

2-Mbit (128K x 16) Static RAM

Features

- **Very high speed: 45 ns**
- **Wide voltage range: 2.20V–3.60V**
- **Pin-compatible with CY62137CV30**
- **Ultra-low standby power**
 - **Typical standby current: 1µA**
 - **Maximum standby current: 7µA**
- **Ultra-low active power**
 - **Typical active current: 2 mA @ f = 1 MHz**
- **Easy memory expansion with \overline{CE} , and \overline{OE} features**
- **Automatic power-down when deselected**
- **CMOS for optimum speed/power**
- **Byte power-down feature**
- **Offered in Pb-free 48-ball VFBGA and 44-pin TSOPII package**

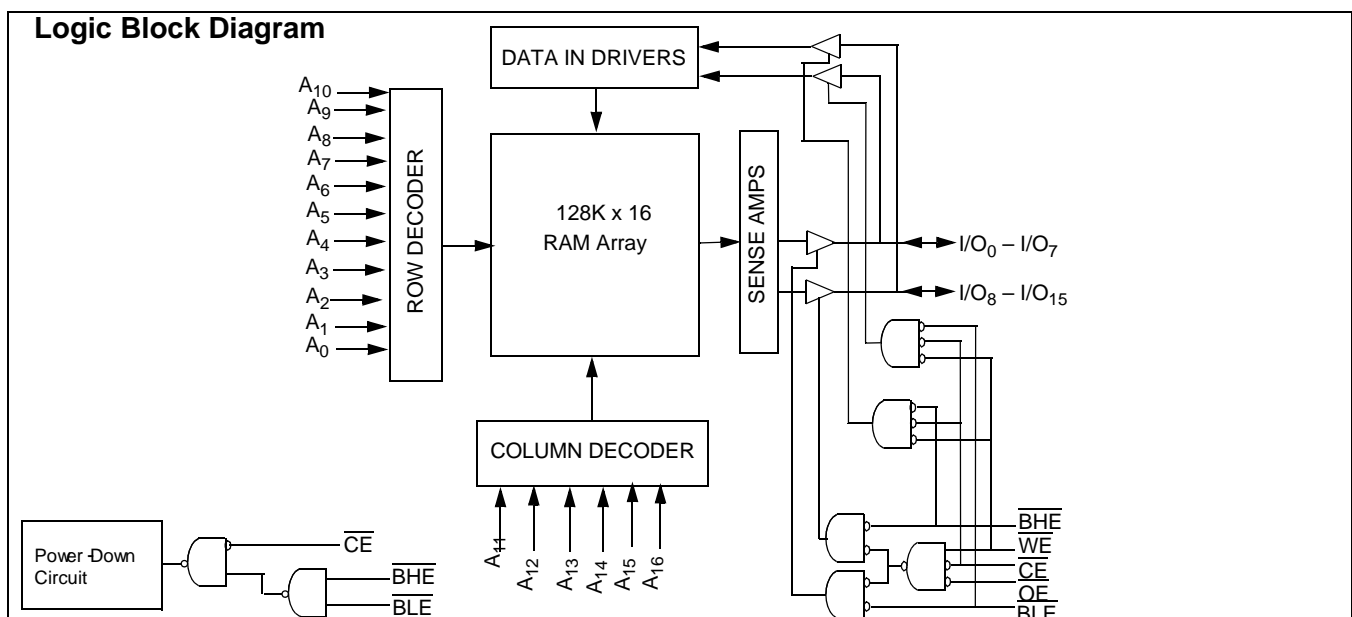
Functional Description^[1]

The CY62137EV30 is a high-performance CMOS static RAM organized as 128K 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 90% when addresses are not toggling. 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 asserting 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_{16}). 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_{16}).

Reading from the device is accomplished by asserting 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.

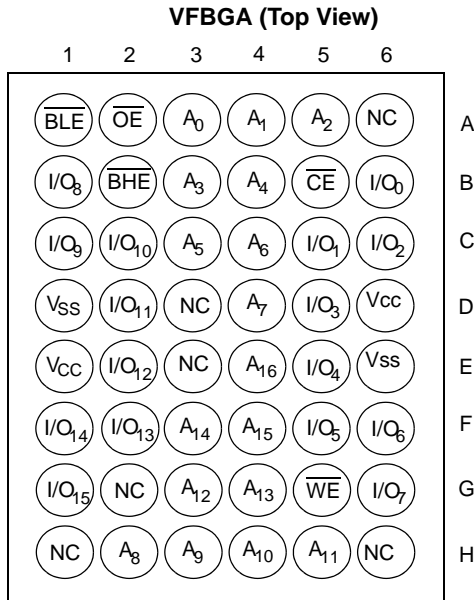
The CY62137EV30 is available in 48-ball VFBGA and 44-pin TSOPII packages.



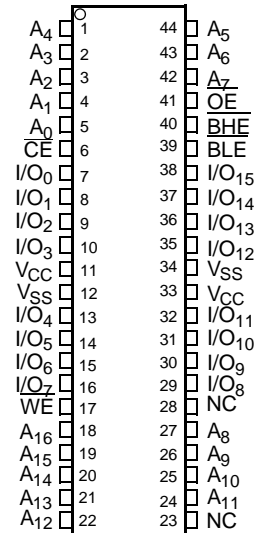
Note:

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

Pin Configurations^[2, 3]



44 TSOP II (Top View)



Product Portfolio

| Product | V _{CC} Range (V) | | | Speed (ns) | Power Dissipation | | | | | |
|------------------|---------------------------|------|---------------------|------------|--------------------------------|------|----------------------|------|-------------------------------|---|
| | | | | | Operating I _{CC} (mA) | | | | Standby I _{SB2} (μA) | |
| | | | | | f = 1MHz | | f = f _{max} | | | |
| Min. | Typ. ^[7] | Max. | Typ. ^[7] | Max. | Typ. ^[7] | Max. | Typ. ^[7] | Max. | | |
| CY62137EV30-45LL | 2.2V | 3.0V | 3.6V | 45 ns | 2 | 2.5 | 15 | 20 | 1 | 7 |

Note:

2. NC pins are not connected on the die.
3. Pins D3, H1, G2, and H6 in the BGA package are address expansion pins for 4 Mb, 8 Mb, 16 Mb, and 32 Mb, respectively.

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 3.9V ($V_{CC(MAX)} + 0.3V$)
 DC Voltage Applied to Outputs in High-Z State^[4, 5] -0.3V to 3.9V ($V_{CC MAX} + 0.3V$)

DC Input Voltage^[4, 5] -0.3V to 3.9V ($V_{CC MAX} + 0.3V$)
 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 | V_{CC} ^[6] |
|------------------|------------|---------------------|-------------------------|
| CY62137EV30-45LL | Industrial | -40°C to +85°C | 2.2V to 3.6V |

Electrical Characteristics Over the Operating Range

| Parameter | Description | Test Conditions | 45 ns | | | Unit | |
|------------------|---|---|--|---------------------|-----------------------|------|----|
| | | | Min. | Typ. ^[7] | 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} = 2.1mA | 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} | | -1 | +1 | μA | |
| I _{OZ} | Output Leakage Current | GND ≤ V _O ≤ V _{CC} , Output Disabled | | -1 | +1 | μA | |
| I _{CC} | V _{CC} Operating Supply Current | f = f _{MAX} = 1/t _{RC} | V _{CC} = V _{CCmax} | | 15 | 20 | mA |
| | | f = 1 MHz | I _{OUT} = 0 mA CMOS levels | | 2.0 | 2.5 | |
| 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 and WE), V _{CC} = 3.60V | | | 1 | 7 | μA |
| 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 | | | 1 | 7 | μA |

Notes:

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 20ns.
6. 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.
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.

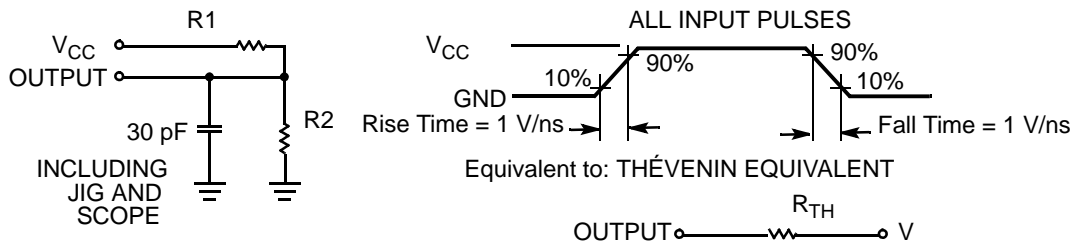
Capacitance (for all packages)^[8]

| 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

| Parameter | Description | Test Conditions | BGA | TSOP II | Unit |
|-----------------|---|--|-----|---------|------|
| Θ _{JA} | Thermal Resistance (Junction to Ambient) ^[8] | Still Air, soldered on a 3 x 4.5 inch, two-layer printed circuit board | 75 | 77 | °C/W |
| Θ _{JC} | Thermal Resistance (Junction to Case) ^[8] | | 10 | 13 | °C/W |

AC Test Loads and Waveforms

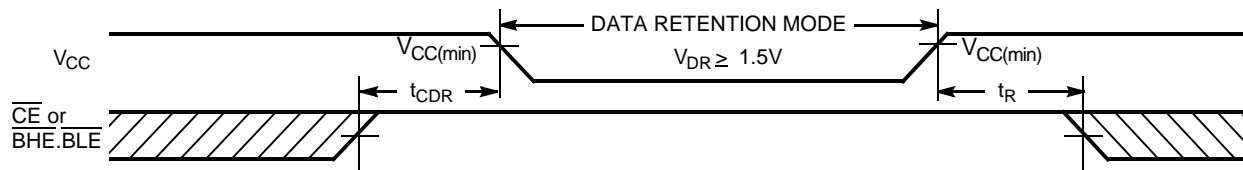


| Parameters | 2.50V | 3.0V | Unit |
|-----------------|-------|------|------|
| R1 | 16667 | 1103 | Ω |
| R2 | 15385 | 1554 | Ω |
| R _{TH} | 8000 | 645 | Ω |
| V _{TH} | 1.20 | 1.75 | V |

Data Retention Characteristics (Over the Operating Range)

| Parameter | Description | Conditions | Min. | Typ. ^[7] | Max. | Unit |
|---------------------------------|--------------------------------------|--|-----------------|---------------------|------|------|
| V _{DR} | V _{CC} for Data Retention | | 1 | | | V |
| I _{CCDR} | Data Retention Current | V _{CC} = 1V CE ≥ V _{CC} - 0.2V, V _{IN} ≥ V _{CC} - 0.2V or V _{IN} ≤ 0.2V | | 0.8 | 3 | μA |
| 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:

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

Switching Characteristics Over the Operating Range ^[11]

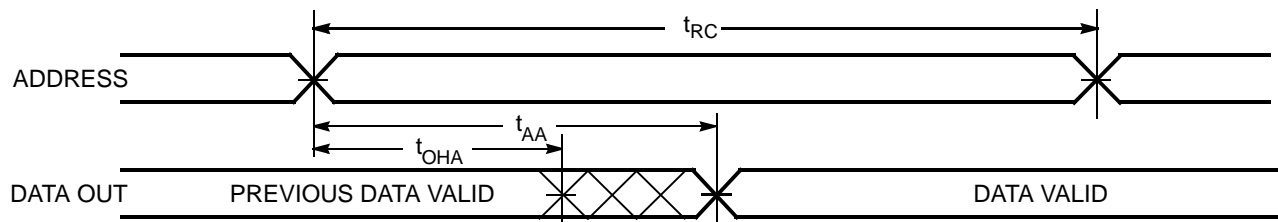
| Parameter | Description | 45 ns | | Unit |
|-----------------------------------|--|-------|------|------|
| | | Min. | Max. | |
| Read Cycle | | | | |
| t _{RC} | Read Cycle Time | 45 | | ns |
| t _{AA} | Address to Data Valid | | 45 | ns |
| t _{OHA} | Data Hold from Address Change | 10 | | ns |
| t _{ACE} | \overline{CE} LOW to Data Valid | | 45 | ns |
| t _{DOE} | \overline{OE} LOW to Data Valid | | 22 | ns |
| t _{LZOE} | \overline{OE} LOW to Low Z ^[12] | 5 | | ns |
| t _{HZOE} | \overline{OE} HIGH to High Z ^[12, 13] | | 18 | ns |
| t _{LZCE} | \overline{CE} LOW to Low Z ^[12] | 10 | | ns |
| t _{HZCE} | \overline{CE} HIGH to High Z ^[12, 13] | | 18 | ns |
| t _{PU} | \overline{CE} LOW to Power-Up | 0 | | ns |
| t _{PD} | \overline{CE} HIGH to Power-Down | | 45 | ns |
| t _{DBE} | $\overline{BLE}/\overline{BHE}$ LOW to Data Valid | | 45 | ns |
| t _{LZBE} | $\overline{BLE}/\overline{BHE}$ LOW to Low Z ^[12] | 5 | | ns |
| t _{HZBE} | $\overline{BLE}/\overline{BHE}$ HIGH to HIGH Z ^[12, 13] | | 18 | ns |
| Write Cycle^[14] | | | | |
| t _{WC} | Write Cycle Time | 45 | | ns |
| t _{SCE} | \overline{CE} LOW to Write End | 35 | | ns |
| t _{AW} | Address Set-Up to Write End | 35 | | ns |
| t _{HA} | Address Hold from Write End | 0 | | ns |
| t _{SA} | Address Set-Up to Write Start | 0 | | ns |
| t _{PWE} | \overline{WE} Pulse Width | 35 | | ns |
| t _{BW} | $\overline{BLE}/\overline{BHE}$ LOW to Write End | 35 | | ns |
| t _{SD} | Data Set-Up to Write End | 25 | | ns |
| t _{HD} | Data Hold from Write End | 0 | | ns |
| t _{HZWE} | \overline{WE} LOW to High-Z ^[12, 13] | | 18 | ns |
| t _{LZWE} | \overline{WE} HIGH to Low-Z ^[12] | 10 | | ns |

Notes:

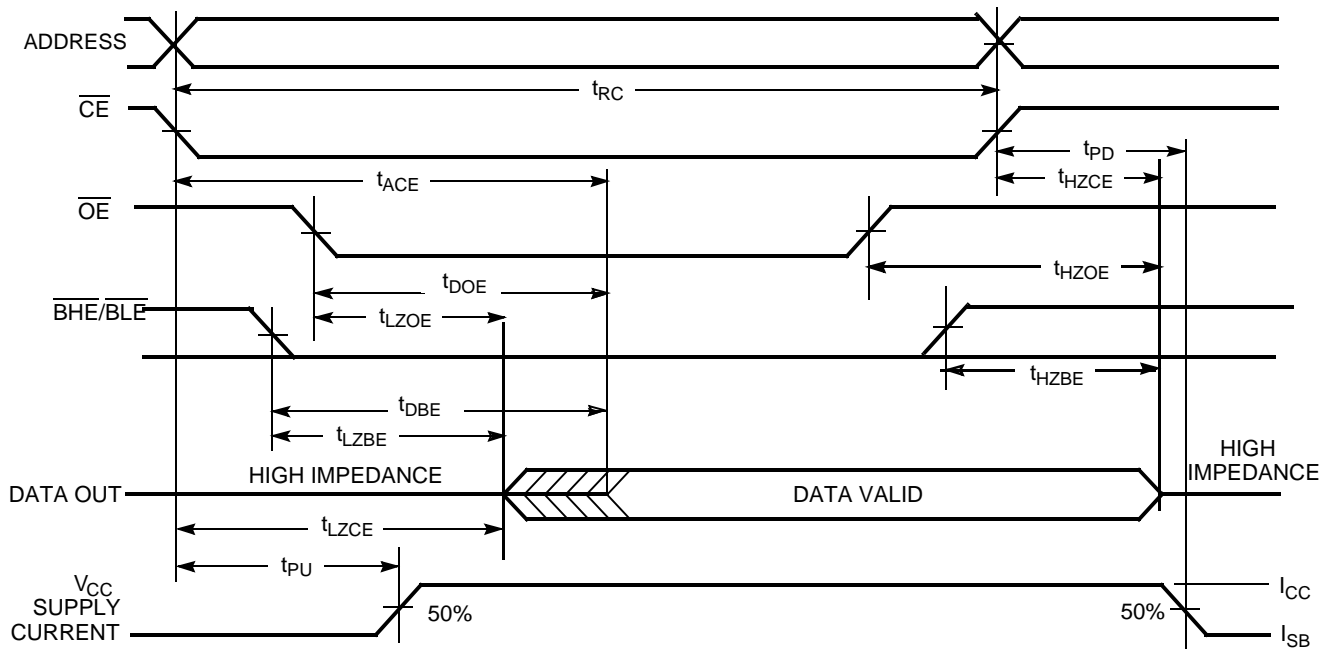
10. $\overline{BHE}.\overline{BLE}$ is the AND of both \overline{BHE} and \overline{BLE} . The chip can be deselected by either disabling the chip enable signals or by disabling both \overline{BHE} and \overline{BLE} .
11. Test conditions for all parameters other than tri-state parameters assume signal transition time of 3 ns (1V/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.
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} , $\overline{CE} = V_{IL}$, \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)^[15, 16]



Read Cycle No. 2 ($\overline{\text{OE}}$ Controlled)^[16, 17]

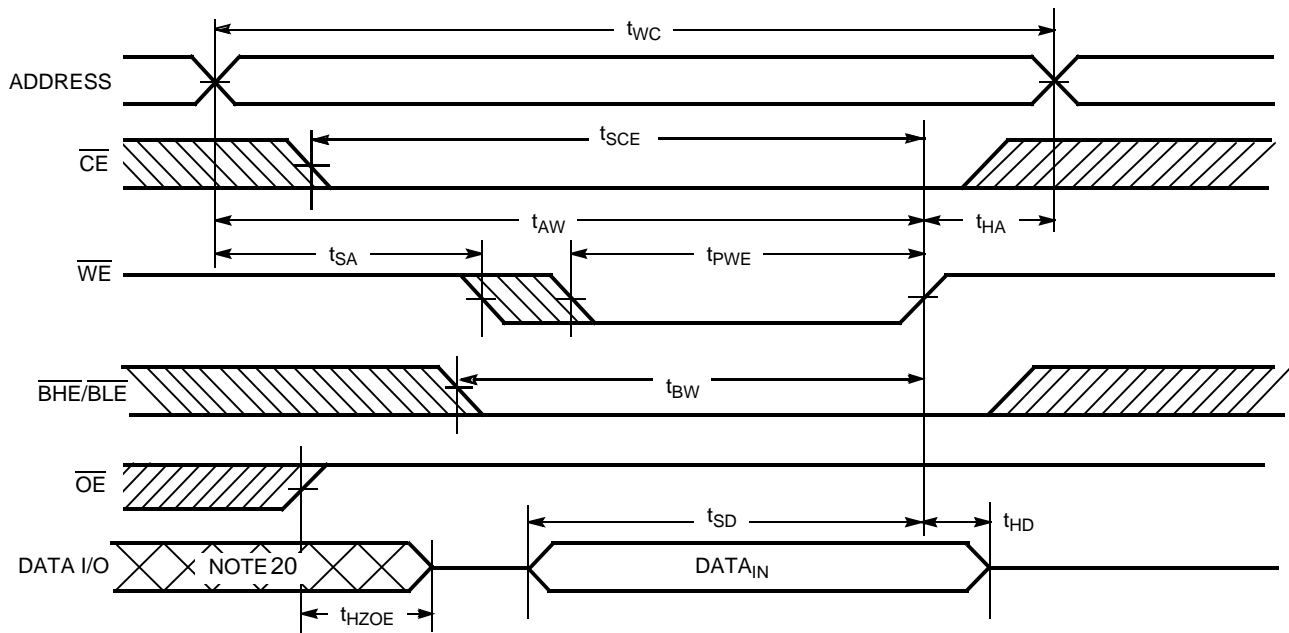


Notes:

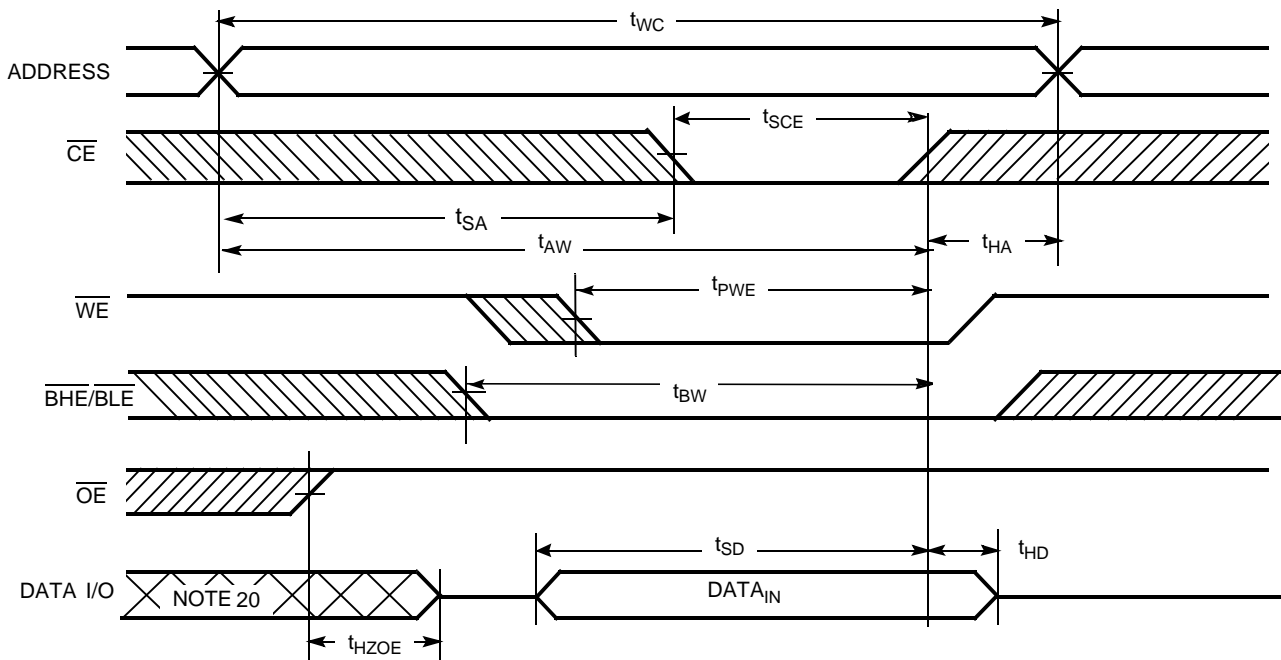
- 15. The device is continuously selected. $\overline{\text{OE}}$, $\overline{\text{CE}} = V_{\text{IL}}$, $\overline{\text{BHE}}$ and/or $\overline{\text{BLE}} = V_{\text{IL}}$.
- 16. $\overline{\text{WE}}$ is HIGH for read cycle.
- 17. Address valid prior to or coincident with $\overline{\text{CE}}$ and $\overline{\text{BHE}}$, $\overline{\text{BLE}}$ transition LOW.

Switching Waveforms (continued)

Write Cycle No. 1 ($\overline{\text{WE}}$ Controlled)^[14, 18, 19]



Write Cycle No. 2 ($\overline{\text{CE}}$ Controlled)^[14, 18, 19]

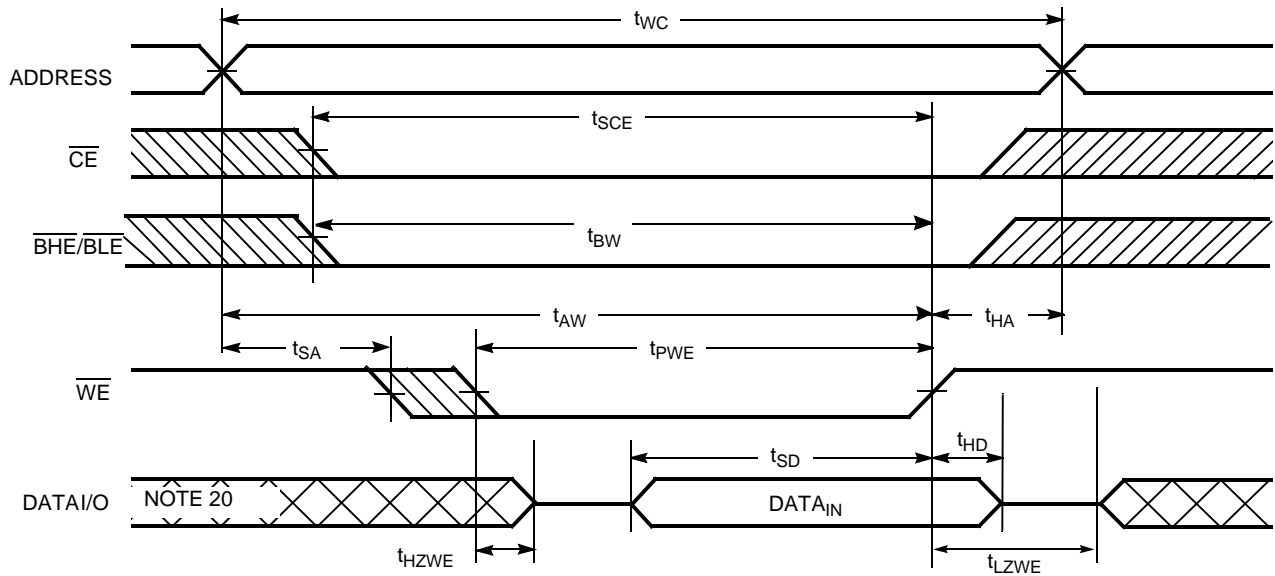


Notes:

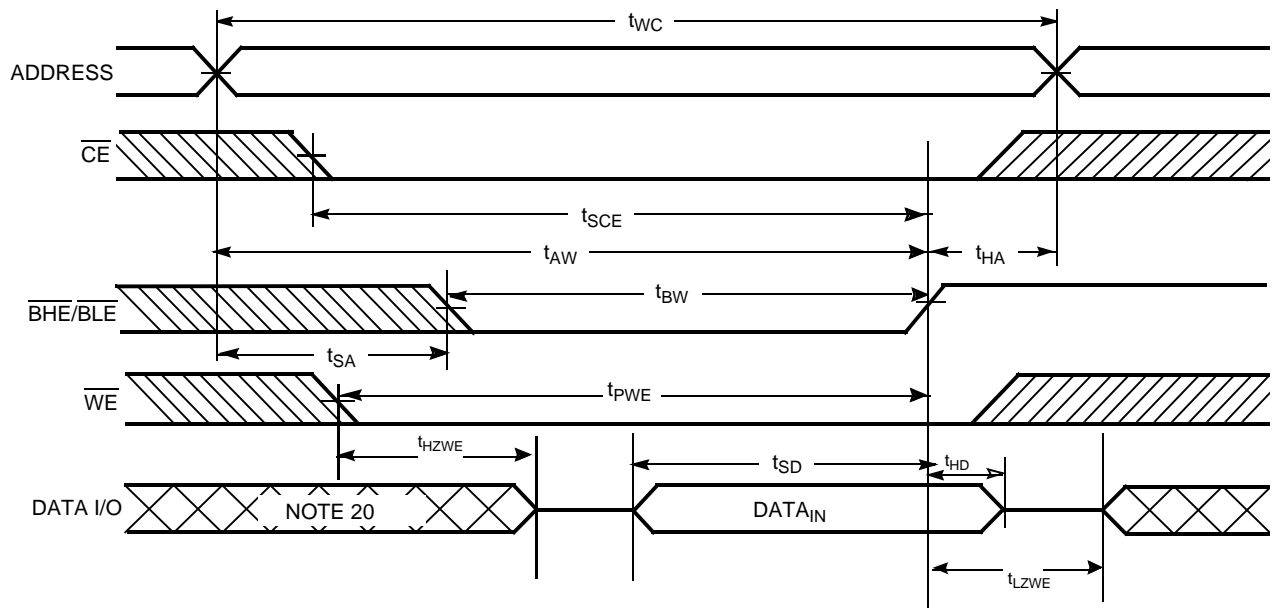
- 18. Data I/O is high impedance if $\overline{\text{OE}} = V_{\text{IH}}$.
- 19. If $\overline{\text{CE}}$ goes HIGH simultaneously with $\text{WE} = V_{\text{IH}}$, the output remains in a high-impedance state.
- 20. During this period, the I/Os are in output state and input signals should not be applied.

Switching Waveforms (continued)

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



Write Cycle No. 4 ($\overline{BHE}/\overline{BLE}$ Controlled, \overline{OE} LOW)^[19]



Truth Table

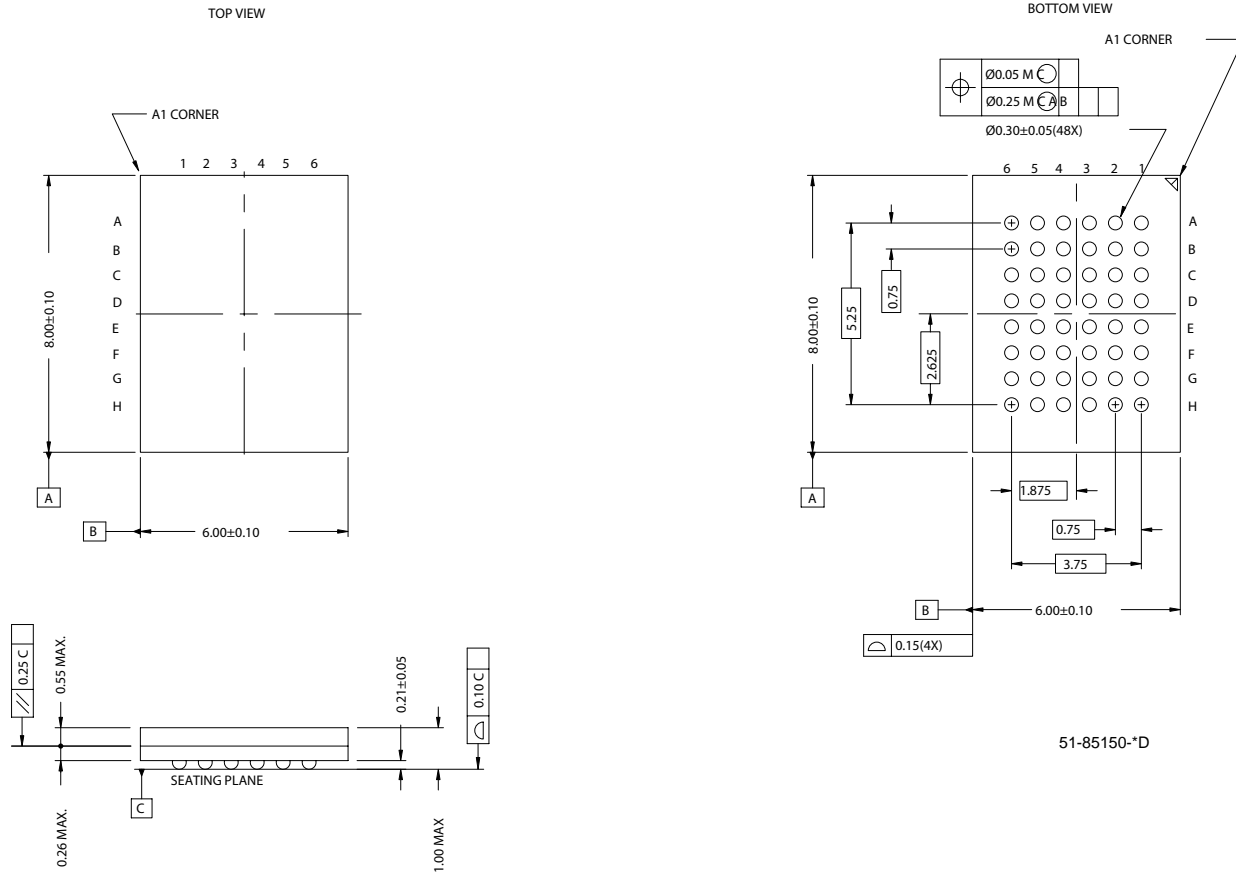
| $\overline{\text{CE}}$ | $\overline{\text{WE}}$ | $\overline{\text{OE}}$ | $\overline{\text{BHE}}$ | $\overline{\text{BLE}}$ | Inputs/Outputs | Mode | Power |
|------------------------|------------------------|------------------------|-------------------------|-------------------------|---|---------------------|-----------------------------|
| 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 | Data Out (I/O_0 – 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_0 – I/O_{15}) | Write | Active (I_{CC}) |
| L | L | X | H | L | Data In (I/O_0 – 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 | CY62137EV30LL-45BVXI | 51-85150 | 48-ball Very Fine Pitch BGA (6 mm x 8mm x 1 mm) (Pb-free) | Industrial |
| 45 | CY62137EV30LL-45ZSXI | 51-85087 | 44-pin TSOP II (Pb-free) | |

Package Diagrams

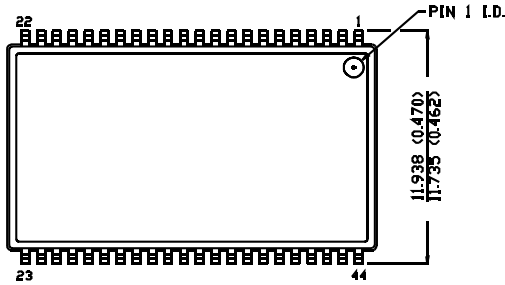
48-pin VFBGA (6 x 8 x 1 mm) (51-85150)



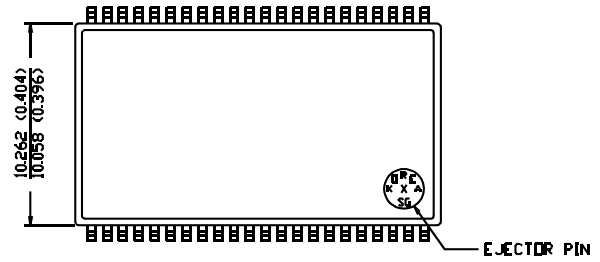
Package Diagrams (continued)

44-Pin TSOP II (51-85087)

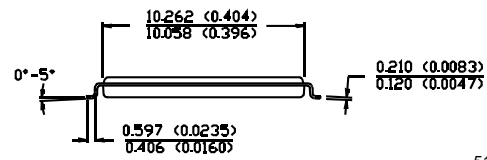
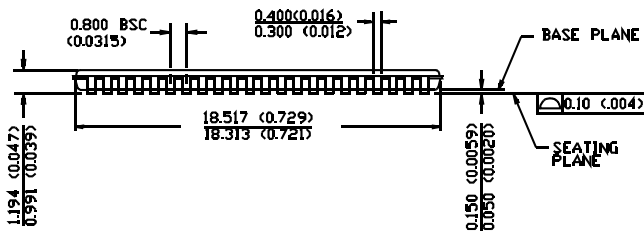
DIMENSION IN MM (INCH)
MAX
MIN



TOP VIEW



BOTTOM VIEW



51-85087-A

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Document History Page

| Document Title: CY62137EV30 MoBL® 2-Mbit (128K x 16) Static RAM Document Number: 38-05443 | | | | |
|--|---------|------------|-----------------|---|
| REV. | ECN NO. | Issue Date | Orig. of Change | Description of Change |
| ** | 203720 | See ECN | AJU | New Data Sheet |
| *A | 234196 | See ECN | AJU | <p>Changed I_{CC} MAX at f=1MHz from 1.7 mA to 2.0 mA Changed I_{CC} TYP from 12 mA (35 ns speed bin) and 10 mA (45 ns speed bin) to 15 mA and 12 mA respectively Changed I_{CC} MAX from 20 mA (35 ns speed bin) and 15 mA (45 ns speed bin) to 25 mA and 20 mA respectively Changed I_{SB1} and I_{SB2} TYP from 0.6 μA to 0.7 μA Changed I_{SB1} and I_{SB2} MAX from 1.5 μA to 2.5 μA Changed I_{CCDR} from 1 μA to 2 μA Fixed typos on TSOP II pinout: Pin 18-22: address lines Pin 23: NC Added Pb-free information</p> |
| *B | 427817 | See ECN | NXR | <p>Converted from Advanced Information to Final. Removed 35 ns Speed Bin Removed "L" version Changed ball E3 from DNU to NC. Removed the redundant footnote on DNU. Moved Product Portfolio from Page # 3 to Page #2. Changed I_{CC} (Max) value from 2 mA to 2.5 mA and I_{CC} (Typ) value from 1.5 mA to 2 mA at f=1 MHz Changed I_{CC} (Typ) value from 12 mA to 15 mA at f = f_{max}=1/t_{RC} Changed I_{SB1} and I_{SB2} Typ. values from 0.7 μA to 1 μA and Max. values from 2.5 μA to 7 μA. Changed V_{CC} stabilization time in footnote #7 from 100 μs to 200 μs Changed the AC test load capacitance from 50pF to 30pF on Page# 4 Changed V_{DR} from 1.5V to 1V on Page# 4. Changed I_{CCDR} from 2 μA to 3 μA. Added I_{CCDR} typical value. Corrected t_R in Data Retention Characteristics from 100 μs to t_{RC} ns Changed t_{OHA}, t_{LZCE} and t_{LZWE} from 6 ns to 10 ns Changed t_{LZBE} from 6 ns to 5 ns Changed t_{LZOE} from 3 ns to 5 ns Changed t_{HZOE}, t_{HZCE}, t_{HZBE} and t_{HZWE} from 15 ns to 18 ns Changed t_{SCE}, t_{AW} and t_{BW} from 40 ns to 35 ns Changed t_{PWE} from 30 ns to 35 ns Changed t_{SD} from 20 ns to 25 ns Updated the Ordering Information table and replaced the Package Name column with Package Diagram.</p> |

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