

## CY7C1051DV33

# 8-Mbit (512 K × 16) Static RAM

### Features

- Temperature ranges
   □ Industrial: -40 °C to 85 °C
   □ Automotive-E: -40 °C to 125 °C<sup>[1]</sup>
- High speed
  □ t<sub>AA</sub> = 10 ns (Industrial)
- Low active power
   I<sub>CC</sub> = 110 mA at 10 ns (Industrial)
- Low CMOS standby power □ I<sub>SB2</sub> = 20 mA (Industrial)
- 2.0-V data retention
- Automatic power down when deselected
- Transistor-transistor logic (TTL)-compatible inputs and outputs
- Easy memory expansion with CE and OE features
- Available in Pb-free 48-ball fine ball grid array (FBGA) and 44-pin thin small outline package (TSOP) II packages

### **Functional Description**

The CY7C1051DV33<sup>[2]</sup> is a high performance CMOS Static RAM organized as 512 K words by 16 bits.

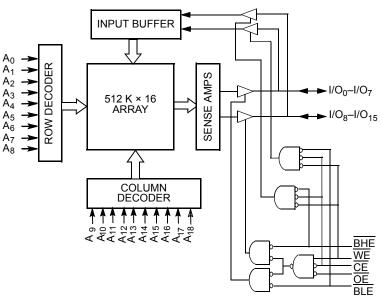
To write to the device, take Chip Enable ( $\overline{CE}$ ) and Write Enable ( $\overline{WE}$ ) inputs LOW. If Byte LOW Enable (BLE) is LOW, then data from I/O pins ( $I/O_0$ – $I/O_7$ ), is written into the location specified on the address pins ( $A_0$ – $A_{18}$ ). If Byte HIGH Enable (BHE) is LOW, then data from I/O pins ( $I/O_8$ – $I/O_{15}$ ) is written into the location specified on the address pins ( $A_0$ – $A_{18}$ ).

To read from the device, take Chip Enable ( $\overline{CE}$ ) and Output Enable ( $\overline{OE}$ ) LOW while forcing the Write Enable ( $\overline{WE}$ ) HIGH. If Byte LOW Enable ( $\overline{BLE}$ ) is LOW, then data from the memory location specified by the address pins appears on I/O<sub>0</sub>–I/O<sub>7</sub>. If Byte HIGH Enable ( $\overline{BHE}$ ) is LOW, then data from memory appears on IO<sub>8</sub> to IO<sub>15</sub>. See the "Truth Table" on page 9 for a complete description of read and write modes.

The input/output pins  $(I/O_0-I/O_{15})$  are placed in <u>a</u> high-impedance state when the device is de<u>selected (CE</u> HIGH), the outputs are disabled (OE HIGH), the BHE and BLE are disabled (BHE, BLE HIGH), or a write operation (CE LOW, and WE LOW) is in progress.

The CY7C1051DV33 is available in a 44-pin TSOP II package with center power and ground (revolutionary) pinout and a 48-ball FBGA package.

### Logic Block Diagram



#### Notes

1. Automotive product information is preliminary.

2. For guidelines about SRAM system design, refer to the Cypress application note AN1064, SRAM System Guidelines available at www.cypress.com.

**Cypress Semiconductor Corporation** Document #: 001-00063 Rev. \*G 198 Champion Court

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### Contents

| Pin Configurations                                     | 3   |
|--|-----|
| Selection Guide  | 3   |
| Maximum Ratings  | 4   |
| Operating Range  | 4   |
| DC Electrical Characteristics Over the Operating Range | e 4 |
| Capacitance  | 4   |
| Thermal Resistance                                     | 4   |
| AC Test Loads and Waveforms                            | 5   |
| Data Retention Characteristics                         | 5   |
| Over the Operating Range                               | 5   |
| Data Retention Waveform                                | 5   |
| AC Switching Characteristics                           | 6   |
| Switching Waveforms                                    | 7   |
| Read Cycle No. 1                                       | 7   |
| Read Cycle No. 2 (OE Controlled)                       | 7   |
| Write Cycle No. 1 (CE Controlled)                      | 8   |

| Write Cycle No. 2 (BLE or BHE Controlled)  |
|--|
| Truth Table 9                              |
| Ordering Information 10                    |
| Ordering Code Definitions 10               |
| Package Diagrams 11                        |
| Acronyms 13                                |
| Document Conventions 13                    |
| Units of Measure 13                        |
| Document History Page 14                   |
| Sales, Solutions, and Legal Information 15 |
| Worldwide Sales and Design Support         |
| Products 15                                |
| PSoC Solutions 15                          |





### **Pin Configurations**

Figure 1. Pin Diagram - 48-ball FBGA (Top View)<sup>[3]</sup>

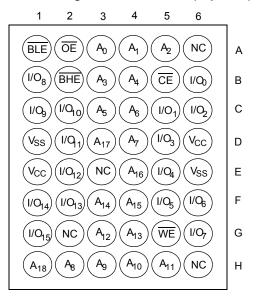


Figure 2. Pin Diagram - 44-Pin TSOP II (Top View)<sup>[3]</sup>

| A <sub>0</sub> 🗖 1             | 44 🗆 A <sub>17</sub>   |
|--------------------------------|------------------------|
| A <sub>1</sub> C 2             | 43 🗆 A <sub>16</sub>   |
| A <sub>2</sub> 🗆 3             | 42 A15                 |
| A3 4                           | 41 0 OF                |
| A <sub>4</sub> 5               | 40 BHF                 |
|                                | 39 1 BLE               |
| 1/0                            | 38 I/O <sub>15</sub>   |
| <b>u</b>                       | - "OI5                 |
|                                |                        |
| I/O <sub>2</sub> 🖸 9           |                        |
| I/O3 🗖 10                      | 35 I/O12               |
| V <sub>CC</sub> 11             | 34 🗆 V <sub>SS</sub>   |
| V <sub>SS</sub> □ 12           | 33 🗆 V <sub>CC</sub>   |
| I/O4 🗖 13                      | 32 🗖 I/O <sub>11</sub> |
| I/O <sub>5</sub> 🗆 14          | 31 ☐ I/O <sub>10</sub> |
| I/Q6 15                        | 30 🗆 I/Qg              |
| I/O7 16                        | 29 🛛 I/Qš              |
| WÉ 17                          | 28 🗆 A <sub>18</sub>   |
| A <sub>5</sub> □ <sup>18</sup> | 27 🛛 A <sub>14</sub>   |
| A <sub>6</sub> [ 19            | 26 🗆 A <sub>13</sub>   |
| A7 20                          | 25 🗆 A <sub>12</sub>   |
| Ag 21                          | 24 🗖 A11               |
| A9 22                          | 23 A10                 |
| ° .                            | - 10                   |

### **Selection Guide**

| Description                  | –10 (Industrial) | -12 (Industrial) | –15 (Automotive-E) <sup>[4]</sup> | Unit |
|------------------------------|------------------|------------------|-----------------------------------|------|
| Maximum access time          | 10               | 12               | 15                                | ns   |
| Maximum operating current    | 110              | 100              | 120                               | mA   |
| Maximum CMOS standby current | 20               | 20               | 20                                | mA   |

#### Notes

NC pins are not connected on the die.
 Automotive product information is preliminary.



## Maximum Ratings

Exceeding the maximum ratings may impair the useful life of the device. These user guidelines are not tested.

| Storage temperature  | –65 °C to +150 °C                  |
|--|------------------------------------|
| Ambient temperature with power applied                       | –55 °C to +125 °C                  |
| Supply voltage on $V_{\mbox{\scriptsize CC}}$ to relative G  | ND <sup>[5]</sup> –0.5 V to +4.6 V |
| DC voltage applied to outputs in high-Z state <sup>[5]</sup> | –0.3 V to V <sub>CC</sub> + 0.3 V  |
| DC input voltage <sup>[5]</sup>                              | –0.3 V to $V_{CC}$ + 0.3 V         |
| Current into outputs (LOW)                                   | 20 mA                              |

Static discharge voltage.....>2001 V

(per MIL-STD-883, Method 3015)

Latch up current......>200 mA

### **Operating Range**

| Range                 | Ambient<br>Temperature | V <sub>cc</sub> | Speed |
|-----------------------|------------------------|-----------------|-------|
| Industrial            | –40 °C to +85 °C       | $3.3~V\pm0.3~V$ | 10 ns |
| Industrial            | –40 °C to +85 °C       | $3.3~V\pm0.3~V$ | 12 ns |
| Auto-E <sup>[6]</sup> | –40 °C to +125 °C      | $3.3~V\pm0.3~V$ | 15 ns |

### DC Electrical Characteristics Over the Operating Range

| Daramatar                      | Description  | Test Conditions   | -10(I | ndustrial)     | –12(Industrial) |                | –15(Auto-E) <sup>[6]</sup> |                | Unit |
|--------------------------------|--|---|-------|----------------|-----------------|----------------|----------------------------|----------------|------|
| Parameter                      | Description  | rest conditions   | Min   | Max            | Min             | Max            | Min                        | Max            | Unit |
| V <sub>OH</sub>                | Output HIGH voltage                                | V <sub>CC</sub> = Min, I <sub>OH</sub> = -4.0 mA  | 2.4   | -              | 2.4             | -              | 2.4                        | -              | V    |
| V <sub>OL</sub>                | Output LOW voltage                                 | V <sub>CC</sub> = Min, I <sub>OL</sub> = 8.0 mA   | -     | 0.4            | _               | 0.4            | -                          | 0.4            | V    |
| V <sub>IH</sub>                | Input HIGH voltage                                 |   | 2.0   | $V_{CC} + 0.3$ | 2.0             | $V_{CC} + 0.3$ | 2.0                        | $V_{CC} + 0.3$ | V    |
| V <sub>IL</sub> <sup>[5]</sup> | Input LOW voltage                                  |   | -0.3  | 0.8            | -0.3            | 0.8            | -0.3                       | 0.8            | V    |
| I <sub>IX</sub>                | Input leakage current                              | $GND \leq V_I \leq V_{CC}$  | -1    | +1             | -1              | +1             | -5                         | +5             | μA   |
| I <sub>OZ</sub>                | Output leakage<br>current                          | $GND \le V_{OUT} \le V_{CC}$ , Output Disabled  | -1    | +1             | –1              | +1             | -5                         | +5             | μA   |
| I <sub>CC</sub>                | V <sub>CC</sub> operating<br>supply current        | $V_{CC}$ = Max, f = f <sub>MAX</sub> = 1/t <sub>RC</sub>  | _     | 110            | -               | 100            | _                          | 120            | mA   |
| I <sub>SB1</sub>               | Automatic CE power<br>down current —TTL<br>inputs  | $\begin{array}{l} \text{Max } V_{CC}, \overline{CE} \geq V_{IH} \\ V_{IN} \geq V_{IH} \text{ or } V_{IN} \leq V_{IL}, f = f_{MAX} \end{array}$  | -     | 40             | _               | 35             | -                          | 60             | mA   |
| I <sub>SB2</sub>               | Automatic CE Power<br>Down Current<br>—CMOS Inputs | $\begin{array}{l} \text{Max V}_{\text{CC}}, \overline{\text{CE}} \geq \text{V}_{\text{CC}} - 0.3 \text{ V}, \\ \text{V}_{\text{IN}} \geq \text{V}_{\text{CC}} - 0.3 \text{ V} \text{ or } \text{V}_{\text{IN}} \leq \\ 0.3 \text{ V}, \text{f} = 0 \end{array}$ | -     | 20             | _               | 20             | -                          | 20             | mA   |

### Capacitance

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

| Parameter        | eter Description Test Conditions |  | Max | Unit |
|------------------|----------------------------------|--|-----|------|
| C <sub>IN</sub>  | Input capacitance                | T <sub>A</sub> = 25 °C, f = 1 MHz, V <sub>CC</sub> = 3.3 V | 12  | pF   |
| C <sub>OUT</sub> | I/O capacitance                  |  | 12  | pF   |

### **Thermal Resistance**

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

| Parameter       | Description                                 | Test Conditions  | FBGA<br>Package | TSOP II<br>Package | Unit |
|-----------------|---|--|-----------------|--------------------|------|
| Θ <sub>JA</sub> | Thermal resistance<br>(Junction to ambient) | Still air, soldered on a 3 × 4.5 inch,<br>four-layer printed circuit board | 28.31           | 51.43              | °C/W |
| Θ <sub>JC</sub> | Thermal resistance<br>(Junction to case)    |  | 11.4            | 15.8               | °C/W |

Notes

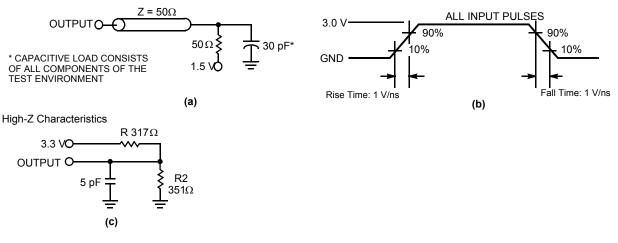
5.  $V_{IL(min)} = -2.0 \text{ V}$  and  $V_{IH(max)} = V_{CC} + 2.0 \text{ V}$  for pulse durations of less than 20 ns. 6. Automotive product information is preliminary.

Document #: 001-00063 Rev. \*G



### AC Test Loads and Waveforms

AC characteristics (except High-Z) are tested using the load conditions shown in Figure 3 (a). High-Z characteristics are tested for all speeds using the test load shown in Figure 3 (c).



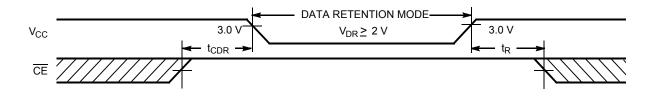
### Figure 3. AC Test Loads and Waveforms

### **Data Retention Characteristics**

Over the Operating Range

| Parameter                       | Description                             | Conditions <sup>[7]</sup>  | Min             | Max | Unit |
|---------------------------------|---|--|-----------------|-----|------|
| V <sub>DR</sub>                 | V <sub>CC</sub> for Data Retention      |  | 2.0             | -   | V    |
| ICCDR                           | Data Retention Current                  | $V_{CC} = V_{DR} = 2.0 \text{ V}, \overline{CE} \ge V_{CC} - 0.3 \text{ V},$<br>$V_{IN} \ge V_{CC} - 0.3 \text{ V} \text{ or } V_{IN} \le 0.3 \text{ V}$ | -               | 20  | mA   |
| t <sub>CDR</sub> <sup>[8]</sup> | Chip Deselect to Data<br>Retention Time | $V_{IN} \ge V_{CC} - 0.3 \text{ V or } V_{IN} \le 0.3 \text{ V}$   | 0               | _   | ns   |
| t <sub>R</sub> <sup>[8]</sup>   | Operation Recovery Time                 |  | t <sub>RC</sub> | Ι   | ns   |

### **Data Retention Waveform**



#### Notes

7. No inputs may exceed  $V_{CC}$  + 0.3 V 8. Full device operation requires linear  $V_{CC}$  ramp from  $V_{DR}$  to  $V_{CC}(min) \ge 50 \ \mu s$  or stable at  $V_{CC}(min) \ge 50 \ \mu s$ .



## **AC Switching Characteristics**

Over the Operating Range<sup>[9]</sup>

| Demonster                          | Description                                   | -10 (In | dustrial) | -12 (Industrial) |     | –15 (Auto-E) <sup>[1]</sup> |     | L Incié |
|------------------------------------|---|---------|-----------|------------------|-----|-----------------------------|-----|---------|
| Parameter                          | Description                                   | Min     | Max       | Min              | Max | Min                         | Max | Unit    |
| Read Cycle                         |   |         |           |                  | •   | •                           | •   |         |
| t <sub>power</sub> <sup>[10]</sup> | V <sub>CC</sub> (typical) to the First Access | 100     | -         | 100              | -   | 100                         | -   | μS      |
| t <sub>RC</sub>                    | Read Cycle Time                               | 10      | -         | 12               | _   | 15                          | -   | ns      |
| t <sub>AA</sub>                    | Address to Data Valid                         | -       | 10        | -                | 12  |                             | 15  | ns      |
| t <sub>OHA</sub>                   | Data Hold from Address Change                 | 2.5     | -         | 2.5              | _   | 3                           | -   | ns      |
| t <sub>ACE</sub>                   | CE LOW to Data Valid                          | -       | 10        | -                | 12  | _                           | 15  | ns      |
| t <sub>DOE</sub>                   | OE LOW to Data Valid                          | -       | 5         | -                | 6   | _                           | 7   | ns      |
| t <sub>LZOE</sub>                  | OE LOW to Low-Z                               | 0       | _         | 0                | _   | 0                           | -   | ns      |
| t <sub>HZOE</sub>                  | OE HIGH to High-Z <sup>[11, 12]</sup>         | _       | 5         | _                | 6   | _                           | 7   | ns      |
| t <sub>LZCE</sub>                  | CE LOW to Low-Z <sup>[12]</sup>               | 3       | -         | 3                | -   | 3                           | -   | ns      |
| t <sub>HZCE</sub>                  | CE HIGH to High-Z <sup>[11, 12]</sup>         | -       | 5         | _                | 6   | _                           | 6   | ns      |
| t <sub>PU</sub>                    | CE LOW to Power Up                            | 0       | -         | 0                | -   | 0                           | -   | ns      |
| t <sub>PD</sub>                    | CE HIGH to Power Down                         | -       | 10        | -                | 12  | _                           | 15  | ns      |
| t <sub>DBE</sub>                   | Byte Enable to Data Valid                     | -       | 5         | -                | 6   | -                           | 7   | ns      |
| t <sub>LZBE</sub>                  | Byte Enable to Low-Z                          | 0       | -         | 0                | -   | 0                           | -   | ns      |
| t <sub>HZBE</sub>                  | Byte Disable to High-Z                        | -       | 5         | _                | 6   | _                           | 7   | ns      |
| Write Cycle                        | [13, 14]                                      |         |           |                  | •   | •                           |     |         |
| t <sub>WC</sub>                    | Write Cycle Time                              | 10      | _         | 12               | _   | 15                          | -   | ns      |
| t <sub>SCE</sub>                   | CE LOW to Write End                           | 7       | -         | 8                | -   | 10                          | -   | ns      |
| t <sub>AW</sub>                    | Address Setup to Write End                    | 7       | -         | 8                | -   | 10                          | -   | ns      |
| t <sub>HA</sub>                    | Address Hold from Write End                   | 0       | -         | 0                | -   | 0                           | -   | ns      |
| t <sub>SA</sub>                    | Address Setup to Write Start                  | 0       | -         | 0                | -   | 0                           | -   | ns      |
| t <sub>PWE</sub>                   | WE Pulse Width                                | 7       | -         | 8                | -   | 10                          | -   | ns      |
| t <sub>SD</sub>                    | Data Setup to Write End                       | 5       | -         | 6                | -   | 7                           | -   | ns      |
| t <sub>HD</sub>                    | Data Hold from Write End                      | 0       | -         | 0                | _   | 0                           | _   | ns      |
| t <sub>LZWE</sub>                  | WE HIGH to Low-Z <sup>[12]</sup>              | 3       | -         | - 3 -            |     | 3                           | _   | ns      |
| t <sub>HZWE</sub>                  | WE LOW to High-Z <sup>[11, 12]</sup>          | _       | 5         |                  | 6   | _                           | 7   | ns      |
| t <sub>BW</sub>                    | Byte Enable to End of Write                   | 7       | -         | 8                | -   | 10                          | -   | ns      |

#### Notes

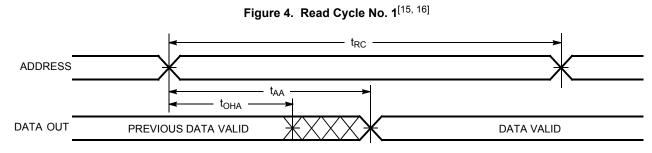
Notes
9. Test conditions assume signal transition time of 3 ns or less, timing reference levels of 1.5 V, input pulse levels of 0 to 3.0 V.
10. t<sub>POWER</sub> gives the minimum amount of time that the power supply must be at typical V<sub>CC</sub> values until the first memory access can be performed.
11. t<sub>HZOE</sub>, t<sub>HZCE</sub>, t<sub>HZBE</sub> and t<sub>HZWE</sub> are specified with a load capacitance of 5 pF as in part (d) of "AC Test Loads and Waveforms" on page 5.Transition is measured when the outputs enter a high impedance state.
12. At any temperature and voltage condition, t<sub>HZCE</sub> is less than t<sub>LZCE</sub>, t<sub>HZOE</sub> is less than t<sub>LZDE</sub>, t<sub>HZDE</sub> is less than t<sub>LZBE</sub>, and t<sub>HZWE</sub> is less than t<sub>LZWE</sub> for any device.
13. The internal write time of the memory is defined by the overlap of CE LOW, and WE LOW. CE and WE must be LOW to initiate a write, and the transition of either of these signals can terminate the write. The input data setup and hold timing must refer to the leading edge of the signal that terminates the write.
14. The minimum write cycle time for Write Cycle No. 3 (WE controlled, OE LOW) is the sum of t<sub>HZWE</sub> and t<sub>SD</sub>.

Document #: 001-00063 Rev. \*G

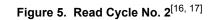


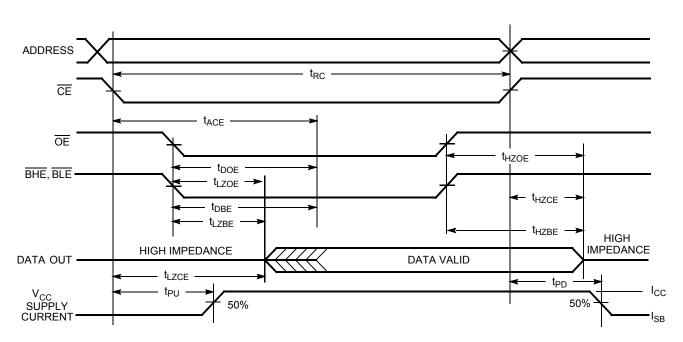
### **Switching Waveforms**

### **Read Cycle No. 1**



### Read Cycle No. 2 (OE Controlled)





#### Notes

15. <u>Device</u> is continuously selected.  $\overline{OE}$ ,  $\overline{CE} = V_{IL}$ ,  $\overline{BHE}$ ,  $\overline{BLE}$ , or both =  $V_{IL}$ .

16. WE is HIGH for Read cycle. 17. Address valid before or coincident with CE transition LOW.



### Switching Waveforms (continued)

Write Cycle No. 1 (CE Controlled)

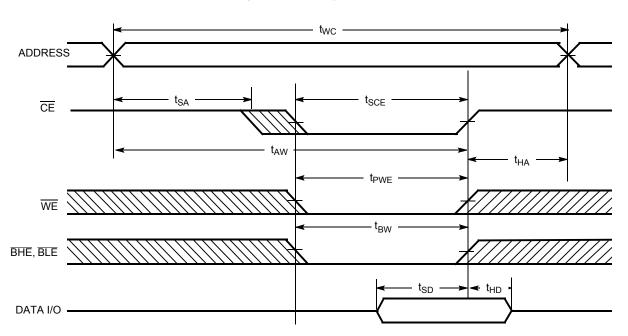
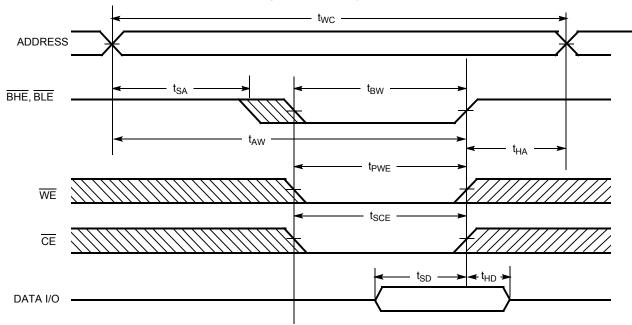


Figure 6. Write Cycle No. 1<sup>[18, 19]</sup>

## Write Cycle No. 2 (BLE or BHE Controlled)

Figure 7. Write Cycle No. 2



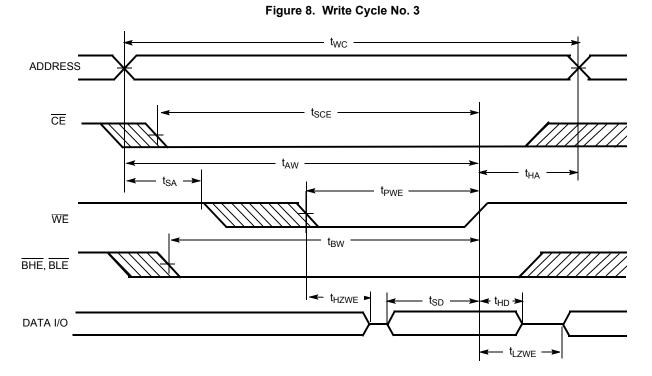
#### Notes

18. Data I/O is high-impedance if OE, or BHE, BLE, or both = V<sub>IH</sub>.
 19. If CE goes HIGH simultaneously with WE going HIGH, the output remains in a high-impedance state.



## Switching Waveforms (continued)





### Truth Table

| CE | OE | WE | BLE | BHE | 10 <sub>0</sub> –10 <sub>7</sub> | 10 <sub>8</sub> –10 <sub>15</sub> | Mode                       | Power                      |
|----|----|----|-----|-----|----------------------------------|-----------------------------------|----------------------------|----------------------------|
| Н  | Х  | Х  | Х   | Х   | High-Z                           | High-Z                            | Power Down                 | Standby (I <sub>SB</sub> ) |
| L  | L  | Н  | L   | L   | Data Out                         | Data Out                          | Read All Bits              | Active (I <sub>CC</sub> )  |
| L  | L  | Н  | L   | Н   | Data Out                         | High-Z                            | Read Lower Bits Only       | Active (I <sub>CC</sub> )  |
| L  | L  | Н  | Н   | L   | High-Z                           | Data Out                          | Read Upper Bits Only       | Active (I <sub>CC</sub> )  |
| L  | Х  | L  | L   | L   | Data In                          | Data In                           | Write All Bits             | Active (I <sub>CC</sub> )  |
| L  | Х  | L  | L   | Н   | Data In                          | High-Z                            | Write Lower Bits Only      | Active (I <sub>CC</sub> )  |
| L  | Х  | L  | Н   | L   | High-Z                           | Data In                           | Write Upper Bits Only      | Active (I <sub>CC</sub> )  |
| L  | Н  | Н  | Х   | Х   | High-Z                           | High-Z                            | Selected, Outputs Disabled | Active (I <sub>CC</sub> )  |



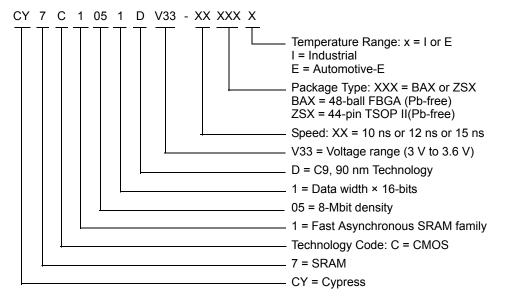
### **Ordering Information**

Cypress offers other versions of this type of product in many different configurations and features. The following table contains only the list of parts that are currently available. For a complete listing of all options, visit the Cypress website at www.cypress.com and refer to the product summary page at http://www.cypress.com/products or contact your local sales representative. Cypress maintains a worldwide network of offices, solution centers, manufacturer's representatives and distributors. To find the office closest to you, visit us at http://www.cypress.com/go/datasheet/offices.

| Speed<br>(ns) | Ordering Code       | Package<br>Diagram | Package Type             | Operating<br>Range     |
|---------------|---------------------|--------------------|--------------------------|------------------------|
| 10            | CY7C1051DV33-10BAXI | 51-85193           | 48-ball FBGA (Pb-free)   | Industrial             |
|               | CY7C1051DV33-10ZSXI | 51-85087           | 44-pin TSOP II (Pb-free) |                        |
| 12            | CY7C1051DV33-12BAXI | 51-85193           | 48-ball FBGA (Pb-free)   | Industrial             |
|               | CY7C1051DV33-12ZSXI | 51-85087           | 44-pin TSOP II (Pb-free) |                        |
| 15            | CY7C1051DV33-15ZSXE | 51-85087           | 44-pin TSOP II (Pb-free) | Auto-E <sup>[20]</sup> |

Contact your local Cypress sales representative for availability of these parts.

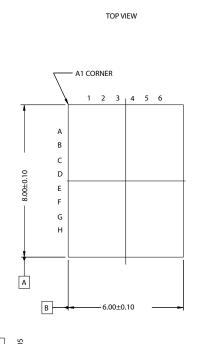
### **Ordering Code Definitions**

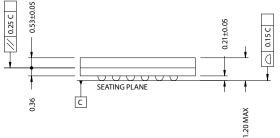


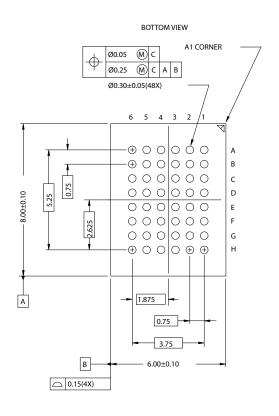


### **Package Diagrams**

Figure 9. 48-Ball FBGA (6 x 8 x 1.2 mm), 51-85193







REFERENCE JEDEC MO-207

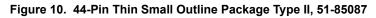
51-85193-\*B

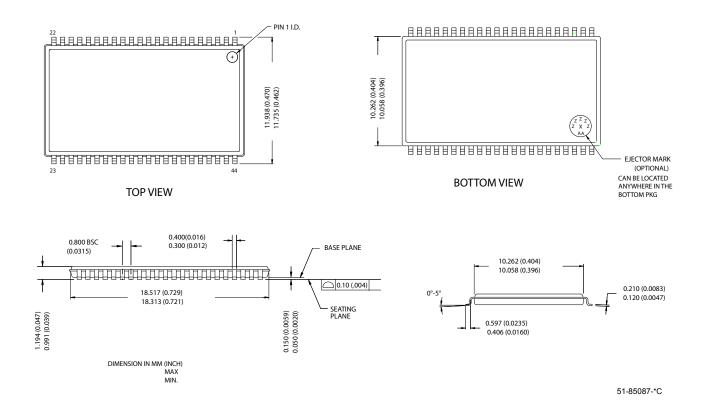
Note 20. Automotive product information is preliminary.

Page 11 of 15



## Package Diagrams (continued)









### Acronyms

| Acronym | Description                             |
|---------|---|
| CE      | chip enable                             |
| CMOS    | Complementary metal oxide semiconductor |
| I/O     | Input/output                            |
| OE      | output enable                           |
| SRAM    | Static random access memory             |
| SOJ     | Small Outline J-Lead                    |
| TSOP    | Thin Small Outline Package              |
| VFBGA   | Very Fine-Pitch Ball Grid Array         |

### **Document Conventions**

### Units of Measure

| Symbol | Unit of Measure |
|--------|-----------------|
| ns     | nano seconds    |
| V      | Volts           |
| μA     | microamperes    |
| mA     | milliamperes    |
| mV     | millivolts      |
| mW     | milliwatts      |
| MHz    | Megahertz       |
| pF     | pico Farad      |
| °C     | degree Celcius  |
| W      | Watts           |



## **Document History Page**

| Document Title: CY7C1051DV33, 8-Mbit (512 K × 16) Static RAM<br>Document Number: 001-00063 |         |            |                    |   |  |  |
|--|---------|------------|--------------------|---|--|--|
| REV.   | ECN NO. | Issue Date | Orig. of<br>Change | Description of Change   |  |  |
| **   | 342195  | See ECN    | PCI                | New Data Sheet  |  |  |
| *A   | 380574  | See ECN    | SYT                | Redefined I <sub>CC</sub> values for Com'l and Ind'l temperature ranges $I_{CC}$ (Com'l): Changed from 110, 90 and 80 mA to 110, 100 and 95 mA for 8, 10 and 12 ns speed bins respectively $I_{CC}$ (Ind'l): Changed from 110, 90 and 80 mA to 120, 110 and 105 mA for 8, 10 and 12 ns speed bins respectively Changed the Capacitance values from 8 pF to 10 pF on Page # 3  |  |  |
| *В   | 485796  | See ECN    | NXR                | Changed address of Cypress Semiconductor Corporation on Page# 1 from "3901<br>North First Street" to "198 Champion Court"<br>Removed -8 and -12 Speed bins from product offering,<br>Removed Commercial Operating Range option,<br>Modified Maximum Ratings for DC input voltage from -0.5 V to -0.3 V and<br>$V_{CC}$ + 0.5 V to $V_{CC}$ + 0.3 V<br>Changed the Description of I <sub>IX</sub> from Input Load Current to<br>Input Leakage Current.<br>Changed t <sub>HZBE</sub> from 5 ns to 6 ns<br>Updated footnote #7 on High-Z parameter measurement<br>Added footnote #11<br>Updated the Ordering Information table and Replaced Package Name column with<br>Package Diagram. |  |  |
| *C   | 866000  | See ECN    | NXR                | Changed ball E3 from V <sub>SS</sub> to NC in FBGA pin configuration  |  |  |
| *D   | 1513285 | See ECN    | VKN/AESA           | Converted from preliminary to final<br>Changed t <sub>HZBE</sub> from 6 ns to 5 ns for 10 ns speed bin<br>Added 12 ns speed bin<br>Changed t <sub>OHA</sub> spec from 3 ns to 2.5 ns<br>Updated Ordering information table  |  |  |
| *E   | 2911009 | 04/12/10   | VKN                | Replaced 48-Ball (7 x 8.5 x 1.2 mm) FBGA with 48-Ball (6 x 8 x 1.2mm) FBGA,<br>Updated Package diagrams, Updated ordering information.  |  |  |
| *F   | 3086522 | 11/15/2010 | PRAS               | Included Auto-E information (preliminary) in Ordering Information.  |  |  |
| *G   | 3112625 | 12/16/2010 | AJU                | Added Ordering Code Definitions.  |  |  |



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Page 15 of 15

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