CY7C1011CV33

2-Mbit (128 K × 16) Static RAM

Features

- Temperature ranges
  - Industrial: –40 °C to 85 °C
  - Automotive-A: –40 °C to 85 °C
  - Automotive-E: –40 °C to 125 °C
- Pin and function compatible with CY7C1011BV33
- High speed
  - t_{AA} = 10 ns (Industrial and Automotive-A)
  - t_{AA} = 12 ns (Automotive-E)
- Low active power
  - 360 mW (max) (Industrial and Automotive-A)
- 2.0 V data retention
- Automatic power down when deselected
- Independent control of upper and lower bits
- Easy memory expansion with Chip Enable ($\overline{CE}$) and Output Enable ($\overline{OE}$) features
- Available in Pb-free 44-pin thin small outline package (TSOP) II, 44-pin thin quad flat package (TQFP), and non Pb-free 48-ball very fine-pitch ball grid array (VFBGA) packages

Functional Description

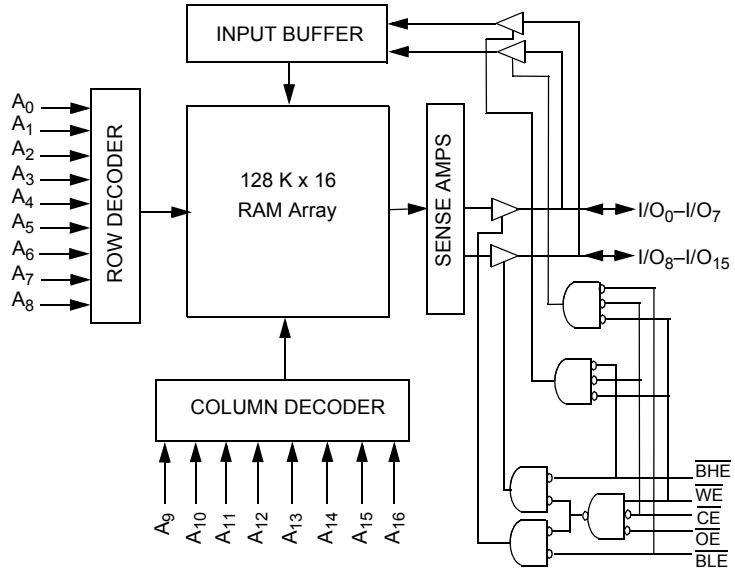
The CY7C1011CV33 is a high performance complementary metal oxide semiconductor (CMOS) static RAM organized as 131,072 words by 16 bits. This device has an automatic power down feature that significantly reduces power consumption when deselected.

To write to the device, take $\overline{CE}$ and Write Enable ($\overline{WE}$) inputs LOW. If Byte Low Enable ($\overline{BLE}$) is LOW, then data from I/O pins (I/O_0 through I/O_7), is written into the location specified on the address pins (A_0 through A_{16}). If Byte High Enable ($\overline{BHE}$) is LOW, then data from I/O pins (I/O_8 through I/O_{15}) is written into the location specified on the address pins (A_0 through A_{16}).

To read from the device, take $\overline{CE}$ and $\overline{OE}$ LOW while forcing the Write Enable ($\overline{WE}$) HIGH. If $\overline{BLE}$ is LOW, then data from the memory location specified by the address pins appear on I/O_0 to I/O_7. If Byte High Enable ($\overline{BHE}$) is LOW, then data from memory appears on I/O_8 to I/O_{15}. For more information, see the Truth Table on page 10 for a complete description of Read and Write modes.

The input and output pins (I/O_0 through I/O_{15}) 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).

Logic Block Diagram



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Pin Configuration

Figure 1. 44-pin TSOP II [1]

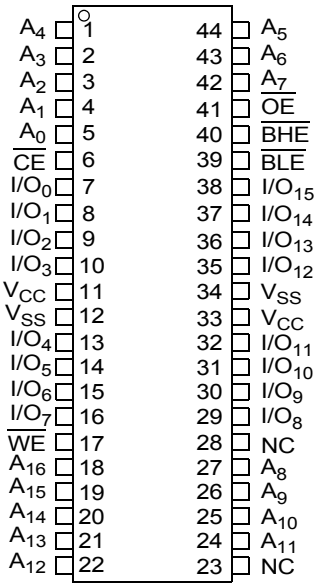
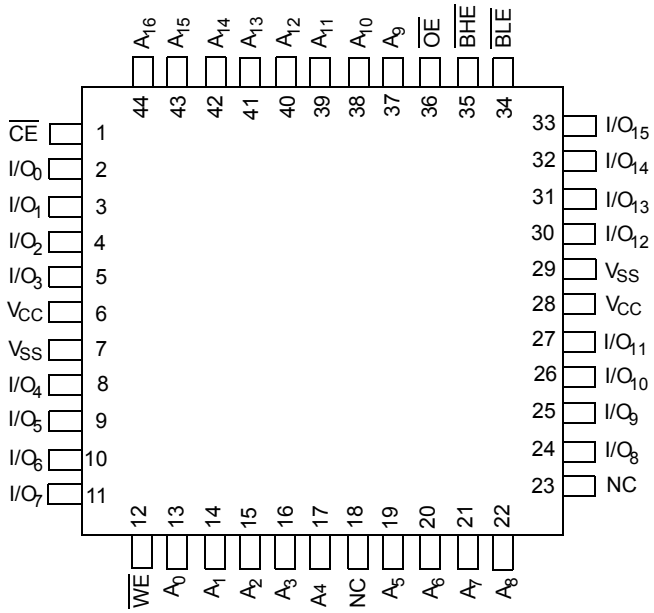


Figure 2. 44-pin TQFP



Note
1. NC pins are not connected on the die.

Selection Guide

Description		-10	-12	Unit
Maximum access time		10	12	ns
Maximum operating current	Industrial	100	95	mA
	Automotive-A	100	–	mA
	Automotive-E	–	120	mA
Maximum CMOS standby current	Industrial	10	10	mA
	Automotive-A	10	–	mA
	Automotive-E	–	15	mA

Maximum Ratings

Exceeding maximum ratings may shorten 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_{CC} relative to GND[2].....–0.5 V to +4.6 V

DC voltage applied to outputs in High Z state[2] .....–0.5 V to V_{CC}+ 0.5 V

DC input voltage[2] .....–0.5 V to V_{CC}+ 0.5 V

Current into outputs (LOW) ..... 20 mA

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

Latch up current ..... > 200 mA

Operating Range

Range	Ambient Temperature (T_A)	V_{CC}
Industrial	–40 °C to +85 °C	3.3 V ± 10%
Automotive-A	–40 °C to +85 °C	
Automotive -E	–40 °C to +125 °C	

Electrical Characteristics

Over the Operating Range

Parameter	Description	Test Conditions		-10		-12		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}	Input HIGH voltage			2.0	V_{CC} + 0.3	2.0	V_{CC} + 0.3	V
V_{IL}	Input LOW voltage[2]			–0.3	0.8	–0.3	0.8	V
I_{IX}	Input leakage current	GND ≤ V_I ≤ V_{CC}	Industrial	–1	+1	–1	+1	µA
			Automotive-A	–1	+1	–	–	
			Automotive-E	–	–	–20	+20	
I_{OZ}	Output leakage current	GND ≤ V_I ≤ V_{CC}, Output disabled	Industrial	–1	+1	–1	+1	µA
			Automotive-A	–1	+1	–	–	
			Automotive-E	–	–	–20	+20	
I_{CC}	V_{CC} operating supply current	V_{CC} = Max, I_{OUT} = 0 mA, f = f_{MAX} = $1/t_{RC}$	Industrial	–	100	–	95	mA
			Automotive-A	–	100	–	–	
			Automotive-E	–	–	–	120	
I_{SB1}	Automatic CE power down current —TTL Inputs	Max V_{CC}, $\overline{CE}$ ≥ V_{IH}, V_{IN} ≥ V_{IH} or V_{IN} ≤ V_{IL}, f = f_{MAX}	Industrial	–	40	–	40	mA
			Automotive-A	–	40	–	–	
			Automotive-E	–	–	–	45	
I_{SB2}	Automatic CE power down current — CMOS inputs	Max V_{CC}, $\overline{CE}$ ≥ V_{CC} – 0.3 V, V_{IN} ≥ V_{CC} – 0.3 V, or V_{IN} ≤ 0.3 V, f = 0	Industrial	–	10	–	10	mA
			Automotive-A	–	10	–	–	
			Automotive-E	–	–	–	15	

Note
2. V_{IL} (min) = –2.0 V for pulse durations of less than 20 ns.

Capacitance

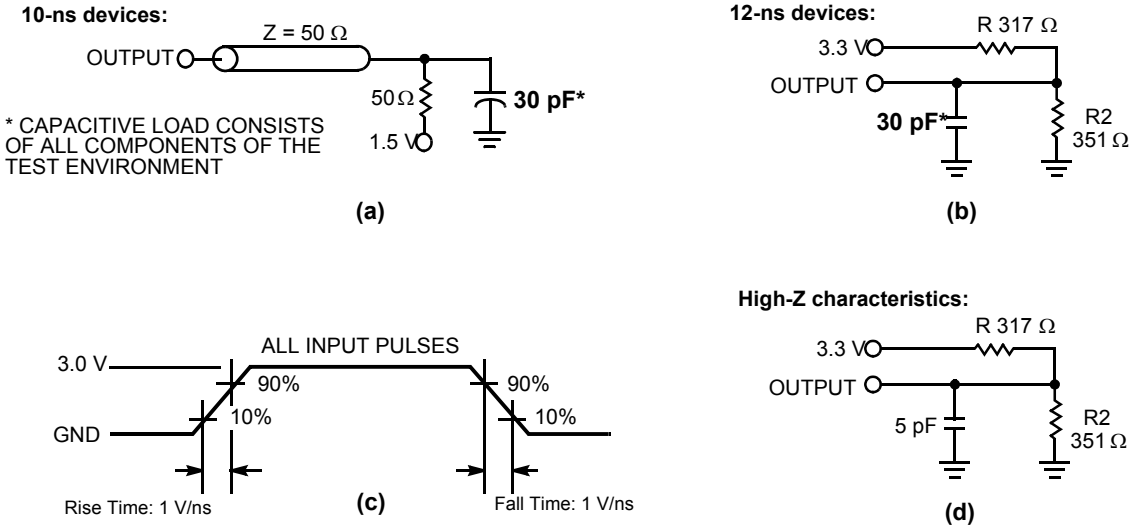
Parameter [3]	Description	Test Conditions	Max	Unit
C_{IN}	Input capacitance	T_A = 25 °C, f = 1 MHz, V_{CC} = 3.3 V	8	pF
C_{OUT}	Output capacitance		8	pF

Thermal Resistance

Parameter [3]	Description	Test Conditions	44-pin TSOP II	44-pin TQFP	Unit
Θ_{JA}	Thermal resistance (Junction to ambient)	Still air, soldered on a 3 × 4.5 inch, four-layer printed circuit board	44.56	42.66	°C/W
Θ_{JC}	Thermal resistance (Junction to case)		10.75	14.64	°C/W

AC Test Loads and Waveforms

Figure 3. AC Test Loads and Waveforms [4]



Notes

3. Tested initially and after any design or process changes that may affect these parameters.
4. AC characteristics (except High Z) for 10-ns parts are tested using the load conditions shown in Figure 3 (a). All other speeds are tested using the Thevenin load shown in Figure 3 (b). High Z characteristics are tested for all speeds using the test load shown in Figure 3 (d).

Switching Characteristics

Over the Operating Range

Parameter [5]	Description		-10		-12		Unit
			Min	Max	Min	Max	
Read Cycle							
t_{power} [6]	V_{CC} (typical) to the first access		1	–	1	–	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}	$\overline{CE}$ LOW to data valid		–	10	–	12	ns
t_{DOE}	$\overline{OE}$ LOW to data valid	Industrial/Automotive-A	–	5	–	6	ns
		Automotive-E	–	–	–	8	
t_{LZOE}	$\overline{OE}$ LOW to Low Z [7]		0	–	0	–	ns
t_{HZOE}	$\overline{OE}$ HIGH to High Z [7, 8]		–	5	–	6	ns
t_{LZCE}	$\overline{CE}$ LOW to Low Z [7]		3	–	3	–	ns
t_{HZCE}	$\overline{CE}$ HIGH to High Z [7, 8]		–	5	–	6	ns
t_{PU}	$\overline{CE}$ LOW to power up		0	–	0	–	ns
t_{PD}	$\overline{CE}$ HIGH to power down		–	10	–	12	ns
t_{DBE}	Byte enable to data valid	Industrial/Automotive-A	–	5	–	6	ns
		Automotive-E	–	–	–	8	
t_{LZBE}	Byte enable to Low Z		0	–	0	–	ns
t_{HZBE}	Byte disable to High Z		–	5	–	6	ns
Write Cycle [9, 10]							
t_{WC}	Write cycle time		10	–	12	–	ns
t_{SCE}	$\overline{CE}$ LOW to write end		7	–	8	–	ns
t_{AW}	Address setup to write end		7	–	8	–	ns
t_{HA}	Address hold from write end		0	–	0	–	ns
t_{SA}	Address setup to write start		0	–	0	–	ns
t_{PWE}	$\overline{WE}$ pulse width		7	–	8	–	ns
t_{SD}	Data setup to write end		5	–	6	–	ns
t_{HD}	Data hold from write end		0	–	0	–	ns
t_{LZWE}	$\overline{WE}$ HIGH to Low Z [7]		3	–	3	–	ns
t_{HZWE}	$\overline{WE}$ LOW to High Z [7, 8]		–	5	–	6	ns
t_{BW}	Byte enable to end of write		7	–	8	–	ns

Notes

5. Test conditions assume signal transition time of 3 ns or less, timing reference levels of 1.5 V, and input pulse levels of 0 to 3.0 V.
6. t_{POWER} gives the minimum amount of time that the power supply is at typical V_{CC} values until the first memory access is performed.
7. 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 device.
8. t_{HZOE}, t_{HZBE}, t_{HZCE}, and t_{HZWE} are specified with a load capacitance of 5 pF as in part (d) of Figure 3 on page 6. Transition is measured ±500 mV from steady state voltage
9. The internal write time of the memory is defined by the overlap of $\overline{CE}$ LOW, $\overline{WE}$ LOW, and $\overline{BHE}$/$\overline{BLE}$ LOW. $\overline{CE}$, $\overline{WE}$, and $\overline{BHE}$/$\overline{BLE}$ must be LOW to initiate a write. The transition of these signals terminate the write. The input data setup and hold timing is referenced to the leading edge of the signal that terminates the write.
10. The minimum write cycle time for Write Cycle No. 3 ($\overline{WE}$ controlled, $\overline{OE}$ LOW) is the sum of t_{HZWE} and t_{SD}.

Switching Waveforms

Figure 4. Read Cycle No. 1 (Address Transition Controlled) [11, 12]

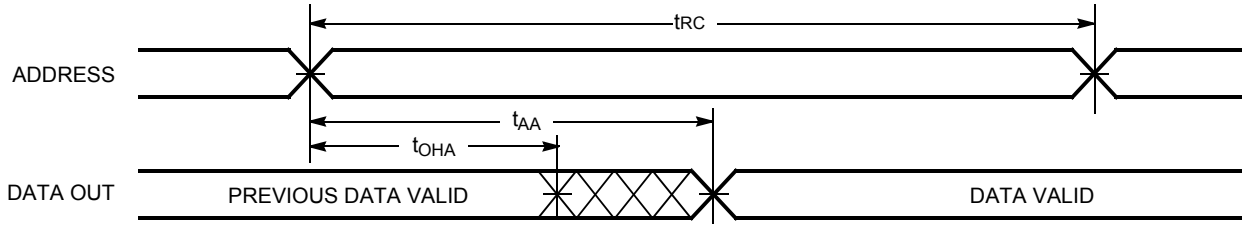
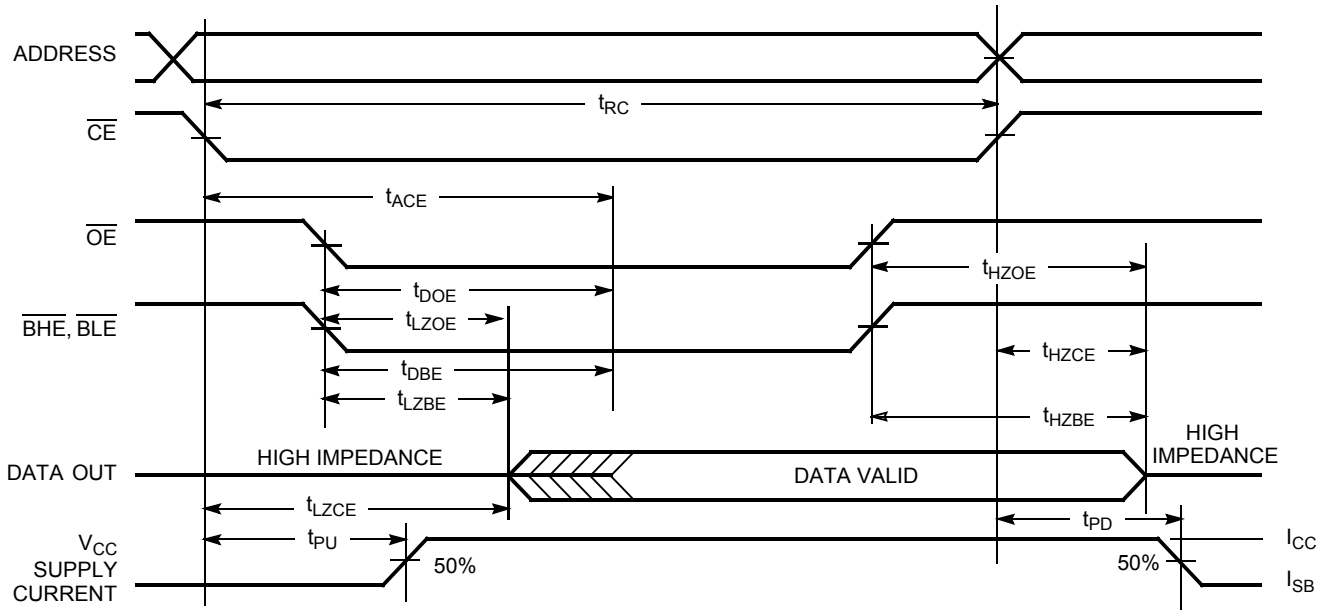


Figure 5. Read Cycle No. 2 ($\overline{OE}$ Controlled) [12, 13]



Notes
11. Device is continuously selected. $\overline{OE}$, $\overline{CE}$, $\overline{BHE}$, and/or $\overline{BLE}$ = V_{IL}.
12. $\overline{WE}$ is HIGH for read cycle.
13. Address valid prior to or coincident with $\overline{CE}$ transition LOW.

Switching Waveforms (continued)

Figure 6. Write Cycle No. 1 ($\overline{CE}$ Controlled) [14, 15]

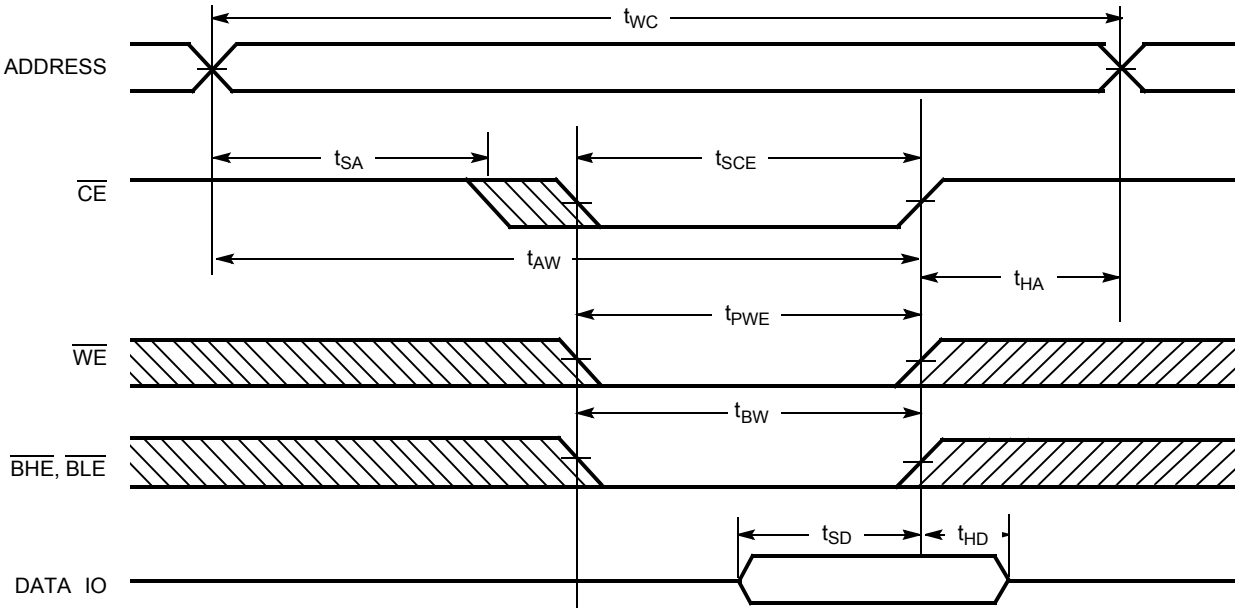
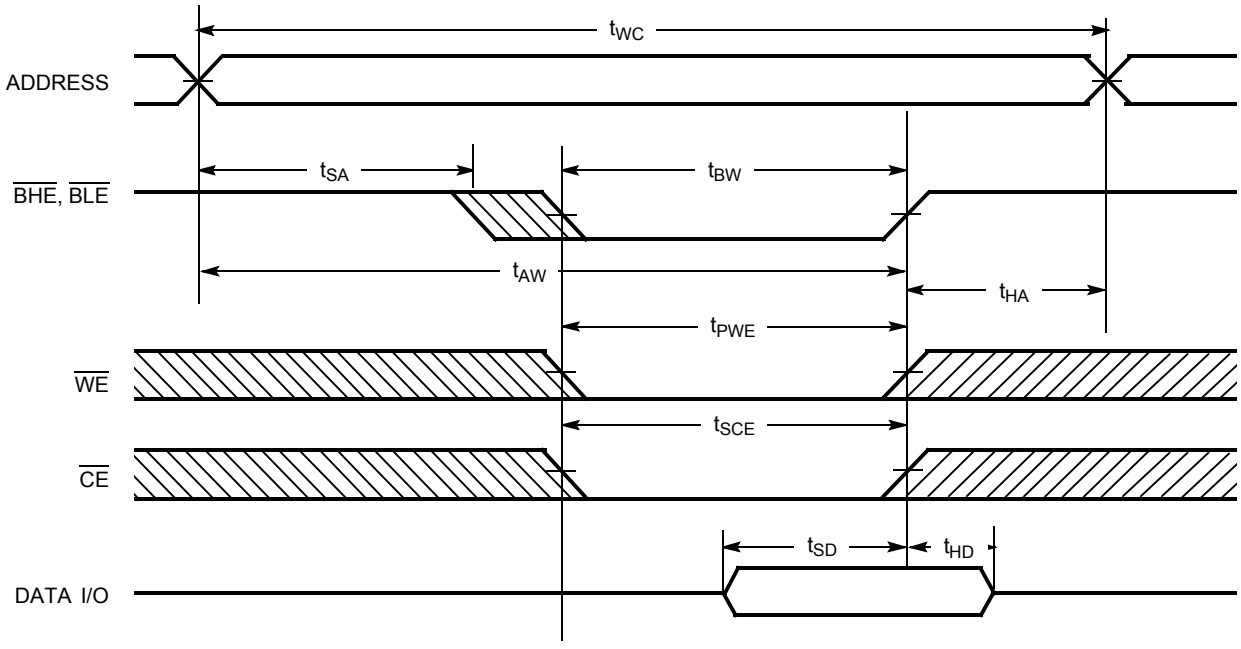


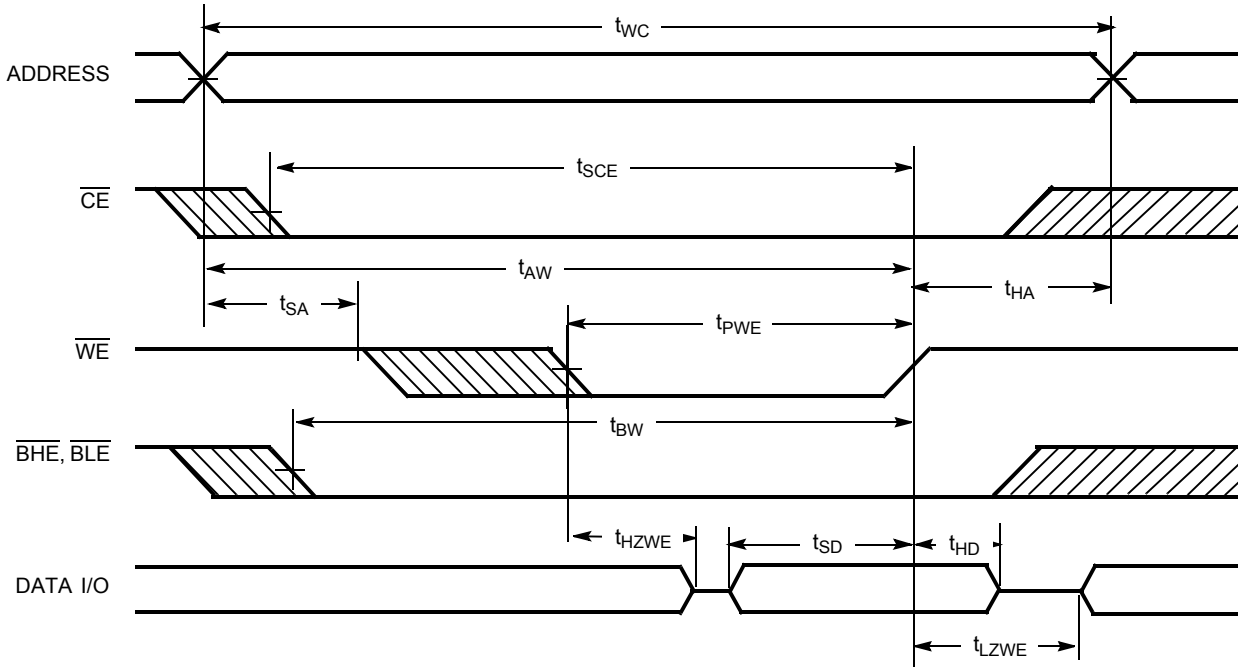
Figure 7. Write Cycle No. 2 ($\overline{BLE}$ or $\overline{BHE}$ Controlled)



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

Switching Waveforms (continued)

Figure 8. Write Cycle No. 3 ($\overline{WE}$ Controlled, LOW)



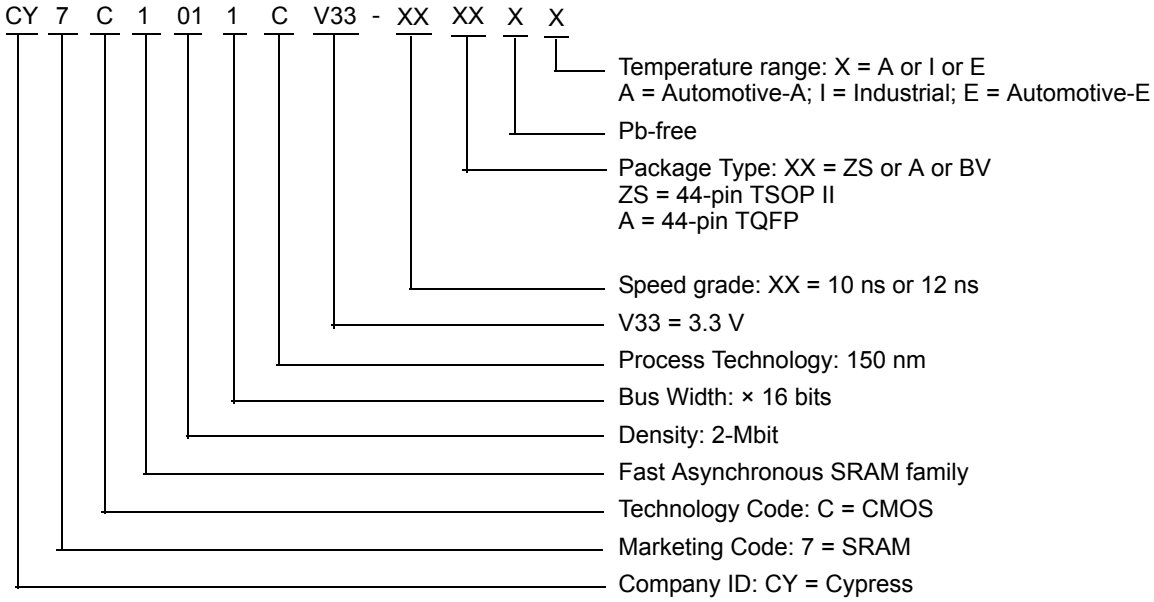
Truth Table

$\overline{CE}$	$\overline{OE}$	$\overline{WE}$	$\overline{BLE}$	$\overline{BHE}$	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

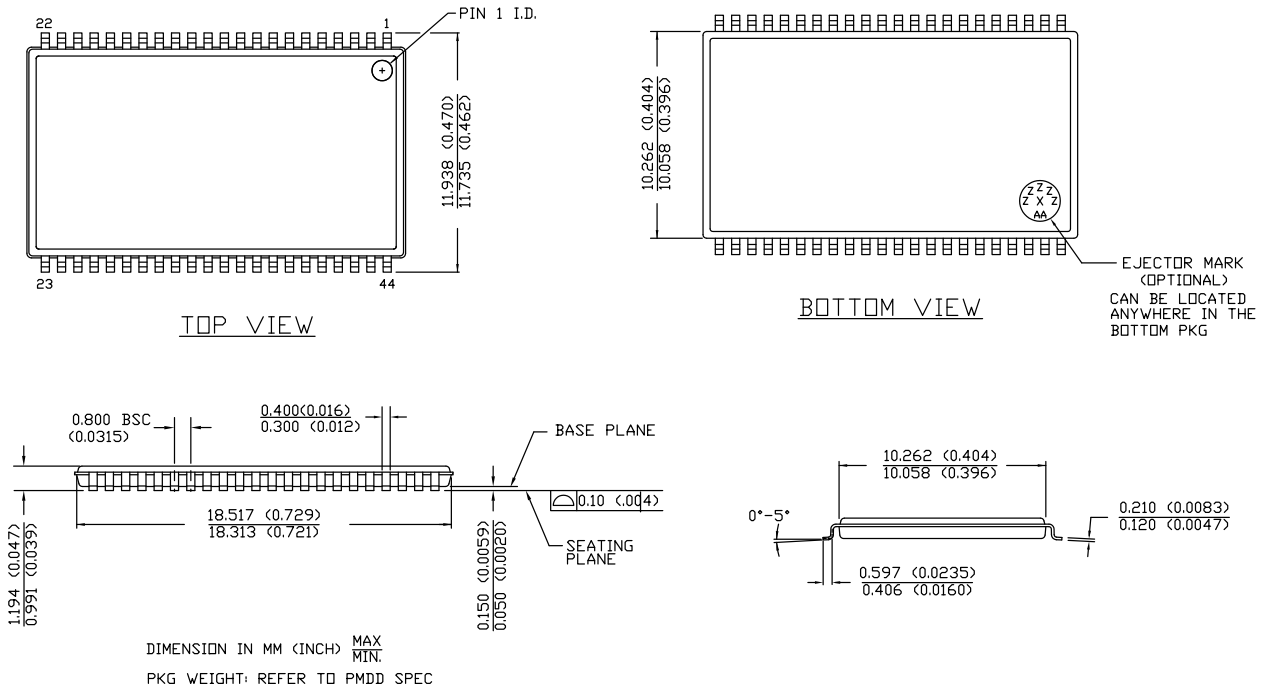
Speed (ns)	Ordering Code	Package Diagram	Package Type	Operating Range
10	CY7C1011CV33-10ZSXA	51-85087	44-pin TSOP II (Pb-free)	Automotive-A
12	CY7C1011CV33-12ZSXE	51-85087	44-pin TSOP II (Pb-free)	Automotive-E

Ordering Code Definitions



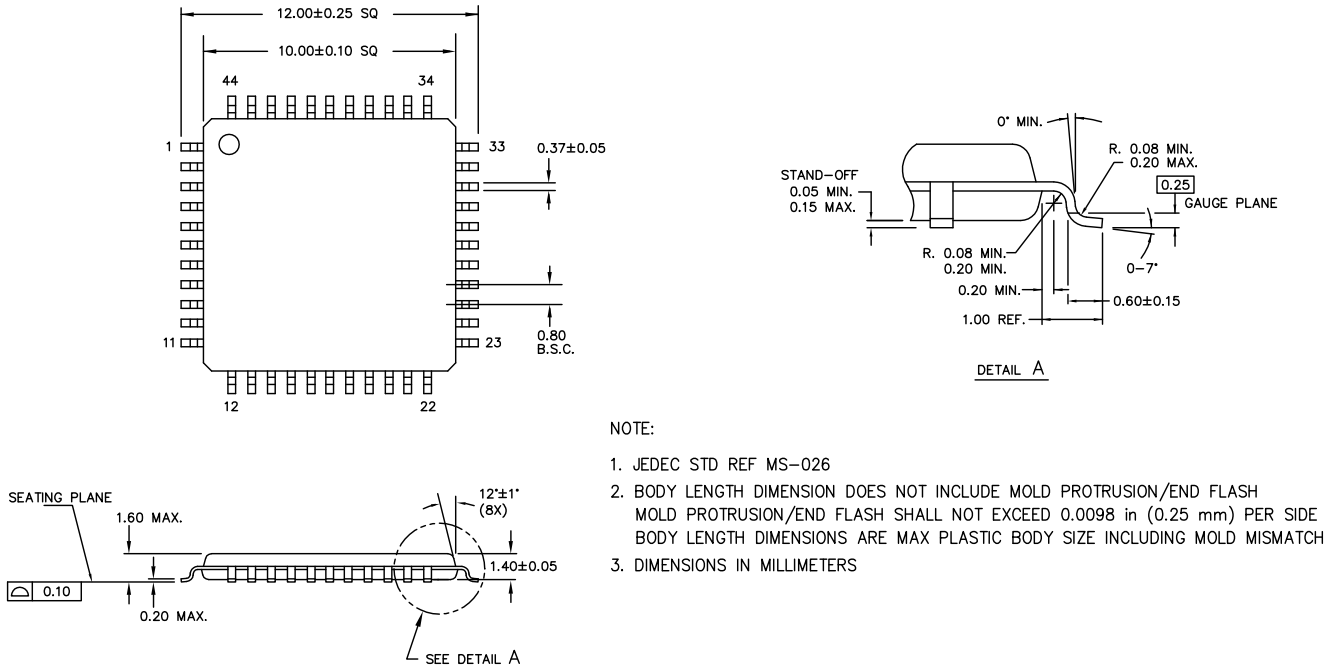
Package Diagrams

Figure 9. 44-pin TSOP Z44-II, 51-85087



Package Diagrams (continued)

Figure 10. 44-pin TQFP (10 × 10 × 1.4 mm) A44S, 51-85064



NOTE:

1. JEDEC STD REF MS-026
2. BODY LENGTH DIMENSION DOES NOT INCLUDE MOLD PROTRUSION/END FLASH
   MOLD PROTRUSION/END FLASH SHALL NOT EXCEED 0.0098 in (0.25 mm) PER SIDE
   BODY LENGTH DIMENSIONS ARE MAX PLASTIC BODY SIZE INCLUDING MOLD MISMATCH
3. DIMENSIONS IN MILLIMETERS

51-85064 *E

Acronyms

Acronym	Description
$\overline{BHE}$	byte high enable
$\overline{BLE}$	byte low enable
CMOS	complementary metal oxide semiconductor
$\overline{CE}$	chip enable
I/O	input/output
$\overline{OE}$	output enable
SRAM	static random access memory
TQFP	thin quad flat pack
TSOP	thin small outline package
TTL	transistor-transistor logic
VFBGA	very fine-pitch ball gird array
$\overline{WE}$	write enable

Document Conventions

Units of Measure

Symbol	Unit of Measure
°C	degree Celsius
MHz	megahertz
µA	microampere
µs	microsecond
mA	milliampere
mm	millimeter
ms	millisecond
mV	millivolt
mW	milliwatt
ns	nanosecond
%	percent
pF	pico farad
V	volt
W	watt

Document History Page

Document Title: CY7C1011CV33, 2-Mbit (128 K × 16) Static RAM Document Number: 38-05232				
Revision	**ECN**	**Orig. of Change**	**Submission Date**	**Description of Change**
**	117132	HGK	07/31/02	New Data Sheet
*A	118057	HGK	08/19/02	Pin configuration for 48-ball FBGA correction
*B	119702	DFP	10/11/02	Updated FBGA to VFBGA; updated package code on page 8 to BV48A. Updated address pinouts on page 1 to A0 to A16. Updated CMOS standby current on page 1 from 8 to 10 mA
*C	386106	PCI	See ECN	Added lead-free parts in Ordering Information Table
*D	498501	NXR	See ECN	Corrected typo in the Logic Block Diagram on page# 1 Included the Maximum Ratings for Static Discharge Voltage and Latch up Current on page# 3 Changed the description of I_{IX} from Input Load Current to Input Leakage Current in DC Electrical Characteristics table Updated the Ordering Information Table
*E	522620	VKN	See ECN	Added Thermal Resistance Table
*F	1891366	VKN/AESA	See ECN	Added -10ZSXA part Updated Ordering Information table
*G	2428606	VKN/PYRS	See ECN	Corrected typo in the 44-Pin TSOP and 48-Ball FBGA pinout Removed Commercial parts Removed 15 ns speed bin Removed inactive parts from the Ordering Information table
*H	2664421	VKN/AESA	02/25/09	Added Automotive-E specs for 12 ns speed Updated Ordering Information table
*I	2898399	KAO/AJU	03/24/2010	Updated Package Diagrams
*J	2950666	VKN	06/11/2010	Included “CY7C1011CV33-12BVXE” in Ordering Information Added Contents and Acronyms Updated Sales, Solutions, and Legal Information Added Ordering Code Definitions.
*K	3089939	PRAS	11/13/2010	Removed inactive part from Ordering Information.
*L	3276463	KAO	06/07/2011	Updated Functional Description (Removed “For best practice recommendations, refer to the Cypress application note AN1064, SRAM System Guidelines.”). Added Units of Measure. Updated Package Diagrams. Updated in new template.
*M	3591978	TAVA	04/19/2012	Removed all information related to 48-ball VFBGA throughout the document. Updated package diagram revisions.
*N	3861271	KAO	01/08/2013	Updated Ordering Information (Updated part numbers). Updated Package Diagrams: spec 51-85087 – Changed revision from *D to *E.

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