

## 64K x 64 SYNCHRONOUS PIPELINE STATIC RAM

APRIL 2001

### FEATURES

- Fast access time:
  - 133, 117, 100 MHz; 6 ns (83 MHz);  
7 ns (75 MHz); 8 ns (66 MHz)
- Internal self-timed write cycle
- Individual Byte Write Control and Global Write
- Clock controlled, registered address, data and control
- Pentium™ or linear burst sequence control using MODE input
- Five chip enables for simple depth expansion and address pipelining
- Common data inputs and data outputs
- Power-down control by ZZ input
- JEDEC 128-Pin TQFP 14mm x 20mm package
- Single +3.3V power supply
- Control pins mode upon power-up:
  - MODE in interleave burst mode
  - ZZ in normal operation modeThese control pins can be connected to GNDQ or VCCQ to alter their power-up state

### DESCRIPTION

The *ISSI* IS61SP6464 is a high-speed, low-power synchronous static RAM designed to provide a burstable, high-performance, secondary cache for the i486™, Pentium™, 680X0™, and PowerPC™ microprocessors. It is organized as 65,536 words by 64 bits, fabricated with *ISSI*'s advanced CMOS technology. The device integrates a 2-bit burst counter, high-speed SRAM core, and high-drive capability outputs into a single monolithic circuit. All synchronous inputs pass through registers controlled by a positive-edge-triggered single clock input.

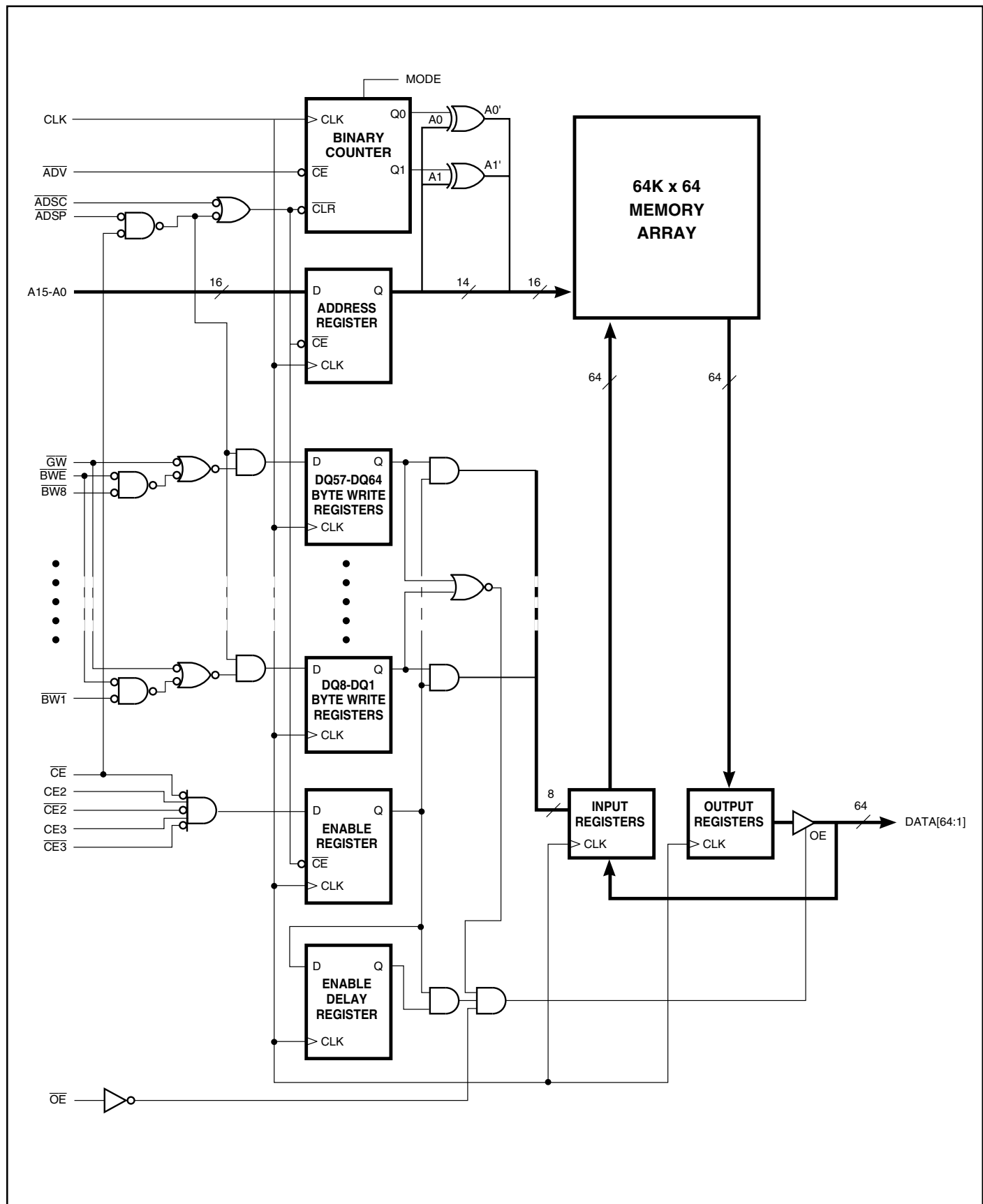
Write cycles are internally self-timed and are initiated by the rising edge of the clock input. Write cycles can be from one to eight bytes wide as controlled by the write control inputs.

Separate byte enables allow individual bytes to be written. BW1 controls I/O1-I/O8, BW2 controls I/O9-I/O16, BW3 controls I/O17-I/O24, BW4 controls I/O25-I/O32, BW5 controls I/O33-I/O40, BW6 controls I/O41-I/O48, BW7 controls I/O49-I/O56, BW8 controls I/O57-I/O64, conditioned by BWE being LOW. A LOW on GW input would cause all bytes to be written.

Bursts can be initiated with either ADSP (Address Status Processor) or ADSC (Address Status Cache Controller) input pins. Subsequent burst addresses can be generated internally by the IS61SP6464 and controlled by the ADV (burst address advance) input pin.

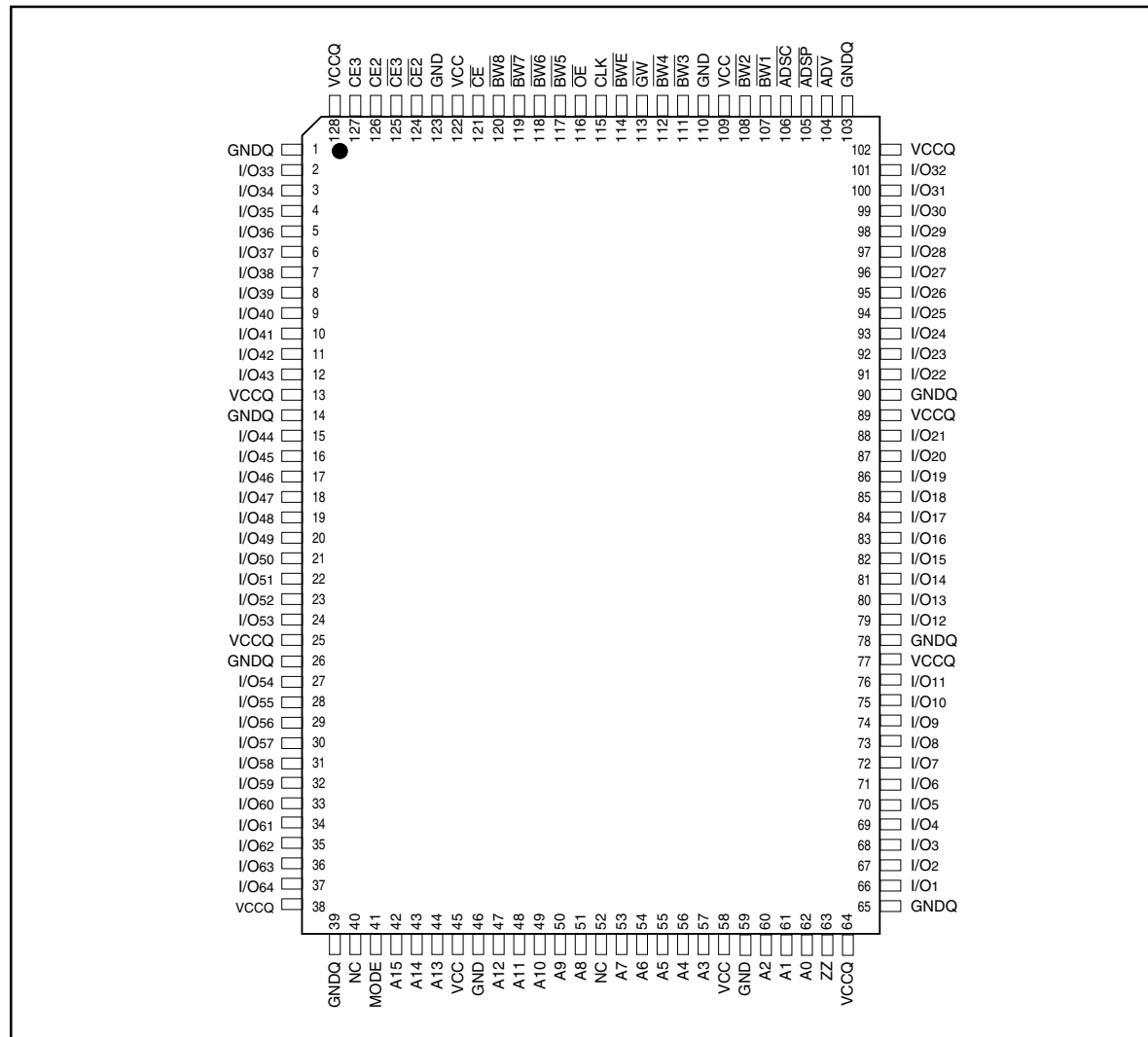
Asynchronous signals include output enable (OE), sleep mode input (ZZ), and burst mode input (MODE). A HIGH input on the ZZ pin puts the SRAM in the power-down state. When ZZ is pulled LOW (or no connect), the SRAM normally operates after the wake-up period. A LOW input, i.e., GNDQ, on MODE pin selects LINEAR Burst. A VCCQ (or no connect) on MODE pin selects INTERLEAVED Burst.

## BLOCK DIAGRAM



## PIN CONFIGURATION

## 128-Pin TQFP



## PIN DESCRIPTIONS

|                                                                       |                               |                  |                                         |
|-----------------------------------------------------------------------|-------------------------------|------------------|-----------------------------------------|
| A0-A15                                                                | Address Inputs                | I/O1-I/O64       | Data Input/Output                       |
| CLK                                                                   | Clock                         | ZZ               | Sleep Mode                              |
| $\overline{\text{ADSP}}$                                              | Processor Address Status      | MODE             | Burst Sequence Mode                     |
| $\overline{\text{ADSC}}$                                              | Controller Address Status     | V <sub>CC</sub>  | +3.3V Power Supply                      |
| $\overline{\text{ADV}}$                                               | Burst Address Advance         | GND              | Ground                                  |
| $\overline{\text{BW1-BW8}}$                                           | Synchronous Byte Write Enable | V <sub>CCQ</sub> | Isolated Output Buffer Supply:<br>+3.3V |
| $\overline{\text{BWE}}$                                               | Byte Write Enable             | NC               | No Connect                              |
| $\overline{\text{GW}}$                                                | Global Write Enable           | GND <sub>Q</sub> | Isolated Output Buffer Ground           |
| $\overline{\text{CE1}}, \overline{\text{CE2}}, \overline{\text{CE3}}$ | Synchronous Chip Enable       |                  |                                         |
| $\overline{\text{OE}}$                                                | Output Enable                 |                  |                                         |

## TRUTH TABLE

| OPERATION                   | ADDRESS  |     |     |                  |                  |                 |                   |                   |                  |                    |                 |     |        |
|-----------------------------|----------|-----|-----|------------------|------------------|-----------------|-------------------|-------------------|------------------|--------------------|-----------------|-----|--------|
|                             | USED     | CE3 | CE2 | $\overline{CE3}$ | $\overline{CE2}$ | $\overline{CE}$ | $\overline{ADSP}$ | $\overline{ADSC}$ | $\overline{ADV}$ | $\overline{WRITE}$ | $\overline{OE}$ | CLK | I/O    |
| Deselected, Power-down      | None     | X   | X   | X                | X                | H               | X                 | L                 | X                | X                  | X               | L-H | High-Z |
| Deselected, Power-down      | None     | L   | X   | X                | X                | L               | L                 | X                 | X                | X                  | X               | L-H | High-Z |
| Deselected, Power-down      | None     | X   | L   | X                | X                | L               | L                 | X                 | X                | X                  | X               | L-H | High-Z |
| Deselected, Power-down      | None     | X   | X   | H                | X                | L               | L                 | X                 | X                | X                  | X               | L-H | High-Z |
| Deselected, Power-down      | None     | X   | X   | X                | H                | L               | L                 | X                 | X                | X                  | X               | L-H | High-Z |
| Deselected, Power-down      | None     | L   | X   | X                | X                | L               | H                 | L                 | X                | X                  | X               | L-H | High-Z |
| Deselected, Power-down      | None     | X   | L   | X                | X                | L               | H                 | L                 | X                | X                  | X               | L-H | High-Z |
| Deselected, Power-down      | None     | X   | X   | H                | X                | L               | H                 | L                 | X                | X                  | X               | L-H | High-Z |
| Deselected, Power-down      | None     | X   | X   | X                | H                | L               | H                 | L                 | X                | X                  | X               | L-H | High-Z |
| Read Cycle, Begin Burst     | External | H   | H   | L                | L                | L               | L                 | X                 | X                | X                  | L               | L-H | Dout   |
| Read Cycle, Begin Burst     | External | H   | H   | L                | L                | L               | L                 | X                 | X                | X                  | H               | L-H | High-Z |
| Write Cycle, Begin Burst    | External | H   | H   | L                | L                | L               | H                 | L                 | X                | L                  | X               | L-H | Din    |
| Read Cycle, Begin Burst     | External | H   | H   | L                | L                | L               | H                 | L                 | X                | H                  | L               | L-H | Dout   |
| Read Cycle, Begin Burst     | External | H   | H   | L                | L                | L               | H                 | L                 | X                | H                  | H               | L-H | High-Z |
| Read Cycle, Continue Burst  | Next     | X   | X   | X                | X                | X               | H                 | H                 | L                | H                  | L               | L-H | Dout   |
| Read Cycle, Continue Burst  | Next     | X   | X   | X                | X                | X               | H                 | H                 | L                | H                  | H               | L-H | High-Z |
| Read Cycle, Continue Burst  | Next     | X   | X   | X                | X                | H               | X                 | H                 | L                | H                  | L               | L-H | Dout   |
| Read Cycle, Continue Burst  | Next     | X   | X   | X                | X                | H               | X                 | H                 | L                | H                  | H               | L-H | High-Z |
| Write Cycle, Continue Burst | Next     | X   | X   | X                | X                | X               | H                 | H                 | L                | L                  | X               | L-H | Din    |
| Write Cycle, Continue Burst | Next     | X   | X   | X                | X                | H               | X                 | H                 | L                | L                  | X               | L-H | Din    |
| Read Cycle, Suspend Burst   | Current  | X   | X   | X                | X                | X               | H                 | H                 | H                | H                  | L               | L-H | Dout   |
| Read Cycle, Suspend Burst   | Current  | X   | X   | X                | X                | X               | H                 | H                 | H                | H                  | H               | L-H | High-Z |
| Read Cycle, Suspend Burst   | Current  | X   | X   | X                | X                | H               | X                 | H                 | H                | H                  | L               | L-H | Dout   |
| Read Cycle, Suspend Burst   | Current  | X   | X   | X                | X                | H               | X                 | H                 | H                | H                  | H               | L-H | High-Z |
| Write Cycle, Suspend Burst  | Current  | X   | X   | X                | X                | X               | H                 | H                 | H                | L                  | X               | L-H | Din    |
| Write Cycle, Suspend Burst  | Current  | X   | X   | X                | X                | H               | X                 | H                 | H                | L                  | X               | L-H | Din    |

**Notes:**

1. All inputs except  $\overline{OE}$  must meet setup and hold times for the Low-to-High transition of clock (CLK).
2. Wait states are inserted by suspending burst.
3. X means don't care.  $\overline{WRITE}=L$  means any one or more byte write enable signals ( $\overline{BW1}$ - $\overline{BW8}$ ) and  $\overline{BWE}$  are LOW or  $\overline{GW}$  is LOW.  $\overline{WRITE}=H$  means all byte write enable signals are HIGH.
4. For a Write operation following a Read operation,  $\overline{OE}$  must be HIGH before the input data required setup time and held HIGH throughout the input data hold time.
5.  $\overline{ADSP}$  LOW always initiates an internal READ at the Low-to-High edge of clock. A WRITE is performed by setting one or more byte write enable signals and  $\overline{BWE}$  LOW or  $\overline{GW}$  LOW for the subsequent L-H edge of clock.

**ASYNCHRONOUS TRUTH TABLE**

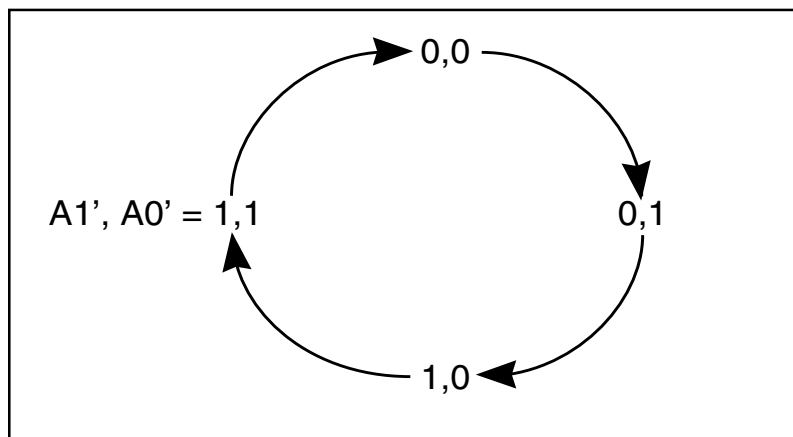
| Operation      | ZZ | $\overline{OE}$ | I/O STATUS |
|----------------|----|-----------------|------------|
| Pipelined Read | L  | L               | Dout       |
| Pipelined Read | L  | H               | High-Z     |
| Write          | L  | L               | High-Z     |
| Write          | L  | H               | Din        |
| Deselect       | L  | X               | High-Z     |
| Sleep          | H  | X               | High-Z     |

**WRITE TRUTH TABLE**

| Operation       | $\overline{GW}$ | $\overline{BWE}$ | $\overline{BW8}$ | $\overline{BW7}$ | $\overline{BW6}$ | $\overline{BW5}$ | $\overline{BW4}$ | $\overline{BW3}$ | $\overline{BW2}$ | $\overline{BW1}$ |
|-----------------|-----------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|
| Read            | H               | H                | X                | X                | X                | X                | X                | X                | X                | X                |
| Read            | H               | L                | H                | H                | H                | H                | H                | H                | H                | H                |
| Write all bytes | H               | L                | L                | L                | L                | L                | L                | L                | L                | L                |
| Write all bytes | L               | X                | X                | X                | X                | X                | X                | X                | X                | X                |
| Write Byte 1    | H               | L                | H                | H                | H                | H                | H                | H                | H                | L                |
| Write Byte 2    | H               | L                | H                | H                | H                | H                | H                | H                | L                | H                |
| Write Byte 3    | H               | L                | H                | H                | H                | H                | H                | L                | H                | H                |
| Write Byte 4    | H               | L                | H                | H                | H                | H                | L                | H                | H                | H                |
| Write Byte 5    | H               | L                | H                | H                | H                | L                | H                | H                | H                | H                |
| Write Byte 6    | H               | L                | H                | H                | L                | H                | H                | H                | H                | H                |
| Write Byte 7    | H               | L                | H                | L                | H                | H                | H                | H                | H                | H                |
| Write Byte 8    | H               | L                | L                | H                | H                | H                | H                | H                | H                | H                |

**INTERLEAVED BURST ADDRESS TABLE** (MODE = Vcc or No Connect)

| External Address<br>A1 A0 | 1st Burst Address<br>A1 A0 | 2nd Burst Address<br>A1 A0 | 3rd Burst Address<br>A1 A0 |
|---------------------------|----------------------------|----------------------------|----------------------------|
| 00                        | 01                         | 10                         | 11                         |
| 01                        | 00                         | 11                         | 10                         |
| 10                        | 11                         | 00                         | 01                         |
| 11                        | 10                         | 01                         | 00                         |

**LINEAR BURST ADDRESS TABLE** (MODE = GNDQ)**ABSOLUTE MAXIMUM RATINGS<sup>(1)</sup>**

| Symbol                             | Parameter                                                     | Value                          | Unit |
|------------------------------------|---------------------------------------------------------------|--------------------------------|------|
| T <sub>BIAS</sub>                  | Temperature Under Bias                                        | −10 to +85                     | °C   |
| T <sub>STG</sub>                   | Storage Temperature                                           | −55 to +150                    | °C   |
| P <sub>D</sub>                     | Power Dissipation                                             | 1.0                            | W    |
| I <sub>OUT</sub>                   | Output Current (per I/O)                                      | 100                            | mA   |
| V <sub>IN</sub> , V <sub>OUT</sub> | Voltage Relative to GND for I/O Pins                          | −0.5 to V <sub>CCQ</sub> + 0.3 | V    |
| V <sub>IN</sub>                    | Voltage Relative to GND for<br>for Address and Control Inputs | −0.5 to 5.5                    | V    |
| V <sub>CC</sub>                    | Voltage on Vcc Supply Relative to GND                         | −0.5 to 4.6                    | V    |

**Notes:**

1. Stress greater than those listed under ABSOLUTE MAXIMUM RATINGS may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect reliability.
2. This device contains circuitry to protect the inputs against damage due to high static voltages or electric fields; however, precautions may be taken to avoid application of any voltage higher than maximum rated voltages to this high-impedance circuit.
3. This device contains circuitry that will ensure the output devices are in High-Z at power up.

**OPERATING RANGE**

| Range      | Ambient Temperature | V <sub>CC</sub> |
|------------|---------------------|-----------------|
| Commercial | 0°C to +70°C        | 3.3V +10%, −5%  |
| Industrial | −40°C to +85°C      | 3.3V +10%, −5%  |

**DC ELECTRICAL CHARACTERISTICS<sup>(1)</sup>** (Over Operating Range)

| Symbol          | Parameter              | Test Conditions                                                      | Min.         | Max.                   | Unit |
|-----------------|------------------------|----------------------------------------------------------------------|--------------|------------------------|------|
| V <sub>OH</sub> | Output HIGH Voltage    | I <sub>OH</sub> = -4.0 mA                                            | 2.4          | —                      | V    |
| V <sub>OL</sub> | Output LOW Voltage     | I <sub>OL</sub> = 8 mA                                               | —            | 0.4                    | V    |
| V <sub>IH</sub> | Input HIGH Voltage     |                                                                      | 2.0          | V <sub>CCQ</sub> + 0.3 | V    |
| V <sub>IL</sub> | Input LOW Voltage      |                                                                      | -0.3         | 0.8                    | V    |
| I <sub>LI</sub> | Input Leakage Current  | GND - V <sub>IN</sub> - V <sub>CCQ</sub> <sup>(2)</sup>              | Com.<br>Ind. | -2<br>10               | μA   |
| I <sub>LO</sub> | Output Leakage Current | GND - V <sub>OUT</sub> - V <sub>CCQ</sub> , $\overline{OE} = V_{IH}$ | Com.<br>Ind. | -2<br>10               | μA   |

**CAPACITANCE<sup>(1,2)</sup>**

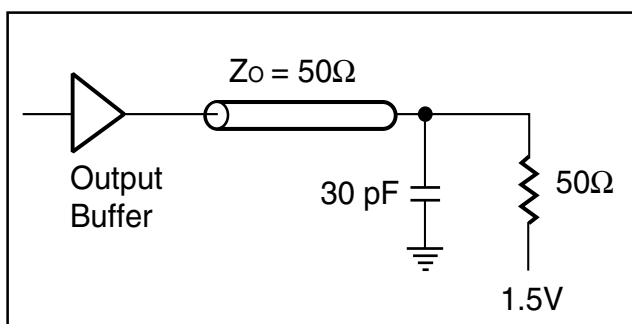
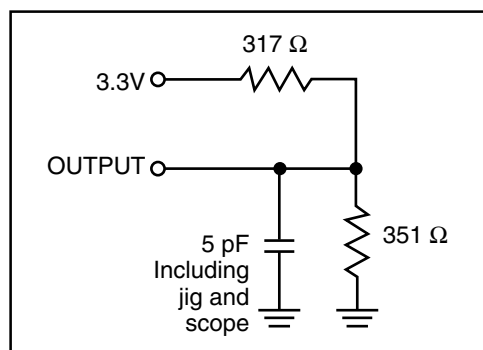
| Symbol           | Parameter                | Conditions            | Max. | Unit |
|------------------|--------------------------|-----------------------|------|------|
| C <sub>IN</sub>  | Input Capacitance        | V <sub>IN</sub> = 0V  | 5    | pF   |
| C <sub>OUT</sub> | Input/Output Capacitance | V <sub>OUT</sub> = 0V | 7    | pF   |

**Notes:**

1. Tested initially and after any design or process changes that may affect these parameters.
2. Test conditions: T<sub>A</sub> = 25°C, f = 1 MHz, V<sub>CC</sub> = 3.3V.

**AC TEST CONDITIONS**

| Parameter                                   | Unit                |
|---------------------------------------------|---------------------|
| Input Pulse Level                           | 0V to 3.0V          |
| Input Rise and Fall Times                   | 1.5 ns              |
| Input and Output Timing and Reference Level | 1.5V                |
| Output Load                                 | See Figures 1 and 2 |

**AC TEST LOADS****Figure 1****Figure 2**

**POWER SUPPLY CHARACTERISTICS** (Over Operating Range)

| Symbol           | Parameter                      | Test Conditions                                                                                                                                               |      | -133<br>Max. | -117<br>Max. | -100<br>Max. | -6<br>Max. | -7<br>Max. | -8<br>Max. | Unit |
|------------------|--------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|------|--------------|--------------|--------------|------------|------------|------------|------|
| I <sub>CC</sub>  | AC Operating<br>Supply Current | Device Selected,<br>All Inputs = V <sub>IL</sub> or V <sub>IH</sub><br>$\overline{OE} = V_{IH}$ ,<br>Cycle Time • t <sub>KC</sub> min.                        | Com. | 280          | 270          | 250          | 200        | 170        | 150        | mA   |
|                  |                                |                                                                                                                                                               | Ind. | —            | 290          | 270          | 220        | 190        | 170        |      |
| I <sub>SB1</sub> | Standby Current<br>TTL Inputs  | Device Deselected,<br>V <sub>CC</sub> = Max.,<br>All Inputs = V <sub>IH</sub> or V <sub>IL</sub><br>CLK Cycle Time • t <sub>KC</sub> min.                     | Com. | 70           | 70           | 70           | 70         | 70         | 70         | mA   |
|                  |                                |                                                                                                                                                               | Ind. | —            | 80           | 80           | 80         | 80         | 80         |      |
| I <sub>SB2</sub> | Standby Current<br>CMOS Inputs | Device Deselected,<br>V <sub>CC</sub> = Max.,<br>V <sub>IN</sub> = V <sub>CC</sub> • 0.2V, or V <sub>IN</sub> - 0.2V<br>CLK Cycle Time • t <sub>KC</sub> min. | Com. | 20           | 20           | 20           | 20         | 20         | 20         | mA   |
|                  |                                |                                                                                                                                                               | Ind. | —            | 30           | 30           | 30         | 30         | 30         |      |
| I <sub>ZZ</sub>  | Power-Down Mode<br>Current     | ZZ = V <sub>CCQ</sub> , CLK Running<br>All Inputs - GND + 0.2V<br>or • V <sub>CC</sub> - 0.2V                                                                 | Com. | 20           | 20           | 20           | 20         | 20         | 20         | mA   |
|                  |                                |                                                                                                                                                               | Ind. | —            | 30           | 30           | 30         | 30         | 30         |      |

**Notes:**

1. The MODE pin has an internal pullup. ZZ pin has an internal pull-down. This pin may be a No Connect, tied to GND, or tied to V<sub>CCQ</sub>.
2. The MODE pin should be tied to V<sub>CC</sub> or GND. It exhibits ±10 µA maximum leakage current when tied to - GND + 0.2V or • V<sub>CC</sub> - 0.2V.

**READ CYCLE SWITCHING CHARACTERISTICS** (Over Operating Range)

| Symbol                             | Parameter                        | -133 MHz |      | -117 MHz |      | -100 MHz |      | Unit |
|------------------------------------|----------------------------------|----------|------|----------|------|----------|------|------|
|                                    |                                  | Min.     | Max. | Min.     | Max. | Min.     | Max. |      |
| t <sub>KC</sub>                    | Cycle Time                       | 7.5      | —    | 8.5      | —    | 10       | —    | ns   |
| t <sub>KH</sub>                    | Clock High Time                  | 3        | —    | 3.4      | —    | 4        | —    | ns   |
| t <sub>KL</sub>                    | Clock Low Time                   | 3        | —    | 3.4      | —    | 4        | —    | ns   |
| t <sub>KQ</sub>                    | Clock Access Time                | —        | 5    | —        | 5    | —        | 5    | ns   |
| t <sub>KQX</sub> <sup>(1)</sup>    | Clock High to Output Invalid     | 1.5      | —    | 1.5      | —    | 2.5      | —    | ns   |
| t <sub>KQLZ</sub> <sup>(1,2)</sup> | Clock High to Output Low-Z       | 0        | —    | 0        | —    | 0        | —    | ns   |
| t <sub>KQHZ</sub> <sup>(1,2)</sup> | Clock High to Output High-Z      | 2        | 5    | 2        | 5    | 2        | 5    | ns   |
| t <sub>OEQ</sub>                   | Output Enable to Output Valid    | —        | 5    | —        | 5    | —        | 5    | ns   |
| t <sub>OEQX</sub> <sup>(1)</sup>   | Output Disable to Output Invalid | 0        | —    | 0        | —    | 0        | —    | ns   |
| t <sub>OELZ</sub> <sup>(1,2)</sup> | Output Enable to Output Low-Z    | 0        | —    | 0        | —    | 0        | —    | ns   |
| t <sub>OEHZ</sub> <sup>(1,2)</sup> | Output Disable to Output High-Z  | —        | —    | —        | —    | 2        | 5    | ns   |
| t <sub>AS</sub>                    | Address Setup Time               | 2.5      | —    | 2.5      | —    | 2.5      | —    | ns   |
| t <sub>SS</sub>                    | Address Status Setup Time        | 2.5      | —    | 2.5      | —    | 2.5      | —    | ns   |
| t <sub>WS</sub>                    | Write Setup Time                 | 2.5      | —    | 2.5      | —    | 2.5      | —    | ns   |
| t <sub>CES</sub>                   | Chip Enable Setup Time           | 2.5      | —    | 2.5      | —    | 2.5      | —    | ns   |
| t <sub>AVS</sub>                   | Address Advance Setup Time       | 2.5      | —    | 2.5      | —    | 2.5      | —    | ns   |
| t <sub>AH</sub>                    | Address Hold Time                | 0.5      | —    | 0.5      | —    | 0.5      | —    | ns   |
| t <sub>SH</sub>                    | Address Status Hold Time         | 0.5      | —    | 0.5      | —    | 0.5      | —    | ns   |
| t <sub>WH</sub>                    | Write Hold Time                  | 0.5      | —    | 0.5      | —    | 0.5      | —    | ns   |
| t <sub>CEH</sub>                   | Chip Enable Hold Time            | 0.5      | —    | 0.5      | —    | 0.5      | —    | ns   |
| t <sub>AVH</sub>                   | Address Advance Hold Time        | 0.5      | —    | 0.5      | —    | 0.5      | —    | ns   |

**Notes:**

1. Guaranteed but not 100% tested. This parameter is periodically sampled.
2. Tested with load in Figure 2.

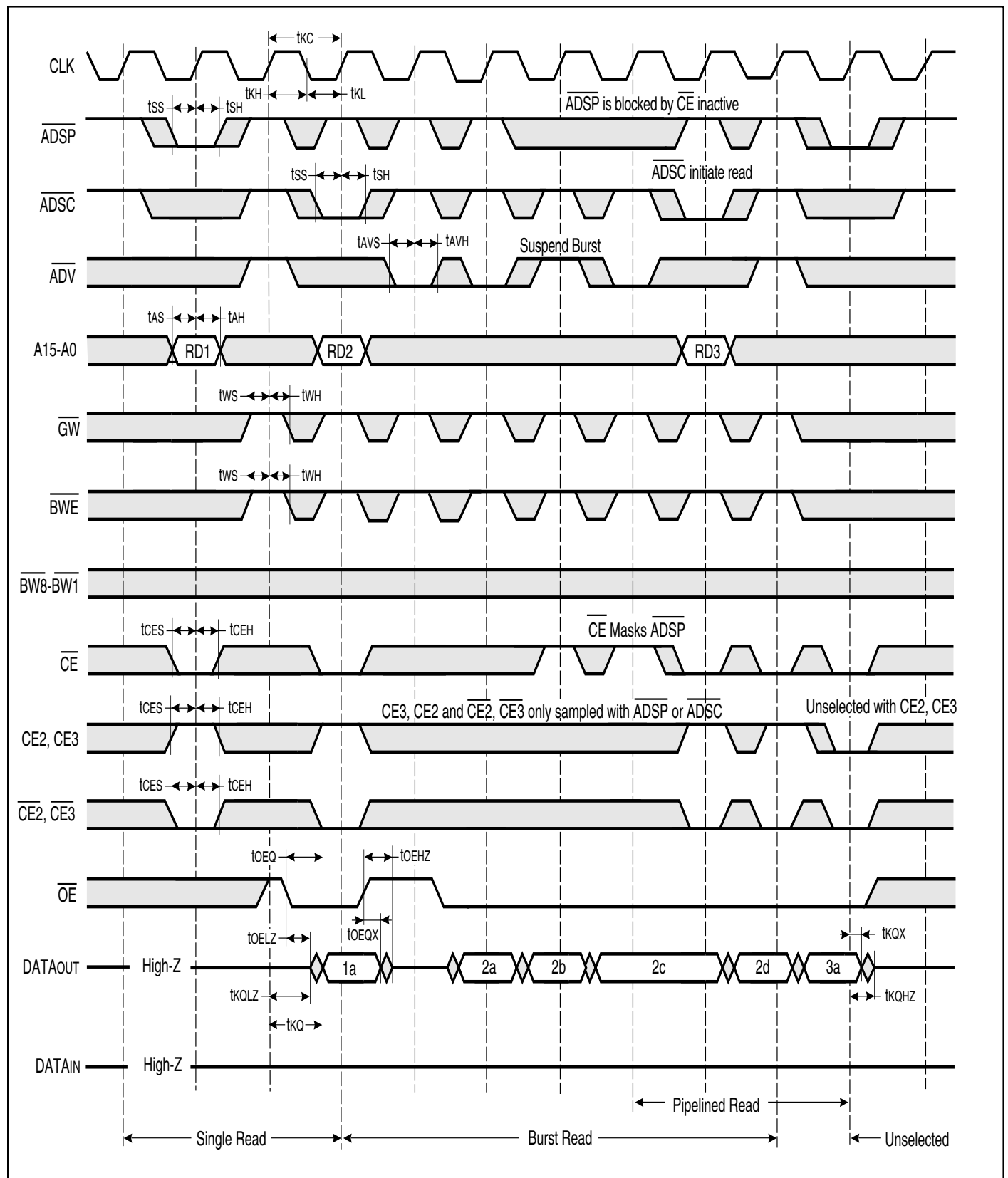
**READ CYCLE SWITCHING CHARACTERISTICS** (Over Operating Range)

| Symbol                             | Parameter                        | -6 ns |      | -7 ns |      | -8 ns |      | Unit |
|------------------------------------|----------------------------------|-------|------|-------|------|-------|------|------|
|                                    |                                  | Min.  | Max. | Min.  | Max. | Min.  | Max. |      |
| t <sub>KC</sub>                    | Cycle Time                       | 12    | —    | 13    | —    | 15    | —    | ns   |
| t <sub>KH</sub>                    | Clock High Time                  | 4.5   | —    | 5     | —    | 6     | —    | ns   |
| t <sub>KL</sub>                    | Clock Low Time                   | 4.5   | —    | 5     | —    | 6     | —    | ns   |
| t <sub>KQ</sub>                    | Clock Access Time                | —     | 6    | —     | 7    | —     | 8    | ns   |
| t <sub>KQX</sub> <sup>(1)</sup>    | Clock High to Output Invalid     | 2.5   | —    | 3     | —    | 3     | —    | ns   |
| t <sub>KQLZ</sub> <sup>(1,2)</sup> | Clock High to Output Low-Z       | 0     | —    | 0     | —    | 0     | —    | ns   |
| t <sub>KQHZ</sub> <sup>(1,2)</sup> | Clock High to Output High-Z      | 2     | 5    | 2     | 5    | 2     | 6    | ns   |
| t <sub>OEQ</sub>                   | Output Enable to Output Valid    | —     | 5    | —     | 5    | —     | 5    | ns   |
| t <sub>OEQX</sub> <sup>(1)</sup>   | Output Disable to Output Invalid | 0     | —    | 0     | —    | 0     | —    | ns   |
| t <sub>OELZ</sub> <sup>(1,2)</sup> | Output Enable to Output Low-Z    | 0     | —    | 0     | —    | 0     | —    | ns   |
| t <sub>OEHZ</sub> <sup>(1,2)</sup> | Output Disable to Output High-Z  | 2     | 5    | 2     | 5    | 2     | 6    | ns   |
| t <sub>AS</sub>                    | Address Setup Time               | 2.5   | —    | 2.5   | —    | 2.5   | —    | ns   |
| t <sub>SS</sub>                    | Address Status Setup Time        | 2.5   | —    | 2.5   | —    | 2.5   | —    | ns   |
| t <sub>WS</sub>                    | Write Setup Time                 | 2.5   | —    | 2.5   | —    | 2.5   | —    | ns   |
| t <sub>CES</sub>                   | Chip Enable Setup Time           | 2.5   | —    | 2.5   | —    | 2.5   | —    | ns   |
| t <sub>AVS</sub>                   | Address Advance Setup Time       | 2.5   | —    | 2.5   | —    | 2.5   | —    | ns   |
| t <sub>AH</sub>                    | Address Hold Time                | 0.5   | —    | 0.5   | —    | 0.5   | —    | ns   |
| t <sub>SH</sub>                    | Address Status Hold Time         | 0.5   | —    | 0.5   | —    | 0.5   | —    | ns   |
| t <sub>WH</sub>                    | Write Hold Time                  | 0.5   | —    | 0.5   | —    | 0.5   | —    | ns   |
| t <sub>CEH</sub>                   | Chip Enable Hold Time            | 0.5   | —    | 0.5   | —    | 0.5   | —    | ns   |
| t <sub>AVH</sub>                   | Address Advance Hold Time        | 0.5   | —    | 0.5   | —    | 0.5   | —    | ns   |

**Notes:**

1. Guaranteed but not 100% tested. This parameter is periodically sampled.
2. Tested with load in Figure 2.

## READ CYCLE TIMING



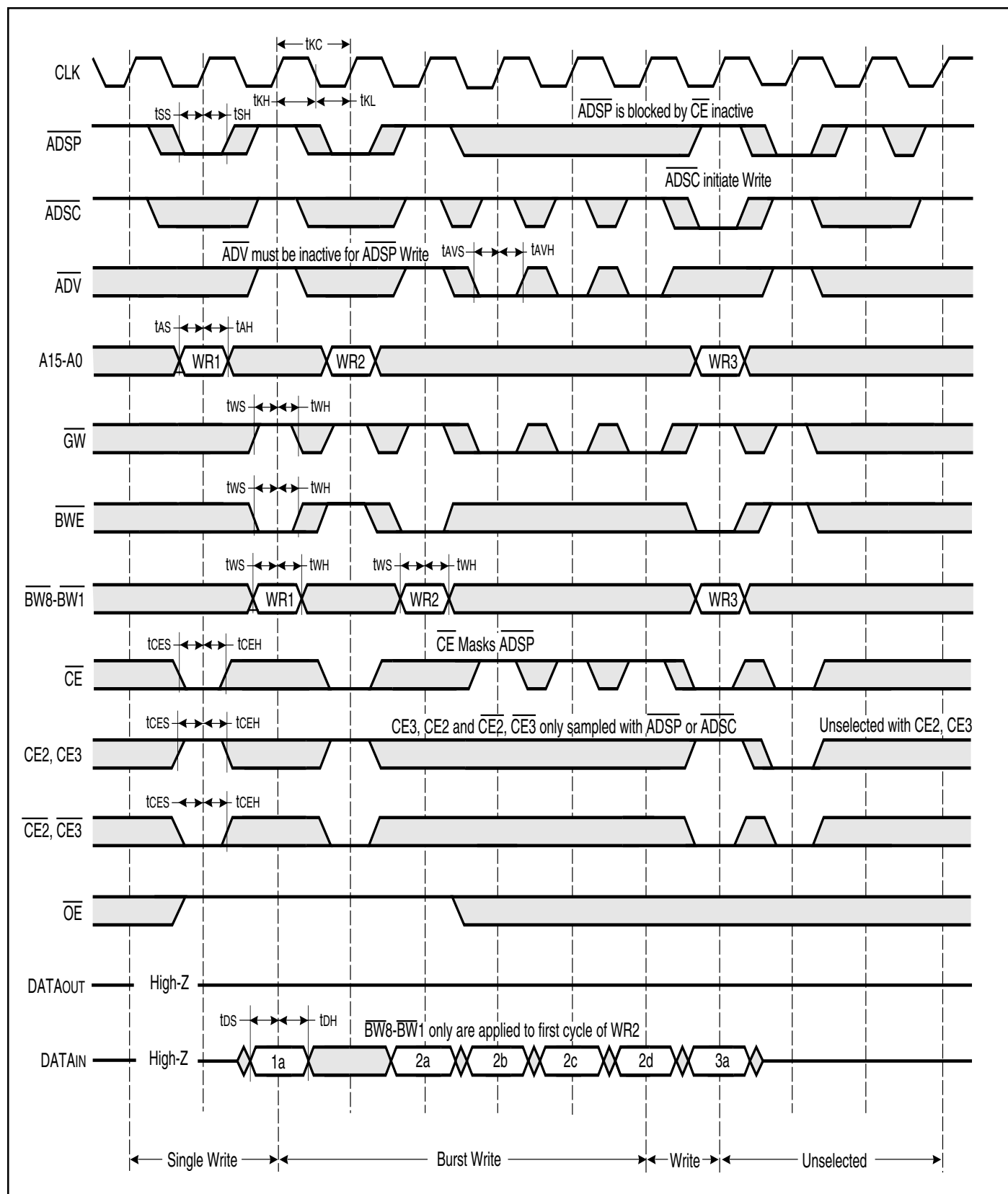
**WRITE CYCLE SWITCHING CHARACTERISTICS** (Over Operating Range)

| Symbol           | Parameter                  | -133 MHz |      | -117 MHz |      | -100 MHz |      | Unit |
|------------------|----------------------------|----------|------|----------|------|----------|------|------|
|                  |                            | Min.     | Max. | Min.     | Max. | Min.     | Max. |      |
| t <sub>CC</sub>  | Cycle Time                 | 7.5      | —    | 8.5      | —    | 10       | —    | ns   |
| t <sub>KH</sub>  | Clock High Time            | 3        | —    | 3.4      | —    | 4        | —    | ns   |
| t <sub>KL</sub>  | Clock Low Time             | 3        | —    | 3.4      | —    | 4        | —    | ns   |
| t <sub>AS</sub>  | Address Setup Time         | 2.5      | —    | 2.5      | —    | 2.5      | —    | ns   |
| t <sub>SS</sub>  | Address Status Setup Time  | 2.5      | —    | 2.5      | —    | 2.5      | —    | ns   |
| t <sub>WS</sub>  | Write Setup Time           | 2.5      | —    | 2.5      | —    | 2.5      | —    | ns   |
| t <sub>DS</sub>  | Data In Setup Time         | 2.5      | —    | 2.5      | —    | 2.5      | —    | ns   |
| t <sub>CES</sub> | Chip Enable Setup Time     | 2.5      | —    | 2.5      | —    | 2.5      | —    | ns   |
| t <sub>AVS</sub> | Address Advance Setup Time | 2.5      | —    | 2.5      | —    | 2.5      | —    | ns   |
| t <sub>AH</sub>  | Address Hold Time          | 0.5      | —    | 0.5      | —    | 0.5      | —    | ns   |
| t <sub>SH</sub>  | Address Status Hold Time   | 0.5      | —    | 0.5      | —    | 0.5      | —    | ns   |
| t <sub>DH</sub>  | Data In Hold Time          | 0.5      | —    | 0.5      | —    | 0.5      | —    | ns   |
| t <sub>WH</sub>  | Write Hold Time            | 0.5      | —    | 0.5      | —    | 0.5      | —    | ns   |
| t <sub>CEH</sub> | Chip Enable Hold Time      | 0.5      | —    | 0.5      | —    | 0.5      | —    | ns   |
| t <sub>AVH</sub> | Address Advance Hold Time  | 0.5      | —    | 0.5      | —    | 0.5      | —    | ns   |

**WRITE CYCLE SWITCHING CHARACTERISTICS** (Over Operating Range)

| Symbol           | Parameter                  | -6 ns |      | -7 ns |      | -8 ns |      | Unit |
|------------------|----------------------------|-------|------|-------|------|-------|------|------|
|                  |                            | Min.  | Max. | Min.  | Max. | Min.  | Max. |      |
| t <sub>CC</sub>  | Cycle Time                 | 12    | —    | 13    | —    | 15    | —    | ns   |
| t <sub>KH</sub>  | Clock High Time            | 4.5   | —    | 5     | —    | 6     | —    | ns   |
| t <sub>KL</sub>  | Clock Low Time             | 4.5   | —    | 5     | —    | 6     | —    | ns   |
| t <sub>AS</sub>  | Address Setup Time         | 2.5   | —    | 2.5   | —    | 2.5   | —    | ns   |
| t <sub>SS</sub>  | Address Status Setup Time  | 2.5   | —    | 2.5   | —    | 2.5   | —    | ns   |
| t <sub>WS</sub>  | Write Setup Time           | 2.5   | —    | 2.5   | —    | 2.5   | —    | ns   |
| t <sub>DS</sub>  | Data In Setup Time         | 2.5   | —    | 2.5   | —    | 2.5   | —    | ns   |
| t <sub>CES</sub> | Chip Enable Setup Time     | 2.5   | —    | 2.5   | —    | 2.5   | —    | ns   |
| t <sub>AVS</sub> | Address Advance Setup Time | 2.5   | —    | 2.5   | —    | 2.5   | —    | ns   |
| t <sub>AH</sub>  | Address Hold Time          | 0.5   | —    | 0.5   | —    | 0.5   | —    | ns   |
| t <sub>SH</sub>  | Address Status Hold Time   | 0.5   | —    | 0.5   | —    | 0.5   | —    | ns   |
| t <sub>DH</sub>  | Data In Hold Time          | 0.5   | —    | 0.5   | —    | 0.5   | —    | ns   |
| t <sub>WH</sub>  | Write Hold Time            | 0.5   | —    | 0.5   | —    | 0.5   | —    | ns   |
| t <sub>CEH</sub> | Chip Enable Hold Time      | 0.5   | —    | 0.5   | —    | 0.5   | —    | ns   |
| t <sub>AVH</sub> | Address Advance Hold Time  | 0.5   | —    | 0.5   | —    | 0.5   | —    | ns   |

## WRITE CYCLE TIMING



**READ/WRITE CYCLE SWITCHING CHARACTERISTICS** (Over Operating Range)

| Symbol                             | Parameter                        | -133 MHz |      | -117 MHz |      | -100 MHz |      | Unit |
|------------------------------------|----------------------------------|----------|------|----------|------|----------|------|------|
|                                    |                                  | Min.     | Max. | Min.     | Max. | Min.     | Max. |      |
| t <sub>CC</sub>                    | Cycle Time                       | 7.5      | —    | 8.5      | —    | 10       | —    | ns   |
| t <sub>KH</sub>                    | Clock High Time                  | 3        | —    | 3.4      | —    | 4.       | —    | ns   |
| t <sub>KL</sub>                    | Clock Low Time                   | 3        | —    | 3.4      | —    | 4        | —    | ns   |
| t <sub>KQ</sub>                    | Clock Access Time                | —        | 5    | —        | 5    | —        | 5    | ns   |
| t <sub>KQX</sub> <sup>(1)</sup>    | Clock High to Output Invalid     | 1.5      | —    | 1.5      | —    | 2.5      | —    | ns   |
| t <sub>KQLZ</sub> <sup>(1,2)</sup> | Clock High to Output Low-Z       | 0        | —    | 0        | —    | 0        | —    | ns   |
| t <sub>KQHZ</sub> <sup>(1,2)</sup> | Clock High to Output High-Z      | 1.5      | 7.5  | 1.5      | 8.5  | 2        | 5    | ns   |
| t <sub>OEQ</sub>                   | Output Enable to Output Valid    | —        | 5    | —        | 5    | —        | 5    | ns   |
| t <sub>OEQX</sub> <sup>(1)</sup>   | Output Disable to Output Invalid | 0        | —    | 0        | —    | 0        | —    | ns   |
| t <sub>OELZ</sub> <sup>(1,2)</sup> | Output Enable to Output Low-Z    | 0        | —    | 0        | —    | 0        | —    | ns   |
| t <sub>OEHZ</sub> <sup>(1,2)</sup> | Output Disable to Output High-Z  | —        | —    | —        | —    | 2        | 5    | ns   |
| t <sub>AS</sub>                    | Address Setup Time               | 2.5      | —    | 2.5      | —    | 2.5      | —    | ns   |
| t <sub>SS</sub>                    | Address Status Setup Time        | 2.5      | —    | 2.5      | —    | 2.5      | —    | ns   |
| t <sub>WS</sub>                    | Write Setup Time                 | 2.5      | —    | 2.5      | —    | 2.5      | —    | ns   |
| t <sub>CES</sub>                   | Chip Enable Setup Time           | 2.5      | —    | 2.5      | —    | 2.5      | —    | ns   |
| t <sub>AH</sub>                    | Address Hold Time                | 0.5      | —    | 0.5      | —    | 0.5      | —    | ns   |
| t <sub>SH</sub>                    | Address Status Hold Time         | 0.5      | —    | 0.5      | —    | 0.5      | —    | ns   |
| t <sub>WH</sub>                    | Write Hold Time                  | 0.5      | —    | 0.5      | —    | 0.5      | —    | ns   |
| t <sub>CEH</sub>                   | Chip Enable Hold Time            | 0.5      | —    | 0.5      | —    | 0.5      | —    | ns   |

**Note:**

1. Guaranteed but not 100% tested. This parameter is periodically sampled.
2. Tested with load in Figure 2.

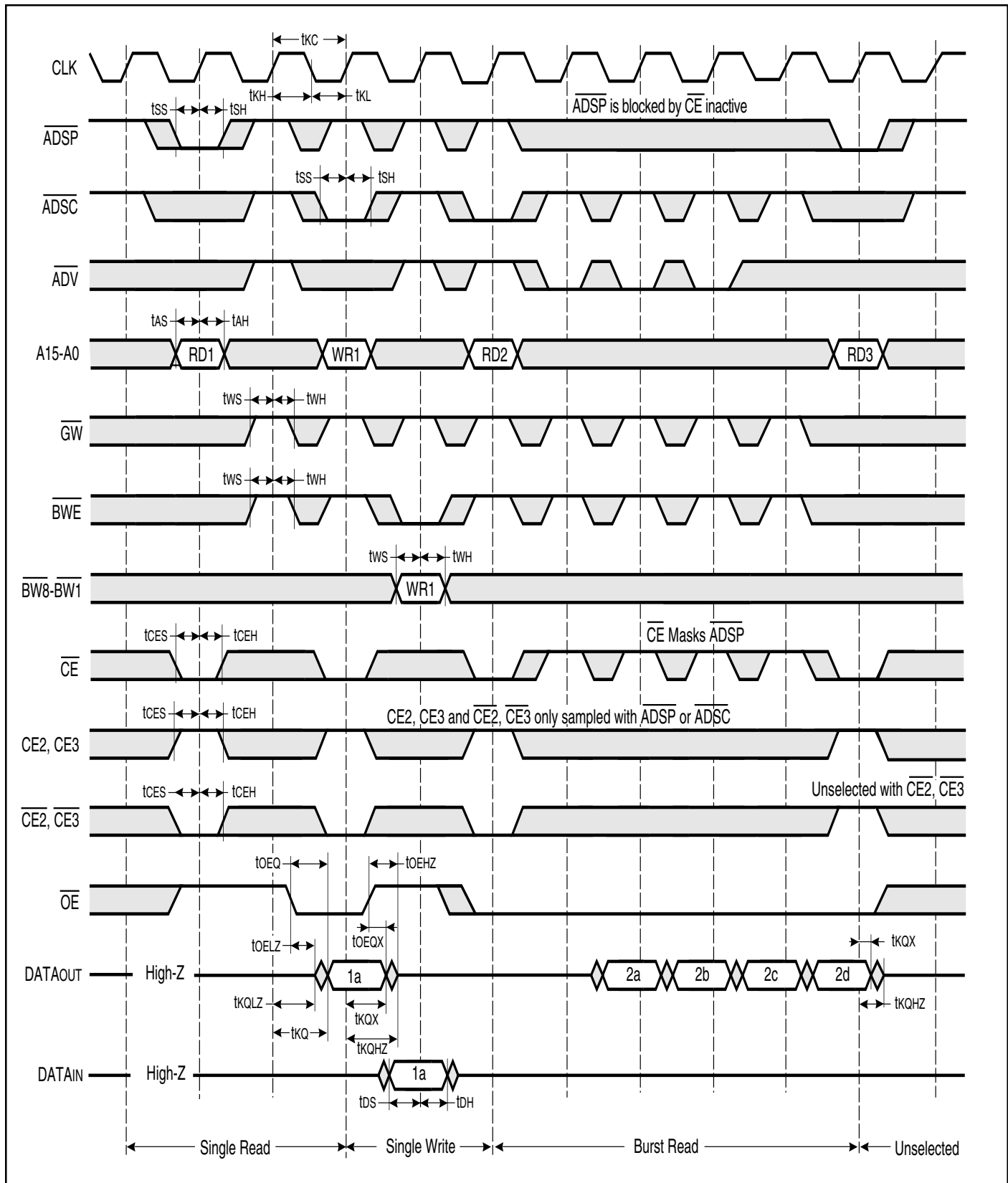
**READ/WRITE CYCLE SWITCHING CHARACTERISTICS** (Over Operating Range)

| Symbol                             | Parameter                        | -6 ns |      | -7 ns |      | -8 ns |      | Unit |
|------------------------------------|----------------------------------|-------|------|-------|------|-------|------|------|
|                                    |                                  | Min.  | Max. | Min.  | Max. | Min.  | Max. |      |
| t <sub>CC</sub>                    | Cycle Time                       | 12    | —    | 13    | —    | 15    | —    | ns   |
| t <sub>KH</sub>                    | Clock High Time                  | 4.5   | —    | 5     | —    | 6     | —    | ns   |
| t <sub>KL</sub>                    | Clock Low Time                   | 4.5   | —    | 5     | —    | 6     | —    | ns   |
| t <sub>KQ</sub>                    | Clock Access Time                | —     | 6    | —     | 7    | —     | 8    | ns   |
| t <sub>KQX</sub> <sup>(1)</sup>    | Clock High to Output Invalid     | 2.5   | —    | 3     | —    | 3     | —    | ns   |
| t <sub>KQLZ</sub> <sup>(1,2)</sup> | Clock High to Output Low-Z       | 0     | —    | 0     | —    | 0     | —    | ns   |
| t <sub>KQHZ</sub> <sup>(1,2)</sup> | Clock High to Output High-Z      | 2     | 5    | 2     | 5    | 2     | 6    | ns   |
| t <sub>OEQ</sub>                   | Output Enable to Output Valid    | —     | 5    | —     | 5    | —     | 5    | ns   |
| t <sub>OEQX</sub> <sup>(1)</sup>   | Output Disable to Output Invalid | 0     | —    | 0     | —    | 0     | —    | ns   |
| t <sub>OELZ</sub> <sup>(1,2)</sup> | Output Enable to Output Low-Z    | 0     | —    | 0     | —    | 0     | —    | ns   |
| t <sub>OEHZ</sub> <sup>(1,2)</sup> | Output Disable to Output High-Z  | 2     | 5    | 2     | 5    | 2     | 6    | ns   |
| t <sub>AS</sub>                    | Address Setup Time               | 2.5   | —    | 2.5   | —    | 2.5   | —    | ns   |
| t <sub>SS</sub>                    | Address Status Setup Time        | 2.5   | —    | 2.5   | —    | 2.5   | —    | ns   |
| t <sub>WS</sub>                    | Write Setup Time                 | 2.5   | —    | 2.5   | —    | 2.5   | —    | ns   |
| t <sub>CES</sub>                   | Chip Enable Setup Time           | 2.5   | —    | 2.5   | —    | 2.5   | —    | ns   |
| t <sub>AH</sub>                    | Address Hold Time                | 0.5   | —    | 0.5   | —    | 0.5   | —    | ns   |
| t <sub>SH</sub>                    | Address Status Hold Time         | 0.5   | —    | 0.5   | —    | 0.5   | —    | ns   |
| t <sub>WH</sub>                    | Write Hold Time                  | 0.5   | —    | 0.5   | —    | 0.5   | —    | ns   |
| t <sub>CEH</sub>                   | Chip Enable Hold Time            | 0.5   | —    | 0.5   | —    | 0.5   | —    | ns   |

**Note:**

1. Guaranteed but not 100% tested. This parameter is periodically sampled.
2. Tested with load in Figure 2.

## READ/WRITE CYCLE TIMING



**SNOOZE AND RECOVERY CYCLE SWITCHING CHARACTERISTICS** (Over Operating Range)

| Symbol                             | Parameter                        | -133 MHz |      | -117 MHz |      | -100 MHz |      | Unit |
|------------------------------------|----------------------------------|----------|------|----------|------|----------|------|------|
|                                    |                                  | Min.     | Max. | Min.     | Max. | Min.     | Max. |      |
| t <sub>KC</sub>                    | Cycle Time                       | 7.5      | —    | 8.5      | —    | 10       | —    | ns   |
| t <sub>KH</sub>                    | Clock High Time                  | 3        | —    | 3.4      | —    | 4        | —    | ns   |
| t <sub>KL</sub>                    | Clock Low Time                   | 3        | —    | 3.4      | —    | 4        | —    | ns   |
| t <sub>KQ</sub>                    | Clock Access Time                | —        | 5    | —        | 5    | —        | 5    | ns   |
| t <sub>KQX</sub> <sup>(3)</sup>    | Clock High to Output Invalid     | 0        | —    | —        | —    | 2.5      | —    | ns   |
| t <sub>KQLZ</sub> <sup>(3,4)</sup> | Clock High to Output Low-Z       | 0        | —    | 0        | —    | 0        | —    | ns   |
| t <sub>KQHZ</sub> <sup>(3,4)</sup> | Clock High to Output High-Z      | 1.5      | 7.5  | 1.5      | 8.5  | 2        | 5    | ns   |
| t <sub>OEQ</sub>                   | Output Enable to Output Valid    | —        | 5    | —        | 4    | —        | 5    | ns   |
| t <sub>OEQX</sub> <sup>(3)</sup>   | Output Disable to Output Invalid | 0        | —    | 0        | —    | 0        | —    | ns   |
| t <sub>OELZ</sub> <sup>(3,4)</sup> | Output Enable to Output Low-Z    | 0        | —    | 0        | —    | 0        | —    | ns   |
| t <sub>OEHZ</sub> <sup>(3,4)</sup> | Output Disable to Output High-Z  | —        | —    | —        | —    | 2        | 5    | ns   |
| t <sub>AS</sub>                    | Address Setup Time               | 2.5      | —    | 2.5      | —    | 2.5      | —    | ns   |
| t <sub>SS</sub>                    | Address Status Setup Time        | 2.5      | —    | 2.5      | —    | 2.5      | —    | ns   |
| t <sub>CES</sub>                   | Chip Enable Setup Time           | 2.5      | —    | 2.5      | —    | 2.5      | —    | ns   |
| t <sub>AH</sub>                    | Address Hold Time                | 0.5      | —    | 0.5      | —    | 0.5      | —    | ns   |
| t <sub>SH</sub>                    | Address Status Hold Time         | 0.5      | —    | 0.5      | —    | 0.5      | —    | ns   |
| t <sub>CEH</sub>                   | Chip Enable Hold Time            | 0.5      | —    | 0.5      | —    | 0.5      | —    | ns   |
| t <sub>ZZS</sub>                   | ZZ Standby <sup>(1)</sup>        | 2        | —    | 2        | —    | 2        | —    | cyc  |
| t <sub>ZZREC</sub>                 | ZZ Recovery <sup>(2)</sup>       | 2        | —    | 2        | —    | 2        | —    | cyc  |

**Notes:**

1. The assertion of ZZ allows the SRAM to enter a lower power state than when deselected within the time specified. Data retention is guaranteed when ZZ is asserted and clock remains active.
2. ADSC and ADSP must not be asserted for at least 2 cyc after leaving ZZ state.
3. Guaranteed but not 100% tested. This parameter is periodically sampled.
4. Tested with load in Figure 2.

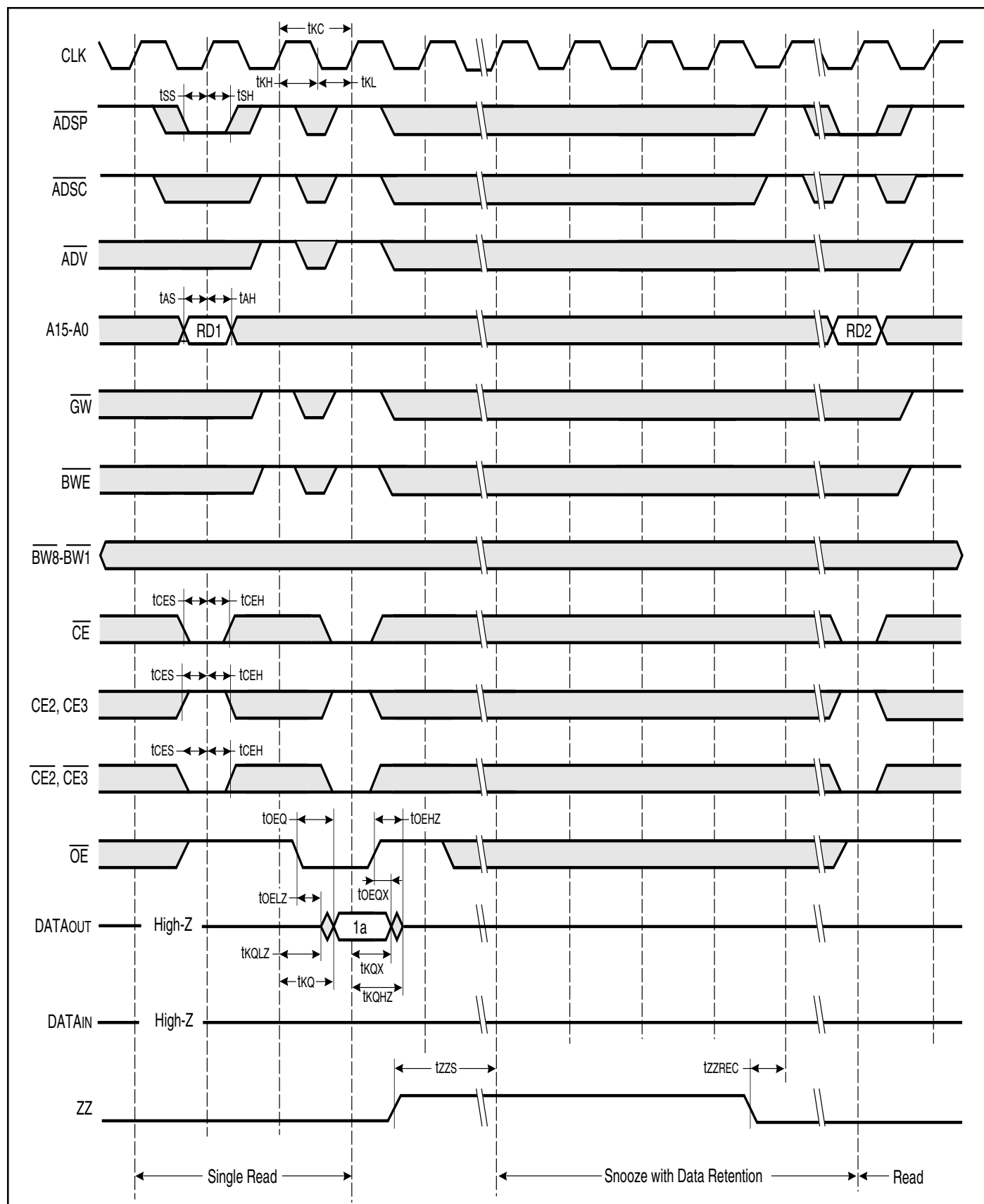
**SNOOZE AND RECOVERY CYCLE SWITCHING CHARACTERISTICS** (Over Operating Range)

| Symbol                             | Parameter                        | -6 ns |      | -7 ns |      | -8 ns |      | Unit |
|------------------------------------|----------------------------------|-------|------|-------|------|-------|------|------|
|                                    |                                  | Min.  | Max. | Min.  | Max. | Min.  | Max. |      |
| t <sub>KC</sub>                    | Cycle Time                       | 12    | —    | 13    | —    | 15    | —    | ns   |
| t <sub>KH</sub>                    | Clock High Time                  | 4.5   | —    | 5     | —    | 6     | —    | ns   |
| t <sub>KL</sub>                    | Clock Low Time                   | 4.5   | —    | 5     | —    | 6     | —    | ns   |
| t <sub>KQ</sub>                    | Clock Access Time                | —     | 6    | —     | 7    | —     | 8    | ns   |
| t <sub>KQX</sub> <sup>(3)</sup>    | Clock High to Output Invalid     | 2.5   | —    | 3     | —    | 3     | —    | ns   |
| t <sub>KQLZ</sub> <sup>(3,4)</sup> | Clock High to Output Low-Z       | 0     | —    | 0     | —    | 0     | —    | ns   |
| t <sub>KQHZ</sub> <sup>(3,4)</sup> | Clock High to Output High-Z      | 2     | 5    | 2     | 5    | 2     | 6    | ns   |
| t <sub>OEQ</sub>                   | Output Enable to Output Valid    | —     | 5    | —     | 5    | —     | 5    | ns   |
| t <sub>OEQX</sub> <sup>(3)</sup>   | Output Disable to Output Invalid | 0     | —    | 0     | —    | 0     | —    | ns   |
| t <sub>OELZ</sub> <sup>(3,4)</sup> | Output Enable to Output Low-Z    | 0     | —    | 0     | —    | 0     | —    | ns   |
| t <sub>OEHZ</sub> <sup>(3,4)</sup> | Output Disable to Output High-Z  | 2     | 5    | 2     | 5    | 2     | 6    | ns   |
| t <sub>AS</sub>                    | Address Setup Time               | 2.5   | —    | 2.5   | —    | 2.5   | —    | ns   |
| t <sub>SS</sub>                    | Address Status Setup Time        | 2.5   | —    | 2.5   | —    | 2.5   | —    | ns   |
| t <sub>CES</sub>                   | Chip Enable Setup Time           | 2.5   | —    | 2.5   | —    | 2.5   | —    | ns   |
| t <sub>AH</sub>                    | Address Hold Time                | 0.5   | —    | 0.5   | —    | 0.5   | —    | ns   |
| t <sub>SH</sub>                    | Address Status Hold Time         | 0.5   | —    | 0.5   | —    | 0.5   | —    | ns   |
| t <sub>CEH</sub>                   | Chip Enable Hold Time            | 0.5   | —    | 0.5   | —    | 0.5   | —    | ns   |
| t <sub>ZZS</sub>                   | ZZ Standby <sup>(1)</sup>        | 2     | —    | 2     | —    | 2     | —    | cyc  |
| t <sub>ZZREC</sub>                 | ZZ Recovery <sup>(2)</sup>       | 2     | —    | 2     | —    | 2     | —    | cyc  |

**Notes:**

1. The assertion of ZZ allows the SRAM to enter a lower power state than when deselected within the time specified. Data retention is guaranteed when ZZ is asserted and clock remains active.
2.  $\overline{ADSC}$  and  $\overline{ADSP}$  must not be asserted for at least 2 cyc after leaving ZZ state.
3. Guaranteed but not 100% tested. This parameter is periodically sampled.
4. Tested with load in Figure 2.

## SNOOZE AND RECOVERY CYCLE TIMING



**ORDERING INFORMATION****Commercial Range: 0°C to +70°C**

| Speed | Order Part Number | Package |
|-------|-------------------|---------|
| 133   | IS61SP6464-133TQ  | TQFP    |
|       | IS61SP6464-133PQ  | PQFP    |
| 117   | IS61SP6464-117TQ  | TQFP    |
|       | IS61SP6464-117PQ  | PQFP    |
| 100   | IS61SP6464-100TQ  | TQFP    |
|       | IS61SP6464-100PQ  | PQFP    |
| 83    | IS61SP6464-6TQ    | TQFP    |
|       | IS61SP6464-6PQ    | PQFP    |
| 75    | IS61SP6464-7TQ    | TQFP    |
|       | IS61SP6464-7PQ    | PQFP    |
| 66    | IS61SP6464-8TQ    | TQFP    |
|       | IS61SP6464-8PQ    | PQFP    |

**Industrial Range: -40°C to +85°C**

| Speed | Order Part Number | Package |
|-------|-------------------|---------|
| 133   | IS61SP6464-133TQI | TQFP    |
|       | IS61SP6464-133PQI | PQFP    |
| 117   | IS61SP6464-117TQI | TQFP    |
|       | IS61SP6464-117PQI | PQFP    |
| 100   | IS61SP6464-100TQI | TQFP    |
|       | IS61SP6464-100PQI | PQFP    |
| 83    | IS61SP6464-6TQI   | TQFP    |
|       | IS61SP6464-6PQI   | PQFP    |
| 75    | IS61SP6464-7TQI   | TQFP    |
|       | IS61SP6464-7PQI   | PQFP    |
| 66    | IS61SP6464-8TQI   | TQFP    |
|       | IS61SP6464-8PQI   | PQFP    |

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