

**VITELIC**

**V61C16 FAMILY**  
**HIGH PERFORMANCE LOW POWER**  
**2K x 8 BIT**  
**CMOS STATIC RAM**

**Features**

- High Speed
  - Maximum access time of 45/55/70 ns
  - Equal access and cycle times
- Low Power
  - 200 mW typical operating
  - 0.5  $\mu$ W typical standby
  - 0.1  $\mu$ W typical data retention
- Battery backup
  - 2 volt data retention (L version)
- Six transistor CMOS memory cell
- CMOS process virtually eliminates alpha particle induced soft errors without die coating
- Fully static operation
  - No clock or refresh required
- Pin Compatible with standard 16K static RAMS and EPROMS in 300 and 600 mil DIP
- TTL compatible

**Description**

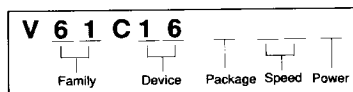
The V61C16 is a high speed, low power, 2048-word by 8-bit CMOS static RAM fabricated using high-performance CMOS process technology. This high reliability process, coupled with innovative circuit design techniques, yields access times of 45 ns maximum.

When the chip select is high, the device assumes a standby mode in which the device power dissipation is reduced to 0.5  $\mu$ W (typically). The low power version has a data retention mode that guarantees that data will remain valid at a minimum power supply voltage of 2.0 volts.

Using CMOS technology, supply voltages from 2.0 to 5.5 volts have little effect on supply current in data retention mode. Reducing the supply voltage to minimize current drain is unnecessary with the V61C16 family.

**6**

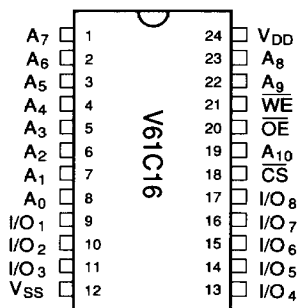
| Package               | Std. | Skinny | Pin Count |
|-----------------------|------|--------|-----------|
| Plastic DIP           | P    | S      | 24        |
| SOIC (Mini Flat Pack) | F    |        | 24        |

**Device Usage Chart**

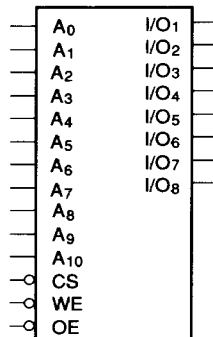
| Operating Temperature Range | Package Outline |   |   | Access Time (ns) |    |    | Power |      | Temperature Mark |
|-----------------------------|-----------------|---|---|------------------|----|----|-------|------|------------------|
|                             | P               | S | F | 45               | 55 | 70 | Low   | Std. |                  |
| 0°C - 70°C                  | •               | • | • | •                | •  | •  | •     | •    | Blank            |

V61C16 Rev. 01 6/90

**24 Pin DIP/SOIC  
PIN CONFIGURATION  
Top View**

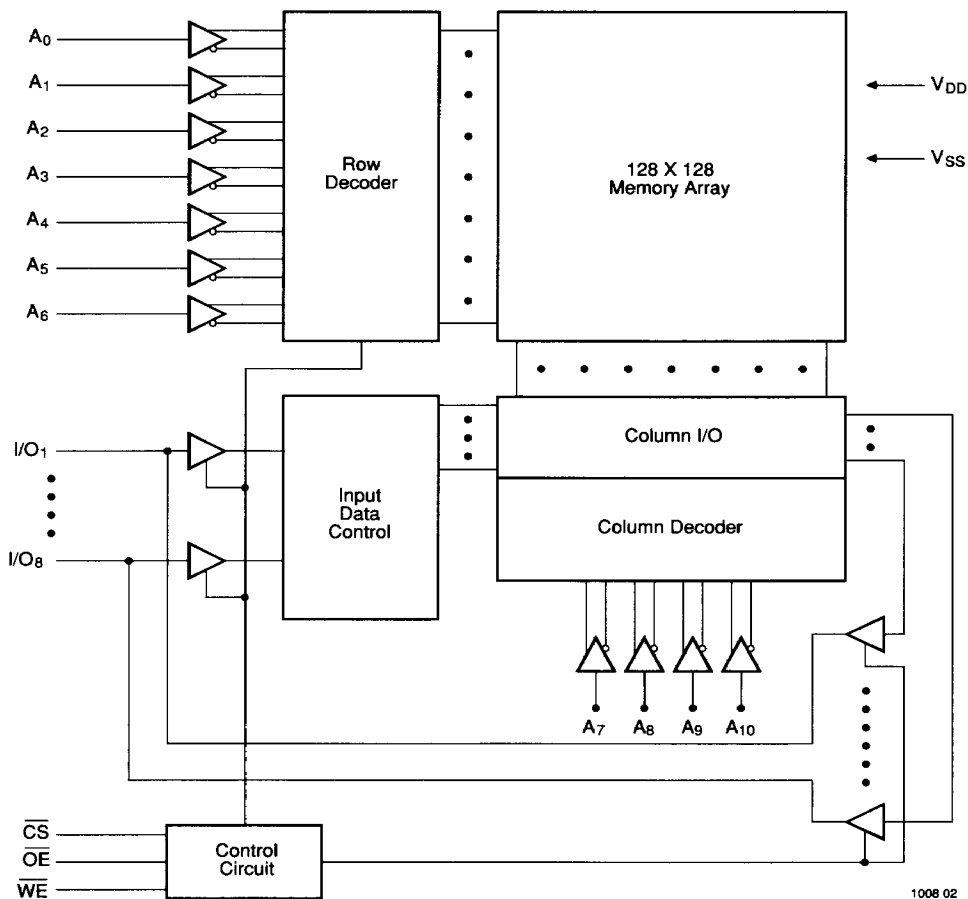


**Logic Symbol**



1008 01

**Functional Block Diagram**



1008 02

**Absolute Maximum Ratings<sup>(1)</sup>**

| Symbol     | Parameter                                   | Rating        | Unit |
|------------|---------------------------------------------|---------------|------|
| $V_{TERM}$ | Voltage on any Pin with Respect to $V_{SS}$ | -0.5* to +7.0 | V    |
| $T_A$      | Operating Temperature Under Bias            | -55 to +125   | °C   |
| $T_{STG}$  | Storage Temperature                         | -65 to +150   | °C   |
| $P_T$      | Power Dissipation                           | 1.0           | W    |
| $I_{OUT}$  | DC Output Current                           | 60            | mA   |

\* -3.5V for 20 ns pulse.

**NOTE:**

1. Operation at or above absolute maximum ratings may affect device reliability.

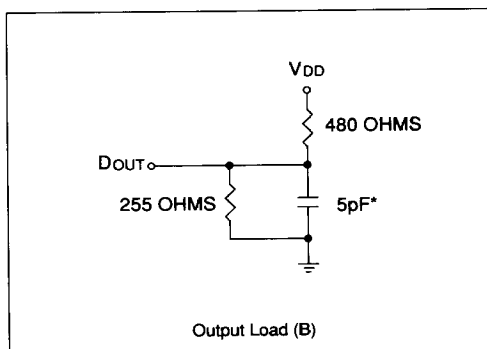
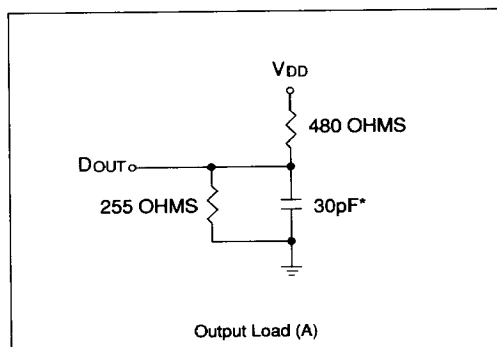
**Recommended Operating Conditions**

| Symbol   | Parameter          | Min.  | Typ. | Max.     | Unit |
|----------|--------------------|-------|------|----------|------|
| $V_{DD}$ | Supply Voltage     | 4.5   | 5.0  | 5.5      | V    |
| $V_{SS}$ | Supply Voltage     | 0.0   | 0.0  | 0.0      | V    |
| $V_{IH}$ | Input High Voltage | 2.2   | 3.5  | $V_{DD}$ | V    |
| $V_{IL}$ | Input Low Voltage  | -0.5* | —    | +0.8     | V    |

\* -3.5V for 20 ns pulse.

**AC Test Conditions**

Signal transition times of 5 ns or less, timing reference levels of 1.5V, input pulse levels of 0.0 to 3.0V, output loading as shown in diagrams below.



\* including scope and jig

**Truth Table**

| Mode    | CS | OE | WE | I/O Operation |
|---------|----|----|----|---------------|
| Standby | H  | X  | X  | High Z        |
| Read    | L  | L  | H  | $D_{OUT}$     |
| Read    | L  | H  | H  | High Z        |
| Write   | L  | X  | L  | $D_{IN}$      |

**Capacitance**

$T_A = 25^\circ\text{C}$ ,  $f = 1.0\text{ MHz}$

| Symbol   | Parameter                | Conditions    | Max. | Unit |
|----------|--------------------------|---------------|------|------|
| $C_{IN}$ | Input Capacitance        | $V_{IN} = 0V$ | 6    | pF   |
| $C_{IO}$ | Input/Output Capacitance | $V_{IO} = 0V$ | 8    | pF   |

**NOTE:**

These parameters are sampled and not 100% tested.

**Commercial Temperature Range**
**DC Characteristics**
 $T_A = 0^\circ\text{C to } 70^\circ\text{C}$ ,  $V_{DD} = 5\text{V} \pm 10\%$ ,  $V_{SS} = 0\text{V}$ , unless otherwise noted.

| Symbol     | Parameter                      | Test Conditions                                                                       | V61C16 |      |      | Unit          |
|------------|--------------------------------|---------------------------------------------------------------------------------------|--------|------|------|---------------|
|            |                                |                                                                                       | Min.   | Typ. | Max. |               |
| $ I_{L} $  | Input Leakage Current          | $V_{DD} = 5.5\text{V}$ , $V_{IN} = V_{SS}$ to $V_{DD}$                                | —      | —    | 2    | $\mu\text{A}$ |
| $ I_{LO} $ | Output Leakage Current         | $\overline{CS} = V_{IH}$ or $\overline{OE} = V_{IH}$<br>$V_{IO} = V_{SS}$ to $V_{DD}$ | —      | —    | 2    | $\mu\text{A}$ |
| $I_{DD}$   | Operating Power Supply Current | $\overline{CS} = V_{IL}$ , $I_{IO} = 0.0\text{mA}$<br>Duty Cycle = 100%               | —      | 55   | 95   | $\text{mA}$   |
| $I_{SB}$   | Standby Power Supply Current   | $\overline{CS} = V_{IH}$                                                              | —      | 2    | 5    | $\text{mA}$   |
| $I_{SB1}$  |                                | $\overline{CS} \geq V_{DD} - 0.2\text{V}$ , $V_{IN} = 0.0$ to $V_{DD}$                | —      | 4    | 1000 | $\mu\text{A}$ |
| $V_{OL}$   | Output Low Voltage             | $I_{OL} = 8\text{mA}$                                                                 | —      | —    | 0.4  | $\text{V}$    |
| $V_{OH}$   | Output High Voltage            | $I_{OH} = -4.0\text{mA}$                                                              | 2.4    | —    | —    | $\text{V}$    |

**Low Power DC Characteristics**
 $T_A = 0^\circ\text{C to } 70^\circ\text{C}$ ,  $V_{DD} = 5\text{V} \pm 10\%$ ,  $V_{SS} = 0\text{V}$ , unless otherwise noted.

| Symbol     | Parameter                      | Test Conditions                                                                       | V61C16***L |      |      | Unit          |
|------------|--------------------------------|---------------------------------------------------------------------------------------|------------|------|------|---------------|
|            |                                |                                                                                       | Min.       | Typ. | Max. |               |
| $ I_{L} $  | Input Leakage Current          | $V_{DD} = 5.5\text{V}$ , $V_{IN} = V_{SS}$ to $V_{DD}$                                | —          | —    | 2    | $\mu\text{A}$ |
| $ I_{LO} $ | Output Leakage Current         | $\overline{CS} = V_{IH}$ or $\overline{OE} = V_{IH}$<br>$V_{IO} = V_{SS}$ to $V_{DD}$ | —          | —    | 2    | $\mu\text{A}$ |
| $I_{DD}$   | Operating Power Supply Current | $\overline{CS} = V_{IL}$ , $I_{IO} = 0.0\text{mA}$<br>Duty Cycle = 100%               | —          | 55   | 80   | $\text{mA}$   |
| $I_{SB}$   | Standby Power Supply Current   | $\overline{CS} = V_{IH}$                                                              | —          | 2    | 5    | $\text{mA}$   |
| $I_{SB1}$  |                                | $\overline{CS} \geq V_{DD} - 0.2\text{V}$ , $V_{IN} = 0.0$ to $V_{DD}$                | —          | 0.1  | 20   | $\mu\text{A}$ |
| $V_{OL}$   | Output Low Voltage             | $I_{OL} = 8.0\text{mA}$                                                               | —          | —    | 0.4  | $\text{V}$    |
| $V_{OH}$   | Output High Voltage            | $I_{OH} = -4.0\text{mA}$                                                              | 2.4        | —    | —    | $\text{V}$    |

**Low  $V_{DD}$  Data Retention Characteristics**

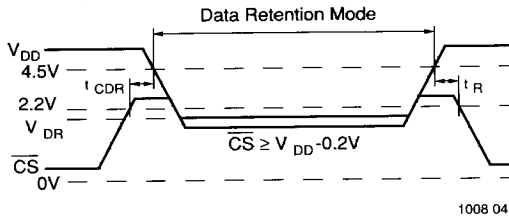
For low power versions only,  $T_A = 0^\circ\text{C to } 70^\circ\text{C}$ ,  $V_{DD} = 5\text{V} \pm 10\%$ ,  $V_{SS} = 0\text{V}$ , unless otherwise noted.

| Parameter                            | Symbol     | Limits         |      |      | Unit          | Test Conditions                                                                                    |
|--------------------------------------|------------|----------------|------|------|---------------|----------------------------------------------------------------------------------------------------|
|                                      |            | Min.           | Typ. | Max. |               |                                                                                                    |
| Data retention supply voltage        | $V_{DDDR}$ | 2.0            | —    | 5.5  | $\text{V}$    | $V_{IN} = 0.0$ to $V_{DD}$ , $\overline{CS} \geq V_{DD} - 0.2\text{V}$                             |
| Data retention supply current        | $I_{DDDR}$ | —              | 0.05 | 2.0  | $\mu\text{A}$ | $V_{DD} = 3.0\text{V}$ , $V_{IN} = 0.0$ to $V_{DD}$ ,<br>$\overline{CS} \geq V_{DD} - 0.2\text{V}$ |
| Chip deselect to data retention time | $t_{CDR}$  | 0.0            | —    | —    | $\text{ns}$   |                                                                                                    |
| Operation recovery time              | $t_R$      | $t_{RC}^{(1)}$ | —    | —    | $\text{ns}$   |                                                                                                    |

**NOTE:**

1.  $t_{RC}$  = Read Cycle Time

### Low $V_{DD}$ Data Retention Waveform



### AC Characteristics

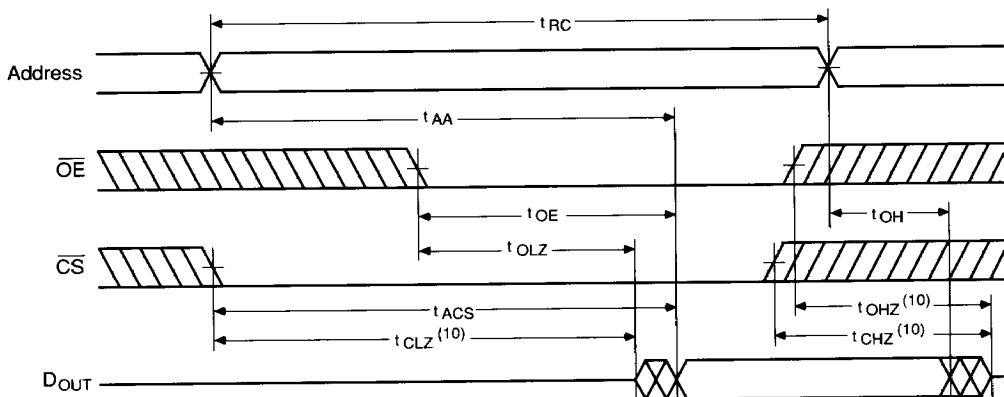
At recommended operating conditions

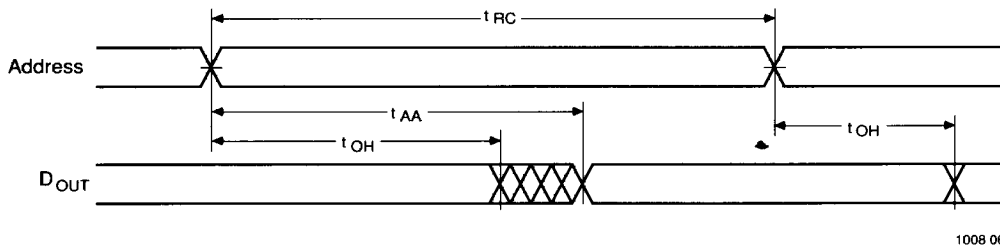
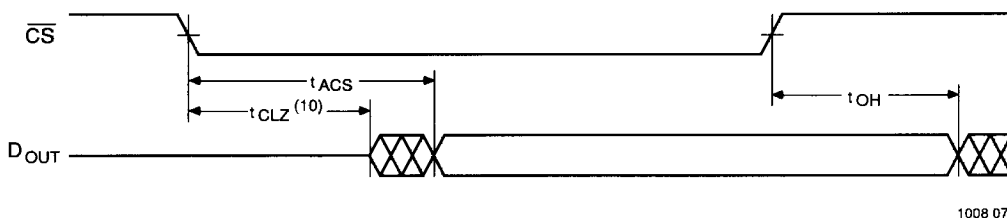
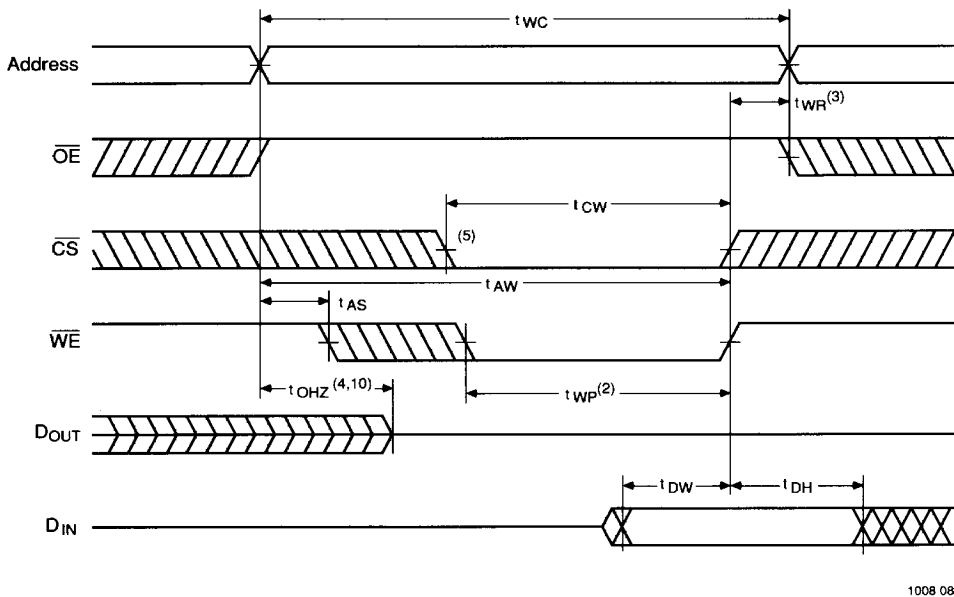
#### Read Cycle

| Symbol    | Parameter                            | V61C16*45 |      | V61C16*55 |      | V61C16*70 |      | Unit |
|-----------|--------------------------------------|-----------|------|-----------|------|-----------|------|------|
|           |                                      | Min.      | Max. | Min.      | Max. | Min.      | Max. |      |
| $t_{RC}$  | Read Cycle Time                      | 45        | —    | 55        | —    | 70        | —    | ns   |
| $t_{AA}$  | Address Access Time                  | —         | 45   | —         | 55   | —         | 70   | ns   |
| $t_{ACS}$ | Chip Select Access Time              | —         | 45   | —         | 55   | —         | 70   | ns   |
| $t_{CLZ}$ | Chip Selection to Output in Low Z    | 5         | —    | 5         | —    | 5         | —    | ns   |
| $t_{OE}$  | Output Enable to Output Valid        | —         | 20   | —         | 25   | —         | 50   | ns   |
| $t_{OLZ}$ | Output Enable to Output in Low Z     | 0         | —    | 5         | —    | 5         | —    | ns   |
| $t_{CHZ}$ | Chip Deselection to Output in High Z | 0         | 20   | 0         | 25   | 0         | 35   | ns   |
| $t_{OHZ}$ | Output Disable to Output in High Z   | —         | 20   | —         | 25   | —         | 35   | ns   |
| $t_{OH}$  | Output Hold from Address Change      | 5         | —    | 5         | —    | 5         | —    | ns   |

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#### Read Cycle 1 (1)



**Read Cycle 2 (1, 6)**

**Read Cycle 3 (1, 6)**

**Write Cycle 1 (1)**


### AC Characteristics (1)

At recommended operating conditions unless otherwise noted.

#### Write Cycle

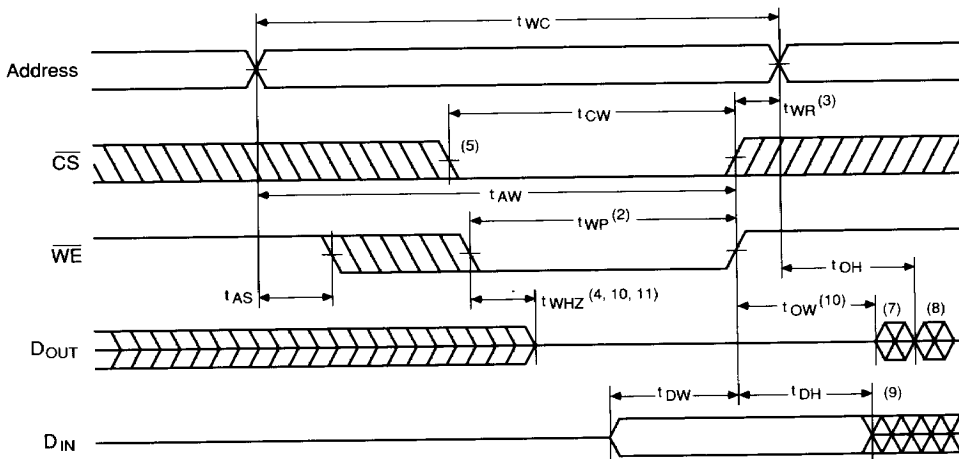
| Symbol    | Parameter                          | V61C16*45 |      | V61C16*55 |      | V61C16*70 |      | Unit |
|-----------|------------------------------------|-----------|------|-----------|------|-----------|------|------|
|           |                                    | Min.      | Max. | Min.      | Max. | Min.      | Max. |      |
| $t_{WC}$  | Write Cycle Time                   | 45        | —    | 55        | —    | 70        | —    | ns   |
| $t_{CW}$  | Chip Selection to End of Write     | 35        | —    | 40        | —    | 40        | —    | ns   |
| $t_{AW}$  | Address Valid to End of Write      | 40        | —    | 50        | —    | 65        | —    | ns   |
| $t_{AS}$  | Address Setup Time                 | 0         | —    | 10        | —    | 15        | —    | ns   |
| $t_{WP}$  | Write Pulse Width                  | 25        | —    | 30        | —    | 40        | —    | ns   |
| $t_{WR}$  | Write Recovery Time                | 0         | —    | 5         | —    | 5         | —    | ns   |
| $t_{OHZ}$ | Output Disable to Output in High Z | —         | 20   | —         | 25   | —         | 35   | ns   |
| $t_{WHZ}$ | Write to Output in High Z          | 0         | 20   | 0         | 25   | 0         | 40   | ns   |
| $t_{DW}$  | Data to Write Time Overlap         | 25        | —    | 30        | —    | 30        | —    | ns   |
| $t_{DH}$  | Data Hold from Write Time          | 0         | —    | 5         | —    | 5         | —    | ns   |
| $t_{OW}$  | Output Active from End of Write    | 0         | —    | 0         | —    | 0         | —    | ns   |

#### NOTE:

1. Test conditions assume signal transition times if 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, as in Output Load (A).

#### Write Cycle 2 (1, 6)

6



1008 09

**NOTES:**

1.  $\overline{WE}$  must be high during all address transitions.
2. A write occurs during the overlap ( $t_{WP}$ ) of a low  $\overline{CS}$  and a low  $\overline{WE}$ .
3.  $t_{WR}$  is measured from the earlier of  $\overline{CS}$  or  $\overline{WE}$  going high to the end of the write cycle.
4. During this period, I/O pins are in the output state and the input signals of opposite phase to the outputs must not be applied.
5. If the  $\overline{CS}$  low transition occurs simultaneously with the  $\overline{WE}$  low transitions or after the  $\overline{WE}$  transition, outputs remain in a high impedance state.
6.  $\overline{OE}$  is continuously low ( $\overline{OE} \leq V_{IL}$ ).
7.  $D_{OUT}$  is the same phase of write data of this write cycle.
8.  $D_{OUT}$  is the read data of next address.
9. If  $\overline{CS}$  is low during this period, I/O pins are in the output state and the data input signals of opposite phase to the outputs must not be applied to them.
10. Transition is measured  $\pm 500\text{mV}$  from steady state. This parameter is sampled and not 100% tested.
11.  $t_{WHZ}$  is tested with  $C_L = 5\text{ pF}$  as in Output Load (B).