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CY62147DV30

4-Mbit (256K x 16) Static RAM

Features

- **Temperature Ranges**
  - **Industrial**: **–40°C to +85°C**
  - **Automotive-A: –40°C to +85°C**
  - **Automotive-E: –40°C to +125°C**
- **Very high speed: 45 ns**
- **Wide voltage range: 2.20V–3.60V**
- **Pin-compatible with CY62147CV25, CY62147CV30, and CY62147CV33**
- **Ultra-low active power**
  - **Typical active current: 1.5 mA @ f = 1 MHz**
  - **Typical active current: 8 mA @ f = f_{max}**
- **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 VFBGA and non Pb-free 44-pin TSOPII**
- **Byte power-down feature**

Functional Description[1]

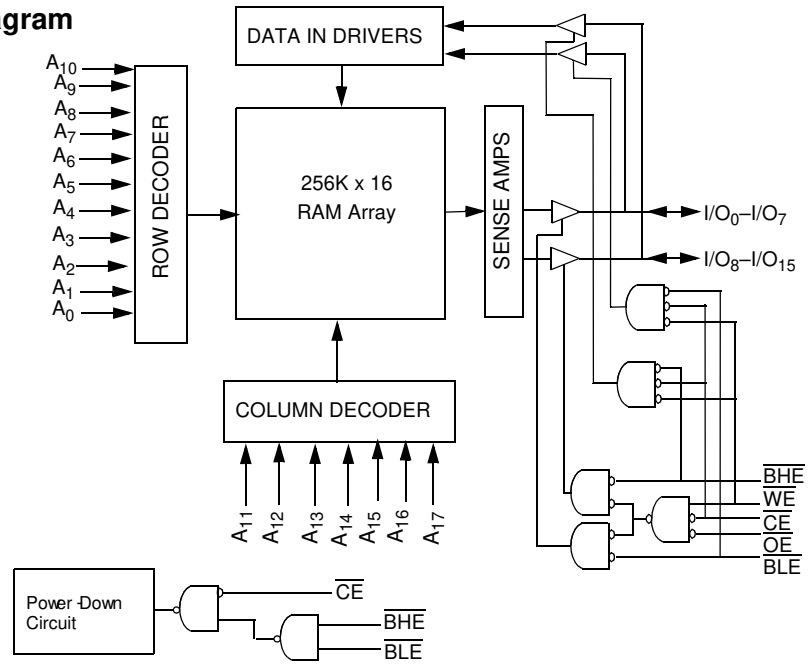
The CY62147DV30 is a high-performance CMOS static RAM organized as 256K words by 16 bits. This device features advanced circuit design to provide ultra-low active current. This is ideal for providing More Battery Life™ (MoBL®) in portable applications such as cellular telephones. The device also has an automatic power-down feature that significantly reduces power consumption. 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_{17}). 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_{17}).

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.

The CY62147DV30 is available in a 48-ball VFBGA, 44 Pin TSOPII packages.

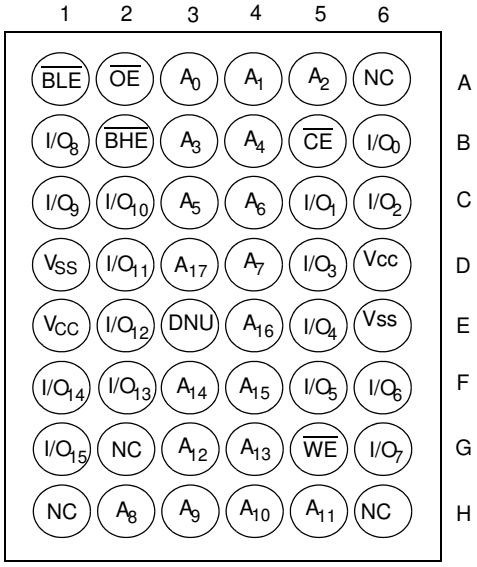
Logic Block Diagram



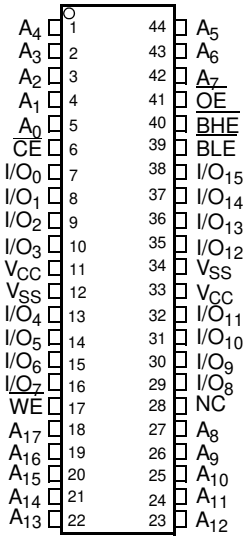
Note:
1. For best practice recommendations, please refer to the Cypress application note "System Design Guidelines" on http://www.cypress.com.

Pin Configuration[2, 3, 4]

VFBGA (Top View)



44 TSOP II (Top View)



Product Portfolio

Product	Range	V_{CC} Range (V)			Speed (ns)	Power Dissipation					
						Operating I_{CC} (mA)				Standby I_{SB2} (μA)	
						f = 1MHz		f = f_{max}			
		Min.	Typ.[5]	Max.		Typ.[5]	Max.	Typ.[5]	Max.	Typ.[5]	Max.
CY62147DV30LL	Industrial	2.2V	3.0	3.6	45	1.5	3	10	20	2	8
CY62147DV30LL	Industrial	2.2V	3.0	3.6	55	1.5	3	8	15	2	8
CY62147DV30L	Auto-E										25
CY62147DV30LL	Industrial	2.2V	3.0	3.6	70	1.5	3	8	15	2	8
CY62147DV30LL	Auto-A										8

Notes:
2. NC pins are not internally connected on the die.
3. DNU pins have to be left floating or tied to V_{SS} to ensure proper application.
4. Pins H1, G2, and H6 in the VFBGA package are address expansion pins for 8 Mb, 16 Mb, and 32 Mb, respectively.
5. Typical values are included for reference only and are not guaranteed or tested. Typical values are measured at $V_{CC} = V_{CC(typ.)}$, $T_A = 25°C$.

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 .....–0.3V to + $V_{CC(MAX)}$ + 0.3V

DC Voltage Applied to Outputs in High-Z State[6,7].....–0.3V to $V_{CC(MAX)}$ + 0.3V

DC Input Voltage[6,7] ..... –0.3V to $V_{CC(MAX)}$ + 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][9]	V_{CC}
CY62147DV30L	Automotive-E	–40°C to +125°C	2.20V to 3.60V
CY62147DV30LL	Industrial	–40°C to +85°C	
	Automotive-A	–40°C to +85°C	

Electrical Characteristics (Over the Operating Range)

Parameter	Description	Test Conditions			–45			–55/–70			Unit
					Min.	Typ.[5]	Max.	Min.	Typ.[5]	Max.	
V_{OH}	Output HIGH Voltage	I_{OH} = –0.1 mA	V_{CC} = 2.20V		2.0			2.0			V
		I_{OH} = –1.0 mA	V_{CC} = 2.70V		2.4			2.4			V
V_{OL}	Output LOW Voltage	I_{OL} = 0.1 mA	V_{CC} = 2.20V				0.4			0.4	V
		I_{OL} = 2.1 mA	V_{CC} = 2.70V				0.4			0.4	V
V_{IH}	Input HIGH Voltage	V_{CC} = 2.2V to 2.7V			1.8		V_{CC} + 0.3V	1.8		V_{CC} + 0.3V	V
		V_{CC}= 2.7V to 3.6V			2.2		V_{CC} + 0.3V	2.2		V_{CC} + 0.3V	V
V_{IL}	Input LOW Voltage	V_{CC} = 2.2V to 2.7V			–0.3		0.6	–0.3		0.6	V
		V_{CC}= 2.7V to 3.6V			–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-A[9]					–1		+1	µA
			Auto-E[9]					–4		+4	µA
I_{OZ}	Output Leakage Current	GND ≤ V_O ≤ V_{CC}, Output Disabled	Ind'l		–1		+1	–1		+1	µA
			Auto-A[9]					–1		+1	µA
			Auto-E[9]					–4		+4	µA
I_{CC}	V_{CC} Operating Supply Current	f = f_{MAX} = 1/t_{RC}	V_{CC} = V_{CCmax}, I_{OUT} = 0 mA CMOS levels			10	20		8	15	mA
		f = 1 MHz				1.5	3		1.5	3	mA
I_{SB1}	Automatic $\overline{CE}$ Power-Down Current — CMOS Inputs	$\overline{CE}$ ≥ V_{CC}–0.2V, V_{IN}≥V_{CC}–0.2V, V_{IN}≤0.2V) f = f_{MAX} (Address and Data Only), f = 0 ($\overline{OE}$, $\overline{WE}$, $\overline{BHE}$ and $\overline{BLE}$), V_{CC} = 3.60V	Ind'l	LL			8			8	µA
			Auto-A[9]	LL						8	
			Auto-E[9]	L						25	
I_{SB2}	Automatic $\overline{CE}$ 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} = 3.60V	Ind'l	LL			8			8	µA
			Auto-A[9]	LL						8	
			Auto-E[9]	L						25	

Notes:
6. $V_{IL(min.)}$ = –2.0V for pulse durations less than 20 ns.
7. $V_{IH(max.)}$ = V_{CC} + 0.75V for pulse durations less than 20 ns.
8. Full device AC operation assumes a 100-µs ramp time from 0 to V_{CC}(min) and 200-µs wait time after V_{CC} stabilization.
9. Auto-A is available in –70 and Auto-E is available in –55.

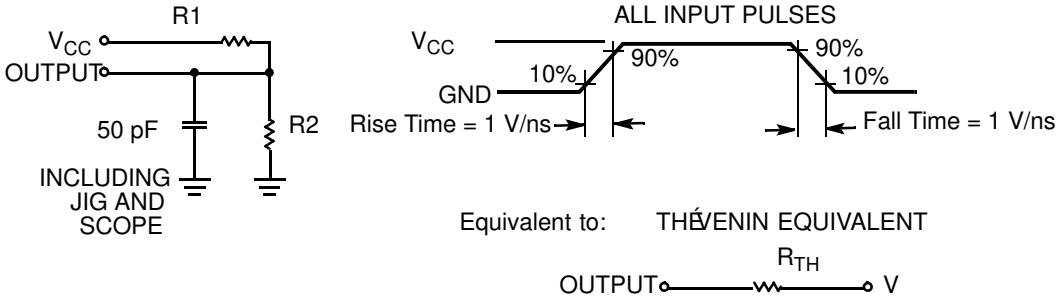
Capacitance (for all packages)[10]

Parameter	Description	Test Conditions	Max.	Unit
C_{IN}	Input Capacitance	T_A = 25°C, f = 1 MHz, V_{CC} = $V_{CC(typ)}$	10	pF
C_{OUT}	Output Capacitance		10	pF

Thermal Resistance[10]

Parameter	Description	Test Conditions	VFBGA	TSOP II	Unit
Θ_{JA}	Thermal Resistance (Junction to Ambient)	Still Air, soldered on a 3 × 4.5 inch, four-layer printed circuit board	72	75.13	°C/W
Θ_{JC}	Thermal Resistance (Junction to Case)		8.86	8.95	°C/W

AC Test Loads and Waveforms[10]

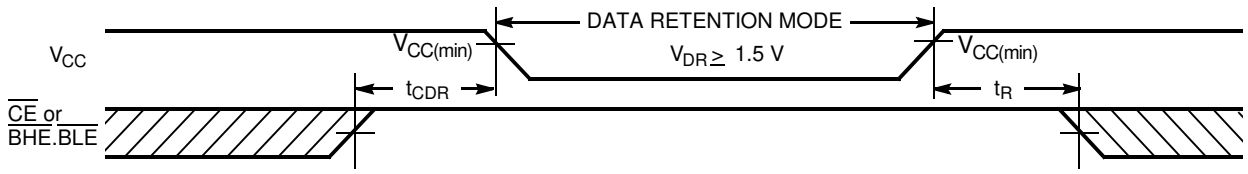


Parameters	2.50V	3.0V	Unit
R1	16667	1103	Ω
R2	15385	1554	Ω
R_{TH}	8000	645	Ω
V_{TH}	1.20	1.75	V

Data Retention Characteristics (Over the Operating Range)

Parameter	Description	Conditions		Min.	Typ.[5]	Max.	Unit
V_{DR}	V_{CC} for Data Retention			1.5			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 $V_{IN} \leq 0.2V$	L (Auto-E)			15	µA
			LL (Ind'l/Auto-A)			6	
t_{CDR}[10]	Chip Deselect to Data Retention Time			0			ns
t_R[12]	Operation Recovery Time			t_{RC}			ns

Data Retention Waveform[13]



Notes:
10. Tested initially and after any design or process changes that may affect these parameters.
11. Test condition for the 45-ns part is a load capacitance of 30 pF.
12. Full device operation requires linear V_{CC} ramp from V_{DR} to $V_{CC(min.)} \geq 100$ µs or stable at $V_{CC(min.)} \geq 100$ µs.
13. $\overline{BHE}.\overline{BLE}$ 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[14]

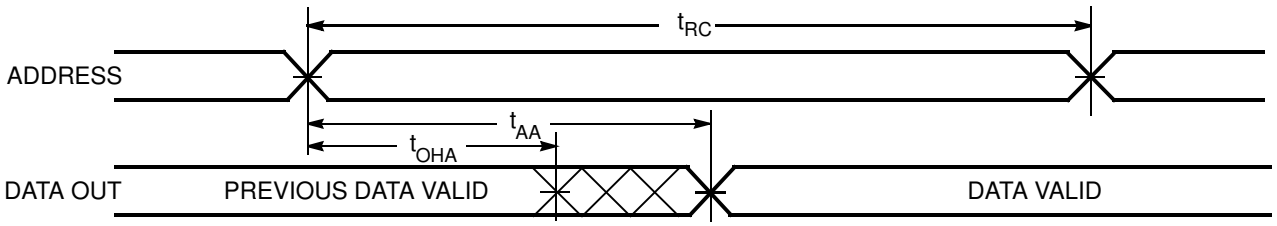
Parameter	Description	45 ns[11]		55 ns		70 ns		Unit
		Min.	Max.	Min.	Max.	Min.	Max.	
Read Cycle								
t_{RC}	Read Cycle Time	45		55		70		ns
t_{AA}	Address to Data Valid		45		55		70	ns
t_{OHA}	Data Hold from Address Change	10		10		10		ns
t_{ACE}	$\overline{CE}$ LOW to Data Valid		45		55		70	ns
t_{DOE}	$\overline{OE}$ LOW to Data Valid		25		25		35	ns
t_{LZOE}	$\overline{OE}$ LOW to LOW Z[15]	5		5		5		ns
t_{HZOE}	$\overline{OE}$ HIGH to High Z[15, 16]		15		20		25	ns
t_{LZCE}	$\overline{CE}$ LOW to Low Z[15]	10		10		10		ns
t_{HZCE}	$\overline{CE}$ HIGH to High Z[15, 16]		20		20		25	ns
t_{PU}	$\overline{CE}$ LOW to Power-Up	0		0		0		ns
t_{PD}	$\overline{CE}$ HIGH to Power-Down		45		55		70	ns
t_{DBE}	$\overline{BLE}$/$\overline{BHE}$ LOW to Data Valid		45		55		70	ns
t_{LZBE}	$\overline{BLE}$/$\overline{BHE}$ LOW to Low Z[15]	10		10		10		ns
t_{HZBE}	$\overline{BLE}$/$\overline{BHE}$ HIGH to HIGH Z[15, 16]		15		20		25	ns
Write Cycle[17]								
t_{WC}	Write Cycle Time	45		55		70		ns
t_{SCE}	$\overline{CE}$ LOW to Write End	40		40		60		ns
t_{AW}	Address Set-up to Write End	40		40		60		ns
t_{HA}	Address Hold from Write End	0		0		0		ns
t_{SA}	Address Set-up to Write Start	0		0		0		ns
t_{PWE}	$\overline{WE}$ Pulse Width	35		40		45		ns
t_{BW}	$\overline{BLE}$/$\overline{BHE}$ LOW to Write End	40		40		60		ns
t_{SD}	Data Set-up to Write End	25		25		30		ns
t_{HD}	Data Hold from Write End	0		0		0		ns
t_{HZWE}	$\overline{WE}$ LOW to High-Z[15, 16]		15		20		25	ns
t_{LZWE}	$\overline{WE}$ HIGH to Low-Z[15]	10		10		10		ns

Notes:

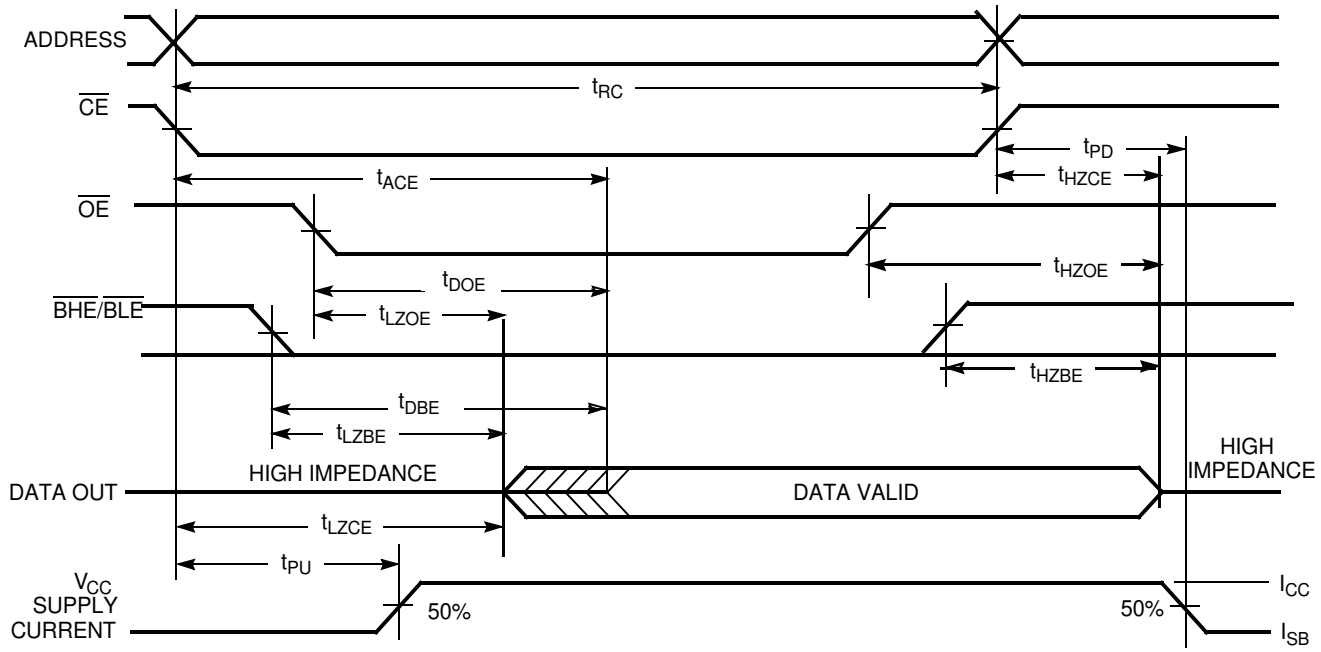
14. Test conditions for all parameters other than tri-state parameters assume signal transition time of 3 ns (1 V/ns) or less, timing reference levels of $V_{CC(typ)}/2$, input pulse levels of 0 to $V_{CC(typ.)}$, and output loading of the specified I_{OL}/I_{OH} as shown in the “AC Test Loads and Waveforms” section.
15. 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.
16. t_{HZOE}, t_{HZCE}, t_{HZBE}, and t_{HZWE} transitions are measured when the outputs enter a high impedence state.
17. 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 1 (Address Transition Controlled)[18, 19]



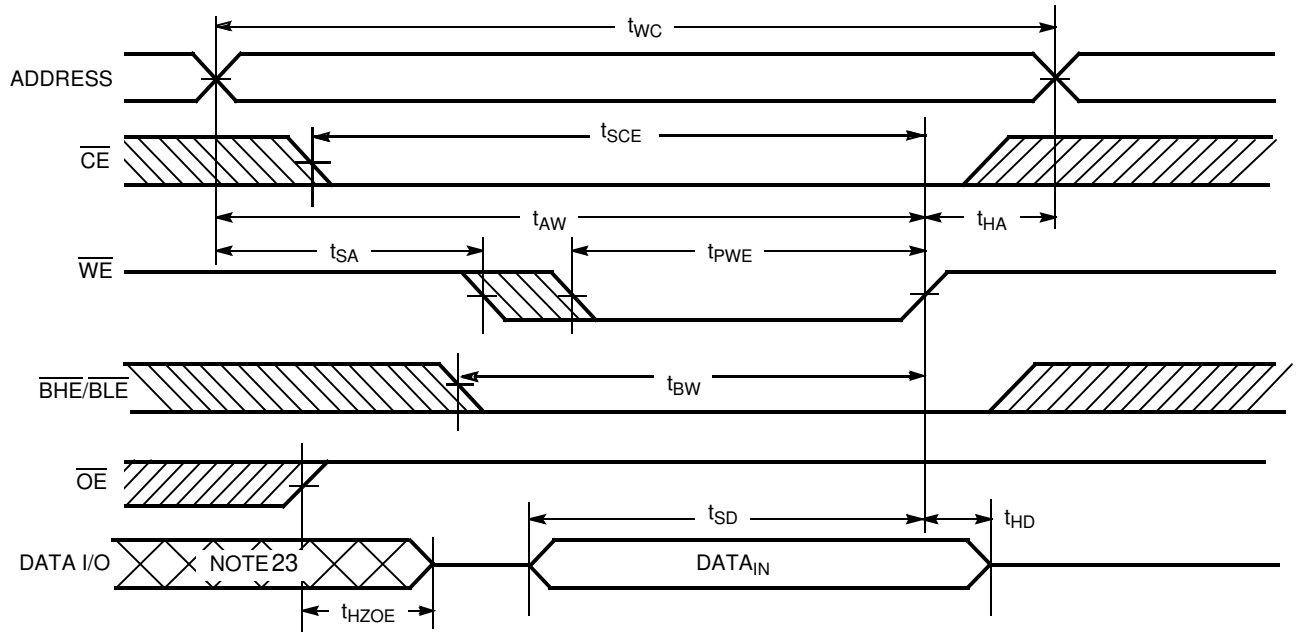
Read Cycle No. 2 (OE Controlled)[19, 20]



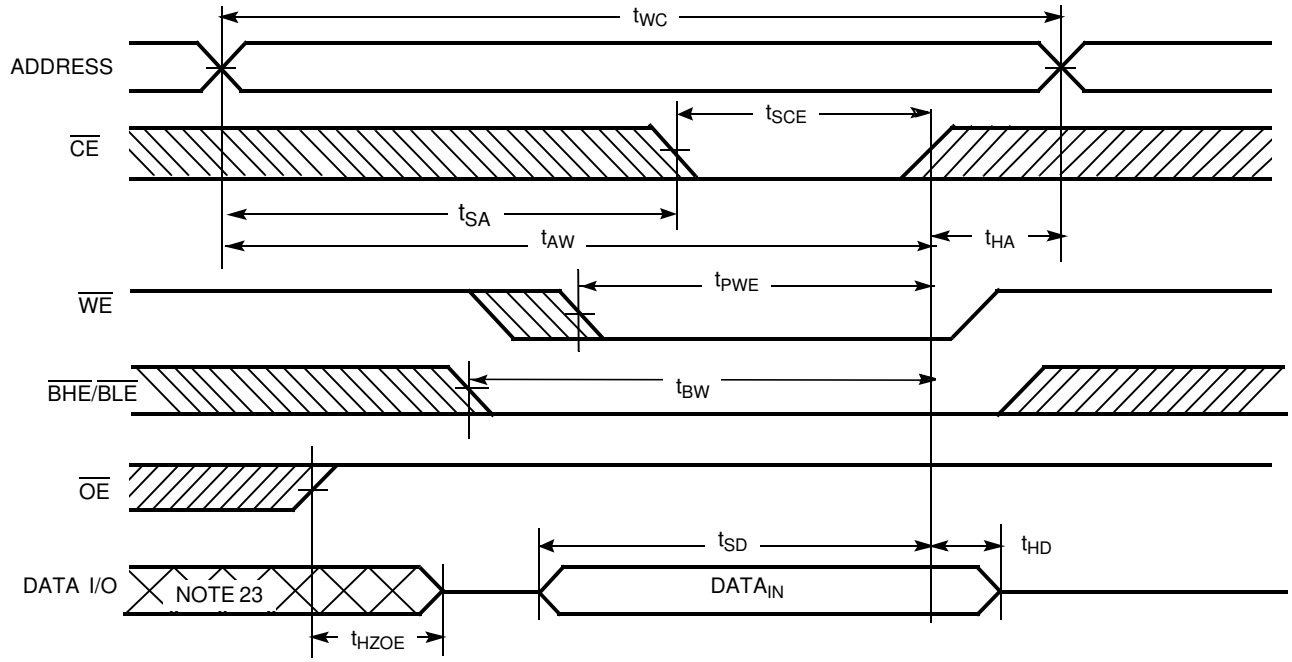
Notes:
18. The device is continuously selected. OE, CE = V_{IL}, BHE and/or BLE = V_{IL}.
19. WE is HIGH for read cycle.
20. Address valid prior to or coincident with CE and BHE, BLE transition LOW.

Switching Waveforms (continued)

Write Cycle No. 1 ($\overline{WE}$ Controlled)[17, 21, 22]



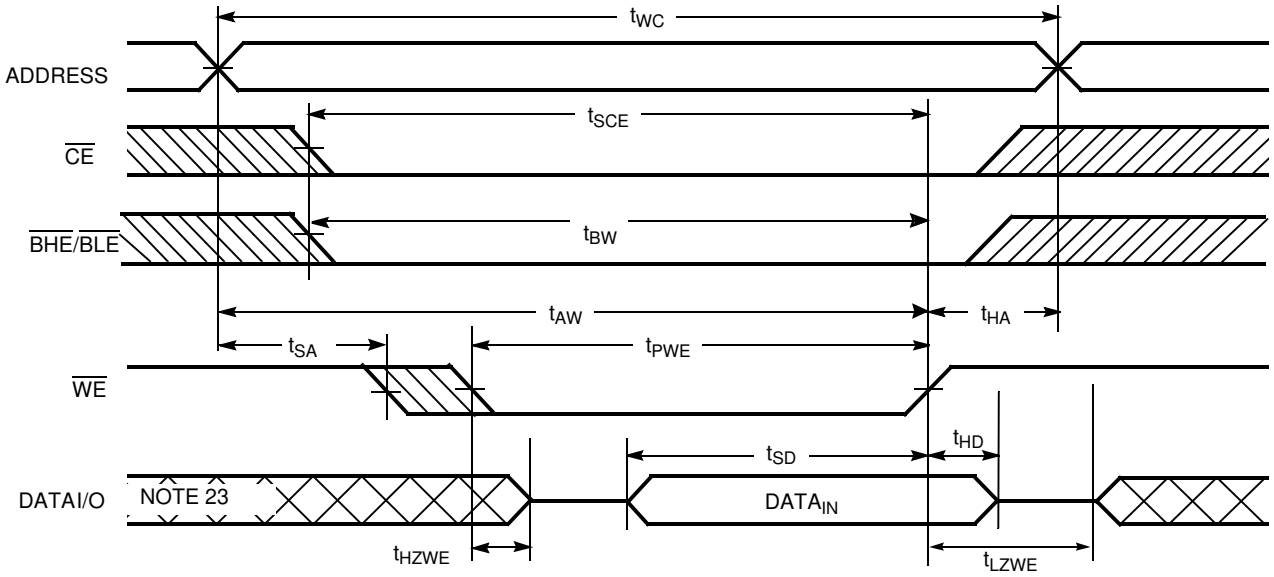
Write Cycle No. 2 ($\overline{CE}$ Controlled)[17, 21, 22]



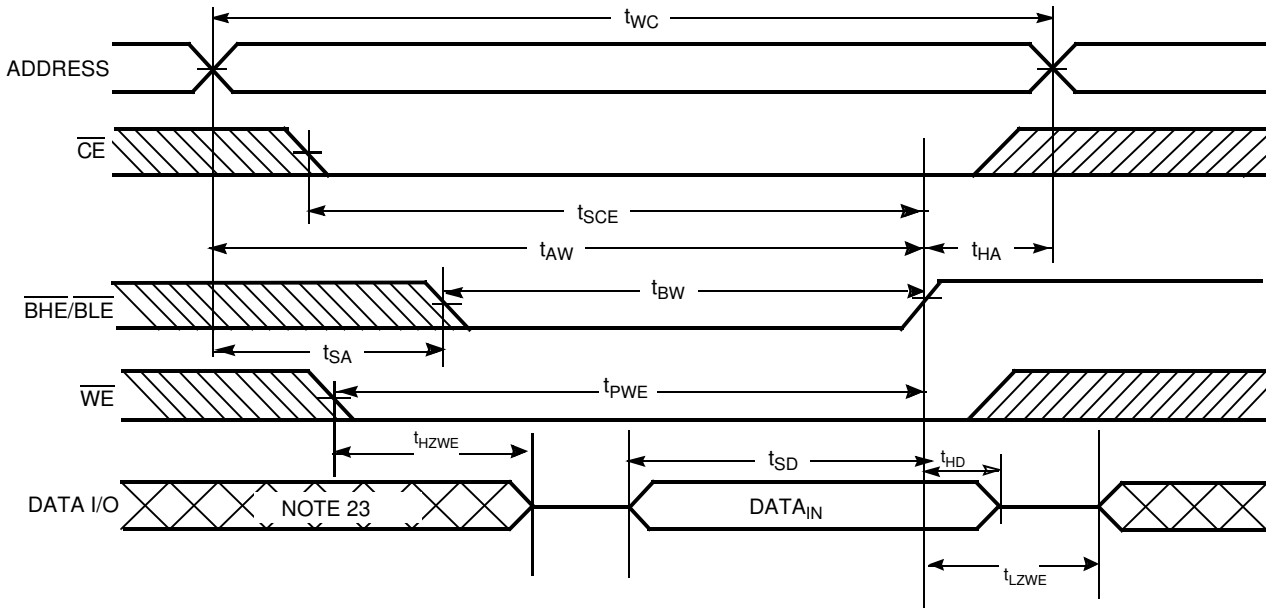
Notes:
21. Data I/O is high impedance if $\overline{OE}$ = V_{IH}.
22. If $\overline{CE}$ goes HIGH simultaneously with $\overline{WE}$ = V_{IH}, the output remains in a high-impedance state.
23. During this period, the I/Os are in output state and input signals should not be applied.

Switching Waveforms (continued)

Write Cycle No. 3 (WE Controlled, OE LOW)[22]



Write Cycle No. 4 (BHE/BLE Controlled, OE LOW)[22]



Truth Table

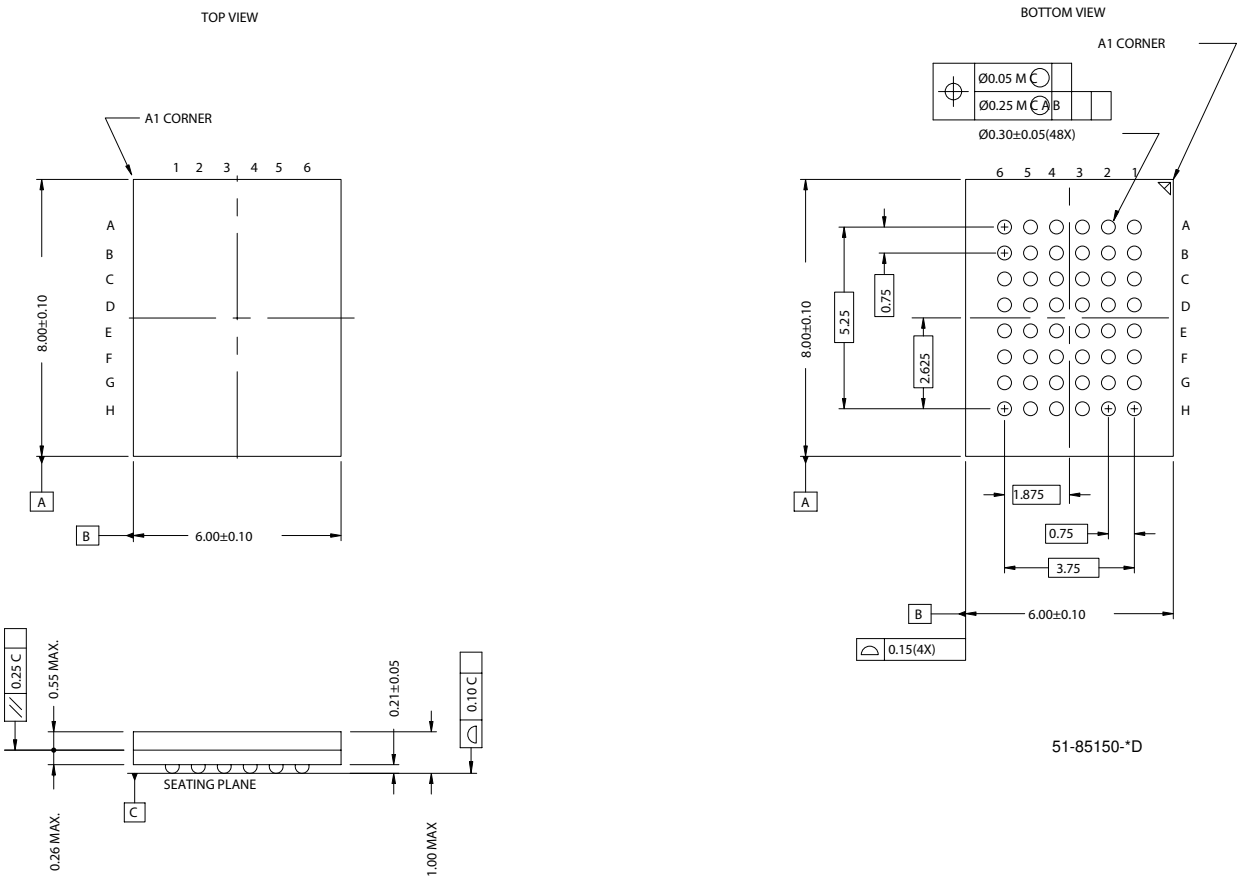
$\overline{CE}$	$\overline{WE}$	$\overline{OE}$	$\overline{BHE}$	$\overline{BLE}$	Inputs/Outputs	Mode	Power
H	X	X	X	X	High Z	Deselect/Power-Down	Standby (I_{SB})
X	X	X	H	H	High Z	Deselect/Power-Down	Standby (I_{SB})
L	H	L	L	L	Data Out (I/O_O–I/O_{15})	Read	Active (I_{CC})
L	H	L	H	L	Data Out (I/O_O–I/O_7);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

Ordering Information

Speed (ns)	Ordering Code	Package Diagram	Package Type	Operating Range
45	CY62147DV30LL-45BVXI	51-85150	48-ball (6 mm × 8mm × 1 mm) VFBGA (Pb-free)	Industrial
	CY62147DV30LL-45ZSXI	51-85087	44-pin TSOP II (Pb-free)	
55	CY62147DV30LL-55BVI	51-85150	48-ball (6 mm × 8mm × 1 mm) VFBGA	Industrial
	CY62147DV30LL-55BVXI		48-ball (6 mm × 8mm × 1 mm) VFBGA (Pb-free)	
	CY62147DV30LL-55ZSXI	51-85087	44-pin TSOP II (Pb-free)	
	CY62147DV30L-55BVXE	51-85150	48-ball (6 mm × 8mm × 1 mm) VFBGA (Pb-free)	Automotive-E
	CY62147DV30L-55ZSXE	51-85087	44-pin TSOP II (Pb-free)	
70	CY62147DV30LL-70BVI	51-85150	48-ball (6 mm × 8mm × 1 mm) VFBGA	Industrial
	CY62147DV30LL-70BVXA		48-ball (6 mm × 8mm × 1 mm) VFBGA (Pb-free)	Automotive-A

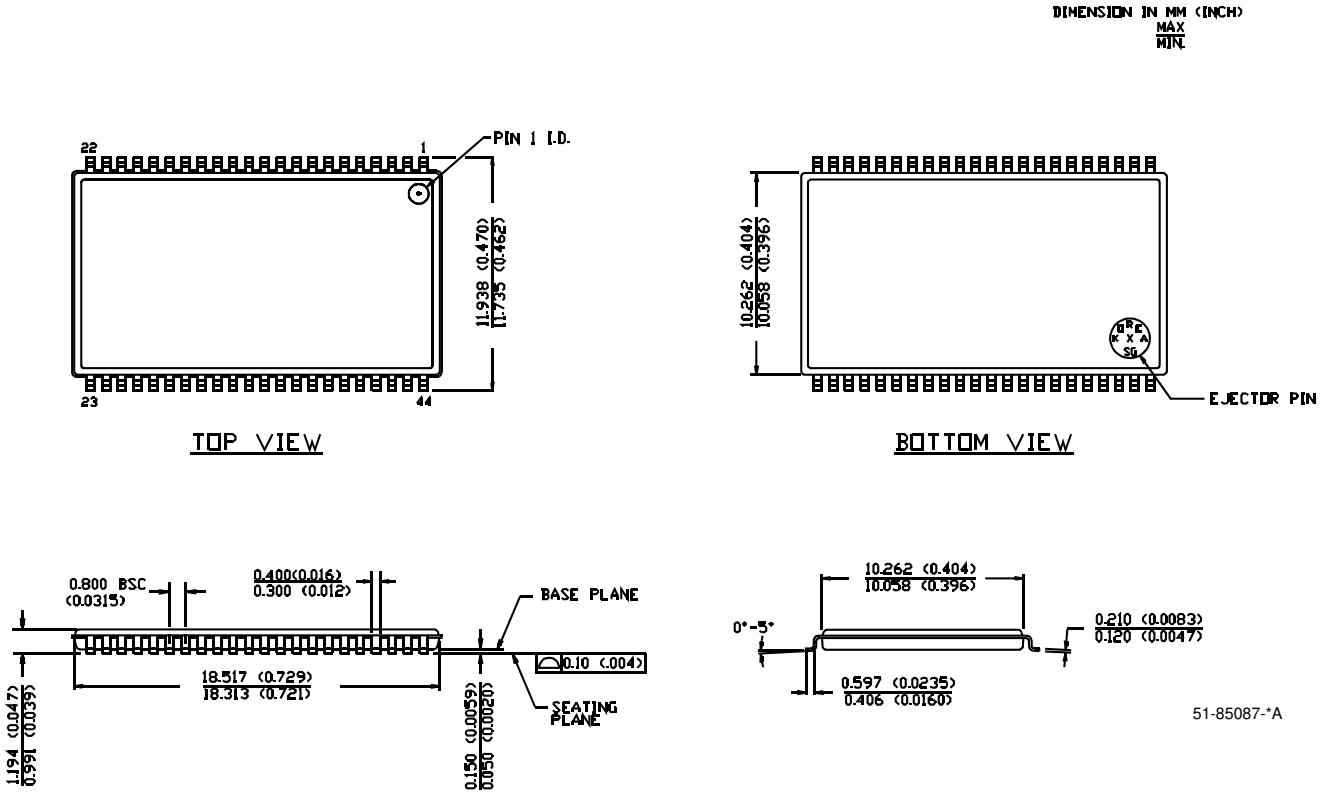
Package Diagram

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



Package Diagram (continued)

44-Pin TSOP II (51-85087)



Document History Page

Document Title:CY62147DV30 MoBL® 4-Mbit (256K x 16) Static RAM Document Number: 38-05340				
REV.	**ECN NO.**	**Issue Date**	**Orig. of Change**	**Description of Change**
**	127481	06/17/03	HRT	New Data Sheet
*A	131010	01/23/04	CBD	Changed from Advance to Preliminary
*B	213252	See ECN	AJU	Changed from Preliminary to Final Added 70 ns speed bin Modified footnote 7 to include ramp time and wait time Modified input and output capacitance values to 10 pF Modified Thermal Resistance values on page 4 Added “Byte power-down feature” in the features section Modified Ordering Information for Pb-free parts
*C	257349	See ECN	PCI	Modified ordering information for 70-ns Speed Bin
*D	316039	See ECN	PCI	Added 45-ns Speed Bin in AC, DC and Ordering Information tables Added Footnote #10 on page #4 Added Pb-free package ordering information on page # 9 Changed 44-lead TSOP-II package name on page 11 from Z44 to ZS44 Standardized Icc values across ‘L’ and ‘LL’ bins
*E	330365	See ECN	AJU	Added Automotive product information
*F	498575	See ECN	NXR	Added Automotive-A range Added note# 9 on page# 3 Updated ordering information table