

512K (64K x 8) CMOS EPROM

FEATURES

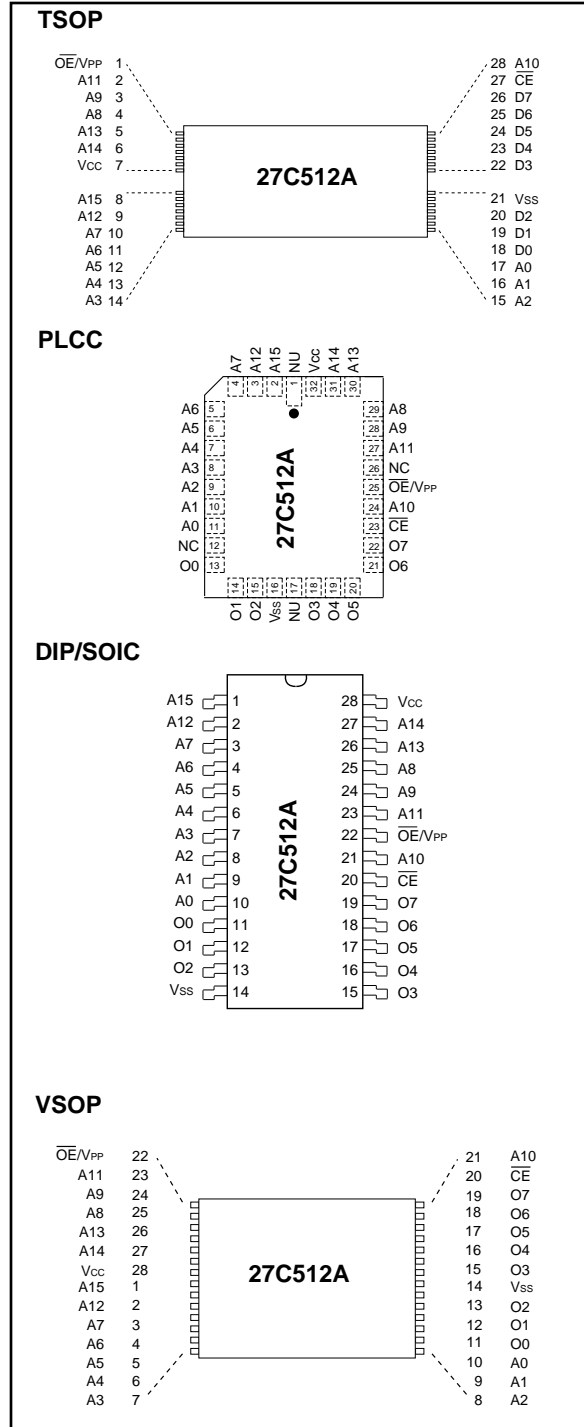
- High speed performance
- CMOS Technology for low power consumption
 - 25 mA Active current
 - 30 μ A Standby current
- Factory programming available
- Auto-insertion-compatible plastic packages
- Auto ID aids automated programming
- High speed express programming algorithm
- Organized 64K x 8: JEDEC standard pinouts
 - 28-pin Dual-in-line package
 - 32-pin PLCC Package
 - 28-pin SOIC package
 - 28-pin TSOP package
 - 28-pin VSOP package
 - Tape and reel
- Data Retention > 200 years
- Available for the following temperature ranges
 - Commercial: 0°C to +70°C
 - Industrial: -40°C to +85°C
 - Automotive: -40°C to +125°C

DESCRIPTION

The Microchip Technology Inc. 27C512A is a CMOS 512K bit electrically Programmable Read Only Memory (EPROM). The device is organized into 64K words by 8 bits (64K bytes). Accessing individual bytes from an address transition or from power-up (chip enable pin going low) is accomplished in less than 90 ns. This very high speed device allows the most sophisticated microprocessors to run at full speed without the need for WAIT states. CMOS design and processing enables this part to be used in systems where reduced power consumption and high reliability are requirements.

A complete family of packages is offered to provide the most flexibility in applications. For surface mount applications, PLCC, VSOP, TSOP or SOIC packaging is available. Tape or reel packaging is also available for PLCC or SOIC packages.

PACKAGE TYPES



27C512A

1.0 ELECTRICAL CHARACTERISTICS

1.1 Maximum Ratings*

VCC and input voltages w.r.t. VSS -0.6V to +7.25V
 VPP voltage w.r.t. VSS during programming -0.6V to +14V
 Voltage on A9 w.r.t. VSS -0.6V to +13.5V
 Output voltage w.r.t. VSS -0.6V to VCC +1.0V
 Storage temperature -65°C to +150°C
 Ambient temp. with power applied -65°C to +125°C

*Notice: Stresses above those listed under "Maximum Ratings" may cause permanent damage to the device. This is a stress rating only and functional operation of the device at those or any other conditions above those indicated in the operation listings of this specification is not implied. Exposure to maximum rating conditions for extended periods may affect device reliability.

TABLE 1-1: PIN FUNCTION TABLE

Name	Function
A0-A15	Address Inputs
\overline{CE}	Chip Enable
\overline{OE}/V_{PP}	Output Enable/Programming Voltage
O0 - O7	Data Output
VCC	+5V Power Supply
VSS	Ground
NC	No Connection; No Internal Connection
NU	Not Used; No External Connection is Allowed

TABLE 1-2: READ OPERATION DC CHARACTERISTICS

VCC = +5V ±10% Commercial: Tamb = 0°C to +70°C Industrial: Tamb = -40°C to +85°C Extended (Automotive): Tamb = -40°C to +125°C							
Parameter	Part*	Status	Symbol	Min	Max	Units	Conditions
Input Voltages	all	Logic "1" Logic "0"	VIH VIL	2.0 -0.5	VCC+1 0.8	V V	
Input Leakage	all		ILI	-10	10	µA	VIN = 0 to VCC
Output Voltages	all	Logic "1" Logic "0"	VOH VOL	2.4	0.45	V V	IOH = - 400 µA IOL = 2.1 mA
Output Leakage	all	—	ILO	-10	10	µA	VOUT = 0V to VCC
Input Capacitance	all	—	CIN	—	6	pF	VIN = 0V; Tamb = 25°C; f = 1 MHz
Output Capacitance	all	—	COUT	—	12	pF	VOUT = 0V; Tamb = 25°C; f = 1 MHz
Power Supply Current, Active	C I, E	TTL input TTL input	ICC ICC	— —	25 35	mA mA	VCC = 5.5V f = 1 MHz; $\overline{OE}/V_{PP} = \overline{CE} = V_{IL}$; IOUT = 0 mA; VIL = -0.1 to 0.8V; VIH = 2.0 to VCC; Note 1
Power Supply Current, Standby	C I, E all	TTL input TTL input CMOS input	ICC(S)TLL ICC(S)TLL ICC(S)CMOS	— — —	1 2 30	mA mA µA	$\overline{CE} = V_{CC} \pm 0.2V$

* Parts: C=Commercial Temperature Range; I, E=Industrial and Extended Temperature Ranges

Note 1: Typical active current increases .75 mA per MHz up to operating frequency for all temperature ranges.

TABLE 1-3: READ OPERATION AC CHARACTERISTICS

		AC Testing Waveform:		V _{IH} = 2.4V and V _{IL} = .45V; V _{OH} = 2.0V and V _{OL} = 0.8V							
		Output Load:		1 TTL Load + 100 pF							
		Input Rise and Fall Times:		10 ns							
		Ambient Temperature:		Commercial:		T _{amb} = 0°C to +70°C		Industrial:		T _{amb} = -40°C to +85°C	
				Extended (Automotive):		T _{amb} = -40°C to +125°C					
Parameter	Sym	27C512-90*		27C512-10*		27C512-12		27C512-15		Units	Conditions
		Min	Max	Min	Max	Min	Max	Min	Max		
Address to Output Delay	t _{ACC}	—	90	—	100	—	120	—	150	ns	$\overline{CE} = \overline{OE}/V_{PP} = V_{IL}$
\overline{CE} to Output Delay	t _{CE}	—	90	—	100	—	120	—	150	ns	$\overline{OE}/V_{PP} = V_{IL}$
\overline{OE} to Output Delay	t _{OE}	—	40	—	40	—	50	—	60	ns	$\overline{CE} = V_{IL}$
\overline{OE} to Output High Impedance	t _{OFF}	0	35	0	35	0	40	0	45	ns	
Output Hold from Address, \overline{CE} or \overline{OE}/V_{PP} , whichever occurred first	t _{OH}	0	—	0	—	0	—	0	—	ns	

*90/10 AC Testing Waveforms: V_{IH} = 3.0V and V_{IL} = 0V; V_{OH} = 1.5V and V_{OL} = 1.5V
Output Load: 1 TTL Load + 30 pF

FIGURE 1-1: READ WAVEFORMS

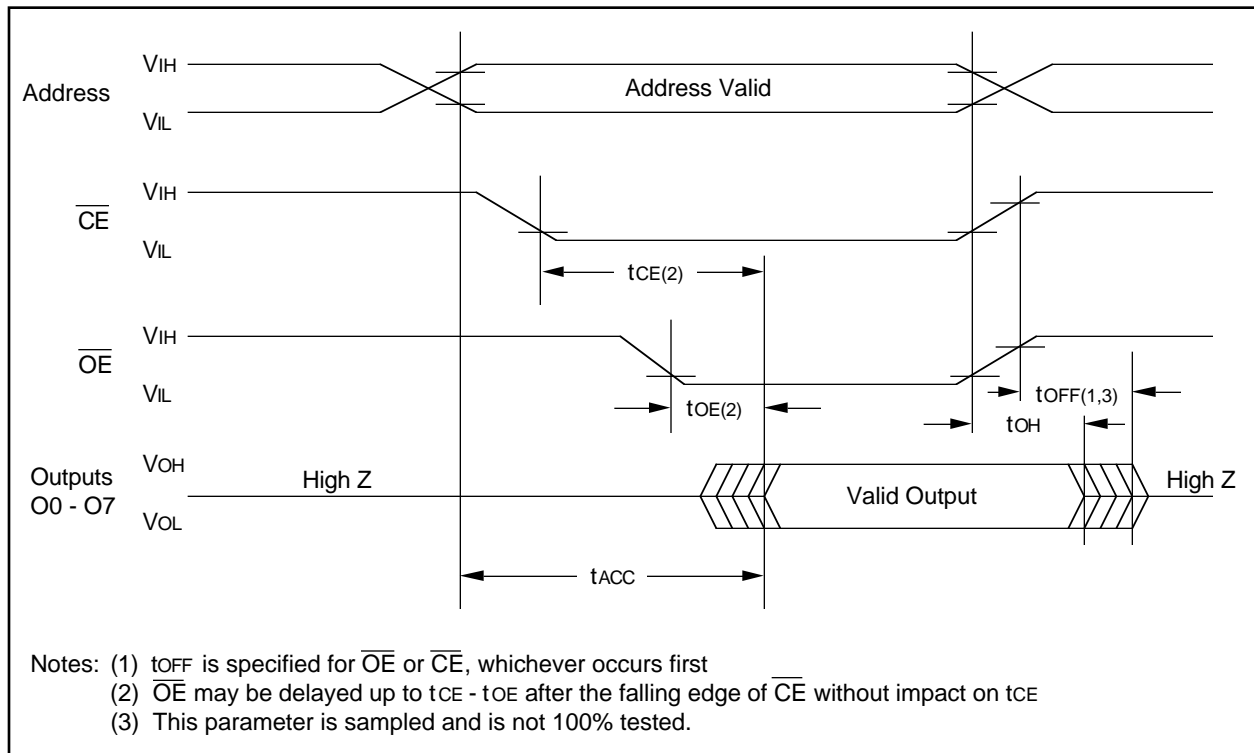


TABLE 1-4: PROGRAMMING DC CHARACTERISTICS

Ambient Temperature: $T_{amb} = 25^{\circ}\text{C} \pm 5^{\circ}\text{C}$ $V_{CC} = 6.5\text{V} \pm 0.25\text{V}$, $\overline{\text{OE}}/V_{PP} = V_H = 13.0\text{V} \pm 0.25\text{V}$						
Parameter	Status	Symbol	Min.	Max.	Units	Conditions (See Note 1)
Input Voltages	Logic "1"	V_{IH}	2.0	$V_{CC}+1$	V	
	Logic "0"	V_{IL}	-0.1	0.8	V	
Input Leakage	—	I_{LI}	-10	10	μA	$V_{IN} = 0\text{V to } V_{CC}$
Output Voltages	Logic "1"	V_{OH}	2.4		V	$I_{OH} = -400 \mu\text{A}$
	Logic "0"	V_{OL}	—	0.45	V	$I_{OL} = 2.1 \text{ mA}$
VCC Current, program & verify	—	I_{CC2}	—	35	mA	$\overline{\text{CE}} = V_{IL}$
$\overline{\text{OE}}/V_{PP}$ Current, program	—	I_{PP2}	—	25	mA	
A9 Product Identification	—	V_{ID}	11.5	12.5	V	

Note 1: V_{CC} must be applied simultaneously or before V_{PP} voltage on $\overline{\text{OE}}/V_{PP}$ and removed simultaneously or after the V_{PP} voltage on $\overline{\text{OE}}/V_{PP}$.

TABLE 1-5: PROGRAMMING AC CHARACTERISTICS

for Program, Program Verify and Program Inhibit Modes		AC Testing Waveform: $V_{IH}=2.4\text{V}$ and $V_{IL}=0.45\text{V}$; $V_{OH}=2.0\text{V}$; $V_{OL}=0.8\text{V}$ Ambient Temperature: $25^{\circ}\text{C} \pm 5^{\circ}\text{C}$ $V_{CC} = 6.5\text{V} \pm 0.25\text{V}$, $\overline{\text{OE}}/V_{PP} = V_H = 13.0\text{V} \pm 0.25 \text{ V}$				
Parameter	Symbol	Min.	Max.	Units	Remarks	
Address Set-Up Time	tAS	2	—	μs		
Data Set-Up Time	tDS	2	—	μs		
Data Hold Time	tDH	2	—	μs		
Address Hold Time	tAH	0	—	μs		
Float Delay (2)	tDF	0	130	ns		
VCC Set-Up Time	tVCS	2	—	μs		
Program Pulse Width (1)	tPW	95	105	μs	100 μs typical	
$\overline{\text{CE}}$ Set-Up Time	tCES	2	—	μs		
$\overline{\text{OE}}$ Set-Up Time	tOES	2	—	μs		
$\overline{\text{OE}}$ Hold Time	tOEH	2	—	μs		
$\overline{\text{OE}}$ Recovery Time	tOR	2	—	μs		
$\overline{\text{OE}}/V_{PP}$ Rise Time During Programming	tPRT	50	—	ns		

Note 1: For express algorithm, initial programming width tolerance is 100 $\mu\text{s} \pm 5\%$.

2: This parameter is only sampled and not 100% tested. Output float is defined as the point where data is no longer driven (see timing diagram).

FIGURE 1-2: PROGRAMMING WAVEFORMS (1)

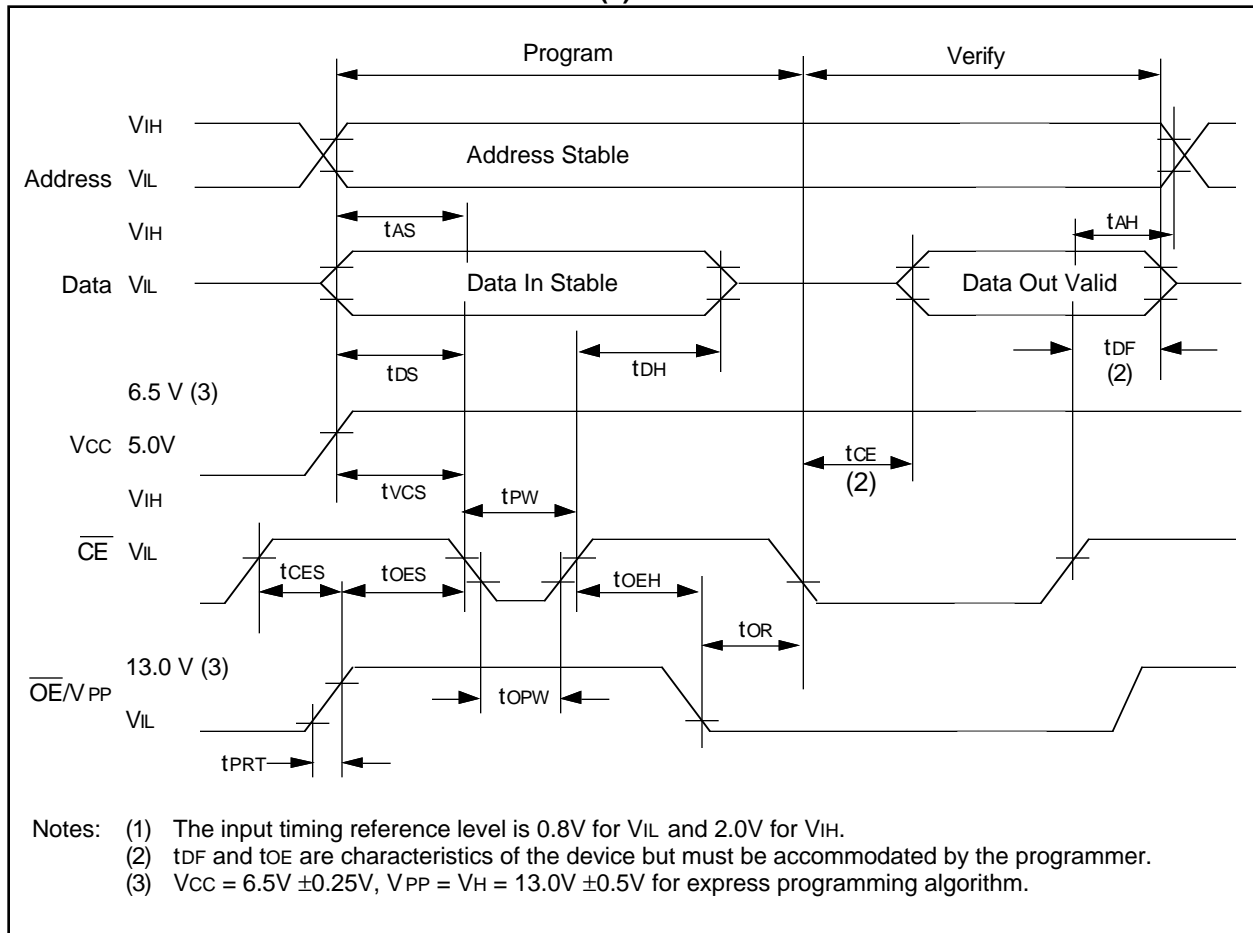


TABLE 1-6: MODES

Operation Mode	\overline{CE}	$\overline{OE/VPP}$	A9	O0 - O7
Read	V _{IL}	V _{IL}	X	DOUT
Program	V _{IL}	V _H	X	DIN
Program Verify	V _{IL}	V _{IL}	X	DOUT
Program Inhibit	V _{IH}	V _H	X	High Z
Standby	V _{IH}	X	X	High Z
Output Disable	V _{IL}	V _{IH}	X	High Z
Identity	V _{IL}	V _{IL}	V _H	Identity Code

X = Don't Care

1.2 Read Mode

(See Timing Diagrams and AC Characteristics)

Read Mode is accessed when

- the CE pin is low to power up (enable) the chip
- the OE/VPP pin is low to gate the data to the output pins

For Read operations, if the addresses are stable, the address access time (t_{ACC}) is equal to the delay from \overline{CE} to output (t_{CE}). Data is transferred to the output after a delay (t_{OE}) from the falling edge of $\overline{OE/VPP}$.

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1.3 Standby Mode

The standby mode is entered when the \overline{CE} pin is high, and the program mode is not identified.

When this conditions are met, the supply current will drop from 25 mA to 30 μ A.

1.4 Output Enable \overline{OE}/VPP

This multifunction pin eliminates bus connection in multiple bus microprocessor systems and the outputs go to high impedance when:

- the \overline{OE}/VPP pin is high (V_{IH}).

When a V_H input is applied to this pin, it supplies the programming voltage (V_{PP}) to the device.

1.5 Erase Mode (UV Windowed Versions)

Windowed products offer the ability to erase the memory array. The memory matrix is erased to the all "1's" state as a result of being exposed to ultraviolet light. To ensure complete erasure, a dose of 15 watt-second/ cm^2 is required. This means that the device window must be placed within one inch and directly underneath an ultraviolet lamp with a wavelength of 2537 Angstroms, intensity of 12,000 mW/ cm^2 for approximately 40 minutes.

1.6 Programming Mode

The Express algorithm must be used for best results. It has been developed to improve programming yields and throughput times in a production environment. Up to 10 100-microsecond pulses are applied until the byte is verified. A flowchart of the Express algorithm is shown in Figure 1-3.

Programming takes place when:

- V_{CC} is brought to the proper voltage,
- \overline{OE}/V_{PP} is brought to the proper V_H level, and
- \overline{CE} line is low.

Since the erased state is "1" in the array, programming of "0" is required. The address to be programmed is set via pins A0 - A15 and the data to be programmed is presented to pins O0 - O7. When data and address are stable, a low going pulse on the \overline{CE} line programs that location.

1.7 Verify

After the array has been programmed it must be verified to ensure all the bits have been correctly programmed. This mode is entered when all the following conditions are met:

- V_{CC} is at the proper level,
- the \overline{OE}/V_{PP} pin is low, and
- the \overline{CE} line is low.

1.8 Inhibit

When programming multiple devices in parallel with different data, only \overline{CE} needs to be under separate control to each device. By pulsing the \overline{CE} line low on a particular device, that device will be programmed; all other devices with \overline{CE} held high will not be programmed with the data (although address and data will be available on their input pins).

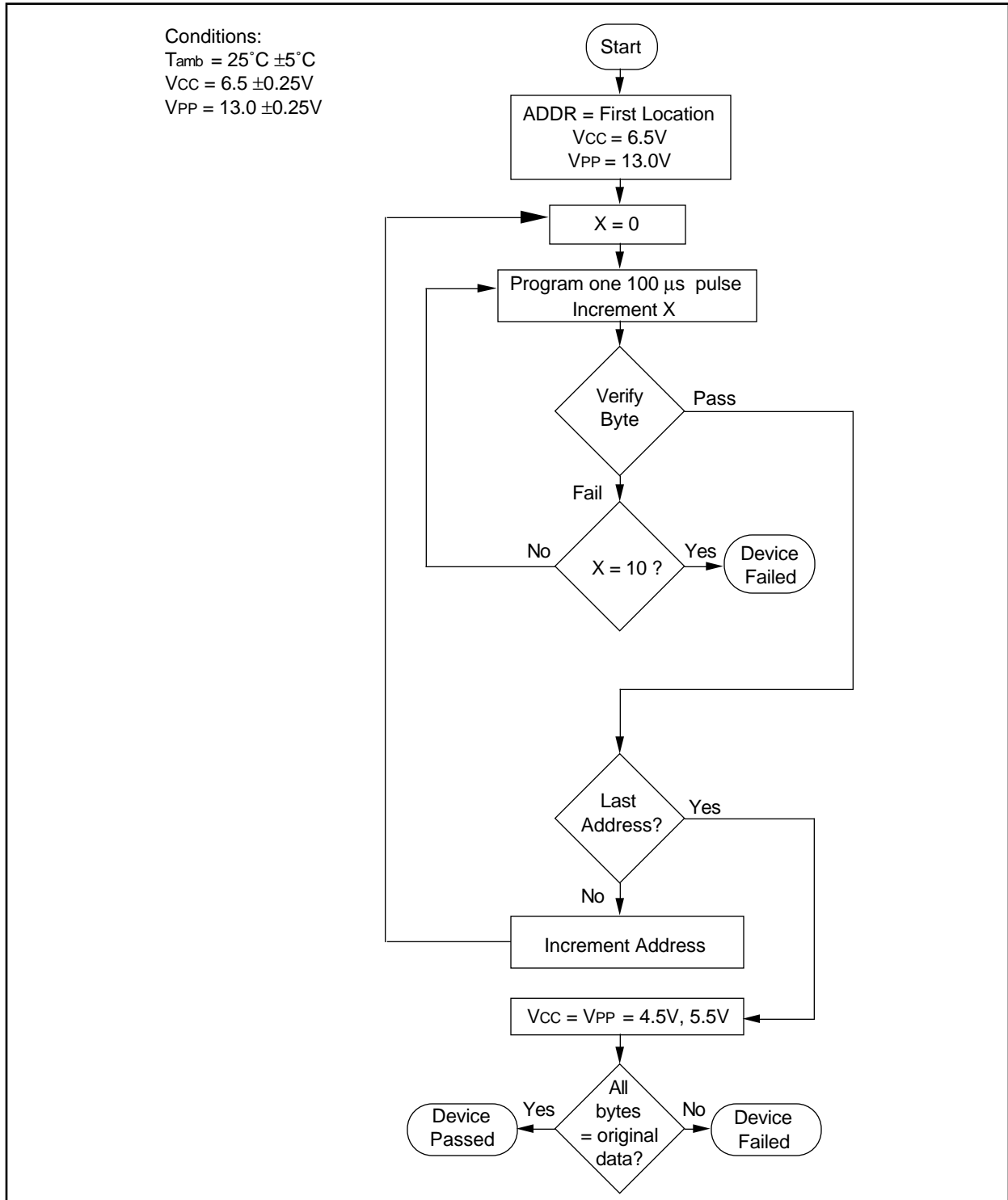
1.9 Identity Mode

In this mode specific data is output which identifies the manufacturer as Microchip Technology Inc. and the device type. This mode is entered when Pin A9 is taken to V_H (11.5V to 12.5V). The \overline{CE} and \overline{OE}/V_{PP} lines must be at V_{IL} . A0 is used to access any of the two non-erasable bytes whose data appears on O0 through O7.

Pin \rightarrow	Input	Output								
Identity \downarrow	A0	0	0	0	0	0	0	0	0	H e x
		7	6	5	4	3	2	1	0	
Manufacturer	V_{IL}	0	0	1	0	1	0	0	1	29
Device Type*	V_{IH}	1	0	0	0	1	1	0	0	0D

* Code subject to change

FIGURE 1-3: PROGRAMMING EXPRESS ALGORITHM



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27C512A Product Identification System

To order or to obtain information (e.g., on pricing or delivery), please use listed part numbers, and refer to factory or listed sales offices.

27C512A	-	70	I	/P	
					Package:
					L = Plastic Leaded Chip Carrier
					P = Plastic DIP (600 Mil)
					SO = Plastic SOIC (300 Mil)
					TS = Thin Small Outline Package(TSOP) 8x20mm
					VS = Very Small Outline Package(VSOP) 8x13.4mm
					Temperature Range:
					Blank = 0°C to +70°C
					I = -40°C to +85°C
					E = -40°C to +125°C
					Access Time:
					90 = 90 ns
					10 = 100 ns
					12 = 120 ns
					15 = 150 ns
					Device:
					27C512A 512K (64K x 8) CMOS EPROM

WORLDWIDE SALES & SERVICE

AMERICAS

Corporate Office

Microchip Technology Inc.
2355 West Chandler Blvd.
Chandler, AZ 85224-6199
Tel: 602 786-7200 Fax: 602 786-7277
Technical Support: 602 786-7627
Web: <http://www.microchip.com>

Atlanta

Microchip Technology Inc.
500 Sugar Mill Road, Suite 200B
Atlanta, GA 30350
Tel: 770 640-0034 Fax: 770 640-0307

Boston

Microchip Technology Inc.
5 Mount Royal Avenue
Marlborough, MA 01752
Tel: 508 480-9990 Fax: 508 480-8575

Chicago

Microchip Technology Inc.
333 Pierce Road, Suite 180
Itasca, IL 60143
Tel: 708 285-0071 Fax: 708 285-0075

Dallas

Microchip Technology Inc.
14651 Dallas Parkway, Suite 816
Dallas, TX 75240-8809
Tel: 972 991-7177 Fax: 972 991-8588

Dayton

Microchip Technology Inc.
Suite 150
Two Prestige Place
Miamisburg, OH 45342
Tel: 513 291-1654 Fax: 513 291-9175

Los Angeles

Microchip Technology Inc.
18201 Von Karman, Suite 1090
Irvine, CA 92612
Tel: 714 263-1888 Fax: 714 263-1338

New York

Microchip Technmgy Inc.
150 Motor Parkway, Suite 416
Hauppauge, NY 11788
Tel: 516 273-5305 Fax: 516 273-5335

San Jose

Microchip Technology Inc.
2107 North First Street, Suite 590
San Jose, CA 95131
Tel: 408 436-7950 Fax: 408 436-7955

Toronto

Microchip Technology Inc.
5925 Airport Road, Suite 200
Mississauga, Ontario L4V 1W1, Canada
Tel: 905 405-6279 Fax: 905 405-6253

ASIA/PACIFIC

China

Microchip Technology
Unit 406 of Shanghai Golden Bridge Bldg.
2077 Yan'an Road West, Hongjiao District
Shanghai, Peoples Republic of China
Tel: 86 21 6275 5700
Fax: 011 86 21 6275 5060

Hong Kong

Microchip Technology
RM 3801B, Tower Two
Metroplaza
223 Hing Fong Road
Kwai Fong, N.T. Hong Kong
Tel: 852 2 401 1200 Fax: 852 2 401 3431

India

Microchip Technology
No. 6, Legacy, Convent Road
Bangalore 560 025 India
Tel: 91 80 526 3148 Fax: 91 80 559 9840

Korea

Microchip Technology
168-1, Youngbo Bldg. 3 Floor
Samsung-Dong, Kangnam-Ku,
Seoul, Korea
Tel: 82 2 554 7200 Fax: 82 2 558 5934

Singapore

Microchip Technology
200 Middle Road
#10-03 Prime Centre
Singapore 188980
Tel: 65 334 8870 Fax: 65 334 8850

Taiwan, R.O.C

Microchip Technology
10F-1C 207
Tung Hua North Road
Taipei, Taiwan, ROC
Tel: 886 2 717 7175 Fax: 886 2 545 0139

EUROPE

United Kingdom

Arizona Microchip Technology Ltd.
Unit 6, The Courtyard
Meadow Bank, Furlong Road
Bourne End, Buckinghamshire SL8 5AJ
Tel: 44 1628 850303 Fax: 44 1628 850178

France

Arizona Microchip Technology SARL
Zone Industrielle de la Bonde
2 Rue du Buisson aux Fraises
91300 Massy - France
Tel: 33 1 69 53 63 20 Fax: 33 1 69 30 90 79

Germany

Arizona Microchip Technology GmbH
Gustav-Heinemann-Ring 125
D-81739 Muenchen, Germany
Tel: 49 89 627 144 0 Fax: 49 89 627 144 44

Italy

Arizona Microchip Technology SRL
Centro Direzionale Colleone Pas Taurus 1
Viale Colleoni 1
20041 Agrate Brianza
Milan Italy
Tel: 39 39 6899939 Fax: 39 39 689 9883

JAPAN

Microchip Technology Intl. Inc.
Benex S-1 6F
3-18-20, Shin Yokohama
Kohoku-Ku, Yokohama
Kanagawa 222 Japan
Tel: 81 45 471 6166 Fax: 81 45 471 6122

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