

Features

- Pin and function compatible with CY7C1049CV33
- High speed
 - $t_{AA} = 10 \text{ ns}$
- Low active power
 - $I_{CC} = 90 \text{ mA @ } 10 \text{ ns (Industrial)}$
- Low CMOS standby power
 - $I_{SB2} = 10 \text{ mA}$
- 2.0V data retention
- Automatic power down when deselected
- TTL compatible inputs and outputs
- Easy memory expansion with \overline{CE} and \overline{OE} features
- Available in Pb-free 36-pin (400 Mil) Molded SOJ and 44-pin TSOP II packages

Functional Description

The CY7C1049DV33 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. You can write to the device by taking Chip Enable (\overline{CE}) and Write Enable (\overline{WE}) inputs LOW. Data on the eight IO pins (IO_0 through IO_7) is then written into the location specified on the address pins (A_0 through A_{18}).

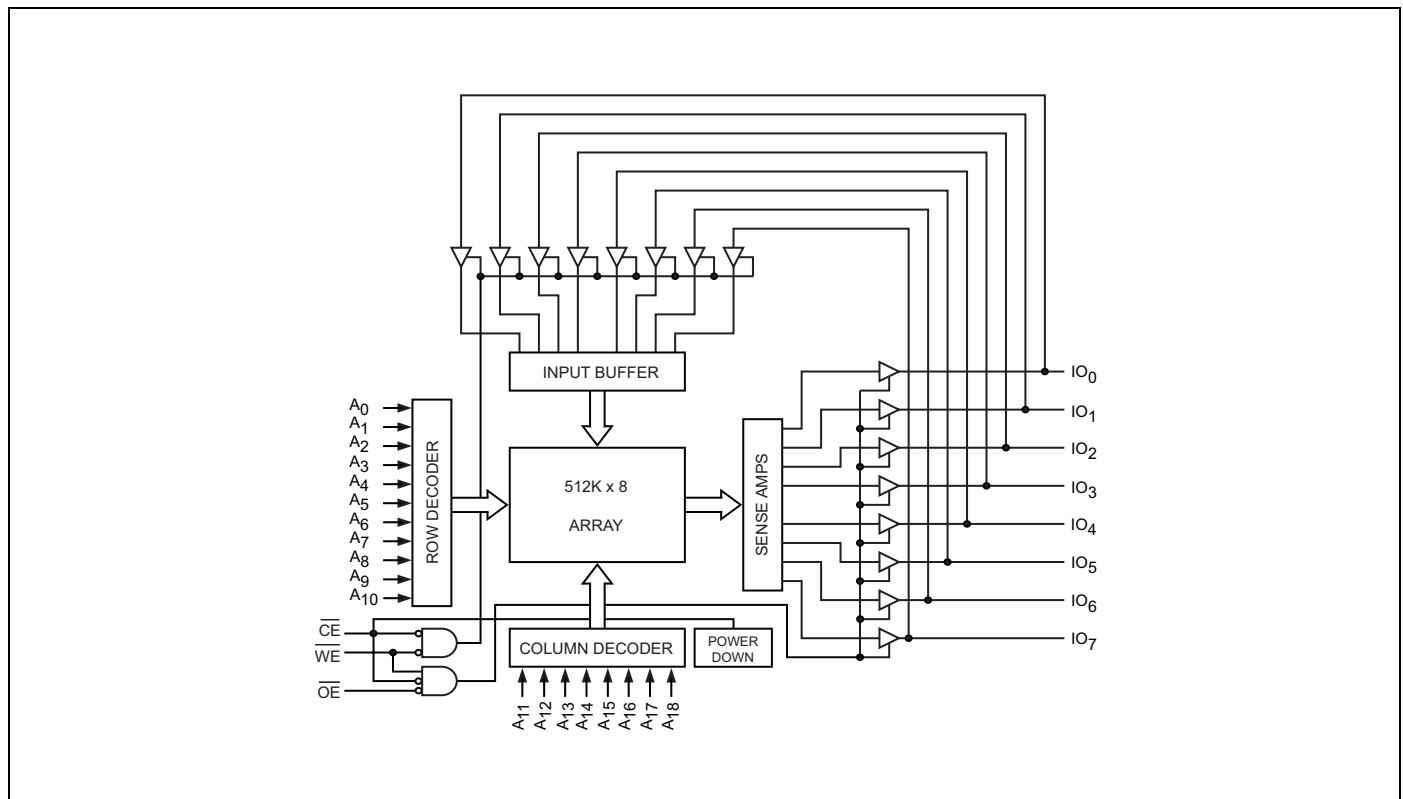
You can read from the device by taking Chip Enable (\overline{CE}) and Output Enable (\overline{OE}) LOW while forcing Write Enable (\overline{WE}) HIGH. Under these conditions, the contents of the memory location specified by the address pins appear on the IO pins.

The eight input or output pins (IO_0 through IO_7) are placed in a high impedance state when the device is deselected (\overline{CE} HIGH), the outputs are disabled (\overline{OE} HIGH), or during a write operation (\overline{CE} LOW, and \overline{WE} LOW).

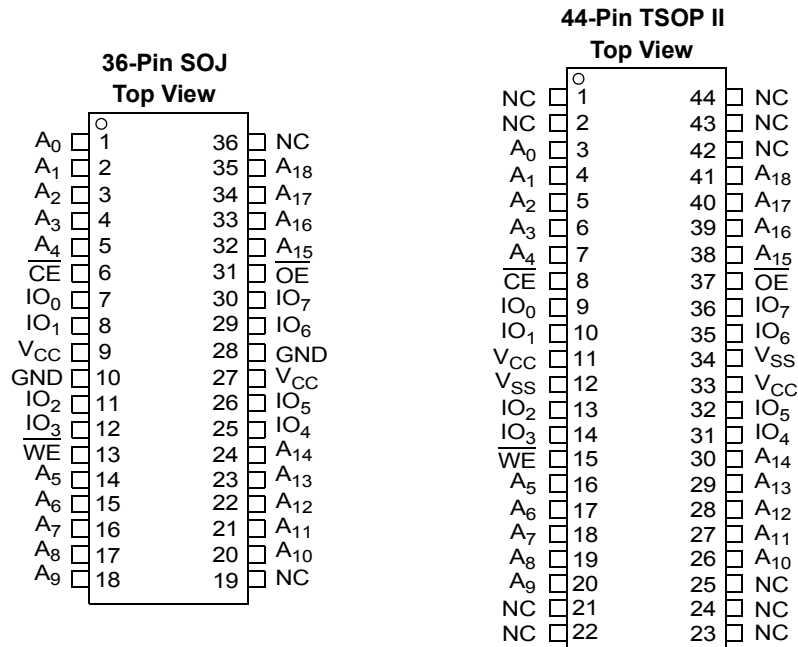
The CY7C1049DV33 is available in standard 400 Mil wide 36-pin SOJ package and 44-pin TSOP II package with center power and ground (revolutionary) pinout.

Refer to the Cypress application note [AN1064, SRAM System Guidelines](#) for best practice recommendations.

Logic Block Diagram



Pin Configuration



Selection Guide

| | -10 (Industrial) | -12 (Automotive) ^[1] | Unit |
|------------------------------|------------------|---------------------------------|------|
| Maximum Access Time | 10 | 12 | ns |
| Maximum Operating Current | 90 | 95 | mA |
| Maximum CMOS Standby Current | 10 | 15 | mA |

Note

1. Automotive product information is preliminary.

Maximum Ratings

Exceeding the maximum ratings may impair the useful life of the device. 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_{CC} to Relative GND^[2] -0.3V to +4.6V
- DC Voltage Applied to Outputs in High Z State^[2] -0.3V to V_{CC} + 0.3V
- DC Input Voltage^[2] -0.3V to V_{CC} + 0.3V

- Current into Outputs (LOW)..... 20 mA
- Static Discharge Voltage..... >2001V (MIL-STD-883, Method 3015)
- Latch up Current..... >200 mA

Operating Range

| Range | Ambient Temperature | V _{CC} | Speed |
|------------|---------------------|-----------------|-------|
| Industrial | -40°C to +85°C | 3.3V ± 0.3V | 10 ns |
| Automotive | -40°C to +125°C | 3.3V ± 0.3V | 12 ns |

Electrical Characteristics Over the Operating Range

| Parameter | Description | Test Conditions | -10 (Industrial) | | -12 (Automotive) | | Unit |
|--------------------------------|--|---|------------------|-----------------------|------------------|-----------------------|------|
| | | | Min | Max | Min | Max | |
| V _{OH} | Output HIGH Voltage | V _{CC} = Min, I _{OH} = -4.0 mA | 2.4 | | 2.4 | | V |
| V _{OL} | Output LOW Voltage | V _{CC} = Min, I _{OL} = 8.0 mA | | 0.4 | | 0.4 | V |
| V _{IH} ^[2] | Input HIGH Voltage | | 2.0 | V _{CC} + 0.3 | 2.0 | V _{CC} + 0.3 | V |
| V _{IL} ^[2] | Input LOW Voltage ^[2] | | -0.3 | 0.8 | -0.3 | 0.8 | V |
| I _{IX} | Input Leakage Current | GND ≤ V _I ≤ V _{CC} | -1 | +1 | -1 | +1 | µA |
| I _{OZ} | Output Leakage Current | GND ≤ V _{OUT} ≤ V _{CC} , Output Disabled | -1 | +1 | -1 | +1 | µA |
| I _{CC} | V _{CC} Operating Supply Current | V _{CC} = Max, f = f _{MAX} = 1/t _{RC} | 100 MHz | 90 | | - | mA |
| | | | 83 MHz | 80 | | 95 | mA |
| | | | 66 MHz | 70 | | 85 | mA |
| | | | 40 MHz | 60 | | 75 | mA |
| I _{SB1} | Automatic CE Power down Current —TTL Inputs | Max V _{CC} , $\overline{CE} \geq V_{IH}$; V _{IN} ≥ V _{IH} or V _{IN} ≤ V _{IL} , f = f _{MAX} | | 20 | | 25 | mA |
| I _{SB2} | Automatic CE Power down Current —CMOS Inputs | Max V _{CC} , $\overline{CE} \geq V_{CC} - 0.3V$, V _{IN} ≥ V _{CC} - 0.3V, or V _{IN} ≤ 0.3V, f = 0 | | 10 | | 15 | mA |

Capacitance

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

| Parameter | Description | Test Conditions | Max | Unit |
|------------------|-------------------|--|-----|------|
| C _{IN} | Input Capacitance | T _A = 25°C, f = 1 MHz, V _{CC} = 3.3V | 8 | pF |
| C _{OUT} | IO Capacitance | | 8 | pF |

Note
 2. V_{IL} (min.) = -2.0V and V_{IH}(max) = V_{CC} + 2V for pulse durations of less than 20 ns.

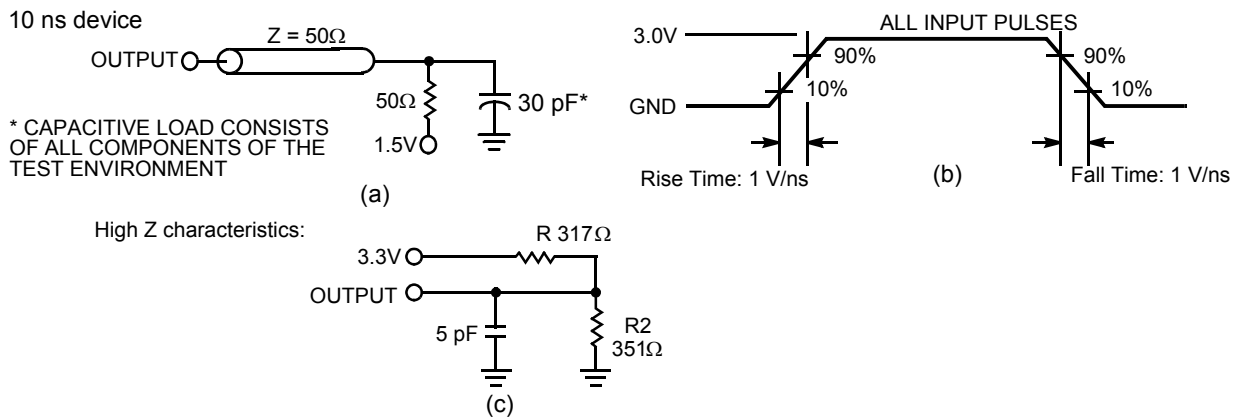
Thermal Resistance

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

| Parameter | Description | Test Conditions | SOJ Package | TSOP II Package | Unit |
|---------------|--|--|-------------|-----------------|------|
| Θ_{JA} | Thermal Resistance (Junction to Ambient) | Still Air, soldered on a 3 × 4.5 inch, two layer printed circuit board | 57.91 | 50.66 | °C/W |
| Θ_{JC} | Thermal Resistance (Junction to Case) | | 36.73 | 17.17 | °C/W |

AC Test Loads and Waveforms

Figure 1. AC Test Loads and Waveforms [4]

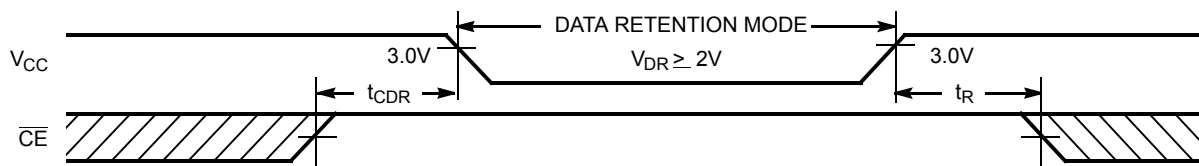


Data Retention Characteristics

Over the Operating Range

| Parameter | Description | Conditions [5] | Min | Max | Unit |
|-----------------|--------------------------------------|--|----------|-----|------|
| V_{DR} | V_{CC} for Data Retention | | 2.0 | | V |
| I_{CCDR} | Data Retention Current | $V_{CC} = V_{DR} = 2.0\text{V}$, $\overline{CE} \geq V_{CC} - 0.3\text{V}$ $V_{IN} \geq V_{CC} - 0.3\text{V}$ or $V_{IN} \leq 0.3\text{V}$ | Ind'l | 10 | mA |
| | | | Auto | 15 | mA |
| $t_{CDR}^{[3]}$ | Chip Deselect to Data Retention Time | | 0 | | ns |
| $t_R^{[6]}$ | Operation Recovery Time | | t_{RC} | | ns |

Figure 2. Data Retention Waveform



Note

- Tested initially and after any design or process changes that may affect these parameters.
- AC characteristics (except High Z) are tested using the load conditions shown in Figure 1. High Z characteristics are tested for all speeds using the test load shown in Figure (c).
- No input may exceed $V_{CC} + 0.3\text{V}$.
- Full device operation requires linear V_{CC} ramp from V_{DR} to $V_{CC(min.)} \geq 50\ \mu\text{s}$ or stable at $V_{CC(min.)} \geq 50\ \mu\text{s}$.

AC Switching Characteristics

Over the Operating Range ^[7]

| Parameter | Description | -10 (Industrial) | | -12 (Automotive) | | Unit |
|---------------------------------------|--|------------------|-----|------------------|-----|------|
| | | Min | Max | Min | Max | |
| Read Cycle | | | | | | |
| t _{power} ^[8] | V _{CC} (typical) to the first access | 100 | | 100 | | μs |
| t _{RC} | Read Cycle Time | 10 | | 12 | | ns |
| t _{AA} | Address to Data Valid | | 10 | | 12 | ns |
| t _{OHA} | Data Hold from Address Change | 3 | | 3 | | ns |
| t _{ACE} | $\overline{\text{CE}}$ LOW to Data Valid | | 10 | | 12 | ns |
| t _{DOE} | $\overline{\text{OE}}$ LOW to Data Valid | | 5 | | 6 | ns |
| t _{LZOE} | $\overline{\text{OE}}$ LOW to Low Z | 0 | | 0 | | ns |
| t _{HZOE} | $\overline{\text{OE}}$ HIGH to High Z ^[9, 10] | | 5 | | 6 | ns |
| t _{LZCE} | $\overline{\text{CE}}$ LOW to Low Z ^[10] | 3 | | 3 | | ns |
| t _{HZCE} | $\overline{\text{CE}}$ HIGH to High-Z ^[9, 10] | | 5 | | 6 | ns |
| t _{PU} | $\overline{\text{CE}}$ LOW to Power up | 0 | | 0 | | ns |
| t _{PD} | $\overline{\text{CE}}$ HIGH to Power down | | 10 | | 12 | ns |
| Write Cycle^[11, 12] | | | | | | |
| t _{WC} | Write Cycle Time | 10 | | 12 | | ns |
| t _{SCE} | $\overline{\text{CE}}$ LOW to Write End | 7 | | 8 | | ns |
| t _{AW} | Address Set up to Write End | 7 | | 8 | | ns |
| t _{HA} | Address Hold from Write End | 0 | | 0 | | ns |
| t _{SA} | Address Set up to Write Start | 0 | | 0 | | ns |
| t _{PWE} | $\overline{\text{WE}}$ Pulse Width | 7 | | 8 | | ns |
| t _{SD} | Data Set up to Write End | 5 | | 6 | | ns |
| t _{HD} | Data Hold from Write End | 0 | | 0 | | ns |
| t _{LZWE} | $\overline{\text{WE}}$ HIGH to Low Z ^[10] | 3 | | 3 | | ns |
| t _{HZWE} | $\overline{\text{WE}}$ LOW to High Z ^[9, 10] | | 5 | | 6 | ns |

Notes

7. Test conditions assume signal transition time of 3 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 30 pF load capacitance.
8. t_{POWER} gives the minimum amount of time that the power supply must be at stable, typical V_{CC} values until the first memory access is performed.
9. t_{HZOE}, t_{HZCE}, and t_{HZWE} are specified with a load capacitance of 5 pF as in part (d) of AC Test Loads. Transition is measured when the outputs enter a high impedance state.
10. At any 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.
11. The internal write time of the memory is defined by the overlap of $\overline{\text{CE}}$ LOW, and $\overline{\text{WE}}$ LOW. $\overline{\text{CE}}$ and $\overline{\text{WE}}$ must be LOW to initiate a write, and the transition of either of these signals can terminate the write. The input data set up and hold timing must be referred to the leading edge of the signal that terminates the write.
12. The minimum write cycle time for Write Cycle No. 2 ($\overline{\text{WE}}$ controlled, $\overline{\text{OE}}$ LOW) is the sum of t_{HZWE} and t_{SD}.

Switching Waveforms

Figure 3. Read Cycle No. 1^[13, 14]

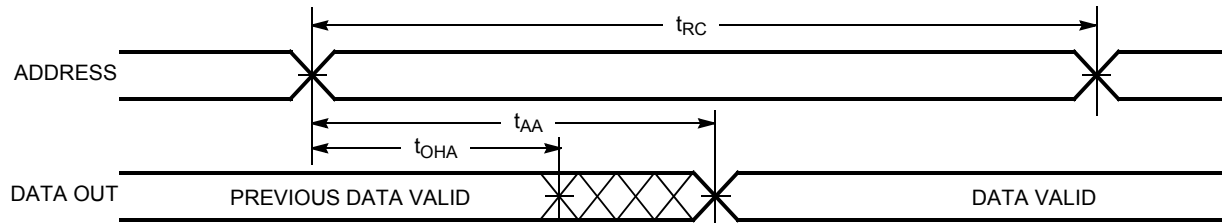


Figure 4. Read Cycle No. 2 (\overline{OE} Controlled)^[14, 15]

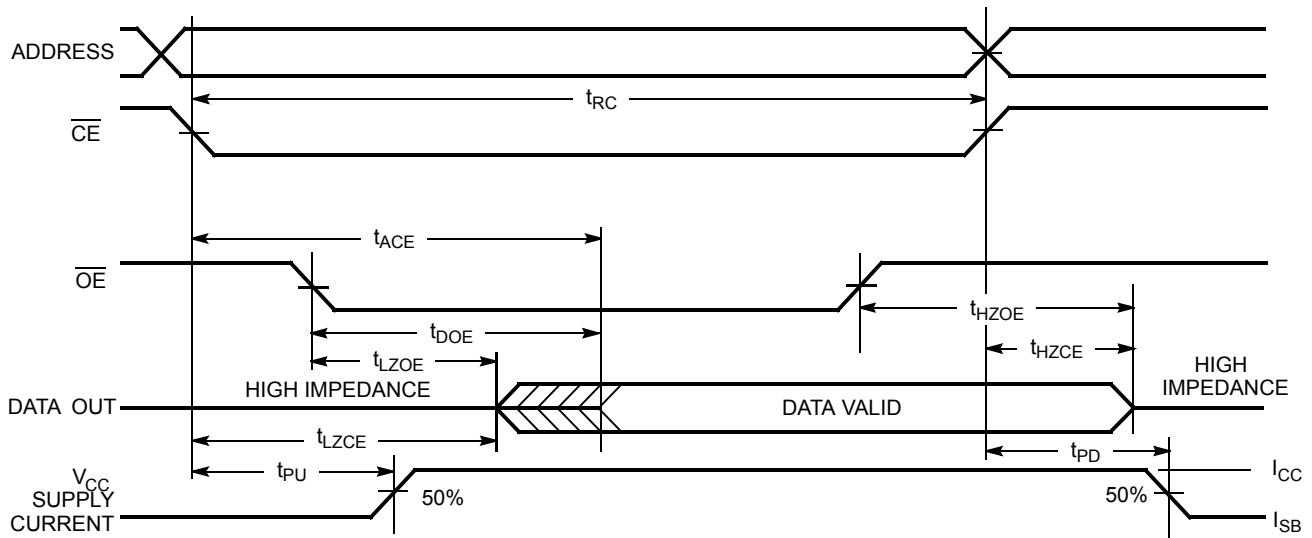
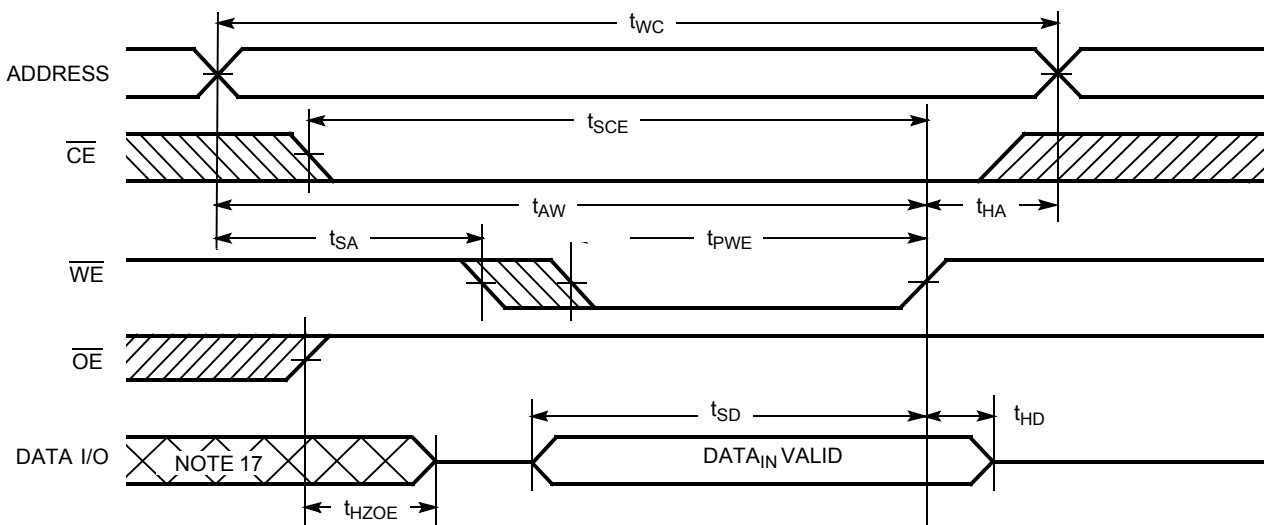


Figure 5. Write Cycle No. 1 (\overline{WE} Controlled, \overline{OE} HIGH During Write)^[16, 17]



Notes

- 13. Device is continuously selected. $\overline{OE}, \overline{CE} = V_{IL}$.
- 14. \overline{WE} is HIGH for read cycle.
- 15. Address valid prior to or coincident with \overline{CE} transition LOW.
- 16. Data IO is high impedance if $\overline{OE} = V_{IH}$.
- 17. If \overline{CE} goes HIGH simultaneously with \overline{WE} going HIGH, the output remains in a high impedance state.

Switching Waveforms (continued)

Figure 6. Write Cycle No. 2 (\overline{WE} Controlled, \overline{OE} LOW)^[17]

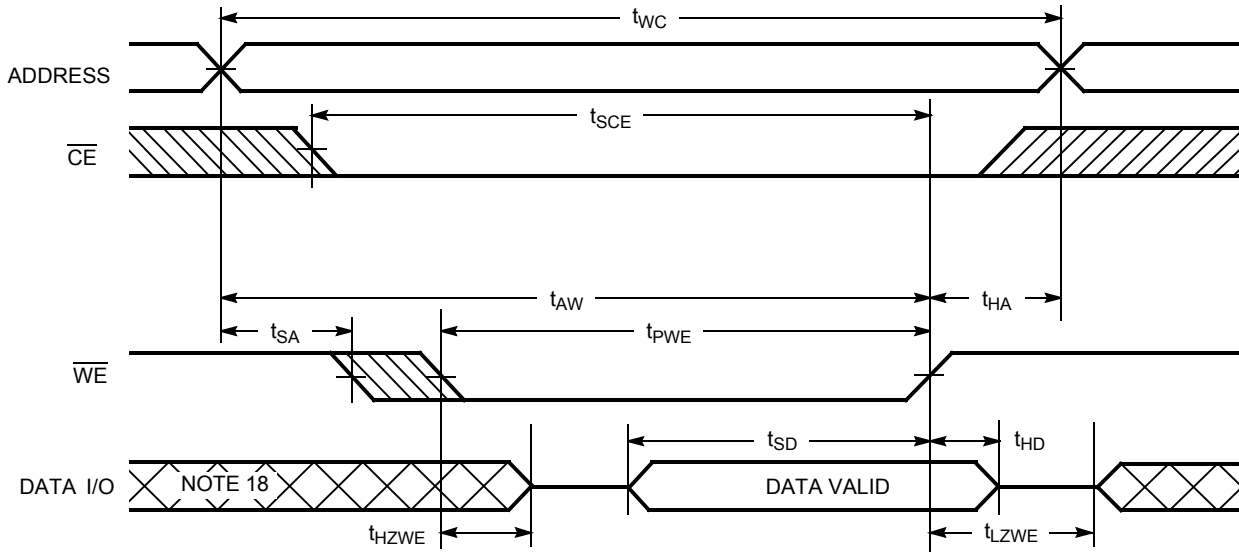
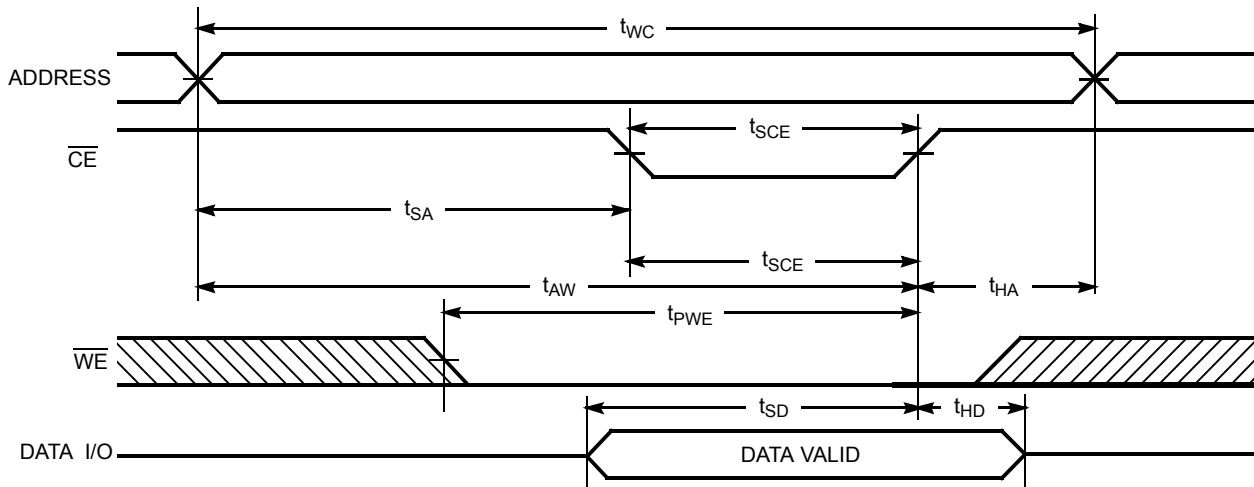


Figure 7. Write Cycle No. 3 (\overline{CE} Controlled)^[16, 17]



Note
18. During this period the IOs are in the output state and input signals must not be applied.

Truth Table

| \overline{CE} | \overline{OE} | \overline{WE} | IO_0 - IO_7 | 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}) |

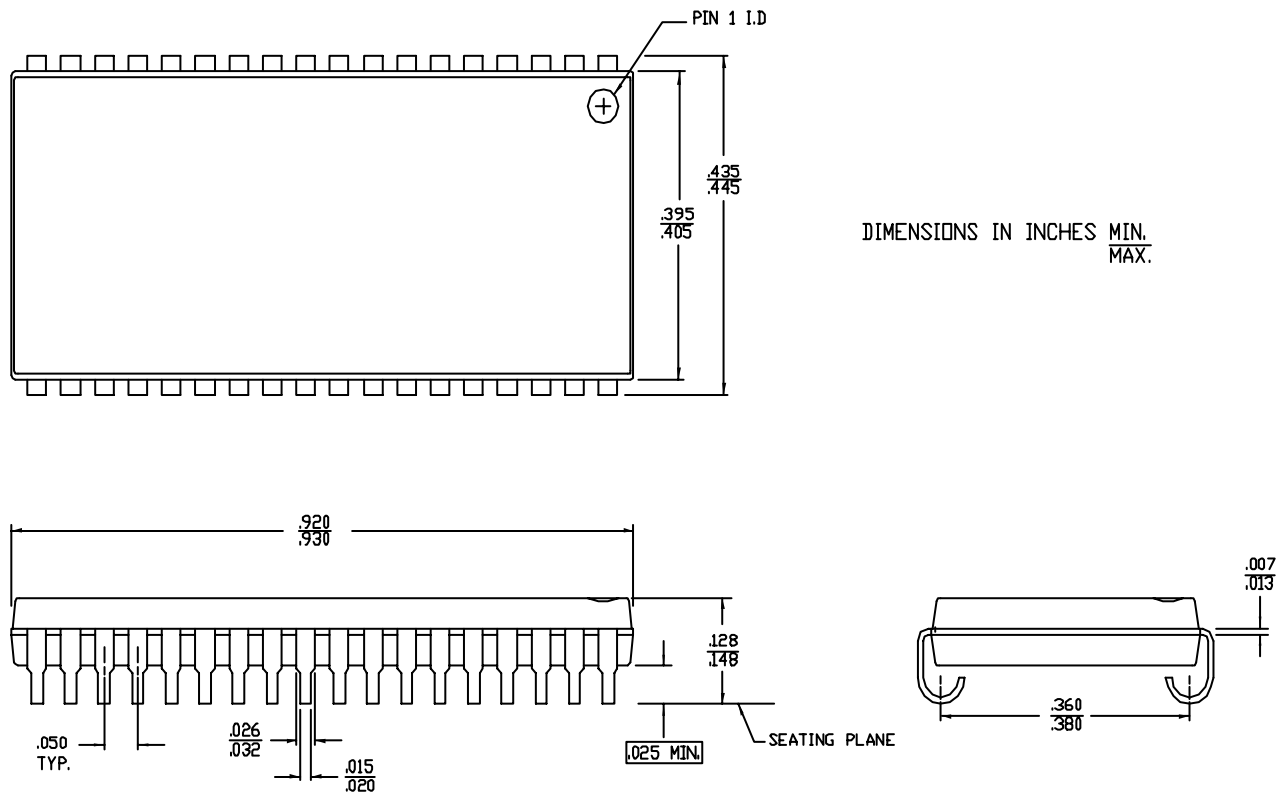
Ordering Information

| Speed (ns) | Ordering Code | Package Name | Package Type | Operating Range |
|------------|---------------------|--------------|---------------------------------------|-----------------|
| 10 | CY7C1049DV33-10VXI | 51-85090 | 36-pin (400-Mil) Molded SOJ (Pb-free) | Industrial |
| | CY7C1049DV33-10ZSXI | 51-85087 | 44-pin TSOP II (Pb-free) | |
| 12 | CY7C1049DV33-12VXE | 51-85090 | 36-pin (400-Mil) Molded SOJ (Pb-free) | Automotive |
| | CY7C1049DV33-12ZSXE | 51-85087 | 44-pin TSOP II (Pb-free) | |

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

Package Diagrams

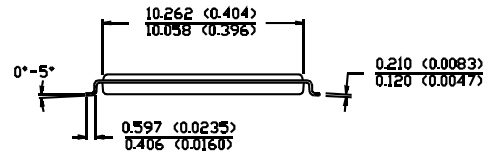
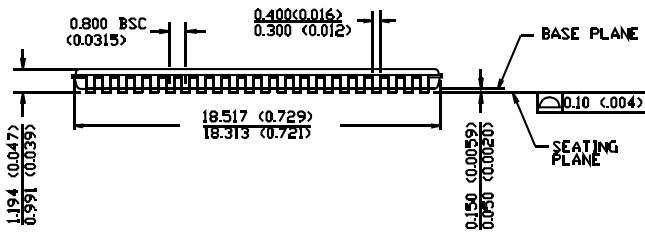
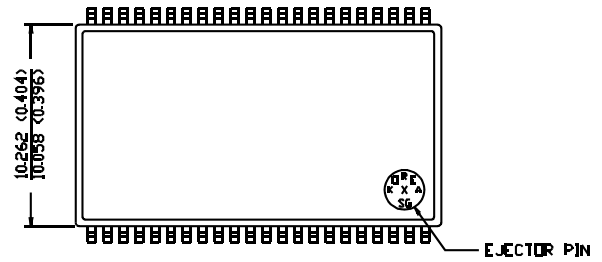
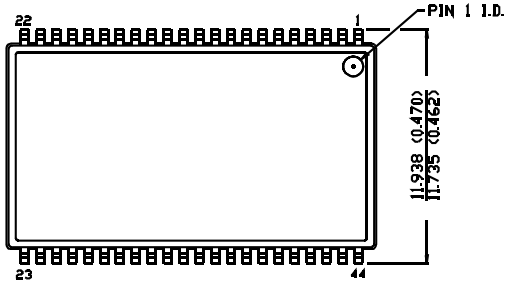
Figure 8. 36-Pin (400-Mil) Molded SOJ (51-85090)



Package Diagrams (continued)

Figure 9. 44-Pin Thin Small Outline Package Type II (51-85087)

DIMENSION IN MM (INCH)
MAX
MIN



51-85087-A

Document History Page

| Document Title: CY7C1049DV33, 4-Mbit (512K x 8) Static RAM | | | | |
|--|---------|------------|-----------------|---|
| Document Number: 38-05475 | | | | |
| REV. | ECN NO. | Issue Date | Orig. of Change | Description of Change |
| ** | 201560 | See ECN | SWI | Advance Datasheet for C9 IPP |
| *A | 233729 | See ECN | SYT | 1.AC, DC parameters are modified as per EROS (Specification # 01-2165) 2.Pb-free offering in the Ordering Information Table |
| *B | 351096 | See ECN | PCI | Changed from Advance to Preliminary Removed 20 ns Speed bin Corrected DC voltage (min) value in maximum ratings section from - 0.5 to - 0.3V Redefined I _{CC} values for Com'l and Ind'l temperature ranges I _{CC} (Com'l): Changed from 100, 80, and 67 mA to 90, 80 and, 75 mA for 8, 10, and 12ns speed bins respectively I _{CC} (Ind'l): Changed from 80 and 67 mA to 90 and 85 mA for 10 and 12ns speed bins respectively Added V _{IH(max)} specification in Note# 2 Changed reference voltage level for measurement of High Z parameters from ±500 mV to ±200 mV Added Data Retention Characteristics, Waveform, and footnotes 11 and 12 Changed Package Diagram name from 44-pin TSOP II Z44 to 44-pin TSOP II ZS44 Changed part names from Z to ZS in the Ordering Information Table Added 8 ns parts in the Ordering Information Table Added Pb-free Ordering Information Shaded Ordering Information Table |
| *C | 446328 | See ECN | NXR | Converted from Preliminary to Final Removed -8 speed bin Removed Commercial Operating Range product information Added Automotive Operating Range product information Updated Thermal Resistance table Updated footnote #8 on High Z parameter measurement Replaced Package Name column with Package Diagram in the Ordering Information table |
| *D | 1274726 | See ECN | VKN/AESA | Corrected typo in the 44-Pin TSOP II pinout |

© Cypress Semiconductor Corporation, 2004-2007. The information contained herein is subject to change without notice. Cypress Semiconductor Corporation assumes no responsibility for the use of any circuitry other than circuitry embodied in a Cypress product. Nor does it convey or imply any license under patent or other rights. Cypress products are not warranted nor intended to be used for medical, life support, life saving, critical control or safety applications, unless pursuant to an express written agreement with Cypress. Furthermore, Cypress does not authorize its products for use as critical components in life-support systems where a malfunction or failure may reasonably be expected to result in significant injury to the user. The inclusion of Cypress products in life-support systems application implies that the manufacturer assumes all risk of such use and in doing so indemnifies Cypress against all charges.

Any Source Code (software and/or firmware) is owned by Cypress Semiconductor Corporation (Cypress) and is protected by and subject to worldwide patent protection (United States and foreign), United States copyright laws and international treaty provisions. Cypress hereby grants to licensee a personal, non-exclusive, non-transferable license to copy, use, modify, create derivative works of, and compile the Cypress Source Code and derivative works for the sole purpose of creating custom software and/or firmware in support of licensee product to be used only in conjunction with a Cypress integrated circuit as specified in the applicable agreement. Any reproduction, modification, translation, compilation, or representation of this Source Code except as specified above is prohibited without the express written permission of Cypress.

Disclaimer: CYPRESS MAKES NO WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, WITH REGARD TO THIS MATERIAL, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. Cypress reserves the right to make changes without further notice to the materials described herein. Cypress does not assume any liability arising out of the application or use of any product or circuit described herein. Cypress does not authorize its products for use as critical components in life-support systems where a malfunction or failure may reasonably be expected to result in significant injury to the user. The inclusion of Cypress' product in a life-support systems application implies that the manufacturer assumes all risk of such use and in doing so indemnifies Cypress against all charges.

Use may be limited by and subject to the applicable Cypress software license agreement.