

## 256K (32K 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
  - 8 mA Active current at 3.0V
  - 20 mA Active current at 5.5V
  - 100  $\mu$ A 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 32K x 8: JEDEC standard pinouts
  - 28-pin Dual-in-line package
  - 32-pin PLCC package
  - 28-pin SOIC 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

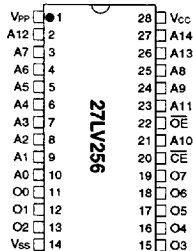
### DESCRIPTION

The Microchip Technology Inc. 27LV256 is a low voltage (3.0 volt) CMOS EPROM designed for battery powered applications. The device is organized as a 32K x 8 (32K-Byte) non-volatile memory product. The 27LV256 consumes only 8 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 3.0V. 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.

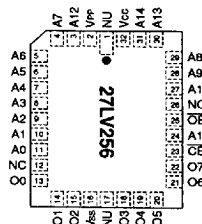
A complete family of packages is offered to provide the most flexibility in applications. For surface mount applications, PLCC, VSOP or SOIC packaging is available. Tape and reel packaging is also available for PLCC or SOIC packages.

### PACKAGE TYPES

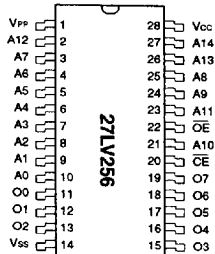
#### PDIP



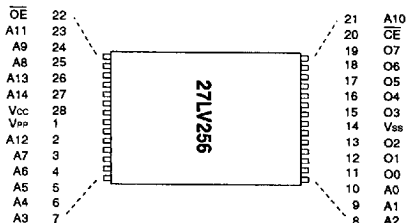
#### PLCC



#### SOIC



#### VSOP



## 1.0 ELECTRICAL CHARACTERISTICS

### 1.1 Maximum Ratings\*

V<sub>CC</sub> and input voltages w.r.t. V<sub>SS</sub> ..... -0.6V to +7.25V

V<sub>PP</sub> voltage w.r.t. V<sub>SS</sub> during programming ..... -0.6V to +14V

Voltage on A9 w.r.t. V<sub>SS</sub>..... -0.6V to +13.5V

Output voltage w.r.t. V<sub>SS</sub>..... -0.6V to V<sub>CC</sub> +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-A14	Address Inputs
$\overline{CE}$	Chip Enable
$\overline{OE}$	Output Enable
V <sub>PP</sub>	Programming Voltage
O0 - O7	Data Output
V <sub>CC</sub>	+5V or +3V Power Supply
V <sub>SS</sub>	Ground
NC	No Connection; No Internal Connection
NU	Not Used; No External Connection Is Allowed

TABLE 1-2: READ OPERATION DC CHARACTERISTICS

V <sub>CC</sub> = +5V ±10% or 3.0V where indicated Commercial: T <sub>amb</sub> = 0°C to +70°C Industrial: T <sub>amb</sub> = -40°C to +85°C							
Parameter	Part*	Status	Symbol	Min.	Max.	Units	Conditions
Input Voltages	all	Logic "1" Logic "0"	V <sub>IH</sub> V <sub>IL</sub>	2.0 -0.5	V <sub>CC</sub> +1 0.8	V V	
Input Leakage	all		I <sub>I</sub>	-10	10	μA	V <sub>IN</sub> = 0 to V <sub>CC</sub>
Output Voltages	all	Logic "1" Logic "0"	V <sub>OH</sub> V <sub>OL</sub>	2.4	0.45	V V	I <sub>OH</sub> = -400 μA I <sub>OL</sub> = 2.1 mA
Output Leakage	all	—	I <sub>LO</sub>	-10	10	μA	V <sub>OUT</sub> = 0V to V <sub>CC</sub>
Input Capacitance	all	—	C <sub>IN</sub>	—	6	pF	V <sub>IN</sub> = 0V; T <sub>amb</sub> = 25°C; f = 1 MHz
Output Capacitance	all	—	C <sub>OUT</sub>	—	12	pF	V <sub>OUT</sub> = 0V; T <sub>amb</sub> = 25°C; f = 1 MHz
Power Supply Current, Active	C	TTL input	I <sub>CC1</sub>	—	20 @ 5.0V	mA	V <sub>CC</sub> = 5.5V; V <sub>PP</sub> = V <sub>CC</sub> f = 1 MHz; $\overline{OE} = \overline{CE} = V_{IL}$ ; I <sub>OUT</sub> = 0 mA; V <sub>IL</sub> = -0.1 to 0.8V; V <sub>IH</sub> = 2.0 to V <sub>CC</sub> ; Note 1
	I	TTL input	I <sub>CC2</sub>	—	8 @ 3.0V	mA	
					25 @ 5.0V	mA	
					10 @ 3.0V	mA	
Power Supply Current, Standby	C	TTL input	I <sub>CC(s)</sub>	—	1 @ 3.0V	mA	$\overline{CE} = V_{CC} \pm 0.2V$
	I	TTL input			2 @ 3.0V	mA	
	all	CMOS input			100 @ 3.0V	μA	

\* Parts: C=Commercial Temperature Range  
I =Industrial 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 <sub>IH</sub> = 2.4V and V <sub>IL</sub> = 0.45V; V <sub>OH</sub> = 2.0V V <sub>OL</sub> = 0.8V					
		Output Load:		1 TTL Load + 100 pF					
		Input Rise and Fall Times:		10 ns					
		Ambient Temperature:		Commercial:			T <sub>amb</sub> = 0°C to +70°C		
				Industrial:			T <sub>amb</sub> = -40°C to +85°C		
Parameter	Sym	27HC256-20		27HC256-25		27HC256-30		Units	Conditions
		Min	Max	Min	Max	Min	Max		
Address to Output Delay	t <sub>ACC</sub>	—	200	—	250	—	300	ns	$\overline{CE} = \overline{OE} = V_{IL}$
$\overline{CE}$ to Output Delay	t <sub>CE</sub>	—	200	—	250	—	300	ns	$\overline{OE} = V_{IL}$
$\overline{OE}$ to Output Delay	t <sub>OE</sub>	—	100	—	125	—	125	ns	$\overline{CE} = V_{IL}$
$\overline{CE}$ or $\overline{OE}$ to O/P High Impedance	t <sub>OFF</sub>	0	50	0	50	0	50	ns	
Output Hold from Address $\overline{CE}$ or $\overline{OE}$ , whichever goes first	t <sub>OH</sub>	0	—	0	—	0	—	ns	

FIGURE 1-1: READ WAVEFORMS

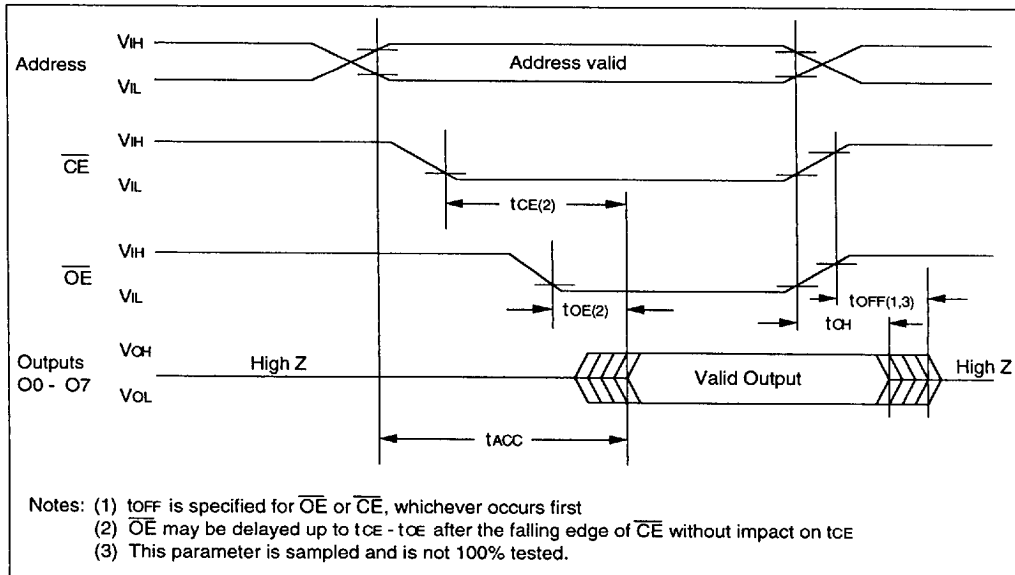


TABLE 1-4: PROGRAMMING DC CHARACTERISTICS

Ambient Temperature: Tamb = 25°C ± 5°C VCC = 6.5V ± 0.25V, VPP = 13.0V ± 0.25V						
Parameter	Status	Symbol	Min	Max.	Units	Conditions
Input Voltages	Logic"1" Logic"0"	V <sub>IH</sub> V <sub>IL</sub>	2.0 -0.1	VCC+1 0.8	V V	
Input Leakage	—	I <sub>LI</sub>	-10	10	μA	V <sub>IN</sub> = 0V to VCC
Output Voltages	Logic"1" Logic"0"	V <sub>OH</sub> V <sub>OL</sub>	2.4	0.45	V V	I <sub>OH</sub> = -400 μA I <sub>OL</sub> = 2.1 mA
VCC Current, program & verify	—	I <sub>CC2</sub>	—	20	mA	Note 1
VPP Current, program	—	I <sub>PP2</sub>	—	25	mA	Note 1
A9 Product Identification	—	V <sub>H</sub>	11.5	12.5	V	

Note 1: VCC must be applied simultaneously or before VPP and removed simultaneously or after VPP.

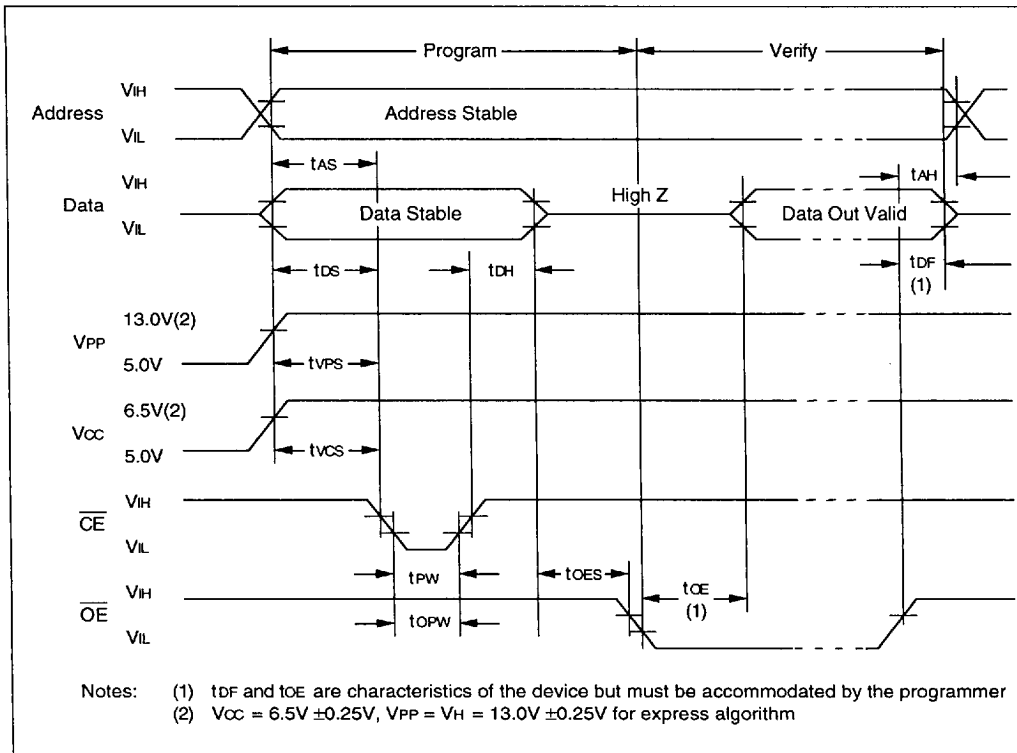
TABLE 1-5: PROGRAMMING AC CHARACTERISTICS

for Program, Program Verify and Program Inhibit Modes		AC Testing Waveform: $V_{IH}=2.4V$ and $V_{IL}=0.45V$ ; $V_{OH}=2.0V$ ; $V_{OL}=0.8V$ Output Load: 1 TLL Load + 100pF Ambient Temperature: $T_{amb}=25^{\circ}C\pm 5^{\circ}C$ $V_{CC}=6.5V \pm 0.25V$ , $V_{PP}=13.0V \pm 0.25V$				
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		
VPP Set-Up Time	tVPS	2	—	μs		
Data Valid from $\overline{OE}$	tOE	—	100	ns		

Note 1: For express algorithm, initial programming width tolerance is 100 μs ±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



7

TABLE 1-6: MODES

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

X = Don't Care

## 1.2 Read Mode

(See Timing Diagrams and AC Characteristics)

Read Mode is accessed when:

- the  $\overline{CE}$  pin is low to power up (enable) the chip
- the  $\overline{OE}$  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 from the falling edge of  $\overline{OE}$  ( $t_{OE}$ ).

## 1.3 Standby Mode

The standby mode is defined when the  $\overline{CE}$  pin is high ( $V_{IH}$ ) and a program mode is not defined. Output Disable

## 1.4 Output Enable

This feature eliminates bus contention in multiple bus microprocessor systems and the outputs go to a high impedance when the following condition is true:

- The  $\overline{OE}$  pin is high and program mode is not defined.

## 1.5 Programming Mode

The Express algorithm has been developed to improve on the programming throughput times in a production environment. Up to 10 100-microsecond pulses are applied until the byte is verified. No over-programming is required. A flowchart of the express algorithm is shown in Figure 1.

Programming takes place when:

- VCC is brought to the proper voltage
- VPP is brought to the proper  $V_H$  level
- the  $\overline{OE}$  pin is high
- the  $\overline{CE}$  pin 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-A14 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 that all the bits have been correctly programmed. This mode is entered when all of the following conditions are met:

- VCC is at the proper level
- VPP is at the proper  $V_H$  level
- the  $\overline{CE}$  pin is high
- the  $\overline{OE}$  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, and all other devices with  $\overline{CE}$  held high will not be programmed with the data although address and data are available on their input pins.

## 1.8 Identity Mode

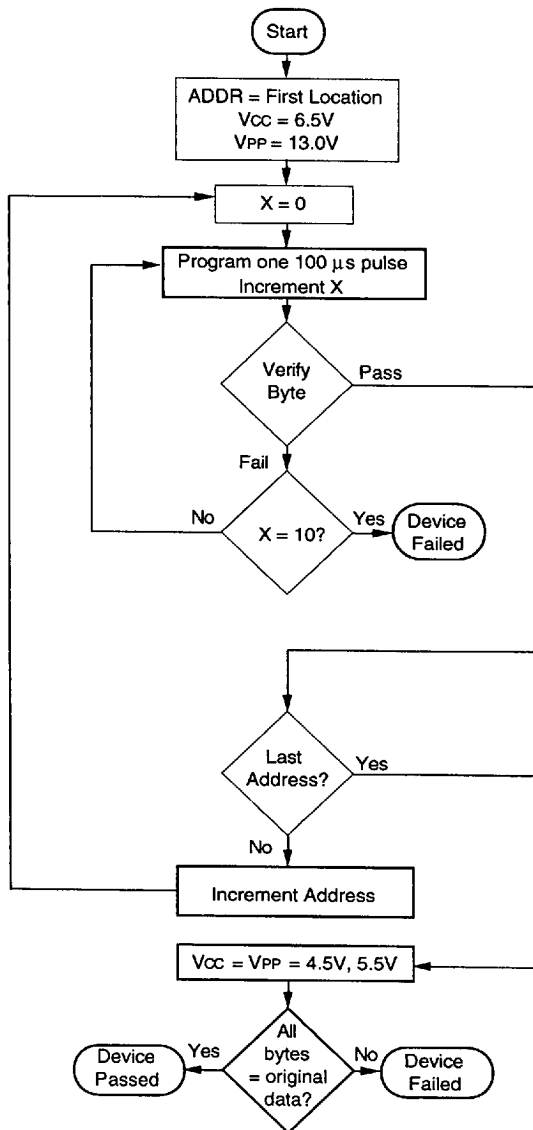
In this mode specific data is outputted which identifies the manufacturer as Microchip Technology Inc. and device type. This mode is entered when Pin A9 is taken to  $V_H$  (11.5V to 12.5V). The  $\overline{CE}$  and  $\overline{OE}$  lines must be at  $V_{IL}$ . A0 is used to access any of the two non-erasable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

Pin →	Input	Output									
Identity ↓	A0	0	0	0	0	0	0	0	0	H	e
		7	6	5	4	3	2	1	0	x	
Manufacturer Device Type*	$V_{IL}$	0	0	1	0	1	0	0	1	29	
	$V_{IH}$	1	0	0	0	1	1	0	0	8C	

\* Code subject to change.

FIGURE 1-3: PROGRAMMING EXPRESS ALGORITHM

Conditions:  
 $T_{amb} = 25 \pm 5^\circ\text{C}$   
 $V_{CC} = 6.5 \pm 0.25\text{V}$   
 $V_{PP} = 13.0 \pm 0.25\text{V}$



# 27LV256

## 27LV256 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.

<b>27LV256</b>	-	<b>25</b>		<b>/P</b>	
					<b>Package:</b>
					L = Plastic Leaded Chip Carrier
					P = Plastic DIP (600 Mil)
					SO = Plastic SOIC (300 Mil)
					VS = Very Small Outline Package (VSOP) 8X13.4mm
					<b>Temperature Range:</b>
					Blank = 0°C to +70°C
					I = -40°C to +85°C
					<b>Access Time:</b>
					20 = 200 ns
					25 = 250 ns
					30 = 300 ns (SOIC only)
					<b>Device:</b>
					27LV256 256K (32K x 8) Low-Voltage CMOS EPROM