CY7C187A

64K x 1 Static RAM

Features

- **High speed**
  - **— 20 ns**
- **CMOS for optimum speed/power**
- **Low active power**
  - **— 495 mW**
- **Low standby power**
  - **— 220 mW**
- **TTl-compatible inputs and outputs**
- **Automatic power-down when deselected**

Functional Description

The CY7C187A is a high-performance CMOS static RAM organized as 65,536 words by 1 bit. Easy memory expansion is provided by an active LOW chip enable ($\overline{CE}$) and three-state drivers. The CY7C187A has an automatic power-down feature, reducing the power consumption by 55% when deselected.

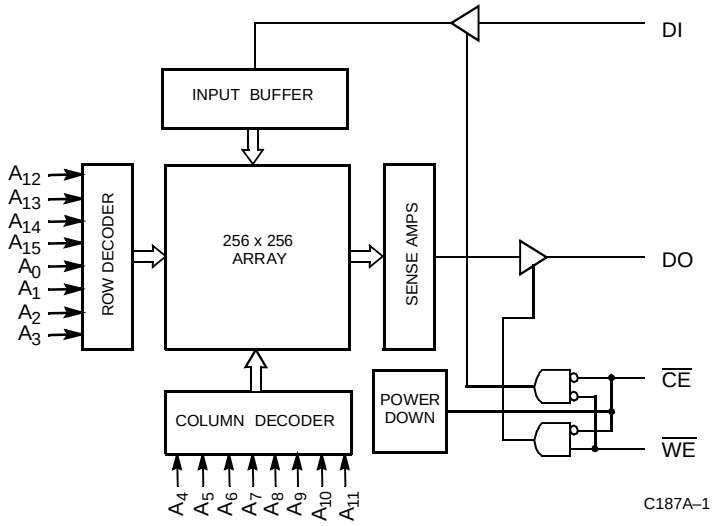
Writing to the device is accomplished when the chip enable ($\overline{CE}$) and write enable ($\overline{WE}$) inputs are both LOW. Data on the input pin (DI) is written into the memory location specified on the address pins (A_0 through A_{15}).

Reading the device is accomplished by taking the chip enable ($\overline{CE}$) LOW, while write enable ($\overline{WE}$) remains HIGH. Under these conditions, the contents of the memory location specified on the address pins will appear on the data output (DO) pin.

The output pin stays in high-impedance state when chip enable ($\overline{CE}$) is HIGH or write enable ($\overline{WE}$) is LOW.

The 7C187A utilizes a die coat to insure alpha immunity.

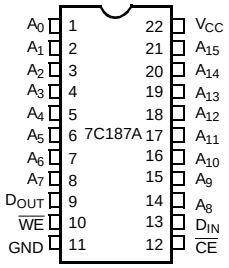
Logic Block Diagram



C187A–1

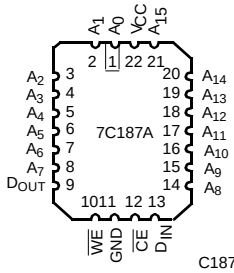
Pin Configurations

DIP
Top View



C187A–2

LCC
Top View



C187A–3

Selection Guide[1]

		7C187A–15	7C187A–20	7C187A–25	7C187A–35
Maximum Access Time (ns)		15	20	25	35
Maximum Operating Current (mA)	Military	160	90	80	80
Maximum Standby Current (mA)	Military	40/20	40/20	40/20	30/20

Shaded area contains preliminary information.

Notes:

1. For commercial specifications, see CY7C187 datasheet.

Maximum Ratings

(Above which the useful life may be impaired. For user guidelines, not tested.)

Storage Temperature .....–65°C to+150°C

Ambient Temperature with Power Applied.....–55°C to+125°C

Supply Voltage to Ground Potential (Pin 22 to Pin 11).....–0.5V to+7.0V

DC Voltage Applied to Outputs in High Z State[2].....–0.5V to+7.0V

DC Input Voltage[2].....–0.5V to +7.0V

Output Current into Outputs (LOW)..... 20 mA

Static Discharge Voltage ..... >2001V (per MIL-STD-883, Method 3015)

Latch-Up Current..... >200 mA

Operating Range

Range	Ambient Temperature	V_{CC}
Military[3]	–55°C to +125°C	5V ± 10%

Electrical Characteristics Over the Operating Range[4]

Parameter	Description	Test Conditions		7C187A–15		7C187A–20		Unit
				Min.	Max.	Min.	Max.	
V_{OH}	Output HIGH Voltage	V_{CC} = Min., I_{OH} = –4.0 mA		2.4		2.4		V
V_{OL}	Output LOW Voltage	V_{CC} = Min., I_{OL}=12.0 mA	Mil		0.4		0.4	V
V_{IH}	Input HIGH Voltage			2.2	V_{CC}	2.2	V_{CC}	V
V_{IL}	Input LOW Voltage[2]			–0.5	0.8	–0.5	0.8	V
I_{IX}	Input Load Current	GND ≤ V_I ≤ V_{CC}		–5	+5	–5	+5	µA
I_{OZ}	Output Leakage Current	GND ≤ V_O ≤ V_{CC}, Output Disabled		–5	+5	–5	+5	µA
I_{OS}	Output Short Circuit Current[5]	V_{CC} = Max., V_{OUT} = GND			–350		–350	mA
I_{CC}	V_{CC} Operating Supply Current	V_{CC} = Max., I_{OUT} = 0 mA	Mil		160		90	mA
I_{SB1}	Automatic $\overline{CE}$ Power-Down Current[6]	Max. V_{CC}, $\overline{CE}$ ≥ V_{IH}	Mil		40		40	mA
I_{SB2}	Automatic $\overline{CE}$ Power-Down Current[6]	Max. V_{CC}, $\overline{CE}$ ≥ V_{CC} – 0.3V, V_{IN} ≥ V_{CC} – 0.3V or V_{IN} ≤ 0.3V	Mil		20		20	mA

Shaded area contains preliminary information.

Notes:

2. V_{IL} (min.) = –3.0V for pulse durations less than 30 ns.
3. T_A is the "instant on" case temperature.
4. See the last page of this specification for Group A subgroup testing information.
5. Not more than 1 output should be shorted at one time. Duration of the short circuit should not exceed 30 seconds.
6. A pull-up resistor to V_{CC} on the $\overline{CE}$ input is required to keep the device deselected during V_{CC} power-up, otherwise I_{SB} will exceed values given.

Electrical Characteristics Over the Operating Range[4] (continued)

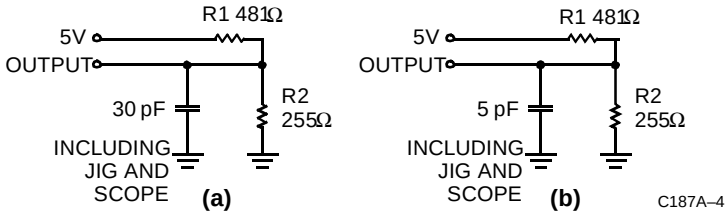
Parameter	Description	Test Conditions		7C187A–25		7C187A–35		Unit
				Min.	Max.	Min.	Max.	
V_{OH}	Output HIGH Voltage	V_{CC} = Min., I_{OH} = –4.0 mA		2.4		2.4		V
V_{OL}	Output LOW Voltage	V_{CC} = Min., I_{OL}=8.0 mA	Mil		0.4		0.4	V
V_{IH}	Input HIGH Voltage			2.2	V_{CC}	2.2	V_{CC}	V
V_{IL}	Input LOW Voltage[2]			–3.0	0.8	–3.0	0.8	V
I_{IX}	Input Load Current	GND ≤ V_I ≤ V_{CC}		–5	+5	–5	+5	µA
I_{OZ}	Output Leakage Current	GND ≤ V_O ≤ V_{CC}, Output Disabled		–5	+5	–5	+5	µA
I_{OS}	Output Short Circuit Current[5]	V_{CC} = Max., V_{OUT} = GND			–350		–350	mA
I_{CC}	V_{CC} Operating Supply Current	V_{CC} = Max., I_{OUT} = 0 mA	Mil		80		80	mA
I_{SB1}	Automatic $\overline{CE}$ Power-Down Current[6]	Max. V_{CC}, $\overline{CE}$ ≥ V_{IH}	Mil		40		30	mA
I_{SB2}	Automatic $\overline{CE}$ Power-Down Current[6]	Max. V_{CC}, $\overline{CE}$ ≥ V_{CC} – 0.3V, V_{IN} ≥ V_{CC} – 0.3V or V_{IN} ≤ 0.3V	Mil		20		20	mA

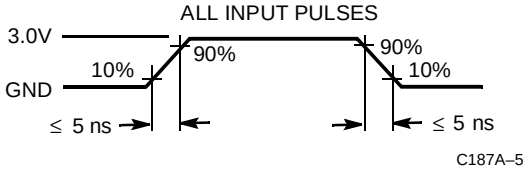
Capacitance[7]

Parameter	Description	Test Conditions	Max.	Unit
C_{IN}	Input Capacitance	T_A = 25°C, f = 1 MHz, V_{CC} = 5.0V	10	pF
C_{OUT}	Output Capacitance		10	pF

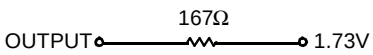
Note:
7. Tested initially and after any design or process changes that may affect these parameters.

AC Test Loads and Waveforms





Equivalent to: THÉVENIN EQUIVALENT



Switching Characteristics Over the Operating Range[4, 8]

Parameter	Description	7C187A–15		7C187A–20		7C187A–25		7C187A–35		Unit
		Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
READ CYCLE										
t_{RC}	Read Cycle Time	15		20		25		35		ns
t_{AA}	Address to Data Valid		15		20		25		35	ns
t_{OHA}	Output Hold from Address Change	3		3		3		3		ns
t_{ACE}	$\overline{CE}$ LOW to Data Valid		15		20		25		35	ns
t_{LZCE}	$\overline{CE}$ LOW to Low Z[9]	3		5		5		5		ns
t_{HZCE}	$\overline{CE}$ HIGH to High Z[9,10]		8		8		10		15	ns
t_{PU}	$\overline{CE}$ LOW to Power-Up	0		0		0		0		ns
t_{PD}	$\overline{CE}$ HIGH to Power-Down		15		20		20		20	ns
WRITE CYCLE[11]										
t_{WC}	Write Cycle Time	15		20		20		25		ns
t_{SCE}	$\overline{CE}$ LOW to Write End	10		15		20		25		ns
t_{AW}	Address Set-Up to Write End	10		15		20		25		ns
t_{HA}	Address Hold from Write End	0		0		0		0		ns
t_{SA}	Address Set-Up to Write Start	0		0		0		0		ns
t_{PWE}	$\overline{WE}$ Pulse Width	10		15		15		20		ns
t_{SD}	Data Set-Up to Write End	7		10		10		15		ns
t_{HD}	Data Hold from Write End	0		0		0		0		ns
t_{LZWE}	$\overline{WE}$ HIGH to Low Z[9]	3		5		5		5		ns
t_{HZWE}	$\overline{WE}$ LOW to High Z[9,10]		7		7		7		10	ns

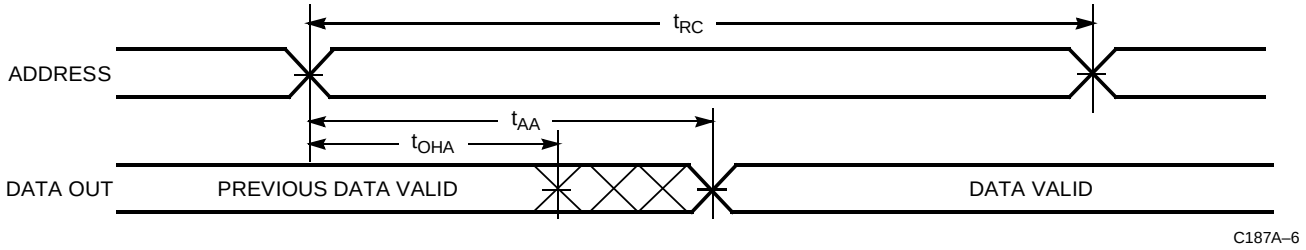
Shaded area contains preliminary information.

Notes:

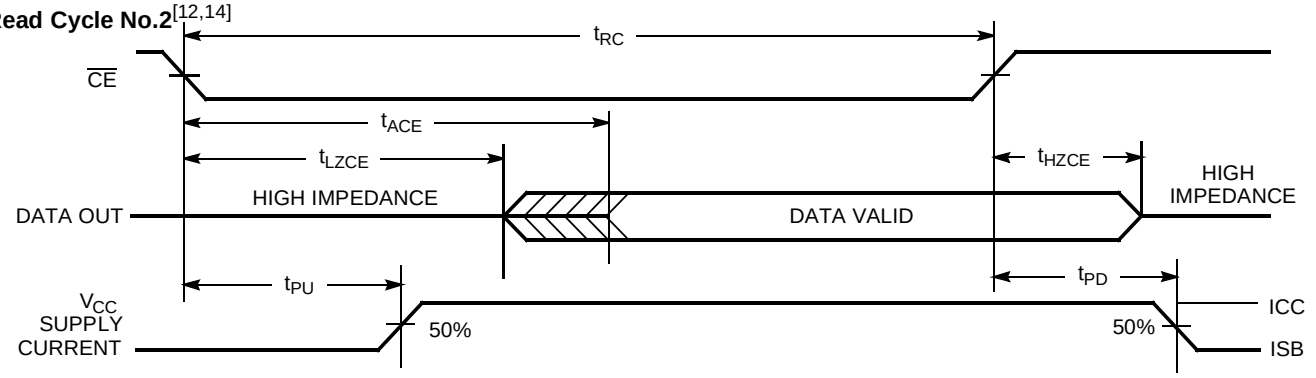
8. Test conditions assume signal transition time of 5 ns or less, timing reference levels of 1.5V, input pulse levels of 0 to 3.0V, and output loading of the specified I_{OL}/I_{OH} and 30-pF load capacitance.
9. At any given temperature and voltage condition, t_{HZCE} is less than t_{LZCE} for any given device.
10. t_{HZCE} and t_{HZWE} are specified with C_L = 5 pF as in part (b) of AC Test Loads. Transition is measured ±500 mV from steady-state voltage.
11. The internal write time of the memory is defined by the overlap of $\overline{CE}$ LOW and $\overline{WE}$ LOW. Both signals must be LOW to initiate a write and either signal can terminate a write by going HIGH. The data input set-up and hold timing should be referenced to the rising edge of the signal that terminates the write.

Switching Waveforms

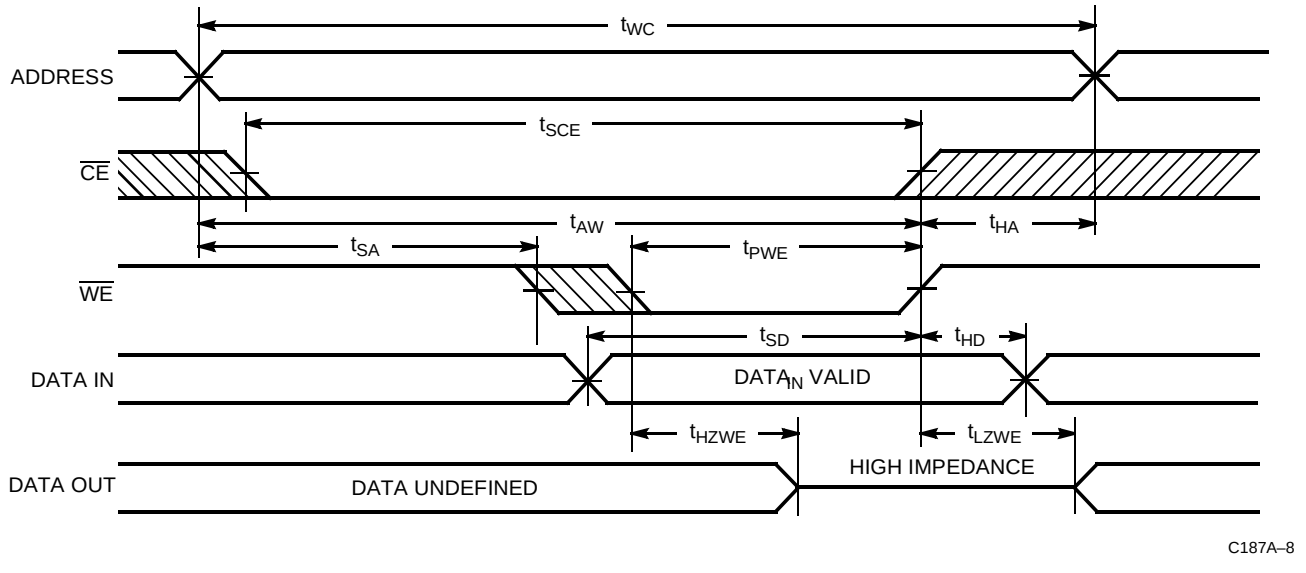
Read Cycle No. 1[12,13]



Read Cycle No.2[12,14]



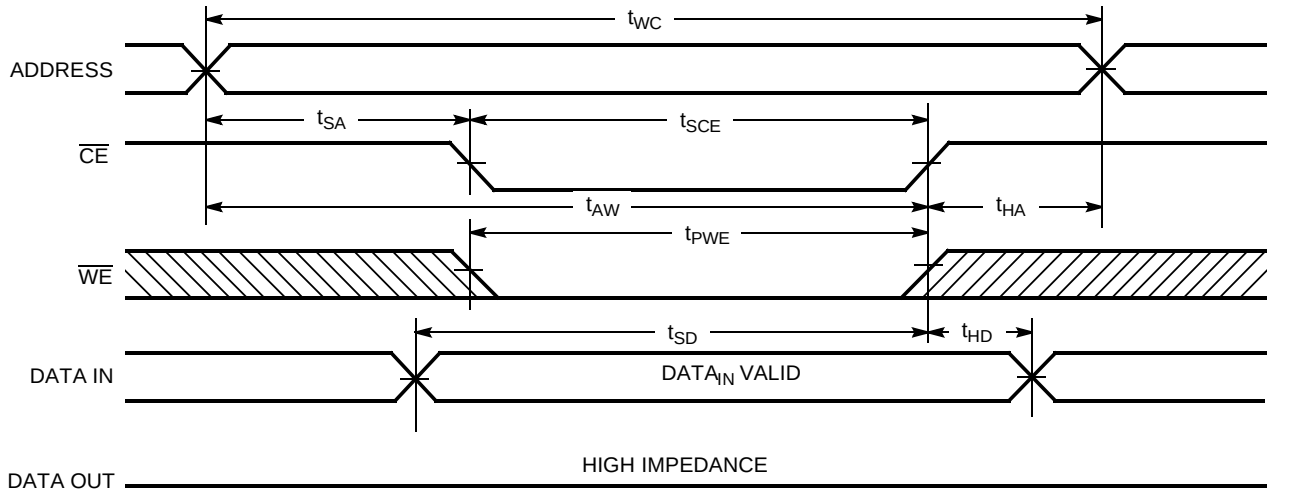
Write Cycle No.1 ($\overline{WE}$ Controlled)[11]



Notes:
12. $\overline{WE}$ is HIGH for read cycle.
13. Device is continuously selected, $\overline{CE} = V_{IL}$.
14. Address valid prior to or coincident with $\overline{CE}$ transition LOW.

Switching Waveforms (Continued)

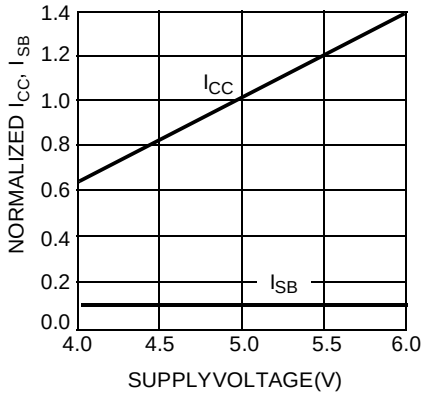
Write Cycle No.2 ($\overline{CE}$ Controlled)[11,15]



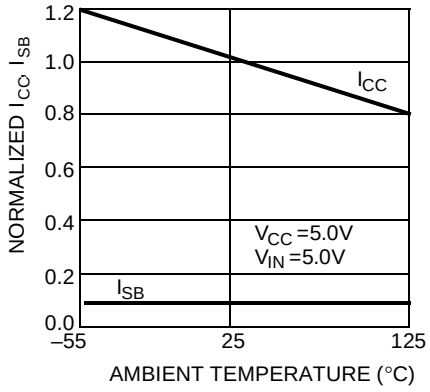
Note:
15. If $\overline{CE}$ goes HIGH simultaneously with $\overline{WE}$ HIGH, the output remains in a high-impedance state.

Typical DC and AC Characteristics

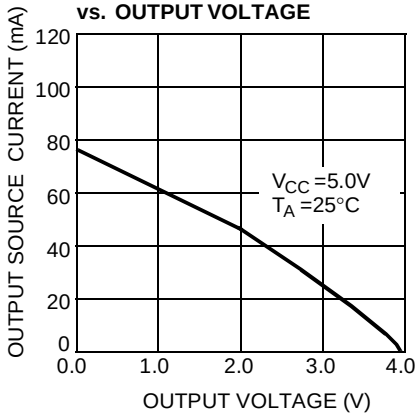
NORMALIZED SUPPLY CURRENT vs. SUPPLY VOLTAGE



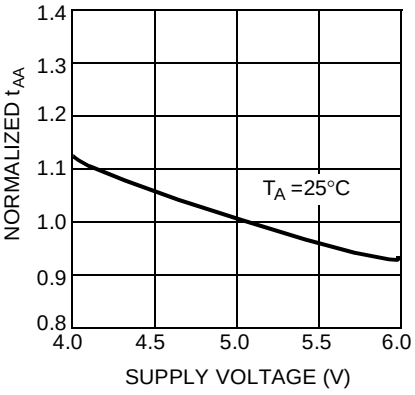
NORMALIZED SUPPLY CURRENT vs. AMBIENT TEMPERATURE



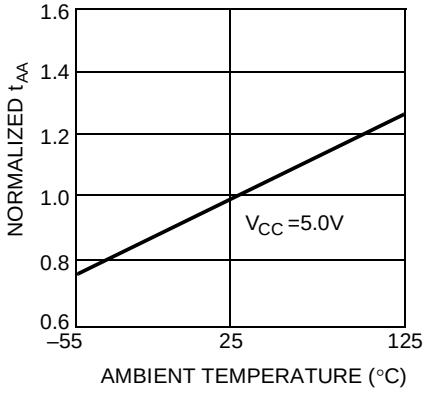
OUTPUT SOURCE CURRENT vs. OUTPUT VOLTAGE



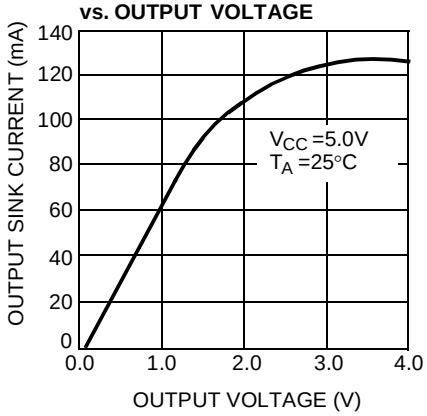
NORMALIZED ACCESS TIME vs. SUPPLY VOLTAGE



NORMALIZED ACCESS TIME vs. AMBIENT TEMPERATURE

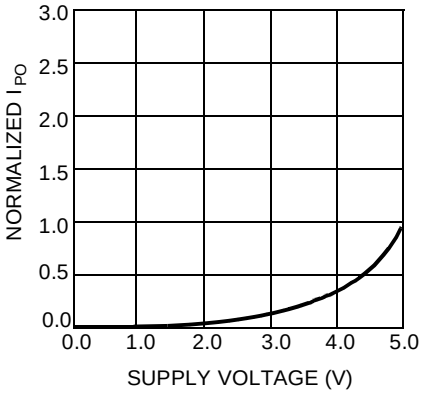


OUTPUT SINK CURRENT vs. OUTPUT VOLTAGE

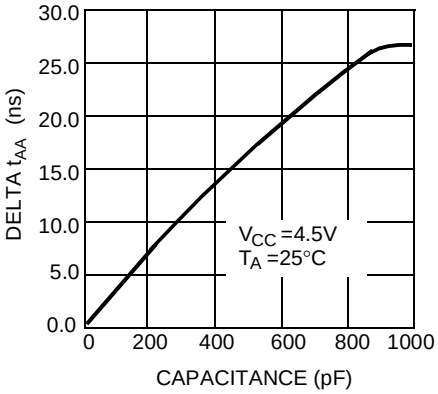


Typical DC and AC Characteristics

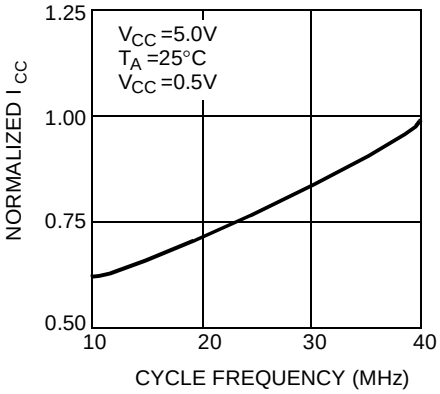
TYPICAL POWER-ON CURRENT vs. SUPPLY VOLTAGE



TYPICAL ACCESS TIME CHANGE vs. OUTPUT LOADING



NORMALIZED I_{CC} vs. CYCLE TIME



Address Designators

Address Name	Address Function	Pin Number
A0	X3	1
A1	X4	2
A2	X5	3
A3	X6	4
A4	X7	5
A5	Y7	6
A6	Y6	7
A7	Y2	8
A8	Y3	14
A9	Y1	15
A10	Y0	16
A11	Y4	17
A12	Y5	18
A13	X0	19
A14	X1	20
A15	X2	21

Truth Table

CE	WE	Input/Output	Mode
H	X	High Z	Deselect/Power-Down
L	H	Data Out	Read
L	L	Data In	Write

Ordering Information

Speed (ns)	Ordering Code	Package Name	Package Type	Operating Range
15	CY7C187A–15DMB	D14	24-Lead (300-Mil) CerDIP	Military
	CY7C187A–15LMB	L52	22-Pin Rectangular Leadless Chip Carrier	
20	CY7C187A–20DMB	D14	24-Lead (300-Mil) CerDIP	Military
	CY7C187A–20LMB	L52	22-Pin Rectangular Leadless Chip Carrier	
25	CY7C187A–25DMB	D14	24-Lead (300-Mil) CerDIP	Military
	CY7C187A–25LMB	L52	22-Pin Rectangular Leadless Chip Carrier	
35	CY7C187A–35DMB	D14	24-Lead (300-Mil) CerDIP	Military
	CY7C187A–35LMB	L52	22-Pin Rectangular Leadless Chip Carrier	

Shaded area contains preliminary information.

MILITARY SPECIFICATIONS
Group A Subgroup Testing

DC Characteristics

Parameter	Subgroups
V_{OH}	1, 2, 3
V_{OL}	1, 2, 3
V_{IH}	1, 2, 3
V_{IL} Max.	1, 2, 3
I_{IX}	1, 2, 3
I_{OZ}	1, 2, 3
I_{OS}	1, 2, 3
I_{CC}	1, 2, 3
I_{SB1}	1, 2, 3
I_{SB2}	1, 2, 3

Switching Characteristics

Parameter	Subgroups
READ CYCLE	
t_{RC}	7, 8, 9, 10, 11
t_{AA}	7, 8, 9, 10, 11
t_{OHA}	7, 8, 9, 10, 11
t_{ACE}	7, 8, 9, 10, 11
WRITE CYCLE	
t_{WC}	7, 8, 9, 10, 11
t_{SCE}	7, 8, 9, 10, 11
t_{AW}	7, 8, 9, 10, 11
t_{HA}	7, 8, 9, 10, 11
t_{SA}	7, 8, 9, 10, 11
t_{PWE}	7, 8, 9, 10, 11
t_{SD}	7, 8, 9, 10, 11
t_{HD}	7, 8, 9, 10, 11

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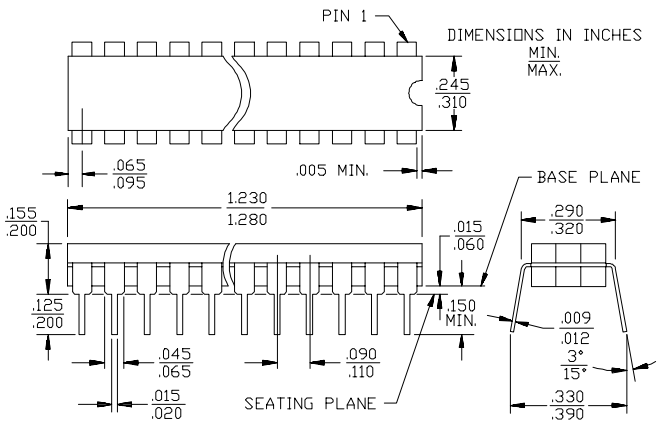
Package Diagrams

24-Lead (300-Mil) CerDIP D14
MIL-STD-1835 D- 9 Config.A



22-Pin Rectangular Leadless Chip Carrier L52