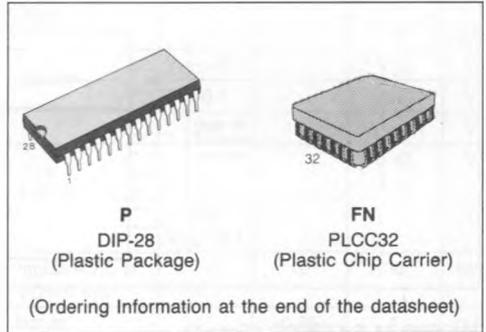


## 256K (32K × 8) CMOS ONE TIME PROGRAMMABLE ROM

- COMPATIBLE TO ST27C256 EPROM (ELECTRICAL PARAMETER, PROGRAMMING)
- PROGRAMMING VOLTAGE 12.5V.
- HIGH SPEED PROGRAMMING
- 28-PIN JEDEC APPROVED PIN-OUT
- 32-PIN JEDEC APPROVED PIN OUT
- IDEAL FOR AUTOMATIC INSERTION



### DESCRIPTION

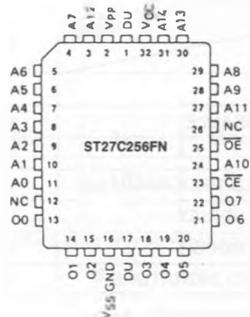
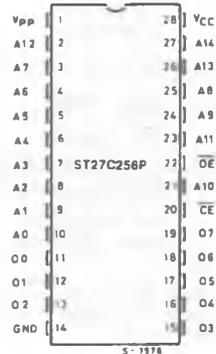
The ST27C256P and ST27C256FN are high speed 262,144K bit One Time Programmable (OTP) CMOS ROM ideally suited for applications where fast turn-around is an important requirement.

The ST27C256P is packaged in a 28-pin dual-in-line plastic package, the ST27C256FN in a 32-pin PLCC plastic package, and therefore can not be re-written. Programming is performed according to standard SGS-THOMSON 256K EPROM procedure.

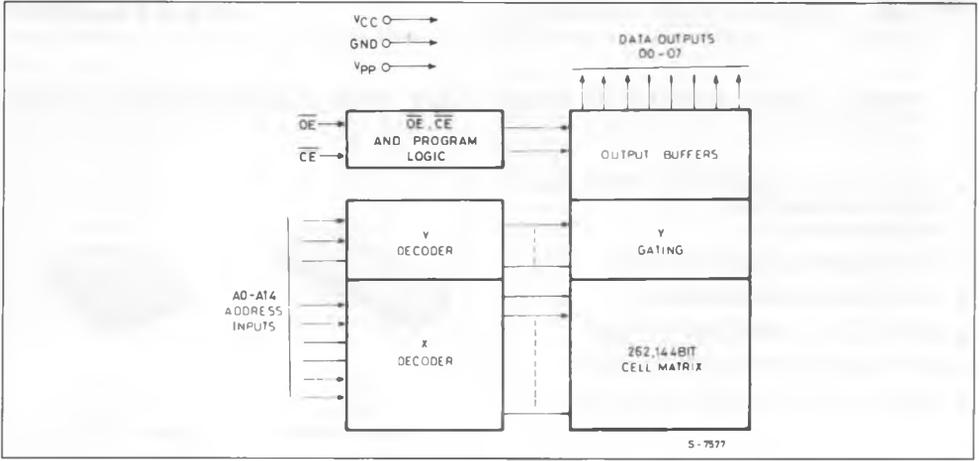
### PIN NAMES

A0—A14	ADDRESS
$\overline{CE}$	CHIP ENABLE
$\overline{OE}$	OUTPUT ENABLE
O0—O7	OUTPUTS
NC	NON CONNECTED
DU	DO NOT USE

### PIN CONNECTIONS



**BLOCK DIAGRAM**



**MAXIMUM RATINGS (Note 1)**

Symbol	Rating	Value	Unit
$T_{amb}$	Operating temperature range ST27C256-C ST27C256-V ST27C256-T	$T_L$ to $T_H$ 0 to +70 -40 to +85 -40 to +105	°C
$T_{stg}$	Storage temperature range	+65 to +125	°C
$V_{PP(2)}$	Supply voltage	-0.6 to +14	V
$V_{in(2)}$	Input voltages Except $V_{PP}$ , A9	-0.6 to +13.5 -0.6 to +6.25	V
$P_D$	Max power dissipation	1.5	W
	Lead temperature (Soldering: 10 seconds)	+300	°C

- Notes: 1. "Maximum ratings" are those values beyond which the safety of the device cannot be guaranteed. Except for "Operating temperature range" they are not meant to imply that the devices should be operated at these limits. The table of "Electrical characteristics" provides conditions for actual device operation.  
 2. With respect to  $V_{SS}$

**OPERATING MODES**

MODE \ PINS	$\overline{CE}$	$\overline{OE}$	A9	$V_{pp}$	$V_{CC}$	OUTPUTS
READ	$V_{IL}$	$V_{IL}$	X	$V_{CC}$	$V_{CC}$	$D_{OUT}$
OUTPUT DISABLE	$V_{IL}$	$V_{IH}$	X	$V_{CC}$	$V_{CC}$	Hi-Z
STANDBY	$V_{IH}$	X	X	$V_{CC}$	$V_{CC}$	Hi-Z
HIGH SPEED PROGRAMMING	$V_{IL}$	$V_{IH}$	X	$V_{PP}$	$V_{CC}$	$D_{IN}$
PROGRAM VERIFY	$V_{IH}$	$V_{IL}$	X	$V_{PP}$	$V_{CC}$	$D_{OUT}$
PROGRAM INHIBIT	$V_{IH}$	$V_{IH}$	X	$V_{PP}$	$V_{CC}$	Hi-Z
ELECTRONIC SIGNATURE <sup>(3)</sup>	$V_{IL}$	$V_{IL}$	$V_H$ <sup>(2)</sup>	$V_{CC}$	$V_{CC}$	CODE

- Notes: 1. X can be either  $V_{IL}$  or  $V_{IH}$  — 2.  $V_H = 12.0V \pm 0.5V$   
 3. All address lines at  $V_{IL}$  except A9 and A0 that is toggled from  $V_{IL}$  (manufacturer code: 9B) to  $V_{IH}$  (type code: 04)

## READ OPERATION

DC CHARACTERISTICS ( $T_{amb} = T_L$  to  $T_H$ ,  $V_{CC} = 5V \pm 10\%$ ,  $V_{SS} = 0V$ ; Unless otherwise specified)

Symbol	Parameter	Test Conditions	Values			Unit
			Min.	Typ. <sup>(1)</sup>	Max.	
$I_{LI}$	Input Load Current	$V_{IN} = V_{CC}$ or GND			10	$\mu A$
$I_{LO}$	Output Leakage Current	$V_{OUT} = V_{CC}$ or $V_{SS}$ , $CE = V_{IH}$			10	$\mu A$
$V_{PP}$	$V_{PP}$ Read Voltage		$V_{CC} - 0.7$		$V_{CC}$	V
$V_{IL}$	Input Low Voltage		-0.1		0.8	V
$V_{IH}$	Input High Voltage		2.0		$V_{CC} + 1$	V
$V_{OL}$	Output Low Voltage	$I_{OL} = 2.1$ mA $I_{OL} = 0$ $\mu A$			0.45 0.1	V
$V_{OH}$	Output High Voltage	$I_{OH} = -400$ $\mu A$ $I_{OH} = 0$ $\mu A$	2.4 $V_{CC} - 0.1$			V
$I_{CC2}$	$V_{CC}$ Supply Active Current TTL Levels	$\overline{CE} = \overline{OE} = V_{IL}$ , Inputs = $V_{IH}$ or $V_{IL}$ , $f = 5$ MHz, $I/O = 0$ mA		10	30	mA
$I_{CCSB1}$	$V_{CC}$ Supply Standby Current	$\overline{CE} = V_{IH}$ $\overline{OE} =$ Inputs		0.05	1	mA
$I_{CCSB2}$	$V_{CC}$ Supply Standby Current	$\overline{CE} = V_{CC} - 0.1V$ , $\overline{OE} =$ Inputs		1	10	$\mu A$
$I_{PP1}$	$V_{PP}$ Read Current	$V_{PP} = V_{CC} = 5.5V$			100	$\mu A$

Note: 1. Typical conditions are for operation at:  $T_{amb} = +25^\circ C$ ,  $V_{CC} = 5V$ ,  $V_{PP} = V_{CC}$ , and  $V_{SS} = 0V$ AC CHARACTERISTICS<sup>(1,2,3)</sup>( $T_{amb} = T_L$  to  $T_H$ )

Symbol	Parameter	Test Conditions	27C256 -17		27C256 -20		27C256 -25		27C256 -30		Unit
			Min	Max	Min	Max	Min	Max	Min	Max	
$t_{ACC}$	Address to Output Delay	$\overline{CE} = \overline{OE} = V_{IL}$		170		200		250		300	ns
$t_{CE}$	$\overline{CE}$ to Output Delay	$\overline{OE} = V_{IL}$		170		200		250		300	ns
$t_{OE}$	Output Enable to Output Delay	$\overline{CE} = V_{IL}$		75		75		100		120	ns
$t_{DF}^{(2)(4)}$	$\overline{OE}$ or $\overline{CE}$ High to	$\overline{CE} = V_{IL}$	0	50	0	55	0	60	0	75	ns
$t_{OH}$	Output Hold from addresses, $\overline{CE}$ or $\overline{OE}$ whichever occurred first	$\overline{CE} = \overline{OE} = V_{IL}$	0		0		0		0		ns

CAPACITANCE  $T_{amb} = +25^\circ C$ ,  $f = 1$  MHz

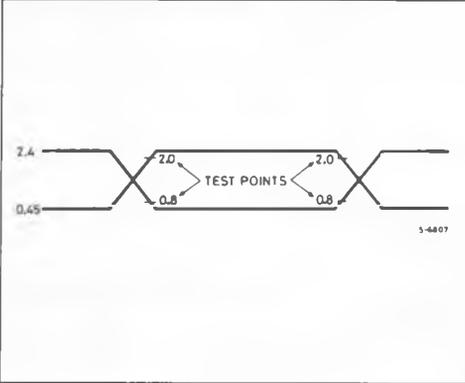
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$C_{in}$	Input Capacitance	$V_{IN} = 0V$		4	6	pF
$C_{out}$	Output Capacitance	$V_{OUT} = 0V$		8	12	pF

Notes: 1.  $V_{CC}$  must be applied at the same time or before  $V_{pp}$  and removed after or at the same time as  $V_{pp}$ .  $V_{pp}$  may be connected to  $V_{CC}$  except during program.2. The  $t_{DF}$  compare level is determined as follows:  
High to THREE-STATE, the measured  $V_{OH}(DC) - 0.1V$   
Low to THREE-STATE the measured  $V_{OL}(DC) + 0.1V$ .3. Capacitance is guaranteed by periodic testing.  $T_{amb} = +25^\circ C$ ,  $f = 1$  MHz4.  $t_{DF}$  is specified from OE or CE whichever occurs first. This parameter is only sampled and not 100% tested.

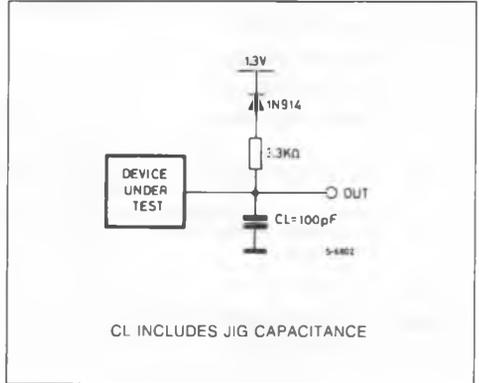
**AC TEST CONDITIONS**

Output Load: 1 TTL gate and  $CL = 100\text{ pF}$   
 Input Rise and Fall Times  $\leq 20\text{ ns}$   
 Input pulse levels: 0.45V to 2.4V  
 Timing Measurement Reference Level  
 Inputs, Outputs 0.8V and 2V

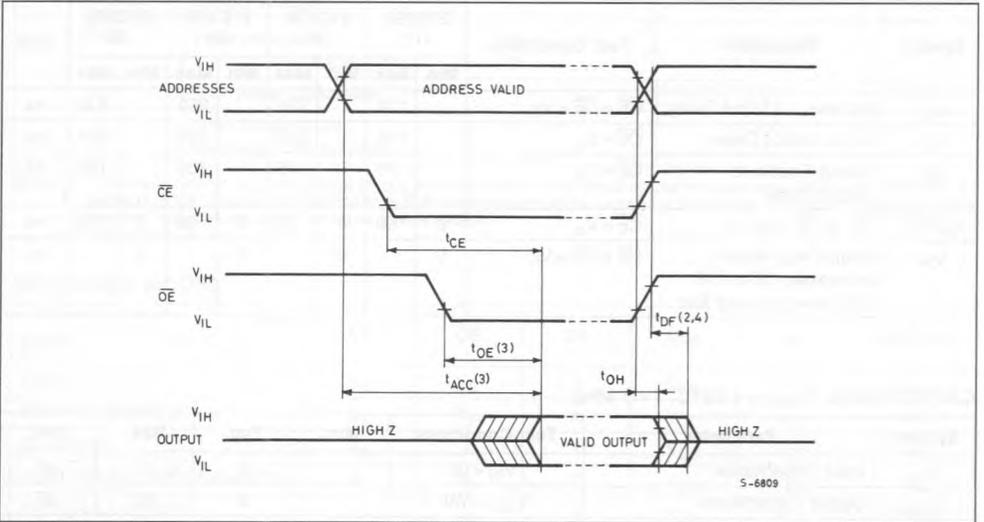
AC TESTING INPUT/OUTPUT WAVEFORM



AC TESTING LOAD CIRCUIT



**AC WAVEFORMS**



**Notes:**

1. Typical values are for  $T_{amb} = 25^\circ\text{C}$  and nominal supply voltage
2. This parameter is only sampled and not 100% tested.
3. OE may be delayed up to  $t_{ACC} - t_{OE}$  after the falling edge CE without impact on  $t_{ACC}$
4.  $t_{DF}$  is specified from OE or CE whichever occurs first.

## DEVICE OPERATION

The seven modes of operation of the ST27C256 are listed in the Operating Modes table. A single 5V power supply is required in the read mode. All inputs are TTL levels except for  $V_{pp}$ .

### READ MODE

The ST27C256 has two control functions, both of which must be logically active in order to obtain data at the outputs. Chip Enable ( $\overline{CE}$ ) is the power control and should be used for device selection. Output Enable ( $\overline{OE}$ ) is the output control and should be used to gate data to the output pins, independent of device selection. Assuming that addresses are stable, address access time ( $t_{ACC}$ ) is equal to the delay from  $\overline{CE}$  to Output ( $t_{CE}$ ). Data is available at the outputs after a delay of  $t_{OE}$  from the falling edge of  $\overline{OE}$ , assuming that  $\overline{CE}$  has been low and addresses have been stable for at least  $t_{ACC}+t_{OE}$ .

### STANDBY MODE

The ST27C256 has a standby mode which reduces the maximum power dissipation to 5.25 mW. The ST27C256 is placed in the standby mode by applying a TTL high signal to the  $\overline{CE}$  input. When in standby mode, the outputs are in a high impedance state, independent of the  $\overline{OE}$  input.

### OUTPUT OR-TYING

Because OTPs are usually used in larger memory arrays, we have provided two control lines which accommodate this multiple memory connection. The two control lines allow for:

- the lowest possible memory power dissipation, and
- complete assurance that output bus contention will not occur.

To use these control lines most efficiently,  $\overline{CE}$  should be decoded and used as the primary device selecting function, while  $\overline{OE}$  should be made a common connection to all devices in the array and connected to the READ line from the system control bus. This assures that all deselected memory devices are in their low power standby modes and that the output pins are active only when data is desired from a particular memory device.

### PROGRAMMING MODES

*Caution: Exceeding 14V on  $V_{pp}$  pin will damage the ST27C256.*

Initially, all bits of the ST27C256 are in the "1" state. Data is introduced by selectively programming "0s" into the desired bit locations. Although only "0s" will be programmed, both "1s" and "0s" can be presented in the data word.

The ST27C256 is in the programming mode when the  $V_{pp}$  input is at 12.5 V and  $\overline{CE}$  and PGM are both at TTL Low. It is required that a 0.1  $\mu$ F capacitor be placed across  $V_{pp}$ ,  $V_{CC}$  and ground to suppress spurious voltage transients which may damage the device. The data to be programmed is applied 8 bits in parallel to the data output pins. The levels required for the address and data inputs are TTL.

Programming of multiple ST27C256s in parallel with the same data can be easily accomplished due to the simplicity of the programming requirements. Like inputs of the paralleled ST27C256s may be connected together when they are programmed with the same data. A low level TTL pulse applied to the  $\overline{CE}$  input programs the paralleled ST27C256s.

### HIGH SPEED PROGRAMMING

The high speed programming algorithm described in the flow chart rapidly programs ST27C256 using an efficient and reliable method particularly suited to the production programming environment. Typical programming times for individual devices are on the order of 5 minute.

### PROGRAM INHIBIT

Programming of multiple ST27C256s in parallel with different data is also easily accomplished by using the program inhibit mode. A high level on  $\overline{CE}$  inputs inhibits the other ST27C256s from being programmed. Except for  $\overline{CE}$ , all like inputs (including  $\overline{OE}$ ) of the parallel ST27C256s may be common. A TTL low-level pulse applied to a ST27C256  $\overline{CE}$  input with  $V_{pp}$  at 12.5V will program that ST27C256.

### PROGRAM VERIFY

A verify may be performed on the programmed bits to determine that they were correctly programmed. The verify is performed with  $\overline{OE}$  at  $V_{IL}$ ,  $\overline{CE}$  at  $V_{IH}$ , and  $V_{pp}$  at 12.5 V.

### ELECTRONIC SIGNATURE MODE

Electronic signature mode allows the reading out of a binary code that will identify the EPROMs manufacturer and type. This mode is intended for use by programming equipment for the purpose of automatically matching the device to be programmed with its corresponding programming algorithm. This mode is functional in the  $25^{\circ}\text{C} \pm 5^{\circ}\text{C}$  ambient temperature range that is required when programming the ST27C256. To activate this mode the programming equipment must force 11.5V to 12.5V on address line A9 of the ST27C256. Two bytes may then be sequenced from the device outputs by toggling address line A0 from  $V_{IL}$  to  $V_{IH}$ . All other address lines must be held at  $V_{IL}$  during electronic signature mode.

PROGRAMMING CHARACTERISTICS ( $T_{amb} = 25 \pm 5^\circ\text{C}$ ,  $V_{CC} = 6.0\text{V} \pm 0.25\text{V}$ ,  $V_{PP} = 12.5\text{V} \pm 0.3\text{V}$ )

## DC AND OPERATING CHARACTERISTICS

Symbol	Parameter	Test Conditions	Values			Unit
			Min.	Typ.	Max.	
$I_I$	Input Current (all inputs)	$V_I = V_{IL}$ or $V_{IH}$			10	$\mu\text{A}$
$V_{IL}$	Input Low Level (all inputs)		-0.1		0.8	V
$V_{IH}$	Input High Level		2.0		$V_{CC} + 1$	V
$V_{OL}$	Output low voltage during verify	$I_{OL} = 2.1 \text{ mA}$			0.45	V
$V_{OH}$	Output high voltage during verify	$I_{OH} = -400 \mu\text{A}$	2.4			V
$I_{CC3}$	$V_{CC}$ Supply current (Program & Verify)				40	mA
$I_{PP2}$	$V_{PP}$ supply current (Program)	$\overline{CE} = V_{IL}$			30	mA

## AC CHARACTERISTICS

Symbol	Parameter	Test Conditions	Values			Unit
			Min.	Typ.	Max.	
$t_{AS}$	Address Set-up Time		2			$\mu\text{s}$
$t_{OES}$	$\overline{OE}$ Set-up Time		2			$\mu\text{s}$
$t_{DS}$	Data Set-up Time		2			$\mu\text{s}$
$t_{AH}$	Address Hold Time		0			$\mu\text{s}$
$t_{DH}$	Data Hold Time		2			$\mu\text{s}$
$t_{DFP}$	Output enable to output float delay		0		130	ns
$t_{VPS}$	$V_{PP}$ set-up time		2			$\mu\text{s}$
$t_{VCS}$	$V_{CC}$ set-up time		2			$\mu\text{s}$
$t_{PW}$	PGM initial program pulse width		0.95	1.0	1.05	ms
$t_{OPW}^{(2)}$	$\overline{CE}$ overprogram pulse width		2.85		78.75	ms
$t_{OE}$	Data valid from $\overline{OE}$				150	ns

Notes: 1.  $V_{CC}$  must be applied simultaneously or before  $V_{PP}$  and removed simultaneously or after  $V_{PP}$ .2.  $t_{OPW}$  is defined in flow chart.

## AC TEST CONDITIONS

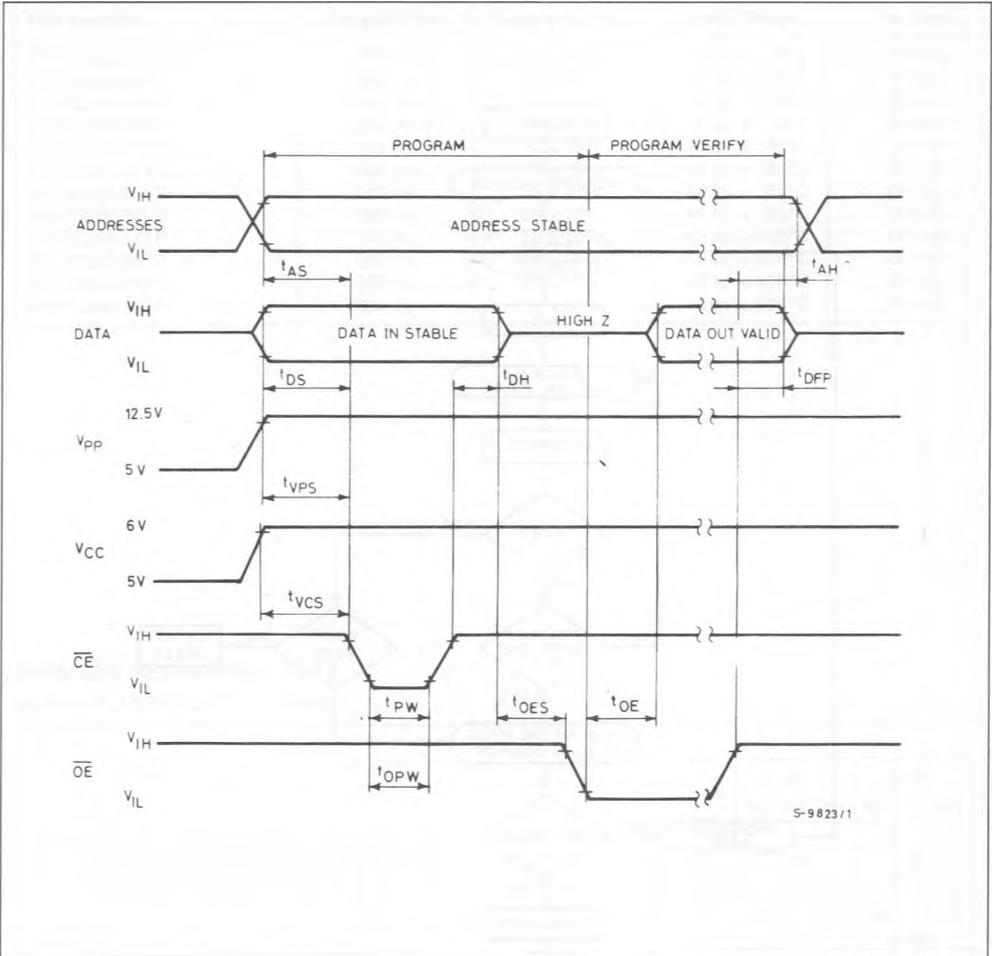
Input rise and fall times (10% to 90%)  $\leq 20\text{ns}$ 

Input pulse levels 0.45V to 2.4V

Input timing reference level 0.8V and 2.0V

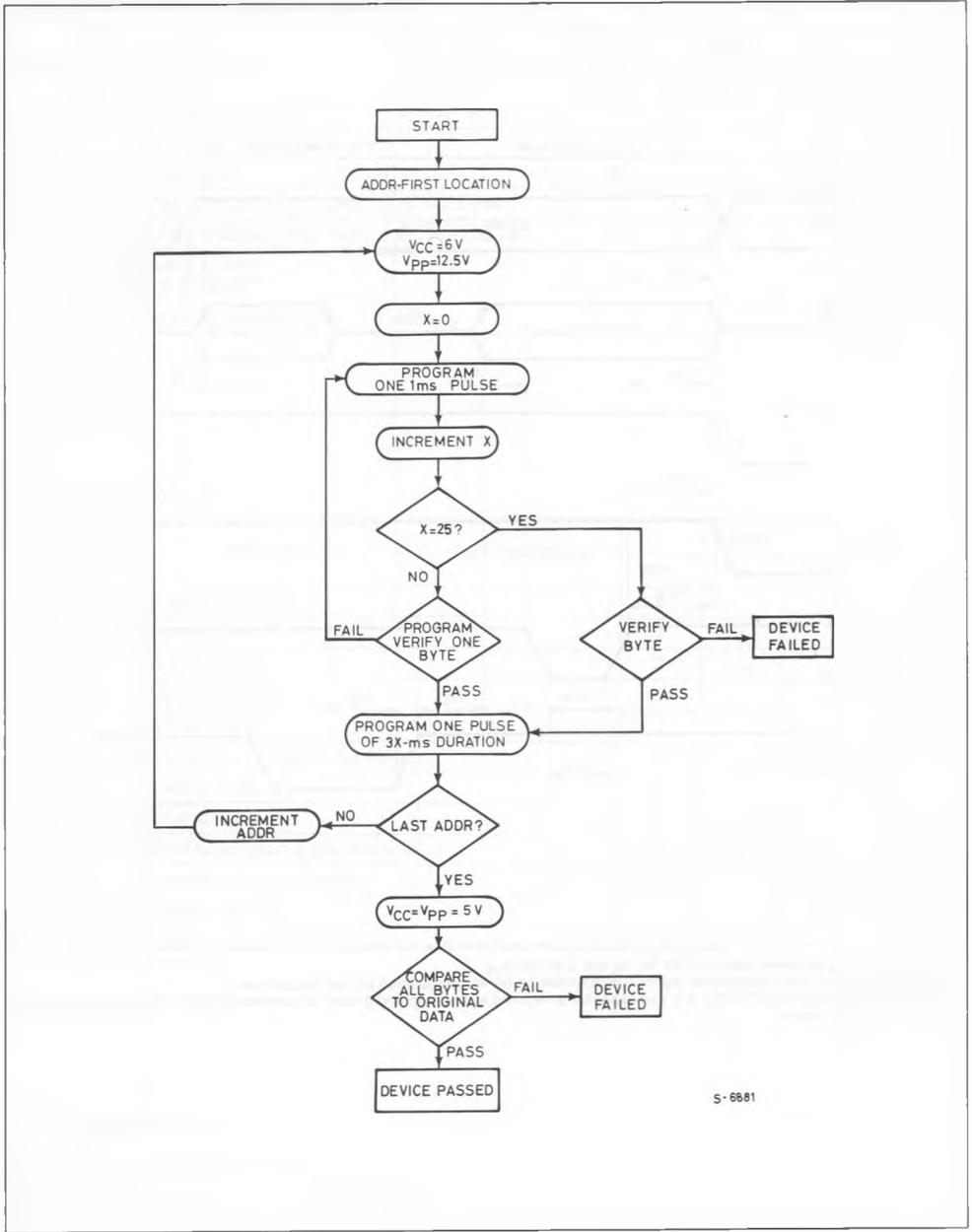
Output timing reference level 0.8V and 2.0V

## HIGH SPEED PROGRAMMING WAVEFORMS



1. The input timing reference level is 0.8V for  $V_{IL}$  and 2.0V for  $V_{IH}$ .
2.  $t_{OE}$  and  $t_{DFP}$  are characteristics of the device but must be accommodated by the programmer.
3. When programming the ST27C256, a 0.1  $\mu$ F capacitor is required across  $V_{pp}$  and ground to suppress spurious voltage transients which can damage the device.

HIGH SPEED PROGRAMMING FLOW CHART



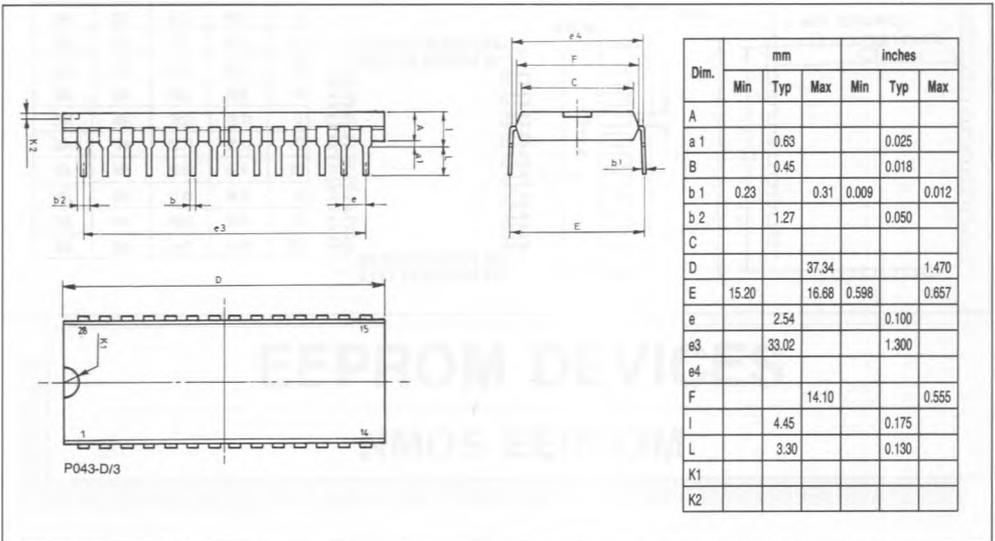
S-6681

## ORDERING INFORMATION (ST27C256P)

Part Number	Access Time	Supply Voltage	Temp. Range	Package
ST27C256-17CP	170 ns	5V ± 10%	0 to + 70°C	DIP-28
ST27C256-20CP	200 ns	5V ± 10%	0 to + 70°C	DIP-28
ST27C256-25CP	250 ns	5V ± 10%	0 to + 70°C	DIP-28
ST27C256-30CP	300 ns	5V ± 10%	0 to + 70°C	DIP-28
ST27C256-17VP	170 ns	5V ± 10%	-40 to + 85°C	DIP-28
ST27C256-20VP	200 ns	5V ± 10%	-40 to + 85°C	DIP-28
ST27C256-25VP	250 ns	5V ± 10%	-40 to + 85°C	DIP-28
ST27C256-30VP	300 ns	5V ± 10%	-40 to + 85°C	DIP-28
ST27C256-17TP	170 ns	5V ± 10%	-40 to + 105°C	DIP-28
ST27C256-20TP	200 ns	5V ± 10%	-40 to + 105°C	DIP-28
ST27C256-25TP	250 ns	5V ± 10%	-40 to + 105°C	DIP-28
ST27C256-30TP	300 ns	5V ± 10%	-40 to + 105°C	DIP-28

## PACKAGE MECHANICAL DATA

## 28-PIN PLASTIC DIP



ORDERING INFORMATION (ST27C256FN)

Part Number	Access Time	Supply Voltage	Temp. Range	Package
ST27C256-17CFN	170 ns	5V ± 10%	0 to + 70°C	PLCC32
ST27C256-20CFN	200 ns	5V ± 10%	0 to + 70°C	PLCC32
ST27C256-25CFN	250 ns	5V ± 10%	0 to + 70°C	PLCC32
ST27C256-30CFN	300 ns	5V ± 10%	0 to + 70°C	PLCC32
ST27C256-17VFN	170 ns	5V ± 10%	- 40 to + 85°C	PLCC32
ST27C256-20VFN	200 ns	5V ± 10%	- 40 to + 85°C	PLCC32
ST27C256-25VFN	250 ns	5V ± 10%	- 40 to + 85°C	PLCC32
ST27C256-30VFN	300 ns	5V ± 10%	- 40 to + 85°C	PLCC32
ST27C256-17TFN	170 ns	5V ± 10%	- 40 to + 105°C	PLCC32
ST27C256-20TFN	200 ns	5V ± 10%	- 40 to + 105°C	PLCC32
ST27C256-25TFN	250 ns	5V ± 10%	- 40 to + 105°C	PLCC32
ST27C256-30TFN	300 ns	5V ± 10%	- 40 to + 105°C	PLCC32

PACKAGE MECHANICAL DATA

PLCC32-32-LEAD PLASTIC LEADED CHIP CARRIER

