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 @ $f = f_{Max}$ (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**

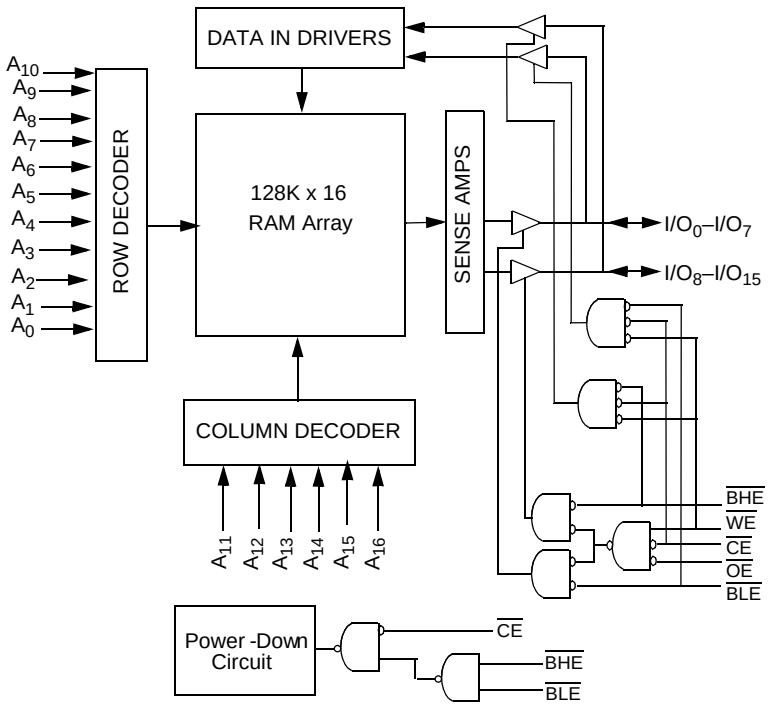
Functional Description[1]

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®) 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 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.

Logic Block Diagram



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

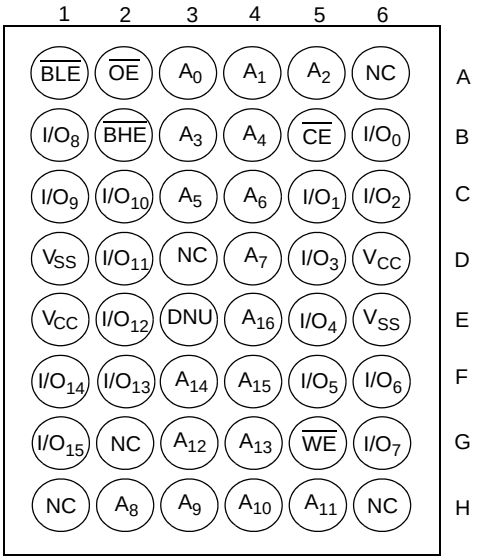
Product Portfolio

Product	Range	V_{CC} Range (V)			Speed (ns)	Power Dissipation					
						Operating, I_{CC} (mA)				Standby, I_{SB2} (µA)	
						f = 1 MHz		f = f_{Max}			
		Min.	Typ.[2]	Max.		Typ.[2]	Max.	Typ.[2]	Max.	Typ.[2]	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[3, 4]

48-ball VFBGA

Top View



Notes:
2. Typical values are included for reference only and are not guaranteed or tested. Typical values are measured at $V_{CC} = V_{CC(typ.)}$, $T_A = 25°C$.
3. NC pins are not connected to the die.
4. E3 (DNU) pin have to be left floating or tied to V_{SS} 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[5] ..... -0.5V to V_{CC} + 0.3V

DC Input Voltage[5]..... -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_A	V_{CC}
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.[2]	Max.	Min.	Typ.[2]	Max.	
V_{OH}	Output HIGH Voltage	I_{OH} = -1.0 mA	V_{CC} = 2.7V		2.4			2.4			V
V_{OL}	Output LOW Voltage	I_{OL} = 2.1 mA	V_{CC} = 2.7V				0.4			0.4	V
V_{IH}	Input HIGH Voltage				2.2		V_{CC} +0.3	2.2		V_{CC} +0.3	V
V_{IL}	Input LOW Voltage				-0.3		0.8	-0.3		0.8	V
I_{IX}	Input Leakage Current	GND ≤ V_I ≤ V_{CC}		Ind'l	-1		+1	-1		+1	µA
				Auto				-2		+2	
I_{OZ}	Output Leakage Current	GND ≤ V_O ≤ V_{CC}, Output Disabled		Ind'l	-1		+1	-1		+1	µA
				Auto				-2		+2	
I_{CC}	V_{CC} Operating Supply Current	f = f_{Max} = $1/t_{RC}$	V_{CC} = 3.3V I_{OUT} = 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_{SB1}	Automatic CE Power-down Current — CMOS Inputs	$\overline{CE}$ ≥ V_{CC} – 0.2V V_{IN} ≥ V_{CC} – 0.2V or V_{IN} ≤ 0.2V, f = f_{Max} (Address and Data only), f=0 ($\overline{OE}$, $\overline{WE}$, $\overline{BHE}$ and $\overline{BLE}$)		Ind'l		2	10		2	10	µA
				Auto					2	15	
I_{SB2}	Automatic CE Power-down Current — CMOS Inputs	$\overline{CE}$ ≥ V_{CC} – 0.2V V_{IN} ≥ V_{CC} – 0.2V or V_{IN} ≤ 0.2V f = 0, V_{CC} = 3.3V		Ind'l		2	10		2	10	µA
				Auto					2	15	

Note:
5. $V_{IL(min.)}$ = –2.0V for pulse durations less than 20 ns.

Electrical Characteristics Over the Operating Range (continued)

Parameter	Description	Test Conditions		CY62137CV33-55 Min.	CY62137CV33-55 Typ.[2]	CY62137CV33-55 Max.	CY62137CV-70 Min.	CY62137CV-70 Typ.[2]	CY62137CV-70 Max.	Unit
V_{OH}	Output HIGH Voltage	I_{OH} = -1.0 mA	V_{CC} = 3.0V	2.4			2.4			V
			V_{CC} = 2.7V				2.4			V
V_{OL}	Output LOW Voltage	I_{OL} = 2.1 mA	V_{CC} = 3.0V			0.4			0.4	V
			V_{CC} = 2.7V						0.4	V
V_{IH}	Input HIGH Voltage			2.2		V_{CC} + 0.3	2.2		V_{CC} + 0.3	V
V_{IL}	Input LOW Voltage			-0.3		0.8	-0.3		0.8	V
I_{IX}	Input Leakage Current	GND ≤ V_I ≤ V_{CC}		-1		+1	-1		+1	µA
I_{OZ}	Output Leakage Current	GND ≤ V_O ≤ V_{CC}, Output Disabled		-1		+1	-1		+1	µA
I_{CC}	V_{CC} Operating Supply Current	f = f_{Max} = 1/t_{RC}	V_{CC} = 3.6V I_{OUT} = 0 mA CMOS Levels		7	15		5.5	12	mA
		f = 1 MHz			1.5	3		1.5	3	
I_{SB1}	Automatic CE Power-down Current —CMOS Inputs	$\overline{CE}$ ≥ V_{CC} – 0.2V V_{IN} ≥ V_{CC} – 0.2V or V_{IN} ≤ 0.2V, f = f_{Max} (Address and Data Only), f=0 ($\overline{OE}$, $\overline{WE}$, $\overline{BHE}$, and $\overline{BLE}$)			5	15		5	15	µA
I_{SB2}	Automatic CE Power-down Current —CMOS Inputs	$\overline{CE}$ ≥ V_{CC} – 0.2V V_{IN} ≥ V_{CC} – 0.2V or V_{IN} ≤ 0.2V, f = 0, V_{CC} = 3.6V	LL		5	15		5	15	µA
			SL		5	15		1	5	

Capacitance[6]

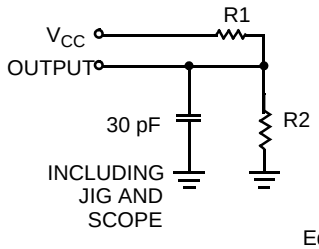
Parameter	Description	Test Conditions	Max.	Unit
C_{IN}	Input Capacitance	T_A = 25°C, f = 1 MHz, V_{CC} = $V_{CC(typ.)}$	6	pF
C_{OUT}	Output Capacitance		8	pF

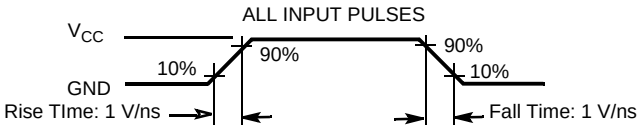
Thermal Resistance[6]

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

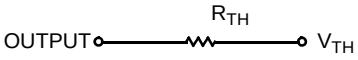
Note:
6. Tested initially and after any design or process changes that may affect these parameters.

AC Test Loads and Waveforms





Equivalent to: THEVENIN EQUIVALENT

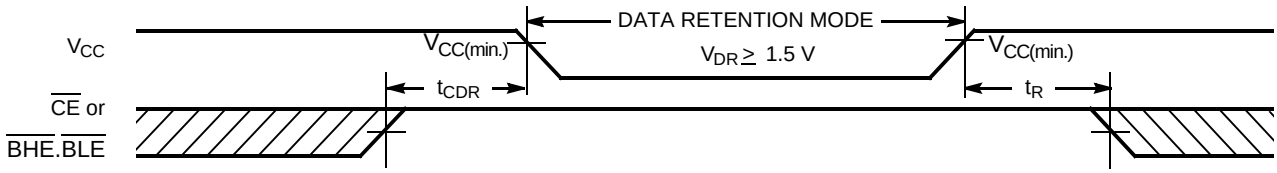


Parameters	3.0V	3.3V	Unit
R1	1105	1216	Ω
R2	1550	1374	Ω
R_{TH}	645	645	Ω
V_{TH}	1.75	1.75	V

Data Retention Characteristics (Over the Operating Range)

Parameter	Description	Conditions			Min.	Typ.[4]	Max.	Unit
V_{DR}	V_{CC} for Data Retention				1.5		$V_{cc(max)}$	V
I_{CCDR}	Data Retention Current	V_{CC}= 1.5V $\overline{CE} \geq V_{CC} - 0.2V$, $V_{IN} \geq V_{CC} - 0.2V$ or $V_{IN} \leq 0.2V$	LL	Ind'l		1	6	µA
				Auto			8	
			SL	Ind'l			4	
t_{CDR}[6]	Chip Deselect to Data Retention Time				0			ns
t_R[7]	Operation Recovery Time				t_{RC}			ns

Data Retention Waveform[8]



Notes:
7. Full-device AC operation requires linear V_{CC} ramp from V_{DR} to $V_{CC(min.)}$ > 100 µs or stable at $V_{CC(min.)}$ > 100 µs.
8. $\overline{BHE}.\overline{BLE}$ is the AND of both $\overline{BHE}$ and $\overline{BLE}$. Chip can be deselected by either disabling the chip enable signals or by disabling both $\overline{BHE}$ and $\overline{BLE}$.

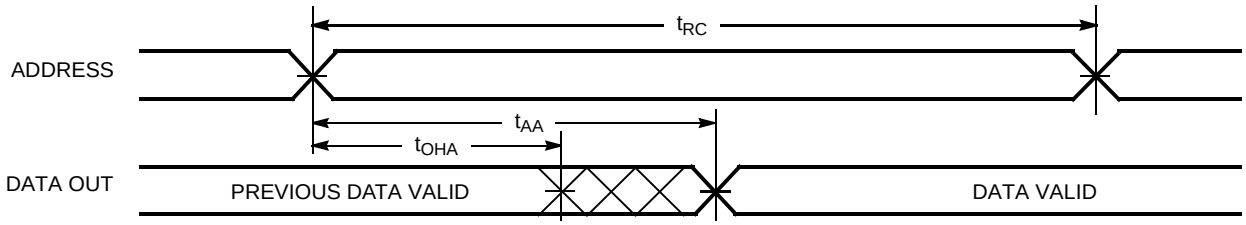
Switching Characteristics Over the Operating Range[9]

Parameter	Description	55 ns		70 ns		Unit
		Min.	Max.	Min.	Max.	
Read Cycle						
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[10]	5		5		ns
t_{HZOE}	$\overline{OE}$ HIGH to High-Z[10, 12]		20		25	ns
t_{LZCE}	$\overline{CE}$ LOW to Low-Z[10]	10		10		ns
t_{HZCE}	$\overline{CE}$ HIGH to High-Z[10, 12]		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		55		70	ns
t_{LZBE}[11]	$\overline{BHE}$/$\overline{BLE}$ LOW to Low-Z[10]	5		5		ns
t_{HZBE}	$\overline{BHE}$/$\overline{BLE}$ HIGH to High-Z[10, 12]		20		25	ns
Write Cycle[13]						
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[10, 12]		20		25	ns
t_{LZWE}	$\overline{WE}$ HIGH to Low-Z[10]	10		10		ns

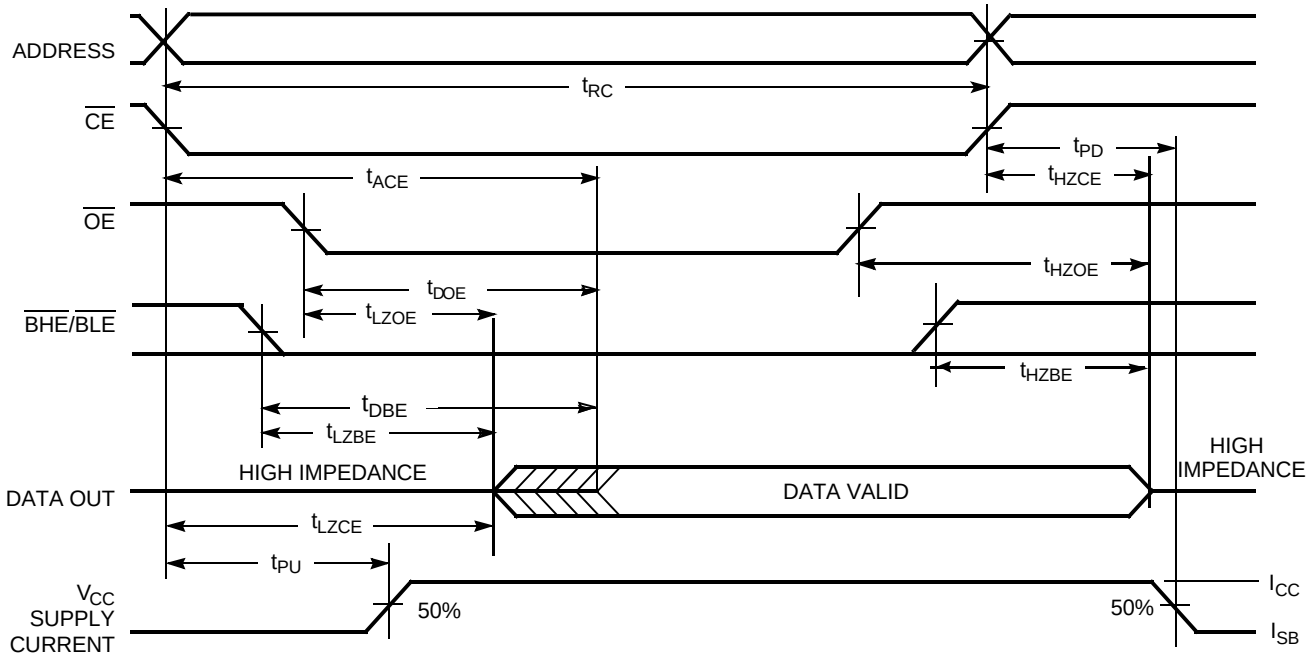
Notes:
9. Test conditions assume signal transition time of 5 ns or less, timing reference levels of $V_{CC(typ.)}/2$, input pulse levels of 0 to $V_{CC(typ.)}$, and output loading of the specified I_{OL}/I_{OH} and 30 pF load capacitance.
10. At any given temperature and voltage condition, t_{HZCE} is 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.
11. If both byte enables are toggled together this value is 10 ns.
12. t_{HZOE}, t_{HZCE}, t_{HZBE}, and t_{HZWE} 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)[14, 15]



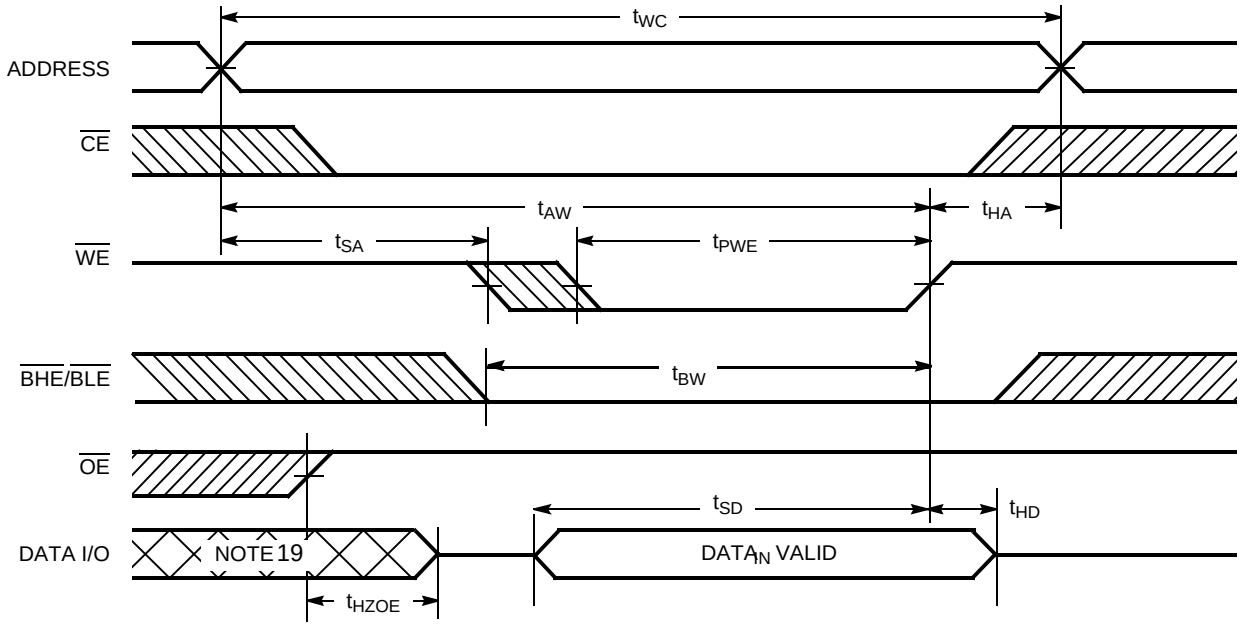
Read Cycle No. 2 ($\overline{OE}$ Controlled)[15, 16]



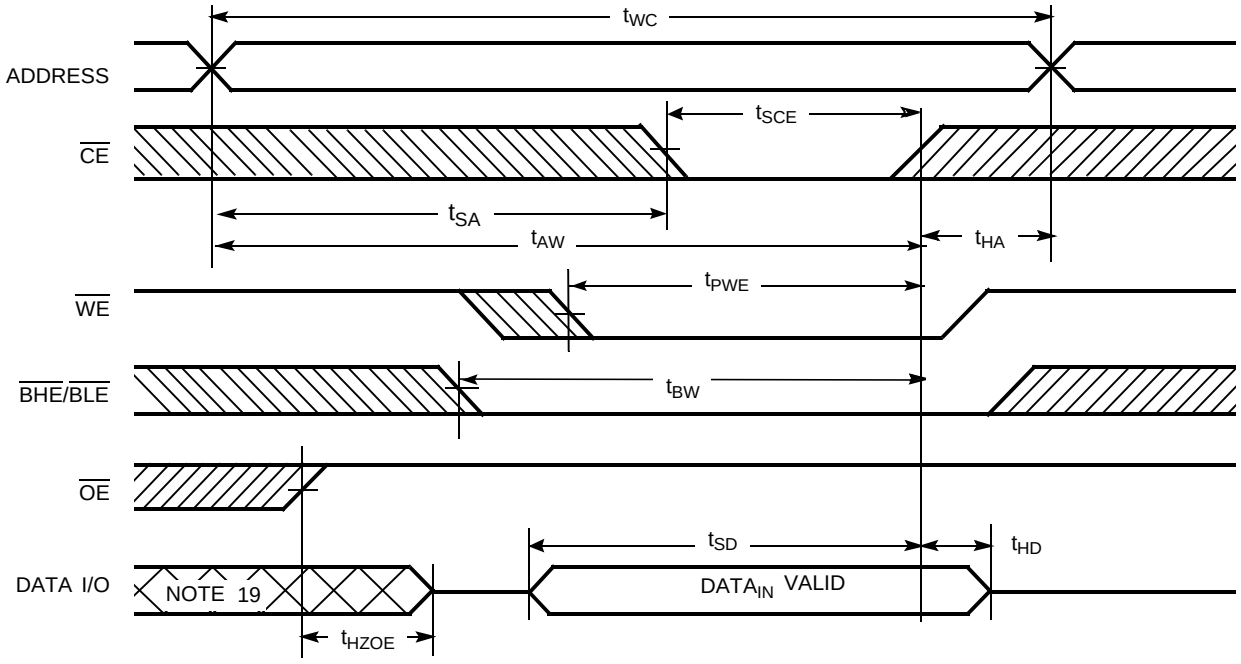
Notes:
14. Device is continuously selected. $\overline{OE}$, $\overline{CE}$ = V_{IL}, $\overline{BHE}$, $\overline{BLE}$ = V_{IL}.
15. $\overline{WE}$ is HIGH for read cycle.
16. Address valid prior to or coincident with $\overline{CE}$, $\overline{BHE}$, $\overline{BLE}$ transition LOW.

Switching Waveforms (continued)

Write Cycle No. 1 (WE Controlled)[13, 17, 18]



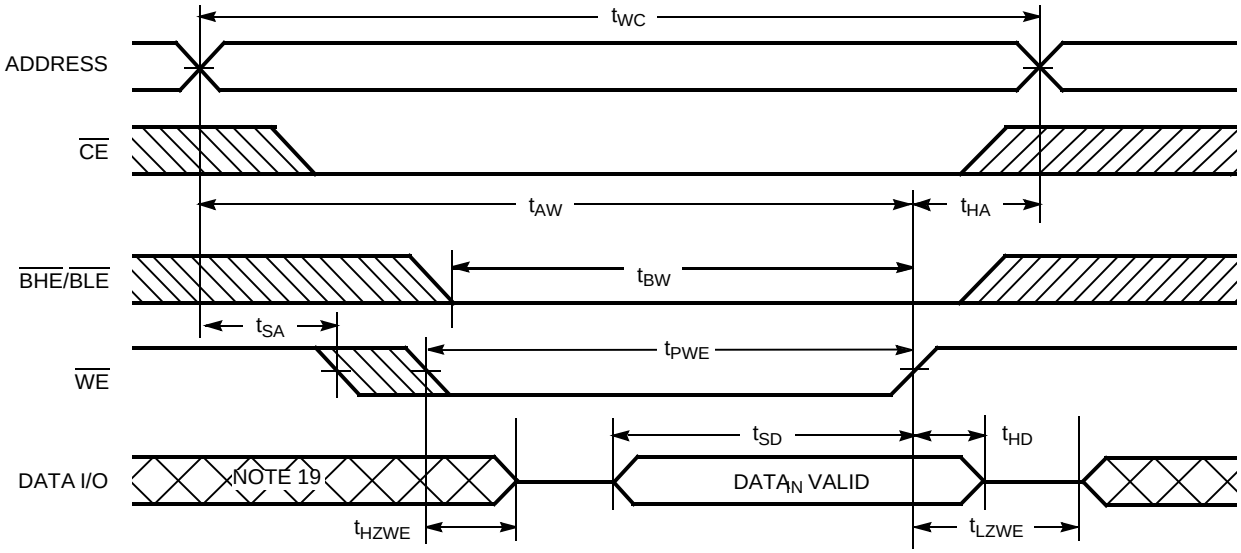
Write Cycle No. 2 (CE Controlled)[13, 17, 18]



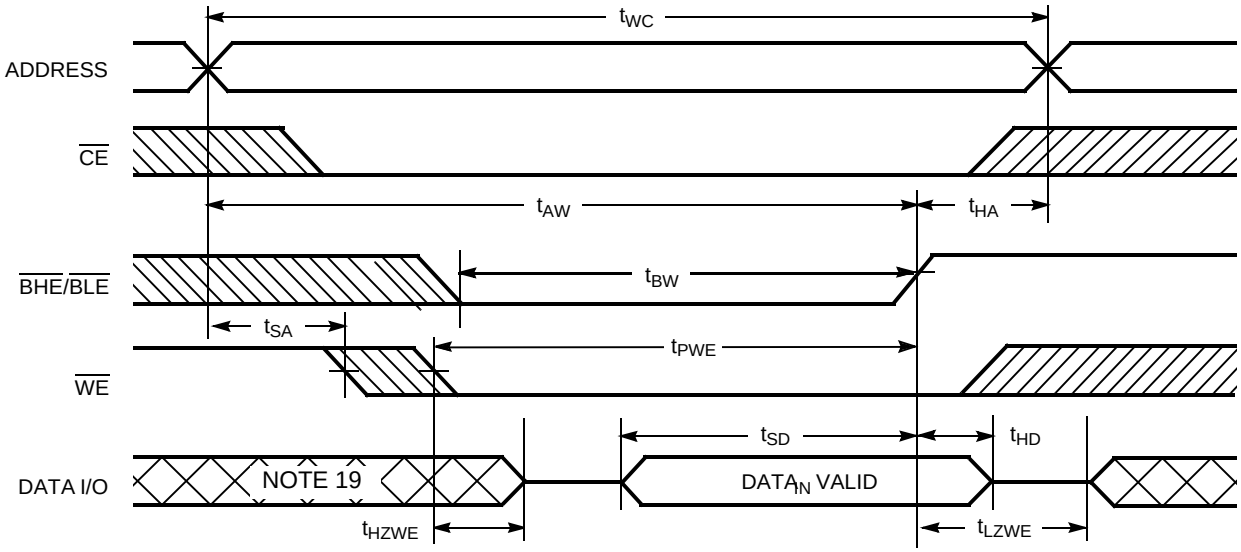
Notes:
17. Data I/O is high-impedance if $\overline{OE}$ = V_{IH}.
18. If $\overline{CE}$ goes HIGH simultaneously with $\overline{WE}$ HIGH, the output remains in a high-impedance state.
19. During this period, the I/Os are in output state and input signals should not be applied.

Switching Waveforms (continued)

Write Cycle No. 3 (WE Controlled, OE LOW)[18]



Write Cycle No. 4 (BHE/BLE Controlled, OE LOW)[18]



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})

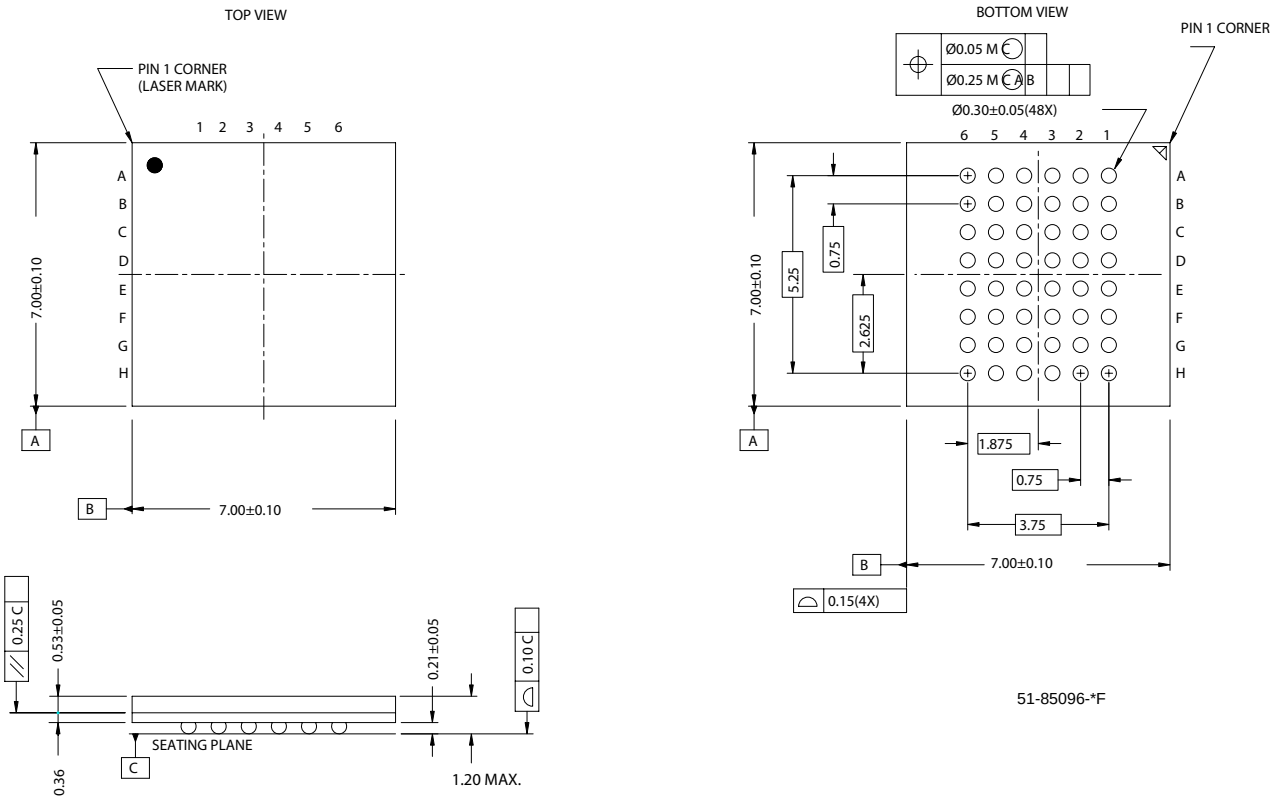
Ordering Information

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

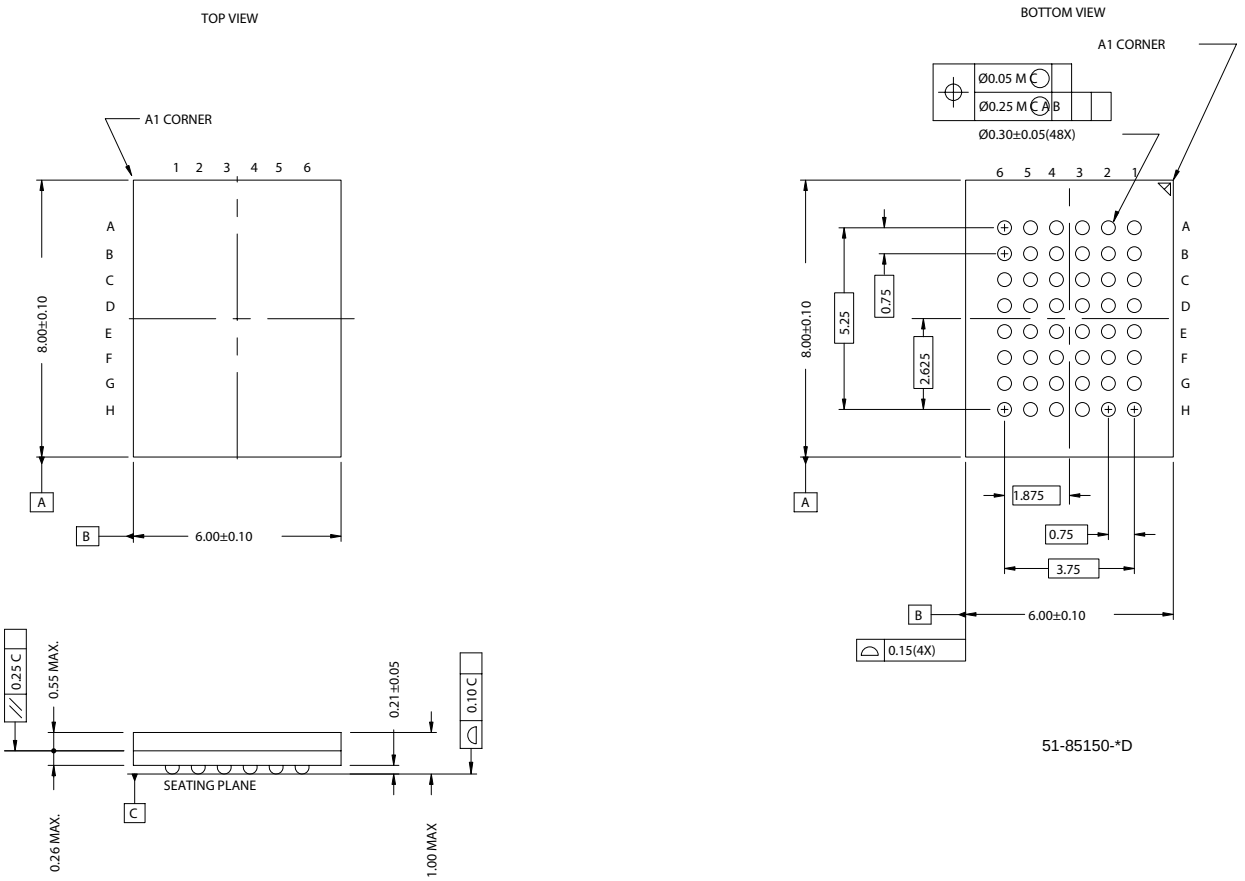
Package Diagrams

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)



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Document History Page

Document Title: CY62137CV30/33 MoBL® and CY62137CV MoBL® 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_{AA} = 55 ns, improved t_{PWE} min. from 45 ns to 40 ns For T_{AA} = 70 ns, improved t_{PWE} min. from 50 ns to 45 ns For T_{AA} = 70 ns, improved t_{LZWE} min. from 5 ns to 10 ns
*D	118761	09/23/02	MGN	Improved Typ. I_{CC} spec to 7 mA (for 55 ns) and 5.5 mA (for 70 ns) Improved Max I_{CC} spec to 15 mA (for 55 ns) and 12 mA (for 70 ns) For T_{AA} = 55 ns, improved t_{LZWE} min. from 5 ns to 10 ns Changed upper spec. for Supply Voltage to Ground Potential to $V_{CC(max)}$ + 0.5V Changed upper spec. for DC Voltage Applied to Outputs in High-Z State and DC Input Voltage to V_{CC} + 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