

## 2-Mbit (128K x 16) Static RAM

### Features

- **Very high speed**
  - 55 ns
- **Voltage range**
  - 2.7V – 3.3V
- **Pin-compatible with the CY62136V**
- **Ultra-low active power**
  - Typical active current: 1.5 mA @ f = 1 MHz
  - Typical active current: 7 mA @ f = f<sub>Max</sub> (55 ns speed)
- **Low standby power**
- **Easy memory expansion with  $\overline{CE}$  and  $\overline{OE}$  features**
- **Automatic power-down when deselected**
- **CMOS for optimum speed/power**
- **Available in Pb-free and non Pb-free 48-ball VFBGA package**

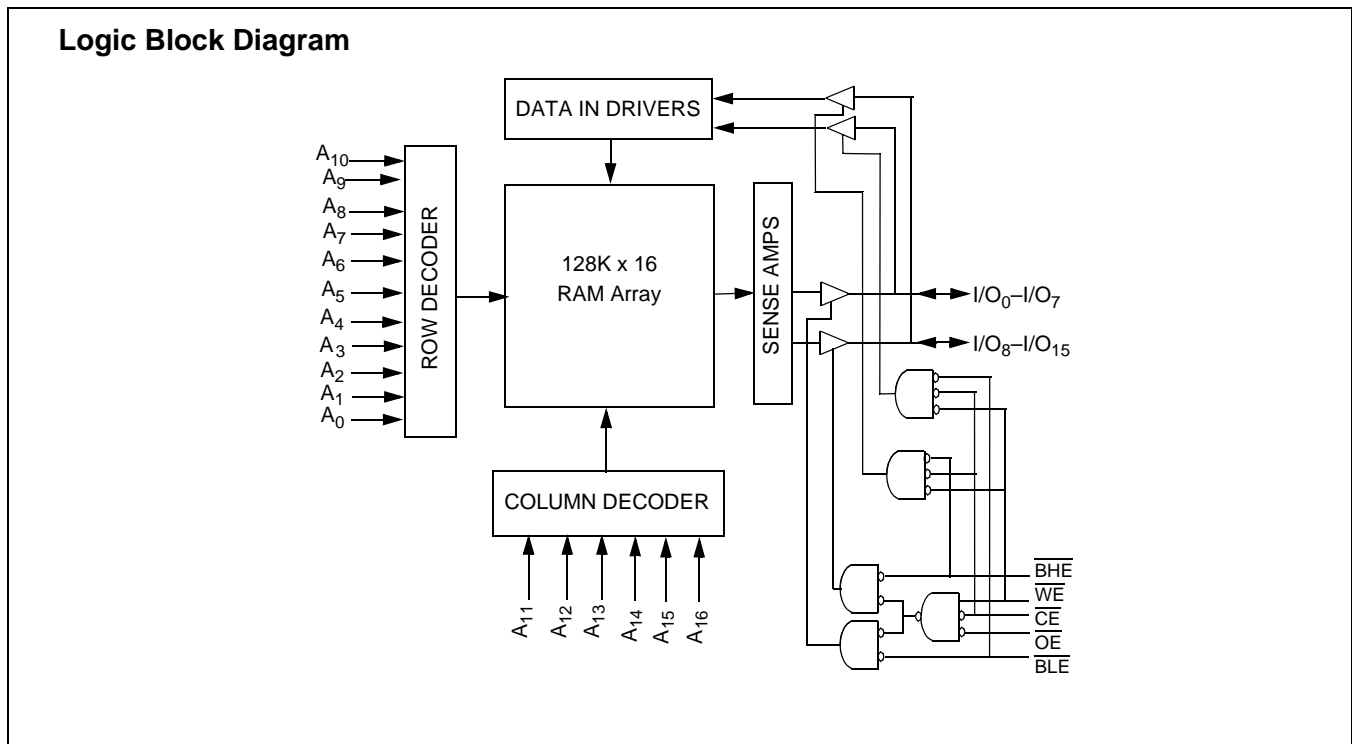
This is ideal for providing More Battery Life™ (MoBL<sup>®</sup>) in portable applications such as cellular telephones. The device also has an automatic power-down feature that significantly reduces power consumption by 80% when addresses are not toggling. The device can also be put into standby mode reducing power consumption by more than 99% when deselected ( $\overline{CE}$  HIGH). The input/output pins (I/O<sub>0</sub> through I/O<sub>15</sub>) are placed in a high-impedance state when: deselected ( $\overline{CE}$  HIGH), outputs are disabled ( $\overline{OE}$  HIGH), both Byte High Enable and Byte Low Enable are disabled ( $\overline{BHE}$ , BLE HIGH), or during a write operation ( $\overline{CE}$  LOW, and  $\overline{WE}$  LOW).

Writing to the device is accomplished by taking Chip Enable ( $\overline{CE}$ ) and Write Enable ( $\overline{WE}$ ) inputs LOW. If Byte Low Enable (BLE) is LOW, then data from I/O pins (I/O<sub>0</sub> through I/O<sub>7</sub>), is written into the location specified on the address pins (A<sub>0</sub> through A<sub>16</sub>). If Byte High Enable ( $\overline{BHE}$ ) is LOW, then data from I/O pins (I/O<sub>8</sub> through I/O<sub>15</sub>) is written into the location specified on the address pins (A<sub>0</sub> through A<sub>16</sub>).

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 (BLE) is LOW, then data from the memory location specified by the address pins will appear on I/O<sub>0</sub> to I/O<sub>7</sub>. If Byte High Enable ( $\overline{BHE}$ ) is LOW, then data from memory will appear on I/O<sub>8</sub> to I/O<sub>15</sub>. See the truth table at the back of this data sheet for a complete description of read and write modes.

### Functional Description<sup>[1]</sup>

The CY62136CV30 is high-performance CMOS static RAM organized as 128K words by 16 bits. This device features advanced circuit design to provide ultra-low active current.

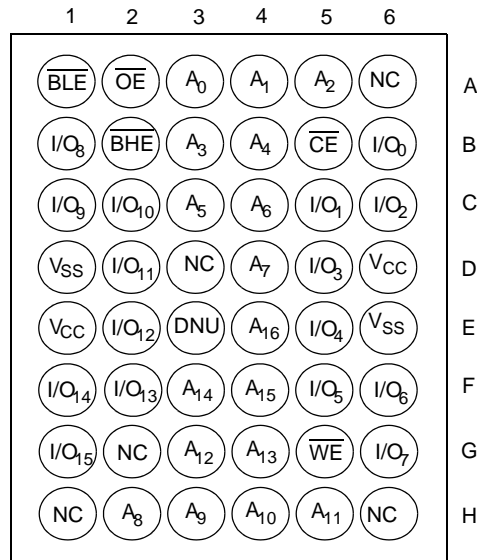


**Note:**

1. For best practice recommendations, please refer to the Cypress application note "System Design Guidelines" on <http://www.cypress.com>.

**Product Portfolio**

Product	V <sub>CC</sub> Range (V)			Speed (ns)	Power Dissipation					
					Operating, I <sub>CC</sub> (mA)				Standby, I <sub>SB2</sub> (μA)	
	V <sub>CC(min.)</sub>	V <sub>CC(typ.)</sub> <sup>[2]</sup>	V <sub>CC(max.)</sub>		f = 1 MHz		f = f <sub>Max</sub>			
					Typ. <sup>[2]</sup>	Max.	Typ. <sup>[2]</sup>	Max.	Typ. <sup>[2]</sup>	Max.
CY62136CV30LL	2.7	3.0	3.3	55	1.5	3	7	15	2	10
				70	1.5	3	5.5	12		

**Pin Configuration<sup>[3, 4]</sup>**
**48-ball VFBGA  
Top View**

**Notes:**

- Typical values are included for reference only and are not guaranteed or tested. Typical values are measured at V<sub>CC</sub> = V<sub>CC(typ.)</sub>, T<sub>A</sub> = 25°C.
- NC pins are not connected to the die.
- E3 (DNU) pin have to be left floating or tied to V<sub>SS</sub> to ensure proper operation.

### 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 to Ground Potential -0.5V to  $V_{CC(max)} + 0.5V$   
 DC Voltage Applied to Outputs in High-Z State<sup>[5]</sup> ..... -0.5V to  $V_{CC} + 0.3V$

DC Input Voltage<sup>[5]</sup> ..... -0.5V to  $V_{CC} + 0.3V$   
 Output Current into Outputs (LOW)..... 20 mA  
 Static Discharge Voltage..... > 2001V (per MIL-STD-883, Method 3015)  
 Latch-up Current..... > 200 mA

### Operating Range

Device	Range	Ambient Temperature	$V_{CC}$
CY62136CV30	Industrial	-40°C to +85°C	2.7V to 3.3V

### Electrical Characteristics Over the Operating Range

Parameter	Description	Test Conditions	CY62136CV30-55			CY62136CV30-70			Unit
			Min.	Typ. <sup>[2]</sup>	Max.	Min.	Typ. <sup>[2]</sup>	Max.	
$V_{OH}$	Output HIGH Voltage	$I_{OH} = -1.0 \text{ mA}$ $V_{CC} = 2.7V$	2.4			2.4			V
$V_{OL}$	Output LOW Voltage	$I_{OL} = 2.1 \text{ mA}$ $V_{CC} = 2.7V$			0.4			0.4	V
$V_{IH}$	Input HIGH Voltage		2.2		$V_{CC} + 0.3V$	2.2		$V_{CC} + 0.3V$	V
$V_{IL}$	Input LOW Voltage		-0.3		0.8	-0.3		0.8	V
$I_{IX}$	Input Leakage Current	$GND \leq V_I \leq V_{CC}$	-1		+1	-1		+1	$\mu\text{A}$
$I_{OZ}$	Output Leakage Current	$GND \leq V_O \leq V_{CC}$ , Output Disabled	-1		+1	-1		+1	$\mu\text{A}$
$I_{CC}$	$V_{CC}$ Operating Supply Current	$f = f_{Max} = 1/t_{RC}$ $f = 1 \text{ MHz}$ $V_{CC} = 3.3V$ $I_{OUT} = 0 \text{ mA}$ CMOS Levels		7	15		5.5	12	mA
				1.5	3		1.5	3	
$I_{SB1}$	Automatic CE Power-down Current—CMOS Inputs	$\overline{CE} \geq V_{CC} - 0.2V$ $V_{IN} \geq V_{CC} - 0.2V$ or $V_{IN} \leq 0.2V$ , $f = f_{Max}$ (Address and Data Only), $f = 0$ (OE, WE, BHE, and BLE)		2	10		2	10	$\mu\text{A}$
$I_{SB2}$	Automatic CE Power-down Current—CMOS Inputs	$\overline{CE} \geq V_{CC} - 0.2V$ $V_{IN} \geq V_{CC} - 0.2V$ or $V_{IN} \leq 0.2V$ , $f = 0$ , $V_{CC} = 3.3V$		2	10		2	10	$\mu\text{A}$

### Capacitance<sup>[7]</sup>

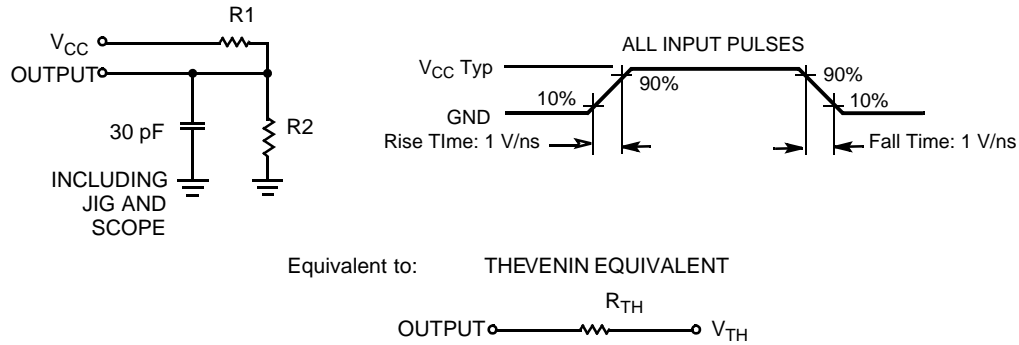
Parameter	Description	Test Conditions	Max.	Unit
$C_{IN}$	Input Capacitance	$T_A = 25^\circ\text{C}$ , $f = 1 \text{ MHz}$ , $V_{CC} = V_{CC(typ.)}$	6	pF
$C_{OUT}$	Output Capacitance		8	pF

### Thermal Resistance<sup>[7]</sup>

Parameter	Description	Test Conditions	VFBGA	Unit
$\theta_{JA}$	Thermal Resistance (Junction to Ambient)	Still Air, soldered on a 3 x 4.5 inch, 2-layer printed circuit board	55	$^\circ\text{C/W}$
$\theta_{JC}$	Thermal Resistance (Junction to Case)		16	$^\circ\text{C/W}$

#### Notes:

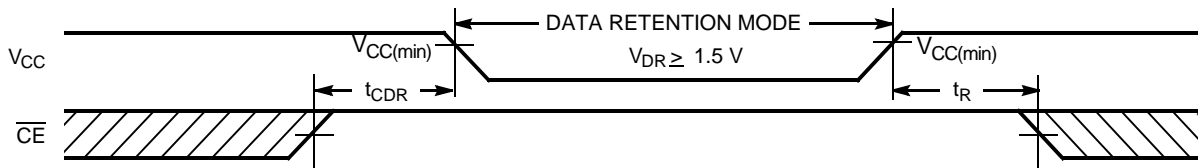
- $V_{IL(min.)} = -2.0V$  for pulse durations less than 20 ns.
- Tested initially and after any design or process changes that may affect these parameters.
- Full Device AC operation requires linear  $V_{CC}$  ramp from  $V_{DR}$  to  $V_{CC(min.)} > 100 \mu\text{s}$  or stable at  $V_{CC(min.)} > 100 \mu\text{s}$ .

**AC Test Loads and Waveforms**


Parameters	3.0V	Unit
R1	1105	$\Omega$
R2	1550	$\Omega$
R <sub>TH</sub>	645	$\Omega$
V <sub>TH</sub>	1.75	V

**Data Retention Characteristics (Over the Operating Range)**

Parameter	Description	Conditions	Min.	Typ. <sup>[2]</sup>	Max.	Unit
V <sub>DR</sub>	V <sub>CC</sub> for Data Retention		1.5		V <sub>CC(max)</sub>	V
I <sub>CCDR</sub>	Data Retention Current	V <sub>CC</sub> = 1.5V, $\overline{CE} \geq V_{CC} - 0.2V$ , V <sub>IN</sub> $\geq V_{CC} - 0.2V$ or V <sub>IN</sub> $\leq 0.2V$		1	6	$\mu A$
t <sub>CDR</sub> <sup>[7]</sup>	Chip Deselect to Data Retention Time		0			ns
t <sub>R</sub> <sup>[7]</sup>	Operation Recovery Time		t <sub>RC</sub>			ns

**Data Retention Waveform**


**Switching Characteristics** Over the Operating Range<sup>[8]</sup>

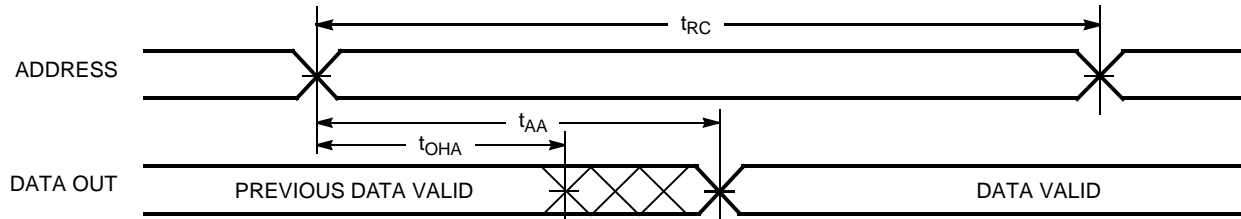
Parameter	Description	55 ns		70 ns		Unit
		Min.	Max.	Min.	Max.	
<b>Read Cycle</b>						
$t_{RC}$	Read Cycle Time	55		70		ns
$t_{AA}$	Address to Data Valid		55		70	ns
$t_{OHA}$	Data Hold from Address Change	10		10		ns
$t_{ACE}$	$\overline{CE}$ LOW to Data Valid		55		70	ns
$t_{DOE}$	$\overline{OE}$ LOW to Data Valid		25		35	ns
$t_{LZOE}$	$\overline{OE}$ LOW to Low-Z <sup>[9]</sup>	5		5		ns
$t_{HZOE}$	$\overline{OE}$ HIGH to High-Z <sup>[9, 10]</sup>		20		25	ns
$t_{LZCE}$	$\overline{CE}$ LOW to Low-Z <sup>[9]</sup>	10		10		ns
$t_{HZCE}$	$\overline{CE}$ HIGH to High-Z <sup>[9, 10]</sup>		20		25	ns
$t_{PU}$	$\overline{CE}$ LOW to Power-up	0		0		ns
$t_{PD}$	$\overline{CE}$ HIGH to Power-down		55		70	ns
$t_{DBE}$	$\overline{BHE}/\overline{BLE}$ LOW to Data Valid		25		35	ns
$t_{LZBE}$	$\overline{BHE}/\overline{BLE}$ LOW to Low-Z <sup>[9]</sup>	5		5		ns
$t_{HZBE}$	$\overline{BHE}/\overline{BLE}$ HIGH to High-Z <sup>[9, 10]</sup>		20		25	ns
<b>Write Cycle<sup>[11]</sup></b>						
$t_{WC}$	Write Cycle Time	55		70		ns
$t_{SCE}$	$\overline{CE}$ LOW to Write End	45		60		ns
$t_{AW}$	Address Set-up to Write End	45		60		ns
$t_{HA}$	Address Hold from Write End	0		0		ns
$t_{SA}$	Address Set-up to Write Start	0		0		ns
$t_{PWE}$	$\overline{WE}$ Pulse Width	40		45		ns
$t_{BW}$	$\overline{BHE}/\overline{BLE}$ Pulse Width	50		60		ns
$t_{SD}$	Data Set-up to Write End	25		30		ns
$t_{HD}$	Data Hold from Write End	0		0		ns
$t_{HZWE}$	$\overline{WE}$ LOW to High-Z <sup>[9, 10]</sup>		20		25	ns
$t_{LZWE}$	$\overline{WE}$ HIGH to Low-Z <sup>[9]</sup>	10		10		ns

**Notes:**

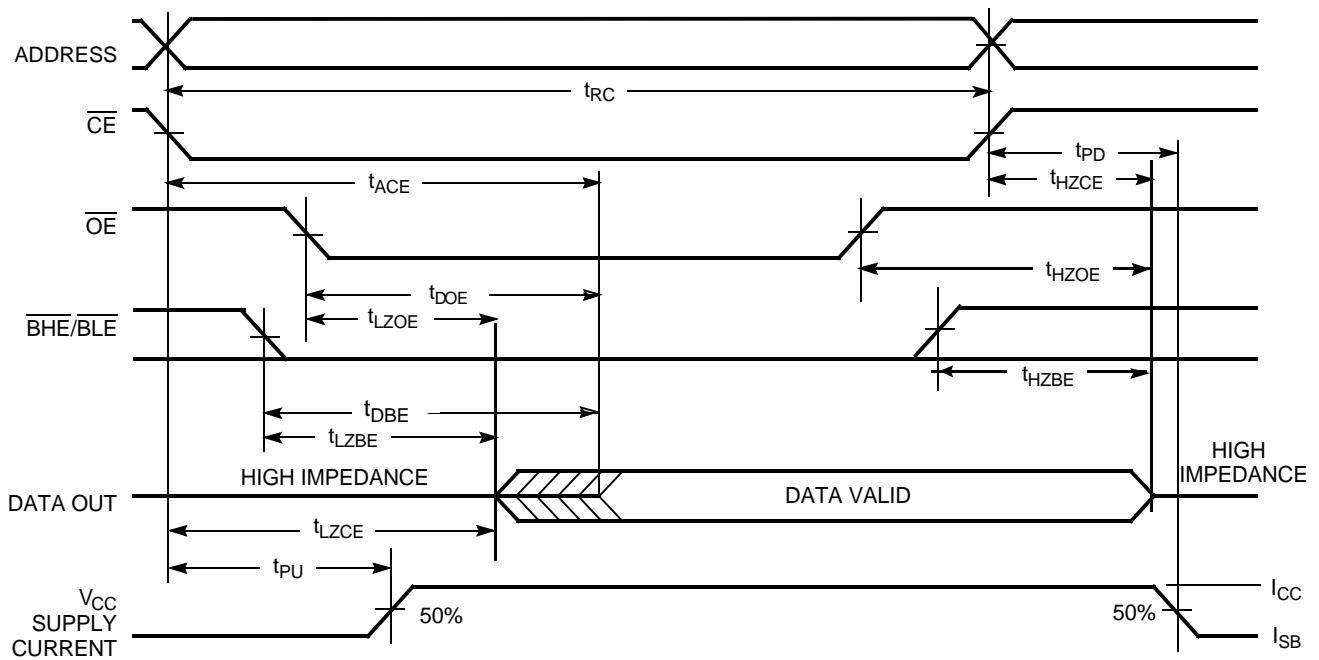
8. Test conditions assume signal transition time of 5 ns or less, timing reference levels of  $V_{CC(typ.)}/2$ , input pulse levels of 0 to  $V_{CC(typ.)}$ , and output loading of the specified  $I_{OL}/I_{OH}$  and 30 pF load capacitance.
9. At any given temperature and voltage condition,  $t_{HZCE}$  is less than  $t_{LZCE}$ ,  $t_{HZBE}$  is less than  $t_{LZBE}$ ,  $t_{HZOE}$  is less than  $t_{LZOE}$ , and  $t_{HZWE}$  is less than  $t_{LZWE}$  for any given device.
10.  $t_{HZOE}$ ,  $t_{HZCE}$ ,  $t_{HZBE}$ , and  $t_{HZWE}$  transitions are measured when the outputs enter a high-impedance state.
11. The internal write time of the memory is defined by the overlap of  $\overline{WE}$ ,  $CE = V_{IL}$ ,  $\overline{BHE}$  and/or  $\overline{BLE} = V_{IL}$ . All signals must be ACTIVE to initiate a write and any of these signals can terminate a write by going INACTIVE. The data input set-up and hold timing should be referenced to the edge of the signal that terminates the write.

### Switching Waveforms

#### Read Cycle No. 1 (Address Transition Controlled)<sup>[12, 13]</sup>



#### Read Cycle No. 2 ( $\overline{OE}$ Controlled)<sup>[13, 14]</sup>

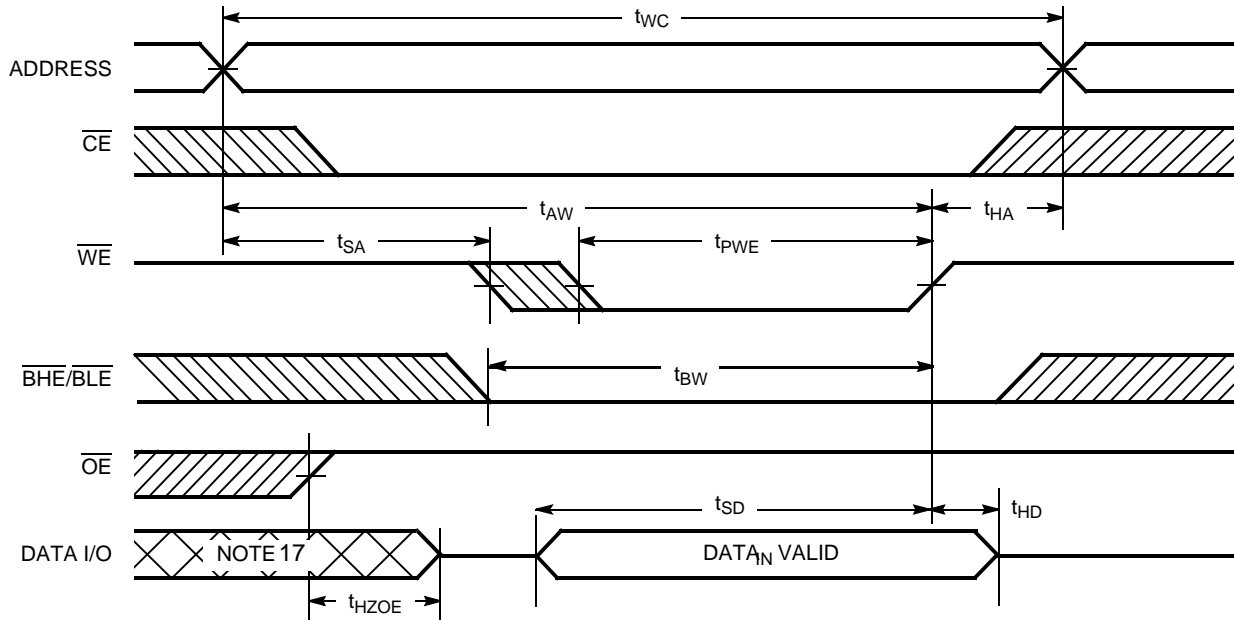


**Notes:**

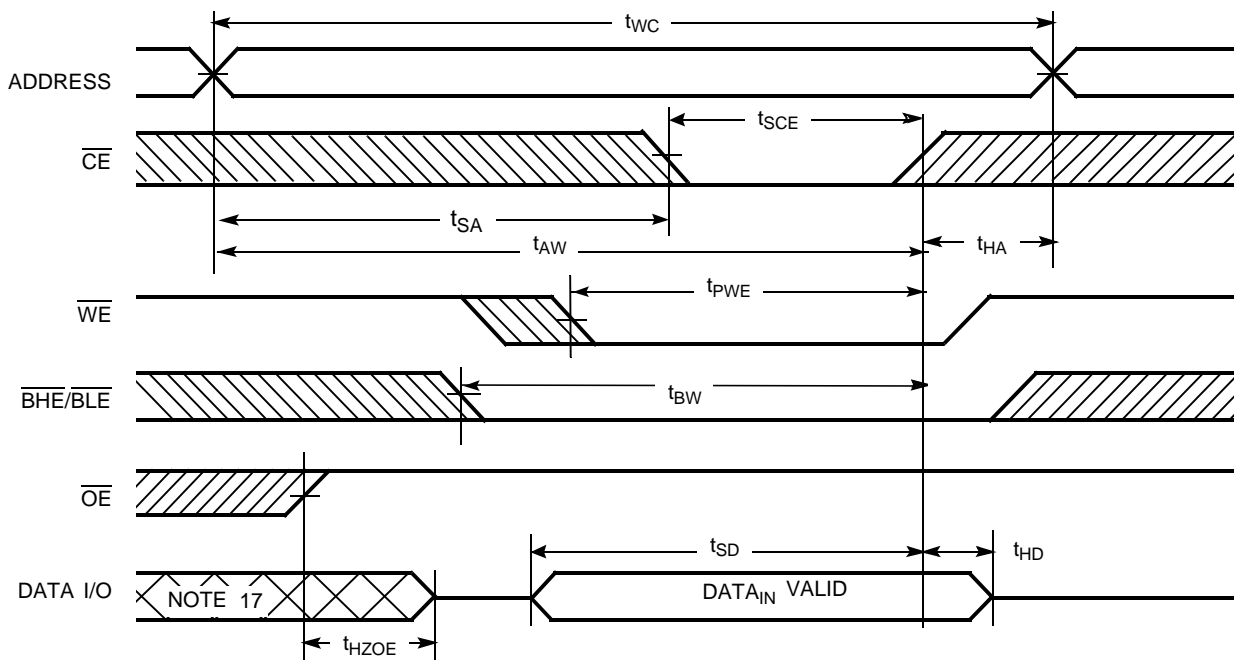
- 12. Device is continuously selected.  $\overline{OE}$ ,  $\overline{CE} = V_{IL}$ ,  $\overline{BHE}$ ,  $\overline{BLE} = V_{IL}$ .
- 13.  $\overline{WE}$  is HIGH for read cycle.
- 14. Address valid prior to or coincident with  $\overline{CE}$ ,  $\overline{BHE}$ ,  $\overline{BLE}$  transition LOW.

**Switching Waveforms**

**Write Cycle No. 1 (WE Controlled)**<sup>[11, 15, 16]</sup>



**Write Cycle No. 2 (CE Controlled)**<sup>[11, 15, 16]</sup>

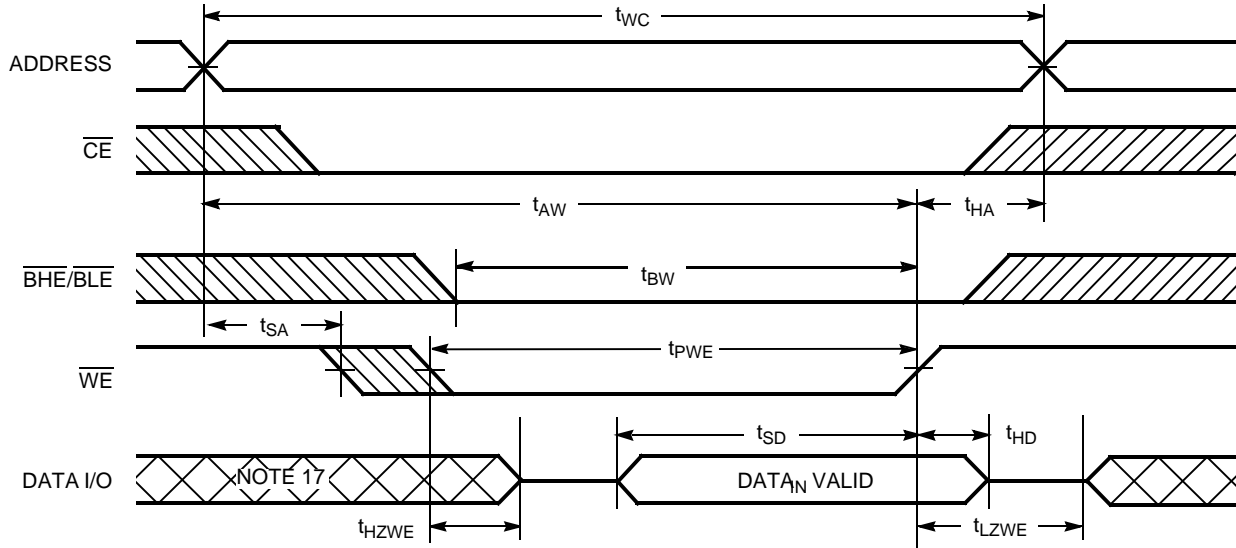


**Notes:**

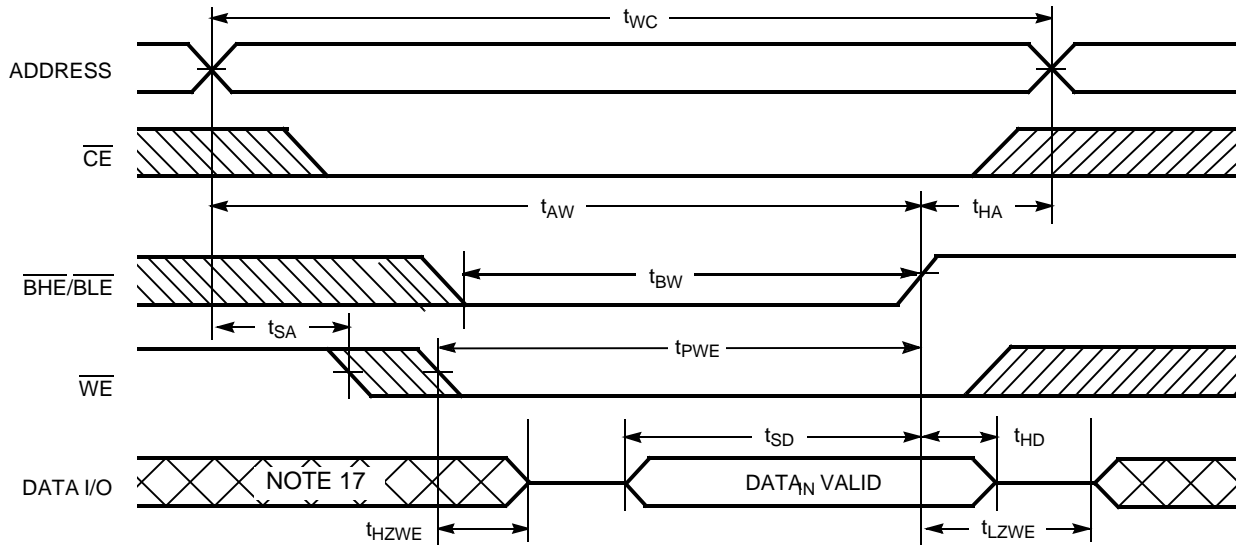
- 15. Data I/O is high-impedance if  $\overline{OE} = V_{IH}$
- 16. If  $\overline{CE}$  goes HIGH simultaneously with WE HIGH, the output remains in a high-impedance state.
- 17. During this period, the I/Os are in output state and input signals should not be applied.

**Switching Waveforms**

**Write Cycle No. 3 ( $\overline{\text{WE}}$  Controlled,  $\overline{\text{OE}}$  LOW)<sup>[16]</sup>**



**Write Cycle No. 4 ( $\overline{\text{BHE/BLE}}$  Controlled,  $\overline{\text{OE}}$  LOW)<sup>[16]</sup>**

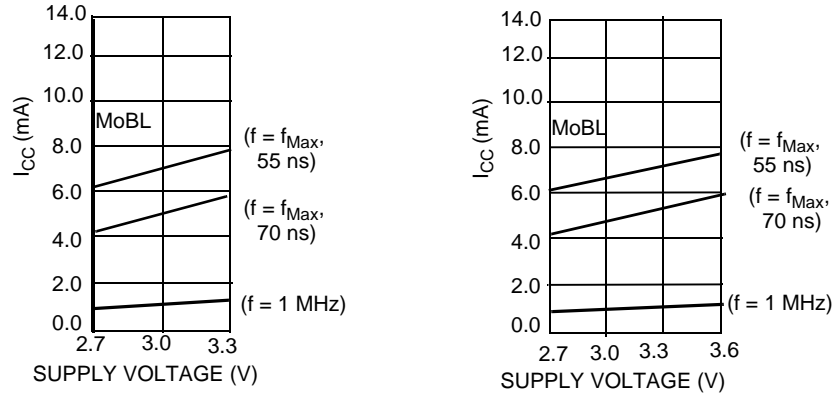




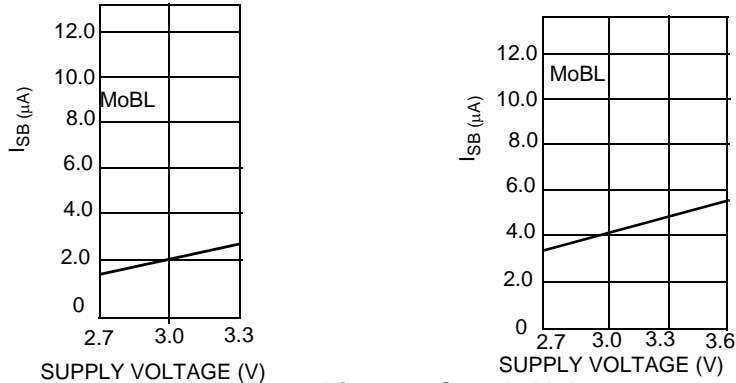
**Typical DC and AC Parameters**

(Typical values are included for reference only and are not guaranteed or tested. Typical values are measured at  $V_{CC} = V_{CC(typ.)}$ ,  $T_A = 25^\circ\text{C}$ )

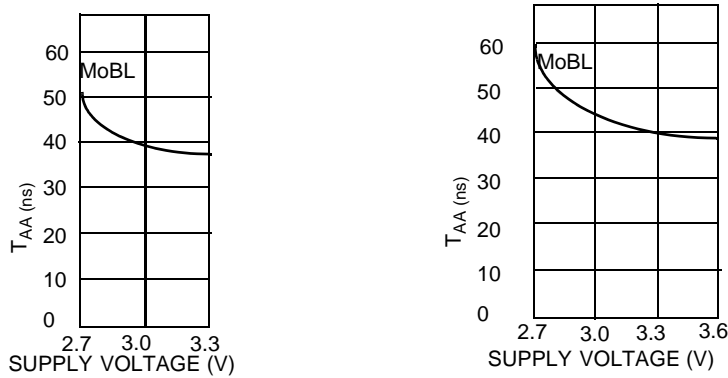
**Operating Current vs. Supply Voltage**



**Standby Current vs. Supply Voltage**



**Access Time vs. Supply Voltage**



**Truth Table**

$\overline{CE}$	$\overline{WE}$	$\overline{OE}$	$\overline{BHE}$	$\overline{BLE}$	Inputs/Outputs	Mode	Power
H	X	X	X	X	High-Z	Deselect/Power-down	Standby ( $I_{SB}$ )
L	X	X	H	H	High-Z	Output Disabled	Active ( $I_{CC}$ )
L	H	L	L	L	Data Out ( $I/O_0$ – $I/O_{15}$ )	Read	Active ( $I_{CC}$ )
L	H	L	H	L	High Z ( $I/O_8$ – $I/O_{15}$ ); Data Out ( $I/O_0$ – $I/O_7$ )	Read	Active ( $I_{CC}$ )
L	H	L	L	H	Data Out ( $I/O_8$ – $I/O_{15}$ ); High Z ( $I/O_0$ – $I/O_7$ )	Read	Active ( $I_{CC}$ )
L	L	X	L	L	Data In ( $I/O_0$ – $I/O_{15}$ )	Write	Active ( $I_{CC}$ )
L	L	X	H	L	High Z ( $I/O_8$ – $I/O_{15}$ ); Data In ( $I/O_0$ – $I/O_7$ )	Write	Active ( $I_{CC}$ )
L	L	X	L	H	Data in ( $I/O_8$ – $I/O_{15}$ ); High Z ( $I/O_0$ – $I/O_7$ )	Write	Active ( $I_{CC}$ )
L	H	H	L	L	High-Z	Output Disabled	Active ( $I_{CC}$ )
L	H	H	H	L	High-Z	Output Disabled	Active ( $I_{CC}$ )
L	H	H	L	H	High-Z	Output Disabled	Active ( $I_{CC}$ )

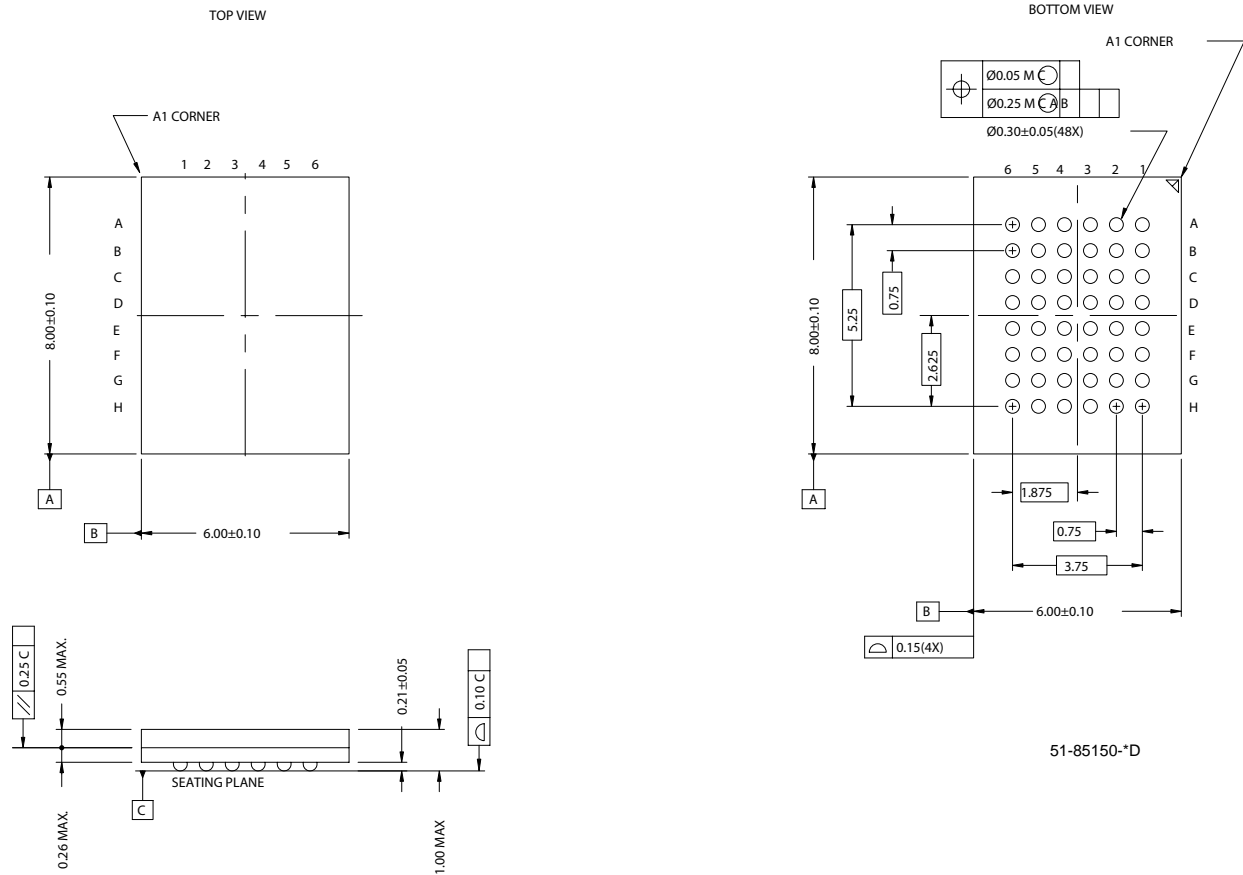
**Ordering Information**

Speed (ns)	Ordering Code	Package Name	Package Type	Operating Range
55	CY62136CV30LL-55BVI	51-85150	48-ball Fine Pitch BGA (6 x 8 x 1 mm)	Industrial
70	CY62136CV30LL-70BVXI		48-ball Fine Pitch BGA (6 x 8 x 1 mm) Pb-free	

Please contact your local Cypress sales representative for availability of these parts

**Package Diagram**

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



51-85150-D

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**Document History Page**

Document Title: CY62136CV30 2-Mbit (128K x 16) Static RAM Document Number: 38-05199				
REV.	ECN NO.	Issue Date	Orig. of Change	Description of Change
**	112379	02/19/02	GAV	New Data Sheet (advance information)
*A	114023	04/25/02	JUI	Added BV package diagram Changed Advance Information to Preliminary
*B	117063	07/12/02	MGN	Changed Preliminary to Final
*C	118121	08/26/02	MGN	Added new part numbers: CY62136CV with wider voltage (2.7V – 3.6V); CY62136CV33 narrower voltage range (3.0V – 3.6V) For T <sub>AA</sub> = 55 ns, improved t <sub>PWE</sub> Min from 45 ns to 40 ns For T <sub>AA</sub> = 70 ns, improved t <sub>PWE</sub> Min from 50 ns to 45 ns For T <sub>AA</sub> = 70 ns, improved t <sub>LZWE</sub> Min from 5 ns to 10 ns
*D	118622	10/3/02	MGN	Improved Typ. I <sub>CC</sub> spec. to 7 mA (for 55 ns) and 5.5 mA (for 70 ns) Improved Max I <sub>CC</sub> spec. to 15 mA (for 55 ns) and 12 mA (for 70 ns) For T <sub>AA</sub> = 55 ns, improved t <sub>LZWE</sub> min. from 5 ns to 10 ns Changed upper spec. for Supply Voltage to Ground Potential to V <sub>CC(max)</sub> + 0.5V Changed upper spec. for DC Voltage Applied to Outputs in High-Z State and DC Input Voltage to V <sub>CC</sub> + 0.3V
*E	486789	SEE ECN	VKN	Changed address of Cypress Semiconductor Corporation on Page# 1 from "3901 North First Street" to "198 Champion Court" Removed Part numbers: CY62136CV and CY62136CV33 Updated Ordering Information table