

Features

- High speed
 - $t_{AA} = 12 \text{ ns}$
- Low active power
 - 612 mW (max.)
- Low CMOS standby power
 - 1.8 mW (max.)
- 2.0 V Data Retention (660 μW at 2.0 V retention)
- Automatic power-down when deselected
- TTL-compatible inputs and outputs
- Easy memory expansion with $\overline{\text{CE}}$ and $\overline{\text{OE}}$ features

Functional Description

The CY7C1041BNV33 is a high-performance CMOS Static RAM organized as 262,144 words by 16 bits.

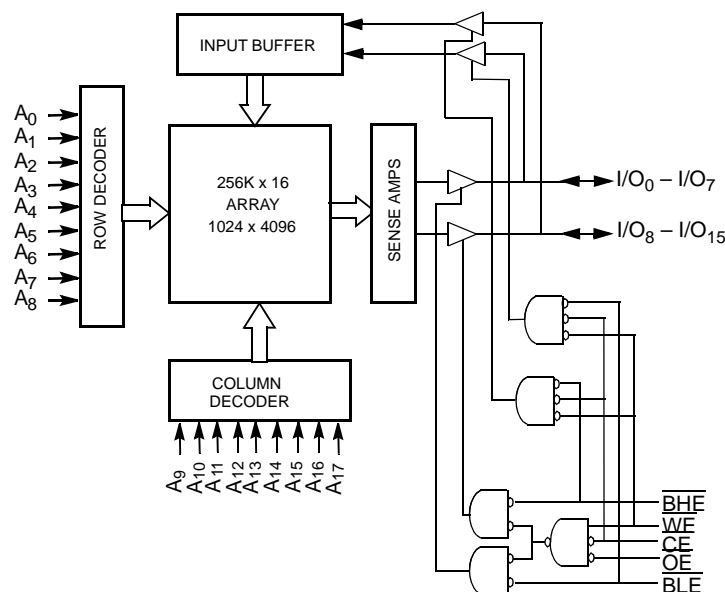
Writing to the device is accomplished by taking Chip Enable ($\overline{\text{CE}}$) and Write Enable ($\overline{\text{WE}}$) inputs LOW. If Byte Low Enable ($\overline{\text{BLE}}$) is LOW, then data from I/O pins (I/O₀ through I/O₇), is written into the location specified on the address pins (A₀ through A₁₇). If Byte High Enable ($\overline{\text{BHE}}$) 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 A₁₇).

Reading from the device is accomplished by taking Chip Enable ($\overline{\text{CE}}$) and Output Enable ($\overline{\text{OE}}$) LOW while forcing the Write Enable ($\overline{\text{WE}}$) HIGH. If Byte Low Enable ($\overline{\text{BLE}}$) 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 ($\overline{\text{BHE}}$) 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 ($\overline{\text{CE}}$ HIGH), the outputs are disabled ($\overline{\text{OE}}$ HIGH), the BHE and $\overline{\text{BLE}}$ are disabled ($\overline{\text{BHE}}$, $\overline{\text{BLE}}$ HIGH), or during a write operation ($\overline{\text{CE}}$ LOW, and $\overline{\text{WE}}$ LOW).

The CY7C1041BNV33 is available in a standard 44-pin 400-mil-wide body width SOJ and 44-pin TSOP II package with center power and ground (revolutionary) pinout.

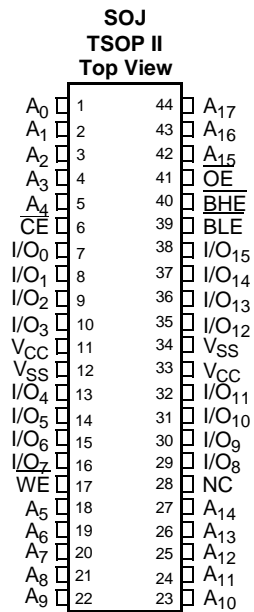
Logic Block Diagram



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Pin Configuration



Selection Guide

| | | |
|-----------------------------------|------------|------------|
| | | -12 |
| Maximum Access Time (ns) | | 12 |
| Maximum Operating Current (mA) | Commercial | 190 |
| Maximum CMOS Standby Current (mA) | Commercial | 0.5 |

Maximum Ratings

Exceeding the maximum ratings may impair the useful life of the device. These 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^[1] ... -0.5 V to +4.6 V

DC Voltage Applied to Outputs in High Z State^[1] -0.5 V to $V_{CC} + 0.5$ V
 DC Input Voltage^[1] -0.5 V to $V_{CC} + 0.5$ V
 Current into Outputs (LOW) 20 mA

Operating Range

| Range | Ambient Temperature ^[2] | V_{CC} |
|------------|------------------------------------|---------------|
| Commercial | 0 °C to +70 °C | 3.3 V ± 0.3 V |

Electrical Characteristics

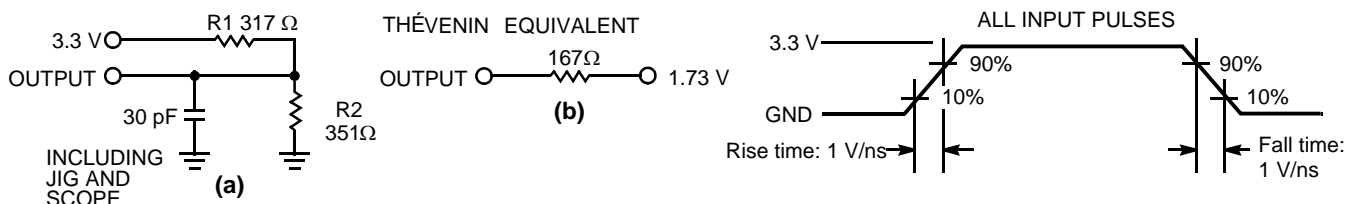
Over the Operating Range

| Parameter | Description | Test Conditions | -12 | | Unit |
|-----------|--|---|------|----------------|------|
| | | | Min | Max | |
| V_{OH} | Output HIGH Voltage | $V_{CC} = \text{Min}$, $I_{OH} = -4.0$ mA | 2.4 | - | V |
| V_{OL} | Output LOW Voltage | $V_{CC} = \text{Min}$, $I_{OL} = 8.0$ mA | - | 0.4 | V |
| V_{IH} | Input HIGH Voltage | | 2.2 | $V_{CC} + 0.5$ | V |
| V_{IL} | Input LOW Voltage ^[1] | | -0.5 | 0.8 | V |
| I_{IX} | Input Leakage Current | $GND \leq V_I \leq V_{CC}$ | -1 | +1 | µA |
| I_{OZ} | Output Leakage Current | $GND \leq V_{OUT} \leq V_{CC}$, Output Disabled | -1 | +1 | µA |
| I_{CC} | V_{CC} Operating Supply Current | $V_{CC} = \text{Max}$., $f = f_{MAX} = 1/t_{RC}$ | | 190 | mA |
| I_{SB1} | Automatic CE Power-Down Current —TTL Inputs | Max. V_{CC} ., $\overline{CE} \geq V_{IH}$, $V_{IN} \geq V_{IH}$ or $V_{IN} \leq V_{IL}$, $f = f_{MAX}$ | - | 40 | mA |
| I_{SB2} | Automatic CE Power-Down Current —CMOS Inputs | Max. V_{CC} ., $\overline{CE} \geq V_{CC} - 0.3V$, $V_{IN} \geq V_{CC} - 0.3V$, or $V_{IN} \leq 0.3V$, $f = 0$ | - | 0.5 | mA |

Capacitance^[3]

| Parameter | Description | Test Conditions | Max | Unit |
|-----------|-------------------|--|-----|------|
| C_{IN} | Input Capacitance | $T_A = 25$ °C, $f = 1$ MHz, $V_{CC} = 3.3$ V | 8 | pF |
| C_{OUT} | I/O Capacitance | | 8 | pF |

AC Test Loads and Waveforms



Notes

- V_{IL} (min.) = -2.0 V for pulse durations of less than 20 ns.
- T_A is the "Instant On" case temperature.
- Tested initially and after any design or process changes that may affect these parameters.

Switching Characteristics^[4]

Over the Operating Range

| Parameter | Description | -12 | | Unit |
|-------------------------------------|--|-----|-----|------|
| | | Min | Max | |
| READ CYCLE | | | | |
| t_{RC} | Read Cycle Time | 12 | – | ns |
| t_{AA} | Address to Data Valid | – | 12 | ns |
| t_{OHA} | Data Hold from Address Change | 3 | – | ns |
| t_{ACE} | \overline{CE} LOW to Data Valid | – | 12 | ns |
| t_{DOE} | \overline{OE} LOW to Data Valid | – | 6 | ns |
| t_{LZOE} | \overline{OE} LOW to Low Z | 0 | – | ns |
| t_{HZOE} | \overline{OE} HIGH to High Z ^[5, 6] | – | 6 | ns |
| t_{LZCE} | \overline{CE} LOW to Low Z ^[6] | 3 | – | ns |
| t_{HZCE} | \overline{CE} HIGH to High Z ^[5, 6] | – | 6 | ns |
| t_{PU} | \overline{CE} LOW to Power-Up | 0 | – | ns |
| t_{PD} | \overline{CE} HIGH to Power-Down | – | 12 | ns |
| t_{DBE} | Byte Enable to Data Valid | – | 6 | ns |
| t_{LZBE} | Byte Enable to Low Z | 0 | – | ns |
| t_{HZBE} | Byte Disable to High Z | – | 6 | ns |
| WRITE CYCLE^[7, 8] | | | | |
| t_{WC} | Write Cycle Time | 12 | – | 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 | 7 | – | ns |
| t_{HD} | Data Hold from Write End | 0 | – | ns |
| t_{LZWE} | \overline{WE} HIGH to Low Z ^[6] | 3 | – | ns |
| t_{HZWE} | \overline{WE} LOW to High Z ^[5, 6] | – | 6 | ns |
| t_{BW} | Byte Enable to End of Write | 10 | – | ns |

Notes

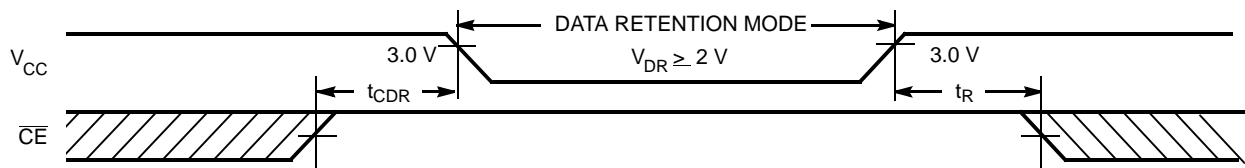
- Test conditions assume signal transition time of 3 ns or less, timing reference levels of 1.5 V, input pulse levels of 0 to 3.0 V, and output loading of the specified I_{OL}/I_{OH} and 30-pF load capacitance.
- t_{HZOE} , t_{HZCE} , and t_{HZWE} are specified with a load capacitance of 5 pF as in part (b) of [AC Test Loads and Waveforms on page 4](#). 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, and \overline{WE} LOW. \overline{CE} and \overline{WE} must be LOW to initiate a write, and the transition of either 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) is the sum of t_{HZWE} and t_{SD} .

Data Retention Characteristics

Over the Operating Range

| Parameter | Description | Conditions ^[9] | 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 $V_{IN} \leq 0.3\text{ V}$ | – | 330 | μA |
| $t_{CDR}^{[10]}$ | Chip Deselect to Data Retention Time | | 0 | – | ns |
| $t_R^{[11]}$ | Operation Recovery Time | | t_{RC} | – | ns |

Data Retention Waveform

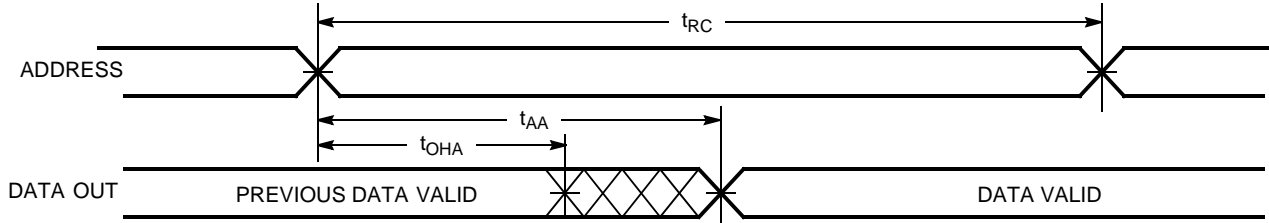


Notes

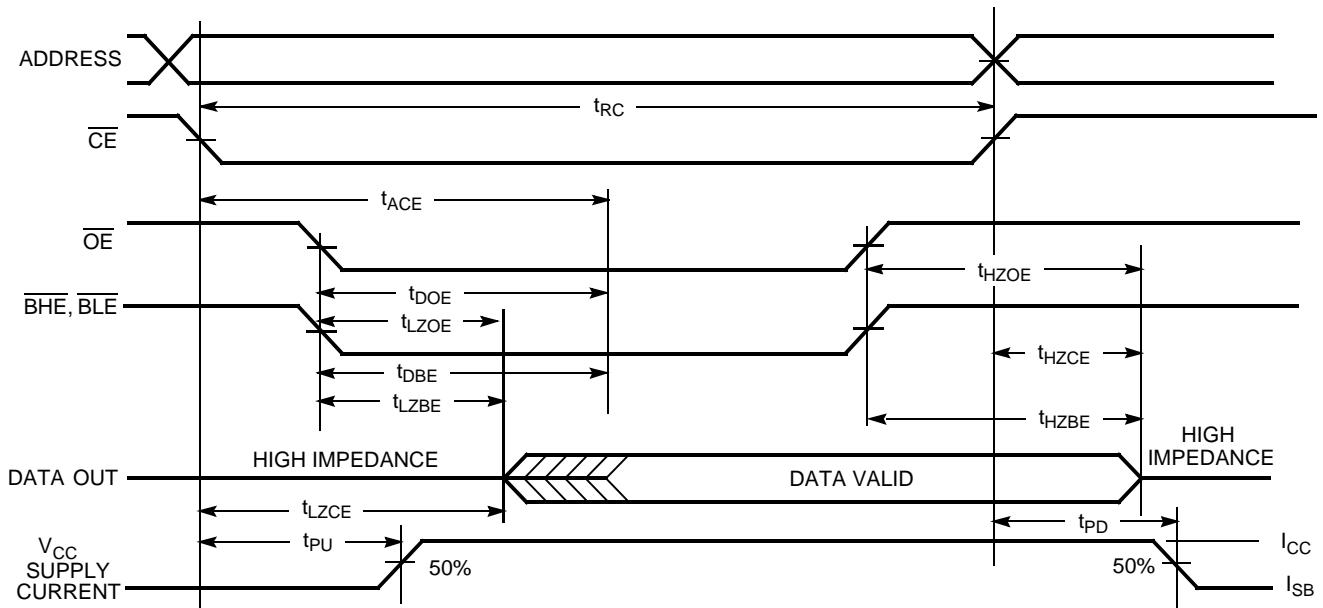
9. No input may exceed $V_{CC} + 0.5\text{ V}$.
10. Tested initially and after any design or process changes that may affect these parameters.
11. $t_r \leq 3\text{ ns}$ for the -12 and -15 speeds.

Switching Waveforms

Read Cycle No. 1^[12, 13]



Read Cycle No. 2 ($\overline{\text{OE}}$ Controlled)^[13, 14]

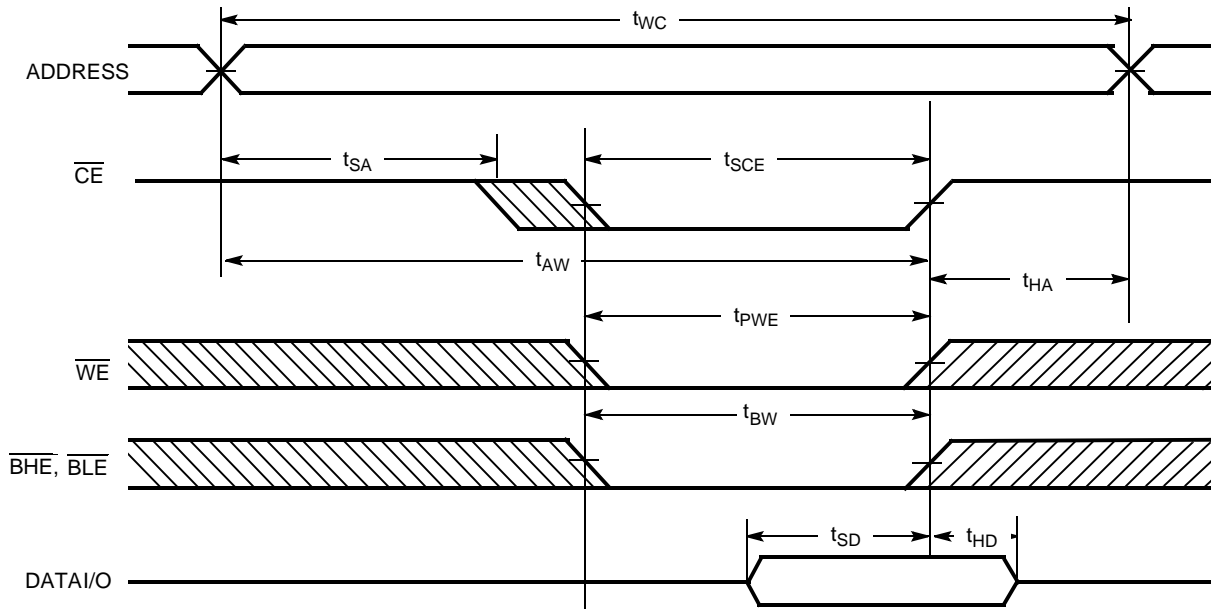


Notes

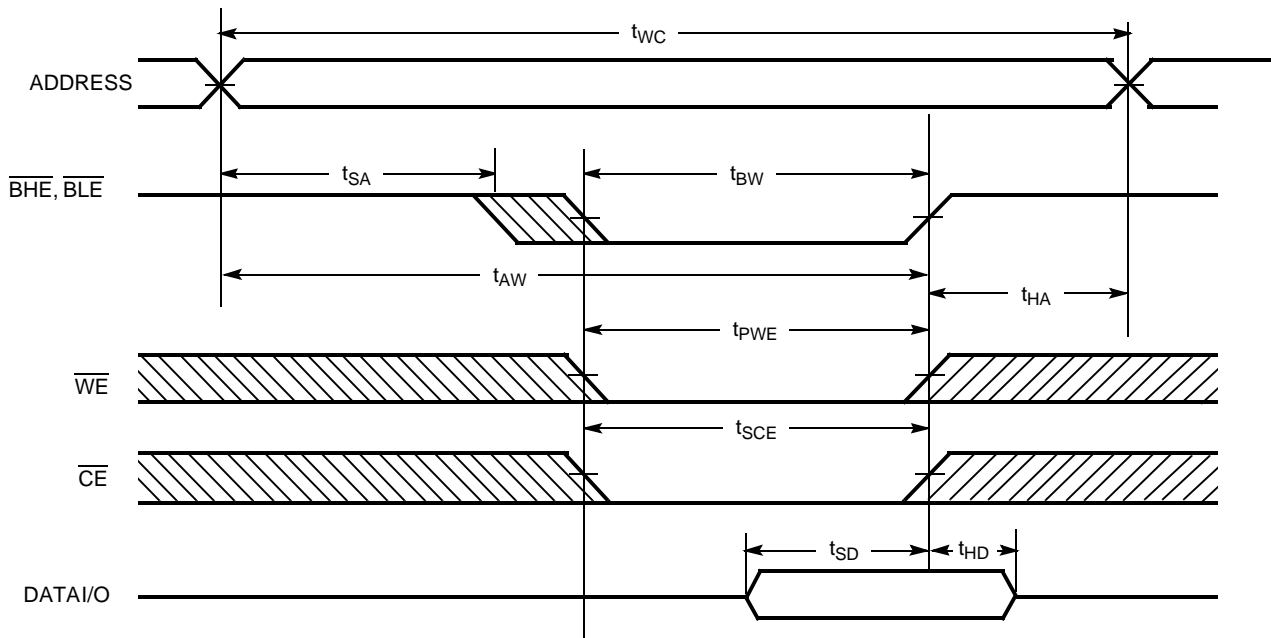
- 12. Device is continuously selected. $\overline{\text{OE}}$, $\overline{\text{CE}}$, $\overline{\text{BHE}}$ and/or $\overline{\text{BHE}} = V_{IL}$.
- 13. $\overline{\text{WE}}$ is HIGH for read cycle.
- 14. Address valid prior to or coincident with $\overline{\text{CE}}$ transition LOW.

Switching Waveforms (continued)

Write Cycle No. 1 ($\overline{\text{CE}}$ Controlled)^[15, 16]



Write Cycle No. 2 ($\overline{\text{BLE}}$ or $\overline{\text{BHE}}$ Controlled)

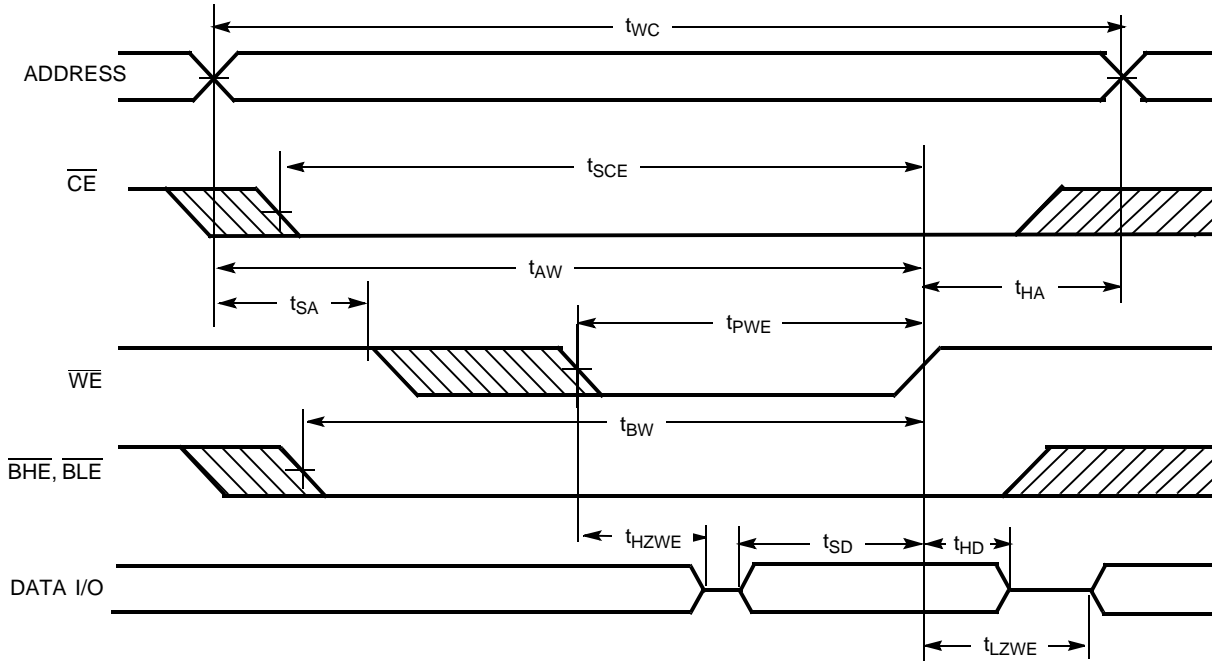


Notes

- 15. Data I/O is high-impedance if $\overline{\text{OE}}$ or $\overline{\text{BHE}}$ and/or $\overline{\text{BLE}} = V_{IH}$.
- 16. If $\overline{\text{CE}}$ goes HIGH simultaneously with WE going HIGH, the output remains in a high-impedance state.

Switching Waveforms (continued)

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



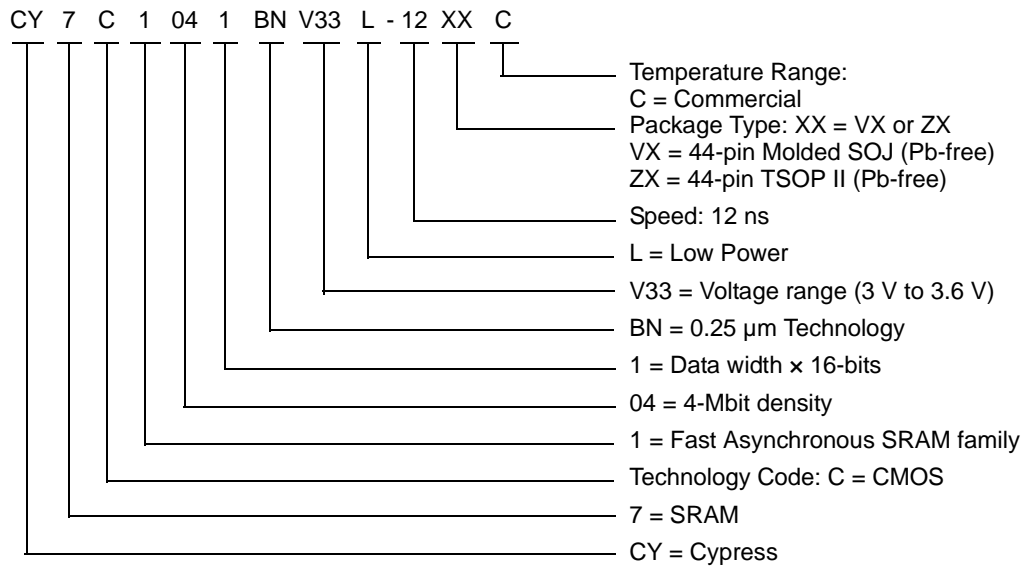
Truth Table

| \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 | L | H | L | H | Data Out | High Z | Read Lower Bits Only | Active (I_{CC}) |
| L | L | H | 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 | X | L | L | H | Data In | High Z | Write Lower Bits Only | Active (I_{CC}) |
| L | X | L | 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}) |

Ordering Information

| Speed (ns) | Ordering Code | Package Diagram | Package Type | Operating Range |
|------------|----------------------|-----------------|---------------------------------------|-----------------|
| 12 | CY7C1041BNV33L-12VXC | 51-85082 | 44-pin (400-Mil) Molded SOJ (Pb-free) | Commercial |
| | CY7C1041BNV33L-12ZXC | 51-85087 | 44-pin TSOP II (Pb-free) | |

Ordering Code Definitions



Please contact local sales representative regarding availability of these parts.

Package Diagrams

Figure 1. 44-Lead (400-Mil) Molded SOJ (51-85082)

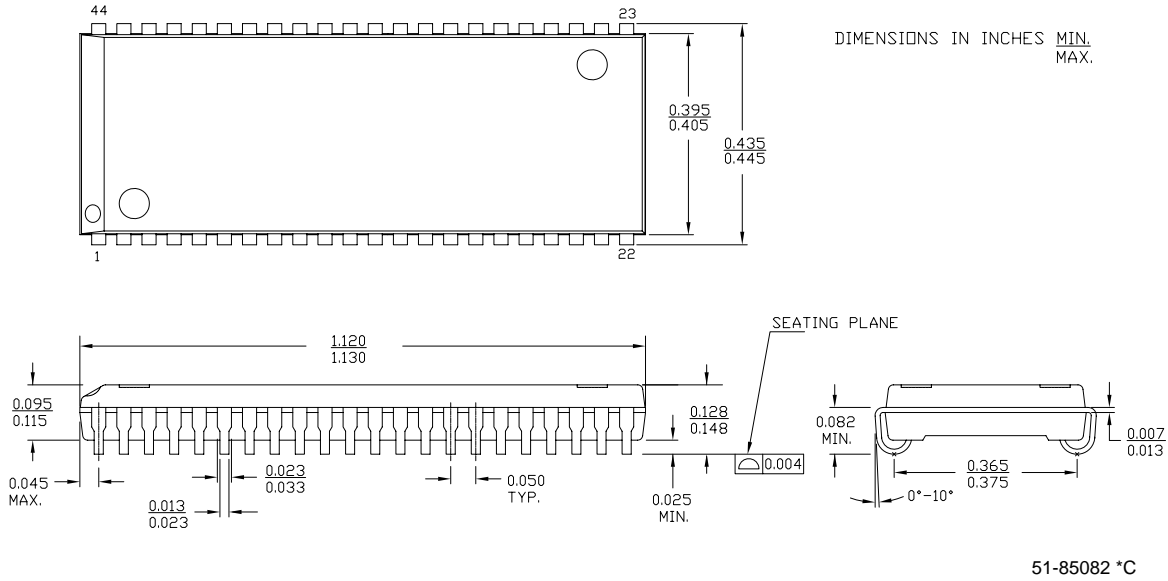
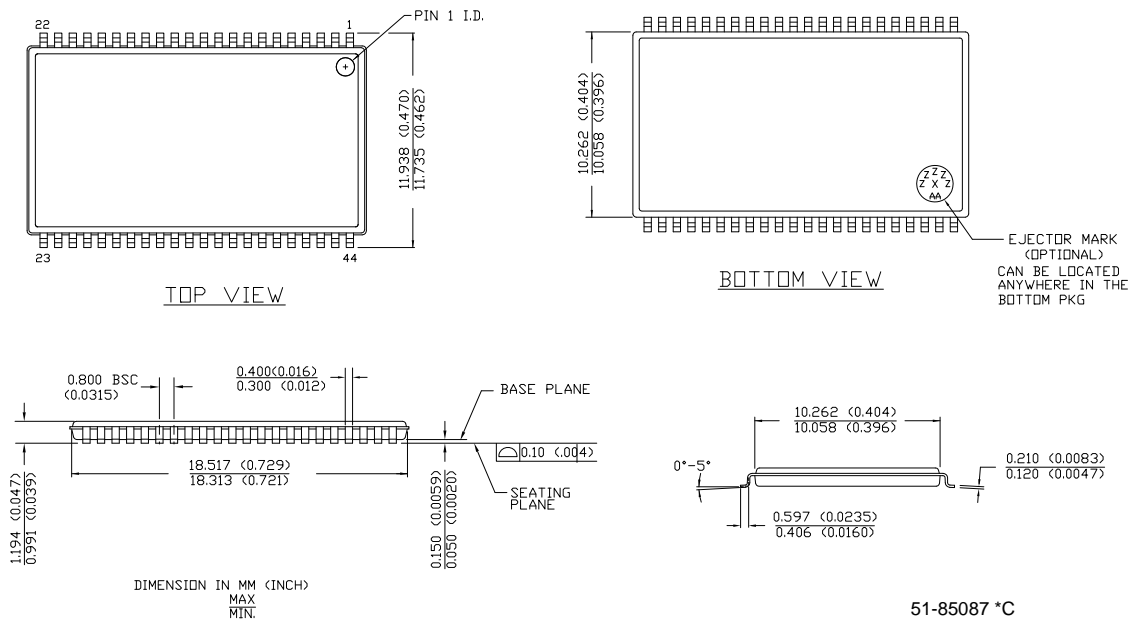


Figure 2. 44-Pin TSOP II (51-85087)



Acronyms

| Acronym | Description |
|---------|---|
| CMOS | Complementary metal oxide semiconductor |
| CE | Chip Enable |
| I/O | Input/output |
| OE | Output Enable |
| SRAM | Static Random Access Memory |
| SOJ | Small Outline J-lead |
| TTL | transistor-transistor logic |
| TSOP | thin small-outline package |
| WE | Write Enable |

Document Conventions

Units of Measure

| Symbol | Unit of Measure |
|--------|-----------------|
| °C | degree Celsius |
| μA | micro Amperes |
| mA | milli Amperes |
| μF | micro Farad |
| μs | micro seconds |
| ms | milli seconds |
| ns | nano seconds |
| pF | pico Farad |
| V | Volts |
| Ω | ohms |
| μW | micro Watts |
| mW | milli Watts |
| W | Watts |
| % | percent |

Document History Page

| Document Title: CY7C1041BNV33 256 K x 16 Static RAM Document Number: 001-06434 | | | | |
|---|---------|-----------------|-----------------|--|
| Revision | ECN | Orig. of Change | Submission Date | Description of Change |
| ** | 423877 | NXR | See ECN | New Data Sheet |
| *A | 2899016 | VKN | See ECN | Removed Industrial grade Removed 15ns speed Updated Ordering Information table Updated Package Diagrams |
| *B | 3109184 | AJU | 12/13/2010 | Added Ordering Code Definitions . |
| *C | 3210222 | PRAS | 03/30/2011 | Updated Selection Guide . Added Acronyms and Units of Measure . Updated in new template. |
| *D | 3232637 | PRAS | 05/04/2011 | Fixed unit for Input Leakage current and Output Leakage current under Electrical Characteristics table from mA to μ A. |

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