

## Features

- High speed
  - $t_{AA} = 10 \text{ ns}$
- Low active power
  - $I_{CC} = 175 \text{ mA}$  at 10 ns
- Low CMOS standby power
  - $I_{SB2} = 25 \text{ mA}$
- Operating voltages of  $3.3 \pm 0.3\text{V}$
- 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
- Available in Pb-free 54-Pin TSOP II and 48-Ball VFBGA packages

## Functional Description

The CY7C1061DV33 is a high performance CMOS Static RAM organized as 1,048,576 words by 16 bits.

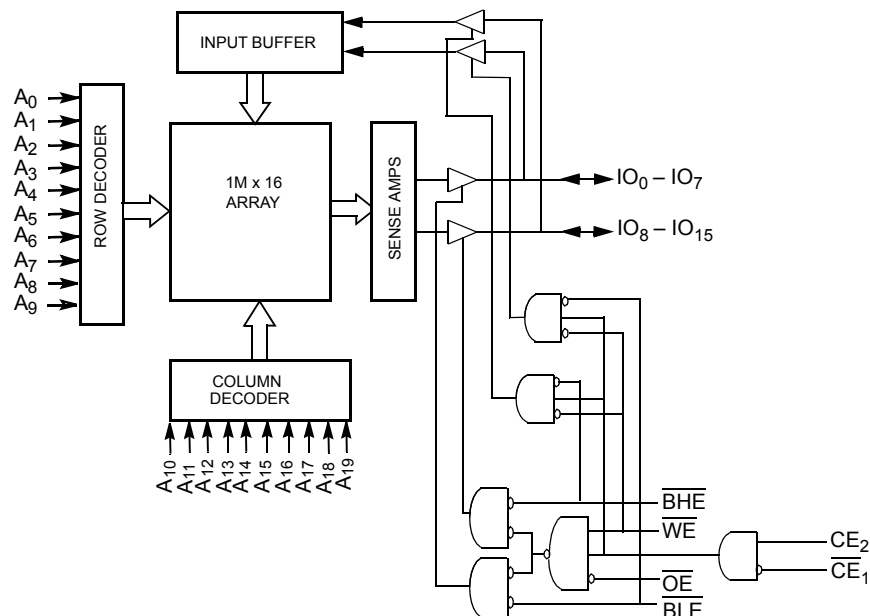
To write to the device, take Chip Enables ( $\overline{CE}_1$  LOW and  $CE_2$  HIGH) and Write Enable ( $WE$ ) input LOW. If Byte Low Enable ( $\overline{BLE}$ ) is LOW, then data from IO pins ( $IO_0$  through  $IO_7$ ), is written into the location specified on the address pins ( $A_0$  through  $A_{19}$ ). If Byte High Enable ( $BHE$ ) is LOW, then data from IO pins ( $IO_8$  through  $IO_{15}$ ) is written into the location specified on the address pins ( $A_0$  through  $A_{19}$ ).

To read from the device, take Chip Enables ( $\overline{CE}_1$  LOW and  $CE_2$  HIGH) and Output Enable ( $OE$ ) LOW while forcing the Write Enable ( $WE$ ) HIGH. If Byte Low Enable ( $\overline{BLE}$ ) is LOW, then data from the memory location specified by the address pins appears on  $IO_0$  to  $IO_7$ . If Byte High Enable ( $BHE$ ) is LOW, then data from memory appears on  $IO_8$  to  $IO_{15}$ . See the [Truth Table](#) on page 9 for a complete description of Read and Write modes.

The input or output pins ( $IO_0$  through  $IO_{15}$ ) are placed in a high impedance state when the device is deselected ( $\overline{CE}_1$  HIGH/ $CE_2$  LOW), the outputs are disabled ( $OE$  HIGH), the  $BHE$  and  $\overline{BLE}$  are disabled ( $BHE$ ,  $\overline{BLE}$  HIGH), or during a write operation ( $\overline{CE}_1$  LOW,  $CE_2$  HIGH, and  $WE$  LOW).

The CY7C1061DV33 is available in a 54-Pin TSOP II package with center power and ground (revolutionary) pinout, and a 48-Ball VFBGA package.

## Logic Block Diagram



### Selection Guide

	-10	Unit
Maximum Access Time	10	ns
Maximum Operating Current	175	mA
Maximum CMOS Standby Current	25	mA

### Pin Configuration

Figure 1. 54-Pin TSOP II (Top View) [1]

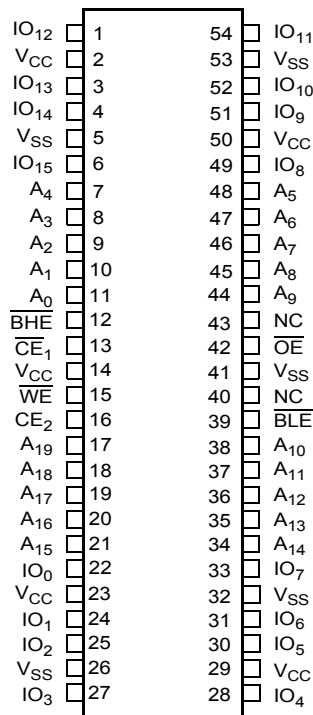
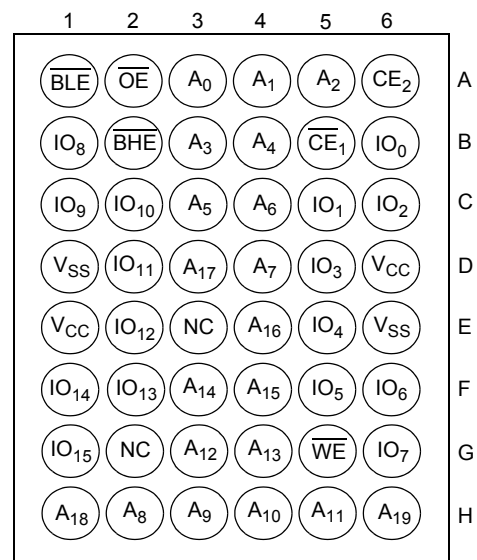


Figure 2. 48-Ball VFBGA (Top View) [1]



**Note**

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

## 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 <sup>[2]</sup> ..... -0.5V to +4.6V  
 DC Voltage Applied to Outputs  
 in High Z State <sup>[2]</sup> ..... -0.5V to  $V_{CC} + 0.5V$   
 DC Input Voltage <sup>[2]</sup> ..... -0.5V to  $V_{CC} + 0.5V$

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

## 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 <sup>[2]</sup>		-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	$V_{CC} = \text{Max}, f = f_{MAX} = 1/t_{RC}, I_{OUT} = 0 \text{ mA CMOS levels}$		175	mA
$I_{SB1}$	Automatic CE Power Down Current — TTL Inputs	Max $V_{CC}$ , $\overline{CE}_1 \geq V_{IH}$ , $CE_2 \leq V_{IL}$ , $V_{IN} \geq V_{IH}$ or $V_{IN} \leq V_{IL}$ , $f = f_{MAX}$		30	mA
$I_{SB2}$	Automatic CE Power Down Current — CMOS Inputs	Max $V_{CC}$ , $\overline{CE}_1 \geq V_{CC} - 0.3V$ , $CE_2 \leq 0.3V$ , $V_{IN} \geq V_{CC} - 0.3V$ , or $V_{IN} \leq 0.3V$ , $f = 0$		25	mA

### Note

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

### Capacitance

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

Parameter	Description	Test Conditions	TSOP II	VFBGA	Unit
C <sub>IN</sub>	Input Capacitance	T <sub>A</sub> = 25°C, f = 1 MHz, V <sub>CC</sub> = 3.3V	6	8	pF
C <sub>OUT</sub>	IO Capacitance		8	10	pF

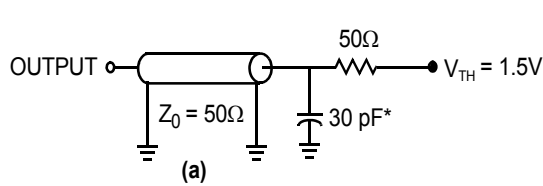
### Thermal Resistance

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

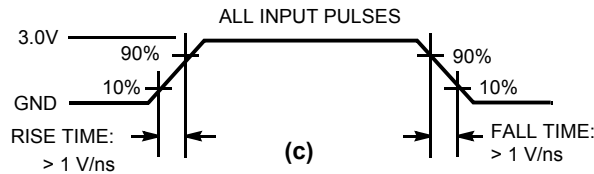
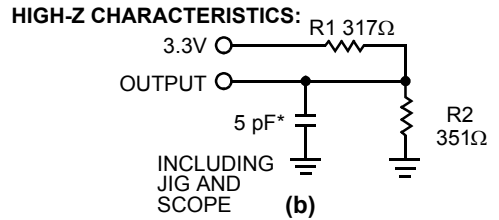
Parameter	Description	Test Conditions	TSOP II	VFBGA	Unit
Θ <sub>JA</sub>	Thermal Resistance (Junction to Ambient)	Still air, soldered on a 3 × 4.5 inch, four layer printed circuit board	24.18	28.37	°C/W
Θ <sub>JC</sub>	Thermal Resistance (Junction to Case)		5.40	5.79	°C/W

### AC Test Loads and Waveforms

The AC test loads and waveform diagram follows. [3]



\* CAPACITIVE LOAD CONSISTS OF ALL COMPONENTS OF THE TEST ENVIRONMENT



**Note**

- Valid SRAM operation does not occur until the power supplies have reached the minimum operating V<sub>DD</sub> (3.0V). 100 μs (t<sub>power</sub>) after reaching the minimum operating V<sub>DD</sub>, normal SRAM operation begins including reduction in V<sub>DD</sub> to the data retention (V<sub>CDDR</sub>, 2.0V) voltage.

## AC Switching Characteristics

Over the Operating Range <sup>[4]</sup>

Parameter	Description	-10		Unit
		Min	Max	
<b>Read Cycle</b>				
$t_{power}$	$V_{CC}$ (Typical) to the First Access <sup>[5]</sup>	100		$\mu s$
$t_{RC}$	Read Cycle Time	10		ns
$t_{AA}$	Address to Data Valid		10	ns
$t_{OHA}$	Data Hold from Address Change	3		ns
$t_{ACE}$	$\overline{CE}_1$ LOW/ $CE_2$ HIGH to Data Valid		10	ns
$t_{DOE}$	$\overline{OE}$ LOW to Data Valid		5	ns
$t_{LZOE}$	$\overline{OE}$ LOW to Low Z	1		ns
$t_{HZOE}$	$\overline{OE}$ HIGH to High Z <sup>[6]</sup>		5	ns
$t_{LZCE}$	$\overline{CE}_1$ LOW/ $CE_2$ HIGH to Low Z <sup>[6]</sup>	3		ns
$t_{HZCE}$	$\overline{CE}_1$ HIGH/ $CE_2$ LOW to High Z <sup>[6]</sup>		5	ns
$t_{PU}$	$\overline{CE}_1$ LOW/ $CE_2$ HIGH to Power Up <sup>[7]</sup>	0		ns
$t_{PD}$	$\overline{CE}_1$ HIGH/ $CE_2$ LOW to Power Down <sup>[7]</sup>		10	ns
$t_{DBE}$	Byte Enable to Data Valid		5	ns
$t_{LZBE}$	Byte Enable to Low Z	1		ns
$t_{HZBE}$	Byte Disable to High Z		5	ns
<b>Write Cycle <sup>[8, 9]</sup></b>				
$t_{WC}$	Write Cycle Time	10		ns
$t_{SCE}$	$\overline{CE}_1$ LOW/ $CE_2$ HIGH to Write End	7		ns
$t_{AW}$	Address Setup to Write End	7		ns
$t_{HA}$	Address Hold from Write End	0		ns
$t_{SA}$	Address Setup to Write Start	0		ns
$t_{PWE}$	$\overline{WE}$ Pulse Width	7		ns
$t_{SD}$	Data Setup to Write End	5.5		ns
$t_{HD}$	Data Hold from Write End	0		ns
$t_{LZWE}$	$\overline{WE}$ HIGH to Low Z <sup>[6]</sup>	3		ns
$t_{HZWE}$	$\overline{WE}$ LOW to High Z <sup>[6]</sup>		5	ns
$t_{BW}$	Byte Enable to End of Write	7		ns

### Notes

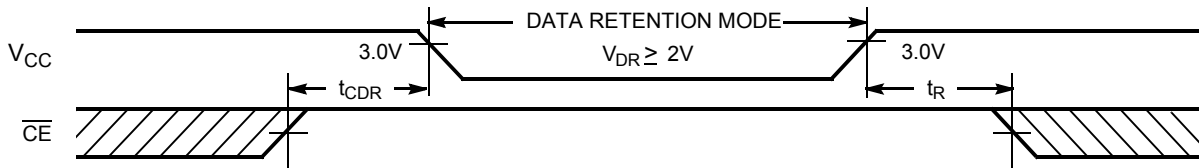
- Test conditions assume signal transition time of 3 ns or less, timing reference levels of 1.5V, and input pulse levels of 0 to 3.0V. Test conditions for the read cycle use output loading shown in part a) of [AC Test Loads and Waveforms](#), unless specified otherwise.
- $t_{POWER}$  gives the minimum amount of time that the power supply is at typical  $V_{CC}$  values until the first memory access is performed.
- $t_{HZOE}$ ,  $t_{HZCE}$ ,  $t_{HZWE}$ ,  $t_{HZBE}$ ,  $t_{LZOE}$ ,  $t_{LZCE}$ ,  $t_{LZWE}$ , and  $t_{LZBE}$  are specified with a load capacitance of 5 pF as in (b) of [AC Test Loads and Waveforms](#). Transition is measured  $\pm 200$  mV from steady state voltage.
- These parameters are guaranteed by design and are not tested.
- The internal write time of the memory is defined by the overlap of  $\overline{WE}$ ,  $\overline{CE}_1 = V_{IL}$ , and  $CE_2 = V_{IH}$ . 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 input data setup and hold timing should be referenced to the edge of the signal that terminates the write.
- The minimum write cycle time for Write Cycle No. 2 ( $\overline{WE}$  controlled,  $\overline{OE}$  LOW) is the sum of  $t_{HZWE}$  and  $t_{SD}$ .

### Data Retention Characteristics

Over the Operating Range

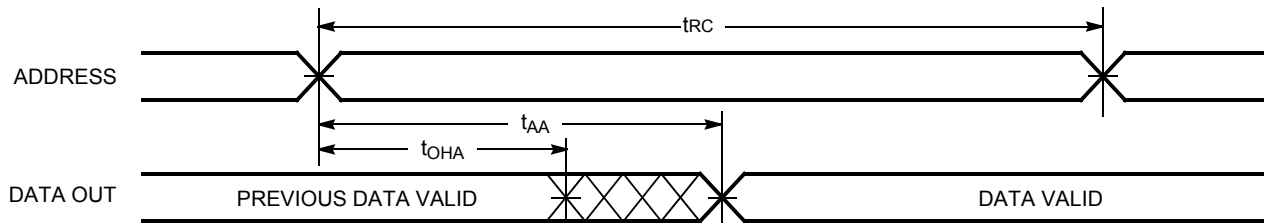
Parameter	Description	Conditions	Min	Typ	Max	Unit
$V_{DR}$	$V_{CC}$ for Data Retention		2			V
$I_{CCDR}$	Data Retention Current	$V_{CC} = 2V, \overline{CE}_1 \geq V_{CC} - 0.2V,$ $CE_2 \leq 0.2V, V_{IN} \geq V_{CC} - 0.2V$ or $V_{IN} \leq 0.2V$			25	mA
$t_{CDR}^{[10]}$	Chip Deselect to Data Retention Time		0			ns
$t_R^{[11]}$	Operation Recovery Time		$t_{RC}$			ns

### Data Retention Waveform



### Switching Waveforms

Figure 3. Read Cycle No. 1 [12, 13]



**Notes**

- 10. Tested initially and after any design or process changes that may affect these parameters.
- 11. Full device operation requires linear  $V_{CC}$  ramp from  $V_{DR}$  to  $V_{CC(min.)} \geq 50 \mu s$  or stable at  $V_{CC(min.)} \geq 50 \mu s$ .
- 12. The device is continuously selected.  $OE, \overline{CE}_1 = V_{IL}, BHE, BLE$  or both  $= V_{IL}$ , and  $CE_2 = V_{IH}$ .
- 13.  $WE$  is HIGH for read cycle.

Switching Waveforms (continued)

Figure 4. Read Cycle No. 2 ( $\overline{OE}$  Controlled) [13, 14]

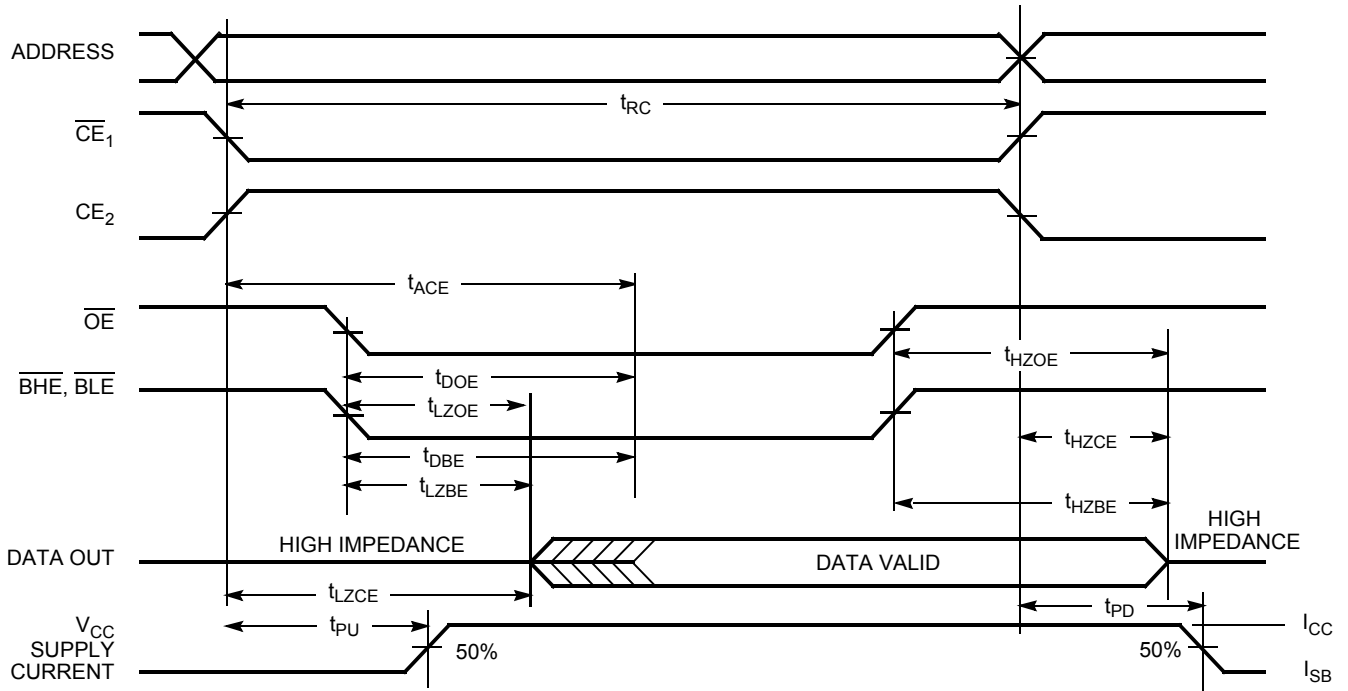
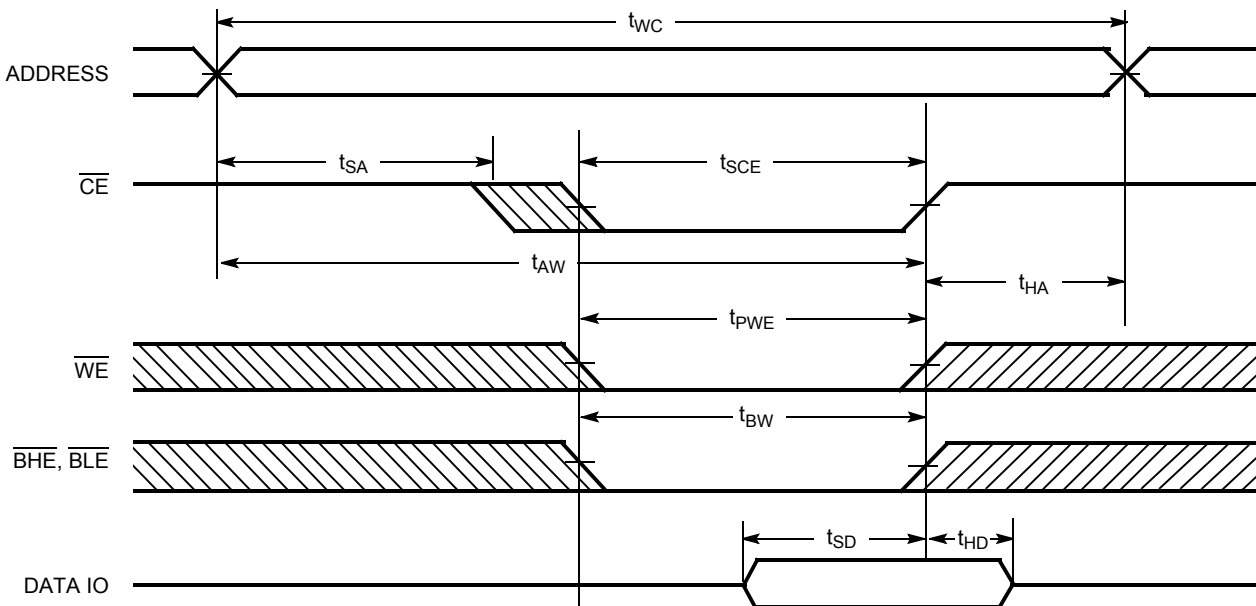


Figure 5. Write Cycle No. 1 ( $\overline{CE}$  Controlled) [15, 16, 17]



Notes

- 14. Address valid before or similar to  $\overline{CE}_1$  transition LOW and  $CE_2$  transition HIGH.
- 15.  $\overline{CE}$  is a shorthand combination of both  $\overline{CE}_1$  and  $CE_2$  combined. It is active LOW.
- 16. Data IO is high impedance if  $\overline{OE}$ ,  $\overline{BHE}$ , and/or  $\overline{BLE} = V_{IH+}$ .
- 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) [15, 16, 17]

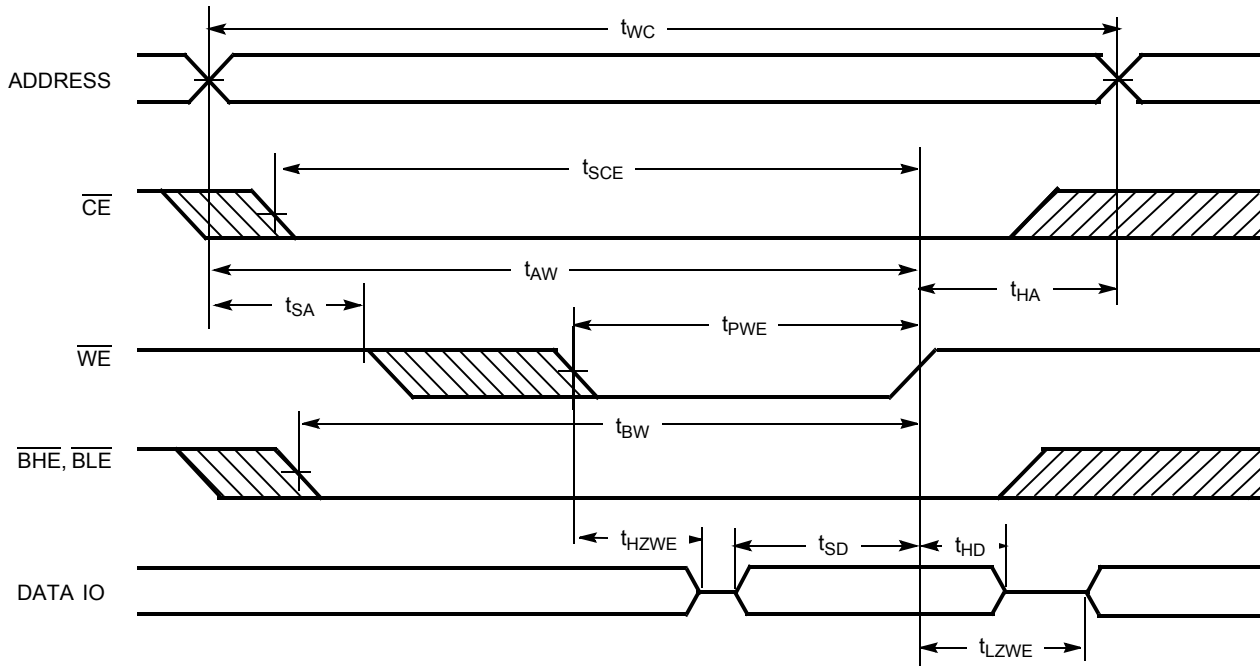
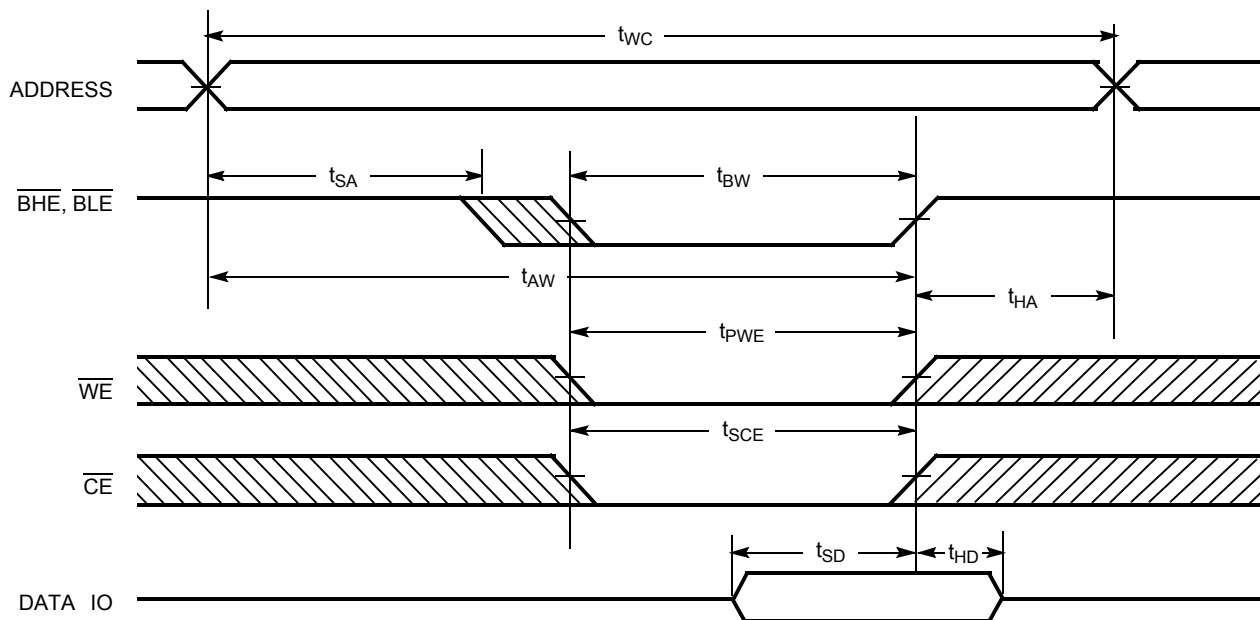


Figure 7. Write Cycle No. 3 ( $\overline{BLE}$  or  $\overline{BHE}$  Controlled) [15]





Truth Table

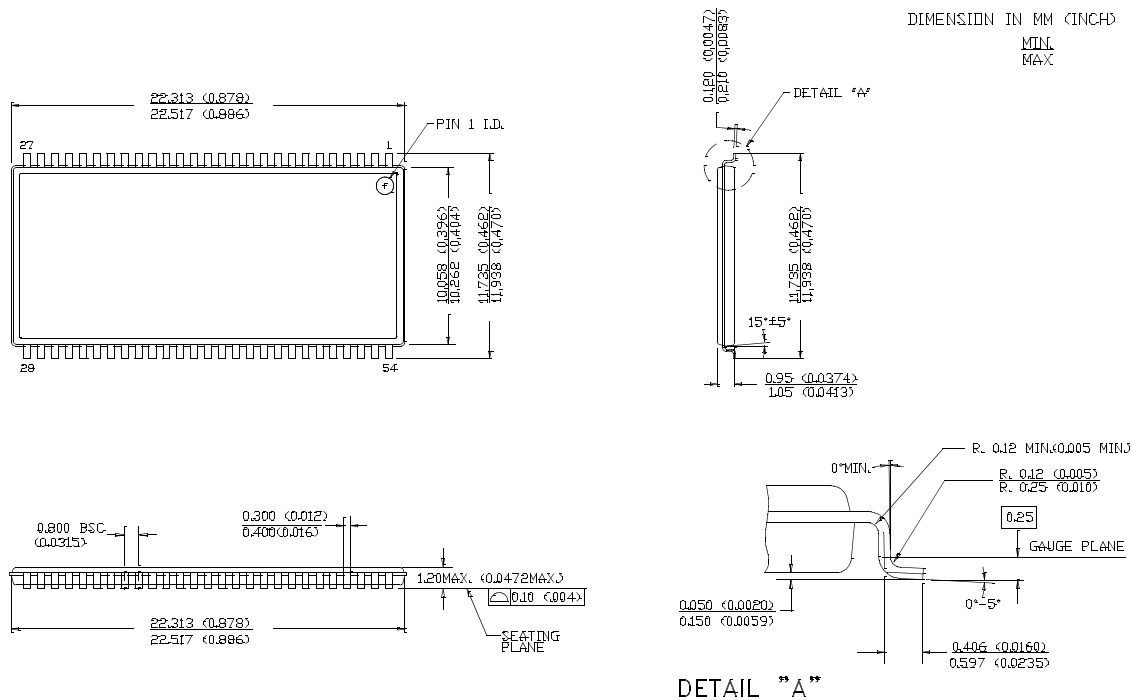
CE <sub>1</sub>	CE <sub>2</sub>	OE	WE	BLE	BHE	IO <sub>0</sub> –IO <sub>7</sub>	IO <sub>8</sub> –IO <sub>15</sub>	Mode	Power
H	X	X	X	X	X	High Z	High Z	Power Down	Standby (I <sub>SB</sub> )
X	L	X	X	X	X	High Z	High Z	Power Down	Standby (I <sub>SB</sub> )
L	H	L	H	L	L	Data Out	Data Out	Read All Bits	Active (I <sub>CC</sub> )
L	H	L	H	L	H	Data Out	High Z	Read Lower Bits Only	Active (I <sub>CC</sub> )
L	H	L	H	H	L	High Z	Data Out	Read Upper Bits Only	Active (I <sub>CC</sub> )
L	H	X	L	L	L	Data In	Data In	Write All Bits	Active (I <sub>CC</sub> )
L	H	X	L	L	H	Data In	High Z	Write Lower Bits Only	Active (I <sub>CC</sub> )
L	H	X	L	H	L	High Z	Data In	Write Upper Bits Only	Active (I <sub>CC</sub> )
L	H	H	H	X	X	High Z	High Z	Selected, Outputs Disabled	Active (I <sub>CC</sub> )

Ordering Information

Speed (ns)	Ordering Code	Package Diagram	Package Type	Operating Range
10	CY7C1061DV33-10ZSXI	51-85160	54-Pin TSOP II (Pb-Free)	Industrial
	CY7C1061DV33-10BVXI	51-85178	48-Ball VFBGA (8 × 9.5 × 1 mm) (Pb-Free)	

Package Diagrams

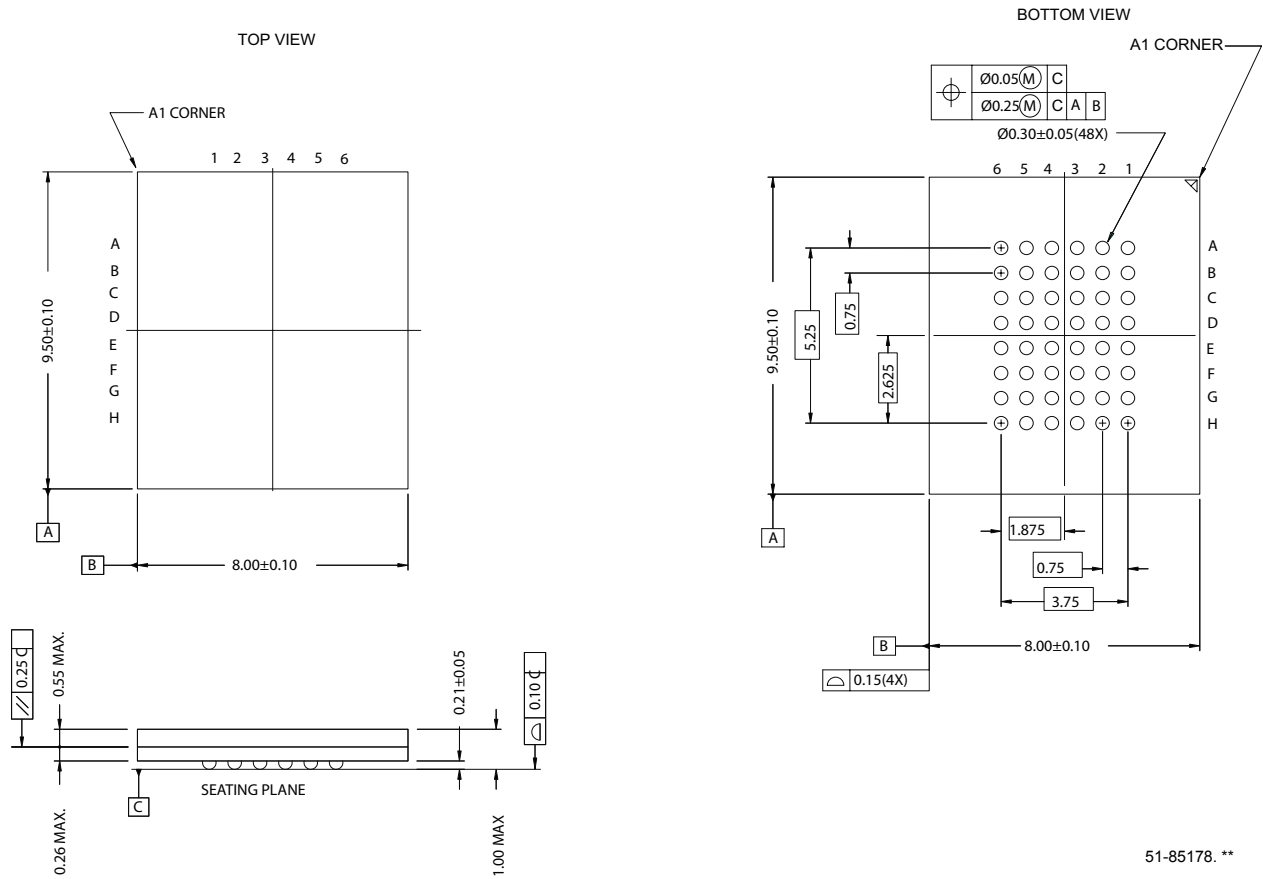
Figure 8. 54-Pin TSOP Type II



51-85160-\*\*

Package Diagrams (continued)

Figure 9. 48-Ball VFBGA (8 x 9.5 x 1 mm)



51-85178. \*\*

Document History Page

Document Title: CY7C1061DV33 16-Mbit (1M x 16) Static RAM				
Document Number: 38-05476				
REV.	ECN NO.	Issue Date	Orig. of Change	Description of Change
**	201560	See ECN	SWI	Advance datasheet for C9 IPP
*A	233748	See ECN	RKF	AC, DC parameters are modified as per EROS (Specification number 01-2165) Added Pb-free devices in the Ordering Information
*B	469420	See ECN	NXR	Converted from Advance Information to Preliminary Corrected typo in the Document Title Removed -8 and -12 speed bins from product offering Removed Commercial Operating Range Changed 2G-Ball of FBGA and pin 40 of TSOPII from DNU to NC Included the Maximum ratings for Static Discharge Voltage and Latch Up Current on page 3 Changed I <sub>CC(Max)</sub> from 220 mA to 125 mA Changed I <sub>SB1(Max)</sub> from 70 mA to 30 mA Changed I <sub>SB2(Max)</sub> from 40 mA to 25 mA Specified the Overshoot specification in footnote 1. Updated the Ordering Information Table
*C	499604	See ECN	NXR	Added note 1 for NC pins Updated Test Condition for I <sub>CC</sub> in DC Electrical Characteristics table Updated the 48-Ball FBGA Package
*D	1462583	See ECN	VKN/AESA	Converted from preliminary to final Changed I <sub>CC</sub> specification from 125 mA to 175 mA Updated thermal specs

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