CY62167DV20
MoBL2™

16-Mb (1024K x 16) Static RAM

Features

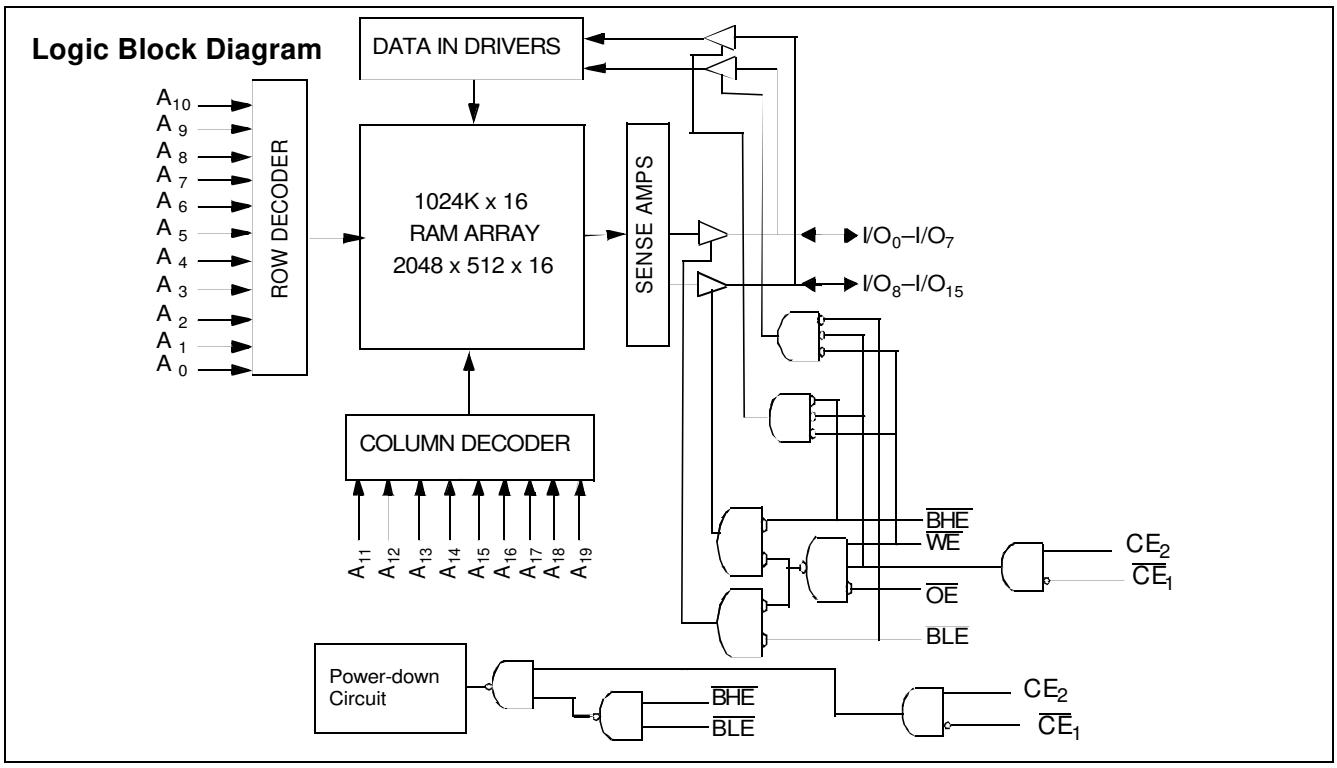
- **Very high speed: 55 ns and 70 ns**
- **Wide voltage range: 1.65V to 2.2V**
- **Ultra-low active power**
  - **Typical active current: 1.5 mA @ f = 1 MHz**
  - **Typical active current: 18 mA @ f = f_{MAX}**
- **Ultra-low standby power**
- **Easy memory expansion with $\overline{CE_1}$, CE_2, and $\overline{OE}$ features**
- **Automatic power-down when deselected**
- **CMOS for optimum speed/power**
- **Packages offered in a 48-ball FBGA**

Functional Description[1]

The CY62167DV20 is a high-performance CMOS static RAM organized as 1024K 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 by 99% when addresses are not toggling. The device can be put into standby mode reducing power consumption by more than 99% when deselected Chip Enable 1 ($\overline{CE_1}$) HIGH or Chip Enable 2 (CE_2) LOW or both $\overline{BHE}$ and $\overline{BLE}$ are HIGH. The input/output pins (I/O_0 through I/O_{15}) are placed in a high-impedance state when: deselected Chip Enable 1 ($\overline{CE_1}$) HIGH or Chip Enable 2 (CE_2) LOW, 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 (Chip Enable 1 ($\overline{CE_1}$) LOW and Chip Enable 2 (CE_2) HIGH and $\overline{WE}$ LOW).

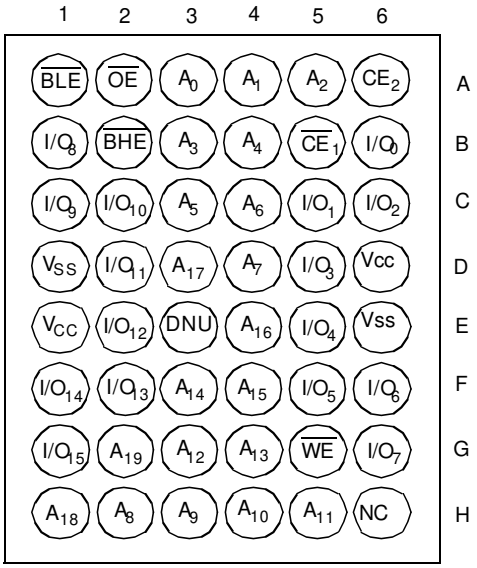
Writing to the device is accomplished by taking Chip Enable 1 ($\overline{CE_1}$) LOW and Chip Enable 2 (CE_2) HIGH and Write Enable ($\overline{WE}$) input LOW. If Byte Low Enable ($\overline{BLE}$) is LOW, then das pins (A_0 through A_{19}). If Byte High Enable ($\overline{BHE}$) is LOW, then data from I/O pins (I/O_8 through I/O_{15}) is written into the location specified on the ad

Reading from the device is accomplished by taking Chip Enable 1 ($\overline{CE_1}$) LOW and Chip Enable 2 (CE_2) HIGH and Output Enable ($\overline{OE}$) LOW while forcing the Write Enable ($\overline{WE}$) HIGH. If Byte Low Enable (<>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.

Pin Configuration[2, 3.]



Notes:
2. DNU pins are to be connected to V_{SS} or left open.
3. NC pins are not connected on the die.

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 ..... –0.2V to V_{CCMAX} + 0.2V

DC Voltage Applied to Outputs in High-Z State[4, 5.] ..... –0.2V to V_{CCMAX} + 0.2V

DC Input Voltage[4, 5.] .....–0.2V to V_{CCMAX} + 0.2V

Output Current into Outputs (LOW)..... 20 mA

Static Discharge Voltage ..... > 2001V (per MIL-STD-883, Method 3015)

Latch-up Current.....> 200 mA

Operating Range

Range	Ambient Temperature (T_A)	V_{CC}[6]
Industrial	–40°C to +85°C	1.65V to 2.2V

Product Portfolio

Product	V_{CC} Range(V)			Speed (ns)	Power Dissipation					
					Operating, Icc (mA)				Standby, I_{SB2} (µA)	
					f = 1 MHz		f = f_{MAX}			
	Min.	Typ.	Max.		Typ.[7]	Max.	Typ.[7]	Max.	Typ.[7]	Max.
CY62167DV20L	1.65	1.8	2.2	55	1.5	5	18	35	2.5	40
				70			15	30	2.5	40
CY62167DV20LL	1.65	1.8	2.2	55	1.5	5	18	35	2.5	30
				70			15	30	2.5	30

DC Electrical Characteristics (over the operating range)

Parameter	Description	Test Conditions			CY62167DV20-55			CY62167DV20-70			Unit
					Min.	Typ.[7]	Max.	Min.	Typ.[7]	Max.	
V_{OH}	Output HIGH Voltage	I_{OH} = –0.1 mA	V_{CC} = 1.65V		1.4			1.4			V
V_{OL}	Output LOW Voltage	I_{OL} = 0.1 mA	V_{CC} = 1.65V				0.2			0.2	V
V_{IH}	Input HIGH Voltage				1.4		V_{CC} + 0.2	1.4		V_{CC} + 0.2	V
V_{IL}	Input LOW Voltage				–0.2		0.4	–0.2		0.4	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} = $1/t_{RC}$	Vcc = 2.2V, I_{OUT} = 0mA, CMOS level			18	35		15	30	mA
		f = 1 MHz				1.5	5		1.5	5	
I_{SB1}	Automatic CE Power-down Current – CMOS Inputs	CE_1 ≥ V_{CC} – 0.2V, CE_2 ≤ 0.2V, V_{IN} ≥ V_{CC} – 0.2V, V_{IN} ≤ 0.2V, f = f_{MAX} (Address and Data Only), f = 0 (OE, WE, BHE and BLE)		L		2.5	40		2.5	40	µA
				LL		2.5	30		2.5	30	
I_{SB2}	Automatic CE Power-down Current – CMOS Inputs	CE_1 ≥ V_{CC} – 0.2V, CE_2 ≤ 0.2V, V_{IN} ≥ V_{CC} – 0.2V or V_{IN} ≤ 0.2V, f = 0, V_{CC}=2.2V		L		2.5	40		2.5	40	µA
				LL		2.5	30		2.5	30	

Capacitance[8]

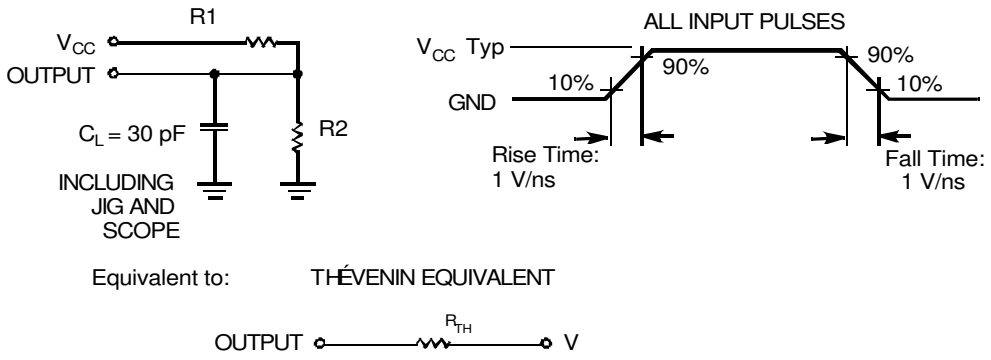
Parameter	Description	Test Conditions	Max.	Unit
C_{IN}	Input Capacitance	TA = 25°C, f = 1 MHz V_{CC} = $V_{CC(typ)}$	8	pF
C_{OUT}	Output Capacitance		10	pF

4. $V_{IL(min.)}$ = –2.0V for pulse durations less than 20 ns.
5. $V_{IH(max)}$ = V_{CC} + 0.75V for pulse durations less than 20 ns.
6. Full device AC operation assumes a 100 µs ramp time from 0 to V_{cc}(min) and 100 µs wait time after V_{cc} stabilization.
7. 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.
8. Tested initially and after any design or process changes that may affect these parameters.

Thermal Resistance

Parameter	Description	Test Conditions	BGA	Unit
θ_{JA}	Thermal Resistance (Junction to Ambient)[8]	Still Air, soldered on a 3 x 4.5 inch, two-layer printed circuit board	55	C/W
θ_{JC}	Thermal Resistance (Junction to Case)[8]		16	C/W

AC Test Loads and Waveforms

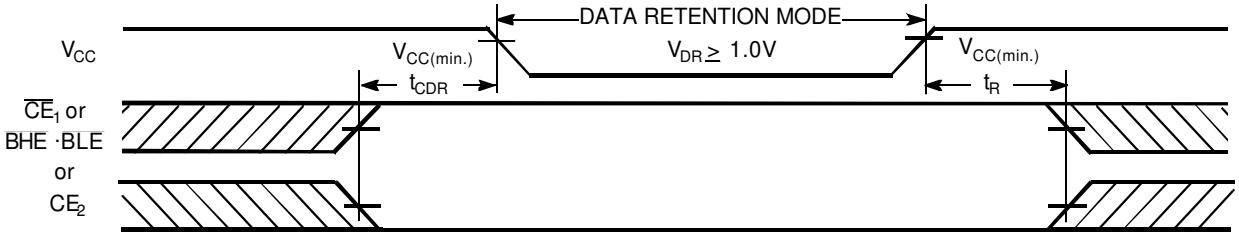


Parameters	1.8V	UNIT
R1	13500	Ω
R2	10800	Ω
R_{TH}	6000	Ω
V_{TH}	0.80	V

Data Retention Characteristics

Parameter	Description	Conditions		Min.	Typ.	Max.	Unit
V_{DR}	V_{CC} for Data Retention			1.0		2.2	V
I_{CCDR}	Data Retention Current	V_{CC}=1.0V, $CE_1 \geq V_{CC} - 0.2V$, $CE_2 \leq 0.2V$, $V_{IN} \geq V_{CC} - 0.2V$ or $V_{IN} \leq 0.2V$	L			15	µA
			LL			10	
t_{CDR}[8]	Chip Deselect to Data Retention Time			0			ns
t_R[9]	Operation Recovery Time			t_{RC}			ns

Data Retention Waveform[10]



Notes:

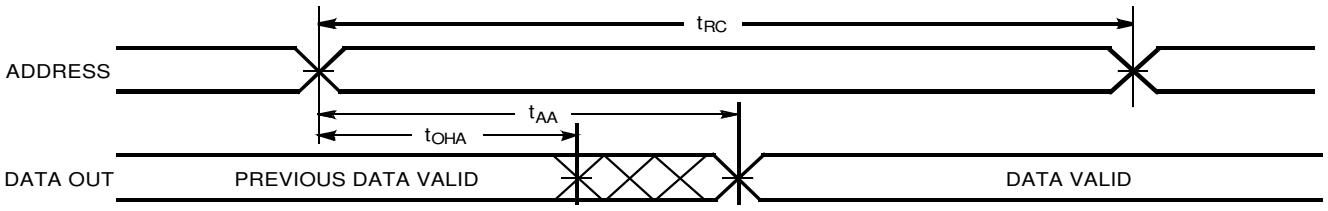
9. Full device operation requires linear V_{CC} ramp from V_{DR} to $V_{CC(min.)} > 100$ µs or stable at $V_{CC(min.)} > 100$ µs.
10. $\overline{BHE} \cdot \overline{BLE}$ is the AND of both $\overline{BHE}$ and $\overline{BLE}$. Chip can be deselected by either disabling the chip enable signals or by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

Switching Characteristics (over the operating range)[11]

Parameter	Description	CY62167DV20-55		CY62167DV20-70		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}	CE_1 LOW or CE_2 HIGH to Data Valid		55		70	ns
t_{DOE}	OE LOW to Data Valid		25		35	ns
t_{LZOE}	OE LOW to Low Z[12]	5		5		ns
t_{HZOE}	OE HIGH to High Z[12, 13]		20		25	ns
t_{LZCE}	CE_1 LOW or CE_2 HIGH to Low Z[12]	10		10		ns
t_{HZCE}	CE_1 HIGH or CE_2 LOW to High Z[12, 13]		20		25	ns
t_{PU}	CE_1 LOW or CE_2 HIGH to Power-up	0		0		ns
t_{PD}	CE_1 HIGH or CE_2 LOW to Power-down		55		70	ns
t_{DBE}	BLE/BHE LOW to Data Valid		55		70	ns
t_{LZBE}[10]	BLE/BHE LOW to Low Z[12]	10		5		ns
t_{HZBE}	BLE/BHE HIGH to High-Z[12, 13]		20		25	ns
Write Cycle[14]						
t_{WC}	Write Cycle Time	55		70		ns
t_{SCE}	CE_1 LOW or CE_2 HIGH to Write End	40		60		ns
t_{AW}	Address Set-up to Write End	40		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}	WE Pulse Width	40		45		ns
t_{BW}	BLE/BHE LOW to Write End	45		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}	WE LOW to High Z[12, 13]		20		25	ns
t_{LZWE}	WE HIGH to Low Z[12]	10		10		ns

Switching Waveforms

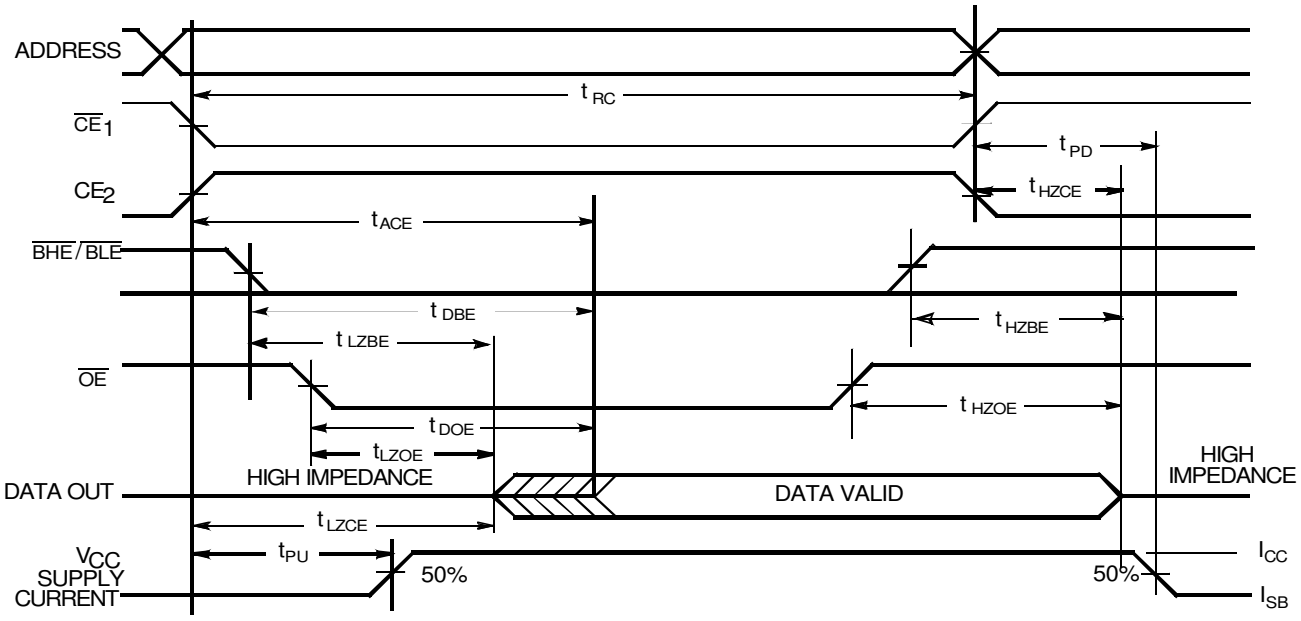
Read Cycle No. 1 (Address Transition Controlled)[15, 16]



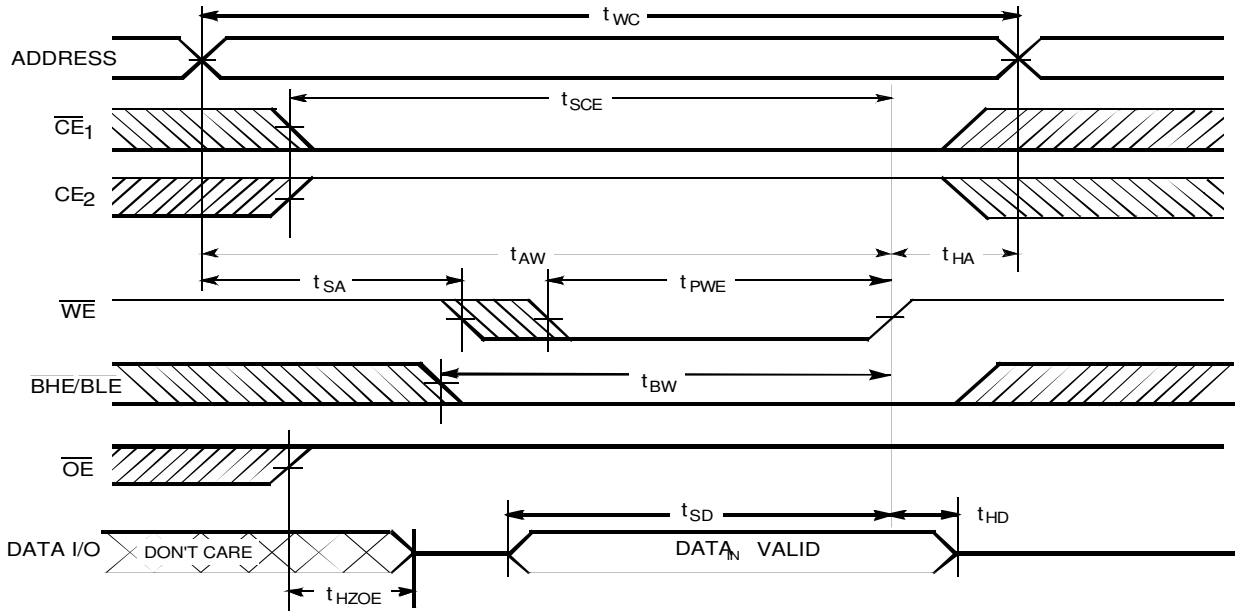
Notes:
11. Test conditions assume signal transition time of 2 ns or less, timing reference levels of $V_{CC(typ.)/2}$, input pulse levels of 0 to $V_{CC(typ.)}$, and output loading of the specified I_{OL}.
12. At any given temperature and voltage condition, t_{HZCE} is less than t_{LZCE}, t_{HZBE} is less than t_{LZBE}, t_{HZOE} is less than t_{LZOE}, and t_{HZWE} is less than t_{LZWE} for any given device.
13. t_{HZOE}, t_{HZCE}, t_{HZBE}, and t_{HZWE} transitions are measured when the outputs enter a high-impedance state.
14. The internal Write time of the memory is defined by the overlap of $\overline{WE}$, $\overline{CE}_1 = V_{IL}$, $\overline{BHE}$ and/or $\overline{BLE} = V_{IL}$.
15. Device is continuously selected. $\overline{OE}$, $\overline{CE1} = V_{IL}$, $CE2 = V_{IH}$
16. $\overline{WE}$ is HIGH for Read cycle.

Switching Waveforms (continued)

Read Cycle No. 2 (OE Controlled)[16, 17]



Write Cycle No. 1 (WE Controlled)[14, 18, 19, 20]

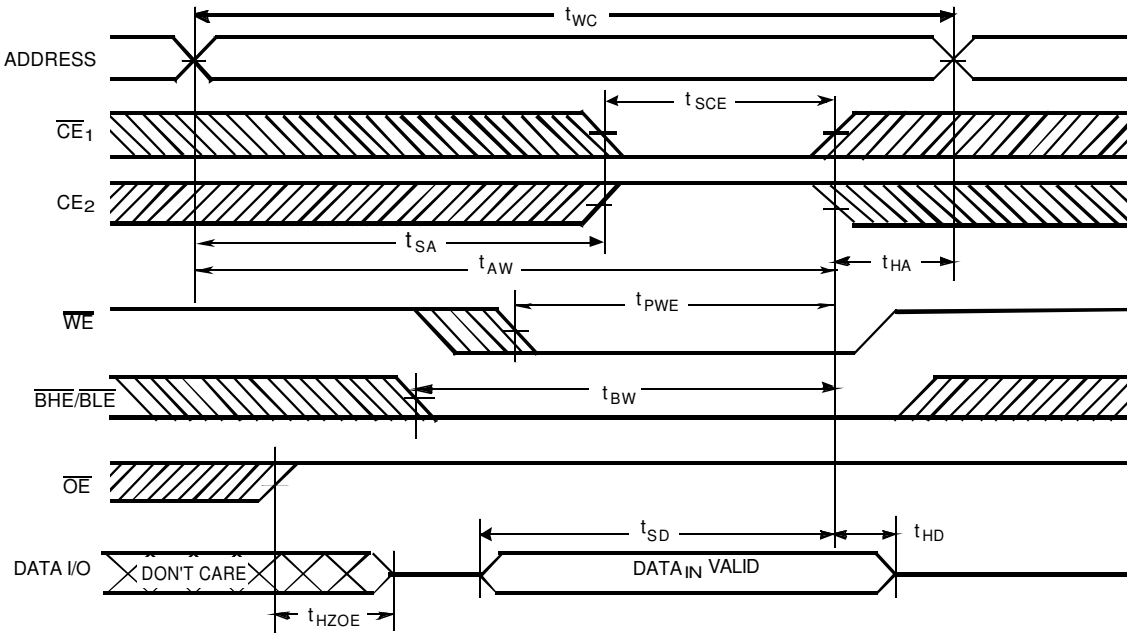


Notes:

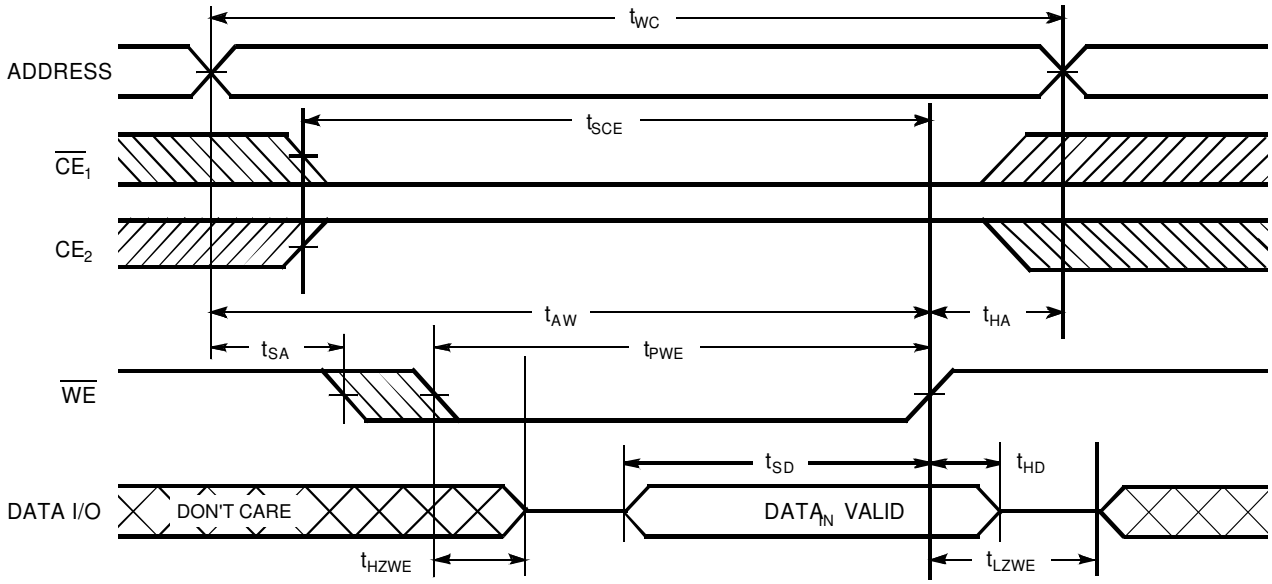
17. Address valid prior to or coincident with $\overline{CE}_1$, $\overline{BHE}$, $\overline{BLE}$ transition LOW and CE_2 transition HIGH.
18. Data I/O is high-impedance if $\overline{OE} = V_{IH}$.
19. If $\overline{CE}_1$ goes HIGH or CE_2 goes LOW simultaneously with $\overline{WE}$ HIGH, the output remains in a high-impedance state.
20. During the DON'T CARE period in the DATA I/O waveform, the I/Os are in output state and input signals should not be applied.

Switching Waveforms (continued)

Write Cycle No. 2 ($\overline{CE1}$ or CE2 Controlled)[14, 18, 19, 20]

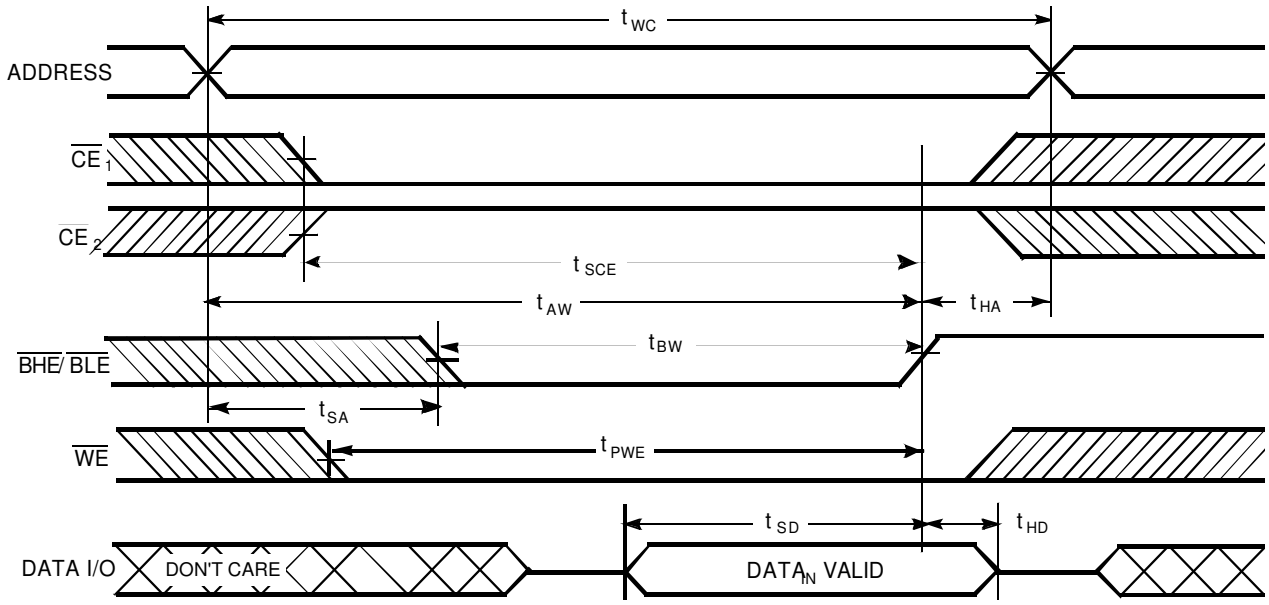


Write Cycle No. 3 ($\overline{WE}$ Controlled, $\overline{OE}$ LOW)[19, 20]



Switching Waveforms (continued)

Write Cycle No. 4(BHE/BLE Controlled, OE LOW)[19]



Truth Table

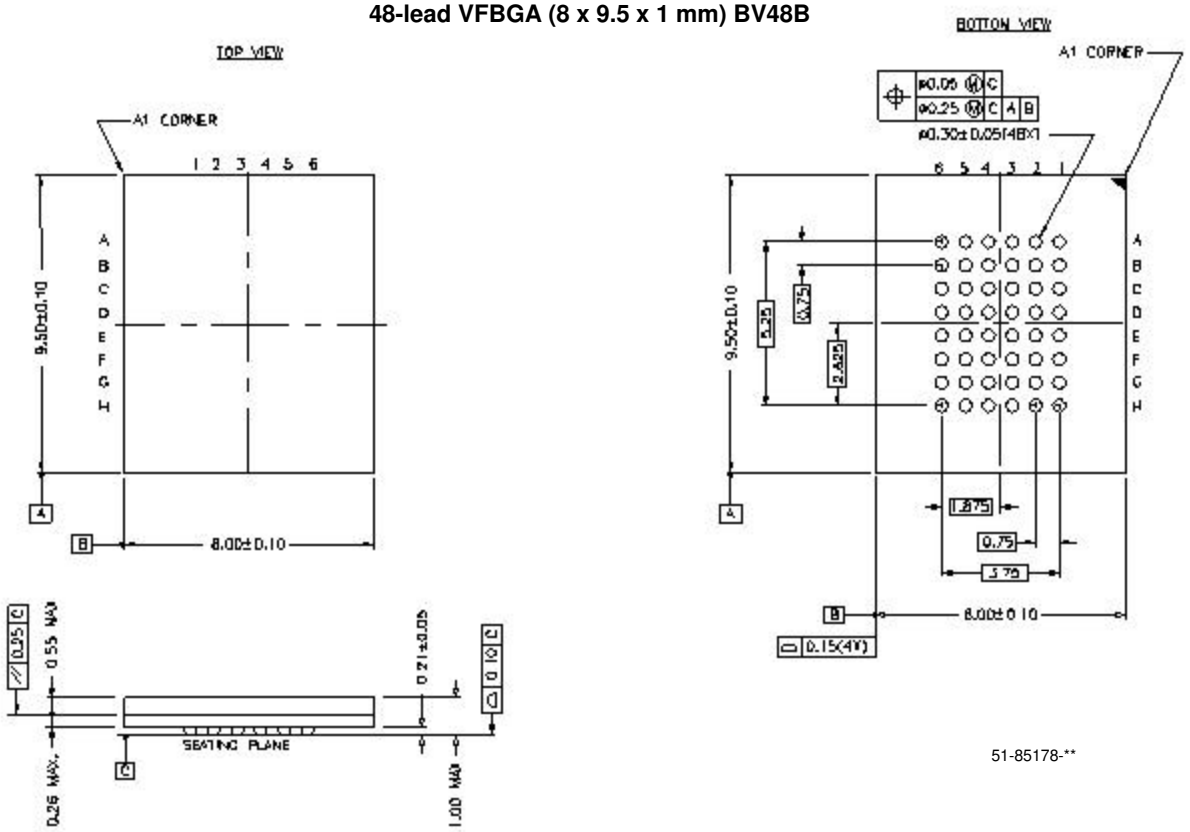
$\overline{CE_1}$	CE_2	$\overline{WE}$	$\overline{OE}$	$\overline{BHE}$	$\overline{BLE}$	Input / Outputs	Mode	Power
H	X	X	X	X	X	High Z	Deselect/Power-down	Standby (I_{SB})
X	L	X	X	X	X	High Z	Deselect/Power-down	Standby (I_{SB})
X	X	X	X	H	H	High Z	Deselect/Power-down	Standby (I_{SB})
L	H	H	L	L	L	Data Out (I/O0–I/O15)	Read	Active (I_{CC})
L	H	H	L	H	L	Data Out (I/O0–I/O7); High Z (I/O8–I/O15)	Read	Active (I_{CC})
L	H	H	L	L	H	High Z (I/O0–I/O7); Data Out (I/O8–I/O15)	Read	Active (I_{CC})
L	H	H	H	L	H	High Z	Output Disabled	Active (I_{CC})
L	H	H	H	H	L	High Z	Output Disabled	Active (I_{CC})
L	H	H	H	L	L	High Z	Output Disabled	Active (I_{CC})
L	H	L	X	L	L	Data In (I/O0–I/O15)	Write	Active (I_{CC})
L	H	L	X	H	L	Data In (I/O0–I/O7); High Z (I/O8–I/O15)	Write	Active (I_{CC})
L	H	L	X	L	H	High Z (I/O0–I/O7); Data In (I/O8–I/O15)	Write	Active (I_{CC})

Ordering Information

Speed (ns)	Ordering Code	Package Name	Package Type	Operating Range
55	CY62167DV20L-55BVI	BV48B	48-ball Fine Pitch BGA (8.0 x 9.5 x 1.0 mm)	Industrial
	CY62167DV20LL-55BVI	BV48B	48-ball Fine Pitch BGA (8.0 x 9.5 x 1.0 mm)	
70	CY62167DV20L-70BVI	BV48B	48-ball Fine Pitch BGA (8.0 x 9.5 x 1.0 mm)	Industrial
	CY62167DV20LL-70BVI	BV48B	48-ball Fine Pitch BGA (8.0 x 9.5 x 1.0 mm)	

Package Diagrams

48-lead VFBGA (8 x 9.5 x 1 mm) BV48B



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Document History Page

Document Title: CY62167DV20 MoBL2™ 16-Mb (1024K x 16) Static RAM Document Number: 38-05327				
REV.	**ECN NO.**	**Issue Date**	**Orig. of Change**	**Description of Change**
**	118407	09/30/02	GUG	New Data Sheet
A	123691	02/11/03	DPM	Changed Advance Information to Preliminary Added package diagram
B	131496	11/25/03	XRJ/LDZ	Changed from Preliminary to Final Added MoBL2™ to title Added package name BV48B