



**THE DATASHEET OF  
CY62148BNLL-70SXI**



## 4-Mbit (512K x 8) Static RAM

### Features

- 4.5V–5.5V operation
- Low active power
  - Typical active current: 2.5 mA @ f = 1 MHz
  - Typical active current: 12.5 mA @ f = f<sub>max</sub>
- Low standby current
- Automatic power down when deselected
- TTL-compatible inputs and outputs
- Easy memory expansion with  $\overline{CE}$  and  $\overline{OE}$  features
- CMOS for optimum speed and power
- Available in standard Pb-free and non Pb-free 32-lead (450-mil) SOIC and 32-lead TSOP II packages

### Functional Description

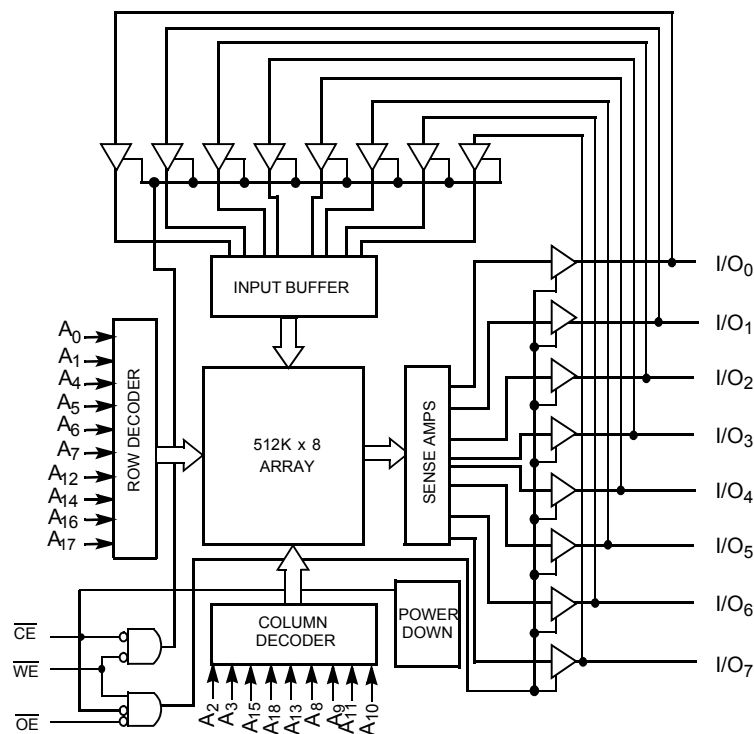
The CY62148BN is a high performance CMOS static RAM organized as 512K words by 8 bits. Easy memory expansion is provided by an active LOW Chip Enable ( $\overline{CE}$ ), an active LOW Output Enable ( $\overline{OE}$ ), and tri-state drivers. This device has an automatic power down feature that reduces power consumption by more than 99% when deselected.

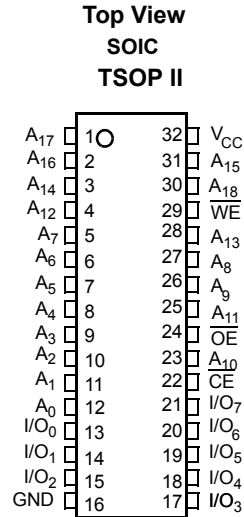
To write to the device, take Chip Enable ( $\overline{CE}$ ) and Write Enable ( $\overline{WE}$ ) inputs LOW. Data on the eight I/O pins (I/O<sub>0</sub> through I/O<sub>7</sub>) is then written into the location specified on the address pins (A<sub>0</sub> through A<sub>18</sub>).

To read from the device, take Chip Enable ( $\overline{CE}$ ) and Output Enable ( $\overline{OE}$ ) LOW while forcing Write Enable ( $\overline{WE}$ ) HIGH for read. Under these conditions, the contents of the memory location specified by the address pins appear on the I/O pins.

The eight input/output pins (I/O<sub>0</sub> through I/O<sub>7</sub>) go into a high-impedance state when the device is deselected ( $\overline{CE}$  HIGH), the outputs are disabled ( $\overline{OE}$  HIGH), or a write operation is in progress ( $\overline{CE}$  LOW and  $\overline{WE}$  LOW).

### Logic Block Diagram



**Pin Configuration**

**Product Portfolio**

| Product     | V <sub>CC</sub> Range |      |      | Speed | Power Dissipation              |     |                               |     |
|-------------|-----------------------|------|------|-------|--------------------------------|-----|-------------------------------|-----|
|             |                       |      |      |       | Operating I <sub>CC</sub> (mA) |     | Standby I <sub>SB2</sub> (μA) |     |
|             |                       |      |      |       | f = f <sub>max</sub>           |     | Typ <sup>[1]</sup>            | Max |
|             |                       |      |      |       | Typ <sup>[1]</sup>             | Max |                               |     |
| CY62148BNLL | 4.5 V                 | 5.0V | 5.5V | 70 ns | 12.5                           | 20  | 4                             | 20  |

**Note**

1. Typical values are measured at V<sub>CC</sub> = 5V, T<sub>A</sub> = 25°C, and are included for reference only and are not tested or guaranteed.

### Maximum Ratings

Exceeding the maximum rating may impair the device's useful life. User guidelines only and are not tested.

|  |                                |
|--|--------------------------------|
| Storage Temperature .....  | -65°C to +150°C                |
| Ambient Temperature with Power Applied .....                       | -55°C to +125°C                |
| Supply Voltage on V <sub>CC</sub> to Relative GND .....            | -0.5V to +7.0V                 |
| DC Voltage Applied to Outputs in High Z State <sup>[2]</sup> ..... | -0.5V to V <sub>CC</sub> +0.5V |

|                                       |                                      |
|---------------------------------------|--------------------------------------|
| DC Input Voltage <sup>[2]</sup> ..... | -0.5V to V <sub>CC</sub> +0.5V       |
| Current into Outputs (LOW) .....      | 20 mA                                |
| Static Discharge Voltage .....        | 2001V (per MIL-STD-883, Method 3015) |
| Latch Up Current .....                | >200 mA                              |

### Operating Range

| Range      | Ambient Temperature <sup>[3]</sup> | V <sub>CC</sub> |
|------------|------------------------------------|-----------------|
| Industrial | -40°C to +85°C                     | 4.5V–5.5V       |

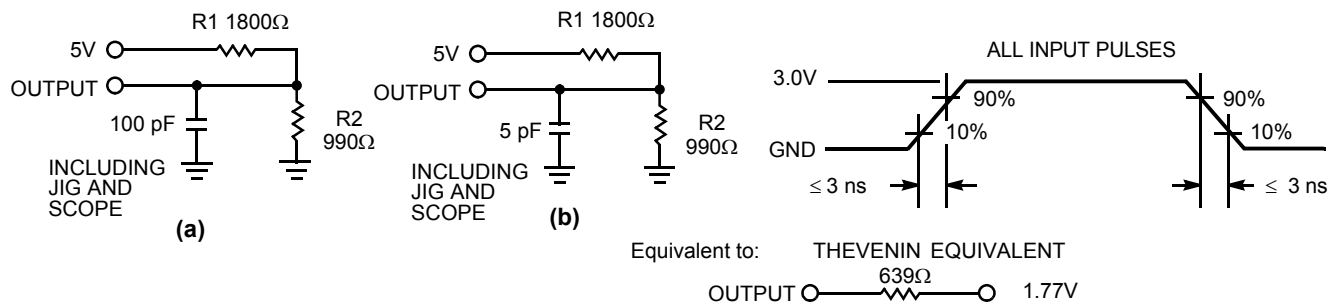
### Electrical Characteristics Over the Operating Range

| Parameter        | Description                                   | Test Conditions  | CY62148BN   |                    |                      | Unit |
|------------------|---|--|---|--------------------|----------------------|------|
|                  |   |  | Min   | Typ <sup>[1]</sup> | Max                  |      |
| V <sub>OH</sub>  | Output HIGH Voltage                           | I <sub>OH</sub> = -1 mA  | 2.4   |                    |                      | V    |
| V <sub>OL</sub>  | Output LOW Voltage                            | I <sub>OL</sub> = 2.1 mA   |   |                    | 0.4                  | V    |
| V <sub>IH</sub>  | Input HIGH Voltage                            |  | 2.2   |                    | V <sub>CC</sub> +0.3 | V    |
| V <sub>IL</sub>  | Input LOW Voltage                             |  | -0.3  |                    | 0.8                  | V    |
| I <sub>IX</sub>  | Input Leakage Current                         | GND ≤ V <sub>I</sub> ≤ V <sub>CC</sub>   | -1  |                    | +1                   | μA   |
| I <sub>OZ</sub>  | Output Leakage Current                        | GND ≤ V <sub>I</sub> ≤ V <sub>CC</sub> , Output Disabled   | -1  |                    | +1                   | μA   |
| I <sub>CC</sub>  | V <sub>CC</sub> Operating Supply Current      | f = f <sub>MAX</sub> = 1/t <sub>RC</sub>   |   | 12.5               | 20                   | mA   |
|                  |   | f = 1 MHz  | I <sub>OZ</sub> = 0 mA<br>V <sub>CC</sub> = Max., | 2.5                |                      | mA   |
| I <sub>SB1</sub> | Automatic CE Power Down Current – TTL Inputs  | Max. V <sub>CC</sub> , CE ≥ V <sub>IH</sub><br>V <sub>IN</sub> ≥ V <sub>IH</sub> or V <sub>IN</sub> ≤ V <sub>IL</sub> , f = f <sub>MAX</sub> |   |                    | 1.5                  | mA   |
| I <sub>SB2</sub> | Automatic CE Power Down Current – CMOS Inputs | Max. V <sub>CC</sub> , CE ≥ V <sub>CC</sub> - 0.3V,<br>V <sub>IN</sub> ≥ V <sub>CC</sub> - 0.3V, or V <sub>IN</sub> ≤ 0.3V, f = 0            |   | 4                  | 20                   | μA   |

### Capacitance<sup>[4]</sup>

| Parameter        | Description        | Test Conditions   | Max. | Unit |
|------------------|--------------------|---|------|------|
| C <sub>IN</sub>  | Input Capacitance  | T <sub>A</sub> = 25°C, f = 1 MHz,<br>V <sub>CC</sub> = 5.0V | 6    | pF   |
| C <sub>OUT</sub> | Output Capacitance |   | 8    | pF   |

### AC Test Loads and Waveforms



#### Notes

- V<sub>IL</sub> (min.) = -2.0V for pulse durations of less than 20 ns.
- T<sub>A</sub> is the "instant on" case temperature
- Tested initially and after any design or process changes that may affect these parameters.

**Switching Characteristics<sup>[5]</sup> Over the Operating Range**

| Parameter                        | Description                                      | CY62148BN |     | Unit |
|----------------------------------|--|-----------|-----|------|
|                                  |  | Min       | Max |      |
| <b>READ CYCLE</b>                |  |           |     |      |
| $t_{RC}$                         | Read Cycle Time                                  | 70        |     | ns   |
| $t_{AA}$                         | Address to Data Valid                            |           | 70  | ns   |
| $t_{OHA}$                        | Data Hold from Address Change                    | 10        |     | ns   |
| $t_{ACE}$                        | $\overline{CE}$ LOW to Data Valid                |           | 70  | ns   |
| $t_{DOE}$                        | $\overline{OE}$ LOW to Data Valid                |           | 35  | ns   |
| $t_{LZOE}$                       | $\overline{OE}$ LOW to Low Z <sup>[6]</sup>      | 5         |     | ns   |
| $t_{HZOE}$                       | $\overline{OE}$ HIGH to High Z <sup>[6, 7]</sup> |           | 25  | ns   |
| $t_{LZCE}$                       | $\overline{CE}$ LOW to Low Z <sup>[6]</sup>      | 10        |     | ns   |
| $t_{HZCE}$                       | $\overline{CE}$ HIGH to High Z <sup>[6, 7]</sup> |           | 25  | ns   |
| $t_{PU}$                         | $\overline{CE}$ LOW to Power Up                  | 0         |     | ns   |
| $t_{PD}$                         | $\overline{CE}$ HIGH to Power Down               |           | 70  | ns   |
| <b>WRITE CYCLE<sup>[8]</sup></b> |  |           |     |      |
| $t_{WC}$                         | Write Cycle Time                                 | 70        |     | ns   |
| $t_{SCE}$                        | $\overline{CE}$ LOW to Write End                 | 60        |     | ns   |
| $t_{AW}$                         | Address Setup to Write End                       | 60        |     | ns   |
| $t_{HA}$                         | Address Hold from Write End                      | 0         |     | ns   |
| $t_{SA}$                         | Address Setup to Write Start                     | 0         |     | ns   |
| $t_{PWE}$                        | $\overline{WE}$ Pulse Width                      | 55        |     | ns   |
| $t_{SD}$                         | Data Setup to Write End                          | 30        |     | ns   |
| $t_{HD}$                         | Data Hold from Write End                         | 0         |     | ns   |
| $t_{LZWE}$                       | $\overline{WE}$ HIGH to Low Z <sup>[6]</sup>     | 5         |     | ns   |
| $t_{HZWE}$                       | $\overline{WE}$ LOW to High Z <sup>[6, 7]</sup>  |           | 25  | ns   |

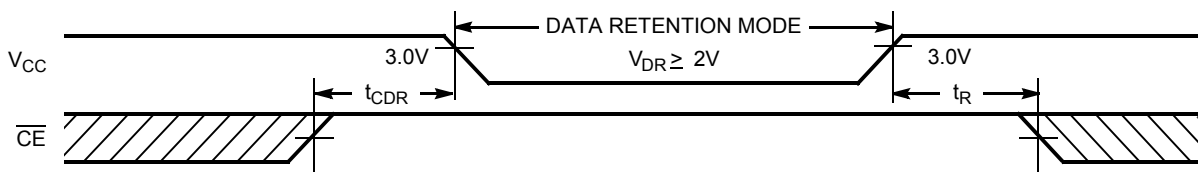
**Notes**

5. Test conditions assume signal transition time of 5 ns or less, timing reference levels of 1.5V, input pulse levels of 0 to 3.0V, and output loading of the specified  $I_{OL}/I_{OH}$  and 100-pF load capacitance.
6. At any given temperature and voltage condition,  $t_{HZCE}$  is less than  $t_{LZCE}$ ,  $t_{HZOE}$  is less than  $t_{LZOE}$ , and  $t_{HZWE}$  is less than  $t_{LZWE}$  for any given device.
7.  $t_{HZOE}$ ,  $t_{HZCE}$ , and  $t_{HZWE}$  are specified with a load capacitance of 5 pF as in part (b) of AC Test Loads. Transition is measured  $\pm 500$  mV from steady-state voltage.
8. The internal write time of the memory is defined by the overlap of  $\overline{CE}$  LOW, and  $\overline{WE}$  LOW.  $\overline{CE}$  and  $\overline{WE}$  must be LOW to initiate a write, and the transition of any of these signals can terminate the write. The input data setup and hold timing should be referenced to the leading edge of the signal that terminates the write.

**Data Retention Characteristics** (Over the Operating Range)

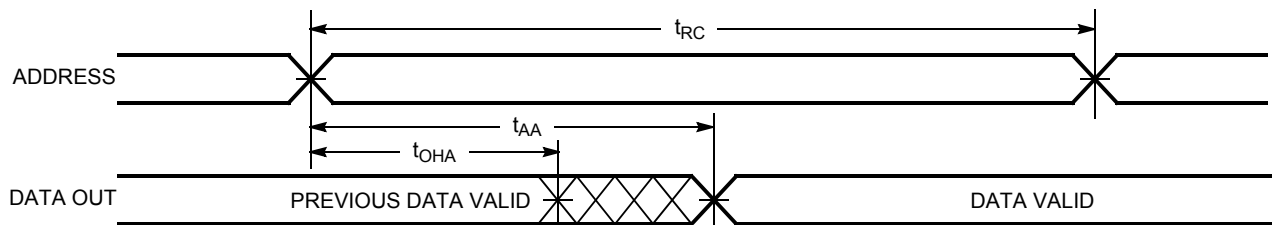
| Parameter       | Description                          | Conditions   | Min      | Typ <sup>[1]</sup> | Max | Unit    |
|-----------------|--------------------------------------|--|----------|--------------------|-----|---------|
| $V_{DR}$        | $V_{CC}$ for Data Retention          |  | 2.0      |                    |     | V       |
| $I_{CCDR}$      | Data Retention Current               | No input may exceed $V_{CC} + 0.3V$                                    |          |                    | 20  | $\mu A$ |
| $t_{CDR}^{[4]}$ | Chip Deselect to Data Retention Time | $V_{CC} = V_{DR}$  | 0        |                    |     | ns      |
| $t_R^{[9]}$     | Operation Recovery Time              | $CE > V_{CC} - 0.3V$<br>$V_{IN} > V_{CC} - 0.3V$ or<br>$V_{IN} < 0.3V$ | $t_{RC}$ |                    |     | ns      |

**Data Retention Waveform**

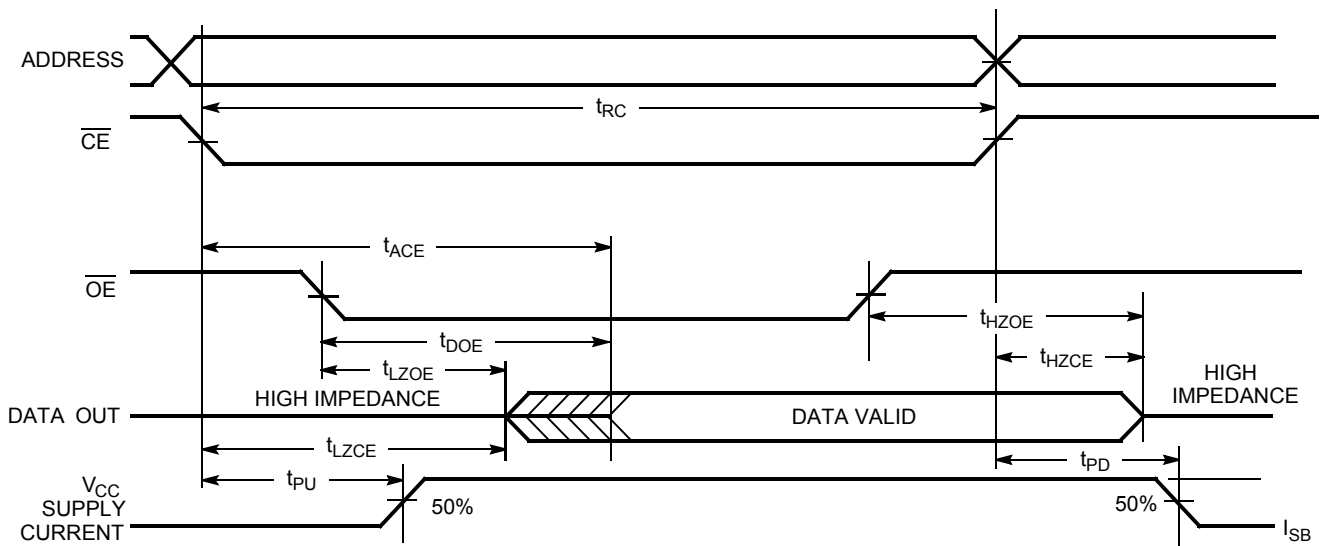


**Switching Waveforms**

**Read Cycle No. 1<sup>[10, 11]</sup>**



**Read Cycle No. 2 ( $\overline{OE}$  Controlled)<sup>[11, 12]</sup>**

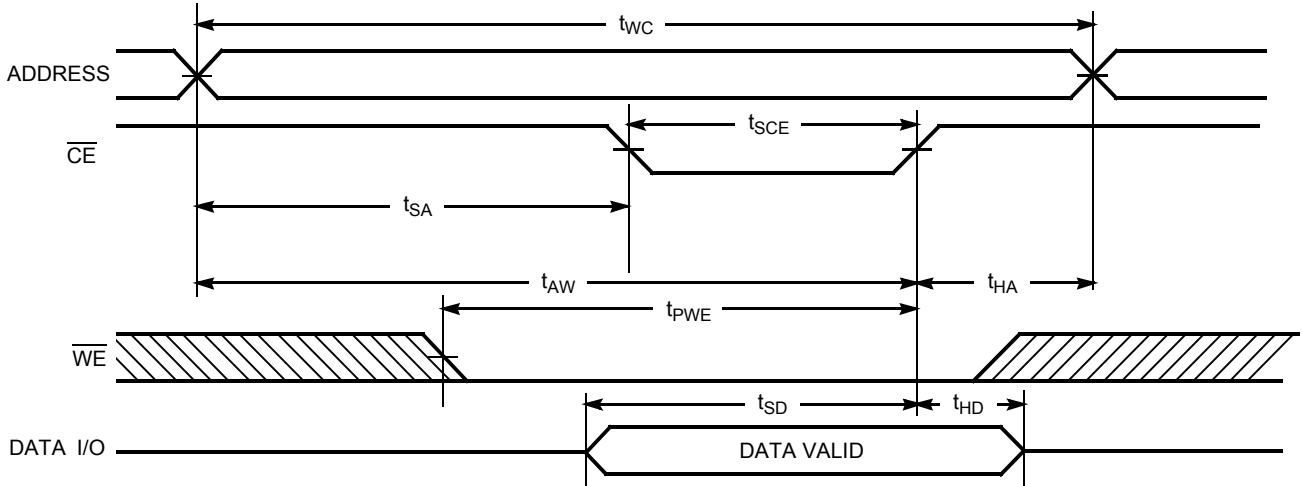


**Notes**

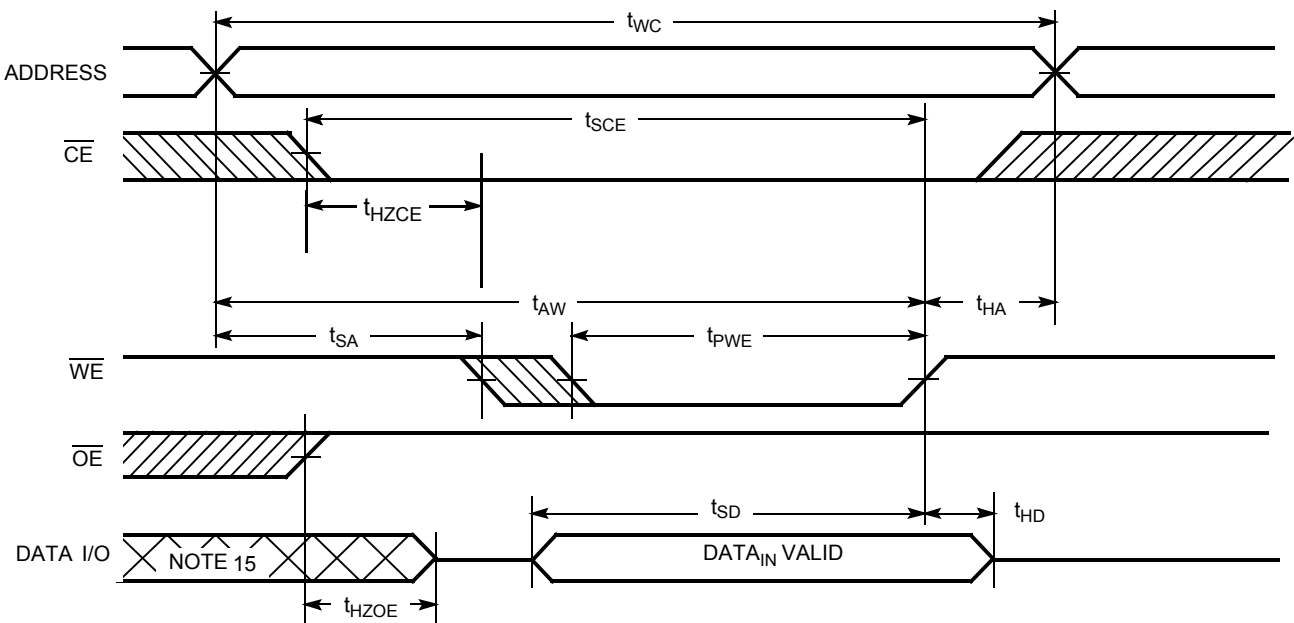
9. Full Device operation requires linear  $V_{CC}$  ramp from  $V_{DR}$  to  $V_{CC(min)} \geq 100$  ms or stable at  $V_{CC(min)} \geq 100$  ms.
10. Device is continuously selected.  $\overline{OE}$ ,  $\overline{CE} = V_{IL}$ .
11.  $\overline{WE}$  is HIGH for read cycle.
12. Address valid prior to or coincident with  $\overline{CE}$  transition LOW.

Switching Waveforms (continued)

Write Cycle No. 1 ( $\overline{\text{CE}}$  Controlled)<sup>[13]</sup>



Write Cycle No. 2 ( $\overline{\text{WE}}$  Controlled,  $\overline{\text{OE}}$  HIGH During Write)<sup>[13, 14]</sup>

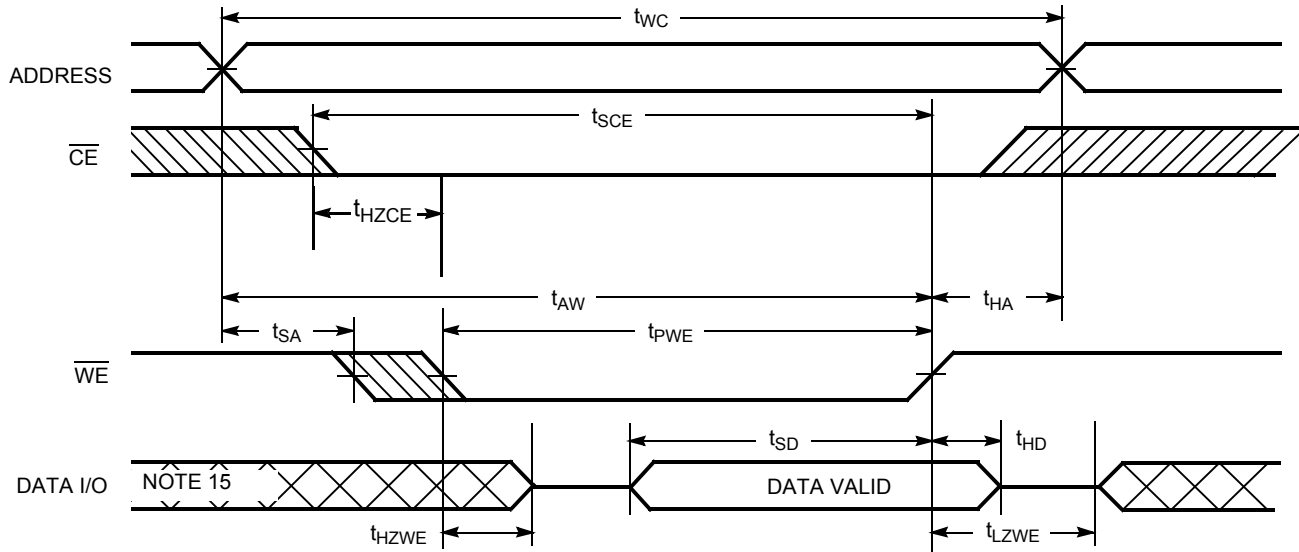


Notes

- 13. If  $\overline{\text{CE}}$  goes HIGH simultaneously with  $\overline{\text{WE}}$  going HIGH, the output remains in a high impedance state.
- 14. Data I/O is high-impedance if  $\overline{\text{OE}} = V_{IH}$ .
- 15. During this period the I/Os are in the output state and input signals should not be applied.

**Switching Waveforms** (continued)

**Write Cycle No. 3 ( $\overline{WE}$  Controlled,  $\overline{OE}$  LOW)<sup>[13, 14]</sup>**



**Truth Table**

| $\overline{CE}$ | $\overline{OE}$ | $\overline{WE}$ | I/O <sub>0</sub> -I/O <sub>7</sub> | Mode                       | Power                |
|-----------------|-----------------|-----------------|------------------------------------|----------------------------|----------------------|
| H               | X               | X               | High Z                             | Power Down                 | Standby ( $I_{SB}$ ) |
| L               | L               | H               | Data Out                           | Read                       | Active ( $I_{CC}$ )  |
| L               | X               | L               | Data In                            | Write                      | Active ( $I_{CC}$ )  |
| L               | H               | H               | High Z                             | Selected, Outputs Disabled | Active ( $I_{CC}$ )  |

**Ordering Information**

| Speed (ns) | Ordering Code                     | Package Diagram | Package Type                            | Operating Range |
|------------|-----------------------------------|-----------------|---|-----------------|
| 70         | CY62148BNSL-70SXI <sup>[16]</sup> | 51-85081        | 32-lead (450-Mil) Molded SOIC (Pb-Free) | Industrial      |
|            | CY62148BNLL-70SXI                 | 51-85081        | 32-lead (450-Mil) Molded SOIC (Pb-Free) |                 |
|            | CY62148BNLL-70ZXI                 | 51-85095        | 32-lead TSOP II (Pb-Free)               |                 |

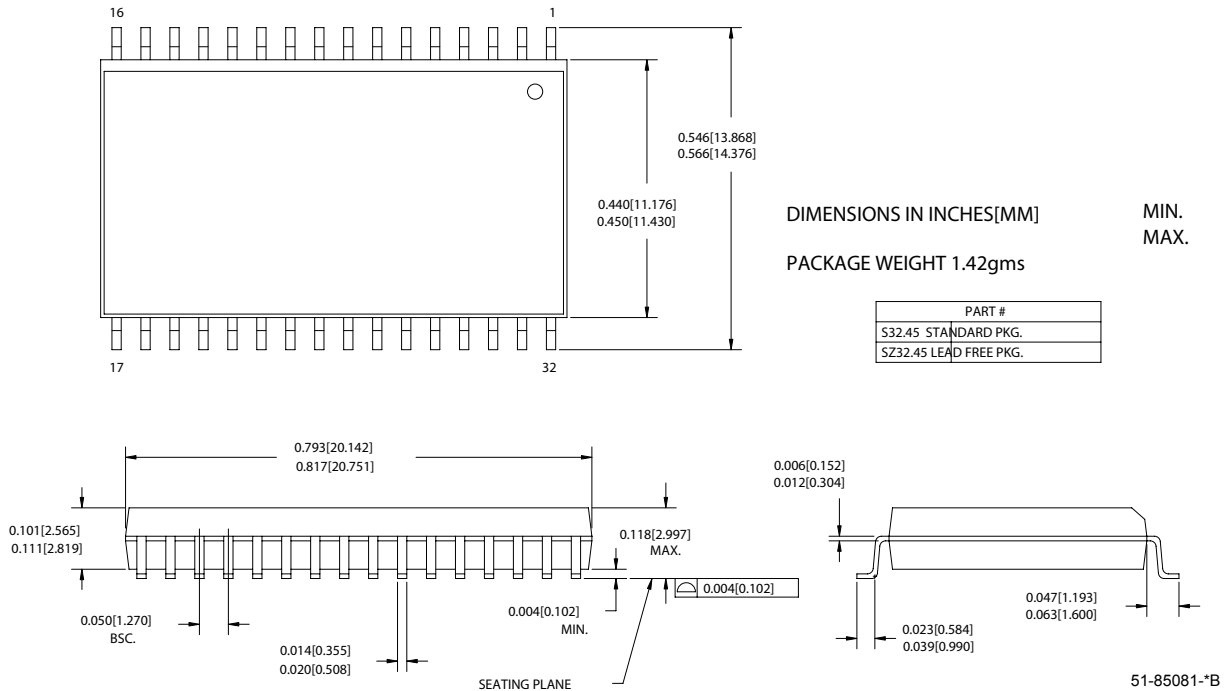
**Note**

16. CY62148BNSL and CY62148BNLL are identical in specs.

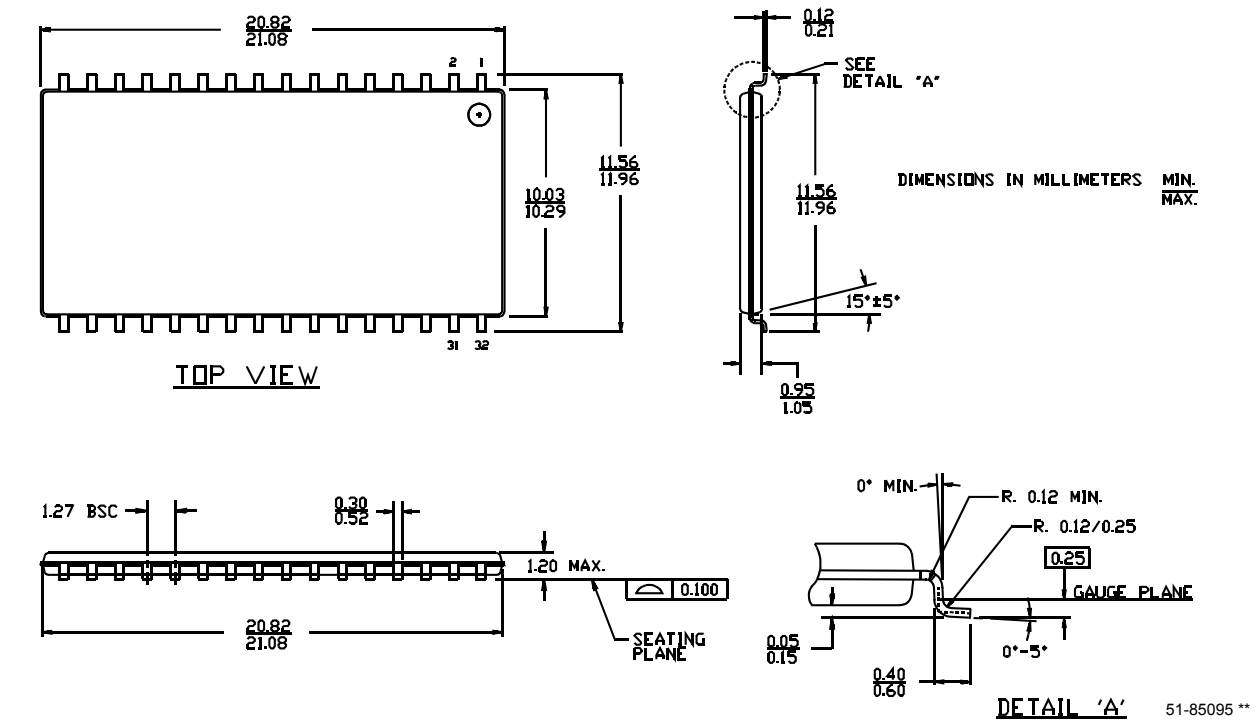
Please contact your local Cypress sales representative for availability of these parts

**Package Diagrams**

**Figure 1. 32-lead (450 Mil) Molded SOIC (51-85081)**



**Figure 2. 32-Lead Thin Small Outline Package Type II (51-85095)**



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**Document History Page**

| Document Title: CY62148BN MoBL <sup>®</sup> 4-Mbit (512K x 8) Static RAM<br>Document Number: 001-06517 |         |            |                 |  |
|--|---------|------------|-----------------|--|
| REV.   | ECN NO. | Issue Date | Orig. of Change | Description of Change  |
| **   | 426504  | See ECN    | NXR             | New Data Sheet   |
| *A   | 485639  | See ECN    | VKN             | Corrected the typo in the Array size in the Logic Block Diagram  |
| *B   | 832320  | See ECN    | NXR             | Removed Commercial Operating Range<br>Removed 32-lead Reverse TSOP II package from product offering<br>Corrected the test condition typo error in Electrical Characteristics table<br>Updated Ordering information table |

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