2-Mbit (128K x 16) Static RAM

Features

- **Pin equivalent to CY7C1011BV33**
- **High speed**
  - **— t_{AA} = 10 ns**
- **Low active power**
  - **— 360 mW (max.)**
- **Data Retention at 2.0**
- **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 and non Pb-free 44-pin TSOP II, 44-pin TQFP and non Pb-free 48-ball VFBGA packages**

Functional Description

The CY7C1011CV33 is a high-performance CMOS Static RAM organized as 131,072 words by 16 bits.

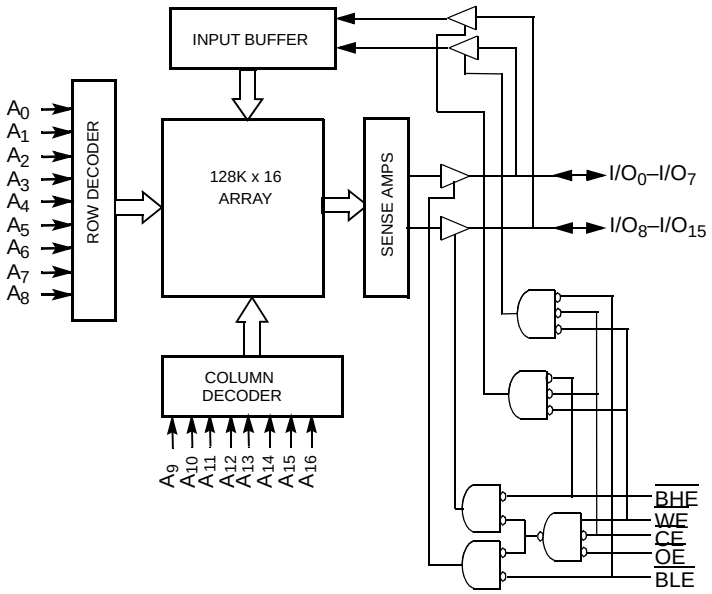
Writing to the device is accomplished by taking Chip Enable ($\overline{CE}$) and Write Enable ($\overline{WE}$) inputs LOW. If Byte Low Enable ($\overline{BLE}$) is LOW, then data from I/O pins (I/O_0 through I/O_7), is written into the location specified on the address pins (A_0 through A_{16}). If 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}).

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/O_0 to I/O_7. If Byte High Enable ($\overline{BHE}$) is LOW, then data from memory will appear on I/O_8 to I/O_{15}. 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/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).

The CY7C1011CV33 is available in a standard 44-pin TSOP II package with center power and ground pinout, a 44-pin Thin Plastic Quad Flatpack (TQFP), as well as a 48-ball fine-pitch ball grid array (VFBGA) package.

Logic Block Diagram



Pin Configuration

TSOP II
Top View

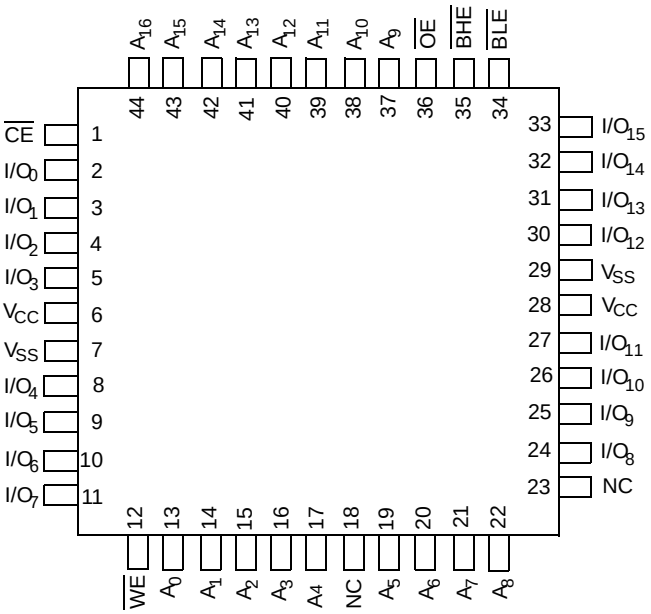
A_4	1	44	A_5
A_3	2	43	A_6
A_2	3	42	A_7
A_1	4	41	$\overline{OE}$
A_0	5	40	$\overline{BHE}$
$\overline{CE}$	6	39	$\overline{BLE}$
I/O_0	7	38	I/O_{15}
I/O_1	8	37	I/O_{14}
I/O_2	9	36	I/O_{13}
I/O_3	10	35	I/O_{12}
V_{CC}	11	34	V_{SS}
V_{SS}	12	33	V_{CC}
I/O_4	13	32	I/O_{11}
I/O_5	14	31	I/O_{10}
I/O_6	15	30	I/O_9
I/O_7	16	29	I/O_8
$\overline{WE}$	17	28	NC
A_{16}	18	27	A_8
A_{15}	19	26	A_9
A_{14}	20	25	A_{10}
A_{13}	21	24	A_{11}
A_{12}	22	23	NC

Selection Guide

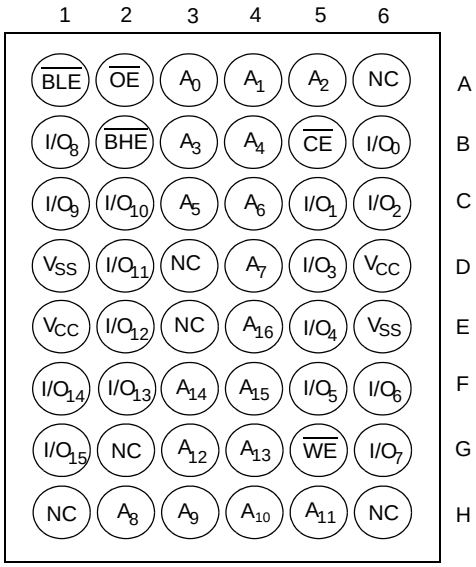
		–10	–12	–15	Unit
Maximum Access Time		10	12	15	ns
Maximum Operating Current	Com'l	90	85	80	mA
	Ind'l	100	95	90	
Maximum CMOS Standby Current	Com'l/Ind'l	10	10	10	mA

Pin Configurations

44-pin TQFP
(Top View)



48-ball VFBGA
(Top View)



Maximum Ratings

(Above which the useful life may be impaired. For user guidelines, 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[1] .... –0.5V to +4.6V

DC Voltage Applied to Outputs in High-Z State[1] .....–0.5V to V_{CC} + 0.5V

DC Input Voltage[1].....–0.5V to V_{CC} + 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	V_{CC}
Commercial	0°C to +70°C	3.3V ± 0.3V
Industrial	–40°C to +85°C	

DC Electrical Characteristics Over the Operating Range

Parameter	Description	Test Conditions		–10 Min.	–10 Max.	–12 Min.	–12 Max.	–15 Min.	–15 Max.	Unit
V_{OH}	Output HIGH Voltage	V_{CC} = Min., I_{OH} = –4.0 mA		2.4		2.4		2.4		V
V_{OL}	Output LOW Voltage	V_{CC} = Min., I_{OL} = 8.0 mA			0.4		0.4		0.4	V
V_{IH}	Input HIGH Voltage			2.0	V_{CC} + 0.3	2.0	V_{CC} + 0.3	2.0	V_{CC} + 0.3	V
V_{IL}	Input LOW Voltage[1]			–0.3	0.8	–0.3	0.8	–0.3	0.8	V
I_{IX}	Input Leakage Current	GND ≤ V_I ≤ V_{CC}		–1	+1	–1	+1	–1	+1	µA
I_{OZ}	Output Leakage Current	GND ≤ V_{OUT} ≤ V_{CC}, Output Disabled		–1	+1	–1	+1	–1	+1	µA
I_{CC}	V_{CC} Operating Supply Current	V_{CC} = Max., f = f_{MAX} = $1/t_{RC}$	Com'l		90		85		80	mA
			Ind'l		100		95		90	mA
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}			40		40		40	mA
I_{SB2}	Automatic CE Power-down Current —CMOS Inputs	Max. V_{CC}, $\overline{CE}$ ≥ V_{CC} – 0.3V, V_{IN} ≥ V_{CC} – 0.3V, or V_{IN} ≤ 0.3V, f = 0	Com'l/ Ind'l		10		10		10	mA

Capacitance[2]

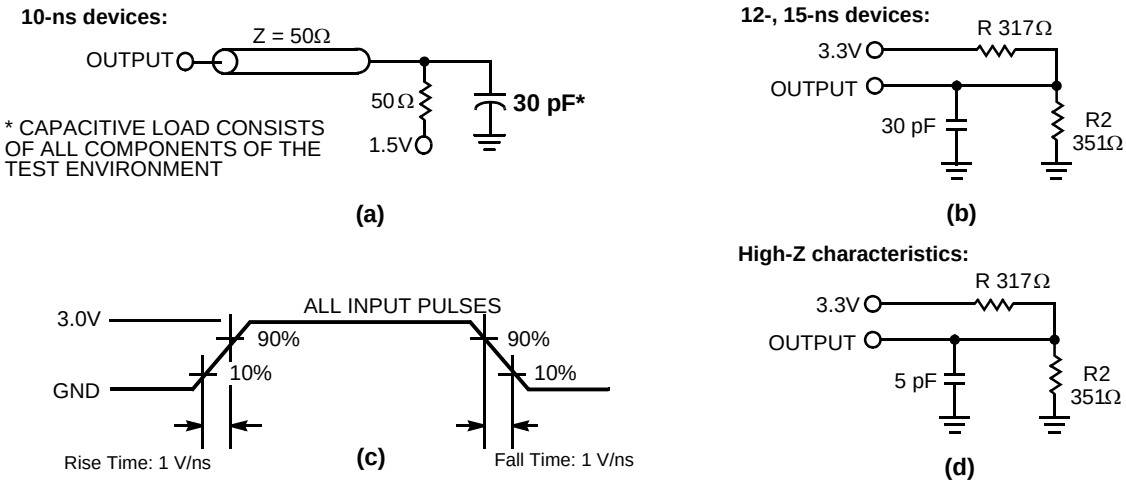
Parameter	Description	Test Conditions	Max.	Unit
C_{IN}	Input Capacitance	T_A = 25°C, f = 1 MHz, V_{CC} = 3.3V	8	pF
C_{OUT}	I/O Capacitance		8	pF

Thermal Resistance[2]

Parameter	Description	Test Conditions	TSOP II	TQFP	VFBGA	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	46.98	°C/W
Θ_{JC}	Thermal Resistance (Junction to Case)		10.75	14.64	9.63	°C/W

Notes:
1. V_{IL} (min.) = –2.0V for pulse durations of less than 20 ns.
2. Tested initially and after any design or process changes that may affect these parameters.

AC Test Loads and Waveforms[3]



AC Switching Characteristics Over the Operating Range[4]

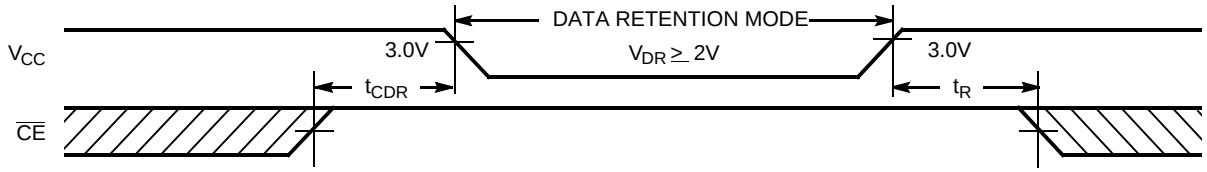
Parameter	Description	–10		–12		–15		Unit
		Min.	Max.	Min.	Max.	Min.	Max.	
Read Cycle								
t_{power}[5]	V_{CC}(typical) to the first access	1		1		1		µs
t_{RC}	Read Cycle Time	10		12		15		ns
t_{AA}	Address to Data Valid		10		12		15	ns
t_{OHA}	Data Hold from Address Change	3		3		3		ns
t_{ACE}	$\overline{CE}$ LOW to Data Valid		10		12		15	ns
t_{DOE}	$\overline{OE}$ LOW to Data Valid		5		6		7	ns
t_{LZOE}	$\overline{OE}$ LOW to Low-Z	0		0		0		ns
t_{HZOE}	$\overline{OE}$ HIGH to High-Z[6, 7]		5		6		7	ns
t_{LZCE}	$\overline{CE}$ LOW to Low-Z[7]	3		3		3		ns
t_{HZCE}	$\overline{CE}$ HIGH to High-Z[6, 7]		5		6		7	ns
t_{PU}	$\overline{CE}$ LOW to Power-up	0		0		0		ns
t_{PD}	$\overline{CE}$ HIGH to Power-down		10		12		15	ns
t_{DBE}	Byte Enable to Data Valid		5		6		7	ns
t_{LZBE}	Byte Enable to Low-Z	0		0		0		ns
t_{HZBE}	Byte Disable to High-Z		6		6		7	ns

Notes:
3. AC characteristics (except High-Z) for all 10-ns parts are tested using the load conditions shown in (a). All other speeds are tested using the Thevenin load shown in (b). High-Z characteristics are tested for all speeds using the test load shown in (d).
4. 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.
5. 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.
6. 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 ± 500 mV from steady-state voltage.
7. 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.

AC Switching Characteristics Over the Operating Range[4] (continued)

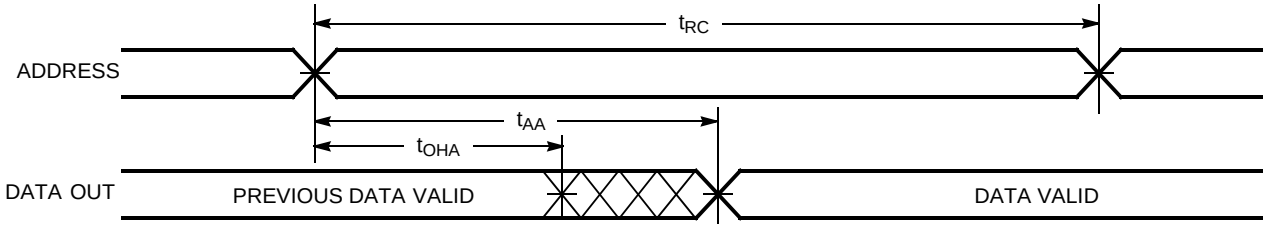
Parameter	Description	–10		–12		–15		Unit
		Min.	Max.	Min.	Max.	Min.	Max.	
Write Cycle[8, 9]								
t_{WC}	Write Cycle Time	10		12		15		ns
t_{SCE}	$\overline{CE}$ LOW to Write End	7		8		10		ns
t_{AW}	Address Set-up to Write End	7		8		10		ns
t_{HA}	Address Hold from Write End	0		0		0		ns
t_{SA}	Address Set-up to Write Start	0		0		0		ns
t_{PWE}	$\overline{WE}$ Pulse Width	7		8		10		ns
t_{SD}	Data Set-up to Write End	5		6		7		ns
t_{HD}	Data Hold from Write End	0		0		0		ns
t_{LZWE}	$\overline{WE}$ HIGH to Low-Z[7]	3		3		3		ns
t_{HZWE}	$\overline{WE}$ LOW to High-Z[6, 7]		5		6		7	ns
t_{BW}	Byte Enable to End of Write	7		8		10		ns

Data Retention Waveform



Switching Waveforms

Read Cycle No. 1[10, 11]

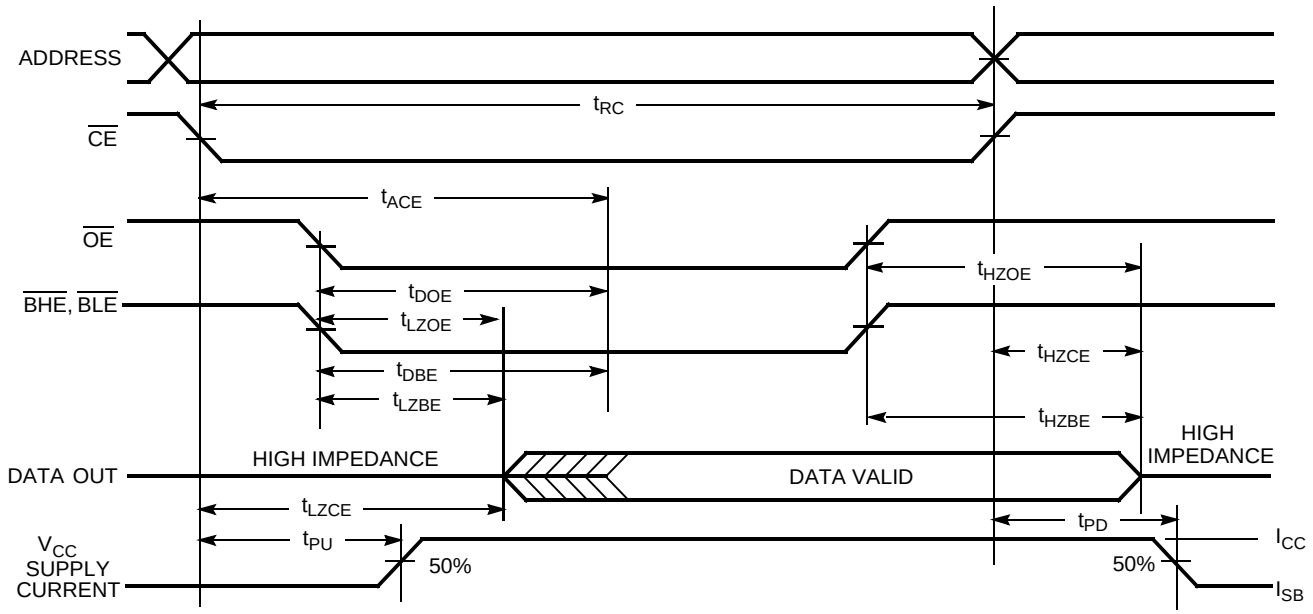


Notes:

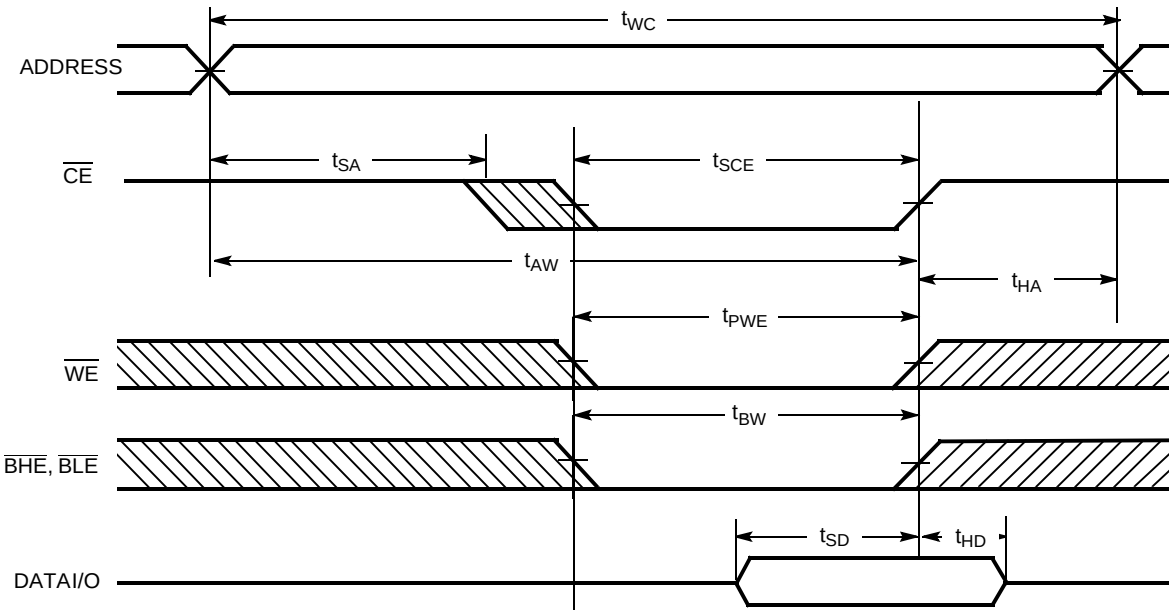
8. The internal write time of the memory is defined by the overlap of $\overline{CE}$ LOW, and $\overline{WE}$ LOW. $\overline{CE}$ and $\overline{WE}$ must be LOW to initiate a write, and the transition of either of these signals can terminate the write. The input data set-up and hold timing should be referenced to the leading edge of the signal that terminates the write.
9. 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}.
10. Device is continuously selected. $\overline{OE}$, $\overline{CE}$, $\overline{BHE}$ and/or $\overline{BHE}$ = V_{IL}.
11. $\overline{WE}$ is HIGH for read cycle.

Switching Waveforms (continued)

Read Cycle No. 2 ($\overline{OE}$ Controlled)[11, 12]



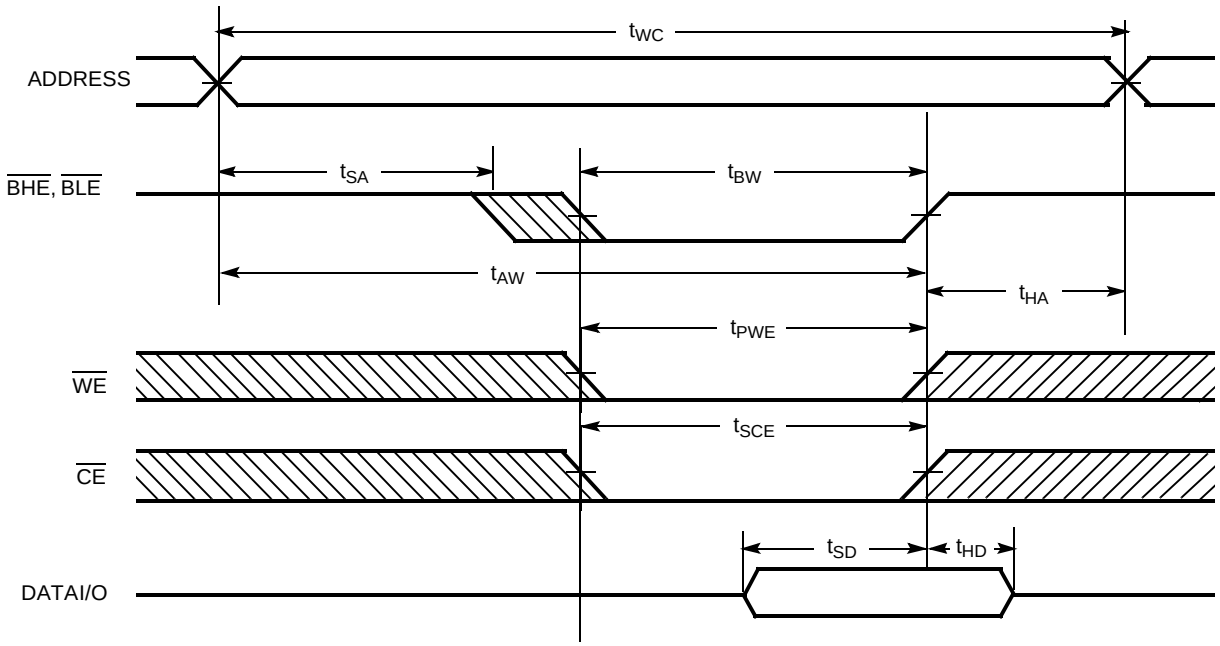
Write Cycle No. 1 ($\overline{CE}$ Controlled)[13, 14]



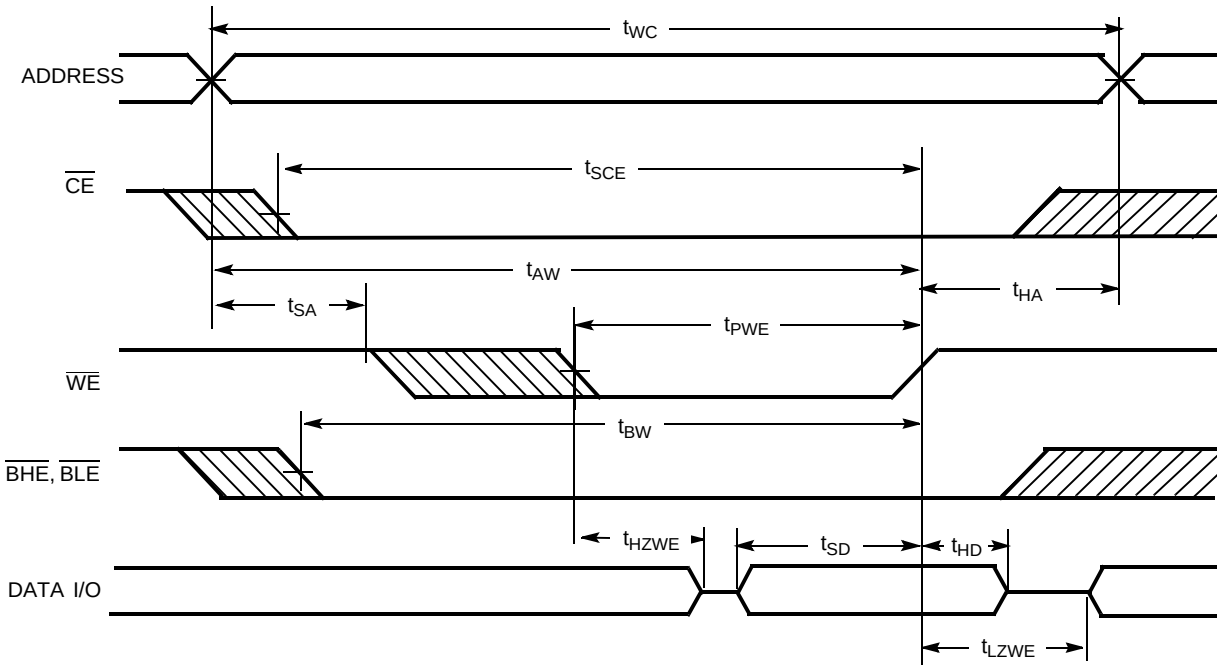
Notes:
12. Address valid prior to or coincident with $\overline{CE}$ transition LOW.
13. Data I/O is high-impedance if $\overline{OE}$ or $\overline{BHE}$ and/or $\overline{BLE}$ = V_{IH}.
14. If $\overline{CE}$ goes HIGH simultaneously with $\overline{WE}$ going HIGH, the output remains in a high-impedance state.

Switching Waveforms (continued)

Write Cycle No. 2 (BLE or BHE Controlled)



Write Cycle No. 3 (WE Controlled, OE 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})

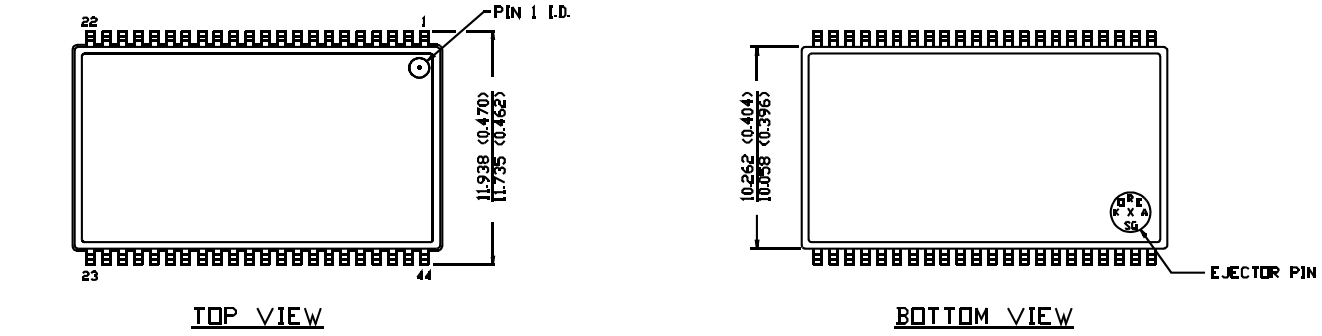
Ordering Information

Speed (ns)	Ordering Code	Package Name	Package Type	Operating Range
10	CY7C1011CV33-10ZC	51-85087	44-pin TSOP II	Commercial
	CY7C1011CV33-10ZXC		44-pin TSOP II (Pb-Free)	
	CY7C1011CV33-10ZXI		44-pin TSOP II (Pb-Free)	Industrial
	CY7C1011CV33-10BVI	51-85150	48-ball (6 x 8 x 1 mm) VFBGA	
12	CY7C1011CV33-12ZC	51-85087	44-pin TSOP II	Commercial
	CY7C1011CV33-12ZXC		44-pin TSOP II (Pb-Free)	
	CY7C1011CV33-12ZI		44-pin TSOP II	Industrial
	CY7C1011CV33-12ZXI		44-pin TSOP II (Pb-Free)	
	CY7C1011CV33-12AXI	51-85064	44-pin TQFP (Pb-Free)	
	CY7C1011CV33-12BVI	51-85150	48-ball (6 x 8 x 1 mm) VFBGA	
15	CY7C1011CV33-15ZXC	51-85087	44-pin TSOP II (Pb-Free)	Commercial
	CY7C1011CV33-15AI	51-85064	44-pin TQFP	Industrial

Package Diagrams

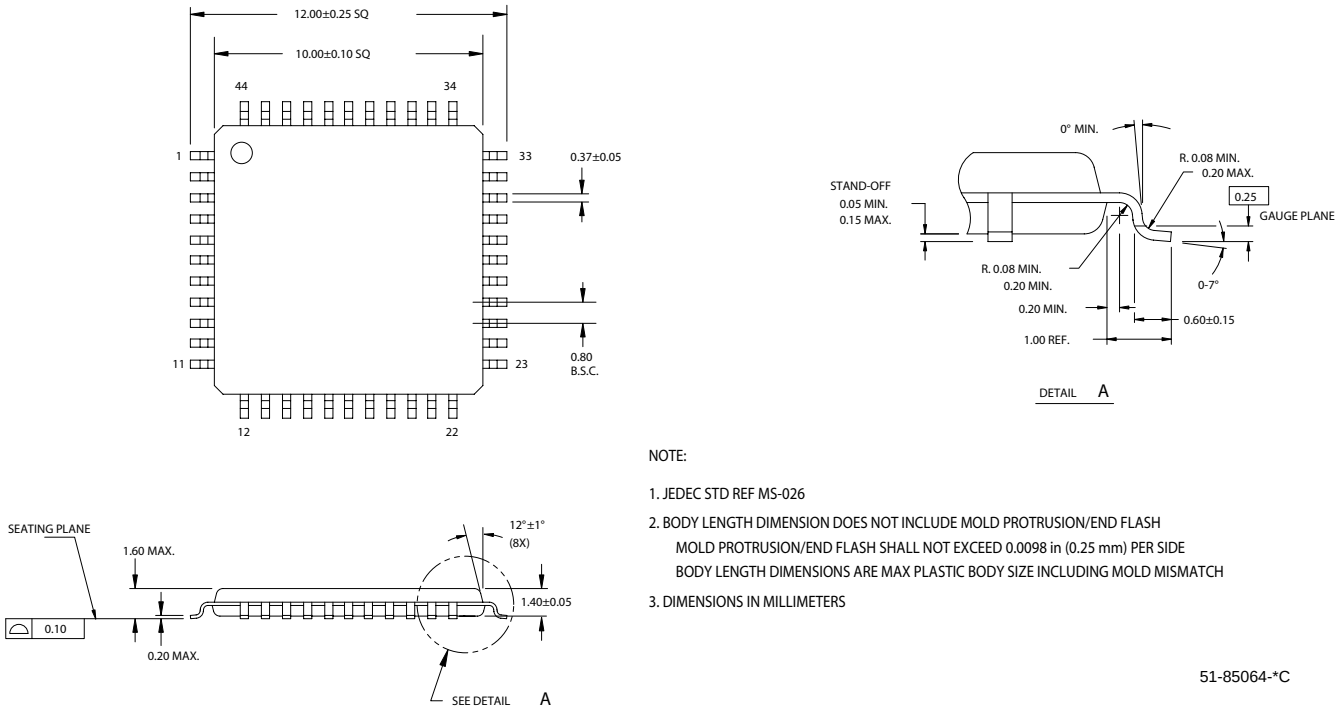
44-Pin TSOP II (51-85087)

DIMENSION IN MM (INCH)
MAX
MIN.



51-85087-*A

44-pin Thin Plastic Quad Flat Pack (51-85064)



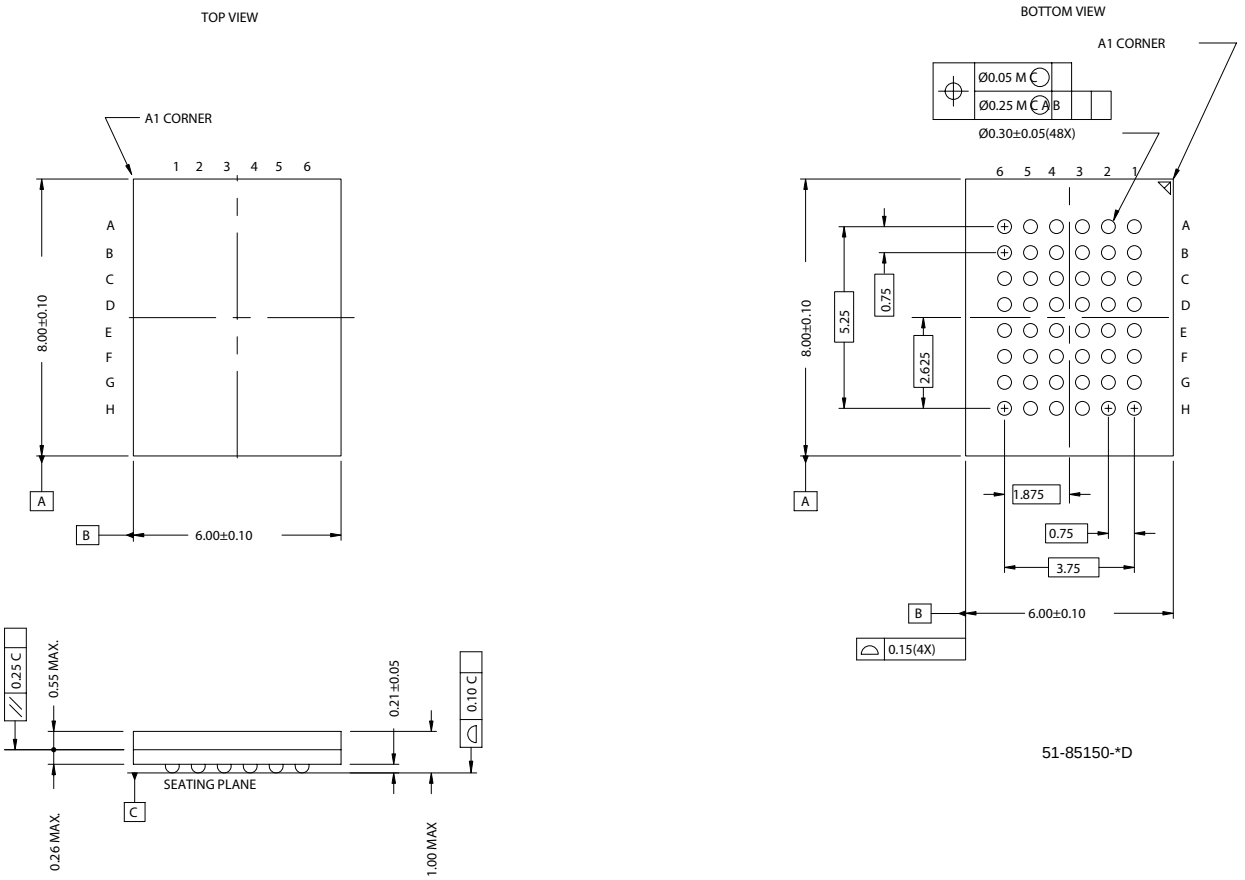
NOTE:

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-*C

Package Diagrams (continued)

48-ball VFBGA (6 x 8 x 1 mm) (51-85150)



Document History Page

Document Title: CY7C1011CV33, 2-Mbit (128K x 16) Static RAM Document Number: 38-05232				
REV.	**ECN NO.**	**Issue Date**	**Orig. of Change**	**Description of Change**
**	117132	07/31/02	HGK	New Data Sheet
*A	118057	08/19/02	HGK	Pin configuration for 48-ball FBGA correction
*B	119702	10/11/02	DFP	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	See ECN	PCI	Added lead-free parts in Ordering Information Table
*D	498501	See ECN	NXR	Corrected typo in the Logic Block Diagram on page# 1 Incuded 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	See ECN	VKN	Added Thermal Resistance Table