16-Mbit (1M x 16) Static RAM

Features

- **High speed**
  - **— t_{AA} = 10 ns**
- **Low active power**
  - **— I_{CC} = 125 mA @ 10 ns**
- **Low CMOS standby power**
  - **— I_{SB2} = 25 mA**
- **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**
- **Available in Pb-free 54-pin TSOP II package 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.

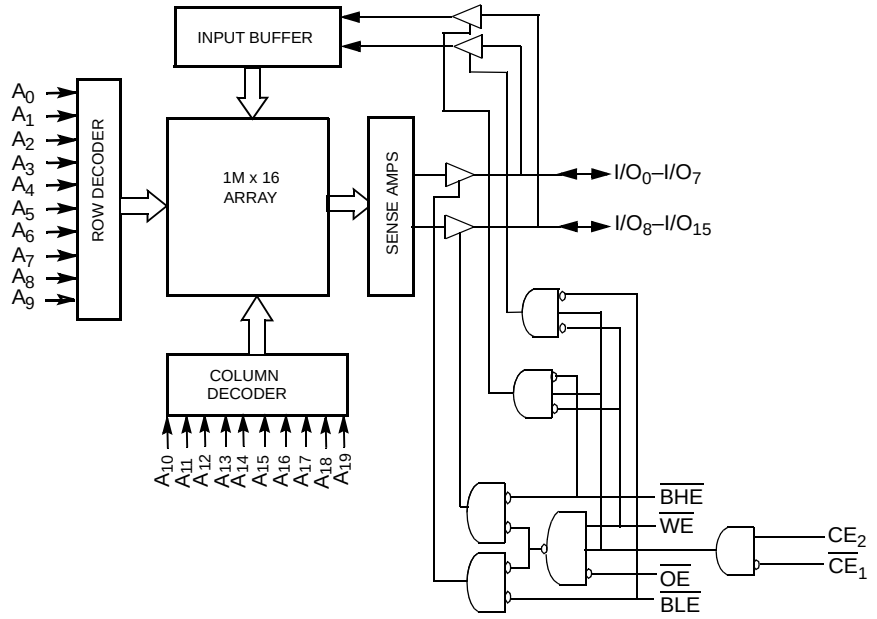
Writing to the device is accomplished by enabling the chip ($\overline{CE_1}$ LOW and CE_2 HIGH) while forcing the Write Enable ($\overline{WE}$) input LOW. If Byte Low Enable ($\overline{BLE}$) is LOW, then data from I/O pins (I/O_0 through I/O_7), is written into the location specified on the address 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).

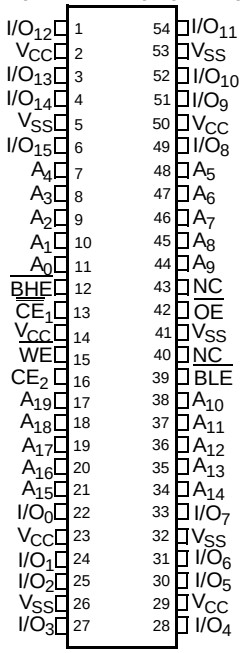
The CY7C1061DV33 is available in a 54-pin TSOP II package with center power and ground (revolutionary) pinout, and a 48-ball Very fine-pitch ball grid array (VFBGA) package

Logic Block Diagram



Pin Configuration

54-pin TSOP II (Top View)



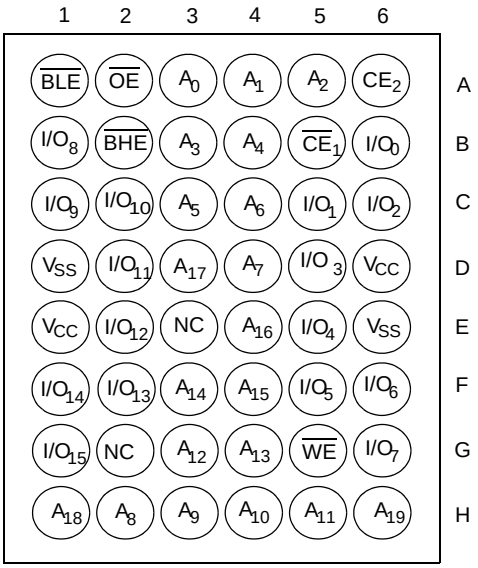
Selection Guide

	–10	Unit
Maximum Access Time	10	ns
Maximum Operating Current	125	mA
Maximum CMOS Standby Current	25	mA

Pin Configuration[1]

48-ball VFBGA

(Top View)



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

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} Relative to GND[2] .... –0.5V to +4.6V

DC Voltage Applied to Outputs in High-Z State[2] .....–0.5V to V_{CC} + 0.5V

DC Input Voltage[2].....–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}
Industrial	–40°C to +85°C	3.3V ± 0.3V

DC Electrical Characteristics Over the Operating Range

Parameter	Description	Test Conditions[7]	–10		Unit
			Min.	Max.	
V_{OH}	Output HIGH Voltage	V_{CC} = Min., I_{OH} = –4.0 mA	2.4		V
V_{OL}	Output LOW Voltage	V_{CC} = Min., I_{OL} = 8.0 mA		0.4	V
V_{IH}	Input HIGH Voltage		2.0	V_{CC} + 0.3	V
V_{IL}	Input LOW Voltage[2]		–0.3	0.8	V
I_{IX}	Input Leakage Current	GND ≤ V_I ≤ V_{CC}	–1	+1	µA
I_{OZ}	Output Leakage Current	GND ≤ V_{OUT} ≤ V_{CC}, Output Disabled	–1	+1	µA
I_{CC}	V_{CC} Operating Supply Current	V_{CC} = Max., f = f_{MAX} = 1/t_{RC}, I_{OUT} = 0 mA CMOS levels		125	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}		30	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		25	mA

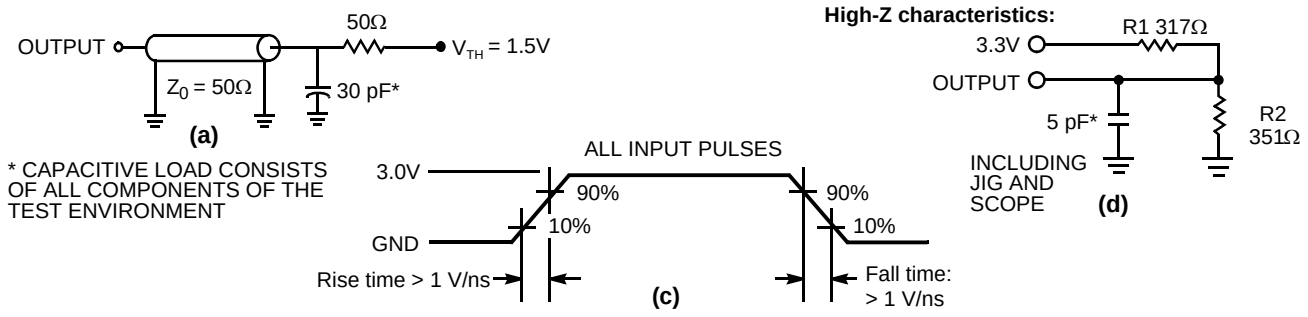
Capacitance[3]

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

Thermal Resistance[3]

Parameter	Description	Test Conditions	All-Packages	Unit
Θ_{JA}	Thermal Resistance (Junction to Ambient)	Still Air, soldered on a 3 × 4.5 inch, four-layer printed circuit board	TBD	°C/W
Θ_{JC}	Thermal Resistance (Junction to Case)		TBD	°C/W

AC Test Loads and Waveforms[4]



Notes:

2. V_{IL} (min.) = –2.0V and V_{IH}(max) = V_{CC} + 2V for pulse durations of less than 20 ns.
3. Tested initially and after any design or process changes that may affect these parameters.
4. Valid SRAM operation does not occur until the power supplies have reached the minimum operating V_{DD} (3.0V). 100µs (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.

AC Switching Characteristics Over the Operating Range [5]

Parameter	Description	–10		Unit
		Min.	Max.	
Read Cycle				
t_{power}	V_{CC}(typical) to the first access[6]	100		µs
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[7]		5	ns
t_{LZCE}	$\overline{CE}_1$ LOW/CE_2 HIGH to Low-Z[7]	3		ns
t_{HZCE}	$\overline{CE}_1$ HIGH/CE_2 LOW to High-Z[7]		5	ns
t_{PU}	$\overline{CE}_1$ LOW/CE_2 HIGH to Power-Up[8]	0		ns
t_{PD}	$\overline{CE}_1$ HIGH/CE_2 LOW to Power-Down[8]		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
Write Cycle[9, 10]				
t_{WC}	Write Cycle Time	10		ns
t_{SCE}	$\overline{CE}_1$ LOW/CE_2 HIGH 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	5.5		ns
t_{HD}	Data Hold from Write End	0		ns
t_{LZWE}	$\overline{WE}$ HIGH to Low-Z[7]	3		ns
t_{HZWE}	$\overline{WE}$ LOW to High-Z[7]		5	ns
t_{BW}	Byte Enable to End of Write	7		ns

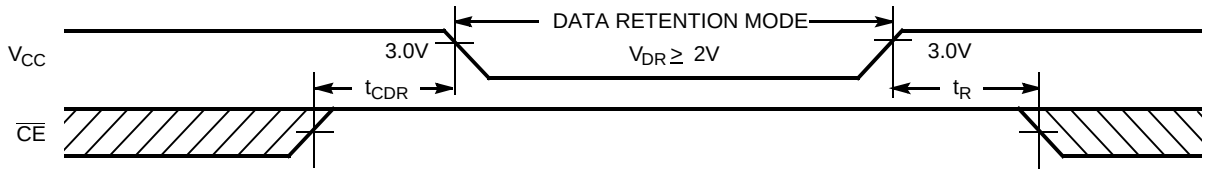
Notes:

5. 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. Test conditions for the Read cycle use output loading shown in part a) of the AC test loads, unless specified otherwise.
6. t_{POWER} gives the minimum amount of time that the power supply should be at typical V_{CC} values until the first memory access can be performed.
7. 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.
8. These parameters are guaranteed by design and are not tested.
9. 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.
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}.

Data Retention Characteristics (Over the Operating Range)

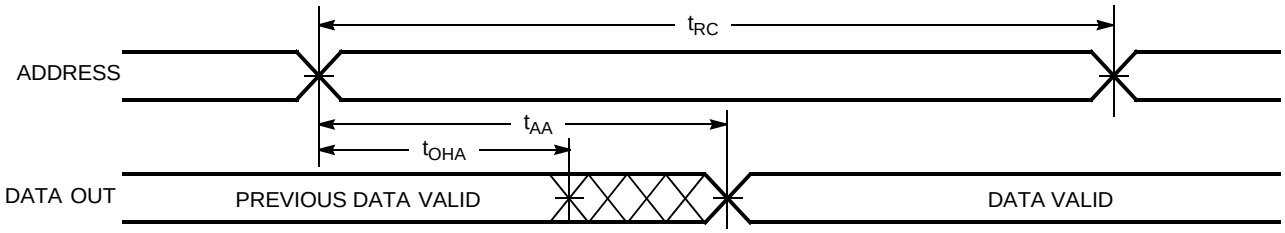
Parameter	Description	Conditions	Min.	Typ.	Max.	Unit
V_{DR}	V_{CC} for Data Retention		2			V
I_{CCDR}	Data Retention Current	$V_{CC} = 2V$, $\overline{CE_1} \geq V_{CC} - 0.2V$, $CE_2 \leq 0.2V$, $V_{IN} \geq V_{CC} - 0.2V$ or $V_{IN} \leq 0.2V$			25	mA
t_{CDR}[3]	Chip Deselect to Data Retention Time		0			ns
t_R[11]	Operation Recovery Time		t_{RC}			ns

Data Retention Waveform



Switching Waveforms

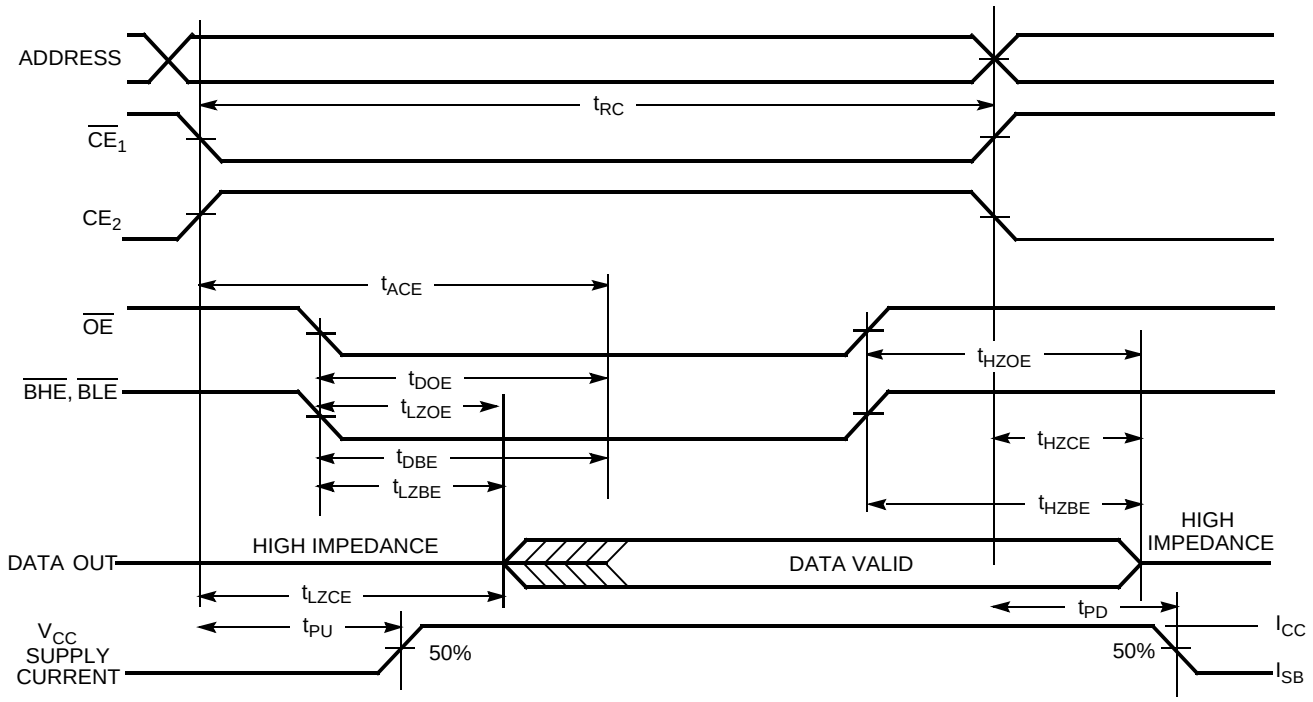
Read Cycle No. 1[12,13]



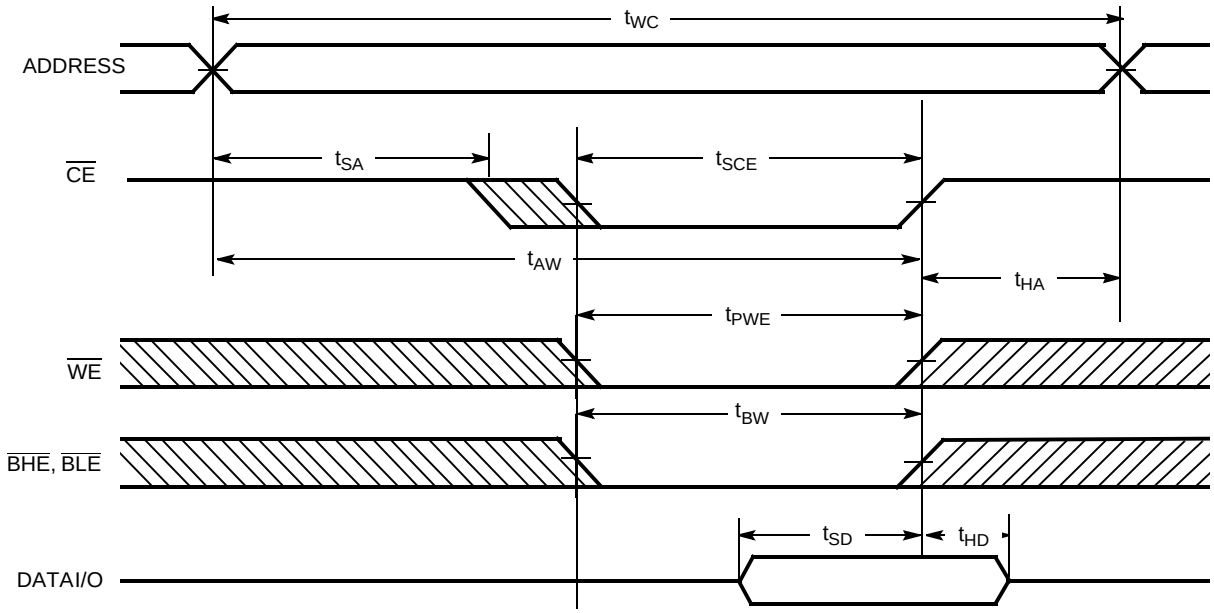
Notes:
11. Full device operation requires linear V_{CC} ramp from V_{DR} to $V_{CC(min.)} \geq 50\,\mu s$ or stable at $V_{CC(min.)} \geq 50\,\mu s$
12. Device is continuously selected. $\overline{OE}$, $\overline{CE}$, $\overline{BHE}$ and/or $\overline{BHE} = V_{IL}$. $CE_2 = V_{IH}$.
13. $\overline{WE}$ is HIGH for Read cycle.

Switching Waveforms (continued)

Read Cycle No. 2(OE Controlled)[13,14]



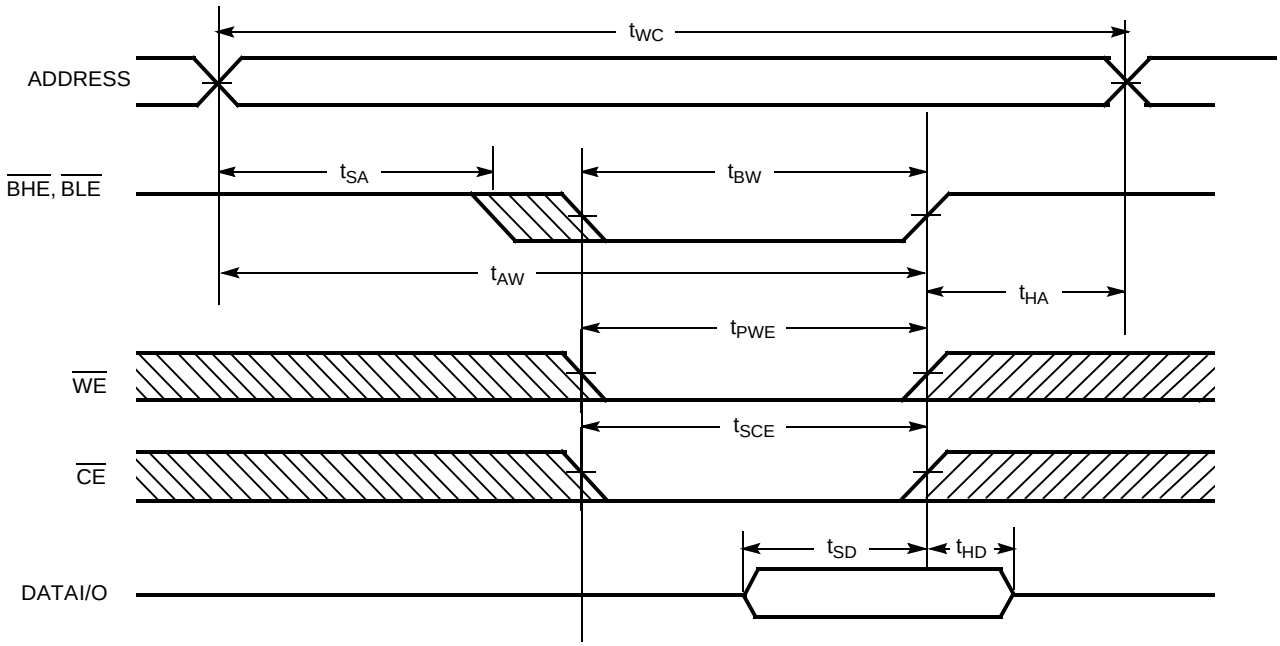
Write Cycle No. 1(CE Controlled)[15,16,17]



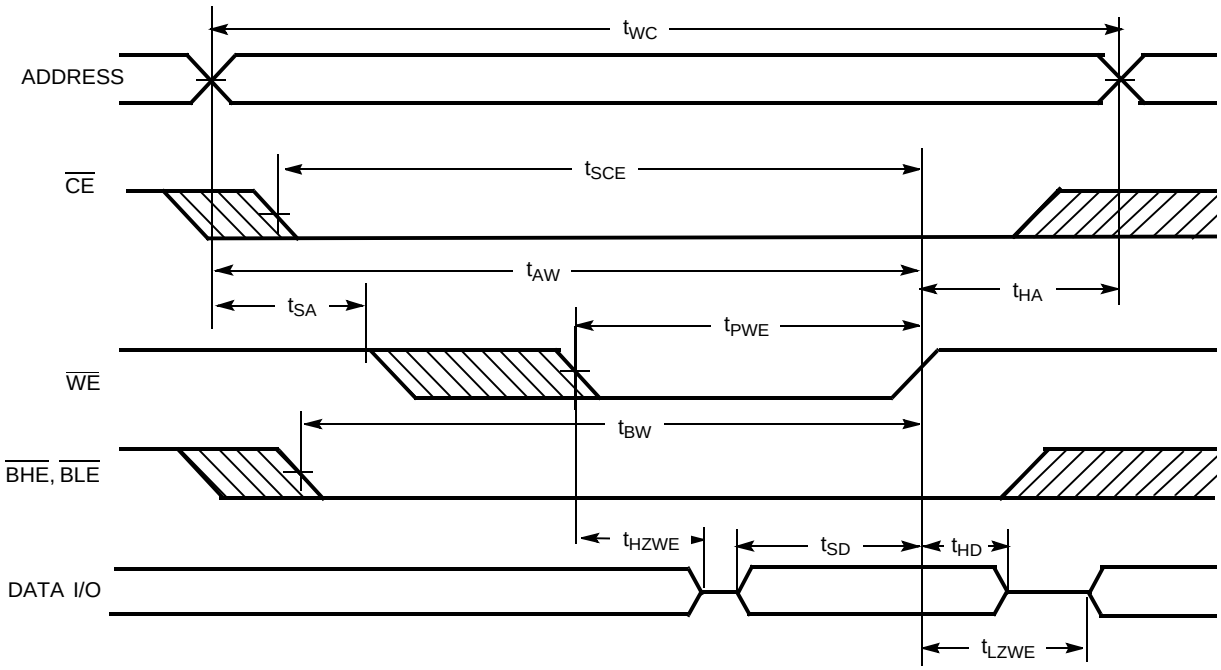
Notes:
14. Address valid prior to or coincident with $\overline{CE}_1$ transition LOW and CE_2 transition HIGH.
15. Data I/O is high-impedance if $\overline{OE}$ or $\overline{BHE}$ and/or $\overline{BLE}$ = V_{IH}.
16. If $\overline{CE}_1$ goes HIGH simultaneously with $\overline{WE}$ going HIGH, the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

Switching Waveforms (continued)

Write Cycle No. 2(BLE or BHE Controlled)



Write Cycle No. 3(WE Controlled, OE LOW)[15,16,17]



Truth Table

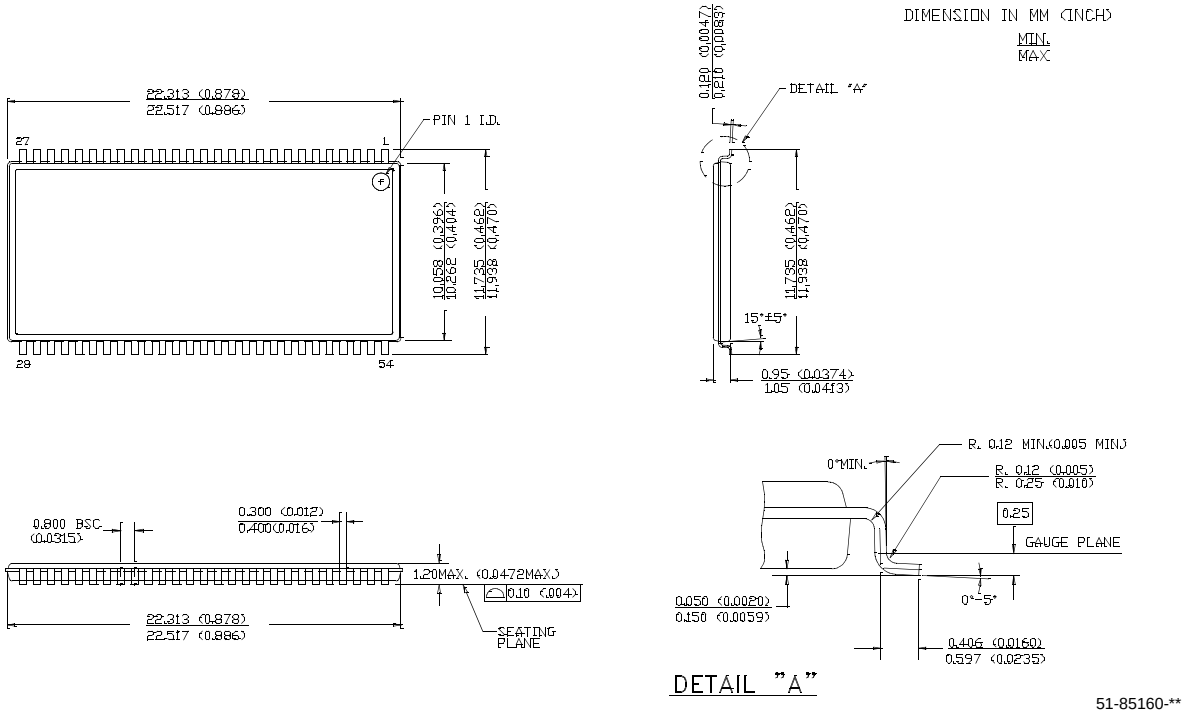
$\overline{CE_1}$	CE_2	$\overline{OE}$	$\overline{WE}$	$\overline{BLE}$	$\overline{BHE}$	I/O_0–I/O_7	I/O_8–I/O_{15}	Mode	Power
H	X	X	X	X	X	High-Z	High-Z	Power-down	Standby (I_{SB})
X	L	X	X	X	X	High-Z	High-Z	Power-down	Standby (I_{SB})
L	H	L	H	L	L	Data Out	Data Out	Read All Bits	Active (I_{CC})
L	H	L	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	Package Diagram	Package Type	Operating Range
10	CY7C1061DV33-10ZXI	51-85160	54-pin TSOP II (Pb-Free)	Industrial
	CY7C1061DV33-10BVXI	51-85178	48-ball Very Fine Pitch Ball Grid Array (8 × 9.5 × 1 mm) (Pb-Free)	

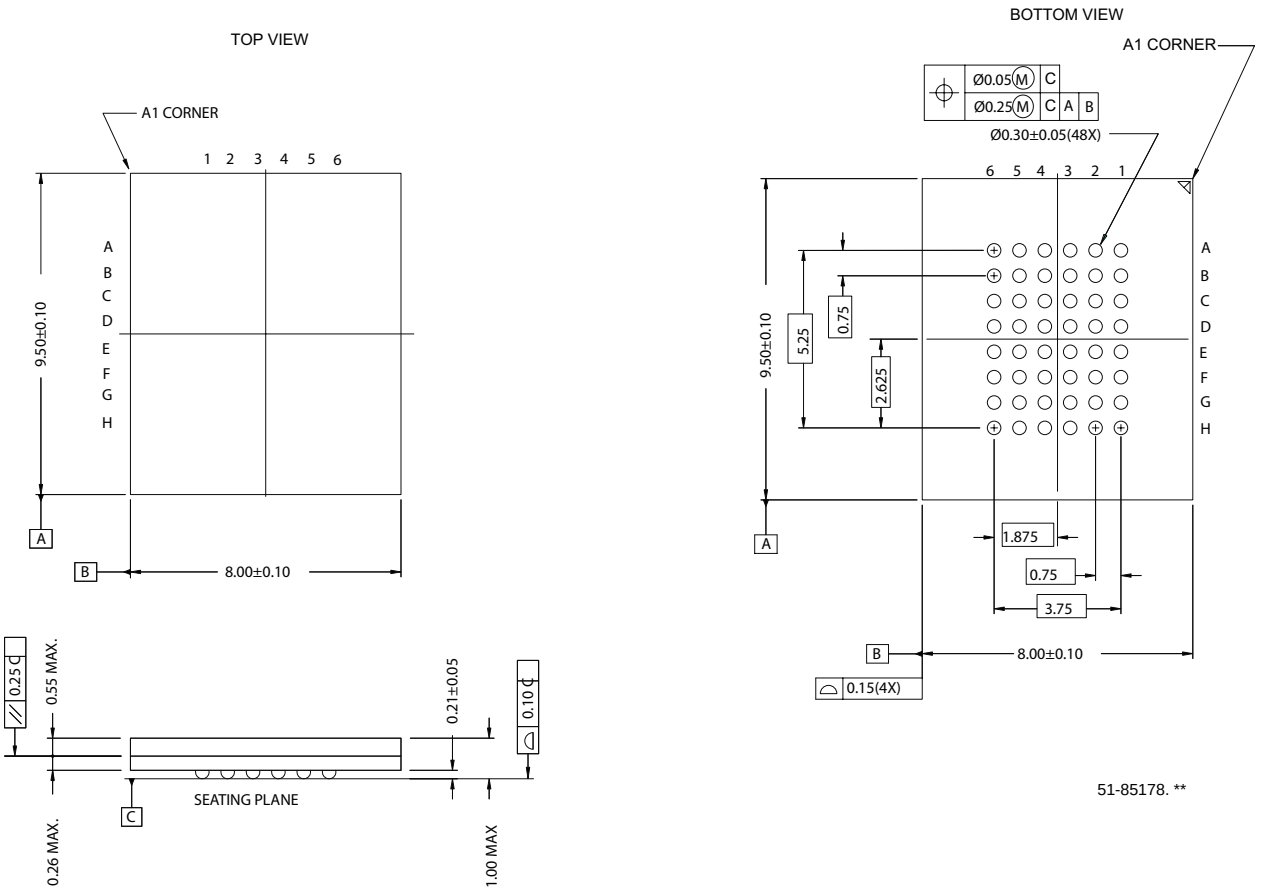
Package Diagrams

54-pin TSOP Type II (51-85160)



Package Diagrams (continued)

48-ball FBGA (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 Data sheet for C9 IPP
*A	233748	See ECN	RKF	1.AC, DC parameters are modified as per EROS (Spec # 01-2165) 2.Pb-free offering 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 $I_{CC(Max)}$ from 220 mA to 125 mA Changed $I_{SB1(Max)}$ from 70 mA to 30 mA Changed $I_{SB2(Max)}$ from 40 mA to 25 mA Specified the Overshoot spec in footnote # 1. Updated the Ordering Information Table
*C	499604	See ECN	NXR	Added note# 1 for NC pins Updated Test Condition for I_{CC} in DC Electrical Characteristics table Updated the 48-ball FBGA Package