

2-Mbit (128 K × 16) Static RAM

Features

- Pin-and function-compatible with CY7C1011CV33
- High speed
 - $t_{AA} = 10 \text{ ns}$
- Low active power
 - $I_{CC} = 90 \text{ mA @ } 10 \text{ ns (Industrial)}$
- Low CMOS standby power
 - $I_{SB2} = 10 \text{ mA}$
- Data Retention at 2.0 V
- Automatic power-down when deselected
- Independent control of upper and lower bits
- Easy memory expansion with \overline{CE} and \overline{OE} features
- Available in Pb-free 44-pin TSOP II, and 48-ball VFBGA

Functional Description

The CY7C1011DV33^[1] is a high-performance CMOS Static RAM organized as 128 K words by 16 bits.

Writing to the device is accomplished by taking Chip Enable (\overline{CE}) and Write Enable (\overline{WE}) inputs LOW. If Byte Low Enable (\overline{BLE}) is LOW, then data from I/O pins (I/O₀ through I/O₇), is written into the location specified on the address pins (A₀ through A₁₆). If Byte High Enable (\overline{BHE}) is LOW, then data from I/O pins (I/O₈ through I/O₁₅) is written into the location specified on the address pins (A₀ through A₁₆).

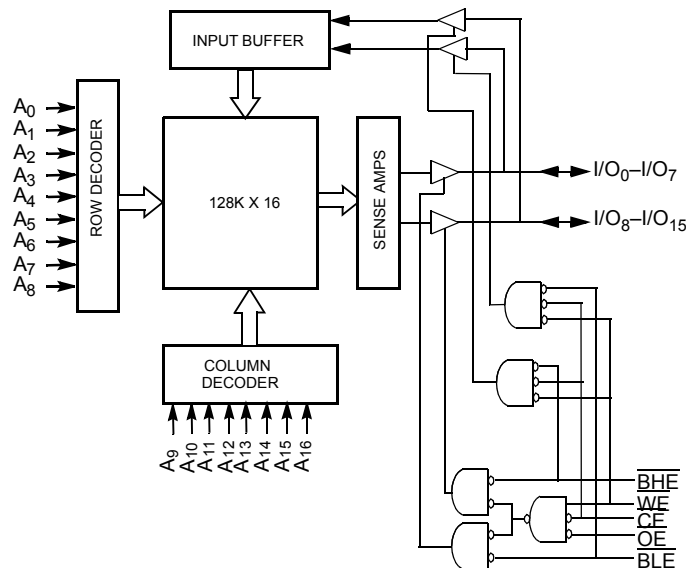
Reading from the device is accomplished by taking Chip Enable (\overline{CE}) and Output Enable (\overline{OE}) LOW while forcing the Write Enable (\overline{WE}) HIGH. If Byte Low Enable (\overline{BLE}) is LOW, then data from the memory location specified by the address pins will appear on I/O₀ to I/O₇. If Byte High Enable (\overline{BHE}) is LOW, then data from memory will appear on I/O₈ to I/O₁₅. See the truth table at the back of this data sheet for a complete description of read and write modes.

The input/output pins (I/O₀ through I/O₁₅) are placed in a high-impedance state when the device is deselected (\overline{CE} HIGH), the outputs are disabled (\overline{OE} HIGH), the \overline{BHE} and \overline{BLE} are disabled (\overline{BHE} , \overline{BLE} HIGH), or during a write operation (\overline{CE} LOW, and \overline{WE} LOW).

The CY7C1011DV33 is available in standard Pb-free 44-pin TSOP II with center power and ground pinout, as well as 48-ball very fine-pitch ball grid array (VFBGA) packages.

For a complete list of related resources, [click here](#).

Logic Block Diagram



Note

1. For guidelines on SRAM system design, please refer to the "System Design Guidelines" Cypress application note, available on the internet at www.cypress.com

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Selection Guide

Description	-10	Unit
Maximum Access Time	10	ns
Maximum Operating Current	90	mA
Maximum CMOS Standby Current	10	mA

Pin Configurations

Figure 1. 44-pin TSOP II pinout (Top View)

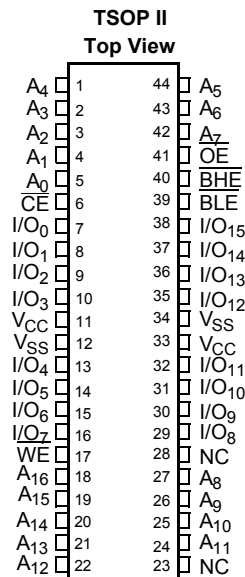
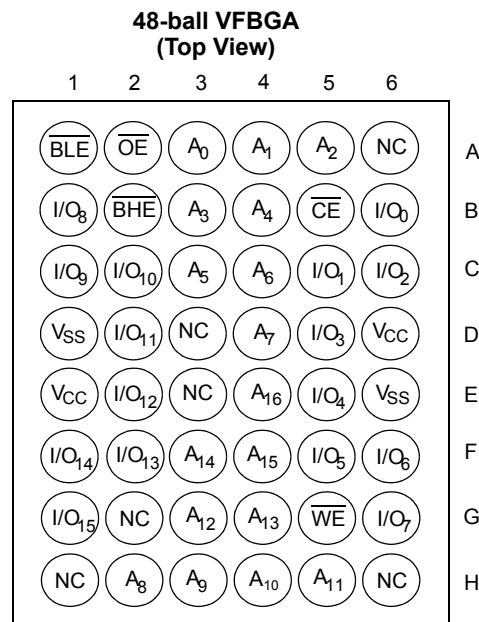


Figure 2. 48-ball VFBGA pinout (Top View)



Maximum Ratings

Exceeding maximum ratings may shorten 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] -0.3 V to +4.6 V

DC voltage applied to outputs in high Z State ^[2] -0.3 V to $V_{CC} + 0.3$ V

DC input voltage ^[2] -0.3 V to $V_{CC} + 0.3$ V

Current into outputs (LOW) 20 mA

Static discharge voltage (per MIL-STD-883, method 3015) > 2001 V

Latch-up current > 200 mA

Operating Range

Range	Ambient Temperature	V_{CC}
Industrial	-40 °C to +85 °C	3.3 V ± 0.3 V

DC Electrical Characteristics

Over the Operating Range

Parameter	Description	Test Conditions	-10		Unit	
			Min	Max		
V_{OH}	Output HIGH voltage	$V_{CC} = \text{Min}, I_{OH} = -4.0 \text{ mA}$	2.4	-	V	
V_{OL}	Output LOW voltage	$V_{CC} = \text{Min}, I_{OL} = 8.0 \text{ mA}$	-	0.4	V	
V_{IH}	Input HIGH voltage		2.0	$V_{CC} + 0.3$	V	
V_{IL}	Input LOW voltage ^[3]		-0.3	0.8	V	
I_{IX}	Input leakage current	$GND \leq V_I \leq V_{CC}$	-1	+1	μA	
I_{OZ}	Output leakage current	$GND \leq V_{OUT} \leq V_{CC}$, Output Disabled	-1	+1	μA	
I_{CC}	V_{CC} operating supply current	$V_{CC} = \text{Max}, f = f_{MAX} = 1/t_{RC}$	100 MHz	-	90	mA
			83 MHz	-	80	
			66 MHz	-	70	
			40 MHz	-	60	
I_{SB1}	Automatic CE Power-down Current — TTL Inputs	$\text{Max } V_{CC}, \overline{CE} \geq V_{IH}, V_{IN} \geq V_{IH} \text{ or } V_{IN} \leq V_{IL}, f = f_{MAX}$	-	20	mA	
I_{SB2}	Automatic CE Power-down Current — CMOS Inputs	$\text{Max } V_{CC}, \overline{CE} \geq V_{CC} - 0.3 \text{ V}, V_{IN} \geq V_{CC} - 0.3 \text{ V}, \text{ or } V_{IN} \leq 0.3 \text{ V}, f = 0$	-	10	mA	

Notes

2. Tested initially and after any design or process changes that may affect these parameters.
3. $V_{IL}(\text{min}) = -2.0 \text{ V}$ and $V_{IH}(\text{max}) = V_{CC} + 2 \text{ V}$ for pulse durations of less than 20 ns.

Capacitance

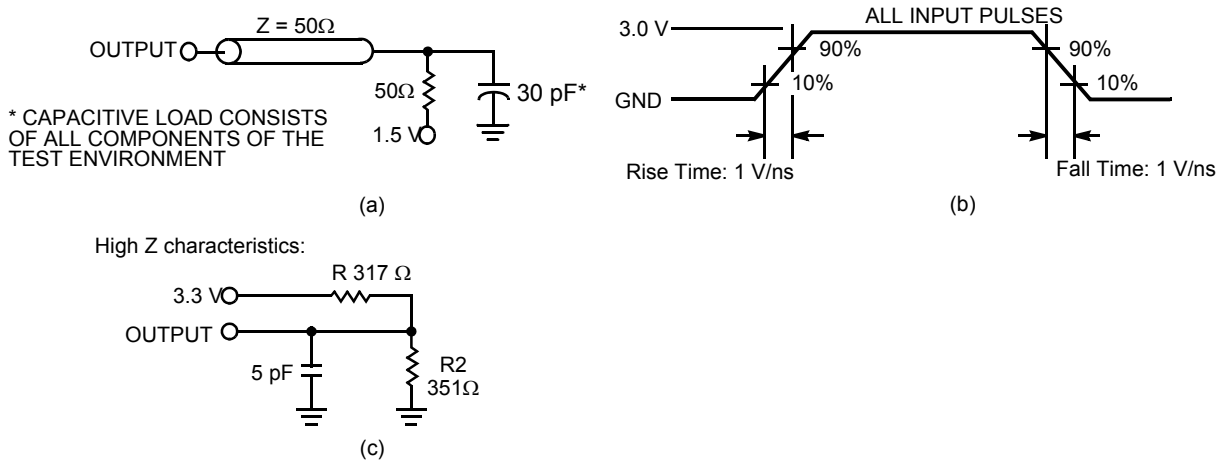
Parameter ^[4]	Description	Test Conditions	Max	Unit
C _{IN}	Input capacitance	T _A = 25 °C, f = 1 MHz, V _{CC} = 3.3 V	8	pF
C _{OUT}	I/O capacitance		8	pF

Thermal Resistance

Parameter ^[4]	Description	Test Conditions	TSOP II	VFBGA	Unit
Θ _{JA}	Thermal resistance (junction to ambient)	Still air, soldered on a 3 × 4.5 inch, four-layer printed circuit board	50.66	27.89	°C/W
Θ _{JC}	Thermal resistance (junction to case)		17.17	14.74	°C/W

AC Test Loads and Waveforms

Figure 3. AC Test Loads and Waveforms ^[5]



Note

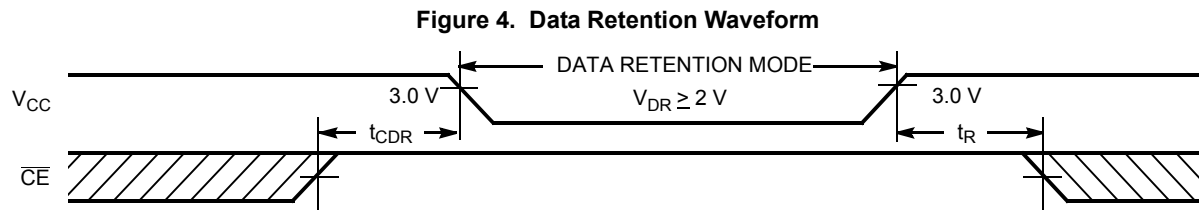
- 4. Tested initially and after any design or process changes that may affect these parameters.
- 5. AC characteristics (except high Z) are tested using the load conditions shown in (a). High Z characteristics are tested for all speeds using the test load shown in (c).

Data Retention Characteristics

Over the Operating Range

Parameter	Description	Conditions ^[6]	Min	Max	Unit
V_{DR}	V_{CC} for data retention		2.0	–	V
I_{CCDR}	Data retention current		–	10	mA
$t_{CDR}^{[7]}$	Chip deselect to data retention time	$V_{CC} = V_{DR} = 2.0\text{ V}$, $\overline{CE} \geq V_{CC} - 0.3\text{ V}$, $V_{IN} \geq V_{CC} - 0.3\text{ V}$ or $V_{IN} \leq 0.3\text{ V}$	0	–	ns
$t_R^{[8]}$	Operation recovery time		t_{RC}	–	ns

Data Retention Waveform



Notes

6. No input may exceed $V_{CC} + 0.3\text{ V}$.
7. Tested initially and after any design or process changes that may affect these parameters.
8. Full device operation requires linear V_{CC} ramp from V_{DR} to $V_{CC(\text{min.})} \geq 50\ \mu\text{s}$ or stable at $V_{CC(\text{min.})} \geq 50\ \mu\text{s}$.

AC Switching Characteristics

Over the Operating Range

Parameter ^[9]	Description	-10		Unit
		Min	Max	
Read Cycle				
$t_{power}^{[10]}$	V_{CC} (typical) to the first access	100	–	μ s
t_{RC}	Read cycle time	10	–	ns
t_{AA}	Address to data valid	–	10	ns
t_{OHA}	Data hold from address change	3	–	ns
t_{ACE}	\overline{CE} LOW to data valid	–	10	ns
t_{DOE}	\overline{OE} LOW to data valid	–	5	ns
t_{LZOE}	\overline{OE} LOW to low Z ^[11]	0	–	ns
t_{HZOE}	\overline{OE} HIGH to high Z ^[11, 12]	–	5	ns
t_{LZCE}	\overline{CE} LOW to low Z ^[11]	3	–	ns
t_{HZCE}	\overline{CE} HIGH to high Z ^[11, 12]	–	5	ns
t_{PU}	\overline{CE} LOW to power-up	0	–	ns
t_{PD}	\overline{CE} HIGH to power-down	–	10	ns
t_{DBE}	Byte enable to data valid	–	5	ns
t_{LZBE}	Byte enable to low Z	0	–	ns
t_{HZBE}	Byte disable to high Z	–	6	ns
Write Cycle ^[13, 14]				
t_{WC}	Write cycle time	10	–	ns
t_{SCE}	\overline{CE} LOW to write end	7	–	ns
t_{AW}	Address set-up to write end	7	–	ns
t_{HA}	Address hold from write end	0	–	ns
t_{SA}	Address set-up to write start	0	–	ns
t_{PWE}	\overline{WE} pulse width	7	–	ns
t_{SD}	Data set-up to write end	5	–	ns
t_{HD}	Data hold from write end	0	–	ns
t_{LZWE}	\overline{WE} HIGH to low Z ^[11]	3	–	ns
t_{HZWE}	\overline{WE} LOW to high Z ^[11, 12]	–	5	ns
t_{BW}	Byte enable to end of write	7	–	ns

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_{POWER} gives the minimum amount of time that the power supply should be at typical V_{CC} values until the first memory access is performed.
11. At any given temperature and voltage condition, t_{HZCE} is less than t_{LZCE} , t_{HZOE} is less than t_{LZOE} , t_{HZBE} is less than t_{LZBE} , and t_{HZWE} is less than t_{LZWE} for any given device.
12. t_{HZOE} , t_{HZCE} , t_{HZBE} 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.
13. 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 either of these signals can terminate the write. The input data set-up and hold timing should be referenced to the leading edge of the signal that terminates the write.
14. The minimum write cycle pulse width for Write Cycle No. 4 (\overline{WE} Controlled, \overline{OE} LOW) should be the sum of t_{SD} and t_{HZWE} .

Switching Waveforms

Figure 5. Read Cycle No. 1 [15, 16]

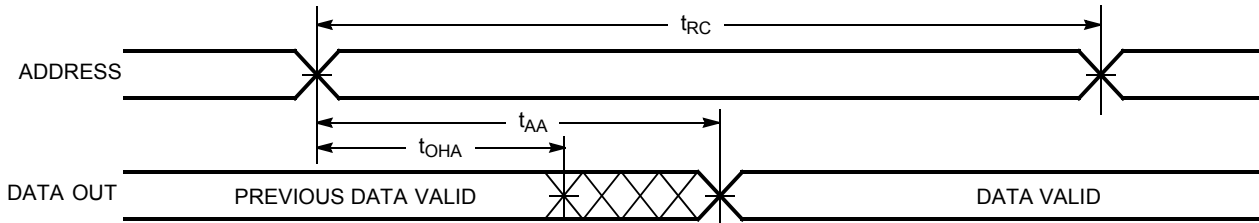
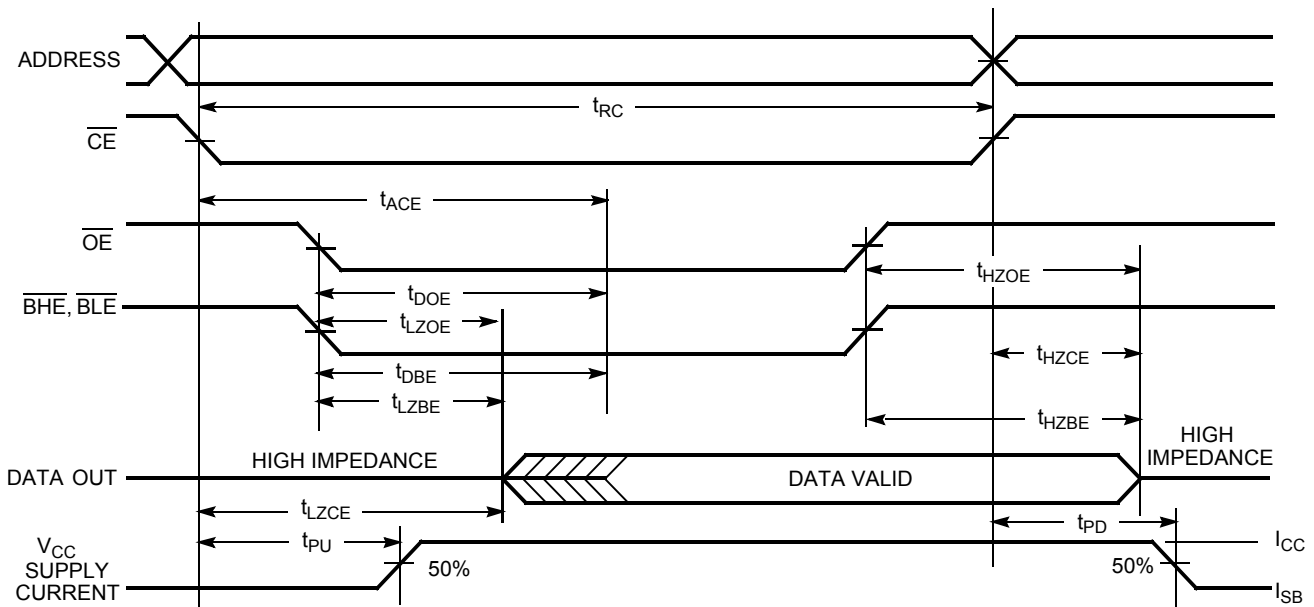


Figure 6. Read Cycle No. 2 (\overline{OE} Controlled) [16, 17]



Notes

- 15. Device is continuously selected. \overline{OE} , \overline{CE} , \overline{BHE} and/or \overline{BLA} = V_{IL} .
- 16. \overline{WE} is HIGH for read cycle.
- 17. Address valid prior to or coincident with \overline{CE} transition LOW.

Switching Waveforms (continued)

Figure 7. Write Cycle No. 1 ($\overline{\text{CE}}$ Controlled) [18, 19]

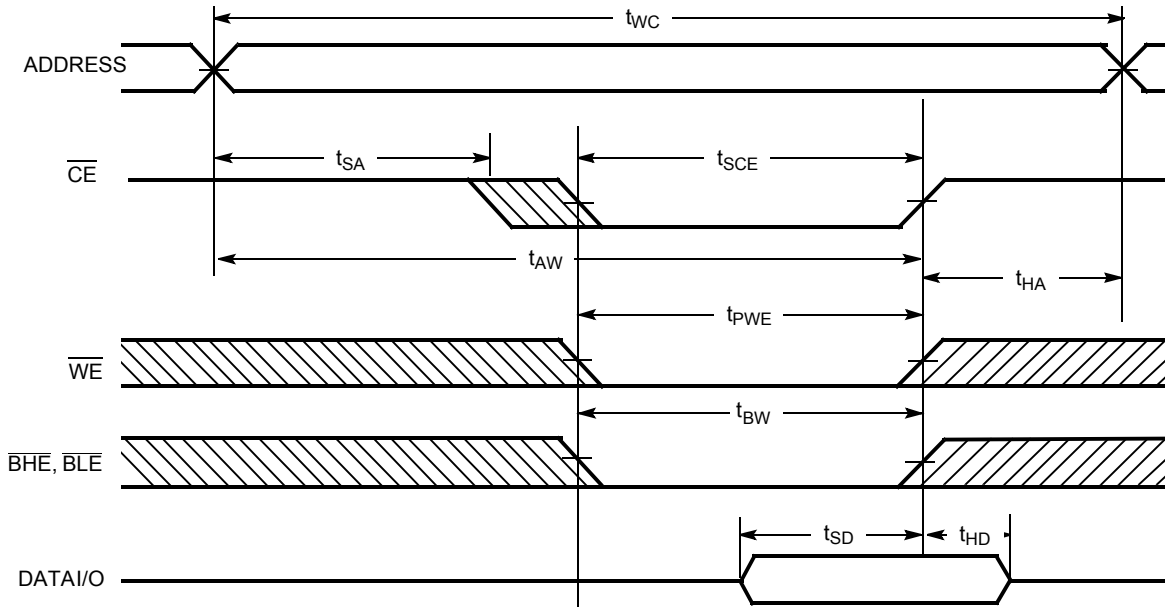
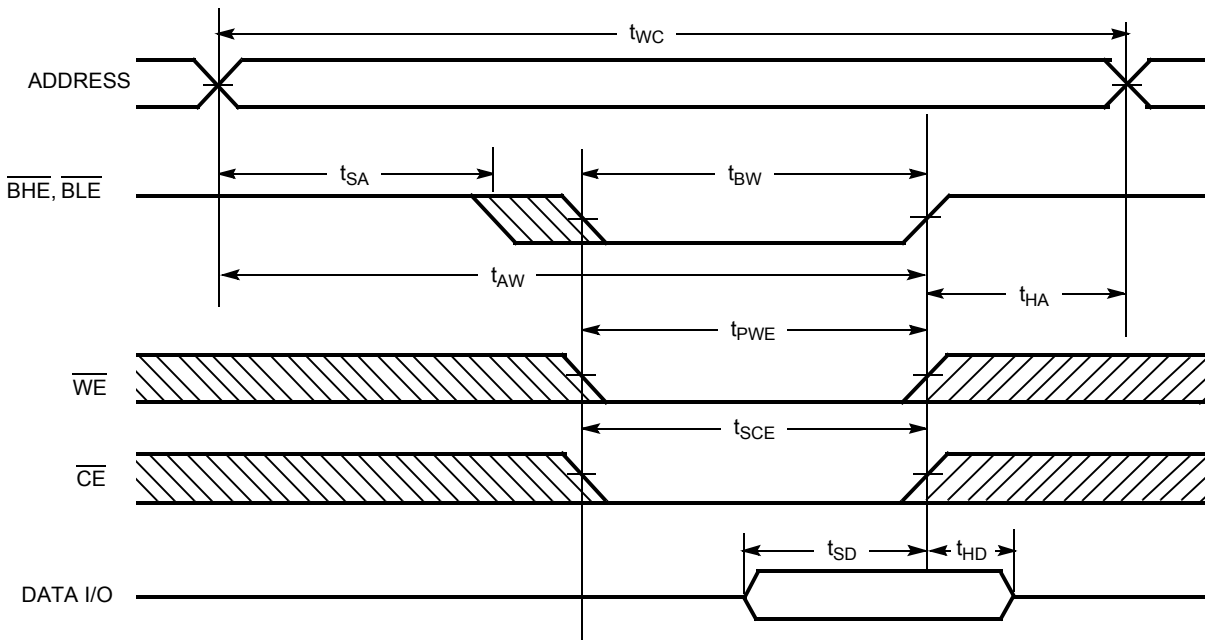


Figure 8. Write Cycle No. 2 ($\overline{\text{BLE}}$ or $\overline{\text{BHE}}$ Controlled)



Notes

- 18. Data I/O is high-impedance if $\overline{\text{OE}}$ or $\overline{\text{BHE}}$ and/or $\overline{\text{BLE}} = V_{IH}$.
- 19. If $\overline{\text{CE}}$ goes HIGH simultaneously with $\overline{\text{WE}}$ going HIGH, the output remains in a high-impedance state.

Switching Waveforms (continued)

Figure 9. Write Cycle No. 3 (\overline{WE} Controlled, \overline{OE} HIGH During Write) [20, 21]

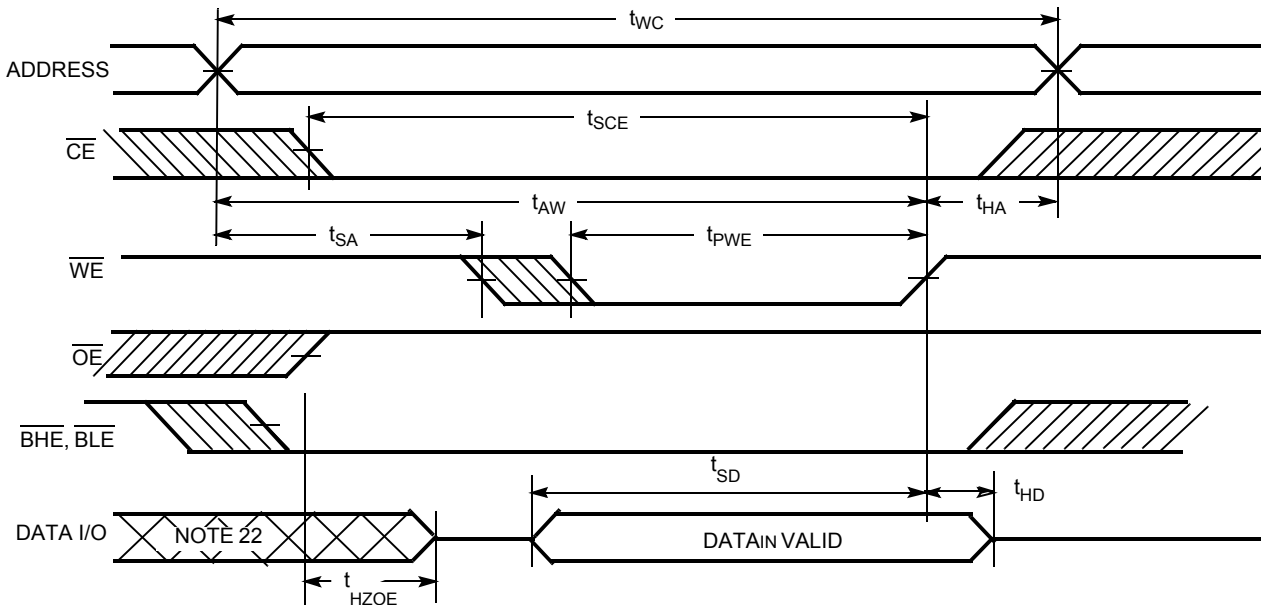
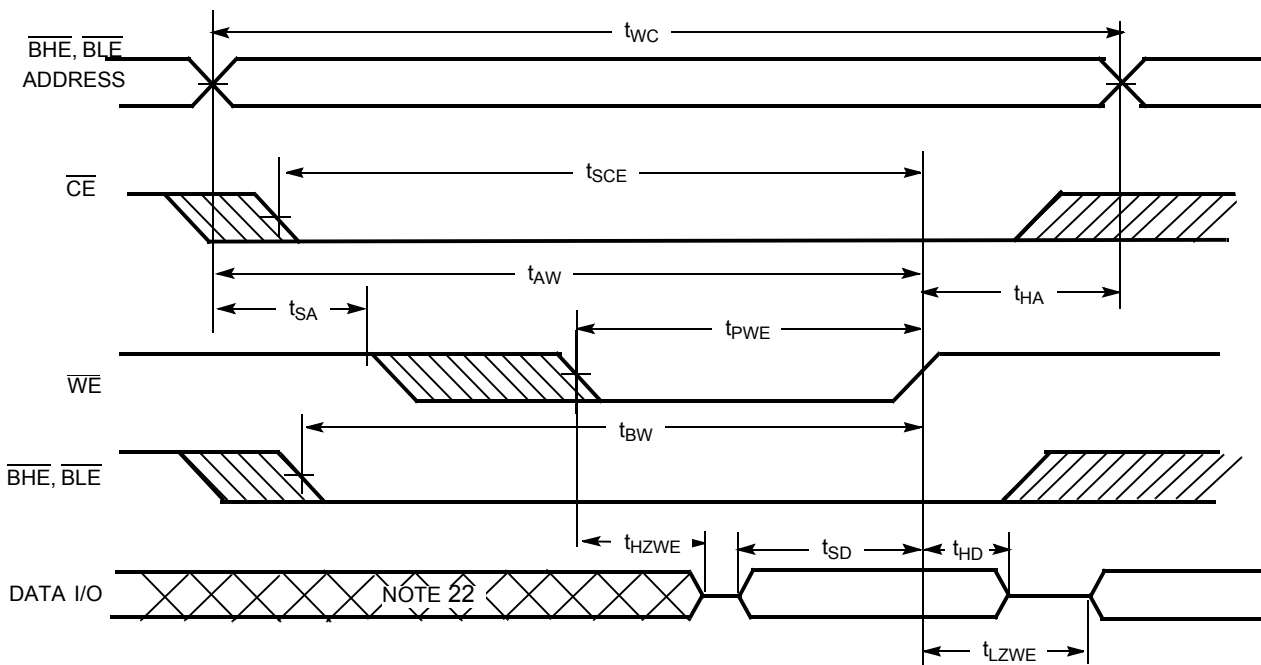


Figure 10. Write Cycle No. 4 (\overline{WE} Controlled, \overline{OE} LOW) [23]



Notes

- 20. Data I/O is high-impedance if \overline{OE} or \overline{BHE} and/or $\overline{BLE} = V_{IH}$.
- 21. If \overline{CE} goes HIGH simultaneously with \overline{WE} going HIGH, the output remains in a high-impedance state.
- 22. During this period the I/Os are in the output state and input signals should not be applied.
- 23. The minimum write pulse width for Write Cycle No. 4 (\overline{WE} controlled, \overline{OE} LOW) should be the sum of t_{SD} and t_{HZWE} .

Truth Table

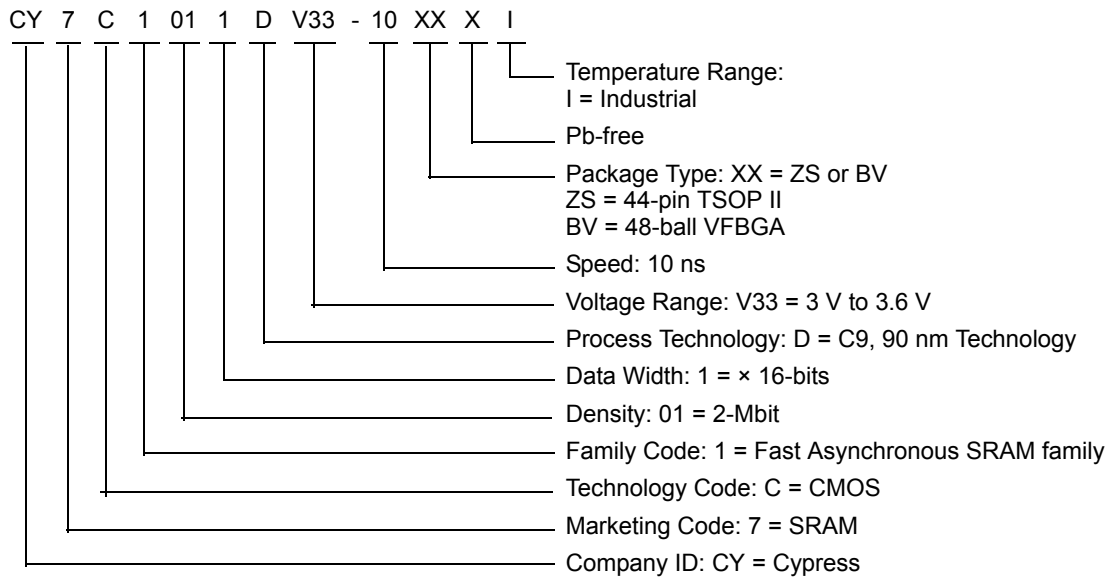
$\overline{\text{CE}}$	$\overline{\text{OE}}$	$\overline{\text{WE}}$	$\overline{\text{BLE}}$	$\overline{\text{BHE}}$	I/O ₀ –I/O ₇	I/O ₈ –I/O ₁₅	Mode	Power
H	X	X	X	X	High Z	High Z	Power-down	Standby (I _{SB})
L	L	H	L	L	Data Out	Data Out	Read all bits	Active (I _{CC})
L	L	H	L	H	Data Out	High Z	Read lower bits only	Active (I _{CC})
L	L	H	H	L	High Z	Data Out	Read upper bits only	Active (I _{CC})
L	X	L	L	L	Data In	Data In	Write all bits	Active (I _{CC})
L	X	L	L	H	Data In	High Z	Write lower bits only	Active (I _{CC})
L	X	L	H	L	High Z	Data In	Write upper bits only	Active (I _{CC})
L	H	H	X	X	High Z	High Z	Selected, outputs disabled	Active (I _{CC})

Ordering Information

Speed (ns)	Ordering Code	Package Diagram	Package Type	Operating Range
10	CY7C1011DV33-10ZSXI	51-85087	44-pin TSOP II (Pb-free)	Industrial
	CY7C1011DV33-10BVXI	51-85150	48-ball VFBGA (Pb-free)	

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

Ordering Code Definitions



Package Diagrams

Figure 11. 44-pin TSOP Z44-II Package Outline, 51-85087

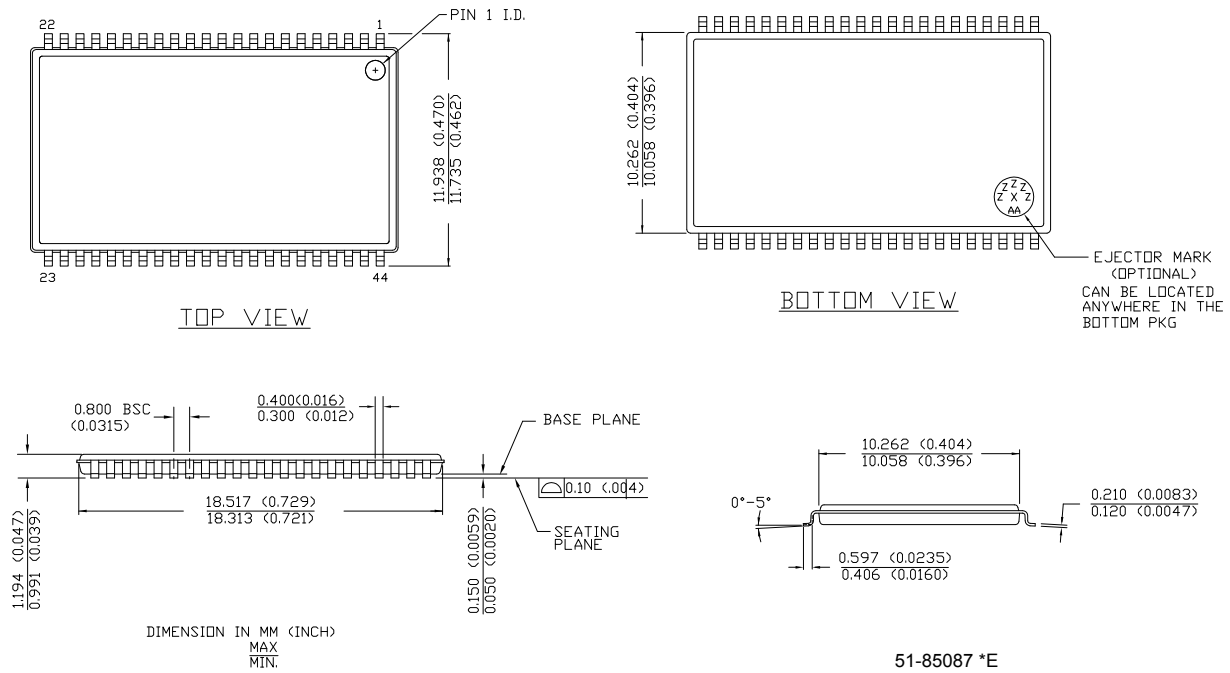
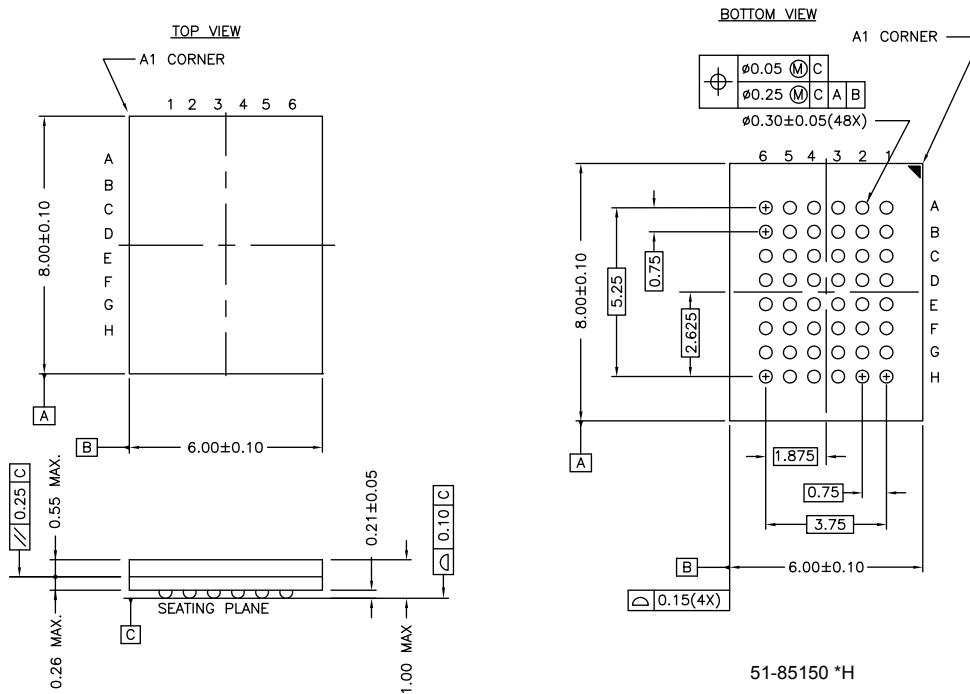


Figure 12. 48-ball VFBGA (6 × 8 × 1 mm) BV48/BZ48 Package Outline, 51-85150



Acronyms

Acronym	Description
CMOS	Complementary Metal Oxide Semiconductor
$\overline{\text{CE}}$	Chip Enable
I/O	Input/Output
$\overline{\text{OE}}$	Output Enable
SRAM	Static Random Access Memory
TSOP	Thin Small Outline Package
TTL	Transistor-Transistor Logic
VFBGA	Very Fine-Pitch Ball Grid Array
$\overline{\text{WE}}$	Write Enable

Document Conventions

Units of Measure

Symbol	Unit of Measure
°C	degree Celsius
MHz	megahertz
μs	microsecond
μA	microampere
mA	milliampere
ns	nanosecond
%	percent
pF	picofarad
V	volt
W	watt

Document History

Document Title: CY7C1011DV33, 2-Mbit (128 K × 16) Static RAM				
Document Number: 38-05609				
Rev.	ECN No.	Issue Date	Orig. of Change	Description of Change
**	250650	See ECN	RKF	New data sheet.
*A	399070	See ECN	NXR	<p>Changed from Advance to Preliminary</p> <p>Changed address of Cypress Semiconductor Corporation on Page# 1 from "3901 North First Street" to "198 Champion Court"</p> <p>Removed TQFP Package from product offering</p> <p>Removed –15 speed bin</p> <p>Corrected DC voltage limits in maximum ratings section from –0.5 to –0.3V and $V_{CC} +0.5V$ to $V_{CC} +0.3V$</p> <p>Redefined I_{CC} values for Com'l and Ind'l temperature ranges</p> <p>I_{CC} (Com'l): Changed from 100, 80 and 70 mA to 90, 80 and 75 mA for 8, 10 and 12ns speed bins respectively</p> <p>I_{CC} (Ind'l): Changed from 80 and 70 mA to 90 and 85 mA for 10 and 12ns speed bins respectively</p> <p>Modified Note# 4 on AC Test Loads</p> <p>Added Static Discharge Voltage and latch-up current spec</p> <p>Added $V_{IH(max)}$ spec in Note# 2</p> <p>Changed reference voltage level for measurement of Hi-Z parameters from ± 500 mV to ± 200 mV</p> <p>Added Data Retention Characteristics Table and footnote on t_R</p> <p>Added Write Cycle (WE Controlled, OE HIGH During Write) Timing Diagram</p> <p>Changed package name for 44-pin TSOP II from Z to ZS</p> <p>Added 8 ns parts in the Ordering Information table</p> <p>Shaded Ordering Information Table</p>
*B	459073	See ECN	NXR	<p>Converted Preliminary to Final.</p> <p>Removed –8 and –12 Speed bins</p> <p>Removed Commercial Operating Range from product offering.</p> <p>Changed the description of I_{IX} from "Input Load Current" to "Input Leakage Current"</p> <p>Updated the Thermal Resistance table.</p> <p>Changed t_{HZBE} from 5 ns to 6 ns.</p> <p>Updated footnote #7 on High-Z parameter measurement</p> <p>Added footnote #12.</p> <p>Updated the Ordering Information and replaced Package Name column with Package Diagram in the Ordering Information table.</p>
*C	480177	See ECN	VKN	Added -10BVI product ordering code in the Ordering Information table.
*D	3059162	10/14/2010	PRAS	<p>Added Ordering Code Definitions.</p> <p>Updated Package Diagrams.</p>
*E	3098812	12/01/2010	PRAS	<p>Added Acronyms and Units of Measure.</p> <p>Minor edits and updated in new template.</p>
*F	3861347	01/08/2013	TAVA	<p>Updated Ordering Information (Updated part numbers).</p> <p>Updated Package Diagrams:</p> <p>spec 51-85087 – Changed revision from *C to *E.</p> <p>spec 51-85150 – Changed revision from *F to *H.</p>
*G	4187715	11/10/2013	MEMJ	<p>Updated in new template.</p> <p>Completing Sunset Review.</p>

Document History *(continued)*

Document Title: CY7C1011DV33, 2-Mbit (128 K × 16) Static RAM				
Document Number: 38-05609				
Rev.	ECN No.	Issue Date	Orig. of Change	Description of Change
*H	4567909	11/12/2014	MEMJ	<p>Updated Functional Description: Added "For a complete list of related resources, click here." at the end.</p> <p>Updated Switching Waveforms: Added Note 23 and referred the same note in Figure 10.</p> <p>Competing Sunset Review.</p>

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