

8-Mbit (512K x 16) MoBL® 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 CY62157CV25, CY62157CV30, and CY62157CV33**
- **Ultra-low active power**
 - Typical active current: 1.5 mA @ $f = 1\text{ MHz}$
 - Typical active current: 12 mA @ $f = f_{\text{max}}$
- **Ultra-low standby power**
- **Easy memory expansion with $\overline{\text{CE}}_1$, CE_2 , and $\overline{\text{OE}}$ features**
- **Automatic power-down when deselected**
- **CMOS for optimum speed/power**
- **Available in Pb-free and non Pb-free 48-ball FBGA, 44-pin TSOPII, and Pb-free 48-pin TSOPI**

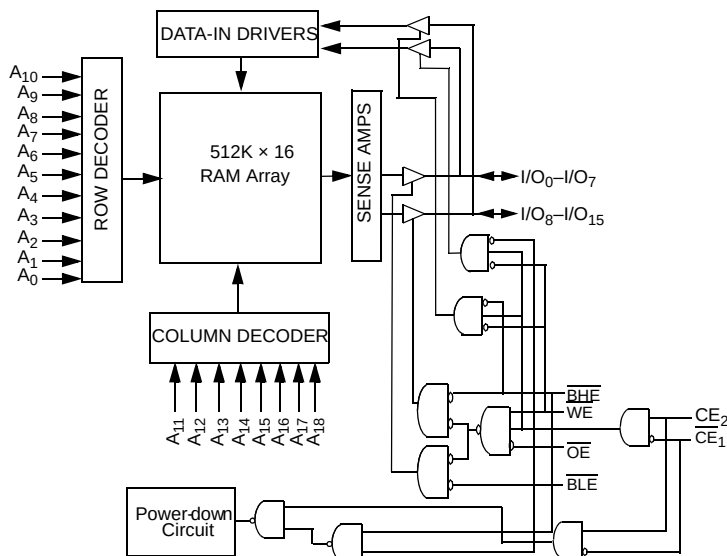
Functional Description^[1]

The CY62157DV30 is a high-performance CMOS static RAM organized as 512K 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 when deselected ($\overline{\text{CE}}_1$ HIGH or CE_2 LOW or both BHE and BLE are HIGH). The input/output pins (I/O_0 through I/O_{15}) are placed in a high-impedance state when: deselected ($\overline{\text{CE}}_1$ HIGH or CE_2 LOW), outputs are disabled ($\overline{\text{OE}}$ HIGH), both Byte High Enable and Byte Low Enable are disabled (BHE, BLE HIGH), or during a write operation (CE_1 LOW, CE_2 HIGH and WE LOW).

Writing to the device is accomplished by taking Chip Enables (CE_1 LOW and CE_2 HIGH) and Write Enable (WE) input LOW. If Byte Low Enable (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_{18}). If Byte High Enable (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_{18}).

Reading from the device is accomplished by taking Chip Enables (CE_1 LOW and CE_2 HIGH) and Output Enable ($\overline{\text{OE}}$) 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/O_0 to I/O_7 . If Byte High Enable (BHE) is LOW, then data from memory will appear on I/O_8 to I/O_{15} . See the truth table for a complete description of read and write modes.

Logic Block Diagram

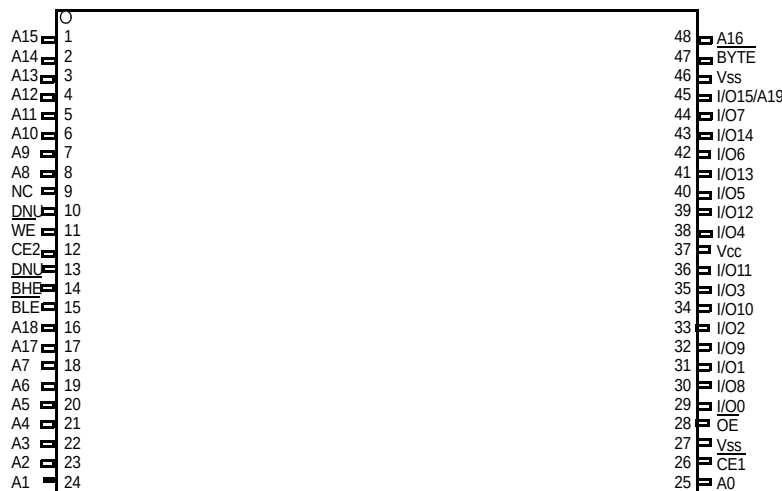
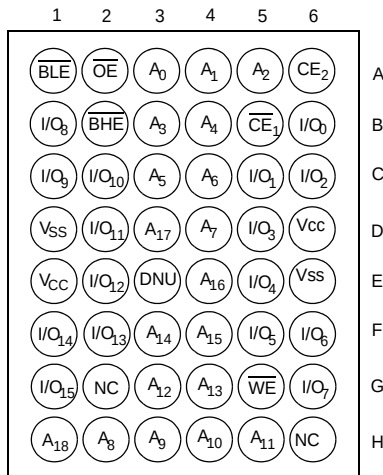
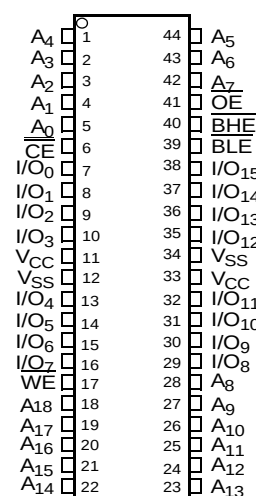


Note:

1. For best practice recommendations, please refer to the Cypress application note entitled *System Design Guidelines*, which is available at <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 = 1MHz		f = f _{max}							
		Min.	Typ. ^[2]	Max.		Typ. ^[2]	Max.	Typ. ^[2]	Max.	Typ. ^[2]	Max.
CY62157DV30L	Industrial	2.2	3.0	3.6	45, 55, 70	1.5	3	12	20	2	20
CY62157DV30LL	Industrial	2.2	3.0	3.6	45, 55, 70	1.5	3	12	15	2	8
CY62157DV30LL	Automotive-A	2.2	3.0	3.6	55	1.5	3	12	15	2	8
CY62157DV30L	Automotive-E	2.2	3.0	3.6	55	1.5	3	12	20	2	50

Pin Configuration^[4, 5, 6]
**48-Pin TSOP I Pinout
Top View**

**48-Ball FBGA Pinout
Top View**

**44-pin TSOP II Pinout
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 internally connected on the die.
- DNU pins have to be left floating.
- The BYTE pin in the 48-TSOP package has to be tied HIGH to use the device as a 512K × 16 SRAM. The 48-TSOP package can also be used as a 1M × 8 SRAM by tying the BYTE signal LOW. For 1M × 8 Functionality, please refer to the CY62158DV30 datasheet. In the 1M × 8 configuration, Pin 45 is A19, while BHE, BLE and I/O8 to I/O14 pins are not used.
- The 44-TSOP package device has only one chip enable pin (CE).

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^[8, 9] -0.3V to $V_{CC(max)}$ + 0.3V

DC Input Voltage^[8, 9] -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)	V_{CC} ^[10]
CY62157DV30L	Industrial	-40°C to +85°C	2.20V to 3.60V
CY62157DV30LL			
CY62157DV30LL	Automotive-A	-40°C to +85°C	
CY62157DV30L	Automotive-E	-40°C to +125°C	

Electrical Characteristics Over the Operating Range

Parameter	Description	Test Conditions		-45, -55, -70			Unit
				Min.	Typ. ^[2]	Max.	
V _{OH}	Output HIGH Voltage	I _{OH} = −0.1 mA	V _{CC} = 2.20V	2.0			V
		I _{OH} = −1.0 mA	V _{CC} = 2.70V	2.4			V
V _{OL}	Output LOW Voltage	I _{OL} = 0.1 mA	V _{CC} = 2.20V			0.4	V
		I _{OL} = 2.1 mA	V _{CC} = 2.70V			0.4	V
V _{IH}	Input HIGH Voltage	V _{CC} = 2.2V to 2.7V		1.8		V _{CC} + 0.3	V
		V _{CC} = 2.7V to 3.6V		2.2		V _{CC} + 0.3	V
V _{IL}	Input LOW Voltage	V _{CC} = 2.2V to 2.7V		−0.3		0.6	V
		V _{CC} = 2.7V to 3.6V		−0.3		0.8	V
I _{IX}	Input Leakage Current	GND ≤ V _I ≤ V _{CC}	Ind'I/Auto-A ^[7]	−1		+1	μA
			Auto-E ^[7]	−4		+4	μA
I _{OZ}	Output Leakage Current	GND ≤ V _O ≤ V _{CC} , Output Disabled	Ind'I/Auto-A ^[7]	−1		+1	μA
			Auto-E ^[7]	−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	L	12	20	mA
				LL	12	15	mA
		f = 1 MHz		L	1.5	3	mA
				LL	1.5	3	mA
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), V _{CC} = 3.60V	Ind'I	L	2	20	μA
			Ind'I/Auto-A ^[7]	LL	2	8	
			Auto-E ^[7]	L		50	
I _{SB2}	Automatic CE Power-Down Current -CMOS Inputs	CE ₁ ≥ V _{CC} − 0.2V or CE ₂ ≤ 0.2V, V _{IN} ≥ V _{CC} − 0.2V or V _{IN} ≤ 0.2V, f = 0, V _{CC} = 3.60V	Ind'I ^[7]	L	2	20	μA
			Ind'I/Auto-A ^[7]	LL	2	8	
			Auto-E ^[7]	L		50	

Capacitance^[11, 12]

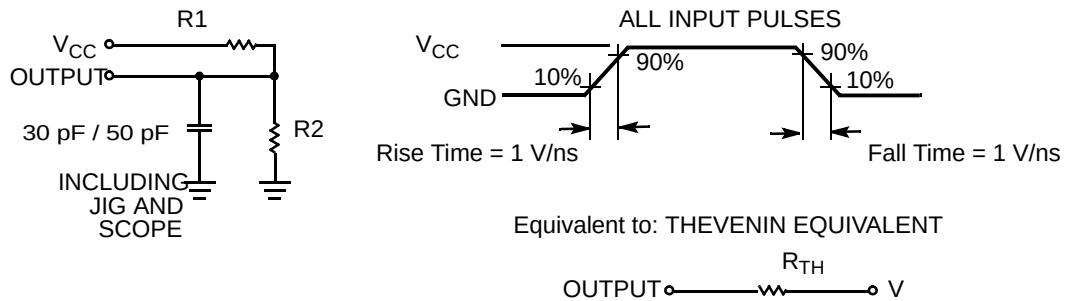
Parameter	Description	Test Conditions	Max.	Unit
C_{IN}	Input Capacitance	$T_A = 25^\circ\text{C}$, $f = 1$ MHz,	10	pF
C_{OUT}	Output Capacitance	$V_{CC} = V_{CC(typ)}$	10	pF

Notes:

- Automotive-A and Automotive-E available only in -55.
- $V_{IL(min.)} = -2.0$ V for pulse durations less than 20 ns.
- $V_{IH(max)} = V_{CC} + 0.75$ V for pulse duration less than 20 ns.
- Full device AC operation assumes a 100 μ s ramp time from 0 to $V_{CC(min)}$ and 200 μ s wait time after V_{CC} stabilization.
- Tested initially and after any design or process changes that may affect these parameters.
- The input capacitance on the CE_2 pin of the FBGA and 48TSOPI packages and on the BHE pin of the 44TSOPI package is 15 pF.

Thermal Resistance^[11]

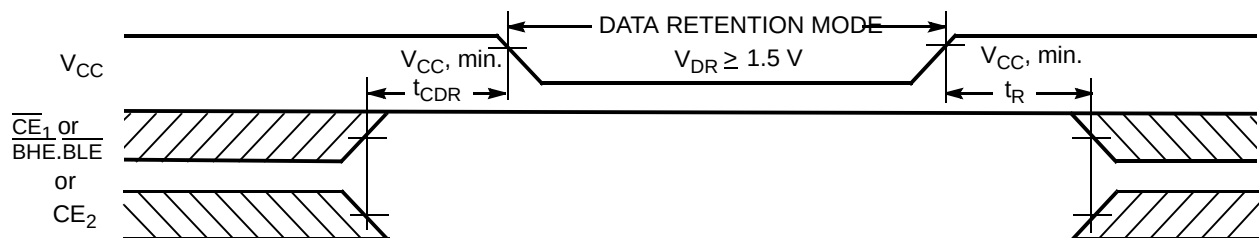
Parameter	Description	Test Conditions	FBGA	TSOP II	TSOP I	Unit
Θ_{JA}	Thermal Resistance (Junction to Ambient)	Still Air, soldered on a 3 × 4.5 inch, four-layer printed circuit board	39.3	35.62	36.9	°C/W
Θ_{JC}	Thermal Resistance (Junction to Case)		9.69	9.13	10.05	°C/W

AC Test Loads and Waveforms^[13]


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. ^[2]	Max.	Unit
V_{DR}	V_{CC} for Data Retention		1.5			V
I_{CCDR}	Data Retention Current	$V_{CC} = 1.5V$ $CE_1 \geq V_{CC} - 0.2V$, $CE_2 \leq 0.2V$, $V_{IN} \geq V_{CC} - 0.2V$ or $V_{IN} \leq 0.2V$	Ind'I (L)		10	μA
			Ind'I/Auto-A (LL)		4	
			Auto-E (L)		25	
$t_{CDR}^{[11]}$	Chip Deselect to Data Retention Time		0			ns
$t_R^{[14]}$	Operation Recovery Time		t_{RC}			ns

Data Retention Waveform^[15]

Notes:

13. Test condition for the 45 ns part is a load capacitance of 30 pF.

14. Full device operation requires linear V_{CC} ramp from V_{DR} to $V_{CC(min.)} \geq 100 \mu s$ or stable at $V_{CC(min.)} \geq 100 \mu s$.

Switching Characteristics Over the Operating Range ^[16]

Parameter	Description	45 ns ^[13]		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}	$\overline{CE}_1$ LOW and CE ₂ HIGH 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 ^[17]	5		5		5		ns
t _{HZOE}	$\overline{OE}$ HIGH to High Z ^[17, 18]		15		20		25	ns
t _{LZCE}	$\overline{CE}_1$ LOW and CE ₂ HIGH to Low Z ^[17]	10		10		10		ns
t _{HZCE}	$\overline{CE}_1$ HIGH and CE ₂ LOW to High Z ^[17, 18]		20		20		25	ns
t _{PU}	$\overline{CE}_1$ LOW and CE ₂ HIGH to Power-Up	0		0		0		ns
t _{PD}	$\overline{CE}_1$ HIGH and CE ₂ LOW to Power-Down		45		55		70	ns
t _{DBE}	$\overline{BLE/BHE}$ LOW to Data Valid		45		55		70	ns
t _{LZBE}	$\overline{BLE/BHE}$ LOW to Low Z ^[17]	10		10		10		ns
t _{HZBE}	$\overline{BLE/BHE}$ HIGH to HIGH Z ^[17, 18]		15		20		25	ns
Write Cycle ^[19]								
t _{WC}	Write Cycle Time	45		55		70		ns
t _{SCE}	$\overline{CE}_1$ LOW and CE ₂ HIGH 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}	$\overline{BLE/BHE}$ 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 ^[17, 18]		15		20		25	ns
t _{LZWE}	$\overline{WE}$ HIGH to Low-Z ^[17]	10		10		10		ns

Notes:

15. $\overline{BHE}/\overline{BLE}$ 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 $\overline{BLE}$.

16. Test conditions for all parameters other than tri-state parameters assume signal transition time of 3 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.

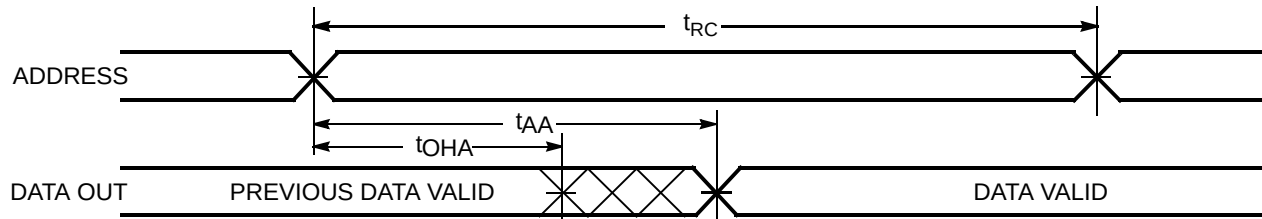
17. At any given temperature and voltage condition, t_{HZCE} is less than t_{LZCE} , t_{HZBE} is less than t_{LZBE} , t_{HZOE} is less than t_{LZOE} , and t_{HZWE} is less than t_{LZWE} for any given device.

18. t_{HZOE} , t_{HZCE} , t_{HZBE} , and t_{HZWE} transitions are measured when the outputs enter a high-impedance state.

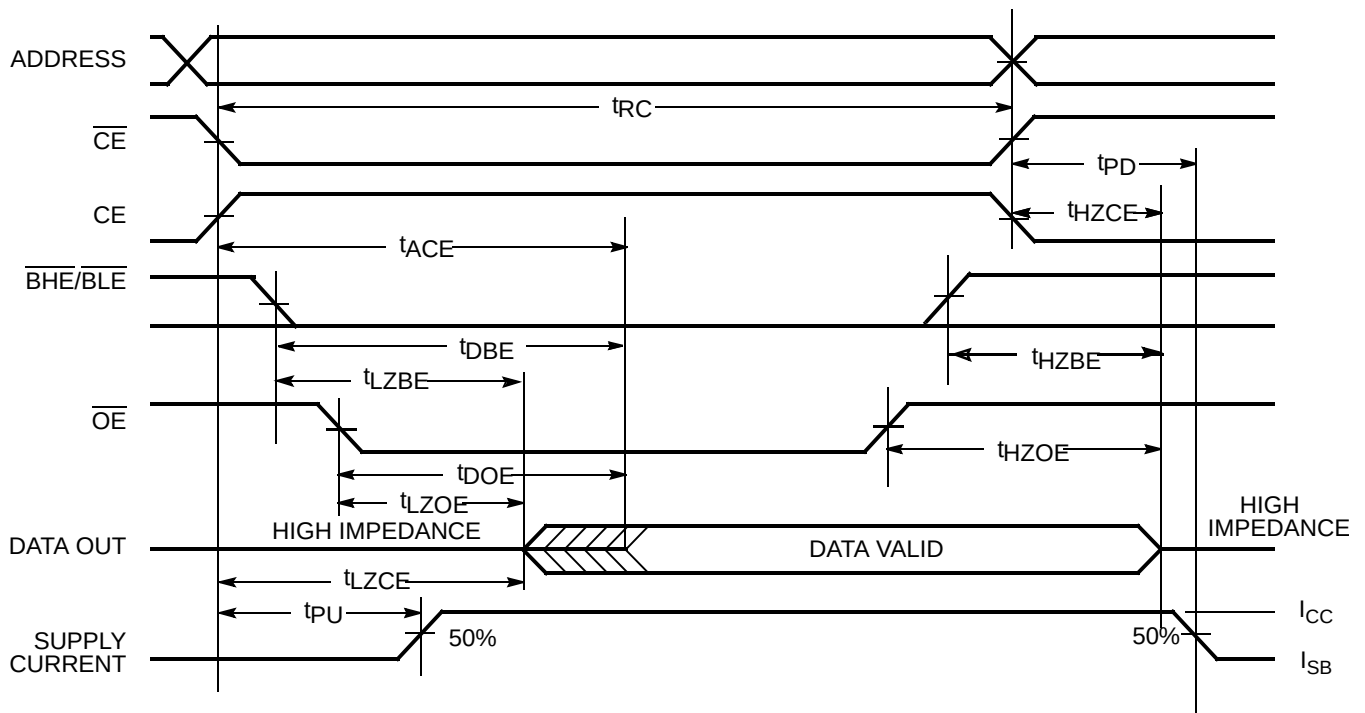
19. The internal Write time of the memory is defined by the overlap of $\overline{WE}$, $\overline{CE}_1 = V_{IL}$, $\overline{BHE}$ and/or $\overline{BLE} = V_{IL}$, and $CE_2 = V_{IH}$. All signals must be ACTIVE to initiate a write and any of these signals can terminate a write by going INACTIVE. 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)^[20, 21]



Read Cycle 2 ($\overline{\text{OE}}$ Controlled)^[21, 22]



Notes:

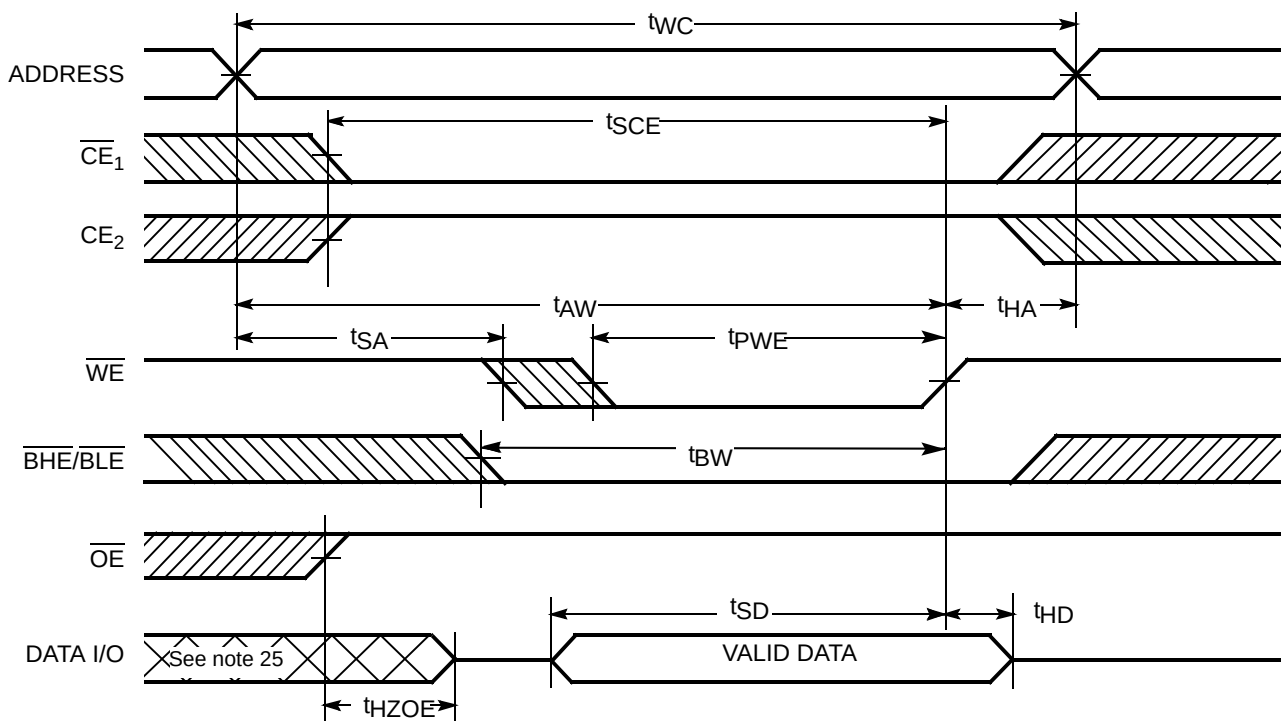
20. The device is continuously selected. $\overline{\text{OE}}$, $\overline{\text{CE}}_1 = V_{\text{IL}}$, $\overline{\text{BHE}}$ and/or $\overline{\text{BLE}} = V_{\text{IL}}$, and $\text{CE}_2 = V_{\text{IH}}$.

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

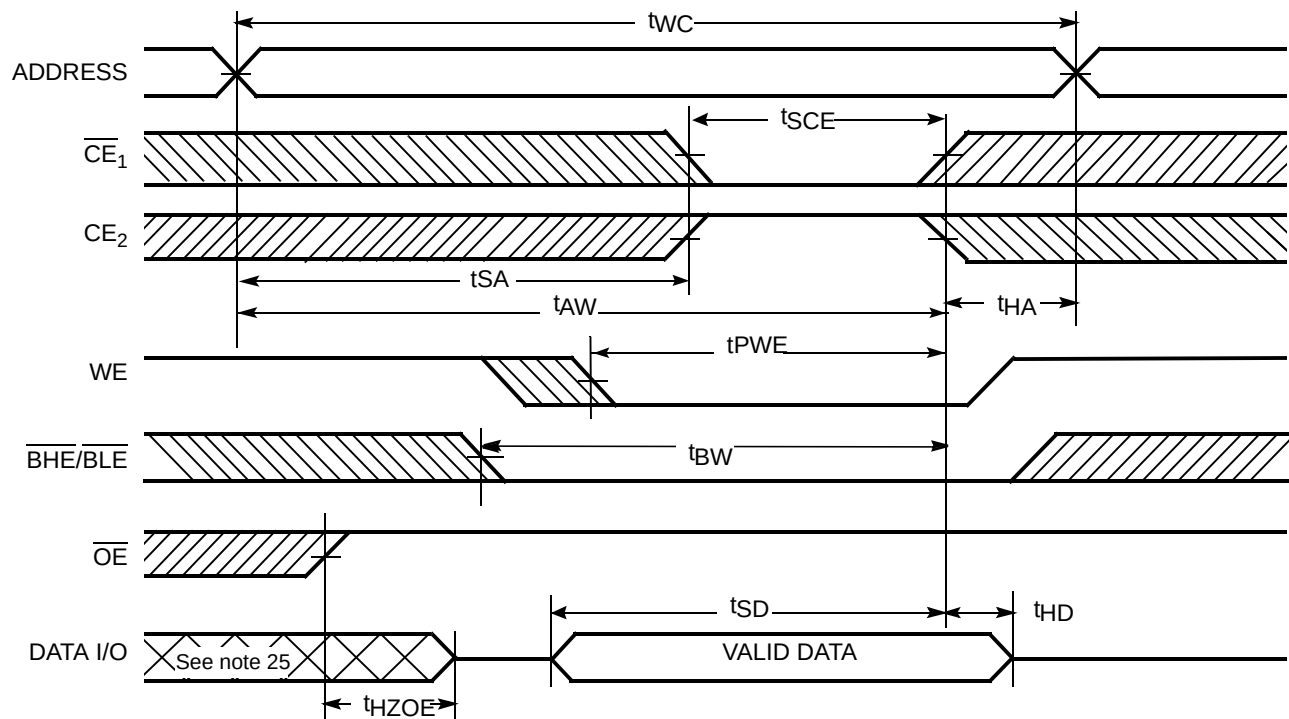
22. Address valid prior to or coincident with $\overline{\text{CE}}_1$, $\overline{\text{BHE}}$, $\overline{\text{BLE}}$ transition LOW and CE_2 transition HIGH.

Switching Waveforms (continued)

Write Cycle 1 ($\overline{\text{WE}}$ Controlled)^[19, 23, 24, 25]



Write Cycle 2 ($\overline{\text{CE}}_1$ or $\overline{\text{CE}}_2$ Controlled)^[19, 23, 24, 25]

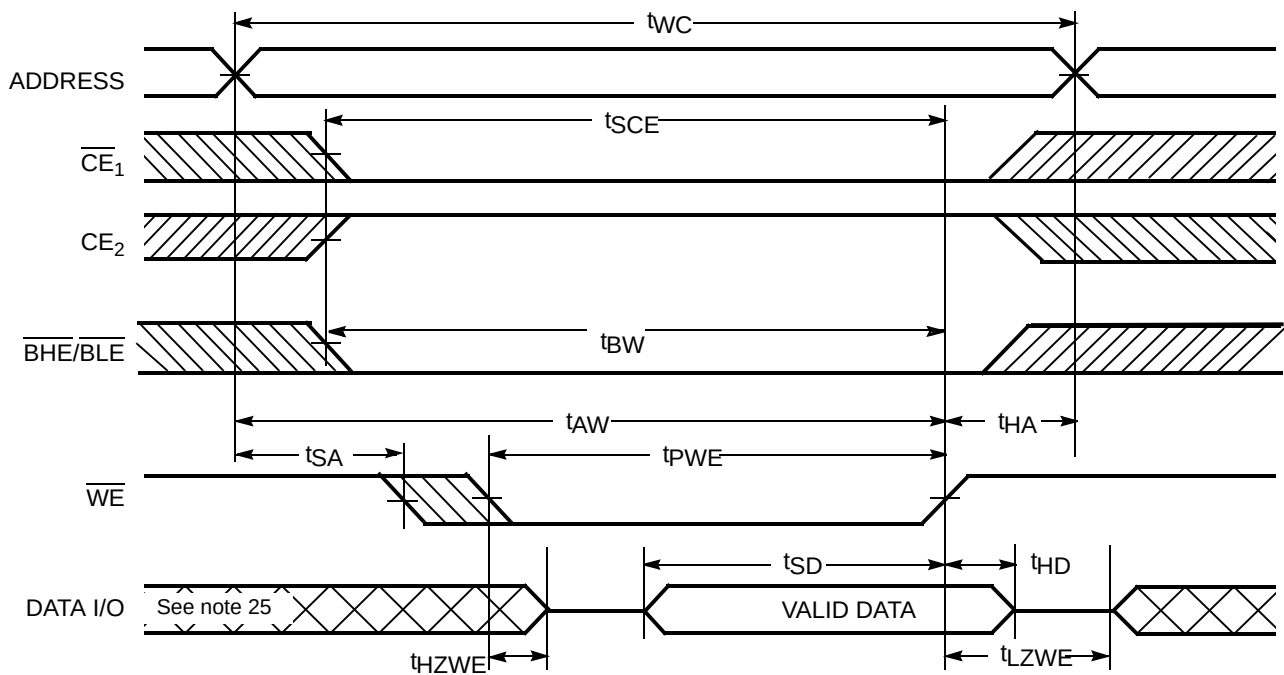
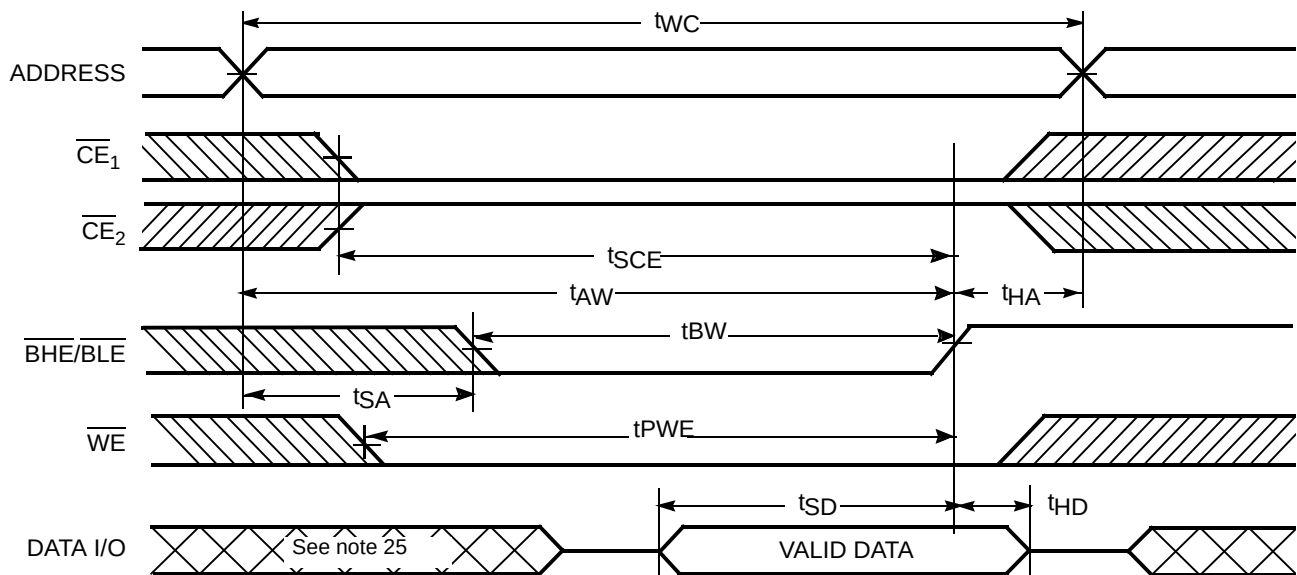


Notes:

23. Data I/O is high-impedance if $\overline{\text{OE}} = V_{IH}$.

24. If $\overline{\text{CE}}_1$ goes HIGH and $\overline{\text{CE}}_2$ goes LOW simultaneously with $\overline{\text{WE}} = V_{IH}$, the output remains in a high-impedance state.

25. During this period, the I/Os are in output state and input signals should not be applied.

Switching Waveforms (continued)
Write Cycle 3 ($\overline{\text{WE}}$ Controlled, $\overline{\text{OE}}$ LOW)^[24, 25]

Write Cycle 4 ($\overline{\text{BHE/BL E}}$ Controlled, $\overline{\text{OE}}$ LOW)^[24, 25]


Truth Table

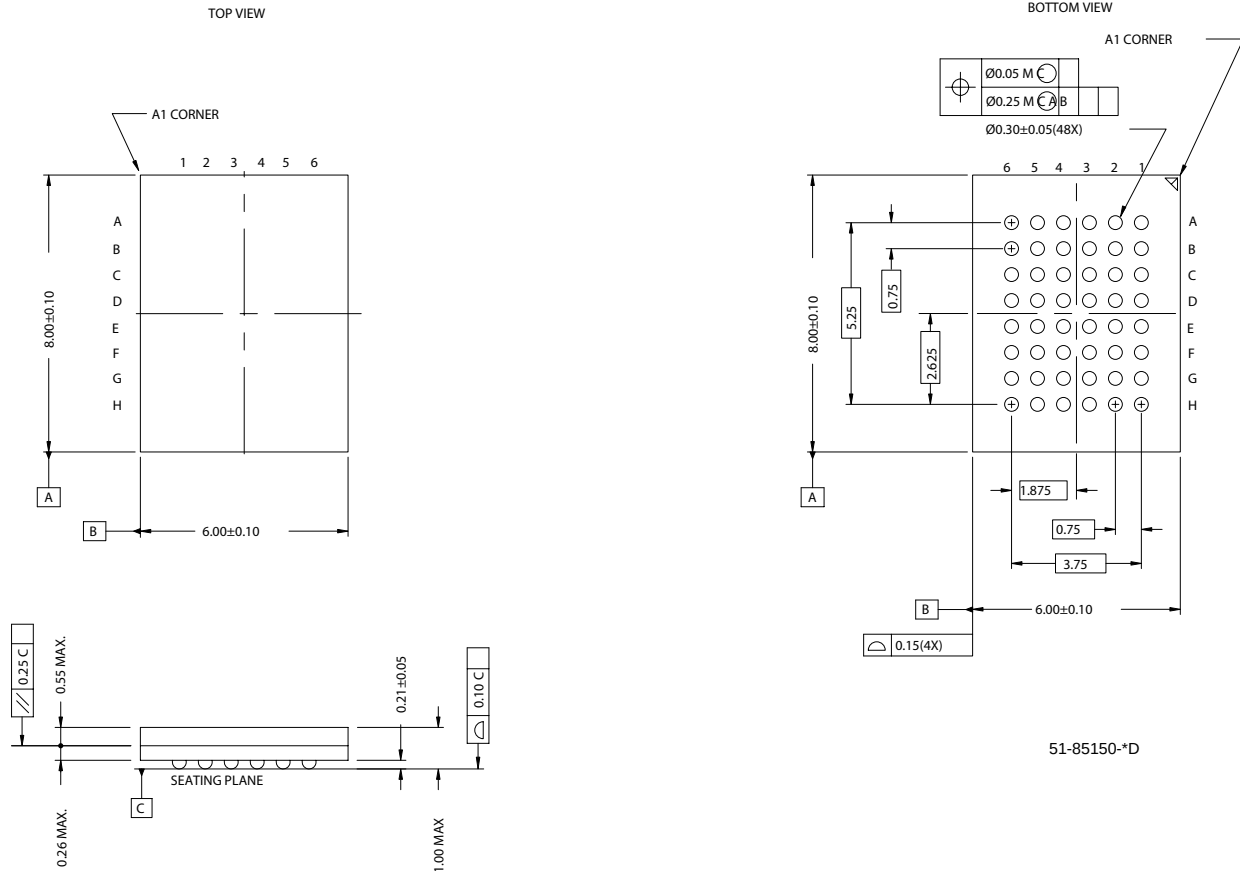
$\overline{CE}_1$	$\overline{CE}_2$	$\overline{WE}$	$\overline{OE}$	$\overline{BHE}$	$\overline{BLE}$	Inputs/Outputs	Mode	Power
H	X	X	X	X	X	High Z	Deselect/Power-Down	Standby (I_{SB})
X	L	X	X	X	X	High Z	Deselect/Power-Down	Standby (I_{SB})
X	X	X	X	H	H	High Z	Deselect/Power-Down	Standby (I_{SB})
L	H	H	L	L	L	Data Out (I/O_0 – I/O_{15})	Read (Upper byte and Lower Byte)	Active (I_{CC})
L	H	H	L	H	L	Data Out (I/O_0 – I/O_7); High Z (I/O_8 – I/O_{15})	Read (Lower Byte only)	Active (I_{CC})
L	H	H	L	L	H	High Z (I/O_0 – I/O_7); Data Out (I/O_8 – I/O_{15})	Read (Upper Byte only)	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/O_0 – I/O_{15})	Write (Upper byte and Lower Byte)	Active (I_{CC})
L	H	L	X	H	L	Data In (I/O_0 – I/O_7); High Z (I/O_8 – I/O_{15})	Write (Lower Byte only)	Active (I_{CC})
L	H	L	X	L	H	High Z (I/O_0 – I/O_7); Data In (I/O_8 – I/O_{15})	Write (Upper Byte only)	Active (I_{CC})

Ordering Information

Speed (ns)	Ordering Code	Package Diagram	Package Type	Operating Range
45	CY62157DV30L-45BVI	51-85150	48-ball (6 x 8 x 1 mm) FBGA	Industrial
	CY62157DV30LL-45ZSXI	51-85087	44-pin TSOP II (Pb-free)	
55	CY62157DV30LL-55BVI	51-85150	48-ball (6 x 8 x 1 mm) FBGA	Industrial
	CY62157DV30L-55BVXI		48-ball (6 x 8 x 1 mm) FBGA (Pb-free)	
	CY62157DV30LL-55BVXI			
	CY62157DV30L-55ZXI	51-85183	44-pin TSOP I (Pb-free)	
	CY62157DV30LL-55ZSI	51-85087	44-pin TSOP II	
	CY62157DV30L-55ZSXI		44-pin TSOP II (Pb-free)	
	CY62157DV30LL-55ZSXI			
	CY62157DV30LL-55BVXA	51-85150	48-ball (6 x 8 x 1 mm) FBGA (Pb-free)	Automotive-A
	CY62157DV30L-55BVXE	51-85150	48-ball (6 x 8 x 1 mm) FBGA (Pb-free)	Automotive-E
70	CY62157DV30LL-70BVI	51-85150	48-ball (6 x 8 x 1 mm) FBGA	Industrial
	CY62157DV30LL-70BVXI		48-ball (6 x 8 x 1 mm) FBGA (Pb-free)	

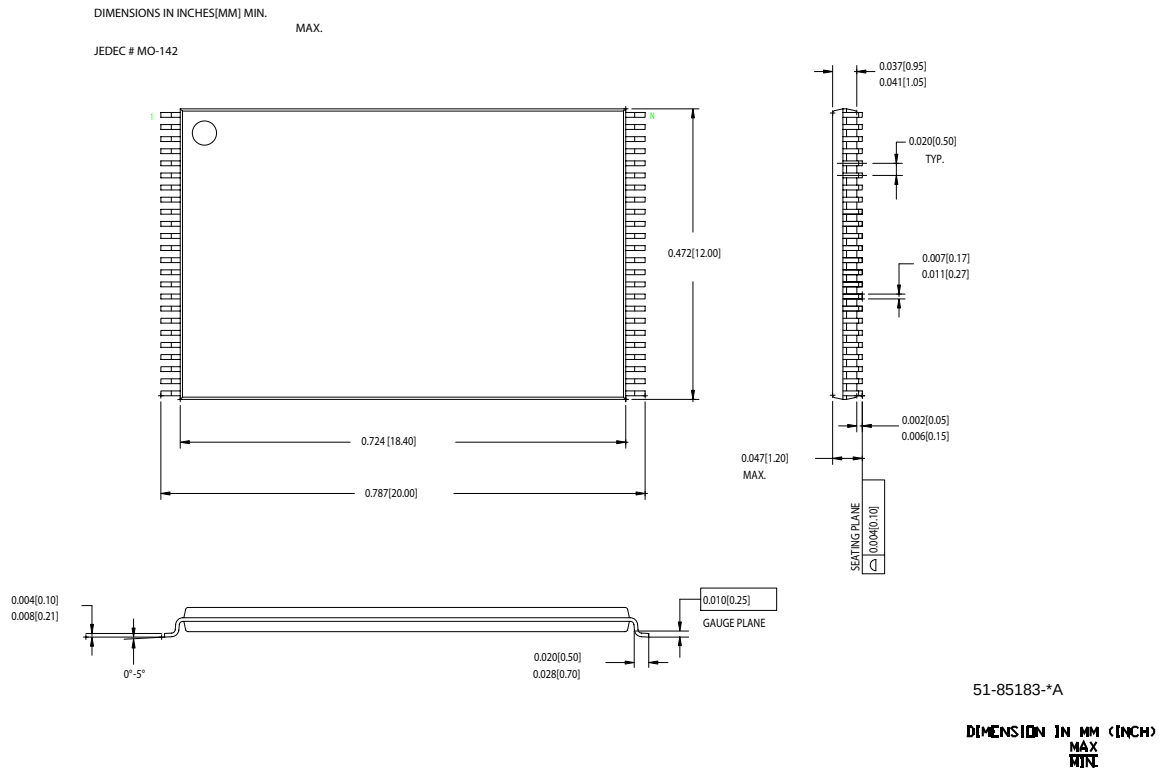
Package Diagrams

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

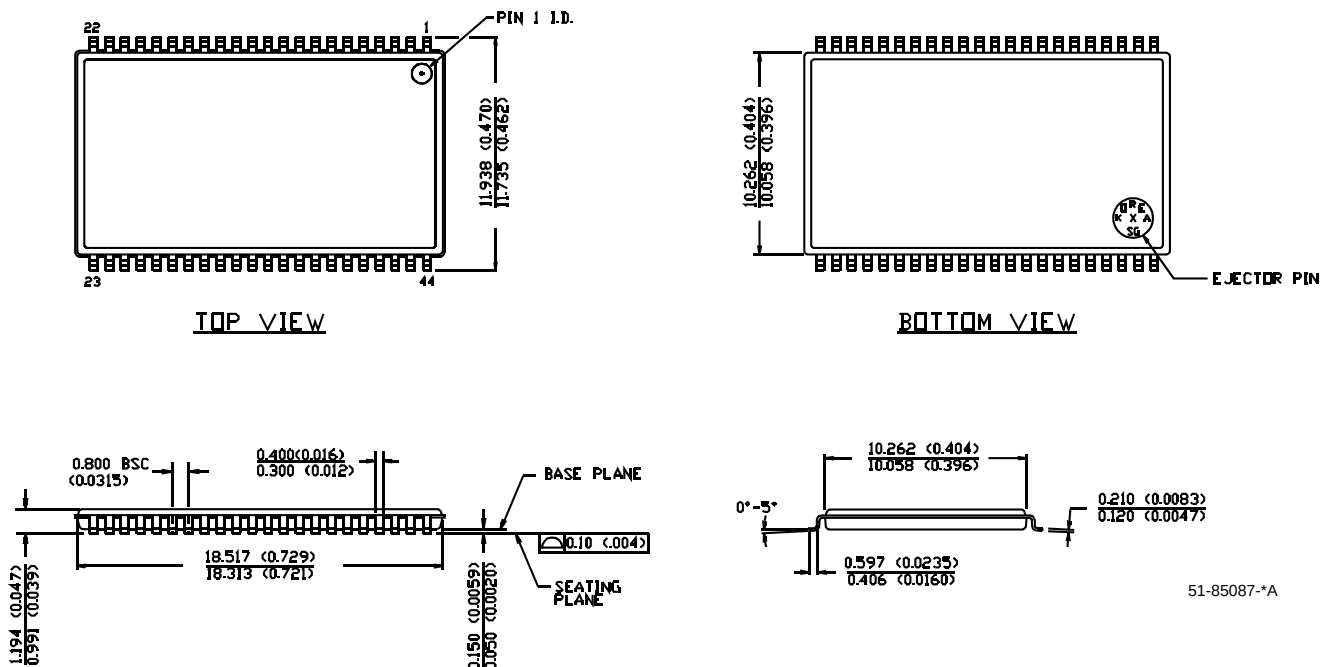


Package Diagrams (continued)

48-pin TSOP I (12 mm x 18.4 mm x 1.0 mm) (51-85183)



44-pin TSOP II (51-85087)



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Document History Page

Document Title: CY62157DV30 MoBL® 8-Mbit (512K x 16) MoBL® Static RAM Document Number: 38-05392				
REV.	ECN NO.	Issue Date	Orig. of Change	Description of Change
**	126316	05/22/03	HRT	New Data Sheet
*A	131013	11/19/03	CBD/LDZ	Change from Advance to Preliminary
*B	133115	01/24/04	CBD	Minor Change: Change MPN and upload.
*C	211601	See ECN	AJU	Change from Preliminary to Final Changed Marketing part number from CY62157DV to CY62157DV30 in the title and in the Ordering Information table Added footnotes 4, 5 and 11 Modified footnote 8 to include ramp time and wait time Removed MAX value for VDR on Data Retention Characteristics table Changed ordering code for Pb-free parts Modified voltage limits in Maximum Ratings section
*D	236628	See ECN	SYT/AJU	Added 45-ns and 70-ns Speed Bins Added Automotive product information
*E	257349	See ECN	PCI	Added test condition for 45 ns part (footnote #13 on page 4)
*F	372074	See ECN	SYT	Added Pb-Free Automotive Part in the Ordering Information Removed 'Preliminary' tag from Automotive Information
*G	433838	See ECN	ZSD	Changed the address of Cypress Semiconductor Corporation on Page #1 from "3901 North First Street" to "198 Champion Court" Updated the thermal resistance table Updated the ordering information table and changed the package name column to package diagram
*H	488954	See ECN	VKN	Added Automotive-A product Updated ordering Information table