CY7C187

64K x 1 Static RAM

Features

- **High speed**
  - **— 15 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 CY7C187 is a high-performance CMOS static RAM organized as 65,536 words x 1 bit. Easy memory expansion is provided by an active LOW Chip Enable ($\overline{CE}$) and three-state drivers. The CY7C187 has an automatic power-down feature, reducing the power consumption by 56% when deselected.

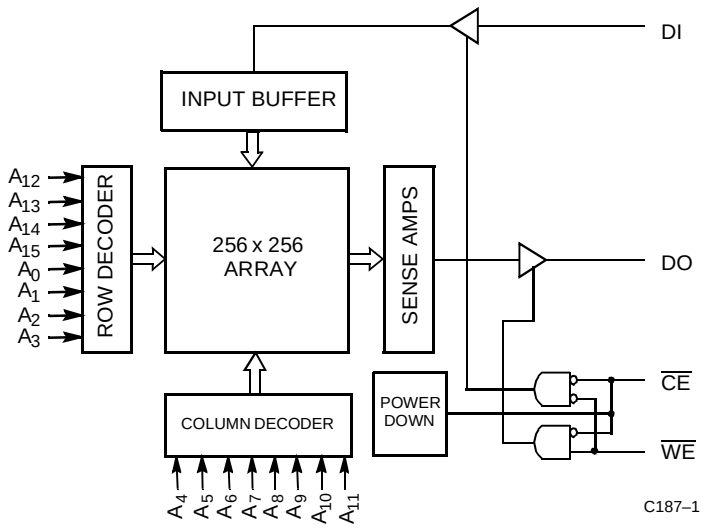
Writing to the device is accomplished when the Chip Enable ($\overline{CE}$) and Write Enable ($\overline{WE}$) inputs are both LOW. Data on the input pin (D_{IN}) is written into the memory location specified on the address pins (A_0 through A_{15}).

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 pin will appear on the data output (D_{OUT}) pin.

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

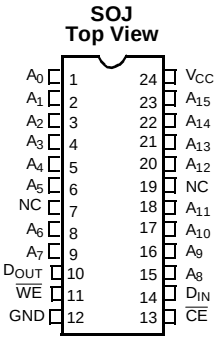
The CY7C187 utilizes a die coat to insure alpha immunity.

Logic Block Diagram

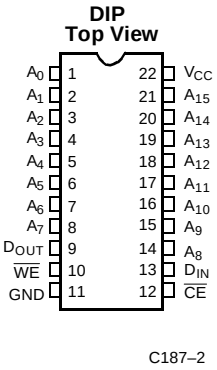


C187–1

Pin Configurations



C187–3



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Selection Guide[1]

	7C187-15	7C187-20	7C187-25	7C187-35
Maximum Access Time (ns)	15	20	25	35
Maximum Operating Current (mA)	90	80	70	70
Maximum Standby Current (mA)	40/20	40/20	20/20	20/20

Note:

1. For military specifications, see the CY7C187A 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}
Commercial	0°C to +70°C	5V ± 10%

Electrical Characteristics Over the Operating Range

Parameter	Description	Test Conditions	7C187-15		7C187-20		7C187-25, 35		Unit
			Min.	Max.	Min.	Max.	Min.	Max.	
V_{OH}	Output HIGH Voltage	V_{CC} = Min., I_{OH} = –4.0 mA	2.4		2.4		2.4		V
V_{OL}	Output LOW Voltage	V_{CC} = Min., I_{OL}=12.0 mA		0.4		0.4		0.4	V
V_{IH}	Input HIGH Voltage		2.2	V_{CC}	2.2	V_{CC}	2.2	V_{CC}	V
V_{IL}	Input LOW Voltage[2]		–0.5	0.8	–0.5	0.8	–0.5	0.8	V
I_{IX}	Input Load Current	GND ≤ V_I ≤ V_{CC}	–5	+5	–5	+5	–5	+5	µA
I_{OZ}	Output Leakage Current	GND ≤ V_O ≤ V_{CC}, Output Disabled	–5	+5	–5	+5	–5	+5	µA
I_{OS}	Output Short Circuit Current[3]	V_{CC} = Max., V_{OUT} = GND		–350		–350		–350	mA
I_{CC}	V_{CC} Operating Supply Current	V_{CC} = Max., I_{OUT} = 0 mA		90		80		70	mA
I_{SB1}	Automatic $\overline{CE}$ Power-Down Current[4]	Max. V_{CC}, $\overline{CE}$ ≥ V_{IH}		40		40		20	mA
I_{SB2}	Automatic $\overline{CE}$ Power-Down Current	Max. V_{CC}, $\overline{CE}$ ≥ V_{CC} – 0.3V, V_{IN} ≥ V_{CC} – 0.3V or V_{IN} ≤ 0.3V		20		20		20	mA

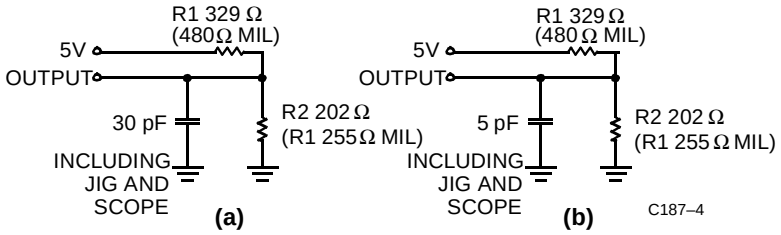
Capacitance[5]

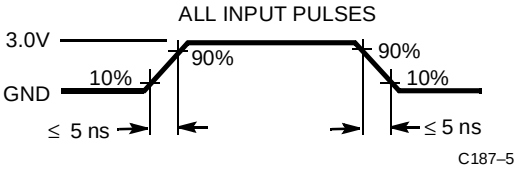
Parameter	Description	Test Conditions	Max.	Unit
C_{IN}	Input Capacitance	T_A = 25°C, f = 1 MHz, V_{CC} = 5.0V	10	pF
C_{OUT}	Output Capacitance		10	pF

Notes:

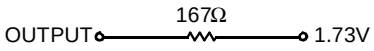
2. V_{IL} (min.) = –3.0V for pulse durations less than 30 ns.
3. Not more than 1 output should be shorted at one time. Duration of the short circuit should not exceed 30 seconds.
4. A pull-up resistor to V_{CC} on the $\overline{CE}$ input is required to keep the device deselected during V_{CC} power-up, otherwise I_{SB} will exceed values given.
5. Tested initially and after any design or process changes that may affect these parameters.

AC Test Loads and Waveforms

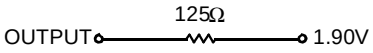




Equivalent to: THÉVENIN EQUIVALENT



Military



Commercial

Switching Characteristics Over the Operating Range[6]

Parameter	Description	7C187-15		7C187-20		Unit
		Min.	Max.	Min.	Max.	
READ CYCLE						
t_{RC}	Read Cycle Time	15		20		ns
t_{AA}	Address to Data Valid		15		20	ns
t_{OHA}	Output Hold from Address Change	3		5		ns
t_{ACE}	$\overline{CE}$ LOW to Data Valid		15		20	ns
t_{LZCE}	$\overline{CE}$ LOW to Low Z[7]	3		5		ns
t_{HZCE}	$\overline{CE}$ HIGH to High Z[7, 8]		8		8	ns
t_{PU}	$\overline{CE}$ LOW to Power Up	0		0		ns
t_{PD}	$\overline{CE}$ HIGH to Power Down		15		20	ns
WRITE CYCLE[9]						
t_{WC}	Write Cycle Time	15		20		ns
t_{SCE}	$\overline{CE}$ LOW to Write End	12		15		ns
t_{AW}	Address Set-Up to Write End	12		15		ns
t_{HA}	Address Hold from Write End	0		0		ns
t_{SA}	Address Set-Up to Write Start	0		0		ns
t_{PWE}	$\overline{WE}$ Pulse Width	12		15		ns
t_{SD}	Data Set-Up to Write End	10		10		ns
t_{HD}	Data Hold from Write End	0		0		ns
t_{LZWE}	$\overline{WE}$ HIGH to Low Z	5		5		ns
t_{HZWE}	$\overline{WE}$ LOW to High Z[8]		7		7	ns

Notes:

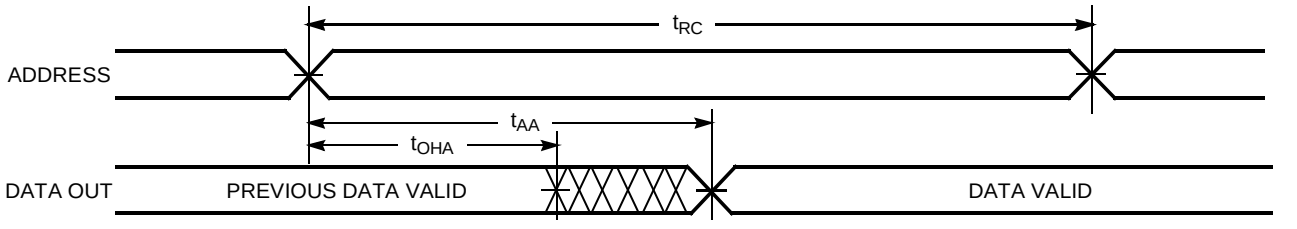
6. Test conditions assume signal transition time of 5 ns or less, timing reference levels of 1.5V, input pulse levels of 0 to 3.0V, and output loading of the specified I_{OL}/I_{OH} and 30-pF load capacitance.
7. At any given temperature and voltage condition, t_{HZCE} is less than t_{LZCE} for any given device.
8. 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.
9. The internal write time of the memory is defined by the overlap of CE LOW and 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 Characteristics Over the Operating Range[6] (continued)

Parameters	Description	7C187-25		7C187-35		Units
		Min.	Max.	Min.	Max.	
READ CYCLE						
t_{RC}	Read Cycle Time	25		35		ns
t_{AA}	Address to Data Valid		25		35	ns
t_{OHA}	Output Hold from Address Change	5		5		ns
t_{ACE}	$\overline{CE}$ LOW to Data Valid		25		35	ns
t_{LZCE}	$\overline{CE}$ LOW to Low Z[7]	5		5		ns
t_{HZCE}	$\overline{CE}$ HIGH to High Z[7, 8]		10		15	ns
t_{PU}	$\overline{CE}$ LOW to Power Up	0		0		ns
t_{PD}	$\overline{CE}$ HIGH to Power Down		20		20	ns
WRITE CYCLE[9]						
t_{WC}	Write Cycle Time	20		25		ns
t_{SCE}	$\overline{CE}$ LOW to Write End	20		25		ns
t_{AW}	Address Set-Up to Write End	20		25		ns
t_{HA}	Address Hold from Write End	0		0		ns
t_{SA}	Address Set-Up to Write Start	0		0		ns
t_{PWE}	$\overline{WE}$ Pulse Width	15		20		ns
t_{SD}	Data Set-Up to Write End	10		15		ns
t_{HD}	Data Hold from Write End	0		0		ns
t_{LZWE}	$\overline{WE}$ HIGH to Low	5		5		ns
t_{HZWE}	$\overline{WE}$ LOW to High Z[8]		7		10	ns

Switching Waveforms

Read Cycle No. 1[10, 11]



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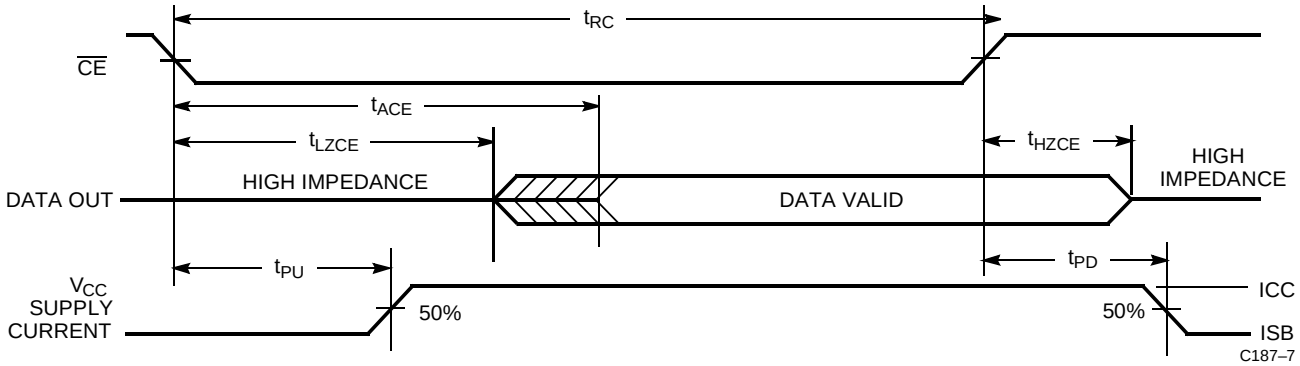
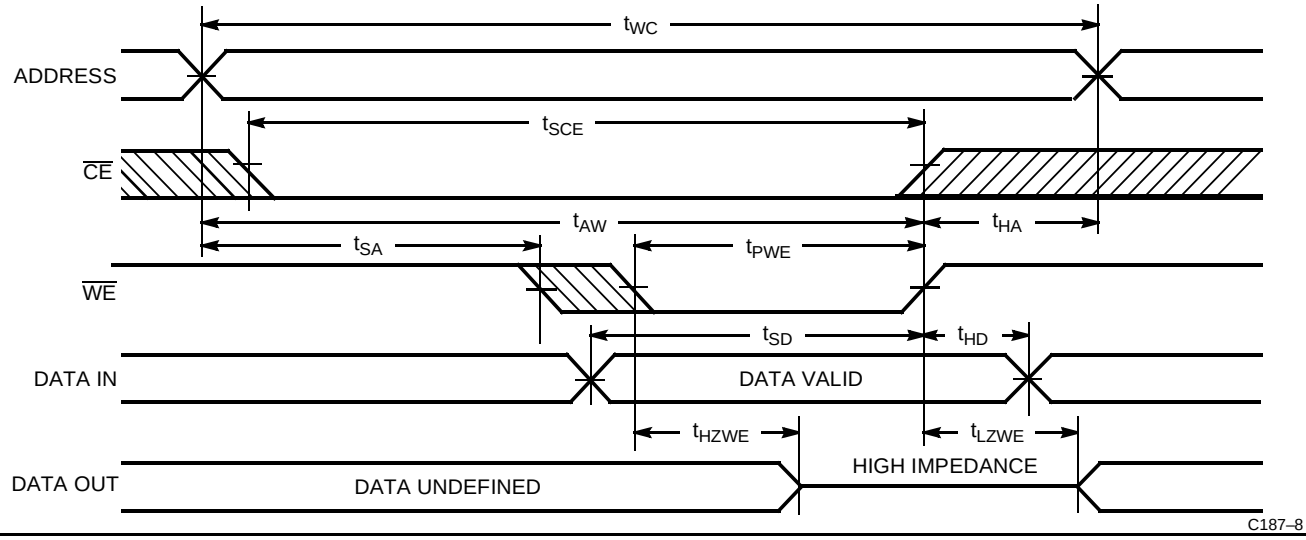
Notes:
10. $\overline{WE}$ is HIGH for read cycle.
11. Device is continuously selected, $\overline{CE} = V_{IL}$.

Switching Waveforms

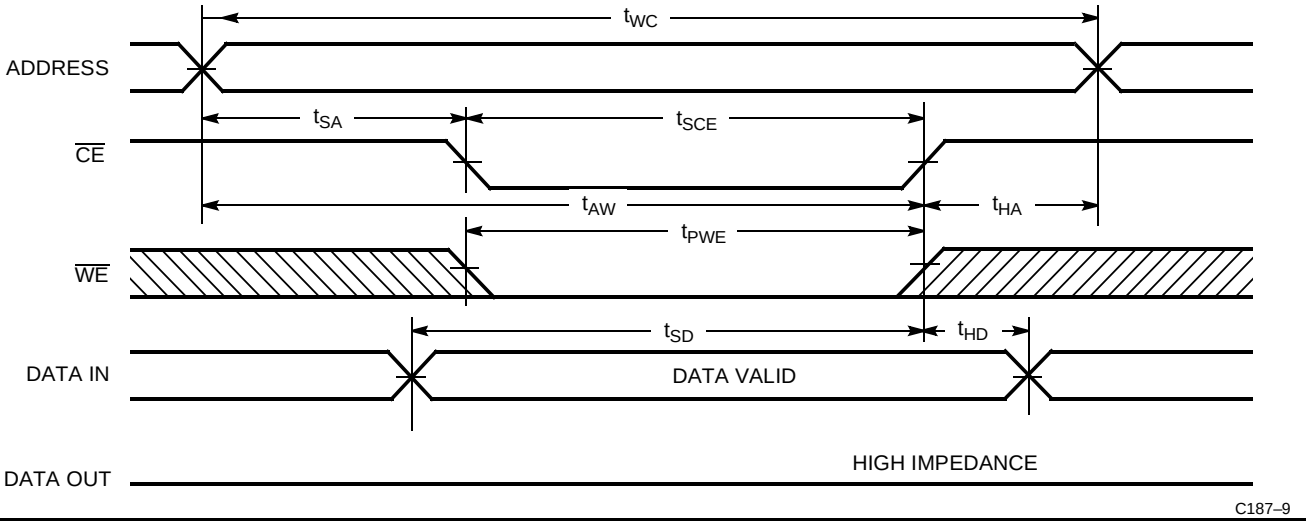
Read Cycle No. 2[10, 12]



Write Cycle No. 1 (WE Controlled)[11]



Write Cycle No. 2 (CE Controlled)[11, 13]

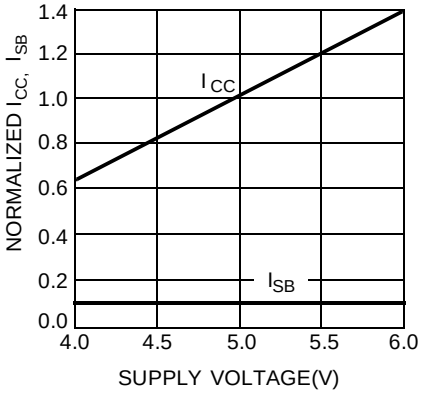


Notes:

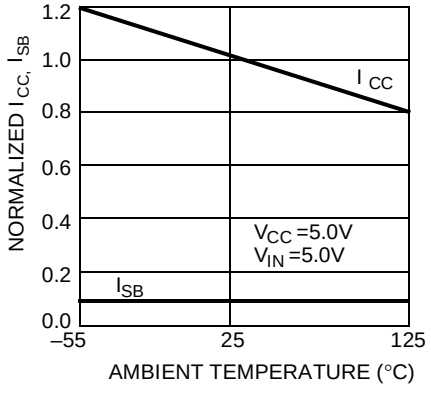
12. Address valid prior to or coincident with CE transition LOW.
13. If CE goes HIGH simultaneously with WE HIGH, the output remains in a high-impedance state.

Typical DC and AC Characteristics

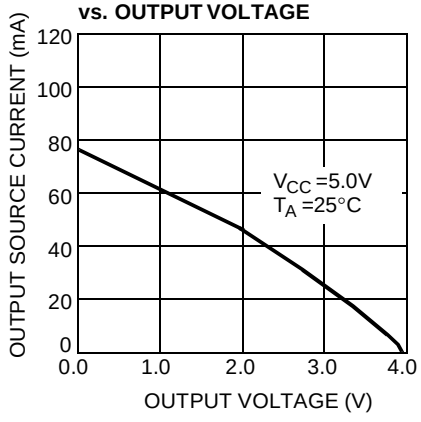
NORMALIZED SUPPLY CURRENT vs. SUPPLY VOLTAGE



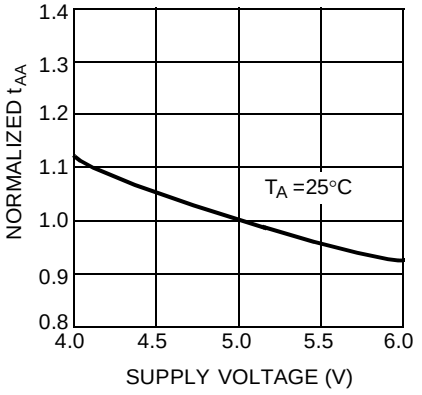
NORMALIZED SUPPLY CURRENT vs. AMBIENT TEMPERATURE



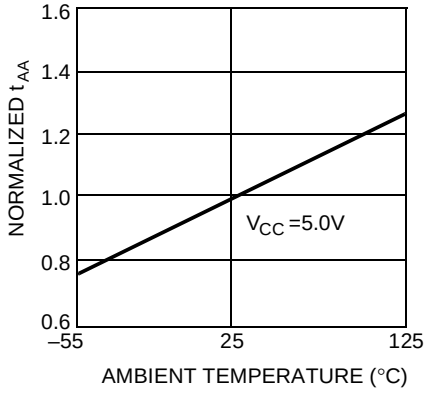
OUTPUT SOURCE CURRENT vs. OUTPUT VOLTAGE



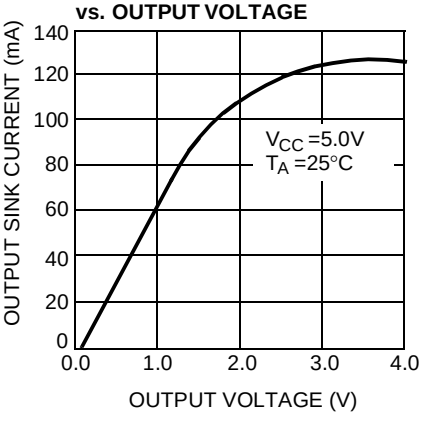
NORMALIZED ACCESS TIME vs. SUPPLY VOLTAGE



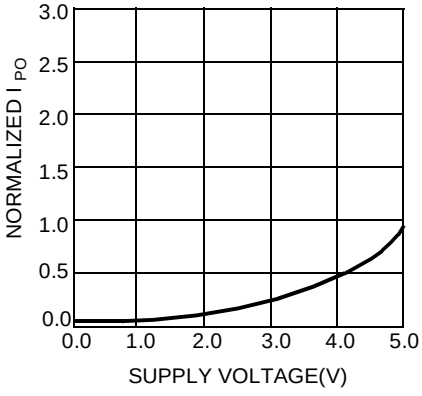
NORMALIZED ACCESS TIME vs. AMBIENT TEMPERATURE



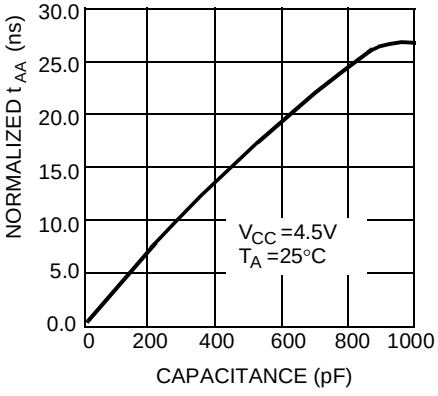
OUTPUT SINK CURRENT vs. OUTPUT VOLTAGE



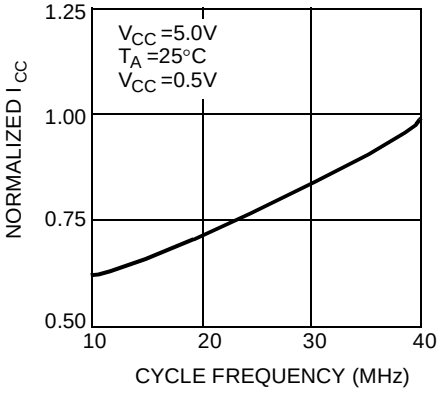
TYPICAL POWER-ON CURRENT vs. SUPPLY VOLTAGE



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

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

Ordering Information[14]

Speed (ns)	Ordering Code	Package Name	Package Type	Operating Range
15	CY7C187-15PC	P9	22-Lead (300-Mil) Molded DIP	Commercial
	CY7C187-15VC	V13	24-Lead Molded SOJ	
20	CY7C187-20PC	P9	22-Lead (300-Mil) Molded DIP	Commercial
	CY7C187-20VC	V13	24-Lead Molded SOJ	
25	CY7C187-25PC	P9	22-Lead (300-Mil) Molded DIP	Commercial
	CY7C187-25VC	V13	24-Lead Molded SOJ	
35	CY7C187-35PC	P9	22-Lead (300-Mil) Molded DIP	Commercial
	CY7C187-35VC	V13	24-Lead Molded SOJ	

Note:
14. For military variations, see the CY7C187A datasheet.

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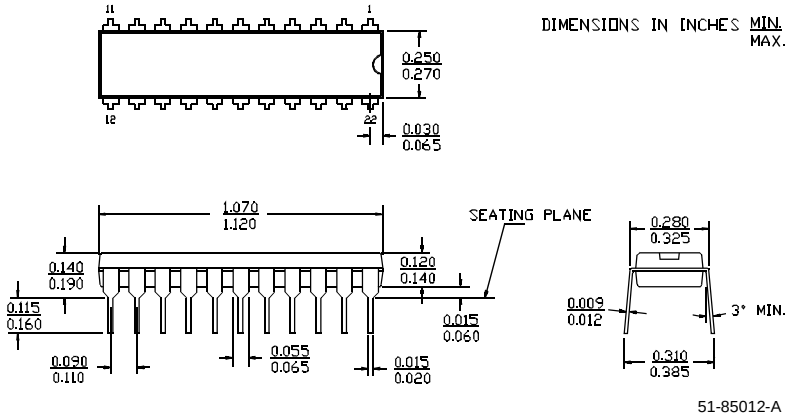
Package Diagrams

22-Lead (300-Mil) Molded DIP P9



24-Lead (300-Mil) Molded SOJ V13