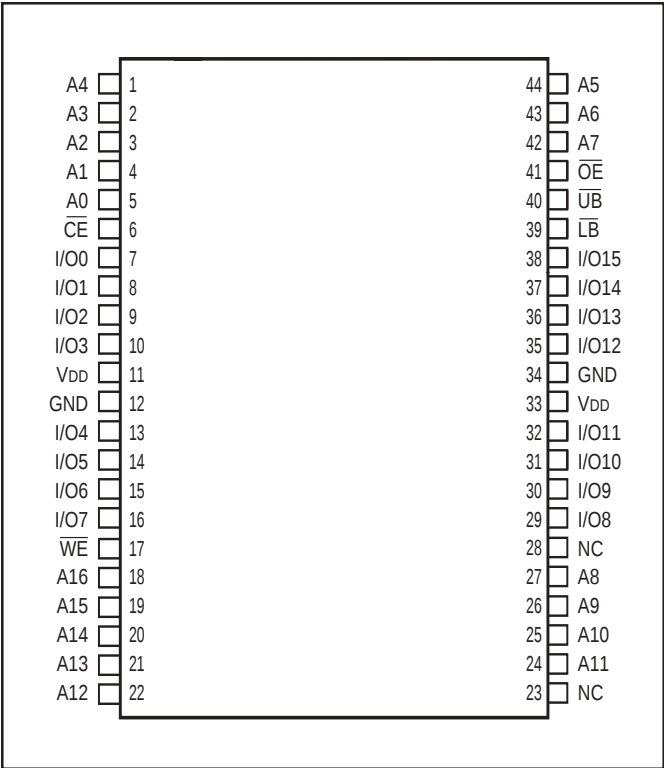


TRUTH TABLE

| Mode            | I/O PIN         |                 |                 |                 |                 |           |            |                                     |
|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------|------------|-------------------------------------|
|                 | $\overline{WE}$ | $\overline{CE}$ | $\overline{OE}$ | $\overline{LB}$ | $\overline{UB}$ | I/O0-I/O7 | I/O8-I/O15 | V <sub>DD</sub> Current             |
| Not Selected    | X               | H               | X               | X               | X               | High-Z    | High-Z     | I <sub>SB1</sub> , I <sub>SB2</sub> |
| Output Disabled | H               | L               | H               | X               | X               | High-Z    | High-Z     | I <sub>CC</sub>                     |
|                 | X               | L               | X               | H               | H               | High-Z    | High-Z     |                                     |
| Read            | H               | L               | L               | L               | H               | DOUT      | High-Z     | I <sub>CC</sub>                     |
|                 | H               | L               | L               | H               | L               | High-Z    | DOUT       |                                     |
|                 | H               | L               | L               | L               | L               | DOUT      | DOUT       |                                     |
| Write           | L               | L               | X               | L               | H               | DIN       | High-Z     | I <sub>CC</sub>                     |
|                 | L               | L               | X               | H               | L               | High-Z    | DIN        |                                     |
|                 | L               | L               | X               | L               | L               | DIN       | DIN        |                                     |

PIN CONFIGURATION  
44-Pin TSOP (Type II) (T)

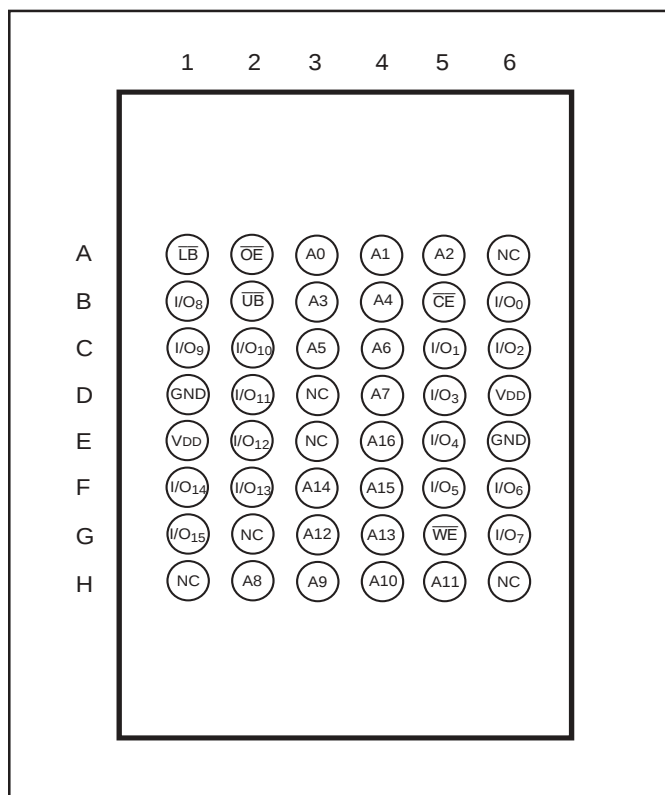


PIN DESCRIPTIONS

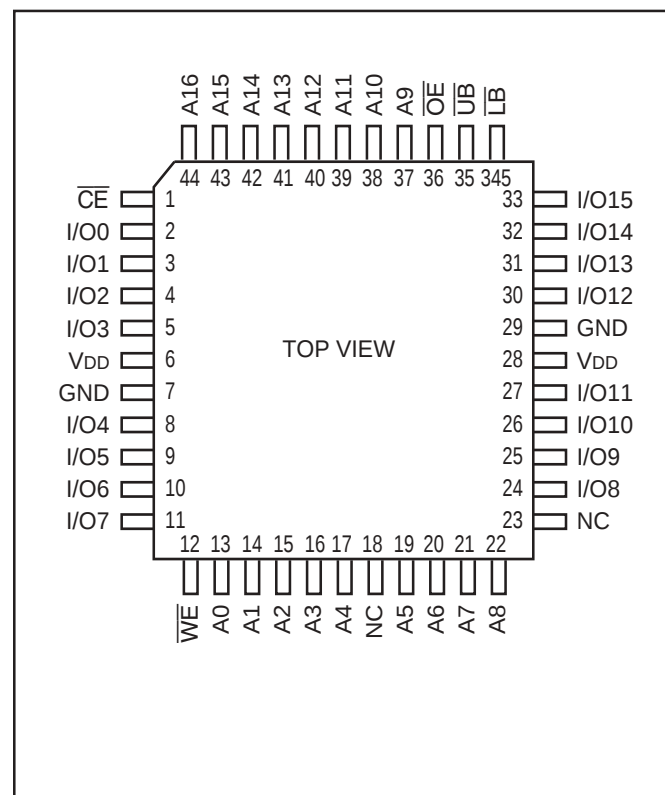
|                 |                                 |
|-----------------|---------------------------------|
| A0-A16          | Address Inputs                  |
| I/O0-I/O15      | Data Inputs/Outputs             |
| $\overline{CE}$ | Chip Enable Input               |
| $\overline{OE}$ | Output Enable 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                   |
| V <sub>DD</sub> | Power                           |
| GND             | Ground                          |

## PIN CONFIGURATION

## 48-Pin mini BGA (B)



## 44-Pin LQFP (LQ)



## PIN DESCRIPTIONS

|                 |                                 |
|-----------------|---------------------------------|
| A0-A16          | 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                   |
| VDD             | Power                           |
| GND             | Ground                          |

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

| Symbol            | Parameter                            | Value                         | Unit |
|-------------------|--------------------------------------|-------------------------------|------|
| V <sub>DD</sub>   | Power Supply Voltage Relative to GND | −0.5 to 4.0V                  | V    |
| V <sub>TERM</sub> | Terminal Voltage with Respect to GND | −0.5 to V <sub>DD</sub> + 0.5 | V    |
| T <sub>STG</sub>  | Storage Temperature                  | −65 to + 150                  | °C   |
| P <sub>T</sub>    | 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**

| Range      | Ambient Temperature | V <sub>DD</sub> (8 ns) | V <sub>DD</sub> (10 ns) |
|------------|---------------------|------------------------|-------------------------|
| Commercial | 0°C to +70°C        | 3.3V + 10%, -5%        | 3.3V ± 10%              |
| Industrial | −40°C to +85°C      | 3.3V + 10%, -5%        | 3.3V ± 10%              |

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

| Symbol          | Parameter                         | Test Conditions                                             | Min. | Max.                  | Unit |
|-----------------|-----------------------------------|-------------------------------------------------------------|------|-----------------------|------|
| V <sub>OH</sub> | Output HIGH Voltage               | V <sub>DD</sub> = Min., I <sub>OH</sub> = −4.0 mA           | 2.4  | —                     | V    |
| V <sub>OL</sub> | Output LOW Voltage                | V <sub>DD</sub> = Min., I <sub>OL</sub> = 8.0 mA            | —    | 0.4                   | V    |
| V <sub>IH</sub> | Input HIGH Voltage <sup>(1)</sup> |                                                             | 2    | 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.) = −0.3V DC; 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> + 0.3V DC; 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                                                                                                                                     |                     | -8 ns |      | -10 ns |      | Unit |
|------------------|------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|-------|------|--------|------|------|
|                  |                                          |                                                                                                                                                     |                     | Min.  | Max. | Min.   | Max. |      |
| I <sub>CC</sub>  | V <sub>DD</sub> Operating Supply Current | V <sub>DD</sub> = Max., $\overline{CE}$ = V <sub>IL</sub><br>I <sub>OUT</sub> = 0 mA, f = Max.                                                      | Com.                | —     | 65   | —      | 60   | mA   |
|                  |                                          |                                                                                                                                                     | Ind.                | —     | 70   | —      | 65   |      |
|                  |                                          |                                                                                                                                                     | typ. <sup>(2)</sup> | —     | 50   | —      | 50   |      |
| 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>$\overline{CE} \geq V_{IH}$ , f = max                            | Com.                | —     | 30   | —      | 25   | mA   |
|                  |                                          |                                                                                                                                                     | Ind.                | —     | 35   | —      | 30   |      |
| I <sub>SB2</sub> | CMOS Standby Current (CMOS Inputs)       | V <sub>DD</sub> = Max.,<br>$\overline{CE} \geq V_{DD} - 0.2V$ ,<br>V <sub>IN</sub> $\geq V_{DD} - 0.2V$ , or<br>V <sub>IN</sub> $\leq 0.2V$ , f = 0 | Com.                | —     | 3    | —      | 3    | mA   |
|                  |                                          |                                                                                                                                                     | Ind.                | —     | 4    | —      | 4    | mA   |
|                  |                                          |                                                                                                                                                     | typ. <sup>(2)</sup> | —     | 700  | —      | 700  | μA   |

**Note:**

- At f = f<sub>MAX</sub>, address and data inputs are cycling at the maximum frequency, f = 0 means no input lines change.
- Typical values are measured at V<sub>DD</sub>=3.3V, T<sub>A</sub>=25°C. Not 100% tested.

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

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

**Note:**

- Tested initially and after any design or process changes that may affect these parameters.

## AC TEST CONDITIONS

| Parameter                                   | Unit                |
|---------------------------------------------|---------------------|
| Input Pulse Level                           | 0V to 3.0V          |
| Input Rise and Fall Times                   | 3 ns                |
| Input and Output Timing and Reference Level | 1.5V                |
| Output Load                                 | See Figures 1 and 2 |

## AC TEST LOADS

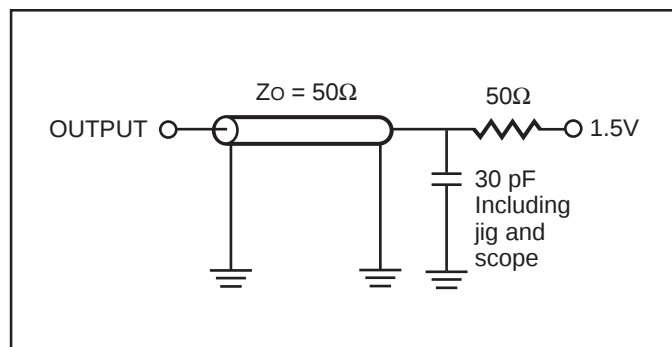


Figure 1.

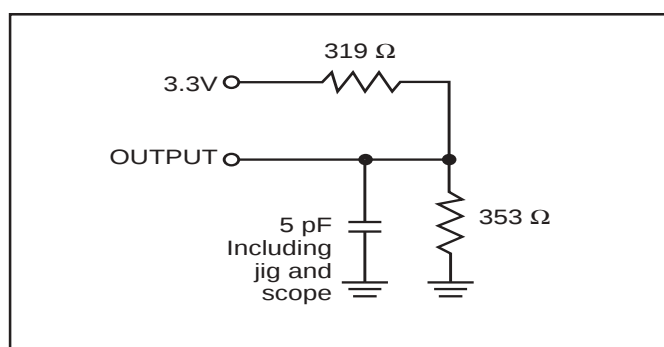


Figure 2.

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

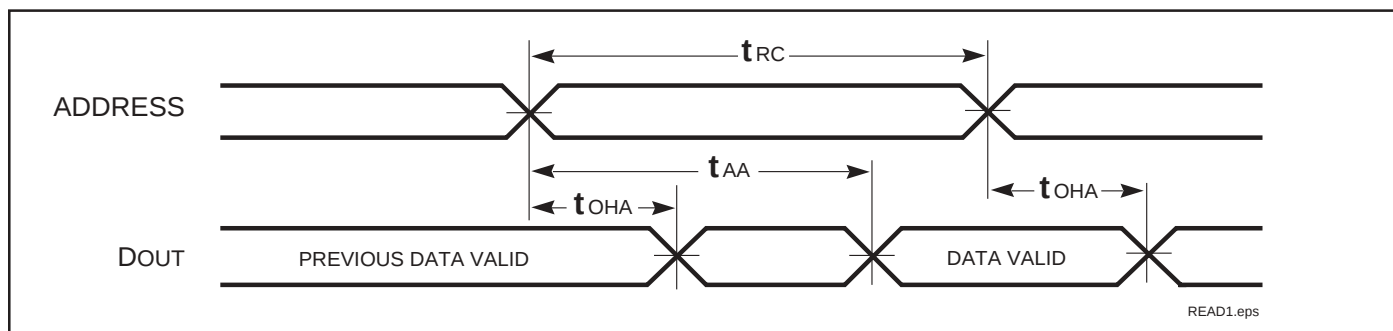
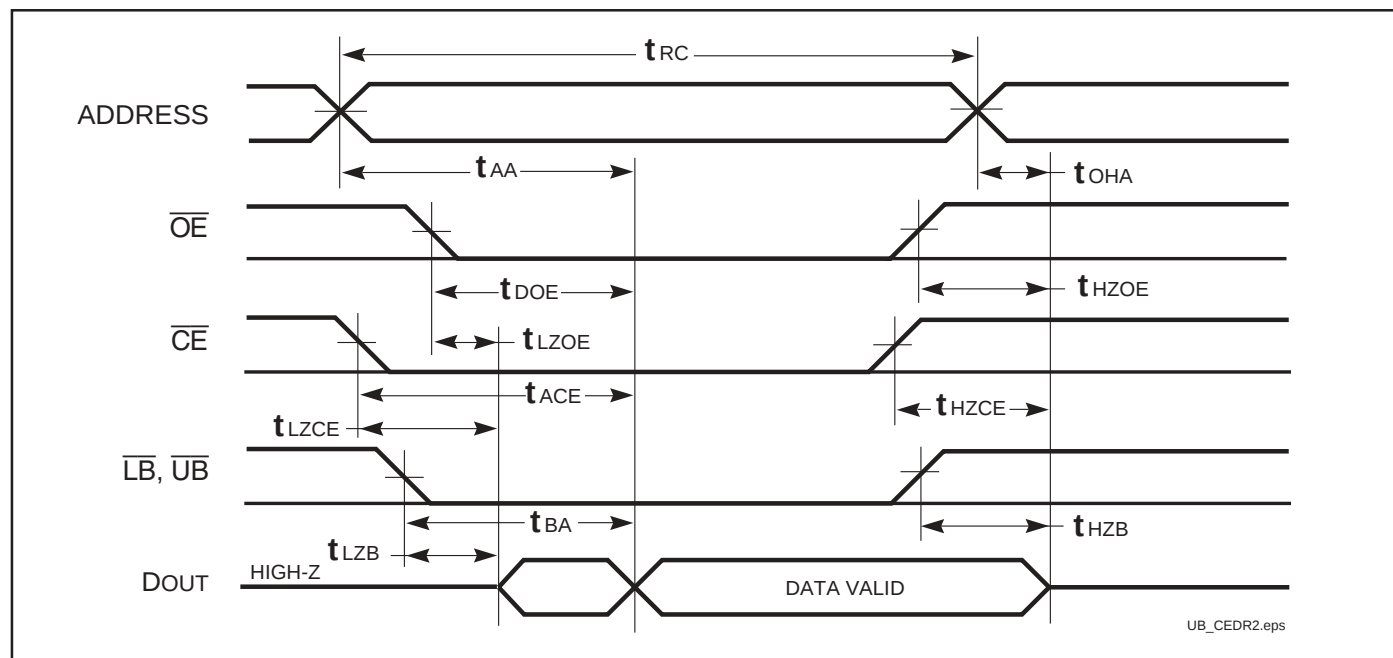
| Symbol                           | Parameter                                                     | -8 ns |      | -10 ns |      | Unit |
|----------------------------------|---------------------------------------------------------------|-------|------|--------|------|------|
|                                  |                                                               | Min.  | Max. | Min.   | Max. |      |
| t <sub>RC</sub>                  | Read Cycle Time                                               | 8     | —    | 10     | —    | ns   |
| t <sub>AA</sub>                  | Address Access Time                                           | —     | 8    | —      | 10   | ns   |
| t <sub>OHA</sub>                 | Output Hold Time                                              | 3     | —    | 3      | —    | ns   |
| t <sub>ACE</sub>                 | $\overline{\text{OE}}$ Access Time                            | —     | 8    | —      | 10   | ns   |
| t <sub>DOE</sub>                 | $\overline{\text{OE}}$ Access Time                            | —     | 3.5  | —      | 4    | ns   |
| t <sub>HZOE</sub> <sup>(2)</sup> | $\overline{\text{OE}}$ to High-Z Output                       | —     | 3.5  | —      | 4    | ns   |
| t <sub>LZOE</sub> <sup>(2)</sup> | $\overline{\text{OE}}$ to Low-Z Output                        | 0     | —    | 0      | —    | ns   |
| t <sub>HZCE</sub> <sup>(2)</sup> | $\overline{\text{CE}}$ to High-Z Output                       | 0     | 3.5  | 0      | 4    | ns   |
| t <sub>LZCE</sub> <sup>(2)</sup> | $\overline{\text{CE}}$ to Low-Z Output                        | 3.5   | —    | 3      | —    | ns   |
| t <sub>BA</sub>                  | $\overline{\text{LB}}, \overline{\text{UB}}$ Access Time      | —     | 3.5  | —      | 4    | ns   |
| t <sub>HZB</sub> <sup>(2)</sup>  | $\overline{\text{LB}}, \overline{\text{UB}}$ to High-Z Output | 0     | 3.5  | 0      | 4    | ns   |
| t <sub>LZB</sub> <sup>(2)</sup>  | $\overline{\text{LB}}, \overline{\text{UB}}$ to Low-Z Output  | 0     | —    | 0      | —    | ns   |

## Notes:

- Test conditions assume signal transition times of 3 ns or less, timing reference levels of 1.5V, input pulse levels of 0V to 3.0V and output loading specified in Figure 1.
- Tested with the load in Figure 2. Transition is measured  $\pm 500$  mV from steady-state voltage. Not 100% tested.

## AC WAVEFORMS

READ CYCLE NO. 1<sup>(1,2)</sup> (Address Controlled) ( $\overline{CE} = \overline{OE} = V_{IL}$ ,  $\overline{UB}$  or  $\overline{LB} = V_{IL}$ )

READ CYCLE NO. 2<sup>(1,3)</sup>

## Notes:

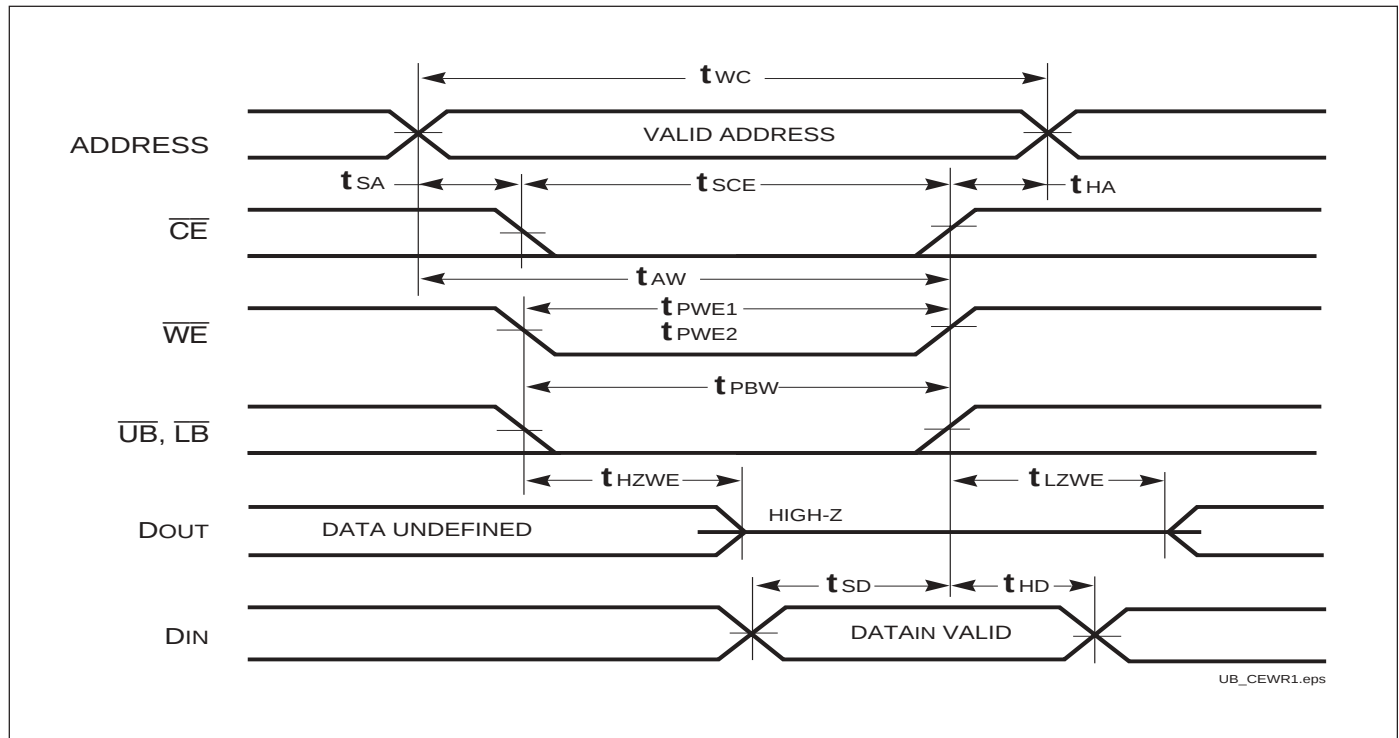
1.  $\overline{WE}$  is HIGH for a Read Cycle.
2. The device is continuously selected.  $\overline{OE}$ ,  $\overline{CE}$ ,  $\overline{UB}$ , or  $\overline{LB} = V_{IL}$ .
3. Address is valid prior to or coincident with  $\overline{CE}$  LOW transition.

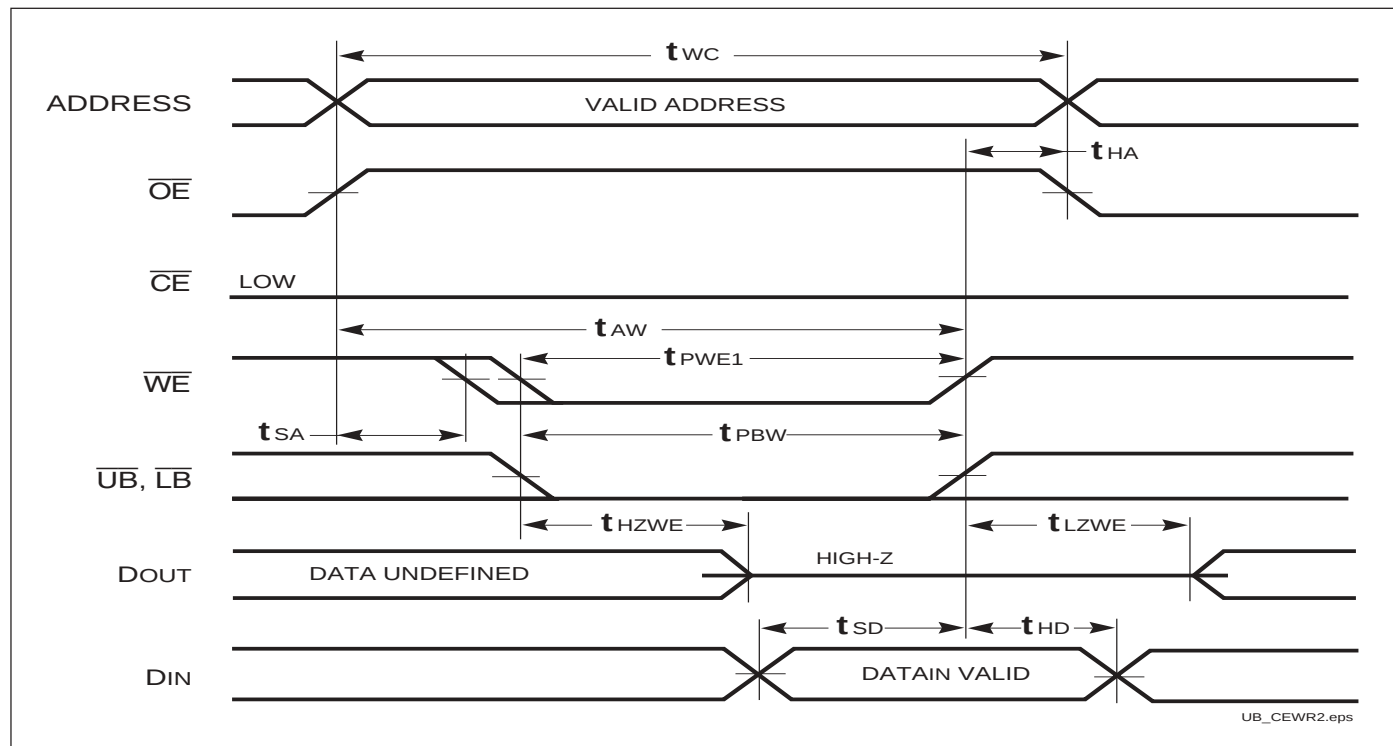
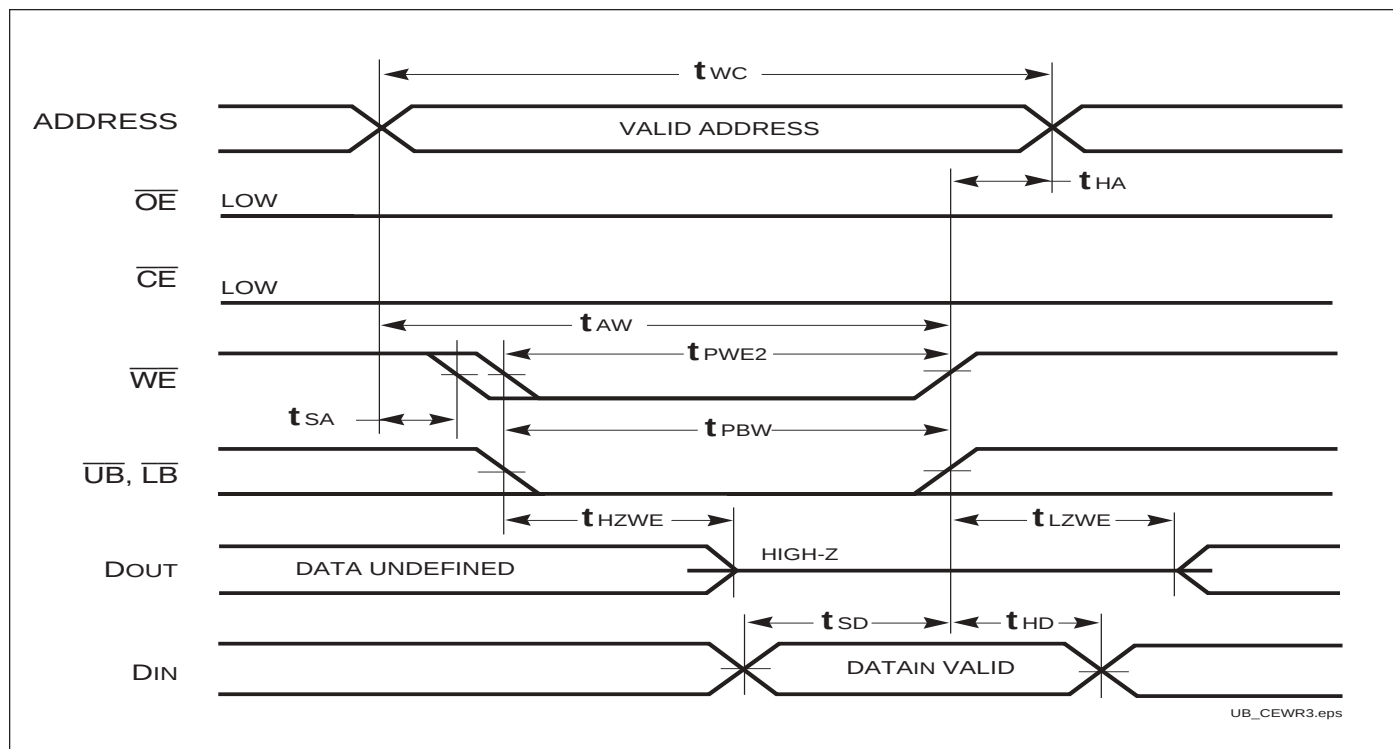
**WRITE CYCLE SWITCHING CHARACTERISTICS<sup>(1,3)</sup>** (Over Operating Range)

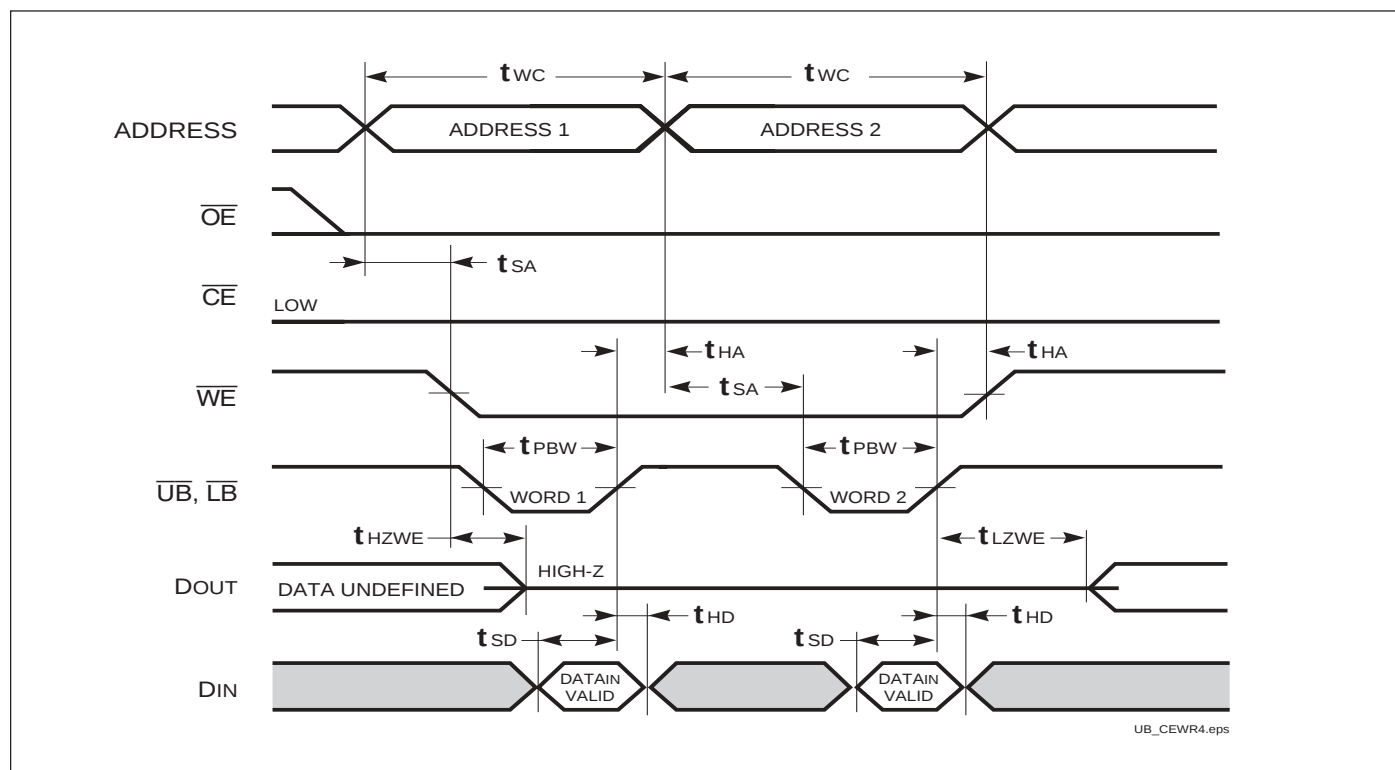
| Symbol                           | Parameter                                               | -8 ns |     | -10 ns |      | Unit |
|----------------------------------|---------------------------------------------------------|-------|-----|--------|------|------|
|                                  |                                                         | Min.  | Max | Min.   | Max. |      |
| t <sub>WC</sub>                  | Write Cycle Time                                        | 8     | —   | 10     | —    | ns   |
| t <sub>SCE</sub>                 | $\overline{CE}$ to Write End                            | 7     | —   | 8      | —    | ns   |
| t <sub>AW</sub>                  | Address Setup Time to Write End                         | 7     | —   | 8      | —    | 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>PBW</sub>                 | $\overline{LB}$ , $\overline{UB}$ Valid to End of Write | 6.5   | —   | 8      | —    | ns   |
| t <sub>PWE1</sub>                | $\overline{WE}$ Pulse Width ( $\overline{OE}$ = HIGH)   | 6     | —   | 7      | —    | ns   |
| t <sub>PWE2</sub>                | $\overline{WE}$ Pulse Width ( $\overline{OE}$ = LOW)    | 6.5   | —   | 8      | —    | ns   |
| t <sub>SD</sub>                  | Data Setup to Write End                                 | 4     | —   | 5      | —    | 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                    | —     | 3   | —      | 4    | ns   |
| t <sub>LZWE</sub> <sup>(3)</sup> | $\overline{WE}$ HIGH to Low-Z Output                    | 0     | —   | 0      | —    | ns   |

**Notes:**

1. Test conditions assume signal transition times of 3 ns or less, timing reference levels of 1.5V, input pulse levels of 0V to 3.0V 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  $\pm 500$  mV from steady-state voltage. Not 100% tested.

**WRITE CYCLE NO. 1<sup>(1,2)</sup>** ( $\overline{\text{CE}}$  Controlled,  $\overline{\text{OE}}$  = HIGH or LOW)

**WRITE CYCLE NO. 2<sup>(1)</sup>** ( $\overline{WE}$  Controlled,  $\overline{OE}$  = HIGH during Write Cycle)**WRITE CYCLE NO. 3** ( $\overline{WE}$  Controlled:  $\overline{OE}$  is LOW During Write Cycle)

WRITE CYCLE NO. 4 ( $\overline{\text{LB}}$ ,  $\overline{\text{UB}}$  Controlled, Back-to-Back Write) <sup>(1,3)</sup>

## Notes:

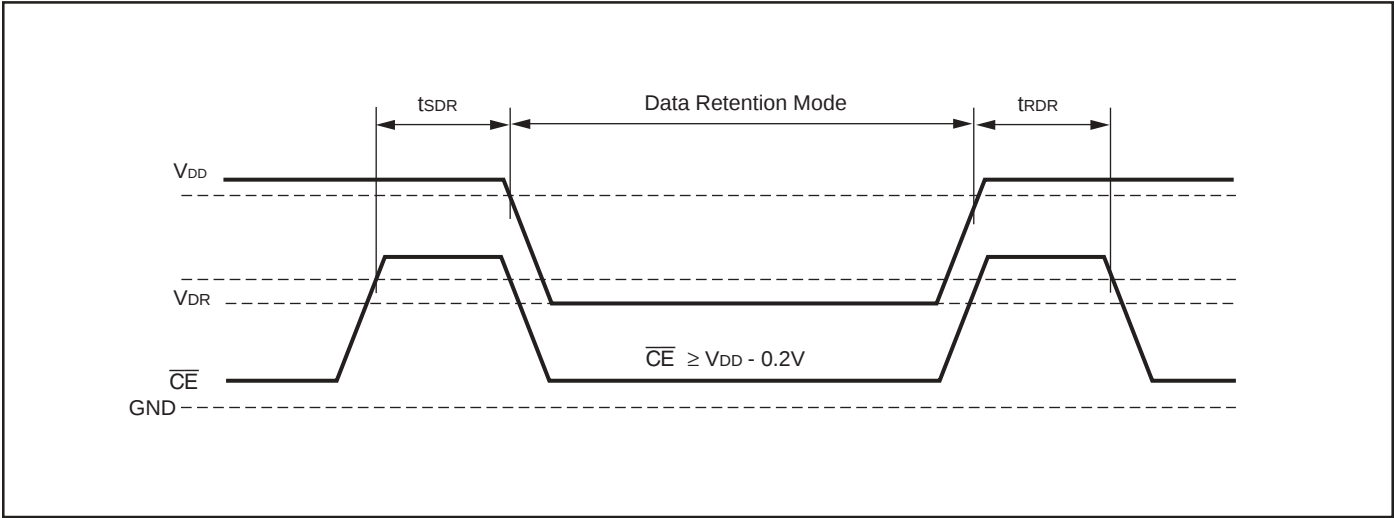
1. The internal Write time is defined by the overlap of  $\overline{\text{CE}} = \text{LOW}$ ,  $\overline{\text{UB}}$  and/or  $\overline{\text{LB}} = \text{LOW}$ , and  $\overline{\text{WE}} = \text{LOW}$ . All signals must be in valid states to initiate a Write, but any can be deasserted to terminate the Write. The  $t_{\text{SA}}$ ,  $t_{\text{HA}}$ ,  $t_{\text{SD}}$ , and  $t_{\text{HD}}$  timing is referenced to the rising or falling edge of the signal that terminates the Write.
2. Tested with OE HIGH for a minimum of 4 ns before  $\overline{\text{WE}} = \text{LOW}$  to place the I/O in a HIGH-Z state.
3. WE may be held LOW across many address cycles and the  $\overline{\text{LB}}$ ,  $\overline{\text{UB}}$  pins can be used to control the Write function.

DATA RETENTION SWITCHING CHARACTERISTICS

| Symbol           | Parameter                          | Test Condition                                             | Options      | Min.            | Typ. <sup>(1)</sup> | Max.   | Unit |
|------------------|------------------------------------|------------------------------------------------------------|--------------|-----------------|---------------------|--------|------|
| V <sub>DR</sub>  | V <sub>DD</sub> for Data Retention | See Data Retention Waveform                                |              | 2.0             | —                   | 3.6    | V    |
| I <sub>DR</sub>  | Data Retention Current             | V <sub>DD</sub> = 2.0V, $\overline{CE} \geq V_{DD} - 0.2V$ | Com.<br>Ind. | —<br>—          | 0.7<br>—            | 3<br>4 | 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> = 3.3V, T<sub>A</sub> = 25°C. Not 100% tested.

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



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

| Speed (ns) | Order Part No.    | Package                           |
|------------|-------------------|-----------------------------------|
| 8          | IS61LV12816L-8T   | Plastic TSOP (Type II)            |
|            | IS61LV12816L-8TL  | Plastic TSOP (Type II), Lead-free |
| 10         | IS61LV12816L-10T  | Plastic TSOP (Type II)            |
|            | IS61LV12816L-10TL | Plastic TSOP (Type II), Lead-free |

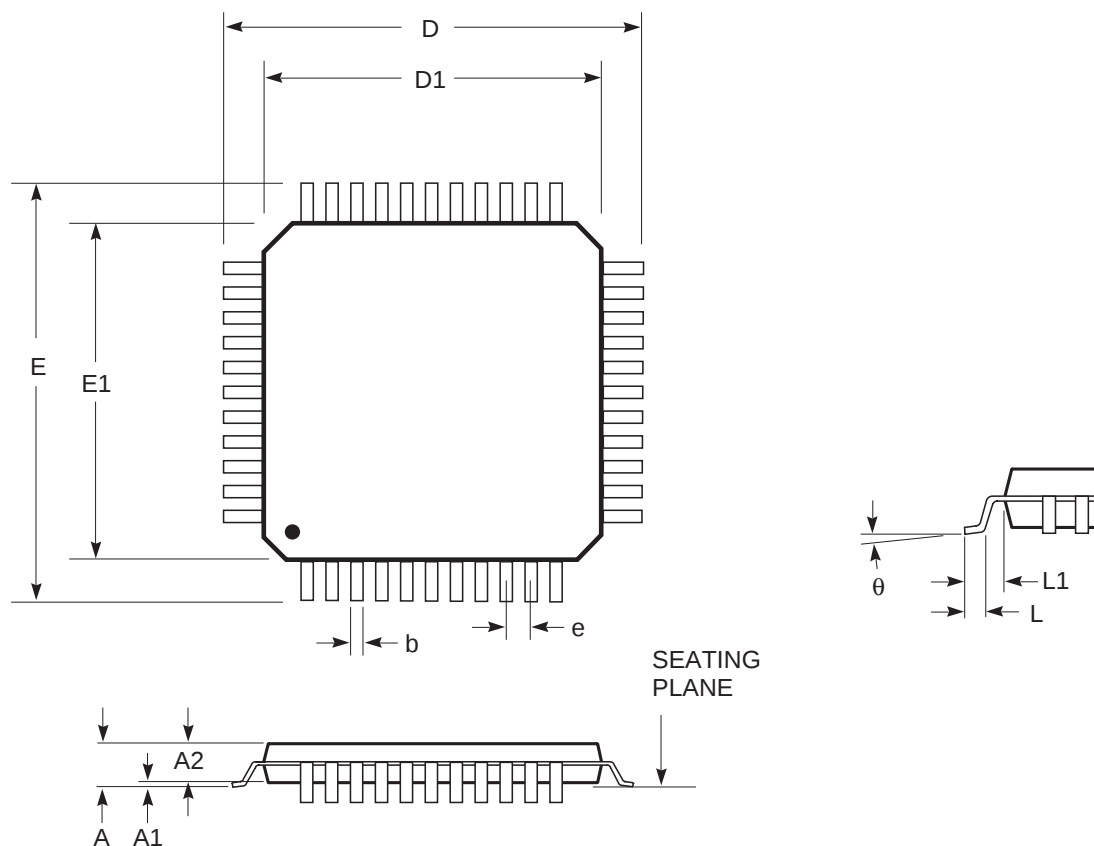
**Industrial Range: -40°C to +85°C**

| Speed (ns) | Order Part No.      | Package                           |
|------------|---------------------|-----------------------------------|
| 8          | IS61LV12816L-8BI    | mini BGA (6mm x 8mm)              |
|            | IS61LV12816L-8TI    | Plastic TSOP (Type II)            |
| 10         | IS61LV12816L-10BI   | mini BGA (6mm x 8mm)              |
|            | IS61LV12816L-10BLI  | mini BGA (6mm x 8mm), Lead-free   |
|            | IS61LV12816L-10LQI  | LQFP                              |
|            | IS61LV12816L-10LQLI | LQFP, Lead-free                   |
|            | IS61LV12816L-10TI   | Plastic TSOP (Type II)            |
|            | IS61LV12816L-10TLI  | Plastic TSOP (Type II), Lead-free |

## PACKAGING INFORMATION

## LQFP (Low Profile Quad Flat Pack)

Package Code: LQ (44-pin)



| Low Profile Quad Flat Pack (LQ) |             |      |            |       |
|---------------------------------|-------------|------|------------|-------|
| Ref. Std.                       | MS-026      |      |            |       |
| No. Leads                       | 44          |      |            |       |
| Symbol                          | Millimeters |      | Inches     |       |
|                                 | Min         | Max  | Min        | Max   |
| A                               | —           | 1.60 | —          | 0.063 |
| A1                              | 0.05        | 0.15 | 0.002      | 0.006 |
| A2                              | 1.35        | 1.45 | 0.053      | 0.057 |
| b                               | 0.30        | 0.45 | 0.012      | 0.018 |
| C                               | 0.09        | 0.20 | 0.004      | 0.008 |
| D                               | 12.00 BSC   |      | 0.472 BSC  |       |
| D1                              | 10.00 BSC   |      | 0.394 BSC  |       |
| E                               | 12.00 BSC   |      | 0.472 BSC  |       |
| E1                              | 10.00 BSC   |      | 0.394 BSC  |       |
| e                               | 0.80 BSC    |      | 0.031 BSC  |       |
| L                               | 0.45        | 0.75 | 0.018      | 0.030 |
| L1                              | 1.00 REF.   |      | 0.039 REF. |       |
| θ                               | 0°          | 7°   | 0°         | 7°    |

## Notes:

1. All dimensioning and tolerancing conforms to ANSI Y14.5M-1982.
2. Dimensions D1 and E1 do not include mold protrusions. Allowable protrusion is 0.25 mm per side. D1 and E1 include mold mismatch.
3. Controlling dimension: millimeters.

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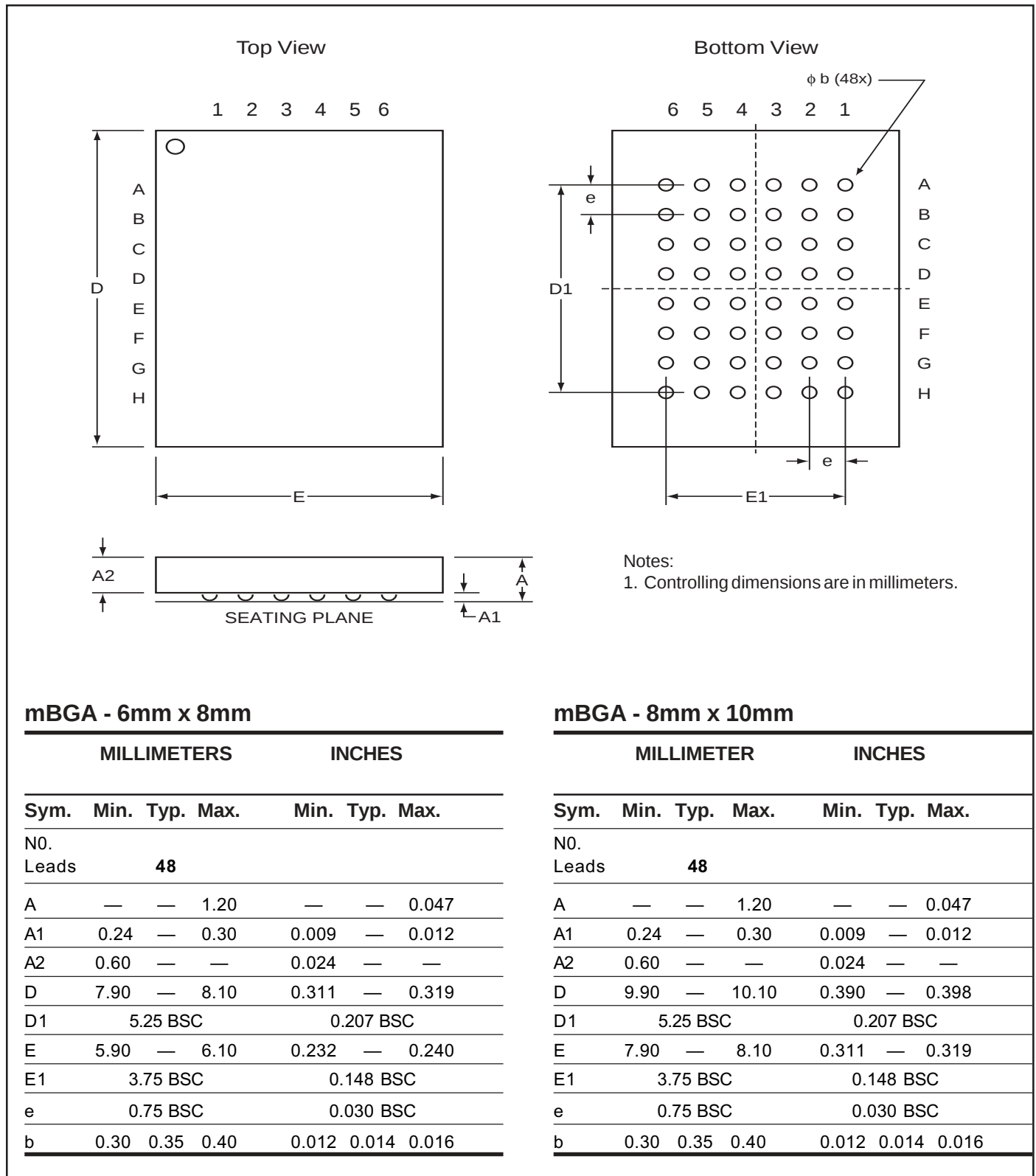
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Rev. B  
05/30/03

# PACKAGING INFORMATION



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



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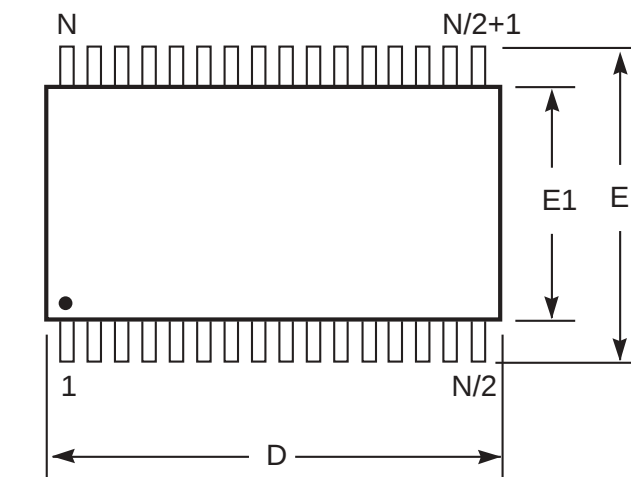
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Rev. D  
01/15/03

# PACKAGING INFORMATION

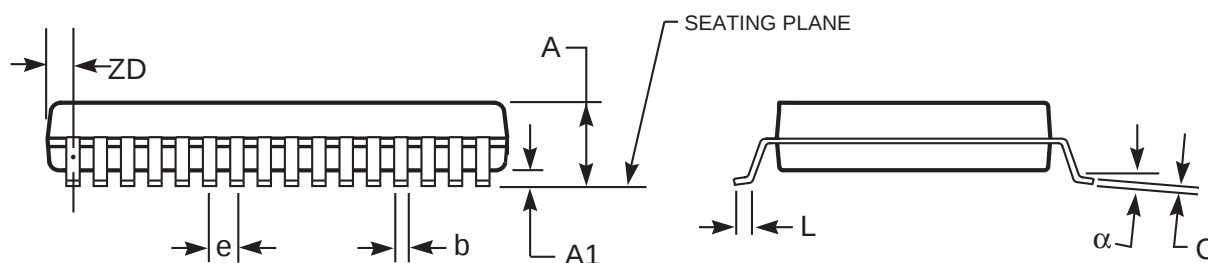
## Plastic TSOP

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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