

## Military 64K x 16 CMOS EPROM

### KEY FEATURES

- **Ultra-High Performance**
  - 120 ns Access Time
- **DESC SMD No. 5962-86805**
- **EPI Processing**
  - Latch-Up Immunity to 200 mA
  - ESD Protection Exceeds 2000 Volts
- **JEDEC Standard Pin Configuration**
  - 40 Pin Cerdip Package
  - 44 Pin Leadless Chip Carrier (CLLCC)
  - 44 Pin Leaded Chip Carrier (CLDCC)

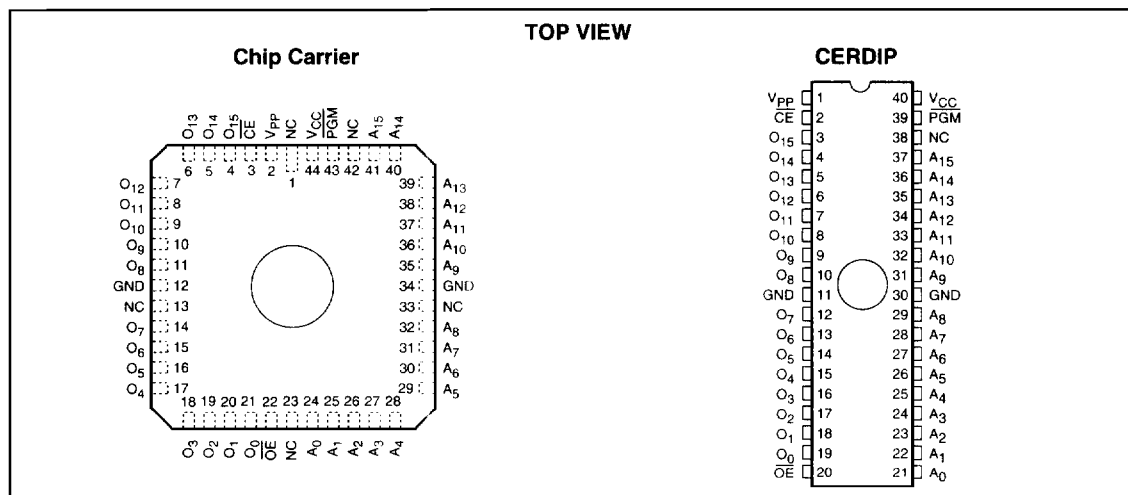
### GENERAL DESCRIPTION

The WS27C210L is a performance oriented 1 Meg UV Erasable Electrically Programmable Read Only Memory organized as 64K words x 16 bits/word. It is manufactured using an advanced CMOS technology which enables it to operate at speeds up to 120 nsecs. The memory was designed utilizing WSI's patented self-aligned split gate EPROM cell, resulting in a low power device with a very cost effective die size.

The WS27C210L 1 Meg EPROM provides extensive 16 bit wide code store capacity for DSP, microprocessor, and microcontroller-based systems. Its 120 nsec access time over the full Military temperature range provides the potential of no-wait state operation. And where this parameter is important, the WS27C210L provides the user with a very fast 35 nsec  $T_{OE}$  output enable time.

The WS27C210L is offered in a 40 pin 600 mil Cerdip, and both a Leaded and Leadless 44 pad Ceramic Chip Carrier (CLDCC and CLLCC respectively) for surface mount applications. All packages incorporate the standard JEDEC X16 EPROM pinout.

### PIN CONFIGURATION



### PRODUCT SELECTION GUIDE

PARAMETER	WS27C210L-12	WS27C210L-15	WS27C210L-20
Address Access Time (Max)	120 ns	150 ns	200 ns
Chip Select Time (Max)	120 ns	150 ns	200 ns
Output Enable Time (Max)	35 ns	40 ns	40 ns

**ABSOLUTE MAXIMUM RATINGS\***

Storage Temperature.....	-65° to +150°C
Voltage on any Pin with Respect to Ground .....	-0.6V to +7V
V <sub>PP</sub> with Respect to Ground.....	-0.6V to +14V
V <sub>CC</sub> Supply Voltage with Respect to Ground .....	-0.6V to +7V
ESD Protection .....	>2000V

**\*NOTICE:**

Stresses above those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods of time may affect device reliability.

**OPERATING RANGE**

RANGE	TEMPERATURE	V <sub>CC</sub>
Military	-55°C to +125°C	+5V ± 10%

**DC READ CHARACTERISTICS** Over Operating Range. (See Above)

SYMBOL	PARAMETER	TEST CONDITIONS	MIN	MAX	UNITS
V <sub>IL</sub>	Input Low Voltage		-0.5	0.8	V
V <sub>IH</sub>	Input High Voltage		2.0	V <sub>CC</sub> + 1	V
V <sub>OL</sub>	Output Low Voltage	I <sub>OL</sub> = 2.1 mA		0.4	V
V <sub>OH</sub>	Output High Voltage	I <sub>OH</sub> = -400 µA	3.5		V
I <sub>SB1</sub>	V <sub>CC</sub> Standby Current (CMOS)	$\overline{CE} = V_{CC} \pm 0.3$ V (Note 2)		100	µA
I <sub>SB2</sub>	V <sub>CC</sub> Standby Current	$\overline{CE} = V_{IH}$		1	mA
I <sub>CC</sub>	V <sub>CC</sub> Active Current (TTL)	$\overline{CE} = \overline{OE} = V_{IL}$ (Note 1)	F = 5 MHz	60	mA
			F = 8 MHz	70	mA
I <sub>PP</sub>	V <sub>PP</sub> Supply Current	V <sub>PP</sub> = V <sub>CC</sub>		100	µA
V <sub>PP</sub>	V <sub>PP</sub> Read Voltage		V <sub>CC</sub> - 0.4	V <sub>CC</sub>	V
I <sub>LI</sub>	Input Leakage Current	V <sub>IN</sub> = 5.5 V or Gnd	-10	10	µA
I <sub>LO</sub>	Output Leakage Current	V <sub>OUT</sub> = 5.5 V or Gnd	-10	10	µA

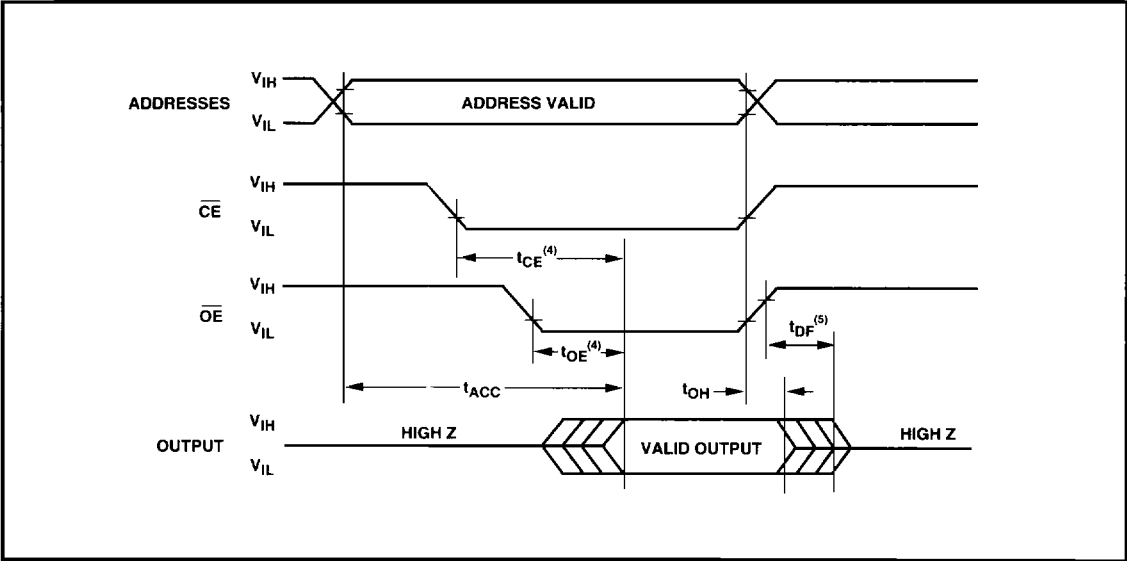
NOTES: 1. The supply current is the sum of I<sub>CC</sub> and I<sub>PP</sub>. The maximum current value is with Outputs O<sub>0</sub> to O<sub>7</sub> unloaded.  
2. CMOS inputs: V<sub>IL</sub> = GND ± 0.3V, V<sub>IH</sub> = V<sub>CC</sub> ± 0.3 V.

**AC READ CHARACTERISTICS** Over Operating Range (See Above)

SYMBOL	PARAMETER	WS27C210L-12		WS27C210L-15		WS27C210L-20		UNITS
		MIN	MAX	MIN	MAX	MIN	MAX	
t <sub>ACC</sub>	Address to Output Delay		120		150		200	ns
t <sub>CE</sub>	$\overline{CE}$ to Output Delay		120		150		200	
t <sub>OE</sub>	$\overline{OE}$ to Output Delay		35		40		40	
t <sub>DF</sub>	Output Disable to Output Float (Note 3)		35		40		40	
t <sub>OH</sub>	Output Hold From Addresses, $\overline{CE}$ or $\overline{OE}$ , Whichever Occurred First (Note 3)	0		0		0		

NOTE: 3. This parameter is only sampled and is not 100% tested. Output Float is defined as the point where data is no longer driven — see timing diagram.

AC READ TIMING DIAGRAM



NOTE: 4.  $\overline{OE}$  may be delayed up to  $t_{CE} - t_{OE}$  after the falling edge of  $\overline{CE}$  without impact on  $t_{CE}$ .

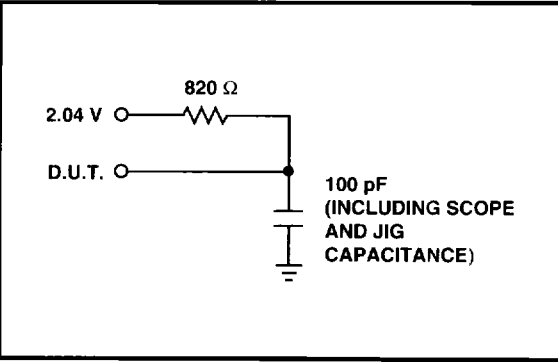
CAPACITANCE<sup>(5)</sup>  $T_A = 25^\circ\text{C}$ ,  $f = 1\text{ MHz}$

SYMBOL	PARAMETER	CONDITIONS	TYP <sup>(6)</sup>	MAX	UNITS
$C_{IN}$	Input Capacitance	$V_{IN} = 0\text{ V}$	4	6	pF
$C_{OUT}$	Output Capacitance	$V_{OUT} = 0\text{ V}$	8	12	pF
$C_{VPP}$	$V_{PP}$ Capacitance	$V_{PP} = 0\text{ V}$	18	25	pF

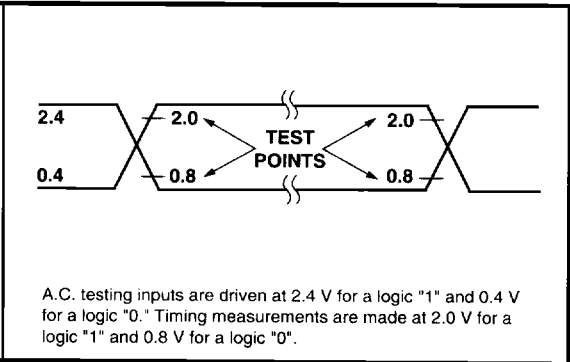
NOTES: 5. This parameter is only sampled and is not 100% tested.  
6. Typical values are for  $T_A = 25^\circ\text{C}$  and nominal supply voltages.

5

TEST LOAD (High Impedance Test Systems)



A.C. TESTING INPUT/OUTPUT WAVEFORM



NOTE: 7. Provide adequate decoupling capacitance as close as possible to this device to achieve the published A.C. and D.C. parameters. A 0.1 microfarad capacitor in parallel with a 0.01 microfarad capacitor connected between  $V_{CC}$  and ground is recommended. Inadequate decoupling may result in access time degradation or other transient performance failures.

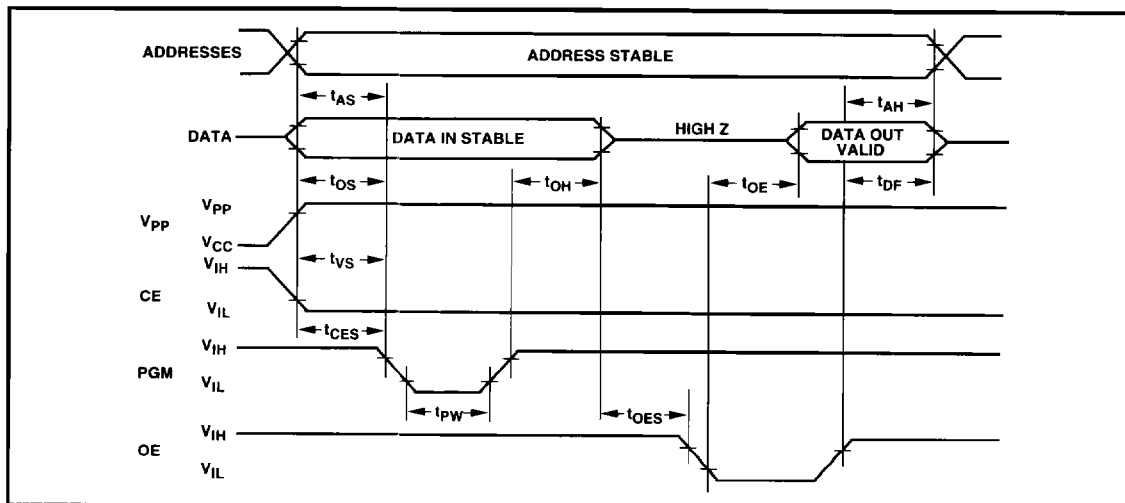
**PROGRAMMING INFORMATION****DC CHARACTERISTICS** ( $T_A = 25 \pm 5^\circ\text{C}$ ,  $V_{CC} = 6.25 \pm 0.25\text{ V}$ ,  $V_{PP} = 12.75 \pm 0.25\text{ V}$ . See Notes 8, 9 and 10)

SYMBOLS	PARAMETER	MIN	MAX	UNITS
$I_{LI}$	Input Leakage Current ( $V_{IN} = V_{CC}$ or Gnd)	-10	10	$\mu\text{A}$
$I_{PP}$	$V_{PP}$ Supply Current During Programming Pulse ( $\overline{CE} = \overline{PGM} = V_{IL}$ )		60	mA
$I_{CC}$	$V_{CC}$ Supply Current		50	mA
$V_{IL}$	Input Low Voltage	-0.1	0.8	V
$V_{IH}$	Input High Voltage	2.0	$V_{CC} + 0.3$	V
$V_{OL}$	Output Low Voltage During Verify ( $I_{OL} = 2.1\text{ mA}$ )		0.4	V
$V_{OH}$	Output High Voltage During Verify ( $I_{OH} = -400\text{ }\mu\text{A}$ )	3.5		V

- NOTES:** 8.  $V_{CC}$  must be applied either coincidentally or before  $V_{PP}$  and removed either coincidentally or after  $V_{PP}$ .  
 9.  $V_{PP}$  must not be greater than 14 volts including overshoot. During  $\overline{CE} = \overline{PGM} = V_{IL}$ ,  $V_{PP}$  must not be switched from 5 volts to 12.75 volts or vice-versa.  
 10. During power up the  $\overline{PGM}$  pin must be brought high ( $\geq V_{IH}$ ) either coincident with or before power is applied to  $V_{PP}$ .

**AC CHARACTERISTICS** ( $T_A = 25 \pm 5^\circ\text{C}$ ,  $V_{CC} = 6.25 \pm 0.25\text{ V}$ ,  $V_{PP} = 12.75 \pm 0.25\text{ V}$ )

SYMBOLS	PARAMETER	MIN	TYP	MAX	UNITS
$t_{AS}$	Address Setup Time	2			$\mu\text{s}$
$t_{OES}$	Output Enable Setup Time	2			$\mu\text{s}$
$t_{OS}$	Data Setup Time	2			$\mu\text{s}$
$t_{AH}$	Address Hold Time	0			$\mu\text{s}$
$t_{OH}$	Data Hold Time	2			$\mu\text{s}$
$t_{DF}$	Chip Disable to Output Float Delay	0		55	ns
$t_{OE}$	Data Valid From Output Enable			55	ns
$t_{VS}/t_{CES}$	$V_{PP}$ Setup Time/ $\overline{CE}$ Setup Time	2			$\mu\text{s}$
$t_{PW}$	$\overline{PGM}$ Pulse Width	0.1		4	ms

**PROGRAMMING WAVEFORM**

## MODE SELECTION

The modes of operation of the WS27C210L are listed below. A single 5 V power supply is required in the read mode. All inputs are TTL levels except for  $V_{PP}$  and  $A_9$  for device signature.

MODE	PINS	$\overline{CE}$	$\overline{OE}$	PGM	$A_9$	$A_0$	$V_{PP}$	$V_{CC}$	OUTPUTS
Read		$V_{IL}$	$V_{IL}$	X <sup>(11)</sup>	X	X	X	5.0 V	$D_{OUT}$
Output Disable		X	$V_{IH}$	X	X	X	X	5.0 V	High Z
Standby		$V_{IH}$	X	X	X	X	X	5.0 V	High Z
Programming		$V_{IL}$	$V_{IH}$	$V_{IL}$	X	X	$V_{PP}$	6.2 V	$D_{IN}$
Program Verify		$V_{IL}$	$V_{IL}$	$V_{IH}$	X	X	$V_{PP}$	6.2 V	$D_{OUT}$
Program Inhibit		$V_{IH}$	X	X	X	X	$V_{PP}$	6.2 V	High Z
Signature	Manufacturer <sup>(13)</sup>	$V_{IL}$	$V_{IL}$	X	$V_H^{(12)}$	$V_{IL}$	X	5.0 V	23 H
	Device <sup>(13)</sup>	$V_{IL}$	$V_{IL}$	X	$V_H^{(12)}$	$V_{IH}$	X	5.0 V	C9 H

- NOTES:** 11. X can be  $V_{IL}$  or  $V_{IH}$ .  
 12.  $V_H = V_{PP} = 12.75 \pm 0.25$  V.  
 13.  $A_1 - A_8, A_{10} - A_{15} = V_{IL}$ .

## ORDERING INFORMATION

PART NUMBER	SPEED (ns)	PACKAGE TYPE	PACKAGE DRAWING	OPERATING TEMPERATURE RANGE	WSI MANUFACTURING PROCEDURE
WS27C210L-12CMB*	120	44 Pad CLLCC	C3	Military	MIL-STD-883C
WS27C210L-12DMB*	120	40 Pin CERDIP, 0.6"	D3	Military	MIL-STD-883C
WS27C210L-15CMB*	150	44 Pad CLLCC	C3	Military	MIL-STD-883C
WS27C210L-15DMB*	150	40 Pin CERDIP, 0.6"	D3	Military	MIL-STD-883C
WS27C210L-15LMB	150	44 Pin CLDCC	L4	Military	MIL-STD-883C
WS27C210L-17CMB*	170	44 Pad CLLCC	C3	Military	MIL-STD-883C
WS27C210L-17DMB*	170	40 Pin CERDIP, 0.6"	D3	Military	MIL-STD-883C

**NOTE:** 14. The actual part marking will not include the initials "WS."

\*SMD product. See page 5-2 for SMD numbers.

## PROGRAMMING/ALGORITHMS/ERASURE/PROGRAMMERS

**REFER TO  
PAGE 6-1**

The WS27C210L is programmed using Algorithm E shown on page 6-11.  
 (This product can also be programmed by using National Semiconductor's 27C210 Programming Algorithm.)