



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

### Features

- **Very high speed**
  - 55 ns
- **Temperature Ranges**
  - Industrial: - 40°C to + 85°C
  - Automotive: - 40°C to + 125°C
- **Pin-compatible with the CY62137V**
- **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 and ultra-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 FBGA package**

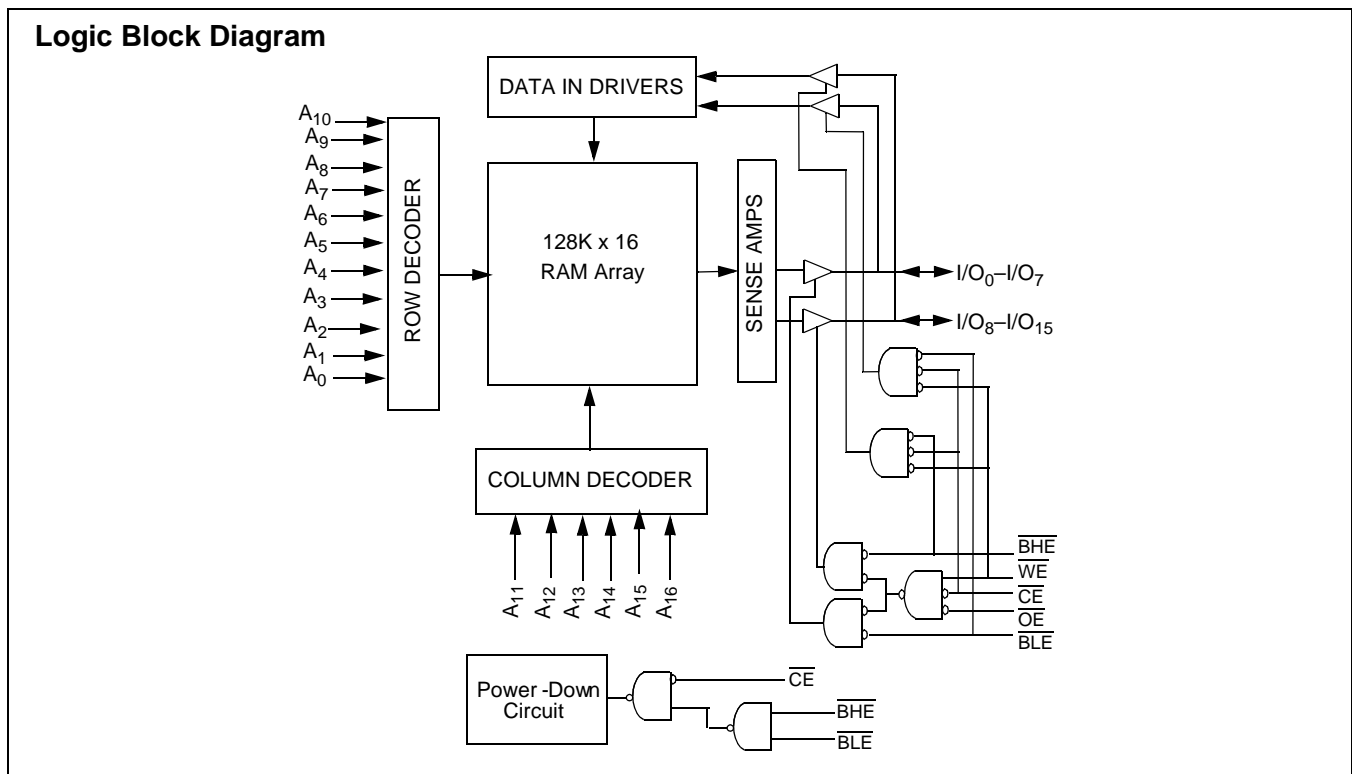
### Functional Description<sup>[1]</sup>

The CY62137CV30/33 and CY62137CV are high-performance CMOS static RAMs organized as 128K words by 16 bits. These devices feature advanced circuit design to provide

ultra-low active current. This is ideal for providing More Battery Life™ (MoBL<sup>®</sup>) in portable applications such as cellular telephones. The devices 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 or both  $\overline{BLE}$  and  $\overline{BHE}$  are HIGH). The input/output pins ( $I/O_0$  through  $I/O_{15}$ ) 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 ( $\overline{BHE}$ ,  $\overline{BLE}$  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 ( $\overline{BLE}$ ) 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.



**Note:**

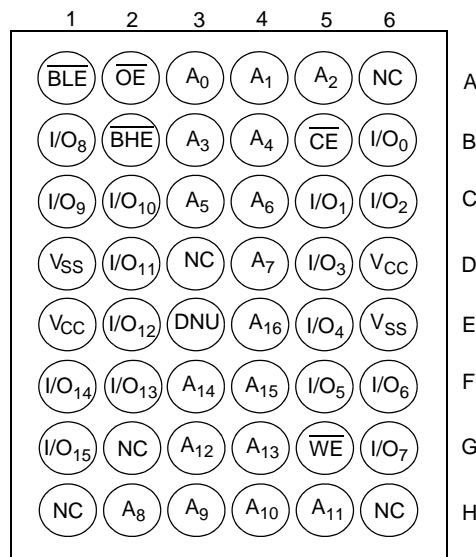
1. For best practice recommendations, please refer to the Cypress application note "System Design Guidelines" on <http://www.cypress.com>.

**Product Portfolio**

Product	Range	V <sub>CC</sub> Range (V)			Speed (ns)	Power Dissipation					
						Operating, I <sub>CC</sub> (mA)				Standby, I <sub>SB2</sub> (μA)	
		Min.	Typ. <sup>[2]</sup>	Max.		f = 1 MHz		f = f <sub>Max</sub>			
						Typ. <sup>[2]</sup>	Max.	Typ. <sup>[2]</sup>	Max.	Typ. <sup>[2]</sup>	Max.
CY62137CV30LL	Industrial	2.7	3.0	3.3	55	1.5	3	7	15	2	10
					70	1.5	3	5.5	12		
CY62137CV30LL	Automotive	2.7	3.0	3.3	70	1.5	3	5.5	15	2	15
CY62137CV33LL	Industrial	3.0	3.3	3.6	55	1.5	3	7	15	5	15
CY62137CVSL	Industrial	2.7	3.3	3.6	70	1.5	3	5.5	12	1	5

**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.
- 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 T <sub>A</sub>	V <sub>CC</sub>
CY62137CV30	Industrial	-40°C to +85°C	2.7V to 3.3V
CY62137CV33			3.0V to 3.6V
CY62137CV			2.7V to 3.6V
CY62137CV30	Automotive	-40°C to +125°C	2.7V to 3.3V

**Electrical Characteristics** Over the Operating Range

Parameter	Description	Test Conditions	CY62137CV30-55			CY62137CV30-70			Unit		
			Min.	Typ. <sup>[2]</sup>	Max.	Min.	Typ. <sup>[2]</sup>	Max.			
V <sub>OH</sub>	Output HIGH Voltage	I <sub>OH</sub> = -1.0 mA V <sub>CC</sub> = 2.7V	2.4			2.4			V		
V <sub>OL</sub>	Output LOW Voltage	I <sub>OL</sub> = 2.1 mA V <sub>CC</sub> = 2.7V			0.4			0.4	V		
V <sub>IH</sub>	Input HIGH Voltage		2.2		V <sub>CC</sub> +0.3	2.2		V <sub>CC</sub> +0.3	V		
V <sub>IL</sub>	Input LOW Voltage		-0.3		0.8	-0.3		0.8	V		
I <sub>IX</sub>	Input Leakage Current	GND ≤ V <sub>I</sub> ≤ V <sub>CC</sub>	Ind'l	-1	+1	-1		+1	μA		
			Auto			-2		+2			
I <sub>OZ</sub>	Output Leakage Current	GND ≤ V <sub>O</sub> ≤ V <sub>CC</sub> , Output Disabled	Ind'l	-1	+1	-1		+1	μA		
			Auto			-2		+2			
I <sub>CC</sub>	V <sub>CC</sub> Operating Supply Current	f = f <sub>Max</sub> = 1/t <sub>RC</sub>	V <sub>CC</sub> = 3.3V I <sub>OUT</sub> = 0mA CMOS Levels	Ind'l		7	15		5.5	12	mA
				Auto					5.5	15	
		f = 1 MHz	Ind'l		1.5	3		1.5	3		
			Auto					1.5	3		
I <sub>SB1</sub>	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 <sub>Max</sub> (Address and Data only), f=0 (OE, WE, BHE and BLE)	Ind'l		2	10		2	10	μA	
			Auto					2	15		
I <sub>SB2</sub>	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 <sub>CC</sub> = 3.3V	Ind'l		2	10		2	10	μA	
			Auto					2	15		

**Note:**

5. V<sub>IL(min.)</sub> = -2.0V for pulse durations less than 20 ns.

**Electrical Characteristics** Over the Operating Range (continued)

Parameter	Description	Test Conditions	CY62137CV33-55			CY62137CV-70			Unit	
			Min.	Typ. <sup>[2]</sup>	Max.	Min.	Typ. <sup>[2]</sup>	Max.		
V <sub>OH</sub>	Output HIGH Voltage	I <sub>OH</sub> = -1.0 mA	V <sub>CC</sub> = 3.0V	2.4			2.4		V	
			V <sub>CC</sub> = 2.7V				2.4		V	
V <sub>OL</sub>	Output LOW Voltage	I <sub>OL</sub> = 2.1 mA	V <sub>CC</sub> = 3.0V			0.4		0.4	V	
			V <sub>CC</sub> = 2.7V					0.4	V	
V <sub>IH</sub>	Input HIGH Voltage		2.2		V <sub>CC</sub> +0.3	2.2		V <sub>CC</sub> +0.3	V	
V <sub>IL</sub>	Input LOW Voltage		-0.3		0.8	-0.3		0.8	V	
I <sub>IX</sub>	Input Leakage Current	GND ≤ V <sub>I</sub> ≤ V <sub>CC</sub>	-1		+1	-1		+1	μA	
I <sub>OZ</sub>	Output Leakage Current	GND ≤ V <sub>O</sub> ≤ V <sub>CC</sub> , Output Disabled	-1		+1	-1		+1	μA	
I <sub>CC</sub>	V <sub>CC</sub> Operating Supply Current	f = f <sub>Max</sub> = 1/t <sub>RC</sub>	V <sub>CC</sub> = 3.6V		7	15		5.5	12	mA
		f = 1 MHz	I <sub>OUT</sub> = 0 mA CMOS Levels		1.5	3		1.5	3	
I <sub>SB1</sub>	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)		5	15		5	15	μA	
I <sub>SB2</sub>	Automatic CE Power-down Current —CMOS Inputs	$\overline{CE} \geq V_{CC} - 0.2V$ $V_{IN} \geq V_{CC} - 0.2V$ or $V_{IN} \leq 0.2V, f = 0, V_{CC} = 3.6V$	LL		5	15		5	15	μA
			SL		5	15		1	5	

**Capacitance<sup>[6]</sup>**

Parameter	Description	Test Conditions	Max.	Unit
C <sub>IN</sub>	Input Capacitance	T <sub>A</sub> = 25°C, f = 1 MHz, V <sub>CC</sub> = V <sub>CC(typ.)</sub>	6	pF
C <sub>OUT</sub>	Output Capacitance		8	pF

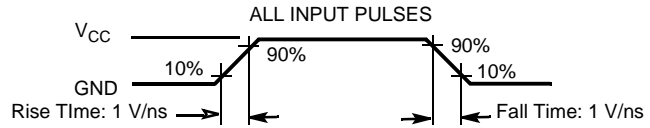
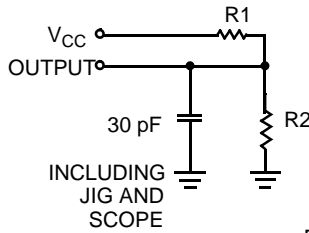
**Thermal Resistance<sup>[6]</sup>**

Parameter	Description	Test Conditions	FBGA	Unit
θ <sub>JA</sub>	Thermal Resistance (Junction to Ambient)	Still Air, soldered on a 3 x 4.5 inch, 2-layer printed circuit board	55	°C/W
θ <sub>JC</sub>	Thermal Resistance (Junction to Case)		16	°C/W

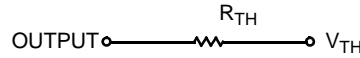
**Note:**

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

### AC Test Loads and Waveforms



Equivalent to: THEVENIN EQUIVALENT

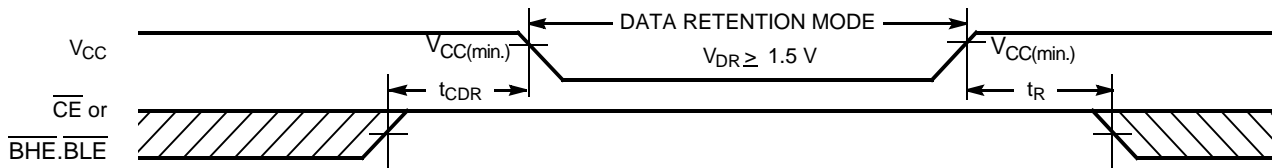


Parameters	3.0V	3.3V	Unit
R1	1105	1216	Ω
R2	1550	1374	Ω
R <sub>TH</sub>	645	645	Ω
V <sub>TH</sub>	1.75	1.75	V

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

Parameter	Description	Conditions	Min.	Typ. <sup>[4]</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 CE ≥ V <sub>CC</sub> - 0.2V, V <sub>IN</sub> ≥ V <sub>CC</sub> - 0.2V or V <sub>IN</sub> ≤ 0.2V		1	6	μA
		LL	Ind'l		8	
		SL	Ind'l		4	
t <sub>CDR</sub> <sup>[6]</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<sup>[8]</sup>



**Notes:**

7. Full-device AC operation requires linear V<sub>CC</sub> ramp from V<sub>DR</sub> to V<sub>CC(min.)</sub> > 100 μs or stable at V<sub>CC(min.)</sub> > 100 μs.
8. BHE.BLE is the AND of both BHE and BLE. Chip can be deselected by either disabling the chip enable signals or by disabling both BHE and BLE.

**Switching Characteristics** Over the Operating Range<sup>[9]</sup>

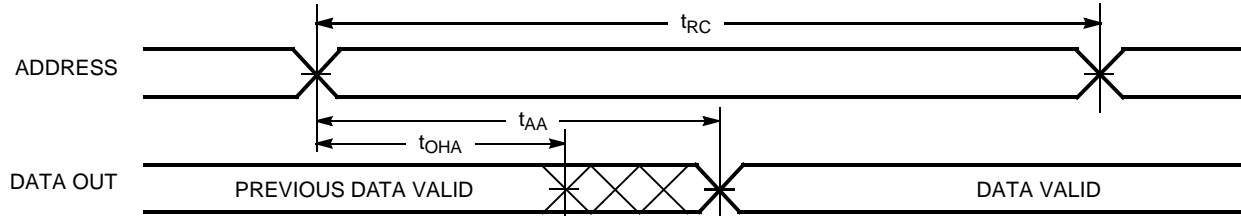
Parameter	Description	55 ns		70 ns		Unit
		Min.	Max.	Min.	Max.	
<b>Read Cycle</b>						
t <sub>RC</sub>	Read Cycle Time	55		70		ns
t <sub>AA</sub>	Address to Data Valid		55		70	ns
t <sub>OHA</sub>	Data Hold from Address Change	10		10		ns
t <sub>ACE</sub>	$\overline{CE}$ LOW to Data Valid		55		70	ns
t <sub>DOE</sub>	$\overline{OE}$ LOW to Data Valid		25		35	ns
t <sub>LZOE</sub>	$\overline{OE}$ LOW to Low-Z <sup>[10]</sup>	5		5		ns
t <sub>HZOE</sub>	$\overline{OE}$ HIGH to High-Z <sup>[10, 12]</sup>		20		25	ns
t <sub>LZCE</sub>	$\overline{CE}$ LOW to Low-Z <sup>[10]</sup>	10		10		ns
t <sub>HZCE</sub>	$\overline{CE}$ HIGH to High-Z <sup>[10, 12]</sup>		20		25	ns
t <sub>PU</sub>	$\overline{CE}$ LOW to Power-up	0		0		ns
t <sub>PD</sub>	$\overline{CE}$ HIGH to Power-down		55		70	ns
t <sub>DBE</sub>	$\overline{BHE}/\overline{BLE}$ LOW to Data Valid		55		70	ns
t <sub>LZBE</sub> <sup>[11]</sup>	$\overline{BHE}/\overline{BLE}$ LOW to Low-Z <sup>[10]</sup>	5		5		ns
t <sub>HZBE</sub>	$\overline{BHE}/\overline{BLE}$ HIGH to High-Z <sup>[10, 12]</sup>		20		25	ns
<b>Write Cycle<sup>[13]</sup></b>						
t <sub>WC</sub>	Write Cycle Time	55		70		ns
t <sub>SCE</sub>	$\overline{CE}$ LOW to Write End	45		60		ns
t <sub>AW</sub>	Address Set-up to Write End	45		60		ns
t <sub>HA</sub>	Address Hold from Write End	0		0		ns
t <sub>SA</sub>	Address Set-up to Write Start	0		0		ns
t <sub>PWE</sub>	$\overline{WE}$ Pulse Width	40		45		ns
t <sub>BW</sub>	$\overline{BHE}/\overline{BLE}$ Pulse Width	50		60		ns
t <sub>SD</sub>	Data Set-up to Write End	25		30		ns
t <sub>HD</sub>	Data Hold from Write End	0		0		ns
t <sub>HZWE</sub>	$\overline{WE}$ LOW to High-Z <sup>[10, 12]</sup>		20		25	ns
t <sub>LZWE</sub>	$\overline{WE}$ HIGH to Low-Z <sup>[10]</sup>	10		10		ns

**Notes:**

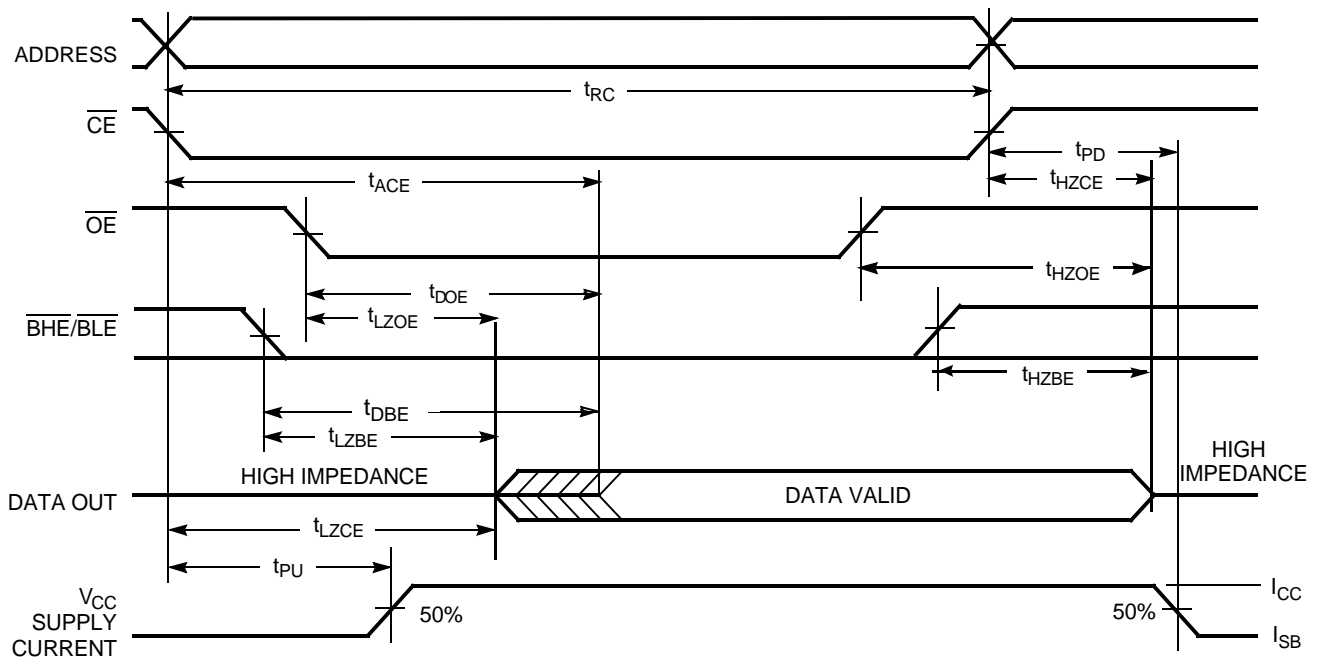
9. Test conditions assume signal transition time of 5 ns or less, timing reference levels of  $V_{CC(typ.)}/2$ , input pulse levels of 0 to  $V_{CC(typ.)}$ , and output loading of the specified  $I_{OL}/I_{OH}$  and 30 pF load capacitance.
10. At any given temperature and voltage condition, t<sub>HZCE</sub> is less than t<sub>LZCE</sub>, t<sub>HZBE</sub> is less than t<sub>LZBE</sub>, t<sub>HZOE</sub> is less than t<sub>LZOE</sub>, and t<sub>HZWE</sub> is less than t<sub>LZWE</sub> for any given device.
11. If both byte enables are toggled together this value is 10 ns.
12. t<sub>HZOE</sub>, t<sub>HZCE</sub>, t<sub>HZBE</sub>, and t<sub>HZWE</sub> transitions are measured when the outputs enter a high impedance state.
13. The internal write time of the memory is defined by the overlap of  $\overline{WE}$ ,  $\overline{CE} = V_{IL}$ ,  $\overline{BHE}$  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>[14, 15]</sup>



#### Read Cycle No. 2 ( $\overline{\text{OE}}$ Controlled)<sup>[15, 16]</sup>

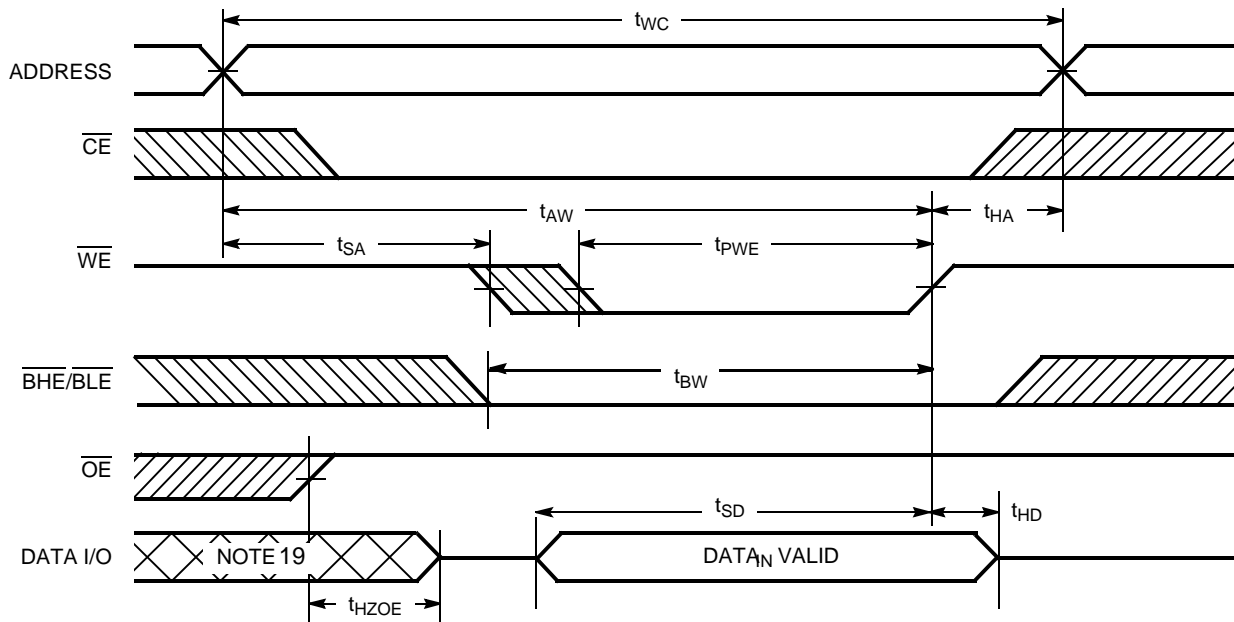


**Notes:**

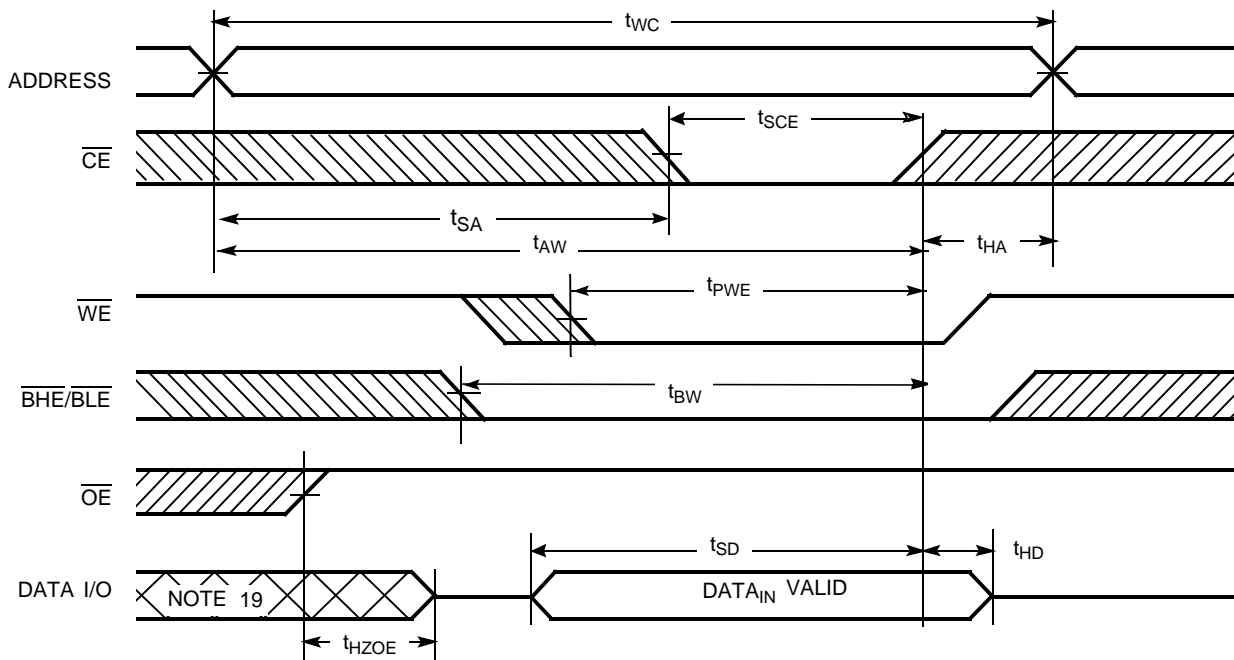
- 14. Device is continuously selected.  $\overline{\text{OE}}, \overline{\text{CE}} = V_{\text{IL}}, \overline{\text{BHE}}, \overline{\text{BLE}} = V_{\text{IL}}$ .
- 15.  $\overline{\text{WE}}$  is HIGH for read cycle.
- 16. Address valid prior to or coincident with  $\overline{\text{CE}}, \overline{\text{BHE}},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

**Switching Waveforms** (continued)

**Write Cycle No. 1 (WE Controlled)**<sup>[13, 17, 18]</sup>



**Write Cycle No. 2 (CE Controlled)**<sup>[13, 17, 18]</sup>

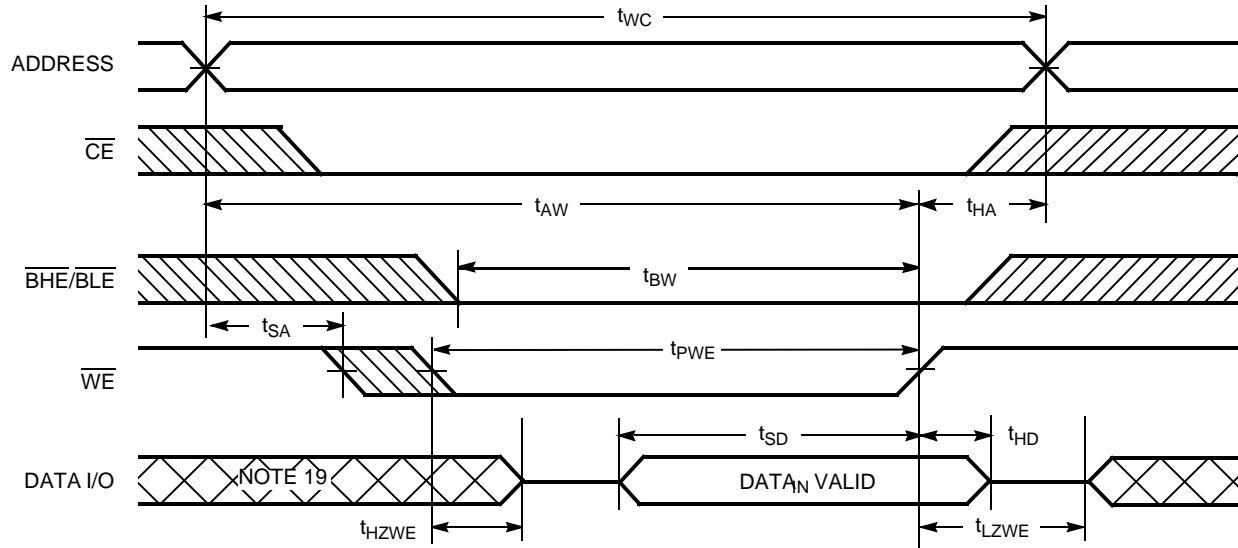


**Notes:**

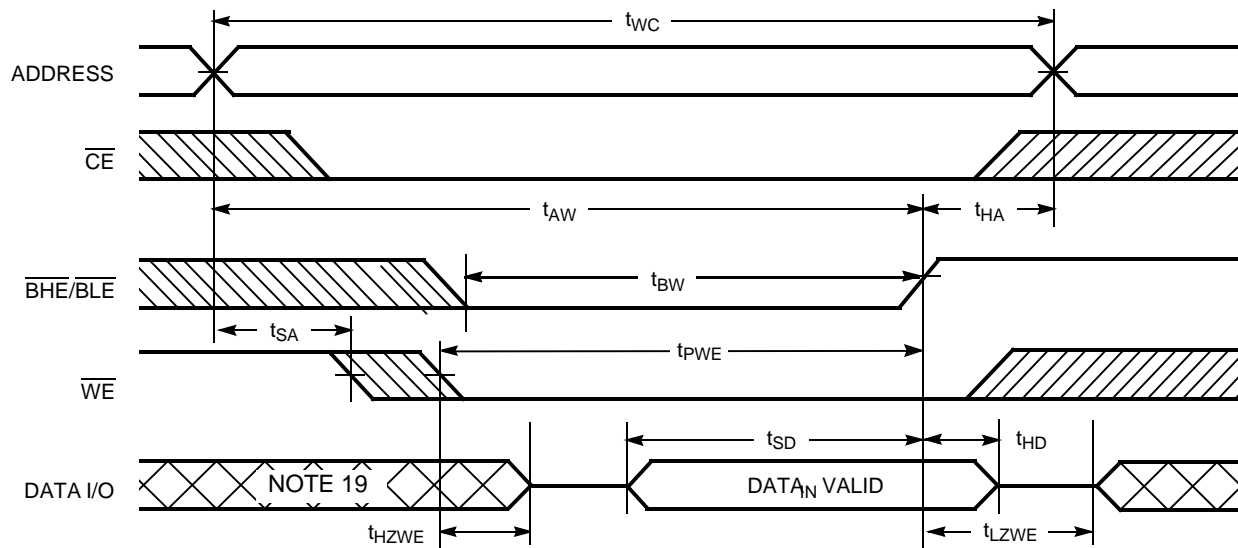
- 17. Data I/O is high-impedance if  $\overline{OE} = V_{IH}$ .
- 18. If CE goes HIGH simultaneously with WE HIGH, the output remains in a high-impedance state.
- 19. During this period, the I/Os are in output state and input signals should not be applied.

**Switching Waveforms** (continued)

**Write Cycle No. 3 ( $\overline{WE}$  Controlled,  $\overline{OE}$  LOW)<sup>[18]</sup>**



**Write Cycle No. 4 ( $\overline{BHE}/\overline{BLE}$  Controlled,  $\overline{OE}$  LOW)<sup>[18]</sup>**



**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 ( $I_{SB}$ )
X	X	X	H	H	High-Z	Deselect/Power-down	Standby ( $I_{SB}$ )
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 ( $I_{CC}$ )

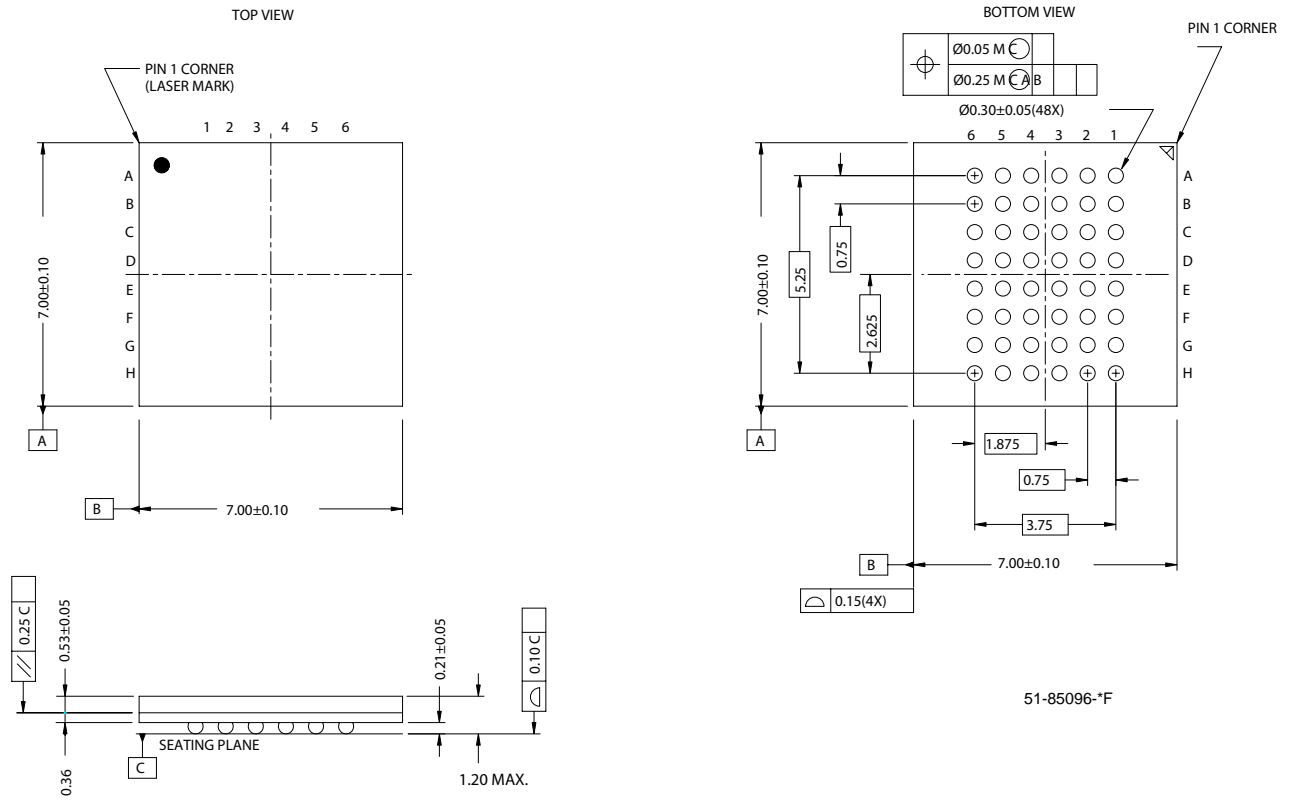
**Ordering Information**

Speed (ns)	Ordering Code	Package Diagram	Package Type	Operating Range
55	CY62137CV30LL-55BVI	51-85150	48-ball FBGA (6 x 8 x 1 mm)	Industrial
	CY62137CV30LL-55BVXI		48-ball FBGA (6 x 8 x 1 mm) (Pb-free)	
	CY62137CV33LL-55BVI		48-ball FBGA (6 x 8 x 1 mm)	
70	CY62137CV30LL-70BAI	51-85096	48-ball FBGA (7 x 7 x 1.2 mm)	Industrial
	CY62137CV30LL-70BVI	51-85150	48-ball FBGA (6 x 8 x 1 mm)	
	CY62137CVSL-70BAI	51-85096	48-ball FBGA (7 x 7 x 1.2 mm)	
	CY62137CVSL-70BAXI		48-ball FBGA (7 x 7 x 1.2 mm) (Pb-free)	
	CY62137CV30LL-70BAE	51-85096	48-ball FBGA (7 x 7 x 1.2 mm)	Automotive
	CY62137CV30LL-70BVE	51-85150	48-ball FBGA (6 x 8 x 1 mm)	
	CY62137CV30LL-70BVXE		48-ball FBGA (6 x 8 x 1 mm) (Pb-free)	

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

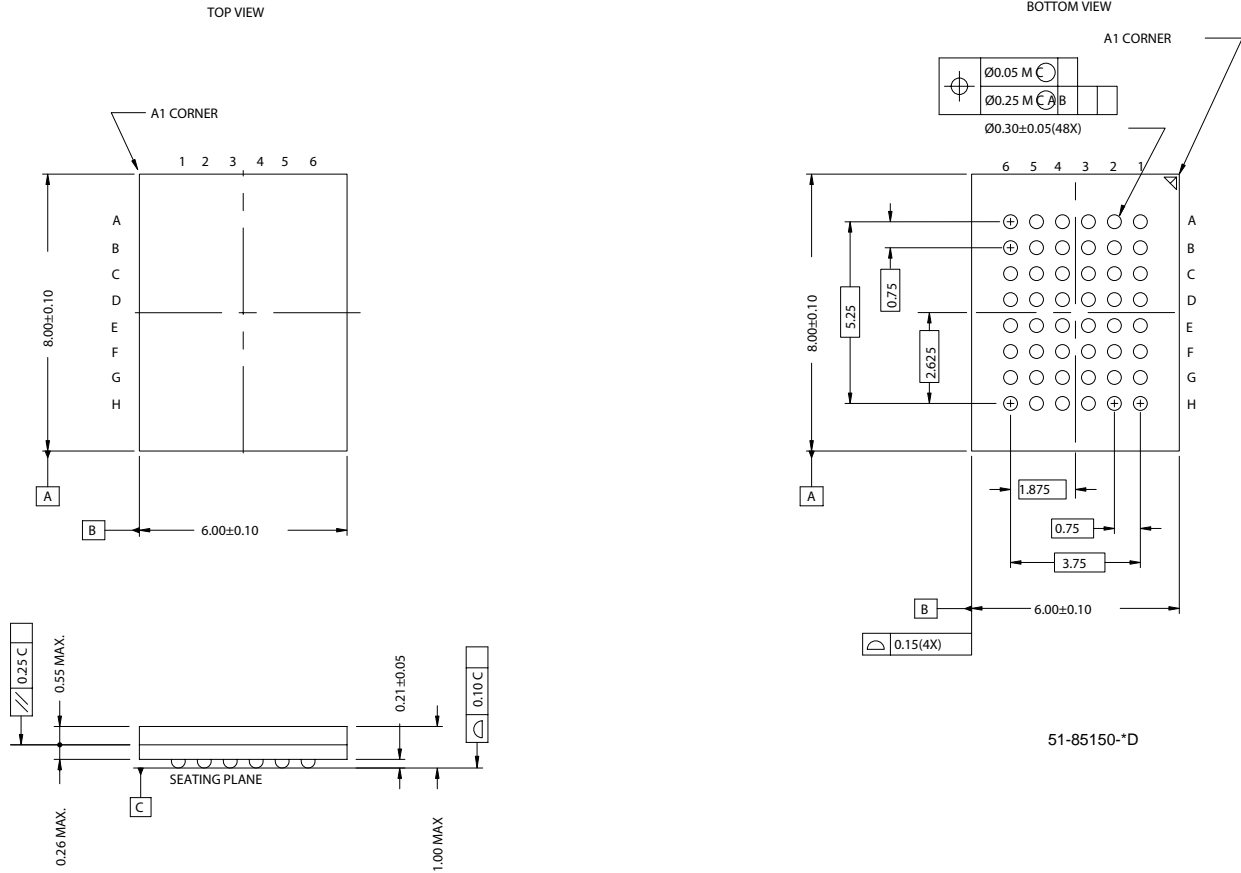
Package Diagrams

48-ball FBGA (7 x 7 x 1.2 mm) (51-85096)



Package Diagrams (continued)

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



51-85150-D



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**Document History Page**

Document Title: CY62137CV30/33 MoBL <sup>®</sup> and CY62137CV MoBL <sup>®</sup> 2-Mbit (128K x 16) Static RAM				
Document Number: 38-05201				
REV.	ECN NO.	Issue Date	Orig. of Change	Description of Change
**	112393	02/19/02	GAV	New Data Sheet (advance information)
*A	114015	04/25/02	JUI	Added BV package diagram Changed from Advance Information to Preliminary
*B	117064	07/12/02	MGN	Changed from Preliminary to Final
*C	118122	09/10/02	MGN	Added new part number: CY62137CV with wider voltage (2.7V – 3.6V) Added new SL power bin for new part number 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	118761	09/23/02	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	343877	See ECN	PCI	Added Automotive Information in Operating Range, DC and Ordering Information Table
*F	419237	See ECN	ZSD	Changed the address of Cypress Semiconductor Corporation on Page #1 from "3901 North First Street" to "198 Champion Court" Updated the ordering information table and replaced the Package name column with Package diagram
*G	486789	See ECN	VKN	Removed part number CY62137CV25 from the product offering Updated the ordering information table

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-  [View CY62137CVSL-70BAXI on WIN SOURCE](#)
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