MICROCHIP

27LV512

512K (64K x 8) Low-Voltage CMOS EPROM

FEATURES

- Wide voltage range 3.0V to 5.5V
- High speed performance
  - 200 ns access time available at 3.0V
- CMOS Technology for low power consumption
  - 12 mA Active current at 3.0V
  - 35 mA Active current at 5.5V
  - 100 µA Standby current
- Factory programming available
- Auto-insertion-compatible plastic packages
- Auto ID™ aids automated programming
- Separate chip enable and output enable controls
- 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
- Available for the following temperature ranges
  - Commercial: 0°C to +70°C
  - Industrial: -40°C to +85°C

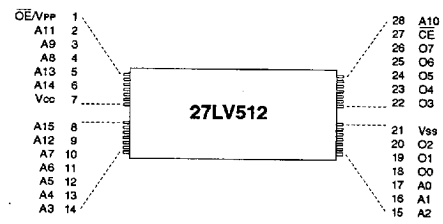
DESCRIPTION

The Microchip Technology Inc. 27LV512 is a low-voltage (3.0 volt) CMOS EPROM designed for battery powered applications. The device is organized as a 64K x 8 (64K-Byte) non-volatile memory product. The 27LV512 consumes only 12 mA maximum of active current during a 3.0 volt read operation therefore improving battery performance. This device is designed for very low-voltage applications where conventional 5.0 volt only EPROMs can not be used. Accessing individual bytes from an address transition or from power-up (chip enable pin going low) is accomplished in less than 200 ns at 3.0 volts. This device allows systems designers the ability to use low voltage non-volatile memory with today's low-voltage microprocessors and peripherals in battery powered applications.

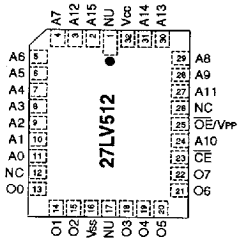
A complete family of packages is offered to provide the most flexibility in applications. For surface mount applications, PLCC, SOIC or TSOP packaging is available. Tape and reel packaging is also available for PLCC or SOIC packages.

PACKAGE TYPE

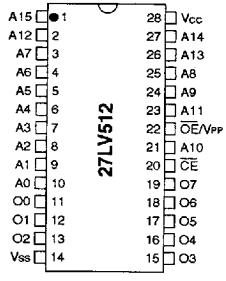
TSOP



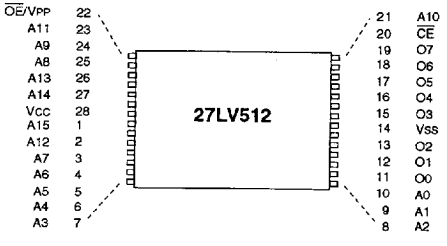
PLCC/LCC



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 +14.0V

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	+3.0V To +5.5V 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 = 3.0V to 5.5V unless otherwise specified
Commercial: Tamb = 0°C to +70°C
Industrial: Tamb = -40°C to +85°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	TTL input TTL input	ICC1 ICC2	— —	35@5.0V 12@3.0V 45@5.0V 12@3.0V	mA mA 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 all	TTL input TTL input CMOS input	ICC(S)TTL ICC(S)TTL ICC(S)CMOS	— — —	1@3.0V 2@3.0V 100@3.0V	mA mA µA	 $\overline{CE}$ = VCC ± 0.2V

* Parts: C=Commercial Temperature Range; I=Industrial Temperature Range

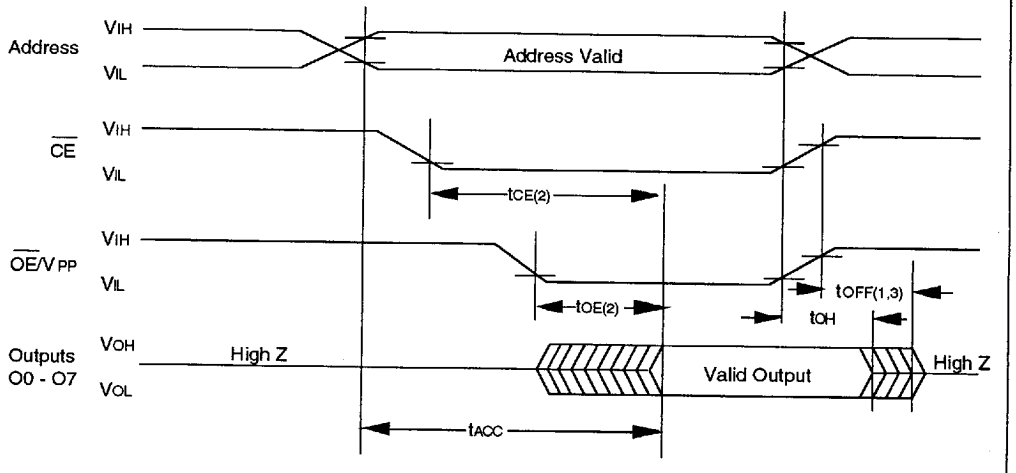
Note 1: Typical active current increases .75 mA per MHz up to operating frequency for all temperature ranges.

TABLE 1-3: READ OPERATION AC CHARACTERISTICS

AC Testing Waveform:	V_{IH} = 2.4V and V_{IL} = 0.45V; 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

Parameter	Sym	27LV512-20		27LV512-25		27LV512-30		Units	Conditions
		Min	Max	Min	Max	Min	Max		
Address to Output Delay	tACC	—	200	—	250	—	300	ns	$\overline{CE}$ = $\overline{OE}$ = V_{IL}
$\overline{CE}$ to Output Delay	tCE	—	200	—	250	—	300	ns	$\overline{OE}$ = V_{IL}
$\overline{OE}$ to Output Delay	tOE	—	90	—	100	—	125	ns	$\overline{CE}$ = V_{IL}
$\overline{CE}$ or $\overline{OE}$ to O/P High Impedance	tOFF	0	50	0	50	0	50	ns	
Output Hold from Address $\overline{CE}$ or $\overline{OE}$, whichever goes first	tOH	0	—	0	—	0	—	ns	

FIGURE 1-1: READ WAVEFORMS



Notes: (1) tOFF is specified for $\overline{OE}$/V_{PP} 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 VCC = 6.5V ± 0.25V, $\overline{OE}$/VPP = VH = 13.0V ± 0.25V						
Parameter	**Status**	**Symbol**	**Min.**	**Max.**	**Units**	**Conditions (See Note 1)**
Input Voltages	Logic "1" Logic "0"	VIH VIL	2.0 -0.1	VCC+1 0.8	V V	
Input Leakage	—	ILI	-10	10	µA	VIN = 0V to VCC
Output Voltages	Logic "1" Logic "0"	VOH VOL	2.4 —	 0.45	V V	IOH = -400 µA IOL = 2.1 mA
VCC Current, program & verify	—	ICC2	—	35	mA	
$\overline{OE}$/VPP Current, program	—	IPP2	—	25	mA	$\overline{CE}$ = VIL
A9 Product Identification	—	VID	11.5	12.5	V	

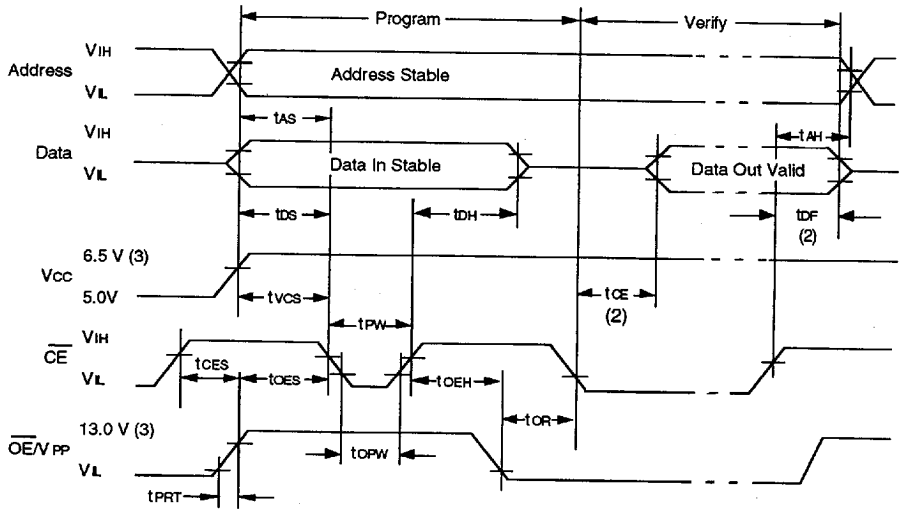
Note 1: VCC must be applied simultaneously or before VPP voltage on $\overline{OE}$/VPP and removed simultaneously or after the VPP voltage on $\overline{OE}$/VPP.

TABLE 1-5: PROGRAMMING AC CHARACTERISTICS

for Program, Program Verify and Program Inhibit Modes	AC Testing Waveform: VIH=2.4V and VIL=0.45V; VOH=2.0V; VOL=0.8V Ambient Temperature: Tamb=25°C ± 5°C VCC = 6.5V ± 0.25V, $\overline{OE}$/VPP = VH = 13.0V ± 0.25 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
$\overline{CE}$ Set-Up Time	tCES	2	—	µs	
$\overline{OE}$ Set-Up Time	tOES	2	—	µs	
$\overline{OE}$ Hold Time	tOEH	2	—	µs	
$\overline{OE}$ Recovery Time	tOR	2	—	µs	
$\overline{OE}$/VPP Rise Time During Programming	tPRT	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



Notes: (1) The input timing reference level is 0.8V for V_{IL} and 2.0V for V_{IH}.
(2) t_{DF} and t_{OE} are characteristics of the device but must be accommodated by the programmer.
(3) V_{CC} = 6.5V ±0.25V, $V_{PP} = V_H$ = 13.0V ±0.25V for express programming algorithm.

TABLE 1-6: MODES

Operation Mode	$\overline{CE}$	$\overline{OE}/V_{PP}$	A9	O0 - O7
Read	V_{IL}	V_{IL}	X	D_{OUT}
Program	V_{IL}	V_H	X	D_{IN}
Program Verify	V_{IL}	V_{IL}	X	D_{OUT}
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

a) the $\overline{CE}$ pin is low to power up (enable) the chip
b) the $\overline{OE}/V_{PP}$ 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 $\overline{OE}/V_{PP}$.

1.3 Standby Mode

The standby mode is defined when the $\overline{CE}$ pin is high and a program mode is not identified.

1.4 Output Enable $\overline{OE}$/VPP

This multifunction pin eliminates bus connection in microprocessor based systems in which multiple devices may drive the bus. The outputs go into a high impedance state 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 Programming Mode

The Express algorithm has been developed to improve on the programming throughput times in a production environment. Up to ten 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.

1.6 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.

1.7 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).

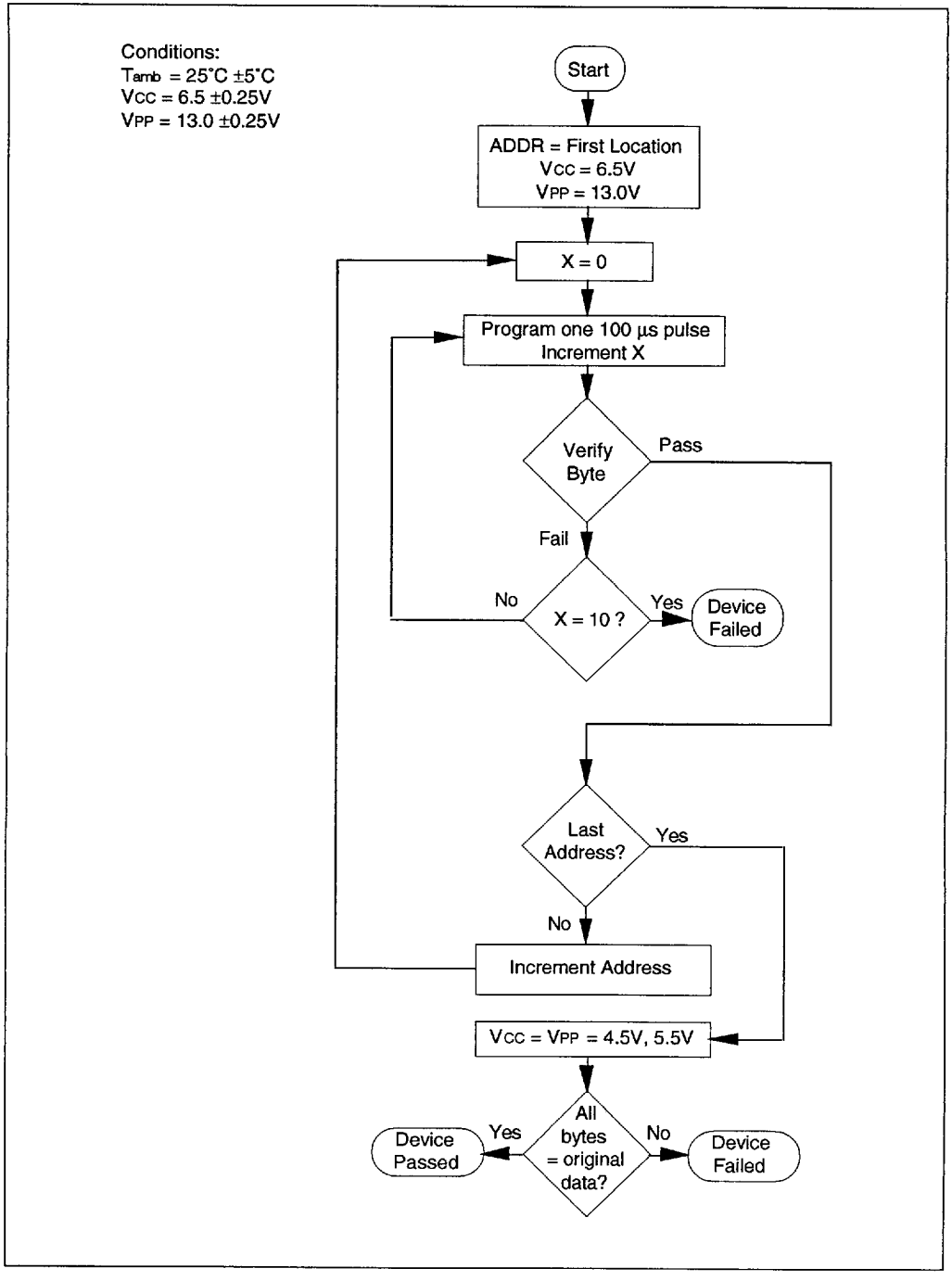
1.8 Identity Mode

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	0	0	0	0	1	1	0	1	0D

* Code subject to change

FIGURE 1-3: PROGRAMMING EXPRESS ALGORITHM



27LV512 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.

27LV512 - 25 I /P

Package:	L	Plastic Leaded Chip Carrier
	P	Plastic DIP
	SO	Plastic SOIC
	J	Ceramic DIP
	K	Ceramic Leaded Chip Carrier
	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
Access Time:	20	200 ns
	25	250 ns
	30	300 ns
Device:	27LV512	512K (64K x 8) Low-Voltage CMOS EPROM