

# IS61WV12824

## 128K x 24 HIGH-SPEED CMOS STATIC RAM WITH 3.3V SUPPLY

AUGUST 2017

### FEATURES

- High-speed access time: 8, 10 ns
- High-performance, low-power CMOS process
- TTL compatible interface levels
- Single power supply  
VDD 3.3V  $\pm$  5% for 8ns  
VDD 2.4V to 3.6V for 10ns
- Fully static operation: no clock or refresh required
- Three state outputs
- Available in 119-pin Ball Grid Array (BGA) and 100-pin QFP packages.
- Industrial temperature available
- Lead-free available

### DESCRIPTION

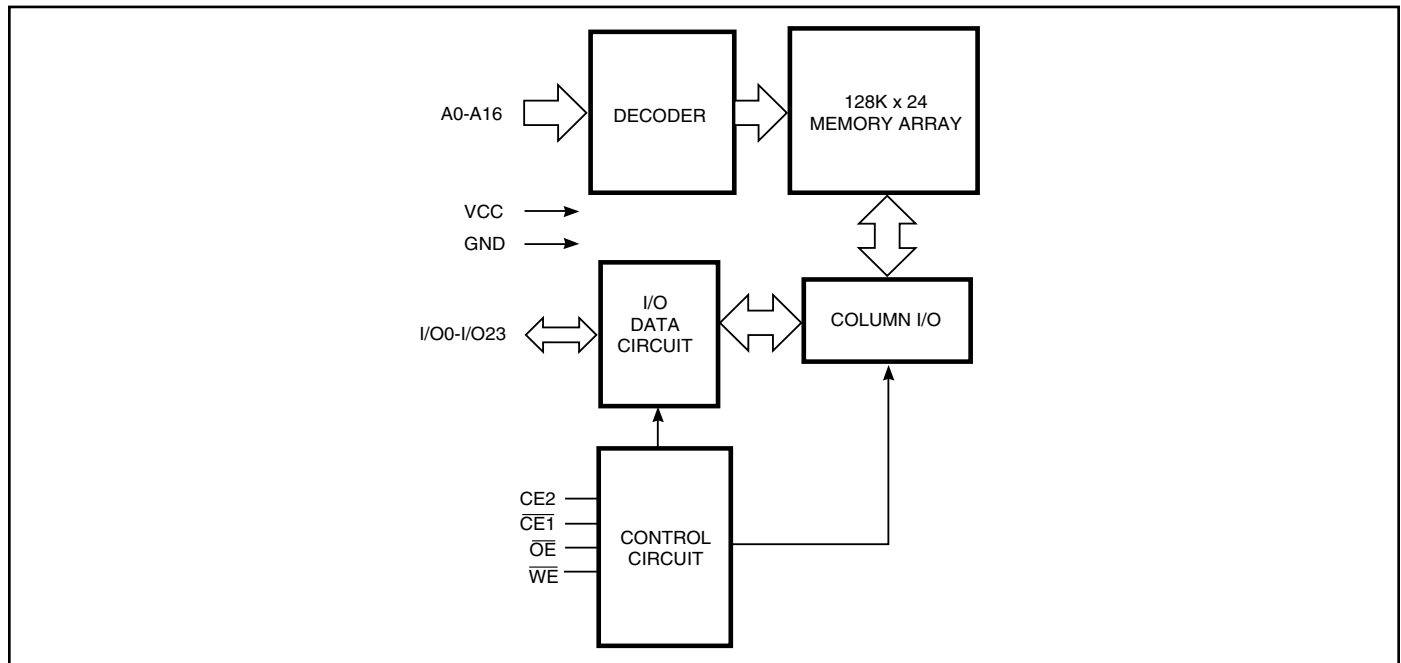
The *ISSI* IS61WV12824 is a high-speed, static RAM organized as 131,072 words by 24 bits. It is fabricated using *ISSI*'s high-performance CMOS technology. This highly reliable process coupled with innovative circuit design techniques, yields access times as fast as 8 ns with low power consumption.

When  $\overline{CE1}$  is HIGH and CE2 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,  $\overline{CE1}$ , CE2 and  $\overline{OE}$ . The active LOW Write Enable ( $\overline{WE}$ ) controls both writing and reading of the memory.

The IS61WV12824 is packaged in the JEDEC standard 119-pin BGA and 100-pin QFP.

### FUNCTIONAL BLOCK DIAGRAM



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- the risk of injury or damage has been minimized;
- the user assume all such risks; and
- potential liability of Integrated Silicon Solution, Inc is adequately protected under the circumstances

**PIN CONFIGURATION - 119-pin BGA**

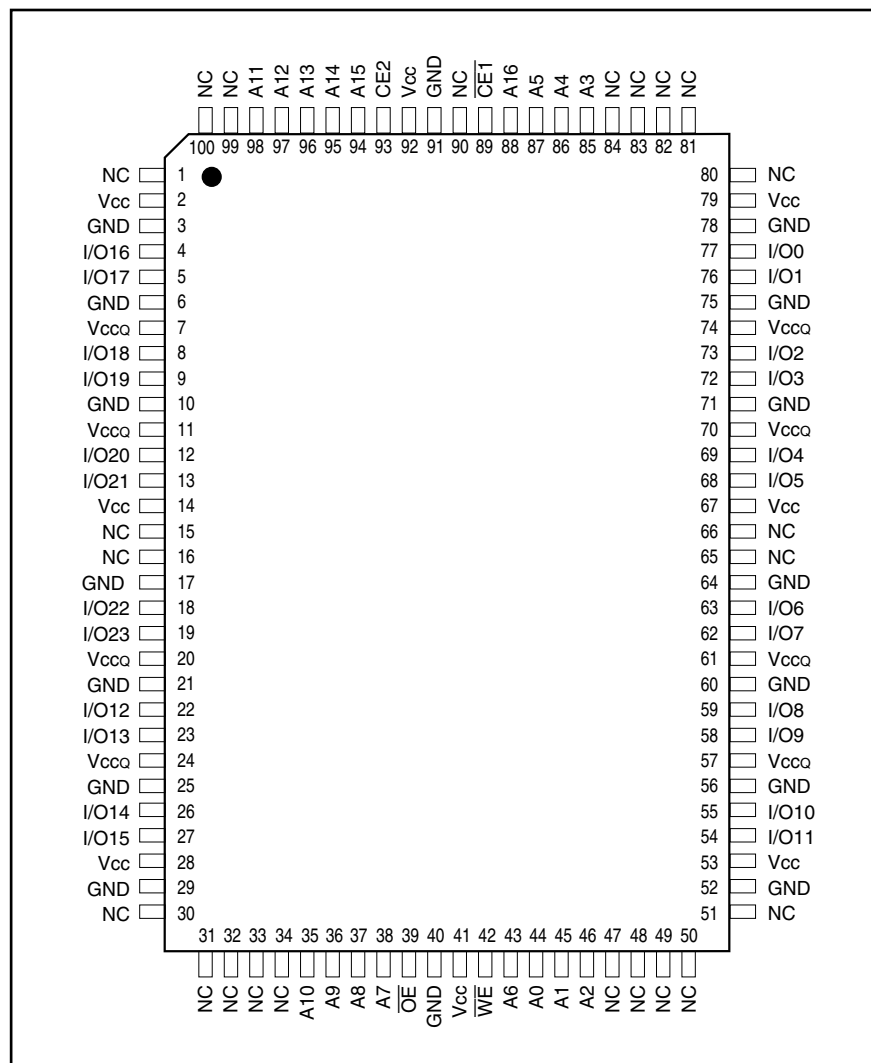
|          | 1               | 2               | 3               | 4                | 5               | 6               | 7               |
|----------|-----------------|-----------------|-----------------|------------------|-----------------|-----------------|-----------------|
| <b>A</b> | NC              | A11             | A14             | A15              | A16             | A4              | NC              |
| <b>B</b> | NC              | A12             | A13             | $\overline{CE1}$ | A5              | A3              | NC              |
| <b>C</b> | I/O16           | NC              | CE2             | NC               | NC              | NC              | I/O0            |
| <b>D</b> | I/O17           | V <sub>CC</sub> | GND             | GND              | GND             | V <sub>CC</sub> | I/O1            |
| <b>E</b> | I/O18           | GND             | V <sub>CC</sub> | GND              | V <sub>CC</sub> | GND             | I/O2            |
| <b>F</b> | I/O19           | V <sub>CC</sub> | GND             | GND              | GND             | V <sub>CC</sub> | I/O3            |
| <b>G</b> | I/O20           | GND             | V <sub>CC</sub> | GND              | V <sub>CC</sub> | GND             | I/O4            |
| <b>H</b> | I/O21           | V <sub>CC</sub> | GND             | GND              | GND             | V <sub>CC</sub> | I/O5            |
| <b>J</b> | V <sub>CC</sub> | GND             | V <sub>CC</sub> | GND              | V <sub>CC</sub> | GND             | V <sub>CC</sub> |
| <b>K</b> | I/O22           | V <sub>CC</sub> | GND             | GND              | GND             | V <sub>CC</sub> | I/O6            |
| <b>L</b> | I/O23           | GND             | V <sub>CC</sub> | GND              | V <sub>CC</sub> | GND             | I/O7            |
| <b>M</b> | I/O12           | V <sub>CC</sub> | GND             | GND              | GND             | V <sub>CC</sub> | I/O8            |
| <b>N</b> | I/O13           | GND             | V <sub>CC</sub> | GND              | V <sub>CC</sub> | GND             | I/O9            |
| <b>P</b> | I/O14           | V <sub>CC</sub> | GND             | GND              | GND             | V <sub>CC</sub> | I/O10           |
| <b>R</b> | I/O15           | NC              | NC              | NC               | NC              | NC              | I/O11           |
| <b>T</b> | NC              | A10             | A8              | $\overline{WE}$  | A0              | A1              | NC              |
| <b>U</b> | NC              | A9              | A7              | $\overline{OE}$  | A6              | A2              | NC              |

**PIN DESCRIPTIONS**

|                  |                        |
|------------------|------------------------|
| A0-A16           | Address Inputs         |
| I/O0-I/O23       | Data Inputs/Outputs    |
| $\overline{CE1}$ | Chip Enable Input LOW  |
| CE2              | Chip Enable Input HIGH |
| $\overline{OE}$  | Output Enable Input    |
| $\overline{WE}$  | Write Enable Input     |
| NC               | No Connection          |
| V <sub>CC</sub>  | Power                  |
| GND              | Ground                 |

## PIN CONFIGURATION

### 100-Pin QFP



## PIN DESCRIPTIONS

|                  |                        |
|------------------|------------------------|
| A0-A16           | Address Inputs         |
| I/O0-I/O23       | Data Inputs/Outputs    |
| $\overline{CE1}$ | Chip Enable Input LOW  |
| CE2              | Chip Enable Input HIGH |
| $\overline{OE}$  | Output Enable Input    |
| $\overline{WE}$  | Write Enable Input     |
| NC               | No Connection          |
| Vcc              | Power                  |
| Vccq             | I/O Power              |
| GND              | Ground                 |

## TRUTH TABLE

| Mode            | $\overline{WE}$ | $\overline{CE1}$ | CE2 | $\overline{OE}$ | I/O0-I/O23 | Vcc Current |
|-----------------|-----------------|------------------|-----|-----------------|------------|-------------|
| Not Selected    | X               | H                | X   | X               | High-Z     | ISB1, ISB2  |
|                 | X               | X                | L   | X               |            |             |
| Output Disabled | H               | L                | H   | H               | High-Z     | Icc         |
| Read            | H               | L                | H   | L               | DOUT       | Icc         |
| Write           | L               | L                | H   | X               | DIN        | Icc         |

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

| Symbol            | Parameter                            |      | Value                         | Unit |
|-------------------|--------------------------------------|------|-------------------------------|------|
| V <sub>CC</sub>   | Power Supply Voltage Relative to GND |      | −0.5 to 5.0                   | V    |
| V <sub>TERM</sub> | Terminal Voltage with Respect to GND |      | −0.5 to V <sub>CC</sub> + 0.5 | V    |
| T <sub>STG</sub>  | Storage Temperature                  |      | −65 to + 150                  | °C   |
| T <sub>BIAS</sub> | Temperature Under Bias:              | Com. | −10 to + 85                   | °C   |
|                   |                                      | Ind. | −45 to + 90                   | °C   |
| P <sub>T</sub>    | Power Dissipation                    |      | 2.0                           | W    |
| I <sub>OUT</sub>  | DC Output Current                    |      | ±20                           | mA   |

## 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 | Vcc (8 ns) | Vcc (10 ns) |
|------------|---------------------|------------|-------------|
| Commercial | 0°C to +70°C        | 3.3V ± 5%  | 2.4V ~ 3.6V |
| Industrial | -40°C to +85°C      | 3.3V ± 5%  | 2.4V ~ 3.6V |

## Note:

1. When operated in the range of 2.4V~3.6V, the device meets 10ns. When operated in the range of 3.3V ± 5%, the device meets 8ns.

**DC ELECTRICAL CHARACTERISTICS** (Over Operating Range)**V<sub>DD</sub> = 3.3V ± 5%**

| 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               |   | 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>                     | -2   | 2                     | μA   |
| I <sub>LO</sub> | Output Leakage                   | GND ≤ V <sub>OUT</sub> ≤ V <sub>DD</sub> , Outputs Disabled | -2   | 2                     | 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.

**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>                     | -2   | 2                     | μA   |
| I <sub>LO</sub> | Output Leakage                   | GND ≤ V <sub>OUT</sub> ≤ V <sub>DD</sub> , Outputs Disabled | -2   | 2                     | 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>CC</sub> Dynamic Operating Supply Current | V <sub>CC</sub> = Max.,  | Com. | —     | 110  | —      | 90   | mA   |
|                  |  | I <sub>OUT</sub> = 0 mA, f = f <sub>MAX</sub>  | Ind. | —     | 115  | —      | 95   |      |
| I <sub>SB1</sub> | TTL Standby Current (TTL Inputs)                 | V <sub>CC</sub> = Max.,  | Com. | —     | 30   | —      | 30   | mA   |
|                  |  | V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> , f = max.<br>$\overline{CE1} \geq V_{IH}$ , CE2 ≤ V <sub>IL</sub>            | Ind. | —     | 35   | —      | 35   |      |
| I <sub>SB2</sub> | CMOS Standby Current (CMOS Inputs)               | V <sub>CC</sub> = Max.,  | Com. | —     | 20   | —      | 20   | mA   |
|                  |  | $\overline{CE1} \geq V_{CC} - 0.2V$ ,<br>CE2 ≤ 0.2V, V <sub>IN</sub> ≥ V <sub>CC</sub> - 0.2V,<br>or V <sub>IN</sub> ≤ 0.2V, f = 0 | Ind. | —     | 25   | —      | 25   |      |

**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.

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

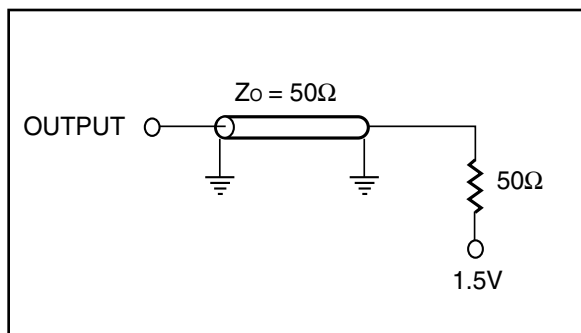
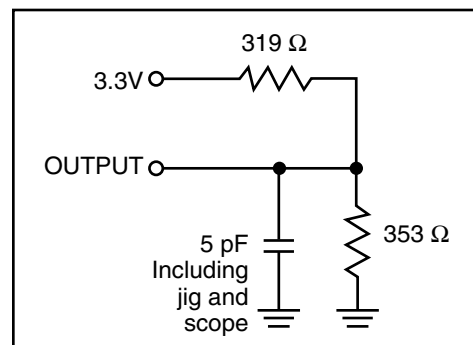
| Symbol           | Parameter                | Conditions            | Max. | Unit |
|------------------|--------------------------|-----------------------|------|------|
| C <sub>IN</sub>  | Input Capacitance        | V <sub>IN</sub> = 0V  | 6    | pF   |
| C <sub>OUT</sub> | Input/Output Capacitance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

**Note:**

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

**AC TEST CONDITIONS**

| Parameter   | Unit<br>(2.4V-3.6V)           | Unit<br>(3.3V ± 5%)           |
|---|-------------------------------|-------------------------------|
|   |                               |                               |
| Input Pulse Level   | 0.4V to V <sub>DD</sub> -0.3V | 0.4V to V <sub>DD</sub> -0.3V |
| Input Rise and Fall Times                                       | 1.5ns                         | 1.5ns                         |
| Input and Output Timing and Reference Level (V <sub>Ref</sub> ) | V <sub>DD</sub> /2            | V <sub>DD</sub> /2 + 0.05     |
| Output Load   | See Figures 1 and 2           | See Figures 1 and 2           |

**AC TEST LOADS**

**Figure 1**

**Figure 2**

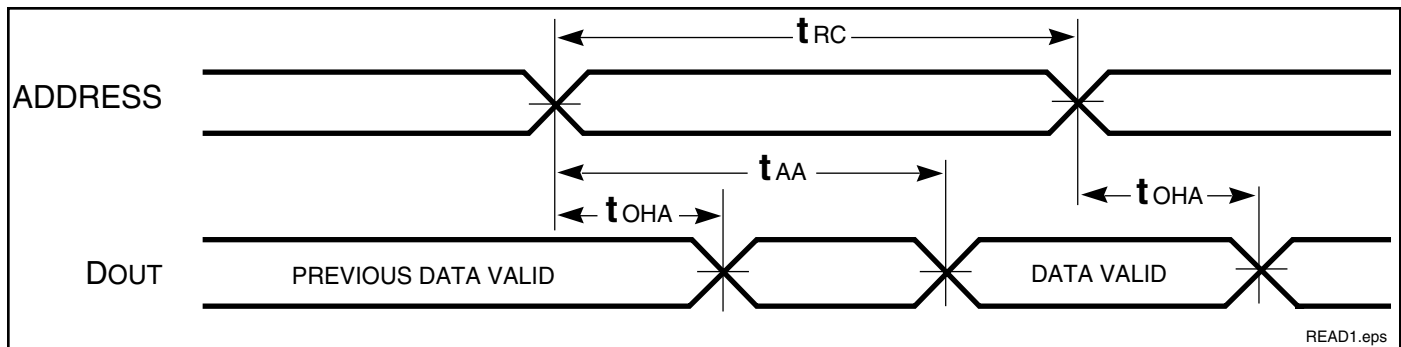
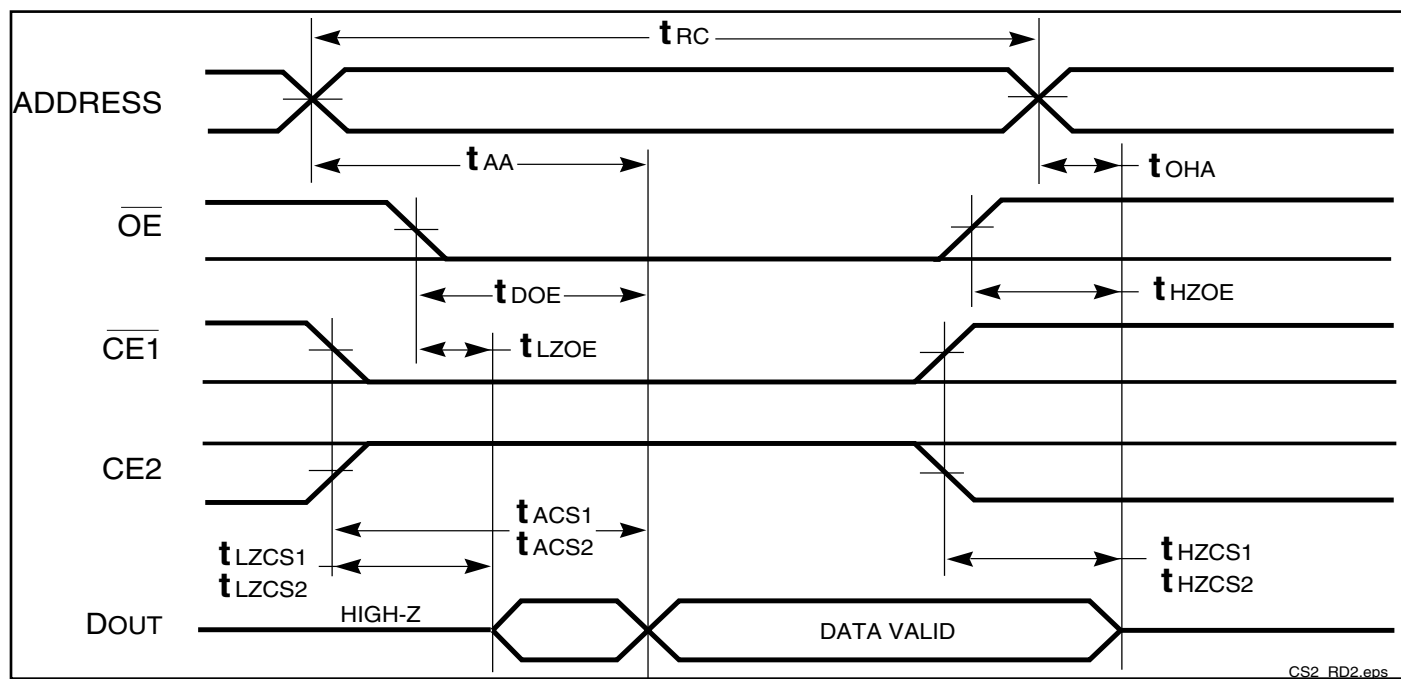
**READ CYCLE SWITCHING CHARACTERISTICS<sup>(1)</sup>** (Over Operating Range)

| Symbol                            | Parameter                                | -8   |      | -10  |      | 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>OH</sub>                   | Output Hold Time                         | 2.5  | —    | 2.5  | —    | ns   |
| t <sub>ACE</sub>                  | $\overline{\text{CE1}}$ Access Time      | 8    | —    | —    | 10   | ns   |
| t <sub>ACE2</sub>                 | CE2 Access Time                          |      |      |      |      |      |
| t <sub>DOE</sub>                  | $\overline{\text{OE}}$ Access Time       | —    | 5.5  | —    | 6.5  | ns   |
| t <sub>HZOE</sub> <sup>(2)</sup>  | $\overline{\text{OE}}$ to High-Z Output  | 0    | 3    | 0    | 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>  | $\overline{\text{CE1}}$ to High-Z Output | 0    | 3    | 0    | 4    | ns   |
| t <sub>HZCE2</sub> <sup>(2)</sup> | CE2 to High-Z Output                     |      |      |      |      |      |
| t <sub>LZCE</sub> <sup>(2)</sup>  | $\overline{\text{CE}}$ to Low-Z Output   | 3    | —    | 3    | —    | ns   |
| t <sub>LZCE2</sub> <sup>(2)</sup> | CE2 to Low-Z Output                      |      |      |      |      |      |

**Notes:**

1. Test conditions assume signal transition times of 2 ns or less, timing reference levels of 1.5V, input pulse levels of 0 to 3.0V and output loading specified in Figure 1.
2. Tested with the load in Figure 2. Transition is measured  $\pm 200$  mV from steady-state voltage. Not 100% tested.

## AC WAVEFORMS

READ CYCLE NO. 1<sup>(1,2)</sup> (Address Controlled) ( $\overline{CE1} = \overline{OE} = V_{IL}$ ;  $CE2 = V_{IH}$ )READ CYCLE NO. 2<sup>(1,3)</sup>**Notes:**

1.  $\overline{WE}$  is HIGH for a Read Cycle.
2. The device is continuously selected.  $\overline{OE}$ ,  $\overline{CE1} = V_{IL}$ .  $CE2 = V_{IH}$ .
3. Address is valid prior to or coincident with  $\overline{CE1}$  LOW and  $CE2$  HIGH transition.

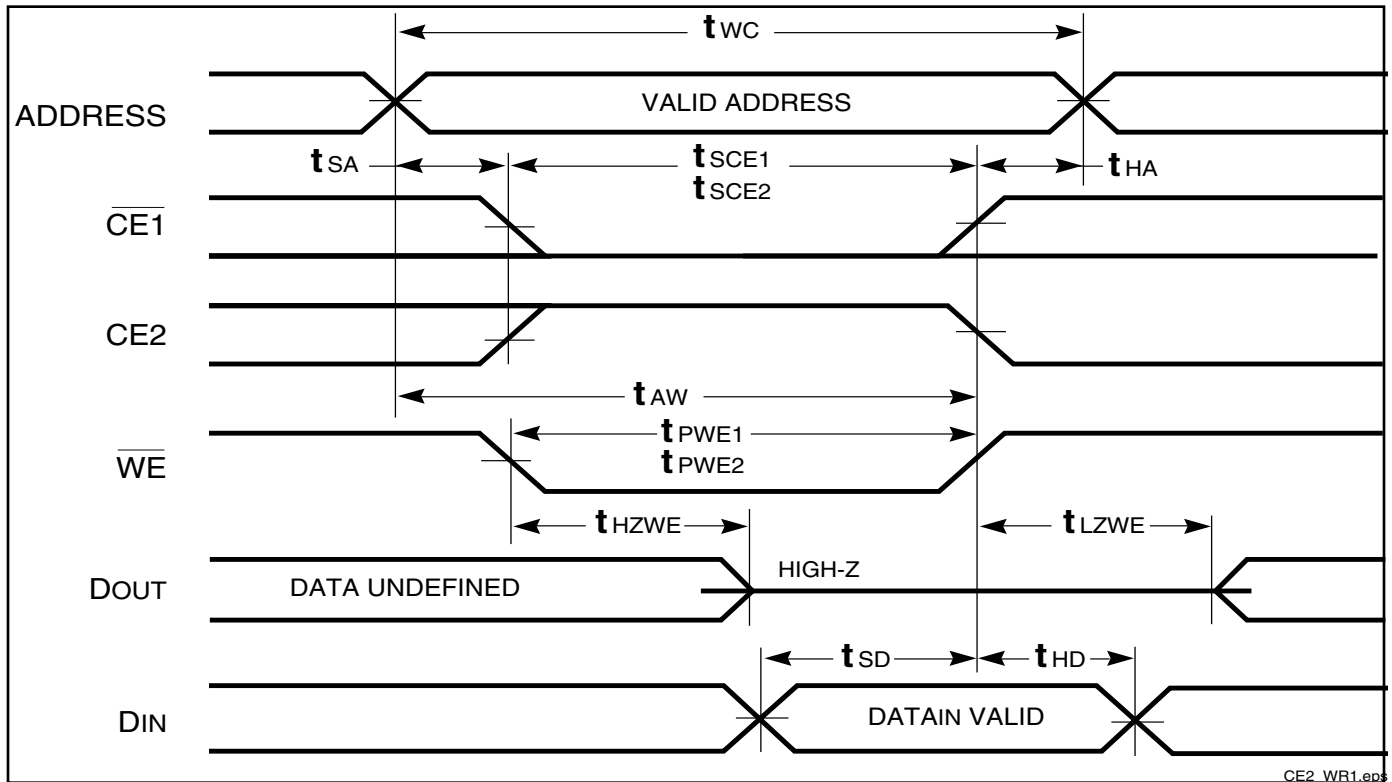
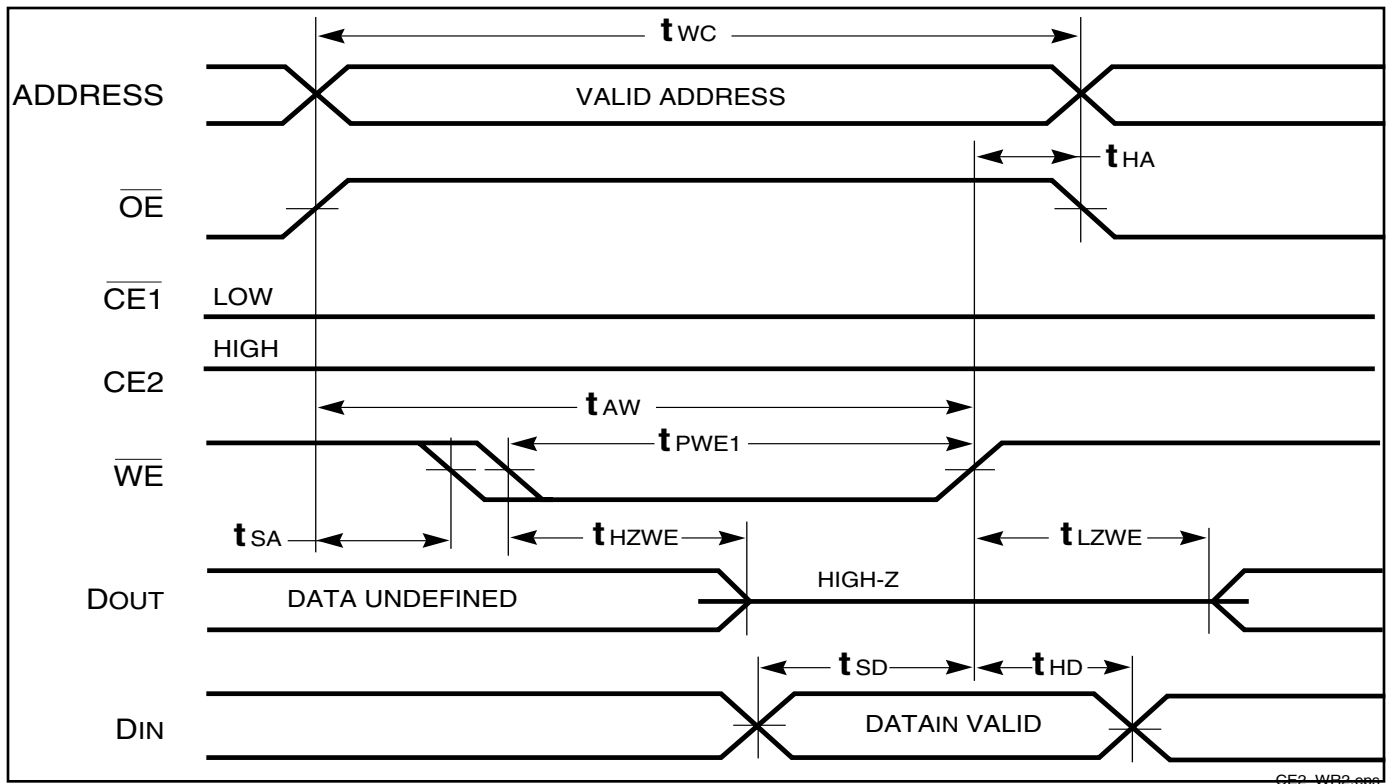


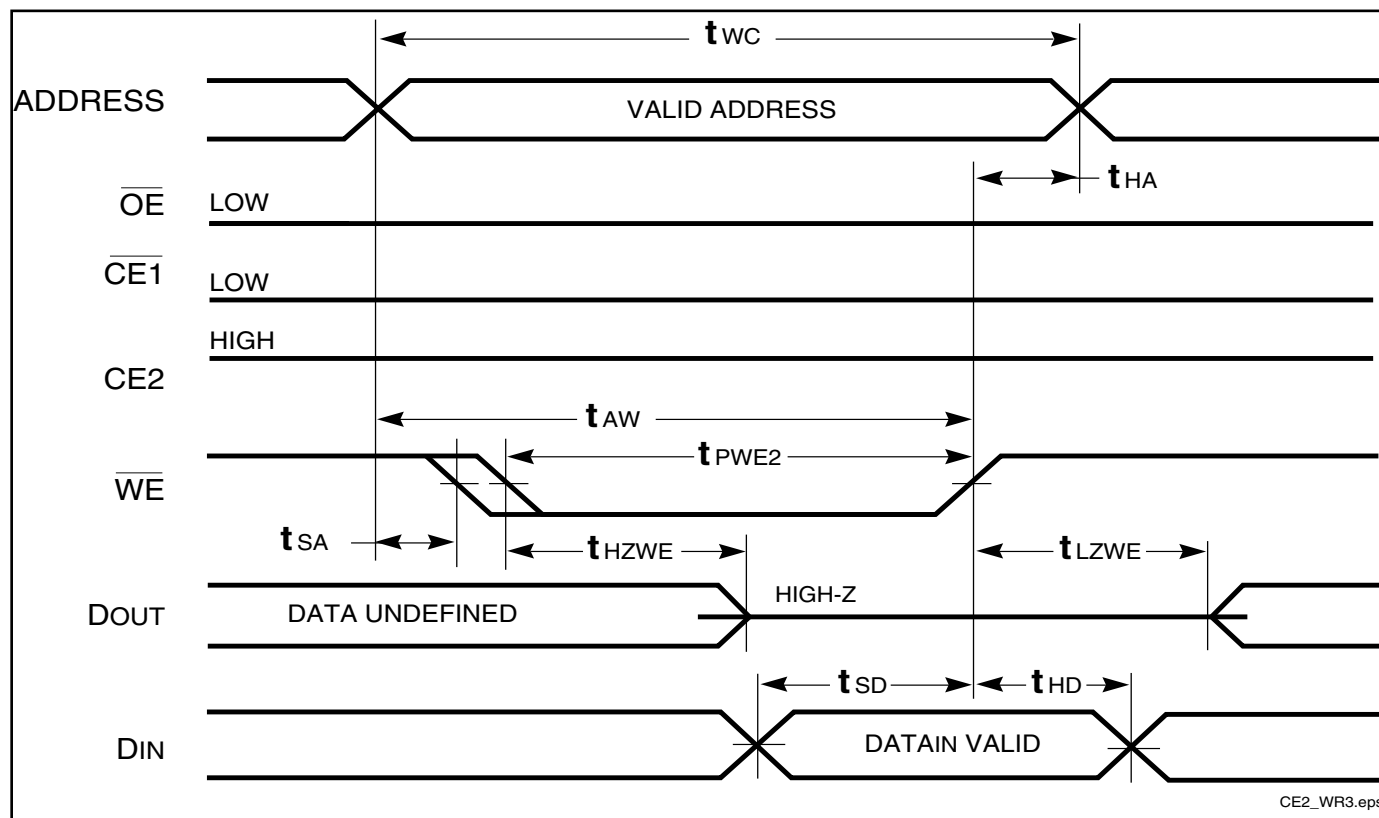
**WRITE CYCLE SWITCHING CHARACTERISTICS<sup>(1,3)</sup>** (Over Operating Range)

| Symbol                           | Parameter   | -8   |      | -10  |      | Unit |
|----------------------------------|---|------|------|------|------|------|
|                                  |   | Min. | Max. | Min. | Max. |      |
| t <sub>wc</sub>                  | Write Cycle Time  | 8    | —    | 10   | —    | ns   |
| t <sub>sce</sub>                 | $\overline{\text{CE1}}$ to Write End                                | 6.5  | —    | 8    | —    | ns   |
| t <sub>sce2</sub>                | CE2 to Write End  | 6.5  | —    | 8    | —    | ns   |
| t <sub>aw</sub>                  | Address Setup Time to Write End                                     | 6.5  | —    | 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>pwe1</sub>                | $\overline{\text{WE}}$ Pulse Width ( $\overline{\text{OE}}$ = HIGH) | 6.5  | —    | 8    | —    | ns   |
| t <sub>pwe2</sub>                | $\overline{\text{WE}}$ Pulse Width ( $\overline{\text{OE}}$ = LOW)  | 8    | —    | 10   | —    | ns   |
| t <sub>sd</sub>                  | Data Setup to Write End   | 5    | —    | 6    | —    | ns   |
| t <sub>hd</sub>                  | Data Hold from Write End  | 0    | —    | 0    | —    | ns   |
| t <sub>hzwe</sub> <sup>(2)</sup> | $\overline{\text{WE}}$ LOW to High-Z Output                         | —    | 3.5  | —    | 5    | ns   |
| t <sub>lzwe</sub> <sup>(2)</sup> | $\overline{\text{WE}}$ HIGH to Low-Z Output                         | 2    | —    | 2    | —    | ns   |

**Notes:**

1. Test conditions assume signal transition times of 1.5 ns or less, timing reference levels of  $V_{DD}/2$ , 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  $\pm 200$  mV from steady-state voltage. Not 100% tested.
3. The internal write time is defined by the overlap of  $\overline{\text{CE1}}$  LOW, CE2 HIGH and  $\overline{\text{WE}}$  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.

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

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


**WRITE CYCLE NO. 3<sup>(1)</sup>** ( $\overline{WE}$  Controlled:  $\overline{OE}$  IS LOW DURING WRITE CYCLE)**Note:**

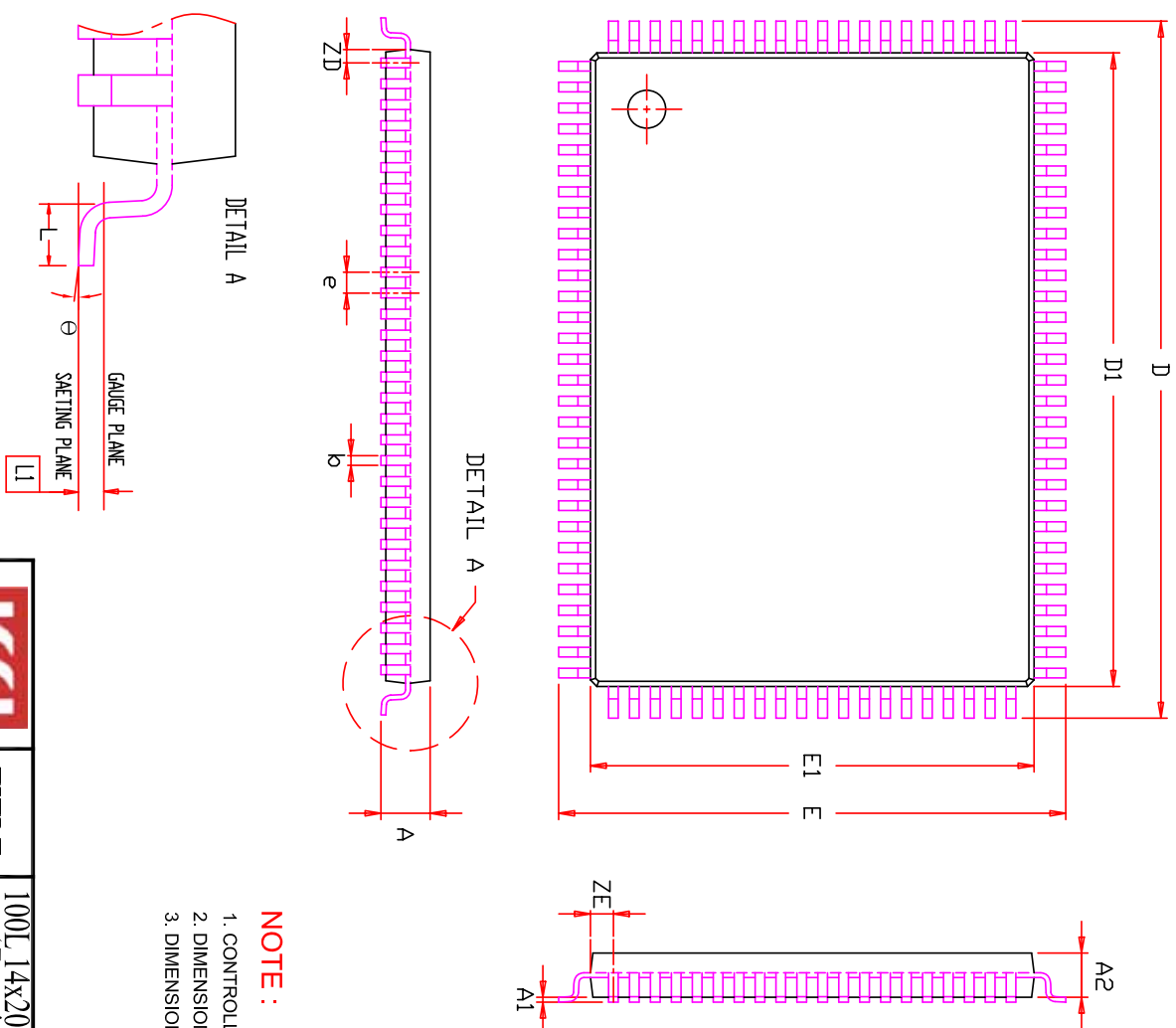
1. The internal Write time is defined by the overlap of  $\overline{CE1} = \text{LOW}$ ,  $\overline{CE2} = \text{HIGH}$  and  $\overline{WE} = \text{LOW}$ . All signals must be in valid states to initiate a Write, but any can be deasserted to terminate the Write. The Data Input Setup and Hold timing is referenced to the rising or falling edge of the signal that terminates the Write.

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

| Speed (ns) | Order Part No.    | Package                    |
|------------|-------------------|----------------------------|
| 8          | IS61WV12824-8B    | Ball Grid Array            |
|            | IS61WV12824-8BL   | Ball Grid Array, Lead-free |
|            | IS61WV12824-8TQL  | QFP, Lead-free             |
| 10         | IS61WV12824-10B   | Ball Grid Array            |
|            | IS61WV12824-10BL  | Ball Grid Array, Lead-free |
|            | IS61WV12824-10TQL | QFP, Lead-free             |

**Industrial Range: -40°C to +85°C**

| Speed (ns) | Order Part No.     | Package         |
|------------|--------------------|-----------------|
| 8          | IS61WV12824-8BI    | Ball Grid Array |
| 10         | IS61WV12824-10BI   | Ball Grid Array |
|            | IS61WV12824-10TQLI | QFP, Lead-free  |



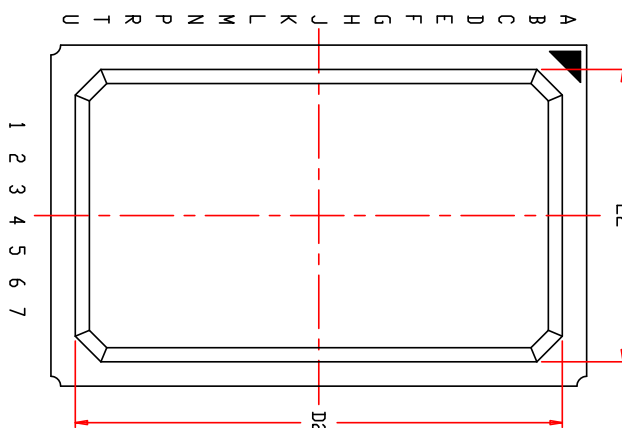
| SYMBOL | DIMENSION IN MM |       |       | DIMENSION IN INCH |       |       |
|--------|-----------------|-------|-------|-------------------|-------|-------|
|        | MIN.            | NOM.  | MAX.  | MIN.              | NOM.  | MAX.  |
| A      | 1.40            |       | 1.60  | 0.055             |       | 0.063 |
| A1     | 0.05            |       | 0.15  | 0.002             |       | 0.006 |
| A2     | 1.35            | 1.40  | 1.45  | 0.053             | 0.055 | 0.057 |
| b      | 0.22            | 0.30  | 0.38  | 0.009             | 0.012 | 0.015 |
| D      | 21.90           | 22.00 | 22.10 | 0.862             | 0.866 | 0.870 |
| D1     | 19.90           | 20.00 | 20.10 | 0.783             | 0.787 | 0.791 |
| E      | 15.90           | 16.00 | 16.10 | 0.626             | 0.630 | 0.634 |
| E1     | 13.90           | 14.00 | 14.10 | 0.547             | 0.551 | 0.555 |
| e      |                 | 0.65  | BSC.  |                   | 0.026 | BSC.  |
| L      | 0.45            | 0.60  | 0.75  | 0.018             | 0.024 | 0.030 |
| L1     |                 | 0.25  | BSC.  |                   | 0.010 | BSC.  |
| ZD     |                 | 0.575 | REF.  |                   | 0.023 | REF.  |
| ZE     |                 | 0.825 | REF.  |                   | 0.032 | REF.  |
| θ      | 0               | 3.5°  | 7°    | 0                 | 3.5°  | 7°    |

**NOTE:**

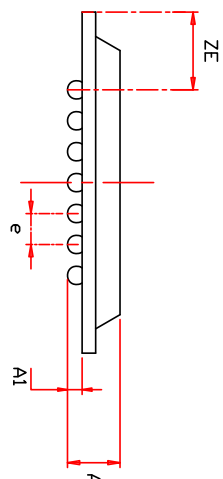
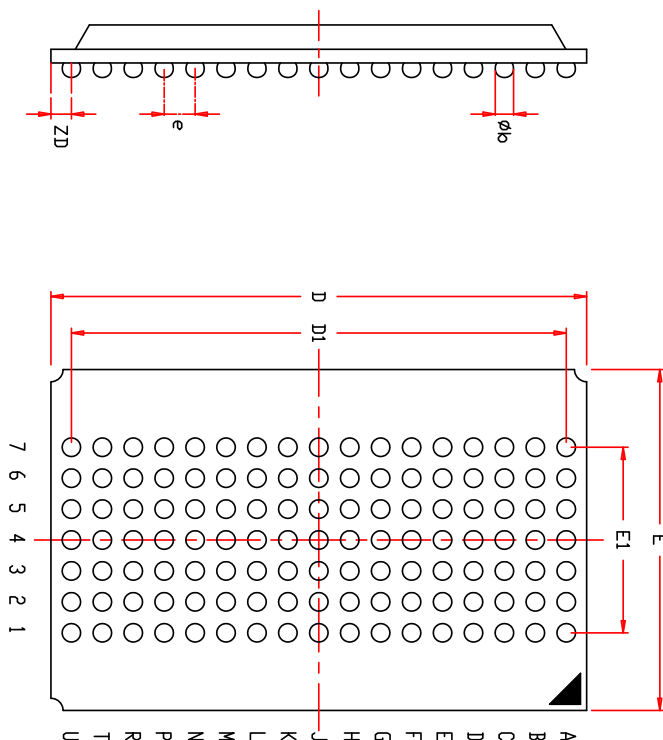
1. CONTROLLING DIMENSION : MM
2. DIMENSION D1 AND E1 DO NOT INCLUDE MOLD PROTRUSION.
3. DIMENSION b DOES NOT INCLUDE DAMBAR PROTRUSION/INTRUSION.

|   |       |  |      |   |      |            |
|---|-------|--|------|---|------|------------|
|  | TITLE | 100L 14x20x1.4mm LQFP<br>(Footprint: 2.0 mm) | REV. | F | DATE | 09/01/2009 |
| Package Outline   |       |  |      |   |      |            |

TOP VIEW



BOTTOM VIEW



**NOTE :**

1. CONTROLLING DIMENSION : MM .
2. Reference document : JEDEC MS-028

| SYMBOL   | DIMENSION IN MM |           | DIMENSION IN INCH |           |
|----------|-----------------|-----------|-------------------|-----------|
|          | MIN.            | NDM. MAX. | MIN.              | NDM. MAX. |
| A        | -               | 2.15      | 3.50              | -         |
| A1       | 0.50            | 0.60      | 0.70              | 0.020     |
| $\phi b$ | 0.66            | 0.76      | 0.86              | 0.026     |
| D        | 21.80           | 22.00     | 22.00             | 0.866     |
| D1       | 20.32           | BSC.      | 0.800             | BSC.      |
| D2       | 19.40           | 19.50     | 19.60             | 0.764     |
| E        | 13.80           | 14.00     | 14.20             | 0.543     |
| E1       | 7.62            | BSC.      | 0.300             | BSC.      |
| E2       | 11.90           | 12.00     | 12.10             | 0.468     |
| e        | 1.27            | BSC.      | 0.050             | BSC.      |
| ZD       | 0.84            | REF.      | 0.033             | REF.      |
| ZE       | 3.19            | REF.      | 0.126             | REF.      |



TITLE

119L 14x22mm PBGA  
Package Outline

REV.

E

DATE

10/13/2010