

# IS62WV20488ALL IS62WV20488BLL



## 2M x 8 HIGH-SPEED LOW POWER CMOS STATIC RAM

JANUARY 2008

### FEATURES

- High-speed access times:  
25, 35 ns
- High-performance, low-power CMOS process
- Multiple center power and ground pins for greater noise immunity
- Fully static operation: no clock or refresh required
- TTL compatible inputs and outputs
- Single power supply
  - V<sub>DD</sub> 1.65V to 2.2V (IS62WV20488ALL)  
speed = 35ns for V<sub>CC</sub> = 1.65V to 2.2V
  - V<sub>DD</sub> 2.4V to 3.6V (IS62WV20488BLL)  
speed = 25ns for V<sub>CC</sub> = 2.4V to 3.6V
- Packages available:
  - 48-ball miniBGA (9mm x 11mm)
  - 44-pin TSOP (Type II)
- Industrial Temperature Support
- Lead-free available

### DESCRIPTION

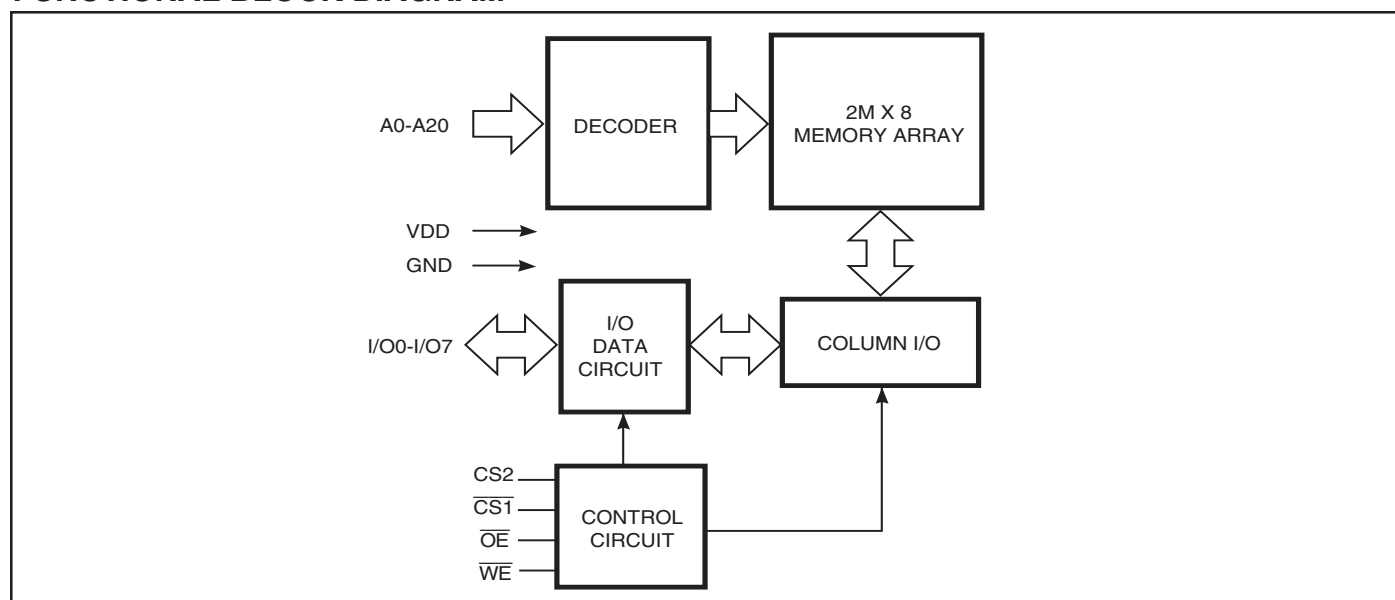
The *ISSI* IS62WV20488ALL/BLL is a high-speed, low power, 2M-word by 8-bit CMOS static RAM. The IS62WV20488ALL/BLL is fabricated using *ISSI*'s high-performance CMOS technology. This highly reliable process coupled with innovative circuit design techniques, yields higher performance and low power consumption devices.

When  $\overline{CS1}$  is HIGH (deselected) or when CS2 is LOW (deselected) or when  $\overline{CS1}$  is LOW, CS2 is HIGH, the device assumes a standby mode at which the power dissipation can be reduced down with CMOS input levels.

The IS62WV20488ALL/BLL operates from a single power supply and all inputs are TTL-compatible.

The IS62WV20488ALL/BLL is available in 48 ball mini BGA and 44-pin TSOP (Type II) packages.

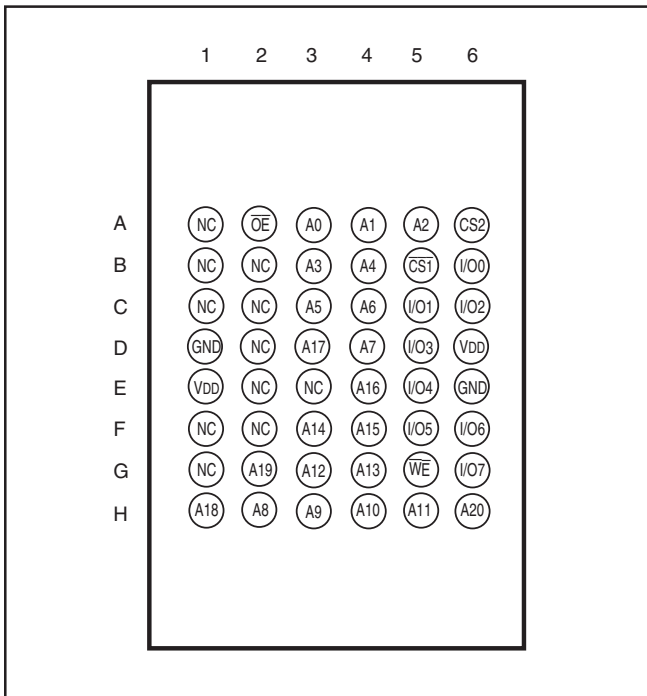
### FUNCTIONAL BLOCK DIAGRAM



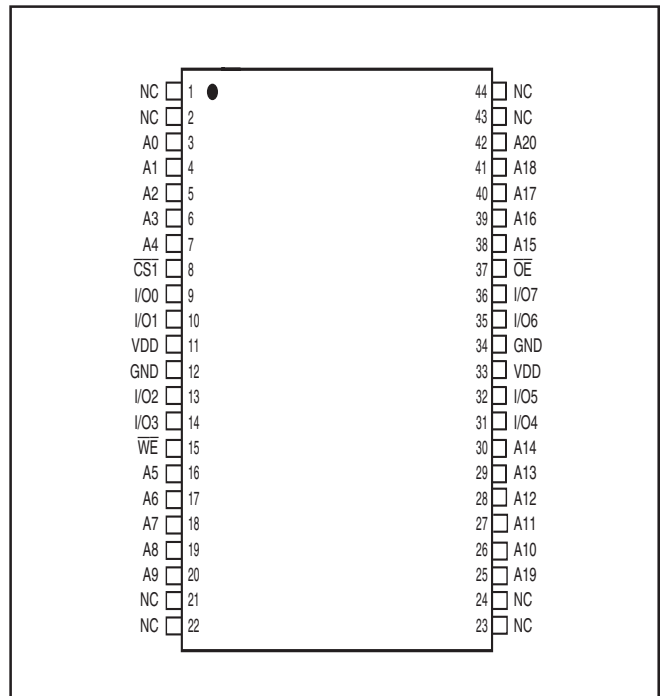
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## PIN CONFIGURATION

### 48-pin Mini BGA (M ) (9mm x 11mm)



### 44-pin TSOP (Type II )



## PIN DESCRIPTIONS

|                                     |                     |
|-------------------------------------|---------------------|
| A0-A20                              | Address Inputs      |
| $\overline{CS1}$ , $\overline{CS2}$ | Chip Enable Input   |
| $\overline{OE}$                     | Output Enable Input |
| $\overline{WE}$                     | Write Enable Input  |
| I/O0-I/O7                           | Data Input / Output |
| VDD                                 | Power               |
| GND                                 | Ground              |
| NC                                  | No Connection       |

## TRUTH TABLE

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

## ABSOLUTE MAXIMUM RATINGS<sup>(1)</sup>

| Symbol            | Parameter                            | Value                         | Unit |
|-------------------|--------------------------------------|-------------------------------|------|
| V <sub>TERM</sub> | Terminal Voltage with Respect to GND | -0.5 to V <sub>DD</sub> + 0.5 | V    |
| V <sub>DD</sub>   | V <sub>DD</sub> Relates to GND       | -0.3 to 4.0                   | V    |
| T <sub>STG</sub>  | Storage Temperature                  | -65 to +150                   | °C   |
| P <sub>T</sub>    | Power Dissipation                    | 1.0                           | W    |

### 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.

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

| Symbol           | Parameter                | Conditions            | Max. | Unit |
|------------------|--------------------------|-----------------------|------|------|
| C <sub>IN</sub>  | Input Capacitance        | V <sub>IN</sub> = 0V  | 6    | pF   |
| C <sub>I/O</sub> | Input/Output Capacitance | V <sub>OUT</sub> = 0V | 8    | 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>DD</sub> = 3.3V.

**OPERATING RANGE (V<sub>DD</sub>) (IS62WV20488ALL)**

| Range      | Ambient Temperature | V <sub>DD</sub> (35 ns) |
|------------|---------------------|-------------------------|
| Commercial | 0°C to +70°C        | 1.65V-2.2V              |
| Industrial | -40°C to +85°C      | 1.65V-2.2V              |

**OPERATING RANGE (V<sub>DD</sub>) (IS62WV20488BLL)<sup>(1)</sup>**

| Range      | Ambient Temperature | V <sub>DD</sub> (25 ns) |
|------------|---------------------|-------------------------|
| Commercial | 0°C to +70°C        | 2.4V-3.6V               |
| Industrial | -40°C to +85°C      | 2.4V-3.6V               |

**Note:**

1. When operated in the range of 2.4V-3.6V, the device meets 25ns. When operated in the range of 3.3V ± 5%, the device meets 15ns.

**DC ELECTRICAL CHARACTERISTICS** (Over Operating Range)

**V<sub>DD</sub> = 2.4V-3.6V**

| Symbol          | Parameter                        | Test Conditions   | Min. | Max.                  | Unit |
|-----------------|----------------------------------|---|------|-----------------------|------|
| V <sub>OH</sub> | Output HIGH Voltage              | V <sub>DD</sub> = Min., I <sub>OH</sub> = -1.0 mA           | 1.8  | —                     | V    |
| V <sub>OL</sub> | Output LOW Voltage               | V <sub>DD</sub> = Min., I <sub>OL</sub> = 1.0 mA            | —    | 0.4                   | V    |
| V <sub>IH</sub> | Input HIGH Voltage               |   | 2.0  | V <sub>DD</sub> + 0.3 | V    |
| V <sub>IL</sub> | Input LOW Voltage <sup>(1)</sup> |   | -0.3 | 0.8                   | V    |
| I <sub>LI</sub> | Input Leakage                    | GND ≤ V <sub>IN</sub> ≤ V <sub>DD</sub>                     | -1   | 1                     | μA   |
| I <sub>LO</sub> | Output Leakage                   | GND ≤ V <sub>OUT</sub> ≤ V <sub>DD</sub> , Outputs Disabled | -1   | 1                     | μA   |

**Note:**

1. V<sub>IL</sub>(min.) = -0.3VDC; V<sub>IL</sub>(min.) = -2.0V AC (pulse width - 2.0 ns). Not 100% tested.  
V<sub>IH</sub>(max.) = V<sub>DD</sub> + 0.3VDC; V<sub>IH</sub>(max.) = V<sub>DD</sub> + 2.0V AC (pulse width - 2.0 ns). Not 100% tested.

**DC ELECTRICAL CHARACTERISTICS** (Over Operating Range)

**V<sub>DD</sub> = 1.65V-2.2V**

| Symbol                         | Parameter           | Test Conditions   | V <sub>DD</sub> | Min. | Max.                  | Unit |
|--------------------------------|---------------------|---|-----------------|------|-----------------------|------|
| V <sub>OH</sub>                | Output HIGH Voltage | I <sub>OH</sub> = -0.1 mA                                   | 1.65-2.2V       | 1.4  | —                     | V    |
| V <sub>OL</sub>                | Output LOW Voltage  | I <sub>OL</sub> = 0.1 mA                                    | 1.65-2.2V       | —    | 0.2                   | V    |
| V <sub>IH</sub>                | Input HIGH Voltage  |   | 1.65-2.2V       | 1.4  | V <sub>DD</sub> + 0.2 | V    |
| V <sub>IL</sub> <sup>(1)</sup> | Input LOW Voltage   |   | 1.65-2.2V       | -0.2 | 0.4                   | V    |
| I <sub>LI</sub>                | Input Leakage       | GND ≤ V <sub>IN</sub> ≤ V <sub>DD</sub>                     |                 | -1   | 1                     | μA   |
| I <sub>LO</sub>                | Output Leakage      | GND ≤ V <sub>OUT</sub> ≤ V <sub>DD</sub> , Outputs Disabled |                 | -1   | 1                     | μA   |

**Note:**

1. V<sub>IL</sub>(min.) = -0.3VDC; V<sub>IL</sub>(min.) = -2.0V AC (pulse width - 2.0 ns). Not 100% tested.  
V<sub>IH</sub>(max.) = V<sub>DD</sub> + 0.3VDC; V<sub>IH</sub>(max.) = V<sub>DD</sub> + 2.0V AC (pulse width - 2.0 ns). Not 100% tested.

**POWER SUPPLY CHARACTERISTICS<sup>(1)</sup>** (Over Operating Range)

| Symbol           | Parameter  | Test Conditions  |                     | -25  |      | -35  |      | Unit |
|------------------|--|--|---------------------|------|------|------|------|------|
|                  |  |  |                     | Min. | Max. | Min. | Max. |      |
| I <sub>CC</sub>  | V <sub>DD</sub> Dynamic Operating Supply Current | V <sub>DD</sub> = Max.,<br>I <sub>OUT</sub> = 0 mA, f = f <sub>MAX</sub>   | Com.                | —    | 25   | —    | 20   | mA   |
|                  |  |  | Ind.                | —    | 30   | —    | 25   |      |
|                  |  |  | typ. <sup>(2)</sup> | 20   | 17   |      |      |      |
| I <sub>CC1</sub> | Operating Supply Current                         | V <sub>DD</sub> = Max.,<br>I <sub>OUT</sub> = 0 mA, f = 0  | Com.                | —    | 10   | —    | 10   | mA   |
|                  |  |  | Ind.                | —    | 15   | —    | 15   |      |
| I <sub>SB1</sub> | TTL Standby Current (TTL Inputs)                 | V <sub>DD</sub> = Max.,<br>V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub><br>$\overline{CS1} \geq V_{IH}$ , f = 0, CS2 = V <sub>IL</sub>                   | Com.                | —    | 5    | —    | 5    | mA   |
|                  |  |  | Ind.                | —    | 6    | —    | 6    |      |
|                  |  |  |                     |      |      |      |      |      |
| I <sub>SB2</sub> | CMOS Standby Current (CMOS Inputs)               | V <sub>DD</sub> = Max.,<br>$\overline{CS1} \geq V_{DD} - 0.2V$ ,<br>CS2 ≤ 0.2V,<br>V <sub>IN</sub> ≥ V <sub>DD</sub> - 0.2V, or<br>V <sub>IN</sub> ≤ 0.2V, f = 0 | Com.                | —    | 1.5  | —    | 1.5  | mA   |
|                  |  |  | Ind.                | —    | 1.5  | —    | 1.5  |      |
|                  |  |  | typ. <sup>(2)</sup> | 0.8  | 0.5  |      |      |      |
|                  |  |  |                     |      |      |      |      |      |

**Note:**

1. At f = f<sub>MAX</sub>, address and data inputs are cycling at the maximum frequency, f = 0 means no input lines change.
2. Typical values are measured at V<sub>DD</sub> = 3.0V, T<sub>A</sub> = 25°C and not 100% tested.

### AC TEST CONDITIONS (LOW POWER)

| Parameter  | Unit<br>(2.4V-3.6V)   | Unit<br>(1.65V-2.2V)  |
|--|-----------------------|-----------------------|
| Input Pulse Level  | 0.4V to $V_{DD}-0.3V$ | 0.4V to $V_{DD}-0.2V$ |
| Input Rise and Fall Times                                    | 1.5ns                 | 1.5ns                 |
| Input and Output Timing<br>and Reference Level ( $V_{Ref}$ ) | $V_{DD}/2$            | $V_{DD}/2$            |
| Output Load  | See Figures 1 and 2   | See Figures 1 and 2   |

### AC TEST LOADS

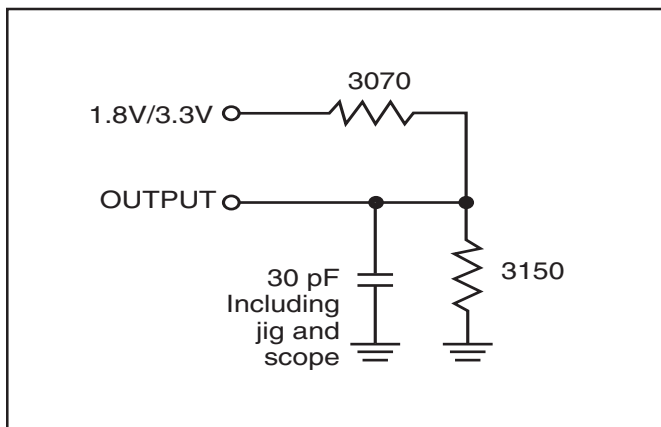


Figure 1

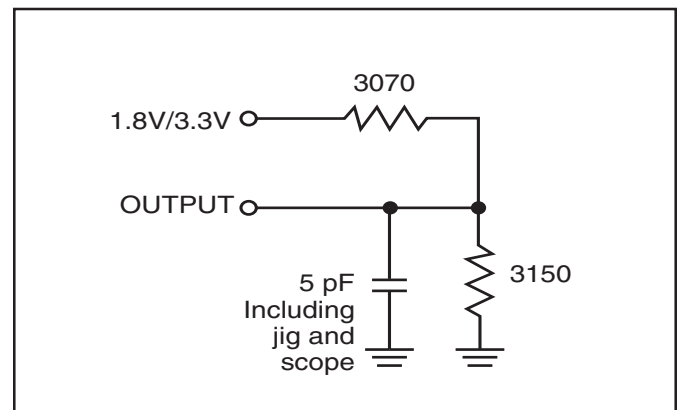


Figure 2

**READ CYCLE SWITCHING CHARACTERISTICS<sup>(1)</sup>** (Over Operating Range)

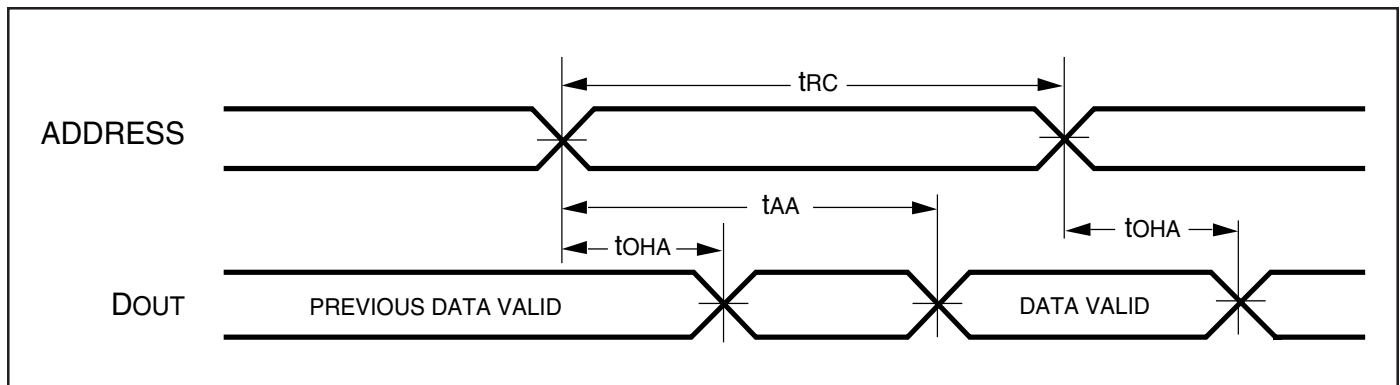
| Symbol   | Parameter                              | 25ns |      | 35ns |      | Unit |
|--|--|------|------|------|------|------|
|  |  | Min. | Max. | Min. | Max. |      |
| t <sub>RC</sub>                                      | Read Cycle Time                        | 25   | —    | 35   | —    | ns   |
| t <sub>AA</sub>                                      | Address Access Time                    | —    | 25   | —    | 35   | ns   |
| t <sub>OHA</sub>                                     | Output Hold Time                       | 4    | —    | 4    | —    | ns   |
| t <sub>ACS1</sub> /t <sub>ACS2</sub>                 | $\overline{CS1}$ /CS2 Access Time      | —    | 25   | —    | 35   | ns   |
| t <sub>DOE</sub>                                     | $\overline{OE}$ Access Time            | —    | 12   | —    | 15   | ns   |
| t <sub>HZOE<sup>(2)</sup></sub>                      | $\overline{OE}$ to High-Z Output       | —    | 8    | —    | 10   | ns   |
| t <sub>LZOE<sup>(2)</sup></sub>                      | $\overline{OE}$ to Low-Z Output        | 5    | —    | 5    | —    | ns   |
| t <sub>HZCS1</sub> /t <sub>HZCS2<sup>(2)</sup></sub> | $\overline{CS1}$ /CS2 to High-Z Output | 0    | 8    | 0    | 10   | ns   |
| t <sub>LZCS1</sub> /t <sub>LZCS2<sup>(2)</sup></sub> | $\overline{CS1}$ /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 0.9V/1.5V, input pulse levels of 0.4 to V<sub>DD</sub>-0.2V/0.4V to V<sub>DD</sub>-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**

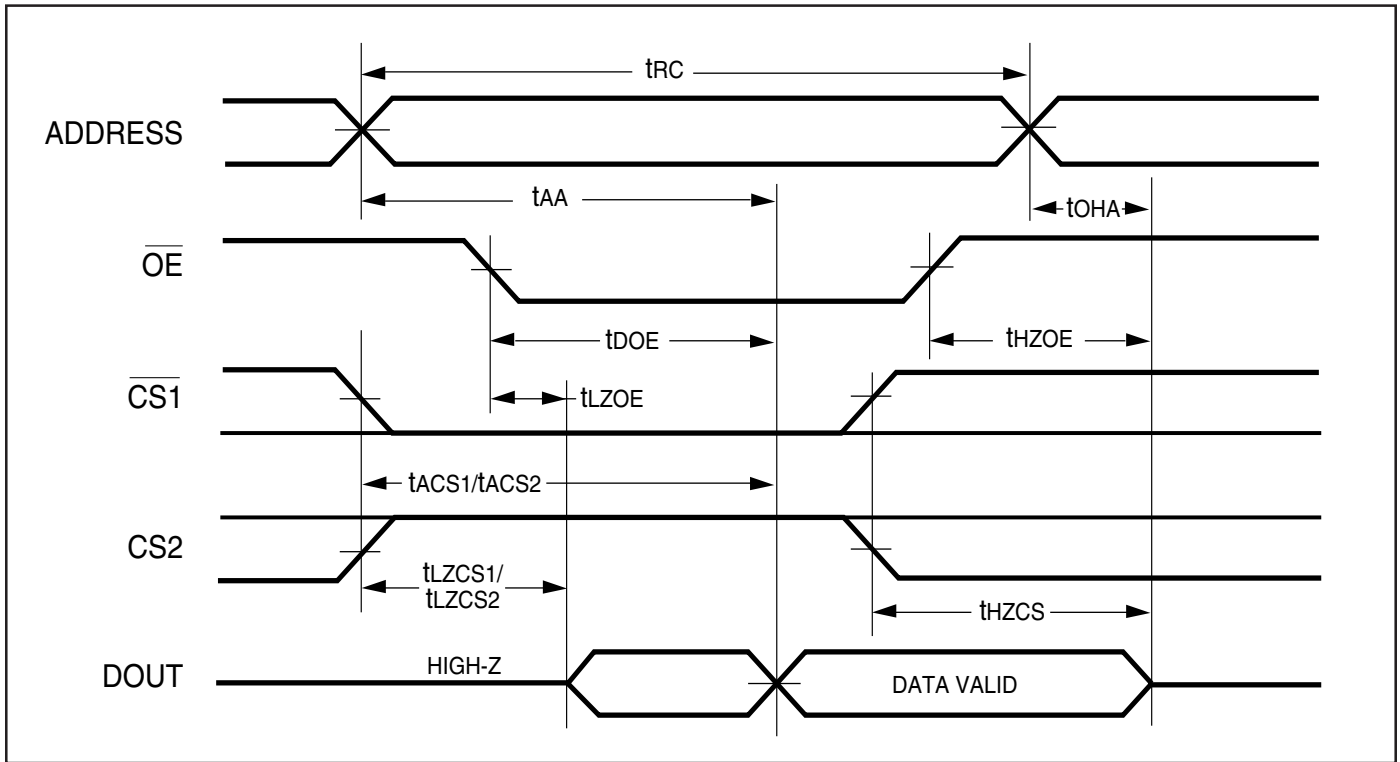
**READ CYCLE NO. 1<sup>(1,2)</sup>** (Address Controlled) ( $\overline{CS1} = \overline{OE} = V_{IL}$ , CS2 =  $\overline{WE} = V_{IH}$ )





AC WAVEFORMS

READ CYCLE NO. 2<sup>(1,3)</sup> ( $\overline{CS1}$ , 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<sup>(1,2)</sup> (Over Operating Range)**

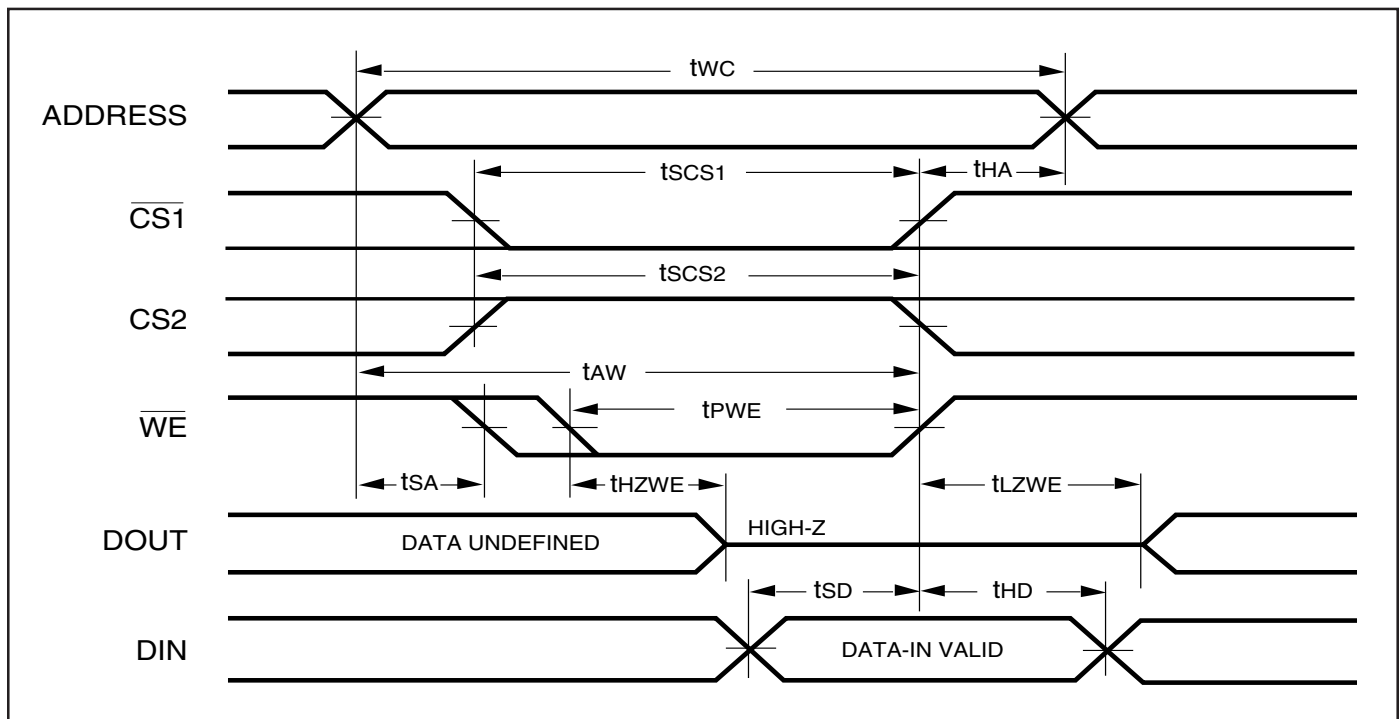
| Symbol                               | Parameter                            | 25 ns |      | 35 ns |      | Unit |
|--------------------------------------|--------------------------------------|-------|------|-------|------|------|
|                                      |                                      | Min.  | Max. | Min.  | Max. |      |
| t <sub>WC</sub>                      | Write Cycle Time                     | 25    | —    | 35    | —    | ns   |
| t <sub>SCS1</sub> /t <sub>SCS2</sub> | $\overline{CS1}$ /CS2 to Write End   | 18    | —    | 25    | —    | ns   |
| t <sub>AW</sub>                      | Address Setup Time to Write End      | 15    | —    | 25    | —    | ns   |
| t <sub>HA</sub>                      | Address Hold from Write End          | 0     | —    | 0     | —    | ns   |
| t <sub>SA</sub>                      | Address Setup Time                   | 0     | —    | 0     | —    | ns   |
| t <sub>PWE</sub> <sup>(4)</sup>      | $\overline{WE}$ Pulse Width          | 18    | —    | 30    | —    | ns   |
| t <sub>SD</sub>                      | Data Setup to Write End              | 12    | —    | 15    | —    | ns   |
| t <sub>HD</sub>                      | Data Hold from Write End             | 0     | —    | 0     | —    | ns   |
| t <sub>HZWE</sub> <sup>(3)</sup>     | $\overline{WE}$ LOW to High-Z Output | —     | 12   | —     | 20   | ns   |
| t <sub>LZWE</sub> <sup>(3)</sup>     | $\overline{WE}$ HIGH to Low-Z Output | 5     | —    | 5     | —    | ns   |

**Notes:**

1. Test conditions assume signal transition times of 5ns or less, timing reference levels of 0.9V/1.5V, input pulse levels of 0.4 to V<sub>DD</sub>-0.2V/0.4V to V<sub>DD</sub>-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  $\overline{UB}$  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 ±500mV from steady-state voltage. Not 100% tested.
4. t<sub>PWE</sub> > t<sub>HZWE</sub> + t<sub>SD</sub> when  $\overline{OE}$  is LOW.

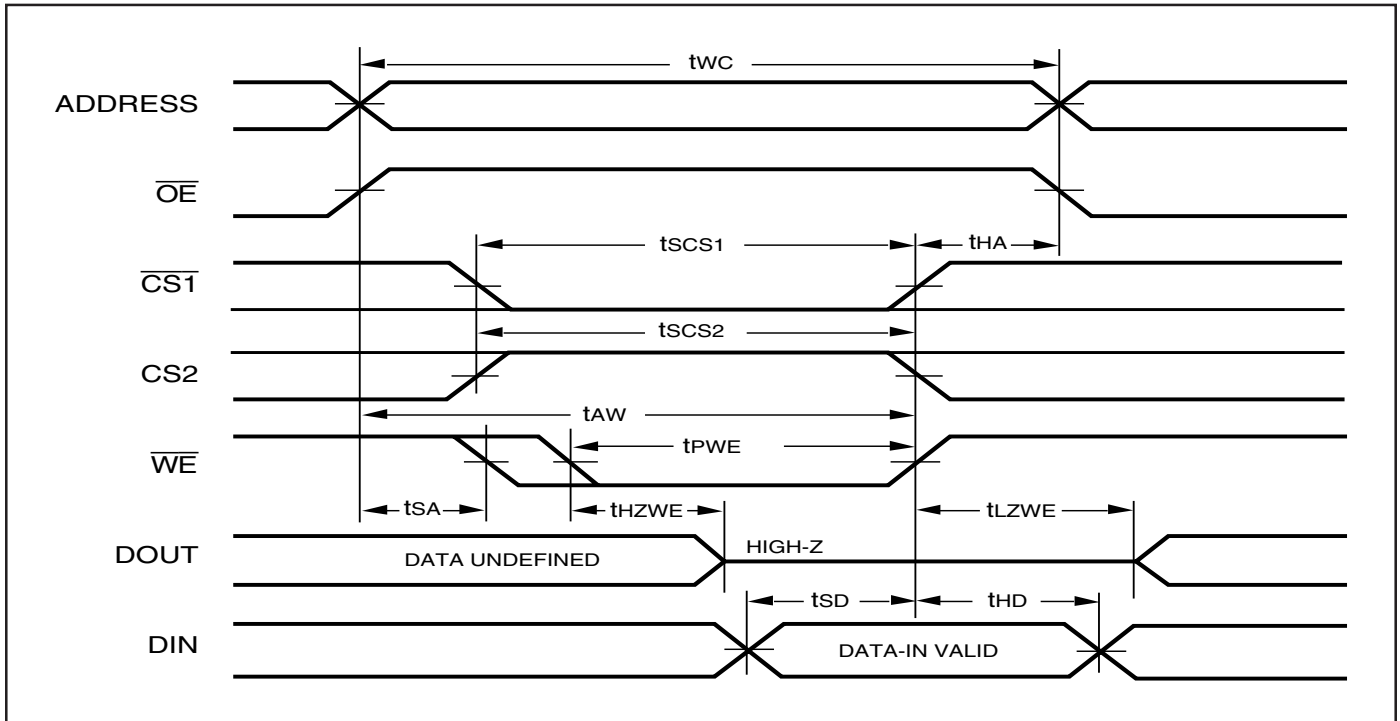
**AC WAVEFORMS**

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

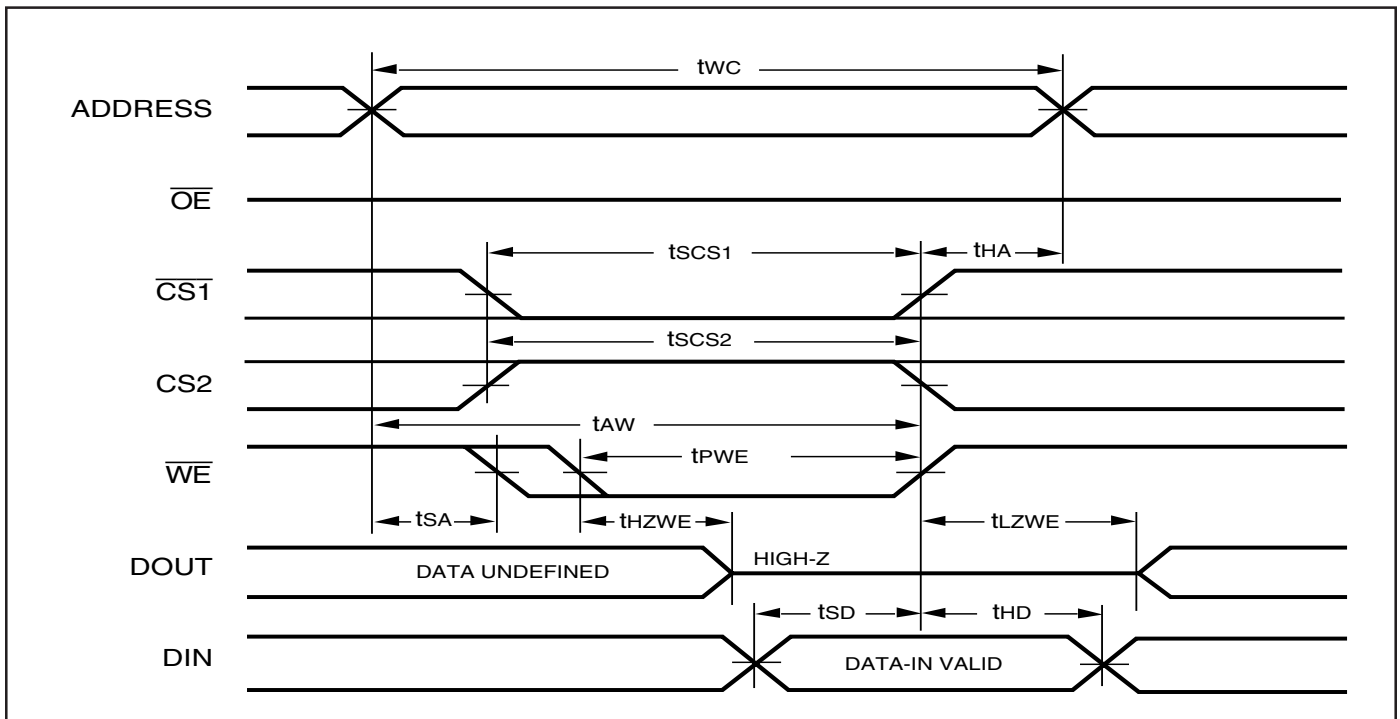


AC WAVEFORMS

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)



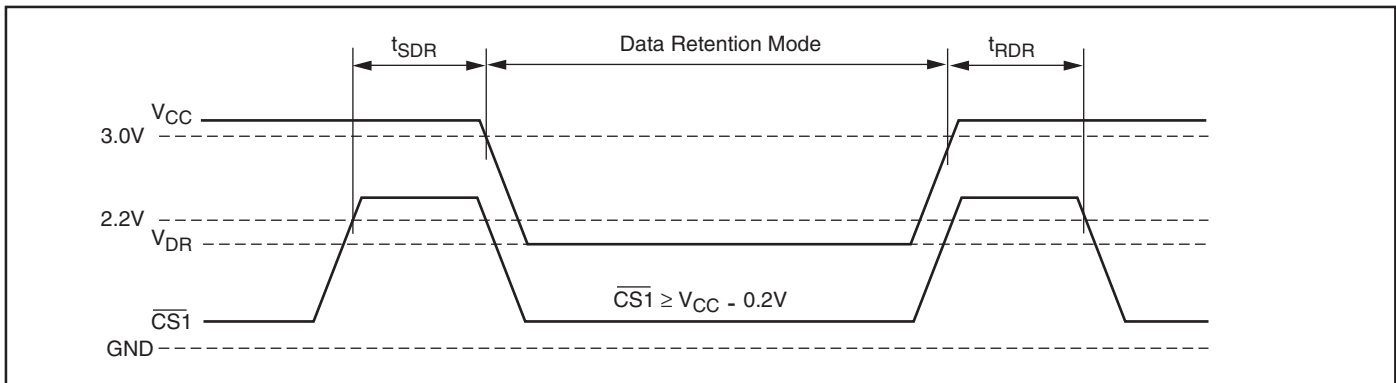
## DATA RETENTION SWITCHING CHARACTERISTICS

| Symbol           | Parameter                          | Test Condition  | Min.            | Typ. <sup>(1)</sup> | Max. | Unit |
|------------------|------------------------------------|---|-----------------|---------------------|------|------|
| V <sub>DR</sub>  | V <sub>CC</sub> for Data Retention | See Data Retention Waveform                                     | 1.2             |                     | 3.6  | V    |
| I <sub>DR</sub>  | Data Retention Current             | V <sub>CC</sub> = 1.2V, $\overline{CS1}/CS2 \geq V_{CC} - 0.2V$ | —               | 0.5                 | 1.5  | mA   |
| t <sub>SDR</sub> | Data Retention Setup Time          | See Data Retention Waveform                                     | 0               |                     | —    | ns   |
| t <sub>RDR</sub> | Recovery Time                      | See Data Retention Waveform                                     | t <sub>RC</sub> |                     | —    | ns   |

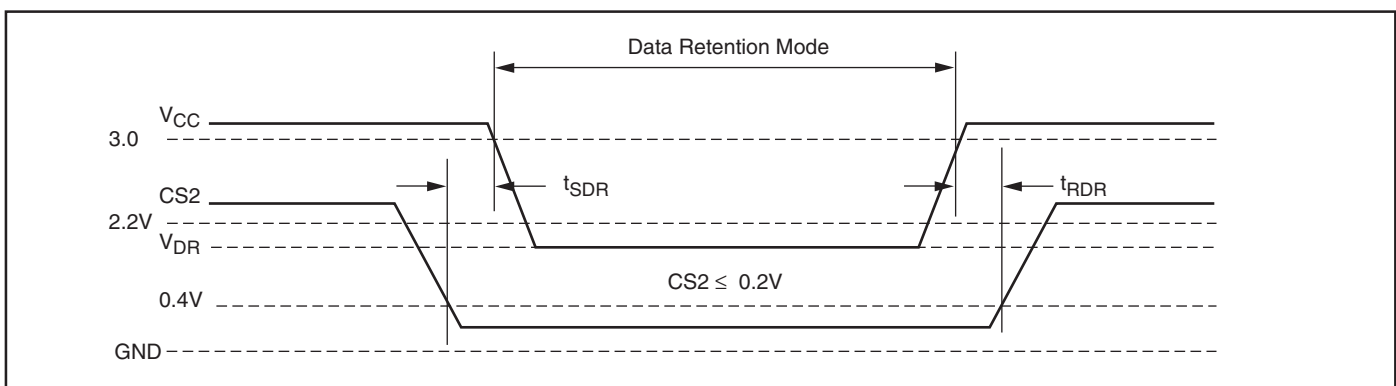
Note:

1. Typical values are measured at V<sub>DD</sub> = 3.0V, T<sub>A</sub> = 25°C and not 100% tested.

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



### DATA RETENTION WAVEFORM (CS2 Controlled)



## ORDERING INFORMATION

**Industrial Range: -40°C to +85°C**

**Voltage Range: 2.4V to 3.6V**

| Speed (ns) | Order Part No.       | Package                             |
|------------|----------------------|-------------------------------------|
| 25         | IS62WV20488BLL-25MI  | 48 mini BGA (9mm x 11mm)            |
|            | IS62WV20488BLL-25MLI | 48 mini BGA (9mm x 11mm), Lead-free |
|            | IS62WV20488BLL-25TI  | TSOP (Type II)                      |
|            | IS62WV20488BLL-25TLI | TSOP (Type II), Lead-free           |

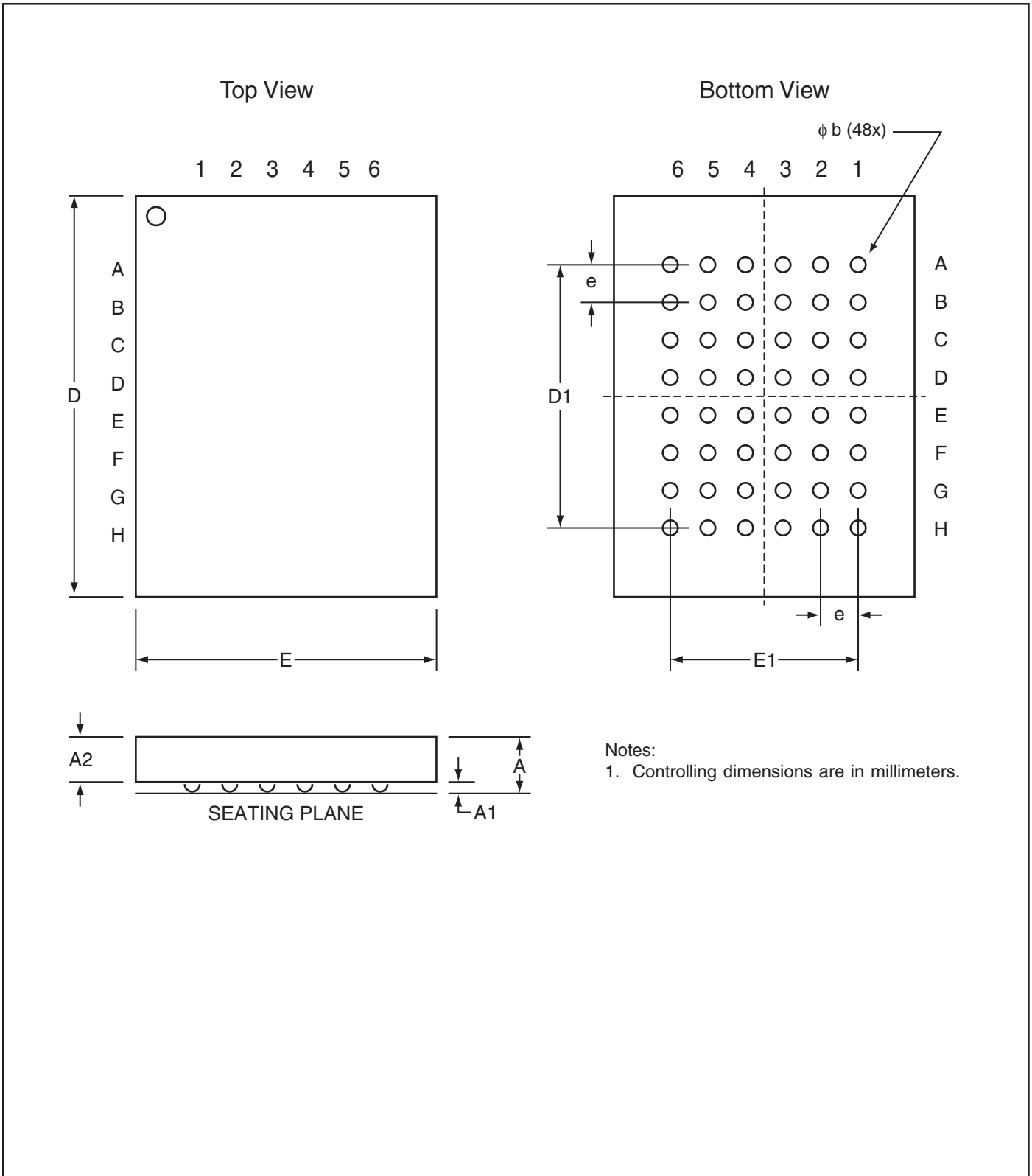
**Industrial Range: -40°C to +85°C**

**Voltage Range: 1.65V to 2.2V**

| Speed (ns) | Order Part No.       | Package                             |
|------------|----------------------|-------------------------------------|
| 35         | IS62WV20488ALL-35MI  | 48 mini BGA (9mm x 11mm)            |
|            | IS62WV20488ALL-35MLI | 48 mini BGA (9mm x 11mm), Lead-free |
|            | IS62WV20488ALL-35TI  | TSOP (Type II)                      |
|            | IS62WV20488ALL-35TLI | TSOP (Type II), Lead-free           |

# PACKAGING INFORMATION

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



Notes:  
 1. Controlling dimensions are in millimeters.



# PACKAGING INFORMATION

## Mini Ball Grid Array

Package Code: M (48-pin)

### mBGA - 6mm x 8mm

|              | MILLIMETERS |      |      | INCHES   |       |       |
|--------------|-------------|------|------|----------|-------|-------|
| Sym.         | Min.        | Typ. | Max. | Min.     | Typ.  | Max.  |
| N0.<br>Leads | 48          |      |      |          |       |       |
| A            | —           | —    | 1.20 | —        | —     | 0.047 |
| A1           | 0.25        | —    | 0.40 | 0.010    | —     | 0.016 |
| A2           | 0.60        | —    | —    | 0.024    | —     | —     |
| D            | 7.90        | 8.00 | 8.10 | 0.311    | 0.314 | 0.319 |
| D1           | 5.60BSC     |      |      | 0.220BSC |       |       |
| E            | 5.90        | 6.00 | 6.10 | 0.232    | 0.236 | 0.240 |
| E1           | 4.00BSC     |      |      | 0.157BSC |       |       |
| e            | 0.80BSC     |      |      | 0.031BSC |       |       |
| b            | 0.40        | 0.45 | 0.50 | 0.016    | 0.018 | 0.020 |

### mBGA - 7.2mm x 8.7mm

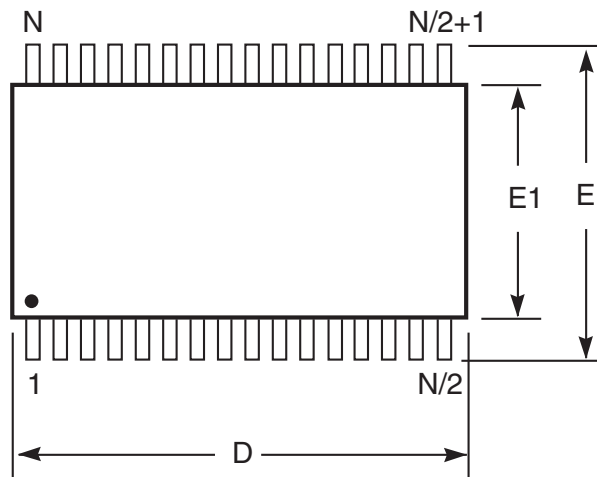
|              | MILLIMETERS |      |      | INCHES   |       |       |
|--------------|-------------|------|------|----------|-------|-------|
| Sym.         | Min.        | Typ. | Max. | Min.     | Typ.  | Max.  |
| N0.<br>Leads | 48          |      |      |          |       |       |
| A            | —           | —    | 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 |

### mBGA - 9mm x 11mm

|              | MILLIMETERS |       |       | INCHES   |       |       |
|--------------|-------------|-------|-------|----------|-------|-------|
| Sym.         | Min.        | Typ.  | Max.  | Min.     | Typ.  | Max.  |
| N0.<br>Leads | 48          |       |       |          |       |       |
| A            | —           | —     | 1.20  | —        | —     | 0.047 |
| A1           | 0.24        | —     | 0.30  | 0.009    | —     | 0.012 |
| A2           | 0.60        | —     | —     | 0.024    | —     | —     |
| D            | 10.90       | 11.00 | 11.10 | 0.429    | 0.433 | 0.437 |
| D1           | 5.25BSC     |       |       | 0.207BSC |       |       |
| E            | 8.90        | 9.00  | 9.10  | 0.350    | 0.354 | 0.358 |
| E1           | 3.75BSC     |       |       | 0.148BSC |       |       |
| e            | 0.75BSC     |       |       | 0.030BSC |       |       |
| b            | 0.30        | 0.35  | 0.40  | 0.012    | 0.014 | 0.016 |

# PACKAGING INFORMATION

Plastic TSOP  
 Package Code: T (Type II)



**Notes:**

1. Controlling dimension: millimeters, unless otherwise specified.
2. BSC = Basic lead spacing between centers.
3. Dimensions D and E1 do not include mold flash protrusions and should be measured from the bottom of the package.
4. Formed leads shall be planar with respect to one another within 0.004 inches at the seating plane.



Plastic TSOP (T - Type II)

| Symbol        | Millimeters |       | Inches    |       | Millimeters |       | Inches    |       | Millimeters |       | Inches    |       |
|---------------|-------------|-------|-----------|-------|-------------|-------|-----------|-------|-------------|-------|-----------|-------|
|               | Min         | Max   | Min       | Max   | Min         | Max   | Min       | Max   | Min         | Max   | Min       | Max   |
| Ref. Std.     |             |       |           |       |             |       |           |       |             |       |           |       |
| No. Leads (N) | 32          |       |           |       | 44          |       |           |       | 50          |       |           |       |
| A             | —           | 1.20  | —         | 0.047 | —           | 1.20  | —         | 0.047 | —           | 1.20  | —         | 0.047 |
| A1            | 0.05        | 0.15  | 0.002     | 0.006 | 0.05        | 0.15  | 0.002     | 0.006 | 0.05        | 0.15  | 0.002     | 0.006 |
| b             | 0.30        | 0.52  | 0.012     | 0.020 | 0.30        | 0.45  | 0.012     | 0.018 | 0.30        | 0.45  | 0.012     | 0.018 |
| C             | 0.12        | 0.21  | 0.005     | 0.008 | 0.12        | 0.21  | 0.005     | 0.008 | 0.12        | 0.21  | 0.005     | 0.008 |
| D             | 20.82       | 21.08 | 0.820     | 0.830 | 18.31       | 18.52 | 0.721     | 0.729 | 20.82       | 21.08 | 0.820     | 0.830 |
| E1            | 10.03       | 10.29 | 0.391     | 0.400 | 10.03       | 10.29 | 0.395     | 0.405 | 10.03       | 10.29 | 0.395     | 0.405 |
| E             | 11.56       | 11.96 | 0.451     | 0.466 | 11.56       | 11.96 | 0.455     | 0.471 | 11.56       | 11.96 | 0.455     | 0.471 |
| e             | 1.27 BSC    |       | 0.050 BSC |       | 0.80 BSC    |       | 0.032 BSC |       | 0.80 BSC    |       | 0.031 BSC |       |
| L             | 0.40        | 0.60  | 0.016     | 0.024 | 0.41        | 0.60  | 0.016     | 0.024 | 0.40        | 0.60  | 0.016     | 0.024 |
| ZD            | 0.95 REF    |       | 0.037 REF |       | 0.81 REF    |       | 0.032 REF |       | 0.88 REF    |       | 0.035 REF |       |
| α             | 0°          | 5°    | 0°        | 5°    | 0°          | 5°    | 0°        | 5°    | 0°          | 5°    | 0°        | 5°    |

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