

# 1-Mbit (64K x 16) Static RAM

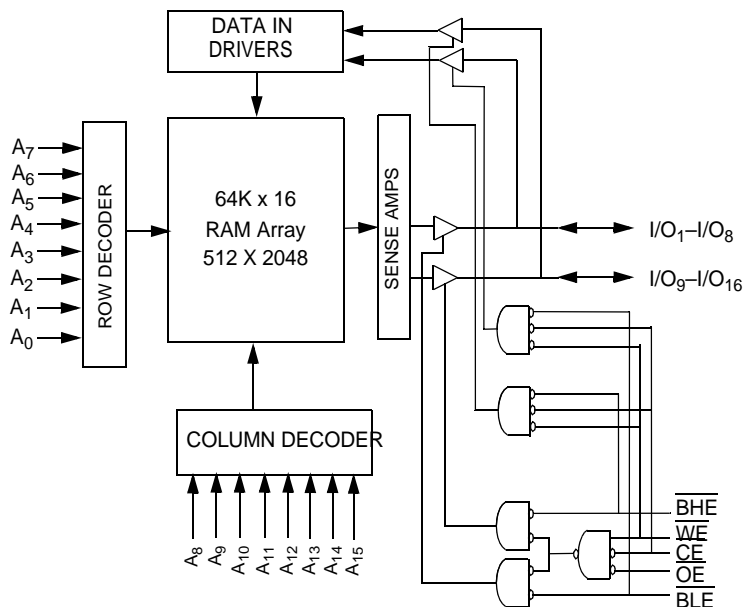
## Features

- **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<sup>[1]</sup>

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



### Note:

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

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/O<sub>1</sub> through I/O<sub>8</sub>), is written into the location specified on the address pins (A<sub>0</sub> through A<sub>15</sub>). If Byte High Enable ( $\overline{BHE}$ ) is LOW, then data from I/O pins (I/O<sub>9</sub> through I/O<sub>16</sub>) is written into the location specified on the address pins (A<sub>0</sub> through A<sub>15</sub>).

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/O<sub>1</sub> to I/O<sub>8</sub>. If Byte High Enable ( $\overline{BHE}$ ) is LOW, then data from memory will appear on I/O<sub>9</sub> to I/O<sub>16</sub>. 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/O<sub>1</sub> through I/O<sub>16</sub>) 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 <sub>4</sub>	1	44	A <sub>5</sub>
A <sub>3</sub>	2	43	A <sub>6</sub>
A <sub>2</sub>	3	42	A <sub>7</sub>
A <sub>1</sub>	4	41	$\overline{OE}$
A <sub>0</sub>	5	40	$\overline{BHE}$
$\overline{CE}$	6	39	$\overline{BLE}$
I/O <sub>1</sub>	7	38	I/O <sub>16</sub>
I/O <sub>2</sub>	8	37	I/O <sub>15</sub>
I/O <sub>3</sub>	9	36	I/O <sub>14</sub>
I/O <sub>4</sub>	10	35	I/O <sub>13</sub>
V <sub>CC</sub>	11	34	V <sub>SS</sub>
V <sub>SS</sub>	12	33	V <sub>CC</sub>
I/O <sub>5</sub>	13	32	I/O <sub>12</sub>
I/O <sub>6</sub>	14	31	I/O <sub>11</sub>
I/O <sub>7</sub>	15	30	I/O <sub>10</sub>
I/O <sub>8</sub>	16	29	I/O <sub>9</sub>
$\overline{WE}$	17	28	NC
A <sub>15</sub>	18	27	A <sub>8</sub>
A <sub>14</sub>	19	26	A <sub>9</sub>
A <sub>13</sub>	20	25	A <sub>10</sub>
A <sub>12</sub>	21	24	A <sub>11</sub>
NC	22	23	NC

## 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 <sub>0</sub> –A <sub>15</sub>	1–5, 18–21, 24–27, 42–44	Input	<b>Address Inputs used to select one of the address locations.</b>
I/O <sub>1</sub> –I/O <sub>16</sub>	7–10, 13–16, 29–32, 35–38	Input/Output	<b>Bidirectional Data I/O lines.</b> Used as input or output lines depending on operation.
NC	22, 23, 28	No Connect	<b>No Connects.</b> Not connected to the die.
$\overline{WE}$	17	Input/Control	<b>Write Enable Input, active LOW.</b> When selected LOW, a Write is conducted. When deselected HIGH, a Read is conducted.
$\overline{CE}$	6	Input/Control	<b>Chip Enable Input, active LOW.</b> When LOW, selects the chip. When HIGH, deselects the chip.
$\overline{BHE}$ , $\overline{BLE}$	40, 39	Input/Control	<b>Byte Write Select Inputs, active LOW.</b> $\overline{BHE}$ controls I/O <sub>16</sub> –I/O <sub>9</sub> , $\overline{BLE}$ controls I/O <sub>8</sub> –I/O <sub>1</sub> , .
$\overline{OE}$	41	Input/Control	<b>Output Enable, active LOW.</b> 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 <sub>SS</sub>	12, 34	Ground	<b>Ground for the device.</b> Should be connected to ground of the system.
V <sub>CC</sub>	11, 33	Power Supply	<b>Power Supply inputs to the device.</b>

### 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 <sub>CC</sub> Relative to GND <sup>[2]</sup> ....	-0.5V to +7.0V
DC Voltage Applied to Outputs in High Z State <sup>[2]</sup> .....	-0.5V to V <sub>CC</sub> +0.5V
DC Input Voltage <sup>[2]</sup> .....	-0.5V to V <sub>CC</sub> +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 <sub>A</sub> ) <sup>[3]</sup>	V <sub>CC</sub>
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 <sub>OH</sub>	Output HIGH Voltage	V <sub>CC</sub> = Min., I <sub>OH</sub> = -4.0 mA	2.4		2.4		2.4		V	
V <sub>OL</sub>	Output LOW Voltage	V <sub>CC</sub> = Min., I <sub>OL</sub> = 8.0 mA		0.4		0.4		0.4	V	
V <sub>IH</sub>	Input HIGH Voltage		2.2	6.0	2.2	6.0	2.2	6.0	V	
V <sub>IL</sub>	Input LOW Voltage <sup>[2]</sup>		-0.5	0.8	-0.5	0.8	-0.5	0.8	V	
I <sub>IX</sub>	Input Leakage Current	GND ≤ V <sub>I</sub> ≤ V <sub>CC</sub>	Com'l / Ind'l	-1	+1	-1	+1	-1	+1	μA
			Automotive-A					-1	+1	μA
			Automotive-E					-4	+4	μA
I <sub>OZ</sub>	Output Leakage Current	GND ≤ V <sub>I</sub> ≤ V <sub>CC</sub> , Output Disabled	Com'l / Ind'l	-1	+1	-1	+1	-1	+1	μA
			Automotive-A					-1	+1	μA
			Automotive-E					-4	+4	μA
I <sub>CC</sub>	V <sub>CC</sub> Operating Supply Current	V <sub>CC</sub> = Max., I <sub>OUT</sub> = 0 mA, f = f <sub>MAX</sub> = 1/t <sub>RC</sub>	Com'l / Ind'l		150		140		130	mA
			Automotive-A						130	
			Automotive-E						130	
I <sub>SB1</sub>	Automatic CE Power-Down Current—TTL Inputs	Max. V <sub>CC</sub> , CE ≥ V <sub>IH</sub> , V <sub>IN</sub> ≥ V <sub>IH</sub> or V <sub>IN</sub> ≤ V <sub>IL</sub> , f = f <sub>MAX</sub>	Com'l / Ind'l		40		40		40	mA
			Automotive-A						40	
			Automotive-E						50	
I <sub>SB2</sub>	Automatic CE Power-Down Current—CMOS Inputs	Max. V <sub>CC</sub> , CE ≥ V <sub>CC</sub> - 0.3V, V <sub>IN</sub> ≥ V <sub>CC</sub> - 0.3V, or V <sub>IN</sub> ≤ 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<sup>[4]</sup>

Parameter	Description	Test Conditions	Max.	Unit
C <sub>IN</sub>	Input Capacitance	T <sub>A</sub> = 25°C, f = 1 MHz, V <sub>CC</sub> = 5.0V	8	pF
C <sub>OUT</sub>	Output Capacitance		8	pF

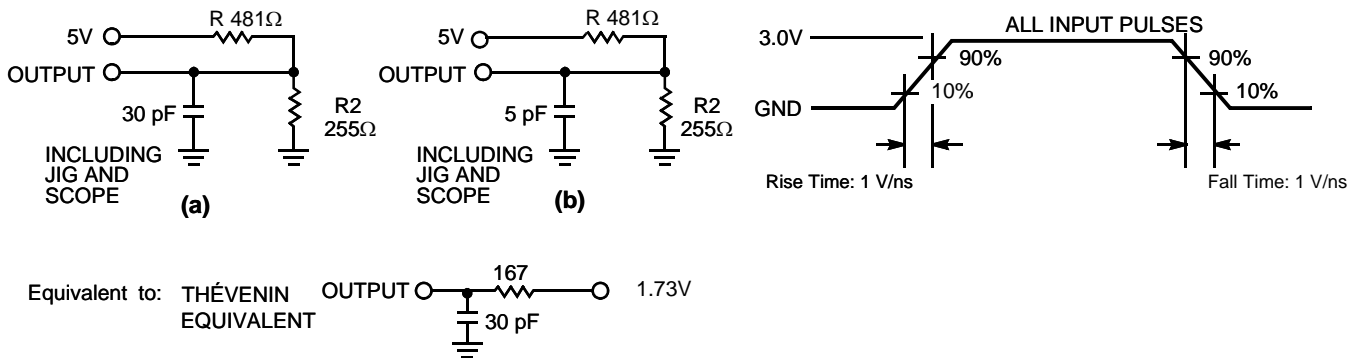
**Notes:**

- V<sub>IL</sub> (min.) = -2.0V and V<sub>IH</sub>(max) = V<sub>CC</sub> + 0.5V for pulse durations of less than 20 ns.
- T<sub>A</sub> is the "Instant On" case temperature.
- Tested initially and after any design or process changes that may affect these parameters.

**Thermal Resistance<sup>[4]</sup>**

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

**AC Test Loads and Waveforms**



**Switching Characteristics<sup>[5]</sup> Over the Operating Range**

Parameter	Description	7C10211B-10		7C1021B-12		7C1021B-15		Unit
		Min.	Max.	Min.	Max.	Min.	Max.	
<b>Read Cycle</b>								
$t_{RC}$	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
$t_{ACE}$	$\overline{\text{CE}}$ LOW to Data Valid		10		12		15	ns
$t_{DOE}$	$\overline{\text{OE}}$ LOW to Data Valid		5		6		7	ns
$t_{LZOE}$	$\overline{\text{OE}}$ LOW to Low Z <sup>[6]</sup>	0		0		0		ns
$t_{HZOE}$	$\overline{\text{OE}}$ HIGH to High Z <sup>[6, 7]</sup>		5		6		7	ns
$t_{LZCE}$	$\overline{\text{CE}}$ LOW to Low Z <sup>[6]</sup>	3		3		3		ns
$t_{HZCE}$	$\overline{\text{CE}}$ HIGH to High Z <sup>[6, 7]</sup>		5		6		7	ns
$t_{PU}$	$\overline{\text{CE}}$ LOW to Power-Up	0		0		0		ns
$t_{PD}$	$\overline{\text{CE}}$ 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:**

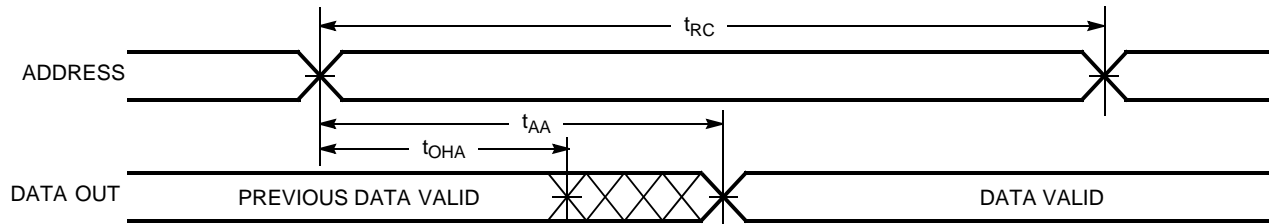
- Test conditions assume signal transition time of 3 ns or less, timing reference levels of 1.5V, input pulse levels of 0 to 3.0V, and output loading of the specified  $I_{OL}/I_{OH}$  and 30-pF load capacitance.
- At any given temperature and voltage condition,  $t_{HZCE}$  is less than  $t_{LZCE}$ ,  $t_{HZOE}$  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  $\pm 500$  mV from steady-state voltage.

**Switching Characteristics<sup>[5]</sup> Over the Operating Range (continued)**

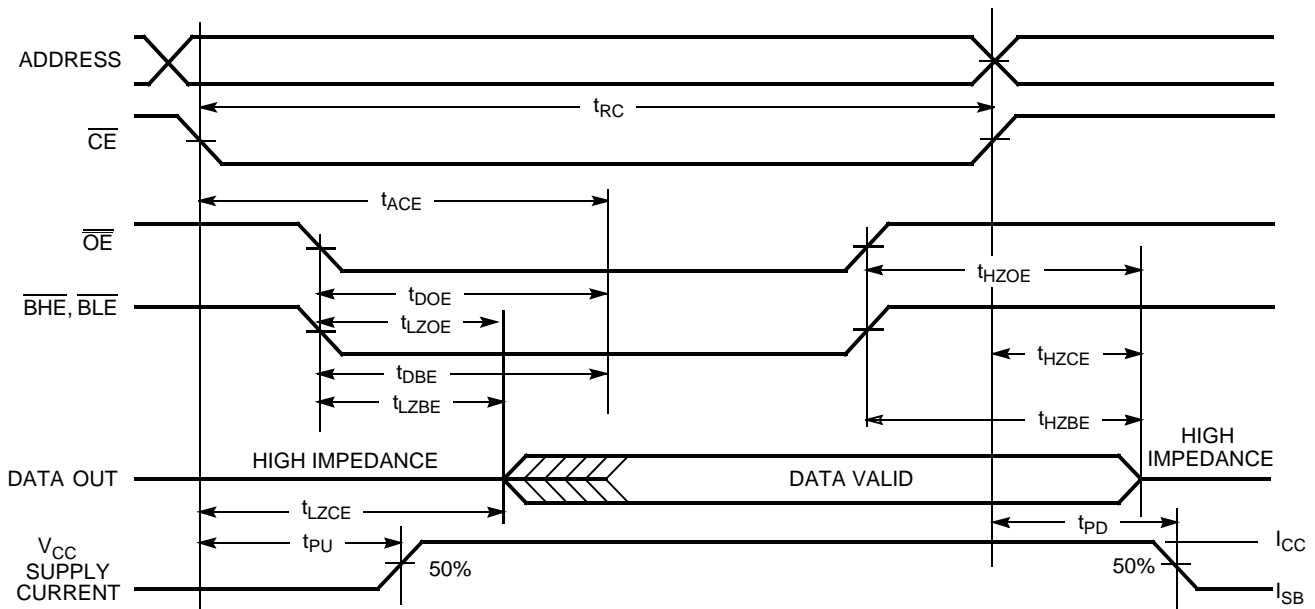
Parameter	Description	7C10211B-10		7C1021B-12		7C1021B-15		Unit
		Min.	Max.	Min.	Max.	Min.	Max.	
<b>Write Cycle<sup>[8]</sup></b>								
$t_{WC}$	Write Cycle Time	10		12		15		ns
$t_{SCE}$	CE LOW to Write End	8		9		10		ns
$t_{AW}$	Address Set-Up to Write End	7		8		10		ns
$t_{HA}$	Address Hold from Write 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 <sup>[6]</sup>	3		3		3		ns
$t_{HZWE}$	$\overline{WE}$ LOW to High Z <sup>[6, 7]</sup>		5		6		7	ns
$t_{BW}$	Byte Enable to End of Write	7		8		9		ns

**Switching Waveforms**

**Read Cycle No. 1<sup>[9, 10]</sup>**



**Read Cycle No. 2 ( $\overline{OE}$  Controlled)<sup>[10, 11]</sup>**

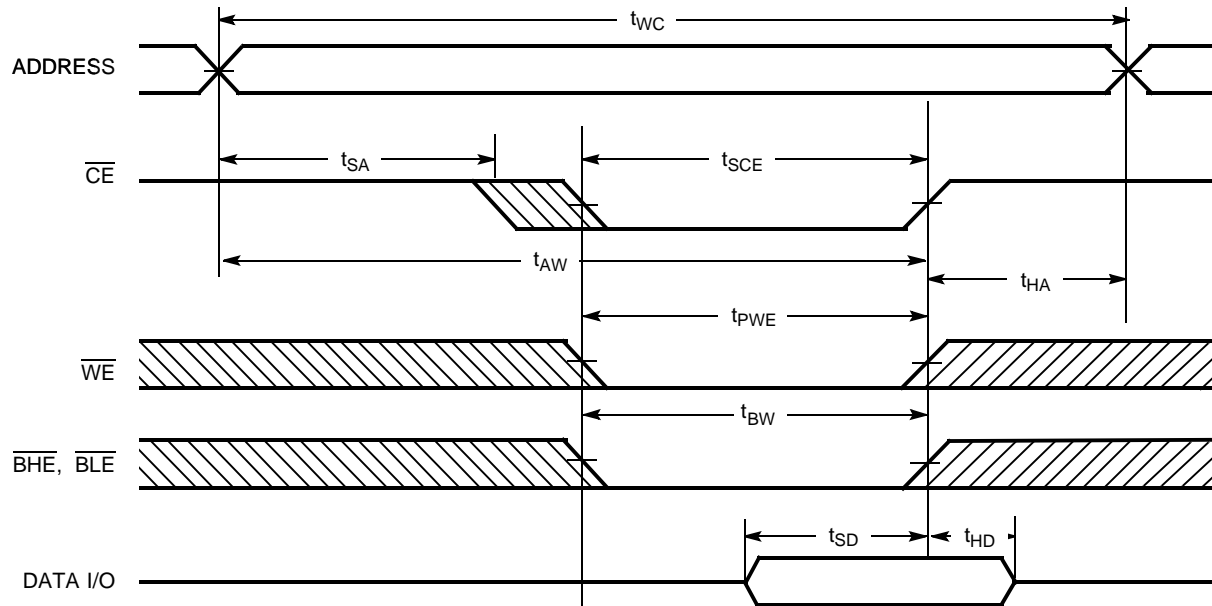


**Notes:**

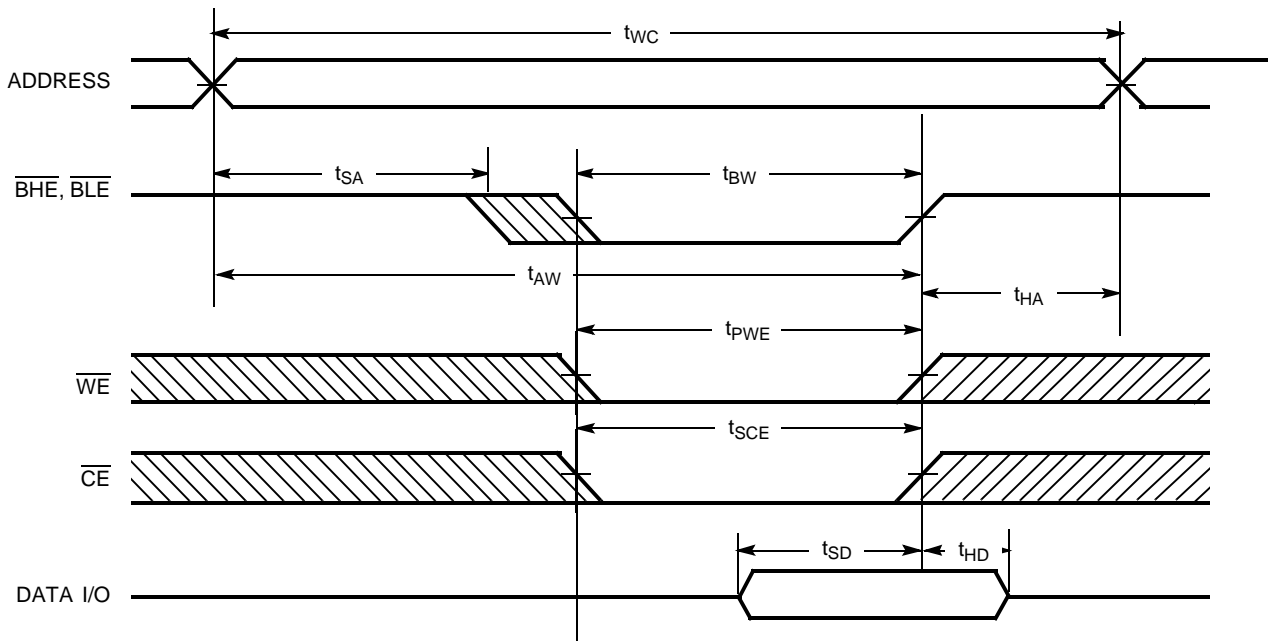
- 8. The internal write time of the memory is defined by the overlap of  $\overline{CE}$  LOW,  $\overline{WE}$  LOW and  $\overline{BHE} / \overline{BLE}$  LOW.  $\overline{CE}$ ,  $\overline{WE}$  and  $\overline{BHE} / \overline{BLE}$  must be LOW to initiate a write, and the transition of these signals 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.
- 9. Device is continuously selected.  $\overline{OE}$ ,  $\overline{CE}$ ,  $\overline{BHE}$  and/or  $\overline{BLE} = V_{IL}$ .
- 10.  $\overline{WE}$  is HIGH for read cycle.

**Switching Waveforms** (continued)

**Write Cycle No. 1 ( $\overline{\text{CE}}$  Controlled)**<sup>[12, 13]</sup>



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

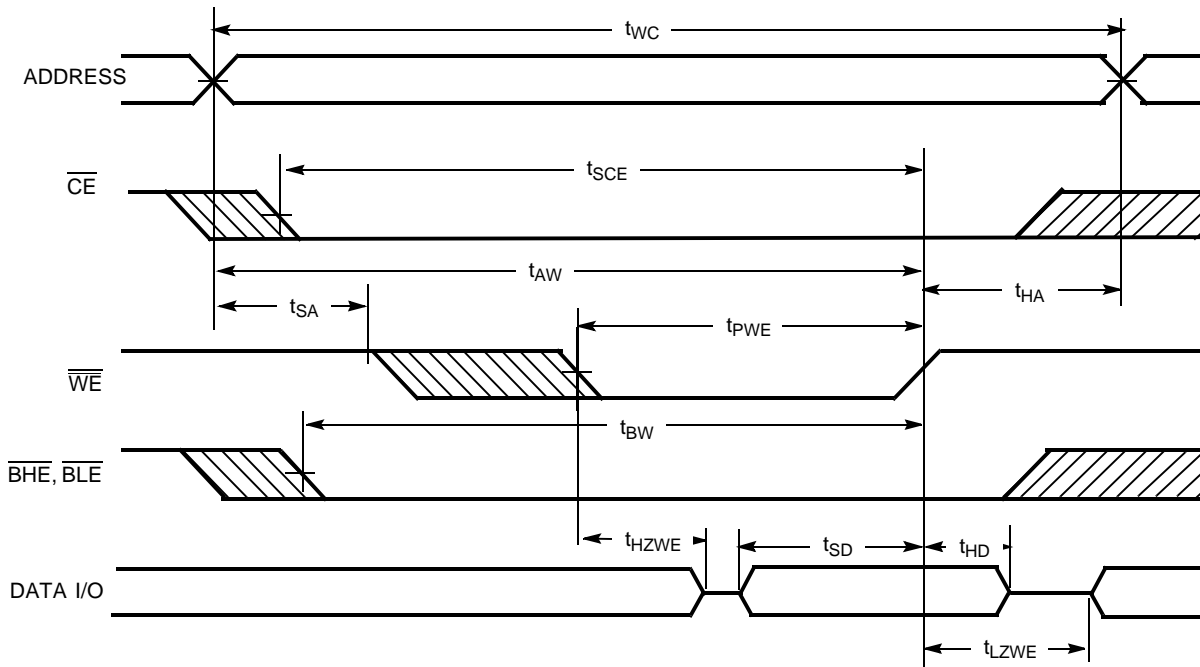


**Notes:**

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**

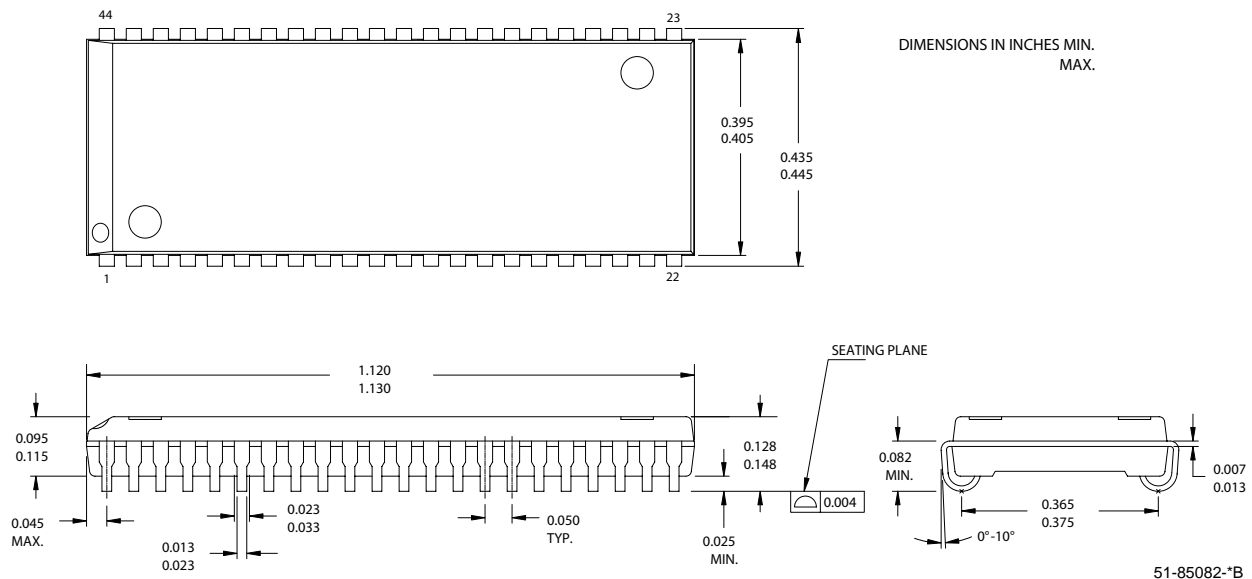
$\overline{CE}$	$\overline{OE}$	$\overline{WE}$	$\overline{BLE}$	$\overline{BHE}$	I/O <sub>1</sub> –I/O <sub>8</sub>	I/O <sub>9</sub> –I/O <sub>16</sub>	Mode	Power
H	X	X	X	X	High Z	High Z	Power-Down	Standby ( $I_{SB}$ )
L	L	H	L	L	Data Out	Data Out	Read - All bits	Active ( $I_{CC}$ )
			L	H	Data Out	High 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)**

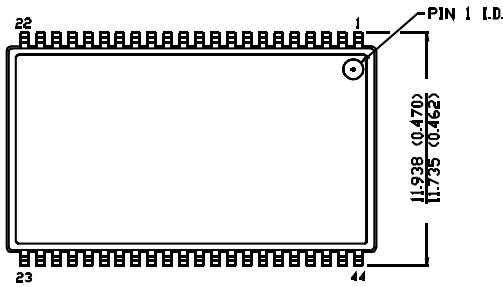




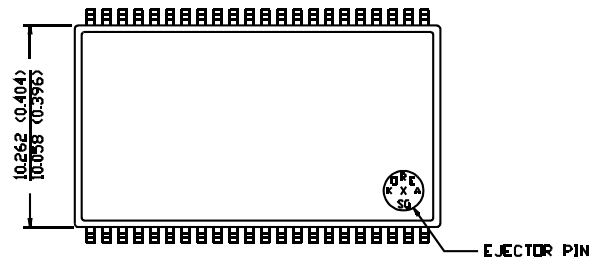
**Package Diagrams** (continued)

**44-Pin TSOP II (51-85087)**

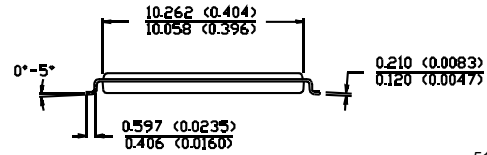
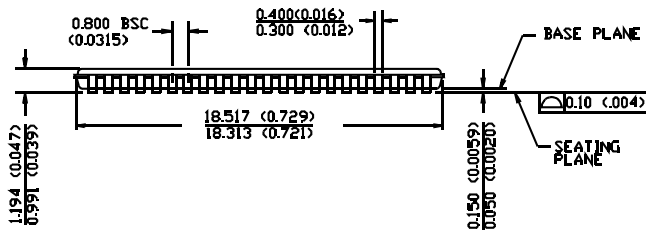
DIMENSION IN MM (INCH)  
MAX  
MIN.



**TOP VIEW**



**BOTTOM VIEW**



51-85087-\*A

All products and company names mentioned in this document may be the trademarks of their respective holders.

**Document History Page**

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