

Features

- 3.3 V operation (3.0 V–3.6 V)
- High speed
 - $t_{AA} = 15$ ns
- CMOS for optimum speed/power
- Low Active Power
 - 576 mW (max)
- Low CMOS Standby Power
 - 1.80 mW (max)
- Automatic power-down when deselected
- Independent control of upper and lower bits
- Available in 44-pin TSOP II and 48-ball Mini BGA package

Functional Description

The CY7C1021BNV33^[1] is a high-performance CMOS static RAM organized as 65,536 words by 16 bits. This device has an automatic power-down feature that significantly reduces power consumption when deselected.

Writing to the device is accomplished by taking Chip Enable (\overline{CE}) and Write Enable (WE) inputs LOW. If Byte Low Enable (BLE) is LOW, then data from I/O pins (I/O₀ through I/O₇), is written into the location specified on the address pins (A₀ through A₁₅). If Byte High Enable (BHE) is LOW, then data from I/O pins (I/O₈ through I/O₁₅) is written into the location specified on the address pins (A₀ through A₁₅).

Reading from the device is accomplished by taking Chip Enable (\overline{CE}) and Output Enable (\overline{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/O₀ to I/O₇. If Byte High Enable (BHE) is LOW, then data from memory will appear on I/O₈ to I/O₁₅. See the truth table at the back of this data sheet for a complete description of read and write modes.

The input/output pins (I/O₀ through I/O₁₅) are placed in a high-impedance state when the device is deselected (\overline{CE} HIGH), the outputs are disabled (\overline{OE} HIGH), the BHE and BLE are disabled (BHE, BLE HIGH), or during a write operation (\overline{CE} LOW, and WE LOW).

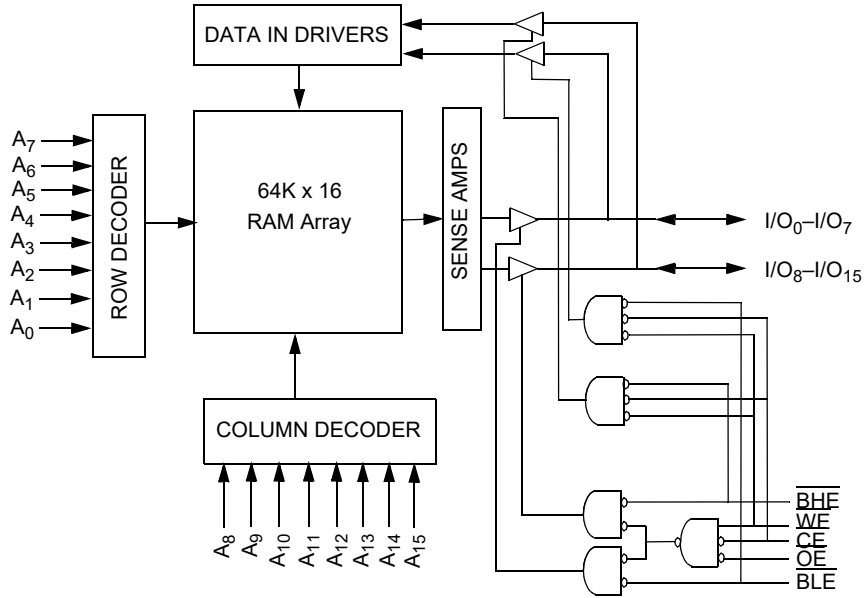
The CY7C1021BNV33 is available in standard 44-pin TSOP Type II and 48-ball mini BGA packages.

For a complete list of related documentation, click [here](#).

Note

1. For guidelines on SRAM system design, please refer to the 'System Design Guidelines' Cypress application note, available on the internet at www.cypress.com.

Logic Block Diagram



Selection Guide

| | |
|-----------------------------------|------------|
| | -15 |
| Maximum Access Time (ns) | 15 |
| Maximum Operating Current (mA) | 160 |
| Maximum CMOS Standby Current (mA) | 0.5 |

Contents

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Pin Configurations

Figure 1. 44-pin TSOP Type II pinout

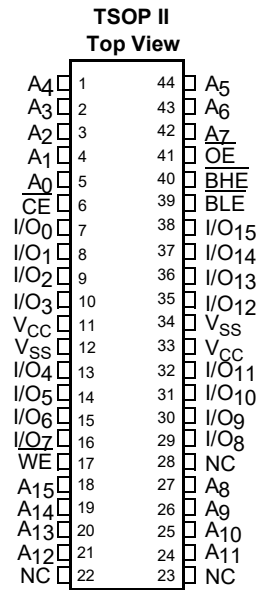
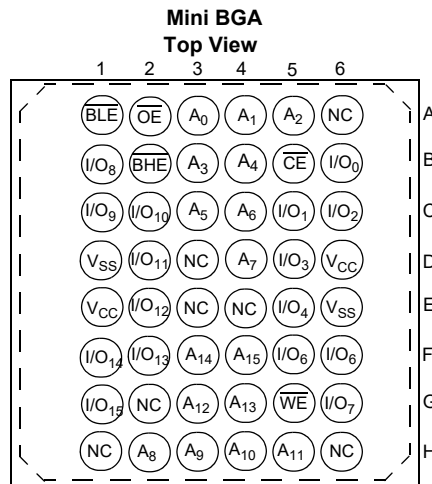


Figure 2. 48-ball mini BGA pinout



Maximum Ratings

Exceeding maximum ratings may shorten the useful life of the device. User guidelines are not tested.

- Storage Temperature -65 °C to +150 °C
- Ambient Temperature with Power Applied -55 °C to +125 °C
- Supply Voltage on V_{CC} to Relative GND [2] -0.5 V to +4.6 V
- DC Voltage Applied to Outputs in High Z State [2] -0.5 V to V_{CC} + 0.5 V

- DC Input Voltage [2] -0.5 V to V_{CC} + 0.5 V
- Current into Outputs (LOW) 20 mA
- Static Discharge Voltage (per MIL-STD-883, Method 3015) > 2001 V
- Latch-Up Current > 200 mA

Operating Range

| Range | Ambient Temperature | V _{CC} |
|------------|---------------------|-----------------|
| Industrial | -40 °C to +85 °C | 3.3 V ± 10% |

Electrical Characteristics

Over the Operating Range

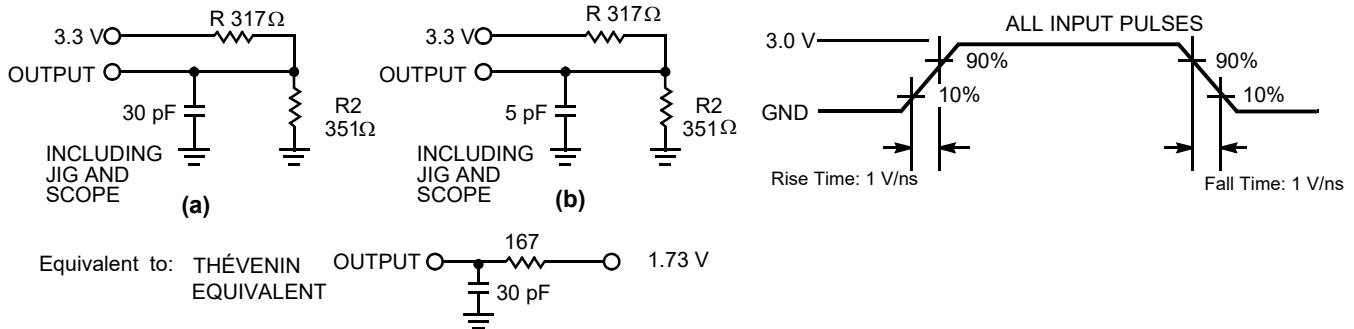
| Parameter | Description | Test Conditions | -15 | | Unit |
|------------------|---|---|------|-----------------------|------|
| | | | Min | Max | |
| V _{OH} | Output HIGH Voltage | V _{CC} = Min, I _{OH} = -4.0 mA | 2.4 | - | V |
| V _{OL} | Output LOW Voltage | V _{CC} = Min, I _{OL} = 8.0 mA | - | 0.4 | V |
| V _{IH} | Input HIGH Voltage | | 2.2 | V _{CC} + 0.3 | V |
| V _{IL} | Input LOW Voltage [2] | | -0.3 | 0.8 | V |
| I _{Ix} | Input Load Current | GND ≤ V _I ≤ V _{CC} | -1 | +1 | μA |
| I _{OZ} | Output Leakage Current | GND ≤ V _I ≤ V _{CC} , Output Disabled | -1 | +1 | μA |
| I _{CC} | V _{CC} Operating Supply Current | V _{CC} = Max, I _{OUT} = 0 mA, f = f _{MAX} = 1/t _{RC} | - | 160 | mA |
| I _{SB1} | Automatic CE Power Down Current – TTL Inputs | Max V _{CC} , $\overline{CE} \geq V_{IH}$, V _{IN} ≥ V _{IH} or V _{IN} ≤ V _{IL} , f = f _{MAX} | - | 40 | mA |
| I _{SB2} | Automatic CE Power Down Current – CMOS Inputs | Max V _{CC} , $\overline{CE} \geq V_{CC} - 0.3 V$, V _{IN} ≥ V _{CC} - 0.3 V or V _{IN} ≤ 0.3 V, f = 0 | - | 500 | μA |

Capacitance

| Parameter [3] | Description | Test Conditions | Max | Unit |
|------------------|--------------------|-----------------------------------|-----|------|
| C _{IN} | Input capacitance | T _A = 25 °C, f = 1 MHz | 6 | pF |
| C _{OUT} | Output capacitance | | 8 | pF |

AC Test Loads and Waveforms

Figure 3. AC Test Loads and Waveforms



- Notes**
2. Minimum voltage is -2.0 V for pulse durations of less than 20 ns.
 3. Tested initially and after any design or process changes that may affect these parameters.

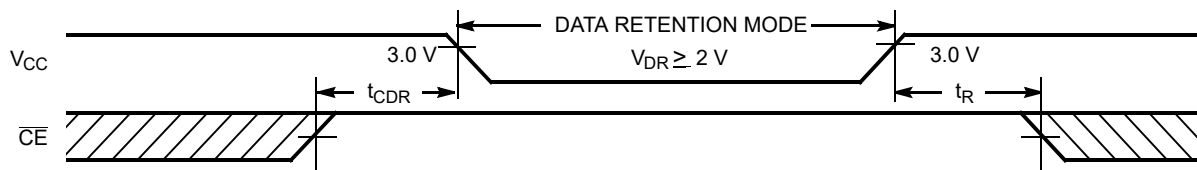
Data Retention Characteristics

Over the Operating Range (L version only)

| Parameter | Description | Conditions ^[4] | Min | Max | Unit |
|-----------------|--------------------------------------|--|-----|-----|---------------|
| V_{DR} | V_{CC} for Data Retention | | 2.0 | – | V |
| I_{CCDR} | Data Retention Current | $V_{CC} = V_{DR} = 2.0\text{ V}$, $\overline{CE} \geq V_{CC} - 0.3\text{ V}$, $V_{IN} \geq V_{CC} - 0.3\text{ V}$ or $V_{IN} \leq 0.3\text{ V}$ | – | 100 | μA |
| $t_{CDR}^{[5]}$ | Chip Deselect to Data Retention Time | | 0 | – | ns |
| $t_R^{[6]}$ | Operation Recovery Time | | 15 | – | ns |

Data Retention Waveform

Figure 4. Data Retention Waveform



Notes

4. No input may exceed $V_{CC} + 0.5\text{ V}$.
5. Tested initially and after any design or process changes that may affect these parameters.
6. $t_r \leq 3\text{ ns}$ for the -12 and -15 speeds. $t_r \leq 5\text{ ns}$ for the -20 and slower speeds.

Switching Characteristics

Over the Operating Range

| Parameter ^[7] | Description | -15 | | Unit |
|--|--|-----|-----|------|
| | | Min | Max | |
| READ CYCLE | | | | |
| t_{RC} | Read Cycle Time | 15 | – | ns |
| t_{AA} | Address to Data Valid | – | 15 | ns |
| t_{OHA} | Data Hold from Address Change | 3 | – | ns |
| t_{ACE} | \overline{CE} LOW to Data Valid | – | 15 | ns |
| t_{DOE} | \overline{OE} LOW to Data Valid | – | 7 | ns |
| t_{LZOE} | \overline{OE} LOW to Low Z | 0 | – | ns |
| t_{HZOE} | \overline{OE} HIGH to High Z ^[8, 9] | – | 7 | ns |
| t_{LZCE} | \overline{CE} LOW to Low Z ^[9] | 3 | – | ns |
| t_{HZCE} | \overline{CE} HIGH to High Z ^[8, 9] | – | 7 | ns |
| t_{PU} | \overline{CE} LOW to Power-Up | 0 | – | ns |
| t_{PD} | \overline{CE} HIGH to Power-Down | – | 15 | ns |
| t_{DBE} | Byte Enable to Data Valid | – | 7 | ns |
| t_{LZBE} | Byte Enable to Low Z | 0 | – | ns |
| t_{HZBE} | Byte Disable to High Z | – | 7 | ns |
| WRITE CYCLE ^[10, 11] | | | | |
| t_{WC} | Write Cycle Time | 15 | – | ns |
| t_{SCE} | \overline{CE} LOW to Write End | 10 | – | ns |
| t_{AW} | Address Set-Up to Write End | 10 | – | 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 | 10 | – | ns |
| t_{SD} | Data Set-Up to Write End | 8 | – | ns |
| t_{HD} | Data Hold from Write End | 0 | – | ns |
| t_{LZWE} | \overline{WE} HIGH to Low Z ^[9] | 3 | – | ns |
| t_{HZWE} | \overline{WE} LOW to High Z ^[8, 9] | – | 7 | ns |
| t_{BW} | Byte Enable to End of Write | 9 | – | ns |

Notes

- Test conditions assume signal transition time of 3 ns or less, timing reference levels of 1.5 V, input pulse levels of 0 to 3.0 V, and output loading of the specified I_{OL}/I_{OH} and 30-pF load capacitance.
- t_{HZOE} , t_{HZBE} , t_{HZCE} , and t_{HZWE} are specified with a load capacitance of 5 pF as in part (b) of [Figure 3 on page 5](#). Transition is measured ± 500 mV from steady-state voltage.
- At any given temperature and voltage condition, t_{HZCE} is less than t_{LZCE} , t_{HZOE} is less than t_{LZOE} , and t_{HZWE} is less than t_{LZWE} for any given device.
- The internal write time of the memory is defined by the overlap of \overline{CE} LOW, \overline{WE} LOW and $\overline{BHE}/\overline{BLE}$ LOW. \overline{CE} , \overline{WE} and $\overline{BHE}/\overline{BLE}$ must be LOW to initiate a write, and LOW to HIGH transition on any of these signals can terminate the write. The input data set-up and hold timing should be referenced to the leading edge of the signal that terminates the write.
- The minimum write cycle time for Write Cycle No. 3 (\overline{WE} Controlled, \overline{OE} LOW) should be equal to the sum of t_{SD} and t_{HZWE} .

Switching Waveforms

Figure 5. Read Cycle No. 1 [12, 13]

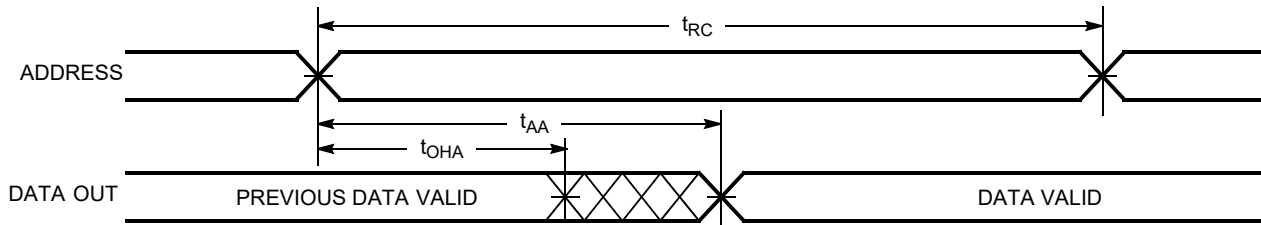
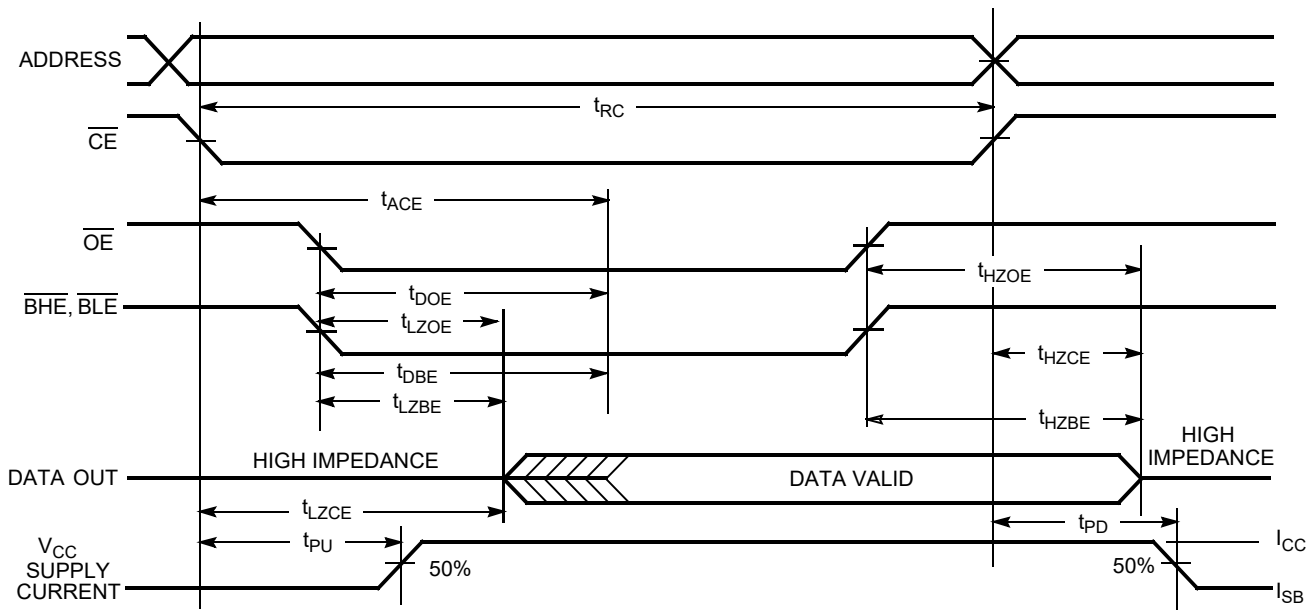


Figure 6. Read Cycle No. 2 (\overline{OE} Controlled) [13, 14]



Notes

- 12. Device is continuously selected. \overline{OE} , \overline{CE} , \overline{BHE} and/or $\overline{BHE} = V_{IL}$.
- 13. \overline{WE} is HIGH for read cycle.
- 14. Address valid prior to or coincident with \overline{CE} transition LOW.

Switching Waveforms(continued)

Figure 7. Write Cycle No. 1 (\overline{CE} Controlled) [15, 16, 17]

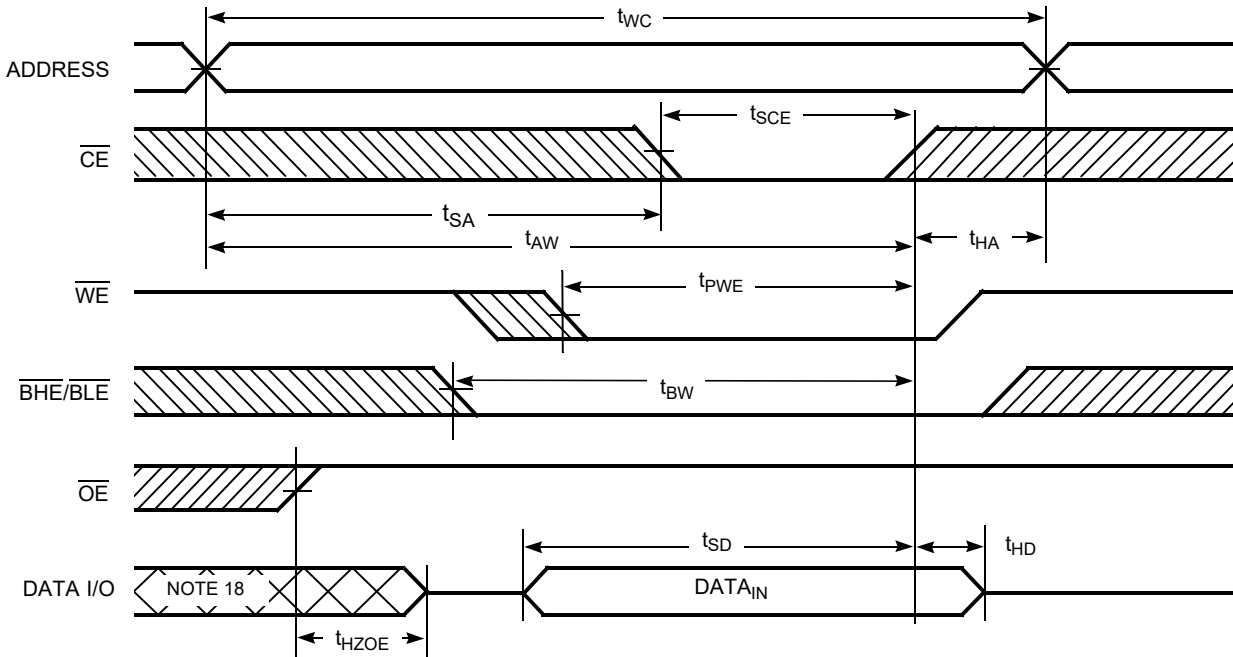
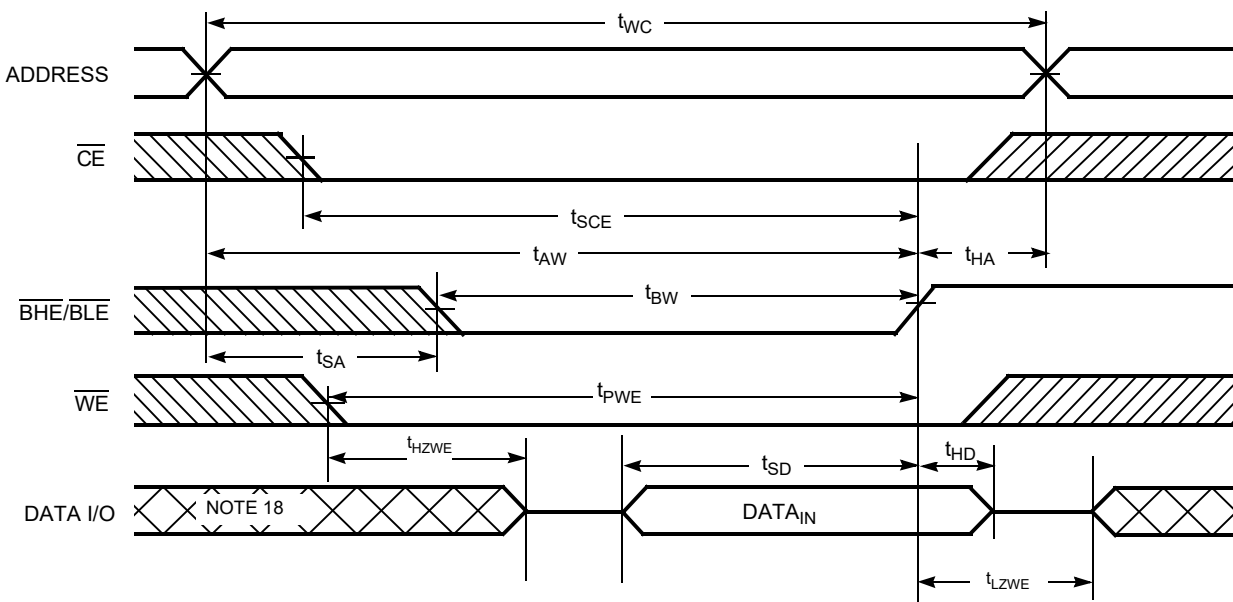


Figure 8. Write Cycle No. 2 (\overline{BLE} or \overline{BHE} Controlled) [15, 16, 17]

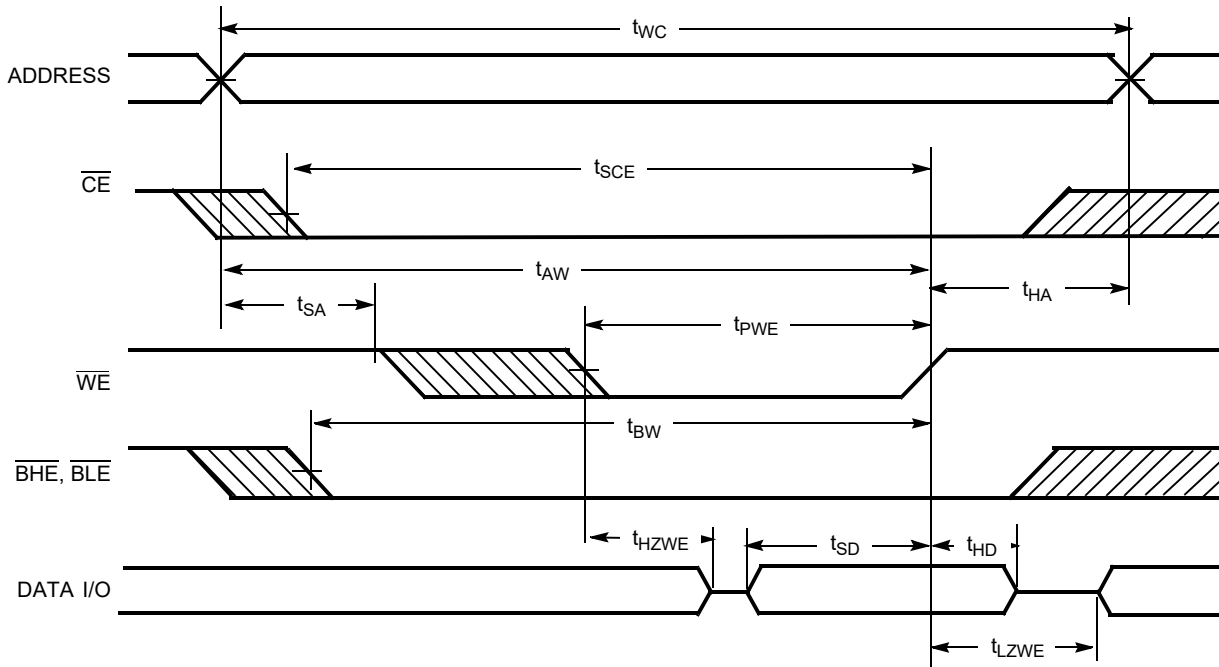


Notes

15. The internal write time of the memory is defined by the overlap of \overline{WE} , $\overline{CE} = V_{IL}$, \overline{BHE} , \overline{BLE} , or both = 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 setup and hold timing must be referenced to the edge of the signal that terminates the write.
16. Data I/O is high impedance if \overline{OE} or \overline{BHE} and/or $\overline{BLE} = V_{IH}$.
17. If \overline{CE} goes HIGH simultaneously with \overline{WE} going HIGH, the output remains in a high-impedance state.
18. During this period, the I/Os are in output state. Do not apply input signals.

Switching Waveforms(continued)

Figure 9. Write Cycle No. 3 (\overline{WE} Controlled, \overline{OE} LOW) [19, 20, 21]



Notes

19. The internal write time of the memory is defined by the overlap of \overline{WE} , $\overline{CE} = V_{IL}$, \overline{BHE} , \overline{BLE} , or both = 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 setup and hold timing must be referenced to the edge of the signal that terminates the write.
20. If \overline{CE} goes HIGH simultaneously with \overline{WE} going HIGH, the output remains in a high-impedance state.
21. The minimum write cycle pulse width should be equal to the sum of t_{SD} and t_{HZWE} .

Truth Table

| \overline{CE} | \overline{OE} | \overline{WE} | \overline{BLE} | \overline{BHE} | I/O ₀ -I/O ₇ | I/O ₈ -I/O ₁₅ | Mode | Power |
|-----------------|-----------------|-----------------|------------------|------------------|------------------------------------|-------------------------------------|----------------------------|----------------------------|
| H | X | X | X | X | High Z | High Z | Power-Down | Standby (I _{SB}) |
| L | L | H | L | L | Data Out | Data Out | Read - All bits | Active (I _{CC}) |
| | | | L | H | Data Out | High Z | Read - Lower bits only | Active (I _{CC}) |
| | | | H | L | High Z | Data Out | Read - Upper bits only | Active (I _{CC}) |
| L | X | L | L | L | Data In | Data In | Write - All bits | Active (I _{CC}) |
| | | | L | H | Data In | High Z | Write - Lower bits only | Active (I _{CC}) |
| | | | H | L | High Z | Data In | Write - Upper bits only | Active (I _{CC}) |
| L | H | H | X | X | High Z | High Z | Selected, Outputs Disabled | Active (I _{CC}) |
| L | X | X | H | H | High Z | High Z | Selected, Outputs Disabled | Active (I _{CC}) |

Ordering Information

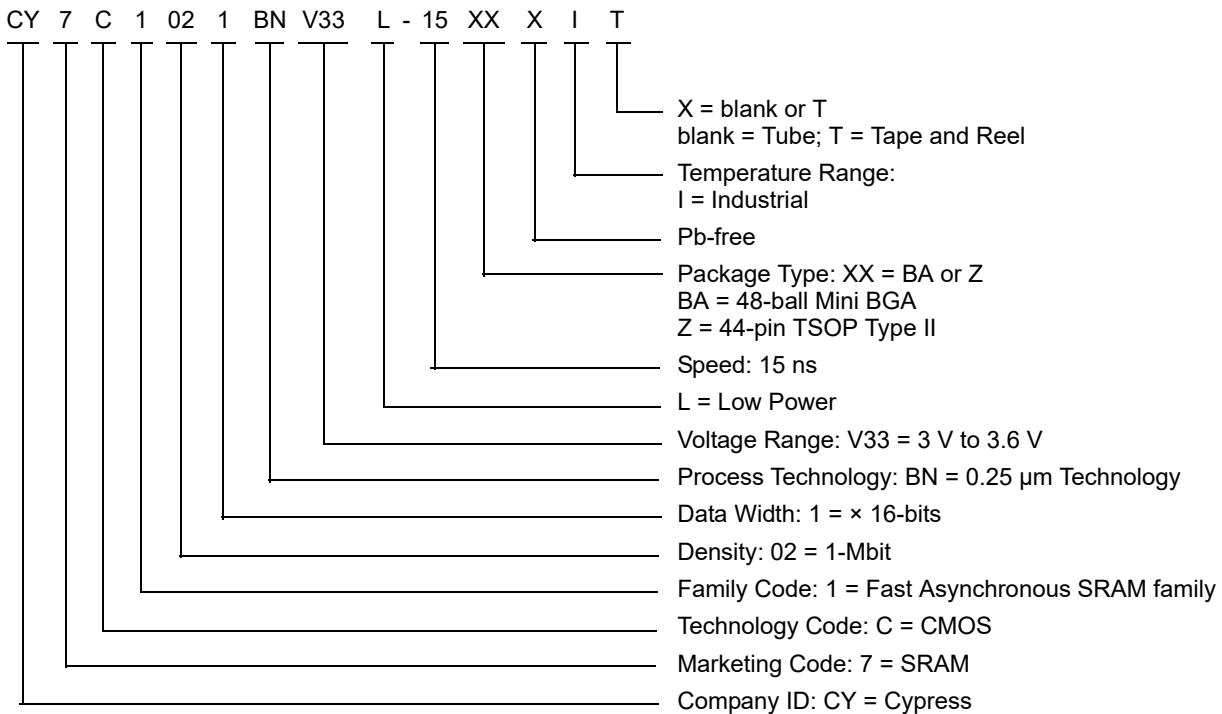
Cypress offers other versions of this type of product in many different configurations and features. The following table contains only the list of parts that are currently available. For a complete listing of all options, visit the Cypress website at <http://www.cypress.com> and refer to the product summary page at <http://www.cypress.com/products> or contact your local sales representative.

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| Speed (ns) | Ordering Code | Package Diagram | Package Type | Operating Range |
|------------|-----------------------|-----------------|--|-----------------|
| 15 | CY7C1021BNV33L-15BAI | 51-85096 | 48-ball Mini BGA (7 mm × 7 mm) | Industrial |
| | CY7C1021BNV33L-15BAIT | 51-85096 | 48-ball Mini BGA (7 mm × 7 mm) Tape and Reel | |
| | CY7C1021BNV33L-15ZXI | 51-85087 | 44-pin TSOP Type II (Pb-free) | |
| | CY7C1021BNV33L-15ZXIT | 51-85087 | 44-pin TSOP Type II (Pb-free) Tape and Reel | |

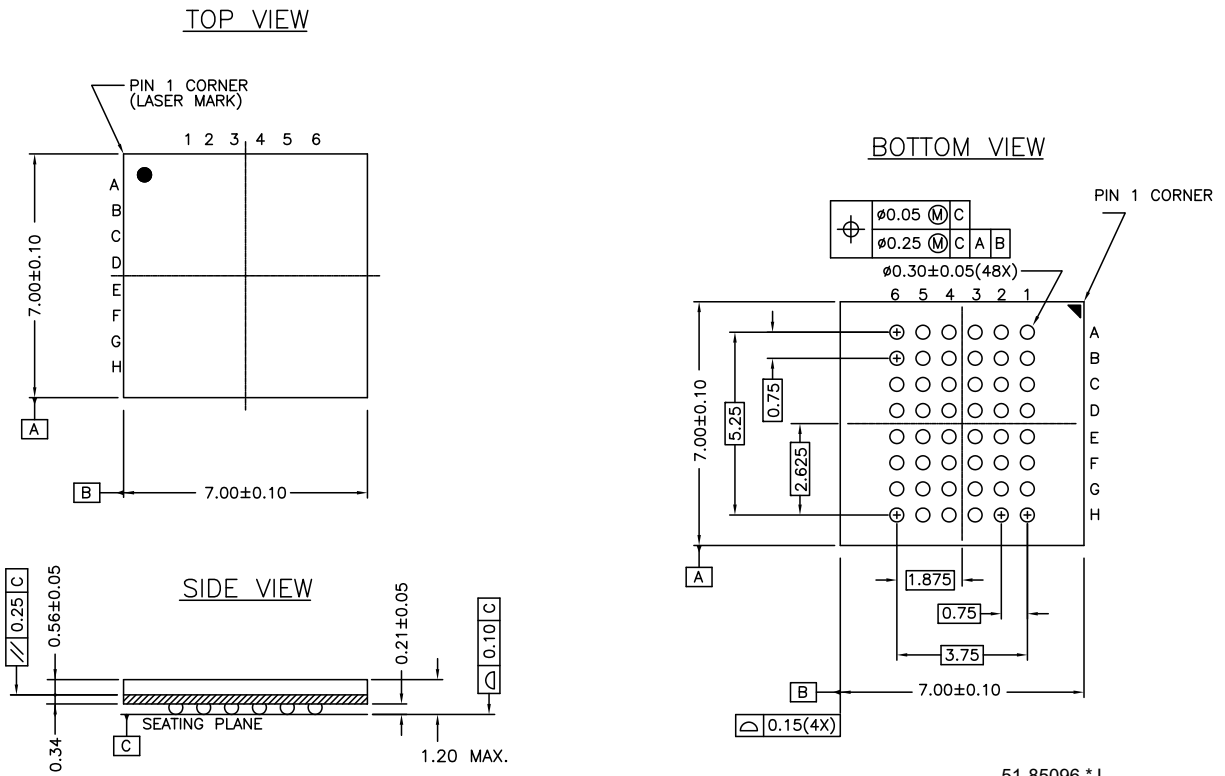
Please contact local sales representative regarding availability of these parts.

Ordering Code Definitions



Package Diagrams

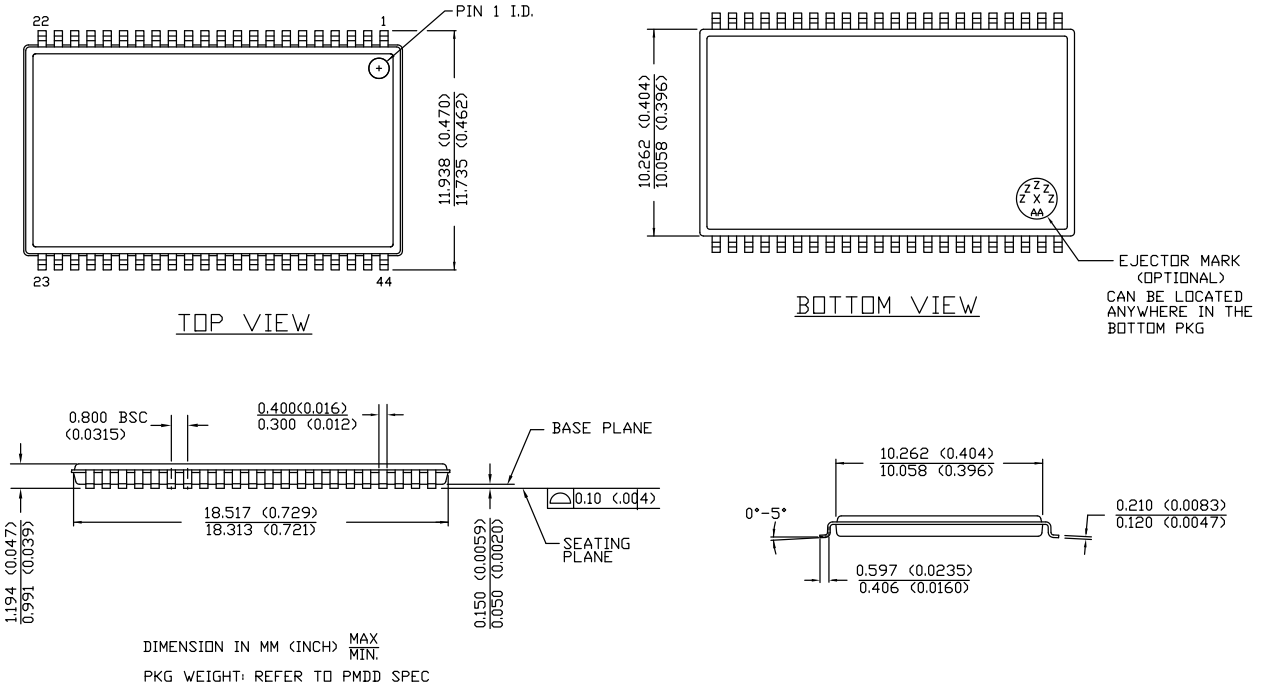
Figure 10. 48-ball FBGA (7 mm × 7 mm × 1.2 mm) BA48 Package Outline, 51-85096



51-85096 *J

Package Diagrams(continued)

Figure 11. 44-pin TSOP Z44-II Package Outline, 51-85087



51-85087 *E

Acronyms

| Acronym | Description |
|-----------------|---|
| BGA | Ball Grid Array |
| \overline{CE} | Chip Enable |
| CMOS | Complementary Metal Oxide Semiconductor |
| FBGA | Fine-pitch Ball Grid Array |
| I/O | Input/Output |
| \overline{OE} | Output Enable |
| SRAM | Static Random Access Memory |
| TSOP | Thin Small-Outline Package |
| TTL | Transistor-Transistor Logic |
| \overline{WE} | Write Enable |

Document Conventions

Units of Measure

| Symbol | Unit of Measure |
|--------|-----------------|
| °C | degree Celsius |
| MHz | megahertz |
| μA | microampere |
| μs | microsecond |
| mA | milliampere |
| mm | millimeter |
| mW | milliwatt |
| ns | nanosecond |
| Ω | ohm |
| % | percent |
| pF | picofarad |
| V | volt |
| W | watt |

Document History Page

| Document Title: CY7C1021BNV33, 64K × 16 Static RAM | | | | |
|--|---------|-----------------|-----------------|--|
| Document Number: 001-06433 | | | | |
| Rev. | ECN No. | Orig. of Change | Submission Date | Description of Change |
| ** | 423847 | NXR | 02/02/2006 | New data sheet. |
| *A | 2897061 | AJU | 03/22/2010 | Updated Ordering Information : Updated part numbers. Updated Package Diagrams : spec 51-85096 – Changed revision from *F to *H. spec 51-85082 – Changed revision from *B to *C. spec 51-85087 – Changed revision from *A to *C. |
| *B | 3109897 | AJU | 12/14/2010 | Added Ordering Code Definitions under Ordering Information . |
| *C | 3103073 | PRAS | 03/08/2011 | Updated Package Diagrams : spec 51-85096 – Changed revision from *H to *I. Added Acronyms and Units of Measure . Updated to new template. |
| *D | 3403051 | AJU | 10/12/2011 | Updated Ordering Information : Updated part numbers. Updated Package Diagrams : spec 51-85082 – Changed revision from *C to *D spec 51-85087 – Changed revision from *C to *D. |
| *E | 3937949 | MEMJ | 03/19/2013 | Removed all references of 400-mil SOJ package in the document. Updated Switching Characteristics : Updated Note 10. Updated Switching Waveforms : Updated Figure 7 , Figure 8 . Added Note 15, 18 and referred the same notes in Figure 7 , Figure 8 . Referred Note 16, 17 in Figure 8 . Referred Note 19, 20 in Figure 9 . Updated Package Diagrams : spec 51-85087 – Changed revision from *D to *E. |
| *F | 4578447 | MEMJ | 01/16/2015 | Updated Functional Description : Added “For a complete list of related documentation, click here .” at the end. Updated Switching Characteristics : Added Note 11 and referred the same note in “WRITE CYCLE”. Updated Switching Waveforms : Added Note 21 and referred the same note in Figure 9 . Updated Package Diagrams : spec 51-85096 – Changed revision from *I to *J. |
| *G | 5989860 | NILE | 12/13/2017 | Updated Ordering Information : Updated part numbers. Updated to new template. |

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