MICROCHIP

27C512A

512K (64K x 8) CMOS EPROM

FEATURES

- High speed performance
  - 70 ns access time available
- CMOS Technology for low power consumption
  - 25 mA Active current
  - 30 µA 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 Chip carrier (leadless or plastic)
  - 28-pin SOIC package
  - 28-pin TSOP package
  - 28-pin VSOP package
  - Tape and reel
- Available for the following temperature ranges
  - Commercial: 0°C to +70°C
  - Industrial: -40°C to +85°C
  - Automotive: -40°C to +125°C

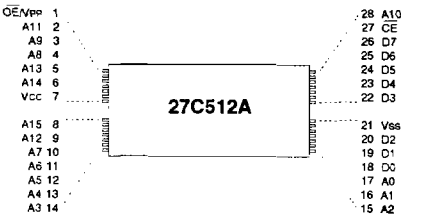
DESCRIPTION

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 70 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.

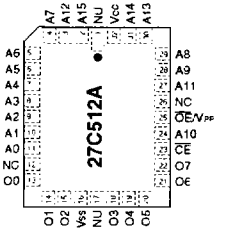
A complete family of packages is offered to provide the most flexibility in applications. For surface mount applications, PLCC or SOIC packaging is available. Tape or reel packaging is also available for PLCC or SOIC packages. UV erasable versions are also available.

PACKAGE TYPE

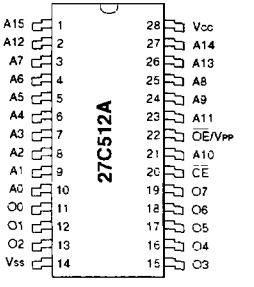
TSOP



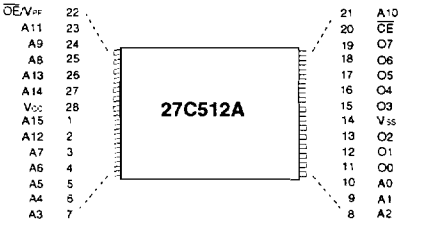
PLCC/LCC



DIP/SOIC



VSOP



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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
$\overline{OE}$/VPP	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; $\overline{OE}$/VPP = $\overline{CE}$ = VIL; 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)TTL ICC(S)TTL ICC(S)CMOS	1 2 30	— — —	mA mA µA	 $\overline{CE}$ = VCC±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.

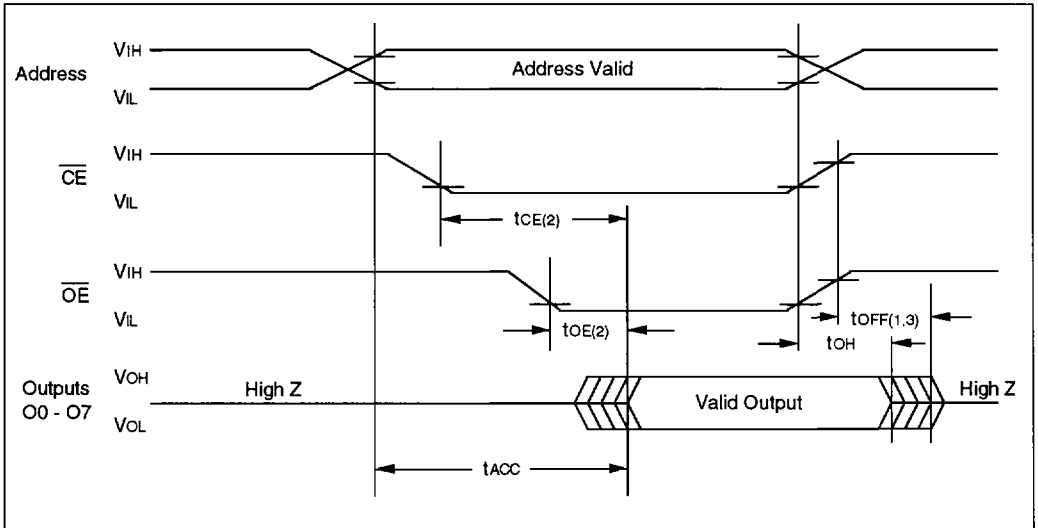
TABLE 1-3: READ OPERATION AC CHARACTERISTICS

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:	Tamb = 0°C to +70°C
	Industrial:	Tamb = -40°C to +85°C
	Extended (Automotive):	Tamb = -40°C to +125°C

Parameter	Sym	27C512-70*		27C512-90*		27C512-10*		27C512-12		27C512-15		Units	Conditions
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max		
Address to Output Delay	tACC	—	70	—	90	—	100	—	120	—	150	ns	$\overline{CE}$ = $\overline{OE}$/ V_{PP} = V_{IL}
$\overline{CE}$ to Output Delay	tCE	—	70	—	90	—	100	—	120	—	150	ns	$\overline{OE}$/V_{PP} = V_{IL}
$\overline{OE}$ to Output Delay	tOE	—	30	—	40	—	40	—	50	—	60	ns	$\overline{CE}$ = V_{IL}
$\overline{OE}$ to Output High Impedance	tOFF	0	30	0	35	0	35	0	40	0	45	ns	
Output Hold from Address, $\overline{CE}$ or $\overline{OE}$/ V_{PP}, whichever occurred first	tOH	0	0	0	—	0	—	0	—	0	—	ns	

*70/90/10 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



Notes: (1) tOFF is specified for $\overline{OE}$ or $\overline{CE}$, whichever occurs first
(2) $\overline{OE}$ may be delayed up to tCE - tOE after the falling edge of $\overline{CE}$ without impact on tCE
(3) This parameter is sampled and is not 100% tested.

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TABLE 1-4: PROGRAMMING DC CHARACTERISTICS

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

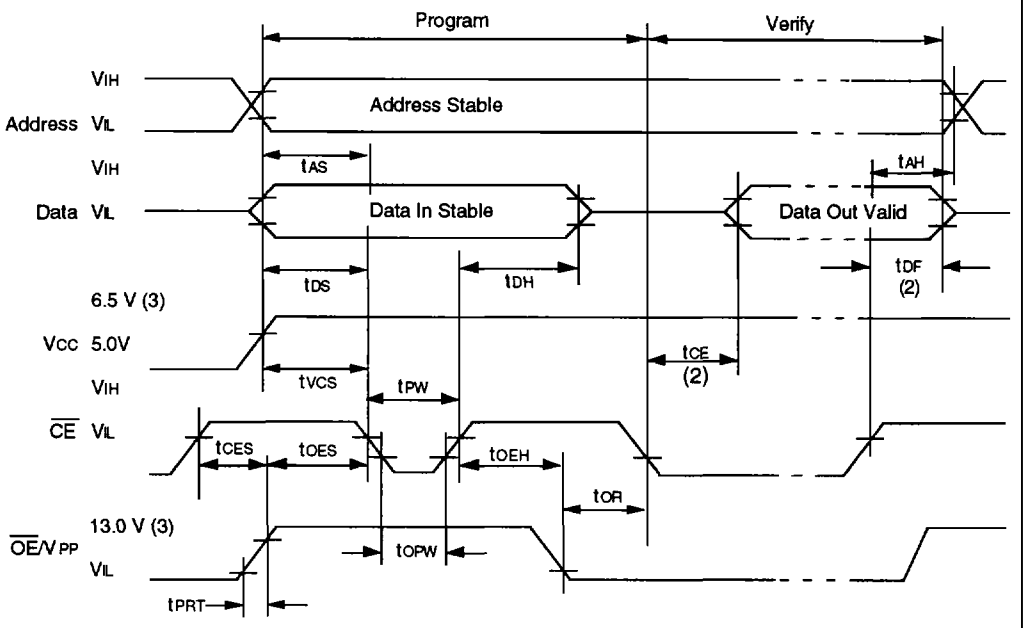
Note 1: V_{CC} must be applied simultaneously or before V_{PP} voltage on $\overline{OE}/V_{PP}$ and removed simultaneously or after the V_{PP} voltage on $\overline{OE}/V_{PP}$.

TABLE 1-5: PROGRAMMING AC CHARACTERISTICS

for Program, Program Verify and Program Inhibit Modes		AC Testing Waveform: V_{IH}=2.4V and V_{IL}=0.45V; V_{OH}=2.0V; V_{OL}=0.8V Ambient Temperature: 25°C ±5°C V_{CC} = 6.5V ± 0.25V, $\overline{OE}/V_{PP}$ = V_H = 13.0V ± 0.25 V			
Parameter	**Symbol**	**Min.**	**Max.**	**Units**	**Remarks**
Address Set-Up Time	t_{AS}	2	—	µs	
Data Set-Up Time	t_{DS}	2	—	µs	
Data Hold Time	t_{DH}	2	—	µs	
Address Hold Time	t_{AH}	0	—	µs	
Float Delay (2)	t_{DF}	0	130	ns	
V_{CC} Set-Up Time	t_{VCS}	2	—	µs	
Program Pulse Width (1)	t_{PW}	95	105	µs	100 µs typical
$\overline{CE}$ Set-Up Time	t_{CES}	2	—	µs	
$\overline{OE}$ Set-Up Time	t_{OES}	2	—	µs	
$\overline{OE}$ Hold Time	t_{OEH}	2	—	µs	
$\overline{OE}$ Recovery Time	t_{OR}	2	—	µs	
$\overline{OE}$ /V_{PP} Rise Time During Programming	t_{PRT}	50	—	ns	

Note 1: For express algorithm, initial programming width tolerance is 100 µs ±5%.
Note 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)



Notes: (1) The input timing reference level is 0.8V for VIL and 2.0V for VIH.
(2) tDF and tOE are characteristics of the device but must be accommodated by the programmer.
(3) VCC = 6.5V ±0.25V, VPP = VH = 13.0V ±0.5V for express programming algorithm.

TABLE 1-6: MODES

Operation Mode	$\overline{CE}$	$\overline{OE}$/VPP	A9	O0 - O7
Read	VIL	VIL	X	DOUT
Program	VIL	VH	X	DIN
Program Verify	VIL	VIL	X	DOUT
Program Inhibit	VIH	VH	X	High Z
Standby	VIH	X	X	High Z
Output Disable	VIL	VIH	X	High Z
Identity	VIL	VIL	VH	Identity Code

X = Don't Care

1.2 Read Mode

(See Timing Diagrams and AC Characteristics)

Read Mode is accessed when

a) the CE pin is low to power up (enable) the chip
b) 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 (tACC) is equal to the delay from $\overline{CE}$ to output (tCE). Data is transferred to the output after a delay (tOE) from the falling edge of $\overline{OE}$/VPP.

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 µA.

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 (VIH).

When a VH input is applied to this pin, it supplies the programming voltage (VPP) 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:

a) VCC is brought to the proper voltage,
b) $\overline{OE}$/VPP is brought to the proper VH level, and
c) $\overline{CE}$ 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:

a) VCC is at the proper level,
b) the $\overline{OE}$/VPP pin is low, and
c) 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).

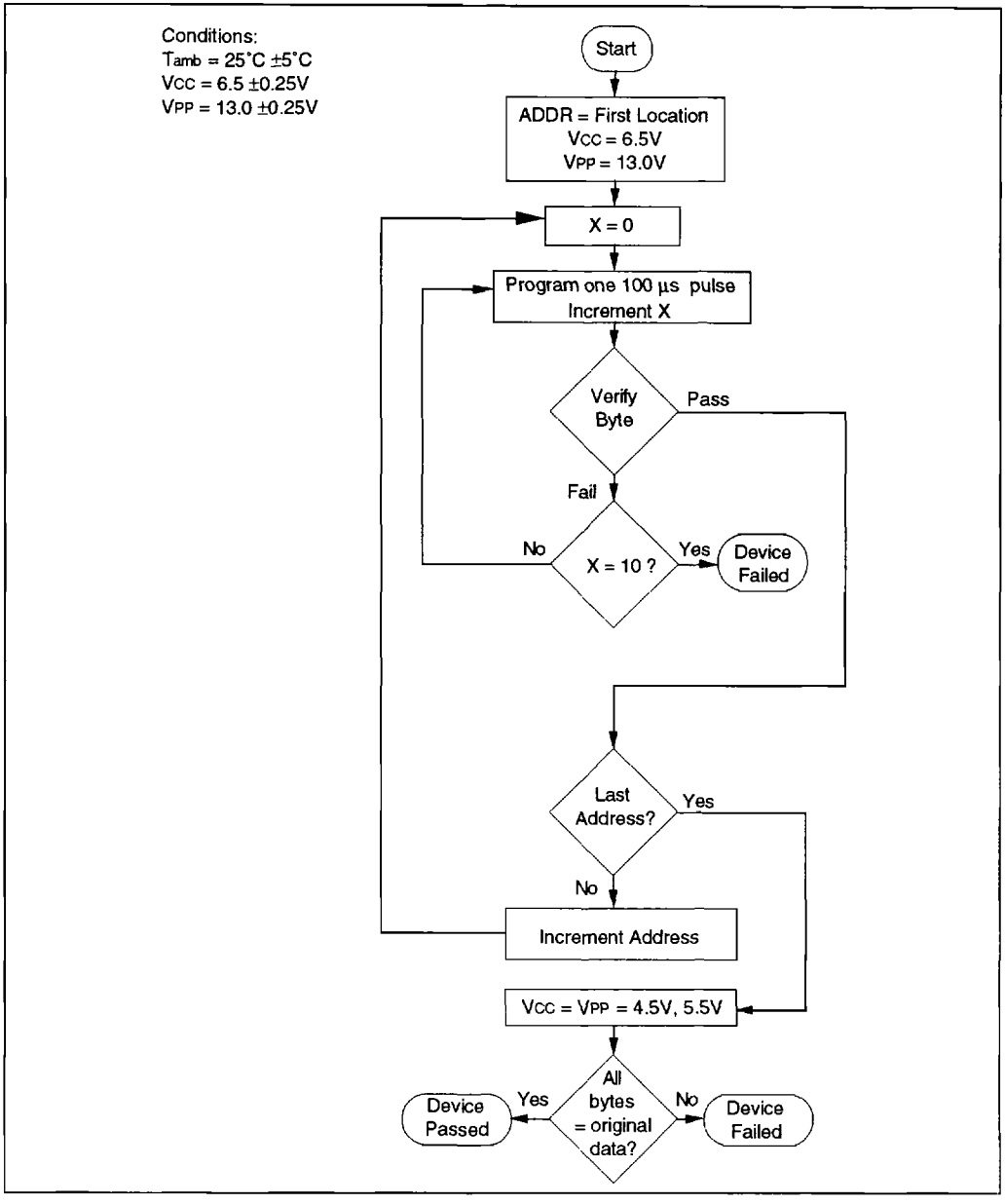
1.9 Identity Mode

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 VH (11.5V to 12.5V). The $\overline{CE}$ and $\overline{OE}$/VPP lines must be at VIL. A0 is used to access any of the two non-erasable bytes whose data appears on O0 through O7.

Pin →	Input	Output								
Identity ↓	A0	O7	O6	O5	O4	O3	O2	O1	O0	Hex
Manufacturer	VIL	0	0	1	0	1	0	0	1	29
Device Type*	VIH	1	0	0	0	1	1	0	0	0D

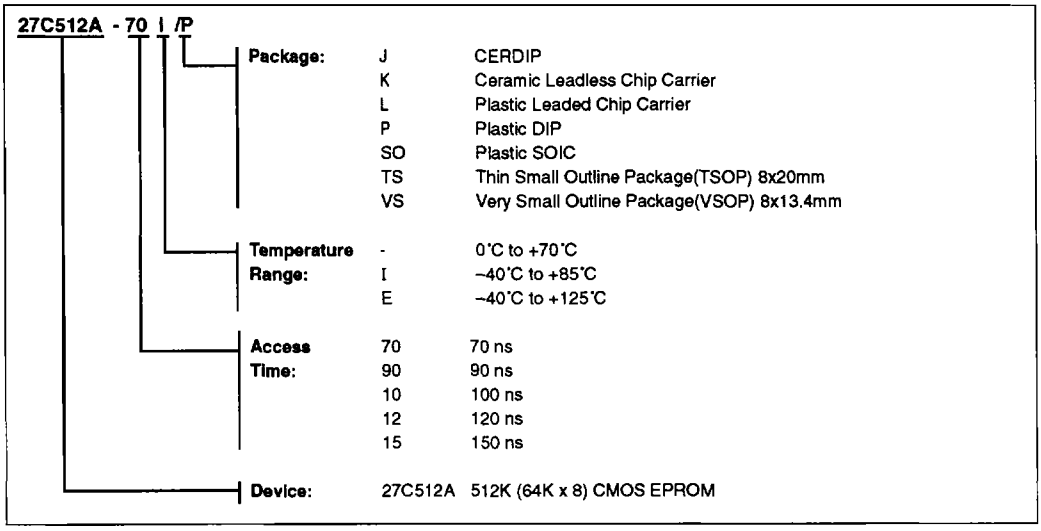
* Code subject to change

FIGURE 1-3: PROGRAMMING EXPRESS ALGORITHM



27C512A Product Identification System

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



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