8K x 8 Static RAM (Low Power) L7C185/L7CL185

FEATURES

- 8K × 8 Static RAM with Chip Select Powerdown, Output Enable
- Auto-Powerdown™ Design
- Advanced CMOS Technology
- High Speed — to 10 ns maximum
- Low Power Operation
  Active:
  320 mW (L7C185) typical at 35 ns
  Standby (typical):
  500 µW (L7C185)
  250 µW (L7CL185)
- Data Retention at 2 V for Battery Backup Operation
- Plug Compatible with IDT7164, Cypress CY7C185/186
- Package Styles Available:
  - 28-pin Plastic DIP
  - 28-pin Sidebraze, Hermetic DIP
  - 28-pin CerDIP
  - 28-pin Plastic SOIC
  - 28-pin Plastic SOJ
  - 28-pin Ceramic LCC
  - 32-pin Ceramic LCC

DESCRIPTION

The L7C185 and L7CL185 are high-performance, low-power CMOS static RAMs. The storage circuitry is organized as 8,192 words by 8 bits per word. The 8 Data In and Data Out signals share I/O pins. These devices are available in six speeds with maximum access times from 10 ns to 35 ns.

Inputs and output are TTL compatible. Operation is from a single +5 V power supply. Power consumption for the L7C185 is 320 mW (typical) at 35 ns. Dissipation drops to 75 mW (typical) for the L7C185 and 60 mW (typical) for the L7CL185 when the memory is deselected (Enable is high).

Two standby modes are available. Proprietary Auto-Powerdown™ circuitry reduces power consumption automatically during read or write accesses which are longer than the minimum access time, or when the memory is deselected. In addition, data may be retained in inactive storage with a supply voltage as low as 2 V. The L7C185 and L7CL185 consume only 30 µW and 15 µW (typical) respectively at 3 V, allowing effective battery backup operation.

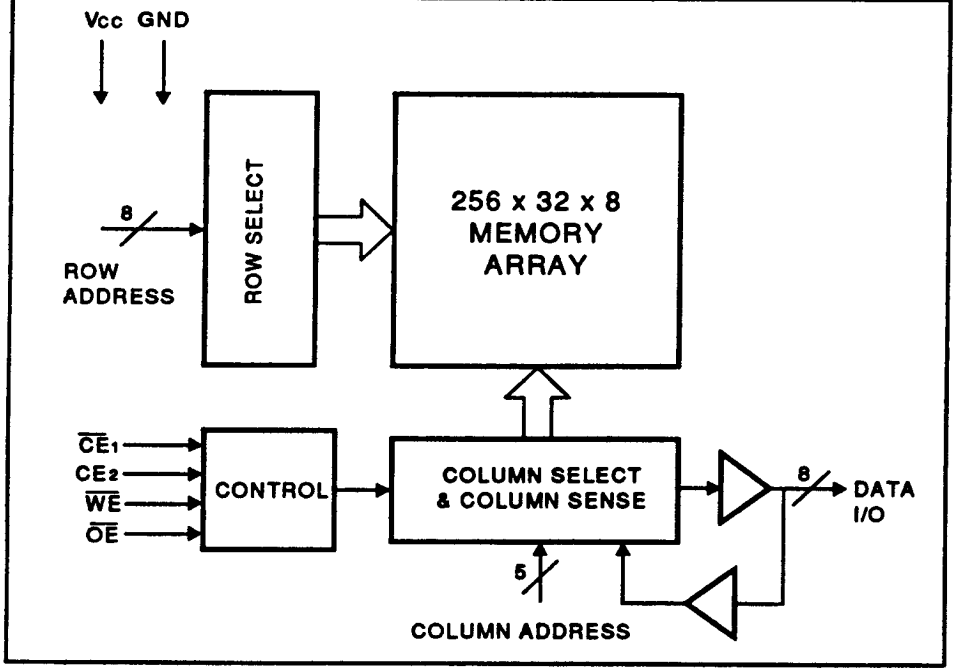
The L7C185 and L7CL185 provide asynchronous (unclocked) operation with matching access and cycle times. Two Chip Enables (one active-low) and a three-state I/O bus with a separate Output Enable control simplify the connection of several chips for increased storage capacity.

Memory locations are specified on address pins A0 through A12. Reading from a designated location is accomplished by presenting an address and driving $\overline{CE_1}$ low and CE_2 high while $\overline{WE}$ remains high. The data in the addressed memory location will then appear on the Data I/O pins within one access time. The I/O pins stay in a high-impedance state when $\overline{CE_1}$ is high or CE_2 or $\overline{WE}$ is low.

Writing to an addressed location is accomplished when the active-low $\overline{CE_1}$ and $\overline{WE}$ inputs are both low, and CE_2 is high. Any of these signals may be used to terminate the write operation. Data In and Data Out signals have the same polarity.

Latchup and static discharge protection are provided on-chip. The L7C185 and L7CL185 can withstand an injection current of up to 200 mA on any pin without damage.

L7C185/L7CL185 Block Diagram



LOGIC DEVICES INCORPORATED

Memory Products

3/15/90

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Maximum Ratings *Above which useful life may be impaired (Notes 1, 2)*

Storage temperature	−65°C to +150°C
Operating ambient temperature	−55°C to +125°C
V_{CC} supply voltage with respect to ground	−0.5 V to +7.0 V
Input signal with respect to ground	−3.0 V to +7.0 V
Signal applied to high impedance output	−3.0 V to +7.0 V
Output current into low outputs	25 mA
Latchup current	> 200 mA

Operating Conditions *To meet specified electrical and switching characteristics*

Mode	Temperature Range (Ambient)	Supply Voltage
Active Operation, Commercial	0°C to +70°C	$4.5\ V \le V_{CC} \le 5.5\ V$
Active Operation, Military	−55°C to +125°C	$4.5\ V \le V_{CC} \le 5.5\ V$
Data Retention, Commercial	0°C to +70°C	$2.0\ V \le V_{CC} \le 5.5\ V$
Data Retention, Military	−55°C to +125°C	$2.0\ V \le V_{CC} \le 5.5\ V$

Electrical Characteristics *Over Operating Conditions*

Symbol	Parameter	Test Condition	L7C185 Min	L7C185 Typ	L7C185 Max	L7CL185 Min	L7CL185 Typ	L7CL185 Max	Unit
V_{OH}	Output High Voltage	$I_{OH} = -4.0$ mA, $V_{CC} = 4.5$ V	2.4			2.4			V
V_{OL}	Output Low Voltage	$I_{OL} = 8.0$ mA			0.4			0.4	V
V_{IH}	Input High Voltage		2.0		V_{CC} +0.3	2.0		V_{CC} +0.3	V
V_{IL}	Input Low Voltage	(Note 3)	−3.0		0.8	−3.0		0.8	V
I_{IX}	Input Leakage Current	$GND \le V_{IN} \le V_{CC}$	−10		+10	−10		+10	µA
I_{OZ}	Output Leakage Current	$GND \le V_{OUT} \le V_{CC}$, $\overline{CE} = V_{CC}$	−10		+10	−10		+10	µA
I_{OS}	Output Short Current	V_{OUT} = GND, V_{CC} = Max (Note 4)			−350			−350	mA
I_{CC2}	Vcc Current, TTL Inactive	(Notes 5, 7)		15	30		12	20	mA
I_{CC3}	Vcc Current, CMOS Standby	(Note 8)		100	500		50	150	µA
I_{CC4}	Vcc Current, Data Retention	$V_{CC} = 3.0$ V (Note 9)		10	250		5	50	µA
C_{IN}	Input Capacitance	Ambient Temp = 25°C, $V_{CC} = 5.0$ V			5			5	pF
C_{OUT}	Output Capacitance	Test Frequency = 1 MHz (Note 10)			7			7	pF

Symbol	Parameter	Test Condition	L7C185- 35	25	20	15	12	10		Unit
I_{CC1}	Vcc Current, Active	(Notes 5, 6)	85	120	140	185	225	240		mA

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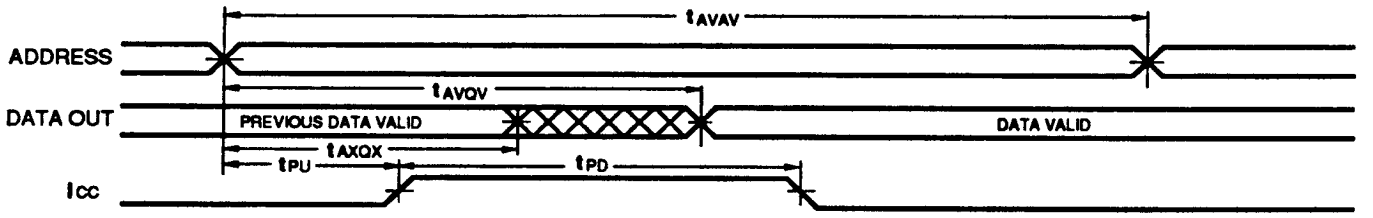
SWITCHING CHARACTERISTICS *Over Operating Range (ns)*

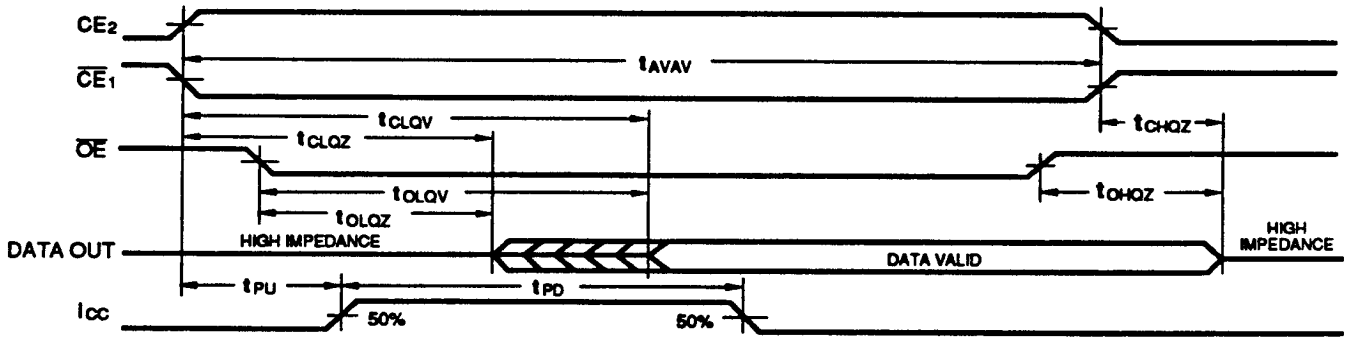
READ CYCLE *(Notes 11, 12, 22, 23, 24)*

Symbol	Parameter	L7C185/L7CL185- 35 Min	35 Max	25 Min	25 Max	20 Min	20 Max	15 Min	15 Max	12 Min	12 Max	10 Min	10 Max	Min	Max
t_{AVAV}	Read Cycle Time	35		25		20		15		12		10			
t_{AVQV}	Address Valid to Output Valid (13, 14)		35		25		20		15		12		10		
t_{AXQX}	Address Change to Output Change	3		3		3		3		3		3			
t_{CLQV}	Chip Enable Active to Output Valid (13, 15)		35		25		20		15		12		10		
t_{CLQZ}	Chip Enable Active to Output Low Z (20, 21)	3		3		3		3		3		3			
t_{CHQZ}	Chip Enable Inactive to Output High Z (20, 21)		15		10		8		8		5		4		
t_{OLQV}	Output Enable Low to Output Valid		15		12		10		8		6		5		
t_{OLQZ}	Output Enable Low to Output Low Z (20, 21)	0		0		0		0		0		0			
t_{OHQZ}	Output Enable High to Output High Z (20, 21)		12		10		8		5		5		4		
t_{PU}	Input Transition to Power Up (10, 19)	0		0		0		0		0		0			
t_{PD}	Power Up to Power Down (10, 19)		35		25		20		20		20		18		
t_{CHVL}	Chip Enable Inactive to Data Retention (10)	0		0		0		0		0		0			

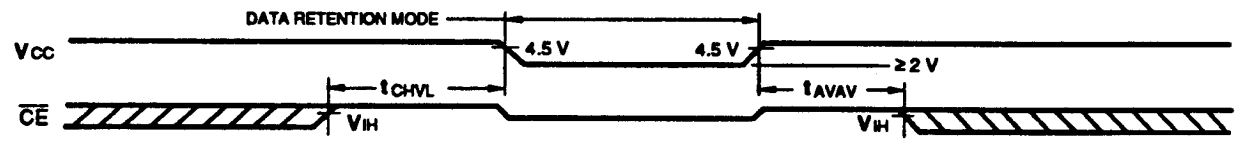
READ CYCLE — ADDRESS CONTROLLED *(Notes 13, 14)*



READ CYCLE — CE/OE CONTROLLED *(Notes 13, 15)*



DATA RETENTION



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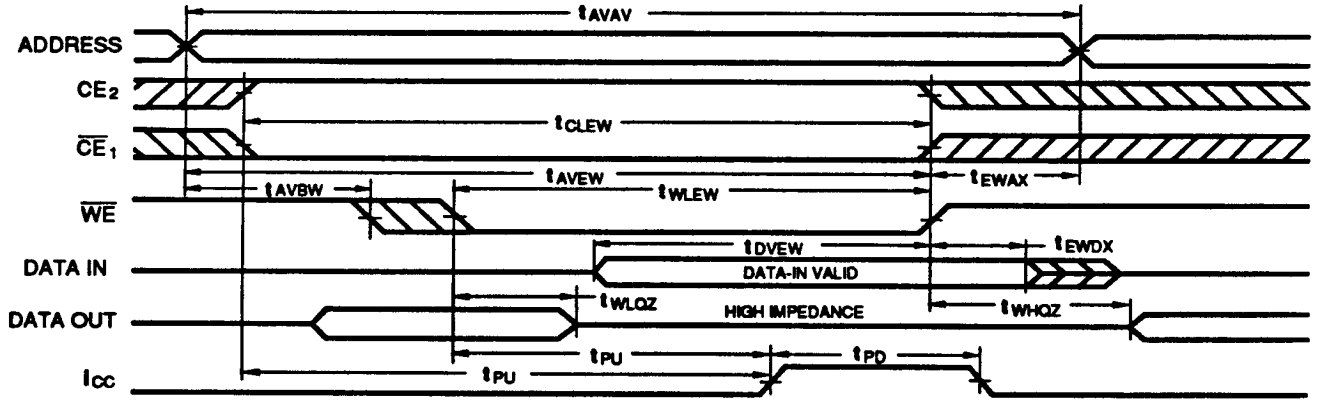
SWITCHING CHARACTERISTICS *Over Operating Range (ns)*

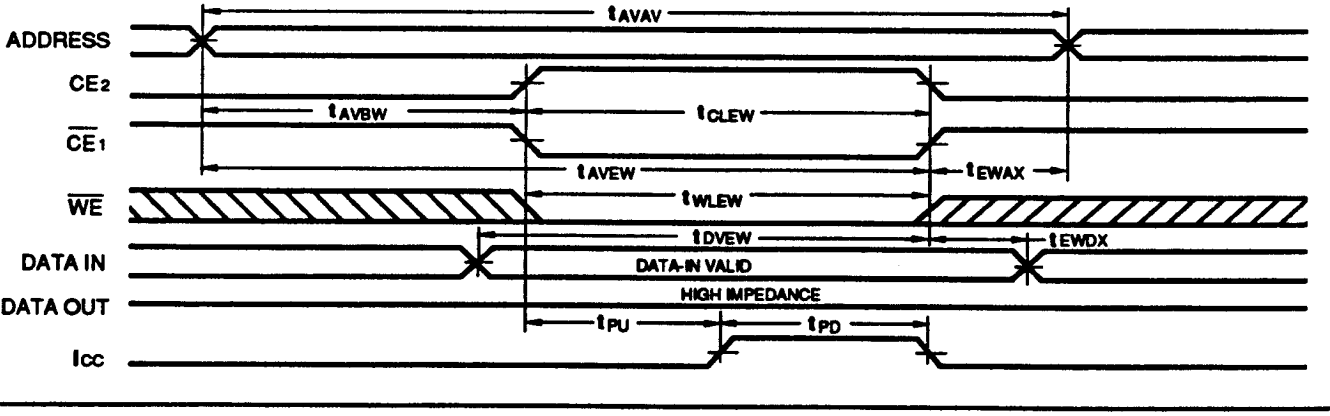
WRITE CYCLE *(Notes 11, 12, 22, 23, 24)*

Symbol	Parameter	L7C185/L7CL185- 35 Min	35 Max	25 Min	25 Max	20 Min	20 Max	15 Min	15 Max	12 Min	12 Max	10 Min	10 Max	Min	Max
tAVAV	Write Cycle Time	25		20		20		15		12		10			
tCLEW	Chip Enable Active to End of Write Cycle	25		15		15		12		10		8			
tAVBW	Address Valid to Beginning of Write Cycle	0		0		0		0		0		0			
tAVEW	Address Valid to End of Write Cycle	25		15		15		12		10		8			
tEWAX	End of Write Cycle to Address Change	0		0		0		0		0		0			
tWLEW	Write Enable Low to End of Write Cycle	20		15		15		12		10		8			
tDVEW	Data Valid to End of Write Cycle	15		10		10		7		6		5			
tEWDX	End of Write Cycle to Data Change	0		0		0		0		0		0			
tWHQZ	Write Enable High to Output Low Z (20, 21)	0		0		0		0		0		0			
tWLQZ	Write Enable Low to Output High Z (20, 21)		10		7		7		5		4		4		

WRITE CYCLE — $\overline{WE}$ CONTROLLED *(Notes 16, 17, 18, 19)*



WRITE CYCLE — $\overline{CE}$ CONTROLLED *(Notes 16, 17, 18, 19)*



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NOTES

1. Maximum Ratings indicate stress specifications only. Functional operation of these products at values beyond those indicated in the Operating Conditions table is not implied. Exposure to maximum rating conditions for extended periods may affect reliability of the tested device.

2. The products described by this specification include internal circuitry designed to protect the chip from damaging substrate injection currents and accumulations of static charge. Nevertheless, conventional precautions should be observed during storage, handling, and use of these circuits in order to avoid exposure to excessive electrical stress values.

3. This product provides hard clamping of transient undershoot. Input levels below ground will be clamped beginning at –0.6 V. A current in excess of 100 mA is required to reach –2 V. The device can withstand indefinite operation with inputs as low as –3 V subject only to power dissipation and bond wire fusing constraints.

4. Duration of the output short circuit should not exceed 30 seconds.

5. 'Typical' supply current values are not shown but may be approximated. At a VCC of +5.0 V, an ambient temperature of +25°C and with nominal manufacturing parameters, the operating supply currents will be approximately 3/4 or less of the maximum values shown.

6. Tested with outputs open and all address and data inputs changing at the maximum read cycle rate. The device is continuously enabled for reading, i.e., $\overline{CE1} \le VIL$, CE2 and $\overline{WE} \ge VIH$. Input pulse levels are 0 to 3.0 V.

7. Tested with outputs open and all address and data inputs changing at the maximum read cycle rate. The device is continuously disabled, i.e., $\overline{CE1} \ge VIH$, $CE2 \le VIL$.

8. Tested with outputs open and all address and data inputs stable. The device is continuously disabled, i.e., $\overline{CE1}$ = VCC, CE2 = GND. Input levels are within 0.2 V of VCC or ground.

9. Data retention operation requires that VCC never drop below 2.0 V. $\overline{CE1}$ must be ≥ VCC – 0.2 V. For the L7C185, all other inputs meet VIN ≤ 0.2 V or VIN ≥ VCC – 0.2 V to ensure full powerdown. For the L7CL185, this requirement applies only to $\overline{CE}$ and $\overline{WE}$; there are no restrictions on data and address.

10. These parameters are guaranteed but not 100% tested.

11. Test conditions assume input transition times of less than 3 ns, reference levels of 1.5 V, output loading for specified IOL and IOH plus 30 pF (Fig. 1a), and input pulse levels of 0 to 3.0 V (Fig. 2).

12. Each parameter is shown as a minimum or maximum value. Input requirements are specified from the point of view of the external system driving the chip. For example, t_{AVEW} is specified as a minimum since the external system must supply at least that much time to meet the worst-case requirements of all parts. Responses from the internal circuitry are specified from the point of view of the device. Access time, for example, is specified as a maximum since worst-case operation of any device always provides data within that time.

13. $\overline{WE}$ is high for the read cycle.

14. The chip is continuously selected ($\overline{CE1}$ low, CE2 high).

15. All address lines are valid prior-to or coincident-with the later of $\overline{CE1}$ and CE2 transition to active.

16. The internal write cycle of the memory is defined by the overlap of $\overline{CE1}$ and CE2 active and $\overline{WE}$ low. All three signals must be active to initiate a write. Any signal can terminate a write by going inactive. The address, data, and control input setup and hold times should be referenced to the signal that becomes active last or becomes inactive first.

17. If $\overline{WE}$ goes low before or concurrent with later of $\overline{CE1}$ and CE2 going active, the output remains in a high impedance state.

18. If $\overline{CE1}$ and CE2 goes inactive before or concurrent with $\overline{WE}$ going high, the output remains in a high impedance state.

19. Powerup from ICC2 to ICC1 occurs as a result of any of the following conditions:

a. Rising edge of CE2.

b. Falling edge of $\overline{WE}$ ($\overline{CE1}$, CE2 active).

c. Transition on any address line ($\overline{CE1}$, CE2 active).

d. Transition on any data line ($\overline{CE1}$, CE2, and $\overline{WE}$ active).

The device automatically powers down from ICC2 to ICC1 after t_{PD} has elapsed from any of the prior conditions. This means that power dissipation is dependent on only cycle rate, and is not on Chip Select pulse width.

20. At any given temperature and voltage condition, output disable time is less than output enable time for any given device.

21. Transition is measured ±200 mV from steady state voltage with specified loading in Fig. 1b. This parameter is sampled and not 100% tested.

22. All address timings are referenced from the last valid address line to the first transitioning address line.

23. $\overline{CE1}$, CE2, or $\overline{WE}$ must be inactive during address transitions.

24. This product is a very high speed device and care must be taken during testing in order to realize valid test information. Inadequate attention to setups and procedures can cause a good part to be rejected as faulty. Long high inductance leads that cause supply bounce must be avoided by bringing the VCC and ground planes directly up to the contactor fingers. A 0.01 µF high frequency capacitor is also required between VCC and ground. To avoid signal reflections, proper terminations must be used.

FIGURE 1a.

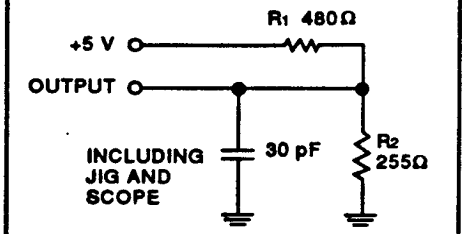


FIGURE 1b.

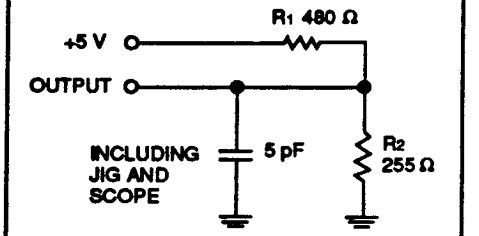
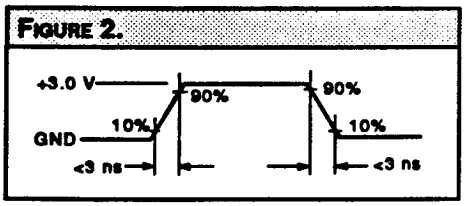


FIGURE 2.



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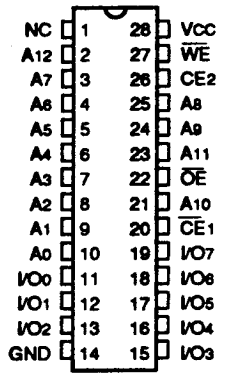
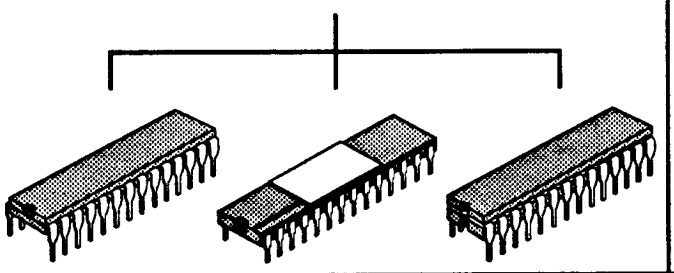
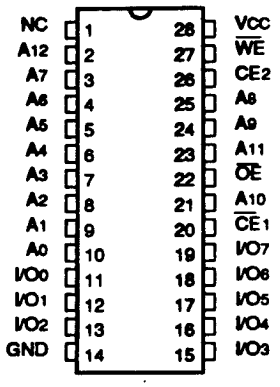
ORDERING INFORMATION

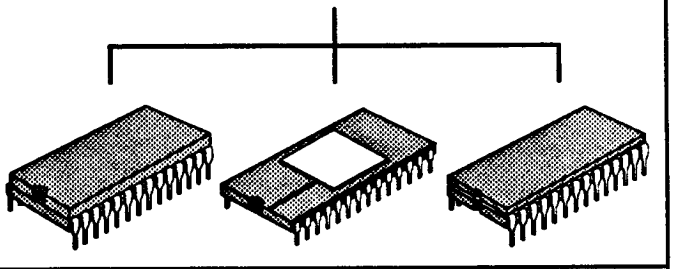
28-pin (0.3" wide)





28-pin (0.6" wide)





Speed	Plastic DIP (P10)	Sidebraze Hermetic DIP (D10)	CerDIP (C5)	Plastic DIP (P9)	Sidebraze Hermetic DIP (D9)	CerDIP (C6)
	0°C to +70°C — Commercial Screening					
35 ns 25 ns 20 ns 15 ns 12 ns 10 ns 8 ns	L7C185PC or L7CL185PC 35 25 20 15 12 10	L7C185DC or L7CL185DC 35 25 20 15 12 10	L7C185CC or L7CL185CC 35 25 20 15 12 10	L7C185NC or L7CL185NC 35 25 20 15 12 10	L7C185HC or L7CL185HC 35 25 20 15 12 10	L7C185IC or L7CL185IC 35 25 20 15 12 10
	–55°C to +125°C — Commercial Screening			**–55°C to +125°C — Commercial Screening**		
35 ns 25 ns 20 ns 15 ns 12 ns 10 ns 8 ns		L7C185DM or L7CL185DM 35 25 20 15 12	L7C185CM or L7CL185CM 35 25 20 15 12		L7C185HM or L7CL185HM 35 25 20 15 12	L7C185IM or L7CL185IM 35 25 20 15 12
	–55°C to +125°C — Extended Screening			**–55°C to +125°C — Extended Screening**		
35 ns 25 ns 20 ns 15 ns 12 ns 10 ns 8 ns		L7C185DME or L7CL185DME 35 25 20 15 12	L7C185CME or L7CL185CME 35 25 20 15 12		L7C185HME or L7CL185HME 35 25 20 15 12	L7C185IME or L7CL185IME 35 25 20 15 12
	–55°C to +125°C — MIL-STD-883 Compliant			**–55°C to +125°C — MIL-STD-883 Compliant**		
35 ns 25 ns 20 ns 15 ns 12 ns 10 ns 8 ns		L7C185DMB or L7CL185DMB 35 25 20 15 12	L7C185CMB or L7CL185CMB 35 25 20 15 12		L7C185HMB or L7CL185HMB 35 25 20 15 12	L7C185IMB or L7CL185IMB 35 25 20 15 12

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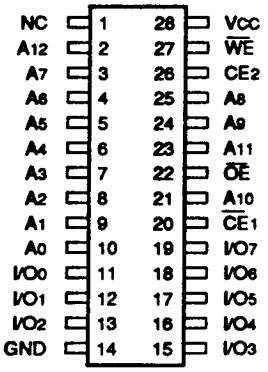
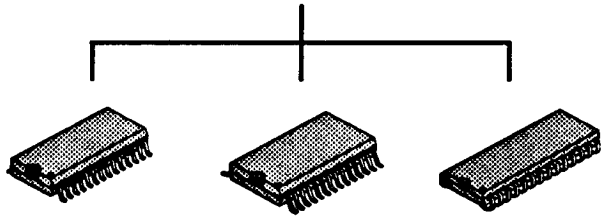
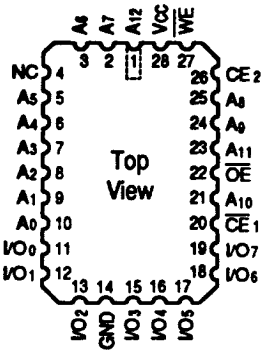
ORDERING INFORMATION

28-pin

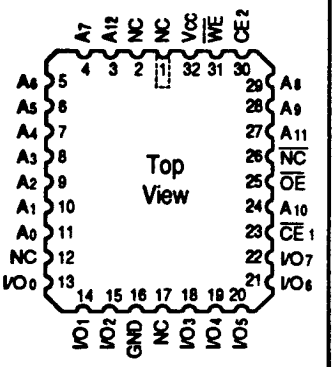


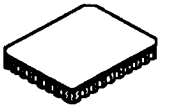


28-pin (350 x 550)



32-pin (450 x 550)





Speed	Plastic SOIC (.300"— U2)	Plastic SOIC (.331"— V2)	Plastic SOJ (.300"— W2)	Ceramic Leadless Chip Carrier (K5)	Ceramic Leadless Chip Carrier (K7)
	0°C to +70°C — Commercial Screening				
35 ns 25 ns 20 ns 15 ns 12 ns 10 ns 8 ns	L7C185UC or L7CL185UC — 35, 25, 20, 15, 12, 10	L7C185VC or L7CL185VC — 35, 25, 20, 15, 12, 10	L7C185WC or L7CL185WC — 35, 25, 20, 15, 12, 10	L7C185KC or L7CL185KC — 35, 25, 20, 15, 12, 10	L7C185TC or L7CL185TC — 35, 25, 20, 15, 12, 10
	–55°C to +125°C — Commercial Screening				
35 ns 25 ns 20 ns 15 ns 12 ns 10 ns 8 ns				L7C185KM or L7CL185KM — 35, 25, 20, 15, 12	L7C185TM or L7CL185TM — 35, 25, 20, 15, 12
	–55°C to +125°C — Extended Screening				
35 ns 25 ns 20 ns 15 ns 12 ns 10 ns 8 ns				L7C185KME or L7CL185KME — 35, 25, 20, 15, 12	L7C185TME or L7CL185TME — 35, 25, 20, 15, 12
	–55°C to +125°C — MIL-STD-883 Compliant				
35 ns 25 ns 20 ns 15 ns 12 ns 10 ns 8 ns				L7C185KMB or L7CL185KMB — 35, 25, 20, 15, 12	L7C185TMB or L7CL185TMB — 35, 25, 20, 15, 12

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