

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**PROGRAM OPERATION**

**WORD PROGRAMMING ALGORITHM**

First set  $V_{CC} = 6V$ ,  $V_{PP} = 12.5V$  and then set an address to first address to be programmed. After applying 0.2ms program pulse (PGM) to the address, verify is performed. If the output data of that address is not verified correctly, apply one more 0.2ms program pulse. The programmer continues 0.2ms 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 0.2ms pulse applied to that address in register X. And then applied a program pulse X times of 0.2ms width 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. When the entire addresses have been programmed completely, all addresses should be verified with  $V_{CC} = V_{PP} = 5V$ .

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

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$I_{L1}$	Input leakage current	$V_{IN} = 0 \sim V_{CC}$			10	$\mu A$
$V_{OL}$	Output low voltage (verify)	$I_{OL} = 2.1mA$			0.45	V
$V_{OH}$	Output high voltage (verify)	$I_{OH} = -400 \mu A$	2.4			V
$V_{IL}$	Input low voltage		-0.1		0.8	V
$V_{IH}$	Input high voltage		2.2		$V_{CC}$	V
$I_{CC}$	$V_{CC}$ supply current				30	mA
$I_{PP}$	$V_{PP}$ supply current	PGM = $V_{IL}$			50	mA

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

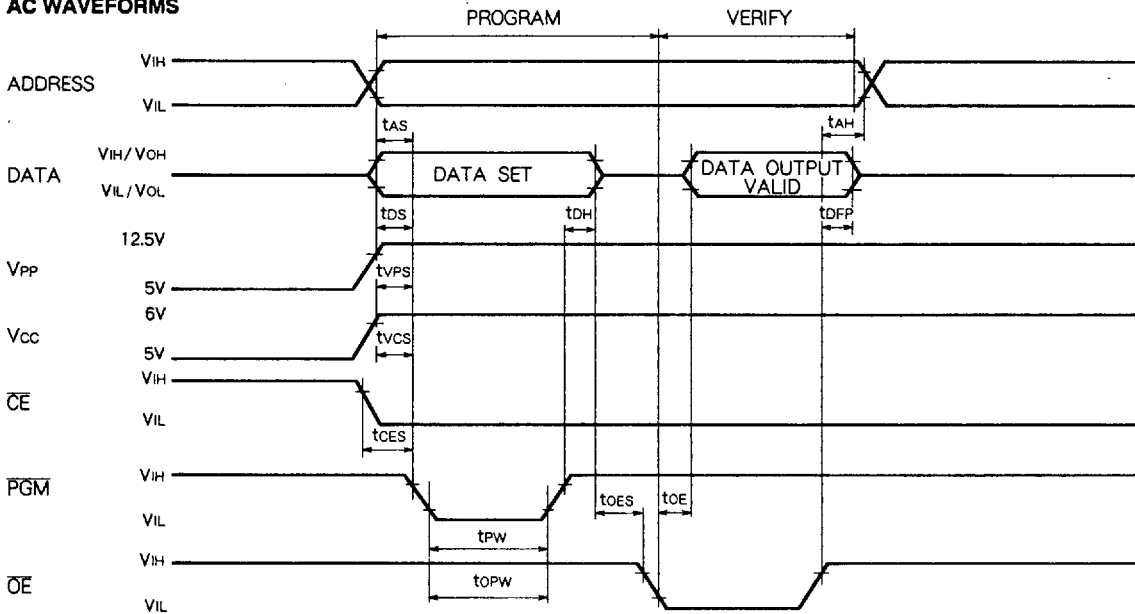
Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$t_{AS}$	Address setup time		2			$\mu s$
$t_{OES}$	$\overline{OE}$ setup time		2			$\mu s$
$t_{DS}$	Data setup time		2			$\mu s$
$t_{AH}$	Address hold time		0			$\mu s$
$t_{DH}$	Data hold time		2			$\mu s$
$t_{DFP}$	Chip enable to output float delay		0		130	ns
$t_{VCS}$	$V_{CC}$ setup time		2			$\mu s$
$t_{VPS}$	$V_{PP}$ setup time		2			$\mu s$
$t_{PW}$	PGM initial program pulse width		0.19	0.2	0.21	ms
$t_{OPW}$	PGM over program pulse width		0.19		5.25	ms
$t_{CES}$	$\overline{CE}$ setup time		2			$\mu s$
$t_{OE}$	Data valid from $\overline{OE}$				150	ns

Note 4:  $V_{CC}$  must be applied simultaneously  $V_{PP}$  and removed simultaneously  $V_{PP}$ .

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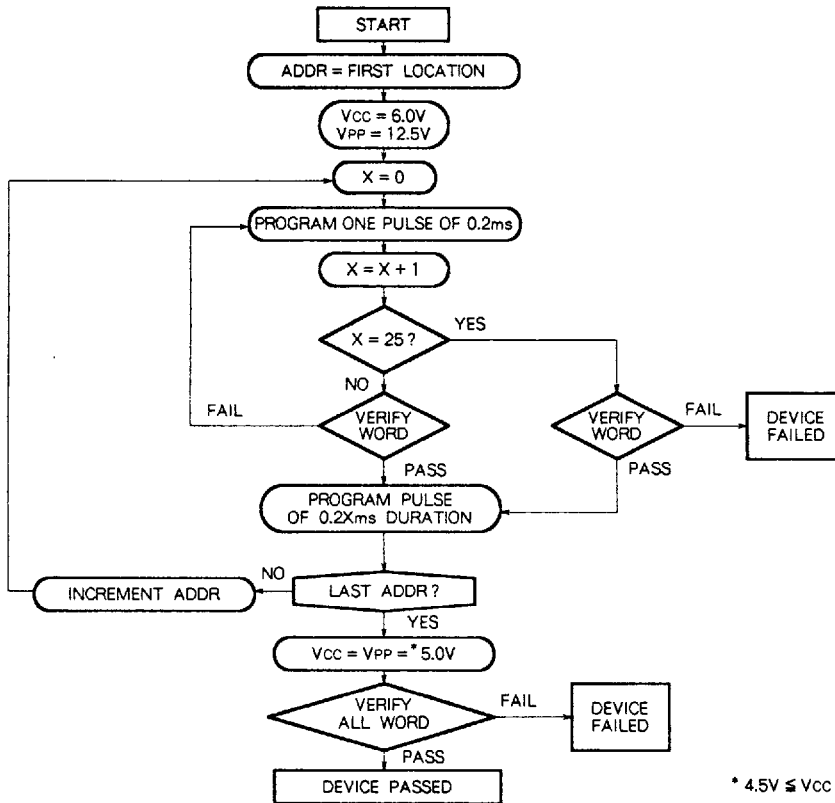
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## AC WAVEFORMS



Test conditions for A.C. characteristics  
Input voltage : VIL = 0.45V, VIH = 2.4V  
Input rise and fall times : ≤ 20ns  
Reference voltage at timing measurement : Input, Output  
"L" = 0.8V, "H" = 2V

## WORD PROGRAMMING ALGORITHM FLOW CHART



\* 4.5V ≤ VCC = VPP ≤ 5.5V

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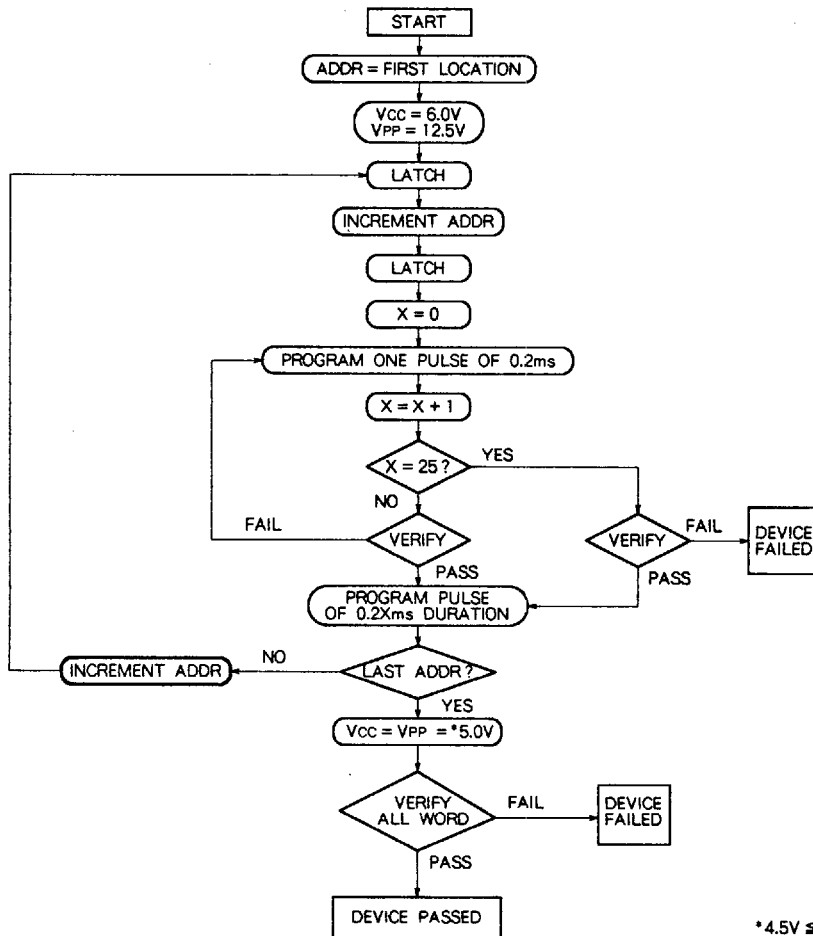
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## PAGE PROGRAMMING ALGORITHM

First set  $V_{CC} = 6V$ ,  $V_{PP} = 12.5V$  and then set an address to first page address to be programmed. After data of 2 words are latched, these latch data are programmed simultaneously by applying 0.2ms program pulse. Then a verify is performed. If each output data is not verified correctly, apply one more 0.2ms program pulse. The programmer continues 0.2ms pulse-then-verify routines until each output data is verified correctly or twenty five of these pulse-then-verify routines have been completed.

The programmer also maintains its total number of 0.2ms pulse applied to that page addresses in register X. And then applied a program pulse X times of 0.2ms width as an overprogram pulse. When the programming procedure above is finished, step to the next page address and repeat this procedure till last page address to be programmed. When the entire page addresses have been programmed completely, all addresses should be verified with  $V_{CC} = V_{PP} = 5V$ .

## PAGE PROGRAMMING ALGORITHM FLOW CHART



\*4.5V ≤ V<sub>CC</sub> = V<sub>PP</sub> ≤ 5.5V

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## DC ELECTRICAL CHARACTERISTICS (Ta = 25 ± 5°C, Vcc = 6V ± 0.25V, Vpp = 12.5V ± 0.3V, 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
V <sub>OL</sub>	Output low voltage (verify)	I <sub>OL</sub> = 2.1mA			0.45	V
V <sub>OH</sub>	Output high voltage (verify)	I <sub>OH</sub> = -400 μA	2.4			V
V <sub>IL</sub>	Input low voltage		-0.1		0.8	V
V <sub>IH</sub>	Input high voltage		2.2		V <sub>CC</sub>	V
I <sub>CC</sub>	V <sub>CC</sub> supply current				30	mA
I <sub>PP</sub>	V <sub>PP</sub> supply current	PGM = V <sub>IL</sub>			100	mA

## AC ELECTRICAL CHARACTERISTICS (Ta = 25 ± 5°C, Vcc = 6V ± 0.25V, Vpp = 12.5V ± 0.3V, unless otherwise noted)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
t <sub>AS</sub>	Address setup time		2			μs
t <sub>OES</sub>	OE setup time		2			μs
t <sub>DS</sub>	Data setup time		2			μs
t <sub>AH</sub>	Address hold time		0			μs
t <sub>AHL</sub>			2			μs
t <sub>DH</sub>	Data hold time		2			μs
t <sub>DFP</sub>	OE to output float delay		0		130	ns
t <sub>VCS</sub>	V <sub>CC</sub> setup time		2			μs
t <sub>VPS</sub>	V <sub>PP</sub> setup time		2			μs
t <sub>pw</sub>	PGM initial program pulse width		0.19	0.2	0.21	ms
t <sub>OPW</sub>	PGM over program pulse width		0.19		5.25	ms
t <sub>CES</sub>	CE setup time		2			μs
t <sub>OE</sub>	Data valid from OE		0		150	ns
t <sub>LW</sub>	Data latch time		1			μs
t <sub>PGMS</sub>	PGM setup time		2			μs
t <sub>CEH</sub>	CE hold time		2			μs
t <sub>OEH</sub>	OE hold time		2			μs

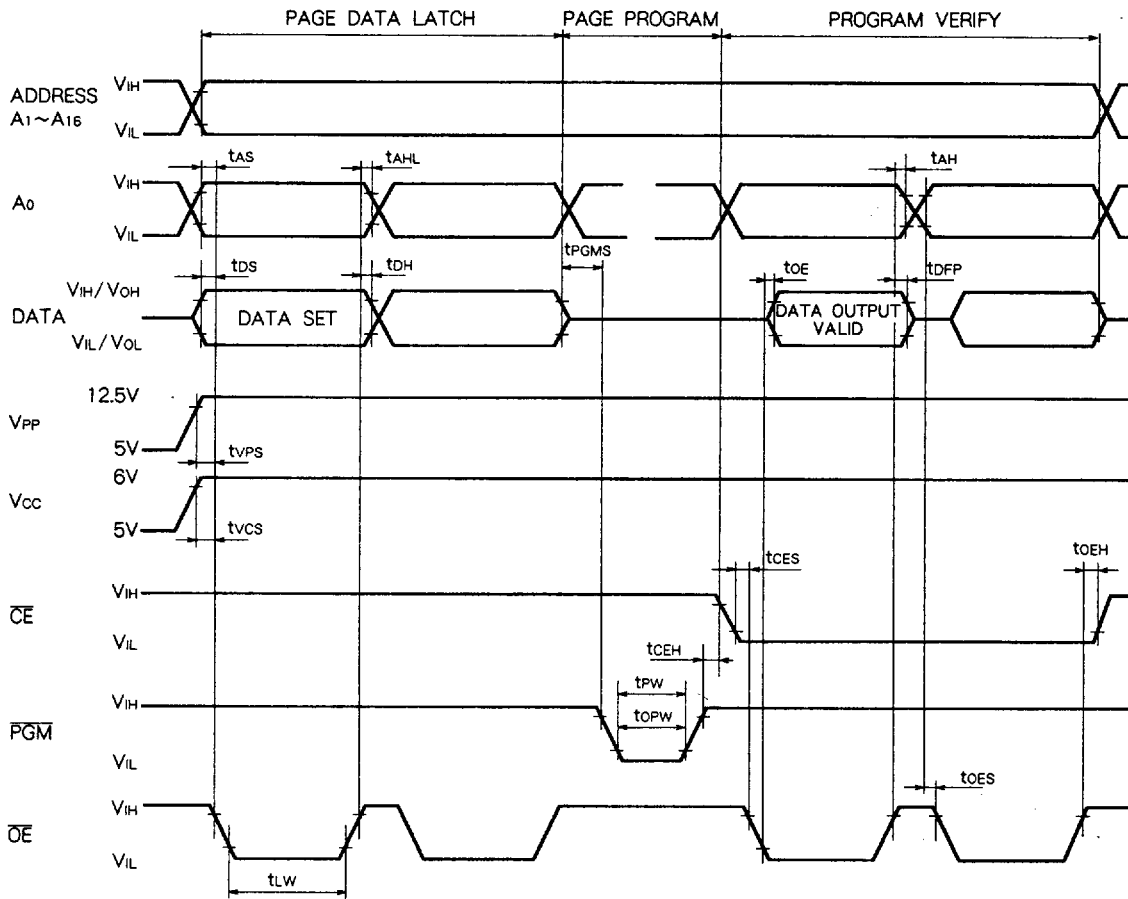
Note 5: VCC must be applied simultaneously VPP and removed simultaneously VPP.



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AC WAVEFORMS



Test condition for A.C characteristics  
 Input voltage :  $V_{IL} = 0.45V, V_{IH} = 2.4V$   
 Input rise and fall time : (10%~90%) :  $\leq 20ns$   
 Reference voltage at timing measurement : Input, Output "L" = 0.8V, "H" = 2V

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**DEVICE IDENTIFIER MODE**

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

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

**M5M27C202P,FP,J,VP,RV DEVICE IDENTIFIER CODE**

Code \ Pin	A <sub>0</sub>	D <sub>15</sub>	D <sub>14</sub>	D <sub>13</sub>	D <sub>12</sub>	D <sub>11</sub>	D <sub>10</sub>	D <sub>9</sub>	D <sub>8</sub>	D <sub>7</sub>	D <sub>6</sub>	D <sub>5</sub>	D <sub>4</sub>	D <sub>3</sub>	D <sub>2</sub>	D <sub>1</sub>	D <sub>0</sub>	Hex Data
Manufacturer code	V <sub>IL</sub>	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	001C
Device code	V <sub>IH</sub>	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	000B

Note 6 : A<sub>9</sub> = 12.0 ± 0.5V  
 A<sub>1</sub>~A<sub>8</sub>, A<sub>10</sub>~A<sub>16</sub>,  $\overline{CE}$ ,  $\overline{OE}$  = V<sub>IL</sub>,  $\overline{PGM}$  = V<sub>IH</sub>  
 V<sub>CC</sub> = V<sub>PP</sub> = 5V ± 10%

**RECOMMENDED SCREENING CONDITION**

The following screening test is recommended before using.

