

## Description

The  $\mu$ PD27C512 is an ultraviolet erasable, electrically programmable 524,288-bit ROM fabricated with an advanced CMOS process for substantial power savings. The device is organized as 64K words by 8 bits and operates from a single +5-volt power supply. All inputs and outputs are TTL-compatible. The device is available in a 28-pin cerdip package with quartz window.

## Features

- 64K x 8-bit organization
- Ultraviolet erasable and electrically programmable
- High-speed programming mode
- Low power dissipation
  - 30 mA max (active)
  - 100  $\mu$ A max (standby)
- TTL-compatible inputs and outputs
- Single +5-volt power supply
- Three-state outputs
- Advanced CMOS technology
- 28-pin cerdip with quartz window

## Ordering Information

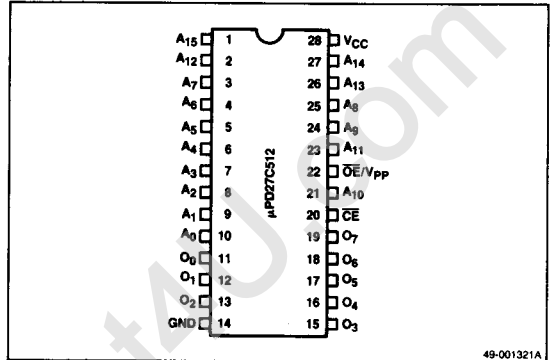
Part Number	Access Time (max)	Package
$\mu$ PD27C512D-15	150 ns	28-pin cerdip with quartz window
D-20	200 ns	

## Pin Identification

Symbol	Function
A <sub>0</sub> -A <sub>15</sub>	Address inputs
O <sub>0</sub> -O <sub>7</sub>	Data outputs
$\overline{CE}$	Chip enable
$\overline{OE}/V_{PP}$	Output enable/program voltage
GND	Ground
V <sub>CC</sub>	Power supply

## Pin Configuration

### 28-Pin Cerdip

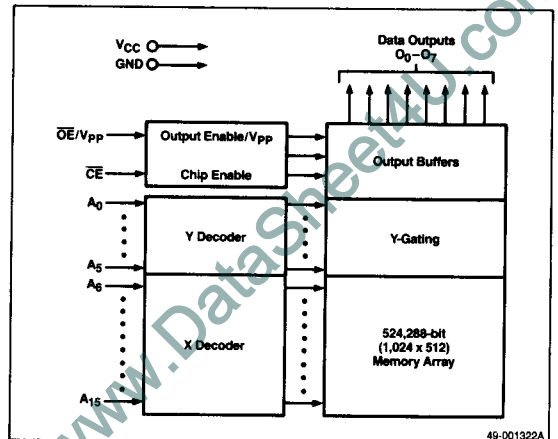


## Absolute Maximum Ratings

Output voltage, V <sub>O</sub>	-0.6 to +7.0 V
Input voltage, V <sub>I</sub>	-0.6 to +7.0 V
Input voltage, A <sub>9</sub>	-0.6 to +13.5 V
Supply voltage, V <sub>CC</sub>	-0.6 to +7.0 V
Supply voltage, V <sub>PP</sub>	-0.6 to +13.5 V
Operating temperature, T <sub>OPR</sub>	-10 to +80°C
Storage temperature, T <sub>STG</sub>	-65 to +125°C

**Comment:** Exposure to Absolute Maximum Ratings for extended periods may affect device reliability; exceeding the ratings could cause permanent damage. The device should be operated within the limits specified under DC and AC Characteristics.

## Block Diagram



**Mode Selection**

Mode	$\overline{CE}$	$\overline{OE}/V_{PP}$	$V_{CC}$	Outputs
Read	$V_{IL}$	$V_{IL}$	+5 V	$D_{OUT}$
Output disable	$V_{IL}$	$V_{IH}$	+5 V	High-Z
Standby	$V_{IH}$	X	+5 V	High-Z
Program	$V_{IL}$	$V_{PP}$	+6 V	$D_{IN}$
Program verify	$V_{IL}$	$V_{IL}$	+6 V	$D_{OUT}$
Program inhibit	$V_{IH}$	$V_{PP}$	+6 V	High-Z

**Notes:**

(1) X =  $V_{IL}$  or  $V_{IH}$

**DC Characteristics**

$T_A = 0$  to  $+70^\circ\text{C}$ ;  $V_{CC} = 5.0\text{ V} \pm 10\%$

Parameter	Symbol	Limits			Unit	Test Conditions
		Min	Typ	Max		
<b>Read and Standby Modes</b>						
Input voltage, high	$V_{IH}$	2.0		$V_{CC} + 0.3$	V	
Input voltage, low	$V_{IL}$	-0.3		0.8	V	
Output voltage, high	$V_{OH1}$	2.4			V	$I_{OH} = -400\ \mu\text{A}$
	$V_{OH2}$	$V_{CC} - 0.7$			V	$I_{OH} = -100\ \mu\text{A}$
Output voltage, low	$V_{OL}$			0.45	V	$I_{OL} = 2.1\text{ mA}$
Output leakage current	$I_{LO}$			10	$\mu\text{A}$	$V_0 = 0$ to $V_{CC}$ ; $\overline{OE} = V_{IH}$
Input leakage current	$I_{LI}$			10	$\mu\text{A}$	$V_I = 0$ to $V_{CC}$
	$I_{CCA1}$			30	$\text{mA}$	$\overline{CE} = V_{IL}$ ; $V_I = V_{IH}$
$V_{CC}$ current, active	$I_{CCA2}$			30	$\text{mA}$	$f = 5\text{ MHz}$ ; $I_{OUT} = 0\text{ mA}$
	$I_{CCS1}$			1	$\text{mA}$	$\overline{CE} = V_{IH}$
$V_{CC}$ current, standby	$I_{CCS2}$		1	100	$\mu\text{A}$	$\overline{CE} = V_{CC}$ ; $V_I = 0$ to $V_{CC}$

**Programming Modes**

$T_A = 25 \pm 5^\circ\text{C}$ ;  $V_{CC} = 6.0 \pm 0.25\text{ V}$ ;  $V_{PP} = 12.5 \pm 0.3\text{ V}$

Input voltage, high	$V_{IH}$	2.0		$V_{CC} + 0.3$	V	
Input voltage, low	$V_{IL}$	-0.3		0.8	V	
Input leakage current	$I_{LI}$			10	$\mu\text{A}$	$V_I = V_{IL}$ or $V_{IH}$
Output voltage, high	$V_{OH}$	2.4			V	$I_{OH} = -400\ \mu\text{A}$
Output voltage, low	$V_{OL}$			0.45	V	$I_{OL} = 2.1\text{ mA}$
$V_{PP}$ current	$I_{PP}$			30	$\text{mA}$	$\overline{CE} = V_{IL}$ ; $\overline{OE}/V_{PP} = V_{IH}$
$V_{CC}$ current	$I_{CC}$			30	$\text{mA}$	

**Capacitance**

$T_A = 25^\circ\text{C}$ ;  $f = 1\text{ MHz}$

Parameter	Symbol	Limits			Unit	Test Conditions
		Min	Typ	Max		
Input capacitance	$C_{IN1}$			6	pF	$V_I = 0\text{ V}$
	$C_{IN2}$			20	pF	$\overline{OE}/V_{PP}$ ; $V_I = 0\text{ V}$
Output capacitance	$C_{OUT}$			12	pF	$V_0 = 0\text{ V}$

## AC Characteristics, Read and Standby Modes

T<sub>A</sub> = 0 to +70°C; V<sub>CC</sub> = 5.0 V ±10%

Parameter	Symbol	Limits				Unit	Test Conditions
		μPD27C512-15		μPD27C512-20			
		Min	Max	Min	Max		
Address to output delay	t <sub>AGC</sub>		150		200	ns	$\overline{CE} = \overline{OE}/V_{PP} = V_{IL}$
$\overline{CE}$ to output delay	t <sub>CE</sub>		150		200	ns	$\overline{OE}/V_{PP} = V_{IL}$
$\overline{OE}/V_{PP}$ to output delay	t <sub>OE</sub>		75		75	ns	$\overline{CE} = V_{IL}$
$\overline{OE}/V_{PP}$ high to output float	t <sub>DF</sub>	0	60	0	60	ns	$\overline{CE} = V_{IL}$
Output hold from address, $\overline{CE}$ or $\overline{OE}$ , whichever transition occurs first	t <sub>OH</sub>	0		0		ns	$\overline{CE} = \overline{OE}/V_{PP} = V_{IL}$

### Notes:

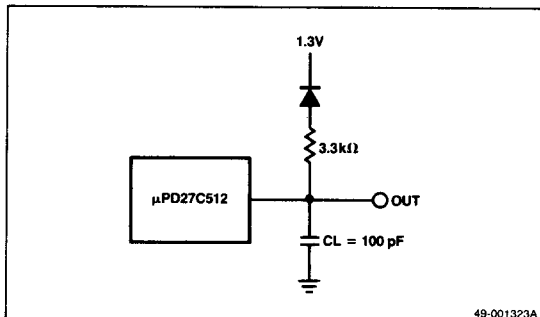
- (1) Output load: see figure 1. Input rise and fall times ≤ 20 ns. Input pulse levels: 0.45 and 2.4 V. Timing measurement reference levels: inputs and outputs = 0.8 and 2.0 V

## AC Characteristics, Programming Modes

T<sub>A</sub> = 25 ±5°C; V<sub>CC</sub> = 6.0 ±0.25 V; V<sub>PP</sub> = 12.5 ±0.3 V

Parameter	Symbol	Limits			Unit	Test Conditions
		Min	Typ	Max		
Address setup time	t <sub>AS</sub>	2			μs	
$\overline{OE}$ setup time	t <sub>OES</sub>	2			μs	
Data setup time	t <sub>DS</sub>	2			μs	
Address hold time	t <sub>AH</sub>	2			μs	
Data hold time	t <sub>DH</sub>	2			μs	
$\overline{CE}$ to output float time	t <sub>DF</sub>	0		130	ns	
V <sub>CC</sub> setup time	t <sub>VCS</sub>	2			μs	
Initial program pulse width	t <sub>PW</sub>	0.95	1.0	1.05	ms	
Overprogram pulse width	t <sub>OPW</sub>	2.85		78.75	ms	
$\overline{CE}$ to output delay	t <sub>DV</sub>			1	μs	$\overline{OE}/V_{PP} = V_{IL}$
$\overline{OE}/V_{PP}$ hold time	t <sub>OEH</sub>	2			μs	
$\overline{OE}/V_{PP}$ recovery time	t <sub>VR</sub>	2			μs	
$\overline{OE}/V_{PP}$ rise time	t <sub>PRT</sub>	50			ns	

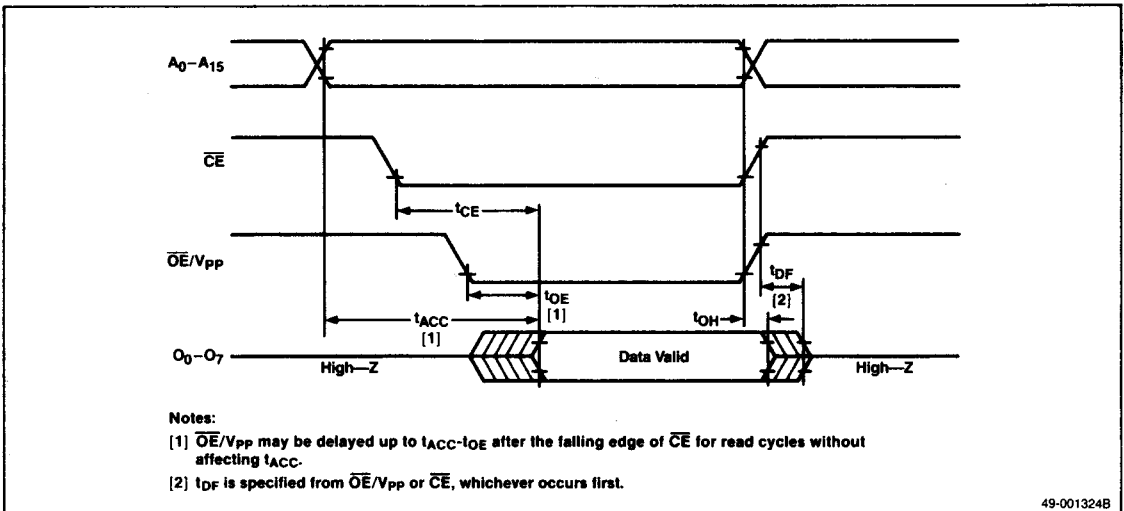
Figure 1. Loading Conditions Test Circuit



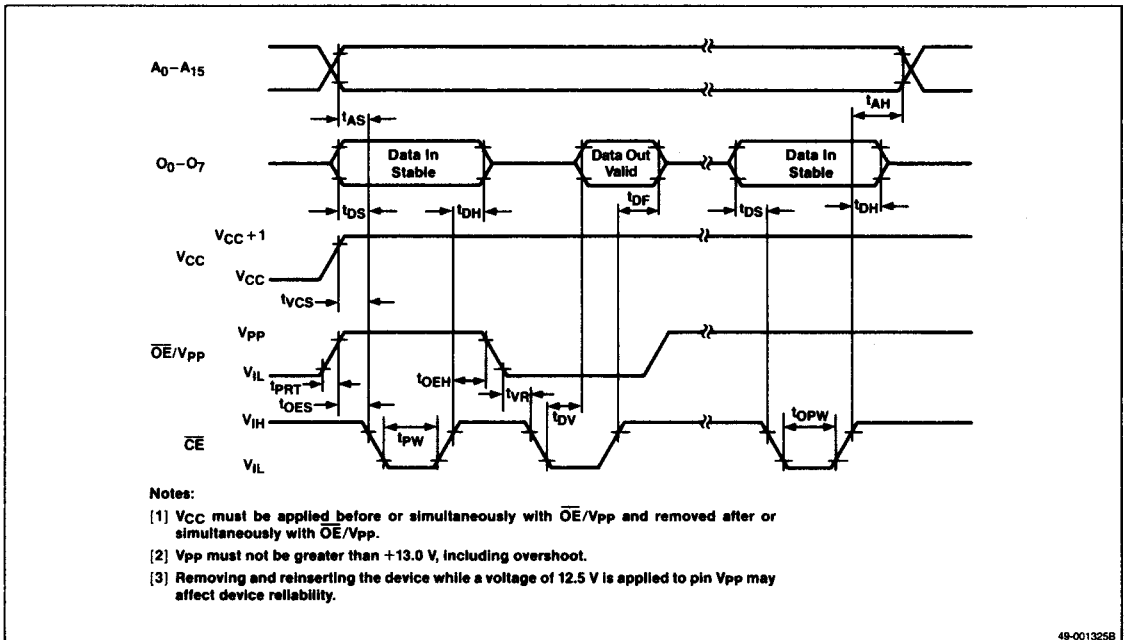
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**Timing Waveforms**

**Read Mode**



**Programming Mode**



## Programming Operation

### High-Speed Programming Mode

Begin programming by erasing all data; this places all bits in the high-level (1) state. Enter data by programming a low-level (0) TTL signal into the chosen bit location.

Address the first location and apply valid data at the eight output pins. Raise  $V_{CC}$  to  $+6V \pm 0.25V$ ; then raise  $\overline{OE}/V_{PP}$  to  $+12.5V \pm 0.3V$ . Apply a 1-ms ( $\pm 5\%$ ) program pulse to  $\overline{CE}$  as shown in the programming mode timing waveform. The bit is verified and the program/no-program decision is made. If the bit is not programmed, apply another 1-ms pulse to  $\overline{CE}$ , up to a maximum of 25 times. If the bit is programmed within 25 tries, apply an additional overprogram pulse of "x" ms (where "x" equals the number of tries multiplied by 3) and input the next address. If the bit is not programmed in 25 tries, reject the device as a program failure.

### Programming Inhibit Mode

Use the programming inhibit mode to program multiple μPD27C512s connected in parallel. All like inputs (except  $\overline{CE}$ , but including  $\overline{OE}/V_{PP}$ ) may be common. Program individual devices by applying a low-level (0) TTL pulse to the  $\overline{CE}$  input of the μPD27C512 to be programmed. Applying a high level (1) to the  $\overline{CE}$  input of the other devices prevents them from being programmed.

### Program Verify Mode

Perform verification on the programmed bits to determine that the data was correctly programmed. The program verification can be performed with  $\overline{CE}$  and  $\overline{OE}/V_{PP}$  at low levels (0).

### Erasure

Erase data on the μPD27C512 by exposing it to light with a wavelength shorter than 400 nm. Exposure to direct sunlight or fluorescent light could also erase the data. Consequently, mask the window to prevent unintentional erasure by ultraviolet rays.

Data is typically erased by 254-nm ultraviolet rays. A minimum lighting level of  $15W \text{ sec/cm}^2$  (ultraviolet ray intensity multiplied by exposure time) is required to completely erase written data.

An ultraviolet lamp rated at  $12,000 \mu\text{W/cm}^2$  takes approximately 15 to 20 minutes to complete erasure. Place the μPD27C512 within 2.5 cm of the lamp tubes. Remove any filter on the lamp.