# IS62VV25616L/LL

## 256K x 16 LOW VOLTAGE, 1.8V ULTRA LOW POWER CMOS STATIC RAM

### FEATURES

- High-speed access time: 70, 85, 100 ns
- CMOS low power operation
  - 36 mW (typical) operating
  - 9 µW (typical) CMOS standby
- TTL compatible interface levels
- Single 1.65V-1.95V $V_{CC}$ power supply
- Fully static operation: no clock or refresh required
- Three state outputs
- Data control for upper and lower bytes
- Industrial temperature available
- Available in the 44-pin TSOP (Type II) and 48-pin mini BGA (7.2mm x 8.7mm)
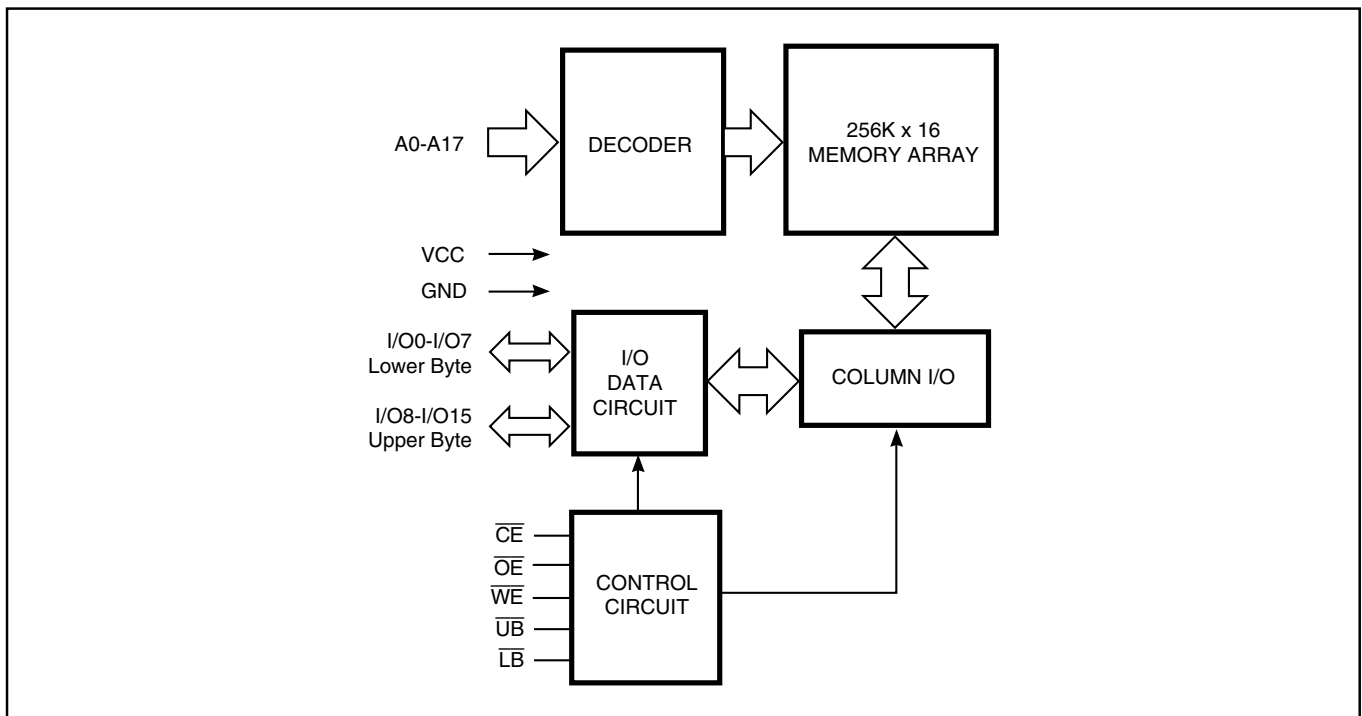
### DESCRIPTION

The *ISSI* IS62VV25616L and IS62VV25616LL are high-speed, 4,194,304 bit static RAMs organized as 262,144 words by 16 bits. They are fabricated using *ISSI*'s high-performance CMOS technology. This highly reliable process coupled with innovative circuit design techniques, yields high-performance and low power consumption devices.

For the IS62VV25616L/LL, when $\overline{CE}$ is HIGH (deselected) or $\overline{CE}$ is low and both $\overline{LB}$ and $\overline{UB}$ are HIGH, the device assumes a standby mode at which the power dissipation can be reduced down with CMOS input levels.

Easy memory expansion is provided by using Chip Enable and Output Enable inputs, $\overline{CE}$ and $\overline{OE}$. The active LOW Write Enable ($\overline{WE}$) controls both writing and reading of the memory. A data byte allows Upper Byte ($\overline{UB}$) and Lower Byte ($\overline{LB}$) access.

The IS62VV25616L and IS62VV25616LL are packaged in the JEDEC standard 44-pin TSOP (Type II) and 48-pin mini BGA (7.2mm x 8.7mm).
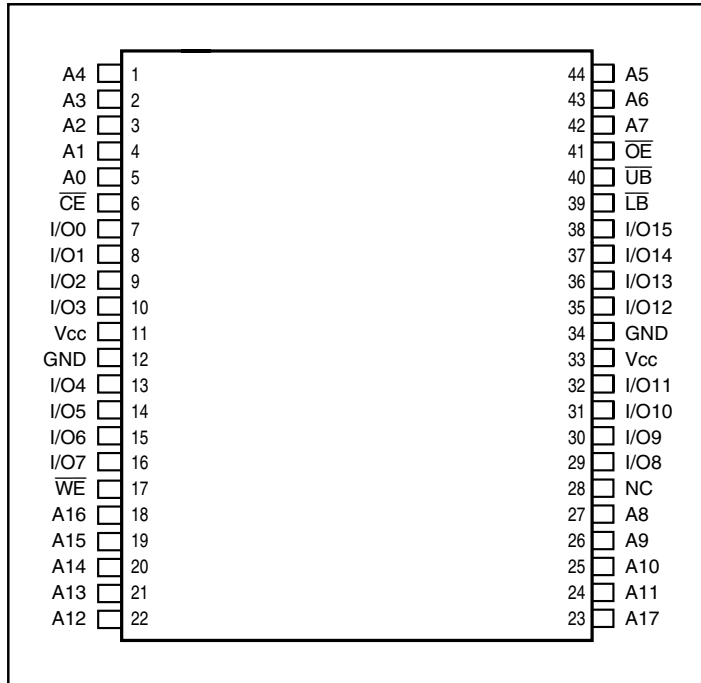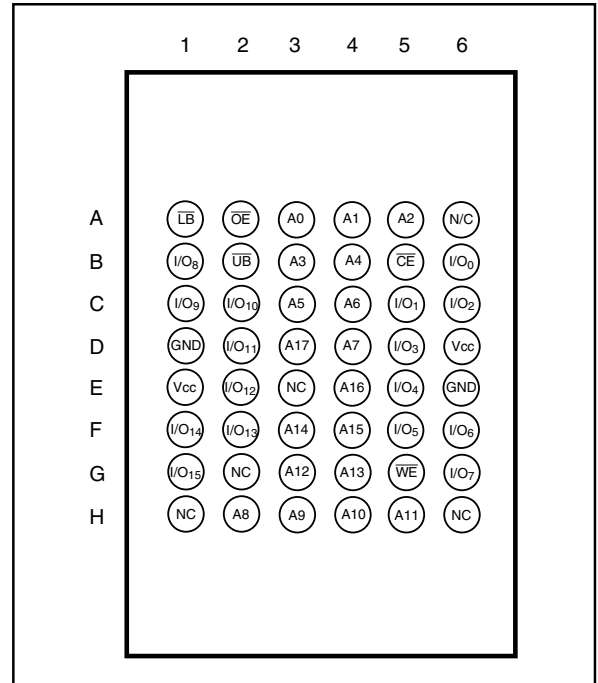
### FUNCTIONAL BLOCK DIAGRAM

## PIN CONFIGURATIONS

### 44-Pin TSOP (Type II)

| | | | |
|---|---|---|---|
| A4 | 1 | 44 | A5 |
| A3 | 2 | 43 | A6 |
| A2 | 3 | 42 | A7 |
| A1 | 4 | 41 | $\overline{OE}$ |
| A0 | 5 | 40 | $\overline{UB}$ |
| $\overline{CE}$ | 6 | 39 | $\overline{LB}$ |
| I/O0 | 7 | 38 | I/O15 |
| I/O1 | 8 | 37 | I/O14 |
| I/O2 | 9 | 36 | I/O13 |
| I/O3 | 10 | 35 | I/O12 |
| Vcc | 11 | 34 | GND |
| GND | 12 | 33 | Vcc |
| I/O4 | 13 | 32 | I/O11 |
| I/O5 | 14 | 31 | I/O10 |
| I/O6 | 15 | 30 | I/O9 |
| I/O7 | 16 | 29 | I/O8 |
| $\overline{WE}$ | 17 | 28 | NC |
| A16 | 18 | 27 | A8 |
| A15 | 19 | 26 | A9 |
| A14 | 20 | 25 | A10 |
| A13 | 21 | 24 | A11 |
| A12 | 22 | 23 | A17 |

### 48-Pin mini BGA (7.2mm x 8.7mm)

| | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| A | $\overline{LB}$ | $\overline{OE}$ | A0 | A1 | A2 | N/C |
| B | I/O8 | $\overline{UB}$ | A3 | A4 | $\overline{CE}$ | I/O0 |
| C | I/O9 | I/O10 | A5 | A6 | I/O1 | I/O2 |
| D | GND | I/O11 | A17 | A7 | I/O3 | Vcc |
| E | Vcc | I/O12 | NC | A16 | I/O4 | GND |
| F | I/O14 | I/O13 | A14 | A15 | I/O5 | I/O6 |
| G | I/O15 | NC | A12 | A13 | $\overline{WE}$ | I/O7 |
| H | NC | A8 | A9 | A10 | A11 | NC |

## PIN DESCRIPTIONS

| | |
|---|---|
| A0-A17 | Address Inputs |
| I/O0-I/O15 | Data Inputs/Outputs |
| $\overline{CE}$ | Chip Enable Input |
| $\overline{OE}$ | Output Enable Input |
| $\overline{WE}$ | Write Enable Input |

| | |
|---|---|
| $\overline{LB}$ | Lower-byte Control (I/O0-I/O7) |
| $\overline{UB}$ | Upper-byte Control (I/O8-I/O15) |
| NC | No Connection |
| Vcc | Power |
| GND | Ground |

## TRUTH TABLE

| Mode | $\overline{WE}$ | $\overline{CE}$ | $\overline{OE}$ | $\overline{LB}$ | $\overline{UB}$ | I/O PIN I/O0-I/O7 | I/O8-I/O15 | Vcc Current |
|---|---|---|---|---|---|---|---|---|
| Not Selected | X | H | X | X | X | High-Z | High-Z | $I_{SB1}, I_{SB2}$ |
| | X | L | X | H | H | High-Z | High-Z | $I_{SB1}, I_{SB2}$ |
| Output Disabled | H | L | H | X | X | High-Z | High-Z | $I_{CC}$ |
| | X | L | X | H | H | High-Z | High-Z | $I_{SB1}, I_{SB2}$ |
| Read | H | L | L | L | H | $D_{OUT}$ | High-Z | $I_{CC}$ |
| | H | L | L | H | L | High-Z | $D_{OUT}$ | |
| | H | L | L | L | L | $D_{OUT}$ | $D_{OUT}$ | |
| Write | L | L | X | L | H | $D_{IN}$ | High-Z | $I_{CC}$ |
| | L | L | X | H | L | High-Z | $D_{IN}$ | |
| | L | L | X | L | L | $D_{IN}$ | $D_{IN}$ | |

*Integrated Silicon Solution, Inc. — 1-800-379-4774*
**PRELIMINARY INFORMATION Rev. 00C**
11/30/00

## OPERATING RANGE

| Range | Ambient Temperature | Vcc |
|---|---|---|
| Commercial | 0°C to +70°C | 1.65V - 1.95V |
| Industrial | −40°C to +85°C | 1.65V - 1.95V |

## ABSOLUTE MAXIMUM RATINGS[1]

| Symbol | Parameter | Value | Unit |
|---|---|---|---|
| $V_{TERM}$ | Terminal Voltage with Respect to GND | −0.2 to Vcc+0.3 | V |
| $T_{BIAS}$ | Temperature Under Bias | −40 to +85 | °C |
| $V_{CC}$ | Vcc Related to GND | −0.2 to +2.6 | V |
| $T_{STG}$ | Storage Temperature | −65 to +150 | °C |
| $P_T$ | Power Dissipation | 1.0 | W |

**Note:**
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.

## DC ELECTRICAL CHARACTERISTICS (Over Operating Range)

| Symbol | Parameter | Test Conditions | Min. | Max. | Unit |
|---|---|---|---|---|---|
| $V_{OH}$ | Output HIGH Voltage | $I_{OH}$ = -0.1 mA | 1.4 | — | V |
| $V_{OL}$ | Output LOW Voltage | $I_{OL}$ = 0.1 mA | — | 0.2 | V |
| $V_{IH}$ | Input HIGH Voltage | | 1.4 | Vcc + 0.2 | V |
| $V_{IL}$[1] | Input LOW Voltage | | −0.3 | 0.4 | V |
| $I_{LI}$ | Input Leakage | GND ≤ $V_{IN}$ ≤ Vcc | −1 | 1 | µA |
| $I_{LO}$ | Output Leakage | GND ≤ $V_{OUT}$ ≤ Vcc, Outputs Disabled | −1 | 1 | µA |

**Notes:**
1. $V_{IL}$ (min.) = −1.0V for pulse width less than 10 ns.

## CAPACITANCE[1]

| Symbol | Parameter | Conditions | Max. | Unit |
|---|---|---|---|---|
| $C_{IN}$ | Input Capacitance | $V_{IN}$ = 0V | 8 | pF |
| $C_{OUT}$ | Input/Output Capacitance | $V_{OUT}$ = 0V | 10 | pF |

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

## AC TEST CONDITIONS

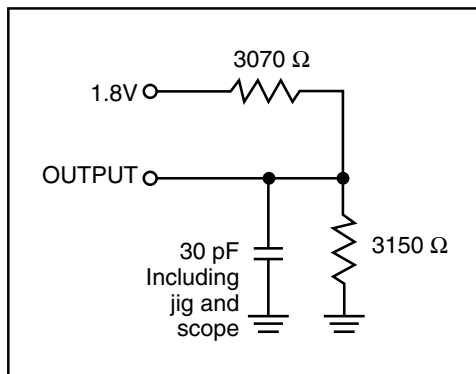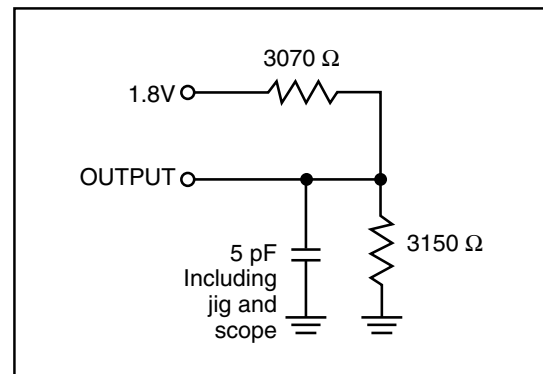| Parameter | Unit |
|---|---|
| Input Pulse Level | 0.4V to $V_{CC}$ - 0.2V |
| Input Rise and Fall Times | 5 ns |
| Input and Output Timing and Reference Level | 0.9V |
| Output Load | See Figures 1 and 2 |

## AC TEST LOADS



**Figure 1**



**Figure 2**

## IS62VV25616L POWER SUPPLY CHARACTERISTICS[1] (Over Operating Range)

| Symbol | Parameter | Test Conditions | | -70 Min. | -70 Max. | -85 Min. | -85 Max. | -100 Min. | -100 Max. | Unit |
|---|---|---|---|---|---|---|---|---|---|---|
| $I_{CC}$ | Vcc Dynamic Operating Supply Current | $V_{CC}$ = Max., $I_{OUT}$ = 0 mA, f = $f_{MAX}$ | Com. | — | 20 | — | 15 | — | 10 | mA |
| | | | Ind. | — | 25 | — | 20 | — | 15 | |
| $I_{CC1}$ | Operating Supply Current | $V_{CC}$ = Max., $I_{OUT}$ = 0 mA, f = 1 MHz | Com. | — | 3 | — | 3 | — | 3 | mA |
| | | | Ind. | — | 3 | — | 3 | — | 3 | |
| $I_{SB1}$ | TTL Standby Current (TTL Inputs) | $V_{CC}$ = Max., $V_{IN}$ = $V_{IH}$ or $V_{IL}$ $\overline{CE} \geq V_{IH}$ , f = 0 | Com. | — | 0.3 | — | 0.3 | — | 0.3 | mA |
| | | | Ind. | — | 0.3 | — | 0.3 | — | 0.3 | |
| | **OR** | | | | | | | | | |
| | ULB Control | $V_{CC}$ = Max., $V_{IN}$ = $V_{IH}$ or $V_{IL}$ $\overline{CE}$ = $V_{IL}$, f = 0, $\overline{UB}$ = $V_{IH}$, $\overline{LB}$ = $V_{IH}$ | | | | | | | | |
| $I_{SB2}$ | CMOS Standby Current (CMOS Inputs) | $V_{CC}$ = Max., $\overline{CE} \geq V_{CC} - 0.2V$, $V_{IN} \geq V_{CC} - 0.2V$, or $V_{IN} \leq 0.2V$, f = 0 | Com. | — | 10 | — | 10 | — | 10 | µA |
| | | | Ind. | — | 10 | — | 10 | — | 10 | |
| | **OR** | | | | | | | | | |
| | ULB Control | $V_{CC}$ = Max., $\overline{CE}$ = $V_{IL}$ $V_{IN} \leq 0.2V$, f = 0; $\overline{UB}$ / $\overline{LB}$ = $V_{CC} - 0.2V$ | | | | | | | | |

**Note:**
1. At f = $f_{MAX}$, address and data inputs are cycling at the maximum frequency, f = 0 means no input lines change.

## IS62VV25616LL POWER SUPPLY CHARACTERISTICS[1] (Over Operating Range)

| Symbol | Parameter | Test Conditions | | -70 Min. | -70 Max. | -85 Min. | -85 Max. | -100 Min. | -100 Max. | Unit |
|---|---|---|---|---|---|---|---|---|---|---|
| $I_{CC}$ | Vcc Dynamic Operating Supply Current | Vcc = Max., $I_{OUT}$ = 0 mA, f = fMAX | Com. Ind. | — — | 20 25 | — — | 15 20 | — — | 10 15 | mA |
| $I_{CC1}$ | Operating Supply Current | Vcc = Max., $I_{OUT}$ = 0 mA, f = 0 | Com. Ind. | — — | 3 3 | — — | 3 3 | — — | 3 3 | mA |
| $I_{SB1}$ | TTL Standby Current (TTL Inputs) | Vcc = Max., VIN = VIH or VIL $\overline{CE}$ ≥ VIH , f = 1 MHz | Com. Ind. | — — | 0.3 0.3 | — — | 0.3 0.3 | — — | 0.3 0.3 | mA |
| | **OR** | | | | | | | | | |
| | ULB Control | Vcc = Max., VIN = VIH or VIL $\overline{CE}$ = VIL, f = 0, $\overline{UB}$ = VIH, $\overline{LB}$ = VIH | | | | | | | | |
| $I_{SB2}$ | CMOS Standby Current (CMOS Inputs) | Vcc = Max., $\overline{CE}$ ≥ Vcc – 0.2V, VIN ≥ Vcc – 0.2V, or VIN ≤ 0.2V, f = 0 | Com. Ind. | — — | 5 5 | — — | 5 5 | — — | 5 5 | µA |
| | **OR** | | | | | | | | | |
| | ULB Control | Vcc = Max., $\overline{CE}$ = VIL VIN ≤ 0.2V, f = 0; $\overline{UB}$ / $\overline{LB}$ = Vcc – 0.2V | | | | | | | | |

**Note:**
1. At f = fMAX, address and data inputs are cycling at the maximum frequency, f = 0 means no input lines change.

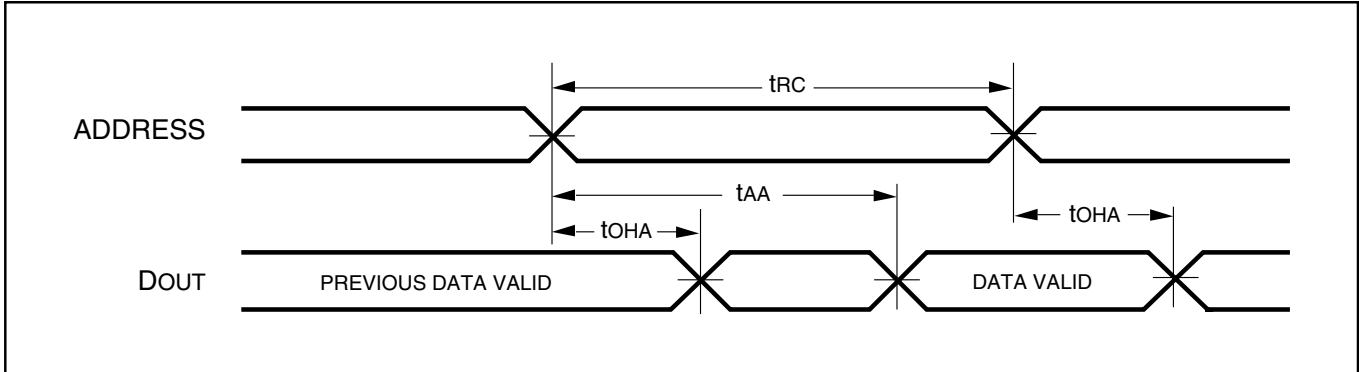## READ CYCLE SWITCHING CHARACTERISTICS[1] (Over Operating Range)

| Symbol | Parameter | -70 Min. | -70 Max. | -85 Min. | -85 Max. | -100 Min. | -100 Max. | Unit |
|---|---|---|---|---|---|---|---|---|
| $t_{RC}$ | Read Cycle Time | 70 | — | 85 | — | 100 | — | ns |
| $t_{AA}$ | Address Access Time | — | 70 | — | 85 | — | 100 | ns |
| $t_{OHA}$ | Output Hold Time | 10 | — | 10 | — | 10 | — | ns |
| $t_{ACE}$ | $\overline{CE}$ Access Time | — | 70 | — | 85 | — | 100 | ns |
| $t_{DOE}$ | $\overline{OE}$ Access Time | — | 35 | — | 40 | — | 50 | ns |
| $t_{HZOE}$[2] | $\overline{OE}$ to High-Z Output | — | 25 | — | 25 | — | 30 | ns |
| $t_{LZOE}$[2] | $\overline{OE}$ to Low-Z Output | 5 | — | 5 | — | 5 | — | ns |
| $t_{HZCE}$[2] | $\overline{CE}$ to High-Z Output | 0 | 25 | 0 | 25 | 0 | 30 | ns |
| $t_{LZCE}$[2] | $\overline{CE}$ to Low-Z Output | 10 | — | 10 | — | 10 | — | ns |
| $t_{BA}$ | $\overline{LB}$, $\overline{UB}$ Access Time | — | 70 | — | 85 | — | 100 | ns |
| $t_{HZB}$ | $\overline{LB}$, $\overline{UB}$ to High-Z Output | 0 | 25 | 0 | 25 | 0 | 35 | ns |
| $t_{LZB}$ | $\overline{LB}$, $\overline{UB}$ to Low-Z Output | 0 | — | 0 | — | 0 | — | ns |

**Notes:**
1. Test conditions assume signal transition times of 5 ns or less, timing reference levels of 0.9V, input pulse levels of 0.4 to 1.4V and output loading specified in Figure 1.
2. Tested with the load in Figure 2. Transition is measured ±500 mV from steady-state voltage. Not 100% tested.
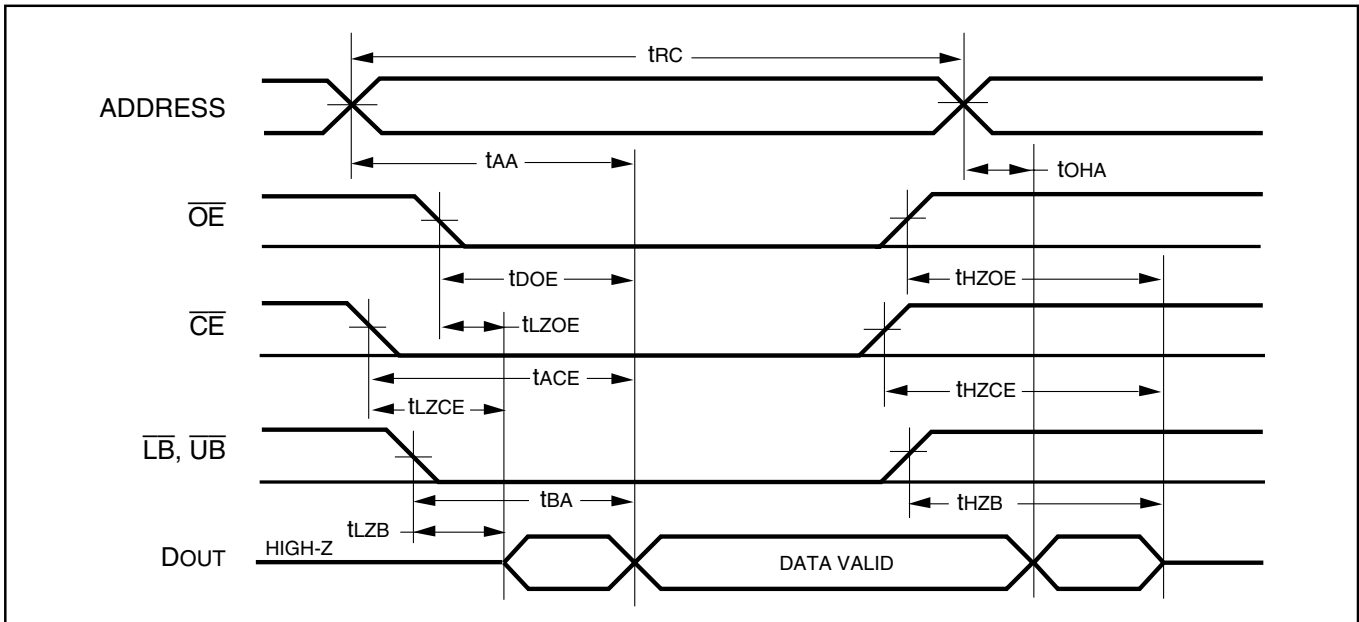
## AC WAVEFORMS

## READ CYCLE NO. 1[1,2] (Address Controlled) ($\overline{CE} = \overline{OE} = V_{IL}$, $\overline{UB}$ or $\overline{LB} = V_{IL}$)



## AC WAVEFORMS

## READ CYCLE NO. 2[1,3] ($\overline{CE}$, $\overline{OE}$, AND $\overline{UB}/\overline{LB}$ Controlled)



**Notes:**
1. $\overline{WE}$ is HIGH for a Read Cycle.
2. The device is continuously selected. $\overline{OE}$, $\overline{CE}$, $\overline{UB}$, or $\overline{LB} = V_{IL}$.
3. Address is valid prior to or coincident with $\overline{CE}$ LOW transition.

## WRITE CYCLE SWITCHING CHARACTERISTICS[1,2] (Over Operating Range)

| Symbol | Parameter | -70 | | -85 | | -100 | | Unit |
|---|---|---|---|---|---|---|---|---|
| | | Min. | Max. | Min. | Max. | Min. | Max. | |
| $t_{WC}$ | Write Cycle Time | 70 | — | 85 | — | 100 | — | ns |
| $t_{SCE}$ | $\overline{CE}$ to Write End | 65 | — | 70 | — | 80 | — | ns |
| $t_{AW}$ | Address Setup Time to Write End | 65 | — | 70 | — | 80 | — | ns |
| $t_{HA}$ | Address Hold from Write End | 0 | — | 0 | — | 0 | — | ns |
| $t_{SA}$ | Address Setup Time | 0 | — | 0 | — | 0 | — | ns |
| $t_{PWB}$ | $\overline{LB}$, $\overline{UB}$ Valid to End of Write | 60 | — | 70 | — | 80 | — | ns |
| $t_{PWE}$ | $\overline{WE}$ Pulse Width | 55 | — | 60 | — | 80 | — | ns |
| $t_{SD}$ | Data Setup to Write End | 30 | — | 35 | — | 40 | — | ns |
| $t_{HD}$ | Data Hold from Write End | 0 | — | 0 | — | 0 | — | ns |
| $t_{HZWE}$[3] | $\overline{WE}$ LOW to High-Z Output | — | 30 | — | 30 | — | 40 | ns |
| $t_{LZWE}$[3] | $\overline{WE}$ HIGH to Low-Z Output | 5 | — | 5 | — | 5 | — | ns |

**Notes:**
1. Test conditions assume signal transition times of 5 ns or less, timing reference levels of 0.9V, input pulse levels of 0.4V to 1.4V and output loading specified in Figure 1.
2. The internal write time is defined by the overlap of $\overline{CE}$ LOW and $\overline{UB}$ or $\overline{LB}$, and $\overline{WE}$ LOW. All signals must be in valid states to initiate a Write, but any one can go inactive to terminate the Write. The Data Input Setup and Hold timing are referenced to the rising or falling edge of the signal that terminates the write.
3. Tested with the load in Figure 2. Transition is measured ±500 mV from steady-state voltage. Not 100% tested.

## AC WAVEFORMS

### WRITE CYCLE NO. 1[1,2] ($\overline{CE}$ Controlled, $\overline{OE}$ = HIGH or LOW)
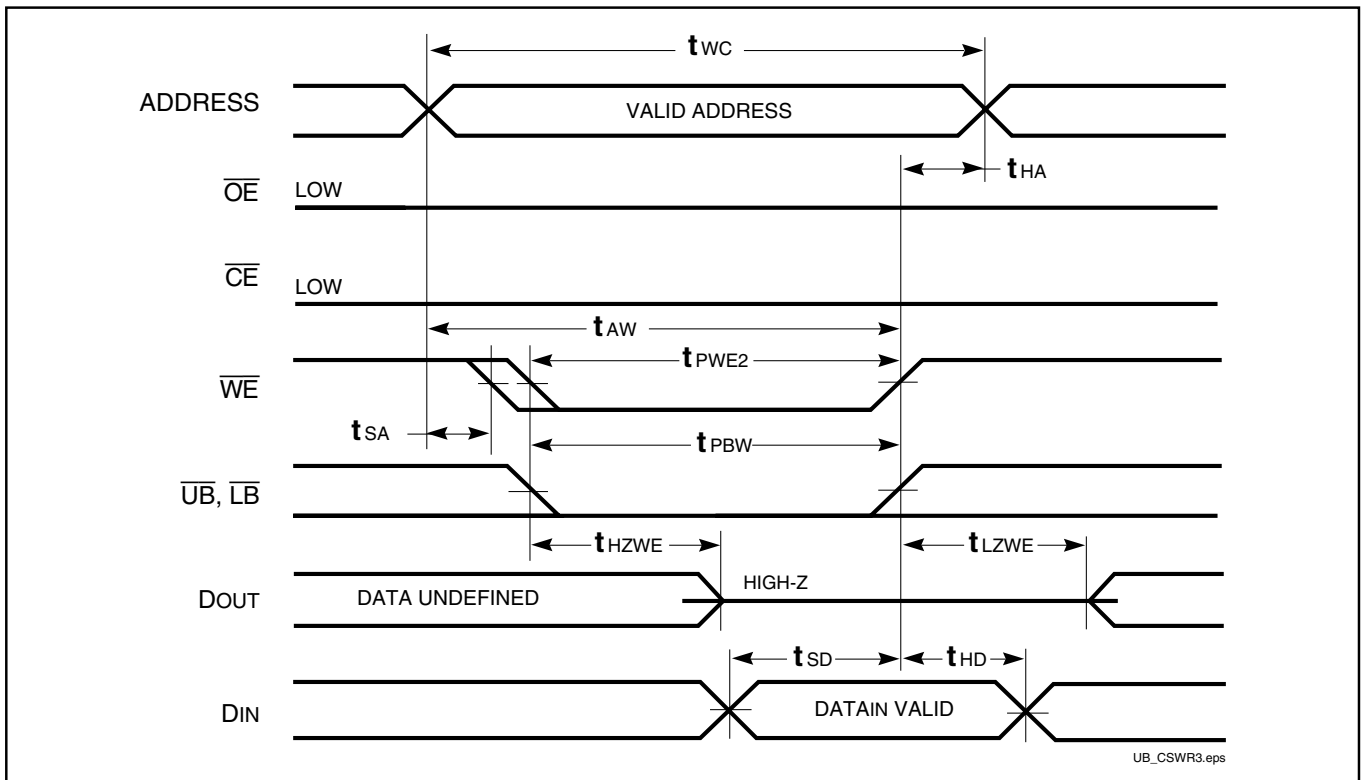


UB_CSWR1.eps
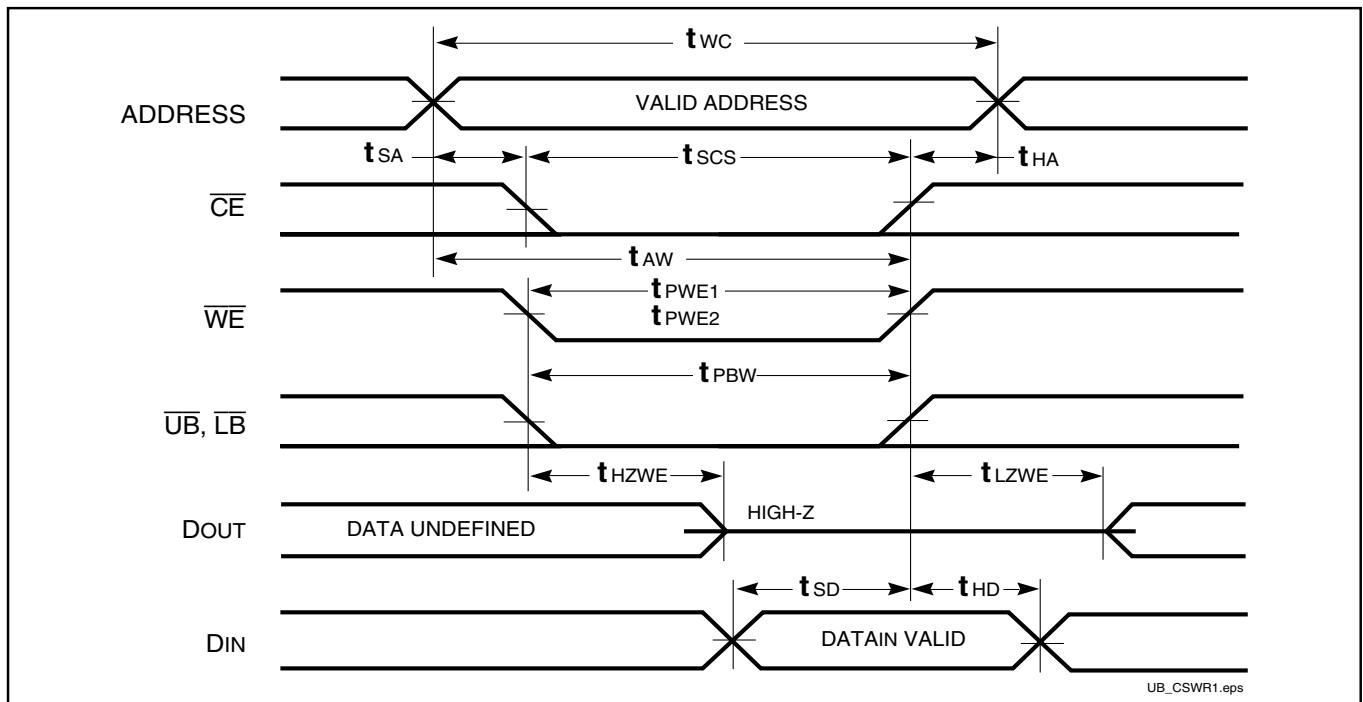
**Notes:**
1. WRITE is an internally generated signal asserted during an overlap of the LOW states on the $\overline{CE}$ and $\overline{WE}$ inputs and at least one of the $\overline{LB}$ and $\overline{UB}$ inputs being in the LOW state.
2. WRITE = ($\overline{CE}$) [ ($\overline{LB}$) = ($\overline{UB}$) ] ($\overline{WE}$).

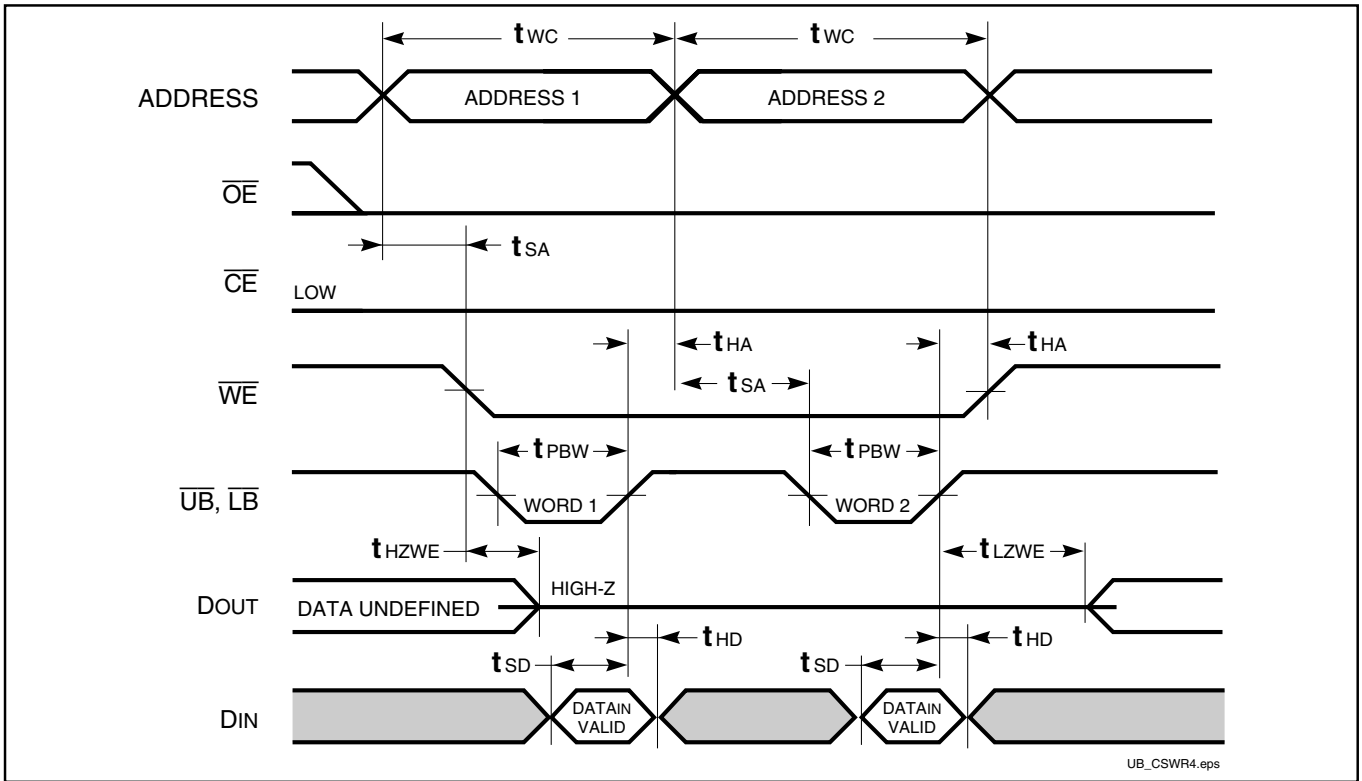## WRITE CYCLE NO. 2 ($\overline{WE}$ Controlled: $\overline{OE}$ is HIGH During Write Cycle)



UB_CSWR2.eps
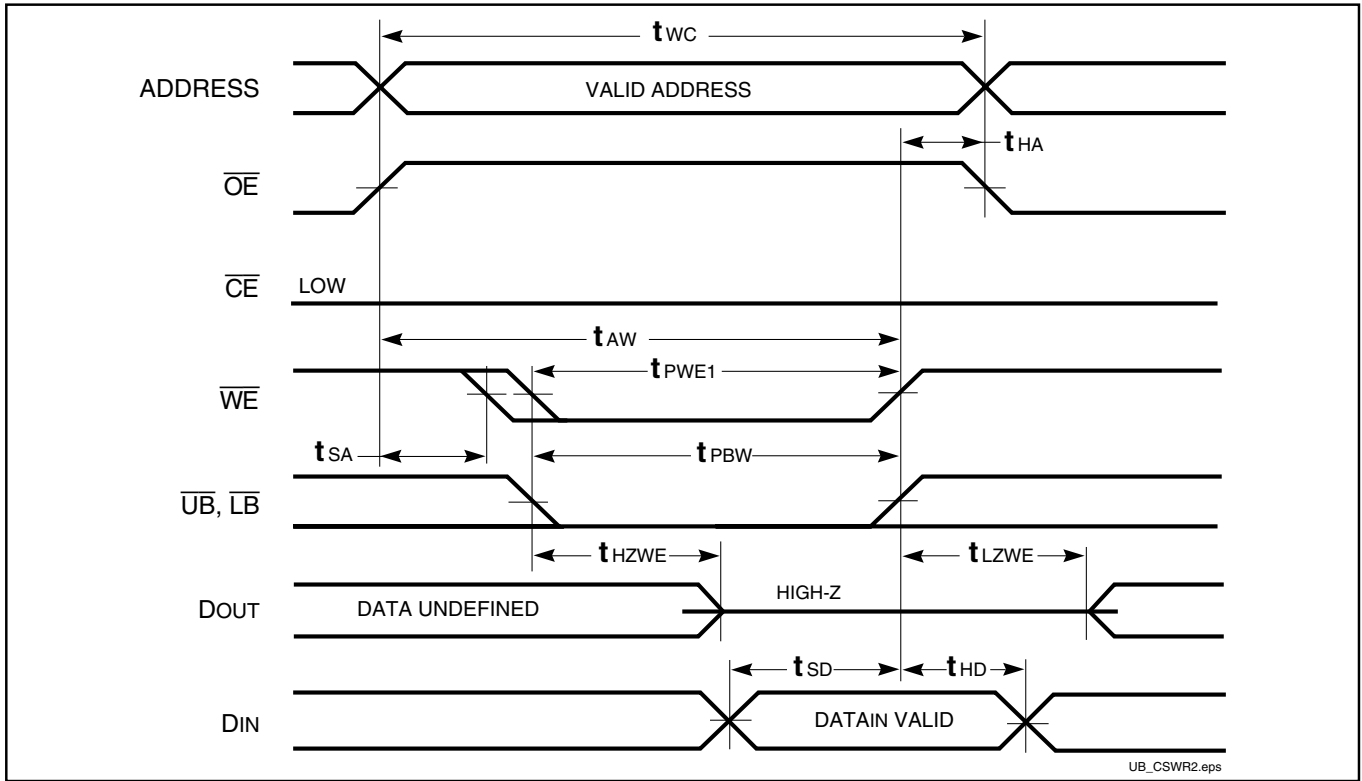
## WRITE CYCLE NO. 3 ($\overline{WE}$ Controlled: $\overline{OE}$ is LOW During Write Cycle)



UB_CSWR3.eps

## WRITE CYCLE NO. 4 ($\overline{UB}/\overline{LB}$ Controlled)



UB_CSWR4.eps

## DATA RETENTION SWITCHING CHARACTERISTICS (L/LL)

| Symbol | Parameter | Test Condition | Min. | Max. | Unit | |
|--------|-----------|----------------|------|------|------|---|
| $V_{DR}$ | Vcc for Data Retention | See Data Retention Waveform | 1.0 | 2.2 | V | |
| $I_{DR}$ | Data Retention Current | Vcc = 1.0V, $\overline{CE} \geq$ Vcc – 0.2V | — | 15 | µA | **(For -L version)** |
| | | | — | 5 | | **(For -LL version)** |
| $t_{SDR}$ | Data Retention Setup Time | See Data Retention Waveform | 0 | — | ns | |
| $t_{RDR}$ | Recovery Time | See Data Retention Waveform | $t_{RC}$ | — | ns | |

## DATA RETENTION WAVEFORM ($\overline{CE}$ Controlled)
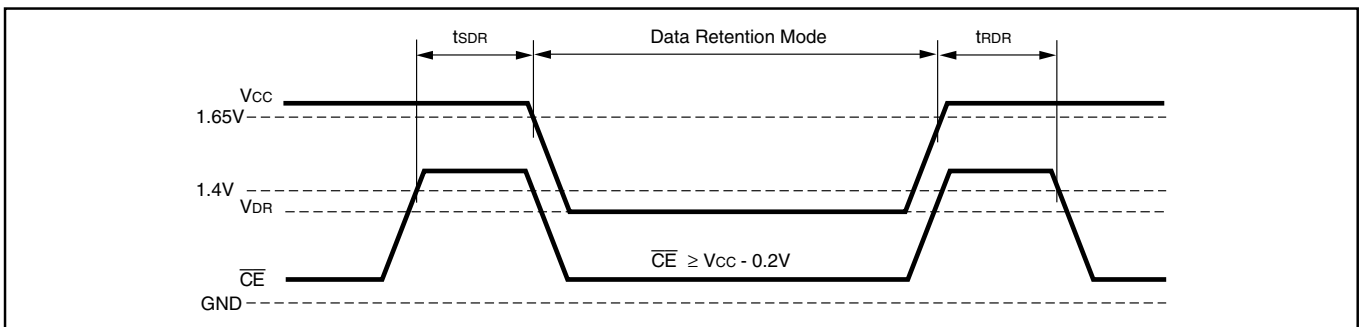
## ORDERING INFORMATION

### Commercial Range: 0°C to +70°C

| Speed (ns) | Order Part No. | Package |
|---|---|---|
| 70 | IS62VV25616L-70T | TSOP (Type II) |
|  | IS62VV25616L-70M | Mini BGA (7.2mm x 8.7mm) |
| 85 | IS62VV25616L-85T | TSOP (Type II) |
|  | IS62VV25616L-85M | Mini BGA (7.2mm x 8.7mm) |
| 100 | IS62VV25616L-10T | TSOP (Type II) |
|  | IS62VV25616L-10M | Mini BGA (7.2mm x 8.7mm) |

### Industrial Range: –40°C to +85°C

| Speed (ns) | Order Part No. | Package |
|---|---|---|
| 70 | IS62VV25616L-70TI | TSOP (Type II) |
|  | IS62VV25616L-70MI | Mini BGA (7.2mm x 8.7mm) |
| 85 | IS62VV25616L-85TI | TSOP (Type II) |
|  | IS62VV25616L-85MI | Mini BGA (7.2mm x 8.7mm) |
| 100 | IS62VV25616L-10TI | TSOP (Type II) |
|  | IS62VV25616L-10MI | Mini BGA (7.2mm x 8.7mm) |

## ORDERING INFORMATION

### Commercial Range: 0°C to +70°C

| Speed (ns) | Order Part No. | Package |
|---|---|---|
| 70 | IS62VV25616LL-70T | TSOP (Type II) |
|  | IS62VV25616LL-70M | Mini BGA (7.2mm x 8.7mm) |
| 85 | IS62VV25616LL-85T | TSOP (Type II) |
|  | IS62VV25616LL-85M | Mini BGA (7.2mm x 8.7mm) |
| 100 | IS62VV25616LL-10T | TSOP (Type II) |
|  | IS62VV25616LL-10M | Mini BGA (7.2mm x 8.7mm) |

### Industrial Range: –40°C to +85°C

| Speed (ns) | Order Part No. | Package |
|---|---|---|
| 70 | IS62VV25616LL-70TI | TSOP (Type II) |
|  | IS62VV25616LL-70MI | Mini BGA (7.2mm x 8.7mm) |
| 85 | IS62VV25616LL-85TI | TSOP (Type II) |
|  | IS62VV25616LL-85MI | Mini BGA (7.2mm x 8.7mm) |
| 100 | IS62VV25616LL-10TI | TSOP (Type II) |
|  | IS62VV25616LL-10MI | Mini BGA (7.2mm x 8.7mm) |