

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 TSOP1**

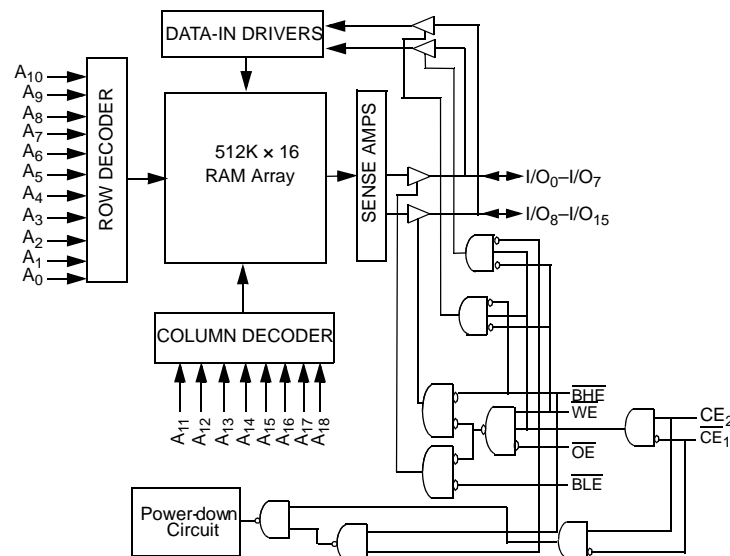
Functional Description^[1]

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 ($\overline{\text{CE}}_1$ LOW, CE_2 HIGH and WE LOW).

Writing to the device is accomplished by taking Chip Enables ($\overline{\text{CE}}_1$ 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 ($\overline{\text{CE}}_1$ 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:

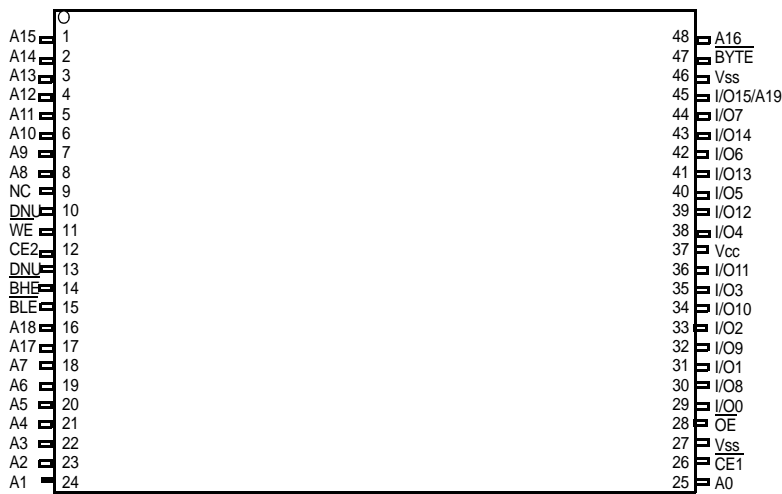
1. For best practice recommendations, please refer to the Cypress application note entitled *System Design Guidelines*, which is available at <http://www.cypress.com>.

Product Portfolio

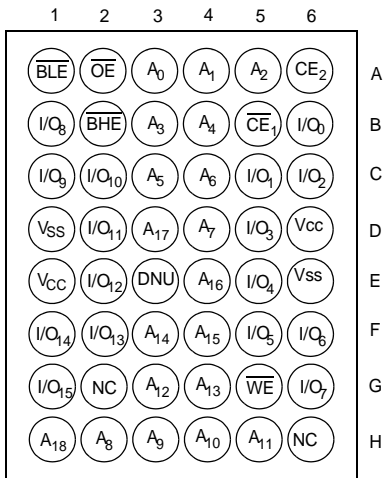
Product	Range	V _{CC} Range (V)			Speed (ns)	Power Dissipation					
						Operating I _{CC} (mA)				Standby I _{SB2} (μA)	
		Min.	Typ. ^[2]	Max.		f = 1MHz		f = f _{max}			
						Typ. ^[2]	Max.	Typ. ^[2]	Max.	Typ. ^[2]	Max.
CY62157DV30L	Industrial	2.2	3.0	3.6	45, 55, 70	1.5	3	12	20	2	20
CY62157DV30LL	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]

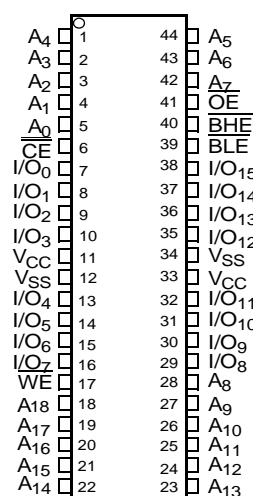
48-Pin TSOP I Pinout
Top View



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 I package has to be tied HIGH to use the device as a 512K x 16 SRAM. The 48-TSOP I package can also be used as a 1M x 8 SRAM by tying the BYTE signal LOW. For 1M x 8 Functionality, please refer to the CY62158DV30 datasheet. In the 1M x 8 configuration, Pin 45 is A19, while BHE, BLE and I/O8 to I/O14 pins are not used.
- The 44-TSOP II package device has only one chip enable pin (\overline{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'l/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'l/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}	L	12	20	mA
			I _{OUT} = 0 mA	LL	12	15	mA
		f = 1 MHz	CMOS levels	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'l	L	2	20	μA
			Ind'l/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'l ^[7]	L	2	20	μA
			Ind'l/Auto-A ^[7]	LL	2	8	
			Auto-E ^[7]	L		50	

Capacitance^[11, 12]

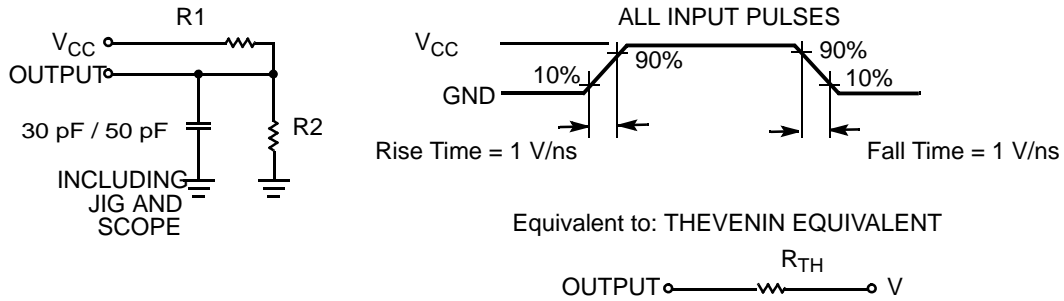
Parameter	Description	Test Conditions	Max.	Unit
C _{IN}	Input Capacitance	T _A = 25°C, f = 1 MHz,	10	pF
C _{OUT}	Output Capacitance	V _{CC} = V _{CC(typ)}	10	pF

Notes:

7. Automotive-A and Automotive-E available only in -55.
8. V_{IL(min.)} = -2.0V for pulse durations less than 20 ns.
9. V_{IH(max.)} = V_{CC} + 0.75V for pulse duration less than 20 ns.
10. 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.
11. Tested initially and after any design or process changes that may affect these parameters.
12. The input capacitance on the CE₂ pin of the FBGA and 48TSOPI packages and on the BHE pin of the 44TSOPII package is 15 pF.

Thermal Resistance^[11]

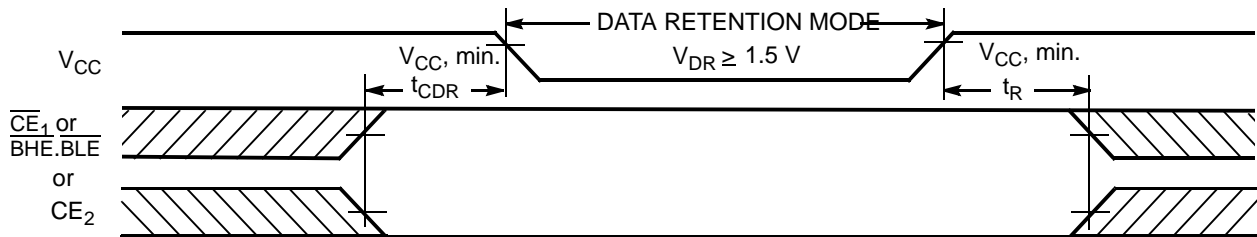
Parameter	Description	Test Conditions	FBGA	TSOP II	TSOP I	Unit
Θ_{JA}	Thermal Resistance (Junction to Ambient)	Still Air, soldered on a 3 x 4.5 inch, four-layer printed circuit board	39.3	35.62	36.9	°C/W
Θ_{JC}	Thermal Resistance (Junction to Case)		9.69	9.13	10.05	°C/W

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]

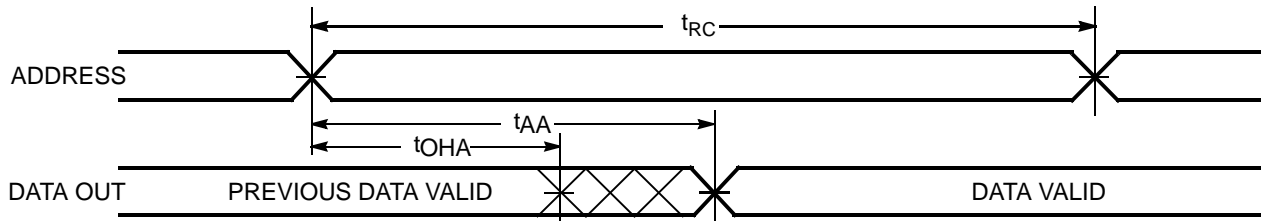
Parameter	Description	45 ns ^[13]		55 ns		70 ns		Unit
		Min.	Max.	Min.	Max.	Min.	Max.	
Read Cycle								
t _{RC}	Read Cycle Time	45		55		70		ns
t _{AA}	Address to Data Valid		45		55		70	ns
t _{OHA}	Data Hold from Address Change	10		10		10		ns
t _{ACE}	\overline{CE}_1 LOW and CE ₂ HIGH to Data Valid		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}	$\overline{BLE}/\overline{BHE}$ LOW to Data Valid		45		55		70	ns
t _{LZBE}	$\overline{BLE}/\overline{BHE}$ LOW to Low Z ^[17]	10		10		10		ns
t _{HZBE}	$\overline{BLE}/\overline{BHE}$ 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}	$\overline{BLE}/\overline{BHE}$ 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 ^[17, 18]		15		20		25	ns
t _{LZWE}	\overline{WE} HIGH to Low-Z ^[17]	10		10		10		ns

Notes:

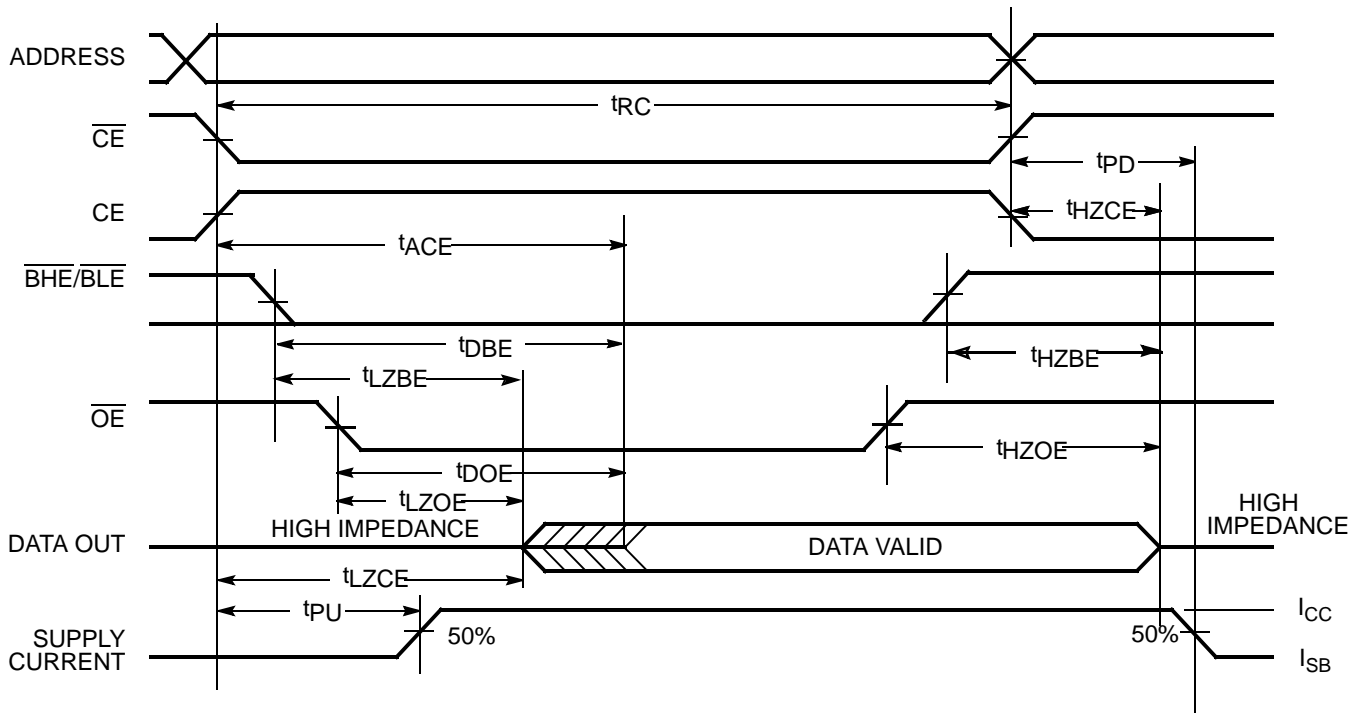
15. BHE.BLE is the AND of both BHE and BLE. Chip can be deselected by either disabling the chip enable signals or by disabling both \overline{BHE} and \overline{BLE} .
16. Test conditions for all parameters other than tri-state parameters assume signal transition time of 3 ns or less, timing reference 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} , $\overline{CE}_1 = V_{IL}$, BHE and/or BLE = V_{IL} , and CE₂ = 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{OE} Controlled)^[21, 22]



Notes:

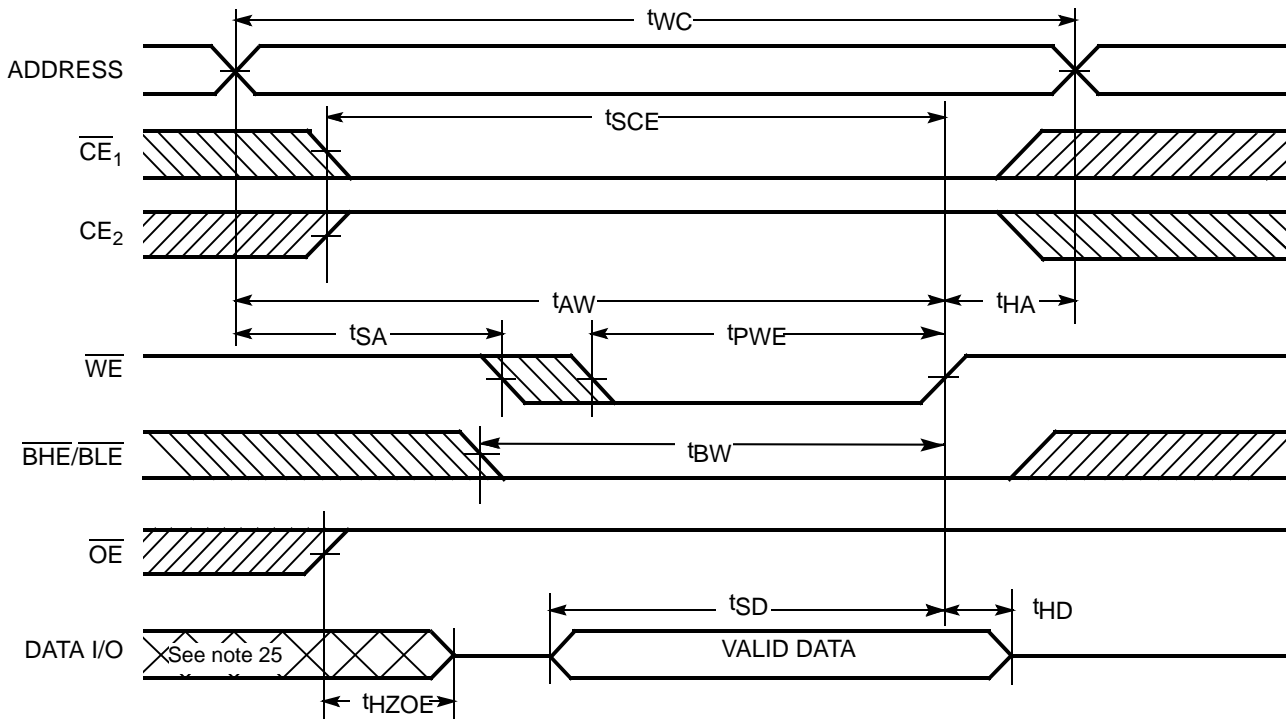
20. The device is continuously selected. OE, $\overline{CE}_1 = V_{IL}$, \overline{BHE} and/or $\overline{BLE} = V_{IL}$, and $CE_2 = V_{IH}$.

21. WE is HIGH for read cycle.

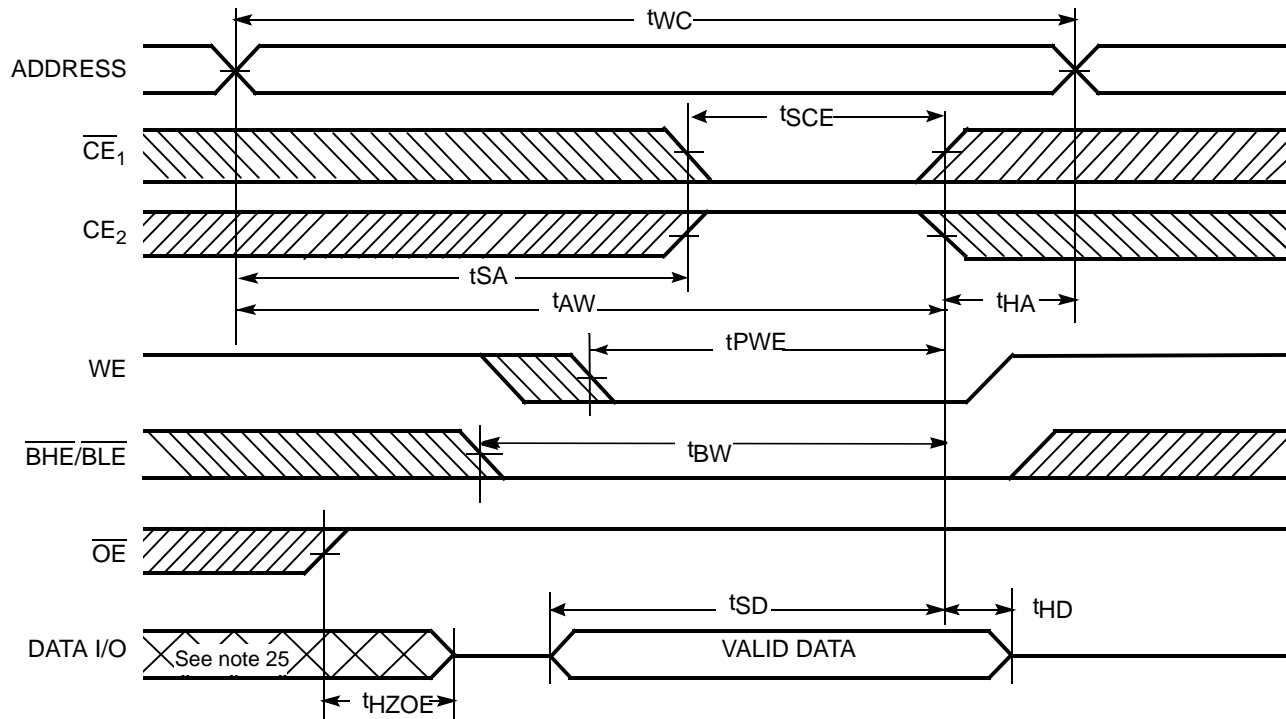
22. Address valid prior to or coincident with \overline{CE}_1 , \overline{BHE} , \overline{BLE} transition LOW and CE_2 transition HIGH.

Switching Waveforms (continued)

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



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

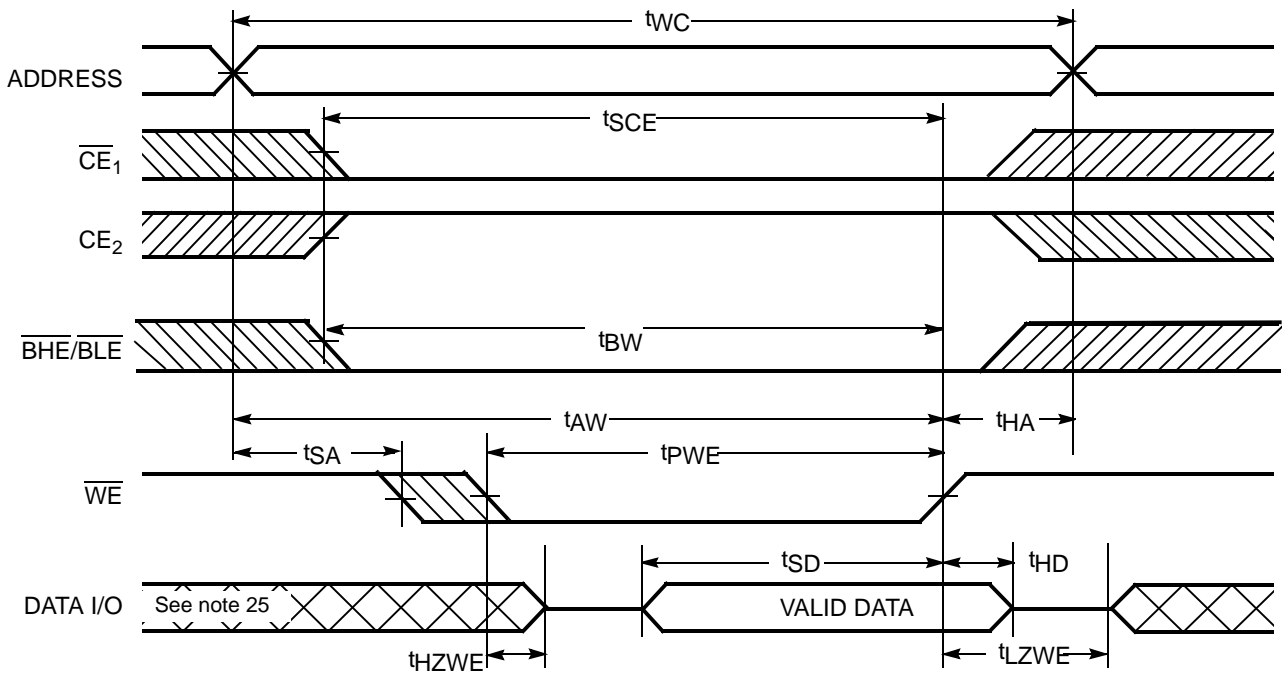


Notes:

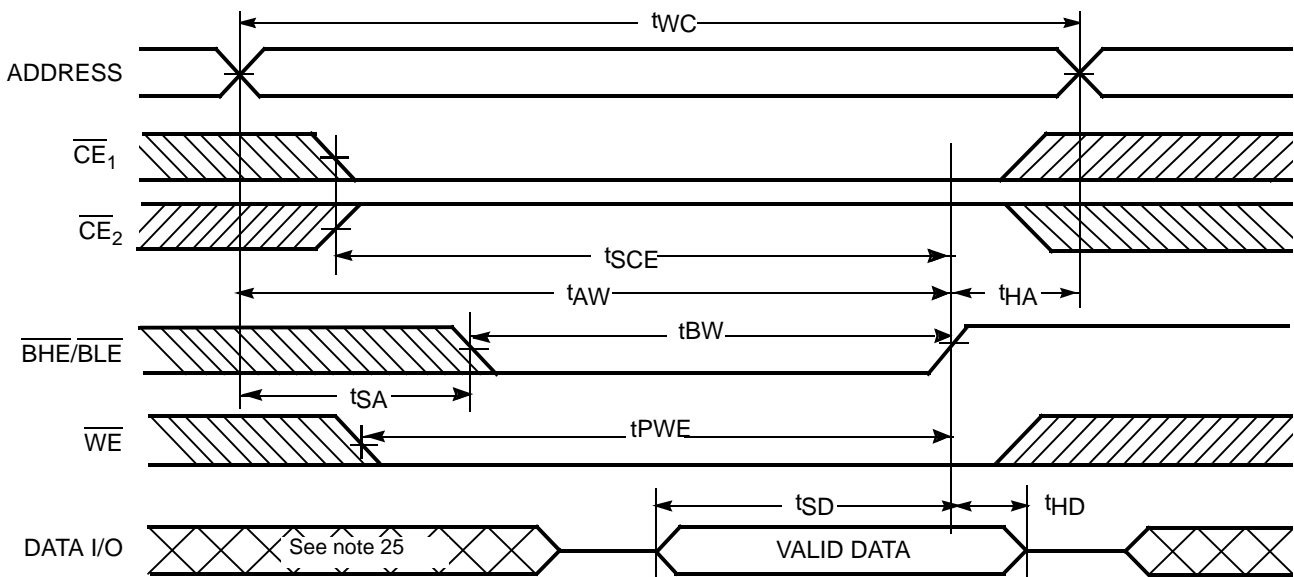
- 23. Data I/O is high-impedance if $\overline{OE} = V_{IH}$.
- 24. If \overline{CE}_1 goes HIGH and \overline{CE}_2 goes LOW simultaneously with $\overline{WE} = V_{IH}$, the output remains in a high-impedance state.
- 25. During this period, the I/Os are in output state and input signals should not be applied.

Switching Waveforms (continued)

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



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



Truth Table

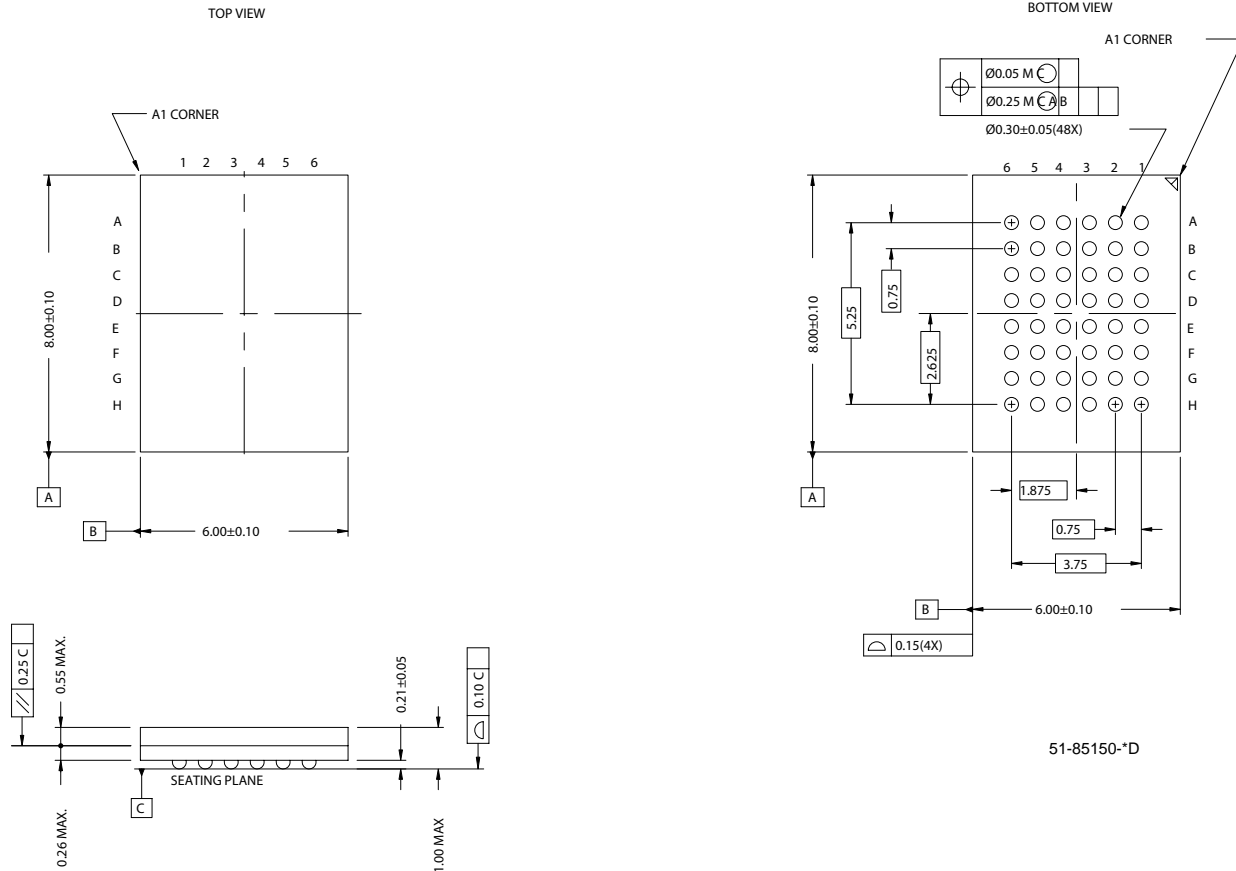
\overline{CE}_1	\overline{CE}_2	\overline{WE}	\overline{OE}	\overline{BHE}	\overline{BLE}	Inputs/Outputs	Mode	Power
H	X	X	X	X	X	High Z	Deselect/Power-Down	Standby (I_{SB})
X	L	X	X	X	X	High Z	Deselect/Power-Down	Standby (I_{SB})
X	X	X	X	H	H	High Z	Deselect/Power-Down	Standby (I_{SB})
L	H	H	L	L	L	Data 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
CY62157DV30L-55ZSXE	51-85087	44-pin TSOP II (Pb-free)		
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

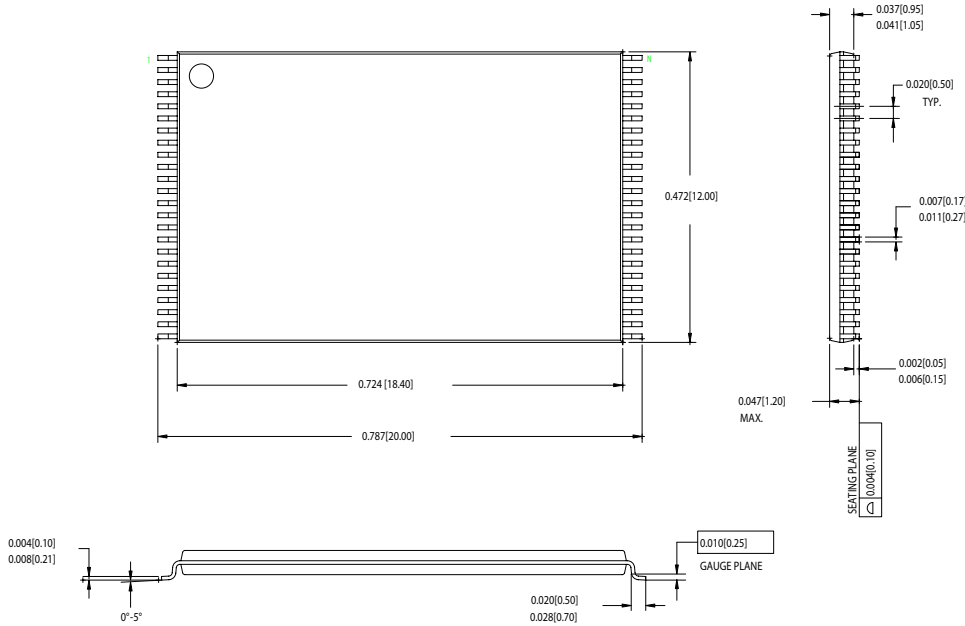
48-ball FBGA (6 x 8 x 1 mm) (51-85150)



Package Diagrams (continued)

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

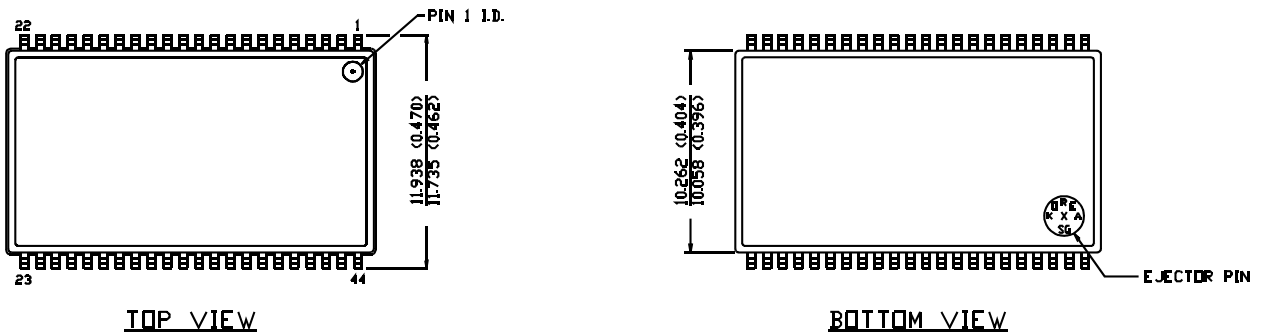
DIMENSIONS IN INCHES(MM) MIN. MAX.
JEDEC # MO-142



51-85183-A

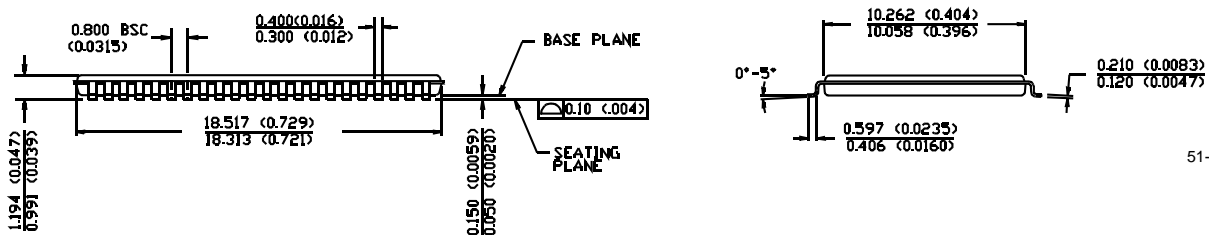
DIMENSION IN MM (INCH)
MAX
MIN

44-pin TSOP II (51-85087)



TOP VIEW

BOTTOM VIEW



51-85087-A

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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