# 1M x 8 LOW VOLTAGE, ULTRA LOW POWER CMOS STATIC RAM

JULY 2003

## FEATURES

- High-speed access time: 55ns, 70ns
- CMOS low power operation:

  36 mW (typical) operating

  12 µW (typical) CMOS standby
- TTL compatible interface levels
- Single power supply:

  2.5V--3.6V $V_{DD}$ (IS62WV10248BLL)
- Fully static operation: no clock or refresh required
- Three state outputs
- Industrial temperature available

## DESCRIPTION

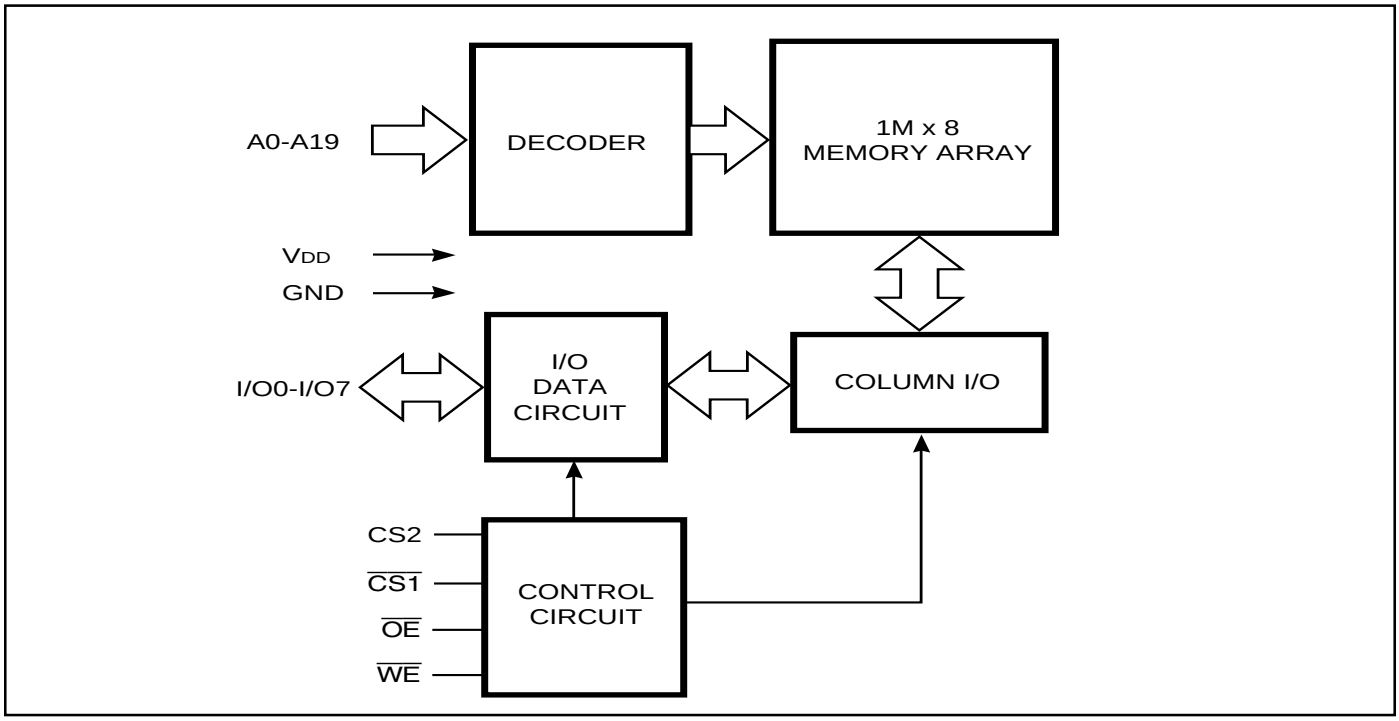
The *ISSI* IS62WV10248BLL is a high-speed, 8M bit static RAMs organized as 1M words by 8 bits. It is fabricated using *ISSI*'s high-performance CMOS technology. This highly reliable process coupled with innovative circuit design techniques, yields high-performance and low power consumption devices.

When $\overline{CS1}$ is HIGH (deselected) or when CS2 is LOW (deselected), 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. The active LOW Write Enable ($\overline{WE}$) controls both writing and reading of the memory.

The IS62WV10248BLL is packaged in the JEDEC standard 48-pin mini BGA (7.2mm x 8.7mm).

## FUNCTIONAL BLOCK DIAGRAM

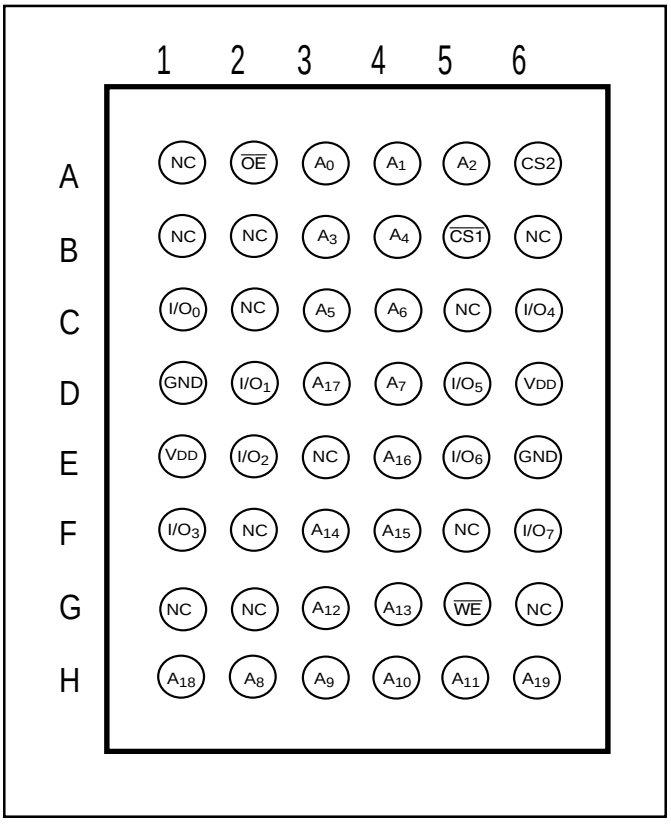


## PIN DESCRIPTIONS

| | |
|---|---|
| A0-A19 | Address Inputs |
| $\overline{CS1}$ | Chip Enable 1 Input |
| CS2 | Chip Enable 2 Input |
| $\overline{OE}$ | Output Enable Input |
| $\overline{WE}$ | Write Enable Input |
| I/O0-I/O7 | Input/Output |
| NC | No Connection |
| $V_{DD}$ | Power |
| GND | Ground |

## PIN CONFIGURATION

### 48-pin mini BGA (B) (7.2mm x 8.7mm)



## TRUTH TABLE

| Mode | $\overline{WE}$ | $\overline{CS1}$ | CS2 | $\overline{OE}$ | I/O Operation | $V_{DD}$ Current |
|---|---|---|---|---|---|---|
| Not Selected | X | H | X | X | High-Z | $I_{SB1}$, $I_{SB2}$ |
| (Power-down) | X | X | L | X | High-Z | $I_{SB1}$, $I_{SB2}$ |
| Output Disabled | H | L | H | H | High-Z | $I_{CC}$ |
| Read | H | L | H | L | $D_{OUT}$ | $I_{CC}$ |
| Write | L | L | H | X | $D_{IN}$ | $I_{CC}$ |

## ABSOLUTE MAXIMUM RATINGS(1)

| Symbol | Parameter | Value | Unit |
|---|---|---|---|
| $V_{TERM}$ | Terminal Voltage with Respect to GND | –0.2 to $V_{DD}$+0.3 | V |
| $V_{DD}$ | $V_{DD}$ Related to GND | –0.2 to +3.8 | 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.

## OPERATING RANGE ($V_{DD}$)

| Range | Ambient Temperature | IS62WV10248BLL |
|---|---|---|
| Commercial | 0°C to +70°C | 2.5V - 3.6V |
| Industrial | –40°C to +85°C | 2.5V - 3.6V |

## DC ELECTRICAL CHARACTERISTICS (Over Operating Range)

| Symbol | Parameter | Test Conditions | $V_{DD}$ | Min. | Max. | Unit |
|---|---|---|---|---|---|---|
| $V_{OH}$ | Output HIGH Voltage | $I_{OH}$ = -1 mA | 2.5-3.6V | 2.2 | — | V |
| $V_{OL}$ | Output LOW Voltage | $I_{OL}$ = 2.1 mA | 2.5-3.6V | — | 0.4 | V |
| $V_{IH}$ | Input HIGH Voltage | | 2.5-3.6V | 2.2 | $V_{DD}$ + 0.3 | V |
| $V_{IL}$(1) | Input LOW Voltage | | 2.5-3.6V | –0.2 | 0.6 | V |
| $I_{LI}$ | Input Leakage | GND ≤ $V_{IN}$ ≤ $V_{DD}$ | | –1 | 1 | µA |
| $I_{LO}$ | Output Leakage | GND ≤ $V_{OUT}$ ≤ $V_{DD}$, 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 | IS62WV10248BLL (Unit) |
|---|---|
| Input Pulse Level | 0.4 to $V_{DD}$-0.3V |
| Input Rise and Fall Times | 5 ns |
| Input and Output Timing and Reference Level | $V_{REF}$ |
| Output Load | See Figures 1 and 2 |

| | IS62WV10248BLL 2.5V - 3.6V |
|---|---|
| R1(Ω) | 1029 |
| R2(Ω) | 1728 |
| $V_{REF}$ | 1.5V |
| $V_{TM}$ | 2.8V |

## AC TEST LOADS

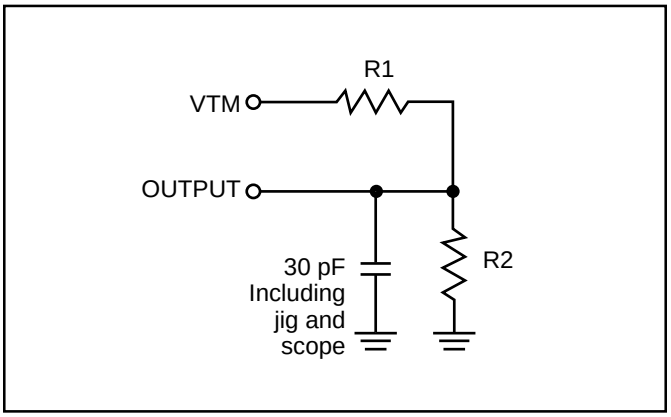



**Figure 1**

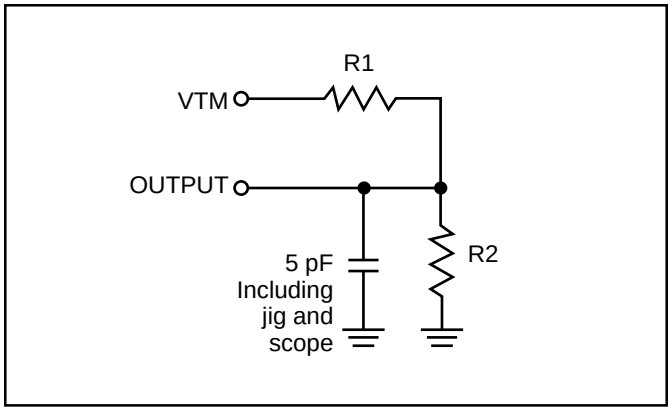



**Figure 2**

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

### IS62WV10248BLL

| Symbol | Parameter | Test Conditions | | Max. 55 | Max. 70 | Unit |
|---|---|---|---|---|---|---|
| $I_{CC}$ | $V_{DD}$ Dynamic Operating Supply Current | $V_{DD}$ = Max., $I_{OUT}$ = 0 mA, f = $f_{MAX}$ | Com. | 30 | 25 | mA |
| | | | Ind. | 35 | 30 | |
| $I_{CC1}$ | Operating Supply Current | $V_{DD}$ = Max., $\overline{CS1}$ = 0.2V | Com. | 5 | 5 | mA |
| | | $\overline{WE}$ = $V_{DD}$ -0.2V | Ind. | 5 | 5 | |
| | | CS2 = $V_{DD}$ -0.2V, f = 1MHz | | | | |
| $I_{SB1}$ | TTL Standby Current (TTL Inputs) | $V_{DD}$ = Max., | Com. | 0.3 | 0.3 | mA |
| | | $V_{IN}$ = $V_{IH}$ or $V_{IL}$ | Ind. | 0.3 | 0.3 | |
| | | $\overline{CS1}$ = $V_{IH}$, CS2 = $V_{IL}$, f = 1 MHz | | | | |
| $I_{SB2}$ | CMOS Standby Current (CMOS Inputs) | $V_{DD}$ = Max., | Com. | 20 | 20 | µA |
| | | $\overline{CS1} \geq V_{DD} - 0.2V$, | Ind. | 25 | 25 | |
| | | $CS2 \leq 0.2V$, | typ.[1] | 3 | 3 | |
| | | $V_{IN} \geq V_{DD} - 0.2V$, or $V_{IN} \leq 0.2V$, f = 0 | | | | |

**Note:**
1. Typical Values are measured at $V_{DD}$ = 3.0V, $T_A$ = 25°C and not 100% tested.

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

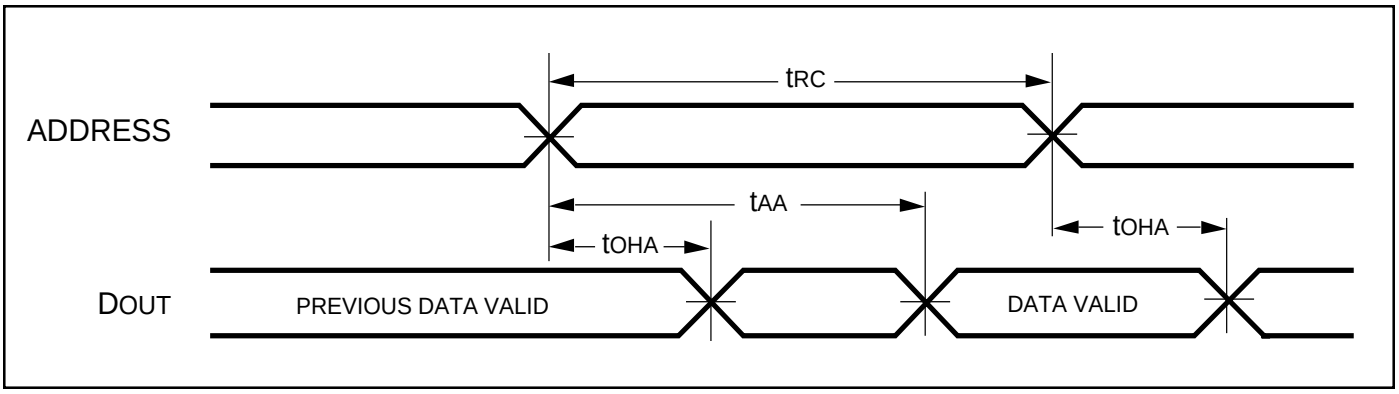
| Symbol | Parameter | 55 ns | | 70 ns | | Unit |
|---|---|---|---|---|---|---|
| | | Min. | Max. | Min. | Max. | |
| $t_{RC}$ | Read Cycle Time | 55 | — | 70 | — | ns |
| $t_{AA}$ | Address Access Time | — | 55 | — | 70 | ns |
| $t_{OHA}$ | Output Hold Time | 10 | — | 10 | — | ns |
| $t_{ACS1}/t_{ACS2}$ | $\overline{CS1}$/CS2 Access Time | — | 55 | — | 70 | ns |
| $t_{DOE}$ | $\overline{OE}$ Access Time | — | 25 | — | 35 | ns |
| $t_{HZOE}$[2] | $\overline{OE}$ to High-Z Output | — | 20 | — | 25 | ns |
| $t_{LZOE}$[2] | $\overline{OE}$ to Low-Z Output | 5 | — | 5 | — | ns |
| $t_{HZCS1}/t_{HZCS2}$[2] | $\overline{CS1}$/CS2 to High-Z Output | 0 | 20 | 0 | 25 | ns |
| $t_{LZCS1}/t_{LZCS2}$[2] | $\overline{CS1}$/CS2 to Low-Z Output | 10 | — | 10 | — | ns |

**Notes:**

1. Test conditions assume signal transition times of 5 ns or less, timing reference levels of 1.5V, input pulse levels of 0.4V to $V_{DD}$-0.3V 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.

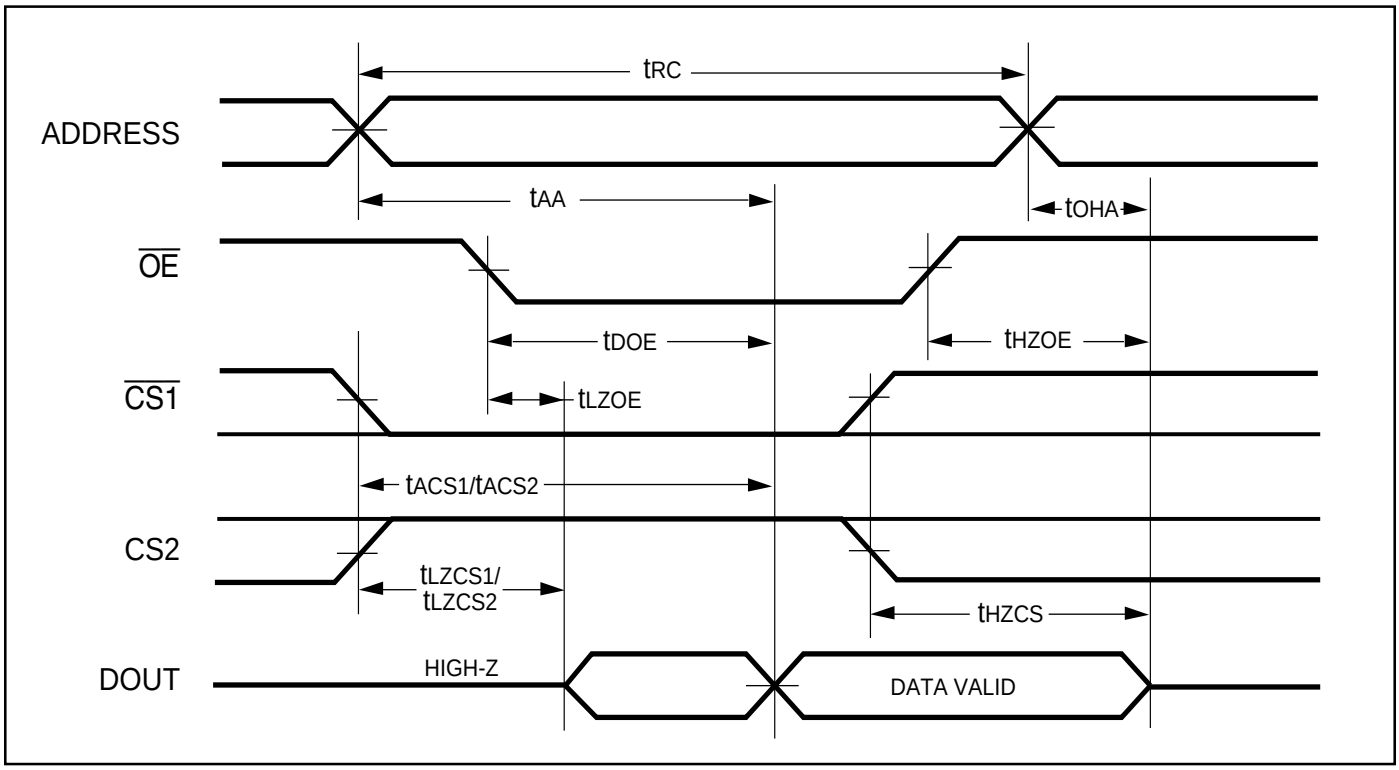
## AC WAVEFORMS

### READ CYCLE NO. 1[1,2] (Address Controlled) ($\overline{CS1}$ = $\overline{OE}$ = $V_{IL}$, CS2 = $\overline{WE}$ = $V_{IH}$)



## AC WAVEFORMS

### READ CYCLE NO. 2[1,3] ($\overline{CS1}$, CS2, $\overline{OE}$ Controlled)




**Notes:**
1. $\overline{WE}$ is HIGH for a Read Cycle.
2. The device is continuously selected. $\overline{OE}$, $\overline{CS1}$= $V_{IL}$. CS2=$\overline{WE}$=$V_{IH}$.
3. Address is valid prior to or coincident with $\overline{CS1}$ LOW and CS2 HIGH transition.

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

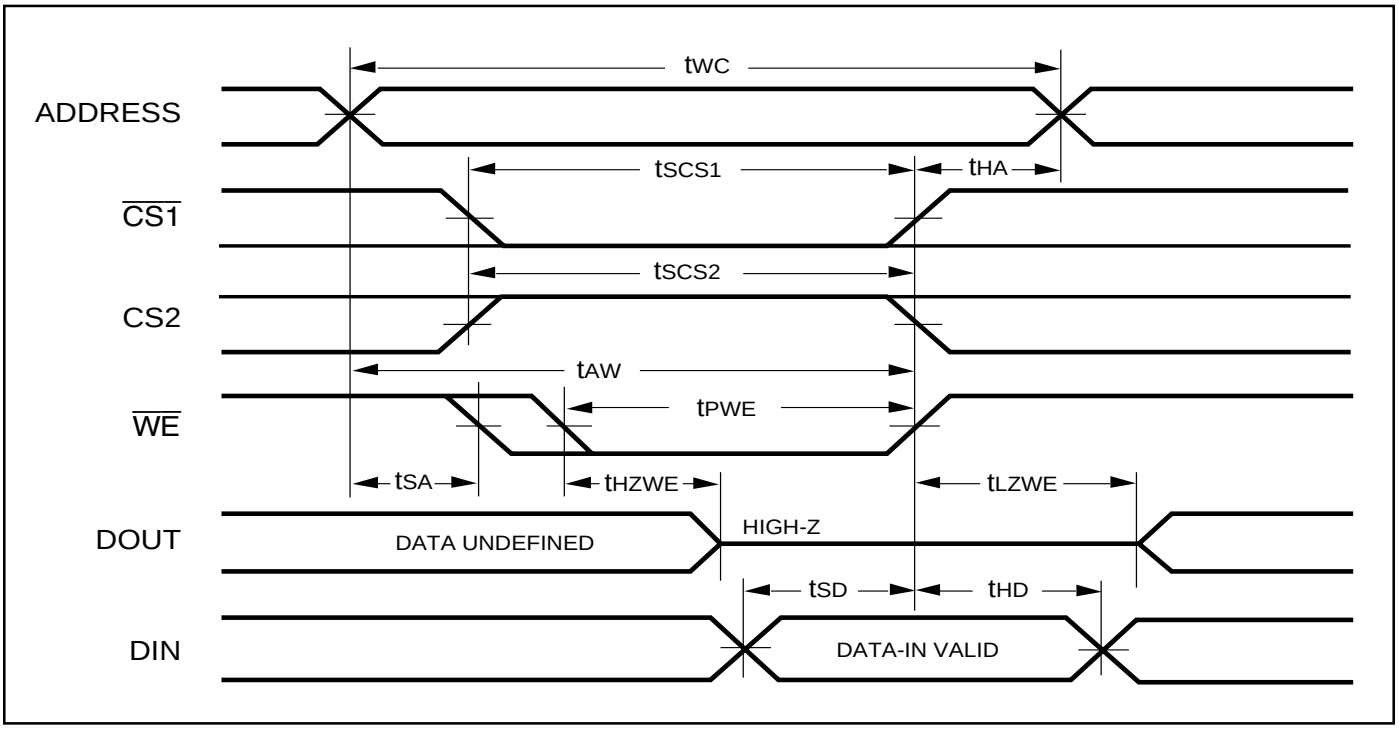
| Symbol | Parameter | 55 ns Min. | 55 ns Max. | 70 ns Min. | 70 ns Max. | Unit |
|---|---|---|---|---|---|---|
| $t_{WC}$ | Write Cycle Time | 55 | — | 70 | — | ns |
| $t_{SCS1}$/$t_{SCS2}$ | $\overline{CS1}$/CS2 to Write End | 45 | — | 60 | — | ns |
| $t_{AW}$ | Address Setup Time to Write End | 45 | — | 60 | — | ns |
| $t_{HA}$ | Address Hold from Write End | 0 | — | 0 | — | ns |
| $t_{SA}$ | Address Setup Time | 0 | — | 0 | — | ns |
| $t_{PWE}$[4] | $\overline{WE}$ Pulse Width | 40 | — | 50 | — | ns |
| $t_{SD}$ | Data Setup to Write End | 25 | — | 30 | — | ns |
| $t_{HD}$ | Data Hold from Write End | 0 | — | 0 | — | ns |
| $t_{HZWE}$[3] | $\overline{WE}$ LOW to High-Z Output | — | 25 | — | 25 | ns |
| $t_{LZWE}$[3] | $\overline{WE}$ HIGH to Low-Z Output | 5 | — | 5 | — | ns |

**Notes:**

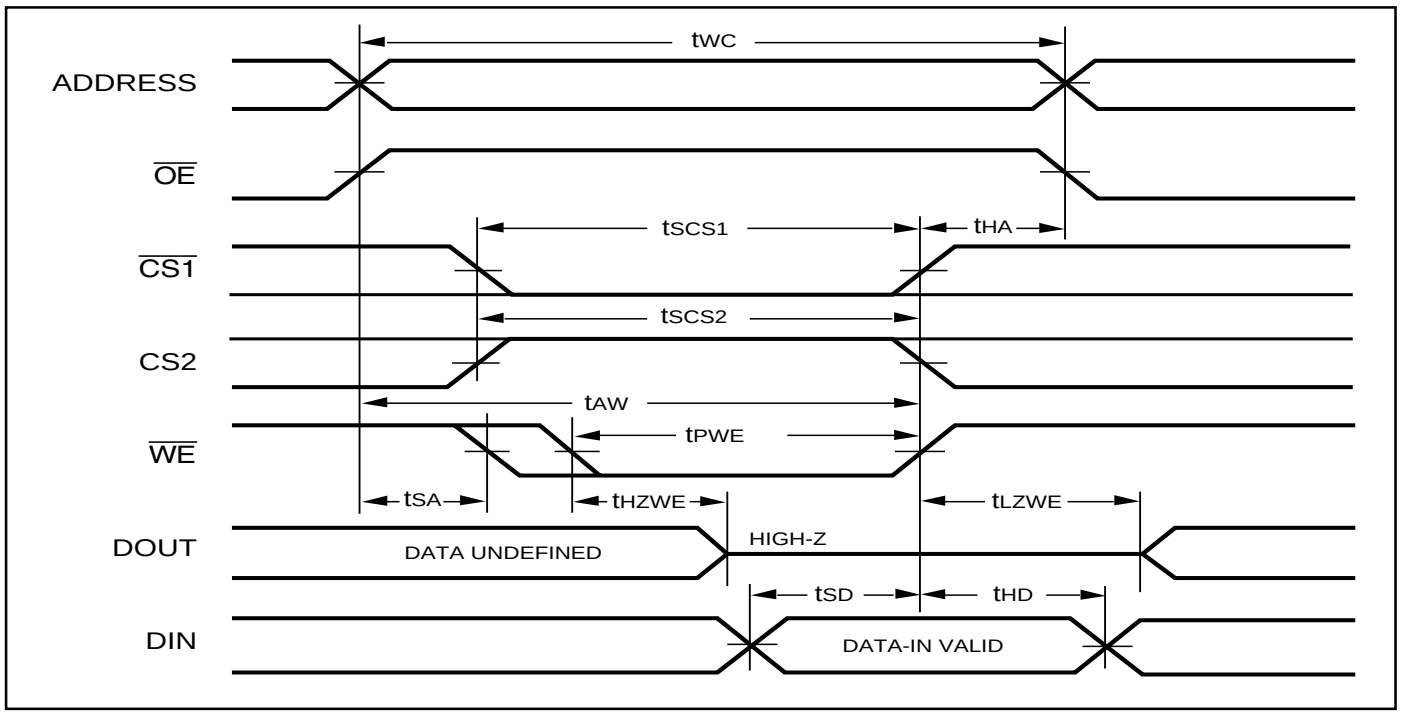
1. Test conditions assume signal transition times of 5 ns or less, timing reference levels of 1.5V, input pulse levels of 0.4V to $V_{DD}$-0.3V and output loading specified in Figure 1.
2. The internal write time is defined by the overlap of $\overline{CS1}$ LOW, CS2 HIGH and $\overline{WE}$ LOW. All 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.
4. $t_{PWE} > t_{HZWE} + t_{SD}$ when $\overline{OE}$ is LOW.

## AC WAVEFORMS

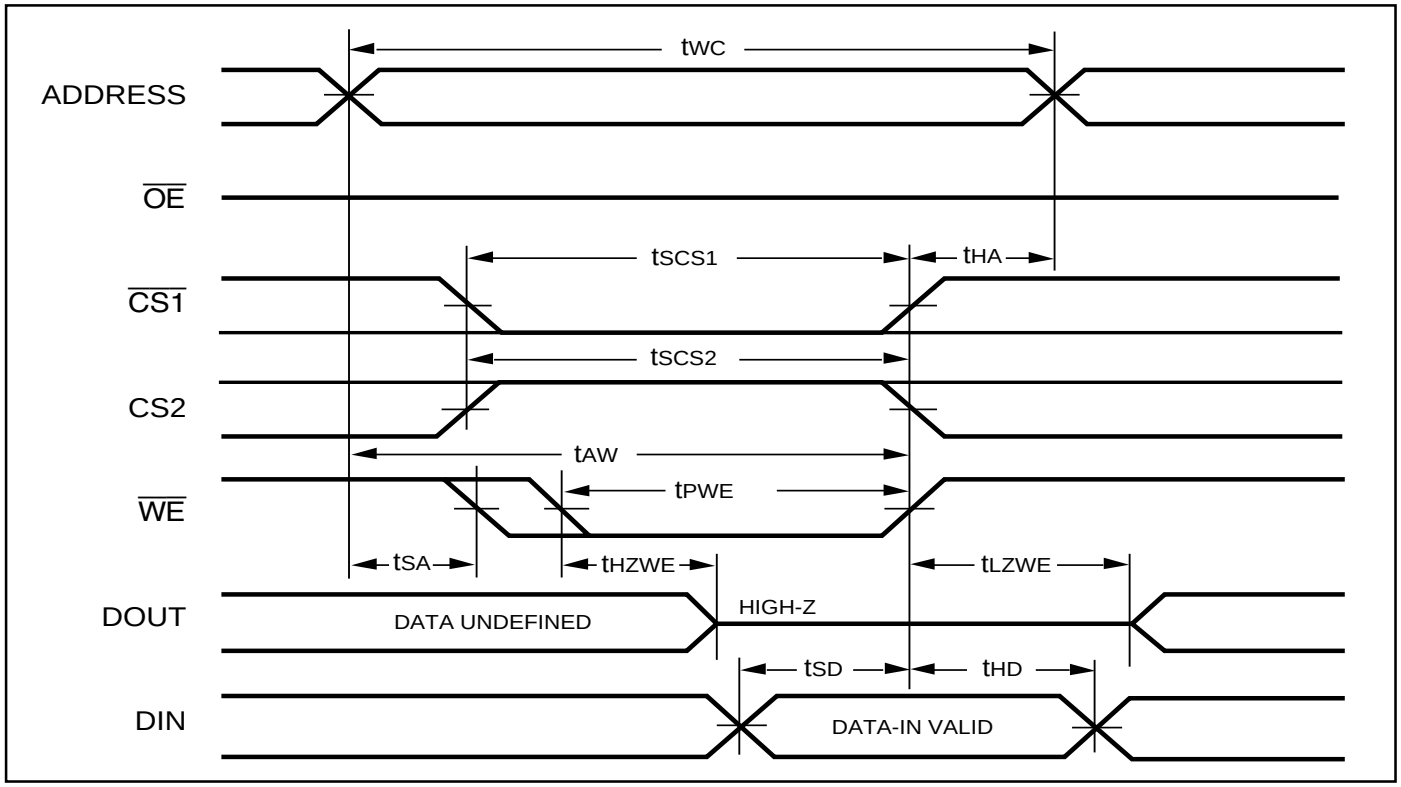
### WRITE CYCLE NO. 1 ($\overline{CS1}$/CS2 Controlled, $\overline{OE}$ = HIGH or LOW)



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



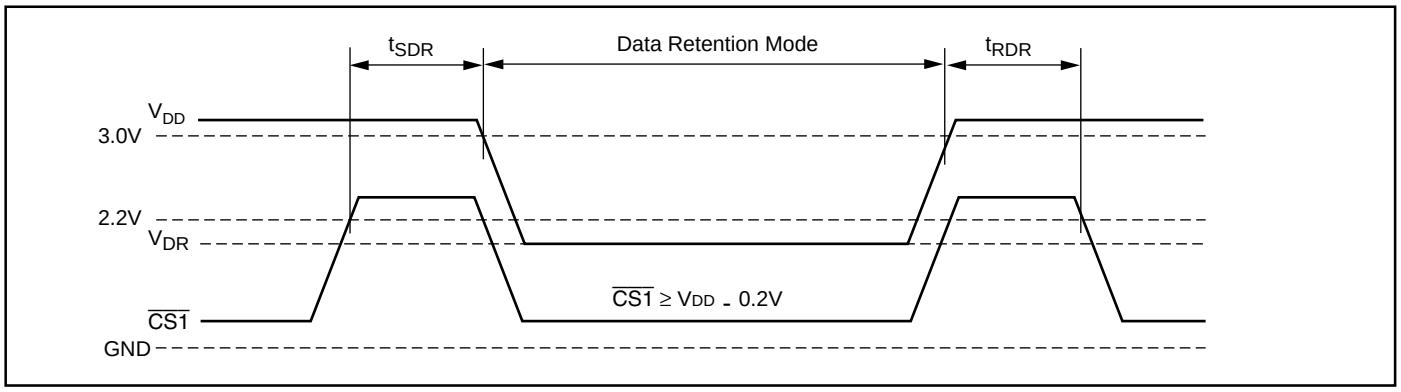

**WRITE CYCLE NO. 3** ($\overline{WE}$ Controlled: $\overline{OE}$ is LOW During Write Cycle)



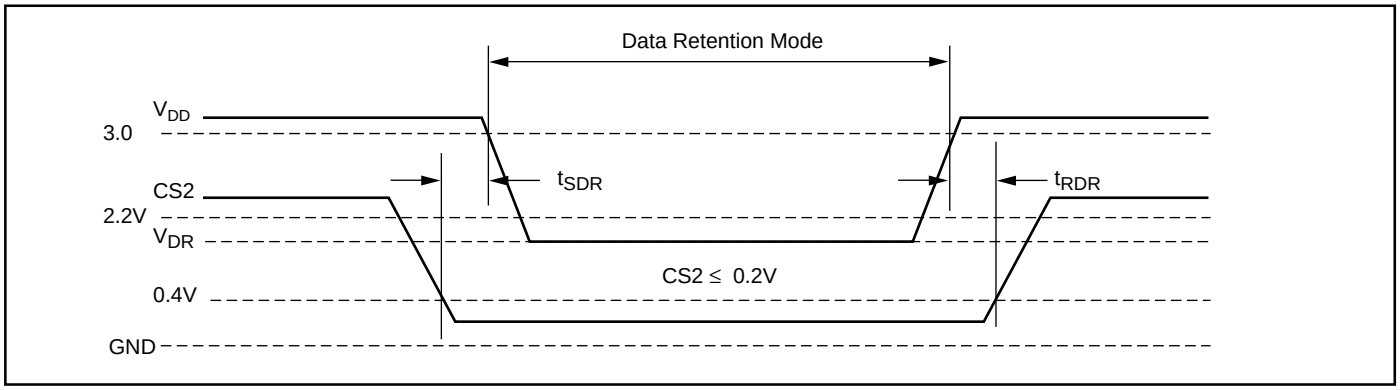
## DATA RETENTION SWITCHING CHARACTERISTICS

| Symbol | Parameter | Test Condition | Min. | Max. | Unit |
|---|---|---|---|---|---|
| $V_{DR}$ | $V_{DD}$ for Data Retention | See Data Retention Waveform | 1.2 | 3.6 | V |
| $I_{DR}$ | Data Retention Current | $V_{DD}$ = 1.2V, $\overline{CS1} \geq V_{DD} - 0.2V$ | — | 20 | µA |
| $t_{SDR}$ | Data Retention Setup Time | See Data Retention Waveform | 0 | — | ns |
| $t_{RDR}$ | Recovery Time | See Data Retention Waveform | $t_{RC}$ | — | ns |

## DATA RETENTION WAVEFORM ($\overline{CS1}$ Controlled)




## DATA RETENTION WAVEFORM (CS2 Controlled)

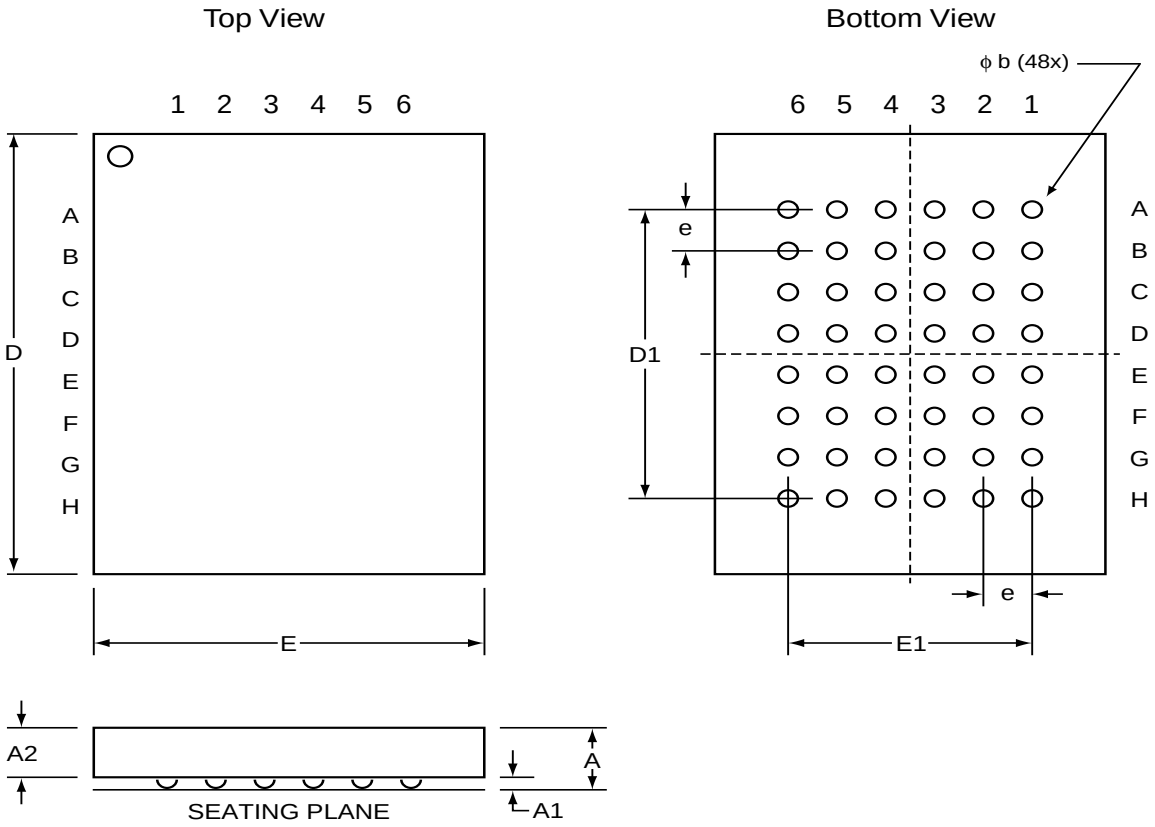


## ORDERING INFORMATION: IS62WV10248BLL (2.5V - 3.6V)

### Industrial Range: –40°C to +85°C

| Speed (ns) | Order Part No. | Package |
|---|---|---|
| 55 | IS62WV10248BLL-55BI | mini BGA (7.2mm x 8.7mm) |
| 70 | IS62WV10248BLL-70BI | mini BGA (7.2mm x 8.7mm) |
| 70 | IS62WV10248BLL-70XI | DIE |

## Mini Ball Grid Array
## Package Code: B (48-pin)




### mBGA - 7.2mm x 8.7mm

| | MILLIMETERS | | | INCHES | | |
|---|---|---|---|---|---|---|
| **Sym.** | **Min.** | **Typ.** | **Max.** | **Min.** | **Typ.** | **Max.** |
| N0. Leads | | **48** | | | | |
| A | — | — | 1.20 | — | — | 0.047 |
| A1 | 0 .24 | — | 0.30 | 0.009 | — | 0.012 |
| A2 | 0.60 | — | — | 0.024 | — | — |
| D | 8.60 | 8.70 | 8.80 | 0.339 | 0.343 | 0.346 |
| D1 | | 5.25BSC | | | 0.207BSC | |
| E | 7.10 | 7.20 | 7.30 | 0.280 | 0.283 | 0.287 |
| E1 | | 3.75BSC | | | 0.148BSC | |
| e | | 0.75BSC | | | 0.030BSC | |
| b | 0.30 | 0.35 | 0.40 | 0.012 | 0.014 | 0.016 |

Notes:
1. Controlling dimensions are in millimeters.