

OKI Semiconductor

1A

MR27V401D

524,288-Word x 8-Bit One Time PROM

DESCRIPTION

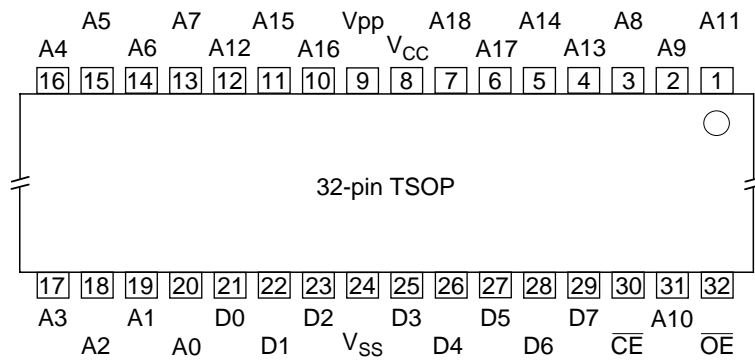
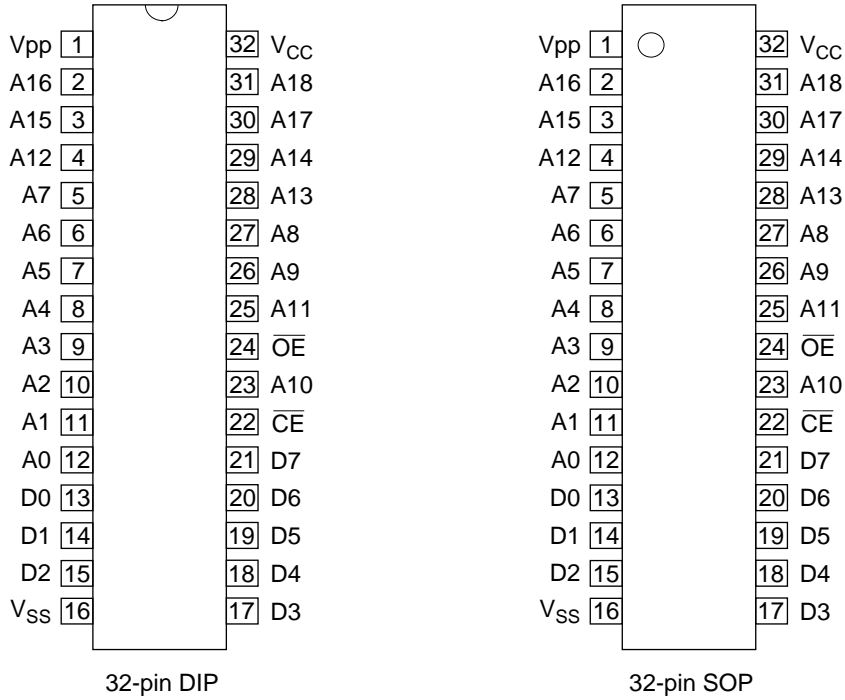
The MR27V401D is a 4Mbit electrically Programmable Read-Only Memory organized as 524,288 word x 8bit. The MR27V401D operates on a single +3V-3.3V power supply and is TTL compatible. Since the MR27V401D operates asynchronously, external clocks are not required, making this device easy-to-use. The MR27V401D is suitable as large-capacity fixed memory for microcomputers and data terminals. It is manufactured using a CMOS double silicon gate technology and is offered in 32-pin DIP, 32-pin SOP or 32-pin TSOP packages.

FEATURES

- 524,288 word x 8bit
- Single +3V-3.3V power supply
- Access time 80ns access time (Vcc=+3V)
 70ns access time (Vcc=+3.3V)
- Input / Output TTL compatible
- Three-state output
- Packages

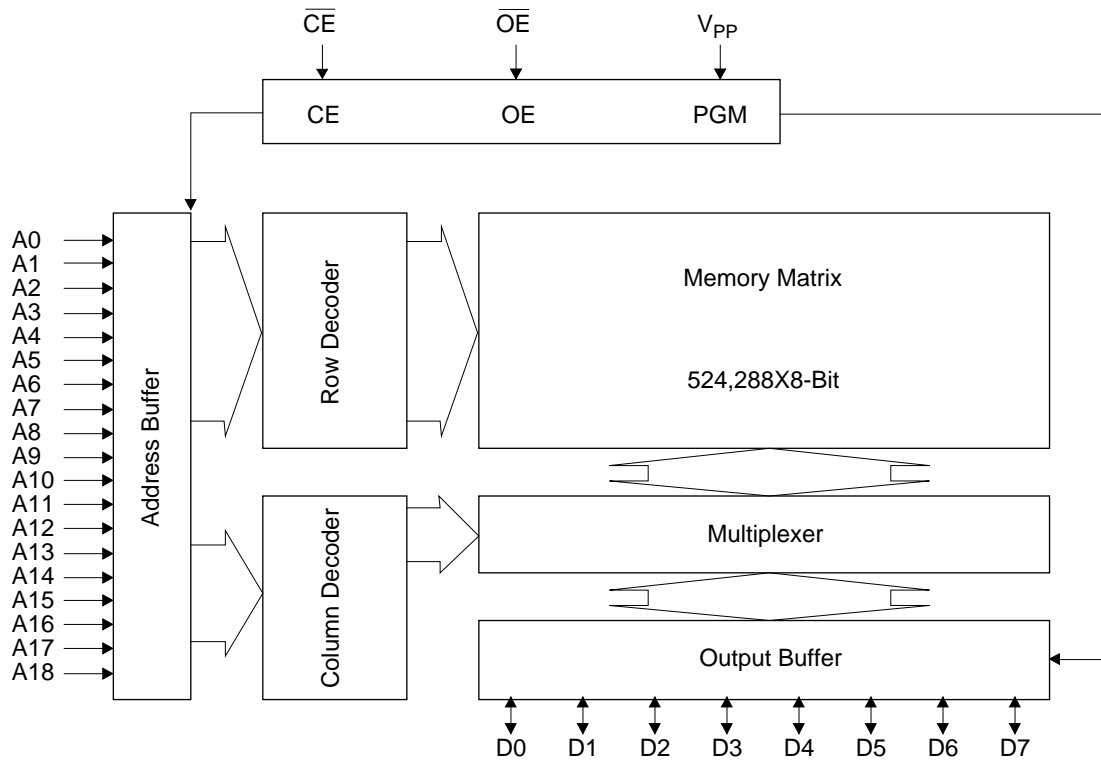
32-pin plastic DIP (DIP32-P-600-2.54) (Product name : MR27V401DRA)
32-pin plastic SOP (SOP32-P-525-1.27-K) (Product name : MR27V401DMA)
32-pin plastic TSOP (TSOP I 32-P-814-0.50-K) (Product name : MR27V401DTA)

PIN CONFIGURATION (TOP VIEW)



| PIN NAMES | FUNCTIONS |
|-----------------|------------------------------|
| A0 - A18 | Address input |
| D0 - D7 | Data output |
| \overline{CE} | Chip enable |
| \overline{OE} | Output enable |
| V _{CC} | Power supply voltage |
| V _{SS} | GND |
| V _{PP} | Program Power supply voltage |

BLOCK DIAGRAM



FUNCTION TABLE

| MODE | \overline{CE} | \overline{OE} | V_{PP} | V_{CC} | D0 - D7 |
|-----------------|-----------------|-----------------|----------|--------------|-----------|
| READ | L | L | ** | 3.0V to 3.3V | D_{OUT} |
| OUTPUT DISABLE | L | H | | | Hi-Z |
| STAND-BY | H | * | | | Hi-Z |
| PROGRAM | L | H | 9.75V | 4.0V | D_{IN} |
| PROGRAM INHIBIT | H | H | | | Hi-Z |
| PROGRAM VERIFY | H | L | | | D_{OUT} |

* : Don't Care (H or L)

** : Don't Care (H or L or Open)

ABSOLUTE MAXIMUM RATINGS

| Parameter | Symbol | Condition | Value | Unit |
|----------------------------------|------------------|-----------------------------|-------------------------------|------|
| Operating temperature under bias | T _{opr} | - | 0 to 70 | °C |
| Storage temperature | T _{stg} | | -55 to 125 | °C |
| Input voltage | V _I | relative to V _{SS} | -0.5 to V _{CC} + 0.5 | V |
| Output voltage | V _O | | -0.5 to V _{CC} + 0.5 | V |
| Power supply voltage | V _{CC} | | -0.5 to 5 | V |
| Program power supply voltage | V _{PP} | | -0.5 to 11.5 | V |
| Power dissipation per package | P _D | - | 1.0 | W |

RECOMMENDED OPERATING CONDITIONS(T_a=0 to 70°C)

| Parameter | Symbol | Condition | Min. | Typ. | Max. | Unit |
|--------------------------------------|-----------------|------------------------------|--------|------|-----------------------|------|
| V _{CC} power supply voltage | V _{CC} | V _{CC} =2.7V - 3.6V | 2.7 | - | 3.6 | V |
| V _{PP} power supply voltage | V _{PP} | | -0.5 | - | V _{CC} +0.5 | V |
| Input "H" level | V _{IH} | | 2.2 | - | V _{CC} +0.5* | V |
| Input "L" level | V _{IL} | | -0.5** | - | 0.6 | V |

Voltage is relative to V_{SS}* : V_{CC}+1.5V (Max.) when pulse width of overshoot is less than 10nS.

** : -1.5V (Min.) when pulse width of undershoot is less than 10nS.

ELECTRICAL CHARACTERISTICS (Read operation)**DC Characteristics 1**(V_{CC}=3V±0.3V, Ta=0 to 70°C)

| Parameter | Symbol | Condition | Min. | Typ. | Max. | Unit |
|--|-------------------|--|--------|------|-----------------------|------|
| Input leakage current | I _{LI} | V _I =0 to V _{CC} | - | - | 10 | μA |
| Output leakage current | I _{LO} | V _O =0 to V _{CC} | - | - | 10 | μA |
| V _{CC} power supply current (Standby) | I _{CCSC} | $\overline{CE}=V_{CC}$ | - | - | 50 | μA |
| | I _{CCST} | $\overline{CE}=V_{IH}$ | - | - | 1 | mA |
| V _{CC} power supply current (Read) | I _{CCA} | $\overline{CE}=V_{IL}$, $\overline{OE}=V_{IH}$ tc=80ns | - | - | 20 | mA |
| V _{PP} power supply current | I _{PP} | V _{PP} =V _{CC} | - | - | 10 | μA |
| Input "H" level | V _{IH} | - | 2.2 | - | V _{CC} +0.5* | V |
| Input "L" level | V _{IL} | - | -0.5** | - | 0.6 | V |
| Output "H" level | V _{OH} | I _{OH} =-400μA | 2.4 | - | - | V |
| Output "L" level | V _{OL} | I _{OL} =2.1mA | - | - | 0.4 | V |

Voltage is relative to V_{SS}* : V_{CC}+1.5V (Max.) when pulse width of overshoot is less than 10nS.

** : -1.5V (Min.) when pulse width of undershoot is less than 10nS.

DC Characteristics 2(V_{CC}=3.3V±0.3V, Ta=0 to 70°C)

| Parameter | Symbol | Condition | Min. | Typ. | Max. | Unit |
|--|-------------------|--|--------|------|-----------------------|------|
| Input leakage current | I _{LI} | V _I =0 to V _{CC} | - | - | 10 | μA |
| Output leakage current | I _{LO} | V _O =0 to V _{CC} | - | - | 10 | μA |
| V _{CC} power supply current (Standby) | I _{CCSC} | $\overline{CE}=V_{CC}$ | - | - | 50 | μA |
| | I _{CCST} | $\overline{CE}=V_{IH}$ | - | - | 1 | mA |
| V _{CC} power supply current (Read) | I _{CCA} | $\overline{CE}=V_{IL}$, $\overline{OE}=V_{IH}$ tc=70ns | - | - | 25 | mA |
| V _{PP} power supply current | I _{PP} | V _{PP} =V _{CC} | - | - | 10 | μA |
| Input "H" level | V _{IH} | - | 2.2 | - | V _{CC} +0.5* | V |
| Input "L" level | V _{IL} | - | -0.5** | - | 0.6 | V |
| Output "H" level | V _{OH} | I _{OH} =-400μA | 2.4 | - | - | V |
| Output "L" level | V _{OL} | I _{OL} =2.1mA | - | - | 0.4 | V |

Voltage is relative to V_{SS}* : V_{CC}+1.5V (Max.) when pulse width of overshoot is less than 10nS.

** : -1.5V (Min.) when pulse width of undershoot is less than 10nS.

AC Characteristics 1

(V_{CC}=3V±0.3V, Ta=0 to 70°C)

| Parameter | Symbol | Condition | Min. | Max. | Unit |
|-----------------------------|------------------|--------------------------------------|------|------|------|
| Address cycle time | T _C | - | 80 | - | ns |
| Address access time | T _{ACC} | $\overline{CE}=\overline{OE}=V_{IL}$ | - | 80 | ns |
| \overline{CE} access time | T _{CE} | $\overline{OE}=V_{IL}$ | - | 80 | ns |
| \overline{OE} access time | T _{OE} | $\overline{CE}=V_{IL}$ | - | 40 | ns |
| Output disable time | T _{CHZ} | $\overline{OE}=V_{IL}$ | 0 | 30 | ns |
| | T _{OHZ} | $\overline{CE}=V_{IL}$ | 0 | 25 | ns |
| Output hold time | T _{OH} | $\overline{CE}=\overline{OE}=V_{IL}$ | 0 | - | ns |

Measurement conditions

| | | |
|-------------------------------|-------|-----------|
| Input signal level | ----- | 0V/3V |
| Input timing reference level | ----- | 0.8V/2.0V |
| Output load | ----- | 50pF |
| Output timing reference level | ----- | 0.8V/2.0V |

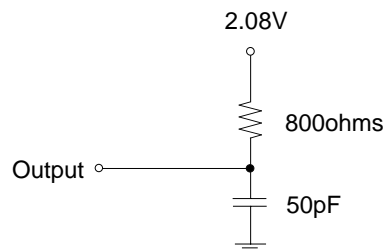
AC Characteristics 2

(V_{CC}=3.3V±0.3V, Ta=0 to 70°C)

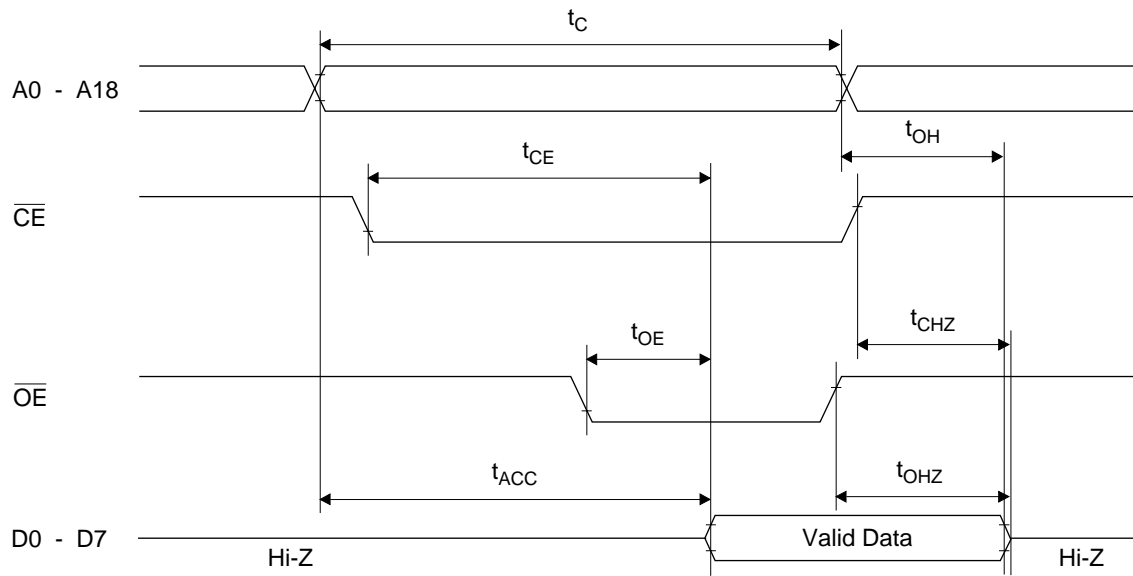
| Parameter | Symbol | Condition | Min. | Max. | Unit |
|-----------------------------|------------------|--------------------------------------|------|------|------|
| Address cycle time | T _C | - | 70 | - | ns |
| Address access time | T _{ACC} | $\overline{CE}=\overline{OE}=V_{IL}$ | - | 70 | ns |
| \overline{CE} access time | T _{CE} | $\overline{OE}=V_{IL}$ | - | 70 | ns |
| \overline{OE} access time | T _{OE} | $\overline{CE}=V_{IL}$ | - | 35 | ns |
| Output disable time | T _{CHZ} | $\overline{OE}=V_{IL}$ | 0 | 30 | ns |
| | T _{OHZ} | $\overline{CE}=V_{IL}$ | 0 | 25 | ns |
| Output hold time | T _{OH} | $\overline{CE}=\overline{OE}=V_{IL}$ | 0 | - | ns |

Measurement conditions

| | | |
|-------------------------------|-------|-----------|
| Input signal level | ----- | 0V/3V |
| Input timing reference level | ----- | 0.8V/2.0V |
| Output load | ----- | 50pF |
| Output timing reference level | ----- | 0.8V/2.0V |



TIMING CHART (READ CYCLE)



ELECTRICAL CHARACTERISTICS (Programming operation)

DC Characteristics

(Ta=25°C±5°C)

| Parameter | Symbol | Condition | Min. | Typ. | Max. | Unit |
|--|------------------|---------------------------------------|------|------|----------------------|------|
| Input leakage current | I _{LI} | V _I =V _{CC} +0.5V | - | - | 10 | μA |
| V _{PP} power supply current (Program) | I _{PP2} | $\overline{CE}=V_{IL}$ | - | - | 50 | mA |
| V _{CC} power supply current | I _{CC} | - | - | - | 50 | mA |
| Input "H" level | V _{IH} | - | 3.0 | - | V _{CC} +0.5 | V |
| Input "L" level | V _{IL} | - | -0.5 | - | 0.8 | V |
| Output "H" level | V _{OH} | I _{OH} =-400μA | 2.4 | - | - | V |
| Output "L" level | V _{OL} | I _{OL} =2.1mA | - | - | 0.45 | V |
| Program voltage | V _{PP} | - | 9.5 | 9.75 | 10.0 | V |
| V _{CC} power supply voltage | V _{CC} | - | 3.9 | 4.0 | 4.1 | V |

Voltage is relative to V_{SS}

AC Characteristics

(V_{CC}=4.0V±0.1V, V_{pp}=9.75V±0.25V, Ta=25°C±5°C)

| Parameter | Symbol | Condition | Min. | Typ. | Max. | Unit |
|---|------------------|-----------|------|------|------|------|
| Address set-up time | T _{AS} | - | 100 | - | - | ns |
| \overline{OE} set-up time | T _{OES} | - | 2 | - | - | μs |
| Data set-up time | T _{DS} | - | 100 | - | - | ns |
| Address hold time | T _{AH} | - | 2 | - | - | μs |
| Data hold time | T _{DH} | - | 100 | - | - | ns |
| Output float delay from \overline{OE} | T _{OHZ} | - | 0 | - | 100 | ns |
| V _{PP} voltage set-up time | T _{VS} | - | 2 | - | - | μs |
| Program pulse width | T _{PW} | - | 9 | 10 | 11 | μs |
| Data valid from \overline{OE} | T _{OE} | - | - | - | 100 | ns |
| Address hold from \overline{OE} high | T _{AHO} | - | 0 | - | - | ns |

Pin Check Function

Pin Check Function is to check contact between each device-pin and each socket-lead with EPROM programmer.

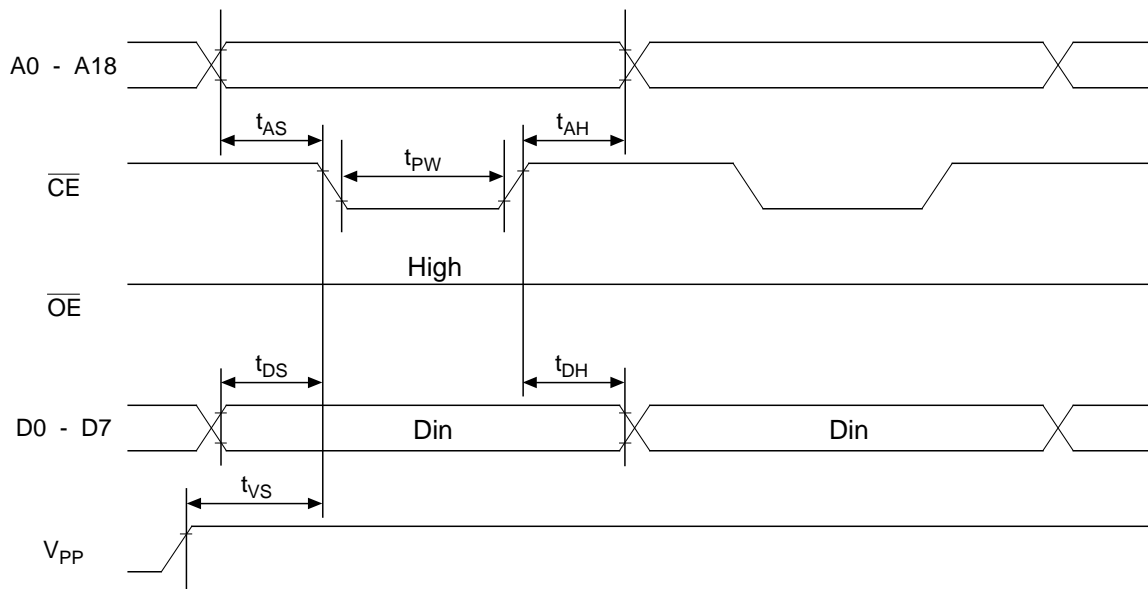
Setting up address as the following condition call the preprogrammed codes on device outputs.

(V_{CC}=3.3V±0.3V, $\overline{CE}=V_{IL}$, $\overline{OE}=V_{IL}$, Ta=25°C±5°C)

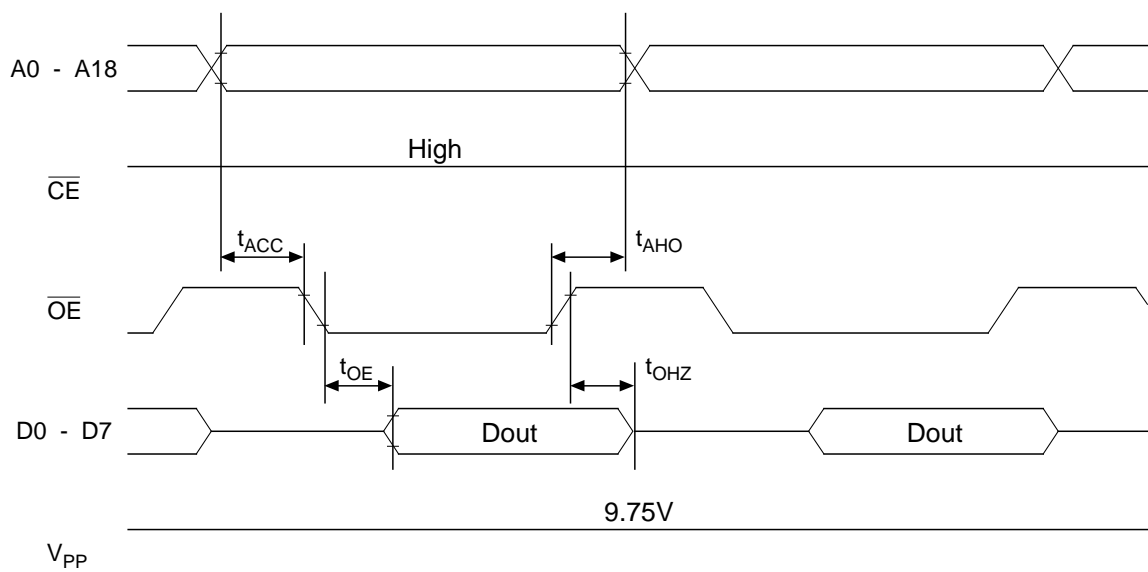
| A0 | A1 | A2 | A3 | A4 | A5 | A6 | A7 | A8 | A9 | A10 | A11 | A12 | A13 | A14 | A15 | A16 | A17 | A18 | DATA |
|------------------|----|----|----|----|----|----|----|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|
| 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | VH* | 1 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | AA |
| 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | VH* | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 55 |
| Other conditions | | | | | | | | | | | | | | | | | | | FF |

*:VH=8V±0.25V

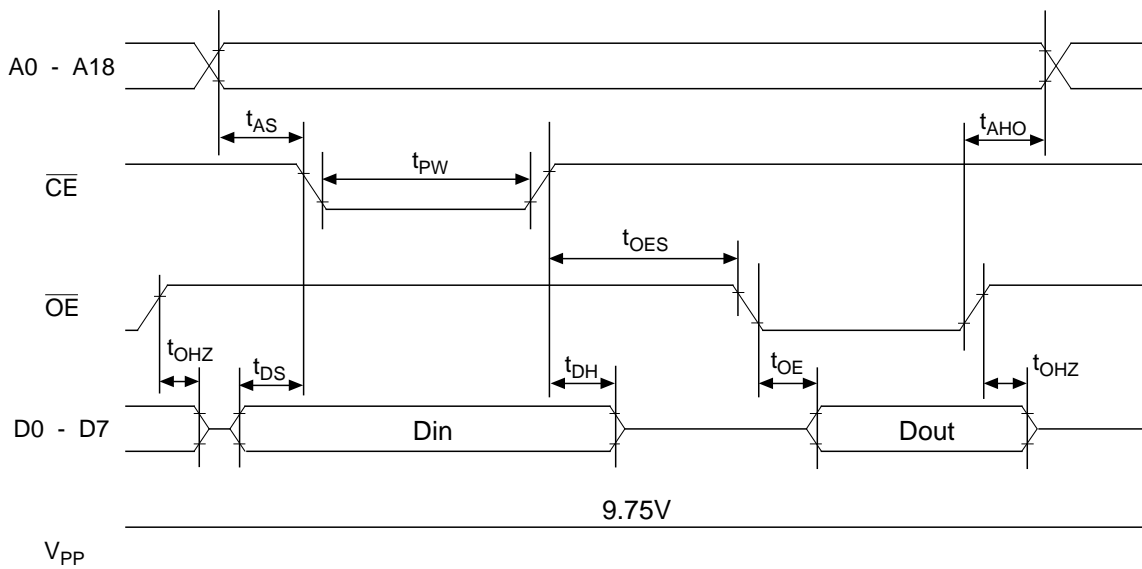
Consecutive Programming Waveforms



Consecutive Program Verify Waveforms



Program and Program Verify Cycle Waveforms



PIN Capacitance

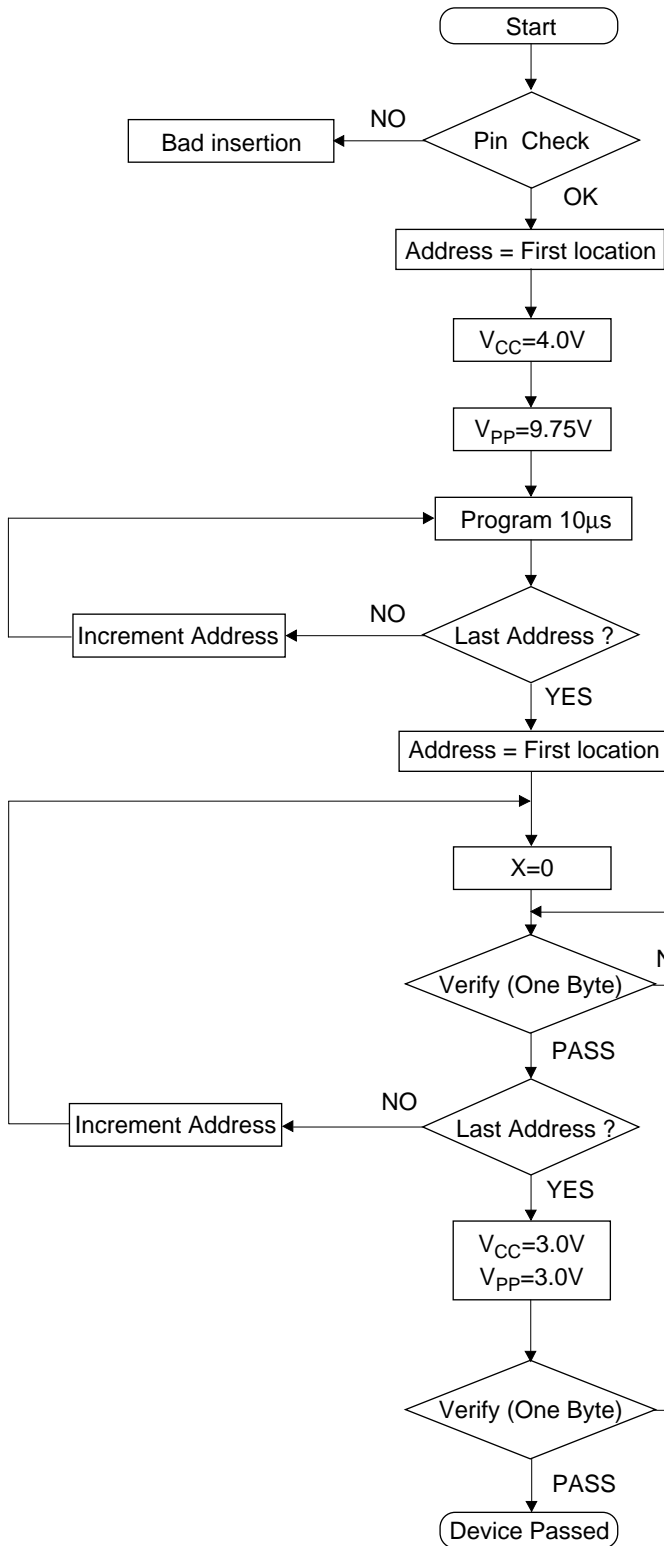
($V_{CC}=3.3V$, $T_a=25^\circ C$, $f=1MHz$)

| Parameter | Symbol | Condition | Min. | Typ. | Max. | Unit |
|-----------|-----------|-----------|------|------|---------|------|
| Input | C_{IN} | $V_I=0V$ | - | - | 8 (10) | pF |
| Output | C_{OUT} | $V_O=0V$ | - | - | 10 (12) | |

() : DIP only

Programming / Verify Flow Chart

Programming



Verify

