CY7C1061AV33

1M x 16 Static RAM

Features

- **High speed**
  - **t_{AA} = 8, 10, 12 ns**
- **Low active power**
  - **1080 mW (max.)**
- **Operating voltages of 3.3 ± 0.3V**
- **2.0V data retention**
- **Automatic power-down when deselected**
- **TTL-compatible inputs and outputs**
- **Easy memory expansion with $\overline{CE}_1$ and CE_2 features**

Functional Description

The CY7C1061AV33 is a high-performance CMOS Static RAM organized as 1,048,576 words by 16 bits.

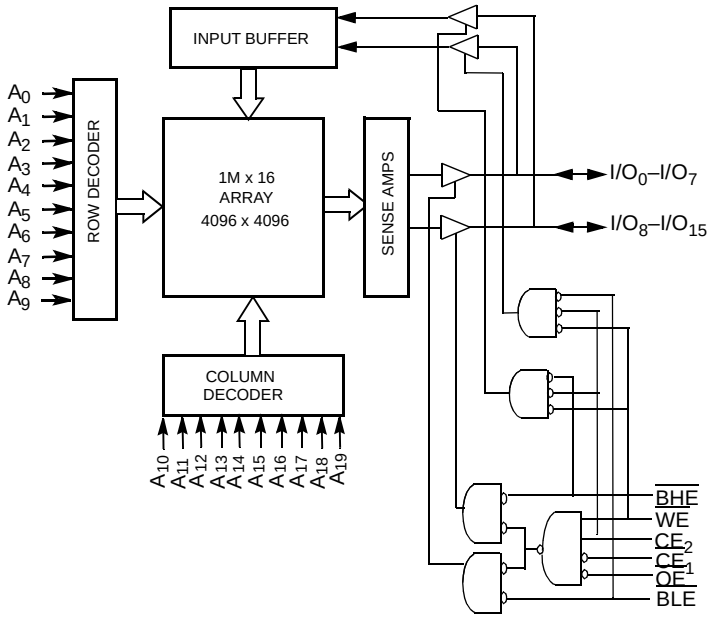
Writing to the device is accomplished by enabling the chip ($\overline{CE}_1$ LOW and CE_2 HIGH) while forcing the Write Enable ($\overline{WE}$) input LOW. If Byte Low Enable ($\overline{BLE}$) is LOW, then data from I/O pins (I/O_0 through I/O_7), is written into the location specified on the address pins (A_0 through A_{19}). 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_{19}).

Reading from the device is accomplished by enabling the chip by taking $\overline{CE}_1$ LOW and CE_2 HIGH while forcing the Output Enable ($\overline{OE}$) LOW and 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 ($\overline{CE}_1$ HIGH/CE_2 LOW), 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 ($\overline{CE}_1$ LOW, CE_2 HIGH, and $\overline{WE}$ LOW).

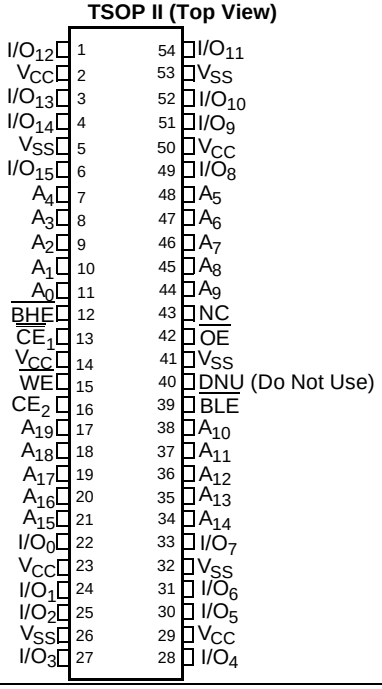
The CY7C1061AV33 is available in a 54-pin TSOP II package with center power and ground (revolutionary) pinout, and a 48-ball fine-pitch ball grid array (FBGA) package.

Logic Block Diagram



Pin Configuration

TSOP II (Top View)



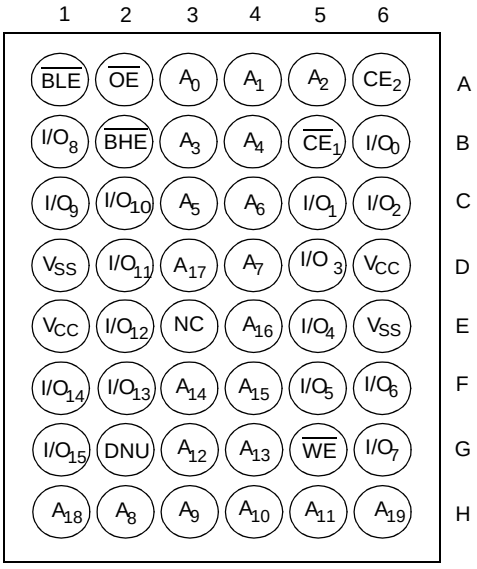
Selection Guide

		-8	-10	-12	Unit
Maximum Access Time		8	10	12	ns
Maximum Operating Current	Commercial	300	275	260	mA
	Industrial	300	275	260	
Maximum CMOS Standby Current	Commercial/Industrial	50	50	50	mA

Pin Configurations

48-ball FBGA

(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

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		-8		-10		-12		Unit
				Min.	Max.	Min.	Max.	Min.	Max.	
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 Load 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} = $1/t_{RC}$	Commercial		300		275		260	mA
			Industrial		300		275		260	mA
I_{SB1}	Automatic CE Power-down Current —TTL Inputs	CE_2 <= V_{IL} Max. V_{CC}, $\overline{CE}$ ≥ V_{IH} V_{IN} ≥ V_{IH} or V_{IN} ≤ V_{IL}, f = f_{MAX}			70		70		70	mA
I_{SB2}	Automatic CE Power-down Current —CMOS Inputs	CE_2 <= 0.3V Max. V_{CC}, $\overline{CE}$ ≥ V_{CC} – 0.3V, V_{IN} ≥ V_{CC} – 0.3V, or V_{IN} ≤ 0.3V, f = 0	Commercial/ Industrial		50		50		50	mA

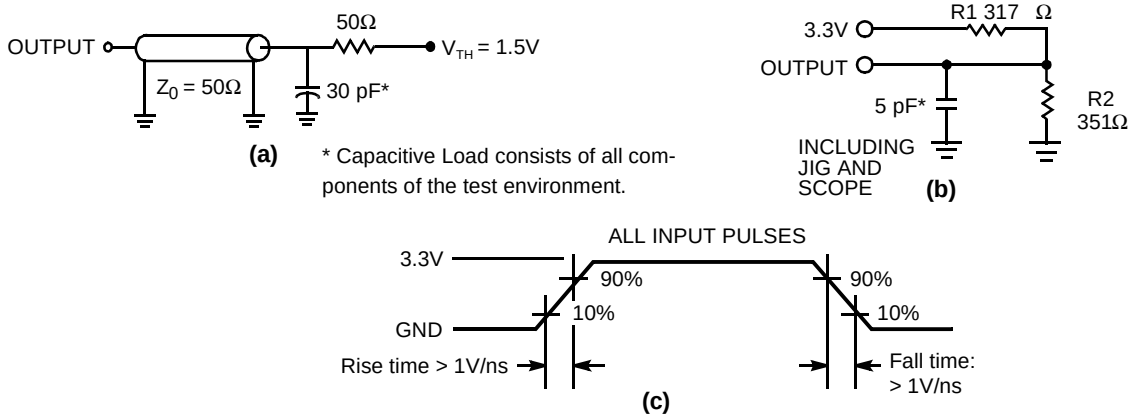
Capacitance[2]

Parameter	Package	Description	Test Conditions	Max.	Unit
C_{IN}	Z54	Input Capacitance	T_A = 25°C, f = 1 MHz, V_{CC} = 3.3V	6	pF
	BA48			8	pF
C_{OUT}	Z54	I/O Capacitance		8	pF
	BA48			10	pF

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	-8		-10		-12		Unit
		Min.	Max.	Min.	Max.	Min.	Max.	
Read Cycle								
t_{power}	V_{CC}(typical) to the first access[5]	1		1		1		ms
t_{RC}	Read Cycle Time	8		10		12		ns
t_{AA}	Address to Data Valid		8		10		12	ns
t_{OHA}	Data Hold from Address Change	3		3		3		ns
t_{ACE}	$\overline{CE}_1$ LOW / CE_2 HIGH to Data Valid		8		10		12	ns
t_{DOE}	$\overline{OE}$ LOW to Data Valid		5		5		6	ns
t_{LZOE}	$\overline{OE}$ LOW to Low-Z	1		1		1		ns
t_{HZOE}	$\overline{OE}$ HIGH to High-Z[6]		5		5		6	ns
t_{LZCE}	$\overline{CE}_1$ LOW/CE_2 HIGH to Low-Z[6]	3		3		3		ns
t_{HZCE}	$\overline{CE}_1$ HIGH/CE_2 LOW to High-Z[6]		5		5		6	ns
t_{PU}	$\overline{CE}_1$ LOW/CE_2 HIGH to Power-Up[7]	0		0		0		ns
t_{PD}	$\overline{CE}_1$ HIGH/CE_2 LOW to Power-Down[7]		8		10		12	ns
t_{DBE}	Byte Enable to Data Valid		5		5		6	ns
t_{LZBE}	Byte Enable to Low-Z	1		1		1		ns
t_{HZBE}	Byte Disable to High-Z		5		5		6	ns
Write Cycle[8, 9]								
t_{WC}	Write Cycle Time	8		10		12		ns
t_{SCE}	$\overline{CE}_1$ LOW/CE_2 HIGH to Write End	6		7		8		ns

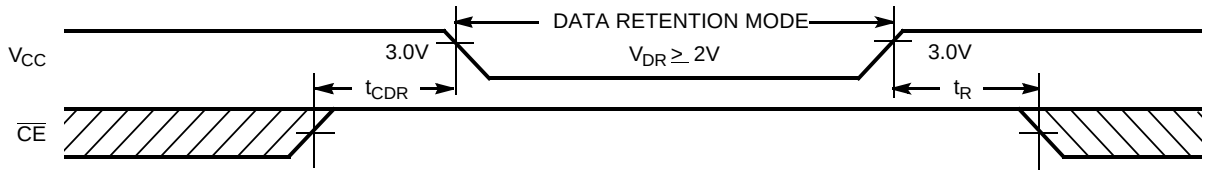
Notes:

3. Valid SRAM operation does not occur until the power supplies have reached the minimum operating V_{DD} (3.0V). As soon as 1ms (T_{power}) after reaching the minimum operating V_{DD}, normal SRAM operation can begin including reduction in V_{DD} to the data retention (V_{CCDR}, 2.0V) voltage.
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, and output loading of the specified I_{OL}/I_{OH} and specified transmission line loads. Test conditions for the Read cycle use output loading shown in part a) of the AC test loads, unless specified otherwise.
5. This part has a voltage regulator which steps down the voltage from 3V to 2V internally. t_{power} time has to be provided initially before a Read/Write operation is started.
6. t_{HZOE}, t_{HZCE}, t_{HZWE}, t_{HZBE} and t_{LZOE}, t_{LZCE}, t_{LZWE}, t_{LZBE} are specified with a load capacitance of 5 pF as in (b) of AC Test Loads. Transition is measured ±200 mV from steady-state voltage.
7. These parameters are guaranteed by design and are not tested.
8. The internal Write time of the memory is defined by the overlap of $\overline{CE}_1$ LOW (CE_2 HIGH) and $\overline{WE}$ LOW. Chip enables must be active and $\overline{WE}$ and byte enables must be LOW to initiate a Write, and the transition of any 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}.

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

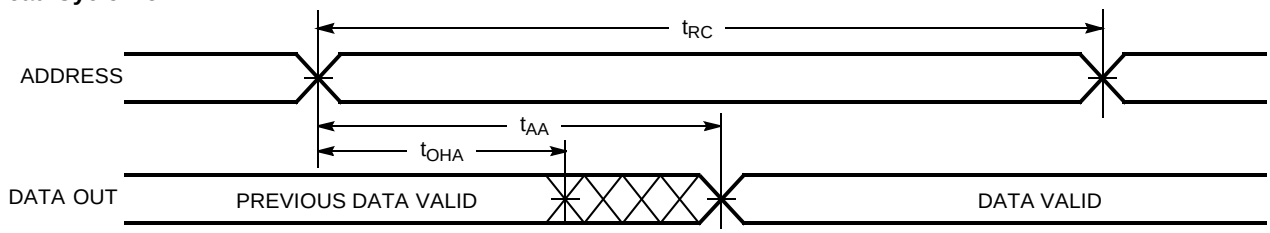
Parameter	Description	-8		-10		-12		Unit
		Min.	Max.	Min.	Max.	Min.	Max.	
t_{AW}	Address Set-up to Write End	6		7		8		ns
t_{HA}	Address Hold from Write End	0		0		0		ns
t_{SA}	Address Set-up to Write Start	0		0		0		ns
t_{PWE}	$\overline{WE}$ Pulse Width	6		7		8		ns
t_{SD}	Data Set-up to Write End	5		5.5		6		ns
t_{HD}	Data Hold from Write End	0		0		0		ns
t_{LZWE}	$\overline{WE}$ HIGH to Low-Z[6]	3		3		3		ns
t_{HZWE}	$\overline{WE}$ LOW to High-Z[6]		5		5		6	ns
t_{BW}	Byte Enable to End of Write	6		7		8		ns

Data Retention Waveform



Switching Waveforms

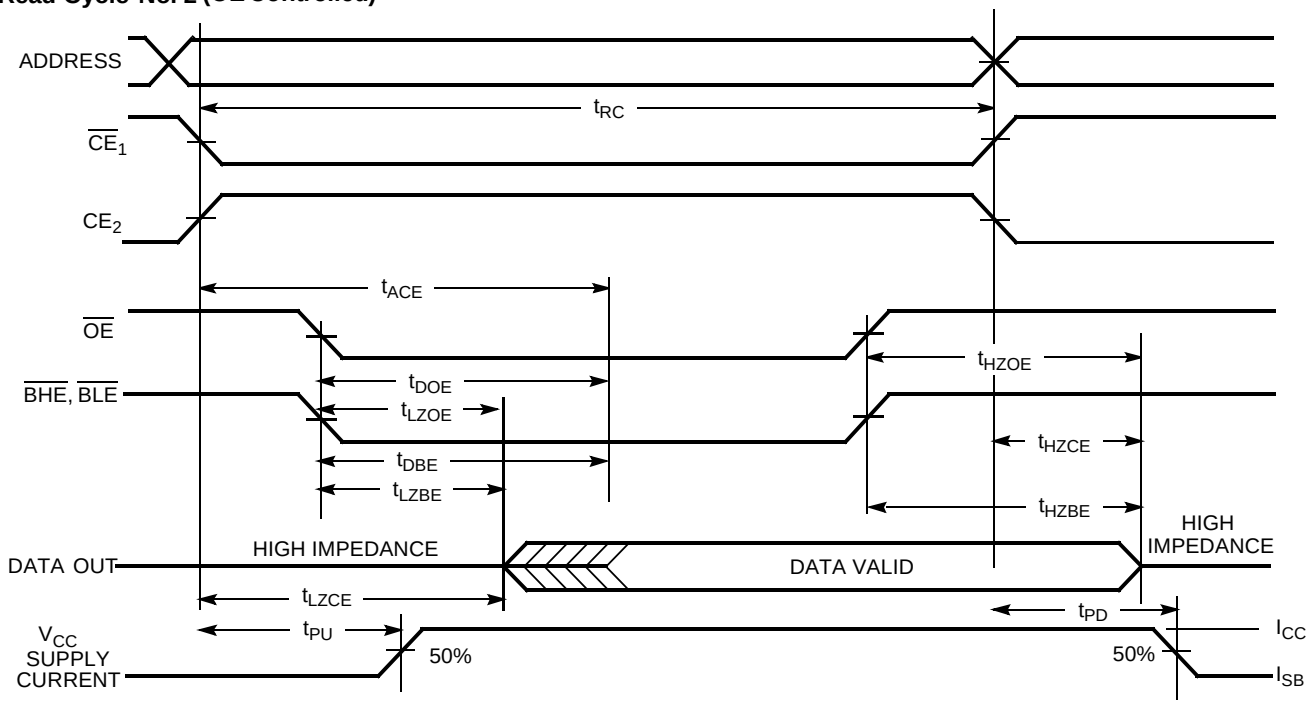
Read Cycle No. 1[10, 11]



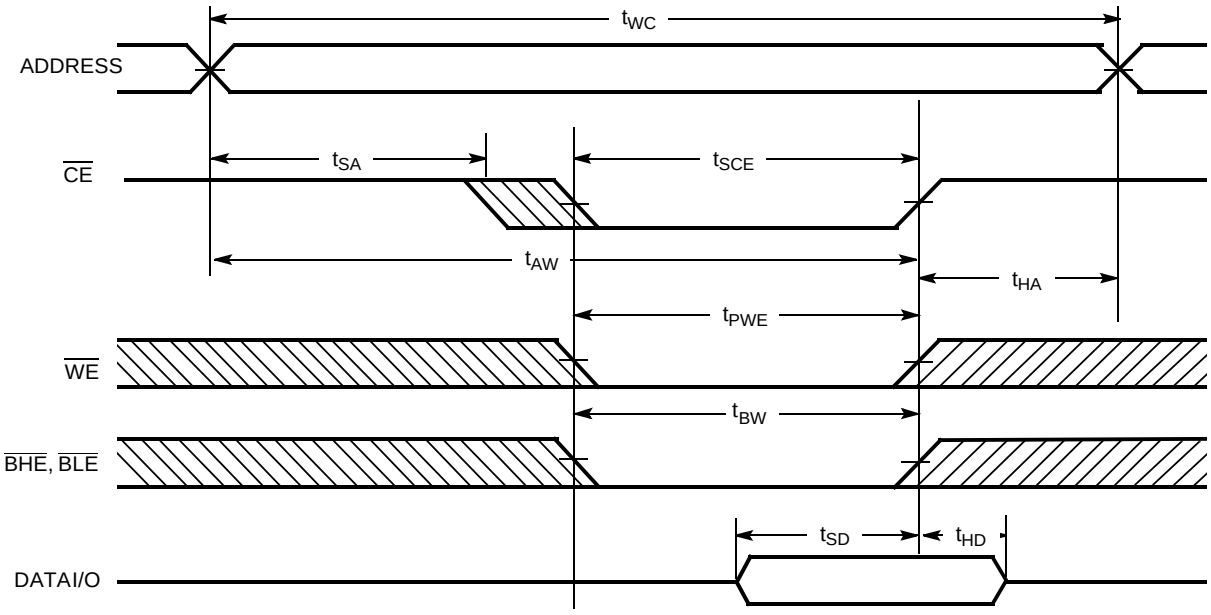
Notes:
10. Device is continuously selected. $\overline{OE}$, $\overline{CE}$, $\overline{BHE}$ and/or $\overline{BHE}$ = V_{IL}. CE2 = V_{IH}.
11. $\overline{WE}$ is HIGH for Read cycle.

Switching Waveforms (continued)

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



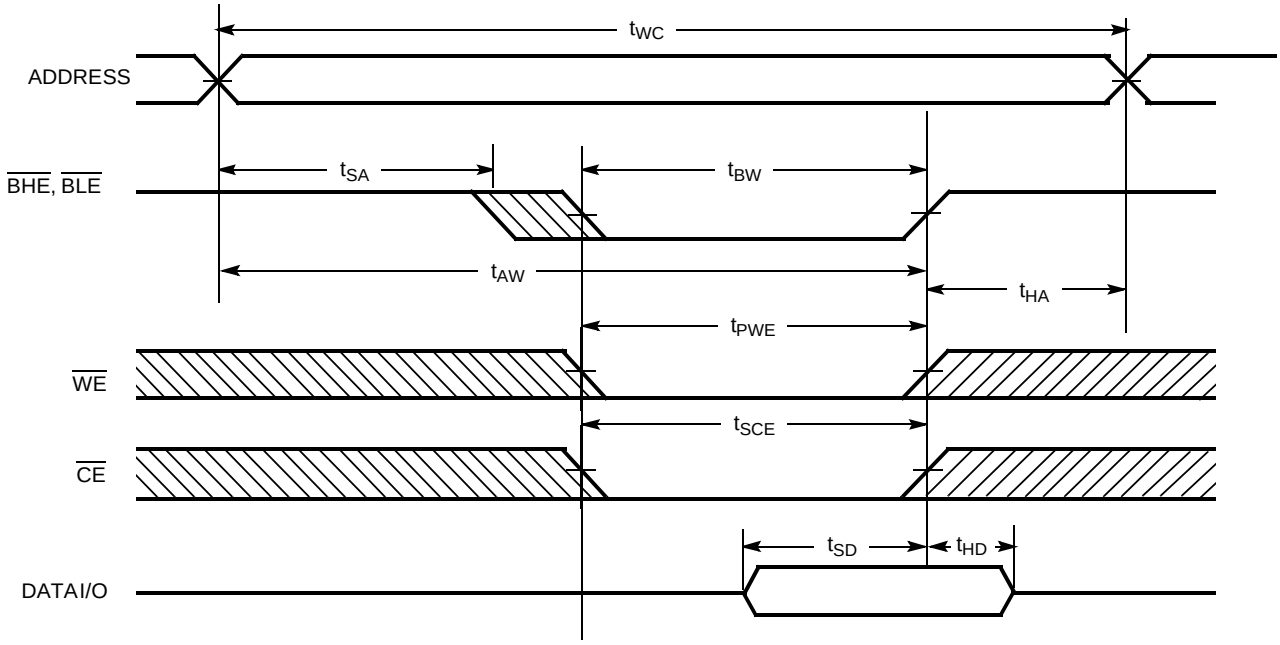
Write Cycle No. 1 ($\overline{CE}$ Controlled)[13, 14, 15]



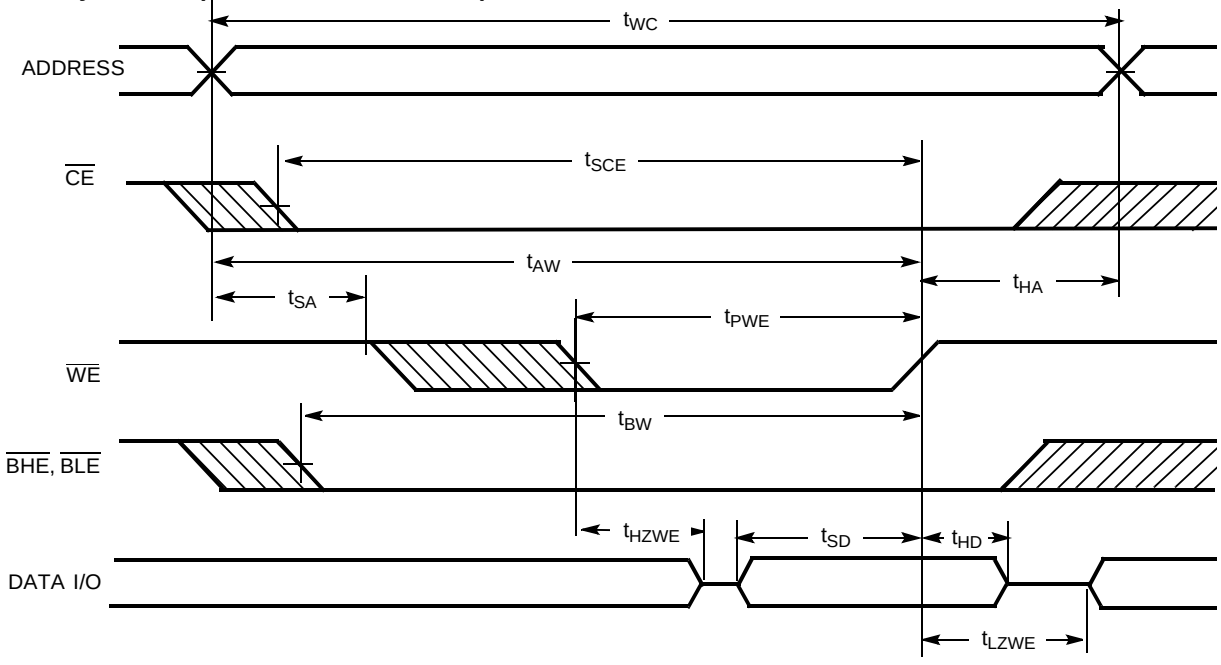
Notes:
12. Address valid prior to or coincident with $\overline{CE}_1$ transition LOW and CE_2 transition HIGH.
13. Data I/O is high-impedance if $\overline{OE}$ or $\overline{BHE}$ and/or $\overline{BLE}$ = V_{IH}.
14. If $\overline{CE}_1$ goes HIGH simultaneously with $\overline{WE}$ going HIGH, the output remains in a high-impedance state.
15. $\overline{CE}$ is a shorthand combination of both $\overline{CE}_1$ and CE_2 combined. It is active LOW.

Switching Waveforms (continued)

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



Write Cycle No. 3 ($\overline{WE}$ Controlled, $\overline{OE}$ LOW)[13, 14, 15]



Truth Table

$\overline{CE_1}$	CE_2	$\overline{OE}$	$\overline{WE}$	$\overline{BLE}$	$\overline{BHE}$	$I/O_0–I/O_7$	$I/O_8–I/O_{15}$	Mode	Power
H	X	X	X	X	X	High-Z	High-Z	Power-down	Standby (I_{SB})
X	L	X	X	X	X	High-Z	High-Z	Power-down	Standby (I_{SB})
L	H	L	H	L	L	Data Out	Data Out	Read All Bits	Active (I_{CC})
L	H	L	H	L	H	Data Out	High-Z	Read Lower Bits Only	Active (I_{CC})
L	H	L	H	H	L	High-Z	Data Out	Read Upper Bits Only	Active (I_{CC})
L	H	X	L	L	L	Data In	Data In	Write All Bits	Active (I_{CC})
L	H	X	L	L	H	Data In	High-Z	Write Lower Bits Only	Active (I_{CC})
L	H	X	L	H	L	High-Z	Data In	Write Upper Bits Only	Active (I_{CC})
L	H	H	H	X	X	High-Z	High-Z	Selected, Outputs Disabled	Active (I_{CC})

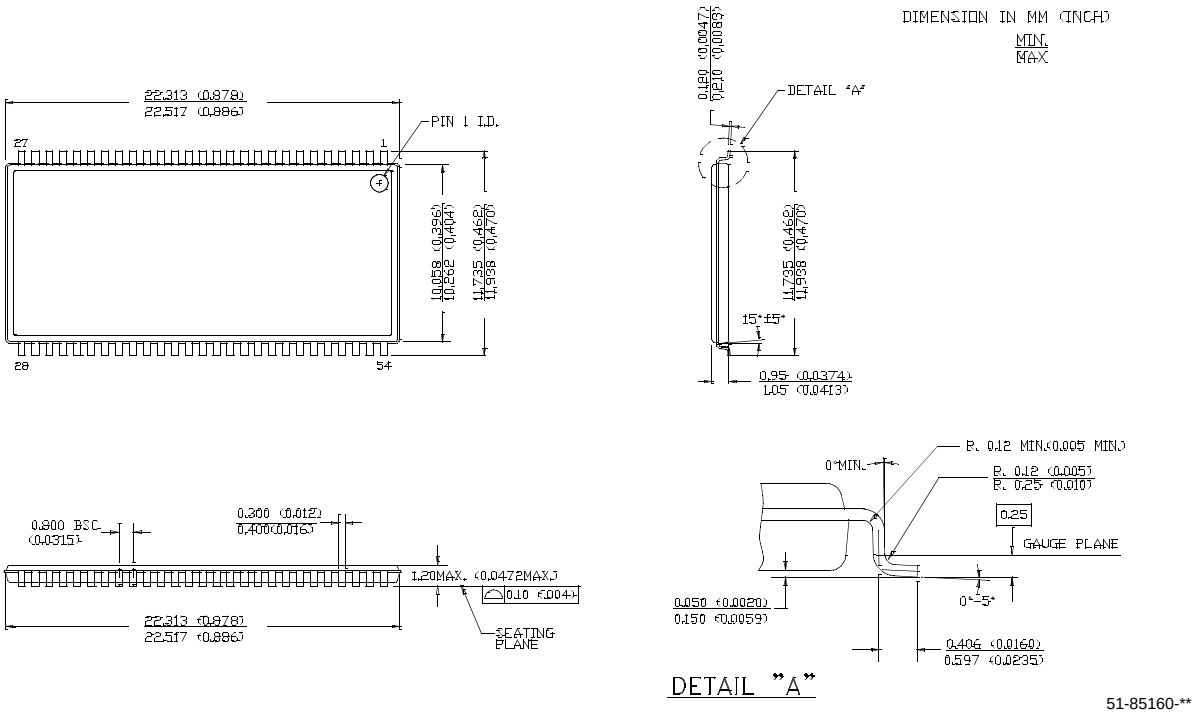
Ordering Information

Speed (ns)	Ordering Code[16]	Package Name	Package Type	Operating Range
8	CY7C1061AV33-8ZC	Z54-II	54-pin TSOP II	Commercial
	CY7C1061AV33-8ZI			Industrial
	CY7C1061AV33-8BAC	BA48G	48-ball Mini BGA	Commercial
	CY7C1061AV33-8BAI			Industrial
10	CY7C1061AV33-10ZC	Z54-II	54-pin TSOP II	Commercial
	CY7C1061AV33-10ZI			Industrial
	CY7C1061AV33-10BAC	BA48G	48-ball Mini BGA	Commercial
	CY7C1061AV33-10BAI			Industrial
12	CY7C1061AV33-12ZC	Z54-II	54-pin TSOP II	Commercial
	CY7C1061AV33-12ZI			Industrial
	CY7C1061AV33-12BAC	BA48G	48-ball Mini BGA	Commercial
	CY7C1061AV33-12BAI			Industrial

Note:
16. Contact a Cypress representative for availability of the 48-ball Mini BGA (BA48) package.

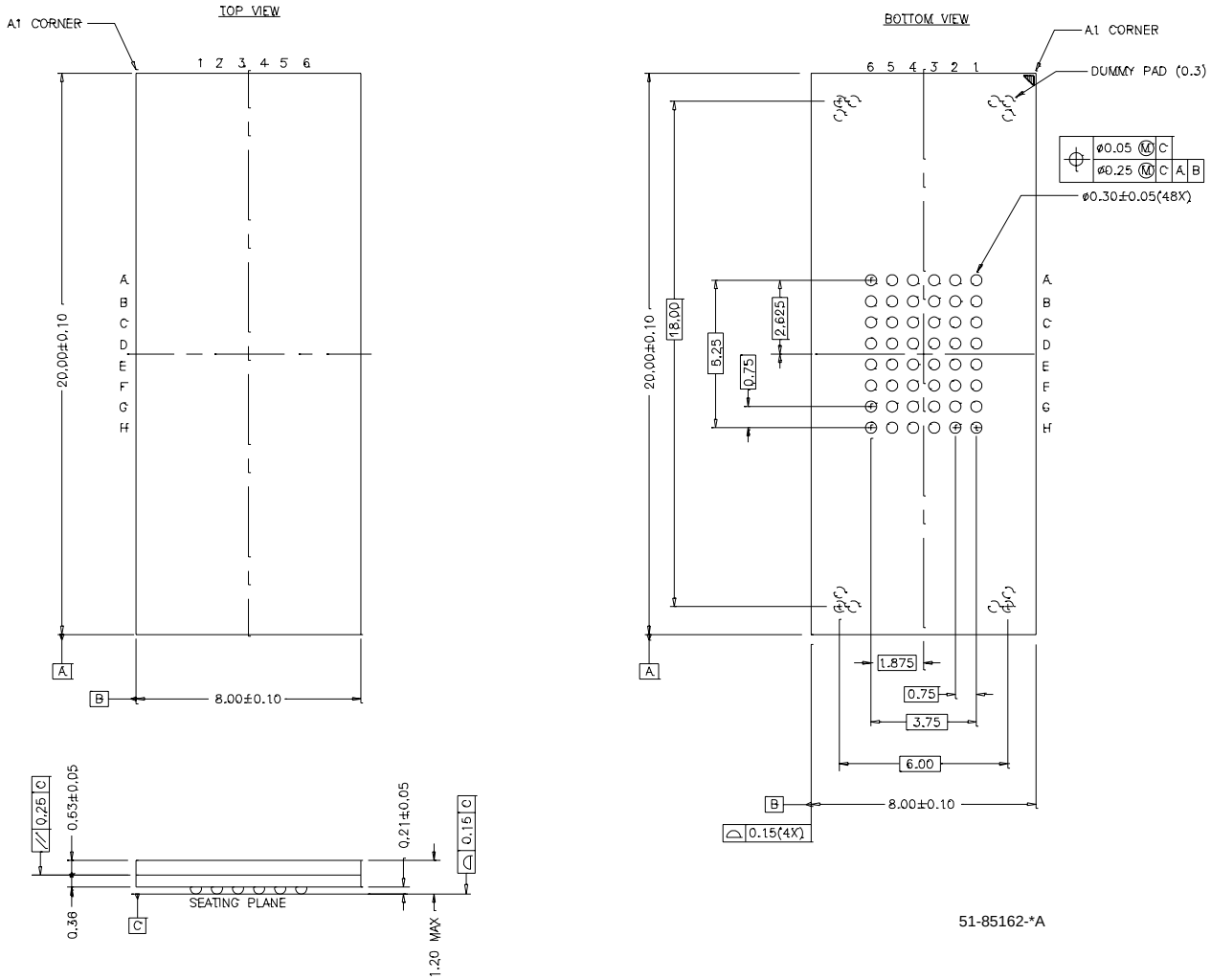
Package Diagrams

54-lead Thin Small Outline Package, Type II Z54-II



Package Diagrams (continued)

48-ball (8 mm x 20 mm x 1.2 mm) FBGA BA48G



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Document History Page

Document Title: CY7C1061AV33 1M x 16 Static RAM Document Number: 38-05256				
REV.	**ECN NO.**	**Issue Date**	**Orig. of Change**	**Description of Change**
**	113725	03/28/02	NSL	New Data Sheet
*A	117058	07/31/02	DFP	Removed 15-ns bin.
*B	117989	08/30/02	DFP	Added 8-ns bin. Changed Icc for 8, 10, 12 bins. t_{power} changed from 1 µs to 1 ms. Load Cap Comment changed (for Tx line load). t_{SD} changed to 5.5 ns for the 10-ns bin. Changed some 8-ns bin numbers (t_{HZ}, t_{DOE}, t_{DBE}). Removed hz<lz comments from data sheet.
*C	120383	11/06/02	DFP	Final data sheet. Added note 3 to “AC Test Loads and Waveforms” and note 7 to t_{pu} and t_{pd}. Updated Input/Output Caps (for 48BGA only) to 8 pF/10 pF and for the 54-pin TSOP to 6/8 pF.
*D	124439	2/25/03	MEG	Changed ISB1 from 100 mA to 70 mA. Shaded fBGA production ordering information.