MICROCHIP

27C512

512K (64K x 8) CMOS EPROM

FEATURES

- High speed performance
  - —90 ns access time available
- CMOS Technology for low power consumption
  - —35 mA Active current
  - —100 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
  - —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

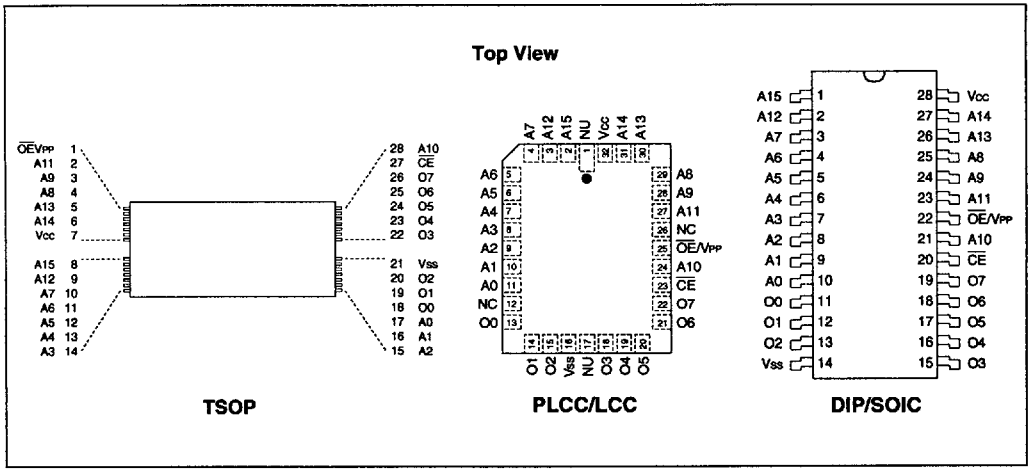
DESCRIPTION

The Microchip Technology Inc. 27C512 is a CMOS 512K bit (electrically) Programmable Read Only Memory. 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 flexability 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.

7

PIN CONFIGURATIONS



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

ELECTRICAL CHARACTERISTICS

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.

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"	V_{IH} V_{IL}	2.0 -0.5	Vcc+1 0.8	V V	
Input Leakage	all		I_{LI}	-10	10	µA	V_{IN} = 0 to Vcc
Output Voltages	all	Logic "1" Logic "0"	V_{OH} V_{OL}	2.4	 0.45	V V	I_{OH} = -400 µA I_{OL} = 2.1 mA
Output Leakage	all	—	I_{LO}	-10	10	µA	V_{OUT} = 0V to Vcc
Input Capacitance	all	—	C_{IN}	—	6	pF	V_{IN} = 0V; Tamb = 25°C; f = 1 MHz
Output Capacitance	all	—	C_{OUT}	—	12	pF	V_{OUT} = 0V; Tamb= 25°C; f = 1 MHz
Power Supply Current, Active	C I, E	TTL input TTL input	I_{CC} I_{CC}	— —	35 45	mA mA	Vcc = 5.5V f = 1 MHz; $\overline{OE}/V_{PP}$= $\overline{CE}$ = V_{IL}; Iout = 0 mA; V_{IL} = -0.1 to 0.8V; V_{IH} = 2.0 to Vcc; Note (1)
Power Supply Current, Standby	C I, E C	TTL input TTL input CMOS input	$I_{CC(S)TTL}$ $I_{CC(S)TTL}$ $I_{CC(S)CMOS}$	— — —	2 3 100	mA mA µA	 $\overline{CE}$ = Vcc ±0.2V

* Parts: C = Commercial Temperature Range; I, E = Industrial and Extended Temperature Ranges
Notes: (1) Active current increases 2 mA per MHz up to operating frequency for all temperature ranges.

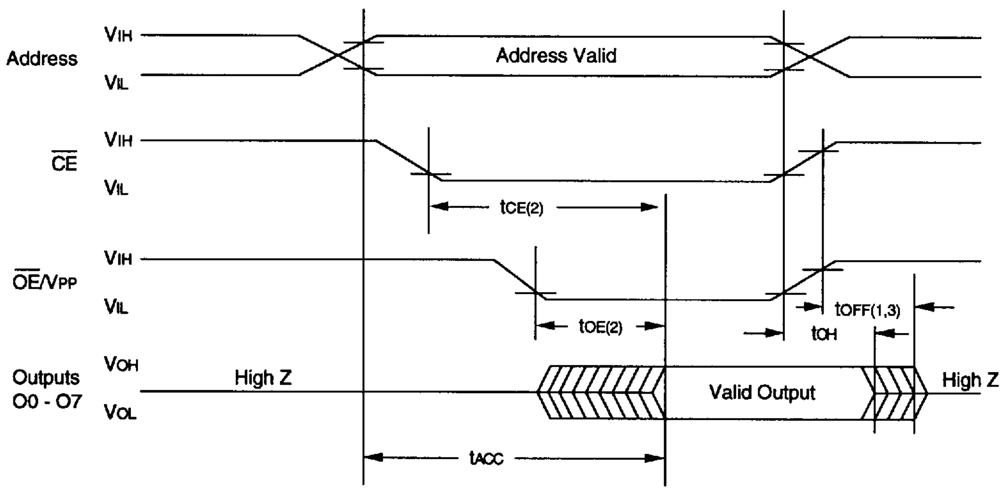
READ OPERATION
AC Characteristics

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: 10nsec
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	27C512-90*		27C512-10		27C512-12		27C512-15		27C512-20		Units	Conditions
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max		
Address to Output Delay	t_{ACC}	—	90	—	100	—	120	—	150	—	200	ns	$\overline{CE}$ = $\overline{OE}$/VPP = VIL
$\overline{CE}$ to Output Delay	t_{CE}	—	90	—	100	—	120	—	150	—	200	ns	$\overline{OE}$/VPP = VIL
$\overline{OE}$ to Output Delay	t_{OE}	—	40	—	40	—	50	—	60	—	75	ns	$\overline{CE}$ = VIL
$\overline{OE}$ to Output High Impedance	t_{OFF}	0	35	0	35	0	40	0	45	0	55	ns	
Output Hold from Address, $\overline{CE}$ or $\overline{OE}$/VPP, whichever occured first	t_{OH}	0	—	0	—	0	—	0	—	0	—	ns	

* -90 AC Testing Waveform: V_{IH} = 2.4V and V_{IL} = .45V; V_{OH} = 1.5V and V_{OL} = 1.5V
Output Load: 1 TTL Load + 30 pF

READ WAVEFORMS



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

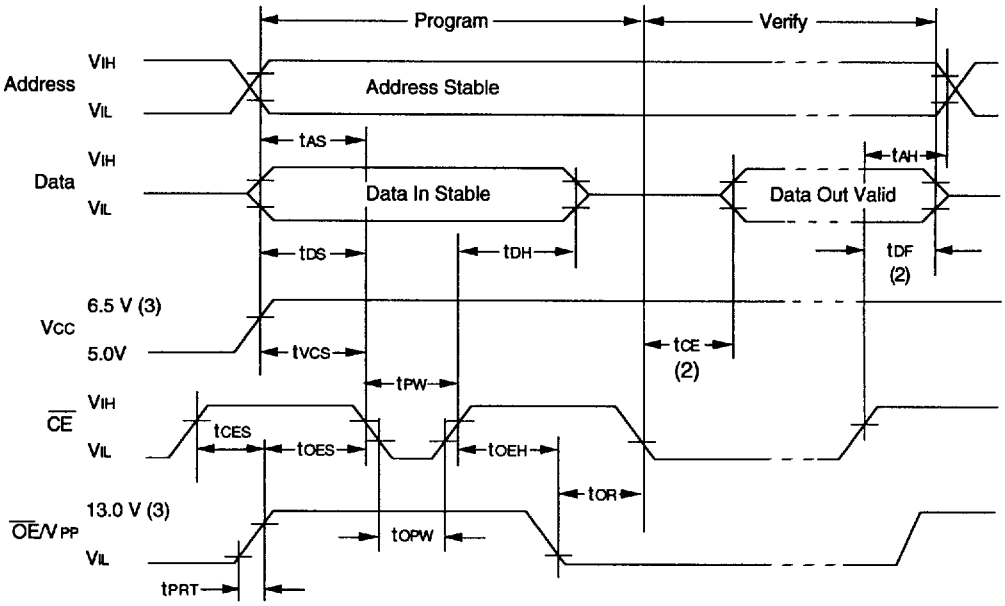
PROGRAMMING DC Characteristics		Ambient Temperature: 25°C ±5°C V_{CC} = 6.5V ± 0.25V, $\overline{OE}/V_{PP}$ = V_H = 13.0V ± 0.25V				
Parameter	**Status**	**Symbol**	**Min**	**Max**	**Units**	**Conditions** (See Note 1)
Input Voltages	Logic "1"	V_{IH}	2.0	V_{CC}+1	V	
	Logic "0"	V_{IL}	-0.1	0.8	V	
Input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

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

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 ± 0.25V				
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	

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

PROGRAMMING
Waveforms (1)



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 ±0.5V for express programming algorithm.

7

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

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 $\overline{OE}/V_{PP}$.

Standby Mode

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

When this condition is met, the supply current will drop from 35 mA to 100 µA.

Output Enable $\overline{OE}$/VPP

This multifunction pin eliminates bus connection in multiple bus microprcessor 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.

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 12,000µW/cm^2 for approximately 20 minutes.

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. A flowchart of the Express algorithm is shown in Figure 1.

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.

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.

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).

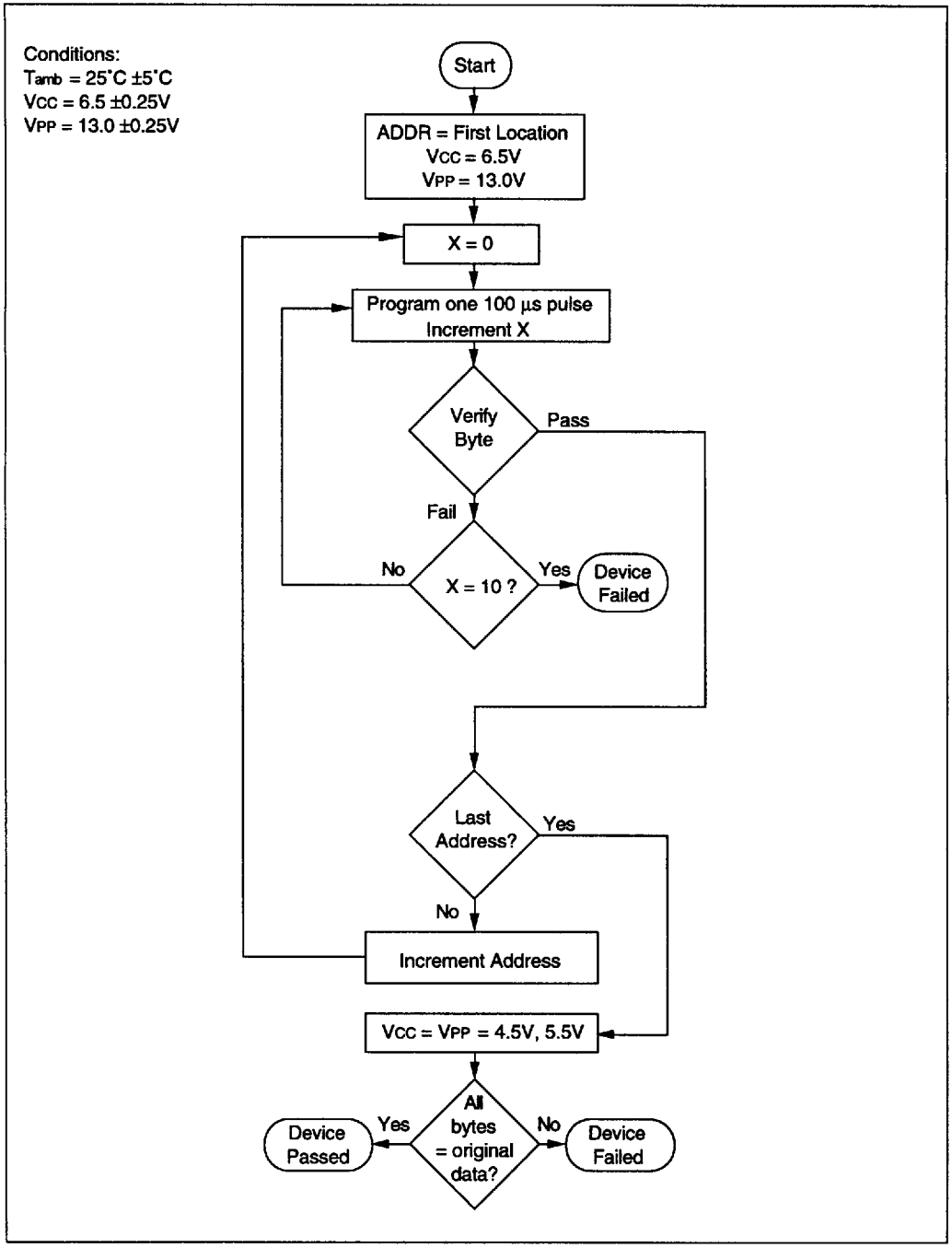
Identity Mode

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 - PROGRAMMING EXPRESS ALGORITHM



SALES AND SUPPORT

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.

PART NUMBERS

27C512 - 90 I / P

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
Temperature Range:	-	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
	20	200 ns
Device:	27C512	512K (64K x 8) CMOS EPROM

PACKAGING

Commercial/Industrial Outlines and Parameters

COMMERCIAL AND INDUSTRIAL PARTS

Part Number Suffix Designations:

XXXXXXXXXX - XX X / XX XXX

Examples:

27C256T-15I/J
PIC16C54-RCI/SO

ROM Code or Special Requirements

Case Outline

D	= Ceramic
J	= Cerdip (with window if EPROM) - all product except Microcontrollers
K	= LCC (Ceramic Leadless Chip Carrier, not thermally enhanced)
L	= PLCC (Plastic Leaded Chip Carrier)
P	= Plastic
S	= Die in Waffle Pack
W	= Die in Wafer Form
CB	= COB (Chip-On-Board)
JN	= Cerdip, no window - for Microcontrollers only
JW	= Cerdip, windowed - for Microcontrollers only
PQ	= PQFP
SJ	= Skinny Cerdip
SL	= 14-Lead Small Outline .150 mil
SM	= Small Outline .207 mil
SN	= Small Outline .150 mil
SO	= Small Outline .300 mil
SP	= Skinny Plastic Carrier
SS	= Shrink Small Outline Package
TS	= Thin Small Outline (TSOP) 8mm x 20mm
VS	= Very Small Outline (VSOP) 8 x 13mm

Process Temperature

Blank	= 0°C to +70°C
I	= -40°C to +85°C
E	= -40°C to +125°C

Speed (EPROM / High Density EEPROM)	**Frequency**	**Crystal Frequency Designator for PIC16/17 Microcontrollers**
-55 = 55 ns	Blank = 20.5 MHz	LP = 4 µs - Low Power
-70 = 70 ns	-14 = 14.4 MHz	RC = 2 µs - Resistor Capacitor
-90 = 90 ns	-25 = 25.6 MHz	XT = 1 µs - Crystal
-10 = 100 ns	-32 = 32.8 MHz	HS = 20 MHz - High Speed Crystal
-12 = 120 ns		-10 = 10 MHz - High Speed Crystal
-15 = 150 ns		-04 = 4 MHz - Crystal or RC
-17 = 170 ns		-16 = 16 MHz - High Speed Crystal
-20 = 200 ns		-20 = 20 MHz - High Speed Crystal
-25 = 250 ns		-25 = 25 MHz - High Speed Crystal

OPTION

-	= twc = 1 ms
F	= twc = 200 µs
X	= Rotated pinout
T	= Tape and Reel

Device Type (Up To 10 Digits)

C	= Indicates CMOS
LC	= Indicates Low Power CMOS
AA	= 1.8V
LV	= Low Voltage
HC	= High Speed
LCS	= Low Power Security

11

TABLE OF CONTENTS

SECTION 1: HERMETIC

TABLE OF CONTENTS (Cont'd)

SECTION 2: PLASTIC