

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]

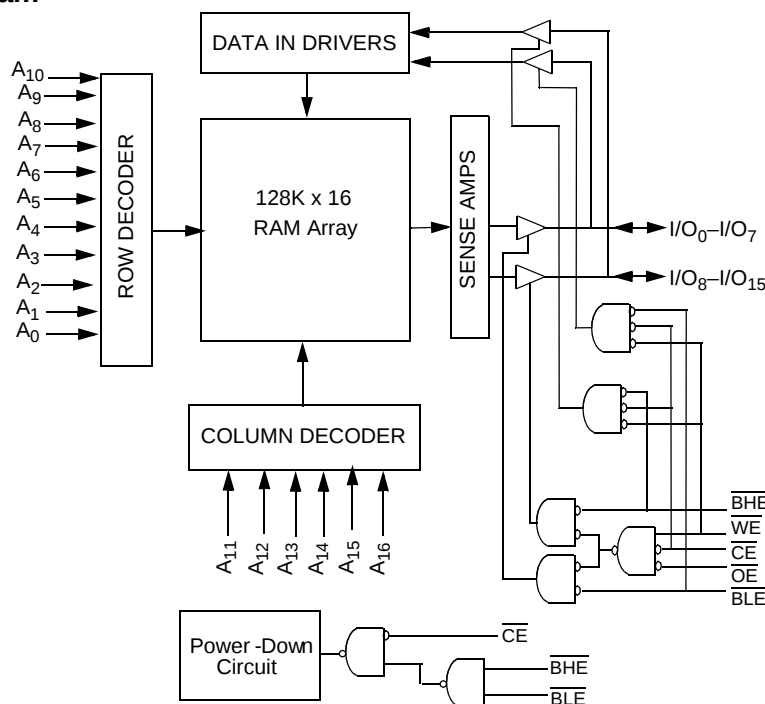
The CY62137CV30/33 and CY62137CV are high-performance CMOS static RAMs organized as 128K words by 16 bits. These devices feature advanced circuit design to provide

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 (CE HIGH or both BLE and BHE are HIGH). The input/output pins (I/O₀ through I/O₁₅) are placed in a high-impedance state when: deselected (CE HIGH), outputs are disabled (OE HIGH), both Byte High Enable and Byte Low Enable are disabled (BHE, BLE HIGH), or during a write operation (CE LOW, and WE LOW).

Writing to the device is accomplished by taking Chip Enable ($\overline{CE}$) and Write Enable (WE) inputs LOW. If Byte Low Enable (BLE) is LOW, then data from I/O pins (I/O₀ through I/O₇), is written into the location specified on the address pins (A₀ through A₁₆). If Byte High Enable (BHE) is LOW, then data from I/O pins (I/O₈ through I/O₁₅) is written into the location specified on the address pins (A₀ through A₁₆).

Reading from the device is accomplished by taking Chip Enable ($\overline{CE}$) and Output Enable ($\overline{OE}$) LOW while forcing the Write Enable (WE) HIGH. If Byte Low Enable (BLE) is LOW, then data from the memory location specified by the address pins will appear on I/O₀ to I/O₇. If Byte High Enable (BHE) is LOW, then data from memory will appear on I/O₈ to I/O₁₅. 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>.

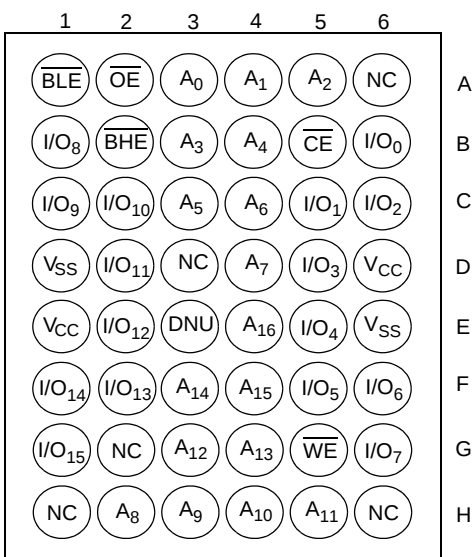
Product Portfolio

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:

- 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.
- NC pins are not connected to the die.
- 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	$I_{OH} = -1.0 \text{ mA}$ $V_{CC} = 2.7V$	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		$V_{CC} + 0.3$	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	$GND \leq V_I \leq V_{CC}$	Ind'l	-1	+1	-1		+1	μA
			Auto			-2		+2	
I_{OZ}	Output Leakage Current	$GND \leq V_O \leq V_{CC}$, 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	mA
			Auto					5.5	
		$f = 1 \text{ MHz}$	Ind'l		1.5	3		1.5	
			Auto					1.5	
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), $f=0$ ($\overline{OE}$, $\overline{WE}$, $\overline{BHE}$ and $\overline{BLE}$)	Ind'l		2	10		2	μA
			Auto					2	
I_{SB2}	Automatic CE Power-down Current — CMOS Inputs	$\overline{CE} \geq V_{CC} - 0.2V$ $V_{IN} \geq V_{CC} - 0.2V$ or $V_{IN} \leq 0.2V$ $f = 0$, $V_{CC} = 3.3V$	Ind'l		2	10		2	μA
			Auto					2	

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			CY62137CV-70			Unit
			Min.	Typ. ^[2]	Max.	Min.	Typ. ^[2]	Max.	
V _{OH}	Output HIGH Voltage	I _{OH} = -1.0 mA V _{CC} = 3.0V V _{CC} = 2.7V	2.4			2.4			V
						2.4			V
V _{OL}	Output LOW Voltage	I _{OL} = 2.1 mA V _{CC} = 3.0V V _{CC} = 2.7V			0.4			0.4	V
								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	$\overline{CE} \geq V_{CC} - 0.2V$ $V_{IN} \geq V_{CC} - 0.2V$ 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 _{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} = 3.6V	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

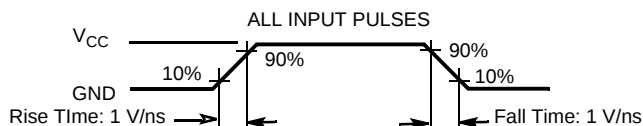
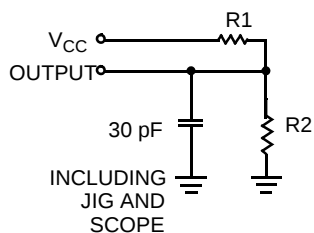
Thermal Resistance^[6]

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

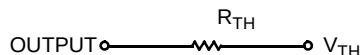
Note:

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

AC Test Loads and Waveforms



Equivalent to: THEVENIN EQUIVALENT

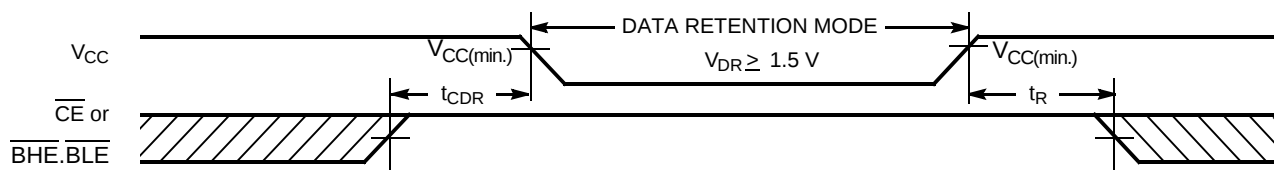


Parameters	3.0V	3.3V	Unit
R1	1105	1216	Ω
R2	1550	1374	Ω
R_{TH}	645	645	Ω
V_{TH}	1.75	1.75	V

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	$V_{CC} = 1.5V$ $CE \geq V_{CC} - 0.2V$, $V_{IN} \geq V_{CC} - 0.2V$ or $V_{IN} \leq 0.2V$		1		μA
		LL	Ind'l		6	
		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:

- Full-device AC operation requires linear V_{CC} ramp from V_{DR} to $V_{CC(min.)} > 100 \mu s$ or stable at $V_{CC(min.)} > 100 \mu s$.
- $\overline{BHE.BLE}$ 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]

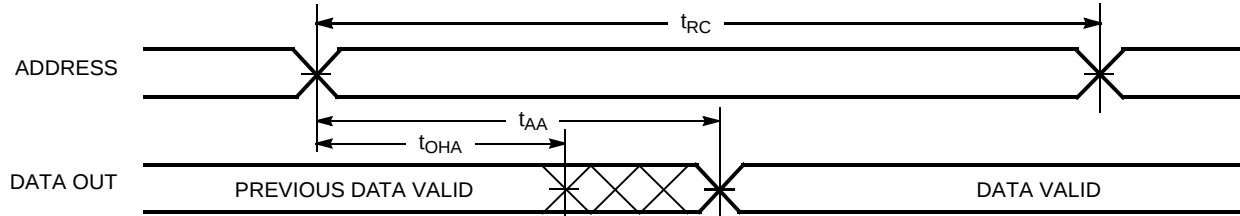
Parameter	Description	55 ns		70 ns		Unit
		Min.	Max.	Min.	Max.	
Read Cycle						
t _{RC}	Read Cycle Time	55		70		ns
t _{AA}	Address to Data Valid		55		70	ns
t _{OHA}	Data Hold from Address Change	10		10		ns
t _{ACE}	$\overline{CE}$ LOW to Data Valid		55		70	ns
t _{DOE}	$\overline{OE}$ LOW to Data Valid		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:

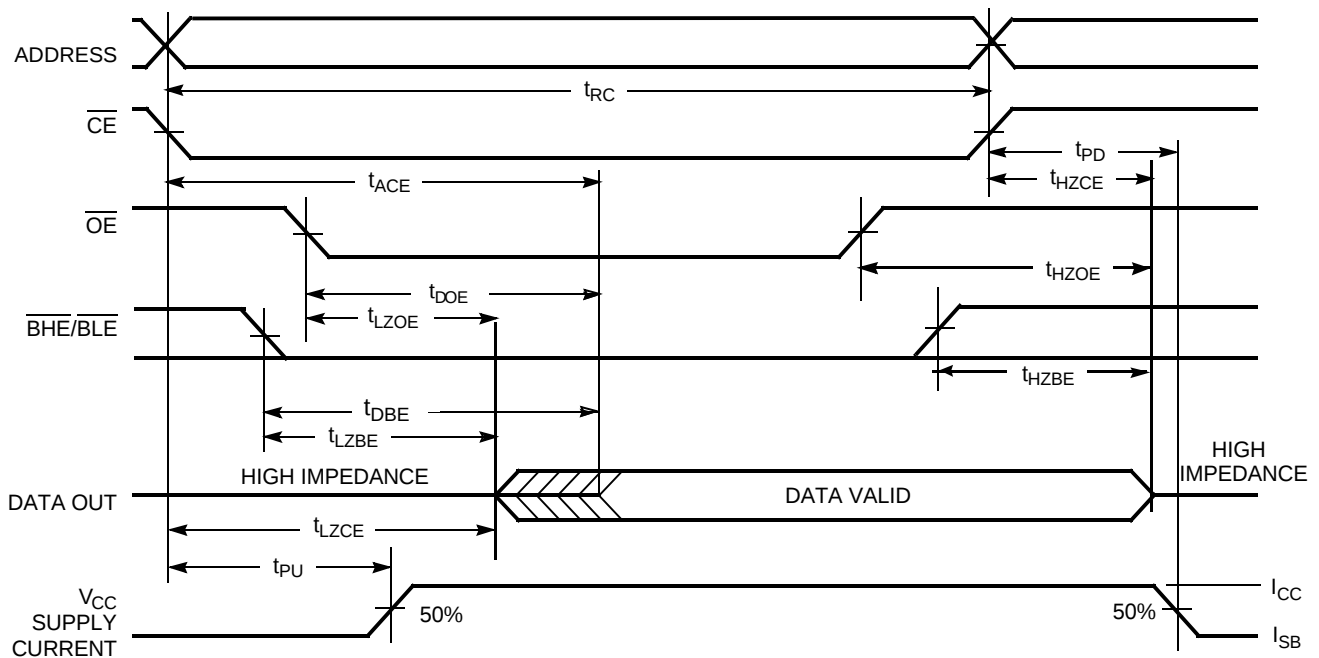
- Test conditions assume signal transition time of 5 ns or less, timing reference levels of $V_{CC(typ.)}/2$, input pulse levels of 0 to $V_{CC(typ.)}$, and output loading of the specified I_{OL}/I_{OH} and 30 pF load capacitance.
- At any given temperature and voltage condition, t_{HZCE} is less than 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.
- If both byte enables are toggled together this value is 10 ns.
- t_{HZOE} , t_{HZCE} , t_{HZBE} , and t_{HZWE} transitions are measured when the outputs enter a high impedance state.
- 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 ($\overline{\text{OE}}$ Controlled)^[15, 16]



Notes:

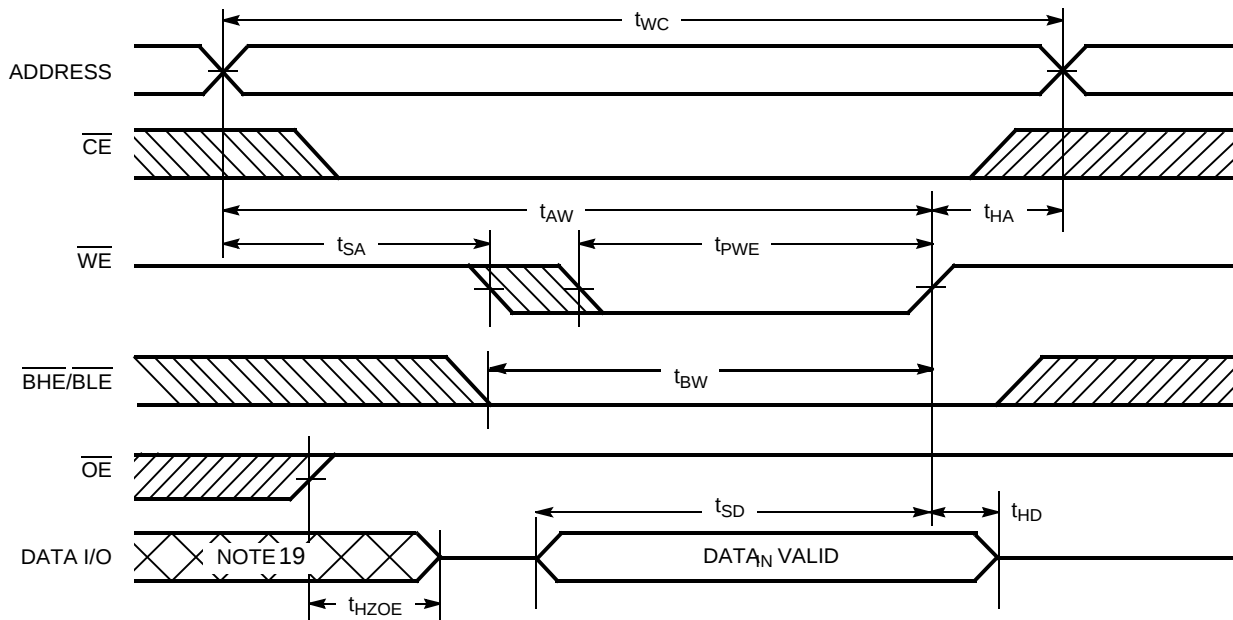
14. Device is continuously selected. $\overline{\text{OE}}$, $\overline{\text{CE}} = V_{\text{IL}}$, $\overline{\text{BHE}}$, $\overline{\text{BLE}} = V_{\text{IL}}$.

15. $\overline{\text{WE}}$ is HIGH for read cycle.

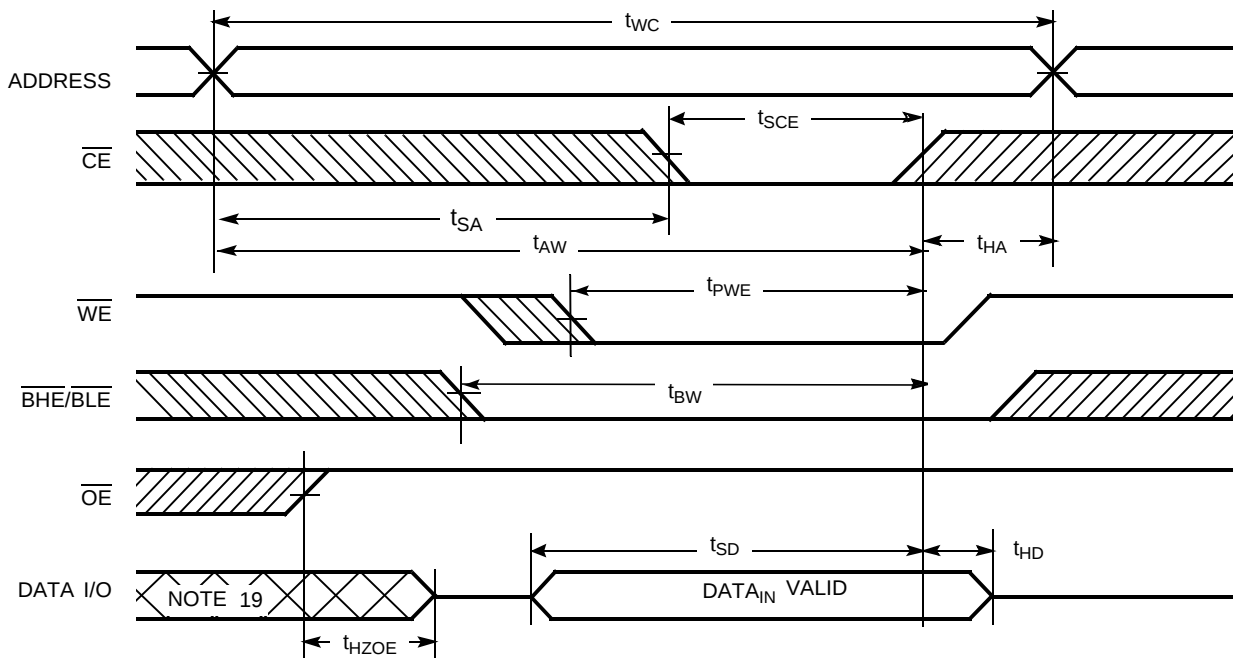
16. Address valid prior to or coincident with $\overline{\text{CE}}$, $\overline{\text{BHE}}$, $\overline{\text{BLE}}$ transition LOW.

Switching Waveforms (continued)

Write Cycle No. 1 ($\overline{\text{WE}}$ Controlled)^[13, 17, 18]



Write Cycle No. 2 ($\overline{\text{CE}}$ Controlled)^[13, 17, 18]

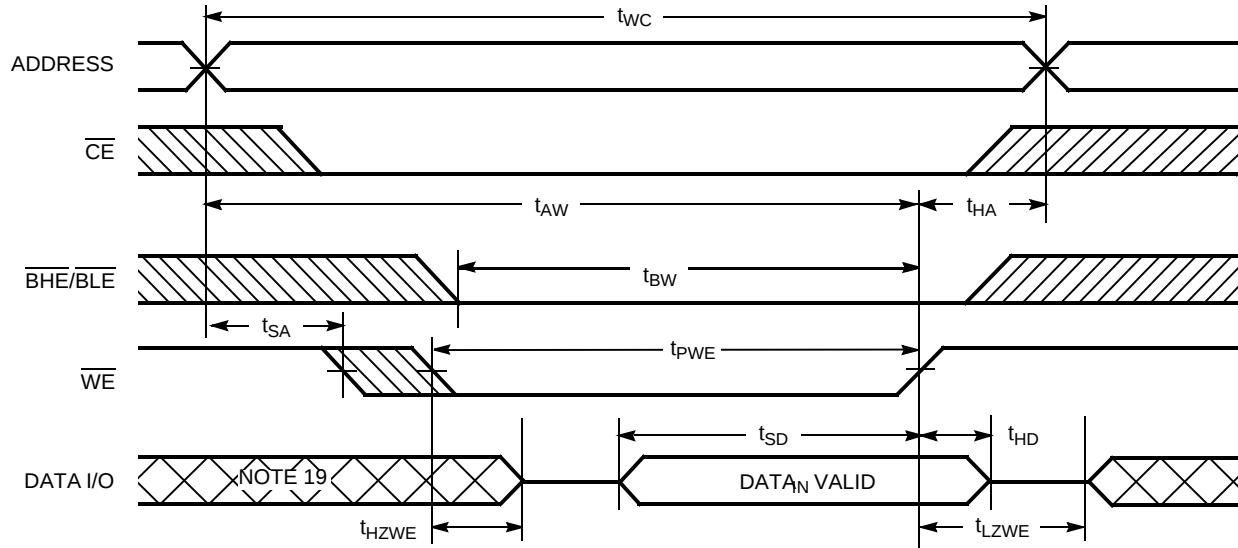


Notes:

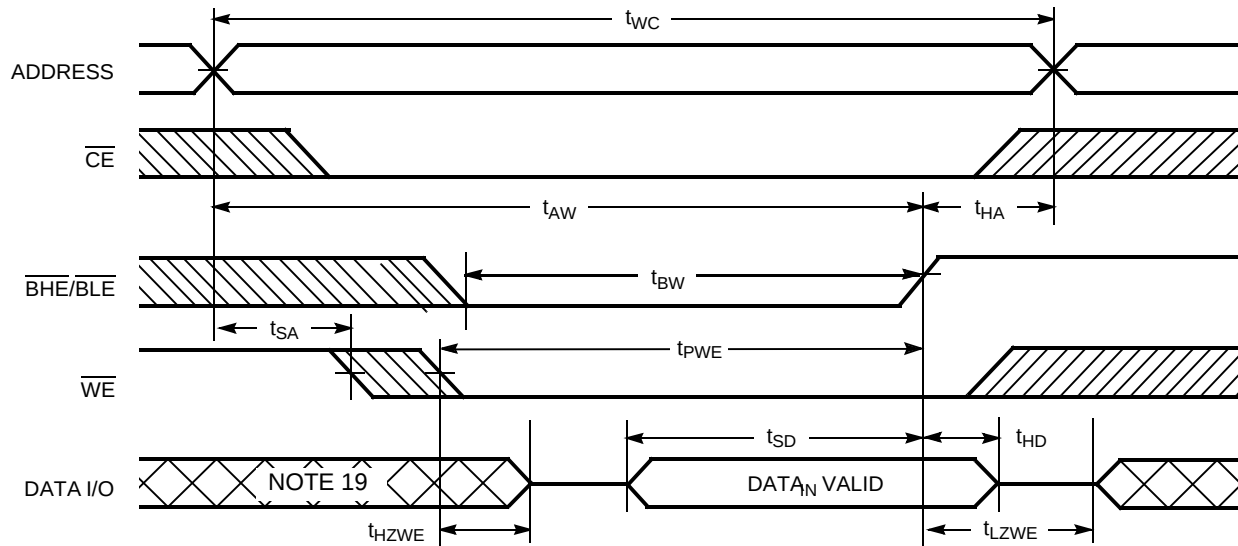
17. Data I/O is high-impedance if $\overline{\text{OE}} = V_{\text{IH}}$.
18. If $\overline{\text{CE}}$ goes HIGH simultaneously with $\overline{\text{WE}}$ HIGH, the output remains in a high-impedance state.
19. During this period, the I/Os are in output state and input signals should not be applied.

Switching Waveforms (continued)

Write Cycle No. 3 ($\overline{\text{WE}}$ Controlled, $\overline{\text{OE}}$ LOW)^[18]



Write Cycle No. 4 (BHE/BL $\overline{\text{E}}$ Controlled, $\overline{\text{OE}}$ LOW)^[18]



Truth Table

$\overline{\text{CE}}$	$\overline{\text{WE}}$	$\overline{\text{OE}}$	$\overline{\text{BHE}}$	$\overline{\text{BLE}}$	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})

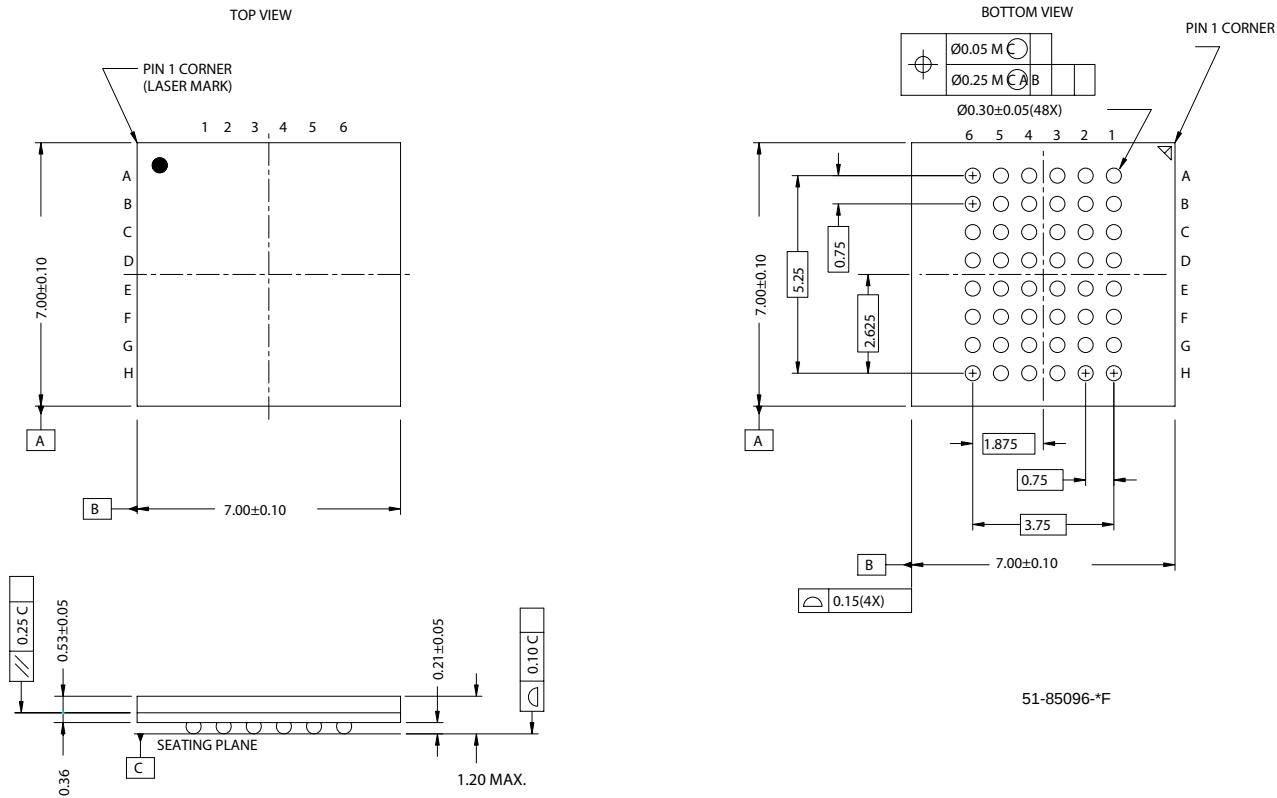
Ordering Information

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

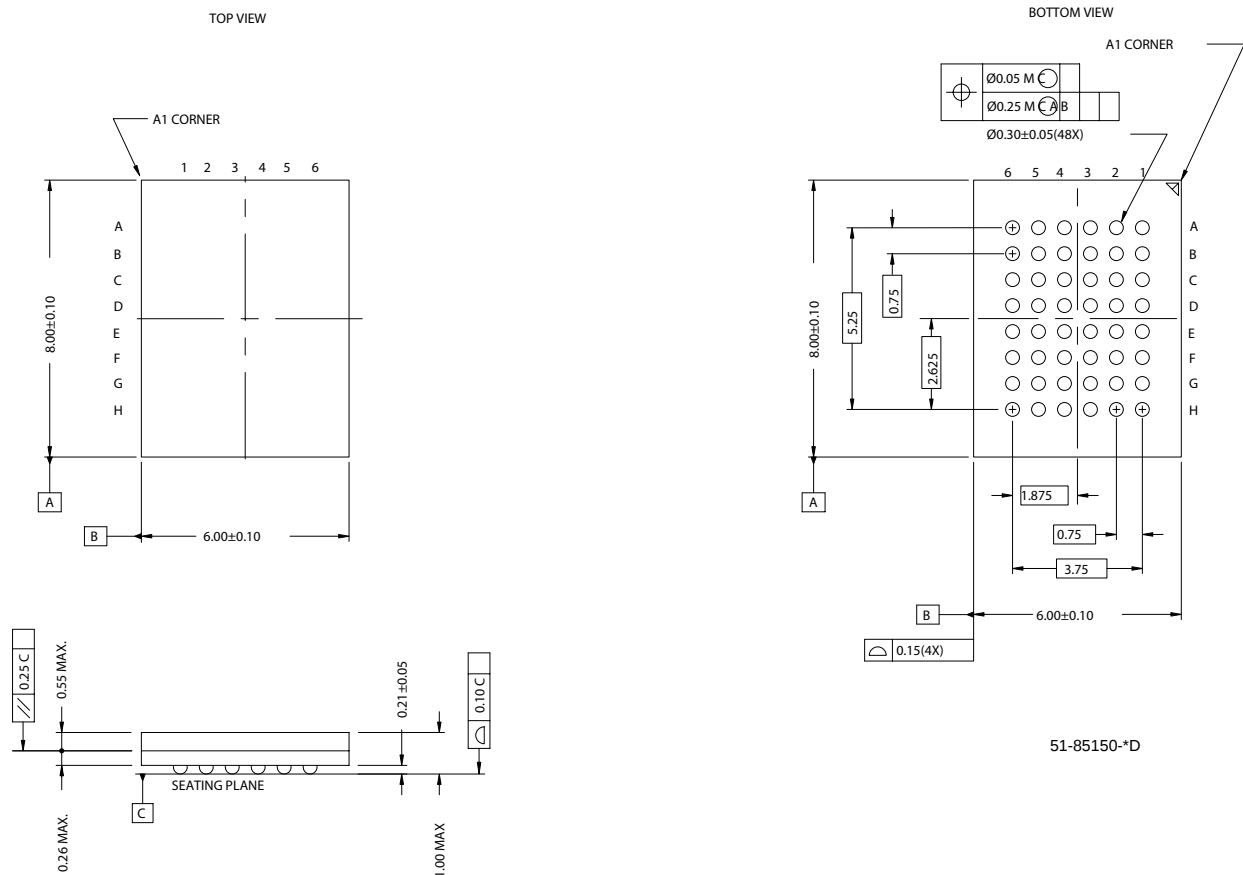
Package Diagrams

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