

M5M27C202K, JK-10, -12, -15

2097152-BIT(131072-WORD BY 16-BIT)
CMOS ERASABLE AND ELECTRICALLY REPROGRAMMABLE ROM

DESCRIPTION

The Mitsubishi M5M27C202K, JK is a high-speed 2097152-bit ultraviolet erasable and electrically reprogrammable read only memory. It is suitable for microprocessor programming applications where rapid turn-around is required. The M5M27C202K, JK is fabricated by N-channel double polysilicon gate for Memory and CMOS technology for peripheral circuits, and is available in a 40 pin DIP or 44 pin CLCC with a transparent lid.

FEATURES

- 131072 word × 16 bit organization
- Access time
 - M5M27C202K-10, JK-10 100ns (max.)
 - M5M27C202K-12, JK-12 120ns (max.)
 - M5M27C202K-15, JK-15 150ns (max.)
- Two line control \overline{OE} , \overline{CE}
- Low power current (I_{cc}): Active 30mA (max.)
(I_{sbz}): Stand-by 0.1mA (max.)
- Single 5V power supply (read operation)
- Programming voltage 12.5V
- 3-State output buffer
- Input and output TTL-compatible in read and program mode
- Standard 40 pin DIP
- Word programming algorithm
- Page programming algorithm

APPLICATION

Microcomputer systems and peripheral equipment

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.

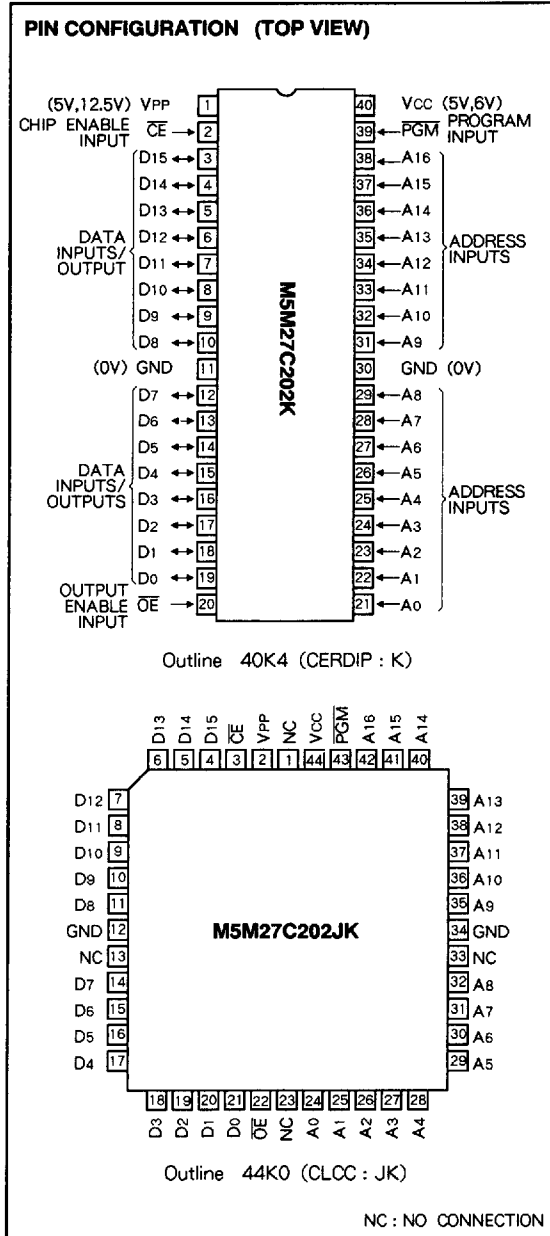
Programming

(Word programming algorithm)

The M5M27C202K, JK enters 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 M5M27C202K, JK 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 M5M27C202K, JK enters 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 M5M27C202K, JK enters the page programming mode when $\overline{OE} = "H"$. In this state, page (2 words) programming is completed when $\overline{PGM} = "L"$.

Erase

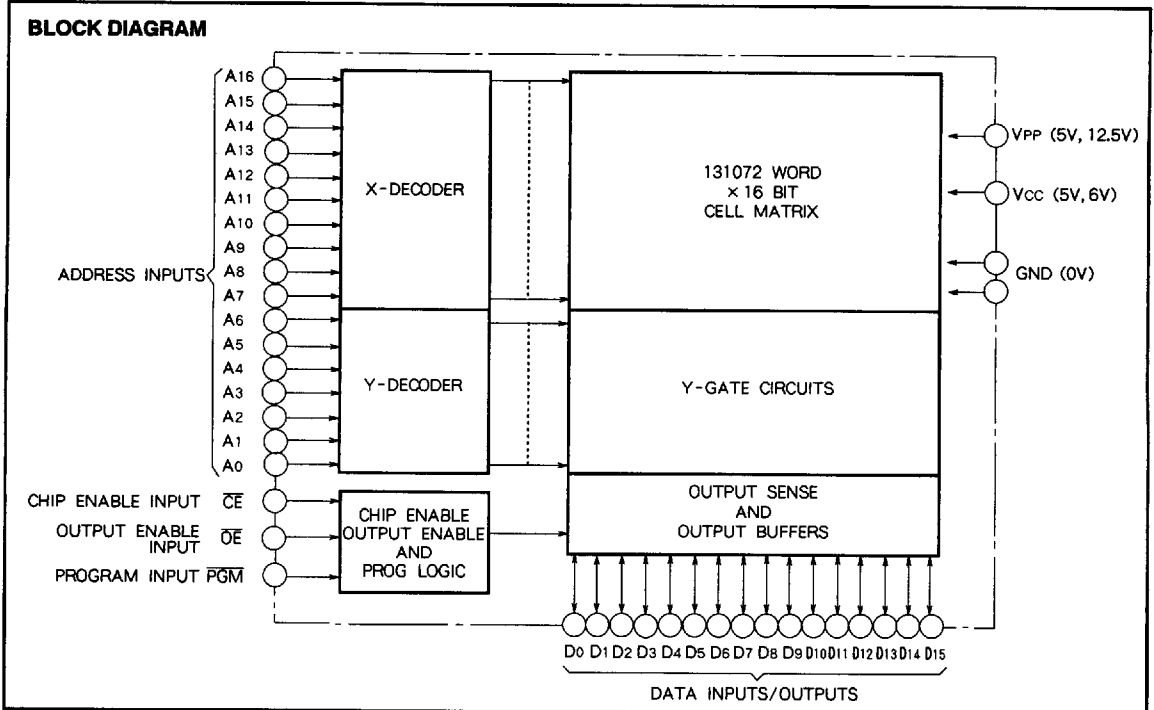
Erase is effected by exposure to ultraviolet light with a wavelength of 2537 Å at an intensity of approximately

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15WS/cm². 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 (K/JK) | \overline{CE} (2/3) | \overline{OE} (20/22) | \overline{PGM} (39/43) | V_{PP} (1/2) | V_{CC} (40/44) | Data I/O (3~10, 12~19/4~11, 14~21) |
|-----------------------|-------------|-----------------------|-------------------------|--------------------------|----------------|------------------|------------------------------------|
| 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 | | - 65~125 | °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 _{LI} | Input leakage current | $V_{IN} = 0 \sim V_{CC}$ | | | 10 | μA |
| I _{LO} | Output leakage current | $V_{OUT} = 0 \sim V_{CC}$ | | | 10 | μA |
| I _{PP1} | V_{PP} current read/stand-by | $V_{PP} = V_{CC} = 5.5V$ | | 1 | 100 | μA |
| I _{SB1} | V_{CC} current stand-by | $\overline{CE} = V_{IH}$ | | | 1 | mA |
| I _{SB2} | | $\overline{CE} = V_{CC}$ | | 1 | 100 | μA |
| I _{CC1} | V_{CC} current Active | $\overline{CE} = \overline{OE} = V_{IL}$, DC, $I_{OUT} = 0\text{mA}$ | | | 30 | mA |
| I _{CC2} | | $\overline{CE} = V_{IL}$, $f = 10\text{MHz}$, $I_{OUT} = 0\text{mA}$ | | | 30 | mA |
| V _{IL} | Input low voltage | | -0.1 | | 0.8 | V |
| V _{IH} | Input high voltage | | 2.2 | | $V_{CC} + 1$ | V |
| V _{OL} | Output low voltage | $I_{OL} = 2.1\text{mA}$ | | | 0.45 | V |
| V _{OH} | Output high voltage | $I_{OH} = -400\mu\text{A}$ | 2.4 | | | V |

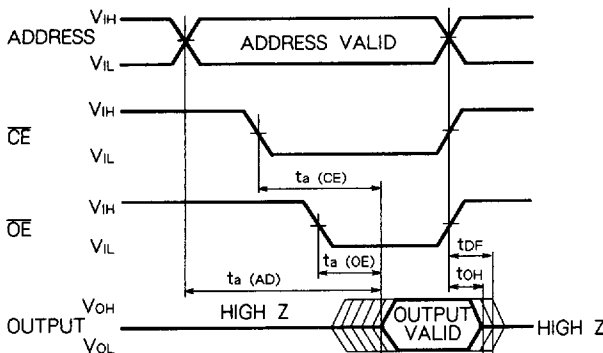
Note 2: Typical values are at $T_a = 25^\circ\text{C}$ and nominal supply voltages.

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

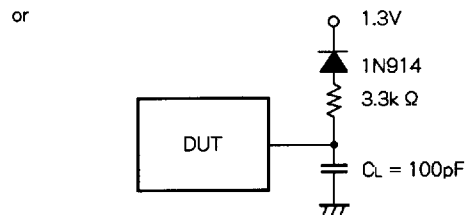
| Symbol | Parameter | Test conditions | Limits | | | | | | Unit |
|---------------------|--|--|---------------|-----|---------------|-----|---------------|-----|------|
| | | | M5M27C202K-10 | | M5M27C202K-12 | | M5M27C202K-15 | | |
| | | | Min | Max | Min | Max | Min | Max | |
| t _a (AD) | Address to output delay | $\overline{CE} = \overline{OE} = V_{IL}$ | | 100 | | 120 | | 150 | ns |
| t _a (CE) | \overline{CE} to output delay | $\overline{OE} = V_{IL}$ | | 100 | | 120 | | 150 | ns |
| t _a (OE) | \overline{OE} to output delay | $\overline{CE} = V_{IL}$ | | 50 | | 60 | | 60 | ns |
| tDF | \overline{OE} high to output float | $\overline{CE} = V_{IL}$ | 0 | 45 | 0 | 50 | 0 | 50 | ns |
| tOH | Output hold from $\overline{CE}, \overline{OE}$ or address | | 0 | | 0 | | 0 | | ns |

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

AC WAVEFORMS



Test conditions 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 _{IN} | Input capacitance (Address, $\overline{CE}, \overline{OE}, \text{PGM}$) | $T_a = 25^\circ\text{C}, f = 1\text{MHz}, V_i = V_o = 0V$ | | | 15 | pF |
| C _{OUT} | Output capacitance | | | | 15 | 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 _{LI} | Input leakage current | $V_{IN} = 0 \sim V_{CC}$ | | | 10 | μA |
| V _{OL} | Output low voltage (verify) | $I_{OL} = 2.1mA$ | | | 0.45 | V |
| V _{OH} | Output high voltage (verify) | $I_{OH} = -400 \mu A$ | | | | 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)

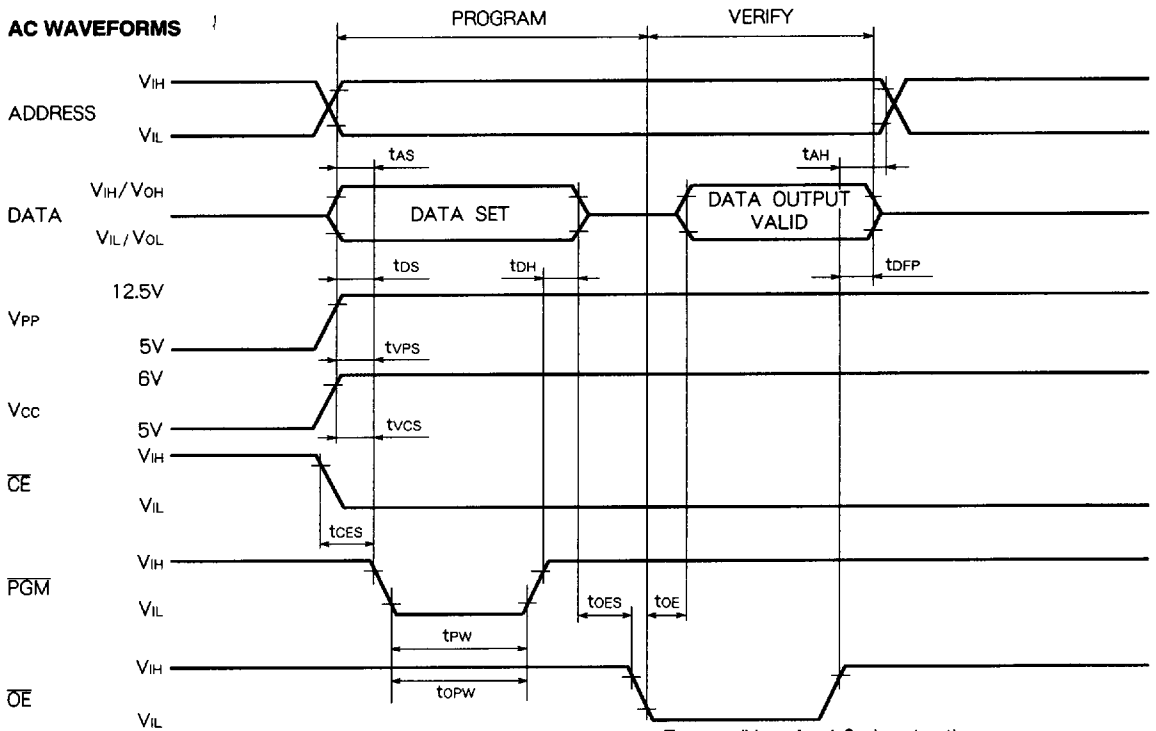
| Symbol | Parameter | Test conditions | Limits | | | Unit |
|------------------|-----------------------------------|-----------------|--------|-----|------|---------|
| | | | Min | Typ | Max | |
| t _{AS} | Address setup time | | 2 | | | μs |
| t _{oES} | \overline{OE} setup time | | 2 | | | μs |
| t _{DS} | Data setup time | | 2 | | | μs |
| t _{AH} | Address hold time | | 0 | | | μs |
| t _{DH} | Data hold time | | 2 | | | μs |
| t _{DFP} | Chip enable to output float delay | | 0 | | 130 | ns |
| t _{VCS} | V_{CC} setup time | | 2 | | | μs |
| t _{VPS} | V_{PP} setup time | | 2 | | | μs |
| 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 | | | μs |
| 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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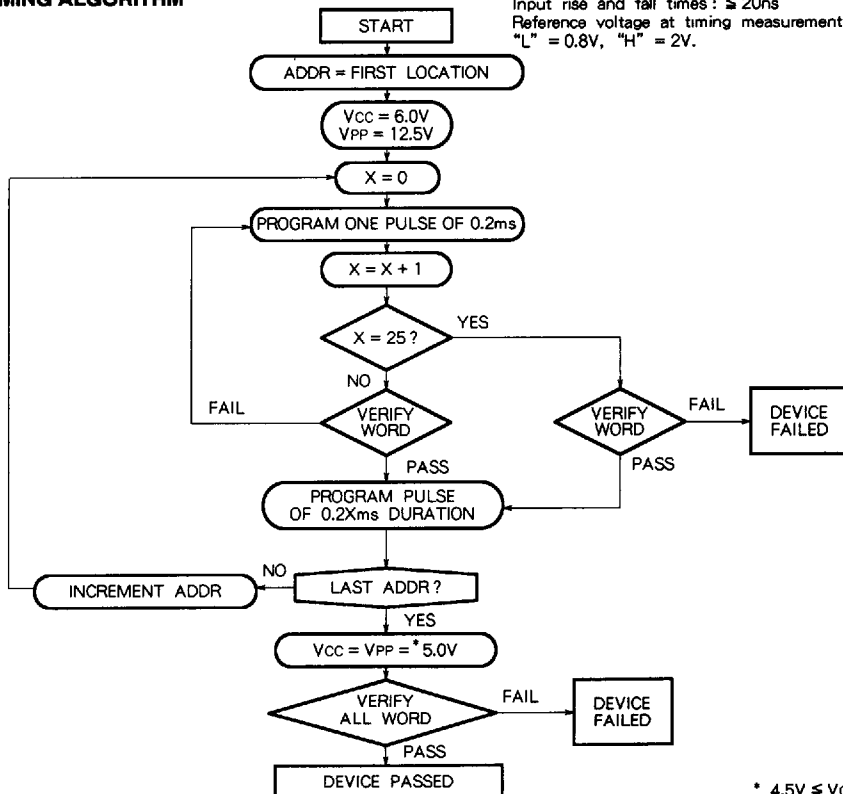
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AC WAVEFORMS



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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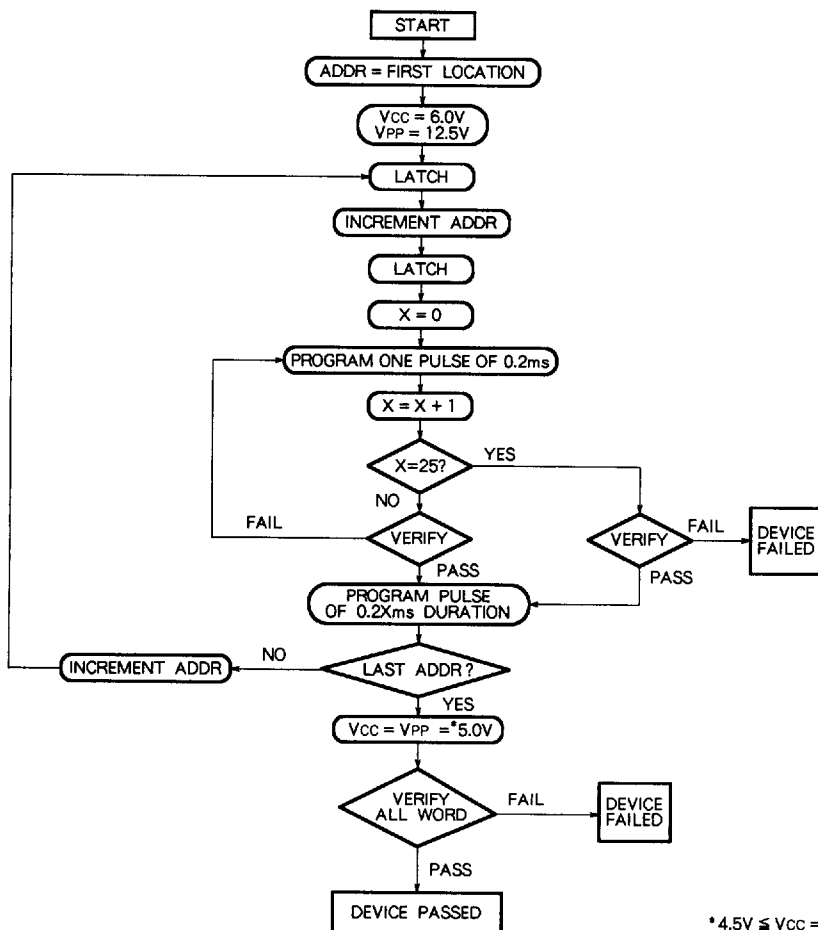
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PAGE PROGRAMMING ALGORITHM

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_{CC} = V_{PP} ≤ 5.5V

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

| Symbol | Parameter | Test conditions | Limits | | | Unit |
|----------|------------------------------|------------------------------|--------|-----|----------|---------------|
| | | | Min | Typ | Max | |
| I_{LI} | Input leakage current | $V_{IN} = 0 \sim V_{CC}$ | | | 10 | μA |
| 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 | | 2.2 | | V_{CC} | V |
| I_{CC} | V_{CC} supply current | | | | 30 | mA |
| I_{PP} | V_{PP} supply current | $PGM = V_{IL}$ | | | 100 | mA |

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

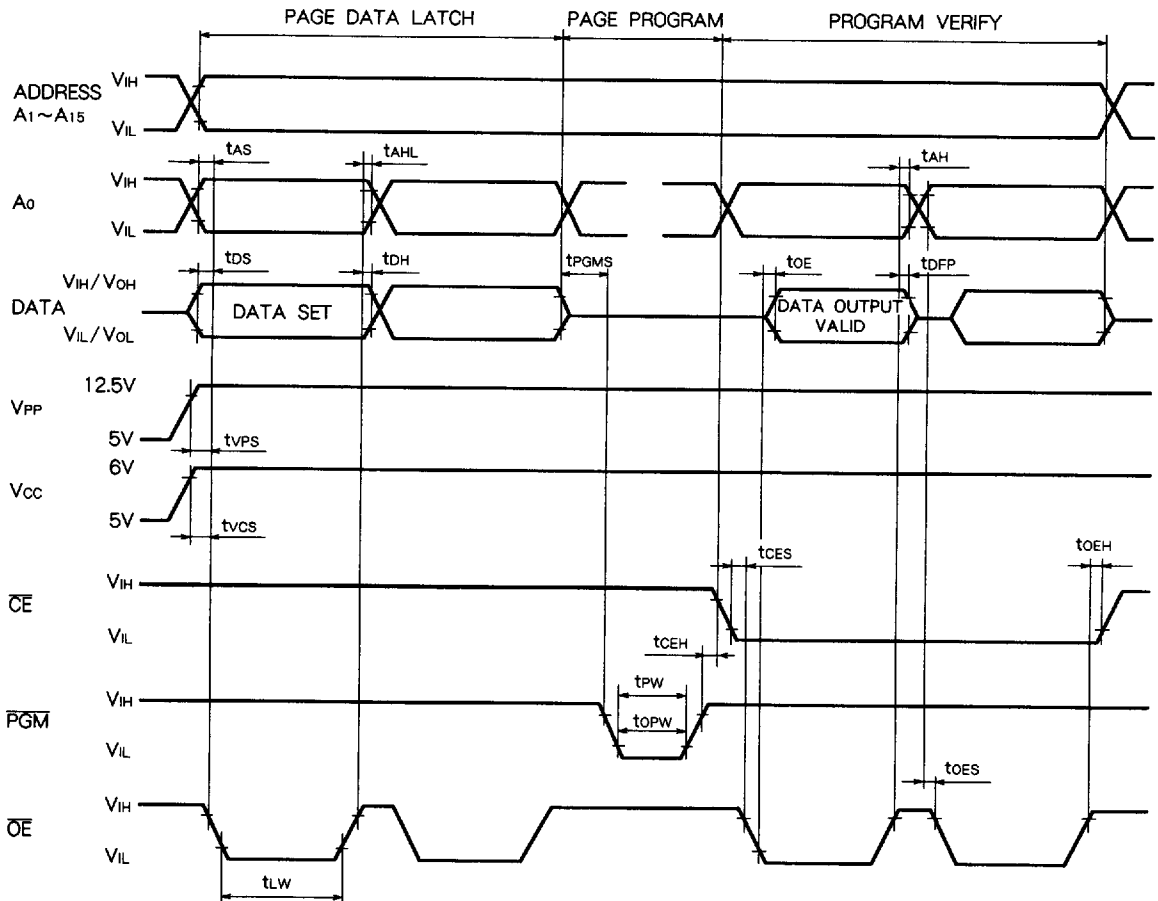
| Symbol | Parameter | Test conditions | Limits | | | Unit |
|------------|---------------------------------------|-----------------|--------|-----|------|---------------|
| | | | Min | Typ | Max | |
| t_{AS} | Address setup time | | 2 | | | μs |
| t_{OES} | \overline{OE} setup time | | 2 | | | μs |
| t_{DS} | Data setup time | | 2 | | | μs |
| t_{AH} | Address hold time | | 0 | | | μs |
| t_{AHL} | | | 2 | | | μs |
| t_{DH} | Data hold time | | 2 | | | μs |
| t_{DFP} | \overline{OE} to output float delay | | 0 | | 130 | ns |
| t_{VCS} | V_{CC} setup time | | 2 | | | μs |
| t_{VPS} | V_{PP} setup time | | 2 | | | μs |
| 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 | | | μs |
| t_{OE} | Data valid from \overline{OE} | | | | 150 | ns |
| t_{LW} | Data latch time | | 1 | | | μs |
| t_{PGMS} | PGM setup time | | 2 | | | μs |
| t_{CEH} | \overline{CE} hold time | | 2 | | | μs |
| t_{OEH} | \overline{OE} hold time | | 2 | | | μs |

Note 5: V_{CC} must be applied simultaneously V_{PP} and removed simultaneously V_{PP} .

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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 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.

M5M27C202K, JK DEVICE IDENTIFIER CODE

| Code \ Pin | A ₀ (21/24) | D ₁₅ (3/4) | D ₁₄ (4/5) | D ₁₃ (5/6) | D ₁₂ (6/7) | D ₁₁ (7/8) | D ₁₀ (8/9) | D ₉ (9/10) | D ₈ (10/11) | D ₇ (12/14) | D ₆ (13/15) | D ₅ (14/16) | D ₄ (15/17) | D ₃ (16/18) | D ₂ (17/19) | D ₁ (18/20) | D ₀ (19/21) | Hex Data |
|-------------------|---------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|---------------------------|---------------------------|---------------------------|---------------------------|---------------------------|---------------------------|---------------------------|---------------------------|---------------------------|----------|
| Manufacturer code | V _{IL} | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 001C |
| Device code | V _{IH} | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 000B |

Note 6: A₉ = 12.0 ± 0.5V

A₁~A₈, A₁₀~A₁₆, \overline{CE} , \overline{OE} = V_{IL}, \overline{PGM} = V_{IH}

V_{CC} = V_{PP} = 5V ± 10%