M5M27C101K-12,-15

1048576-BIT(131072-WORD BY 8-BIT) CMOS ERASABLE AND ELECTRICALLY REPROGRAMMABLE ROM

DESCRIPTION

The Mitsubishi M5M27C101K is a high-speed 1048576-bit ultraviolet erasable and electrically reprogrammable read only memory. It is suitable for microprocessor programming applications where rapid turn-around is required. The M5M27C101K is fabricated by N-channel double polysilicon gate for Memory and CMOS technology for peripheral circuits, and is available in DIP with a transparent lid.

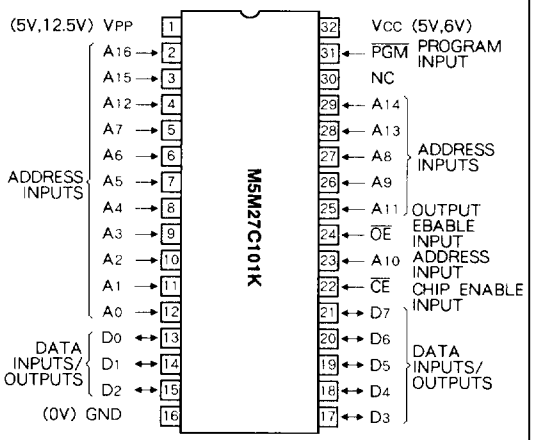
FEATURES

- 131072 word × 8 bit organization
- Access time M5M27C101K-12 ..... 120ns (max.)
  M5M27C101K-15 ..... 150ns (max.)
- Two line control $\overline{OE}$, $\overline{CE}$
- Low power current (Icc) : Active ..... 50mA (max.)
  Stand-by ..... 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 32 pin DIP
- Byte programming algorithm
- Page programming algorithm

APPLICATION

Microcomputer systems and peripheral equipment

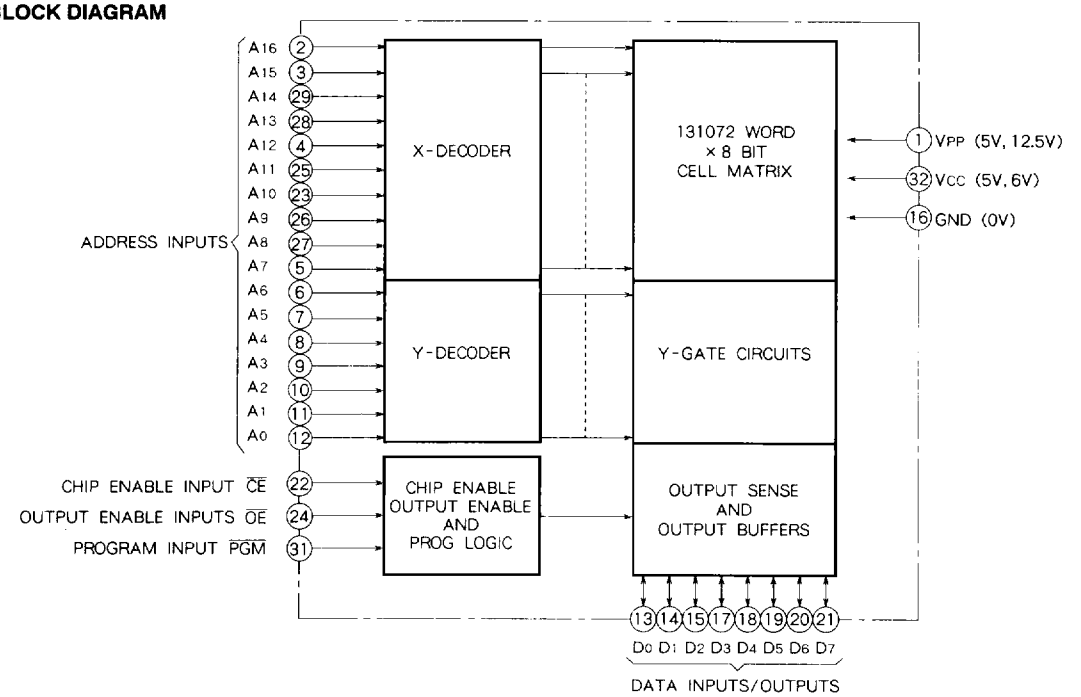
PIN CONFIGURATION (TOP VIEW)



Outline 32K4

NC : NO CONNECTION

BLOCK DIAGRAM



1048576-BIT(131072-WORD BY 8-BIT)
CMOS ERASABLE AND ELECTRICALLY REPROGRAMMABLE ROM

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~A_{16}) make the data contents of the designated address location available at the data input/output (D_0~D_7). 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 standby mode or power-down mode.

Programming

(Byte programming algorithm)

The M5M27C101K enters the byte 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~A_{16}), and the data to be programmed must be applied at 8-bits in parallel to the data inputs (D_0 ~D_7). In this state, byte programming is completed when $\overline{PGM}$ is at low level.

(Page programming algorithm)

Page programming feature of the M5M27C101K allows 4 bytes of data to be simultaneously programmed. The destination addresses for a page programming operation must reside on the same page; that is, A_2 through A_{16} must not change. At first, the M5M27C101K enters the page data latch mode when V_{PP} = 12.5V, $\overline{CE}$ = "H", $\overline{OE}$ = "L"and $\overline{PGM}$ = "H". The four locations in same page are designated by address signals (A_0, A_1 change) and the data to be programmed must be applied to each location at 8-bits in parallel to the data inputs (D_0~D_7). In this state, the data (4-bytes) latch is completed. Then the M5M27C101K enters the page programming mode when $\overline{OE}$ = "H". In this state, page (4-bytes) 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 15W · sec/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	$\overline{CE}$ (22)	$\overline{OE}$ (24)	$\overline{PGM}$ (31)	V_{PP} (1)	V_{CC} (32)	Data I/O (13~15,17~21)
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
Byte 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}·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	℃
T_{stg}	Storage temperature		− 65~125	℃

Note 1 : Stresses above those listed may cause parmanent 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.

READ OPERATION

DE ELECTRICAL CHARACTERISTICS (Ta = 0~70℃, Vcc = 5V ± 10%, Vpp = Vcc, unless otherwise noted)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
I_{LI}	Input leakage current	V_{IN} = 0~Vcc			10	μA
I_{LO}	Output leakage current	V_{OUT} = 0~Vcc			10	μA
I_{PP1}	Vpp current read/stand-by	Vpp = 5.5V		1	100	μA
I_{SB1}	Vcc current stand-by	$\overline{CE}$ = V_{IH}			1	mA
I_{SB2}		$\overline{CE}$ = Vcc		1	100	μA
I_{CC1}	Vcc current Active	$\overline{CE}$ = $\overline{OE}$ = V_{IL}, DC, I_{OUT} = 0mA			50	mA
I_{CC2}		$\overline{CE}$ = V_{IL}, f = 8.3MHz, I_{OUT} = 0mA			50	mA
V_{IL}	Input low voltage		−0.1		0.8	V
V_{IH}	Input high voltage		2.0		Vcc+1	V
V_{OL}	Output low voltage	I_{OL} = 2.1mA			0.45	V
V_{OH}	Output high voltage	I_{OH} = −400 μA	2.4			V

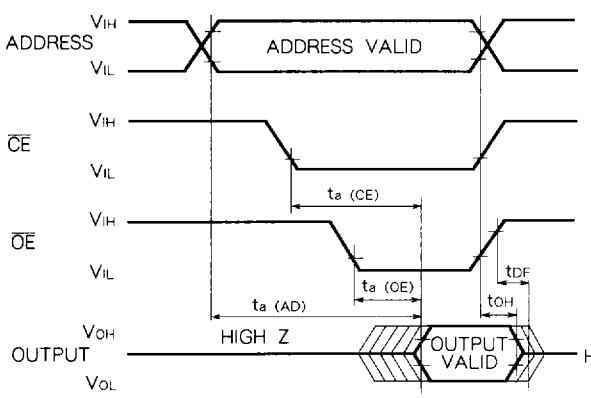
Note 2 : Typical values are at Ta = 25℃ and nominal supply voltages.

AC ELECTRICAL CHARACTERISTICS (Ta = 0~70℃, Vcc = 5V ± 10%, Vpp = Vcc, unless otherwise noted)

Symbol	Parameter	Test conditions	Limits				Unit
			M5M27C101K-12		M5M27C101K-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_{DF}	Output enable high to output float	$\overline{CE}$ = V_{IL}	0	50	0	50	ns
t_{OH}	Output hold from $\overline{CE}$, $\overline{OE}$ or address		0		0		ns

Note 3 : Vcc must be applied simultaneously Vpp and removed simultaneously Vpp.

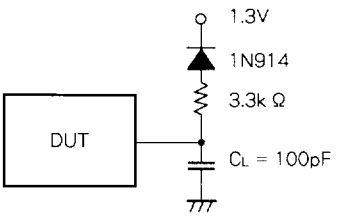
AC WAVEFORMS



Test conditions for A.C. characteristics
Input voltage : V_{IL} = 0.45V , V_{IH} = 2.4V
Input rise and fall times : ≦ 20ns
Reference voltage at timing measurement : Input, Output "L" = 0.8V, "H" = 2V

Output load : 1TTL gate + C_L (100pF)

or



CAPACITANCE

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
C_{IN}	Input capacitance (Address, $\overline{CE}$, $\overline{OE}$, $\overline{PGM}$)	Ta = 25℃, f = 1MHz, V_I = V_O = 0V			10	pF
C_{OUT}	Output capacitance				15	pF

PROGRAM OPERATION

BYTE 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 ($\overline{PGM}$) 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 (Ta = 25 ± 5℃, V_{CC} = 6V ± 0.25V, V_{PP} = 12.5V ± 0.3V, unless otherwise noted)

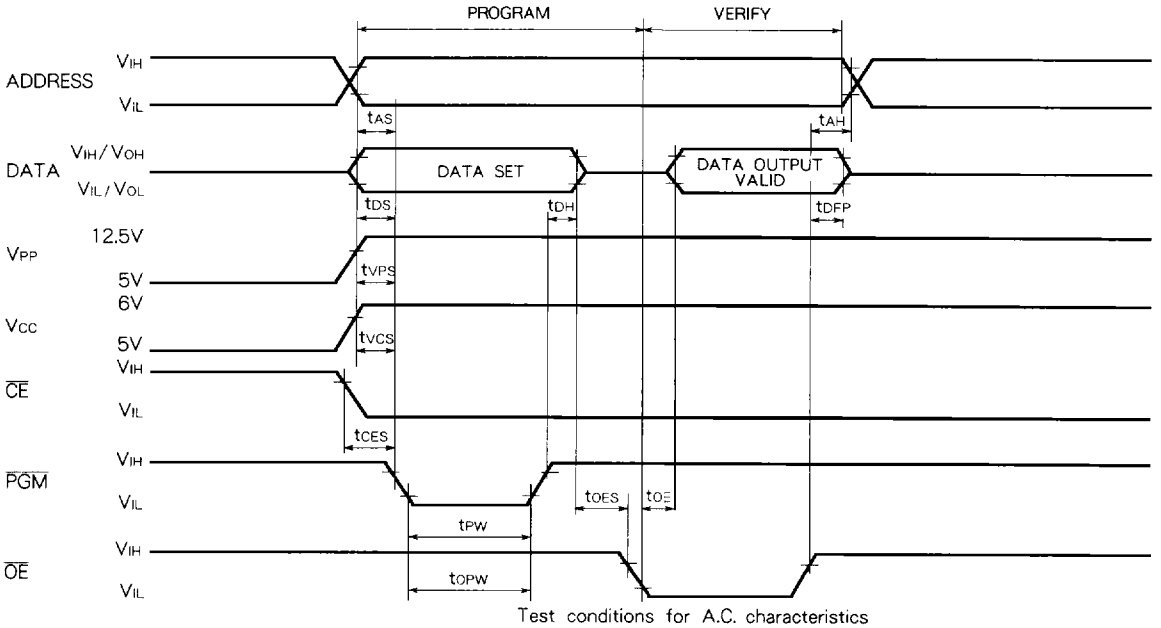
Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
I_{LI}	Input leakage current	V_{IN} = 0~V_{CC}			10	μA
V_{OL}	Output low voltage (verify)	I_{OL} = 2.1mA			0.45	V
V_{OH}	Output high voltage (verify)	I_{OH} = −400 μA	2.4			V
V_{IL}	Input low voltage		−0.1		0.8	V
V_{IH}	Input high voltage		2.0		V_{CC}	V
I_{CC}	V_{CC} supply current				50	mA
I_{PP}	V_{PP} supply current	$\overline{CE}$ = $\overline{PGM}$ = V_{IL}			50	mA

AC ELECTRICAL CHARACTERISTICS (Ta = 25 ± 5℃, V_{CC} = 6V ± 0.25V, V_{PP} = 12.5V ± 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}	$\overline{PGM}$ initial program pulse width		0.19	0.2	0.21	ms
t_{OPW}	$\overline{PGM}$ 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

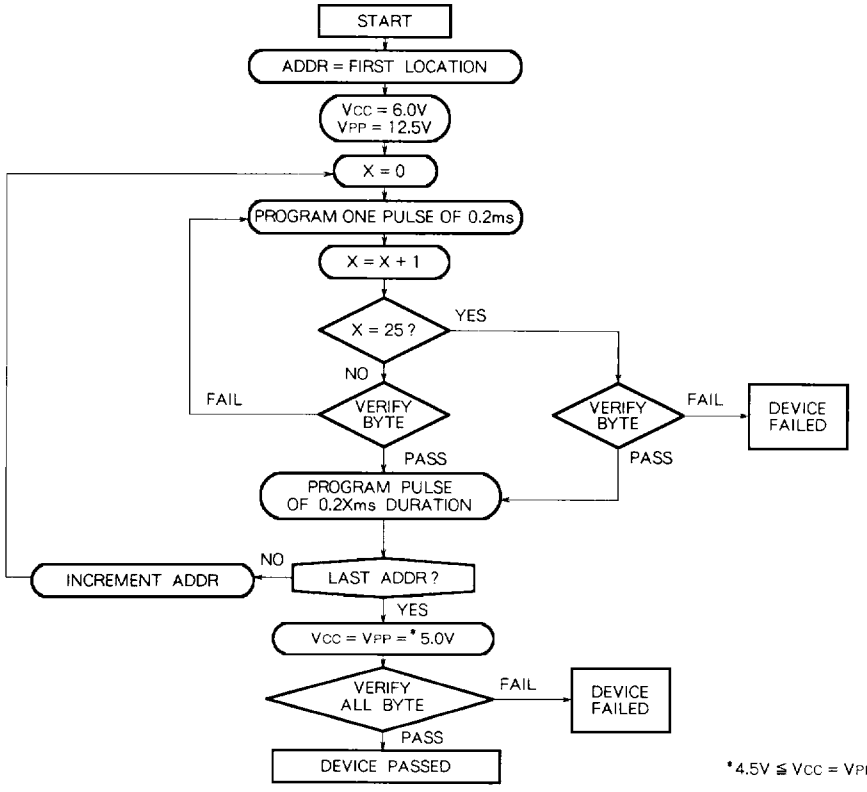
Note 4 : V_{CC} must be applied simultaneously V_{PP} and removed simultaneously V_{PP}.

AC WAVEFORMS



Test conditions for A.C. characteristics
Input voltage : V_{IL} = 0.45V, V_{IH} = 2.4V
Input rise and fall times : ≦ 20ns
Reference voltage at timing measurement : Input, Output
"L" = 0.8V, "H" = 2V

BYTE PROGRAMMING ALGORITHM FLOW CHART



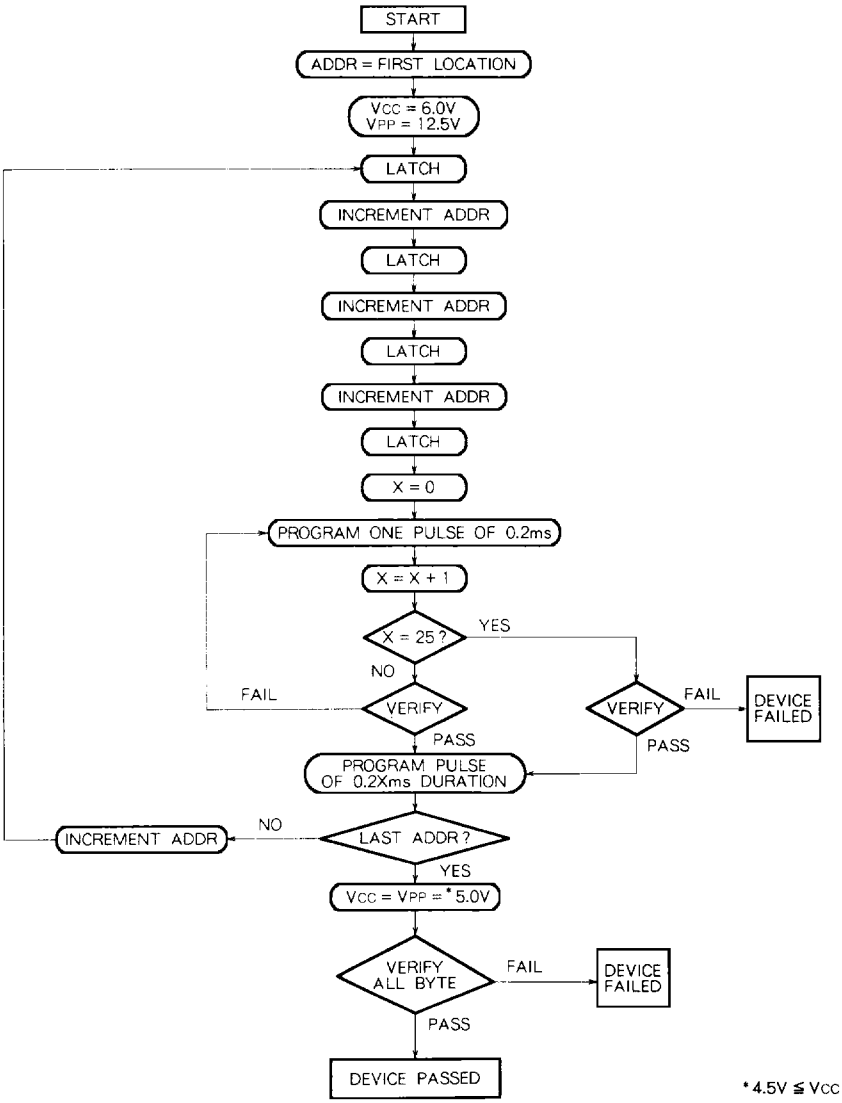
*4.5V ≦ VCC = VPP ≦ 5.5V

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 4 bytes 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 addressed 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 (Ta = 25 ± 5℃, V_{CC} = 6V ± 0.25V, V_{PP} = 12.5V ± 0.3V, unless otherwise noted)

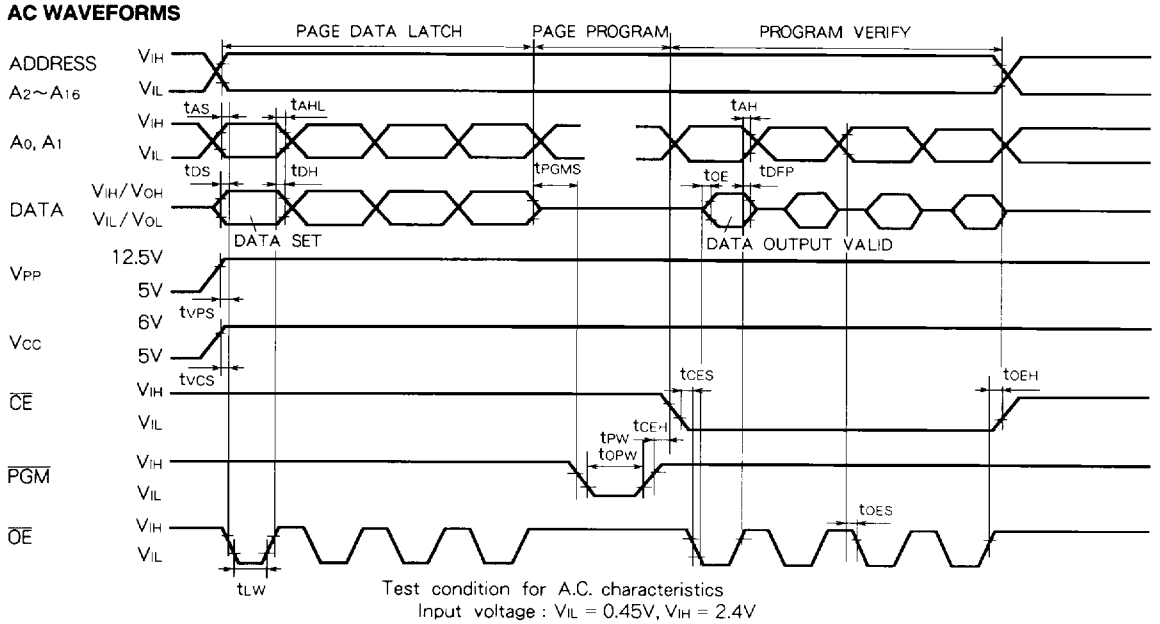
symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
I_{LI}	Input leakage current	V_{IN} = 0~V_{CC}			10	μA
V_{OL}	Output low voltage (verify)	I_{OL} = 2.1mA			0.45	V
V_{OH}	Output high voltage (verify)	I_{OH} = − 400 μA	2.4			V
V_{IL}	Input low voltage		− 0.1		0.8	V
V_{IH}	Input high voltage		2.0		V_{CC}	V
I_{CC}	V_{CC} supply current				50	mA
I_{PP}	V_{PP} supply current	$\overline{PGM}$ = V_{IL}			100	mA

AC ELECTRICAL CHARACTERISTICS (Ta = 25 ± 5℃, V_{CC} = 6V ± 0.25V, V_{PP} = 12.5V ± 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}	$\overline{PGM}$ initial program pulse width		0.19	0.2	0.21	ms
t_{OPW}	$\overline{PGM}$ over program pulse width		0.19		5.25	ms
t_{CES}	$\overline{CE}$ setup time		2			μs
t_{OE}	Data valid from $\overline{OE}$		0		150	ns
t_{LW}	Data latch time		1			μs
t_{PGMS}	$\overline{PGM}$ 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}.

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%) : ≤ 20ns
Reference voltage at timing measurement : Input, Output "L" = 0.8V, "H" = 2V

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.

M5M27C101K DEVICE IDENTIFIER CODE

Pins / Code	A_0 (12)	D_7 (21)	D_6 (20)	D_5 (19)	D_4 (18)	D_3 (17)	D_2 (15)	D_1 (14)	D_0 (13)	Hex Data
Manufacturer code	V_{IL}	0	0	0	1	1	1	0	0	1C
Device code	V_{IH}	1	0	0	0	0	0	1	1	83

Note 6 : $A_9 = 12.0 \pm 0.5V$
$A_1 \sim A_8$, $A_{10} \sim A_{16}$, $\overline{CE}$, $\overline{OE} = V_{IL}$, $\overline{PGM} = V_{IH}$
$V_{CC} = V_{PP} = 5V \pm 10\%$