

1-Mbit (64K x 16) Static RAM

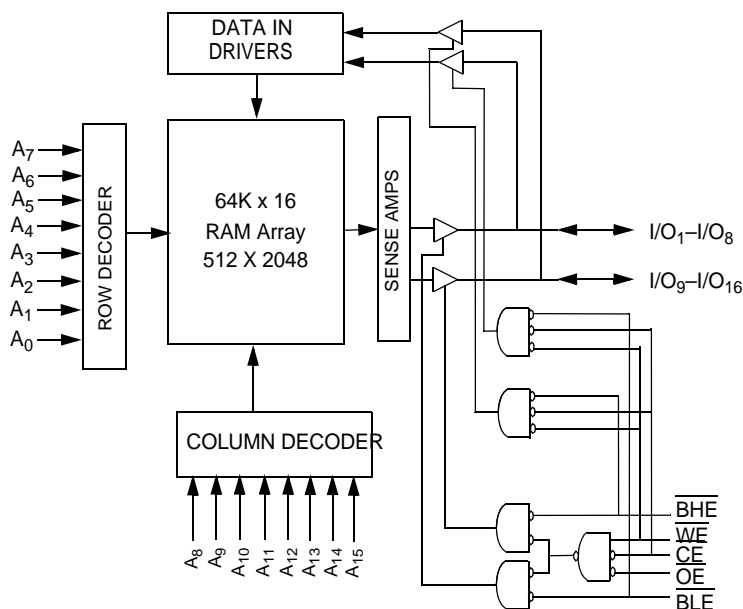
Features

- **Temperature Ranges**
 - Commercial: 0°C to 70°C
 - Industrial: -40°C to 85°C
 - Automotive-A: -40°C to 85°C
 - Automotive-E: -40°C to 125°C
- **High speed**
 - $t_{AA} = 10$ ns (Commercial)
 - $t_{AA} = 15$ ns (Automotive)
- **CMOS for optimum speed/power**
- **Low active power**
 - 825 mW (max.)
- **Automatic power-down when deselected**
- **Independent control of upper and lower bits**
- **Available in Pb free and non Pb free 44-pin TSOP II and 44-pin 400-mil-wide SOJ**

Functional Description^[1]

The CY7C1021BN/CY7C10211BN 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.

Logic Block Diagram



Writing to the device is accomplished by taking 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/O₁ through I/O₈), is written into the location specified on the address pins (A₀ through A₁₅). If Byte High Enable (\overline{BHE}) is LOW, then data from I/O pins (I/O₉ through I/O₁₆) 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 (\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/O₁ to I/O₈. If Byte High Enable (\overline{BHE}) is LOW, then data from memory will appear on I/O₉ to I/O₁₆. 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/O₁ through I/O₁₆) are placed in a high-impedance state when the device is deselected (\overline{CE} HIGH), the outputs are disabled (\overline{OE} HIGH), the \overline{BHE} and \overline{BLE} are disabled (\overline{BHE} , \overline{BLE} HIGH), or during a write operation (\overline{CE} LOW, and \overline{WE} LOW).

The CY7C1021BN/CY7C10211BN is available in standard 44-pin TSOP Type II and 44-pin 400-mil-wide SOJ packages. Customers should use part number CY7C10211BN when ordering parts with 10 ns t_{AA} , and CY7C1021BN when ordering 12 ns and 15 ns t_{AA} .

Pin Configurations

SOJ / TSOP II Top View

| | | | |
|------------------|----|----|-------------------|
| A ₄ | 1 | 44 | A ₅ |
| A ₃ | 2 | 43 | A ₆ |
| A ₂ | 3 | 42 | A ₇ |
| A ₁ | 4 | 41 | \overline{OE} |
| A ₀ | 5 | 40 | \overline{BHE} |
| \overline{CE} | 6 | 39 | \overline{BLE} |
| I/O ₁ | 7 | 38 | I/O ₁₆ |
| I/O ₂ | 8 | 37 | I/O ₁₅ |
| I/O ₃ | 9 | 36 | I/O ₁₄ |
| I/O ₄ | 10 | 35 | I/O ₁₃ |
| V _{CC} | 11 | 34 | V _{SS} |
| V _{SS} | 12 | 33 | V _{CC} |
| I/O ₅ | 13 | 32 | I/O ₁₂ |
| I/O ₆ | 14 | 31 | I/O ₁₁ |
| I/O ₇ | 15 | 30 | I/O ₁₀ |
| I/O ₈ | 16 | 29 | I/O ₉ |
| \overline{WE} | 17 | 28 | NC |
| A ₁₅ | 18 | 27 | A ₈ |
| A ₁₄ | 19 | 26 | A ₉ |
| A ₁₃ | 20 | 25 | A ₁₀ |
| A ₁₂ | 21 | 24 | A ₁₁ |
| NC | 22 | 23 | NC |

Note:

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

Selection Guide

| | | 7C10211B-10 | 7C1021B-12 | 7C1021B-15 |
|-----------------------------------|---------------------------|-------------|------------|------------|
| Maximum Access Time (ns) | | 10 | 12 | 15 |
| Maximum Operating Current (mA) | Com'I / Ind'I | 150 | 140 | 130 |
| | Automotive-A | | | 130 |
| | Automotive-E | | | 130 |
| Maximum CMOS Standby Current (mA) | Com'I / Ind'I | 10 | 10 | 10 |
| | Com'I / Ind'I (L version) | 0.5 | 0.5 | 0.5 |
| | Automotive-A (L version) | | | 0.5 |
| | Automotive-E | | | 15 |

Pin Definitions

| Pin Name | SOJ, TSOP–Pin Number | I/O Type | Description |
|-------------------------------------|---------------------------|---------------|---|
| A ₀ –A ₁₅ | 1–5, 18–21, 24–27, 42–44 | Input | Address Inputs used to select one of the address locations. |
| I/O ₁ –I/O ₁₆ | 7–10, 13–16, 29–32, 35–38 | Input/Output | Bidirectional Data I/O lines. Used as input or output lines depending on operation. |
| NC | 22, 23, 28 | No Connect | No Connects. Not connected to the die. |
| \overline{WE} | 17 | Input/Control | Write Enable Input, active LOW. When selected LOW, a Write is conducted. When deselected HIGH, a Read is conducted. |
| \overline{CE} | 6 | Input/Control | Chip Enable Input, active LOW. When LOW, selects the chip. When HIGH, deselects the chip. |
| \overline{BHE} , \overline{BLE} | 40, 39 | Input/Control | Byte Write Select Inputs, active LOW. \overline{BHE} controls I/O ₁₆ –I/O ₉ , \overline{BLE} controls I/O ₈ –I/O ₁ , . |
| \overline{OE} | 41 | Input/Control | Output Enable, active LOW. Controls the direction of the I/O pins. When LOW, the I/O pins are allowed to behave as outputs. When deasserted HIGH, I/O pins are tri-stated, and act as input data pins. |
| V _{SS} | 12, 34 | Ground | Ground for the device. Should be connected to ground of the system. |
| V _{CC} | 11, 33 | Power Supply | Power Supply inputs to the device. |

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 on V _{CC} Relative to GND ^[2] | -0.5V to +7.0V |
| DC Voltage Applied to Outputs in High Z State ^[2] | -0.5V to V _{CC} +0.5V |
| DC Input Voltage ^[2] | -0.5V to V _{CC} +0.5V |
| Current into Outputs (LOW) | 20 mA |

Static Discharge Voltage..... >2001V
(per MIL-STD-883, Method 3015)

Latch-Up Current..... >200 mA

Operating Range

| Range | Ambient Temperature (T _A) ^[3] | V _{CC} |
|--------------|--|-----------------|
| Commercial | 0°C to +70°C | 5V ± 10% |
| Industrial | -40°C to +85°C | |
| Automotive-A | -40°C to +85°C | |
| Automotive-E | -40°C to +125°C | |

Electrical Characteristics Over the Operating Range

| Parameter | Description | Test Conditions | -10 | | -12 | | -15 | | Unit | |
|------------------|---|---|-------------------|------|------|------|------|------|------|----|
| | | | Min. | Max. | Min. | Max. | Min. | Max. | | |
| V _{OH} | Output HIGH Voltage | V _{CC} = Min., I _{OH} = -4.0 mA | 2.4 | | 2.4 | | 2.4 | | V | |
| V _{OL} | Output LOW Voltage | V _{CC} = Min., I _{OL} = 8.0 mA | | 0.4 | | 0.4 | | 0.4 | V | |
| V _{IH} | Input HIGH Voltage | | 2.2 | 6.0 | 2.2 | 6.0 | 2.2 | 6.0 | V | |
| V _{IL} | Input LOW Voltage ^[2] | | -0.5 | 0.8 | -0.5 | 0.8 | -0.5 | 0.8 | V | |
| I _{IX} | Input Leakage Current | GND ≤ V _I ≤ V _{CC} | Com'l / Ind'l | -1 | +1 | -1 | +1 | -1 | +1 | μA |
| | | | Automotive-A | | | | | -1 | +1 | μA |
| | | | Automotive-E | | | | | -4 | +4 | μA |
| I _{OZ} | Output Leakage Current | GND ≤ V _I ≤ V _{CC} , Output Disabled | Com'l / Ind'l | -1 | +1 | -1 | +1 | -1 | +1 | μA |
| | | | Automotive-A | | | | | -1 | +1 | μA |
| | | | Automotive-E | | | | | -4 | +4 | μA |
| I _{CC} | V _{CC} Operating Supply Current | V _{CC} = Max., I _{OUT} = 0 mA, f = f _{MAX} = 1/t _{RC} | Com'l / Ind'l | | 150 | | 140 | | 130 | mA |
| | | | Automotive-A | | | | | | 130 | |
| | | | Automotive-E | | | | | | 130 | |
| I _{SB1} | Automatic CE Power-Down Current—TTL Inputs | Max. V _{CC} , CE ≥ V _{IH} , V _{IN} ≥ V _{IH} or V _{IN} ≤ V _{IL} , f = f _{MAX} | Com'l / Ind'l | | 40 | | 40 | | 40 | mA |
| | | | Automotive-A | | | | | | 40 | |
| | | | Automotive-E | | | | | | 50 | |
| I _{SB2} | Automatic CE Power-Down Current—CMOS Inputs | Max. V _{CC} , CE ≥ V _{CC} - 0.3V, V _{IN} ≥ V _{CC} - 0.3V, or V _{IN} ≤ 0.3V, f = 0 | Com'l / Ind'l | | 10 | | 10 | | 10 | mA |
| | | | Com'l / Ind'l (L) | | 0.5 | | 0.5 | | 0.5 | |
| | | | Automotive-A (L) | | | | | | 0.5 | |
| | | | Automotive-E | | | | | | 15 | |

Capacitance^[4]

| Parameter | Description | Test Conditions | Max. | Unit |
|------------------|--------------------|--|------|------|
| C _{IN} | Input Capacitance | T _A = 25°C, f = 1 MHz, V _{CC} = 5.0V | 8 | pF |
| C _{OUT} | Output Capacitance | | 8 | pF |

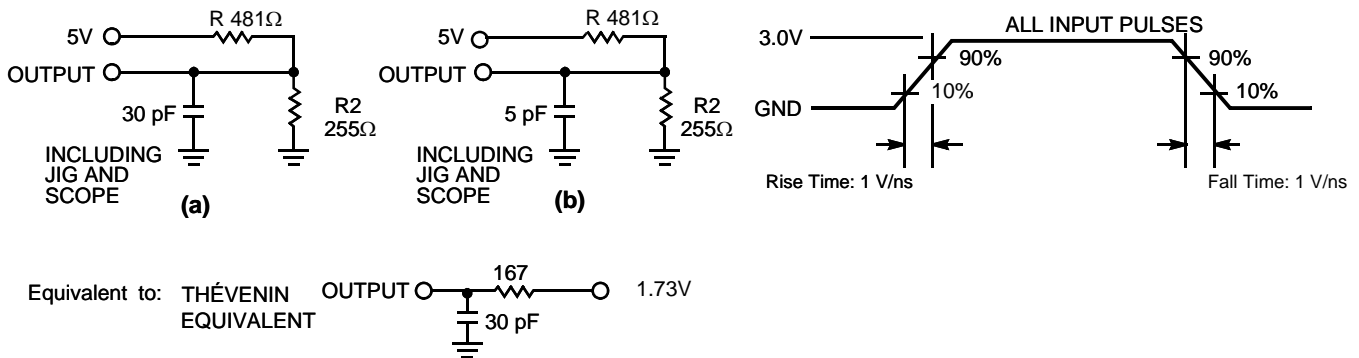
Notes:

- V_{IL} (min.) = -2.0V and V_{IH}(max) = V_{CC} + 0.5V 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.

Thermal Resistance^[4]

| Parameter | Description | Test Conditions | 44-pin SOJ | 44-pin TSOP-II | Unit |
|---------------|--|--|------------|----------------|-----------------------------|
| Θ_{JA} | Thermal Resistance (Junction to Ambient) | Test conditions follow standard test methods and procedures for measuring thermal impedance, per EIA / JESD51. | 64.32 | 76.89 | $^{\circ}\text{C}/\text{W}$ |
| Θ_{JC} | Thermal Resistance (Junction to Case) | | 31.03 | 14.28 | $^{\circ}\text{C}/\text{W}$ |

AC Test Loads and Waveforms



Switching Characteristics^[5] Over the Operating Range

| Parameter | Description | 7C10211B-10 | | 7C1021B-12 | | 7C1021B-15 | | Unit |
|-------------------|--|-------------|------|------------|------|------------|------|------|
| | | Min. | Max. | Min. | Max. | Min. | Max. | |
| Read Cycle | | | | | | | | |
| t_{RC} | Read Cycle Time | 10 | | 12 | | 15 | | ns |
| t_{AA} | Address to Data Valid | | 10 | | 12 | | 15 | ns |
| t_{OHA} | Data Hold from Address Change | 3 | | 3 | | 3 | | ns |
| t_{ACE} | \overline{CE} LOW to Data Valid | | 10 | | 12 | | 15 | ns |
| t_{DOE} | \overline{OE} LOW to Data Valid | | 5 | | 6 | | 7 | ns |
| t_{LZOE} | \overline{OE} LOW to Low Z ^[6] | 0 | | 0 | | 0 | | ns |
| t_{HZOE} | \overline{OE} HIGH to High Z ^[6, 7] | | 5 | | 6 | | 7 | ns |
| t_{LZCE} | \overline{CE} LOW to Low Z ^[6] | 3 | | 3 | | 3 | | ns |
| t_{HZCE} | \overline{CE} HIGH to High Z ^[6, 7] | | 5 | | 6 | | 7 | ns |
| t_{PU} | \overline{CE} LOW to Power-Up | 0 | | 0 | | 0 | | ns |
| t_{PD} | \overline{CE} HIGH to Power-Down | | 10 | | 12 | | 15 | ns |
| t_{DBE} | Byte Enable to Data Valid | | 5 | | 6 | | 7 | ns |
| t_{LZBE} | Byte Enable to Low Z | 0 | | 0 | | 0 | | ns |
| t_{HZBE} | Byte Disable to High Z | | 5 | | 6 | | 7 | ns |

Notes:

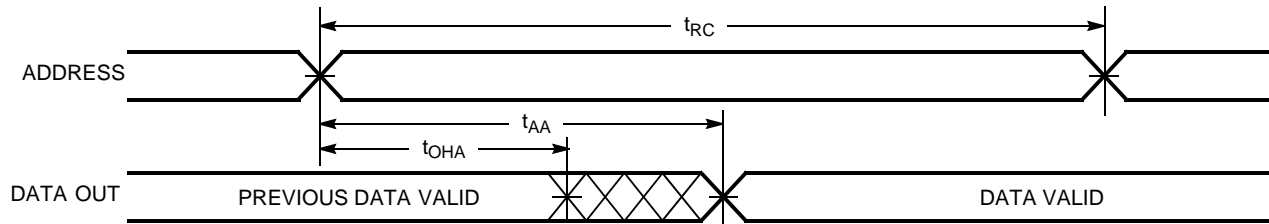
- Test conditions assume signal transition time of 3 ns or less, timing reference levels of 1.5V, input pulse levels of 0 to 3.0V, and output loading of the specified I_{OL}/I_{OH} and 30-pF load capacitance.
- At any given temperature and voltage condition, t_{HZCE} is less than t_{LZCE} , t_{HZOE} is less than t_{LZOE} , and t_{HZWE} is less than t_{LZWE} for any given device.
- t_{HZOE} , t_{HZBE} , t_{HZCE} , and t_{HZWE} are specified with a load capacitance of 5 pF as in part (b) of AC Test Loads. Transition is measured ± 500 mV from steady-state voltage.

Switching Characteristics^[5] Over the Operating Range (continued)

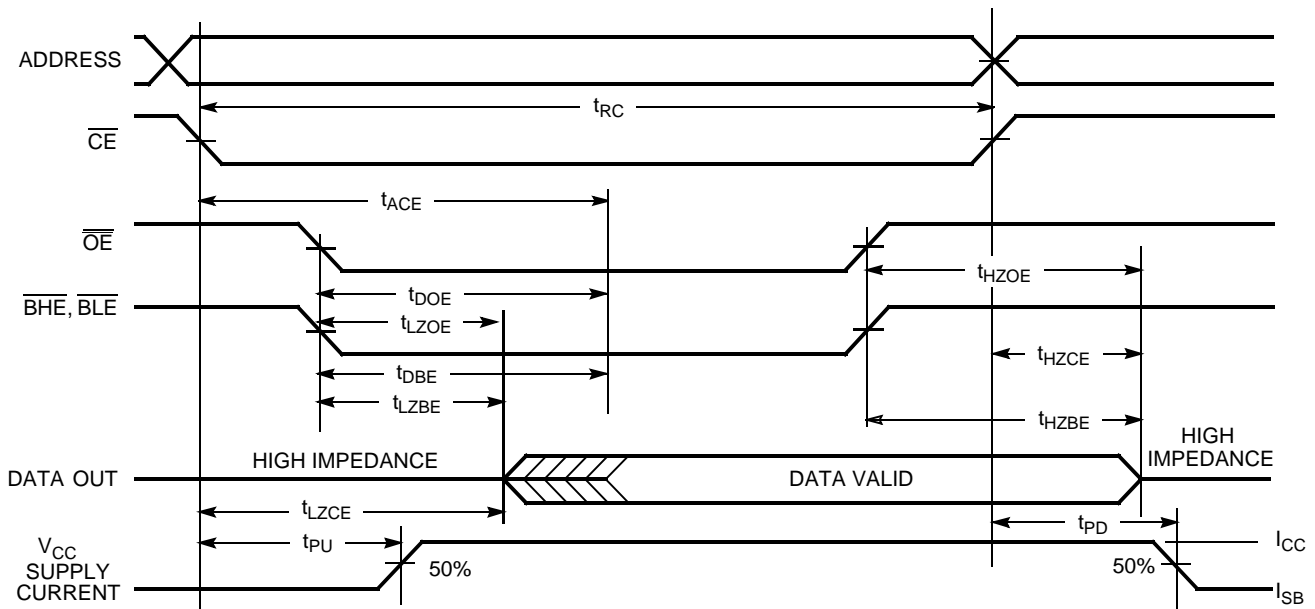
| Parameter | Description | 7C10211B-10 | | 7C1021B-12 | | 7C1021B-15 | | Unit |
|----------------------------------|---|-------------|------|------------|------|------------|------|------|
| | | Min. | Max. | Min. | Max. | Min. | Max. | |
| Write Cycle^[8] | | | | | | | | |
| t_{WC} | Write Cycle Time | 10 | | 12 | | 15 | | ns |
| t_{SCE} | CE LOW to Write End | 8 | | 9 | | 10 | | ns |
| t_{AW} | Address Set-Up to Write End | 7 | | 8 | | 10 | | 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_{SD} | Data Set-Up to Write End | 5 | | 6 | | 8 | | ns |
| t_{HD} | Data Hold from Write End | 0 | | 0 | | 0 | | ns |
| t_{LZWE} | \overline{WE} HIGH to Low Z ^[6] | 3 | | 3 | | 3 | | ns |
| t_{HZWE} | \overline{WE} LOW to High Z ^[6, 7] | | 5 | | 6 | | 7 | ns |
| t_{BW} | Byte Enable to End of Write | 7 | | 8 | | 9 | | ns |

Switching Waveforms

Read Cycle No. 1^[9, 10]



Read Cycle No. 2 (OE Controlled)^[10, 11]

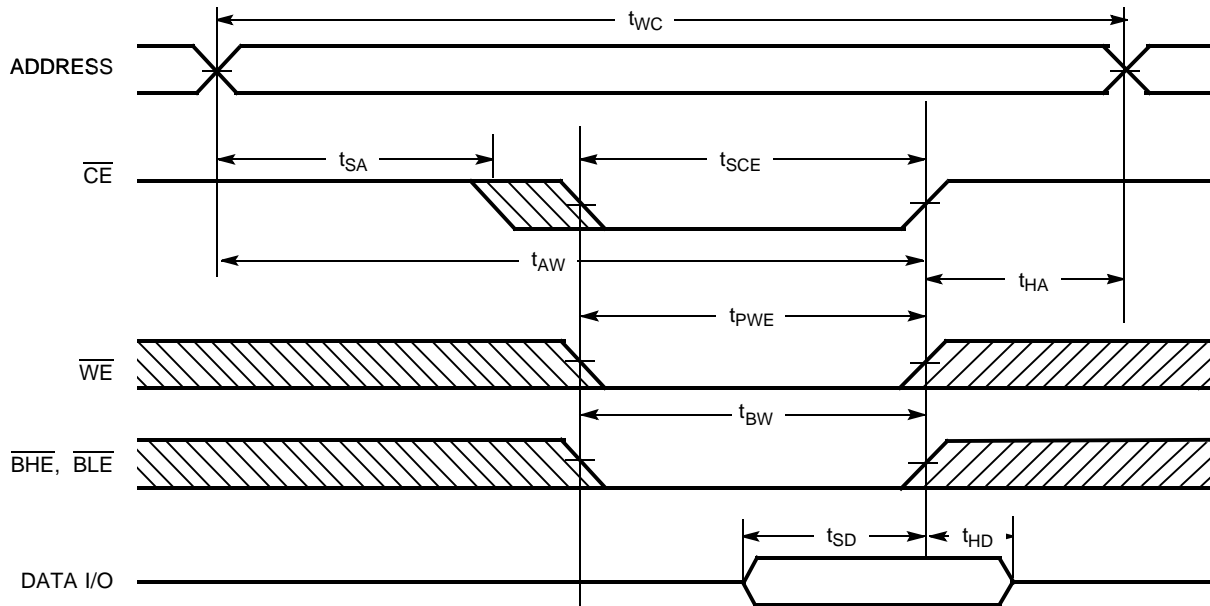


Notes:

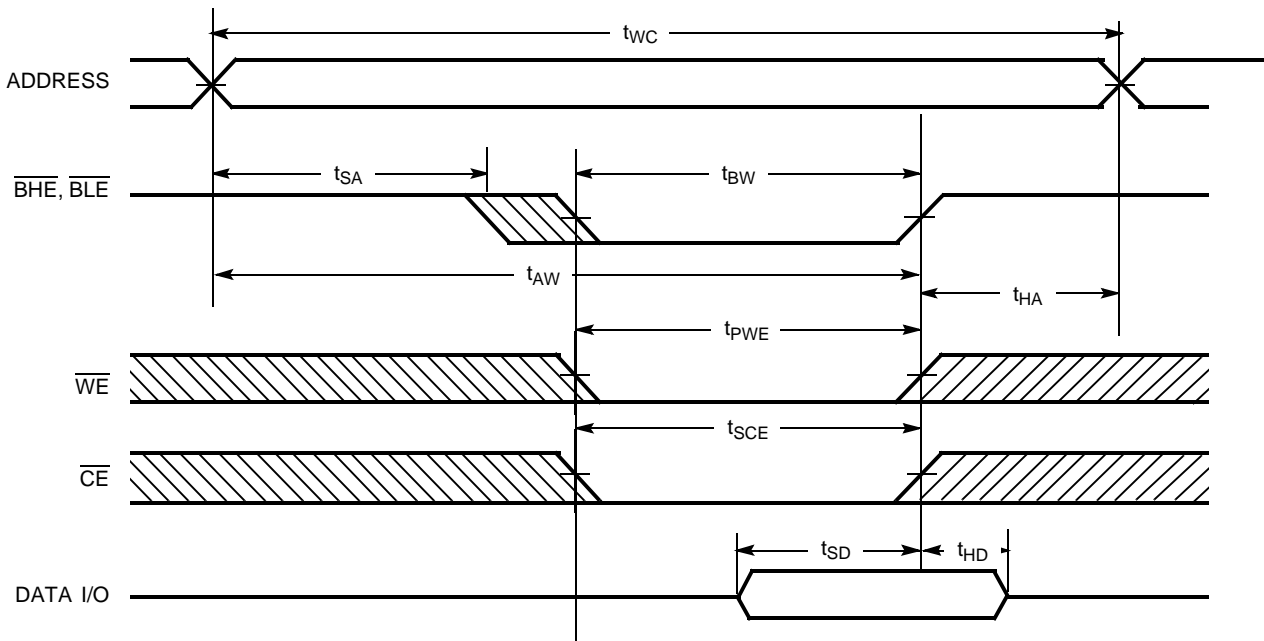
- The internal write time of the memory is defined by the overlap of \overline{CE} LOW, \overline{WE} LOW and $\overline{BHE} / \overline{BLE}$ LOW. \overline{CE} , \overline{WE} and $\overline{BHE} / \overline{BLE}$ must be LOW to initiate a write, and the transition of these signals can terminate the write. The input data set-up and hold timing should be referenced to the leading edge of the signal that terminates the write.
- Device is continuously selected. \overline{OE} , \overline{CE} , \overline{BHE} and/or $\overline{BLE} = V_{IL}$.
- \overline{WE} is HIGH for read cycle.

Switching Waveforms (continued)

Write Cycle No. 1 ($\overline{\text{CE}}$ Controlled)^[12, 13]



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

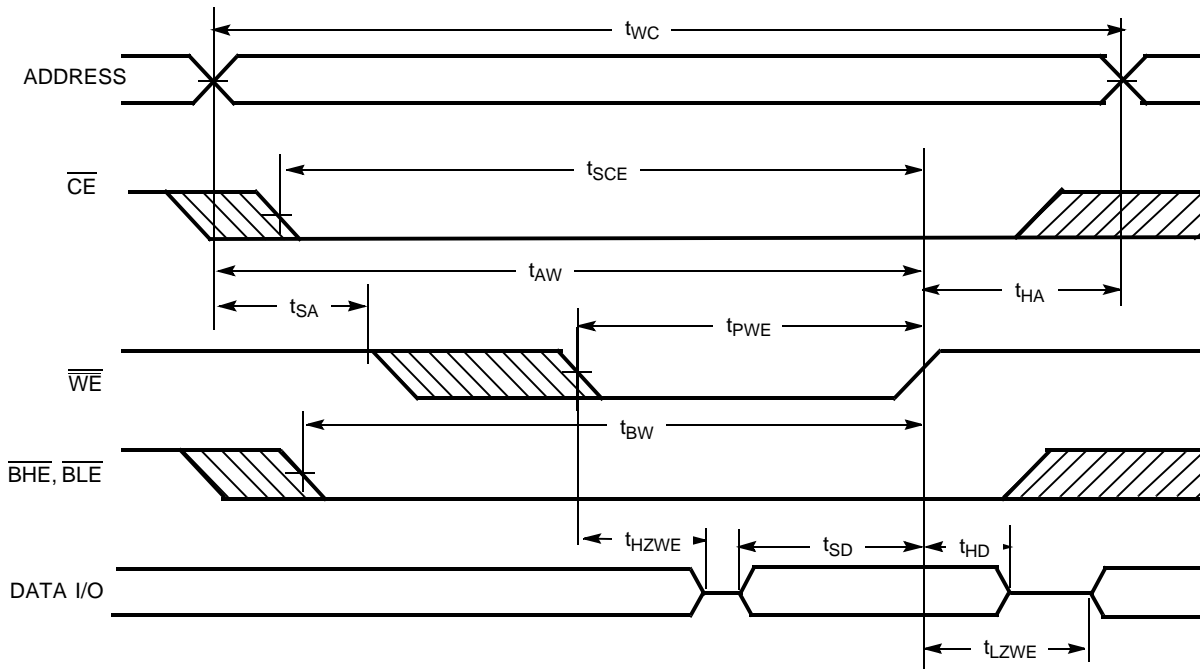


Notes:

11. Address valid prior to or coincident with $\overline{\text{CE}}$ transition LOW.
12. Data I/O is high impedance if OE or BHE and/or BLE = V_{IH} .
13. 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

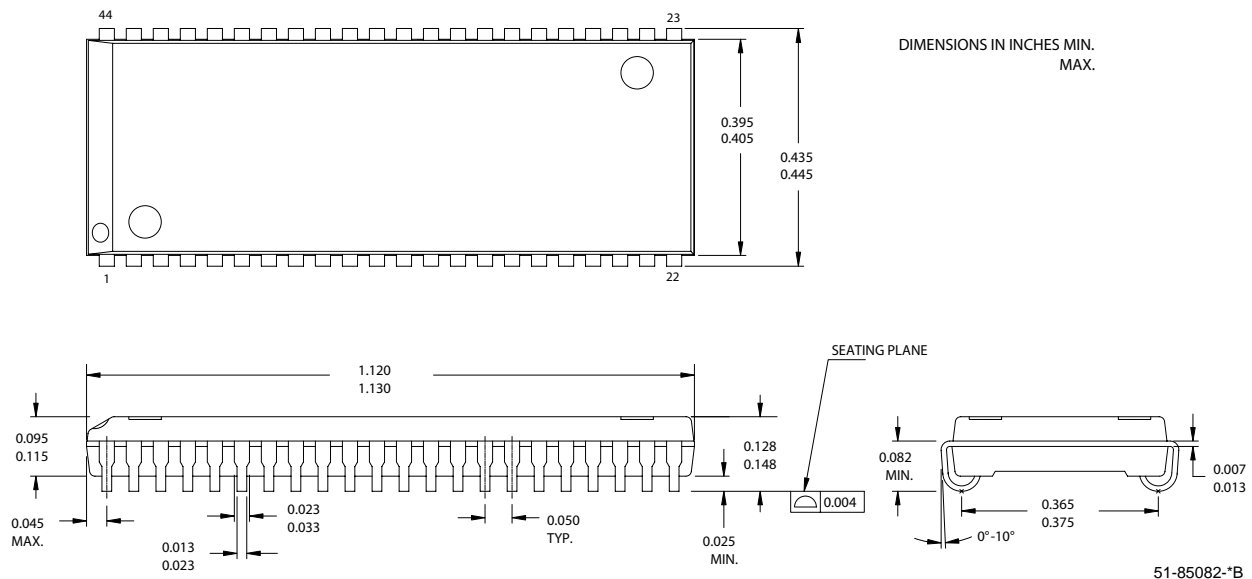
| \overline{CE} | \overline{OE} | \overline{WE} | \overline{BLE} | \overline{BHE} | I/O ₁ -I/O ₈ | I/O ₉ -I/O ₁₆ | Mode | Power |
|-----------------|-----------------|-----------------|------------------|------------------|------------------------------------|-------------------------------------|----------------------------|----------------------|
| 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

| Speed (ns) | Ordering Code | Package Diagram | Package Type | Operating Range |
|------------|--------------------|-----------------|---------------------------------------|-----------------|
| 10 | CY7C10211BN-10ZXC | 51-85087 | 44-pin TSOP Type II | Commercial |
| 12 | CY7C1021BN-12VC | 51-85082 | 44-pin (400-Mil) Molded SOJ | Commercial |
| | CY7C1021BN-12VXC | | 44-pin (400-Mil) Molded SOJ (Pb-Free) | |
| | CY7C1021BN-12ZC | 51-85087 | 44-pin TSOP Type II | Commercial |
| | CY7C1021BN-12ZXC | | 44-pin TSOP Type II (Pb-Free) | |
| | CY7C1021BN-12VI | 51-85082 | 44-pin (400-Mil) Molded SOJ | Industrial |
| | CY7C1021BN-12VXI | | 44-pin (400-Mil) Molded SOJ (Pb-Free) | |
| 15 | CY7C1021BN-15VC | 51-85082 | 44-pin (400-Mil) Molded SOJ | Commercial |
| | CY7C1021BN-15VXC | | 44-pin (400-Mil) Molded SOJ (Pb-Free) | |
| | CY7C1021BNL-15VXC | | 44-pin (400-Mil) Molded SOJ (Pb-Free) | |
| | CY7C1021BN-15ZC | 51-85087 | 44-pin TSOP Type II | Commercial |
| | CY7C1021BN-15ZXC | | 44-pin TSOP Type II (Pb-Free) | |
| | CY7C1021BNL-15ZC | | 44-pin TSOP Type II | |
| | CY7C1021BNL-15ZXC | | 44-pin TSOP Type II (Pb-Free) | |
| | CY7C1021BN-15VI | 51-85082 | 44-pin (400-Mil) Molded SOJ | Industrial |
| | CY7C1021BN-15VXI | | 44-pin (400-Mil) Molded SOJ (Pb-Free) | |
| | CY7C1021BN-15ZI | 51-85087 | 44-pin TSOP Type II | Commercial |
| | CY7C1021BNL-15ZI | | 44-pin TSOP Type II | |
| | CY7C1021BN-15ZXI | | 44-pin TSOP Type II (Pb-Free) | |
| | CY7C1021BNL-15ZXI | 51-85087 | 44-pin TSOP Type II (Pb-Free) | Commercial |
| | CY7C1021BNL-15ZSXA | | 44-pin TSOP Type II (Pb-Free) | |
| | CY7C1021BN-15VXE | 51-85082 | 44-pin (400-Mil) Molded SOJ (Pb-Free) | Automotive-E |
| | CY7C1021BN-15ZSXE | 51-85087 | 44-pin TSOP Type II (Pb-Free) | Automotive-A |

Package Diagrams

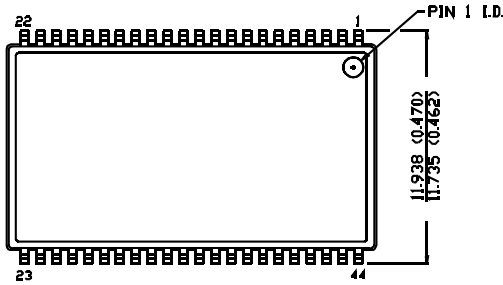
44-pin (400-Mil) Molded SOJ (51-85082)



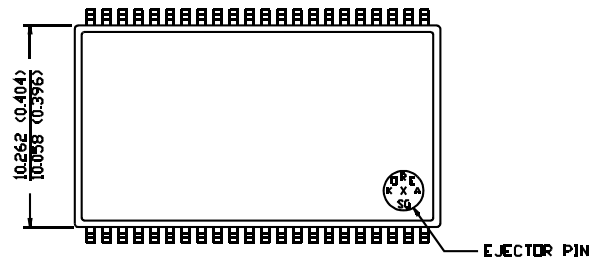
Package Diagrams (continued)

44-Pin TSOP II (51-85087)

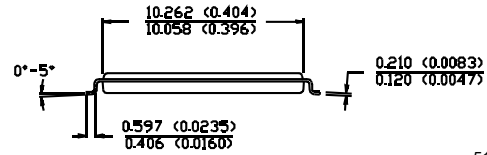
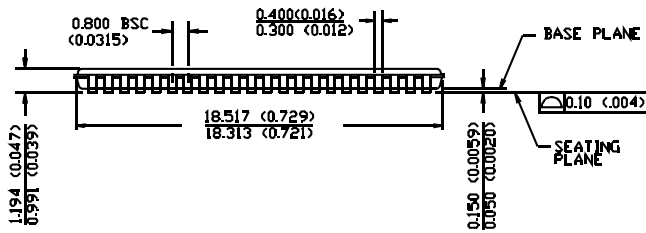
DIMENSION IN MM (INCH)
MAX
MIN.



TOP VIEW



BOTTOM VIEW



51-85087-A



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Document History Page

| Document Title: CY7C1021BN/CY7C10211BN (64K x 16) Static RAM | | | | |
|--|---------|------------|-----------------|--|
| Document Number: 001-06494 | | | | |
| REV. | ECN NO. | Issue Date | Orig. of Change | Description of Change |
| ** | 423877 | See ECN | NXR | New Data Sheet |
| *A | 505726 | See ECN | NXR | Removed I _{OS} parameter from DC Electrical Characteristics table. Added Automotive products Updated ordering Information table |

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