



CYPRESS

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 pro-

vided 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.

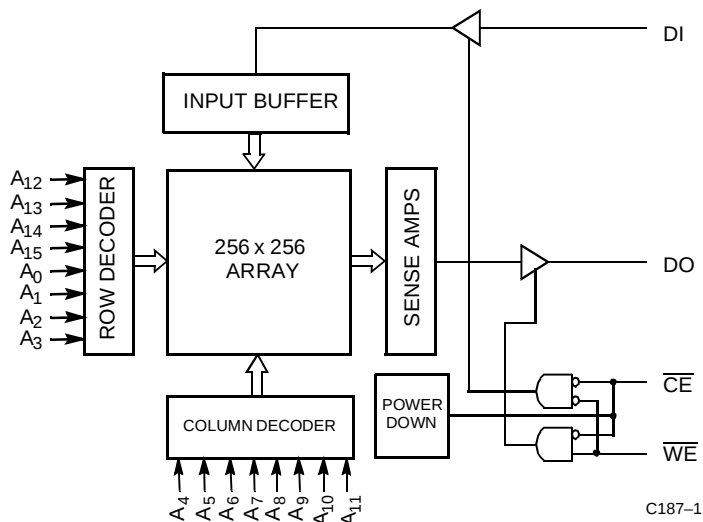
Writing to the device is accomplished when the Chip Enable ( $\overline{CE}$ ) and Write Enable ( $\overline{WE}$ ) inputs are both LOW. Data on the input pin ( $D_{IN}$ ) is written into the memory location specified on the address pins ( $A_0$  through  $A_{15}$ ).

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.

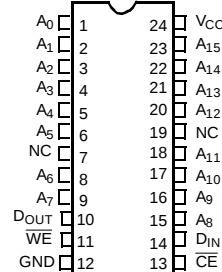
The CY7C187 utilizes a die coat to insure alpha immunity.

### Logic Block Diagram



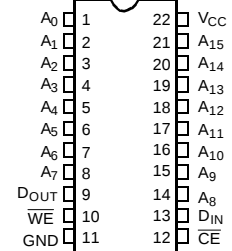
### Pin Configurations

#### SOJ Top View



C187-3

#### DIP Top View



C187-2

### Selection Guide<sup>[1]</sup>

|                                | 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<sup>[2]</sup> ..... -0.5V to +7.0V

DC Input Voltage<sup>[2]</sup> ..... -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 <sub>CC</sub> |
|------------|---------------------|-----------------|
| 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 <sub>OH</sub>  | Output HIGH Voltage                                         | V <sub>CC</sub> = Min.,<br>I <sub>OH</sub> = -4.0 mA                                                                                    | 2.4      |                 | 2.4      |                 | 2.4          |                 | V    |
| V <sub>OL</sub>  | Output LOW Voltage                                          | V <sub>CC</sub> = Min.,<br>I <sub>OL</sub> = 12.0 mA                                                                                    |          | 0.4             |          | 0.4             |              | 0.4             | V    |
| V <sub>IH</sub>  | Input HIGH Voltage                                          |                                                                                                                                         | 2.2      | V <sub>CC</sub> | 2.2      | V <sub>CC</sub> | 2.2          | V <sub>CC</sub> | V    |
| V <sub>IL</sub>  | Input LOW Voltage <sup>[2]</sup>                            |                                                                                                                                         | -0.5     | 0.8             | -0.5     | 0.8             | -0.5         | 0.8             | V    |
| I <sub>IX</sub>  | Input Load Current                                          | GND ≤ V <sub>I</sub> ≤ V <sub>CC</sub>                                                                                                  | -5       | +5              | -5       | +5              | -5           | +5              | μA   |
| I <sub>OZ</sub>  | Output Leakage Current                                      | GND ≤ V <sub>O</sub> ≤ V <sub>CC</sub> ,<br>Output Disabled                                                                             | -5       | +5              | -5       | +5              | -5           | +5              | μA   |
| I <sub>OS</sub>  | Output Short Circuit Current <sup>[3]</sup>                 | V <sub>CC</sub> = Max.,<br>V <sub>OUT</sub> = GND                                                                                       |          | -350            |          | -350            |              | -350            | mA   |
| I <sub>CC</sub>  | V <sub>CC</sub> Operating Supply Current                    | V <sub>CC</sub> = Max.,<br>I <sub>OUT</sub> = 0 mA                                                                                      |          | 90              |          | 80              |              | 70              | mA   |
| I <sub>SB1</sub> | Automatic $\overline{CE}$ Power-Down Current <sup>[4]</sup> | Max. V <sub>CC</sub> , $\overline{CE} \geq V_{IH}$                                                                                      |          | 40              |          | 40              |              | 20              | mA   |
| I <sub>SB2</sub> | Automatic $\overline{CE}$ Power-Down Current                | Max. V <sub>CC</sub> ,<br>$\overline{CE} \geq V_{CC} - 0.3V$ ,<br>V <sub>IN</sub> ≥ V <sub>CC</sub> - 0.3V<br>or V <sub>IN</sub> ≤ 0.3V |          | 20              |          | 20              |              | 20              | mA   |

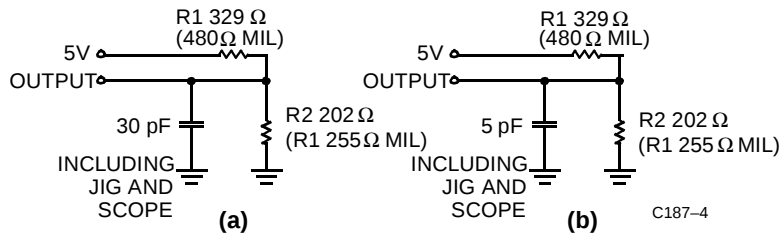
## Capacitance<sup>[5]</sup>

| Parameter        | Description        | Test Conditions                                             | Max. | Unit |
|------------------|--------------------|-------------------------------------------------------------|------|------|
| C <sub>IN</sub>  | Input Capacitance  | T <sub>A</sub> = 25°C, f = 1 MHz,<br>V <sub>CC</sub> = 5.0V | 10   | pF   |
| C <sub>OUT</sub> | Output Capacitance |                                                             | 10   | pF   |

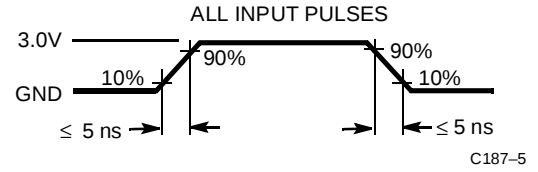
### Notes:

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

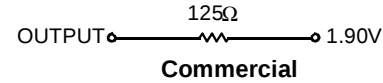
## AC Test Loads and Waveforms



C187-4



Equivalent to: THÉVENIN EQUIVALENT



## Switching Characteristics Over the Operating Range<sup>[6]</sup>

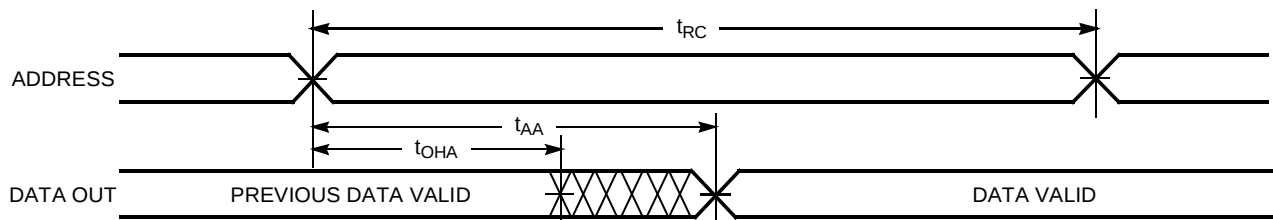
| Parameter                  | Description                                      | 7C187-15 |      | 7C187-20 |      | Unit |
|----------------------------|--------------------------------------------------|----------|------|----------|------|------|
|                            |                    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

### Notes:

- 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.
- At any given temperature and voltage condition,  $t_{HZCE}$  is less than  $t_{LZCE}$  for any given device.
- $t_{HZCE}$  and  $t_{HZWE}$  are specified with  $C_L = 5$  pF as in part (b) of AC Test Loads. Transition is measured  $\pm 500$  mV from steady-state voltage.
- 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 Characteristics** Over the Operating Range<sup>[6]</sup> (continued)

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

**Switching Waveforms**
**Read Cycle No. 1<sup>[10, 11]</sup>**


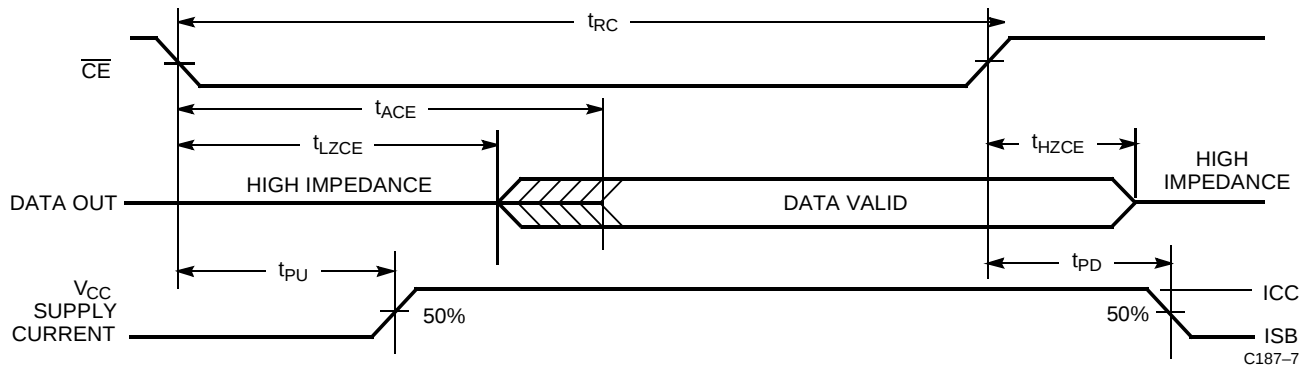
C187-6

**Notes:**

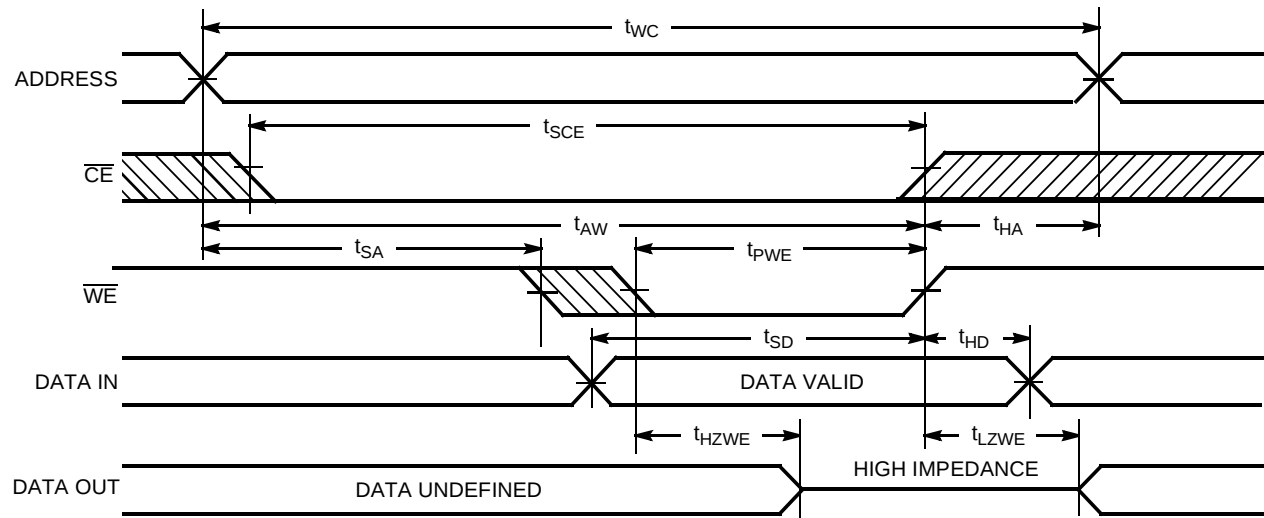
10.  $\overline{WE}$  is HIGH for read cycle.
11. Device is continuously selected,  $\overline{CE} = V_{IL}$ .

## Switching Waveforms

### Read Cycle No. 2<sup>[10, 12]</sup>

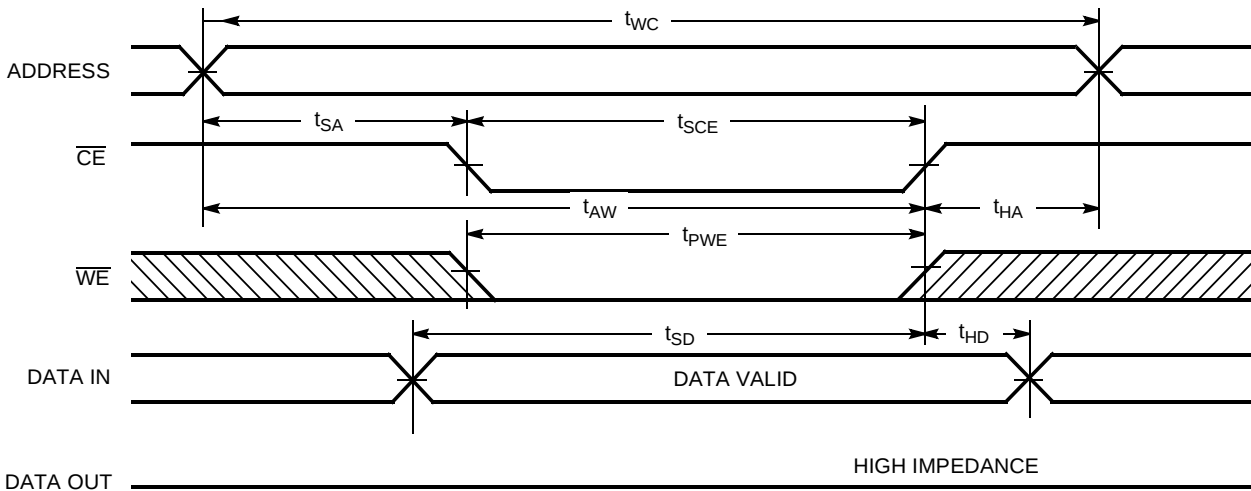


### Write Cycle No. 1 ( $\overline{WE}$ Controlled)<sup>[11]</sup>



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### Write Cycle No. 2 ( $\overline{CE}$ Controlled)<sup>[11, 13]</sup>

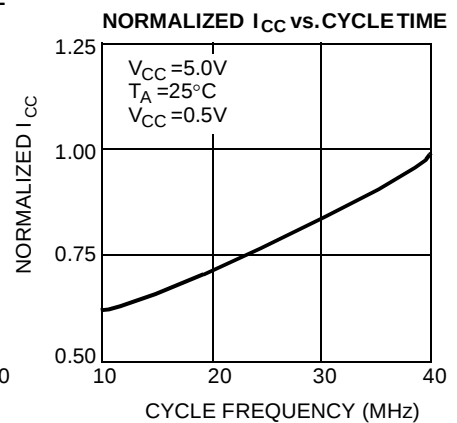
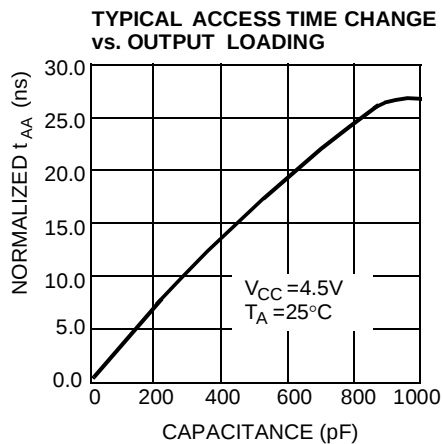
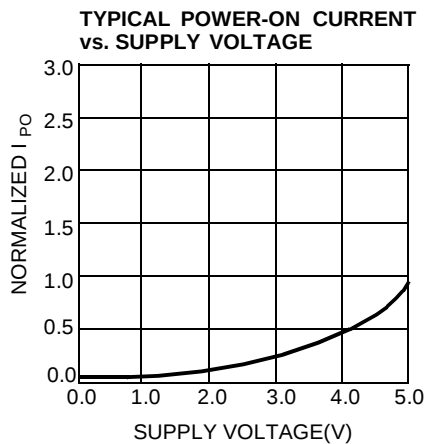
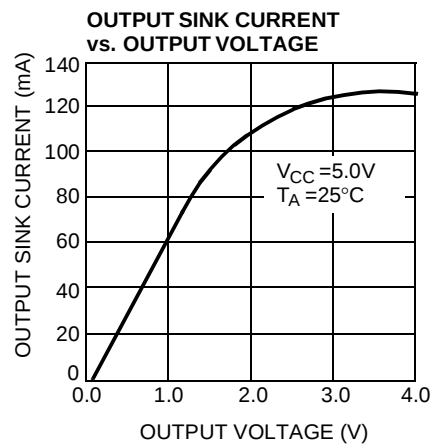
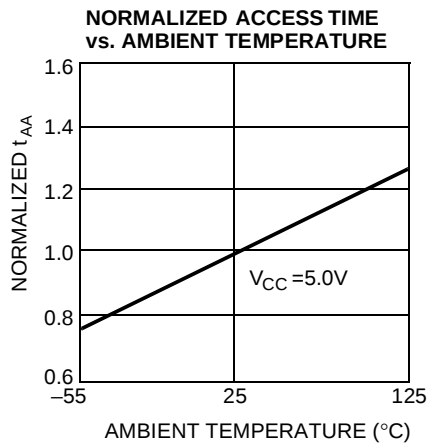
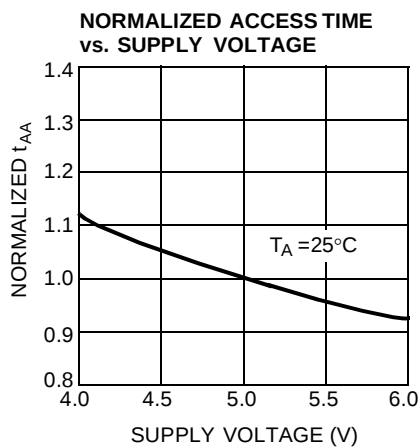
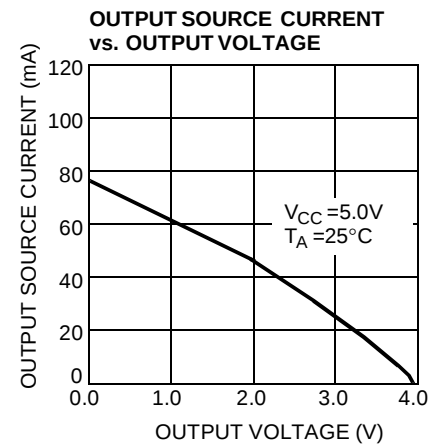
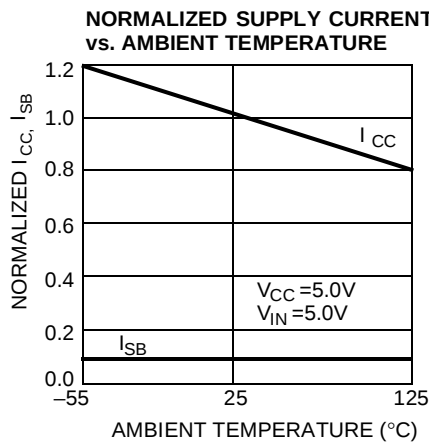
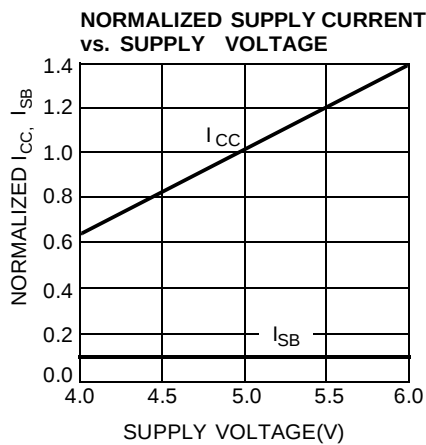


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#### Notes:

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

## Typical DC and AC Characteristics



### 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<sup>[14]</sup>

| 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           |                 |

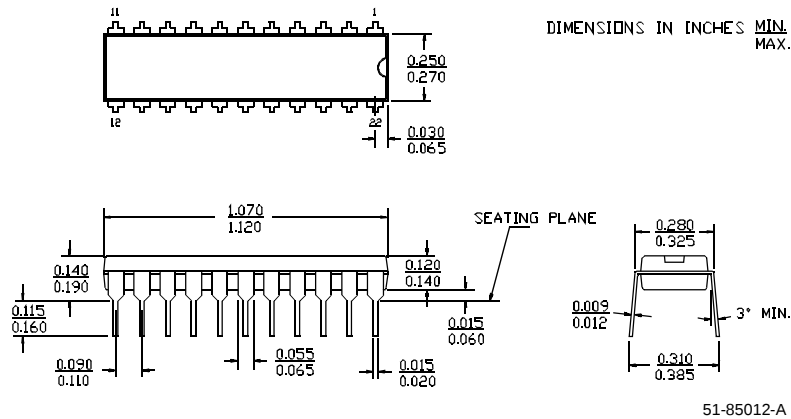
**Note:**

14. For military variations, see the CY7C187A datasheet.

Document #: 38-00038-K

## Package Diagrams

22-Lead (300-Mil) Molded DIP P9



24-Lead (300-Mil) Molded SOJ V13

